The NASA Fireball Network Database

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The NASA Meteoroid Environment Office (MEO) has been operating an automated video fireball network since late-2008. Since that time, over 1,700 multi-station fireballs have been observed. A database containing orbital data and trajectory information on all these events has recently been compiled and is currently being mined for information. Preliminary results are presented here.
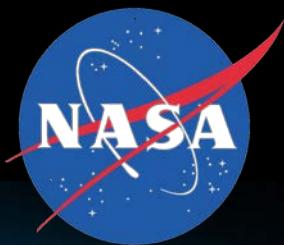
The NASA Fireball Network Database

Danielle Moser

Dynetics/MEO

Objectives of the NASA Fireball Network

1. Determine the speed distribution of cm-sized meteoroids

2. Determine the major sources of cm-sized meteoroids (showers/sporadic sources)

3. Characterize meteor showers (numbers, magnitudes, trajectories, orbits)

4. Determine the size at which showers dominate the meteor flux

5. Discriminate between re-entering space debris and meteors

6. Locate meteorite falls

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Data Flow

Events with trajectory/orbit solutions displayed on public website

Fireballs (MSFC)
fireballs.ndc.nasa.gov

Individual cameras

01 Huntsville AL	02 Chickamauga GA	03 Tullahoma TN	04 Cartersville GA
12/2008	12/2008	01/2011	03/2011

Grimsby (MSFC)
Database and data backup
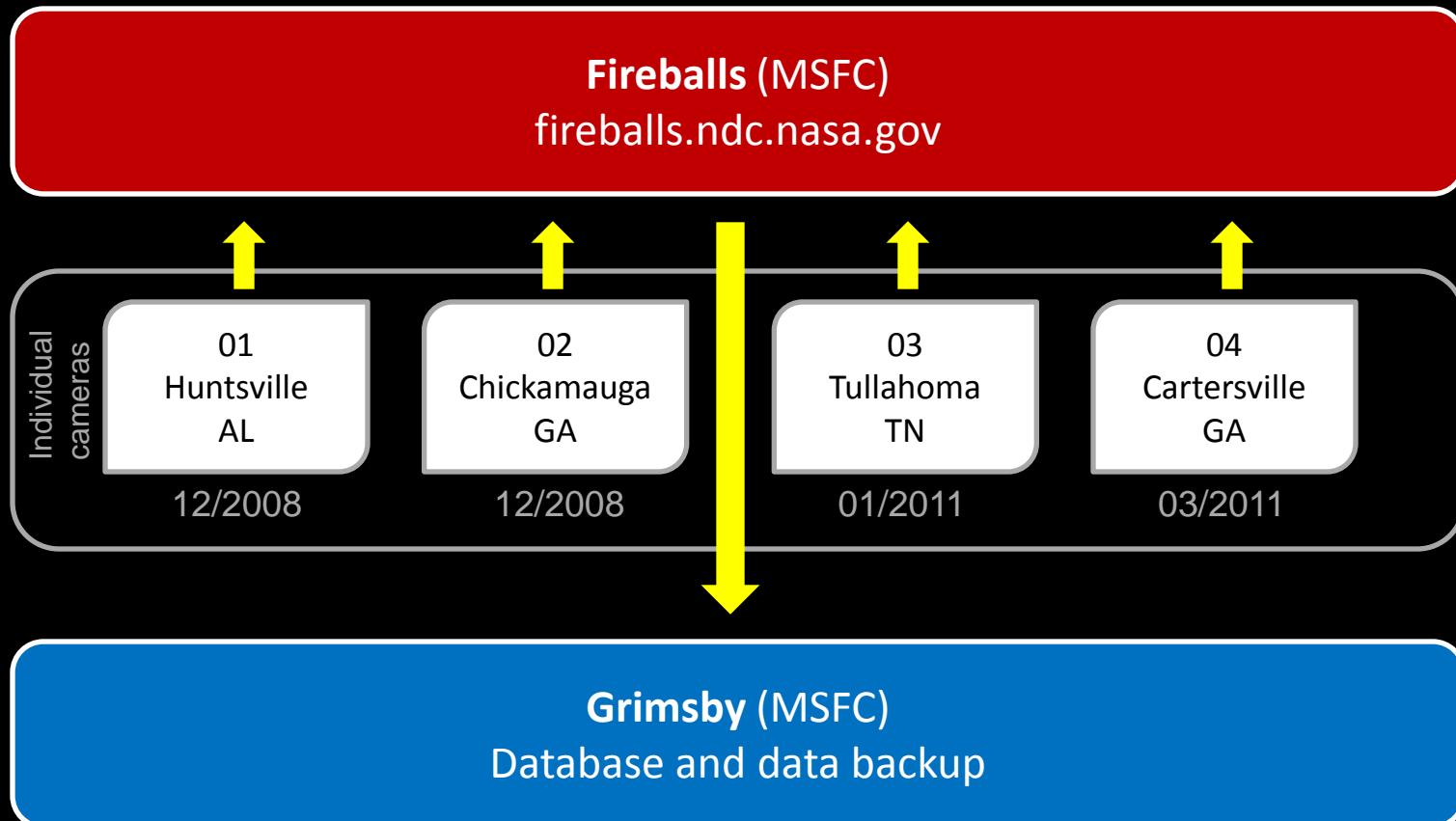
Database Computing Environment

