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Volume I

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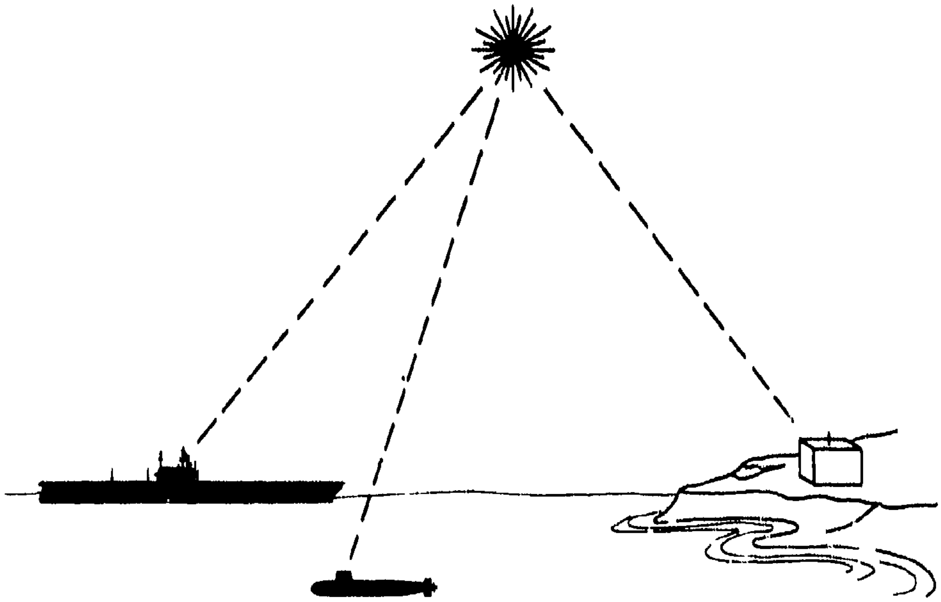

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This document reports on the results of a series of experiments performed in June through August 1975 at Santa Catalina Island. The purpose of these experiments was to determine the feasibility of satellite-to-submarine communications. The experiments addressed the propagation aspects of the problem through the water and through the air/sea interface for both the uplink and downlink. Certain aspects of cloud penetration were also considered. The relationship of radiative transfer theory to this problem was also addressed.

ADMINISTRATIVE INFORMATION

The experiment described in Volume I constitutes a complex assemblage of apparatus. The construction, assembly, test, checkout, fielding, maintenance, and data reduction of this equipment would not have been possible without the able assistance of many dedicated technical people. Among those deserving special mention are:

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Mr. Robert Stapleford, Scripps Institution of Oceanography
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TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Cont)

LIST OF TABLES

SECTION 1

INTRODUCTION

The ability of light to penetrate the sea to operationally useful depths, the ease with which optical energy can be generated and modulated, and the ability to direct this energy into narrow beams utilizing small antennas (optical systems) illustrate the theoretical feasibility of optical communication links in the sea. For example, when the proportionate sea path is limited to lengths of hundreds of feet (or meters),* optical communication links between an earth orbiting satellite and submerged terminals appear possible.

Before such optical communication links become practical, phenomena reported in the literature must be quantified to reliably predict system performance. This is necessary for systematic design and evaluation of terminals. For example, optical beam spreading, attenuation, air/sea interface effects, and background radiant intensities must all be documented to be used for component development.

With these objectives in mind, an experiment designed to measure the propagation characteristics of light in the ocean was conducted in the vicinity of Santa Catalina Island, California, between June and August 1975 (ref. 1).

1.1 PURPOSE

The purpose of this experiment was to examine the propagation of light in the sea, at the sea/air interface, and in the air above the sea. This served to quantify and catalog previous measurements and to obtain necessary new data. These data will be used as the basis for the design of optical communication links operating in the conglomerate environment. Specifically, this experiment was designed to:

a. Measure (in the atmosphere) the radiant intensity pattern produced by an underwater optical projector at various orientations and depths whose beam transits the air/sea interface. These measurements were made in the far field of perturbations caused by wave effects.

b. Measure the underwater radiant intensity profile produced by a simulated extended optical source whose beam transits the air/sea interface. The definition of an extended optical source is one whose projected dimension at the air/sea interface is much greater than the depth at which the measurement is made.

Although the experiment was not geared to any specific propagation model, the propagation model that was developed has been verified, and provides a very useful tool for understanding the physical requirements of transceivers operating in the ocean environment. The verification of this model, which is highlighted in Section 4, will provide a basis for the engineering design of communication systems and a mechanism to predict the performance of optical communication links when penetration of the sea is a requirement.

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*Distance measurements throughout this document are mostly in feet. However, some measurements are presented in metric units, while others indicate meters followed by the equivalent in feet. For those measurements that do not display a combination of both, conversion factors are provided: Multiply feet by 0.3048 to obtain meters, and meters by 3.2808 for the value in feet.

1.2 BACKGROUND (ref. 1)

The study and progress of ocean optics have been closely connected with the evolution both of instrumental techniques and of motivational factors for investigating the optical character of the seas.

For the earliest work, which dates back to 1885, only photographic methods were available (refs. 2 and 3). The advent of photocells revolutionized techniques in optical oceanography and led to the development, beginning in the 1930's, of relatively sophisticated instruments for measuring apparent and inherent optical properties of the sea.

Throughout the history of underwater optics, a fundamental incentive for research has been the photosynthetic activity of the ocean in terms of planktonic abundance and primary organic productivity (ref. 4). In particular, studies of the ecology of fish have made wide use of a subjective measurement technique known as the Secchi disc. Although the properties of the Secchi disc have never been standardized, Secchi disc measurements represent the most complete worldwide body of knowledge of submarine daylight and water transparency available, with more than 67,000 sightings cataloged (ref. 5).

Another long-term motivational factor in ocean optics has been its relationship with meteorology and the physical processes occurring at the sea surface which determine the interchange of energy between the atmosphere and the sea. This work has stressed modeling of radiative transfer in the sea and experimentally measuring upwelling and downwelling irradiances in the oceans (ref. 6).

More recent applications in underwater photography, vision, remote viewing/surveillance, and in remote detection of chlorophyll from aircraft or satellites have added impetus to the study of underwater natural light fields (ref. 7).

For the most part, there exists adequate documentation of the ocean optical propagation properties (ref. 8) utilizing the sun as a source. There are, however, new applications of optics where data required to predict system performance in the ocean are either scarce or nonexistent. Examples of such optical systems in the ocean are those which operate through the air/water, for example, an optical communication link between a satellite and a submerged terminal.

1.3 SCOPE OF WORK

To describe optical systems which operate in the environment, quantitative data are required on underwater radiant intensity distributions from natural backgrounds; radiance distributions from artificially collimated sources on axis, off axis, and operating through the air/water interface; and the optical properties of the air/water interface.

Quantitative descriptions of natural background radiance (or special radiance) and the radiance distributions are essential for determining noise levels in submerged optical equipment. Although absolute or quantitative data have not been reported, relative data have been presented by several workers (ref. 8).

The only work which specifically studied the effect of propagating a light beam through the air/water interface (Ohio State University) employed a small diameter beam (compared to the surface wave structure) and examined the results in the near field of the wave optics (ref. 9). The data needed to understand most systems that operate through the surface relate to beam diameters of several water wave lengths and the effects observed in the far field of both upward and downward directed energy.

Some investigators have published results, both experimental and theoretical, describing underwater light fields from immersed light sources (refs. 4, 10, 11, 12, 13, and 14). Unfortunately, it is not possible to reconcile the various data sources to obtain a meaningful description of the geometrical beam spreading expected in a collimated light beam for predicting the performance of a system. Little work has been reported on the optics of waves in terms of scattering, reflection, transmission, and their effect on the radiant intensity pattern thus produced.

What is needed is a workable model that can be used to describe the propagation of light beams over a water path and through the air/sea interface. The objective of the experiment herein described was to obtain the measurements necessary to verify a model. The model used is presented in Appendix A.

The results of this experiment will find immediate applications among electro-optical system designers working on other programs that must operate in this environment. It is currently necessary, in at least one advanced development program, to overdesign and construct equipment to compensate for uncertainties in the hydrosol environment. This approach has proven expensive, and the equipment designs are complex and large. Acquisition of the necessary optical oceanographic data and development of a predictive ocean optics model will result in substantial savings in these programs, and will provide a primary mechanism to enhance reliability at lower system costs.

SECTION 2

FORMULATION OF THE EXPERIMENTAL MODEL

The basic theory describing the propagation of light through any multiple scattering medium is radiative transport. References on this topic are listed in Appendix A. Unfortunately, closed form solutions exist only for certain special cases. The solution most closely matching the underwater environment is the forward scattering solution, in which the scattered energy is concentrated in a tight cone around the direction of origin of the ray. In this case, the mutual coherence function is known to have the general form

$$M(\rho,z) = e^{-az}e^{-sz[1-Q(\rho)]}; \qquad \begin{matrix} Q(o) = 1 \\ Q(\infty) = 0 \end{matrix}, \tag{2-1}$$

which specializes to the function

$$M(\rho,z) = e^{-(az)}\exp\left[-(sz)\right]\left[1-\frac{1}{\sqrt{\left(\frac{2\pi\rho}{\lambda}\right)^2\overline{\theta^2}+1}}\right] \tag{2-2}$$

when an empirically derived scatter function (ref. 15) is used. The $\overline{\theta^2}$ is a measure of the scattered cone angle; s is the scattering coefficient, a is the absorption coefficient; ρ is the correlation length; λ is the wavelength; and z is the distance propagated. An off axis correction has been offered (ref. 16) to account for wide angle scattering. This solution, which is presented as Appendix A, forms the basis for the Optical Satellite Communications (OPSATCOM) model. In this section, we will give some elementary insight into the model and a discussion of how the model was adapted for reducing the data taken at Santa Catalina Island.

It is shown (ref. 17) that the Fourier transform of the mutual coherence function is a function whose relative amplitude is proportional to the direction of arrival of the intensity. Thus, by examining the mutual coherence function, information can be obtained concerning the angular distribution of the arriving intensity. For example, a constant mutual coherence function implies a point source, whereas an impulsive mutual coherence function is generated from radiation coming from all directions to the receiver. It is also shown that equation (2-1) has the following limiting form:

$$
\left.\begin{aligned}
M(\rho,z) &\approx e^{-az} e^{-\frac{(\rho/\rho_o)^2}{2}} &;\quad \left(\frac{2\pi}{\lambda}\right)^2 \overline{\theta^2}\, \rho^2 << 1 \\
&\approx e^{-(a+s)z} &;\quad \left(\frac{2\pi}{\lambda}\right)^2 \overline{\theta^2}\, \rho^2 >> 1
\end{aligned}\right\} \quad sz >> 1 ,
$$

$$
= e^{-az} \quad ; \quad sz << 1 \tag{2-3}
$$

where

$$
\rho_o^2 = \left(\frac{\lambda}{2\pi}\right)^2 \frac{1}{sz\overline{\theta^2}} . \tag{2-4}
$$

Thus, we see that for short distances a point source will retain its imaging properties. At large distances, the mutual coherence function is predominantly Gaussian in shape with an asymptotic value of exp $-(a + s)z$, whereby, the residual imaging term is reduced to this asymptotic value. Since $M(\rho, z) = \exp -(az)$ for $\rho = 0$, we see that the total power at a point z is always much greater than that contained in the residual (unscattered) term. Specifically, it is exp (sz) times greater. However, this abundant power is associated mainly with the Gaussian portion of the mutual coherence function, and consequently appears to come from a source subtending a large field of view. This holds true whenever the receiver is in the scattering medium.

In the model used, the energy at any point is constructed from all the rays converging there. Thus, the solution is derived in the transform domain by examining the divergence of a zero cross section collimated beam which can be described as a spatial impulse response. Once a boundary has been defined, the solution at any point is obtained by convolving the spatial impulse response over the boundary. The spatial impulse is derived as a sum of two terms. The first term corresponds to the residual image (or, in this case, the point source) which is merely reduced by the factor exp $-(a + s)z$. The second term in the spatial impulse response is obtained by subtracting the residual value and assigning the remaining weight to the Gaussian term, which becomes

$$
e^{-az} e^{-\frac{(\rho/\rho_o)^2}{2}} [1 - e^{-sz}] . \tag{2-5}
$$

The model takes the random surface into account by assuming that the point source is Gaussian distributed and then adds the appropriate variance to the angular spread. This procedure is correct on an ensemble basis. However, it must be noted that when the point image is discernible, this spread is traced by the motion of the point caused by the dynamics of the surface. Thus, if the radiation were frozen in time, it would most likely be seen as one or several spots coming from a direction whose angle of arrival was Gaussian distributed in time, but fixed at any instant. Although we have not done so in this case, it can be represented as a point or sum of points with a time varying mean. For the scattered part of the radiation, this ensemble averaging has already been performed by the multiple scattering medium and is of no concern.

Another addition to the model is identified as the glow field component. This term,as described in Appendix C, is included to take account of the transition region existing between 1 and 10 scattering lengths (sz). In essence, what is done is to subtract both the residual image and the scattering field, and to fit a second Gaussian term to the remainder. This gives a better fit to the function in equation (2-2) through the transition region. A final modification to the model is described in Appendix B. This modification accounts for the fact that all the coefficients, a, s, and θ^2, are actually functions of z in any real environment. We are therefore able to layer the model to accommodate any variations in depth. The presence of the experimental test barge can also be accounted for when convolving the impulse response. By knowing the exact orientation and coordinates of the boundary, this area is given zero weight during the convolution.

SECTION 3

EXPERIMENTAL METHODS AND APPARATUS

3.1 METHODS UTILIZED

In general, the atmospheric radiance pattern of an underwater optical projector was measured by overflying the surface spot illuminated by the projector with a tracking optical receiver. The orientation, field of view, and depth of the projector were correlated in consonance with the measured oceanographic parameters and with the radiance pattern measured during the surface spot overflights.

The sun was used to simulate a point source, and a hemispherical scanning receiver was employed to measure the radiance profile at various receiver depths and source orientations.

Both the uplink and downlink data obtained in open ocean waters were concurrently calibrated in terms of the physical characteristics of the water. This calibration was accomplished by the Visibility Laboratory of Scripps Institution of Oceanography where measurements were made to determine the extinction coefficient (α), scattering coefficient (s), absorption coefficient (a), and the volume scattering function ($\sigma(\theta)$).

The collection of this empirical data has permitted verification of the model presented in Section 2 and Appendix A. Using this model it will be possible to predict link parameters which influence the intercept contours of air or space to undersea,and of undersea to air or space communication links.

3.2 EQUIPMENT DESCRIPTION

The equipment used to gather data during this experiment can be separated into three distinct areas: the underwater equipment package, the aircraft equipment package, and the surface support platform. For a more complete description of the above equipment, refer to Volume II, Sections 2, 3, and 6, respectively.

3.2.1 UNDERWATER EQUIPMENT PACKAGE

In general, the underwater equipment package is a submergible equipment platform which is controlled from the surface.

Attached to it are a dye laser (see Volume II, Section 1) and the underwater radiance scanner (see Volume II, Section 2).

3.2.1.1 THE DYE LASER. The dye laser (figure 3-1), which was mounted on the underwater platform, was housed in a watertight container and controlled from the surface. It could be lowered on the platform to a predetermined depth and activated at will. The mount allowed 360° azimuth rotation with 0° to 50° variances in zenith angle. The azimuthal rotation was continuous, while the zenith angle was controlled discretely in 10° steps.

Figure 3-1. View of dye laser in watertight housing (with top removed for servicing).

The laser driver, which controlled the activation of the laser, also output a trigger voltage that activated a surface mounted radio transmitter. This radio transmitter was used to synchronize time with a tracking receiver that was mounted in an aircraft and flown over the experimental test site to measure the upward radiance pattern.

The pertinent specifications of the laser were:

Pulse repetition rate	20 pulses/sec^{-1}
Peak pulse amplitude	5 kW (±6% relative ±10% absolute)
Pulse width	0.75 μsec
Center wavelength	5,214 Å
Bandwidth	46.5 Å
Beamwidth (in water)	1.23°

3.2.1.2 UNDERWATER RADIANCE SCANNER. The underwater radiance scanner (figure 3-2), which is essentially an electronic video camera, image dissector tube, was mounted on the underwater platform. By scanning its focal plane, it discretely sampled the composite field of view, including the upper hemisphere. The scanner was mounted inside a watertight container (figure 3-3), with an acrylic transparent dome and a fisheye lens (figure 3-4). The fisheye lens was installed so that its focal plane was the photoemissive surface of the image dissector tube.

Appendix K contains a program for the implementation of calibration taken by the underwater radiance scanner.

The platform could be lowered to any desired depth. Computer control from the surface support platform allowed the field of view to be scanned in segments of approximately 1° by 1°. Each field of view segment was uniquely identified and the measured radiance was recorded as raw data.

A narrow spectral filter of 93 Å bandwidth centered at 5,200 Å was incorporated into the optic train.

3.2.2 AIRCRAFT EQUIPMENT PACKAGE

The aircraft equipment package consisted of a calibrated tracking optical receiver, its electronic control circuitry, and a digital data recording system. A complete description of the aircraft receiver system is contained in Volume II, Section 3.

The tracking optical receiver (figure 3-5) was designed to measure the radiance distribution of an underwater laser at various depths and orientations. Measurements were made while the receiver passed overhead in its aircraft platform (figure 3-6) and tracked the optical source, the dye laser. The receiver was manually controlled by a joystick pointing mechanism that was pointed at the surface of the water above the laser source. When sufficient energy was detected, the receiver automatically tracked the laser signal (figure 3-7) and recorded on magnetic tape the signal intensity, and the receiver pitch and roll angles. Using these data and known aircraft altitude, one can determine the cuts that were taken of the desired upward radiance profiles. Changing the laser depth or angular orientation and repeating the above procedure yields a family of radiance profiles, as a function of the transmitter configuration and the water parameters which were measured simultaneously.

The operational characteristics of the aircraft optical tracking receiver were:

Sensitivity	4.7×10^{-9} w/cm^{-2}
f/#	3

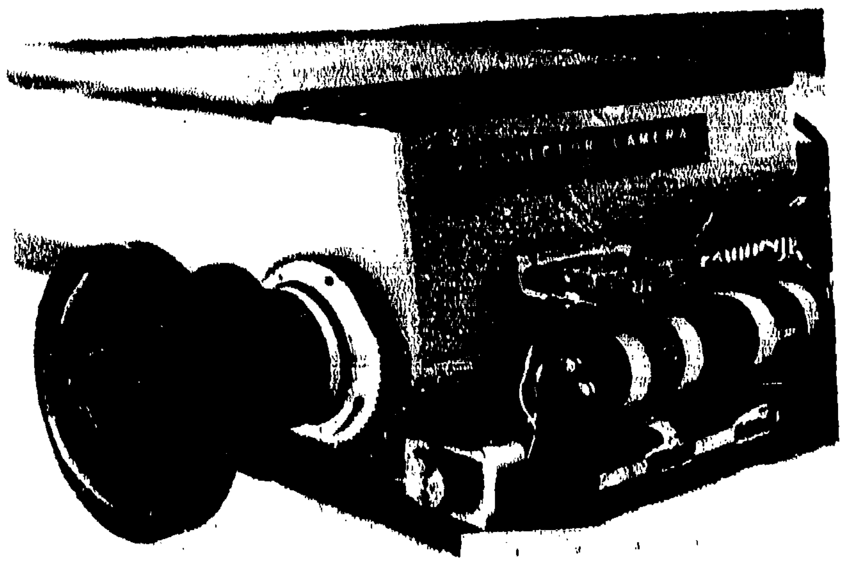


Figure 3-2. Underwater radiance scanner and vidissector camera.

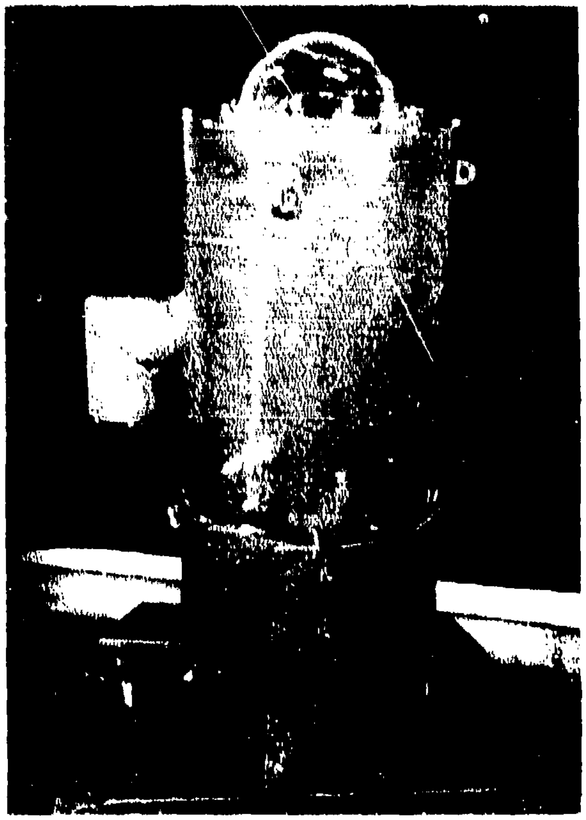


Figure 3-3. Underwater radiance scanner housed in watertight canister.

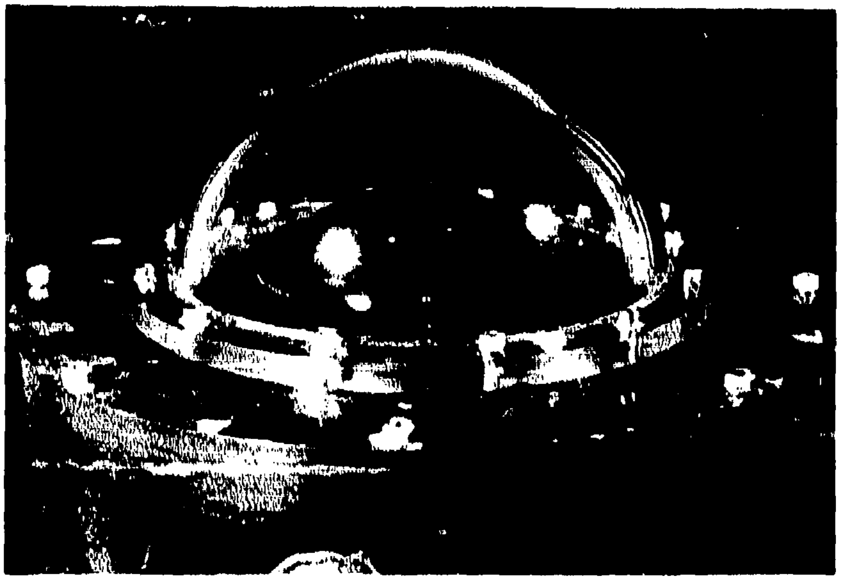


Figure 3-4. Closeup view of acrylic dome (with fisheye lens of the underwater radiance scanner visible).

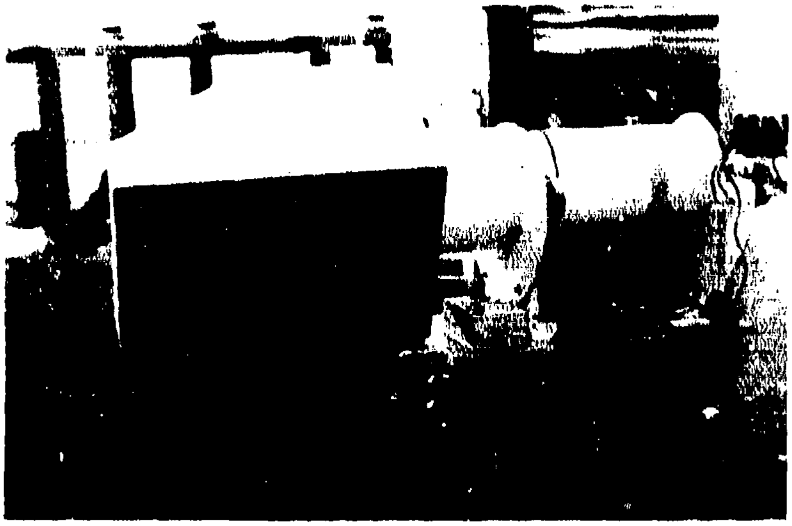


Figure 3-5. Tracking optical receiver in laboratory test mount.

Figure 3-6. Tracking optical receiver mounted in PBY aircraft.

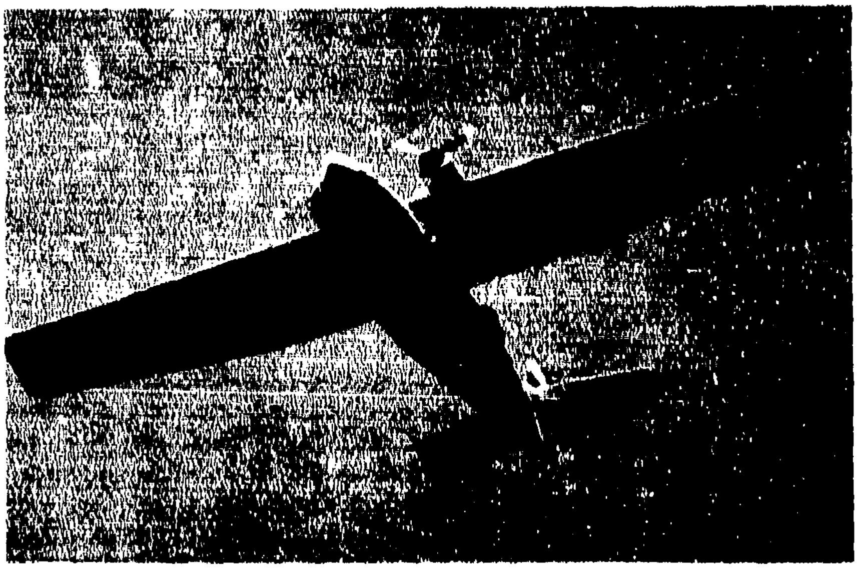


Figure 3-7. Aircraft overflight of the experimental test site (with the tracking optical receiver automatically tracking the submerged laser source).

Lens diameter	6″
Spectral bandpass	5,240 ±38 Å
Data field of view	1.4°
Visual field of view	15°
Maximum roll angle	±22.5°
Maximum pitch angle	±90°
Roll rate correction	$> 5°\ sec^{-1}$
Pitch rate correction	$> 5°\ sec^{-1}$
Joystick slew rate	$> 15°\ sec^{-1}$

A radio link between the surface support platform and the aircraft provided timing information that was synchronous with the tracking optical receiver.

3.2.3 SURFACE SUPPORT PLATFORM

The surface support platform (figure 3-8) provided stability for conducting the experiments in an exposed ocean environment under nonsevere weather conditions. A complete description is presented in Volume II, Section 6. It had a mechanism in the form of an assembly which could be raised, lowered, or rotated to provide vertical access to depths of approximately 164 feet, and upon which the underwater radiance scanner and the dye laser could be mounted (figure 3-9). The platform also provided the means to traverse an optical detector along a horizontal path slightly beneath the surface of the water. Necessary power supplies, personnel accommodations, a control equipment shelter, oceanographic instruments, support hut, and operating equipment to facilitate experimental data gathering operations were provided. Also mounted on this platform, were the following environmental sensing instruments, which are described in Volume II, Section 7.

a) Solar monitor – a narrow field of view (7°) calibrated receiver, filtered identically to the underwater radiance scanner, which was used to monitor direct sun rays.

b) Deck cell – a lambertian collecting thermopile filtered at 5,220 Å center wavelength with an 820 Å bandwidth that was used to monitor ambient background levels.

c) Wind speed and direction measuring instruments.

3.3 EXPERIMENTAL TEST SITE

The test site was located in waters adjacent to Santa Catalina Island. The criteria for this selection are described in ref. 1.

This test site was near NELC and provided appropriate water depths. Water clarity was comparable to that of open ocean areas. Laboratory, dockage, and personnel support facilities were available at the Santa Catalina Marine Biological Research Station, operated by the University of Southern California. Figure 3-10 shows the test site, the approximate location of the Marine Biological Research Station, and the aircraft overflight path that was used in conducting the uplink measurements.

3.3.1 AZIMUTHAL ALIGNMENT OF THE UNDERWATER RADIANCE SCANNER

In order to align the azimuth of the underwater radiance scanner (URS) with the earth's coordinate system, a precise mark on the URS was aligned with a prominent projection of the coast of Santa Catalina Island at Fisherman Cove so that the Y-axis was oriented north-south. To calibrate this alignment, the URS was operated out of the water at a known time. This imaged the sun, slightly out of focus, on the image

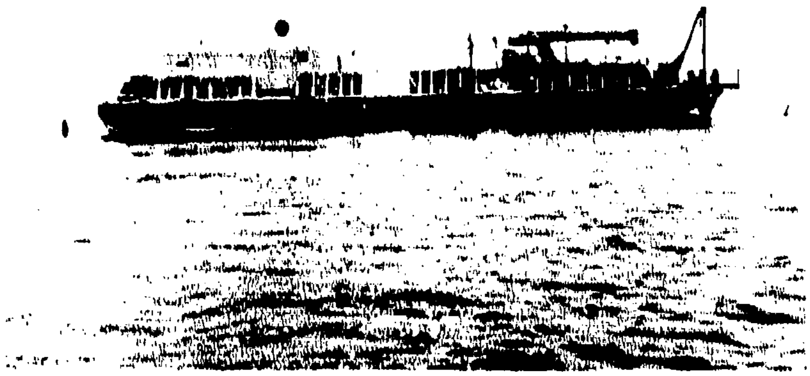


Figure 3-8. Experimental test barge (with 180 foot guide pipe suspended from right-hand corner and underwater platform in raised position).

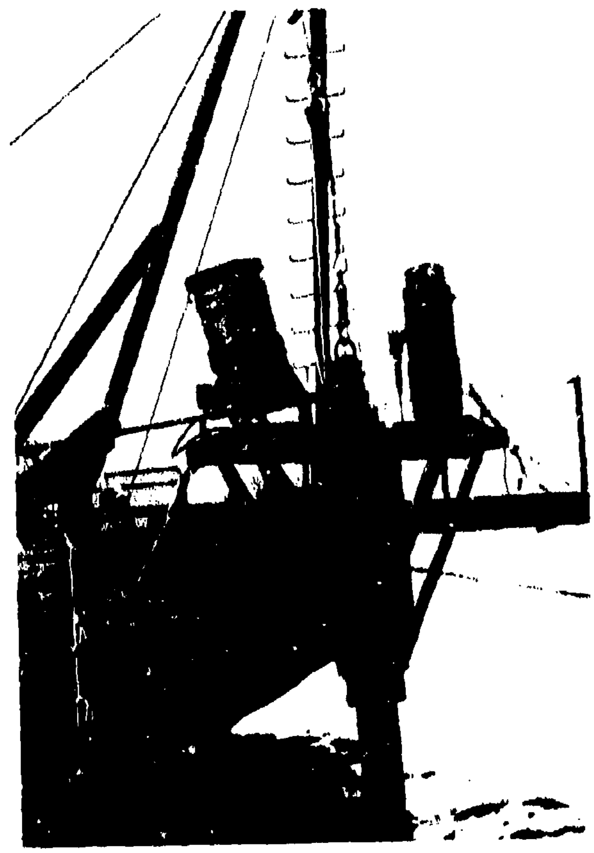


Figure 3-9. Underwater platform in raised position (showing dye laser and underwater radiance scanner with protective cover attached mounted).

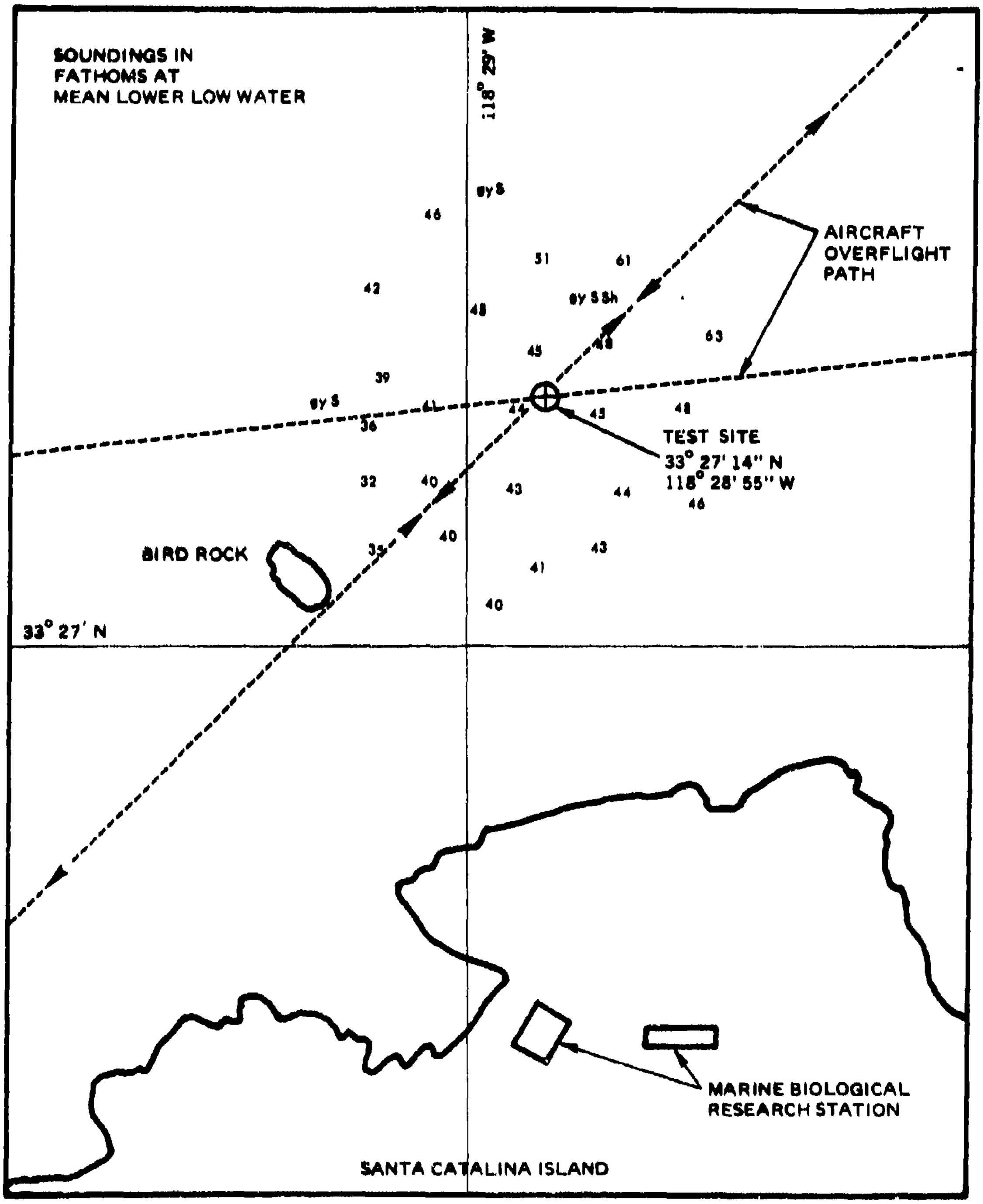


Figure 3-10. Test site location.

plane which was then scanned by the URS image dissector tube. The location of the peak radiance in the image plane yielded the angular location of the sun with respect to the URS. By simultaneously determining the angular orientation of the sun with respect to the known geographic location of the URS, it was possible to determine the alignment of the URS in relation to true North and the zenith.

A summary of these measurements follows:

(a) URS location, 33°27'14" N, 118°28'55" W.

(b) Time of observation 2224 Greenwich mean time 24 June 1975.

(c)	Calculated	Observed
azimuth	262.5°	263.0°
elevation	56.2°	54.72°

This measurement confirms that the angular alignment was within the experimental goal of ±3°.

3.3.2 GENERAL WATER CHARACTERISTICS

The test site was located in waters adjacent to the Southern California coast generally classified as coastal waters. This water has its maximum transmission peaking in the 480 to 550 nm wavelength region of the visible spectrum. Typical attenuation lengths in terms of meters/ln, the distance in which the intensity is reduced by a factor of exp (-1), are shown in figure 3-11 which is extracted from ref. 10. For the experiment described here, a laser source of wavelength 5,214 Å was chosen and the URS was spectrally filtered about a center frequency 5,200 Å wavelength.

The test site was somewhat protected from the prevailing seas by the northeastern projection of Santa Catalina Island. During the experiment, the sea state ranged from a flat calm, with swells of 1 to 2 feet from the northwest, to seas of 5 to 8 feet with patches of wind-generated whitecaps covering approximately 5 percent of the ocean surface.

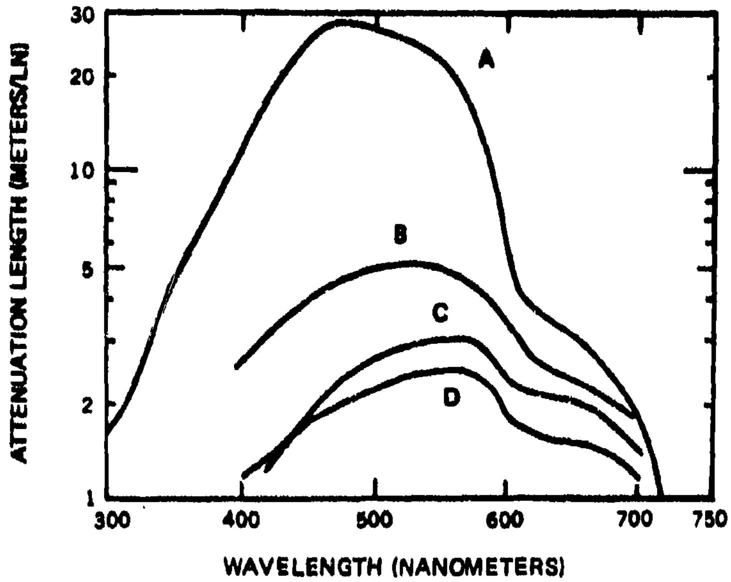
3.4 EXPERIMENTAL SCENARIOS

The experiment made three measurements to describe the propagation of light in the ocean environment: Downlink, uplink, and F(θ). Of these three measurements, approximately 99 percent of the experimental time was spent making the downlink and uplink measurements which were considered the most important. The F(θ) data is presented in Appendix M. Following is a brief description of the experimental scenarios that were used to collect the data analyzed that is presented in Section 4.

3.4.1 DOWNLINK MEASUREMENTS

The sun was used as the downlink source because as a stable source of sufficient intensity, it adequately represented a satellite transmitter. The use of an airborne laser as the source was rejected early in the experiment for the following reasons. To satisfy the simplified range equation, the radius of the surface spot is required to exceed half the depth of the receiver (see Appendix A, figure 10). If a spot of such dimensions (e.g. 164 feet), is projected from an airborne laser at reasonable altitudes of 3,280 feet or less, the wavefront departs substantially from a plane wave. In addition, flying and pointing a laser from an aircraft is a difficult and expensive task.

The solar intensity was monitored continuously at the sea surface to correct the data for any changes in source intensity. Recorded data were normalized to these readings, simultaneously taken, so that the results could be expressed in terms of loss per steradian as a function of depth.



Spectral attenuation length (1/α) vs wavelength for (A) distilled water, (B) coastal water, (C) Chesapeake Bay, (D) Diamond Island. Data sources: A, B, C: E. O. Hulbert, J. Opt. Soc. Am. 35, 698 (1945); D: Section 3.3.2 of this report using relative units. At Diamond Island the attenuation length for 530 nm is about 1.5 meters/ln.

Figure 3-11. Spectral attenuation length vs. wavelength.

Figure 3-12 depicts a downlink recording event. Using the sun as the optical source, the solar cell (or deck cell) was used to measure the solar intensity; Scripps Institution of Oceanography was at the test site providing water calibration measurements (a and s calibration), and the URS was mounted to operate vertically on the 180 foot guide pipe suspended from the southern corner of the experimental test barge.

Data was recorded at approximately extinction length intervals down to a depth of 150 feet. The URS was used to record a hemispherical mapping of the radiant intensity profile produced by the solar source. The tilt angles of the underwater platforms were monitored to determine both vertical and azimuthal references.

Measurements were conducted under predominantly cloudy conditions, however, some were under clear conditions. These are described in detail in Section 4. Figure 3-13 represents the zenith and azimuthal angle trajectory of the sun as recorded at the test site during the experiment. This trajectory permitted zenith angle opportunities of from approximately 10° to greater than 90° over an azimuthal range of approximately 50° to 310° referenced to true North.

The suspension of the underwater platform and its guide pipe left a clear field of view to the sun at all angles during the day, and provided unobstructed views of sunrises and sunsets.

Experimental data was recorded in the following way:

(a) The URS was lowered to a known depth.

(b) The URS was exercised to set its gain characteristics, which were then recorded in the test log.

(c) The deck cell (solar monitor instruments) readings were recorded.

(d) The URS was programmed to execute a preset quantity of scans and was then activated, thus automatically recording the data in digital format on magnetic tape for later processing.

(e) The time of each scan was both manually and automatically recorded individually or by series.

(f) The URS was then lowered or raised to a new depth and the above procedure was repeated.

3.4.2 UPLINK MEASUREMENTS

The dye laser was used as the underwater source for the uplink tests. The tracking optical receiver was mounted in an aircraft to record data while flying over this source.

The short pulses of the underwater laser required the use of a peak reading circuit to hold the level of the pulse until the next pulse occurred. The output of this circuit was recorded on one channel of the 9-track digital tape recorder. A timing signal was recorded for reference purposes. As the signal was received, the pointing angles of the tracking optical receiver were recorded. These data were later reduced and are presented in Section 4, paragraph 4.2 of this document.

Figure 3-14 presents a pictorial representation of an uplink data gathering event. This event differs from the downlink in that the dye laser, which was mounted on the underwater platform, was activated at various depth and zenith angle orientations. As the aircraft overflew the test site, the tracking optical receiver measured the radiant intensity produced by the laser source. All background and water calibration measurements that were conducted during the downlink events were repeated during the uplink episodes with the exception of simultaneous operation of the URS. A radio link between the laser control point and the aircraft passed time gating signals to synchronize the optical receiver and laser transmitter.

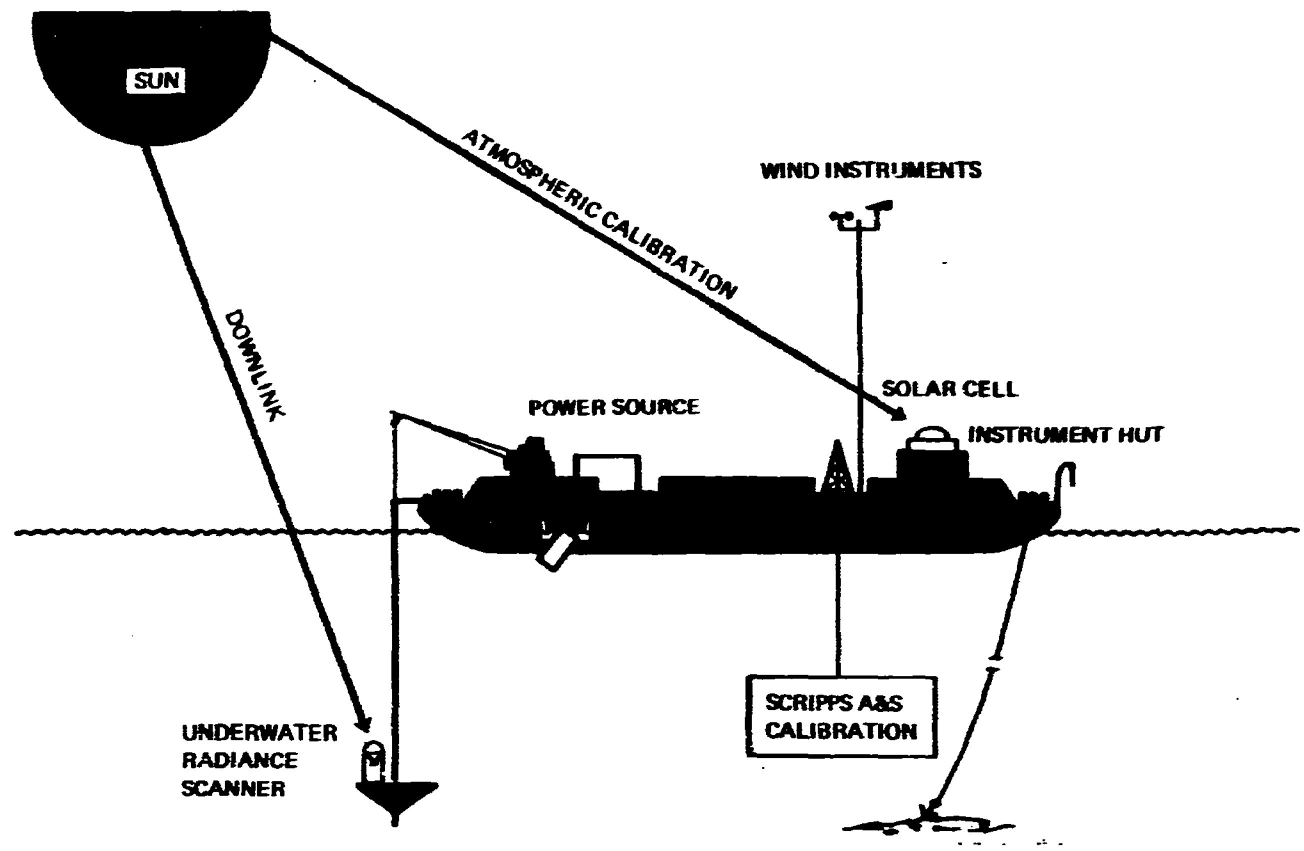


Figure 3-12. Blue-green propagation experiment downlink measurements.

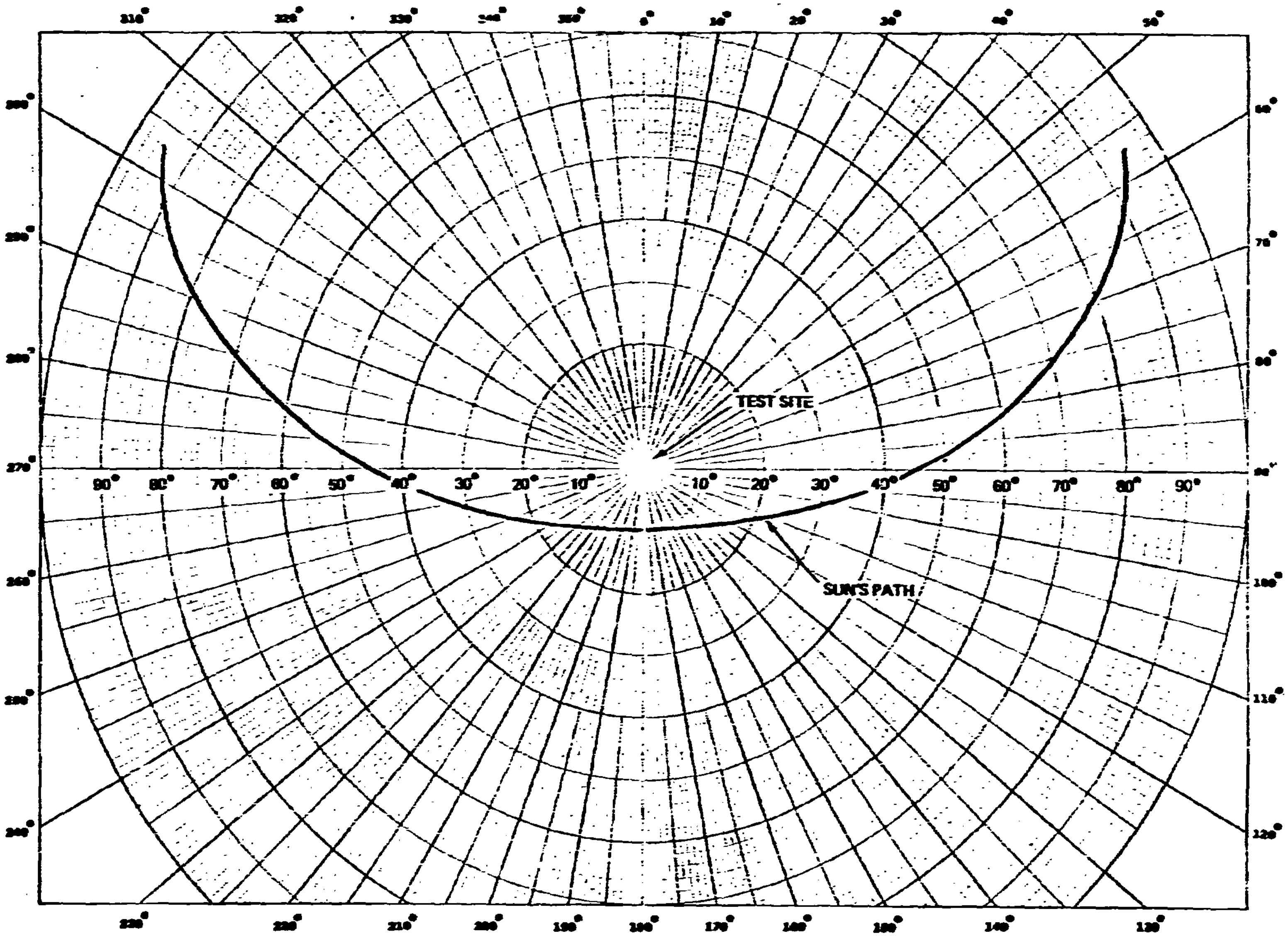


Figure 3-13. Zenith of the sun and azimuthal angle trajectory.

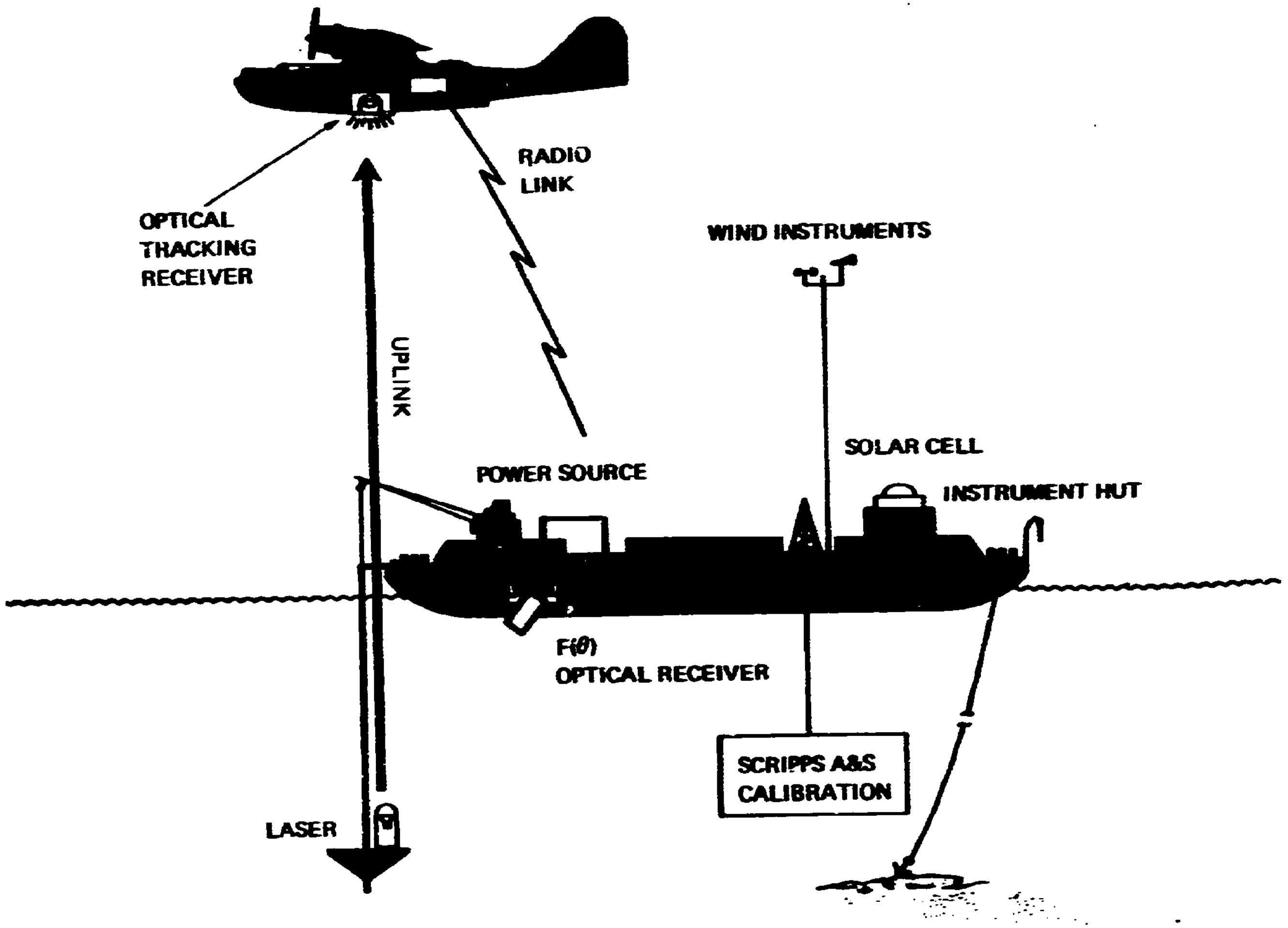


Figure 3-14. Blue-green propagation experiment uplink measurements.

3.4.3 F(θ) MEASUREMENTS

The F(θ) measurements recorded the spatial impulse response of the dye laser. In order to make this measurement, an optical receiver (described in Volume II, Section 4) was transited just beneath the water surface along a specially constructed I-beam attached to the side of the barge (see figure 3-14). This receiver was mounted so that it could be stopped at any position along the optical bench and pivoted through 160° (±80° about the nadir) in the plane which contained the underwater platform suspension pipe and the F(θ) optical receiver.

Data were gathered as follows:

(a) The dye laser was placed in a preselected angular orientation with respect to the vertical and was lowered to a predetermined depth so that it transmitted in the plane that contained the laser, the pipe, and the F(θ) optical receiver.

(b) The F(θ) optical receiver was positioned at a known horizontal position away from the laser.

(c) The angular position of the F(θ) optical receiver was set, the dye laser was activated, and the signal level as received was recorded.

(d) After the angular position of the F(θ) optical receiver had been exercised through its range, the horizontal position was changed, and the sequence was repeated.

(e) When a complete sequence of measurements had been made that sufficiently exhausted the receiver angular and horizontal position possibilities, the laser was lowered to a different depth, its angular orientation was changed, or a combination of both. This different configuration then formed a new set of experimental knowns, and steps (b) through (d) were repeated.

SECTION 4

DATA AND RESULTS

The experiment consisted of two major portions: uplink and downlink measurements. In addition, several levels of calibration were employed. The calibration, which is discussed in detail in Volume II, consisted of equipment calibration, water calibration at the fundamental level, and water calibration at the system level. The equipment calibration was used to determine the absolute levels of the uplink and downlink measurements in order to obtain quantitative results. This resulted in absolute accuracies of 3 to 5 dB. The water calibration was necessary as an input to model development. These measurements were performed by Scripps Institution of Oceanography with the results appearing in Appendix D and Volume II, Section 5.

4.1 DOWNLINK MEASUREMENTS

The downlink measurements that were performed by the URS are described briefly in Section 3 and in detail in Volume II, Section 2. This instrument was used to make solar measurements in a 95 Å bandwidth around 5,200 Å. This scenario closely describes that of a satellite except that there is no modulation and the sun is not a point source, but rather subtends an angle of 0.5°. Neither of these deficiencies mattered as far as the goals of this experiment were concerned. The data-recording equipment was previously described in Section 3. Two data acquisition programs were used and are described in Appendices B and H, and in Volume II, Section 2. The data taken with the quick scan program are summarized in figure 4-1. Representative curves are shown in figures 4-2 and 4-3. For each data point plotted, there is an accompanying hemispherical radiant pattern, together with an integration of the power in this pattern as a function of the field of view (figure 4-2). Notice the power loss in the upper left hand quadrant of figure 4-3 resulting from the shadow cast by the supporting pipe. The origin of the coordinate system corresponds to the zenith, while edges are 90° from the zenith. The patterns are truncated whenever the noise level is reached so that all the plots do not display the horizon. The data points in figure 4-1 correspond to the asymptotic value of the integrated curves in figure 4-2 which correspond to the total irradiance (intensity) incident upon the radiance scanner. All curves are normalized to the surface irradiance so that we have units of loss/steradian for radiance and loss for the integrated power.

4.1.1 DATA CALIBRATION

Notice that at 40 feet and below anomalies exist in the data. This is better observed by focusing on a single set of data taken as the radiance scanner was submerged (see figure 4-4A). Observe the 10 dB discontinuity occurring at 40 feet. It is our opinion that there was an intermittent malfunction regarding the gain-determining mechanism which was depth dependent. (The underwater connector failed late in the experiment and might have been the trouble.) We support this claim in the following manner. If 10 dB is subtracted from each of the data points below 40 feet, and the resultant curve compared to a K-meter measurement of irradiance taken simultaneously by John Shannon of the Naval Air Development Center, then the comparison in figure 4-4B can be made. Notice that the greatest deviation is only 3 dB which

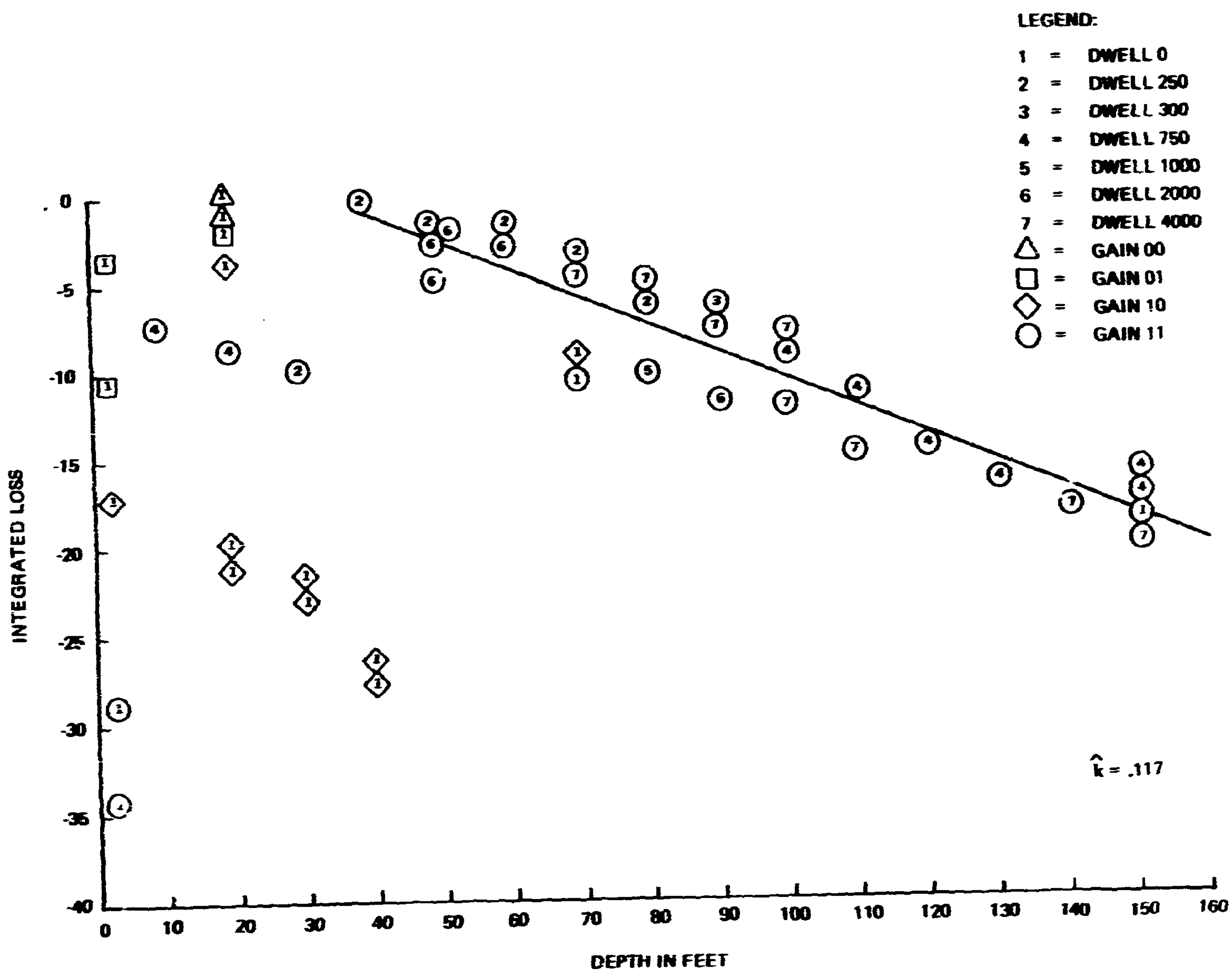


Figure 4-1. Irradiant loss (radiance scanner).

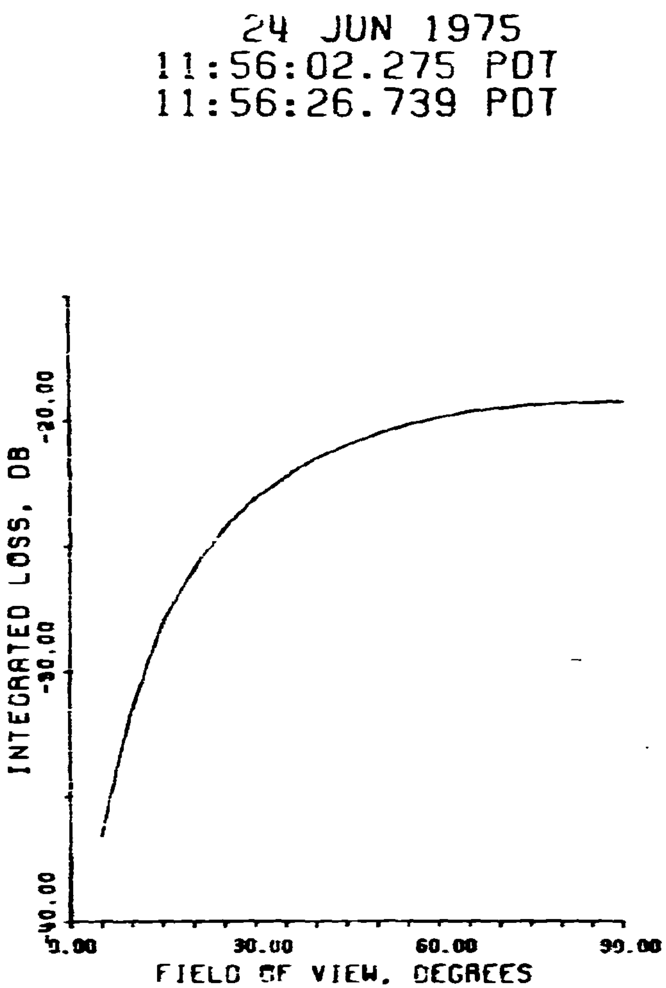


Figure 4-2. Integral of radiance.

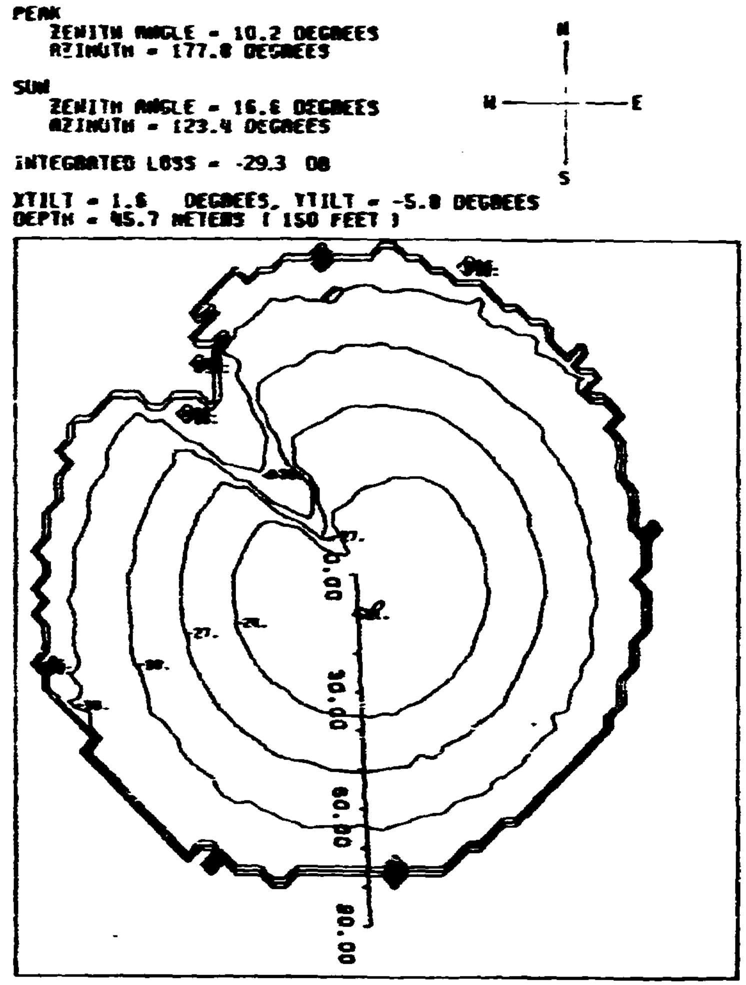


Figure 4-3. Radiant loss (dB/unit solid angle).

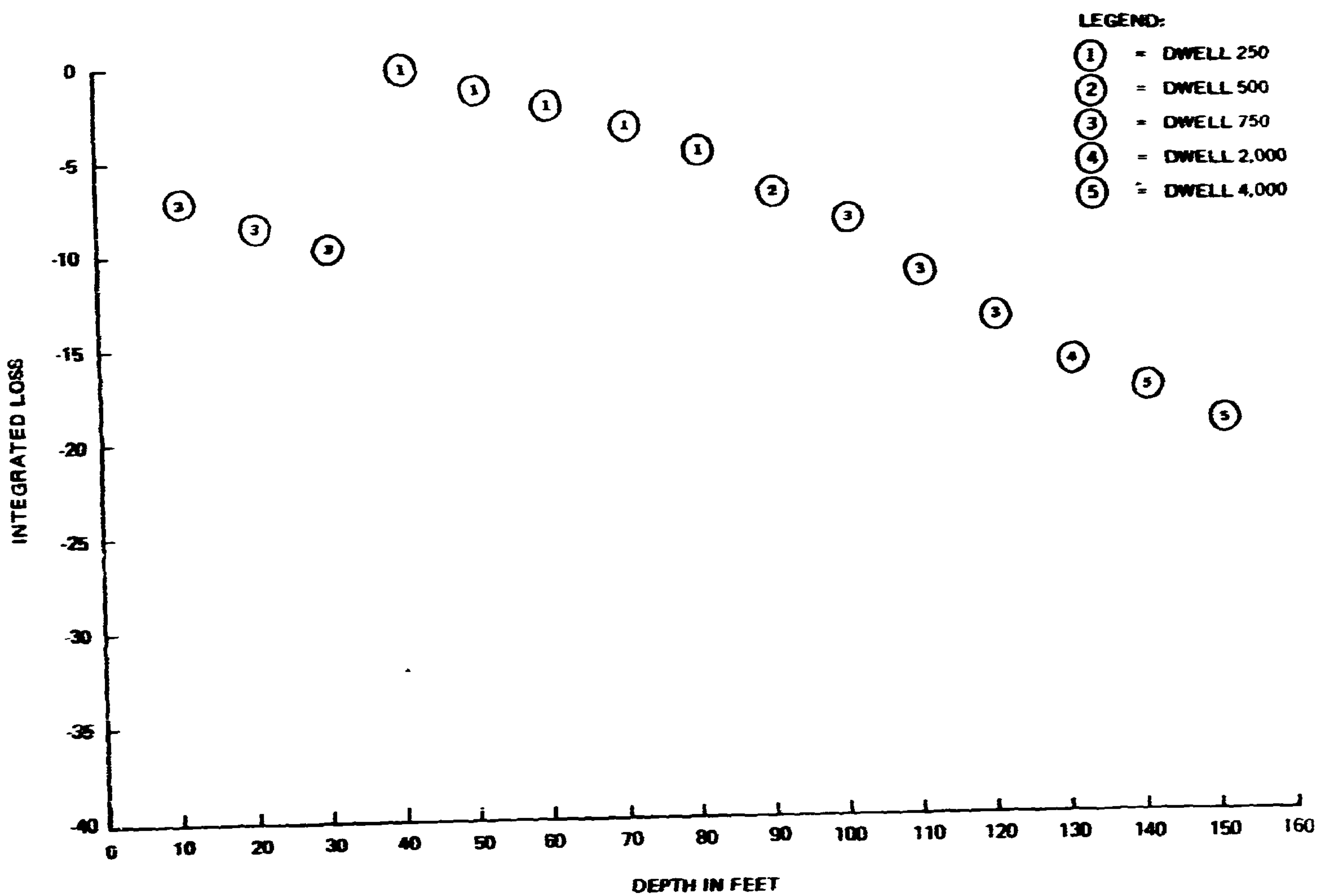


Figure 4-4A. Irradiant loss (radiance scanner).

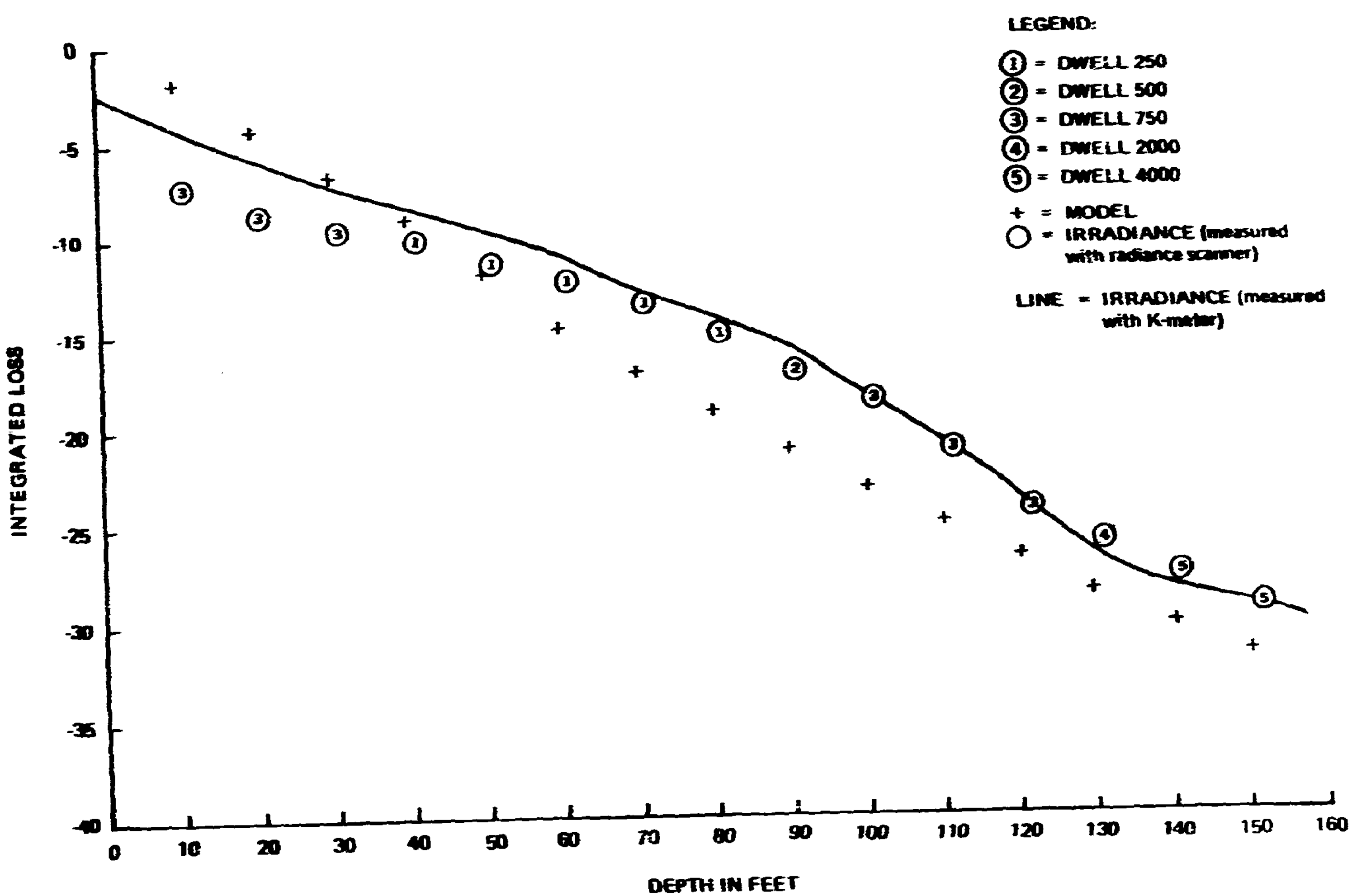


Figure 4-4B. Irradiant loss.

occurs at the shallow depths. R. W. Austin of Scripps Institution of Oceanography indicated (in private conversation) that based upon his extensive experience in K-meter measurements, the behavior in figure 4-4B is what he would expect; namely, a lower value for the radiance scanner at shallow depths with an asymptotic convergence at the deeper depths. He also expected the results at the deeper depths to be independent of whether it was a sunny or an overcast day. A suggestion has been made at NELC* that the 10 dB correction should be made by increasing the value of the shallow depth measurements. It is believed that this would be incorrect for two reasons. First, this would result in a systematic 10 dB discrepancy between the radiance measurements and the K-meter measurements. Since the latter are taken with a single instrument, this would imply a 10 dB error in calibration. Second, and more compelling, is the fact that the greatest loss occurring at 150 feet on June 20 and 24 was 19.3 dB without the 10 dB correction. However, the absorptive loss alone when projected from measurements of the absorption coefficient taken by Scripps is at least 22.5 dB for these two days. Allowing for a 10 percent error in the measurement of the absorption coefficient still results in an absorptive loss of at least 20.5 dB. Examining consecutive scans of the quick scan program at a 150 foot depth shows a peak deviation of only 0.3 dB in irradiance. Consequently, the proposed correction would violate the laws of thermodynamics. What is important to point out is that the only difference between the K-meter and the radiance scanner is that the former has a $\cos\theta$ pattern while the pattern of the latter is $\sin\theta/\theta$. Hence, within a maximum 2.16 dB factor, both measurements are identical.

Finally, figure 4-4B plots the results of the propagation model with the water calibration data inserted for the same time and day. This appears to give confirmation to within 5 dB. It is interesting to point out that the model seems conservative; so that projection to Jerlov II water made in figure 11 of Appendix A should be accurate.

By contrast, our confidence in the repeatability or accuracy of the Automatic Hemispherical Scan (AHS) program is low. This can best be explained with reference to figure 4-5 where the irradiance values obtained from the AHS are displayed. The measurements made at 50 feet were recorded in 22 consecutive scans. The irradiant loss ranged from 0.7 dB to -12.7 dB, or peak to peak of 13.4 dB. This range in irradiance values supports the earlier conjecture of an equipment malfunction. Furthermore, it took 1 hour and 15 minutes to make these measurements since each scan took approximately 4 minutes. (By contrast, the quick scan program on June 20 took 26 scans in one minute at 150 feet with 0.3 dB peak to peak deviation.) As a consequence further discussion is concentrated on the quick scan measurements with the inclusion of the 10 dB correction as proposed. Table 4-1 shows a complete data summary of the experiment; table 4-2 reports each of the quick scan measurements; and table 4-3 is a complete report of the Automatic Hemispherical Scan measurements.

4.1.2 INTERPRETATION OF DATA

As evidenced by tables 4-2 and 4-3, the bulk of the data were taken on June 24 and June 26. As it was decided not to use the Automatic Hemispherical Scan data because of large variances, and since most of the June 26 data were taken with the AHS program, we will concentrate on the June 24 data. These data consist of two distinct portions. The portion between 1111PDT and 1156PDT was taken during heavy overcast conditions (refer to paragraph 4.1.1). The airport at Santa Catalina Island reported a cloud thickness of 800 to 1,500 feet. We consider this set of data to be well calibrated. Figure 4-3 displays the hemispherical radiance pattern of the data at 150 feet. Figures 4-6A through O represent cuts of the radiance profiles taken through the sun angle (Appendix G). Also plotted are cuts through the radiance peak, and the model developed with the Scripps data inserted. Since it was an overcast day, the sun could not be considered as a point source. Instead, an initial spread (θ_0)[1] of 45° was used to simulate the isotropic

*NELC Memo Ser 2500-224, by R. D. Anderson, 17 June 1976.

[1] Appendix A, equation 6.

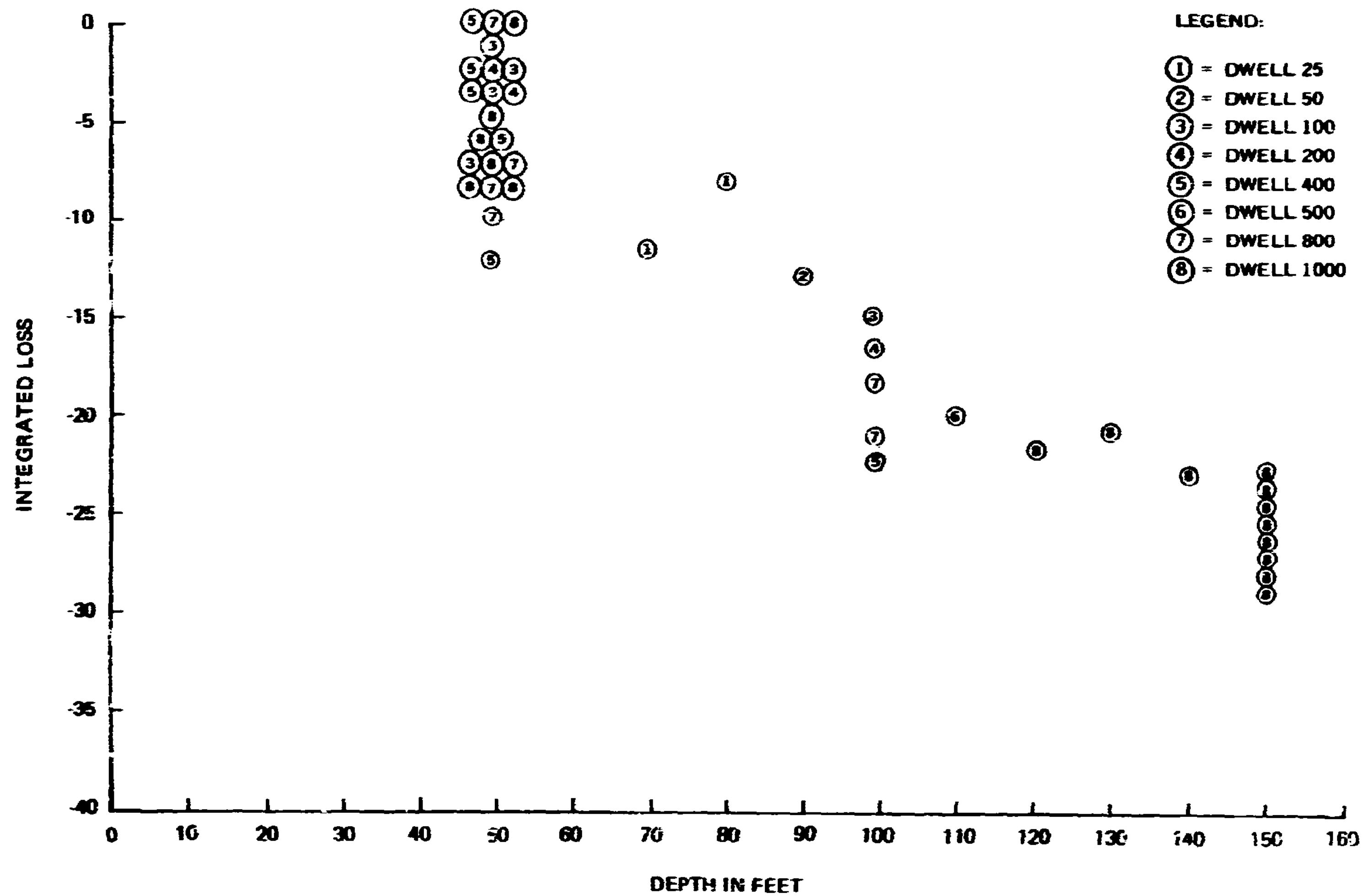


Figure 4-5. Irradiant loss (automatic hemispherical scan program).

TABLE 4-1. OPSATCOM DATA SUMMARY (SHEET 1 OF 4).

DATE	TAPE	FILE NO.	TIME	DEPTH (FEET)	DECK CELL LOG (mw/cm²)	DECK CELL TAPE	NBNF (READING)	ZENITH ANGLE	*NBNF CHECK	HORIZONTAL REF mw/cm²	CONFIDENCE	/DWELL	REMARKS
18 June	2	2	1022	50	1.72					1.72	1		
		3	1024	50	1.40					1.40	2		*NBNF Check = $\frac{4.07 \times 10^{-5}}{8} (M - 2.5)\pi$ / $\cos\theta$ w/cm²
		4	1064	100	1.72					1.72	2		
		5	1130	130	1.81					1.81			
		6	1140	100	1.74					1.74			
		7	1355	50	0.73					0.73			
19 June	2	8	0936	50	1.36					1.36			
		9	0938	50	1.36					1.36			
		10	0940	50	[illegible]					1.36			50 scans
		11	0942	50	1.36					1.36			50 scans
		12	0947	00	1.37					1.37			
		13	0957	100	1.37					1.37			50 scans
		14	1000	150	1.37	-				1.37			50 scans
20 June	5	[illegible]	0855	20	–	1.01				1.01			
		1	0858	20		1.01				1.01			no signal
		2	0902	20		1.01				1.01			
		3	0906	20		1.02	33.5	51°	0.99	1.02			50 scans
		4	0913	0.5-1		1.08	33.5		0.99	1.08			scintillation data
		5	0916	0.5-1		1.08		49°	1.05	1.08			
		6	0922	0.5-1		1.13	34.5	47°	1.11	1.13			scintillation data
		[illegible]	0930	0.5-1		1.15	34.5	46°	1.13	1.15			
		8	1003			1.31		~43°	–	1.31			no good
	3	0	1013	150		1.31	36	37°	1.36	1.31		0	
		1	1016	150		1.40			–	1.40		750	
		2	1321	150		1.40	36	~35°	1.39	1.40		750	25 scans
		3	1056	150	1.54	–	37	28°	1.55	1.54			no data
		Run 1	1111	150	1.54					1.54		750	Automatic Hemispherical Scan program.
		Run 2										↓	scrubbed dwell 750
		Run 3	1135	150	1.54		38	17°	1.72	1.54			
		Run 6	1145	150	1.66					1.66			dwell 750
		Run 7	1155	150	1.66		38	13°	1.75	1.66			dwell 750
		Run 8	1158	150	1.66					1.66			
		Run 9	1203	150	1.02					1.02			sun behind clouds intermittently
		Run 10	1209	150	0.54		39 → 4			0.54	3		clouded sun
		Run 11	1214	150			38 → 8			1.66 → 0.27	3		
		Run 12	1225	150									variable clouds
		Run 13	1230	150	1.70		39	11°	1.82	1.70			
		Run 14	1245										possible data loss
23 June	11	0	1442	~1		1.64				1.64	2		dwell 750
		1	1447	~1		1.64				1.64	2		dwell 0
		2	1451	~1		1.64				1.64	2		low signal
		3	1504	~1		1.53				1.53	2		f 2.8
		4	1506	~1		1.53				1.53	2		
		5	1517	15		1.53				1.53	2		
		6	1520	15		1.53				1.53	2		
		7	1523	15		1.53				1.53	2		

TABLE 4-1. OPSATCOM DATA SUMMARY (SHEET 2 OF 4).

DATE	TAPE	FILE NO.	TIME	DEPTH (FEET)	DECK CELL LOG (mw/cm^2)	DECK CELL TAPE	NBNF (READING)	ZENITH ANGLE	"NBNF CHECK	HORIZONTAL REF mw/cm^2	CONFIDENCE /DWELL	REMARKS
23 June	11	8	1528	15		1.53	36	35°	1.40	1.40	1	30 scans
		9	1537	65		1.53	35	37°	1.32	1.32	1	
		10	1542	65		1.53	35	38°	1.30	1.30	1	30 scans
		11	1602	65			~20			?		dwell 500, 30 frames
		12	clock off	65	0.76		~10			0.76	3	dwell 750,
		13	clock off	65	0.76					0.76	3	
24 June	4	0,1	1037	2→5	—							Bottle latern } alignment check
		2,3	1108	3→10	—							
		4	1111	10	0.42					0.42	1	4 scans } dwell 750 heavy overcast
		5	1114	20		0.43				0.43		
		6	1116	30		0.43				0.43		
		7	1121	40		0.43				0.43		dwell 250, 4 scans
		8	1124	50		0.43				0.43		4 scans
		9	1127	60		0.45				0.45		4 scans
		10	1128	70		0.45				0.45		4 scans
		11	1129	80		0.45				0.45		4 scans
		12	1133	90		0.50				0.50		
		13	1136	100		0.50				0.50		dwell 750
		14	1137	110		0.57				0.57		4 scans
		15	1138	120		0.57				0.57		4 scans
		16	1150	130		0.63				0.63		dwell 2000
		17	1154	140		0.63				0.63		dwell 4000
		18	1156	150		0.63				0.63		dwell 4000
	6	0	1548	1		1.27				1.27		206 scans } scintillation
		1	1555	10		1.27				1.27	1	209 scans } data
	7	0	1907	10		—	11.5	80°	0.08	0.08	2	
		1	1909	20			13	81°	0.07	0.09	2	analog turned off
		2	1910	30								
		3	1913	40								
		4	1915	50								
		5										
		6	1918	70							1	dwell 500, analog off
		7	1920	80		0.15				0.15	1	dwell 1000
		8	1921	90		0.15				0.15	1	dwell 2000
		9	1924	100		0.10				0.10	2	dwell 4000
		10	1926	110	0.10	0.10				0.10	2	
		11	1935	100		0.04				0.04	2	
		12	1936	90		0.04				0.04	2	
		13	1938	80		0.04				0.04	2	
		14	1939	70		0.04				0.04	2	
		15	1941	60		0.04				0.04	2	dwell 2000
		16	1943	50		0.04				0.04		
		17	1947	50		0.04				0.04		
		18	2006	50		0.02				0.02		dwell 4000
		19	2009	50		.						
		20	2015	20		-				-		

TABLE 4-1. OPSATCOM DATA SUMMARY (SHEET 3 OF 4).

DATE	TAPE	FILE NO.	TIME	DEPTH (FEET)	DECK CELL LOG ($\mu w/cm^2$)	DECK CELL TAPE	[illegible] (HEADING)	ZENITH ANGLE	*[illegible] CHECK	HORIZONTAL REF $\mu w/cm^2$	CONFIDENCE /DWELL	REMARKS
24 June	7	21	2019	above water		..				—		
26 June	10	0	1352			1.73	41	16°		1.73		dwell 250
		1	1353			1.73				1.73		out of water
		2	1354			1.73				1.73		
		3	1403	1-2		1.73	4?	18°		1.73		dwell 250
		4	1428	1-2		1.49	40.5	23°		1.49		dwell 0
		5	1440	10		1.49				1.49		dwell 0
		6	1443	10		1.45		26°		1.45	* lens set	dwell 250 — 200 scans each
		7	1506	10		1.41				1.41	f #22 → *	dwell 0
	9	0	1529	1-2		1.36	40	36°		1.36		dwell 0
		1	1538	20		1.30				1.30		
		2	1540	20		1.30				1.30		
		3	1541	30		1.30				1.30		
		4	1542	30		1.30				1.30		
		5	1544	40		1.30				1.30		
		6	1545	40		1.30				1.36		
	8	0	1637	50			38	~50°	1.16	1.16		dwell 0
		1	1646	60			36.5	52°	1.06	1.06		
		2	1657	70			36.5	54°	1.02	1.02		dwell 025
		3	1708	80			36.5	56°	0.97	0.97		
		4	1718	90			35.5	58°	0.89	0.89		dwell 050
		5	1722	90			35	59°	0.85	0.85		dwell 100
		6	1727	100			35	60°	0.82	0.82		dwell 200
		7	1732	110			34	61°	0.78	0.78		dwell 500
		8	1736	120			34.0	62°	0.75	0.75	1000	dwell 1000 → maximum on these readings
		9	1740	130			33.5	63°	0.72	0.72		(= 10 mean)
		10	1746	140			33.0	64°	0.68	0.68		
		11	1751	140			33.0	65°	0.66	0.66		
		12	1755	150			32.3	66°	0.61	0.61		
		13	1800	150			31.0	67°	0.57	0.57		
		14	1803	150			30.5	67°	0.56	0.56		
		15	1806	150			30.5	68°	0.53	0.53		
		16	1810	156			29.0	69°	0.48	0.48		
		17	1820	150			28.5	71°	0.43	0.43		
		18	1823	150			28.0	71°	0.42	0.42		
		19	1829	150			26.0	73°	0.35	0.35		
		20	1836	156			25.5	74°	0.32	0.32	400	
		21	1840	100			23.0	75°	0.27	0.27	400	
		22	1849	100			21.5	77°	0.22	0.22	800	
		23	1855	100			20.5	78°	0.19	0.19	800	
		24	1859	50			18.0	79°	0.15	0.15	400	
		25	1909	50			15.0	81°	0.10	0.10	100	
		26	1915	50			14.0	82°	0.08	0.08	100	
		27	1918	50			13.5	82°	0.08	0.08	200	
		28	1921	50			12.5	83°	0.06	0.06	200	
		29	1923	50			11.5	83°	0.06	0.06	200	

TABLE 4-1. OPSATCOM DATA SUMMARY (SHEET 4 OF 4).

DATE	TAPE	FILE NO.	TIME	DEPTH (FEET)	DECK CELL LOG (mw/cm²)	DECK CELL TAPE	[illegible] (READING)	ZENITH ANGLE	"[illegible] CHECK	HORIZONTAL REF mw/cm²	CONFIDENCE	/DWELL	REMARKS
26 June	8	30	1927	50			10.[illegible]	84°	0.04	0.04	1	400	
		31	1930	50			10.0	85°	0.03	0.03	1	400	
		32	1932	50			8.0	85°	0.02	0.02	1	400	
		33	1936	50			6.5	86°	0.01	0.01	2	400	
		34	1939	50			5.5	86°	0.01	0.01	2	400	dwell either 400 or 800
		35	1942	50			5.0	87°	0.007	0.007	2	800	
		36	1946	50			4.0	88°	0.003	0.003	2	800	
		37	1949	50			noise + 1.0	88°	0.002	0.002	3	800	
		38	1952	50			noise + 0.5	89°	–	–		800	
		39	1956	50			noise + 0.5	89°	–	–		1000	
		40	1959	50			noise ↓			uncalibrated ↓			
		41	2002	50									
		42	2005	50									
		43	2008	50									
		44	2011	50									
		45	2014	50									
		46	2017	5" out of water			noise			uncalibrated			
17 July	–	Run 1	1125	out of water							f #22	0	dwell = 0, overcast, ceiling ~ 100 feet
		Run 2	no good									↓	
		Run 3	1145								f #2.8		
		Run 4	1200	out of water ↓	0.52					0.52			
		Run 5	1243		0.68					0.68			
		Run 6	1253									↓	
		Run 7	1305	out of water								0	overcast breaking up
19 July		Run 2											
24 July		Run 0	← 1357				36	42°					no log data
		Run 18											

TABLE 4-2. QUICK SCAN MEASUREMENTS (SHEET 1 OF 2).

DEPTH (FT)	JUNE 18	JUNE 19	JUNE 20	JUNE 20	JUNE 20	JUNE 23	JUNE 23	JUNE 23	JUNE 23	JUNE 23	JUNE 24	JUNE 24
1				0818 PDT 19.8 dB NEARLY CLEAR GAIN 11	0830 PDT 18.7 dB NEARLY CLEAR GAIN 10	1442 PDT 40.7 dB SCATTERED CLOUDS DWELL 750 GAIN 11	1447 PDT 29.1 dB SCATTERED CLOUDS DWELL 0 GAIN 11	1451 PDT 34.2 dB SCATTERED CLOUDS DWELL 0 GAIN 11	1454 PDT 3.6 dB SCATTERED CLOUDS DWELL 0 GAIN 0	1504 PDT 10.2 dB SCATTERED CLOUDS DWELL 0 GAIN 01		1948 PDT 8.6 dB HEAVY OVERCAST GAIN 1
10											1111 PDT 7.4 dB HEAVY OVERCAST DWELL 750 GAIN 11	1955 PDT 8.1 dB HEAVY OVERCAST GAIN 1
20			0858 PDT 2.2 dB NEARLY CLEAR	0902 PDT 1.4 dB NEARLY CLEAR	0906 PDT 1.2 dB NEARLY CLEAR GAIN 01		1517 PDT 3.4 dB SCATTERED CLOUDS DWELL 0 GAIN 10	1520 PDT 1.1 dB SCATTERED CLOUDS DWELL 0 GAIN 01	1523 PDT 1.0 dB SCATTERED CLOUDS DWELL 0 GAIN 00	1526 PDT -0.3 dB SCATTERED CLOUDS DWELL 0 GAIN 00	1114 PDT -8.6 dB HEAVY OVERCAST DWELL 750 GAIN 11	
30											1117 PDT -6.6 dB HEAVY OVERCAST DWELL 750 GAIN 11	
40											1121 PDT -3.7 dB HEAVY OVERCAST DWELL 750 GAIN 11	
50	1022 PDT 3.7 dB PTLY CLOUDY GAIN 10	0837 PDT 22.9 dB									1124 PDT 1.3 dB HEAVY OVERCAST DWELL 750 GAIN 11	1943 PDT -1.5 dB LOW SUN DWELL 2000 GAIN 11
60											1127 PDT 2.4 dB HEAVY OVERCAST DWELL 750 GAIN 11	
70									1537 PDT -9.4 dB SCATTERED CLOUDS DWELL 0 GAIN 10	1542 PDT -9.8 dB SCATTERED CLOUDS DWELL 0 GAIN 11	1126 PDT 3.5 dB HEAVY OVERCAST DWELL 750 GAIN 11	
80											1129 PDT 4.9 dB HEAVY OVERCAST DWELL 750 GAIN 11	1920 PDT 8.9 dB HEAVY OVERCAST DWELL 1000 GAIN 11
90											1133 PDT 4.9 dB HEAVY OVERCAST DWELL 900 GAIN 11	1921 PDT -11.8 dB HEAVY OVERCAST DWELL 2000 GAIN 11
100											1136 PDT 8.5 dB HEAVY OVERCAST DWELL 750 GAIN 11	1924 PDT 11.9 dB HEAVY OVERCAST DWELL 4000 GAIN 11
110											1137 PDT 11.2 dB HEAVY OVERCAST DWELL 750 GAIN 11	1926 PDT 14.3 dB LIGHT CLOUDS DWELL 4000 GAIN 11
120											1138 PDT 13.7 dB HEAVY OVERCAST DWELL 750 GAIN 11	
130											1150 PDT 16.0 dB HEAVY OVERCAST DWELL 2000 GAIN 11	
140											1154 PDT 17.6 dB HEAVY OVERCAST DWELL 4000 GAIN 11	
150			1013 PDT 18.3 dB NEARLY CLEAR DWELL 0 GAIN 11	1016 PDT 15.8 dB NEARLY CLEAR DWELL 750 GAIN 11	1020 PDT 18.3 dB NEARLY CLEAR DWELL 750 GAIN 11						1156 PDT 19.3 dB HEAVY OVERCAST DWELL 4000 GAIN 11	

TABLE 4-2. QUICK SCAN MEASUREMENTS (SHEET 2 OF 2).

DEPTH (IN FT)	JUNE 24	JUNE 24	JUNE 26	JUNE 26	JUNE 26							
1			1539 PDT 16.9 dB DWELL 0 GAIN 10									
10												
20			1539 PDT 19.7 dB DWELL 0 GAIN 10	1540 PDT 19.8 dB DWELL 0 GAIN 10								
30				1541 PDT -21.8 dB DWELL 0 GAIN 10	1542 PDT -22.2 dB DWELL 0 GAIN 10							
40				1544 PDT -26.5 dB DWELL 0 GAIN 10	1545 PDT -26.9 dB DWELL 0 GAIN 10							
50	1947 PDT -3.4 dB LOW SUN DWELL 2000 GAIN 11	2000 PDT 4.6 dB LOW SUN DWELL 2000 GAIN 11										
60	1941 PDT 3.3 dB LOW SUN DWELL 2000 GAIN 11											
70	1938 PDT -3.7 dB LOW SUN DWELL 4000 GAIN 11											
80	1938 PDT 5.3 dB LOW SUN DWELL 4000 GAIN 11											
90	1938 PDT -7.0 dB LOW SUN DWELL 4000 GAIN 11											
100	1936 PDT -8.7 dB CLEAR SKY LOW SUN DWELL 4000 GAIN 11											
110												
120												
130												
140												
150												

TABLE 4-3. AUTOMATIC HEMISPHERICAL SCAN MEASUREMENTS (SHEET 1 OF 2).

DEPTH (IN FT)	JUNE 20	JUNE 20	JUNE 20	JUNE 20	JUNE 20	JUNE 20	JUNE 20	JUNE 20	JUNE 20	JUNE 20	JUNE 21	JUNE 20
1												
10												
20												
30												
40												
50	1800 PDT -12.7 dB DWELL 400	1806 PDT -1.0 dB DWELL 100	1815 PDT 2.2 dB DWELL 100	1818 PDT -6.4 dB DWELL 100	1821 PDT 2.1 dB DWELL 300	1823 PDT -1.0 dB DWELL 200	1827 PDT -4.0 dB DWELL 400	1830 PDT 0.0 dB DWELL 400	1836 PDT -0.5 dB DWELL 400	1838 PDT -2.0 dB DWELL 400	1839 PDT -1.0 dB DWELL 400	1842 PDT -0.0 dB DWELL 800
60												
70		1687 PDT -11.3 dB DWELL 20										
80		1700 PDT -7.0 dB DWELL 20										
90		1710 PDT -12.0 dB DWELL 60	1722 PDT -16.0 dB DWELL 100									
100			1727 PDT -18.0 dB DWELL 200									
110			1732 PDT -19.0 dB DWELL 300									
120			1736 PDT -21.3 dB DWELL 1000									
130				1740 PDT 20.4 dB DWELL 1000								
140				1746 PDT -22.8 dB DWELL 1000	1751 PDT -27.0 dB DWELL 1000							
150					1756 PDT -24.0 dB DWELL 1000	1759 PDT -24.8 dB DWELL 1000	1803 PDT -26.1 dB DWELL 1000	1806 PDT -24.7 dB DWELL 1000	1810 PDT -25.7 dB DWELL 1000	1820 PDT -26.3 dB DWELL 1000	1823 PDT -27.3 dB DWELL 1000	1826 PDT -27.3 dB DWELL 1000

TABLE 4-3. AUTOMATIC HEMISPHERICAL SCAN MEASUREMENTS (SHEET 2 OF 2).

DEPTH (IN FT)	JUNE [illegible]	JUNE [illegible]	JUNE [illegible]	JUNE [illegible]	JUNE [illegible]	JUNE [illegible]	JUNE [illegible]	JUNE [illegible]	JUNE [illegible]	JUNE [illegible]		
1												
10										2017 PDT 0.3 dB		
20												
30												
40												
50	1946 PDT 5.0 dB DWELL 800	1940 PDT 7.4 dB DWELL 800	1952 PDT 9.6 dB DWELL 800	1956 PDT 7.4 dB DWELL 1000	1960 PDT -7.4 dB DWELL 1000	2001 PDT 6.0 dB DWELL 1000	2005 PDT 5.0 dB DWELL 1000	2008 PDT 4.1 dB DWELL 1000	2011 PDT 3.2 dB DWELL 1000	2014 PDT 11.7 dB DWELL 1000		
60												
70												
80												
90												
100	1940 PDT 22.0 dB DWELL 400	1940 PDT -21.0 dB DWELL 800	1955 PDT 18.8 dB DWELL 800									
110												
120												
130												
140												
150	1838 PDT 22.6 dB DWELL 400											

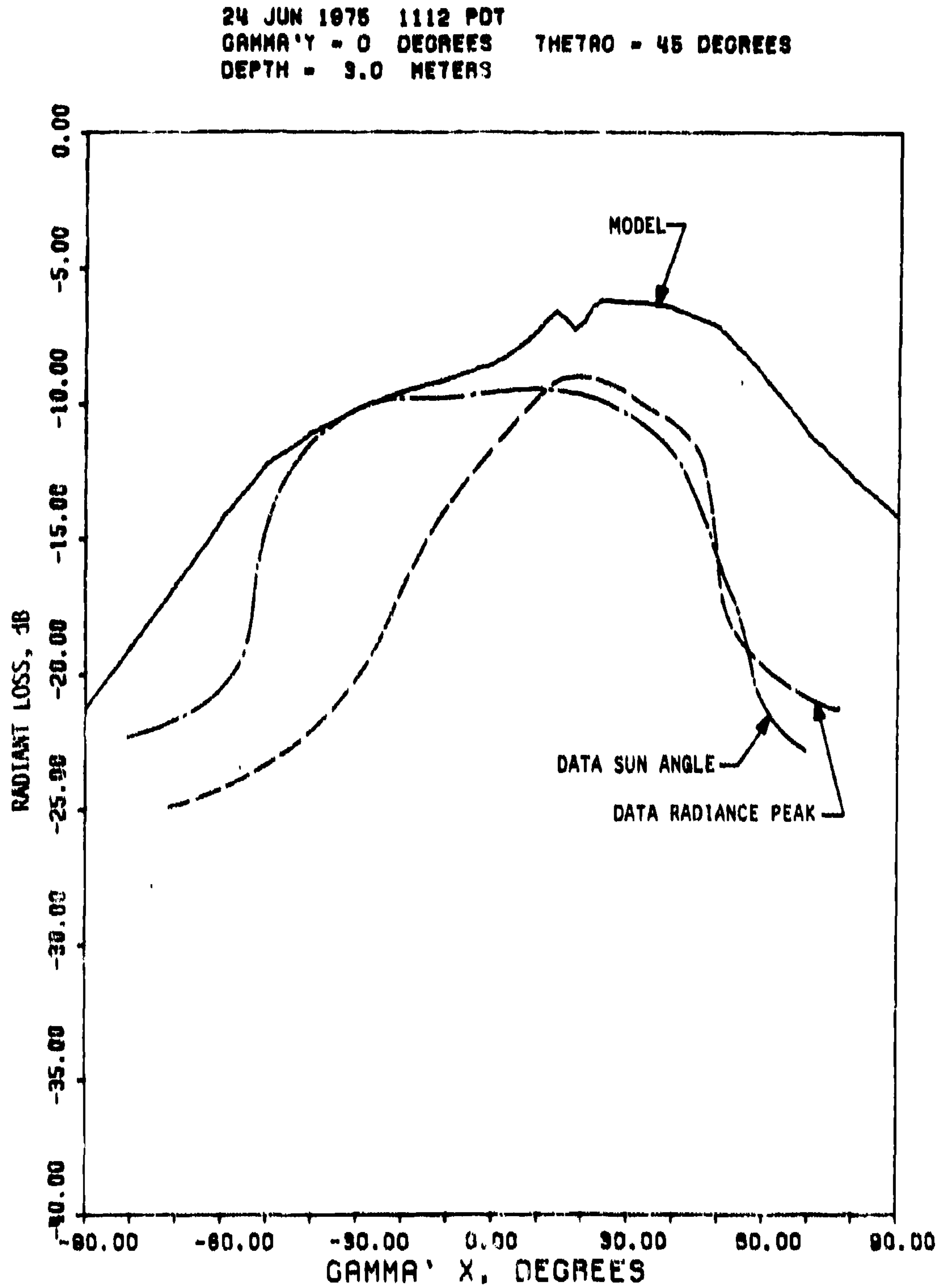


Figure 4-6A. Radiance profile through sun angle.

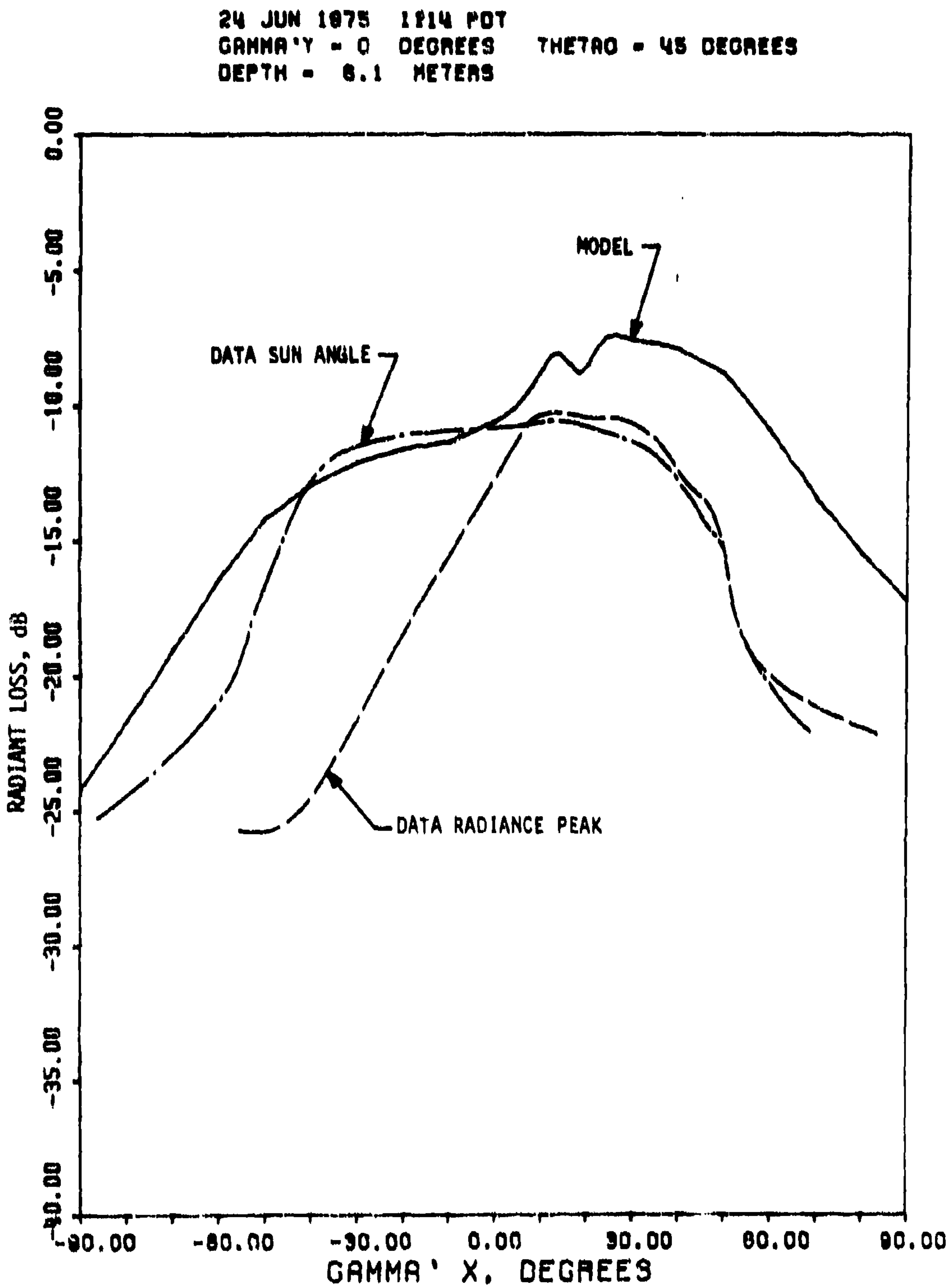


Figure 4-6B. Radiance profile through sun angle.

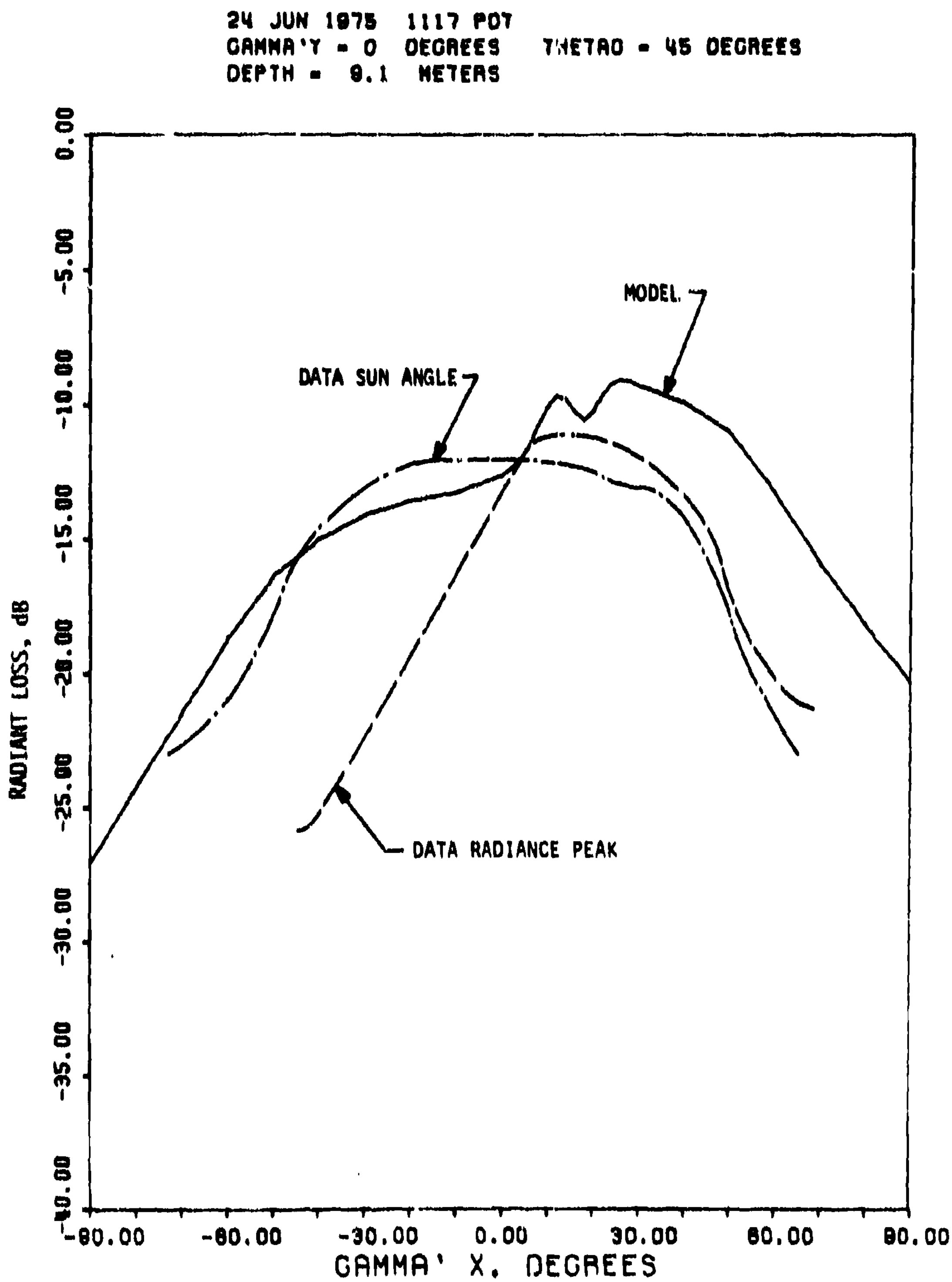


Figure 4-6C. Radiance profile through sun angle.

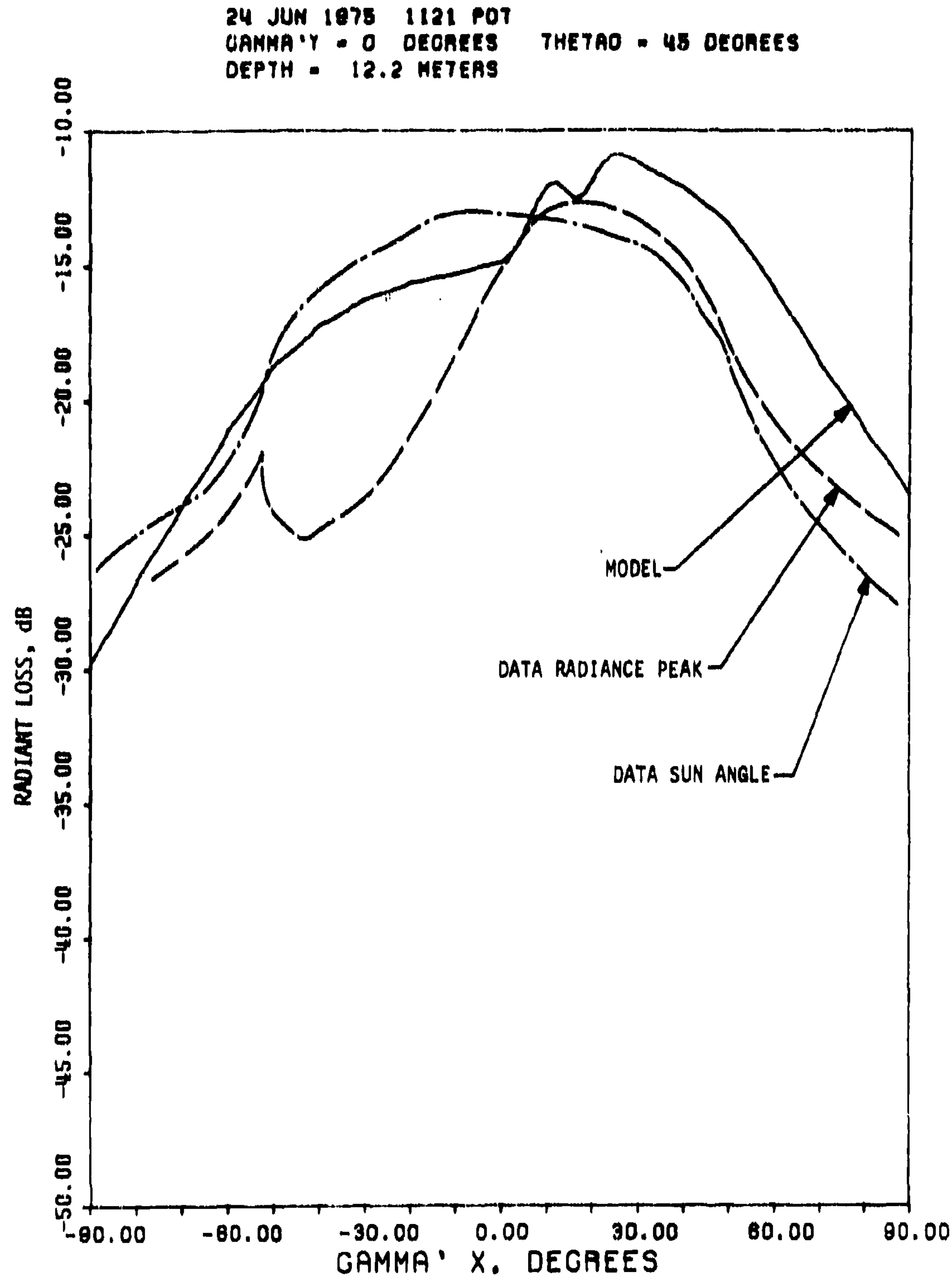


Figure 4-6D. Radiance profile through sun angle.

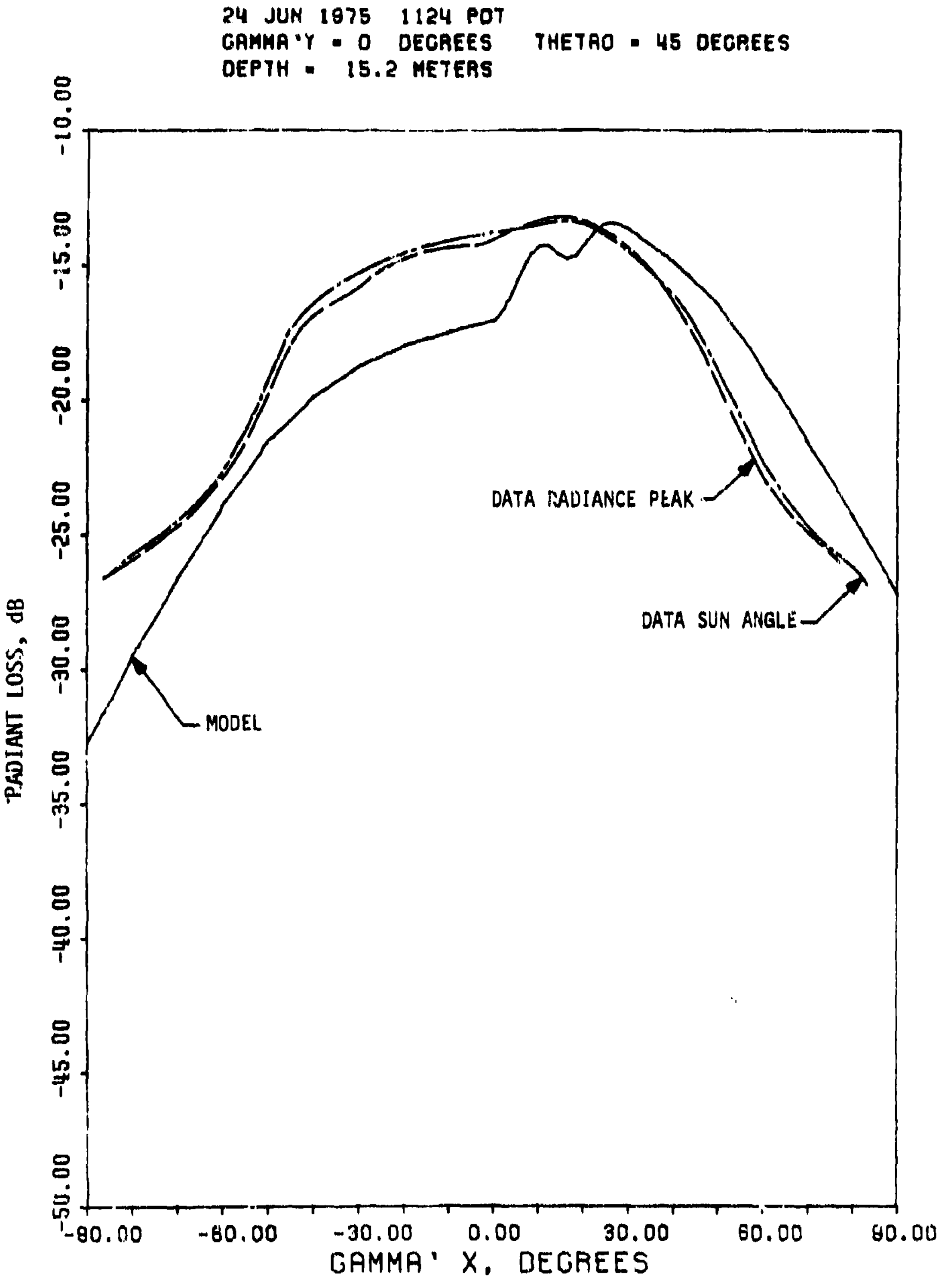


Figure 4-6E. Radiance profile through sun angle.

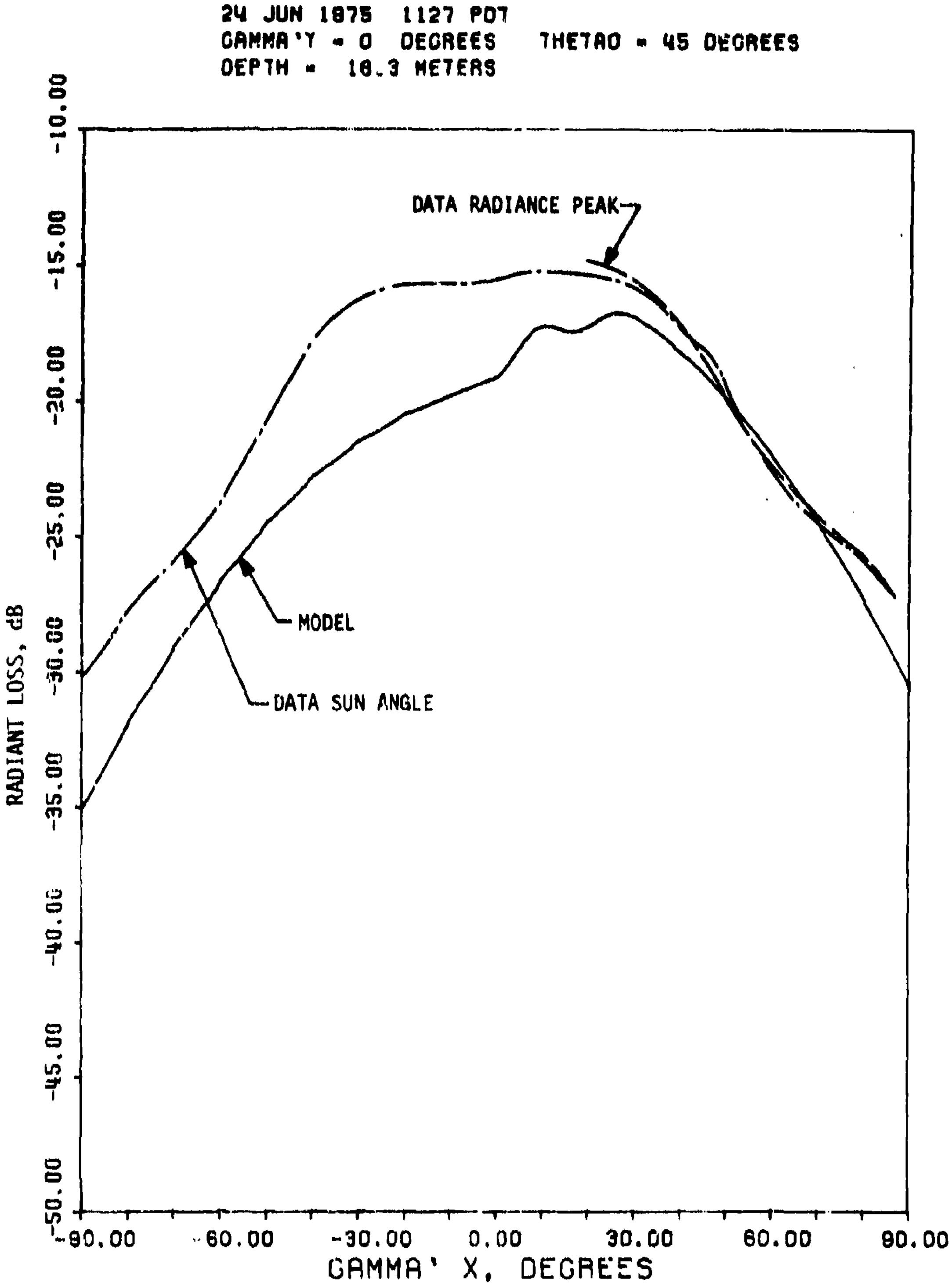


Figure 4-6F. Radiance profile through sun angle.

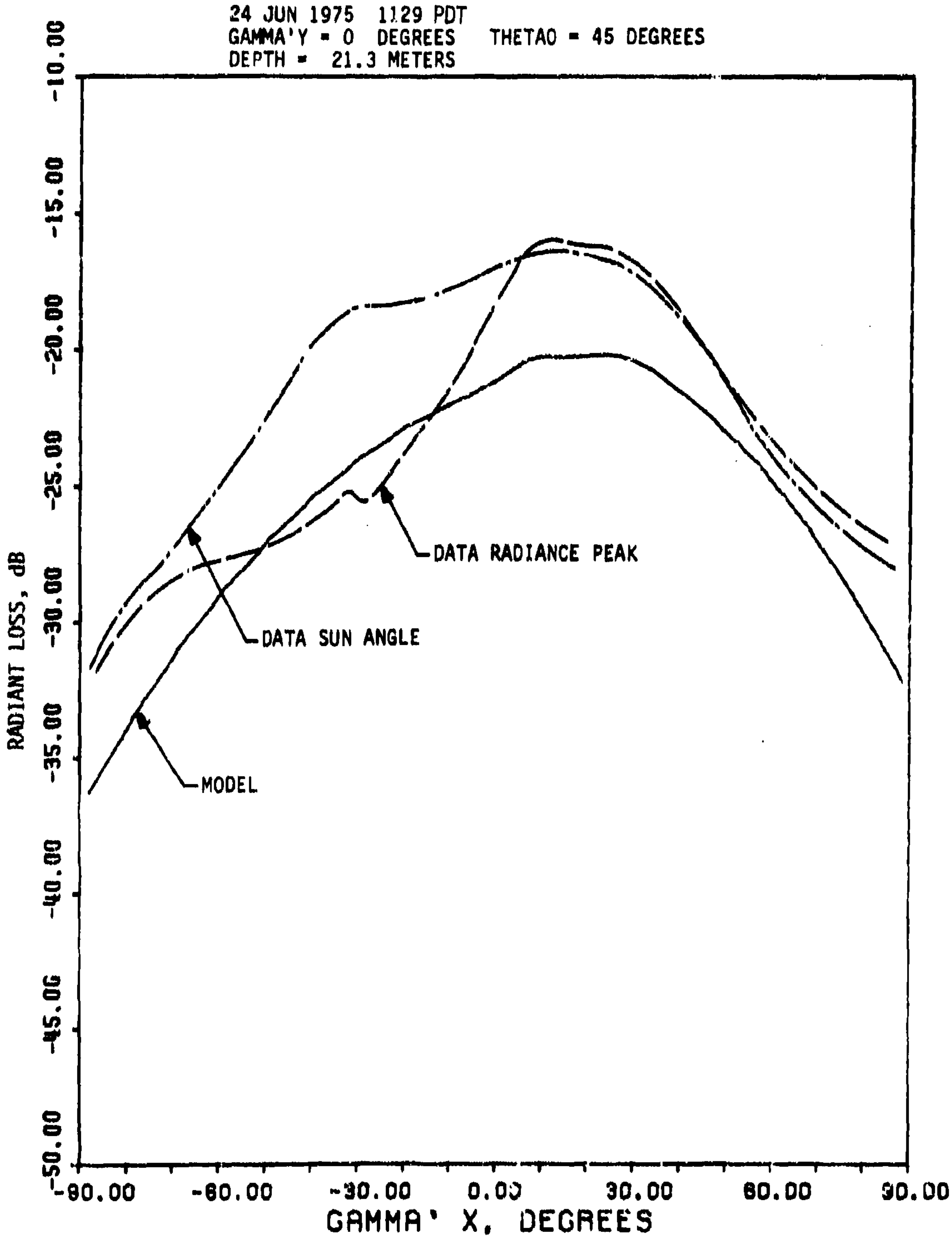


Figure 4-6G. Radiance profile through sun angle.

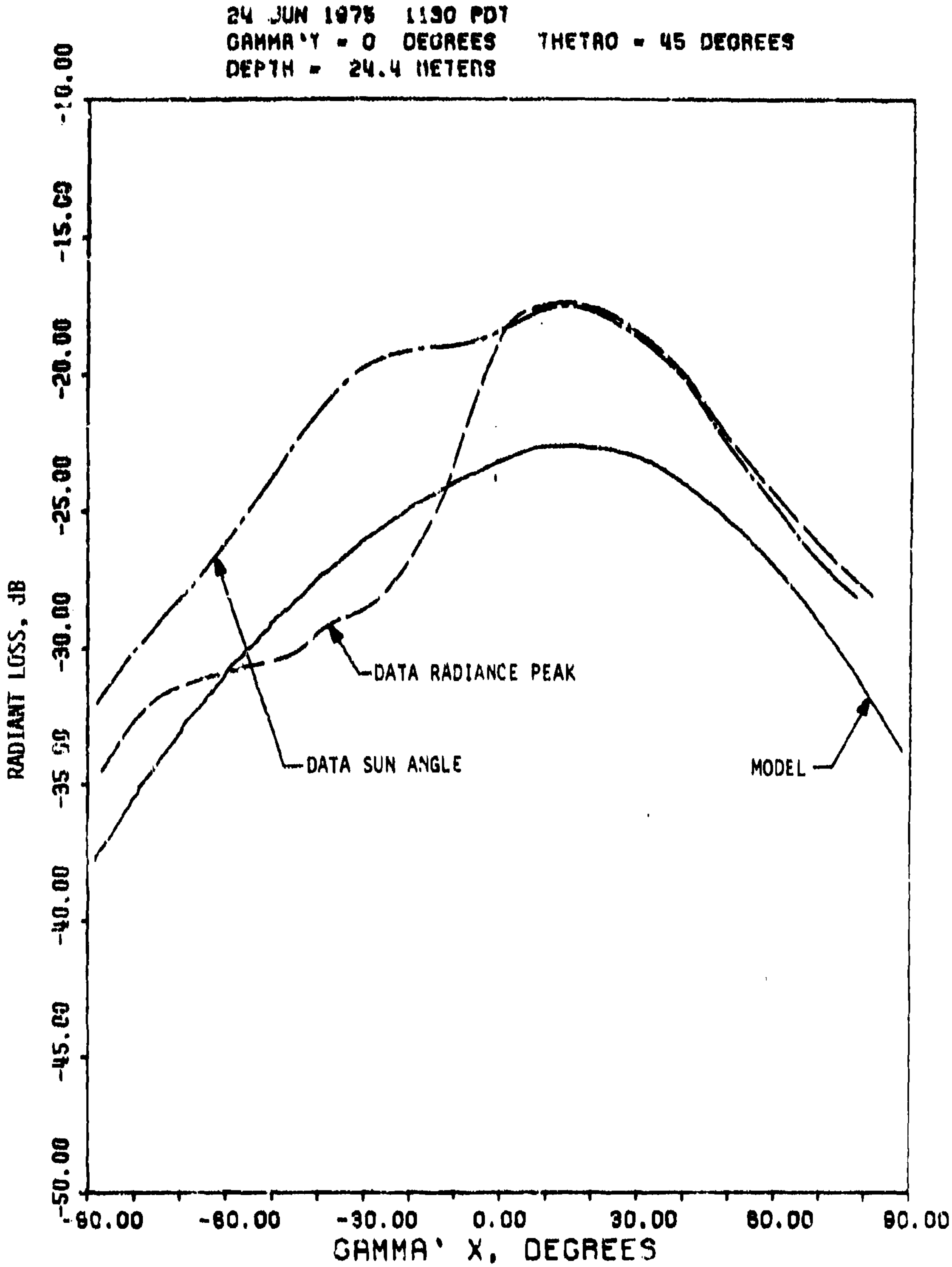


Figure 4-6H. Radiance profile through sun angle.

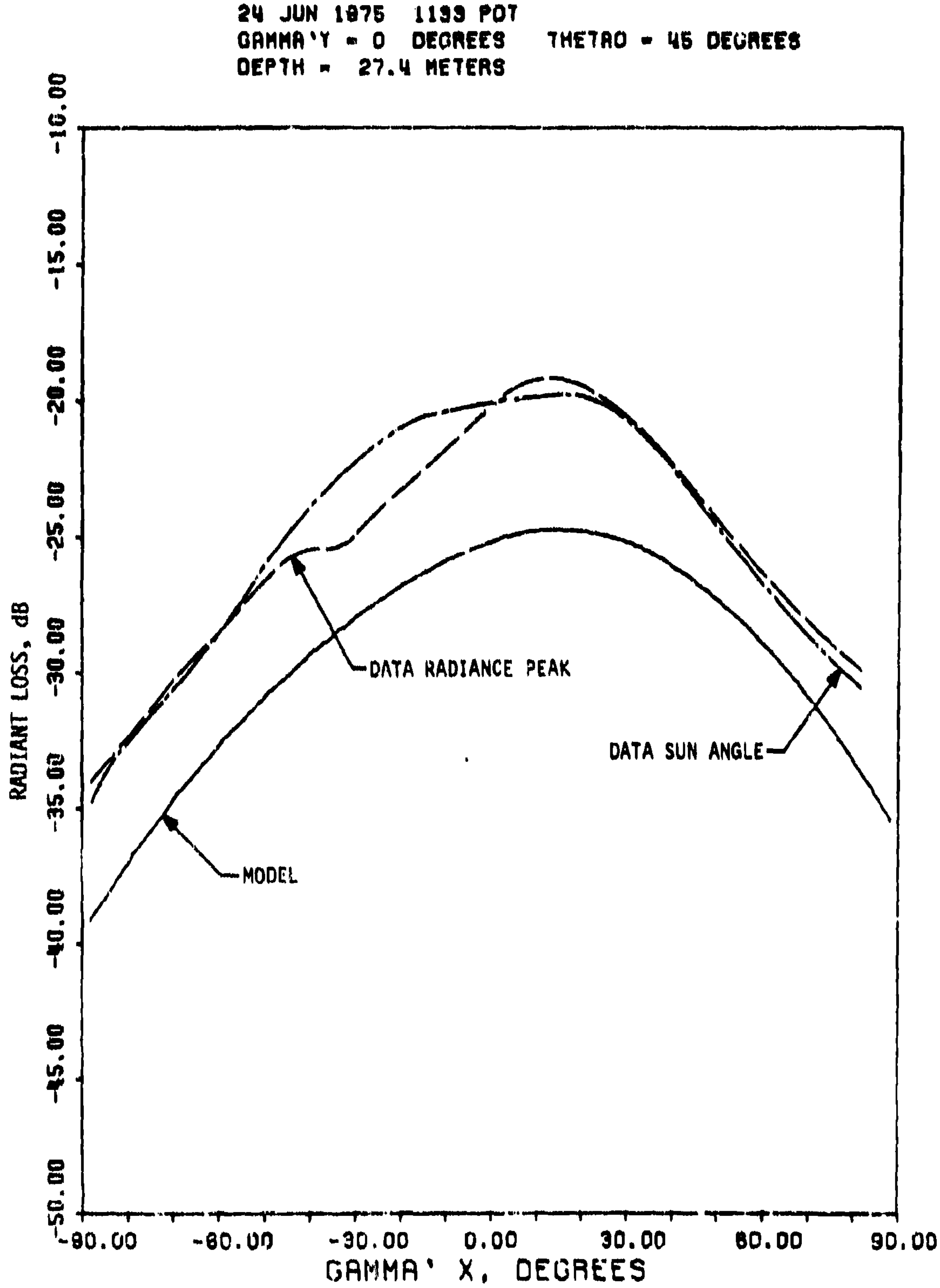


Figure 4-51. Radiance profile through sun angle.

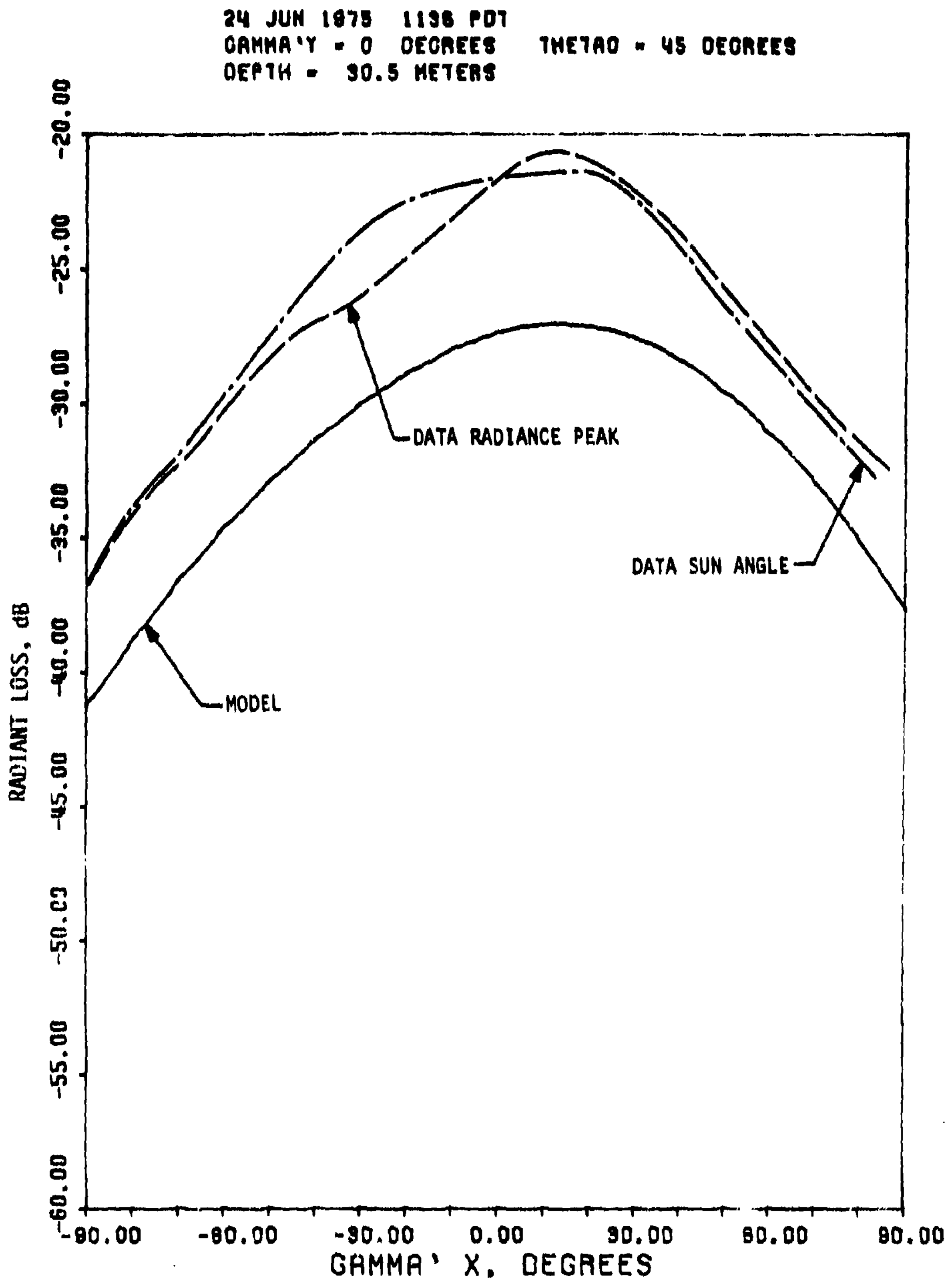


Figure 4-6J. Radiance profile through sun angle.

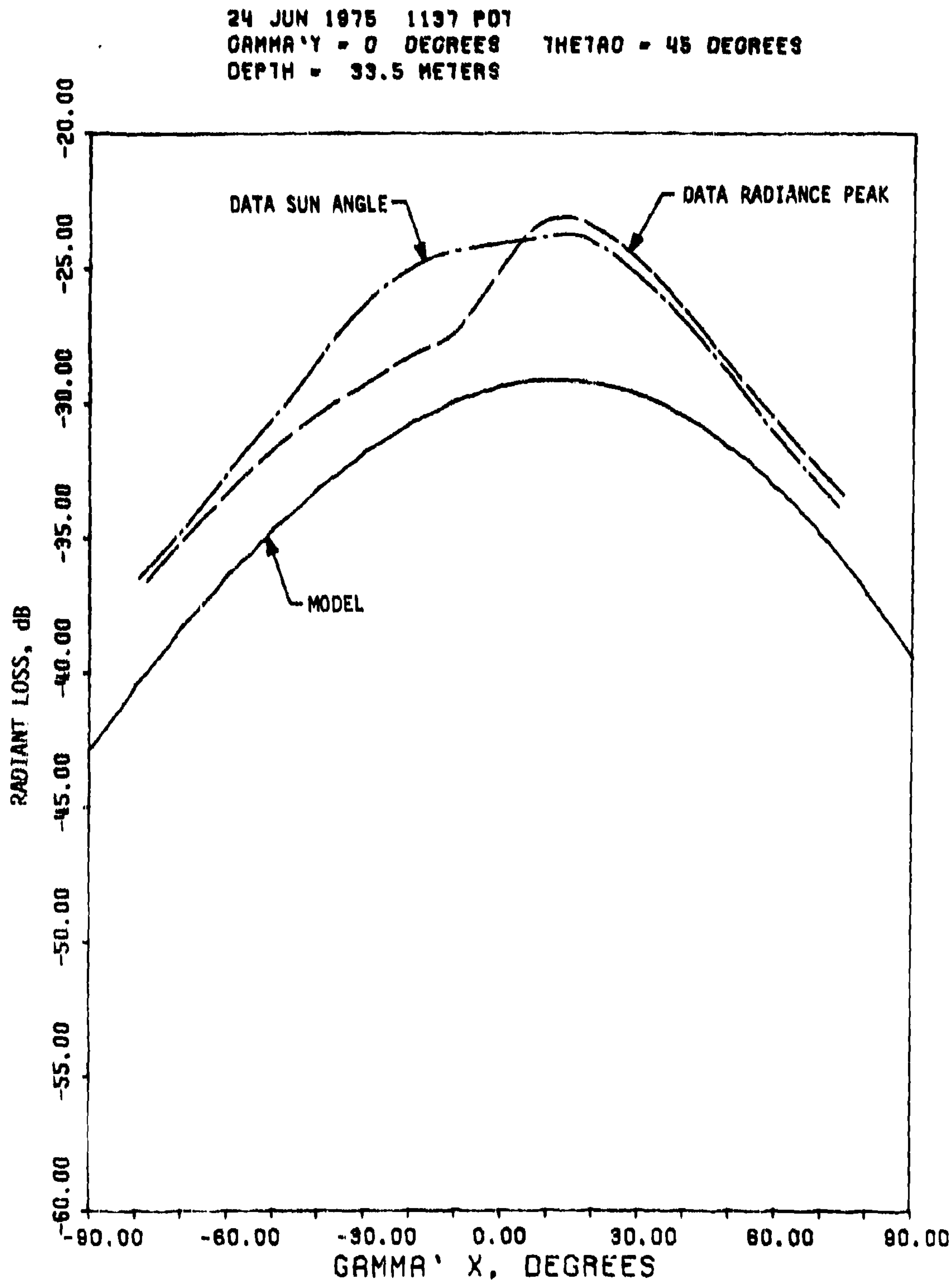


Figure 4-6K. Radiance profile through sun angle.

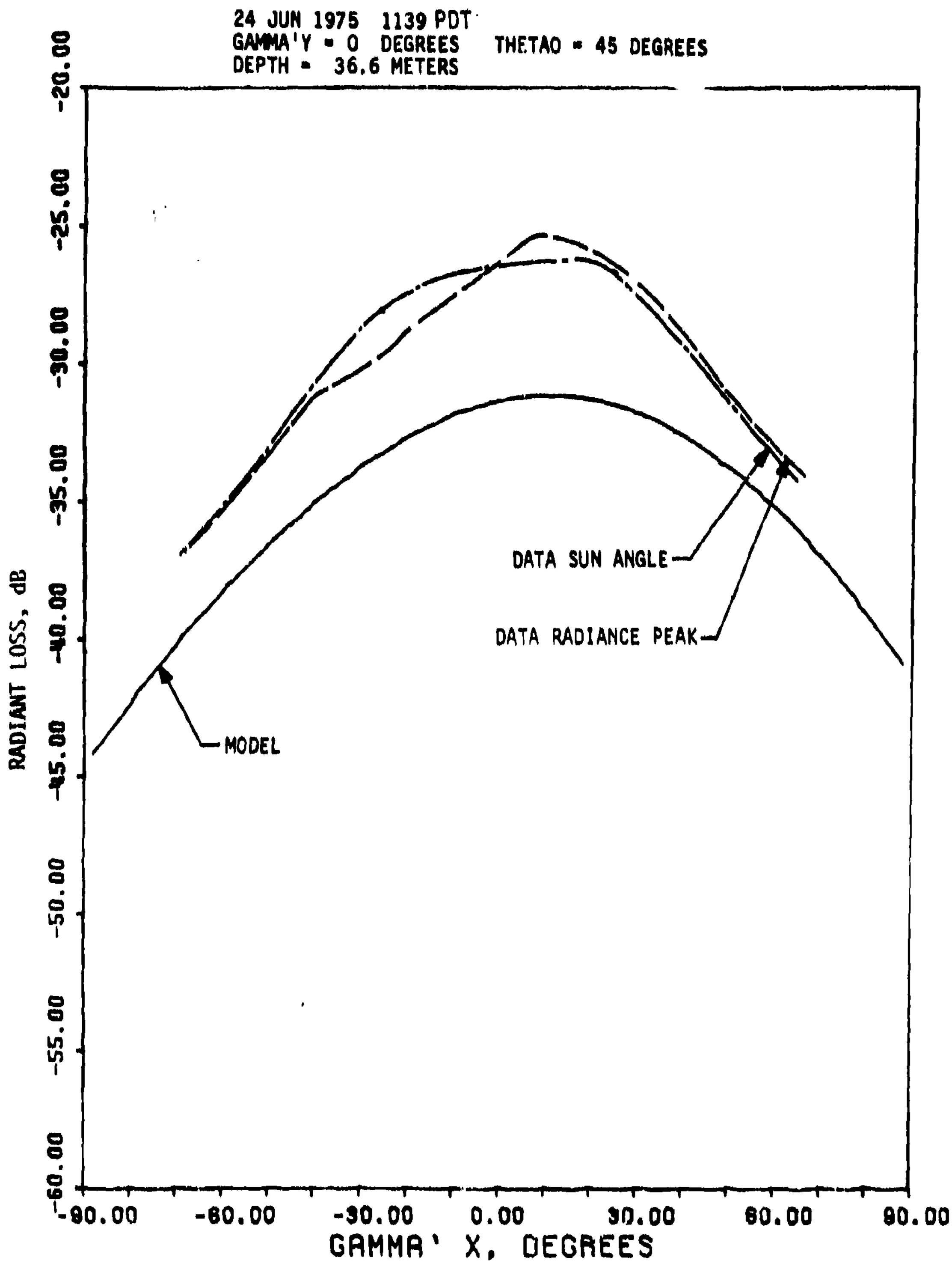


Figure 4-6L. Radiance profile through sun angle.

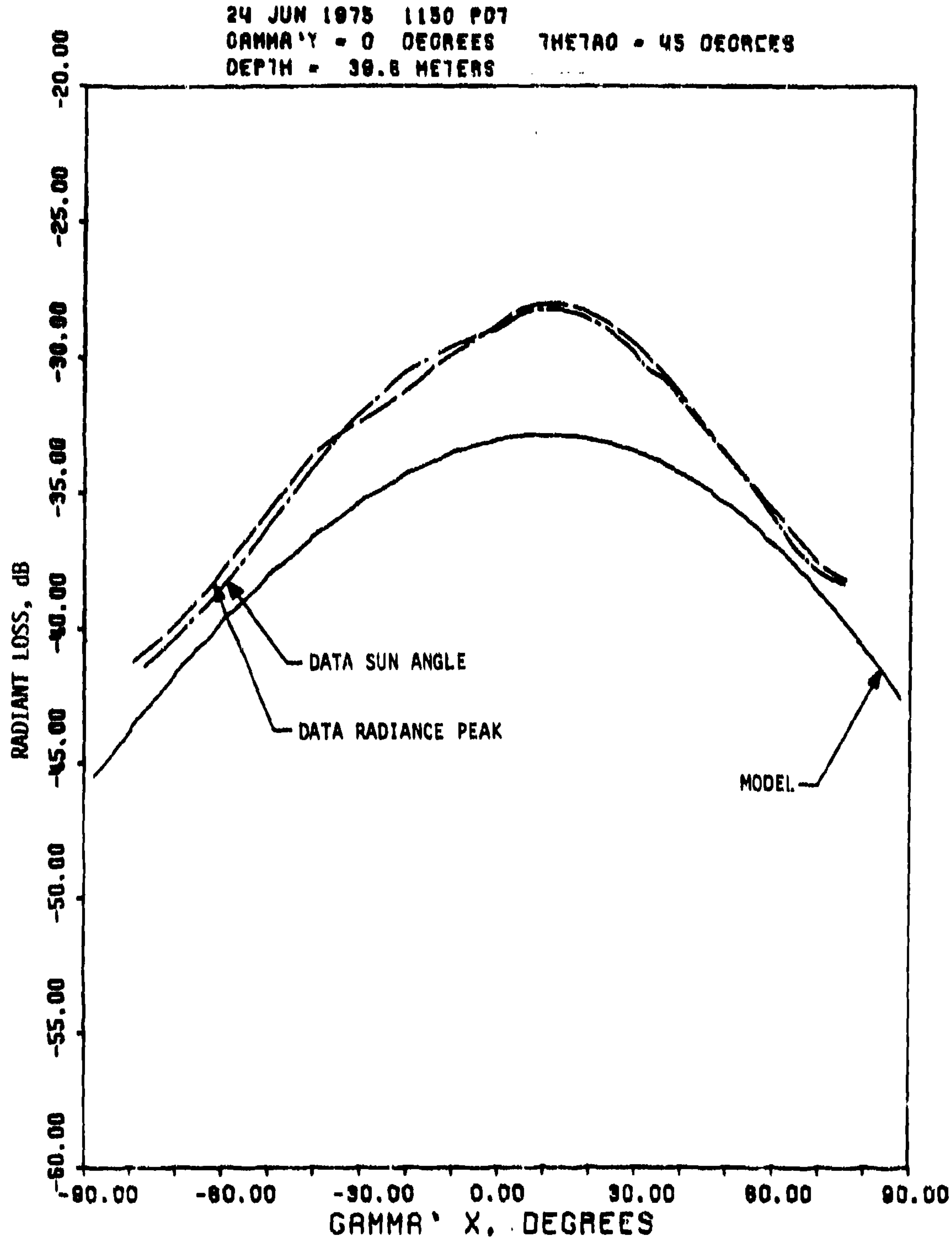


Figure 4-6M. Radiance profile through sun angle.

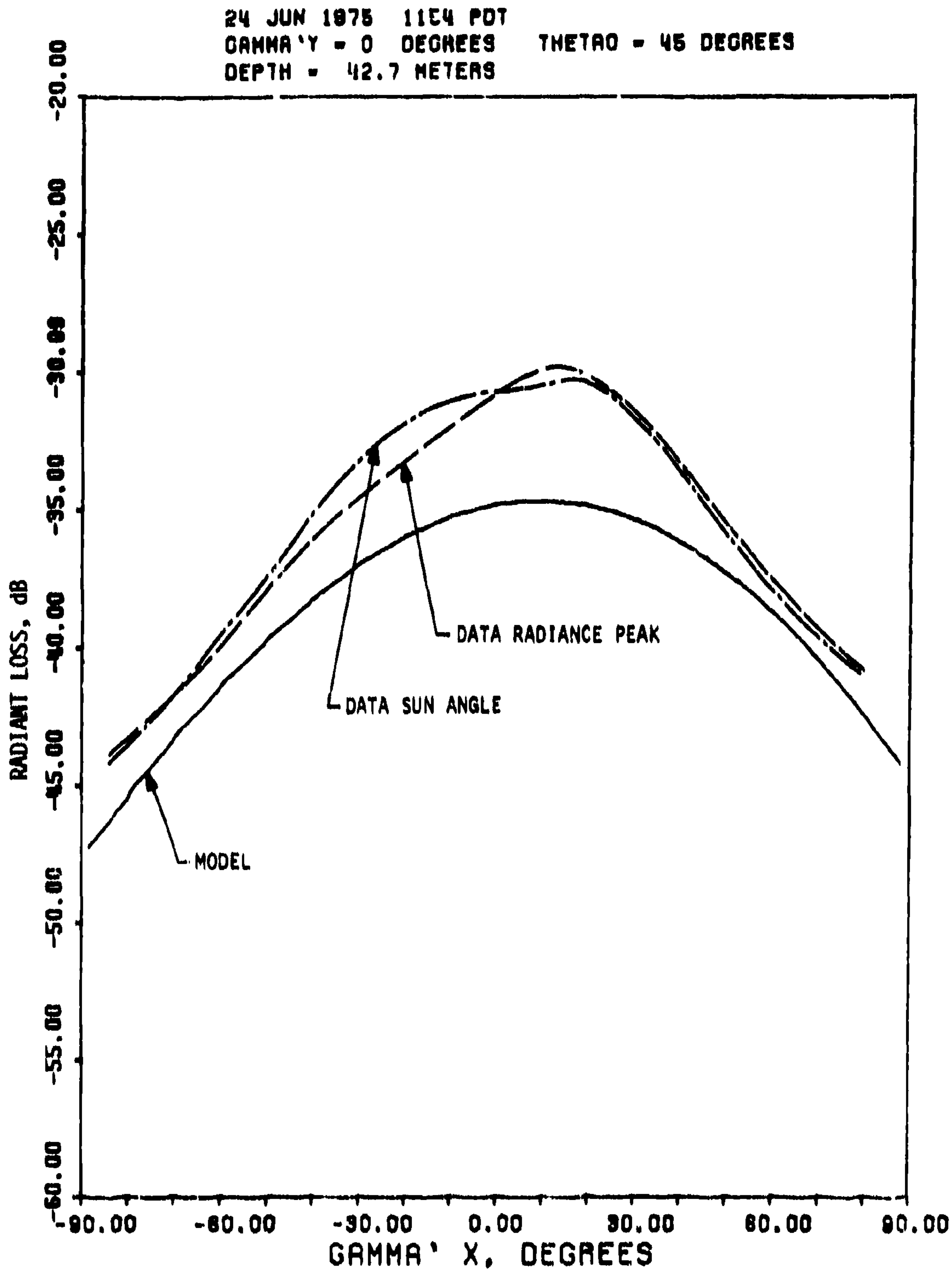


Figure 4-6N. Radiance profile through sun angle.

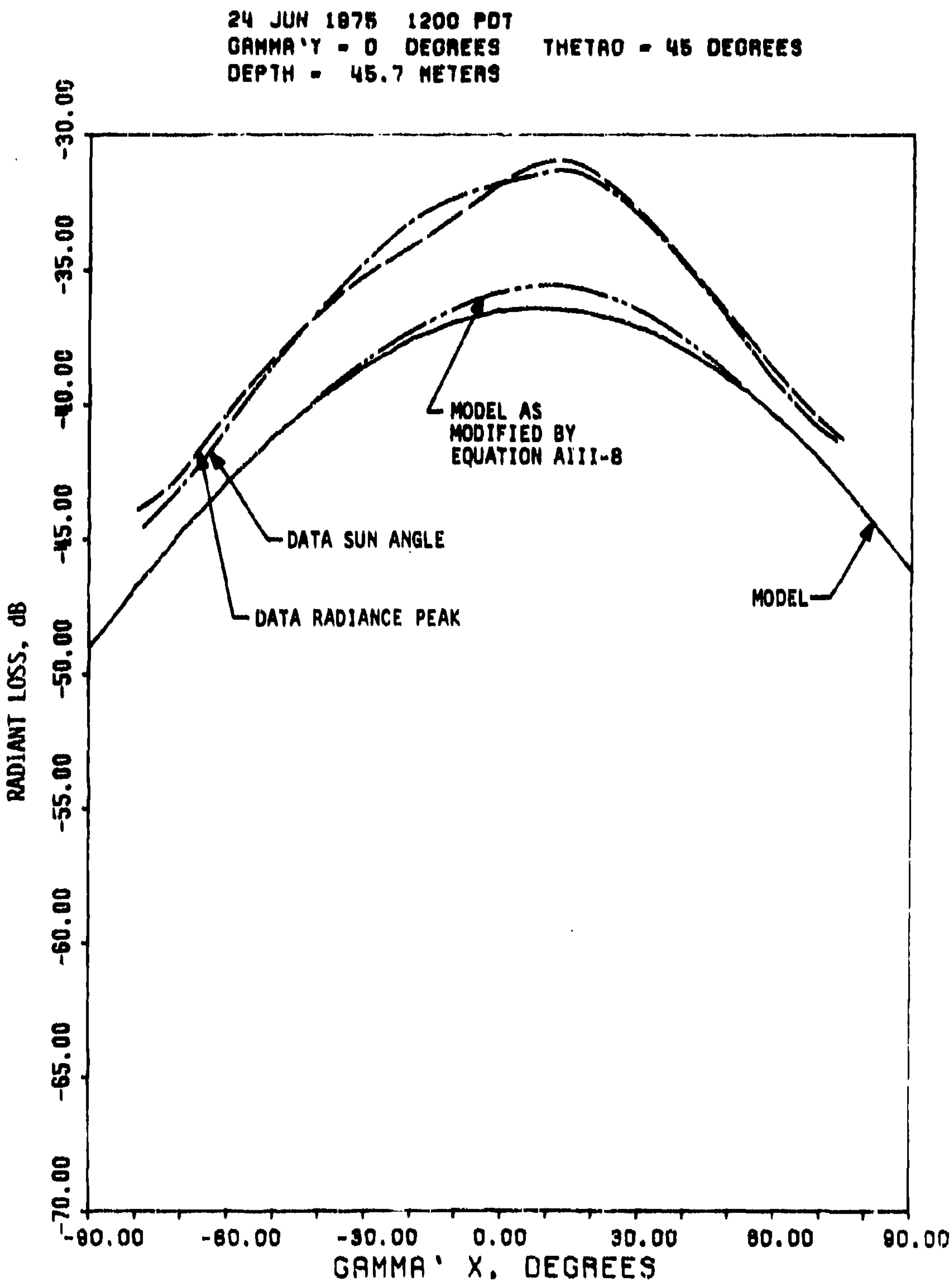


Figure 4-60. Radiance profile through sun angle.

nature of the source. (A cos θ pattern is approximately ±60° with a contraction of 3/4 because of the water index.) This correction seems to be better behaved at the deeper depths. Because little data were obtained on a sunny day, it was difficult to make a comparison between the model and the data. However, two good runs were made on June 20, one at 150 feet and the other at 20 feet. At 150 feet, a deviation of approximately 5 dB at the peak of the radiance pattern was noted. However, away from the peak there was good agreement. This was interpreted to mean that the shallow water correction was truncated too quickly. The model was rerun with the original function for A, in equation (C-12). A noticeable improvement was seen as evidenced in figure 4-7. For the 20 feet data, both A and A′ produced identical results which is in close agreement with the measured data in figure 4-8. The model was also rerun at 150 feet with the new value of A for the June 24 data (figure 4-6O) and a slight improvement was noticed. Because of the lack of data, it was decided to discontinue model reruns. However, it is believed that a shallow water correction can be empirically determined to further reduce the discrepancy. What is more important for system design is the integrated power as a function of the field of view. This is displayed in figure 4-9A through N for the June 24 data together with upper and lower bounds derived in Appendix A. Notice that there is a 0 to 5 dB discrepancy throughout the range, with the larger discrepancies occurring at the asymptotic values. Also note that the 3 dB field of view is approximately ±30°. This is true even on a sunny day as seen in figure 4-10. Here the discrepancy between data and model is also smaller. We also point out that the ocean roughness which did not vary greatly was estimated using data taken on June 23. Here, the radiance scanner was submerged to 1 foot, and 100 consecutive scans were taken. As pointed out in Appendix A, the ensemble average of all these scans should approach a Gaussian distribution whose variance is

$$\sigma^2 = \left| 1 - \frac{n}{n'} \right|^2 \mathrm{var}[R] \ .$$

The ensemble average is plotted in figure 4-11 and the resulting value for var(R) is .044.

The second portion of the June 24 measurements concerns uncalibrated data taken with the sun at or below the horizon. These measurements were taken to simulate the effects of ship-submarine line of sight and over-the-horizon scatter modes of communication. Figure 4-12 portrays a radiance profile taken by the radiance scanner at 50 feet with the sun precisely on the horizon. Notice the large solid angle around the Snell's angle over which the intensity is approximately constant. In figure 4-13, there is a radiance profile with the radiance scanner submerged to 20 feet, the surface irradiance set equal to unity, and the sun 15° below the horizon. Note the concentration of power at the Snell's angle. In order to obtain a rough calibration, the radiance scanner was taken out of the water and the sunset viewed directly (figure 4-14). Now the concentration of power falls at the horizon. The total integrated power in figure 4-14 was only 13 dB greater than the integrated power in figure 4-13. Furthermore, the peak power on the horizon in figure 4-14, was only 6 dB greater than that of figure 4-13. Thus, it is concluded that the loss in power and the inability to calibrate were due to the absence of 5,200 Å in a red sunset and not due to loss through the water. To emphasize this, irradiance vs. zenith angle were plotted at each depth for all of our data (Appendix L). The most enlightening of these curves is shown in figure 4-15. The results of the model were also plotted to substantiate the invariance of loss with the zenith angle at a depth of 100 feet. These results are most important for any system communicating to a submarine in the blue-green portion of the visible spectrum.

4.1.3 CLOUD PENETRATION

Although no attempt was made to record quantitative data on light penetration through clouds, a pyrheliometer was used to continuously monitor the irradiance at the ocean surface. The output from this

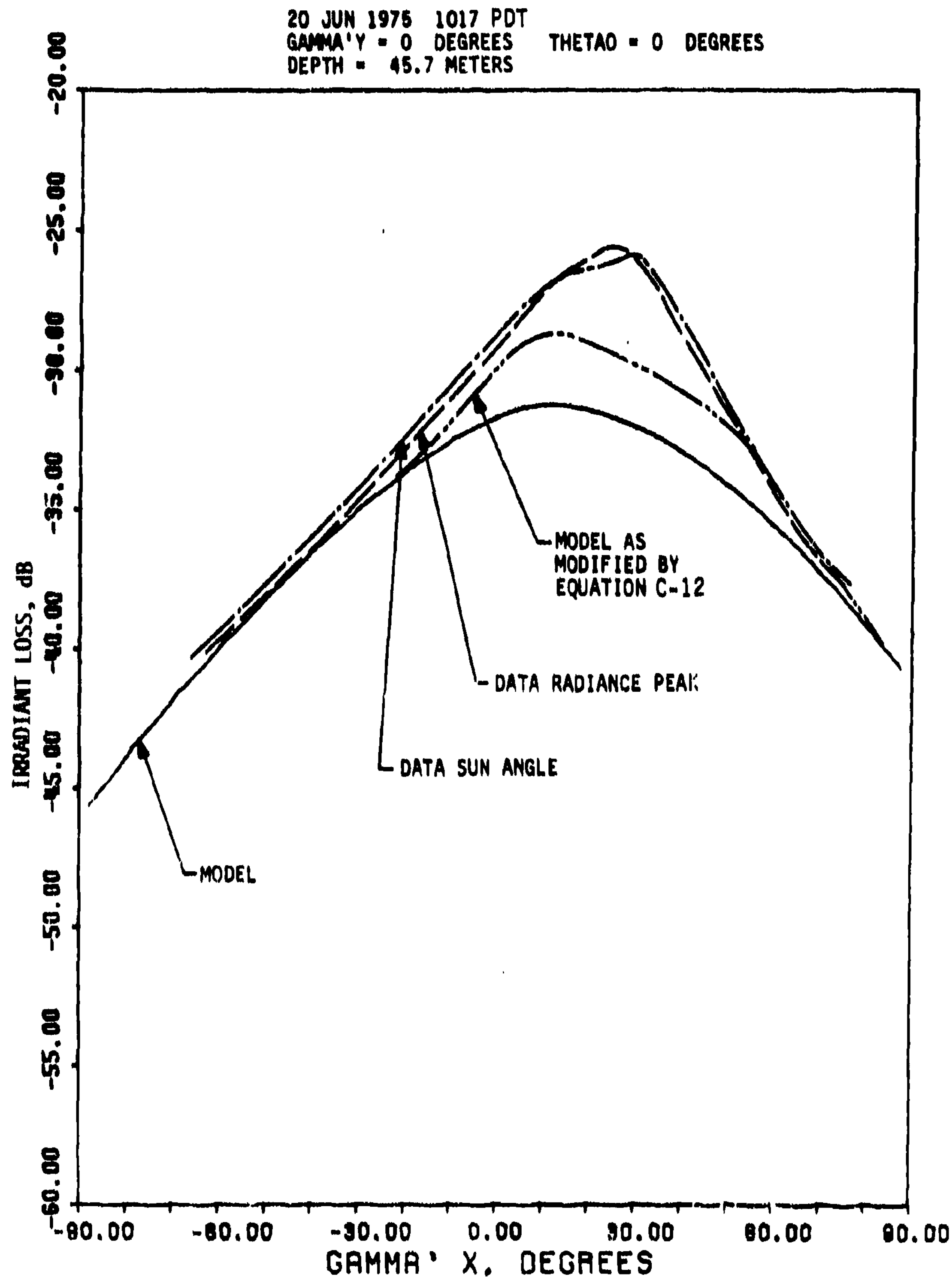


Figure 4-7. Radiance profile through sun angle.

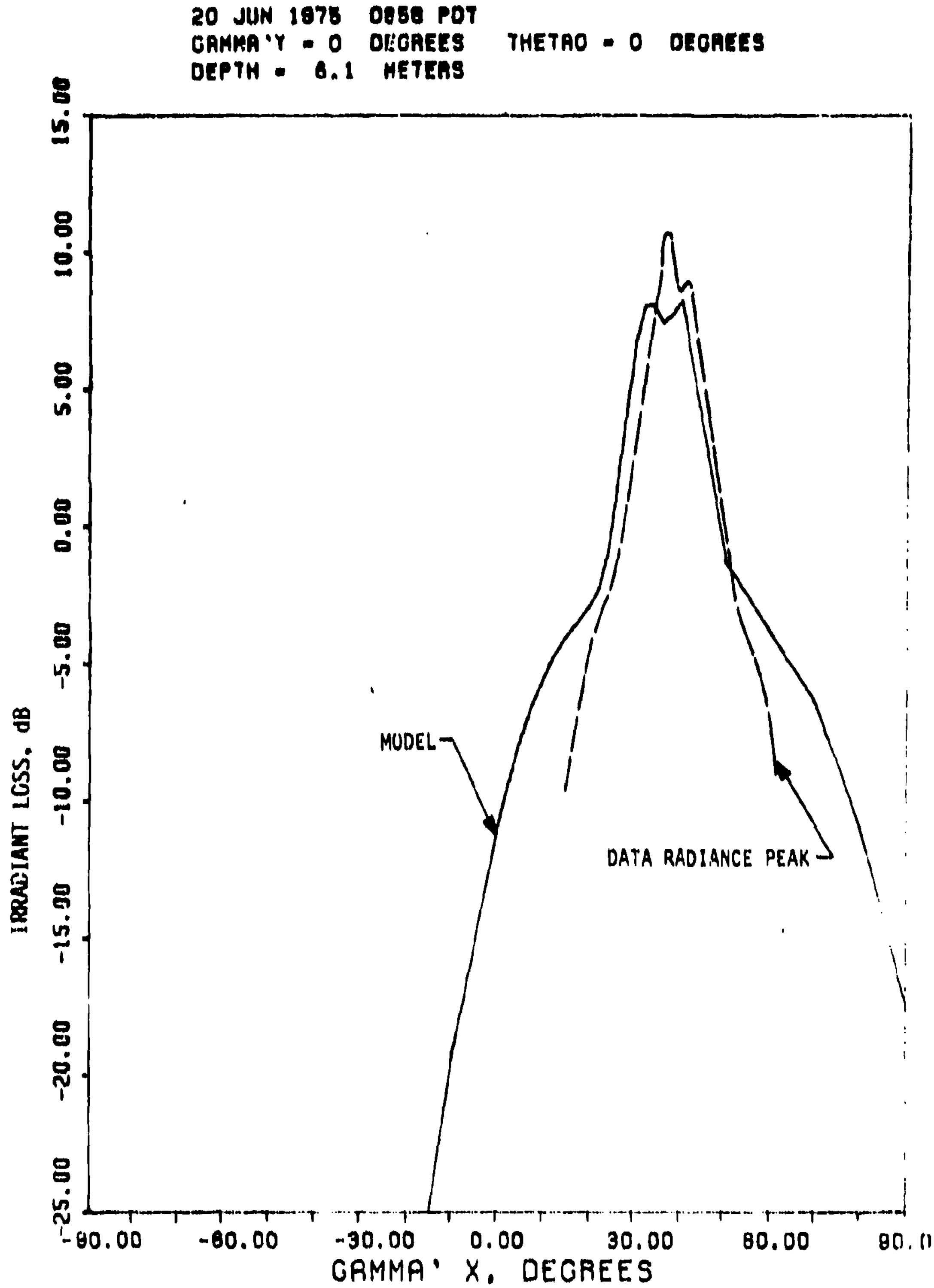


Figure 4-8. Radiance profile through sun angle.

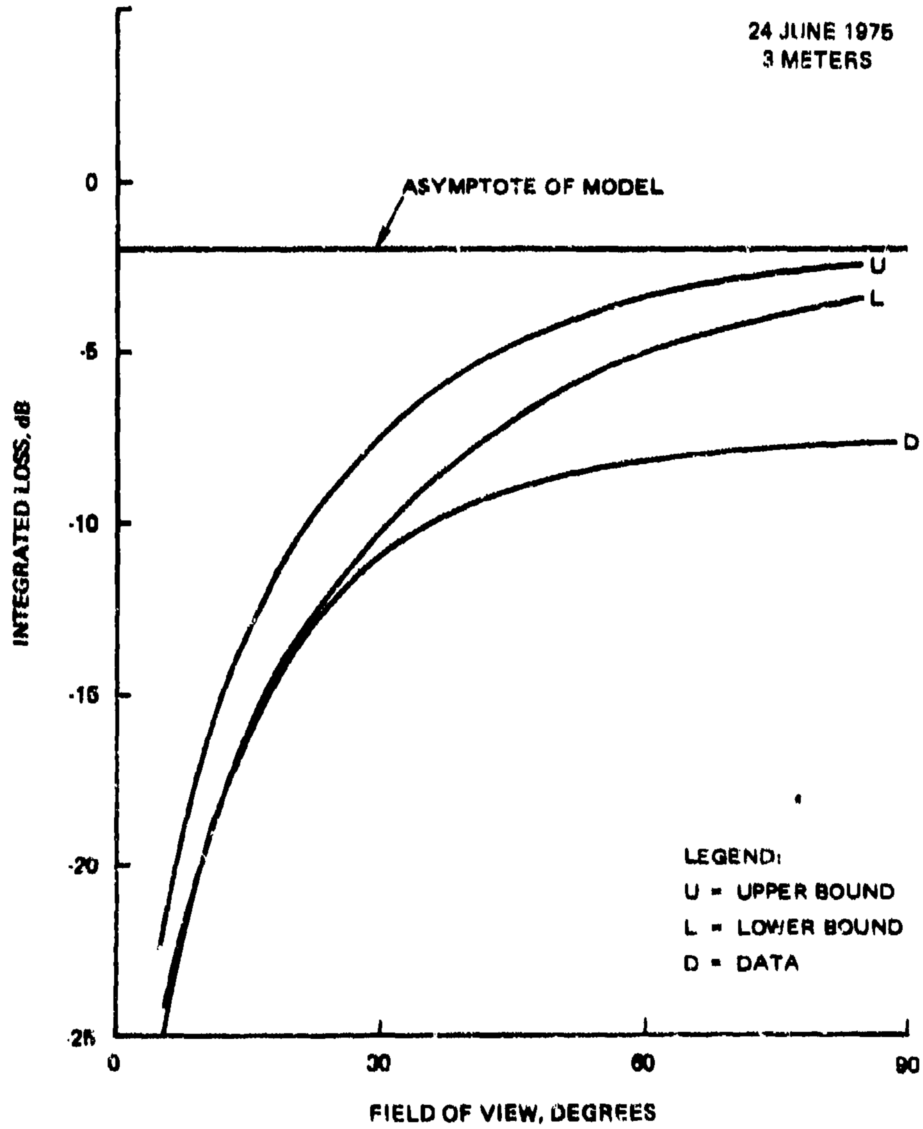


Figure 4-9A. Integral of radiance.

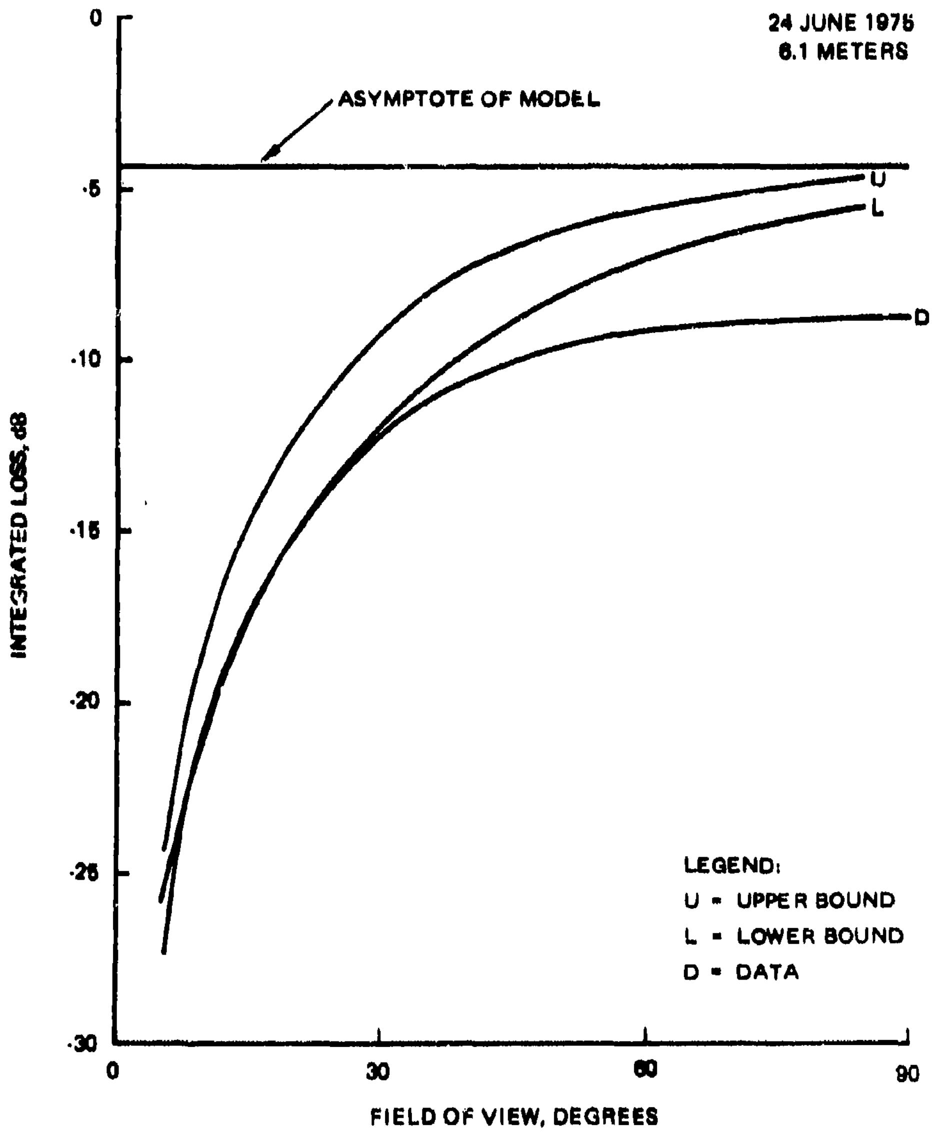


Figure 4-9B. Integral of radiance.

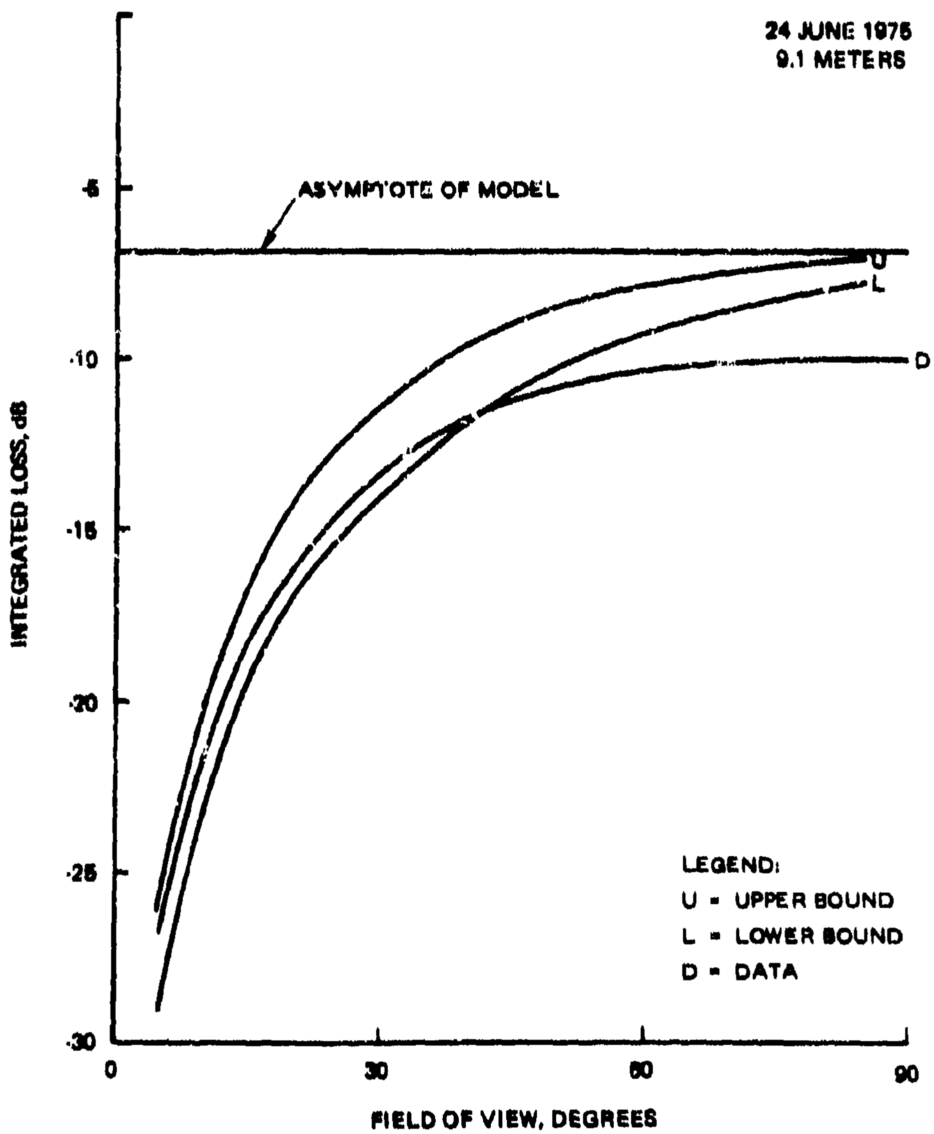


Figure 4-9C. Integral of radiance.

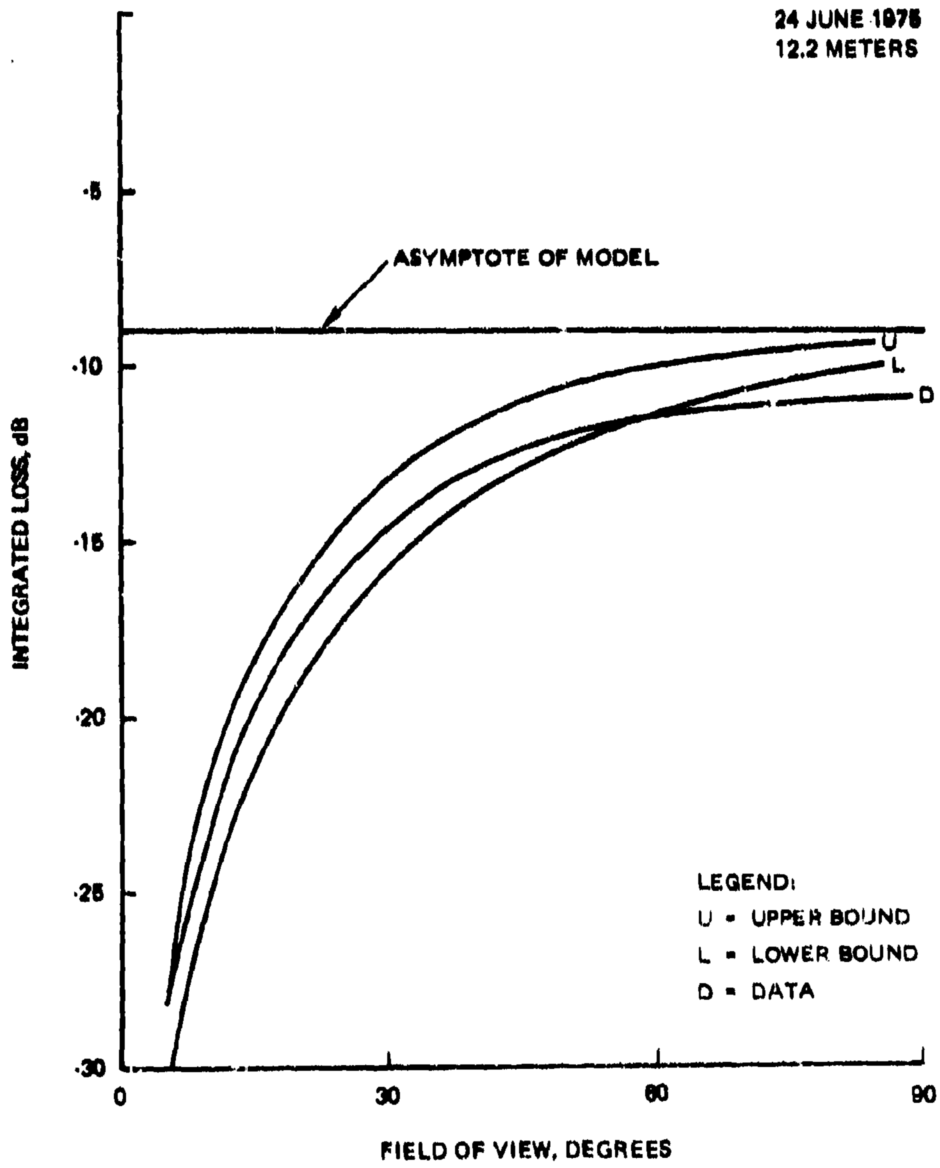


Figure 4-9D. Integral of radiance.

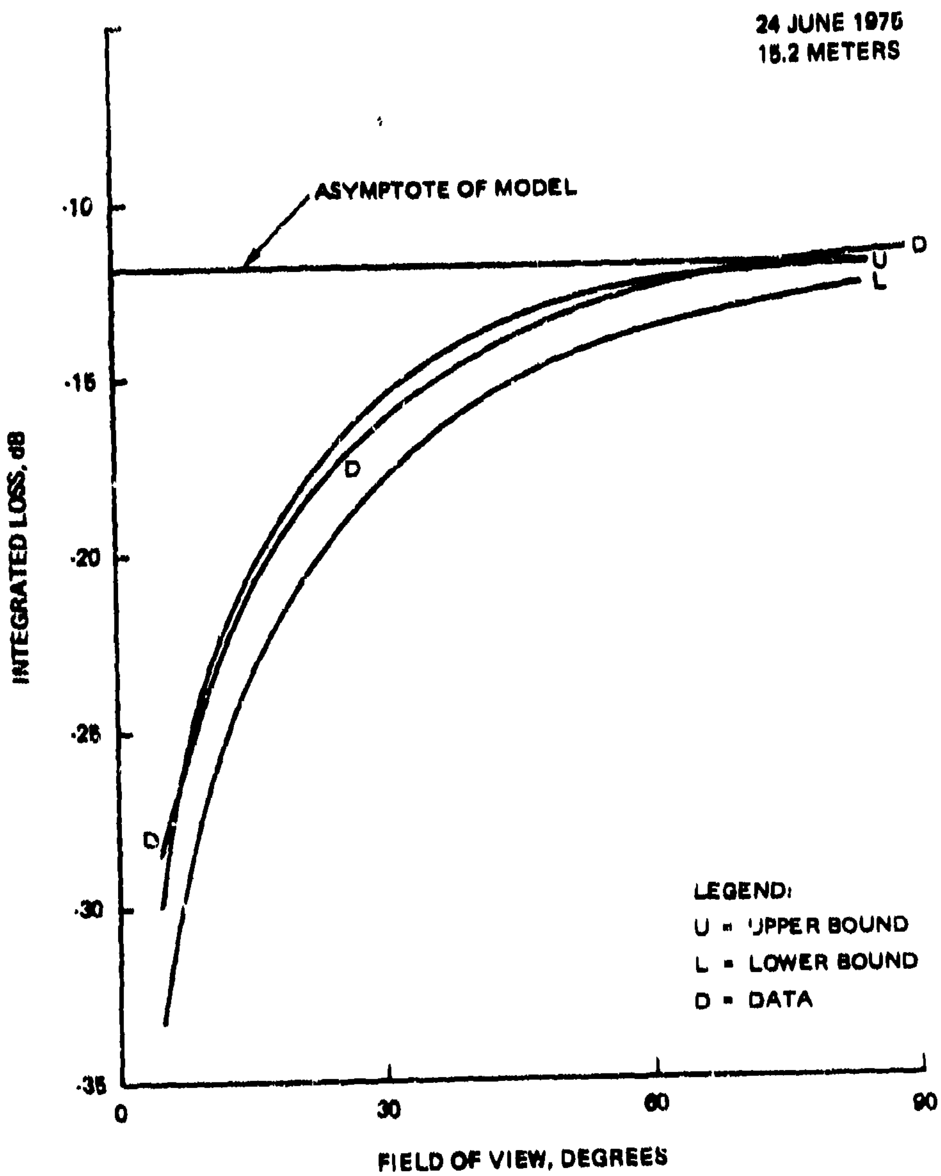


Figure 4-9E. Integral of radiance.

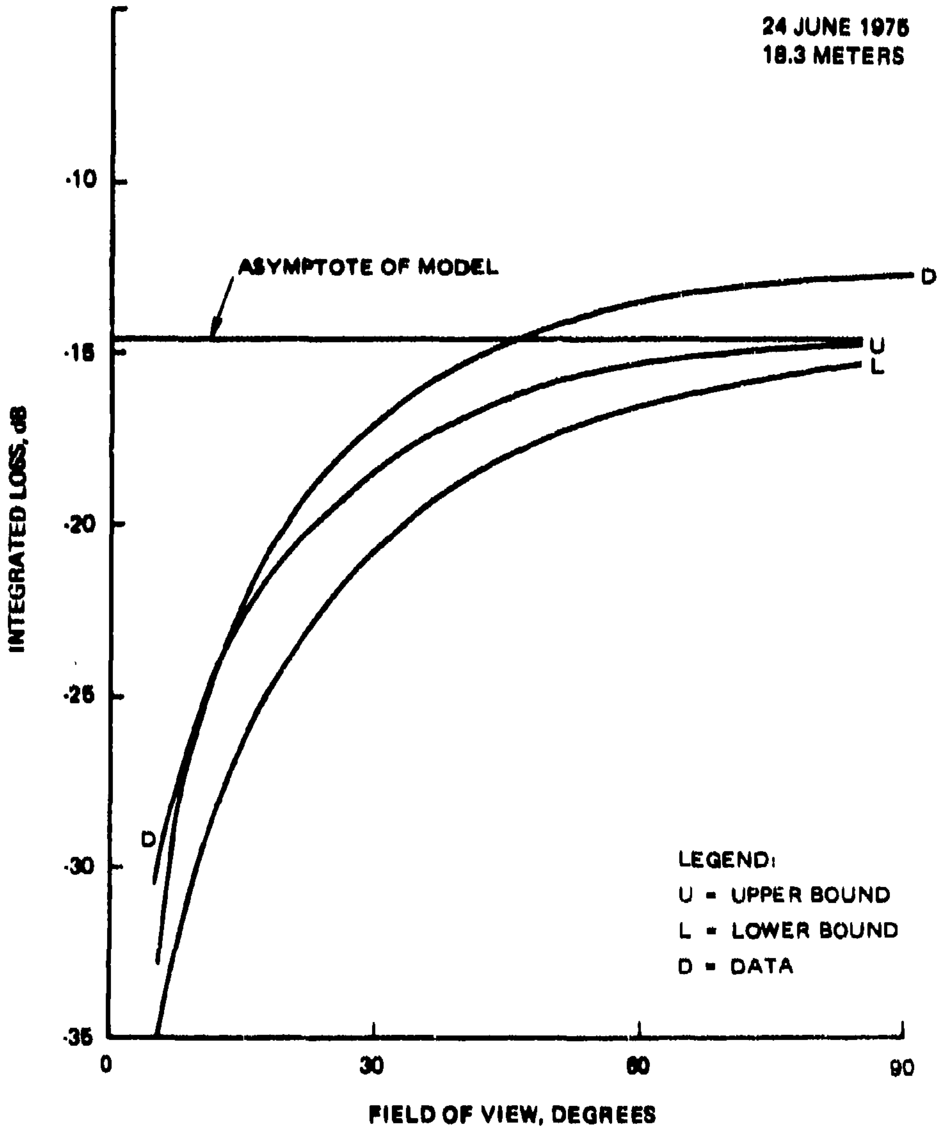


Figure 4-9F. Integral of radiance.

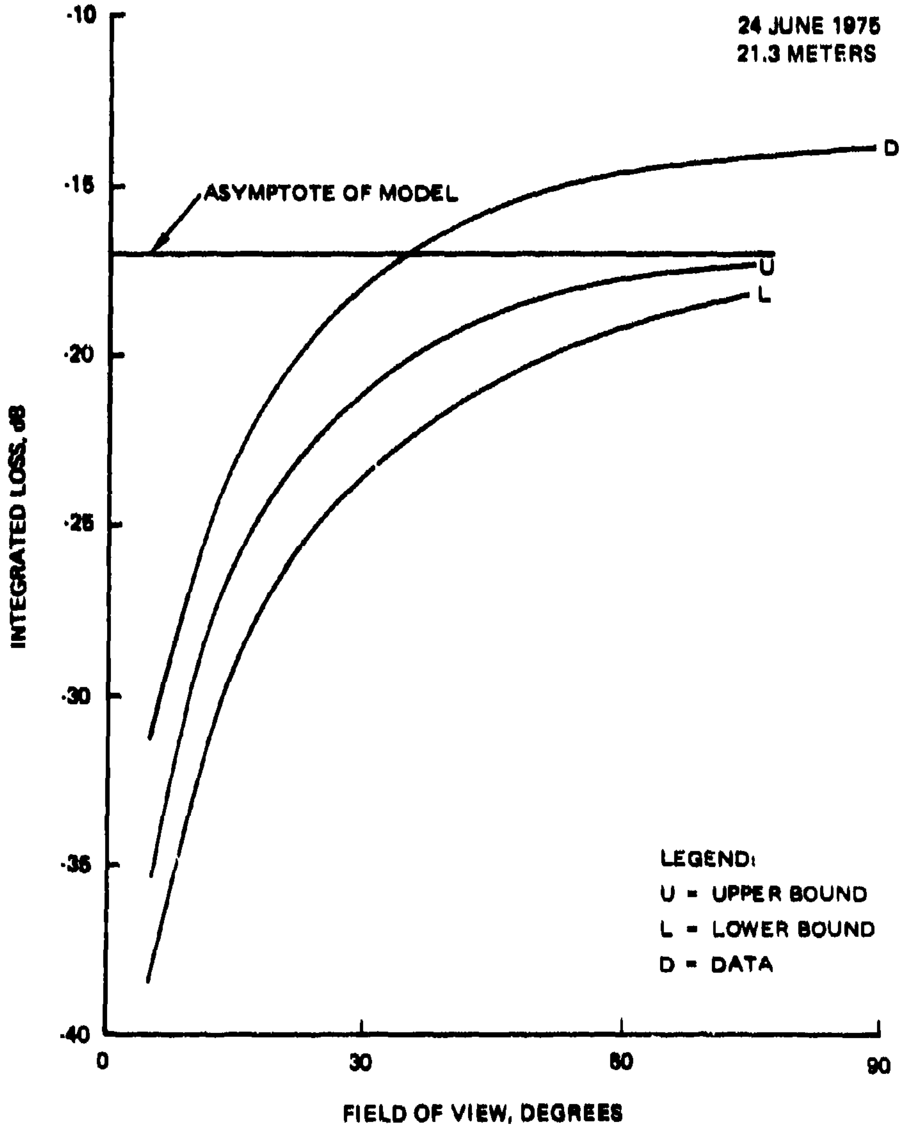


Figure 4-9G. Integral of radiance.

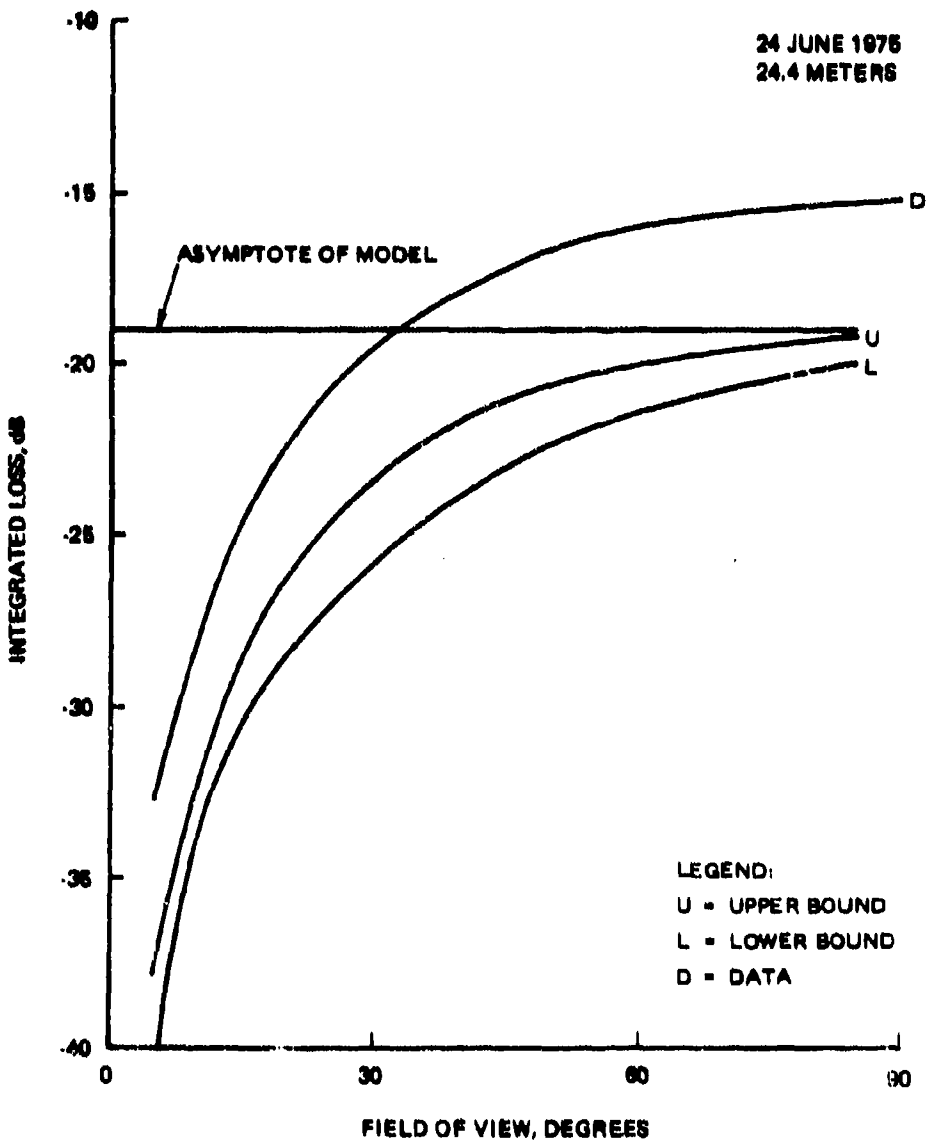


Figure 4-9H. Integral of radiance.

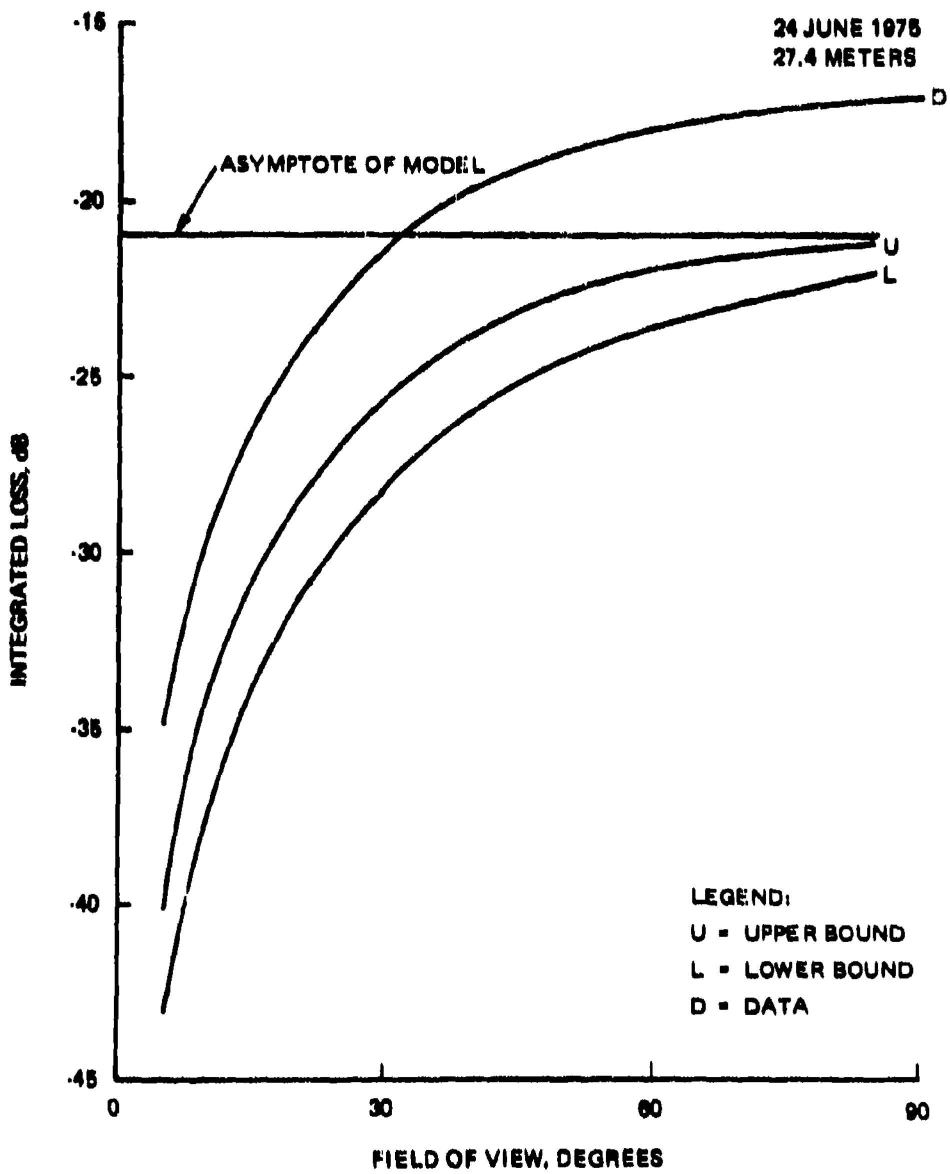


Figure 4-91. Integral of radiance.

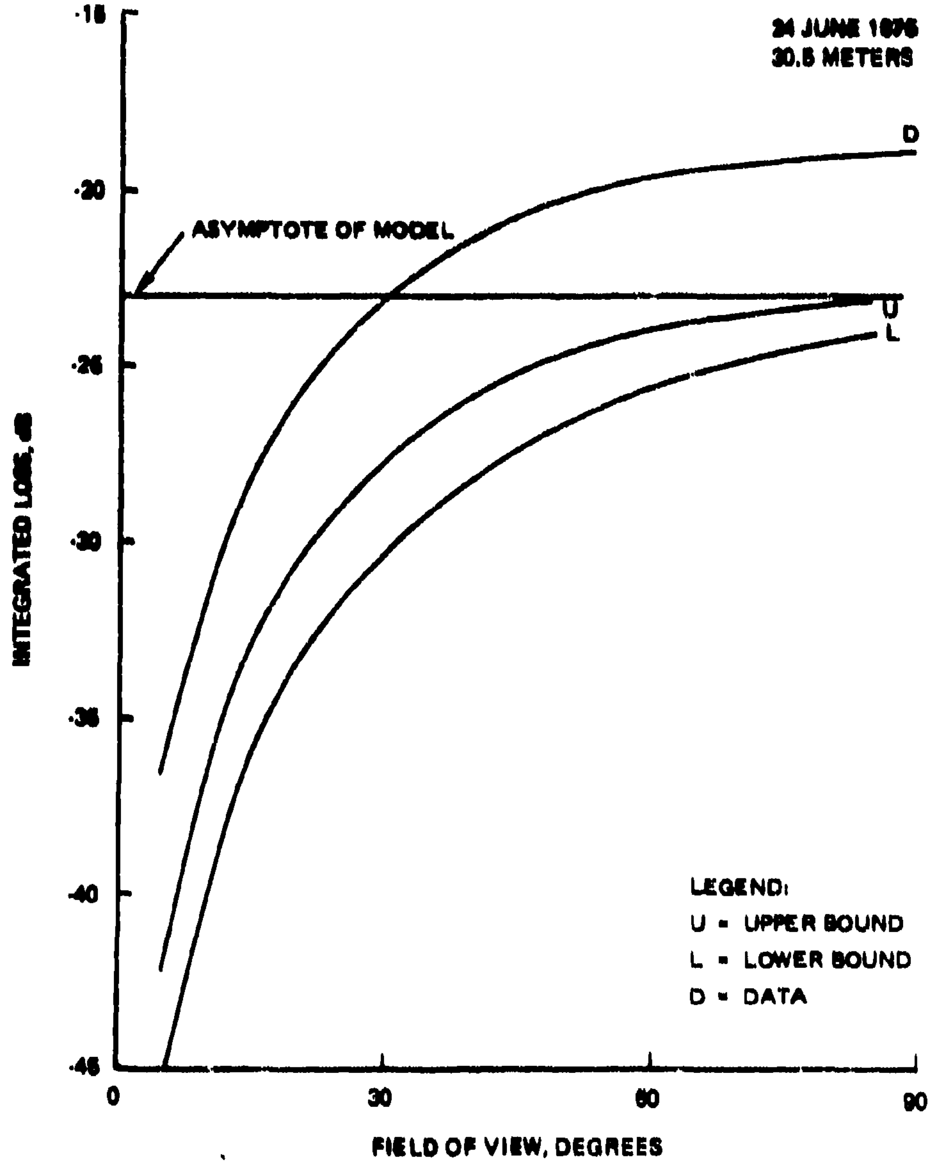


Figure 4-9J. Integral of radiance.

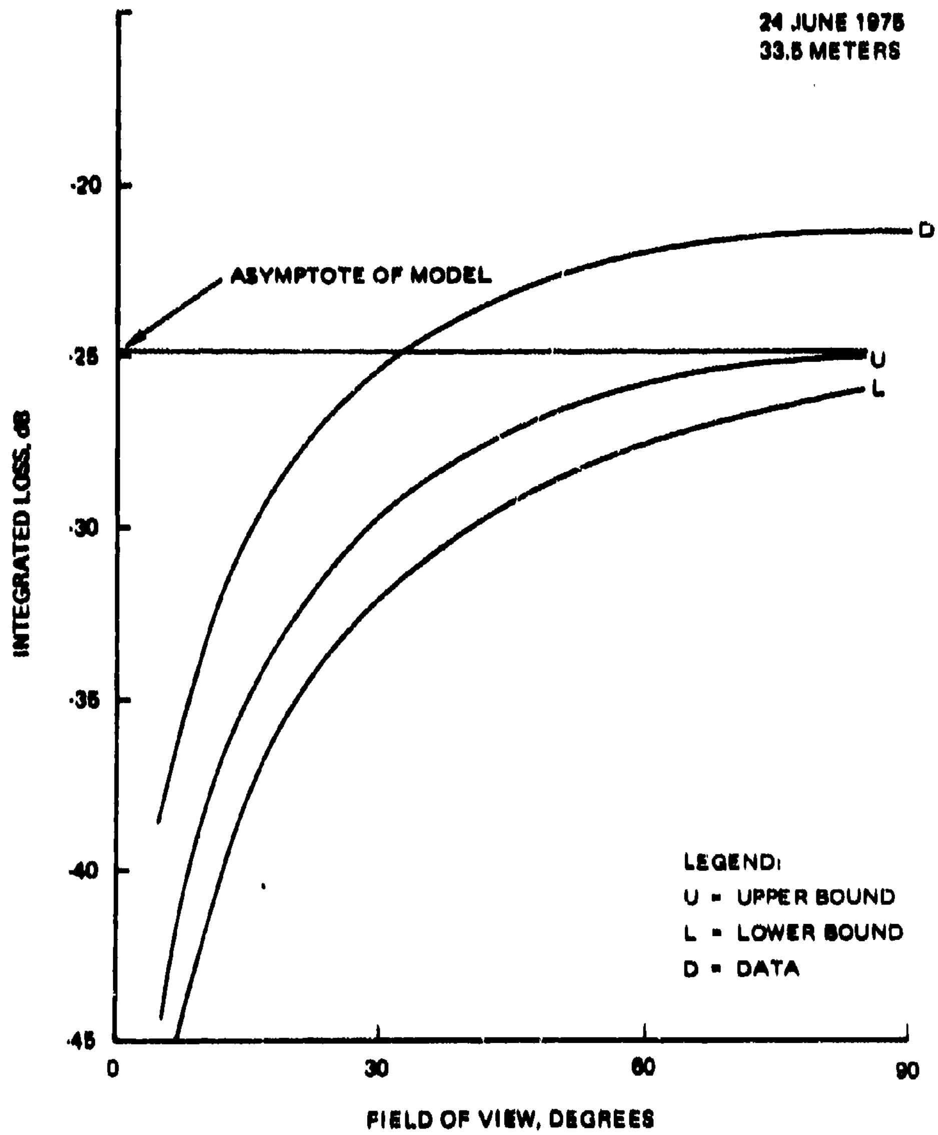


Figure 4.9K. Integral of radiance.

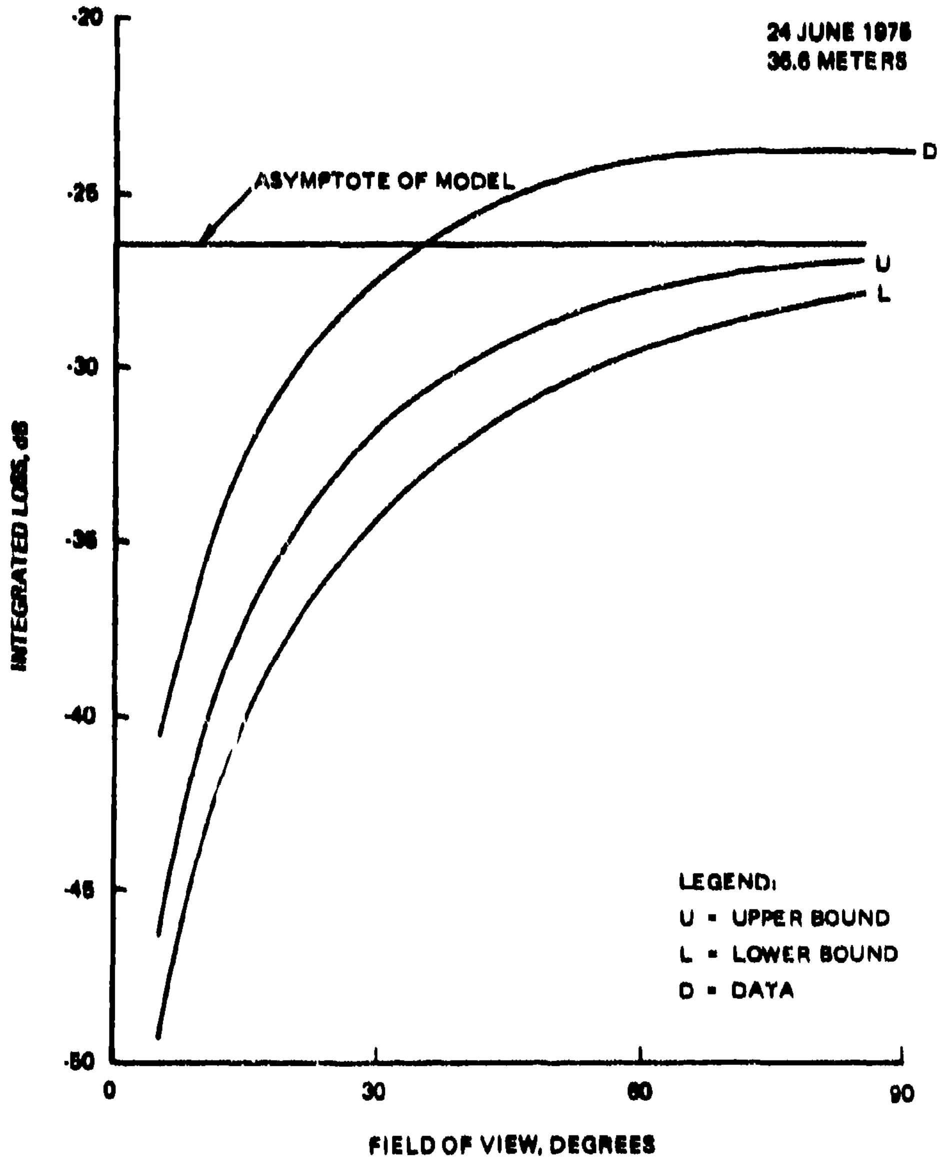


Figure 4-9L. Integral of radiance.

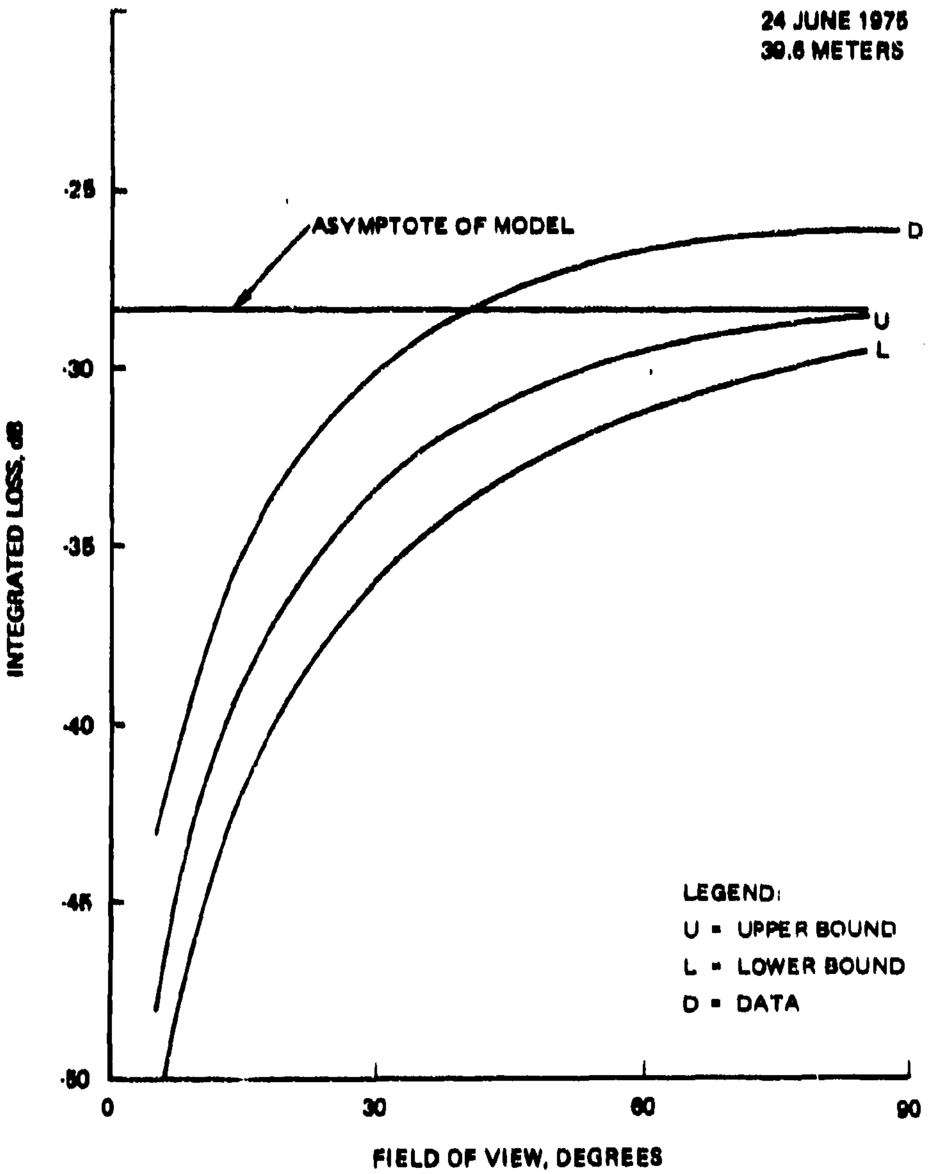


Figure 4-9M. Integral of radiance.

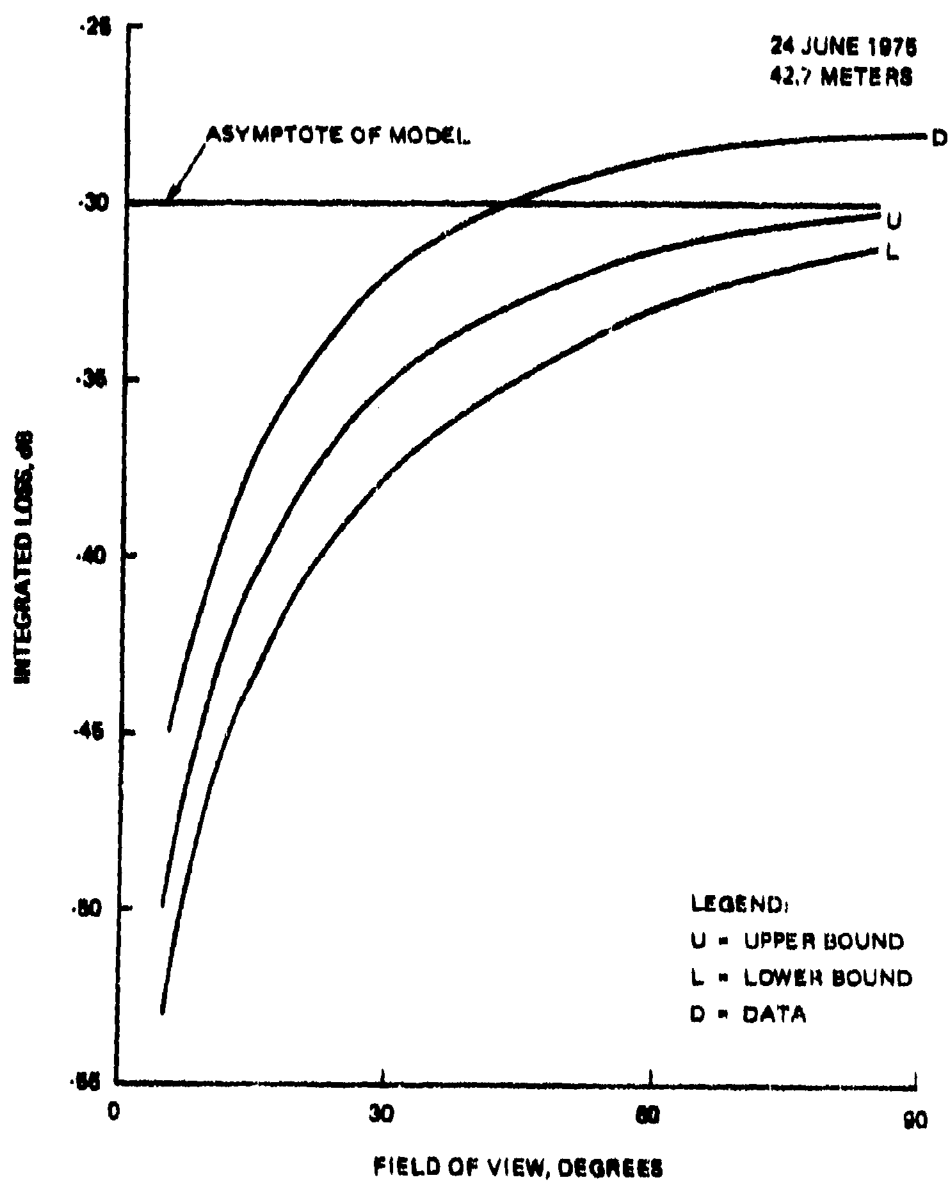


Figure 4-9N. Integral of radiance.

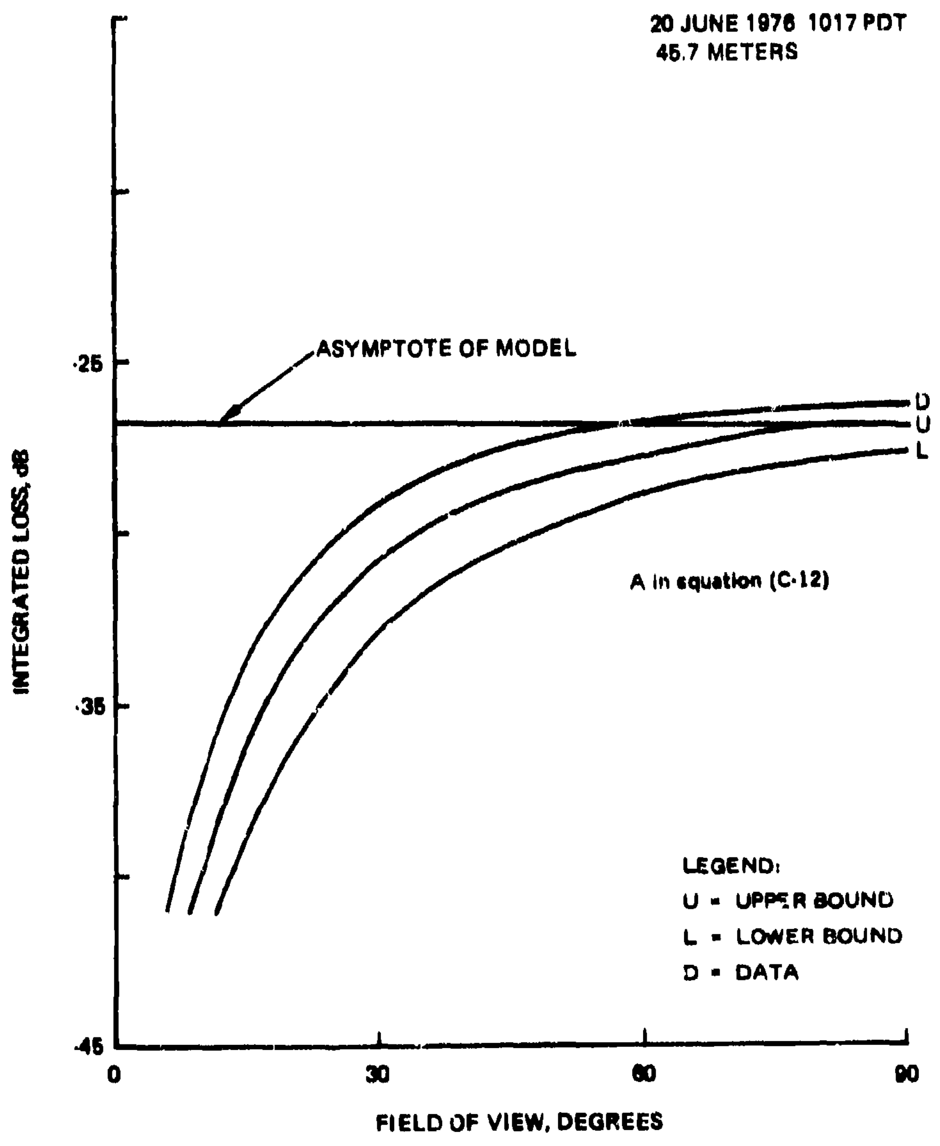


Figure 4-10A. Integral of radiance.

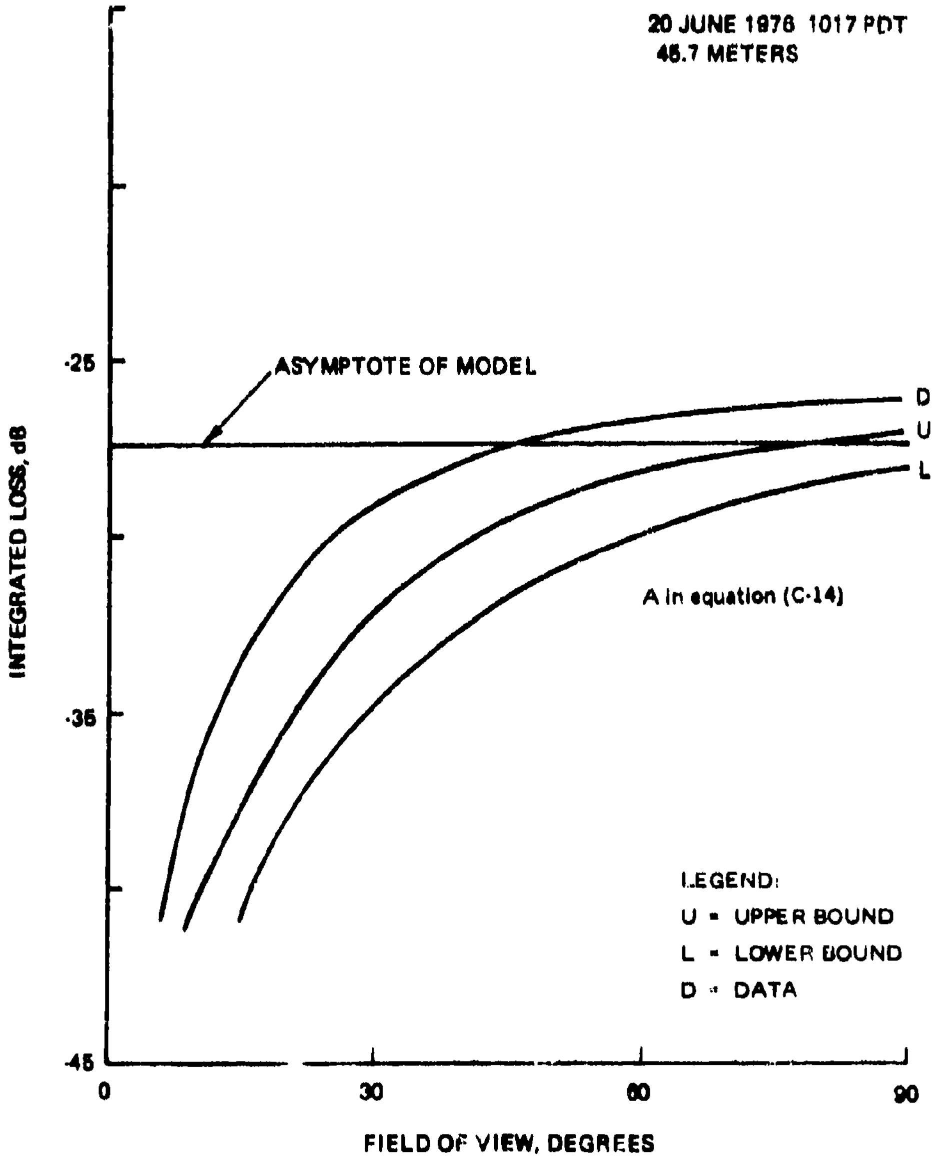


Figure 4-10B. Integral of radiance.

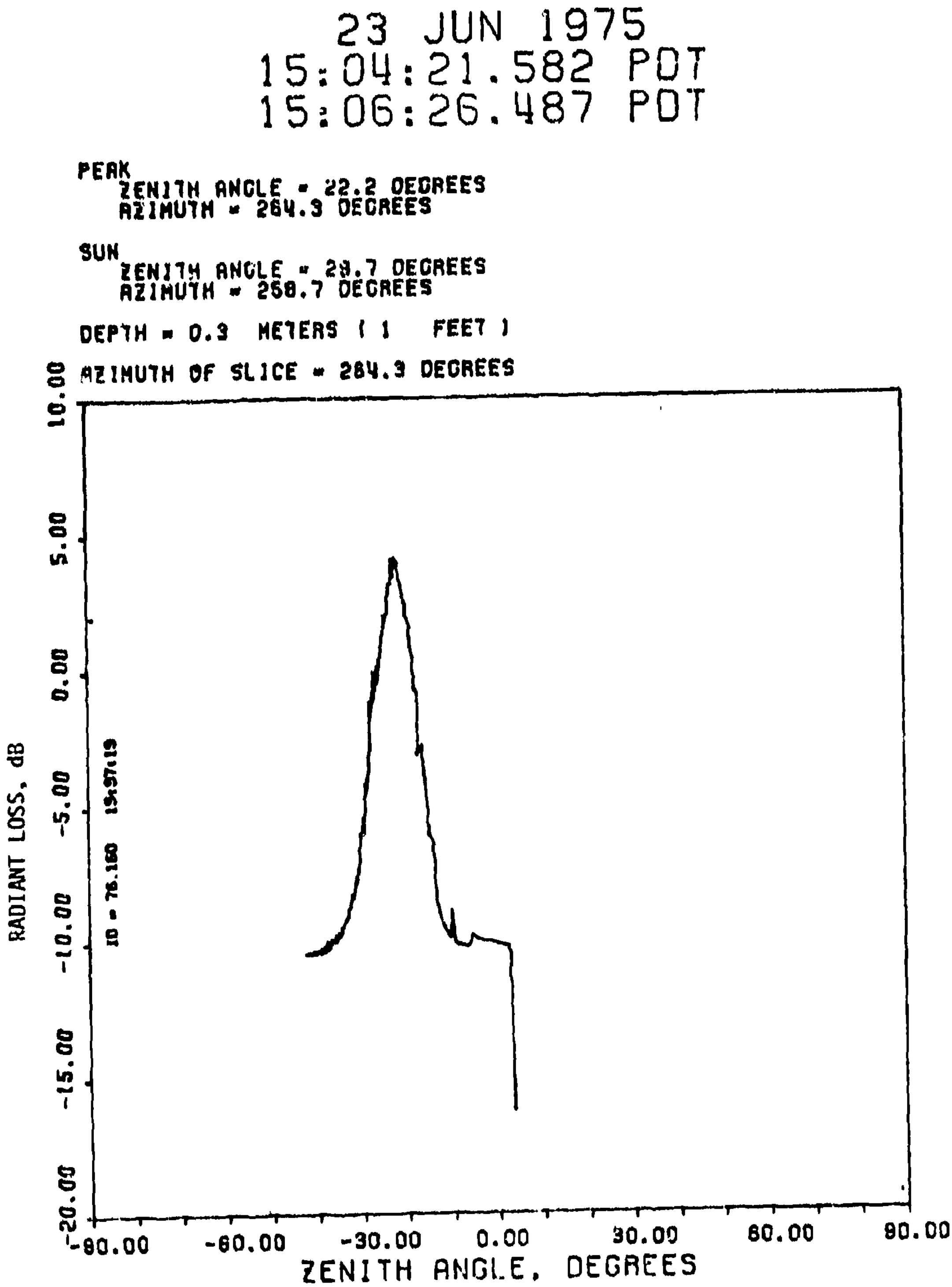


Figure 4-11. Ensemble average.

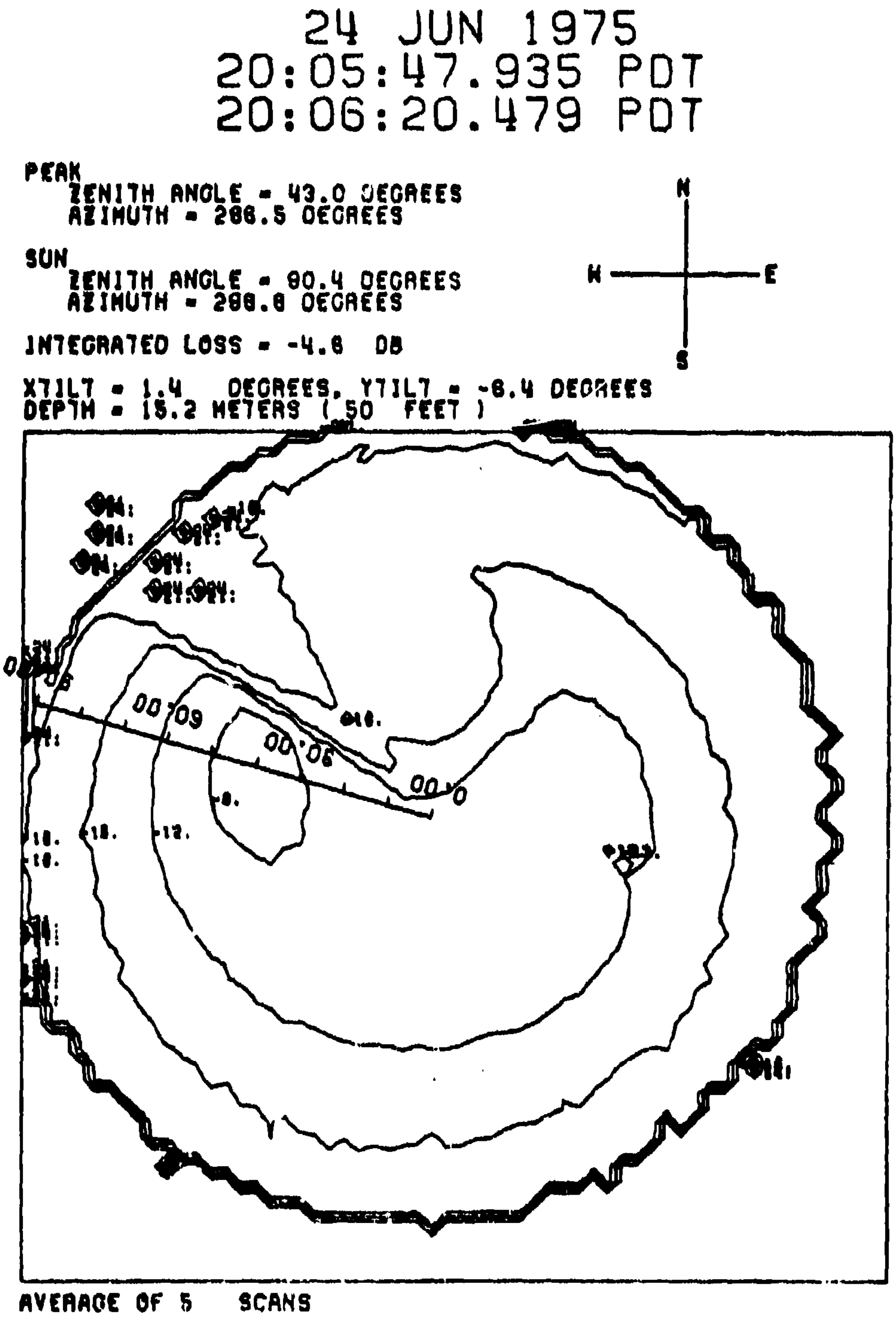


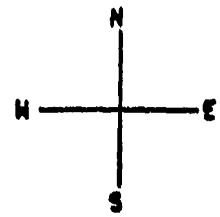
Figure 4-12. Radiance profile with sun on horizon.

24 JUN 1975
20:15:39.659 PDT
20:16:12.188 PDT

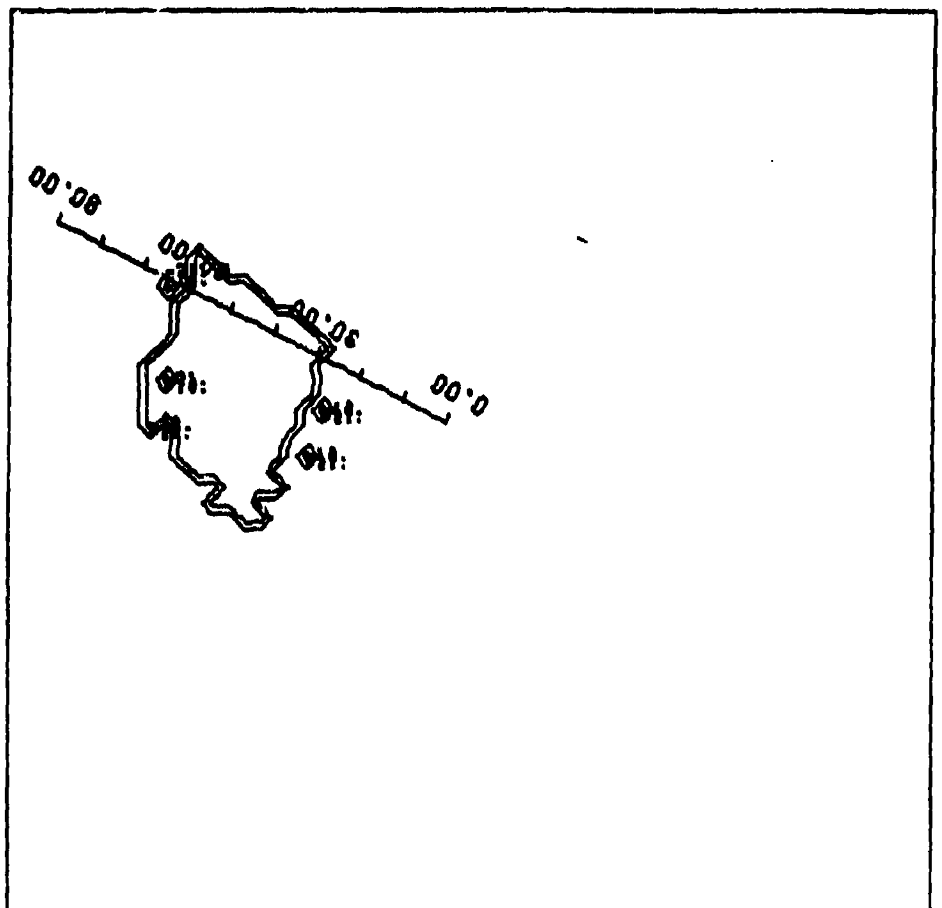
PEAK
ZENITH ANGLE = 53.8 DEGREES
AZIMUTH = 297.7 DEGREES

SUN
ZENITH ANGLE = 92.2 DEGREES
AZIMUTH = 300.2 DEGREES

INTEGRATED LOSS = -7.6 DB



XTILT = 1.8 DEGREES, YTILT = -8.4 DEGREES
DEPTH = 6.1 METERS (20 FEET)



AVERAGE OF 5 SCANS

Figure 4-13. Radiance profile with sun 15° below horizon.

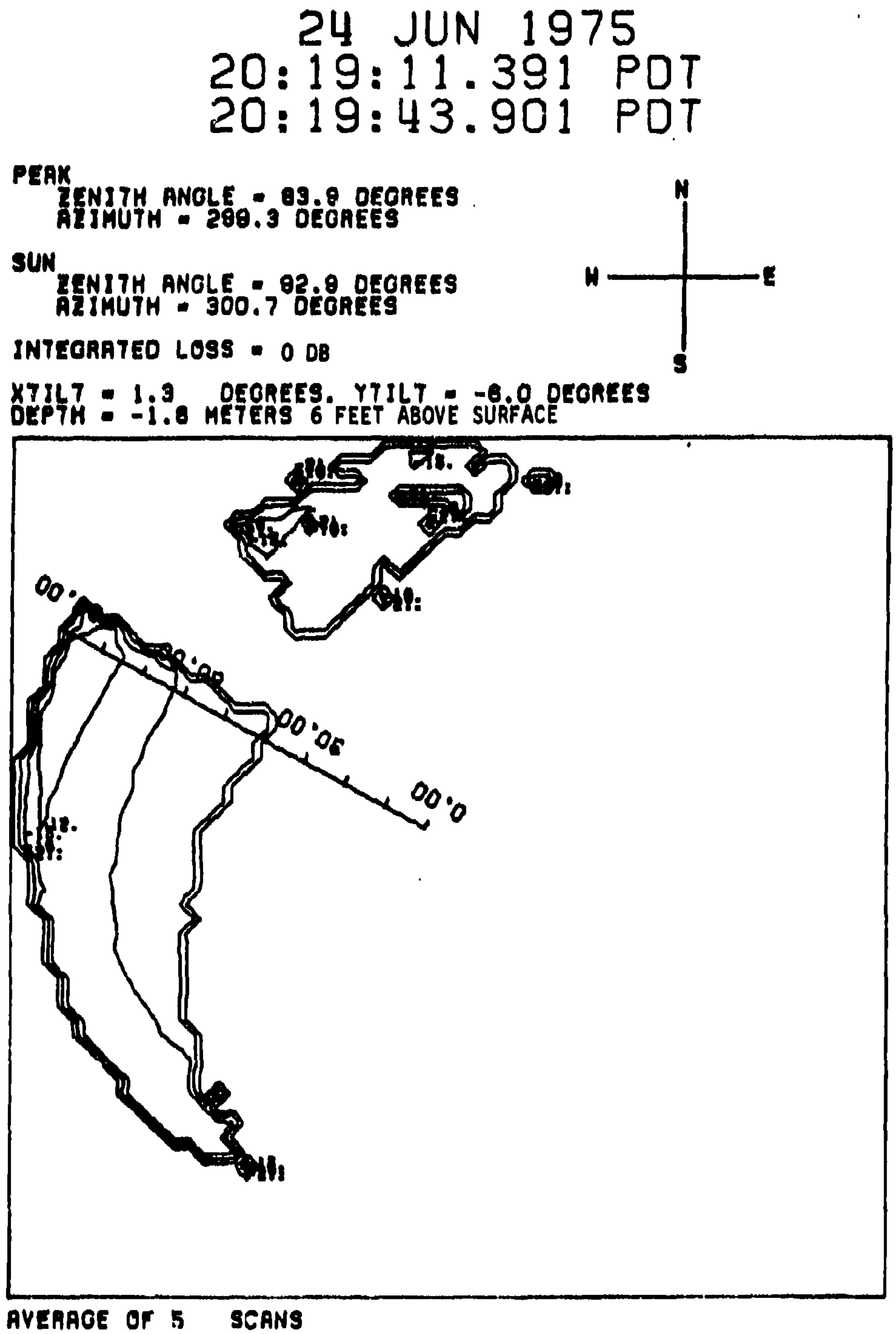


Figure 4-14. Radiance profile with sun 15° below horizon (radiance scanner out of water).

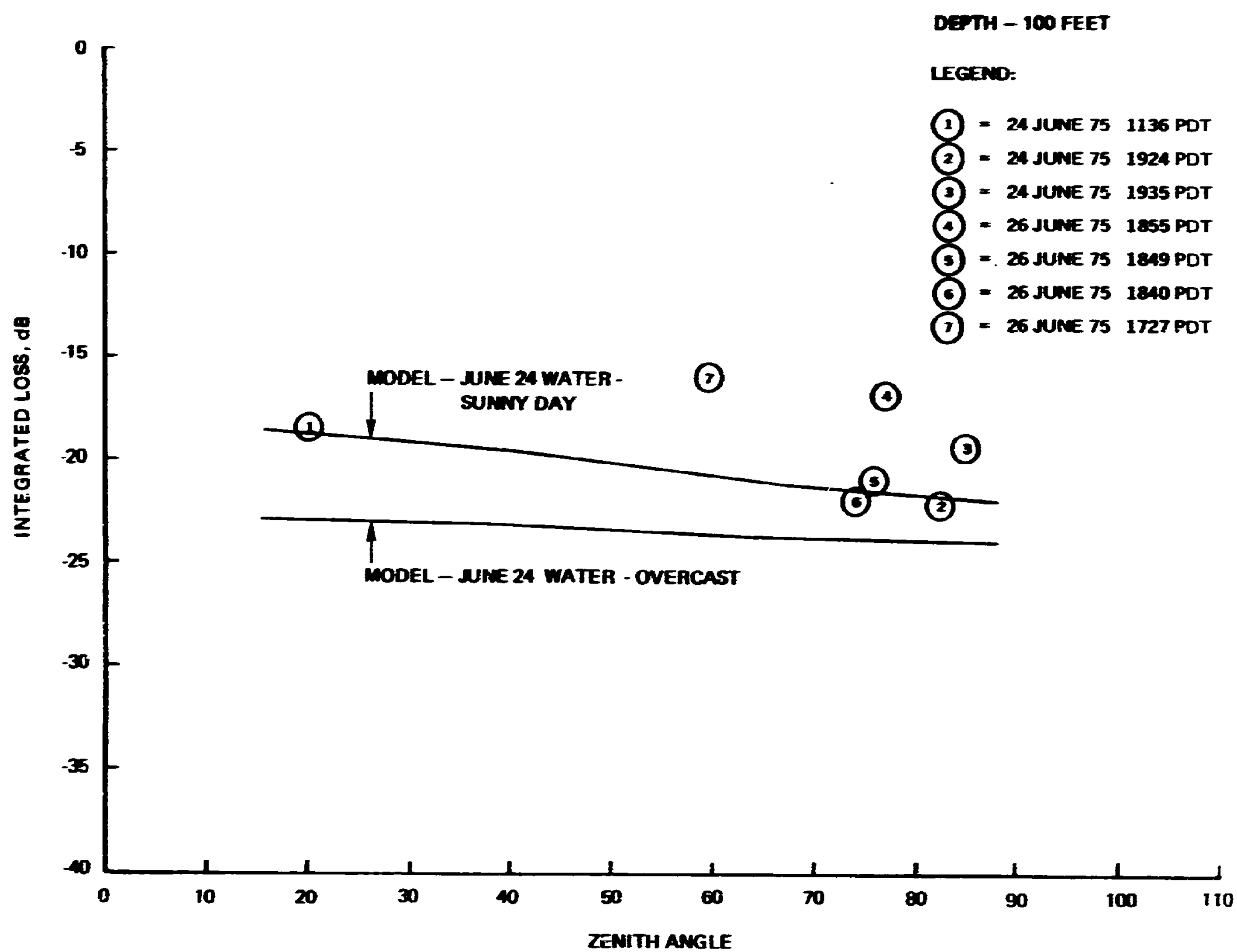


Figure 4-15. Irradiance vs. source zenith angle.

device was recorded on a strip chart with a few representative samples shown in figures 4-16A through C. Figure 4-16C is a trace for a sunny day. By using this curve as a reference, it was possible to obtain meaningful statistical data on cloud penetration. Thus, for example, figure 4-17A is a distribution of points taken every hour between 1100 and 1500. The value of each point is divided by the corresponding value of the sunny day curve at the same time of day. This is designated as the transmission and is always less than or equal to one. The transmission values are plotted on the abscissa and the relative frequency (number of times a particular value occurs divided by the total number of values) is plotted on the ordinate. This bar chart is an estimate of the probability distribution for transmission. It is bimodal, that is, an impulse occurs between .9 and 1.0, and a bell-shaped portion between 0 and .9. Of a total of 36 points, 21 represent clear conditions or a cloud-free line of sight probability of .58. The cumulative probability was superimposed to demonstrate this better. However, 36 points do not represent a significant sample so the same procedure was repeated every 10 minutes and plotted in figure 4-17B. Notice the same basic shape, but more filled in. The same data were reprocessed every 10 minutes between 0900 and 1700, as plotted in figure 4-17C, which gave a more continuous sampling of the same time period. Notice that there is no basic change to the curves with the exception that the probability of a cloud-free line of sight is now .62. Therefore, now that 274 points have been obtained, it represents a significant set of data and some conclusions may be reached. For example, the probability of having less than a 10 dB loss is .986, or 98.6%. Even the conditional probability (the probability when there is a cloud, referring only to the bell-shaped part of the curve) of having less than a 10 dB loss given an overcast condition is 96.2%. Although only a spot sample was taken of all clouds, it is clear that transmission through clouds with nominal values and at high probabilities is feasible. This contention is substantiated since the major set of water penetration measurements were made in overcast conditions so that the penetration of diffuse light into the water is understood. The extension of these results to spot beam transmission and other types of clouds would be desirable in view of the potential impact on system availability.

4.2 UPLINK DATA REDUCTION

The experimental procedures, descriptions, and scenarios for the uplink measurements are outlined in Section 3. The equipment used and the calibration employed are described in Volume II, Section 3. The goal of the uplink measurements was to determine, as best as possible, those parameters which are critical in determining uplink performance. Specifically, there were three parameters which received the most attention: overall link loss, beamwidth (antenna gain), and beam direction. Furthermore, it was desired that models be developed which could adequately describe these parameters. The model used in this report is the one developed in Appendix A. All the data presented are in one format; link loss vs. zenith angle. These represent a slice of the transmitted pattern as seen by a receiver passing through the beam toward the source. The program used to reduce the uplink data is described in Appendix E. Because of equipment difficulties, aircraft failures, and a narrow operational window, the only data deemed acceptable were obtained on July 21 and 22, 1975. We also point out that for logistical reasons, the uplink measurements were always given first priority over the downlink measurements, which contributed to some spottiness in the latter.

In figures 4-18A through F, data taken with the laser pointing in the zenith direction are displayed; e.g. zenith angle is 0°. There are several items that should be pointed out with regard to the data. First, the dynamic range of the receiver was only 10 dB, so that the data went from the noise floor to saturation very quickly. This required some adjustment on each pass; for example, figures 4-18B and C were repeated passes taken with different gain settings. Notice also that at the higher zenith angles the noise floor starts to increase. This is due to the secant squared correction that was used to account for the difference in path lengths at the various zenith angles to a constant altitude aircraft. This effect can also be observed when the

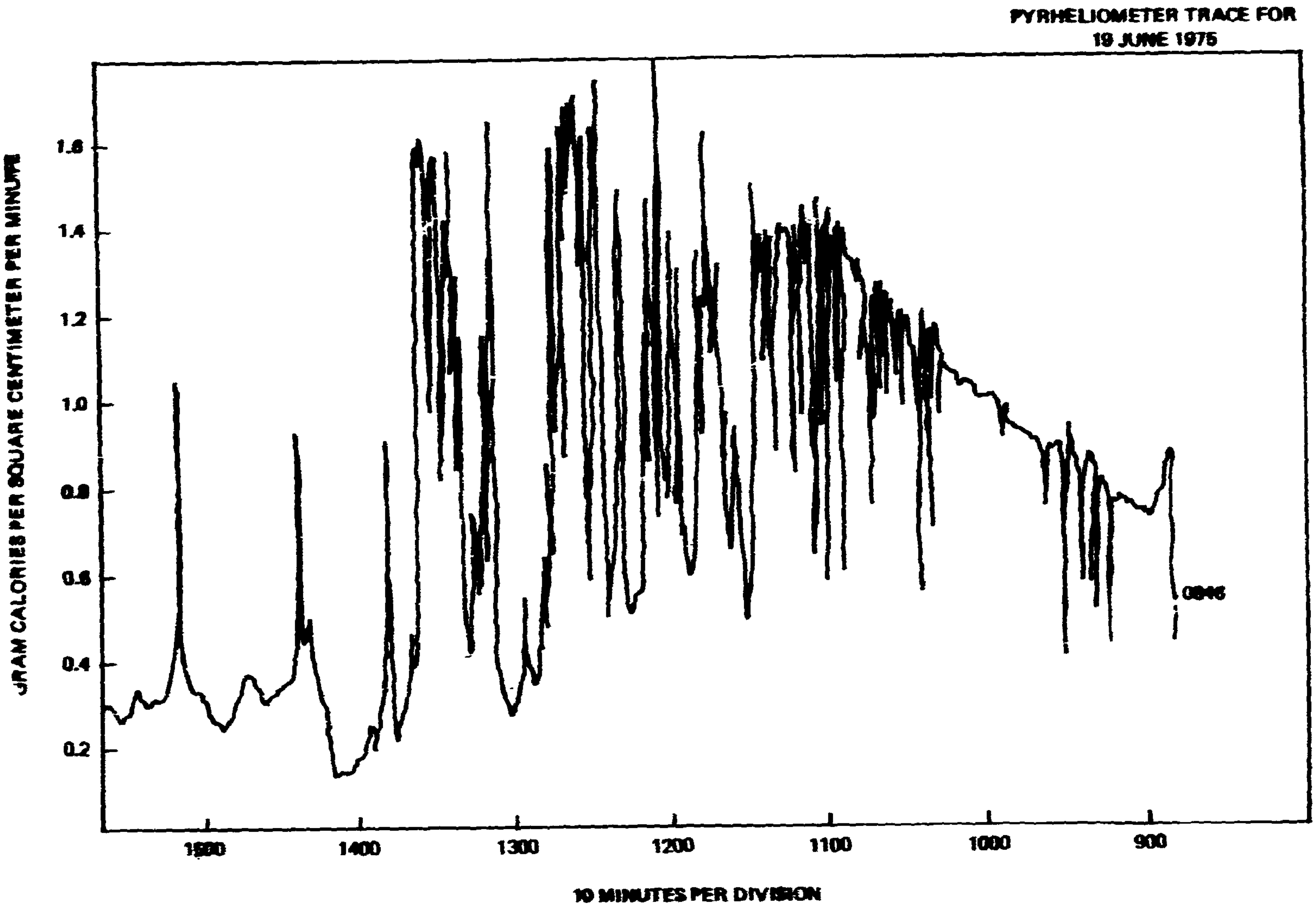


Figure 4-16A. Irradiance at the ocean surface – cloudy day.

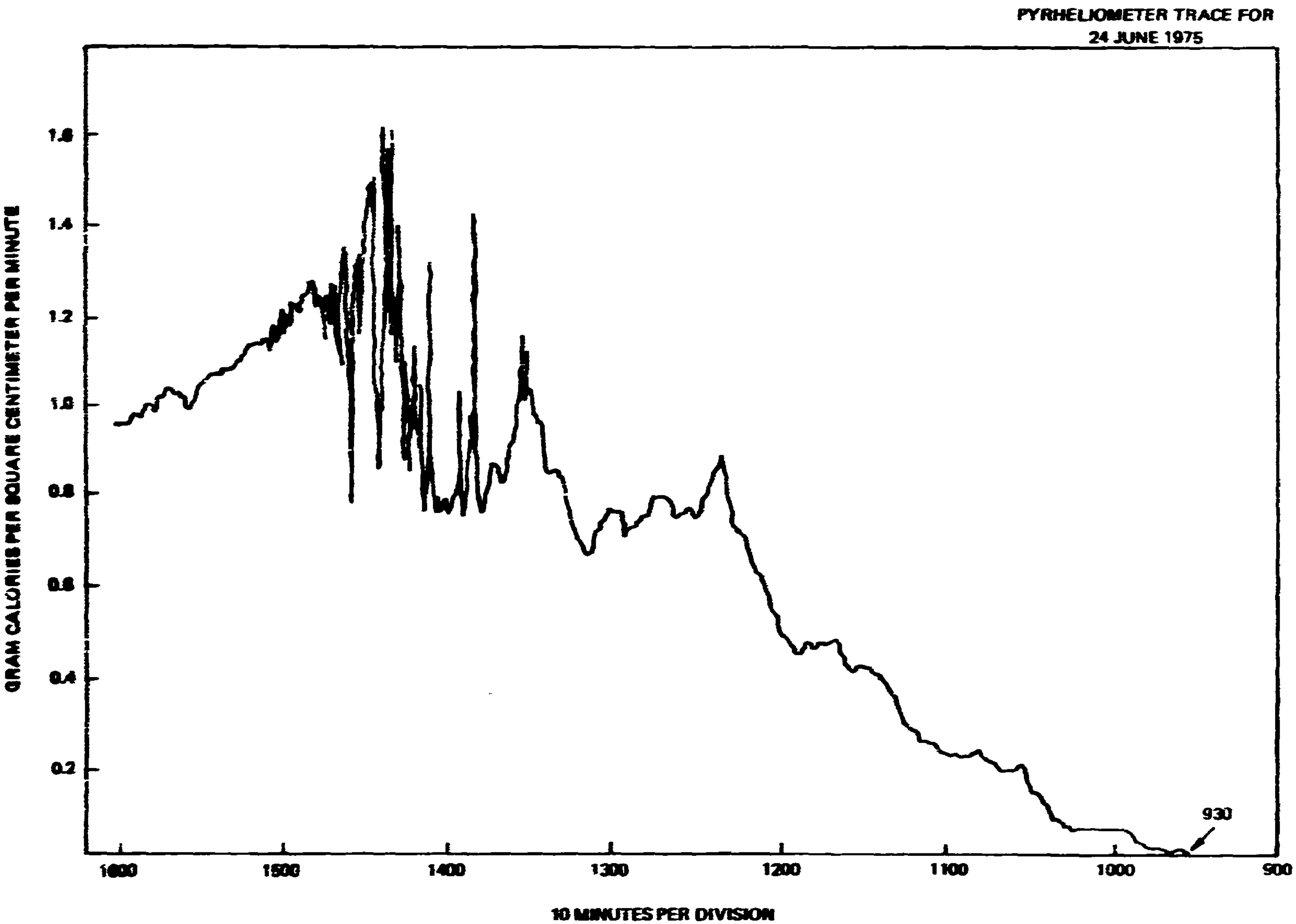


Figure 4-16B. Irradiance at the ocean surface – cloudy day.

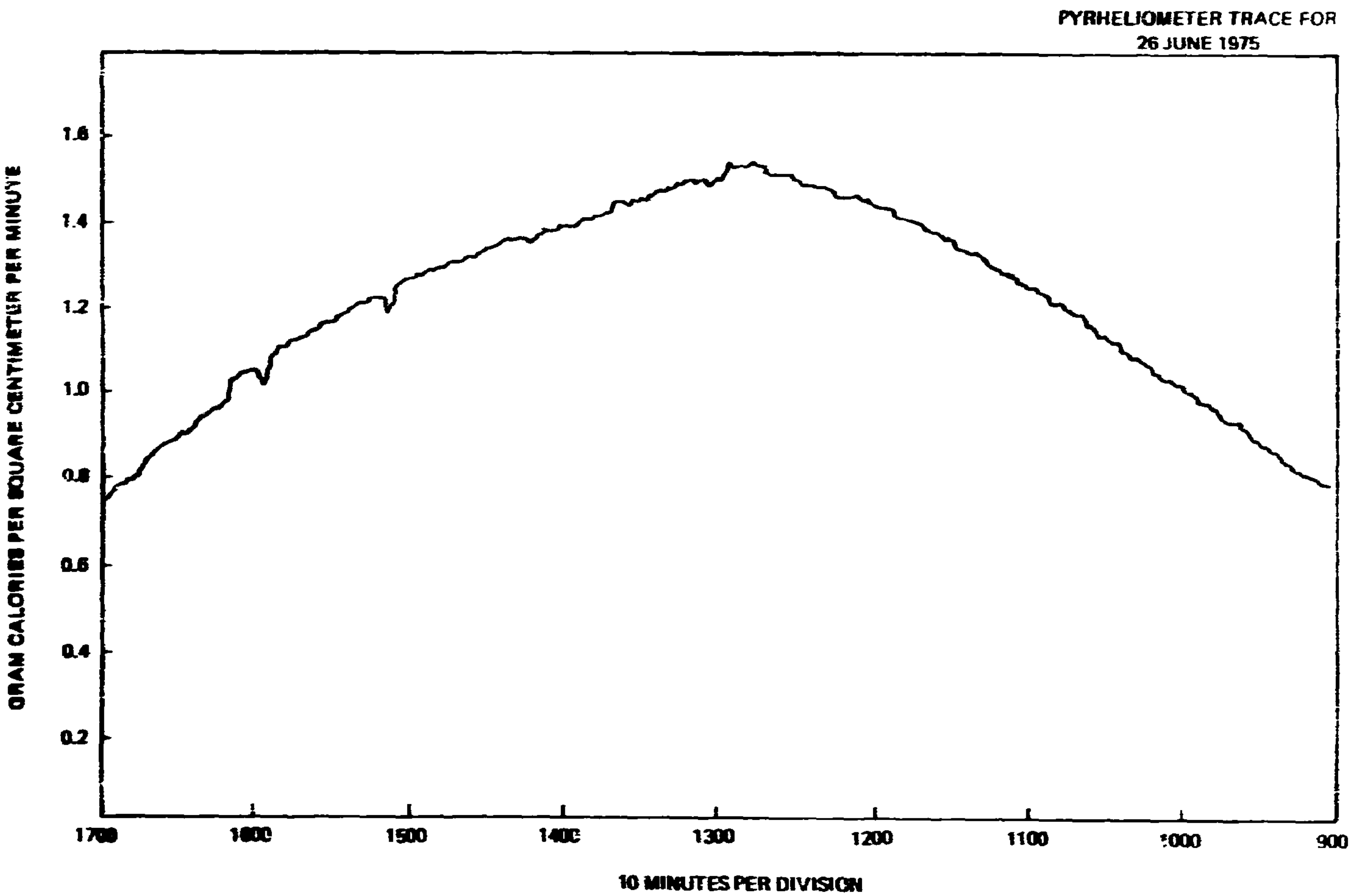


Figure 4-16C. Irradiance at the ocean surface – sunny day.

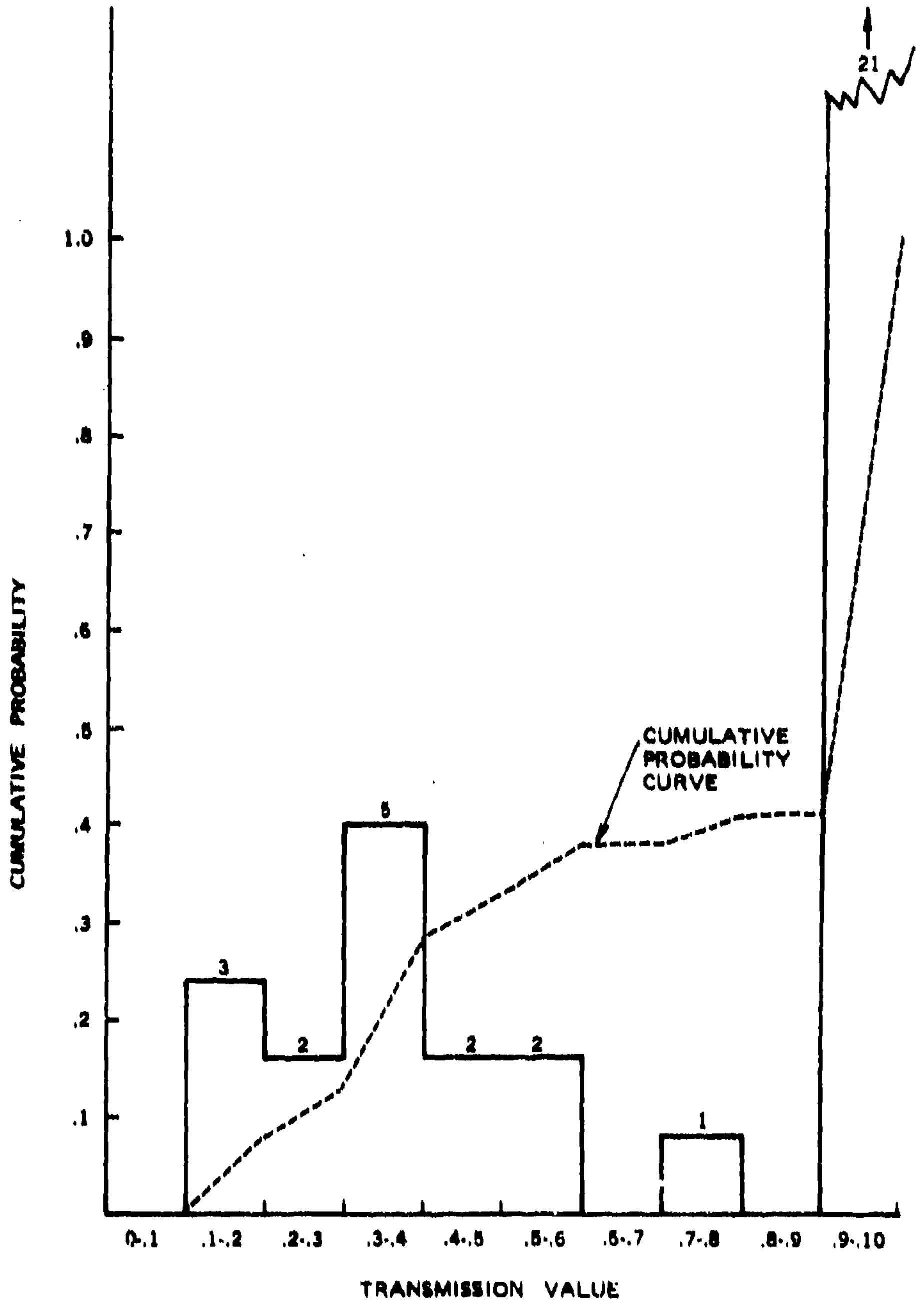


Figure 4-17A. Distribution of points every hour from 1100 to 1500.

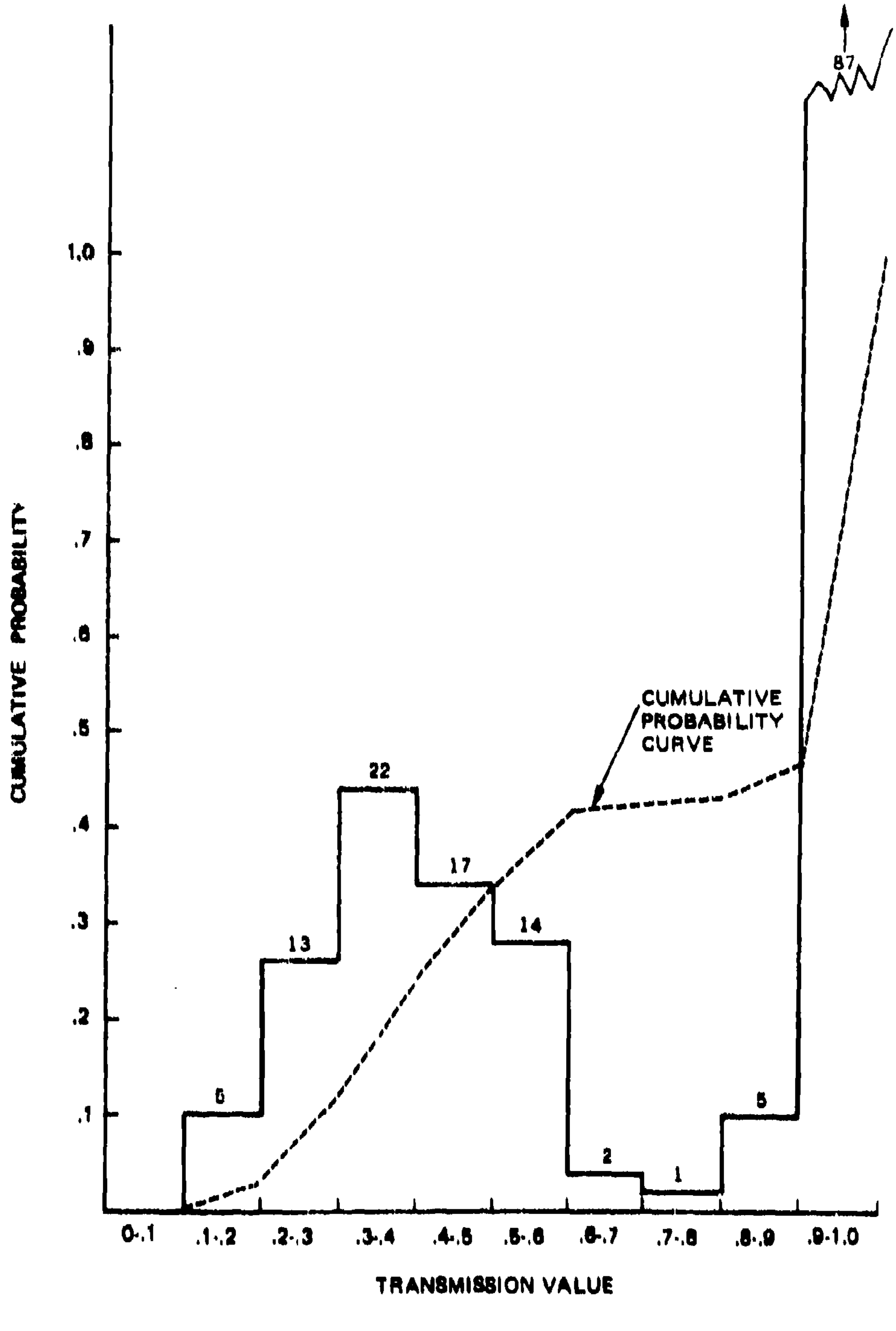


Figure 4-17B. Distribution of points every 10 minutes from 1100 to 1500.

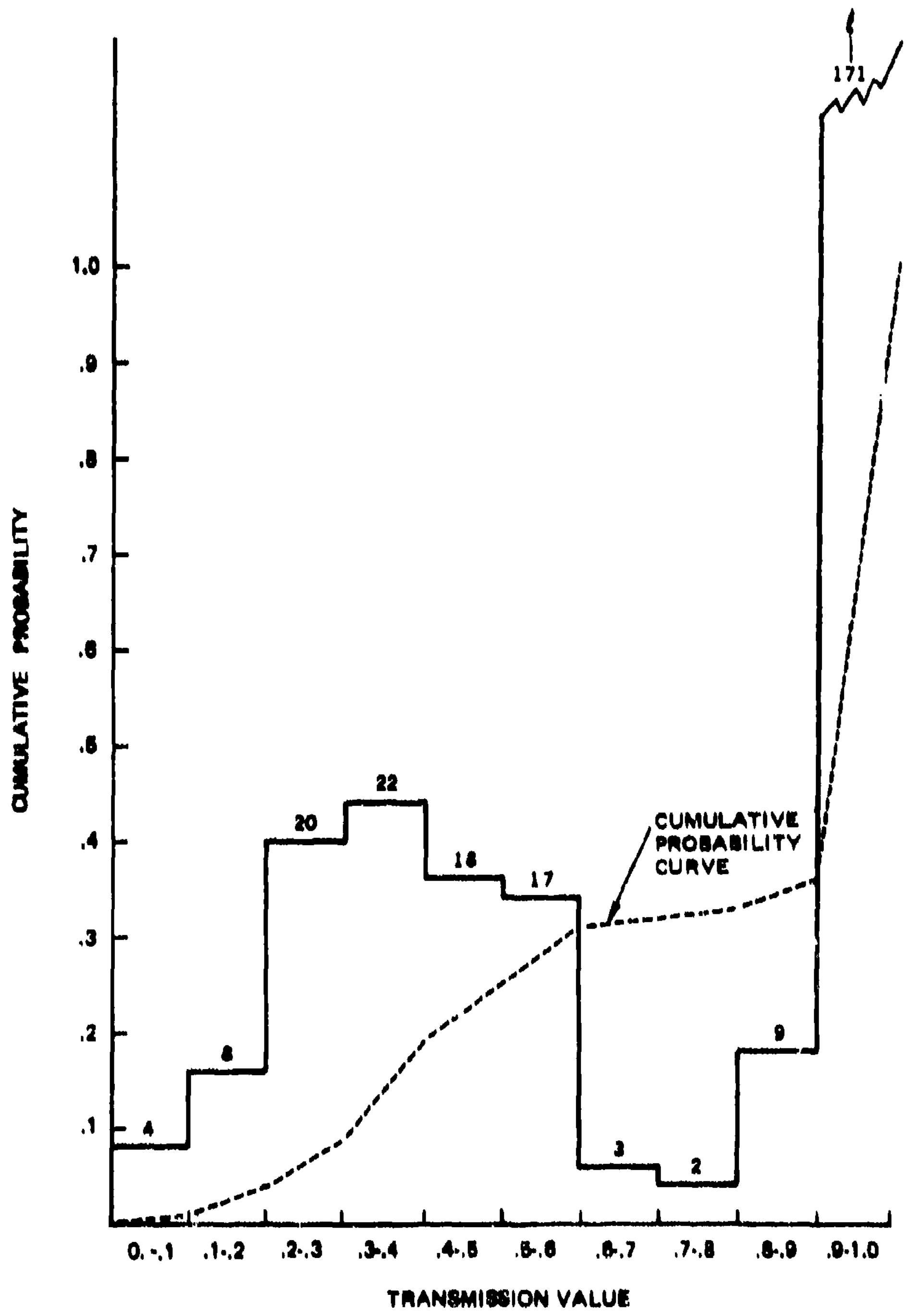


Figure 4-17C. Distribution of points every 10 minutes from 0900 to 1700.

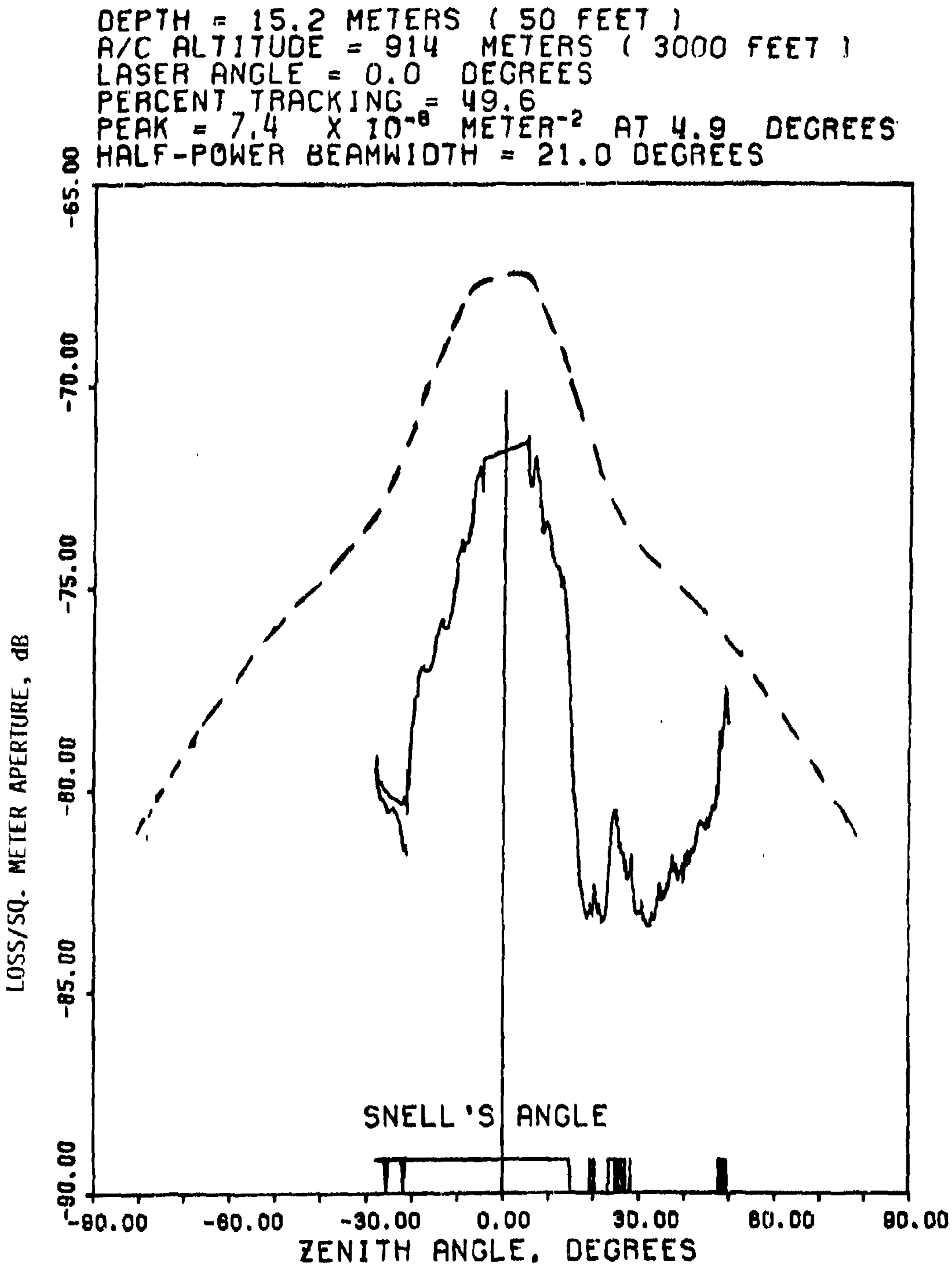


Figure 4-18A. Radiance profile through angle of aircraft (Run No. 16, 22 July 1975).

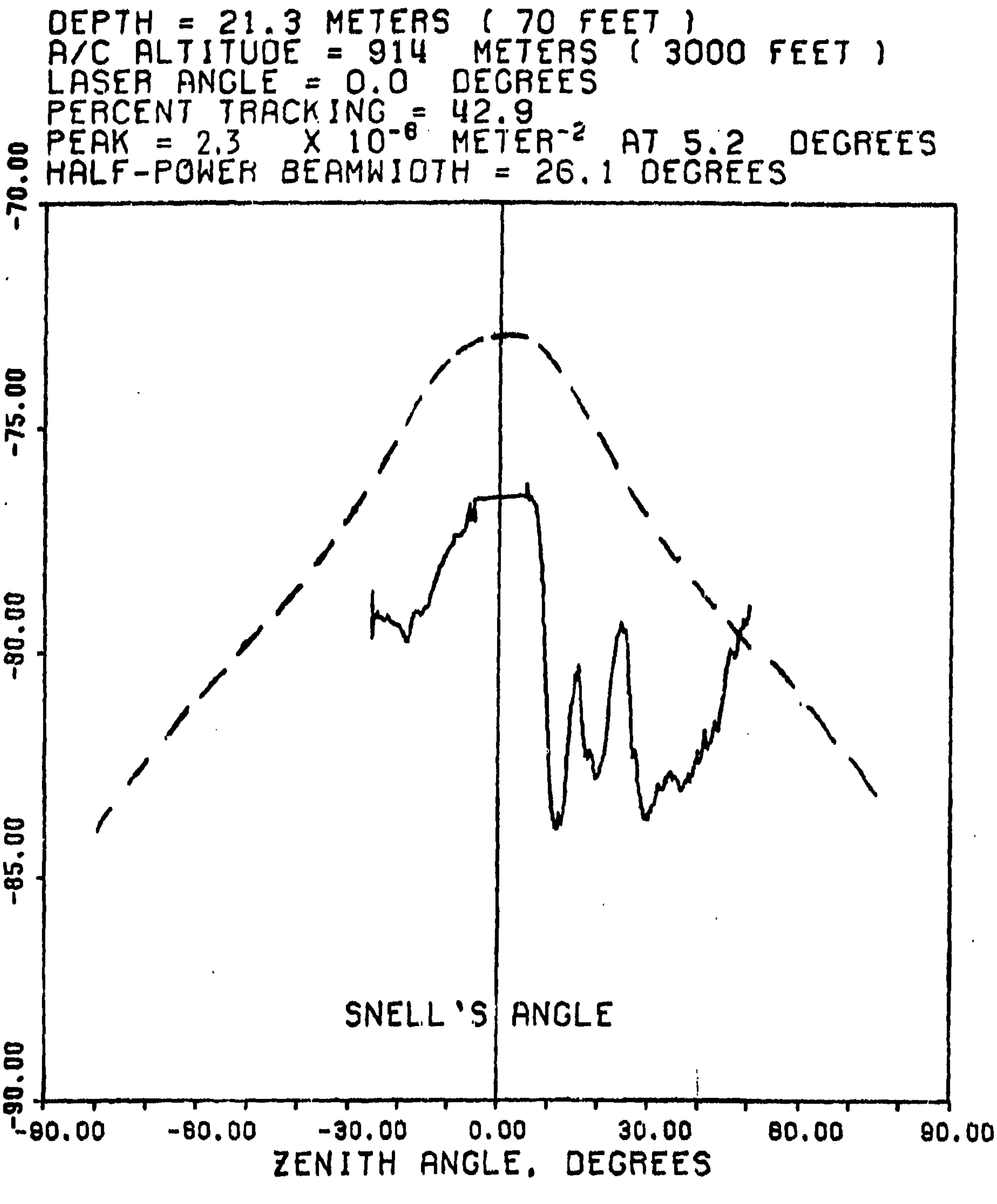


Figure 4-18B. Radiance profile through angle of aircraft (Run No. 17, 22 July 1975).

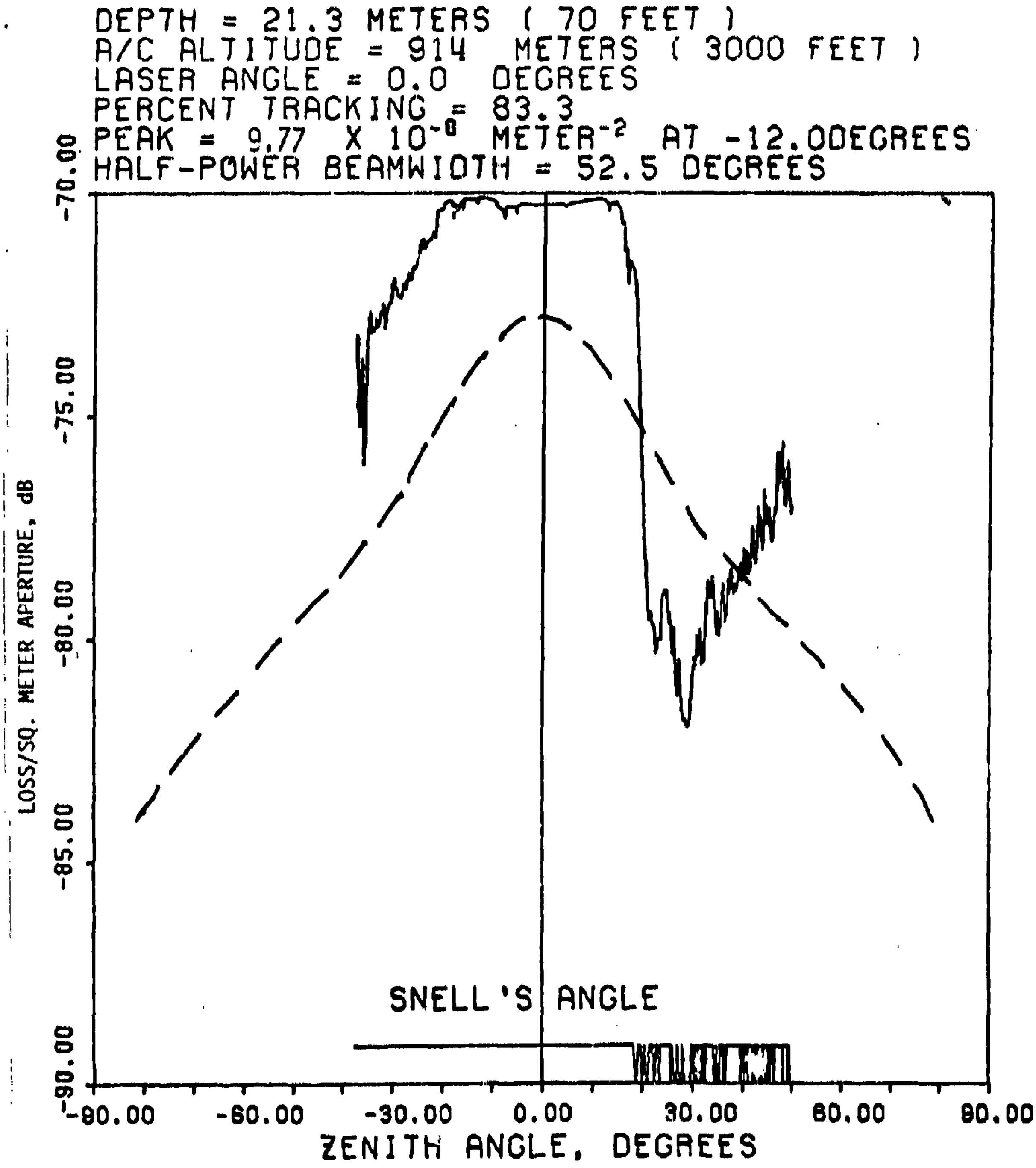


Figure 4-18C. Radiance profile through angle of aircraft (Run No. 19, 22 July 1975).

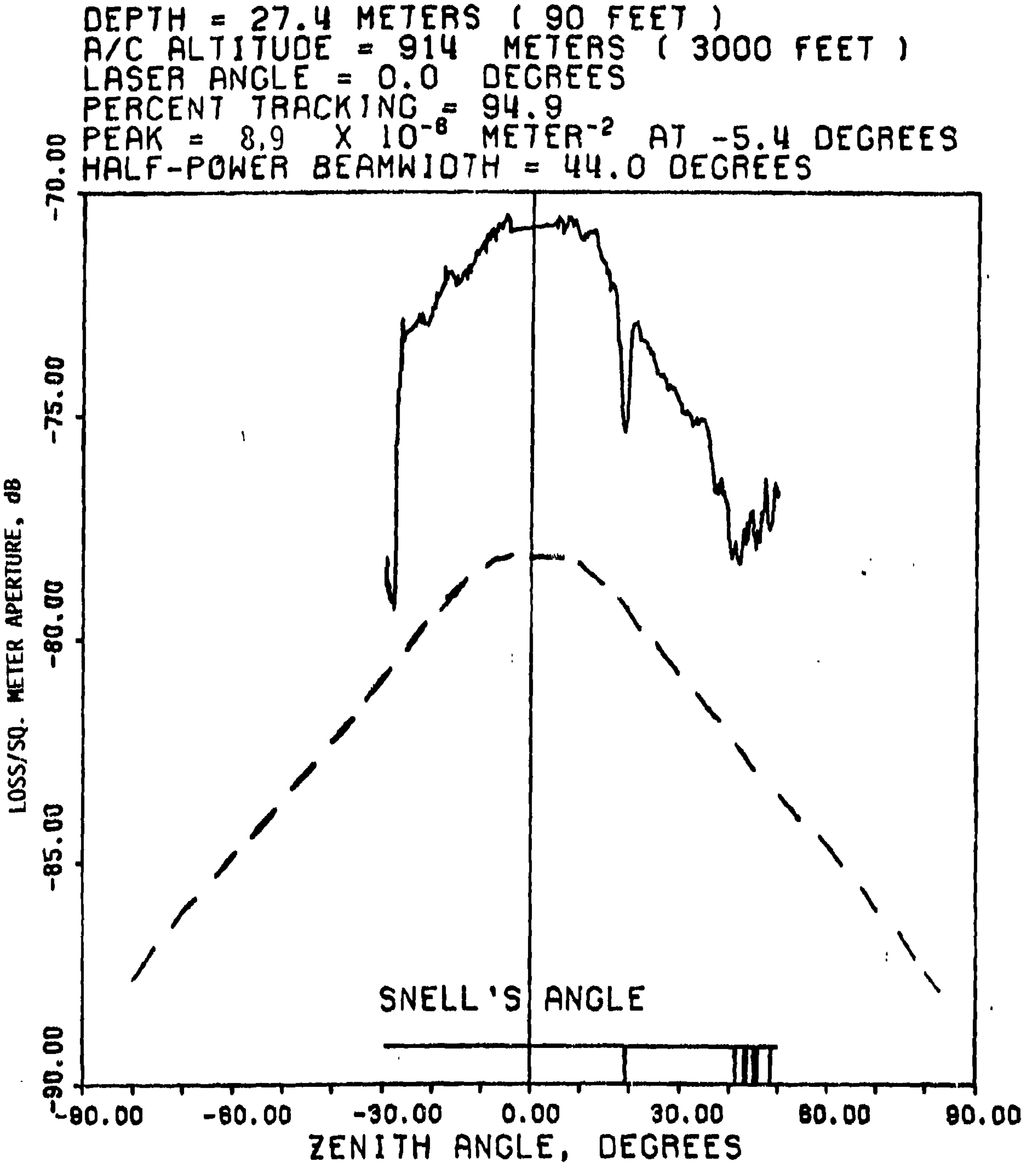


Figure 4-18D. Radiance profile through angle of aircraft (Run No. 20, 22 July 1975).

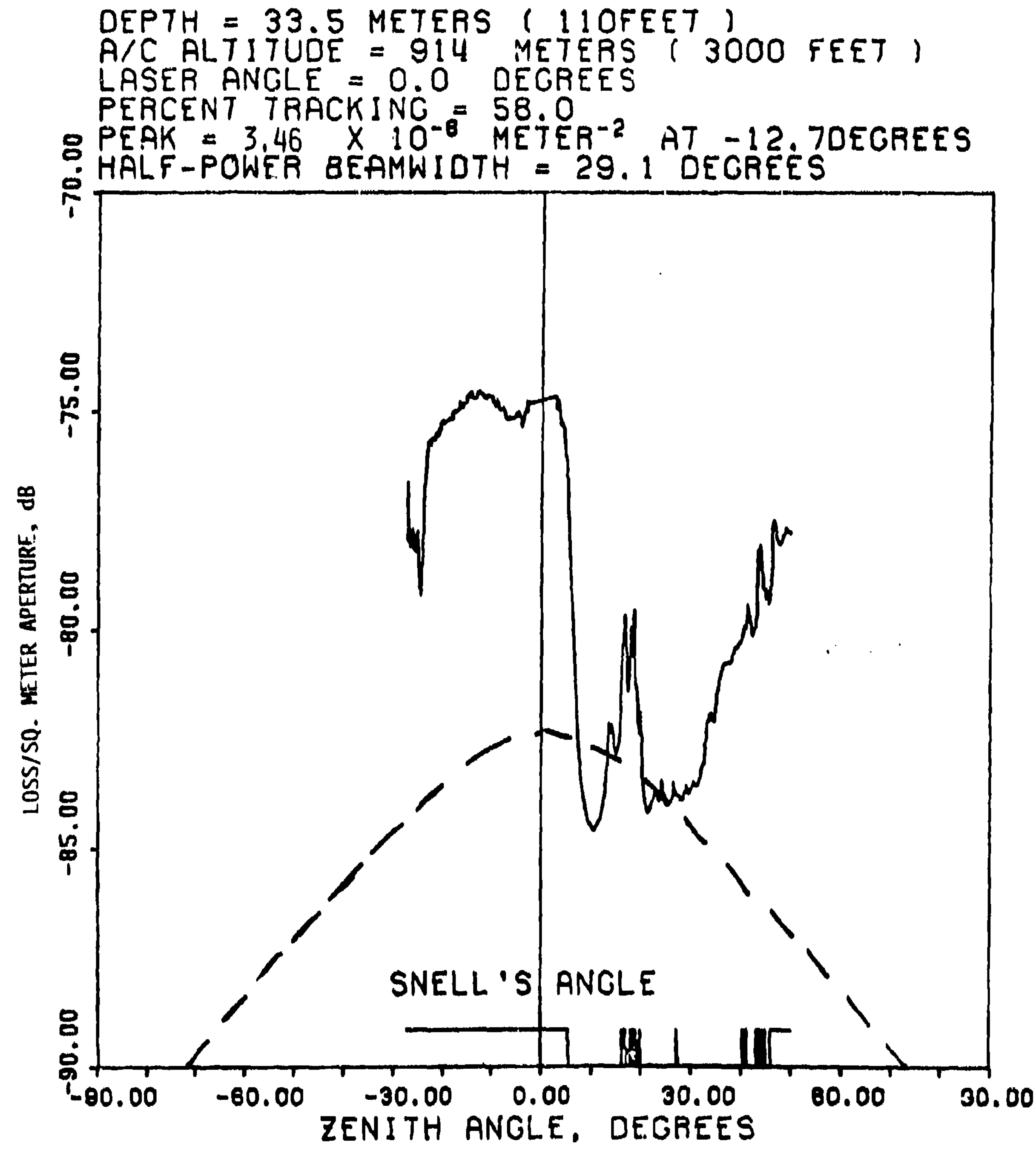


Figure 4-18E. Radiance profile through angle of aircraft (Run No. 21, 22 July 1975).

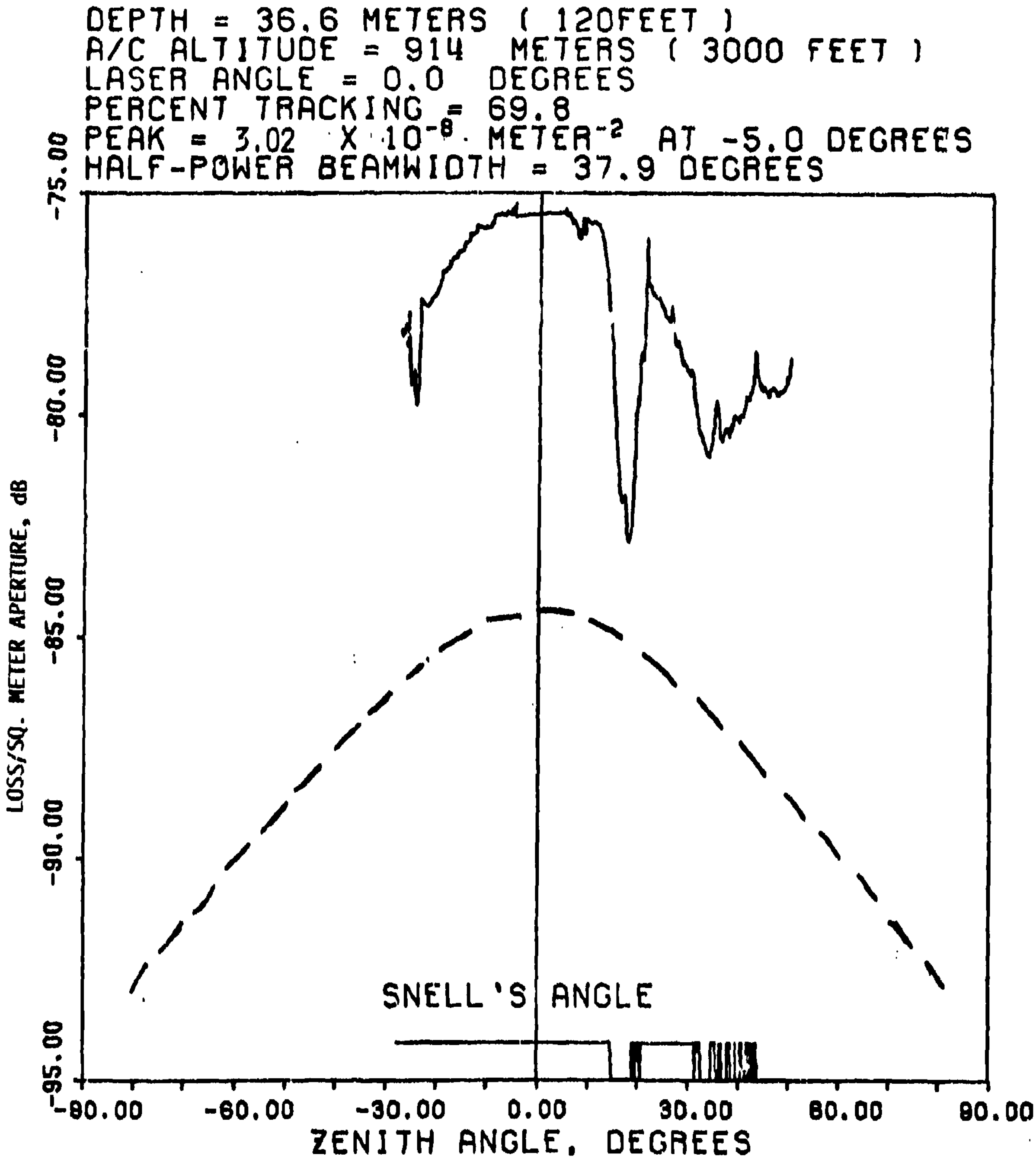


Figure 4-18F. Radiance profile through angle of aircraft (Run No. 22, 22 July 1975).

data are saturated. On most data plots there is a constant line going through zero degrees zenith. Because the aircraft could not always pass directly overhead, a minimum zenith angle resulted. Since a sign reversal occurs in the gimbal readings, a plus/minus indication occurs on adjacent pulses. Along the abscissa, an indication of when the receiver was in track has been noted. A deviation from the abscissa indicates track. The filtering of the data is described in Appendix E. Filtering of approximately one second was used for a few reasons. First, this was the shortest integration time that would eliminate the grass in the data due to noise without altering the results. Second, the aircraft was traveling at 80 mph which is approximately 117 feet per second. At 3,000 feet this is 2.2°, while at 2,000 feet this is 3.3°. Since the beamwidth of the source was 2°, this is approximately the maximum resolution inherent in the experiment. Finally, the results of the model were overlaid using the data taken by Scripps.

In figures 4-18 A through F, the model ranges from several dB too high to several dB too low, and is consistent with the downlink data. There also appears to be some conservatism at the deeper depth, which is appropriate for system design. However, there is some uncertainty, that is more difficult to explain. Notice that figures 4-18 B and C which were taken within 15 minutes of each other and represent the same scenario are 10 dB different, with the model falling halfway in between. One could possibly envision some sudden change in the environment to explain this. What is more plausible, however, is to look for other causes. For example, the sensitivity of the receiver was changed between the two runs by inserting a neutral density filter. Although it was accounted for in the calibration, this might be suspect. Also, the percentage of track was different in the two runs. And finally, there could be some dynamic effects caused by the ocean surface that might have caused the difference. What can be concluded, however, is qualitative concurrence. This same qualitative concurrence is also maintained as the angle of the laser source is varied.

In figures 4-19 A through E, the laser angle is changed to 12.5° off the vertical. (The refracted angle predicted from Snell's law is also plotted.) In figures 4-20 A through D, this angle is increased to 32.5° and in figures 4-21 A through J, to 42.5°. In every case where two scenarios were repeated, there were several dB variation, with the model residing in between. Furthermore, the data clearly indicate a spreading of the beam away from the Snell's angle and toward the zenith. This has been predicted by the model and is in qualitative agreement with the data.

The above data have been selected so that only the better runs are presented. Tables 4-4 A through D represent complete listings of all the data with some accompanying comments. Approximately 50 hours of aircraft time were employed. The data taken on July 24 were lost due to a tape recorder malfunction.

4.3 CONCLUSIONS AND RECOMMENDATIONS

While it cannot be said that all the goals of the experiment were reached in a quantitative manner, the experiment was nevertheless highly successful. Use of the radiative transport theory as a principal tool in predicting system performance in the ocean environment has been clearly established. Although some approximations were used in the OPSATCOM application, it is also clear that a more global application is well within the state of existing knowledge. The basic parameters on which the radiative transport theory are based are well known. However, the mechanism for extracting these parameters is still an art, and some advances in this direction were also made (Appendix D). Some of the regression curves derived are shown in figures 4-22 through 4-24. The most interesting one from a system point of view is figure 4-24. This is the regression of θ^2 against s. Notice that in the clearer waters, θ^2 is larger than in the turbid waters. This of course implies that in the latter case the particulates are large and concentrate the scattering in a forward direction. This in turn will somewhat offset the deleterious effects of a large value of s upon system performance. On the other hand, in clear water we must recognize that the medium is less forward scattering, which will degrade system performance to some degree.

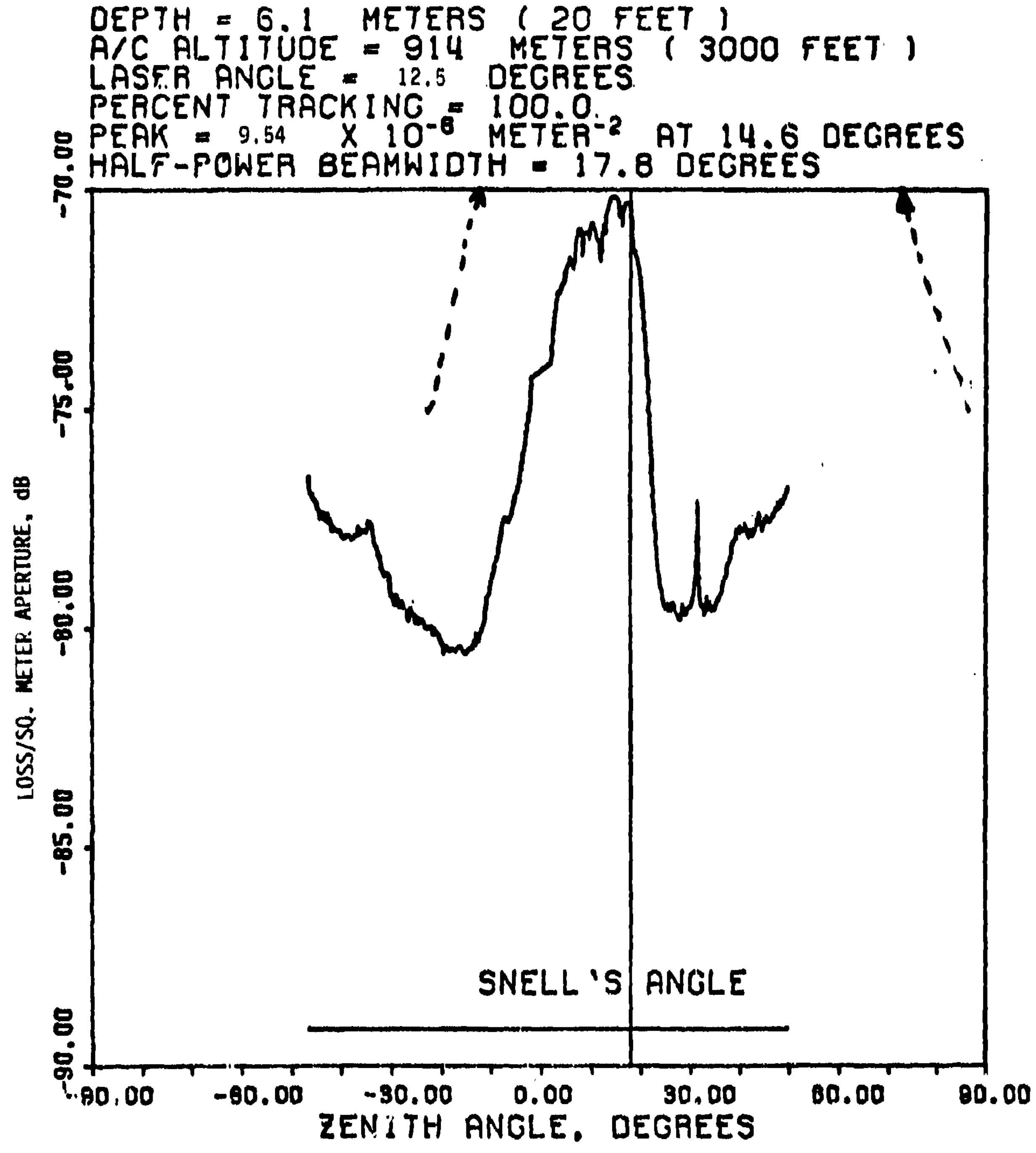


Figure 4-19A. Radiance profile through angle of aircraft (Run No. 12, 21 July 1975).

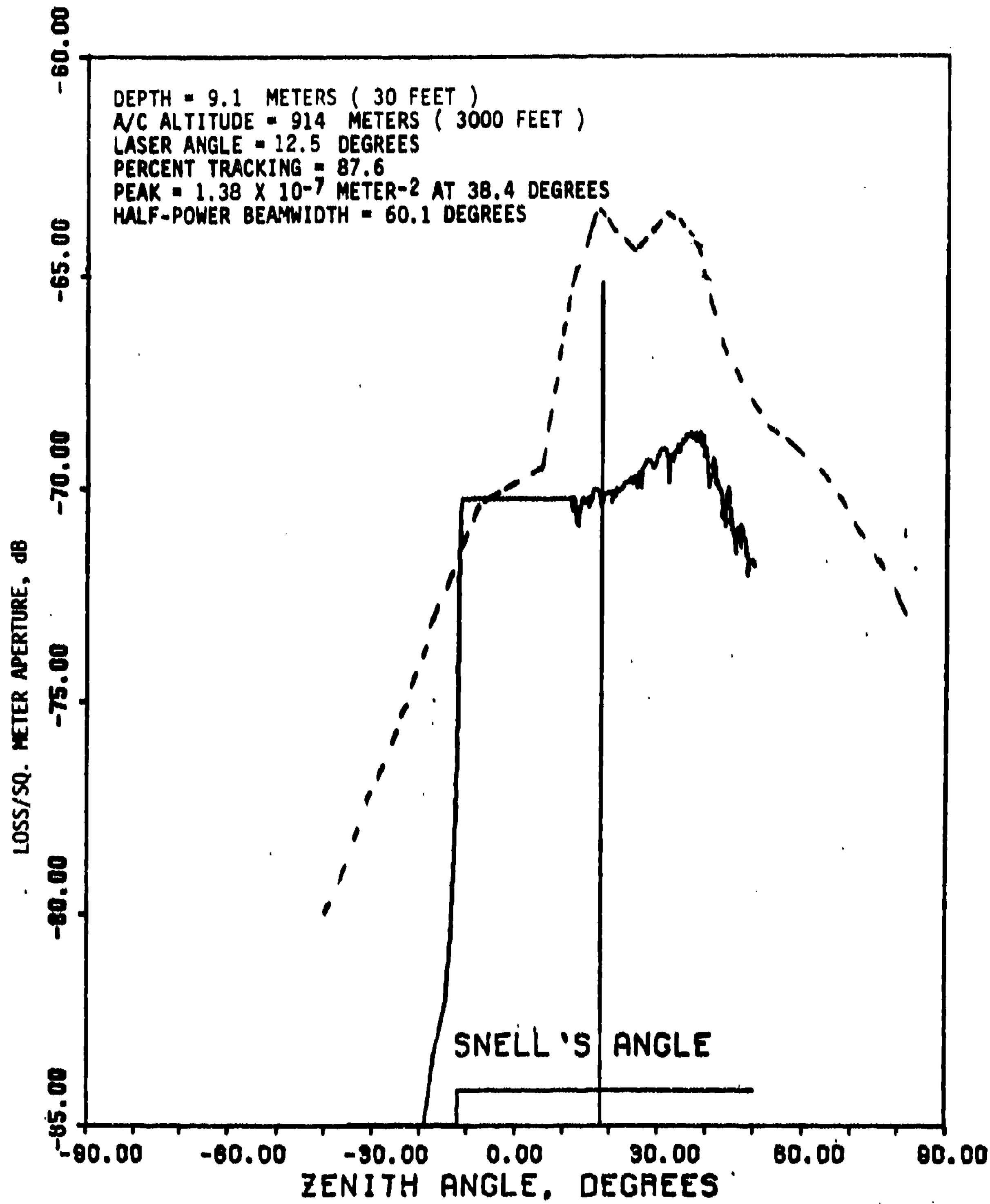


Figure 4-19B. Radiance profile through angle of aircraft (Run No. 1, 21 July 1975).

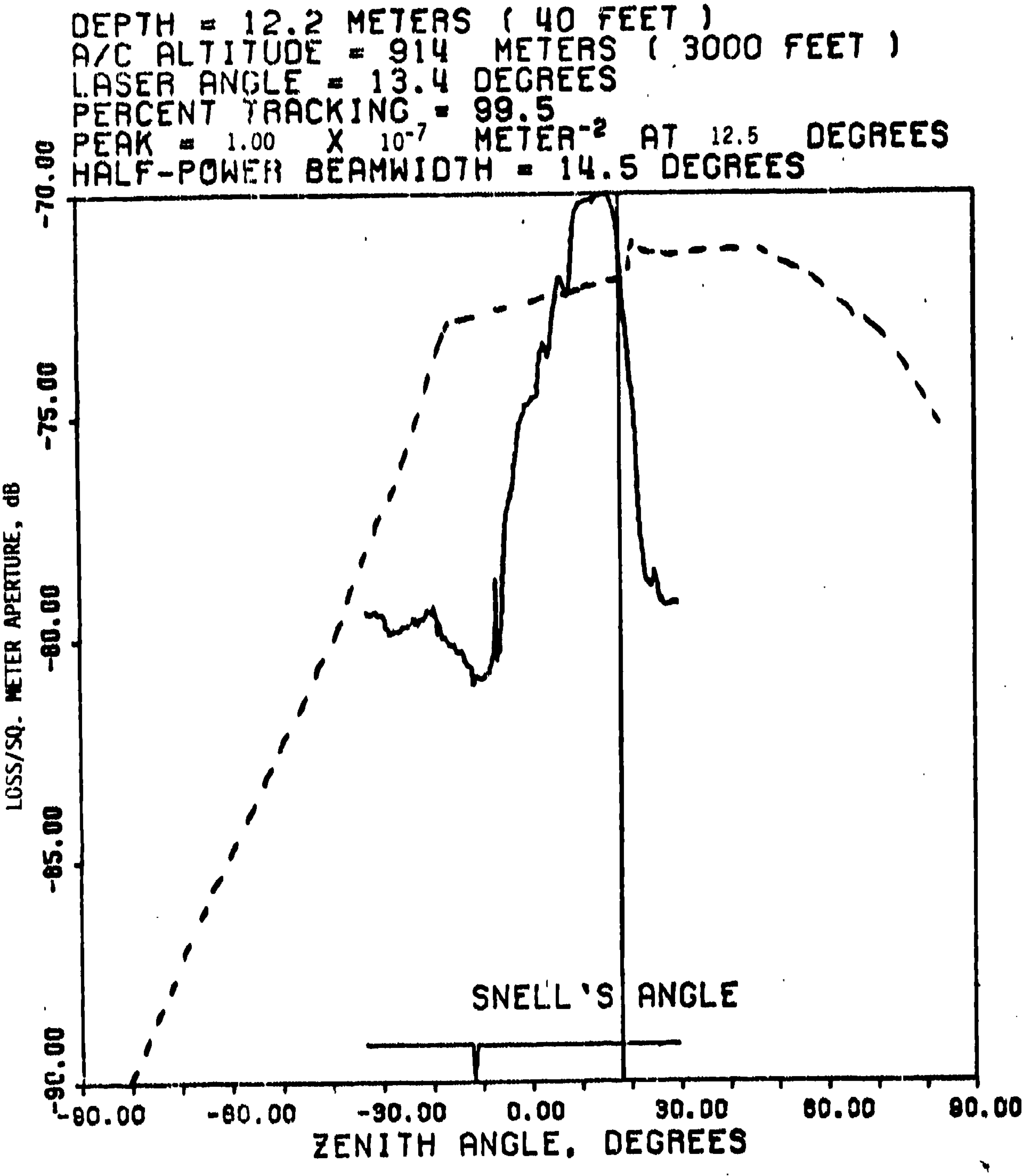


Figure 4-19C. Radiance profile through angle of aircraft (Run No. 4, 21 July 1975).

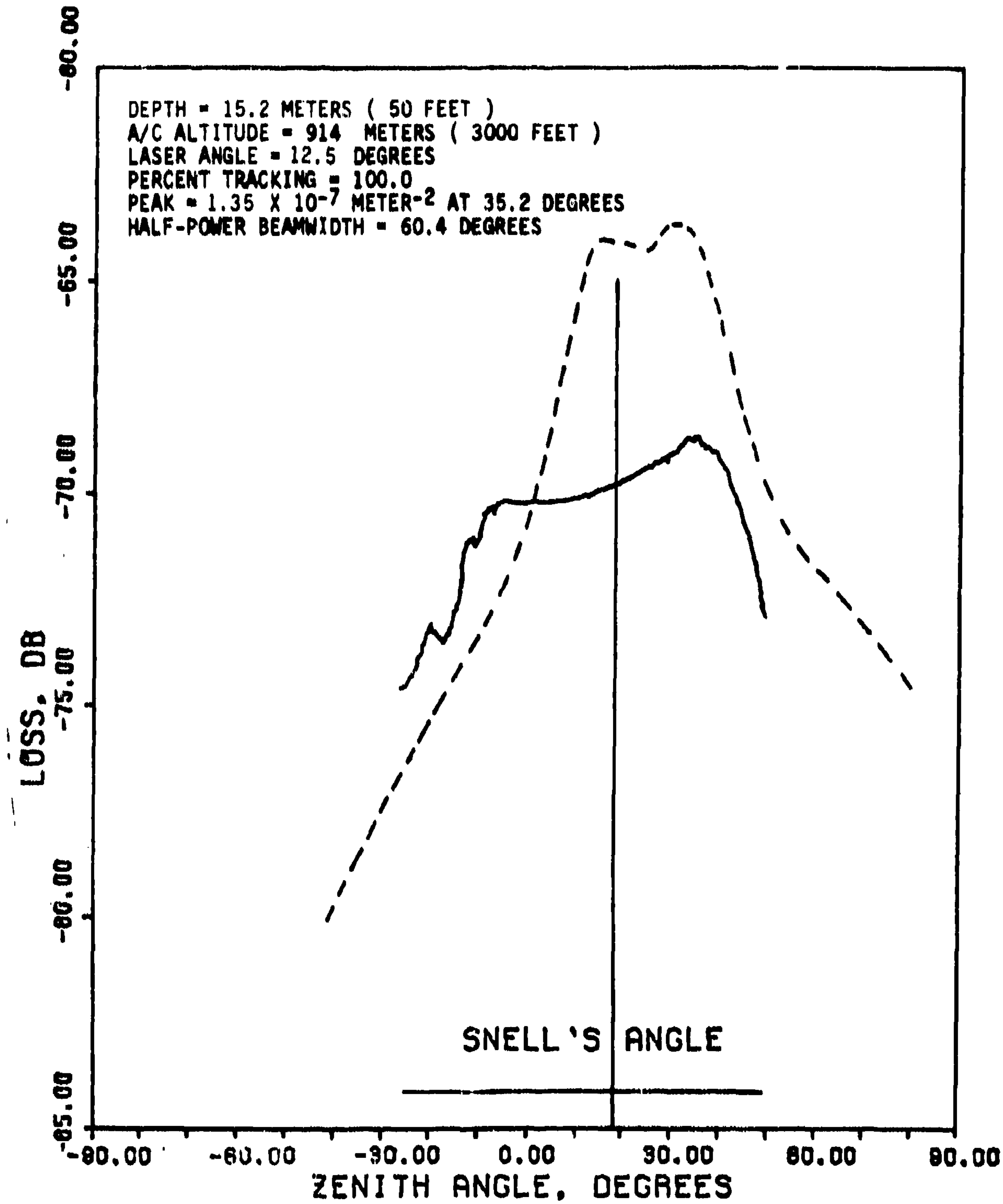


Figure 4-19D. Radiance profile through angle of aircraft (Run No. 5, 21 July 1975).

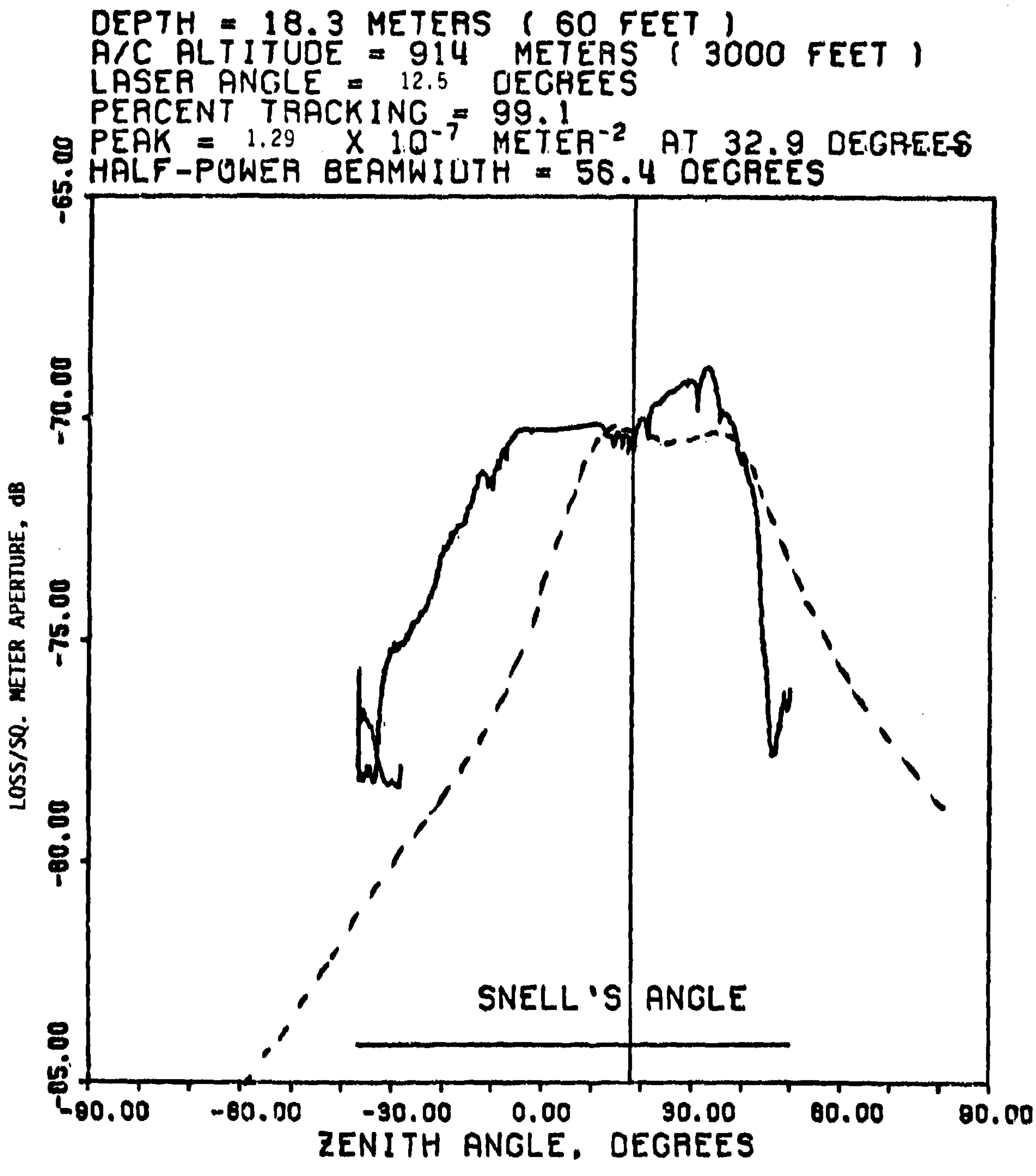


Figure 4-19E. Radiance profile through angle of aircraft (Run No. 6, 21 July 1975).

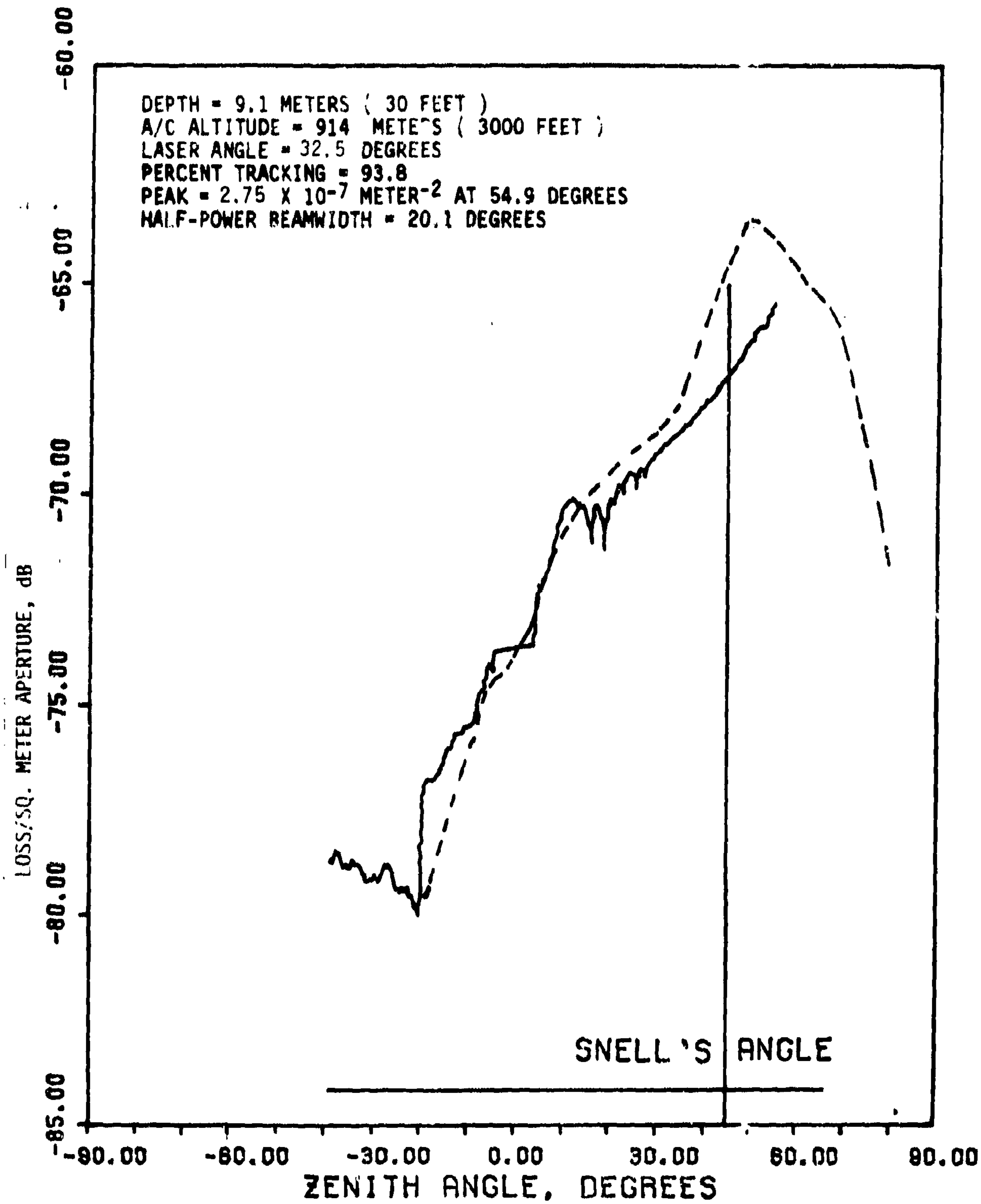


Figure 4-20A. Radiance profile through angle of aircraft (Run No. 14, 21 July 1975).

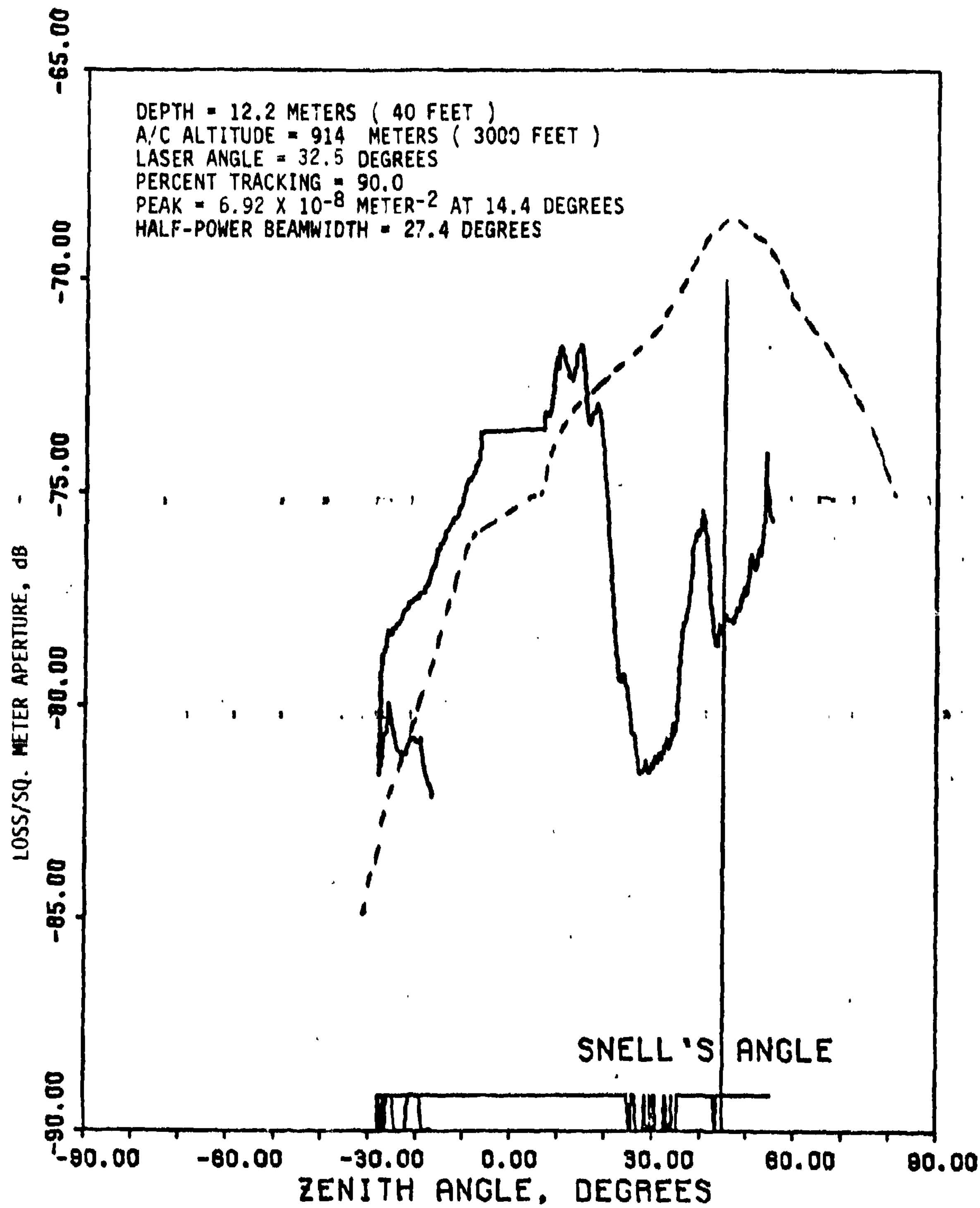


Figure 4-20B. Radiance profile through angle of aircraft (Run No. 16, 21 July 1975).

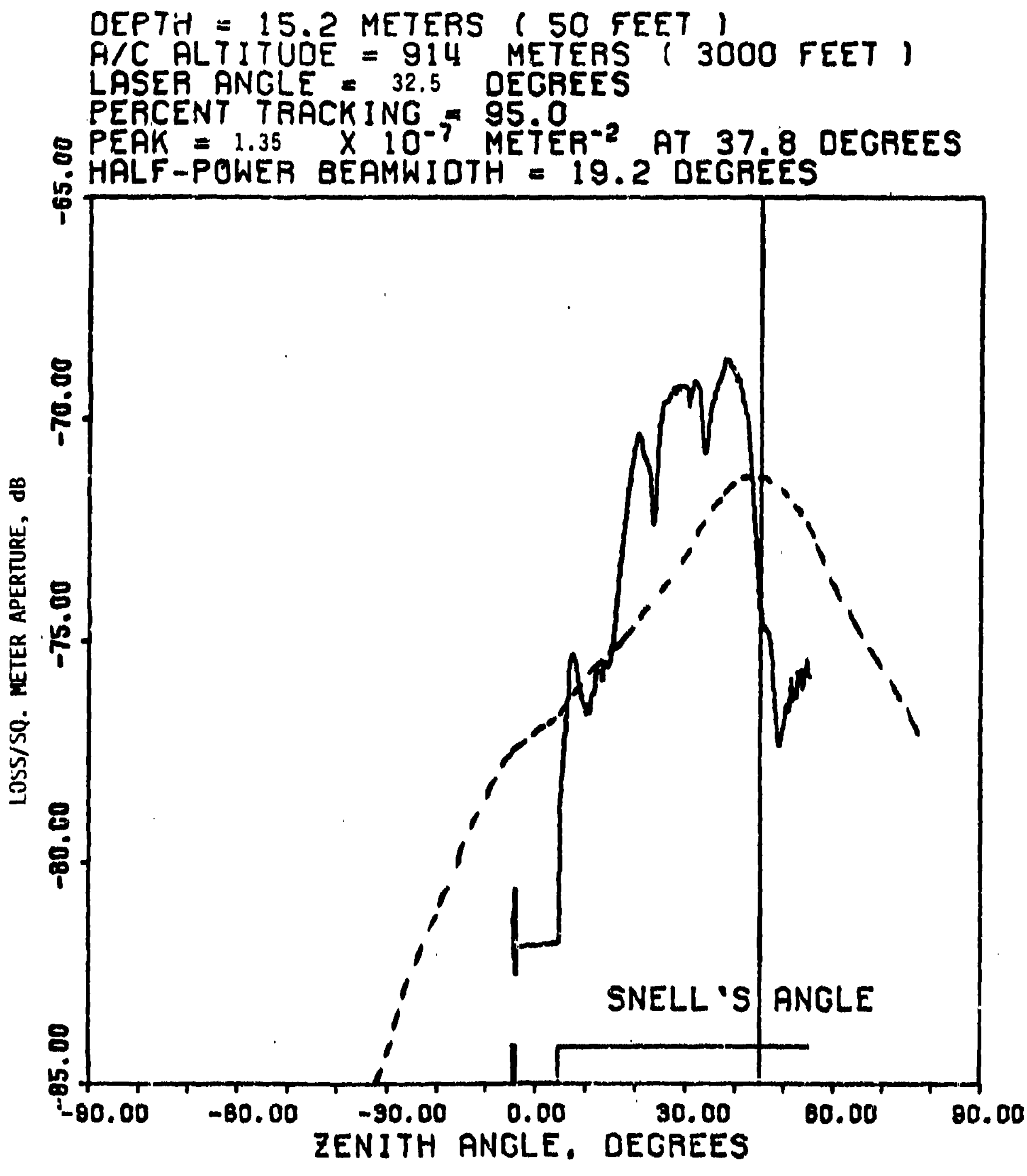


Figure 4-20C. Radiance profile through angle of aircraft (Run No. 17, 21 July 1975).

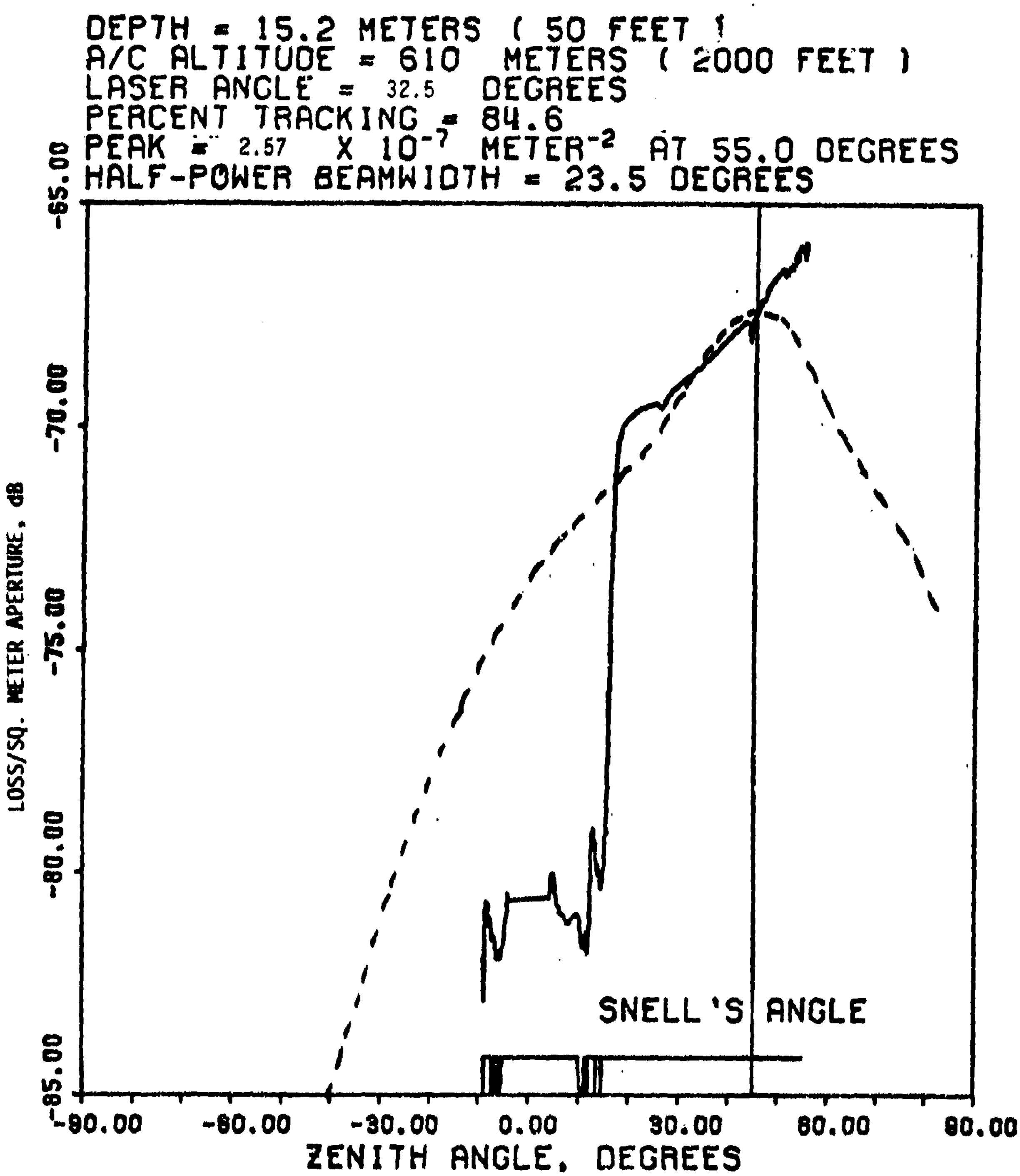


Figure 4-20D. Radiance profile through angle of aircraft (Run No. 19, 21 July 1975).

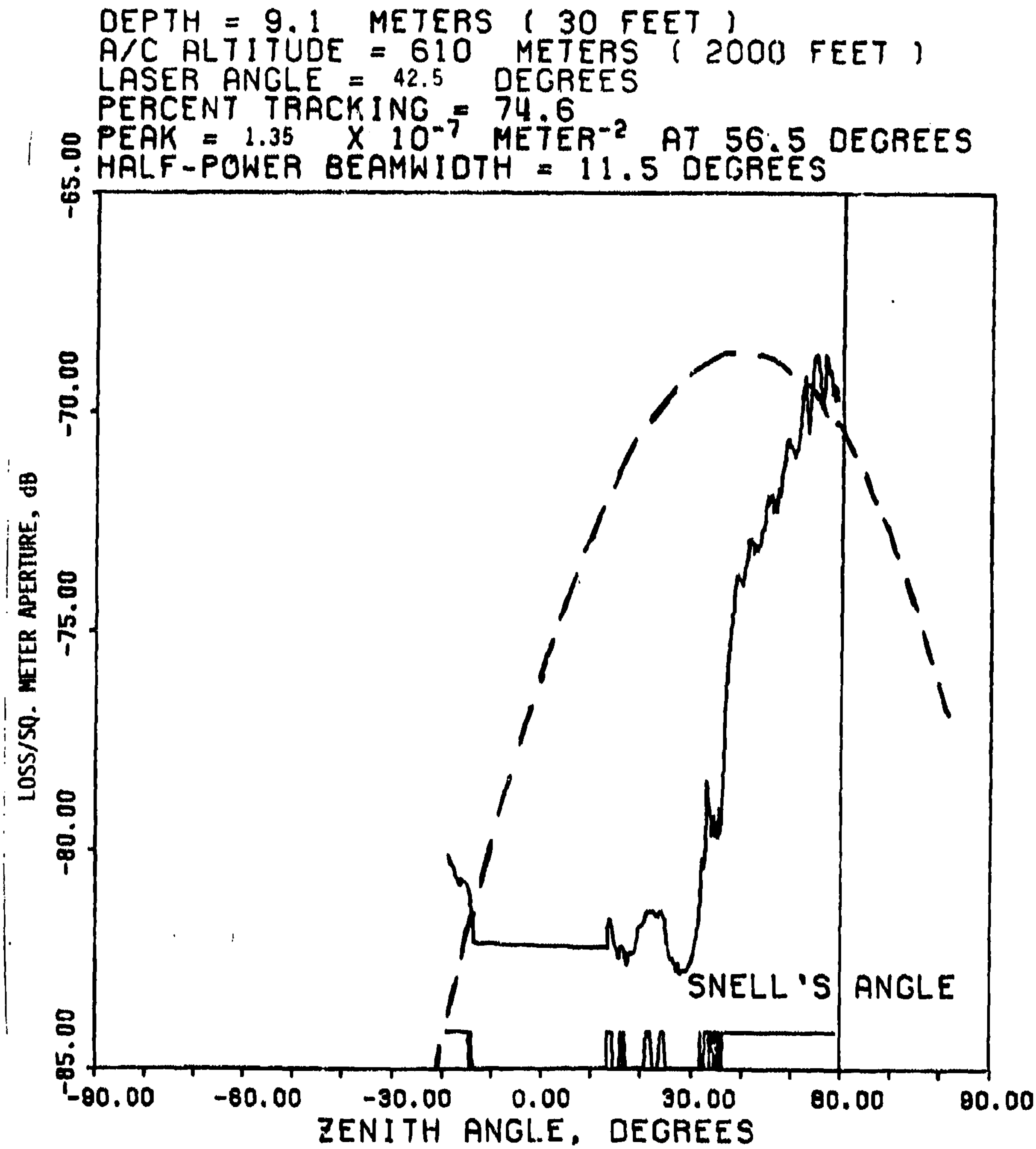


Figure 4-21A. Radiance profile through angle of aircraft (Run No. 12, 22 July 1975).

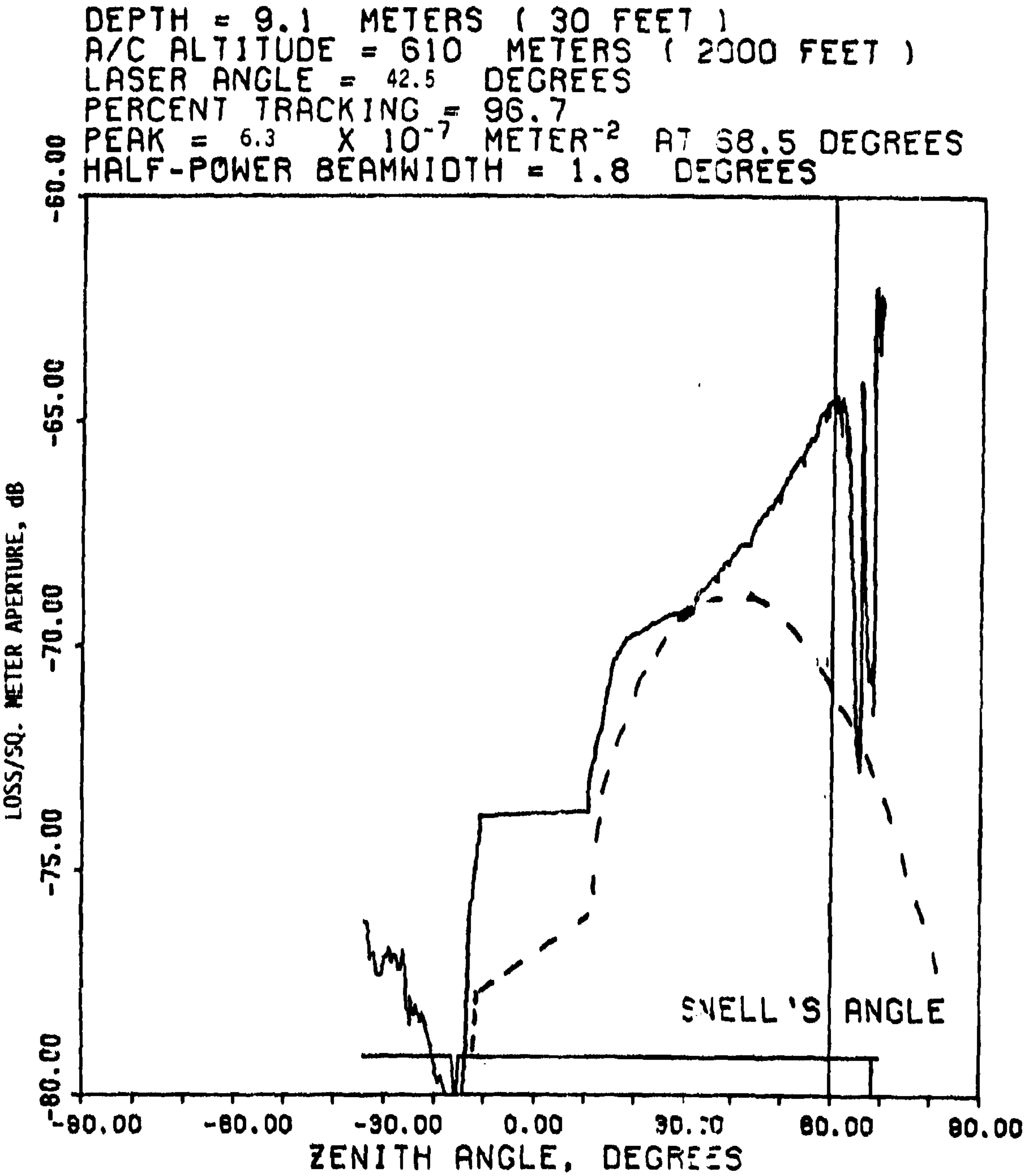


Figure 4-21B. Radiance profile through angle of aircraft (Run No. [illegible], 22 July 1975).

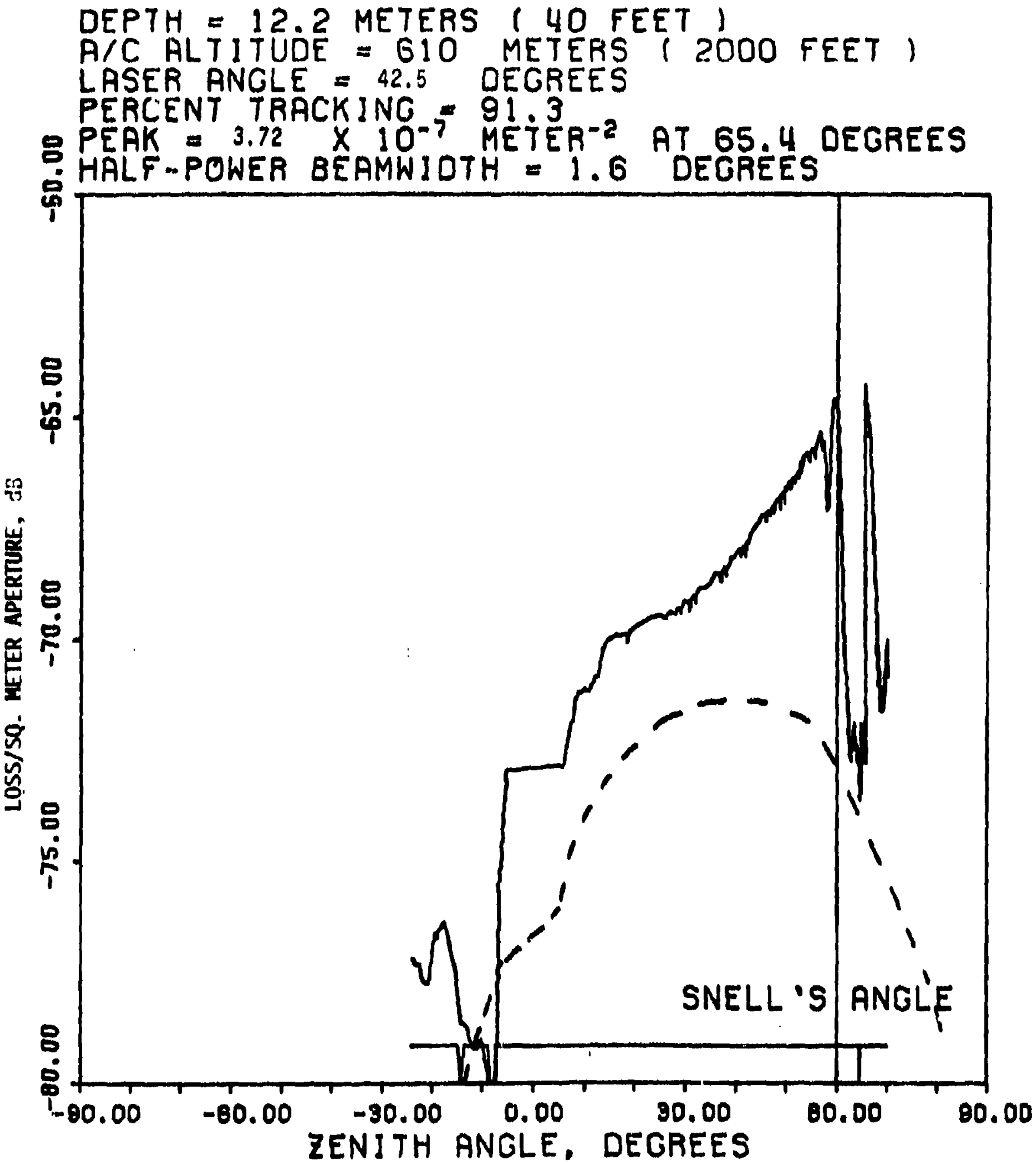


Figure 4-21C. Radiance profile through angle of aircraft (Run No. 2 22 July 1975).

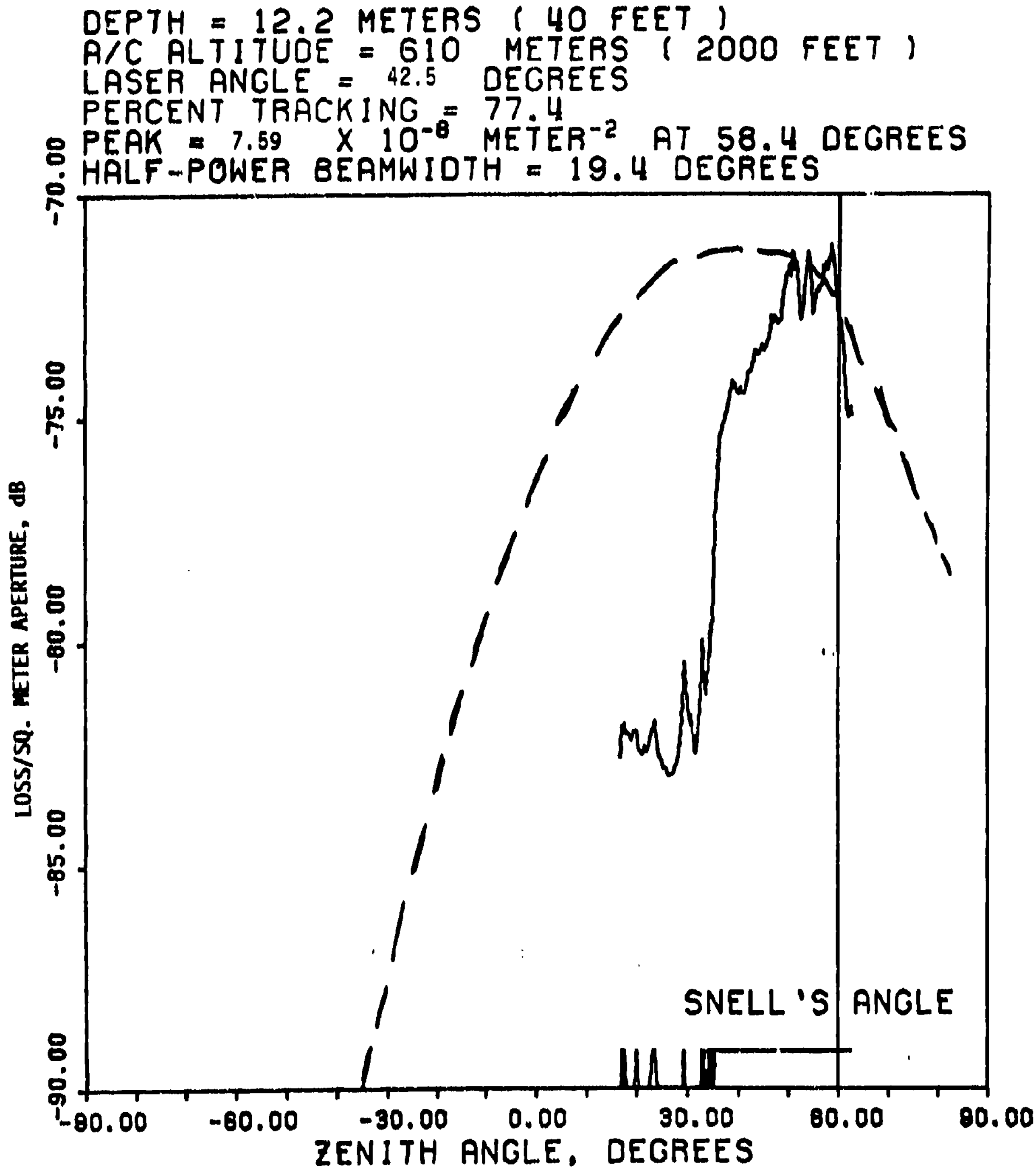


Figure 4-21D. Radiance profile through angle of aircraft (Run No. 11, 22 July 1975).

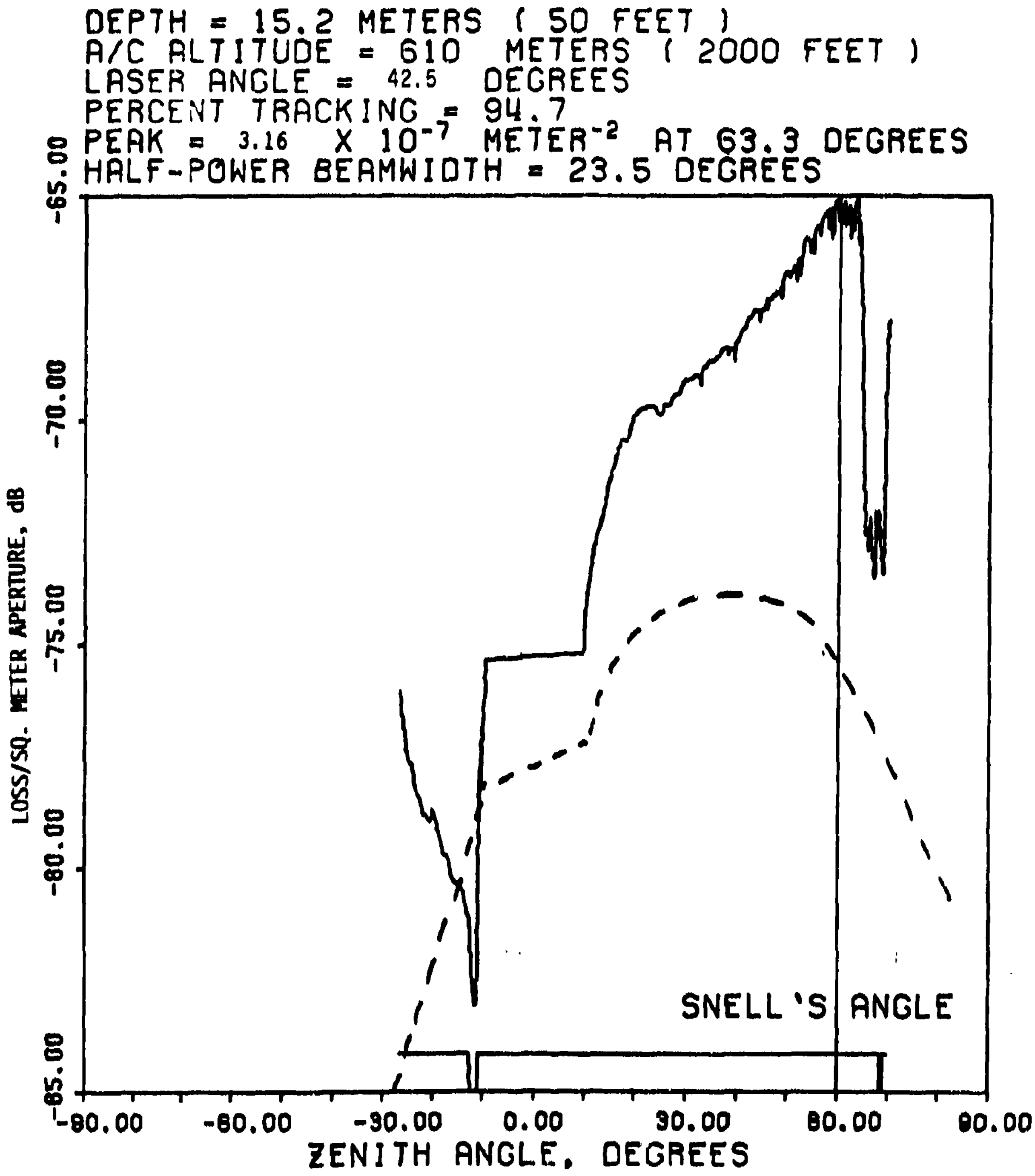


Figure 4-21E. Radiance profile through angle of aircraft (Run No. 3, 22 July 1975).

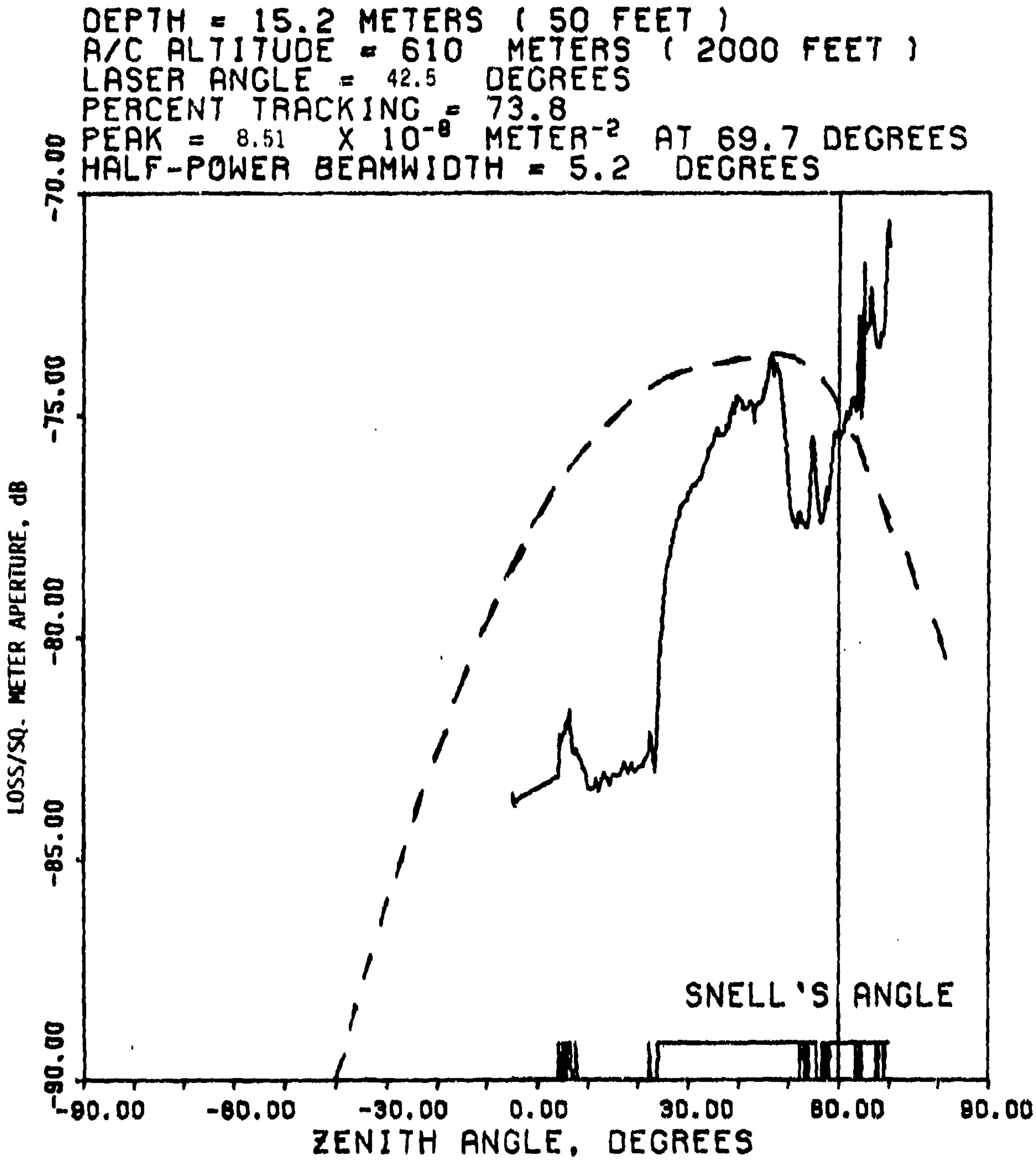


Figure 4-21F. Radiance profile through angle of aircraft (Run No. 10, 22 July 1975).

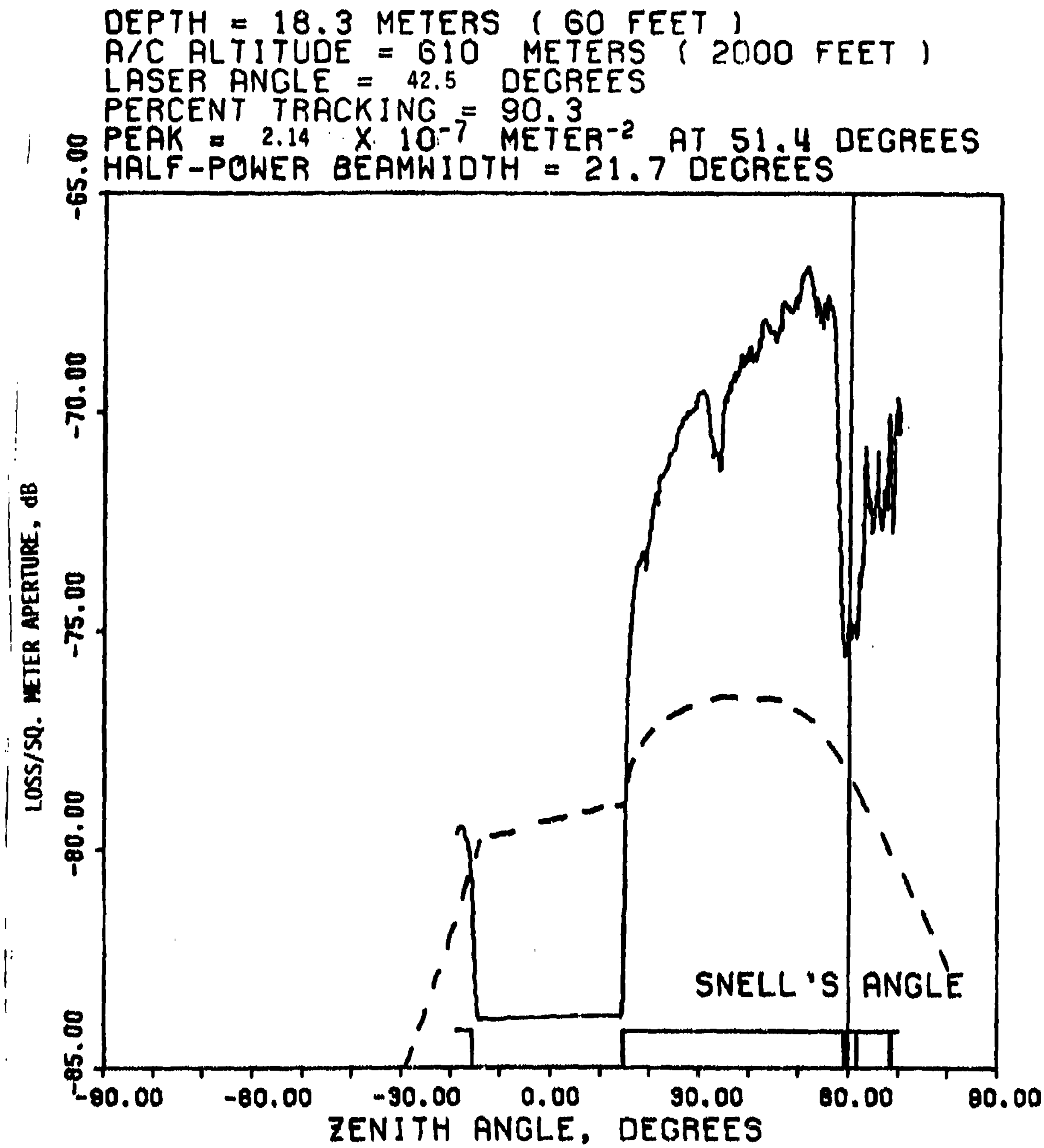


Figure 4-21G. Radiance profile through angle of aircraft (Run No. 4, 22 July 1975).

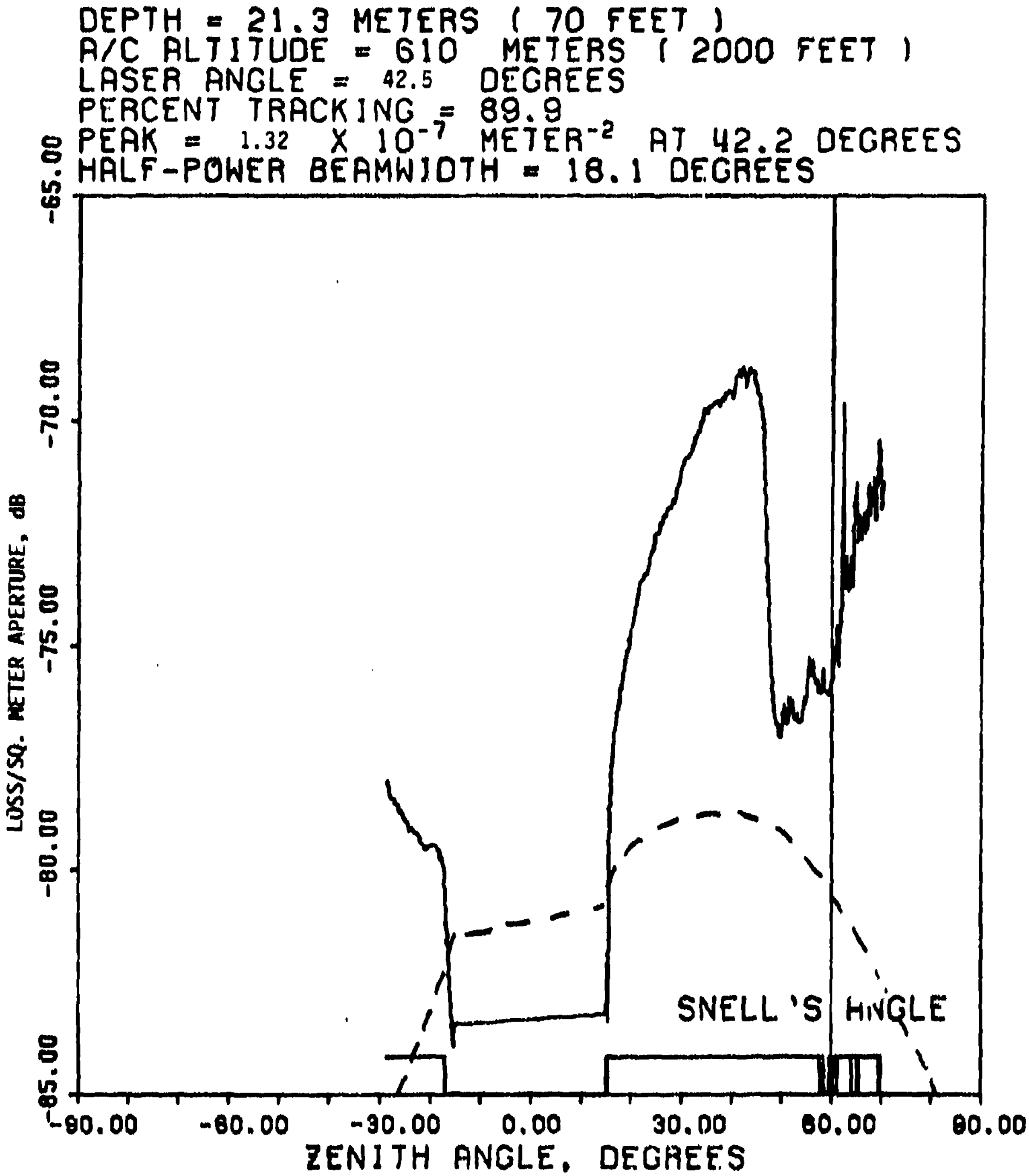


Figure 4-21H. Radiance profile through angle of aircraft (Run No. 5, 22 July 1975).

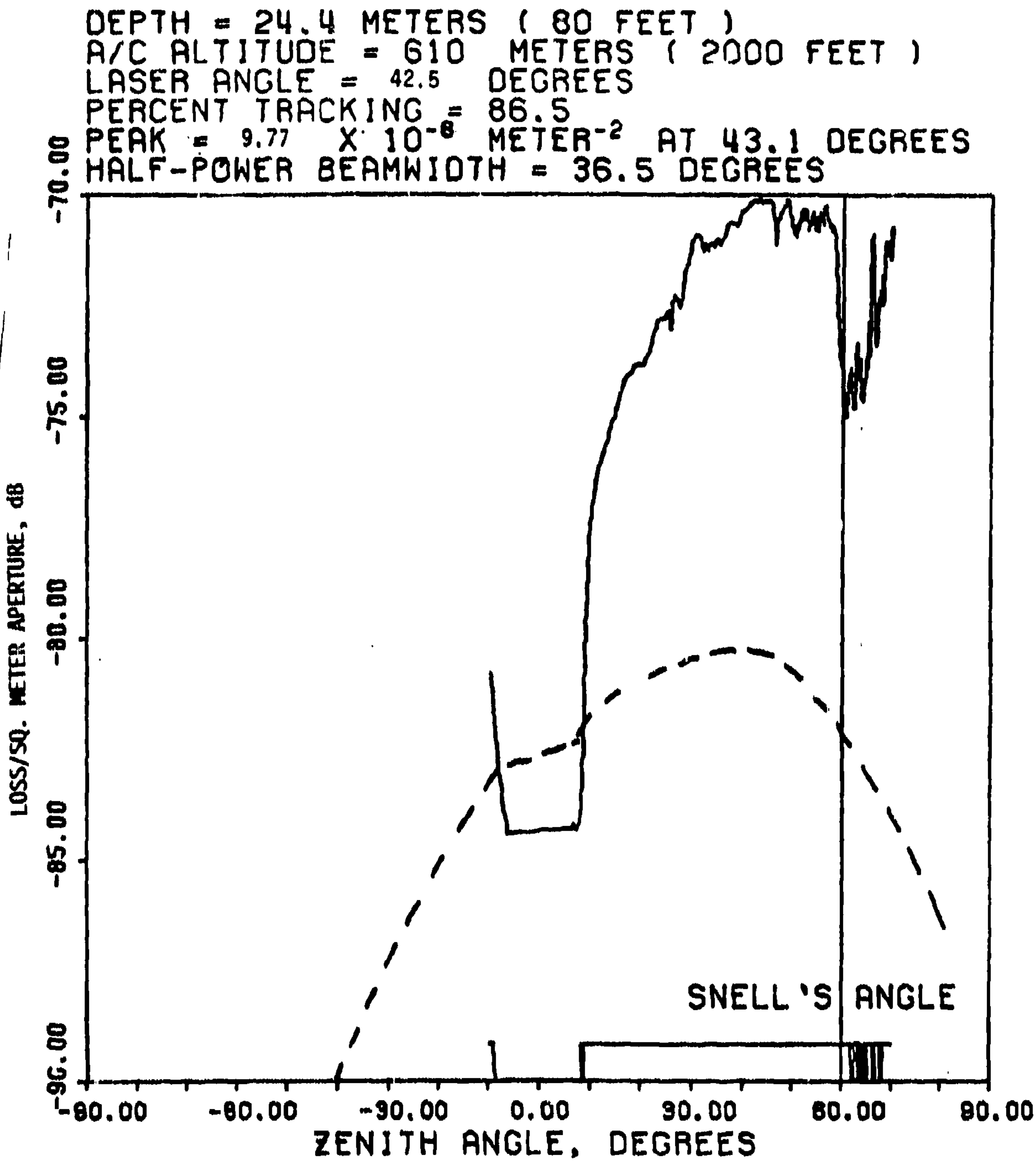


Figure 4-211. Radiance profile through angle of aircraft (Run No. 6, 22 July 1975).

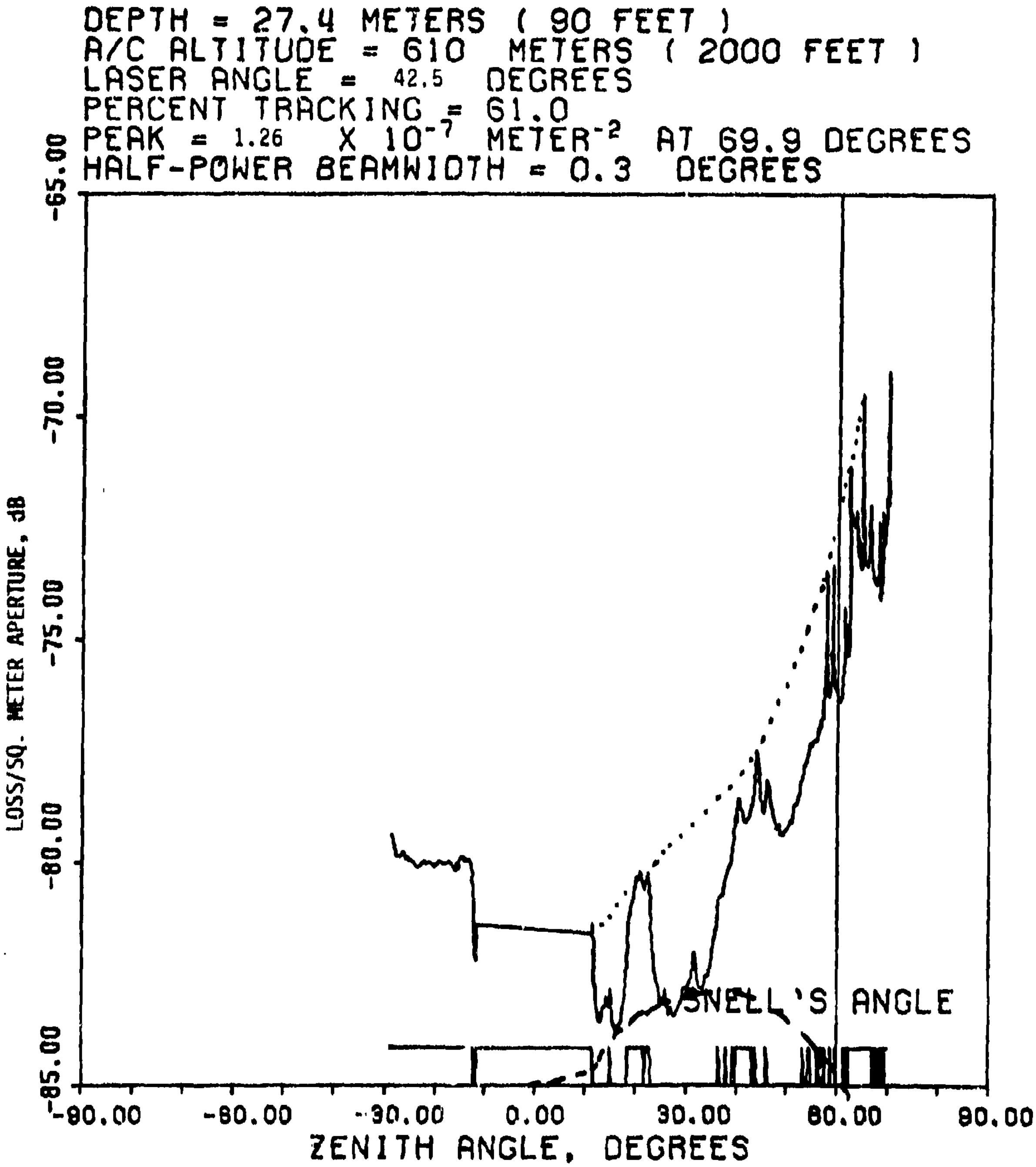


Figure 4-21J. Radiance profile through angle of aircraft. (Run No. 7, 22 July 1975).

TABLE 4-4A. PBY DYE LASER TRACKS.

19 July 1975

PASS NO.	ALT	TIME HRS	LASER UW Z θ°	LASER UW DEPTH	GAIN RANGE	FILTER IN N.D.	Σ SIGNAL	NOISE	TRACK	SWX 64	EOF	COMMENTS
1												No good
2												No good
3												No good
4		1634										Some track near Snell's angle
5		1641										Some track near Snell's angle
6												No good
7		1657										Some track on side of Snell's angle
8												No good
9		1718										Some track
10												No good
11												No good
12		1746										Some track, very little
13												No good
14		1807										Some
15												No good
16		1822										Some
17												No good

TABLE 4-4B. PBY DYE LASER TRACKS.

21 July 1975

PASS NO.		TIME	LASER UW Z	LASER UW	GAIN RANGE	FILTER IN N.D.	Σ SIGNAL	NOISE	TRACK	SWX 64	EOF	COMMENTS
.	ALT	HRS	θ°	DEPTH								
1	3K'	1427	18°/air	30'	1	No	>100	2-3	Yes			Tried range and kicked out
2	3K'	1435	18°/air	30'	2		None	0	No			Bad pass ↑
3	3K'	1442	18°/air	30'								
4	3K'		18°/air	40'		1.0	>100					49:32
5	3K'		18°/air	50'	1		>100		Yes			50:24
6	3K'	1503	18°/air	60'	1		>100	5	Yes			Repairing intercom
7	3K'		18°/air	70'	1		10-12	5	No			
8	3K'		18°/air		1		10-12	5	No			
9	3K'	≈1526	18°/air	60'	1		20	5	No			↓
10	3K'	1534	18°/air		1		≈15	4	No			Circled while barge crew examined laser disposition
11	3K'	1545	18°/air	30'	1		>100		No			
12	3K'	1553	18°/air	20'	1	1.0		4	Yes			
13	3K'	≈1603	18°/air	10'	1	2.0	≈15		No			
14	3K'	1616	45°	30'	1	No	>100	3	Yes			≈50° to overhead, through clouds
15	3K'	1623	45°	30'	1	1.0	≈15	4	No			Lost barge due to clouds
16	3K'	1630	45°	40'	1	No	≈80	4	Yes			Tracked through clouds
17	3K'	1638	45°	50'	1	No	some>100	4	Yes			Some spurious sync. through clouds ≈.1K'
18	2K'	1647	45°	50'	1	No	≈20	4	No			Trying to pick up approach information
19	2K'	1652	45°	50'	1	No	>100	4	Yes			Good track, broke due to clouds
20	2K'	1700	45°	50'	1	No		4	No			
		1704	EOF									

Note: Had trouble starting APU on this trip. After connector rattling and relay tapping, it went. Intermittently dropped out three times and finally held.

TABLE 4-4C. PBY DYE LASER TRACKS.

22 July 1975

PASS NO.	ALT	TIME HRS	LASER UW Z θ°	LASER UW DEPTH	GAIN RANGE	FILTER IN N.D.	Σ SIGNAL	NOISE	TRACK	SWX 64	EOF	COMMENTS	
*1	2K'	1458	60°/air	30'	1	No	>100	6/10	Yes		Yes	Good track	50° – 90°
*2	2K'	1507	60°/air	40'	1	No	>100	≈10	Yes		Yes	Good track	35° – 90°
*3	2K'	1517	60°/air	50'	1	No	>100	6/8	Yes		Yes	Good track	28° – 90°
*4	2K'	1524	60°/air	60'	1	No	>100	5/8	Yes		Yes	Good track	40° – 85°
*5	2K'	1533	60°/air	70'	1	No	≈90	5/7	Yes		Yes	Good track	40° – 80°
*6	2K'	1540	60°/air	80'	1	No	≈70	≈5	Yes		Yes	Good track	30° – 85°
*7	2K'	1549	60°/air	90'	1	No	≈20	≈5	No		Yes		
*8	2K'	1557	60°/air	90'	1	No	≈15	4	No				
@9	2K'	1605	60°/air	60'	1	1.0	12	5	No				
10	2K'	1614	60°/air	50'	1	1.0	25	4	Yes		Yes	Looked good	60° – 80°
11	2K'	1620	60°/air	40'	1	1.0	≈30	4	Yes		Yes	Looked good	37° – 80°
12	2K'	1627	60°/air	30'	1	1.0	≈55	5	Yes		Yes	Looked good	30° – 62°
13	1K'	1634	60°/air	30'	1	1.0	100	4	Yes			Turbulent at isthmus	38° – ≈75°
14	.5K'	1641	60°/air	30'	1	1.0	≈10	5	No			Very turbulent	
15	1K'	1650	90°	30'	1	1.0	≈40	4	Yes				35° – 55°
16	3K'	1725	0°	50'	1	1.0	90	4	Yes				85° – 100°
17	3K'	1713	0°	70'	1	1.0	20	5	Yes		Yes	Clock laser with barge clock	85° – 100°
18	3K'	1721	0°	70'	1	No	25	5/10				Phantom track or ?	85° – 100°
19	3K'	1728	0°	70'	1	No	>100	8/10	Yes		Yes	Good track	80° – 100°
20	3K'	1736	0°	90'	1	No	>100	5/8	Yes		Yes	Good track, minimal	80° – 110°
21	3K'	1744	0°	110'	1	No	≈30	5	Yes		Yes	Signal > 100	85° – 110°
22	3K'	1751	0°	120'	1	No	28	5	Yes				88° – 95°

Notes: EOF inserted after each pass. Sync usually sporadic at turning point; cleans up at 15° to 20° and looks good through tracking portion of pass. @ Pass No. on tape will be 8 for this pass. Forgot to change switch. *Bottom door open for photographer. Pitch of A/C measured to be +2.5° to 3° during this pass. Assume same A/C pitch for all * passes.

TABLE 4-4D. PBY DYE LASER TRACKS.

24 July 1975

PASS NO.	ALT	TIME HRS	LASER UW Z θ°	LASER UW DEPTH	GAIN RANGE	FILTER IN N.D.	Σ SIGNAL	NOISE	TRACK	SWX 64	EOF	COMMENTS
1	2K'	1414	42°/water	25'	1	No			No	X	No	No sync
2	25K'	1418	42°/water	25'	1	No	>100		Yes	X	No	250' 93 knots
3	25K'	1423	42°/water	25'	1	No			Yes	X	No	97 knots
4	25K'	1427	42°/water	25'	1	No			Yes	X	Yes	96 knots
5	25K'	1432	42°/water	40'	1	No	>100	6/10	Yes	X	Yes	97 knots
6	25K'	1436	42°/water	50'	1	No	None	5/8	No	X	Yes	95 knots
7	22K'	1440	42°/water	50'	1	No	>100		Yes	X	Yes	93
8	25K'	1450	52½°	30'	1	No	>100		Yes	No*	Yes	98
9		1454	52½°	30'	1	No	None		No	X	Yes	
10	26K'	1459	52½°	30'	1	No	≈15		No	X	Yes	
11	3K'	1512	32½°	30'	1	No	?	3/6	No	X	Yes	
12	3K'	1517	32½°	30'	1	No	≈15		No	X	Yes	
13	3K'	1523	32½°	30'	1	No	>100	3/6	Yes	X	Yes	
14	3K'	1527	32½°	50'	1	No	>100		Yes	X	Yes	
15	3K'	1535	32½°	90'	1	No	≈40	3/8	Yes	X	Yes	
16	3K'	1541	32½°	100'	1	No	≈15		No	X	Yes	
17	3K'	1547	32½°	100'	1	No	≈20		?	X	Yes	
18	3K'	1554	32½°	70'	1	No	≈75		Yes	X	Yes	
19	3K'	1559	32½°	50'	1	1.0	≈20	3/6	Yes	X	Yes	
20	3K'	1604	32½°	30'	1	1.0	≈60	3/6	Yes	X	Yes	Excellent
21	3K'	1613	32½°	50'	1	No	>100		Yes	X	Yes	Offset 12° in azimuth
22	3K'	1619	32½°	50'	1	No	>100		Yes	X	Yes	Offset 32° in azimuth
23	3K'	1635	32½°	50'	1	No	≈60			X	Yes	Offset 90° in azimuth

32 (0° pitch), 33 (+45° fwd pitch), 34 (+90° pitch); 35 (−45° pitch), 36 (−90° pitch) EOF

44 (0° roll), 45 (10 out), 46 (30 out); 47 (−10 in), 48 (−20 in) EOF

NOTES: Motorola walkie talkie failed at commencement of passes, hence had to use Motorola mobile unit with external speaker. Forgot to turn off recorder after Pass No. 2. Pitch and roll calibration; roll readings are roll meter divisions and not degrees.

*End of data marks overhead position.

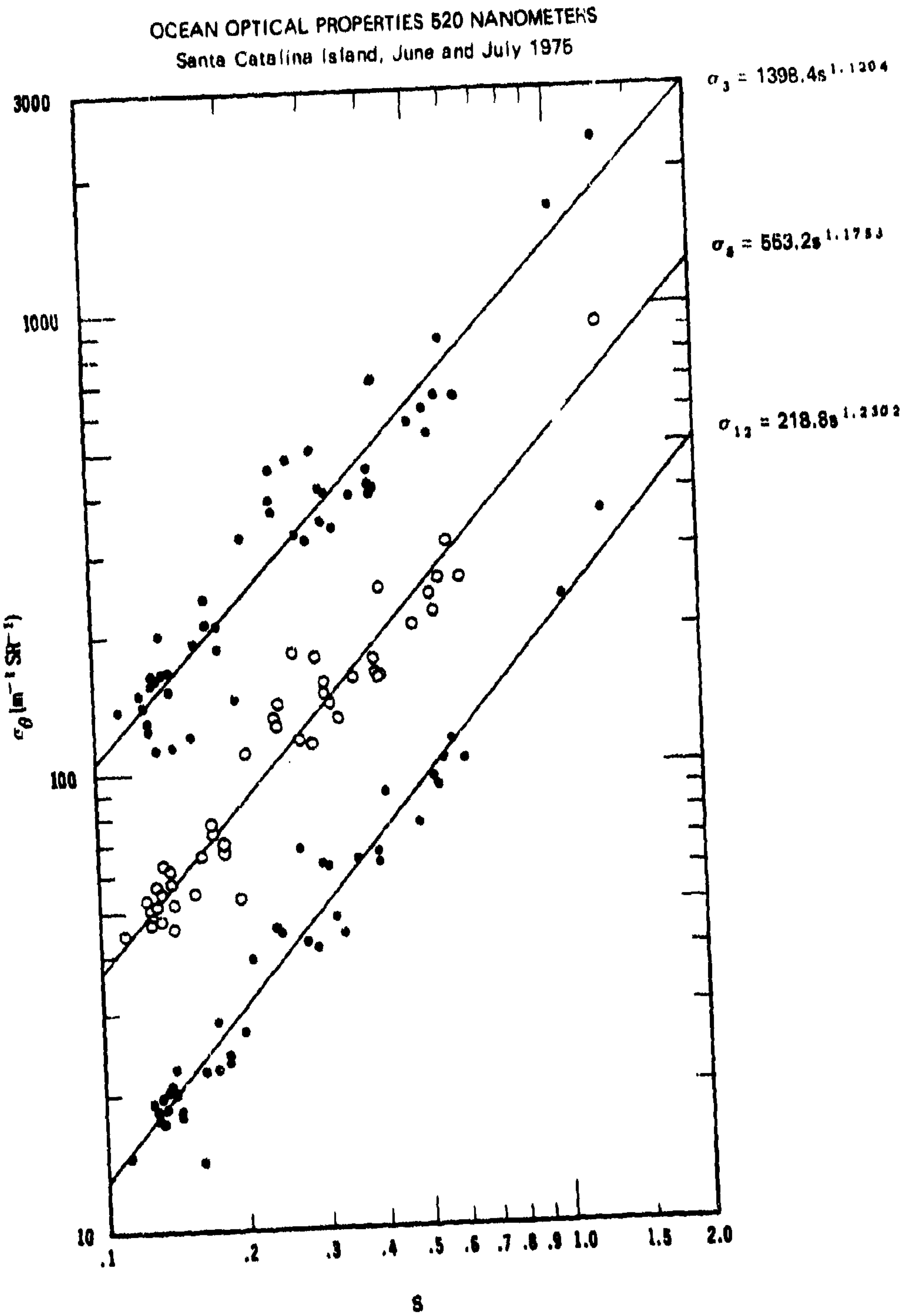


Figure 4-22. Regression of volume scattering function $\sigma(\theta)$ against scattering coefficient s.

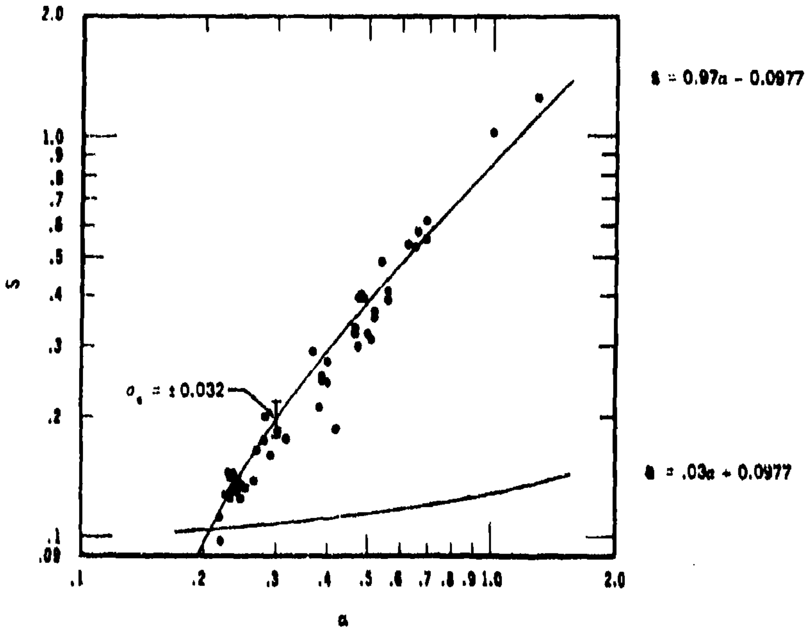


Figure 4-23. Regression of scattering coefficients against volume attenuation coefficient $\underline{a}$.

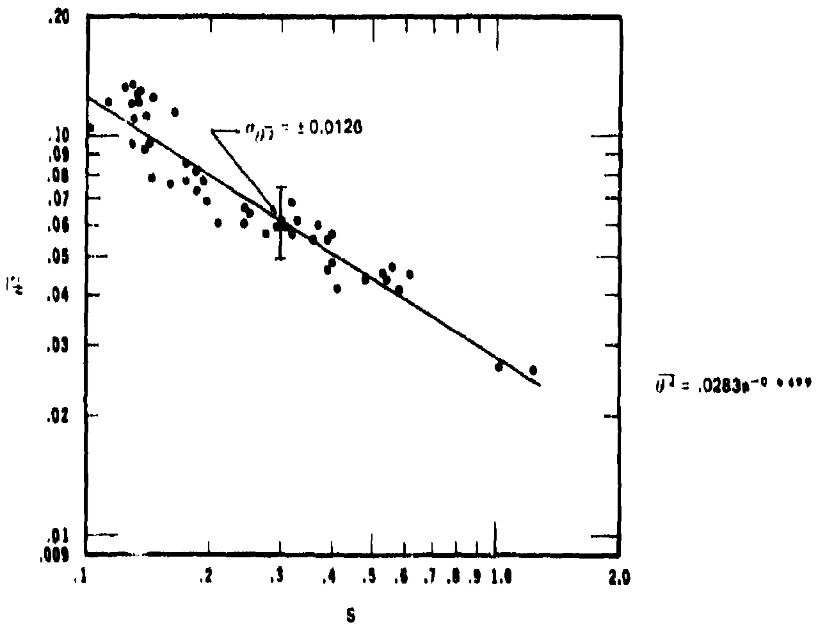


Figure 4-24. Regression of normalized second moment of the scattering function $\overline{\theta^2}$ against scattering coefficient $\underline{s}$.

With the confirmation of radiative transport as the underlying theory for these system applications there are some suggestions that can be made for future work:

a. General Cleanup. This is basically a firming up of the general theory to include all scenarios that the Navy might envision.

b. Monte Carlo Techniques. These are primarily an augmentation of the general theory to include those cases that are not conducive to analytic computation.

c. Cloud Propagation. This is an extension of (a) and (b) that includes any scenarios in the total environment that are of interest to the Navy.

d. Model Range. Establishment of the theory automatically implies an understanding of scale change. This means that system scenarios can be studied in a suitably designed test tank similar to the manner that antennas are designed on an antenna range.

e. Experimental Test Site. In much the same manner that a test tank can scale, so too, can a test site. Having such a facility as a convenient adjunct to system-related design activities would allow for total interaction between theory, experimentation, and testing.

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*NELC technical notes are informal documents intended primarily for use within the Center.

APPENDIX A
OPTICAL COMMUNICATIONS BETWEEN UNDERWATER AND ABOVE SURFACE (SATELLITE) TERMINALS

SHERMAN KARP

Abstract—A multiple scattering model is used and extended to characterize the channel between underwater and airborne (satellite) terminals at optical frequencies. The effects of the air/sea interface are also included with approximate solutions accurate for elevation angles above 45°. The results are presented in terms of a radiance function which is related to the transform of the spatial covariance function (mutual coherence function). The primary losses are shown to be a result of the water absorption coeffecient and not the extinction coefficient. The scattering losses can be isolated from the absorption losses and for certain cases, where the receiver is imbedded in the scattering medium, can be completely recovered. New components may be required to achieve this performance. The effects of ocean roughness are shown to have a minimal effect upon the subsurface reception while causing possible beam steering of subsurface transmission. Although substantial losses are experienced, duplex operation can be achieved at modest data rates.

I. INTRODUCTION

THE ACCEPTANCE of optical communications for use in operational systems has been severely hampered by our inability to adequately compensate for channel effects induced by the environment. Consequently, most if not all of the projected system gains are quickly nullified when rudimentary measures of system margin are added to the link budgets to account for these effects. It is, therefore, extremely important that environmental effects be accurately accounted for, and systems designed to best exploit these channels in a most advantageous manner. The most difficult channel that the optical communications engineer has to deal with is the multiple scattering channel. Such a channel exists when propagating through clouds, fog, water, etc. [1]-[3]. In this paper we will extend the model, which has been independently developed by Heggestad [4] and Arnush [5] for multiple scattering media, and apply it to compute the effects we would encounter while traversing a satellite to underwater channel. In doing so, we will try to validate the use and interpretation of the model by applying it to experimental data.

In its most general form, the problem of optical communications between a satellite and a submerged platform can be described as: 1) a problem in communications from a platform in a nonscattering, nondispersive environment, through a random surface and into a medium with a different index, which is multiple-scattering, absorbing, and dispersive; and conversely, 2) a problem in communications from a platform in a multiple-scattering, absorbing, and dispersive medium, through a random surface and into a medium with a different index which is nonscattering and nondisperive. These two problems are nonreciprocal. Thus, it is necessary to decompose them into their fundamental elements and to individually identify and characterize the contributing factors. To this end this discussion is divided into four parts. The first part involves the actual propagation effects encountered while traversing a multiple scattering medium. The three system parameters which can be identified are the attenuation, the beam spreading and the apparent source size. These in turn are related to the absorption coefficient, the scattering coefficient, and the volume scattering function. The second part addresses the problem of transmitting through a random surface characterized by a slope distribution. The effect on scintillation will be discussed in addition to beam pointing and beam broadening. The third and fourth parts will address link calculations from the satellite platform to the submerged platform and from the submerged platform to the satellite platform, respectively. It is estimated that the model presented can be verified to within several decibels over most operational scenarios envisioned.

II. THE UNDERWATER CHANNEL

Over the past two decades there has been an interest in understanding the behavior of light while propagating through water. With the advent of the laser this interest intensified when viewed in the context of operational equipment. Although there have been numerous measurements [6], [7] and many empirical curves derived to fit the data [7] the latter are of limited use for extrapolating system performance. For this paper we will use a model which has been developed independently by two separate authors [4], [5]. While this model is derived for small angle forward scattering it appears to be fairly accurate out to ±45° providing the optical thickness is not too large. Fortunately the range of validity is within the operational ranges envisioned. The model describes the radiance transfer while traversing the multiple scattering region. This region is characterized by three variables.

1) Absorption: The absorption coefficient of the medium, a, is the amount of energy absorbed by the medium per unit length of propagation. This loss is attenuation and goes directly into heating and other irreversible processes.

2) Scattering Function $F(\theta)$: Multiple scattering media are characterized by scattering centers which, in the case of ocean water, appear to be both from plankton and from molecular scattering. The volume scattering function is defined as the secondary radiation pattern created by a plane wave traversing

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a small enough volume so that only single scattering occurs. This represents the average scattering distribution of all the scattering centers. There does not appear to be a great deal of variation in the general shape of $F(\theta)$ although the average width does change.

3) *Scattering Coefficient:* If we normalize $F(\theta)$, then

$$s = 2\pi \int_0^{\pi} F(\theta) \sin\theta \, d\theta \tag{1}$$

and

$$f(\theta) = \frac{F(\theta)}{s} \tag{2}$$

is the normalized version. s is the scattering coefficient with s^{-1} interpreted as the average distance between scatterings. Arnush assumed a form for $f(\theta)$ as

$$f(\theta) = \frac{\delta}{2\pi\theta} e^{-\delta\theta}, \qquad \delta \geq 10. \tag{3}$$

Heggestad, on the other hand, defines a modified variance

$$2\overline{\theta^2} = 2\pi \int_0^{\pi} \theta^2 \sin\theta f(\theta) \, d\theta \approx \frac{2}{\delta^2} \tag{4}$$

and by equating $\overline{\theta^2}$ with $1/\delta^2$ the two models are identical. This is true for large δ. We will use the notation $\overline{\theta^2}$. It is also common to define an extinction coefficient α, defined by

$$\alpha = a + s. \tag{5}$$

Thus, to completely characterize the environment it would be necessary to have measuring equipment for a, s, and $f(\theta)$. An alternate procedure, and less desirable, would be to measure two parameters and scale the measurements to the third. Although feasible, this would assume the validity of a model and the confidence to extrapolate from it. With these parameters in mind we will now present the model.

For convenience we assume that the transmitted beam is Gaussian and has the form

$$f_0(\theta, r) = \frac{1}{(\pi\theta_0 r_0)^2} \exp\left[-\frac{\theta^2}{\theta_0^2} - \frac{r^2}{r_0^2}\right]. \tag{6}$$

That is, it has a Gaussian distribution both in its spatial cross section and its ray direction. Next we assume the geometry in Fig. 1, where the source is at (0,0), the observer is at (r,z) and, as we will see, the apparent source is at $(0,z_0)$. In terms of the observation point (r,z) we have as the transfer in intensity $f(\boldsymbol{\theta}, r)$

$$f(\boldsymbol{\theta}, r) = \frac{1}{(\pi U_r R_0)^2} \exp\left[-az - \frac{(r-r_m)^2}{R_0^2} - \frac{\theta_r^2}{U_r^2} - \frac{\theta_\phi^2}{U_\phi^2}\right]$$
$$= \frac{1}{(\pi U_\phi R_1)^2} \exp\left[-az - \frac{(\theta_r - \theta_m)^2 + \theta_\phi^2}{U_\phi^2} - \frac{r^2}{R_1^2}\right] \tag{7}$$

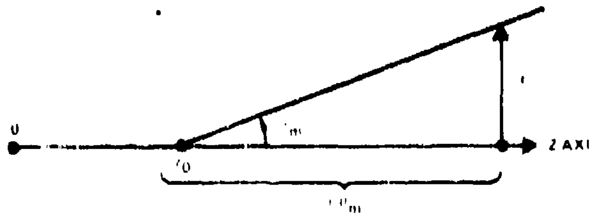


Fig. 1. Model geometry.

where

$$R_0^2 = sz^3\overline{\theta^2}\left[\frac{1 + 2V + 6I + 3IV}{3(2+V)}\right]$$
$$U_r^2 = sz\overline{\theta^2}(2+V)$$
$$U_\phi^2 = sz^3\overline{\theta^2}\left[\frac{1 + 2V + 6I + 3IV}{2 + 3(I+V)}\right]$$
$$R_1^2 = sz^3\overline{\theta^2}\left[\frac{2 + 3(I+V)}{3}\right] \tag{8}$$

with

$$\theta_m = \left[\frac{3(1+V)}{2+3(I+V)}\right]\left(\frac{r}{z}\right)$$
$$r_m = \left[\frac{1+V}{2+V}\right] z U_r \tag{9}$$

and

$$I = \frac{r_0^2}{sz^3\overline{\theta^2}}; \qquad V = \frac{\theta_0^2}{sz\overline{\theta^2}}. \tag{10}$$

Some explanation of the interpretation of (7) is now warranted. First notice that if we had a receiver at point (r,z) and added equally the contributions coming from all angles, we could integrate over the variables θ_r, θ_ϕ and obtain the result[1]

$$f(r) = \int f(\boldsymbol{\theta}, r) \, d\Omega = \frac{e^{-az}}{(\pi R_1^2)} \exp\left[\frac{-r^2}{R_1^2}\right]. \tag{11}$$

Thus the total energy has a distribution which is Gaussian in the z-plane, centered at $r = 0$, and is a result of scattering. The standard deviation of this spread is $(R_1^2/2)^{1/2} = (sz^3\overline{\theta^2}/6)[2 + 3(I+V)]^{1/2}$. If in addition we could collect all the scattered radiation in the z-plane (a large collector) we would integrate over r and obtain

$$f = \int f(r) \, dr = e^{-az} \tag{12}$$

and identify this as an irretrievable loss which we see is due to absorption.

[1] *Note:* If the ray is coming from the direction $\boldsymbol{\theta} = (\theta_r, \theta_\phi)$, then the receiver is pointed in the $(-\boldsymbol{\theta}) = (-\theta_r, -\theta_\phi)$ direction. Hence there is only a sign difference between the two.

... suppose we observe the source at the point (r, z) as a function of angle, Fig. 2.

Notice $\mathbf{u}_\phi$ is the unit vector in the direction θ_ϕ, the angle out of the r-z-plane, and $\mathbf{u}_r$ is the unit vector representing the angular tilt up from the z-axis θ_r in a plane described by r,z. Thus for any r, the maximum always occurs in the r-z-plane $(\theta_\phi = 0)$ at a tilt angle of θ_m. Alternatively, for a fixed tilt angle θ, the maximum occurs when the receiver is off the axis a distance r_m. The net result of both interpretations is that the source appears to be located at the point z_0, Fig. 1, where

$$z_0 = \frac{z}{3}\left(\frac{1-3I}{1+V}\right). \tag{13}$$

Furthermore, the source will have an apparent extent (size) in diameter (twice the standard deviation) of

$$z^{3/2}(s\overline{\theta^2})^{1/2}\left\{\frac{2+3(I+V)}{3(1+V)}\left(1+\frac{V}{2}\right)\right\}^{1/2} \tag{14}$$

or

$$2(s\overline{\theta^2}z)^{1/2} \tag{15}$$

in radians (field of view). Consequently, any system should account for the spatial filtering that may occur when optical elements are used.

Finally we can identify

$$I = \frac{r_0^2}{sz^3\overline{\theta^2}} \sim \frac{r_0^2}{R_1^2} \tag{16}$$

as the ratio of the initial beam cross section to the cross section at (r,z) which should be much less than one and

$$V = \frac{\theta_0^2}{sz\overline{\theta^2}} \sim \frac{\theta_0^2}{U_r^2} \tag{17}$$

as the ratio of the initial beam spread to the beam spread at (r,z) which should also be much less than one. Thus we can set $I = V = 0$ when collimated beams are used.

Strictly speaking, the model used here is only valid for small angle forward scatter. This is true because in the derivation, the approximations $\sin\theta \sim \theta$ and $\cos\theta \sim 1$ are used. However, these approximations are only off by 10-20 percent at 30-40° and hence the model should degrade gracefully at larger angles. Some modification has to be made, however, to use this at large angles. This is due to the fact that the absorption and scattering paths are longer by the factor $z[\sec\theta - 1]$ at the angle θ. This can be easily accounted for by changing z to $z\sec\theta = \sqrt{z^2 + r^2}$ wherever z occurs. Then we will interpret (7) to be the transfer in intensity from the source to a sphere of radius z. With the latter interpretation in mind we will now show the justification of using this model and then point out the remaining verification needed.

Consider the geometry in Fig. 3. A collimated source emits radiation along the z-axis. The medium is characterized by the

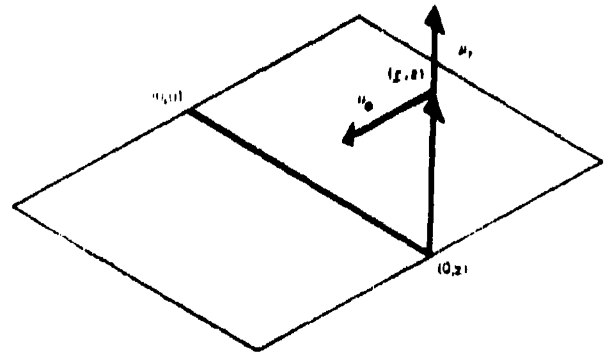


Fig. 2. Source as a function of angle.

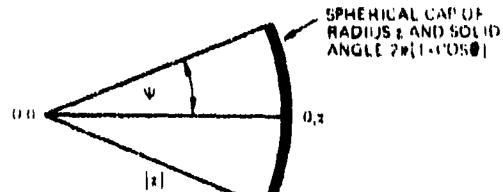


Fig. 3. Geometry used by Duntley.

ratio α/a. Since $\alpha = s + a$, $s/a = (\alpha/a) - 1$. The unit of length is $N = \alpha z$ extinction lengths. Thus, N extinction lengths correspond by the relationship

$$N = \alpha z = \frac{\alpha}{a}az = \left(\frac{\alpha}{a}\right)N_{\text{absorption}} \tag{18}$$

to $[N/(\alpha/a)]$ absorption lengths and since

$$N_{\text{scat}} = sz = [(s+a)-a]z = \alpha z - az = N\frac{[\alpha/a - 1]}{\alpha/a} \tag{19}$$

to $[(\alpha/a) - 1]/(\alpha/a)$ scattering lengths.

With this geometry and parameterization, Duntley [7] has made extensive measurements of the power collected as a function of N for various values of Ψ. Two representative samples are shown in Fig. 4. For this case, (11) integrates to

$$\begin{aligned}\int_0^{\Psi z} f(r)\,dr &= e^{-az}\left[1 - \exp\left(\frac{-(\Psi z)^2}{R_1^2}\right)\right]\\ &= e^{-az}\left[1 - \exp\left(\frac{-(\Psi)^2}{(2/3)s\overline{\theta^2}z}\right)\right]\\ &= \exp\left(-\frac{N}{\alpha/a}\right)\\ &\cdot\left[1 - \exp\left\{\frac{-\Psi^2}{(2/3)\overline{\theta^2}N\,\dfrac{\alpha/a - 1}{\alpha/a}}\right\}\right].\end{aligned} \tag{20}$$

As pointed out by Duntley and as observed in (12), for large values of Ψ we would expect the relationship

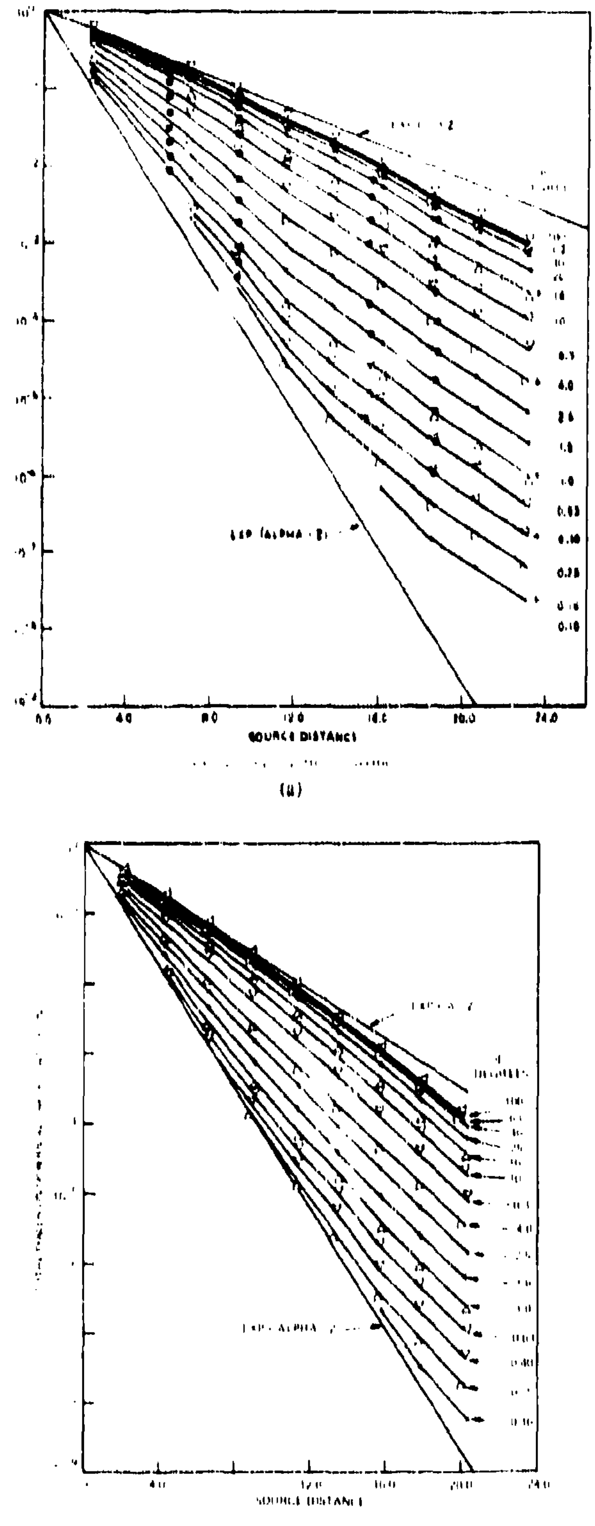


Fig. 4. Total power on spherical cap. (a) Alpha/A = 2.49. (b) Alpha/A = 4.

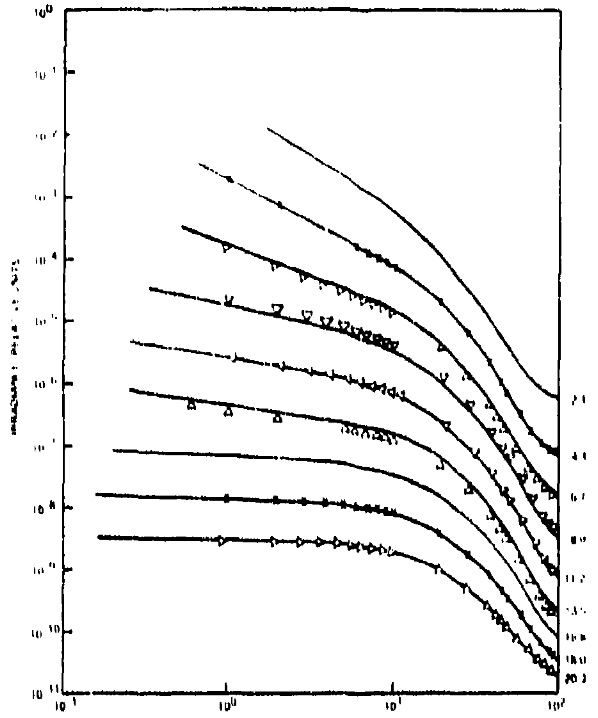
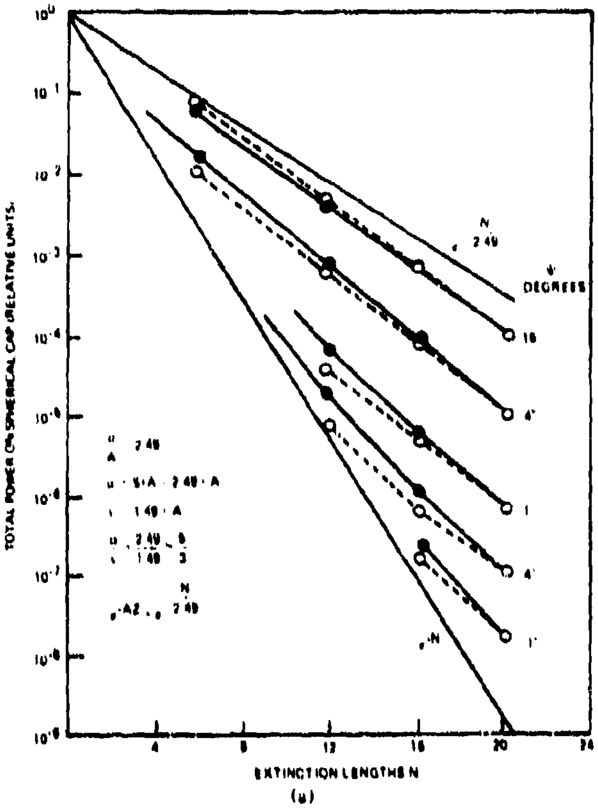


Fig. 5. Duntley measurements of anomalous model behavior. Alpha/A = 2.49.

$e^{-N_{absorption}}$ to hold. However, this is not happening even though the curve saturates for $\Psi > 60°$. We can compensate with our model by recalling that the effective source broadens and shifts location as N increases. Duntley was able to observe and measure the former phenomenon although he was not able to explain it (see Fig. 5). In the actual measurements an integrating sphere was used in the collecting optics. This has a spatial response of cos θ. Consequently at large values of N one would expect to start to observe spatial filtering of the source. This is precisely what we see for N greater than 8. This was corrected for as follows. It was assumed that the difference between the $e^{-N_{absorption}}$ line and the $\Psi = 100°$ curve was due to spatial filtering. Therefore, at every value of N this difference was added to each of the curves (on a log scale) and replotted. The model was then calibrated at the largest value of N and the smallest value of Ψ, where it should be most accurate, and $\overline{\theta^2}$ was calculated. The model was then plotted on the revised curves, Fig. 6. Although the agreement is not perfect, it is remarkably close. The validity of this calibration should be checked at some point by comparing the results of an integrating sphere with those of a hemispherical coverage lens (fisheye).

III. THE AIR/SEA INTERFACE

In this section a geometric optics model will be developed to determine the effect of surface irregularities on beam spreading, pointing and scintillation when traversing the boundary. To do so, we consider the following model of an



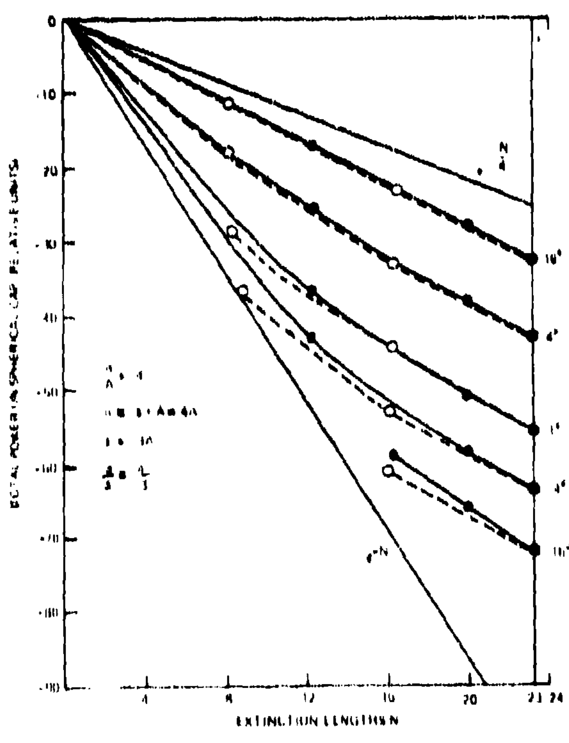


Fig. 6. Revised model curves. (a) $e^{-AZ} = e^{-(N/2.49)}$. (b) $e^{-AZ} = e^{-(N/4)}$.

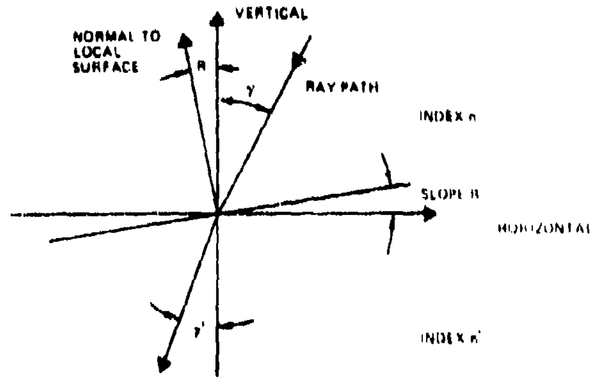


Fig. 7. Model of an element of the surface.

element of the surface, Fig. 7. A ray of light, γ degrees off the normal, impinges upon the surface whose local slope is R degrees from the horizontal. By Snell's law

$$n' \sin(\gamma' + R) = n \sin(\gamma + R) \tag{21}$$

and

$$\gamma' = \sin^{-1}\left[\frac{n}{n'} \sin(\gamma + R)\right] - R \tag{22}$$

which is valid for both positive and negative slopes. γ and γ' are always taken with respect to the true vertical. If R is a random variable, the statistics of the slope must also be factored in. We do this in the following manner. Given a sample R from the set of possible slopes, γ' is well defined. That is, the probability of γ' conditioned upon γ and R is

$$p(\gamma'/R,\gamma) = \delta\left[\gamma' - \left(\sin^{-1}\left(\frac{n}{n'}\sin(\gamma + R)\right) - R\right)\right]. \tag{23}$$

We arrive at the angular distribution of γ', given γ, by averaging over the variable R. Thus,

$$\begin{aligned} p(\gamma'/\gamma) &= \int_{-\infty}^{\infty} dR\, p_R(R)\, p(\gamma'/\gamma,R) \\ &= \int_{-\infty}^{\infty} dR\, p_R(R) \\ &\quad \cdot \delta\left[\gamma' - \sin^{-1}\left(\frac{n}{n'}\sin(\gamma + R)\right) - R\right] \end{aligned} \tag{24}$$

where $p_R(R)$ is the probability density of R.

Rigorously, this is merely the change of variables in the density $p_R(R)$ from R to γ' using

$$R = \tan^{-1}\left[\frac{\frac{n}{n'}\sin\gamma - \sin\gamma'}{\cos\gamma' - \frac{n}{n'}\cos\gamma}\right] = R(\gamma',\gamma). \tag{25}$$

Thus,

$$p(\gamma'/\gamma) = p_R[R(\gamma',\gamma)] \left| \frac{dR(\gamma',\gamma)}{d\gamma'} \right|$$

$$= p_R \left\{ \tan^{-1} \left[\frac{\frac{n}{n'} \sin\gamma - \sin\gamma'}{\cos\gamma' - \frac{n}{n'}\cos\gamma} \right] \right\}$$

$$\cdot \left| \frac{\frac{n}{n'}\cos(\gamma - \gamma') - 1}{1 + \left(\frac{n}{n'}\right)^2 - 2\frac{n}{n'}\cos(\gamma - \gamma')} \right|. \quad (26)$$

Knowing $p(\gamma'/\gamma)$ we can compute the average spreading and offset of a ray incident at the angle γ. This becomes

$$\text{average offset} = \int \gamma' p(\gamma'/\gamma)\, d\gamma' = \bar{\gamma}'$$

$$= \int \left\{ \sin^{-1}\left[\frac{n}{n'}\sin(\gamma + R)\right] - R \right\} p_R(R)\, dR$$

$$= \int \sin^{-1}\left[\frac{n}{n'}\sin(\gamma + R)\right] p_R(R)\, dR - \bar{R}. \quad (27)$$

Defining $\overline{\gamma'^2}$ as

$$\overline{\gamma'^2} = \int \gamma'^2 p(\gamma'/\gamma)\, d\gamma'$$

$$= \int \left\{ \sin^{-1}\left[\frac{n}{n'}\sin(\gamma + R)\right] - R \right\}^2 p_R(R)\, dR \quad (28)$$

the rms spread becomes

$$\Delta = (\overline{\gamma'^2} - \bar{\gamma}'^2)^{1/2}. \quad (29)$$

There are some practical limitations to these results which require modification, Fig. 8.

A ray of light with zenith angle γ will never intercept a wave whose slope is greater than $\pi/2 - \gamma$ because of wave obscuration. However, the ray will still penetrate the interface with probability one. Consequently, the limits of integration for R are set at $[-\pi/2, \pi/2 - \gamma]$ and the density $p_R(R)$ should be modified to that of

$$\frac{p_R(R)}{\int_{-\pi/2}^{\pi/2-\gamma} p_R(R)\, dR} = \begin{cases} \hat{p}_R(R), & -\pi/2 \le R \le \pi/2 - \gamma \\ 0, & \text{elsewhere.} \end{cases} \quad (30)$$

The results in (26)–(29) would then be modified by replacing $\hat{p}_R(R)$ with $p_R(R)$. In general, the results presented can be simplified by only considering those values of $(\gamma + R) < 45°$. This corresponds to the major operational requirements and gives good engineering insight into the behavior of a ray going through the air/sea interface. For this case

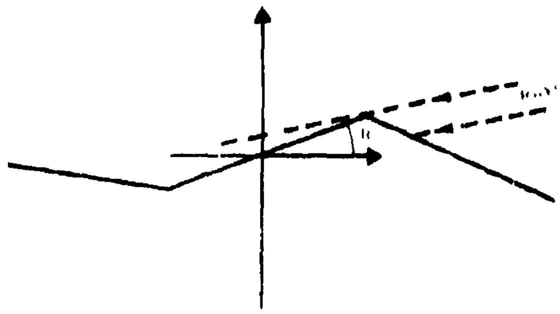


Fig. 8. Modifications of model.

$$p(\gamma'/\gamma) \approx p_R \left[\frac{\frac{n}{n'}\gamma - \gamma'}{1 - \frac{n}{n'}} \right] \left| \frac{1}{1 - \frac{n}{n'}} \right|$$

$$\bar{\gamma}' \approx \frac{n}{n'}\gamma + \left(1 - \frac{n}{n'}\right)\bar{R}$$

$$\Delta^2 \approx \left| 1 - \frac{n}{n'} \right|^2 \operatorname{var}\{R\}. \quad (31)$$

Notice that $|1 - n/n'|^2 < 1$ for the air/sea interface (index of water = 1.33, index of air = 1) and consequently the ray spreading is appreciably less than the slope spreading of the ocean. In addition the surface adds the contribution $(1 - n/n')\bar{R}$ to the normal bending due to Snell's law.

In all cases, the model used represents an optical beam of zero cross section and zero divergence. The exiting beam also has zero cross section and zero divergence but is being steered by the roughness of the surface. If this surface is the ocean, $p(\gamma'/\gamma)$ represents the average time history of the beam direction γ', with $p(\gamma'/\gamma)d\gamma'$ the probability that it is pointing within a $d\gamma'$ interval of the γ' direction at any instant in time. This apparent beam wander would cause severe scintillation in an operating system. As the cross section of the beam increases the refracting surface can no longer be considered locally flat and different portions of the beam are refracted at different angles. Consequently, it would be possible to average out the beam wander in the direction of the mean $\bar{\gamma}'$ by spreading the beam over a larger portion of the surface. If the area of the beam is A, and the correlation length of the surface statistics is L, then there are approximately $A/(\pi(L/2))^2$ identically distributed independent paths similar to diversity paths. If we further assume a depth z such that the beam cross section is greater than A,

$$\frac{8z^2\theta^2}{3} > A, \quad (32)$$

then all of the paths will overlap at the receiver. This can be analyzed in the following manner. First we notice that the probability of having the beam within an rms deviation about the mean is

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$$\int_{\bar{\gamma}'-\Delta}^{\bar{\gamma}'+\Delta} p(\gamma'/\gamma)\, d\gamma' \qquad (33)$$

which for the Gaussian density becomes 0.68. Thus, even if we had no time variations the beam would only be within a deviation of the mean 68 percent of the time. Now suppose we pick N independent, identically distributed, paths to the receiver and transmitted $(1/N)$th of the power p_i in each path. Since the paths are identically distributed, the average direction of the sum is still $\bar{\gamma}'$. Now, however, the variance of the sum becomes Δ^2/N, or a standard deviation for the sum of $\Delta/\sqrt{N}$ about the mean $\bar{\gamma}'$. If, for example, we set $N = 25$, and assume the central limit is approximately valid, the probability that the beam is within $\pm\Delta$ is now 0.999994. Since the correlation length is approximately the separation between independent spatial Nyquist samples we see that

$$N \sim \frac{A}{\pi\left(\frac{L}{2}\right)^2} \qquad (34)$$

and can be used accordingly. Furthermore, it can be shown that the scintillation will reduce the average signal-to-noise ratio by the factor

$$\frac{1}{1 + \Delta^2/N}. \qquad (35)$$

A verification of these results and the relationship in (32) would be warranted.

Finally, we can interpret the function $p(\gamma'/\gamma)$ as a beam spreading factor. Thus, if we have a propagating beam of the form $f(\theta,r)$ in (7), or $f(\gamma,r)$ then the output beam after traversing the surface will be

$$f(\gamma',r) = \int d\gamma p(\gamma'/\gamma) f(\gamma,r) \qquad (36)$$

or an average over all input ray directions weighted by the relative intensity. Notice, that we have not restricted the results to which medium corresponds to air and which to water. When going from air to water set $n = 1$, $n' = 1.33$ and when going from water to air set $n = 1.33$ and $n' = 1$. Then the computation of the beam moments after traversing the surface yields

$$\bar{\gamma}' = \frac{\int \gamma' f(\gamma',r)\, d\gamma'}{\int f(\gamma',r)\, d\gamma'}$$

$$\operatorname{var}[\gamma'] = \frac{\int (\gamma' - \bar{\gamma}')^2 f(\gamma',r)\, d\gamma'}{\int f(\gamma',r)\, d\gamma'} \qquad (37)$$

The results derived in this section were performed for a one-dimensional surface. To extend them to a two-dimensional surface is straightforward if we restrict ourselves to Cartesian coordinates. The variable R would then become the pair $R = (x,y)$ and the one-dimensional results would carry over to each of the orthogonal coordinates. The interpretation would then be one of projecting the true slope distribution onto the Cartesian coordinate system. Although simple in theory the actual computations are difficult. If we use the linearization implicit in (31), this problem is greatly simplified. For this reason we will restrict our analysis to this assumption. To make the calculations for large zenith angles a more rigorous assessment of the surface geometry must be performed [8].

IV. SATELLITE-TO-SUBMERGED PLATFORM

The computation of satellite-to-submerged platform power budget is aided by a brief discussion of the geomerty. It is assumed, for a variety of reasons, that we will project a spot on the ocean approximately one mile in diameter. Thus, if we transmit P_t watts of radiation, from the zenith the full angle of the beam will be approximately (1/22 000) rad ≈ 50 μrad = 10 s. The power density, intensity, at the surface will be approximately

$$\frac{P_t}{\pi(830)^2} = 4.62 \times 10^{-7} P_t \text{ w}/M^2. \qquad (38)$$

If the surface is illuminated at an angle γ from the zenith then the power density will be

$$\frac{P_t \cos\gamma}{\pi(830)^2} = 4.62 \times 10^{-7} P_t \cos\gamma \text{ w}/M^2. \qquad (39)$$

Now, however, the circular spot has elongated into an ellipse with minor axis $830M$ and major axis $(830/\cos\gamma)M$. We will use the symmetry along the major axis of the ellipse to pick a convenient coordinate system. We will call this the x-axis. The minor axis will define the y-axis of the coordinate system and the depth of the ocean will constitute the z-axis, Fig. 9.

In practice, the spot will have a nonuniform illumination. We will account for this by defining a normalized intensity $I(x_0,y_0)$ which is then multiplied by the factor in (38).[2] Notice that the angle γ is always measured between the x-y plane and a line in the x-z plane. This will allow us to use the second form in (7). At any location (x_0,y_0) in the x-y plane an elementary surface element $x_0 y_0$ contributes an amount $I(x_0,y_0)dx_0dy_0$. A ray with this intensity passing through the air/sea interface yields the value

$$f(\gamma', (x - x_0), (y - y_0)) = I(x_0,y_0)dx_0dy_0 p(\gamma'/\gamma) \qquad (40)$$

as the intensity on the water side of the boundary. At this point we will consider a functional form for $p(\gamma'/\gamma)$ to aid in the computation. From experimental results [10] it can be assumed that $p(\gamma'/\gamma)$ is Gaussian. Furthermore, if we keep to the angles such that (31) is valid, then[3]

[2] To be correct, the transmission coefficient at the boundary should also be included as a function of angle [9].

[3] To use correlated Gaussian variables would only be the refinement of an approximation.

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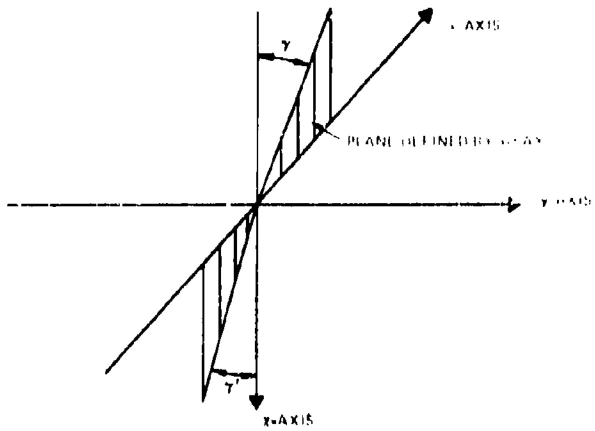

Fig. 9. Axes of coordinate system.

$$p(\gamma'/\gamma) = \frac{\exp - \dfrac{\left[\gamma' - \left\{\dfrac{n}{n'}\gamma + \left(1 - \dfrac{n}{n'}\right)\bar{R}\right\}\right]^2}{2\left[1 - \dfrac{n}{n'}\right]^2 \operatorname{var}[R]}}{2\pi\left[\left|1 - \dfrac{n}{n'}\right|^2 (\operatorname{var}[R])\right]} \tag{41}$$

For this approximation

$$f(\gamma'; (x - x_0), (y - y_0)) = \frac{I(x_0,y_0)dx_0dy_0}{2\pi\left[\left|1 - \dfrac{n}{n'}\right|^2 (\operatorname{var}[R])\right]} \cdot \exp - \frac{\left[\gamma' - \left\{\dfrac{n}{n'}\gamma + \left(1 - \dfrac{n}{n'}\right)\bar{R}\right\}\right]^2}{2\left[1 - \dfrac{n}{n'}\right]^2 \operatorname{var}[R]} \tag{42}$$

Inserting this into (7), and using the off-axis correction to the intensity we find at a point below the surface that the contribution from the intensity $I(x_0,y_0)$ in an area dx_0dy_0 at the point $(x_0,y_0,0)$ to the intensity at (x,y,z) is

$$\begin{aligned}\Delta I(x,y,z;\gamma'_x\gamma_y') &= \frac{I(x_0,y_0)dx_0dy_0}{(\pi U_\phi' R_1')^2} \exp - \Bigg\{ a[z^2 + (x_0 - x)^2 + (y_0 - y)^2]^{1/2} + \left[\frac{\xi_x^2 + \xi_y^2}{R_1'^2}\right] + \frac{1}{U_\phi'^2} \\ &\cdot \Bigg[(\gamma_x' - \bar{\gamma}_x)^2 + (\gamma_y' - \bar{\gamma}_y)^2 + \theta_m'^2 - 2\theta_m' \Bigg\{ \frac{\epsilon_x |x_0 - x| (\gamma_x' - \bar{\gamma}_x)}{\sqrt{(x_0 - x)^2 + (y_0 - y)^2}} + \frac{\epsilon_y |y_0 - y| (\gamma_y' - \bar{\gamma}_y)}{\sqrt{(x_0 - x)^2 + (y_0 - y)^2}} \Bigg\}\Bigg]\Bigg\}\end{aligned} \tag{43}$$

where

$$\theta_m' = \frac{3(1 + V')}{2 + 3(I' + V')} \left[\frac{\sqrt{\xi_x^2 + \xi_y^2}}{\sqrt{z^2 + (x_0 - x)^2 + (y_0 - y)^2}}\right]$$

$$R_1'^2 = s[z^2 + (x_0 - x)^2 + (y_0 - y)^2]^{3/2}\bar{\theta}^2 \cdot \left[\frac{2 + 3(I' + V')}{3}\right]$$

$$U_\phi'^2 = s[z^2 + (x_0 - x)^2 + (y_0 - y)^2]^{1/2}\bar{\theta}^2 \cdot \left[\frac{1 + 2V' + 6I' + 3I'V'}{2 + 3(I' + V')}\right] \tag{44}$$

with

$$V' = \frac{\left(1 - \dfrac{n}{n'}\right)^2 \operatorname{var}[R]}{s\bar{\theta}^2[z^2 + (x_0 - x)^2 + (y_0 - y)^2]^{1/2}}$$

$$I' = \frac{\Delta x_0 \Delta y_0}{s\bar{\theta}^2[z^2 + (x_0 - x)^2 + (y_0 - y)^2]^{3/2}} \approx 0$$

$$\bar{\gamma}_x = \frac{n}{n'}\gamma + \left(1 - \frac{n}{n'}\right)\bar{R}_x$$

$$\bar{\gamma}_y = \left(1 - \frac{n}{n'}\right)\bar{R}_y \tag{45}$$

$$\xi_x = \left\{-\bar{\gamma}_x + \sin^{-1}\frac{(x_0 - x)}{\sqrt{z^2 + (x_0 - x)^2}}\right\}(z^2 + (x_0 - x)^2)^{1/2}$$

$$\xi_y = \left\{-\bar{\gamma}_y + \sin^{-1}\frac{(y_0 - y)}{\sqrt{z^2 + (y_0 - y)^2}}\right\}(z^2 + (x_0 - x))^{1/2}$$

$$\epsilon_x = \operatorname{sgn} \xi_x; \qquad \epsilon_y = \operatorname{sgn} \xi_y. \tag{46}$$

In (43) we have introduced the new variables γ_x' and γ_y'. The former is the angle measured in the x-z plane while the latter is the angle perpendicular to the x-z plane. This set of variables results from a rotation of coordinates of the variables θ_r and

θ_ϕ by the transformation

$$\theta_\phi = \frac{(y_0 - y)}{\sqrt{(y_0 - y)^2 + (x_0 - x)^2}} \gamma_x' + \frac{(x_0 - x)}{\sqrt{(y_0 - y)^2 + (x_0 - x)^2}} \gamma_y'$$

$$\theta_r = \frac{(x_0 - x)}{\sqrt{(y_0 - y)^2 + (x_0 - x)^2}} \gamma_x' - \frac{(y_0 - y)}{\sqrt{(y_0 - y)^2 + (x_0 - x)^2}} \gamma_y' \tag{47}$$

and represents the viewing angle at the receiver.

The necessity for this rotation arises from the fact that θ_r lies in the plane described by the points (x_0,y_0), (x,y) and the refracted angle. Consequently, it is necessary to project the angular contributions onto a common set of coordinates before integration. Since the transformation is unitary, the variables γ_x' and γ_y' are still normalized to one. Finally, we see that

$$I(x,y,z;\gamma_x',\gamma_y') = \iint_{-\infty}^{\infty} \Delta I(x,y,z)\, dx_0\, dy_0. \tag{48}$$

It is evident that even with the simplifying assumptions used, the model is complicated. Therefore, in terms of an experiment, it is important to pick a geometry such that we can make further simplifying assumptions. For example, an experiment using the sun at zenith would have $\gamma = 0$, $I(x_0,y_0) =$ constant, $x = y = 0$. We could also pick a calm day so that we can assume $\bar{R}_x = \bar{R}_y = V' = 0$. If in addition we collect over a sphere with a fisheye lens, we have

$$\frac{I(0,0,z)}{I(x_0,y_0,z)} = \iint_{-\infty}^{\infty} \frac{1}{\pi R_1'^2} \exp - \left\{ a[z^2 + x_0^2 + y_0^2]^{1/2} + \frac{(\xi_x^2 + \xi_y^2)}{R_1'^2} \bigg|_{x=y=\bar{\gamma}_x=\bar{\gamma}_y=0} \right\} dx_0\, dy_0$$

$$R_1'^2 = (2/3) s\theta^2 [z^2 + x_0^2 + y_0^2]^{3/2}. \tag{49}$$

Setting $x_0 = r_0 \cos \rho$, $y_0 = r_0 \sin \rho$ and assuming

$$\sin^{-1} \frac{x_0}{\sqrt{z^2 + x_0^2}} \approx \frac{x_0}{\sqrt{z^2 + x_0^2}}$$

and

$$\sin^{-1} \frac{y_0}{\sqrt{z^2 + y_0^2}} \approx \frac{y_0}{\sqrt{z^2 + y_0^2}}$$

we have

$$\frac{I(0,0,z)}{I(x_0,y_0)} = 2\int_0^{\infty} \frac{\exp - \left\{ a[z^2 + r_0^2]^{1/2} + \dfrac{r_0^2}{(2/3)s\theta^2[z^2 + r_0^2]^{3/2}} \right\}}{(2/3)s\overline{\theta^2}[z^2 + r_0^2]^{3/2}}\, r_0\, dr_0. \tag{50}$$

(Notice that for $z = 0$ the approximation $1' = 0$ does not hold.)

The power collected at depth z will be merely $AI(0,0,z)$ where A is the size of the collecting aperture. Consequently, a measurement of $I(0,0,z)/I(x_0,y_0)$ over many extinction lengths would indicate the validity of extrapolating the model to great depths.

We have now presented three separate methods for computing the power loss to a depth z when the source is at the zenith and no other effects are considered. By order of expected accuracy they are (49), (50), and (7) when the beam radius r_0 is considered large. In Fig. 10 we plot (50) as a function of the upper limit of integration. Notice that in all cases convergence occurs when the radius is approximately $z/2$ for $\overline{\theta^2} = 0.01$. As $\overline{\theta^2}$ increases from 0.01-0.11 the effective surface area increases and the total contribution decreases. A calculation of (49) was also made and the result was within a few percent of that calculated by (50) for $\overline{\theta^2} = 0.01$. Finally, when we use (7) with r_0 large, it can be easily shown that $I(0,0,z)/I(x_0,y_0)$ is merely e^{-az}. This is plotted together with the previous results in Fig. 11 as a function of z. At $300M$ and $\overline{\theta^2} = 0.01$ the difference was only 3 dB. This result implies that the diffuse reflection coefficient [6] when measured at the zenith is approximately the absorption coefficient.

In a practical system, one will encounter background noise arising from the sky and the sun. When this occurs, the use of a 4π steradian collector will admit an unacceptable amount of noise into the detector circuitry. For these cases it can be shown that to optimize the received signal-to-noise ratio a spatially matched filter should be used. Simply stated, the matched filter will take two forms depending upon whether we have blue sky or the sun (or both). To eliminate a source such as the sun the filter reduces to an obscuration covering the field of view subtended by the sun to the receiver. For an extended source, the filter takes on the angular distribution subtended by the source to the receiver. In practice this reduces to an obscuration which only passes that portion of the field in which the major portion of the source subtends. Mathematically, we would integrate (48) over the variables γ_x' and γ_y' with the integration boundary determined by the receiver field of view. Then (43) can be rewritten as

$$\Delta I(x,y,z;\gamma_x',\gamma_y') = \frac{I(x_0,y_0) dx_0 dy_0}{(\pi U_\phi' R_1')^2} \exp - \left\{ a[z^2 + (x - x_0)^2 + (y - y_0)^2]^{1/2} + \left[\frac{\xi_x^2 + \xi_y^2}{R_1'^2}\right] + \frac{1}{U_\phi'^2} \cdot \left[\left(\gamma_x' - \bar{\gamma}_x - \frac{\epsilon_x |x_0 - x| \theta_m'}{\sqrt{(x_0 - x)^2 + (y_0 - y)^2}} \right)^2 + \left(\gamma_y' - \bar{\gamma}_y - \frac{\epsilon_y |y_0 - y| \theta_m'}{\sqrt{(x_0 - x)^2 + (y_0 - y)^2}} \right)^2 \right] \right\}. \tag{51}$$

If we assume that the receiver will be pointing at the refracted angle $(n/n')\gamma$ we can perform the integration over a finite field of view between say $(n/n')\gamma - \Delta$ and $(n/n')\gamma + \Delta$. If we perform the integration over a cone, we find that some difficulty would arise in trying to obtain a closed form solution. However, by referring to Fig. 12 we see that upper and lower bounds can easily be obtained in closed form. The resultant received power over the finite field of view Ω can be obtained using combinations of the function

$$I(x,y,z,\Omega) = \iint_{x_0,y_0} \frac{I_0(x_0,y_0)\,dx_0\,dy_0}{\pi R_1'^2}\left[\exp\left\{a\left[z^2 + (x-x_0)^2 + (y-y_0)^2\right]^{1/2} + \frac{(\xi_x^2+\xi_y^2)}{R_1'^2}\right\}\right]G \tag{52}$$

where

$$G = \left\{\frac{1}{2}\operatorname{erf}\left\{\left[\Delta - \left(1 - \frac{n}{n'}\right)\bar{R}_x - \frac{\epsilon_x\,|x_0 - x|\,\theta_m'}{\sqrt{(x-x_0)^2+(y-y_0)^2}}\right]\frac{1}{U_\phi'}\right\} - \frac{1}{2}\operatorname{erf}\left\{\left[-\Delta - \left(1 - \frac{n}{n'}\right)\bar{R}_x - \frac{\epsilon_x\,|x_0 - x|\,\theta_m'}{\sqrt{(x-x_0)^2+(y-y_0)^2}}\right]\frac{1}{U_\phi'}\right\}\right\}\cdot\left\{\frac{1}{2}\operatorname{erf}\left\{\left[\Delta - \left(1 - \frac{n}{n'}\right)\bar{R}_y - \frac{\epsilon_y\,|y_0 - y|\,\theta_m'}{\sqrt{(x-x_0)^2+(y-y_0)^2}}\right]\frac{1}{U_\phi'}\right\} - \frac{1}{2}\operatorname{erf}\left\{\left[-\Delta - \left(1 - \frac{n}{n'}\right)\bar{R}_y - \frac{\epsilon_y\,|y_0 - y|\,\theta_m'}{\sqrt{(x-x_0)^2+(y-y_0)^2}}\right]\frac{1}{U_\phi'}\right\}\right\}. \tag{53}$$

For small fields of view, G can be replaced by

$$G = \frac{\Omega}{\pi U_\phi'^2}\exp -\frac{1}{U_\phi'^2}\left\{\left(\left(1 - \frac{n}{n'}\right)\bar{R}_x - \frac{\epsilon_x\,|x_0 - x|\,\theta_m'}{\sqrt{(x_0-x)^2+(y_0-y)^2}}\right)^2 + \left(\left(1 - \frac{n}{n'}\right)\bar{R}_y - \frac{\epsilon_y\,|y_0 - y|\,\theta_m'}{\sqrt{(x_0-x)^2+(y_0-y)^2}}\right)^2\right\}, \qquad \Omega < U_\phi'^2. \tag{54}$$

On a final note, it is possible to obtain an estimate of the pulse spreading by referring to Fig. 13, for the zenith geometry. If the primary contributions come from the disc with diameter z, then the maximum path difference is

$$\rho = \frac{z}{2}(\sec\theta - 1), \qquad \sec\theta = 1.115$$

and the maximum time difference is

$$\Delta t = \frac{n'}{c}\rho = \frac{1.33z}{2c}[0.115] = 3 \times 10^{-10} z. \tag{55}$$

At $z = 300M$, $\Delta T = 90$ ns. If the primary contributions come from twice the disk diameter, $\Delta T = 324$ ns.

Heggestad has computed the impulse response of the medium from which he evaluates the delay spread as the $1/e$ point. This value takes the form

$$\Delta t = \frac{1}{\alpha c}\left[1 + 2\left(\frac{s}{\alpha} - \sqrt{\frac{s}{\alpha}}\right)\alpha z + 2\sqrt{(\alpha z)^2\left(\sqrt{\frac{s}{\alpha}} - 1\right)^2 + \alpha z\left(2\frac{s}{\alpha} - \sqrt{\frac{s}{\alpha}}\right)}\right]. \tag{56}$$

For $z = 300M$, this yields 193 ns.

V. SUBSURFACE-TO-SATELLITE BUDGETS

The part of the system most difficult to model has been the subsurface-to-satellite uplink. This difficulty can best be understood by showing why the two are not reciprocal. On the downlink a one mile spot projected from 22 000 miles represents an antenna gain of

$$\frac{4\pi(22\,000)^2}{1} \approx 96 \text{ dB}.$$

On the uplink, however, if we go through one scattering length of water the beam solid angle will be approximately $\bar{\theta}^2$ or an antenna gain of $4\pi/\bar{\theta}^2$. Since $\bar{\theta}^2 \sim 10^{-2}$–$10^{-1}$ the gain is only 21–31 dB. The gain then goes down as $10 \log N_{scatt}$ in scattering lengths. Because of the paucity in gain it would be necessary to operate the system closer to the surface on the uplink than for the downlink, if the scattered radiation as described by the Heggestad-Arnush approximation is used exclusively.

For this portion of the link it is necessary to investigate the radiation in greater detail. To do so it is helpful to use the normalized version of the mutual coherence function (MCF) [11]–[13] (spatial covariance function). For the scattering function described in (3) this becomes

$$\gamma(\rho) = \exp\left[-\frac{\pi^2 r_0^2\rho^2}{Z^2\lambda^2} + sZ\left\{\frac{1}{\sqrt{1+(k_0\rho)^2\bar{\theta}^2}} - 1\right\}\right], \qquad k_0 = \frac{2\pi}{\lambda}. \tag{57}$$

Notice that at $\rho = 0$ this is normalized to unity, and we assumed a Gaussian source with an aperture equal to πr_0^2 focused at infinity. In normal system design we are commonly interested in the beamwidth of the antenna defined at the 3

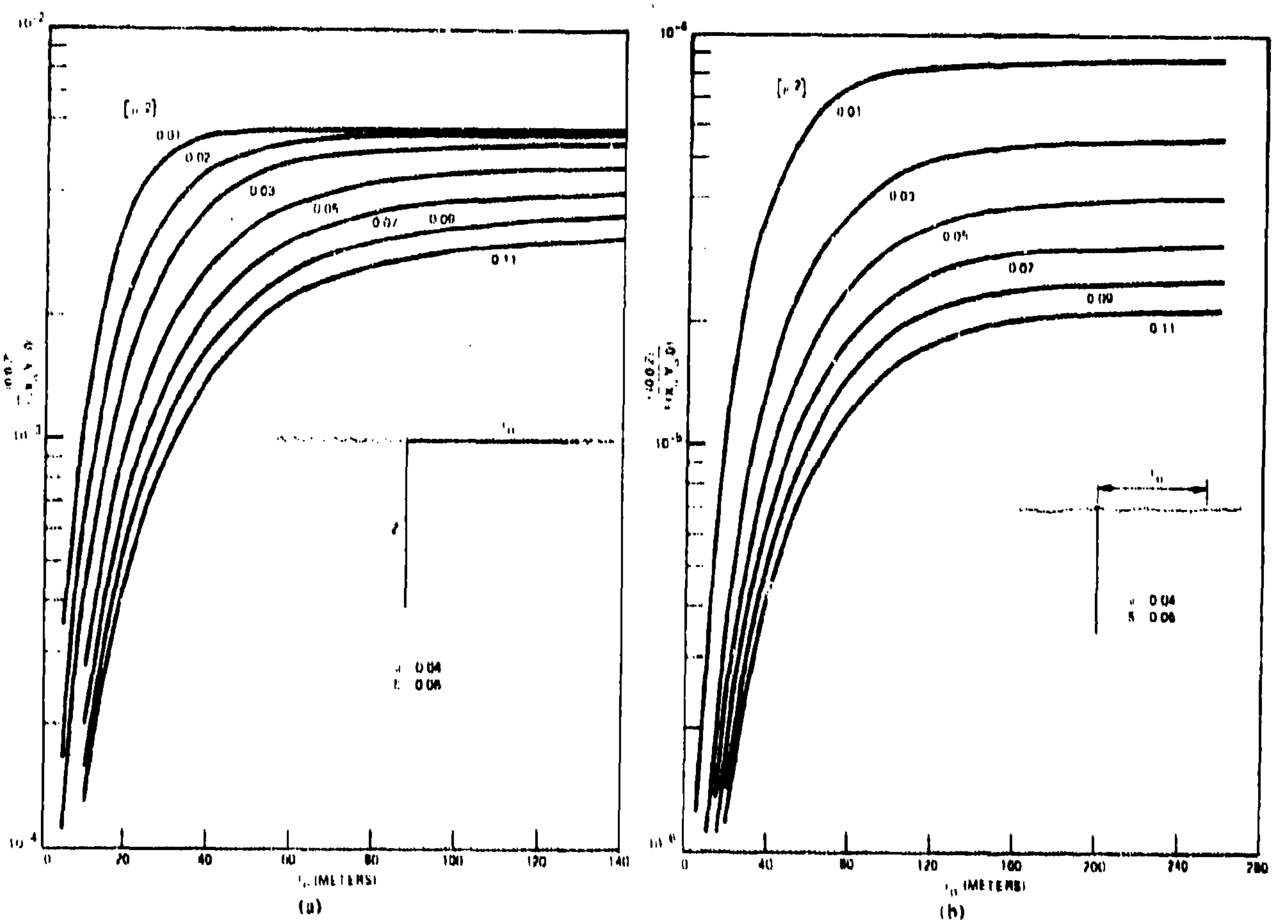

Fig. 10. Equation (50) plotted as a function of the upper limit of integration. (a) $Z = 100$ m. (b) $Z = 200$ m.

dB points. Since MCF is the transform of the angular distribution of the source as seen by the receiver, we can equivalently define a "coherence length" ρ_e as a comparable measure of antenna collimation. Thus, the greater the coherence length, the closer the source appears to approximate an impulse in angle (point source). By setting the MCF equal to $e^{-0.693}$ (−3 dB) and solving for ρ_e, we can investigate the behavior of the radiation as it traverses the scattering medium. The expression for ρ_e becomes

$$\rho_e = 0.693\left(\frac{\lambda Z}{\pi r_0}\right), \qquad Z < \frac{0.693}{s}$$

$$\rho_e = \lambda \frac{[(1.386(sZ) - 0.48)/\overline{\theta^2}]^{1/2}}{2\pi[sZ - 0.693]}, \qquad Z > \frac{0.693}{s} \tag{58}$$

which is shown in Fig. 14 as a function of Z for an initial divergence of 10^{-3} rad, and for the water properties defined by $s = 0.06$, $a = 0.04$, and $\overline{\theta^2} = 0.01$. Notice that for a distance $Z = 0.693/s$ the beam propagates as it would in vacuum, and the correlation length increases as the beam diverges. However, the scattering mechanisms abruptly take hold at this distance and the coherence length decreases dramatically in a very short distance, and rapidly approaches the value

$$\rho_e \approx 0.19\lambda\left(\frac{1}{s\overline{\theta^2}_Z}\right)^{1/2} \tag{59}$$

defining the Heggestad-Arnush approximation. Since this behavior is dependent upon the scattering properties of the water, it is instructive to define the albedo [2] ω as the ratio $s/(s + a)$ and the extinction length as $N = \alpha Z = (a + s)Z$ and replot Fig. 14 for various water parameters in Fig. 15. Thus, we see that we rapidly lose the gain (or imaging capability) of the medium as we traverse a few scattering lengths, which can vary in terms of the extinction length. This, however, is not the whole story.

If we observe the MCF, (57), for large values of ρ, we observe the asymptotic value of e^{-sZ}. From Fourier transform theory we know that this corresponds to a point source which relates to the unscattered portion of the beam. And, while the power associated with this portion of the beam is significantly less than that associated with the scattered radiation (lower by e^{-sZ}), it nevertheless retains the full gain of the original source. Consequently, it can be shown that for the uplink geometry a receiver located out of the scattering media at a

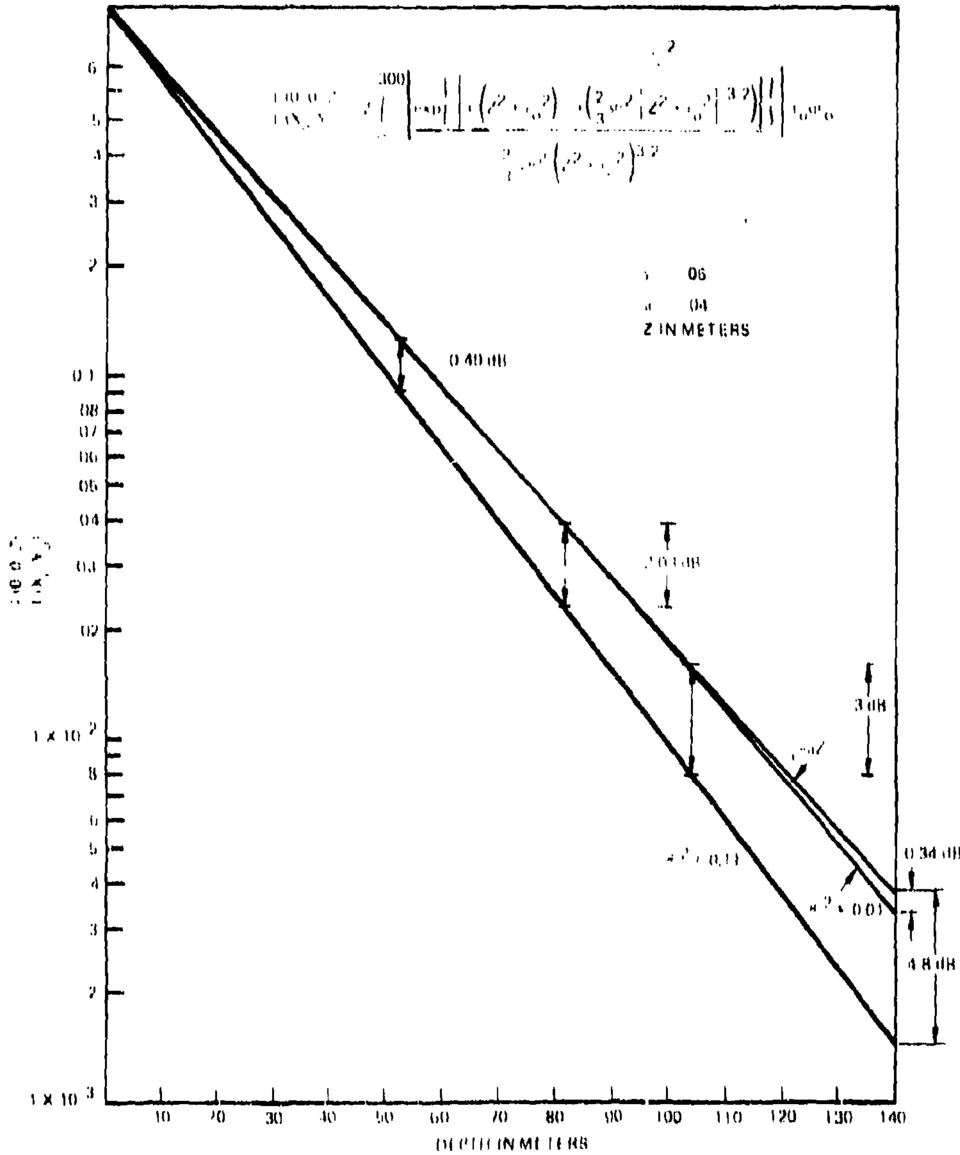

Fig. 11. Equation (7) plotted with r_0 large.

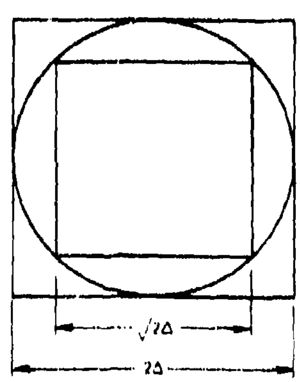

Fig. 12. Integration upper and lower bonds in closed form.

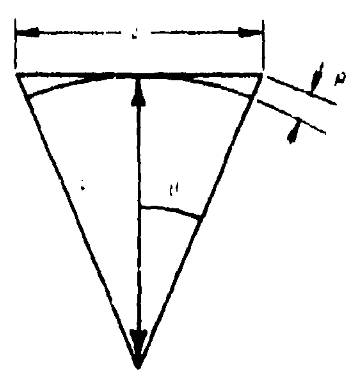

Fig. 13. Zenith geometry for estimating pulse spreading.

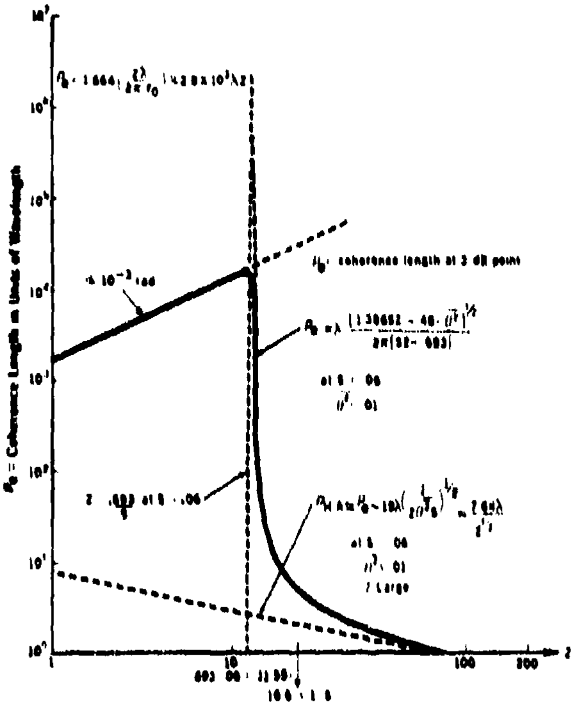

Fig. 14. Coherence length as a function of propagation path.

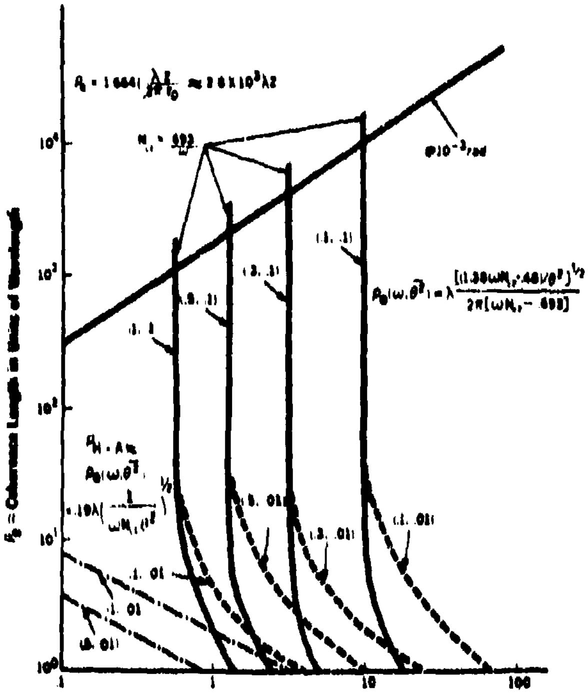

Fig. 15. Coherence length as a function of extinction lengths for various values of the albedo and θ^2.

great distance from the source will always collect more power from this unscattered component that from the scattered component [12]. It is therefore possible to consider the uplink radiation as composed of two additive Gaussian terms. The first, retaining all the geometric properties of the radiated source, but attenuated by the factor $e^{-(a+s)Z}$, and the second consisting of the scattered portion of the radiation as considered for the downlink. Either of these terms may be used to develop a system, but the resulting systems will have vastly differing operating scenarios due to the difference in coverage and pointing requirements. Consequently, we will consider the general problem of a Gaussian beam propagating up through the air/sea interface and determine the effects.

We will first make the computations outlined in (36) for the Heggestad–Arnush approximation and then show how the unscattered result follows.

To compute the surface irradiance profile upon passing through the interface on the uplink it is only necessary to insert (7) into (36). This yields

$$f(\gamma' r) = \int d\gamma\, P(\gamma'/\gamma) f(\gamma r) \tag{60}$$

[we assume a collimated, zero cross section illuminating source ($l = V = 0$)]. Finally, to determine the angular distribution of the beam (γ', r) is integrated over the surface to yield

$$f(\gamma') = \int f(\gamma' r)\, dr = \int f(\gamma r) p(\gamma'/\gamma)\, d\gamma\, dr. \tag{61}$$

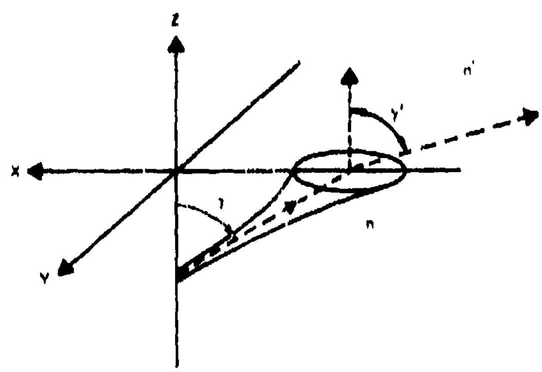

Fig. 16. Coordinate system of Fig. 9 turned upside down.

To perform the integration in (60), several factors must be taken into account. First recall that we have defined the medium containing the source to have the index n, and zenith angle γ. Thus, if we want a more figurative description we should turn the coordinate system in Fig. 9 upside down to yield Fig. 16.

Next recall that we projected the true slope statistics of the surface onto the x and y coordinates. However, the scattered beam has circular symmetry with regard to the angular divergence. Consequently, it is again necessary to rotate the axis of the angular coordinates by the transformation in (47), which will allow us to perform the integration in (60) in Cartesian coordinates. Taking the latter remarks into account and again assuming Gaussian slope statistics yields the function $f(\gamma', r)$ with

$$f(\gamma', r) = p_t \int \frac{d\theta_x\, d\theta_y}{[\pi U_\phi' R_1']^2 \left[2\pi \left|1 - \frac{n}{n'}\right|^2 \text{var}\,[R]\right]} \cdot \exp - \left\{ a\sqrt{z^2 + x^2 + y^2} + \frac{\xi_x^2 + \xi_y^2}{R_1'^2} + \frac{1}{U_\phi'^2} \left[\left(\theta_x - \gamma_x - \frac{\epsilon_x |x| \theta_m'}{\sqrt{x^2 + y^2}}\right)^2 + \left(\theta_y - \frac{\epsilon_y |y| \theta_m'}{\sqrt{x^2 + y^2}}\right)^2 \right] + \frac{1}{2\left[1 - \frac{n}{n'}\right]^2 \text{var}\,[R]} \cdot \left[\left(\gamma_x' - \frac{n}{n'}\theta_x - \left(1 - \frac{n}{n'}\right) R_x\right)^2 + \left(\gamma_y' - \frac{n}{n'}\theta_y - \left(1 - \frac{n}{n'}\right) R_y\right)^2 \right] \right\} \qquad (62)$$

where we have assumed that the source is located at $(x_0 = 0, y_0 = 0, z)$ and the surface radiance profile is over (x, y, z). Consequently, the angular distribution of the emerging beam is obtained by integrating $f(\gamma', r)$ over the variables (x, y), where γ_x' and γ_y' are now the angles projected by the source.

As the surface roughness goes to zero in (62), $p(\gamma, \gamma)$ approaches the delta function $\delta(\gamma' - (n/n')\gamma)$. For this case the integration can be performed over θ_x, θ_y to yield

$$f(\gamma', r) = \frac{p_t}{\left(\pi \frac{n}{n'} U_\phi' R_1'\right)^2} \exp - \left\{ a\sqrt{z^2 + x^2 + y^2} + \frac{\xi_x^2 + \xi_y^2}{R_1'^2} + \frac{1}{\left(\frac{n}{n'}\right)^2 U_\phi'^2} \left[\left(\gamma_x' - \frac{n}{n'}\gamma_x - \frac{n}{n'} \frac{\epsilon_x |x| \theta_m'}{\sqrt{x^2 + y^2}}\right)^2 + \left(\gamma_y' - \frac{n}{n'} \frac{\epsilon_y |y| \theta_m'}{\sqrt{x^2 + y^2}}\right)^2 \right] \right\} \qquad (63)$$

We can also perform the integration in (62) for the narrow beam case. For this case we can extend the integration from $-\infty$ to ∞ yielding

$$f(\gamma', r) = \left\{ \frac{1}{U_\phi'^2 \Sigma} \exp - \left[\Delta + \frac{\Gamma}{\Sigma}\right] \right\} \frac{p_t}{\pi R_1'^2} \cdot \exp - \left[a\sqrt{z^2 + x^2 + y^2} + \frac{\xi_x^2 + \xi_y^2}{R_1'^2} \right] \qquad (64)$$

where

$$\Sigma = \frac{1}{U_\phi'^2} + \frac{1}{2\left[\frac{n}{n'} - 1\right]^2 \text{var}\,[R]}$$

$$\Delta = \frac{1}{2\left[\frac{n'}{n} - 1\right]^2 \text{var}\,[R]} \left[\left\{\frac{n'}{n}\gamma_x' - \left(\frac{n'}{n} - 1\right) R_x\right\}^2 + \left\{\frac{n'}{n}\gamma_y' - \left(\frac{n'}{n} - 1\right) R_y\right\}^2 \right] + \frac{1}{U_\phi'^2} \left[\left\{\gamma_x - \frac{\epsilon_x |x| \theta_m'}{\sqrt{x^2 + y^2}}\right\}^2 + \left\{\frac{y \theta_m'}{\sqrt{x^2 + y^2}}\right\}^2 \right]$$

$$\Gamma = \left[\frac{\left\{\gamma_x - \frac{\epsilon_x |x| \theta_m'}{\sqrt{x^2 + y^2}}\right\}}{U_\phi'^2} + \frac{\left\{\frac{n'}{n}\gamma_x' - \left(\frac{n'}{n} - 1\right) R_x\right\}}{2\left(\frac{n'}{n} - 1\right)^2 \text{var}\,[R]} \right]^2 + \left[\frac{\left\{\frac{\epsilon_y |y| \theta_m'}{\sqrt{x^2 + y^2}}\right\}}{U_\phi'^2} + \frac{\left\{\frac{n'}{n}\gamma_y' - \left(\frac{n'}{n} - 1\right) R_y\right\}}{2\left(\frac{n'}{n} - 1\right)^2 \text{var}\,[R]} \right]^2. \qquad (65)$$

For the case where the ocean roughness is absent (63) we see that the exiting beam is centered around the linearized Snell's angle, $(n/n')\gamma_x$, but somewhat steered toward the zenith. Physically, this is due to the fact that the scattered paths which lie closest to the zenith traverse a shorter distance and consequently are absorbed less which skews the beam.

We can integrate the contribution at an angle γ' over the entire surface as indicated in (61). This results in the function $f(\gamma')$ which is the angular power distribution. To compute an uplink budget one needs to integrate $f(\gamma')$ over the solid angle subtended by the collecting aperture. At a distance R large enough for the function $f(\gamma')$ to be constant over the collecting aperture, this solid angle is merely A/R^2. Consequently the collected power is

$$P_r = f(\gamma') \frac{A}{R^2}. \qquad (66)$$

An important case to notice is when the beam is exiting the water at the zenith and the surface is smooth. Then (63) integrated over the hemisphere yields the result in (49), multiplied by the normalized angular distribution

$$\frac{1}{\pi\left(\frac{n}{n'} U_\phi'\right)^2} \exp\left(- \frac{(\gamma_x'^2 + \gamma_y'^2)}{\left(\frac{n}{n'} U_\phi'\right)^2} \right). \qquad (67)$$

If we look at the 3 dB contour, the beam half-angle is (n/n') ×

$U_\phi'\sqrt{0.693}$, and the effective gain is

$$G = \frac{2}{1-\cos\left(\frac{n}{n'}U_\phi'\sqrt{0.693}\right)}. \tag{68}$$

The link loss for this case becomes $(\gamma_x' = \gamma_y' = 0)L$, where

$$L = \frac{f(\gamma')|_{\gamma'=0}}{p_t} = \frac{A}{\pi\left(\frac{n}{n'}U_\phi\right)^2(R^2)} \cdot \iint_\infty \frac{1}{\pi R_1'^2\left(\frac{U_\phi'}{U_\phi}\right)^2}\exp - \left\{a[z^2+x^2+y^2]^{1/2} + \frac{\xi_x^2+\xi_y^2}{R_1'^2}\Big|_{x_0=y_0=\bar{\gamma}_x=0}\right\}dx\,dy. \tag{69}$$

To obtain the results for the unscattered beam we would use (6) in place of (7). This, however, merely requires the substitutions

$$\begin{aligned} &S = 0\\ &R_0'^2 \to r_0^2\\ &U_r'^2 \to \theta_0^2\\ &U_\phi'^2 \to \theta_0^2\\ &R_1'^2 \to r_0^2 + \theta_0^2 z'^2\\ &P_t' \to P_t e^{-sz'} \end{aligned} \tag{70}$$

with $\theta_m = r_m = 0$. With these substitutions (62)–(64), (67)–(69) become (71)–(76), respectively.

$$f(\gamma' r) = P_t\int \frac{d\theta_x\,d\theta_y}{[\pi z'\theta_0^2]^2\,2\pi\left|1-\frac{n}{n'}\right|^2 \mathrm{var}\,[R]} \cdot \exp - \left\{\alpha\sqrt{z^2+x^2+y^2} + \frac{\xi_x^2+\xi_y^2}{\theta_0^2(z^2+x^2+y^2)} + \frac{1}{\theta_0^2}[(\theta_x-\bar{\gamma}_x)^2+\theta_y^2] + \frac{1}{2\left[1-\frac{n}{n'}\right]^2\mathrm{var}\,[R]} \cdot \left[\left(\gamma_x' - \frac{n}{n'}\theta_x - \left(1-\frac{n}{n'}\right)R_x\right)^2 + \left(\gamma_y' - \frac{n}{n'}\theta_y - \left(1-\frac{n}{n'}\right)R_y\right)^2\right]\right\} \tag{71}$$

$$f(\gamma' r) = \frac{P_t}{\left(\pi\frac{n}{n'}z'\theta_0^2\right)^2}\exp - \left\{\alpha\sqrt{z^2+x^2+y^2} + \frac{\xi_x^2+\xi_y^2}{\theta_0^2 Z'^2} + \frac{1}{\left(\frac{n}{n'}\right)^2(\theta_0^2)} \cdot \left[\left(\gamma_x' - \frac{n}{n'}\bar{\gamma}_x\right)^2 + \gamma_y'^2\right]\right\} \tag{72}$$

$$f(\gamma' r) = \frac{1}{\theta_0^2\Sigma}\exp - \left[\Delta + \frac{\Gamma}{\Sigma}\right]\frac{P_t}{\theta_0^2 Z'^2} \cdot \exp - \left[\alpha\sqrt{x^2+y^2+z^2} + \frac{\xi_x^2+\xi_y^2}{\theta_0^2 Z'^2}\right] \tag{73}$$

$$\frac{1}{\pi\left(\frac{n}{n'}\right)^2(\theta_0^2)}\exp - \frac{\gamma_x'^2+\gamma_y'^2}{\left(\frac{n}{n'}\right)^2(\theta_0^2)} \tag{74}$$

$$G' = \frac{2}{1-\cos\left(\frac{n}{n'}\sqrt{\theta_0^2(0.693)}\right)} \tag{75}$$

$$L' = \frac{A}{\pi\left(\frac{n}{n'}\right)^2(\theta_0^2)(R^2)}\iint_\infty \frac{dx\,dy}{\pi\theta_0^2 z'^2} \cdot \exp - \left\{\alpha\sqrt{z^2+x^2+y^2} + \frac{\xi_x^2+\xi_y^2}{\theta_0^2 Z'^2}\Big|_{x_0=y_0=\bar{\gamma}_x=0}\right\}. \tag{76}$$

We again point out that for large zenith angles, the linearization used to derive these results is not valid, and a more detailed analysis is required.

Comparing (68) and (75) and letting $\cos X = 1 - (X^2/2)$ we see that the ratio of the gain in the unscattered to scattered beam on-axis is

$$\frac{N_s\overline{\theta^2}}{(\lambda/r_0)^2} \tag{77}$$

where we have assumed that the beam is focused at infinity ($\theta_0 = \lambda/r_0$) and we are transmitting from N_s scattering lengths. Since the unscattered beam has e^{-N_s} times the power of the scattered beam we see that the inequality

$$\frac{N_s\overline{\theta^2}e^{N_s}}{(\lambda/r_0)^2} \le 1 \tag{78}$$

determines which portion dominates.

VI. DISCUSSION

In this paper we have developed models for use in evaluating the performance of the duplex subsurface-to-above surface optical communications systems. We will now briefly discuss the limitations of the models and the areas of applicability. We will also point out relevant areas of future work. The first aspect of the model is the estimate of underwater propagation. The Heggestad-Arnush model used appears to have all the attributes necessary for accurate predictions. Although the model has been calibrated to existing data, an independent verification is warranted. The results of such an effort would determine whether or not further refinement is necessary. The major implication of this propagation model is a clear distinction between the contribution of absorption and scattering to the extinction coefficient. Couched in system terminology, the model states that if the size of the beam on the surface is comparable or greater than the depth from which it is to be viewed, and if the field of view at the receiver can be made large, then the only loss is from absorption. Since the extinction coefficient is usually two or more times greater than the absorption coefficient, so too would the depth prediction under these conditions from those normally expected using only the extinction coefficient. The field of view encountered is also seen to be proportional to the square root of the scattering coefficient and the depth.

The second aspect of the model relates to the effects of the surface. In order to obtain usable results, a linearization of Snell's law was employed which should be reasonably accurate for zenith angles out to 45°. The important result is that at sufficient depth the effects of a random surface would be negligible. The major concern should be blockage of light due to foam, etc. The basis of this conclusion stems from the prediction that the rms beam spreading will be proportional to $[1 - (n/n')]$ times the rms slope distribution of the surface. This would imply that a maximum of five or so degrees is all that would ever be expected. The major impact would seem to be on the uplink where the beam steering would occur.

The most difficult part of this communication system appears to be the uplink. Because of the nonreciprocal nature of the duplex system the unscattered portion of the beam provides the greater potential for power transfer. The power in this portion of the beam is greatly diminished over the scattered term, yet retains its high directionality. The diminished power alone implies a depth reduction of $a/(a + s)$. The addition the spot size on the ocean surface will not encompass enough area to average out the dynamic effects of the wave motion. Consequently, measures will have to be taken to compensate for this wave motion in an active and dynamic manner. This implies a form of image enhancement of the downlink beam so as to track the unscattered component. This is an area where future work can be directed and efforts are already underway.

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APPENDIX B

LAYERED WATER CORRECTION

When a and s are functions of z, it becomes necessary to determine the effect upon the model and to correct for it when necessary. Write $s(z)\overline{\theta^2}(z)$ as

$$s(z)\overline{\theta^2}(z) = s_i \overline{\theta_i^2} \; ; \; z \in (z_{i-1}, z_i) . \tag{B-1}$$

Let us first consider the effect upon the angle. For constant parameters, the angular variance grows as $s\overline{\theta^2} z = \Omega$. Since

$$\frac{d\Omega}{dz} = s\overline{\theta^2} , \tag{B-2}$$

we argue that for $z \in (z_{i-1}, z_i)$

$$\Delta \Omega_i = s_i \overline{\theta_i^2} (z_i - z_{i-1}) . \tag{B-3}$$

For $z \in (z_{i-1}, z_i)$

$$\frac{\Delta \Omega_i}{\Delta z} = \frac{\Delta \Omega_i}{z_i - z_{i-1}} = s_i \overline{\theta_i^2} . \tag{B-4}$$

Hence,

$$\Omega(z) = \int_0^z \frac{\Delta \Omega}{\Delta z} \, dz = \sum_{i=1}^{N} s_i \overline{\theta_i^2} (z_i - z_{i-1}) \; ; \; z \in (z_{N-1}, z_N) . \tag{B-5}$$

In general,

$$\Omega(z) = \left[\sum_{i=1}^{N} s_i \overline{\theta_i^2} (z_i - z_{i-1}) \right] \sec\theta , \tag{B-6}$$

where θ is the angle relative to the normal that the ray takes to get to the depth z. Since the absorption loss is linear in z, a similar argument can be given to yield

$$a z = \left[\sum_{i=1}^{N} a_i (z_i - z_{i-1}) \right] \sec\theta \tag{B-7}$$

as the exponential absorption loss to replace az.

The spatial spread, on the other hand, goes as

$$s\,\overline{\theta^2}\,z^3 \tag{B-8}$$

which is actually Ωz^2. Now

$$(\Omega + \Delta\Omega)(z + \Delta z)^2 \cong \Omega z^2 + \Delta\Omega z^2 + 2\Omega z \Delta z + \Delta\Omega \Delta z^2 + O(\Delta z^2) \tag{B-9}$$

or

$$\frac{\Delta(\Omega z^2)}{\Delta z} = \frac{\Omega z^2 + \Delta\Omega z^2 + 2\Omega z \Delta z + O(\Delta z^2) - \Omega z^2}{\Delta z} = 3\,s(z)\,z^2\,\overline{\theta^2}(z)\,. \tag{B-10}$$

Hence, the spatial spread can be modeled as

$$\int_0^z 3s(z)\,z^2\,\overline{\theta^2}(z)\,dz = \sum_{i=1}^{N} s_i\,\overline{\theta_i^2}\left(z_i^3 - z^3_{i-1}\right), \tag{B-11}$$

which becomes

$$\left[\sum_{i=1}^{N} s_i\,\overline{\theta^2}\left(z_i^3 - z^3_{i-1}\right)\right]\sec^3\theta \tag{B-12}$$

to account for the slant angles. Better approximations of the integrals could be obtained with linear interpolation, but was not considered necessary.

APPENDIX C

SHALLOW DEPTH CORRECTION

In this appendix, we will develop an empirical correction to the model in Appendix A which will apply in the region of 1 to 10 scattering lengths. There will actually be two corrections presented; one for illustrative purposes and the other for data reduction.

In figure 14 of Appendix A, we see that the correlation length ρ of the model used is always less than an empirical fit to the volume scattering function. Since the measure of radiant spread is inversely related to the correlation length, this implies an overestimate of the radiant spread and hence, a conservative model. We know, however, that the correlation length defined has the form

$$\rho_e = \frac{\lambda\left[(1.38\, zs - .48)/\overline{\theta^2}\right]^{1/2}}{2\pi\,(sz - .693)}, \tag{C-1}$$

which can be rewritten as

$$\rho_e = \rho_{H\text{-}A}\left[\frac{\left(1-\frac{.3478}{sz}\right)}{\left(1-\frac{.693}{sz}\right)}\right]^{1/2}. \tag{C-2}$$

We can define an effective value for $\overline{\theta^2}$ as

$$\overline{\theta_{eff}^2} = \overline{\theta^2}\left[\frac{\left(1-\frac{.693}{sz}\right)^2}{\left(1-\frac{.3478}{sz}\right)}\right] = \overline{\theta^2}\,F \tag{C-3}$$

and rewrite ρ_e as

$$\rho_e = \rho'_{H\text{-}A} = .19\,\lambda\left(\frac{1}{sz\,\overline{\theta_{eff}^2}}\right)^{1/2}\ ;\ sz > .693 \tag{C-4}$$

F is plotted in figure C-1.

This correction gives the value for the correlation length. However, since the radiant pattern used remains Gaussian, it turns out to be only slightly better than the uncorrected function, but falls far short of reproducing the correct correlation function and hence, correct radiant pattern. A better approach would be to try a functional fit to the actual correlation function. In addition, since there already was a Gaussian solution, we will try to make this functional fit by adding another Gaussian term in a judicious manner. The function that we are trying to fit is

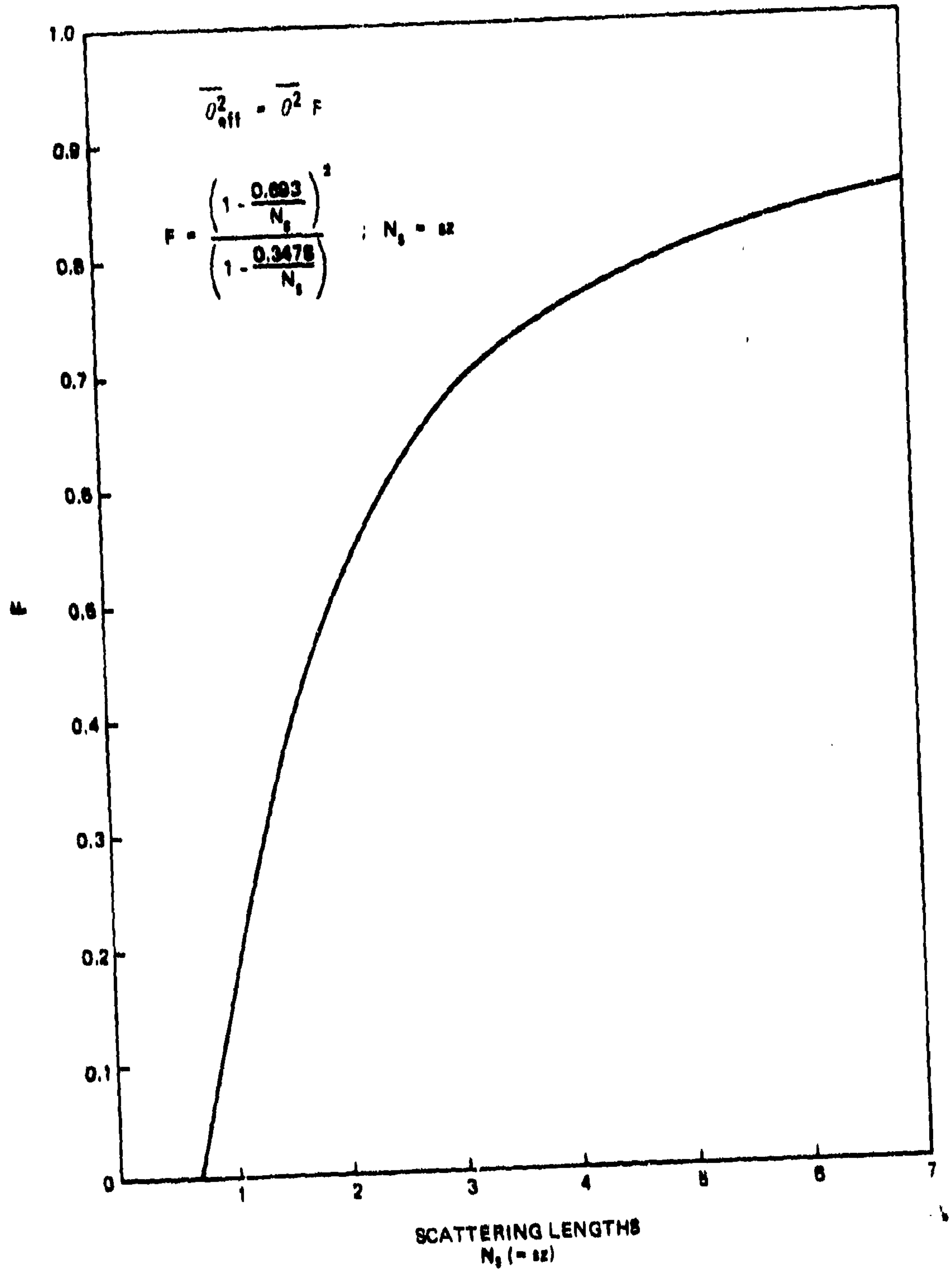

Figure C-1. Shallow depth correction to $\overline{\theta^2_{eff}}$.

$$e^{sz\left[\frac{1}{\sqrt{1+\rho^2\overline{\theta^2}\left(\frac{2\pi}{\lambda}\right)^2}}-1\right]} \qquad \text{(C-5)}$$

where the exp (-a z) multiplier was omitted. It was already pointed out that the asymptotic value of this function is exp(-sz) so that we are trying to fit

$$e^{sz\left[\frac{1}{\sqrt{1+\rho^2\overline{\theta^2}\left(\frac{2\pi}{\lambda}\right)^2}}-1\right]} - e^{-sz} = \left\{\left(e^{sz\frac{1}{\sqrt{1+\rho^2\overline{\theta^2}\left(\frac{2\pi}{\lambda}\right)^2}}}\right)-1\right\}e^{-sz}. \qquad \text{(C-6)}$$

By observing several values of this function (figures C-2 through C-5), the scattered term in equation (C-9) is always visible for small values of ρ. This term will always have the form

$$e^{-\frac{\rho^2}{2}\left(sz\overline{\theta^2}\left(\frac{2\pi}{\lambda}\right)^2\right)}. \qquad \text{(C-7)}$$

Now, if the following is set

$$\rho = 3\rho_0 = \rho_{co} = \frac{3\lambda}{2\pi\sqrt{sz\overline{\theta^2}}} \qquad \text{(C-8)}$$

then this portion of the coherence function at most contributes 1 percent to the total. Consequently, whatever remains of equation (C-6) at this value of ρ can be considered to be one value for a new function. If this new function takes the form

$$Ae^{-\frac{B}{2}\rho^2}, \qquad \text{(C-9)}$$

then we are clearly solving for the point where

$$Ae^{-\frac{B}{2}\rho_{co}^2} = e^{sz\left[\frac{1}{\sqrt{1+\frac{9}{sz}}}-1\right]} - e^{-sz}. \qquad \text{(C-10)}$$

Similarly, a second fit at the value $\rho = 3\rho_{co}$ yields

$$Ae^{-\frac{9B}{2}\rho_{co}^2} = e^{sz\left[\frac{1}{\sqrt{1+\frac{81}{sz}}}-1\right]} - e^{-sz}. \qquad \text{(C-11)}$$

Solving for A and B yields

$$A = -\frac{e^{-sz}\left[e^{\frac{sz}{\sqrt{1+\frac{9}{sz}}}}-1\right]^{9/8}}{\left[e^{\frac{sz}{\sqrt{1+\frac{81}{sz}}}}-1\right]^{1/8}}$$

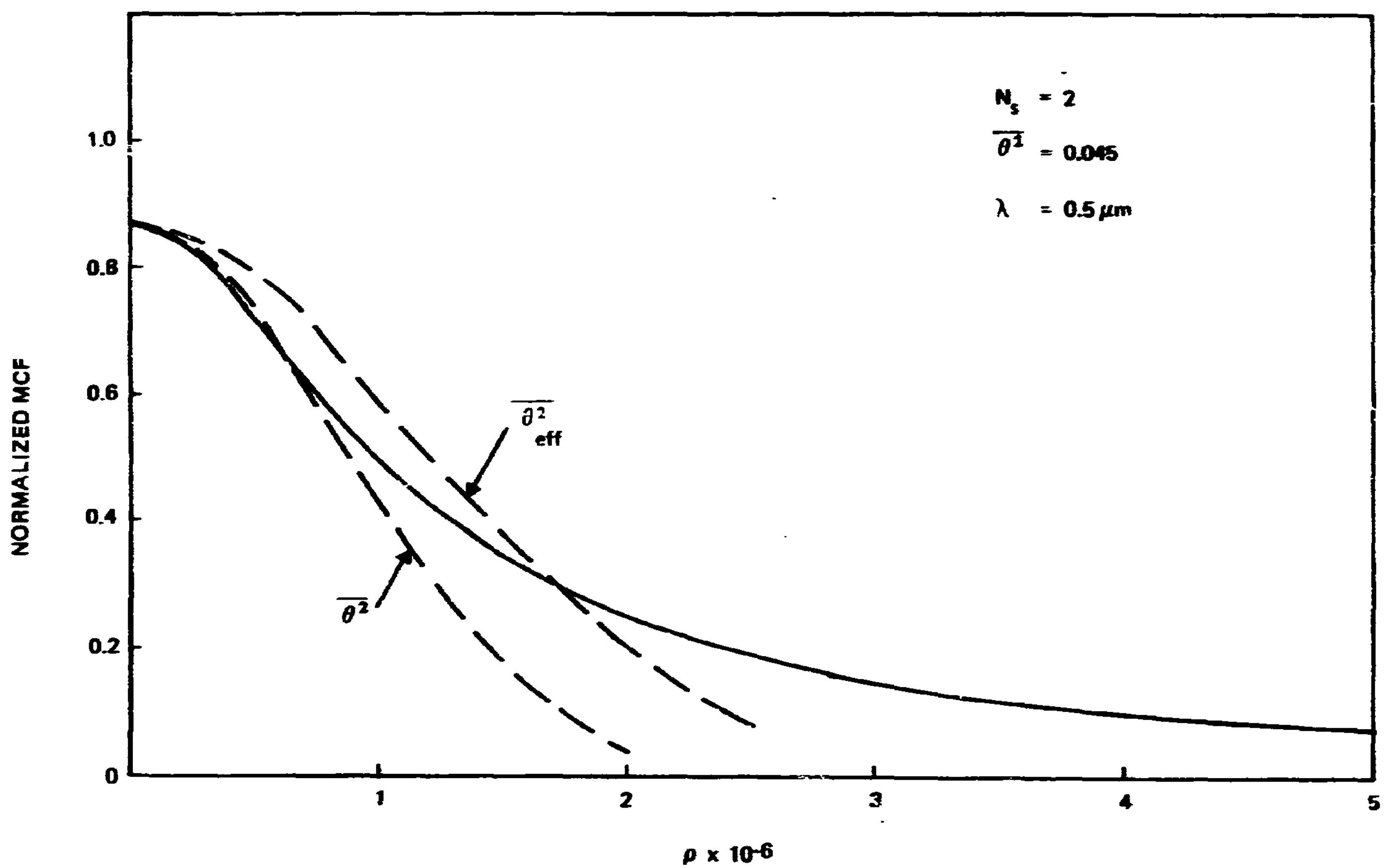

Figure C-2. Mutual coherence function.