- Programmer: Ellen Jones/MITS
- OS: Linux
- Development Language: PHP
- DB design: Navicat
- Database: MySQL
- Data browsing: PhpMyAdmin
- Custom file parsing/loading code
  - 52,000 files

Database Contents

- Trajectory
  - Beg/end location: lat, lon, ht
  - Speed
- Orbit
  - Radiant info
  - Orbital elements
- Media file links
  - Calibration plates
  - Movies
  - Images
  - Summary graphic

- Shower identification
- Camera data
  - Cams that saw event
  - GPS status
  - Number of frames detected

Database Interface

# Note

- All data here is raw, with only minimal processing to retrieve Q*>15
- All results are therefore preliminary.

Coverage

MEO Multi–Station Meteors

S.Lon.	Name
11.1	delta Pavonids
13.5	beta Craterids
15.7	kappa Serpentids
17.8	April alpha Comae Berenicids
19.2	Dayt. chi Piscids
20	zeta Cygnids
20	lambda Virginids
22.7	South. gamma Virginids
23	delta Aquilids
23	April psi Ursae Majorids
24.3	Northern gamma Virginids
27.7	sigma Leonids
28	alpha Virginids
29.2	mu Draconids
29.7	Dayt. lambda Pegasids
29.7	Dayt. April Cetids
30.3	Dayt. April Piscids
32.4	April Lyrids
33.67	pi Puppids
35	nu Cygnids
36	beta Pegasids
36.7	alpha Bootids
37	April rho Cygnids
39	gamma Librids
39	h Virginids
39	April chi Librids
39	mu Virginids
41	lambda Lyrids
42	May Lacertids
42.1	phi Bootids
45	May lambda Virginids
46	Daytime Triangulids
46.7	South. Dayt. omega Cetids
46.7	North. Dayt. omega Cetids
46.9	eta Aquariids
47	zeta Ophiuchids
49	sigma Cetids
49.1	eta Lyrids
49.7	North. May Ophiuchids
53	Dayt. delta Trianguiids
54	phi Pegasids
54	Daytime xi Cetids
54	May Vulpeculids
54.4	nu Ursae Majorids
54.7	beta Coronae Australids
55	Northern Dayt. May Arietids
55	Dayt. epsilon Arietids
55	South. Dayt. May Arietids
55	tau Ophiuchids
55.2	alpha Scorpiids
56.7	South. May Ophiuchids
57.9	May Microscopiids
58.1	chi Capricornids
59	epsilon Aquilids
60	phi Aquariids
60	May zeta Cygnids
62	omega Ursae Majorids
62	iota Cassiopeiids
63	psi Pegasids
64.9	Southern Librids-Luppids
65	theta Serpentids
67.8	Northern Librids-Luppids
70	South. omega Scorpiids
70	North. omega Scorpiids
72.6	tau Herculids
73.9	alpha Circinids
74	June mu Cassiopeiids
76.7	Dayt. Arietids
78	South. mu Sagittariids
78	North. mu Sagittariids
78.6	Dayt. zeta Perseids
79.7	chi Librids
80	South. June Aquilids
80.4	gamma Delphinids
80.5	alpha Draconids
85.2	June Lyrids
85.5	Dayt. lambda Taurids
86	North. June Aquilids
87	South. sigma Sagittariids
92	delta Piscids
92.3	Northern sigma Sagittariids
93	zeta Arietids
94	kappa Cetids
94.9	Scutids
94.9	Corvids
95	pi Cetids
95.5	epsilon Perseids
96	Dayt. theta Aurigids
96.3	June Bootids
96.7	Dayt. beta Taurids
97.3	tau Aquariids
98	f Ophiuchids
100	July beta Pegasids
100	omicron Pegasids
100	beta Camelopardalis
100.5	Dayt. beta Andromedids
101	July Andromedids
103.3	July Centaurids
104	Microscopiids
104	July Taurids
105.5	epsilon Pegasids
105.5	alpha Lacertids
106	phi Piscids
106	theta Perseids
106	alpha Pegasids
106	epsilon Ursae Majorids