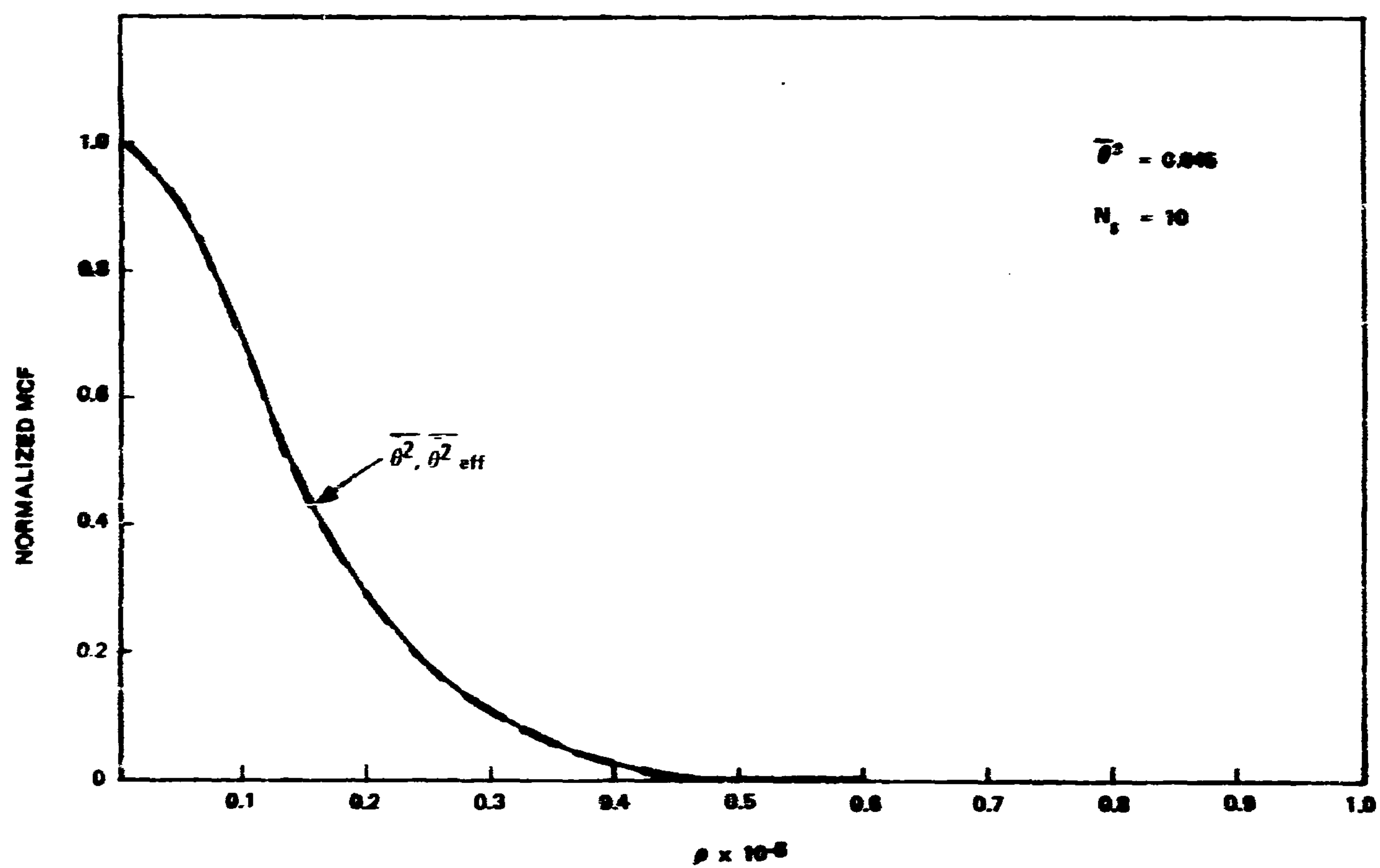

Figure C-3. Mutual coherence function.

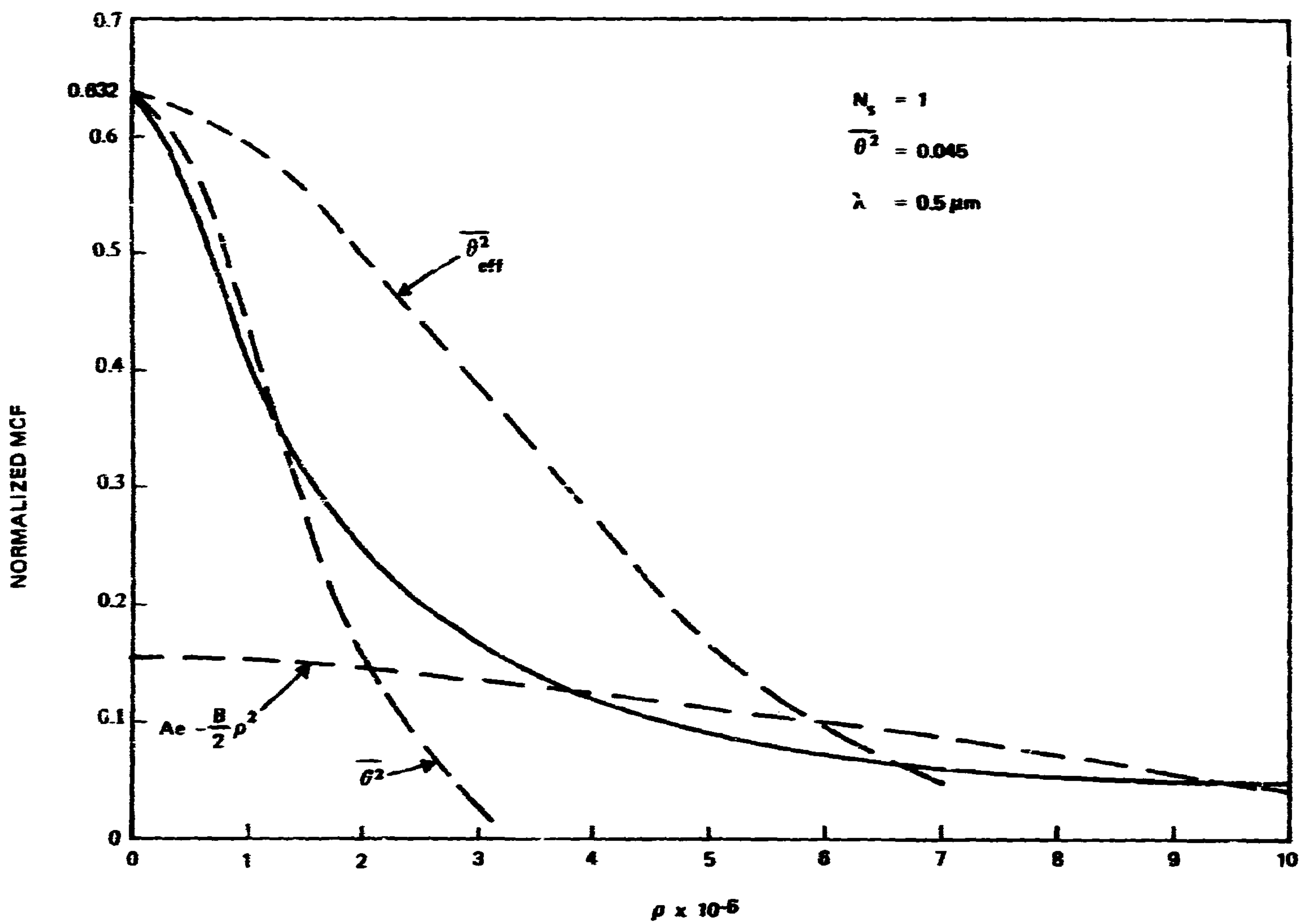

Figure C4. Mutual coherence function.

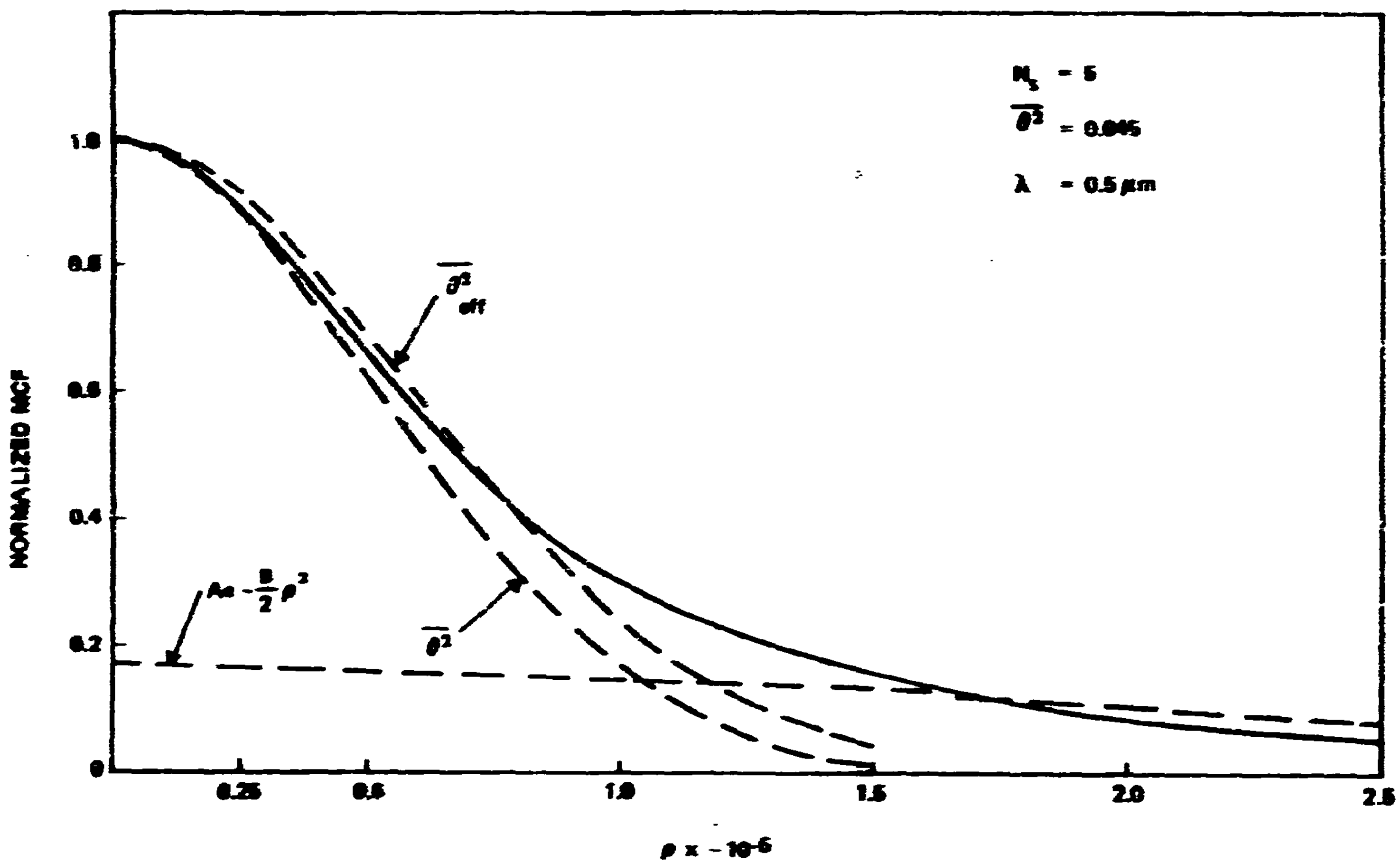

Figure C-5. Mutual coherence function.

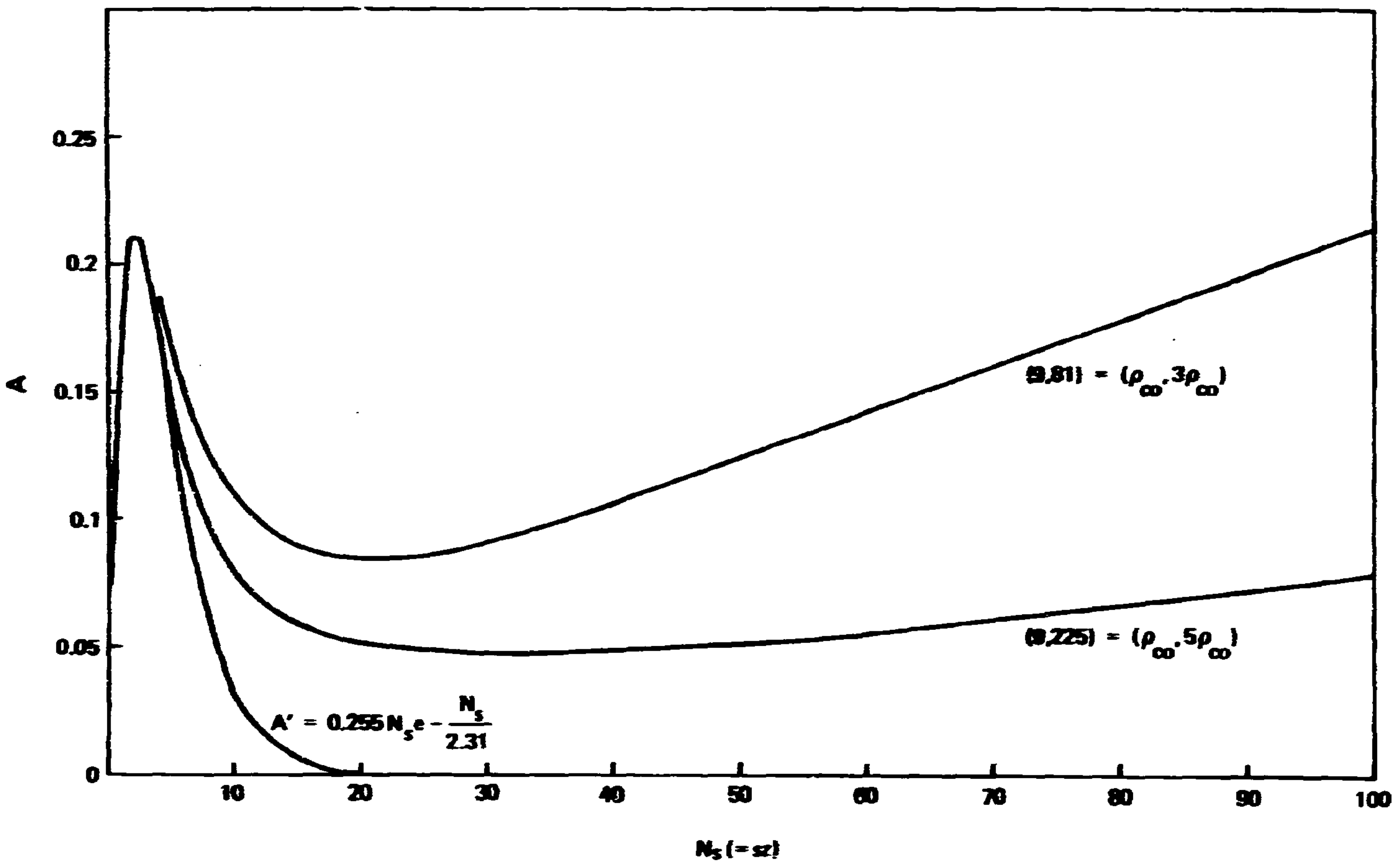

Figure C-6. Glow field correction.

$$B = \frac{1}{36\left[\frac{\lambda^2}{(2\pi)^2\, sz\, \overline{\theta^2}}\right]} \log \left[\frac{\frac{sz}{e\sqrt{1+\frac{9}{sz}}} - 1}{\frac{sz}{e\sqrt{1+\frac{81}{sz}}} - 1} \right] \tag{C-12}$$

By defining

$$\overline{\theta^{2'}_{eff}} = \frac{\overline{\theta^2}}{36} \log \left[\frac{\frac{sz}{e\sqrt{1+\frac{9}{sz}}} - 1}{\frac{sz}{e\sqrt{1+\frac{81}{sz}}} - 1} \right] \tag{C-13}$$

we are able to use our previous Gaussian solution without any changes. Ignoring absorption, the relative weights for the three terms become:

exp (−sz) for the residual image,

A for the third or glow field term using $\overline{\theta^{2'}_{eff}}$,

$(1-A-e^{-sz})$ for the scattered term.

Values for A and B are plotted in figures C-6 and 7. Notice that $\overline{\theta^2} \gg \overline{\theta^2_{eff}}$ and the glow field makes its greatest contribution in the region of 1 to 10 scattering lengths. The fact that A starts to increase after 10 scattering lengths is attributed to the fact that after this point the Gaussian fit for the third term is no longer valid for a number of reasons. As a consequence, a modified value for A was used which takes the form

$$A' = .235\,(sz)\, e^{-sz/2.31}. \tag{C-14}$$

This is also plotted in figure C-6. Finally, we have also shown the values for A and B when the second calibrate point is taken at $\rho = 5\rho_{CO}$. This is also plotted in figures C-6 and 7 and shows no appreciable difference other than the calibrate at $\rho = 3\rho_{CO}$.

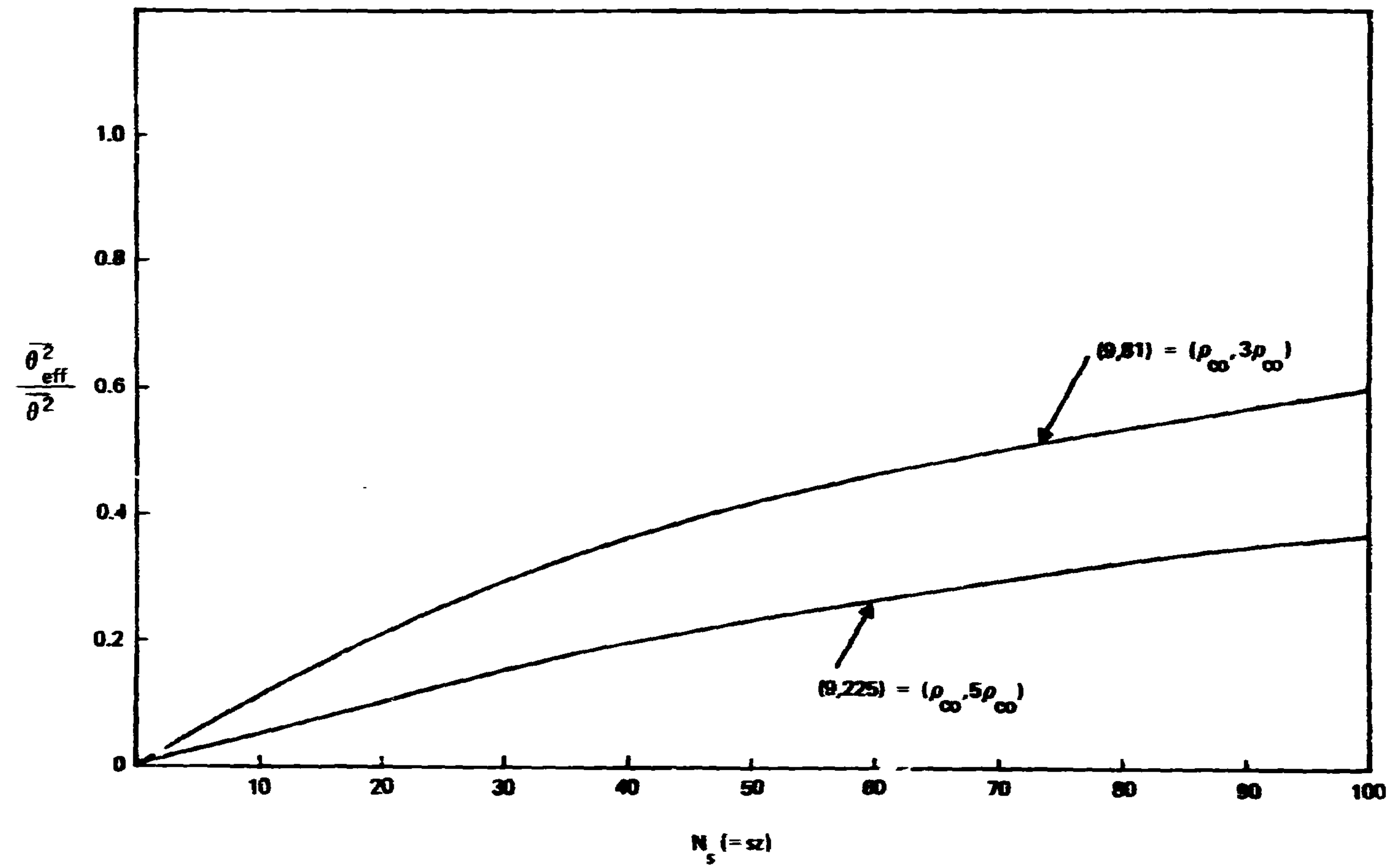

Figure C-7. Glow field correction.

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APPENDIX D

VISIBILITY LABORATORY
SCRIPPS INSTITUTION OF OCEANOGRAPHY

SAN DIEGO, CALIFORNIA 92152

23 June 1976
ML-76-005t - REVISED

TECHNICAL MEMORANDUM

SUBJECT: Ocean Optical Properties -- 520 Nanometers
Santa Catalina Island, Lat: 33°27.2'N, Long: 118°29.0'W

1. Near surface daytime optical measurements of the water properties at the Santa Catalina Island SATCOM test site were limited to the beam transmittance and its derivative, the volume attenuation coefficient, α. This limitation was incurred because of the effects of ambient daylight on the instruments used for measuring scattering. Measurements of all required properties were obtained at night, however, and correlations between them were explored for a variety of water conditions. Curve-fitting techniques were applied to these night data, and empirical relationships were derived allowing the prediction of the required but unmeasured daytime scattering and absorption properties of the water from the measured beam transmittance. The fits of the nighttime data to the derived analytic expressions was generally good-to-excellent, with correlation coefficients of 0.946 or better. These expressions may, therefore, be used with confidence to predict the unmeasured properties.

2. NOTE: A window correction factor of 0.9794 has been applied to all transmittance values obtained in the field. Any preliminary data issued prior to 12 April 1976 were not so corrected. Any original transmittance or alpha profiles, i.e., those obtained in the field with the x-y plotter or data logger, must have this correction applied. All computer-generated output has now been corrected.

3. Using the expressions obtained from the nighttime June and July data, daylight transmittance profiles have been used to obtain estimates of the scattering and absorption properties of the water column to a depth of 50 meters. These values are listed for the various depths, Z(m), at which the transmittance data were sampled. The following is a description of the information supplied in the computer listing titled, "Ocean Optical Properties:"

a. The transmittance on the computer listing under the column T(1/M) is the field data multiplied by the correction factor (see paragraph 2 above).

b. The column headed ALPHA' is obtained by taking the natural logarithm of the reciprocal of the corrected transmittance, i.e.,

$$ALPHA' = \ln(1/T')$$

c. The true volume attenuation coefficient α (column headed ALPHA) is greater than the apparent volume attenuation coefficient ALPHA' by a small amount which accounts for the scattering included within the acceptance angle (1.5 milliradians) of the transmissometer.

d. The scattering coefficient, s, (column headed SCAT) is calculated from a linear relationship of the form

$$s = m\,\alpha - c$$

where m and c were slightly adjusted from the constants derived from the straight line, least squares curve fit. Specifically, from the regression of s vs α (disregarding two data points with obvious difficulty)

$$s = 0.958\alpha - 0.101, \quad \sigma_s = 0.0315$$

and after adjustment

$$s = 0.97\,\alpha - 0.0977, \; \sigma_s = .0324$$

The reason for the adjustment was to provide a better agreement between the absorption coefficient calculated from the relationship, $a = \alpha - s$, and other estimates of absorption arrived at by independent methods. As is indicated by the standard deviations between the data points and the values predicted by the two relationships (i.e., σ_s), there is only a slight decrease in the precision with which the adjusted equation predicts the observations of s from α.

e. The absorption coefficient, a, listed in the column ABS, is obtained by subtracting the values in the SCAT column from the ALPHA column since $a = \alpha - s$.

f. The volume scattering function $\sigma(\Theta)$ at 3, 6 and 12 milliradians was calculated using expressions obtained from the regression of $\sigma(\Theta)$ vs s.

g. The normalized second moment of the volume scattering function $\overline{\Theta^2}$, i.e.,

$$\overline{\Theta^2} = \frac{\pi}{s} \int_0^{\pi} \sigma(\Theta) \cdot \Theta^2 \cdot \sin\Theta \, d\Theta,$$

is listed in the column headed THTA* 2 BAR. The values listed were calculated using the expression obtained from the regression of $\overline{\Theta^2}$ vs s.

4. The narrow angle volume scattering function data, viz; VSF3, VSF6, and VSF12, were obtained with the ALSCAT instrument which performed these measurements concurrently with determination of the beam transmittance. These data, therefore, are all obtained from the same sample of water. The volume scattering function data at angles from 10^{0} to 170^{0} were obtained with a second instrument, the General Angle Scatter Meter (GASM), which was lowered to the same indicated depth as ALSCAT but was about 4 meters away horizontally. Some vertical separation may also have occurred due to errors in the indicated depth. This may have been as much as 2 meters on some occasions. Operational considerations did not always permit data from the two instruments to be obtained at the same time although that was the intention. In general, the operational procedure in July was improved over that in June, and the time difference between the two measurements, i.e., ALSCAT and GASM was, with three exceptions, reduced to less than 5 minutes. These time and spatial separations between the ALSCAT & GASM data were usually of little consequence with the possible exception of those circumstances where the measurements were obtained in the turbid scattering layer that occurred frequently at depths of from 15 to 40 meters. As this layer was sometimes very localized vertically and would move up and down with the passage of the coastal current or with the propagation of internal waves, temporal and spatial coincidence of the measurements assumed greater significance for these cases. Despite these concerns there appears little difference, as determined by the correlation coefficient r, with the tightness of fit of the observations to the resulting analytic expressions obtained for the 18 nighttime data sets in June, the 30 sets in July and the 48 combined sets. The expressions derived from the regressions are listed below.

Expressions Coupling Measured Ocean Optical Properties
(Derived from 48 sets of nighttime data)

$\alpha = 1.0188\alpha'^{1.0066}$	$r = 1.000$
$s = 0.970\,\alpha - .0977$	
$a = \alpha - s$	
$\sigma(3) = 1398.4s^{1.1204}$	$r = 0.9597$
$\sigma(6) = 553.2s^{1.1788}$	$r = 0.9800$
$\sigma(12) = 218.8s^{1.2302}$	$r = 0.9872$
$\overline{\Theta^2} = 0.0283s^{-.6499}$	$r = 0.9467$

5. The scattering properties, as determined from the combined ALSCAT and GASM data for the 48 nighttime measurements, are submitted herewith. Each set consists of a plot of log-volume scattering function vs. log-angle and two pages of computed properties. The "Iterated Data" differs from the "Data Read-In" by a correction applied to "Sigma" values for the three smallest angles, viz. $\sigma(\Theta)$ at 3,6 and 12 milliradians to account for multiple scattering in the one-meter measurement path length used in ALSCAT.

The correction to "ALPHA" is that required to account for the inclusion of scattering in the acceptance angle of the transmissometer. The column headed "Integral" is the portion of the total scattering coefficient due to angles from zero to the listed angle. Thus

$$\text{"Integral"} \quad (\Theta) \equiv 2\pi \int_0^{\Theta} \sigma(\theta') \sin\theta' \, d\theta' .$$

Similarly, the "Normalized Integral" is the decimal fraction obtained by dividing the value listed in the "Integral" column by the total scattering coefficient s.

$$\text{"Norm. Integral"} \ (\Theta) \equiv \frac{2\pi}{s} \int_0^{\Theta} \sigma(\theta') \sin\theta' \, d\theta' .$$

6. The values of α, s, and a obtained from the nighttime measurements described in paragraph 5 above have been entered on the curves of these properties generated from the regression expressions. The times of the measurements are printed beside the data points to aid in evaluating this comparison between the measurements and the values predicted from a transmittance profile obtained on the same night but at a somewhat different time. It will be noted that the predicted values agree well with the measured values considering the changes that are found in repetitive measurements performed within relatively short periods of time in a dynamic ocean.

7. Secchi disc observations were obtained on six days in June. The disappearance depths varied from 14 to 22 meters. The observations are listed in the attached table. No analysis of these data will be attempted. No single-value parameter, e.g., s or $\bar{\sigma}$ at a single depth, would be expected to correlate as well with these observations as would an average or "effective" value obtained by some weighted integral of the parameter over the depth interval.

SECCHI DISC OBSERVATIONS

DATE	TIME	DEPTH	DATE	TIME	DEPTH
6/18/75	1230	18 m	6/24/75	1125	22 m
	1330	21 m			
			6/25/75	1008	17 m
6/19/75	1030	15 m		1014	17 m
	1130	15 m		1103	17 m
	1230	14 m		1125	17 m
	1330	15 m		1204	17 m
	1430	18 m		1255	15 m
				1303	15 m
6/20/75	0950	19 m		1439	18 m
	1054	19 m		1448	18 m
	1205	15 m		1554	17 m
	1250	15 m			
	1345	15 m	6/26/75	1350	15 m

8. The errors in the optical properties presented have been the subject of considerable study. Unfortunately no single, simple statement can be offered regarding the magnitude of the errors as they depend upon the property under consideration and the value or magnitude of that property. Furthermore, the optical nature of ocean water is highly variable both spatially and temporally -- particularly so in coastal waters. Any values of ocean optical properties presented as a result of measurements in this dynamic system must be understood to have inherent "errors" due to sampling in space and time. As mentioned in Paragraph 4 above, the sampling problem was examined with regard to the nighttime data sets and was not found to affect, significantly, the observed correlations between the several properties. The prediction of the set of optical properties pertinent to the SATCOM tests by the application of the regression-derived relationships to the daytime transmittance profiles circumvents any concern with simultaneity of data acquisition. The remaining question is "did the transmittance profile change significantly from that which existed at some critical time of concern?" This question must be examined for each situation. Frequent profiles were taken in order to provide a measure of the rates of change of the optical properties and with the intent of bracketing the SATCOM observations.

Absolute errors in the measurement of beam transmittance were less than ±0.4%. The resulting relative errors in the volume attenuation coefficient would be between ±2% for the clearest water and ±1% for the most turbid water encountered in the upper 50 meters at the site in June and July 1975.

Absolute errors in the determination of the volume scattering function, $\alpha(\Theta)$, over the angular range of measurement are somewhat greater, probably ranging up to 10% in some circumstances. More significant to the calculation of the scattering coefficient is the fact that the volume scattering function was not measured between 0.7° and 10°, necessitating interpolation of the function between these values. As up to 50% of the scattering coefficient may be due to the scattering in this angular range, the magnitude of the coefficient is significantly affected by the nature of the interpolation. Furthermore; since the scattering coefficient accounted for something between 51% (for the clearest waters encountered) and 89% (for turbid water) of the volume attenuation coefficient, the magnitude of the absorption coefficient -- as determined by the differences between α and s becomes particularly sensitive to the method of interpolation of the volume scattering function. For example, when $\alpha = 0.6m^{-1}$, $s/\alpha \approx .81$ and $a/\alpha \approx .19$. Under these conditions a 10% change in s results in a 43% change in a. If, as in the application of these water properties data to the SATCOM system analysis, the absorption data is particularly significant, we need a better capability for determining absorption -- either by more complete and accurate determination of the volume scattering function or, more desirably, by a direct measurement of the absorption coefficient itself.

The determination of the normalized second moment of the volume scattering function, $\overline{\Theta^2}$, is inherently less sensitive to the value of the VSF at small angles than is the scattering coefficient. $\overline{\Theta^2}$ is, in fact, primarily dependent upon the VSF in the angular range measured by the General Angle Scattering Meter, i.e., for $\Theta > 10°$.

R. W. Austin

RWA:vb

cc: Lt. R. Driscoll (2)
C. F. Edgerton
T. J. Petzold

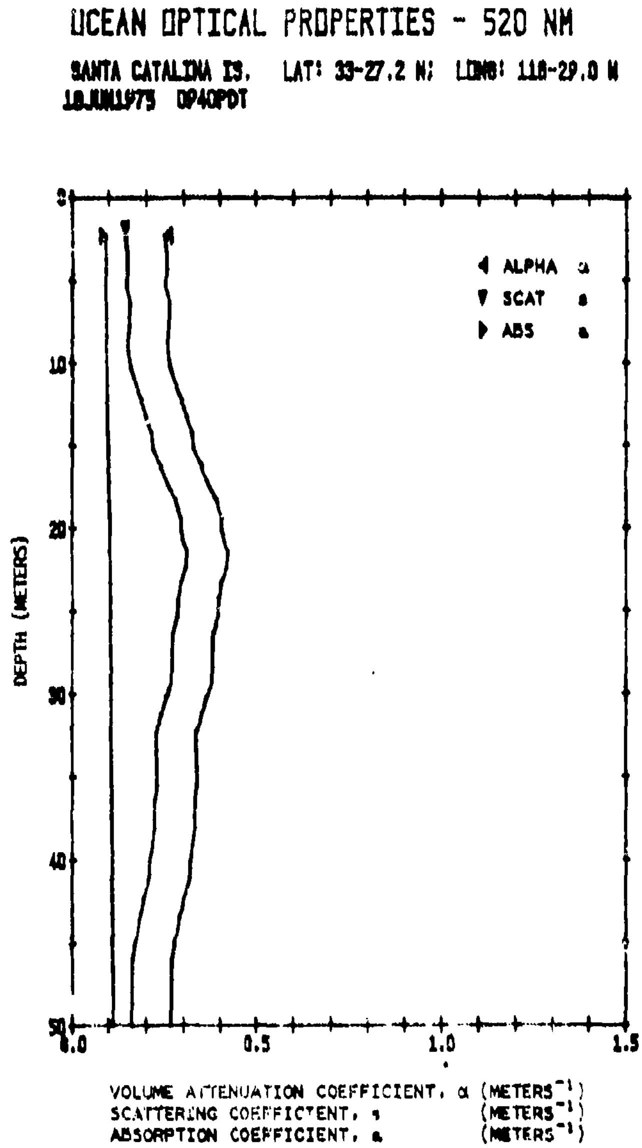

Figure D-1 . Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
18JUN1975 0940PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
2.0	0.770	0.262	0.264	0.158	0.106	177.5	63.5	22.7	0.096
3.0	0.767	0.265	0.268	0.162	0.106	182.2	65.3	23.4	0.092
4.0	0.767	0.265	0.268	0.162	0.106	182.2	65.3	23.4	0.092
5.0	0.769	0.263	0.265	0.160	0.106	179.1	64.1	22.9	0.093
6.0	0.762	0.272	0.275	0.169	0.106	190.2	68.3	24.5	0.090
7.0	0.764	0.269	0.272	0.166	0.106	187.0	67.1	24.0	0.091
8.0	0.766	0.267	0.269	0.164	0.106	183.8	65.9	23.6	0.092
9.0	0.766	0.267	0.269	0.164	0.106	183.8	65.9	23.6	0.092
10.0	0.762	0.272	0.275	0.169	0.106	190.2	68.3	24.5	0.090
11.0	0.752	0.285	0.288	0.181	0.106	206.4	74.4	26.8	0.086
12.0	0.741	0.299	0.302	0.196	0.107	224.6	81.3	29.4	0.082
13.0	0.732	0.313	0.316	0.209	0.107	241.6	87.7	31.8	0.078
14.0	0.721	0.327	0.331	0.223	0.108	260.7	95.0	34.6	0.075
15.0	0.718	0.331	0.335	0.227	0.108	266.0	97.0	35.4	0.074
16.0	0.704	0.351	0.355	0.246	0.108	291.0	106.6	39.1	0.070
17.0	0.692	0.368	0.372	0.263	0.109	313.1	115.1	42.3	0.067
18.1	0.677	0.390	0.395	0.286	0.110	343.5	126.9	46.8	0.064
19.2	0.669	0.402	0.407	0.297	0.110	359.0	132.9	49.2	0.062
20.0	0.668	0.404	0.409	0.299	0.110	361.0	133.7	49.5	0.062
21.2	0.658	0.418	0.424	0.313	0.110	380.8	141.4	52.5	0.060
22.2	0.661	0.414	0.419	0.309	0.110	374.8	139.1	51.6	0.061
23.1	0.670	0.401	0.406	0.296	0.110	357.0	132.1	48.9	0.062
24.1	0.675	0.393	0.398	0.289	0.110	347.3	128.4	47.4	0.063
25.2	0.678	0.389	0.394	0.284	0.110	341.5	126.1	46.6	0.064
26.2	0.685	0.379	0.384	0.274	0.109	328.2	121.0	44.6	0.066
27.2	0.687	0.376	0.381	0.271	0.109	324.4	119.5	44.0	0.066
28.2	0.688	0.375	0.379	0.270	0.109	322.5	118.8	43.7	0.066
29.2	0.689	0.373	0.378	0.269	0.109	320.6	118.0	43.4	0.066
30.1	0.698	0.359	0.363	0.255	0.109	302.0	110.9	40.7	0.069
31.1	0.708	0.345	0.349	0.241	0.108	283.8	103.9	38.0	0.071
32.2	0.718	0.331	0.335	0.227	0.108	266.0	97.0	35.4	0.074
33.2	0.718	0.331	0.335	0.227	0.108	266.0	97.0	35.4	0.074
34.3	0.718	0.331	0.335	0.227	0.108	266.0	97.0	35.4	0.074
35.4	0.718	0.331	0.335	0.227	0.108	266.0	97.0	35.4	0.074
36.3	0.723	0.325	0.328	0.221	0.108	257.2	93.7	34.1	0.076
38.0	0.723	0.325	0.328	0.221	0.108	257.2	93.7	34.1	0.076
40.1	0.735	0.308	0.312	0.205	0.107	236.5	85.8	31.1	0.079
41.1	0.736	0.307	0.310	0.203	0.107	234.8	85.1	30.8	0.080
42.2	0.746	0.293	0.296	0.189	0.107	216.3	78.1	28.2	0.084
43.5	0.756	0.280	0.282	0.176	0.106	199.9	71.9	25.9	0.087
44.9	0.765	0.268	0.271	0.165	0.106	185.4	66.5	23.8	0.091
46.1	0.772	0.259	0.262	0.156	0.106	174.4	62.3	22.3	0.095
48.0	0.774	0.257	0.259	0.153	0.105	171.2	61.1	21.8	0.096
50.0	0.775	0.235	0.258	0.152	0.105	169.7	60.5	21.6	0.096

PAUSE READY PLOTTER

Figure D-1. Ocean optical properties (sheet 2 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT: 33-27.2 N; LONG: 118-29.0 W
18JUN1975 1030PDT

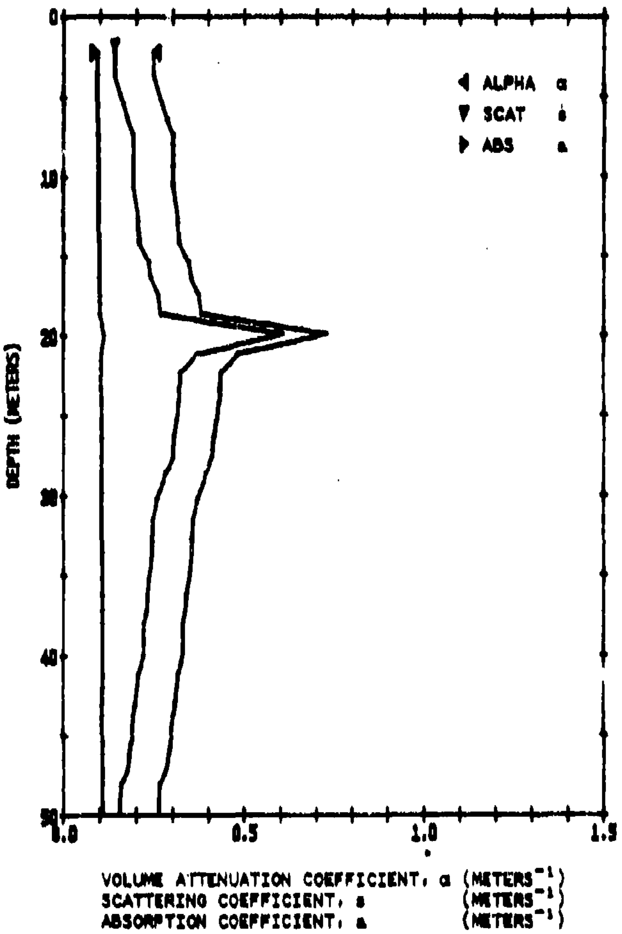

Figure D- 2. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
18JUN1975 1030PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
2.0	0.773	0.258	0.260	0.155	0.106	172.8	61.7	22.0	0.095
3.4	0.773	0.258	0.260	0.155	0.106	172.8	61.7	22.0	0.095
5.1	0.757	0.278	0.281	0.175	0.106	198.3	71.3	25.6	0.088
6.2	0.747	0.291	0.294	0.188	0.107	214.6	77.5	28.0	0.084
7.2	0.737	0.306	0.309	0.202	0.107	233.1	84.5	30.6	0.080
9.2	0.737	0.306	0.309	0.202	0.107	233.1	84.5	30.6	0.080
10.3	0.737	0.306	0.309	0.202	0.107	233.1	84.5	30.6	0.080
12.4	0.728	0.318	0.321	0.214	0.107	248.5	90.3	32.8	0.077
14.0	0.726	0.321	0.324	0.217	0.107	251.9	91.7	33.3	0.076
15.2	0.700	0.345	0.349	0.241	0.108	283.8	103.9	38.0	0.071
16.2	0.703	0.352	0.356	0.248	0.108	292.9	107.3	39.3	0.070
17.3	0.689	0.373	0.378	0.269	0.109	320.6	118.0	43.4	0.066
18.5	0.684	0.380	0.385	0.276	0.109	330.1	121.7	44.8	0.065
19.2	0.576	0.552	0.560	0.445	0.114	565.0	213.9	80.9	0.048
19.8	0.490	0.714	0.726	0.606	0.119	798.0	307.2	118.2	0.039
21.0	0.619	0.480	0.486	0.374	0.112	464.4	174.1	65.2	0.054
22.2	0.649	0.432	0.437	0.327	0.111	399.0	148.5	55.2	0.059
23.2	0.652	0.427	0.433	0.322	0.111	392.9	146.1	54.3	0.059
24.1	0.655	0.423	0.428	0.318	0.111	386.8	143.7	53.4	0.060
25.2	0.658	0.418	0.424	0.313	0.110	380.8	141.4	52.5	0.060
26.3	0.664	0.407	0.415	0.304	0.110	368.9	136.7	50.7	0.061
27.5	0.666	0.406	0.412	0.302	0.110	364.9	135.2	50.1	0.062
28.5	0.678	0.389	0.394	0.284	0.110	341.5	126.1	46.6	0.064
29.7	0.689	0.373	0.378	0.269	0.109	320.6	118.0	43.4	0.066
30.2	0.694	0.365	0.369	0.260	0.109	309.4	113.7	41.8	0.068
31.5	0.702	0.353	0.358	0.249	0.108	294.7	108.0	39.6	0.070
32.5	0.704	0.351	0.355	0.246	0.108	291.0	106.6	39.1	0.070
32.8	0.706	0.348	0.352	0.244	0.108	287.4	105.2	38.5	0.071
33.5	0.707	0.347	0.351	0.242	0.108	285.6	104.6	38.3	0.071
35.2	0.713	0.338	0.342	0.234	0.108	274.8	100.4	36.7	0.073
36.2	0.717	0.333	0.337	0.229	0.108	267.7	97.7	35.6	0.074
37.2	0.719	0.330	0.334	0.226	0.108	264.2	96.3	35.1	0.074
38.0	0.724	0.323	0.327	0.219	0.108	255.4	93.0	33.8	0.076
40.0	0.725	0.322	0.325	0.218	0.107	253.7	92.3	33.6	0.076
41.2	0.735	0.308	0.312	0.205	0.107	236.5	85.8	31.1	0.079
42.1	0.737	0.305	0.308	0.201	0.107	231.4	83.8	30.4	0.080
43.1	0.741	0.299	0.302	0.196	0.107	224.6	81.3	29.4	0.082
43.8	0.745	0.294	0.297	0.190	0.107	218.0	78.7	28.4	0.083
44.4	0.747	0.291	0.294	0.188	0.107	214.6	77.5	28.0	0.084
45.5	0.750	0.287	0.290	0.184	0.106	209.7	75.6	27.2	0.085
46.2	0.754	0.282	0.285	0.179	0.106	203.1	73.1	26.3	0.087
47.3	0.759	0.276	0.278	0.172	0.106	195.0	70.1	25.2	0.089
48.1	0.771	0.260	0.263	0.157	0.106	175.9	62.9	22.5	0.094
49.2	0.774	0.257	0.259	0.153	0.105	171.2	61.1	21.8	0.096
50.0	0.774	0.257	0.259	0.153	0.105	171.2	61.1	21.8	0.096

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Figure D-2. Ocean optical properties (sheet 2 of 2).

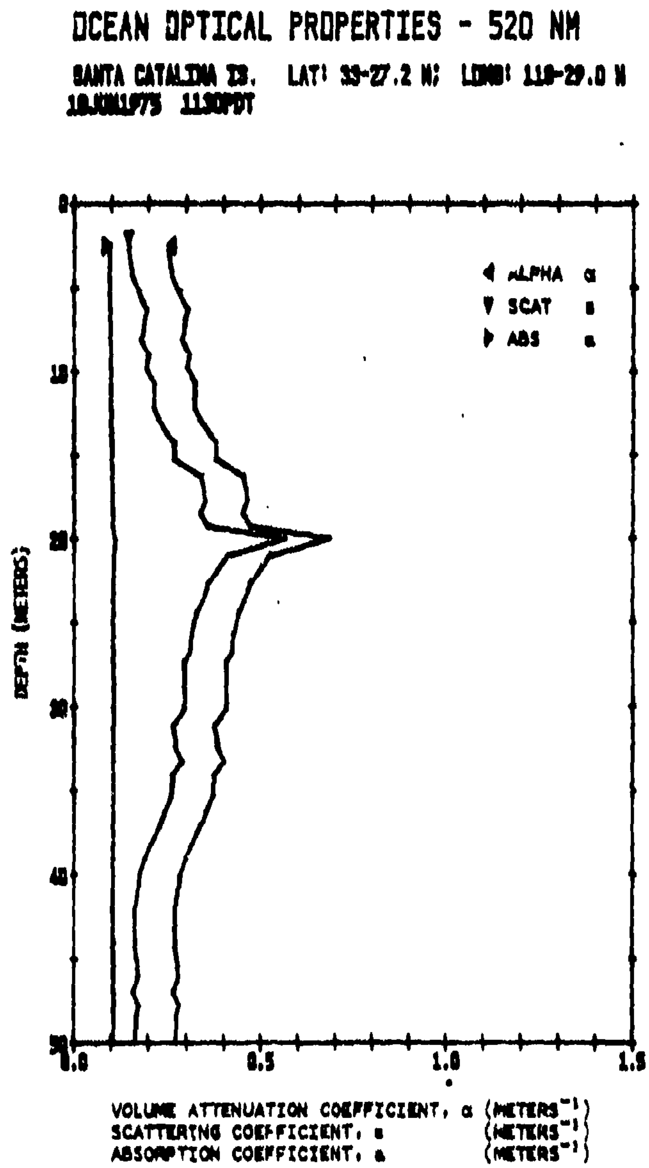

Figure D-3. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
18JUN19 78 1130PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
2.2	0.771	0.260	0.263	0.157	0.106	175.9	62.9	22.5	0.094
3.5	0.767	0.265	0.268	0.162	0.106	182.2	65.3	23.4	0.092
4.2	0.762	0.272	0.275	0.169	0.106	190.2	68.3	24.5	0.090
5.0	0.749	0.289	0.292	0.185	0.106	211.3	76.2	27.5	0.085
6.0	0.737	0.306	0.309	0.202	0.107	233.1	84.5	30.6	0.080
7.8	0.746	0.293	0.296	0.189	0.107	216.3	78.1	28.2	0.084
8.8	0.733	0.311	0.315	0.207	0.107	239.9	87.1	31.6	0.079
9.5	0.737	0.305	0.308	0.201	0.107	231.4	83.8	30.4	0.080
10.4	0.723	0.325	0.328	0.221	0.108	257.2	93.7	34.1	0.076
12.0	0.723	0.325	0.328	0.221	0.108	257.2	93.7	34.1	0.076
13.0	0.706	0.348	0.352	0.244	0.108	287.4	105.2	38.5	0.071
14.0	0.684	0.380	0.385	0.276	0.109	330.1	121.7	44.8	0.065
15.0	0.685	0.379	0.384	0.274	0.109	328.2	121.0	44.6	0.066
16.1	0.638	0.450	0.456	0.345	0.111	423.8	158.2	59.0	0.057
17.5	0.631	0.461	0.467	0.355	0.112	438.6	164.0	61.3	0.055
18.3	0.640	0.447	0.453	0.342	0.111	419.7	156.6	58.4	0.057
19.1	0.627	0.467	0.473	0.362	0.112	447.1	167.3	62.6	0.055
19.8	0.509	0.675	0.686	0.567	0.118	740.8	284.2	108.9	0.041
20.8	0.594	0.520	0.527	0.414	0.114	520.4	196.2	73.9	0.050
21.5	0.607	0.499	0.506	0.393	0.113	490.9	184.6	69.3	0.052
22.5	0.627	0.467	0.473	0.362	0.112	447.1	167.3	62.6	0.055
23.5	0.637	0.452	0.458	0.346	0.111	425.9	159.0	59.3	0.056
24.2	0.646	0.436	0.442	0.331	0.111	405.2	150.9	56.2	0.058
25.5	0.656	0.421	0.427	0.316	0.111	384.8	142.9	53.1	0.060
26.5	0.659	0.417	0.422	0.312	0.110	378.8	140.6	52.2	0.060
27.2	0.669	0.402	0.407	0.297	0.110	359.0	132.9	49.2	0.062
28.5	0.669	0.402	0.407	0.297	0.110	359.0	132.9	49.2	0.062
30.0	0.669	0.402	0.407	0.297	0.110	359.0	132.9	49.2	0.062
31.0	0.689	0.373	0.378	0.269	0.109	320.6	118.0	43.6	0.066
32.3	0.685	0.379	0.384	0.274	0.109	328.2	121.0	44.6	0.066
33.2	0.674	0.395	0.400	0.290	0.110	349.3	129.1	47.7	0.063
34.0	0.690	0.370	0.375	0.266	0.109	316.9	116.6	42.9	0.067
35.2	0.693	0.366	0.370	0.262	0.109	311.3	114.4	42.0	0.068
36.2	0.705	0.349	0.353	0.245	0.108	289.2	105.9	38.8	0.071
37.0	0.715	0.336	0.339	0.231	0.108	271.3	99.1	36.2	0.073
38.2	0.734	0.310	0.313	0.206	0.107	238.2	86.4	31.3	0.079
39.0	0.745	0.294	0.297	0.190	0.107	218.0	78.7	28.4	0.083
40.0	0.756	0.280	0.282	0.176	0.106	199.9	71.9	25.9	0.087
42.0	0.766	0.267	0.269	0.164	0.106	183.8	65.9	23.6	0.092
44.0	0.766	0.267	0.269	0.164	0.106	183.8	65.9	23.6	0.092
45.0	0.763	0.271	0.273	0.167	0.106	188.6	67.7	24.3	0.090
46.0	0.760	0.274	0.277	0.171	0.106	193.4	69.5	24.9	0.089
47.0	0.770	0.262	0.264	0.158	0.106	177.5	63.5	22.7	0.094
47.8	0.760	0.274	0.277	0.171	0.106	193.4	69.5	24.9	0.089
48.5	0.764	0.269	0.272	0.166	0.106	187.0	67.1	24.0	0.091
50.0	0.767	0.265	0.268	0.162	0.106	182.2	65.3	23.4	0.092

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Figure D-3 . Ocean optical properties (sheet 2 of 2).

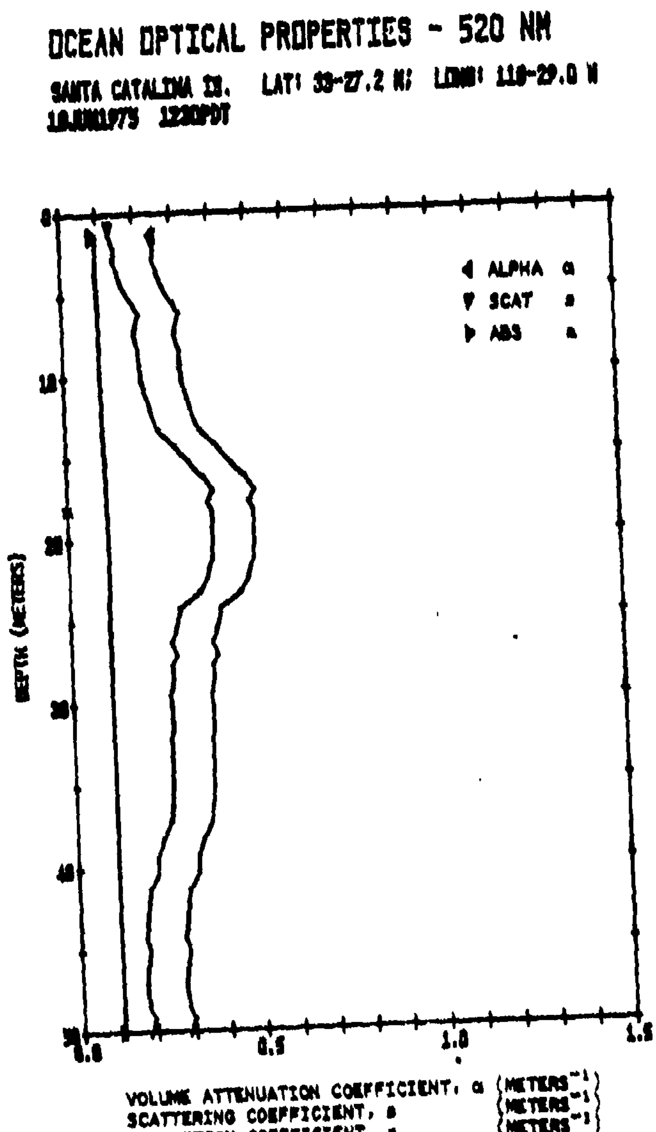

Figure D-4. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
18JUN1975   1230PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.0	0.782	0.246	0.249	0.144	0.105	158.9	56.5	20.1	0.100
1.8	0.773	0.258	0.260	0.155	0.106	172.8	61.7	22.0	0.095
2.5	0.775	0.255	0.258	0.152	0.105	169.7	60.5	21.6	0.096
3.2	0.766	0.267	0.269	0.164	0.106	183.8	65.9	23.6	0.092
4.2	0.756	0.280	0.282	0.176	0.106	199.9	71.9	25.9	0.087
5.2	0.737	0.306	0.309	0.202	0.107	233.1	84.5	30.6	0.080
5.8	0.727	0.319	0.323	0.215	0.107	250.2	91.0	33.1	0.077
6.9	0.737	0.306	0.309	0.202	0.107	233.1	84.5	30.6	0.080
8.0	0.730	0.315	0.319	0.211	0.107	245.0	89.0	32.3	0.078
9.0	0.727	0.319	0.323	0.215	0.107	250.2	91.0	33.1	0.077
10.0	0.725	0.322	0.325	0.218	0.107	253.7	92.3	33.6	0.076
11.0	0.717	0.333	0.337	0.229	0.108	267.7	97.7	35.6	0.074
12.0	0.708	0.345	0.349	0.241	0.108	285.8	103.9	38.0	0.071
13.0	0.696	0.362	0.366	0.257	0.109	305.7	112.3	41.2	0.068
14.0	0.666	0.406	0.412	0.302	0.110	364.9	135.2	50.1	0.062
15.0	0.644	0.439	0.445	0.334	0.111	409.3	152.5	56.8	0.058
16.0	0.619	0.480	0.486	0.374	0.112	464.4	174.1	65.2	0.054
16.9	0.604	0.504	0.511	0.398	0.113	497.6	187.2	70.4	0.052
17.5	0.614	0.488	0.494	0.382	0.113	475.4	178.4	66.9	0.053
18.0	0.607	0.499	0.506	0.393	0.113	490.9	184.6	69.3	0.052
19.2	0.607	0.499	0.506	0.393	0.113	490.9	184.6	69.3	0.052
20.2	0.608	0.497	0.504	0.391	0.113	488.7	183.7	69.0	0.052
21.0	0.610	0.494	0.501	0.388	0.113	484.2	181.9	68.3	0.052
21.5	0.614	0.488	0.494	0.382	0.113	475.4	178.4	66.9	0.053
22.2	0.620	0.478	0.485	0.372	0.112	462.3	173.3	64.9	0.054
23.0	0.632	0.459	0.465	0.354	0.112	436.5	163.1	60.9	0.056
24.0	0.668	0.404	0.409	0.299	0.110	361.0	133.7	49.5	0.062
25.2	0.676	0.392	0.397	0.287	0.110	345.4	127.6	47.1	0.064
26.1	0.685	0.379	0.384	0.274	0.109	328.2	121.0	44.6	0.066
26.9	0.678	0.389	0.394	0.284	0.110	341.5	126.1	46.6	0.064
27.5	0.686	0.377	0.382	0.273	0.109	326.3	120.2	44.3	0.066
28.5	0.686	0.377	0.382	0.273	0.109	326.3	120.2	44.3	0.066
29.2	0.690	0.370	0.375	0.266	0.109	316.9	116.6	42.9	0.067
30.0	0.689	0.372	0.376	0.267	0.109	318.7	117.3	43.2	0.067
31.0	0.689	0.372	0.376	0.267	0.109	318.7	117.3	43.2	0.067
32.1	0.692	0.368	0.372	0.263	0.109	313.1	115.1	42.3	0.067
33.0	0.692	0.368	0.372	0.263	0.109	313.1	115.1	42.3	0.067
34.0	0.693	0.366	0.370	0.262	0.109	311.3	114.4	42.0	0.068
35.0	0.694	0.365	0.369	0.260	0.109	309.4	113.7	41.8	0.068
36.1	0.697	0.360	0.365	0.256	0.109	303.9	111.6	40.9	0.069
37.0	0.700	0.356	0.360	0.252	0.109	298.3	109.5	40.1	0.069
38.2	0.717	0.333	0.337	0.229	0.108	267.7	97.7	35.6	0.074
39.3	0.729	0.317	0.320	0.213	0.107	246.8	89.7	32.6	0.077
40.2	0.729	0.317	0.320	0.213	0.107	246.8	89.7	32.6	0.077
41.2	0.746	0.293	0.296	0.189	0.107	216.3	78.1	28.2	0.084
42.1	0.752	0.285	0.288	0.181	0.106	206.4	74.4	26.8	0.086
43.1	0.755	0.281	0.284	0.177	0.106	201.5	72.5	26.1	0.087
44.2	0.760	0.274	0.277	0.171	0.106	193.4	69.5	24.9	0.089
45.0	0.752	0.285	0.288	0.181	0.106	206.4	74.4	26.8	0.086
46.0	0.758	0.277	0.280	0.174	0.106	196.6	70.7	25.4	0.088
47.0	0.762	0.272	0.275	0.169	0.106	190.2	68.3	24.5	0.090
48.5	0.757	0.278	0.281	0.175	0.106	198.3	71.3	25.6	0.088
49.2	0.748	0.290	0.293	0.186	0.106	213.0	76.9	27.7	0.084
50.2	0.759	0.276	0.278	0.172	0.106	194.0	70.1	25.2	0.089

PAUSE READY PLOTTER

Figure D-4. Ocean optical properties (sheet 2 of 2).

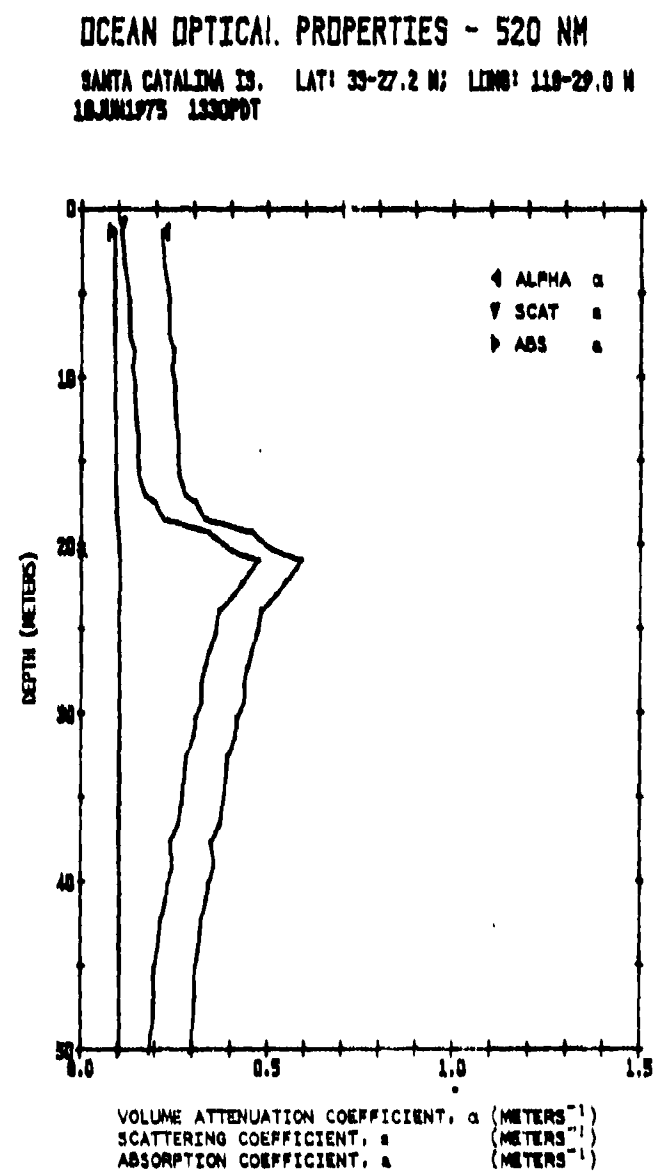

Figure D-5. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
18JUN1975   1330PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA=25AR
1.0	0.796	0.228	0.230	0.125	0.105	136.3	48.1	17.0	0.109
3.0	0.791	0.234	0.236	0.131	0.105	143.7	50.9	18.0	0.106
5.1	0.782	0.246	0.249	0.144	0.105	158.9	56.5	20.1	0.100
7.0	0.782	0.246	0.249	0.144	0.105	158.9	56.5	20.1	0.100
8.0	0.773	0.258	0.260	0.155	0.106	172.8	61.7	22.0	0.095
9.0	0.776	0.254	0.256	0.151	0.105	168.1	60.0	21.4	0.097
10.0	0.772	0.259	0.262	0.156	0.106	174.4	62.3	22.3	0.095
12.0	0.771	0.260	0.263	0.157	0.106	175.9	62.9	22.5	0.094
13.1	0.766	0.267	0.269	0.164	0.106	183.8	65.9	23.6	0.092
15.0	0.766	0.267	0.269	0.164	0.106	183.8	65.9	23.6	0.092
16.0	0.760	0.274	0.277	0.171	0.106	193.4	69.5	24.9	0.089
16.8	0.752	0.285	0.288	0.181	0.106	206.6	74.4	26.8	0.086
17.2	0.734	0.310	0.313	0.206	0.107	238.2	86.4	31.3	0.079
18.2	0.715	0.336	0.339	0.231	0.108	271.3	99.1	36.2	0.073
19.0	0.635	0.455	0.461	0.349	0.112	430.1	160.7	60.0	0.056
20.1	0.599	0.512	0.519	0.406	0.113	509.0	191.7	72.1	0.051
20.7	0.556	0.586	0.595	0.480	0.116	613.9	233.3	88.6	0.046
22.0	0.581	0.543	0.551	0.437	0.114	553.1	209.1	79.0	0.048
22.8	0.595	0.518	0.526	0.412	0.113	518.1	195.3	73.6	0.050
23.7	0.619	0.480	0.486	0.374	0.112	464.4	174.1	65.2	0.054
25.0	0.625	0.470	0.477	0.365	0.112	451.4	169.0	63.2	0.055
26.1	0.635	0.455	0.461	0.349	0.112	430.1	160.7	60.0	0.056
27.1	0.642	0.442	0.448	0.337	0.111	413.4	154.1	57.4	0.057
28.1	0.648	0.433	0.439	0.328	0.111	401.1	149.3	55.5	0.058
29.1	0.647	0.435	0.440	0.330	0.111	403.1	150.1	55.9	0.058
30.1	0.660	0.415	0.421	0.310	0.110	376.8	139.8	51.9	0.061
31.2	0.664	0.409	0.415	0.304	0.110	368.9	136.7	50.7	0.061
32.4	0.677	0.390	0.395	0.286	0.110	343.5	126.9	46.8	0.064
33.3	0.681	0.385	0.389	0.280	0.109	335.8	123.9	45.7	0.065
35.2	0.687	0.376	0.381	0.271	0.109	324.4	119.5	44.0	0.066
36.5	0.693	0.366	0.370	0.262	0.109	311.3	114.4	42.0	0.068
37.5	0.707	0.347	0.351	0.242	0.108	285.6	104.6	38.3	0.071
39.0	0.703	0.352	0.356	0.248	0.108	292.9	107.3	39.3	0.070
40.0	0.713	0.338	0.342	0.234	0.108	274.8	100.4	36.7	0.073
41.0	0.717	0.333	0.337	0.229	0.108	267.7	97.7	35.6	0.074
42.0	0.725	0.322	0.325	0.218	0.107	253.7	92.3	33.6	0.076
43.0	0.730	0.315	0.319	0.211	0.107	245.0	89.0	32.3	0.078
44.0	0.733	0.311	0.315	0.207	0.107	239.9	87.1	31.6	0.079
45.0	0.739	0.302	0.305	0.198	0.107	228.0	82.6	29.9	0.081
47.0	0.739	0.302	0.305	0.198	0.107	228.0	82.6	29.9	0.081
48.1	0.742	0.298	0.301	0.194	0.107	223.0	80.6	29.2	0.082
49.0	0.745	0.294	0.297	0.190	0.107	218.0	78.7	28.4	0.083
50.1	0.749	0.289	0.292	0.185	0.106	211.3	76.2	27.5	0.085

PAUSE READY PLOTTER

Figure D- 5 . Ocean optical properties (sheet 2 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT: 33-27.2 N; LONG: 118-29.0 W
19JUN1975 1430PDT

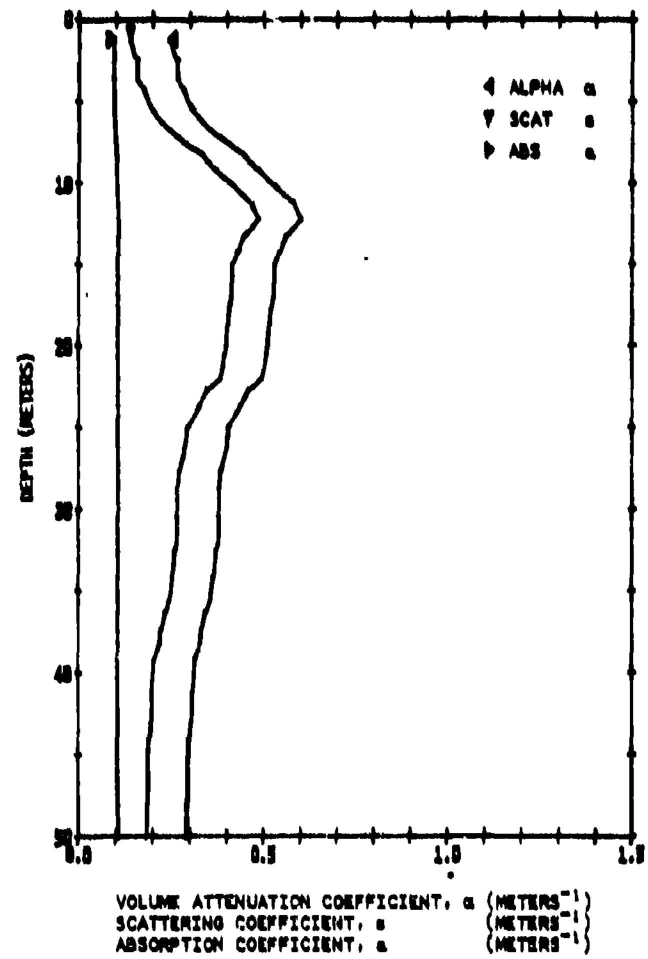

Figure D-6. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
18JUN1975 1430PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
0.9	0.776	0.254	0.256	0.151	0.105	168.1	60.0	21.4	0.097
1.9	0.768	0.264	0.267	0.161	0.106	180.7	64.7	23.1	0.093
2.2	-0.760	0.274	0.277	0.171	0.106	193.4	69.5	24.9	0.089
3.3	0.760	0.274	0.277	0.171	0.106	193.4	69.5	24.9	0.089
4.0	0.747	0.291	0.294	0.188	0.107	214.6	77.5	28.0	0.084
5.1	0.735	0.308	0.312	0.205	0.107	236.5	85.8	31.1	0.079
6.0	0.715	0.336	0.339	0.231	0.108	271.5	99.1	36.2	0.073
7.0	0.681	0.385	0.389	0.280	0.109	335.8	123.9	45.7	0.065
8.0	0.642	0.444	0.450	0.339	0.111	415.5	154.9	57.7	0.057
9.0	0.617	0.483	0.489	0.377	0.112	468.8	175.8	65.9	0.053
10.0	0.587	0.533	0.541	0.427	0.114	538.9	203.5	76.8	0.049
11.0	0.561	0.578	0.586	0.471	0.115	601.5	228.4	86.7	0.046
12.0	0.550	0.597	0.606	0.490	0.116	629.0	239.4	91.0	0.045
13.1	0.573	0.557	0.565	0.451	0.115	572.2	216.7	82.0	0.048
14.1	0.583	0.540	0.548	0.434	0.114	548.3	207.3	78.5	0.049
14.8	0.590	0.528	0.536	0.422	0.114	531.9	200.8	75.7	0.050
15.5	0.591	0.527	0.534	0.420	0.114	529.6	199.8	75.4	0.050
16.8	0.593	0.523	0.531	0.417	0.114	525.0	198.0	74.6	0.050
17.5	0.596	0.517	0.524	0.411	0.113	515.8	194.4	73.2	0.050
18.5	0.599	0.512	0.519	0.406	0.113	509.0	191.7	72.1	0.051
19.8	0.602	0.507	0.514	0.401	0.113	502.2	189.0	71.1	0.051
20.3	0.604	0.504	0.511	0.398	0.113	497.6	187.2	70.4	0.052
21.8	0.612	0.491	0.498	0.385	0.113	479.8	180.2	67.6	0.053
22.5	0.635	0.455	0.461	0.349	0.112	430.1	160.7	60.0	0.056
23.5	0.648	0.433	0.439	0.328	0.111	401.1	149.3	55.5	0.058
24.8	0.668	0.404	0.409	0.299	0.110	361.0	133.7	49.5	0.062
26.0	0.673	0.396	0.401	0.291	0.110	351.2	129.9	48.0	0.063
27.5	0.684	0.380	0.385	0.276	0.109	330.1	121.7	44.8	0.065
29.5	0.688	0.375	0.379	0.270	0.109	322.5	118.8	43.7	0.066
30.3	0.688	0.375	0.379	0.270	0.109	322.5	118.8	43.7	0.066
31.0	0.688	0.375	0.379	0.270	0.109	322.5	118.8	43.7	0.066
32.0	0.689	0.372	0.376	0.267	0.109	318.7	117.3	43.2	0.067
32.4	0.693	0.366	0.370	0.262	0.109	311.3	114.4	42.0	0.068
34.0	0.698	0.359	0.363	0.255	0.109	302.0	110.9	40.7	0.069
35.5	0.705	0.349	0.353	0.245	0.108	289.2	105.9	38.8	0.071
36.2	0.713	0.338	0.342	0.234	0.108	274.8	100.4	36.7	0.073
37.3	0.722	0.326	0.330	0.222	0.108	258.9	94.3	34.4	0.075
38.1	0.725	0.322	0.325	0.218	0.107	253.7	92.3	33.6	0.076
39.1	0.735	0.308	0.312	0.205	0.107	236.5	85.8	31.1	0.079
41.0	0.739	0.302	0.305	0.198	0.107	228.0	82.6	29.9	0.081
42.1	0.739	0.302	0.305	0.198	0.107	228.0	82.6	29.9	0.081
43.0	0.742	0.298	0.301	0.194	0.107	223.0	80.6	29.2	0.082
44.0	0.745	0.294	0.297	0.190	0.107	218.0	78.7	28.4	0.083
45.2	0.747	0.291	0.294	0.188	0.107	214.6	77.5	28.0	0.084
46.0	0.747	0.291	0.294	0.188	0.107	214.6	77.5	28.0	0.084
47.0	0.747	0.291	0.294	0.188	0.107	214.6	77.5	28.0	0.084
48.0	0.750	0.287	0.290	0.184	0.106	209.7	75.6	27.2	0.085
49.0	0.750	0.287	0.290	0.184	0.106	209.7	75.6	27.2	0.085
50.0	0.752	0.285	0.288	0.181	0.106	206.4	74.4	26.8	0.086

PAUSE READY PLOTTER

Figure D-6. Ocean optical properties (sheet 2 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT: 33-27.2 N; LONG: 118-29.0 W

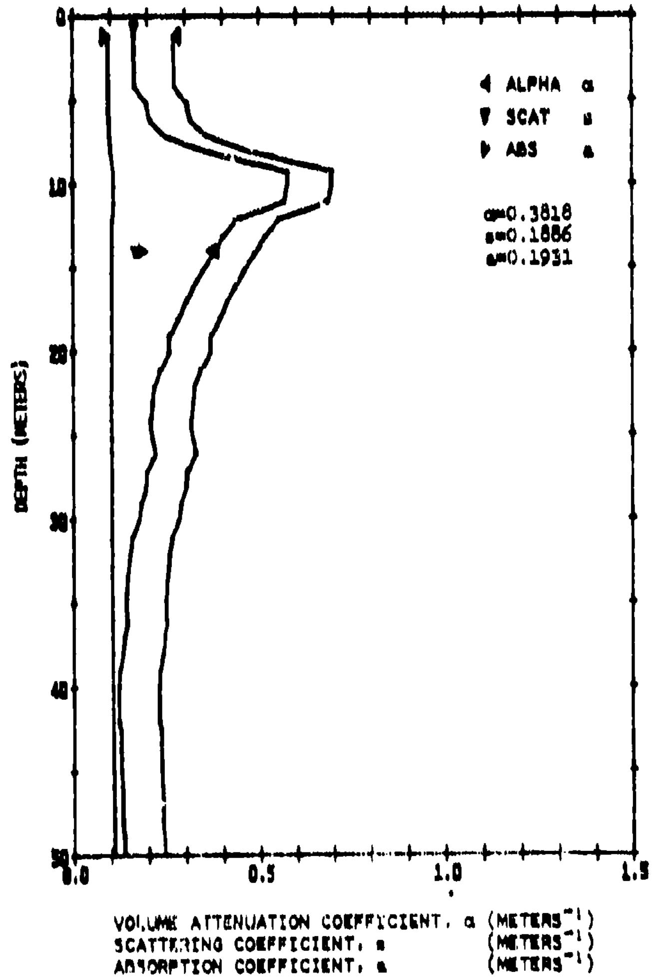

Figure D-7. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
18JUN1975 1952PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2HAR
1.0	0.756	0.280	0.282	0.176	0.106	199.9	71.9	25.9	0.087
4.0	0.756	0.280	0.282	0.176	0.106	199.9	71.9	25.9	0.087
5.0	0.733	0.311	0.315	0.207	0.107	239.9	87.1	31.6	0.079
6.0	0.727	0.319	0.323	0.215	0.107	250.2	91.0	33.1	0.077
7.0	0.697	0.360	0.365	0.256	0.109	303.9	111.6	40.9	0.069
8.0	0.619	0.480	0.486	0.374	0.112	464.4	174.1	63.2	0.054
9.2	0.501	0.690	0.701	0.583	0.119	763.3	293.2	112.6	0.040
10.0	0.501	0.690	0.701	0.583	0.119	763.3	293.2	112.6	0.040
11.0	0.506	0.681	0.692	0.573	0.118	749.2	287.5	110.3	0.041
12.0	0.576	0.552	0.560	0.445	0.114	565.0	213.9	80.9	0.046
13.1	0.599	0.512	0.519	0.406	0.113	509.0	191.7	72.1	0.051
14.1	0.615	0.486	0.493	0.380	0.112	473.2	177.6	66.6	0.053
15.1	0.633	0.458	0.464	0.352	0.112	434.4	162.3	60.6	0.056
16.1	0.648	0.433	0.439	0.328	0.111	401.1	149.3	55.5	0.058
17.0	0.663	0.411	0.416	0.306	0.110	370.8	137.5	51.0	0.061
18.0	0.676	0.392	0.397	0.287	0.110	345.4	127.6	47.1	0.064
19.0	0.692	0.368	0.372	0.263	0.109	313.1	115.1	42.3	0.067
20.0	0.694	0.365	0.369	0.260	0.109	309.4	113.7	41.8	0.068
21.0	0.711	0.341	0.345	0.237	0.108	278.4	101.8	37.2	0.072
22.0	0.723	0.325	0.328	0.221	0.108	257.2	93.7	34.1	0.076
23.0	0.727	0.319	0.323	0.215	0.107	250.2	91.0	33.1	0.077
24.0	0.731	0.314	0.317	0.210	0.107	243.3	88.4	32.1	0.078
25.1	0.727	0.319	0.323	0.215	0.107	250.2	91.0	33.1	0.077
26.0	0.722	0.326	0.330	0.222	0.108	258.9	94.3	34.4	0.075
27.1	0.738	0.303	0.306	0.199	0.107	229.7	83.2	30.1	0.081
28.0	0.741	0.299	0.302	0.196	0.107	224.6	81.3	29.4	0.082
29.0	0.750	0.287	0.290	0.184	0.106	209.7	75.6	27.2	0.085
30.1	0.756	0.280	0.282	0.176	0.106	199.9	71.9	25.9	0.087
31.1	0.770	0.262	0.264	0.158	0.106	177.5	63.5	22.7	0.094
32.0	0.775	0.255	0.258	0.152	0.105	169.7	60.5	21.6	0.096
33.5	0.781	0.248	0.250	0.145	0.105	160.4	57.1	20.3	0.099
34.8	0.784	0.244	0.246	0.141	0.105	155.8	55.4	19.7	0.101
36.0	0.782	0.246	0.249	0.144	0.105	158.9	56.5	20.1	0.100
37.0	0.787	0.239	0.241	0.136	0.105	149.7	53.1	18.8	0.103
38.0	0.791	0.234	0.236	0.131	0.105	143.7	50.9	18.0	0.106
39.0	0.798	0.225	0.227	0.123	0.105	133.3	47.0	16.6	0.111
40.0	0.800	0.223	0.225	0.120	0.104	130.4	45.9	16.2	0.112
42.0	0.800	0.223	0.225	0.120	0.104	130.4	45.9	16.2	0.112
42.5	0.796	0.228	0.230	0.125	0.105	136.3	48.1	17.0	0.109
45.0	0.796	0.228	0.230	0.125	0.105	136.3	48.1	17.0	0.109
46.0	0.794	0.230	0.232	0.128	0.105	139.3	49.2	17.4	0.108
48.0	0.794	0.230	0.232	0.128	0.105	139.3	49.2	17.4	0.108
49.0	0.791	0.234	0.236	0.131	0.105	143.7	50.9	18.0	0.106
50.0	0.791	0.234	0.236	0.131	0.105	143.7	50.9	18.0	0.106

PAUSE READY PLOTTER

Figure D-7. Ocean optical properties (sheet 2 of 2).

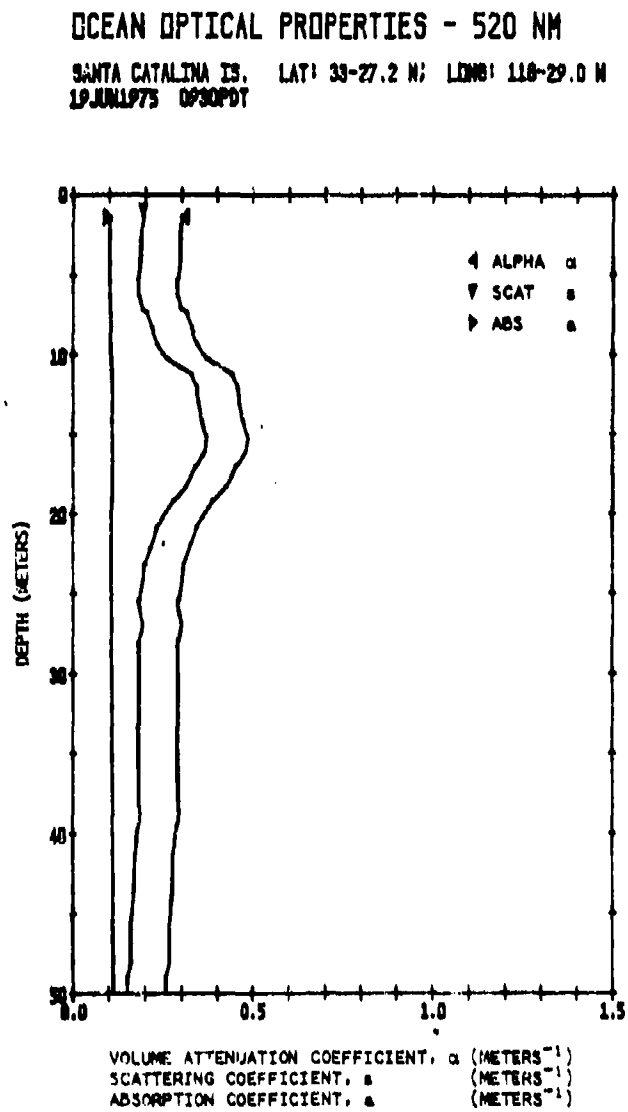

Figure D-8. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
19JUN1975 0930PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.2	0.740	0.301	0.304	0.197	0.107	226.3	81.9	29.6	0.081
2.5	0.744	0.295	0.298	0.192	0.107	219.6	79.4	28.7	0.083
4.0	0.746	0.293	0.296	0.189	0.107	216.3	78.1	28.2	0.084
5.1	0.751	0.286	0.289	0.183	0.106	208.0	75.0	27.0	0.085
6.1	0.749	0.289	0.292	0.185	0.106	211.3	76.2	27.5	0.085
7.0	0.743	0.297	0.300	0.193	0.107	221.3	80.0	28.9	0.082
7.2	0.733	0.311	0.315	0.2[illegible]7	0.107	239.9	87.1	31.6	0.079
8.1	0.723	0.325	0.328	0.221	0.108	257.2	93.7	34.1	0.076
9.1	0.713	0.338	0.342	0.234	0.108	274.8	100.4	36.7	0.073
10.1	0.693	0.366	0.370	0.262	0.109	311.3	114.4	42.0	0.068
11.1	0.648	0.433	0.439	0.328	0.111	401.1	149.3	55.5	0.058
11.9	0.639	0.449	0.454	0.343	0.111	421.7	157.4	58.7	0.057
13.0	0.635	0.455	0.461	0.349	0.112	430.1	160.7	60.0	0.056
14.0	0.629	0.464	0.470	0.358	0.112	442.9	165.6	61.9	0.055
15.0	0.621	0.477	0.483	0.371	0.112	460.1	172.4	64.6	0.054
16.0	0.624	0.472	0.478	0.366	0.112	453.6	169.9	63.6	0.054
17.0	0.642	0.442	0.448	0.337	0.111	413.4	154.1	57.4	0.057
18.2	0.659	0.417	0.422	0.312	0.110	378.8	140.6	52.2	0.060
19.1	0.684	0.380	0.385	0.276	0.109	330.1	121.7	44.8	0.065
20.7	0.713	0.338	0.342	0.234	0.108	274.8	100.4	36.7	0.073
22.0	0.728	0.318	0.321	0.214	0.107	248.5	90.3	32.8	0.077
23.1	0.741	0.299	0.302	0.196	0.107	224.6	81.3	29.4	0.082
24.1	0.745	0.294	0.297	0.190	0.107	218.0	78.7	28.4	0.083
25.3	0.753	0.283	0.286	0.180	0.106	204.8	73.7	26.5	0.086
26.8	0.746	0.293	0.296	0.189	0.107	216.3	78.1	28.2	0.084
28.0	0.753	0.283	0.286	0.180	0.106	204.8	73.7	26.5	0.086
30.0	0.753	0.283	0.286	0.180	0.106	204.8	73.7	26.5	0.086
33.1	0.755	0.281	0.284	0.177	0.106	201.5	72.5	26.1	0.087
35.0	0.755	0.281	0.284	0.177	0.106	201.5	72.5	26.1	0.087
38.0	0.755	0.281	0.284	0.177	0.106	201.5	72.5	26.1	0.087
38.9	0.752	0.285	0.288	0.181	0.106	206.4	74.4	26.8	0.086
40.0	0.760	0.274	0.277	0.171	0.106	193.4	69.5	24.9	0.089
41.3	0.765	0.268	0.271	0.165	0.105	185.4	66.5	23.8	0.091
43.0	0.767	0.265	0.268	0.162	0.106	182.2	65.3	23.4	0.092
46.0	0.775	0.255	0.258	0.152	0.105	169.7	60.5	21.6	0.096
48.0	0.775	0.255	0.258	0.152	0.105	169.7	60.5	21.6	0.096
49.0	0.782	0.246	0.249	0.144	0.105	158.9	56.5	20.1	0.100
50.0	0.782	0.246	0.249	0.144	0.105	158.9	56.5	20.1	0.100

PAUSE READY PLOTTER

Figure D-8. Ocean optical properties (sheet 2 of 2).

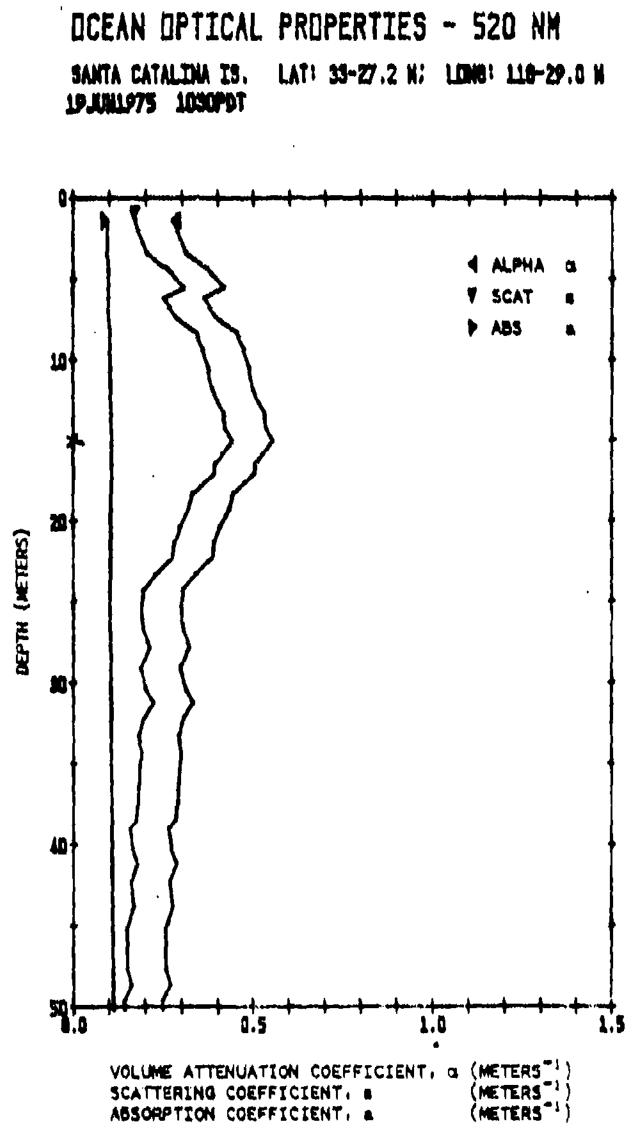

Figure D-9. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
19JUN1975 1030PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.0	0.752	0.285	0.288	0.181	0.105	206.4	74.4	26.8	0.086
3.0	0.730	0.315	0.319	0.211	0.107	245.0	89.0	32.3	0.078
4.0	0.688	0.375	0.379	0.270	0.109	322.5	118.8	43.7	0.066
5.2	0.657	0.420	0.425	0.315	0.110	382.8	142.2	52.8	0.060
5.8	0.693	0.366	0.370	0.262	0.109	311.3	114.4	42.0	0.068
7.0	0.674	0.395	0.400	0.290	0.110	349.3	129.1	47.7	0.063
8.0	0.637	0.452	0.458	0.346	0.111	425.9	159.0	59.3	0.056
9.0	0.625	0.470	0.477	0.365	0.112	451.4	169.0	63.2	0.055
10.2	0.615	0.486	0.493	0.380	0.112	473.2	177.6	66.6	0.053
11.5	0.609	0.496	0.503	0.390	0.113	486.5	182.8	68.7	0.052
13.0	0.591	0.527	0.534	0.420	0.114	529.6	199.8	75.4	0.050
14.0	0.588	0.532	0.539	0.425	0.114	536.6	202.6	76.5	0.049
14.8	0.578	0.548	0.556	0.442	0.114	560.2	212.0	80.2	0.048
16.2	0.605	0.502	0.509	0.396	0.113	495.4	186.3	70.0	0.052
16.8	0.607	0.499	0.506	0.393	0.113	490.9	184.6	69.3	0.052
18.0	0.644	0.439	0.445	0.334	0.111	409.3	152.5	56.8	0.058
19.0	0.652	0.427	0.433	0.322	0.111	392.9	146.1	54.3	0.059
20.1	0.669	0.402	0.407	0.297	0.110	359.0	132.9	49.2	0.062
21.0	0.679	0.388	0.392	0.283	0.109	339.6	125.4	46.3	0.064
22.0	0.684	0.380	0.385	0.276	0.109	330.1	121.7	44.8	0.065
23.0	0.715	0.336	0.339	0.231	0.108	271.3	99.1	36.2	0.073
24.0	0.740	0.301	0.304	0.197	0.107	226.3	81.9	29.6	0.081
25.0	0.744	0.295	0.298	0.192	0.107	219.6	79.4	28.7	0.083
26.5	0.739	0.302	0.305	0.198	0.107	228.0	82.6	29.9	0.081
27.5	0.728	0.318	0.321	0.214	0.107	248.5	90.3	32.8	0.077
28.8	0.746	0.293	0.296	0.189	0.107	216.3	78.1	28.2	0.084
30.0	0.737	0.305	0.308	0.201	0.107	231.4	83.9	30.4	0.080
31.0	0.722	0.326	0.330	0.222	0.108	258.9	94.3	34.4	0.075
32.0	0.741	0.299	0.302	0.196	0.107	224.6	81.3	29.4	0.082
33.0	0.751	0.286	0.289	0.183	0.106	208.0	75.0	27.0	0.085
34.0	0.746	0.293	0.296	0.189	0.107	216.3	78.1	28.2	0.084
36.0	0.752	0.285	0.288	0.181	0.106	206.4	74.4	26.8	0.086
37.2	0.754	0.282	0.285	0.179	0.106	203.1	73.1	26.3	0.087
38.3	0.759	0.276	0.278	0.172	0.106	195.0	70.1	25.2	0.089
38.8	0.772	0.259	0.262	0.156	0.106	174.4	62.3	22.3	0.095
40.0	0.768	0.264	0.267	0.161	0.106	180.7	64.7	23.1	0.093
41.0	0.757	0.278	0.281	0.175	0.106	198.3	71.3	25.6	0.088
42.1	0.771	0.260	0.263	0.157	0.106	175.9	62.9	22.5	0.094
43.7	0.766	0.267	0.269	0.164	0.106	183.8	65.9	23.6	0.092
45.0	0.781	0.248	0.250	0.145	0.105	160.4	57.1	20.3	0.099
47.5	0.781	0.248	0.250	0.145	0.105	160.4	57.1	20.3	0.099
48.5	0.773	0.258	0.260	0.155	0.106	172.8	61.7	22.0	0.095
49.5	0.788	0.238	0.240	0.135	0.105	148.2	52.5	18.6	0.104
50.0	0.788	0.238	0.240	0.135	0.105	148.2	52.5	18.6	0.104

PAUSE READY PLOTTER

Figure D-9. Ocean optical properties (sheet 2 of 2).

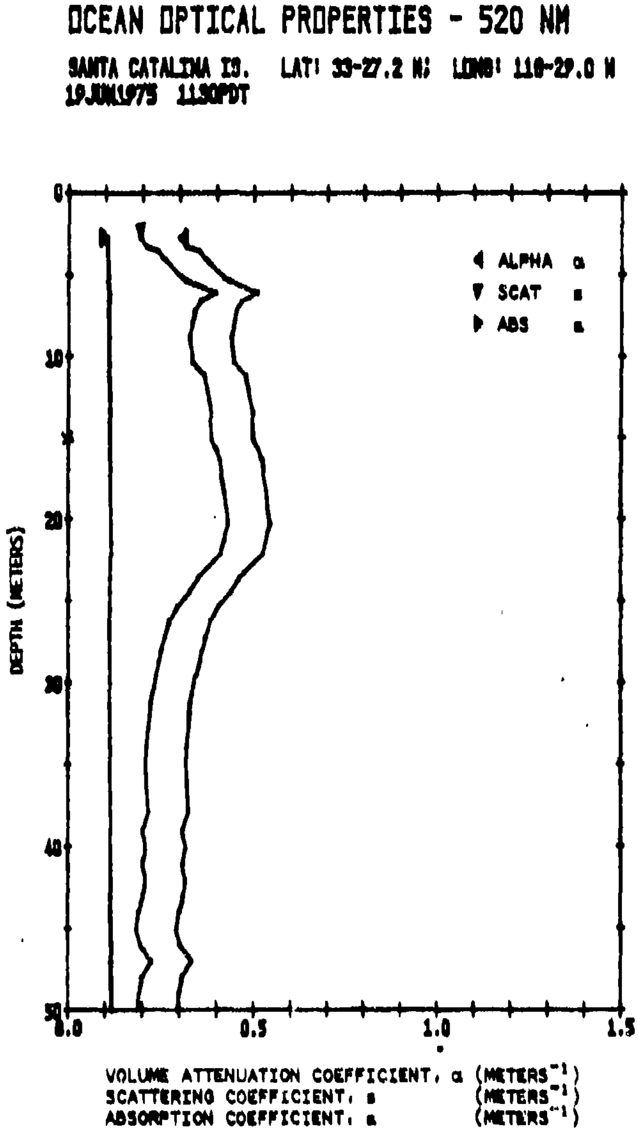

Figure D-10. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
19JUN1976 1130PDT

Z(M)	T (1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
2.5	0.740	0.301	0.304	0.197	0.107	226.3	81.9	29.6	0.081
3.1	0.728	0.318	0.321	0.214	0.107	248.5	90.3	32.8	0.077
3.3	0.707	0.347	0.351	0.242	0.108	285.6	104.6	38.3	0.071
3.9	0.692	0.368	0.372	0.263	0.109	313.1	115.1	42.3	0.067
4.9	0.663	0.411	0.416	0.306	0.110	370.8	137.5	51.0	0.061
5.2	0.653	0.426	0.431	0.321	0.111	390.9	145.3	54.0	0.059
5.9	0.605	0.502	0.509	0.396	0.113	495.4	186.3	70.0	0.052
6.4	0.630	0.462	0.469	0.357	0.112	440.7	164.8	61.6	0.055
7.0	0.640	0.447	0.453	0.342	0.111	419.7	156.6	58.4	0.057
8.6	0.648	0.433	0.439	0.328	0.111	401.1	149.3	55.5	0.058
10.2	0.644	0.439	0.445	0.334	0.111	409.3	152.5	56.8	0.058
11.0	0.625	0.470	0.477	0.365	0.112	451.4	169.0	63.2	0.055
13.2	0.614	0.488	0.494	0.382	0.113	475.4	178.4	66.9	0.053
15.0	0.612	0.491	0.498	0.385	0.113	479.8	180.2	67.6	0.053
15.5	0.605	0.502	0.509	0.396	0.113	495.4	186.3	70.0	0.052
16.2	0.599	0.512	0.519	0.406	0.113	509.0	191.7	72.1	0.051
18.2	0.592	0.525	0.533	0.419	0.114	527.3	198.9	75.0	0.050
20.1	0.587	0.533	0.541	0.427	0.114	538.9	203.5	76.8	0.049
22.0	0.599	0.512	0.519	0.406	0.113	509.0	191.7	72.1	0.051
23.4	0.637	0.452	0.458	0.346	0.111	425.9	159.0	59.3	0.056
24.3	0.651	0.429	0.434	0.324	0.111	394.9	146.9	54.6	0.059
25.2	0.674	0.395	0.400	0.290	0.110	349.3	129.1	47.7	0.063
26.1	0.688	0.375	0.379	0.270	0.109	322.5	118.8	43.7	0.066
27.1	0.697	0.360	0.365	0.256	0.109	303.9	111.6	40.9	0.069
28.0	0.705	0.349	0.353	0.245	0.108	289.2	105.9	38.8	0.071
29.5	0.717	0.333	0.337	0.229	0.108	267.7	97.7	35.6	0.074
31.2	0.727	0.319	0.323	0.215	0.107	250.2	91.0	33.1	0.077
33.9	0.736	0.307	0.310	0.203	0.107	234.8	85.1	30.8	0.080
37.8	0.732	0.313	0.316	0.209	0.107	241.6	87.7	31.8	0.078
38.9	0.742	0.298	0.301	0.194	0.107	223.0	80.6	29.2	0.082
40.1	0.737	0.305	0.308	0.201	0.107	231.4	83.8	30.4	0.080
41.0	0.743	0.297	0.300	0.193	0.107	221.3	80.0	28.9	0.082
42.0	0.738	0.303	0.306	0.199	0.107	229.7	83.2	30.1	0.081
43.0	0.742	0.298	0.301	0.194	0.107	223.0	80.6	29.2	0.082
44.0	0.751	0.286	0.289	0.183	0.106	208.0	75.0	27.0	0.085
45.0	0.756	0.280	0.282	0.176	0.106	199.9	71.9	25.9	0.087
46.0	0.749	0.289	0.292	0.185	0.106	211.3	76.2	27.5	0.085
47.0	0.728	0.318	0.321	0.214	0.107	248.5	90.3	32.8	0.077
48.0	0.745	0.294	0.297	0.190	0.107	218.0	78.7	28.4	0.083
49.0	0.752	0.285	0.288	0.181	0.106	206.4	74.4	26.8	0.086
50.0	0.756	0.280	0.282	0.176	0.106	199.9	71.9	25.9	0.087

PAUSE READY PLOTTER

Figure D-10. Ocean optical properties (sheet 2 of 2).

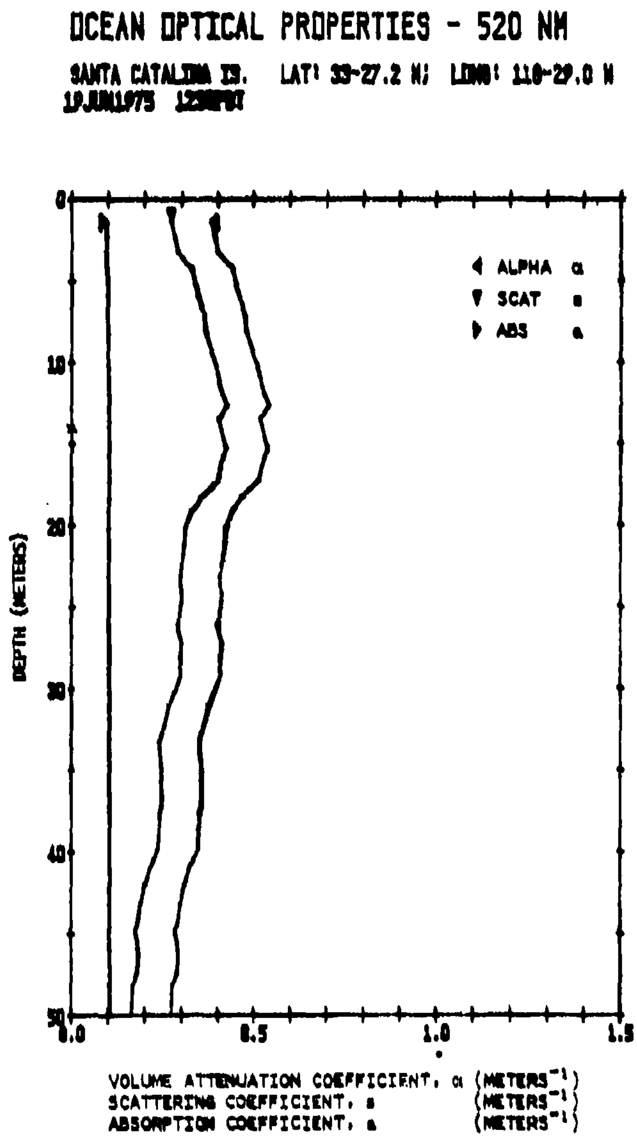

Figure D-11. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
19JUN1975 1230PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.2	0.678	0.389	0.394	0.284	0.110	341.5	126.1	46.6	0.064
2.0	0.673	0.396	0.401	0.291	0.110	351.2	129.9	48.0	0.063
3.0	0.666	0.406	0.412	0.302	0.110	364.9	135.2	50.1	0.062
4.0	0.641	0.445	0.451	0.340	0.111	417.6	155.7	58.1	0.057
5.0	0.635	0.455	0.461	0.349	0.112	430.1	160.7	60.0	0.056
6.9	0.620	0.478	0.485	0.372	0.112	462.3	173.3	64.9	0.054
8.0	0.617	0.483	0.489	0.377	0.112	468.8	175.8	65.9	0.053
10.0	0.600	0.510	0.517	0.404	0.113	506.7	190.8	71.8	0.051
11.8	0.590	0.528	0.536	0.422	0.114	531.9	200.8	75.7	0.050
12.5	0.583	0.540	0.548	0.434	0.114	548.3	207.3	78.3	0.049
13.3	0.595	0.518	0.526	0.412	0.113	518.1	195.3	73.6	0.050
15.1	0.586	0.535	0.543	0.429	0.114	541.3	204.5	77.2	0.049
17.1	0.599	0.512	0.519	0.406	0.113	509.0	191.7	72.1	0.051
18.2	0.629	0.464	0.470	0.358	0.112	442.9	165.6	61.9	0.055
19.0	0.643	0.441	0.447	0.336	0.111	411.3	153.3	57.1	0.058
20.0	0.655	0.423	0.428	0.318	0.111	386.8	143.7	53.4	0.060
21.0	0.658	0.418	0.424	0.313	0.110	380.8	141.4	52.5	0.060
23.0	0.666	0.406	0.412	0.302	0.110	364.9	135.2	50.1	0.062
24.0	0.663	0.411	0.416	0.306	0.110	370.8	137.5	51.0	0.061
26.0	0.671	0.399	0.404	0.294	0.110	355.1	131.4	48.6	0.063
27.1	0.664	0.409	0.415	0.304	0.110	368.9	136.7	50.7	0.061
28.0	0.667	0.405	0.410	0.300	0.110	362.9	134.4	49.8	0.062
29.0	0.665	0.408	0.413	0.303	0.110	366.9	136.0	50.4	0.061
30.2	0.679	0.388	0.392	0.283	0.109	339.6	125.4	46.3	0.064
31.0	0.689	0.372	0.376	0.267	0.109	318.7	117.3	43.2	0.067
33.2	0.707	0.347	0.351	0.242	0.108	285.6	104.6	38.3	0.071
35.0	0.703	0.352	0.356	0.248	0.108	292.9	107.3	39.3	0.070
36.5	0.703	0.352	0.356	0.248	0.108	292.9	107.3	39.3	0.070
37.2	0.704	0.351	0.355	0.246	0.108	291.0	106.6	39.1	0.070
37.6	0.708	0.345	0.349	0.241	0.108	283.8	103.9	38.0	0.071
39.8	0.712	0.340	0.343	0.235	0.108	276.6	101.1	36.9	0.072
41.0	0.728	0.318	0.321	0.214	0.107	248.5	90.3	32.8	0.077
42.0	0.737	0.305	0.308	0.201	0.107	231.4	83.8	30.4	0.080
43.2	0.746	0.293	0.296	0.189	0.107	216.3	78.1	28.2	0.084
44.7	0.755	0.281	0.284	0.177	0.106	201.5	72.5	26.1	0.087
46.0	0.750	0.287	0.290	0.184	0.106	209.7	75.6	27.2	0.085
47.5	0.754	0.282	0.285	0.179	0.106	203.1	73.1	26.3	0.087
48.2	0.762	0.272	0.275	0.169	0.106	190.2	68.3	24.5	0.090
50.0	0.766	0.267	0.269	0.164	0.106	182.8	65.9	23.6	0.092

PAUSE READY PLOTTER

Figure D-11. Ocean optical properties (sheet 2 of 2).

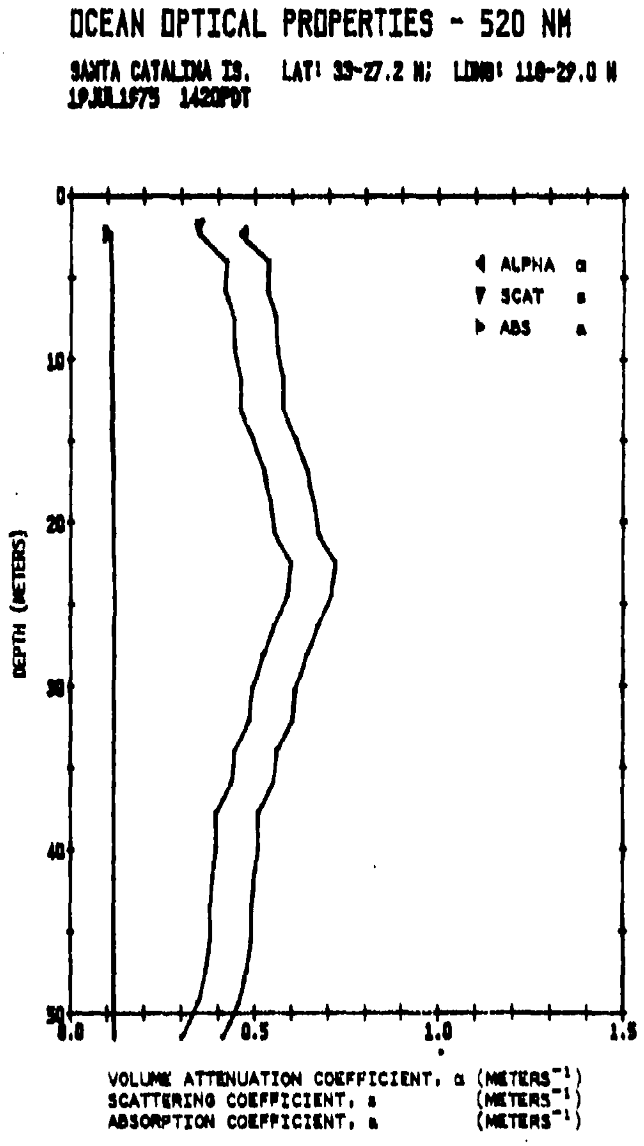

Figure D-12. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
19JUL1975   1420PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
2.1	0.634	0.456	0.462	0.351	0.112	432.2	161.5	60.3	0.056
3.8	0.590	0.528	0.536	0.422	0.114	531.9	200.8	75.7	0.050
5.6	0.592	0.525	0.533	0.419	0.114	527.3	198.9	75.0	0.050
7.3	0.578	0.548	0.556	0.442	0.114	560.2	212.0	80.2	0.048
9.1	0.576	0.552	0.560	0.445	0.114	565.0	213.9	80.9	0.048
11.0	0.567	0.567	0.576	0.461	0.115	586.7	222.5	84.3	0.047
12.8	0.568	0.566	0.574	0.459	0.115	584.3	221.5	84.0	0.047
14.7	0.548	0.601	0.610	0.494	0.116	634.1	241.4	91.8	0.045
16.6	0.534	0.628	0.638	0.521	0.117	673.0	256.9	98.0	0.043
18.5	0.524	0.646	0.657	0.539	0.117	699.6	267.6	102.3	0.042
20.5	0.518	0.658	0.668	0.550	0.118	715.9	274.2	104.9	0.042
22.3	0.495	0.704	0.716	0.596	0.119	783.4	301.3	115.8	0.040
24.3	0.500	0.692	0.703	0.585	0.119	766.2	294.4	113.1	0.040
26.2	0.519	0.656	0.666	0.548	0.118	713.2	273.1	104.5	0.042
28.0	0.536	0.624	0.634	0.517	0.117	667.7	254.8	97.2	0.043
30.1	0.551	0.595	0.604	0.489	0.116	626.5	238.4	90.6	0.045
32.0	0.556	0.586	0.595	0.480	0.116	613.9	233.3	88.6	0.046
33.9	0.579	0.547	0.555	0.440	0.114	557.8	211.0	79.8	0.048
35.9	0.586	0.535	0.543	0.429	0.114	541.3	204.5	77.2	0.049
37.7	0.609	0.496	0.503	0.390	0.113	486.5	182.8	68.7	0.052
39.8	0.610	0.494	0.501	0.388	0.113	484.2	181.9	68.3	0.052
41.7	0.617	0.483	0.489	0.377	0.112	468.3	175.8	65.9	0.053
43.5	0.621	0.477	0.483	0.371	0.112	460.1	172.4	64.6	0.054
45.6	0.622	0.475	0.481	0.369	0.112	457.9	171.6	64.2	0.054
47.5	0.630	0.462	0.469	0.357	0.112	440.7	164.8	61.6	0.055
49.4	0.642	0.442	0.448	0.337	0.111	413.4	154.1	57.4	0.057
51.5	0.672	0.398	0.403	0.293	0.110	353.1	130.6	48.3	0.063

PAUSE   READY PLOTTER

Figure D-12. Ocean optical properties (sheet 2 of 2).

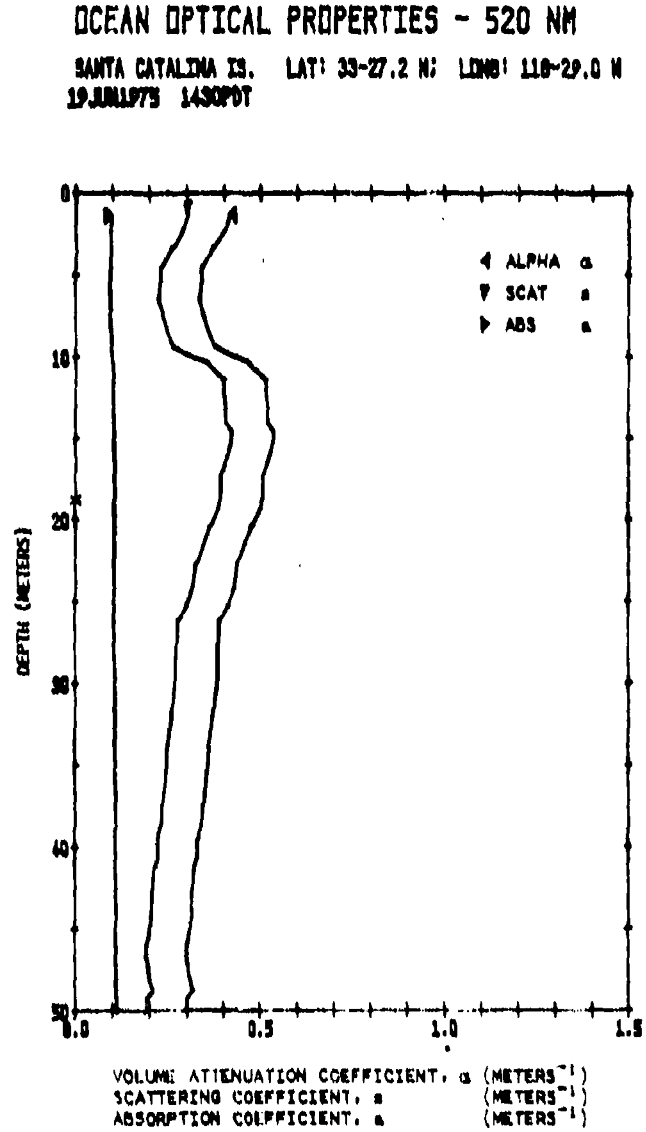

Figure D-13. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
19JUN1975 1430PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.0	0.657	0.420	0.425	0.315	0.110	382.8	142.2	52.8	0.060
2.0	0.667	0.405	0.410	0.300	0.110	362.9	134.4	49.8	0.062
3.0	0.688	0.375	0.379	0.270	0.109	322.5	118.8	43.7	0.066
4.2	0.707	0.347	0.351	0.242	0.108	285.6	104.6	38.3	0.071
5.1	0.708	0.345	0.349	0.241	0.108	283.8	103.9	38.0	0.071
6.1	0.712	0.340	0.343	0.235	0.108	276.6	101.1	36.9	0.072
8.1	0.697	0.360	0.365	0.256	0.109	303.9	111.6	40.9	0.069
9.1	0.686	0.377	0.382	0.273	0.109	326.3	120.2	44.3	0.066
9.5	0.664	0.409	0.415	0.304	0.110	368.9	136.7	50.7	0.061
10.0	0.629	0.464	0.470	0.358	0.112	442.9	165.6	61.9	0.055
11.2	0.599	0.512	0.519	0.406	0.113	509.0	191.7	72.1	0.051
13.8	0.595	0.518	0.526	0.412	0.113	518.1	195.3	73.6	0.050
14.3	0.588	0.532	0.539	0.425	0.114	536.6	202.6	76.5	0.049
15.0	0.588	0.532	0.539	0.425	0.114	536.6	202.6	76.5	0.049
17.0	0.605	0.502	0.509	0.396	0.113	495.4	186.3	70.0	0.052
19.0	0.609	0.496	0.503	0.390	0.113	486.5	182.8	68.7	0.052
20.2	0.625	0.470	0.477	0.365	0.112	451.4	169.0	63.2	0.055
22.5	0.648	0.433	0.439	0.328	0.111	401.1	149.3	55.5	0.058
24.1	0.656	0.421	0.427	0.316	0.111	384.8	142.9	53.1	0.060
25.1	0.665	0.408	0.413	0.303	0.110	366.9	136.0	50.4	0.061
26.0	0.681	0.384	0.389	0.280	0.109	335.8	123.9	45.7	0.065
28.2	0.686	0.377	0.382	0.273	0.109	326.3	120.2	44.3	0.066
29.0	0.687	0.376	0.381	0.271	0.109	324.4	119.5	44.0	0.066
30.2	0.689	0.373	0.378	0.269	0.109	320.6	118.0	43.4	0.066
31.5	0.694	0.365	0.369	0.260	0.109	309.4	113.7	41.8	0.068
33.8	0.703	0.352	0.356	0.248	0.108	292.9	107.3	39.3	0.070
35.3	0.706	0.348	0.352	0.244	0.108	287.4	105.2	38.5	0.071
37.3	0.715	0.336	0.339	0.231	0.108	271.3	99.1	36.2	0.073
38.7	0.720	0.329	0.332	0.225	0.108	262.4	95.7	34.9	0.075
39.5	0.725	0.322	0.325	0.218	0.107	253.7	92.3	33.6	0.076
40.7	0.727	0.319	0.323	0.215	0.107	250.2	91.0	33.1	0.077
41.2	0.732	0.313	0.316	0.209	0.107	241.6	87.7	31.8	0.078
42.5	0.737	0.306	0.309	0.202	0.107	233.1	84.5	30.6	0.080
45.2	0.742	0.298	0.301	0.194	0.107	223.0	80.6	29.2	0.082
46.0	0.749	0.289	0.292	0.185	0.106	211.3	76.2	27.5	0.085
47.9	0.743	0.297	0.300	0.193	0.107	221.3	80.0	28.9	0.082
48.7	0.737	0.306	0.309	0.202	0.107	233.1	84.5	30.6	0.080
49.2	0.747	0.291	0.294	0.188	0.107	214.6	77.5	28.0	0.084
50.0	0.752	0.285	0.288	0.181	0.106	206.4	74.4	26.8	0.086

PAUSE READY PLOTTER

Figure D-13. Ocean optical properties (sheet 2 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT: 33-27.2 N; LONG: 118-29.0 W
19JUL1975 1507PDT

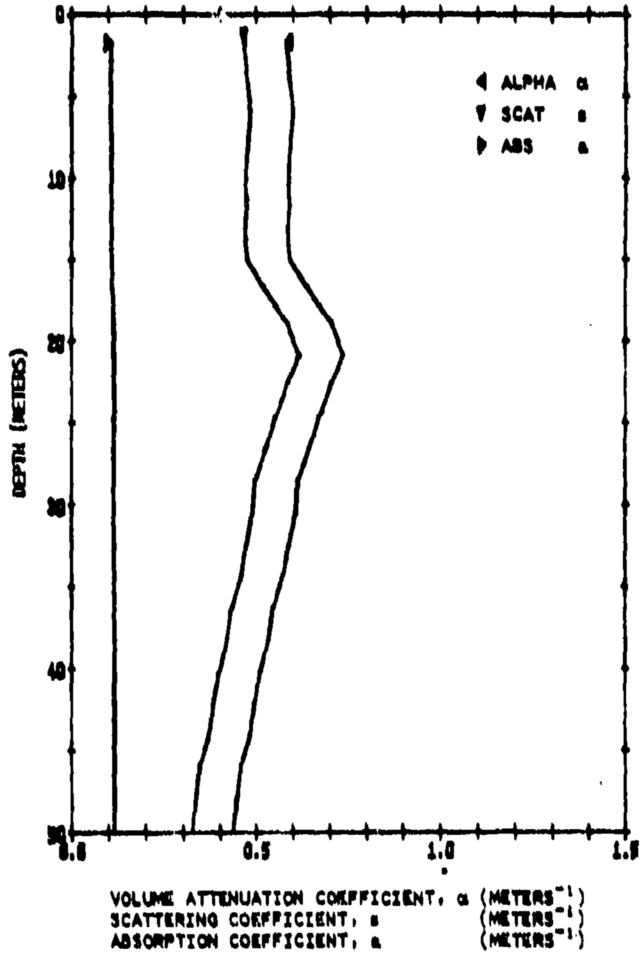

Figure D-14. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
19JUL1975   1507PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.6	0.561	0.578	0.586	0.471	0.115	601.5	228.4	86.7	0.046
2.6	0.557	0.585	0.594	0.478	0.116	611.4	232.3	88.2	0.046
4.1	0.554	0.590	0.599	0.483	0.116	618.9	235.3	89.4	0.045
5.7	0.550	0.597	0.606	0.490	0.116	629.0	239.4	91.0	0.045
7.5	0.554	0.590	0.599	0.483	0.116	618.9	235.3	89.4	0.045
9.5	0.558	0.583	0.592	0.476	0.115	608.9	231.3	87.8	0.046
11.2	0.556	0.586	0.595	0.480	0.116	613.9	233.3	88.6	0.046
13.0	0.559	0.581	0.590	0.475	0.115	606.4	230.4	87.5	0.046
15.0	0.555	0.588	0.597	0.481	0.116	616.4	234.3	89.0	0.046
16.7	0.532	0.631	0.641	0.524	0.117	678.3	257.1	98.9	0.043
18.9	0.499	0.696	0.707	0.589	0.119	771.9	296.7	114.0	0.040
20.8	0.484	0.726	0.738	0.618	0.120	815.7	314.4	121.1	0.039
22.6	0.499	0.694	0.705	0.587	0.119	769.0	295.5	113.5	0.040
24.7	0.517	0.659	0.670	0.552	0.118	718.7	275.3	105.4	0.042
26.6	0.531	0.633	0.643	0.526	0.117	680.9	260.1	99.7	0.043
28.5	0.567	0.602	0.612	0.496	0.116	636.7	242.4	92.3	0.045
30.5	0.551	0.595	0.606	0.489	0.116	626.5	238.4	90.6	0.045
32.5	0.561	0.578	0.586	0.471	0.115	601.5	228.4	86.7	0.046
34.4	0.570	0.562	0.570	0.456	0.115	579.4	219.6	83.2	0.047
36.4	0.586	0.535	0.543	0.429	0.114	541.3	204.5	77.2	0.049
38.3	0.594	0.522	0.529	0.416	0.114	522.7	197.1	74.3	0.050
40.3	0.607	0.499	0.506	0.393	0.113	490.9	184.6	69.3	0.052
42.2	0.617	0.483	0.489	0.377	0.112	468.8	175.8	65.9	0.053
44.2	0.625	0.470	0.477	0.365	0.112	451.4	169.0	63.2	0.055
46.0	0.640	0.447	0.453	0.342	0.111	419.7	156.6	58.4	0.057
48.1	0.647	0.435	0.440	0.330	0.111	403.1	150.1	55.9	0.058
50.0	0.654	0.424	0.430	0.319	0.111	388.9	144.5	53.7	0.059

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Figure D-14. Ocean optical properties (sheet 2 of 2).

BEST AVAILABLE COPY

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT: 33-27.2 N; LONG: 118-29.0 W
19JUL1975 1550PDT

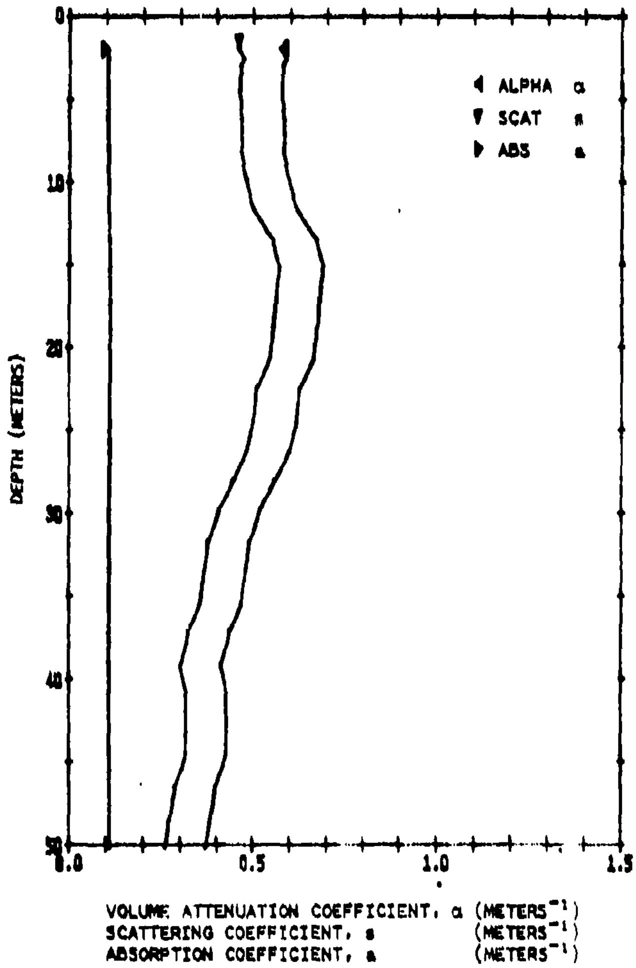

Figure D-15. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
19JUL1975   1550PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2HAR
1.8	0.563	0.574	0.583	0.468	0.115	596.5	226.4	85.9	0.046
2.4	0.555	0.588	0.597	0.481	0.116	616.4	234.3	89.0	0.046
2.8	0.560	0.579	0.588	0.473	0.115	604.0	229.4	87.1	0.046
4.3	0.562	0.576	0.585	0.469	0.115	599.0	227.4	86.3	0.046
6.0	0.558	0.583	0.592	0.476	0.115	608.9	231.3	87.8	0.046
8.0	0.560	0.579	0.588	0.473	0.115	604.0	229.4	87.1	0.046
9.7	0.552	0.594	0.603	0.487	0.116	624.0	237.3	90.2	0.045
11.5	0.541	0.615	0.625	0.508	0.116	654.7	249.6	95.1	0.044
13.4	0.512	0.669	0.680	0.562	0.118	732.4	280.8	107.6	0.041
15.1	0.504	0.684	0.695	0.577	0.119	754.8	289.8	111.2	0.040
17.0	0.509	0.675	0.686	0.567	0.118	740.8	284.2	108.9	0.041
18.7	0.513	0.667	0.678	0.560	0.118	729.7	279.7	107.2	0.041
20.6	0.518	0.658	0.668	0.550	0.118	715.9	274.2	104.9	0.042
22.4	0.537	0.622	0.632	0.515	0.117	665.1	253.8	96.8	0.044
24.3	0.543	0.611	0.621	0.504	0.116	649.5	247.5	94.3	0.044
26.2	0.553	0.592	0.601	0.485	0.116	621.5	236.3	89.8	0.045
28.0	0.575	0.554	0.562	0.447	0.115	567.4	214.8	81.3	0.048
29.7	0.596	0.517	0.524	0.411	0.113	515.8	194.4	73.2	0.050
31.7	0.615	0.486	0.493	0.380	0.112	473.2	177.6	66.6	0.053
33.5	0.623	0.473	0.480	0.368	0.112	455.7	170.7	63.9	0.054
35.5	0.631	0.461	0.467	0.355	0.112	438.6	164.0	61.3	0.055
37.1	0.650	0.430	0.436	0.325	0.111	397.0	147.7	54.9	0.059
39.1	0.665	0.408	0.413	0.303	0.110	366.9	136.0	50.4	0.061
40.9	0.656	0.421	0.427	0.316	0.111	384.8	142.9	53.1	0.060
42.3	0.656	0.421	0.427	0.316	0.111	384.8	142.9	53.1	0.060
44.6	0.657	0.420	0.425	0.315	0.110	382.8	142.2	52.8	0.060
46.5	0.676	0.392	0.397	0.287	0.110	345.4	127.6	47.1	0.064
48.6	0.687	0.376	0.381	0.271	0.109	324.4	119.5	44.0	0.066
50.2	0.695	0.363	0.368	0.259	0.109	307.6	113.0	41.5	0.068

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Figure D-15. Ocean optical properties (sheet 2 of 2).

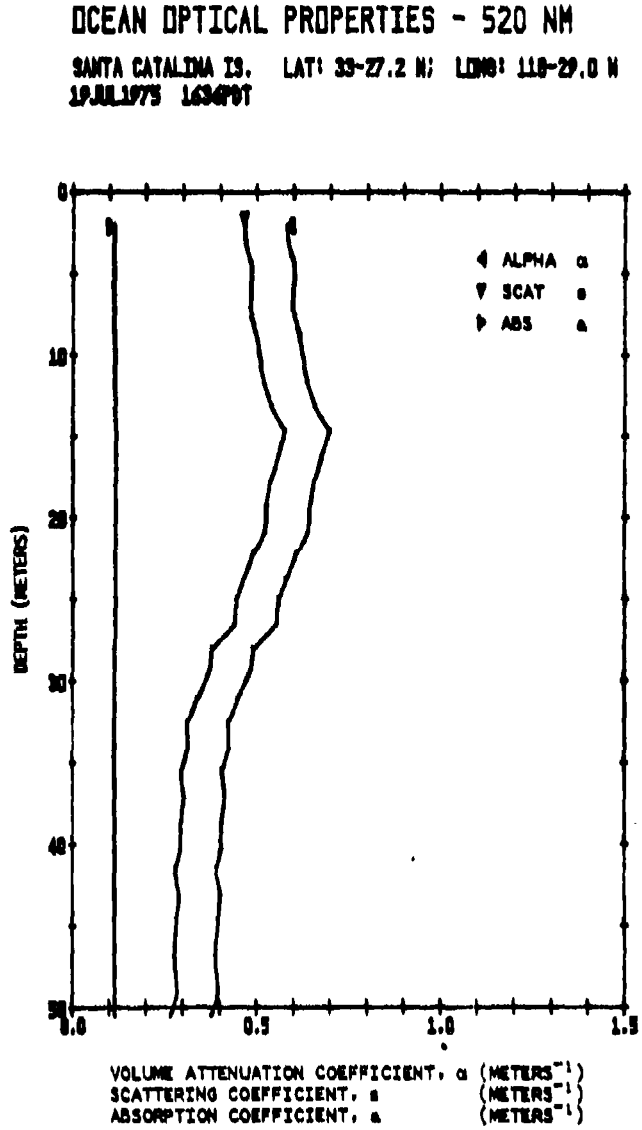

Figure D-16. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
19JUL1975   1636PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.8	0.562	0.576	0.585	0.469	0.115	599.0	227.4	86.3	0.046
2.6	0.561	0.578	0.586	0.471	0.115	601.5	228.4	86.7	0.046
4.0	0.552	0.594	0.603	0.487	0.116	624.0	237.3	90.2	0.045
5.4	0.552	0.594	0.603	0.487	0.116	624.0	237.3	90.2	0.045
6.8	0.554	0.590	0.599	0.483	0.116	618.9	235.3	89.4	0.045
8.4	0.546	0.606	0.615	0.499	0.116	641.8	244.5	93.1	0.044
9.9	0.541	0.615	0.625	0.508	0.116	654.7	249.6	95.1	0.044
11.4	0.535	0.626	0.636	0.519	0.117	670.4	255.9	97.6	0.043
12.9	0.524	0.646	0.657	0.539	0.117	699.6	267.6	102.3	0.042
14.4	0.504	0.684	0.695	0.577	0.118	754.8	289.8	111.2	0.040
15.9	0.513	0.667	0.678	0.560	0.118	729.7	279.7	107.2	0.041
17.5	0.526	0.643	0.653	0.535	0.117	694.3	265.5	101.5	0.042
19.1	0.533	0.630	0.639	0.523	0.117	675.6	258.0	98.5	0.043
20.6	0.535	0.626	0.636	0.519	0.117	670.4	255.9	97.6	0.043
21.9	0.550	0.597	0.606	0.490	0.116	629.0	239.4	91.0	0.045
23.5	0.565	0.571	0.579	0.464	0.115	591.6	224.5	85.1	0.047
24.7	0.577	0.550	0.558	0.444	0.114	562.6	212.9	80.5	0.048
26.3	0.581	0.543	0.551	0.437	0.114	553.1	209.1	79.0	0.048
27.8	0.618	0.481	0.488	0.376	0.112	466.6	175.0	65.6	0.053
29.3	0.624	0.472	0.478	0.366	0.112	453.6	169.9	63.6	0.054
30.9	0.643	0.441	0.447	0.336	0.111	411.3	153.3	57.1	0.058
32.3	0.660	0.415	0.421	0.310	0.110	375.8	139.8	51.9	0.061
34.0	0.660	0.415	0.421	0.310	0.110	376.4	139.8	51.9	0.061
35.3	0.673	0.396	0.401	0.291	0.110	351.2	129.9	48.0	0.063
37.0	0.668	0.404	0.409	0.299	0.110	361.0	133.7	49.5	0.062
38.6	0.675	0.393	0.398	0.289	0.110	347.3	128.4	47.4	0.063
40.1	0.675	0.393	0.398	0.289	0.110	347.3	128.4	47.4	0.063
41.3	0.685	0.379	0.384	0.274	0.109	328.2	121.0	44.6	0.066
43.0	0.677	0.390	0.395	0.286	0.110	343.5	126.9	46.8	0.064
44.4	0.682	0.383	0.388	0.279	0.109	333.9	123.2	45.4	0.065
46.0	0.687	0.376	0.381	0.271	0.109	324.4	119.5	44.0	0.066
47.4	0.685	0.379	0.384	0.274	0.109	328.2	121.0	44.6	0.066
49.2	0.682	0.383	0.388	0.279	0.109	333.9	123.2	45.4	0.065
50.4	0.694	0.365	0.369	0.260	0.109	309.4	113.7	41.8	0.068

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Figure D-16. Ocean optical properties (sheet 2 of 2).

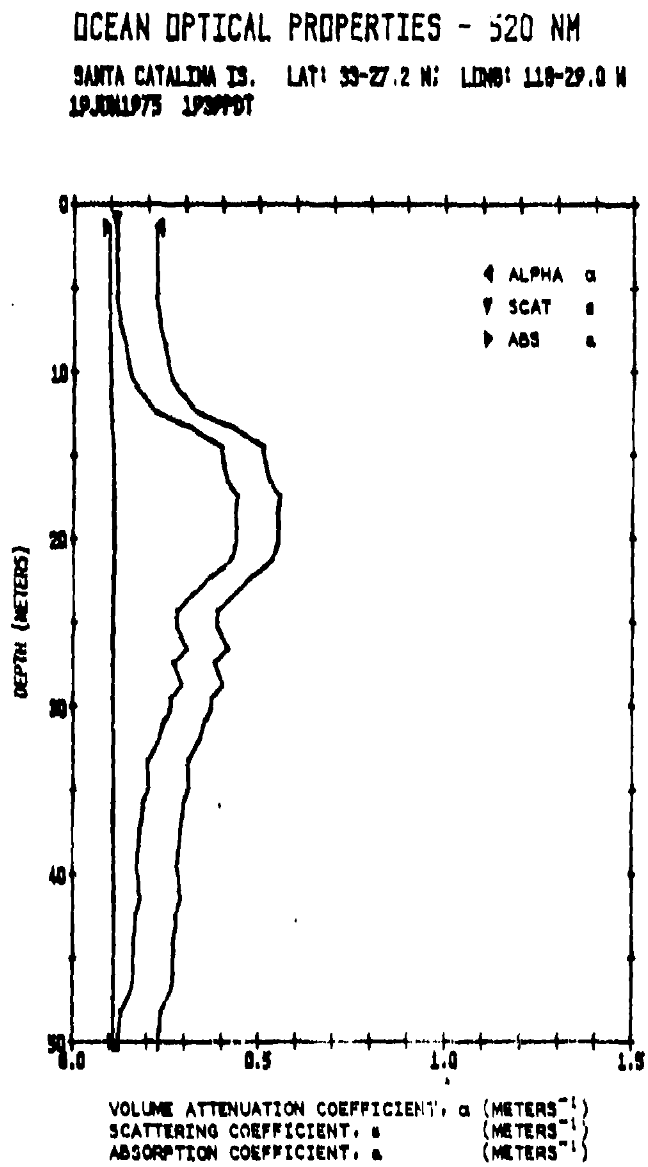

Figure D-17. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
19JUN1975   1939PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.0	0.796	0.228	0.230	0.125	0.105	136.3	48.1	17.0	0.109
3.0	0.795	0.229	0.231	0.126	0.105	137.8	48.7	17.2	0.109
5.0	0.796	0.228	0.230	0.125	0.105	136.3	48.1	17.0	0.109
7.0	0.788	0.238	0.240	0.135	0.105	148.2	52.5	18.6	0.104
8.0	0.781	0.248	0.250	0.145	0.105	160.4	57.1	20.3	0.099
9.2	0.774	0.257	0.259	0.153	0.105	171.2	61.1	21.8	0.096
10.2	0.766	0.267	0.269	0.164	0.106	183.8	65.9	23.6	0.092
11.2	0.741	0.299	0.302	0.196	0.107	224.6	81.3	29.4	0.082
12.1	0.720	0.329	0.332	0.225	0.108	262.4	95.7	34.9	0.075
13.0	0.656	0.421	0.427	0.316	0.111	384.8	142.9	53.1	0.060
14.0	0.612	0.491	0.498	0.385	0.113	479.8	180.2	67.6	0.053
14.2	0.602	0.507	0.514	0.401	0.113	502.2	189.0	71.1	0.051
15.2	0.599	0.512	0.519	0.406	0.113	509.0	191.7	72.1	0.051
16.3	0.593	0.523	0.531	0.417	0.114	525.0	198.0	74.6	0.050
17.2	0.578	0.548	0.556	0.442	0.114	560.2	[illegible]	80.2	0.048
18.0	0.580	0.545	0.553	0.439	0.114	555.4	210.1	79.4	0.048
19.0	0.580	0.545	0.553	0.439	0.114	555.4	210.1	79.4	0.048
19.8	0.580	0.545	0.553	0.439	0.114	555.4	210.1	79.4	0.048
20.2	0.583	0.540	0.548	0.434	0.114	548.3	207.3	78.3	0.049
21.0	0.590	0.528	0.536	0.422	0.114	531.9	200.8	75.7	0.050
22.0	0.622	0.475	0.481	0.369	0.112	457.9	171.6	64.2	0.054
23.0	0.651	0.429	0.434	0.324	0.111	394.9	146.9	54.6	0.059
24.0	0.682	0.385	0.388	0.279	0.109	333.9	123.2	45.4	0.065
25.0	0.682	0.383	0.388	0.279	0.109	333.9	123.2	45.4	0.065
26.3	0.664	0.409	0.415	0.304	0.110	368.9	136.7	50.7	0.061
27.1	0.687	0.376	0.381	0.271	0.109	324.4	119.5	44.0	0.066
28.5	0.674	0.395	0.400	0.290	0.110	349.3	129.1	47.7	0.063
29.2	0.691	0.369	0.373	0.264	0.109	315.0	115.9	42.6	0.067
30.0	0.695	0.363	0.368	0.259	0.109	307.6	113.0	41.5	0.068
30.7	0.706	0.348	0.352	0.244	0.108	287.4	105.2	38.5	0.071
32.0	0.720	0.329	0.332	0.225	0.108	262.4	95.7	34.9	0.075
33.0	0.738	0.303	0.306	0.199	0.107	229.7	83.2	30.1	0.081
34.7	0.738	0.303	0.306	0.199	0.107	229.7	83.2	30.1	0.081
35.4	0.747	0.291	0.294	0.188	0.107	214.6	77.5	28.0	0.084
36.3	0.749	0.289	0.292	0.185	0.106	211.3	76.2	27.5	0.085
36.8	0.752	0.285	0.288	0.181	0.106	206.4	74.4	26.8	0.086
39.2	0.761	0.273	0.276	0.170	0.106	191.8	68.9	24.7	0.090
39.8	0.758	0.277	0.280	0.174	0.106	196.6	70.7	25.4	0.088
40.8	0.757	0.278	0.281	0.175	0.106	198.3	71.3	25.6	0.088
41.2	0.754	0.[illegible]82	0.285	0.179	0.106	203.1	73.1	26.3	0.087
42.3	0.764	0.269	0.272	0.166	0.106	187.0	67.1	24.0	0.091
44.0	0.770	0.2[illegible]2	0.264	0.158	0.106	177.5	63.5	22.7	0.094
46.2	0.770	0.262	0.264	0.158	0.106	177.5	63.5	22.7	0.094
47.2	0.781	0.248	0.250	0.145	0.105	160.4	57.1	20.3	0.099
48.0	0.795	0.229	0.231	0.126	0.105	137.8	48.7	17.2	0.109
49.2	0.800	0.223	0.225	0.120	0.104	130.4	45.9	16.2	0.112
50.3	0.803	0.219	0.221	0.117	0.104	126.0	44.3	15.6	0.114

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Figure D-17. Ocean optical properties (sheet 2 of 2).

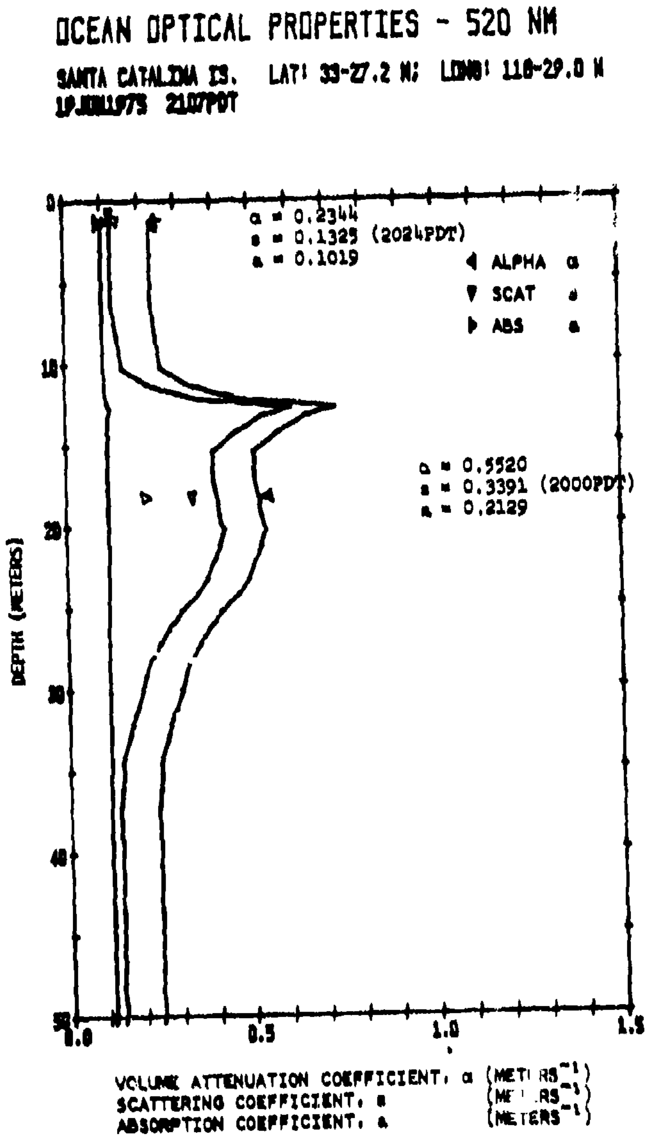

Figure D-18. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
19JUN1975 2107PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.0	0.791	0.234	0.236	0.131	0.105	143.7	50.9	18.0	0.106
2.5	0.791	0.234	0.236	0.131	0.105	143.7	50.9	18.0	0.106
3.0	0.791	0.234	0.236	0.131	0.105	143.7	50.9	18.0	0.106
5.0	0.791	0.234	0.236	0.131	0.105	143.7	50.9	18.0	0.106
6.0	0.791	0.234	0.236	0.131	0.105	143.7	50.9	18.0	0.106
8.0	0.782	0.246	0.249	0.144	0.105	158.9	56.5	20.1	0.100
10.0	0.772	0.259	0.262	0.156	0.106	174.4	62.3	22.3	0.095
11.0	0.725	0.322	0.325	0.218	0.107	253.7	92.3	33.6	0.076
12.0	0.627	0.467	0.473	0.362	0.112	447.1	167.3	62.6	0.055
12.5	0.490	0.714	0.726	0.606	0.119	798.0	307.2	118.2	0.039
13.0	0.527	0.641	0.651	0.534	0.117	691.6	264.4	101.0	0.043
14.0	0.568	0.566	0.574	0.459	0.115	584.3	221.5	84.0	0.047
15.2	0.605	0.502	0.509	0.396	0.113	495.4	186.3	70.0	0.052
16.5	0.605	0.502	0.509	0.396	0.113	495.4	186.3	70.0	0.052
17.0	0.604	0.504	0.511	0.398	0.113	497.6	187.2	70.4	0.052
18.0	0.599	0.512	0.519	0.406	0.113	509.0	191.7	72.1	0.051
19.1	0.595	0.518	0.526	0.412	0.113	518.1	195.3	73.6	0.050
20.0	0.590	0.528	0.536	0.422	0.114	531.9	200.8	75.7	0.050
21.0	0.596	0.517	0.524	0.411	0.113	515.8	194.4	73.2	0.050
22.0	0.607	0.499	0.506	0.393	0.113	490.9	184.6	69.3	0.052
23.0	0.617	0.483	0.489	0.377	0.112	468.8	175.8	65.9	0.053
24.0	0.637	0.452	0.458	0.346	0.111	425.9	159.0	59.3	0.056
25.0	0.666	0.406	0.412	0.302	0.110	364.9	135.2	50.1	0.062
26.0	0.686	0.377	0.382	0.273	0.109	326.3	120.2	44.3	0.066
27.0	0.705	0.349	0.353	0.245	0.108	289.2	105.9	38.8	0.071
28.0	0.725	0.322	0.325	0.218	0.107	253.7	92.3	33.6	0.076
29.0	0.737	0.306	0.309	0.202	0.107	233.1	84.5	30.6	0.080
30.0	0.745	0.294	0.297	0.190	0.107	218.0	78.7	28.4	0.083
32.0	0.766	0.267	0.269	0.164	0.106	183.8	65.9	23.6	0.092
34.0	0.784	0.243	0.245	0.140	0.105	154.3	54.8	19.5	0.102
34.3	0.787	0.239	0.241	0.136	0.105	149.7	53.1	18.8	0.103
35.0	0.784	0.243	0.245	0.140	0.105	154.3	54.8	19.5	0.102
36.0	0.790	0.235	0.237	0.133	0.105	145.2	51.4	18.2	0.105
37.0	0.793	0.232	0.234	0.129	0.105	140.7	49.8	17.6	0.107
39.0	0.791	0.234	0.236	0.131	0.105	143.7	50.9	18.0	0.106
40.0	0.791	0.234	0.236	0.131	0.105	143.7	50.9	18.0	0.106
42.0	0.792	0.233	0.235	0.130	0.105	142.2	50.3	17.8	0.107
43.5	0.791	0.234	0.236	0.131	0.105	143.7	50.9	18.0	0.106
45.5	0.793	0.232	0.234	0.129	0.105	140.7	49.8	17.6	0.107
46.2	0.791	0.234	0.236	0.131	0.105	143.7	50.9	18.0	0.106
47.2	0.794	0.230	0.232	0.128	0.105	139.3	49.2	17.4	0.108
49.2	0.791	0.234	0.236	0.131	0.105	143.7	50.9	18.0	0.106
50.3	0.793	0.232	0.234	0.129	0.105	140.7	49.8	17.6	0.107

PAUSE READY PLOTTER

Figure D-18. Ocean optical properties (sheet 2 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT: 33-27.2 N; LONG: 118-29.0 W
19JUL1975 2127PDT

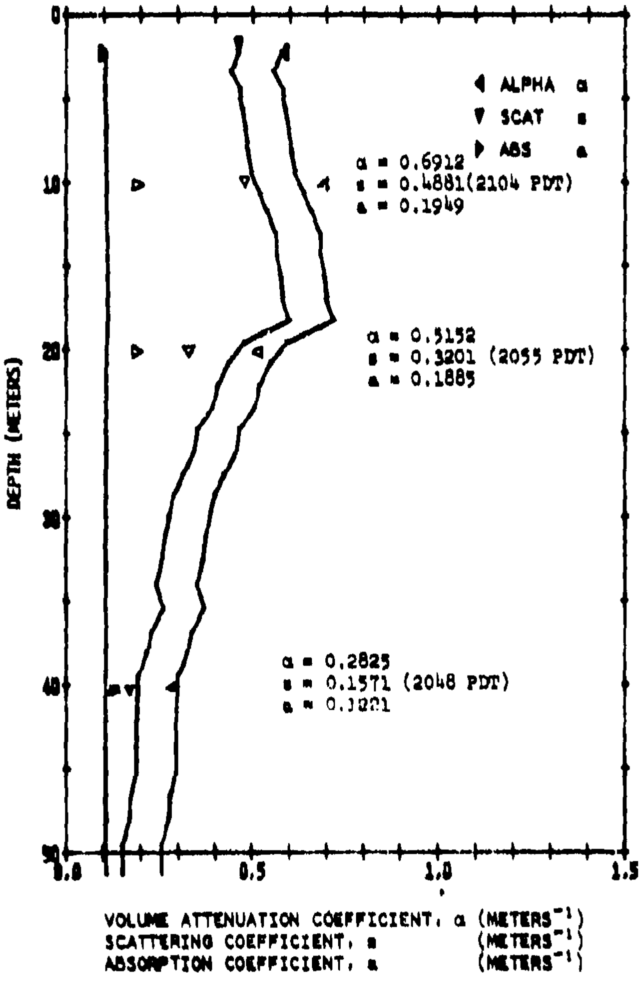

Figure D-19. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PRUPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
19JUL1975 2127PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
2.0	0.561	0.578	0.586	0.471	0.115	601.5	228.4	86.7	0.046
3.1	0.572	0.559	0.567	0.452	0.115	574.6	217.7	82.4	0.047
4.2	0.559	0.581	0.590	0.475	0.115	606.4	230.4	87.5	0.046
5.4	0.559	0.588	0.597	0.481	0.116	616.4	234.3	89.0	0.046
6.6	0.551	0.595	0.604	0.489	0.116	626.5	238.4	90.6	0.045
7.9	0.547	0.602	0.612	0.496	0.116	636.7	242.4	92.3	0.045
9.2	0.543	0.611	0.621	0.504	0.116	649.5	247.5	94.3	0.044
10.5	0.530	0.635	0.645	0.528	0.117	683.6	261.2	99.7	0.043
11.6	0.519	0.656	0.666	0.548	0.118	713.2	273.1	104.5	0.042
12.9	0.507	0.679	0.690	0.571	0.118	746.4	286.4	109.8	0.041
14.2	0.506	0.681	0.692	0.573	0.118	749.2	287.5	110.3	0.041
15.5	0.501	0.690	0.701	0.583	0.119	763.3	293.2	112.6	0.040
16.8	0.499	0.694	0.705	0.587	0.119	769.0	295.5	113.5	0.040
18.1	0.492	0.710	0.722	0.602	0.119	792.1	304.8	117.3	0.039
19.4	0.555	0.588	0.597	0.481	0.116	616.4	234.3	89.0	0.046
20.6	0.579	0.547	0.555	0.440	0.114	557.8	211.0	79.8	0.048
22.0	0.596	0.517	0.524	0.411	0.113	515.8	194.4	73.2	0.050
23.3	0.605	0.502	0.509	0.396	0.113	495.4	186.3	70.0	0.052
24.6	0.631	0.461	0.467	0.355	0.112	438.6	164.0	61.3	0.055
26.0	0.638	0.450	0.456	0.345	0.111	423.8	158.2	59.0	0.057
27.3	0.656	0.421	0.427	0.316	0.111	384.8	142.9	53.1	0.060
28.5	0.673	0.396	0.401	0.291	0.110	351.2	129.9	48.0	0.063
29.8	0.682	0.383	0.388	0.279	0.109	333.9	123.2	45.4	0.065
31.1	0.689	0.372	0.376	0.267	0.109	318.7	117.3	43.2	0.067
32.6	0.696	0.362	0.366	0.257	0.109	305.7	112.3	41.2	0.068
33.9	0.706	0.348	0.352	0.244	0.108	287.4	105.2	38.5	0.071
35.3	0.692	0.368	0.372	0.263	0.109	313.1	115.1	42.3	0.067
36.8	0.716	0.334	0.338	0.230	0.108	269.5	98.4	35.9	0.074
38.0	0.726	0.321	0.324	0.217	0.107	251.9	91.7	33.3	0.076
39.4	0.743	0.297	0.300	0.193	0.107	221.3	80.0	28.9	0.082
40.9	0.745	0.294	0.297	0.190	0.107	218.0	78.7	28.4	0.083
42.1	0.747	0.291	0.294	0.188	0.107	214.6	77.5	28.0	0.084
43.7	0.747	0.291	0.294	0.188	0.107	214.6	77.5	28.0	0.084
45.2	0.749	0.289	0.292	0.185	0.106	211.3	76.2	27.5	0.085
46.5	0.760	0.274	0.277	0.171	0.106	193.4	69.5	24.9	0.089
47.8	0.763	0.271	0.273	0.167	0.106	188.6	67.7	24.3	0.090
49.5	0.777	0.253	0.255	0.150	0.105	166.6	59.4	21.2	0.097
51.2	0.779	0.250	0.253	0.147	0.105	163.5	58.2	20.7	0.098

PAUSE READY PLOTTER

Figure D-19. Ocean optical properties (sheet 2 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT: 33-27.2 N; LONG: 118-29.0 W
20JUN1975 OPSOPDT

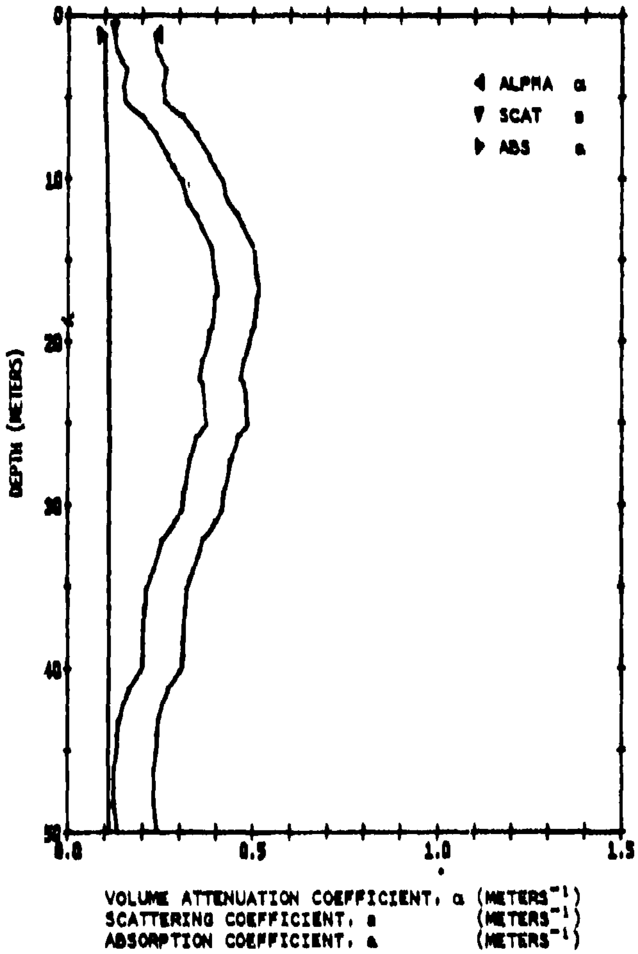

Figure D-20. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
20JUN1975 0950PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.0	0.789	0.236	0.239	0.134	0.105	146.7	52.0	18.4	0.105
2.0	0.785	0.241	0.244	0.139	0.105	152.8	54.2	19.2	0.102
3.1	0.766	0.267	0.269	0.164	0.106	183.8	65.9	23.6	0.092
4.1	0.772	0.259	0.262	0.156	0.106	174.4	62.3	22.3	0.095
5.1	0.769	0.263	0.265	0.160	0.106	179.1	64.1	22.9	0.093
6.0	0.735	0.308	0.312	0.205	0.107	236.5	85.8	31.1	0.079
7.1	0.710	0.342	0.346	0.238	0.108	280.2	102.5	37.5	0.072
8.5	0.686	0.377	0.382	0.273	0.109	326.3	120.2	44.3	0.066
9.1	0.676	0.392	0.397	0.287	0.110	345.4	127.6	47.1	0.064
10.0	0.661	0.414	0.419	0.309	0.110	374.8	139.1	51.6	0.061
11.3	0.651	0.429	0.434	0.324	0.111	394.9	146.9	54.6	0.059
12.1	0.637	0.452	0.458	0.346	0.111	425.9	159.0	59.3	0.056
14.0	0.611	0.492	0.499	0.387	0.113	482.0	181.0	68.0	0.052
14.3	0.608	0.497	0.504	0.391	0.113	488.7	183.7	69.0	0.052
15.8	0.605	0.502	0.509	0.396	0.113	495.4	186.3	70.0	0.052
16.3	0.601	0.509	0.516	0.403	0.113	504.4	189.9	71.4	0.051
17.0	0.601	0.509	0.516	0.403	0.113	504.4	189.9	71.4	0.051
17.2	0.605	0.502	0.509	0.396	0.113	495.4	186.3	70.0	0.052
19.0	0.609	0.496	0.503	0.390	0.113	486.5	182.8	68.7	0.052
19.3	0.614	0.488	0.494	0.382	0.113	475.4	178.4	66.9	0.053
19.9	0.617	0.483	0.489	0.377	0.112	468.8	175.8	65.9	0.053
21.1	0.627	0.467	0.473	0.362	0.112	447.1	167.3	62.6	0.055
22.2	0.633	0.458	0.464	0.352	0.112	434.4	162.3	60.6	0.056
22.5	0.627	0.467	0.473	0.362	0.112	447.1	167.3	62.6	0.055
23.0	0.625	0.470	0.477	0.365	0.112	451.4	169.0	63.2	0.055
25.0	0.621	0.477	0.483	0.371	0.112	460.1	172.4	64.6	0.054
25.8	0.639	0.449	0.454	0.343	0.111	421.7	157.4	58.7	0.057
27.2	0.650	0.430	0.436	0.325	0.111	397.0	147.7	54.9	0.059
29.0	0.661	0.414	0.419	0.309	0.110	374.8	139.1	51.6	0.061
30.3	0.666	0.406	0.412	0.302	0.110	364.9	135.2	50.1	0.062
31.0	0.678	0.389	0.394	0.284	0.110	341.5	126.1	46.6	0.064
31.2	0.680	0.386	0.391	0.281	0.109	337.7	124.6	46.0	0.065
31.4	0.684	0.380	0.385	0.276	0.109	330.1	121.7	44.8	0.065
32.1	0.700	0.356	0.360	0.252	0.109	298.3	109.5	40.1	0.069
34.0	0.720	0.329	0.332	0.225	0.108	262.4	95.7	34.9	0.075
35.1	0.733	0.311	0.315	0.207	0.107	239.9	87.1	31.6	0.079
36.1	0.736	0.307	0.310	0.203	0.107	234.8	85.1	30.8	0.080
36.3	0.737	0.305	0.308	0.201	0.107	231.4	83.8	30.4	0.080
38.4	0.741	0.299	0.302	0.196	0.107	224.6	81.3	29.4	0.082
39.4	0.741	0.299	0.302	0.196	0.107	224.6	81.3	29.4	0.082
39.8	0.741	0.299	0.302	0.196	0.107	224.6	81.3	29.4	0.082
40.2	0.746	0.293	0.296	0.189	0.107	216.3	78.1	28.2	0.084
41.2	0.768	0.254	0.267	0.161	0.106	180.7	64.7	23.1	0.093
42.1	0.780	0.249	0.251	0.146	0.105	161.9	57.7	20.5	0.099
43.2	0.790	0.235	0.237	0.133	0.105	145.2	51.4	18.2	0.105
44.1	0.794	0.230	0.232	0.128	0.105	139.3	49.2	17.4	0.108
45.1	0.794	0.230	0.232	0.128	0.105	139.3	49.2	17.4	0.108
46.2	0.801	0.222	0.224	0.119	0.104	129.0	45.4	16.0	0.113
48.1	0.801	0.222	0.224	0.119	0.104	129.0	45.4	16.0	0.113
48.3	0.800	0.223	0.225	0.120	0.104	130.4	45.9	16.2	0.112
48.5	0.800	0.223	0.225	0.120	0.104	130.4	45.9	16.2	0.112
50.0	0.795	0.229	0.231	0.126	0.105	137.8	48.7	17.2	0.109

PAUSE READY PLOTTER

Figure D-20. Ocean optical properties (sheet 2 of 2).

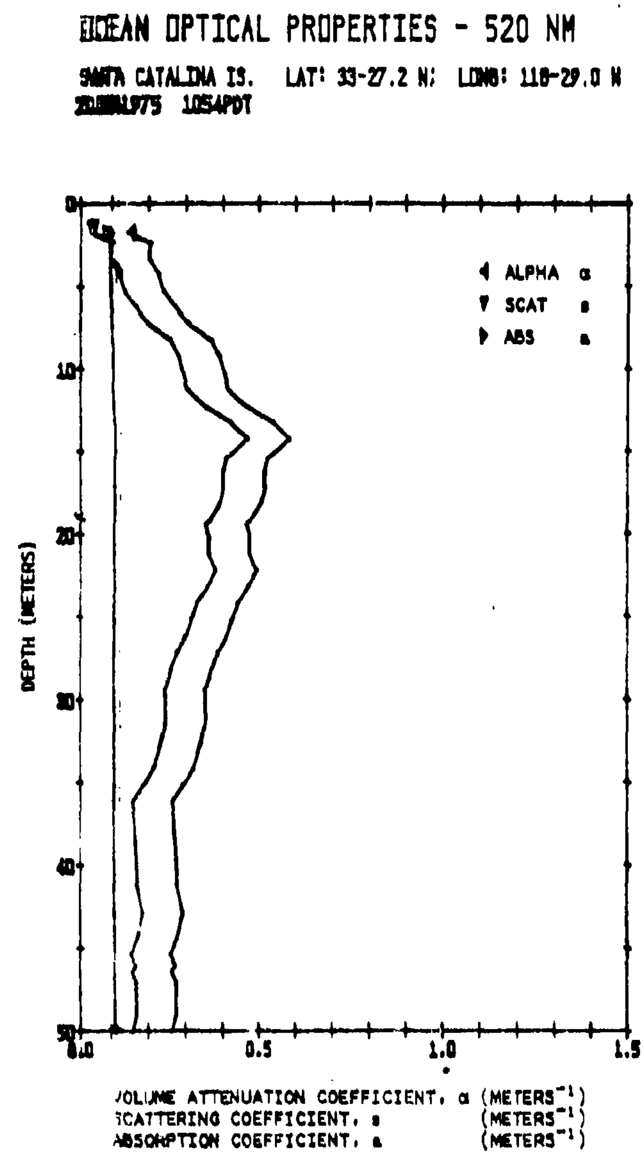

Figure D-21. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
20JUN1975 1054PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.5	0.861	0.150	0.151	0.048	0.102	47.0	15.8	5.3	0.202
2.1	0.811	0.210	0.211	0.107	0.104	114.5	40.1	14.0	0.121
3.0	0.813	0.207	0.209	0.105	0.104	111.7	39.1	13.6	0.123
4.0	0.793	0.232	0.234	0.129	0.105	140.7	49.8	17.6	0.107
5.0	0.784	0.243	0.245	0.140	0.105	154.3	54.8	19.5	0.102
6.0	0.759	0.276	0.278	0.172	0.106	195.0	70.1	25.2	0.089
7.0	0.735	0.308	0.312	0.205	0.107	236.5	85.8	31.1	0.079
8.0	0.692	0.368	0.372	0.263	0.109	313.1	115.1	42.3	0.067
9.0	0.677	0.390	0.395	0.286	0.110	343.5	126.9	46.8	0.064
10.0	0.668	0.404	0.409	0.299	0.110	361.0	133.7	49.5	0.062
11.0	0.661	0.414	0.419	0.309	0.110	374.8	139.1	51.6	0.061
12.0	0.632	0.459	0.465	0.354	0.112	436.5	163.1	60.9	0.056
13.0	0.588	0.532	0.539	0.425	0.114	536.6	202.6	76.5	0.049
14.0	0.561	0.578	0.586	0.471	0.115	601.5	228.4	86.7	0.046
15.2	0.594	0.520	0.527	0.414	0.114	520.4	196.2	73.9	0.052
16.0	0.600	0.510	0.517	0.404	0.113	506.7	190.8	71.8	0.051
17.0	0.600	0.510	0.517	0.404	0.113	506.7	190.8	71.8	0.051
18.0	0.607	0.499	0.506	0.393	0.113	490.9	184.6	69.3	0.052
19.2	0.629	0.464	0.470	0.358	0.112	442.9	165.6	61.9	0.055
20.0	0.625	0.470	0.477	0.365	0.112	451.4	169.0	63.2	0.055
21.0	0.625	0.470	0.477	0.365	0.112	451.4	169.0	63.2	0.055
22.0	0.614	0.488	0.494	0.382	0.113	475.4	178.4	66.9	0.053
23.0	0.628	0.466	0.472	0.360	0.112	445.0	166.5	62.3	0.055
24.0	0.644	0.439	0.445	0.334	0.111	409.3	152.5	56.8	0.058
25.0	0.656	0.421	0.427	0.316	0.111	384.8	142.9	53.1	0.060
26.0	0.666	0.406	0.412	0.302	0.110	364.9	135.2	50.1	0.062
27.0	0.683	0.382	0.386	0.277	0.109	332.0	122.4	45.1	0.065
28.0	0.693	0.366	0.370	0.262	0.109	311.3	114.4	42.0	0.068
29.2	0.705	0.349	0.353	0.245	0.108	289.2	105.9	38.8	0.071
30.0	0.705	0.349	0.353	0.245	0.108	289.2	105.9	38.8	0.071
31.0	0.704	0.351	0.355	0.246	0.108	291.0	106.6	39.1	0.070
32.0	0.710	0.342	0.346	0.238	0.108	280.2	102.5	37.5	0.072
34.0	0.728	0.318	0.321	0.214	0.107	248.5	90.3	32.8	0.077
35.1	0.749	0.289	0.292	0.185	0.106	211.3	76.2	27.5	0.085
36.0	0.770	0.262	0.264	0.158	0.106	177.5	63.5	22.7	0.094
38.0	0.766	0.267	0.269	0.164	0.106	183.8	65.9	23.6	0.092
41.0	0.762	0.272	0.275	0.169	0.106	190.2	68.3	24.5	0.090
42.8	0.750	0.287	0.290	0.184	0.106	209.7	75.6	27.2	0.085
44.0	0.759	0.276	0.278	0.172	0.106	195.0	70.1	25.2	0.089
45.3	0.776	0.254	0.256	0.151	0.105	168.1	60.0	21.4	0.097
46.0	0.766	0.267	0.269	0.164	0.106	183.8	65.9	23.6	0.092
46.4	0.773	0.258	0.260	0.155	0.106	172.8	61.7	22.0	0.095
47.0	0.765	0.268	0.271	0.165	0.106	185.4	66.5	23.8	0.091
49.0	0.765	0.268	0.271	0.165	0.106	185.4	66.5	23.8	0.091
50.0	0.774	0.257	0.259	0.153	0.105	171.2	61.1	21.8	0.096

PAUSE READY PLOTTER

Figure D-21. Ocean optical properties (sheet 2 of 2).

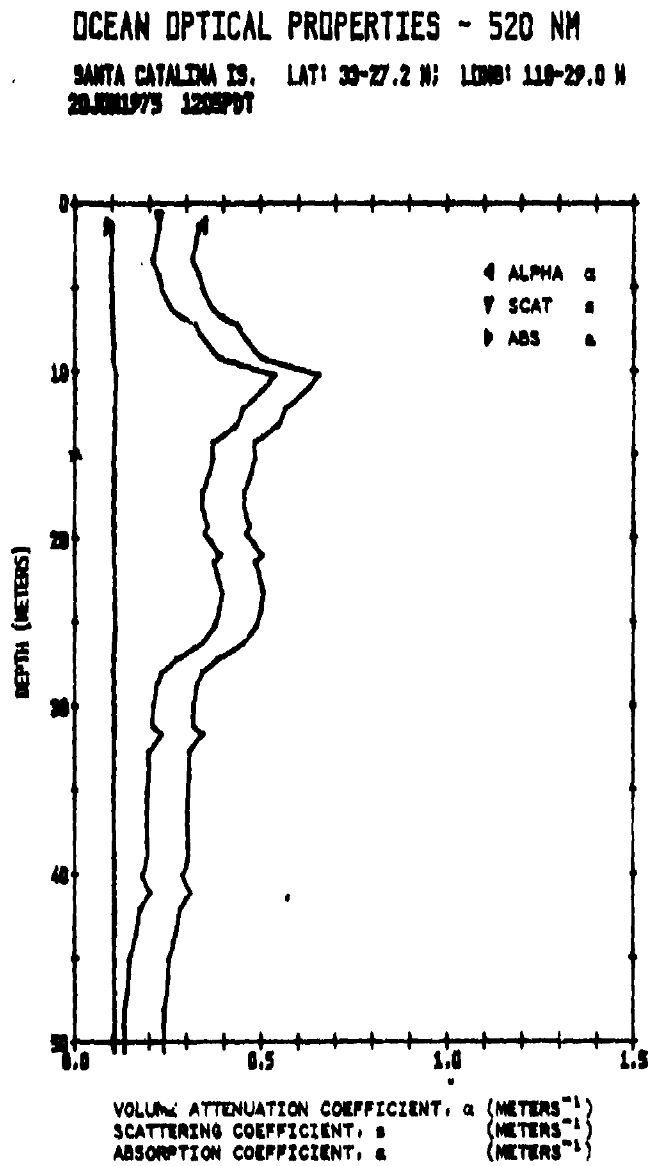

Figure D-22. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
20JUN1975   1205PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.0	0.713	0.338	0.342	0.234	0.108	274.8	100.4	36.7	0.073
3.0	0.727	0.319	0.323	0.215	0.107	250.2	91.0	33.1	0.077
4.0	0.713	0.338	0.342	0.234	0.108	274.8	100.4	36.7	0.073
5.0	0.705	0.349	0.353	0.245	0.108	289.2	105.9	38.8	0.071
6.0	0.689	0.373	0.378	0.269	0.109	320.6	118.0	43.4	0.066
6.5	0.671	0.399	0.404	0.294	0.110	355.1	131.4	48.6	0.063
7.0	0.646	0.436	0.442	0.331	0.111	405.2	150.9	56.2	0.058
8.0	0.629	0.464	0.470	0.358	0.112	442.9	165.6	61.9	0.055
9.0	0.604	0.504	0.511	0.398	0.113	497.6	187.2	70.4	0.052
10.0	0.522	0.650	0.660	0.543	0.118	705.0	269.8	103.2	0.042
11.0	0.542	0.613	0.623	0.506	0.116	652.1	248.6	94.7	0.044
12.0	0.570	0.562	0.570	0.456	0.115	579.4	219.6	83.2	0.047
13.0	0.581	0.543	0.551	0.437	0.114	553.1	209.1	79.0	0.048
14.0	0.617	0.483	0.489	0.377	0.112	468.8	175.8	65.9	0.053
15.0	0.617	0.483	0.489	0.377	0.112	468.8	175.8	65.9	0.053
16.0	0.625	0.470	0.477	0.365	0.112	451.4	169.0	63.2	0.055
17.0	0.636	0.453	0.459	0.348	0.111	428.0	159.8	59.7	0.056
18.0	0.636	0.453	0.459	0.348	0.111	428.0	159.8	59.7	0.056
19.0	0.627	0.467	0.473	0.362	0.112	447.1	167.3	62.6	0.055
19.5	0.631	0.461	0.467	0.355	0.112	438.6	164.0	61.3	0.055
20.0	0.621	0.477	0.483	0.371	0.112	460.1	172.4	64.6	0.054
20.8	0.606	0.500	0.507	0.395	0.113	493.2	185.4	69.7	0.052
21.2	0.616	0.484	0.491	0.379	0.112	471.0	176.7	66.3	0.053
23.0	0.604	0.504	0.511	0.398	0.113	497.6	187.2	70.4	0.052
24.0	0.608	0.497	0.504	0.391	0.113	488.7	183.7	69.0	0.052
25.0	0.616	0.484	0.491	0.379	0.112	471.0	176.7	66.3	0.053
26.0	0.636	0.453	0.459	0.348	0.111	428.0	159.8	59.7	0.056
27.0	0.683	0.382	0.386	0.277	0.109	332.0	122.4	45.1	0.065
27.8	0.710	0.342	0.346	0.238	0.108	280.2	102.5	37.5	0.072
28.5	0.721	0.327	0.331	0.223	0.108	260.7	95.0	34.6	0.075
29.8	0.728	0.318	0.321	0.214	0.107	248.5	90.3	32.8	0.077
31.0	0.730	0.315	0.319	0.211	0.107	245.0	89.0	32.3	0.078
31.5	0.711	0.341	0.345	0.237	0.108	278.4	101.8	37.2	0.072
32.6	0.737	0.305	0.308	0.201	0.107	231.4	83.8	30.4	0.080
34.0	0.737	0.305	0.308	0.201	0.107	231.4	83.8	30.4	0.080
35.0	0.741	0.299	0.302	0.196	0.107	224.6	81.3	29.4	0.082
38.0	0.741	0.299	0.302	0.196	0.107	224.6	81.3	29.4	0.082
39.0	0.742	0.298	0.301	0.194	0.107	223.0	80.6	29.2	0.082
40.0	0.752	0.285	0.288	0.181	0.106	206.4	74.4	26.8	0.086
41.0	0.737	0.306	0.309	0.202	0.107	233.1	84.5	30.6	0.080
42.0	0.757	0.278	0.281	0.175	0.106	198.3	71.3	25.6	0.088
43.5	0.766	0.267	0.269	0.164	0.106	183.8	65.9	23.6	0.092
45.0	0.781	0.248	0.250	0.145	0.105	160.4	57.1	20.3	0.099
47.0	0.785	0.241	0.244	0.139	0.105	152.8	54.2	19.2	0.102
48.0	0.791	0.234	0.236	0.131	0.105	143.7	50.9	18.0	0.106
49.0	0.792	0.233	0.235	0.130	0.105	142.2	50.3	17.8	0.107
50.5	0.792	0.233	0.235	0.130	0.105	142.2	50.3	17.8	0.107

PAUSE READY PLOTTER

Figure D-22. Ocean optical properties (sheet 2 of 2).

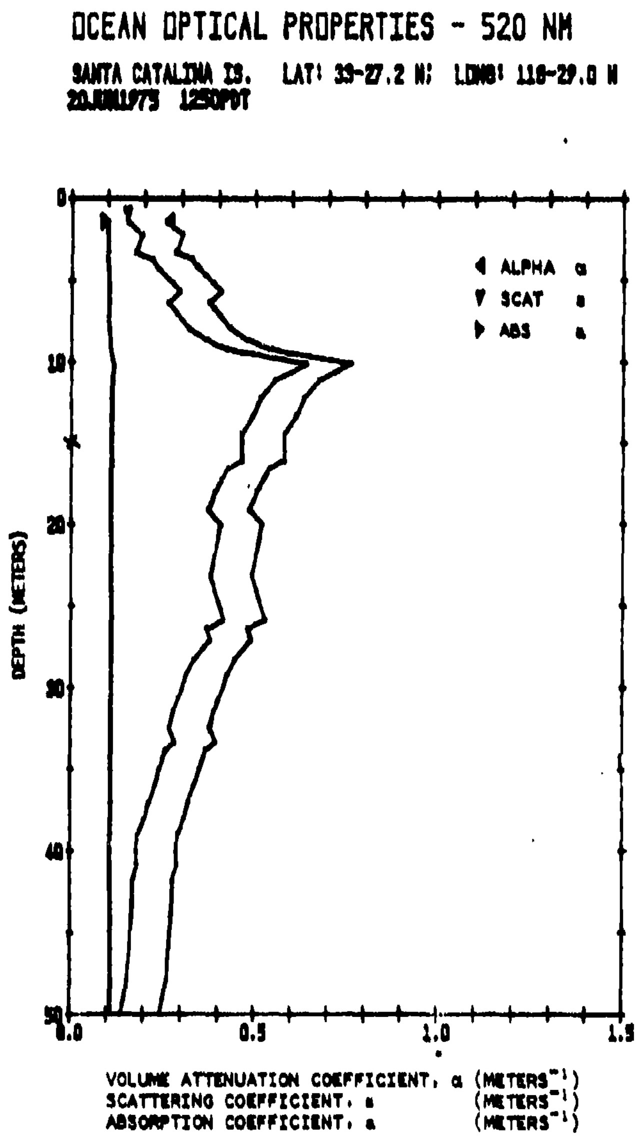

Figure D-23. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
20JUN1975 1250PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.2	0.770	0.262	0.264	0.158	0.106	177.5	63.5	22.7	0.094
2.0	0.739	0.302	0.305	0.198	0.107	228.0	82.6	29.9	0.081
3.1	0.752	0.285	0.288	0.181	0.106	206.4	74.4	26.8	0.086
3.5	0.719	0.330	0.334	0.226	0.108	264.2	96.3	35.1	0.074
4.0	0.710	0.342	0.346	0.238	0.108	280.2	102.5	37.5	0.072
5.0	0.681	0.385	0.389	0.280	0.109	335.8	123.9	45.7	0.065
5.5	0.667	0.405	0.410	0.300	0.110	362.9	134.4	49.8	0.062
6.2	0.689	0.373	0.378	0.269	0.109	320.6	118.0	43.4	0.066
7.8	0.651	0.429	0.434	0.324	0.111	394.9	146.9	54.6	0.059
8.5	0.622	0.475	0.481	0.369	0.112	457.9	171.6	64.2	0.054
9.1	0.588	0.532	0.539	0.425	0.114	536.6	202.6	76.5	0.049
10.0	0.473	0.749	0.761	0.641	0.121	848.8	327.8	126.5	0.038
11.0	0.514	0.665	0.676	0.558	0.118	726.9	278.6	106.7	0.041
12.1	0.535	0.626	0.636	0.519	0.117	670.4	255.9	97.6	0.043
13.2	0.547	0.604	0.613	0.497	0.116	639.2	243.4	92.7	0.045
14.3	0.563	0.574	0.583	0.468	0.115	596.5	226.4	85.9	0.046
16.0	0.563	0.574	0.583	0.468	0.115	596.5	226.4	85.9	0.046
16.4	0.586	0.535	0.543	0.429	0.114	541.3	204.5	77.2	0.049
17.1	0.595	0.518	0.526	0.412	0.113	518.1	195.3	73.6	0.050
17.9	0.607	0.499	0.506	0.393	0.113	490.9	184.6	69.3	0.052
19.0	0.619	0.480	0.486	0.374	0.112	464.4	174.1	65.2	0.054
19.9	0.599	0.512	0.519	0.406	0.113	509.0	191.7	72.1	0.051
23.0	0.615	0.486	0.493	0.380	0.112	473.2	177.6	66.6	0.053
24.0	0.608	0.497	0.504	0.391	0.113	488.7	183.7	69.0	0.052
25.8	0.594	0.520	0.527	0.414	0.114	520.4	196.2	73.9	0.050
26.3	0.622	0.475	0.481	0.369	0.112	457.9	171.6	64.2	0.054
27.0	0.617	0.483	0.489	0.377	0.112	468.8	175.8	65.9	0.053
28.2	0.643	0.441	0.447	0.336	0.111	411.3	153.3	57.1	0.058
29.2	0.659	0.417	0.422	0.312	0.110	378.8	140.6	52.2	0.060
31.4	0.682	0.383	0.388	0.279	0.109	333.9	123.2	45.4	0.065
32.4	0.690	0.370	0.375	0.266	0.109	316.9	116.6	42.9	0.067
33.3	0.680	0.386	0.391	0.281	0.109	337.7	124.6	46.0	0.065
33.8	0.697	0.360	0.365	0.256	0.109	303.9	111.6	40.9	0.069
35.0	0.709	0.344	0.348	0.240	0.108	282.0	103.2	37.7	0.072
37.0	0.730	0.315	0.319	0.211	0.107	245.0	89.0	32.3	0.078
38.0	0.739	0.302	0.305	0.198	0.107	228.0	82.6	29.9	0.081
39.0	0.752	0.285	0.288	0.181	0.106	206.4	74.4	26.8	0.086
40.0	0.754	0.282	0.285	0.179	0.106	203.1	73.1	26.3	0.087
40.8	0.752	0.285	0.288	0.181	0.106	206.4	74.4	26.8	0.086
41.8	0.762	0.272	0.275	0.169	0.106	190.2	68.3	24.5	0.090
44.0	0.766	0.267	0.269	0.164	0.106	183.8	65.9	23.6	0.092
46.0	0.771	0.260	0.263	0.157	0.106	175.9	62.9	22.5	0.094
48.0	0.777	0.253	0.255	0.150	0.105	166.6	59.4	21.2	0.097
50.0	0.790	0.235	0.237	0.133	0.105	145.2	51.4	18.2	0.105

PAUSE READY PLOTTER

Figure D-23. Ocean optical properties (sheet 2 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT! 33-27.2 N; LONG! 118-29.0 W
20JUN1975 1345PDT

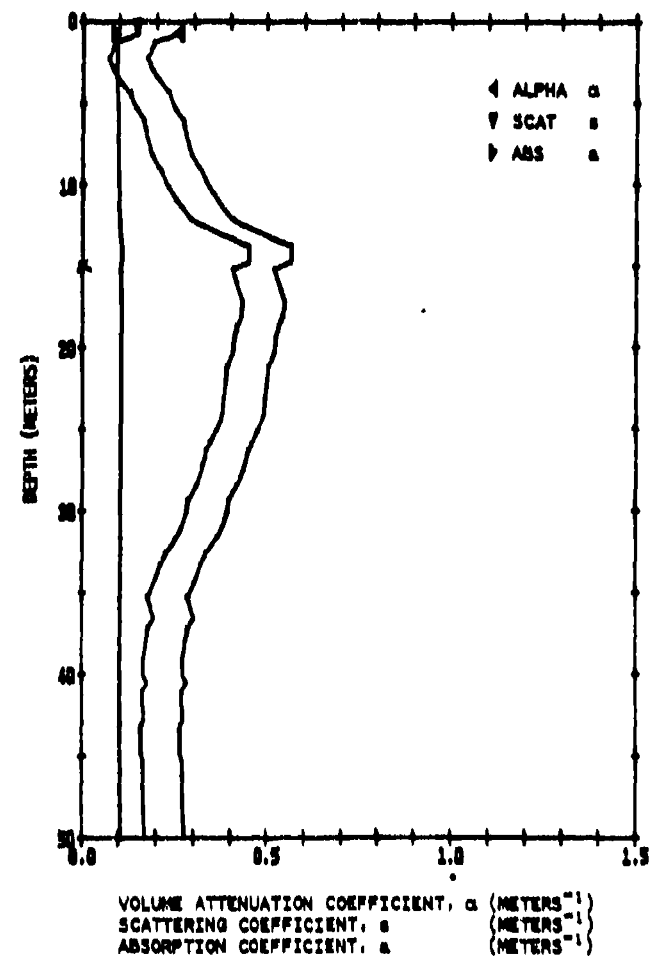

Figure D-24. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
20JUN1975   1345PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
0.5	0.772	0.259	0.262	0.156	0.106	174.4	62.3	22.3	0.095
1.0	0.819	0.200	0.201	0.098	0.104	103.3	36.0	12.5	0.128
2.0	0.834	0.181	0.182	0.079	0.103	81.5	28.0	9.6	0.147
3.1	0.815	0.205	0.206	0.102	0.104	108.9	38.0	13.3	0.124
4.1	0.786	0.240	0.242	0.137	0.105	151.3	53.7	19.0	0.103
5.0	0.776	0.254	0.256	0.151	0.105	168.1	60.0	21.4	0.097
5.8	0.759	0.276	0.278	0.172	0.106	195.0	70.1	25.2	0.089
6.2	0.756	0.280	0.282	0.176	0.106	199.9	71.9	25.9	0.087
8.0	0.741	0.299	0.302	0.196	0.107	224.6	81.3	29.4	0.082
9.0	0.723	0.325	0.328	0.221	0.108	257.2	93.7	34.1	0.076
10.0	0.708	0.345	0.349	0.241	0.108	283.8	103.9	38.0	0.071
12.0	0.666	0.406	0.412	0.302	0.110	364.9	135.2	50.1	0.062
13.0	0.605	0.502	0.509	0.396	0.113	495.4	186.3	70.0	0.052
13.6	0.571	0.560	0.569	0.454	0.115	577.0	218.6	82.8	0.047
14.6	0.571	0.560	0.569	0.454	0.115	577.0	218.6	82.8	0.047
15.0	0.595	0.518	0.526	0.412	0.113	518.1	195.3	73.6	0.050
17.0	0.581	0.543	0.551	0.437	0.114	553.1	209.1	79.0	0.048
18.0	0.584	0.538	0.546	0.432	0.114	546.0	206.3	77.9	0.049
18.5	0.590	0.528	0.536	0.422	0.114	531.9	200.8	75.7	0.050
19.0	0.593	0.523	0.531	0.417	0.114	525.0	198.0	74.6	0.050
20.0	0.595	0.518	0.526	0.412	0.113	518.1	195.3	73.6	0.050
21.0	0.605	0.502	0.509	0.396	0.113	495.4	186.3	70.0	0.052
23.0	0.612	0.491	0.498	0.385	0.113	479.8	180.2	67.6	0.053
24.0	0.615	0.486	0.493	0.380	0.112	473.2	177.6	66.6	0.053
25.0	0.625	0.470	0.477	0.365	0.112	451.4	169.0	63.2	0.055
25.7	0.635	0.455	0.461	0.349	0.112	430.1	160.7	60.0	0.056
26.2	0.642	0.444	0.450	0.339	0.111	415.5	154.9	57.7	0.057
27.1	0.648	0.433	0.439	0.328	0.111	401.1	149.3	55.5	0.058
28.3	0.660	0.415	0.421	0.310	0.110	376.8	139.8	51.9	0.061
29.2	0.674	0.395	0.400	0.290	0.110	349.3	129.1	47.7	0.063
30.0	0.678	0.389	0.394	0.284	0.110	341.5	126.1	46.6	0.064
31.0	0.688	0.375	0.379	0.270	0.109	322.5	118.8	43.7	0.066
31.6	0.697	0.360	0.365	0.256	0.109	303.9	111.6	40.9	0.069
32.5	0.717	0.333	0.337	0.229	0.108	267.7	97.7	35.6	0.074
33.2	0.727	0.319	0.323	0.215	0.107	250.2	91.0	33.1	0.077
35.2	0.753	0.283	0.286	0.180	0.106	204.8	73.7	26.5	0.086
36.5	0.742	0.298	0.301	0.194	0.107	223.0	80.6	29.2	0.082
37.1	0.753	0.283	0.286	0.180	0.106	204.8	73.7	26.5	0.086
39.0	0.763	0.271	0.273	0.167	0.106	188.6	67.7	24.3	0.090
40.0	0.763	0.271	0.273	0.167	0.106	188.6	67.7	24.3	0.090
40.5	0.756	0.280	0.282	0.176	0.106	199.9	71.9	25.9	0.087
41.0	0.765	0.268	0.271	0.165	0.106	185.4	66.5	23.8	0.091
42.0	0.765	0.268	0.271	0.165	0.106	185.4	66.5	23.8	0.091
42.3	0.764	0.269	0.272	0.166	0.106	187.0	67.1	24.0	0.091
42.8	0.764	0.269	0.272	0.166	0.106	187.0	67.1	24.0	0.091
43.1	0.769	0.263	0.265	0.160	0.106	179.1	64.1	22.9	0.093
44.8	0.769	0.263	0.265	0.160	0.106	179.1	64.1	22.9	0.093
45.2	0.765	0.268	0.271	0.165	0.106	185.4	66.5	23.8	0.091
48.0	0.764	0.269	0.272	0.166	0.106	187.0	67.1	24.0	0.091
50.0	0.761	0.273	0.276	0.170	0.106	191.8	68.9	24.7	0.090

PAUSE READY PLOTTER

Figure D-24. Ocean optical properties (sheet 2 of 2).

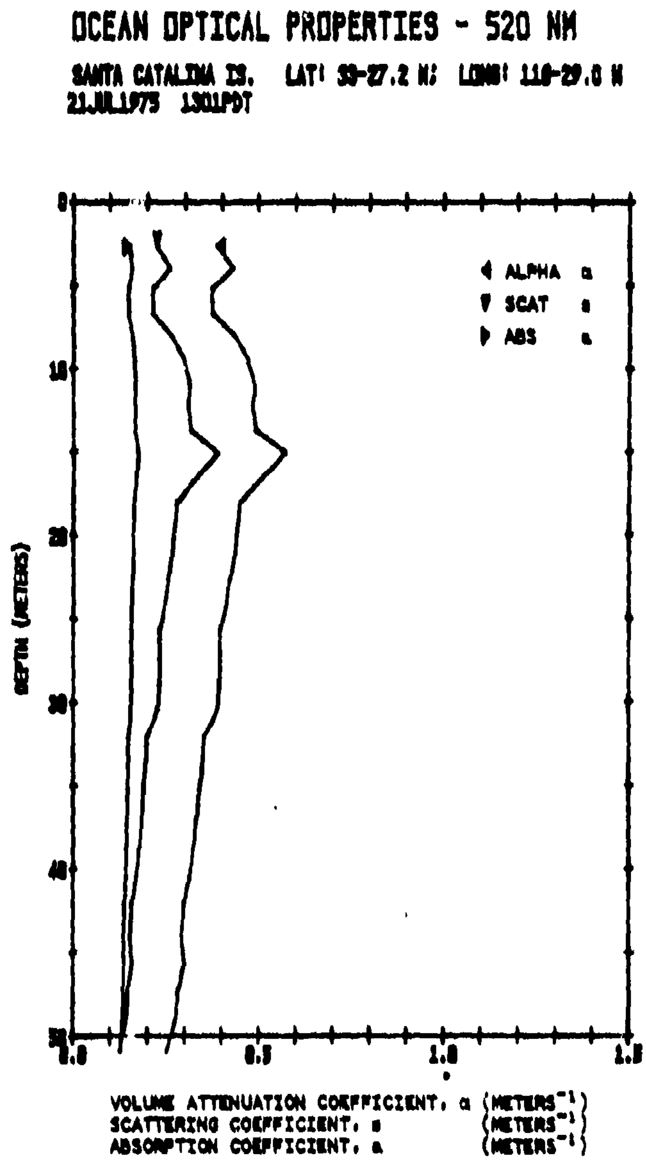

Figure D-25. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
21JUL1975 1301PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
2.4	0.676	0.392	0.396	0.236	0.160	312.3	104.6	40.6	0.076
3.7	0.650	0.430	0.435	0.268	0.167	355.6	120.8	47.5	0.070
4.9	0.686	0.377	0.382	0.224	0.157	296.5	98.7	38.2	0.079
6.4	0.688	0.375	0.379	0.222	0.157	293.4	97.6	37.7	0.079
7.8	0.648	0.433	0.438	0.271	0.167	359.1	122.1	48.1	0.070
9.2	0.625	0.470	0.476	0.303	0.173	402.3	138.5	55.1	0.065
10.7	0.613	0.489	0.495	0.320	0.175	425.1	147.3	58.9	0.063
12.0	0.616	0.484	0.490	0.316	0.175	419.3	145.0	57.9	0.064
13.5	0.611	0.492	0.498	0.323	0.176	429.0	148.7	59.5	0.063
14.9	0.566	0.569	0.576	0.393	0.183	524.4	185.9	75.8	0.055
16.6	0.607	0.499	0.505	0.328	0.176	436.8	151.8	60.8	0.062
17.9	0.639	0.449	0.454	0.284	0.170	376.8	128.8	50.9	0.068
19.5	0.644	0.439	0.444	0.276	0.168	366.1	124.0	49.2	0.069
20.8	0.648	0.433	0.438	0.271	0.167	359.1	122.1	48.1	0.070
22.3	0.658	0.418	0.423	0.258	0.165	342.0	115.7	45.3	0.072
23.9	0.664	0.409	0.414	0.251	0.163	331.9	111.9	43.7	0.074
25.6	0.676	0.392	0.396	0.236	0.160	312.3	104.6	40.6	0.076
27.0	0.675	0.393	0.398	0.237	0.160	313.9	105.2	40.9	0.076
28.8	0.678	0.389	0.393	0.234	0.160	309.1	103.4	40.1	0.077
30.3	0.681	0.385	0.389	0.230	0.159	304.3	101.6	39.4	0.078
32.0	0.705	0.349	0.353	0.202	0.151	266.2	87.6	33.5	0.084
33.4	0.708	0.345	0.349	0.198	0.150	261.8	86.0	32.9	0.085
35.2	0.715	0.336	0.339	0.191	0.148	251.7	82.3	31.4	0.087
37.0	0.720	0.329	0.332	0.186	0.147	244.6	79.8	30.3	0.089
38.7	0.726	0.321	0.324	0.179	0.145	236.2	76.7	29.1	0.091
40.5	0.734	0.310	0.313	0.171	0.142	225.3	72.8	27.4	0.093
42.1	0.745	0.294	0.297	0.159	0.138	209.4	67.1	25.1	0.098
43.7	0.750	0.287	0.290	0.154	0.136	202.9	64.8	24.2	0.100
45.7	0.744	0.295	0.298	0.160	0.138	210.7	67.6	25.3	0.097
47.3	0.757	0.278	0.281	0.148	0.133	194.1	61.7	22.9	0.102
49.1	0.763	0.271	0.273	0.142	0.131	186.6	59.1	21.9	0.105
51.0	0.782	0.246	0.249	0.125	0.124	163.9	51.2	18.7	0.114

PAUSE READY PLOTTER

Figure D-25. Ocean optical properties (sheet 2 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT: 33-27.2 N; LONG: 118-29.0 W
21JUL1975 1305PDT

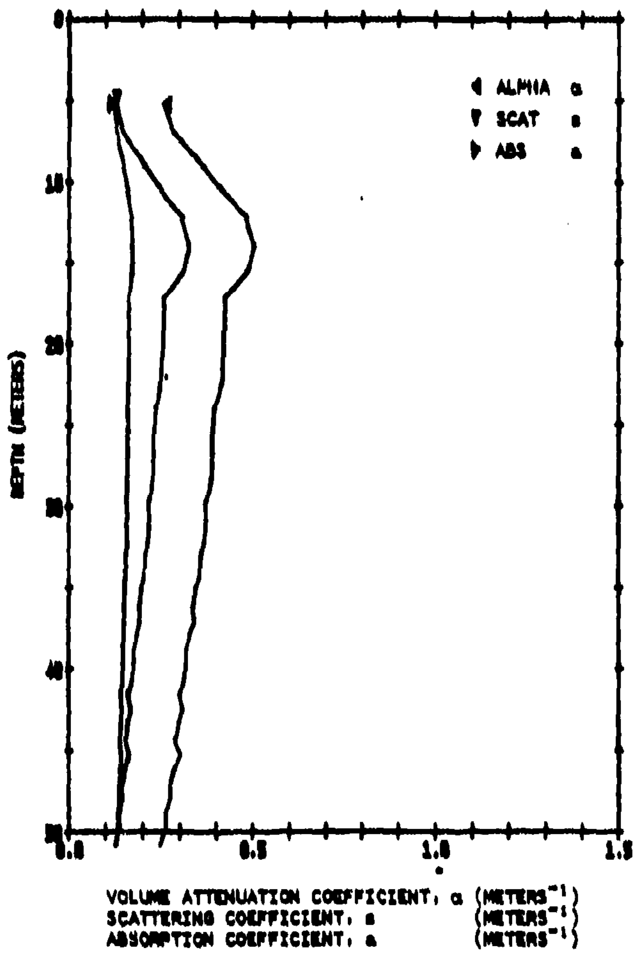

Figure D-26. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
21JUL1975 1305PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*ZBAR
5.0	0.771	0.260	0.263	0.135	0.128	176.9	55.7	20.5	0.108
6.7	0.752	0.285	0.288	0.152	0.135	200.4	63.9	23.8	0.100
8.3	0.709	0.344	0.347	0.197	0.150	260.3	85.5	32.7	0.085
10.2	0.665	0.408	0.413	0.249	0.163	330.2	111.3	43.5	0.074
12.0	0.620	0.478	0.484	0.310	0.174	411.7	142.1	56.6	0.064
13.8	0.607	0.499	0.505	0.328	0.176	436.8	151.8	60.8	0.062
15.4	0.618	0.481	0.487	0.313	0.174	415.5	143.6	57.3	0.064
17.0	0.657	0.420	0.425	0.259	0.165	343.6	116.3	45.6	0.072
20.4	0.661	0.414	0.418	0.254	0.164	336.9	113.8	44.5	0.073
22.4	0.666	0.406	0.411	0.248	0.163	328.6	110.7	43.2	0.074
23.8	0.677	0.390	0.395	0.235	0.160	310.7	104.0	40.4	0.077
25.2	0.682	0.383	0.387	0.229	0.159	302.7	101.1	39.1	0.078
26.6	0.684	0.380	0.385	0.227	0.158	299.6	99.9	38.7	0.078
28.1	0.685	0.379	0.383	0.225	0.158	298.0	99.3	38.4	0.079
29.7	0.694	0.365	0.369	0.214	0.155	282.6	93.6	36.0	0.081
31.3	0.693	0.366	0.370	0.215	0.155	284.1	94.2	36.3	0.081
32.9	0.703	0.352	0.356	0.204	0.152	269.1	88.7	34.0	0.084
34.5	0.709	0.344	0.347	0.197	0.150	260.3	85.5	32.7	0.085
35.0	0.715	0.336	0.339	0.191	0.148	251.7	82.3	31.4	0.087
36.2	0.720	0.329	0.332	0.186	0.147	244.6	79.8	30.3	0.089
37.0	0.717	0.333	0.336	0.189	0.148	248.8	81.3	30.9	0.088
37.9	0.727	0.319	0.323	0.178	0.144	234.9	76.2	28.9	0.091
38.8	0.733	0.311	0.314	0.172	0.142	226.6	73.3	27.6	0.093
39.7	0.735	0.308	0.312	0.170	0.142	223.9	72.3	27.3	0.094
40.7	0.738	0.303	0.306	0.166	0.140	218.6	70.4	26.5	0.095
41.5	0.747	0.291	0.294	0.157	0.137	206.8	66.2	24.8	0.098
42.5	0.741	0.299	0.302	0.163	0.139	214.6	69.0	25.9	0.096
43.3	0.749	0.289	0.292	0.155	0.136	204.2	65.3	24.4	0.099
44.3	0.756	0.280	0.282	0.149	0.134	195.3	62.1	23.1	0.102
45.3	0.747	0.291	0.294	0.157	0.137	206.8	66.2	24.8	0.098
46.2	0.758	0.277	0.280	0.147	0.133	192.8	61.3	22.8	0.103
47.0	0.766	0.267	0.269	0.139	0.130	182.9	57.8	21.4	0.106
48.0	0.767	0.265	0.268	0.138	0.130	181.7	57.4	21.2	0.107
48.9	0.776	0.254	0.256	0.130	0.126	170.9	53.6	19.7	0.111
49.8	0.776	0.254	0.256	0.130	0.126	170.9	53.6	19.7	0.111
50.9	0.788	0.238	0.240	0.119	0.121	155.9	48.4	17.6	0.117

PAUSE READY PLOTTER

Figure D-26. Ocean optical properties (sheet 2 of 2).

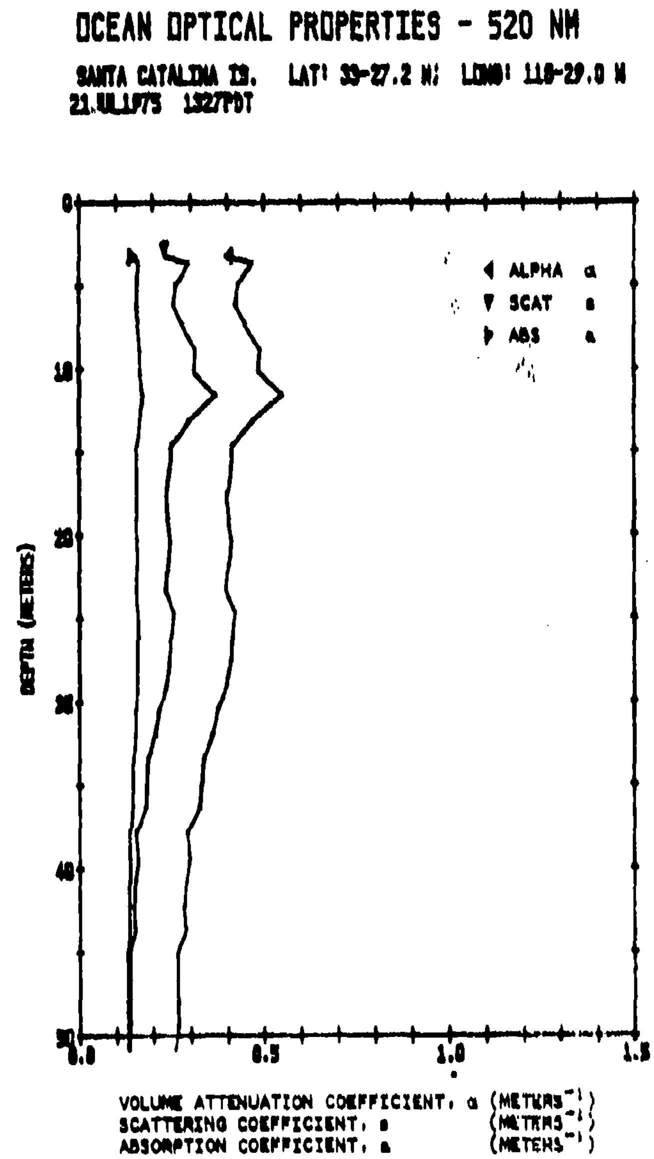

Figure D-27. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
21JUL1975 1327PDT

Z(M)	T(17M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*28AR
3.0	0.668	0.404	0.408	0.246	0.162	325.3	109.4	42.7	0.074
3.4	0.623	0.478	0.479	0.306	0.173	406.1	140.0	55.7	0.065
4.7	0.647	0.435	0.440	0.272	0.168	360.9	122.8	48.3	0.070
5.9	0.653	0.426	0.431	0.264	0.166	350.5	118.9	46.7	0.071
7.1	0.636	0.453	0.458	0.288	0.170	382.2	130.9	51.8	0.067
8.6	0.611	0.492	0.498	0.323	0.176	429.0	148.7	59.5	0.063
10.0	0.613	0.489	0.495	0.320	0.175	425.1	147.3	58.9	0.063
11.4	0.577	0.550	0.557	0.376	0.181	500.4	176.5	71.6	0.057
12.9	0.623	0.473	0.479	0.306	0.173	406.1	140.0	55.7	0.065
14.4	0.659	0.417	0.422	0.257	0.165	340.3	115.0	45.0	0.072
15.8	0.662	0.412	0.417	0.253	0.164	335.2	113.2	44.2	0.073
17.3	0.670	0.401	0.405	0.243	0.162	322.0	108.2	42.2	0.075
18.8	0.667	0.405	0.410	0.247	0.163	326.9	110.1	42.9	0.074
20.1	0.663	0.411	0.415	0.252	0.164	333.6	112.5	44.0	0.073
21.7	0.668	0.404	0.408	0.246	0.162	325.3	109.4	42.7	0.074
23.1	0.673	0.396	0.401	0.240	0.161	317.1	106.4	41.4	0.076
24.5	0.657	0.420	0.425	0.259	0.165	343.6	116.3	45.6	0.072
26.1	0.662	0.412	0.417	0.253	0.164	335.2	113.2	44.2	0.073
27.4	0.666	0.406	0.411	0.248	0.163	328.6	110.7	43.2	0.074
29.1	0.675	0.393	0.398	0.237	0.160	313.9	105.2	40.9	0.076
30.4	0.689	0.373	0.377	0.221	0.157	291.8	[illegible]	37.5	0.080
32.0	0.700	0.356	0.360	0.207	0.153	273.6	90.3	34.7	0.083
33.3	0.716	0.334	0.338	0.190	0.148	250.2	81.8	31.1	0.088
35.0	0.720	0.329	0.332	0.186	0.147	244.6	79.8	30.3	0.089
36.3	0.724	0.323	0.327	0.181	0.145	239.0	77.7	29.5	0.090
37.8	0.748	0.290	0.293	0.156	0.137	205.5	65.8	24.6	0.099
39.4	0.744	0.295	0.298	0.160	0.138	210.7	67.6	25.3	0.097
40.7	0.752	0.285	0.288	0.152	0.135	200.4	63.9	23.8	0.100
42.3	0.757	0.278	0.281	0.148	0.133	194.1	61.7	22.9	0.102
43.6	0.753	0.283	0.286	0.151	0.135	199.1	63.5	23.7	0.101
45.1	0.770	0.262	0.264	0.136	0.128	178.1	56.1	20.7	0.108
46.7	0.772	0.259	0.262	0.134	0.128	175.7	55.3	20.4	0.109
48.0	0.769	0.263	0.265	0.137	0.129	179.3	56.5	20.9	0.107
49.5	0.770	0.262	0.264	0.136	0.128	178.1	56.1	20.7	0.108
50.9	0.778	0.251	0.254	0.129	0.125	166.6	52.9	19.4	0.112

PAUSE READY PLOTTER

Figure D-27. Ocean optical properties (sheet 2 of 2).

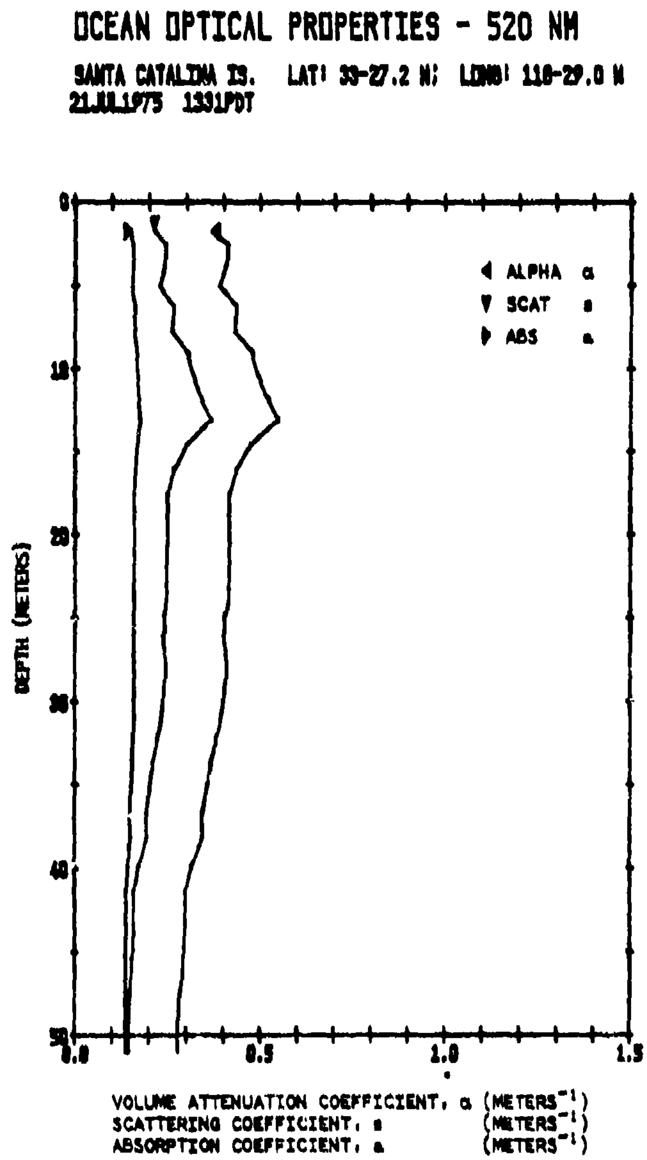

Figure D-28. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA ISL LAT 33-27.2 N LONG. 118-29.0 W

21JUL1975 1331PDT

Z(M)	T(17M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.5	0.689	0.373	0.377	0.221	0.157	291.8	97.0	37.5	0.080
2.3	0.663	0.411	0.415	0.252	0.164	333.6	112.5	44.0	0.073
3.8	0.666	0.406	0.411	0.248	0.163	328.6	110.7	43.2	0.074
4.8	0.678	0.389	0.393	0.234	0.160	309.1	103.4	40.1	0.077
6.0	0.648	0.433	0.438	0.271	0.167	359.1	122.1	48.1	0.070
7.5	0.651	0.429	0.434	0.267	0.167	353.9	120.2	47.2	0.071
8.8	0.622	0.475	0.480	0.307	0.173	408.0	140.7	56.0	0.065
10.2	0.611	0.492	0.498	0.323	0.176	429.0	148.7	59.5	0.063
11.6	0.596	0.517	0.523	0.345	0.178	458.7	160.2	64.5	0.060
12.9	0.580	0.545	0.552	0.371	0.181	494.0	174.0	70.5	0.058
14.4	0.624	0.472	0.477	0.304	0.173	404.2	139.3	55.4	0.065
15.9	0.648	0.433	0.438	0.271	0.167	359.1	122.1	48.1	0.070
17.4	0.661	0.414	0.418	0.254	0.164	336.9	113.8	44.5	0.073
18.7	0.661	0.414	0.418	0.254	0.164	336.9	113.8	44.5	0.073
20.3	0.663	0.411	0.415	0.252	0.164	333.6	112.5	44.0	0.073
21.7	0.664	0.409	0.414	0.251	0.163	331.9	111.9	43.7	0.074
23.2	0.663	0.411	0.415	0.252	0.164	333.6	112.5	44.0	0.073
24.7	0.670	0.401	0.405	0.243	0.162	322.0	108.2	42.2	0.075
25.9	0.672	0.398	0.402	0.241	0.161	318.8	107.0	41.6	0.075
27.6	0.666	0.406	0.411	0.248	0.163	328.6	110.7	43.2	0.074
29.1	0.671	0.399	0.404	0.242	0.162	320.4	107.6	41.9	0.075
30.5	0.676	0.392	0.396	0.236	0.160	312.3	104.6	40.6	0.076
32.0	0.686	0.377	0.382	0.224	0.157	296.5	98.7	38.2	0.079
33.5	0.696	0.362	0.366	0.212	0.154	279.6	92.5	34.6	0.082
35.0	0.704	0.351	0.354	0.203	0.152	267.6	88.1	33.8	0.084
36.6	0.713	0.338	0.342	0.193	0.149	254.5	83.4	31.8	0.087
38.1	0.713	0.338	0.342	0.193	0.149	254.5	83.4	31.8	0.087
39.9	0.733	0.311	0.314	0.172	0.142	226.6	73.3	27.6	0.093
41.4	0.746	0.293	0.296	0.158	0.137	208.1	66.7	24.9	0.098
43.4	0.748	0.290	0.293	0.156	0.137	205.5	65.8	24.6	0.099
45.4	0.752	0.285	0.288	0.152	0.135	200.4	63.9	23.8	0.100
47.5	0.758	0.277	0.280	0.147	0.133	192.8	61.3	22.8	0.103
49.2	0.762	0.272	0.275	0.143	0.132	187.8	59.5	22.1	0.104
51.1	0.765	0.268	0.271	0.140	0.130	184.1	58.2	21.5	0.106

PAUSE READY PLOTTER

Figure D-28. Ocean optical properties (sheet 2 of 2).

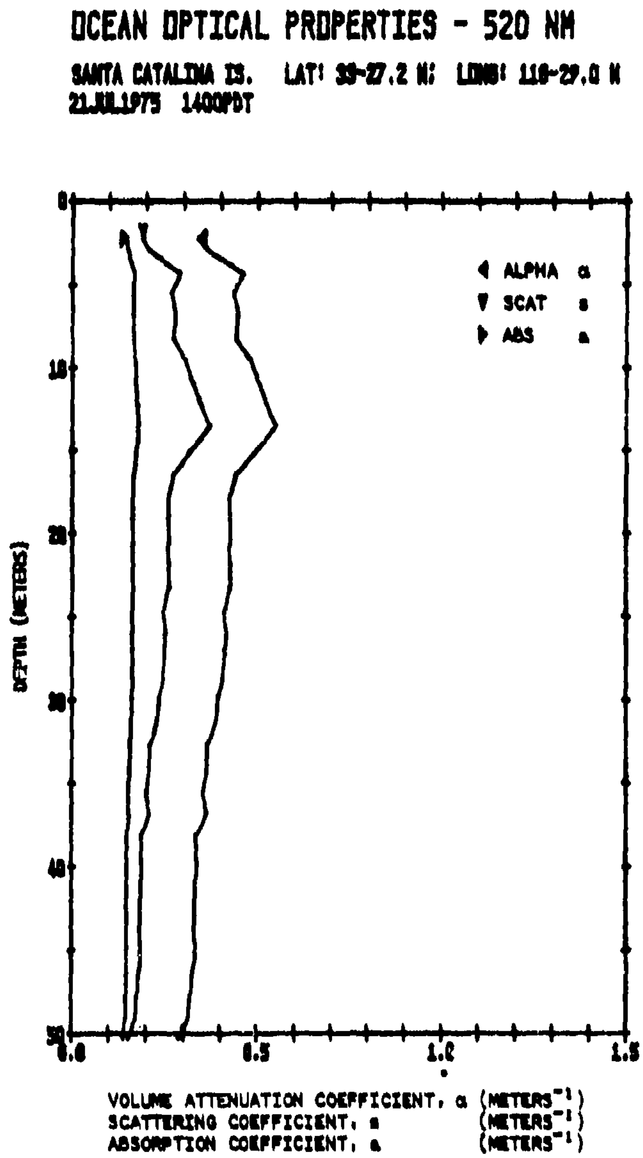

Figure D-29. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 35-27.2 N LONG 118-29.0 W
21JUL1975 1400PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.9	0.712	0.340	0.343	0.194	0.149	256.0	83.9	32.0	0.086
2.6	0.697	0.360	0.364	0.211	0.154	278.1	92.0	35.3	0.082
4.0	0.634	0.456	0.461	0.291	0.171	385.8	132.2	52.4	0.067
5.2	0.649	0.432	0.437	0.270	0.167	357.4	121.5	47.8	0.070
6.5	0.642	0.442	0.447	0.279	0.169	369.6	126.1	49.8	0.069
8.0	0.645	0.438	0.443	0.275	0.168	364.4	124.1	48.9	0.069
9.3	0.622	0.475	0.480	0.307	0.173	408.0	140.7	56.0	0.065
10.8	0.606	0.500	0.506	0.330	0.176	438.8	152.5	61.1	0.062
12.0	0.594	0.520	0.526	0.348	0.179	452.8	161.8	65.2	0.060
13.3	0.581	0.543	0.550	0.369	0.181	491.9	173.1	70.1	0.058
14.8	0.613	0.489	0.495	0.320	0.175	425.1	147.3	58.9	0.063
16.2	0.646	0.436	0.441	0.273	0.168	362.6	123.4	48.6	0.070
17.5	0.657	0.420	0.425	0.259	0.165	343.6	116.3	45.6	0.072
18.9	0.656	0.421	0.426	0.261	0.165	345.3	116.9	45.9	0.072
20.4	0.655	0.418	0.423	0.258	0.165	342.0	115.7	45.3	0.072
21.6	0.656	0.421	0.426	0.261	0.165	345.3	116.9	45.9	0.072
23.0	0.657	0.420	0.425	0.259	0.165	343.6	116.3	45.6	0.072
24.4	0.667	0.405	0.410	0.247	0.163	326.9	110.1	42.9	0.074
25.9	0.663	0.411	0.415	0.252	0.164	333.6	112.5	44.0	0.073
26.9	0.667	0.405	0.410	0.247	0.163	326.9	110.1	42.9	0.074
28.6	0.671	0.399	0.404	0.242	0.162	320.4	107.6	41.9	0.075
29.7	0.679	0.388	0.392	0.232	0.159	307.5	102.8	39.9	0.077
31.2	0.685	0.379	0.383	0.225	0.158	298.0	99.3	38.4	0.079
32.6	0.699	0.358	0.362	0.208	0.153	275.1	90.9	34.9	0.083
33.9	0.700	0.356	0.360	0.207	0.153	273.6	90.3	34.7	0.083
35.4	0.708	0.345	0.349	0.198	0.150	261.8	86.0	32.9	0.085
36.7	0.700	0.356	0.360	0.207	0.153	273.6	90.3	34.7	0.083
38.1	0.721	0.327	0.331	0.184	0.146	243.2	79.3	30.1	0.089
39.6	0.719	0.330	0.334	0.187	0.147	246.0	80.3	30.5	0.088
40.9	0.723	0.325	0.328	0.182	0.146	240.4	78.2	29.7	0.090
42.3	0.724	0.323	0.327	0.181	0.145	239.0	77.7	29.5	0.090
43.6	0.725	0.322	0.325	0.180	0.145	237.6	77.2	29.3	0.090
45.2	0.722	0.326	0.329	0.183	0.146	241.8	78.7	29.9	0.089
46.4	0.729	0.317	0.320	0.176	0.144	232.1	75.3	28.4	0.092
47.8	0.734	0.310	0.313	0.171	0.142	225.3	72.8	27.4	0.093
49.2	0.738	0.303	0.306	0.166	0.140	218.6	70.4	26.5	0.095
50.3	0.756	0.280	0.282	0.149	0.134	195.3	62.1	23.1	0.102

PAUSE READY PLOTTER

Figure D-29. Ocean optical properties (sheet 2 of 2).

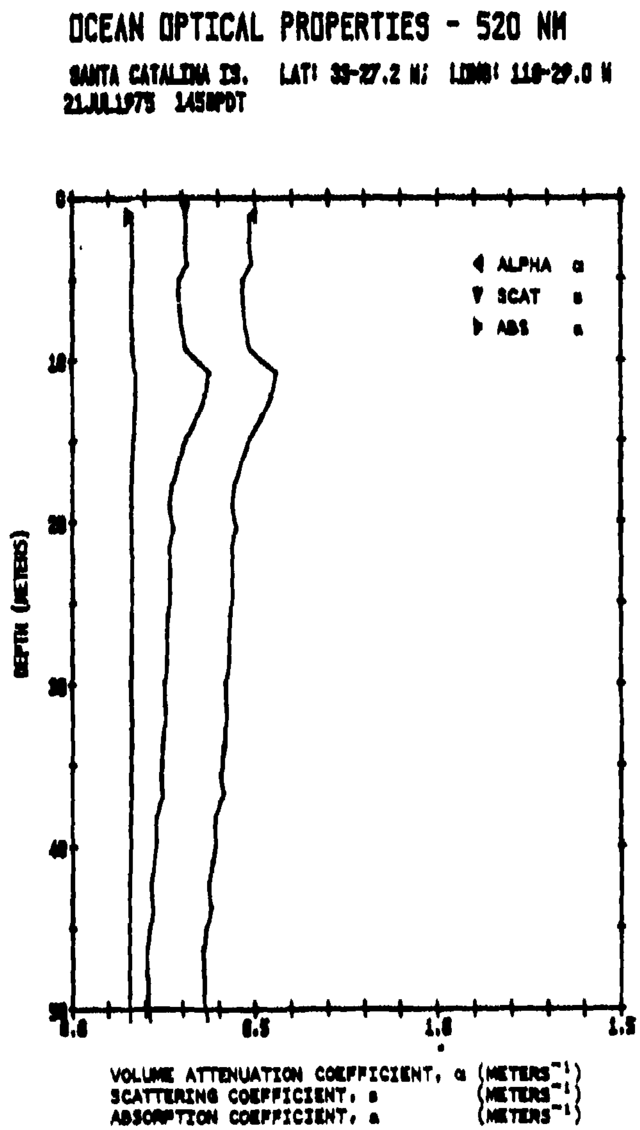

Figure D-30. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
21JUL1975 1458PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
0.8	0.612	0.491	0.497	0.321	0.175	427.0	148.0	59.2	0.063
2.4	0.614	0.488	0.493	0.318	0.175	423.2	146.5	58.5	0.063
3.7	0.611	0.492	0.498	0.323	0.176	429.0	148.7	59.5	0.063
4.8	0.627	0.467	0.473	0.300	0.172	398.6	137.1	54.5	0.066
6.2	0.626	0.469	0.474	0.302	0.173	400.5	137.8	54.8	0.065
7.8	0.621	0.477	0.482	0.308	0.174	409.8	141.4	56.3	0.065
9.1	0.613	0.489	0.495	0.320	0.175	425.1	147.3	58.9	0.063
10.5	0.573	0.557	0.564	0.382	0.182	509.1	179.9	73.1	0.056
11.9	0.580	0.545	0.552	0.371	0.181	494.0	174.0	70.5	0.058
13.2	0.594	0.520	0.526	0.348	0.179	462.8	161.8	65.2	0.060
14.6	0.615	0.486	0.492	0.317	0.175	421.3	145.8	58.2	0.063
15.9	0.628	0.466	0.471	0.299	0.172	396.8	136.4	54.2	0.066
17.4	0.642	0.444	0.449	0.280	0.169	371.4	126.8	50.0	0.069
18.7	0.647	0.435	0.440	0.272	0.168	360.9	122.8	48.3	0.070
20.1	0.640	0.447	0.452	0.283	0.169	375.0	128.1	50.6	0.068
21.4	0.647	0.435	0.440	0.272	0.168	360.9	122.8	48.3	0.070
22.9	0.647	0.435	0.440	0.272	0.168	360.9	122.8	48.3	0.070
24.2	0.647	0.435	0.440	0.272	0.168	360.9	122.8	48.3	0.070
25.6	0.652	0.427	0.432	0.266	0.166	352.2	119.5	47.0	0.071
26.9	0.653	0.426	0.431	0.264	0.166	350.5	118.9	46.7	0.071
28.4	0.653	0.426	0.431	0.264	0.166	350.5	118.9	46.7	0.071
29.7	0.659	0.417	0.422	0.257	0.165	340.3	115.0	45.0	0.072
31.2	0.658	0.418	0.423	0.258	0.165	342.0	115.7	45.3	0.072
32.5	0.661	0.414	0.418	0.254	0.164	336.9	113.8	44.5	0.073
33.8	0.666	0.406	0.411	0.248	0.163	328.6	110.7	43.2	0.074
35.4	0.669	0.402	0.407	0.244	0.162	323.6	108.8	42.4	0.075
36.6	0.665	0.408	0.413	0.249	0.163	330.2	111.3	43.5	0.074
38.1	0.680	0.386	0.390	0.231	0.159	305.9	102.2	39.6	0.077
39.5	0.681	0.385	0.389	0.230	0.159	304.3	101.6	39.4	0.078
40.9	0.687	0.376	0.380	0.223	0.157	294.9	98.2	37.9	0.079
42.2	0.693	0.366	0.370	0.215	0.155	284.1	94.2	36.3	0.081
43.7	0.689	0.373	0.377	0.221	0.157	291.8	97.0	37.5	0.080
45.0	0.697	0.360	0.364	0.211	0.154	278.1	92.0	35.3	0.082
46.4	0.704	0.351	0.354	0.203	0.152	267.6	88.1	33.8	0.084
48.0	0.701	0.355	0.359	0.206	0.153	272.1	89.8	34.4	0.083
49.2	0.702	0.353	0.357	0.205	0.152	270.6	89.2	34.2	0.083
50.7	0.697	0.360	0.364	0.211	0.154	278.1	92.0	35.3	0.082

PAUSE READY PLOTTER

Figure D-30. Ocean optical properties (sheet 2 of 2).

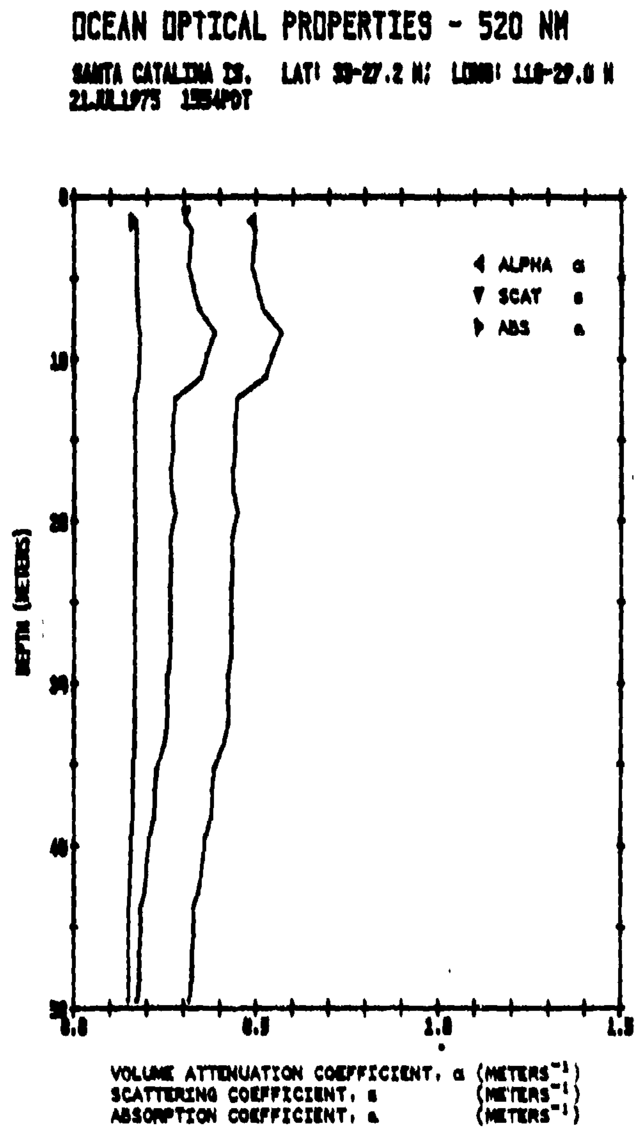

Figure D-31. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
21JUL1975 1554PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.3	0.621	0.477	0.482	0.308	0.174	409.8	141.4	56.3	0.065
1.8	0.611	0.492	0.498	0.323	0.170	429.0	148.7	59.8	0.063
2.6	0.612	0.491	0.497	0.321	0.175	427.0	148.0	59.2	0.063
4.0	0.616	0.484	0.490	0.316	0.175	419.3	145.0	57.9	0.064
5.4	0.607	0.499	0.505	0.328	0.176	436.8	151.8	60.8	0.062
6.7	0.598	0.513	0.520	0.342	0.178	454.7	158.7	63.8	0.061
8.2	0.571	0.560	0.567	0.385	0.182	513.4	181.6	73.9	0.056
9.6	0.584	0.538	0.545	0.365	0.180	485.6	170.7	69.1	0.058
11.0	0.596	0.517	0.523	0.345	0.178	458.7	160.2	64.5	0.060
12.3	0.643	0.441	0.446	0.277	0.169	367.9	125.4	49.5	0.069
13.8	0.648	0.433	0.438	0.271	0.167	359.1	122.1	48.1	0.070
15.1	0.647	0.435	0.440	0.272	0.168	360.9	122.8	48.3	0.070
16.6	0.652	0.427	0.432	0.266	0.166	352.2	119.5	47.0	0.071
18.2	0.650	0.430	0.435	0.268	0.167	355.6	120.8	47.5	0.070
19.5	0.644	0.439	0.444	0.276	0.168	366.1	124.3	49.2	0.069
20.9	0.654	0.424	0.429	0.263	0.166	348.8	118.2	46.4	0.071
22.4	0.652	0.427	0.432	0.266	0.166	352.2	119.5	47.0	0.071
23.9	0.656	0.421	0.426	0.261	0.165	345.3	116.9	45.9	0.072
25.3	0.655	0.423	0.428	0.262	0.166	347.0	117.6	46.1	0.072
26.6	0.656	0.421	0.426	0.261	0.165	345.3	116.9	45.9	0.072
28.1	0.656	0.421	0.426	0.261	0.165	345.3	116.9	45.9	0.072
29.5	0.663	0.411	0.415	0.252	0.164	333.6	112.5	44.0	0.073
32.4	0.662	0.412	0.417	0.253	0.164	335.2	113.2	44.2	0.073
34.0	0.674	0.395	0.399	0.238	0.161	315.5	105.8	41.1	0.076
35.3	0.689	0.373	0.377	0.221	0.157	291.8	97.0	37.5	0.080
36.6	0.692	0.368	0.372	0.216	0.155	285.7	94.8	36.5	0.081
38.3	0.695	0.363	0.367	0.213	0.154	281.1	93.1	35.8	0.081
39.5	0.706	0.348	0.352	0.201	0.151	264.7	87.1	33.3	0.085
41.0	0.712	0.340	0.343	0.194	0.149	256.0	83.9	32.0	0.086
42.5	0.717	0.333	0.336	0.189	0.148	248.8	81.3	30.9	0.088
43.8	0.728	0.318	0.321	0.177	0.144	233.5	75.7	28.6	0.091
45.3	0.728	0.318	0.321	0.177	0.144	233.5	75.7	28.6	0.091
46.8	0.732	0.313	0.316	0.173	0.143	227.0	73.8	27.8	0.093
48.2	0.732	0.313	0.316	0.173	0.143	228.0	73.8	27.8	0.093
49.7	0.738	0.303	0.306	0.166	0.140	218.6	70.4	26.5	0.095

PAUSE READY PLOTTER

Figure D-31. Ocean optical properties (sheet 2 of 2).

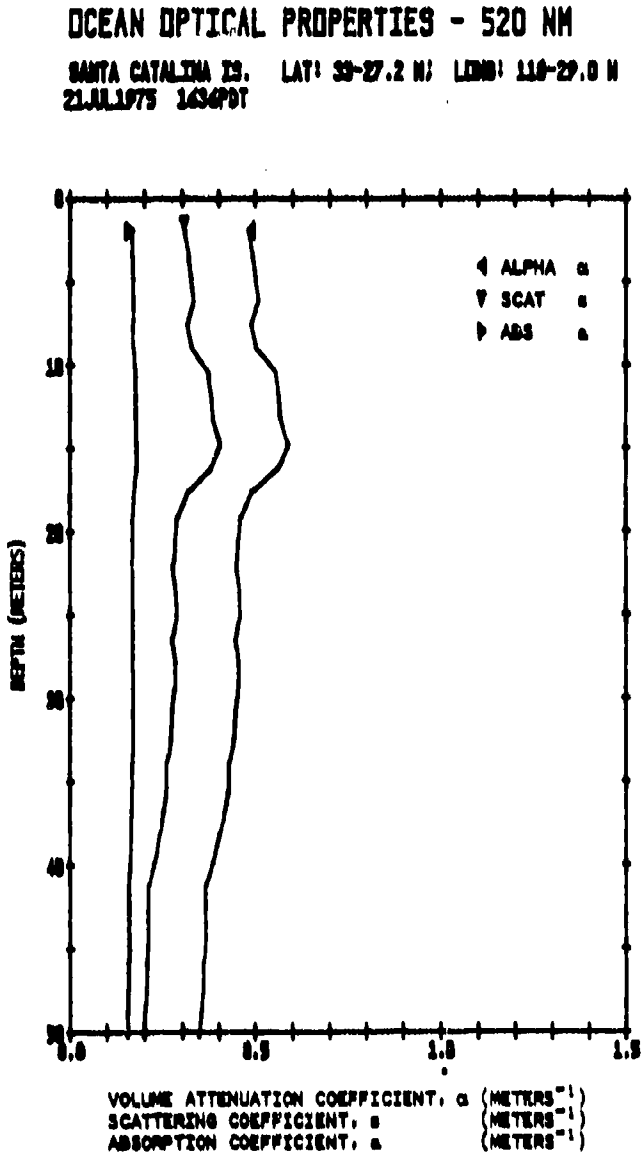

Figure D-32. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
21JUL1975   1636PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.7	0.617	0.483	0.488	0.314	0.174	417.4	144.3	57.6	0.064
3.2	0.610	0.494	0.500	0.324	0.176	430.9	149.5	59.8	0.063
4.6	0.605	0.502	0.508	0.331	0.177	440.7	153.3	61.5	0.062
5.9	0.601	0.509	0.515	0.337	0.177	448.7	156.3	62.8	0.061
7.4	0.613	0.489	0.495	0.320	0.175	425.1	147.3	58.9	0.063
8.8	0.605	0.502	0.508	0.331	0.177	440.7	153.3	61.5	0.062
10.3	0.576	0.552	0.558	0.377	0.181	502.6	177.3	72.0	0.057
11.7	0.571	0.560	0.567	0.385	0.182	513.4	181.6	73.9	0.056
13.1	0.569	0.564	0.571	0.388	0.182	517.8	183.3	74.6	0.056
14.6	0.557	0.585	0.592	0.408	0.184	544.7	193.8	79.3	0.054
16.1	0.573	0.557	0.564	0.382	0.182	509.1	179.9	73.1	0.056
17.5	0.614	0.488	0.493	0.318	0.175	423.2	146.5	58.5	0.063
19.1	0.635	0.455	0.460	0.289	0.171	384.0	131.5	52.1	0.067
20.4	0.639	0.449	0.454	0.284	0.170	376.8	128.8	50.9	0.068
21.9	0.642	0.442	0.447	0.279	0.169	369.6	126.1	49.6	0.069
23.5	0.637	0.452	0.457	0.287	0.170	380.4	130.2	51.5	0.068
24.9	0.636	0.453	0.458	0.288	0.170	382.2	130.9	51.8	0.067
26.4	0.644	0.439	0.444	0.276	0.168	366.1	124.8	49.2	0.069
27.8	0.639	0.449	0.454	0.284	0.170	376.8	128.8	50.9	0.068
29.4	0.641	0.445	0.451	0.281	0.169	373.2	127.5	50.3	0.068
30.7	0.645	0.438	0.443	0.275	0.168	364.4	124.1	48.9	0.069
32.4	0.648	0.433	0.438	0.271	0.167	359.1	122.1	48.1	0.070
33.9	0.657	0.420	0.425	0.259	0.165	343.6	116.3	46.6	0.072
35.4	0.658	0.418	0.423	0.258	0.165	342.0	115.7	45.8	0.072
36.8	0.665	0.408	0.413	0.249	0.163	330.2	111.3	43.5	0.074
38.2	0.674	0.395	0.399	0.238	0.161	315.5	105.8	41.1	0.076
39.9	0.686	0.377	0.382	0.224	0.157	296.5	98.7	38.2	0.079
41.3	0.699	0.358	0.362	0.208	0.153	275.1	90.9	34.9	0.083
42.6	0.700	0.356	0.360	0.207	0.153	273.6	90.3	34.7	0.083
44.4	0.700	0.356	0.360	0.207	0.153	273.6	90.3	34.7	0.083
45.9	0.705	0.349	0.353	0.202	0.151	266.2	87.6	33.5	0.084
47.5	0.706	0.348	0.352	0.201	0.151	264.7	87.1	33.3	0.085
48.9	0.711	0.341	0.345	0.195	0.150	257.4	84.4	32.2	0.086
50.4	0.716	0.334	0.338	0.190	0.148	250.2	81.8	31.1	0.088

PAUSE READY PLOTTER

Figure D-32. Ocean optical properties (sheet 2 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT: 33-27.2 N; LONG: 118-29.0 W
21JUL1973 2040PDT

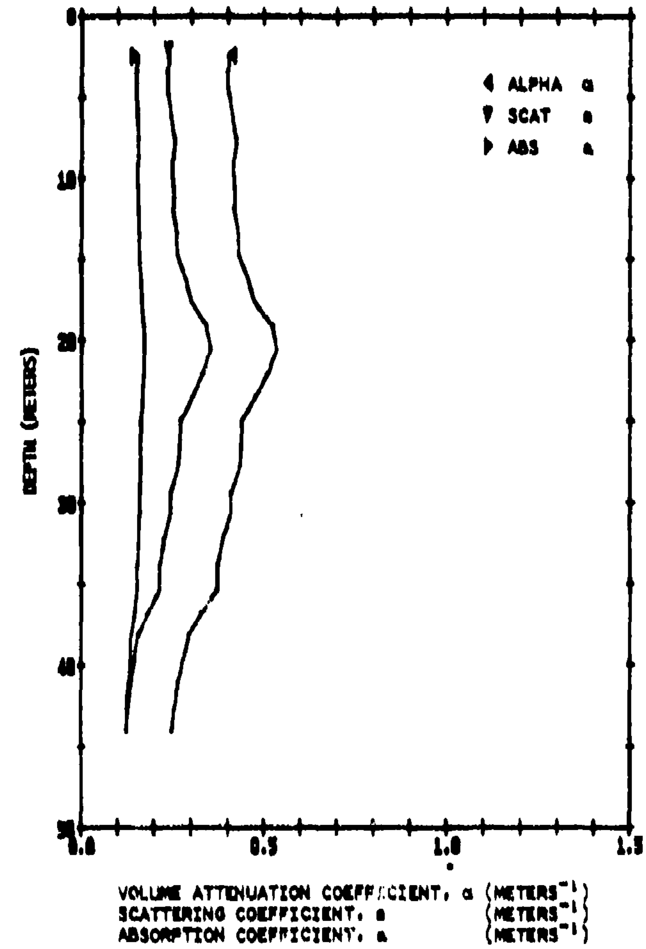

Figure D-33. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
21JUL1975 2048PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
2.1	0.665	0.408	0.413	0.249	0.163	330.2	111.3	43.5	0.074
[illegible]	0.667	0.405	0.410	0.247	0.163	326.9	110.1	42.9	0.074
4.5	0.665	0.408	0.413	0.249	0.163	330.2	111.3	43.5	0.074
5.9	0.660	0.415	0.420	0.256	0.164	338.6	114.4	44.8	0.073
7.2	0.653	0.426	0.431	0.264	0.166	350.5	118.9	46.7	0.071
8.8	0.658	0.418	0.423	0.258	0.165	342.0	115.7	45.3	0.072
10.2	0.655	0.423	0.428	0.262	0.166	347.0	117.6	46.1	0.072
11.5	0.657	0.420	0.425	0.259	0.165	343.6	116.3	45.6	0.072
13.1	0.650	0.430	0.435	0.268	0.167	355.6	120.8	47.5	0.070
14.5	0.648	0.433	0.438	0.271	0.167	359.1	122.1	48.1	0.070
16.0	0.633	0.458	0.463	0.292	0.171	387.6	132.9	52.7	0.067
17.4	0.622	0.475	0.480	0.307	0.173	408.0	140.7	56.0	0.065
18.9	0.594	0.520	0.526	0.348	0.179	462.8	161.8	65.2	0.060
20.3	0.588	0.532	0.538	0.358	0.180	477.2	167.4	67.6	0.059
21.9	0.602	0.507	0.513	0.336	0.177	446.7	155.6	62.5	0.061
23.3	0.622	0.475	0.480	0.307	0.173	408.0	140.7	56.0	0.065
24.7	0.645	0.438	0.443	0.275	0.168	364.4	124.1	48.9	0.069
26.3	0.647	0.435	0.440	0.272	0.168	360.9	122.8	48.3	0.070
27.5	0.650	0.430	0.435	0.268	0.167	355.6	120.8	47.5	0.070
29.2	0.667	0.405	0.410	0.247	0.163	326.9	110.1	42.9	0.074
30.6	0.667	0.405	0.410	0.247	0.163	326.9	110.1	42.9	0.074
32.1	0.682	0.383	0.387	0.229	0.159	302.7	101.1	39.1	0.078
33.7	0.692	0.368	0.372	0.216	0.155	285.7	94.8	36.5	0.081
35.2	0.693	0.366	0.370	0.215	0.155	284.1	94.2	36.3	0.081
36.7	0.723	0.325	0.328	0.182	0.146	240.4	78.2	29.7	0.090
38.1	0.748	0.290	0.293	0.156	0.137	205.5	65.8	24.6	0.099
39.7	0.761	0.273	0.278	0.144	0.132	189.1	60.0	22.2	0.104
41.0	0.772	0.259	0.262	0.134	0.128	175.7	55.3	20.4	0.109
42.6	0.779	0.250	0.253	0.128	0.125	167.4	52.4	19.2	0.112
44.0	0.785	0.241	0.244	0.122	0.122	154.3	49.6	18.1	0.116

PAUSE READY PLOTTER

Figure D-33. Ocean optical properties (sheet 2 of 2).