106	psi Cassiopeiids
106.5	beta Equuleids
107.5	July Pegasids
109	gamma Camelopardalids
110	sigma Capricornids
110	c Andromedids
110.3	July Phoenicids
112.2	July mu Serpentids
114	mu Serpentids
114.8	kappa Pavonids
115.5	omicron Draconids
115.7	July zeta Draconids
116	mu Lyrids
117.2	omicron Cygnids
117.7	Dayt. xi Orionids
120	alpha Triangulids
122	zeta Draconids
123.4	North. iota Aquariids
123.7	Piscis Austrinids
125.3	July Gamma Draconids
125.6	South. delta Aquariids
126	Dayt. mu Cancrids
126.6	beta Cassiopeiids
127	alpha Capricornids
128	iota Sculptorids
129.7	nu Phoenicids
131.7	South. iota Aquariids
132	August Piscids
134	August omicron Eridanids
135	August Lyncids
135.4	beta Perseids
137	Daytime Monocerotids
137.5	eta Eridanids
138	gamma Eridanids
139.8	August Triangulids
140	August Beta Piscids
140.2	Perseids
141.7	delta Librids
142	August Draconids
143.8	beta Hydrusids
145.2	kappa Cygnids
146	August delta Capricornids
146	upsilon Cetids
146	zeta Arietids
147	Dayt. zeta Cancrids
147.7	North. iota Aquariids
147.8	Dayt. gamma Leonids
151	eta Serpentids
153	August Cetids
154	Dayt. chi Leonids
155.7	gamma Doradids
157.3	beta Indids
158	Daytime Craterids
158	kappa Draconids
158	xi Aurigids
158.2	Aurigids
160.3	beta Gruids
167	September Lyncids
167.7	beta Capricornids
167.9	Nu Eridanids
169	September iota Cassiopeiids
170	epsilon Eridanids
170	Sept. epsilon Perseids
170.1	Sept. gamma Sagittariids
170.3	nu Draconids
173	Sept. beta Cassiopeiids
174	omega Piscids
174	South. delta Piscids
174	Daytime pi Leonids
179	Sept. mu Arietids
179	kappa Aquariids
179.3	beta Aurigids
181	Dayt. kappa Leonids
183	Dayt. delta Leonids
183	Sept. alpha Orionids
184	Dayt. gamma Virginids
184	beta Ursae Majorids
184	North. delta Piscids
186	September-October Piscids
188.4	Dayt. Sextantids
189.7	October Capricornids
191	October delta Aurigids
191.7	sigma Orionids
192.6	October Camelopardalids
195	October epsilon Piscids
196	zeta Taurids
196	lambda Draconids
196.4	October Draconids
198.5	South. October delta Arietids
199	lambda Cygnids
199	psi Aurigids
200	gamma Piscids
200.8	delta Cygnids
201	October eta Eridanids
201.7	North. October delta Arietids
202	Dayt. psi Virginids
202	sigma Arietids
202	Oct. Ursae Majorids
202.7	October gamma Camelopardalids
203	October Leporids
204	Dayt. alpha Canis Majorids
206	October Cygnids
206	epsilon Geminids
206	October Monocerotids
206	October Lyncids
206.4	October gamma C etids
207.3	nu Aurigids
208	October Ursae Minorids
208	alpha Doradids
208.6	Orionids
209	alpha Ursae Majorids
209	October iota Cassiopeiids
209.7	Leonis Minorids
210.8	xi Draconids
211	eta Taurids
213	Dayt. beta Cancrids
214	October beta Camelopardalids
216	October kappa Draconids
218.1	pi Leonids
220	chi Taurids
223	Dayt. iota Virginids
224	South. Taurids
224	North. Taurids
225	zeta Cancrids
227	psi Aurigids
228.9	Omicron Ursae Majorids
230.4	mu Pegasids
231	Andromedids
232.8	gamma Taurids
233.6	Nov. iota Aurigids
234	omega Eridanids
234.7	Omicron Eridanids