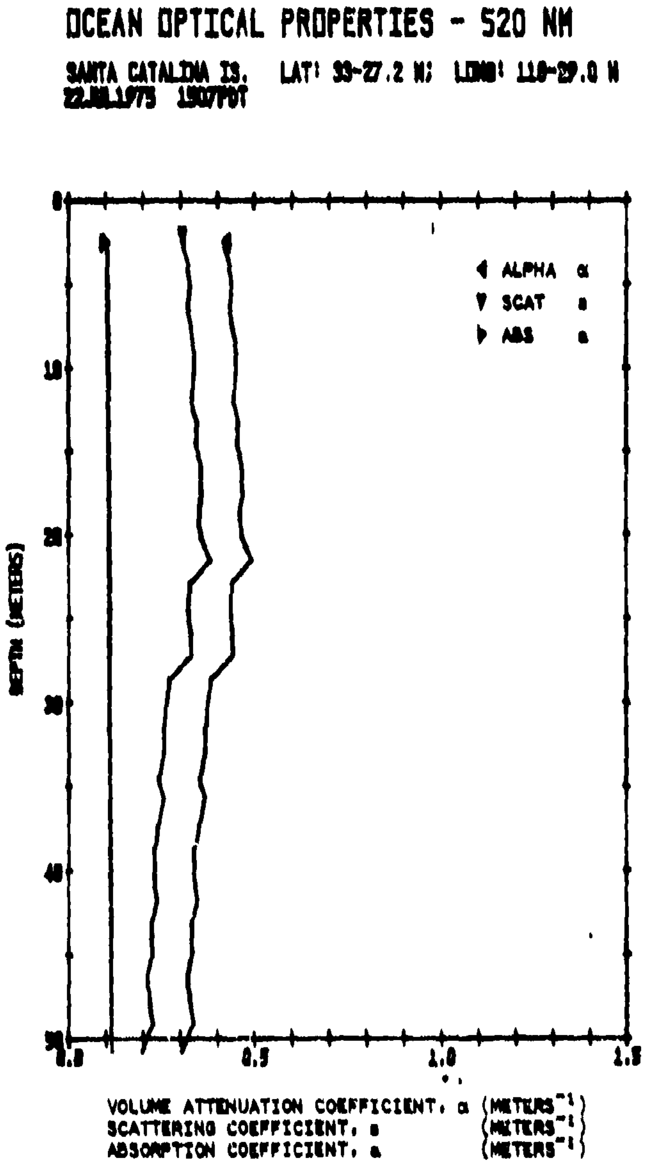

Figure D-34. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
22JUL1975 1507PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
2.4	0.661	0.414	0.419	0.309	0.110	374.8	139.1	51.6	0.061
3.7	0.651	0.429	0.434	0.324	0.111	394.9	146.9	54.6	0.059
4.9	0.647	0.435	0.440	0.330	0.111	403.1	150.1	55.9	0.058
6.2	0.651	0.429	0.434	0.324	0.111	394.9	146.9	54.6	0.059
7.5	0.645	0.438	0.444	0.333	0.111	407.2	151.7	56.5	0.058
9.0	0.640	0.447	0.453	0.342	0.111	419.7	156.6	58.4	0.057
10.3	0.642	0.444	0.450	0.339	0.111	415.5	154.9	57.7	0.057
11.7	0.644	0.439	0.445	0.334	0.111	409.3	152.5	56.8	0.058
13.1	0.637	0.452	0.458	0.346	0.111	425.9	159.0	59.3	0.056
14.4	0.639	0.449	0.454	0.343	0.111	421.7	157.4	58.7	0.057
15.8	0.631	0.461	0.467	0.355	0.112	438.6	164.0	61.3	0.055
17.3	0.630	0.462	0.469	0.357	0.112	440.7	164.8	61.6	0.055
18.6	0.635	0.455	0.461	0.349	0.112	430.1	160.7	60.0	0.056
20.1	0.631	0.461	0.467	0.355	0.112	438.6	164.0	61.3	0.055
21.4	0.617	0.483	0.489	0.377	0.112	468.8	175.8	65.9	0.053
22.8	0.649	0.432	0.437	0.327	0.111	399.0	148.5	55.2	0.059
24.3	0.653	0.426	0.431	0.321	0.111	390.9	145.3	54.0	0.059
25.7	0.648	0.433	0.439	0.328	0.111	401.1	149.3	55.5	0.058
27.1	0.647	0.435	0.440	0.330	0.111	403.1	150.1	55.9	0.058
28.5	0.689	0.373	0.378	0.269	0.109	320.6	118.0	43.6	0.066
30.0	0.695	0.363	0.368	0.259	0.109	307.6	113.0	41.5	0.068
31.3	0.699	0.358	0.362	0.253	0.109	300.2	110.2	40.4	0.069
32.9	0.701	0.355	0.359	0.251	0.108	296.5	108.7	39.9	0.070
34.4	0.710	0.342	0.346	0.238	0.108	280.2	102.5	37.5	0.072
35.7	0.701	0.355	0.359	0.251	0.108	296.5	108.7	39.9	0.070
37.3	0.712	0.340	0.343	0.235	0.108	276.6	101.1	36.9	0.072
38.7	0.720	0.329	0.332	0.225	0.108	262.4	95.7	34.9	0.075
40.2	0.720	0.329	0.332	0.225	0.108	262.4	95.7	34.9	0.075
41.6	0.715	0.336	0.339	0.231	0.108	271.3	99.1	36.2	0.073
43.1	0.726	0.321	0.324	0.217	0.107	251.9	91.7	33.3	0.076
44.7	0.724	0.323	0.327	0.219	0.108	255.4	93.0	33.8	0.076
46.2	0.735	0.308	0.312	0.205	0.107	236.5	85.8	31.1	0.079
47.6	0.730	0.315	0.319	0.211	0.107	245.0	89.0	32.3	0.078
49.1	0.725	0.322	0.325	0.218	0.107	253.7	92.3	33.6	0.076
50.7	0.746	0.293	0.296	0.189	0.107	216.3	78.1	28.2	0.08[illegible]

PAUSE READY PLOTTER

Figure D-34. Ocean optical properties (sheet 2 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT: 33-27.2 N; LONG: 118-29.0 W
22JUL1975 1401PDT

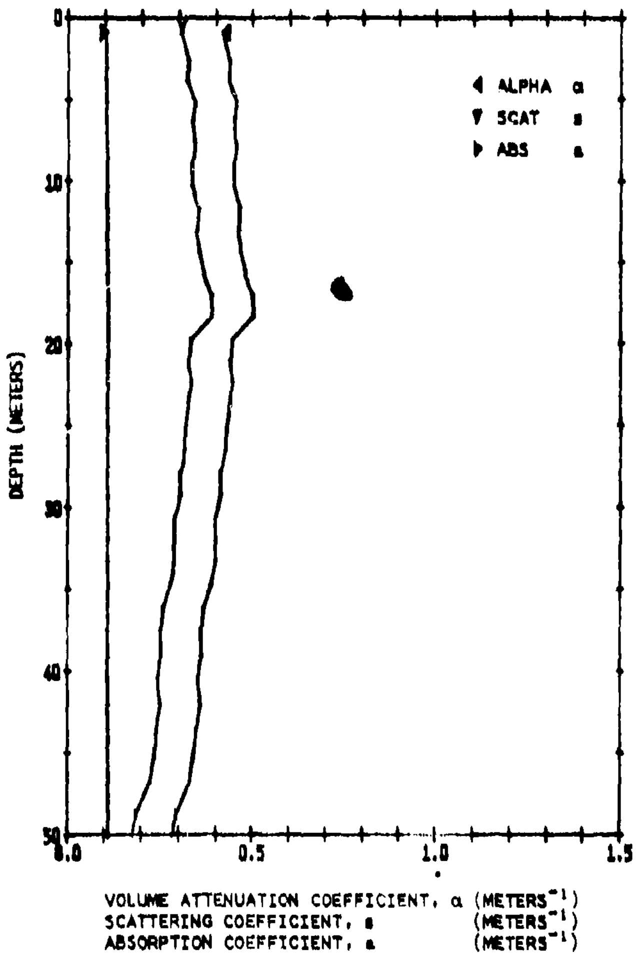

Figure D-35. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
22JUL1975 1601PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
0.8	0.658	0.418	0.424	0.313	0.110	380.8	141.4	52.5	0.060
2.5	0.647	0.435	0.440	0.330	0.111	403.1	150.1	55.9	0.058
3.7	0.648	0.433	0.439	0.328	0.111	401.1	149.3	55.5	0.058
5.0	0.636	0.453	0.459	0.348	0.111	428.0	159.8	59.7	0.056
6.2	0.639	0.449	0.454	0.343	0.111	421.7	157.4	58.7	0.057
7.5	0.636	0.453	0.459	0.348	0.111	428.0	159.8	59.7	0.056
8.9	0.641	0.445	0.451	0.340	0.111	417.6	155.7	58.1	0.057
10.2	0.640	0.447	0.453	0.342	0.111	419.7	156.6	58.4	0.057
11.5	0.630	0.462	0.469	0.357	0.112	440.7	164.8	61.6	0.055
12.9	0.633	0.458	0.464	0.352	0.112	434.4	162.3	60.6	0.056
14.2	0.628	0.466	0.472	0.360	0.112	443.0	166.5	62.3	0.055
15.6	0.621	0.477	0.483	0.371	0.112	460.1	172.4	64.6	0.054
16.9	0.609	0.496	0.503	0.390	0.113	486.5	182.8	68.7	0.052
18.2	0.607	0.499	0.506	0.393	0.113	490.9	184.6	69.3	0.052
19.6	0.643	0.441	0.447	0.336	0.111	411.3	153.3	57.1	0.058
20.9	0.648	0.433	0.439	0.328	0.111	401.1	149.3	55.5	0.058
22.2	0.643	0.441	0.447	0.336	0.111	411.3	153.3	57.1	0.058
23.8	0.650	0.430	0.436	0.325	0.111	397.0	147.7	54.9	0.059
25.0	0.655	0.423	0.428	0.318	0.111	386.8	143.7	53.4	0.060
26.4	0.658	0.418	0.424	0.313	0.110	380.8	141.4	52.5	0.060
27.8	0.666	0.406	0.412	0.302	0.110	364.9	135.2	50.1	0.062
29.1	0.666	0.406	0.412	0.302	0.110	364.9	135.2	50.1	0.062
30.5	0.676	0.392	0.397	0.287	0.110	345.4	127.6	47.1	0.064
31.9	0.676	0.392	0.397	0.287	0.110	345.4	127.6	47.1	0.064
33.2	0.676	0.392	0.397	0.287	0.110	345.4	127.6	47.1	0.064
34.7	0.685	0.379	0.384	0.274	0.109	328.2	121.0	44.6	0.066
36.0	0.696	0.362	0.366	0.257	0.109	305.7	112.3	41.2	0.068
37.4	0.702	0.353	0.358	0.249	0.108	294.7	108.0	39.6	0.070
39.0	0.702	0.353	0.358	0.249	0.108	294.7	108.0	39.6	0.070
40.3	0.708	0.345	0.349	0.241	0.108	283.8	103.9	38.0	0.071
42.0	0.703	0.352	0.356	0.248	0.108	292.9	107.3	39.3	0.070
43.5	0.711	0.341	0.345	0.237	0.108	278.4	101.8	37.2	0.072
45.2	0.717	0.333	0.337	0.229	0.108	267.7	97.7	35.6	0.074
46.8	0.726	0.321	0.324	0.217	0.107	251.9	91.7	33.3	0.076
48.5	0.750	0.287	0.290	0.184	0.106	209.7	75.6	27.2	0.065
50.0	0.760	0.274	0.277	0.171	0.106	193.4	69.5	24.9	0.089

PAUSE READY PLOTTER

Figure D-35. Ocean optical properties (sheet 2 of 2).

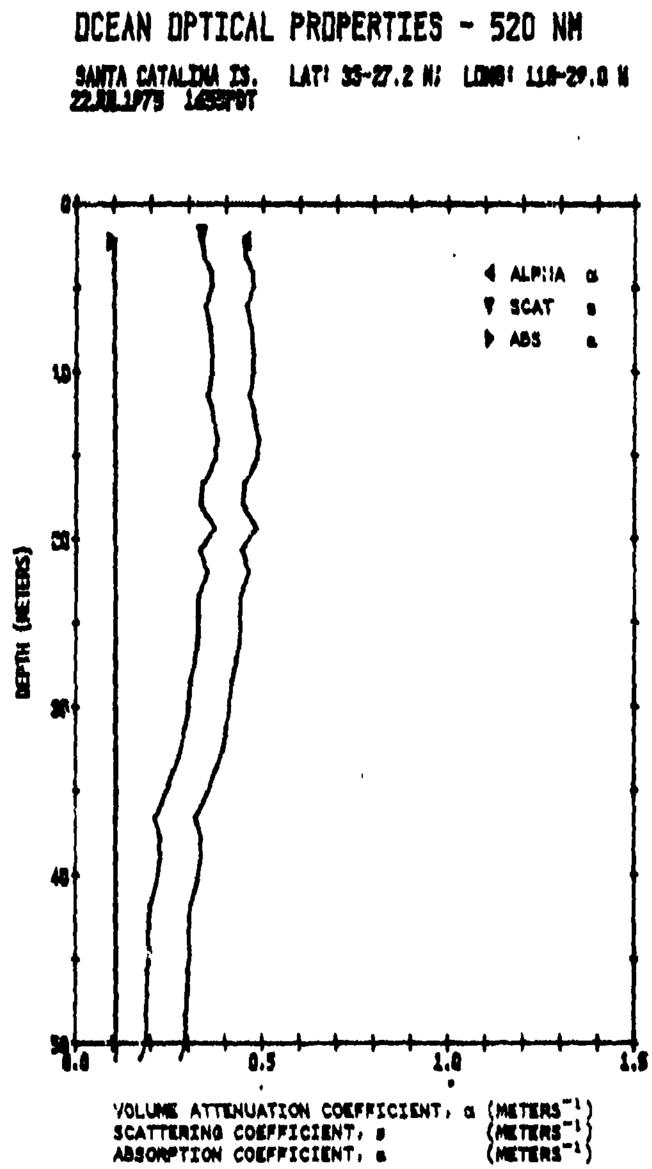

Figure D-36. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
22JUL1975 1655PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
2.1	0.639	0.449	0.454	0.343	0.111	421.7	157.4	58.7	0.057
3.1	0.635	0.455	0.461	0.349	0.112	430.1	160.7	60.0	0.056
4.0	0.624	0.472	0.478	0.366	0.112	453.6	169.9	63.6	0.054
4.8	0.624	0.472	0.478	0.366	0.112	453.6	169.9	63.6	0.054
6.0	0.633	0.458	0.464	0.352	0.112	434.4	162.3	60.6	0.056
7.3	0.627	0.467	0.473	0.362	0.112	447.1	167.3	62.6	0.055
8.7	0.623	0.473	0.480	0.368	0.112	455.7	170.7	63.9	0.054
10.0	0.625	0.470	0.477	0.365	0.112	451.4	169.0	63.2	0.055
11.3	0.630	0.462	0.469	0.357	0.112	440.7	164.8	61.6	0.055
12.6	0.622	0.475	0.481	0.369	0.112	457.9	171.6	64.2	0.054
13.9	0.615	0.486	0.493	0.380	0.112	473.2	177.6	66.6	0.053
15.2	0.619	0.480	0.486	0.374	0.112	464.4	174.1	65.2	0.054
16.6	0.639	0.449	0.454	0.343	0.111	421.7	157.4	58.7	0.057
17.8	0.642	0.442	0.448	0.337	0.111	413.4	154.1	57.4	0.057
19.3	0.621	0.477	0.483	0.371	0.112	460.1	172.4	64.6	0.054
20.5	0.642	0.442	0.448	0.337	0.111	413.4	154.1	57.4	0.057
21.9	0.633	0.458	0.464	0.352	0.112	434.4	162.3	60.6	0.056
23.3	0.646	0.436	0.442	0.331	0.111	405.2	150.9	56.2	0.058
24.5	0.647	0.435	0.440	0.330	0.111	403.1	150.1	55.9	0.058
26.0	0.649	0.432	0.437	0.327	0.111	399.0	148.5	55.2	0.059
27.1	0.654	0.424	0.430	0.319	0.111	388.9	144.5	53.7	0.059
28.5	0.663	0.411	0.416	0.306	0.110	370.8	137.5	51.0	0.061
29.9	0.667	0.405	0.410	0.300	0.110	362.9	134.4	49.8	0.062
31.2	0.673	0.396	0.401	0.291	0.110	351.2	129.9	48.0	0.063
32.5	0.680	0.386	0.391	0.281	0.109	337.7	124.6	46.0	0.065
33.8	0.694	0.365	0.369	0.260	0.109	309.4	113.7	41.0	0.068
35.1	0.709	0.344	0.348	0.240	0.108	282.0	103.2	37.7	0.072
36.5	0.729	0.317	0.320	0.213	0.107	246.8	89.7	32.6	0.077
37.0	0.720	0.329	0.332	0.225	0.108	262.4	95.7	34.9	0.075
39.2	0.721	0.327	0.331	0.223	0.108	260.7	95.0	34.6	0.075
40.5	0.728	0.318	0.321	0.214	0.107	248.5	90.3	32.8	0.077
41.8	0.740	0.301	0.304	0.197	0.107	226.3	81.9	29.6	0.081
43.2	0.744	0.295	0.298	0.192	0.107	219.6	79.4	28.7	0.083
44.4	0.740	0.301	0.304	0.197	0.107	226.3	81.9	29.6	0.081
45.7	0.746	0.293	0.296	0.189	0.107	216.3	78.1	28.2	0.084
47.0	0.748	0.290	0.293	0.186	0.106	213.0	76.9	27.7	0.084
48.3	0.749	0.289	0.292	0.135	0.106	211.3	76.2	27.5	0.085
49.7	0.749	0.299	0.292	0.185	0.106	211.3	76.2	27.5	0.085
50.9	0.760	0.274	0.277	0.171	0.106	193.4	69.5	24.9	0.089

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Figure D-36. Ocean optical properties (sheet 2 of 2).

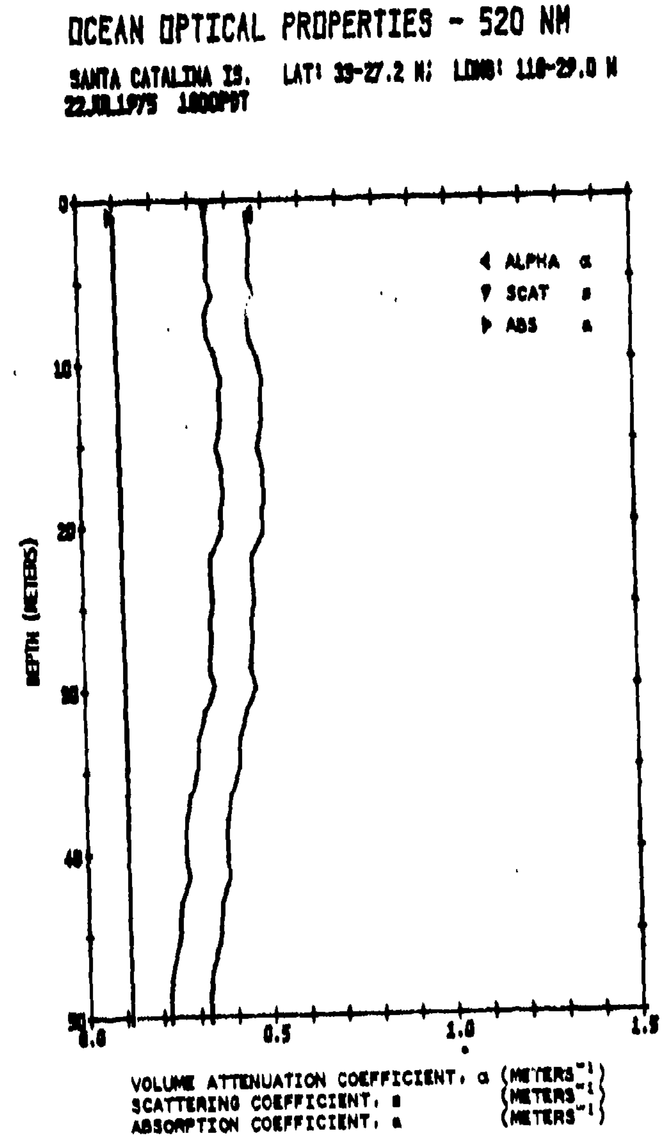

Figure D-37. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
22JUL1975 1800PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
0.7	0.631	0.461	0.467	0.355	0.112	438.6	164.0	61.3	0.055
1.7	0.628	0.466	0.472	0.360	0.112	445.0	166.5	62.3	0.055
3.2	0.629	0.464	0.470	0.358	0.112	442.9	165.6	61.9	0.055
4.3	0.630	0.462	0.469	0.357	0.112	440.7	164.8	61.6	0.055
5.6	0.624	0.472	0.478	0.366	0.112	453.6	169.9	63.6	0.054
6.8	0.635	0.455	0.461	0.349	0.112	430.1	160.7	60.0	0.056
8.2	0.631	0.461	0.467	0.355	0.112	438.6	164.0	61.3	0.055
9.5	0.619	0.480	0.486	0.374	0.112	464.4	174.1	65.2	0.054
10.8	0.612	0.491	0.498	0.385	0.113	479.8	180.2	67.6	0.053
12.2	0.615	0.486	0.493	0.380	0.112	473.2	177.6	66.6	0.053
13.5	0.614	0.488	0.494	0.382	0.113	475.4	178.4	66.9	0.053
14.8	0.622	0.475	0.481	0.369	0.112	457.9	171.6	64.2	0.054
16.2	0.615	0.486	0.493	0.380	0.112	473.2	177.6	66.6	0.053
17.6	0.613	0.489	0.496	0.383	0.113	477.6	179.3	67.3	0.053
18.9	0.617	0.483	0.489	0.377	0.112	468.8	175.8	65.9	0.053
20.3	0.617	0.483	0.489	0.377	0.112	468.8	175.8	65.9	0.053
21.6	0.635	0.455	0.461	0.349	0.112	430.1	160.7	60.0	0.056
22.9	0.637	0.452	0.458	0.346	0.111	425.9	159.0	59.3	0.056
24.4	0.633	0.458	0.464	0.352	0.112	434.4	162.3	60.6	0.056
25.5	0.639	0.449	0.454	0.343	0.111	421.7	157.4	58.7	0.057
27.1	0.639	0.449	0.454	0.343	0.111	421.7	157.4	58.7	0.057
28.5	0.643	0.441	0.447	0.336	0.111	411.3	153.3	57.1	0.058
29.8	0.635	0.455	0.461	0.349	0.112	430.1	160.7	60.0	0.056
31.2	0.650	0.430	0.436	0.325	0.111	397.0	147.7	54.9	0.059
32.9	0.665	0.408	0.413	0.303	0.110	366.9	136.0	50.4	0.061
34.6	0.668	0.404	0.409	0.299	0.110	361.0	133.7	49.5	0.062
36.3	0.683	0.382	0.386	0.277	0.109	332.0	122.4	45.1	0.065
37.9	0.692	0.368	0.372	0.263	0.109	313.1	115.1	42.3	0.067
39.6	0.694	0.365	0.369	0.260	0.109	309.6	113.7	41.8	0.068
41.3	0.689	0.373	0.378	0.269	0.109	320.6	118.0	43.4	0.066
43.0	0.705	0.349	0.353	0.245	0.108	289.2	105.9	38.8	0.071
44.9	0.709	0.344	0.348	0.240	0.108	282.0	103.2	37.7	0.072
46.8	0.723	0.325	0.328	0.221	0.108	257.2	93.7	34.1	0.076
48.5	0.730	0.315	0.319	0.211	0.107	245.0	89.0	32.3	0.078
50.3	0.730	0.315	0.319	0.211	0.107	245.0	89.0	32.3	0.078

PAUSE READY PLOTTER

Figure D-37. Ocean optical properties (sheet 2 of 2).

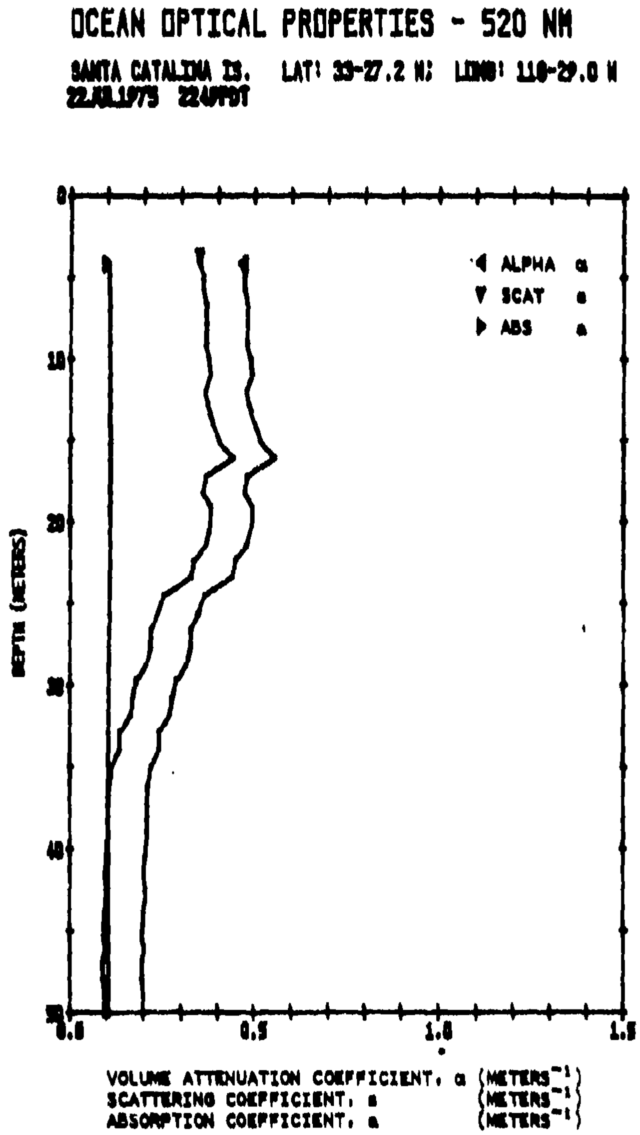

Figure D-38. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
22JUL1975   2249PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
4.0	0.632	0.459	0.465	0.354	0.112	436.5	163.1	60.9	0.056
4.7	0.625	0.470	0.477	0.365	0.112	451.4	169.0	63.2	0.055
5.6	0.625	0.470	0.477	0.365	0.112	451.4	169.0	63.2	0.055
6.5	0.620	0.478	0.485	0.372	0.112	462.3	173.3	64.9	0.054
7.7	0.621	0.477	0.483	0.371	0.112	460.1	172.4	64.6	0.054
8.8	0.621	0.477	0.483	0.371	0.112	460.1	172.4	64.6	0.054
9.7	0.616	0.484	0.491	0.379	0.112	471.0	176.7	66.3	0.053
10.9	0.614	0.488	0.494	0.382	0.113	475.4	178.4	66.9	0.053
11.8	0.622	0.475	0.481	0.369	0.112	457.9	171.6	64.2	0.054
12.7	0.618	0.481	0.488	0.376	0.112	466.6	175.0	65.6	0.053
13.9	0.609	0.496	0.503	0.390	0.113	486.5	182.8	68.7	0.052
15.0	0.598	0.513	0.521	0.407	0.113	511.2	192.6	72.5	0.051
16.0	0.577	0.550	0.558	0.444	0.114	562.6	212.9	80.5	0.048
17.1	0.622	0.475	0.481	0.369	0.112	457.9	171.6	64.2	0.054
18.1	0.627	0.467	0.473	0.362	0.112	447.1	167.3	62.6	0.055
19.0	0.613	0.489	0.496	0.383	0.113	477.6	179.3	67.3	0.053
20.2	0.615	0.486	0.493	0.380	0.112	473.2	177.6	66.6	0.053
21.3	0.623	0.473	0.480	0.368	0.112	455.7	170.7	63.9	0.054
22.3	0.642	0.442	0.448	0.337	0.111	413.4	154.1	57.4	0.057
23.3	0.647	0.435	0.440	0.330	0.111	403.1	150.1	55.9	0.058
24.4	0.697	0.360	0.365	0.256	0.109	303.9	111.6	40.9	0.069
25.5	0.710	0.342	0.346	0.238	0.108	280.2	102.5	37.5	0.072
26.5	0.723	0.325	0.328	0.221	0.108	257.2	93.7	34.1	0.076
27.5	0.723	0.325	0.328	0.221	0.108	257.2	93.7	34.1	0.076
28.7	0.733	0.311	0.315	0.207	0.107	239.9	87.1	31.6	0.079
29.6	0.752	0.285	0.288	0.181	0.106	206.6	74.6	26.8	0.086
30.8	0.761	0.273	0.276	0.170	0.106	191.8	68.9	24.7	0.090
31.8	0.766	0.267	0.269	0.164	0.106	183.8	65.9	23.6	0.092
32.8	0.785	0.241	0.244	0.139	0.105	152.8	54.2	19.2	0.102
33.9	0.788	0.238	0.240	0.135	0.105	148.2	52.5	18.6	0.104
34.9	0.804	0.218	0.220	0.116	0.104	124.6	43.8	15.4	0.115
36.1	0.812	0.208	0.210	0.106	0.104	113.1	39.6	13.8	0.122
37.3	0.814	0.206	0.208	0.104	0.104	110.3	38.5	13.5	0.123
38.2	0.814	0.206	0.208	0.104	0.104	110.3	38.5	13.5	0.123
39.4	0.815	0.205	0.206	0.102	0.104	108.9	38.0	13.3	0.124
40.4	0.819	0.200	0.201	0.098	0.104	103.3	36.0	12.5	0.128
41.5	0.822	0.196	0.198	0.094	0.104	99.1	34.4	12.0	0.131
42.6	0.817	0.202	0.204	0.100	0.104	106.1	37.0	12.9	0.126
43.8	0.823	0.195	0.197	0.093	0.104	97.7	33.9	11.8	0.132
44.7	0.826	0.192	0.193	0.090	0.103	93.6	32.4	11.2	0.136
45.9	0.822	0.196	0.198	0.094	0.104	99.1	34.4	12.0	0.131
46.9	0.827	0.190	0.192	0.088	0.103	92.2	31.9	11.1	0.137
48.0	0.825	0.193	0.194	0.091	0.104	95.0	32.9	11.4	0.135
49.1	0.824	0.196	0.195	0.092	0.104	96.4	33.4	11.6	0.134
50.2	0.826	0.192	0.193	0.090	0.103	93.6	32.4	11.2	0.136

/& END OF JOB

Figure D-38. Ocean optical properties (sheet 2 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT: 33-27.2 N; LONG: 118-29.0 W
23JUN1975 1237PDT

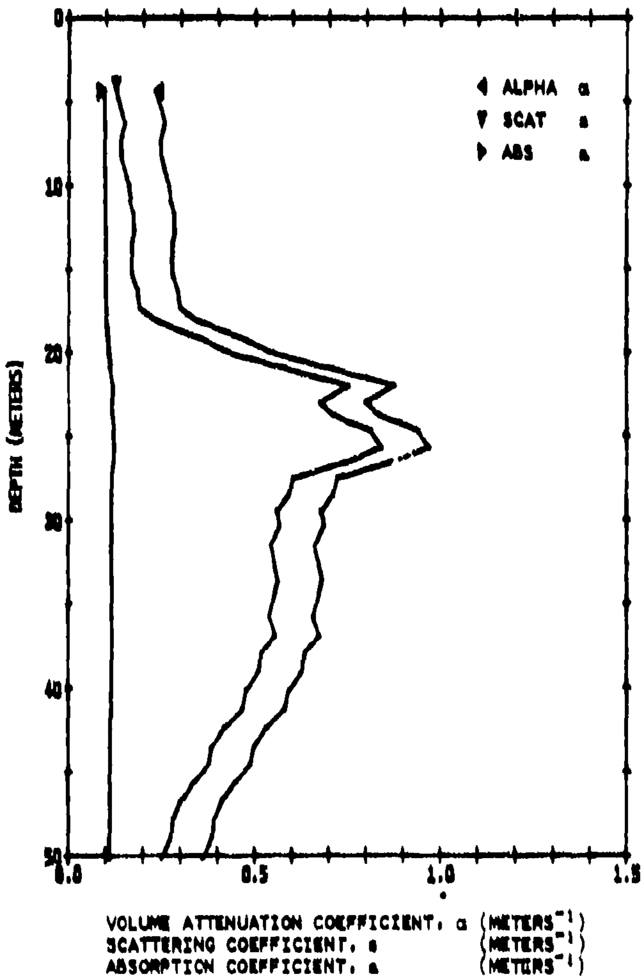

Figure D-39. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
23JUN1975   1237PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
4.2	0.787	0.239	0.241	0.136	0.105	149.7	53.1	18.8	0.103
6.1	0.771	0.260	0.263	0.157	0.106	175.9	62.9	22.5	0.094
6.9	0.778	0.251	0.254	0.149	0.105	165.0	58.8	20.9	0.098
7.9	0.779	0.250	0.253	0.147	0.105	163.5	58.2	20.7	0.098
8.8	0.772	0.259	0.262	0.156	0.106	174.4	62.3	22.3	0.095
9.8	0.763	0.271	0.273	0.167	0.106	188.6	67.7	24.3	0.090
10.7	0.759	0.276	0.278	0.172	0.106	195.0	70.1	25.2	0.089
11.5	0.752	0.285	0.288	0.181	0.106	206.4	74.4	26.8	0.086
12.5	0.751	0.286	0.289	0.183	0.106	208.0	75.0	27.0	0.085
13.3	0.756	0.280	0.282	0.176	0.106	199.9	71.9	25.9	0.087
14.3	0.756	0.280	0.282	0.176	0.106	199.9	71.9	25.9	0.087
15.3	0.754	0.282	0.285	0.179	0.106	203.1	73.1	26.3	0.087
16.1	0.745	0.294	0.297	0.190	0.107	218.0	78.7	28.4	0.083
17.2	0.740	0.301	0.304	0.197	0.107	226.3	81.9	29.6	0.081
18.0	0.708	0.345	0.349	0.241	0.108	283.8	103.9	38.0	0.071
19.0	0.633	0.458	0.464	0.352	0.112	434.4	162.3	60.6	0.056
19.9	0.585	0.537	0.544	0.430	0.114	543.6	205.4	77.6	0.049
20.8	0.504	0.684	0.695	0.577	0.119	754.8	289.8	111.2	0.040
21.9	0.422	0.862	0.878	0.754	0.124	1018.5	396.8	154.5	0.034
22.9	0.455	0.787	0.800	0.678	0.122	905.0	350.6	135.7	0.036
23.7	0.440	0.822	0.836	0.713	0.123	957.1	371.8	144.3	0.035
24.6	0.398	0.922	0.939	0.813	0.126	1108.8	433.8	169.6	0.032
25.6	0.386	0.952	0.970	0.843	0.127	1154.5	452.6	177.3	0.032
26.5	0.426	0.853	0.868	0.745	0.124	1004.6	391.1	152.2	0.034
27.4	0.491	0.712	0.724	0.604	0.119	795.1	306.0	117.7	0.039
28.4	0.496	0.702	0.714	0.594	0.119	780.5	300.2	115.4	0.040
29.4	0.511	0.671	0.682	0.564	0.118	735.2	281.9	108.0	0.041
30.3	0.508	0.677	0.688	0.569	0.118	743.6	285.3	109.4	0.041
31.4	0.520	0.654	0.664	0.547	0.118	710.5	272.0	104.1	0.042
33.6	0.511	0.671	0.682	0.564	0.118	735.2	281.9	108.0	0.041
35.7	0.523	0.648	0.658	0.541	0.117	702.3	268.7	102.8	0.042
36.9	0.515	0.663	0.674	0.556	0.118	724.2	277.5	106.3	0.041
37.9	0.536	0.624	0.634	0.517	0.117	667.7	254.8	97.2	0.043
39.0	0.540	0.617	0.626	0.510	0.116	657.3	250.7	95.5	0.044
40.2	0.559	0.581	0.590	0.475	0.115	606.4	230.4	87.5	0.046
41.3	0.565	0.571	0.579	0.464	0.115	591.6	224.5	85.1	0.047
42.4	0.592	0.528	0.533	0.419	0.114	527.3	198.9	75.0	0.050
43.6	0.614	0.488	0.494	0.382	0.113	475.4	178.4	66.9	0.053
44.6	0.620	0.478	0.485	0.372	0.112	462.3	173.3	64.9	0.054
45.7	0.644	0.439	0.445	0.334	0.111	409.3	152.5	56.8	0.058
46.8	0.667	0.405	0.410	0.300	0.110	362.9	134.4	49.0	0.062
47.9	0.682	0.383	0.388	0.279	0.109	333.9	123.2	45.4	0.065
49.0	0.686	0.377	0.382	0.273	0.109	326.3	120.2	44.3	0.066
50.2	0.703	0.352	0.356	0.248	0.108	292.9	107.3	39.3	0.070

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Figure D-39. Ocean optical properties (sheet 2 of 2).

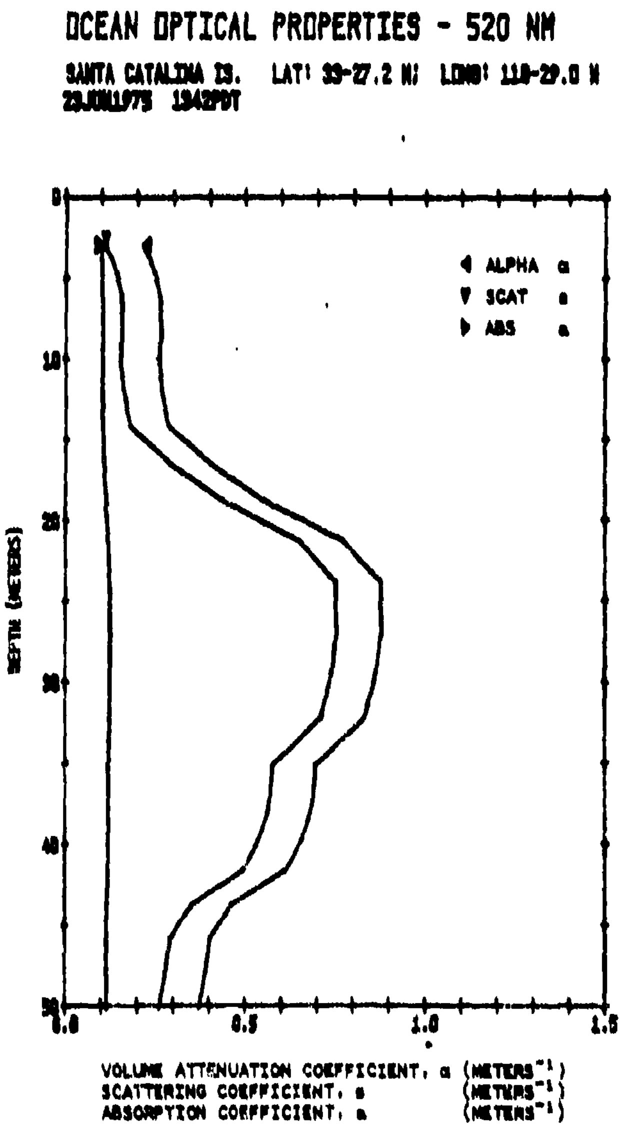

Figure D-40. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
23JUN1975 1342PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2HAH
2.7	0.804	0.218	0.220	0.116	0.104	124.6	43.8	15.4	0.115
3.6	0.789	0.236	0.239	0.134	0.105	146.7	52.0	18.4	0.105
4.4	0.781	0.248	0.250	0.145	0.105	160.4	57.1	20.3	0.098
5.8	0.770	0.262	0.264	0.158	0.106	177.5	63.5	22.7	0.094
7.6	0.768	0.264	0.267	0.161	0.106	180.7	64.7	23.1	0.093
9.7	0.773	0.258	0.260	0.155	0.106	172.8	61.7	22.0	0.095
11.7	0.766	0.267	0.269	0.164	0.106	183.8	65.9	23.6	0.092
13.9	0.753	0.283	0.286	0.180	0.106	204.8	73.7	26.5	0.086
16.2	0.677	0.390	0.395	0.286	0.110	343.5	126.9	46.8	0.064
18.5	0.586	0.535	0.543	0.429	0.114	541.3	204.5	77.2	0.049
21.1	0.470	0.755	0.768	0.647	0.121	858.0	331.5	128.0	0.038
23.7	0.425	0.856	0.871	0.747	0.124	1008.1	392.6	152.8	0.034
26.5	0.424	0.858	0.873	0.749	0.124	1011.5	394.0	153.4	0.034
29.3	0.431	0.842	0.857	0.733	0.123	987.5	384.1	149.4	0.035
32.1	0.444	0.813	0.827	0.704	0.123	943.9	366.4	142.2	0.036
35.0	0.506	0.681	0.692	0.573	0.118	749.2	287.5	110.3	0.041
37.6	0.512	0.669	0.680	0.56[illegible]	0.118	732.4	280.8	107.6	0.041
39.7	0.528	0.639	0.649	0.53[illegible]	0.117	688.9	263.3	100.6	0.043
41.6	0.551	0.595	0.604	0.489	0.116	626.5	238.4	90.6	0.045
43.7	0.638	0.450	0.456	0.345	0.111	423.8	158.2	59.0	0.057
45.8	0.676	0.392	0.397	0.287	0.110	345.4	127.6	47.1	0.064
47.9	0.686	0.377	0.382	0.273	0.109	326.3	120.2	44.3	0.066
50.1	0.699	0.358	0.362	0.253	0.109	300.2	110.2	40.4	0.069

PAUSE READY PLOTTER

Figure D-40. Ocean optical properties (sheet 2 of 2).

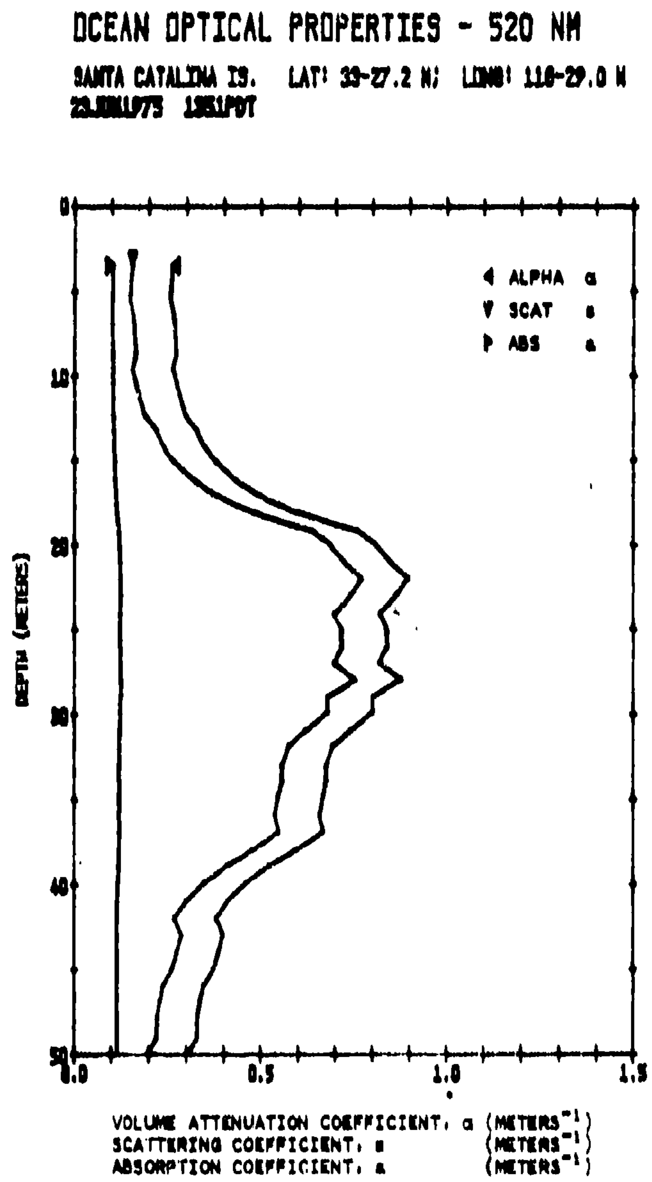

Figure D-41. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTISS - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
23JUN1975 1351PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
3.1	0.768	0.264	0.267	0.161	0.106	180.7	64.7	23.1	0.093
4.0	0.773	0.258	0.260	0.155	0.106	172.8	61.7	22.0	0.095
6.4	0.765	0.268	0.271	0.165	0.106	185.4	66.5	23.8	0.091
8.2	0.761	0.273	0.276	0.170	0.106	191.8	68.9	24.7	0.090
9.2	0.768	0.264	0.267	0.161	0.106	180.7	64.7	23.1	0.093
10.1	0.761	0.273	0.276	0.170	0.106	191.8	68.9	24.7	0.090
11.0	0.744	0.293	0.298	0.192	0.107	219.6	79.4	28.7	0.085
12.9	0.724	0.323	0.327	0.219	0.108	255.4	93.0	33.8	0.076
13.9	0.708	0.343	0.349	0.241	0.108	283.8	103.9	38.0	0.071
14.7	0.690	0.370	0.375	0.266	0.109	316.9	116.6	42.9	0.067
15.9	0.652	0.427	0.433	0.322	0.111	392.9	146.1	54.3	0.059
16.8	0.615	0.486	0.493	0.380	0.112	473.2	177.6	66.6	0.053
17.8	0.556	0.586	0.595	0.480	0.116	613.9	233.3	88.6	0.046
18.9	0.476	0.742	0.755	0.634	0.120	839.7	324.1	125.0	0.038
19.7	0.453	0.791	0.804	0.683	0.122	911.4	353.2	136.8	0.036
20.8	0.438	0.830	0.845	0.722	0.123	970.5	377.2	146.5	0.035
21.7	0.417	0.874	0.890	0.765	0.124	1036.1	404.0	157.5	0.034
22.7	0.430	0.844	0.859	0.735	0.123	990.9	385.1	149.9	0.035
23.8	0.449	0.802	0.816	0.693	0.122	927.5	359.7	139.4	0.036
24.7	0.441	0.819	0.834	0.711	0.123	953.8	370.4	143.8	0.035
25.7	0.440	0.822	0.836	0.713	0.123	957.1	371.8	144.3	0.035
26.7	0.450	0.800	0.813	0.691	0.122	924.3	358.4	138.9	0.036
27.7	0.426	0.853	0.868	0.745	0.124	1004.6	391.1	152.2	0.034
28.7	0.457	0.782	0.796	0.674	0.122	898.6	348.0	134.7	0.037
29.6	0.458	0.780	0.795	0.672	0.122	895.4	346.7	134.2	0.037
30.7	0.486	0.722	0.734	0.614	0.120	809.7	312.0	120.1	0.039
31.6	0.508	0.677	0.688	0.569	0.118	743.6	289.3	109.4	0.041
32.8	0.518	0.658	0.668	0.550	0.118	715.9	274.2	104.9	0.042
33.7	0.518	0.658	0.668	0.550	0.118	715.9	274.2	104.9	0.042
34.7	0.524	0.646	0.657	0.539	0.117	699.6	267.6	102.3	0.042
35.7	0.528	0.639	0.649	0.532	0.117	688.9	263.3	100.6	0.043
36.7	0.523	0.648	0.658	0.541	0.117	702.3	268.7	102.8	0.042
37.8	0.562	0.576	0.585	0.469	0.115	599.0	227.4	86.3	0.046
38.7	0.601	0.509	0.516	0.403	0.113	504.4	189.9	71.4	0.051
39.7	0.640	0.447	0.453	0.342	0.111	419.7	156.6	58.4	0.057
40.8	0.672	0.398	0.403	0.293	0.110	353.1	130.6	48.3	0.063
41.8	0.692	0.368	0.372	0.263	0.109	313.1	115.1	42.3	0.067
42.8	0.681	0.385	0.389	0.280	0.109	335.8	123.9	45.7	0.065
43.8	0.689	0.373	0.378	0.269	0.109	320.6	118.0	43.4	0.066
44.8	0.698	0.359	0.363	0.253	0.109	302.0	110.9	40.7	0.069
45.8	0.716	0.334	0.338	0.230	0.106	269.5	98.4	35.9	0.074
46.7	0.723	0.325	0.328	0.221	0.108	257.2	93.7	34.1	0.076
47.7	0.729	0.317	0.320	0.213	0.107	246.8	89.7	32.6	0.077
48.9	0.730	0.315	0.319	0.211	0.107	245.0	89.0	32.3	0.078
49.8	0.746	0.293	0.296	0.189	0.107	216.3	78.1	28.2	0.084

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Figure D-41. Ocean optical properties (sheet 2 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT: 33-27.2 N; LONG: 118-29.0 W
23JUN1975 1505PDT

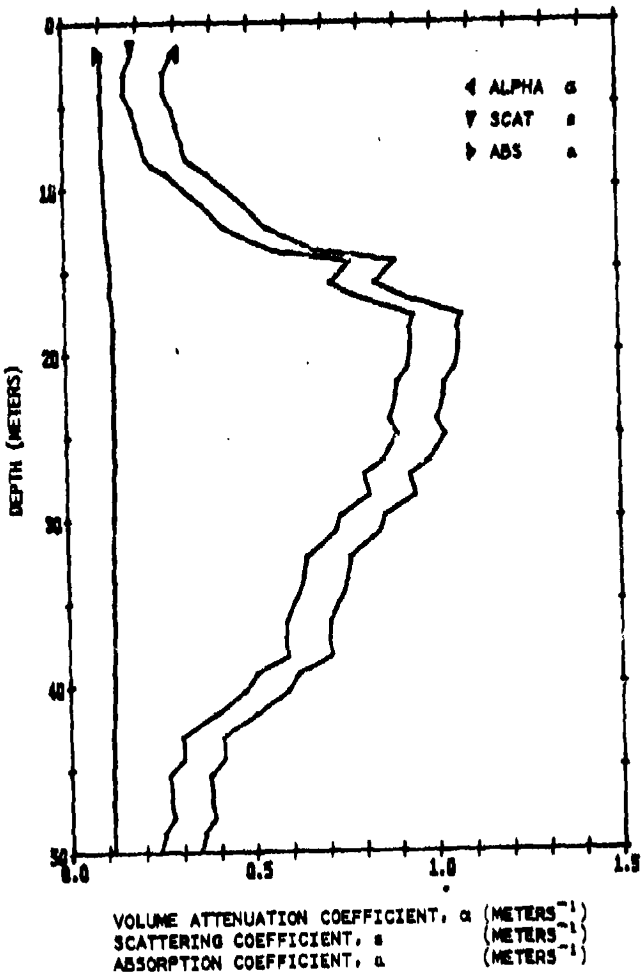

Figure D-42. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
23JUN1975   1505PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.5	0.747	0.291	0.294	0.188	0.107	214.6	77.5	28.0	0.084
2.7	0.762	0.272	0.275	0.169	0.106	190.2	68.3	24.5	0.090
3.9	0.762	0.272	0.275	0.169	0.106	190.2	68.3	24.5	0.090
4.9	0.748	0.290	0.293	0.186	0.106	213.0	76.9	27.7	0.084
5.8	0.740	0.301	0.304	0.197	0.107	226.3	81.9	29.6	0.081
6.9	0.731	0.314	0.317	0.210	0.107	243.3	88.4	32.1	0.078
7.9	0.721	0.327	0.331	0.223	0.108	260.7	95.0	34.6	0.075
8.2	0.712	0.340	0.343	0.235	0.108	276.6	101.1	36.9	0.072
8.8	0.684	0.380	0.385	0.276	0.109	330.1	121.7	44.8	0.065
9.7	0.654	0.424	0.430	0.319	0.111	388.9	144.5	53.7	0.059
10.8	0.618	0.481	0.488	0.376	0.112	466.6	175.0	65.6	0.053
12.1	0.587	0.533	0.541	0.427	0.114	538.9	203.5	76.8	0.049
13.5	0.514	0.665	0.676	0.558	0.118	726.9	278.6	106.7	0.041
14.2	0.415	0.879	0.895	0.770	0.125	1043.2	406.9	158.6	0.034
15.5	0.440	0.822	0.836	0.713	0.123	957.1	371.8	144.3	0.035
16.3	0.411	0.888	0.904	0.779	0.125	1057.5	412.8	161.0	0.033
17.5	0.351	1.048	1.068	0.938	0.130	1301.8	513.3	202.3	0.029
18.3	0.354	1.040	1.060	0.930	0.129	1288.9	508.0	200.1	0.030
19.3	0.353	1.042	1.062	0.933	0.130	1293.2	509.8	200.9	0.030
20.5	0.356	1.034	1.054	0.925	0.129	1280.3	504.5	198.7	0.030
21.6	0.366	1.004	1.023	0.895	0.128	1234.3	485.5	190.8	0.030
22.4	0.368	0.999	1.018	0.890	0.128	1226.1	482.1	189.5	0.031
23.8	0.374	0.983	1.002	0.874	0.128	1201.8	472.1	185.3	0.031
24.7	0.367	1.002	1.020	0.892	0.128	1230.2	483.8	190.1	0.030
26.2	0.381	0.965	0.983	0.856	0.127	1174.0	460.6	180.6	0.031
27.1	0.403	0.910	0.926	0.801	0.125	1090.3	426.2	166.5	0.033
28.4	0.399	0.920	0.937	0.811	0.126	1105.1	432.3	169.0	0.032
29.6	0.431	0.842	0.857	0.733	0.123	987.5	384.1	149.4	0.035
30.6	0.438	0.826	0.840	0.716	0.123	963.8	374.5	145.4	0.035
32.1	0.474	0.746	0.759	0.639	0.120	845.7	326.5	126.0	0.038
33.4	0.478	0.738	0.751	0.630	0.120	833.6	321.6	124.0	0.038
34.8	0.490	0.714	0.726	0.606	0.119	798.0	307.2	118.2	0.039
36.0	0.502	0.688	0.699	0.581	0.119	760.5	292.1	112.1	0.040
37.0	0.503	0.686	0.697	0.579	0.119	757.7	290.9	111.7	0.040
38.1	0.500	0.692	0.703	0.585	0.119	766.2	294.4	113.1	0.040
39.1	0.545	0.608	0.617	0.501	0.116	644.4	245.5	93.5	0.044
40.2	0.564	0.572	0.581	0.466	0.115	594.1	225.4	85.5	0.046
41.6	0.613	0.489	0.496	0.383	0.113	477.6	179.3	67.3	0.053
42.9	0.671	0.399	0.404	0.294	0.110	355.1	131.4	48.6	0.063
44.2	0.670	0.401	0.406	0.296	0.110	357.0	132.1	48.9	0.062
45.3	0.695	0.363	0.368	0.259	0.109	307.6	113.0	41.5	0.068
46.8	0.693	0.366	0.370	0.262	0.109	311.3	114.4	42.0	0.068
47.8	0.689	0.372	0.376	0.267	0.109	318.7	117.3	43.2	0.067
48.8	0.707	0.347	0.351	0.242	0.108	285.6	104.6	38.3	0.071
49.8	0.716	0.334	0.338	0.230	0.108	269.5	98.4	35.9	0.074

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Figure D-42. Ocean optical properties (sheet 2 of 2).

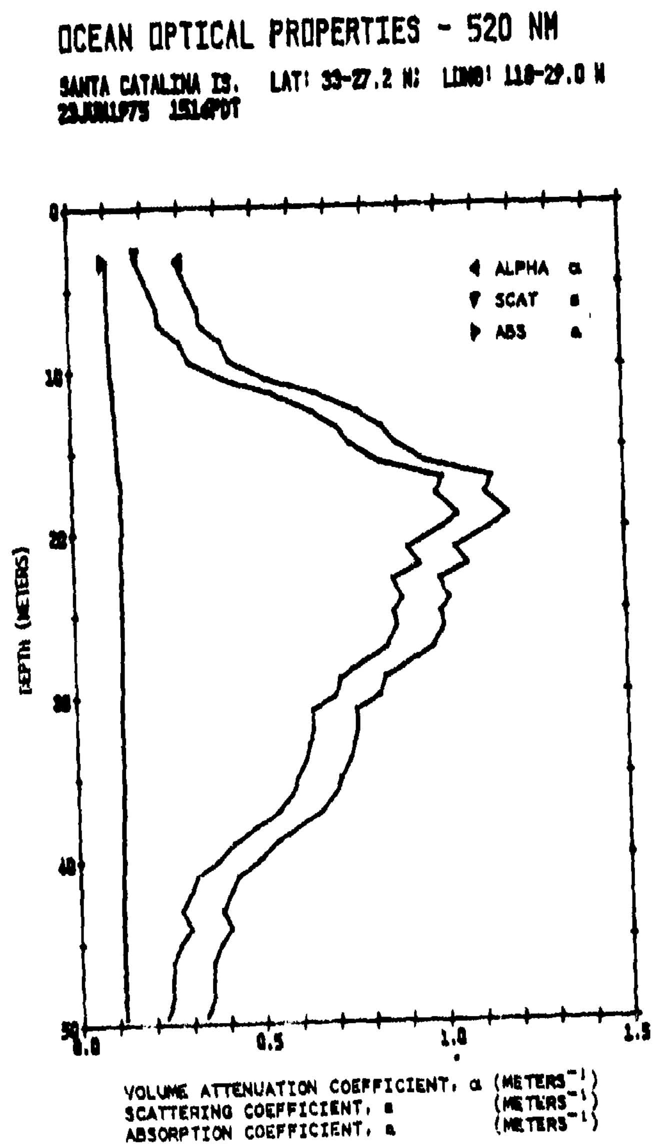

Figure D-43. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
23JUN1975 1516PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
3.1	0.747	0.291	0.294	0.188	0.107	214.6	77.5	28.0	0.084
4.9	0.724	0.323	0.327	0.219	0.108	255.4	93.0	33.8	0.076
6.0	0.708	0.345	0.349	0.241	0.108	283.8	103.9	38.0	0.071
7.0	0.705	0.349	0.353	0.245	0.108	289.2	105.9	38.8	0.071
8.1	0.667	0.405	0.410	0.300	0.110	362.9	134.4	49.8	0.062
9.3	0.652	0.427	0.433	0.322	0.111	392.9	146.1	54.3	0.059
10.4	0.594	0.520	0.527	0.414	0.114	520.4	196.2	73.9	0.050
11.3	0.523	0.648	0.658	0.541	0.117	702.3	268.7	102.8	0.042
12.5	0.467	0.761	0.774	0.653	0.121	867.2	335.2	129.5	0.037
13.5	0.437	0.828	0.843	0.720	0.123	967.2	375.9	146.0	0.035
14.5	0.422	0.862	0.878	0.754	0.124	1018.5	396.8	154.5	0.034
15.7	0.389	0.945	0.962	0.835	0.127	1143.0	447.8	175.4	0.032
16.7	0.329	1.111	1.133	1.001	0.132	1400.3	554.2	219.2	0.028
17.7	0.335	1.094	1.115	0.984	0.131	1372.7	542.7	214.5	0.029
19.0	0.315	1.154	1.177	1.044	0.133	1466.9	581.8	230.7	0.028
19.8	0.331	1.106	1.127	0.996	0.132	1391.1	550.3	217.6	0.028
21.0	0.363	1.012	1.031	0.903	0.129	1246.7	490.6	192.9	0.030
22.0	0.351	1.048	1.068	0.938	0.130	1301.8	513.3	202.3	0.029
22.9	0.379	0.970	0.988	0.861	0.127	1181.9	463.9	182.0	0.031
24.1	0.370	0.994	1.012	0.884	0.128	1218.0	478.7	188.1	0.031
24.9	0.378	0.973	0.991	0.863	0.127	1185.9	465.5	182.6	0.031
25.8	0.376	0.978	0.996	0.869	0.128	1193.8	468.8	184.0	0.031
27.1	0.387	0.950	0.967	0.840	0.127	1150.7	451.0	176.7	0.032
27.8	0.406	0.900	0.917	0.791	0.125	1075.6	420.2	164.1	0.033
28.9	0.440	0.822	0.836	0.713	0.123	957.1	371.8	144.3	0.035
30.0	0.447	0.806	0.820	0.698	0.122	934.1	362.4	140.5	0.036
30.9	0.476	0.742	0.755	0.634	0.120	839.7	324.1	125.0	0.038
32.0	0.475	0.744	0.757	0.636	0.120	842.7	325.3	125.5	0.038
33.0	0.481	0.732	0.744	0.624	0.120	824.6	318.0	122.6	0.038
34.0	0.487	0.720	0.732	0.612	0.120	806.8	310.8	119.6	0.039
35.0	0.499	0.696	0.707	0.589	0.119	771.9	296.7	114.0	0.040
36.0	0.506	0.681	0.692	0.573	0.118	749.2	287.5	110.3	0.041
37.1	0.526	0.643	0.653	0.535	0.117	694.3	265.5	101.5	0.042
38.0	0.559	0.581	0.590	0.475	0.115	606.4	230.4	87.5	0.046
39.0	0.595	0.518	0.526	0.412	0.113	518.1	195.3	73.6	0.050
40.1	0.625	0.470	0.477	0.365	0.112	451.4	169.0	63.2	0.055
41.0	0.661	0.414	0.419	0.309	0.110	374.8	139.1	51.6	0.061
42.1	0.676	0.392	0.397	0.287	0.110	345.4	127.6	47.1	0.064
43.1	0.689	0.372	0.376	0.267	0.109	318.7	117.3	43.2	0.067
44.2	0.675	0.393	0.398	0.289	0.110	347.3	128.4	47.4	0.063
45.2	0.695	0.363	0.368	0.259	0.109	307.6	113.0	41.5	0.068
46.3	0.709	0.344	0.348	0.240	0.108	282.0	103.2	37.7	0.072
47.4	0.711	0.341	0.345	0.237	0.108	278.4	101.8	37.2	0.072
48.5	0.712	0.340	0.343	0.235	0.108	276.6	101.1	36.9	0.072
49.6	0.725	0.322	0.325	0.218	0.107	253.7	92.3	33.6	0.076

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Figure D-43. Ocean optical properties (sheet 2 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.

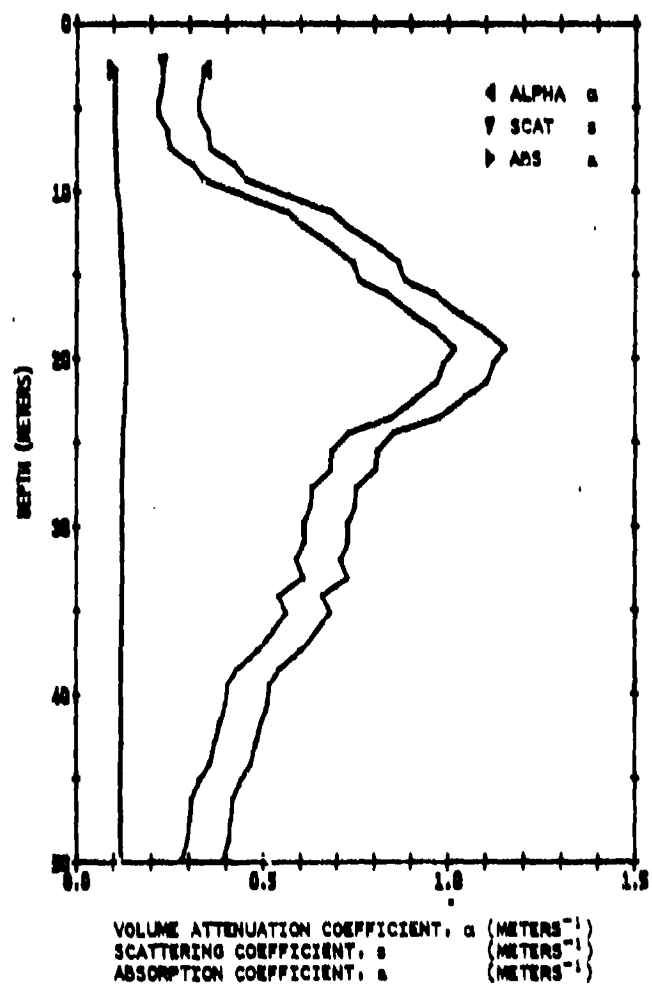

Figure D-44. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
23JUN1975   1556PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
2.5	0.713	0.338	0.342	0.234	0.108	274.8	100.4	36.7	0.073
3.5	0.717	0.333	0.337	0.229	0.108	267.7	97.7	35.6	0.074
4.4	0.723	0.325	0.328	0.221	0.108	257.2	93.7	34.1	0.076
5.2	0.721	0.327	0.331	0.223	0.108	260.7	95.0	34.6	0.075
6.2	0.705	0.349	0.357	0.245	0.108	289.2	105.9	38.8	0.071
7.2	0.701	0.355	0.359	0.251	0.108	296.5	108.7	39.9	0.070
8.2	0.660	0.415	0.421	0.310	0.110	376.8	139.8	51.9	0.061
9.1	0.641	0.445	0.451	0.340	0.111	417.6	155.7	58.1	0.057
10.1	0.574	0.555	0.563	0.449	0.115	569.8	215.8	81.7	0.048
11.1	0.510	0.673	0.684	0.565	0.118	738.0	283.0	108.5	0.041
11.9	0.491	0.712	0.724	0.604	0.119	795.1	306.0	117.7	0.039
13.1	0.453	0.791	0.804	0.683	0.122	911.4	353.2	136.8	0.036
14.1	0.428	0.849	0.864	0.740	0.124	997.7	388.3	151.1	0.034
15.2	0.421	0.865	0.880	0.756	0.124	1022.0	398.2	155.1	0.034
16.0	0.391	0.940	0.957	0.830	0.126	1135.3	444.7	174.1	0.032
17.3	0.363	1.012	1.031	0.903	0.129	1246.7	490.6	192.9	0.030
18.1	0.345	1.065	1.085	0.955	0.130	1328.0	524.2	206.8	0.029
19.3	0.325	1.123	1.145	1.013	0.132	1419.0	561.9	222.4	0.028
20.2	0.335	1.094	1.115	0.984	0.131	1372.7	542.7	214.5	0.029
21.3	0.342	1.073	1.094	0.964	0.131	1341.2	529.7	209.1	0.029
22.2	0.360	1.020	1.040	0.911	0.129	1259.2	495.7	195.1	0.030
23.4	0.385	0.955	0.972	0.846	0.127	1158.4	454.2	178.0	0.032
24.3	0.434	0.835	0.850	0.726	0.123	977.3	380.0	147.7	0.035
25.4	0.454	0.789	0.802	0.680	0.122	908.2	351.9	136.3	0.036
26.5	0.456	0.784	0.798	0.676	0.122	901.8	349.3	135.2	0.036
27.6	0.480	0.734	0.746	0.626	0.120	827.6	319.2	123.0	0.038
28.7	0.483	0.728	0.740	0.620	0.120	818.6	315.6	121.6	0.039
29.7	0.491	0.712	0.724	0.604	0.119	795.1	306.0	117.7	0.039
30.8	0.491	0.712	0.724	0.604	0.119	795.1	306.0	117.7	0.039
31.9	0.500	0.692	0.703	0.585	0.119	766.2	294.4	113.1	0.040
33.0	0.493	0.708	0.720	0.600	0.119	789.2	303.7	116.8	0.039
34.1	0.526	0.643	0.653	0.535	0.117	694.3	265.5	101.5	0.042
35.1	0.516	0.661	0.672	0.554	0.118	721.4	276.4	105.8	0.042
36.2	0.535	0.626	0.636	0.519	0.117	670.4	255.9	97.6	0.043
37.4	0.557	0.585	0.594	0.478	0.116	611.4	232.3	88.2	0.046
38.5	0.591	0.527	0.534	0.420	0.114	529.6	199.8	75.4	0.050
39.4	0.605	0.502	0.509	0.396	0.113	495.4	186.3	70.0	0.052
40.5	0.609	0.496	0.503	0.390	0.113	486.5	182.8	68.7	0.052
41.7	0.619	0.480	0.486	0.374	0.112	464.4	174.1	65.2	0.054
42.9	0.628	0.466	0.472	0.360	0.112	445.0	166.5	62.3	0.055
44.1	0.636	0.453	0.459	0.348	0.111	428.0	159.8	59.7	0.056
45.1	0.653	0.426	0.431	0.321	0.111	390.9	145.3	54.0	0.059
46.3	0.668	0.404	0.409	0.299	0.110	361.0	133.7	49.5	0.062
47.5	0.672	0.398	0.403	0.293	0.110	353.1	130.6	48.3	0.063
48.7	0.676	0.392	0.397	0.287	0.110	345.4	127.6	47.1	0.064
49.9	0.688	0.375	0.379	0.270	0.109	322.5	118.8	43.7	0.066

PAUSE READY PLOTTER

Figure D-44. Ocean optical properties (sheet 2 of 2).

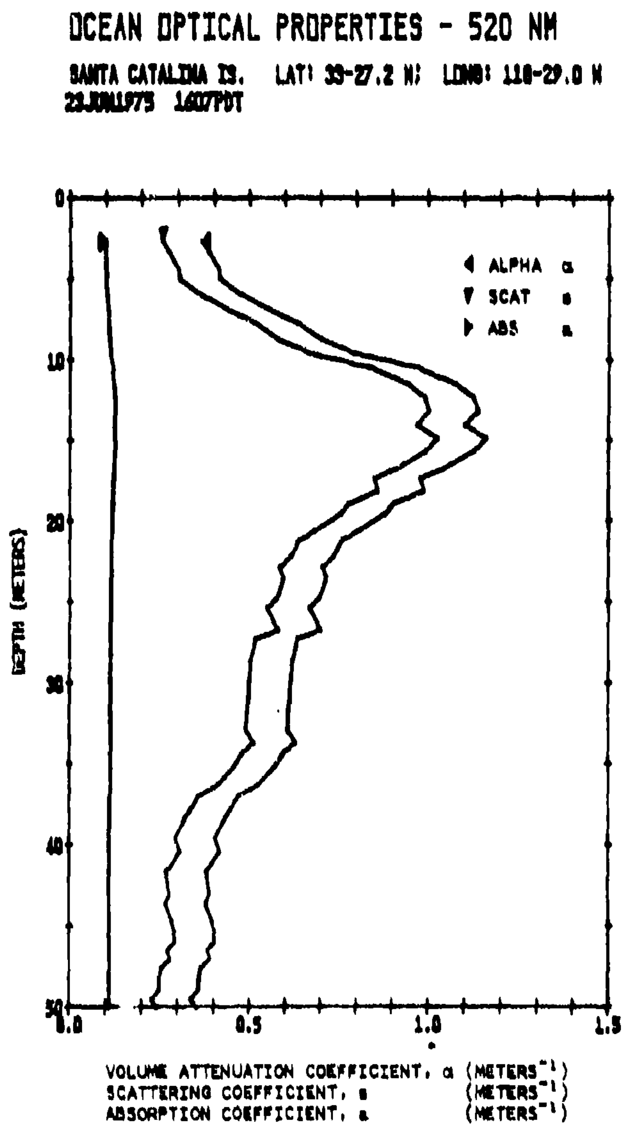

Figure D-45. Ocean optical properties (sheet 1 of 3).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
23JUN1975 1607PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
2.4	0.689	0.372	0.376	0.267	0.109	318.7	117.3	43.2	0.067
3.2	0.677	0.390	0.395	0.286	0.110	343.5	126.9	46.8	0.064
4.1	0.662	0.412	0.418	0.307	0.110	372.8	138.3	51.3	0.061
4.7	0.659	0.417	0.422	0.312	0.110	378.8	140.6	52.2	0.060
5.7	0.622	0.475	0.481	0.369	0.112	457.9	171.6	64.2	0.054
6.6	0.578	0.548	0.556	0.442	0.114	560.2	212.0	80.2	0.048
7.5	0.533	0.630	0.639	0.523	0.117	675.6	258.0	98.5	0.043
8.5	0.499	0.694	0.705	0.587	0.119	769.0	295.5	113.5	0.040
9.4	0.457	0.782	0.796	0.674	0.122	898.6	348.0	134.7	0.037
10.3	0.386	0.952	0.970	0.843	0.127	1154.5	452.6	177.3	0.032
11.3	0.349	1.054	1.074	0.944	0.130	1310.5	516.9	203.8	0.029
12.2	0.332	1.103	1.124	0.993	0.131	1386.4	548.4	216.8	0.028
13.0	0.328	1.114	1.136	1.004	0.132	1405.0	556.1	220.0	0.028
13.9	0.339	1.082	1.103	0.972	0.131	1354.6	535.2	211.4	0.029
14.7	0.321	1.136	1.158	1.025	0.132	1438.0	569.8	225.7	0.028
15.5	0.331	1.106	1.127	0.996	0.132	1391.1	550.3	217.6	0.028
16.3	0.352	1.045	1.065	0.936	0.130	1297.5	511.5	201.6	0.030
17.2	0.382	0.962	0.980	0.853	0.127	1170.1	459.0	180.0	0.031
18.0	0.379	0.970	0.988	0.861	0.127	1181.9	463.9	182.0	0.031
18.7	0.410	0.891	0.907	0.782	0.125	1061.1	414.2	161.6	0.033
19.4	0.420	0.867	0.883	0.758	0.124	1025.5	399.7	155.7	0.034
20.4	0.452	0.793	0.807	0.685	0.122	914.6	354.5	137.3	0.036
21.0	0.473	0.749	0.761	0.641	0.121	848.8	327.8	126.5	0.038
22.0	0.484	0.726	0.738	0.618	0.120	815.7	314.4	121.1	0.039
22.7	0.499	0.696	0.707	0.589	0.119	771.9	296.7	114.0	0.040
23.4	0.494	0.706	0.718	0.598	0.119	786.3	302.5	116.3	0.040
24.0	0.498	0.698	0.709	0.590	0.119	774.8	297.8	114.4	0.040
24.6	0.503	0.686	0.697	0.579	0.119	757.7	290.9	111.7	0.040
25.2	0.517	0.659	0.670	0.552	0.118	718.7	275.3	105.4	0.042
26.6	0.501	0.690	0.701	0.583	0.119	763.3	293.2	112.6	0.040
27.1	0.535	0.626	0.636	0.519	0.117	670.4	255.9	97.6	0.043
28.5	0.544	0.610	0.619	0.503	0.116	646.9	246.5	93.9	0.044
29.8	0.546	0.606	0.615	0.499	0.116	641.8	244.5	93.1	0.044
31.0	0.547	0.602	0.612	0.496	0.116	636.7	242.4	92.3	0.045
31.7	0.549	0.599	0.608	0.492	0.116	631.6	240.4	91.4	0.045
32.8	0.552	0.594	0.603	0.487	0.116	624.0	237.3	90.2	0.045
33.6	0.540	0.617	0.626	0.510	0.116	657.3	250.7	95.5	0.044
34.2	0.555	0.588	0.597	0.481	0.116	616.4	234.3	89.0	0.046
35.1	0.570	0.562	0.570	0.456	0.115	579.4	219.6	83.2	0.047
36.2	0.597	0.515	0.522	0.409	0.113	513.5	193.5	72.9	0.051
36.9	0.630	0.462	0.469	0.357	0.112	440.7	164.8	61.6	0.055
37.7	0.642	0.442	0.448	0.337	0.111	413.4	154.1	57.4	0.057
38.2	0.652	0.427	0.433	0.322	0.111	372.9	146.1	54.3	0.059
39.5	0.672	0.398	0.403	0.293	0.110	353.1	130.6	48.3	0.063
40.3	0.663	0.411	0.416	0.306	0.110	370.8	137.5	51.0	0.061
41.6	0.689	0.372	0.376	0.267	0.109	318.7	117.3	43.2	0.067
43.0	0.684	0.380	0.385	0.276	0.109	330.1	121.7	44.8	0.065
43.6	0.690	0.370	0.375	0.266	0.109	316.9	116.6	42.9	0.067

Figure D-45. Ocean optical properties (sheet 2 of 3).

44.0	0.687	0.376	0.381	0.271	0.109	324.4	119.5	44.0	0.066
44.6	0.680	0.386	0.391	0.281	0.109	337.7	124.6	46.0	0.065
45.3	0.675	0.393	0.398	0.289	0.110	347.3	128.4	47.4	0.063
45.9	0.673	0.396	0.401	0.291	0.110	351.2	129.9	48.0	0.063
46.5	0.688	0.375	0.379	0.270	0.109	322.5	118.8	43.7	0.066
47.0	0.684	0.380	0.385	0.276	0.109	330.1	121.7	44.8	0.065
47.6	0.700	0.356	0.360	0.252	0.109	298.3	109.5	40.1	0.069
48.3	0.704	0.351	0.355	0.246	0.108	291.0	106.6	39.1	0.070
48.9	0.705	0.349	0.353	0.245	0.108	289.2	105.9	38.8	0.071
49.5	0.720	0.329	0.332	0.225	0.108	262.4	95.7	34.9	0.075
50.0	0.709	0.344	0.348	0.240	0.108	282.0	103.2	37.7	0.072

PAUSE READY PLOTTER

Figure D-45. Ocean optical properties (sheet 3 of 3).

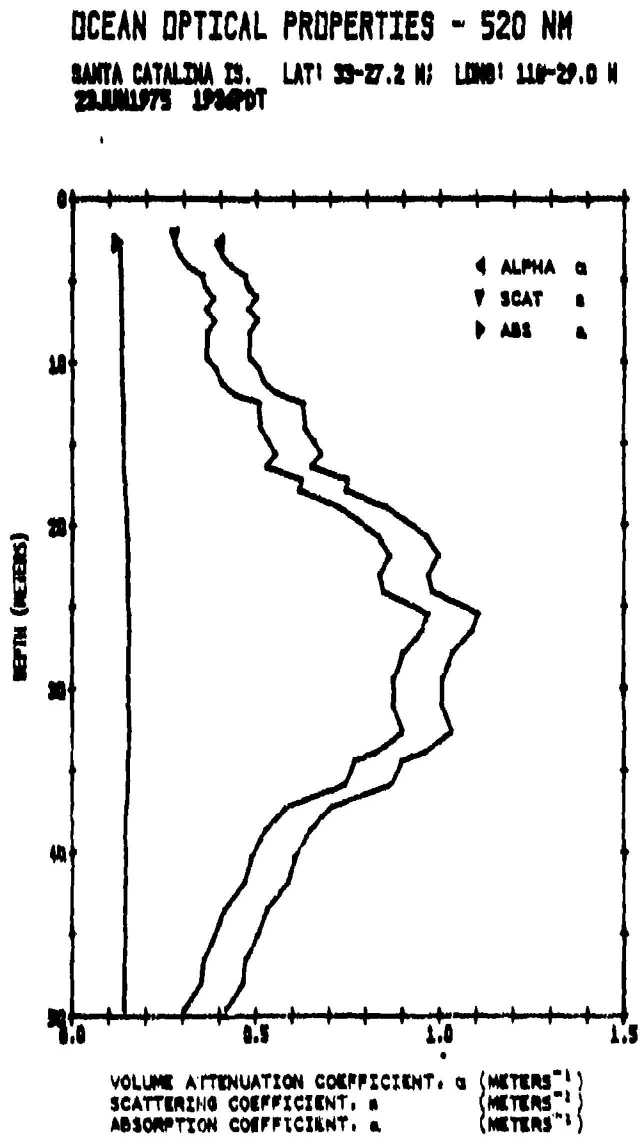

Figure D-46. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
23JUN1975   1936PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
2.5	0.702	0.353	0.358	0.249	0.108	294.7	108.0	39.6	0.070
3.3	0.692	0.368	0.372	0.263	0.109	313.1	115.1	42.3	0.067
3.9	0.679	0.388	0.392	0.283	0.109	339.6	125.4	46.3	0.064
4.5	0.652	0.427	0.433	0.322	0.111	392.9	146.1	54.3	0.059
5.2	0.648	0.433	0.439	0.328	0.111	401.1	149.3	55.5	0.058
5.9	0.634	0.456	0.462	0.351	0.112	432.2	161.5	60.3	0.056
6.6	0.646	0.436	0.442	0.331	[illegible]	405.2	150.9	56.2	0.058
7.3	0.634	0.456	0.462	0.351	[illegible]	432.2	161.5	60.3	0.056
8.0	0.645	0.438	0.444	0.333	0.111	407.2	151.7	56.5	0.058
8.9	0.646	0.436	0.442	0.331	0.111	405.2	150.9	56.2	0.058
9.6	0.646	0.436	0.442	0.331	0.111	405.2	150.9	56.2	0.058
10.3	0.632	0.459	0.465	0.354	0.112	436.5	163.1	60.9	0.056
11.1	0.623	0.473	0.480	0.368	0.112	455.7	170.7	63.9	0.054
11.8	0.602	0.507	0.514	0.401	0.113	502.2	189.0	71.1	0.051
12.4	0.564	0.572	0.581	0.466	0.115	594.1	225.4	85.5	0.046
13.9	0.561	0.578	0.586	0.471	0.115	601.5	228.4	86.7	0.046
14.7	0.550	0.597	0.606	0.490	0.116	629.0	239.4	91.0	0.045
15.5	0.540	0.617	0.626	0.510	0.116	657.3	250.7	95.5	0.044
16.3	0.552	0.594	0.603	0.487	0.116	624.0	237.5	90.2	0.045
17.1	0.505	0.682	0.693	0.575	0.119	752.0	288.7	110.8	0.041
17.8	0.507	0.679	0.690	0.571	0.118	746.4	286.4	109.8	0.041
18.8	0.458	0.780	0.793	0.672	0.122	895.4	346.7	134.2	0.037
19.6	0.438	0.826	0.840	0.718	0.123	963.8	374.5	145.4	0.035
20.6	0.413	0.884	0.899	0.775	0.125	1050.3	409.8	159.8	0.033
21.8	0.402	0.912	0.929	0.803	0.126	1094.0	427.7	167.2	0.033
23.0	0.411	0.888	0.904	0.779	0.125	1057.5	412.8	161.0	0.033
24.0	0.408	0.895	0.912	0.787	0.125	1068.3	417.2	162.9	0.033
25.4	0.363	1.012	1.031	0.903	0.129	1246.7	490.6	192.9	0.030
26.4	0.368	0.999	1.018	0.890	0.128	1226.1	482.1	189.5	0.031
27.8	0.388	0.947	0.965	0.838	0.127	1146.8	449.4	176.0	0.032
29.4	0.398	0.922	0.939	0.813	0.126	1108.8	433.8	169.6	0.032
31.0	0.399	0.920	0.937	0.811	0.126	1105.1	432.3	169.0	0.032
32.7	0.390	0.942	0.959	0.833	0.126	1139.1	446.3	174.7	0.032
33.9	0.415	0.879	0.895	0.770	0.125	1043.2	406.9	158.6	0.034
34.4	[illegible]	0.819	0.834	0.711	0.123	953.8	370.4	143.8	0.035
35.9	0.453	0.791	0.804	0.683	0.122	911.4	353.2	136.8	0.036
37.2	0.526	0.643	0.653	0.535	0.117	694.3	265.5	101.5	0.042
38.7	0.557	[illegible]	0.594	0.478	0.116	611.4	232.3	88.2	0.046
40.3	0.580	0.545	0.553	0.439	0.114	555.4	210.1	79.4	0.048
41.9	0.591	0.527	0.534	0.420	0.114	529.6	199.8	75.4	0.050
43.5	0.622	0.475	[illegible]	0.369	0.112	457.9	171.6	64.2	0.054
45.1	0.639	0.449	0.454	0.343	0.111	421.7	157.4	58.7	0.057
46.6	0.658	0.418	0.424	0.313	0.110	380.8	141.4	52.5	0.060
48.0	0.663	0.411	0.416	0.306	0.110	370.8	137.5	51.0	0.061
49.6	0.690	0.370	0.375	0.266	0.109	316.9	116.6	42.9	0.067

PAUSE READY PLOTTER

Figure D-46. Ocean optical properties (sheet 2 of 2).

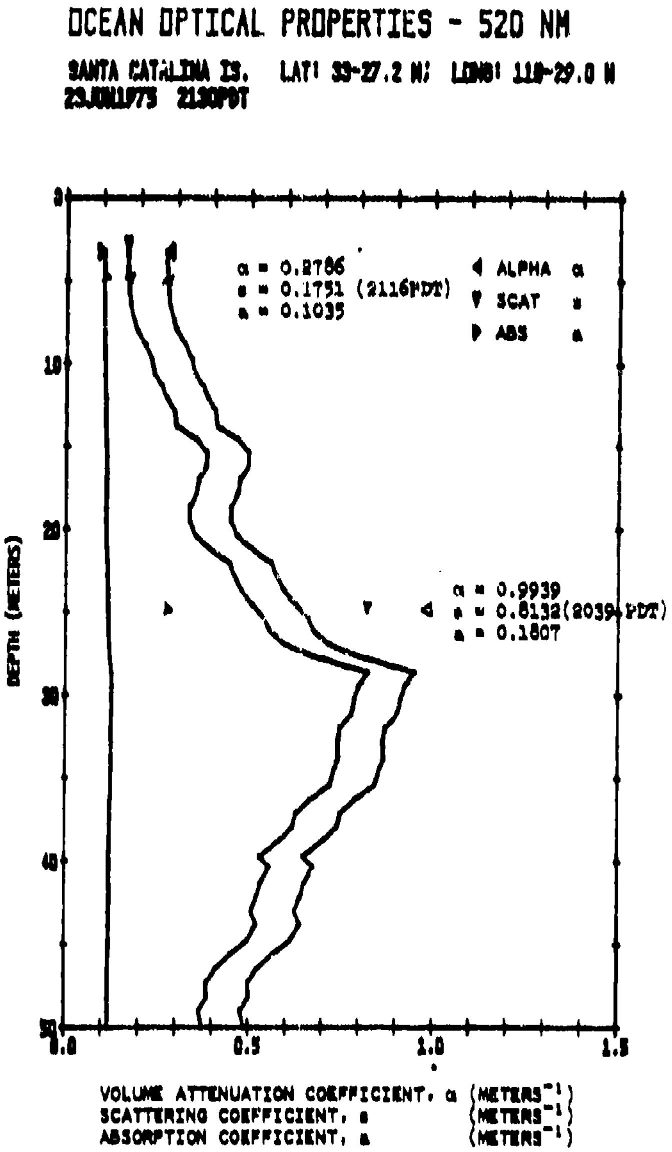

Figure D-47. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
23JUN1975   2130PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
3.0	0.762	0.272	0.275	0.169	0.106	190.2	68.3	24.5	0.090
4.0	0.762	0.272	0.275	0.169	0.106	190.2	68.3	24.5	0.090
5.3	0.759	0.276	0.278	0.172	0.106	195.0	70.1	25.2	0.089
6.2	0.757	0.278	0.281	0.175	0.106	198.3	71.3	25.6	0.088
7.1	0.750	0.287	0.290	0.184	0.106	209.7	75.6	27.2	0.085
7.8	0.743	0.297	0.300	0.193	0.107	221.3	80.0	28.9	0.082
8.7	0.727	0.319	0.323	0.215	0.107	250.2	91.0	33.1	0.077
9.6	0.714	0.337	0.341	0.233	0.108	273.0	99.7	36.4	0.073
10.4	0.709	0.344	0.348	0.240	0.108	282.0	103.2	37.7	0.072
11.2	0.693	0.366	0.370	0.262	0.109	311.3	114.4	42.0	0.068
11.9	0.685	0.379	0.384	0.274	0.109	328.2	121.0	44.6	0.066
12.7	0.671	0.399	0.404	0.294	0.110	355.1	131.4	48.6	0.063
13.6	0.668	0.404	0.409	0.299	0.110	361.0	133.7	49.5	0.062
14.4	0.633	0.458	0.464	0.352	0.112	434.4	162.3	60.6	0.056
15.2	0.615	0.486	0.493	0.380	0.112	473.2	177.6	66.6	0.053
16.1	0.616	0.484	0.491	0.379	0.112	471.0	176.7	66.3	0.053
16.8	0.629	0.464	0.470	0.358	0.112	442.9	165.6	61.9	0.055
17.7	0.634	0.456	0.462	0.351	0.112	432.2	161.5	60.3	0.056
18.5	0.644	0.439	0.445	0.334	0.111	409.3	152.5	56.8	0.058
19.3	0.645	0.438	0.444	0.333	0.111	407.2	151.7	56.5	0.058
20.2	0.636	0.453	0.459	0.348	0.111	428.0	159.8	59.7	0.056
21.0	0.611	0.492	0.499	0.387	0.113	482.0	181.0	68.0	0.052
21.9	0.579	0.547	0.555	0.440	0.114	557.8	211.0	79.8	0.048
22.7	0.571	0.560	0.569	0.454	0.115	577.0	218.6	82.8	0.047
23.5	0.561	0.578	0.586	0.471	0.115	601.5	228.4	86.7	0.046
24.4	0.545	0.608	0.617	0.501	0.116	644.4	245.5	93.5	0.044
25.2	0.527	0.641	0.651	0.534	0.117	691.6	264.4	101.0	0.043
26.0	0.518	0.658	0.668	0.550	0.118	715.9	274.2	104.9	0.042
26.9	0.497	0.700	0.711	0.592	0.119	777.7	299.0	114.9	0.040
27.7	0.452	0.795	0.809	0.687	0.122	917.8	355.8	137.6	0.036
28.5	0.398	0.922	0.939	0.813	0.126	1108.8	433.8	169.6	0.032
29.4	0.407	0.898	0.914	0.789	0.125	1072.0	418.7	163.5	0.033
30.2	0.412	0.886	0.902	0.777	0.125	1053.9	411.3	160.4	0.033
31.1	0.416	0.876	0.892	0.768	0.124	1039.6	405.5	158.1	0.034
31.9	0.429	0.846	0.861	0.738	0.124	994.3	386.9	150.5	0.034
32.7	0.432	0.840	0.854	0.731	0.123	984.0	382.8	148.8	0.035
33.7	0.431	0.842	0.857	0.733	0.123	987.5	384.1	149.4	0.035
34.4	0.436	0.830	0.845	0.722	0.123	970.5	377.2	146.6	0.035
35.4	0.442	0.817	0.831	0.709	0.123	950.5	369.1	143.2	0.035
36.2	0.464	0.767	0.780	0.659	0.121	876.6	339.0	131.1	0.037
37.1	0.484	0.726	0.738	0.618	0.120	815.7	314.4	121.1	0.039
37.9	0.489	0.716	0.728	0.608	0.120	800.9	308.4	118.7	0.039
38.7	0.504	0.684	0.695	0.577	0.119	754.8	289.8	111.2	0.040
39.7	0.534	0.628	0.638	0.521	0.117	673.0	256.9	98.0	0.043
40.3	0.520	0.654	0.664	0.547	0.118	710.5	272.0	104.1	0.042
41.4	0.533	0.630	0.639	0.523	0.117	675.6	258.0	98.5	0.043
42.2	0.539	0.619	0.628	0.512	0.117	659.9	251.7	96.0	0.044
43.0	0.547	0.604	0.613	0.497	0.116	639.2	243.4	92.7	0.045
43.8	0.539	0.619	0.628	0.512	0.117	659.9	251.7	96.0	0.044
44.8	0.552	0.594	0.603	0.487	0.116	624.0	237.3	90.2	0.045
45.6	0.578	0.548	0.556	0.442	0.114	560.2	212.0	80.2	0.048
46.5	0.602	0.507	0.514	0.401	0.113	502.2	189.0	71.1	0.051
47.3	0.617	0.483	0.489	0.377	0.112	468.8	175.8	65.9	0.053
48.2	0.616	0.484	0.491	0.379	0.112	471.0	176.7	66.3	0.053
49.0	0.630	0.462	0.469	0.357	0.112	440.7	164.8	61.6	0.055
50.0	0.625	0.470	0.477	0.365	0.112	451.4	169.0	63.2	0.055

PAUSE READY PLOTTER

Figure D-47. Ocean optical properties (sheet 2 of 2).

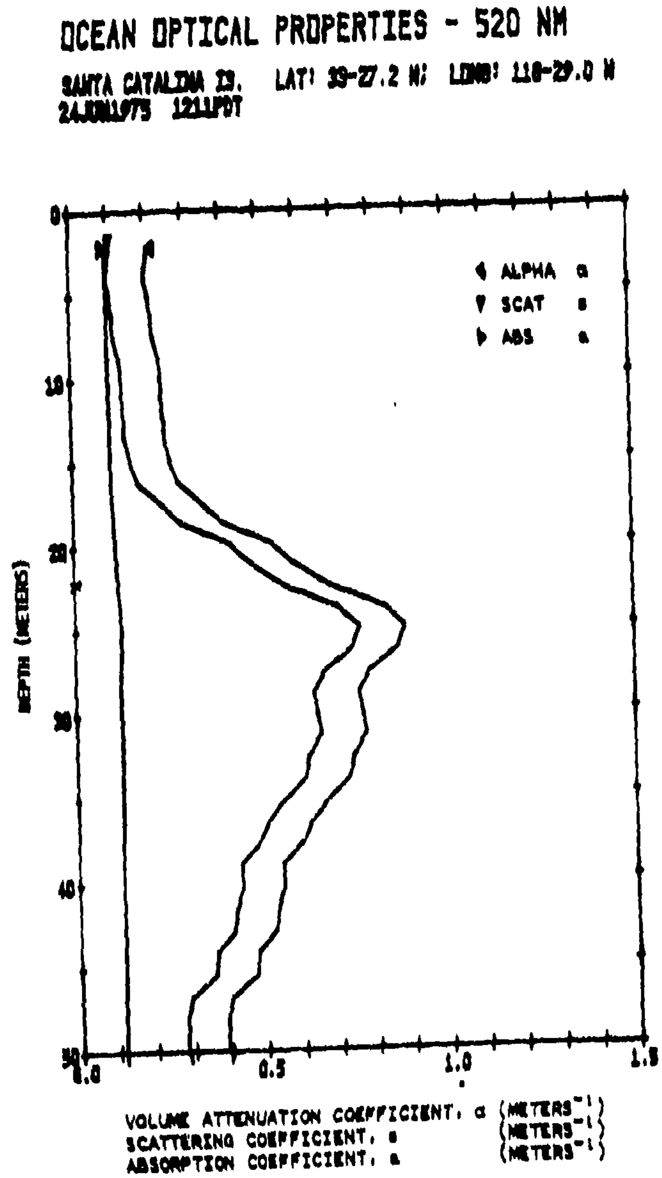

Figure D-48 Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
24JUN1975   1211PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
2.0	0.805	0.217	0.219	0.114	0.104	123.1	43.3	15.2	0.116
3.7	0.813	0.207	0.209	0.105	0.104	111.7	39.1	13.6	0.122
4.9	0.806	0.216	0.217	0.113	0.104	121.7	42.7	15.0	0.117
5.9	0.802	0.220	0.222	0.118	0.104	127.5	44.9	15.8	0.114
7.3	0.798	0.225	0.227	0.123	0.105	133.3	47.0	16.6	0.111
8.5	0.789	0.236	0.239	0.134	0.105	146.7	52.0	18.4	0.105
9.7	0.784	0.243	0.245	0.140	0.105	154.3	54.8	19.5	0.102
10.0	0.784	0.243	0.245	0.140	0.105	154.3	54.8	19.5	0.102
12.2	0.782	0.246	0.249	0.144	0.105	158.9	56.5	20.1	0.100
13.3	0.781	0.248	0.250	0.145	0.105	160.4	57.1	20.3	0.099
14.7	0.770	0.262	0.264	0.158	0.106	177.5	63.5	22.7	0.094
16.0	0.735	0.281	0.284	0.177	.106	201.5	72.5	26.1	0.087
17.3	0.712	0.340	0.343	0.235	.108	276.6	101.1	36.9	0.072
18.5	0.675	0.393	0.398	0.289	0.110	347.2	128.4	47.4	0.063
19.8	0.592	0.525	0.533	0.419	0.114	527.3	198.9	75.0	0.050
21.0	0.559	0.581	0.590	0.475	0.115	606.4	230.4	87.5	0.046
22.4	0.510	0.673	0.684	0.565	0.118	738.0	283.0	108.5	0.041
23.7	0.444	0.813	0.827	0.704	0.123	943.9	366.4	142.2	0.036
24.9	0.420	0.867	0.883	0.758	0.124	1025.5	399.7	155.7	0.034
26.2	0.428	0.849	0.864	0.740	0.124	997.7	388.3	151.1	0.034
27.6	0.462	0.772	0.785	0.663	0.121	892.8	341.6	132.1	0.037
28.8	0.475	0.744	0.757	0.636	0.120	842.7	325.3	125.5	0.038
30.1	0.471	0.753	0.765	0.645	0.121	854.9	330.2	127.5	0.038
31.2	0.467	0.761	0.774	0.653	0.121	867.2	335.2	129.5	0.037
32.7	0.484	0.726	0.738	0.618	0.120	815.7	314.4	121.1	0.039
33.9	0.490	0.714	0.726	0.606	0.119	798.0	307.2	118.2	0.039
35.4	0.521	0.652	0.662	0.545	0.118	707.8	270.9	103.6	0.042
36.5	0.542	0.613	0.623	0.506	0.116	652.1	248.6	94.7	0.044
37.8	0.557	0.585	0.594	0.478	0.116	611.4	232.3	88.2	0.046
39.0	0.585	0.537	0.544	0.430	0.114	543.6	205.4	77.6	0.049
40.4	0.585	0.537	0.544	0.430	0.114	543.6	205.4	77.6	0.049
41.7	0.594	0.520	0.527	0.414	0.114	[illegible]20.4	196.2	73.9	0.050
43.0	0.599	0.512	0.519	0.406	0.113	509.0	191.7	72.1	0.051
44.2	0.629	0.464	0.470	0.[illegible]58	0.112	442.9	165.[illegible]	61.9	0.055
45.6	0.634	0.456	0.462	0.351	0.112	432.2	16[illegible]	60.3	0.056
46.9	0.677	0.390	0.395	0.286	0.110	343.5	125.9	46.8	0.064
48.1	0.685	0.379	0.384	0.274	0.109	323.2	121.0	44.6	0.066
49.4	0.687	0.376	0.381	0.271	0.109	324.4	119.5	44.0	0.066
50.7	0.682	0.383	0.388	0.279	0.109	323.9	123.2	45.4	0.065

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Figure D-48. Ocean optical properties (sheet 2 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT: 33-27.2 N;   LONG: 118-29.0 W
24JUN1975 1222PDT

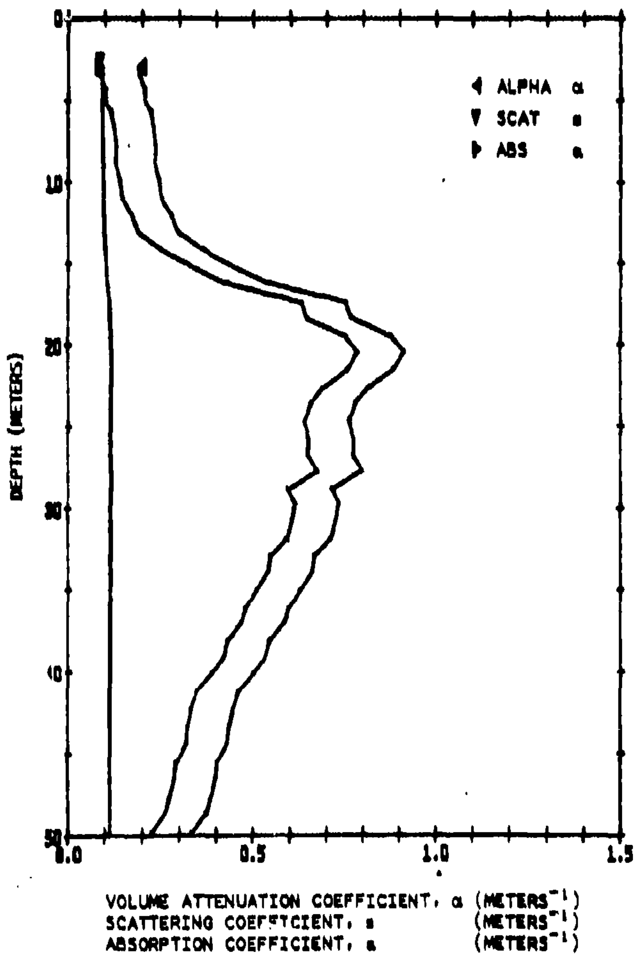

Figure D-49. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
24JUN1975 1222PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
2.6	0.819	0.200	0.201	0.098	0.104	103.3	36.0	12.5	0.128
3.1	0.818	0.201	0.203	0.099	0.104	104.7	36.5	12.7	0.127
3.9	0.808	0.213	0.215	0.111	0.104	118.8	41.7	14.6	0.118
4.8	0.804	0.218	0.220	0.116	0.104	124.6	43.8	15.4	0.115
5.3	0.793	0.232	0.234	0.129	0.105	140.7	49.8	17.6	0.107
6.2	0.788	0.238	0.240	0.135	0.105	148.2	52.5	18.6	0.104
7.4	0.784	0.243	0.245	0.140	0.105	154.3	54.8	19.5	0.102
8.4	0.786	0.240	0.242	0.137	0.105	151.3	53.7	19.0	0.103
9.5	0.778	0.251	0.254	0.149	0.105	165.0	58.8	20.9	0.098
10.6	0.773	0.258	0.260	0.155	0.106	172.8	61.7	22.0	0.095
11.7	0.752	0.285	0.288	0.181	0.106	206.4	74.4	26.8	0.086
12.8	0.739	0.302	0.305	0.198	0.107	228.0	82.6	29.9	0.081
13.8	0.696	0.362	0.366	0.257	0.109	305.7	112.3	41.2	0.068
15.0	0.636	0.453	0.459	0.348	0.111	428.0	159.8	59.7	0.056
15.9	0.587	0.533	0.541	0.427	0.114	538.9	203.5	76.8	0.049
17.1	0.477	0.740	0.753	0.632	0.120	836.6	322.8	124.5	0.038
18.1	0.470	0.755	0.768	0.647	0.121	858.0	331.5	128.0	0.038
19.2	0.424	0.858	0.873	0.749	0.124	1011.5	394.0	153.4	0.034
20.2	0.409	0.893	0.909	0.784	0.125	1064.7	415.7	162.2	0.033
21.3	0.421	0.865	0.880	0.756	0.124	1022.0	398.2	155.1	0.034
22.4	0.451	0.797	0.811	0.689	0.122	921.1	357.1	138.4	0.036
23.3	0.465	0.765	0.778	0.657	0.121	873.5	337.8	130.5	0.037
24.4	0.474	0.746	0.759	0.639	0.120	845.7	326.5	126.0	0.038
25.5	0.468	0.759	0.772	0.651	0.121	864.1	334.0	129.0	0.037
26.5	0.469	0.757	0.770	0.649	0.121	861.1	332.7	128.5	0.037
27.5	0.458	0.780	0.793	0.672	0.122	895.4	346.7	134.2	0.037
28.6	0.497	0.700	0.711	0.592	0.119	777.7	299.0	114.9	0.040
29.5	0.488	0.718	0.730	0.610	0.120	803.8	309.6	119.2	0.039
30.6	0.492	0.710	0.722	0.602	0.119	792.1	304.8	117.3	0.039
31.7	0.499	0.696	0.707	0.589	0.119	771.9	296.7	114.0	0.040
32.7	0.520	0.654	0.664	0.547	0.118	710.5	272.0	104.1	0.042
33.7	0.524	0.646	0.657	0.539	0.117	699.6	267.6	102.3	0.042
34.8	0.541	0.615	0.625	0.508	0.116	654.7	249.6	95.1	0.044
35.9	0.557	0.585	0.594	0.478	0.116	611.4	232.3	88.2	0.046
36.8	0.564	0.572	0.581	0.466	0.115	594.1	225.4	85.5	0.046
37.9	0.586	0.535	0.543	0.429	0.114	541.3	204.5	77.2	0.049
39.0	0.594	0.522	0.529	0.416	0.114	522.7	197.1	74.3	0.050
39.9	0.612	0.491	0.498	0.385	0.113	479.8	180.2	67.6	0.053
41.0	0.638	0.450	0.456	0.345	0.111	423.8	158.2	59.0	0.057
42.1	0.647	0.435	0.440	0.330	0.111	403.1	150.1	55.9	0.058
43.2	0.655	0.423	0.428	0.318	0.111	386.8	143.7	53.4	0.060
44.2	0.659	0.417	0.422	0.312	0.110	378.8	140.6	52.2	0.060
45.4	0.676	0.392	0.397	0.287	0.110	345.4	127.6	47.1	0.064
46.4	0.680	0.386	0.391	0.281	0.109	337.7	124.6	46.0	0.065
47.6	0.689	0.373	0.378	0.269	0.109	320.6	118.0	43.4	0.066
48.5	0.696	0.362	0.366	0.257	0.109	305.7	112.3	41.2	0.068
49.7	0.724	0.323	0.327	0.219	0.108	255.4	93.0	33.8	0.076

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Figure D-49. Ocean optical properties (sheet 2 of 2).

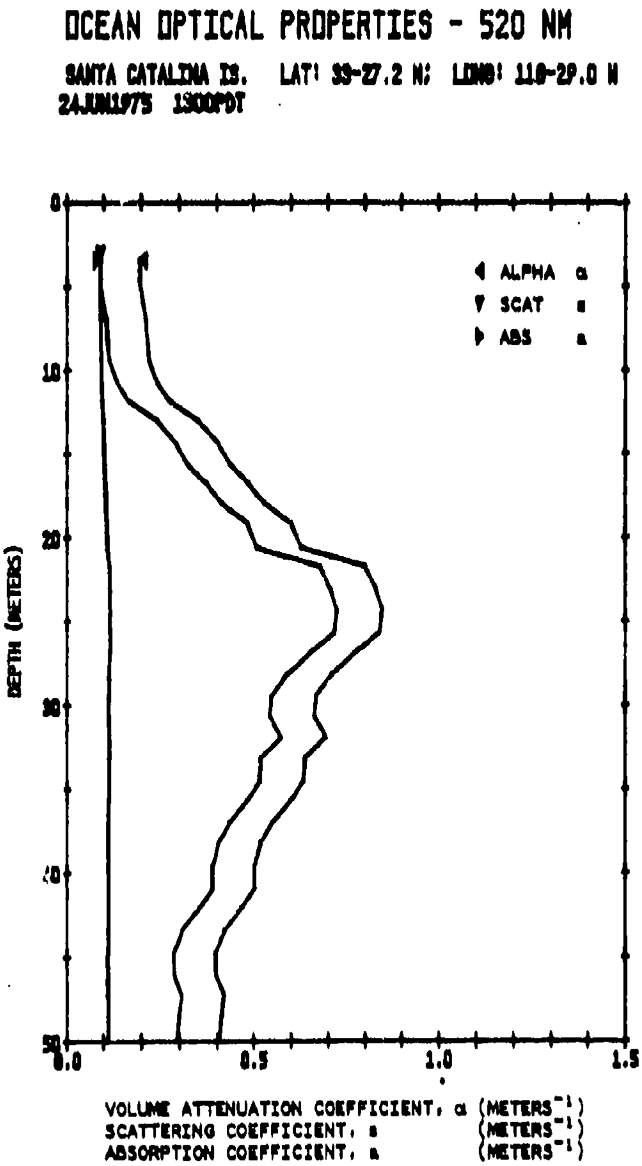

Figure D-50. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
24JUN1975   1300PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
3.1	0.813	0.207	0.209	0.105	0.104	111.7	39.1	13.6	0.123
4.3	0.814	0.206	0.205	0.104	0.104	110.3	38.5	13.5	0.123
5.4	0.809	0.212	0.214	0.110	0.104	117.4	41.1	14.4	0.119
6.6	0.802	0.220	0.222	0.118	0.104	127.5	44.9	15.8	0.114
7.9	0.799	0.224	0.226	0.122	0.104	131.9	46.5	16.4	0.111
9.1	0.796	0.228	0.230	0.125	0.105	136.3	48.1	17.0	0.109
10.4	0.782	0.246	0.249	0.144	0.105	158.9	56.5	20.1	0.100
11.5	0.758	0.277	0.280	0.174	0.106	196.6	70.7	25.4	0.088
12.7	0.703	0.352	0.356	0.248	0.108	292.9	107.3	39.3	0.070
14.1	0.668	0.404	0.409	0.299	0.110	361.0	133.7	49.5	0.062
15.3	0.648	0.433	0.439	0.3'8	0.111	401.1	149.3	55.5	0.058
16.5	0.617	0.483	0.489	0.377	0.112	468.8	175.8	65.9	0.053
17.7	0.593	0.523	0.531	0.417	0.114	525.0	198.0	74.6	0.050
18.9	0.552	0.594	0.603	0.487	0 '16	624.0	237.3	90.2	0.045
20.4	0.539	0.619	0.628	0.512	0.117	659.9	251.7	96.0	0.044
21.5	0.455	0.787	0.800	0.678	0.122	905.0	350.6	135.7	0.036
22.9	0.443	0.815	0.829	0.706	0.123	947.2	367.7	142.7	0.035
24.1	0.435	0.833	0.847	0.724	0.123	973.9	378.6	147.1	0.035
25.5	0.438	0.826	0.840	0.718	0.123	963.8	374.5	145.4	0.035
26.6	0.465	0.765	0.778	0.657	0.121	873.5	337.8	130.5	0.037
28.0	0.498	0.698	0.709	0.590	0.119	774.8	297.8	114.4	0.040
29.3	0.519	0.656	0.666	0.548	0.118	713.2	273.1	104.5	0.042
30.5	0.522	0.650	0.660	0.543	0.118	705.0	269.8	103.2	0.042
31.8	0.506	0.681	0.692	0.573	0.118	749.2	287.5	110.3	0.041
33.0	0.535	0.626	0.636	0.519	0.117	670.4	255.9	97.6	0.043
34.4	0.538	0.620	0.630	0.513	0.117	662.5	252.7	96.4	0.044
35.6	0.555	0.588	0.597	0.481	0.116	616.4	234.3	89.0	0.046
36.9	0.583	0.540	0.548	0.434	0.114	548.3	207.3	78.3	0.049
38.1	0.601	0.509	0.516	0.403	0.113	504.4	189.9	71.4	0.051
39.5	0.611	0.492	0.499	0.387	0.113	482.0	181.0	68.0	0.052
40.8	0.611	0.492	0.499	0.387	0.113	482.0	181.0	68.0	0.052
42.0	0.633	0.458	0.464	0.352	0.112	434.4	162.3	60.6	0.056
43.3	0.662	0.412	0.418	0.307	0.110	372.8	138.3	51.3	0.061
44.7	0.679	0.388	0.392	0.283	0.109	339.6	125.4	46.3	0.064
46.0	0.678	0.389	0.394	0.284	0.110	341.5	126.1	46.6	0.064
47.2	0.665	0.408	0.413	0.303	0.110	366.9	136.0	50.4	0.061
48.4	0.669	0.402	0.407	0.297	0.110	359.0	132.9	49.2	0.062
49.9	0.674	0.395	0.400	0.290	0.110	349.3	129.1	47.7	0.063

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Figure D-50. Ocean optical properties (sheet 2 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT: 33-27.2 N; LONG: 118-29.0 W
24JUN1975 1310PDT

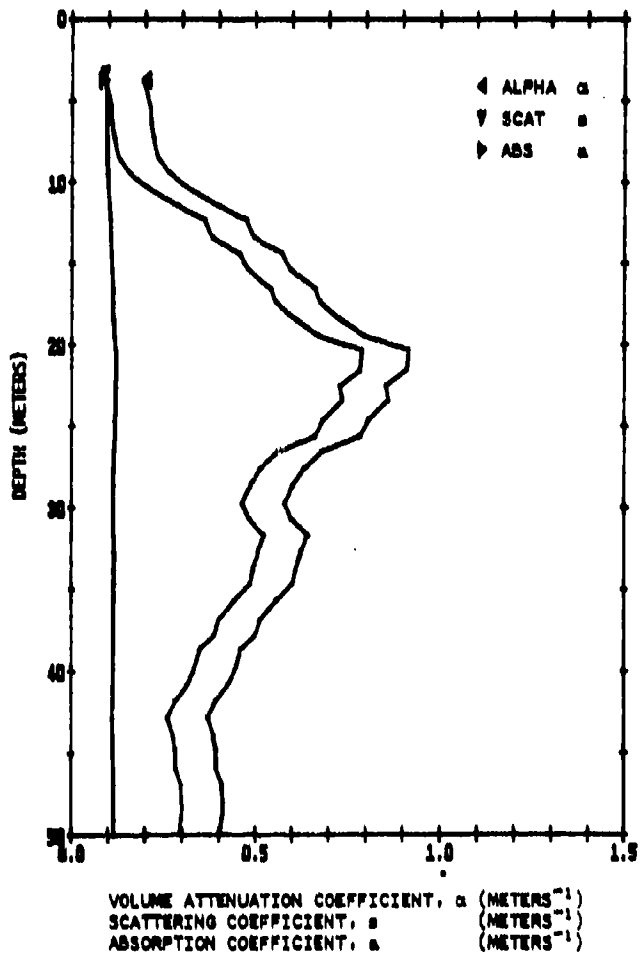

Figure D-51. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
24JUN1975 1310PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
3.4	0.817	0.202	0.204	0.100	0.104	106.1	37.0	12.9	0.126
4.3	0.809	0.212	0.214	0.110	0.104	117.4	41.1	14.4	0.119
4.9	0.804	0.218	0.220	0.116	0.104	124.6	43.8	15.4	0.115
6.0	0.802	0.220	0.222	0.118	0.104	127.5	44.9	15.8	0.114
6.9	0.797	0.227	0.229	0.124	0.105	134.8	47.6	16.8	0.110
8.1	0.789	0.236	0.239	0.134	0.105	146.7	52.0	18.4	0.105
9.1	0.765	0.268	0.271	0.165	0.106	185.4	66.5	23.8	0.091
10.0	0.730	0.315	0.319	0.211	0.107	245.0	89.0	32.3	0.078
11.1	0.675	0.393	0.398	0.289	0.110	347.3	128.4	47.4	0.063
12.0	0.625	0.470	0.477	0.365	0.112	451.4	169.0	63.2	0.055
13.1	0.612	0.491	0.498	0.385	0.113	479.8	180.2	67.6	0.053
14.1	0.568	0.566	0.574	0.459	0.115	584.3	221.5	84.0	0.047
15.1	0.555	0.588	0.597	0.481	0.116	616.4	234.3	89.0	0.046
16.3	0.521	0.652	0.662	0.545	0.118	707.8	270.9	103.6	0.042
17.1	0.515	0.663	0.674	0.556	0.118	724.2	277.5	106.3	0.041
18.2	0.488	0.718	0.730	0.610	0.120	803.8	309.6	119.2	0.039
19.2	0.460	0.776	0.789	0.668	0.121	889.1	344.1	133.1	0.037
20.1	0.408	0.895	0.912	0.787	0.125	1068.3	417.2	162.9	0.033
21.3	0.410	0.891	0.907	0.782	0.125	1061.1	414.2	161.6	0.033
22.3	0.433	0.837	0.852	0.729	0.123	980.7	381.4	148.2	0.035
23.2	0.431	0.842	0.857	0.733	0.123	987.5	384.1	149.4	0.035
24.4	0.453	0.791	0.804	0.683	0.122	911.4	353.2	136.8	0.036
25.4	0.464	0.767	0.780	0.659	0.121	876.6	339.0	131.1	0.037
26.3	0.512	0.669	0.680	0.562	0.118	732.4	280.8	107.6	0.041
27.4	0.539	0.619	0.628	0.512	0.117	659.9	251.7	96.0	0.044
28.4	0.553	0.592	0.601	0.485	0.116	621.5	236.3	89.8	0.045
29.5	0.566	0.569	0.577	0.462	0.115	589.2	223.5	84.7	0.047
30.5	0.556	0.586	0.595	0.480	0.116	613.9	233.3	88.6	0.046
31.5	0.534	0.628	0.638	0.521	0.117	673.0	256.9	98.0	0.043
32.5	0.543	0.611	0.621	0.504	0.116	649.5	247.5	94.3	0.044
33.6	0.550	0.597	0.606	0.490	0.116	629.0	239.4	91.0	0.045
34.5	0.555	0.588	0.597	0.481	0.116	616.4	234.3	89.0	0.046
35.5	0.579	0.547	0.555	0.440	0.114	557.8	211.0	79.8	0.048
36.7	0.605	0.502	0.509	0.396	0.113	495.4	186.3	70.0	0.052
37.7	0.614	0.488	0.494	0.382	0.113	475.4	178.4	66.9	0.053
38.5	0.638	0.450	0.456	0.345	0.111	423.8	158.2	59.0	0.057
39.7	0.646	0.436	0.442	0.331	0.111	405.2	150.9	56.2	0.058
40.7	0.660	0.415	0.421	0.310	0.110	376.8	139.8	51.9	0.061
41.7	0.683	0.382	0.386	0.277	0.109	332.0	122.4	45.1	0.065
42.7	0.697	0.360	0.365	0.256	0.109	303.9	111.6	40.9	0.069
43.8	0.688	0.375	0.379	0.270	0.109	322.5	118.8	43.7	0.066
44.7	0.683	0.382	0.386	0.277	0.109	332.0	122.4	45.1	0.065
45.8	0.683	0.382	0.386	0.277	0.109	332.0	122.4	45.1	0.065
46.8	0.673	0.396	0.401	0.291	0.110	351.2	129.9	48.0	0.063
47.9	0.671	0.399	0.404	0.294	0.110	355.1	131.4	48.6	0.063
48.9	0.673	0.396	0.401	0.291	0.110	351.2	129.9	48.0	0.063
49.9	0.677	0.390	0.395	0.286	0.110	343.5	126.9	46.8	0.064

PAUSE READY PLOTTER

Figure D-51. Ocean optical properties (sheet 2 of 2).

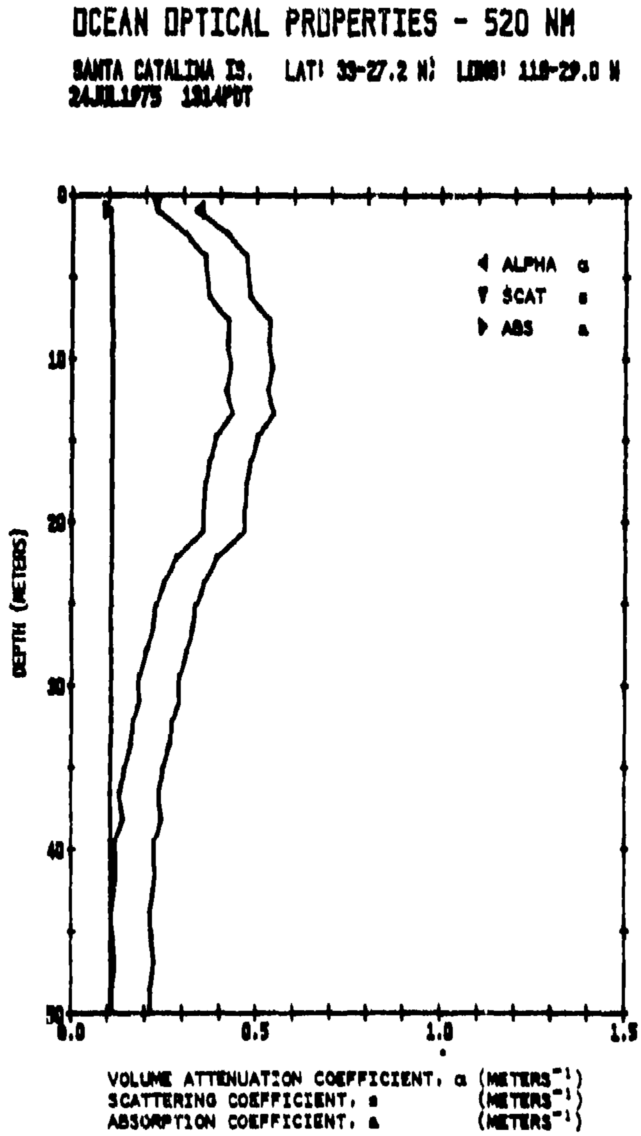

Figure D-52. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
24JUL1975   1314PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
0.7	0.714	0.337	0.341	0.233	0.108	273.0	99.7	36.4	0.073
2.1	0.662	0.412	0.418	0.307	0.110	372.8	138.3	51.3	0.061
3.5	0.626	0.469	0.475	0.363	0.112	449.3	168.2	62.9	0.055
4.7	0.623	0.473	0.480	0.368	0.112	455.7	170.7	63.9	0.054
6.0	0.620	0.478	0.485	0.372	0.112	462.3	173.3	64.9	0.054
7.5	0.589	0.530	0.538	0.424	0.114	534.3	201.7	76.1	0.049
8.9	0.591	0.527	0.534	0.420	0.114	529.6	199.8	75.4	0.050
10.3	0.585	0.537	0.544	0.430	0.114	543.6	205.4	77.6	0.049
11.8	0.593	0.523	0.531	0.417	0.114	525.0	198.0	74.6	0.050
13.2	0.583	0.540	0.548	0.434	0.114	548.3	207.3	78.3	0.049
14.6	0.608	0.497	0.504	0.391	0.113	488.7	183.7	69.0	0.052
16.1	0.619	0.480	0.486	0.374	0.112	464.4	174.1	65.2	0.054
17.5	0.627	0.467	0.473	0.362	0.112	447.1	167.3	62.6	0.055
18.9	0.630	0.462	0.469	0.357	0.112	440.7	164.8	61.6	0.055
20.4	0.631	0.461	0.467	0.355	0.112	438.6	164.0	61.3	0.055
22.0	0.679	0.388	0.392	0.283	0.109	339.6	125.4	46.3	0.064
23.6	0.701	0.355	0.359	0.251	0.108	296.5	108.7	39.9	0.070
25.0	0.718	0.331	0.335	0.227	0.108	266.0	97.0	35.4	0.074
26.4	0.724	0.323	0.327	0.219	0.108	255.4	93.0	33.8	0.076
27.8	0.737	0.306	0.309	0.202	0.107	233.1	84.5	30.6	0.080
29.3	0.751	0.286	0.289	0.183	0.106	208.0	75.0	27.0	0.085
30.8	0.750	0.287	0.290	0.184	0.106	209.7	75.6	27.2	0.085
32.1	0.765	0.268	0.271	0.165	0.106	185.4	66.5	23.8	0.091
33.6	0.771	0.260	0.263	0.157	0.106	175.9	62.9	22.5	0.094
35.0	0.784	0.243	0.245	0.140	0.105	154.3	54.8	19.5	0.102
36.5	0.793	0.232	0.234	0.129	0.105	140.7	49.8	17.6	0.107
38.1	0.787	0.239	0.241	0.136	0.105	149.7	53.1	18.8	0.103
39.5	0.803	0.219	0.221	0.117	0.104	126.0	44.3	15.6	0.114
41.0	0.801	0.222	0.224	0.119	0.104	129.0	45.4	16.0	0.113
42.5	0.806	0.216	0.217	0.113	0.104	121.7	42.7	15.0	0.117
43.8	0.813	0.207	0.209	0.105	0.104	111.7	39.1	13.6	0.123
45.4	0.809	0.212	0.214	0.110	0.104	117.4	41.1	14.4	0.119
46.9	0.805	0.217	0.219	0.114	0.104	123.1	43.3	15.2	0.116
48.4	0.812	0.208	0.210	0.106	0.104	113.1	39.6	13.8	0.122
49.9	0.812	0.208	0.210	0.106	0.104	113.1	39.6	13.8	0.122

PAUSE   READY PLOTTER

Figure D-52. Ocean optical properties (sheet 2 of 2).

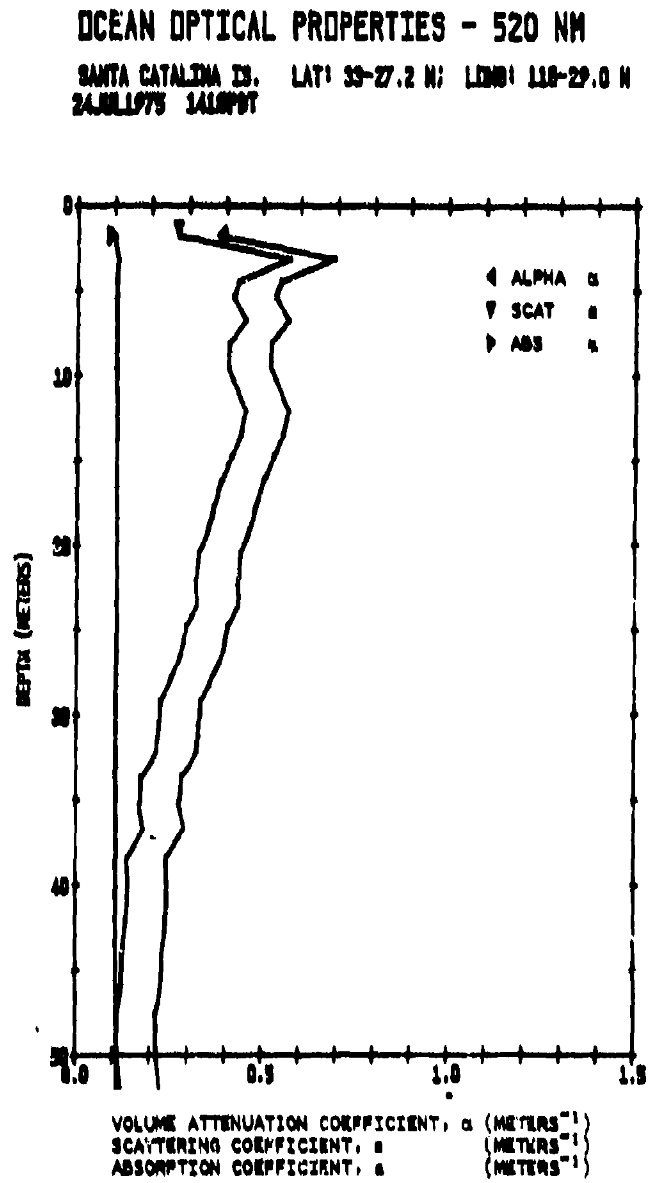

Figure D-53. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
24JUL1975   1418PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.5	0.682	0.383	0.388	0.279	0.109	333.9	123.2	45.4	0.065
2.9	0.505	0.682	0.693	0.575	0.119	752.0	288.7	110.8	0.041
4.2	0.580	0.545	0.553	0.439	0.114	555.4	210.1	79.6	0.048
5.1	0.589	0.530	0.538	0.424	0.114	534.3	201.7	76.1	0.049
6.5	0.569	0.564	0.572	0.457	0.115	581.9	220.6	83.6	0.047
7.9	0.595	0.518	0.526	0.412	0.113	518.1	195.3	73.6	0.050
9.3	0.597	0.515	0.522	0.409	0.113	513.5	193.5	72.9	0.051
10.6	0.583	0.540	0.548	0.434	0.114	548.3	207.3	78.3	0.049
11.9	0.570	0.562	0.570	0.456	0.115	579.4	219.6	83.2	0.047
13.3	0.578	0.548	0.556	0.442	0.114	560.2	212.0	80.2	0.048
14.6	0.593	0.523	0.531	0.417	0.114	525.0	198.0	74.6	0.050
16.1	0.609	0.496	0.503	0.390	0.113	486.5	182.8	68.7	0.052
17.5	0.621	0.477	0.483	0.371	0.112	460.1	172.4	64.6	0.054
18.9	0.631	0.461	0.467	0.355	0.112	438.6	164.0	61.3	0.055
20.3	0.646	0.436	0.442	0.331	0.111	405.2	150.9	56.2	0.058
21.8	0.652	0.427	0.433	0.322	0.111	392.9	146.1	54.3	0.059
23.3	0.649	0.432	0.437	0.327	0.111	399.0	148.5	55.2	0.059
24.6	0.670	0.401	0.406	0.296	0.110	357.0	132.1	48.9	0.062
26.1	0.679	0.388	0.392	0.283	0.109	339.6	125.4	46.3	0.064
27.6	0.697	0.360	0.365	0.256	0.109	303.9	111.6	40.9	0.069
29.0	0.718	0.331	0.335	0.227	0.108	266.0	97.0	35.4	0.074
30.5	0.723	0.325	0.328	0.221	0.108	257.2	93.7	34.1	0.076
32.1	0.728	0.318	0.321	0.214	0.107	248.5	90.3	32.8	0.077
33.5	0.756	0.280	0.282	0.176	0.106	199.9	71.9	25.9	0.087
35.0	0.762	0.272	0.275	0.169	0.106	190.2	68.3	24.5	0.090
36.6	0.754	0.282	0.285	0.179	0.106	203.1	73.1	26.3	0.087
38.3	0.787	0.239	0.241	0.136	0.105	149.7	53.1	18.8	0.103
39.8	0.787	0.239	0.241	0.136	0.105	149.7	53.1	18.8	0.103
41.8	0.790	0.235	0.237	0.133	0.105	145.2	51.4	18.2	0.105
44.0	0.799	0.224	0.226	0.122	0.104	131.9	46.5	16.6	0.111
45.8	0.801	0.222	0.224	0.119	0.104	129.0	45.4	16.0	0.113
47.5	0.812	0.208	0.210	0.106	0.104	113.1	39.6	13.8	0.122
49.6	0.811	0.210	0.211	0.107	0.104	114.5	40.1	14.0	0.121
51.8	0.806	0.216	0.217	0.113	0.104	121.7	42.7	15.0	0.117

PAUSE READY PLOTTER

Figure D-53. Ocean optical properties (sheet 2 of 2).

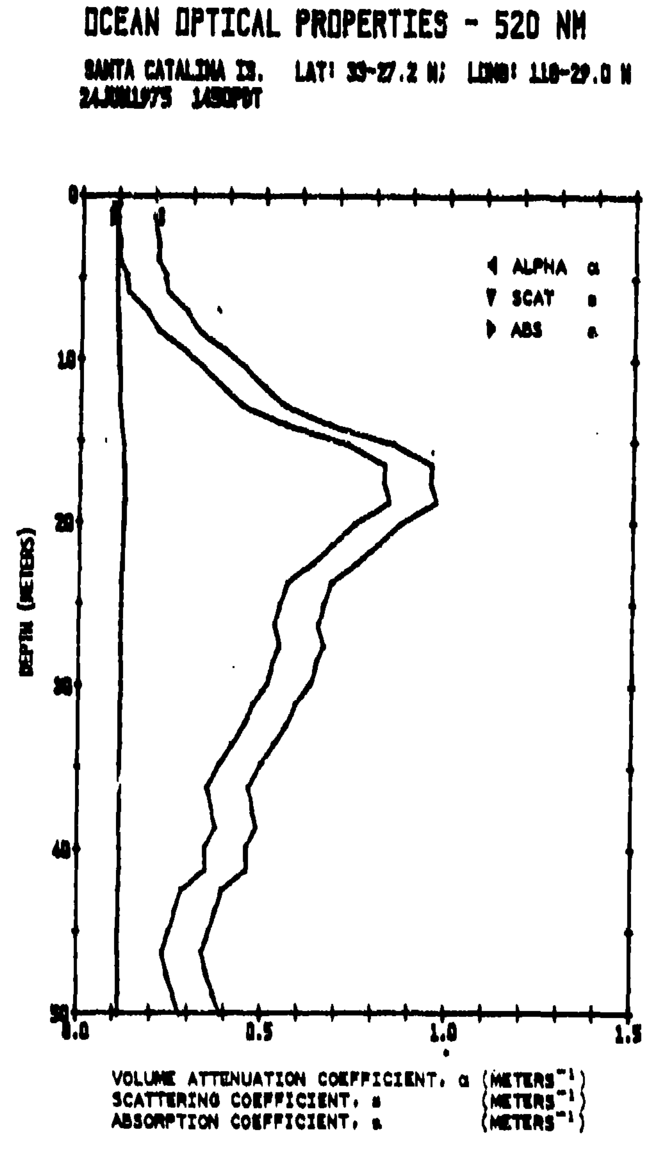

Figure D-54. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
24JUN1975 1450PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.0	0.816	0.704	0.205	0.101	0.104	107.5	37.5	13.1	0.125
2.5	0.808	0.213	0.215	0.111	0.104	118.8	41.7	14.6	0.118
3.6	0.809	0.212	0.214	0.110	0.104	117.4	41.1	14.4	0.119
4.6	0.793	0.232	0.234	0.129	0.105	140.7	49.8	17.6	0.107
5.6	0.788	0.238	0.240	0.135	0.105	148.2	52.5	18.6	0.104
6.8	0.749	0.289	0.292	0.185	0.106	211.3	76.2	27.5	0.085
8.0	0.727	0.319	0.323	0.219	0.107	250.2	91.0	33.1	0.077
9.2	0.678	0.389	0.394	0.284	0.110	341.5	126.1	46.6	0.064
10.3	0.642	0.444	0.450	0.339	0.111	415.5	154.9	57.7	0.057
11.5	0.609	0.496	0.503	0.390	0.113	486.5	182.8	68.7	0.052
12.6	0.579	0.547	0.555	0.440	0.114	557.8	211.0	79.8	0.048
13.8	0.514	0.665	0.676	0.558	0.118	726.9	278.6	106.7	0.041
15.0	0.434	0.835	0.850	0.726	0.123	977.3	380.0	147.7	0.035
16.3	0.392	0.937	0.954	0.828	0.126	1131.5	443.1	173.5	0.032
17.4	0.393	0.935	0.952	0.825	0.126	1127.7	441.6	172.8	0.032
18.6	0.387	0.950	0.967	0.840	0.127	1150.7	451.0	176.7	0.032
19.9	0.424	0.858	0.873	0.749	0.124	1011.5	394.0	153.4	0.034
21.2	0.452	0.795	0.809	0.687	0.122	917.8	355.8	137.8	0.036
22.3	0.476	0.742	0.755	0.634	0.120	839.7	324.1	125.0	0.038
23.5	0.509	0.675	0.686	0.567	0.118	740.8	284.2	108.9	0.041
24.9	0.521	0.652	0.662	0.545	0.118	707.8	270.9	103.6	0.042
26.1	0.528	0.639	0.649	0.532	0.117	688.9	263.3	100.6	0.043
27.4	0.521	0.652	0.662	0.545	0.118	707.8	270.9	103.6	0.042
28.4	0.531	0.633	0.643	0.526	0.117	680.9	260.1	99.3	0.043
29.7	0.539	0.619	0.628	0.512	0.117	659.9	251.7	96.0	0.044
31.0	0.559	0.581	0.590	0.475	0.115	606.4	230.4	87.5	0.046
32.3	0.574	0.555	0.563	0.449	0.115	569.8	215.8	81.7	0.048
33.5	0.594	0.522	0.529	0.416	0.114	522.7	197.1	74.3	0.050
34.7	0.613	0.489	0.496	0.383	0.113	477.6	179.3	67.3	0.053
36.1	0.635	0.455	0.461	0.349	0.112	430.1	160.7	60.0	0.056
37.2	0.629	0.464	0.470	0.358	0.112	442.9	165.6	61.9	0.055
38.6	0.621	0.477	0.483	0.371	0.112	460.1	172.4	64.6	0.054
39.8	0.639	0.449	0.454	0.343	0.111	421.7	157.4	58.7	0.057
41.2	0.638	0.450	0.456	0.345	0.111	423.8	158.2	59.0	0.057
42.4	0.681	0.385	0.389	0.280	0.109	335.8	123.9	45.7	0.065
43.7	0.692	0.366	0.370	0.262	0.109	311.3	114.6	42.0	0.068
44.9	0.704	0.351	0.355	0.246	0.108	291.0	106.6	39.1	0.070
46.2	0.718	0.331	0.335	0.227	0.108	266.0	97.0	35.4	0.074
47.5	0.710	0.342	0.346	0.238	0.108	280.2	102.5	37.5	0.072
48.8	0.697	0.360	0.365	0.256	0.109	303.9	111.6	40.9	0.069
50.0	0.685	0.379	0.384	0.274	0.109	328.2	121.0	44.6	0.066

PAUSE READY PLOTTER

Figure D-54. Ocean optical properties (sheet 2 of 2).

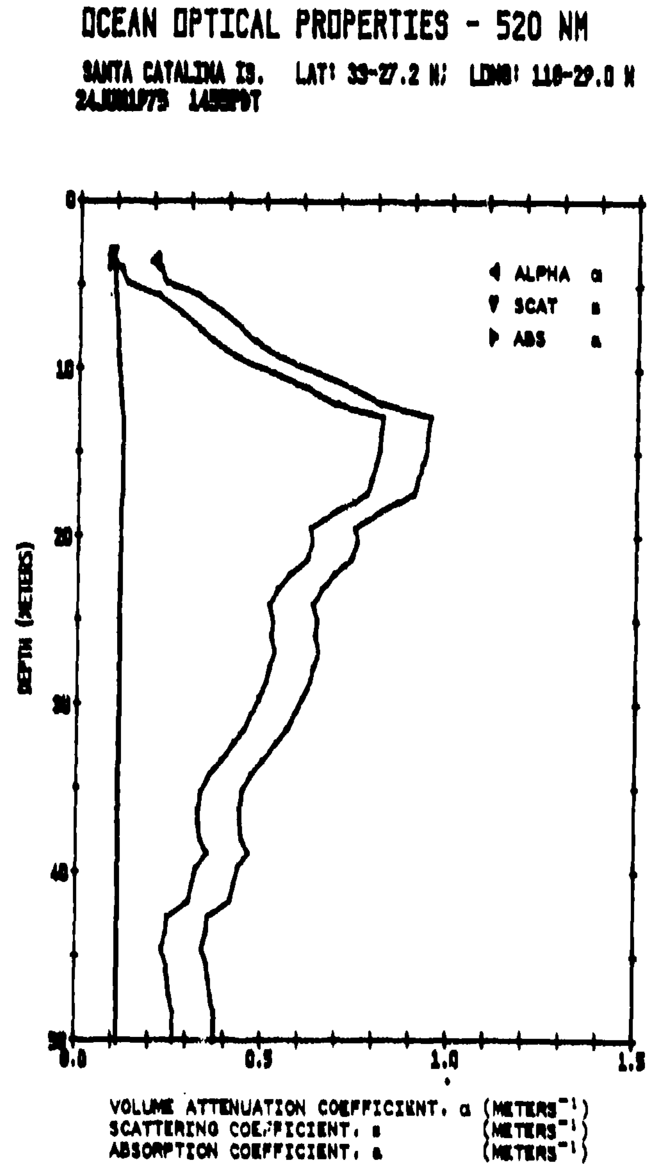

Figure D-55. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
24JUN1975   1455PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
3.3	0.817	0.202	0.204	0.100	0.104	106.1	37.0	12.9	0.126
3.7	0.799	0.224	0.226	0.122	0.104	131.9	46.5	16.4	0.111
4.6	0.788	0.238	0.240	0.135	0.105	148.2	52.5	18.6	0.104
5.3	0.725	0.322	0.325	0.218	0.107	253.7	92.3	33.6	0.076
6.3	0.684	0.380	0.385	0.276	0.109	330.1	121.7	44.8	0.065
7.3	0.648	0.433	0.439	0.328	0.111	401.1	149.3	55.5	0.058
8.1	0.625	0.470	0.477	0.365	0.112	451.4	169.0	63.2	0.055
9.0	0.590	0.523	0.536	0.422	0.114	531.9	200.8	75.7	0.050
10.0	0.533	0.650	0.639	0.523	0.117	675.6	258.0	98.5	0.043
10.9	0.486	0.722	0.734	0.614	0.120	809.7	312.0	120.1	0.039
11.9	0.450	0.800	0.813	0.691	0.122	924.3	358.4	138.9	0.036
12.7	0.395	0.930	0.947	0.821	0.126	1120.1	438.5	171.5	0.032
13.7	0.398	0.922	0.939	0.813	0.126	1108.8	433.8	169.6	0.032
14.6	0.398	0.922	0.939	0.813	0.126	1108.8	433.8	169.6	0.032
15.5	0.403	0.910	0.926	0.801	0.125	1090.3	426.2	166.5	0.033
16.5	0.408	0.895	0.912	0.787	0.125	1068.3	417.2	162.9	0.033
17.3	0.412	0.886	0.902	0.777	0.125	1053.9	411.3	160.4	0.033
18.3	0.447	0.806	0.820	0.698	0.122	934.1	362.4	140.5	0.036
19.3	0.480	0.734	0.746	0.626	0.120	827.6	319.2	123.0	0.038
20.2	0.478	0.738	0.751	0.630	0.120	833.6	321.6	124.0	0.038
21.2	0.485	0.724	0.736	0.616	0.120	812.7	313.2	120.6	0.039
22.1	0.506	0.681	0.692	0.573	0.118	749.2	287.5	110.3	0.041
23.0	0.524	0.646	0.657	0.539	0.117	699.6	267.6	102.3	0.042
23.9	0.536	0.624	0.634	0.517	0.117	667.7	254.8	97.2	0.043
24.9	0.531	0.633	0.643	0.526	0.117	680.9	260.1	99.3	0.043
25.8	0.534	0.628	0.638	0.521	0.117	673.0	256.9	98.0	0.043
26.7	0.529	0.637	0.647	0.530	0.117	686.2	262.2	100.2	0.043
27.7	0.536	0.624	0.634	0.517	0.117	667.7	254.8	97.2	0.043
28.5	0.541	0.615	0.625	0.508	0.116	654.7	249.6	95.1	0.044
29.5	0.551	0.595	0.604	0.489	0.116	626.5	238.4	90.6	0.045
30.5	0.563	0.574	0.583	0.468	0.115	596.5	226.4	85.9	0.046
31.4	0.573	0.557	0.565	0.451	0.115	572.2	216.7	82.0	0.048
32.2	0.590	0.528	0.536	0.422	0.114	531.9	200.8	75.7	0.050
33.3	0.612	0.491	0.498	0.385	0.113	479.8	180.2	67.6	0.053
34.1	0.630	0.462	0.469	0.357	0.112	440.7	164.8	61.6	0.055
35.1	0.645	0.438	0.444	0.333	0.111	407.2	151.7	56.5	0.058
36.1	0.649	0.432	0.437	0.327	0.111	399.0	148.5	55.2	0.059
37.0	0.648	0.433	0.439	0.328	0.111	401.1	149.3	55.5	0.058
38.0	0.646	0.436	0.442	0.331	0.111	405.2	150.2	56.2	0.058
38.8	0.636	0.453	0.459	0.348	0.111	428.0	159.8	59.7	0.056
39.7	0.652	0.427	0.433	0.322	0.111	392.9	146.1	54.3	0.059
40.7	0.660	0.415	0.421	0.310	0.110	376.8	139.9	51.9	0.061
41.7	0.668	0.404	0.409	0.299	0.110	361.0	133.7	49.5	0.062
42.6	0.707	0.347	0.351	0.242	0.108	285.6	104.6	38.3	0.071
43.6	0.710	0.342	0.346	0.238	0.108	280.2	102.5	37.5	0.072
44.5	0.718	0.331	0.335	0.227	0.108	266.0	97.0	35.4	0.074
45.5	0.709	0.344	0.348	0.240	0.108	282.0	103.2	37.7	0.072
46.3	0.705	0.349	0.353	0.245	0.108	289.2	105.9	38.8	0.071
47.3	0.702	0.353	0.358	0.249	0.108	294.7	108.0	39.6	0.070
48.3	0.696	0.362	0.366	0.257	0.109	305.7	112.3	41.2	0.068
49.2	0.695	0.363	0.368	0.259	0.109	307.6	113.0	41.5	0.068
50.1	0.697	0.360	0.365	0.256	0.109	303.9	111.6	40.9	0.069

PAUSE   READY PLOTTER

Figure D-55. Ocean optical properties (sheet 2 of 2).

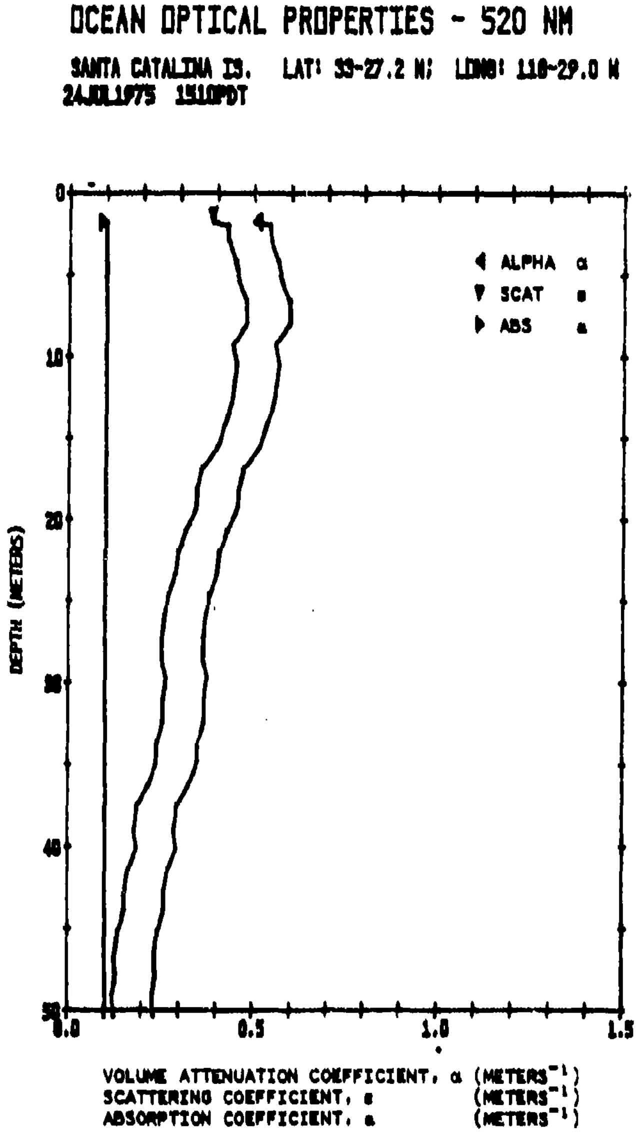

Figure D-56. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
24JUL1975   1510PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.5	0.603	0.505	0.512	0.399	0.113	499.9	188.1	70.7	0.051
1.7	0.580	0.545	0.553	0.439	0.114	555.4	210.1	79.4	0.048
2.6	0.578	0.548	0.556	0.442	0.114	560.2	212.0	80.2	0.048
3.9	0.568	0.566	0.574	0.459	0.115	584.3	221.5	84.0	0.047
5.1	0.562	0.576	0.585	0.469	0.115	599.0	227.4	86.3	0.046
6.3	0.551	0.595	0.604	0.489	0.116	626.5	238.4	90.6	0.045
7.7	0.550	0.597	0.606	0.490	0.116	629.0	239.4	91.0	0.045
9.0	0.571	0.560	0.569	0.454	0.115	577.0	218.6	82.8	0.047
10.3	0.567	0.567	0.576	0.461	0.115	586.7	222.5	84.3	0.047
11.6	0.571	0.560	0.569	0.454	0.115	577.0	218.6	82.8	0.047
12.7	0.576	0.552	0.560	0.445	0.114	565.0	213.9	80.9	0.048
14.0	0.586	0.535	0.543	0.429	0.114	541.3	204.5	77.2	0.049
15.4	0.597	0.515	0.522	0.409	0.113	513.5	193.5	72.9	0.051
16.7	0.623	0.473	0.480	0.368	0.112	455.7	170.7	63.9	0.054
17.9	0.631	0.461	0.467	0.355	0.112	438.6	164.0	61.3	0.055
19.1	0.634	0.456	0.462	0.351	0.112	432.2	161.5	60.3	0.056
20.5	0.651	0.429	0.434	0.324	0.111	394.9	146.9	54.6	0.059
21.8	0.664	0.409	0.415	0.304	0.110	368.9	136.7	50.7	0.061
23.2	0.670	0.401	0.406	0.296	0.110	357.0	132.1	48.9	0.062
24.4	0.682	0.383	0.388	0.279	0.109	333.9	123.2	45.4	0.065
25.7	0.689	0.373	0.378	0.269	0.109	320.6	118.0	43.4	0.066
27.1	0.694	0.365	0.369	0.260	0.109	309.4	113.7	41.8	0.068
28.3	0.695	0.363	0.368	0.259	0.109	307.6	113.0	41.5	0.068
29.6	0.688	0.375	0.379	0.270	0.109	322.5	118.8	43.7	0.066
31.0	0.692	0.368	0.372	0.263	0.109	313.1	115.1	42.3	0.067
32.2	0.693	0.366	0.370	0.262	0.109	311.3	114.4	42.0	0.068
33.5	0.704	0.351	0.355	0.246	0.108	291.0	106.6	39.1	0.070
34.8	0.707	0.347	0.351	0.242	0.108	285.6	104.6	38.3	0.071
36.1	0.722	0.326	0.330	0.222	0.108	258.9	94.3	34.4	0.075
37.4	0.744	0.295	0.298	0.192	0.107	219.6	79.4	28.7	0.083
38.8	0.749	0.289	0.292	0.185	0.106	211.3	76.2	27.5	0.085
40.0	0.745	0.294	0.297	0.190	0.107	218.0	78.7	28.4	0.083
41.3	0.762	0.272	0.275	0.169	0.106	190.2	68.3	24.5	0.090
42.6	0.770	0.262	0.264	0.158	0.106	177.5	63.5	22.7	0.094
43.8	0.771	0.260	0.263	0.157	0.106	175.9	62.9	22.5	0.094
45.1	0.784	0.244	0.246	0.141	0.105	155.8	55.4	19.7	0.101
46.5	0.790	0.235	0.237	0.133	0.105	145.2	51.4	18.2	0.105
47.6	0.788	0.238	0.240	0.135	0.105	148.2	52.5	18.6	0.104
49.0	0.796	0.228	0.230	0.125	0.105	136.3	48.1	17.0	0.109
50.3	0.791	0.234	0.236	0.131	0.105	143.7	50.9	18.0	0.106

PAUSE READY PLOTTER

Figure D-56. Ocean optical properties (sheet 2 of 2).

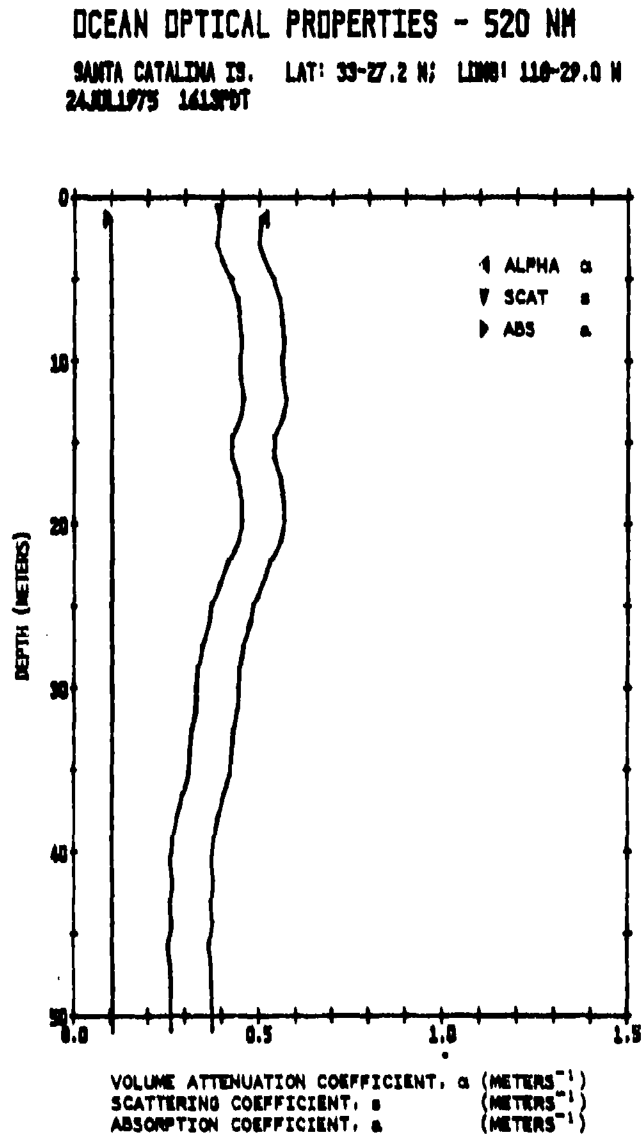

Figure D-57. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
24JUL1975   1613PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	T[illegible]TA*2BAR
1.0	0.600	0.510	0.517	0.404	0.113	506.7	190.8	71.8	0.051
2.5	0.605	0.502	0.509	0.396	0.113	495.4	186.3	70.0	0.052
3.5	0.596	0.517	0.524	0.411	0.113	515.8	194.4	73.2	0.050
4.7	0.582	0.542	0.550	0.435	0.114	550.7	208.2	78.7	0.049
5.9	0.572	0.559	0.567	0.452	0.115	574.6	217.7	82.4	0.047
7.0	0.569	0.564	0.572	0.457	0.115	581.9	220.6	83.6	0.047
8.3	0.566	0.569	0.577	0.462	0.115	589.2	223.5	84.7	0.047
9.5	0.569	0.564	0.572	0.457	0.115	581.9	220.6	83.6	0.047
10.7	0.568	0.566	0.574	0.459	0.115	584.3	221.5	84.0	0.047
12.0	0.563	0.574	0.583	0.468	0.115	596.5	226.4	85.9	0.046
13.1	0.568	0.566	0.574	0.459	0.115	584.3	221.5	84.0	0.047
14.4	0.582	0.542	0.550	0.435	0.114	550.7	208.2	78.7	0.049
15.7	0.582	0.542	0.550	0.435	0.114	550.7	208.2	78.7	0.049
16.9	0.573	0.557	0.565	0.451	0.115	572.2	216.7	82.0	0.048
18.3	0.568	0.566	0.574	0.459	0.115	584.3	221.5	84.0	0.047
19.5	0.567	0.567	0.576	0.461	0.115	586.7	222.5	84.3	0.047
20.8	0.573	0.557	0.565	0.451	0.115	572.2	216.7	82.0	0.048
22.0	0.599	0.530	0.538	0.424	0.114	534.3	201.7	76.1	0.049
23.4	0.602	0.507	0.514	0.401	0.113	502.2	189.0	71.1	0.051
24.6	0.616	0.484	0.491	0.379	0.112	471.0	176.7	66.3	0.053
25.9	0.623	0.473	0.480	0.368	0.112	455.7	170.7	63.9	0.054
27.2	0.634	0.456	0.462	0.351	0.112	432.2	161.5	60.3	0.056
28.5	0.641	0.445	0.451	0.340	0.111	417.6	155.7	58.1	0.057
29.8	0.643	0.441	0.447	0.336	0.111	411.3	153.3	57.1	0.058
31.1	0.645	0.438	0.444	0.333	0.111	407.2	151.7	56.5	0.058
32.4	0.652	0.427	0.433	0.322	0.111	392.9	146.1	54.3	0.059
33.7	0.656	0.421	0.427	0.316	0.111	384.8	142.9	53.1	0.060
35.1	0.659	0.417	0.422	0.312	0.110	[illegible]	140.6	52.2	0.060
36.3	0.669	0.402	0.407	0.297	0.110	[illegible]	132.9	49.2	0.062
37.7	0.680	0.386	0.391	0.281	0.109	337.7	124.6	46.0	0.065
39.0	0.688	0.375	0.379	0.270	0.109	322.5	118.8	43.7	0.066
40.2	0.692	0.368	0.372	0.263	0.109	313.1	115.1	42.3	0.067
41.6	0.689	0.373	0.378	0.269	0.109	320.6	118.0	43.4	0.066
42.9	0.693	0.366	0.370	0.262	0.109	311.3	114.4	42.0	0.068
44.1	0.690	0.370	0.375	0.266	0.109	316.9	116.6	42.9	0.067
45.5	0.697	0.360	0.365	0.256	0.109	303.9	111.6	40.9	0.069
46.8	0.693	0.366	0.370	0.262	0.109	311.3	114.4	42.0	0.068
48.2	0.693	0.366	0.370	0.262	0.109	311.3	114.4	42.0	0.068
49.5	0.691	0.369	0.373	0.264	0.109	315.0	115.9	42.6	0.067
50.9	0.692	0.368	0.372	0.263	0.109	313.1	115.1	42.3	0.067

/& END OF JOB

Figure D-57. Ocean optical properties (sheet 2 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT: 33-27.2 N; LONG: 118-29.0 W
24JUN1975 1934PDT

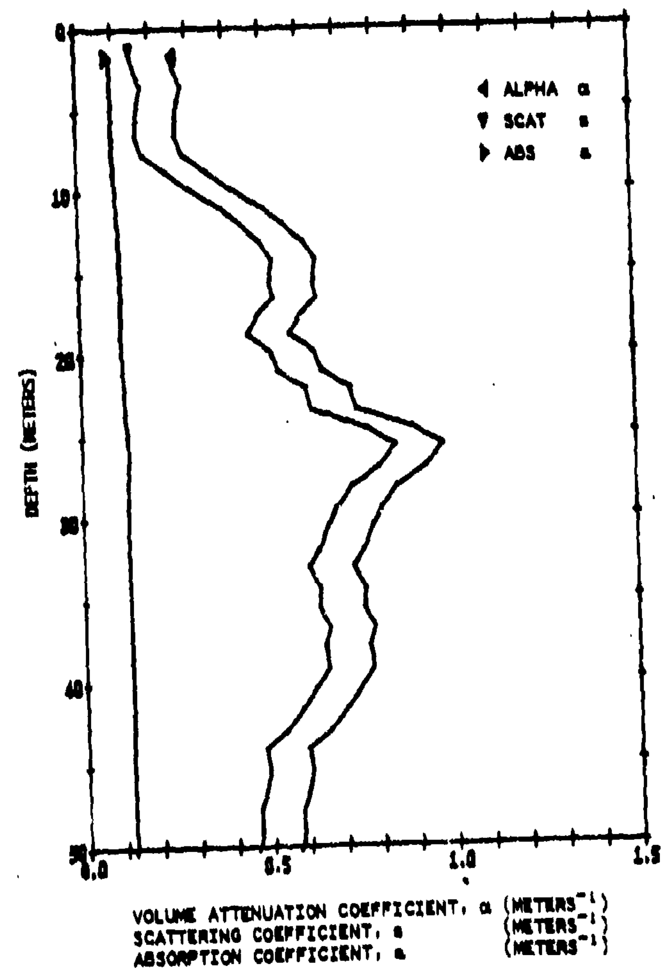

Figure D-58. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG' 118-29.0 W
24JUN1975   1934PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.5	0.769	0.263	0.265	0.160	0.106	179.1	64.1	22.9	0.093
2.1	0.762	0.272	0.275	0.169	0.106	190.2	68.3	24.5	0.090
3.3	0.747	0.291	0.294	0.188	0.107	214.6	77.5	28.0	0.084
4.3	0.756	0.280	0.282	0.176	0.106	199.9	71.9	25.9	0.087
5.3	0.759	0.276	0.278	0.172	0.106	195.0	70.1	25.2	0.089
6.4	0.761	0.273	0.276	0.170	0.106	191.8	68.9	24.7	0.090
7.5	0.747	0.291	0.294	0.188	0.107	214.6	77.5	28.0	0.084
8.6	0.703	0.352	0.356	0.248	0.108	292.9	107.3	39.3	0.070
9.7	0.660	0.415	0.421	0.310	0.110	376.8	139.8	51.9	0.061
10.9	0.606	0.500	0.507	0.395	0.113	493.2	185.4	69.7	0.052
11.9	0.576	0.552	0.560	0.445	0.114	565.0	213.9	80.9	0.048
13.0	0.547	0.602	0.612	0.496	0.116	636.7	242.4	92.3	0.045
14.1	0.531	0.633	0.643	0.526	0.117	680.9	260.1	99.3	0.043
15.3	0.535	0.626	0.636	0.519	0.117	670.4	255.9	97.6	0.043
16.4	0.531	0.633	0.643	0.526	0.117	680.9	260.1	99.3	0.043
17.5	0.554	0.590	0.599	0.483	0.116	618.9	235.3	89.4	0.045
18.6	0.570	0.562	0.570	0.456	0.115	579.4	219.6	83.2	0.047
19.8	0.535	0.626	0.636	0.519	0.117	670.4	255.9	97.6	0.043
20.9	0.527	0.641	0.651	0.534	0.117	691.6	264.4	101.0	0.043
22.0	0.489	0.716	0.728	0.608	0.120	800.9	308.4	118.7	0.039
23.3	0.483	0.728	0.740	0.620	0.120	818.6	315.6	121.6	0.039
24.5	0.417	0.874	0.890	0.765	0.124	1036.1	404.0	157.5	0.034
25.6	0.385	0.955	0.972	0.846	0.127	1158.4	454.2	178.0	0.032
26.9	0.403	0.910	0.926	0.801	0.125	1090.3	426.2	166.5	0.033
28.1	0.435	0.833	0.847	0.724	0.123	973.9	378.6	147.1	0.035
29.4	0.453	0.791	0.804	0.683	0.122	911.4	353.2	136.8	0.036
30.5	0.465	0.765	0.778	0.657	0.121	873.5	337.8	130.5	0.037
31.9	0.477	0.740	0.753	0.632	0.120	836.6	322.8	124.5	0.038
33.0	0.492	0.710	0.722	0.602	0.119	792.1	304.8	117.3	0.039
34.3	0.478	0.738	0.751	0.630	0.120	833.6	321.6	124.0	0.038
35.5	0.479	0.736	0.748	0.628	0.120	830.6	320.4	123.5	0.038
36.7	0.467	0.761	0.774	0.653	0.121	867.2	335.2	129.5	0.037
37.9	0.473	0.749	0.761	0.641	0.121	848.8	327.8	126.5	0.038
39.2	0.469	0.757	0.770	0.649	0.121	861.1	332.7	128.5	0.037
40.4	0.486	0.722	0.734	0.614	0.120	809.7	312.0	120.1	0.039
41.7	0.505	0.682	0.693	0.575	0.119	752.0	288.7	110.8	0.041
43.0	0.528	0.639	0.649	0.532	0.117	688.9	263.3	100.6	0.043
44.1	0.561	0.578	0.586	0.471	0.115	601.5	228.4	86.7	0.046
45.4	0.556	0.586	0.595	0.480	0.116	613.9	233.3	88.6	0.046
46.6	0.562	0.576	0.585	0.469	0.115	599.0	227.4	86.3	0.046
47.8	0.572	0.559	0.567	0.452	0.115	574.6	217.7	82.4	0.047
49.1	0.571	0.560	0.569	0.454	0.115	577.0	218.6	82.8	0.047
50.3	0.578	0.548	0.556	0.442	0.114	560.2	212.0	80.2	0.048

PAUSE READY PLOTTER

Figure D-58. Ocean optical properties (sheet 2 of 2).

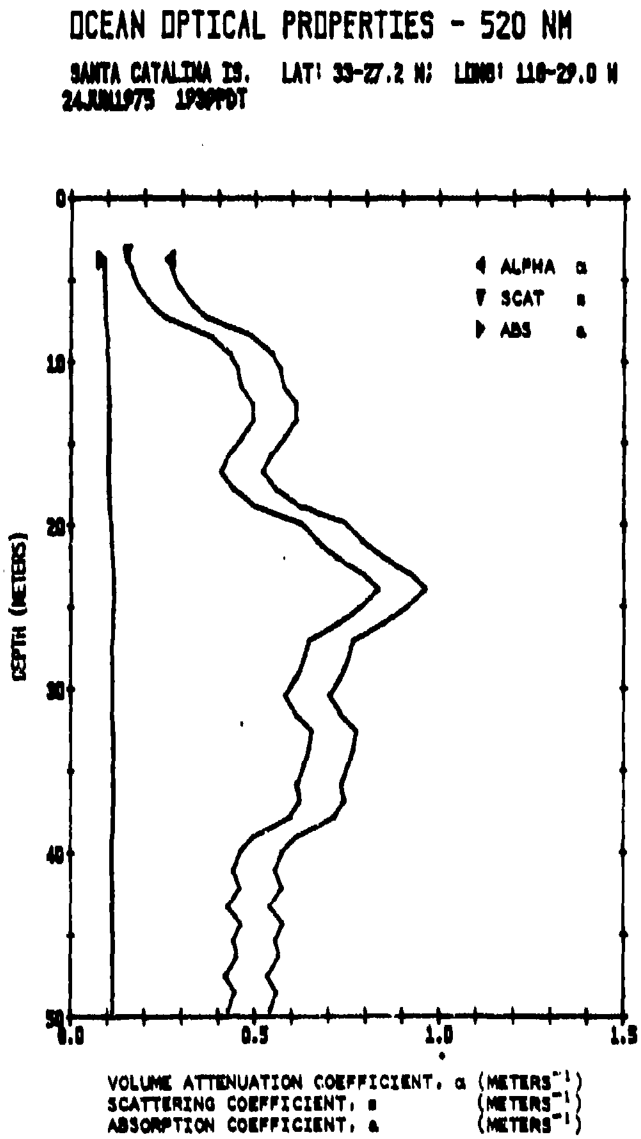

Figure D-59. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
24JUN1975 1939PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
3.5	0.762	0.272	0.275	0.169	0.106	190.2	68.3	24.5	0.090
4.0	0.754	0.282	0.285	0.179	0.106	203.1	73.1	26.3	0.087
5.1	0.743	0.297	0.300	0.193	0.107	221.3	80.0	28.9	0.082
6.3	0.716	0.334	0.338	0.230	0.108	269.5	98.4	35.9	0.074
7.1	0.689	0.372	0.376	0.267	0.109	318.7	117.3	43.2	0.067
8.3	0.610	0.494	0.501	0.388	0.113	484.2	181.9	68.3	0.052
9.4	0.579	0.547	0.555	0.440	0.114	557.8	211.0	79.8	0.048
10.3	0.567	0.567	0.576	0.461	0.115	586.7	222.5	84.3	0.047
11.4	0.562	0.576	0.585	0.469	0.115	599.0	227.4	86.3	0.046
12.4	0.546	0.606	0.615	0.499	0.116	641.8	244.5	93.1	0.044
13.4	0.544	0.610	0.619	0.503	0.116	646.9	246.5	93.9	0.044
14.6	0.562	0.576	0.585	0.469	0.115	599.0	227.4	86.3	0.046
15.6	0.583	0.540	0.548	0.434	0.114	548.3	207.3	78.3	0.049
16.6	0.594	0.520	0.527	0.414	0.114	520.4	196.2	73.9	0.050
17.7	0.576	0.552	0.560	0.445	0.116	565.0	213.9	80.9	0.048
18.8	0.539	0.619	0.628	0.512	0.117	659.9	251.7	96.0	0.044
19.8	0.480	0.734	0.746	0.626	0.120	827.6	319.2	123.0	0.038
20.9	0.459	0.778	0.791	0.670	0.121	892.3	345.4	133.6	0.037
21.9	0.436	0.830	0.845	0.722	0.123	970.5	377.2	146.6	0.035
23.0	0.404	0.905	0.922	0.796	0.125	1082.9	423.2	165.3	0.033
23.9	0.390	0.942	0.959	0.833	0.126	1139.1	446.3	174.7	0.032
25.0	0.409	0.893	0.909	0.784	0.125	1064.7	415.7	162.2	0.033
26.0	0.435	0.833	0.847	0.724	0.123	973.9	378.6	147.1	0.035
27.0	0.471	0.753	0.765	0.645	0.121	854.9	330.2	127.5	0.038
28.2	0.478	0.738	0.751	0.630	0.120	833.6	321.6	124.0	0.038
29.3	0.488	0.718	0.730	0.610	0.120	803.8	309.6	119.2	0.039
30.4	0.501	0.690	0.701	0.583	0.119	763.3	293.2	112.6	0.040
31.5	0.489	0.716	0.728	0.608	0.120	800.9	308.4	118.7	0.039
32.6	0.469	0.757	0.770	0.649	0.121	861.1	332.7	128.5	0.037
33.6	0.472	0.751	0.763	0.643	0.121	851.8	329.0	127.0	0.038
34.7	0.479	0.736	0.748	0.628	0.120	830.6	320.4	123.5	0.038
35.8	0.488	0.718	0.730	0.610	0.120	803.8	309.6	119.2	0.039
36.8	0.485	0.724	0.736	0.616	0.120	812.7	313.2	120.6	0.039
37.9	0.497	0.700	0.711	0.592	0.119	777.7	299.0	114.9	0.040
39.0	0.548	0.601	0.610	0.494	0.116	634.1	241.4	91.8	0.045
40.0	0.569	0.564	0.572	0.457	0.115	581.9	220.6	83.6	0.047
41.1	0.581	0.543	0.551	0.437	0.114	553.1	209.1	79.0	0.048
42.2	0.571	0.560	0.569	0.454	0.115	577.0	218.6	82.8	0.047
43.3	0.590	0.528	0.536	0.422	0.114	531.9	200.8	75.7	0.050
44.4	0.570	0.562	0.570	0.456	0.115	579.4	219.6	83.2	0.047
45.4	0.582	0.542	0.550	0.435	0.114	550.7	208.2	78.7	0.049
46.4	0.576	0.552	0.560	0.445	0.114	565.0	213.9	80.9	0.048
47.6	0.594	0.520	0.527	0.414	0.114	520.4	196.2	73.9	0.050
48.6	0.581	0.543	0.551	0.437	0.114	553.1	209.1	79.0	0.048
49.7	0.590	0.528	0.536	0.422	0.114	531.9	200.8	75.7	0.050

PAUSE READY PLOTTER

Figure D-59. Ocean optical properties (sheet 2 of 2).

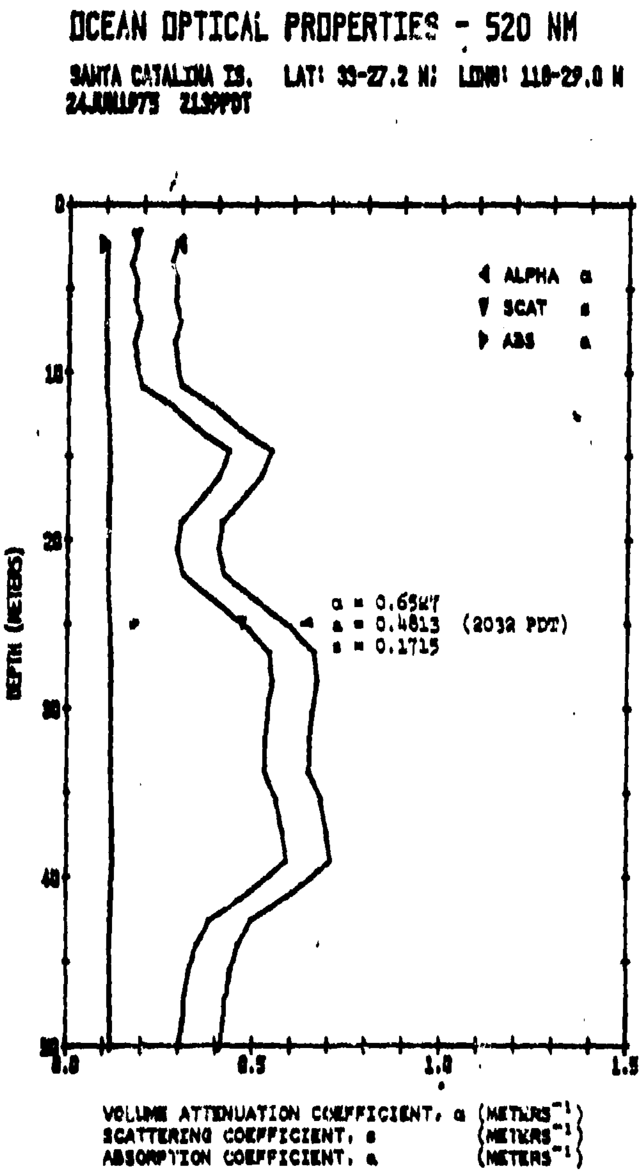

Figure D-60. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
24JUN1975 2139PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
2.1	0.748	0.290	0.293	0.186	0.106	213.0	76.9	27.7	0.084
3.2	0.758	0.277	0.280	0.174	0.106	196.6	70.7	25.4	0.088
4.2	0.749	0.289	0.292	0.185	0.106	211.3	76.2	27.5	0.085
5.4	0.750	0.287	0.290	0.184	0.106	209.7	75.6	27.2	0.085
6.7	0.742	0.298	0.301	0.194	0.107	223.0	80.6	29.2	0.082
8.0	0.753	0.283	0.286	0.180	0.106	204.0	73.7	26.5	0.086
9.3	0.747	0.291	0.294	0.188	0.107	214.6	77.5	28.0	0.084
10.6	0.740	0.301	0.304	0.197	0.107	226.3	81.9	29.6	0.081
11.8	0.682	0.383	0.388	0.279	0.109	333.9	123.2	45.4	0.065
13.2	0.636	0.453	0.459	0.348	0.111	428.0	159.8	59.7	0.056
14.5	0.585	0.537	0.544	0.430	0.114	543.6	205.4	77.6	0.049
16.0	0.599	0.512	0.519	0.406	0.113	509.0	191.7	72.1	0.051
17.1	0.623	0.473	0.480	0.368	0.112	455.7	170.7	63.9	0.054
18.8	0.666	0.406	0.412	0.302	0.110	364.9	135.2	50.1	0.062
20.3	0.673	0.396	0.401	0.291	0.110	351.2	129.9	48.0	0.063
21.9	0.662	0.412	0.418	0.307	0.110	372.8	138.3	51.3	0.061
23.5	0.606	0.500	0.507	0.395	0.113	493.2	185.4	69.7	0.052
25.1	0.555	0.588	0.597	0.481	0.116	616.4	234.3	89.0	0.046
26.6	0.524	0.646	0.657	0.539	0.117	699.6	267.6	102.3	0.042
28.3	0.520	0.654	0.664	0.547	0.118	710.5	272.0	104.1	0.042
30.1	0.527	0.641	0.651	0.534	0.117	691.6	264.4	101.0	0.043
31.8	0.531	0.633	0.643	0.526	0.117	680.9	260.1	99.3	0.043
33.6	0.532	0.631	0.641	0.524	0.117	678.3	259.1	98.9	0.043
35.4	0.515	0.663	0.674	0.556	0.118	724.2	277.5	106.3	0.041
37.2	0.507	0.679	0.690	0.571	0.118	746.4	286.4	109.8	0.041
39.0	0.501	0.690	0.701	0.583	0.119	763.3	293.2	112.6	0.040
40.9	0.554	0.590	0.599	0.483	0.116	618.9	235.3	89.4	0.045
42.5	0.617	0.483	0.489	0.377	0.112	468.8	175.8	65.9	0.053
44.0	0.640	0.447	0.453	0.342	0.111	419.7	156.6	58.4	0.057
45.5	0.652	0.427	0.433	0.322	0.111	392.9	146.1	54.3	0.059
47.0	0.661	0.414	0.419	0.309	0.110	374.8	139.1	51.6	0.061
48.6	0.665	0.408	0.413	0.303	0.110	366.9	136.0	50.4	0.061
50.2	0.673	0.396	0.401	0.291	0.110	351.2	129.9	48.0	0.063

PAUSE READY PLOTTER

Figure D-60. Ocean optical properties (sheet 2 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT: 33-27.2 N; LONG: 118-29.0 W
26JUN1975 1345PDT

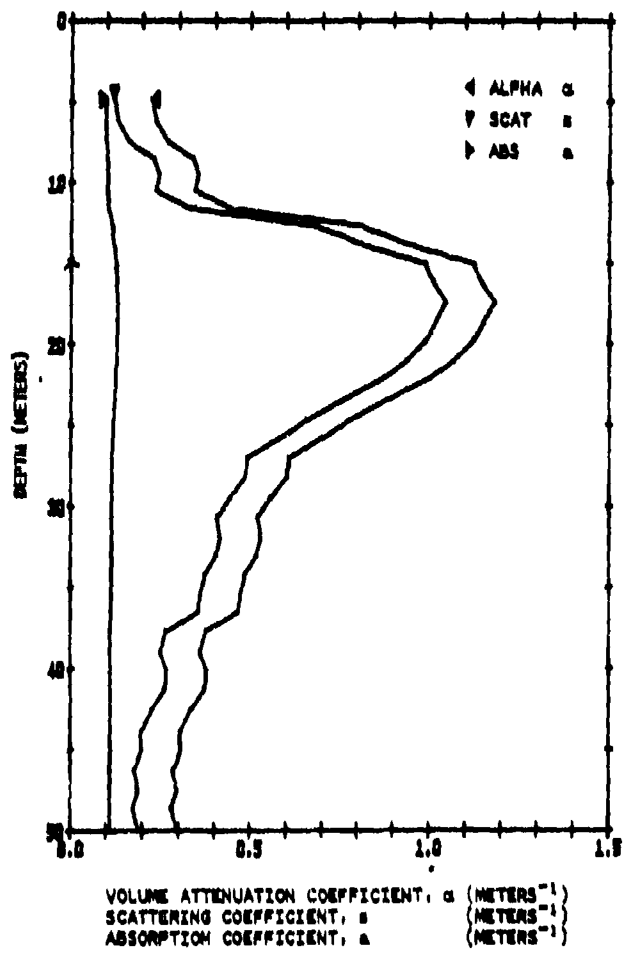

Figure D-61. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
26JUN1978 1345PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
4.6	0.794	0.230	0.232	0.128	0.105	139.3	49.2	17.4	0.108
5.9	0.787	0.239	0.241	0.136	0.105	149.7	53.1	18.8	0.103
7.2	0.763	0.271	0.273	0.167	0.106	188.6	67.7	24.3	0.090
8.3	0.712	0.340	0.343	0.235	0.108	276.6	101.1	36.9	0.072
9.2	0.702	0.353	0.358	0.249	0.108	294.7	108.0	39.6	0.070
10.3	0.707	0.347	0.351	0.242	0.108	285.6	104.6	38.3	0.071
11.4	0.642	0.442	0.448	0.337	0.111	413.4	154.1	57.4	0.057
12.5	0.453	0.791	0.804	0.683	0.122	911.4	353.2	136.8	0.036
13.8	0.393	0.935	0.952	0.825	0.126	1127.7	441.6	172.8	0.032
14.9	0.334	1.097	1.118	0.987	0.131	1377.3	544.6	215.2	0.029
16.1	0.327	1.117	1.139	1.007	0.132	1409.6	558.0	220.8	0.028
17.3	0.316	1.151	1.174	1.041	0.133	1462.0	579.8	229.8	0.028
18.4	0.324	1.126	1.149	1.016	0.132	1423.7	563.9	223.2	0.028
19.7	0.334	1.097	1.118	0.987	0.131	1377.3	544.6	215.2	0.029
21.0	0.354	1.040	1.060	0.930	0.129	1288.9	508.0	200.1	0.030
22.0	0.376	0.978	0.996	0.869	0.128	1193.8	468.8	184.0	0.031
23.3	0.420	0.867	0.883	0.758	0.124	1025.5	399.7	155.7	0.034
24.6	0.467	0.761	0.774	0.653	0.121	867.2	335.2	129.5	0.037
25.7	0.503	0.686	0.697	0.579	0.119	757.7	290.9	111.7	0.040
26.9	0.550	0.597	0.606	0.490	0.116	629.0	239.4	91.0	0.045
28.1	0.554	0.590	0.599	0.483	0.116	618.9	235.3	89.4	0.045
29.4	0.579	0.547	0.555	0.440	0.114	557.8	211.0	79.8	0.048
30.6	0.599	0.512	0.519	0.406	0.113	509.0	191.7	72.1	0.051
31.9	0.595	0.518	0.526	0.412	0.113	518.1	195.3	73.6	0.050
33.0	0.602	0.507	0.514	0.401	0.113	502.2	189.0	71.1	0.051
34.2	0.622	0.475	0.481	0.369	0.112	457.9	171.6	64.2	0.054
35.4	0.630	0.462	0.469	0.357	0.112	440.7	164.8	61.6	0.055
36.5	0.635	0.455	0.461	0.349	0.112	430.1	160.7	60.0	0.056
37.7	0.693	0.366	0.370	0.262	0.109	311.3	114.4	42.0	0.068
39.0	0.703	0.352	0.356	0.248	0.108	292.9	107.3	39.3	0.070
40.2	0.692	0.368	0.372	0.263	0.109	313.1	115.1	42.3	0.067
41.3	0.695	0.363	0.368	0.259	0.109	307.6	113.0	41.5	0.068
42.6	0.723	0.325	0.328	0.221	0.108	257.2	93.7	34.1	0.076
43.9	0.744	0.295	0.298	0.192	0.107	219.6	79.4	28.7	0.083
45.1	0.744	0.295	0.298	0.192	0.107	219.6	79.4	28.7	0.083
46.3	0.758	0.277	0.280	0.174	0.106	196.6	70.7	25.4	0.088
47.5	0.752	0.285	0.288	0.181	0.106	206.4	74.4	26.8	0.086
48.7	0.762	0.272	0.275	0.169	0.106	190.2	68.3	24.5	0.090
50.0	0.752	0.285	0.288	0.181	0.106	206.4	74.4	26.8	0.086

PAUSE READY PLOTTER

Figure D-61. Ocean optical properties (sheet 2 of 2).

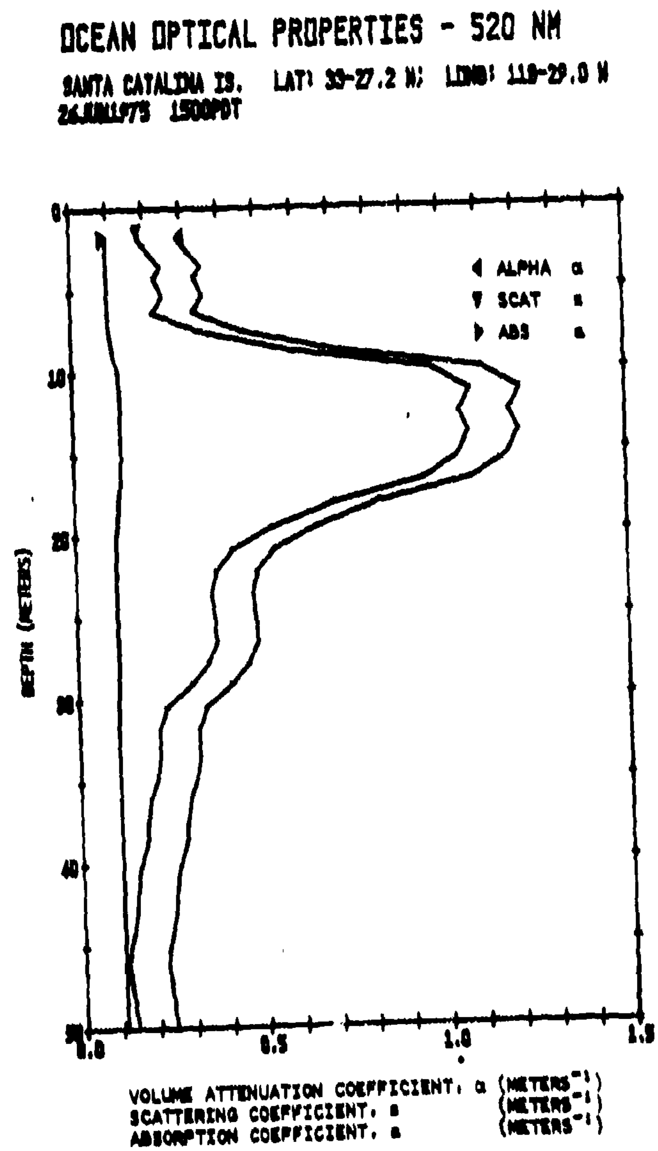

Figure D-62. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS.   LAT 33-27.2 N   LONG 118-29.0 W
26JUN1975   1500PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.5	0.742	0.298	0.301	0.194	0.107	223.0	80.6	29.2	0.082
2.0	0.732	0.313	0.316	0.209	0.107	241.6	87.7	31.8	0.078
3.3	0.700	0.356	0.360	0.252	0.109	298.3	109.5	40.1	0.069
4.0	0.712	0.340	0.343	0.235	0.108	276.6	101.1	36.9	0.072
5.1	0.697	0.360	0.365	0.256	0.109	303.9	111.6	40.9	0.069
6.1	0.717	0.333	0.337	0.229	0.108	267.7	97.7	35.6	0.074
7.3	0.633	0.458	0.464	0.352	0.112	434.4	162.3	60.6	0.056
8.6	0.490	0.714	0.726	0.606	0.119	798.0	307.2	118.2	0.039
9.8	0.338	1.085	1.106	0.975	0.131	1359.1	537.1	212.1	0.029
11.2	0.305	1.189	1.213	1.078	0.134	1521.5	604.6	240.1	0.027
12.5	0.313	1.160	1.183	1.050	0.133	1476.6	585.9	232.4	0.027
13.8	0.307	1.182	1.206	1.072	0.134	1511.4	600.4	238.4	0.027
15.2	0.315	1.154	1.177	1.044	0.133	1466.9	581.8	230.7	0.028
16.6	0.347	1.059	1.080	0.950	0.130	1319.2	520.5	205.3	0.029
17.9	0.441	0.819	0.834	0.711	0.123	953.8	370.4	143.8	0.035
19.4	0.526	0.643	0.653	0.535	0.117	694.3	265.5	101.5	0.042
20.7	0.587	0.533	0.541	0.427	0.114	538.9	203.5	76.8	0.049
22.1	0.616	0.484	0.491	0.379	0.112	471.0	176.7	66.3	0.053
23.5	0.624	0.472	0.478	0.366	0.112	453.6	169.9	63.6	0.054
24.9	0.619	0.480	0.486	0.374	0.112	464.4	174.1	65.2	0.054
26.3	0.617	0.483	0.489	0.377	0.112	468.8	175.8	65.9	0.053
27.6	0.631	0.461	0.467	0.355	0.112	438.6	164.0	61.3	0.055
29.0	0.664	0.409	0.415	0.304	0.110	368.9	136.7	50.7	0.061
30.4	0.712	0.340	0.343	0.235	0.108	276.6	101.1	36.9	0.072
31.8	0.727	0.319	0.323	0.215	0.107	250.2	91.0	33.1	0.077
33.2	0.727	0.319	0.323	0.215	0.107	250.2	91.0	33.1	0.077
34.6	0.733	0.311	0.315	0.207	0.107	239.9	87.1	31.6	0.079
35.9	0.748	0.290	0.293	0.186	0.106	213.0	76.9	27.7	0.084
37.5	0.756	0.280	0.282	0.176	0.106	199.9	71.9	25.9	0.087
38.8	0.759	0.276	0.278	0.172	0.106	195.0	70.1	25.2	0.089
40.1	0.774	0.257	0.259	0.153	0.105	171.2	61.1	21.8	0.096
41.6	0.782	0.246	0.249	0.144	0.105	158.9	56.5	20.1	0.100
42.9	0.784	0.244	0.246	0.141	0.105	155.8	55.4	19.7	0.101
44.3	0.794	0.230	0.232	0.128	0.105	139.3	49.2	17.4	0.108
45.8	0.804	0.218	0.220	0.116	0.104	124.6	43.8	15.4	0.115
47.1	0.800	0.223	0.225	0.120	0.104	130.4	45.9	16.2	0.112
48.5	0.794	0.230	0.232	0.128	0.105	139.3	49.2	17.4	0.108
50.0	0.789	0.236	0.239	0.134	0.105	146.7	52.0	18.4	0.105

PAUSE READY PLOTTER

Figure D-62. Ocean optical properties (sheet 2 of 2).

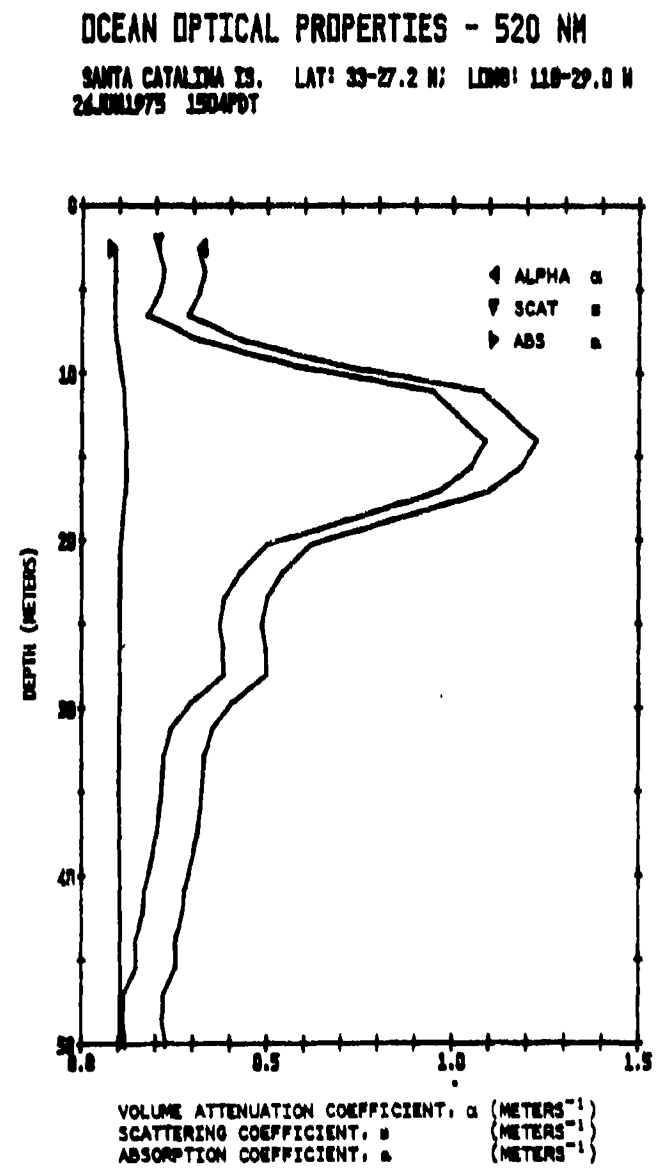

Figure D-63. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PRUPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
26JUN1975 1504PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
2.4	0.721	0.327	0.331	0.223	0.108	260.7	95.0	34.6	0.075
3.7	0.712	0.340	0.343	0.235	0.108	276.6	101.1	36.9	0.072
5.0	0.719	0.330	0.334	0.226	0.108	264.2	96.3	35.1	0.074
6.4	0.743	0.297	0.300	0.193	0.107	221.3	80.0	28.9	0.082
7.9	0.648	0.433	0.439	0.328	0.111	401.1	149.3	55.5	0.058
9.5	0.501	0.690	0.701	0.583	0.119	763.3	293.2	112.6	0.040
11.1	0.347	1.059	1.080	0.950	0.130	1319.2	520.5	205.3	0.029
12.5	0.326	1.120	1.142	1.010	0.132	1414.3	560.0	221.6	0.028
14.1	0.303	1.195	1.219	1.085	0.134	1531.6	608.8	241.9	0.027
15.6	0.313	1.160	1.183	1.050	0.133	1476.6	585.9	232.4	0.027
17.1	0.341	1.076	1.097	0.967	0.131	1345.7	531.5	209.8	0.029
18.8	0.438	0.826	0.840	0.718	0.123	963.8	374.5	145.4	0.035
20.2	0.543	0.611	0.621	0.504	0.116	649.5	247.5	94.3	0.044
21.9	0.584	0.538	0.546	0.432	0.114	546.0	206.3	77.9	0.049
23.4	0.608	0.497	0.504	0.391	0.113	488.7	183.7	69.0	0.052
25.0	0.617	0.483	0.489	0.377	0.112	468.8	175.8	65.9	0.053
26.5	0.611	0.492	0.499	0.387	0.113	482.0	181.0	60.0	0.052
28.0	0.610	0.494	0.501	0.388	0.113	484.2	181.9	68.3	0.052
29.7	0.669	0.402	0.407	0.297	0.110	359.0	132.9	49.2	0.062
31.3	0.704	0.351	0.355	0.246	0.108	291.0	106.6	39.1	0.070
32.9	0.720	0.329	0.332	0.225	0.108	262.4	95.7	34.9	0.075
34.4	0.723	0.325	0.328	0.221	0.108	257.2	93.7	34.1	0.076
36.1	0.729	0.317	0.320	0.213	0.107	246.8	89.7	32.6	0.077
37.6	0.736	0.307	0.310	0.203	0.107	234.8	85.1	30.8	0.080
39.2	0.745	0.294	0.297	0.190	0.107	218.0	78.7	28.4	0.083
40.8	0.758	0.277	0.280	0.174	0.106	196.6	70.7	25.4	0.088
42.3	0.764	0.269	0.272	0.166	0.106	187.0	67.1	24.0	0.091
43.8	0.778	0.251	0.254	0.149	0.105	165.0	58.8	20.9	0.098
45.5	0.779	0.250	0.253	0.147	0.105	163.5	58.2	20.7	0.098
47.1	0.805	0.217	0.219	0.114	0.104	123.1	43.3	15.2	0.116
48.6	0.808	0.213	0.215	0.111	0.104	118.8	41.7	14.6	0.118
50.2	0.801	0.222	0.224	0.119	0.104	129.0	45.4	16.0	0.113

PAUSE READY PLOTTER

Figure D-63. Ocean optical properties (sheet 2 of 2).

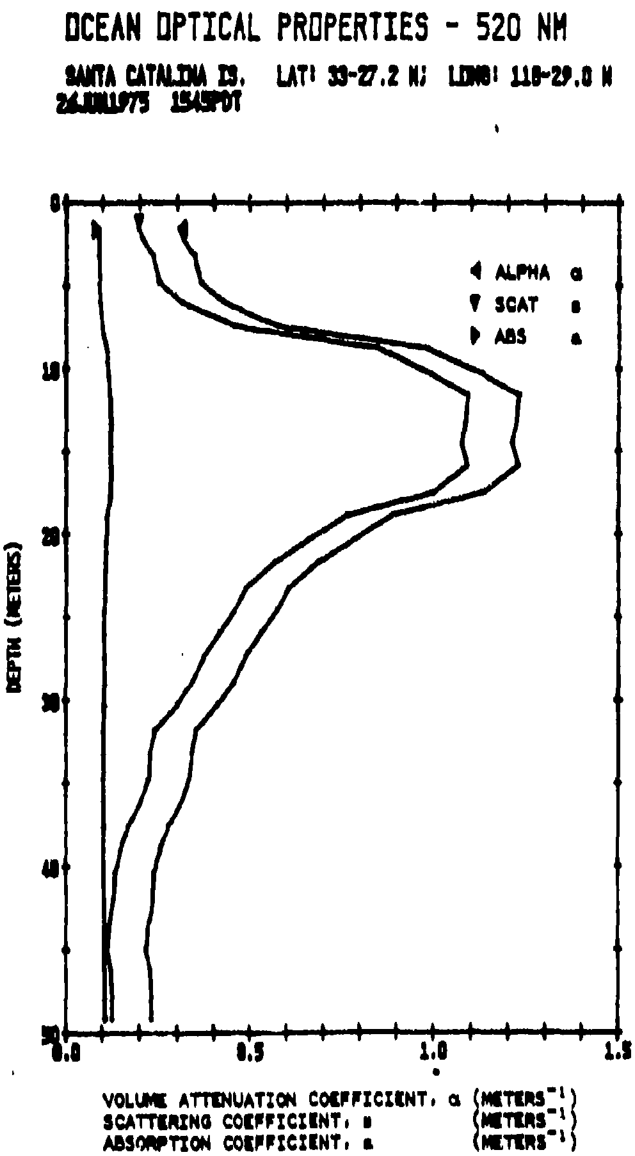

Figure D-64. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
26JUN1975 1545PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
1.4	0.728	0.318	0.321	0.214	0.107	248.5	90.3	32.8	0.077
2.0	0.721	0.327	0.331	0.223	0.108	260.7	95.0	34.6	0.075
3.0	0.700	0.356	0.360	0.252	0.109	298.3	109.5	40.1	0.069
4.6	0.689	0.372	0.376	0.267	0.109	318.7	117.3	43.2	0.067
5.8	0.651	0.429	0.434	0.324	0.111	394.9	146.9	54.6	0.059
7.3	0.564	0.572	0.581	0.466	0.115	594.1	225.4	85.5	0.046
8.7	0.383	0.960	0.978	0.851	0.127	1166.2	457.4	179.5	0.031
10.3	0.332	1.103	1.124	0.993	0.131	1386.4	548.4	216.8	0.028
11.6	0.302	1.198	1.223	1.088	0.134	1536.8	610.9	242.8	0.027
13.1	0.304	1.192	1.216	1.082	0.134	1526.6	606.7	241.0	0.027
14.5	0.307	1.182	1.206	1.072	0.134	1511.4	600.4	238.4	0.027
15.9	0.303	1.195	1.219	1.085	0.134	1531.6	608.8	241.9	0.027
17.5	0.331	1.106	1.127	0.996	0.132	1391.1	550.3	217.6	0.028
18.8	0.416	0.876	0.892	0.768	0.124	1039.6	405.5	158.1	0.034
20.3	0.463	0.769	0.783	0.661	0.121	879.7	340.3	131.6	0.037
21.6	0.507	0.679	0.690	0.571	0.118	746.4	286.4	109.8	0.041
23.2	0.550	0.597	0.606	0.490	0.116	629.0	239.4	91.0	0.045
24.5	0.567	0.567	0.576	0.461	0.115	586.7	222.5	84.3	0.047
25.9	0.592	0.525	0.533	0.419	0.114	527.3	198.9	75.0	0.050
27.3	0.617	0.483	0.489	0.377	0.112	468.8	175.8	65.9	0.053
28.9	0.639	0.449	0.454	0.343	0.111	421.7	157.4	58.7	0.057
30.2	0.664	0.409	0.415	0.304	0.110	368.9	136.7	50.7	0.061
31.8	0.705	0.349	0.353	0.245	0.108	289.2	105.9	38.8	0.071
33.2	0.715	0.336	0.339	0.231	0.108	271.3	99.1	36.2	0.073
34.7	0.718	0.331	0.335	0.227	0.108	266.0	97.0	35.4	0.074
36.0	0.733	0.311	0.315	0.207	0.107	239.9	87.1	31.6	0.079
37.6	0.761	0.273	0.276	0.170	0.106	191.8	68.9	24.7	0.090
39.0	0.777	0.253	0.255	0.150	0.105	166.6	59.4	21.2	0.097
40.4	0.788	0.238	0.240	0.135	0.105	148.2	52.5	18.6	0.104
42.0	0.793	0.232	0.234	0.129	0.105	140.7	49.8	17.6	0.107
43.4	0.801	0.222	0.224	0.119	0.104	129.0	45.4	16.0	0.113
45.0	0.807	0.214	0.216	0.112	0.104	120.3	42.2	14.8	0.117
46.2	0.799	0.224	0.226	0.122	0.104	131.9	46.5	16.4	0.111
48.0	0.797	0.227	0.229	0.124	0.105	134.8	47.6	16.8	0.110
49.2	0.798	0.225	0.227	0.123	0.105	133.3	47.0	16.6	0.111

PAUSE READY PLOTTER

Figure D-64. Ocean optical properties (sheet 2 of 2).

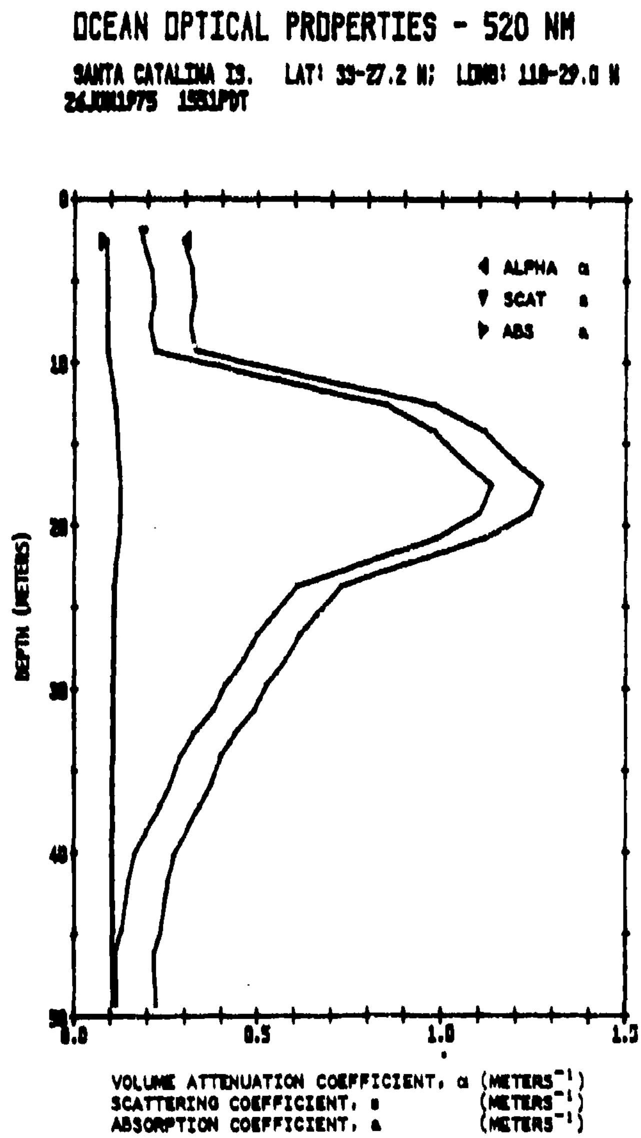

Figure D-65. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
26JUN1975 1551PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA*2BAR
2.3	0.735	0.308	0.312	0.205	0.107	236.5	85.8	31.1	0.079
4.1	0.719	0.330	0.334	0.226	0.108	264.2	96.3	35.1	0.074
5.7	0.715	0.336	0.339	0.231	0.108	271.3	99.1	36.2	0.073
7.5	0.722	0.326	0.330	0.222	0.108	258.9	94.3	34.4	0.075
9.1	0.713	0.338	0.342	0.234	0.108	274.8	100.4	36.7	0.073
10.9	0.514	0.665	0.676	0.558	0.118	726.9	278.6	106.7	0.041
12.5	0.380	0.968	0.986	0.858	0.127	1178.0	462.2	181.3	0.031
14.2	0.334	1.097	1.118	0.987	0.131	1377.3	544.6	215.2	0.029
16.0	0.310	1.170	1.193	1.059	0.133	1491.4	592.0	234.9	0.027
17.5	0.288	1.245	1.270	1.134	0.136	1610.3	641.6	255.5	0.026
19.2	0.297	1.215	1.239	1.104	0.135	1562.6	621.7	247.2	0.027
20.7	0.333	1.100	1.121	0.990	0.131	1381.9	546.5	216.0	0.028
22.2	0.405	0.903	0.919	0.794	0.125	1079.2	421.7	164.7	0.033
23.6	0.487	0.720	0.732	0.612	0.120	806.8	310.8	119.6	0.039
25.3	0.518	0.658	0.668	0.550	0.118	715.9	274.2	104.9	0.042
26.6	0.544	0.610	0.619	0.503	0.116	646.9	246.5	93.9	0.044
28.1	0.565	0.571	0.579	0.464	0.115	591.6	224.5	85.1	0.047
29.7	0.594	0.520	0.527	0.414	0.114	520.4	196.2	73.9	0.050
31.2	0.614	0.488	0.494	0.382	0.113	475.4	178.4	66.9	0.053
32.7	0.649	0.432	0.437	0.327	0.111	399.0	148.5	55.2	0.059
34.1	0.675	0.393	0.398	0.289	0.110	347.3	128.4	47.4	0.063
35.8	0.691	0.369	0.373	0.264	0.109	315.0	115.9	42.6	0.067
37.1	0.712	0.340	0.343	0.235	0.108	276.6	101.1	36.9	0.072
38.6	0.738	0.303	0.306	0.199	0.107	229.7	83.2	30.1	0.081
40.1	0.763	0.271	0.273	0.167	0.106	188.6	67.7	24.3	0.090
41.7	0.777	0.253	0.255	0.150	0.105	166.6	59.4	21.2	0.097
43.1	0.784	0.243	0.245	0.140	0.105	154.3	54.8	19.5	0.102
44.7	0.792	0.233	0.235	0.130	0.105	142.2	50.3	17.8	0.107
46.1	0.806	0.216	0.217	0.113	0.104	121.7	42.7	15.0	0.117
47.8	0.806	0.216	0.217	0.113	0.104	121.7	42.7	15.0	0.117
49.3	0.804	0.218	0.220	0.116	0.104	124.6	43.8	15.4	0.115

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Figure D-65. Ocean optical properties (sheet 2 of 2).

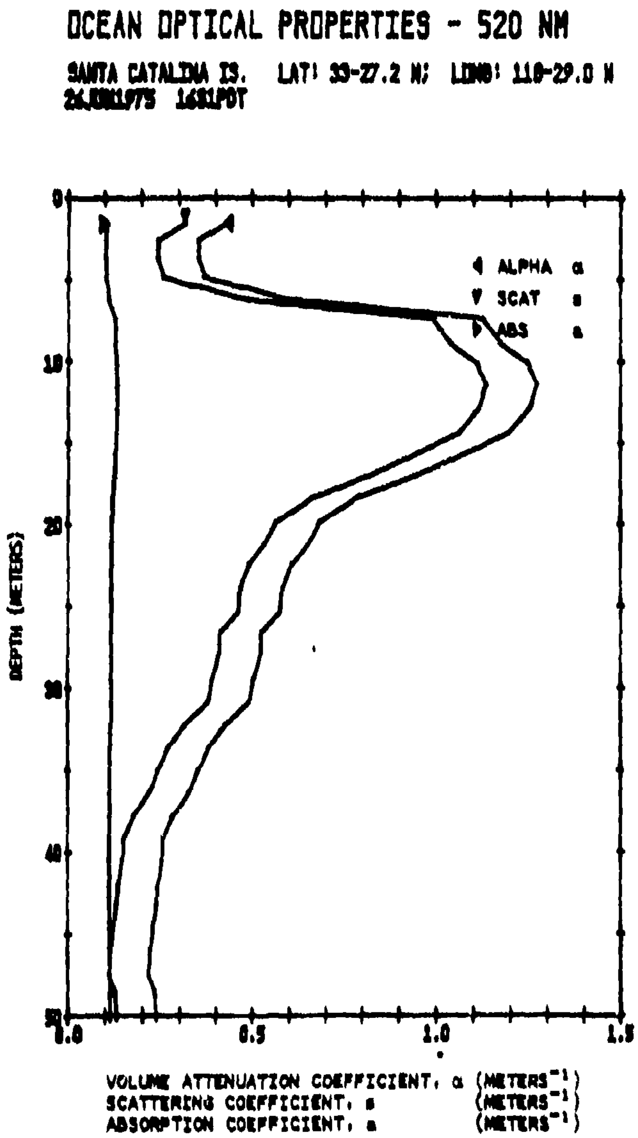

Figure D-66. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES -520 [illegible]

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
26JUN1975 1631PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTAB2[illegible]
1.4	0.653	0.426	0.431	0.321	0.111	390.9	145.3	54.0	0.059
2.4	0.702	0.353	0.358	0.249	0.108	294.7	108.0	39.6	0.070
3.5	0.703	0.352	0.356	0.248	0.108	292.9	107.3	39.3	0.070
4.7	0.693	0.366	0.370	0.262	0.109	311.3	114.4	42.0	0.066
6.1	0.549	0.599	0.608	0.492	0.116	631.6	240.4	91.4	0.045
7.3	0.333	1.100	1.121	0.990	0.131	1391.9	546.5	216.0	0.025
8.8	0.319	1.142	1.164	1.032	0.133	1447.5	573.8	227.3	0.028
10.1	0.297	1.215	1.239	1.104	0.135	1562.6	621.7	247.2	0.027
11.4	0.290	1.238	1.263	1.128	0.136	1599.5	637.1	253.7	0.026
12.8	0.295	1.221	1.245	1.111	0.135	1573.0	625.1	249.1	0.026
14.3	0.310	1.170	1.193	1.059	0.133	1491.4	592.0	234.9	0.027
15.6	0.348	1.056	1.077	0.947	0.130	[illegible]	518.7	204.5	0.029
17.0	0.399	0.920	0.937	0.811	0.126	1109.1	432.3	169.0	0.032
18.3	0.462	0.772	0.785	0.653	0.121	882.8	341.6	132.1	0.037
19.8	0.511	0.671	0.682	0.564	0.118	734.2	281.9	108.0	0.041
21.2	0.529	0.637	0.647	0.530	0.117	686.2	262.2	100.2	0.042
22.4	0.552	0.594	0.603	0.487	0.116	624.0	237.3	90.2	0.045
23.9	0.566	0.569	0.577	0.462	0.115	589.2	223.5	84.7	0.047
25.4	0.571	0.560	0.569	0.454	0.115	577.0	218.6	82.8	0.047
26.6	0.598	0.513	0.521	0.407	0.113	511.2	192.6	72.5	0.051
28.0	0.601	0.509	0.516	0.403	0.113	504.4	189.9	71.4	0.051
29.5	0.612	0.491	0.498	0.385	0.113	479.8	180.2	67.6	0.053
30.9	0.620	0.479	0.485	0.372	0.112	462.3	173.3	64.9	0.054
32.3	0.660	0.415	0.421	0.310	0.110	[illegible]	139.8	51.9	0.061
33.7	0.690	0.370	0.375	0.266	0.109	316.9	116.6	42.9	0.067
35.1	0.711	0.341	0.345	0.237	0.108	279.4	101.8	37.2	0.072
36.5	0.730	0.315	0.319	0.211	0.107	245.0	89.0	32.3	0.078
37.9	-0.760	0.274	0.277	0.171	0.106	193.4	69.5	24.6	0.089
39.3	0.781	0.248	0.250	0.145	0.105	160.4	57.1	20.3	0.099
40.6	-0.784	0.243	0.245	0.140	0.105	154.3	54.9	19.5	0.102
42.2	0.793	0.232	0.234	0.129	0.105	140.7	49.8	17.6	0.107
43.4	0.797	0.227	0.229	0.124	0.105	134.8	47.6	16.9	0.110
44.8	0.805	0.217	0.219	0.114	0.104	123.1	43.3	15.2	0.116
46.1	0.811	0.210	0.211	0.107	0.104	114.5	40.1	14.0	0.121
47.6	0.816	0.205	0.206	0.102	0.104	108.9	38.0	13.3	0.126
48.9	0.806	0.223	0.225	0.120	0.104	130.4	45.9	16.2	0.112
50.4	0.797	0.227	0.229	0.124	0.105	134.8	47.6	16.8	0.110

PAUSE READY PLOTTER

Figure D-66. Ocean optical properties (sheet 2 of 2).

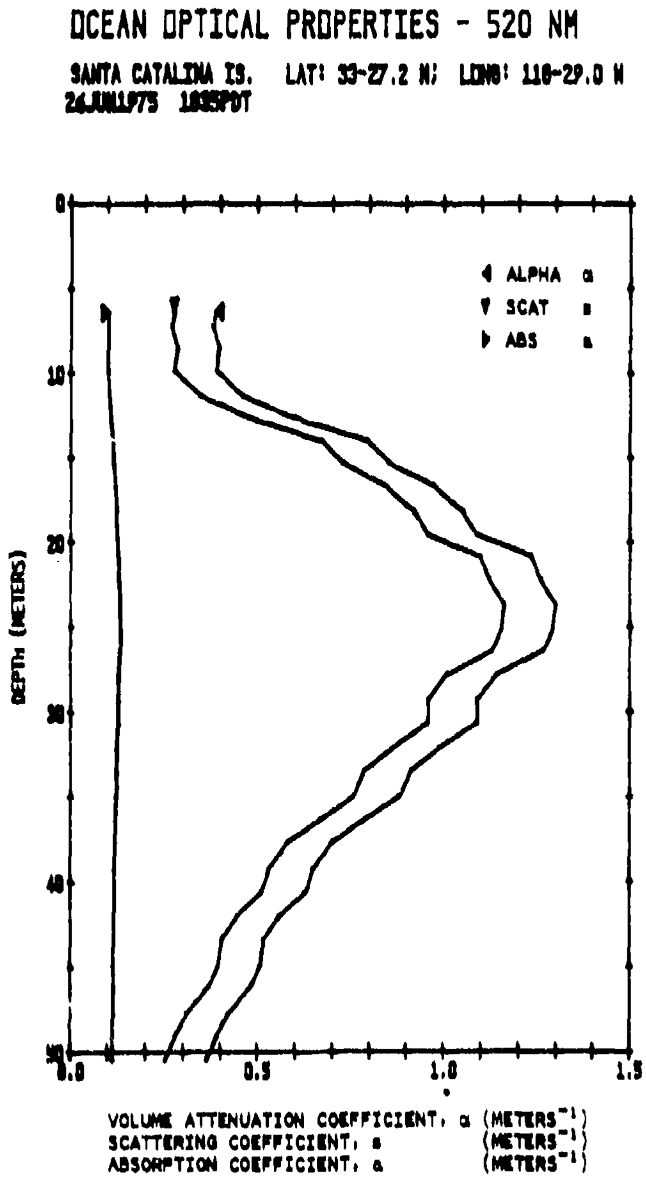

Figure D-67. Ocean optical properties (sheet 1 of 2).

[illegible] OPTICAL PROPERTIES - 520 [illegible]

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
28JUN1975 1835PDT

[illegible]	T(1/)	ALPHA1	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA[illegible]
6.2	0.678	0.349	0.394	0.284	0.110	341.5	126.1	46.6	0.064
7.0	0.693	0.382	0.386	0.277	0.109	332.0	122.4	45.1	0.065
8.4	0.673	0.396	0.401	0.291	0.110	351.2	129.9	48.0	0.063
9.7	0.678	0.389	0.394	0.284	0.110	341.5	126.1	46.6	0.064
11.2	0.634	0.456	0.462	0.351	0.112	432.2	161.5	60.3	0.056
12.5	0.555	0.588	0.597	0.481	0.116	614.4	236.3	89.0	0.046
13.9	0.457	0.792	0.796	0.674	0.122	898.6	348.0	134.7	0.037
15.2	0.434	0.835	0.850	0.726	0.123	977.3	380.0	147.7	0.035
16.6	0.387	0.950	0.967	0.840	0.127	1150.7	451.0	176.7	0.032
18.1	0.358	1.026	1.045	0.916	0.129	1267.6	499.2	196.8	0.030
19.5	0.346	1.062	1.083	0.952	0.130	1323.6	522.3	206.0	0.029
21.4	0.301	1.202	1.226	1.091	0.134	1541.9	613.1	243.6	0.027
22.2	0.295	1.228	1.253	1.118	0.135	1583.6	630.5	250.9	0.026
23.7	0.282	1.266	1.291	1.155	0.136	1643.0	655.3	261.2	0.026
25.1	0.284	1.259	1.284	1.149	0.136	1632.0	650.7	259.3	0.026
26.4	0.291	1.235	1.260	1.124	0.135	1594.2	634.9	252.7	0.026
27.9	0.328	1.114	1.136	1.004	0.132	1405.0	556.1	220.0	0.028
29.3	0.346	1.062	1.083	0.952	0.130	1323.6	522.3	206.0	0.029
30.7	0.347	1.058	1.080	0.950	0.130	1319.2	520.5	205.3	0.029
32.2	0.391	0.965	0.983	0.856	0.127	1174.0	460.6	180.6	0.031
33.5	0.410	0.891	0.907	0.782	0.125	1061.1	414.2	161.6	0.033
35.0	0.427	0.852	0.870	0.744	0.124	1014.5	396.[illegible]	154.5	0.034
36.4	0.463	0.769	0.783	0.661	0.121	870.7	340.3	131.6	0.037
37.7	0.506	0.684	0.695	0.577	0.119	754.3	299.4	111.2	0.040
39.3	0.530	0.635	0.645	0.528	0.117	683.6	261.2	99.7	0.043
40.7	0.542	0.613	0.623	0.506	0.116	652.1	248.6	94.7	0.044
42.1	0.580	0.545	0.553	0.439	0.114	555.4	210.1	79.4	0.048
43.5	0.606	0.504	0.511	0.398	0.113	497.6	187.2	70.4	0.052
44.9	0.606	0.496	0.503	0.390	0.113	486.9	182.8	68.7	0.052
46.2	0.626	0.472	0.479	0.366	0.112	453.6	169.9	63.6	0.054
47.6	0.665	0.408	0.413	0.303	0.110	366.9	136.0	50.4	0.061
49.2	0.686	0.380	0.385	0.276	0.109	330.1	121.7	44.8	0.065
50.6	0.702	0.353	0.358	0.249	0.108	294.7	108.0	39.6	0.071

[illegible]

Figure D-67. Ocean optical properties (sheet 2 of 2).

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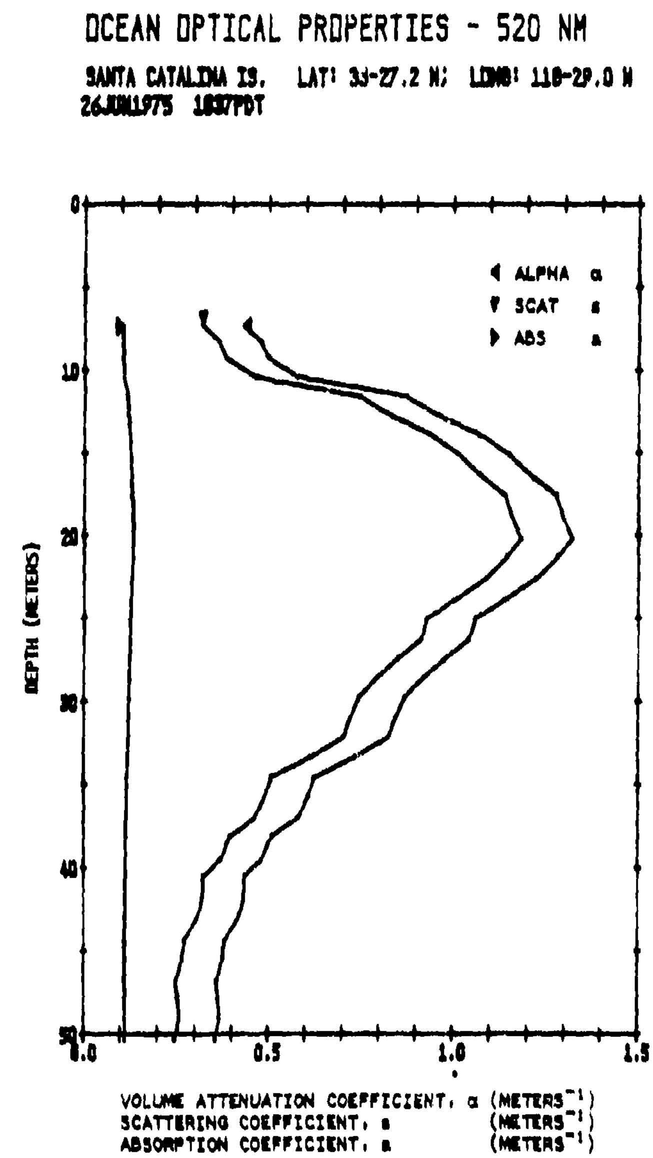

Figure D-68. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES = 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
26JUN1975 1937PDT

Z(M)	T(1/M)	ALPHA1	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	TOT [illegible]
7.1	0.650	0.430	0.436	0.325	0.111	397.0	147.7	54.9	[illegible]
8.1	0.622	0.475	0.481	0.359	0.112	457.9	171.6	64.2	0.054
9.0	0.610	0.494	0.501	0.388	0.113	484.2	181.9	68.3	0.052
10.2	0.565	0.571	0.579	0.464	0.115	591.6	224.5	85.1	0.047
11.4	0.425	0.856	0.871	0.747	0.124	1008.1	392.6	152.8	0.034
12.6	0.390	0.942	0.959	0.833	0.125	1139.1	446.3	174.7	0.032
13.7	0.352	1.045	1.065	0.936	0.130	1297.5	511.5	201.6	0.030
15.0	0.324	1.126	1.149	1.016	0.132	1423.7	563.9	223.2	[illegible]
16.2	0.308	1.179	1.203	1.069	0.134	1506.4	[illegible]	237.5	0.027
17.5	[illegible]	1.248	1.274	1.138	0.136	1615.7	643.9	256.5	0.026
18.7	0.282	1.266	1.291	1.155	0.136	1643.0	655.3	261.2	0.026
20.1	0.275	1.290	1.317	1.180	0.137	[illegible]	671.7	[illegible]	[illegible]
21.2	0.285	1.252	1.277	1.141	0.136	1621.1	646.2	257.4	0.026
22.5	0.303	1.195	1.219	1.085	0.134	1531.6	608.8	241.9	0.027
23.7	0.326	1.120	1.142	1.010	0.132	1414.3	560.0	221.6	0.029
24.9	0.355	1.037	1.057	0.927	0.129	1284.6	506.2	199.4	0.030
26.2	0.360	1.020	1.040	0.911	0.129	1259.2	495.7	195.1	0.030
27.3	0.385	0.960	0.978	0.851	0.127	1166.2	457.4	179.3	0.031
28.5	0.406	0.900	0.917	0.791	0.125	1075.6	420.2	164.1	0.033
29.7	0.427	0.851	0.865	0.742	0.124	1001.2	389.7	151.6	0.034
31.0	0.438	0.826	0.840	0.718	0.123	963.8	374.5	145.6	0.035
32.1	0.446	0.808	0.822	0.700	0.122	937.3	363.7	141.1	0.036
33.3	0.487	0.720	0.732	0.612	0.120	806.8	312.9	119.6	0.039
34.8	0.542	0.613	0.623	0.506	0.116	652.1	242.6	94.7	0.044
35.7	0.551	0.595	0.604	0.489	0.116	626.5	235.4	90.6	0.045
37.0	0.567	0.567	0.576	0.461	0.115	586.7	222.5	84.3	0.047
38.1	0.607	0.499	0.506	0.393	0.113	490.9	184.6	69.3	0.052
39.5	0.625	0.472	0.480	0.368	0.112	455.7	170.7	63.9	0.054
40.5	0.653	0.426	0.431	0.321	0.111	390.9	145.3	54.0	0.059
41.9	0.655	0.423	0.424	0.313	0.111	386.9	143.7	53.4	0.060
43.0	0.665	0.409	0.413	0.303	0.110	366.9	135.9	50.4	0.061
44.4	0.689	0.373	0.378	0.269	0.109	320.6	119.1	43.4	0.066
45.5	0.693	0.366	0.370	0.262	0.109	311.3	114.4	42.5	[illegible]
46.9	0.706	0.351	0.355	0.246	0.108	291.0	106.5	39.1	[illegible]
47.9	0.701	0.355	0.359	0.251	0.108	296.5	108.7	39.9	[illegible]
49.1	0.690	0.358	0.362	0.253	0.109	300.2	110.2	41.4	0.069
50.4	0.708	0.345	0.349	0.241	0.108	283.4	103.2	38.0	0.071

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Figure D-68. Ocean optical properties (sheet 2 of 2).

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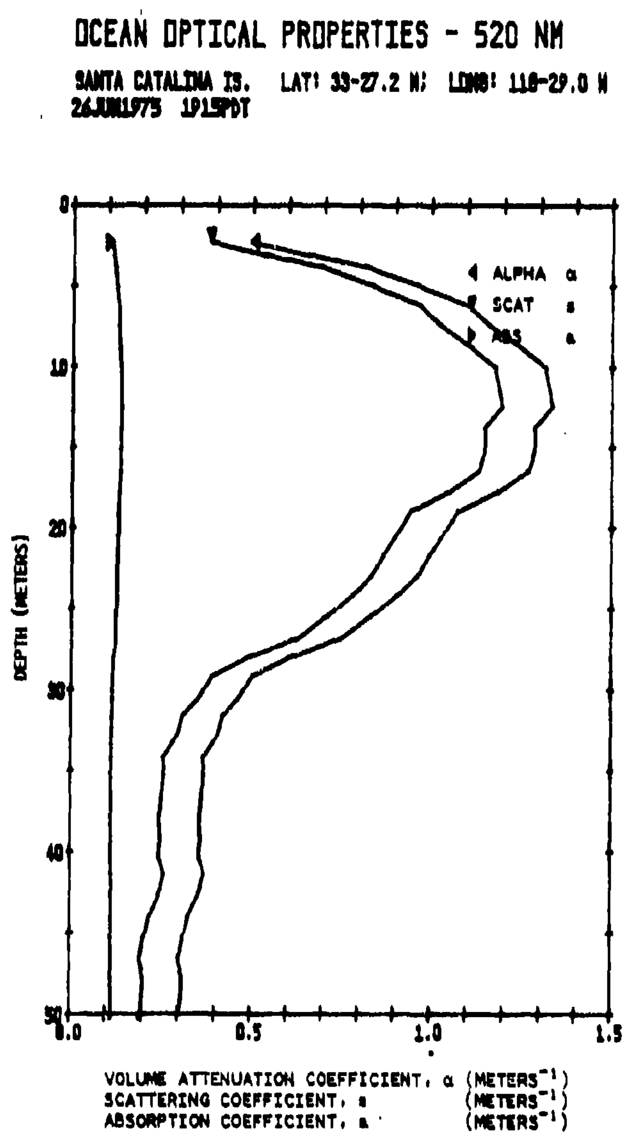


Figure D-69. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
26JUN1975 1915PDT

Z(M)	T(1/M)	ALPHA'	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA**2BAR
2.1	0.613	0.489	0.496	0.383	0.113	477.6	179.3	67.3	0.053
2.9	0.526	0.643	0.653	0.535	0.117	694.3	265.5	101.5	0.042
3.6	0.452	0.795	0.809	0.687	0.122	917.8	355.8	137.8	0.036
4.8	0.392	0.937	0.954	0.828	0.126	1131.5	443.1	173.5	0.032
6.1	0.341	1.076	1.097	0.967	0.131	1345.7	531.5	209.8	0.029
7.3	0.323	1.129	1.152	1.019	0.132	1428.4	565.8	224.0	0.028
8.7	0.297	1.215	1.239	1.104	0.135	1562.6	521.7	247.2	0.027
10.0	0.278	1.280	1.306	1.169	0.137	1665.2	664.6	265.1	0.026
11.3	0.275	1.290	1.317	1.180	0.137	1682.1	671.7	268.1	0.025
12.4	0.273	1.297	1.324	1.187	0.137	1693.5	676.5	270.1	0.025
13.7	0.286	1.252	1.277	1.141	0.136	1621.1	646.2	257.4	0.026
15.0	0.296	1.252	1.277	1.141	0.136	1621.1	646.2	257.4	0.026
16.4	0.291	1.235	1.260	1.124	0.135	1594.2	634.9	252.7	0.026
17.7	0.315	1.154	1.177	1.044	0.133	1466.9	581.8	230.7	0.028
18.9	0.351	1.046	1.068	0.938	0.130	1301.8	513.3	202.3	0.029
20.3	0.364	1.010	1.029	0.900	0.129	1242.6	[illegible]	192.2	0.030
21.6	0.378	0.973	0.991	0.863	0.127	1185.9	465.5	182.6	0.031
22.9	0.390	0.942	0.959	0.833	0.126	1139.1	446.3	174.7	0.032
24.1	0.412	0.886	0.902	0.777	0.125	1053.9	411.3	160.4	0.033
25.4	0.443	0.815	0.829	0.706	0.123	947.2	367.7	142.7	0.035
26.8	0.482	0.730	0.742	0.622	0.120	821.6	316.8	122.1	0.039
27.9	0.549	0.594	0.608	0.492	0.116	631.6	240.4	91.4	0.045
29.1	0.612	0.491	0.498	0.385	0.113	479.8	180.2	67.6	0.053
30.5	0.635	0.455	0.461	0.349	0.112	430.1	160.7	60.0	0.056
31.6	0.664	0.409	0.415	0.304	0.110	368.9	136.7	50.7	0.061
32.8	0.675	0.393	0.398	0.289	0.110	347.3	128.4	47.4	0.063
34.2	0.700	0.356	0.360	0.252	0.109	298.3	109.5	40.1	0.069
35.2	0.699	0.358	0.362	0.253	0.109	300.2	110.2	40.4	0.069
36.6	0.704	0.351	0.355	0.246	0.108	291.0	106.6	39.1	0.070
37.9	0.708	0.345	0.349	0.241	0.108	283.8	103.9	38.0	0.071
39.0	0.706	0.348	0.352	0.244	0.108	287.4	105.2	38.5	0.071
40.3	0.709	0.344	0.348	0.240	0.108	282.0	103.2	37.7	0.072
41.4	0.700	0.356	0.360	0.252	0.109	298.3	109.5	40.1	0.069
42.8	0.710	0.342	0.346	0.238	0.108	280.2	[illegible]	37.5	0.072
44.1	0.729	0.317	0.320	0.213	0.107	246.8	89.7	32.6	0.077
45.3	0.739	0.302	0.305	0.198	0.107	228.0	82.6	29.9	0.081
46.6	0.748	0.290	0.293	0.196	0.106	213.0	76.5	27.7	0.084
47.9	0.741	0.299	0.302	0.196	0.107	224.6	81.3	29.4	0.082
49.1	0.743	0.297	0.300	0.193	0.107	221.3	80.0	28.9	0.082
50.3	0.749	0.289	0.292	0.185	0.106	211.3	75.2	27.5	0.085

PAUSE READY PLOTTER

Figure D-69. Ocean optical properties (sheet 2 of 2).

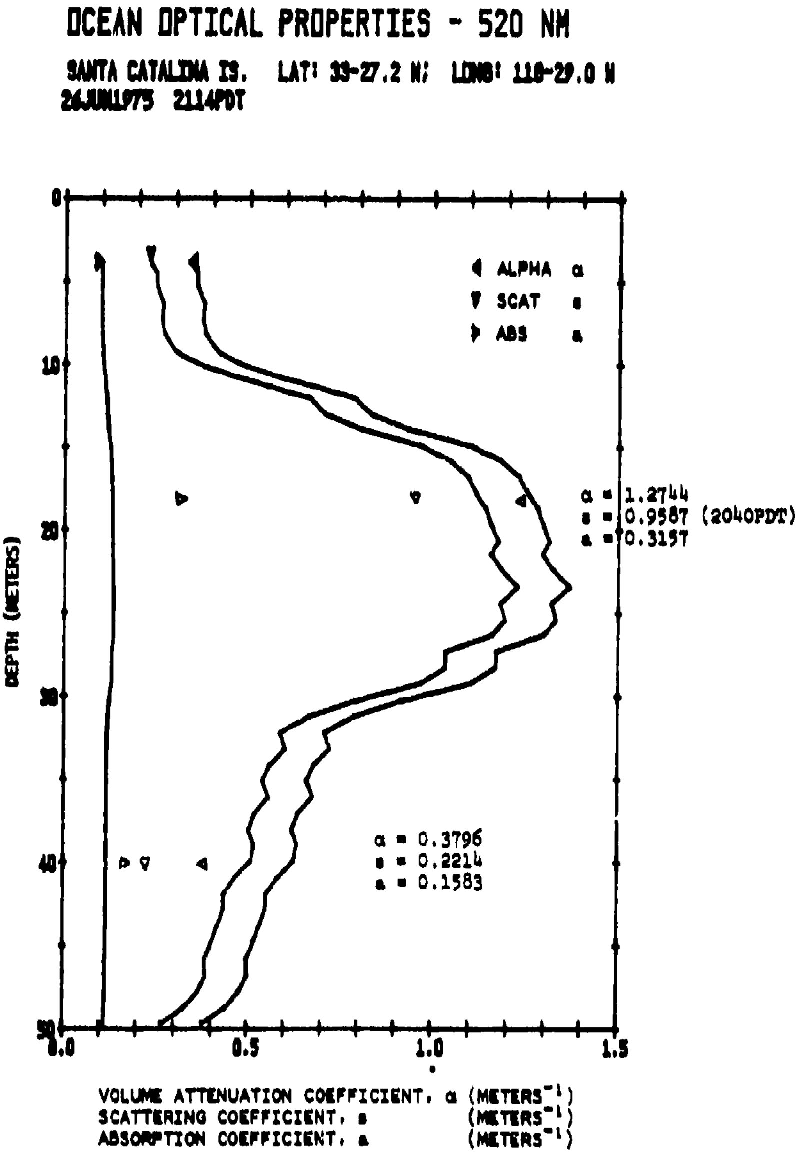


Figure D-70. Ocean optical properties (sheet 1 of 2).

OCEAN OPTICAL PROPERTIES - 520 NM

SANTA CATALINA IS. LAT 33-27.2 N LONG 118-29.0 W
[illegible]JUN1975 2114PDT

Z(M)	T(1/M)	ALPHA1	ALPHA	SCAT	ABS	VSF3	VSF6	VSF12	THTA**2*ABS
3.3	0.711	0.341	0.345	0.237	0.108	278.4	101.8	37.2	0.072
4.2	0.699	0.358	0.362	0.253	0.109	300.2	110.2	40.4	0.069
5.0	0.697	0.360	0.365	0.256	0.109	303.9	111.6	40.9	0.069
6.0	0.687	0.376	0.381	0.271	0.109	324.4	119.5	44.0	0.066
7.0	0.689	0.373	0.378	0.269	0.109	320.6	118.0	43.4	0.066
7.9	0.684	0.380	0.385	0.276	0.109	330.1	121.7	44.8	0.065
8.8	0.642	0.412	0.418	0.307	0.110	372.8	138.3	51.3	0.061
9.9	0.615	0.486	0.493	0.380	0.112	473.2	177.6	66.6	0.053
10.8	0.538	0.620	0.630	0.513	0.117	662.5	252.7	96.4	0.044
[illegible]	0.462	0.772	0.795	0.663	0.121	[illegible]	341.5	132.1	0.037
[illegible]	0.442	0.817	0.831	0.709	0.123	950.5	369.1	143.2	0.035
13.7	0.402	0.912	0.929	0.803	0.126	1094.0	427.7	167.2	0.033
14.7	0.343	1.071	1.091	0.961	0.130	1336.3	527.8	208.3	0.029
15.6	0.317	1.149	1.171	1.038	0.133	1457.2	577.8	229.0	0.028
16.6	0.302	1.198	1.223	1.088	0.134	1536.8	610.9	242.8	0.027
17.5	0.296	1.218	1.243	1.108	0.135	1567.3	623.9	248.1	0.026
18.5	0.288	1.265	1.270	1.134	0.136	1610.3	641.6	255.5	0.026
19.5	0.284	1.259	1.284	1.148	0.136	1632.0	650.7	259.3	0.026
20.5	0.279	1.276	1.302	1.165	0.137	1659.6	662.3	264.2	0.026
21.3	0.284	1.259	1.284	1.148	0.136	1632.0	650.7	259.3	0.026
22.3	0.276	1.287	1.313	1.176	0.137	1676.5	669.3	267.1	0.025
23.3	0.264	1.330	1.358	1.219	0.139	1745.8	698.4	279.3	0.025
24.3	0.277	1.283	1.309	1.172	0.137	1670.8	667.0	266.1	0.026
25.3	0.274	1.294	1.320	1.183	0.137	1687.3	674.1	269.1	0.025
26.2	0.283	1.262	1.288	1.152	0.136	1637.5	653.0	260.3	0.026
27.2	0.320	1.139	1.161	1.029	0.133	1442.7	571.8	226.5	0.023
28.2	0.321	1.136	1.158	1.025	0.132	1439.0	569.8	225.7	0.028
29.1	0.341	1.076	1.097	0.967	0.131	1345.7	531.5	209.8	0.029
30.2	0.408	0.895	0.912	0.787	0.125	1068.3	417.2	162.9	0.033
31.1	0.461	0.774	0.787	0.665	0.121	[illegible]	342.4	132.6	0.037
32.1	0.500	0.692	0.703	0.585	0.119	756.2	294.6	113.1	0.040
33.1	0.494	0.706	0.718	0.598	0.119	786.3	302.5	116.3	0.040
34.1	0.515	0.663	0.674	0.556	0.118	724.2	277.5	106.3	0.041
35.0	0.525	0.644	0.655	0.537	0.117	697.0	266.8	101.9	0.042
36.0	0.517	0.659	0.670	0.552	0.118	719.7	275.3	105.4	0.042
37.0	0.537	0.622	0.632	0.515	0.117	665.1	253.8	96.8	0.044
38.0	0.546	0.606	0.615	0.499	0.115	641.8	244.5	93.1	0.044
38.9	0.539	0.619	0.628	0.512	0.117	659.9	251.7	96.0	0.044
39.9	0.543	0.611	0.621	0.504	0.116	649.5	247.5	94.3	0.044
40.9	0.566	0.569	0.577	0.462	0.115	590.2	223.5	84.7	0.047
41.9	0.584	0.538	0.546	0.432	0.114	546.0	206.3	77.9	0.049
42.9	0.585	0.537	0.544	0.430	0.114	543.6	205.4	77.6	0.049
43.9	0.595	0.518	0.526	0.412	0.113	518.1	195.3	73.6	0.050
44.9	0.604	0.504	0.511	0.398	0.113	497.6	187.2	70.4	0.052
45.9	0.615	0.486	0.493	0.380	0.112	473.2	177.6	66.6	0.053
46.9	0.614	0.488	0.494	0.382	0.113	475.4	178.4	66.9	0.053
47.9	0.627	0.467	0.473	0.362	0.112	447.1	167.3	62.6	0.055
48.9	0.651	0.429	0.434	0.324	0.111	394.9	146.9	54.6	0.059
49.7	0.692	0.368	0.372	0.263	0.109	313.1	115.1	42.3	0.067

PAUSE READY PLOTTER

Figure D-70. Ocean optical properties (sheet 2 of 2).

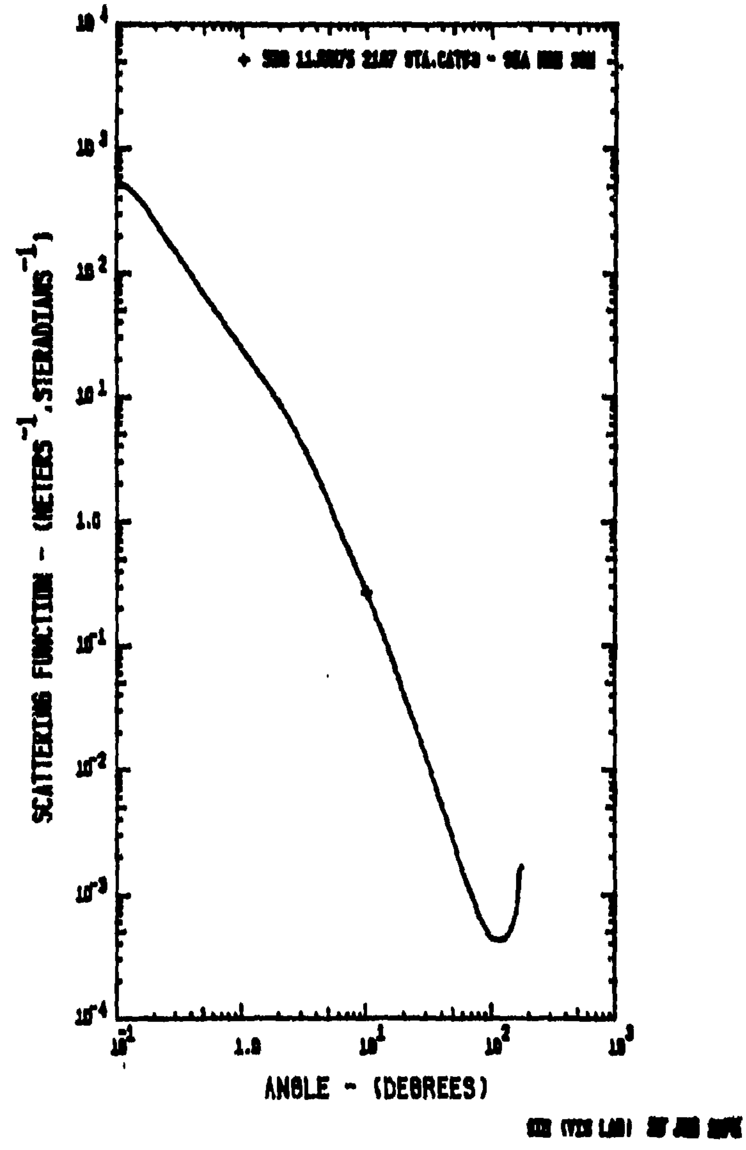


Figure D-71. Volume scattering function (sheet 1 of 3).

*20 11JUN75 2107 STA.CAT#3 - SEA H2O 30M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	3.2500E 02	0	0.1750	3.2695E 02
2	0.3500	1.1900E 02	0	0.3500	1.1754E 02
3	0.7000	4.2000E 01	0	0.7000	4.2254E 01
4	10.00	2.7480E-01	0	10.00	2.7480E-01
5	15.00	9.9464E-02	0	15.00	9.9464E-02
6	20.00	4.1943E-02	0	20.00	4.1943E-02
7	25.00	2.2785E-02	0	25.00	2.2785E-02
8	30.00	1.3811E-02	0	30.00	1.3811E-02
9	40.00	5.4604E-03	0	40.00	5.4604E-03
10	50.00	2.8342E-03	0	50.00	2.8342E-03
11	60.00	1.6188E-03	0	60.00	1.6188E-03
12	70.00	1.0578E-03	0	70.00	1.0578E-03
13	80.00	7.2681E-04	0	80.00	7.2681E-04
14	90.00	5.6762E-04	0	90.00	5.6762E-04
15	100.0	4.6830E-04	0	100.0	4.6830E-04
16	110.0	4.3962E-04	0	110.0	4.3962E-04
17	120.0	4.3490E-04	0	120.0	4.3490E-04
18	130.0	4.4705E-04	0	130.0	4.4705E-04
19	140.0	4.8863E-04	0	140.0	4.8863E-04
20	150.0	5.6615E-04	0	150.0	5.6615E-04
21	160.0	7.0203E-04	0	160.0	7.0203E-04
22	170.0	1.4185E-03	0	170.0	1.4185E-03
23			1	180.0	1.7183E-03

ALPHA= 0.3920 S/ALPHA= 0.704
S= 0.2760 A/ALPHA= 0.296
A= 0.1160 B/S= 0.012

CORRECTED ALPHA CORRECTION=0.005

ALPHA= 0.3968 S/ALPHA= 0.696
S= 0.2760 A/ALPHA= 0.304
A= 0.1207 B/S= 0.012

SIGMA(0.0 DEGREES)= 749.0
SIGMA(0.1 DEGREES)= 562.3
SLOPE(3 MILLIRAD)= -1.476
S UP TO 0.1 DEGREES= 6.2260E-03 NORMALIZED= 2.25557E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 109.0
EXPECTED K/ALPHA= 0.4082 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K =

	MU	RADIANS	DEGREES
MEDIAN	0.9987	0.5111E-01	2.929
MEAN 1	0.9562	0.2971	17.02
VARIANCE	0.1897		
MEAN 2		0.1481	8.485
RMS		0.3386	19.40
RMS 2		0.3045	17.45

KAPPA= 0.1620 KAPPA'= 2.3349E-03

THETA**2 BAR 5.7322E-02 RADIANS**2

Figure D-71. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0709.39

520 11JUN75 2107 STA.CAT#3 - SEA H2O 30M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	5.6233E 02	6.2260E-03	2.2556E-02	1
2.1972E-03	1.2589E-01	4.7846E 02	9.1312E-03	3.3081E-02	11
2.7662E-03	1.5849E-01	3.7486E 02	1.2892E-02	4.6707E-02	21
3.4824E-03	1.9953E-01	2.6941E 02	1.7340E-02	6.2819E-02	31
4.3841E-03	2.5119E-01	1.9179E 02	2.2363E-02	8.1019E-02	41
5.5192E-03	3.1623E-01	1.3653E 02	2.8031E-02	1.0155E-01	51
6.9483E-03	3.9811E-01	9.7191E 01	3.4426E-02	1.2472E-01	61
8.7474E-03	5.0119E-01	6.9188E 01	4.1641E-02	1.5086E-01	71
1.1012E-02	6.3096E-01	4.9253E 01	4.9781E-02	1.8035E-01	81
1.3864E-02	7.9433E-01	3.5126E 01	5.8968E-02	2.1363E-01	91
1.7453E-02	1.0000E 00	2.5292E 01	6.9404E-02	2.5144E-01	101
2.1972E-02	1.2589E 00	1.8225E 01	8.1328E-02	2.9464E-01	111
2.7662E-02	1.5849E 00	1.2995E 01	9.4885E-02	3.4376E-01	121
3.4824E-02	1.9953E 00	9.0642E 00	1.1005E-01	3.9869E-01	131
4.3841E-02	2.5119E 00	6.1152E 00	1.2655E-01	4.5846E-01	141
5.5192E-02	3.1623E 00	3.9452E 00	1.4381E-01	5.2099E-01	151
6.9483E-02	3.9811E 00	2.4144E 00	1.6099E-01	5.8324E-01	161
8.7473E-02	5.0119E 00	1.4193E 00	1.7730E-01	6.4231E-01	171
1.1012E-01	6.3096E 00	8.1704E-01	1.9230E-01	6.9667E-01	181
1.3864E-01	7.9433E 00	4.6963E-01	2.0594E-01	7.4609E-01	191
1.7453E-01	1.0000E 01	2.7480E-01	2.1844E-01	7.9137E-01	201
2.6180E-01	1.5000E 01	9.9464E-02	2.3801E-01	8.6228E-01	206
3.4907E-01	2.0000E 01	4.1943E-02	2.4853E-01	9.0039E-01	211
4.3633E-01	2.5000E 01	2.2785E-02	2.5497E-01	9.2373E-01	216
5.2360E-01	3.0000E 01	1.3811E-02	2.5945E-01	9.3994E-01	221
6.1086E-01	3.5000E 01	8.4567E-03	2.6265E-01	9.5154E-01	226
6.9813E-01	4.0000E 01	5.4604E-03	2.6491E-01	9.5971E-01	231
7.8540E-01	4.5000E 01	3.8637E-03	2.6660E-01	9.6586E-01	236
8.7266E-01	5.0000E 01	2.8342E-03	2.6794E-01	9.7071E-01	241
9.5993E-01	5.5000E 01	2.1067E-03	2.6900E-01	9.7456E-01	246
1.0472E 00	6.0000E 01	1.6188E-03	2.6986E-01	9.7764E-01	251
1.1345E 00	6.5000E 01	1.2963E-03	2.7056E-01	9.8019E-01	256
1.2217E 00	7.0000E 01	1.0578E-03	2.7115E-01	9.8234E-01	261
1.3090E 00	7.5000E 01	8.7019E-04	2.7165E-01	9.8416E-01	266
1.3963E 00	8.0000E 01	7.2681E-04	2.7208E-01	9.8570E-01	271
1.4[illegible]35E 00	8.5000E 01	6.3351E-04	2.7245E-01	9.8703E-01	276
1.5708E 00	9.0000E 01	5.6762E-04	2.7277E-01	9.8822E-01	281
1.6581E 00	9.5000E 01	5.1045E-04	2.7307E-01	9.8929E-01	286
1.7453E 00	1.0000E 02	4.6930E-04	2.7333E-01	9.9025E-01	291
1.8326E 00	1.0500E 02	4.4725E-04	2.7358E-01	9.9113E-01	296
1.9199E 00	1.1000E 02	4.3962E-04	2.7381E-01	9.9197E-01	301
2.0071E 00	1.1500E 02	4.3561E-04	2.7403E-01	9.9277E-01	306
2.0944E 00	1.2000E 02	4.3490E-04	2.7424E-01	9.9354E-01	311
2.1817E 00	1.2500E 02	4.3854E-04	2.7444E-01	9.9427E-01	316
2.2689E 00	1.3000E 02	4.4705E-04	2.7464E-01	9.9497E-01	321
2.3562E 00	1.3500E 02	4.6364E-04	2.7482E-01	9.9563E-01	326
2.4435E 00	1.4000E 02	4.8863E-04	2.7500E-01	9.9627E-01	331
2.5307E 00	1.4500E 02	5.2365E-04	2.7516E-01	9.9688E-01	336
2.6180E 00	1.5000E 02	5.6615E-04	2.7533E-01	9.9746E-01	341
2.7053E 00	1.5500E 02	6.2081E-04	2.7547E-01	9.9800E-01	346
2.7925E 00	1.6000E 02	7.0203E-04	2.7561E-01	9.9850E-01	351
2.8798E 00	1.6500E 02	9.2087E-04	2.7574E-01	9.9897E-01	356
2.9671E 00	1.7000E 02	1.4185E-03	2.7588E-01	9.9946E-01	361
3.0543E 00	1.7500E 02	1.6476E-03	2.7599E-01	9.9985E-01	366
3.1416E 00	1.8000E 02	1.7183E-03	2.7603E-01	1.0000E 00	371

PAUSE READY PLOTTER,MAKE AREA 3X LONG AND 2X HIGH

Figure D-71. Volume scattering function (sheet 3 of 3).

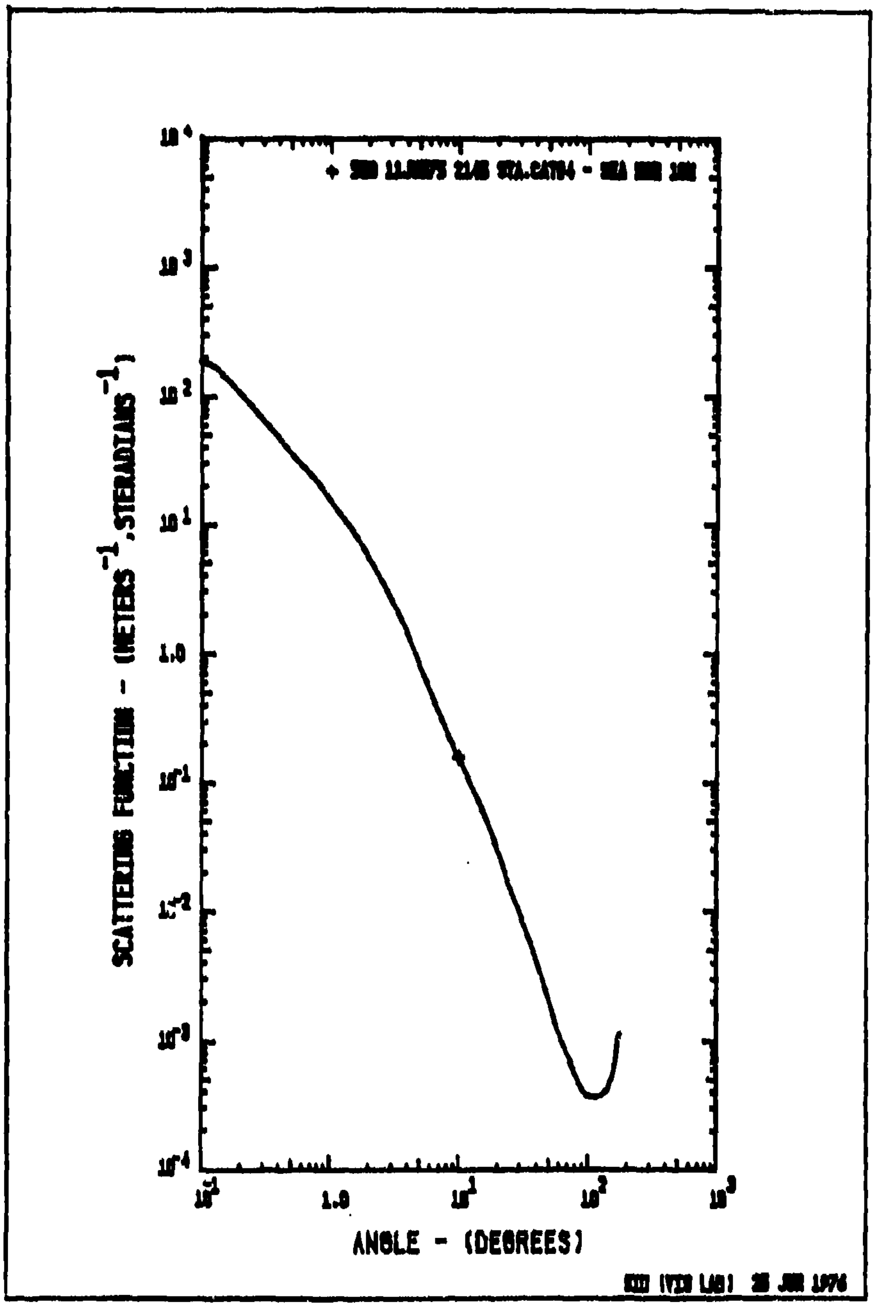


Figure D-72. Volume scattering function (sheet 1 of 3).

25 JUN 1976 0710.51 IBM 360

520 11JUN75 2145 STA.CAT#4 - SEA H2O 10M

	DATA READ IN ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	SIGMA
1	0.1750	1.2600E 02	0	0.1750	1.2283E 02
2	0.3500	5.2000E 01	0	0.3500	5.4714E 01
3	0.7000	2.5000E 01	0	0.7000	2.6372E 01
4	10.00	1.5449E-01	0	10.00	1.5449E-01
5	15.00	6.4203E-02	0	15.00	6.4203E-02
6	20.00	3.0191E-02	0	20.00	3.0191E-02
7	25.00	1.5339E-02	0	25.00	1.5339E-02
8	30.00	9.6876E-03	0	30.00	9.6876E-03
9	40.00	4.2190E-03	0	40.00	4.2190E-03
10	50.00	2.0664E-03	0	50.00	2.0664E-03
11	60.00	1.1377E-03	0	60.00	1.1377E-03
12	70.00	7.8929E-04	0	70.00	7.8929E-04
13	80.00	5.6324E-04	0	80.00	5.6324E-04
14	90.00	4.2574E-04	0	90.00	4.2574E-04
15	100.0	3.7177E-04	0	100.0	3.7177E-04
16	110.0	3.6241E-04	0	110.0	3.6241E-04
17	120.0	3.6301E-04	0	120.0	3.6301E-04
18	130.0	3.7925E-04	0	130.0	3.7925E-04
19	140.0	4.1863E-04	0	140.0	4.1863E-04
20	150.0	4.8415E-04	0	150.0	4.8415E-04
21	160.0	6.0623E-04	0	160.0	6.0623E-04
22	170.0	9.9359E-04	0	170.0	9.9359E-04
23			1	180.0	1.1454E-03

ALPHA= 0.2901 S/ALPHA= 0.552
S= 0.1602 A/ALPHA= 0.448
A= 0.1299 B/S= 0.017

CORRECTED ALPHA CORRECTION=0.002

ALPHA= 0.2916 S/ALPHA= 0.549
S= 0.1602 A/ALPHA= 0.451
A= 0.1314 B/S= 0.017

SIGMA(0.0 DEGREES)= 231.1

SIGMA(0.1 DEGREES)= 186.5
SLOPE(3 MILLIRAD)= -1.167
S UP TO 0.1 DEGREES= 1.9897E-03 NORMALIZED= 1.24219E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 94.00
EXPECTED K/ALPHA= 0.5490 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K =

	MU	RADIANS	DEGREES
MEDIAN	0.9984	0.5699E-01	3.266
MEAN 1	0.9430	0.3394	19.44
VARIANCE	0.2216		
MEAN 2		0.1753	10.05
RMS		0.3892	22.30
RMS 2		0.3475	19.91

KAPPA= 0.1601 KAPPA'= 3.0267E-03

THETA**2 BAR 7.5749E-02 RADIANS**2

Figure D-72. Volume scattering function (sheet 2 of 3).

520 11JUN75 2145 STA.CAT#4 - SEA H2O 10M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	1.8652E 02	1.9897E-03	1.2422E-02	1
2.1972E-03	1.2589E-01	1.6506E 02	2.9722E-03	1.8556E-02	11
2.7662E-03	1.5849E-01	1.3679E 02	4.3064E-03	2.6885E-02	21
3.4824E-03	1.9953E-01	1.0940E 02	5.9874E-03	3.7380E-02	31
4.3841E-03	2.5119E-01	8.0572E 01	8.0260E-03	5.0107E-02	41
5.5192E-03	3.1623E-01	6.1591E 01	1.0496E-02	6.5526E-02	51
6.9483E-03	3.9811E-01	4.7081E 01	1.3488E-02	8.4207E-02	61
8.7474E-03	5.0119E-01	3.5990E 01	1.7113E-02	1.0684E-01	71
1.1012E-02	6.3096E-01	2.7511E 01	2.1505E-02	1.3426E-01	81
1.3864E-02	7.9433E-01	2.0961E 01	2.6822E-02	1.6745E-01	91
1.7453E-02	1.0000E 00	1.5644E 01	3.3181E-02	2.0715E-01	101
2.1972E-02	1.2589E 00	1.1383E 01	4.0607E-02	2.5351E-01	111
2.7662E-02	1.5849E 00	8.0530E 00	4.9050E-02	3.0622E-01	121
3.4824E-02	1.9953E 00	5.5256E 00	5.8373E-02	3.6443E-01	131
4.3841E-02	2.5119E 00	3.6677E 00	6.8343E-02	4.2667E-01	141
5.5192E-02	3.1623E 00	2.3490E 00	7.8646E-02	4.9099E-01	151
6.9483E-02	3.9811E 00	1.4200E 00	8.8834E-02	5.5460E-01	161
8.7473E-02	5.0119E 00	8.1243E-01	9.8302E-02	6.1371E-01	171
1.1012E-01	6.3096E 00	4.5540E-01	1.0677E-01	6.6659E-01	181
1.3864E-01	7.9433E 00	2.5888E-01	1.1432E-01	7.1371E-01	191
1.7453E-01	1.0000E 01	1.5449E-01	1.2126E-01	7.5701E-01	201
2.6180E-01	1.5000E 01	6.4203E-02	1.3287E-01	8.2952E-01	206
3.4907E-01	2.0000E 01	3.0191E-02	1.4012E-01	8.7480E-01	211
4.3633E-01	2.5000E 01	1.5339E-02	1.4461E-01	9.0281E-01	216
5.2360E-01	3.0000E 01	9.6876E-03	1.4768E-01	9.2190E-01	221
6.1086E-01	3.5000E 01	6.2959E-03	1.4998E-01	9.3632E-01	226
6.9813E-01	4.0000E 01	4.2190E-03	1.5170E-01	9.4707E-01	231
7.8540E-01	4.5000E 01	2.9001E-03	1.5299E-01	9.5516E-01	236
8.7266E-01	5.0000E 01	2.0664E-03	1.5394E-01	9.6113E-01	241
9.5993E-01	5.5000E 01	1.5039E-03	1.5475E-01	9.6612E-01	246
1.0472E 00	6.0000E 01	1.1377E-03	1.5535E-01	9.6989E-01	251
1.1345E 00	6.5000E 01	9.3291E-04	1.5585E-01	9.7300E-01	256
1.2217E 00	7.0000E 01	7.8929E-04	1.5629E-01	9.7571E-01	261
1.3090E 00	7.5000E 01	6.6304E-04	1.5667E-01	9.7807E-01	266
1.3963E 00	8.0000E 01	5.6324E-04	1.5699E-01	9.8012E-01	271
1.4835E 00	8.5000E 01	4.8572E-04	1.5728E-01	9.8189E-01	276
1.5708E 00	9.0000E 01	4.2574E-04	1.5752E-01	9.8344E-01	281
1.6581E 00	9.5000E 01	3.8808E-04	1.5775E-01	9.8486E-01	286
1.7453E 00	1.0000E 02	3.7177E-04	1.5795E-01	9.8611E-01	291
1.8326E 00	1.0500E 02	3.6520E-04	1.5815E-01	9.8734E-01	296
1.9199E 00	1.1000E 02	3.6241E-04	1.5834E-01	9.8853E-01	301
2.0071E 00	1.1500E 02	3.6177E-04	1.5852E-01	9.8967E-01	306
2.0944E 00	1.2000E 02	3.6301E-04	1.5870E-01	9.9077E-01	311
2.1817E 00	1.2500E 02	3.6860E-04	1.5887E-01	9.9182E-01	316
2.2689E 00	1.3000E 02	3.7925E-04	1.5903E-01	9.9284E-01	321
2.3562E 00	1.3500E 02	3.9605E-04	1.5919E-01	9.9382E-01	326
2.4435E 00	1.4000E 02	4.1863E-04	1.5934E-01	9.9476E-01	331
2.5307E 00	1.4500E 02	4.4818E-04	1.5948E-01	9.9566E-01	336
2.6180E 00	1.5000E 02	4.8415E-04	1.5962E-01	9.9651E-01	341
2.7053E 00	1.5500E 02	5.3241E-04	1.5975E-01	9.9731E-01	346
2.7925E 00	1.6000E 02	6.0423E-04	1.5986E-01	9.9805E-01	351
2.8798E 00	1.6500E 02	7.4264E-04	1.5997E-01	9.9873E-01	356
2.9671E 00	1.7000E 02	9.9359E-04	1.6007E-01	9.9936E-01	361
3.0543E 00	1.7500E 02	1.1128E-03	1.6015E-01	9.9983E-01	366
3.1416E 00	1.8000E 02	1.1454E-03	1.6018E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-72. Volume scattering function (sheet 3 of 3).

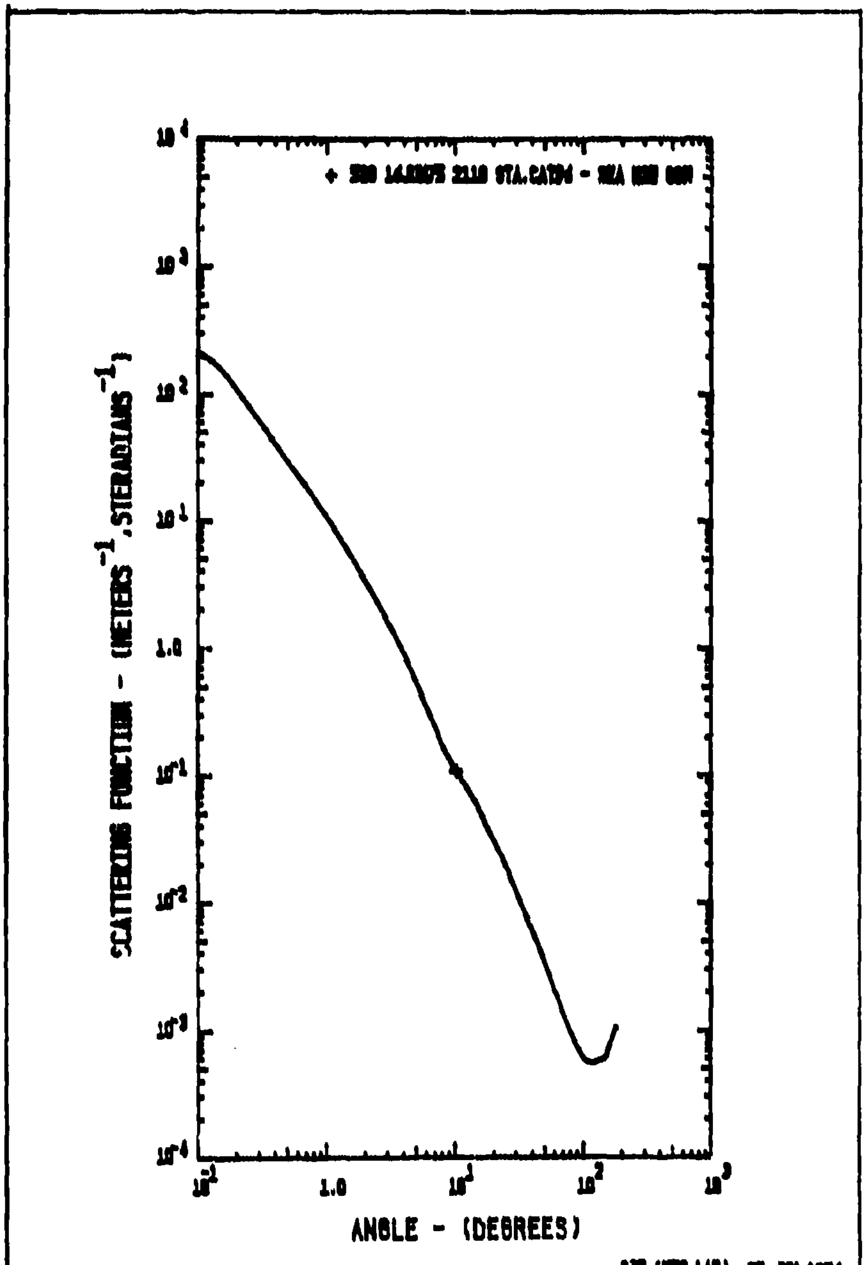


Figure D-73. Volume scattering function (sheet 1 of 3).

520 16JUN75 2110 STA.CAT#6 - SEA H2O 80M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	1.3700E 02	0	0.1750	1.3017E 02
2	0.3500	4.4000E 01	0	0.3500	4.0731E 01
3	0.7000	1.9200E 01	0	0.7000	1.8243E 01
4	10.00	1.1193E-01	0	10.00	1.1193E-01
5	15.00	5.7907E-02	0	15.00	5.7907E-02
6	20.00	3.0845E-02	0	20.00	3.0845E-02
7	25.00	1.9094E-02	0	25.00	1.9094E-02
8	30.00	1.2320E-02	0	30.00	1.2320E-02
9	40.00	6.0717E-03	0	40.00	6.0717E-03
10	50.00	3.3613E-03	0	50.00	3.3613E-03
11	60.00	2.0534E-03	0	60.00	2.0534E-03
12	70.00	1.3645E-03	0	70.00	1.3645E-03
13	80.00	9.7592E-04	0	80.00	9.7592E-04
14	90.00	7.5985E-04	0	90.00	7.5985E-04
15	100.0	6.2228E-04	0	100.0	6.2228E-04
16	110.0	5.8343E-04	0	110.0	5.8343E-04
17	120.0	5.7524E-04	0	120.0	5.7524E-04
18	130.0	5.9352E-04	0	130.0	5.9352E-04
19	140.0	6.1206E-04	0	140.0	6.1206E-04
20	150.0	6.6309E-04	0	150.0	6.6309E-04
21	160.0	8.1453E-04	0	160.0	8.1453E-04
22	170.0	1.0112E-03	0	170.0	1.0112E-03
23			1	180.0	1.0939E-03

ALPHA= 0.2291 S/ALPHA= 0.564
S= 0.1292 A/ALPHA= 0.436
A= 0.0999 B/S= 0.031

CORRECTED ALPHA CORRECTION=0.002

ALPHA= 0.2309 S/ALPHA= 0.559
S= 0.1292 A/ALPHA= 0.441
A= 0.1018 B/S= 0.031

SIGMA(0.0 DEGREES)= 286.3
SIGMA(0.1 DEGREES)= 218.3
SLOPE(3 MILLIRAD)= -1.417
S UP TO 0.1 DEGREES= 2.3978E-03 NORMALIZED= 1.8564E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 106.0
EXPECTED K/ALPHA= 0.5397 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K =

	MU	RADIANS	DEGREES
MEDIAN	0.9974	0.7276E-01	4.169
MEAN 1	0.8971	0.4577	26.22
VARIANCE	0.2947		
MEAN 2		0.2611	14.96
RMS		0.5218	29.90
RMS 2		0.4518	25.89

KAPPA= 0.1246 KAPPA'= 6.0847E-03

THETA**2 BAR 0.1362 RADIANS**2

Figure D-73. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0712.26

520 16JUN75 2110 STA.CAT#6 - SEA H2O 80M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	2.1828E 02	2.3978E-03	1.8564E-02	1
2.1972E-03	1.2589E-01	1.8725E 02	3.5300E-03	2.7331E-02	11
2.7662E-03	1.5849E-01	1.4839E 02	5.0104E-03	3.8792E-02	21
3.4824E-03	1.9953E-01	1.0809E 02	6.7820E-03	5.2515E-02	31
4.3841E-03	2.5119E-01	7.7987E 01	8.8122E-03	6.8227E-02	41
5.5192E-03	3.1623E-01	5.6269E 01	1.1133E-02	8.6194E-02	51
6.9483E-03	3.9811E-01	4.0600E 01	1.3787E-02	1.0674E-01	61
8.7474E-03	5.0119E-01	2.9294E 01	1.6821E-02	1.3024E-01	71
1.1012E-02	6.3096E-01	2.1136E 01	2.0292E-02	1.5710E-01	81
1.3864E-02	7.9433E-01	1.5196E 01	2.4257E-02	1.8781E-01	91
1.7453E-02	1.0000E 00	1.0698E 01	2.8731E-02	2.2244E-01	101
2.1972E-02	1.2589E 00	7.3769E 00	3.3669E-02	2.6067E-01	111
2.7662E-02	1.5849E 00	4.9985E 00	3.9016E-02	3.0207E-01	121
3.4824E-02	1.9953E 00	3.3387E 00	4.4715E-02	3.4620E-01	131
4.3841E-02	2.5119E 00	2.2053E 00	5.0712E-02	3.9263E-01	141
5.5192E-02	3.1623E 00	1.4450E 00	5.6962E-02	4.4102E-01	151
6.9483E-02	3.9811E 00	9.0000E-01	6.3332E-02	4.9034E-01	161
8.7473E-02	5.0119E 00	5.2527E-01	6.9394E-02	5.3727E-01	171
1.1012E-01	6.3096E 00	3.0078E-01	7.4925E-02	5.8009E-01	181
1.3864E-01	7.9433E 00	1.7692E-01	7.9987E-02	6.1928E-01	191
1.7453E-01	1.0000E 01	1.1193E-01	8.4854E-02	6.5697E-01	201
2.6180E-01	1.5000E 01	5.7907E-02	9.4273E-02	7.2989E-01	206
3.4907E-01	2.0000E 01	3.0845E-02	1.0115E-01	7.8317E-01	211
4.3633E-01	2.5000E 01	1.9094E-02	1.0621E-01	8.2234E-01	216
5.2360E-01	3.0000E 01	1.2320E-02	1.1009E-01	8.5234E-01	221
6.1086E-01	3.5000E 01	8.4709E-03	1.1309E-01	8.7556E-01	226
6.9813E-01	4.0000E 01	6.0717E-03	1.1548E-01	8.9407E-01	231
7.8540E-01	4.5000E 01	4.4601E-03	1.1740E-01	9.0898E-01	236
8.7266E-01	5.0000E 01	3.3613E-03	1.1897E-01	9.2109E-01	241
9.5993E-01	5.5000E 01	2.5977E-03	1.2025E-01	9.3103E-01	246
1.0472E 00	6.0000E 01	2.0534E-03	1.2132E-01	9.3929E-01	251
1.1345E 00	6.5000E 01	1.6591E-03	1.2222E-01	9.4623E-01	256
1.2217E 00	7.0000E 01	1.3645E-03	1.2298E-01	9.5213E-01	261
1.3090E 00	7.5000E 01	1.1423E-03	1.2363E-01	9.5718E-01	266
1.3963E 00	8.0000E 01	9.7592E-04	1.2419E-01	9.6155E-01	271
1.4835E 00	8.5000E 01	8.5441E-04	1.2469E-01	9.6539E-01	276
1.5708E 00	9.0000E 01	7.5995E-04	1.2513E-01	9.6881E-01	281
1.6581E 00	9.5000E 01	6.8092E-04	1.2552E-01	9.7185E-01	286
1.7453E 00	1.0000E 02	6.2228E-04	1.2588E-01	9.7459E-01	291
1.8326E 00	1.0500E 02	5.9361E-04	1.2620E-01	9.7709E-01	296
1.9199E 00	1.1000E 02	5.8343E-04	1.2651E-01	9.7948E-01	301
2.0071E 00	1.1500E 02	5.7488E-04	1.2680E-01	9.8174E-01	306
2.0944E 00	1.2000E 02	5.7526E-04	1.2708E-01	9.8391E-01	311
2.1817E 00	1.2500E 02	5.8430E-04	1.2735E-01	9.8598E-01	316
2.2689E 00	1.3000E 02	5.9352E-04	1.2761E-01	9.8796E-01	321
2.3562E 00	1.3500E 02	6.0276E-04	1.2785E-01	9.8983E-01	326
2.4435E 00	1.4000E 02	6.1206E-04	1.2807E-01	9.9158E-01	331
2.5307E 00	1.4500E 02	6.2613E-04	1.2828E-01	9.9317E-01	336
2.6180E 00	1.5000E 02	6.6309E-04	1.2847E-01	9.9464E-01	341
2.7053E 00	1.5500E 02	7.3024E-04	1.2864E-01	9.9599E-01	346
2.7925E 00	1.6000E 02	8.1453E-04	1.2880E-01	9.9725E-01	351
2.8798E 00	1.6500E 02	9.0731E-04	1.2895E-01	9.9834E-01	356
2.9671E 00	1.7000E 02	1.0112E-03	1.2906E-01	9.9922E-01	361
3.0543E 00	1.7500E 02	1.0825E-03	1.2913E-01	9.9980E-01	366
3.1416E 00	1.8000E 02	1.0939E-03	1.2916E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-73. Volume scattering function (sheet 3 of 3).

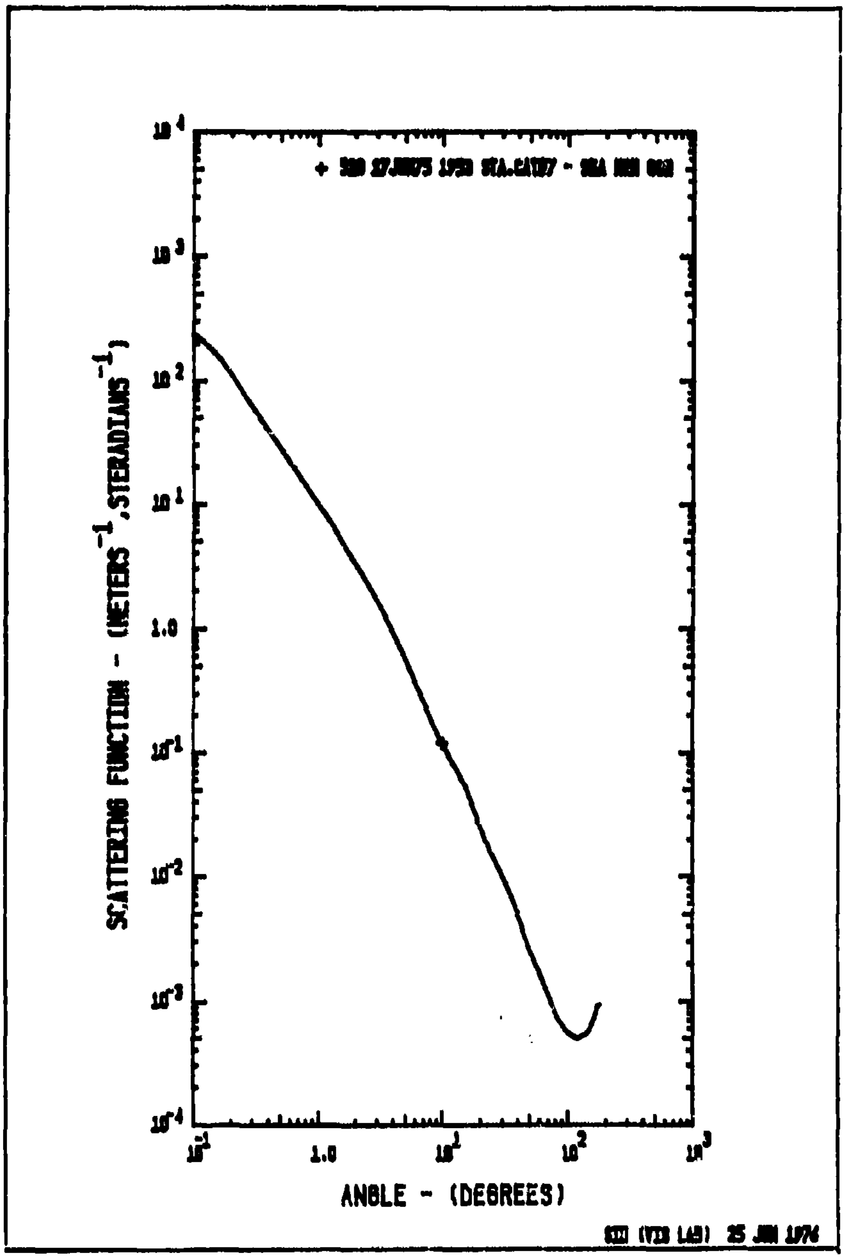


Figure D-74. Volume scattering function (sheet 1 of 3).

25 JUN 1976 0717.10 IBM 360

520 17JUN75 1953 STA.CAT#7 - SEA H2O 80M

	DATA READ IN ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	SIGMA
1	0.1750	1.5200E 02	0	0.1750	1.4358E 02
2	0.3500	4.5300E 01	0	0.3500	5.0764E 01
3	0.7000	1.9000E 01	0	0.7000	1.7968E 01
4	10.00	1.2144E-01	0	10.00	1.2144E-01
5	15.00	5.5561E-02	0	15.00	5.5561E-02
6	20.00	2.5655E-02	0	20.00	2.5655E-02
7	25.00	1.5389E-02	0	25.00	1.5389E-02
8	30.00	1.0421E-02	0	30.00	1.0421E-02
9	40.00	5.1529E-03	0	40.00	5.1529E-03
10	50.00	2.6594E-03	0	50.00	2.6594E-03
11	60.00	1.7268E-03	0	60.00	1.7268E-03
12	70.00	1.1612E-03	0	70.00	1.1612E-03
13	80.00	8.1209E-04	0	80.00	8.1209E-04
14	90.00	6.6195E-04	0	90.00	6.6195E-04
15	100.0	5.7410E-04	0	100.0	5.7410E-04
16	110.0	5.3495E-04	0	110.0	5.3495E-04
17	120.0	5.1247E-04	0	120.0	5.1247E-04
18	130.0	5.2809E-04	0	130.0	5.2809E-04
19	140.0	5.5459E-04	0	140.0	5.5459E-04
20	150.0	6.1311E-04	0	150.0	6.1311E-04
21	160.0	7.2119E-04	0	160.0	7.2119E-04
22	170.0	8.9659E-04	0	170.0	8.9659E-04
23			1	180.0	9.6219E-04

ALPHA=	0.2304	S/ALPHA=	0.557
S=	0.1284	A/ALPHA=	0.443
A=	0.1020	B/S=	0.028

CORRECTED ALPHA CORRECTION=0.002

ALPHA=	0.2325	S/ALPHA=	0.552
S=	0.1284	A/ALPHA=	0.448
A=	0.1041	B/S=	0.028

SIGMA(0.0 DEGREES)= 333.4
SIGMA(0.1 DEGREES)= 249.0
SLOPE(3 MILLIRAD)= -1.500
S UP TO 0.1 DEGREES= 2.7647E-03 NORMALIZED= 2.15334E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 110.0
EXPECTED K/ALPHA= 0.5463 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K =

	MU	RADIANS	DEGREES
MEDIAN	0.9978	0.6655E-01	3.813
MEAN 1	0.9096	0.4284	24.55
VARIANCE	0.2806		
MEAN 2		0.2347	13.44
RMS		0.4903	28.09
RMS 2		0.4305	24.66

KAPPA= 0.1270 KAPPA'= 5.2295E-03

THETA**2 BAR 0.1202 RADIANS**2

Figure D-74. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0717.10

520 17JUN75 1953 STA.CAT67 - SEA H2O 80M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	2.4904E 02	2.7647E-03	2.1533E-02	1
2.1972E-03	1.2589E-01	2.1131E 02	4.0496E-03	3.1541E-02	11
2.7662E-03	1.5849E-01	1.6493E 02	5.7076E-03	4.4455E-02	21
3.4824E-03	1.9953E-01	1.1794E 02	7.6595E-03	5.9657E-02	31
4.3841E-03	2.5119E-01	8.3493E 01	9.8525E-03	7.6738E-02	41
5.5192E-03	3.1623E-01	5.9109E 01	1.2313E-02	9.5903E-02	51
6.9483E-03	3.9811E-01	4.1846E 01	1.5074E-02	1.1741E-01	61
8.7474E-03	5.0119E-01	2.9625E 01	1.8172E-02	1.4153E-01	71
1.1012E-02	6.3096E-01	2.0973E 01	2.1647E-02	1.6860E-01	81
1.3864E-02	7.9433E-01	1.4832E 01	2.5546E-02	1.9897E-01	91
1.7453E-02	1.0000E 00	1.0422E 01	2.9903E-02	2.3291E-01	101
2.1972E-02	1.2589E 00	7.2634E 00	3.4736E-02	2.7054E-01	111
2.7662E-02	1.5849E 00	5.0140E 00	4.0048E-02	3.1192E-01	121
3.4824E-02	1.9953E 00	3.4238E 00	4.5828E-02	3.5694E-01	131
4.3841E-02	2.5119E 00	2.3097E 00	5.2046E-02	4.0537E-01	141
5.5192E-02	3.1623E 00	1.5374E 00	5.8648E-02	4.5679E-01	151
6.9483E-02	3.9811E 00	9.7132E-01	6.5471E-02	5.0993E-01	161
8.7473E-02	5.0119E 00	5.7585E-01	7.2065E-02	5.6129E-01	171
1.1012E-01	6.3096E 00	3.3321E-01	7.8164E-02	6.0880E-01	181
1.3864E-01	7.9433E 00	1.9575E-01	8.3775E-02	6.5250E-01	191
1.7453E-01	1.0000E 01	1.2144E-01	8.9118E-02	6.9411E-01	201
2.6180E-01	1.5000E 01	5.5561E-02	9.8643E-02	7.6830E-01	206
3.4907E-01	2.0000E 01	2.5655E-02	1.0485E-01	8.1664E-01	211
4.3633E-01	2.5000E 01	1.5389E-02	1.0897E-01	8.4876E-01	216
5.2360E-01	3.0000E 01	1.0421E-02	1.1216E-01	8.7361E-01	221
6.1086E-01	3.5000E 01	7.2513E-03	1.1472E-01	8.9354E-01	226
6.9813E-01	4.0000E 01	5.1529E-03	1.1676E-01	9.0947E-01	231
7.8540E-01	4.5000E 01	3.6213E-03	1.1837E-01	9.2193E-01	236
8.7266E-01	5.0000E 01	2.6594E-03	1.1962E-01	9.3165E-01	241
9.5993E-01	5.5000E 01	2.1230E-03	1.2064E-01	9.3966E-01	246
1.0472E 00	6.0000E 01	1.7268E-03	1.2153E-01	9.4657E-01	251
1.1345E 00	6.5000E 01	1.4066E-03	1.2229E-01	9.5247E-01	256
1.2217E 00	7.0000E 01	1.1612E-03	1.2294E-01	9.5751E-01	261
1.3090E 00	7.5000E 01	9.6530E-04	1.2349E-01	9.6182E-01	266
1.3963E 00	8.0000E 01	8.1209E-04	1.2396E-01	9.6550E-01	271
1.4835E 00	8.5000E 01	7.2079E-04	1.2438E-01	9.6872E-01	276
1.5708E 00	9.0000E 01	6.6195E-04	1.2475E-01	9.7167E-01	281
1.6581E 00	9.5000E 01	6.1105E-04	1.2510E-01	9.7438E-01	286
1.7453E 00	1.0000E 02	5.7410E-04	1.2542E-01	9.7689E-01	291
1.8326E 00	1.0500E 02	5.5149E-04	1.2572E-01	9.7922E-01	296
1.9199E 00	1.1000E 02	5.3495E-04	1.2601E-01	9.8144E-01	301
2.0071E 00	1.1500E 02	5.2020E-04	1.2627E-01	9.8351E-01	306
2.0944E 00	1.2000E 02	5.1247E-04	1.2653E-01	9.8547E-01	311
2.1817E 00	1.2500E 02	5.1722E-04	1.2676E-01	9.8731E-01	316
2.2689E 00	1.3000E 02	5.2809E-04	1.2699E-01	9.8909E-01	321
2.3562E 00	1.3500E 02	5.3990E-04	1.2721E-01	9.9076E-01	326
2.4435E 00	1.4000E 02	5.5459E-04	1.2741E-01	9.9235E-01	331
2.5307E 00	1.4500E 02	5.7825E-04	1.2760E-01	9.9381E-01	336
2.6180E 00	1.5000E 02	6.1311E-04	1.2777E-01	9.9518E-01	341
2.7053E 00	1.5500E 02	6.5972E-04	1.2793E-01	9.9642E-01	346
2.7925E 00	1.6000E 02	7.2119E-04	1.2808E-01	9.9756E-01	351
2.8798E 00	1.6500E 02	7.9890E-04	1.2820E-01	9.9852E-01	356
2.9671E 00	1.7000E 02	8.9659E-04	1.2830E-01	9.9931E-01	361
3.0543E 00	1.7500E 02	9.5110E-04	1.2837E-01	9.9981E-01	366
3.1416E 00	1.8000E 02	9.6219E-04	1.2839E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-74. Volume scattering function (sheet 3 of 3).

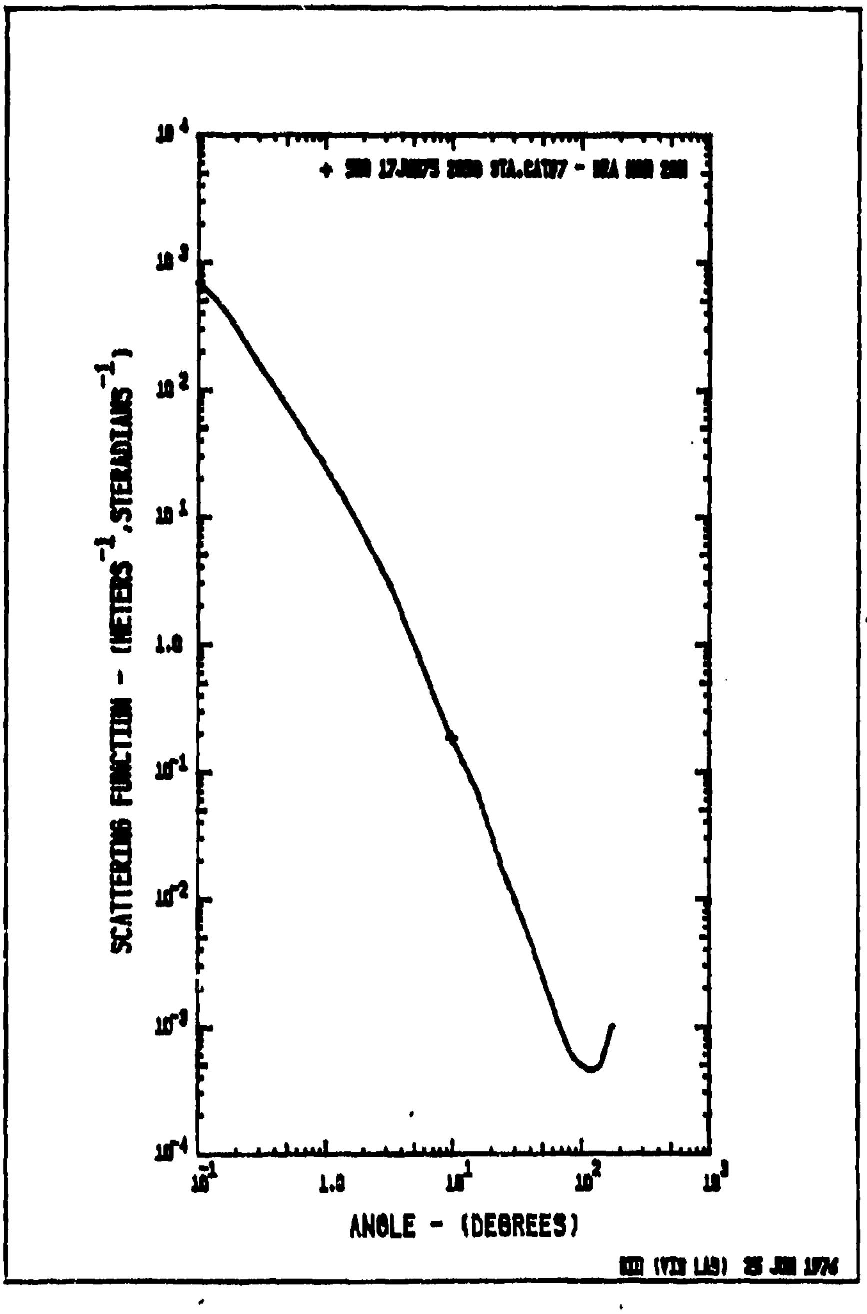


Figure D-75. Volume scattering function (sheet 1 of 3).

25 JUN 1976 0715.35 IBM 360

520 17JUN75 2058 STA.CAT#7 - SEA H2O 20M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	[illegible].9500E 02	0	0.1750	3.9125E 02
2	0.3500	1.3100E 02	0	0.3500	1.3352E 02
3	0.7000	4.6000E 01	0	0.7000	4.5565E 01
4	10.00	1.8627E-01	0	10.00	1.8627E-01
5	15.00	7.5997E-02	0	15.00	7.5997E-02
6	20.00	3.3792E-02	0	20.00	3.3792E-02
7	25.00	1.7357E-02	0	25.00	1.7357E-02
8	30.00	1.0616E-02	0	30.00	1.0616E-02
9	40.00	4.8883E-03	0	40.00	4.8883E-03
10	50.00	2.6114E-03	0	50.00	2.6114E-03
11	60.00	1.5450E-03	0	60.00	1.5450E-03
12	70.00	9.7309E-04	0	70.00	9.7309E-04
13	80.00	6.8673E-04	0	80.00	6.8673E-04
14	90.00	5.6447E-04	0	90.00	5.6447E-04
15	100.0	5.0797E-04	0	100.0	5.0797E-04
16	110.0	4.7306E-04	0	110.0	4.7306E-04
17	120.0	4.5353E-04	0	120.0	4.5353E-04
18	130.0	4.6251E-04	0	130.0	4.6251E-04
19	140.0	4.8786E-04	0	140.0	4.8786E-04
20	150.0	5.7069E-04	0	150.0	5.7069E-04
21	160.0	7.3677E-04	0	160.0	7.3677E-04
22	170.0	9.3407E-04	0	170.0	9.3407E-04
23			1	180.0	1.0190E-03

ALPHA= 0.3847 S/ALPHA= 0.633
S= 0.2434 A/ALPHA= 0.367
A= 0.1413 B/S= 0.013

CORRECTED ALPHA CORRECTION=0.006

ALPHA= 0.3907 S/ALPHA= 0.623
S= 0.2434 A/ALPHA= 0.377
A= 0.1472 B/S= 0.013

SIGMA(0.0 DEGREES)= 946.8
SIGMA(0.1 DEGREES)= 696.1
SLOPE(3 MILLIRAD)= -1.551
S UP TO 0.1 DEGREES= 7.7912E-03 NORMALIZED= 3.20054E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 113.0
EXPECTED K/ALPHA= 0.4791 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K =

	MU	RADIANS	DEGREES
MEDIAN	0.9993	0.3819E-01	2.188
MEAN 1	0.9544	0.3031	17.37
VARIANCE	0.1992		
MEAN 2		0.1412	8.087
RMS		0.3469	19.87
RMS 2		0.3169	18.15

KAPPA= 0.1872 KAPPA'= 2.4968E-03

THETA**2 BAR 6.0161E-02 RADIANS**2

Figure D-75. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0715.35

520 17JUN75 2058 STA.CAT#7 - SEA H2O 20M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	6.9613E 02	7.7912E-03	3.2005E-02	1
2.1972E-03	1.2589E-01	5.8575E 02	1.1368E-02	4.6699E-02	11
2.7662E-03	1.5849E-01	4.5195E 02	1.5938E-02	6.5471E-02	21
3.4824E-03	1.9953E-01	3.1923E 02	2.1252E-02	8.7302E-02	31
4.3841E-03	2.5119E-01	2.2336E 02	2.7153E-02	1.1154E-01	41
5.5192E-03	3.1623E-01	1.5628E 02	3.3696E-02	1.3842E-01	51
6.9483E-03	3.9811E-01	1.0934E 02	4.0952E-02	1.6823E-01	61
8.7474E-03	5.0119E-01	7.6504E 01	4.8998E-02	2.0128E-01	71
1.1012E-02	6.3096E-01	5.3528E 01	5.7920E-02	2.3793E-01	81
1.3864E-02	7.9433E-01	3.7376E 01	6.7809E-02	2.7855E-01	91
1.7453E-02	1.0000E 00	2.5773E 01	7.8691E-02	3.2325E-01	101
2.1972E-02	1.2589E 00	1.7503E 01	9.0492E-02	3.7173E-01	111
2.7662E-02	1.5849E 00	1.1689E 01	1.0309E-01	4.2348E-01	121
3.4824E-02	1.9953E 00	7.6668E 00	1.1630E-01	4.7775E-01	131
4.3841E-02	2.5119E 00	4.9312E 00	1.2990E-01	5.3362E-01	141
5.5192E-02	3.1623E 00	3.1060E 00	1.4362E-01	5.8998E-01	151
6.9483E-02	3.9811E 00	1.8513E 00	1.5701E-01	6.4498E-01	161
8.7473E-02	5.0119E 00	1.0370E 00	1.6923E-01	6.9518E-01	171
1.1012E-01	6.3096E 00	5.6785E-01	1.7992E-01	7.3909E-01	181
1.3864E-01	7.9433E 00	3.1621E-01	1.8923E-01	7.7735E-01	191
1.7453E-01	1.0000E 01	1.8627E-01	1.9764E-01	8.1189E-01	201
2.6180E-01	1.5000E 01	7.5997E-02	2.1155E-01	8.6904E-01	206
3.4907E-01	2.0000E 01	3.3792E-02	2.1991E-01	9.0335E-01	211
4.3633E-01	2.5000E 01	1.7357E-02	2.2494E-01	9.2402E-01	216
5.2360E-01	3.0000E 01	1.0616E-02	2.2836E-01	9.3807E-01	221
6.1086E-01	3.5000E 01	7.0066E-03	2.3089E-01	9.4847E-01	226
6.9813E-01	4.0000E 01	4.8883E-03	2.3284E-01	9.5648E-01	231
7.8540E-01	4.5000E 01	3.5249E-03	2.3438E-01	9.6279E-01	236
8.7266E-01	5.0000E 01	2.6114E-03	2.3560E-01	9.6783E-01	241
9.5993E-01	5.5000E 01	1.9872E-03	2.3659E-01	9.7189E-01	246
1.0472E 00	6.0000E 01	1.5450E-03	2.3740E-01	9.7522E-01	251
1.1345E 00	6.5000E 01	1.2165E-03	2.3807E-01	9.7796E-01	256
1.2217E 00	7.0000E 01	9.7309E-04	2.3862E-01	9.8022E-01	261
1.3090E 00	7.5000E 01	8.0337E-04	2.3908E-01	9.8212E-01	266
1.3963E 00	8.0000E 01	6.8673E-04	2.3948E-01	9.8375E-01	271
1.4835E 00	8.5000E 01	6.1070E-04	2.3983E-01	9.8519E-01	276
1.5708E 00	9.0000E 01	5.6447E-04	2.4015E-01	9.8651E-01	281
1.6581E 00	9.5000E 01	5.3246E-04	2.4045E-01	9.8774E-01	286
1.7453E 00	1.0000E 02	5.0797E-04	2.4073E-01	9.8890E-01	291
1.8326E 00	1.0500E 02	4.8898E-04	2.4100E-01	9.8999E-01	296
1.9199E 00	1.1000E 02	4.7306E-04	2.4125E-01	9.9103E-01	301
2.0071E 00	1.1500E 02	4.6069E-04	2.4148E-01	9.9200E-01	306
2.0944E 00	1.2000E 02	4.5353E-04	2.4171E-01	9.9291E-01	311
2.1817E 00	1.2500E 02	4.5528E-04	2.4192E-01	9.9377E-01	316
2.2689E 00	1.3000E 02	4.6251E-04	2.4212E-01	9.9459E-01	321
2.3562E 00	1.3500E 02	4.7230E-04	2.4230E-01	9.9536E-01	326
2.4435E 00	1.4000E 02	4.8786E-04	2.4248E-01	9.9610E-01	331
2.5307E 00	1.4500E 02	5.1572E-04	2.4265E-01	9.9678E-01	336
2.6180E 00	1.5000E 02	5.7069E-04	2.4281E-01	9.9743E-01	341
2.7053E 00	1.5500E 02	6.4843E-04	2.4296E-01	9.9806E-01	346
2.7925E 00	1.6000E 02	7.3477E-04	2.4311E-01	9.9866E-01	351
2.8798E 00	1.6500E 02	8.2982E-04	2.4323E-01	9.9919E-01	356
2.9671E 00	1.7000E 02	9.3407E-04	2.4334E-01	9.9961E-01	361
3.0543E 00	1.7500E 02	1.0072E-03	2.4341E-01	9.9990E-01	366
3.1416E 00	1.8000E 02	1.0190E-03	2.4343E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-75. Volume scattering function (sheet 3 of 3).

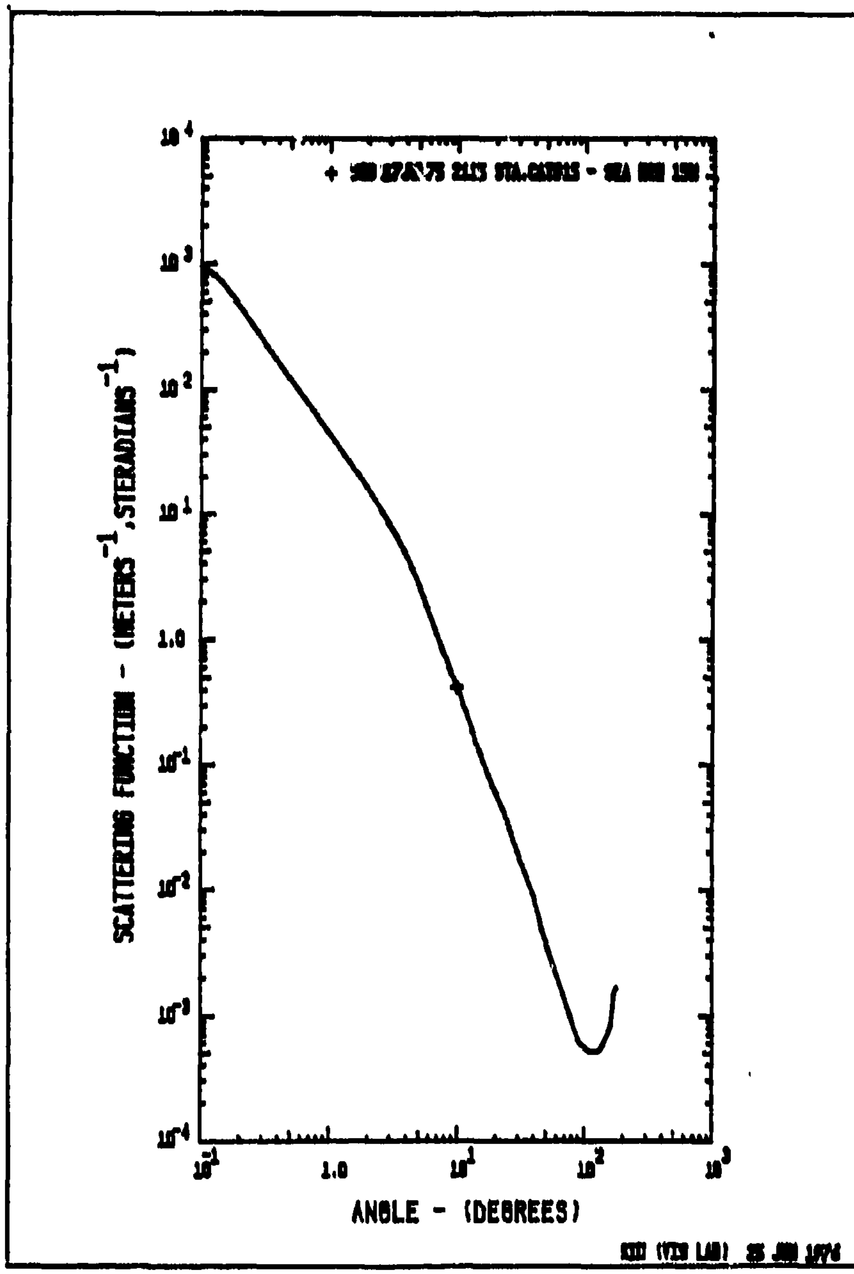


Figure D-76. Volume scattering function (sheet 1 of 3).

520 17JUL75 2115 STA.CAT#15 - SEA H2O 15M

	DATA READ IN ANGLE (DEG)	DATA READ IN SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	ITERATED DATA SIGMA
1	0.1750	5.8000E 02	0	0.1750	5.6813E 02
2	0.3500	2.0000E 02	0	0.3500	2.0835E 02
3	0.7000	7.8000E 01	0	0.7000	7.6407E 01
4	10.00	4.2699E-01	0	10.00	4.2699E-01
5	15.00	1.3620E-01	0	15.00	1.3630E-01
6	20.00	6.2800E-02	0	20.00	6.2800E-02
7	25.00	3.6508E-02	0	25.00	3.6508E-02
8	30.00	2.0856E-02	0	30.00	2.0856E-02
9	40.00	9.3629E-03	0	40.00	9.3629E-03
10	50.00	4.1331E-03	0	50.00	4.1331E-03
11	60.00	2.3033E-03	0	60.00	2.3033E-03
12	70.00	1.4379E-03	0	70.00	1.4379E-03
13	80.00	9.6234E-04	0	80.00	9.6234E-04
14	90.00	6.7747E-04	0	90.00	6.7747E-04
15	100.0	5.9582E-04	0	100.0	5.9582E-04
16	110.0	5.4295E-04	0	110.0	5.4295E-04
17	120.0	5.3582E-04	0	120.0	5.3582E-04
18	130.0	5.4539E-04	0	130.0	5.4539E-04
19	140.0	6.0898E-04	0	140.0	6.0898E-04
20	150.0	7.1527E-04	0	150.0	7.1527E-04
21	160.0	8.6831E-04	0	160.0	8.6831E-04
22	170.0	1.4759E-03	0	170.0	1.4759E-03
23			1	180.0	1.7104E-03

ALPHA= 0.5312   S/ALPHA= 0.917
S= 0.4874   A/ALPHA= 0.083
A= 0.0438   B/S= 0.008

CORRECTED ALPHA   CORRECTION=0.008

ALPHA= 0.5394   S/ALPHA= 0.904
S= 0.4874   A/ALPHA= 0.096
A= 0.0520   B/S= 0.008

SIGMA(0.0 DEGREES)= 1284.
SIGMA(0.1 DEGREES)= 968.9
SLOPE(3 MILLIRAD)= -1.447
S UP TO 0.1 DEGREES= 1.0699E-02   NORMALIZED= 2.19528E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 108.0
EXPECTED K/ALPHA= 0.1858   EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K =

	MU	RADIANS	DEGREES
MEDIAN	0.9988	0.4910E-01	2.813
MEAN 1	0.9658	0.2622	15.02
VARIANCE	0.1606		
MEAN 2		0.1285	7.361
RMS		0.2951	16.91
RMS 2		0.2656	15.22

KAPPA= 0.1002   KAPPA'= 1.8407E-03

THETA**2 BAR   4.3534E-02 RADIANS**2

Figure D-76. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0736.41

520 17JUL75 2115 STA.CAT#15 - SEA H2O 15M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	9.6890E 02	1.0699E-02	2.1953E-02	1
2.1972E-03	1.2589E-01	8.2665E 02	1.5712E-02	3.2238E-02	11
2.7662E-03	1.5849E-01	6.5016E 02	2.2222E-02	4.5597E-02	21
3.4824E-03	1.9953E-01	4.6991E 02	2.9956E-02	6.1464E-02	31
4.3841E-03	2.5119E-01	3.3674E 02	3.8748E-02	7.9504E-02	41
5.5192E-03	3.1623E-01	2.6131E 02	4.8733E-02	9.9992E-02	51
6.9483E-03	3.9811E-01	1.7292E 02	6.0074E-02	1.2326E-01	61
8.7474E-03	5.0119E-01	1.2391E 02	7.2954E-02	1.4969E-01	71
1.1012E-02	6.3096E-01	8.8797E 01	8.7582E-02	1.7970E-01	81
1.3864E-02	7.9433E-01	6.3681E 01	1.0420E-01	2.1380E-01	91
1.7453E-02	1.0000E 00	4.5844E 01	1.2312E-01	2.5263E-01	101
2.1972E-02	1.2589E 00	3.2979E 01	1.4471E-01	2.9693E-01	111
2.7662E-02	1.5849E 00	2.3572E 01	1.6926E-01	3.4730E-01	121
3.4824E-02	1.9953E 00	1.6645E 01	1.9691E-01	4.0403E-01	131
4.3841E-02	2.5119E 00	1.1546E 01	2.2759E-01	4.6698E-01	141
5.5192E-02	3.1623E 00	7.8225E 00	2.6092E-01	5.3538E-01	151
6.9483E-02	3.9811E 00	4.9362E 00	2.9569E-01	6.0672E-01	161
8.7473E-02	5.0119E 00	2.8379E 00	3.2880E-01	6.7463E-01	171
1.1012E-01	6.3096E 00	1.5357E 00	3.5798E-01	7.3451E-01	181
1.3864E-01	7.9433E 00	8.0797E-01	3.8258E-01	7.8499E-01	191
1.7453E-01	1.0000E 01	4.2699E-01	4.0305E-01	8.2699E-01	201
2.6180E-01	1.5000E 01	1.3630E-01	4.3112E-01	8.8459E-01	206
3.4907E-01	2.0000E 01	6.2800E-02	4.4617E-01	9.1547E-01	211
4.3633E-01	2.5000E 01	3.6508E-02	4.5616E-01	9.3596E-01	216
5.2360E-01	3.0000E 01	2.0856E-02	4.6314E-01	9.5029E-01	221
6.1086E-01	3.5000E 01	1.3681E-02	4.6808E-01	9.6043E-01	226
6.9813E-01	4.0000E 01	9.3629E-03	4.7187E-01	9.6821E-01	231
7.8540E-01	4.5000E 01	6.0975E-03	4.7469E-01	9.7399E-01	236
8.7266E-01	5.0000E 01	4.1331E-03	4.7671E-01	9.7813E-01	241
9.5993E-01	5.5000E 01	3.0304E-03	4.7825E-01	9.8129E-01	246
1.0472E 00	6.0000E 01	2.3033E-03	4.7947E-01	9.8379E-01	251
1.1345E 00	6.5000E 01	1.8015E-03	4.8046E-01	9.8582E-01	256
1.2217E 00	7.0000E 01	1.4379E-03	4.8127E-01	9.8749E-01	261
1.3090E 00	7.5000E 01	1.1683E-03	4.8195E-01	9.8888E-01	266
1.3963E 00	8.0000E 01	9.6234E-04	4.8252E-01	9.9005E-01	271
1.4835E 00	8.5000E 01	8.0083E-04	4.8299E-01	9.9103E-01	276
1.5708E 00	9.0000E 01	6.7747E-04	4.8340E-01	9.9186E-01	281
1.6581E 00	9.5000E 01	6.2012E-04	4.8375E-01	9.9258E-01	286
1.7453E 00	1.0000E 02	5.9582E-04	4.8408E-01	9.9326E-01	291
1.8326E 00	1.0500E 02	5.6538E-04	4.8439E-01	9.9389E-01	296
1.9199E 00	1.1000E 02	5.4295E-04	4.8468E-01	9.9449E-01	301
2.0071E 00	1.1500E 02	5.3558E-04	4.8495E-01	9.9504E-01	306
2.0944E 00	1.2000E 02	5.3582E-04	4.8521E-01	9.9558E-01	311
2.1817E 00	1.2500E 02	5.3735E-04	4.8546E-01	9.9609E-01	316
2.2689E 00	1.3000E 02	5.4339E-04	4.8570E-01	9.9657E-01	321
2.3562E 00	1.3500E 02	5.6935E-04	4.8592E-01	9.9703E-01	326
2.4435E 00	1.4000E 02	6.0898E-04	4.8614E-01	9.9748E-01	331
2.5307E 00	1.4500E 02	6.5877E-04	4.8635E-01	9.9791E-01	336
2.6180E 00	1.5000E 02	7.1527E-04	4.8655E-01	9.9832E-01	341
2.7053E 00	1.5500E 02	7.8179E-04	4.8674E-01	9.9871E-01	346
2.7925E 00	1.6000E 02	8.6831E-04	4.8691E-01	9.9907E-01	351
2.8798E 00	1.6500E 02	1.0699E-03	4.8707E-01	9.9938E-01	356
2.9671E 00	1.7000E 02	1.4759E-03	4.8722E-01	9.9969E-01	361
3.0543E 00	1.7500E 02	1.6577E-03	4.8733E-01	9.9992E-01	366
3.1416E 00	1.8000E 02	1.7104E-03	4.8737E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-76. Volume scattering function (sheet 3 of 3).

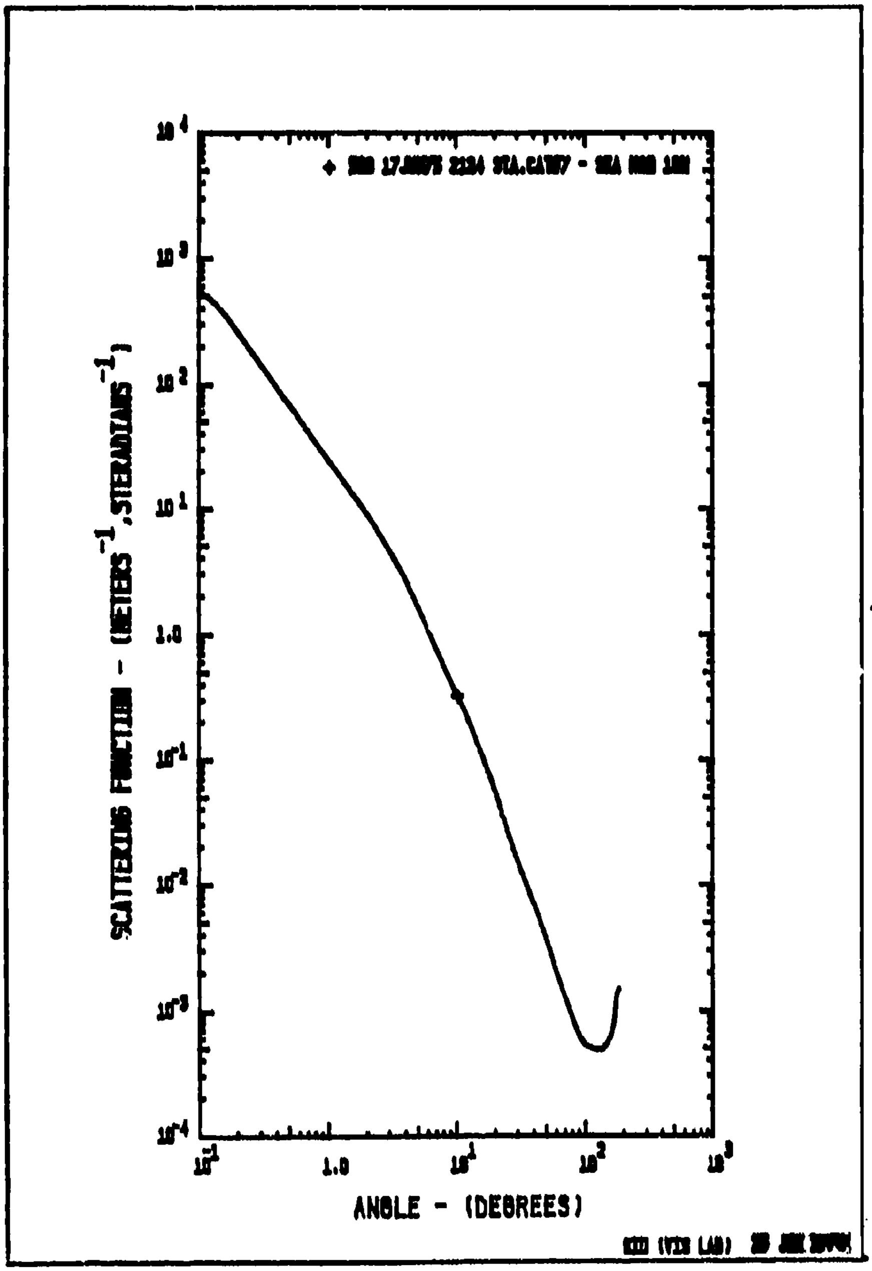


Figure D-77. Volume scattering function (sheet 1 of 3).

25 JUN 1976 0714.01 IBM 360

520 17JUN75 2124 STA.CAT#7 - SEA H2O 10M

	DATA READ IN ANGLE (DEG)	DATA READ IN SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	ITERATED DATA SIGMA
1	0.1750	3.2500E 02	0	0.1750	3.1946E 02
2	0.3500	1.1100E 02	0	0.3500	1.1484E 02
3	0.7000	4.2000E 01	0	0.7000	4.1285E 01
4	10.00	3.2127E-01	0	10.00	3.2127E-01
5	15.00	1.2028E-01	0	15.00	1.2028E-01
6	20.00	5.1733E-02	0	20.00	5.1733E-02
7	25.00	2.4779E-02	0	25.00	2.4779E-02
8	30.00	1.4470E-02	0	30.00	1.4470E-02
9	40.00	6.5160E-03	0	40.00	6.5160E-03
10	50.00	3.2976E-03	0	50.00	3.2976E-03
11	60.00	1.7969E-03	0	60.00	1.7969E-03
12	70.00	1.1606E-03	0	70.00	1.1606E-03
13	80.00	7.8914E-04	0	80.00	7.8914E-04
14	90.00	5.9526E-04	0	90.00	5.9526E-04
15	100.0	5.2011E-04	0	100.0	5.2011E-04
16	110.0	4.9189E-04	0	110.0	4.9189E-04
17	120.0	4.8543E-04	0	120.0	4.8543E-04
18	130.0	4.8841E-04	0	130.0	4.8841E-04
19	140.0	5.3429E-04	0	140.0	5.3429E-04
20	150.0	6.0745E-04	0	150.0	6.0745E-04
21	160.0	7.7006E-04	0	160.0	7.7006E-04
22	170.0	1.2750E-03	0	170.0	1.2750E-03
23			1	180.0	1.4746E-03

ALPHA= 0.3578 S/ALPHA= 0.816
S= 0.2919 A/ALPHA= 0.184
A= 0.0659 B/S= 0.012

CORRECTED ALPHA CORRECTION=0.005

ALPHA= 0.3625 S/ALPHA= 0.805
S= 0.2919 A/ALPHA= 0.195
A= 0.0705 B/S= 0.012

SIGMA(0.0 DEGREES)= 731.8
SIGMA(0.1 DEGREES)= 549.4
SLOPE(3 MILLIRAD)= -1.476
S UP TO 0.1 DEGREES= 6.0832E-03 NORMALIZED= 2.08395E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 109.0
EXPECTED K/ALPHA= 0.2960 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K

	MU	RADIANS	DEGREES
MEDIAN	0.9983	0.5806E-01	3.327
MEAN 1	0.9541	0.3041	17.43
VARIANCE	0.1912		
MEAN 2		0.1568	8.984
RMS		0.3448	19.76
RMS 2		0.3071	17.59

KAPPA= 0.1073 KAPPA'= 2.4591E-03

THETA**2 BAR 5.9445E-02 RADIANS**2

Figure D-77. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0714.01

520 17JUN75 2124 STA.CAT#7 - SEA H2O 10M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	5.4943E 02	6.0832E-03	2.0839E-02	1
2.1972E-03	1.2589E-01	4.6749E 02	8.9218E-03	3.0564E-02	11
2.7662E-03	1.5849E-01	3.6627E 02	1.2597E-02	4.3153E-02	21
3.4824E-03	1.9953E-01	2.6323E 02	1.6942E-02	5.8039E-02	31
4.3841E-03	2.5119E-01	1.8739E 02	2.1850E-02	7.4854E-02	41
5.5192E-03	3.1623E-01	1.3340E 02	2.7388E-02	9.3826E-02	51
6.9483E-03	3.9811E-01	9.4962E 01	3.3637E-02	1.1523E-01	61
8.7474E-03	5.0119E-01	6.7601E 01	4.0686E-02	1.3938E-01	71
1.1012E-02	6.3096E-01	4.8124E 01	4.8640E-02	1.6663E-01	81
1.3864E-02	7.9433E-01	3.4313E 01	5.7618E-02	1.9738E-01	91
1.7453E-02	1.0000E 00	2.4682E 01	6.7804E-02	2.3228E-01	101
2.1972E-02	1.2589E 00	1.7796E 01	7.9442E-02	2.7215E-01	111
2.7662E-02	1.5849E 00	1.2748E 01	9.2705E-02	3.1758E-01	121
3.4824E-02	1.9953E 00	8.9935E 00	1.0766E-01	3.6880E-01	131
4.3841E-02	2.5119E 00	6.1947E 00	1.2418E-01	4.2542E-01	141
5.5192E-02	3.1623E 00	4.1295E 00	1.4194E-01	4.8624E-01	151
6.9483E-02	3.9811E 00	2.6134E 00	1.6025E-01	5.4896E-01	161
8.7473E-02	5.0119E 00	1.5735E 00	1.7812E-01	6.1019E-01	171
1.1012E-01	6.3096E 00	9.2251E-01	1.9491E-01	6.6770E-01	181
1.3864E-01	7.9433E 00	5.3902E-01	2.1043E-01	7.2089E-01	191
1.7453E-01	1.0000E 01	3.2127E-01	2.2491E-01	7.7047E-01	201
2.6180E-01	1.5000E 01	1.2028E-01	2.4816E-01	8.5014E-01	206
3.4907E-01	2.0000E 01	5.1733E-02	2.6116E-01	8.9467E-01	211
4.3633E-01	2.5000E 01	2.4779E-02	2.6863E-01	9.2026E-01	216
5.2360E-01	3.0000E 01	1.4470E-02	2.7339E-01	9.3656E-01	221
6.1086E-01	3.5000E 01	9.4511E-03	2.7682E-01	9.4831E-01	226
6.9813E-01	4.0000E 01	6.5160E-03	2.7944E-01	9.5728E-01	231
7.8540E-01	4.5000E 01	4.5822E-03	2.8146E-01	9.6422E-01	236
8.7266E-01	5.0000E 01	3.2976E-03	2.8303E-01	9.6960E-01	241
9.5993E-01	5.5000E 01	2.3864E-03	2.8426E-01	9.7379E-01	246
1.0472E 00	6.0000E 01	1.7969E-03	2.8521E-01	9.7705E-01	251
1.1345E 00	6.5000E 01	1.4307E-03	2.8599E-01	9.7972E-01	256
1.2217E 00	7.0000E 01	1.1606E-03	2.8664E-01	9.8196E-01	261
1.3090E 00	7.5000E 01	9.5092E-04	2.8719E-01	9.8384E-01	266
1.3963E 00	8.0000E 01	7.8914E-04	2.8765E-01	9.8543E-01	271
1.4835E 00	8.5000E 01	6.7322E-04	2.8805E-01	9.8678E-01	276
1.5708E 00	9.0000E 01	5.9526E-04	2.8840E-01	9.8797E-01	281
1.6581E 00	9.5000E 01	5.4711E-04	2.8871E-01	9.8904E-01	286
1.7453E 00	1.0000E 02	5.2011E-04	2.8900E-01	9.9002E-01	291
1.8326E 00	1.0500E 02	5.0232E-04	2.8927E-01	9.9096E-01	296
1.9199E 00	1.1000E 02	4.9189E-04	2.8953E-01	9.9185E-01	301
2.0071E 00	1.1500E 02	4.8768E-04	2.8978E-01	9.9270E-01	306
2.0944E 00	1.2000E 02	4.8543E-04	2.9001E-01	9.9351E-01	311
2.1817E 00	1.2500E 02	4.8470E-04	2.9024E-01	9.9428E-01	316
2.2689E 00	1.3000E 02	4.8841E-04	2.9045E-01	9.9500E-01	321
2.3562E 00	1.3500E 02	5.0618E-04	2.9065E-01	9.9569E-01	326
2.4435E 00	1.4000E 02	5.3429E-04	2.9084E-01	9.9635E-01	331
2.5307E 00	1.4500E 02	5.6730E-04	2.9102E-01	9.9698E-01	336
2.6180E 00	1.5000E 02	6.0745E-04	2.9120E-01	9.9757E-01	341
2.7053E 00	1.5500E 02	6.6944E-04	2.9136E-01	9.9812E-01	346
2.7925E 00	1.6000E 02	7.7004E-04	2.9151E-01	9.9863E-01	351
2.8798E 00	1.6500E 02	9.5302E-04	2.9165E-01	9.9911E-01	356
2.9671E 00	1.7000E 02	1.2750E-03	2.9178E-01	9.9955E-01	361
3.0543E 00	1.7500E 02	1.4323E-03	2.9187E-01	9.9988E-01	366
3.1416E 00	1.8000E 02	1.4746E-03	2.9191E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-77. Volume scattering function (sheet 3 of 3).

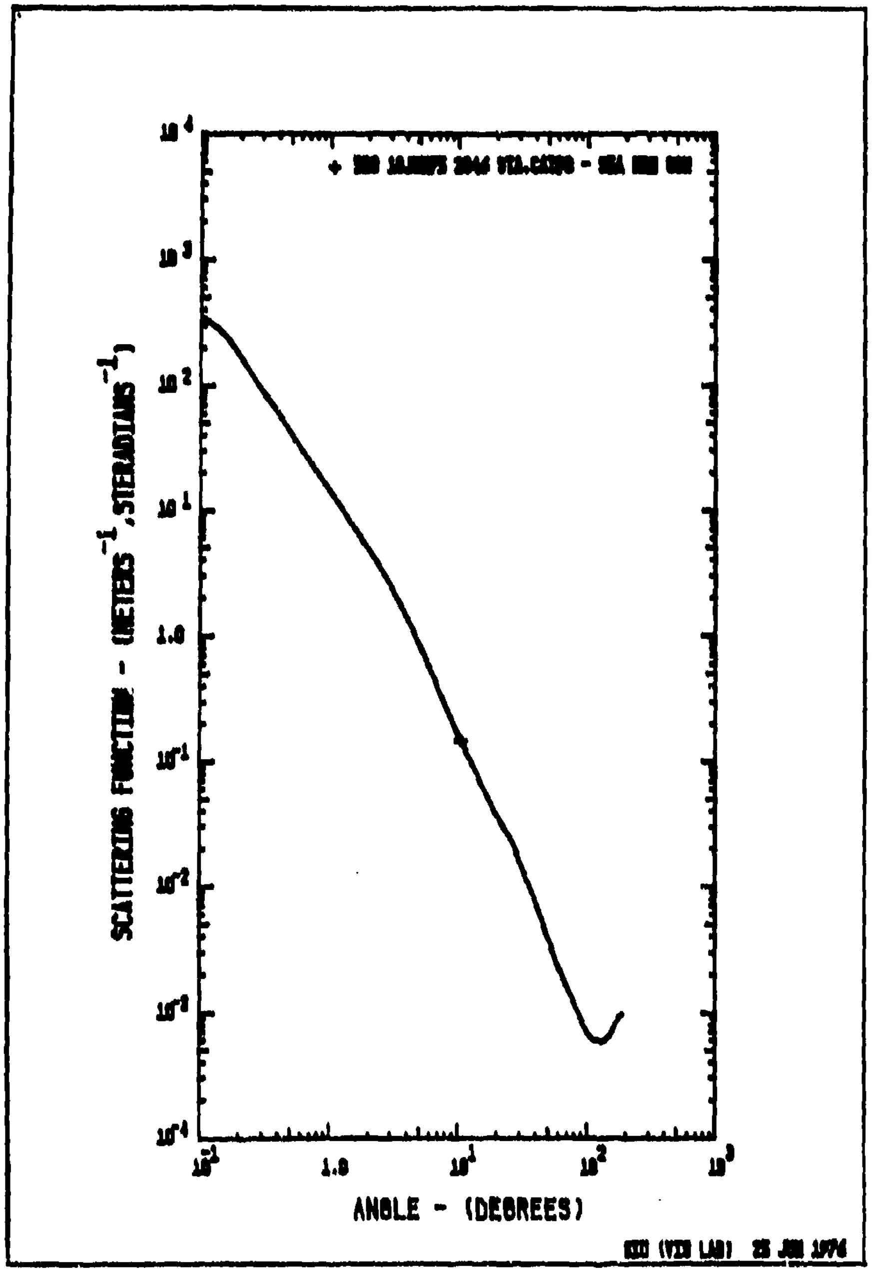


Figure D-78. Volume scattering function (sheet 1 of 3).

520 18JUN75 2046 STA.CAT#8 - SEA H2O 80M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	1.9500E 02	0	0.1750	1.9333E 02
2	0.3500	6.5000E 01	0	0.3500	6.6110E 01
3	0.7000	2.2800E 01	0	0.7000	2.2606E 01
4	10.00	1.4682E-01	0	10.00	1.4682E-01
5	15.00	5.9892E-02	0	15.00	5.9892E-02
6	20.00	3.3888E-02	0	20.00	3.3888E-02
7	25.00	2.2863E-02	0	25.00	2.2863E-02
8	30.00	1.3783E-02	0	30.00	1.3783E-02
9	40.00	6.7975E-03	0	40.00	6.7975E-03
10	50.00	3.4464E-03	0	50.00	3.4464E-03
11	60.00	2.0799E-03	0	60.00	2.0799E-03
12	70.00	1.4614E-03	0	70.00	1.4614E-03
13	80.00	1.0676E-03	0	80.00	1.0676E-03
14	90.00	8.1827E-04	0	90.00	8.1827E-04
15	100.0	6.6664E-04	0	100.0	6.6664E-04
16	110.0	6.1603E-04	0	110.0	6.1603E-04
17	120.0	6.0077E-04	0	120.0	6.0077E-04
18	130.0	6.1264E-04	0	130.0	6.1264E-04
19	140.0	6.5809E-04	0	140.0	6.5809E-04
20	150.0	7.2713E-04	0	150.0	7.2713E-04
21	160.0	8.4343E-04	0	160.0	8.4343E-04
22	170.0	9.3990E-04	0	170.0	9.3990E-04
23			1	180.0	9.7173E-04

ALPHA= 0.2617 S/ALPHA= 0.627
S= 0.1641 A/ALPHA= 0.373
A= 0.0976 B/S= 0.026

CORRECTED ALPHA CORRECTION=0.003

ALPHA= 0.2647 S/ALPHA= 0.620
S= 0.1641 A/ALPHA= 0.380
A= 0.1005 B/S= 0.026

SIGMA(0.0 DEGREES)= 467.9
SIGMA(0.1 DEGREES)= 344.0
SLOPE(3 MILLIRAD)= -1.548
S UP TO 0.1 DEGREES= 3.8499E-03 NORMALIZED= 2.34582E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 113.0
EXPECTED K/ALPHA= 0.4819 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K =

	MU	RADIANS	DEGREES
MEDIAN	0.9979	0.6448E-01	3.694
MEAN 1	0.9133	0.4196	24.04
VARIANCE	0.2706		
MEAN 2		0.2292	13.13
RMS		0.4777	27.37
RMS 2		0.4191	24.01

KAPPA= 0.1275 KAPPA'= 5.1104E-03

THETA**2 BAR 0.1141 RADIANS**2

Figure D-78. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0720.21

520 18JUN75 2046 STA.CAT#8 - SEA H2O 80M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	3.4398E 02	3.8499E-03	2.3458E-02	1
2.1972E-03	1.2589E-01	2.8944E 02	5.6174E-03	3.4223E-02	11
2.7662E-03	1.5849E-01	2.2333E 02	7.8755E-03	4.7987E-02	21
3.4824E-03	1.9953E-01	1.5781E 02	1.0502E-02	6.3990E-02	31
4.3841E-03	2.5119E-01	1.1049E 02	1.3420E-02	8.1768E-02	41
5.5192E-03	3.1623E-01	7.7355E 01	1.6657E-02	1.0150E-01	51
6.9483E-03	3.9811E-01	5.4159E 01	2.0250E-02	1.2339E-01	61
8.7474E-03	5.0119E-01	3.7919E 01	2.4237E-02	1.4768E-01	71
1.1012E-02	6.3096E-01	2.6548E 01	2.8660E-02	1.7463E-01	81
1.3864E-02	7.9433E-01	1.8602E 01	3.3569E-02	2.0454E-01	91
1.7453E-02	1.0000E 00	1.3088E 01	3.9033E-02	2.3783E-01	101
2.1972E-02	1.2589E 00	9.2056E 00	4.5127E-02	2.7497E-01	111
2.7662E-02	1.5849E 00	6.4350E 00	5.1902E-02	3.1625E-01	121
3.4824E-02	1.9953E 00	4.4447E 00	5.9366E-02	3.6173E-01	131
4.3841E-02	2.5119E 00	3.0159E 00	6.7467E-02	4.1109E-01	141
5.5192E-02	3.1623E 00	1.9987E 00	7.6078E-02	4.6355E-01	151
6.9483E-02	3.9811E 00	1.2574E 00	8.4920E-02	5.1743E-01	161
8.7473E-02	5.0119E 00	7.4657E-01	9.3463E-02	5.6949E-01	171
1.1012E-01	6.3096E 00	4.3046E-01	1.0136E-01	6.1762E-01	181
1.3864E-01	7.9433E 00	2.4797E-01	1.0856E-01	6.6145E-01	191
1.7453E-01	1.0000E 01	1.4682E-01	1.1519E-01	7.0185E-01	201
2.6180E-01	1.5000E 01	5.9892E-02	1.2602E-01	7.6784E-01	206
3.4907E-01	2.0000E 01	3.3888E-02	1.3332E-01	8.1235E-01	211
4.3633E-01	2.5000E 01	2.2863E-02	1.3914E-01	8.4780E-01	216
5.2360E-01	3.0000E 01	1.3783E-02	1.4364E-01	8.7524E-01	221
6.1086E-01	3.5000E 01	9.5151E-03	1.4699E-01	8.9567E-01	226
6.9813E-01	4.0000E 01	6.7975E-03	1.4969E-01	9.1206E-01	231
7.8540E-01	4.5000E 01	4.7623E-03	1.5180E-01	9.2493E-01	236
8.7266E-01	5.0000E 01	3.4464E-03	1.5343E-01	9.3488E-01	241
9.5993E-01	5.5000E 01	2.6152E-03	1.5473E-01	9.4282E-01	246
1.0472E 00	6.0000E 01	2.0799E-03	1.5581E-01	9.4937E-01	251
1.1345E 00	6.5000E 01	1.7306E-03	1.5673E-01	9.5498E-01	256
1.2217E 00	7.0000E 01	1.4614E-03	1.5754E-01	9.5989E-01	261
1.3090E 00	7.5000E 01	1.2424E-03	1.5824E-01	9.6418E-01	266
1.3963E 00	8.0000E 01	1.0676E-03	1.5886E-01	9.6794E-01	271
1.4835E 00	8.5000E 01	9.2964E-04	1.5940E-01	9.7123E-01	276
1.5708E 00	9.0000E 01	8.1827E-04	1.5987E-01	9.7414E-01	281
1.6581E 00	9.5000E 01	7.2981E-04	1.6030E-01	9.7672E-01	286
1.7453E 00	1.0000E 02	6.6664E-04	1.6068E-01	9.7902E-01	291
1.8326E 00	1.0500E 02	6.3217E-04	1.6102E-01	9.8113E-01	296
1.9199E 00	1.1000E 02	6.1603E-04	1.6135E-01	9.8312E-01	301
2.0071E 00	1.1500E 02	6.0552E-04	1.6166E-01	9.8500E-01	306
2.0944E 00	1.2000E 02	6.0077E-04	1.6195E-01	9.8679E-01	311
2.1817E 00	1.2500E 02	6.0265E-04	1.6223E-01	9.8848E-01	316
2.2689E 00	1.3000E 02	6.1264E-04	1.6249E-01	9.9009E-01	321
2.3562E 00	1.3500E 02	6.3210E-04	1.6274E-01	9.9162E-01	326
2.4435E 00	1.4000E 02	6.5809E-04	1.6298E-01	9.9307E-01	331
2.5307E 00	1.4500E 02	6.8833E-04	1.6321E-01	9.9444E-01	336
2.6180E 00	1.5000E 02	7.2713E-04	1.6341E-01	9.9571E-01	341
2.7053E 00	1.5500E 02	7.8338E-04	1.6360E-01	9.9687E-01	346
2.7925E 00	1.6000E 02	8.4343E-04	1.6377E-01	9.9791E-01	351
2.8798E 00	1.6500E 02	8.9414E-04	1.6392E-01	9.9878E-01	356
2.9671E 00	1.7000E 02	9.3990E-04	1.6403E-01	9.9944E-01	361
3.0543E 00	1.7500E 02	9.6592E-04	1.6409E-01	9.9986E-01	366
3.1416E 00	1.8000E 02	9.7173E-04	1.6412E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-78. Volume scattering function (sheet 3 of 3).

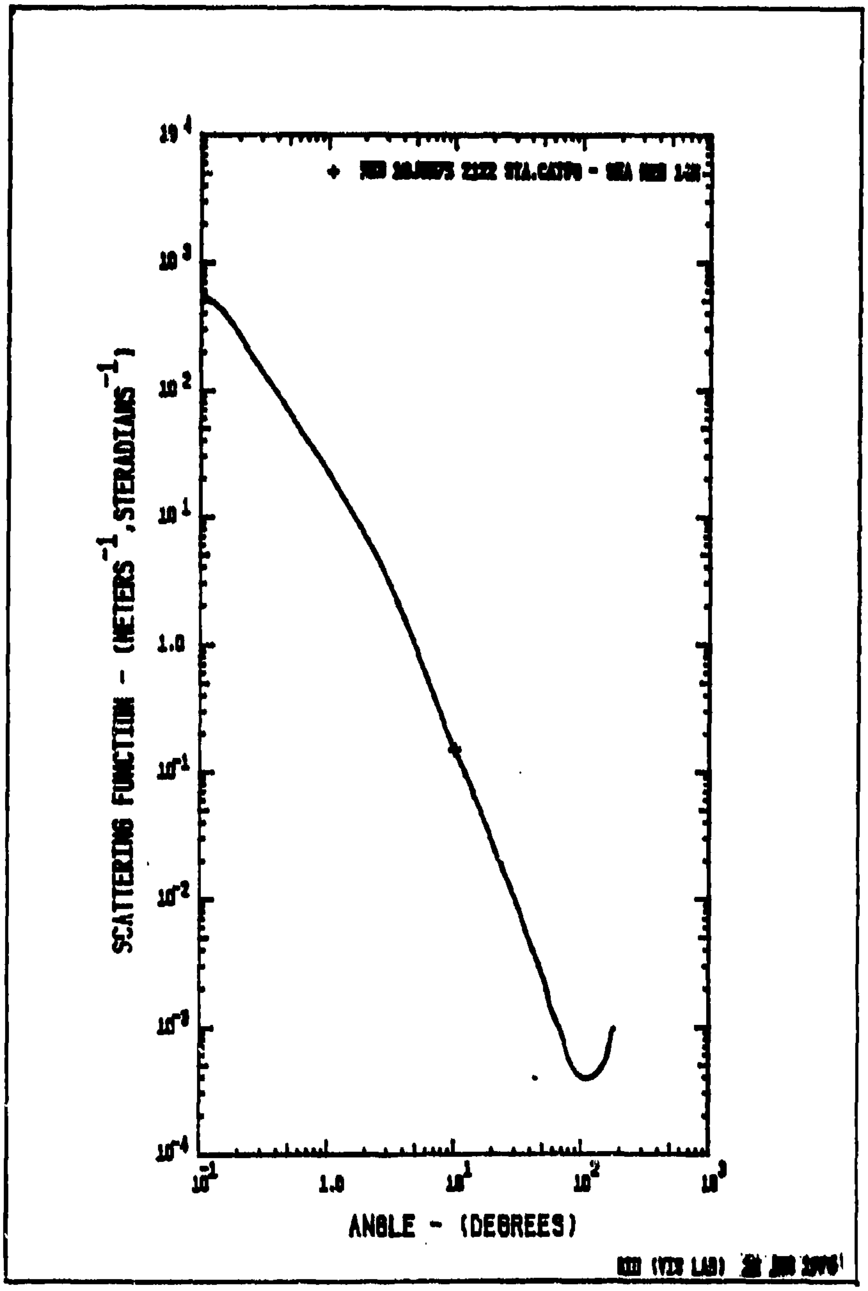


Figure D-79. Volume scattering function (sheet 1 of 3).

520 18JUN75 2122 STA.CAT#8 - SEA H2O 14M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	3.2500E 02	0	0.1750	3.2536E 02
2	0.3500	1.1300E 02	0	0.3500	1.1271E 02
3	0.7000	3.9000E 01	0	0.7000	3.9046E 01
4	10.00	1.5027E-01	0	10.00	1.5027E-01
5	15.00	5.7334E-02	0	15.00	5.7334E-02
6	20.00	2.7682E-02	0	20.00	2.7682E-02
7	25.00	1.5477E-02	0	25.00	1.5477E-02
8	30.00	9.7139E-03	0	30.00	9.7139E-03
9	40.00	4.4265E-03	0	40.00	4.4265E-03
10	50.00	2.5952E-03	0	50.00	2.5952E-03
11	60.00	1.2578E-03	0	60.00	1.2578E-03
12	70.00	8.7211E-04	0	70.00	8.7211E-04
13	80.00	5.6762E-04	0	80.00	5.6762E-04
14	90.00	4.5536E-04	0	90.00	4.5536E-04
15	100.0	4.0358E-04	0	100.0	4.0358E-04
16	110.0	3.9044E-04	0	110.0	3.9044E-04
17	120.0	3.9407E-04	0	120.0	3.9407E-04
18	130.0	4.1171E-04	0	130.0	4.1171E-04
19	140.0	4.5062E-04	0	140.0	4.5062E-04
20	150.0	5.0345E-04	0	150.0	5.0345E-04
21	160.0	5.8923E-04	0	160.0	5.8923E-04
22	170.0	8.6670E-04	0	170.0	8.6670E-04
23			1	180.0	9.6432E-04

ALPHA= 0.3776 S/ALPHA= 0.554
S= 0.2091 A/ALPHA= 0.446
A= 0.1685 B/S= 0.013

CORRECTED ALPHA CORRECTION=0.005

ALPHA= 0.3825 S/ALPHA= 0.547
S= 0.2091 A/ALPHA= 0.453
A= 0.1734 B/S= 0.013

SIGMA(0.0 DEGREES)= 776.6
SIGMA(0.1 DEGREES)= 574.0
SLOPE(3 MILLIRAD)= -1.529
S UP TO 0.1 DEGREES= 6.4066E-03 NORMALIZED= 3.06413E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 112.0
EXPECTED K/ALPHA= 0.5515 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K =

	MU	RADIANS	DEGREES
MEDIAN	0.9993	0.3799E-01	2.176
MEAN 1	0.9541	0.3043	17.43
VARIANCE	0.1998		
MEAN 2		0.1412	8.092
RMS		0.3483	19.96
RMS 2		0.3184	18.24

KAPPA= 0.2110 KAPPA'= 2.5149E-03

THETA**2 BAR 6.0671E-02 RADIANS**2

Figure D-79. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0718.46

520 18JUN75 2122 STA.CAT#8 - SEA H2O 14M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	5.7399E 02	6.4066E-03	3.0641E-02	1
2.1972E-03	1.2589E-01	4.8434E 02	9.3600E-03	4.4766E-02	11
2.7662E-03	1.5849E-01	3.7514E 02	1.3146E-02	6.2873E-02	21
3.4824E-03	1.9953E-01	2.6622E 02	1.7567E-02	8.4019E-02	31
4.3841E-03	2.5119E-01	1.8720E 02	2.2500E-02	1.0761E-01	41
5.5192E-03	3.1623E-01	1.3163E 02	2.7998E-02	1.3391E-01	51
6.9483E-03	3.9811E-01	9.2558E 01	3.4125E-02	1.6321E-01	61
8.7474E-03	5.0119E-01	6.5084E 01	4.0953E-02	1.9587E-01	71
1.1012E-02	6.3096E-01	4.5765E 01	4.8563E-02	2.3226E-01	81
1.3864E-02	7.9433E-01	3.2151E 01	5.7041E-02	2.7281E-01	91
1.7453E-02	1.0000E 00	2.2441E 01	6.6455E-02	3.1784E-01	101
2.1972E-02	1.2589E 00	1.5473E 01	7.6810E-02	3.6736E-01	111
2.7662E-02	1.5849E 00	1.0479E 01	8.8027E-02	4.2101E-01	121
3.4824E-02	1.9953E 00	6.9309E 00	9.9929E-02	4.7793E-01	131
4.3841E-02	2.5119E 00	4.4520E 00	1.1223E-01	5.3676E-01	141
5.5192E-02	3.1623E 00	2.7614E 00	1.2454E-01	5.9562E-01	151
6.9483E-02	3.9811E 00	1.6170E 00	1.3632E-01	6.5200E-01	161
8.7473E-02	5.0119E 00	8.9587E-01	1.4694E-01	7.0277E-01	171
1.1012E-01	6.3096E 00	4.8482E-01	1.5612E-01	7.4670E-01	181
1.3864E-01	7.9433E 00	2.6456E-01	1.6400E-01	7.8439E-01	191
1.7453E-01	1.0000E 01	1.5027E-01	1.7093E-01	8.1750E-01	201
2.6180E-01	1.5000E 01	5.7334E-02	1.8173E-01	8.6914E-01	206
3.4907E-01	2.0000E 01	2.7682E-02	1.8823E-01	9.0023E-01	211
4.3633E-01	2.5000E 01	1.5477E-02	1.9254E-01	9.2086E-01	216
5.2360E-01	3.0000E 01	9.7139E-03	1.9563E-01	9.3563E-01	221
6.1086E-01	3.5000E 01	6.3982E-03	1.9795E-01	9.4673E-01	226
6.9813E-01	4.0000E 01	4.4245E-03	1.9972E-01	9.5520E-01	231
7.8540E-01	4.5000E 01	3.3390E-03	2.0113E-01	9.6196E-01	236
8.7266E-01	5.0000E 01	2.5952E-03	2.0233E-01	9.6767E-01	241
9.5993E-01	5.5000E 01	1.7834E-03	2.0328E-01	9.7221E-01	246
1.0472E 00	6.0000E 01	1.2578E-03	2.0396E-01	9.7549E-01	251
1.1345E 00	6.5000E 01	1.0388E-03	2.0451E-01	9.7813E-01	256
1.2217E 00	7.0000E 01	8.7211E-04	2.0500E-01	9.8045E-01	261
1.3090E 00	7.5000E 01	6.9421E-04	2.0541E-01	9.8240E-01	266
1.3963E 00	8.0000E 01	5.6762E-04	2.0574E-01	9.8400E-01	271
1.4835E 00	8.5000E 01	4.9882E-04	2.0603E-01	9.8538E-01	276
1.5708E 00	9.0000E 01	4.5536E-04	2.0629E-01	9.8662E-01	281
1.6581E 00	9.5000E 01	4.2371E-04	2.0653E-01	9.8777E-01	286
1.7453E 00	1.0000E 02	4.0358E-04	2.0675E-01	9.8884E-01	291
1.8326E 00	1.0500E 02	3.9398E-04	2.0697E-01	9.8986E-01	296
1.9199E 00	1.1000E 02	3.9044E-04	2.0717E-01	9.9084E-01	301
2.0071E 00	1.1500E 02	3.9085E-04	2.0737E-01	9.9179E-01	306
2.0944E 00	1.2000E 02	3.9407E-04	2.0756E-01	9.9270E-01	311
2.1817E 00	1.2500E 02	4.0047E-04	2.0774E-01	9.9358E-01	316
2.2689E 00	1.3000E 02	4.1171E-04	2.0792E-01	9.9442E-01	321
2.3562E 00	1.3500E 02	4.2925E-04	2.0809E-01	9.9523E-01	326
2.4435E 00	1.4000E 02	4.5062E-04	2.0825E-01	9.9601E-01	331
2.5307E 00	1.4500E 02	4.7535E-04	2.0841E-01	9.9675E-01	336
2.6180E 00	1.5000E 02	5.0345E-04	2.0855E-01	9.9744E-01	341
2.7053E 00	1.5500E 02	5.4178E-04	2.0868E-01	9.9807E-01	346
2.7925E 00	1.6000E 02	5.9823E-04	2.0880E-01	9.9864E-01	351
2.8798E 00	1.6500E 02	6.9875E-04	2.0891E-01	9.9914E-01	356
2.9671E 00	1.7000E 02	8.6670E-04	2.0900E-01	9.9958E-01	361
3.0543E 00	1.7500E 02	9.4389E-04	2.0906E-01	9.9989E-01	366
3.1416E 00	1.8000E 02	9.6432E-04	2.0909E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-79. Volume scattering function (sheet 3 of 3).

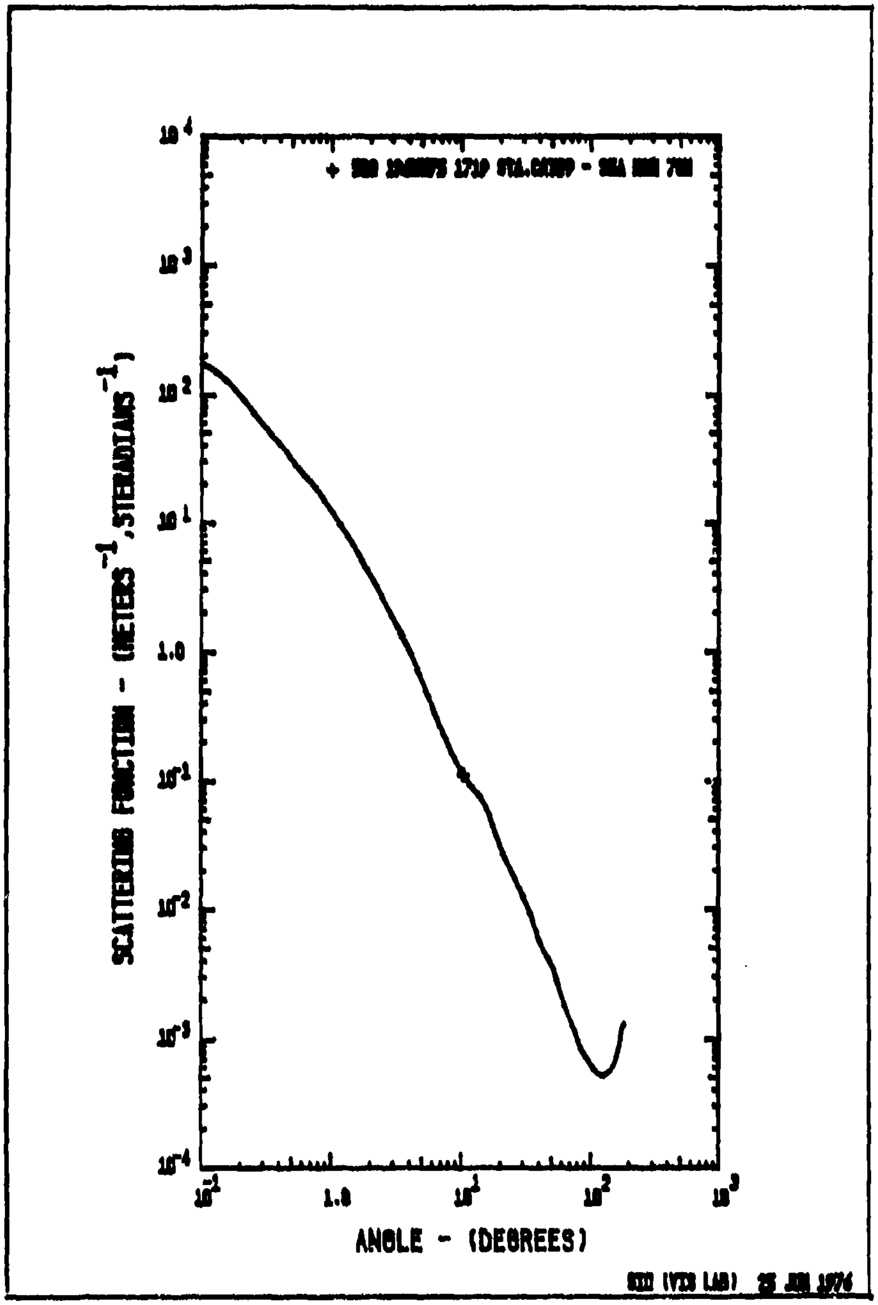


Figure D-80. Volume scattering function (sheet 1 of 3).

25 JUN 1976 0723.34 IBM 3(

520 19JUN75 1719 STA.CAT#9 - SEA H2O 78M

	DATA READ IN ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	SIGMA
1	0.1750	1.1300E 02	0	0.1750	1.1317E 02
2	0.3500	4.8000E 01	0	0.3500	4.7848E 01
3	0.7000	2.0200E 01	0	0.7000	2.0231E 01
4	10.00	1.1378E-01	0	10.00	1.1378E-01
5	15.00	6.4557E-02	0	15.00	6.4557E-02
6	20.00	2.9066E-02	0	20.00	2.9066E-02
7	25.00	1.7675E-02	0	25.00	1.7675E-02
8	30.00	1.2129E-02	0	30.00	1.2129E-02
9	40.00	5.4582E-03	0	40.00	5.4582E-03
10	50.00	3.4464E-03	0	50.00	3.4464E-03
11	60.00	1.9322E-03	0	60.00	1.9322E-03
12	70.00	1.3349E-03	0	70.00	1.3349E-03
13	80.00	9.2207E-04	0	80.00	9.2207E-04
14	90.00	7.2818E-04	0	90.00	7.2818E-04
15	100.0	6.1836E-04	0	100.0	6.1836E-04
16	110.0	5.6349E-04	0	110.0	5.6349E-04
17	120.0	5.3981E-04	0	120.0	5.3981E-04
18	130.0	5.6817E-04	0	130.0	5.6817E-04
19	140.0	6.0898E-04	0	140.0	6.0898E-04
20	150.0	7.0939E-04	0	150.0	7.0939E-04
21	160.0	8.5971E-04	0	160.0	8.5971E-04
22	170.0	1.2135E-03	0	170.0	1.2135E-03
23			1	180.0	1.3449E-03

ALPHA=	0.2341	S/ALPHA=	0.573
S=	0.1340	A/ALPHA=	0.427
A=	0.1001	B/S=	0.030

CORRECTED ALPHA CORRECTION=0.001

ALPHA=	0.2355	S/ALPHA=	0.569
S=	0.1340	A/ALPHA=	0.431
A=	0.1015	B/S=	0.030

SIGMA(0.0 DEGREES)= 221.2
SIGMA(0.1 DEGREES)= 176.1
SLOPE(3 MILLIRAD)= -1.242
S UP TO 0.1 DEGREES= 1.8916E-03 NORMALIZED= 1.41132E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 97.00
EXPECTED K/ALPHA= 0.5305 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K

	MU	RADIANS	DEGREES
MEDIAN	0.9977	0.6810E-01	3.902
MEAN 1	0.9025	0.4453	25.52
VARIANCE	0.2904		
MEAN 2		0.2497	14.31
RMS		0.5103	29.24
RMS 2		0.4450	25.50

KAPPA= 0.1250 KAPPA'= 5.6526E-03

THETA**2 BAR 0.1302 RADIANS**2

Figure D-80. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0723.34

520 19JUN75 1719 STA.CAT#9 - SEA H2O 70M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	1.7609E 02	1.8916E-03	1.4113E-02	1
2.1972E-03	1.2589E-01	1.5466E 02	2.8157E-03	2.1008E-02	11
2.7662E-03	1.5849E-01	1.2677E 02	4.0590E-03	3.0284E-02	21
3.4824E-03	1.9953E-01	9.6158E 01	5.6051E-03	4.1819E-02	31
4.3841E-03	2.5119E-01	7.2242E 01	7.4483E-03	5.5572E-02	41
5.5192E-03	3.1623E-01	5.4275E 01	9.6431E-03	7.1947E-02	51
6.9483E-03	3.9811E-01	4.0776E 01	1.2256E-02	9.1445E-02	61
8.7474E-03	5.0119E-01	3.0634E 01	1.5368E-02	1.1466E-01	71
1.1012E-02	6.3096E-01	2.3015E 01	1.9073E-02	1.4230E-01	81
1.3864E-02	7.9433E-01	1.7178E 01	2.3479E-02	1.7518E-01	91
1.7453E-02	1.0000E 00	1.2339E 01	2.8596E-02	2.1336E-01	101
2.1972E-02	1.2589E 00	8.5456E 00	3.4311E-02	2.5599E-01	111
2.7662E-02	1.5849E 00	5.7500E 00	4.0488E-02	3.0208E-01	121
3.4824E-02	1.9953E 00	3.7871E 00	4.7000E-02	3.5067E-01	131
4.3841E-02	2.5119E 00	2.4599E 00	5.3746E-02	4.0100E-01	141
5.5192E-02	3.1623E 00	1.5877E 00	6.0663E-02	4.5260E-01	151
6.9483E-02	3.9811E 00	9.7280E-01	6.7608E-02	5.0442E-01	161
8.7473E-02	5.0119E 00	5.5628E-01	7.4096E-02	5.5283E-01	171
1.1012E-01	6.3096E 00	3.1222E-01	7.9895E-02	5.9609E-01	181
1.3864E-01	7.9433E 00	1.8090E-01	8.5107E-02	6.3498E-01	191
1.7453E-01	1.0000E 01	1.1378E-01	9.0065E-02	6.7197E-01	201
2.6180E-01	1.5000E 01	6.4557E-02	1.0011E-01	7.4690E-01	206
3.4907E-01	2.0000E 01	2.9066E-02	1.0721E-01	7.9988E-01	211
4.3633E-01	2.5000E 01	1.7675E-02	1.1191E-01	8.3498E-01	216
5.2360E-01	3.0000E 01	1.2129E-02	1.1560E-01	8.6252E-01	221
6.1086E-01	3.5000E 01	7.9746E-03	1.1852E-01	8.8428E-01	226
6.9813E-01	4.0000E 01	5.4582E-03	1.2071E-01	9.0059E-01	231
7.8540E-01	4.5000E 01	4.3007E-03	1.2248E-01	9.1386E-01	236
8.7266E-01	5.0000E 01	3.4464E-03	1.2405E-01	9.2554E-01	241
9.5993E-01	5.5000E 01	2.5436E-03	1.2535E-01	9.3520E-01	246
1.0472E 00	6.0000E 01	1.9322E-03	1.2637E-01	9.4281E-01	251
1.1345E 00	6.5000E 01	1.5949E-03	1.2722E-01	9.4915E-01	256
1.2217E 00	7.0000E 01	1.3349E-03	1.2796E-01	9.5468E-01	261
1.3090E 00	7.5000E 01	1.0993E-03	1.2859E-01	9.5940E-01	266
1.3963E 00	8.0000E 01	9.2207E-04	1.2913E-01	9.6342E-01	271
1.4835E 00	8.5000E 01	8.0851E-04	1.2960E-01	9.6690E-01	276
1.5708E 00	9.0000E 01	7.2818E-04	1.3002E-01	9.7005E-01	281
1.6581E 00	9.5000E 01	6.6540E-04	1.3040E-01	9.7288E-01	286
1.7453E 00	1.0000E 02	6.1836E-04	1.3075E-01	9.7549E-01	291
1.8326E 00	1.0500E 02	5.8644E-04	1.3107E-01	9.7788E-01	296
1.9199E 00	1.1000E 02	5.6349E-04	1.3137E-01	9.8013E-01	301
2.0071E 00	1.1500E 02	5.4513E-04	1.3165E-01	9.8221E-01	306
2.0944E 00	1.2000E 02	5.3981E-04	1.3191E-01	9.8418E-01	311
2.1817E 00	1.2500E 02	5.5097E-04	1.3216E-01	9.8605E-01	316
2.2689E 00	1.3000E 02	5.6817E-04	1.3241E-01	9.8787E-01	321
2.3562E 00	1.3500E 02	5.8579E-04	1.3264E-01	9.8960E-01	326
2.4435E 00	1.4000E 02	6.0898E-04	1.3286E-01	9.9126E-01	331
2.5307E 00	1.4500E 02	6.5162E-04	1.3307E-01	9.9281E-01	336
2.6180E 00	1.5000E 02	7.0939E-04	1.3327E-01	9.9432E-01	341
2.7053E 00	1.5500E 02	7.7513E-04	1.3346E-01	9.9570E-01	346
2.7925E 00	1.6000E 02	8.5971E-04	1.3363E-01	9.9699E-01	351
2.8798E 00	1.6500E 02	9.9764E-04	1.3378E-01	9.9811E-01	356
2.9671E 00	1.7000E 02	1.2135E-03	1.3391E-01	9.9909E-01	361
3.0543E 00	1.7500E 02	1.3190E-03	1.3400E-01	9.9975E-01	366
3.1416E 00	1.8000E 02	1.3449E-03	1.3403E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-80. Volume scattering function (sheet 3 of 3).

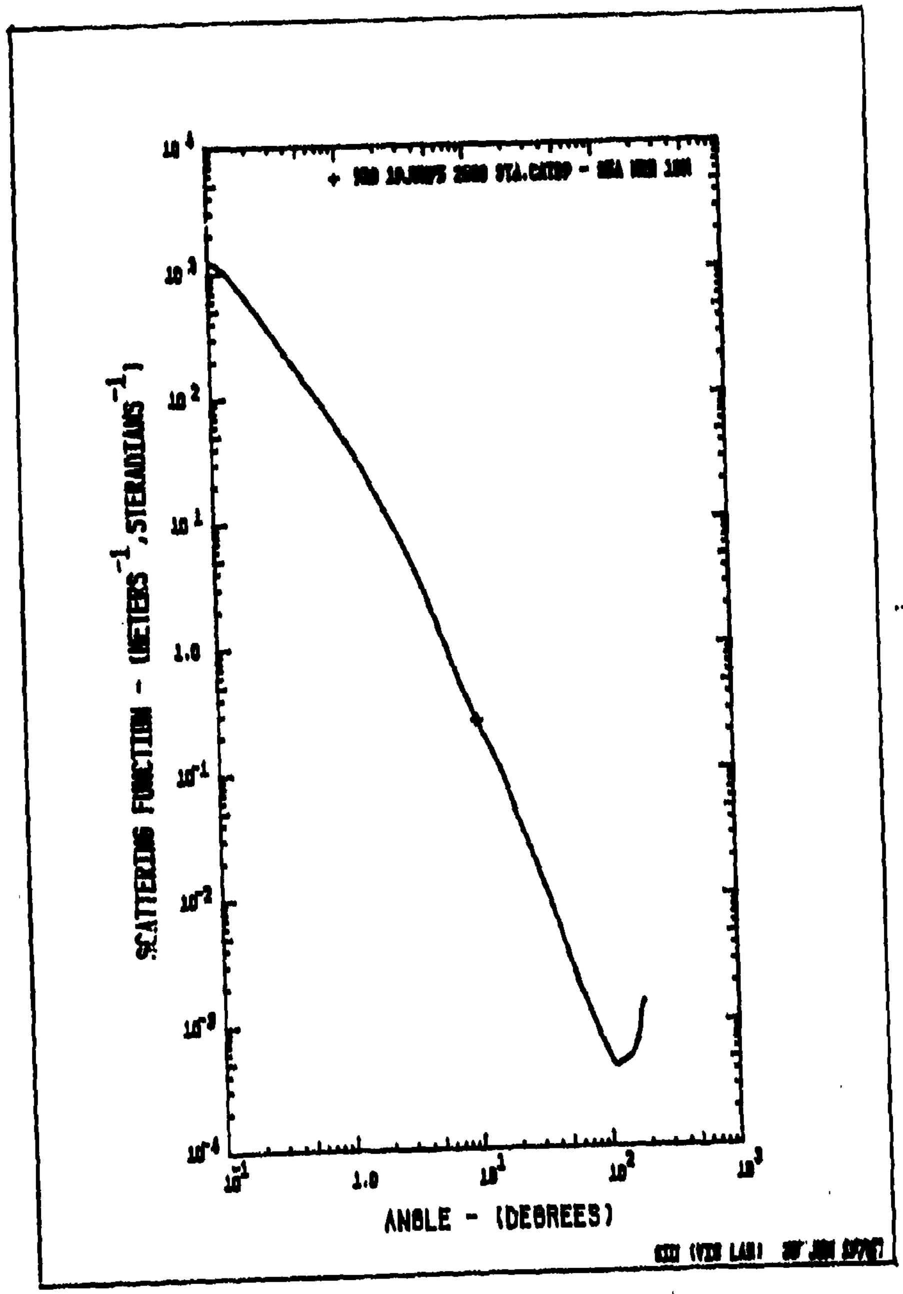


Figure D-81. Volume scattering function (sheet 1 of 3).

520 19JUN75 2000 STA.CAT#9 - SEA H2O 18M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	7.0000E 02	0	0.1750	7.0906E 02
2	0.3500	2.5800E 02	0	0.3500	2.5142E 02
3	0.7000	8.8000E 01	0	0.7000	8.9147E 01
4	10.00	2.6126E-01	0	10.00	2.6126E-01
5	15.00	1.0833E-01	0	15.00	1.0833E-01
6	20.00	4.5472E-02	0	20.00	4.5472E-02
7	25.00	2.4912E-02	0	25.00	2.4912E-02
8	30.00	1.4726E-02	0	30.00	1.4726E-02
9	40.00	6.2160E-03	0	40.00	6.2160E-03
10	50.00	3.0875E-03	0	50.00	3.0875E-03
11	60.00	1.7664E-03	0	60.00	1.7664E-03
12	70.00	1.1700E-03	0	70.00	1.1700E-03
13	80.00	8.2169E-04	0	80.00	8.2169E-04
14	90.00	6.1446E-04	0	90.00	6.1446E-04
15	100.0	4.8007E-04	0	100.0	4.8007E-04
16	110.0	4.5741E-04	0	110.0	4.5741E-04
17	120.0	4.8620E-04	0	120.0	4.8620E-04
18	130.0	5.1514E-04	0	130.0	5.1514E-04
19	140.0	5.4261E-04	0	140.0	5.4261E-04
20	150.0	6.3784E-04	0	150.0	6.3784E-04
21	160.0	7.4397E-04	0	160.0	7.4397E-04
22	170.0	1.2591E-03	0	170.0	1.2591E-03
23			1	180.0	1.4464E-03

ALPHA= 0.5435 S/ALPHA= 0.753
S= 0.4093 A/ALPHA= 0.247
A= 0.1342 B/S= 0.009

CORRECTED ALPHA CORRECTION=0.010

ALPHA= 0.5540 S/ALPHA= 0.739
S= 0.4093 A/ALPHA= 0.261
A= 0.1446 B/S= 0.009

SIGMA(0.0 DEGREES)= 1647.
SIGMA(0.1 DEGREES)= 1230.
SLOPE(3 MILLIRAD)= -1.496
S UP TO 0.1 DEGREES= 1.3653E-02 NORMALIZED= 3.33548E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 110.0
EXPECTED K/ALPHA= 0.3648 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K

	MU	RADIANS	DEGREES
MEDIAN	0.9995	0.3045E-01	1.745
MEAN 1	0.9680	0.2538	14.54
VARIANCE	0.1629		
MEAN 2		0.1115	6.389
RMS		0.2889	16.55
RMS 2		0.2665	15.27

KAPPA= 0.2021 KAPPA'= 1.7222E-03

THETA**2 BAR 4.1726E-02 RADIANS**2

Figure D-81. Volume scattering function (sheet 2 of 3).

520 19JUN75 2000 STA.CAT#9 - SEA H2O 18M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	1.2299E 03	1.3653E-02	3.3355E-02	1
2.1972E-03	1.2589E-01	1.0436E 03	1.9999E-02	4.8857E-02	11
2.7662E-03	1.5849E-01	8.1449E 02	2.8187E-02	6.8860E-02	21
3.4824E-03	1.9953E-01	5.8274E 02	3.7828E-02	9.2412E-02	31
4.3841E-03	2.5119E-01	4.1295E 02	4.8669E-02	1.1890E-01	41
5.5192E-03	3.1623E-01	2.9263E 02	6.0845E-02	1.4864E-01	51
6.9483E-03	3.9811E-01	2.0736E 02	7.4519E-02	1.8205E-01	61
8.7474E-03	5.0119E-01	1.4694E 02	8.9877E-02	2.1957E-01	71
1.1012E-02	6.3096E-01	1.0413E 02	1.0712E-01	2.6170E-01	81
1.3864E-02	7.9433E-01	7.3452E 01	1.2648E-01	3.0898E-01	91
1.7453E-02	1.0000E 00	5.0413E 01	1.4784E-01	3.6117E-01	101
2.1972E-02	1.2589E 00	3.3607E 01	1.7073E-01	4.1709E-01	111
2.7662E-02	1.5849E 00	2.1801E 01	1.9458E-01	4.7536E-01	121
3.4824E-02	1.9953E 00	1.3788E 01	2.1879E-01	5.3450E-01	131
4.3841E-02	2.5119E 00	8.5170E 00	2.4277E-01	5.9307E-01	141
5.5192E-02	3.1623E 00	5.1483E 00	2.6598E-01	6.4978E-01	151
6.9483E-02	3.9811E 00	2.9451E 00	2.8773E-01	7.0290E-01	161
8.7473E-02	5.0119E 00	1.5844E 00	3.0678E-01	7.4946E-01	171
1.1012E-01	6.3096E 00	8.3650E-01	3.2282E-01	7.8864E-01	181
1.3864E-01	7.9433E 00	4.5225E-01	3.3633E-01	8.2165E-01	191
1.7453E-01	1.0000E 01	2.6126E-01	3.4823E-01	8.5073E-01	201
2.6180E-01	1.5000E 01	1.0835E-01	3.6770E-01	8.9827E-01	206
3.4907E-01	2.0000E 01	4.5472E-02	3.7931E-01	9.2665E-01	211
4.3633E-01	2.5000E 01	2.4912E-02	3.8633E-01	9.4380E-01	216
5.2360E-01	3.0000E 01	1.4726E-02	3.9117E-01	9.5563E-01	221
6.1086E-01	3.5000E 01	9.3195E-03	3.9462E-01	9.6403E-01	226
6.9813E-01	4.0000E 01	6.2140E-03	3.9716E-01	9.7024E-01	231
7.8540E-01	4.5000E 01	4.2992E-03	3.9907E-01	9.7491E-01	236
8.7266E-01	5.0000E 01	3.0875E-03	4.0054E-01	9.7851E-01	241
9.5993E-01	5.5000E 01	2.2875E-03	4.0169E-01	9.8132E-01	246
1.0472E 00	6.0000E 01	1.7664E-03	4.0262E-01	9.8359E-01	251
1.1345E 00	6.5000E 01	1.4230E-03	4.0339E-01	9.8547E-01	256
1.2217E 00	7.0000E 01	1.1700E-03	4.0405E-01	9.8707E-01	261
1.3090E 00	7.5000E 01	9.7410E-04	4.0460E-01	9.8843E-01	266
1.3963E 00	8.0000E 01	8.2169E-04	4.0508E-01	9.8960E-01	271
1.4835E 00	8.5000E 01	7.0591E-04	4.0549E-01	9.9061E-01	276
1.5708E 00	9.0000E 01	6.1446E-04	4.0586E-01	9.9150E-01	281
1.6581E 00	9.5000E 01	5.3932E-04	4.0617E-01	9.9226E-01	286
1.7453E 00	1.0000E 02	4.8007E-04	4.0645E-01	9.9294E-01	291
1.8326E 00	1.0500E 02	4.5272E-04	4.0669E-01	9.9354E-01	296
1.9199E 00	1.1000E 02	4.5741E-04	4.0693E-01	9.9412E-01	301
2.0071E 00	1.1500E 02	4.7172E-04	4.0717E-01	9.9469E-01	306
2.0944E 00	1.2000E 02	4.8620E-04	4.0740E-01	9.9527E-01	311
2.1817E 00	1.2500E 02	5.0075E-04	4.0763E-01	9.9582E-01	316
2.2689E 00	1.3000E 02	5.1514E-04	4.0785E-01	9.9636E-01	321
2.3562E 00	1.3500E 02	5.2868E-04	4.0806E-01	9.9687E-01	326
2.4435E 00	1.4000E 02	5.4261E-04	4.0826E-01	9.9736E-01	331
2.5307E 00	1.4500E 02	5.8081E-04	4.0844E-01	9.9781E-01	336
2.6180E 00	1.5000E 02	6.3784E-04	4.0862E-01	9.9826E-01	341
2.7053E 00	1.5500E 02	6.9478E-04	4.0879E-01	9.9866E-01	346
2.7925E 00	1.6000E 02	7.6397E-04	4.0895E-01	9.9904E-01	351
2.8798E 00	1.6500E 02	9.2860E-04	4.0908E-01	9.9937E-01	356
2.9671E 00	1.7000E 02	1.2591E-03	4.0921E-01	9.9968E-01	361
3.0543E 00	1.7500E 02	1.4043E-03	4.0930E-01	9.9991E-01	366
3.1416E 00	1.8000E 02	1.4454E-03	4.0934E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-81. Volume scattering function (sheet 3 of 3).

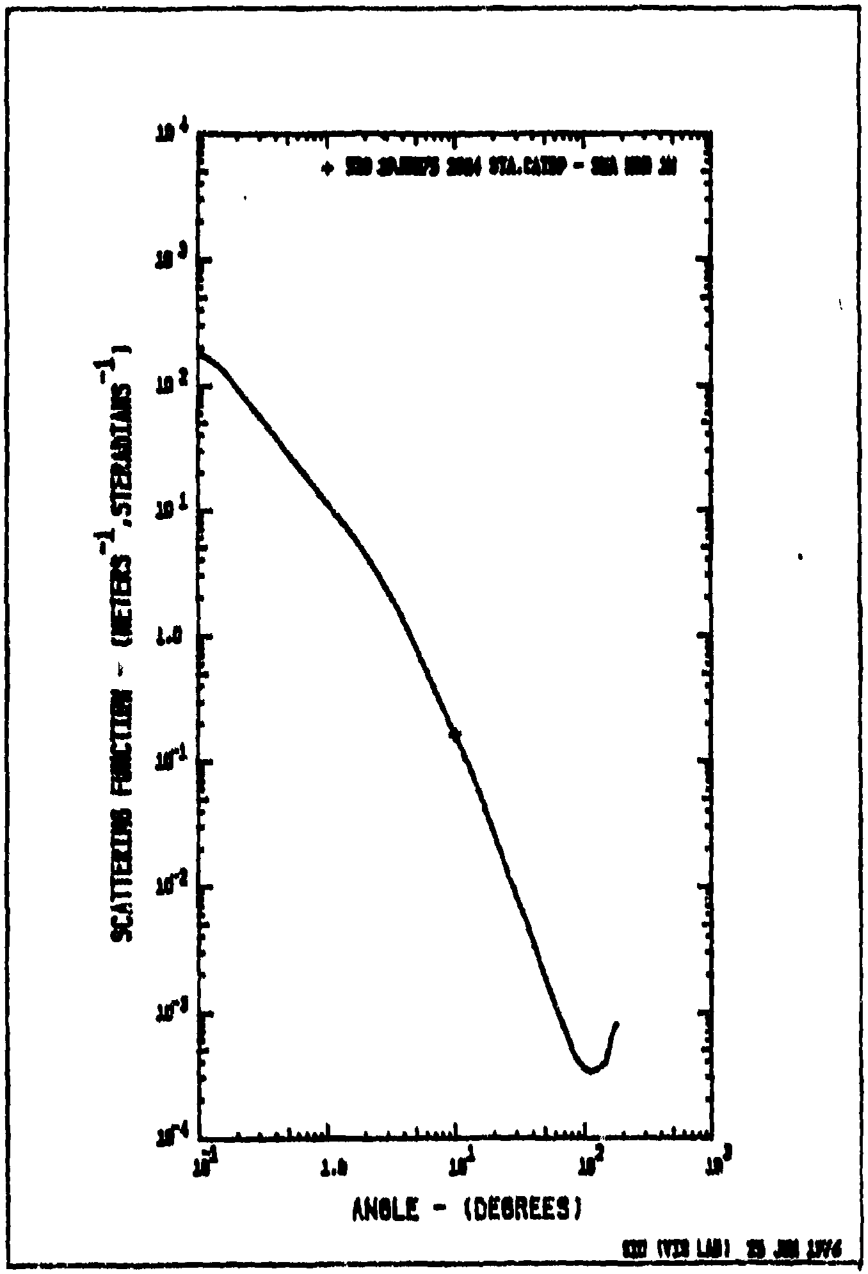


Figure D-82. Volume scattering function (sheet 1 of 3).

320 19JUN75 2024 STA.CAT#9 - SEA H2O 1M

	DATA READ IN ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	SIGMA
1	0.1750	1.1900E 02	0	0.1750	1.1639E 02
2	0.3500	4.4500E 01	0	0.3500	4.6509E 01
3	0.7000	1.9000E 01	0	0.7000	1.8586E 01
4	10.00	1.6703E-01	0	10.00	1.6703E-01
5	15.00	6.2972E-02	0	15.00	6.2972E-02
6	20.00	2.6571E-02	0	20.00	2.6571E-02
7	25.00	1.4262E-02	0	25.00	1.4262E-02
8	30.00	8.6717E-03	0	30.00	8.6717E-03
9	40.00	3.7371E-03	0	40.00	3.7371E-03
10	50.00	1.9664E-03	0	50.00	1.9664E-03
11	60.00	1.1751E-03	0	60.00	1.1751E-03
12	70.00	7.8958E-04	0	70.00	7.8958E-04
13	80.00	5.4065E-04	0	80.00	5.4065E-04
14	90.00	4.1985E-04	0	90.00	4.1985E-04
15	100.0	3.7039E-04	0	100.0	3.7039E-04
16	110.0	3.4538E-04	0	110.0	3.4538E-04
17	120.0	3.5020E-04	0	120.0	3.5020E-04
18	130.0	3.6839E-04	0	130.0	3.6839E-04
19	140.0	3.9206E-04	0	140.0	3.9206E-04
20	150.0	4.2720E-04	0	150.0	4.2720E-04
21	160.0	5.6216E-04	0	160.0	5.6216E-04
22	170.0	7.4012E-04	0	170.0	7.4012E-04
23			1	180.0	8.2043E-04

ALPHA= 0.2329 S/ALPHA= 0.620
S= 0.1444 A/ALPHA= 0.380
A= 0.0885 B/S= 0.017

CORRECTED ALPHA CORRECTION=0.002

ALPHA= 0.2344 S/ALPHA= 0.616
S= 0.1444 A/ALPHA= 0.384
A= 0.0900 B/S= 0.017

SIGMA(0.0 DEGREES)= 239.6
SIGMA(0.1 DEGREES)= 187.2
SLOPE(3 MILLIRAD)= -1.323
S UP TO 0.1 DEGREES= 2.0303E-03 NORMALIZED= 1.40557E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 101.0
EXPECTED K/ALPHA= 0.4858 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K

	MU	RADIANS	DEGREES
MEDIAN	0.9978	0.6629E-01	3.798
MEAN 1	0.9403	0.3473	19.90
VARIANCE	0.2250		
MEAN 2		0.1841	10.55
RMS		0.3966	22.73
RMS 2		0.3515	20.15

KAPPA= 0.1139 KAPPA'= 3.2394E-03

THETA**2 BAR 7.8656E-02 RADIANS**2

Figure D-82. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0725.07

520 19JUN75 2024 STA.CAT#9 - SEA H2O 1M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	1.8718E 02	2.0303E-03	1.4056E-02	1
2.1972E-03	1.2589E-01	1.6272E 02	3.0077E-03	2.0822E-02	11
2.7662E-03	1.5849E-01	1.3141E 02	4.3061E-03	2.9811E-02	21
3.4824E-03	1.9953E-01	9.7846E 01	5.8937E-03	4.0802E-02	31
4.3841E-03	2.5119E-01	7.2144E 01	7.7513E-03	5.3662E-02	41
5.5192E-03	3.1623E-01	5.3193E 01	9.9221E-03	6.8690E-02	51
6.9483E-03	3.9811E-01	3.9221E 01	1.2459E-02	8.6251E-02	61
8.7474E-03	5.0119E-01	2.8918E 01	1.5423E-02	1.0677E-01	71
1.1012E-02	6.3096E-01	2.1322E 01	1.8887E-02	1.3075E-01	81
1.3864E-02	7.9433E-01	1.5742E 01	2.2936E-02	1.5878E-01	91
1.7453E-02	1.0000E 00	1.1702E 01	2.7691E-02	1.9170E-01	101
2.1972E-02	1.2589E 00	8.6853E 00	3.3293E-02	2.3049E-01	111
2.7662E-02	1.5849E 00	6.3677E 00	3.9848E-02	2.7586E-01	121
3.4824E-02	1.9953E 00	4.5631E 00	4.7381E-02	3.2802E-01	131
4.3841E-02	2.5119E 00	3.1623E 00	5.5800E-02	3.8630E-01	141
5.5192E-02	3.1623E 00	2.0970E 00	6.4849E-02	4.4894E-01	151
6.9483E-02	3.9811E 00	1.3185E 00	7.4108E-02	5.1304E-01	161
8.7473E-02	5.0119E 00	7.9530E-01	8.3127E-02	5.7548E-01	171
1.1012E-01	6.3096E 00	4.6973E-01	9.1640E-02	6.3442E-01	181
1.3864E-01	7.9433E 00	2.7731E-01	9.9587E-02	6.8943E-01	191
1.7453E-01	1.0000E 01	1.6703E-01	1.0707E-01	7.4125E-01	201
2.6180E-01	1.5000E 01	6.2972E-02	1.1926E-01	8.2562E-01	206
3.4907E-01	2.0000E 01	2.6571E-02	1.2593E-01	8.7181E-01	211
4.3633E-01	2.5000E 01	1.4262E-02	1.2988E-01	8.9988E-01	216
5.2360E-01	3.0000E 01	8.6717E-03	1.3279E-01	9.1930E-01	221
6.1086E-01	3.5000E 01	5.5317E-03	1.3483E-01	9.3341E-01	226
6.9813E-01	4.0000E 01	3.7371E-03	1.3634E-01	9.4399E-01	231
7.8540E-01	4.5000E 01	2.6614E-03	1.3751E-01	9.5196E-01	236
8.7266E-01	5.0000E 01	1.9664E-03	1.3843E-01	9.5836E-01	241
9.5993E-01	5.5000E 01	1.4994E-03	1.3918E-01	9.6352E-01	246
1.0472E 00	6.0000E 01	1.1751E-03	1.3979E-01	9.6777E-01	251
1.1345E 00	6.5000E 01	9.5361E-04	1.4031E-01	9.7132E-01	256
1.2217E 00	7.0000E 01	7.8958E-04	1.4074E-01	9.7437E-01	261
1.3090E 00	7.5000E 01	6.4961E-04	1.4112E-01	9.7696E-01	266
1.3963E 00	8.0000E 01	5.4065E-04	1.4144E-01	9.7916E-01	271
1.4835E 00	8.5000E 01	4.6691E-04	1.4171E-01	9.8104E-01	276
1.5708E 00	9.0000E 01	4.1985E-04	1.4195E-01	9.8272E-01	281
1.6581E 00	9.5000E 01	3.9053E-04	1.4217E-01	9.8425E-01	286
1.7453E 00	1.0000E 02	3.7039E-04	1.4238E-01	9.8568E-01	291
1.8326E 00	1.0500E 02	3.5456E-04	1.4257E-01	9.8702E-01	296
1.9199E 00	1.1000E 02	3.4538E-04	1.4275E-01	9.8828E-01	301
2.0071E 00	1.1500E 02	3.4468E-04	1.4293E-01	9.8949E-01	306
2.0944E 00	1.2000E 02	3.5020E-04	1.4310E-01	9.9066E-01	311
2.1817E 00	1.2500E 02	3.5864E-04	1.4326E-01	9.9179E-01	316
2.2689E 00	1.3000E 02	3.6839E-04	1.4342E-01	9.9289E-01	321
2.3562E 00	1.3500E 02	3.7984E-04	1.4357E-01	9.9393E-01	326
2.4435E 00	1.4000E 02	3.9206E-04	1.4371E-01	9.9492E-01	331
2.5307E 00	1.4500E 02	4.0196E-04	1.4385E-01	9.9586E-01	336
2.6180E 00	1.5000E 02	4.2720E-04	1.4397E-01	9.9668E-01	341
2.7053E 00	1.5500E 02	4.8531E-04	1.4408E-01	9.9747E-01	346
2.7925E 00	1.6000E 02	5.6216E-04	1.4419E-01	9.9823E-01	351
2.8798E 00	1.6500E 02	6.4556E-04	1.4429E-01	9.9891E-01	356
2.9671E 00	1.7000E 02	7.4012E-04	1.4437E-01	9.9948E-01	361
3.0543E 00	1.7500E 02	8.0991E-04	1.4443E-01	9.9986E-01	366
3.1416E 00	1.8000E 02	8.2043E-04	1.4445E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-82. Volume scattering function (sheet 3 of 3).

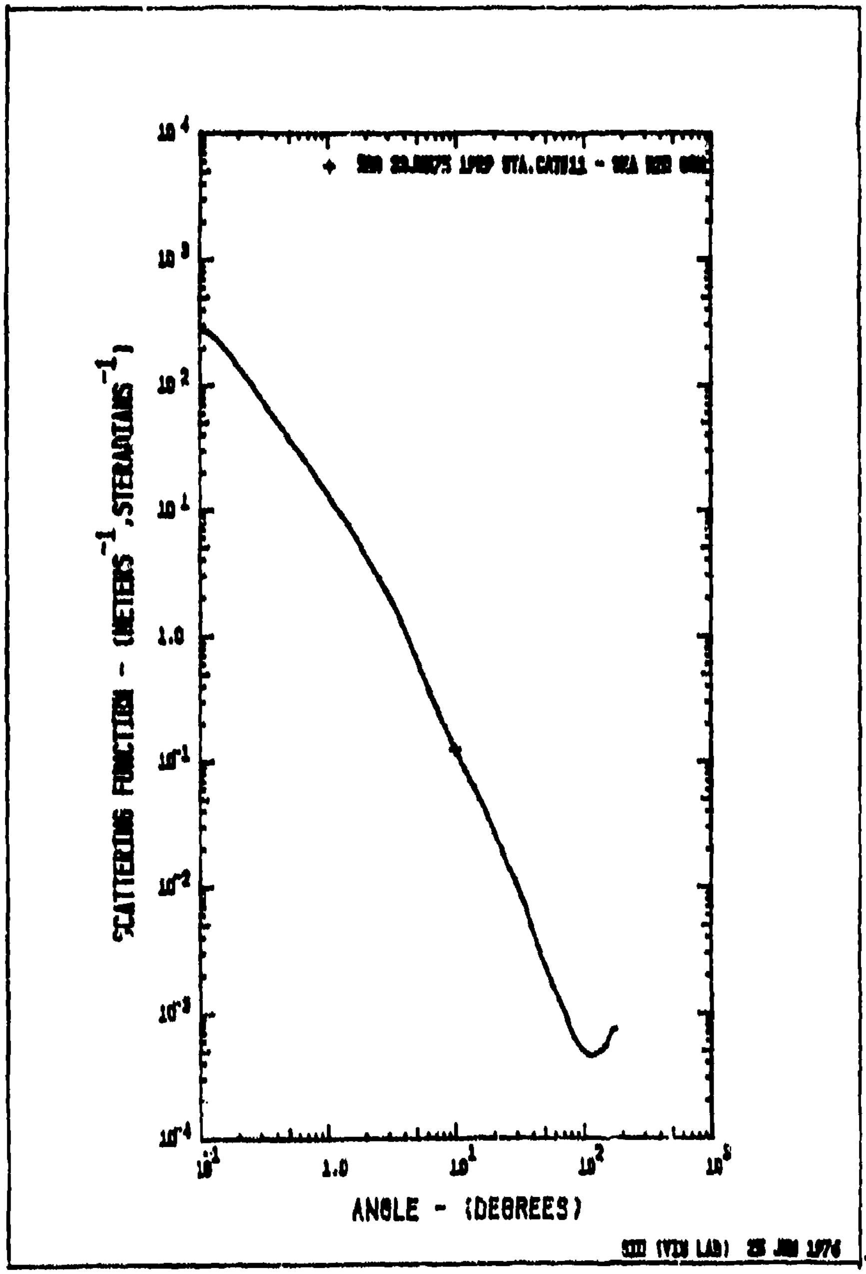


Figure D-83. Volume scattering function (sheet 1 of 3).

520 23JUN75 1929 STA.CAT#11 - SEA H2O 80M

	DATA READ IN ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	SIGMA
1	0.1750	1.7000E 02	0	0.1750	1.6764E 02
2	0.3500	6.0000E 01	0	0.3500	6.1665E 01
3	0.7000	2.3000E 01	0	0.7000	2.2682E 01
4	10.00	1.2266E-01	0	10.00	1.2266E-01
5	15.00	5.2630E-02	0	15.00	5.2630E-02
6	20.00	2.7533E-02	0	20.00	2.7533E-02
7	25.00	1.5612E-02	0	25.00	1.5612E-02
8	30.00	1.0488E-02	0	30.00	1.0488E-02
9	40.00	4.4516E-03	0	40.00	4.4516E-03
10	50.00	2.3906E-03	0	50.00	2.3906E-03
11	60.00	1.5179E-03	0	60.00	1.5179E-03
12	70.00	1.0615E-03	0	70.00	1.0615E-03
13	80.00	7.1903E-04	0	80.00	7.1903E-04
14	90.00	5.6092E-04	0	90.00	5.6092E-04
15	100.0	4.9376E-04	0	100.0	4.9376E-04
16	110.0	4.5981E-04	0	110.0	4.5981E-04
17	120.0	4.5743E-04	0	120.0	4.5743E-04
18	130.0	4.7346E-04	0	130.0	4.7346E-04
19	140.0	5.0368E-04	0	140.0	5.0368E-04
20	150.0	5.4564E-04	0	150.0	5.4564E-04
21	160.0	6.5240E-04	0	160.0	6.5240E-04
22	170.0	7.2778E-04	0	170.0	7.2778E-04
23			1	180.0	7.5024E-04

ALPHA= 0.2366 S/ALPHA= 0.607
S= 0.1437 A/ALPHA= 0.393
A= 0.0929 B/S= 0.022

CORRECTED ALPHA CORRECTION=0.002

ALPHA= 0.2390 S/ALPHA= 0.601
S= 0.1437 A/ALPHA= 0.399
A= 0.0953 B/S= 0.022

SIGMA(0.0 DEGREES)= 373.8
SIGMA(0.1 DEGREES)= 283.5
SLOPE(3 MILLIRAD)= -1.443
S UP TO 0.1 DEGREES= 3.1223E-03 NORMALIZED= 2.17276E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 107.0
EXPECTED K/ALPHA= 0.5000 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K

	MU	RADIANS	DEGREES
MEDIAN	0.9985	0.5423E-01	3.107
MEAN 1	0.9272	0.3839	22.00
VARIANCE	0.2516		
MEAN 2		0.1994	11.42
RMS		0.4388	25.14
RMS 2		0.3909	22.39

KAPPA= 0.1195 KAPPA'= 4.1579E-03

THETA**2 BAR 9.6263E-02 RADIANS**2

Figure D-83. Volume scattering function (sheet 2 of 3).

520 23JUN75 1929 STA.CAT#11 - SEA H2O 80M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	2.8349E 02	3.1223E-03	2.1728E-02	1
2.1972E-03	1.2589E-01	2.4253E 02	4.5909E-03	3.1947E-02	11
2.7662E-03	1.5849E-01	1.9148E 02	6.5047E-03	4.5266E-02	21
3.4824E-03	1.9953E-01	1.3874E 02	8.7861E-03	6.1141E-02	31
4.3841E-03	2.5119E-01	9.9519E 01	1.1383E-02	7.9214E-02	41
5.5192E-03	3.1623E-01	7.1387E 01	1.4336E-02	9.9761E-02	51
6.9483E-03	3.9811E-01	5.1207E 01	1.7693E-02	1.2312E-01	61
8.7474E-03	5.0119E-01	3.6732E 01	2.1509E-02	1.4968E-01	71
1.1012E-02	6.3096E-01	2.6349E 01	2.5847E-02	1.7987E-01	81
1.3864E-02	7.9433E-01	1.8868E 01	3.0778E-02	2.1418E-01	91
1.7453E-02	1.0000E 00	1.3364E 01	3.6346E-02	2.5292E-01	101
2.1972E-02	1.2589E 00	9.3316E 00	4.2552E-02	2.9611E-01	111
2.7662E-02	1.5849E 00	6.4079E 00	4.9363E-02	3.4351E-01	121
3.4824E-02	1.9953E 00	4.3169E 00	5.6705E-02	3.9460E-01	131
4.3841E-02	2.5119E 00	2.8464E 00	6.4461E-02	4.4857E-01	141
5.5192E-02	3.1623E 00	1.8326E 00	7.2469E-02	5.0430E-01	151
6.9483E-02	3.9811E 00	1.1169E 00	8.0454E-02	5.5987E-01	161
8.7473E-02	5.0119E 00	6.4139E-01	8.7917E-02	6.1180E-01	171
1.1012E-01	6.3096E 00	3.6000E-01	9.4609E-02	6.5837E-01	181
1.3864E-01	7.9433E 00	2.0489E-01	1.0058E-01	6.9992E-01	191
1.7453E-01	1.0000E 01	1.2266E-01	1.0607E-01	7.3816E-01	201
2.6180E-01	1.5000E 01	5.2630E-02	1.1538E-01	8.0292E-01	206
3.4907E-01	2.0000E 01	2.7533E-02	1.2160E-01	8.462[illegible]E-01	211
4.3633E-01	2.5000E 01	1.5612E-02	1.2593E-01	8.7[illegible]E-01	216
5.2360E-01	3.0000E 01	1.0488E-02	1.2917E-01	8.9885E-01	221
6.1086E-01	3.5000E 01	6.6516E-03	1.3163E-01	9.1601E-01	226
6.9813E-01	4.0000E 01	4.4516E-03	1.3344E-01	9.2859E-01	231
7.8540E-01	4.5000E 01	3.1872E-03	1.3483E-01	9.3828E-01	236
8.7266E-01	5.0000E 01	2.390[illegible]E-03	1.3595E-01	9.4602E-01	241
9.5993E-01	5.5000E 01	1.8771E-03	1.3686E-01	9.5242E-01	246
1.0472E 00	6.0000E 01	1.5179E-03	1.3764E-01	9.5785E-01	251
1.1345E 00	6.5000E 01	1.2606E-03	1.3832E-01	9.6252E-01	256
1.2217E 00	7.0000E 01	1.0615E-03	1.3890E-01	9.6660E-01	261
1.3090E 00	7.5000E 01	8.7005E-04	1.3941E-01	9.7011E-01	266
1.3963E 00	8.0000E 01	7.1903E-04	1.3983E-01	9.7305E-01	271
1.4835E 00	8.5000E 01	6.2297E-04	1.4019E-01	9.7557E-01	276
1.5708E 00	9.0000E 01	5.6092E-04	1.4051E-01	9.7782E-01	281
1.6581E 00	9.5000E 01	5.2134E-04	1.4081E-01	9.7988E-01	286
1.7453E 00	1.0000E 02	4.9376E-04	1.4109E-01	9.8179E-01	291
1.8326E 00	1.0500E 02	4.7304E-04	1.4134E-01	9.8359E-01	296
1.9199E 00	1.1000E 02	4.5981E-04	1.4159E-01	9.8528E-01	301
2.0071E 00	1.1500E 02	4.5531E-04	1.4182E-01	9.8690E-01	306
2.0944E 00	1.2000E 02	4.5743E-04	1.4204E-01	9.8844E-01	311
2.1817E 00	1.2500E 02	4.6356E-04	1.4225E-01	9.8992E-01	316
2.2689E 00	1.3000E 02	4.7346E-04	1.4246E-01	9.9133E-01	321
2.3562E 00	1.3500E 02	4.8760E-04	1.4265E-01	9.9269E-01	326
2.4435E 00	1.4000E 02	5.0368E-04	1.4283E-01	9.9396E-01	331
2.5307E 00	1.4500E 02	5.2159E-04	1.4300E-01	9.9515E-01	336
2.6180E 00	1.5000E 02	5.4564E-04	1.4316E-01	9.9624E-01	341
2.7053E 00	1.5500E 02	5.9475E-04	1.4331E-01	9.9724E-01	346
2.7925E 00	1.6000E 02	6.5240E-04	1.4344E-01	9.9815E-01	351
2.8798E 00	1.6500E 02	6.9407E-04	1.4355E-01	9.9892E-01	356
2.9671E 00	1.7000E 02	7.2778E-04	1.4363E-01	9.9951E-01	361
3.0543E 00	1.7500E 02	7.4542E-04	1.4368E-01	9.9988E-01	366
3.1416E 00	1.8000E 02	7.5024E-04	1.4370E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-83. Volume scattering function (sheet 3 of 3).

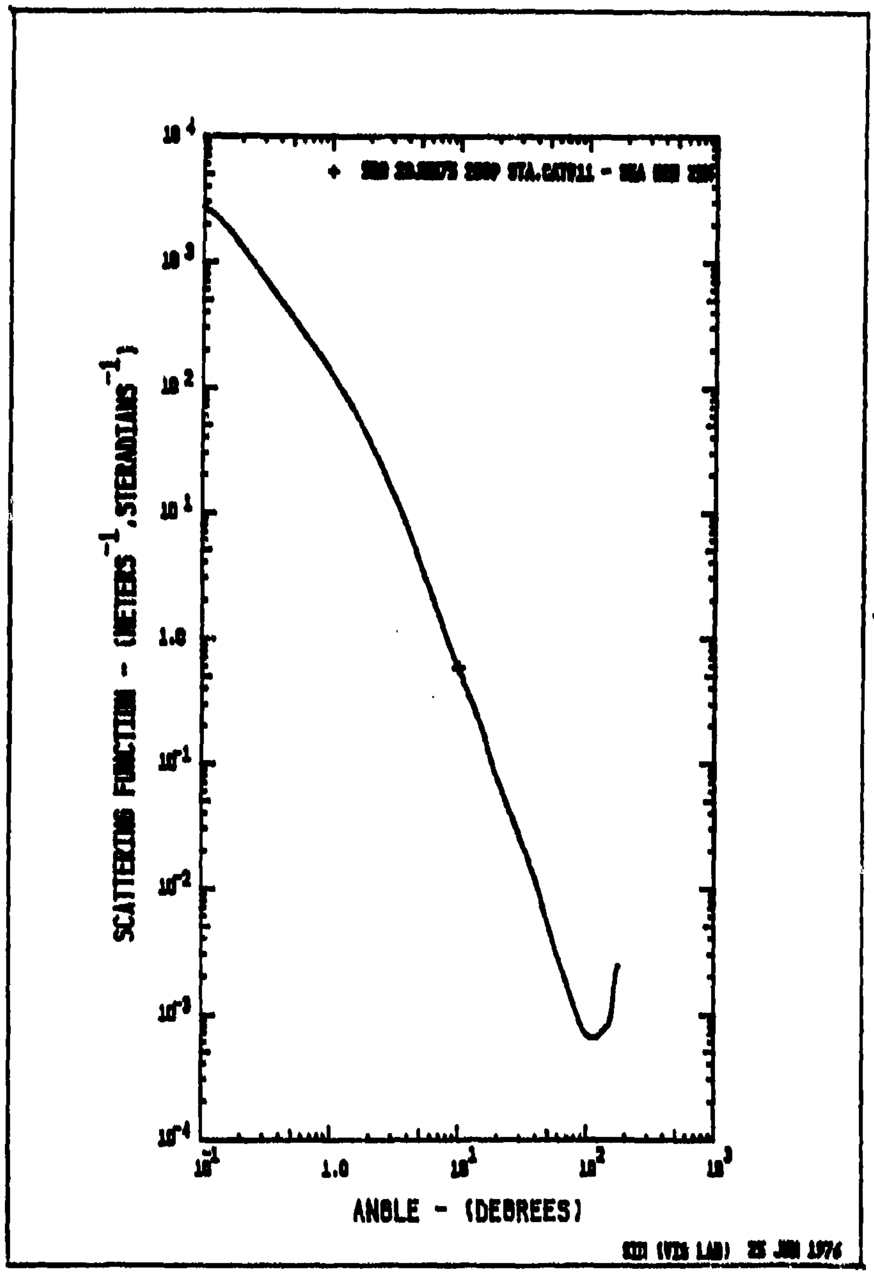


Figure D-84. Volume scattering function (sheet 1 of 3).

520 23JUN75 2039 STA.CAT#11 - SEA H2O 25M

	DATA READ IN ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	SIGMA
1	0.1750	1.6400E 03	0	0.1750	1.6713E 03
2	0.3500	6.5000E 02	0	0.3500	6.2591E 02
3	0.7000	2.3000E 02	0	0.7000	2.3460E 02
4	10.00	5.8157E-01	0	10.00	5.8157E-01
5	15.00	2.0069E-01	0	15.00	2.0069E-01
6	20.00	7.7817E-02	0	20.00	7.7817E-02
7	25.00	4.3996E-02	0	25.00	4.3996E-02
8	30.00	2.6413E-02	0	30.00	2.6413E-02
9	40.00	1.2261E-02	0	40.00	1.2261E-02
10	50.00	5.4711E-03	0	50.00	5.4711E-03
11	60.00	2.9450E-03	0	60.00	2.9450E-03
12	70.00	1.8411E-03	0	70.00	1.8411E-03
13	80.00	1.2279E-03	0	80.00	1.2279E-03
14	90.00	8.6396E-04	0	90.00	8.6396E-04
15	100.0	7.1157E-04	0	100.0	7.1157E-04
16	110.0	6.5569E-04	0	110.0	6.5569E-04
17	120.0	6.5365E-04	0	120.0	6.5365E-04
18	130.0	6.9870E-04	0	130.0	6.9870E-04
19	140.0	7.7052E-04	0	140.0	7.7052E-04
20	150.0	8.2189E-04	0	150.0	8.2189E-04
21	160.0	1.0764E-03	0	160.0	1.0764E-03
22	170.0	2.0157E-03	0	170.0	2.0157E-03
23			1	180.0	2.4092E-03

ALPHA= 0.9754 S/ALPHA= 1.043
S= 1.0169 A/ALPHA= -0.043
A=-0.0415 B/S= 0.005

CORRECTED ALPHA CORRECTION=0.024

ALPHA= 0.9989 S/ALPHA= 1.018
S= 1.0169 A/ALPHA= -0.018
A=-0.0180 B/S= 0.005

SIGMA(0.0 DEGREES)= 3677.
SIGMA(0.1 DEGREES)= 2803.
SLOPE(3 MILLIRAD)= -1.417
S UP TO 0.1 DEGREES= 3.0787E-02 NORMALIZED= 3.02743E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 106.0
EXPECTED K/ALPHA= 1.5877E-02 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K

	MU	RADIANS	DEGREES
MEDIAN	0.9996	0.2861E-01	1.639
MEAN 1	0.9790	0.2055	11.77
VARIANCE	0.1256		
MEAN 2		0.8767E-01	5.023
RMS		0.2310	13.23
RMS 2		0.2137	12.24

KAPPA= 1.5860E-02 KAPPA'= 1.1254E-03

THETA**2 BAR 2.6676E-02 RADIANS**2

Figure D-84. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0728.12

520 23JUN75 2039 STA.CAT#11 - SEA H2O 25M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	2.8026E 03	3.0787E-02	3.0274E-02	1
2.1972E-03	1.2589E-01	2.4042E 03	4.5325E-02	4.4570E-02	11
2.7662E-03	1.5849E-01	1.9053E 03	6.4332E-02	6.3261E-02	21
3.4824E-03	1.9953E-01	1.3879E 03	8.7091E-02	8.5641E-02	31
4.3841E-03	2.5119E-01	1.0019E 03	1.1315E-01	1.1127E-01	41
5.5192E-03	3.1623E-01	7.2269E 02	1.4295E-01	1.4057E-01	51
6.9483E-03	3.9811E-01	5.2150E 02	1.7704E-01	1.7409E-01	61
8.7474E-03	5.0119E-01	3.7632E 02	2.1602E-01	2.1243E-01	71
1.1012E-02	6.3096E-01	2.7155E 02	2.6061E-01	2.5627E-01	81
1.3864E-02	7.9433E-01	1.9520E 02	3.1155E-01	3.0637E-01	91
1.7453E-02	1.0000E 00	1.3694E 02	3.6895E-01	3.6281E-01	101
2.1972E-02	1.2589E 00	9.3217E 01	4.3181E-01	4.2462E-01	111
2.7662E-02	1.5849E 00	6.1370E 01	4.9851E-01	4.9021E-01	121
3.4824E-02	1.9953E 00	3.8951E 01	5.6686E-01	5.5742E-01	131
4.3841E-02	2.5119E 00	2.3758E 01	6.3427E-01	6.2370E-01	141
5.5192E-02	3.1623E 00	1.3880E 01	6.9806E-01	6.8644E-01	151
6.9483E-02	3.9811E 00	7.6483E 00	7.5555E-01	7.4297E-01	161
8.7473E-02	5.0119E 00	4.0053E 00	8.0438E-01	7.9099E-01	171
1.1012E-01	6.3096E 00	2.0579E 00	8.4441E-01	8.3035E-01	181
1.3864E-01	7.9433E 00	1.0701E 00	8.7707E-01	8.6247E-01	191
1.7453E-01	1.0000E 01	5.8158E-01	9.0447E-01	8.8941E-01	201
2.6180E-01	1.5000E 01	2.0069E-01	9.4455E-01	9.2883E-01	206
3.4907E-01	2.0000E 01	7.7817E-02	9.6498E-01	9.4891E-01	211
4.3633E-01	2.5000E 01	4.3996E-02	9.7716E-01	9.6089E-01	216
5.2360E-01	3.0000E 01	2.6413E-02	9.8576E-01	9.6935E-01	221
6.1086E-01	3.5000E 01	1.7686E-02	9.9209E-01	9.7557E-01	226
6.9813E-01	4.0000E 01	1.2261E-02	9.9702E-01	9.8042E-01	231
7.8540E-01	4.5000E 01	8.0961E-03	1.0007E 00	9.8407E-01	236
8.7266E-01	5.0000E 01	5.4711E-03	1.0034E 00	9.8671E-01	241
9.5993E-01	5.5000E 01	3.9220E-03	1.0054E 00	9.8869E-01	246
1.0472E 00	6.0000E 01	2.9450E-03	1.0070E 00	9.9023E-01	251
1.1345E 00	6.5000E 01	2.3061E-03	1.0083E 00	9.9147E-01	256
1.2217E 00	7.0000E 01	1.8411E-03	1.0093E 00	9.9250E-01	261
1.3090E 00	7.5000E 01	1.4934E-03	1.0102E 00	9.9335E-01	266
1.3963E 00	8.0000E 01	1.2279E-03	1.0109E 00	9.9407E-01	271
1.4835E 00	8.5000E 01	1.0231E-03	1.0115E 00	9.9466E-01	276
1.5708E 00	9.0000E 01	8.6396E-04	1.0120E 00	9.9518E-01	281
1.6581E 00	9.5000E 01	7.6530E-04	1.0125E 00	9.9561E-01	286
1.7453E 00	1.0000E 02	7.1157E-04	1.0129E 00	9.9600E-01	291
1.8326E 00	1.0500E 02	6.7553E-04	1.0132E 00	9.9636E-01	296
1.9199E 00	1.1000E 02	6.5569E-04	1.0136E 00	9.9671E-01	301
2.0071E 00	1.1500E 02	6.4803E-04	1.0139E 00	9.9703E-01	306
2.0944E 00	1.2000E 02	6.5365E-04	1.0142E 00	9.9734E-01	311
2.1817E 00	1.2500E 02	6.7179E-04	1.0145E 00	9.9764E-01	316
2.2689E 00	1.3000E 02	6.9870E-04	1.0148E 00	9.9794E-01	321
2.3562E 00	1.3500E 02	7.3375E-04	1.0151E 00	9.9822E-01	326
2.4435E 00	1.4000E 02	7.7052E-04	1.0154E 00	9.9850E-01	331
2.5307E 00	1.4500E 02	7.9716E-04	1.0157E 00	9.9875E-01	336
2.6180E 00	1.5000E 02	8.2189E-04	1.0159E 00	9.9899E-01	341
2.7053E 00	1.5500E 02	9.0417E-04	1.0161E 00	9.9920E-01	346
2.7925E 00	1.6000E 02	1.0764E-03	1.0163E 00	9.9940E-01	351
2.8798E 00	1.6500E 02	1.4024E-03	1.0165E 00	9.9959E-01	356
2.9671E 00	1.7000E 02	2.0157E-03	1.0167E 00	9.9974E-01	361
3.0543E 00	1.7500E 02	2.3228E-03	1.0169E 00	9.9994E-01	366
3.1416E 00	1.8000E 02	2.4092E-03	1.0169E 00	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-84. Volume scattering function (sheet 3 of 3).

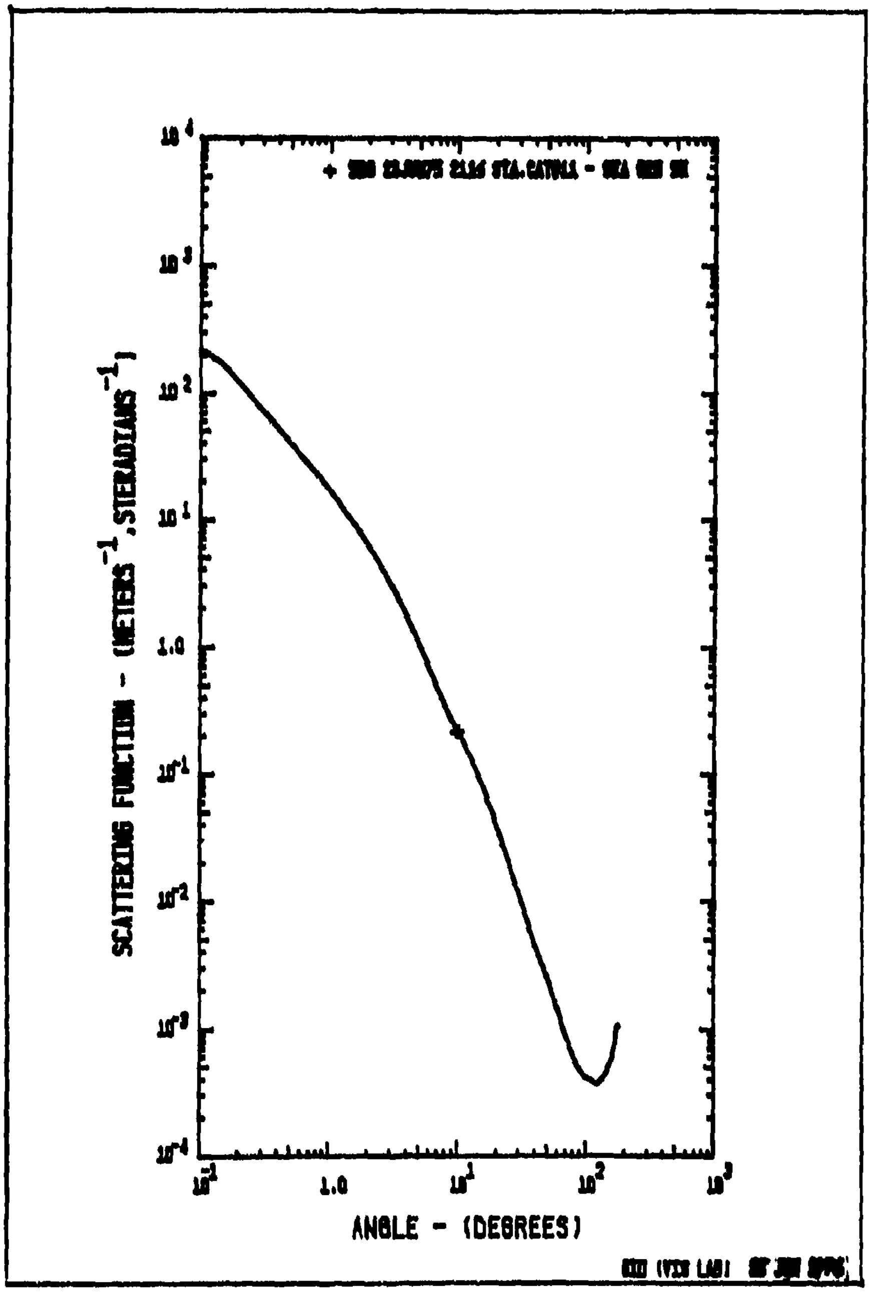


Figure D-85. Volume scattering function (sheet 1 of 3).

520 23JUN75 2116 STA.CAT#11 - SEA H2O 5M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	1.4200E 02	0	0.1750	1.4432E 02
2	0.3500	6.5000E 01	0	0.3500	6.2932E 01
3	0.7000	2.7000E 01	0	0.7000	2.7442E 01
4	10.00	2.2042E-01	0	10.00	2.2042E-01
5	15.00	9.2601E-02	0	15.00	9.2601E-02
6	20.00	4.0431E-02	0	20.00	4.0431E-02
7	25.00	1.9694E-02	0	25.00	1.9694E-02
8	30.00	1.1699E-02	0	30.00	1.1699E-02
9	40.00	4.5749E-03	0	40.00	4.5749E-03
10	50.00	2.5539E-03	0	50.00	2.5539E-03
11	60.00	1.4612E-03	0	60.00	1.4612E-03
12	70.00	9.0660E-04	0	70.00	9.0660E-04
13	80.00	6.2060E-04	0	80.00	6.2060E-04
14	90.00	4.8901E-04	0	90.00	4.8901E-04
15	100.0	4.2379E-04	0	100.0	4.2379E-04
16	110.0	4.0379E-04	0	110.0	4.0379E-04
17	120.0	3.8425E-04	0	120.0	3.8425E-04
18	130.0	4.0971E-04	0	130.0	4.0971E-04
19	140.0	4.4944E-04	0	140.0	4.4944E-04
20	150.0	5.1852E-04	0	150.0	5.1852E-04
21	160.0	6.1572E-04	0	160.0	6.1572E-04
22	170.0	9.6025E-04	0	170.0	9.6025E-04
23			1	180.0	1.0875E-03

ALPHA= 0.2771 S/ALPHA= 0.717
S= 0.1987 A/ALPHA= 0.283
A= 0.0784 B/S= 0.014

CORRECTED ALPHA CORRECTION=0.002

ALPHA= 0.2789 S/ALPHA= 0.713
S= 0.1987 A/ALPHA= 0.287
A= 0.0801 B/S= 0.014

SIGMA(0.0 DEGREES)= 275.0
SIGMA(0.1 DEGREES)= 220.9
SLOPE(3 MILLIRAD)= -1.197
S UP TO 0.1 DEGREES= 2.3622E-03 NORMALIZED= 1.18856E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 95.00
EXPECTED K/ALPHA= 0.3913 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K

	MU	RADIANS	DEGREES
MEDIAN	0.9980	0.6389E-01	3.661
MEAN 1	0.9469	0.3273	18.75
VARIANCE	0.2076		
MEAN 2		0.1739	9.962
RMS		0.3719	21.31
RMS 2		0.3288	18.84

KAPPA= 0.1091 KAPPA'= 2.8467E-03

THETA**2 BAR 6.9166E-02 RADIANS**2

Figure D-85. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0726.38

520 23JUN75 2116 STA.CAT#11 - SEA H2O 5M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	2.2093E 02	2.3622E-03	1.1886E-02	1
2.1972E-03	1.2589E-01	1.9503E 02	3.5246E-03	1.7734E-02	11
2.7662E-03	1.5849E-01	1.6104E 02	5.0981E-03	2.5651E-02	21
3.4824E-03	1.9953E-01	1.2335E 02	7.0716E-03	3.5581E-02	31
4.3841E-03	2.5119E-01	9.3623E 01	9.4485E-03	4.7540E-02	41
5.5192E-03	3.1623E-01	7.1062E 01	1.2308E-02	6.1927E-02	51
6.9483E-03	3.9811E-01	5.3938E 01	1.5748E-02	7.9234E-02	61
8.7474E-03	5.0119E-01	4.0941E 01	1.9886E-02	1.0005E-01	71
1.1012E-02	6.3096E-01	3.1075E 01	2.4863E-02	1.2510E-01	81
1.3864E-02	7.9433E-01	2.3535E 01	3.0849E-02	1.5522E-01	91
1.7453E-02	1.0000E 00	1.7580E 01	3.7988E-02	1.9114E-01	101
2.1972E-02	1.2589E 00	1.2892E 01	4.6362E-02	2.3327E-01	111
2.7662E-02	1.5849E 00	9.2524E 00	5.5990E-02	2.8171E-01	121
3.4824E-02	1.9953E 00	6.4772E 00	6.6805E-02	3.3613E-01	131
4.3841E-02	2.5119E 00	4.4089E 00	7.8637E-02	3.9566E-01	141
5.5192E-02	3.1623E 00	2.9085E 00	9.1203E-02	4.5889E-01	151
6.9483E-02	3.9811E 00	1.8142E 00	1.0402E-01	5.2336E-01	161
8.7473E-02	5.0119E 00	1.0701E 00	1.1630E-01	5.8516E-01	171
1.1012E-01	6.3096E 00	6.1745E-01	1.2762E-01	6.4210E-01	181
1.3864E-01	7.9433E 00	3.6055E-01	1.3799E-01	6.9429E-01	191
1.7453E-01	1.0000E 01	2.2042E-01	1.4777E-01	7.4349E-01	201
2.6180E-01	1.5000E 01	9.2601E-02	1.6457E-01	8.2805E-01	206
3.4907E-01	2.0000E 01	4.0431E-02	1.7470E-01	8.7901E-01	211
4.3633E-01	2.5000E 01	1.9694E-02	1.8059E-01	9.0863E-01	216
5.2360E-01	3.0000E 01	1.1699E-02	1.8441E-01	9.2787E-01	221
6.1086E-01	3.5000E 01	7.0511E-03	1.8710E-01	9.4138E-01	226
6.9813E-01	4.0000E 01	4.5749E-03	1.8898E-01	9.5086E-01	231
7.8540E-01	4.5000E 01	3.3752E-03	1.9043E-01	9.5813E-01	236
8.7266E-01	5.0000E 01	2.5539E-03	1.9162E-01	9.6412E-01	241
9.5993E-01	5.5000E 01	1.9093E-03	1.9258E-01	9.6895E-01	246
1.0472E 00	6.0000E 01	1.4612E-03	1.9335E-01	9.7284E-01	251
1.1345E 00	6.5000E 01	1.1405E-03	1.9398E-01	9.7600E-01	256
1.2217E 00	7.0000E 01	9.0660E-04	1.9449E-01	9.7859E-01	261
1.3090E 00	7.5000E 01	7.3949E-04	1.9492E-01	9.8074E-01	266
1.3963E 00	8.0000E 01	6.2060E-04	1.9528E-01	9.8256E-01	271
1.4835E 00	8.5000E 01	5.4171E-04	1.9560E-01	9.8414E-01	276
1.5708E 00	9.0000E 01	4.8901E-04	1.9588E-01	9.8556E-01	281
1.6581E 00	9.5000E 01	4.4768E-04	1.9613E-01	9.8684E-01	286
1.7453E 00	1.0000E 02	4.2379E-04	1.9637E-01	9.8803E-01	291
1.8326E 00	1.0500E 02	4.1320E-04	1.9659E-01	9.8916E-01	296
1.9199E 00	1.1000E 02	4.0379E-04	1.9681E-01	9.9023E-01	301
2.0071E 00	1.1500E 02	3.9311E-04	1.9701E-01	9.9125E-01	306
2.0944E 00	1.2000E 02	3.8425E-04	1.9720E-01	9.9220E-01	311
2.1817E 00	1.2500E 02	3.9126E-04	1.9738E-01	9.9309E-01	316
2.2689E 00	1.3000E 02	4.0971E-04	1.9755E-01	9.9397E-01	321
2.3562E 00	1.3500E 02	4.2740E-04	1.9772E-01	9.9482E-01	326
2.4435E 00	1.4000E 02	4.4944E-04	1.9788E-01	9.9564E-01	331
2.5307E 00	1.4500E 02	4.8106E-04	1.9804E-01	9.9642E-01	336
2.6180E 00	1.5000E 02	5.1852E-04	1.9818E-01	9.9716E-01	341
2.7053E 00	1.5500E 02	5.6116E-04	1.9832E-01	9.9784E-01	346
2.7925E 00	1.6000E 02	6.1572E-04	1.9844E-01	9.9846E-01	351
2.8798E 00	1.6500E 02	7.3472E-04	1.9855E-01	9.9901E-01	356
2.9671E 00	1.7000E 02	9.6025E-04	1.9865E-01	9.9951E-01	361
3.0543E 00	1.7500E 02	1.0594E-03	1.9872E-01	9.9987E-01	366
3.1416E 00	1.8000E 02	1.0875E-03	1.9875E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-85. Volume scattering function (sheet 3 of 3).

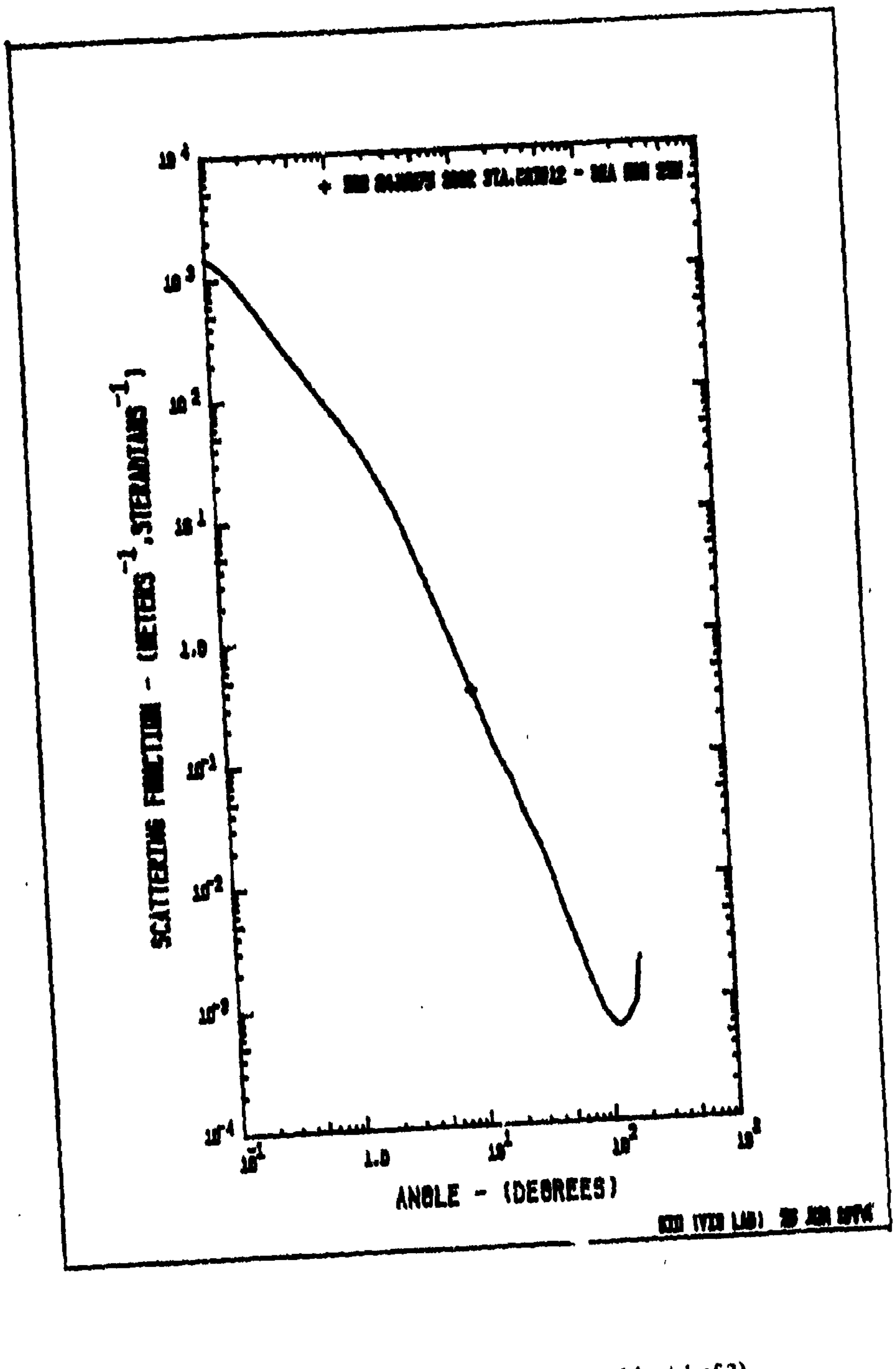


Figure D-86. Volume scattering function (sheet 1 of 3).

520 24JUN75 2032 STA.CAT#12 - SEA H2O 29M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	8.5000E 02	0	0.1750	8.6233E 02
2	0.3500	3.2500E 02	0	0.3500	3.1580E 02
3	0.7000	1.1400E 02	0	0.7000	1.1565E 02
4	10.00	3.6980E-01	0	10.00	3.6980E-01
5	15.00	1.1637E-01	0	15.00	1.1637E-01
6	20.00	6.3968E-02	0	20.00	6.3968E-02
7	25.00	3.2670E-02	0	25.00	3.2670E-02
8	30.00	2.1676E-02	0	30.00	2.1676E-02
9	40.00	9.6797E-03	0	40.00	9.6797E-03
10	50.00	4.6013E-03	0	50.00	4.6013E-03
11	60.00	2.6410E-03	0	60.00	2.6410E-03
12	70.00	1.6411E-03	0	70.00	1.4411E-03
13	80.00	1.1549E-03	0	80.00	1.1549E-03
14	90.00	8.5261E-04	0	90.00	8.5261E-04
15	100.0	7.2708E-04	0	100.0	7.2708E-04
16	110.0	6.3876E-04	0	110.0	6.3876E-04
17	120.0	6.1928E-04	0	120.0	6.1928E-04
18	130.0	6.5475E-04	0	130.0	6.5475E-04
19	140.0	7.3063E-04	0	140.0	7.3063E-04
20	150.0	8.2860E-04	0	150.0	8.2860E-04
21	160.0	9.5474E-04	0	160.0	9.5474E-04
22	170.0	1.8395E-03	0	170.0	1.8395E-03
23			1	180.0	2.1889E-03

ALPHA= 0.6427 S/ALPHA= 0.894
S= 0.5748 A/ALPHA= 0.106
A= 0.0679 B/S= 0.008

CORRECTED ALPHA CORRECTION=0.012

ALPHA= 0.6551 S/ALPHA= 0.877
S= 0.5748 A/ALPHA= 0.123
A= 0.0803 B/S= 0.008

SIGMA(0.0 DEGREES)= 1949.
SIGMA(0.1 DEGREES)= 1471.
SLOPE(3 MILLIRAD)= -1.449
S UP TO 0.1 DEGREES= 1.6239E-02 NORMALIZED= 2.8250E-02

THETA** C BAR 4.1189E-02 RADIANS**2

Figure D-86. Volume scattering function (sheet 2 of 3).

25 JUN 1976 1138.34

520 24JUN75 2032 STA.CAT#12 - SFA H2O 25M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	1.4706E 03	1.6239E-02	2.8251E-02	1
2.1972E-03	1.2589E-01	1.2547E 03	2.3848E-02	4.1486E-02	11
2.7662E-03	1.5849E-01	9.8681E 02	3.3730E-02	5.8678E-02	21
3.4824E-03	1.9953E-01	7.1305E 02	4.5467E-02	7.9095E-02	31
4.3841E-03	2.5119E-01	5.1074E 02	5.8805E-02	1.0230E-01	41
5.5192E-03	3.1623E-01	3.6583E 02	7.3947E-02	1.2864E-01	51
6.9483E-03	3.9811E-01	2.6203E 02	9.1136E-02	1.5854E-01	61
8.7474E-03	5.0119E-01	1.8769E 02	1.1065E-01	1.9249E-01	71
1.1012E-02	6.3096E-01	1.3444E 02	1.3280E-01	2.3102E-01	81
1.3864E-02	7.9433E-01	9.6369E 01	1.5795E-01	2.7477E-01	91
1.7453E-02	1.0000E 00	6.9221E 01	1.8657E-01	3.2456E-01	101
2.1972E-02	1.2589E 00	4.9129E 01	2.1899E-01	3.8097E-01	111
2.7662E-02	1.5849E 00	3.3898E 01	2.5500E-01	4.4360E-01	121
3.4824E-02	1.9953E 00	2.2373E 01	2.9354E-01	5.1065E-01	131
4.3841E-02	2.5119E 00	1.3898E 01	3.3270E-01	5.7878E-01	141
5.5192E-02	3.1623E 00	7.9943E 00	3.6986E-01	6.4342E-01	151
6.9483E-02	3.9811E 00	4.3769E 00	4.0271E-01	7.0058E-01	161
8.747[illegible]E-02	5.0119E 00	2.3746E 00	4.3108E-01	7.4992E-01	171
1.1012E-01	6.3096E 00	1.2804E 00	4.5537E-01	7.9218E-01	181
1.3864E-01	7.9433E 00	6.6818E-01	4.7508E-01	8.2820E-01	191
1.7453E-01	1.0000E 01	3.6980E-01	4.9368E-01	8.5883E-01	201
2.6180E-01	1.5000E 01	1.1637E-01	5.1781E-01	9.0080E-01	206
3.4907E-01	2.0000E 01	6.3968E-02	5.3185E-01	9.2523E-01	211
4.3633E-01	2.5000E 01	3.2670E-02	5.4139E-01	9.4183E-01	216
5.2360E-01	3.0000E 01	2.1676E-02	5.4810E-01	9.5349E-01	221
6.1086E-01	3.5000E 01	1.4370E-02	5.5330E-01	9.6253E-01	226
6.9813E-01	4.0000E 01	9.6797E-03	5.5724E-01	9.6939E-01	231
7.8540E-01	4.5000E 01	6.5171E-03	5.6019E-01	9.7452E-01	236
8.7266E-01	5.0000E 01	4.6013E-03	5.6239E-01	9.7835E-01	241
9.5993E-01	5.5000E 01	3.4420E-03	5.6412E-01	9.8137E-01	246
1.0472E 00	6.0000E 01	2.6410E-03	5.6551E-01	9.8379E-01	251
1.1345E 00	6.5000E 01	2.0358E-03	5.6665E-01	9.8576E-01	256
1.2217E 00	7.0000E 01	1.6411E-03	5.6750E-01	9.8737E-01	261
1.3090E 00	7.5000E 01	1.3626E-03	5.6836E-01	9.8874E-01	266
1.3963E 00	8.0000E 01	1.1549E-03	5.6903E-01	9.8990E-01	271
1.4835E 00	8.5000E 01	9.8316E-04	5.6961E-01	9.9091E-01	276
1.5708E 00	9.0000E 01	8.5261E-04	5.7011E-01	9.9178E-01	281
1.6581E 00	9.5000E 01	7.7702E-04	5.7055E-01	9.9256E-01	286
1.7453E 00	1.0000E 02	7.2708E-04	5.7096E-01	9.9326E-01	291
1.8326E 00	1.0500E 02	6.7880E-04	5.7134E-01	9.9392E-01	296
1.9199E 00	1.1000E 02	6.3876E-04	5.7168E-01	9.9451E-01	301
2.0071E 00	1.1500E 02	6.1884E-04	5.7200E-01	9.9507E-01	306
2.0944E 00	1.2000E 02	6.1928E-04	5.7230E-01	9.9559E-01	311
2.1817E 00	1.2500E 02	6.3044E-04	5.7259E-01	9.9609E-01	316
2.2689E 00	1.3000E 02	6.5475E-04	5.7286E-01	9.9657E-01	321
2.3562E 00	1.3500E 02	6.8962E-04	5.7314E-01	9.9705E-01	326
2.4435E 00	1.4000E 02	7.3063E-04	5.7340E-01	9.9750E-01	331
2.5307E 00	1.4500E 02	7.7809E-04	5.7365E-01	9.9795E-01	336
2.6180E 00	1.5000E 02	8.2860E-04	5.7388E-01	9.9835E-01	341
2.7053E 00	1.5500E 02	8.7534E-04	5.7410E-01	9.9873E-01	346
2.7925E 00	1.6000E 02	9.5474E-04	5.7429E-01	9.9906E-01	351
2.8798E 00	1.6500E 02	1.2114E-03	5.7447E-01	9.9937E-01	356
2.9671E 00	1.7000E 02	1.8395E-03	5.7464E-01	9.9967E-01	361
3.0543E 00	1.7500E 02	2.1036E-03	5.7479E-01	9.9992E-01	366
3.1416E 00	1.8000E 02	2.1889E-03	5.7483E-01	1.0000E 00	371

PAUSE READY PLOTTER, MAKE AREA 3X LONG AND 2X HIGH

Figure D-86. Volume scattering function (sheet 3 of 3).

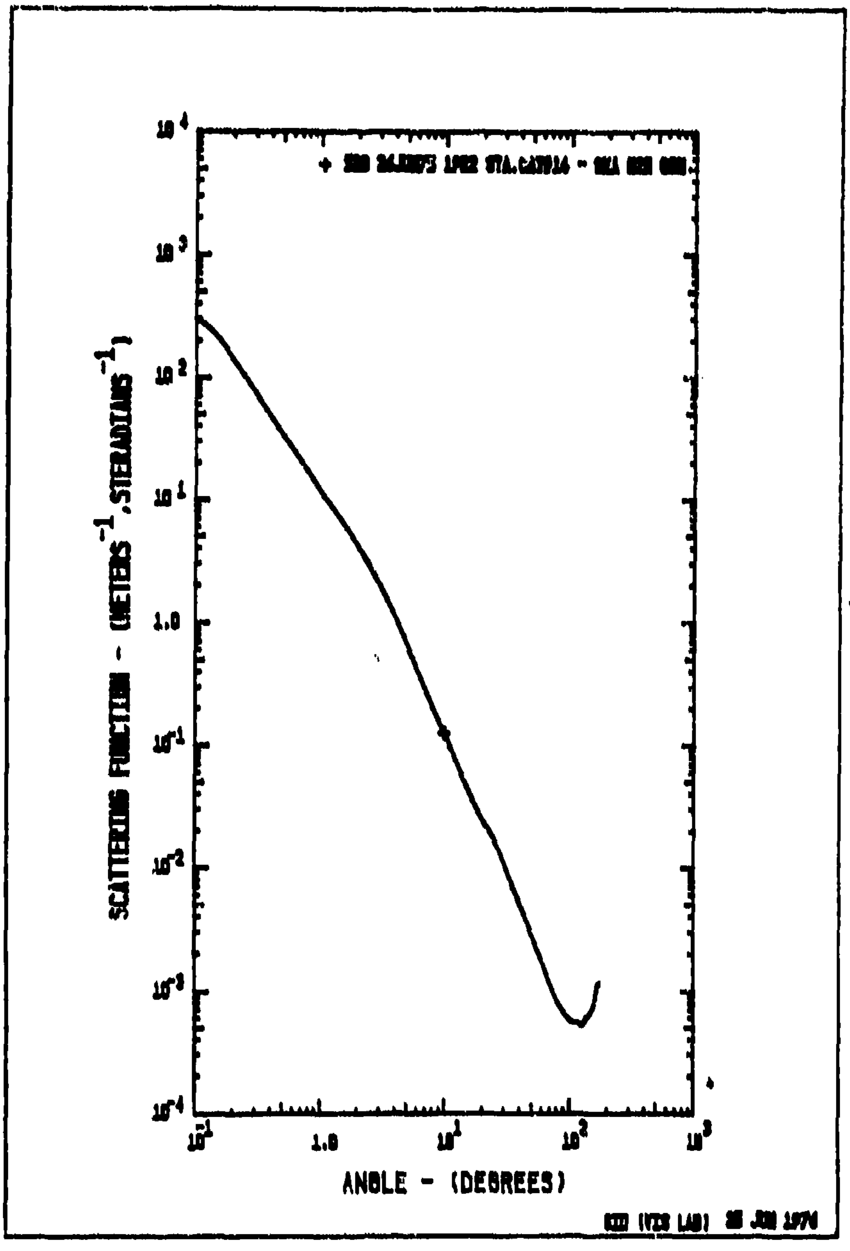


Figure D-87. Volume scattering function (sheet 1 of 3).

25 JUN 1976 0733.18 IBM 3

520 26JUN75 1922 STA.CAT#14 - SSA H20 80N

	DATA READ IN ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	SIGMA
1	0.1750	1.6900E 02	0	0.1750	1.6789E 02
2	0.3500	5.7000E 01	0	0.3500	5.7757E 01
3	0.7000	2.0000E 01	0	0.7000	1.9169E 01
4	10.00	1.2144E-01	0	10.00	1.2144E-01
5	15.00	4.6976E-02	0	15.00	4.6976E-02
6	20.00	2.4475E-02	0	20.00	2.4475E-02
7	25.00	1.6945E-02	0	25.00	1.6945E-02
8	30.00	1.1203E-02	0	30.00	1.1203E-02
9	40.00	5.2125E-03	0	40.00	5.2125E-03
10	50.00	2.9528E-03	0	50.00	2.9528E-03
11	60.00	1.8116E-03	0	60.00	1.8116E-03
12	70.00	1.1927E-03	0	70.00	1.1927E-03
13	80.00	8.6160E-04	0	80.00	8.6160E-04
14	90.00	6.8829E-04	0	90.00	6.8829E-04
15	100.0	5.8269E-04	0	100.0	5.8269E-04
16	110.0	5.3495E-04	0	110.0	5.3495E-04
17	120.0	5.2792E-04	0	120.0	5.2792E-04
18	130.0	5.0356E-04	0	130.0	5.0356E-04
19	140.0	5.7369E-04	0	140.0	5.7369E-04
20	150.0	6.2984E-04	0	150.0	6.2984E-04
21	160.0	7.0803E-04	0	160.0	7.0803E-04
22	170.0	1.0094E-03	0	170.0	1.0094E-03
23			1	180.0	1.1127E-03

ALPHA= 0.2304 S/ALPHA= 0.612
S= 0.1411 A/ALPHA= 0.388
A= 0.0893 B/S= 0.026

CORRECTED ALPHA CORRECTION=0.003

ALPHA= 0.2329 S/ALPHA= 0.606
S= 0.1411 A/ALPHA= 0.394
A= 0.0919 B/S= 0.026

SIGMA(0.0 DEGREES)= 400.7
SIGMA(0.1 DEGREES)= 296.2
SLOPE(3 MILLIRAD)= -1.539
S UP TO 0.1 DEGREES= 3.3060E-03 NORMAL'ZED= 2.34365E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 112.0
EXPECTED K/ALPHA= 0.4959 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K =

	MU	RADIANS	DEGREES
MEDIAN	0.9983	0.5915E-01	3.389
MEAN 1	0.9153	0.4145	23.75
VARIANCE	0.2717		
MEAN 2		0.2208	12.65
RMS		0.4743	27.17
RMS 2		0.4198	24.05

KAPPA= 0.1159 KAPPA'= 4.9520E-03

THETA**2 BAR 0.1125 RADIANS**2

Figure D-87. Volume scattering function (sheet 2 of 3).

520 26JUN75 1922 STA.CAT#14 - SEA H2O 80M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	2.9619E 02	3.3060E-03	2.3437E-02	1
2.1972E-03	1.2589E-01	2.4993E 02	4.8299E-03	3.4240E-02	11
2.7662E-03	1.5849E-01	1.9358E 02	6.7835E-03	4.8090E-02	21
3.4824E-03	1.9953E-01	1.3719E 02	9.0641E-03	6.4257E-02	31
4.3841E-03	2.5119E-01	9.6248E 01	1.1603E-02	8.2259E-02	41
5.5192E-03	3.1623E-01	6.7522E 01	1.4427E-02	1.0227E-01	51
6.9483E-03	3.9811E-01	4.7369E 01	1.7566E-02	1.2453E-01	61
8.7474E-03	5.0119E-01	3.3231E 01	2.1056E-02	1.4927E-01	71
1.1012E-02	6.3096E-01	2.3313E 01	2.4937E-02	1.7678E-01	81
1.3864E-02	7.9433E-01	1.6392E 01	2.9254E-02	2.0738E-01	91
1.7453E-02	1.0000E 00	1.1669E 01	3.4094E-02	2.4170E-01	101
2.1972E-02	1.2589E 00	8.3410E 00	3.9571E-02	2.8053E-01	111
2.7662E-02	1.5849E 00	5.9214E 00	4.5760E-02	3.2440E-01	121
3.4824E-02	1.9953E 00	4.1289E 00	5.2666E-02	3.7336E-01	131
4.3841E-02	2.5119E 00	2.7966E 00	6.0193E-02	4.2672E-01	141
5.5192E-02	3.1623E 00	1.8198E 00	6.8117E-02	4.8290E-01	151
6.9483E-02	3.9811E 00	1.1186E 00	7.6069E-02	5.3927E-01	161
8.7473E-02	5.0119E 00	6.5347E-01	8.3606E-02	5.9270E-01	171
1.1012E-01	6.3096E 00	3.7146E-01	9.0473E-02	6.4138E-01	181
1.3864E-01	7.9433E 00	2.1033E-01	9.6629E-02	6.8502E-01	191
1.7453E-01	1.0000E 01	1.2144E-01	1.0219E-01	7.2444E-01	201
2.6180E-01	1.5000E 01	4.6976E-02	1.1093E-01	7.8642E-01	206
3.4907E-01	2.0000E 01	2.4479E-02	1.1643E-01	8.2542E-01	211
4.3633E-01	2.5000E 01	1.6945E-02	1.2066E-01	8.5538E-01	216
5.2360E-01	3.0000E 01	1.1203E-02	1.2416E-01	8.8020E-01	221
6.1086E-01	3.5000E 01	7.4258E-03	1.2684E-01	8.9921E-01	226
6.9813E-01	4.0000E 01	5.2125E-03	1.2891E-01	9.1388E-01	231
7.8540E-01	4.5000E 01	3.8705E-03	1.3057E-01	9.2564E-01	236
8.7266E-01	5.0000E 01	2.9528E-03	1.3194E-01	9.3533E-01	241
9.5993E-01	5.5000E 01	2.[illegible]893E-03	1.3307E-01	9.4334E-01	246
1.0472E 00	6.0000E 01	1.[illegible]116E-03	1.3401E-01	9.5001E-01	251
1.1345E 00	6.5000E 01	1.[illegible]83E-03	1.3480E-01	9.5561E-01	256
1.2217E 00	7.0000E 01	1.[illegible]27E-03	1.3547E-01	9.6035E-01	261
1.3090E 00	7.5000E 01	9.9983E-04	1.3604E-01	9.6438E-01	266
1.3963E 00	8.0000E 01	8.6160E-04	1.3653E-01	9.6790E-01	271
1.4835E 00	8.5000E 01	7.6278E-04	1.3697E-01	9.7102E-01	276
1.5708E 00	9.0000E 01	6.8829E-04	1.3737E-01	9.7383E-01	281
1.6581E 00	9.5000E 01	6.2865E-04	1.3773E-01	9.7638E-01	286
1.7453E 00	1.0000E 02	5.8269E-04	1.3806E-01	9.7871E-01	291
1.8326E 00	1.0500E 02	5.5161E-04	1.3836E-01	9.8086E-01	296
1.9199E 00	1.1000E 02	5.3495E-04	1.3864E-01	9.8287E-01	301
2.0071E 00	1.1500E 02	5.3033E-04	1.3891E-01	9.8478E-01	306
2.0944E 00	1.2000E 02	5.2792E-04	1.3917E-01	9.8660E-01	311
2.1817E 00	1.2500E 02	5.1064E-04	1.3941E-01	9.8831E-01	316
2.2689E 00	1.3000E 02	5.0356E-04	1.3963E-01	9.8986E-01	321
2.3562E 00	1.3500E 02	5.3434E-04	1.3984E-01	9.9134E-01	326
2.4435E 00	1.4000E 02	5.7369E-04	1.4004E-01	9.9280E-01	331
2.5307E 00	1.4500E 02	6.0171E-04	1.4024E-01	9.9419E-01	336
2.6180E 00	1.5000E 02	6.2984E-04	1.4042E-01	9.9547E-01	341
2.7053E 00	1.5500E 02	6.6396E-04	1.4058E-01	9.9663E-01	346
2.7925E 00	1.6000E 02	7.0803E-04	1.4073E-01	9.9765E-01	351
2.8798E 00	1.6500E 02	8.1235E-04	1.4085E-01	9.9852E-01	356
2.9671E 00	1.7000E 02	1.0094E-03	1.4096E-01	9.9928E-01	361
3.0543E 00	1.7500E 02	1.0895E-03	1.4103E-01	9.9981E-01	366
3.1416E 00	1.8000E 02	1.1127E-03	1.4106E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-87. Volume scattering function (sheet 3 of 3).

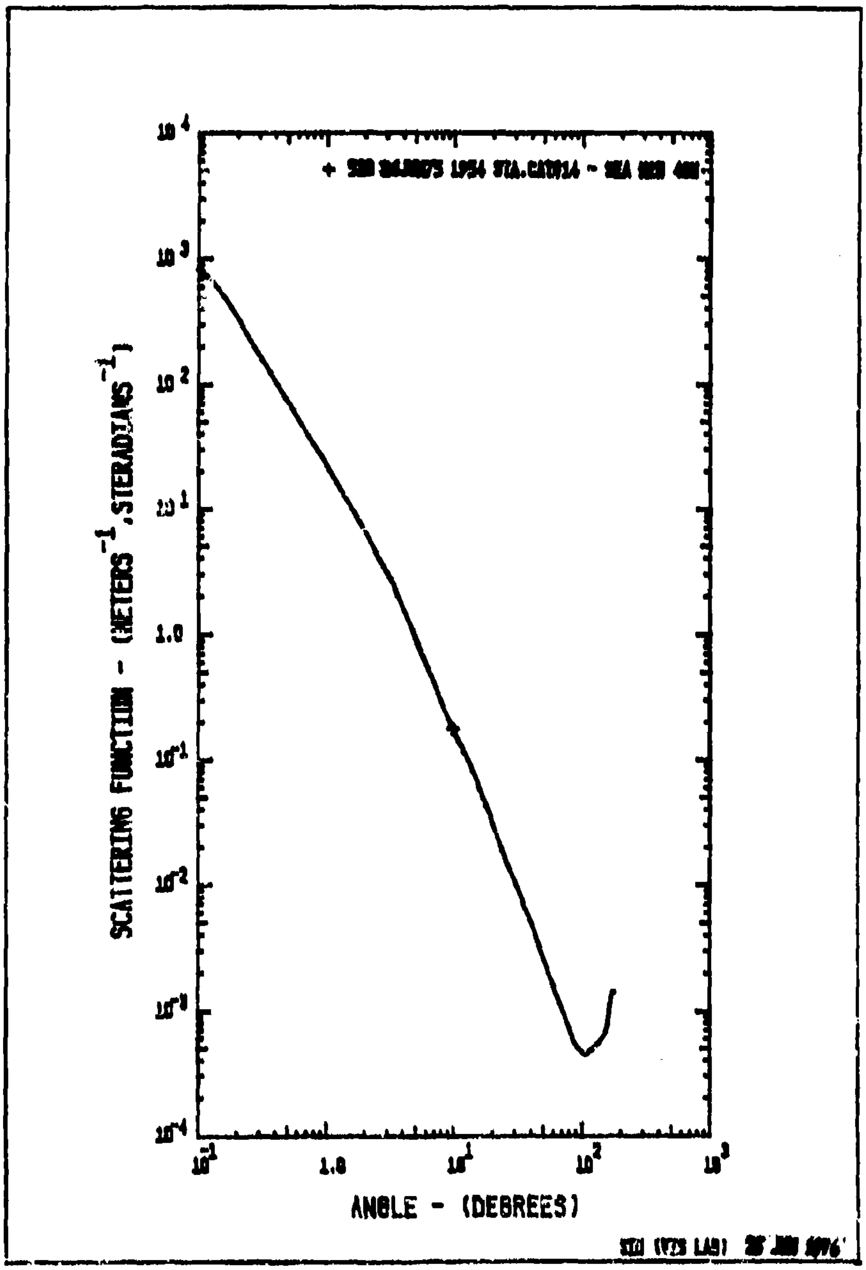


Figure D-38. Volume scattering function (sheet 1 of 3).

520 26JUN75 1954 STA.CAT#14 - SEA H2O 40M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	4.6000E 02	0	0.1750	4.5778E 02
2	0.3500	1.4100E 02	0	0.3500	1.4238E 02
3	0.7000	4.4500E 01	0	0.7000	4.4285E 01
4	10.00	1.8271E-01	0	10.00	1.8271E-01
5	15.00	7.3591E-02	0	15.00	7.3591E-02
6	20.00	3.3888E-02	0	20.00	3.3888E-02
7	25.00	1.8184E-02	0	25.00	1.8184E-02
8	30.00	1.1467E-02	0	30.00	1.1467E-02
9	40.00	5.4582E-03	0	40.00	5.4582E-03
10	50.00	2.8916E-03	0	50.00	2.8916E-03
11	60.00	1.7105E-03	0	60.00	1.7105E-03
12	70.00	1.1306E-03	0	70.00	1.1306E-03
13	80.00	7.7838E-04	0	80.00	7.7838E-04
14	90.00	5.7057E-04	0	90.00	5.7057E-04
15	100.0	4.9426E-04	0	100.0	4.9426E-04
16	110.0	4.6389E-04	0	110.0	4.6389E-04
17	120.0	4.9013E-04	0	120.0	4.9013E-04
18	130.0	5.2809E-04	0	130.0	5.2809E-04
19	140.0	5.7859E-04	0	140.0	5.7859E-04
20	150.0	6.4128E-04	0	150.0	6.4128E-04
21	160.0	7.9077E-04	0	160.0	7.9077E-04
22	170.0	1.2707E-03	0	170.0	1.2707E-03
23			1	180.0	1.4549E-03

ALPHA= 0.3733   S/ALPHA= 0.655
S= 0.2445   A/ALPHA= 0.345
A= 0.1288   B/S= 0.014

CORRECTED ALPHA   CORRECTION=0.008

ALPHA= 0.3809   S/ALPHA= 0.642
S= 0.2445   A/ALPHA= 0.358
A= 0.1364   B/S= 0.014

SIGMA(0.0 DEGREES)= 1221.
SIGMA(0.1 DEGREES)= 864.2
SLOPE(3 MILLIRAD)= -1.685
S UP TO 0.1 DEGREES= 9.8656E-03   NORMALIZED= 4.03548E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 120.0
EXPECTED K/ALPHA= 0.4610   EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K =

	MU	RADIANS	DEGREES
MEDIAN	0.9993	0.3669E-01	2.102
MEAN 1	0.9507	0.3155	18.07
VARIANCE	0.2090		
MEAN 2		0.1468	8.414
RMS		0.3625	20.77
RMS 2		0.3315	18.99

KAPPA= 0.1756   KAPPAT= 2.6967E-03

THETA**2 BAR   0.5719E-02 RADIANS**2

Figure D-88. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0734.54

520 26JUN75 1954 STA.CAT#14 - SEA H2O 40M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	8.6419E 02	9.8656E-03	4.0355E-02	1
2.1972E-03	1.2589E-01	7.1275E 02	1.4262E-02	5.8339E-02	11
2.7662E-03	1.5849E-01	5.3542E 02	1.9749E-02	8.0784E-02	21
3.4824E-03	1.9953E-01	3.6701E 02	2.5951E-02	1.0615E-01	31
4.3841E-03	2.5119E-01	2.4900E 02	3.2630E-02	1.3347E-01	41
5.5192E-03	3.1623E-01	1.6893E 02	3.9811E-02	1.6285E-01	51
6.9483E-03	3.9811E-01	1.1461E 02	4.7533E-02	1.9443E-01	61
8.7474E-03	5.0119E-01	7.7756E 01	5.5835E-02	2.2839E-01	71
1.1012E-02	6.3096E-01	5.2753E 01	6.4763E-02	2.6491E-01	81
1.3864E-02	7.9433E-01	3.5764E 01	7.4360E-02	3.0417E-01	91
1.7453E-02	1.0000E 00	2.4141E 01	8.4652E-02	3.4627E-01	101
2.1972E-02	1.2589E 00	1.6187E 01	9.5628E-02	3.9116E-01	111
2.7662E-02	1.5849E 00	1.0759E 01	1.0724E-01	4.3867E-01	121
3.4824E-02	1.9953E 00	7.0741E 00	1.1941E-01	4.8844E-01	131
4.3841E-02	2.5119E 00	4.5915E 00	1.3201E-01	5.3998E-01	141
5.5192E-02	3.1623E 00	2.9358E 00	1.4487E-01	5.9260E-01	151
6.9483E-02	3.9811E 00	1.7781E 00	1.5763E-01	6.4480E-01	161
8.7473E-02	5.0119E 00	1.0082E 00	1.6945E-01	6.9311E-01	171
1.1012E-01	6.3096E 00	5.5640E-01	1.7988E-01	7.3580E-01	181
1.3864E-01	7.9433E 00	3.1080E-01	1.8902E-01	7.7320E-01	191
1.7453E-01	1.0000E 01	1.8271E-01	1.9729E-01	8.0699E-01	201
2.6180E-01	1.5000E 01	7.3591E-02	2.1086E-01	8.6253E-01	206
3.4907E-01	2.0000E 01	3.3888E-02	2.1904E-01	8.9599E-01	211
4.3633E-01	2.5000E 01	1.8184E-02	2.2420E-01	9.1710E-01	216
5.2360E-01	3.0000E 01	1.1467E-02	2.2784E-01	9.3196E-01	221
6.1086E-01	3.5000E 01	7.7588E-03	2.3061E-01	9.4329E-01	226
6.9813E-01	4.0000E 01	5.4582E-03	2.3278E-01	9.5217E-01	231
7.8540E-01	4.5000E 01	3.9159E-03	2.3449E-01	9.5918E-01	236
8.7266E-01	5.0000E 01	2.8916E-03	2.3585E-01	9.6473E-01	241
9.5993E-01	5.5000E 01	2.1959E-03	2.3695E-01	9.6921E-01	246
1.0472E 00	6.0000E 01	1.7105E-03	2.3784E-01	9.7288E-01	251
1.1345E 00	6.5000E 01	1.3775E-03	2.3859E-01	9.7592E-01	256
1.2217E 00	7.0000E 01	1.1306E-03	2.3922E-01	9.7851E-01	261
1.3090E 00	7.5000E 01	9.3282E-04	2.3976E-01	9.8071E-01	266
1.3963E 00	8.0000E 01	7.7838E-04	2.4021E-01	9.8257E-01	271
1.4835E 00	8.5000E 01	6.5964E-04	2.4060E-01	9.8416E-01	276
1.5708E 00	9.0000E 01	5.7057E-04	2.4094E-01	9.8554E-01	281
1.6581E 00	9.5000E 01	5.2061E-04	2.4123E-01	9.8675E-01	286
1.7453E 00	1.0000E 02	4.9426E-04	2.4151E-01	9.8788E-01	291
1.8326E 00	1.0500E 02	4.7128E-04	2.4177E-01	9.8893E-01	296
1.9199E 00	1.1000E 02	4.6389E-04	2.4201E-01	9.8993E-01	301
2.0071E 00	1.1500E 02	4.7386E-04	2.4225E-01	9.9090E-01	306
2.0944E 00	1.2000E 02	4.9013E-04	2.4248E-01	9.9186E-01	311
2.1817E 00	1.2500E 02	5.0802E-04	2.4271E-01	9.9280E-01	316
2.2689E 00	1.3000E 02	5.2809E-04	2.4294E-01	9.9372E-01	321
2.3562E 00	1.3500E 02	5.5234E-04	2.4315E-01	9.9461E-01	326
2.4435E 00	1.4000E 02	5.7859E-04	2.4336E-01	9.9547E-01	331
2.5307E 00	1.4500E 02	6.0803E-04	2.4356E-01	9.9628E-01	336
2.6180E 00	1.5000E 02	6.4128E-04	2.4375E-01	9.9703E-01	341
2.7053E 00	1.5500E 02	6.9669E-04	2.4391E-01	9.9772E-01	346
2.7925E 00	1.6000E 02	7.9077E-04	2.4407E-01	9.9835E-01	351
2.8798E 00	1.6500E 02	9.6438E-04	2.4421E-01	9.9893E-01	356
2.9671E 00	1.7000E 02	1.2707E-03	2.4434E-01	9.9947E-01	361
3.0543E 00	1.7500E 02	1.4154E-03	2.4444E-01	9.9986E-01	366
3.1416E 00	1.8000E 02	1.4549E-03	2.4447E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-88. Volume scattering function (sheet 3 of 3).

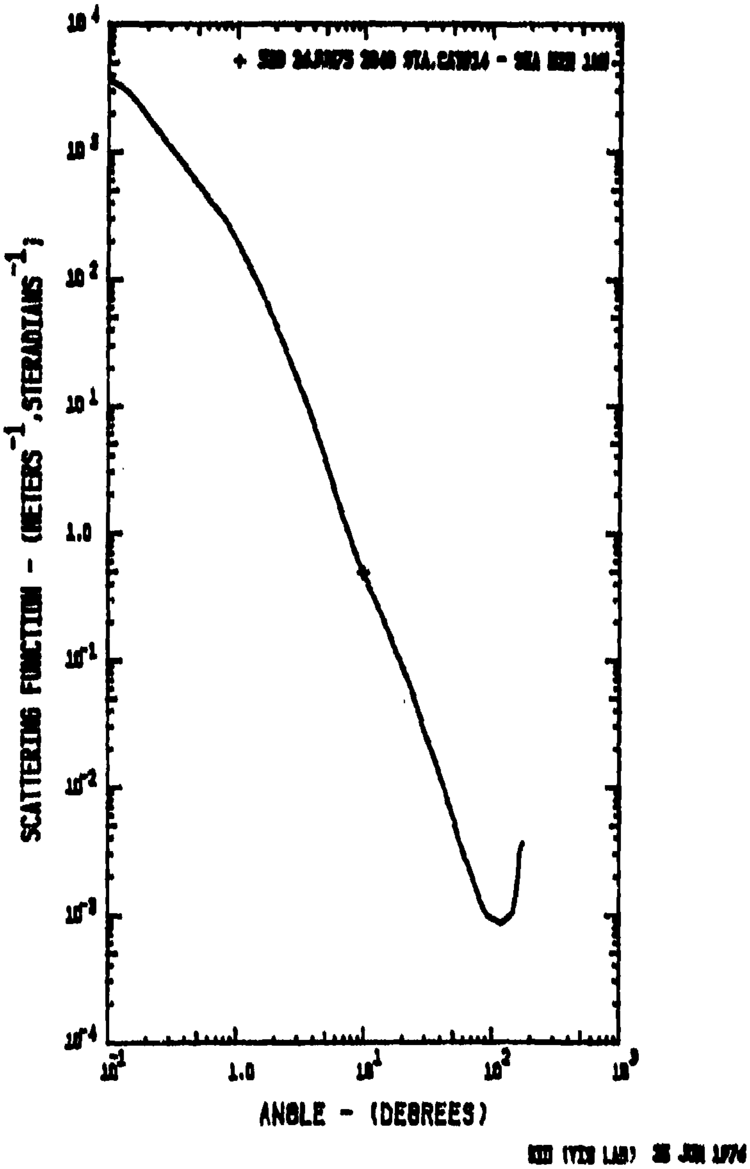


Figure D-89. Volume scattering function (sheet 1 of 3).

520 26JUN75 2040 STA.CAT#14 - SEA H2O 18M

	DATA READ IN ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	SIGMA
1	0.1750	2.3000E 03	0	0.1750	2.3304E 03
2	0.3500	9.4000E 02	0	0.3500	9.1559E 02
3	0.7000	3.5500E 02	0	0.7000	3.5972E 02
4	10.00	4.9437E-01	0	10.00	4.9437E-01
5	15.00	1.9336E-01	0	15.00	1.9336E-01
6	20.00	9.3782E-02	0	20.00	9.3782E-02
7	25.00	5.2770E-02	0	25.00	5.2770E-02
8	30.00	2.8893E-02	0	30.00	2.8893E-02
9	40.00	1.3062E-02	0	40.00	1.3062E-02
10	50.00	6.3394E-03	0	50.00	6.3394E-03
11	60.00	3.2896E-03	0	60.00	3.2896E-03
12	70.00	2.1880E-03	0	70.00	2.1880E-03
13	80.00	1.5091E-03	0	80.00	1.5091E-03
14	90.00	1.1138E-03	0	90.00	1.1138E-03
15	100.0	9.6234E-04	0	100.0	9.6234E-04
16	110.0	9.0134E-04	0	110.0	9.0134E-04
17	120.0	8.6204E-04	0	120.0	8.6204E-04
18	130.0	8.9453E-04	0	130.0	8.9453E-04
19	140.0	9.5537E-04	0	140.0	9.5537E-04
20	150.0	1.0353E-03	0	150.0	1.0353E-03
21	160.0	1.4782E-03	0	160.0	1.4782E-03
22	170.0	2.9515E-03	0	170.0	2.9515E-03
23			1	180.0	3.6153E-03

ALPHA= 1.2489 S/ALPHA= 1.011
S= 1.2629 A/ALPHA= -0.011
A=-0.0140 B/S= 0.005

CORRECTED ALPHA CORRECTION=0.032

ALPHA= 1.2806 S/ALPHA= 0.986
S= 1.2629 A/ALPHA= 0.014
A= 0.0177 B/S= 0.005

SIGMA(0.0 DEGREES)= 4925.
SIGMA(0.1 DEGREES)= 3811.
SLOPE(3 MILLIRAD)= -1.348
S UP TO 0.1 DEGREES= 4.1541E-02 NORMALIZED= 3.28941E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 103.0
EXPECTED K/ALPHA= 6.1167E-02 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K

	MU	RADIANS	DEGREES
MEDIAN	0.9998	0.2200E-01	1.260
MEAN 1	0.9799	0.2009	11.51
VARIANCE	0.1281		
MEAN 2		0.7817E-01	4.479
RMS		0.2284	13.09
RMS 2		0.2146	12.30

KAPPA= 7.8329E-02 KAPPA'= 1.0755E-03

THETA**2 BAR 2.6083E-02 RADIANS**2

Figure D-89. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0731.42

520 26JUN75 2040 STA.CAT#14 - SEA H2O 18M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	3.8106E 03	4.1541E-02	3.2894E-02	1
2.1972E-03	1.2589E-01	3.2953E 03	6.1386E-02	4.8609E-02	11
2.7662E-03	1.5849E-01	2.6413E 03	8.7585E-02	6.9354E-02	21
3.4824E-03	1.9953E-01	1.9528E 03	1.1937E-01	9.4520E-02	31
4.3841E-03	2.5119E-01	1.4318E 03	1.5633E-01	1.2379E-01	41
5.5192E-03	3.1623E-01	1.0498E 03	1.9929E-01	1.5781E-01	51
6.9483E-03	3.9811E-01	7.6969E 02	2.4921E-01	1.9734E-01	61
8.7474E-03	5.0119E-01	5.6433E 02	3.0722E-01	2.4327E-01	71
1.1012E-02	6.3096E-01	4.1376E 02	3.7462E-01	2.9664E-01	81
1.3864E-02	7.9433E-01	3.0011E 02	4.5279E-01	3.5854E-01	91
1.7453E-02	1.0000E 00	2.0421E 02	5.3995E-01	4.2756E-01	101
2.1972E-02	1.2589E 00	1.3059E 02	6.3098E-01	4.9964E-01	111
2.7662E-02	1.5849E 00	7.9341E 01	7.2082E-01	5.7078E-01	121
3.4824E-02	1.9953E 00	4.6292E 01	8.0554E-01	6.3786E-01	131
4.3841E-02	2.5119E 00	2.6219E 01	8.8266E-01	6.9893E-01	141
5.5192E-02	3.1623E 00	1.4572E 01	9.5118E-01	7.5319E-01	151
6.9483E-02	3.9811E 00	7.6397E 00	1.0102E 00	7.9995E-01	161
8.7473E-02	5.0119E 00	3.7376E 00	1.0575E 00	8.3735E-01	171
1.1012E-01	6.3096E 00	1.8005E 00	1.0936E 00	8.6599E-01	181
1.3864E-01	7.9433E 00	9.0111E-01	1.1216E 00	8.8814E-01	191
1.7453E-01	1.0000E 01	4.9438E-01	1.1447E 00	9.0640E-01	201
2.6180E-01	1.5000E 01	1.9336E-01	1.1805E 00	9.3481E-01	206
3.4907E-01	2.0000E 01	9.3782E-02	1.2025E 00	9.5220E-01	211
4.3633E-01	2.5000E 01	5.2770E-02	1.2172E 00	9.6383E-01	216
5.2360E-01	3.0000E 01	2.8893E-02	1.2271E 00	9.7168E-01	221
6.1086E-01	3.5000E 01	1.8956E-02	1.2339E 00	9.7710E-01	226
6.9813E-01	4.0000E 01	1.3062E-02	1.2392E 00	9.8127E-01	231
7.8540E-01	4.5000E 01	8.9949E-03	1.2432E 00	9.8445E-01	236
8.7266E-01	5.0000E 01	6.3394E-03	1.2463E 00	9.8687E-01	241
9.5993E-01	5.5000E 01	4.4487E-03	1.2486E 00	9.8870E-01	246
1.0472E 00	6.0000E 01	3.2896E-03	1.2504E 00	9.9010E-01	251
1.1345E 00	6.5000E 01	2.6549E-03	1.2518E 00	9.9123E-01	256
1.2217E 00	7.0000E 01	2.1880E-03	1.2530E 00	9.9220E-01	261
1.3090E 00	7.5000E 01	1.8059E-03	1.2541E 00	9.9302E-01	266
1.3963E 00	8.0000E 01	1.5091E-03	1.2549E 00	9.9372E-01	271
1.4835E 00	8.5000E 01	1.2821E-03	1.2557E 00	9.9432E-01	276
1.5708E 00	9.0000E 01	1.1138E-03	1.2563E 00	9.9484E-01	281
1.6581E 00	9.5000E 01	1.0128E-03	1.2569E 00	9.9529E-01	286
1.7453E 00	1.0000E 02	9.6234E-04	1.2575E 00	9.9572E-01	291
1.8326E 00	1.0500E 02	9.2882E-04	1.2580E 00	9.9612E-01	296
1.9199E 00	1.1000E 02	9.0134E-04	1.2584E 00	9.9650E-01	301
2.0071E 00	1.1500E 02	8.7733E-04	1.2589E 00	9.9685E-01	306
2.0944E 00	1.2000E 02	8.6204E-04	1.2593E 00	9.9719E-01	311
2.1817E 00	1.2500E 02	8.6959E-04	1.2597E 00	9.9750E-01	316
2.2689E 00	1.3000E 02	8.9453E-04	1.2601E 00	9.9781E-01	321
2.3562E 00	1.3500E 02	9.2401E-04	1.2605E 00	9.9810E-01	326
2.4435E 00	1.4000E 02	9.5537E-04	1.2608E 00	9.9837E-01	331
2.5307E 00	1.4500E 02	9.9140E-04	1.2611E 00	9.9863E-01	336
2.6180E 00	1.5000E 02	1.0353E-03	1.2614E 00	9.9887E-01	341
2.7053E 00	1.5500E 02	1.1760E-03	1.2617E 00	9.9908E-01	346
2.7925E 00	1.6000E 02	1.4782E-03	1.2620E 00	9.9930E-01	351
2.8798E 00	1.6500E 02	2.0015E-03	1.2623E 00	9.9952E-01	356
2.9671E 00	1.7000E 02	2.9515E-03	1.2626E 00	9.9975E-01	361
3.0543E 00	1.7500E 02	3.4754E-03	1.2628E 00	9.9993E-01	366
3.1416E 00	1.8000E 02	3.6153E-03	1.2629E 00	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-89. Volume scattering function (sheet 3 of 3).

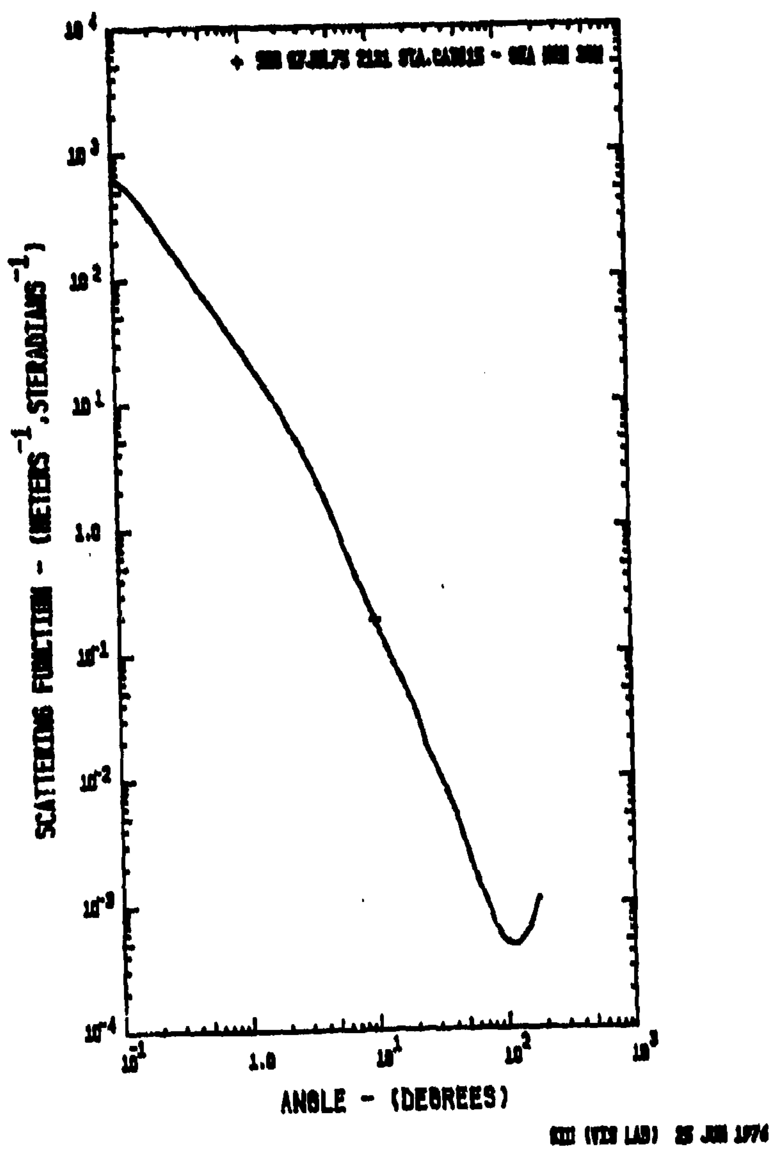


Figure D-90. Volume scattering function (sheet 1 of 3).

520 17JUL75 2131 STA.CAT#15 - SEA H2O 30M

	DATA READ IN ANGLE (DEG)	DATA READ IN SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	ITERATED DATA SIGMA
1	0.1750	3.7000E 02	0	0.1750	3.7132E 02
2	0.3500	1.2900E 02	0	0.3500	1.2805E 02
3	0.7000	4.4000E 01	0	0.7000	4.4158E 01
4	10.00	1.8955E-01	0	10.00	1.8955E-01
5	15.00	7.3851E-02	0	15.00	7.3851E-02
6	20.00	3.8548E-02	0	20.00	3.8548E-02
7	25.00	1.7579E-02	0	25.00	1.7579E-02
8	30.00	1.2033E-02	0	30.00	1.2033E-02
9	40.00	5.7943E-03	0	40.00	5.7943E-03
10	50.00	2.8768E-03	0	50.00	2.8768E-03
11	60.00	1.5885E-03	0	60.00	1.5885E-03
12	70.00	1.0739E-03	0	70.00	1.0739E-03
13	80.00	7.4335E-04	0	80.00	7.4335E-04
14	90.00	5.8319E-04	0	90.00	5.8319E-04
15	100.0	5.0508E-04	0	100.0	5.0508E-04
16	110.0	4.8124E-04	0	110.0	4.8124E-04
17	120.0	4.8270E-04	0	120.0	4.8270E-04
18	130.0	5.1853E-04	0	130.0	5.1853E-04
19	140.0	5.8515E-04	0	140.0	5.8515E-04
20	150.0	6.5931E-04	0	150.0	6.5931E-04
21	160.0	7.8343E-04	0	160.0	7.8343E-04
22	170.0	1.0233E-03	0	170.0	1.0233E-03
23			1	180.0	1.1115E-03

ALPHA= 0.3769 S/ALPHA= 0.659
S= 0.2484 A/ALPHA= 0.341
A= 0.1285 B/S= 0.014

CORRECTED ALPHA CORRECTION=0.006

ALPHA= 0.3825 S/ALPHA= 0.649
S= 0.2484 A/ALPHA= 0.351
A= 0.1341 B/S= 0.014

SIGMA(0.0 DEGREES)= 886.3
SIGMA(0.1 DEGREES)= 655.1
SLOPE(3 MILLIRAD)= -1.536
S UP TO 0.1 DEGREES= 7.3117E-03 NORMALIZED= 2.94351E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 112.0
EXPECTED K/ALPHA= 0.4536 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K =

	MU	RADIANS	DEGREES
MEDIAN	0.9992	0.41006E-01	2.349
MEAN 1	0.9515	0.3126	17.91
VARIANCE	0.2056		
MEAN 2		0.1481	8.486
RMS		0.3581	20.52
RMS 2		0.3261	18.68

KAPPA= 0.1735 KAPPA'= 2.6334E-03

THETA**2 BAR 6.4133E-02 RADIANS**2

Figure D-90. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0738.20

520 17JUL75 2131 STA.CAT#15 - SEA H2O 30M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	6.5508E 02	7.3117E-03	2.9435E-02	1
2.1972E-03	1.2589E-01	5.5276E 02	1.0682E-02	4.3004E-02	11
2.7662E-03	1.5849E-01	4.2813E 02	1.5003E-02	6.0398E-02	21
3.4824E-03	1.9953E-01	3.0357E 02	2.0048E-02	8.0707E-02	31
4.3841E-03	2.5119E-01	2.1314E 02	2.5669E-02	1.0334E-01	41
5.5192E-03	3.1623E-01	1.4965E 02	3.1924E-02	1.2852E-01	51
6.9483E-03	3.9811E-01	1.0507E 02	3.8884E-02	1.5654E-01	61
8.7474E-03	5.0119E-01	7.3769E 01	4.6629E-02	1.8771E-01	71
1.1012E-02	6.3096E-01	5.1794E 01	5.5247E-02	2.2241E-01	81
1.3864E-02	7.9433E-01	3.6358E 01	6.4837E-02	2.6101E-01	91
1.7453E-02	1.0000E 00	2.5467E 01	7.5498E-02	3.0393E-01	101
2.1972E-02	1.2589E 00	1.7689E 01	8.7288E-02	3.5140E-01	111
2.7662E-02	1.5849E 00	1.2101E 01	1.0018E-01	4.0328E-01	121
3.4824E-02	1.9953E 00	8.0975E 00	1.1400E-01	4.5893E-01	131
4.3841E-02	2.5119E 00	5.2645E 00	1.2846E-01	5.1719E-01	141
5.5192E-02	3.1623E 00	3.3028E 00	1.4309E-01	5.7606E-01	151
6.9483E-02	3.9811E 00	1.9572E 00	1.5728E-01	6.3315E-01	161
8.7473E-02	5.0119E 00	1.0989E 00	1.7021E-01	6.8521E-01	171
1.1012E-01	6.3096E 00	6.0227E-01	1.8154E-01	7.3085E-01	181
1.3864E-01	7.9433E 00	3.3194E-01	1.9139E-01	7.7047E-01	191
1.7453E-01	1.0000E 01	1.8955E-01	2.0010E-01	8.0554E-01	201
2.6180E-01	1.5000E 01	7.3851E-02	2.1378E-01	8.6063E-01	206
3.4907E-01	2.0000E 01	3.8548E-02	2.2246E-01	8.9558E-01	211
4.3633E-01	2.5000E 01	1.7879E-02	2.2793E-01	9.1760E-01	216
5.2360E-01	3.0000E 01	1.2033E-02	2.3159E-01	9.3233E-01	221
6.1086E-01	3.5000E 01	8.3209E-03	2.3453E-01	9.4417E-01	226
6.9813E-01	4.0000E 01	5.7943E-03	2.3686E-01	9.5353E-01	231
7.8540E-01	4.5000E 01	4.0233E-03	2.3865E-01	9.6073E-01	236
8.7266E-01	5.0000E 01	2.8768E-03	2.4002E-01	9.6626E-01	241
9.5993E-01	5.5000E 01	2.0992E-03	2.4109E-01	9.7057E-01	246
1.0472E 00	6.0000E 01	1.5855E-03	2.4193E-01	9.7396E-01	251
1.1345E 00	6.5000E 01	1.2881E-03	2.4263E-01	9.7675E-01	256
1.2217E 00	7.0000E 01	1.0739E-03	2.4322E-01	9.7915E-01	261
1.3090E 00	7.5000E 01	8.8701E-04	2.4373E-01	9.8121E-01	266
1.3963E 00	8.0000E 01	7.4335E-04	2.4417E-01	9.8295E-01	271
1.4835E 00	8.5000E 01	6.4806E-04	2.4454E-01	9.8447E-01	276
1.5708E 00	9.0000E 01	5.8319E-04	2.4488E-01	9.8582E-01	281
1.6581E 00	9.5000E 01	5.3555E-04	2.4519E-01	9.8705E-01	286
1.7453E 00	1.0000E 02	5.0508E-04	2.4547E-01	9.8819E-01	291
1.8326E 00	1.0500E 02	4.8897E-04	2.4573E-01	9.8926E-01	296
1.9199E 00	1.1000E 02	4.8124E-04	2.4599E-01	9.9027E-01	301
2.0071E 00	1.1500E 02	4.7865E-04	2.4623E-01	9.9125E-01	306
2.0944E 00	1.2000E 02	4.8270E-04	2.4646E-01	9.9219E-01	311
2.1817E 00	1.2500E 02	4.9488E-04	2.4669E-01	9.9310E-01	316
2.2689E 00	1.3000E 02	5.1853E-04	2.4691E-01	9.9398E-01	321
2.3562E 00	1.3500E 02	5.3085E-04	2.4712E-01	9.9486E-01	326
2.4435E 00	1.4000E 02	5.8515E-04	2.4733E-01	9.9570E-01	331
2.5307E 00	1.4500E 02	6.2120E-04	2.4754E-01	9.9651E-01	336
2.6180E 00	1.5000E 02	6.5931E-04	2.4772E-01	9.9726E-01	341
2.7053E 00	1.5500E 02	7.1105E-04	2.4790E-01	9.9796E-01	346
2.7925E 00	1.6000E 02	7.8343E-04	2.4805E-01	9.9859E-01	351
2.8798E 00	1.6500E 02	8.8379E-04	2.4819E-01	9.9914E-01	356
2.9671E 00	1.7000E 02	1.0233E-03	2.4830E-01	9.9959E-01	361
3.0543E 00	1.7500E 02	1.0953E-03	2.4838E-01	9.9990E-01	366
3.1416E 00	1.8000E 02	1.1115E-03	2.4840E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-90. Volume scattering function (sheet 3 of 3).