235	Nov. Hydrids
235.1	Leonids
237	November theta Aurigids
239.3	alpha Monocerotids
240.2	omega Taurids
240.8	Nov. epsilon Eridanids
241	November i Draconids
241	Nov. nu Arietids
241	November delta Draconids
242	rho Bootids
244.7	Columbids
245	Nov. Orionids
247	alpha Canis Majorids
249.4	Theta Pyxidis
250.2	December Kappa Draconids
252.4	Dec. Canis Minorids
252.9	Psi Ursae Majorids
253	Phoenicids
253.7	sigma Puppids
254	Dayt. delta Scorpiids
254.7	zeta Puppids
255	gamma Puppids
256.3	b Puppids
256.5	North. Dec. delta Arietids
256.5	December Alpha Draconids
256.5	South. Dec. delta Arietids
256.7	December Chi Virginids
257	gamma Canis Majorids
257.3	North. chi Orionids
259	Dayt. kappa Librids
260	South. chi Orionids
260.9	Dec. Monocerotids
261	December theta Aurigids
262	mu Velids
262	nu Geminids
262.1	Geminids
262.2	Dec. alpha Aurigids
262.4	Dec. Leonis Minorids
263.7	epsilon Carinids
265.5	sigma Hydrids
266	December Canis Majorids
266	December Hydrids
268.9	alpha Lyncids
269.7	lambda Velids
270.7	tau Puppids
271	Ursids
271	beta Monocerotids
272	gamma Triangulids
273	c Velids
274	Dec. Comae Berenicids
275.5	sigma Serpentids
275.5	omega Serpentids
280.4	Dayt. Scutids
280.7	eta Carinids
282.5	January Leonids
283	kappa Hydrids
283.3	Quadrantids
285.5	alpha Hydrids
286.3	xi Cetids
286.3	nu Andromedids
288	gamma Velids
289.4	January gamma Delphinids
290.7	January pi Puppids
292	beta Sextantids
292	January Hydrids
292	January zeta Aurigids
293	Canum Venaticids
294.5	xi Coronae Borealids
295	January pi Virginids
295.5	lambda Bootids
295.6	upsilon Eridanids
296.3	South. delta Cancrids
296.3	North. delta Cancrids
296.5	theta Coronae Borealids
297	rho Geminids
299	gamma Ursae Minorids
299.7	alpha Crucids
300	mu Hydrids
300.6	January Xi Ursae Majorids
301	January Comae Berenicids
303.5	alpha Cancrids
304.7	January alpha Pixidids
304.9	Dayt. xi Sagittariids
307.1	epsilon Columbids
307.9	January nu Orionids
311.2	alpha Carinids
311.3	Dayt. chi Capricornids
312.5	Dayt. Sagittariids-Capricornids
313.1	alpha Antliids
315.1	February eta Draconids
315.8	Dayt. epsilon Aquariids
316.2	beta Cancrids
317.1	pi Hydrids
317.5	omega Cassiopeiids
318	Febuary alpha Orionids
319.4	alpha Centaurids
319.7	delta Velids
320.7	beta Hydrids
321	gamma Bootids
322.7	omega Centaurids
322.7	theta Centaurids
323	delta Serpentids
324	February Comae Berenicids
324	beta Herculids
325	delta Chamaeleontids
325	Dayt. c Aquariids
325	alpha Pictorids
330.6	February Canis Majorids
334.7	North. delta Leonids
334.7	South. delta Leonids
339.4	March Lyncids
340.4	beta Tucanids
343.1	nu Hydrids
345.9	alpha Pyxidids
346	f Herculids
349	North. alpha Leonids
350	March Cassiopeiids
352	x Herculids
353	gamma Normids
354	Northern March Virginids
354	Dayt. kappa Aquariids
354	Dayt. q Pegasids
354	South. March Virginids
354	eta Virginids
356.7	delta Mensids
358	xi Ursae Majorids
359	South. alpha Leonids
359	lambda Centaurids
361	March delta-Geminids
365	zeta Serpentids
368	phi Draconids