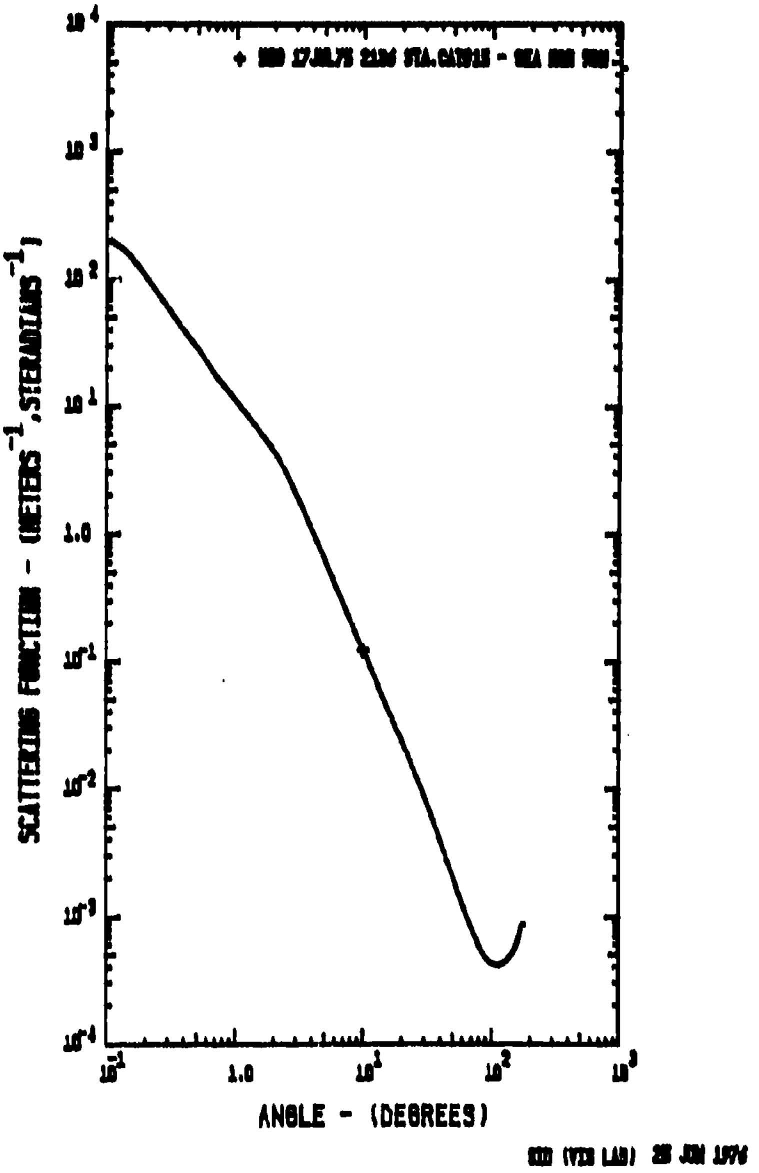


Figure D-91. Volume scattering function (sheet 1 of 3).

25 JUN 1976 0739.55 IBM 3

520 17JUL75 2136 STA.CAT#15 - SEA H2O 50M

	DATA READ IN ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	SIGMA
1	0.1750	1.2600E 02	0	0.1750	1.2532E 02
2	0.3500	4.6600E 01	0	0.3500	4.7103E 01
3	0.7000	1.7800E 01	0	0.7000	1.7704E 01
4	10.00	1.2060E-01	0	10.00	1.2060E-01
5	15.00	4.5354E-02	0	15.00	4.5354E-02
6	20.00	2.3528E-02	0	20.00	2.3528E-02
7	25.00	1.3596E-02	0	25.00	1.3596E-02
8	30.00	8.5997E-03	0	30.00	8.5997E-03
9	40.00	3.8591E-03	0	40.00	3.8591E-03
10	50.00	2.0606E-03	0	50.00	2.0606E-03
11	60.00	1.2372E-03	0	60.00	1.2372E-03
12	70.00	8.0960E-04	0	70.00	8.0960E-04
13	80.00	5.8245E-04	0	80.00	5.8245E-04
14	90.00	4.6948E-04	0	90.00	4.6948E-04
15	100.0	4.2336E-04	0	100.0	4.2336E-04
16	110.0	4.0926E-04	0	110.0	4.0926E-04
17	120.0	4.0927E-04	0	120.0	4.0927E-04
18	130.0	4.3710E-04	0	130.0	4.3710E-04
19	140.0	4.7061E-04	0	140.0	4.7061E-04
20	150.0	5.2388E-04	0	150.0	5.2388E-04
21	160.0	6.2050E-04	0	160.0	6.2050E-04
22	170.0	7.9706E-04	0	170.0	7.9706E-04
23			1	180.0	8.6222E-04

ALPHA= 0.2236 S/ALPHA= 0.575
S= 0.1285 A/ALPHA= 0.425
A= 0.0951 B/S= 0.023

CORRECTED ALPHA CORRECTION=0.002

ALPHA= 0.2254 S/ALPHA= 0.570
S= 0.1285 A/ALPHA= 0.430
A= 0.0969 B/S= 0.023

SIGMA(0.0 DEGREES)= 275.7
SIGMA(0.1 DEGREES)= 210.1
SLOPE(3 MILLIRAD)= -1.412
S UP TO 0.1 DEGREES= 2.3084E-03 NORMALIZED= 1.7969E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 106.0
EXPECTED K/ALPHA= 0.5296 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K =

	MU	RADIANS	DEGREES
MEDIAN	0.9983	0.5756E-01	3.298
MEAN 1	0.9286	0.3801	21.78
VARIANCE	0.2534		
MEAN 2		0.1976	11.32
RMS		0.4375	25.07
RMS 2		0.3904	22.37

KAPPA= 0.1193 KAPPA'= 3.8935E-03

THETA**2 BAR 9.5715E-02 RADIANS**2

Figure D-91. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0739.55

520 17JUL75 2136 STA.CAT#15 - SEA M2D 90M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	2.1014E 02	2.3084E-03	1.7970E-02	1
2.1972E-03	1.2589E-01	1.8027E 02	3.3985E-03	2.6455E-02	11
2.7662E-03	1.5849E-01	1.4286E 02	4.8237E-03	3.7550E-02	21
3.4824E-03	1.9953E-01	1.0414E 02	6.5305E-03	5.0836E-02	31
4.3841E-03	2.5119E-01	7.5237E 01	8.4871E-03	6.6067E-02	41
5.5192E-03	3.1623E-01	5.4358E 01	1.0728E-02	8.3506E-02	51
6.9483E-03	3.9811E-01	3.9273E 01	1.3293E-02	1.0348E-01	61
8.7474E-03	5.0119E-01	2.8374E 01	1.6230E-02	1.2634E-01	71
1.1012E-02	6.3096E-01	2.0499E 01	1.9594E-02	1.5253E-01	81
1.3864E-02	7.9433E-01	1.4877E 01	2.3448E-02	1.8253E-01	91
1.7453E-02	1.0000E 00	1.1059E 01	2.7936E-02	2.1747E-01	101
2.1972E-02	1.2589E 00	8.2835E 00	3.3254E-02	2.5886E-01	111
2.7662E-02	1.5849E 00	6.1156E 00	3.9552E-02	3.0775E-01	121
3.4824E-02	1.9953E 00	4.3531E 00	4.6754E-02	3.6395E-01	131
4.3841E-02	2.5119E 00	2.9222E 00	5.4677E-02	4.2562E-01	141
5.5192E-02	3.1623E 00	1.8097E 00	6.2786E-02	4.8875E-01	151
6.9483E-02	3.9811E 00	1.0631E 00	7.0484E-02	5.4867E-01	161
8.7473E-02	5.0119E 00	6.1958E-01	7.7619E-02	6.0421E-01	171
1.1012E-01	6.3096E 00	3.5932E-01	8.4187E-02	6.5534E-01	181
1.3864E-01	7.9433E 00	2.0803E-01	9.0213E-02	7.0224E-01	191
1.7453E-01	1.0000E 01	1.2060E-01	9.5735E-02	7.4523E-01	201
2.6180E-01	1.5000E 01	4.5354E-02	1.0429E-01	8.1186E-01	206
3.4907E-01	2.0000E 01	2.3528E-02	1.0962E-01	8.5332E-01	211
4.3633E-01	2.5000E 01	1.3596E-02	1.1335E-01	8.8235E-01	216
5.2360E-01	3.0000E 01	8.5997E-03	1.1608E-01	9.0363E-01	221
6.1086E-01	3.5000E 01	5.6198E-03	1.1813E-01	9.1955E-01	226
6.9813E-01	4.0000E 01	3.8591E-03	1.1968E-01	9.3162E-01	231
7.8540E-01	4.5000E 01	2.7708E-03	1.2089E-01	9.4103E-01	236
8.7266E-01	5.0000E 01	2.0606E-03	1.2185E-01	9.4854E-01	241
9.5993E-01	5.5000E 01	1.5779E-03	1.2264E-01	9.5464E-01	246
1.0472E 00	6.0000E 01	1.2372E-03	1.2328E-01	9.5967E-01	251
1.1345E 00	6.5000E 01	9.9147E-04	1.2382E-01	9.6386E-01	256
1.2217E 00	7.0000E 01	8.0960E-04	1.2427E-01	9.6739E-01	261
1.3090E 00	7.5000E 01	6.7816E-04	1.2466E-01	9.7040E-01	266
1.3963E 00	8.0000E 01	5.8245E-04	1.2500E-01	9.7301E-01	271
1.4835E 00	8.5000E 01	5.1440E-04	1.2529E-01	9.7532E-01	276
1.5708E 00	9.0000E 01	4.6948E-04	1.2556E-01	9.7741E-01	281
1.6581E 00	9.5000E 01	4.4019E-04	1.2581E-01	9.7935E-01	286
1.7453E 00	1.0000E 02	4.2336E-04	1.2604E-01	9.8117E-01	291
1.8326E 00	1.0500E 02	4.1441E-04	1.2627E-01	9.8292E-01	296
1.9199E 00	1.1000E 02	4.0926E-04	1.2648E-01	9.8459E-01	301
2.0071E 00	1.1500E 02	4.0590E-04	1.2669E-01	9.8620E-01	306
2.0944E 00	1.2000E 02	4.0927E-04	1.2689E-01	9.8773E-01	311
2.1817E 00	1.2500E 02	4.2167E-04	1.2708E-01	9.8923E-01	316
2.2689E 00	1.3000E 02	4.3710E-04	1.2727E-01	9.9068E-01	321
2.3562E 00	1.3500E 02	4.5323E-04	1.2745E-01	9.9208E-01	326
2.4435E 00	1.4000E 02	4.7061E-04	1.2762E-01	9.9341E-01	331
2.5307E 00	1.4500E 02	4.9373E-04	1.2778E-01	9.9466E-01	336
2.6180E 00	1.5000E 02	5.2385E-04	1.2793E-01	9.9583E-01	341
2.7053E 00	1.5500E 02	5.6451E-04	1.2806E-01	9.9689E-01	346
2.7925E 00	1.6000E 02	6.2050E-04	1.2819E-01	9.9786E-01	351
2.8798E 00	1.6500E 02	6.9593E-04	1.2830E-01	9.9870E-01	356
2.9671E 00	1.7000E 02	7.9706E-04	1.2838E-01	9.9938E-01	361
3.0543E 00	1.7500E 02	8.5053E-04	1.2844E-01	9.9984E-01	366
3.1416E 00	1.8000E 02	8.6722E-04	1.2846E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-91. Volume scattering function (sheet 3 of 3).

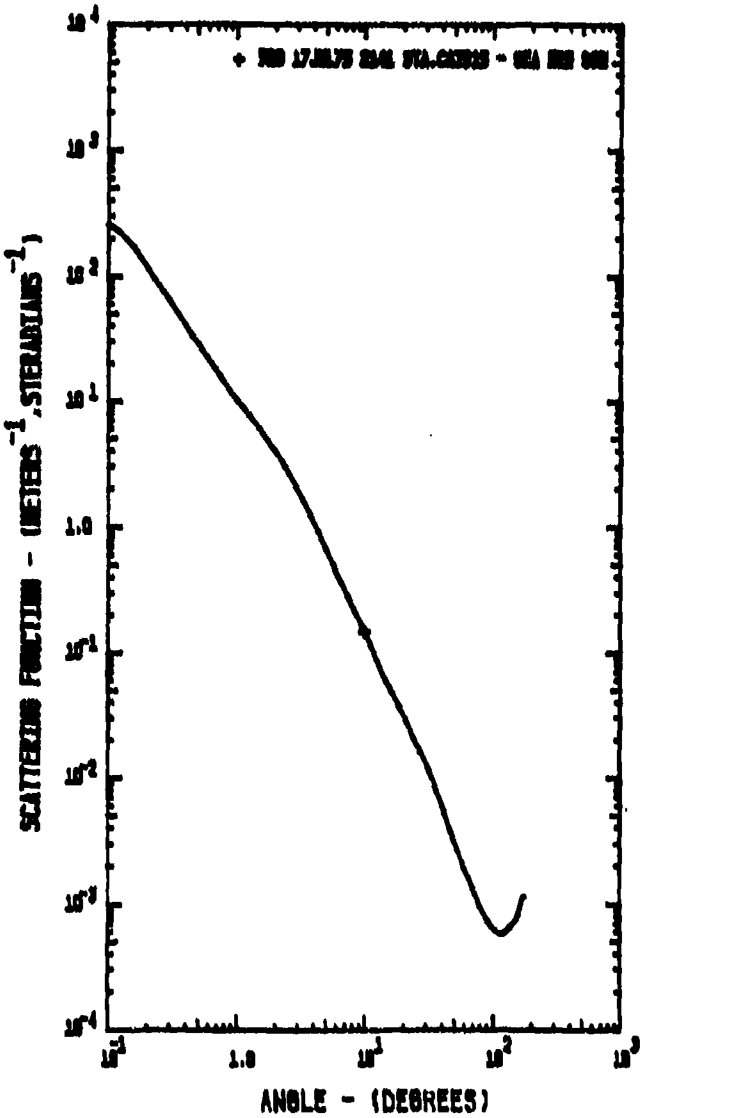


Figure D-92. Volume scattering function (sheet 1 of 3).

520 17JUL75 2141 STA.CAT#15 - SEA H2O 80M

	DATA READ IN ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	SIGMA
1	0.1750	1.5100E 02	0	0.1750	1.5114E 02
2	0.3500	5.2000E 01	0	0.3500	5.1893E 01
3	0.7000	1.7800E 01	0	0.7000	1.7817E 01
4	10.00	1.4607E-01	0	10.00	1.4607E-01
5	15.00	5.8531E-02	0	15.00	5.8531E-02
6	20.00	3.2063E-02	0	20.00	3.2063E-02
7	25.00	1.9692E-02	0	25.00	1.9692E-02
8	30.00	1.3437E-02	0	30.00	1.3437E-02
9	40.00	6.1376E-03	0	40.00	6.1376E-03
10	50.00	3.2278E-03	0	50.00	3.2278E-03
11	60.00	1.9861E-03	0	60.00	1.9861E-03
12	70.00	1.3732E-03	0	70.00	1.3732E-03
13	80.00	9.8982E-04	0	80.00	9.8982E-04
14	90.00	7.7420E-04	0	90.00	7.7420E-04
15	100.0	6.6084E-04	0	100.0	6.6084E-04
16	110.0	5.9775E-04	0	110.0	5.9775E-04
17	120.0	5.8120E-04	0	120.0	5.8120E-04
18	130.0	6.1446E-04	0	130.0	6.1446E-04
19	140.0	6.6522E-04	0	140.0	6.6522E-04
20	150.0	7.2986E-04	0	150.0	7.2986E-04
21	160.0	8.6336E-04	0	160.0	8.6336E-04
22	170.0	1.0715E-03	0	170.0	1.0715E-03
23			1	180.0	1.1524E-03

ALPHA= 0.2255 S/ALPHA= 0.650
S= 0.1467 A/ALPHA= 0.350
A= 0.0788 B/S= 0.029

CORRECTED ALPHA CORRECTION=0.002

ALPHA= 0.2278 S/ALPHA= 0.644
S= 0.1467 A/ALPHA= 0.356
A= 0.0811 B/S= 0.029

SIGMA(0.0 DEGREES)= 360.7
SIGMA(0.1 DEGREES)= 266.6
SLOPE(3 MILLIRAD)= -1.542
S UP TO 0.1 DEGREES= 2.9761E-03 NORMALIZED= 2.0288E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 112.0
EXPECTED K/ALPHA= 0.4589 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K =

	MU	RADIANS	DEGREES
MEDIAN	0.9973	0.7301E-01	4.183
MEAN 1	0.9065	0.4360	24.98
VARIANCE	0.2835		
MEAN 2		0.2439	13.98
RMS		0.4983	28.55
RMS 2		0.4345	24.90

KAPPA= 0.1045 KAPPA'= 5.4125E-03

THETA**2 BAR 0.1241 RADIANS**2

Figure D-92. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0741.31

520 17JUL75 2141 STA.CAT#15 - SEA H2O 80M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	2.6664E 02	2.9761E-03	2.0289E-02	1
2.1972E-03	1.2589E-01	2.2499E 02	4.3480E-03	2.9642E-02	11
2.7662E-03	1.5849E-01	1.7426E 02	6.1067E-03	4.1631E-02	21
3.4824E-03	1.9953E-01	[illegible]	8.1596E-03	5.5626E-02	31
4.3841E-03	2.5119E-01	8.6557E 01	1.0444E-02	7.1198E-02	41
5.5192E-03	3.1623E-01	6.0684E 01	1.2982E-02	8.8502E-02	51
6.9483E-03	3.9811E-01	4.2545E 01	1.5803E-02	1.0773E-01	61
8.7474E-03	5.0119E-01	2.9828E 01	1.8936E-02	1.2909E-01	71
1.1012E-02	6.3096E-01	2.0912E 01	2.2419E-02	1.5283E-01	81
1.3864E-02	7.9433E-01	1.4728E 01	2.6291E-02	1.7923E-01	91
1.7453E-02	1.0000E 00	1.0646E 01	3.0669E-02	2.0908E-01	101
2.1972E-02	1.2589E 00	7.8020E 00	3.5728E-02	2.4357E-01	111
2.7662E-02	1.5849E 00	5.6955E 00	4.1600E-02	2.8360E-01	121
3.4824E-02	1.9953E 00	4.0691E 00	4.8330E-02	3.2947E-01	131
4.3841E-02	2.5119E 00	2.7955E 00	5.5809E-02	3.8046E-01	141
5.5192E-02	3.1623E 00	1.8145E 00	6.3734E-02	4.3449E-01	151
6.9483E-02	3.9811E 00	1.1226E 00	7.1664E-02	4.8855E-01	161
8.7473E-02	5.0119E 00	6.7987E-01	7.9349E-02	5.4094E-01	171
1.1012E-01	6.3096E 00	4.0691E-01	8.6673E-02	5.9086E-01	181
1.3864E-01	7.9433E 00	2.4295E-01	9.3599E-02	6.3808E-01	191
1.7453E-01	1.0000E 01	1.4607E-01	1.0016E-01	6.8282E-01	201
2.6180E-01	1.5000E 01	5.8531E-02	1.1036E-01	7.5576E-01	206
3.4907E-01	2.0000E 01	3.2063E-02	1.1791E-01	8.0383E-01	211
4.3633E-01	2.5000E 01	1.9692E-02	1.2316E-01	8.3950E-01	216
5.2360E-01	3.0000E 01	1.3437E-02	1.2725E-01	8.6748E-01	221
6.1086E-01	3.5000E 01	8.9881E-03	1.3050E-01	8.8962E-01	226
6.9813E-01	4.0000E 01	6.1376E-03	1.3297E-01	9.0649E-01	231
7.8540E-01	4.5000E 01	4.3665E-03	1.3489E-01	9.1956E-01	236
8.7266E-01	5.0000E 01	3.2278E-03	1.3640E-01	9.2988E-01	241
9.5993E-01	5.5000E 01	2.4841E-03	1.3763E-01	9.3826E-01	246
1.0472E 00	6.0000E 01	1.9861E-03	1.3866E-01	9.4524E-01	251
1.1345E 00	6.5000E 01	1.6389E-03	1.3953E-01	9.5122E-01	256
1.2217E 00	7.0000E 01	1.3732E-03	1.4029E-01	9.5640E-01	261
1.3090E 00	7.5000E 01	1.1595E-03	1.4095E-01	9.6090E-01	266
1.3963E 00	8.0000E 01	9.8982E-04	1.4152E-01	9.6480E-01	271
1.4835E 00	8.5000E 01	8.6467E-04	1.4203E-01	9.6822E-01	276
1.5708E 00	9.0000E 01	7.7420E-04	1.4247E-01	9.7127E-01	281
1.6581E 00	9.5000E 01	7.0894E-04	1.4288E-01	9.7404E-01	286
1.7453E 00	1.0000E 02	6.6084E-04	1.4325E-01	9.7657E-01	291
1.8326E 00	1.0500E 02	6.2423E-04	1.4359E-01	9.7891E-01	296
1.9199E 00	1.1000E 02	5.9775E-04	1.4391E-01	9.8108E-01	301
2.0071E 00	1.1500E 02	5.8172E-04	1.4421E-01	9.8312E-01	306
2.0944E 00	1.2000E 02	5.8120E-04	1.4449E-01	9.8504E-01	311
2.1817E 00	1.2500E 02	5.9411E-04	1.4476E-01	9.8689E-01	316
2.2689E 00	1.3000E 02	6.1446E-04	1.4503E-01	9.8868E-01	321
2.3562E 00	1.3500E 02	6.3886E-04	1.4528E-01	9.9040E-01	326
2.4435E 00	1.4000E 02	6.6522E-04	1.4552E-01	9.9205E-01	331
2.5307E 00	1.4500E 02	6.9546E-04	1.4575E-01	9.9359E-01	336
2.6180E 00	1.5000E 02	7.2986E-04	1.4596E-01	9.9502E-01	341
2.7053E 00	1.5500E 02	7.7692E-04	1.4615E-01	9.9632E-01	346
2.7925E 00	1.6000E 02	8.4334E-04	1.4632E-01	9.9747E-01	351
2.8798E 00	1.6500E 02	9.3819E-04	1.4646E-01	9.9847E-01	356
2.9671E 00	1.7000E 02	1.0715E-03	1.4658E-01	9.9927E-01	361
3.0543E 00	1.7500E 02	1.1371E-03	1.4666E-01	9.9982E-01	366
3.1416E 00	1.8000E 02	1.1524E-03	1.4669E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-92. Volume scattering function (sheet 3 of 3).

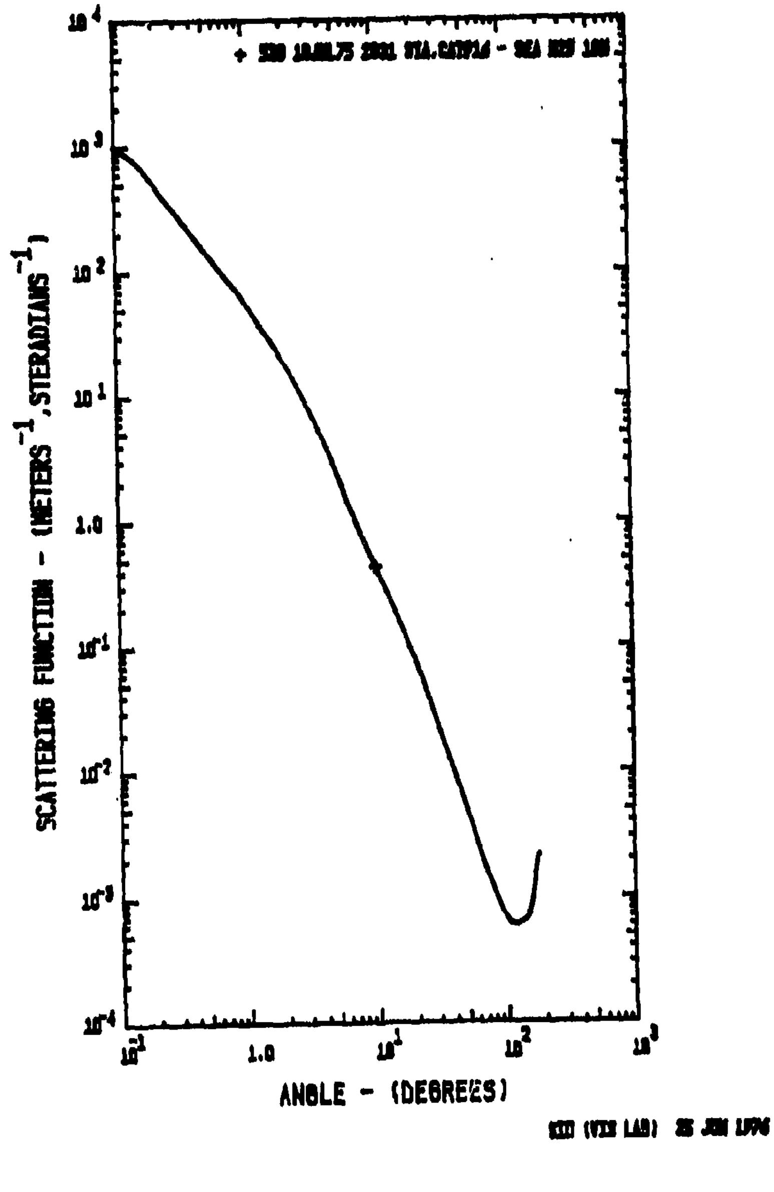


Figure D-93. Volume scattering function (sheet 1 of 3).

520 18JUL75 2031 STA.CAT#16 - SEA H2O 10M

	DATA READ IN ANGLE (DEG)	DATA READ IN SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	ITERATED DATA SIGMA
1	0.1750	6.2000E 02	0	0.1750	6.0955E 02
2	0.3500	2.3300E 02	0	0.3500	2.4110E 02
3	0.7000	9.7000E 01	0	0.7000	9.5367E 01
4	10.00	4.3266E-01	0	10.00	4.3266E-01
5	15.00	1.6595E-01	0	15.00	1.6595E-01
6	20.00	7.8695E-02	0	20.00	7.8695E-02
7	25.00	4.1018E-02	0	25.00	4.1018E-02
8	30.00	2.2994E-02	0	30.00	2.2994E-02
9	40.00	9.7675E-03	0	40.00	9.7675E-03
10	50.00	4.9510E-03	0	50.00	4.9510E-03
11	60.00	2.6395E-03	0	60.00	2.6395E-03
12	70.00	1.6205E-03	0	70.00	1.6205E-03
13	80.00	1.1280E-03	0	80.00	1.1280E-03
14	90.00	8.2882E-04	0	90.00	8.2882E-04
15	100.0	6.7810E-04	0	100.0	6.7810E-04
16	110.0	6.0882E-04	0	110.0	6.0882E-04
17	120.0	6.1008E-04	0	120.0	6.1008E-04
18	130.0	6.3112E-04	0	130.0	6.3112E-04
19	140.0	6.7172E-04	0	140.0	6.7172E-04
20	150.0	7.8736E-04	0	150.0	7.8736E-04
21	160.0	1.0722E-03	0	160.0	1.0722E-03
22	170.0	1.8175E-03	0	170.0	1.8175E-03
23			1	180.0	2.1312E-03

ALPHA= 0.6422 S/ALPHA= 0.826
S= 0.5306 A/ALPHA= 0.174
A= 0.1116 B/S= 0.009

CORRECTED ALPHA CORRECTION=0.008

ALPHA= 0.6504 S/ALPHA= 0.816
S= 0.5306 A/ALPHA= 0.184
A= 0.1198 B/S= 0.009

SIGMA(0.0 DEGREES)= 1271.
SIGMA(0.1 DEGREES)= 988.4
SLOPE(3 MILLIRAD)= -1.338
S UP TO 0.1 DEGREES= 1.0748E-02 NORMALIZED= 2.02569E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 102.0
EXPECTED K/ALPHA= 0.2849 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K

	MU	RADIANS	DEGREES
MEDIAN	0.9991	0.4304E-01	2.466
MEAN 1	0.9643	0.2680	15.36
VARIANCE	0.1654		
MEAN 2		0.1295	7.422
RMS		0.3023	17.32
RMS 2		0.2732	15.65

KAPPA= 0.1853 KAPPA'= 1.9326E-03

THETA**2 BAR 4.5707E-02 RADIANS**2

Figure D-93. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0744.39

520 18JUL75 2031 STA.CAT#16 - SEA H2O 10M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	9.8842E 02	1.0748E-02	2.0257E-02	1
2.1972E-03	1.2589E-01	8.5700E 02	1.5902E-02	2.9971E-02	11
2.7662E-03	1.5849E-01	6.8952E 02	2.2729E-02	4.2837E-02	21
3.4824E-03	1.9953E-01	5.1143E 02	3.1041E-02	5.8503E-02	31
4.3841E-03	2.5119E-01	3.7582E 02	4.0734E-02	7.6771E-02	41
5.5192E-03	3.1623E-01	2.7617E 02	5.2023E-02	9.8047E-02	51
6.9483E-03	3.9811E-01	2.0294E 02	6.5170E-02	1.2283E-01	61
8.7474E-03	5.0119E-01	1.4913E 02	8.0481E-02	1.5168E-01	71
1.1012E-02	6.3096E-01	1.0958E 02	9.8313E-02	1.8529E-01	81
1.3864E-02	7.9433E-01	8.0379E 01	1.1907E-01	2.2442E-01	91
1.7453E-02	1.0000E 00	5.8241E 01	1.4308E-01	2.6965E-01	101
2.1972E-02	1.2589E 00	4.1405E 01	1.7038E-01	3.2112E-01	111
2.7662E-02	1.5849E 00	2.8708E 01	2.0078E-01	3.7841E-01	121
3.4824E-02	1.9953E 00	1.9298E 01	2.3367E-01	4.4041E-01	131
4.3841E-02	2.5119E 00	1.2501E 01	2.6809E-01	5.0526E-01	141
5.5192E-02	3.1623E 00	7.7575E 00	3.0268E-01	5.7046E-01	151
6.9483E-02	3.9811E 00	4.5396E 00	3.3577E-01	6.3282E-01	161
8.7473E-02	5.0119E 00	2.5258E 00	3.6562E-01	6.8908E-01	171
1.1012E-01	6.3096E 00	1.3764E 00	3.9160E-01	7.3805E-01	181
1.3864E-01	7.9433E 00	7.5690E-01	4.1406E-01	7.8038E-01	191
1.7453E-01	1.0000E 01	4.3266E-01	4.3393E-01	8.1783E-01	201
2.6180E-01	1.5000E 01	1.6595E-01	4.6512E-01	8.7661E-01	206
3.4907E-01	2.0000E 01	7.8695E-02	4.8385E-01	9.1191E-01	211
4.3633E-01	2.5000E 01	4.1018E-02	4.9577E-01	9.3438E-01	216
5.2360E-01	3.0000E 01	2.2994E-02	5.0351E-01	9.4897E-01	221
6.1086E-01	3.5000E 01	1.4526E-02	5.0888E-01	9.5909E-01	226
6.9813E-01	4.0000E 01	9.7675E-03	5.1285E-01	9.6657E-01	231
7.8540E-01	4.5000E 01	6.8479E-03	5.1588E-01	9.7227E-01	236
8.7266E-01	5.0000E 01	4.9510E-03	5.1823E-01	9.7671E-01	241
9.5993E-01	5.5000E 01	3.5774E-03	5.2007E-01	9.8017E-01	246
1.0472E 00	6.0000E 01	2.6395E-03	5.2148E-01	9.8284E-01	251
1.1345E 00	6.5000E 01	2.0294E-03	5.2261E-01	9.8496E-01	256
1.2217E 00	7.0000E 01	1.6205E-03	5.2353E-01	9.8669E-01	261
1.3090E 00	7.5000E 01	1.3405E-03	5.2430E-01	9.8814E-01	266
1.3963E 00	8.0000E 01	1.1280E-03	5.2495E-01	9.8938E-01	271
1.4835E 00	8.5000E 01	9.6058E-04	5.2552E-01	9.9044E-01	276
1.5708E 00	9.0000E 01	8.2882E-04	5.2601E-01	9.9136E-01	281
1.6581E 00	9.5000E 01	7.3872E-04	5.2643E-01	9.9217E-01	286
1.7453E 00	1.0000E 02	6.7810E-04	5.2682E-01	9.9289E-01	291
1.8326E 00	1.0500E 02	6.3225E-04	5.2717E-01	9.9355E-01	296
1.9199E 00	1.1000E 02	6.0882E-04	5.2749E-01	9.9416E-01	301
2.0071E 00	1.1500E 02	6.0495E-04	5.2780E-01	9.9474E-01	306
2.0944E 00	1.2000E 02	6.1008E-04	5.2809E-01	9.9530E-01	311
2.1817E 00	1.2500E 02	6.1951E-04	5.2838E-01	9.9583E-01	316
2.2689E 00	1.3000E 02	6.3112E-04	5.2865E-01	9.9634E-01	321
2.3562E 00	1.3500E 02	6.4825E-04	5.2891E-01	9.9683E-01	326
2.4435E 00	1.4000E 02	6.7172E-04	5.2915E-01	9.9729E-01	331
2.5307E 00	1.4500E 02	7.1632E-04	5.2938E-01	9.9772E-01	336
2.6180E 00	1.5000E 02	7.8736E-04	5.2960E-01	9.9814E-01	341
2.7053E 00	1.5500E 02	8.9674E-04	5.2981E-01	9.9854E-01	346
2.7925E 00	1.6000E 02	1.0722E-03	5.3002E-01	9.9892E-01	351
2.8798E 00	1.6500E 02	1.3561E-03	5.3021E-01	9.9930E-01	356
2.9671E 00	1.7000E 02	1.8175E-03	5.3040E-01	9.9964E-01	361
3.0543E 00	1.7500E 02	2.0691E-03	5.3054E-01	9.9991E-01	366
3.1416E 00	1.8000E 02	2.1312E-03	5.3059E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-93. Volume scattering function (sheet 3 of 3).

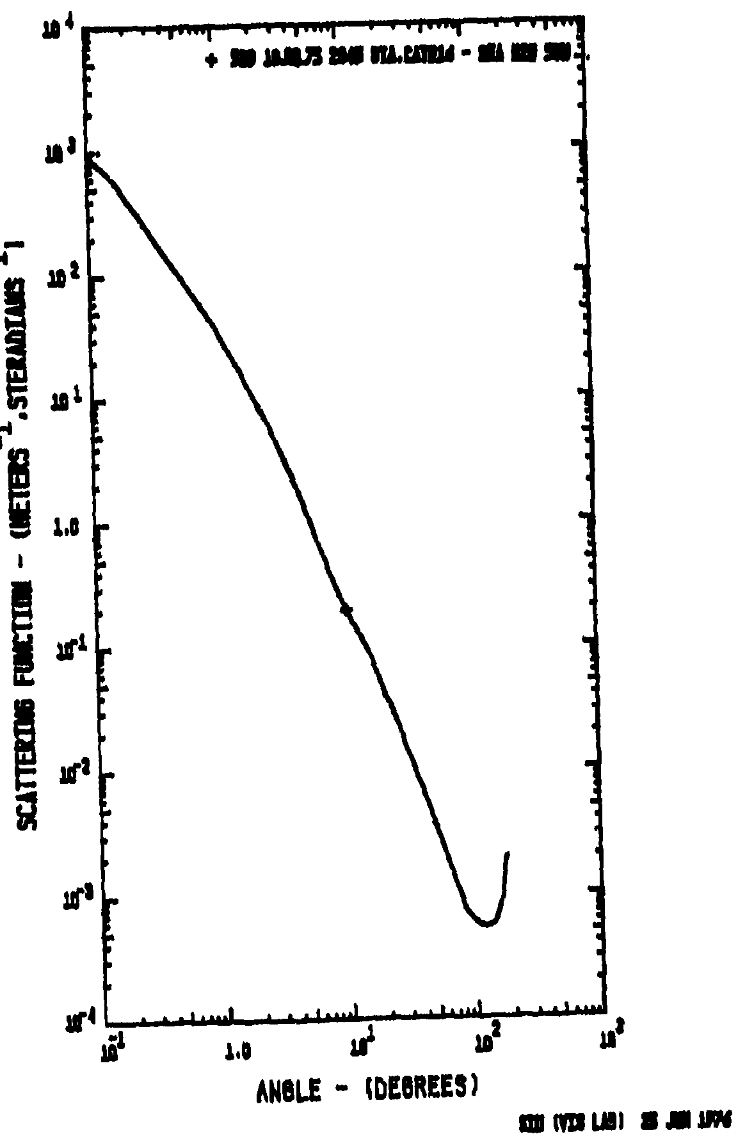


Figure D-94. Volume scattering function (sheet 1 of 3).

25 JUN 1976 0746.15 IBM 36

520 18JUL75 2045 STA.CAT#16 - SEA H2O 50M

	DATA READ IN ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	SIGMA
1	0.1750	5.0000E 02	0	0.1750	4.9854E 02
2	0.3500	1.7600E 02	0	0.3500	1.7697E 02
3	0.7000	6.3000E 01	0	0.7000	6.2818E 01
4	10.00	1.9323E-01	0	10.00	1.9323E-01
5	15.00	8.6320E-02	0	15.00	8.6320E-02
6	20.00	4.0743E-02	0	20.00	4.0743E-02
7	25.00	2.3497E-02	0	25.00	2.3497E-02
8	30.00	1.3783E-02	0	30.00	1.3783E-02
9	40.00	6.4871E-03	0	40.00	6.4871E-03
10	50.00	3.2761E-03	0	50.00	3.2761E-03
11	60.00	1.9145E-03	0	60.00	1.9145E-03
12	70.00	1.2143E-03	0	70.00	1.2143E-03
13	80.00	8.1209E-04	0	80.00	8.1209E-04
14	90.00	6.6195E-04	0	90.00	6.6195E-04
15	100.0	5.9141E-04	0	100.0	5.9141E-04
16	110.0	5.5932E-04	0	110.0	5.5932E-04
17	120.0	5.3981E-04	0	120.0	5.3981E-04
18	130.0	5.5435E-04	0	140.0	5.5435E-04
19	140.0	5.8852E-04	0	140.0	5.8852E-04
20	150.0	7.0939E-04	0	150.0	7.0939E-04
21	160.0	8.9493E-04	0	160.0	8.9493E-04
22	170.0	1.6592E-03	0	170.0	1.6592E-03
23			1	180.0	1.9710E-03

ALPHA= 0.4609 S/ALPHA= 0.650
S= 0.2994 A/ALPHA= 0.350
A= 0.1615 B/S= 0.013

CORRECTED ALPHA CORRECTION=0.007

ALPHA= 0.4683 S/ALPHA= 0.639
S= 0.2994 A/ALPHA= 0.361
A= 0.1689 B/S= 0.013

SIGMA(0.0 DEGREES)= 1158.
SIGMA(0.1 DEGREES)= 264.7
SLOPE(3 MILLIRAD)= -1.494
S UP TO 0.1 DEGREES= 9.5996E-03 NORMALIZED= 3.20660E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 110.0
EXPECTED K/ALPHA= 0.4634 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K =

	MU	RADIANS	DEGREES
MEDIAN	0.9995	0.3313E-01	1.898
MEAN 1	0.9541	0.3040	17.42
VARIANCE	0.2007		
MEAN 2		0.1390	7.963
RMS		0.3494	20.02
RMS 2		0.3206	18.37

KAPPA= 0.2170 KAPPA'= 2.4928E-03

THETA**2 BAR 6.1040E-02 RADIANS**2

Figure D-94. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0746.15

520 18JUL75 2045 STA.CAT#16 - SEA H2O 50M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	8.6472E 02	9.5996E-03	3.2066E-02	1
2.1972E-03	1.2589E-01	7.3373E 02	1.4061E-02	4.6969E-02	11
2.7662E-03	1.5849E-01	5.7267E 02	1.9818E-02	6.6199E-02	21
3.4824E-03	1.9953E-01	4.0981E 02	2.6597E-02	8.8843E-02	31
4.3841E-03	2.5119E-01	2.9051E 02	3.4222E-02	1.1431E-01	41
5.5192E-03	3.1623E-01	2.0596E 02	4.2790E-02	1.4293E-01	51
6.9483E-03	3.9811E-01	1.4599E 02	5.2415E-02	1.7508E-01	61
8.7474E-03	5.0119E-01	1.0349E 02	6.3229E-02	2.1121E-01	71
1.1012E-02	6.3096E-01	7.3361E 01	7.5379E-02	2.5179E-01	81
1.3864E-02	7.9433E-01	5.1729E C1	8.9015E-02	2.9734E-01	91
1.7453E-02	1.0000E 00	3.5346E 01	1.0403E-01	3.4749E-01	101
2.1972E-02	1.2589E 00	2.3406E 01	1.2003E-01	4.0093E-01	111
2.7662E-02	1.5849E 00	1.5088E 01	1.3658E-01	4.5623E-01	121
3.4824E-02	1.9953E 00	9.5085E 00	1.5330E-01	5.1208E-01	131
4.3841E-02	2.5119E 00	5.8847E 00	1.6984E-01	5.6733E-01	141
5.5192E-02	3.1623E 00	3.5923E 00	1.8595E-01	6.2112E-01	151
6.9483E-02	3.9811E 00	2.0775E 00	2.0121E-01	6.7211E-01	161
8.7473E-02	5.0119E 00	1.1251E 00	2.1470E-01	7.1717E-01	171
1.1012E-01	6.3096E 00	5.9811E-01	2.2612E-01	7.5533E-01	181
1.3864E-01	7.9433E 00	3.2727E-01	2.3584E-01	7.8777E-01	191
1.7453E-01	1.0000E 01	1.9323E-01	2.4453E-01	H.1682E-01	201
2.6180E-01	1.5000E 01	8.6320E-02	2.5958E-01	8.6710E-01	206
3.4907E-01	2.0000E 01	4.0743E-02	2.6929E-01	8.9951E-01	211
4.3633E-01	2.5000E 01	2.3497E-02	2.7574E-01	9.2107E-01	216
5.2360E-01	3.0000E 01	1.3783E-02	2.8029E-01	9.3627E-01	221
6.1086E-01	3.5000E 01	9.2715E-03	2.8360E-01	9.4731E-01	226
6.9813E-01	4.0000E 01	6.4871E-03	2.8619E-01	9.5598E-01	231
7.8540E-01	4.5000E 01	4.5225E-03	2.8820E-01	9.6269E-01	236
8.7266E-01	5.0000E 01	3.2761E-03	2.8975E-01	9.6787E-01	241
9.5993E-01	5.5000E 01	2.4742E-03	2.9099E-01	9.7200E-01	246
1.0472E 00	6.0000E 01	1.9145E-03	2.9200E-01	9.7537E-01	251
1.1345E 00	6.5000E 01	1.5115E-03	2.9282E-01	9.7813E-01	256
1.2217E 00	7.0000E 01	1.2143E-03	2.9351E-01	9.8042E-01	261
1.3090E 00	7.5000E 01	9.8556E-04	2.9408E-01	9.8233E-01	266
1.3963E 00	8.0000E 01	8.1209E-04	2.9456E-01	9.8393E-01	271
1.4835E 00	8.5000E 01	7.1361E-04	2.9497E-01	9.8530E-01	276
1.5708E 00	9.0000E 01	6.6195E-04	2.9535E-01	9.8656E-01	281
1.6581E 00	9.5000E 01	6.2009E-04	2.9570E-01	9.8773E-01	286
1.7453E 00	1.0000E 02	5.9141E-04	2.9603E-01	9.8883E-01	291
1.8326E 00	1.0500E 02	5.7359E-04	2.9634E-01	9.8986E-01	296
1.9199E 00	1.1000E 02	5.5932E-04	2.9663E-01	9.9086E-01	301
2.0071E 00	1.1500E 02	5.4742E-04	2.9691E-01	9.9179E-01	306
2.0944E 00	1.2000E 02	5.3981E-04	2.9718E-01	9.9267E-01	311
2.1817E 00	1.2500E 02	5.4356E-04	2.9743E-01	9.9350E-01	316
2.2689E 00	1.3000E 02	5.5435E-04	2.9767E-01	9.9431E-01	321
2.3562E 00	1.3500E 02	5.6619E-04	2.9789E-01	9.9506E-01	326
2.4435E 00	1.4000E 02	5.8852E-04	2.9811E-01	9.9577E-01	331
2.5307E 00	1.4500E 02	6.3929E-04	2.9831E-01	9.9645E-01	336
2.6180E 00	1.5000E 02	7.0939E-04	2.9851E-01	9.9712E-01	341
2.7053E 00	1.5500E 02	7.8880E-04	2.9869E-01	9.9774E-01	346
2.7925E 00	1.6000E 02	8.9493E-04	2.9887E-01	9.9833E-01	351
2.8798E 00	1.6500E 02	1.1431E-03	2.9903E-01	9.9888E-01	356
2.9671E 00	1.7000E 02	1.6592E-03	2.9920E-01	9.9942E-01	361
3.0543E 00	1.7500E 02	1.9007E-03	2.9932E-01	9.9984E-01	366
3.1416E 00	1.8000E 02	1.9710E-03	2.9937E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-94. Volume scattering function (sheet 3 of 3).

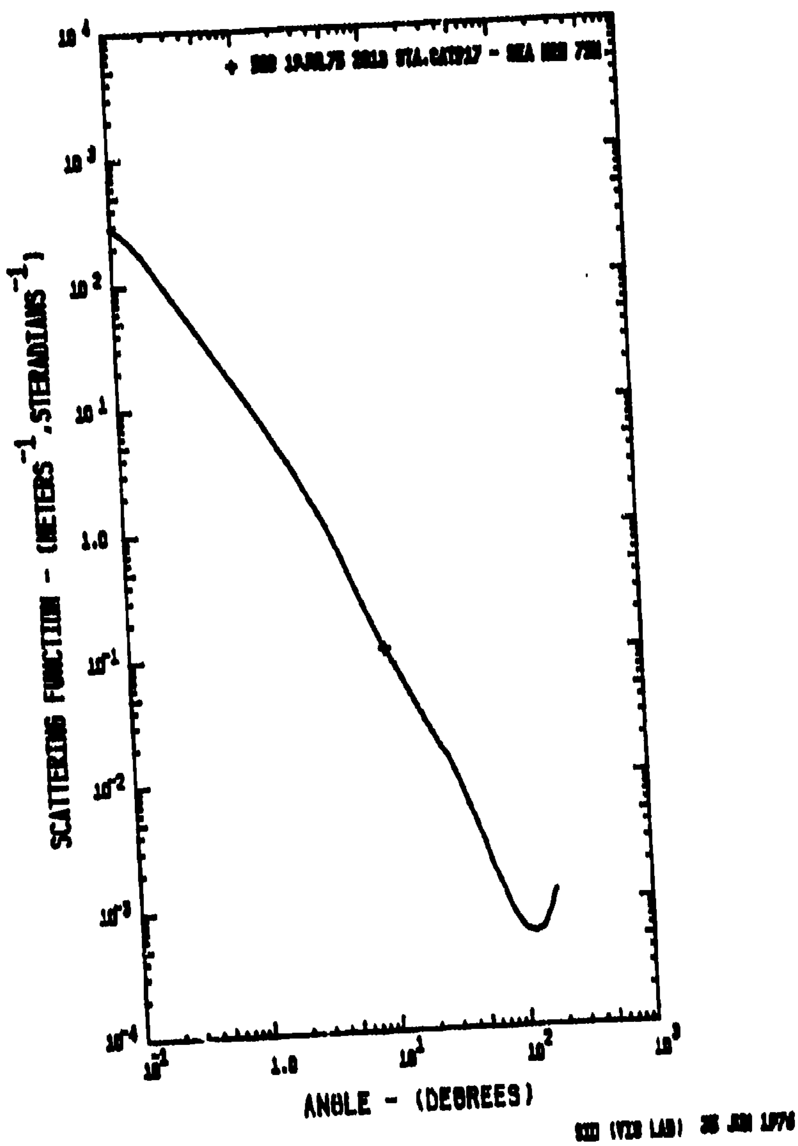


Figure D-95. Volume scattering function (sheet 1 of 3).

520 19JUL75 2013 STA.CAT#17 - SEA H2O 75M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	1.7400E 02	0	0.1750	1.6617E 02
2	0.3500	5.2000E 01	0	0.3500	5.7036E 01
3	0.7000	2.0500E 01	0	0.7000	1.9577E 01
4	10.00	1.0863E-01	0	10.00	1.0863E-01
5	15.00	4.8080E-02	0	15.00	4.8080E-02
6	20.00	2.6619E-02	0	20.00	2.6619E-02
7	25.00	1.7526E-02	0	25.00	1.7526E-02
8	30.00	1.2759E-02	0	30.00	1.2759E-02
9	40.00	5.8683E-03	0	40.00	5.8683E-03
10	50.00	3.1913E-03	0	50.00	3.1913E-03
11	60.00	1.8083E-03	0	60.00	1.8083E-03
12	70.00	[illegible]	0	70.00	[illegible]
13	80.00	8.8645E-04	0	80.00	8.8645E-04
14	90.00	7.0511E-04	0	90.00	7.0511E-04
15	100.0	5.9363E-04	0	100.0	5.9363E-04
16	110.0	5.6982E-04	0	110.0	5.6982E-04
17	120.0	5.6234E-04	0	120.0	5.6234E-04
18	130.0	5.7800E-04	0	130.0	5.7800E-04
19	140.0	6.1066E-04	0	140.0	6.1066E-04
20	150.0	7.2377E-04	0	150.0	7.2377E-04
21	160.0	8.4433E-04	0	160.0	8.4433E-04
22	170.0	1.0833E-03	0	170.0	1.0333E-03
23			1	180.0	1.1691E-03

ALPHA= 0.2492 S/ALPHA= 0.534
S= 0.1330 A/ALPHA= 0.466
A= 0.1162 B/S= 0.030

CORRECTED ALPHA CORRECTION=0.003

ALPHA= 0.2517 S/ALPHA= 0.528
S= 0.1330 A/ALPHA= 0.472
A= 0.1187 B/S= 0.030

SIGMA(0.0 DEGREES)= 396.6
SIGMA(0.1 DEGREES)= 293.1
SLOPE(3 MILLIRAD)= -1.543
S UP TO 0.1 DEGREES= 3.2720E-03 NORMALIZED= 2.46069E-02

THETA**2 BAR 0.1286 RADIANS**2

Figure D-95. Volume scattering function (sheet 2 of 3).

520 19JUL75 2013 STA.CAT#17 - SEA H2O 75M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	2.9315E 02	3.2720E-03	2.4607E-02	1
2.1972E-03	1.2589E-01	2.4736E 02	4.7803E-03	3.5950E-02	11
2.7662E-03	1.5849E-01	1.9159E 02	6.7138E-03	5.0491E-02	21
3.4824E-03	1.9953E-01	1.3573E 02	8.9708E-03	6.7464E-02	31
4.3841E-03	2.5119E-01	9.5148E 01	1.1482E-02	8.6349E-02	41
5.5192E-03	3.1623E-01	6.6701E 01	1.4272E-02	1.0733E-01	51
6.9483E-03	3.9811E-01	4.6758E 01	1.7372E-02	1.3064E-01	61
8.7474E-03	5.0119E-01	3.2779E 01	2.0816E-02	1.5654E-01	71
1.1012E-02	6.3096E-01	2.2978E 01	2.4642E-02	1.8532E-01	81
1.3864E-02	7.9433E-01	1.6090E 01	2.8893E-02	2.1729E-01	91
1.7453E-02	1.0000E 00	1.1188E 01	3.3594E-02	2.5264E-01	101
2.1972E-02	1.2589E 00	7.7076E 00	3.8752E-02	2.9143E-01	111
2.7662E-02	1.5849E 00	5.2515E 00	4.4353E-02	3.3355E-01	121
3.4824E-02	1.9953E 00	3.5325E 00	5.0362E-02	3.7875E-01	131
4.3841E-02	2.5119E 00	2.3419E 00	5.6722E-02	4.2658E-01	141
5.5192E-02	3.1623E 00	1.5274E 00	6.3350E-02	4.7642E-01	151
6.9483E-02	3.9811E 00	9.4470E-01	7.0056E-02	5.2686E-01	161
8.7473E-02	5.0119E 00	5.4863E-01	7.6405E-02	5.7460E-01	171
1.1012E-01	6.3096E 00	3.1097E-01	8.2157E-02	6.1786E-01	181
1.3864E-01	7.9433E 00	1.7882E-01	8.7340E-02	6.5683E-01	191
1.7453E-01	1.0000E 01	1.0843E-01	9.2165E-02	6.9312E-01	201
2.6180E-01	1.5000E 01	4.8080E-02	1.0051E-01	7.5587E-01	206
3.4907E-01	2.0000E 01	2.6619E-02	1.0633E-01	7.9962E-01	211
4.3633E-01	2.5000E 01	1.7526E-02	1.1081E-01	8.3333E-01	216
5.2360E-01	3.0000E 01	1.2759E-02	1.1461E-01	8.6195E-01	221
6.1086E-01	3.5000E 01	8.4722E-03	1.1768E-01	8.8497E-01	226
6.9813E-01	4.0000E 01	5.8683E-03	1.2002E-01	9.0263E-01	231
7.8540E-01	4.5000E 01	4.2575E-03	1.2187E-01	9.1653E-01	236
8.7266E-01	5.0000E 01	3.1913E-03	1.2336E-01	9.2772E-01	241
9.5993E-01	5.5000E 01	2.3668E-03	1.2456E-01	9.3675E-01	246
1.0472E 00	6.0000E 01	1.8083E-03	1.2551E-01	9.4391E-01	251
1.1345E 00	6.5000E 01	1.4970E-03	1.2631E-01	9.4990E-01	256
1.2217E 00	7.0000E 01	1.2649E-03	1.2701E-01	9.5515E-01	261
1.3090E 00	7.5000E 01	1.0486E-03	1.2761E-01	9.5968E-01	266
1.3963E 00	8.0000E 01	8.8645E-04	1.2812E-01	9.6355E-01	271
1.4835E 00	8.5000E 01	7.8274E-04	1.2858E-01	9.6695E-01	276
1.5708E 00	9.0000E 01	7.0511E-04	1.2898E-01	9.7001E-01	281
1.6581E 00	9.5000E 01	6.3841E-04	1.2935E-01	9.7277E-01	286
1.7453E 00	1.0000E 02	5.9363E-04	1.2968E-01	9.7520E-01	291
1.8326E 00	1.0500E 02	5.7611E-04	1.3000E-01	9.7762E-01	296
1.9199E 00	1.1000E 02	5.6982E-04	1.3029E-01	9.7988E-01	301
2.0071E 00	1.1500E 02	5.6423E-04	1.3058E-01	9.8204E-01	306
2.0944E 00	1.2000E 02	5.6234E-04	1.3086E-01	9.8409E-01	311
2.1817E 00	1.2500E 02	5.6813E-04	1.3112E-01	9.8606E-01	316
2.2689E 00	1.3000E 02	5.7800E-04	1.3137E-01	9.8793E-01	321
2.3562E 00	1.3500E 02	5.8471E-04	1.3160E-01	9.8970E-01	326
2.4435E 00	1.4000E 02	6.1066E-04	1.3182E-01	9.9135E-01	331
2.5307E 00	1.4500E 02	6.6446E-04	1.3203E-01	9.9295E-01	336
2.6180E 00	1.5000E 02	7.2377E-04	1.3224E-01	9.9448E-01	341
2.7053E 00	1.5500E 02	7.8248E-04	1.3243E-01	9.9592E-01	346
2.7925E 00	1.6000E 02	8.4433E-04	1.3260E-01	9.9720E-01	351
2.8798E 00	1.6500E 02	9.4021E-04	1.3274E-01	9.9829E-01	356
2.9671E 00	1.7000E 02	1.0833E-03	1.3286E-01	9.9919E-01	361
3.0543E 00	1.7500E 02	1.1531E-03	1.3294E-01	9.9979E-01	366
3.1416E 00	1.8000E 02	1.1691E-03	1.3297E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-95. Volume scattering function (sheet 3 of 3).

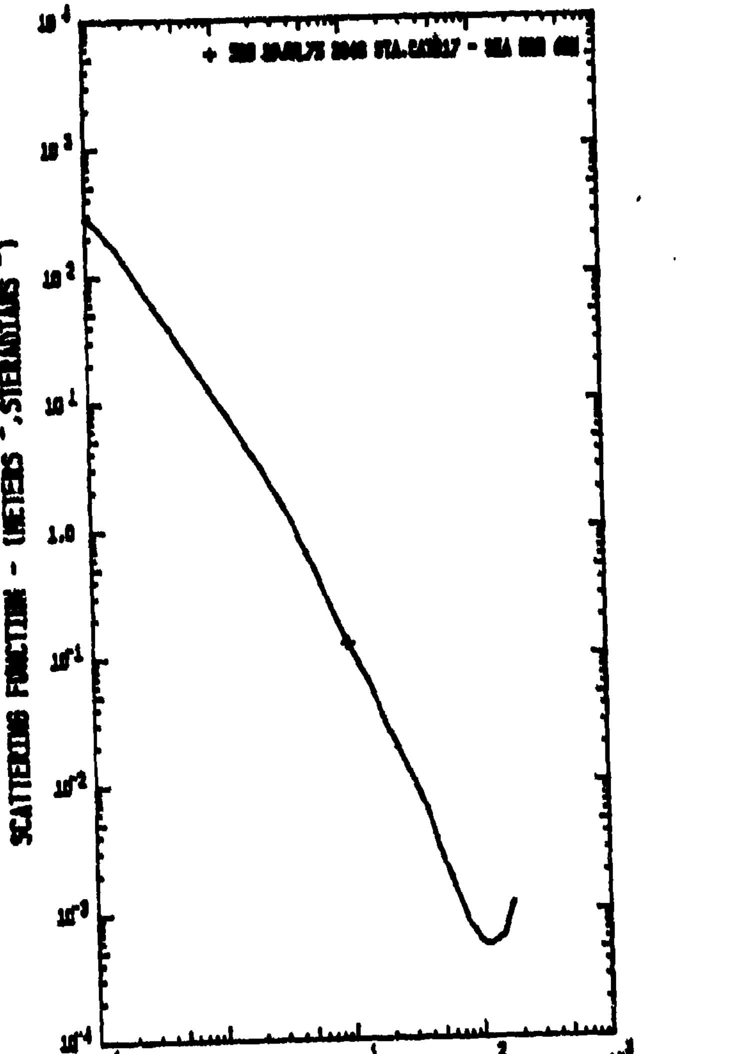


Figure D-96. Volume scattering function (sheet 1 of 3).

25 JUN 1976 1140.19 IBM 36

520 19JUL75 2040 STA.CAT#17 - SEA H2O 62M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	1.6700E 02	0	0.1750	1.6112E 02
2	0.3500	5.1000E 01	0	0.3500	5.4774E 01
3	0.7000	1.9300E 01	0	0.7000	1.8621E 01
4	10.00	1.2645E-01	0	10.00	1.2645E-01
5	15.00	5.5591E-02	0	15.00	5.5591E-02
6	20.00	2.7245E-02	0	20.00	2.7245E-02
7	25.00	1.7023E-02	0	25.00	1.7023E-02
8	30.00	1.1381E-02	0	30.00	1.1381E-02
9	40.00	5.7568E-03	0	40.00	5.7568E-03
10	50.00	2.8587E-03	0	50.00	2.8587E-03
11	60.00	1.7958E-03	0	60.00	1.7958E-03
12	70.00	1.1829E-03	0	70.00	1.1829E-03
13	80.00	8.8430E-04	0	80.00	8.8430E-04
14	90.00	6.8532E-04	0	90.00	6.8532E-04
15	100.0	5.8051E-04	0	100.0	5.8051E-04
16	110.0	5.5311E-04	0	110.0	5.5311E-04
17	120.0	5.4655E-04	0	120.0	5.4655E-04
18	130.0	5.7419E-04	0	130.0	5.7419E-04
19	140.0	6.1366E-04	0	140.0	6.1366E-04
20	150.0	6.4084E-04	0	150.0	6.4084E-04
21	160.0	8.0017E-04	0	160.0	8.0017E-04
22	170.0	1.0488E-03	0	170.0	1.0488E-03
23			1	180.0	1.1489E-03

ALPHA= 0.2429 S/ALPHA= 0.557
S= 0.1353 A/ALPHA= 0.443
A= 0.1075 B/S= 0.029

CORRECTED ALPHA CORRECTION=0.002

ALPHA= 0.2453 S/ALPHA= 0.552
S= 0.1353 A/ALPHA= 0.440
A= 0.1099 B/S= 0.029

SIGMA(0.0 DEGREES)= 389.9
SIGMA(0.1 DEGREES)= 286.7
SLOPE(3 MILLIRAD)= -1.557
S UP TO 0.1 DEGREES= 3.2084E-03 NORMALIZED= 2.37097E-02

THETA**2 BAR 0.1218 RADIANS**2

Figure D-96. Volume scattering function (sheet 2 of 3).

520 19JUL75 2040 STA.CAT#17 - SEA H2O 62M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	2.8666E 02	3.2084E-03	2.3710E-02	1
2.1972E-03	1.2589E-01	2.4121E 02	4.6813E-03	3.4594E-02	11
2.7662E-03	1.5849E-01	1.8611E 02	6.5631E-03	4.8501E-02	21
3.4824E-03	1.9953E-01	1.3136E 02	8.7511E-03	6.4670E-02	31
4.3841E-03	2.5119E-01	9.1796E 01	1.1178E-02	8.2602E-02	41
5.5192E-03	3.1623E-01	6.4145E 01	1.3865E-02	1.0246E-01	51
6.9483E-03	3.9811E-01	4.4824E 01	1.6841E-02	1.2446E-01	61
8.7474E-03	5.0119E-01	3.1322E 01	2.0137E-02	1.4881E-01	71
1.1012E-02	6.3096E-01	2.1887E 01	2.3788E-02	1.7579E-01	81
1.3864E-02	7.9433E-01	1.5289E 01	2.7830E-02	2.0567E-01	91
1.7453E-02	1.0000E 00	1.0659E 01	3.2302E-02	2.3871E-01	101
2.1972E-02	1.2589E 00	7.4025E 00	3.7234E-02	2.7515E-01	111
2.7662E-02	1.5849E 00	5.1124E 00	4.2647E-02	3.1516E-01	121
3.4824E-02	1.9953E 00	3.5046E 00	4.8551E-02	3.5879E-01	131
4.3841E-02	2.5119E 00	2.3804E 00	5.4936E-02	4.0597E-01	141
5.5192E-02	3.1623E 00	1.5990E 00	6.1771E-02	4.5648E-01	151
6.9483E-02	3.9811E 00	1.0196E 00	6.8901E-02	5.0917E-01	161
8.7473E-02	5.0119E 00	6.0816E-01	7.5846E-02	5.6050E-01	171
1.1012E-01	6.3096E 00	[illegible]	8.2295E-02	[illegible]	181
1.3864E-01	7.9433E 00	2.0620E-01	8.8222E-02	6.5196E-01	191
1.7453E-01	1.0000E 01	1.2645E-01	9.3821E-02	6.9333E-01	201
2.6180E-01	1.5000E 01	5.5591E-02	1.0358E-01	7.6542E-01	206
3.4907E-01	2.0000E 01	2.7245E-02	1.0992E-01	8.1228E-01	211
4.3630E-01	2.5000E 01	1.7023E-02	1.1440E-01	8.4540E-01	216
5.2360E-01	3.0000E 01	1.1331E-02	1.1791E-01	8.7132E-01	221
6.1086E-01	3.5000E 01	7.9069E-03	1.2071E-01	8.9204E-01	226
6.9813E-01	4.0000E 01	5.7560E-03	1.2297E-01	9.0876E-01	231
7.8540E-01	4.5000E 01	3.9846E-03	1.2476E-01	9.2196E-01	236
8.7266E-01	5.0000E 01	2.9587E-03	1.2611E-01	9.3197E-01	241
9.5993E-01	5.5000E 01	2.2443E-03	1.2721E-01	9.4009E-01	246
1.0472E 00	6.0000E 01	1.7958E-03	1.2814E-01	9.4696E-01	251
1.1345E 00	6.5000E 01	1.4460E-03	1.2892E-01	9.5274E-01	256
1.2217E 00	7.0000E 01	1.1429E-03	1.2959E-01	9.5764E-01	261
1.3090E 00	7.5000E 01	9.7863E-04	1.3015E-01	9.6179E-01	266
1.3963E 00	8.0000E 01	8.3430E-04	1.3063E-01	9.6536E-01	271
1.4835E 00	8.5000E 01	7.4837E-04	1.3106E-01	9.6852E-01	276
1.5708E 00	9.0000E 01	6.5532E-04	1.3145E-01	9.7142E-01	281
1.6581E 00	9.5000E 01	6.2712E-04	1.3181E-01	9.7407E-01	286
1.7453E 00	1.0000E 02	5.8351E-04	1.3214E-01	9.7649E-01	291
1.8326E 00	1.0500E 02	5.5927E-04	1.3244E-01	9.7873E-01	296
1.9199E 00	1.1000E 02	5.5311E-04	1.3273E-01	9.8089E-01	301
2.0071E 00	1.1500E 02	5.4662E-04	1.3301E-01	9.8294E-01	306
2.0944E 00	1.2000E 02	5.4655E-04	1.3328E-01	9.8490E-01	311
2.1817E 00	1.2500E 02	5.5702E-04	1.3353E-01	9.8678E-01	316
2.2689E 00	1.3000E 02	5.7419E-04	1.3378E-01	9.8860E-01	321
2.3562E 00	1.3500E 02	5.9591E-04	1.3401E-01	9.9034E-01	326
2.4435E 00	1.4000E 02	6.1866E-04	1.3424E-01	9.9201E-01	331
2.5307E 00	1.4500E 02	6.2690E-04	1.3445E-01	9.9355E-01	336
2.6180E 00	1.5000E 02	6.4084E-04	1.3463E-01	9.9492E-01	341
2.7053E 00	1.5500E 02	7.0184E-04	1.3480E-01	9.9617E-01	346
2.7925E 00	1.6000E 02	8.0017E-04	1.3496E-01	9.9733E-01	351
2.8798E 00	1.6500E 02	9.1257E-04	1.3510E-01	9.9836E-01	356
2.9671E 00	1.7000E 02	1.0488E-03	1.3521E-01	9.9922E-01	361
3.0543E 00	1.7500E 02	1.1330E-03	1.3529E-01	9.9979E-01	366
3.1416E 00	1.8000E 02	1.1489E-03	1.3532E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-96. Volume scattering function (sheet 3 of 3).

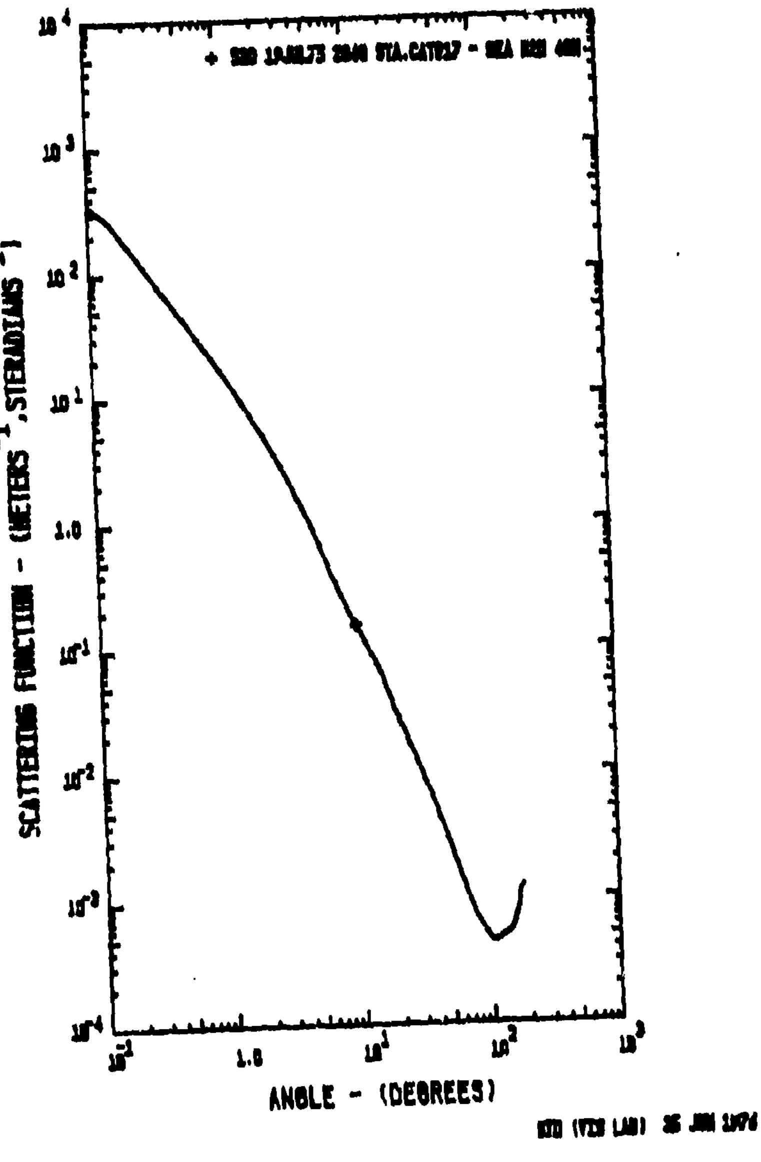


Figure D-97. Volume scattering function (sheet 1 of 3).

25 JUN 1976 1141.51 IBM 36

520 19JUL75 2048 STA.CAT017 - SEA H2O 40M

	DATA READ IN ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	SIGMA
1	0.1750	2.2500E 02	0	0.1750	2.1270E 02
2	0.3500	7.0000E 01	0	0.3500	7.8313E 01
3	0.7000	3.0500E 01	0	0.7000	2.8833E 01
4	10.00	1.5349E-01	0	10.00	1.5349E-01
5	15.00	6.6496E-02	0	15.00	6.6496E-02
6	20.00	3.0258E-02	0	20.00	3.0258E-02
7	40.00	5.0329E-03	0	40.00	5.0329E-03
8	50.00	2.6026E-03	0	50.00	2.6026E-03
9	60.00	1.4922E-03	0	60.00	1.4922E-03
10	70.00	9.2919E-04	0	70.00	9.2919E-04
11	80.00	6.8144E-04	0	80.00	6.8144E-04
12	90.00	5.5326E-04	0	90.00	5.5326E-04
13	100.0	4.6695E-04	0	100.0	4.6695E-04
14	110.0	4.5464E-04	0	110.0	4.5464E-04
15	120.0	4.7881E-04	0	120.0	4.7881E-04
16	130.0	5.1139E-04	0	130.0	5.1139E-04
17	140.0	5.3964E-04	0	140.0	5.3964E-04
18	150.0	6.2312E-04	0	150.0	6.2312E-04
19	160.0	7.6257E-04	0	160.0	7.6257E-04
20	170.0	1.1042E-03	0	170.0	1.1042E-03
21			1	180.0	1.2325E-03

ALPHA= 0.2792 S/ALPHA= 0.628
S= 0.1753 A/ALPHA= 0.372
A= 0.1039 B/S= 0.019

CORRECTED ALPHA CORRECTION=0.003

ALPHA= 0.2822 S/ALPHA= 0.621
S= 0.1753 A/ALPHA= 0.379
A= 0.1069 B/S= 0.019

SIGMA(0.0 DEGREES)= 474.2
SIGMA(0.1 DEGREES)= 359.7
SLOPE(3 MILLIRAD)= -1.442
S UP TO 0.1 DEGREES= 3.9615E-03 NORMALIZED= 2.25978E-02

THETA**2 BAR 8.4746E-02 RADIANS**2

Figure D-97. Volume scattering function (sheet 2 of 3).

520 19JUL75 2048 STA.CAT#17 - SEA H20 40M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	3.5969E 02	3.9615E-03	2.2598E-02	1
2.1972E-03	1.2589E-01	3.0772E 02	5.8248E-03	3.3227E-02	11
2.7662E-03	1.5849E-01	2.4294E 02	8.2530e-03	4.7079E-02	21
3.4824E-03	1.9953E-01	1.7606E 02	1.1148E-02	6.3591E-02	31
4.3841E-03	2.5119E-01	1.2633E 02	1.4444E-02	8.2394E-02	41
5.5192E-03	3.1623E-01	9.0647E 01	1.8193E-02	1.0378E-01	51
6.9483E-03	3.9811E-01	6.5044E 01	2.2456E-02	1.2810E-01	61
8.7474E-03	5.0119E-01	4.6672E 01	2.7304E-02	1.5575E-01	71
1.1012E-02	6.3096E-01	3.3489E 01	3.2817E-02	1.8720E-01	81
1.3864E-02	7.9433E-01	2.3973E 01	3.9084E-02	2.2295E-01	91
1.7453E-02	1.0000E 00	1.6917E 01	4.6147E-02	2.6324E-01	101
2.1972E-02	1.2589E 00	1.1739E 01	5.3979E-02	3.0792E-01	111
2.7662E-02	1.5849E 00	8.0054E 00	6.2517E-02	3.5663E-01	121
3.4824E-02	1.9953E 00	5.3605E 00	7.1661E-02	4.0878E-01	131
4.3841E-02	2.5119E 00	3.5220E 00	8.1271E-02	4.6361E-01	141
5.5192E-02	3.1623E 00	2.2689E 00	9.1180E-02	5.2013E-01	151
6.9483E-02	3.9811E 00	1.3834E 00	1.0107E-01	5.7656E-01	161
8.7473E-02	5.0119E 00	7.9225E-01	1.1030E-01	6.2922E-01	171
1.1012E-01	6.3096E 00	4.4384E-01	1.1856E-01	6.7632E-01	181
1.3864E-01	7.9433E 00	2.5336E-01	1.2593E-01	7.1834E-01	191
1.7453E-01	1.0000E 01	1.5349E-01	1.3276E-01	7.5731E-01	201
2.6180E-01	1.5000E 01	6.6495E-02	1.4455E-01	8.2458E-01	206
3.4907E-01	2.0000E 01	3.0258E-02	1.5192E-01	8.6661E-01	211
4.3633E-01	2.5000E 01	1.7078E-02	1.5664E-01	8.9356E-01	216
5.2360E-01	3.0000E 01	1.0793E-02	1.6006E-01	9.1308E-01	221
6.1086E-01	3.5000E 01	7.2425E-03	1.6256E-01	9.2790E-01	226
6.9813E-01	4.0000E 01	5.0329E-03	1.6468E-01	9.3940E-01	231
7.8540E-01	4.5000E 01	3.5763[illegible] 03	1.6625E-01	9.4836E-01	236
8.7266E-01	5.0000E 01	2.602[illegible] 03	1.6748E-01	9.5540E-01	241
9.5993E-01	5.5000E 01	1.9462E-03	1.6846E-01	9.6097E-01	246
1.0472E 00	6.0000E 01	1.4922E-03	1.6925E-01	9.6547E-01	251
1.1345E 00	6.5000E 01	1.1666E-03	1.6989E-01	9.6913E-01	256
1.2217E 00	7.0000E 01	9.2919E-04	1.7042E-01	9.7214E-01	261
1.3090E 00	7.5000E 01	7.7634E-04	1.7086E-01	9.7465E-01	266
1.3963E 00	8.0000E 01	6.8144E-04	1.7125E-01	9.7687E-01	271
1.4835E 00	8.5000E 01	6.1086E-04	1.7160E-01	9.7887E-01	276
1.5708E 00	9.0000E 01	5.5326E-04	1.7192E-01	9.8069E-01	281
1.6581E 00	9.5000E 01	5.0501E-04	1.7221E-01	9.8233E-01	286
1.7453E 00	1.0000E 02	4.6695E-04	1.7247E-01	9.8384E-01	291
1.8326E 00	1.0500E 02	4.5050E-04	1.7271E-01	9.8523E-01	296
1.9199E 00	1.1000E 02	4.5444E-04	1.7295E-01	9.8658E-01	301
2.0071E 00	1.1500E 02	4.6514E-04	1.7318E-01	9.8790E-01	306
2.0944E 00	1.2000E 02	4.7881E-04	1.7341E-01	9.8922E-01	311
2.1817E 00	1.2500E 02	4.9512E-04	1.7364E-01	9.9050E-01	316
2.2689E 00	1.3000E 02	5.1139E-04	1.7386E-01	9.9175F-01	321
2.3562E 00	1.3500E 02	5.2541E-04	1.7406E-01	9.9294E-01	326
2.4435E 00	1.4000E 02	5.3964E-04	1.7426E-01	9.9407E-01	331
2.5307E 00	1.4500E 02	5.7287E-04	1.7445E-01	9.9512E-01	336
2.6180E 00	1.5000E 02	6.2312E-04	1.7462E-01	9.9612E-01	341
2.7053E 00	1.5500E 02	6.8220E-04	1.7479E-01	9.9706E-01	346
2.7925E 00	1.6000E 02	7.6257E-04	1.7494E-01	9.9792E-01	351
2.8798E 00	1.6500E 02	8.9489E-04	1.7507E-01	9.9869E-01	356
2.9671E 00	1.7000E 02	1.1042E-03	1.7519E-01	9.9936E-01	361
3.0543E 00	1.7500E 02	1.2069E-03	1.7527E-01	9.9983E-01	366
3.1416E 00	1.8000E 02	1.2325E-03	1.7530E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-97. Volume scattering function (sheet 3 of 3).

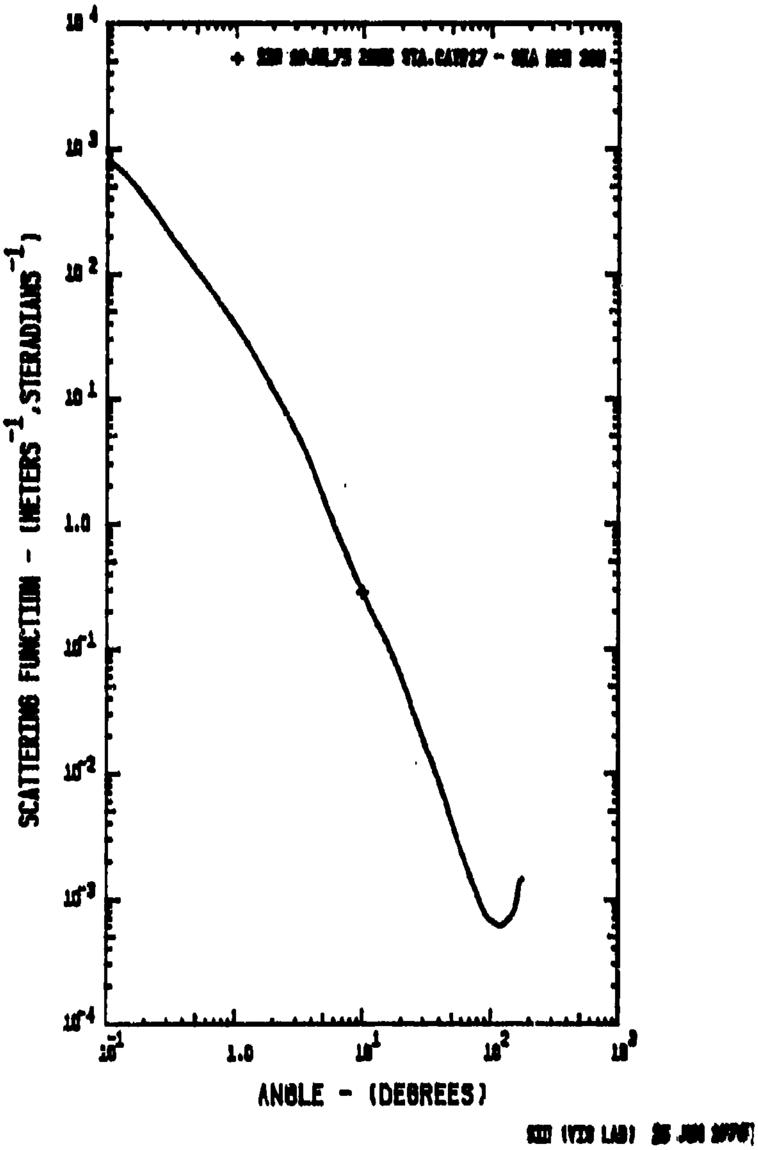


Figure D-98. Volume scattering function (sheet 1 of 3).

520 19JUL75 2055 STA.CAT#17 - SEA H2O 20M

	DATA READ IN ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	SIGMA
1	0.1750	4.9500E 02	0	0.1750	4.8609E 02
2	0.3500	1.7500E 02	0	0.3500	1.8149E 02
3	0.7000	6.9000E 01	0	0.7000	6.7759E 01
4	10.00	2.8775E-01	0	10.00	2.8775E-01
5	15.00	1.2140E-01	0	15.00	1.2140E-01
6	20.00	5.9317E-02	0	20.00	5.9317E-02
7	25.00	3.2442E-02	0	25.00	3.2442E-02
8	30.00	1.9088E-02	0	30.00	1.9088E-02
9	40.00	8.5219E-03	0	40.00	8.5219E-03
10	50.00	4.2098E-03	0	50.00	4.2098E-03
11	60.00	2.4128E-03	0	60.00	2.4128E-03
12	70.00	1.5978E-03	0	70.00	1.5978E-03
13	80.00	1.0866E-03	0	80.00	1.0866E-03
14	90.00	7.9013E-04	0	90.00	7.9013E-04
15	100.0	6.8870E-04	0	100.0	6.8870E-04
16	110.0	6.4173E-04	0	110.0	6.4173E-04
17	120.0	6.2396E-04	0	120.0	6.2396E-04
18	130.0	6.4175E-04	0	130.0	6.4175E-04
19	140.0	6.9353E-04	0	140.0	6.9353E-04
20	150.0	7.5559E-04	0	150.0	7.5559E-04
21	160.0	9.0890E-04	0	160.0	9.0890E-04
22	170.0	1.3198E-03	0	170.0	1.3198E-03
23			1	180.0	1.4712E-03

ALPHA= 0.5087 S/ALPHA= 0.722
S= 0.3675 A/ALPHA= 0.278

A= 0.1412 B/S= 0.012

CORRECTED ALPHA CORRECTION=0.007

ALPHA= 0.5155 S/ALPHA= 0.713
S= 0.3675 A/ALPHA= 0.287
A= 0.1481 B/S= 0.012

SIGMA(0.0 DEGREES)= 1069.
SIGMA(0.1 DEGREES)= 815.1
SLOPE(3 MILLIRAD)= -1.421
S UP TO 0.1 DEGREES= 8.9540E-03 NORMALIZED= 2.43667E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 106.0
EXPECTED K/ALPHA= 0.3911 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K =

	MU	RADIANS	DEGREES
MEDIAN	0.9991	0.4224E-01	2.420
MEAN 1	0.9541	0.3040	17.42
VARIANCE	0.1921		
MEAN 2		0.1475	8.451
RMS		0.3441	19.72
RMS 2		0.3109	17.81

KAPPA= 0.2017 KAPPA'= 2.5774E-03

THETA**2 BAR 5.9205E-02 RADIANS**2

Figure D-98. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0754.09

520 19JUL75 2055 STA.CAT#17 - SEA H2O 20M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	8.1511E 02	8.9540E-03	2.4367E-02	1
2.1972E-03	1.2589E-01	6.9924E 02	1.3182E-02	3.5873E-02	11
2.7662E-03	1.5849E-01	5.5414E 02	1.8710E-02	5.0917E-02	21
3.4824E-03	1.9953E-01	4.0342E 02	2.5328E-02	6.8926E-02	31
4.3841E-03	2.5119E-01	2.9082E 02	3.2899E-02	8.9529E-02	41
5.5192E-03	3.1623E-01	2.0964E 02	4.1549E-02	1.1307E-01	51
6.9483E-03	3.9811E-01	1.5113E 02	5.1432E-02	1.3996E-01	61
8.7474E-03	5.0119E-01	1.0894E 02	6.2723E-02	1.7069E-01	71
1.1012E-02	6.3096E-01	7.8535E 01	7.5623E-02	2.0579E-01	81
1.3864E-02	7.9433E-01	5.6427E 01	9.0352E-02	2.4588E-01	91
1.7453E-02	1.0000E 00	3.9730E 01	1.0697E-01	2.9109E-01	101
2.1972E-02	1.2589E 00	2.7338E 01	1.2529E-01	3.4095E-01	111
2.7662E-02	1.5849E 00	1.8379E 01	1.4504E-01	3.9470E-01	121
3.4824E-02	1.9953E 00	1.2068E 01	1.6583E-01	4.5129E-01	131
4.3841E-02	2.5119E 00	7.7379E 00	1.8722E-01	5.0947E-01	141
5.5192E-02	3.1623E 00	4.8432E 00	2.0868E-01	5.6788E-01	151
6.9483E-02	3.9811E 00	2.8679E 00	2.2949E-01	6.2450E-01	161
8.7473E-02	5.0119E 00	1.5992E 00	2.4837E-01	6.7590E-01	171
1.1012E-01	6.3096E 00	8.7379E-01	2.6484E-01	7.2070E-01	131
1.3864E-01	7.9433E 00	4.8881E-01	2.7917E-01	7.5970E-01	191
1.7453E-01	1.0000E 01	2.8775E-01	2.9213E-01	7.9498E-01	201
2.6180E-01	1.5000E 01	1.2140E-01	3.1381E-01	8.5397E-01	206
3.4907E-01	2.0000E 01	5.9317E-02	3.2776E-01	8.9194E-01	211
4.3633E-01	2.5000E 01	3.2442E-02	3.3694E-01	9.1691E-01	216
5.2360E-01	3.0000E 01	1.9088E-02	3.4322E-01	9.3399E-01	221
6.1086E-01	3.5000E 01	1.2447E-02	3.4773E-01	9.4629E-01	226
6.9813E-01	4.0000E 01	8.5219E-03	3.5117E-01	9.5565E-01	231
7.8540E-01	4.5000E 01	5.8920E-03	3.5380E-01	9.6280E-01	236
8.7266E-01	5.0000E 01	4.2098E-03	3.5581E-01	9.6827E-01	241
9.5993E-01	5.5000E 01	3.1337E-03	3.5739E-01	9.7257E-01	246
1.0472E 00	6.0000E 01	2.4128E-03	3.5866E-01	9.7602E-01	251
1.1345E 00	6.5000E 01	1.9445E-03	3.5971E-01	9.7888E-01	256
1.2217E 00	7.0000E 01	1.5978E-03	3.6060E-01	9.8131E-01	261
1.3090E 00	7.5000E 01	1.3101E-03	3.6136E-01	9.8337E-01	266
1.3963E 00	8.0000E 01	1.0866E-03	3.6200E-01	9.8511E-01	271
1.4835E 00	8.5000E 01	9.1540E-04	3.6254E-01	9.8658E-01	276
1.5708E 00	9.0000E 01	7.9013E-04	3.6301E-01	9.8785E-01	281
1.6581E 00	9.5000E 01	7.2219E-04	3.6342E-01	9.8897E-01	286
1.7453E 00	1.0000E 02	6.8870E-04	3.6380E-01	9.9001E-01	291
1.8326E 00	1.0500E 02	6.6171E-04	3.6416E-01	9.9099E-01	296
1.9199E 00	1.1000E 02	6.4173E-04	3.6450E-01	9.9192E-01	301
2.0071E 00	1.1500E 02	6.2929E-04	3.6482E-01	9.9279E-01	306
2.0944E 00	1.2000E 02	6.2396E-04	3.6513E-01	9.9362E-01	311
2.1817E 00	1.2500E 02	6.2691E-04	3.6541E-01	9.9441E-01	316
2.2689E 00	1.3000E 02	6.4175E-04	3.6569E-01	9.9516E-01	321
2.3562E 00	1.3500E 02	6.6630E-04	3.6595E-01	9.9587E-01	326
2.4435E 00	1.4000E 02	6.9353E-04	3.6621E-01	9.9656E-01	331
2.5307E 00	1.4500E 02	7.2302E-04	3.6644E-01	9.9720E-01	336
2.6180E 00	1.5000E 02	7.5559E-04	3.6666E-01	9.9779E-01	341
2.7053E 00	1.5500E 02	8.1267E-04	3.6686E-01	9.9833E-01	346
2.7925E 00	1.6000E 02	9.0890E-04	3.6704E-01	9.9882E-01	351
2.8798E 00	1.6500E 02	1.0668E-03	3.6720E-01	9.9926E-01	356
2.9671E 00	1.7000E 02	1.3198E-03	3.6734E-01	9.9964E-01	361
3.0543E 00	1.7500E 02	1.4401E-03	3.6744E-01	9.9990E-01	366
3.1416E 00	1.8000E 02	1.4712E-03	3.6747E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-98. Volume scattering function (sheet 3 of 3).

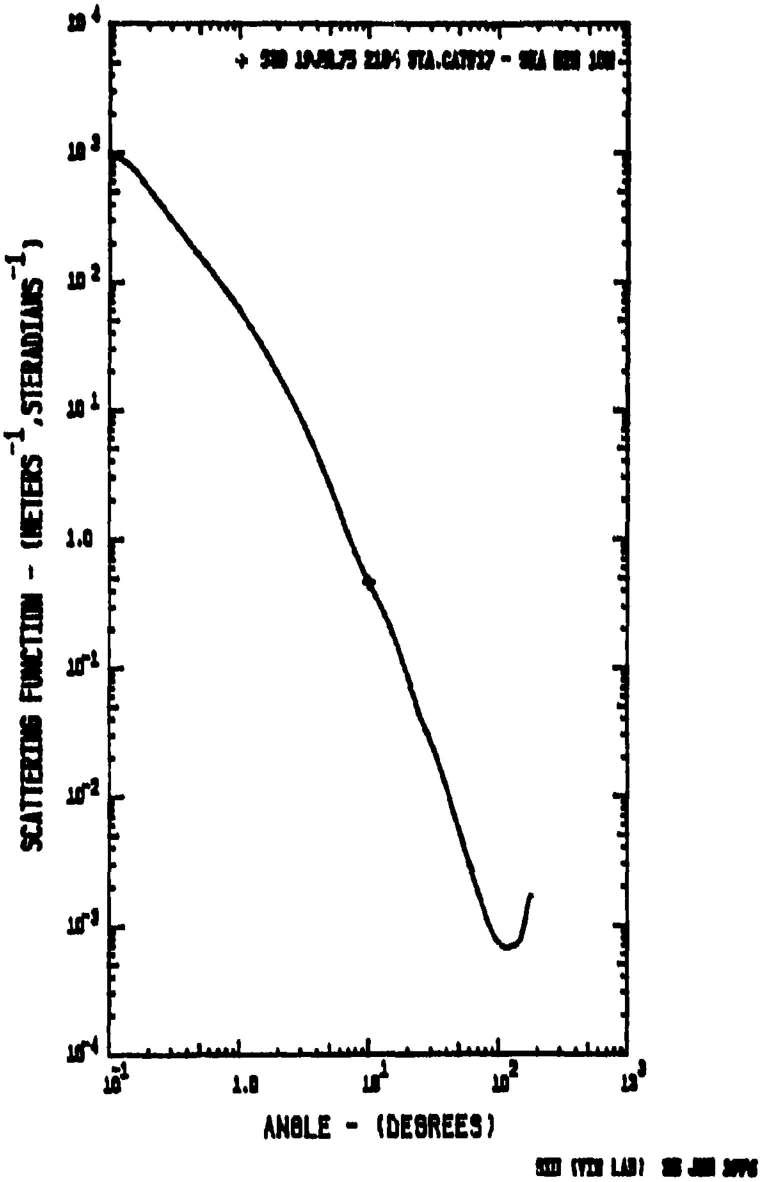


Figure D-99. Volume scattering function (sheet 1 of 3).

520 19JUL75 2104 STA.CAT#17 - SEA H2O 10M

	DATA READ IN ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	SIGMA
1	0.1750	6.6000E 02	0	0.1750	6.4354E 02
2	0.3500	2.5200E 02	0	0.3500	2.6025E 02
3	0.7000	1.0600E 02	0	0.7000	1.0430E 02
4	10.00	4.7045E-01	0	10.00	4.7045E-01
5	15.00	1.9557E-01	0	15.00	1.9557E-01
6	20.00	8.6157E-02	0	20.00	[illegible]
7	25.00	4.2296E-02	0	25.00	[illegible]
8	30.00	2.6580E-02	0	30.00	2.6580E-02
9	40.00	1.1567E-02	0	40.00	1.1567E-02
10	50.00	5.6360E-03	0	50.00	5.6360E-03
11	60.00	3.0337E-03	0	60.00	3.0337E-03
12	70.00	1.8480E-03	0	70.00	1.8480E-03
13	80.00	1.2101E-03	0	80.00	1.2101E-03
14	90.00	8.9457E-04	0	90.00	8.9457E-04
15	100.0	7.5711E-04	0	100.0	7.5711E-04
16	110.0	6.9283E-04	0	110.0	[illegible]
17	120.0	6.8297E-04	0	120.0	[illegible]
18	130.0	6.9859E-04	0	130.0	[illegible]
19	140.0	7.3269E-04	0	140.0	7.3269E-04
20	150.0	8.2637E-04	0	150.0	8.2637E-04
21	160.0	1.0956E-03	0	160.0	1.0956E-03
22	170.0	1.5240E-03	0	170.0	1.5240E-03
23			1	180.0	1.7068E-03

ALPHA= 0.6830 S/ALPHA= 0.828
S= 0.5655 A/ALPHA= 0.172
A= 0.1175 B/S= 0.009

CORRECTED ALPHA CORRECTION=0.009

ALPHA= 0.6916 S/ALPHA= 0.818
S= 0.5655 A/ALPHA= 0.182
A= 0.1261 B/S= 0.009

SIGMA(0.0 DEGREES)= 1337.
SIGMA(0.1 DEGREES)= 1064.
SLOPE(3 MILLIRAD)= -1.319
S UP TO 0.1 DEGREES= 1.1327E-02 NORMALIZED= 2.00299E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 101.0
EXPECTED K/ALPHA= 0.2830 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K =

	MU	RADIANS	DEGREES
MEDIAN	0.9991	0.4327E-01	2.479
MEAN 1	0.9630	0.2727	15.62
VARIANCE	0.1657		
MEAN 2		0.1332	7.634
RMS		0.3050	17.52
RMS 2		0.2753	15.77

KAPPA= 0.1957 KAPPA'= 2.0444E-03

THETA**2 BAR 4.6765E-02 RADIANS**2

Figure D-99. Volume scattering function (sheet 2 of 3).

520 19JUL75 2104 STA.CAT#17 - SEA H2O 10M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	1.0442E 03	1.1327E-02	2.0030E-02	1
2.1972E-03	1.2589E-01	9.0777E 02	1.6779E-02	2.9672E-02	11
2.7662E-03	1.5849E-01	7.3311E 02	2.4023E-02	4.2482E-02	21
3.4824E-03	1.9953E-01	5.4618E 02	3.2881E-02	5.8146E-02	31
4.3841E-03	2.5119E-01	4.0311E 02	4.3256E-02	7.6492E-02	41
5.5192E-03	3.1623E-01	2.9752E 02	5.5392E-02	9.7952E-02	51
6.9483E-03	3.9811E-01	2.1958E 02	6.9587E-02	1.2305E-01	61
8.7474E-03	5.0119E-01	1.6207E 02	8.6192E-02	1.5242E-01	71
1.1012E-02	6.3096E-01	1.[illegible]61E 02	1.0561E-01	1.8676E-01	81
1.3864E-02	7.9433E-01	8.7928E 01	1.2832E-01	2.2691E-01	91
1.7453E-02	1.0000E 00	6.3075E 01	1.5446E-01	2.7315E-01	101
2.1972E-02	1.2589E 00	4.4023E 01	1.8378E-01	3.2498E-01	111
2.7662E-02	1.5849E 00	2.9897E 01	2.1575E-01	3.8153E-01	121
3.4824E-02	1.9953E 00	1.9756E 01	2.4970E-01	4.4155E-01	131
4.3841E-02	2.5119E 00	1.2704E 01	2.8476E-01	5.0356E-01	141
5.5192E-02	3.1623E 00	7.9504E 00	3.2001E-01	5.6589E-01	151
6.9483E-02	3.9811E 00	4.7010E 00	3.5616E-01	6.2624E-01	161
8.7473E-02	5.0119E 00	2.6184E 00	3.8508E-01	6.6096E-01	171
1.1012E-01	6.3096E 00	1.4295E 00	4.1202E-01	7.2860E-01	181
1.3864E-01	7.9433E 00	7.9601E-01	4.3546E-01	7.7005E-01	191
1.7453E-01	1.0000E 01	4.7045E-01	4.5666E-01	8.0753E-01	201
2.6180E-01	1.5000E 01	1.9557E-01	4.9201E-01	8.7004E-01	206
3.4907E-01	2.0000E 01	8.6157E-02	5.1352E-01	9.0809E-01	211
4.3633E-01	2.5000E 01	4.2296E-02	5.2609E-01	9.3032E-01	216
5.2360E-01	3.0000E 01	2.6580E-02	5.3453E-01	9.4523E-01	221
6.1086E-01	3.5000E 01	1.7229E-02	5.4082E-01	9.5636E-01	226
6.9813E-01	4.0000E 01	1.1567E-02	5.4553E-01	9.6470E-01	231
7.8540E-01	4.5000E 01	7.9637E-03	5.4909E-01	9.7099E-01	236
8.7266E-01	5.0000E 01	5.6360E-03	5.5180E-01	9.7578E-01	241
9.5993E-01	5.5000E 01	4.0686E-03	5.5388E-01	9.7946E-01	246
1.0472E 00	6.0000E 01	3.0337E-03	5.5551E-01	9.8233E-01	251
1.1345E 00	6.5000E 01	2.3432E-03	5.5680E-01	9.8462E-01	256
1.2217E 00	7.0000E 01	1.8480E-03	5.5786E-01	9.8649E-01	261
1.3090E 00	7.5000E 01	1.4834E-03	5.5872E-01	9.8802E-01	266
1.3963E 00	8.0000E 01	1.2101E-03	5.5944E-01	9.8929E-01	271
1.4835E 00	8.5000E 01	1.0200E-03	5.6004E-01	9.9035E-01	276
1.5708E 00	9.0000E 01	8.9457E-04	5.6056E-01	9.9128E-01	281
1.6581E 00	9.5000E 01	8.1180E-04	5.6103E-01	9.9210E-01	286
1.7453E 00	1.0000E 02	7.5711E-04	5.6145E-01	9.9285E-01	291
1.8326E 00	1.0500E 02	7.1711E-04	5.6185E-01	9.9355E-01	296
1.9199E 00	1.1000E 02	6.9283E-04	5.6221E-01	9.9420E-01	301
2.0071E 00	1.1500E 02	6.8319E-04	5.6256E-01	9.9481E-01	306
2.0944E 00	1.2000E 02	6.8297E-04	5.6289E-01	9.9540E-01	311
2.1817E 00	1.2500E 02	6.8919E-04	5.6321E-01	9.9596E-01	316
2.2689E 00	1.3000E 02	6.9859E-04	5.6351E-01	9.9649E-01	321
2.3562E 00	1.3500E 02	7.1319E-04	5.6380E-01	9.9699E-01	326
2.4435E 00	1.4000E 02	7.3269E-04	5.6406E-01	9.9747E-01	331
2.5307E 00	1.4500E 02	7.6362E-04	5.6431E-01	9.9791E-01	336
2.6180E 00	1.5000E 02	8.2637E-04	5.6455E-01	9.9832E-01	341
2.7053E 00	1.5500E 02	9.3804E-04	5.6477E-01	9.9871E-01	346
2.7925E 00	1.6000E 02	1.0956E-03	5.6498E-01	9.9909E-01	351
2.8798E 00	1.6500E 02	1.2871E-03	5.[illegible]517E-01	9.9943E-01	356
2.9671E 00	1.7000E 02	1.5240E-03	5.6534E-01	9.9973E-01	361
3.0543E 00	1.7500E 02	1.6784E-03	5.6545E-01	9.9993E-01	366
3.1416E 00	1.8000E 02	1.7068E-03	5.6550E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-99. Volume scattering function (sheet 3 of 3).

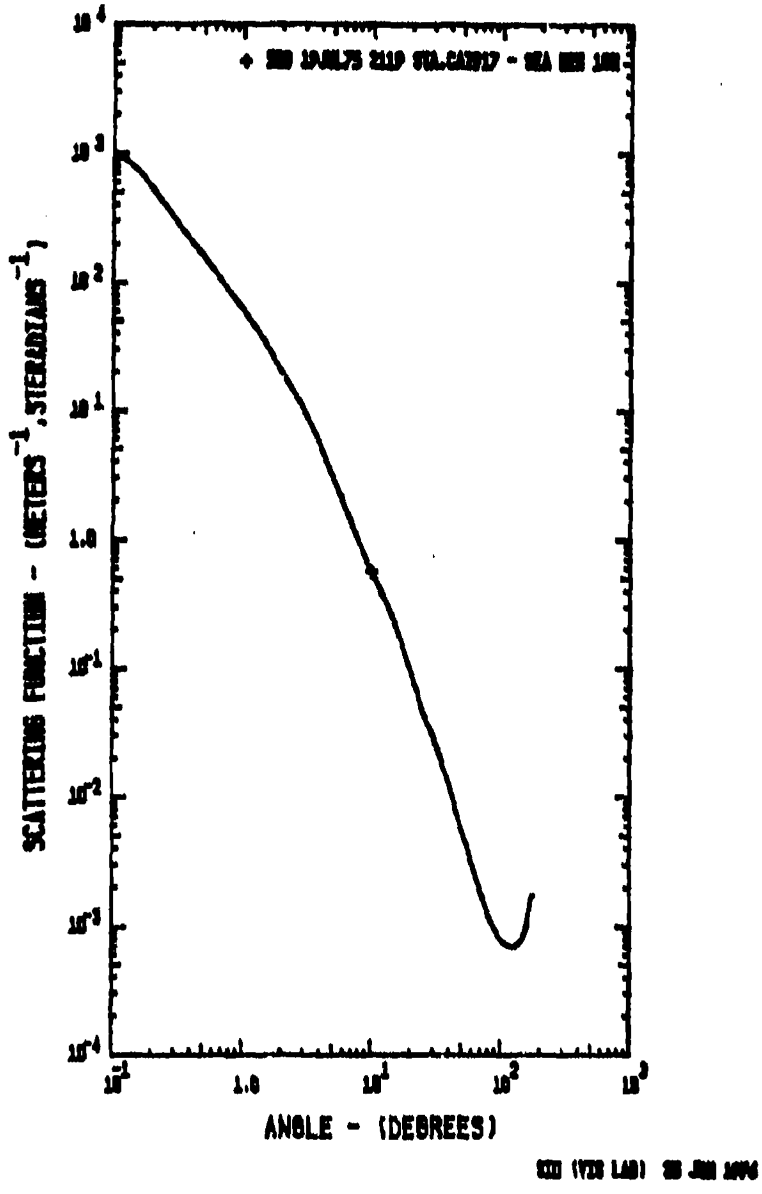


Figure D-100. Volume scattering function (sheet 1 of 3).

520 19JUL75 2119 STA.CAT#17 - SEA H2O 10M

	DATA READ IN ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	SIGMA
1	0.1750	6.6000E 02	0	0.1750	6.4769E 02
2	0.3500	2.5000E 02	0	0.3500	2.5958E 02
3	0.7000	1.0600E 02	0	0.7000	1.0403E 02
4	10.00	5.7970E-01	0	10.00	5.7970E-01
5	15.00	2.3088E-01	0	15.00	2.3088E-01
6	20.00	9.6384E-02	0	20.00	9.6384E-02
7	25.00	4.8133E-02	0	25.00	4.8133E-02
8	30.00	3.0005E-02	0	30.00	3.0005E-02
9	40.00	1.2666E-02	0	40.00	1.2666E-02
10	50.00	5.7162E-03	0	50.00	5.7162E-03
11	60.00	3.2832E-03	0	60.00	3.2832E-03
12	70.00	1.9537E-03	0	70.00	1.9537E-03
13	80.00	1.2897E-03	0	80.00	1.2897E-03
14	90.00	9.8486E-04	0	90.00	9.8486E-04
15	100.0	8.1871E-04	0	100.0	8.1871E-04
16	110.0	7.4263E-04	0	110.0	7.4263E-04
17	120.0	7.1471E-04	0	120.0	7.1471E-04
18	130.0	7.0697E-04	0	130.0	7.0697E-04
19	140.0	7.4725E-04	0	140.0	7.4725E-04
20	150.0	8.1717E-04	0	150.0	8.1717E-04
21	160.0	1.0332E-03	0	160.0	1.0332E-03
22	170.0	1.5635E-03	0	170.0	1.5635E-03
23			1	180.0	1.7699E-03

ALPHA= 0.6830 S/ALPHA= 0.904
S= 0.6174 A/ALPHA= 0.096
A= 0.0656 B/S= 0.008

CORRECTED ALPHA CORRECTION=0.009

ALPHA= 0.6916 S/ALPHA= 0.893
S= 0.6174 A/ALPHA= 0.107
A= 0.0742 B/S= 0.008

SIGMA(0.0 DEGREES)= 1333.
SIGMA(0.1 DEGREES)= 1042.
SLOPE(3 MILLIRAD)= -1.319
S UP TO 0.1 DEGREES= 1.1298E-02 NORMALIZED= 1.82999E-02

MAXIMUM PARTICLE DIAMETER (MICRONS)= 101.0
EXPECTED K/ALPHA= 0.1989 EXPECTED DIFFUSE ATTENUATION COEFFICIENT - K =

	MU	RADIANS	DEGREES
MEDIAN	0.9988	0.4854E-01	2.781
MEAN 1	0.9636	0.2707	15.51
VARIANCE	0.1613		
MEAN 2		0.1362	7.805
RMS		0.3020	17.30
RMS 2		0.2695	15.44

KAPPA= 0.1376 KAPPA'= 2.0110E-03

THETA**2 BAR 4.5602E-02 RADIANS**2

Figure D-100. Volume scattering function (sheet 2 of 3).

25 JUN 1976 0752.36

520 19JUL75 2119 STA.CAT#17 - SEA H2O 10M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	1.0416E 03	1.1298E-02	1.8300E-02	1
2.1972E-03	1.2589E-01	9.0546E 02	1.6737E-02	2.7109E-02	11
2.7662E-03	1.5849E-01	7.3124E 02	2.3962E-02	3.8813E-02	21
3.4824E-03	1.9953E-01	5.4479E 02	3.2798E-02	5.3124E-02	31
4.3841E-03	2.5119E-01	4.0208E 02	4.3146E-02	6.9885E-02	41
5.5192E-03	3.1623E-01	2.9676E 02	5.5250E-02	8.9492E-02	51
6.9483E-03	3.9811E-01	2.1902E 02	6.9409E-02	1.1243E-01	61
8.7474E-03	5.0119E-01	1.6165E 02	8.5971E-02	1.3925E-01	71
1.1012E-02	6.3096E-01	1.1930E 02	1.0534E-01	1.7063E-01	81
1.3864E-02	7.9433E-01	8.7824E 01	1.2799E-01	2.0732E-01	91
1.7453E-02	1.0000E 00	6.3602E 01	1.5422E-01	2.4979E-01	101
2.1972E-02	1.2589E 00	4.5142E 01	1.8401E-01	2.9806E-01	111
2.7662E-02	1.5849E 00	3.1336E 01	2.1715E-01	3.5174E-01	121
3.4824E-02	1.9953E 00	2.1232E 01	2.5318E-01	4.1009E-01	131
4.3841E-02	2.5119E 00	1.4013E 01	2.9136E-01	4.7193E-01	141
5.5192E-02	3.1623E 00	8.9908E 00	3.3073E-01	5.3571E-01	151
6.9483E-02	3.9811E 00	5.4390E 00	3.6977E-01	5.9894E-01	161
8.7474E-02	5.0119E 00	3.0928E 00	4.0598E-01	6.5753E-01	171
1.1012E-01	6.3096E 00	1.7189E 00	4.3806E-01	7.0954E-01	181
1.3864E-01	7.9433E 00	9.7100E-01	4.6645E-01	7.5553E-01	191
1.7453E-01	1.0000E 01	5.7971E-01	4.9245E-01	7.9764E-01	201
2.6180E-01	1.5000E 01	2.3088E-01	5.3587E-01	8.6798E-01	206
3.4907E-01	2.0000E 01	9.6384E-02	5.6035E-01	9.0762E-01	211
4.3633E-01	2.5000E 01	4.8133E-02	5.7455E-01	9.3062E-01	216
5.2360E-01	3.0000E 01	3.0005E-02	5.8409E-01	9.4607E-01	221
6.1086E-01	3.5000E 01	1.9216E-02	5.9116E-01	9.5753E-01	226
6.9813E-01	4.0000E 01	1.2666E-02	5.9637E-01	9.6597E-01	231
7.8540E-01	4.5000E 01	8.3111E-03	6.0019E-01	9.7216E-01	236
8.7266E-01	5.0000E 01	5.7162E-03	6.0296E-01	9.7665E-01	241
9.5993E-01	5.5000E 01	4.2823E-03	6.0511E-01	9.8012E-01	246
1.0472E 00	6.0000E 01	3.2832E-03	6.0685E-01	9.8294E-01	251
1.1345E 00	6.5000E 01	2.5088E-03	6.0824E-01	9.8520E-01	256
1.2217E 00	7.0000E 01	1.9537E-03	6.0936E-01	9.8702E-01	261
1.3090E 00	7.5000E 01	1.5645E-03	6.1028E-01	9.8850E-01	266
1.3963E 00	8.0000E 01	1.2897E-03	6.1104E-01	9.8973E-01	271
1.4835E 00	8.5000E 01	1.1089E-03	6.1168E-01	9.9077E-01	276
1.5708E 00	9.0000E 01	9.8486E-04	6.1226E-01	9.9170E-01	281
1.6581E 00	9.5000E 01	8.8867E-04	6.1277E-01	9.9253E-01	286
1.7453E 00	1.0000E 02	8.1871E-04	6.1323E-01	9.9328E-01	291
1.8326E 00	1.0500E 02	7.7152E-04	6.1365E-01	9.9397E-01	296
1.9199E 00	1.1000E 02	7.4263E-04	6.1405E-01	9.9461E-01	301
2.0071E 00	1.1500E 02	7.2593E-04	6.1442E-01	9.9521E-01	306
2.0944E 00	1.2000E 02	7.1471E-04	6.1477E-01	9.9578E-01	311
2.1817E 00	1.2500E 02	7.0720E-04	6.1510E-01	9.9631E-01	316
2.2689E 00	1.3000E 02	7.0697E-04	6.1541E-01	9.9680E-01	321
2.3562E 00	1.3500E 02	7.2243E-04	6.1569E-01	9.9727E-01	326
2.4435E 00	1.4000E 02	7.4725E-04	6.1597E-01	9.9771E-01	331
2.5307E 00	1.4500E 02	7.7706E-04	6.1622E-01	9.9812E-01	336
2.6180E 00	1.5000E 02	8.1717E-04	6.1645E-01	9.9850E-01	341
2.7053E 00	1.5500E 02	8.9616E-04	6.1667E-01	9.9885E-01	346
2.7925E 00	1.6000E 02	1.0332E-03	6.1687E-01	9.9918E-01	351
2.8798E 00	1.6500E 02	1.2422E-03	6.1706E-01	9.9948E-01	356
2.9671E 00	1.7000E 02	1.5635E-03	6.1722E-01	9.9974E-01	361
3.0543E 00	1.7500E 02	1.7291E-03	6.1734E-01	9.9993E-01	366
3.1416E 00	1.8000E 02	1.7699E-03	6.1738E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-100. Volume scattering function (sheet 3 of 3).

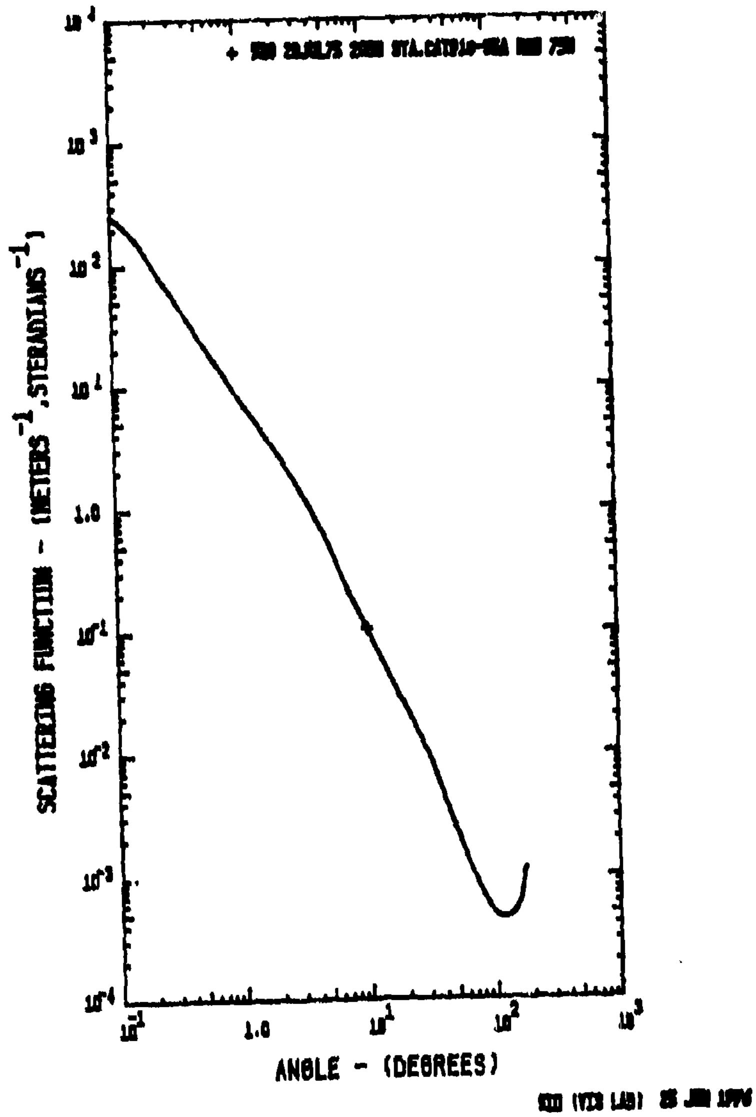


Figure D-101. Volume scattering function (sheet 1 of 3).

520 20JUL75 2050 STA.CAT#18-SEA H2O 75M

	DATA READ IN ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	SIGMA
1	0.1750	1.4200E 02	0	0.1750	1.3869E 02
2	0.3500	4.3000E 01	0	0.3500	4.5077E 01
3	0.7000	1.5000E 01	0	0.7000	1.4651E 01
4	10.00	1.0422E-01	0	10.00	1.0422E-01
5	15.00	4.3848E-02	0	15.00	4.3848E-02
6	20.00	2.3964E-02	0	20.00	2.3964E-02
7	25.00	1.4799E-02	0	25.00	1.4799E-02
8	30.00	1.0161E-02	0	30.00	1.0161E-02
9	40.00	4.5287E-03	0	40.00	4.5287E-03
10	50.00	2.3444E-03	0	50.00	2.3444E-03
11	60.00	1.4148E-03	0	60.00	1.4148E-03
12	70.00	9.6883E-04	0	70.00	9.6883E-04
13	80.00	7.2136E-04	0	80.00	7.2136E-04
14	90.00	5.7660E-04	0	90.00	5.7660E-04
15	100.0	4.8823E-04	0	100.0	4.8823E-04
16	110.0	4.5836E-04	0	110.0	4.5836E-04
17	120.0	4.5591E-04	0	120.0	4.5591E-04
18	130.0	4.6204E-04	0	130.0	4.6204E-04
19	140.0	4.8720E-04	0	140.0	4.8720E-04
20	150.0	5.3823E-04	0	150.0	5.3823E-04
21	160.0	6.3784E-04	0	160.0	6.3784E-04
22	170.0	1.0051E-03	0	170.0	1.0051E-03
23			1	180.0	1.1409E-03

ALPHA= 0.2145 S/ALPHA= 0.524
S= 0.1124 A/ALPHA= 0.476
A= 0.1021 B/S= 0.029

CORRECTED ALPHA CORRECTION=0.002

ALPHA= 0.2167 S/ALPHA= 0.519
S= 0.1124 A/ALPHA= 0.481
A= 0.1043 B/S= 0.029

SIGMA(0.0 DEGREES)= 354.8
SIGMA(0.1 DEGREES)= 255.3
SLOPE(3 MILLIRAD)= -1.621
S UP TO 0.1 DEGREES= 2.8891E-03 NORMALIZED= 2.56974E-02

THETA**2 BAR 0.1218 RADIANS**2

Figure D-101. Volume scattering function (sheet 2 of 3).

520 20JUL75 2050 STA.CAT#18-SEA H2O 75M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	2.5527E 02	2.8891E-03	2.5697E-02	1
2.1972E-03	1.2589E-01	2.1237E 02	4.1934E-03	3.7298E-02	11
2.7662E-03	1.5849E-01	1.6137E 02	5.8377E-03	5.1923E-02	21
3.4824E-03	1.9953E-01	1.1212E 02	7.7192E-03	6.8658E-02	31
4.3841E-03	2.5119E-01	7.7187E 01	9.7746E-03	8.6940E-02	41
5.5192E-03	3.1623E-01	5.3138E 01	1.2017E-02	1.0689E-01	51
6.9483E-03	3.9811E-01	3.6581E 01	1.4464E-02	1.2865E-01	61
8.7474E-03	5.0119E-01	2.5184E 01	1.7134E-02	1.5240E-01	71
1.1012E-02	6.3096E-01	1.7337E 01	2.0047E-02	1.7831E-01	81
1.3864E-02	7.9433E-01	1.1960E 01	2.3226E-02	2.0658E-01	91
1.7453E-02	1.0000E 00	8.3526E 00	2.6723E-02	2.3769E-01	101
2.1972E-02	1.2589E 00	5.8779E 00	3.0611E-02	2.7227E-01	111
2.7662E-02	1.5849E 00	4.1383E 00	3.4951E-02	3.1087E-01	121
3.4824E-02	1.9953E 00	2.8940E 00	3.9779E-02	3.5381E-01	131
4.3841E-02	2.5119E 00	1.9960E 00	4.5096E-02	4.0110E-01	141
5.5192E-02	3.1623E 00	1.3479E 00	5.0848E-02	4.5227E-01	151
6.9483E-02	3.9811E 00	8.6164E-01	5.6863E-02	5.0576E-01	161
8.7473E-02	5.0119E 00	5.1700E-01	6.2750E-02	5.5813E-01	171
1.1012E-01	6.3096E 00	3.0037E-01	6.8242E-02	6.0698E-01	181
1.3864E-01	7.9433E 00	1.7431E-01	7.3278E-02	6.5177E-01	191
1.7453E-01	1.0000E 01	1.0422E-01	7.7960E-02	6.9341E-01	201
2.6180E-01	1.5000E 01	4.3848E-02	8.5771E-02	7.6289E-01	206
3.4907E-01	2.0000E 01	2.3964E-02	9.1044E-02	8.0979E-01	211
4.3633E-01	2.5000E 01	1.4799E-02	9.4967E-02	8.4465E-01	216
5.2360E-01	3.0000E 01	1.0161E-02	9.8065E-02	8.7223E-01	221
6.1086E-01	3.5000E 01	6.7166E-03	1.0051E-01	8.9396E-01	226
6.9813E-01	4.0000E 01	4.5287E-03	1.0235E-01	9.1031E-01	231
7.8540E-01	4.5000E 01	3.1963E-03	1.0375E-01	9.2283E-01	236
8.7266E-01	5.0000E 01	2.3444E-03	1.0486E-01	9.3266E-01	241
9.5993E-01	5.5000E 01	1.7899E-03	1.0575E-01	9.4057E-01	246
1.0472E 00	6.0000E 01	1.4148E-03	1.0648E-01	9.4710E-01	251
1.1345E 00	6.5000E 01	1.1555E-03	1.0710E-01	9.5262E-01	256
1.2217E 00	7.0000E 01	9.6883E-04	1.0764E-01	9.5738E-01	261
1.3090E 00	7.5000E 01	8.2834E-04	1.0811E-01	9.6154E-01	266
1.3963E 00	8.0000E 01	7.2136E-04	1.0852E-01	9.6522E-01	271
1.4835E 00	8.5000E 01	6.4043E-04	1.0889E-01	9.6850E-01	276
1.5708E 00	9.0000E 01	5.7660E-04	1.0922E-01	9.7146E-01	281
1.6581E 00	9.5000E 01	5.2551E-04	1.0952E-01	9.7414E-01	286
1.7453E 00	1.0000E 02	4.8823E-04	1.0980E-01	9.7659E-01	291
1.8326E 00	1.0500E 02	4.6668E-04	1.1005E-01	9.7885E-01	296
1.9199E 00	1.1000E 02	4.5834E-04	1.1029E-01	9.8099E-01	301
2.0071E 00	1.1500E 02	4.5591E-04	1.1052E-01	9.8305E-01	306
2.0944E 00	1.2000E 02	4.5591E-04	1.1075E-01	9.8502E-01	311
2.1817E 00	1.2500E 02	4.5793E-04	1.1096E-01	9.8690E-01	316
2.2689E 00	1.3000E 02	4.6204E-04	1.1116E-01	9.8868E-01	321
2.3562E 00	1.3500E 02	4.7186E-04	1.1135E-01	9.9026E-01	326
2.4435E 00	1.4000E 02	4.8720E-04	1.1152E-01	9.9193E-01	331
2.5307E 00	1.4500E 02	5.0967E-04	1.1169E-01	9.9341E-01	336
2.6180E 00	1.5000E 02	5.3823E-04	1.1184E-01	9.9478E-01	341
2.7053E 00	1.5500E 02	5.7740E-04	1.1198E-01	9.9603E-01	346
2.7925E 00	1.6000E 02	6.3784E-04	1.1211E-01	9.9716E-01	351
2.8798E 00	1.6500E 02	7.6584E-04	1.1222E-01	9.9817E-01	356
2.9671E 00	1.7000E 02	1.0051E-03	1.1233E-01	9.9909E-01	361
3.0543E 00	1.7500E 02	1.1107E-03	1.1240E-01	9.9976E-01	366
3.1416E 00	1.8000E 02	1.1409E-03	1.1243E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-101. Volume scattering function (sheet 3 of 3).

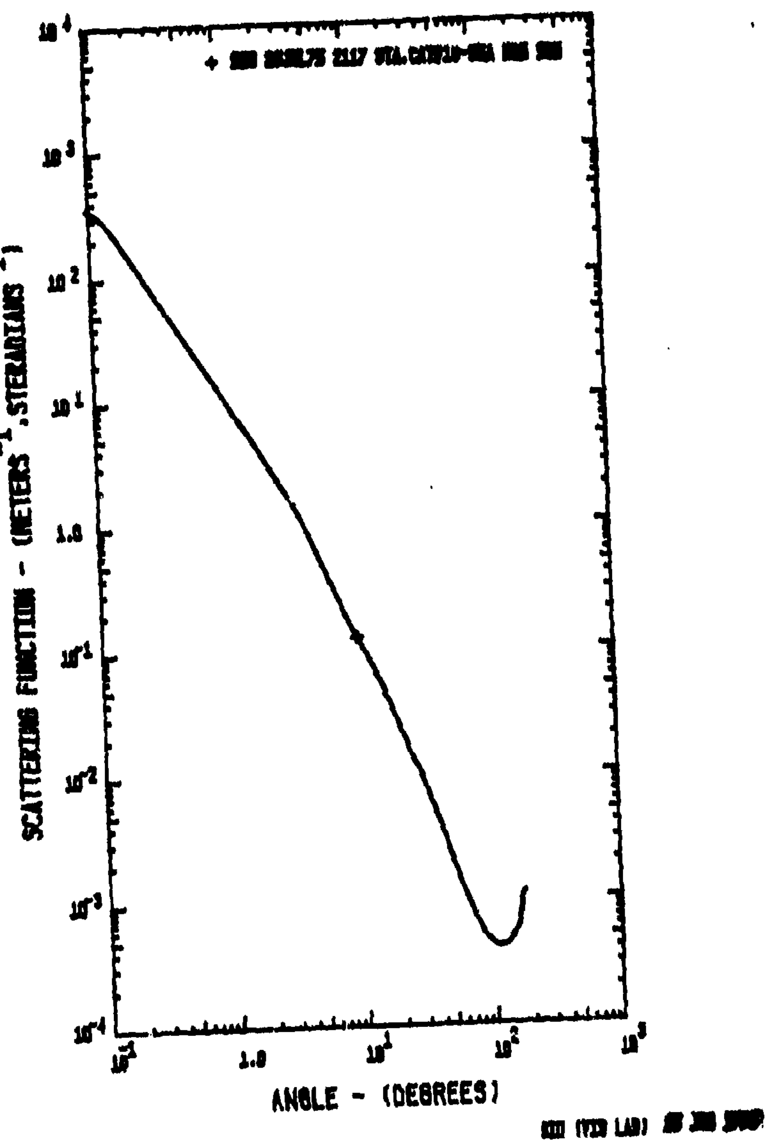


Figure D-102. Volume scattering function (sheet 1 of 3).

25 JUN 1976 1144.54

520 20JUL75 2117 STA.CAT#1R-SEA H2O 50M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	2.0700E 02	0	0.1750	1.9996E 02
2	0.3500	6.0000E 01	0	0.3500	6.4295E 01
3	0.7000	2.1400E 01	0	0.7000	2.0673E 01
4	10.00	1.2716E-01	0	10.00	1.2716E-01
5	15.00	5.4560E-02	0	15.00	5.4560E-02
6	20.00	2.6010E-02	0	20.00	2.6010E-02
7	25.00	1.4708E-02	0	25.00	1.4708E-02
8	30.00	9.9805E-03	0	30.00	9.9805E-03
9	40.00	4.2087E-03	0	40.00	4.2087E-03
10	50.00	2.1341E-03	0	50.00	2.1341E-03
11	60.00	1.2727E-03	0	60.00	1.2727E-03
12	70.00	8.2683E-04	0	70.00	8.2683E-04
13	80.00	5.9827E-04	0	80.00	5.9827E-04
14	90.00	4.8587E-04	0	90.00	4.8587E-04
15	100.0	4.3409E-04	0	100.0	4.3409E-04
16	110.0	4.1058E-04	0	110.0	4.1058E-04
17	120.0	4.1737E-04	0	120.0	4.1737E-04
18	130.0	4.2940E-04	0	130.0	4.2940E-04
19	140.0	4.6792E-04	0	140.0	4.6792E-04
20	150.0	5.2712E-04	0	150.0	5.2712E-04
21	160.0	6.2695E-04	0	160.0	6.2695E-04
22	170.0	9.9118E-04	0	170.0	9.9118E-04
23			1	180.0	1.1264E-03

ALPHA= 0.2607   S/ALPHA= 0.529
S= 0.1380   A/ALPHA= 0.471
A= 0.1227   B/S= 0.021

CORRECTED ALPHA   CORRECTION=0.003

ALPHA= 0.2639   S/ALPHA= 0.523
S= 0.1380   A/ALPHA= 0.477
A= 0.1260   B/S= 0.021

SIGMA(0.0 DEGREES)= 518.7
SIGMA(0.1 DEGREES)= 371.2
SLOPE(3 MILLIRAD)= -1.637
S UP TO 0.1 DEGREES= 4.2129E-03   NORMALIZED= 3.09342E-02

THETA**2 BAR   9.2964E-02 RADIANS**2

Figure D-102. Volume scattering function (sheet 2 of 3).

25 JUN 1976 1144.54

520 20JUL75 2117 STA.CAT#18-SEA H2O SUM

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	3.7117E 02	4.2129E-03	3.0534E-02	1
2.1972E-03	1.2589E-01	3.0791E 02	6.1067E-03	4.4260E-02	11
2.7662E-03	1.5849E-01	2.3307E 02	8.4862E-03	6.1505E-02	21
3.4824E-03	1.9953E-01	1.6133E 02	1.1198E-02	8.1163E-02	31
4.3841E-03	2.5119E-01	1.1066E 02	1.4150E-02	1.0256E-01	41
5.5192E-03	3.1623E-01	7.5912E 01	1.7360E-02	1.2582E-01	51
6.9483E-03	3.9811E-01	5.2073E 01	2.0849E-02	1.5111E-01	61
8.7474E-03	5.0119E-01	3.5721E 01	2.4643E-02	1.7860E-01	71
1.1012E-02	6.3096E-01	2.4503E 01	2.8767E-02	2.0849E-01	81
1.3864E-02	7.9433E-01	1.6804E 01	3.3250E-02	2.4099E-01	91
1.7453E-02	1.0000E 00	1.1511E 01	3.8121E-02	2.7629E-01	101
2.1972E-02	1.2589E 00	7.8700E 00	4.3404E-02	3.1458E-01	111
2.7662E-02	1.5849E 00	5.3657E 00	4.9120E-02	3.5601E-01	121
3.4824E-02	1.9953E 00	3.6450E 00	5.5286E-02	4.0069E-01	131
4.3841E-02	2.5119E 00	2.4651E 00	6.1909E-02	4.4870E-01	141
5.5192E-02	3.1623E 00	1.6583E 00	6.8988E-02	5.0001E-01	151
6.9483E-02	3.9811E 00	1.0563E 00	7.6385E-02	5.5362E-01	161
8.7473E-02	5.0119E 00	6.2455E-01	8.3552E-02	6.0556E-01	171
1.1012E-01	6.3096E 00	3.5790E-01	9.0138E-02	6.5330E-01	181
1.3864E-01	7.9433E 00	2.0795E-01	9.6128E-02	6.9671E-01	191
1.7453E-01	1.0000E 01	1.2716E-01	1.0176E-01	7.3749E-01	201
2.6180E-01	1.5000E 01	5.4560E-02	1.1156E-01	8.0853E-01	206
3.4907E-01	2.0000E 01	2.6010E-02	1.1770E-01	8.5303E-01	211
4.3633E-01	2.5000E 01	1.4708E-02	1.2177E-01	8.8255E-01	216
5.2360E-01	3.0000E 01	9.9805E-03	1.2484E-01	9.0479E-01	221
6.1086E-01	3.5000E 01	6.3081E-03	1.2717E-01	9.2171E-01	226
6.9813E-01	4.0000E 01	4.2087E-03	1.2889E-01	9.3415E-01	231
7.8540E-01	4.5000E 01	2.9320E-03	1.3019E-01	9.4357E-01	236
8.7266E-01	5.0000E 01	2.1341E-03	1.3120E-01	9.5088E-01	241
9.5993E-01	5.5000E 01	1.6248E-03	1.3201E-01	9.5674E-01	246
1.0472E 00	6.0000E 01	1.2727E-03	1.3267E-01	9.6156E-01	251
1.1345E 00	6.5000E 01	1.0165E-03	1.3322E-01	9.6557E-01	256
1.2217E 00	7.0000E 01	8.2683E-04	1.3369E-01	9.6893E-01	261
1.3090E 00	7.5000E 01	6.9281E-04	1.3408E-01	9.7179E-01	266
1.3963E 00	8.0000E 01	5.9827E-04	1.3443E-01	9.7429E-01	271
1.4835E 00	8.5000E 01	5.3100E-04	1.3473E-01	9.7650E-01	276
1.5708E 00	9.0000E 01	4.8587E-04	1.3501E-01	9.7851E-01	281
1.6581E 00	9.5000E 01	4.5541E-04	1.3527E-01	9.8038E-01	286
1.7453E 00	1.0000E 02	4.3409E-04	1.3551E-01	9.8213E-01	291
1.8326E 00	1.0500E 02	4.1770E-04	1.3574E-01	9.8378E-01	296
1.9199E 00	1.1000E 02	4.1058E-04	1.3595E-01	9.8534E-01	301
2.0071E 00	1.1500E 02	4.1279E-04	1.3616E-01	9.8685E-01	306
2.0944E 00	1.2000E 02	4.1737E-04	1.3636E-01	9.8831E-01	311
2.1817E 00	1.2500E 02	4.2232E-04	1.3656E-01	9.8972E-01	316
2.2689E 00	1.3000E 02	4.2940E-04	1.3674E-01	9.9106E-01	321
2.3562E 00	1.3500E 02	4.4499E-04	1.3692E-01	9.9234E-01	326
2.4435E 00	1.4000E 02	4.6792E-04	1.3709E-01	9.9356E-01	331
2.5307E 00	1.4500E 02	4.9541E-04	1.3725E-01	9.9473E-01	336
2.6180E 00	1.5000E 02	5.2712E-04	1.3740E-01	9.9582E-01	341
2.7053E 00	1.5500E 02	5.6802E-04	1.3754E-01	9.9682E-01	346
2.7925E 00	1.6000E 02	6.2695E-04	1.3766E-01	9.9772E-01	351
2.8798E 00	1.6500E 02	7.5318E-04	1.3777E-01	9.9855E-01	356
2.9671E 00	1.7000E 02	9.9118E-04	1.3787E-01	9.9927E-01	361
3.0543E 00	1.7500E 02	1.0964E-03	1.3795E-01	9.9981E-01	366
3.1416E 00	1.8000E 02	1.1264E-03	1.3797E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-102. Volume scattering function (sheet 3 of 3).

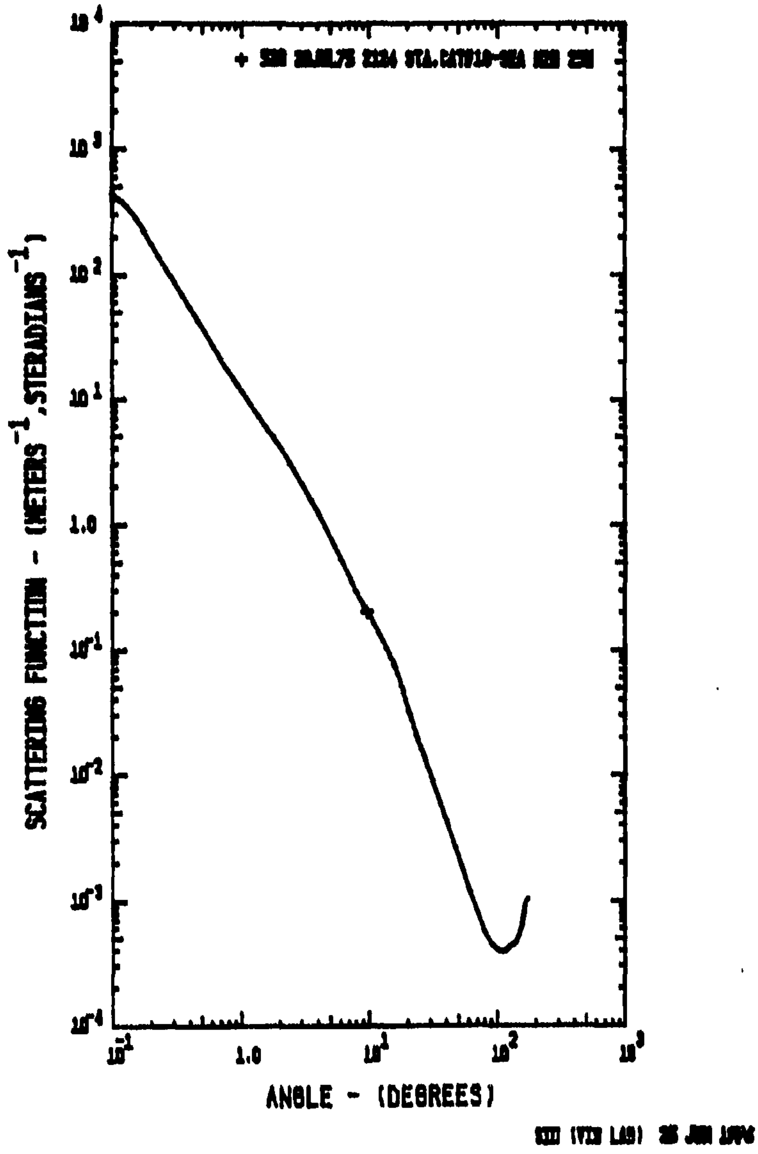


Figure D-103. Volume scattering function (sheet 1 of 3).

25 JUN 1976 1147.59

520 20JUL75 2124 STA.CAT#18-SEA H2O 25M

	DATA READ IN ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	SIGMA
1	0.1750	2.6000E 02	0	0.1750	2.3899E 02
2	0.3500	6.2000E 01	0	0.3500	7.3364E 01
3	0.7000	2.4500E 01	0	0.7000	2.2521E 01
4	10.00	2.0417E-01	0	10.00	2.0417E-01
5	15.00	9.1464E-02	0	15.00	9.1464E-02
6	20.00	4.0122E-02	0	20.00	4.0122E-02
7	25.00	1.8982E-02	0	25.00	1.8982E-02
8	30.00	1.0941E-02	0	30.00	1.0941E-02
9	40.00	4.8646E-03	0	40.00	4.8646E-03
10	50.00	2.4688E-03	0	50.00	2.4688E-03
11	60.00	1.4051E-03	0	60.00	1.4051E-03
12	70.00	8.9366E-04	0	70.00	8.9366E-04
13	80.00	6.1379E-04	0	80.00	6.1379E-04
14	90.00	4.8018E-04	0	90.00	4.8018E-04
15	100.0	4.2313E-04	0	100.0	4.2313E-04
16	110.0	3.9650E-04	0	110.0	3.9650E-04
17	120.0	3.9744E-04	0	120.0	3.9744E-04
18	130.0	4.3404E-04	0	130.0	4.3404E-04
19	140.0	4.5364E-04	0	140.0	4.5364E-04
20	150.0	5.0939E-04	0	150.0	5.0939E-04
21	160.0	6.5693E-04	0	160.0	6.5693E-04
22	170.0	9.3990E-04	0	170.0	9.3990E-04
23			1	180.0	1.0536E-03

ALPHA= 0.3142 S/ALPHA= 0.561
S= 0.1763 A/ALPHA= 0.439
A= 0.1379 B/S= 0.016

CORRECTED ALPHA CORRECTION=0.004

ALPHA= 0.3183 S/ALPHA= 0.554
S= 0.1763 A/ALPHA= 0.446
A= 0.1420 B/S= 0.016

SIGMA(0.0 DEGREES)= 655.7
SIGMA(0.1 DEGREES)= 458.8
SLOPE(3 MILLIRAD)= -1.704
S UP TO 0.1 DEGREES= 5.2685E-03 NORMALIZED= 2.98911E-02

THETA**2 BAR 7.7628E-02 RADIANS**2

Figure D-103. Volume scattering function (sheet 2 of 3).

520 20JUL75 2124 STA.CAT#1A-SEA H2O 25M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	4.5880E 02	5.2685E-03	2.9891E-02	1
2.1972E-03	1.2589E-01	3.7621E 02	7.5960E-03	4.3096E-02	11
2.7662E-03	1.5849E-01	2.8047E 02	1.0481E-02	5.9466E-02	21
3.4824E-03	1.9953E-01	1.9113E 02	1.3719E-02	7.7836E-02	31
4.3841E-03	2.5119E-01	1.2911E 02	1.7189E-02	9.7525E-02	41
5.5192E-03	3.1623E-01	8.7209E 01	2.0905E-02	1.1860E-01	51
6.9483E-03	3.9811E-01	5.8909E 01	2.4882E-02	1.4117E-01	61
8.7474E-03	5.0119E-01	3.9792E 01	2.9140E-02	1.6533E-01	71
1.1012E-02	6.3096E-01	2.6879E 01	3.3699E-02	1.9119E-01	81
1.3864E-02	7.9433E-01	1.8220E 01	3.8582E-02	2.1890E-01	91
1.7453E-02	1.0000E 00	1.2614E 01	4.3882E-02	2.4897E-01	101
2.1972E-02	1.2589E 00	8.8683E 00	4.9747E-02	2.8224E-01	111
2.7662E-02	1.5849E 00	6.2705E 00	5.6307E-02	3.1946E-01	121
3.4824E-02	1.9953E 00	4.4161E 00	6.3648E-02	3.6111E-01	131
4.3841E-02	2.5119E 00	3.0679E 00	7.1792E-02	4.0732E-01	141
5.5192E-02	3.1623E 00	2.0822E 00	8.0659E-02	4.5762E-01	151
6.9483E-02	3.9811E 00	1.3531E 00	9.0007E-02	5.1066E-01	161
8.7473E-02	5.0119E 00	8.4404E-01	9.9417E-02	5.6405E-01	171
1.1012E-01	6.3096E 00	5.1776E-01	1.0862E-01	6.1625E-01	181
1.3864E-01	7.9433E 00	3.2001E-01	1.1757E-01	6.6705E-01	191
1.7453E-01	1.0000E 01	2.0417E-01	1.2645E-01	7.1742E-01	201
2.6180E-01	1.5000E 01	9.1464E-02	1.4248E-01	8.0839E-01	206
3.4907E-01	2.0000E 01	4.0122E-02	1.5260E-01	8.6578E-01	211
4.3633E-01	2.5000E 01	1.8982E-02	1.5836E-01	8.9844E-01	216
5.2360E-01	3.0000E 01	1.0941E-02	1.6198E-01	9.1900E-01	221
6.1086E-01	3.5000E 01	7.1155E-03	1.6457E-01	9.3367E-01	226
6.9813E-01	4.0000E 01	4.8646E-03	1.6653E-01	9.4482E-01	231
7.8540E-01	4.5000E 01	3.4079E-03	1.6804E-01	9.5337E-01	236
8.7266E-01	5.0000E 01	2.4689E-03	1.6921E-01	9.6002E-01	241
9.5993E-01	5.5000E 01	1.8376E-03	1.7014E-01	9.6527E-01	246
1.0472E 00	6.0000E 01	1.4051E-03	1.7088E-01	9.6949E-01	251
1.1345E 00	6.5000E 01	1.1081E-03	1.7146E-01	9.7292E-01	256
1.2217E 00	7.0000E 01	8.9366E-04	1.7199E-01	9.7579E-01	261
1.3090E 00	7.5000E 01	7.3368E-04	1.7241E-01	9.7818E-01	266
1.3963E 00	8.0000E 01	6.1379E-04	1.7277E-01	9.8022E-01	271
1.4835E 00	8.5000E 01	5.3165E-04	1.7308E-01	9.8197E-01	276
1.5708E 00	9.0000E 01	4.8018E-04	1.7336E-01	9.8354E-01	281
1.6581E 00	9.5000E 01	4.4657E-04	1.7361E-01	9.8498E-01	286
1.7453E 00	1.0000E 02	4.2313E-04	1.7384E-01	9.8632E-01	291
1.8326E 00	1.0500E 02	4.0588E-04	1.7407E-01	9.8757E-01	296
1.9199E 00	1.1000E 02	3.9450E-04	1.7428E-01	9.8876E-01	301
2.0071E 00	1.1500E 02	3.9090E-04	1.7447E-01	9.8988E-01	306
2.0944E 00	1.2000E 02	3.9744E-04	1.7466E-01	9.9097E-01	311
2.1817E 00	1.2500E 02	4.1516E-04	1.7485E-01	9.9203E-01	316
2.2689E 00	1.3000E 02	4.3404E-04	1.7504E-01	9.9308E-01	321
2.3562E 00	1.3500E 02	4.4414E-04	1.7521E-01	9.9409E-01	326
2.4435E 00	1.4000E 02	4.5364E-04	1.7538E-01	9.9503E-01	331
2.5307E 00	1.4500E 02	4.7424E-04	1.7553E-01	9.9591E-01	336
2.6180E 00	1.5000E 02	5.0939E-04	1.7568E-01	9.9673E-01	341
2.7053E 00	1.5500E 02	5.6808E-04	1.7581E-01	9.9749E-01	346
2.7925E 00	1.6000E 02	6.5693E-04	1.7594E-01	9.9822E-01	351
2.8798E 00	1.6500E 02	7.7665E-04	1.7606E-01	9.9888E-01	356
2.9671E 00	1.7000E 02	9.3990E-04	1.7616E-01	9.9946E-01	361
3.0543E 00	1.7500E 02	1.0335E-03	1.7623E-01	9.9986E-01	366
3.1416E 00	1.8000E 02	1.0536E-03	1.7626E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-103. Volume scattering function (sheet 3 of 3).

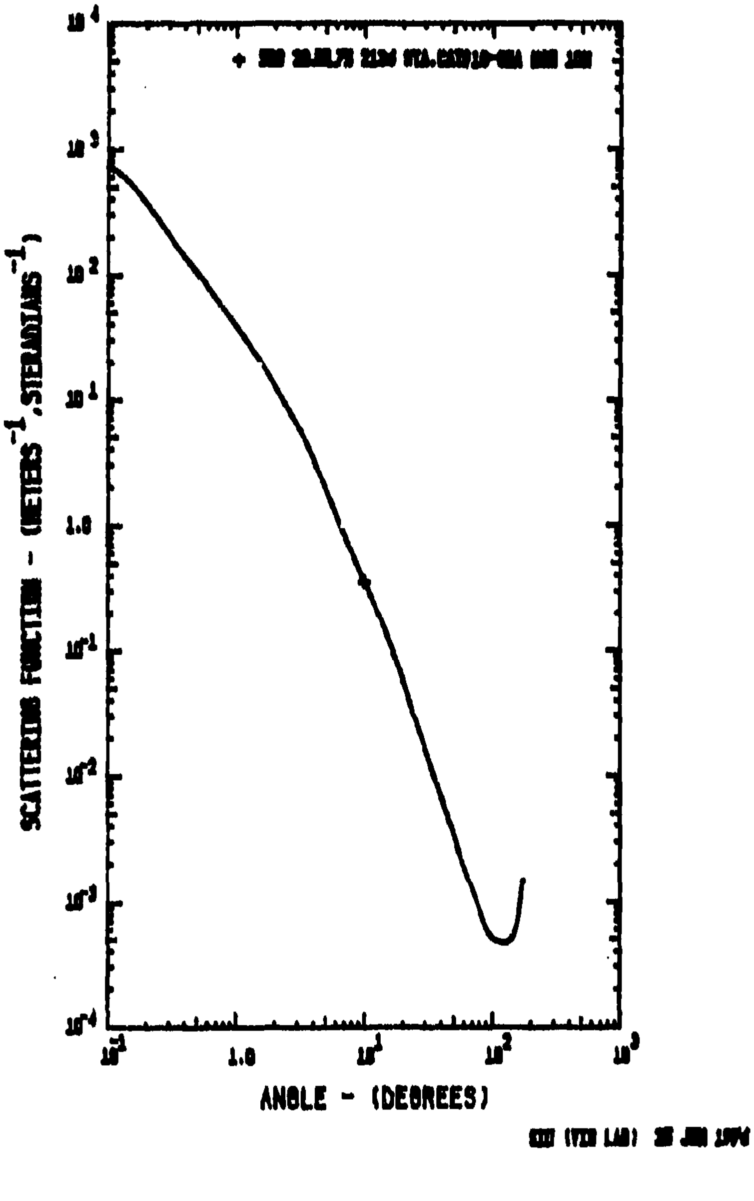


Figure D-104. Volume scattering function (sheet 1 of 3).

520 20JUL75 2136 STA.CAT#18-SEA H2O 10M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	4.6500E 02	0	0.1750	4.5798E 02
2	0.3500	1.7000E 02	0	0.3500	1.7514E 02
3	0.7000	6.8000E 01	0	0.7000	6.6974E 01
4	10.00	3.6427E-01	0	10.00	3.6427E-01
5	15.00	1.4107E-01	0	15.00	1.4107E-01
6	20.00	6.0581E-02	0	20.00	6.0581E-02
7	25.00	2.9577E-02	0	25.00	2.9577E-02
8	30.00	1.7445E-02	0	30.00	1.7445E-02
9	40.00	7.2628E-03	0	40.00	7.2628E-03
10	50.00	3.6790E-03	0	50.00	3.6790E-03
11	60.00	1.9702E-03	0	60.00	1.9702E-03
12	70.00	1.3290E-03	0	70.00	1.3290E-03
13	80.00	9.2736E-04	0	80.00	9.2736E-04
14	90.00	6.5198E-04	0	90.00	6.5198E-04
15	100.0	5.3979E-04	0	100.0	5.3979E-04
16	110.0	4.9189E-04	0	110.0	4.9189E-04
17	120.0	4.7473E-04	0	120.0	4.7473E-04
18	130.0	4.7699E-04	0	130.0	4.7699E-04
19	140.0	4.9947E-04	0	140.0	4.9947E-04
20	150.0	5.5051E-04	0	150.0	5.5051E-04
21	160.0	7.2864E-04	0	160.0	7.2864E-04
22	170.0	1.2750E-03	0	170.0	1.2750E-03
23			1	180.0	1.5011E-03

ALPHA= 0.5538 S/ALPHA= 0.714
S= 0.3956 A/ALPHA= 0.286
A= 0.1582 B/S= 0.009

CORRECTED ALPHA CORRECTION=0.006

ALPHA= 0.5601 S/ALPHA= 0.706
S= 0.3956 A/ALPHA= 0.294
A= 0.1645 B/S= 0.009

SIGMA(0.0 DEGREES)= 980.8
SIGMA(0.1 DEGREES)= 755.2
SLOPE(3 MILLIRAD)= -1.387
S UP TO 0.1 DEGREES= 8.2531E-03 NORMALIZED= 2.08607E-02

THETA**2 BAR 4.6522E-02 RADIANS**2

Figure D-104. Volume scattering function (sheet 2 of 3).

25 JUN 1976 1151.06

520 20JUL75 2136 STA.CAT#18-SEA H2O 10M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	7.5516E 02	8.2531E-03	2.0861E-02	1
2.1972E-03	1.2589E-01	6.5130E 02	1.2181E-02	3.0788E-02	11
2.7662E-03	1.5849E-01	5.2007E 02	1.7349E-02	4.3852E-02	21
3.4824E-03	1.9953E-01	3.8181E 02	2.3588E-02	5.9621E-02	31
4.3841E-03	2.5119E-01	2.7744E 02	3.0782E-02	7.7807E-02	41
5.5192E-03	3.1623E-01	2.0160E 02	3.9068E-02	9.8750E-02	51
6.9483E-03	3.9811E-01	1.4649E 02	4.8611E-02	1.2287E-01	61
8.7474E-03	5.0119E-01	1.0645E 02	5.9600E-02	1.5065E-01	71
1.1012E-02	6.3096E-01	7.7350E 01	7.2257E-02	1.8264E-01	81
1.3864E-02	7.9433E-01	5.6132E 01	8.6828E-02	2.1947E-01	91
1.7453E-02	1.0000E 00	4.0376E 01	1.0352E-01	2.6166E-01	101
2.1972E-02	1.2589E 00	2.8632E 01	1.2242E-01	3.0943E-01	111
2.7662E-02	1.5849E 00	1.9921E 01	1.4346E-01	3.6262E-01	121
3.4824E-02	1.9953E 00	1.3533E 01	1.6640E-01	4.2059E-01	131
4.3841E-02	2.5119E 00	8.9331E 00	1.9074E-01	4.8213E-01	141
5.5192E-02	3.1623E 00	5.7020E 00	2.1579E-01	5.4544E-01	151
6.9483E-02	3.9811E 00	3.4419E 00	2.4050E-01	6.0789E-01	161
8.7473E-02	5.0119E 00	1.9685E 00	2.6345E-01	6.6590E-01	171
1.1012E-01	6.3096E 00	1.1006E 00	2.8395E-01	7.1772E-01	181
1.3864E-01	7.9433E 00	6.2065E-01	3.0213E-01	7.6368E-01	191
1.7453E-01	1.0000E 01	3.6427E-01	3.1864E-01	8.0539E-01	201
2.6180E-01	1.5000E 01	1.4107E-01	3.4532E-01	8.7288E-01	206
3.4907E-01	2.0000E 01	6.0581E-02	3.6056E-01	9.1137E-01	211
4.3633E-01	2.5000E 01	2.9577E-02	3.6939E-01	9.3367E-01	216
5.2360E-01	3.0000E 01	1.7445E-02	3.7512E-01	9.4816E-01	221
6.1086E-01	3.5000E 01	1.0909E-02	3.7917E-01	9.5840E-01	226
6.9813E-01	4.0000E 01	7.2628E-03	3.8214E-01	9.6590E-01	231
7.8540E-01	4.5000E 01	5.0725E-03	3.8438E-01	9.7157E-01	236
8.7266E-01	5.0000E 01	3.6790E-03	3.8613E-01	9.7598E-01	241
9.5993E-01	5.5000E 01	2.6360E-03	3.8749E-01	9.7942E-01	246
1.0472E 00	6.0000E 01	1.9702E-03	3.8853E-01	9.8207E-01	251
1.1345E 00	6.5000E 01	1.6023E-03	3.8940E-01	9.8425E-01	256
1.2217E 00	7.0000E 01	1.3290E-03	3.9014E-01	9.8612E-01	261
1.3090E 00	7.5000E 01	1.1048E-03	3.9077E-01	9.8772E-01	266
1.3963E 00	8.0000E 01	9.2736E-04	3.9131E-01	9.8909E-01	271
1.4835E 00	8.5000E 01	7.7275E-04	3.9177E-01	9.9025E-01	276
1.5708E 00	9.0000E 01	6.5198E-04	3.9216E-01	9.9123E-01	281
1.6581E 00	9.5000E 01	5.8076E-04	3.9250E-01	9.9208E-01	286
1.7453E 00	1.0000E 02	5.3979E-04	3.9280E-01	9.9285E-01	291
1.8326E 00	1.0500E 02	5.1090E-04	3.9306E-01	9.9356E-01	296
1.9199E 00	1.1000E 02	4.9189E-04	3.9334E-01	9.9422E-01	301
2.0071E 00	1.1500E 02	4.8074E-04	3.9359E-01	9.9484E-01	306
2.0944E 00	1.2000E 02	4.7473E-04	3.9382E-01	9.9543E-01	311
2.1817E 00	1.2500E 02	4.7379E-04	3.9404E-01	9.9598E-01	316
2.2689E 00	1.3000E 02	4.7699E-04	3.9425E-01	9.9650E-01	321
2.3562E 00	1.3500E 02	4.8616E-04	3.9444E-01	9.9699E-01	326
2.4435E 00	1.4000E 02	4.9947E-04	3.9462E-01	9.9746E-01	331
2.5307E 00	1.4500E 02	5.2001E-04	3.9479E-01	9.9788E-01	336
2.6180E 00	1.5000E 02	5.5051E-04	3.9495E-01	9.9828E-01	341
2.7053E 00	1.5500E 02	6.1291E-04	3.9509E-01	9.9865E-01	346
2.7925E 00	1.6000E 02	7.2864E-04	3.9523E-01	9.9900E-01	351
2.8798E 00	1.6500E 02	9.2855E-04	3.9537E-01	9.9934E-01	356
2.9671E 00	1.7000E 02	1.2750E-03	3.9550E-01	9.9966E-01	361
3.0543E 00	1.7500E 02	1.4538E-03	3.9559E-01	9.9991E-01	366
3.1416E 00	1.8000E 02	1.5011E-03	3.9563E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-104. Volume scattering function (sheet 3 of 3).

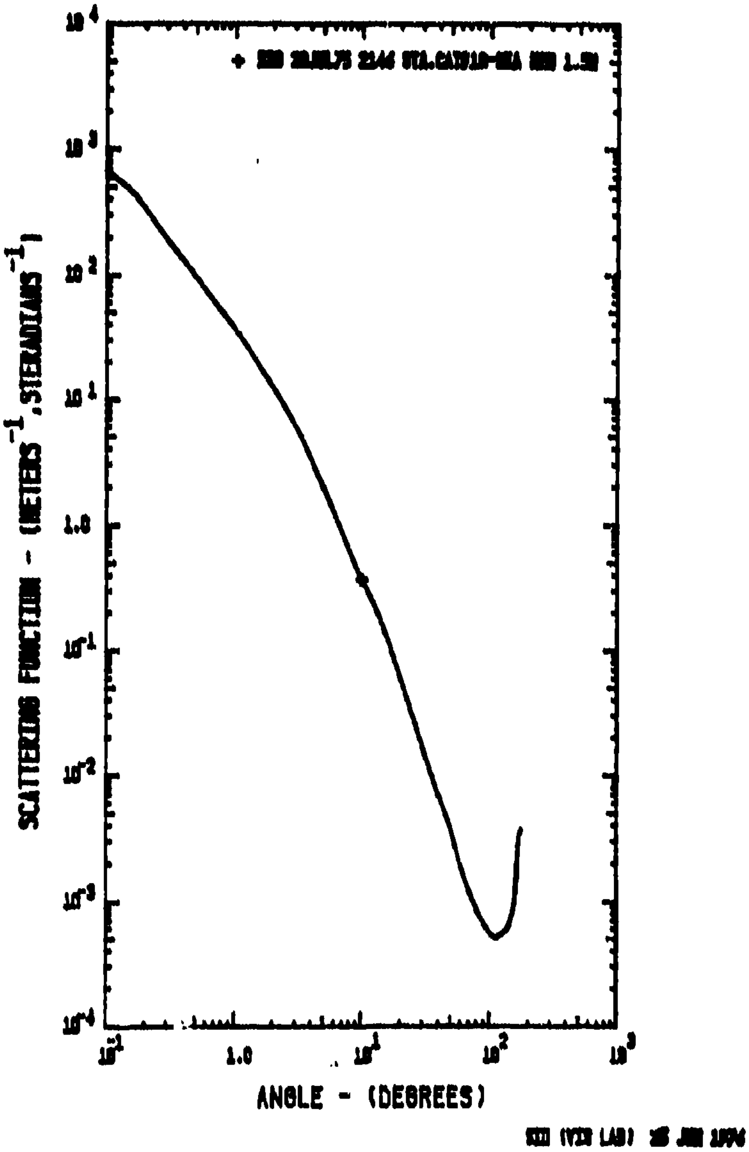


Figure D-105. Volume scattering function (sheet 1 of 3).

25 JUN 1976 1149.34

520 20JUL75 2146 STA.CAT#18-SEA H2O 1.5M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	4.3000E 02	0	0.1750	4.2104E 02
2	0.3500	1.5700E 02	0	0.3500	1.6370E 02
3	0.7000	6.5000E 01	0	0.7000	6.5647E 01
4	10.00	3.8691E-01	0	10.00	3.8691E-01
5	15.00	1.5027E-01	0	15.00	1.5027E-01
6	20.00	6.3559E-02	0	20.00	6.3559E-02
7	25.00	3.1782E-02	0	25.00	3.1782E-02
8	30.00	1.7842E-02	0	30.00	1.7842E-02
9	40.00	7.3313E-03	0	40.00	7.3313E-03
10	50.00	3.9968E-03	0	50.00	3.9968E-03
11	60.00	2.0630E-03	0	60.00	2.0630E-03
12	70.00	1.2914E-03	0	70.00	1.2914E-03
13	80.00	9.0581E-04	0	80.00	9.0581E-04
14	90.00	7.0076E-04	0	90.00	7.0076E-04
15	100.0	5.9382E-04	0	100.0	5.9382E-04
16	110.0	5.3276E-04	0	110.0	5.3276E-04
17	120.0	5.3440E-04	0	120.0	5.3440E-04
18	130.0	5.7419E-04	0	130.0	5.7419E-04
19	140.0	6.1339E-04	0	140.0	6.1339E-04
20	150.0	7.3208E-04	0	150.0	7.3208E-04
21	160.0	1.0379E-03	0	160.0	1.0379E-03
22	170.0	2.8940E-03	0	170.0	2.8940E-03
23			1	180.0	3.8393E-03

ALPHA= 0.4695 S/ALPHA= 0.840
S= 0.3942 A/ALPHA= 0.160
A= 0.0753 B/S= 0.011

CORRECTED ALPHA CORRECTION=0.006

ALPHA= 0.4752 S/ALPHA= 0.829
S= 0.3942 A/ALPHA= 0.171
A= 0.0810 B/S= 0.011

SIGMA(0.0 DEGREES)= 689.6
SIGMA(0.1 DEGREES)= 688.5
SLOPE(3 MILLIRAD)= -1.363
S UP TO 0.1 DEGREES= 7.5052E-03 NORMALIZED= 1.90396E-02

THETA**2 BAR 5.5117E-02 RADIANS**2

Figure D-105. Volume scattering function (sheet 2 of 3).

25 JUN 1976 1149.34

520 20JUL75 2146 STA.CAT#18-SEA H2O 1.5M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	6.8847E 02	7.5052E-03	1.9040E-02	1
2.1972E-03	1.2589E-01	5.9535E 02	1.1091E-02	2.8136E-02	11
2.7662E-03	1.5849E-01	4.7720E 02	1.5824E-02	4.0143E-02	21
3.4824E-03	1.9953E-01	3.5212E 02	2.1562E-02	5.4701E-02	31
4.3841E-03	2.5119E-01	2.5728E 02	2.8216E-02	7.1581E-02	41
5.5192E-03	3.1623E-01	1.8798E 02	3.5922E-02	9.1129E-02	51
6.9483E-03	3.9811E-01	1.3735E 02	4.4844E-02	1.1376E-01	61
8.7474E-03	5.0119E-01	1.0035E 02	5.5177E-02	1.3998E-01	71
1.1012E-02	6.3096E-01	7.3323E 01	6.7142E-02	1.7033E-01	81
1.3864E-02	7.9433E-01	5.3502E 01	8.0994E-02	2.0547E-01	91
1.7453E-02	1.0000E 00	3.8692E 01	9.6948E-02	2.4595E-01	101
2.1972E-02	1.2589E 00	2.7599E 01	1.1511E-01	2.9203E-01	111
2.7662E-02	1.5849E 00	1.9335E 01	1.3547E-01	3.4366E-01	121
3.4824E-02	1.9953E 00	1.3247E 01	1.5782E-01	4.0036E-01	131
4.3841E-02	2.5119E 00	8.8392E 00	1.8177E-01	4.6114E-01	141
5.5192E-02	3.1623E 00	5.7193E 00	2.0672E-01	5.2443E-01	151
6.9483E-02	3.9811E 00	3.4965E 00	2.3167E-01	5.8772E-01	161
8.7473E-02	5.0119E 00	2.0182E 00	2.5509E-01	6.4714E-01	171
1.1012E-01	6.3096E 00	1.1375E 00	2.7620E-01	7.0068E-01	181
1.3864E-01	7.9433E 00	6.4748E-01	2.9507E-01	7.4856E-01	191
1.7453E-01	1.0000E 01	3.8491E-01	3.1239E-01	7.9250E-01	201
2.6180E-01	1.5000E 01	1.5027E-01	3.4089E-01	8.6480E-01	206
3.4907E-01	2.0000E 01	6.3559E-02	3.5694E-01	9.0552E-01	211
4.3633E-01	2.5000E 01	3.1782E-02	3.6633E-01	9.2935E-01	216
5.2360E-01	3.0000E 01	1.7842E-02	3.7234E-01	9.4458E-01	221
6.1086E-01	3.5000E 01	1.1042E-02	3.7646E-01	9.5504E-01	226
6.9813E-01	4.0000E 01	7.3313E-03	3.7946E-01	9.6264E-01	231
7.8540E-01	4.5000E 01	5.3294E-03	3.8176E-01	9.6848E-01	236
8.7266E-01	5.0000E 01	3.9968E-03	3.8363E-01	9.7322E-01	241
9.5993E-01	5.5000E 01	2.8349E-03	3.8510E-01	9.7696E-01	246
1.0472E 00	6.0000E 01	2.0630E-03	3.8622E-01	9.7979E-01	251
1.1345E 00	6.5000E 01	1.6056E-03	3.8710E-01	9.8203E-01	256
1.2217E 00	7.0000E 01	1.2914E-03	3.8783E-01	9.8388E-01	261
1.3090E 00	7.5000E 01	1.0688E-03	3.8844E-01	9.8543E-01	266
1.3963E 00	8.0000E 01	9.0581E-04	3.8897E-01	9.8677E-01	271
1.4835E 00	8.5000E 01	7.8661E-04	3.8943E-01	9.8793E-01	276
1.5708E 00	9.0000E 01	7.0076E-04	3.8983E-01	9.8896E-01	281
1.6581E 00	9.5000E 01	6.4002E-04	3.9020E-01	9.8989E-01	286
1.7453E 00	1.0000E 02	5.9382E-04	3.9053E-01	9.9074E-01	291
1.8326E 00	1.0500E 02	5.5720E-04	3.9084E-01	9.9152E-01	296
1.9199E 00	1.1000E 02	5.3276E-04	3.9113E-01	9.9224E-01	301
2.0071E 00	1.1500E 02	5.2417E-04	3.9139E-01	9.9291E-01	306
2.0944E 00	1.2000E 02	5.3440E-04	3.9165E-01	9.9356E-01	311
2.1817E 00	1.2500E 02	5.5433E-04	3.9190E-01	9.9420E-01	316
2.2689E 00	1.3000E 02	5.7419E-04	3.9215E-01	9.9482E-01	321
2.3562E 00	1.3500E 02	5.9383E-04	3.9238E-01	9.9542E-01	326
2.4435E 00	1.4000E 02	6.1339E-04	3.9260E-01	9.9599E-01	331
2.5307E 00	1.4500E 02	6.5962E-04	3.9282E-01	9.9652E-01	336
2.6180E 00	1.5000E 02	7.3208E-04	3.9302E-01	9.9704E-01	341
2.7053E 00	1.5500E 02	8.4121E-04	3.9322E-01	9.9754E-01	346
2.7925E 00	1.6000E 02	1.0379E-03	3.9341E-01	9.9804E-01	351
2.8798E 00	1.6500E 02	1.5599E-03	3.9362E-01	9.9855E-01	356
2.9671E 00	1.7000E 02	2.8940E-03	3.9386E-01	9.9918E-01	361
3.0543E 00	1.7500E 02	3.6128E-03	3.9410E-01	9.9977E-01	366
3.1416E 00	1.8000E 02	3.8393E-03	3.9419E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-105. Volume scattering function (sheet 3 of 3).

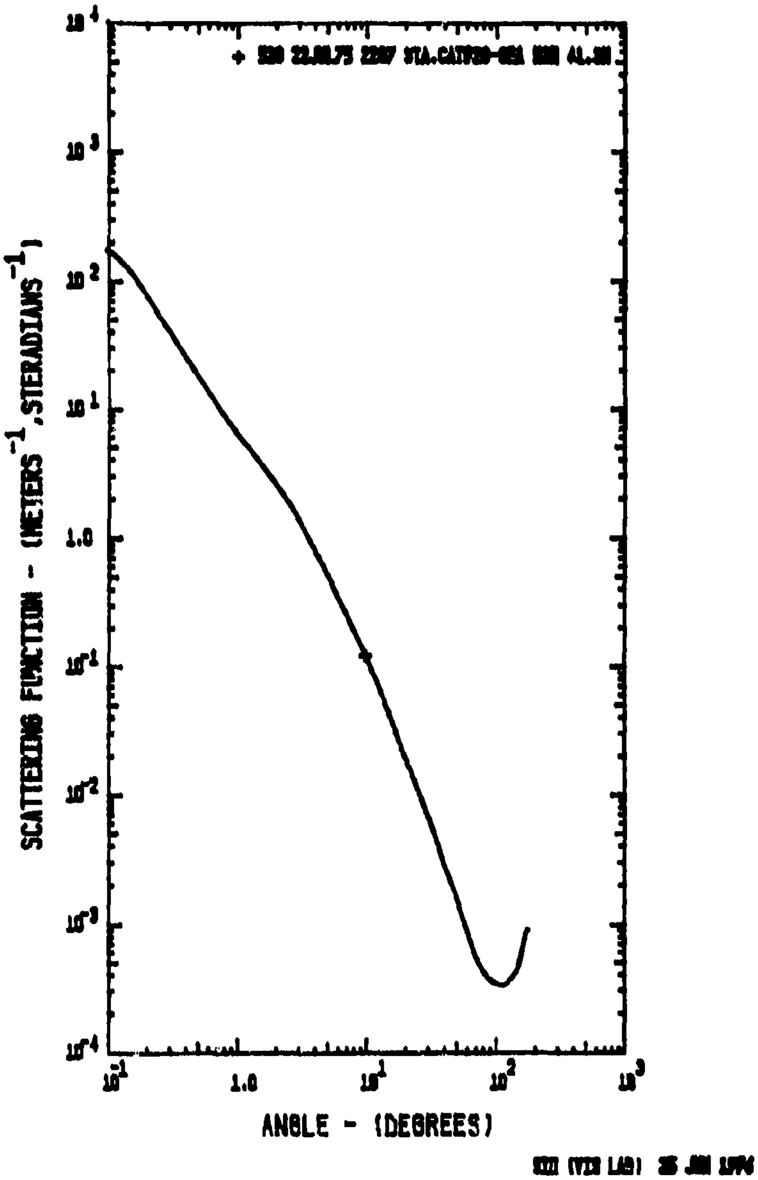


Figure D-106. Volume scattering function (sheet 1 of 3).

25 JUN 1976 1158.47

920 22JUL75 2207 STA.CAT#20-SEA H2O 41.3M

	DATA READ IN ANGLE (DEG)	DATA READ IN SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	ITERATED DATA SIGMA
1	0.1750	9.9000E 01	0	0.1750	9.7174E 01
2	0.3500	3.1500E 01	0	0.3500	3.2685E 01
3	0.7000	1.1200E 01	0	0.7000	1.0994E 01
4	10.00	1.1944E-01	0	10.00	1.1944E-01
5	15.00	4.3823E-02	0	15.00	4.3823E-02
6	20.00	2.0269E-02	0	20.00	2.0269E-02
7	25.00	1.1570E-02	0	25.00	1.1570E-02
8	30.00	6.9082E-03	0	30.00	6.9082E-03
9	40.00	2.9810E-03	0	40.00	2.9810E-03
10	50.00	1.6445E-03	0	50.00	1.6445E-03
11	60.00	9.3322E-04	0	60.00	9.3322E-04
12	70.00	5.7668E-04	0	70.00	5.7668E-04
13	80.00	4.4044E-04	0	80.00	4.4044E-04
14	90.00	3.7248E-04	0	90.00	3.7248E-04
15	100.0	3.4497E-04	0	100.0	3.4497E-04
16	110.0	3.3270E-04	0	110.0	3.3270E-04
17	120.0	3.3838E-04	0	120.0	3.3830E-04
18	130.0	3.6818E-04	0	130.0	3.6818E-04
19	140.0	4.0661E-04	0	140.0	4.0661E-04
20	150.0	4.5642E-04	0	150.0	4.5642E-04
21	160.0	6.0585E-04	0	160.0	6.0585E-04
22	170.0	8.0437E-04	0	170.0	8.0437E-04
23			1	180.0	8.9453E-04

ALPHA= 0.2195 S/ALPHA= 0.444
S= 0.0975 A/ALPHA= 0.556
A= 0.1220 B/S= 0.025

CORRECTED ALPHA CORRECTION=0.002

ALPHA= 0.2210 S/ALPHA= 0.441
S= 0.0975 A/ALPHA= 0.559
A= 0.1235 B/S= 0.025

SIGMA(0.0 DEGREES)= 238.4
SIGMA(0.1 DEGREES)= 174.4
SLOPE(3 MILLIRAD)= -1.572
S UP TO 0.1 DEGREES= 1.9569E-03 NORMALIZED= 2.00795E-02

THETA**2 BAR 0.1061 RADIANS**2

Figure D-106. Volume scattering function (sheet 2 of 3).

520 22JUL75 2207 STA.CAT#20-SEA H2O 41.3M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	1.7437E 02	1.9569E-03	2.0080E-02	1
2.1972E-03	1.2589E-01	1.4631E 02	2.8516E-03	2.9260E-02	11
2.7662E-03	1.5849E-01	1.1245E 02	3.9909E-03	4.0949E-02	21
3.4824E-03	1.9953E-01	7.9069E 01	5.3102E-03	5.4487E-02	31
4.3841E-03	2.5119E-01	5.5057E 01	6.7682E-03	6.9446E-02	41
5.5192E-03	3.1623E-01	3.8337E 01	8.3771E-03	8.5955E-02	51
6.9483E-03	3.9811E-01	2.6695E 01	1.0153E-02	1.0417E-01	61
8.7474E-03	5.0119E-01	1.8588E 01	1.2112E-02	1.2428E-01	71
1.1012E-02	6.3096E-01	1.2943E 01	1.4275E-02	1.4647E-01	81
1.3864E-02	7.9433E-01	9.0609E 00	1.6663E-02	1.7098E-01	91
1.7453E-02	1.0000E 00	6.5451E 00	1.9355E-02	1.9859E-01	101
2.1972E-02	1.2589E 00	4.8283E 00	2.2473E-02	2.3059E-01	111
2.7662E-02	1.5849E 00	3.5785E 00	2.6133E-02	2.6814E-01	121
3.4824E-02	1.9953E 00	2.6219E 00	3.0412E-02	3.1204E-01	131
4.3841E-02	2.5119E 00	1.8674E 00	3.5315E-02	3.6236E-01	141
5.5192E-02	3.1623E 00	1.2726E 00	4.0735E-02	4.1796E-01	151
6.9483E-02	3.9811E 00	8.2733E-01	4.6442E-02	4.7652E-01	161
8.7473E-02	5.0119E 00	5.2093E-01	5.2221E-02	5.3583E-01	171
1.1012E-01	6.3096E 00	3.2110E-01	5.7919E-02	5.9429E-01	181
1.3864E-01	7.9433E 00	1.9583E-01	6.3447E-02	6.5101E-01	191
1.7453E-01	1.0000E 01	1.1944E-01	6.8776E-02	7.0569E-01	201
2.6180E-01	1.5000E 01	4.3623E-02	7.7333E-02	7.9349E-01	206
3.4907E-01	2.0000E 01	2.0269E-02	8.2186E-02	8.4328E-01	211
4.3633E-01	2.5000E 01	1.1570E-02	8.5381E-02	8.7607E-01	216
5.2360E-01	3.0000E 01	6.9082E-03	8.7640E-02	8.9925E-01	221
6.1086E-01	3.5000E 01	4.4019E-03	8.9262E-02	9.1589E-01	226
6.9813E-01	4.0000E 01	2.9810E-03	9.0467E-02	9.2826E-01	231
7.8540E-01	4.5000E 01	2.1924E-03	9.1409E-02	9.3792E-01	236
8.7266E-01	5.0000E 01	1.6445E-03	9.2180E-02	9.4583E-01	241
9.5993E-01	5.5000E 01	1.2237E-03	9.2797E-02	9.5216E-01	246
1.0472E 00	6.0000E 01	9.3322E-04	9.3291E-02	9.5722E-01	251
1.1345E 00	6.5000E 01	7.2658E-04	9.3591E-02	9.6133E-01	256
1.2217E 00	7.0000E 01	5.7668E-04	9.4019E-02	9.6470E-01	261
1.3090E 00	7.5000E 01	4.8999E-04	9.4294E-02	9.6753E-01	266
1.3963E 00	8.0000E 01	4.4044E-04	9.4543E-02	9.7007E-01	271
1.4835E 00	8.5000E 01	4.0005E-04	9.4771E-02	9.7241E-01	276
1.5708E 00	9.0000E 01	3.7248E-04	9.4981E-02	9.7458E-01	281
1.6581E 00	9.5000E 01	3.5601E-04	9.5181E-02	9.7662E-01	286
1.7453E 00	1.0000E 02	3.4497E-04	9.5371E-02	9.7857E-01	291
1.8326E 00	1.0500E 02	3.3733E-04	9.5553E-02	9.8044E-01	296
1.9199E 00	1.1000E 02	3.3270E-04	9.5728E-02	9.8224E-01	301
2.0071E 00	1.1500E 02	3.3201E-04	9.5896E-02	9.8396E-01	306
2.0944E 00	1.2000E 02	3.3838E-04	9.6059E-02	9.8563E-01	311
2.1817E 00	1.2500E 02	3.5154E-04	9.6218E-02	9.8727E-01	316
2.2689E 00	1.3000E 02	3.6818E-04	9.6375E-02	9.8887E-01	321
2.3562E 00	1.3500E 02	3.8689E-04	9.6527E-02	9.9043E-01	326
2.4435E 00	1.4000E 02	4.0661E-04	9.6674E-02	9.9194E-01	331
2.5307E 00	1.4500E 02	4.2464E-04	9.6813E-02	9.9336E-01	336
2.6180E 00	1.5000E 02	4.5642E-04	9.6942E-02	9.9467E-01	341
2.7053E 00	1.5500E 02	5.2074E-04	9.7064E-02	9.9595E-01	346
2.7925E 00	1.6000E 02	6.0585E-04	9.7182E-02	9.9715E-01	351
2.8798E 00	1.6500E 02	6.9860E-04	9.7289E-02	9.9825E-01	356
2.9671E 00	1.7000E 02	8.0437E-04	9.7378E-02	9.9916E-01	361
3.0543E 00	1.7500E 02	8.8272E-04	9.7438E-02	9.9978E-01	366
3.1416E 00	1.8000E 02	8.9453E-04	9.7459E-02	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-106. Volume scattering function (sheet 3 of 3).

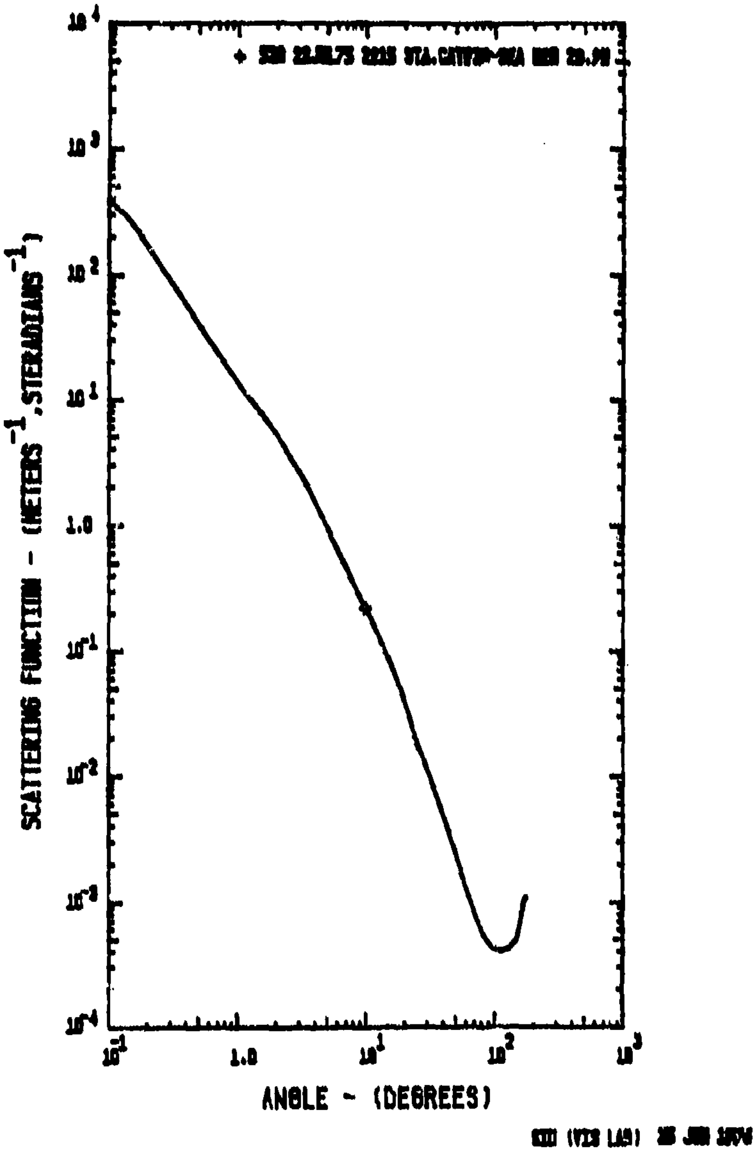


Figure D-107. Volume scattering function (sheet 1 of 3).

25 JUN 1976 1157.15

520 22JUL75 2215 STA.CAT#20-SEA H2O 28.9M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	2.0500E 02	0	0.1750	2.1016E 02
2	0.3500	7.4000E 01	0	0.3500	7.0396E 01
3	0.7000	2.3000E 01	0	0.7000	2.3580E 01
4	10.00	2.1662E-01	0	10.00	2.1662E-01
5	15.00	8.6752E-02	0	15.00	8.6752E-02
6	20.00	4.1429E-02	0	20.00	4.1429E-02
7	25.00	1.8663E-02	0	25.00	[illegible]
8	30.00	1.1657E-02	0	30.00	1.1657E-02
9	40.00	5.0485E-03	0	40.00	[illegible]
10	50.00	2.4963E-03	0	50.00	[illegible]
11	60.00	[illegible]	0	60.00	[illegible]
12	70.00	8.4614E-04	0	70.00	[illegible]
13	80.00	[illegible]	0	80.00	[illegible]
14	90.00	4.7399E-04	0	90.00	4.7399E-04
15	100.0	4.2102E-04	0	100.0	4.2102E-04
16	110.0	3.9853E-04	0	110.0	3.9853E-04
17	120.0	4.0156E-04	0	120.0	[illegible]
18	130.0	4.1963E-04	0	130.0	[illegible]
19	140.0	[illegible]	0	140.0	[illegible]
20	150.0	4.8395E-04	0	150.0	4.8395E-04
21	160.0	6.5546E-04	0	160.0	6.5546E-04
22	170.0	9.4551E-04	0	170.0	9.4551E-04
23			1	180.0	[illegible]

ALPHA= 0.2985 S/ALPHA= 0.622
S= 0.1857 A/ALPHA= 0.378
A= 0.1128 B/S= 0.015

CORRECTED ALPHA , CORRECTION=0.003

ALPHA= 0.3019 S/ALPHA= 0.615
S= 0.1857 A/ALPHA= 0.385
A= 0.1161 B/S= 0.015

SIGMA(0.0 DEGREES)= 515.7
SIGMA(0.1 DEGREES)= 377.1
SLOPE(3 MILLIRAD)= -1.573
S UP TO 0.1 DEGREES= 4.2323E-03 NORMALIZED= 2.2792E-02

THETA**2 BAR 7.3343E-02 RADIANS**2

Figure D-107. Volume scattering function (sheet 2 of 3).

520 22JUL75 2215 STA.CAT#20-SEA H2O 20.9M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	3.7711E 02	4.2323E-03	2.2792E-02	1
2.1972E-03	1.2589E-01	3.1642E 02	6.1673E-03	3.3213E-02	11
2.7662E-03	1.5849E-01	2.4321E 02	8.6312E-03	4.6482E-02	21
3.4824E-03	1.9953E-01	1.7087E 02	1.1484E-02	6.1845E-02	31
4.3841E-03	2.5119E-01	1.1882E 02	1.4632E-02	7.8799E-02	41
5.5192E-03	3.1623E-01	8.2619E 01	1.8102E-02	9.7485E-02	51
6.9483E-03	3.9811E-01	5.7450E 01	2.1926E-02	1.1809E-01	61
8.7474E-03	5.0119E-01	3.9948E 01	2.6140E-02	1.4077E-01	71
1.1012E-02	6.3096E-01	2.7778E 01	3.0786E-02	1.6578E-01	81
1.3866E-02	7.9433E-01	1.9397E 01	3.5906E-02	1.9336E-01	91
1.7453E-02	1.0000E 00	1.3877E 01	4.1642E-02	2.2426E-01	101
2.1972E-02	1.2589E 00	1.0074E 01	4.8203E-02	2.5954E-01	111
2.7662E-02	1.5849E 00	7.3138E 00	5.5761E-02	3.0029E-01	121
3.4824E-02	1.9953E 00	5.2333E 00	6.4403E-02	3.4683E-01	131
4.3841E-02	2.5119E 00	3.6373E 00	7.4070E-02	3.9889E-01	141
5.5192E-02	3.1623E 00	2.4201E 00	8.4697E-02	4.5504E-01	151
6.9483E-02	3.9811E 00	1.5390E 00	9.5229E-02	5.1284E-01	161
8.7473E-02	5.0119E 00	9.5194E-01	1.0588E-01	5.7018E-01	171
1.1012E-01	6.3096E 00	5.7932E-01	1.1621E-01	6.2858E-01	181
1.3866E-01	7.9433E 00	3.5219E-01	1.2416E-01	6.7942E-01	191
1.7453E-01	1.0000E 01	2.1662E-01	1.3578E-01	7.3120E-01	201
2.6180E-01	1.5000E 01	8.6752E-02	1.5144E-01	8.1771E-01	206
3.4907E-01	2.0000E 01	4.1429E-02	1.6171E-01	8.7085E-01	211
4.3633E-01	2.5000E 01	1.8663E-02	1.6754E-01	9.0224E-01	216
5.2360E-01	3.0000E 01	1.1657E-02	1.7125E-01	9.2225E-01	221
6.1086E-01	3.5000E 01	7.4972E-03	1.7400E-01	9.3795E-01	226
6.9813E-01	4.0000E 01	5.0485E-03	1.7605E-01	9.4810E-01	231
7.8540E-01	4.5000E 01	3.5021E-03	1.7761E-01	9.5680E-01	236
8.7266E-01	5.0000E 01	2.4963E-03	1.7881E-01	9.6293E-01	241
9.5993E-01	5.5000E 01	1.7914E-03	1.7973E-01	9.6790E-01	246
1.0472E 00	6.0000E 01	1.3250E-03	1.8044E-01	9.7172E-01	251
1.1345E 00	6.5000E 01	1.0395E-03	1.8101E-01	9.7479E-01	256
1.2217E 00	7.0000E 01	8.4614E-04	1.8148E-01	9.7734E-01	261
1.3090E 00	7.5000E 01	7.0776E-04	1.8189E-01	9.7952E-01	266
1.3963E 00	8.0000E 01	6.0486E-04	1.8224E-01	9.8140E-01	271
1.4835E 00	8.5000E 01	5.2777E-04	1.8255E-01	9.8306E-01	276
1.5708E 00	9.0000E 01	4.7399E-04	1.8282E-01	9.8452E-01	281
1.6581E 00	9.5000E 01	4.4112E-04	1.8307E-01	9.8586E-01	286
1.7453E 00	1.0000E 02	4.2102E-04	1.8330E-01	9.8712E-01	291
1.8326E 00	1.0500E 02	4.0644E-04	1.8352E-01	[illegible]	296
1.9199E 00	1.1000E 02	3.9853E-04	1.8373E-01	9.8945E-01	301
2.0071E 00	1.1500E 02	3.9764E-04	1.8393E-01	9.9054E-01	306
2.0944E 00	1.2000E 02	4.0156E-04	1.8413E-01	9.9158E-01	311
2.1817E 00	1.2500E 02	4.0830E-04	1.8432E-01	9.9259E-01	316
2.2689E 00	1.3000E 02	4.1888E-04	1.8449E-01	9.9356E-01	321
2.3562E 00	1.3500E 02	4.3316E-04	1.8467E-01	9.9449E-01	326
2.4435E 00	1.4000E 02	4.4863E-04	1.8483E-01	9.9536E-01	331
2.5307E 00	1.4500E 02	4.6406E-04	1.8498E-01	9.9619E-01	336
2.6180E 00	1.5000E 02	4.8395E-04	1.8512E-01	9.9693E-01	341
2.7053E 00	1.5500E 02	5.4602E-04	1.8525E-01	9.9763E-01	346
2.7925E 00	1.6000E 02	6.5546E-04	1.8537E-01	9.9830E-01	351
2.8798E 00	1.6500E 02	7.9323E-04	1.8549E-01	9.9894E-01	356
2.9671E 00	1.7000E 02	9.4551E-04	1.8559E-01	9.9949E-01	361
3.0543E 00	1.7500E 02	1.0503E-03	1.8567E-01	9.9987E-01	366
3.1416E 00	1.8000E 02	1.0703E-03	1.8569E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-107. Volume scattering function (sheet 3 of 3).

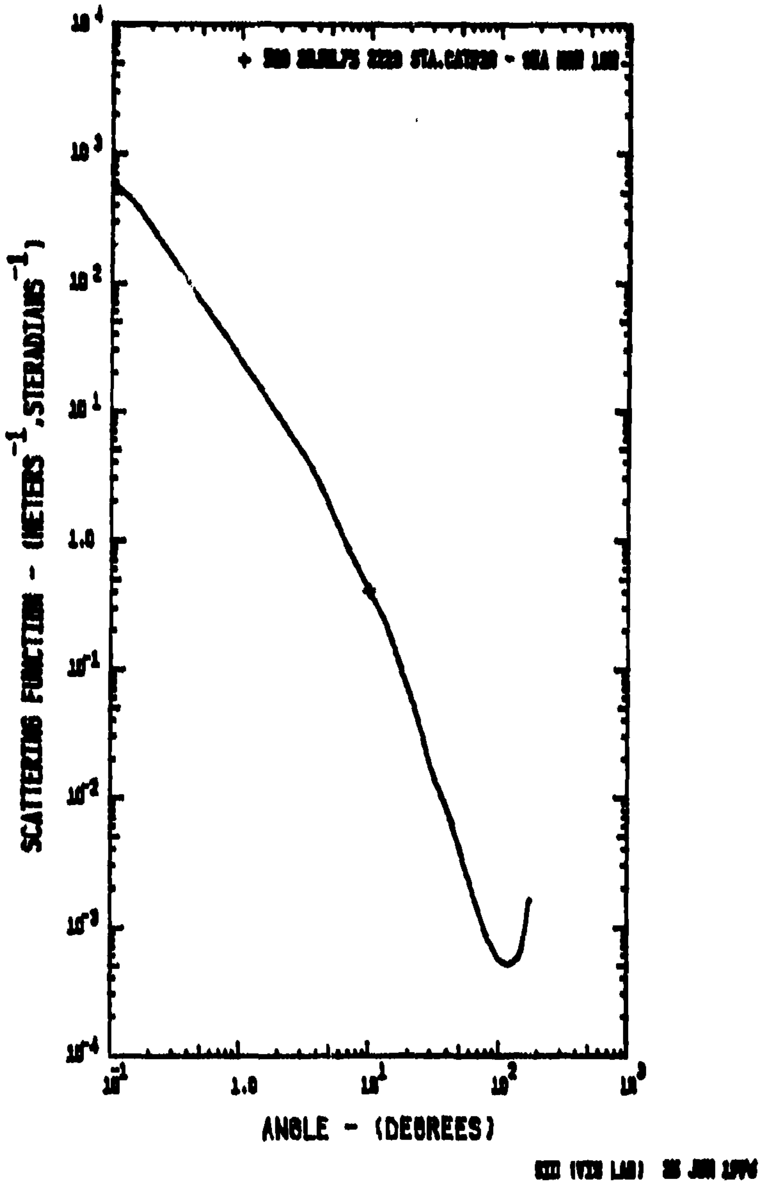


Figure D-108. Volume scattering function (sheet 1 of 3).

25 JUN 1976 1155.42

520 22JUL75 2223 STA.CAT#20 - SEA H2O 18M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	3.5500E 02	0	0.1750	3.3972E 02
2	0.3500	1.1100E 02	0	0.3500	1.2193E 02
3	0.7000	4.6000E 01	0	0.7000	4.3891E 01
4	10.00	4.0738E-01	0	10.00	4.0738E-01
5	15.00	1.7182E-01	0	15.00	1.7182E-01
6	20.00	7.0146E-02	0	20.00	7.0146E-02
7	25.00	3.5075E-02	0	25.00	3.5075E-02
8	30.00	1.7776E-02	0	30.00	1.7776E-02
9	40.00	8.2794E-03	0	40.00	8.2794E-03
10	50.00	4.1063E-03	0	50.00	4.1063E-03
11	60.00	2.2552E-03	0	60.00	2.2552E-03
12	70.00	1.4003E-03	0	70.00	1.4003E-03
13	80.00	9.0603E-04	0	80.00	9.0603E-04
14	90.00	7.0219E-04	0	90.00	7.0219E-04
15	100.0	5.7312E-04	0	100.0	5.7312E-04
16	110.0	5.3424E-04	0	110.0	5.3424E-04
17	120.0	5.1146E-04	0	120.0	5.1146E-04
18	130.0	5.3022E-04	0	130.0	5.3022E-04
19	140.0	5.6011E-04	0	140.0	5.6011E-04
20	150.0	6.3165E-04	0	150.0	6.3165E-04
21	160.0	8.7459E-04	0	160.0	8.7459E-04
22	170.0	1.3804E-03	0	170.0	1.3804E-03
23			1	180.0	[illegible]

ALPHA= 0.4599 S/ALPHA= 0.726
S= 0.3339 A/ALPHA= 0.274
A= 0.1260 B/S= 0.011

CORRECTED ALPHA CORRECTION=0.005

ALPHA= 0.4648 S/ALPHA= 0.718
S= 0.3339 A/ALPHA= 0.282
A= 0.1309 B/S= 0.011

SIGMA(0.0 DEGREES)= 775.9
SIGMA(0.1 DEGREES)= 582.6
SLOPE(3 MILLIRAD)= -1.474
S UP TO 0.1 DEGREES= 6.4500E-03 NORMALIZED= 1.93173E-02

THETA**2 BAR 6.0834E-02 RADIANS**2

Figure D-108. Volume scattering function (sheet 2 of 3).

520 22JUL75 2223 STA.CAT820 - SEA H2C 18M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	I
1.7453E-03	1.0000E-01	5.8256E 02	6.4500E-03	1.9317E-02	1
2.1972E-03	1.2589E-01	4.9567E 02	[illegible]	2.8331E-02	11
2.7662E-03	1.5849E-01	3.8835E 02	1.3356E-02	4.0001E-02	21
3.4824E-03	1.9953E-01	2.7917E 02	1.7964E-02	5.3800E-02	31
4.3841E-03	2.5119E-01	1.9882E 02	2.3171E-02	6.9395E-02	41
5.5192E-03	3.1623E-01	1.4160E 02	2.9048E-02	8.6997E-02	51
6.9483E-03	3.9811E-01	1.0085E 02	3.5682E-02	1.0687E-01	61
8.7474E-03	5.0119E-01	7.1821E 01	4.3170E-02	1.2929E-01	71
1.1012E-02	6.3096E-01	5.1150E 01	5.1622E-02	1.5460E-01	81
1.3864E-02	7.9433E-01	3.6419E 01	6.1161E-02	1.8317E-01	91
1.7453E-02	1.0000E 00	2.5899E 01	7.1919E-02	2.1539E-01	101
2.1972E-02	1.2589E 00	1.8380E 01	8.4033E-02	2.5167E-01	111
2.7662E-02	1.5849E 00	1.3007E 01	9.7639E-02	2.9242E-01	121
3.4824E-02	1.9953E 00	9.1694E 00	1.1287E-01	3.3803E-01	131
4.3841E-02	2.5119E 00	6.4342E 00	1.2984E-01	3.8888E-01	141
5.5192E-02	3.1623E 00	4.4901E 00	1.4867E-01	4.4526E-01	151
6.9483E-02	3.9811E 00	2.9641E 00	1.6906E-01	5.0634E-01	161
8.7473E-02	5.0119E 00	1.8136E 00	1.8952E-01	5.6761E-01	171
1.1012E-01	6.3096E 00	1.0744E 00	2.0897E-01	6.2584E-01	181
1.3864E-01	7.9433E 00	6.4367E-01	2.2724E-01	6.8057E-01	191
1.7453E-01	1.0000E 01	4.0738E-01	2.4498E-01	7.3370E-01	201
2.6180E-01	1.5000E 01	1.7182E-01	2.7686E-01	8.2918E-01	206
3.4907E-01	2.0000E 01	7.0146E-02	2.9481E-01	8.8293E-01	211
4.3633E-01	2.5000E 01	3.5075E-02	3.0516E-01	9.1393E-01	216
5.2360E-01	3.0000E 01	1.7776E-02	3.1148E-01	9.3284E-01	221
6.1086E-01	3.5000E 01	1.1514E-02	3.1570E-01	9.4549E-01	226
6.9813E-01	4.0000E 01	8.2794E-03	3.1901E-01	9.5543E-01	231
7.8540E-01	4.5000E 01	5.7441E-03	3.2157E-01	9.6307E-01	236
8.7266E-01	5.0000E 01	4.1063E-03	3.2353E-01	9.6896E-01	241
9.5993E-01	5.5000E 01	2.9982E-03	3.2506E-01	9.7352E-01	246
1.0472E 00	6.0000E 01	2.3552E-03	3.2626E-01	9.7712E-01	251
1.1345E 00	6.5000E 01	1.7583E-03	3.2722E-01	9.8002E-01	256
1.2217E 00	7.0000E 01	1.4003E-03	3.2802E-01	9.8240E-01	261
1.3090E 00	7.5000E 01	1.1120E-03	3.2867E-01	9.8436E-01	266
1.3963E 00	8.0000E 01	9.0603E-04	3.2921E-01	9.8596E-01	271
1.4835E 00	8.5000E 01	7.8607E-04	3.2967E-01	9.8733E-01	276
1.5708E 00	9.0000E 01	7.0219E-04	3.3007E-01	9.8855E-01	281
1.6581E 00	9.5000E 01	6.2563E-04	3.3044E-01	9.8963E-01	286
1.7453E 00	1.0000E 02	5.7312E-04	3.3076E-01	9.9061E-01	291
1.8326E 00	1.0500E 02	5.4919E-04	3.3106E-01	9.9150E-01	296
1.9199E 00	1.1000E 02	5.3424E-04	3.3134E-01	9.9235E-01	301
2.0071E 00	1.1500E 02	5.1943E-04	3.3161E-01	9.9315E-01	306
2.0944E 00	1.2000E 02	5.1146E-04	3.3186E-01	9.9390E-01	311
2.1817E 00	1.2500E 02	5.1753E-04	3.3210E-01	9.9451E-01	316
2.2689E 00	1.3000E 02	5.3022E-04	3.3232E-01	9.9529E-01	321
2.3562E 00	1.3500E 02	5.4409E-04	3.3254E-01	9.9594E-01	326
2.4435E 00	1.4000E 02	5.6011E-04	3.3275E-01	9.9655E-01	331
2.5307E 00	1.4500E 02	5.8590E-04	3.3294E-01	9.9712E-01	336
2.6180E 00	1.5000E 02	6.3165E-04	3.3311E-01	9.9766E-01	341
2.7053E 00	1.5500E 02	7.2299E-04	3.3328E-01	9.9816E-01	346
2.7925E 00	1.6000E 02	8.7459E-04	3.3345E-01	9.9866E-01	351
2.8798E 00	1.6500E 02	1.0934E-03	3.3361E-01	9.9914E-01	356
2.9671E 00	1.7000E 02	1.3004E-03	3.3375E-01	9.9957E-01	361
3.0543E 00	1.7500E 02	1.5582E-03	3.3386E-01	9.9988E-01	366
3.1416E 00	1.8000E 02	1.5969E-03	3.3390E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-108. Volume scattering function (sheet 3 of 3).

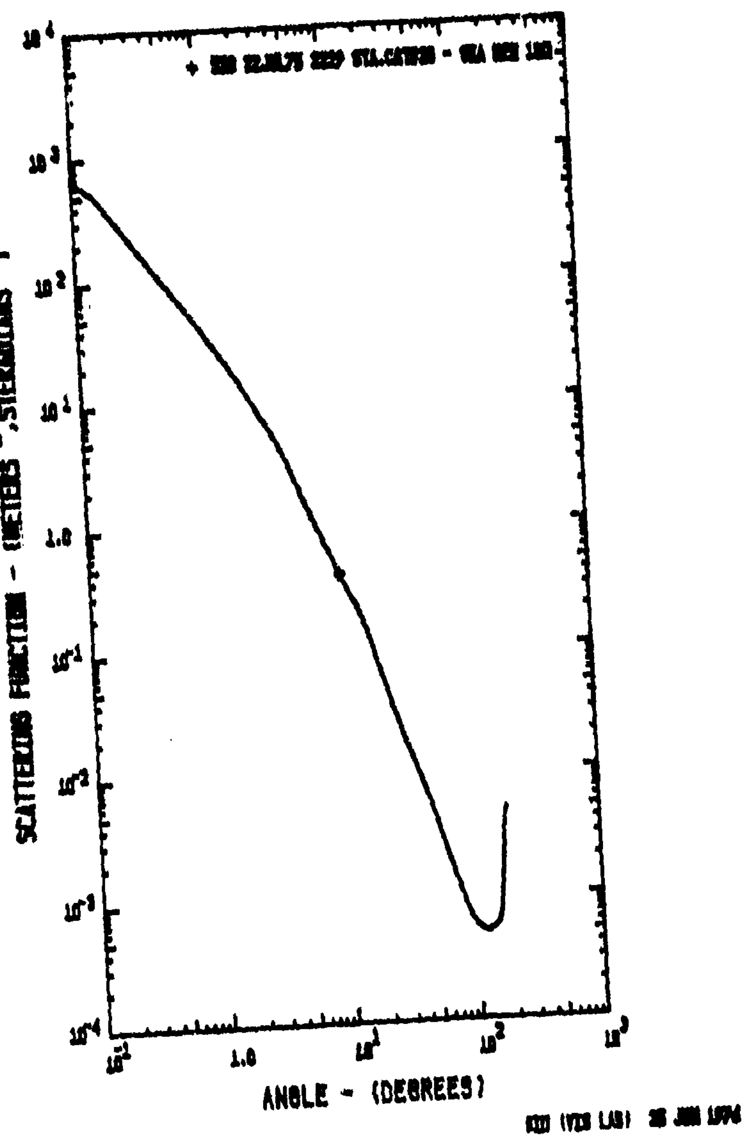


Figure D-109. Volume scattering function (sheet 1 of 3).

25 JUN 1976 1154.10

520 22JUL75 2229 STA.CAT#20 - SEA H2O 10M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	4.2200E 02	0	0.1750	4.1469E 02
2	0.3500	1.5600E 02	0	0.3500	1.6149E 02
3	0.7000	6.4000E 01	0	0.7000	6.2892E 01
4	10.00	4.1432E-01	0	10.00	4.1432E-01
5	15.00	1.6652E-01	0	15.00	1.6652E-01
6	20.00	6.5145E-02	0	20.00	6.5145E-02
7	25.00	3.2482E-02	0	25.00	3.2482E-02
8	30.00	1.7961E-02	0	30.00	1.7961E-02
9	40.00	8.0925E-03	0	40.00	8.0925E-03
10	50.00	4.2814E-03	0	50.00	4.2814E-03
11	60.00	2.2674E-03	0	60.00	2.2674E-03
12	70.00	1.3813E-03	0	70.00	1.3813E-03
13	80.00	8.9549E-04	0	80.00	8.9549E-04
14	90.00	6.8008E-04	0	90.00	6.8008E-04
15	100.0	5.7475E-04	0	100.0	5.7475E-04
16	110.0	5.3235E-04	0	110.0	5.3235E-04
17	120.0	5.1628E-04	0	120.0	5.1628E-04
18	130.0	5.3690E-04	0	130.0	5.3690E-04
19	140.0	5.6733E-04	0	140.0	5.6733E-04
20	150.0	6.5189E-04	0	150.0	6.5189E-04
21	160.0	1.1927E-03	0	160.0	1.1927E-03
22	170.0	3.5280E-03	0	170.0	3.5280E-03
23			1	180.0	4.9754E-03

ALPHA= 0.4743 S/ALPHA= 0.845
S= 0.4006 A/ALPHA= 0.155
A= 0.0737 B/S= 0.011

CORRECTED ALPHA CORRECTION=0.006

ALPHA= 0.4799 S/ALPHA= 0.835
S= 0.4006 A/ALPHA= 0.165
A= 0.0793 B/S= 0.011

SIGMA(0.0 DEGREES)= 376.4
SIGMA(0.1 DEGREES)= 679.1
SLOPE(3 MILLIRAD)= -1.361
S UP TO 0.1 DEGREES= 7.3919E-03 NORMALIZED= 1.8450E-02

THETA**2 BAR 5.6698E-02 RADIANS**2

Figure D-109. Volume scattering function (sheet 2 of 3).

25 JUN 197- 1154.10

520 22JUL75 2229 STA.CAT#20 - SEA H20 10M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	6.7808E 02	7.3919E-03	1.8451E-02	1
2.1972E-03	1.2589E-01	5.8637E 02	1.0923E-02	2.7265E-02	11
2.7662E-03	1.5849E-01	4.7000E 02	1.5565E-02	3.8902E-02	21
3.4924E-03	1.9953E-01	3.4691E 02	2.1238E-02	5.3010E-02	31
4.3841E-03	2.5119E-01	2.5361E 02	2.7795E-02	6.9378E-02	41
5.5192E-03	3.1623E-01	1.8540E 02	3.5393E-02	8.8342E-02	51
6.9483E-03	3.9811E-01	1.3554E 02	4.4196E-02	1.1031E-01	61
8.7474E-03	5.0119E-01	9.9083E 01	5.4395E-02	1.3577E-01	71
1.1012E-02	6.3096E-01	7.2436E 01	6.6212E-02	1.6527E-01	81
1.3864E-02	7.9433E-01	5.2862E 01	7.9899E-02	1.9943E-01	91
1.7453E-02	1.0000E 00	3.8158E 01	9.5649E-02	2.3875E-01	101
2.1972E-02	1.2589E 00	2.7158E 01	1.1354E-01	2.8340E-01	111
2.7662E-02	1.5849E 00	1.9003E 01	1.3359E-01	3.3335E-01	121
3.4924E-02	1.9953E 00	1.3049E 01	1.5554E-01	[illegible]	131
4.3841E-02	2.5119E 00	8.7709E 00	1.7921E-01	4.4731E-01	141
5.5192E-02	3.1623E 00	5.7577E 00	2.0413E-01	5.0951E-01	151
6.9483E-02	3.9811E 00	3.5711E 00	2.2944E-01	5.7270E-01	161
8.7473E-02	5.0119E 00	2.0804E 00	2.5348E-01	6.3269E-01	171
1.1012E-01	6.3096E 00	1.1829E 00	2.7582E-01	6.8722E-01	181
1.3864E-01	7.9433E 00	6.4195E-01	2.9506E-01	[illegible]	191
1.7453E-01	1.0000E 01	4.1432E-01	3.1348E-01	7.8267E-01	201
2.6180E-01	1.5000E 01	1.6652E-01	3.4494E-01	8.6073E-01	206
3.4907E-01	2.0000E 01	6.5145E-02	3.6195E-01	9.0344E-01	211
4.3633E-01	2.5000E 01	3.2482E-02	3.7155E-01	9.2741E-01	216
5.2360E-01	3.0000E 01	1.7961E-02	3.7763E-01	9.4259E-01	221
6.1086E-01	3.5000E 01	1.1657E-02	3.8177E-01	9.5315E-01	226
6.9813E-01	4.0000E 01	8.0825E-03	3.8510E-01	9.6124E-01	231
7.8540E-01	4.5000E 01	5.8097E-03	3.8764E-01	[illegible]	236
8.7266E-01	5.0000E 01	4.2819E-03	3.8965E-01	9.7260E-01	241
9.5993E-01	5.5000E 01	3.0860E-03	3.9124E-01	9.7654E-01	246
1.0472E 00	6.0000E 01	2.2674E-03	3.9246E-01	9.7961E-01	251
1.1345E 00	6.5000E 01	1.7529E-03	3.9343E-01	[illegible]	256
1.2217E 00	7.0000E 01	1.3813E-03	3.9422E-01	[illegible]	261
1.3090E 00	7.5000E 01	1.1039E-03	3.9476E-01	[illegible]	266
1.3963E 00	8.0000E 01	8.9549E-04	3.9540E-01	9.8694E-01	271
1.4835E 00	8.5000E 01	7.6303E-04	3.9584E-01	9.8035E-01	276
1.5708E 00	9.0000E 01	6.8008E-04	3.9624E-01	9.8903E-01	281
1.6581E 00	9.5000E 01	6.1696E-04	3.9659E-01	[illegible]	286
1.7453E 00	1.0000E 02	5.7475E-04	3.9692E-01	9.9072E-01	291
1.8326E 00	1.0500E 02	5.4724E-04	3.9721E-01	[illegible]	296
1.9199E 00	1.1000E 02	5.3235E-04	3.9750E-01	[illegible]	301
2.0071E 00	1.1500E 02	5.1967E-04	3.9776E-01	[illegible]	306
2.0944E 00	1.2000E 02	5.1628E-04	3.9802E-01	[illegible]	311
2.1817E 00	1.2500E 02	5.2459E-04	3.9825E-01	[illegible]	316
2.2689E 00	1.3000E 02	5.3690E-04	3.9849E-01	[illegible]	321
2.3562E 00	1.3500E 02	5.5120E-04	3.9870E-01	[illegible]	326
2.4435E 00	1.4000E 02	5.6733E-04	3.9891E-01	9.9571E-01	331
2.5307E 00	1.4500E 02	5.9756E-04	3.9910E-01	9.9619E-01	336
2.6180E 00	1.5000E 02	6.5189E-04	3.9929E-01	9.9665E-01	341
2.7053E 00	1.5500E 02	8.1543E-04	3.9947E-01	[illegible]	346
2.7925E 00	1.6000E 02	1.1927E-03	3.9968E-01	9.9761E-01	351
2.8798E 00	1.6500E 02	1.9342E-03	3.9992E-01	[illegible]	356
2.9671E 00	1.7000E 02	3.5280E-03	4.0023E-01	9.9899E-01	361
3.0543E 00	1.7500E 02	4.5858E-03	4.0052E-01	9.9971E-01	366
3.1416E 00	1.8000E 02	4.8754E-03	4.0063E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-109. Volume scattering function (sheet 3 of 3).

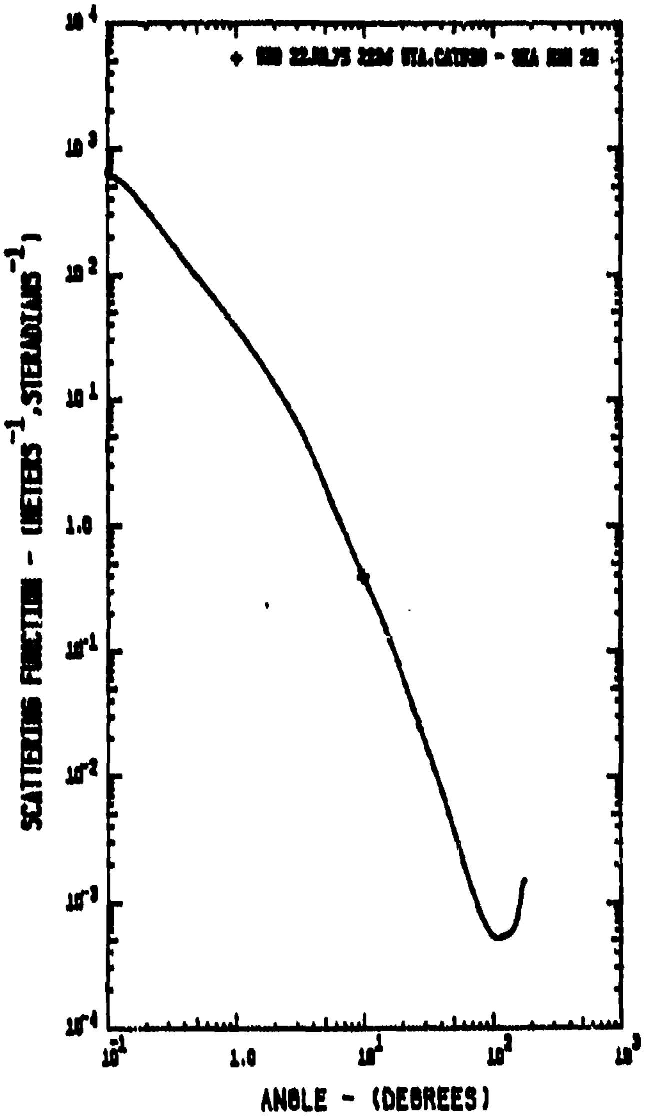


Figure D-110. Volume scattering function (sheet 1 of 3).

25 JUN 1976 1152.38

520 22JUL75 2236 STA,CAT#20 - SEA H2O 2M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	4.1000E 02	0	0.1750	4.0134E 02
2	0.3500	1.5200E 02	0	0.3500	1.5657E 02
3	0.7000	6.4000E 01	0	0.7000	6.2651E 01
4	10.00	3.8942E-01	0	10.00	3.8942E-01
5	15.00	1.4734E-01	0	15.00	1.4734E-01
6	20.00	6.4332E-02	0	20.00	6.4332E-02
7	25.00	3.2636E-02	0	25.00	3.2636E-02
8	30.00	1.8852E-02	0	30.00	1.8052E-02
9	40.00	8.0741E-03	0	40.00	8.0741E-03
10	50.00	3.8970E-03	0	50.00	3.8970E-03
11	60.00	2.0606E-03	0	60.00	2.0606E-03
12	70.00	1.2440E-03	0	70.00	1.2440E-03
13	80.00	8.[illegible]955E-04	0	80.00	[illegible]
14	90.00	6.4038E-04	0	90.00	6.4038E-04
15	100.0	5.3647E-04	0	100.0	5.3647E-04
16	110.0	5.0387E-04	0	110.0	5.0387E-04
17	120.0	5.1466E-04	0	120.0	5.1466E-04
18	130.0	5.3742E-04	0	130.0	5.3742E-04
19	140.0	5.5299E-04	0	140.0	5.6295E-04
20	150.0	6.3401E-04	0	150.0	6.3401E-04
21	160.0	7.9040E-04	0	160.0	7.9040E-04
22	170.0	1.2686E-03	0	170.0	1.2686E-03
23			1	180.0	1.4538E-03

ALPHA= 0.4812 S/ALPHA= 0.826
S= 0.3976 A/ALPHA= 0.174
A= 0.0836 B/S= 0.009

CORRECTED ALPHA CORRECTION=0.005

ALPHA= 0.4866 S/ALPHA= 0.817
S= 0.3976 A/ALPHA= 0.183
A= 0.0890 B/S= 0.009

SIGMA(0.0 DEGREES)= 837.1
SIGMA(0.1 DEGREES)= 650.8
SLOPE(3 MILLIRAD)= -1.360
S UP TO 0.1 DEGREES= 7.0768E-03 NORMALIZED= 1.77971E-02

THETA**2 BAR 4.8747E-02 RADIANS**2

Figure D-110. Volume scattering function (sheet 2 of 3).

520 22JUL75 2256 STA.CAT#20 - SEA H2O 2M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	6.5080E 02	7.0768E-03	1.7797E-02	1
2.1972E-03	1.2589E-01	5.6427E 02	1.0471E-02	2.6332E-02	11
2.7662E-03	1.5849E-01	4.5400E 02	1.4965E-02	3.7635E-02	21
3.4824E-03	1.9953E-01	3.3667E 02	2.0438E-02	5.1398E-02	31
4.3841E-03	2.5119E-01	2.4780E 02	2.6817E-02	6.7441E-02	41
5.5192E-03	3.1623E-01	1.8166E 02	3.4244E-02	8.6119E-02	51
6.9493E-03	3.9811E-01	1.3344E 02	4.2891E-02	1.0786E-01	61
8.7474E-03	5.0119E-01	9.8021E 01	5.2957E-02	1.3318E-01	71
1.1012E-02	6.3096E-01	7.2002E 01	6.4676E-02	1.6265E-01	81
1.3864E-02	7.9433E-01	5.2872E 01	7.8317E-02	1.9696E-01	91
1.7453E-02	1.0000E 00	3.8691E 01	9.4173E-02	2.3683E-01	101
2.1972E-02	1.2589E 00	2.8013E 01	1.1247E-01	2.8285E-01	111
2.7662E-02	1.5849E 00	1.9910E 01	1.3329E-01	3.3520E-01	121
3.4824E-02	1.9953E 00	1.3783E 01	1.5644E-01	3.9341E-01	131
4.3841E-02	2.5119E 00	9.2215E 00	1.8141E-01	4.5623E-01	141
5.5192E-02	3.1623E 00	5.9164E 00	2.0736E-01	5.2148E-01	151
6.9483E-02	3.9811E 00	3.5870E 00	2.3304E-01	5.8603E-01	161
8.7473E-02	5.0119E 00	2.0718E 00	2.5706E-01	6.4646E-01	171
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.3864E-01	7.9433E 00	6.6476E-01	2.9817E-01	7.4986E-01	191
1.7453E-01	1.0000E 01	3.8942E-01	3.1585E-01	7.9431E-01	201
2.6180E-01	1.5000E 01	1.4734E-01	3.4410E-01	8.6536E-01	206
3.4907E-01	2.0000E 01	6.4332E-02	3.6009E-01	9.0555E-01	211
4.3633E-01	2.5000E 01	3.2636E-02	3.6964E-01	9.2959E-01	216
5.2360E-01	3.0000E 01	1.8852E-02	3.7590E-01	9.4532E-01	221
6.1086E-01	3.5000E 01	1.1977E-02	3.8031E-01	9.5641E-01	226
6.9813E-01	4.0000E 01	8.0741E-03	3.8359E-01	9.6466E-01	231
7.8540E-01	4.5000E 01	5.5550E-03	3.8607E-01	9.7091E-01	236
8.7266E-01	5.0000E 01	3.8970E-03	3.8795E-01	9.7564E-01	241
9.5993E-01	5.5000E 01	2.7935E-03	3.8939E-01	9.7925E-01	246
1.0472E 00	6.0000E 01	2.0606E-03	3.4050E-01	9.8204E-01	251
1.1345E 00	6.5000E 01	1.5771E-03	3.9137E-01	9.8424E-01	256
1.2217E 00	7.0000E 01	1.2440E-03	3.9208E-01	9.8602E-01	261
1.3090E 00	7.5000E 01	1.0140E-03	3.9267E-01	9.8750E-01	266
1.3963E 00	8.0000E 01	8.4955E-04	3.9316E-01	9.8874E-01	271
1.4835E 00	8.5000E 01	7.2905E-04	3.9359E-01	9.8982E-01	276
1.5708E 00	9.0000E 01	6.4038E-04	3.9397E-01	9.9076E-01	281
1.6581E 00	9.5000E 01	5.7750E-04	3.9430E-01	9.9150E-01	286
1.7453E 00	1.0000E 02	5.3647E-04	3.9460E-01	9.9235E-01	291
1.8326E 00	1.0500E 02	5.1173E-04	3.9488E-01	9.9306E-01	296
1.9199E 00	1.1000E 02	5.0387E-04	3.9514E-01	9.9372E-01	301
2.0071E 00	1.1500E 02	5.0673E-04	3.9540E-01	9.9437E-01	306
2.0944E 00	1.2000E 02	5.1466E-04	3.9565E-01	9.9499E-01	311
2.1817E 00	1.2500E 02	5.2591E-04	3.9589E-01	9.9559E-01	316
2.2689E 00	1.3000E 02	5.3742E-04	3.9612E-01	9.9617E-01	321
2.3562E 00	1.3500E 02	5.4968E-04	3.9634E-01	9.9673E-01	326
2.4435E 00	1.4000E 02	5.6299E-04	3.9654E-01	9.9724E-01	331
2.5307E 00	1.4500E 02	5.9105E-04	3.9674E-01	9.9773E-01	336
2.6180E 00	1.5000E 02	6.3401E-04	3.9692E-01	9.9818E-01	341
2.7053E 00	1.5500E 02	6.9458E-04	3.9708E-01	9.9860E-01	346
2.7925E 00	1.6000E 02	7.9040E-04	3.9724E-01	9.9899E-01	351
2.8798E 00	1.6500E 02	9.6507E-04	3.9738E-01	9.9935E-01	356
2.9671E 00	1.7000E 02	1.2688E-03	3.9751E-01	9.9967E-01	361
3.0543E 00	1.7500E 02	1.4146E-03	3.9761E-01	9.9991E-01	366
3.1416E 00	1.8000E 02	1.6538E-03	3.9764E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-110. Volume scattering function (sheet 3 of 3).

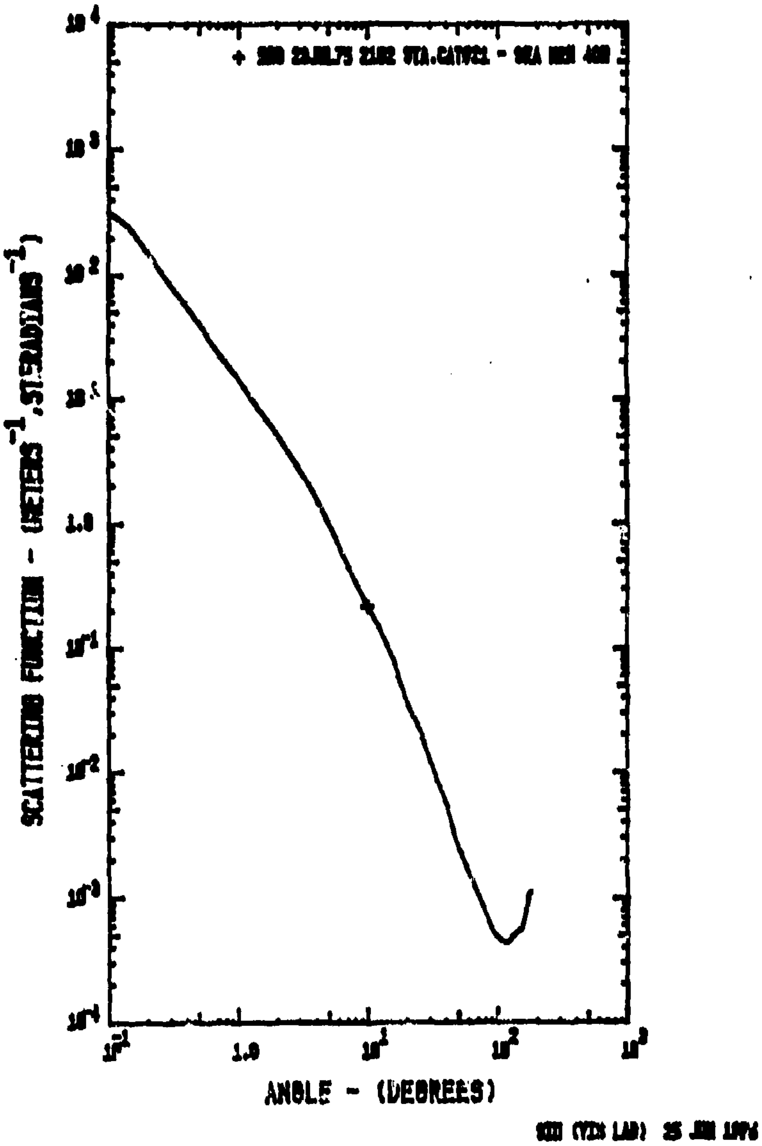


Figure D-111. Volume scattering function (sheet 1 of 3).

25 JUN 1976 1208.49

520 23JUL75 2102 STA.CAT#21 - SEA H2O 40M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	1.9500E 02	0	0.1750	1.8476E 02
2	0.3500	6.0000E 01	0	0.3500	6.6815E 01
3	0.7000	2.5500E 01	0	0.7000	2.4162E 01
4	10.00	2.1672E-01	0	10.00	2.1672E-01
5	15.00	9.1453E-02	0	15.00	9.1453E-02
6	20.00	3.6813E-02	0	20.00	3.6813E-02
7	25.00	2.2131E-02	0	25.00	2.2131E-02
8	30.00	1.2389E-02	0	30.00	1.2389E-02
9	40.00	5.5976E-03	0	40.00	5.5976E-03
10	50.00	2.5704E-03	0	50.00	2.5704E-03
11	60.00	1.5840E-03	0	60.00	1.5840E-03
12	70.00	1.0361E-03	0	70.00	1.0367E-03
13	80.00	7.5538E-04	0	80.00	7.5538E-04
14	90.00	5.5754E-04	0	90.00	5.5754E-04
15	100.0	4.7917E-04	0	100.0	4.7917E-04
16	110.0	4.4406E-04	0	110.0	4.4406E-04
17	120.0	4.4252E-04	0	120.0	4.4252E-04
18	130.0	4.9162E-04	0	130.0	4.9162E-04
19	140.0	5.3100E-04	0	140.0	5.3100E-04
20	150.0	5.6052E-04	0	150.0	5.6052E-04
21	160.0	6.9593E-04	0	160.0	6.9593E-04
22	170.0	9.9362E-04	0	170.0	9.9362E-04
23			1	180.0	1.1074E-03

ALPHA= 0.3079   S/ALPHA= 0.605
S= 0.1862   A/ALPHA= 0.395
A= 0.1217   B/S= 0.017

CORRECTED ALPHA   CORRECTION=0.003

ALPHA= 0.3106   S/ALPHA= 0.600
S= 0.1862   A/ALPHA= 0.400
A= 0.1244   B/S= 0.017

SIGMA(0.0 DEGREES)= 423.3
SIGMA(0.1 DEGREES)= 317.8
SLOPE(3 MILLIRAD)= -1.467
S UP TO 0.1 DEGREES= 3.5183E-03   NORMALIZED= 1.38930E-02

THETA**2 BAR   8.1707E-02 RADIANS**2

Figure D-111. Volume scattering function (sheet 2 of 3).

25 JUN 1976 1208.49

520 23JUL75 2102 STA.CATA21 - SEA H20 40M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	3.1777E 02	3.5183E-03	1.8893E-02	1
2.1972E-03	1.2589E-01	2.7037E 02	5.1600E-03	2.7709E-02	11
2.7662E-03	1.5849E-01	2.1183E 02	7.2855E-03	3.9123E-02	21
3.4824E-03	1.9953E-01	1.5241E 02	9.7994E-03	5.2622E-02	31
4.3841E-03	2.5119E-01	1.0871E 02	1.2644E-02	6.7899E-02	41
5.5192E-03	3.1623E-01	7.7542E 01	1.5860E-02	8.5169E-02	51
6.9483E-03	3.9811E-01	5.5309E 01	1.9496E-02	1.0469E-01	61
8.7474E-03	5.0119E-01	3.9450E 01	2.3606E-02	1.2676E-01	71
1.1012E-02	6.3096E-01	2.9139E 01	2.8252E-02	1.5171E-01	81
1.3864E-02	7.9433E-01	2.0070E 01	3.3504E-02	1.7992E-01	91
1.7453E-02	1.0000E 00	1.4314E 01	3.9441E-02	2.1180E-01	101
2.1972E-02	1.2589E 00	1.0187E 01	4.6147E-02	2.4781E-01	111
2.7662E-02	1.5849E 00	7.2170E 00	5.3093E-02	2.8833E-01	121
3.4824E-02	1.9953E 00	5.0769E 00	6.2138E-02	3.3368E-01	131
4.3841E-02	2.5119E 00	3.5376E 00	7.1508E-02	3.8400E-01	141
5.5192E-02	3.1623E 00	2.4358E 00	8.1794E-02	4.3923E-01	151
6.9483E-02	3.9811E 00	1.5954E 00	9.2798E-02	4.9832E-01	161
8.7473E-02	5.0119E 00	9.6033E-01	1.0383E-01	5.5755E-01	171
1.1012E-01	6.3096E 00	5.0437E-01	1.1437E-01	6.1417E-01	181
1.3864E-01	7.9433E 00	3.4941E-01	1.2431E-01	6.6753E-01	191
1.7453E-01	1.0000E 01	2.1672E-01	1.3396E-01	7.1934E-01	201
2.6190E-01	1.5000E 01	9.1433E-02	1.5044E-01	8.0787E-01	206
3.4907E-01	2.0000E 01	3.6813E-02	1.6000E-01	8.5918E-01	211
4.3633E-01	2.5000E 01	2.2131E-02	1.6596E-01	8.9119E-01	216
5.2360E-01	3.0000E 01	1.2389E-02	1.7014E-01	9.1367E-01	221
6.1085E-01	3.5000E 01	8.1191E-03	1.7308E-01	9.2941E-01	226
6.9813E-01	4.0000E 01	5.5976E-03	1.7533E-01	9.4153E-01	231
7.8540E-01	4.5000E 01	3.6788E-03	1.7702E-01	9.5061E-01	236
8.7266E-01	5.0000E 01	2.5704E-03	1.7826E-01	9.5724E-01	241
9.5993E-01	5.5000E 01	1.9946E-03	1.7924E-01	9.6250E-01	246
1.0472E 00	6.0000E 01	1.5840E-03	1.8006E-01	9.6693E-01	251
1.1345E 00	6.5000E 01	1.2687E-03	1.8075E-01	9.7062E-01	256
1.2217E 00	7.0000E 01	1.0367E-03	1.8133E-01	9.7374E-01	261
1.3090E 00	7.5000E 01	8.7737E-04	1.8183E-01	9.7640E-01	266
1.3963E 00	8.0000E 01	7.5538E-04	1.8227E-01	9.7876E-01	271
1.4835E 00	8.5000E 01	6.4478E-04	1.8264E-01	9.8078E-01	276
1.5708E 00	9.0000E 01	5.5754E-04	1.8297E-01	9.8256E-01	281
1.6581E 00	9.5000E 01	5.0754E-04	1.8326E-01	9.8410E-01	286
1.7453E 00	1.0000E 02	4.7917E-04	1.8353E-01	9.8555E-01	291
1.8326E 00	1.0500E 02	4.5814E-04	1.8378E-01	9.8688E-01	296
1.9199E 00	1.1000E 02	4.4406E-04	1.8402E-01	9.8816E-01	301
2.0071E 00	1.1500E 02	4.3601E-04	1.8424E-01	9.8934E-01	306
2.0944E 00	1.2000E 02	4.4252E-04	1.8445E-01	9.9050E-01	311
2.1817E 00	1.2500E 02	4.5537E-04	1.8466E-01	9.9161E-01	316
2.2689E 00	1.3000E 02	4.9162E-04	1.8487E-01	9.9274E-01	321
2.3562E 00	1.3500E 02	5.1162E-04	1.8507E-01	9.9382E-01	326
2.4435E 00	1.4000E 02	5.3100E-04	1.8527E-01	9.9487E-01	331
2.5307E 00	1.4500E 02	5.4575E-04	1.8544E-01	9.9582E-01	336
2.6180E 00	1.5000E 02	5.6052E-04	1.8561E-01	9.9671E-01	341
2.7053E 00	1.5500E 02	6.0782E-04	1.8575E-01	9.9748E-01	346
2.7925E 00	1.6000E 02	6.9593E-04	1.8589E-01	9.9823E-01	351
2.8798E 00	1.6500E 02	8.1811E-04	1.8601E-01	9.9888E-01	356
2.9671E 00	1.7000E 02	9.9362E-04	1.8612E-01	9.9946E-01	361
3.0543E 00	1.7500E 02	1.0857E-03	1.8619E-01	9.9985E-01	366
3.1416E 00	1.8000E 02	1.1074E-03	1.8622E-01	1.0000E 00	371

PAUSE READY PLOTTER
76 END OF JOB

Figure D-111. Volume scattering function (sheet 3 of 3).

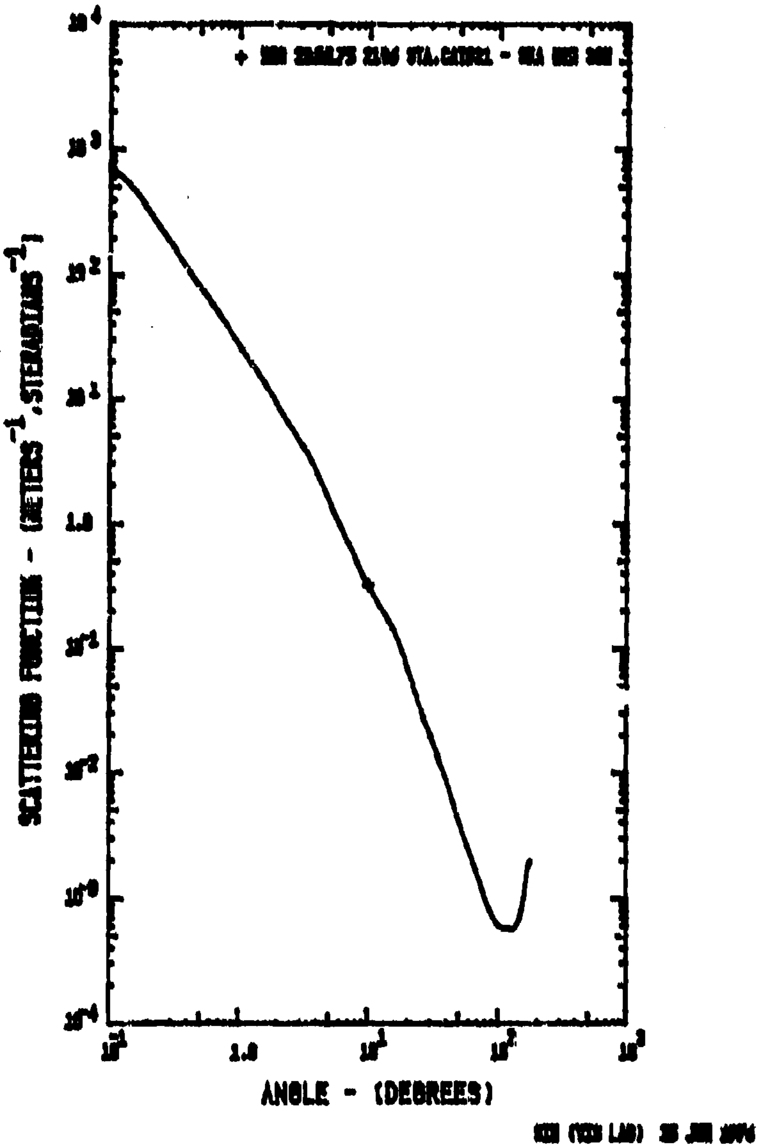


Figure D-112. Volume scattering function (sheet 1 of 3).

25 JUN 1976 1204.55

520 23JUL75 2106 STA.CAT#21 - SEA H2O 30M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	4.2000E 02	0	0.1750	4.0288E 02
2	0.3500	1.2800E 02	0	0.3500	1.3901E 02
3	0.7000	5.0000E 01	0	0.7000	4.7965E 01
4	10.00	3.2359E-01	0	10.00	3.2359E-01
5	15.00	1.5211E-01	0	15.00	1.5211E-01
6	20.00	7.0146E-02	0	20.00	7.0146E-02
7	25.00	3.5075E-02	1	25.00	3.5075E-02
8	30.00	2.0215E-02	0	30.00	2.0215E-02
9	40.00	8.7729E-03	0	40.00	8.7729E-03
10	50.00	4.1922E-03	0	50.00	4.1922E-03
11	60.00	2.4099E-03	0	60.00	2.4099E-03
12	70.00	1.5717E-03	0	70.00	1.5717E-03
13	80.00	9.9867E-04	0	80.00	9.9867E-04
14	90.00	7.3966E-04	0	90.00	7.3966E-04
15	100.0	6.1709E-04	0	100.0	6.1709E-04
16	110.0	5.8796E-04	0	110.0	5.8796E-04
17	120.0	5.8085E-04	0	120.0	5.8085E-04
18	130.0	5.7110E-04	0	130.0	5.7110E-04
19	140.0	6.1721E-04	0	140.0	6.1721E-04
20	150.0	7.3910E-04	0	150.0	7.3910E-04
21	160.0	1.0233E-03	0	160.0	1.0233E-03
22	170.0	1.7179E-03	0	170.0	1.7179E-03
23			1	180.0	2.0143E-03

ALPHA= 0.4551   S/ALPHA= 0.707
S= 0.3220   A/ALPHA= 0.293
A= 0.1331   B/S= 0.013

CORRECTED ALPHA   CORRECTION=0.006

ALPHA= 0.4612   S/ALPHA= 0.698
S= 0.3220   A/ALPHA= 0.302
A= 0.1392   B/S= 0.013

SIGMA(0.0 DEGREES)= 961.6
SIGMA(0.1 DEGREES)= 710.7
SLOPE(3 ILLIRAD)= -1.535
S UP TO 0.1 DEGREES= 7.9331E-03   NORMALIZED= 2.46398E-02

THETA**2 BAR 6.0038E-02 RADIANS**2

Figure D-112. Volume scattering function (sheet 2 of 3).

[illegible] 23JUL75 2106 STA.CAT#21 - SEA H2O [illegible]

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	7.1075E 02	7.9331E-03	2.4640E-02	1
2.1972E-03	1.2589E-01	5.9973E 02	1.1950E-02	3.5999E-02	11
2.7662E-03	1.5849E-01	4.6451E 02	1.6278E-02	5.0559E-02	21
3.4824E-03	1.9953E-01	3.2940E 02	2.1751E-02	6.7559E-02	31
4.3841E-03	2.5119E-01	2.3132E 02	2.7851E-02	8.6505E-02	41
5.5192E-03	3.1623E-01	1.6244E 02	3.4640E-02	1.0759E-01	51
6.9483E-03	3.9811E-01	1.1407E 02	4.2196E-02	1.3106E-01	61
8.7476E-03	5.0119E-01	8.0107E 01	5.0605E-02	1.5718E-01	71
1.1012E-02	6.3096E-01	5.6256E 01	5.9956E-02	1.8625E-01	81
1.3866E-02	7.9432E-01	3.9467E 01	7.0340E-02	2.1860E-01	91
1.7453E-02	1.0000E 00	2.7537E 01	8.1931E-02	2.5448E-01	101
2.1972E-02	1.2589E 00	1.9081E 01	9.4660E-02	2.9401E-01	111
2.7662E-02	1.5849E 00	1.3118E 01	1.0855E-01	3.3726E-01	121
3.4824E-02	1.9953E 00	8.9400E 00	1.2369E-01	3.8417E-01	131
4.3841E-02	2.5119E 00	6.0324E 00	1.3992E-01	4.3460E-01	141
5.5192E-02	3.1623E 00	4.0296E 00	1.5720E-01	4.8825E-01	151
6.9483E-02	3.9811E 00	2.5557E 00	1.7512E-01	5.4391E-01	161
8.7473E-02	5.0119E 00	1.5188E 00	1.9249E-01	5.9787E-01	171
1.1012E-01	6.3096E 00	8.8077E-01	2.0859E-01	6.4780E-01	181
1.3864E-01	7.9433E 00	5.1900E-01	2.2546E-01	6.9602E-01	191
1.7453E-01	1.0000E 01	3.2359E-01	2.3754E-01	7.3911E-01	201
2.6180E-01	1.5000E 01	1.5211E-01	2.6329E-01	8.1777E-01	206
3.4907E-01	2.0000E 01	7.0146E-02	2.8060E-01	8.7155E-01	211
4.3633E-01	2.5000E 01	3.5075E-02	2.9095E-01	9.0368E-01	216
5.2360E-01	3.0000E 01	2.0215E-02	2.9766E-01	9.2456E-01	221
6.1086E-01	3.5000E 01	1.2944E-02	3.0241E-01	9.3926E-01	226
6.9813E-01	4.0000E 01	8.7729E-03	3.0596E-01	9.5031E-01	231
7.8540E-01	4.5000E 01	5.9563E-03	3.0866E-01	9.5865E-01	236
8.7266E-01	5.0000E 01	4.1922E-03	3.1056E-01	9.6491E-01	241
9.5993E-01	5.5000E 01	3.1254E-03	3.1223E-01	9.6979E-01	246
1.0472E 00	6.0000E 01	2.4099E-03	3.1350E-01	9.7373E-01	251
1.1345E 00	6.5000E 01	1.9294E-03	3.1455E-01	9.7697E-01	256
1.2217E 00	7.0000E 01	1.5717E-03	3.1543E-01	9.7972E-01	261
1.3090E 00	7.5000E 01	1.2459E-03	3.1617E-01	9.8200E-01	266
1.3963E 00	8.0000E 01	9.9967E-04	3.1676E-01	9.8385E-01	271
1.4835E 00	8.5000E 01	8.4588E-04	3.1726E-01	9.8540E-01	276
1.5708E 00	9.0000E 01	7.3966E-04	3.1769E-01	9.8674E-01	281
1.6581E 00	9.5000E 01	6.5213E-04	[illegible]	9.8795E-01	286
1.7453E 00	1.0000E 02	6.1709E-04	3.1842E-01	9.8901E-01	291
1.8326E 00	1.0500E 02	5.9629E-04	3.1874E-01	9.9001E-01	296
1.9199E 00	1.1000E 02	5.8796E-04	3.1905E-01	9.9097E-01	301
2.0071E 00	1.1500E 02	5.8430E-04	3.1935E-01	9.9189E-01	306
2.0944E 00	1.2000E 02	5.8085E-04	3.1963E-01	9.9277E-01	311
2.1817E 00	1.2500E 02	5.7583E-04	3.1990E-01	9.9360E-01	316
2.2689E 00	1.3000E 02	5.7110E-04	3.2015E-01	9.9438E-01	321
2.3562E 00	1.3500E 02	5.8472E-04	3.2039E-01	9.9510E-01	326
2.4435E 00	1.4000E 02	6.1721E-04	3.2061E-01	9.9579E-01	331
2.5307E 00	1.4500E 02	6.6619E-04	3.2082E-01	9.9645E-01	336
2.6180E 00	1.5000E 02	7.3910E-04	3.2102E-01	9.9709E-01	341
2.7053E 00	1.5500E 02	8.5036E-04	3.2122E-01	9.9771E-01	346
2.7925E 00	1.6000E 02	1.0233E-03	3.2142E-01	9.9832E-01	351
2.8798E 00	1.6500E 02	1.2931E-03	3.2161E-01	9.9890E-01	356
2.9671E 00	1.7000E 02	1.7179E-03	3.2178E-01	9.9944E-01	361
3.0543E 00	1.7500E 02	1.9574E-03	3.2191E-01	9.9985E-01	366
3.1416E 00	1.8000E 02	2.0143E-03	3.2196E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-112. Volume scattering function (sheet 3 of 3).

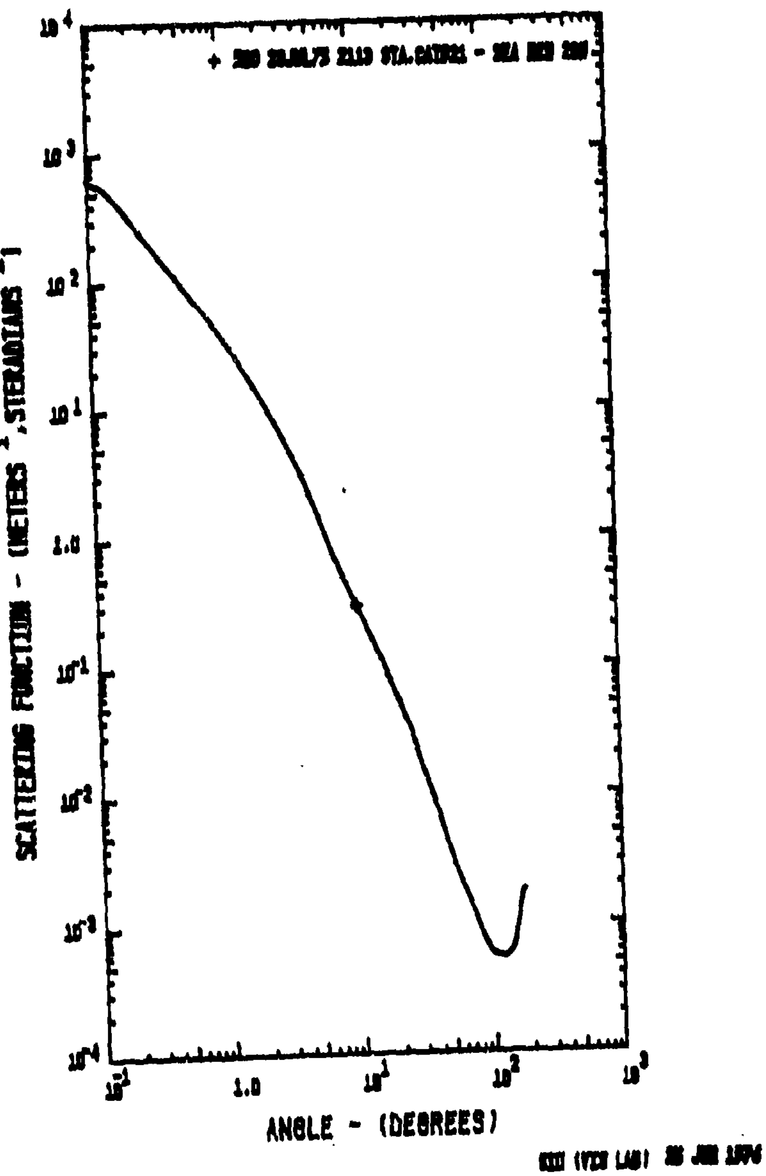


Figure D-113. Volume scattering function (sheet 1 of 3).

25 JUN 1976 1203.22

920 23JUL75 2113 STA.CAT#21 - SEA H2O 20M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	4.1000E 02	0	0.1750	3.9925E 02
2	0.3500	1.5200E 02	0	0.3500	1.6020E 02
3	0.7000	6.6000E 01	0	0.7000	6.4278E 01
4	10.00	2.9537E-01	0	10.00	2.9537E-01
5	15.00	1.1942E-01	0	15.00	1.1942E-01
6	20.00	5.7811E-02	0	20.00	5.7811E-02
7	25.00	3.2828E-02	0	25.00	3.2828E-02
8	30.00	1.7740E-02	0	30.00	1.7740E-02
9	40.00	7.4246E-03	0	40.00	7.4246E-03
10	50.00	3.3725E-03	0	50.00	3.3725E-03
11	60.00	2.0110E-03	0	60.00	2.0110E-03
12	70.00	1.3939E-03	0	70.00	1.3939E-03
13	80.00	8.4470E-04	0	80.00	8.4470E-04
14	90.00	6.9507E-04	0	90.00	6.9507E-04
15	100.0	5.7134E-04	0	100.0	5.7134E-04
16	110.0	5.4437E-04	0	110.0	5.4437E-04
17	120.0	5.3338E-04	0	120.0	5.3338E-04
18	130.0	5.4470E-04	0	130.0	5.4470E-04
19	140.0	6.0307E-04	0	140.0	6.0307E-04
20	150.0	7.1651E-04	0	150.0	7.1651E-04
21	160.0	1.0296E-03	0	160.0	1.0296E-03
22	170.0	1.5229E-03	0	170.0	1.5229E-03
23			1	180.0	1.7519E-03

ALPHA= 0.5118 S/ALPHA= 0.701
S= 0.3589 A/ALPHA= 0.299
A= 0.1529 B/S= 0.011

CORRECTED ALPHA CORRECTION=0.005

ALPHA= 0.5171 S/ALPHA= 0.694
S= 0.3589 A/ALPHA= 0.306
A= 0.1582 B/S= 0.011

SIGMA(0.0 DEGREES)= 821.9
SIGMA(0.1 DEGREES)= 642.1
SLOPE(3 MILLIRAD)= -1.318
S UP TO 0.1 DEGREES= 6.9650E-03 NORMALIZED= 1.94057E-02

THETA**2 BAR 5.0439E-02 RADIANS**2

Figure D-113. Volume scattering function (sheet 2 of 3).

25 JUN 1976 1203.22

520 23JUL75 2113 STA.CAT#21 - SEA H2O 20M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	6.4211E 02	6.9650E-03	1.9406E-02	1
2.1972E-03	1.2589E-01	5.5819E 02	1.0313E-02	2.9747E-02	11
2.7662E-03	1.5849E-01	4.5079E 02	1.4772E-02	4.1158E-02	21
3.4824E-03	1.9953E-01	3.3592E 02	2.0219E-02	5.6335E-02	31
4.3841E-03	2.5119E-01	2.4802E 02	2.6601E-02	7.4116E-02	41
5.5192E-03	3.1623E-01	1.8312E 02	3.4069E-02	9.4924E-02	51
6.9483E-03	3.9811E-01	1.3520E 02	4.2808E-02	1.1927E-01	61
8.7474E-03	5.0119E-01	9.9821E 01	5.3054E-02	1.4776E-01	71
1.1012E-02	6.3096E-01	7.3702E 01	6.5000E-02	1.8110E-01	81
1.3864E-02	7.9433E-01	5.4239E 01	7.9002E-02	2.2005E-01	91
1.7453E-02	1.0000E 00	3.9110E 01	9.5136E-02	2.6513E-01	101
2.1972E-02	1.2589E 00	2.7519E 01	1.1361E-01	3.1597E-01	111
2.7662E-02	1.5849E 00	1.8861E 01	1.3349E-01	3.7192E-01	121
3.4824E-02	1.9953E 00	1.2569E 01	1.5500E-01	4.3185E-01	131
4.3841E-02	2.5119E 00	8.1289E 00	1.7737E-01	4.9419E-01	141
5.5192E-02	3.1623E 00	5.0936E 00	1.9994E-01	5.5710E-01	151
6.9483E-02	3.9811E 00	3.0073E 00	2.2180E-01	6.1798E-01	161
8.7473E-02	5.0119E 00	1.6735E 00	2.4159E-01	6.7312E-01	171
1.1012E-01	6.3096E 00	9.1124E-01	2.5879E-01	7.2106E-01	181
1.3864E-01	7.9433E 00	5.0445E-01	2.7370E-01	7.6257E-01	191
1.7453E-01	1.0000E 01	2.9537E-01	2.8708E-01	7.9965E-01	201
2.6180E-01	1.5000E 01	1.1942E-01	3.0902E-01	8.6099E-01	206
3.4907E-01	2.0000E 01	5.7611E-02	3.2256E-01	8.9871E-01	211
4.3633E-01	2.5000E 01	3.2828E-02	3.3164E-01	9.2401E-01	216
5.2360E-01	3.0000E 01	1.7740E-02	3.3779E-01	9.4115E-01	221
6.1086E-01	3.5000E 01	1.1147E-02	3.4191E-01	9.5265E-01	226
6.9813E-01	4.0000E 01	7.4246E-03	3.4495E-01	9.6110E-01	231
7.8540E-01	4.5000E 01	4.8840E-03	3.4719E-01	9.6734E-01	236
8.7266E-01	5.0000E 01	3.3728E-03	3.4888E-01	9.7189E-01	241
9.5993E-01	5.5000E 01	2.5396E-03	3.5009E-01	9.7542E-01	246
1.0472E 00	6.0000E 01	2.0110E-03	3.5114E-01	9.7834E-01	251
1.1345E 00	6.5000E 01	1.6670E-03	3.5202E-01	9.8080E-01	256
1.2217E 00	7.0000E 01	1.3939E-03	3.5280E-01	9.8296E-01	261
1.3090E 00	7.5000E 01	1.1418E-03	3.5346E-01	9.8480E-01	266
1.3963E 00	8.0000E 01	9.4470E-04	3.5401E-01	9.8635E-01	271
1.4835E 00	8.5000E 01	8.0294E-04	3.5449E-01	9.8766E-01	276
1.5708E 00	9.0000E 01	6.9507E-04	3.5489E-01	9.8880E-01	281
1.6581E 00	9.5000E 01	6.1540E-04	3.5525E-01	9.8979E-01	286
1.7453E 00	1.0000E 02	5.7134E-04	3.5557E-01	9.9069E-01	291
1.8326E 00	1.0500E 02	5.5369E-04	3.5587E-01	9.9153E-01	296
1.9199E 00	1.1000E 02	5.4437E-04	3.5616E-01	9.9233E-01	301
2.0071E 00	1.1500E 02	5.3761E-04	3.5643E-01	9.9309E-01	306
2.0944E 00	1.2000E 02	5.3338E-04	3.5669E-01	9.9382E-01	311
2.1817E 00	1.2500E 02	5.3597E-04	3.5694E-01	9.9452E-01	316
2.2689E 00	1.3000E 02	5.4470E-04	3.5718E-01	9.9519E-01	321
2.3562E 00	1.3500E 02	5.6335E-04	3.5740E-01	9.9578E-01	326
2.4435E 00	1.4000E 02	5.9307E-04	3.5761E-01	9.9638E-01	331
2.5307E 00	1.4500E 02	6.3565E-04	3.5782E-01	9.9694E-01	336
2.6180E 00	1.5000E 02	7.1651E-04	3.5801E-01	9.9749E-01	341
2.7053E 00	1.5500E 02	8.5013E-04	3.5821E-01	9.9804E-01	346
2.7925E 00	1.6000E 02	1.0296E-03	3.5841E-01	9.9859E-01	351
2.8798E 00	1.6500E 02	1.2501E-03	3.5859E-01	9.9911E-01	356
2.9671E 00	1.7000E 02	1.5229E-03	3.5876E-01	9.9958E-01	361
3.0543E 00	1.7500E 02	1.7185E-03	3.5887E-01	9.9989E-01	366
3.1416E 00	1.8000E 02	1.7519E-03	3.5891E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-113. Volume scattering function (sheet 3 of 3).

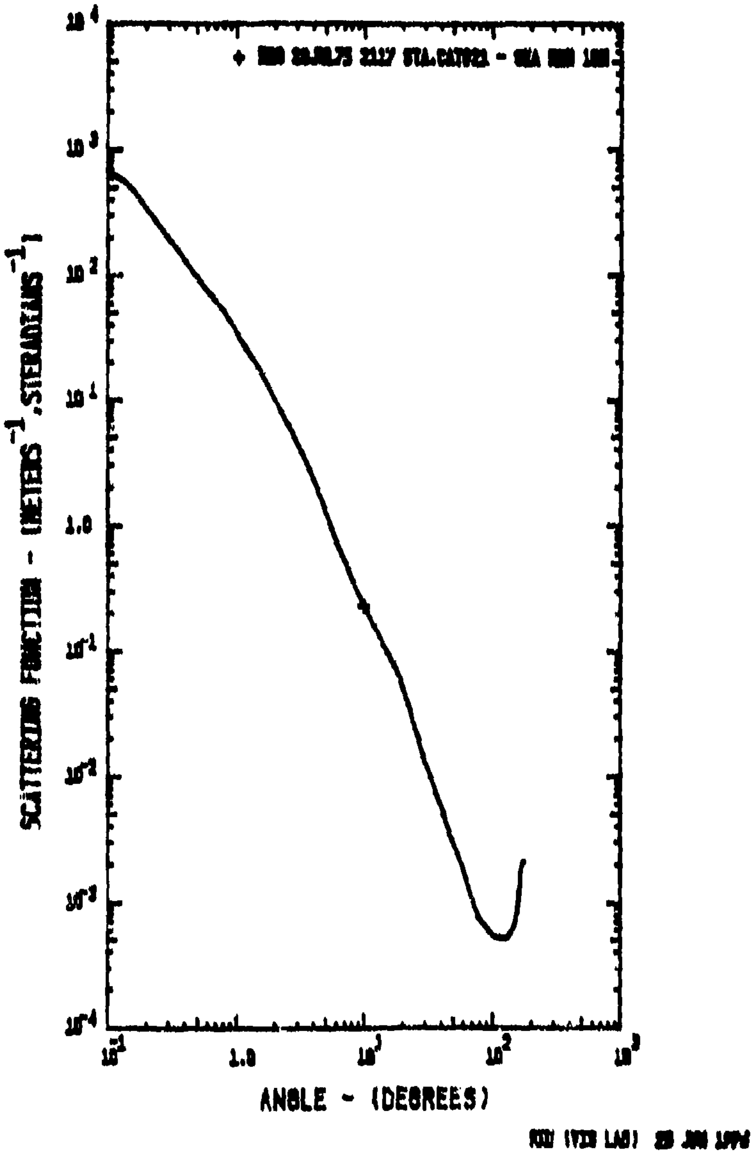


Figure D-114. Volume scattering function (sheet 1 of 3).

25 JUN 1976 1201.50

520 25JUL75 2117 STA.CAT#21 - SEA H2O 10M

	DATA READ IN ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ITERATED DATA ANGLE (DEG)	SIGMA
1	0.1750	4.2000E 02	0	0.1750	4.0880E 02
2	0.3500	1.5000E 02	0	0.3500	1.5833E 02
3	0.7000	6.3000E 01	0	0.7000	6.1320E 01
4	10.00	2.3234E-01	0	10.00	2.3234E-01
5	15.00	1.0424E-01	0	15.00	1.0424E-01
6	20.00	5.3082E-02	0	20.00	5.3082E-02
7	25.00	2.5549E-02	0	25.00	2.5548E-02
8	30.00	1.3851E-02	0	30.00	1.3851E-02
9	40.00	6.0993E-03	0	40.00	6.0993E-03
10	50.00	3.1314E-03	0	50.00	3.1314E-03
11	60.00	1.9481E-03	0	60.00	1.9481E-03
12	70.00	1.1466E-03	0	70.00	1.1466E-03
13	80.00	7.4902E-04	0	80.00	7.4902E-04
14	90.00	6.5681E-04	0	90.00	6.5681E-04
15	100.0	5.7805E-04	0	100.0	5.7805E-04
16	110.0	5.3833E-04	0	110.0	5.3833E-04
17	120.0	5.3166E-04	0	120.0	5.3166E-04
18	130.0	5.2242E-04	0	130.0	5.2242E-04
19	140.0	5.7029E-04	0	140.0	[illegible]
20	150.0	6.6109E-04	0	150.0	6.6109E-04
21	160.0	9.2529E-04	0	160.0	9.2529E-04
22	170.0	1.7989E-03	0	170.0	1.7989E-03
23			1	180.0	2.1098E-03

ALPHA= 0.5013 S/ALPHA= 0.620
S= 0.3108 A/ALPHA= 0.380
A= 0.1905 B/S= 0.013

CORRECTED ALPHA CORRECTION =0.006

ALPHA= 0.5069 S/ALPHA= 0.613
S= 0.3108 A/ALPHA= 0.387
A= 0.1961 B/S= 0.013

SIGMA(0.0 DEGREES)= 875.5
SIGMA(0.1 DEGREES)= 674.1
SLOPE(3 MILLIRAD)= -1.368
S UP TO 0.1 DEGREES= 7.3669E-03 NORMALIZED= 2.36994E-02

THETA**2 BAR 5.8980E-02 RADIANS**2

Figure D-114. Volume scattering function (sheet 2 of 3).

25 JUN 1976 1201.50

520 23J.LT? 2117 STA.CAT=21 - SEA H2O 10M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	I
1.7453E-03	1.0000E-01	6.7407E 02	7.3669E-03	2.3699E-02	1
2.1972E-03	1.2589E-01	5.3136E 02	1.0873E-02	3.4978E-02	11
2.7662E-03	1.5849E-01	4.6423E 02	1.5486E-02	4.9820E-02	21
3.4824E-03	1.9953E-01	3.4169E 02	2.1059E-02	6.7747E-02	31
4.3841E-03	2.5119E-01	2.4924E 02	2.7510E-02	8.8502E-02	41
5.5192E-03	3.1623E-01	1.8191E 02	3.4972E-02	1.1251E-01	51
6.9483E-03	3.9811E-01	1.3274E 02	4.3601E-02	1.4027E-01	61
8.7474E-03	5.0119E-01	9.5?65E 01	5.3??1E-02	1.7237E-01	71
1.1017E-02	6.3096E-01	7.0624E 01	6.5122E-02	2.0950E-01	81
1.3864E-02	7.9433E-01	5.1295E 01	7.9466E-02	2.5240E-01	91
1.7453E-02	1.0000E 00	3.6022E 01	9.3554E-02	3.0097E-01	101
2.1972E-02	1.2589E 00	2.4466E 01	1.1007E-01	3.5410E-01	111
2.7662E-02	1.5849E 00	1.6133E 01	1.2758E-01	4.1043E-01	121
3.4824E-02	1.9953E 00	1.0??9E 01	1.4604E-01	[illegible]	131
4.3841E-02	2.5119E 00	6.5204E 00	1.6383E-01	5.2703E-01	141
5.5192E-02	3.1623E 00	4.0273E 00	1.8175E-01	5.8???E-01	151
6.9483E-02	3.9811E 00	2.3568E 00	1.9990E-01	6.4015E-01	161
8.7473E-02	5.0119E 00	1.2937E 00	2.1440E-01	6.8974E-01	171
1.1017E-01	6.3096E 00	7.0007E-01	2.27?6E-01	7.3239E-01	181
1.3864E-01	7.9433E 00	3.????E-01	[illegible]	[illegible]	191
1.7453E-01	1.0000E 01	2.3234E-01	2.4991E-01	?.?27?E-01	201
2.6180E-01	1.5000E 01	1.?4?4E-01	2.67??E-01	?.8027E-01	206
3.4907E-01	2.0000E 01	5.3082E-02	2.7991E-01	9.0050E-01	211
4.3633E-01	2.5000E 01	2.5548E-02	2.8764E-01	9.2534E-01	216
5.2360E-01	3.0000E 01	1.3891E-02	2.9230E-01	9.4059E-01	221
6.1087E-01	3.5000E 01	?.?375E-03	2.9501E-01	9.?100E-01	226
6.9813E-01	4.0000E 01	6.0993E-03	2.9707E-01	9.5?99E-01	231
7.8540E-01	4.5000E 01	4.2994E-03	2.9906E-01	9.6493E-01	236
8.7266E-01	5.0000E 01	3.1314E-03	3.0144E-01	9.6974E-01	241
9.5993E-01	5.5000E 01	2.4483E-03	3.0264E-01	9.7367E-01	246
1.0472E 00	6.0000E 01	1.9481E-03	3.0365E-01	9.7689E-01	251
1.1345E 00	6.5000E 01	1.4973E-03	3.04??E-01	9.7?34E-01	256
1.2217E 00	7.0000E 01	1.1466E-03	3.0?1?E-01	9.?150E-01	261
1.3090E 00	7.5000E 01	9.0797E-04	3.0588E-01	9.?237E-01	266
1.3963E 00	8.0000E 01	7.6902E-04	3.0612E-01	9.8480E-01	271
1.4835E 00	8.5000E 01	7.0433E-04	3.0652E-01	9.8608E-01	276
1.5708E 00	9.0000E 01	6.5681E-04	3.0699E-01	9.8729E-01	281
1.6581E 00	9.5000E 01	6.????E-04	3.0729E-01	9.?840E-01	286
1.7453E 00	1.0000E 02	5.7605E-04	3.0753E-01	9.?944E-01	291
1.8326E 00	1.0500E 02	5.6138E-04	3.0794E-01	9.?061E-01	296
1.9199E 00	1.1000E 02	5.3833E-04	3.0815E-01	9.9132E-01	301
2.0071E 00	1.1500E 02	5.3456E-04	3.0842E-01	9.9220E-01	306
2.0944E 00	1.2000E 02	5.3166E-04	3.0868E-01	9.?303E-01	311
2.1817E 00	1.2500E 02	5.2644E-04	3.0892E-01	9.?382E-01	316
2.2689E 00	1.3000E 02	5.2262E-04	3.0915E-01	9.9455E-01	321
2.3562E 00	1.3500E 02	5.4023E-04	3.0937E-01	9.9524E-01	326
2.4435E 00	1.4000E 02	5.7428E-04	3.0957E-01	9.9590E-01	331
2.5307E 00	1.4500E 02	6.1218E-04	3.0977E-01	9.9?46E-01	336
2.6180E 00	1.5000E 02	6.?103E-04	3.0996E-01	9.9714E-01	341
2.7053E 00	1.5500E 02	7.5437E-04	3.1013E-01	9.9771E-01	346
2.7925E 00	1.6000E 02	9.?529E-04	3.1031E-01	9.9?27E-01	351
2.8798E 00	1.6500E 02	1.2313E-03	3.1048E-01	9.9883E-01	356
2.9671E 00	1.7000E 02	1.7889E-03	3.1066E-01	9.9937E-01	361
3.0543E 00	1.7500E 02	2.0895E-03	3.1079E-01	9.9984E-01	366
3.1416E 00	1.8000E 02	2.1698E-03	3.10?5E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-114. Volume scattering function (sheet 3 of 3).

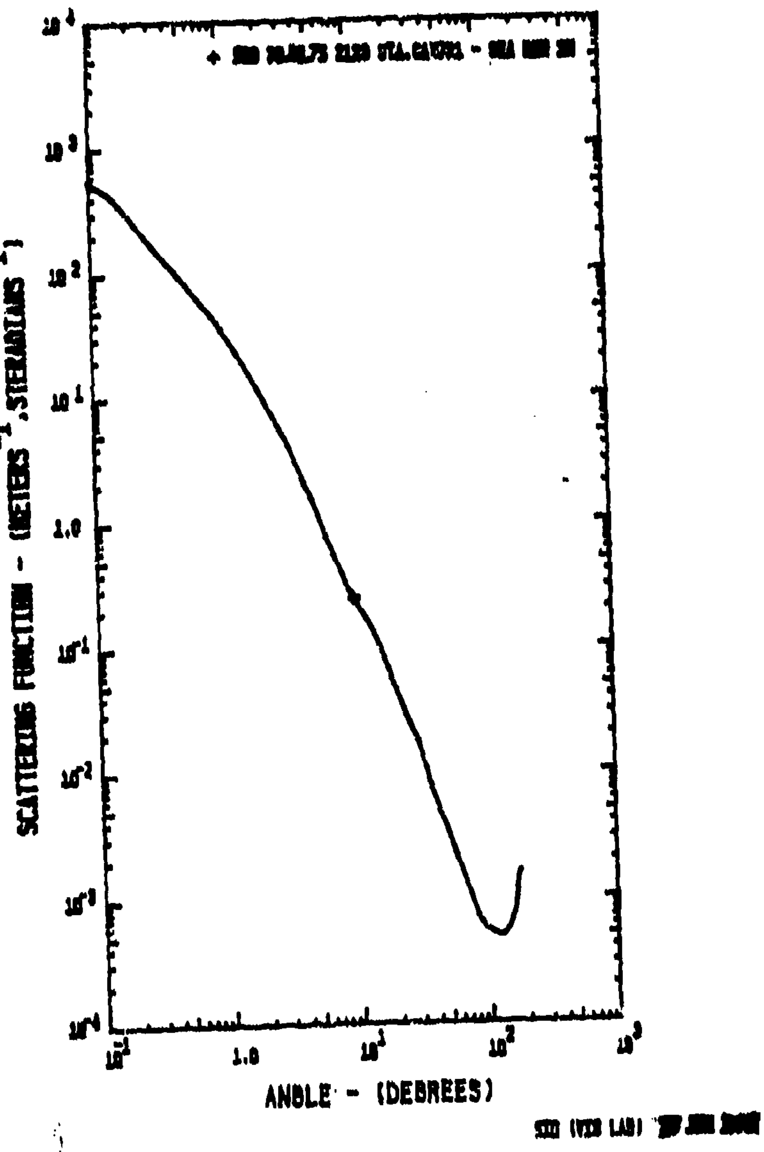


Figure D-115. Volume scattering function (sheet 1 of 3).

25 JUN 1976 1200.19

520 23JUL75 2123 STA.CAT#21 - SEA H2O 2M

	DATA READ IN			ITERATED DATA	
	ANGLE (DEG)	SIGMA	INSTR=0 HAND=1	ANGLE (DEG)	SIGMA
1	0.1750	3.6500E 02	0	0.1750	3.5359E 02
2	0.3500	1.3900E 02	0	0.3500	1.4807E 02
3	0.7000	6.4000E 01	0	0.7000	6.2002E 01
4	10.00	2.5435E-01	0	10.00	2.5435E-01
5	15.00	1.1495E-01	0	15.00	1.1495E-01
6	20.00	5.1663E-02	0	20.00	5.1663E-02
7	25.00	2.7125E-02	0	25.00	2.7125E-02
8	30.00	1.7397E-02	0	30.00	1.7397E-02
9	40.00	6.2880E-03	0	40.00	6.2880E-03
10	50.00	3.3981E-03	0	50.00	3.3981E-03
11	60.00	1.8939E-03	0	60.00	1.8939E-03
12	70.00	1.2318E-03	0	70.00	1.2318E-03
13	80.00	8.2271E-04	0	80.00	8.2271E-04
14	90.00	6.3077E-04	0	90.00	6.3077E-04
15	100.0	5.5866E-04	0	100.0	5.5866E-04
16	110.0	5.2830E-04	0	110.0	5.2830E-04
17	120.0	5.1037E-04	0	120.0	5.1037E-04
18	130.0	5.1684E-04	0	130.0	5.1684E-04
19	140.0	5.6579E-04	0	140.0	5.6579E-04
20	150.0	6.5022E-04	0	150.0	6.5022E-04
21	160.0	8.1379E-04	0	160.0	8.1379E-04
22	170.0	1.3980E-03	0	170.0	1.3980E-03
23			1	180.0	1.6291E-03

ALPHA= 0.4923 S/ALPHA= 0.655
S= 0.3227 A/ALPHA= 0.345
A= 0.1696 B/S= 0.012

CORRECTED ALPHA CORRECTION=0.005

ALPHA= 0.4968 S/ALPHA= 0.649
S= 0.3227 A/ALPHA= 0.351
A= 0.1742 B/S= 0.012

SIGMA(0.0 DEGREES)= 700.0
SIGMA(0.1 DEGREES)= 554.7
SLOPE(3 MILLIRAD)= -1.256
S UP TO 0.1 DEGREES= 5.9731E-03 NORMALIZED= 1.85116E-02

THETA**2 BAR 5.6301E-02 RADIANS**2

Figure D-115. Volume scattering function (sheet 2 of 3).

520 23JUL75 2123 STA.CAT#21 - SEA H2O 2M

ANGLE(RAD)	ANGLE(DEG)	SIGMA	INTEGRAL	NORM. INTEGRAL	
1.7453E-03	1.0000E-01	5.5471E 02	5.9731E-03	1.8512E-02	1
2.1972E-03	1.2589E-01	4.8597E 02	8.8806E-03	2.7522E-02	11
2.7662E-03	1.5849E-01	3.9688E 02	1.2780E-02	3.9607E-02	21
3.4824E-03	1.9953E-01	2.9989E 02	1.7610E-02	5.4576E-02	31
4.3841E-03	2.5119E-01	2.2459E 02	2.3349E-02	7.2362E-02	41
5.5192E-03	3.1623E-01	1.6819E 02	3.0161E-02	9.3473E-02	51
6.9483E-03	3.9811E-01	1.2595E 02	3.8246E-02	1.1853E-01	61
8.7474E-03	5.0119E-01	9.4325E 01	4.7842E-02	1.4827E-01	71
1.1012E-02	6.3096E-01	7.0638E 01	5.9232E-02	1.8357E-01	81
1.3864E-02	7.9433E-01	5.2559E 01	7.2733E-02	2.2541E-01	91
1.7453E-02	1.0000E 00	3.7633E 01	8.8365E-02	2.7385E-01	101
2.1972E-02	1.2589E 00	2.5927E 01	1.0575E-01	3.2774E-01	111
2.7662E-02	1.5849E 00	1.7275E 01	1.2441E-01	3.8556E-01	121
3.4824E-02	1.9953E 00	1.1139E 01	1.4382E-01	4.4573E-01	131
4.3841E-02	2.5119E 00	7.0820E 00	1.6351E-01	5.0675E-01	141
5.5192E-02	3.1623E 00	4.4028E 00	1.8308E-01	5.6738E-01	151
6.9483E-02	3.9811E 00	2.5848E 00	2.0193E-01	6.2501E-01	161
8.7473E-02	5.0119E 00	1.4188E 00	2.1883E-01	6.7817E-01	171
1.1012E-01	6.3096E 00	7.6418E-01	2.3332E-01	7.2310E-01	181
1.3864E-01	7.9433E 00	4.3998E-01	2.4541E-01	7.6131E-01	191
1.7453E-01	1.0000E 01	2.5435E-01	2.5717E-01	7.9700E-01	201
2.6190E-01	1.5000E 01	1.1495E-01	2.7716E-01	8.5895E-01	206
3.4907E-01	2.0000E 01	5.1663E-02	2.8997E-01	8.9834E-01	211
4.3633E-01	2.5000E 01	2.7125E-02	2.9767E-01	9.2253E-01	216
5.2360E-01	3.0000E 01	1.7397E-02	3.0314E-01	9.3949E-01	221
6.1086E-01	3.5000E 01	1.0104E-02	3.0710E-01	9.5173E-01	226
6.9813E-01	4.0000E 01	6.2880E-03	3.0973E-01	9.5990E-01	231
7.8540E-01	4.5000E 01	4.5561E-03	3.1170E-01	9.6601E-01	236
8.7266E-01	5.0000E 01	3.3981E-03	3.1330E-01	9.7095E-01	241
9.5993E-01	5.5000E 01	2.4955E-03	3.1457E-01	9.7488E-01	246
1.0472E 00	6.0000E 01	1.8939E-03	3.1557E-01	9.7799E-01	251
1.1345E 00	6.5000E 01	1.5133E-03	3.1639E-01	9.8053E-01	256
1.2217E 00	7.0000E 01	1.2318E-03	3.1708E-01	9.8268E-01	261
1.3090E 00	7.5000E 01	1.0001E-03	3.1766E-01	9.8448E-01	266
1.3963E 00	8.0000E 01	8.2271E-04	3.1815E-01	9.8598E-01	271
1.4835E 00	8.5000E 01	7.0430E-04	3.1856E-01	9.8726E-01	276
1.5708E 00	9.0000E 01	6.3077E-04	3.1892E-01	9.8839E-01	281
1.6581E 00	9.5000E 01	5.8530E-04	3.1926E-01	9.8942E-01	286
1.7453E 00	1.0000E 02	5.5866E-04	3.1957E-01	9.9038E-01	291
1.8326E 00	1.0500E 02	5.4178E-04	3.1986E-01	9.9129E-01	296
1.9199E 00	1.1000E 02	5.2830E-04	3.2014E-01	9.9216E-01	301
2.0071E 00	1.1500E 02	5.1806E-04	3.2040E-01	9.9298E-01	306
2.0944E 00	1.2000E 02	5.1037E-04	3.2066E-01	9.9375E-01	311
2.1817E 00	1.2500E 02	5.0902E-04	3.2089E-01	9.9448E-01	316
2.2689E 00	1.3000E 02	5.1684E-04	3.2111E-01	9.9517E-01	321
2.3562E 00	1.3500E 02	5.3645E-04	3.2132E-01	9.9583E-01	326
2.4435E 00	1.4000E 02	5.6579E-04	3.2153E-01	9.9646E-01	331
2.5307E 00	1.4500E 02	6.0392E-04	3.2172E-01	9.9706E-01	336
2.6180E 00	1.5000E 02	6.5022E-04	3.2191E-01	9.9764E-01	341
2.7053E 00	1.5500E 02	7.1463E-04	3.2208E-01	9.9817E-01	346
2.7925E 00	1.6000E 02	8.1379E-04	3.2224E-01	9.9866E-01	351
2.9798E 00	1.6500E 02	1.0157E-03	3.2239E-01	9.9912E-01	356
2.9671E 00	1.7000E 02	1.3980E-03	3.2253E-01	9.9955E-01	361
3.0543E 00	1.7500E 02	1.5784E-03	3.2263E-01	9.9988E-01	366
3.1416E 00	1.8000E 02	1.6291E-03	3.2267E-01	1.0000E 00	371

PAUSE READY PLOTTER

Figure D-115. Volume scattering function (sheet 3 of 3).

APPENDIX E

GENERAL DESCRIPTION OF UPLINK PROGRAM

Program UPLINK is used to reduce the experiment uplink data. This data was recorded aboard an aircraft using a receiver looking at an underwater laser pointed upward. The receiver data for each received pulse is digitized and recorded on magnetic tape. A data sample from one of these tapes is shown in table E-1. Program UPLINK reads this data from tape along with control information from cards. The tape is searched for a specified run number. The data for this run number is read in, filtered, calibrated, and plots of radiance loss versus zenith angle are generated.

The data is calibrated using the values for receiver sensitivity and laser power given in Volume II, Section 5. The program initially assumes that the receiver was operated at its most sensitive range. This value is then multiplied by 100 if switch 5 is zero, indicating that the 1 percent transmission filter was in place, and by 10 if switch 4 indicates that the 10 percent transmission filter was in place.

The data for one run are read and the receiver output, roll angle, pitch angle, and value of switch 12 are saved. Switch 12 is an indication of whether or not the receiver was getting sufficient signal for automatic tracking. When all data for one run have been read from tape; the signal, roll angle, and pitch angle are filtered. The signal is multiplied by the calibration factor, and the zenith angle is calculated from the roll and pitch angle. Two plots of the signal are generated (see figure E-1A and figure E-1B); one is the uncorrected signal and the second is multiplied by the secant squared of the zenith angle to correct for variable range to the aircraft. The plots are drawn side by side on an 11 inch by 17 inch page.

The digital filter applied to the data is defined as follows. Let the digital sequence to be filtered be denoted by

$$\{s_i\},\ i = 1, n. \qquad \text{(E-1)}$$

then define

$$u_1 = s_1$$

$$u_i = u_{i-1} - \frac{1}{N}(u_{i-1} - s_i) \qquad i = 2, n \qquad \text{(E-2)}$$

where N is a constant with $N \geq 1$. This is essentially a low pass filter with a time constant of $(N-1)\ \Delta t$ where Δt is the sample interval for the original sequence $\{s_i\}$. The sequence $\{u_i\}$ is a smoothed and time delayed image of $\{s_i\}$.

Now define

$$v_n = s_n$$

$$v_n = v_{i+1} - \frac{1}{N}(v_{i+1} - s_i) \qquad i = N-1, 1. \qquad \text{(E-3)}$$

TABLE E-1. UPLINK PROGRAM DATA SAMPLE.

15 JULY 75

FILE NO. 1

TIME HH:MM:SS.SS	③ 12 (1)	② 11 (2)	④ 10 (3)	⑧ 9 (4)	⑥ 8 (5)	⑥ 7 (6)	② 6 (7)	FILTER 2 5 (8)	FILTER 1 4 (9)	CALIBRATE 3 (10)	ROVR. O.L. 2 (11)	TRACKING 1 (12)	Σ DATA CH1	GAIN 4.97V = MAX. 0V = MED. +4.98V = MIN. CH2	PITCH ANGLE DATA CH3	ROLL ANGLE CH4	NOT USED CH5	NOT USED CH6
15:46:56.53	1	0	0	0	0	0	0	1	1	0	1	0	-1.235	-4.463	0.156	-0.055	-3.315	-0.293
15:46:56.56	1	0	0	0	0	0	0	1	1	0	1	0	-1.094	-4.463	0.156	-0.054	-3.315	-0.303
15:46:56.60	1	0	0	0	0	0	0	1	1	0	1	0	-1.302	-4.463	0.156	-0.059	-3.320	-0.293
15:46:56.63	1	0	0	0	0	0	0	1	1	0	1	0	-1.235	-4.463	0.156	-0.054	-3.315	-0.264
15:46:56.67	1	0	0	0	0	0	0	1	1	0	1	0	-1.338	-4.463	0.156	-0.059	-3.315	-0.254
15:46:56.71	1	0	0	0	0	0	0	1	1	0	1	0	-0.825	-4.463	0.156	-0.055	-3.311	-0.254
15:46:56.74	1	0	0	0	0	0	0	1	1	0	1	0	-1.253	-4.463	0.156	-0.054	-3.311	-0.273
15:46:56.78	1	0	0	0	0	0	0	1	1	0	1	0	-1.138	-4.463	0.156	-0.057	-3.315	-0.293
15:46:56.41	1	0	0	0	0	0	0	1	1	0	1	0	-1.035	-4.463	0.156	-0.054	-3.315	-0.303
15:46:56.85	1	0	0	0	0	0	0	1	1	0	1	0	-1.177	-4.463	0.156	-0.054	-3.320	-0.288
15:46:56.69	1	0	0	0	0	0	0	1	1	0	1	0	-1.201	-4.463	0.156	-0.059	-3.320	-0.254
15:46:56.52	1	0	0	0	0	0	0	1	1	0	1	0	-0.674	-4.463	0.156	-0.054	-3.315	-0.249
15:46:56.56	1	0	0	0	0	0	0	1	1	0	1	0	-1.216	-4.463	0.156	-0.054	-3.311	-0.254
15:46:56.99	1	0	0	0	0	0	0	1	1	0	1	0	-1.221	-4.463	0.156	-0.054	-3.311	-0.273
15:46:56.63	1	0	0	0	0	0	0	1	1	0	1	0	-1.079	-4.463	0.156	-0.054	-3.315	-0.293
15:46:56.66	1	0	0	0	0	0	0	1	1	0	1	0	-1.191	-4.463	0.156	-0.054	-3.320	-0.293
15:46:56.70	1	0	0	0	0	0	0	1	1	0	1	0	-1.250	-4.463	0.156	-0.059	-3.320	-0.273
15:46:56.74	1	0	0	0	0	0	0	1	1	0	1	0	-1.167	-4.463	0.156	-0.059	-3.315	-0.254
15:46:55.77	1	0	0	0	0	0	0	1	1	0	1	0	-1.226	-4.463	0.161	-0.059	-3.315	-0.249
15:46:57.21	1	0	0	0	0	0	0	1	1	0	1	0	-1.128	-4.463	0.156	-0.054	-3.315	-0.264
15:46:57.24	1	0	0	0	0	0	0	1	1	0	1	0	-1.117	-4.463	0.156	-0.054	-3.315	-0.288
15:46:57.28	1	0	0	0	0	0	0	1	1	0	1	0	-1.206	-4.463	0.158	-0.059	-3.320	-0.293
15:46:57.32	1	0	0	0	0	0	0	1	1	0	1	0	-1.120	-4.458	0.156	-0.057	-3.320	-0.288
15:46:57.35	1	0	0	0	0	0	0	1	1	0	1	0	-1.372	-4.463	0.156	-0.055	-3.320	-0.264
15:46:57.39	1	0	0	0	0	0	0	1	1	0	1	0	-0.752	-4.463	0.156	-0.059	-3.315	-0.249
15:46:57.42	1	0	0	0	0	0	0	1	1	0	1	0	-1.191	-4.463	0.156	-0.059	-3.306	-0.249
15:46:57.46	1	0	0	0	0	0	0	1	1	0	1	0	-1.074	-4.463	0.156	-0.059	-3.311	-0.264
15:46:57.49	1	0	0	0	0	0	0	1	1	0	1	0	-1.205	-4.463	0.156	-0.059	-3.315	-0.288
15:46:57.53	1	0	0	0	0	0	0	1	1	0	1	0	-1.274	-4.463	0.156	-0.055	-3.320	-0.293
15:46:57.57	1	0	0	0	0	0	0	1	1	0	1	0	-1.265	-4.463	0.156	-0.054	-3.320	-0.273
15:46:57.60	1	0	0	0	0	0	0	1	1	0	1	0	-1.191	-4.463	0.156	-0.054	-3.315	-0.254
15:46:57.64	1	0	0	0	0	0	0	1	1	0	1	0	-0.757	-4.463	0.156	-0.054	-3.315	-0.249
15:46:57.67	1	0	0	0	0	0	0	1	1	0	1	0	-3.906	-4.463	0.156	-0.054	-3.311	-0.254
15:46:57.71	1	0	0	0	0	0	0	1	1	0	1	0	-1.260	-4.463	0.156	-0.054	-3.311	-0.273
15:46:57.75	1	0	0	0	0	0	0	1	1	0	1	0	-0.894	-4.463	0.156	-0.059	-3.315	-0.293
15:46:57.78	1	0	0	0	0	0	0	1	1	0	1	0	-0.967	-4.463	0.156	-0.054	-3.320	-0.293
15:46:57.42	1	0	0	0	0	0	0	1	1	0	1	0	-1.323	-4.463	0.156	-0.054	-3.315	-0.273
15:46:57.85	1	0	0	0	0	0	0	1	1	0	1	0	-1.118	-4.463	0.156	-0.054	-3.315	-0.254
15:46:57.49	1	0	0	0	0	0	0	1	1	0	1	0	-1.270	-4.463	0.156	-0.055	-3.306	-0.249
15:46:57.52	1	0	0	0	0	0	0	1	1	0	1	0	-0.981	-4.463	0.156	-0.059	-3.306	-0.254
15:46:57.55	1	0	0	0	0	0	0	1	1	0	1	0	-0.728	-4.463	0.155	-0.059	-3.315	-0.283
15:46:57.60	1	0	0	0	0	0	0	1	1	0	1	0	-1.284	-4.463	0.156	-0.054	-3.315	-0.293
15:46:57.63	1	0	0	0	0	0	0	1	1	0	1	0	-1.162	-4.463	0.156	-0.054	-3.320	-0.293
15:46:57.67	1	0	0	0	0	0	0	1	1	0	1	0	-1.191	-4.463	0.156	-0.054	-3.320	-0.269
15:46:57.70	1	0	0	0	0	0	0	1	1	0	1	0	-1.274	-4.463	0.156	-0.054	-3.315	-0.249
15:46:57.74	1	0	0	0	0	0	0	1	1	0	1	0	-1.167	-4.463	0.156	-0.059	-3.311	-0.234
15:46:57.78	1	0	0	0	0	0	0	1	1	0	1	0	-1.406	-4.463	0.156	-0.059	-3.306	-0.264
15:46:58.21	1	0	0	0	0	0	0	1	1	0	1	0	-0.925	-4.463	0.156	-0.054	-3.311	-0.288
15:46:56.25	1	0	0	0	0	0	0	1	1	0	1	0	-1.230	-4.463	0.156	-0.055	-3.315	-0.293
15:46:58.28	1	0	0	0	0	0	0	1	1	0	1	0	-0.972	-4.463	0.156	-0.054	-3.315	-0.283
15:46:58.32	1	0	0	0	0	0	0	1	1	0	1	0	-1.133	-4.463	0.156	-0.054	-3.315	-0.254
15:46:58.35	1	0	0	0	0	0	0	1	1	0	1	0	-1.118	-4.463	0.156	-0.059	-3.315	-0.234
15:46:58.39	1	0	0	0	0	0	0	1	1	0	1	0	-1.272	-4.463	0.156	-0.059	-3.311	-0.249
15:46:58.43	1	0	0	0	0	0	0	1	1	0	1	0	-1.259	-4.463	0.155	-0.059	-3.306	-0.264

FILTERS:
0 ≡ FILTER IN
1 ≡ FILTER OUT

CALIBRATE:
1 ≡ IN CALIBRATE
0 ≡ NOT IN CALIBRATE

OVERLOAD
0 ≡ OVERLOAD
1 ≡ O.K.

TRACKING
0 ≡ SIGNAL SUFFICIENT FOR TRACKING
1 ≡ NOT ENOUGH SIGNAL FOR TRACKING

Σ SIGNAL CH.
0 → -10,000 CORRESPONDS TO
0 → 100 ON METER

PITCH ANGLE
+V = FORWARD
0 = NADIR
-V = AFT

ROLL ANGLE
+V = OUT
0 = NADIR
-V = IN

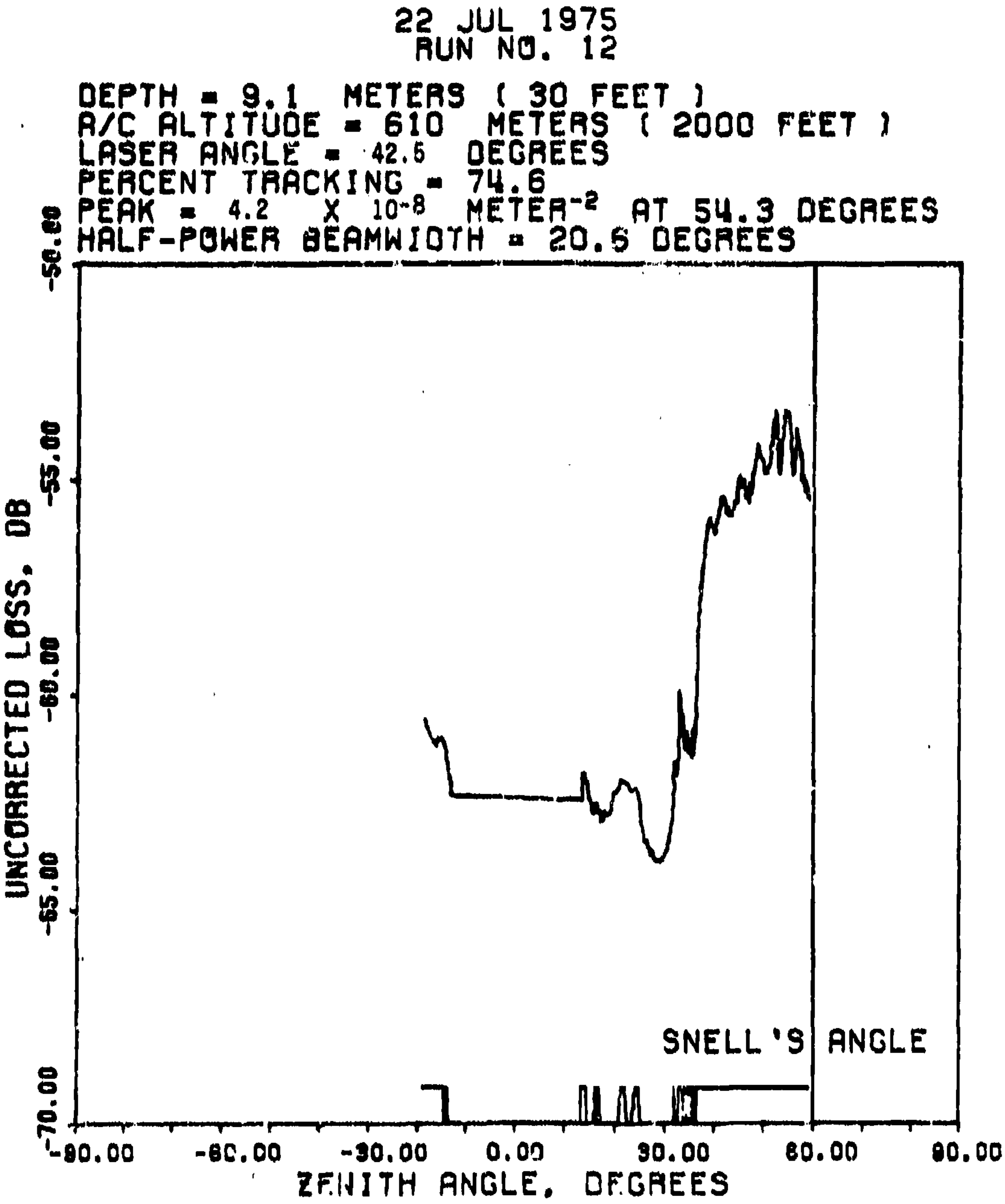


Figure E-1A. Uncorrected uplink plot.

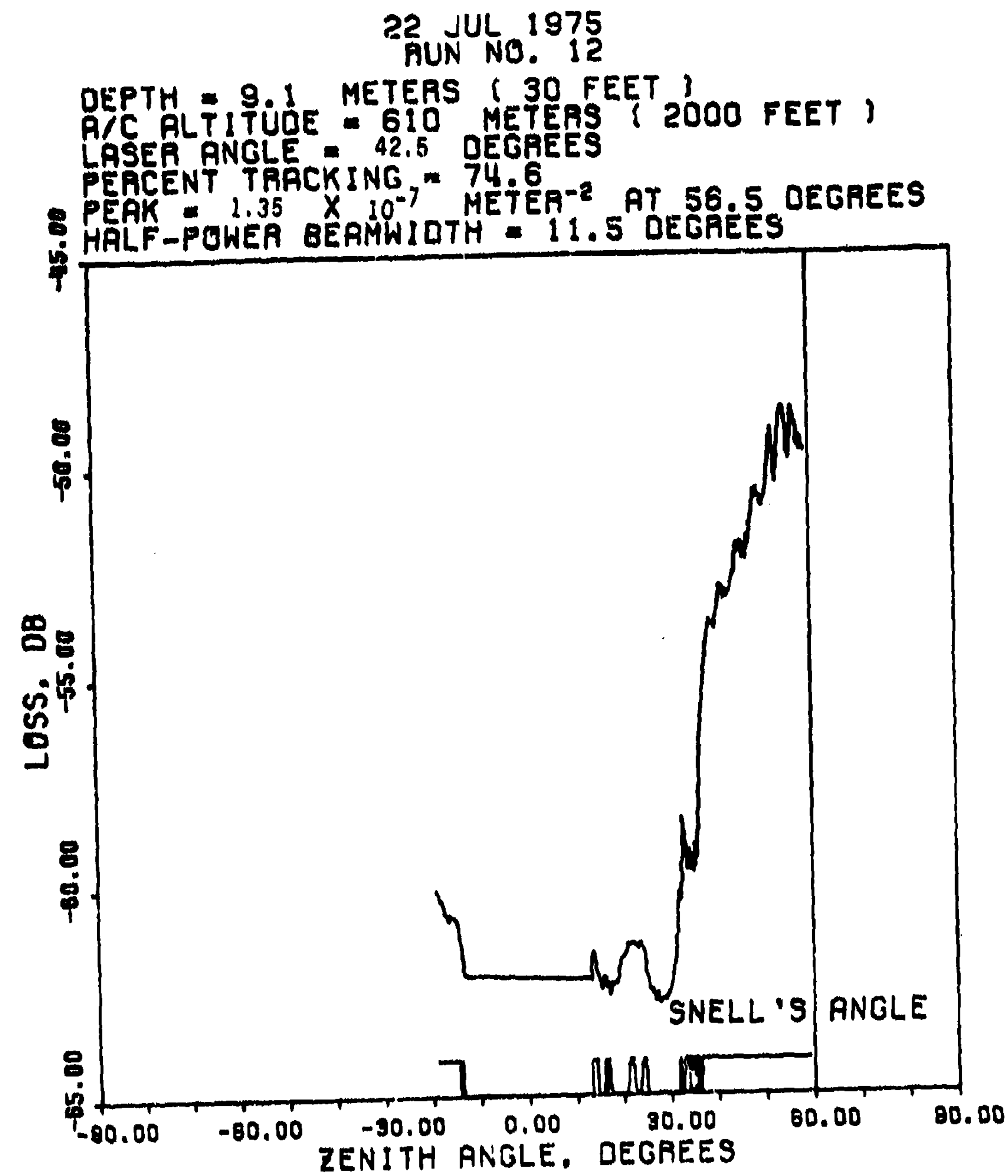


Figure E-1B. Corrected uplink plot.

This is really the same filter applied in the opposite direction, so that {v} has a time advance rather than a time delay. Finally, define

$$z_i = \frac{1}{2}(u_i + v_i) \qquad i = 1, n. \tag{E-4}$$

Then $\{z_i\}$ has neither an advance or delay. Any desired degree of smoothing can be accomplished with this filter by choosing different values of the filter constant, *N*. Figures E-2A through E-2C show the results of filtering the same raw data with various values of *N*.

INPUT DATA. The raw data to be processed is read from magnetic tape. Control information is read from cards using NAMELIST with name INPUT. Variables to be input from cards are defined as follows.

SIZE – A real variable allowing plots of different size to be generated. See DOWNLINK for details. Default value is 1.0.

NAVG – An integer variable specifying the filter time constant. Same as *N* in the discussion of the filter. Default value is NAVG = 6 which gives a filter time constant of 0.25 seconds.

RUN – An integer variable specifying the run number of the data to be processed. The tape is searched until the proper run number is found. Data is then read in and processed until the run number changes.

DATE – An integer array of dimension 3. Used for the date as a character string; i.e., DATE = '24 JUL 75'. Default value is all blanks.

LASANG – A real variable specifying the angle of the laser in degrees from the zenith. $0 < \text{LASANG} < 48.75$ (the critical angle).

DEPTH – A real variable specifying the depth of the laser in meters.

ALT – A real variable specifying the altitude of the receiver (aircraft) in feet.

OUTPUT DATA. All output from the program is either to the plotter or to the printer. The tracking signal is plotted on the graphs just above the zenith angle axis.

EXTERNAL SUBROUTINES REQUIRED:

AXISM, COPY, HEDING, PHILINE – See discussion of these routines in program DOWNLINK.

OPSAT – A PL/I subroutine to read and decode the raw data tapes. For each call to OPSAT, one logical record is returned. A logical record consists of the time, the settings of the 12 switches, and the values of the 6 data channels. OPSAT also returns the length of the block read from tape and flags for end of record, end of data set, and error.

Figure E-3 represents a program listing on the following 14 pages of the SATCOM UPLINK data reduction.

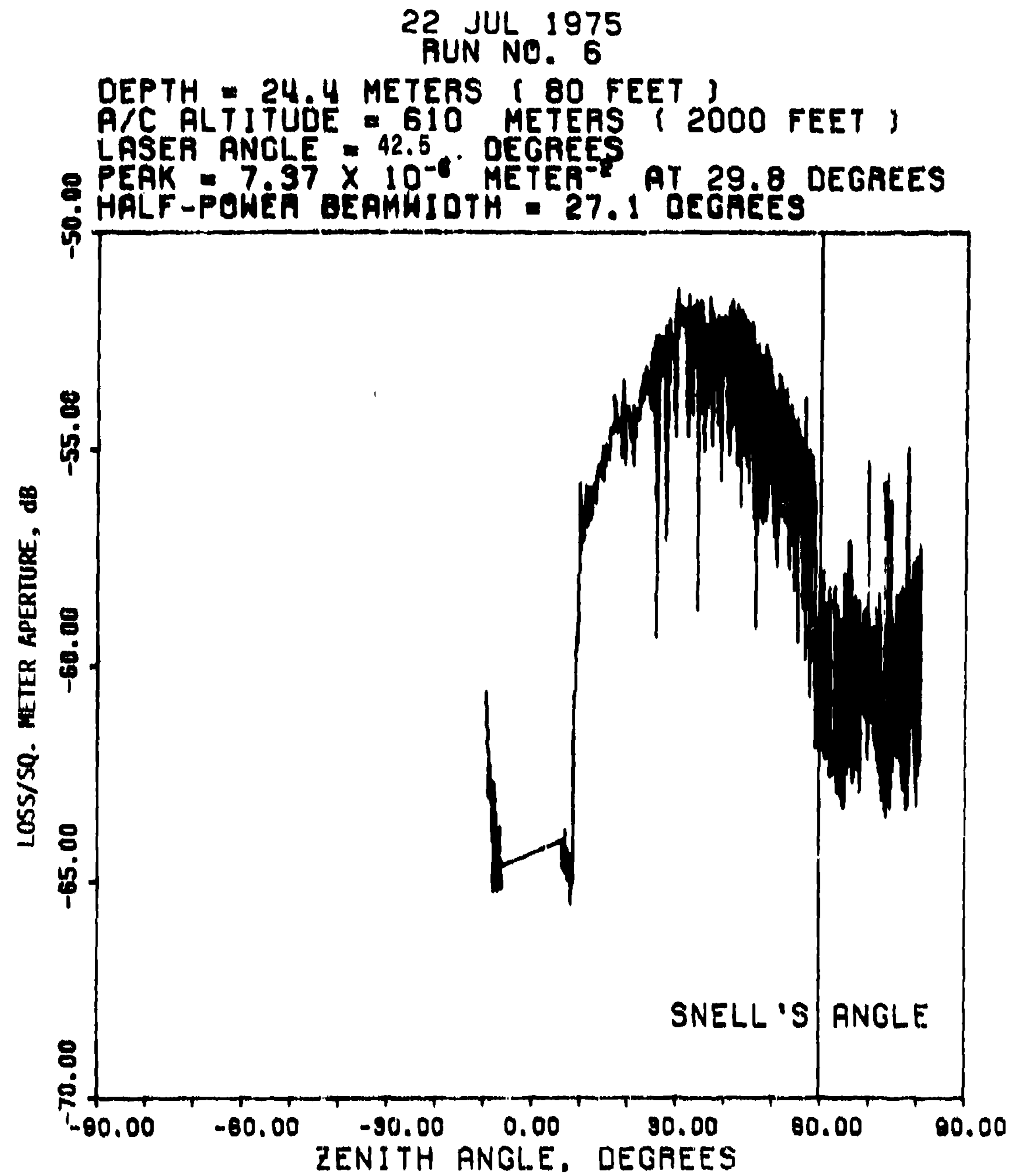


Figure E-2A. Uplink data filtered with time constant = 0 seconds.

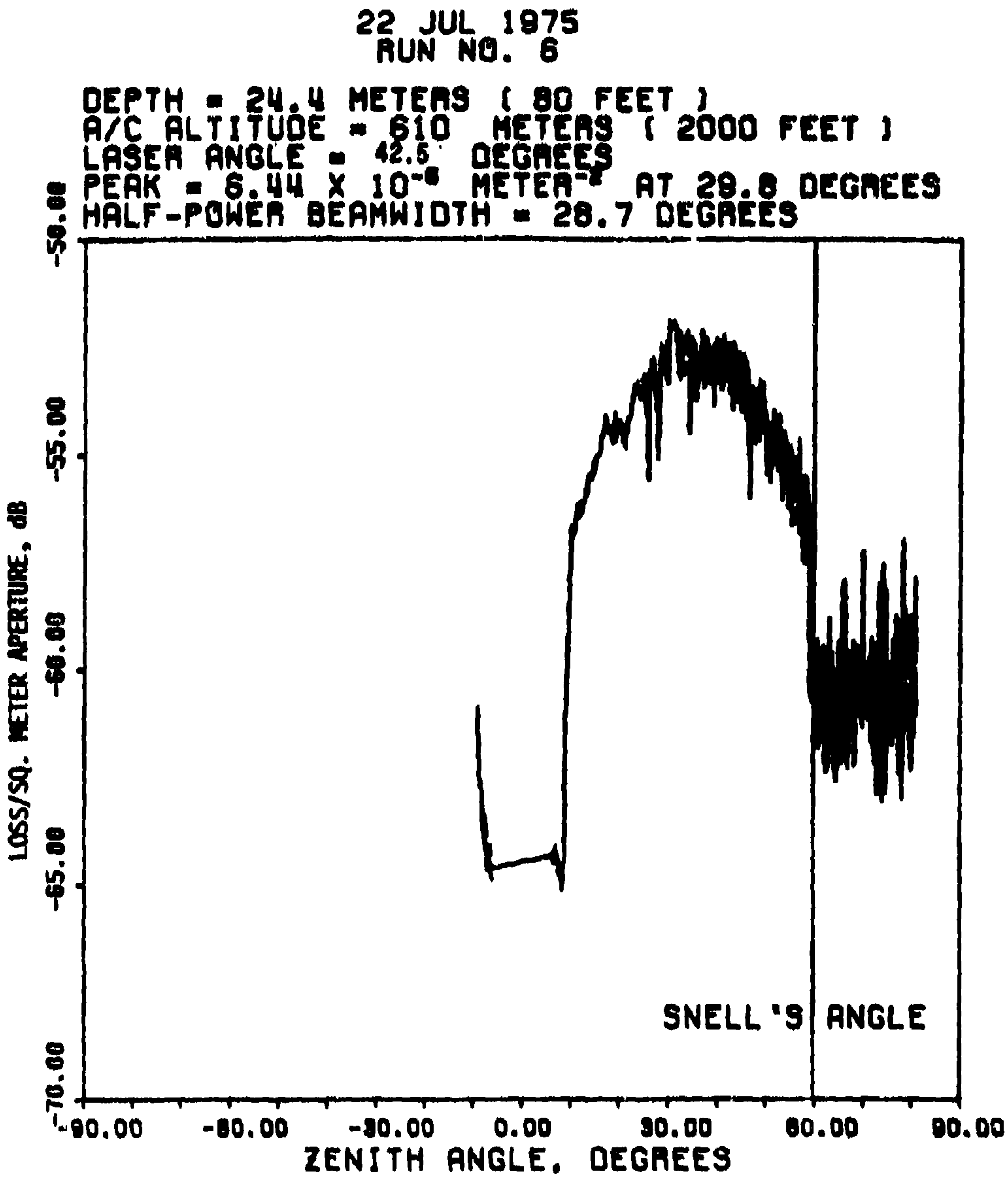


Figure E-2B. Uplink data filtered with time constant = .05 seconds.

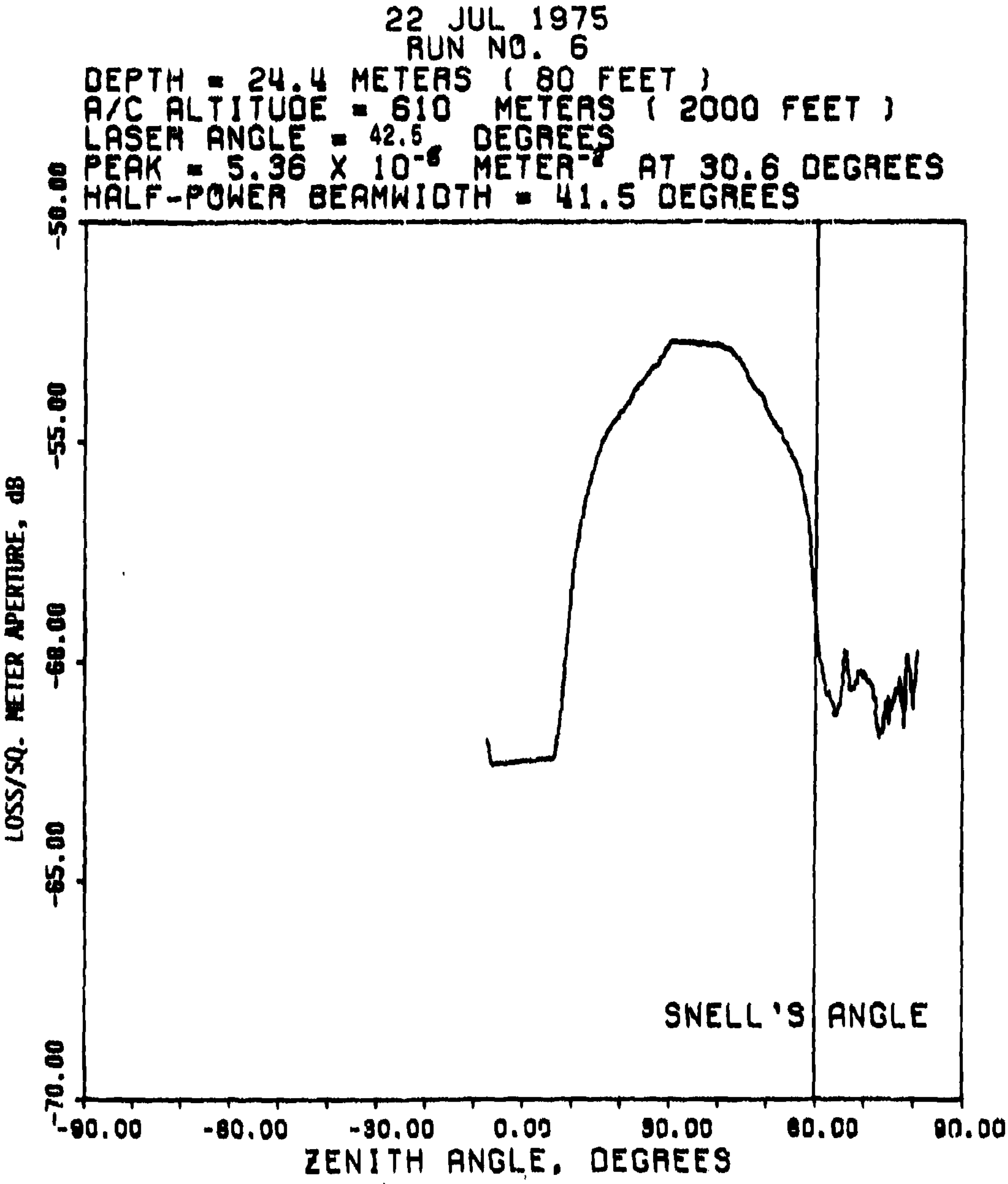


Figure E-2C. Uplink data filtered with time constant = .95 seconds.

```
C
C     ****************************************************************
C     *                                                              *
C     *     SATCOM UPLINK DATA REDUCTION PROGRAM                     *
C     *                                                              *
C     ****************************************************************
C
      LOGICAL        EOF, EOR, ERROR, SECON, FIRST, VRYFST, FOUND
C
      INTEGER        HR, MIN, SW(12), RUN, DATE(3), BLANK /'     '/
C
      REAL           DATA(6), BUFFER(4096), SYNC(4000),
     #               SIG(4000), PITCH(4000), ROLL(4000), U(4000),
     #               V(4000), Z(4000), P(4000), R(4000), LASANG
C
      COMMON         /IDNO/     IYR, IDAY, IHR, MINUTE, ISECND
C
      NAMELIST       /INPUT/    ISTART, ISTOP, SECON, SIZE, NAVG, RUN,
     #                          DATE, LASANG, DEPTH, ALT
C
C     ****************************************************************
C     *                                                              *
C     *     STATEMENT FUNCTION:                                      *
C     *     GSTINT(X,Y) = Y*<X/Y>, WHERE <X/Y> IS THE                *
C     *     LARGEST INTEGER NOT GREATER THAN X/Y                     *
C     *                                                              *
C     ****************************************************************
C
      GSTINT(X, Y) = Y*AINT( (X/Y) - 0.5*( 1.0 - ( X/ABS(X) ) ) )
C
C     ****************************************************************
C     *                                                              *
C     *     COPY THE INPUT DATA.  OPEN AND INITIALIZE THE            *
C     *     PLOTTER.  INITIALIZE VARIABLES TO DEFAULT VALUES         *
C     *                                                              *
C     ****************************************************************
C
      CALL COPY(5, 1700 )
      CALL PLOTS( BUFFER, 4096, 99 )
      CALL PLOT( 5.0, -11.0, -3 )
      SIZE = 1.0
      SECON = .TRUE.
      NAVG = 6
      ISTART = 0
      ISTOP = 235959
      DATE(1) = BLANK
      DATE(2) = BLANK
      DATE(3) = BLANK
  100 CONTINUE
C
C     ****************************************************************
C     *
```

Figure E-3. SATCOM uplink data reduction program listing (sheet 1 of 14).

```
C         *     READ ONE SET OF INPUT DATA                                *
C         *                                                               *
C         *****************************************************************
C
      READ(8,INPUT,END=700)
      CALL FACTOR( SIZE )
      IF ( FSTART .GE. ISTOP )  GO TO 740
      FTC = ( NAV - 1 )*0.05
      ANGAIR = 1.33*SIN( LASANG*0.0174533 )
      ANGAIR = 57.29578*ARSIN( ANGAIR )
      DEPTHM = DEPTH*0.3048
      ALTM = ALT*0.3048
      CALFAC = -9.4E-7
      CALL HEDING( 0 )
      CALL HEDING( 7 )
      WRITE(6,110)  RUN, DATE, FTC, LASANG, ANGAIR, DEPTHM, DEPTH,
     #              ALTM, ALT
  110 FORMAT(/10X,'RUN NO. ',I3,', ',3A6/
     #       10X,'FILTER TIME CONSTANT = ',F7.3,' SECONDS'/
     #       10X,'LASER ANGLE = ',F6.1,' DEGREES (WATER),',F6.1,
     #           ' DEGREES (AIR)'/
     #       10X,'DEPTH = ',F6.2,' METERS (',F6.1,' FEET )'/
     #       10X,'A/C ALTITUDE = ',F6.0,' METERS (',F6.0,' FEET )'/)
C
C         *****************************************************************
C         *                                                               *
C         *     READ IN THE DATA FROM TAPE                                *
C         *                                                               *
C         *****************************************************************
C
      NPTS = 0
      NTRK = 0
      FIRST = .TRUE.
      VRYFST = .TRUE.
      FOUND = .FALSE.
  120 CALL OPSATC( HR, MIN, SEC, SW, DATA, EOF, EOR, ERRCR, LREC )
      IF ( EOF )  GO TO 780
      IF ( HR .GT. 23 )  GO TO 120
      IF ( DATA(1) .GE. 0.0 )  GO TO 120
      ISEC = SEC
      ITIME = HR*10000 + MIN*100 + ISEC
      LASTM = ITIME
      IRUN = SW(1) + 2*SW(2) + 4*SW(3) + 8*SW(4) + 16*SW(5) + 32*SW(6)
      IF ( IRUN .NE. RUN .AND. .NOT. FOUND )  GO TO 120
      IF ( IRUN .NE. RUN .AND. FOUND )  GO TO 160
      IF ( .NOT. VRYFST )  GO TO 133
C
C         *****************************************************************
C         *                                                               *
C         *     SAVE FIRST TIME FOR THIS RUN                              *
C         *                                                               *
C         *****************************************************************
C
```

Figure E-3. SATCOM uplink data reduction program listing (sheet 2 of 14).

```
      FOUND = .TRUE.
      VRYFST = .FALSE.
      CALL HEDING( 2 )
      WRITE(6,125)  ITIME
125   FORMAT(/10X,'FIRST TIME FOR THIS RUN = ',I8)
130   CONTINUE
      IF ( .NOT. FIRST )  GO TO 140
C
C           ****************************************************************
C           *                                                              *
C           *    HAVE FOUND FIRST TIME TO BE PROCESSED.                    *
C           *     MODIFY CALIBRATION FACTOR FOR FILTERS                    *
C           *                                                              *
C           ****************************************************************
C
      FIRST = .FALSE.
      NPTS = 1
      IF ( SW(12) .EQ. 0 )  NTRK = NTRK + 1
      IFIRST = ITIME
      IF ( SW(8) .EQ. 0 )  CALFAC = CALFAC*100.0
      IF ( SW(9) .EQ. 0 )  CALFAC = CALFAC*10.0
      SIG(NPTS) = DATA(1)
      PITCH( NPTS ) = DATA(3)
      ROLL(NPTS) = DATA(4)
      SYNC(NPTS) = 1 - SW(12)
      GO TO 120
140   CONTINUE
      NPTS = NPTS + 1
      IF ( SW(12) .EQ. 0 )  NTRK = NTRK + 1
      IF ( NPTS .GT. 3998 )  GO TO 160
      SIG(NPTS) = DATA(1)
      PITCH(NPTS) = DATA(3)
      ROLL(NPTS) = DATA(4)
      SYNC(NPTS) = 1 - SW(12)
      GO TO 120
160   CONTINUE
      TRACK = ( FLOAT( NTRK )/FLOAT( NPTS ) )*100.0
      CALL HEDING( 4 )
      WRITE(6,180)  LASTM, NPTS, TRACK
180   FORMAT(10X,'LAST TIME FOR THIS RUN = ',I8/
     &       10X,I6,' POINTS PROCESSED'/
     &       10X,'PERCENT OF TIME TRACKING = ',F6.1/)
200   CONTINUE
      IF ( NPTS .EQ. 0 )  GO TO 820
      NOUT = NAVG/3
      IF ( NOUT .EQ. 0 )  NOUT = 1
      ALPHA = 1.0/NAVG
C
C           ****************************************************************
C           *                                                              *
C           *    FILTER THE SIGNAL                                         *
C           *                                                              *
C           ****************************************************************
C
```

Figure E-3. SATCOM uplink data reduction program listing (sheet 3 of 14).

```
C
      U(1) = SIG(1)
      V(NPTS) = SIG(NPTS)
      DO 220 I = 2,NPTS
        U(I) = U(I-1) - ALPHA*( U(I-1) - SIG(I) )
        K = NPTS + 1 - I
        V(K) = V(K+1) - ALPHA*( V(K+1) - SIG(K) )
  220 CONTINUE
      K = 0
      DO 240 I = 1,NPTS, NOUT
        K = K + 1
        Z(K) = ( U(I) + V(I) )/2.0
  240 CONTINUE
C
C           ****************************************************
C           *                                                  *
C           *    FILTER THE PITCH ANGLE                        *
C           *                                                  *
C           ****************************************************
C
C
      U(1) = PITCH(1)
      V(NPTS) = PITCH(NPTS)
      DO 260 I = 2,NPTS
        U(I) = U(I-1) - ALPHA*( U(I-1) - PITCH(I) )
        K = NPTS + 1 - I
        V(K) = V(K+1) - ALPHA*( V(K+1) - PITCH(K) )
  260 CONTINUE
      K = 0
      DO 280 I = 1,NPTS,NOUT
        K = K + 1
        P(K) = ( U(I) + V(I) )/2.0
  280 CONTINUE
C
C           ****************************************************
C           *                                                  *
C           *    FILTER THE ROLL ANGLE AND SIFT THE TRACKING SIGNAL *
C           *                                                  *
C           ****************************************************
C
C
      U(1) = ROLL(1)
      V(NPTS) = ROLL(NPTS)
      DO 300 I = 2,NPTS
        U(I) = U(I-1) - ALPHA*( U(I-1) - ROLL(I) )
        K = NPTS + 1 - I
        V(K) = V(K+1) - ALPHA*( V(K+1) - ROLL(K) )
  300 CONTINUE
      K = 0
      DO 320 I = 1,NPTS,NOUT
        K = K + 1
        R(K) = ( U(I) + V(I) )/2.0
        SYNC(K) = SYNC(I)
  320 CONTINUE
```

Figure E-3. SATCOM uplink data reduction program listing (sheet 4 of 14).

```
      KPTS = K
C
C     ****************************************************************
C     *                                                              *
C     *    CALIBRATE THE SIGNAL AND COMPUTE THE ZENITH ANGLE        *
C     *     LOCATE MAXIMUM SIGNAL                                    *
C     *                                                              *
C     ****************************************************************
C
      DO 340 I = 1,KPTS
        PANG = 0.066716*P(I)
        RANG = 0.246091*R(I)
        ARCT = SQRT( TAN( PANG )**2 + TAN( RANG )**2 )
        IF ( ARCT .GT. 1.0E4 )  U(I) = 1.5707
        IF ( ARCT .LE. 1.0E4 )  U(I) = ATAN( ARCT )
        U(I) = U(I)*SIGN( 1.0, PANG )
        V(I) = U(I)*57.29578
        Z(I) = Z(I)*CALFAC
  340 CONTINUE
      ALIM = ANGAIR + 10.0
      IF ( ALIM .LT. 50.0 )  ALIM = 50.0
      IF ( ALIM .GT. 85.0 )  ALIM = 85.0
      DO 360 I = 1,KPTS
        IF ( V(I) .GT. ALIM )  GO TO 360
        IFRST = I
        GO TO 380
  360 CONTINUE
      IFRST = 1
  380 CONTINUE
      LPTS = KPTS - IFRST + 1
      SMAX = -1.0E70
      ZMAX = -1.0E70
      DO 420 I = IFRST, KPTS
        SIG(I) = 10.0*ALOG10( Z(I) )
        Z(I) = Z(I)/COS( U(I) )**2
        Z(I) = 10.0*ALOG10( Z(I) )
        IF ( Z(I) .LE. ZMAX )  GO TO 400
        ZMAX = Z(I)
        IMAX = I
  400   CONTINUE
        IF ( SIG(I) .LE. SMAX )  GO TO 420
        SMAX = SIG(I)
        JMAX = I
  420 CONTINUE
      CALL MEDIN
      WRITE(6,440)  Z(IMAX), V(IMAX), SIG(JMAX), V(JMAX)
  440 FORMAT(/10X,'PEAK VALUE = ',F6.1,' DB AT ZENITH ANGLE = ',F5.1,
     #   ' DEGREES'/
     #      10X,'UNCORRECTED PEAK VALUE = ',F6.1,
     #   ' DB AT ZENITH ANGLE = ',F5.1,' DEGREES')
C
C     ****************************************************************
C     *
```

Figure E-3. SATCOM uplink data reduction program listing (sheet 5 of 14).

```
C          *     FIND HALF-POWER BEAMWIDTH                                          *
C          *                                                                        *
C          *************************************************************************
C
           HALF = Z(IMAX) - 3.0
           II = IMAX - IFRST + 1
           DO 460 I = 1,II
             L = IMAX - I + 1
             IF ( Z(L) .GT. HALF )  GO TO 460
             ILEFT = L + 1
             GO TO 480
     460   CONTINUE
           ILEFT = IFRST
     480   CONTINUE
           DO 500 I = IMAX, KPTS
             IF ( Z(I) .GT. HALF )  GO TO 500
             IRIGHT = I - 1
             GO TO 520
     500   CONTINUE
           IRIGHT = KPTS
     520   CONTINUE
           ZENMIN = AMIN1( V(ILEFT), V(IRIGHT) )
           ZENMAX = AMAX1( V(ILEFT), V(IRIGHT) )
           BEAMW = ZENMAX - ZENMIN
           CALL HEDING( 1 )
           WRITE(6,540)  ZENMIN, ZENMAX, BEAMW
     540   FORMAT( 10X,'HALF POWER POINTS AT ',F5.1,',',F5.1,
          #             ', BEAMWIDTH = ',F5.1,' DEGREES')
           HALF = SIG(JMAX) - 3.0
           DO 560 I = 1,JMAX
             L = JMAX - I + 1
             IF ( SIG(L) .GT. HALF )  GO TO 560
             ILEFT = L + 1
             GO TO 580
     560   CONTINUE
           ILEFT = 1
     580   CONTINUE
           DO 600 I = JMAX,KPTS
             IF ( SIG(I) .GT. HALF )  GO TO 600
             IRIGHT = I - 1
             GO TO 620
     600   CONTINUE
           IRIGHT = KPTS
     620   CONTINUE
           ZENMIN = AMIN1( V(ILEFT), V(IRIGHT) )
           ZENMAX = AMAX1( V(ILEFT), V(IRIGHT) )
           BEEMW = ZENMAX - ZENMIN
           CALL HEDING( 3 )
           WRITE(6,640)  ZENMIN, ZENMAX, BEEMW
     640   FORMAT( 10X,'UNCORRECTED HALF-POWER POINTS AT ',F5.1,',',F5.1,
          #             ' DEGREES'/
          #        10X,'UNCORRECTED BEAMWIDTH = ',F5.1,' DEGREES'/)
C
```

Figure E-3. SATCOM uplink data reduction program listing (sheet 6 of 14).

```
C     ****************************************************************
C     *                                                              *
C     *     U(I) = ZENITH ANGLE IN RADIANS                           *
C     *     V(I) = ZENITH ANGLE IN DEGREES                           *
C     *                                                              *
C     ****************************************************************
C
      ZMAX = -GSTINT( -ZMAX, 5.0 )
      ZMIN = ZMAX - 20.0
      Z(KPTS+1) = ZMIN
      Z(KPTS+2) = 3.3333
      SYNC(KPTS+1) = 0.0
      SYNC(KPTS+2) = 4.0
      SMAX = -GSTINT( -SMAX, 5.0 )
      SMIN = SMAX - 20.0
      SIG(KPTS+1) = SMIN
      SIG(KPTS+2) = 3.3333
      V(KPTS+1) = -90.0
      V(KPTS+2) = 30.0
C
C     ****************************************************************
C     *                                                              *
C     *     FRAME THE PLOT PAGE                                      *
C     *                                                              *
C     ****************************************************************
C
      CALL PLOT( 18.0, -1.75, -3 )
      CALL PLOT( 0.0, 11.0, 2 )
      CALL PLOT( 17.0, 11.0, 2 )
      CALL PLOT( 17.0, 0.0, 2 )
      CALL PLOT( 0.0, 0.0, 2 )
      CALL PLOT( 1.5, 1.75, -3 )
C
C     ****************************************************************
C     *                                                              *
C     *     DRAW THE AXES AND FRAME THE PLOT                         *
C     *                                                              *
C     ****************************************************************
C
      CALL AXISM( 0.0, 0.0, 'ZENITH ANGLE, DEGREES', -21, 6.0, 0.0,
     #  -90.0, 30.0, 6.3333, 3 )
      CALL AXISM( 0.0, 0.0, 'LOSS, DB', 8, 6.0, 90.0, ZMIN, 5.0,
     #  1.5, 1 )
      CALL PLOT( 0.0, 6.0, 3 )
      CALL PLOT( 6.0, 6.0, 2 )
      CALL PLOT( 6.0, 0.0, 2 )
      ARROW = ( ANGAIR + 90.0 )/30.0
      CALL PLOT( ARROW, 0.0, 3 )
      CALL PLOT( ARROW, 6.0, 2 )
      CALL SYMBOL( ARROW - 1.0, 6.5, 0.14, 'SNELL''S ANGLE', 0.0, 13 )
C
C     ****************************************************************
```

Figure E-3. SATCOM uplink data reduction program listing (sheet 7 of 14).

```
C
C           *                                                             *
C           *    DRAW THE CURVE AND DOCUMENT THE PLOT                     *
C           *                                                             *
C           ***************************************************************
C
      CALL PHLINE( V(IFRST), Z(IFRST), LPTS, 6.0, 6.3, 0.0, 0.0,
     *             1, 0, 0 )
      CALL PHLINE( V(IFRST), SYNC(IFRST), LPTS, 6.0, 6.3, 0.0, 0.0,
     *             1, 0, 0 )
      HT = 0.07
      XO = -1.3
      ANG = 90.0
      CALL SYMBOL( XO, 2.0, HT, 'ID =', ANG, 4 )
      CALL SYMBOL( XO, 2.35, HT, IYR, ANG, 2 )
      CALL SYMBOL( XO, 2.49, HT, '.', ANG, 1 )
      CALL SYMBOL( XO, 2.56, HT, IDAY, ANG, 3 )
      FPN = IHR
      CALL NUMBER( XO, 2.98, HT, FPN, ANG, -1 )
      CALL SYMBOL( XO, 3.12, HT, ':', ANG, 1 )
      FPN = MINUTE
      CALL NUMBER( XO, 3.19, HT, FPN, ANG, -1 )
      CALL SYMBOL( XO, 3.33, HT, ':', ANG, 1 )
      FPN = ISECND
      CALL NUMBER( XO, 3.40, HT, FPN, ANG, -1 )
      IPLOT = 1
  660 HT = 0.14
      CALL SYMBOL( 0.0, 6.1, HT, 'HALF-POWER BEAMWIDTH = ', 0.0, 22 )
      IF ( IPLOT .EQ. 1 )  FPN = BEAMW
      IF ( IPLOT .EQ. 2 )  FPN = BEEMW
      CALL NUMBER( 3.22, 6.1, HT, FPN, 0.0, 1 )
      CALL SYMBOL( 3.92, 6.1, HT, 'DEGREES', 0.0, 7 )
      IF ( IPLOT .EQ. 1 )  SMAX = Z(IMAX)
      IF ( IPLOT .EQ. 2 )  SMAX = SIG(JMAX)
      XP = SMAX/10.0
      XP = GSTINT( XP, 1.0 )
      SMAX = EXP( 2.30259*( SMAX - XP ) )
      CALL SYMBOL( 0.0, 6.3, HT, 'PEAK = ', 0.0, 8 )
      CALL NUMBER( 0.98, 6.3, HT, SMAX, 0.0, 2 )
      CALL SYMBOL( 1.68, 6.3, HT, 'X 10', 0.0, 4 )
      CALL NUMBER( 2.24, 6.39, 0.1, XP, 0.0, -1 )
      CALL SYMBOL( 2.66, 6.3, HT, 'METER', 0.0, 5 )
      CALL NUMBER( 3.36, 6.39, 0.1, -2.0, 0.0, -1 )
      CALL SYMBOL( 3.78, 6.3, HT, 'AT', 0.0, 2 )
      IF ( IPLOT .EQ. 1 )  ISUB = IMAX
      IF ( IPLOT .EQ. 2 )  ISUB = JMAX
      CALL NUMBER( 4.2, 6.3, HT, V(ISUB), 0.0, 1 )
      CALL SYMBOL( 4.9, 6.3, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 0.0, 6.5, HT, 'PERCENT TRACKING =', 0.0, 18 )
      CALL NUMBER( 2.66, 6.5, HT, TRACK, 0.0, 1 )
      CALL SYMBOL( 0.0, 6.7, HT, 'LASER ANGLE = ', 0.0, 13 )
      CALL NUMBER( 1.96, 6.7, HT, LASANG, 0.0, 1 )
      CALL SYMBOL( 2.66, 6.7, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 0.0, 6.9, HT, 'A/C ALTITUDE = ', 0.0, 14 )
```

Figure E-3. SATCOM uplink data reduction program listing (sheet 8 of 14).

```
      CALL NUMBER( 2.1, 6.9, HT, ALTM, 0.0, -1 )
      CALL SYMBOL( 2.8, 6.9, HT, 'METERS (', 0.0, 8 )
      CALL NUMBER( 4.30, 6.9, HT, ALT, 0.0, -1 )
      CALL SYMBOL( 4.76, 6.9, HT, 'FEET )', 0.0, 6 )
      CALL SYMBOL( 0.0, 7.1, HT, 'DEPTH = ', 0.0, 7 )
      CALL NUMBER( 1.12, 7.1, HT, DEPTHM, 0.0, 1 )
      CALL SYMBOL( 1.52, 7.1, HT, 'METERS (', 0.0, 8 )
      CALL NUMBER( 3.08, 7.1, HT, DEPTH, 0.0, -1 )
      CALL SYMBOL( 3.5, 7.1, HT, 'FEET )', 0.0, 6 )
      CALL SYMBOL( 2.14, 8.5, HT, 'RUN NO. ', 0.0, 7 )
      FPN = RUN
      CALL NUMBER( 3.26, 8.5, HT, FPN, 0.0, -1 )
      CALL SYMBOL( 2.0, 8.7, HT, DATE, 0.0, 12 )
      GO TO ( 680, 700 ), IPLOT
680   CONTINUE
C
C           ****************************************************
C           *                                                  *
C           *     GENERATE THE UNCORRECTED PLOT                *
C           *                                                  *
C           ****************************************************
      CALL PLOT( 0.5, 0.0, -3 )
      CALL AXISM( 0.0, 0.0, 'ZENITH ANGLE, DEGREES', -21, 6.0, 0.0,
     #            -90.0, 30.0, 0.3333, 3 )
      CALL AXISM ( 0.0, 0.0, 'UNCORRECTED LOSS, DB', 20, 6.0, 90.0,
     #            SMIN, 5.0, 1.5, 1 )
      CALL PLOT( 0.5, 6.0, 3 )
      CALL PLOT( 6.0, 6.0, 2 )
      CALL PLOT( 6.0, 0.0, 2 )
      CALL PLOT( ARROW, 0.0, 3 )
      CALL PLOT( ARROW, 6.0, 2 )
      CALL SYMBOL( ARROW - 1.0, 0.5, 0.14, 'SNELL''S ANGLE', 0.0, 13 )
      CALL PHLINE( V, SIG, KPTS, 6.0, 6.0, 0.0, 0.0, 1, 0, 0 )
      CALL PHLINE( V, SYNC, KPTS, 6.0, 6.0, 0.0, 0.0, 1, 0, 0 )
      IPLOT = 2
      GO TO 660
C
C           ****************************************************
C           *                                                  *
C           *     MESSAGES                                     *
C           *                                                  *
C           ****************************************************
C
700   CONTINUE
      WRITE(6,720)
720   FORMAT(/30X,'*** END OF JOB ***')
      CALL PLOT( 0, 0, 999 )
      STOP
740   CONTINUE
      CALL HEDING( 4 )
      WRITE(6,760)  ISTART, ISTOP
760   FORMAT(/10X,'ISTART = ',I10,5X,'ISTOP = ',I10/
     #        10X,'START TIME MUST BE > STOP TIME'/)
```

Figure E-3. SATCOM uplink data reduction program listing (sheet 9 of 14).

```
      GO TO 100
780   CONTINUE
      WRITE(6,800) LASTM
800   FORMAT(/10X,'END FILE ON INPUT TAPE'/
     $       10X,'LAST TIME ON TAPE = ',I8)
      GO TO 160
820   CONTINUE
      CALL HEDING( 3 )
      WRITE(6,840)
840   FORMAT(/10X,'NO DATA BETWEEN START AND STOP TIME'/)
      GO TO 100
860   CALL HEDING( 3 )
      WRITE(6,880) RUN
880   FORMAT(/10X,'MORE THAN 6000 POINTS FOR RUN # ',I6/)
      GO TO 100
      END
```

Figure E-3. SATCOM uplink data reduction program listing (sheet 10 of 14).

```
SATCOM UPLINK DATA REDUCTION     17/18/57     76.155                    PAGE  1

INPUT DATA FOR PROGRAM UPLINK

CARD NO.
    1      &INPUT  RUN = 8,  DATE = '22 JUL 1975', LASANG = 40.63,  ALT = 2000,
    2         DEPTH = 60,  &END
    3      &INPUT  RUN = 10,  DEPTH = 50,  &END
    4      &INPUT  RUN = 11,  DEPTH = 40,  &END
    5      &INPUT  RUN = 12,  DEPTH = 30,  &END
    6      &INPUT  RUN = 13,  ALT = 1000,  &END
    7      &INPUT  RUN = 14,  ALT = 500,  &END
    8      &INPUT  RUN = 15,  ALT = 1000,  LASANG = 48.75,  &END
    9      &INPUT  RUN = 16,  ALT = 3000,  DEPTH = 50,  LASANG = 0,  &END
   10      &INPUT  RUN = 17,  DEPTH = 70,  &END
   11      &INPUT  RUN = 18,  &END
   12      &INPUT  RUN = 19,  &END
   13      &INPUT  RUN = 20,  DEPTH = 90,  &END
   14      &INPUT  RUN = 21,  DEPTH = 110,  &END
   15      &INPUT  RUN = 22,  DEPTH = 120,  &END
   15     /*
```

Figure E-3. SATCOM uplink data reduction program listing (sheet 11 of 14).

SATCOM UPLINK DATA REDUCTION 17/10/57 76.155 PAGE

Figure E-3. SATCOM uplink data reduction program listing (sheet 12 of 14).

```
SATCOM UPLINK DATA REDUCTION      17/18/57      76.155                    PAGE  3

RUN NO.   8, 22 JUL 1975
FILTER TIME CONSTANT =    0.250 SECONDS
LASER ANGLE =   40.6 DEGREES (WATER),  60.0 DEGREES (AIR)
DEPTH =  18.29 METERS (  60.0 FEET )
A/C ALTITUDE =   610. METERS ( 2000. FEET )

FIRST TIME FOR THIS RUN =   160550
LAST TIME FOR THIS RUN =   161336
  1914 POINTS PROCESSED
PERCENT OF TIME TRACKING =   85.6

PEAK VALUE =  -49.4 DB AT ZENITH ANGLE =  69.9 DEGREES
UNCORRECTED PEAK VALUE =  -58.5 DB AT ZENITH ANGLE = -13.8 DEGREES
HALF POWER POINTS AT  62.5, 70.0, BEAMWIDTH =   7.5 DEGREES
UNCORRECTED HALF-POWER POINTS AT -37.4, -3.9 DEGREES
UNCORRECTED BEAMWIDTH =  33.5 DEGREES
```

Figure E-3. SATCOM uplink data reduction program listing (sheet 13 of 14).

```
SATCOM UPLINK DATA REDUCTION     17/18/57     76.155          PAGE

RUN NO.  19, 22 JUL 1975
FILTER TIME CONSTANT =    0.250 SECONDS
LASER ANGLE =   40.6 DEGREES (WATER),  68.0 DEGREES (AIR)
DEPTH =  15.24 METERS (  50.0 FEET )
A/C ALTITUDE =    610. METERS ( 2000. FEET )

FIRST TIME FOR THIS RUN =   161336
LAST TIME FOR THIS RUN =   162142
  1902 POINTS PROCESSED
PERCENT OF TIME TRACKING =    73.8

PEAK VALUE =  -50.7 DB AT ZENITH ANGLE =  69.7 DEGREES
UNCORRECTED PEAK VALUE =  -56.9 DB AT ZENITH ANGLE =  39.7 DEGREES
HALF POWER POINTS AT  64.8, 70.0, BEAMWIDTH =   5.2 DEGREES
UNCORRECTED HALF-POWER POINTS AT  25.2, 49.5 DEGREES
UNCORRECTED BEAMWIDTH =  24.3 DEGREES
```

Figure E-3. SATCOM uplink data reduction program listing (sheet 14 of 14).

APPENDIX F

GENERAL DESCRIPTION OF DOWNLINK PROGRAM

Program DOWNLINK is used to reduce the SATCOM downlink data which was recorded in the quick scan mode. In this mode of operation, a 60 by 60 point scan was made of the photo cathode surface and the resulting 3,600 points, plus seven words of additional information were recorded on magnetic tape in one record. At each depth, a specified number of scans (records) were written onto the tape with the last record followed by a tape mark. The first record of each file contains the seven words of environmental data. The original raw data tapes were copied to prevent loss of data in the event of damage to a tape. All files from a given original tape were written into a single file of the copy. In addition to the original data, each record of the copy contains four words of information giving the tape number, file number, record number, and number of data words from the original tape.

Program DOWNLINK reads certain control information from cards; included in this are the tape and file number to be processed. The input tape is then searched for this data. All data records from the indicated tape and file are read in and averaged. This averaged data is then calibrated and contour plots of the image are generated.

Calibration of the data follows the procedure outlined in Volume II, Section C. Let $S_{x,y}$ be the raw data value recorded on tape for camera coordinates (x, y). Then the calibrated value $Z_{x,y}$ is calculated as

$$Z_{x,y} = \frac{(S_{x,y} + 14)\,(600)\,(93)}{G\,G_D\,F\,P_{x,y}}\,\Delta N_\lambda \qquad \text{for } S_{x,y} \neq 0 \qquad \text{(F-1)}$$

$$Z_{x,y} = 0 \qquad \text{for } S_{x,y} = 0.$$

Where,

G is the camera gain factor,

G_D is the dwell gain factor,

$G_D = 1 + 11.23D^{1.036}$,

D is the number of turns on the dwell potentiometer.

F is the surface flux in watt-cm^{-2}

ΔN_λ is a unit spectral radiance factor as defined in Volume II, Section 3. It has the value

$$\Delta N_\lambda = 2.68 \times 10^{-8} \qquad r^2 < 898704 \qquad \text{(F-2)}$$

$$\Delta N_\lambda = 2.68 \times 10^{-8} + 2 \times 10^{-10} \left(\frac{r^{1.06}}{31.61} - 45 \right) r^2 > 898704,$$

where $r^2 = x^2 + y^2$ and x, y are the camera coordinates of each point.

The factor $600/P_{x,y}$ corrects for the variable response over the photo cathode surface. $P_{x,y}$ is a least squares fit to the response of the photo cathode surface with uniform illumination.

The factor 93 accounts for the 93 Å bandwidth of the filter.

The term 14 added to the raw data corrects for the dc bias in the raw data.

The calibrated data is searched to locate the peak, then integrated over circles centered on the peak. These circles are opened up from 5° to 90° in 5° steps. The resulting values are plotted to give integrated loss vs. field of view. The values are also output in tabular form on the printer.

A sample plot generated by this program is shown in figures F-1A and F-1B A sample of the printed output appears at the end of the program listing.

INPUT DATA. The data to be processed is read from magnetic tape as described above. Control information is read from cards using NAMELIST with name INPUT. The variables to be input from cards are as follows:

TAPE – An integer variable specifying the number of the original raw data tape.

FILE – An integer variable specifying the file number on the original raw data tape.

GAIN – An integer variable specifying the camera gain for the data to be processed. This is a coded value and must be either 0, 1, 2, or 3.

DWELL – A real variable specifying the dwell setting for the data to be processed. This is given as the number of turns of the dwell potentiometer. $0 < \text{DWELL} \leq 10$.

FLUX – A real variable specifying the surface flux at the time the data was recorded. Units are watt-cm^{-2}.

SIZE – A real variable which allows plots of variable size to be generated. The default value is SIZE = 1.0. This produces plots on an 11 inch by 17 inch page. SIZE = 0.5 would reduce the plots to a 5 1/2 inch by 8 1/2 inch page. If SIZE is given a value greater than 1.0, then a request must be made for 30 inch plotter paper. SIZE should not be given a value greater than 2.72 since this would attempt to generate a plot page greater than 30 inches high.

C TIME – An integer array of dimension 5 which may be used to correct the tape time for cases in which the clock was in error when the data were recorded. Default values for this array are all zeros which assumes the clock was correct.

C TIME (1) = day correction

C TIME (2) = hour correction

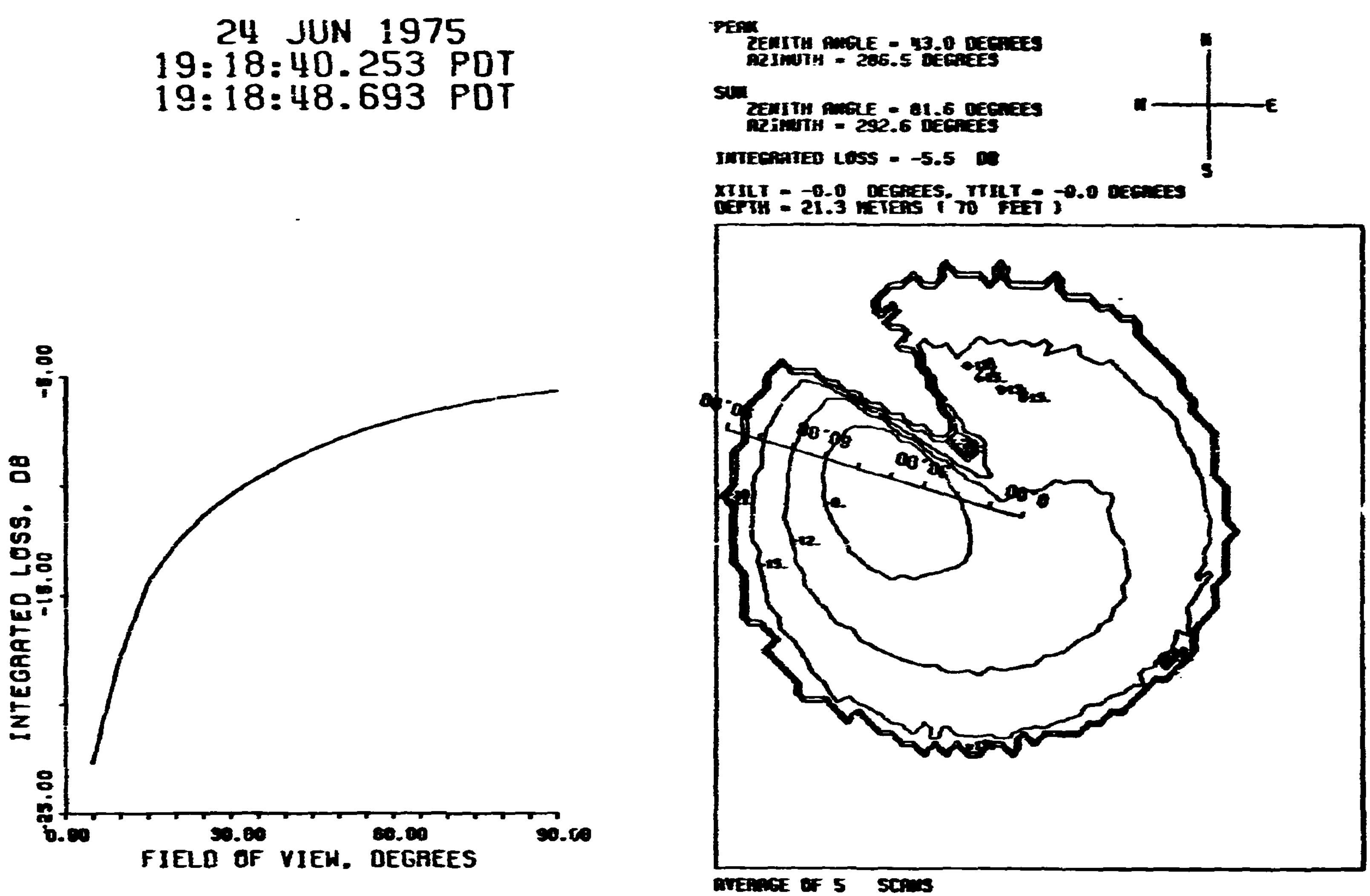
C TIME (3) = minute correction

C TIME (4) = seconds correction

C TIME (5) = milliseconds correction

The correction is added to the tape time so that the correction for a clock 1 hour slow would be C TIME = 0, 1, 0,0,0.

DEPTH – A real variable specifying the depth of the camera in meters.



F-1A F-1B

Figure F-1. Sample plot of downlink.

When processing is completed for one set of input data, another set is read, and processing continues. Any number of sets of input data may be stacked for a given job. No special code is required for the last set; the program terminates normally when no more cards are found. Since the input tape is rewound after each set of data is processed, it is not necessary to process the data in the order in which it appears on the tape; and if desired, the same data may be processed more than once.

OUTPUT DATA. All output from the program is either to the plotter or the printer and should be self explanatory. Note that the printer output and plots may be matched by the ID number which appears along the left hand edge of each plot and at the top of each printer page. This ID number is merely the date and time at which the job began.

EXTERNAL SUBROUTINES REQUIRED.

ALMNAC – This subroutine calculates the solar declination and the equation of time for the date and time given. This information is used by the main program to calculate the zenith angle and azimuth of the sun at the time the data were recorded.

AXISM – This routine generates the coordinate axes for the plots. It is a slightly modified version of the CALCOMP routine AXIS.

BCDBIN – This routine converts the tape time from three words of binary coded decimal information to five integer words giving time in days, hours, minutes, seconds, and milliseconds. It also produces a character string giving date and time of day for easy output to the plotter.

CONTUR – This routine generates the contour plots from the 60 X 60 array of tape data.

COPY – This routine copies the input cards to the printer and to a scratch data set for subsequent reading by the main program.

HEDING – This routine keeps track of lines output to the printer and prints a new heading at the top of the next page whenever the current page is filled.

PHLINE – This routine generates the line plot of integrated loss versus field of view. It is a modified version of the CALCOMP routine.

Figure F-2 represents a program listing on the following 21 pages of the DOWNLINK data reduction.

```
C
C     ****************************************************
C     *                                                  *
C     *   MAIN PROGRAM FOR STACOM UNDERWATER CAMERA      *
C     *   DATA REDUCTION                                 *
C     *                                                  *
C     ****************************************************
C
      INTEGER       IDATA(4096), FLAGS(200), FRSTM(5), ALPHA1(6),
     #              GAIN, FILE, LASTM(5), ALPHA2(6), TAPE,
     #              CTIME(5) / 5*0 /
C
      REAL*8        DAY, DEC, EQNT
C
      REAL          DATA(60,60), BUFFER(4096), AR(3), PA(20),
     #              GEE(4) / 0.037, 0.228, 1.0, 3.067 /,
     #              PL(20) /  5.0, 10.0, 15.0, 20.0, 25.0, 30.0,
     #                       35.0, 40.0, 45.0, 50.0, 55.0, 60.0,
     #                       65.0, 70.0, 75.0, 80.0, 85.0, 90.0 /,
     #              CLAT / 0.98692 /, CLON /2.0679 /,
     #              A1 / 5.3250E+2/, A2 / 1.2447E-1/,
     #              A3 /-6.1724E-2/, A4 /-1.2029E-5/,
     #              A5 /-1.0780E-5/, A6 /-1.6940E-5/,
     #              A7 / 1.5297E-9/, A8 /-1.2021E-9/,
     #              A9 /-6.8711E-9/, A10/-9.6330E-9/
C
      COMMON        /IONO/    IYR, IDAY, IHR, MIN, ISEC
C
      NAMELIST      /INPUT/   MODE, AR, SIZE, GAIN, DWELL, FILE, FLUX,
     #                        TAPE, DEPTH, CTIME
C
C     ****************************************************
C     *                                                  *
C     *   GSTINT(X,Y) = Y*<X/Y>, WHERE <X/Y> IS THE LARGEST*
C     *   INTEGER WHICH IS NOT GREATER THAN X/Y          *
C     *                                                  *
C     ****************************************************
C
      GSTINT( X, Y ) = Y*AINT( (X/Y) - 0.5*( 1.0 - (X/ABS(X) ) ) )
C
      CALL COPY(8, 6780)
C
C     ****************************************************
C     *                                                  *
C     *   OPEN & INITIALIZE THE PLOTTER                  *
C     *                                                  *
C     ****************************************************
C
      CALL PLOTS( BUFFER, 4096, 99 )
C
C     ****************************************************
C     *
```

Figure F-2. Downlink data reduction program listing (sheet 1 of 21).

```
C                   *     INITIALIZE VARIABLES TO DEFAULT VALUES              *
C                   *                                                         *
C                   ***********************************************************
C
      SIZE = 1.0
      FLUX = 0.0
C
C                   ***********************************************************
C                   *                                                         *
C                   *     READ ONE SET OF INPUT DATA                          *
C                   *                                                         *
C                   ***********************************************************
C
100   READ(8,INPUT,END=700)
C
C                   ***********************************************************
C                   *                                                         *
C                   *     SET PLOT SIZE                                       *
C                   *                                                         *
C                   ***********************************************************
C
      CALL FACTOR( SIZE )
C
C                   ***********************************************************
C                   *                                                         *
C                   *     CALCULATE PARTIAL CALIBRATION FACTOR AND            *
C                   *     ZERO LEVEL                                          *
C                   *                                                         *
C                   ***********************************************************
C
      GSUBD = 1.0 + 11.23*( DWELL**1.036 )
      G = GEE(GAIN+1)
      TEMP = G*GSLBC*FLUX
      CALFAC = 5.58E4/TEMP
      ZERO = 10.0*ALOG10( 2.094E-5/TEMP ) - 4.0
      MODE = 1
      AR(1) = 3.C
      AR(2) = ZERC + 4.0
      AR(3) = AR(2) + 30.0
      DEPTHM = DEPTH*0.3048
C
C                   ***********************************************************
C                   *                                                         *
C                   *     INITIALIZE DATA ARRAY TO ZEROES                     *
C                   *                                                         *
C                   *     INITIALIZE FRAME COUNT TO ZERO                      *
C                   *                                                         *
C                   ***********************************************************
C
      DO 140 I = 1,60
        DO 120 J = 1,60
          DATA(I,J) = 0.0
120     CONTINUE
```

Figure F-2. Downlink data reduction program listing (sheet 2 of 21).

```
  140 CONTINUE
      NSCAN = 0
C
C                *****************************************************
C                *                                                   *
C                *    READ A RECORD FROM THE DATA TAPE               *
C                *                                                   *
C                *****************************************************
C
  160 READ(9,END=820) ITAPE, IFILE, IREC, N, (IDATA(I),I=1,N)
C
C                *****************************************************
C                *                                                   *
C                *    CHECK FOR CORRECT TAPE AND FILE NUMBER         *
C                *                                                   *
C                *****************************************************
C
      IF ( ITAPE .NE. TAPE )  GO TO 900
      IF ( IFILE .LT. FILE )  GO TO 160
      IF ( IFILE .GT. FILE )  GO TO 340
      IF ( N .NE. 7 )  GO TO 200
C
C                *****************************************************
C                *                                                   *
C                *    N = 7 => ENVIRONMENTAL RECORD - DECODE AND PRINT *
C                *                                                   *
C                *****************************************************
C
      WS = IDATA(1)/20.47
      WD = IDATA(2)/5.686
      XTILT = IDATA(4)/20.47
      YTILT = IDATA(5)/20.47
      FLX = IDATA(7)/1.1E6
      CALL HEDING( 0 )
      CALL HEDING(8)
      WRITE(6,180)  WS, WD, XTILT, YTILT, FLX, DEPTHM, DEPTH
  180 FORMAT(/ 10X,'WINDSPEED = ',F5.0,' MPH'/
     #         10X,'WIND DIRECTION = ',F6.0,' DEGREES'/
     #         10X,'XTILT = ',F6.1,' DEGREES'/
     #         10X,'YTILT = ',F6.1,' DEGREES'/
     #         10X,'FLUX DENSITY = ',1PE12.3,' MW/CM SQ'/
     #         10X,'DEPTH = ',0PF6.1,' METERS (',F6.1,' FEET )'/)
      GO TO 160
  200 CONTINUE
C
C                *****************************************************
C                *                                                   *
C                *    N .NE. 7 => DATA RECORD.  IF NOT THE CORRECT   *
C                *    LENGTH, SKIP IT                                *
C                *                                                   *
C                *****************************************************
C
      IF ( N .NE. 3607 )  GO TO 160
```

Figure F-2. Downlink data reduction program listing (sheet 3 of 21).

```
C
C         ******************************************************
C         *                                                    *
C         *     HAVE GOT A GOOD DATA RECORD - PROCESS IT      *
C         *                                                    *
C         ******************************************************
C
      NSCAN = NSCAN + 1
      IF ( NSCAN .NE. 1 )  GO TO 240
      XO = IDATA(4)
      YO = IDATA(5)
      DX = IDATA(6)
      DY = IDATA(7)
      GEOM = DX*EX/314.1593
      CALL BCDBIN( IDATA, FRSTM, ALPHA1, CTIME, &220 )
      GO TO 240
  220 CONTINUE
C
C         ******************************************************
C         *                                                    *
C         *     TIME ERROR IN THIS RECORD - SKIP IT AND       *
C         *     DECREMENT SCAN COUNT                           *
C         *                                                    *
C         ******************************************************
C
      NSCAN = NSCAN - 1
      GO TO 160
  240 CONTINUE
      X1 = IDATA(4)
      Y1 = IDATA(5)
      DX1 = IDATA(6)
      DY1 = IDATA(7)
      IF ( X1 .NE. XO .OR.
     #     Y1 .NE. YO .OR.
     #     DX1 .NE. DX .OR.
     #     DY1 .NE. DY )  GO TO 300
      CALL BCDBIN( IDATA, LASTM, ALPHA2, CTIME, &220 )
C
C         ******************************************************
C         *                                                    *
C         *     UPDATA THE SUMS FOR SCAN AVERAGE               *
C         *                                                    *
C         ******************************************************
C
      DO 280 I = 1,60
        L = 61 - I
        DO 260 J = 1,60
          K = 61 - J
          KQ = (J-1)*60 + I + 7
          DATA(K,L) = DATA(K,L) + IDATA(KQ)
  260   CONTINUE
  280 CONTINUE
      GO TO 160
```

Figure F-2. Downlink data reduction program listing (sheet 4 of 21).

```
300   CONTINUE
C
C             *****************************************************
C             *                                                   *
C             *     SCAN LOCATION OR RESOLUTION DOES NOT MATCH.   *
C             *     WRITE A MESSAGE, DECREMENT THE SCAN COUNT     *
C             *     AND SKIP THE RECORD                           *
C             *                                                   *
C             *****************************************************
C
      CALL HEDING( 6 )
      WRITE(6,320)  X0 X1, Y0, Y1, DX, DX1, CY, DY1
320   FORMAT(/10X,'SCAN RESOLUTION OR LOCATION DOES NOT MATCH'/
     #       10X,'X0 = ',F6.0,',  X1 = ',F6.C/
     #       10X,'Y0 = ',F6.0,',  Y1 = ',F6.0/
     #       10X,'CX = ',F6.0,',  DX1 = ',F6.0/
     #       10X,'CY = ',F6.0,',  DY1 = ',F6.0/)
      NSCAN = NSCAN - 1
      GO TO 160
340   CONTINUE
C
C             *****************************************************
C             *                                                   *
C             *     HAVE SUMMED ALL RECORDS IN THE SPECIFIED      *
C             *     FILE.  NOW COMPUTE THE AVERAGE, INTEGRATE     *
C             *     TOTAL POWER, AND FIND THE LOCATION OF THE     *
C             *     PEAK.                                         *
C             *                                                   *
C             *****************************************************
C
      IF ( NSCAN .EC. 0 )  GO TO 860
      CALL HEDING( 6 )
      WRITE(6,360)  (ALPHA1(I),I=1,3), (ALPHA1(I),I=4,6),
     #              (ALPHA2(I),I=1,3), (ALPHA2(I),I=4,6), NSCAN
360   FORMAT(/10X,'TIME OF FIRST SCAN = ',3A4,5X,3A4/
     #       10X,'TIME CF LAST SCAN =  ',3A4,5X,3A4/
     #       10X,I5,' SCANS AVERAGED'//)
C
      PMAX = -1.CE70
      PTOTAL = 0.C
      DO 420 I = 1,60
        X = (I-1)*DX + X0
        DO 400 J = 1,60
          Y = (J-1)*DY + Y0
          TEMP = CATA(I,J)/NSCAN
          IF ( TEMP .NE. 0.0 )  TEMP = TEMP + 14.0
          P = A1 + X*( A2 + X*( A5 + X*A9 ) )
     #           + Y*( A3 + Y*( A6 + Y*A10 ) )
     #           + X*Y*( A4 + X*A7 + Y*A8 )
C
C             *****************************************************
C             *                                                   *
C             *     P IS THE PHOTOCATHODE RESPONSIVITY            *
```

Figure F-2. Downlink data reduction program listing (sheet 5 of 21).

```
C                 *
C                 *******************************************************
C
            RSQ = (I - 72.0 )**2 + ( Y + 204.0 )**2
            R = SQRT( RSQ )
            IF ( RSQ .LE. 8.98704E5 )  DNL = 2.68E-8
            IF ( RSQ .GT. 8.98704E5 )  DNL = 2.68E-8 +
     &                                  ( (R**1.06)/31.61 - 45.0 )*2.0E-10
            TEMP = TEMP*CALFAC*DNL/P
            IF ( TEMP .LE. PMAX )  GO TO 380
            PMAX = TEMP
            IMAX = I
            JMAX = J
  380       CONTINUE
            PTOTAL = PTOTAL + TEMP
            DATA(I,J) = TEMP
  400     CONTINUE
  420   CONTINUE
C
C                 *******************************************************
C                 *                                                     *
C                 *     CORRECT TOTAL POWER FOR SCAN RESOLUTION AND     *
C                 *     FIELD OF VIEW                                   *
C                 *                                                     *
C                 *******************************************************
C
        PTOTAL = PTOTAL*GEOM*2.3925E-4
        YM = ( 60 - IMAX )*DY + YO
        XM = ( 60 - JMAX )*DX + XO
        RM = ( XM - 72.0 )**2 + ( YM + 204.0 )**2
        ZENTH = SQRT( RM )/20.0
        AZIM = 57.29578*ATAN2( 72.0 - XM, -204.0 - YM )
        IF ( AZIM .LT. 0.0 )  AZIM = AZIM + 360.0
C
C                 *******************************************************
C                 *                                                     *
C                 *     ELEV AND AZIM ARE THE ZENITH ANGLE AND          *
C                 *     AZIMUTH, RESPECTIVELY, OF THE IRRADIANCE        *
C                 *     PEAK.  NOW CALCULATE THE ZENITH ANGLE AND       *
C                 *     AZIMUTH OF THE SUN. CONVERT PDT TO GMT          *
C                 *                                                     *
C                 *******************************************************
C
        DAY = FRSTP(1)
        IHOUR = FRSTM(2) + 7
        IF ( IHOUR .LT. 24 )  GO TO 440
        IHOUR = IHOUR - 24
        DAY = DAY + 1.0
  440   DAY = DAY + IHOUR/24.0 + FRSTM(3)/1440.0
        CALL ALMNAC( 1975, DAY, DEC, EQNT )
        SLON = ( IHOUR + 12.0 + ( EQNT + FRSTM(3) )/60.0 )*15.0
        SLON = AMOD( SLON, 360.0 )*0.0174533
        SLAT = ( 90.0 - DEC )*0.0174533
```

Figure F-2. Downlink data reduction program listing (sheet 6 of 21).

```
C
C     ****************************************************
C     *                                                  *
C     *    SLAT AND SLON ARE THE CO-LAT AND LONG,        *
C     *    RESPECTIVELY, OF THE SUB-SOLAR POINT          *
C     *                                                  *
C     ****************************************************
C
      ZENTHS = ARCOS( COS( CLAT )*COS( SLAT )
     #       + SIN( CLAT )*SIN( SLAT )*COS( SLON - CLON ) )
      S = ( CLAT + SLAT + ZENTHS )/2.0
      AZIMS = 114.5916*ATAN( SQRT( SIN( S - CLAT )*SIN( S - ZENTHS )/
     #                       ( SIN( S - SLAT )*SIN( S ) ) ) )
      IF ( SLON .GT. CLON ) AZIMS = 360.0 - AZIMS
      ZENTHS = ZENTHS*57.29578
      CALL HEDING( 4 )
      WRITE(6,460)  ZENTH, AZIM, ZENTHS, AZIMS
  460 FORMAT(/10X,'IRRADIANCE PEAK AT ',F5.1,
     #           ' DEGREES ZENITH ANGLE, ',F6.1,
     #           ' DEGREES AZIMUTH'/
     #       22X,'SUN AT ',F5.1,' DEGREES ZENITH ANGLE, ',F6.1,
     #           ' DEGREES AZIMUTH'/)
C
C     ****************************************************
C     *                                                  *
C     *    INTEGRATE IN CIRCLES AROUND THE PEAK.         *
C     *    FIRST INITIALIZE ALL INTEGRALS TO ZERO        *
C     *                                                  *
C     ****************************************************
C
      DO 480 I = 1,18
        PA(I) = 0.0
  480 CONTINUE
      DO 540 I = 1,60
        Y = ( I - IMAX )*DY
        DO 520 J = 1,60
          X = ( J - JMAX )*DX
          R = SQRT( X*X + Y*Y )/20.0
          DO 500 K = 1,18
            IF ( R .GT. PL(K) )  GO TO 500
            PA(K) = PA(K) + DATA(I,J)
  500     CONTINUE
          IF ( DATA(I,J) .NE. 0.0 )  DATA(I,J) = 10.0*ALOG10(DATA(I,J))
          IF ( DATA(I,J) .EQ. 0.0 )  DATA(I,J) = ZERO
  520   CONTINUE
  540 CONTINUE
      DO 560 I = 1,18
        PA(I) = 10.0*ALOG10( PA(I)*GEOM*2.3925E-4 )
  560 CONTINUE
      CALL HEDING( 12 )
      WRITE(6,580)  ( PL(I), PA(I),I=1,18 )
  580 FORMAT(/3(10X,'FIELD',10X,' LOSS')/11X,'DF',14X,'DB',
     #       2(12X,'DF',14X,'DB')/
```

Figure F-2. Downlink data reduction program listing (sheet 7 of 21).

```
#            10X,'VIEW',26X,'VIEW',26X,'VIEW'//
$            (10X,0PF5.0,F15.2,10X,F5.0,F15.2,10X,F5.0,F15.2))
C
C                    *********************************************************
C                    *                                                       *
C                    *      FIND MAX AND MIN FOR PLOTTING.                   *
C                    *                                                       *
C                    *********************************************************
C
      PMAX = -1.0E70
      PMIN = +1.0E7.
      DO 600 I = 1,18
        IF ( PA(I) .GT. PMAX )  PMAX = PA(I)
        IF ( PA(I) .LT. PMIN )  PMIN = PA(I)
600   CONTINUE
C
C                    *********************************************************
C                    *                                                       *
C                    *     SET SCALE TO 10 DB/INCH.  SET MAX AND MIN         *
C                    *     TO MULTIPLES OF 5 DB.                             *
C                    *                                                       *
C                    *********************************************************
C
      ADY = 10.0
      PMAX = -GSTINT( -PMAX, 5.0 )
      PMIN = GSTINT( PMIN, 5.0 )
      YLEN = ( PMAX - PMIN )/10.0
C
C                    *********************************************************
C                    *                                                       *
C                    *     IF PLOT IS TOO SMALL, INCREASE SIZE BY            *
C                    *     A FACTOR OF 2                                     *
C                    *                                                       *
C                    *********************************************************
C
620   IF ( YLEN .GT. 3.5 )  GO TO 640
      YLEN = YLEN*2.0
      ADY = ADY/2.0
      GO TO 620
640   CONTINUE
C
C                    *********************************************************
C                    *                                                       *
C                    *     IF PLOT IS TOO LARGE, DECREASE SIZE BY A          *
C                    *     FACTOR OF 2                                       *
C                    *                                                       *
C                    *********************************************************
C
      IF ( YLEN .LT. 8.1 )  GO TO 660
      YLEN = YLEN/2.0
      ADY = ADY*2.0
      GO TO 640
660   CONTINUE
```

Figure F-2. Downlink data reduction program listing (sheet 8 of 21).

```
C
C          ****************************************************
C          *                                                  *
C          *    SET THE ORIGIN AND FRAME THE PAGE             *
C          *                                                  *
C          ****************************************************
C
      CALL PLOT( 18.0, -11.0, -3 )
      CALL PLOT( 0.0, 11.0, 2 )
      CALL PLOT( 17.0, 11.0, 2 )
      CALL PLOT( 17.0, 0.0, 2 )
      CALL PLOT( 0.0, 0.0, 2 )
C
C          ****************************************************
C          *                                                  *
C          *    RESET THE ORIGIN FOR THE PLOT AND DRAW THE    *
C          *    AXES                                          *
C          *                                                  *
C          ****************************************************
C
      CALL PLOT( 2.0, ( 11.0 - YLEN )*0.4, -3 )
      CALL AXISM( 0.0, 0.0, 'INTEGRATED LOSS, DB',19, YLEN, 90.0,
     #            PMIN, 10.0, 5.0/ADY, 2 )
      CALL AXISM( 0.0, 0.0, 'FIELD OF VIEW, DEGREES', -22, 4.5, 0.0,
     #            0.0, 30.0, 0.25, 6 )
C
C          ****************************************************
C          *                                                  *
C          *    LOAD SCALE FACTORS AND ORIGINS INTO THE       *
C          *    PLOT ARRAYS                                   *
C          *                                                  *
C          ****************************************************
C
      PL(19) = 0.0
      PL(20) = 20.0
      PA(19) = PMIN
      PA(20) = ADY
C
C          ****************************************************
C          *                                                  *
C          *    DRAW THE CURVE AND DOCUMENT THE PLOT          *
C          *                                                  *
C          ****************************************************
C
      CALL PMLINE( PL, PA, 18, 4.5, YLEN, 0.0, 0.0, 1, 0, 0 )
      CALL PLOT( -2.0, ( YLEN - 11.0 )*0.4, -3 )
      HT = 0.07
      CALL SYMBOL( 0.2, 2.0, HT, 'ID =', 90.0, 4 )
      CALL SYMBOL( 0.2, 2.35, HT, IYR, 90.0, 2 )
      CALL SYMBOL( 0.2, 2.49, HT, '.', 90.0, 1 )
      CALL SYMBOL( 0.2, 2.56, HT, IDAY, 90.0, 3 )
      FPN = IHR
      CALL NUMBER( 0.2, 2.98, HT, FPN, 90.0, -1 )
```

Figure F-2. Downlink data reduction program listing (sheet 9 of 21).

```
      CALL SYMBOL( 0.2, 3.12, HT, ':', 90.0, 1 )
      FPN = MIN
      CALL NUMBER( 0.2, 3.19, HT, FPN, 90.0, -1 )
      CALL SYMBOL( 0.2, 3.33, HT, ':', 90.0, 1 )
      FPN = ISEC
      CALL NUMBER( 0.2, 3.40, HT, FPN, 90.0, -1 )
680   CALL SYMBOL( 3.5, 10.25, 0.14, ALPHA1, 0.0, 12 )
      CALL SYMBOL( 3.2, 9.85, 0.14, ALPHA1(4), 0.0, 12 )
      CALL SYMBOL( 5.02, 9.85, 0.14, 'PDT', 0.0, 3 )
      CALL SYMBOL( 3.2, 9.45, 0.14, ALPHA2(4), 0.0, 12 )
      CALL SYMBOL( 5.02, 9.45, 0.14, 'PDT', 0.0, 3 )
C
C                 ***************************************************
C                 *                                                 *
C                 *    FINISHED WITH INTEGRATED POWER PLOT.  MOVE   *
C                 *    THE PLOTTER ORIGIN AND FRAME THE             *
C                 *    CONTOUR PLOTS                                *
C                 *                                                 *
C                 ***************************************************
C
      CALL PLOT( 10.0, 1.25, -3 )
      CALL PLOT( 0.0, 5.9, 2 )
      CALL PLOT( 5.9, 5.9, 2 )
      CALL PLOT( 5.9, 0.0, 2 )
      CALL PLOT( 0.0, 0.0, 2 )
C
C                 ***************************************************
C                 *                                                 *
C                 *    DRAW THE CONTOURS AND DOCUMENT THE PLOT      *
C                 *                                                 *
C                 ***************************************************
C
      CALL CONTUR( DATA, 60, 60, FLAGS, AR, MODE, 18.0, 10.0, 0.0, 1, F
      HT = 0.21
      CALL SYMBOL( 1.70, 8.6, HT, ALPHA1, 0.0, 12 )
      CALL SYMBOL( 1.32, 8.3, HT, ALPHA1(4), 0.0, 12 )
      CALL SYMBOL( 4.05, 8.3, HT, 'PDT', 0.0, 3 )
      CALL SYMBOL( 1.32, 8.0, HT, ALPHA2(4), 0.0, 12 )
      CALL SYMBOL( 4.05, 8.0, HT, 'PDT', 0.0, 3 )
      HT = 0.1
      CALL SYMBOL( 0.0, 7.65, HT, 'PEAK', 0.0, 4 )
      CALL SYMBOL( 0.3, 7.50, HT, 'ZENITH ANGLE =', 0.0, 14 )
      CALL NUMBER( 1.8, 7.50, HT, ZENITH, 0.0, 1 )
      CALL SYMBOL( 2.3, 7.50, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 0.3, 7.35, HT, 'AZIMUTH =', 0.0, 9 )
      CALL NUMBER( 1.3, 7.35, HT, AZIM, 0.0, 1 )
      CALL SYMBOL( 1.9, 7.35, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 0.0, 7.05, HT, 'SUN', 0.0, 3 )
      CALL SYMBOL( 0.3, 6.90, HT, 'ZENITH ANGLE =', 0.0, 14 )
      CALL NUMBER( 1.8, 6.90, HT, ZENTHS, 0.0, 1 )
      CALL SYMBOL( 2.3, 6.90, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 0.3, 6.75, HT, 'AZIMUTH =', 0.0, 9 )
      CALL NUMBER( 1.3, 6.75, HT, AZIMS, 0.0, 1 )
```

Figure F-2. Downlink data reduction program listing (sheet 10 of 21).

```
      CALL SYMBOL( 1.9, 6.75, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 0.0, 6.45, HT, 'INTEGRATED LOSS =', 0.0, 17 )
      FPN = 10.0*ALOG10( PTOTAL )
      CALL NUMBER( 1.8, 6.45, HT, FPN, 0.0, 1 )
      CALL SYMBOL( 2.4, 6.45, HT, 'DB', 0.0, 2 )
      CALL SYMBOL( 0.0, 6.15, HT, 'XTILT =', 0.0, 7 )
      CALL NUMBER( 0.8, 6.15, HT, XTILT, 0.0, 1 )
      CALL SYMBOL( 1.4, 6.15, HT, 'DEGREES, YTILT =', 0.0, 16 )
      CALL NUMBER( 3.1, 6.15, HT, YTILT, 0.0, 1 )
      CALL SYMBOL( 3.6, 6.15, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 0.0, 6.00, HT, 'DEPTH =', 0.0, 7 )
      CALL NUMBER( 0.8, 6.00, HT, DEPTHM, 0.0, 1 )
      CALL SYMBOL( 1.3, 6.00, HT, 'METERS (', 0.0, 8 )
      CALL NUMBER( 2.2, 6.00, HT, DEPTH, 0.0, -1 )
      CALL SYMBOL( 2.6, 6.00, HT, 'FEET )', 0.0, 6 )
      CALL PLOT ( 4.5, 7.5, 3 )
      CALL PLOT( 4.5, 6.5, 2 )
      CALL PLOT( 4.0, 7.0, 3 )
      CALL PLOT( 5.0, 7.0, 2 )
      CALL SYMBOL( 4.45, 7.55, HT, 'N', 0.0, 1 )
      CALL SYMBOL( 4.45, 6.35, HT, 'S', 0.0, 1 )
      CALL SYMBOL( 3.85, 6.95, HT, 'W', 0.0, 1 )
      CALL SYMBOL( 5.05, 6.95, HT, 'E', 0.0, 1 )
      CALL SYMBOL( 0.0, -0.2, HT, 'AVERAGE OF', 0.0, 10 )
      FPN = NSCAN
      CALL NUMBER( 1.1, -0.2, HT, FPN, 0.0, -1 )
      CALL SYMBOL( 1.5, -0.2, HT, 'SCANS', 0.0, 5 )
C
C                ***********************************************************
C                *         CALCULATE PARAMETERS TO DRAW ZENITH ANGLE       *
C                *         SCALE FROM THE OPTICAL AXIS THROUGH THE         *
C                *         IRRADIANCE PROFILE PEAK                         *
C                *                                                         *
C                ***********************************************************
C
      CK = 60.0 + ( 204.0 + Y0 )/DY
      CL = 60.0 - ( 72.0 - X0 )/DX
      XP = ( CL - 1.0 )/10.0
      YP = ( CK - 1.0 )/10.0
      AXANG = 57.29578*ATAN2( -204.0 - YM, 72.0 - XM )
      AXLEN = 180.0/DX
      TIC = AXLEN/9.0
      CALL AXISP( XP, YP, ' ', -1, AXLEN, AXANG, 0.0, 30.0, TIC, 3 )
C
C                ***********************************************************
C                *                                                         *
C                *         REWIND THE TAPE, AND READ MORE INPUT DATA,      *
C                *         IF ANY.                                         *
C                *                                                         *
C                ***********************************************************
C
      REWIND 9
      GO TO 100
```

Figure F-2. Downlink data reduction program listing (sheet 11 of 21).

```
C
C      ********************************************
C      *                                          *
C      *    MESSAGES                              *
C      *                                          *
C      ********************************************
C
780    WRITE(6,800)
800    FORMAT(///30X,'*** EOF ON SYSIN - END OF JOB ***')
       CALL PLOT( 0, 0, 999 )
       STOP
C
820    CALL MEDING( 7 )
       WRITE(6,840)
840    FORMAT(///30X,'*** EOF ON UNIT 9 ***'///)
       GO TO 340
C
860    CALL MEDING( 7 )
       WRITE(6,880)
880    FORMAT(///20X,'*** NO RECORDS IN THE SPECIFIED FILE ***'///)
       GO TO 100
C
900    CALL MEDING( 7 )
       WRITE(6,920)
920    FORMAT(///20X,'*** WRONG TAPE SPECIFIED ***'///)
       GO TO 100
C
       END
```

Figure F-2. Downlink data reduction program listing (sheet 12 of 21).

```
SATCOM DOWN LINK DATA REDUCTION      14/44/23      76.063                    PAGE   1

INPUT DATA FOR PROGRAM SATCOM DOWN LINK

CARD NO.

   1      &INPUT  TAPE = 7,  FILE = 0,  GAIN = 2,  DWELL = 1.0E-8,  DEPTH = 10,
   2          FLUX = 8.0E-5,  CTIME(2) = -1,  &END
   3      &INPUT  FILE = 1,  DEPTH = 20,  FLUX = 9.0E-5,  &END
   4      &INPUT  FILE = 2,  DEPTH = 30,  &END
   5      &INPUT  FILE = 3,  DEPTH = 40,  GAIN = 3,  &END
   6      &INPUT  FILE = 4,  DEPTH = 50,  DWELL = 0.25,  &END
   7      &INPUT  FILE = 5,  DEPTH = 60,  &END
   8      &INPUT  FILE = 6,  DEPTH = 70,  DWELL = 0.5,  &END
   9     /*
```

Figure F-2. Downlink data reduction program listing (sheet 13 of 21).

```
SATCOM DOWN LINK DATA REDUCTION     14/44/23     76.083                PAGE   2
```

Figure F-2. Downlink data reduction program listing (sheet 14 of 21).

```
SATCUM DOWN LINK DATA REDUCTION      14/44/23      76.063                                   PAGE   3

WINDSPEED =     -0. MPH
WIND DIRECTION =       -0. DEGREES
XTILT =     -0.0 DEGREES
YTILT =     -0.0 DEGREES
FLUX DENSITY =     -9.091E-07 MW/CM SQ
DEPTH =     3.0 METERS (  10.0 FEET )

TIME OF FIRST SCAN =   24 JUN 1975      19:07:32.055
TIME OF LAST SCAN =    24 JUN 1975      19:07:37.135
     5 SCANS AVERAGED

IRRADIANCE PEAK AT   52.2 DEGREES ZENITH ANGLE,   283.5 DEGREES AZIMUTH
              SUN AT   79.4 DEGREES ZENITH ANGLE,   291.2 DEGREES AZIMUTH
```

FIELD OF VIEW	LOSS DB	FIELD OF VIEW	LOSS DB	FIELD OF VIEW	LOSS DB
5.	-3.47	10.	-0.56	15.	1.34
20.	2.15	25.	2.64	30.	2.93
35.	3.12	40.	3.26	45.	3.42
50.	3.55	55.	3.67	60.	3.77
65.	3.86	70.	3.91	75.	3.99
80.	4.05	85.	4.13	90.	4.25

Figure F-2. Downlink data reduction program listing (sheet 15 of 21).

```
WINDSPEED =    -0. MPH
WIND DIRECTION =    -0. DEGREES
XTILT =    -0.0 DEGREES
YTILT =    -0.0 DEGREES
FLUX DENSITY =    -9.091E-07 MW/CM SQ
DEPTH =    6.1 METERS (  20.0 FEET )

TIME OF FIRST SCAN =  24 JUN 1975    19:09:59.136
TIME OF LAST SCAN =   24 JUN 1975    19:10:04.215
    5 SCANS AVERAGED

IRRADIANCE PEAK AT   50.0 DEGREES ZENITH ANGLE,  287.9 DEGREES AZIMUTH
           SUN AT    79.8 DEGREES ZENITH ANGLE,  291.4 DEGREES AZIMUTH
```

FIELD OF VIEW	LOSS DB	FIELD OF VIEW	LOSS DB	FIELD OF VIEW	LOSS DB
5.	-6.81	10.	-3.05	15.	-1.18
20.	-0.37	25.	0.16	30.	0.52
35.	0.74	40.	0.91	45.	1.07
50.	1.19	55.	1.26	60.	1.30
65.	1.31	70.	1.31	75.	1.31
80.	1.31	85.	1.31	90.	1.31

Figure F-2. Downlink data reduction program listing (sheet 16 of 21).

```
WINDSPEED =      -0. MPH
WIND DIRECTION =      -0. DEGREES
XTILT =     -0.0 DEGREES
YTILT =     -0.0 DEGREES
FLUX DENSITY =     -9.091E-07 MW/CM SQ
DEPTH =      9.1 METERS (  30.0 FEET )

TIME OF FIRST SCAN =  24 JUN 1975      19:10:48.145
TIME OF LAST SCAN =   24 JUN 1975      19:10:53.225
     5 SCANS AVERAGED

IRRADIANCE PEAK AT   53.1 DEGREES ZENITH ANGLE,  296.9 DEGREES AZIMUTH
              SUN AT   83.3 DEGREES ZENITH ANGLE,  291.6 DEGREES AZIMUTH          2
```

FIELD OF VIEW	LOSS DB	FIELD OF VIEW	LOSS DB	FIELD OF VIEW	LOSS DB
5.	-9.73	10.	-5.36	15.	-3.60
20.	-2.59	25.	-1.81	30.	-1.44
35.	-1.18	40.	-0.97	45.	-0.84
50.	-0.78	55.	-0.77	60.	-0.77
65.	-0.77	70.	-0.77	75.	-0.77
80.	-0.77	85.	-0.77	90.	-0.77

Figure F-2. Downlink data reduction program listing (sheet 17 of 21).

SATCOM DOWN LINK DATA REDUCTION 14/44/23 76.083 PAGE 6

```
WINDSPEED =    -0. MPH
WIND DIRECTION =      -0. DEGREES
XTILT =    -0.0 DEGREES
YTILT =    -0.0 DEGREES
FLUX DENSITY =    -9.091E-07 MW/CM SQ
DEPTH =    12.2 METERS (  40.0 FEET )

TIME OF FIRST SCAN =  24 JUN 1975      19:13:07.786
TIME OF LAST SCAN =   24 JUN 1975      19:13:12.866
    5 SCANS AVERAGED

IRRADIANCE PEAK AT  52.2 DEGREES ZENITH ANGLE,  283.5 DEGREES AZIMUTH        5
           SUN AT   80.6 DEGREES ZENITH ANGLE,  291.9 DEGREES AZIMUTH
```

FIELD OF VIEW	LOSS DB	FIELD OF VIEW	LOSS DB	FIELD OF VIEW	LOSS DB
5.	-13.01	10.	-8.76	15.	-6.04
20.	-4.52	25.	-3.57	30.	-2.94
35.	-2.47	40.	-2.10	45.	-1.81
50.	-1.56	55.	-1.35	60.	-1.17
65.	-0.99	70.	-0.84	75.	-0.66
80.	-0.52	85.	-0.38	90.	-0.27

Figure F-2. Downlink data reduction program listing (sheet 18 of 21).

SATCOM DOWN LINK DATA REDUCTION 19/44/23 76.063 PAGE 7

```
WINDSPEED =    -0. MPH
WIND DIRECTION =     -0. DEGREES
XTILT =    -0.0 DEGREES
YTILT =    -0.0 DEGREES
FLUX DENSITY =   -9.091E-07 MW/CM SQ
DEPTH =    15.2 METERS (  50.0 FEET )

TIME OF FIRST SCAN =  24 JUN 1975     19:15:49.230
TIME OF LAST SCAN =   24 JUN 1975     19:15:55.988
    5 SCANS AVERAGED

IRRADIANCE PEAK AT  52.2 DEGREES ZENITH ANGLE,  283.5 DEGREES AZIMUTH
           SUN AT   81.0 DEGREES ZENITH ANGLE,  292.2 DEGREES AZIMUTH
```

FIELD OF VIEW	LOSS DB	FIELD OF VIEW	LOSS DB	FIELD OF VIEW	LOSS DB
5.	-16.56	10.	-12.15	15.	-9.14
20.	-7.40	25.	-6.26	30.	-5.49
35.	-4.93	40.	-4.45	45.	-4.03
50.	-3.67	55.	-3.34	60.	-3.06
65.	-2.77	70.	-2.55	75.	-2.29
80.	-2.10	85.	-1.91	90.	-1.75

Figure F-2. Downlink data reduction program listing (sheet 19 of 21).

```
SATCOM DOWN LINK DATA REDUCTION     14/44/23     76.063                    PAGE   8

WINDSPEED =     -0. MPH
WIND DIRECTION =      -0. DEGREES
XTILT =    -0.0 DEGREES
YTILT =    -0.0 DEGREES
FLUX DENSITY =    -9.091E-07 MW/CM SQ
DEPTH =    18.3 METERS (  60.0 FEET )

TIME OF FIRST SCAN =  24 JUN 1975     19:17:51.700
TIME OF LAST SCAN =   24 JUN 1975     19:17:58.458
    5 SCANS AVERAGED

IRRADIANCE PEAK AT  45.3 DEGREES ZENITH ANGLE,  281.5 DEGREES AZIMUTH
           SUN AT  61.4 DEGREES ZENITH ANGLE,  292.4 DEGREES AZIMUTH

FIELD          LOSS          FIELD          LOSS          FIELD          LOSS
 OF             DB            OF             DB            OF             DB
VIEW                         VIEW                         VIEW

  5.          -20.08           10.         -15.20           15.         -11.82
 20.           -9.67           25.          -8.63           30.          -7.74
 35.           -7.07           40.          -6.46           45.          -5.97
 50.           -5.55           55.          -5.18           60.          -4.87
 65.           -4.56           70.          -4.33           75.          -4.07
 80.           -3.90           85.          -3.74           90.          -3.62
```

Figure F-2. Downlink data reduction program listing (sheet 20 of 21).

```
SATCOM DOWN LINK DATA REDUCTION     14/44/23     75.083                    PAGE   9

WINDSPEED =    -0. MPH
WIND DIRECTION =     -0. DEGREES
XTILT =    -0.0 DEGREES
YTILT =    -0.0 DEGREES
FLUX DENSITY =    -9.091E-07 MW/CM SQ
DEPTH =    21.3 METERS (  70.0 FEET )

TIME OF FIRST SCAN =  24 JUN 1975    19:16:40.253
TIME OF LAST SCAN =   24 JUN 1975    19:16:48.093
    5 SCANS AVERAGED

IRRADIANCE PEAK AT   45.0 DEGREES ZENITH ANGLE,  286.5 DEGREES AZIMUTH
              SUN AT   61.6 DEGREES ZENITH ANGLE,  292.6 DEGREES AZIMUTH

FIELD        LOSS        FIELD        LOSS        FIELD        LOSS
 OF           DB          OF           DB          OF           DB
VIEW                     VIEW                     VIEW

   5.       -22.71        10.       -17.85        15.       -14.47
  20.       -12.68        25.       -11.37        30.       -10.43
  35.        -9.63        40.        -8.94        45.        -8.35
  50.        -7.85        55.        -7.41        60.        -7.05
  65.        -6.65        70.        -6.43        75.        -6.15
  80.        -5.96        85.        -5.79        90.        -5.66

         *** EOF ON SYSIN - END OF JOB ***
```

Figure F-2. Downlink data reduction program listing (sheet 21 of 21).

APPENDIX G

GENERAL DESCRIPTION OF SLICE PROGRAM

Program SLICE is similar to DOWNLINK and processes the same data. The difference is that instead of a contour plot of the data array, SLICE generates a plot of a cross section of the contours along a specified azimuth angle. The data are read from tape and averaged exactly as in DOWNLINK. The azimuth of each point in the array is calculated and compared to specified limits. If it falls within these limits the value is calibrated, its zenith angle calculated, and the calibrated value and zenith angle are saved. If the azimuth of the point falls outside the specified limits it is ignored. When all points have been examined, those saved are sorted into increasing zenith angle order and a plot of radiance loss vs. zenith angle is generated.

It is necessary to specify limits around the desired azimuth angle, since it is probable that no point will have exactly the desired azimuth. A more elegant method would have been to utilize an interpolation scheme to obtain values at exactly the required azimuth, but this seemed to be an unnecessary complication. Azimuth limits of any width may be specified, but experience suggests that the desired value ± 2 1/2 degrees produces good results.

A sample plot generated by the program is shown in figure G-1 and a sample of the printed output appears at the end of the program listing.

INPUT DATA. The camera data to be processed is read from magnetic tape as described for program DOWNLINK. Control information is read from cards. All variables defined for DOWNLINK also apply to program SLICE.

In addition, the following variables are required:

AZL1, AZL2, AZL3, AZL4 real variables specifying the azimuth limits in degrees. The restrictions are AZL1 < AZL2, AZL3 < AZL4, and 0 < AZL1, AZL2, AZL3, AZL4 < 360. Example: to obtain a cross section along the azimuth 215 degrees, specify

AZL1 = 212.5, AZL2 = 217.5, AZL3 = 32.5, AZL4 = 37.5,

The values AZL1 = 32.5, AZL2 = 37.5, AZL3 = 212.5, AZL4 = 217.5, would produce the same results except that the resulting cross section plot would be reversed left-to-right.

As a general rule use,

AZL1 = A-2.5, AZL2 = A +2.5, AZL3 = AZL1 ± 180, AZL4 = AZL2 ± 180. .

All cards are read from NAMELIST name INPUT. Any number of sets of data may be stacked for a given job. Processing continues until no more cards are found.

OUTPUT DATA. All output is either to the printer or the plotter. Examples have been cited above and should be self-explanatory.

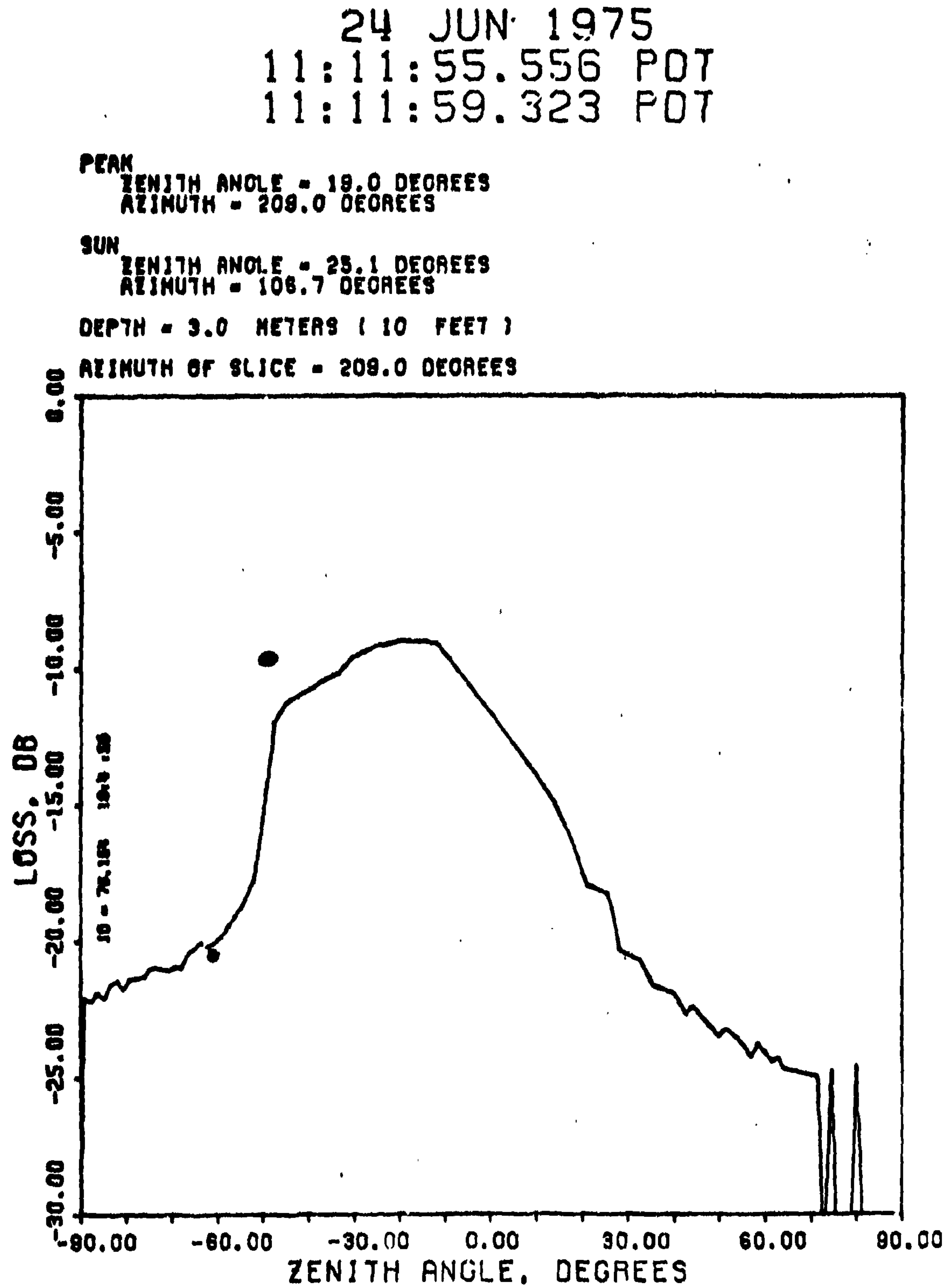


Figure G-1. Sample plot from program SLICE.

EXTERNAL SUBROUTINES REQUIRED. Same as for program DOWNLINK except for CONTUR which is not required.

Figure G-2 represents a program listing on the following 14 pages of the SLICE data reduction.

```
C
C
C       ****************************************************
C       *                                                  *
C       *   MAIN PROGRAM FOR STACOM UNDERWATER CAMERA      *
C       *   DATA REDUCTION                                 *
C       *                                                  *
C       ****************************************************
C
      INTEGER     IDATA(4096), FLAGS(200), FRSTM(5), ALPHA1(6),
     #            GAIN, FILE, LASTM(5), ALPHA2(6), TAPE,
     #            CTIME(5) / 5*0 /
C
      REAL*8      DAY, DEC, EQNT
C
      REAL        DATA(60,60), BUFFER(4096), AR(3), PA(20),
     #            GEE(4) / 0.037, 0.228, 1.0, 3.067 /,
     #            PL(20) /  5.0, 10.0, 15.0, 20.0, 25.0, 30.0,
     #                     35.0, 40.0, 45.0, 50.0, 55.0, 60.0,
     #                     65.0, 70.0, 75.0, 80.0, 85.0, 90.0 /,
     #            CLAT / 0.98692 /, CLON /2.0679 /,
     #            Z(300), SLICE(300),
     #            A1 / 5.8250E+2/, A2 / 1.2447E-1/,
     #            A3 /-6.1724E-2/, A4 /-1.2029E-5/,
     #            A5 /-1.0780E-5/, A6 /-1.6040E-5/,
     #            A7 / 1.5297E-9/, A8 /-1.2021E-9/,
     #            A9 /-6.8711E-9/, A10/-9.6330E-9/
C
      COMMON      /IDNO/    IYR, IDAY, IHR, MIN, ISEC
C
      NAMELIST    /INPUT/   MODE, AR, SIZE, GAIN, DWELL, FILE, FLUX,
     #                      TAPE, DEPTH, CTIME, AZL1, AZL2, AZL3, AZL4
C
C       ****************************************************
C       *                                                  *
C       *   GSTINT(X,Y) = Y*<X/Y>, WHERE <X/Y> IS THE LARGEST*
C       *   INTEGER WHICH IS NOT GREATER THAN X/Y          *
C       *                                                  *
C       ****************************************************
C
      GSTINT( X, Y ) = Y*AINT( (X/Y) - 0.5*( 1.0 - (X/ABS(X)) ) )
C
      CALL COPY(8, £780)
C
C       ****************************************************
C       *                                                  *
C       *   OPEN & INITIALIZE THE PLOTTER                  *
C       *                                                  *
C       ****************************************************
C
      CALL PLOTS( BUFFER, 4096, 99 )
C
```

Figure G-2. SLICE data reduction program listing (sheet 1 of 14).

```
C
C                 ****************************************************
C                 *                                                  *
C                 *     INITIALIZE VARIABLES TO DEFAULT VALUES       *
C                 *                                                  *
C                 ****************************************************
C
      SIZE = 1.0
      FLUX = 0.0
C
C                 ****************************************************
C                 *                                                  *
C                 *     READ ONE SET OF INPUT DATA                   *
C                 *                                                  *
C                 ****************************************************
C
100   READ(8,INPUT,END=730)
C                 ****************************************************
C                 *                                                  *
C                 *     SET PLOT SIZE                                *
C                 *                                                  *
C                 ****************************************************
C
      CALL FACTOR( SIZE )
C
C                 ****************************************************
C                 *                                                  *
C                 *     CALCULATE PARTIAL CALIBRATION FACTOR AND     *
C                 *     ZERO LEVEL                                   *
C                 *                                                  *
C                 ****************************************************
C
      GSUBD = 1.0 + 11.23*( DWELL**1.036 )
      G = GEE(GAIN+1)
      TEMP = G*GSUBD*FLUX
      CALFAC = 5.58E6/TEMP
      ZERO = 10.0*ALOG10( 2.094E-5/TEMP ) - 4.0
      MODE = 1
      AR(1) = 3.0
      AR(2) = ZERO + 4.0
      AR(3) = AR(2) + 30.0
      DEPTHM = DEPTH*0.3048
C
C                 ****************************************************
C                 *                                                  *
C                 *     INITIALIZE DATA ARRAY TO ZEROES              *
C                 *     INITIALIZE FRAME COUNT TO ZERO               *
C                 *                                                  *
C                 ****************************************************
C
      DO 140 I = 1,60
         DO 120 J = 1,60
```

Figure G-?. SLICE data reduction program listing (sheet 2 of 14).

```
      DATA(I,J) = 0.0
120   CONTINUE
140   CONTINUE
      NSCAN = 0
C
C                ****************************************************
C                *                                                  *
C                *       READ A RECORD FROM THE DATA TAPE           *
C                *                                                  *
C                ****************************************************
C
160   READ(9,END=820)  ITAPE, IFILE, IREC, N, (IDATA(I),I=1,N)
C
C                ****************************************************
C                *                                                  *
C                *      CHECK FOR CORRECT TAPE AND FILE NUMBER      *
C                *                                                  *
C                ****************************************************
C
      IF ( ITAPE .NE. TAPE )  GO TO 900
      IF ( IFILE .LT. FILE )  GO TO 160
      IF ( IFILE .GT. FILE )  GO TO 340
      IF ( N .NE. 7 )  GO TO 200
C
C                ****************************************************
C                *                                                  *
C                * N = 7 => ENVIRONMENTAL RECORD - DECODE AND PRINT *
C                *                                                  *
C                ****************************************************
C
      WS = IDATA(1)/20.47
      WD = IDATA(2)/5.686
      XTILT = IDATA(4)/20.47
      YTILT = IDATA(5)/20.47
      FLX = IDATA(7)/1.1E6
      CALL HEDING( 0 )
      CALL HEDING(8)
      WRITE(6,180)  WS, WD, XTILT, YTILT, FLX, DEPTHM, DEPTH
180   FORMAT(/10X,'WINDSPEED = ',F5.0,' MPH'/
     #            10X,'WIND DIRECTION = ',F6.0,' DEGREES'/
     #            10X,'XTILT = ',F6.1,' DEGREES'/
     #            10X,'YTILT = ',F6.1,' DEGREES'/
     #            13X,'FLUX DENSITY = ',1PE12.3,' MW/CM SQ'/
     #            10X,'DEPTH = ',0PF6.1,' METERS (',F6.1,' FEET )'/)
      GO TO 160
200   CONTINUE
C
C                ****************************************************
C                *                                                  *
C                *   N .NE. 7 => DATA RECORD,  IF NOT THE CORRECT   *
C                *   LENGTH, SKIP IT                                *
C                *                                                  *
C                ****************************************************
C
```

Figure G-2. SLICE data reduction program listing (sheet 3 of 14).

```
C
      IF ( N .NE. 3607 )  GO TO 160
C
C                 ************************************************************
C                 *                                                          *
C                 *     HAVE GOT A GOOD DATA RECORD - PROCESS IT             *
C                 *                                                          *
C                 ************************************************************
C
      NSCAN = NSCAN + 1
      IF ( NSCAN .NE. 1 )  GO TO 240
      XO = IDATA(4)
      YO = IDATA(5)
      DX = IDATA(6)
      DY = IDATA(7)
      GEOM = DX*DX/314.1593
      CALL BCDBIN( IDATA, FRSTM, ALPHA1, CTIME, &220 )
      GO TO 240
  220 CONTINUE
C
C                 ************************************************************
C                 *                                                          *
C                 *     TIME ERROR IN THIS RECORD - SKIP IT AND              *
C                 *     DECREMENT SCAN COUNT                                 *
C                 *                                                          *
C                 ************************************************************
C
      NSCAN = NSCAN - 1
      GO TO 160
  240 CONTINUE
      X1 = IDATA(4)
      Y1 = IDATA(5)
      DX1 = IDATA(6)
      DY1 = IDATA(7)
      IF ( X1 .NE. XO .OR.
     #     Y1 .NE. YO .OR.
     #     DX1 .NE. DX .OR.
     #     DY1 .NE. DY )  GO TO 300
      CALL BCDBIN( IDATA, LASTM, ALPHA2, CTIME, &220 )
C
C                 ************************************************************
C                 *                                                          *
C                 *     UPDATA THE SUMS FOR SCAN AVERAGE                     *
C                 *                                                          *
C                 ************************************************************
C
      DO 280 I = 1,60
         L = 61 - I
         DO 260 J = 1,60
            K = 61 - J
            KQ = (J-1)*60 + I + 7
            DATA(K,L) = DATA(K,L) + IDATA(KQ)
  260    CONTINUE
```

Figure G-2. SLICE data reduction program listing (sheet 4 of 14).

```
  280 CONTINUE
  300 CONTINUE
C
C     ******************************************************
C     *                                                    *
C     *     SCAN LOCATION OR RESOLUTION DOES NOT MATCH.    *
C     *     WRITE A MESSAGE, DECREMENT THE SCAN COUNT      *
C     *     AND SKIP THE RECORD                            *
C     *                                                    *
C     ******************************************************
C
      CALL HEDING( 6 )
      WRITE(6,320)  X0, X1, Y0, Y1, DX, DX1, DY, DY1
  320 FORMAT(/10X,'SCAN RESOLUTION OR LOCATION DOES NOT MATCH'/
     #        10X,'X0 = ',F6.0,', X1 = ',F6.0/
     #        10X,'Y0 = ',F6.0,', Y1 = ',F6.0/
     #        10X,'DX = ',F6.0,', DX1 = ',F6.0/
     #        10X,'DY = ',F6.0,', DY1 = ',F6.0/)
      NSCAN = NSCAN - 1
      GO TO 160
  340 CONTINUE
C
C     ******************************************************
C     *                                                    *
C     *     HAVE SUMMED ALL RECORDS IN THE SPECIFIED       *
C     *     FILE.  NOW COMPUTE THE AVERAGE, INTEGRATE      *
C     *     TOTAL POWER, AND FIND THE LOCATION OF THE      *
C     *     PEAK.                                          *
C     *                                                    *
C     ******************************************************
C
      IF ( NSCAN .EQ. 0 )  GO TO 860
      CALL HEDING( 6 )
      WRITE(6,360)   (ALPHA1(I),I=1,3), (ALPHA1(I),I=4,6),
     #               (ALPHA2(I),I=1,3), (ALPHA2(I),I=4,6), NSCAN
  360 FORMAT(/10X,'TIME OF FIRST SCAN = ',3A4,5X,3A4/
     #        10X,'TIME OF LAST SCAN =  ',3A4,5X,3A4/
     #        10X,I5,' SCANS AVERAGED'//)
C
      PMAX = -1.0E70
      PTOTAL = 0.0
      DO 420 I = 1,60
        X = (I-1)*DX + X0
        DO 400 J = 1,60
          Y = (J-1)*DY + Y0
          TEMP = DATA(I,J)/NSCAN
          IF ( TEMP .NE. 0.0 )  TEMP = TEMP + 14.0
          P = A1 + X*( A2 + X*( A5 + X*A9 ) )
     #           + Y*( A3 + Y*( A6 + Y*A10 ) )
     #           + X*Y*( A4 + X*A7 + Y*A8 )
C
C     ******************************************************
```

Figure G-2. SLICE data reduction program listing (sheet 5 of 14).

```
C               *                                                          *
C               *        P IS THE PHOTOCATHODE RESPONSIVITY                *
C               *                                                          *
C               ************************************************************
C
      RSQ = (X - 72.0 )**2 + ( Y + 204.0 )**2
      R = SQRT( RSQ )
      IF ( RSQ .LE. 8.98704E5 )  DNL = 2.68E-8
      IF ( RSQ .GT. 8.98704E5 )  DNL = 2.68E-8 +
     &                           ( (R**1.06)/31.61 - 45.0 )*2.0E-10
      TEMP = TEMP*CALFAC*DNL/P
      IF ( TEMP .LE. PMAX )  GO TO 380
      PMAX = TEMP
      IMAX = I
      JMAX = J
  380 CONTINUE
      PTOTAL = PTOTAL + TEMP
    IF ( TEMP .EQ. 0.0 )  DATA(I,J) = ZERO
    IF ( TEMP .NE. 0.0 )  DATA(I,J) = 10.0*ALOG10( TEMP )
  400 CONTINUE
  420 CONTINUE
C               ************************************************************
C               *                                                          *
C               *        CORRECT TOTAL POWER FOR SCAN RESOLUTION AND       *
C               *        FIELD OF VIEW                                     *
C               *                                                          *
C               ************************************************************
C
      PTOTAL = PTOTAL*GEOM*2.3925E-4
      YM = ( 60 - IMAX )*DY + Y0
      XM = ( 60 - JMAX )*DX + X0
      RM = ( XM - 72.0 )**2 + ( YM + 204.0 )**2
      ZENITH = SQRT( RM )/22.0
      AZIM = 57.29578*ATAN2( 72.0 - XM, -204.0 - YM )
      IF ( AZIM .LT. 0.0 )  AZIM = AZIM + 360.0
C               ************************************************************
C               *                                                          *
C               *        ELEV AND AZIM ARE THE ZENITH ANGLE AND            *
C               *        AZIMUTH, RESPECTIVELY, OF THE IRRADIANCE          *
C               *        PEAK.  NOW CALCULATE THE ZENITH ANGLE AND         *
C               *        AZIMUTH OF THE SUN. CONVERT PDT TO GMT            *
C               *                                                          *
C               ************************************************************
C
      DAY = FRSTM(1)
      IHOUR = FRSTM(2) + 7
      IF ( IHOUR .LT. 24 )  GO TO 440
      IHOUR = IHOUR - 24
      DAY = DAY + 1.0
  440 DAY = DAY + IHOUR/24.0 + FRSTM(3)/1440.0
      CALL ALMNAC( 1975, DAY, DEC, EQNT )
```

Figure G-2. SLICE data reduction program listing (sheet 6 of 14).

```
      SLON = ( IHOUR + 12.0 + ( EQNT + FRSTM(3) )/60.0 )*15.0
      SLON = AMOD( SLON, 360.0 )*0.0174533
      SLAT = ( 90.0 - DEC )*0.0174533
C
C               ****************************************************
C               *                                                  *
C               *    SLAT AND SLON ARE THE CO-LAT AND LONG,        *
C               *    RESPECTIVELY, OF THE SUB-SOLAR POINT          *
C               *                                                  *
C               ****************************************************
C
      ZENTHS = ARCOS( COS( CLAT )*COS( SLAT )
     #        + SIN( CLAT )*SIN( SLAT )*COS( SLON - CLON ) )
      S = ( CLAT + SLAT + ZENTHS )/2.0
      AZIMS = 114.5916*ATAN( SQRT( SIN( S - CLAT )*SIN( S - ZENTHS ) /
     #        ( SIN( S - SLAT )*SIN( S ) ) ) )
      IF ( SLON .GT. CLON )  AZIMS = 360.0 - AZIMS
      ZENTHS = ZENTHS*57.29578
      CALL REDING( 4 )
      WRITE(6,400)  ZENTH, AZIM, ZENTHS, AZIMS
  400 FORMAT(/10X,'IRRADIANCE PEAK AT ',F5.1,
     #       ' DEGREES ZENITH ANGLE, ',F6.1,
     #       ' DEGREES AZIMUTH'/
     #  22X,'SUN AT ',F5.1,' DEGREES ZENITH ANGLE, ',F6.1,
     #       ' DEGREES AZIMUTH'/)
C
C               ****************************************************
C               *                                                  *
C               *    FIND POINTS WITHIN AZIMUTH LIMITS             *
C               *                                                  *
C               ****************************************************
C
  470 LQ = 0
      DO 500 L = 1,60
        X = ( 60 - L )*DX + XO
        DO 480 K = 1,60
          Y = ( 60 - K )*DY + YO
          AZ = 57.29578*ATAN2( 72.0 - X, -204.0 - Y )
          IF ( AZ .LT. 0.0 )  AZ = AZ + 360.0
          IF ( (AZ .LT. AZL1 .OR. AZ .GT. AZL2 ) .AND.
     #       (AZ .LT. AZL3 .OR. AZ .GT. AZL4) )  GO TO 480
          LQ = LQ + 1
          R = ( X - 72.0 )**2 + ( Y + 204.0 )**2
          Z(LQ) = SQRT( R )/20.0
          CA = COS( AZ*0.0174533 )
          Z(LQ) = SIGN( Z(LQ), CA )
          SLICE(LQ) = DATA(K,L)
          IF ( LQ .GE. 298 )  GO TO 940
  480   CONTINUE
  500 CONTINUE
C
C               ****************************************************
C               *
C
```

Figure G-2. SLICE data reduction program listing (sheet 7 of 14).

```
C                    *     SORT POINTS IN ORDER OF INCREASING ZENITH          *
C                    *     ANGLE                                              *
C                    *                                                        *
C                    **********************************************************
C
      CALL HEDING( 3 )
      WRITE (6,510)  LQ
510   FORMAT(/10X,I6,' POINTS FOUND WITHIN AZIMUTH LIMITS'/)
      IF ( LQ .GE. 10 )  GO TO 515
      AZL1 = AZL1 - 0.5
      AZL2 = AZL2 + 0.5
      IF ( AZL2 - AZL1 .GT. 5.0 )  STOP
      AZL3 = AZL3 - 0.5
      AZL4 = AZL4 + 0.5
      GO TO 470
515   LQM1 = LQ - 1
      DO 540 I = 1,LQM1
        ZENMAX = Z(I)
        JMAX = I
        IP1 = I + 1
        DO 520 J = IP1,LQ
          IF ( Z(J) .LE. ZENMAX )  GO TO 520
          JMAX = J
          ZENMAX = Z(J)
520     CONTINUE
        IF ( JMAX .EQ. I )  GO TO 540
        TEMP = Z(I)
        Z(I) = Z(JMAX)
        Z(JMAX) = TEMP
        TEMP = SLICE(I)
        SLICE(I) = SLICE(JMAX)
        SLICE(JMAX) = TEMP
540   CONTINUE
C
C                    **********************************************************
C                    *                                                        *
C                    *     FIND MAXIMUM DATA POINT ALONG THE SLICE            *
C                    *                                                        *
C                    **********************************************************
C
      ZMAX = -1.0E70
      DO 560 I = 1,LQ
        IF ( SLICE(I) .LE. ZMAX )  GO TO 560
        IMAX = I
        ZMAX = SLICE(I)
560   CONTINUE
C
C                    **********************************************************
C                    *                                                        *
C                    *     MAKE PLOT LIMIT A MULTIPLE OF 10 DB                *
C                    *                                                        *
C                    **********************************************************
C
```

Figure G-2. SLICE data reduction program listing (sheet 8 of 14).

```
      IF ( ZMAX .NE. 0.0 )  ZMAX = -GSTINT( -ZMAX, 10.0 )
      ZMIN = ZMAX - 30.0
C
C                 ***************************************************
C                 *                                                 *
C                 *    LOAD PLOTTING PARAMETERS INTO THE ARRAYS     *
C                 *                                                 *
C                 ***************************************************
C
      SLICE(LQ+1) = ZMIN
      SLICE(LQ+2) = 5.0
      Z(LQ+1) = -90.0
      Z(LQ+2) = 30.0
C                 ***************************************************
C                 *                                                 *
C                 *    SET PLOTTER ORIGIN AND FRAME THE PAGE        *
C                 *                                                 *
C                 ***************************************************
C
      CALL PLOT( 8.5, -11.0, -3 )
      CALL PLOT( 0.0, 11.0, 2 )
      CALL PLOT( 8.5, 11.0, 2 )
      CALL PLOT( 8.5, 0.0, 2 )
      CALL PLOT( 0.0, 0.0, 2 )
      CALL PLOT( 1.5, 1.5, -3 )
C
C                 ***************************************************
C                 *                                                 *
C                 *    DRAW THE AXES AND FRAME THE PLOT             *
C                 *                                                 *
C                 ***************************************************
C
      CALL AXISM( 0.0, 0.0, 'ZENITH ANGLE, DEGREES', -21, 6.0, 0.0,
     $   -90.0, 30.0, 0.333, 3 )
      CALL AXISM( 0.0, 0.0, 'LOSS, DB', 8, 6.0, 90.0, ZMIN, 5.0, 1.0,
     $   1 )
      CALL PLOT( 0.0, 6.0, 3 )
      CALL PLOT( 6.0, 6.0, 2 )
      CALL PLOT( 6.0, 0.0, 2 )
C
C
C                 ***************************************************
C                 *                                                 *
C                 *    DRAW THE CURVE AND DOCUMENT THE PLOT         *
C                 *                                                 *
C                 ***************************************************
C
      CALL PHLINE( Z, SLICE, LQ, 6.0, 6.0, 0.0, 0.0, 1, 0, 6 )
      HT = 0.07
      CALL SYMBOL( 0.2, 2.0, HT, 'ID =', 90.0, 4 )
      CALL SYMBOL( 0.2, 2.35, HT, IYR, 90.0, 2 )
      CALL SYMBOL( 0.2, 2.49, HT, '.', 90.0, 1 )
      CALL SYMBOL( 0.2, 2.56, HT, IDAY, 90.0, 3 )
```

Figure G-2. SLICE data reduction program listing (sheet 9 of 14).

```
      FPN = IHR
      CALL NUMBER( 0.2, 2.98, HT, FPN, 90.0, -1 )
      CALL SYMBOL( 0.2, 3.12, HT, ':', 90.0, 1 )
      FPN = MIN
      CALL NUMBER( 0.2, 3.19, HT, FPN, 90.0, -1 )
      CALL SYMBOL( 0.2, 3.33, HT, ':', 90.0, 1 )
      FPN = ISEC
      CALL NUMBER( 0.2, 3.46, HT, FPN, 90.0, -1 )
      HT = 0.21
      CALL SYMBOL( 1.70, 8.6, HT, ALPHA1, 0.0, 12 )
      CALL SYMBOL( 1.32, 8.3, HT, ALPHA1(4), 0.0, 12 )
      CALL SYMBOL( 4.05, 8.3, HT, 'PDT', 0.0, 3 )
      CALL SYMBOL( 1.32, 8.0, HT, ALPHA2(4), 0.0, 12 )
      CALL SYMBOL( 4.05, 8.0, HT, 'PDT', 0.0, 3 )
      HT = 0.1
      CALL SYMBOL( 0.0, 7.65, HT, 'PEAK', 0.0, 4 )
      CALL SYMBOL( 0.3, 7.50, HT, 'ZENITH ANGLE =', 0.0, 14 )
      CALL NUMBER( 1.8, 7.50, HT, ZENTH, 0.0, 1 )
      CALL SYMBOL( 2.3, 7.50, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 0.3, 7.35, HT, 'AZIMUTH =', 0.0, 9 )
      CALL NUMBER( 1.3, 7.35, HT, AZIM, 0.0, 1 )
      CALL SYMBOL( 1.9, 7.35, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 0.0, 7.05, HT, 'SUN', 0.0, 3 )
      CALL SYMBOL( 0.3, 6.90, HT, 'ZENITH ANGLE =', 0.0, 14 )
      CALL NUMBER( 1.8, 6.90, HT, ZENTHS, 0.0, 1 )
      CALL SYMBOL( 2.3, 6.90, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 0.3, 6.75, HT, 'AZIMUTH =', 0.0, 9 )
      CALL NUMBER( 1.3, 6.75, HT, AZIMS, 0.0, 1 )
      CALL SYMBOL( 1.9, 6.75, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 0.0, 6.45, HT, 'DEPTH =', 0.0, 7 )
      CALL NUMBER( 0.8, 6.45, HT, DEPTHM, 0.0, 1 )
      CALL SYMBOL( 1.3, 6.45, HT, 'METERS (', 0.0, 8 )
      CALL NUMBER( 2.2, 6.45, HT, DEPTH, 0.0, -1 )
      CALL SYMBOL( 2.6, 6.45, HT, 'FEET )', 0.0, 6 )
      CALL SYMBOL( 0.0, 6.15, HT, 'AZIMUTH OF SLICE =', 0.0, 18 )
      FPN = ( AZL1 + AZL2 )/2.0
      CALL NUMBER( 1.9, 6.15, HT, FPN, 0.0, 1 )
      CALL SYMBOL( 2.5, 6.15, HT, 'DEGREES', 0.0, 7 )
C
C          ***************************************************
C          *                                                 *
C          *    REWIND THE TAPE, AND READ MORE INPUT DATA,   *
C          *    IF ANY.                                      *
C          *                                                 *
C          ***************************************************
C
      REWIND 9
      GO TO 100
C
C          ***************************************************
C          *                                                 *
C          *    MESSAGES                                     *
C          *                                                 *
```

Figure G-2. SLICE data reduction program listing (sheet 10 of 14).

```
C       *************************************************************
C
780     WRITE(6,800)
800     FORMAT(///30X,'*** EOF ON SYSIN - END OF JOB ***')
        CALL PLOT( 0, 0, 999 )
        STOP
C
820     CALL HEDING( 7 )
        WRITE(6,840)
840     FORMAT(///30X,'*** EOF ON UNIT 9 ***'///)
        GO TO 340
C
860     CALL HEDING( 7 )
        WRITE(6,880)
880     FORMAT(///20X,'*** NO RECORDS IN THE SPECIFIED FILE ***'///)
        GO TO 100
C
900     CALL HEDING( 7 )
        WRITE(6,920)
920     FORMAT(///20X,'*** WRONG TAPE SPECIFIED ***'///)
        GO TO 100
940     CALL HEDING( 7 )
        WRITE(6,960)
960     FORMAT(///20X,'*** TOO MANY POINTS IN SLICE ***'///)
        GO TO 100
C
        END
```

Figure G-2. SLICE data reduction program listing (sheet 11 of 14).

```
SATCOM DOWN LINK SLICE DATA REDUCTION      7/49/ 6      76.161                    PAGE   1

INPUT DATA FOR PROGRAM DOWN LINK SLICE

CARD NO.

   1      &INPUT  TAPE = 4,  FILE = 4,  GAIN = 3,  DWELL = 0.75,  FLUX = 4.2E-4,
   2          DEPTH=10,  AZL1=104.2,  AZL2=109.2,  AZL3=284.2,  AZL4=289.2,   &END
   3      &INPUT  FILE = 5,  FLUX = 4.3E-4,  DEPTH = 20,
   4          DEPTH=20,  AZL1=105.0,  AZL2=110.0,  AZL3=285.0,  AZL4=290.0,   &END
   5      &INPUT  FILE = 6,
   6          DEPTH=30,  AZL1=105.6,  AZL2=110.6,  AZL3=285.1,  AZL4=290.5,   &END
   7      &INPUT  FILE = 7,  DWELL = 0.25,  DEPTH = 40,
   8          DEPTH=40,  AZL1=107.0,  AZL2=112.0,  AZL3=287.0,  AZL4=292.0,   &END
   9      &INPUT  FILE = 8,  DWELL = 0.25,  DEPTH = 50,
  10          DEPTH=50,  AZL1=107.9,  AZL2=112.9,  AZL3=287.9,  AZL4=292.9,   &END
  11      &INPUT  FILE = 9,  DEPTH = 60,  FLUX = 4.5E-4,
  12          DEPTH=60,  AZL1=108.9,  AZL2=113.9,  AZL3=288.9,  AZL4=293.9,   &END
  13      &INPUT  FILE = 10,  DEPTH = 70,
  14          DEPTH=70,  AZL1=109.2,  AZL2=114.2,  AZL3=289.2,  AZL4=294.2,   &END
  15      &INPUT  FILE = 11,  DEPTH = 80,
  16          DEPTH=80,  AZL1=109.6,  AZL2=114.6,  AZL3=289.6,  AZL4=294.6,   &END
  17      &INPUT  FILE = 12,  DEPTH = 90,  DWELL = 0.5,  FLUX = 5.0E-4,
  18          DEPTH=90,  AZL1=110.9,  AZL2=115.9,  AZL3=290.9,  AZL4=295.9,   &END
  19      &INPUT  FILE = 13,  DEPTH = 100,  DWELL = 0.75,
  20          DEPTH=100, AZL1=112.0,  AZL2=117.0,  AZL3=292.0,  AZL4=297.0,   &END
  21      &INPUT  FILE = 14,  DEPTH = 110,  FLUX = 5.7E-4,
  22          DEPTH=110, AZL1=112.0,  AZL2=117.0,  AZL3=292.0,  AZL4=297.0,   &END
  23      &INPUT  FILE = 15,  DEPTH = 120,
  24          DEPTH=120, AZL1=112.8,  AZL2=117.8,  AZL3=292.8,  AZL4=297.8,   &END
  25      &INPUT  FILE = 16,  DEPTH = 130,  DWELL = 2,  FLUX = 6.3E-4,
  26          DEPTH=130, AZL1=117.9,  AZL2=122.9,  AZL3=297.9,  AZL4=302.9,   &END
  27      &INPUT  FILE = 17,  DEPTH = 140,  DWELL = 4,
  28          DEPTH=140, AZL1=119.8,  AZL2=124.8,  AZL3=299.8,  AZL4=304.8,   &END
  29      &INPUT  FILE = 18,  FLUX = 6.3E-4,  DEPTH = 150,
  30          DEPTH=150, AZL1=120.9,  AZL2=125.9,  AZL3=300.9,  AZL4=305.9,   &END
  30      /*
```

Figure G-2. SLICE data reduction program listing (sheet 12 of 14).

SATCOM DOWN LINK SLICE DATA REDUCTION 7/49/ 6 76.161 PAGE 2

Figure G-2. SLICE data reduction program listing (sheet 13 of 14).

```
SATCOM DOWN LINK SLICE DATA REDUCTION      7/49/ 6     76.161                    PAGE   3

WINDSPEED =     -6. MPH
WIND DIRECTION =     87. DEGREES
XTILT =     1.6 DEGREES
YTILT =    -5.5 DEGREES
FLUX DENSITY =      9.091E-07 MW/CM SQ
DEPTH =     3.0 METERS (   10.0 FEET )

TIME OF FIRST SCAN =  24 JUN 1975      11:11:55.556
TIME OF LAST SCAN =   24 JUN 1975      11:11:59.323
    4 SCANS AVERAGED

IRRADIANCE PEAK AT   19.0 DEGREES ZENITH ANGLE,   209.0 DEGREES AZIMUTH
           SUN AT   25.1 DEGREES ZENITH ANGLE,   166.7 DEGREES AZIMUTH

    87 POINTS FOUND WITHIN AZIMUTH LIMITS
```

Figure G-2. SLICE data reduction program listing (sheet 14 of 14).

APPENDIX H

GENERAL DESCRIPTION OF AUTOMATIC HEMISPHERICAL SCAN PROGRAM

This program is similar to DOWNLINK but is used to reduce SATCOM data recorded in the full scan mode. In this mode of operation, the photo cathode was divided into three different regions which were scanned with a different point density in each region. Figure H-1 illustrates the scan areas. The center square was sampled with ΔX, $\Delta Y = 20$, the outer square with ΔX, $\Delta Y = 80$. Since the contour plotting routine requires a rectangular array of data with constant ΔX and constant ΔY, it is necessary to interpolate values to produce a constant ΔX, $\Delta Y = 20$. The result is a 185 by 185 point array. Points outside the circular area actually scanned are set to zero.

Except for the differences in bookkeeping to read the data and the interpolation scheme required, the program is the same as DOWNLINK. The same input is required and the same output is produced. A sample plot is shown in figures H-2A and H-2B, and the printer output appears at the end of the program listing.

INPUT DATA. Same as program DOWNLINK.

OUTPUT DATA. Same as program DOWNLINK.

EXTERNAL SUBROUTINES REQUIRED. Automatic Hemispherical Scan uses all the subroutines used by DOWNLINK plus the following:

DENNIS -- This subroutine handles the bookkeeping required in reading the camera data from tape and loading it into the data matrix in the proper location. There are actually three versions of this routine to handle three different modes of recording the camera data. In some cases of data recording, each of the three regions of the image were scanned four times; once at each of the four possible camera gain settings. Thus, the data are recorded as four scans of region 1 followed by four scans of region 2, followed by four scans of region 3. The version of DENNIS for this case will retain for processing only one scan of each region. The scan processed is the highest gain which did not cause saturation of the A-D converter. If the lowest gain saturated the converter, that data is kept and a message is written to the printer to warn of the saturation condition. At other times, only two scans were made of each region, and at still other times, only one scan of each region. Separate versions of DENNIS handle each of these cases and some care is required to insure that the correct version is used for the data to be processed.

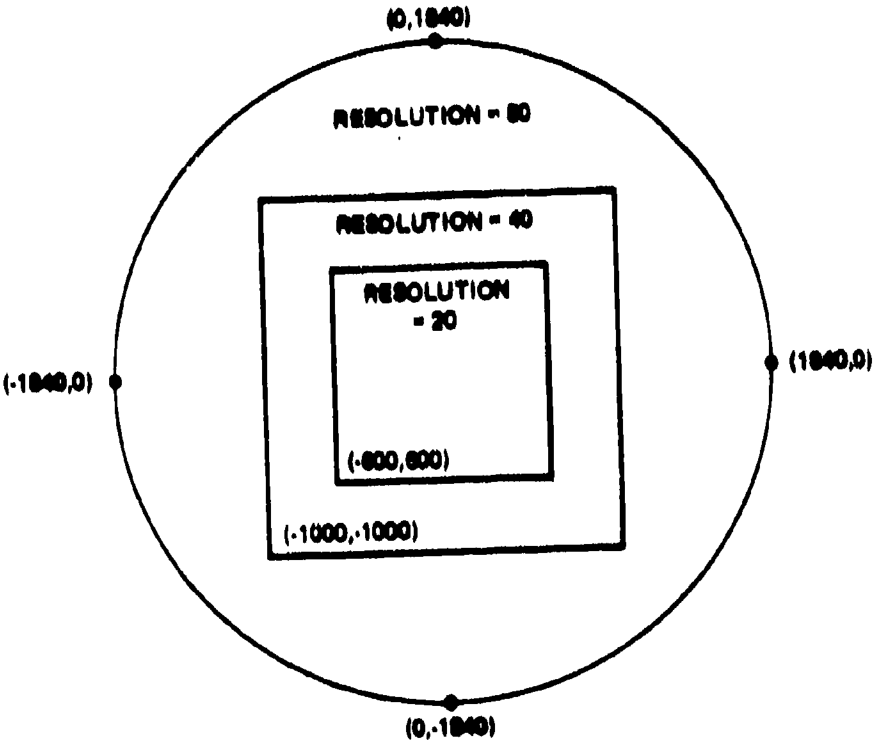
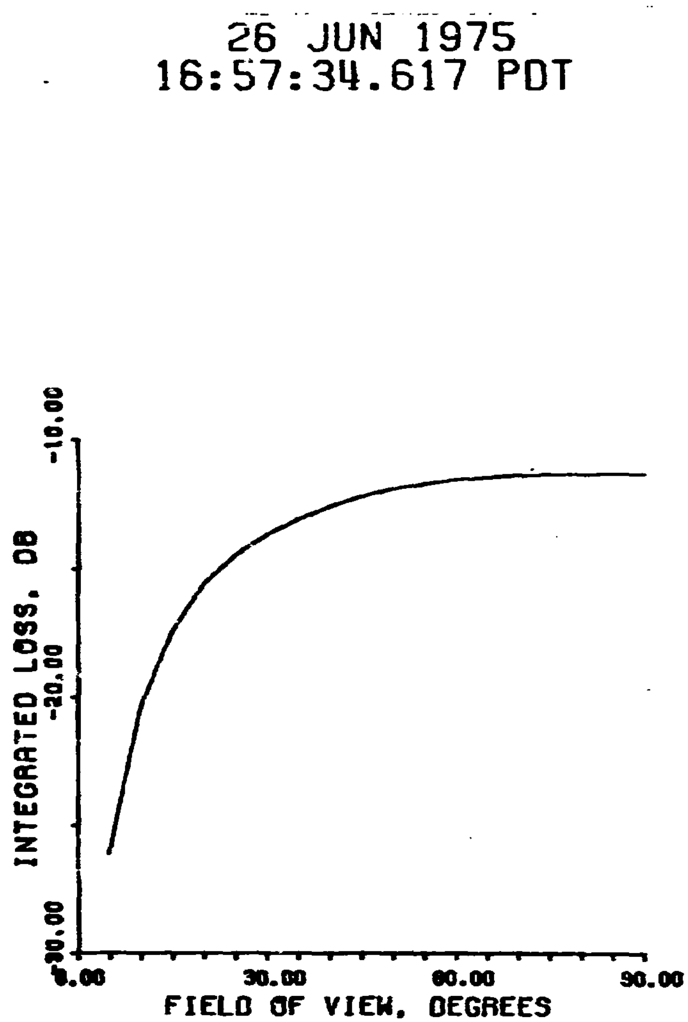
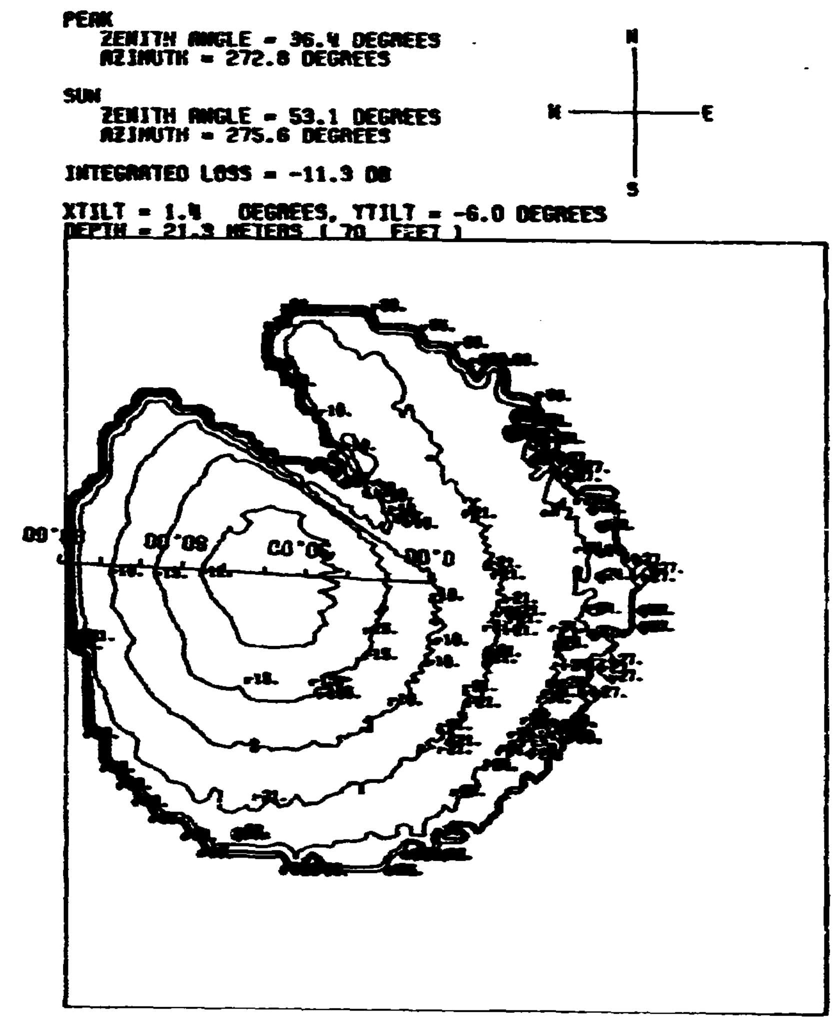


Figure H-1. Scanning regions.



H-2A



H-2B

Figure H-2. Sample plot from automatic hemispherical scan program.

INTERP – This routine calibrates the data read in by DENNIS, and interpolates values in the two outer regions so that the resulting data array has the same density of points in these regions as in region 1. Calibration follows the procedure described in DOWNLINK.

UWCAM – This is a PL/I subroutine which reads the raw data tape, checks for errors and determines the length of each record read. The data, the length of the record, an error flag, and an end of data set flag are returned to the calling program.

Figure H-3 represents a program listing on 8 pages of the Automatic Hemispherical Scan data reduction.

```
      IF ( SLON .GT. CLON )  AZIMS = 360.0 - AZIMS
      ZENTHS = ZENTHS*57.29579
      CALL HEDING( 4 )
      WRITE(6,460)  ZENTH, AZIM, ZENTHS, AZIMS
460   FORMAT(/10X,'IRRADIANCE PEAK AT ',F5.1,
     #       ' DEGREES ZENITH ANGLE, ',F6.1,
     #       ' DEGREES AZIMUTH'/
     #    22X,'SUN AT ',F5.1,' DEGREES ZENITH ANGLE, ',F5.1,
     #       ' DEGREES AZIMUTH'/)
C
C             ****************************************************
C             *                                                  *
C             *     INTEGRATE IN CIRCLES AROUND THE PEAK.        *
C             *     FIRST INITIALIZE ALL INTEGRALS TO ZERO       *
C             *                                                  *
C             ****************************************************
C
      DO 480 I = 1,18
        PA(I) = 0.0
480   CONTINUE
      DO 540 I = 1,185
        Y = ( I - IMAX )
        DO 520 J = 1,185
          X = ( J - JMAX )
          R = SQRT( X*X + Y*Y )
          DO 500 K = 1,18
            IF ( R .GT. PL(K) )  GO TO 500
            PA(K) = PA(K) + Z(I,J)
500       CONTINUE
          IF ( Z(I,J) .NE. 0.0 )  Z(I,J) = 10.0*ALOG10( Z(I,J) )
          IF ( Z(I,J) .EQ. 0.0 )  Z(I,J) = ZERO
520     CONTINUE
540   CONTINUE
      DO 560 I = 1,18
        PA(I) = 10.0*ALOG10( PA(I)*GEOM*2.3925E-4 )
560   CONTINUE
      CALL HEDING( 12 )
      WRITE(6,580)  ( PL(I), PA(I),I=1,18 )
580   FORMAT(/3(10X,'FIELD',10X,' LOSS')/11X,'OF',14X,'DB',
     #       2(12X,'OF',14X,'DB')/
     #       10X,'VIEW',26X,'VIEW',26X,'VIEW'//
     #       (10X,0PF5.0,F15.2,10X,F5.0,F15.2,10X,F5.0,F15.2))
C
C             ****************************************************
C             *                                                  *
C             *     FIND MAX AND MIN FOR PLOTTING.               *
C             *                                                  *
C             ****************************************************
C
      PMAX = -1.0E70
      PMIN = +1.0E70
      DO 600 I = 1,18
        IF ( PA(I) .GT. PMAX )  PMAX = PA(I)
```

Figure H-3. Automatic hemispherical scan data reduction program listing (sheet 1 of 8).

```
      IF ( PA(I) .LT. PMIN )  PMIN = PA(I)
  600 CONTINUE
C
C                 ******************************************************
C                 *                                                    *
C                 *     SET SCALE TO 10 DB/INCH.  SET MAX AND MIN      *
C                 *     TO MULTIPLES OF 5 DB.                          *
C                 *                                                    *
C                 ******************************************************
C
      ADY = 10.0
      PMAX = -GSTINT( -PMAX, 5.0 )
      PMIN = GSTINT( PMIN, 5.0 )
      YLEN = ( PMAX - PMIN )/10.0
C
C                 ******************************************************
C                 *                                                    *
C                 *     IF PLOT IS TOO SMALL, INCREASE SIZE BY         *
C                 *     A FACTOR OF 2                                  *
C                 *                                                    *
C                 ******************************************************
C
  620 IF ( YLEN .GT. 3.5 )  GO TO 640
      YLEN = YLEN*2.0
      ADY = ADY/2.0
      GO TO 620
  640 CONTINUE
C
C                 ******************************************************
C                 *                                                    *
C                 *     IF PLOT IS TOO LARGE, DECREASE SIZE BY A       *
C                 *     FACTOR OF 2                                    *
C                 *                                                    *
C                 ******************************************************
C
      IF ( YLEN .LT. 8.1 )  GO TO 660
      YLEN = YLEN/2.0
      ADY = ADY*2.0
      GO TO 640
  660 CONTINUE
C
C                 ******************************************************
C                 *                                                    *
C                 *     SET THE ORIGIN AND FRAME THE PAGE              *
C                 *                                                    *
C                 ******************************************************
C
      CALL PLOT( 18.0, -11.0, -3 )
      CALL PLOT( 0.0, 11.0, 2 )
      CALL PLOT( 17.0, 11.0, 2 )
      CALL PLOT( 17.0, 0.0, 2 )
      CALL PLOT( 0.0, 0.0, 2 )
C
```

Figure H-3. Automatic hemispherical scan data reduction program listing (sheet 2 of 8).

```
C
C      ****************************************************
C      *                                                  *
C      *   RESET THE ORIGIN FOR THE PLOT AND DRAW THE     *
C      *   AXES                                           *
C      *                                                  *
C      ****************************************************
C
      CALL PLOT( 2.0, ( 11.0 - YLEN )*0.4, -3 )
      CALL AXISM( 0.0, 0.0, 'INTEGRATED LOSS, DB',-19, YLEN, 90.0,
     #            PMIN, -19.3, 5.0/ADY, 2 )
      CALL AXISM( 0.0, 0.0, 'FIELD OF VIEW, DEGREES', -22, 4.5, 0.0,
     #            0.0, 30.0, 0.25, 6 )
C
C      ****************************************************
C      *                                                  *
C      *   LOAD SCALE FACTORS AND ORIGINS INTO THE        *
C      *   PLOT ARRAYS                                    *
C      *                                                  *
C      ****************************************************
C
      PL(19) = 0.0
      PL(20) = 20.0
      PA(19) = PMIN
      PA(20) = ADY
C
C      ****************************************************
C      *                                                  *
C      *   DRAW THE CURVE AND DOCUMENT THE PLOT           *
C      *                                                  *
C      ****************************************************
C
      CALL PMLINE( PL, PA, 18, 4.5, YLEN, 0.0, 0.0, 1, 0, 0 )
      CALL PLOT( -2.0, ( YLEN - 11.0 )*0.4, -3 )
      HT = 0.07
      CALL SYMBOL( 0.2, 2.0, HT, 'ID =', 90.0, 4 )
      CALL SYMBOL( 0.2, 2.35, HT, IYR, 90.0, 2 )
      CALL SYMBOL( 0.2, 2.49, HT, '-', 90.0, 1 )
      CALL SYMBOL( 0.2, 2.56, HT, IDAY, 90.0, 3 )
      FPN = IHR
      CALL NUMBER( 0.2, 2.98, HT, FPN, 90.0, -1 )
      CALL SYMBOL( 0.2, 3.12, HT, ':', 90.0, 1 )
      FPN = MIN
      CALL NUMBER( 0.2, 3.19, HT, FPN, 90.0, -1 )
      CALL SYMBOL( 0.2, 3.33, HT, ':', 90.0, 1 )
      FPN = ISEC
      CALL NUMBER( 0.2, 3.40, HT, FPN, 90.0, -1 )
  660 CALL SYMBOL( 3.5, 10.25, 0.14, ALPHA, 0.0, 12 )
      CALL SYMBOL( 3.2, 9.85, 0.14, ALPHA (4), 0.0, 12 )
      CALL SYMBOL( 5.02, 9.85, 0.14, 'PDT', 0.0, 3 )
C
C      ****************************************************
C      *                                                  *
C      *   FINISHED WITH INTEGRATED POWER PLOT.  MOVE     *
```

Figure H-3. Automatic hemispherical scan data reduction program listing (sheet 3 of 8).

```
C               *     THE PLOTTER ORIGIN AND FRAME THE                        *
C               *     CONTOUR PLOTS                                           *
C               *                                                             *
C               ***************************************************************
C
      CALL PLOT( 10.0, 1.25, -3 )
      CALL PLOT( 0.0, 6.0, 2 )
      CALL PLOT( 6.0, 6.0, 2 )
      CALL PLOT( 6.0, 0.0, 2 )
      CALL PLOT( 0.0, 0.0, 2 )
C
C               ***************************************************************
C               *                                                             *
C               *     DRAW THE CONTOURS AND DOCUMENT THE PLOT                 *
C               *                                                             *
C               ***************************************************************
C
      CALL CONTUR( 2, 185, 185, FLAGS, AR, MODE, 30.667, 30.667,
     &             0.3, 1 )
      HT = 0.21
      CALL SYMBOL( 1.70, 8.6, HT, ALPHA, 0.0, 12 )
      CALL SYMBOL( 1.32, 8.3, HT, ALPHA (4), 0.0, 12 )
      CALL SYMBOL( 4.05, 8.3, HT, 'PDT', 0.0, 3 )
      HT = 0.1
      CALL SYMBOL( 0.0, 7.65, HT, 'PEAK', 0.0, 4 )
      CALL SYMBOL( 0.3, 7.50, HT, 'ZENITH ANGLE =', 0.0, 14 )
      CALL NUMBER( 1.8, 7.50, HT, ZENTH, 0.0, 1 )
      CALL SYMBOL( 2.3, 7.50, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 0.3, 7.35, HT, 'AZIMUTH =', 0.0, 9 )
      CALL NUMBER( 1.3, 7.35, HT, AZIM, 0.0, 1 )
      CALL SYMBOL( 1.9, 7.35, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 0.0, 7.05, HT, 'SUM', 0.0, 3 )
      CALL SYMBOL( 0.3, 6.90, HT, 'ZENITH ANGLE =', 0.0, 14 )
      CALL NUMBER( 1.8, 6.90, HT, ZENTHS, 0.0, 1 )
      CALL SYMBOL( 2.3, 6.90, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 0.3, 6.75, HT, 'AZIMUTH =', 0.0, 9 )
      CALL NUMBER( 1.3, 6.75, HT, AZIMS, 0.0, 1 )
      CALL SYMBOL( 1.9, 6.75, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 0.0, 6.65, HT, 'INTEGRATED LOSS =', 0.0, 17 )
      FPN = 10.0*ALOG10( PTOTAL )
      CALL NUMBER( 1.8, 6.45, HT, FPN, 0.0, 1 )
      CALL SYMBOL( 2.4, 6.45, HT, 'DB', 0.0, 2 )
      CALL SYMBOL( 0.0, 6.15, HT, 'XTILT =', 0.0, 7 )
      CALL NUMBER( 0.8, 6.15, HT, XTILT, 0.0, 1 )
      CALL SYMBOL( 1.4, 6.15, HT, 'DEGREES, YTILT =', 0.0, 16 )
      CALL NUMBER( 3.1, 6.15, HT, YTILT, 0.0, 1 )
      CALL SYMBOL( 3.6, 6.15, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 0.0, 6.00, HT, 'DEPTH =', 0.0, 7 )
      CALL NUMBER( 0.8, 6.00, HT, DEPTHM, 0.0, 1 )
      CALL SYMBOL( 1.3, 6.00, HT, 'METERS (', 0.0, 8 )
      CALL NUMBER( 2.2, 6.00, HT, DEPTH, 0.0, -1 )
      CALL SYMBOL( 2.6, 6.00, HT, 'FEET )', 0.0, 6 )
      CALL PLOT ( 4.5, 7.5, 3 )
```

Figure H-3. Automatic hemispherical scan data reduction program listing (sheet 4 of 8).

```
      CALL PLOT( 4.5, 6.5, 2 )
      CALL PLOT( 4.0, 7.0, 3 )
      CALL PLOT( 5.0, 7.0, 2 )
      CALL SYMBOL( 4.45, 7.55, HT, 'N', 0.0, 1 )
      CALL SYMBOL( 4.45, 6.35, HT, 'S', 0.0, 1 )
      CALL SYMBOL( 3.85, 6.95, HT, 'W', 0.0, 1 )
      CALL SYMBOL( 5.05, 6.95, HT, 'E', 0.0, 1 )
C
C               ***************************************************
C               *   CALCULATE PARAMETERS TO DRAW ZENITH ANGLE     *
C               *     SCALE FROM THE OPTICAL AXIS THROUGH THE     *
C               *     IRRADIANCE PROFILE PEAK                     *
C               *                                                 *
C               ***************************************************
C
      AXANG = 57.29578*ATAN2( YPM - YP, XPM - XP )
      AXLEN = 2.96
      TIC = AXLEN/9.0
      CALL AXISM( XP, YP, ' ', -1, AXLEN, AXANG, 0.0, 30.0, TIC, 3 )
      GO TO 106
C
C               ***************************************************
C               *                                                 *
C               *     MESSAGES                                    *
C               *                                                 *
C               ***************************************************
C
780   WRITE(6,800)
800   FORMAT(///30X,'*** EOF ON SYSIN - END OF JOB ***')
      CALL PLOT( 0, 0, 999 )
      STOP
      END
```

Figure H-3. Automatic hemispherical scan data reduction program listing (sheet 5 of 8).

```
SATCOM DOWN LINK DATA REDUCTION     14/16/35     76.107                    PAGE   1

INPUT DATA FOR PROGRAM SATCOM DOWN LINK

CARD NO.
   1      &INPUT
   2        TAPE = 4,  FILE = 2,  DWELL = 0.25,  FLUX = 1.02E-3,  DEPTH = 70,
   3      &END
   4      &INPUT
   5        TAPE = 8,  FILE = 3,  DWELL = 0.25,  FLUX = 9.7E-4,  DEPTH = 80,
   6      &END
   *      /*
```

Figure H-3. Automatic hemispherical scan data reduction program listing (sheet 6 of 8).

SATCON DOWN LINK DATA REDUCTION 14/16/35 76.107 PAGE 2

Figure H-3. Automatic hemispherical scan data reduction program listing (sheet 7 of 8).

SATCOM DOWN LINK DATA REDUCTION   14/16/35   76.107   PAGE 3

```
26 JUN 1975     16:57:34.617
TAPE NO.   8, FILE NO.   2
SURFACE FLUX =         1.020E-03 WATTS/CM-SQ
DWELL =      0.25
DEPTH =  21.3 METERS(   70.0 FEET)
GAINS =    3,  3,  3
WIND SPEED =

IRRADIANCE PEAK AT   36.4 DEGREES ZENITH ANGLE,  272.8 DEGREES AZIMUTH
           SUN AT   53.1 DEGREES ZENITH ANGLE,  275.6 DEGREES AZIMUTH
```

FIELD OF VIEW	LOSS DB	FIELD OF VIEW	LOSS DB	FIELD OF VIEW	LOSS DB
5.	-26.07	10.	-20.41	15.	-17.49
20.	-15.44	25.	-14.50	30.	-13.71
35.	-13.09	40.	-12.60	45.	-12.22
50.	-11.92	55.	-11.71	60.	-11.56
65.	-11.45	70.	-11.38	75.	-11.34
80.	-11.32	85.	-11.31	90.	-11.31

Figure H-3. Automatic hemispherical scan data reduction program listing (sheet 8 of 8).

APPENDIX I

GENERAL DESCRIPTION OF DOWNMODEL

This program is used to evaluate two of the integrals in Appendix A. The first section of the program calculates and stores functions which are common to both integrals. The different integrals are evaluated in subsequent sections of the program. Evaluation of either or both integrals is selected by program input. The first of the integrals which may be evaluated is

$$I(x, y, z, \gamma_x', \gamma_y') = f_1 + \iint_R \left\{ (1 - e^{-sz} - A)\Delta I + A\Delta I \Big|_{\overline{\theta^2} = \overline{\theta^2_{eff}}} \right\} dx_o \cdot dy_o \tag{I-1}$$

where ΔI is defined in equations (43) through (46) of Appendix A.

The term f_1 is given by

$$f_1 = \frac{1}{2\pi(\theta_1^2 + \theta_o^2)} \exp\left[-(a + s)z\sec\sqrt{\overline{\gamma_x^2} + \overline{\gamma_y^2}} - \frac{(\gamma_x' - \overline{\gamma}_x)^2 + (\gamma_y' - \overline{\gamma}_y)^2}{2(\sigma_1^2 + \theta_o)} \right] \tag{I-2}$$

where,

$$\sigma_1^2 = \left[\left(\frac{e_1}{2}\right)^2 + \left(\frac{e_2}{2}\right)^2 + \left(1 - \frac{n}{n'}\right) var(R) \right]. \tag{I-3}$$

e_1 is the angular diameter of the source,

e_2 is the angular diameter of the receiver field of view,

θ_o^2 = variance of source distribution at the surface.

The term A is defined as

$$A = .255(sz')\exp^{-sz'2.31} . \tag{I-4}$$

The notation $A\Delta I_{\overline{\theta^2}=\overline{\theta^2_{eff}}}$ means that this integration is performed with A and ΔI evaluated at an effective value of $\overline{\theta^2}$. This is accomplished by multiplying the original $\overline{\theta^2}$ by

$$\overline{\theta^2} = \frac{1}{36} \log \left\{ \frac{\exp(sz'/\sqrt{1+9/sz'}) - 1}{\exp(sz'/\sqrt{1+81/sz'}) - 1} \right\} . \qquad \text{(I-5)}$$

The calculations are further generalized to allow the water properties a, s, and $\overline{\theta^2}$ to be functions of the depth. This is done by dividing the water into n layers of arbitrary thickness. The top of the i^{th} layer is at depth z_{i-1} and the bottom of this layer is at depth z_i. The water in this layer is assigned a scattering coefficient s_i, an attenuation coefficient a_i, and a variance in $f(\theta)$ of $\overline{\theta_i^2}$. z' is defined by

$$z' = \left[z_n^2 + (x - x_0)^2 + (y - y_0)^2 \right]^{1/2} .$$

Then the terms az', sz', $(a + s)z'$, $s\overline{\theta^2}z'$, and $s\overline{\theta^2}z'^3$ in the original equations are replaced by the following terms respectively

$$\frac{z'}{z_n} \sum_{i=1}^{n} a_i \, dz_i , \qquad \text{(I-6)}$$

$$\frac{z'}{z_n} \sum_{i=1}^{n} s_i \, dz_i , \qquad \text{(I-7)}$$

$$\frac{z'}{z_n} \sum_{i=1}^{n} (a_i + s_i) dz_i , \qquad \text{(I-8)}$$

$$\frac{z'}{z_n} \sum_{i=1}^{n} s_i \, \overline{\theta_i^2} \, dz_i , \qquad \text{(I-9)}$$

$$\left(\frac{z'}{z_n}\right)^3 \sum_{i=1}^{n} s_i \, \overline{\theta_i^2} \left(z_i^3 - z_{i-1}^3 \right) ,$$

where

$$dz_i = z_i - z_{i-1} . \qquad \text{(I-10)}$$

Also evaluated by this program is the integral

$$I(x, y, z, \Omega) = \iint_R \left\{(1 - e^{-sz'}A)\Delta I^* + A\Delta I^*\right\}\Big|_{\theta^2 = \overline{\theta^2_{eff}}} dx_o\, dy_o \tag{I-11}$$

where ΔI^* is the integral in equation (52) of Appendix A. In both integrals, the region of integration R is defined by

$$-5/3\, z_n < x_o < 5/3\, z_n$$

$$-4/3\, z_n < y_o < 4/3\, z_n \,. \tag{I-12}$$

The program has the option of blanking out a region in the x_o - y_o plane corresponding to the location of the barge used in the experiment. The shadow of the pipe holding the camera platform will also be considered if this option is selected.

As part of the input data, the program requires the date and time (PDT). This information is used to compute the azimuth and zenith angle of the sun, and the x_o, y_o coordinate system is oriented so that the $+x_o$ axis is directed toward the sun. The known orientation of the barge, camera, and sun are used to define a coordinate transformation from x_o - y_o to x'' - y'' with the x'' - y'' coordinates having the origin at the corner of the barge, and $-x''$ axis along one end with $-y''$ axis along one side of the barge. This transformation is used to simplify the determination of whether or not points in R fall on the barge or not. The relationship of the barge, camera, and various coordinate systems are illustrated in figure I-1.

INPUT DATA. All data for the program are read from cards using NAMELIST name INPUT. The following variables are defined:

ZL	– a real array of dimension 50 giving the depths in meters of the water layers, ZL(I) is depth of top of layer I. ZL(I + 1) is the depth of the bottom of the layer.
AL	– a real array of dimension 50 giving the scattering coefficient in each layer of water
S	– a real array of dimension 50 giving the scattering coefficient in each layer of water
THBRSQ	– a real array giving the value of $\overline{\theta^2}$ in each layer of water.
LAYERS	– the number of values of ZL, i.e., 1 more than the number of water layers.
NXGD	– an integer variable giving the number of grid points in R parallel to the x_o axis. Default value is NXGD = 90. Values less than 90 may be input, 90 is the maximum value unless the program is modified to increase the dimension of all arrays that depend on this number.
NYGD	number of grid points in R parallel to the y_o axis. Default (and maximum) value is NYGD = 60.
VARR	– a real variable specifying the value of var(R).

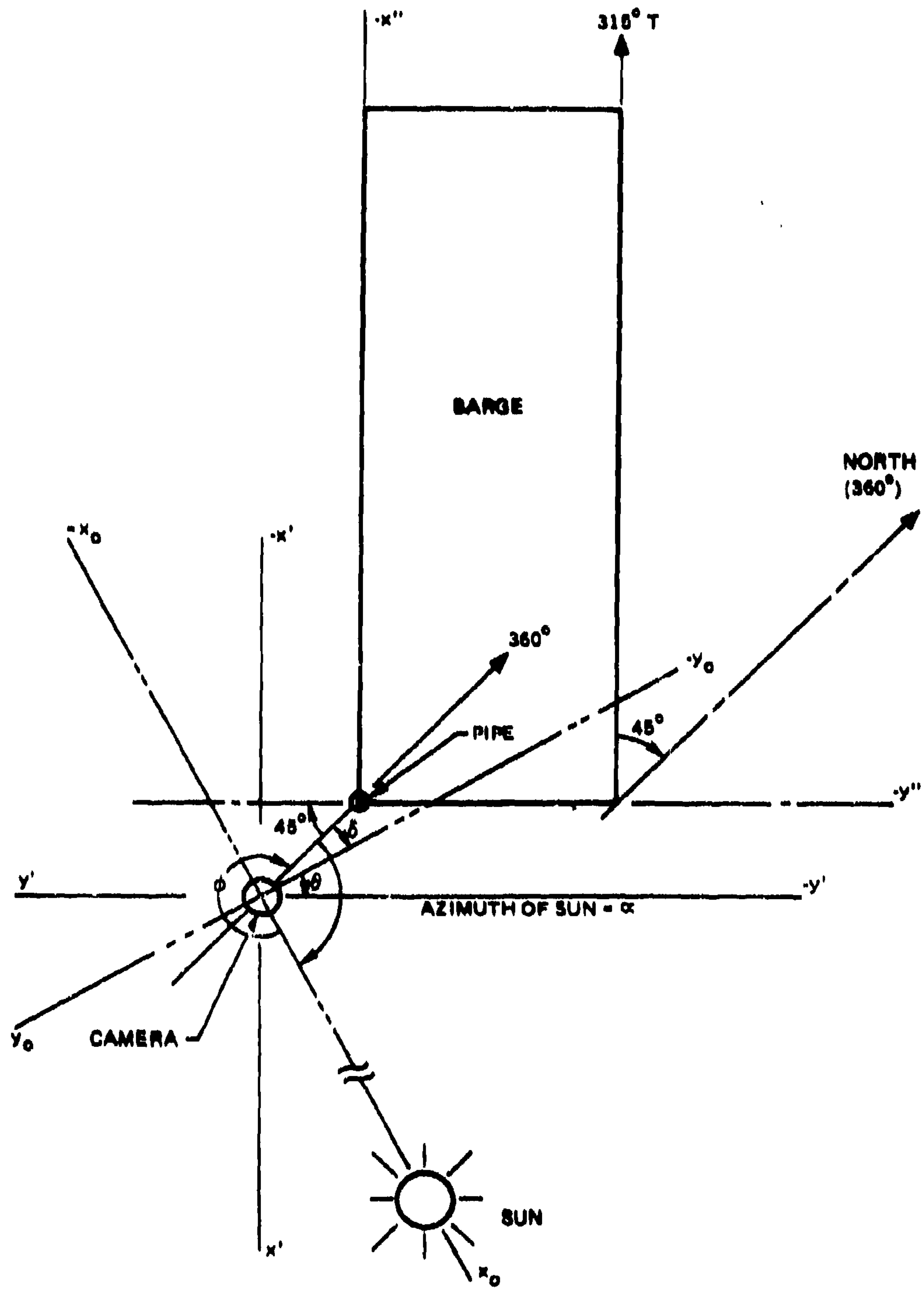


Figure I-1. Coordinate system for program DNMODEL.

FOVIEW	–	a real variable specifying the angular diameter in degrees of the detector field of view. Default value is 1°.
GAMP1, GAMP2, STEP1	–	real variables specifying the range and increment for γ_x' in the evaluation of equation (I-1). γ_x' takes values from GAMP1 to GAMP2 in steps of STEP1. All units are degrees. Default values are -90, 90, and 10.
GAMP3, GAMP4, STEP2	–	real variables which allow a different step size in γ_x' over a subinterval of the range GAMP1, GAMP2.
THZERO	–	a real variable specifying a value in degrees for θ_0, the variance of the source distribution at the surface.
GPY	–	a real variable specifying a value for γ_y' in degrees.
BARGE	–	a logical variable specifying whether or not to consider the barge in the calculations. BARGE = .FALSE. will cause the barge to be ignored. Default value is .TRUE.
TIME	–	An integer array of dimension four for specifying the date and time. TIME(1) = month, TIME(2) = day of month, TIME(3) = hour of day (PDT), TIME(4) = minute.
DEL1, DEL2, STEPD	–	real variables specifying the range and increment for values of Δ in the evaluation of equation (I-11). Units are degrees and default values are 5, 90, and 5.
BETAX, BETAY	–	real variables specifying values for the terms $(1 - n/n')\bar{R}_x$ and $(1 - n/n')\bar{R}_y$ which appear in the evaluation of equation (I-11). See equation (53) of Appendix A.
XPEAK, YPEAK	–	real variables specifying the values of γ_x' and γ_y' at which the irradiance distribution has its peak. This point is the origin for Δ in equation (I-11). Default values are 0, 0 if equation (I-1) is not evaluated. If equation (I-1) is evaluated, the actual location of the peak is used and any values read in are ignored.
IRPROF	–	a logical variable specifying whether or not to evaluate equation (I-1). Default value is .TRUE.
INTPWWR	–	a logical variable specifying whether or not to evaluate equation (I-11). Default value is .TRUE.

OUTPUT DATA. A sample of the printed output from this program follows the program listing. The first page is a copy of the input cards. Page 2 is a list of parameters for the first set of input data, and includes the depth profiles of a, s, and θ^2. Page 3 contains the results of evaluating equation (I-1). The columns labeled GPX and GPY are the values of γ_x' and γ_y'. The column labeled SUM is the value of equation (I-1) at this point. The column labeled F1 is the value of f_1 equation (I-2). The column labeled SUM1 is the term

$$\iint_R (1 - e^{-sz'} - A)\Delta I \, dx_0 \, dy_0 \,, \qquad \text{(I-13)}$$

and the column labeled SUM2 is the term

$$\iint_R A\Delta I \Big|_{\overline{\theta^2} = \overline{\theta^2_{eff}}} dx_0 \, dy_0 \,. \qquad \text{(I-14)}$$

The columns labeled zenith and azimuth are just γ'_x, γ'_y converted to polar coordinates with the 000° azimuth taken in the $X_0 - Z$ plane. Page 4 of the printed output is the result of evaluating equation (I-11). The column labeled DELTA is the radius of the field of view in degrees. The column labeled UPPER BOUND is equation (I-11) integrated over the outer square of figure 12 in Appendix A. The column labeled LOWER BOUND is the value of the integral over the inner square of the same figure. The column labeled ASMPTOTE is the theoretical value approached as Δ goes to 090°. This value is obtained by setting $G = 1$ in equation (53) of Appendix A. A plot is also generated for equation (I-1); a sample is shown in figure I-2.

Figure I-3 represents a program listing on 19 pages of the downlink model.

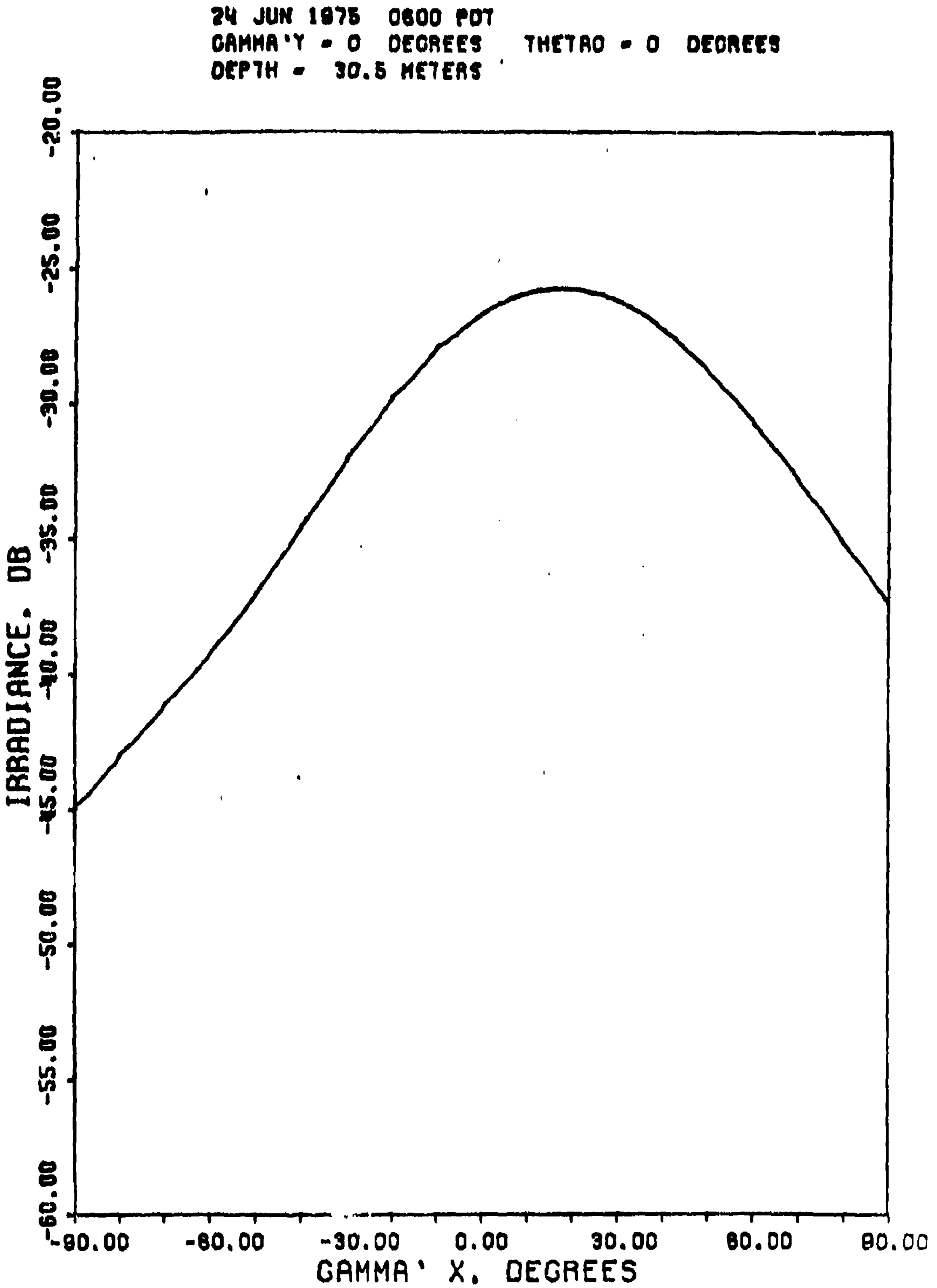


Figure I-2. Sample plot from program DNMODEL.

```
SATCOM DOWN LINK MODEL      13/48/ 0      76.167                    PAGE   1

INPUT DATA FOR DOWN LINK MODEL

CARD NO.
  1         SCRIPPS DATA FOR 24 JUNE 1975  1222 PDT
  2       &INPUT
  3         ZL = 0, 2.5, 3.1, 3.9, 4.8, 5.3, 6.2, 7.4, 8.4, 9.5, 10.6, 11.7, 12.8, 13.8,
  4         15.0, 15.9, 17.1, 18.1, 19.2, 20.2, 21.3, 22.6, 23.3, 24.4, 25.5, 26.5,
  5         27.5, 28.6, 29.5, 30.6, 31.7, 32.7, 33.7, 34.8, 35.9, 36.8, 37.9, 39.0,
  6         39.9, 41.0, 42.1, 43.2, 44.2, 45.4, 46.4, 47.5, 48.5, 49.7,
  7         A = .104, .104, .104, .104, .105, .105, .135, .105, .105, .106, .106,
  8         .107, .109, .111, .114, .123, .121, .124, .125, .124, .122, .121,
  9         .120, .121, .121, .122, .119, .120, .119, .119, .118, .117, .115, .116, .115,
 10         .114, .114, .113, .111, .111, .111, .110, .110, .109, .109, .109,
 11         .108,
 12         S = .398, .093, .111, .116, .129, .135, .149, .137, .149, .155, .181,
 13         .198, .257, .343, .427, .532, .647, .743, .734, .756, .689, .657, .639,
 14         .651, .649, .672, .592, .610, .602, .583, .547, .539, .508, .478, .466,
 15         .429, .416, .335, .345, .330, .318, .312, .287, .281, .269, .257, .219,
 16         THARS3 = .128, .127, .118, .115, .107, .104, .102, .103, .098, .095,
 17         .086, .081, .068, .056, .049, .038, .038, .034, .033, .034, .036, .037,
 18         .038, .037, .037, .037, .040, .039, .039, .343, .342, .042, .044, .046,
 19         .046, .049, .050, .053, .057, .058, .060, .350, .064, .065, .066, .068,
 20         .076,
 21         STEPD = 10,          THZERO = 45,
 22         ZL(45) = 45.72,  LAYERS = 45,
 23                          LAYERS = 45,  GAMP3 = 0,  GAMP4 = 40,  STEP2 = 2,
 24         TIME = 6, 24, 6, 0,
 25        &END
 26        &INPUT
 27         TIME = 6, 24, 7, 0,
 28        &END
 28       /*
```

Figure I-3. Program listing for downlink model (sheet 1 of 19).

```
SATCOM DOWN LINK MODEL      13/48/ 0      76.167                    PAGE  2

DEPTH =      45.7 METERS
GAMMAX =     88.1 DEGREES, GAMMA BAR X =    48.7 DEGREES
GAMMAY =      0.0 DEGREES, GAMMA BAR Y =     0.0 DEGREES
VAR(R) =  0.0    , THETA) =    45.0 DEGREES
FIELD OF VIEW =   1.0 DEGREES

AZIMUTH OF SUN =   63.0 DEGREES
CO-ORDINATE ROTATION ANGLE =     72.0 DEGREES
CORNER OF BARGE AT (XO,YO) = (  2.77E-01, -5.43E-01)
```

DEPTH METERS	A	S	THSRSQ
0.0	1.04E-01	9.80E-02	1.28E-01
2.6	1.04E-01	9.90E-02	1.27E-01
3.1	1.04E-01	1.11E-01	1.18E-01
3.9	1.04E-01	1.16E-01	1.15E-01
4.8	1.05E-01	1.29E-01	1.07E-01
5.3	1.05E-01	1.35E-01	1.04E-01
6.2	1.05E-01	1.40E-01	1.02E-01
7.4	1.05E-01	1.37E-01	1.03E-01
8.4	1.05E-01	1.49E-01	9.80E-02
9.5	1.06E-01	1.55E-01	9.50E-02
10.6	1.06E-01	1.81E-01	8.60E-02
11.7	1.07E-01	1.98E-01	8.10E-02
12.8	1.09E-01	2.57E-01	6.80E-02
13.8	1.11E-01	3.48E-01	5.60E-02
15.0	1.14E-01	4.27E-01	4.90E-02
15.9	1.20E-01	6.32E-01	3.80E-02
17.1	1.21E-01	6.47E-01	3.80E-02

Figure I-3. Program listing for downlink model (sheet 2 of 19).

SATCOM DOWN LINK MODEL		13/48/ 0	76.167	PAGE 3
18.1	1.24E-01	7.49E-01	3.40E-02	
19.2	1.25E-01	[illegible].84E-01	3.30E-02	
20.2	1.24E-01	7.56E-01	3.40E-02	
21.3	1.22E-01	6.89E-01	3.60E-02	
22.4	1.21E-01	6.57E-01	3.70E-02	
23.3	1.20E-01	6.39E-01	3.80E-02	
24.4	1.21E-01	6.51E-01	3.70E-02	
25.5	1.21E-01	6.49E-01	3.70E-02	
26.5	1.22E-01	6.72E-01	3.70E-02	
27.5	1.19E-01	5.92E-01	4.00E-02	
28.6	1.20E-01	6.10E-01	3.90E-02	
29.5	1.19E-01	6.02E-01	3.90E-02	
30.6	1.19E-01	5.89E-01	4.00E-02	
31.7	1.18E-01	5.47E-01	4.20E-02	
32.7	1.17E-01	5.39E-01	4.20E-02	
33.7	1.16E-01	5.08E-01	4.40E-02	
34.8	1.16E-01	4.78E-01	4.60E-02	
35.9	1.15E-01	4.66E-01	4.60E-02	
36.8	1.14E-01	4.29E-01	4.90E-02	
37.9	1.14E-01	4.16E-01	5.00E-02	
39.0	1.13E-01	3.85E-01	5.30E-02	
39.9	1.11E-01	3.45E-01	5.70E-02	
41.0	1.11E-01	3.30E-01	5.80E-02	
42.1	1.11E-01	3.18E-01	6.00E-02	
43.2	1.10E-01	3.12E-01	6.00E-02	

Figure I-3. Program listing for downlink model (sheet 3 of 19).

```
SATCOM DOWN LINK MODEL      13/49/ 0     76.167                    PAGE   4

 44.2
               1.10E-C1    2.87E-01    6.40E-02
 45.4
               1.09E-01    2.81E-01    6.50E-02
 45.7
```

Figure I-3. Program listing for downlink model (sheet 4 of 19).

SATCOM DOWN LINK MODEL 13/48/ 0 76.167 PAGE 5

GRID CORNERS: (-76.2, 61.0) (76.2, 61.0)
(-76.2, -61.0) (76.2, -61.0)

GPX DEG	GPY DEG	SUM	F1	SUMI	SUM2	ZENITH DEG	AZIMUTH DEG
-90.0	0.0	6.543E-06	2.874E-19	6.543E-06	5.209E-11	90.0	0.0
-80.0	0.0	1.057E-05	5.562E-19	1.057E-05	2.273E-10	80.0	180.0
-70.0	0.0	1.637E-05	1.025E-18	1.637E-05	8.960E-10	70.0	180.0
-60.0	0.0	2.436E-05	1.796E-18	2.436E-05	3.062E-09	60.0	180.0
-50.0	0.0	3.491E-05	2.998E-18	3.493E-05	8.873E-09	50.0	180.0
-40.0	0.0	4.827E-05	4.761E-18	4.820E-05	2.111E-08	40.0	180.0
-30.0	0.0	6.412E-05	7.109E-18	6.408E-05	4.350E-08	30.0	180.0
-20.0	0.0	8.172E-05	1.036E-17	8.166E-05	6.439E-08	20.0	180.0
-10.0	0.0	9.913E-05	1.419E-17	9.903E-05	9.668E-08	10.0	180.0
0.0	0.0	1.138E-04	1.850E-17	1.136E-04	1.436E-07	0.0	0.0
2.0	0.0	1.161E-04	1.939E-17	1.159E-04	1.544E-07	2.0	0.0
4.0	0.0	1.181E-04	2.029E-17	1.180E-04	1.650E-07	4.0	0.0
6.0	0.0	1.199E-04	2.118E-17	1.199E-04	1.753E-07	6.0	0.0
8.0	0.0	1.214E-04	2.207E-17	1.212E-04	1.847E-07	8.0	0.0
10.0	0.0	1.226E-04	2.296E-17	1.224E-04	1.933E-07	10.0	0.0
12.0	0.0	1.234E-04	2.383E-17	1.232E-04	1.996E-07	12.0	0.0
14.0	0.0	1.239E-04	2.468E-17	1.237E-04	2.043E-07	14.0	0.0
16.0	0.0	1.241E-04	2.552E-17	1.238E-04	2.059E-07	16.0	0.0
18.0	0.0	1.238E-04	2.633E-17	1.236E-04	2.073E-07	18.0	0.0
20.0	0.0	1.233E-04	2.711E-17	1.231E-04	2.047E-07	20.0	0.0
22.0	0.0	1.223E-04	2.787E-17	1.221E-04	1.993E-07	22.0	0.0
24.0	0.0	1.210E-04	2.858E-17	1.209E-04	1.929E-07	24.0	0.0
26.0	0.0	1.194E-04	2.926E-17	1.192E-04	1.839E-07	26.0	0.0
28.0	0.0	1.174E-04	2.989E-17	1.173E-04	1.730E-07	28.0	0.0
30.0	0.0	1.152E-04	3.048E-17	1.150E-04	1.637E-07	30.0	0.0
32.0	0.0	1.126E-04	3.102E-17	1.124E-04	1.475E-07	32.0	0.0
34.0	0.0	1.097E-04	3.151E-17	1.096E-04	1.337E-07	34.0	0.0
36.0	0.0	1.066E-04	3.193E-17	1.065E-04	1.197E-07	36.0	0.0
38.0	0.0	1.033E-04	3.231E-17	1.032E-04	1.059E-07	38.0	0.0
40.0	0.0	9.973E-05	3.262E-17	9.964E-05	9.256E-08	40.0	0.0
50.0	0.0	8.001E-05	3.322E-17	7.997E-05	3.957E-08	50.0	0.0
60.0	0.0	5.941E-05	3.221E-17	5.939E-05	1.303E-08	60.0	0.0
70.0	0.0	4.090E-05	2.972E-17	4.090E-05	3.411E-09	70.0	0.0
80.0	0.0	2.618E-05	2.610E-17	2.618E-05	7.531E-10	80.0	0.0
90.0	0.0	1.564E-05	2.182E-17	1.564E-05	1.527E-10	90.0	0.0

PEAK VALUE = 1.2606E-04 AT GAMMA* = 15.79 DEGREES
EXP(-1/2) POINTS AT -23.4, 52.1

MEAN ABSORPTION = 1.136E-01
MEAN SCATTERING = 4.144E-01
MEAN ALPHA = 5.250E-01

Figure I-3. Program listing for downlink model (sheet 5 of 19).