Raw Radiant Map

Fireballs, Q*<15
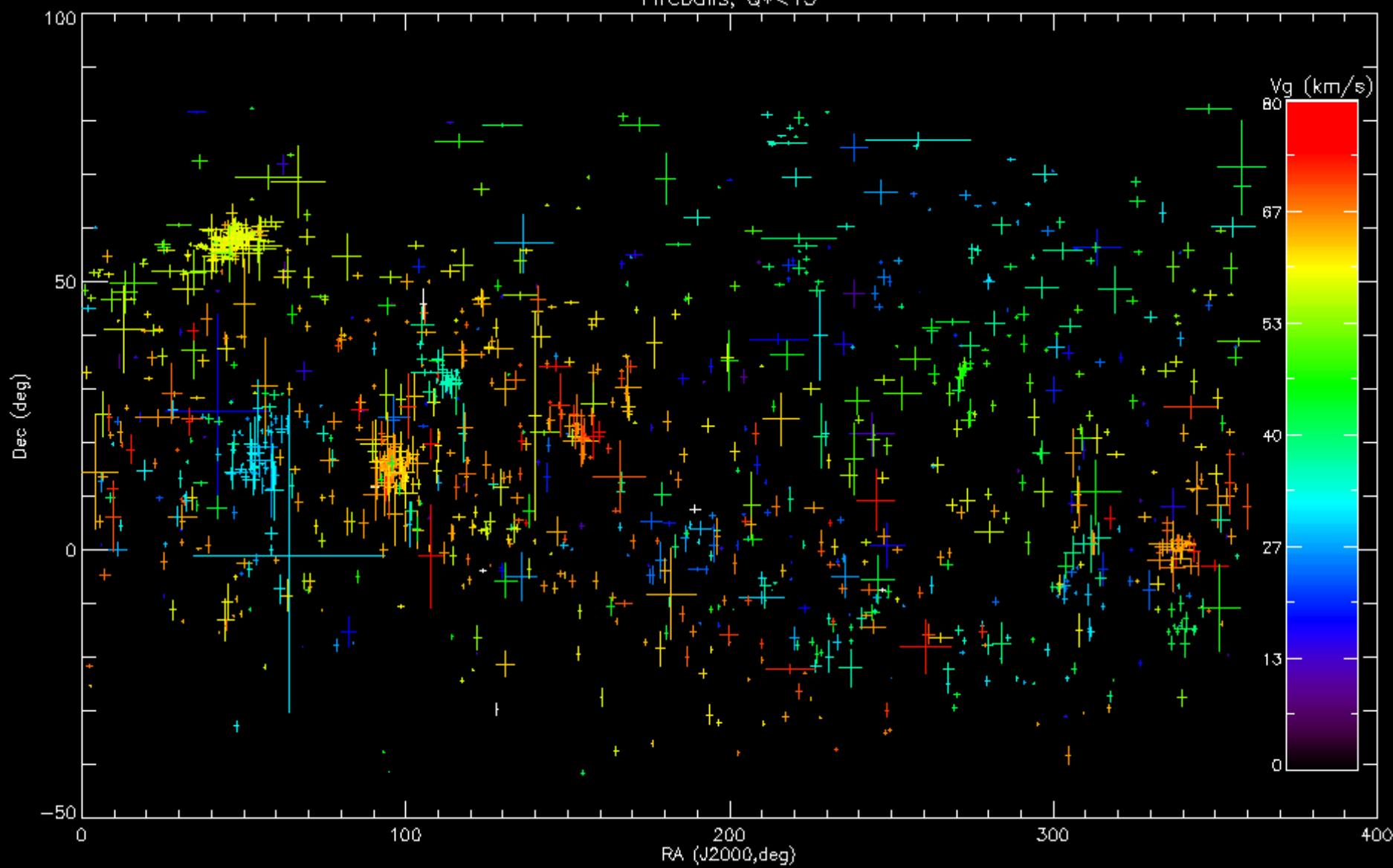
Raw Radiant Distribution