SATCOM DOWN LINK MODEL 13/48/ 3 76.167 PAGE 6

DELTA	I(X,Y,Z,OMEGA) UPPER BOUND	LOWER BOUND	ASYMPTOTE
5.000	2.5137E-06	1.2574E-06	5.2651E-04
15.000	2.2384E-05	1.1265E-05	5.2651E-04
25.000	6.9792E-05	3.0942E-05	5.2651E-04
35.000	1.1468E-04	5.9620E-05	5.2651E-04
45.000	1.7912E-04	9.6129E-05	5.2651E-04
55.000	2.4780E-04	1.3883E-04	5.2651E-04
65.000	3.1402E-04	1.8565E-04	5.2651E-04
75.000	3.7287E-04	2.3427E-04	5.2651E-04
85.000	4.2106E-04	2.8221E-04	5.2651E-04

K = 1.651E-01

Figure I-3. Program listing for downlink model (sheet 6 of 19).

```
//LAYERS JOB (027900,J425A04,F,D,10,5),JMARTIN,MSGLEVEL=1,CLASS=C
/*MESSAGE      Q11
/*SETUP        (TAPE7=1)
// EXEC FORTHCLG,PARM.FORT='MAP,XREF,NODECK',REGION.GO=340K,
// TIME.GO=10
//FORT.SYSUT2 DD UNIT=SYSDA,SPACE=(1024,(200,100))
//SYSIN DD *
C
C        **********************************************************
C        *                                                        *
C        *    LAYERED MODEL FOR UNDERWATER IRRADIANCE             *
C        *    PROFILES                                            *
C        *                                                        *
C        **********************************************************
C
      LOGICAL*1     SHADOW(60,90), BARGE, HOLE, IRPROF, INTPWR
C
      INTEGER       TIME(4), MONTH(12) / 0, 31, 59, 90, 120, 151, 181,
     #                            212, 243, 273, 304, 334 /,
     #              MON(12) /'JAN ', 'FEB ', 'MAR ', 'APR ',
     #                       'MAY ', 'JUN ', 'JUL ', 'AUG ',
     #                       'SEP ', 'OCT ', 'NOV ', 'DEC '/,
     #              ATIME
C
      REAL          SUM(200), DEPTH(200), THM(60,90), EXPMNU(60,90),
     #              TERMB(60,90), TERMBE(60,90), ZL(50), THRSU(50),
     #              A(50), S(50), LLX, LLY, MU, KAPPA, EX(90),
     #              EPX(90), XSU(90), EY(60), EPY(60), YSU(60),
     #              LAMDA, NU, UUPI(60,90), UUPIE(60,90), TERMA(60,90),
     #              TERMAE(60,90), AF(60,90), THME(60,90), AUZ,
     #              XZ(90), YZ(60), THETA(200), PHI(200), SUML(25),
     #              SUMU(25), SUMA(25), DELTA(25), UP(60,90),
     #              UPE(60,90), BUFFER(1024), KAPPAZ
C
      REAL*8        DAY, DEC, EQNT
C
      DATA          DTR /0.0174533/, AN /1.0/, ANP /1.33/,
     #              CLAT /0.98692/, CLUN /2.0679/, PIPE /0.1807/
C
      NAMELIST      /INPUT/   X, Y, ZL, A, S, THRSO, LAYERS,
     #                        NXGD, NYGD, VARR, FOVIEW, GAMP1, GAMP2,
     #                        GAMP3, GAMP4, STEP1, STEP2, THZERO, AN,
     #                        ANP, GPY, BARGE, TIME, DEL1, DEL2, STEPD,
     #                        BETAX, BETAY, XPEAK, YPEAK, IRPROF,
     #                        INTPWR
C
      GSTINT(X,Y) = Y*AINT( (X/Y) - 0.5*( 1.0 - (X/ABS(X) ) ) )
C
C
C        **********************************************************
C        *                                                        *
C        *    COPY INPUT DATA AND ASSIGN DEFAULT VALUES           *
```

Figure I-3. Program listing for downlink model (sheet 7 of 19).

```
C          *                                                            *
C          **************************************************************
C
      CALL COPY( 8, E640 )
C
      BARGE = .TRUE.
      X = 0.0
      Y = 0.0
      GAMMAY = 0.0
      GPY = 0.0
      NXGD = 90
      NYGD = 60
      VARR = 0.0
      FOVIEW = 1.0
      GAMP1 = -90.0
      GAMP2 = 91.0
      GAMP3 = 0.0
      GAMP4 = 0.0
      STEP1 = 10.0
      STEP2 = 10.0
      THZERO = 0.0
      DEL1 = 5.0
      DEL2 = 91.0
      STEPD = 5.0
      BETAX = 0.0
      BETAY = 0.0
      XPEAK = 0.0
      YPEAK = 0.0
      INPPOF = .TRUE.
      INTPWR = .TRUE.
      CALL PLOTS( BUFFER, 1024, 99 )
      CALL PLOT ( 5.0, -11.0, -3 )
  100 CONTINUE
C
C          **************************************************************
C          *                                                            *
C          *      READ INPUT DATA, CONVERT ANGLES TO RADIANS, AND       *
C          *      COMPUTE CONSTANT QUANTITIES                           *
C          *                                                            *
C          **************************************************************
      READ( 8,INPUT,END=640 )
      FOV = FOVIEW*DTR
      VPFAC = ( 1.0 - AN/ANP )*VARR
      SIGSQ = 2.0*( 1.90386E-5 + FOV*FOV/4.0 + VPFAC )
      SYGSQ = 2.0*( THZERO*DTR )**2
      VPFAC = VPFAC*( 1.0 - AN/ANP ) + SYGSQ
      Z = ZL(LAYERS)
      ZSQ = Z*Z
      ULX = 5.0*Z/3.0
      LLX = -ULX
      ULY = 4.0*Z/3.0
      LLY = -ULY
      DX = ( ULX - LLX )/NXGD
```

Figure I-3. Program listing for downlink model (sheet 8 of 19).

```
      DY = ( ULY - LLY )/NYGD
      DADY = DX*DY/9.869604
      DXDYPI = DX*DY/3.141593
C
C           ************************************************************
C           *                                                          *
C           *    INITIALIZE SHADOW ARRAY AND CALCULATE CO-ORDINATE     *
C           *    TRANSFORMATION                                        *
C           *                                                          *
C           ************************************************************
C
      DO 104 J = 1,60
        DO 102 I = 1,60
          SHADOW(I,J) = .FALSE.
102     CONTINUE
104   CONTINUE
C
      DAY = TIME(2) + MONTH( TIME(1) )
      IHOUR = TIME(3) + 7
      IF ( IHOUR .LT. 24 )  GO TO 106
        IHOUR = IHOUR - 24
        DAY = DAY + 1.0
106   CONTINUE
      DAY = DAY + IHOUR/24.0 + TIME(4)/1440.0
      CALL ALMNAC( 1975, DAY, DEC, EQNT )
      SLON = ( IHOUR + 12.0 + ( EQNT + TIME(4) )/60.0 )*15.0
      SLON = AMOD( SLON, 360.0 )*DTR
      SLAT = ( 90.0 - DEC )*DTR
      ZENTHS = ARCOS( COS( CLAT )*COS( SLAT ) + SIN( CLAT )*SIN( SLAT )*
     $              COS( CLON - SLON ) )
      SP = ( CLAT + SLAT + ZENTHS )/2.0
      AZIMS = 2.0*ATAN( SQRT( SIN( SP - CLAT )*SIN( SP - ZENTHS )/
     $          ( SIN( SP - SLAT )*SIN( SP ) ) ) )
      IF ( SLON .GT. CLON )  AZIMS = 6.28319 - AZIMS
      ROTAT = 2.35619 - AZIMS
      BARANG = 6.28319 - AZIMS
      CT = COS( ROTAT )
      ST = SIN( ROTAT )
      RCP = 0.609601*COS( BARANG )
      RSP = 0.609601*SIN( BARANG )
      GAMMAX = ZENTHS/DTR
      GBX = GAMMAX*DTR
      GBX = ARSIN( AN*SIN( GBX )/AMP )
      GBY = GAMMAY*DTR
      GBY = ARSIN( AN*SIN( GBY )/AMP )
      GPY = GPY*DTR
      GY = GPY - GBY
      GYSQ = GY*GY
      GBARX = GBX/DTR
      GBARY = GBY/DTR
        CALL HEDING( 7 )
        WRITE(6,120)  Z, GAMMAX, GBARX, GAMMAY, GBARY,
     $                VARR, THZERO, FOVIEW
```

Figure I-3. Program listing for downlink model (sheet 9 of 19).

```
120   FORMAT(    10X,'DEPTH = ',F7.1,' METERS'/
     #           10X,'GAMMAX = ',F6.1,' DEGREES, GAMMA BAR X = ',
     #               F6.1,' DEGREES'/
     #           10X,'GAMMAY = ',F6.1,' DEGREES, GAMMA BAR Y = ',
     #               F6.1,' DEGREES'/
     #           10X,'VAR(R) = ',F7.4,', THETAO = ',F6.1,' DEGREES'/
     #           10X,'FIELD OF VIEW = ',F5.1,' DEGREES'//)
C
      ROT = ROTAT/DTR
      AZIM = AZIMS/DTR
      IF ( .NOT. BARGE )  GO TO 124
      CALL HEDING( 5 )
      WRITE(6,122)  AZIM, ROT, PCP, KSP
122   FORMAT(10X,'AZIMUTH OF SUN = ',F6.1,' DEGREES'/
     #       10X,'CO-ORDINATE ROTATION ANGLE = ',F7.1,' DEGREES'/
     #       10X,'CORNER OF BARGE AT (XO,YO) = (',1PE10.2,',',
     #       1PE10.2,')'//)
C
124   CALL HEDING( 4 )
      WRITE(6,125)
125   FORMAT(/10X,'DEPTH',11X,'A',11X,'S',8X,'THBRSQ'/
     #         10X,'METERS'/)
      ILAST = LAYERS - 1
      DO 135 I = 1,ILAST
        CALL HEDING( 2 )
        WRITE(6,130)  Z(I), A(I), S(I), THBRSQ(I)
130     FORMAT(10X,F5.1/20X,1P3E12.2)
135   CONTINUE
      CALL HEDING( 1 )
      WRITE(6,130)  Z(LAYERS)
      CALL HEDING( 0 )
        CALL HEDING( 5 )
        WRITE(6,140)  LLX, ULY, ULX, ULY, LLX, LLY, ULX, LLY
140     FORMAT(10X,'GRID CORNERS:   (',F6.1,',',F6.1,')  (',F6.1,',',
     #          F6.1,')'/
     #        25X,'(',F6.1,',',F5.1,')  (',F6.1,',',F6.1,')'//
     #        11X,'GPX',5X,'GPY',6X,'SUM',10X,'FI',10X,'SUM1',
     #        6X,'SUM2',5X,'ZENITH',4X,'AZIMUTH'/
     #        11X,'DEG     DEG',52X,'DEG',8X,'DEG'//)
      MU = 0.0
      PSI = 0.0
      ZETA = 0.0
      RHOP = 0.0
C     ************************************************************
C     *                                                          *
C     *      CALCULATE QUANTITIES WHICH ARE FUNCTIONS OF         *
C     *      LAYERING, BUT NOT FUNCTIONS OF XO, YO, OR           *
C     *      GAMMA PRIME                                         *
C     *                                                          *
C     ************************************************************
C
      DO 160 I = 2, LAYERS
```

Figure I-3. Program listing for downlink model (sheet 10 of 19).

```
      DZ = ZL(I) - ZL(I-1)
      MU = MU + THBRSQ(I-1)*S(I-1)*DZ
      PSI = PSI + S(I-1)*DZ
      ZETA = ZETA + A(I-1)*DZ
      RHOF = RHOF + THBRSQ(I-1)*S(I-1)*( ZL(I)**3 - ZL(I-1)**3 )
  160 CONTINUE
     MUZ = MU/Z
     PSIZ = PSI/Z
     ZETAZ = ZETA/Z
     RHOP = RHOF/Z**3
     KAPPA = ZETA + PSI
     KAPPAZ = KAPPA/Z
C
C        ****************************************************************
C        *                                                              *
C        *      CALCULATE QUANTITIES WHICH ARE FUNCTIONS OF             *
C        *      Z AND XO ONLY                                           *
C        *                                                              *
C        ****************************************************************
C
      DO 180 I = 1,AXGD
        XO = ( I - 0.5 )*DX + LLX
        TEMP = XO - X
        XZ(I) = TEMP
        XSQ(I) = TEMP*TEMP
        RX = SQRT( ZSQ + XSQ(I) )
        EX(I) = ( -GDX + ARSIN( TEMP/RX ) )*RX
        EPX(I) = SIGN( 1.0, EX(I) )*ABS( TEMP )
        EX(I) = EX(I)**2
  180 CONTINUE
C
C        ****************************************************************
C        *                                                              *
C        *      CALCULATE QUANTITIES WHICH ARE FUNCTIONS OF             *
C        *      Z AND YO ONLY                                           *
C        *                                                              *
C        ****************************************************************
C
      DO 200 I = 1,AYGD
        YO = ( I - 0.5 )*DY + LLY
        TEMP = YO - Y
        YZ(I) = TEMP
        YSQ(I) = TEMP*TEMP
        RY = SQRT( ZSQ + YSQ(I) )
        EY(I) = ( -GDY + ARSIN( TEMP/RY ) )*RY
        EPY(I) = SIGN( 1.0, EY(I) )*ABS( TEMP )
        EY(I) = EY(I)**2
  200 CONTINUE
C
C        ****************************************************************
C        *                                                              *
C        *      CALCULATE QUANTITIES WHICH ARE FUNCTIONS OF             *
C        *      Z, XO, AND YO, BUT NOT OF GAMMA PRIME                   *
```

Figure I-3. Program listing for downlink model (sheet 11 of 19).

```
C         *                                                              *
C         ****************************************************************
C
      DO 240 I = 1,NYGD
        YO = YZ(I) - RSP
        DO 220 J = 1,NXGD
          IF ( .NOT. PAPGE )  GO TO 210
          XO = XZ(J) - RCP
          XPP = CT*XO + ST*YO
          YPP = CT*YO - ST*XO
          SHADOW(I,J) = ( XPP .LT. 0.0 ) .AND. ( XPP .GT. -33.53 )
     #                .AND. ( YPP .LT. 0.0 ) .AND. ( YPP .GT. -12.19 )
          IF ( SHADOW(I,J) )  GO TO 220
  210     CONTINUE
          SR = XSQ(J) + YSQ(I)
          ZPRIME = SQRT( ZSQ + SR )
          SR = SQRT( SR )
          LAMDA = MUZ*ZPRIME
          VP = VPFAC/LAMDA
          NU = PSIZ*ZPRIME
          ETA = ZETAZ*ZPRIME
          RHO = RHOP*ZPRIME**3
          ASUPN = EXP( NU/SQRT( 1.0 + 9.0/NU ) ) - 1.0
          ASUBD = EXP( NU/SQRT( 1.0+ 81.0/NU ) ) - 1.0
          EXPMNU(I,J) = EXP( -NU )
          THBARG = ALOG( ASUBN/ASUBD )/36.0
          ASUBN = ASUBN*SQRT( SQRT( SQRT( ASUBN ) ) )
          ASUBD = SQRT( SQRT( SQRT( ASUBD ) ) )
          AF(I,J) = EXPMNU(I,J)*ASUBN/ASUBD
          VPE = VP/THBARG
          UUPI(I,J) = LAMDA*( 1.0 + 2.0*VP )/( 2.0 + 3.0*VP )
          UUPIE(I,J) = LAMDA*THBARG*( 1.0 + 2.0*VPE)/( 2.0 + 3.0*VPE )
          UP(I,J) = SQRT( UUPI(I,J) )
          UPE(I,J) = SQRT( UUPIE(I,J) )
          RR = RHO*( 0.666667 + VP )
          EXEY = EX(J) + EY(I)
          RRE = RHO*THBARG*( 0.666667 + VPE )
          TEMP = EXP( -ETA )
          XP = EXEY/RR
          IF ( XP .GT. 30.0 )  TERMA(I,J) = 0.0
          IF ( XP .LE. 30.0 )
     #    TERMA(I,J) = TEMP*EXP( -XP )/RR
          XP = EXEY/RRE
          IF ( XP .GT. 30.0 )  TERMAE(I,J) = 0.0
          IF ( XP .LE. 30.0 )
     #    TERMAE(I,J) = TEMP*EXP( -XP )/RRE
          IF ( TERMA(I,J) .LT. 1.0E-30 )  TERMA(I,J) = 1.0E-30
          IF ( TERMAE(I,J) .LT. 1.0E-30 )  TERMAE(I,J) = 1.0E-30
          EXEY = SQRT( EXEY )
          TEMP = ( 3.0 + 3.0*VP )/( 2.0 + 3.0*VP )*EXEY/ZPRIME
          TEMPE = ( 3.0 + 3.0*VPE )/( 2.0 + 3.0*VPE )*EXEY/ZPRIME
          TERMB(I,J) = -2.0*TEMP/SR
          TERMBE(I,J) = -2.0*TEMPE/SR
```

Figure I-3. Program listing for downlink model (sheet 12 of 19).

```
         THMI(I,J) = TEMP*TEMP
         THME(I,J) = TEMPE*TEMPE
220    CONTINUE
240   CONTINUE
C
C        ***********************************************************
C        *                                                         *
C        *        BEGIN GAMMA PRIME LOOP                           *
C        *                                                         *
C        ***********************************************************
C
      IF ( .NOT. IRPROF )  GO TO 540
      GAMPY = GPY/DTR
      GAMPX = GAPPI
      KGXP = 0
      HOLE = .FALSE.
260   CONTINUE
        KGXP = KGXP + 1
        SUMI = 0.0
        SUMIE = 0.0
        GPX = GAMPX*DTR
        ATEST = ABS( ABS( GPX ) - 1.570796 )
        IF ( ATEST .LE. 1.0E-5 )  TANGX = 1.0E5
        IF ( ATEST .GT. 1.0E-5 )  TANGX = TAN( GPX )
        ATEST = ABS( ABS( GPY ) - 1.570796 )
        IF ( ATEST .LE. 1.0E-5 )  TANGY = 1.0E5
      IF ( ATEST .GT. 1.0E-5 )  TANGY = TAN( GPY )
        ZLOS = ATAN( SQRT( TANGX**2 + TANGY**2 ) )
        IF ( GPX .EQ. 0.0 .AND. GPY .EQ. 0.0 )  ALOS = 0.0
        IF ( GPX .NE. 0.0 .OR. GPY .NE. 0.0 )
     #      ALOS = ATAN2( TANGY, TANGX )
        IF ( ALOS .LT. 0.0 )  ALOS = ALOS + 6.28319
          THETA(KGXP) = ZLOS/DTR
        PHI(KGXP) = ALOS/DTR
        IF ( .NOT. BARGE )  GO TO 265
        IF ( ZLOS .LT. ATAN( 0.609601/Z ) )  GO TO 265
        IF ( ALOS .LT. BARGE - PIPE .OR.
     #      ALOS .GT. BARGE + PIPE )  GO TO 265
C
C        ***********************************************************
C        *                                                         *
C        *        WE ARE LOOKING AT THE PIPE                       *
C        *                                                         *
C        ***********************************************************
C
        HOLE = .TRUE.
        FI = 0.0
        SUMI = 0.0
        SUMIE = 0.0
        GO TO 315
265     CONTINUE
C
C        ***********************************************************
```

Figure I-3. Program listing for downlink model (sheet 13 of 19).

```
C        *                                                            *
C        *     WE ARE NOT LOOKING AT THE PIPE - CALCULATE THE         *
C        *     INTEGRALS                                              *
C        *                                                            *
C        **************************************************************
C
      GX = GPX - GBX
      GXSQ = GX*GX
      DO 300 J = 1,NXGD
        DO 280 I = 1,NYGD
          IF ( SHADOW(I,J) )  GO TO 280
          TERMC = GXSQ + GYSQ + THM(I,J) + TERMB(I,J)*
     #             ( EPX(J)*GX + EPY(I)*GY )
          TERMC = TERMC/UUPI(I,J)
          IF ( TERMC .GT.  70.0 )  TERMD = 1.0E-30
          IF ( TERMC .LE.  70.0 )  TERMD = EXP( -TERMC )
          TERMCE = GXSQ + GYSQ + THME(I,J) + TERMBE(I,J)*
     #             ( EPX(J)*GX + EPY(I)*GY )
          TERMCE = TERMCE/UUPIE(I,J)
          IF ( TERMCE .GT.  70.0 )  TERMDE = 1.0E-30
          IF ( TERMCE .LE.  70.0 )  TERMDE = EXP( -TERMCE )
          SUMI = SUMI + ( 1.0 - EXPMNU(I,J) - AF(I,J) )
     #             *TERMA(I,J)*TERMD/UUPI(I,J)
          SUMIE = SUMIE + AF(I,J)*TERMAE(I,J)*TERMDE/UUPIE(I,J)
280     CONTINUE
300   CONTINUE
      XP = KAPPA/COS( SQRT( GBX*GBX + GBY*GBY ) )
     #     + ( GXSQ + GYSQ )/( SIGSQ + SYGSQ )
      IF ( XP .GT. 160.0 )  FI = 0.0
      IF ( XP .LT. 160.0 )  FI = EXP( -XP )/( 3.14159*(SIGSQ+SYGSQ))
      SUMI = SUMI*DXDY
      SUMIE = SUMIE*DXDY
315   CONTINUE
      SUM(KGXP) = FI + SUMI + SUMIE
      DGPX(KGXP) = GAMPX
     CALL HEDING(1)
C
      WRITE(6,320)  DGPX(KGXP), GAMPY, SUM(KGXP), FI, SUMI, SUMIE,
     #              THETA(KGXP), PHI(KGXP)
320   FORMAT(F15.1, F8.1, 1P4E12.3, 0PF8.1, F11.1 )
      IF ( GAMPX .GE. GAMP3 .AND. GAMPX .LT. GAMP4 )  STEP = STEP2
      IF ( (GAMPX .GE. GAMP1 .AND. GAMPX .LT. GAMP3) .OR.
     #     (GAMPX .GE. GAMP4 .AND. GAMPX .LT. GAMP2) )  STEP = STEP1
      GAMPX = GAMPX + STEP
     IF ( GAMPX .LE. GAMP2 )  GO TO 260
C
C        **************************************************************
C        *                                                            *
C        *     FINISHED WITH GAMMA' LOOP.  SEARCH FOR PEAK AND        *
C        *     SPREAD UNLESS WE HAVE A HOLE DUE TO THE PIPE           *
C        *                                                            *
C        **************************************************************
C
```

Figure I-3. Program listing for downlink model (sheet 14 of 19).

```
      IF ( HOLE )  GO TO 450
      ILAST = KGXP
      RMAX = 0.0
      DO 340 I = 1,ILAST
        IF ( SUM(I) .LT. RMAX )  GO TO 340
        RMAX = SUM(I)
        IMAX = I
340   CONTINUE
      Y1 = ALOG( SUM(IMAX-1) )
      Y2 = ALOG( RMAX )
      Y3 = ALOG( SUM(IMAX+1) )
      X1 = DGPX(IMAX-1)
      X2 = DGPX(IMAX)
      X3 = DGPX(IMAX+1)
      AK = ( X1*X1*(Y3 - Y2) + X2*X2*(Y1 - Y3) + X3*X3*(Y2 - Y1) )/
     #     ( (Y1 - Y3)*(X2 - X1) + (Y1 - Y2)*(X1 - X3) )
      AK = AK/2.0
      AA = (Y1 - Y2)/( (X1 - AK)**2 - (X2 - AK)**2 )
      AH = Y1 - AA*(X1 - AK)**2
      RMAX = EXP( AH )
      XPEAK = AK
      RTEST = EXP( AH - 0.5 )
      IL1 = IMAX - 1
      IL2 = KGXP - IMAX
      DO 360 I = 1,IL1
        IK = IMAX - I
        IF ( SUM(IK) .GT. RTEST )  GO TO 360
        ILEFT = IK
        GO TO 380
360   CONTINUE
380   CONTINUE
      DO 400 I = 1,IL2
        IK = IMAX + I
        IF ( SUM(IK) .GT. RTEST )  GO TO 400
        IRGHT = IK
        GO TO 420
400   CONTINUE
420   CONTINUE
      Y1 = ALOG( SUM(ILEFT) )
      Y2 = ALOG( SUM(ILEFT+1) )
      X1 = DGPX(ILEFT)
      X2 = DGPX(ILEFT+1)
      XLEFT = (X2 - X1)*(AH - 0.5 - Y1)/(Y2 - Y1) + X1
      Y1 = ALOG( SUM(IRGHT) )
      Y2 = ALOG( SUM(IRGHT-1) )
      X1 = DGPX(IRGHT)
      X2 = DGPX(IRGHT-1)
      XRGHT = (X2 - X1)*(AH - 0.5 - Y1)/(Y2 - Y1) + X1
      SPRD = ( XRGHT - XLEFT )/2.0
      SPRD = SPRD*DTR
      GPARX = AK
      GBX = AK*DTR
      CALL HEDING( 6 )
```

Figure I-3. Program listing for downlink model (sheet 15 of 19).

```
      WRITE(6,440)  RMAX, AK, XLEFT, XRGHT
440   FORMAT(//10X,'PEAK VALUE = ',1PE15.4,' AT GAMMA'' = ',0PF7.2,
     #       ' DEGREES'/
     #       10X,'EXP( -1/2 ) POINTS AT ',F6.1,',',F6.1//)
      CALL HEDING( 3 )
      WRITE(6,445)  ZETAZ, PSIZ, KAPPAZ
445   FORMAT(10X,'MEAN ABSORPTION = ',1PE12.3/
     #       10X,'MEAN SCATTERING = ',1PE12.3/
     #       10X,'MEAN ALPHA = ',1PE12.3)
450   CALL HEDING( 0 )
460   CONTINUE
      IF ( .NOT. HOLE )  GO TO 500
      RMAX = -1.0E50
      DO 480 I = 1,KGXP
        IF ( SUM(I) .EQ. 0.0 )  SUM(I) = 1.0E-70
        IF ( SUM(I) .GT. RMAX )  RMAX = SUM(I)
480   CONTINUE
500   CONTINUE
      RMAX = 10.0*ALOG10( RMAX )
      RMAX = -GSTINT( -RMAX, 10.0 )
      DO 520 I = 1,KGXP
        SUM(I) = 10.0*ALOG10( SUM(I) )
520   CONTINUE
      CALL PLOT( 0.0, 11.0, 2 )
      CALL PLOT( 8.50, 11.0, 2 )
      CALL PLOT( 8.50, 0.0, 2 )
      CALL PLOT( 0.0, 0.0, 2 )
      CALL PLOT( 1.5, 1.75, -3 )
      DGPX(KGXP+1) = -90.0
      DGPX(KGXP+2) = 30.0
      SUM(KGXP+1) = RMAX - 40.0
      SUM(KGXP+2) = 5.0
      CALL AXISM( 0.0, 0.0, 'GAMMA'' X, DEGREES', -17, 6.0, 0.0,
     #       -90.0, 30.0, 0.3333, 3 )
      CALL AXISM( 0.0, 0.0, 'IRRADIANCE, DB', 14, 8.0, 90.0,
     #       RMAX - 40.0, 5.0, 1.0, 1 )
      CALL PLOT( 0.0, 8.0, 3 )
      CALL PLOT( 6.0, 8.0, 2 )
      CALL PLOT( 6.0, 0.0, 2 )
      CALL PHLINE( DGPX, SUM, KGXP, 6.0, 8.0, 0.0, 0.0, 1, 3, 0 )
      IMT = TIME(4)/10
      IMU = TIME(4) - 10*IMT
      IHT = TIME(3)/10
      IHU = TIME(3) - 10*IHT
      ATIME = IMU + 240 + 256*( IMT + 240 + 256*( IHU + 240 +
     #       256*(IHT + 240 ) ) )
      FPM = TIME(2)
      CALL NUMBER ( 1.0, 8.8, 0.1, FPM, 0.0, -1 )
      CALL SYMBOL( 1.3, 8.8, 0.1, MON(TIME(1)), 0.0, 3 )
      CALL SYMBOL( 1.7, 8.8, 0.1, '1975', 0.0, 4 )
      CALL SYMBOL( 2.3, 8.8, 0.1, ATIME, 0.0, 4 )
      CALL SYMBOL( 2.8, 8.8, 0.1, 'PDT', 0.0, 3 )
      CALL SYMBOL( 1.0, 8.6, 0.1, 'GAMMA''Y = ', 0.0, 10 )
```

Figure I-3. Program listing for downlink model (sheet 16 of 19).

```
      CALL NUMBER( 2.0, 8.6, 0.1, GAMPY, 0.0, -1 )
      CALL SYMBOL( 2.3, 8.6, 0.1, 'DEGREES',0.0, 7 )
      CALL SYMBOL( 3.3, 8.6, 0.1, 'THETA0 = ', 0.0, 9 )
      CALL NUMBER( 4.2, 8.6, 0.1, THZERO, 0.0, -1 )
      CALL SYMBOL( 4.5, 8.6, 0.1, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 1.0, 8.4, 0.1, 'DEPTH = ', 0.0, 8 )
      CALL NUMBER( 1.9, 8.4, 0.1, Z, 0.0, 1 )
      CALL SYMBOL( 2.4, 8.4, 0.1, 'METERS', 0.0, 6 )
      CALL PLOT( 10.0, -1.75, -3 )
540   IF ( .NOT. INTPWR )  GO TO 100
      CALL HEDING( 4 )
      WRITE(6,550)
550   FORMAT(14X,'DELTA',6X,'I(X,Y,Z,OMEGA)'/
     #      25X,'UPPER BOUND    LOWER BOUND    ASYMPTOTE'//)
      EPSX = XPEAK - GBX/DTR
      EPSY = YPEAK - GBY/DTR
C
C          **************************************************************
C          *                                                            *
C          *     BEGIN LOOP ON DELTA                                    *
C          *                                                            *
C          **************************************************************
C
      KDELF = 0
      DELF = DEL1
560   KDELF = KDELF + 1
         DXLUB = ( EPSX - DELF )*DTR
         DXLLB = ( EPSX - DELF*0.7071 )*DTR
         DXUUB = ( EPSX + DELF )*DTR
         DXULB = ( EPSX + DELF*0.7071 )*DTR
         DYLUB = ( EPSY - DELF )*DTR
         DYLLB = ( EPSY - DELF*0.7071 )*DTR
         DYUUB = ( EPSY + DELF )*DTR
         DYULB = ( EPSY + DELF*0.7071 )*DTR
         SUMASM = 0.0
         SUMUB = 0.0
         SUMLB = 0.0
         DO 600 I = 1,NYGD
            DO 580 J = 1,NXGD
               IF ( SHADOW(I,J) )  GO TO 580
               ARG = BETAX - EPX(J)*TERMB(I,J)/2.0
               ARGE = BETAX - EPX(J)*TERMBE(I,J)/2.0
               GXUB = ( ERF( ( DXUUB - ARG)/UP(I,J) )
     #                 -ERF( ( DXLUB - ARG )/UP(I,J) ) )/2.0
               GXUBE = ( ERF( ( DXUUB - ARGE )/UPE(I,J) )
     #                 -ERF( ( DXLUB - ARGE )/UPE(I,J) ) )/2.0
               GXLB = ( ERF( ( DXULB - ARG )/UP(I,J) )
     #                 -ERF( ( DXLLB - ARG )/UP(I,J) ) )/2.0
               GXLBE = ( ERF( ( DXULB - ARGE )/UPE(I,J) )
     #                 -ERF( ( DXLLB - ARGE )/UPE(I,J) ) )/2.0
               ARG = BETAY - EPY(I)*TERMB(I,J)/2.0
               ARGE = BETAY - EPY(I)*TERMBE(I,J)/2.0
               GYUB = ( ERF( ( DYUUB - ARG )/UP(I,J) )
```

Figure I-3. Program listing for downlink model (sheet 17 of 19).

```
     #          -ERF( ( DYLUB - ARG )/UP(I,J) ) )/2.0
           GYUBE = ( ERF( ( DYUUB - ARGE )/UPE(I,J) )
     #              -ERF( ( DYLUB - ARGE )/UPE(I,J) ) )/2.0
           GYLB = ( ERF( ( DYULB - ARG )/UP(I,J) )
     #              -ERF( ( DYLLB - ARG )/UP(I,J) ) )/2.0
           GYLBE = ( ERF( ( DYULB - ARGE )/UPE(I,J) )
     #              -ERF( ( DYLLB - ARGE )/UPE(I,J) ) )/2.0
           TEMP1 = ( 1.0 - EXPMNU(I,J) - AF(I,J) )*TERMA(I,J)
           TEMP2 = AF(I,J)*TERMAE(I,J)
           SUMUB = SUMUB + TEMP1*GXUB*GYUB + TEMP2*GXUBE*GYUBE
           SUMLB = SUMLB + TEMP1*GXLB*GYLB + TEMP2*GXLBE*GYLBE
           SUMASM = SUMASM + TEMP1 + TEMP2
 580     CONTINUE
 600   CONTINUE
       SIGMA = SQRT( SIGSQ + SYGSQ )
       ARG1 = ( DXUUB - BETAX )/SIGMA
       ARG2 = ( DXLUB - BETAX )/SIGMA
       GXUB = ( ERF( ARG1 ) - ERF( ARG2 ) )/2.0
       ARG1 = ( DXULB - BETAX )/SIGMA
       ARG2 = ( DXLLB - BETAX )/SIGMA
       GXLB = ( ERF( ARG1 ) - ERF( ARG2 ) )/2.0
       ARG1 = ( DYUUB - BETAY )/SIGMA
       ARG2 = ( DYLUB - BETAY )/SIGMA
       GYUB = ( ERF( ARG1 ) - ERF( ARG2 ) )/2.0
       ARG1 = ( DYULB - BETAY )/SIGMA
       ARG2 = ( DYLLB - BETAY )/SIGMA
       GYLB = ( ERF( ARG1 ) - ERF( ARG2 ) )/2.0
       XP = KAPPA/COS( GBX )
       IF ( XP .GT. 70.0 )  EXPON = 0.0
       IF ( XP .LE. 70.0 )  EXPON = EXP( -XP )
       SUMU(KDELF) = SUMUB*UXDYPI + EXPON*GXUB*GYUB
       SUML(KDELF) = SUMLB*UXDYPI + EXPON*GXLB*GYLB
       SUMA(KDELF) = SUMASM*UXDYPI + EXPON
       DELTA(KDELF) = DELF
      CALL HEDING(1)
       WRITE(6,620)  DELF, SUMU(KDELF), SUML(KDELF), SUMA(KDELF)
 620   FORMAT(10X,F10.3,1P3E15.4)
       DELF = DELF + STEPD
       IF ( DELF .LE. DEL2 )  GO TO 560
      AKAY = -ALOG( SUMA(KDELF) )/Z
      CALL HEDING( 2 )
      WRITE(6,630)  AKAY
 630  FORMAT(/10X,'K = ',1PE12.3)
      CALL HEDING( 0 )
      GO TO 150
 640  CALL PLOT( 0, 0, 999 )
      WRITE(6,680)
 680  FORMAT(///30X,'*** END OF JOB ***')
      STOP
      END
```

Figure I-3. Program listing for downlink model (sheet 18 of 19).

```
SUBROUTINE   ALMNAC ( YEAR, DAY, DEC, EQNT )
IMPLICIT      REAL*8     ( A-H, O-Z )
INTEGER YEAR
REAL*4          A0, A1, A2, A3, A4, A5, A6
REAL*4          B1, B2, B3, B4, B5
REAL*4          C1, C2, C3, C4, C5, D1, D2, D3, D4, D5
DATA            A0, A1, A2, A3, A4, A5, A6 / 0.3798, -23.0009,
1            -0.3802, -0.1550, -0.0076, -0.0025, -0.0004 /
DATA            B1, B2, B3, B4, B5 / 3.5354, 0.0302, 0.0726,
1               0.0032, 0.0020 /
DATA    C1,C2,C3,C4,C5 /0.5965, -2.9502, -0.0653, -0.1248, -0.0103/
DATA    D1,D2,D3,D4,D5/-7.3435, -9.4847, -0.3083, -0.1747, -0.0159/
DATA            ONE, TWO / 1.000, 2.000 /
K = MOD (YEAR, 4)
DATE = 365*K + 0.0078*(YEAR - 1968)
IF (K .NE. 0)  DATE = DATE + 1.0
DATE = DATE + DAY
X = DATE/365.2500 *6.2831853
CX = DCOS( X )
SX = DSIN( X )
TWOCX = TWO*CX
C2X = TWOCX*CX - ONE
S2X = TWOCX*SX
C3X = TWOCX*C2X - CX
S3X = TWOCX*S2X - SX
C4X = TWOCX*C3X - C2X
S4X = TWOCX*S3X - S2X
C5X = TWOCX*C4X - C3X
S5X = TWOCX*S4X - S3X
C6X = TWOCX*C5X - C4X
DEC =  A0 + A1*CX + A2*C2X + A3*C3X + A4*C4X + A5*C5X + A6*C6X
1           + B1*SX + B2*S2X + B3*S3X + B4*S4X + B5*S5X
EQNT = C1*CX + C2*C2X + C3*C3X + C4*C4X + C5*C5X
1   +    D1*SX + D2*S2X + D3*S3X + D4*S4X + D5*S5X
RETURN
END
```

Figure I-3. Program listing for downlink model (sheet 19 of 19).

APPENDIX J

GENERAL DESCRIPTION OF UPMODEL

Program UPMODEL is designed to integrate equation (63) of Appendix A. The function evaluated is

$$I(\gamma') = \iint_R \left\{ (1 - e^{-az'} - A) f(\gamma', \gamma) + A\, f(\gamma', \gamma) \Big|_{\overline{\theta^2} = \overline{\theta^2_{eff}}} \right\} dx\, dy \,. \qquad \text{(J-1)}$$

A modified form of (J-1) is also computed. The modification is the substitution of $f^*(\gamma', \gamma)$ for $f(\gamma', \gamma)$, where f^* is defined by

$$f^*(\gamma', \gamma) = f(\gamma', \gamma) \exp(-az' \sec\psi) \,, \qquad \text{(J-2)}$$

where

$$\psi = \left\{ \left(\gamma'_x - \frac{n}{n'} \overline{\gamma}_x - \frac{n}{n'} \frac{\epsilon_x |x| \theta'_m}{\sqrt{x^2 + y^2}} \right)^2 + \left(\gamma'_y - \frac{n}{n'} \overline{\gamma}_y - \frac{n}{n'} \frac{\epsilon_y |y| \theta'_m}{\sqrt{x^2 + y^2}} \right)^2 \right\}^{1/2} . \qquad \text{(J-3)}$$

INPUT DATA. All input to program UPMODEL is from cards using NAMELIST name INPUT. The variables to be input are as follows:

ZL, A, S, THBRSQ, LAYERS, NXGD, NYDG, FOVIEW, GAMP1, GAMP2, STEP1, THZERO,

GPY – these are identical to the input for DNMODEL; see the discussion there for definitions.

ADATE – an integer array of dimension 3 for the date in character string form. Example, ADATE = 22 JUN 1975. Default value is all blanks.

ATIME – an integer array of dimension 2 for the time of day in character string form. The default value is "bbbbbPDT".

OUTPUT DATA. A sample of the printer output is shown following the program listing. Page 1 is a list of all input data. Page 2 is a list of parameters for the first set of input data. Page 3 is the tabular listing of the results of evaluating the integrals. The columns labeled GPX, GPY, ZENITH, and AZIMUTH are the same as in the output for program DNMODEL. The column labeled SUM1 is the value of equation (J-1) directly. The column labeled SUM2 is the value of equation (J-1) with f^* substituted for f. The column labeled SUM is the term

$$\iint_R 1 - e^{-az'} - A)f(\gamma', \gamma)dx\, dy\,. \tag{J-4}$$

The column labeled SUME is the term

$$\iint_R A\, f(\gamma', \gamma)\Big|_{\overline{\theta^2}=\overline{\theta^2_{eff}}} dx\, dy\,. \tag{J-5}$$

The columns labeled SUMS and SUMSE are the terms (J-4) and (J-5) with f^* substituted for f.

A sample plot generated by UPMODEL is shown in figures J-1A and 1B. The first curve is a plot of SUM1 vs. zenith angle and the second curve is the plot of SUM2 vs. zenith angle.

EXTERNAL SUBROUTINES REQUIRED. COPY, HEDING, AXISM, PHLINE – See discussion of these in DNMODEL.

FIT – This is a subroutine to locate the peak of the data and the points at which the data falls to a value of $e^{-1/2}$ of the peak.

Figure J-2 represents a program listing on 12 pages of the uplink model.

22 JUL 1975 1725 PDT
GAMMA'Y = 5 DEGREES THETAO = 0 DEGREES
DEPTH = 15.2 METERS
ALTITUDE = 914.4 METERS
GAMMA X = 0.0 DEGREES

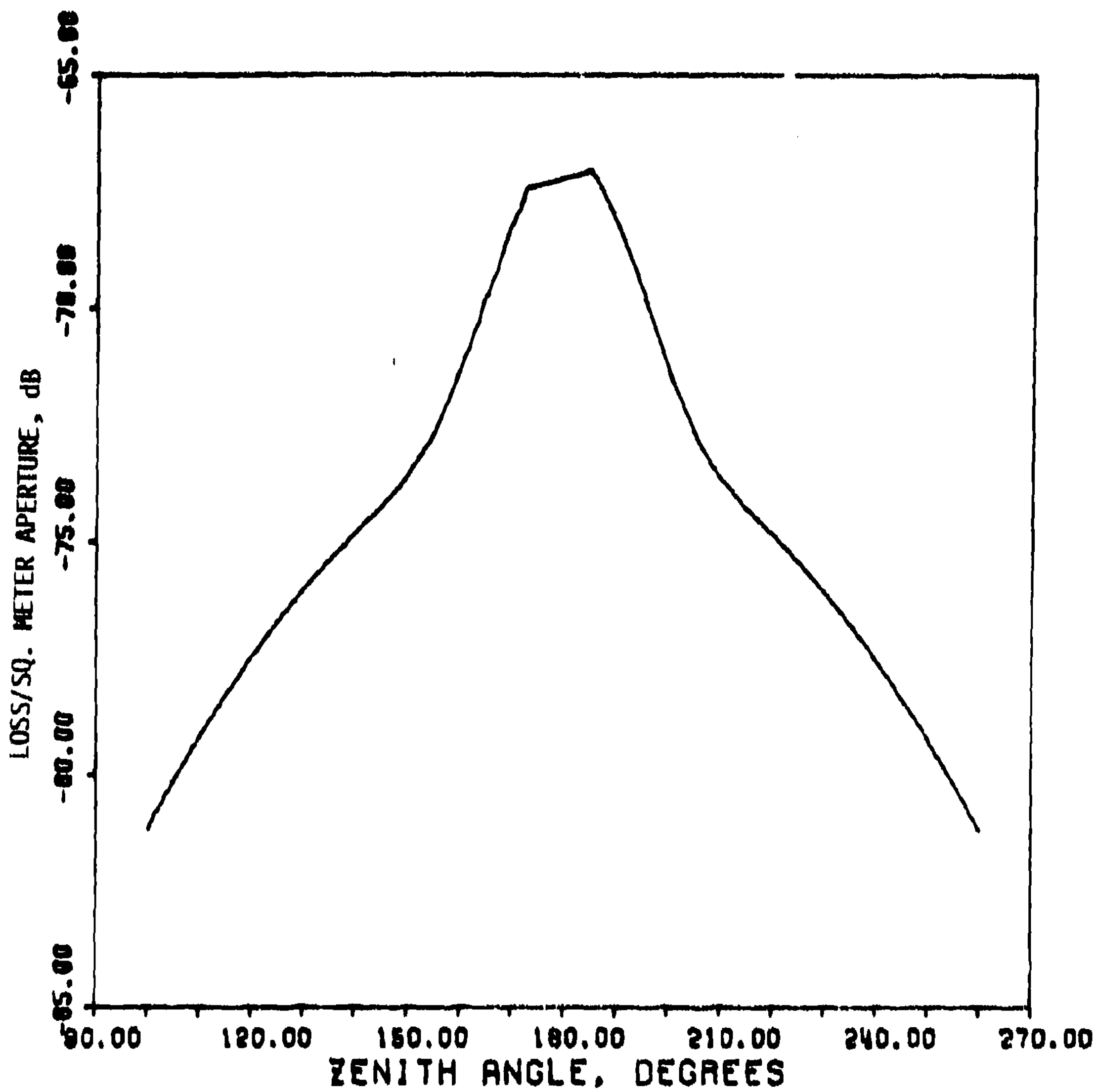


Figure J-1A. Sample plot from UPMODEL.

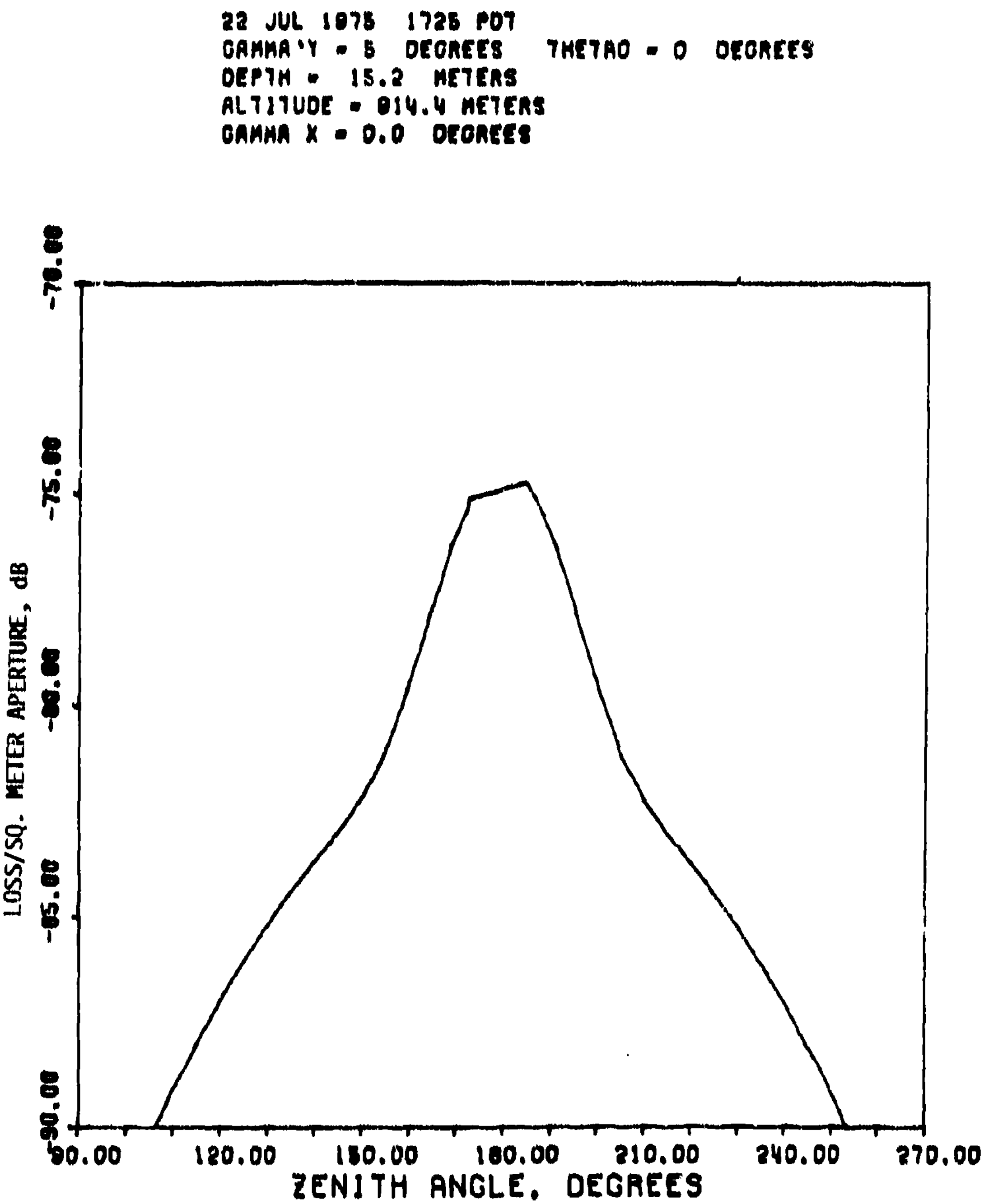


Figure J-1B. Sample plot from UPMODEL (using secant correction).

```
C
C        ****************************************************
C        *                                                  *
C        *    MODEL FOR SATCOM UPLINK WITH SURFACE ZERO     *
C        *                                                  *
C        ****************************************************
      INTEGER     ADATE(3), ATIME(2) /'     ',' PDT'/
C
      REAL        ZL(50), A(50), S(50), THBRSQ(50),
     #            DTR /0.0174533/, BUFFER(1024), LLX, LLY, NMP,
     #            NMPSQ, MU, MUZ, XZ(90), XSQ(90), EX(90), EPX(90),
     #            YZ(60), YSQ(60), EY(60), EPY(60), LAMDA, NU,
     #            EXPMMU(60,90), AF(60,90), UP(60,90), UPE(60,90),
     #            TERMA(60,90), TERMAE(60,90), TERMB(60,90),
     #            TERMBE(60,90), TERMC(60,90), TERMCE(60,90),
     #            SUM1(300), SUM2(300), DGPX(600), THETA(300),
     #            PHI(300), KAPPA, KAPPAZ
C
      COMMON      /IONO/     IYR, IDAY, IHR, MINUTE, ISECND
C
      NAMELIST    /INPUT/    ZL, A, S, THBRSQ, LAYERS, NXGD, NYGD,
     #                       FOVIEW, GAMP1, GAMP2, STEP1, THZERO,
     #                       AN, AMP, GAMMAY, GPY, ADATE, ATIME,
     #                       GAMMAX, ALT
C
C        ****************************************************
C        *                                                  *
C        *   GSTINT(X,Y) = Y*<X/Y>, WHERE <X/Y> IS THE LARGEST*
C        *   INTEGER WHICH IS NOT GREATER THAN X/Y          *
C        *                                                  *
C        ****************************************************
C
      GSTINT( X, Y ) = Y*AINT( (X/Y) - 0.5*( 1.0 - (X/ABS(X) ) ) )
C
C        ****************************************************
C        *                                                  *
C        *    COPY INPUT DATA AND ASSIGN DEFAULT VALUES     *
C        *                                                  *
C        ****************************************************
C
      CALL COPY( 8, 6440 )
C
      GAMMAY = 0.0
      GAMMAX = 0.0
      GPY = 0.0
      NXGD = 90
      NYGD = 60
      FOVIEW = 1.0
      AN = 1.33
```

Figure J-2. Program listing for uplink model (sheet 1 of 12).

```
      AMP = 1.0
      GAMP1 = -80.0
      GAMP2 = 81.0
      STEP1 = 10.0
      THZERO = 0.0
      ALT = 3000.0
C
C                 ************************************************
C                 *                                              *
C                 *    INITIALIZE THE PLOTTER                    *
C                 *                                              *
C                 ************************************************
C
      CALL PLOTS( BUFFER, 1024, 99 )
C
100   CONTINUE
C
C                 ************************************************
C                 *                                              *
C                 *    READ INPUT DATA, CONVERT ANGLES TO RADIANS,
C                 *    AND COMPUTE CONSTANT QUANTITIES           *
C                 *                                              *
C                 ************************************************
C
      READ(8,INPUT,END=440)
C
      ALTM = ALT*0.3048
      FOV = FOVIEW*DTR
      NMP = AN/AMP
      NMPSQ = NMP*NMP
      SIGSQ = 2.0*( 3.04610E-4 + FOV*FOV/4.0 )
      SYGSQ = 2.0*( THZERO*DTR)**2
      VPFAC = SYGSQ
      Z = ZL(LAYERS)
      ZSQ = Z*Z
      GBX = GAMMAX*DTR
      GBX = ARSIN( NMP*SIN( GBX ) )
      GBY = GAMMAY*DTR
      GBY = ARSIN( NMP*SIN( GBY ) )
      GPY = GPY*DTR
      GY = GPY - GBY
      GYSQ = GY*GY
      GBARX = GBX/DTR
      GBARY = GBY/DTR
      CALL NEDING( 8 )
      WRITE(6,120 )  Z, GAMMAX, GBARX, GAMMAY, GBARY, THZERO,
     #               FOVIEW, ALTM, ALT, ADATE, ATIME
120   FORMAT(        10X,'DEPTH = ',F7.1,' METERS'/
     #               10X,'GAMMAX = ',F6.1,' DEGREES, GAMMA BAR X = ',
     #                  F6.1,' DEGREES'/
     #               10X,'GAMMAY = ',F6.1,' DEGREES, GAMMA BAR Y = ',
     #                  F6.1,' DEGREES'/
```

Figure J-2. Program listing for uplink model (sheet 2 of 12).

```
     &       10X,'THETAO = ',F6.1,' DEGREES'/
     &       10X,'FIELD OF VIEW = ',F5.1,' DEGREES'/
     &       10X,'ALTITUDE = ',F6.1,' METERS (',F7.1,' FEET)'/
     &       10X,3A4,5X,2A4//)
      CALL HEDING( 4 )
      WRITE(6,130)
  130 FORMAT(/10X,'DEPTH',11X,'A',11X,'S',8X,'THBRSQ'/
     &        10X,'METERS'/)
      ILAST = LAYERS - 1
      DO 150 I = 1,ILAST
        CALL HEDING( 2 )
        WRITE(6,140)  ZL(I), A(I), S(I), THBRSQ(I)
  140   FORMAT(10X,F5.1/20X,1P3E12.2)
  150 CONTINUE
      CALL HEDING( 1 )
      WRITE(6,140)  ZL(LAYERS)
C           ****************************************************
C           *                                                  *
C           *   CALCULATE QUANTITIES WHICH ARE FUNCTIONS       *
C           *   OF LAYERING BUT NOT OF XO, YO OR GAMMA PRIME   *
C           *                                                  *
C           ****************************************************
C
      MU = 0.0
      PSI = 0.0
      ZETA = 0.0
      RHOP = 0.0
      DO 180 I = 2,LAYERS
        DZ = ZL(I) - ZL(I-1)
        MU = MU + THBRSQ(I-1)*S(I-1)*DZ
        PSI = PSI + S(I-1)*DZ
        ZETA = ZETA + A(I-1)*DZ
        RHOP = RHOP + THBRSQ(I-1)*S(I-1)
     &           *( ZL(I)**3 - ZL(I-1)**3 )
  180 CONTINUE
C
      ZTA = Z*TAN( GAMMAX*DTR )
      ZTAMAX = 1.14*Z
      ALIM = 3.0*SQRT( RHOP/3.0 )
      ULY = AMIN1( ALIM, ZTAMAX )
      LLY = -ULY
      ULX = AMIN1( ZTA + ALIM, ZTAMAX )
      LLX = AMAX1( ZTA - ALIM, -ZTAMAX )
      DX = ( ULX - LLX )/NXGD
      DY = ( ULY - LLY )/NYGD
      DXDY = DX*DY/( 9.869604*ALTM*ALTM )
C
      CALL HEDING( 0 )
      WRITE(6,190)  LLX, LLY, ULX, ULY, LLX, LLY, ULX, LLY
  190   FORMAT(10X,'GRID CORNERS:  (',F6.1,',',F6.1,')  (',F6.1,',',
     &          F6.1,')'/
     &        25X,'(',F6.1,',',F6.1,')  (',F6.1,',',F6.1,')'//
```

Figure J-2. Program listing for uplink model (sheet 3 of 12).

```
     #        11X,'GPX',6X,'GPY',6X,'SUM1',8X,'SUM2',9X,'SUM',8X,
     #         'SUME',8X,'SUMS',7X,'SUMSE',4X,'ZENITH',4X,
     #         'AZIMUTH'/
     #        11X,'DEG',6X,'DEG',75X,'DEG',8X,'DEG'//)
C
      MUZ = MU/Z
      PSIZ = PSI/Z
      ZETAZ = ZETA/Z
      RHOP = RHOP/Z**3
      KAPPA = ZETA + PSI
      KAPPAZ = KAPPA/Z
C
C            ******************************************************
C            *                                                    *
C            *   CALCULATE QUANTITIES WHICH ARE FUNCTIONS         *
C            *   OF Z AND X ONLY                                  *
C            *                                                    *
C            ******************************************************
C
      DO 200 I = 1,NXGD
        X = ( I - 0.5 )*DX + LLX
        XZ(I) = X
        XSQ(I) = X*X
        RX = SQRT( ZSQ + XSQ(I) )
        EX(I) = ( -GBX + ARSIN( X/RX ) )*F
        EPX(I) = SIGN( 1.0, EX(I) )*ABS( X )
        EX(I) = EX(I)**2
  200 CONTINUE
C
C            ******************************************************
C            *                                                    *
C            *   CALCULATE QUANTITIES WHICH ARE FUNCTIONS         *
C            *   OF Z AND Y ONLY                                  *
C            *                                                    *
C            ******************************************************
C
      DO 220 I = 1,NYGD
        Y = ( I - 0.5 )*DY + LLY
        YZ(I) = Y
        YSQ(I) = Y*Y
        RY = SQRT( ZSQ + YSQ(I) )
        EY(I) = ( -GBY + ARSIN( Y/RY ) )*RY
        EPY(I) = SIGN( 1.0, EY(I) )*ABS( Y )
        EY(I) = EY(I)**2
  220 CONTINUE
C
C            ******************************************************
C            *                                                    *
C            *   CALCULATE QUANTITIES WHICH ARE FUNCTIONS         *
C            *   OF X, Y, AND Z                                   *
C            *                                                    *
C            ******************************************************
C
```

Figure J-2. Program listing for uplink model (sheet 4 of 12).

```
C
      DO 260 I = 1,NYGD
        DO 240 J = 1,NXGD
          SR = XSQ(J) + YSQ(I)
          ZPRIME = SQRT( ZSQ + SR )
          SR = SQRT( SR )
          LAMDA = MUZ*ZPRIME
          VP = VPFAC/LAMDA
          NU = PSIZ*ZPRIME
          ETA = ZETAZ*ZPRIME
          RHO = RHOP*ZPRIME**3
          ASUBN = EXP( NU/SQRT( 1.0 + 9.0/NU ) ) - 1.0
          ASUBD = EXP( NU/SQRT( 1.0 + 81.0/NU ) ) - 1.0
          EXPMNU(I,J) = EXP( -NU )
          THBARQ = ALOG( ASUBN/ASUBD )/36.0
C         AF(I,J) = 0.255*NU*EXP( -NU/2.31 )
          ASUBN = ASUBN*SQRT( SQRT( SQRT( ASUBN ) ) )
          ASUBD = SQRT( SQRT( SQRT( ASUBD ) ) )
          AF(I,J) = EXPMNU(I,J)*ASUBN/ASUBD
          VPE = VP/THBARQ
          UP(I,J) = NNPSQ*LAMDA*( 1.0 + 2.0*VP)/( 2.0 + 3.0*VP )
          UPE(I,J) = NNPSQ*LAMDA*THBARQ*( 1.0 + 2.0*VPE )
     $                                 /( 2.0 + 3.0*VPE )
          RR = RHO*( 0.6666667 + VP )
          RRE = RHO*THBARQ*( 0.6666667 + VPE )
          EXEY = EX(J) + EY(I)
          TEMP = EXP( -ETA )
          XP = EXEY/RR
          IF ( XP .GT. 30.0 )  TERMA(I,J) = 0.0
          IF ( XP .LE. 30.0 )  TERMA(I,J) = TEMP*EXP( -XP )/RR
          XP = EXEY/RRE
          IF ( XP .GT. 30.0 )  TERMAE(I,J) = 0.0
          IF ( XP .LE. 30.0 )  TERMAE(I,J) = TEMP*EXP( -XP )/RRE
          IF ( TERMA(I,J) .LT. 1.0E-30 )  TERMA(I,J) = 1.0E-30
          IF ( TERMAE(I,J) .LT. 1.0E-30 )  TERMAE(I,J) = 1.0E-30
          EXEY = SQRT( EXEY )
          THM = ( 3.0 + 3.0*VP )/( 2.0 + 3.0*VP )*( EXEY/ZPRIME )
          THME = ( 3.0 + 3.0*VPE )/( 2.0 + 3.0*VPE )*( EXEY/ZPRIME )
          TERMB(I,J) = -NNP*( GBX + EPX(J)*THM/SR )
          TERMBE(I,J) = -NNP*( GBX + EPX(J)*THME/SR )
          TERMC(I,J) = ( GPY - NNP*EPY(I)*THM/SR )**2
          TERMCE(I,J) = ( GPY - NNP*EPY(I)*THME/SR )**2
  240   CONTINUE
  260 CONTINUE
C
C             ***********************************************************
C             *                                                         *
C             *     BEGIN GAMMA PRIME LOOP                              *
C             *                                                         *
C             ***********************************************************
C
      GAMPY = GPY/DTR
      GAMPX = GAMPI
```

Figure J-2. Program listing for uplink model (sheet 5 of 12).

```
      KGXP = 0
  280 CONTINUE
      KGXP = KGXP + 1
      GPX = GAMPX*DTR
      SUM = 0.0
      SUME = 0.0
      SUMS = 0.0
      SUMSE = 0.0
         ATEST = ABS( ABS( GPX ) - 1.570796 )
         IF ( ATEST .LE. 1.0E-5 )  TANGX = 1.0E5
         IF ( ATEST .GT. 1.0E-5 )  TANGX = TAN( GPX )
         ATEST = ABS( ABS( GPY ) - 1.570796 )
         IF ( ATEST .LE. 1.0E-5 )  TANGY = 1.0E5
         IF ( ATEST .GT. 1.0E-5 )  TANGY = TAN( GPY )
         ZLOS = ATAN( SQRT( TANGX**2 + TANGY**2 ) )
         IF ( GPX .EQ. 0.0 .AND. GPY .EQ. 0.0 )  ALOS = 0.0
         IF ( GPX .NE. 0.0 .OR. GPY .NE. 0.0 )
     #              ALOS = ATAN2( TANGY, TANGX )
         IF ( ALOS .LT. 0.0 )  ALOS = ALOS + 6.28319
         THETA(KGXP) = ZLOS/DTR
         PHI(KGXP) = ALOS/DTR
         DGPX(KGXP) = THETA(KGXP)*SIGN( 1.0, COS( ALOS ) )
      DO 320 J = 1,NXGD
        DO 300 I = 1,NYGD
         TERMD = ( GPX + TERMB(I,J) )**2 + TERMC(I,J)
         ANGL = SQRT( TERMD )
         XP = TERMD/UP(I,J)
         IF ( XP .GT. 70.0 )  TERMD = 1.0E-30
         IF ( XP .LE. 70.0 )  TERMD = EXP( -XP )
         TERMDE = ( GPX + TERMBE(I,J) )**2 + TERMCE(I,J)
         ANGLE = SQRT( TERMDE )
         XP = TERMDE/UPE(I,J)
         IF ( XP .GT. 70.0 )  TERMDE = 1.0E-30
         IF ( XP .LE. 70.0 )  TERMDE = EXP( -XP )
         ZPRIME = SQRT( ZSQ + XSQ(J) + YSQ(I) )
         ETA = ZETAZ*ZPRIME
         XP = ETA/COS( ANGL )
         IF ( XP .GT. 70.0 .OR. XP .LT. 0.0 )
     #     TERMF = 1.0E-30
         IF ( XP .LE. 70.0 .AND. XP .GE. 0.0 )
     #     TERMF = EXP( -XP )
         XP = ETA/COS( ANGLE )
         IF ( XP .GT. 70.0 .OR. XP .LT. 0.0 )
     #     TERMFE = 1.0E-30
         IF ( XP .LE. 70.0 .AND. XP .GE. 0.0 )
     #     TERMFE = EXP( -XP )
         TEMP1 = TERMA(I,J)*TERMD/UP(I,J)
         TEMP2 = TERMAE(I,J)*TERMDE/UPE(I,J)
         TEMP3 = ( 1.0 - EXPMUL(I,J) - AF(I,J) )*TEMP1
         IF ( TEMP3 .LT. 1.0E-30 )  TEMP3 = 1.0E-30
         TEMP4 = AF(I,J)*TEMP2
         IF ( TEMP4 .LT. 1.0E-30 )  TEMP4 = 1.0E-30
         SUM = SUM + TEMP3
```

Figure J-2. Program listing for uplink model (sheet 6 of 12).

```
              SUME = SUME + TEMP6
              SUMS = SUMS + TEMP3*TERMF
              SUMSE = SUMSE + TEMP4*TERMFE
  300      CONTINUE
  320    CONTINUE
         SUM = SUM*DXDY
         SUME = SUME*DXDY
         SUMS = SUMS*DXDY
         SUMSE = SUMSE*DXDY
         SUM1(KGXP) = SUM + SUME
         SUM2(KGXP) = SUMS + SUMSE
         CALL HEDING( 1 )
         WRITE(6,340)  GAMPX, GAMPY, SUM1(KGXP), SUM2(KGXP), SUM, SUME,
      #              SUMS, SUMSE, THETA(KGXP), PHI(KGXP)
  340    FORMAT(F15.1,F8.1,1P6E12.3,0PF8.1,F11.1)
         GAMPX = GAMPX + STEP1
         IF ( GAMPX .LE. GAMP2 )  GO TO 200
         CALL FIT( KGXP, SUM1, DGPX, RMAX1, XPEAK1, IMAX1, ILEFT1, IRGHT1,
      #            XLEFT1, XRGHT1 )
         CALL HEDING( 6 )
         WRITE(6,360)  RMAX1, XPEAK1, XLEFT1, XRGHT1
  360    FORMAT(//10X,'PEAK VALUE = ',1PE15.4,' AT GAMMA'' = ',0PF7.2,
      #            ' DEGREES'/
      #          10X,'EXP(-1/2) POINTS AT ',F6.1,',',F6.1//)
         CALL FIT( KGXP, SUM2, DGPX, RMAX2, XPEAK2, IMAX2, ILEFT2, IRGHT2,
      #            XLEFT2, XRGHT2 )
         CALL HEDING( 6 )
         WRITE(6,360)  RMAX2, XPEAK2, XLEFT2, XRGHT2
         CALL HEDING( 4 )
         WRITE(6,380)  ZETAZ, PSIZ, KAPPAZ
  380    FORMAT(/10X,'MEAN ABSORPTION = ',1PE12.3/
      #         10X,'MEAN SCATTERING = ',1PE12.3/
      #          10X,'MEAN ALPHA = ',1PE12.3)
         CALL HEDING( 0 )
C
C                 ***********************************************
C                 *                                             *
C                 *     CONVERT RADIANCE LOSS TO DB             *
C                 *                                             *
C                 ***********************************************
C
         DO 400 I = 1,KGXP
            IF ( SUM1(I) .EQ. 0.0 )  SUM1(I) = 1.0E-70
            SUM1(I) = 10.0*ALOG10( SUM1(I) )
            IF ( SUM2(I) .EQ. 0.0 )  SUM2(I) = 1.0E-70
            SUM2(I) = 10.0*ALOG10( SUM2(I) )
  400    CONTINUE
C
C                 ***********************************************
C                 *                                             *
C                 *     LOAD PLOTTING PARAMETERS INTO ARRAYS    *
C                 *                                             *
C                 ***********************************************
C
```

Figure J-2. Program listing for uplink model (sheet 7 of 12).

```
      RMAX = 10.0*ALOG10( RMAX1 )
      IF ( RMAX .NE. 0.0 )  RMAX = -GSTINT( -RMAX, 5.0 )
      SUM1(KGXP+1) = RMAX - 20.0
      SUM1(KGXP+2) = 3.3333
      RMAX = 10.0*ALOG10( RMAX2 )
      IF ( RMAX .NE. 0.0 )  RMAX = -GSTINT( -RMAX, 5.0 )
      SUM2(KGXP+1) = RMAX - 20.0
      SUM2(KGXP+2) = 3.3333
      DGPX(KGXP+1) = -90.0
      DGPX(KGXP+2) = 30.0
C
C                 ****************************************************
C                 *                                                  *
C                 *      GENERATE AND DOCUMENT THE PLOTS             *
C                 *                                                  *
C                 ****************************************************
      IPLOT = 1
C
420   CONTINUE
      CALL PLOT( 10.0, -11.0, -3 )
      CALL PLOT( 0.0, 11.0, 2 )
      CALL PLOT( 8.5, 11.0, 2 )
      CALL PLOT( 8.5, 0.0, 2 )
      CALL PLOT( 0.0, 0.0, 2 )
      CALL PLOT( 1.5, 2.25, -3 )
      CALL AXISM( 0.0, 0.0, 'ZENITH ANGLE, DEGREES', -21, 6.0, 0.0,
     #            90.0, 30.0, 0.3333, 3 )
      IF ( IPLOT .EQ. 1 )  RMIN = SUM1(KGXP+1)
      IF ( IPLOT .EQ. 2 )  RMIN = SUM2(KGXP+1)
      CALL AXISM( 0.0, 0.0, 'RADIANCE LOSS, DB', 17, 6.0, 90.0, RMIN,
     #            5.0, 1.5, 1 )
      CALL PLOT( 0.0, 6.0, 3 )
      CALL PLOT( 6.0, 6.0, 2 )
      CALL PLOT( 6.0, 0.0, 2 )
      IF ( IPLOT .EQ. 1 )
     #     CALL PHLINE( DGPX, SUM1, KGXP, 6.0, 6.0, 0.0, 0.0, 1, 0, 0 )
      IF ( IPLOT .EQ. 2 )
     #     CALL PHLINE( DGPX, SUM2, KGXP, 6.0, 6.0, 0.0, 0.0, 1, 0, 0 )
      HT = 0.07
      XO = -1.3
      ANG = 90.0
      CALL SYMBOL( XO, 2.0, HT, 'ID = ', ANG, 4 )
      CALL SYMBOL( XO, 2.35, HT, IYR, ANG, 2 )
      CALL SYMBOL( XO, 2.49, HT, '.', ANG, 1 )
      CALL SYMBOL( XO, 2.56, HT, IDAY, ANG, 3 )
      FPN = IHR
      CALL NUMBER( XO, 2.98, HT, FPN, ANG, -1 )
      CALL SYMBOL( XO, 3.12, HT, ':', ANG, 1 )
      FPN = MINUTE
      CALL NUMBER( XO, 3.19, HT, FPN, ANG, -1 )
      CALL SYMBOL( XO, 3.33, HT, ':', ANG, 1 )
      FPN = ISECND
      CALL NUMBER( XO, 3.40, HT, FPN, ANG, -1 )
```

Figure J-2. Program listing for uplink model (sheet 8 of 12).

```
      HT = 0.1
      CALL SYMBOL( 1.0, 7.8, HT, ADATE, 0.0, 12 )
      CALL SYMBOL( 2.3, 7.8, HT, ATIME, 0.0, 8 )
      CALL SYMBOL( 1.0, 7.6, HT, 'GAMMA''Y = ', 0.0, 10 )
      CALL SYMBOL( 1.0, 7.6, HT, GAMPY, 0.0, -1 )
      CALL NUMBER( 2.0, 7.6, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 2.3, 7.6, HT, 'THETAO = ', 0.0, 9 )
      CALL SYMBOL( 3.3, 7.6, HT, THZERO, 0.0, -1 )
      CALL NUMBER( 4.2, 7.6, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 4.5, 7.6, HT, 'DEPTH = ', 0.0, 8 )
      CALL SYMBOL( 1.0, 7.4, HT, Z, 0.0, 1 )
      CALL NUMBER( 1.9, 7.4, HT, ' METERS', 0.0, 7 )
      CALL SYMBOL( 2.4, 7.4, HT, 'ALTITUDE = ', 0.0, 11 )
      CALL SYMBOL( 1.0, 7.2, HT, ALTM, 0.0, 1 )
      CALL NUMBER( 2.1, 7.2, HT, 'METERS', 0.0, 6 )
      CALL SYMBOL( 2.7, 7.2, HT, 'GAMMA X = ', 0.0, 10 )
      CALL SYMBOL( 1.0, 7.0, HT, GAMMAX, 0.0, 1 )
      CALL NUMBER( 2.0, 7.0, HT, 'DEGREES', 0.0, 7 )
      CALL SYMBOL( 2.5, 7.0, HT,
      IF ( IPLOT .EQ. 2 ) GO TO 100
      IPLOT = 2
      GO TO 420
440   WRITE(6,460)
460   FORMAT(//30X,'*** EOF ON SYSIN - END OF JOB ***')
      CALL PLOT( 0, 0, 999 )
      STOP
      END
```

Figure J-2. Program listing for uplink model (sheet 9 of 12).

```
SATCOM UPLINK MODEL      20/44/48      76.175                    PAGE   1

INPUT DATA FOR PROGRAM UPMODEL

CARD NO.

  1          RUN # 16,  50 FEET
  2       &INPUT
  3         ADATE = '22 JUL 1975', ATIME = '1725', GAMMAX = 0., ALT = 3000.,
  4         ZL = 0., 2.1, 3.1, 4., 4.8, 6., 7.3, 8.7, 10., 11.3, 12.6, 13.9, 15.2,
  5         LAYERS = 13,
  6         A = 0.111, 11*3.112,
  7         S = .343, .349, .366, .366, .352, .362, .364, .365, .357, .369,
  8           .380, .374,
  9         THBRSQ = .057, .056, .054, .054, .056, .055, .054, .055,
 10           .055, .054, .053, .054,
 11         ETEFL = 5.
 12         EPY = 5.
 13       &END
 13       /*
```

Figure J-2. Program listing for uplink model (sheet 10 of 12).

SATCOM UPLINK MODEL 20/44/48 76.175 PAGE 2

```
DEPTH =          15.2 METERS
GAMMAX =          0.0 DEGREES, GAMMA BAR X =    0.0 DEGREES
GAMMAY =          0.0 DEGREES, GAMMA BAR Y =    0.0 DEGREES
THETAO =          0.0 DEGREES
FIELD OF VIEW =   1.0 DEGREES
ALTITUDE =   914.4 METERS ( 3000.0 FEET)
22 JUL 1976      1725 PDT
```

DEPTH METERS	A	S	THORSO
0.0	1.11E-01	3.43E-01	5.70E-02
2.1	1.12E-01	3.49E-01	5.60E-02
3.1	1.12E-01	[illegible]	5.40E-02
4.0	1.12E-01	3.66E-01	5.40E-02
4.8	1.12E-01	3.52E-01	5.60E-02
6.0	1.12E-01	3.62E-01	5.50E-02
7.3	[illegible]	[illegible]	5.40E-02
8.7	1.12E-01	3.65E-01	5.50E-02
10.0	1.12E-01	3.57E-01	5.50E-02
11.3	1.12E-01	3.69E-01	5.40E-02
12.6	[illegible]	3.80E-01	5.30E-02
13.9	1.12E-01	3.74E-01	5.40E-02
15.2			

Figure J-2. Program listing for uplink model (sheet 11 of 12).

SATCOM UPLINK MODEL 20/44/48 76.175 PAGE 3

GRID CORNERS: (-14.5, 14.5) (14.5, 14.5)
(-14.5, -14.5) (14.5, -14.5)

GPX DEG	GPY DEG	SUM1	SUM2	SUM	SUME	SUMS	SUMSE	ZENITH DEG	AZIMUTH DEG
-80.0	5.0	7.602E-09	6.638E-10	7.602E-09	4.659E-17	6.838E-10	5.548E-18	80.0	179.1
-75.0	5.0	9.628E-09	9.222E-10	9.628E-09	2.648E-16	9.222E-10	3.607E-17	75.0	178.7
-70.0	5.0	1.199E-08	1.215E-09	1.199E-08	1.925E-15	1.215E-09	2.572E-16	70.0	178.2
-65.0	5.0	1.469E-08	1.566E-09	1.469E-08	1.373E-14	1.566E-09	1.921E-15	65.0	177.7
-60.0	5.0	1.772E-08	1.980E-09	1.772E-08	9.888E-14	1.980E-09	1.441E-14	60.0	177.1
-55.0	5.0	2.106E-08	2.455E-09	2.106E-08	6.925E-13	2.455E-09	1.047E-13	55.1	176.5
-50.0	5.0	2.468E-08	2.989E-09	2.467E-08	4.559E-12	2.988E-09	7.115E-13	50.1	175.8
-45.0	5.0	2.852E-08	3.576E-09	2.849E-08	2.738E-11	3.571E-09	4.395E-12	45.1	175.0
-40.0	5.0	3.257E-08	4.216E-09	3.243E-08	1.400E-10	4.192E-09	2.402E-11	40.2	174.0
-35.0	5.0	3.705E-08	4.944E-09	3.638E-08	6.752E-10	4.630E-09	1.135E-10	35.2	172.9
-30.0	5.0	4.286E-08	5.918E-09	4.021E-08	2.652E-09	5.464E-09	4.542E-10	30.3	171.4
-25.0	5.0	5.246E-08	7.579E-09	4.378E-08	8.696E-09	6.067E-09	1.512E-09	25.4	169.4
-20.0	5.0	7.040E-08	1.074E-08	4.696E-08	2.344E-08	6.611E-09	4.127E-09	20.5	166.5
-15.0	5.0	1.009E-07	1.619E-08	4.960E-08	5.131E-08	7.069E-09	9.121E-09	15.7	161.9
-10.0	5.0	1.420E-07	2.359E-08	5.158E-08	9.038E-08	7.416E-09	1.618E-08	11.1	153.6
-5.0	5.0	1.801E-07	3.050E-08	5.281E-08	1.272E-07	7.632E-09	2.287E-08	7.1	135.0
0.0	5.0	1.953E-07	3.338E-08	5.323E-08	1.427E-07	7.706E-09	2.567E-08	5.0	90.0
5.0	5.0	1.801E-07	3.050E-08	5.281E-08	1.272E-07	7.632E-09	2.287E-08	7.1	45.0
10.0	5.0	1.420E-07	2.359E-08	5.158E-08	9.038E-08	7.416E-09	1.618E-08	11.1	26.4
15.0	5.0	1.009E-07	1.619E-08	4.960E-08	5.131E-08	7.069E-09	9.121E-09	15.7	18.1
20.0	5.0	7.040E-08	1.074E-08	4.696E-08	2.344E-08	6.611E-09	4.127E-09	20.5	13.5
25.0	5.0	5.246E-08	7.579E-09	4.378E-08	8.696E-09	6.067E-09	1.512E-09	25.4	10.6
30.0	5.0	4.286E-08	5.918E-09	4.021E-08	2.652E-09	5.464E-09	4.542E-10	30.3	8.6
35.0	5.0	3.705E-08	4.943E-09	3.638E-08	6.752E-10	4.630E-09	1.135E-10	35.2	7.1
40.0	5.0	3.257E-08	4.215E-09	3.243E-08	1.400E-10	4.191E-09	2.402E-11	40.2	6.0
45.0	5.0	2.852E-08	3.576E-09	2.849E-08	2.738E-11	3.571E-09	4.395E-12	45.1	5.0
50.0	5.0	2.468E-08	2.989E-09	2.467E-08	4.559E-12	2.988E-09	7.115E-13	50.1	4.2
55.0	5.0	2.106E-08	2.455E-09	2.106E-08	6.925E-13	2.455E-09	1.047E-13	55.1	3.5
60.0	5.0	1.772E-08	1.979E-09	1.772E-08	9.888E-14	1.979E-09	1.441E-14	60.0	2.9
65.0	5.0	1.469E-08	1.566E-09	1.469E-08	1.373E-14	1.566E-09	1.921E-15	65.0	2.3
70.0	5.0	1.199E-08	1.215E-09	1.199E-08	1.925E-15	1.215E-09	2.572E-16	70.0	1.8
75.0	5.0	9.629E-09	9.222E-10	9.628E-09	2.648E-16	9.222E-10	3.607E-17	75.0	1.3
80.0	5.0	7.603E-09	6.838E-10	7.603E-09	4.659E-17	6.838E-10	5.548E-18	80.0	0.9

PEAK VALUE = 2.1332E-07 AT GAMMA' = -0.00 DEGREES
EXP(-1/2) POINTS AT -12.4, 12.4

PEAK VALUE = 3.6566E-08 AT GAMMA' = 0.0 DEGREES
EXP(-1/2) POINTS AT -11.9, 11.9

MEAN ABSORPTION = 1.119E-01
MEAN SCATTERING = 3.617E-01
MEAN ALPHA = 4.736E-01

Figure J-2. Program listing for uplink model (sheet 12 of 12).

APPENDIX K
UNDERWATER RADIANCE SCANNER CALIBRATION PROGRAM

```
      SUBROUTINE   ALMNAC ( YEAR, DAY, DEC, EQNT )
      IMPLICIT     REAL*8    ( A-H, O-Z )
      INTEGER YEAR
      REAL*4          A0, A1, A2, A3, A4, A5, A6
      REAL*4          B1, B2, B3, B4, B5
      REAL*4          C1, C2, C3, C4, C5, D1, D2, D3, D4, D5
      DATA            A0, A1, A2, A3, A4, A5, A6 / 0.3796, -23.0009,
     1         -0.3802, -0.1550, -0.0076, -0.0025, -0.0004 /
      DATA            B1, B2, B3, B4, B5 / 3.3354, 0.0302, 0.0728,
     1                0.0032, 0.0020 /
      DATA   C1,C2,C3,C4,C5 /0.5965, -2.9502, -0.0653, -0.1246, -0.0103/
      DATA   D1,D2,D3,D4,D5/-7.3435, -9.4667, -0.3083, -0.1747, -0.0159/
      DATA            ONE, TWO / 1.000, 2.000 /
      K = MOD (YEAR, 4)
      DATE = 365*K + 0.0078*(YEAR - 1968)
      IF (K .NE. 0)  DATE = DATE + 1.0
      DATE = DATE + DAY
      X = DATE/365.2500 *6.2831853
      CX = DCOS( X )
      SX = DSIN( X )
      TWOCX = TWO*CX
      C2X = TWOCX*CX - ONE
      S2X = TWOCX*SX
      C3X = TWOCX*C2X - CX
      S3X = TWOCX*S2X - SX
      C4X = TWOCX*C3X - C2X
      S4X = TWOCX*S3X - S2X
      C5X = TWOCX*C4X - C3X
      S5X = TWOCX*S4X - S3X
      C6X = TWOCX*C5X - C4X
      DEC =  A0 + A1*CX + A2*C2X + A3*C3X + A4*C4X + A5*C5X + A6*C6X
     1          + B1*SX + B2*S2X + B3*S3X + B4*S4X + B5*S5X
      EQNT = C1*CX + C2*C2X + C3*C3X + C4*C4X + C5*C5X
     1   +   D1*SX + D2*S2X + D3*S3X + D4*S4X + D5*S5X
      RETURN
      END
```

Figure K-1. Program for radiance scanner calibration (Sheet 1 of 39).

```
      SUBROUTINE AXISM (X,Y,BCD,NC,SIZE,THETA,XMIN,DX,TIC,NTIC)
C
C     (X,Y)       COORDINATES OF THE BEGINNING OF THE AXIS
C     BCD         ALPHANUMERIC ARRAY CONTAINING THE AXIS LABEL
C     NC          NUMBER OF CHARACTERS IN AXIS LABEL.  IF NC .GT. 0,
C                 THE AXIS ANNOTATION WILL BE ON THE COUNTER-CLOCKWISE
C                 SIDE OF THE AXIS.  NC .LT. 0 PLACES THE ANNOTATION ON
C                 THE CLOCKWISE SIDE
C     SIZE        LENGTH OF THE AXIS IN INCHES
C     THETA       THE ANGLE AT WHICH THE AXIS IS TO BE DRAWN
C     XMIN        THE VALUE OF THE COORDINATE AT THE BEGINNING OF THE
C                 AXIS.
C     DX          THE CHANGE IN COORDINATE VALUE BETWEEN SUCCESSIVE
C                 LABELED TIC-MARKS.
C     TIC         THE DISTANCE BETWEEN TIC-MARKS, IN INCHES
C     NTIC        THE REPEAT CYCLE FOR PLACING COORDINATE VALUES AT
C                 TIC-MARKS
C                 .EQ. 1 CAUSES VALUES TO BE PLACED AT EVERY TIC-MARK
C                 .EQ. 2 CAUSES VALUES TO BE PLACED AT EVERY SECOND
C                        TIC MARK, ETC.
C                 .EQ. 0 SUPPRESSES ALL COORDINATE VALUES
C
C     J MARTIN     JUNE 1966
C
      DIMENSION BCD(2)
      INTEGER ALPHA(2)
      SYGN=1.0
      IF (NC) 5,10,10
    5 SYGN=-1.0
   10 NAC=IABS(NC)
      SWITCH=0.0
      TH=THETA*0.01745329
      CTH=COS(TH)
      STH=SIN(TH)
      DXT=TIC*CTH
      DYT=TIC*STH
      N=SIZE/TIC
      TN=N
      XB=X
      YB=Y
      XA=X-0.05*SYGN*STH
      YA=Y+0.05*SYGN*CTH
      CALL PLOT (XA,YA,3)
C          DRAW TICS.=
      DO 15 I=1,N
      CALL PLOT (XB,YB,2)
      XC=XB+DXT
      YC=YB+DYT
      CALL PLOT (XC,YC,2)
      XA=XA+DXT
      YA=YA+DYT
      CALL PLOT (XA,YA,2)
```

Figure K-1. Program for radiance scanner calibration (Sheet 2 of 39).

```
      XB=XC
      YB=YC
15    IF (NTIC) 25,20,25
20    EXPX=0.0
      GO TO 90
25    ADX=ABS(DX)
C        CALCULATE VALUE OF LAST LABELED TIC.*
      ABSV=AMIN+DX*N/NTIC
      EXPX=0.0
      IF (ADX) 30,90,30
30    IF (ADX-100.0) 45,35,35
35    ADX=ADX/10.0
      ABSV=ABSV/10.0
      EXPX=EXPX+1.0
      GO TO 30
40    ADX=ADX*10.0
      ABSV=ABSV*10.0
      EXPX=EXPX-1.0
45    IF (ADX-0.01) 40,90,90
50    M=N
      MM=M+1
      DO 65 I=1,MM
      K=MM-I
      AK=FLOAT(K)/FLOAT(NTIC)-FLOAT(K/NTIC)
      IF (AK) 55,60,55
55    XB=XB-DXT
      YB=YB-DYT
      ABSV = ABSV - ADX/NTIC
      GO TO 65
60    XA=XB-(0.20*SYGN-0.05)*STH-0.17143*CTH
      YA=YB+(0.20*SYGN-0.05)*CTH-0.17143*STH
      GO TO 70
65    CONTINUE
70    N=K/NTIC+1
      DO 80 I=1,N
C        LABEL TICS, IN REVERSE ORDER.*
      CALL NUMBER (XA,YA,0.1,ABSV,THETA,2)
      ABSV = ABSV - ADX
      XA=XA-DXT*FLOAT(NTIC)
      YA=YA-DYT*FLOAT(NTIC)
      IF (SWITCH) 80,75,80
75    CALL WHERE (XW,YW,FACT)
      D1=SQRT((XW-XT)**2+(YW-YT)**2)
      D2=SQRT((XW-XA)**2+(YW-YA)**2)
      IF (D1-D2) 110,110,80
80    CONTINUE
85    RETURN
90    IF (EXPX) 95,100,95
95    TNC=NAC+7
      ALPHA(1)=200+256*(291+256*(231+256*TT))
      ALPHA(2)=64+256*(93+256*(64+256*64))
      GO TO 105
100   TNC=NAC
```

Figure K-1. Program for radiance scanner calibration (Sheet 3 of 39).

```
105   XT=X+(SIZE/2.C-0.07*TNC)*CTH-(-0.07+SYGN*C.4225)*STH
      YT=Y+(SIZE/2.C-0.07*TNC)*STH+(-0.07+SYGN*0.4225)*CTH
      IF (NTIC) 50,110,59
C         DRAW AXIS NAME.=
110   CALL SYMBOL (XT,YT,0.14,BCD(1),THETA,NAC)
      IF (EXPX) 120,115,120
115   SWITCH=1.0
      IF (NTIC) 80,85,80
120   XT=XT+((TNC-6.0)*0.14)*CTH
      YT=YT+((TNC-6.0)*0.14)*STH
      CALL SYMBOL (XT,YT,0.14,ALPHA(1),THETA,7)
      XT=XT+0.56*CTH-0.07*STH
      YT=YT+0.56*STH-0.07*CTH
      CALL NUMBER (XT,YT,0.10,EXPX,THETA,-1)
      GO TO 115
      END
```

Figure K-1. Program for radiance scanner calibration (Sheet 4 of 39).

```
      SUBROUTINE    BCDBIN ( BCD, BIN, ALPHA, CTIME, * )
C
      INTEGER       BCD(3), BIN(5), SHFT2, SHFT3, SHFT4, MONTH(12),
     *              ALPHA(6), COLON2, COLON3, PERIOD,
     *              MON(12), BLANK, BLANK2, IYEAR /'1975'/, CTIME(5),
     *              DH, DT, DU, HT, HU, ST, SU
C
      DATA          MASK1 /Z0000000F/, MASK2 /Z00000OF0/,
     *              MASK3 /Z00000F00/, MASK4 /Z0000F000/,
     *              SHFT2 /16/, SHFT3 /256/, SHFT4 /4096/,
     *              COLON2 /Z007A0000/,
     *              COLON3 /Z00007A00/, PERIOD /Z4B000000/,
     *              MONTH /'JAN ', 'FEB ', 'MAR ', 'APR ', 'MAY ',
     *                     'JUN ', 'JUL ', 'AUG ', 'SEP ', 'OCT ',
     *                     'NOV ', 'DEC '/,
     *              MON / 0, 31, 59, 90, 120, 151, 181, 212, 243,
     *                    273, 304, 334 /, BLANK /Z40000040/,
     *              BLANK2 /Z00400000/
C
      DO 100 I = 1,3
         IF ( BCD(I) .LT. 0 )  BCD(I) = BCD(I) + 65536
  100 CONTINUE
C
      DH = IAND( BCD(1), MASK4 )/SHFT4
      DT = IAND( BCD(1), MASK3 )/SHFT3
      DU = IAND( BCD(1), MASK2 )/SHFT2
      BIN(1) = DH*100 + DT*10 + DU
C
      HT = IAND( BCD(1), MASK1 )
      HU = IAND( BCD(2), MASK4 )/SHFT4
      BIN(2) = HT*10 + HU
C
      MT = IAND( BCD(2), MASK3 )/SHFT3
      MU = IAND( BCD(2), MASK2 )/SHFT2
      BIN(3) = MT*10 + MU
C
      ST = IAND( BCD(2), MASK1 )
      SU = IAND( BCD(3), MASK4 )/SHFT4
      BIN(4) = ST*10 + SU
C
      MSH = IAND( BCD(3), MASK3 )/SHFT3
      MST = IAND( BCD(3), MASK2 )/SHFT2
      MSU = IAND( BCD(3), MASK1 )
      BIN(5) = MSH*100 + MST*10 + MSU
C
      DO 120 I = 1,5
         BIN(I) = BIN(I) + CTIME(I)
  120 CONTINUE
C
  130 IF ( BIN(5) .LT. 1000 )  GO TO 140
      BIN(5) = BIN(5) - 1000
```

Figure K-1. Program for radiance scanner calibration (Sheet 5 of 39).

```
      BIN(4) = BIN(4) + 1
      GO TO 130
140   IF ( BIN(4) .LT. 60 )  GO TO 160
      BIN(4) = BIN(4) - 60
      BIN(3) = BIN(3) + 1
      GO TO 140
160   IF ( BIN(3) .LT. 60 )  GO TO 180
      BIN(3) = BIN(3) - 60
      BIN(2) = BIN(2) + 1
      GO TO 160
180   IF ( BIN(2) .LT. 24 )  GO TO 200
      BIN(2) = BIN(2) - 24
      BIN(1) = BIN(1) + 1
      GO TO 180
200   CONTINUE
C
      DH = BIN(1)/100
      DT = ( BIN(1) - 100*DH )/10
      DU = BIN(1) - 100*DH - 10*DT
C
      HT = BIN(2)/10
      HU = BIN(2) - 10*HT
C
      MT = BIN(3)/10
      MU = BIN(3) - 10*MT
C
      ST = BIN(4)/10
      SU = BIN(4) - 10*ST
C
      MSH = BIN(5)/100
      MST = ( BIN(5) - 100*MSH )/10
      MSU = BIN(5) - 100*MSH - 10*MST
C
      DO 220 I = 1,11
        K = I
        IF ( BIN(1) .GT. MON(I) .AND.
     #       BIN(1) .LE. MON(I+1) )  GO TO 240
220   CONTINUE
      K = 12
240   CONTINUE
      ALPHA(2) = MONTH(K)
      ALPHA(3) = IYEAR
      IDAY = BIN(1) - MON(K)
      IT = IDAY/10
      IU = IDAY - IT*10
      IF ( IT .EQ. 0 )  ALPHA(1) = BLANK + BLANK2
      IF ( IT .NE. 0 )  ALPHA(1) = BLANK + ( IT + MASK2 )*SHFT3*SHFT3
      ALPHA(1) = ALPHA(1) + ( IU + MASK2 )*SHFT3
      ALPHA(4) = ( ( MASK2 + HT )*SHFT3 + MASK2 + HU )*SHFT3*SHFT3
     #         + COLON3 + MT + MASK2
      ALPHA(5) = ( ( MASK2 + MU )*SHFT3*SHFT3 + MASK2 + ST )*SHFT3
     #         + COLON2 + SU + MASK2
      ALPHA(6) = ( ( MASK2 + MSH )*SHFT3 + MASK2 + MST )*SHFT3
```

Figure K-1. Program for radiance scanner calibration (Sheet 6 of 39).

```
      #             + PERIOD + MSU + MASK2
      IF ( BIN(1) .GT. 365 )  RETURN 1
      RETURN
      END
```

Figure K-1. Program for radiance scanner calibration (Sheet 7 of 39).

```
C     *     SUBROUTINE CONTUR ( F, JMAX, IMAX, FS, AR, MODE, SCALEJ,      *
C     *    #                  SCALEI, THETA, NONO )                        *
C     *                                                                    *
C     *     "CONTUR" TRACES CONTOURS THROUGH THE ARRAY "F(JMAX,IMAX)"      *
C     *     AND PLOTS THEM WITH "SCALEI" POINTS PER INCH ALONG THE         *
C     *     X-AXIS AND "SCALEJ" POINTS PER INCH ALONG THE                  *
C     *     Y-AXIS.  THE CONTOURS ARE LABELED WITH THEIR VALUE             *
C     *     WRITTEN AT "THETA" DEGREES, PROVIDED "NONO" IS                 *
C     *     NON-NEGATIVE.  "NONO" < 0 SUPPRESSES THE LABELING              *
C     *     OF CONTOURS.  THE ARRAY "AR", AND THE FLAG "MODE"              *
C     *     CONTROL THE VARIOUS CONTOURING OPTIONS IN THE FOLLOWING        *
C     *     MANNER:                                                        *
C     *                                                                    *
C     *     MODE = 1    A FAMILY OF CONTOURS WITH CONTOUR INTERVAL         *
C     *                 OF AR(1), AND WITH EXTREMES GIVEN BY THE           *
C     *                 RELATIONS                                          *
C     *                   FMIN = AMAX1( AR(2),FMIN ) )                     *
C     *                   FMAX = AMIN1( AR(3),FMAX ) )                     *
C     *                 IS PLOTTED                                         *
C     *                                                                    *
C     *     MODE = 2    A FAMILY  OF APPROXIMATELY AR(1) CONTOURS WITH     *
C     *                 REASONABLY COMPUTED CONTOUR INTERVAL IS PLOTTED    *
C     *                 UPON RETURN FROM "CONTUR", "AR" CONTAINS:          *
C     *                   AR(1) = CONTOUR INTERVAL DECIDED UPON            *
C     *                   AR(2) = MINIMUM CONTOUR PLOTTED                  *
C     *                   AR(3) = MAXIMUM CONTOUR PLOTTED                  *
C     *                                                                    *
C     *     MODE = 3    A SINGLE CONTOUR OF VALUE "AR(1)" IS PLOTTED       *
C     *                                                                    *
C     *     MODE = 4    A FAMILY OF CONTOURS WITH                          *
C     *                   AR(1) = CONTOUR INTERVAL                         *
C     *                   AR(2) = MINIMUM CONTOUR VALUE                    *
C     *                   AR(3) = MAXIMUM CONTOUR VALUE                    *
C     *                 IS PLOTTED                                         *
C     *                                                                    *
C     *     MODE = 5    A FAMILY OF AR(1) CONTOURS IS PLOTTED, WITH        *
C     *                   FMIN = AR(2)*FMIN                                *
C     *                   FMAX = AR(3)*FMAX                                *
C     *                 UPON RETURN FROM "CONTUR", "AR" CONTAINS           *
C     *                   AR(1) = CONTOUR INTERVAL COMPUTED                *
C     *                   AR(2) = FMIN                                     *
C     *                   AR(3) = FMAX                                     *
C     *                                                                    *
C     *     THE ARRAY "FS" IS A SET OF FLAGS USED TO KEEP TRACK            *
C     *     OF THOSE POINTS WHICH HAVE ALREADY BEEN CONNECTED BY THE       *
C     *     CURRENT CONTOUR.  IT MUST BE DIMENSIONED AT LEAST              *
C     *     (IMAX*JMAX)/NBITN) + 1 IN THE CALLING PROGRAM.  NBITN IS       *
C     *     THE NUMBER OF BITS MINUS 1 IN ONE FORTRAN INTEGER WORD.        *
C     *                                                                    *
C     *                                                                    *
C     *     EXTERNAL REFERENCES:                                           *
```

Figure K-1. Program for radiance scanner calibration (Sheet 8 of 39).

```
C     *       IAND(X,Y) - A FUNCTION TO RETURN THE LOGICAL AND OF       *
C     *                  X AND Y.
C     *       IOR(X,Y) - A FUNCTION TO RETURN THE LOGICAL OR OF X AND Y. *
C     *                                                                  *
C     *       CAL-COMP PLOT ROUTINES "PLOT" AND "NUMBER".                *
C     *                                                                  *
C     *                                                                  *
C     ********************************************************************
C
      SUBROUTINE    CONTUR ( F, JMAX, IMAX, FS, AR, MODE, SCALEJ, SCALEI,
     2                      THETA, NUMO )
      DIMENSION     F(JMAX,IMAX)
      DIMENSION     MASK(31), NPT(4,3), AR(3), AC(5), ALG(5)
      DIMENSION     IBEG(100), JBEG(100), CONSV(100), NINSV(100)
      REAL          JAY, JAYZRO
      INTEGER       AND, OR, FS(1)
      LOGICAL       HALT, LPLCT, KLOG
      DATA          NPT / 3, 4, 1, 2, 2, 1, 4, 3, 4, 3, 2, 1 /, IFLAG/ 0/
      DATA          AC / 1.25, 2.0, 2.5, 5.0, 10.0 /, NBIT /32/
      DATA          ALG / 0.097, 0.3, 0.398, 0.7, 1.0 /
C
C     STATEMENT FUNCTION
C
      G(I,A,B) = FLOAT(I) - A/(B - A)
C
C     INITIALIZE PLOTTING PARAMETERS
C
      IDFS = JMAX*IMAX
      IDFS = IDFS/(NBIT - 1) + 1
      ARG2 = AR(1)
      KREG = 1
      KBEGMX = 0
      CSALEI = 1.0/SCALEI
      CSALEJ = 1.0/SCALEJ
      IF( IFLAG .EQ. 5 )                 GO TO 4
      NBITM1 = NBIT - 1
      DO 3 I = 1,NBITM1
    3 MASK(I) = 2**(NBITM1 - I)
C
C     SET-UP LOOP CONTROLLING SELECTION OF CONTOURS
C
      IFLAG = 5
    4 IMAX1 = IMAX - 1
      JMAX1 = JMAX - 1
      IF( MODE .NE. 3 )                  GO TO 10
      FMIN = ARG2
      CONINT = ARG2
      NCONS = 1
      GO TO 15
   10 FMAX = F(1,1)
      FMIN = FMAX
      DO 12 I = 1, IMAX
      DO 12 J = 1, JMAX
```

Figure K-1. Program for radiance scanner calibration (Sheet 9 of 39).

```
      FMIN = AMIN1( FMIN, F(I,J) )
12    FMAX = AMAX1( FMAX, F(I,J) )
      IF( MODE .NE. 5 )                   GO TO 120
      AR(3) = AR(3)*FMAX
      AR(2) = AR(2)*FMAX
      ARG2 = (AR(3) - AR(2))/AR(1)
      AR(1) = ARG2
120   CONINT = ARG2
      IF( MODE .NE. 2 )                   GO TO 13
C
C     IF MODE = 2, SELECT CONTOUR INTERVAL
      ALGCNT = ALOG10((FMAX - FMIN)/ARG2)
      N = ALGCNT
      ALGCNT = AMOD( ALGCNT, 1.0 )
      IF( ALGCNT .GE. 0.0 )               GO TO 18
      N = N - 1
      ALGCNT = 1.0 + ALGCNT
18    B = ALGCNT
      A = 1.0
      DO 19 I = 1, 5
      C = ABS( ALGCNT - ALG(I) )
      IF( C .GE. B )                      GO TO 19
      B = C
      A = AC(I)
19    CONTINUE
      CONINT = A*10.0**N
C
C     DETERMINE NUMBER OF CONTOURS AND MINIMUM VALUE
C
13    IF( FMIN .GT. 0.0 )                 FMIN = FMIN + CONINT
      FMIN = CONINT*AINT( FMIN/CONINT )
      IF( FMAX .LT. 0.0 )                 FMAX = FMAX - CONINT
      FMAX = CONINT*AINT( FMAX/CONINT )
      IF( MODE .LT. 4 )                   GO TO 11
      FMIN = AMAX1( FMIN, AR(2) )
      FMAX = AMIN1( FMAX, AR(3) )
11    NCONS = (FMAX - FMIN)/CONINT + 1.0
      NCONS = MIN0( NCONS, 46 )
C
C     DETERMINE NUMBER OF DIGITS IN LABEL
C
15    DEL = 1.0E-4*CONINT
      NDGT = 0
21    IF( ABS(AMOD( CONINT*10.0**NDGT, 1.0 )) .LT. DEL )   GO TO 20
      NDGT = NDGT + 1
      IF( NDGT .LT. 11 )                  GO TO 21
C
C     INSURE THAT NO POINT IS EXACTLY ON A CONTOUR
C
20    DO 32 I = 1, IMAX
      DO 32 J = 1, JMAX
      IF( ABS( AMOD( F(J,I), CONINT ) ) .GE. DEL )         GO TO 32
      F(J,I) = 1.000001*F(J,I) + 2.0*DEL
```

Figure K-1. Program for radiance scanner calibration (Sheet 10 of 39).

```
   12  CONTINUE
C
C      START CONTOUR PLOTTING
C
       KONTUR = 0
   10  KONTUR = KONTUR + 1
       CON = FMIN + CONINT*FLOAT( KONTUR-1 )
       DO 14 MP = 1, IDFS
   14  FS(MP) = 0
C
C      BEGIN EDGE SEARCH
C
       LPLOT = .FALSE.
       JE = 0
   17  JE = JE + 1
       IRET = 1
   42  D = F(JE,IMAX) - CON
       C = F(JE+1,IMAX) - CON
       IF( C*D .GT. 0.0 )                    GO TO 22
       IE = IMAXI
       NIN = 3
       EYE = FLOAT( IMAX-1 )
       JAY = G( JE,D,C)
       GO TO 50
   22  IF( JE .NE. JMAXI )                   GO TO 17
       IE = 0
   23  IE = IE + 1
       IRET = 2
   43  A = F(1,IE) - CON
       D = F(1,IE+1) - CON
       IF( A*D .GT. 0.0 )                    GO TO 24
       NIN = 4
       JE = 1
       EYE = G(IE,A,D)
       JAY = 1.0
       GO TO 50
   24  IRET = 3
   41  B = F(JMAX,IE) - CON
       C = F(JMAX,IE+1) - CON
       IF( B*C .GT. 0.0 )                    GO TO 26
       NIN = 2
       JE = JMAXI
       EYE = G(IE,B,C)
       JAY = FLOAT(JMAX)
       GO TO 50
   26  IF( IE .NE. IMAXI )                   GO TO 23
C
C      BEGIN INTERIOR SEARCH
C
       IE = 0
   27  IE = IE + 1
       LPLOT = .TRUE.
       IF( IE .EQ. 1 )                       LPLOT = .FALSE.
```

Figure K-1. Program for radiance scanner calibration (Sheet 11 of 39).

```
      JE = 0
39    JE = JE + 1
      IRET = 4
40    A = F(JE,IE) - CON
      B = F(JE+1,IE) - CON
      IF( A*B .GT. 0.0 )                GO TO 30
      NIN = 1
      EYE = FLOAT( IE )
      JAY = G(JE,A,B)
      GO TO 50
30    IF( JE .NE. JMAXI )               GO TO 39
      IF( IE .NE. IMAXI )               GO TO 27
      IF( KONTUR .LT. NCONS     .AND.   KBEG .LT. 80 )        GO TO 16
C
C     PURGE INITIAL POINTS BUFFER
C     SEARCH STORED INITIAL POINTS FOR ONE CLOSEST TO PRESENT PEN
C     POSITION
C
      KBEGMX = KBEG - 1
      IRET = 5
      KBMXD2 = KBEGMX/2 + 1
      K = 0
52    K = K + 1
      IF( K .LT. KBMXD2 )               GO TO 82
C
C     RETURN IF ALL CONTOURS ARE PLOTTED
C
      IF( KONTUR .GE. NCONS )           RETURN
      KBEG = 1
      GO TO 16
82    IRSQMN = 9999999
      DO 56 KBEG = 1, KBEGMX
      IF( IBEG(KBEG) .EQ. 0 )           GO TO 56
      IRSQ = (I - IBEG(KBEG))**2 + (J - JBEG(KBEG))**2
      IF( IRSQ .NE. 0 )                 GO TO 53
      IF( CON .NE. CONSV(KBEG) )        GO TO 53
      IBEG(KBEG) = 0
      GO TO 56
53    IF( IRSQ .GE. IRSQMN )            GO TO 56
      IRSQMN = IRSQ
      KBEGMN = KBEG
56    CONTINUE
      KBEG = KBEGMX
C
C     TRACE AND PLOT CLOSEST- STARTING CONTOUR
C
      IF( KBEGMN .LE. 0    .OR.   KBEGMN .GT. 100 )       GO TO 4500
      IE = IBEG(KBEGMN)
      JE = JBEG(KBEGMN)
      CON = CONSV(KBEGMN)
      NIN = NINSV(KBEGMN)
      IBEG(KBEGMN) = 0
      DO 57 MP = 1, IOFS
```

Figure K-1. Program for radiance scanner calibration (Sheet 12 of 39).

```
   57  FS(NP) = 0
       IF( NIN .LT. 1    .OR.   NIN .GT. 4 )          GO TO 4500
       GO TO ( 40, 41, 42, 43 ), NIN
   58  IF( J .EQ. 0 )                         J = 1
       IF( I .EQ. 0 )                         I = 1
       IF( I .EQ. IMAX )                      I = IMAX1
       IF( J .EQ. JMAX )                      J = JMAX1
       GO TO 52
C
C      CURVE FOLLOW ROUTINE - BEGIN
C
C      IF THERE IS ROOM, SAVE THE INITIAL POINT
   50  IF( KBEG .LT. 100 )                    LPLOT = .TRUE.
       IF( LPLOT )                            GO TO 59
       CONSV(KBEG) = CON
       IBEG(KBEG) = IE
       JBEG(KBEG) = JE
       NINSV(KBEG) = NIN
       KBEG = KBEG + 1
C      WHY IS THIS A COMMENT? PHW
C      IF( KBEG .GT. 100 )                    GO TO 4500
   59  IBIT = JE + JMAX*(IE - 1) - 1
       IWORD = IBIT/NBITM1 + 1
       IBIT = IBIT - NBITM1*IWORD + NBIT
       IF(IAND(MASK(IBIT),FS(IWORD)).NE.0) GO TO (22,24,26,30), IRET
       I = IE
       J = JE
       IF( NOND .LT. 0 )                      GO TO 1000
       IF( LPLOT )              CALL NUMBER ( (EYE-1.0)*CSALEI,
      2              (JAY-1.0)*CSALEJ, 0.07, CON, THETA, NDGT )
 1000  CONTINUE
       IF( LPLOT )   CALL PLOT ( (EYE-1.0)*CSALEI, (JAY-1.0)*CSALEJ, 3 )
       EYEZRO = EYE
       JAYZRO = JAY
       KLOG = .FALSE.
       IPEN = 2
       HALT = .FALSE.
C
C      CURVE FOLLOWING ROUTINE
C
   60  A = F(J,I) - CON
       B = F(J+1,I) - CON
       C = F(J+1,I+1) - CON
       D = F(J,I+1) - CON
       IBIT = J + JMAX*(I - 1) - 1
       IWORD = IBIT/NBITM1 + 1
       IBIT = IBIT - NBITM1*IWORD + NBIT
       FS(IWORD) = IOR( FS(IWORD),MASK(IBIT) )
       JPP = 1
       IF( A*C .GE. 0.0 )                     JPP = JPP + 1
       IF( B*D .GE. 0.0 )                     JPP = JPP + 2
       IF( JPP .EQ. 4 )                       GO TO 44
   73  NOUT = NPT( NIN, JPP )
```

Figure K-1. Program for radiance scanner calibration (Sheet 13 of 39).

```
      GO TO ( 72, 74, 76, 78 ), NOUT
44    IF( A*C )                      46, 46, 47
46    JPP = 2
      GO TO 73
47    CONTINUE
C     WHY COMMENTS? PHM
C     IM1 = I - 1
C     JM1 = J - 1
C     IP2 = I + 2
C     JP2 = J + 2
C     WRITE( 6, 45 )  I,J,NIN,CON,((F(IZ,JZ),IZ=IM1,IP2),JZ=JM1,JP2)
C  45 FORMAT(23H0ERROR IN CONTUR FOR I=,I2,3H,J=,I2,5H,NIN=,I1,12H,AND C
C    1ONTUR=,I18.8 //(1X, 4E20.8) )
      GO TO ( 22, 24, 26, 30, 58 ), IRET
72    EYE = FLOAT(I)
      JAY = G(J,A,B)
      IF( I .EQ. 1 )                       HALT = .TRUE.
      I = I - 1
      GO TO 80
74    EYE = G(I,B,C)
      JAY = FLOAT(J + 1)
      IF( J .EQ. JMAX1 )                   HALT = .TRUE.
      J = J + 1
      GO TO 80
76    EYE = FLOAT( I+1 )
      JAY = G(J,D,C)
      IF( I .EQ. IMAX1 )                   HALT = .TRUE.
      I = I + 1
      GO TO 80
78    EYE = G(I,A,D)
      JAY = FLOAT(J)
      IF( J .EQ. 1 )                       HALT = .TRUE.
      J = J - 1
80    IF( LPLOT )  CALL PLOT ( (EYE-1.0)*CSALEI, (JAY-1.0)*CSALEJ, IPEN)
      IF( KLOG .AND.EYE.EQ.EYEZRO.AND.JAY.EQ.JAYZRO)         HALT = .TRUE.
      IF( HALT )                           GO TO 90
      IPEN = 1
      NIN = MPT(NOUT,2)
      KLOG = .TRUE.
      GO TO 60
C
C     CURVE FOLLOW - END
C
90    IF( NONO .LT. 0 )                    GO TO 1001
      IF( LPLOT )  CALL NUMBER ( (EYE-1.0)*CSALEI, (JAY-1.0)*CSALEJ,
     2             0.07, CON, THETA, NDOT )
1001  CONTINUE
      GO TO ( 22, 24, 26, 30, 58 ), IRET
4500  WRITE( 6, 4501 ) NIN,KBEG,KBEGMX,K,IE,JE,KONTUR,CON,KBEGMN
4501  FORMAT(5H NIN=,I15,/6H KBEG=,I15/8H KBEGMX=,I15/3H K=,I15/4H IE=,I
     215/4H JE=,I15/8H KONTUR=,I15/5H CON=,E20.8/8H KBEGMN=,I15//)
      KBEG = 1
      GO TO 16
```

Figure K-1. Program for radiance scanner calibration (Sheet 14 of 39).

END

Figure K-1. Program for radiance scanner calibration (Sheet 15 of 39).

```
      SUBROUTINE   COPY     ( IUNIT, * )
C
C     ****************************************************************
C     *                                                              *
C     *     THIS ROUTINE COPIES THE INPUT STREAM FROM UNIT 5 TO      *
C     *     UNIT 6 AND IUNIT.  A RETURN 1 IS EXECUTED IF THE INPUT   *
C     *     STREAM IS EMPTY.                                         *
C     *                                                              *
C     ****************************************************************
C
      DIMENSION     ICARD(20)
C
      CALL HEDING(0)
      CALL HEDING(4)
      WRITE(6,100)
  100 FORMAT(10X, 'INPUT DATA FOR SATCOM DOWNLINK DATA'//
     *       10X, 'CARD NO.'/)
      LINE = 0
  120 READ(5,140,END=180)  ICARD
  140 FORMAT(20A4)
      WRITE(IUNIT,140)  ICARD
      LINE = LINE + 1
      CALL HEDING(1)
      WRITE(6,160) LINE, ICARD
  160 FORMAT(9X, I5, 5X, 20A4)
      GO TO 120
  180 IF ( LINE .EQ. 0 )  RETURN 1
      CALL HEDING(1)
      WRITE(6,200)  LINE
  200 FORMAT(9X, I5, 5X, '/*')
      REWIND IUNIT
      CALL HEDING(0)
      RETURN
      END
```

Figure K-1. Program for radiance scanner calibration (Sheet 16 of 39).

```
      SUBROUTINE    DENNIS ( Z, GAIN1, GAIN2, GAIN3, TAPE, FILE,
     #                      FRSTM, ALPHA, CTIME, ERROR, WS, WD, XTILT,
     #                      YTILT )
C
C              ****************************************************
C              *                                                  *
C              *    SUBROUTINE TO READ UNDERWATER CAMERA TAPES    *
C              *    RECORDED WITH THE DENNIS GUILFORD PROGRAM.    *
C              *                                                  *
C              ****************************************************
C
      REAL          Z(185,185)
C
      LOGICAL       SATRAT, ENDSW, EOF, TERR
C
      INTEGER       GAIN1, GAIN2, GAIN3, T1(61,61), T2(51,51),
     #              IDATA(4096), TAPE, FILE, FRSTM(5), ALPHA(5),
     #              CTIME(5), BLANK /'     '/, ERROR
C
      EQUIVALENCE   ( T1(1,1), T2(1,1) )
C
      ERROR = 0
      DO 140 I = 1,185
        DO 120 J = 1,185
          Z(I,J) = 0.0
120     CONTINUE
140   CONTINUE
C
      DO 180 I = 1,61
        DO 160 J = 1,61
          T1(I,J) = 0
160     CONTINUE
180   CONTINUE
      IREC = 0
C
C               ****************************************************
C               *                                                  *
C               *    FIND CORRECT TAPE AND FILE NUMBER.            *
C               *                                                  *
C               ****************************************************
C
200   CALL UWCAM( IDATA, N, TERR, EOF )
      IF ( EOF )  GO TO 880
      IREC = IREC + 1
      IF ( N .NE. 11 )  GO TO 960
      CALL BCDBIN( IDATA(2), FRSTM, ALPHA, CTIME, &1060 )
      WS = IDATA(5)/20.47
      WD = IDATA(7)/5.686
      XTILT = IDATA(8)/20.47
      YTILT = IDATA(9)/20.47
220   CONTINUE
      GAIN1 = 0
```

Figure K-1. Program for radiance scanner calibration (Sheet 17 of 39).

```
      SATRAT = .FALSE.
C
C                ************************************************************
C                *                                                          *
C                *     READ FIRST RECORD OF FIRST SCAN                      *
C                *                                                          *
C                ************************************************************
C
  240 CALL UNCAM( IDATA, N, TERR, EOF )
      IF ( EOF )  GO TO 880
      IREC = IREC + 1
      IF ( N .NE. 4096 )  GO TO 960
      IF ( IDATA(1) .NE. 1 )  GO TO 1060
      IF ( IDATA(2) .NE. JAIN1 )  GO TO 1100
      DO 260 L = 1,1364
        K = ( L - 1 )*3 + 3
        J = 31 - IDATA(K)/20
        I = 31 - IDATA(K+1)/20
        T1(I,J) = IDATA(K+2)
        IF ( T1(I,J) .EQ. 1023 )  SATRAT = .TRUE.
  260 CONTINUE
C
C                ************************************************************
C                *                                                          *
C                *     READ SECOND RECORD OF FIRST SCAN                     *
C                *                                                          *
C                ************************************************************
C
      CALL UNCAM( IDATA, N, TERR, EOF )
      IF ( EOF )  GO TO 880
      IREC = IREC + 1
      IF ( N .NE. 4092 )  GO TO 960
      DO 280 L = 1,1364
        K = ( L - 1 )*3 + 1
        J = 31 - IDATA(K)/20
        I = 31 - IDATA(K+1)/20
        T1(I,J) = IDATA(K+2)
        IF ( T1(I,J) .EQ. 1023 )  SATRAT = .TRUE.
  280 CONTINUE
C
C                ************************************************************
C                *                                                          *
C                *     READ THIRD RECORD OF FIRST SCAN                      *
C                *                                                          *
C                ************************************************************
C
      CALL UNCAM( IDATA, N, TERR, EOF )
      IF ( EOF )  GO TO 880
      IREC = IREC + 1
      IF ( N .NE. 2010 )  GO TO 960
      DO 300 L = 1,593
        K = ( L - 1 )*3 + 1
        J = 31 - IDATA(K)/20
```

Figure K-1. Program for radiance scanner calibration (Sheet 18 of 39).

```
      I = 31 - IDATA(K+1)/20
      T1(I,J) = IDATA(K+2)
      IF ( T1(I,J) .EQ. 1023 )  SATRAT = .TRUE.
300   CONTINUE
      IF ( SATRAT )  GO TO 345
      ENDSW = .FALSE.
310   CONTINUE
C
C            **************************************************************
C            *                                                            *
C            *   MOVE DATA FROM TEMPORARY BUFFER TO DATA BUFFER           *
C            *                                                            *
C            **************************************************************
C
      DO 340 I = 1,61
        DO 320 J = 1,61
          K = I + 62
          L = J + 62
          Z(K,L) = T1(I,J)
320     CONTINUE
340   CONTINUE
C
C            **************************************************************
C            *                                                            *
C            *   IF NOT GAIN = 3 OR END SWITCH, READ FIRST SCAN           *
C            *   AGAIN AT NEXT HIGHEST GAIN                               *
C            *                                                            *
C            **************************************************************
C
      IF ( GAIN1 .EQ. 3 )  GO TO 400
      IF ( ENDSW )  GO TO 360
      GAIN1 = GAIN1 + 1
      GO TO 240
345   IF ( GAIN1 .NE. 0 )  GO TO 355
      ENDSW = .TRUE.
      ISKIP = 9
      CALL HEDING(3)
      WRITE(6,350)
350   FORMAT(/10X,'SATURATION AT GAIN = 0 IN INNER SQUARE'/)
      GO TO 310
355   ISKIP = ( 3 - GAIN1 )*9
      GAIN1 = GAIN1 - 1
360   CONTINUE
C
C            **************************************************************
C            *                                                            *
C            *   SKIP ANY UNREAD RECORDS OF FIRST SCAN                    *
C            *                                                            *
C            **************************************************************
C
      IF ( ISKIP .EQ. 0 )  GO TO 400
      DO 380 I = 1,ISKIP
```

Figure K-1. Program for radiance scanner calibration (Sheet 19 of 39).

```
      CALL UNCAM( IDATA, N, TERR, EOF )
      IF ( EOF )  GO TO 880
      IREC = IREC + 1
380   CONTINUE
400   CONTINUE
      DO 440 I = 1,51
        DO 420 J = 1,51
          T2(I,J) = 0
420     CONTINUE
440   CONTINUE
      SATRAT = .FALSE.
      GAIN2 = 0
C
C              ****************************************************
C              *                                                  *
C              *    READ FIRST RECORD OF SECOND SCAN              *
C              *                                                  *
C              ****************************************************
C
460   CALL UNCAM( IDATA, N, TERR, EOF )
      IF ( EOF )  GO TO 880
      IREC = IREC + 1
      IF ( IDATA(1) .NE. 2 )  GO TO 1060
      IF ( IDATA(2) .NE. GAIN2 )  GO TO 1100
      IF ( N .NE. 4094 )  GO TO 960
      DO 480 L = 1,1364
        K = ( L - 1 )*3 + 3
        J = 26 - IDATA(K)/40
        I = 26 - IDATA(K+1)/40
        T2(I,J) = IDATA(K+2)
        IF ( T2(I,J) .EQ. 1023 )  SATRAT = .TRUE.
480   CONTINUE
C
C              ****************************************************
C              *                                                  *
C              *    READ SECOND RECORD OF SECOND SCAN             *
C              *                                                  *
C              ****************************************************
C
      CALL UNCAM( IDATA, N, TERR, EOF )
      IF ( EOF )  GO TO 880
      IREC = IREC + 1
      IF ( N .NE. 828 )  GO TO 960
      DO 500 L = 1,276
        K = ( L - 1 )*3 + 1
        J = 26 - IDATA(K)/40
        I = 26 - IDATA(K+1)/40
        T2(I,J) = IDATA(K+2)
        IF ( T2(I,J) .EQ. 1023 )  SATRAT = .TRUE.
500   CONTINUE
      IF ( SATRAT )  GO TO 580
      ENDSW = .FALSE.
520   CONTINUE
```

Figure K-1. Program for radiance scanner calibration (Sheet 20 of 39).

```
C
C     *************************************************************
C     *                                                           *
C     *     MOVE DATA FROM TEMPORARY BUFFER INTO DATA BUFFER      *
C     *                                                           *
C     *************************************************************
C
      DO 560 I = 1,51
        DO 540 J = 1,51
          K = ( I - 26 )*2 + 93
          L = ( J - 26 )*2 + 93
          IF ( K .LE. 61 .OR. K .GE. 125 .OR.
     *         L .LE. 61 .OR. L .GE. 125 )  Z(K,L) = T2(I,J)
  540   CONTINUE
  560 CONTINUE
      IF ( GAIN2 .EQ. 3 )  GO TO 660
      IF ( ENDSW )  GO TO 640
      GAIN2 = GAIN2 + 1
      GO TO 460
  580 IF ( GAIN2 .NE. 0 )  GO TO 620
      ENDSW = .TRUE.
      ISKIP = 0
      CALL HEDING( 2 )
      WRITE(6,600)
  600 FORMAT(/10X,'SATURATION AT GAIN=0 IN OUTER SQUARE SCAN'/)
      GO TO 520
  620 ISKIP = ( 3 - GAIN2 )*2
      GAIN2 = GAIN2 - 1
  640 CONTINUE
C
C     *************************************************************
C     *                                                           *
C     *     SKIP ANY UNREAD RECORDS IN SECOND SCAN                *
C     *                                                           *
C     *************************************************************
C
      IF ( ISKIP .EQ. 0 )  GO TO 680
      DO 660 I = 1,ISKIP
        CALL UNCAP( IDATA, N, IERR, EOF )
        IF ( EOF )  GO TO 880
        IREC = IREC + 1
  660 CONTINUE
  680 CONTINUE
      GAIN3 = 0
      SATRAT = .FALSE.
  700 CONTINUE
C
C     *************************************************************
C     *                                                           *
C     *     READ THIRD SCAN                                       *
C     *                                                           *
C     *************************************************************
C
```

Figure K-1. Program for radiance scanner calibration (Sheet 21 of 39).

```
      CALL UWCAM( IDATA, N, TERR, EOF )
      IF ( EOF ) GO TO 880
      IREC = IREC + 1
      IF ( IDATA(1) .NE. 3 ) GO TO 1060
      IF ( IDATA(2) .NE. GAIN3 ) GO TO 1100
      IF ( N .NE. 3240 ) GO TO 920
      DO 720 L = 1,1080
        K = ( L - 1 )*3 + 3
        IF ( IDATA(K) .NE. 1023 ) GO TO 720
        SATRAT = .TRUE.
        GO TO 800
720   CONTINUE
740   CONTINUE
      ENDSW = .FALSE.
760   DO 780 L = 1,1080
        K = ( L - 1)*3 + 3
        J = 93 - IDATA(K)/20
        I = 93 - IDATA(K+1)/20
        Z(I,J) = IDATA(K+2)
780   CONTINUE
      IF ( GAIN3 .EQ. 3 ) GO TO 860
      IF ( ENDSW ) GO TO 860
      GAIN3 = GAIN3 + 1
      GO TO 700
800   CONTINUE
      IF ( GAIN3 .NE. 0 ) GO TO 840
      ENDSW = .TRUE.
      CALL HEDING( 3 )
      WRITE(6,620)
620   FORMAT(/10X,'SATURATION AT GAIN = 0 IN OUTER CIRCULAR SCAN'/)
      GO TO 760
840   GAIN3 = GAIN3 - 1
860   CONTINUE
      DO 870 I = 1,25
        CALL UWCAP( IDATA, N, TERR, EOF )
        IF ( EOF ) RETURN
870   CONTINUE
      RETURN
C
C             ***************************************************************
C             *                                                             *
C             *     MESSAGES                                                *
C             *                                                             *
C             ***************************************************************
C
880   CALL HEDING( 3 )
      WRITE(6,900)
900   FORMAT(/10X,'UNEXPECTED EOF ON INPUT TAPE'/)
      ERROR = 1
      RETURN
C
920   CALL HEDING( 3 )
      WRITE(6,940)
```

Figure K-1. Program for radiance scanner calibration (Sheet 22 of 39).

```
  940  FORMAT(/10X,'WRONG TAPE SPECIFIED'/)
       ERROR = 2
       RETURN
C
  960  CALL HEDING( 4 )
       WRITE(6,980)  IREC, N
  980  FORMAT(/10X,'RECORD NO. ',I3,' WRONG LENGTH'/
     #         10X,'LENGTH = ',I6/)
       ERROR = 3
       RETURN
C
 1000  CALL HEDING( 3 )
       WRITE(6,1020)
 1020  FORMAT(/10X,'TIME ERROR, TIME SET TO BLANKS'/)
       DO 1040 I = 1,6
          ALPHA(I) = BLANK
 1040  CONTINUE
       GO TO 220
C
 1060  CALL HEDING( 3 )
       WRITE(6,1080)  IREC, IDATA(1)
 1080  FORMAT(/10X,'RECORD NO. ',I3,' WRONG SCAN TYPE, SCAN = ',I6/)
       ERROR = 4
       RETURN
 1100   CALL HEDING( 3 )
       WRITE(6,1120)  IREC, IDATA(2)
 1120  FORMAT(/10X,'RECORD NO. ',I3,' WRONG GAIN, GAIN = ',I6/)
       ERROR = 5
       RETURN
       END
```

Figure K-1. Program for radiance scanner calibration (Sheet 23 of 39).

```
      SUBROUTINE     DENNIS-4 ( Z, GAIN1, GAIN2, GAIN3, TAPE, FILE,
     #                FRSTM, ALPHA, CTIME, ERROR, MS, WD, XTILT,
     #                YTILT )
C
C              ****************************************************
C              *                                                  *
C              *    SUBROUTINE TO READ UNDERWATER CAMERA TAPES    *
C              *    RECORDED WITH THE DENNIS GUILFORD PROGRAM.    *
C              *                                                  *
C              ****************************************************
C
C
      REAL           Z(185,185)
C
      LOGICAL        SATRAT, ENDSW, EOF, TERR
C
      INTEGER        GAIN1, GAIN2, GAIN3, T1(61,61), T2(51,51),
     #               IDATA(4096), TAPE, FILE, FRSTM(5), ALPHA(6),
     #               CTIME(5), BLANK /'    '/, ERROR
C
      EQUIVALENCE    ( T1(1,1), T2(1,1) )
C
      ERROR = 0
      DO 140 I = 1,185
        DO 120 J = 1,185
          Z(I,J) = 0.0
  120   CONTINUE
  140 CONTINUE
C
      DO 180 I = 1,61
        DO 160 J = 1,61
          T1(I,J) = 0
  160   CONTINUE
  180 CONTINUE
      IREC = 0
C
C              ****************************************************
C              *                                                  *
C              *    FIND CORRECT TAPE AND FILE NUMBER.            *
C              *                                                  *
C              ****************************************************
C
  200 CALL UWCAM( IDATA, N, TERR, EOF )
      IF ( EOF )  GO TO 880
      IREC = IREC + 1
      IF ( N .NE. 11 )  GO TO 960
      CALL BCDBIN( IDATA(2), FRSTM, ALPHA, CTIME, 81000 )
      MS = IDATA(5)/20.47
      WD = IDATA(7)/5.686
      XTILT = IDATA(8)/20.47
      YTILT = IDATA(9)/20.47
  220 CONTINUE
      SATRAT = .FALSE.
```

Figure K-1. Program for radiance scanner calibration (Sheet 24 of 39).

```
C
C     ************************************************************
C     *    READ FIRST RECORD OF FIRST SCAN                       *
C     ************************************************************
C
  240 CALL UWCAM( ICATA, N, TERR, EOF )
      IF ( EOF )  GO TO 880
      IREC = IREC + 1
      IF ( N .NE. 4094 )  GO TO 960
      IF ( IDATA(1) .NE. 1 )  GO TO 1060
      GAIN1 = IDATA(2)
      DO 260 L = 1,1364
        K = ( L - 1 )*3 + 3
        J = 31 - IDATA(K)/20
        I = 31 - IDATA(K+1)/20
        T1(I,J) = ICATA(K+2)
        IF ( T1(I,J) .EQ. 1023 )  SATRAT = .TRUE.
  260 CONTINUE
C
C     ************************************************************
C     *    READ SECOND RECORD OF FIRST SCAN                      *
C     ************************************************************
C
      CALL UWCAM( ICATA, N, TERR, EOF )
      IF ( EOF )  GO TO 880
      IREC = IREC + 1
      IF ( N .NE. 4092 )  GO TO 960
      DO 280 L = 1,1364
        K = ( L - 1 )*3 + 1
        J = 31 - IDATA(K)/20
        I = 31 - IDATA(K+1)/20
        T1(I,J) = IDATA(K+2)
        IF ( T1(I,J) .EQ. 1023 )  SATRAT = .TRUE.
  280 CONTINUE
C
C     ************************************************************
C     *    READ THIRD RECORD OF FIRST SCAN                       *
C     ************************************************************
C
      CALL UWCAM( ICATA, N, TERR, EOF )
      IF ( EOF )  GO TO 880
      IREC = IREC + 1
      IF ( N .NE. 2979 )  GO TO 960
      DO 300 L = 1,993
        K = ( L - 1 )*3 + 1
        J = 31 - IDATA(K)/20
        I = 31 - IDATA(K+1)/20
```

Figure K-1. Program for radiance scanner calibration (Sheet 25 of 39).

```
         T1(I,J) = IDATA(K+2)
         IF ( T1(I,J) .EQ. 1023 )  SATRAT = .TRUE.
300   CONTINUE
310   CONTINUE
C
C              ***********************************************************
C              *                                                         *
C              *    MOVE DATA FROM TEMPORARY BUFFER TO DATA BUFFER .     *
C              *                                                         *
C              ***********************************************************
C
      DO 340 I = 1,61
        DO 320 J = 1,61
          K = I + 62
          L = J + 62
          Z(K,L) = T1(I,J)
320     CONTINUE
340   CONTINUE
      IF ( .NOT. SATRAT )  GO TO 360
      CALL HEDING(3)
      WRITE(6,350)  GAIN1
350   FORMAT(/10X,'SATURATION AT GAIN = ',I2,' IN INNER SQUARE'/)
360   CONTINUE
      DO 440 I = 1,51
        DO 420 J = 1,51
          T2(I,J) = 0
420     CONTINUE
440   CONTINUE
      SATRAT = .FALSE.
C
C              ***********************************************************
C              *                                                         *
C              *  - READ FIRST RECORD OF SECOND SCAN                     *
C              *                                                         *
C              ***********************************************************
C
C
460   CALL UNCAM( IDATA, N, IERR, EOF )
      IF ( EOF )  GO TO 680
      IREC = IREC + 1
      IF ( IDATA(1) .NE. 2 )  GO TO 1060
      GAIN2 = IDATA(2)
      IF ( N .NE. 4096 )  GO TO 960
      DO 480 L = 1,1364
        K = ( L - 1 )*3 + 3
        J = 26 - IDATA(K)/40
        I = 26 - IDATA(K+1)/40
        T2(I,J) = IDATA(K+2)
        IF ( T2(I,J) .EQ. 1023 )  SATRAT = .TRUE.
480   CONTINUE
C              ***********************************************************
C              *                                                         *
C              *    READ SECOND RECORD OF SECOND SCAN                    *
```

Figure K-1. Program for radiance scanner calibration (Sheet 26 of 39).

```
C                *                                                       *
C                *********************************************************
C
      CALL UNCAME( ICATA, N, TERR, EOF )
      IF ( EOF )  GO TO 660
      IREC = IREC + 1
      IF ( N .NE. 828 )  GO TO 960
      DO 500 L = 1,276
        K = ( L - 1 )*3 + 1
        J = 26 - IDATA(K)/40
        I = 26 - IDATA(K+1)/40
        T2(I,J) = ICATA(K+2)
        IF ( T2(I,J) .EQ. 1023 )  SATRAT = .TRUE.
  500 CONTINUE
  520 CONTINUE
C
C                *********************************************************
C                *                                                       *
C                *    MOVE CATA FROM TEMPORARY BUFFER INTO CATA BUFFER   *
C                *                                                       *
C                *********************************************************
C
      DO 560 I = 1,51
        DO 540 J = 1,51
          K = ( I - 26 )*2 + 93
          L = ( J - 26 )*2 + 93
          IF ( K .LE. 61 .OR. K .GE. 125 .OR.
     #         L .LE. 61 .OR. L .GE. 125 )  Z(K,L) = T2(I,J)
  540   CONTINUF
  560 CONTINUE
      IF ( .NOT. SATRAT )  GO TO 640
      CALL HEDING( 3 )
      WRITE(6,600)  GAIN2
  600 FORMAT(/10X,'SATURATION AT GAIN = ',I2,' IN OUTER SQUARE SCAN'/)
  640 CONTINUE
      SATRAT = .FALSE.
  700 CONTINUF
C
C                *********************************************************
C                *                                                       *
C                *    READ THIRD SCAN                                    *
C                *                                                       *
C                *********************************************************
C
      CALL UNCAME( ICATA, N, TERR, EOF )
      IF ( EOF )  GO TO 660
      IREC = IREC + 1
      IF ( IDATA(1) .NE. 3 )  GO TO 1060
      GAIN3 = IDATA(2)
      IF ( N .NE. 3242 )  GO TO 960
  760 DO 780 L = 1,1080
        K = ( L - 1 )*3 + 3
        J = 93 - IDATA(K)/20
```

Figure K-1. Program for radiance scanner calibration (Sheet 27 of 39).

```
      I = 93 - IDATA(K+1)/20
      Z(I,J) = IDATA(K+2)
      IF ( IDATA(K+2) .EQ. 1023 )  SATRAT = .TRUE.
780   CONTINUE
800   CONTINUE
      IF ( .NOT. SATRAT )  GO TO 830
      CALL HEDING( 3 )
      WRITE(6,820)  GAIN3
820   FORMAT(/10X,'SATURATION AT GAIN = ',I2,' IN OUTER CIRCULAR SCAN'/)
830   CALL UNCAN( IDATA, N, IERR, EOF )
      IF ( .NOT. EOF )  GO TO 830
      RETURN
C
C           ***************************************************************
C           *                                                             *
C           *      MESSAGES                                               *
C           *                                                             *
C           ***************************************************************
C
880   CALL HEDING( 3 )
      WRITE(6,900)
900   FORMAT(/10X,'UNEXPECTED EOF ON INPUT TAPE'/)
      ERROR = 1
      RETURN
C
920   CALL HEDING( 3 )
      WRITE(6,940)
940   FORMAT(/10X,'WRONG TAPE SPECIFIED'/)
      ERROR = 2
      RETURN
C
960   CALL HEDING( 4 )
      WRITE(6,980)  IREC, N
980   FORMAT(/10X,'RECORD NO. ',I3,' WRONG LENGTH'/,
     #       10X,'LENGTH = ',I6/)
      ERROR = 3
      RETURN
C
1000  CALL HEDING( 3 )
      WRITE(6,1020)
1020  FORMAT(/10X,'TIME ERROR, TIME SET TO BLANKS'/)
      DO 1040 I = 1,6
         ALPHA(I) = BLANK
1040  CONTINUE
      GO TO 220
C
1060  CALL HEDING( 3 )
      WRITE(6,1080)  IREC, IDATA(1)
1080  FORMAT(/10X,'RECORD NO. ',I3,' WRONG SCAN TYPE, SCAN = ',I6/)
      ERROR = 4
      RETURN
1100   CALL HEDING( 3 )
      WRITE(6,1120)  IREC, IDATA(2)
```

Figure K-1. Program for radiance scanner calibration (Sheet 28 of 39).

```
 1120  FORMAT(//10X,'RECORD NO. ',I3,' WRONG GAIN, GAIN = ',I4/)
       ERROR = 1
       RETURN
       END
```

Figure K-1. Program for radiance scanner calibration (Sheet 29 of 39).

```
      SUBROUTINE    FIT       ( KGXP, SUM, DGPX, RMAX, XPEAK, IMAX,
     #                          ILEFT, IRGHT, XLEFT, XRGHT )
C
      REAL          SUM(1), DGPX(1)
C
      RMAX = 0.0
      DO 100 I = 1,KGXP
         IF ( SUM(I) .LE. RMAX )  GO TO 100
         RMAX = SUM(I)
         IMAX = I
  100 CONTINUE
      Y1 = ALOG( SUM(IMAX-1) )
      Y2 = ALOG( RMAX )
      Y3 = ALOG( SUM(IMAX+1) )
      X1 = DGPX(IMAX-1)
      X2 = DGPX(IMAX)
      X3 = DGPX(IMAX+1)
      AK = ( X1*X1*( Y3 - Y2 ) + X2*X2*( Y1 - Y3 ) + X3*X3*( Y2 - Y1 ) )
     #     /( ( Y1 - Y3 )*( X2 - X1 ) + ( Y1 - Y2 )*( X1 - X3 ) )
      AK = AK/2.0
      AA = ( Y1 - Y2 )/( ( X1 - AK )**2 - ( X2 - AK )**2 )
      AH = Y1 - AA*( X1 - AK )**2
      JMAX = EXP( AH )
      XPEAK = AK
      RTEST = EXP( AH - 0.5 )
      IL1 = IMAX - 1
      IL2 = KGXP - IMAX
      DO 120 I = 1,IL1
         IK = IMAX - I
         IF ( SUM(IK) .GT. RTEST )  GO TO 120
         ILEFT = IK
      GO TO 140
  120 CONTINUE
      ILEFT = 1
  140 CONTINUE
      DO 160 I = 1,IL2
         IK = IMAX + I
         IF ( SUM(IK) .GT. RTEST )  GO TO 160
         IRGHT = IK
         GO TO 180
  160 CONTINUE
      IRGHT = KGXP
  180 CONTINUE
      Y1 = ALOG( SUM(ILEFT) )
      Y2 = ALOG( SUM(ILEFT+1) )
      X1 = DGPX(ILEFT)
      X2 = DGPX(ILEFT+1)
      XLEFT = ( X2 - X1 )*( AH - 0.5 - Y1 )/( Y2 - Y1 ) + X1
      Y1 = ALOG( SUM(IRGHT) )
      Y2 = ALOG( SUM(IRGHT-1) )
      X1 = DGPX(IRGHT)
```

Figure K-1. Program for radiance scanner calibration (Sheet 30 of 39).

```
X2 = DCPX(IRGHT-1)
XRGHT = ( X2 - X1 )*( AH - 0.5 - Y1 )/( Y2 - Y1 ) + X1
RETURN
END
```

Figure K-1. Program for radiance scanner calibration (Sheet 31 of 39).

```
      SUBROUTINE   HEDING ( I )
C
      LOGICAL      FIRST / .TRUE. /
C
      INTEGER      LINES / 0 /, PAGE / 0 /
      COMMON       / IDNO /   IYR, IDAY, IHR, MIN, ISEC
C
      IF ( .NOT. FIRST )  GO TO 100
      FIRST = .FALSE.
      CALL DATE ( IYR, IDAY, ISEC )
      ISEC = ISFC/100
      IHR = ISEC/3600
      ISEC = ISEC - IHR*3600
      MIN = ISEC/60
      ISEC = ISEC - MIN*60
      GO TO 200
100   IF ( I .EQ. 0 )  GO TO 200
      LINES = LINES + 1
      IF ( LINES .LE. 55 )  RETURN
C
200   LINES = I + 5
      PAGE = PAGE + 1
      WRITE(6,300)  IHR, MIN, ISEC, IYR, IDAY, PAGE
300   FORMAT('1'//10X,'SATCOM DOWNLINK DATA REDUCTION',
     #        5X,I2,':',I2,':',I2,
     #        5X, A2, '.', A3, 20X, 'PAGE ', I3//)
      RETURN
      END
```

Figure K-1. Program for radiance scanner calibration (Sheet 32 of 39).

```
      SUBROUTINE    INTERP  ( Z, GAIN1, GAIN2, GAIN3, DWELL, FLUX,
     #                       ZERO )
C
C              ****************************************************
C              *                                                  *
C              *     ROUTINE TO INTERPOLATE MISSING POINTS IN     *
C              *     UNDERWATER CAMERA DATA TAKEN WITH THE GUILFORD *
C              *     PROGRAM                                      *
C              *                                                  *
C              ****************************************************
C
      REAL          Z(185,185), GEE(4) / 0.037, 9.228, 1.0, 3.067 /,
     #              A1 / 5.8250E+2/, A2 / 1.2467E-1/,
     #              A3 /-6.1724E-2/, A4 /-1.2029E-5/,
     #              A5 /-1.0780E-5/, A6 /-1.6040E-5/,
     #              A7 / 1.5297E-9/, A8 /-1.2021E-9/,
     #              A9 /-6.8711E-9/, A10/-9.6330E-9/
C
      INTEGER       GAIN1, GAIN2, GAIN3
C
      LOGICAL       NOTS3, NOTS2
C
C              ****************************************************
C              *                                                  *
C              *     PF(X,Y) IS THE APPROXIMATION TO THE PHOTO    *
C              *     CATHODE RESPONSIVITY AT CO-ORDINATES X,Y     *
C              *                                                  *
C              ****************************************************
C
      PF(X,Y) = A1 + X*( A2 + X*( A5 + X*A9 ) )
     #             + Y*( A3 + Y*( A6 + Y*A10 ) )
     #             + X*Y*( A4 + X*A7 + Y*A8 )
C
      NOTS3(I,J) = I .GT. 41 .AND. I .LT. 145 .AND.
     #             J .GT. 41 .AND. J .LT. 145
C
      NOTS2(I,J) = I .GT. 61 .AND. I .LT. 125 .AND.
     #             J .GT. 61 .AND. J .LT. 125
      GSUBD = 1.0 + 11.23*( DWELL**1.036 )
      G1 = GEE(GAIN1 + 1)
      G2 = GEE(GAIN2 + 1)
      G3 = GEE(GAIN3 + 1)
      GMAX = AMAX1( G1, G2, G3 )
      ZERO = 10.0*ALOG10( 2.094E-5/( GMAX*GSUBD*FLUX ) ) - 4.0
      CALFAC = 5.58E4/( G3*GSUBD*FLUX )
C
C              ****************************************************
C              *     CALIBRATE DATA IN THE OUTER CIRCULAR SCAN    *
C              *                                                  *
C              ****************************************************
C
```

Figure K-1. Program for radiance scanner calibration (Sheet 33 of 39).

```
C
      DO 120 I =-1,185,4
        Y = ( I - 93 )*20
        DO 100 J = 1,185,4
          IF ( NOTS3(I,J) )  GO TO 100
          X = ( J - 93 )*20
          TEMP = Z(I,J)
          IF ( TEMP .NE. 0.0 )  TEMP = TEMP + 14.0
          RSQ = ( X - 72.0 )**2 + ( Y + 204.0 )**2
          R = SQRT( RSQ )
          IF ( RSQ .LE. 8.98704E5 )  DNL = 2.68E-8
          IF ( RSQ .GT. 8.98704E5 )  DNL = 2.68E-8
     #                  +( ( R**1.06 )/31.61 - 45.0 )*2.0E-10
          Z(I,J) = TEMP*CALFAC*DNL/PF(X,Y)
100     CONTINUE
120   CONTINUE
C
C           ************************************************
C           *                                              *
C           *    CALIBRATE DATA IN THE OUTER SQUARE SCAN   *
C           *                                              *
C           ************************************************
C
      CALFAC = 5.58E4/( G2*GSUBD*FLUX )
      DO 160 I = 43,143,2
        Y = ( I - 93 )*20
        DO 140 J = 43,143,2
          IF ( NOTS2(I,J) )  GO TO 140
          X = ( J - 93 )*20
          TEMP = Z(I,J)
          IF ( TEMP .NE. 0.0 )  TEMP = TEMP + 14.0
          RSQ = ( X - 72.0 )**2 + ( Y + 204.0 )**2
          R = SQRT( RSQ )
          IF ( RSQ .LE. 8.98704E5 )  DNL = 2.68E-8
          IF ( RSQ .GT. 8.98704E5 )  DNL = 2.68E-8
     #                  + ( ( R**1.06 )/31.61 - 45.0 )*2.0E-10
          Z(I,J) = TEMP*CALFAC*DNL/PF(X,Y)
140     CONTINUE
160   CONTINUE
C
C           ************************************************
C           *                                              *
C           *    CALIBRATE DATA IN THE INNER SQUARE SCAN   *
C           *                                              *
C           ************************************************
C
      CALFAC = 5.58E4/( G1*GSUBD*FLUX )
      DO 200 I = 63,123
        Y = ( I - 93 )*20
        DO 180 J = 63,123
          X = ( J - 93 )*20
          TEMP = Z(I,J)
          IF ( TEMP .NE. 0.0 )  TEMP = TEMP + 14.0
```

Figure K-1. Program for radiance scanner calibration (Sheet 34 of 39).

```
      RSQ = ( X - 72.0 )**2 + ( Y + 204.0 )**2
      R = SQRT( RSQ )
      IF ( RSQ .LE. 8.96704E5 )  DNL = 2.68E-8
      IF ( RSC .GT. 8.96704E5 )  DNL = 2.68E-8
     #   + ( ( R**1.06 )/31.61 - 45.0 )*2.0E-10
      Z(I,J) = TEMP*CALFAC*DNL/PF(X,Y)
180   CONTINUE
230 CONTINUE
C
C         ************************************************************
C         *                                                          *
C         *     FILL IN ROWS OF THE OUTER CIRCULAR SCAN              *
C         *                                                          *
C         ************************************************************
C
      DO 240 I = 1,185,4
        DO 220 J = 1,181,4
          IF ( I .GT. 41 .AND. I .LT. 145 .AND.
     #         J .GT. 37 .AND. J .LT. 145 )  GO TO 220
          TEMP = Z(I,J)
          DZ = Z(I,J+4) - TEMP
          Z(I,J+1) = TEMP + DZ*0.25
          Z(I,J+2) = TEMP + DZ*0.5
          Z(I,J+3) = TEMP + DZ*0.75
220     CONTINUE
240 CONTINUE
C
C         ************************************************************
C         *                                                          *
C         *     NOW FILL IN THE COLUMNS OF THE OUTER CIRCULAR        *
C         *     SCAN                                                 *
C         *                                                          *
C         ************************************************************
C
      DO 280 I = 1,181,4
        DO 260 J = 1,185
          IF ( I .GT. 37 .AND. I .LT. 145 .AND.
     #         J .GT. 41 .AND. J .LT. 145 )  GO TO 260
          TEMP = Z(I,J)
          DZ = Z(I+4,J) - TEMP
          Z(I+1,J) = TEMP + DZ*0.25
          Z(I+2,J) = TEMP + DZ*0.5
          Z(I+3,J) = TEMP + DZ*0.75
260     CONTINUE
280 CONTINUE
C
C         ************************************************************
C         *                                                          *
C         *     FILL IN ROWS OF THE OUTER SQUARE SCAN                *
C         *                                                          *
C         ************************************************************
C
      DO 320 I = 43,143,2
```

Figure K-1. Program for radiance scanner calibration (Sheet 35 of 39).

```
         DO 300 J = 41,143,2
           IF ( I .GT. 61 .AND. I .LT. 125 .AND.
     #          J .GT. 61 .AND. J .LT. 123 )  GO TO 300
           TEMP = Z(I,J)
           DZ = Z(I,J+2) - TEMP
           Z(I,J+1) = TEMP + DZ*0.5
  300    CONTINUE
  320  CONTINUE
C
C                ****************************************************
C                *
C                *     FILL IN COLUMNS OF THE OUTER SQUARE SCAN     *
C                *                                                  *
C                ****************************************************
       DO 360 I = 41,143,2
         DO 340 J = 42,144
           IF ( I .GT. 61 .AND. I .LT. 123 .AND.
     #          J .GT. 62 .AND. J .LT. 124 )  GO TO 340
           TEMP = Z(I,J)
           DZ = Z(I+2,J) - TEMP
           Z(I+1,J) = TEMP + DZ*0.5
  340    CONTINUE
  360  CONTINUE
       RETURN
       END
```

Figure K-1. Program for radiance scanner calibration (Sheet 36 of 39).

```
      SUBROUTINE PHLINE (X,Y,N,XEXTMX,YEXTMX,XEXTMN,YEXTMN,K,J,L)
      DIMENSION X(1), Y(1)
C
C           X  IS THE NAME OF THE ARRAY OF UNSCALED ORDINATE VALUES.
C           Y  IS THE NAME OF THE ARRAY OF UNSCALED ABCISSA VALUES.
C           N  IS THE NUMBER OF POINTS IN THE ARRAY
C           XEXTMX, YEXTMX, XEXTMN, YEXTMN ARE RESPECTIVELY THE
C           GREATEST AND SMALLEST DISTANCES IN INCHES FROM THE PEN
C           ORGIN THAT POINTS ARE TO BE POLTTED.
C           K  IS THE REPEAT CYCLE OF A MIXED ARRAY (NORMALLY = 1).
C           J  IS THE ALTERNATE NUMBER OF DATA POINT TO PLOT A SYMBOL.
C              J WILL = 0 FOR LINE PLOT,NEGATIVE FOR POINT PLOT,
C              J = 1 FOR POINT FOR EVERY DATA POINT,2 FOR EVERY OTHER
C           L  IS AN INTEGER DESCRIBING SYMBOL TO BE USED, SEE SYMBOL
C              ROUTINE FOR LIST
C
C     NOTE THIS ROUTINE EXPECTS  XMIN,DX,YMIN AND DY TO BE STORED IN
C           X(N*K+1),X(N*K+1+K),Y(N*K+1),AND Y(N*K+1+K) RESPECTIVELY.
C
C           EXTERNAL REFERENCES-
C                 NTRPLT
C                 PLOT
C                 SYMBOL
C                 WHERE
C
      JPOINT=-1
      NP=N*K+1
      NQ=NP+K
      ND=NP-K
      XMIN=X(NP)
      DX=X(NQ)
      YMIN=Y(NP)
      DY=Y(NQ)
      I3=3
      CALL WHERE (XN,YN,TIMES)
      I2=-1
      XN=XN*DX+XMIN
      YN=YN*DY+YMIN
      DX1=X(1)-XN
      DY1=Y(1)-YN
      DX2=X(ND)-XN
      DY2=Y(ND)-YN
      DX1=(DX1*DX1)+(DY1*DY1)
      DX2=(DX2*DX2)+(DY2*DY2)
      KK=K
      NT=IABS(J)
      NA=NT
      IF (DX1-DX2) 5,5,10
    5 ND=1
      KK=-KK
   10 NW=-2
      KL=2
```

Figure K-1. Program for radiance scanner calibration (Sheet 37 of 39).

```
      IF (J) 15,20,25
15    NW=-1
      KL=1
      GO TO 25
20    NA=NP
25    DO 155 I=1,N
      XCOORD=(X(NO)-XMIN)/DX
      YCOORD=(Y(NO)-YMIN)/DY
      IPOINT=0
      NOPLOT=0
C
C     IS (XCOORD,YCOORD) WITHIN BOUNDRY-
C
      IF (XCOORD-XEXTMN) 35,30,30
30    IF (XCOORD-XEXTMX) 45,45,40
35    IPOINT=1
      EX=XEXTMN
      IF (JPOINT) 45,160,75
40    IPOINT=2
      EX=XEXTMX
      IF (JPOINT) 45,160,75
45    IF (YCOORD-YEXTMN) 55,50,50
50    IF (YCOORD-YEXTMX) 65,65,60
55    IPOINT=3
      EX=YEXTMN
      IF (JPOINT) 75,165,75
60    IPOINT=3
      EX=YEXTMX
      IF (JPOINT) 75,165,75
C
C     IF IPOINT IS ZERO, THEN (XCOORD,YCOORD) IS WITHIN BOUNDRY-
C     IF JPOINT IS ZERO, THEN (XLAST,YLAST) IS WITHIN BOUNDRY-
C     IF I = 1, THEN THIS IS THE FIRST POINT IN QUESTION, AND THEREFORE
C     THERE IS NO VALID VALUE FOR XLAST OR YLAST
C
65    IF (I-1) 80,70,80
70    IF (IPOINT) 75,110,75
75    NOPLOT=1
      GO TO 110
80    IF (JPOINT) 85,110,85
85    IF (JPOINT-2) 170,175,90
90    IF (YLAST-YEXTMN) 185,190,190
95    IF (XLAST-XEXTMN) 170,100,100
100   IF (XLAST-XEXTMX) 105,105,175
105   CALL PLOT (XLAST,YLAST,3)
110   IF (NA-NT) 190,115,135
115   IF (NOPLOT-1) 120,125,120
120   CALL SYMBOL (XCOORD,YCOORD,0.08,L,0.0,12)
125   NA=1
      GO TO 150
130   GO TO (145,135), KL
135   IF (NOPLOT-1) 140,145,140
140   CALL PLOT (XCOORD,YCOORD,13)
```

Figure K-1. Program for radiance scanner calibration (Sheet 38 of 39).

```
 145   NA=NA+1                                                    PHL 106
 150   I3=2                                                       PHL 107
       I2=IW                                                      PHL 108
       XLAST=(X(NO)-XMIN)/DX                                      PHL 109
       YLAST=(Y(NO)-YMIN)/DY                                      PHL 110
       JPOINT=IPOINT                                              PHL 111
       NO=NO-NK                                                   PHL 112
 155   CONTINUE                                                   PHL 113
       RETURN                                                     PHL 114
C                                                                 PHL 115
C      NTRPLTS                                                    PHL 116
C                                                                 PHL 117
 160   A=XLAST-XCOORD                                             PHL 118
       B=YLAST-YCOORD                                             PHL 119
       C=EX-XCOORD                                                PHL 120
       D=B/A*C                                                    PHL 121
       XCOORD=EX                                                  PHL 122
       YCOORD=YCOORD+D                                            PHL 123
       GO TO 45                                                   PHL 124
C                                                                 PHL 125
 165   A=YLAST-YCOORD                                             PHL 126
       B=XLAST-XCOORD                                             PHL 127
       C=EX-YCOORD                                                PHL 128
       D=B/A*C                                                    PHL 129
       YCOORD=EX                                                  PHL 130
       XCOORD=XCOORD+D                                            PHL 131
       GO TO 65                                                   PHL 132
C                                                                 PHL 133
 170   EX=XEXTMN                                                  PHL 134
       GO TO 180                                                  PHL 135
 175   EX=XEXTMX                                                  PHL 136
 180   A=XCOORD-XLAST                                             PHL 137
       B=YCOORD-YLAST                                             PHL 138
       C=EX-XLAST                                                 PHL 139
       D=B/A*C                                                    PHL 140
       XLAST=EX                                                   PHL 141
       YLAST=YLAST+D                                              PHL 142
       GO TO 105                                                  PHL 143
C                                                                 PHL 144
 185   EX=YEXTMN                                                  PHL 145
       GO TO 195                                                  PHL 146
 190   EX=YEXTMX                                                  PHL 147
 195   A=YCOORD-YLAST                                             PHL 148
       B=XCOORD-XLAST                                             PHL 149
       C=EX-YLAST                                                 PHL 150
       D=B/A*C                                                    PHL 151
       YLAST=EX                                                   PHL 152
       XLAST=XLAST+D                                              PHL 153
       GO TO 95                                                   PHL 154
C                                                                 PHL 155
       END                                                        PHL 156-
```

Figure K-1. Program for radiance scanner calibration (Sheet 39 of 39).

APPENDIX L
PLOTS OF IRRADIANCE LOSS AT GIVEN DEPTH AS FUNCTION OF THE SUN'S ZENITH ANGLE

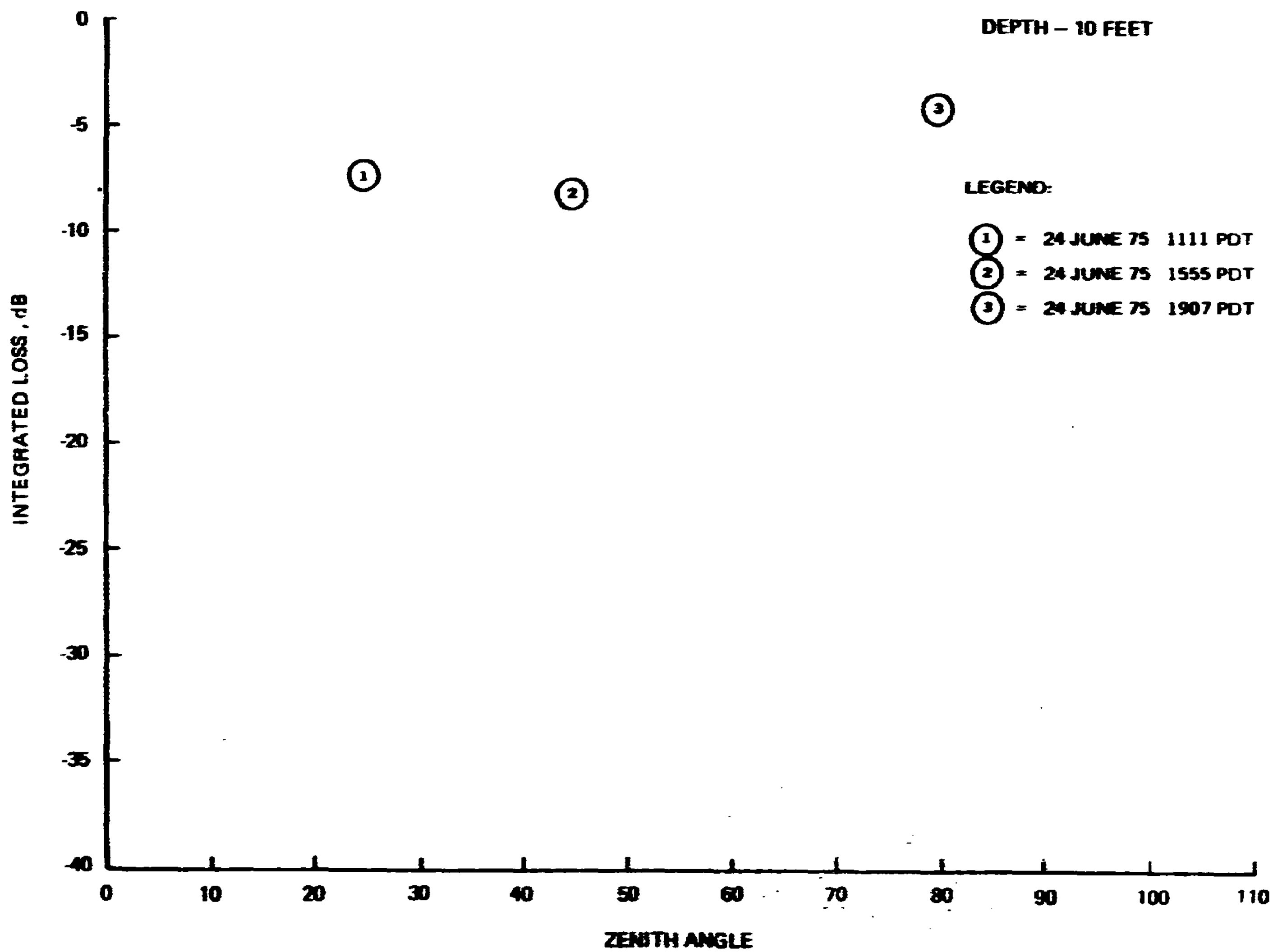


Figure L-1. Irradiant loss vs. zenith angle.

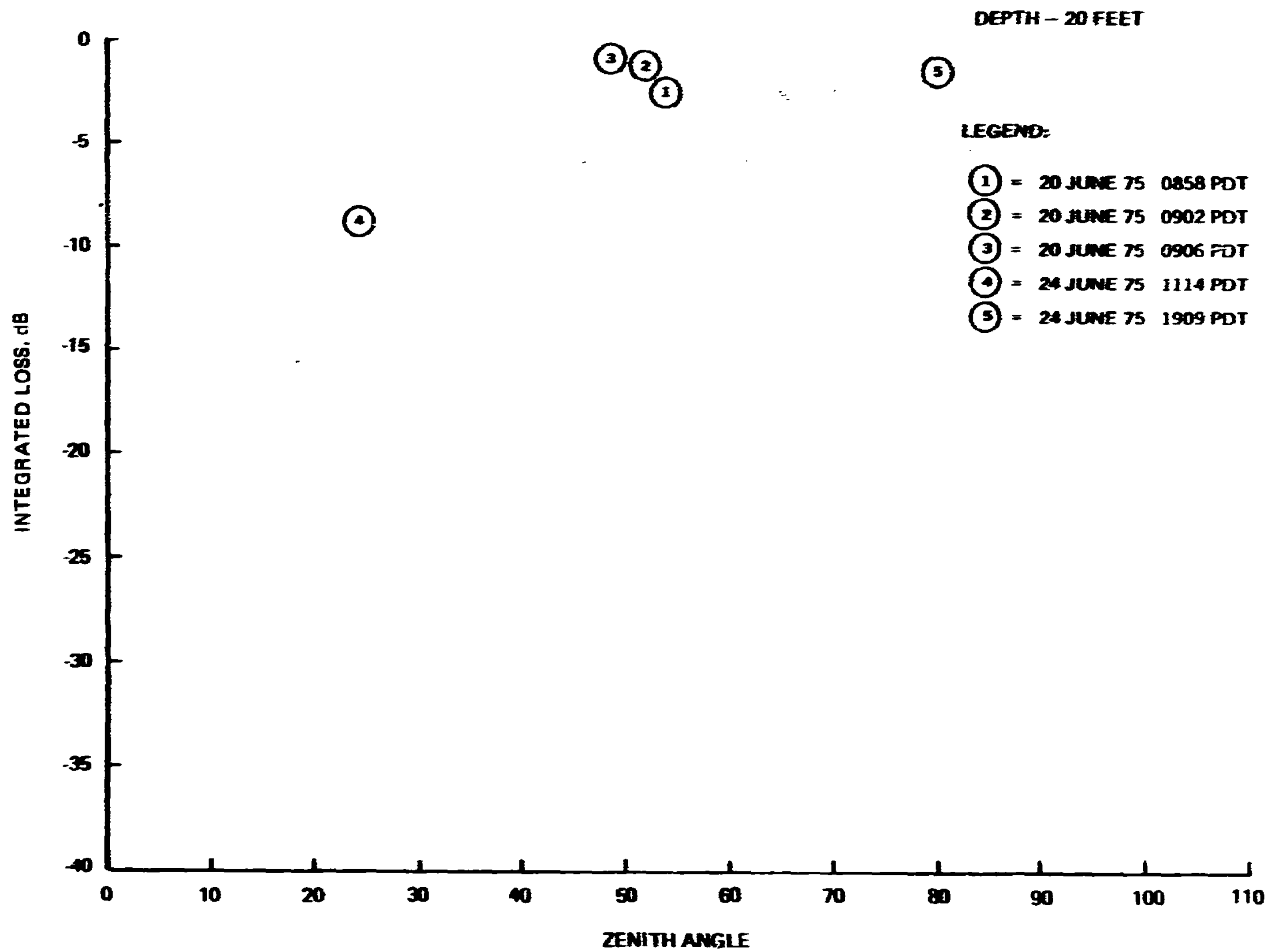


Figure L-2. Irradiant loss vs. zenith angle.

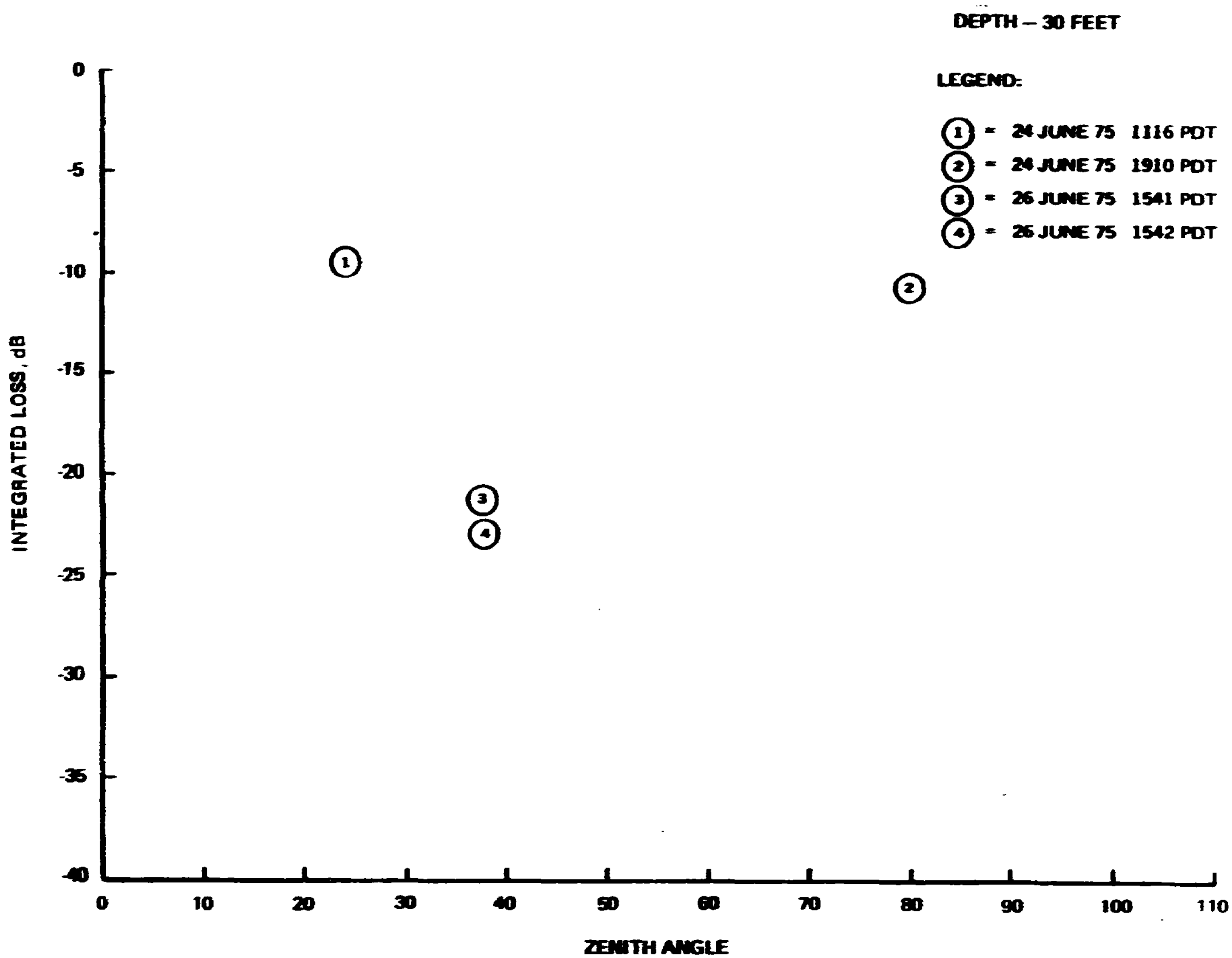


Figure L-3. Irradiant loss vs. zenith angle.

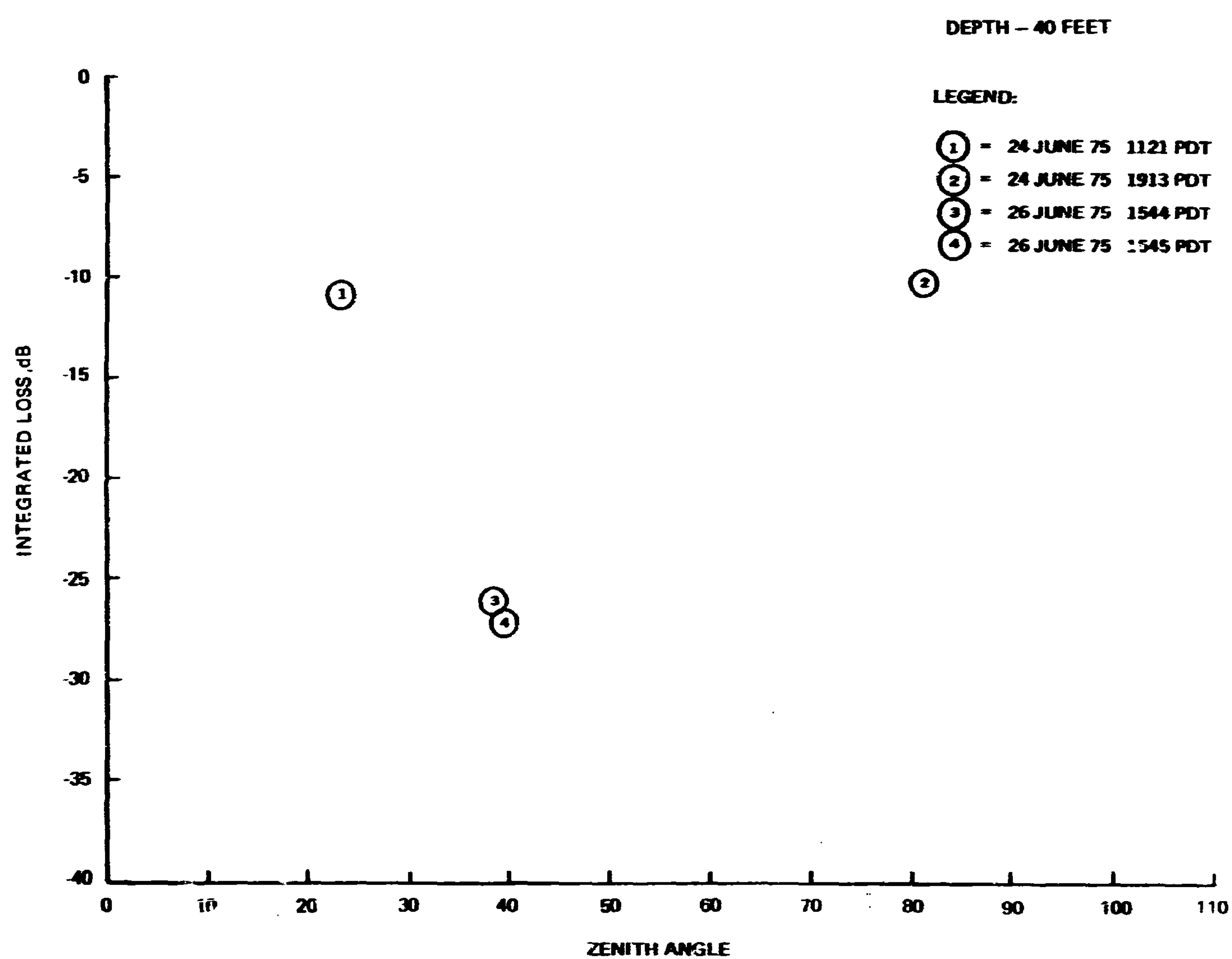
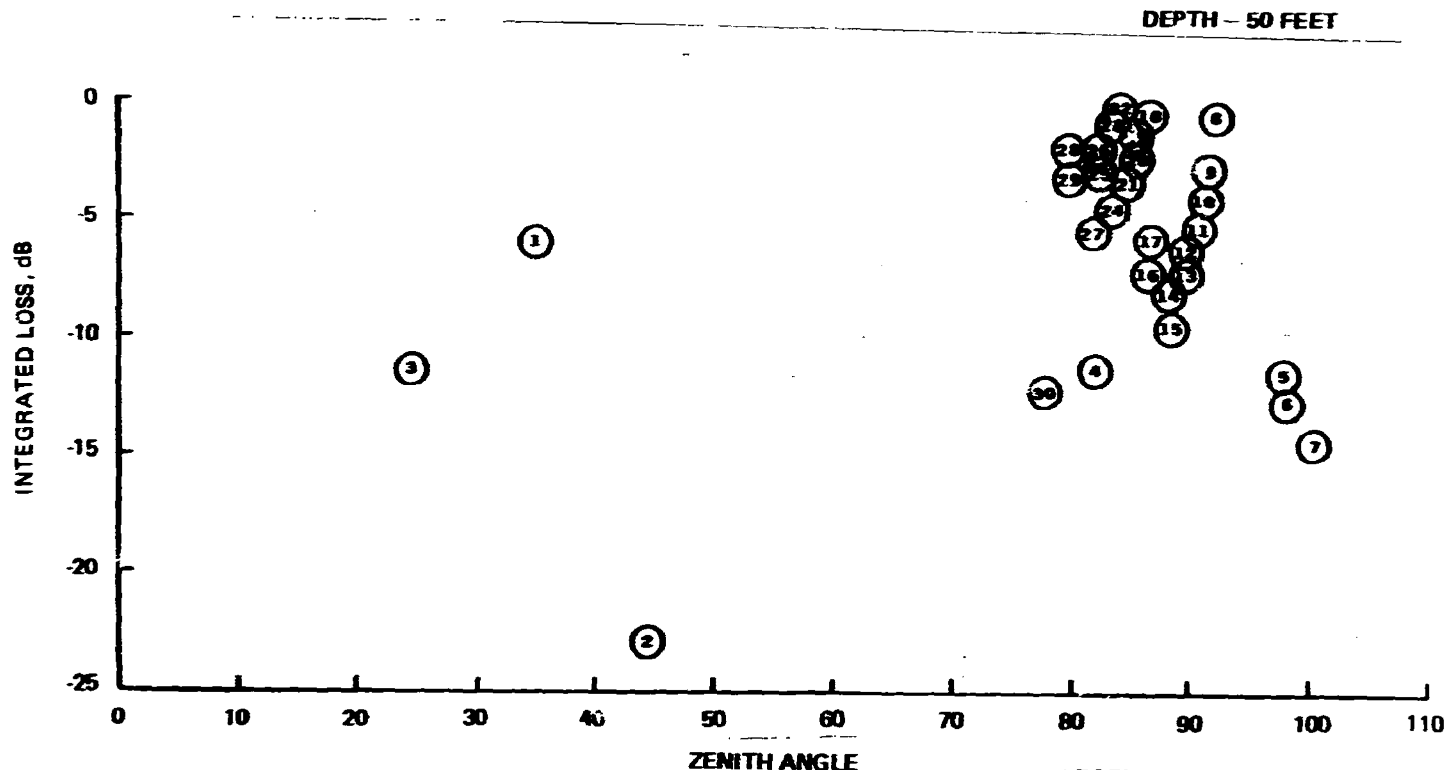


Figure L-4. Irradiant loss vs. zenith angle.



LEGEND:

	DAY	HOUR		DAY	HOUR		DAY	HOUR
(1) =	18	1022	(11) =	26	2005	(21) =	26	1936
(2) =	19	0936	(12) =	26	2002	(22) =	26	1932
(3) =	24	1124	(13) =	26	1959	(23) =	26	1930
(4) =	24	1915	(14) =	26	1956	(24) =	26	192[illegible]
(5) =	24	1943	(15) =	26	1952	(25) =	26	1923
(6) =	24	1947	(16) =	26	1949	(26) =	26	1921
(7) =	24	2005	(17) =	26	1946	(27) =	26	1918
(8) =	26	2014	(18) =	26	1942	(28) =	26	1915
(9) =	26	2011	(19) =	26	1939	(29) =	26	[illegible]
(10) =	26	2008	(20) =	26	1939	(30) =	26	[illegible]

Figure L-5. Irradiant loss vs. zenith angle.

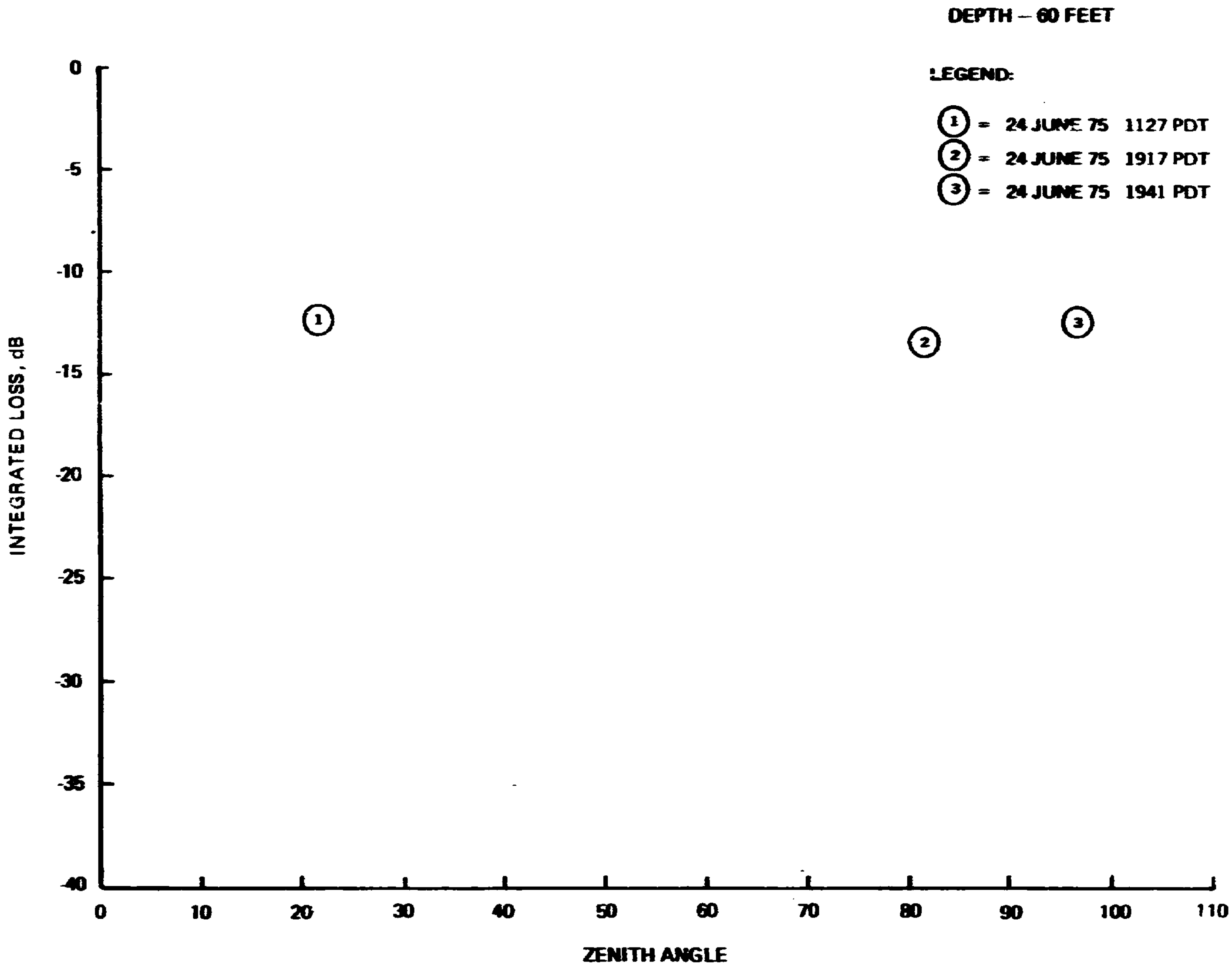


Figure L-6. Irradiant loss vs. zenith angle.

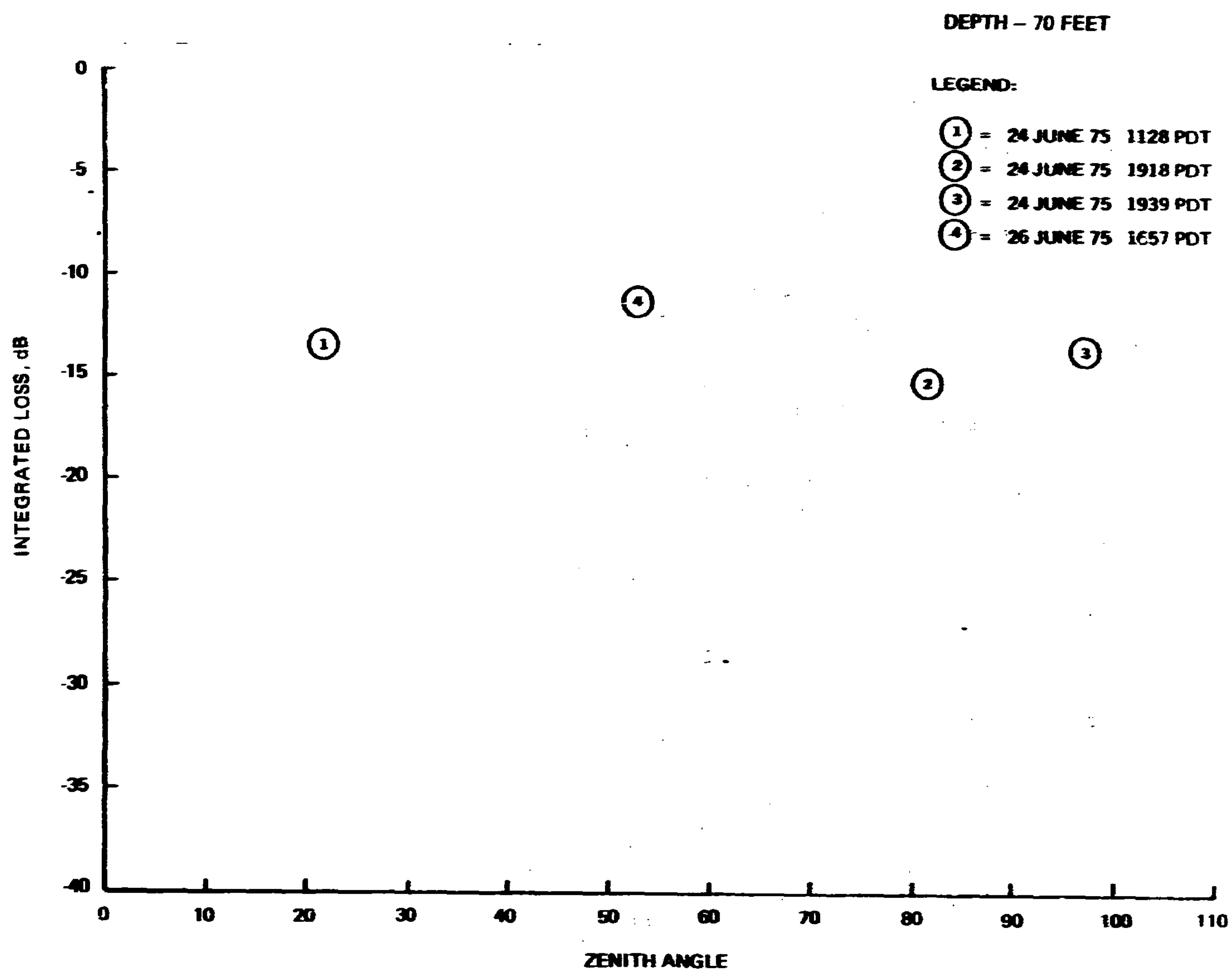


Figure L-7. Irradiant loss vs. zenith angle.

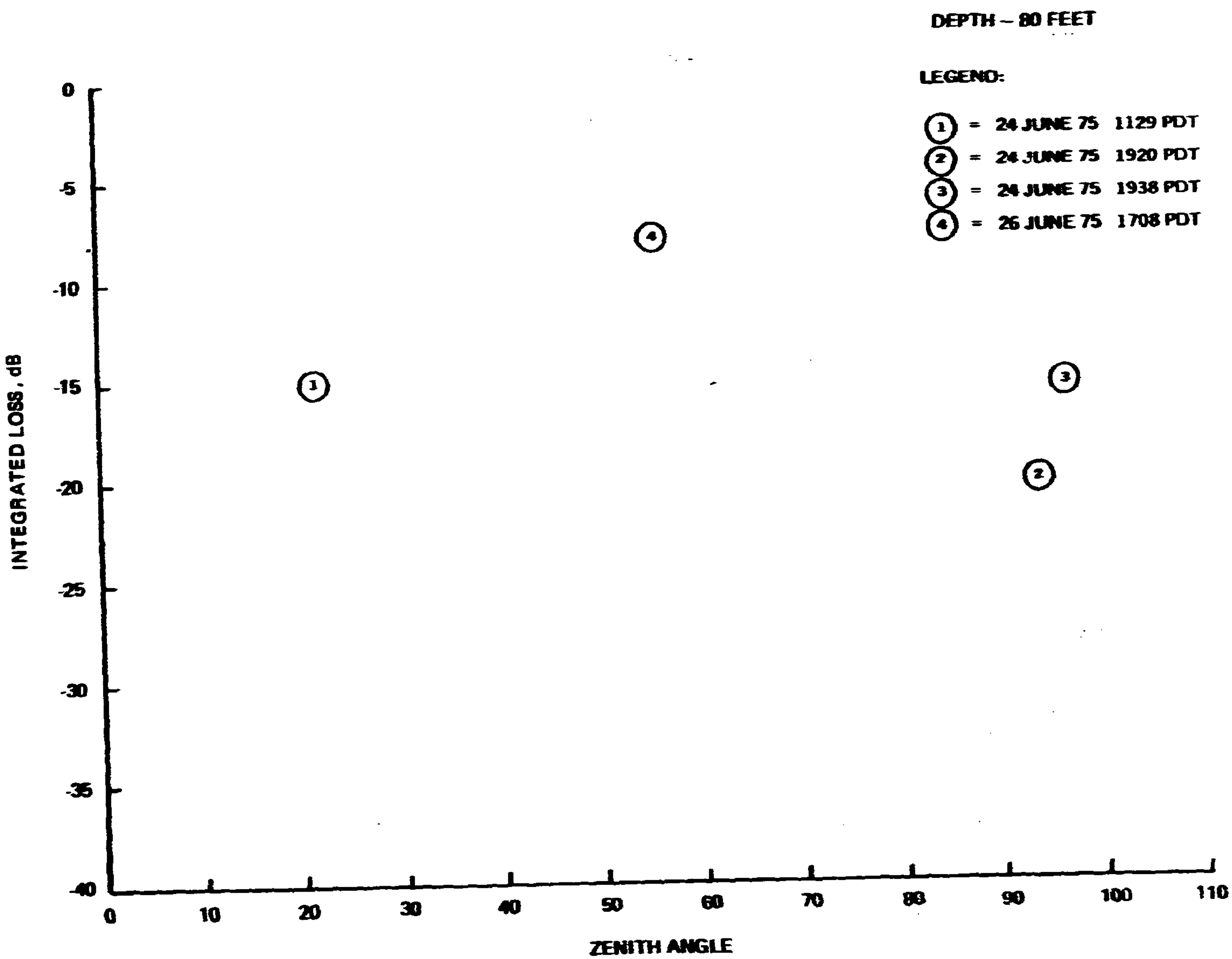


Figure L-8. Irradiant loss vs. zenith angle.

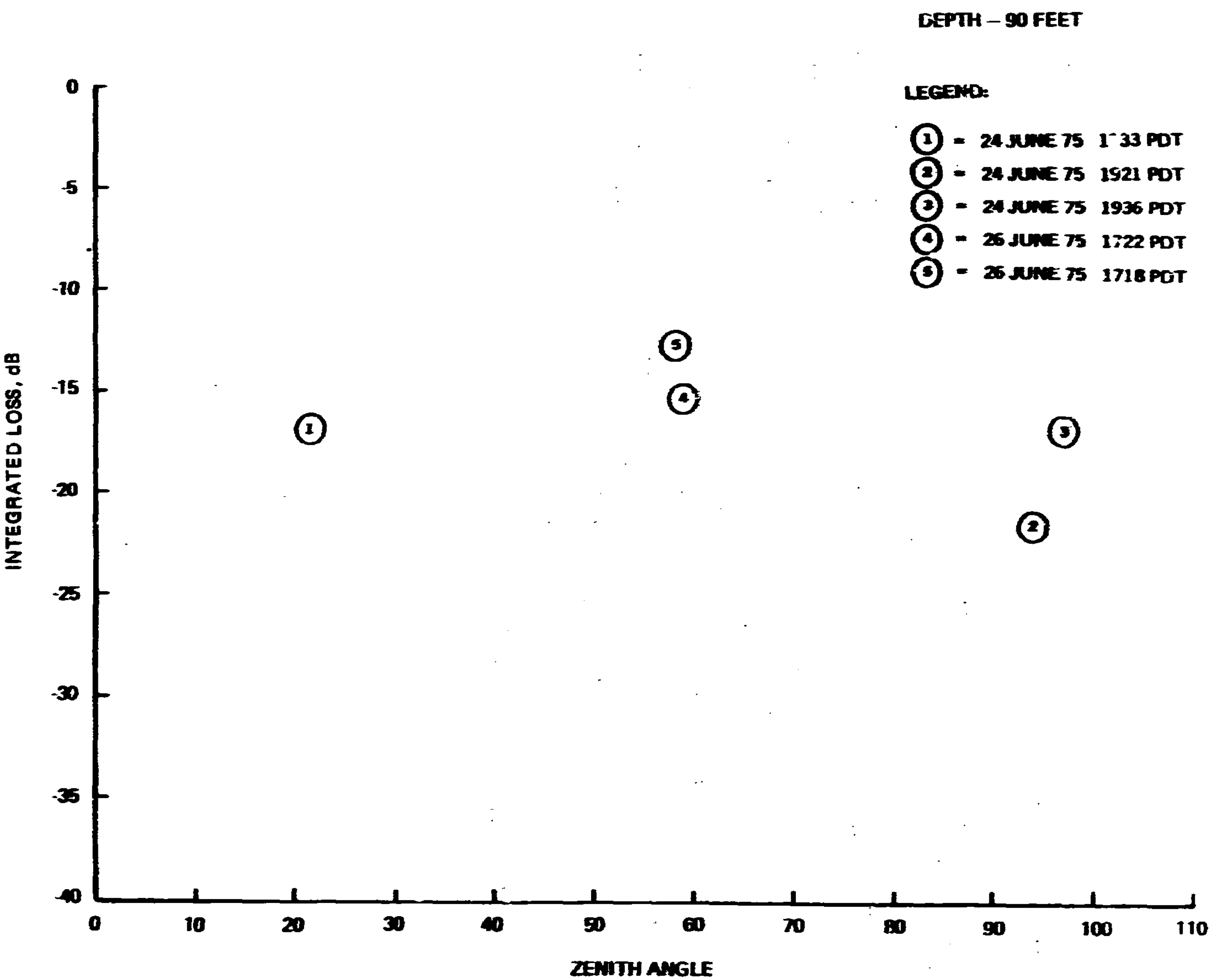


Figure L-9. Irradiant loss vs. zenith angle.

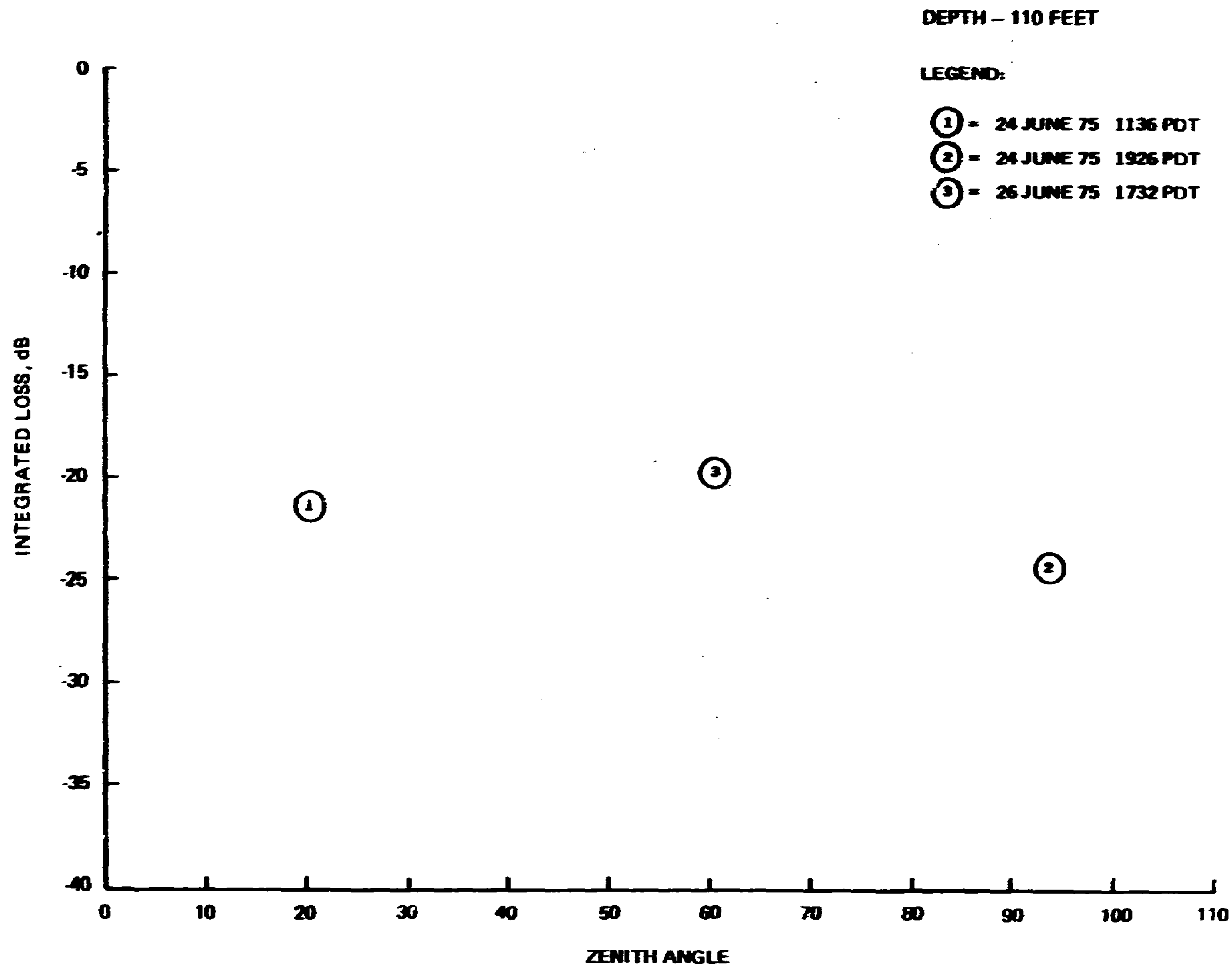


Figure L-10. Irradiant loss vs. zenith angle.

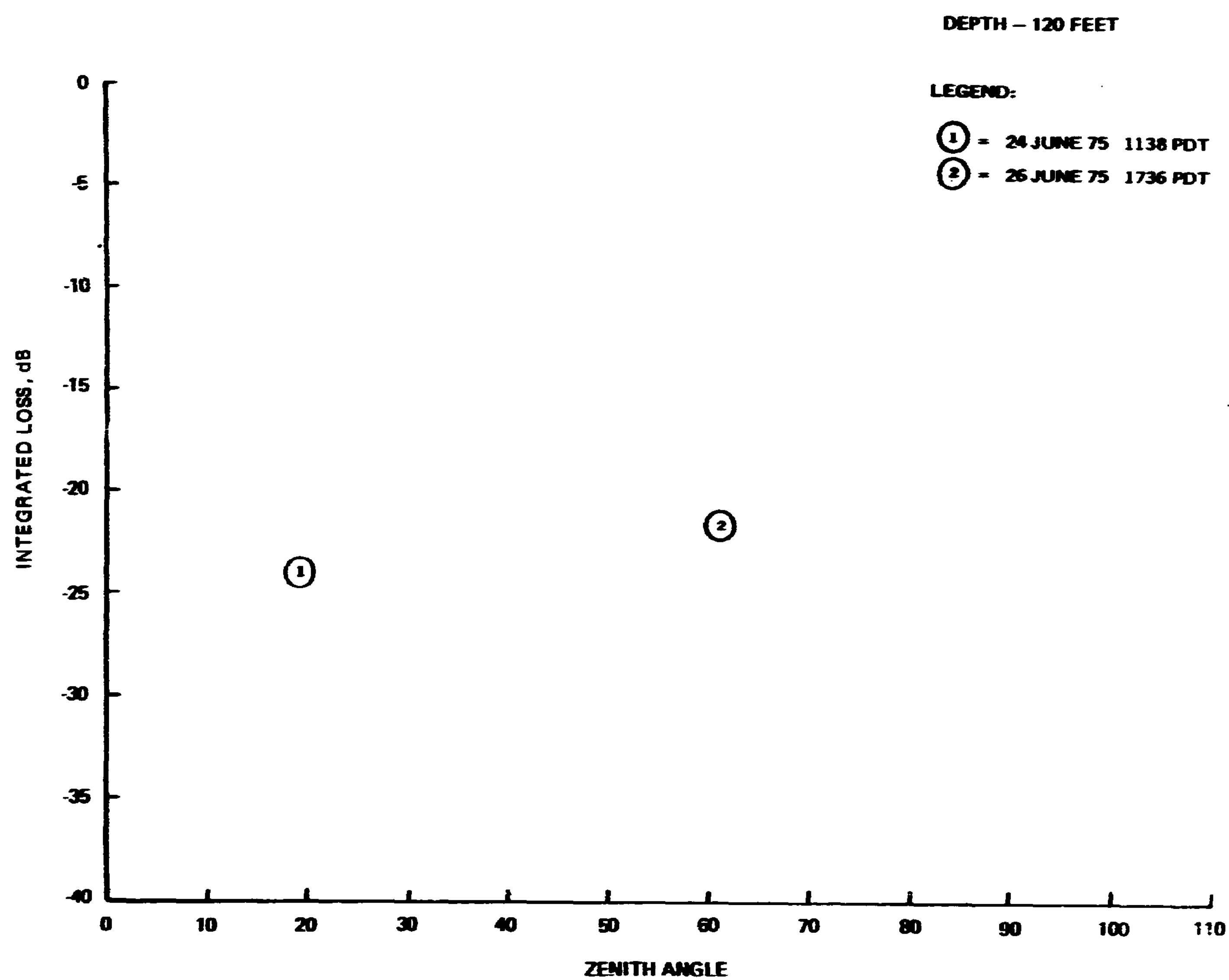


Figure L-11. Irradiant loss vs. zenith angle.

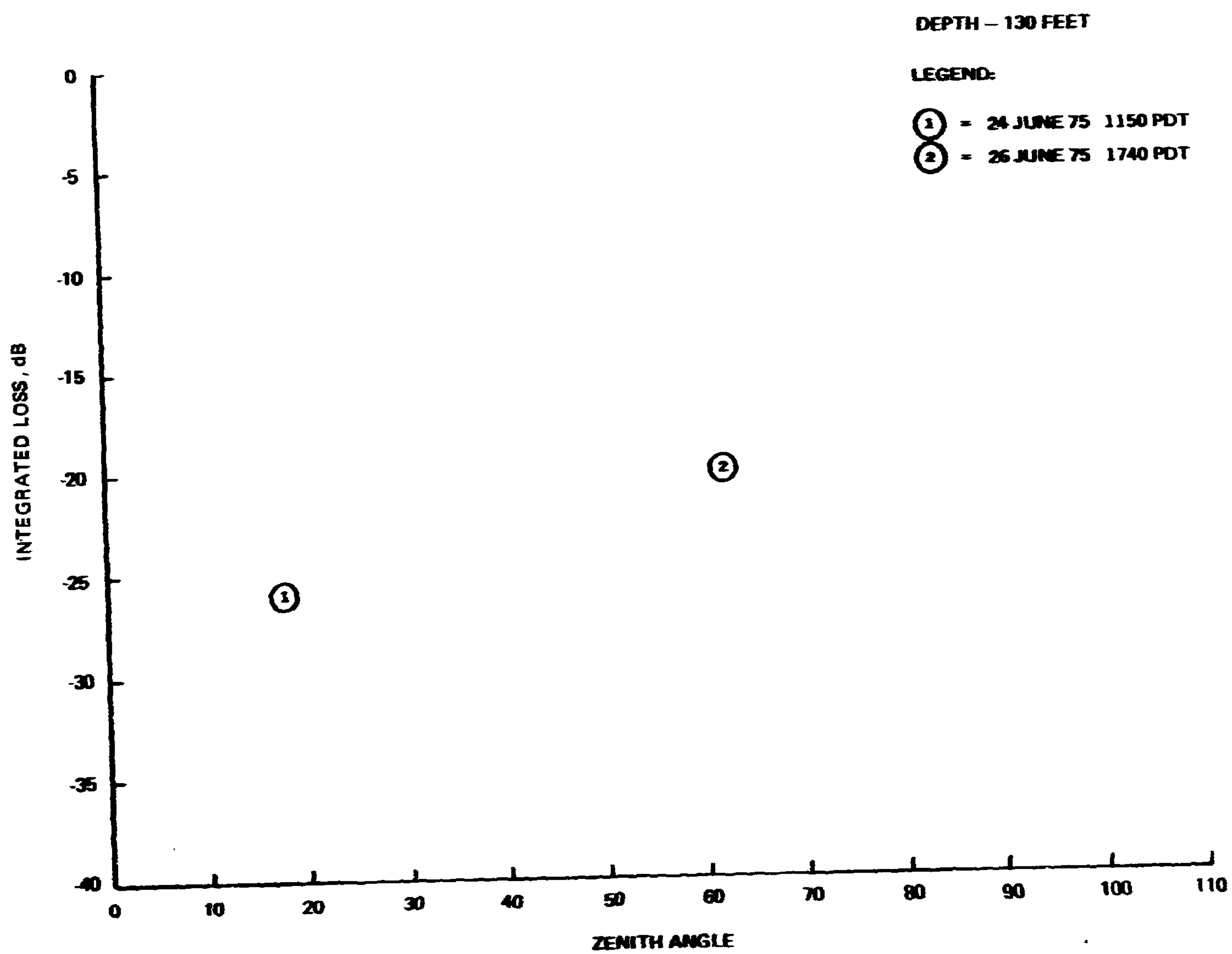


Figure L-12. Irradiant loss vs. zenith angle.

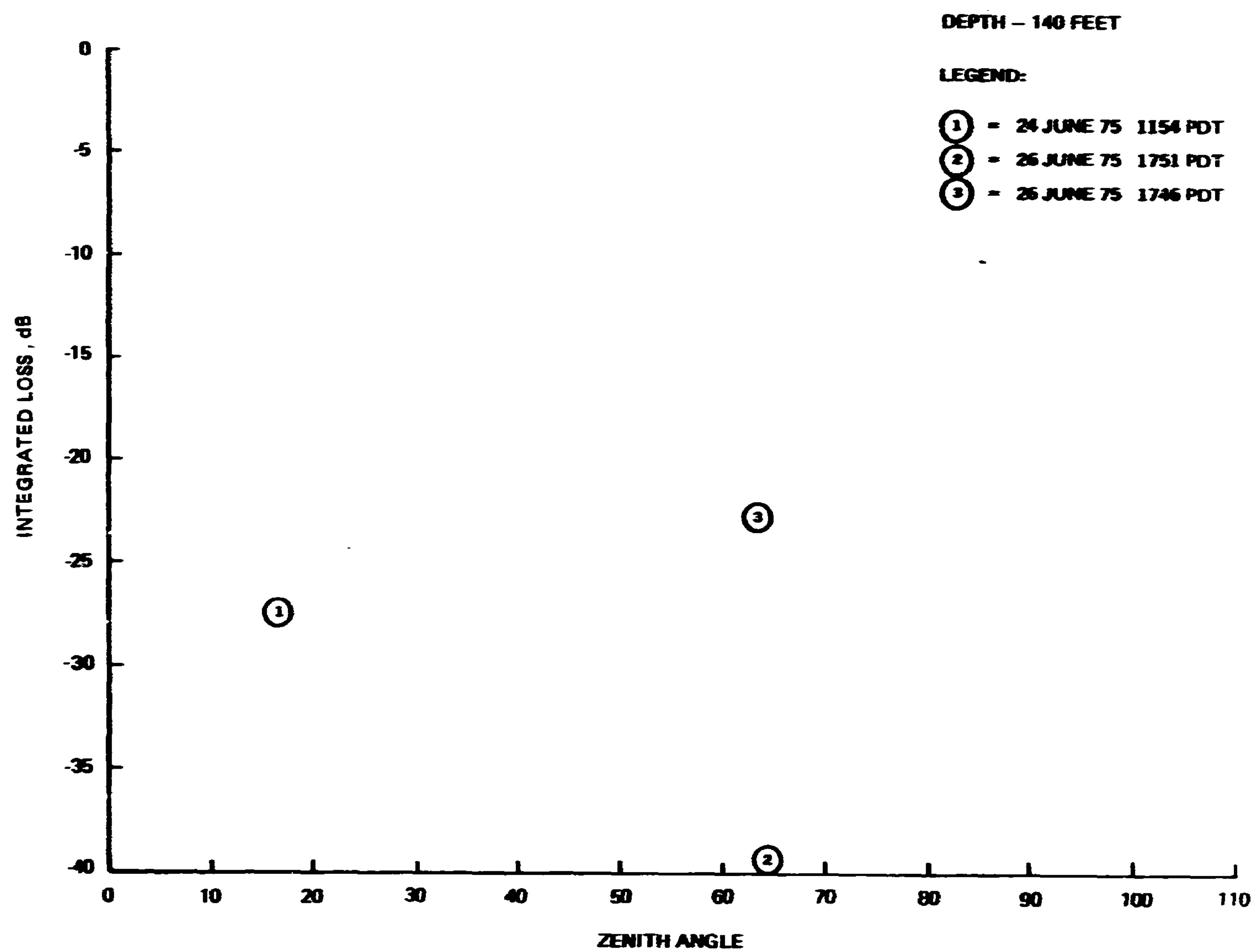


Figure L-13. Irradiant loss vs. zenith angle.

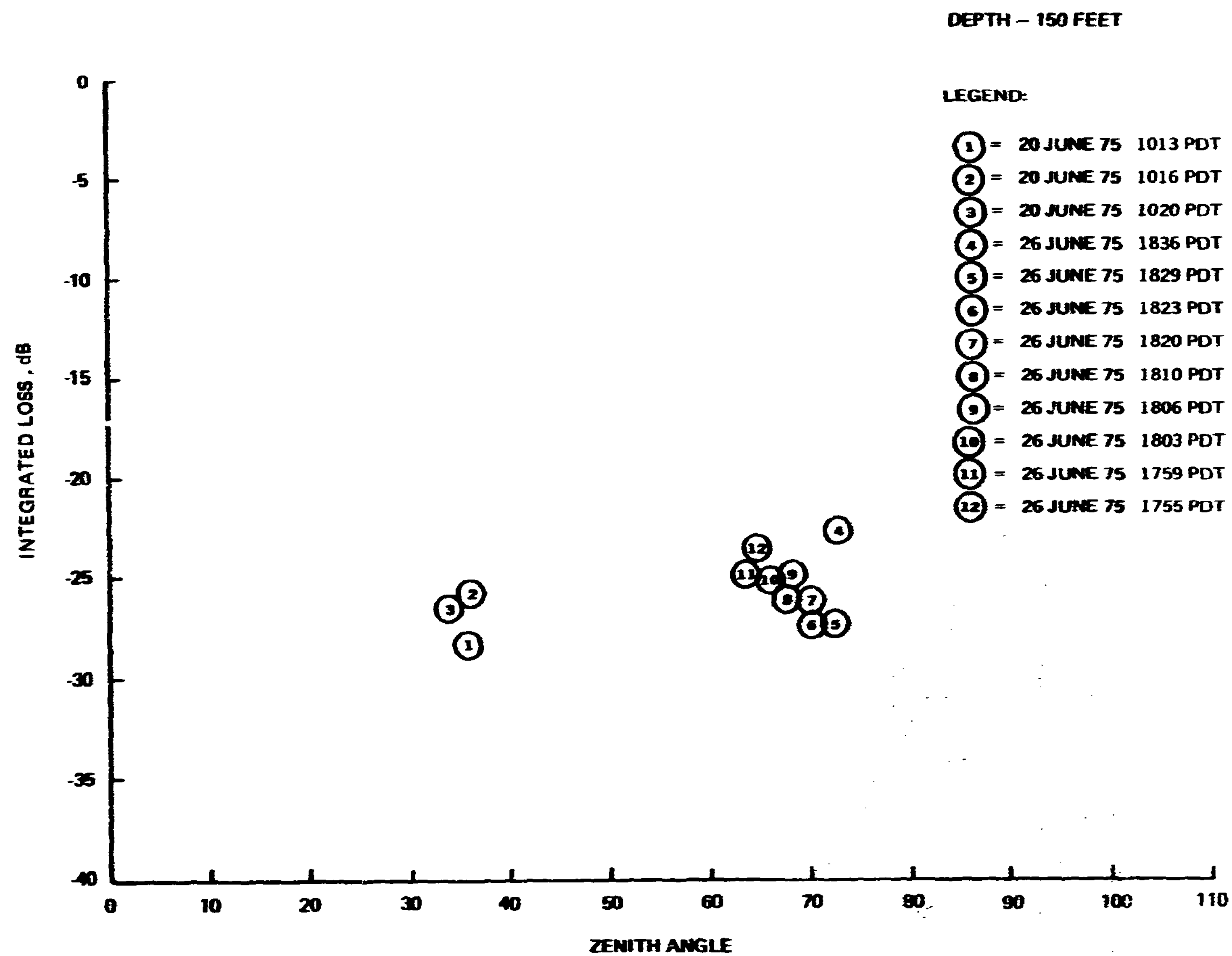


Figure L-14. Irradiant loss vs. zenith angle.

APPENDIX M

$F(\theta)$ RECEIVER DATA

The $F(\theta)$ receiver was deployed to make an independent measurement of the radiant impulse response as described in Appendix A, equation (7). Two sets of these measurements were taken and are plotted in figures M-1 and M-2. The conditions for these measurements were as follows: the laser was inclined at an angle 12.5° off the zenith. The receiver, mounted alongside the barge, was moved roughly perpendicular to the direction of propagation. At each point (measured in feet), the receiver was rotated and a radiant pattern recorded. In figure M-1, the position of the receiver was measured from the point on the surface where the undistorted beam would normally intercept, thus recording plus/minus distances. In figure M-2, the distances were measured from the location of the laser and therefore only positive distances occur.

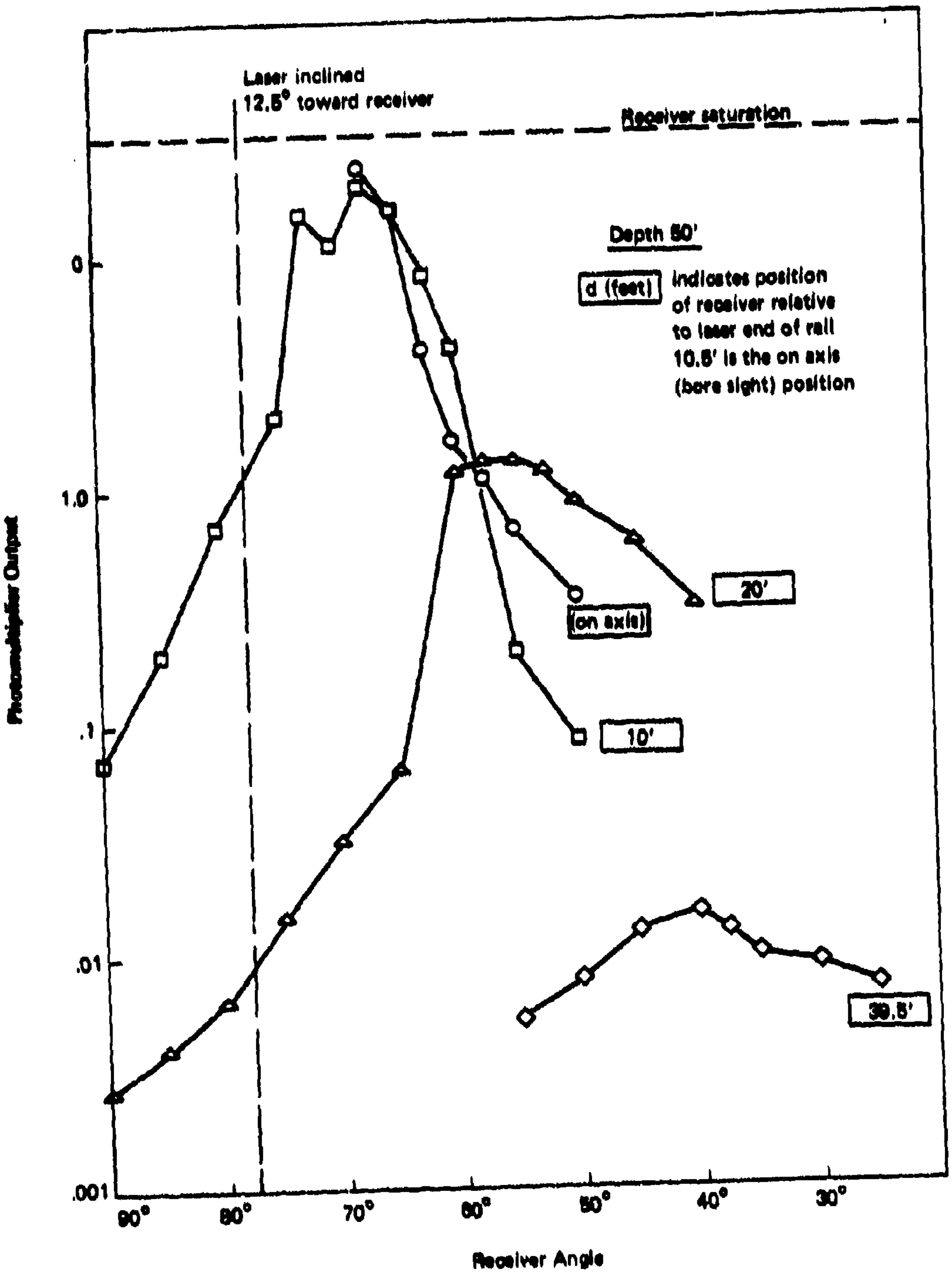


Figure M-1A. Radiance profile through F(θ) receiver (June 1975).

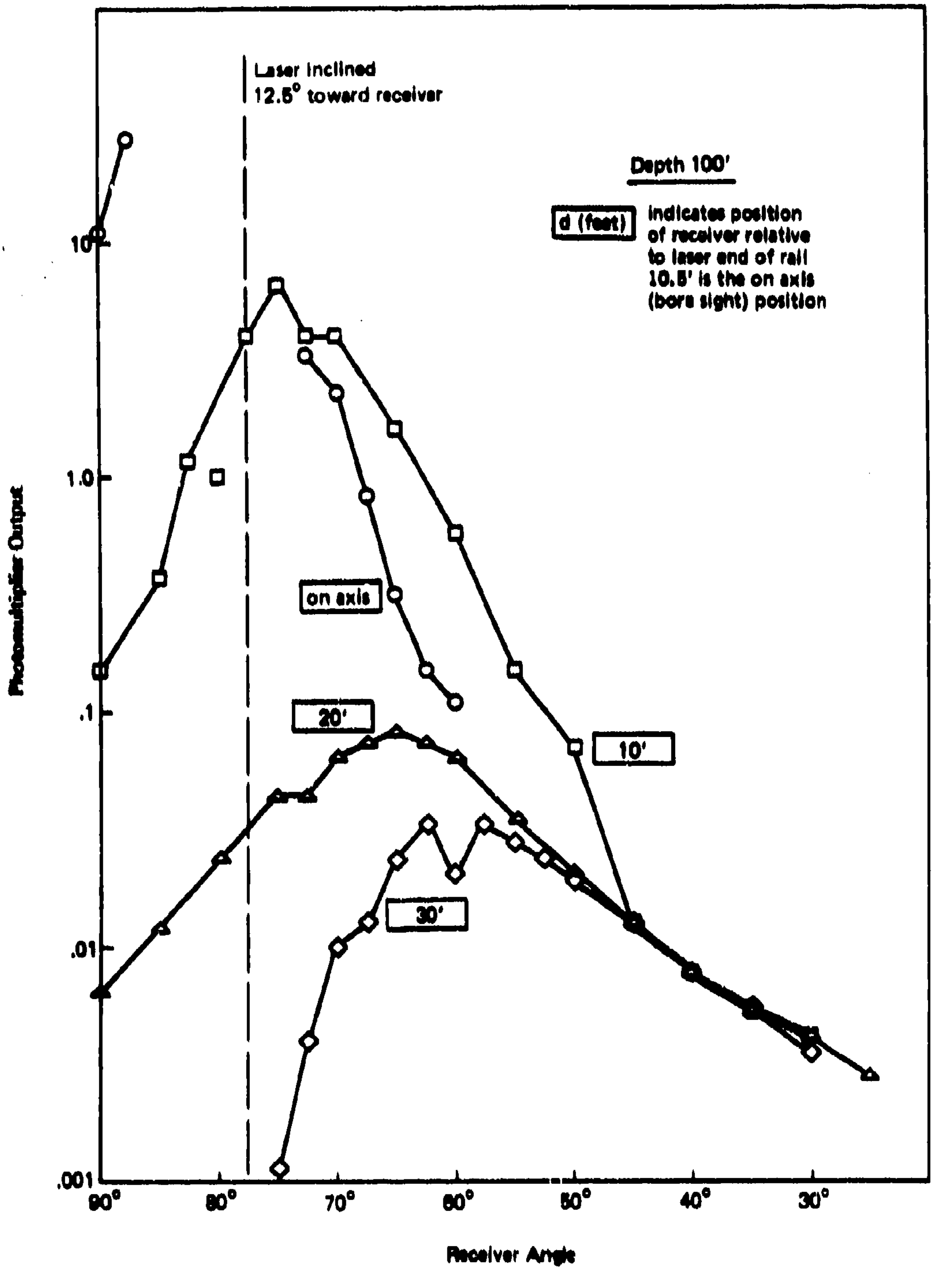


Figure M-1B. Radiance profile through F(θ) receiver (June 1975).

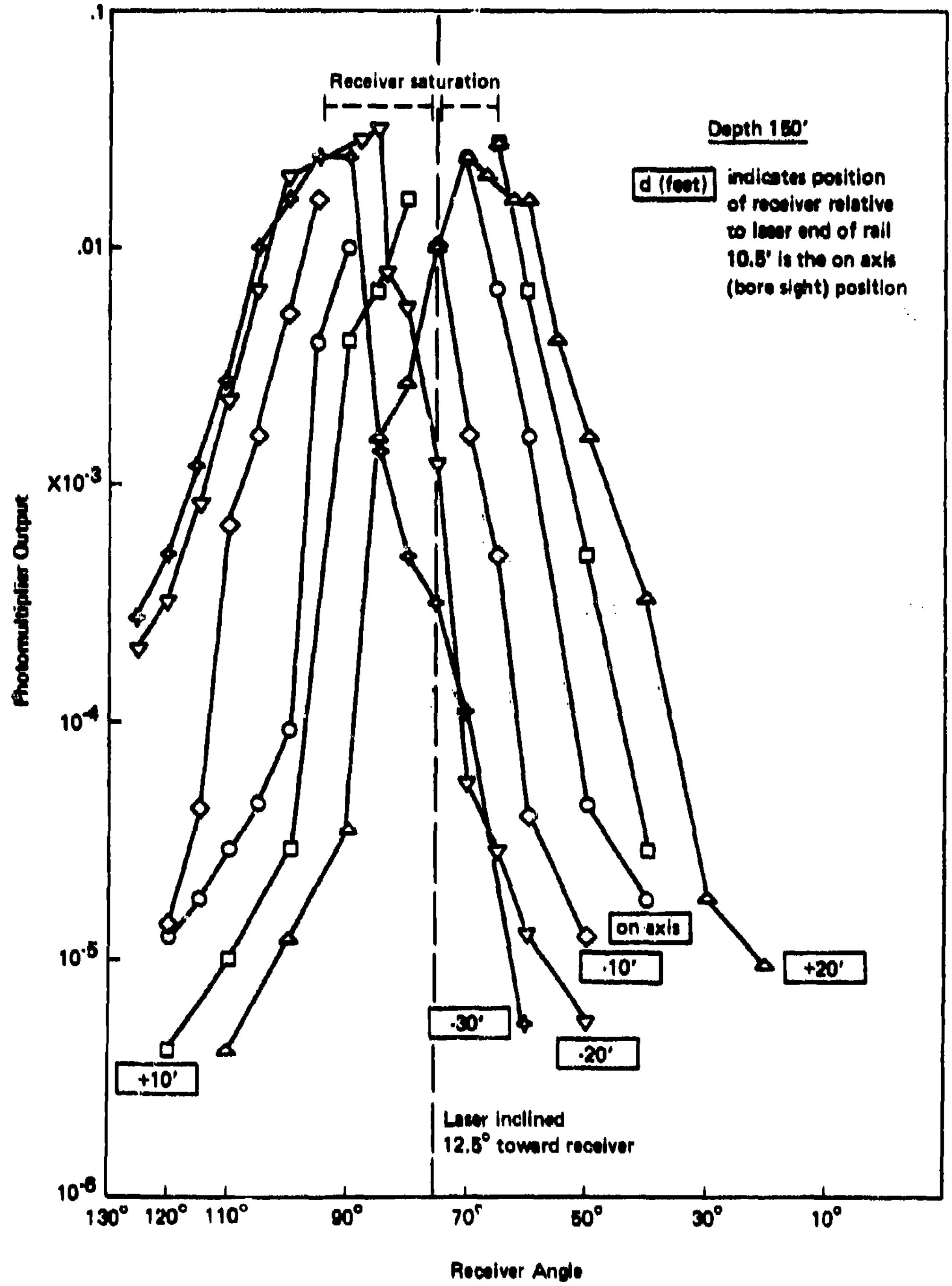


Figure M-1C. Radiance profile through F(θ) receiver (June 1975).

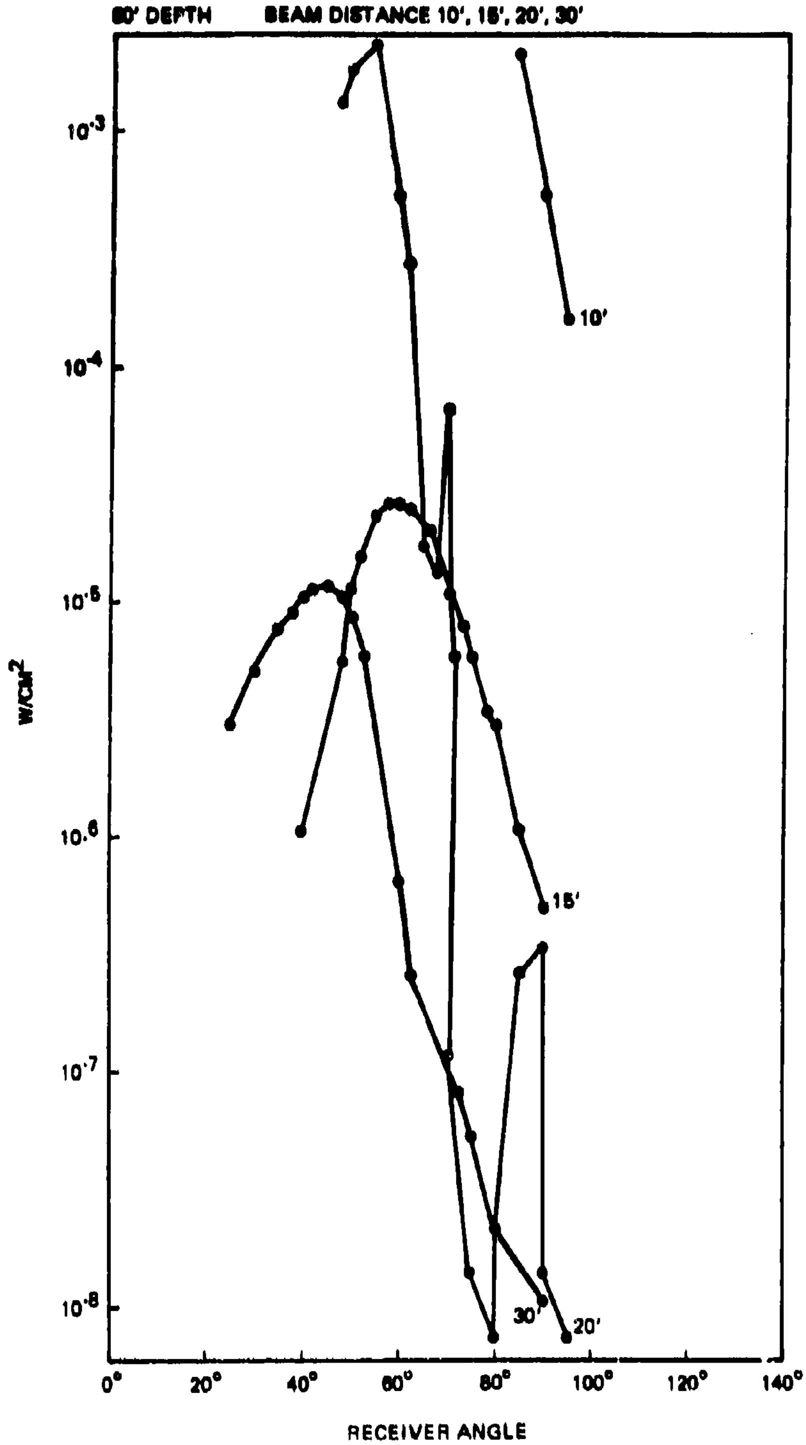


Figure M-2A. Radiance profile through F(θ) receiver (July 1975).

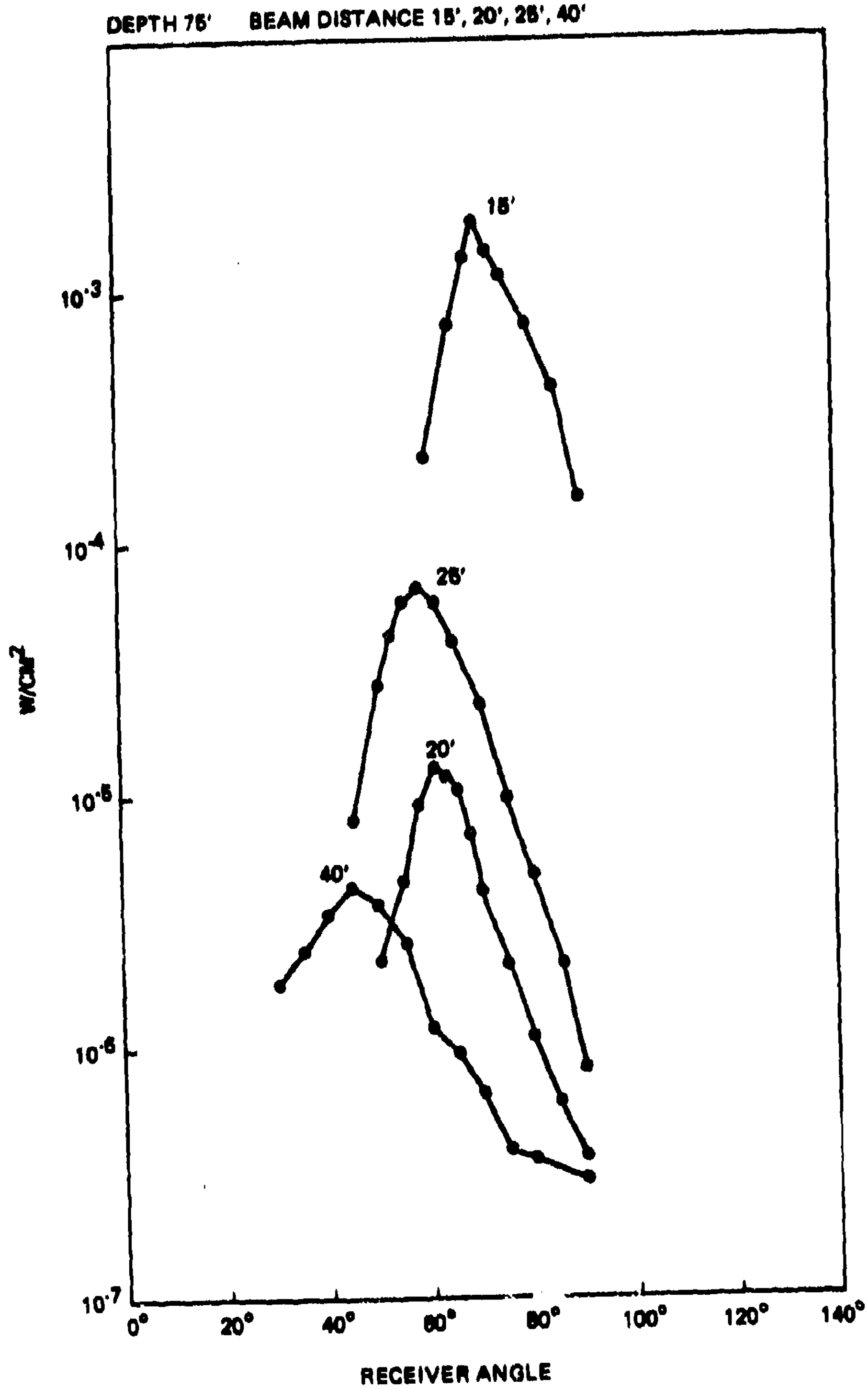


Figure M-2B. Radiance profile through F(θ) receiver (July 1975).

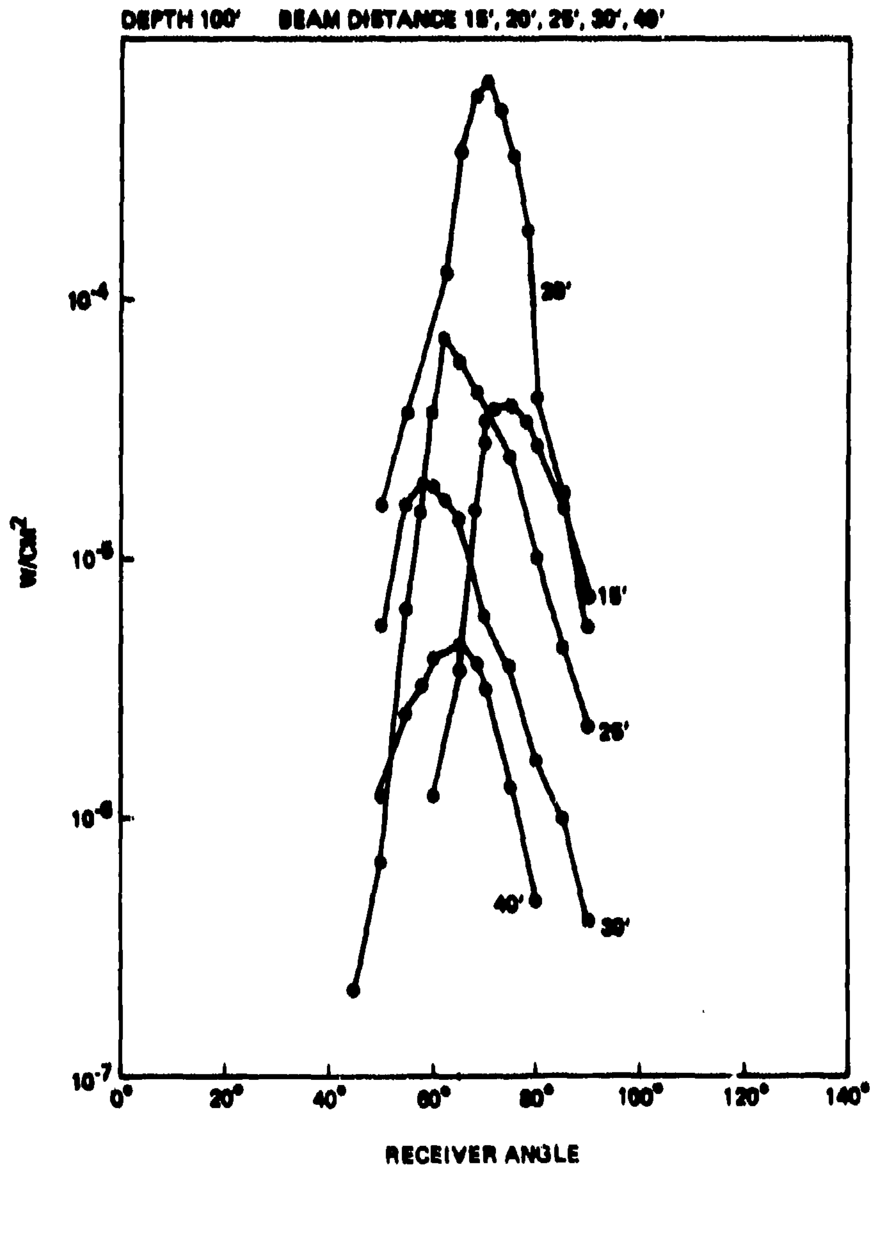


Figure M-2C. Radiance profile through F(θ) receiver (July 1975).

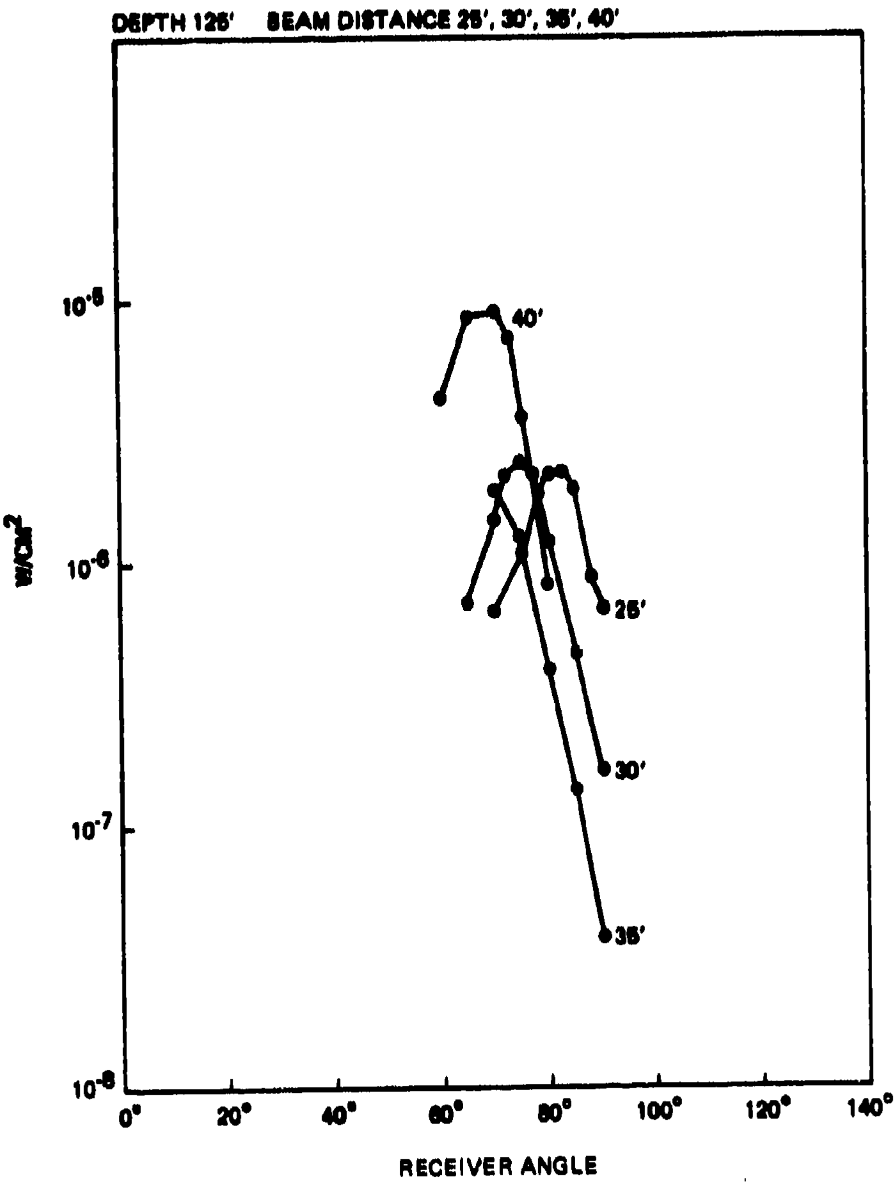


Figure M-2D. Radiance profile through F(θ) receiver (July 1975).

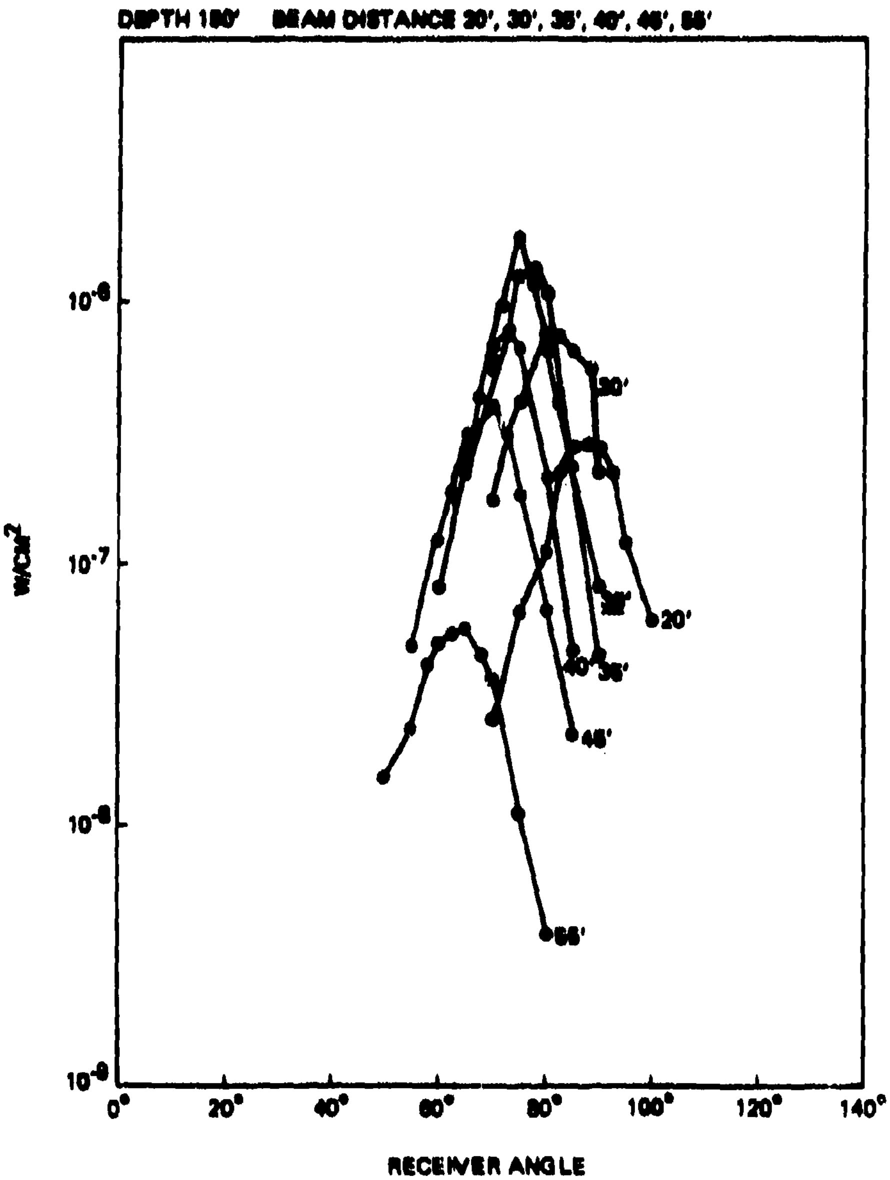


Figure M-2E. Radiance profile through F(θ) receiver (July 1975).