Fireballs, Q*>15

Vg (km/s)
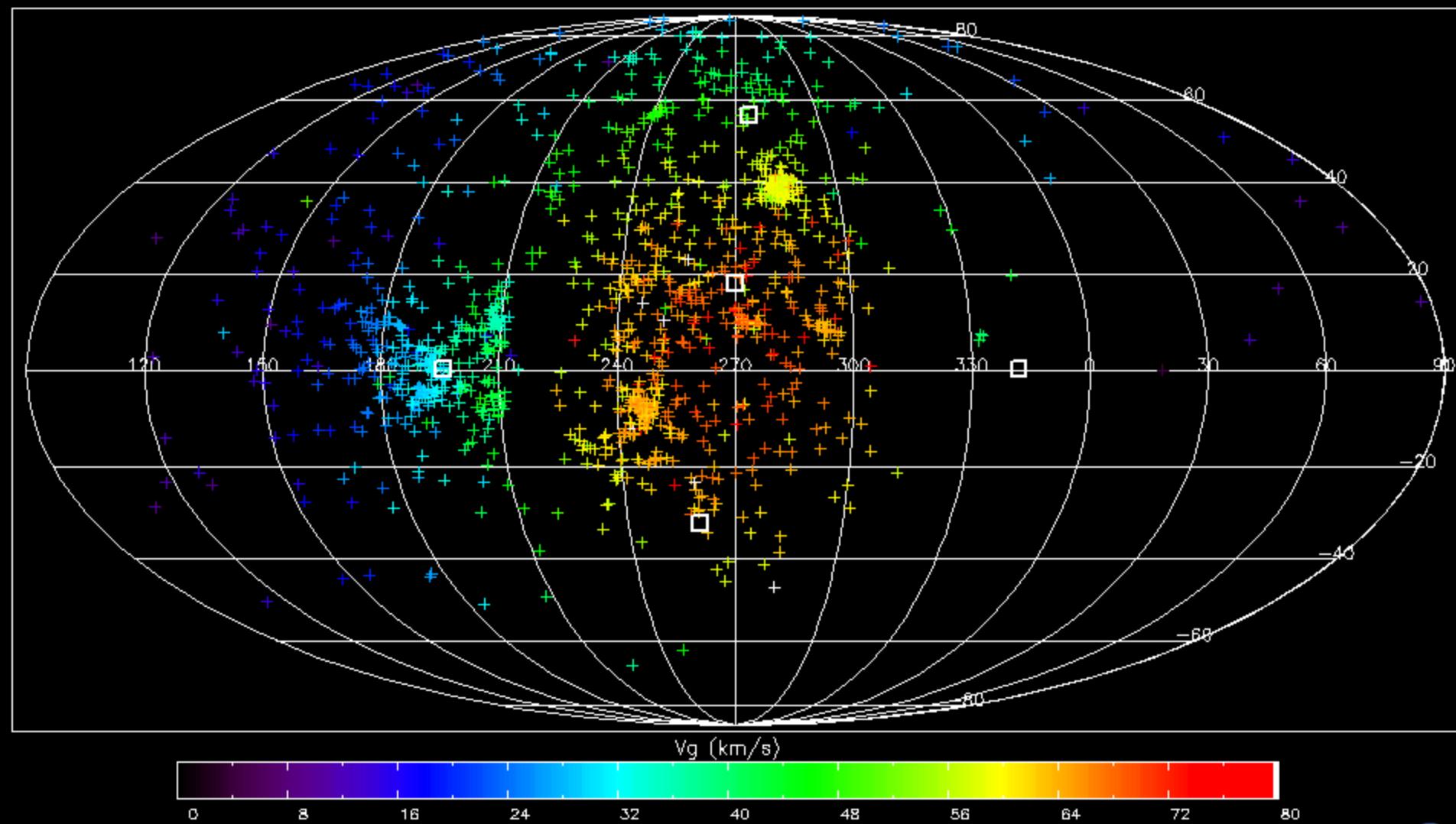
Raw Radiant Distribution - Sporadics

Sporadics, Q*>15

Vg (km/s)
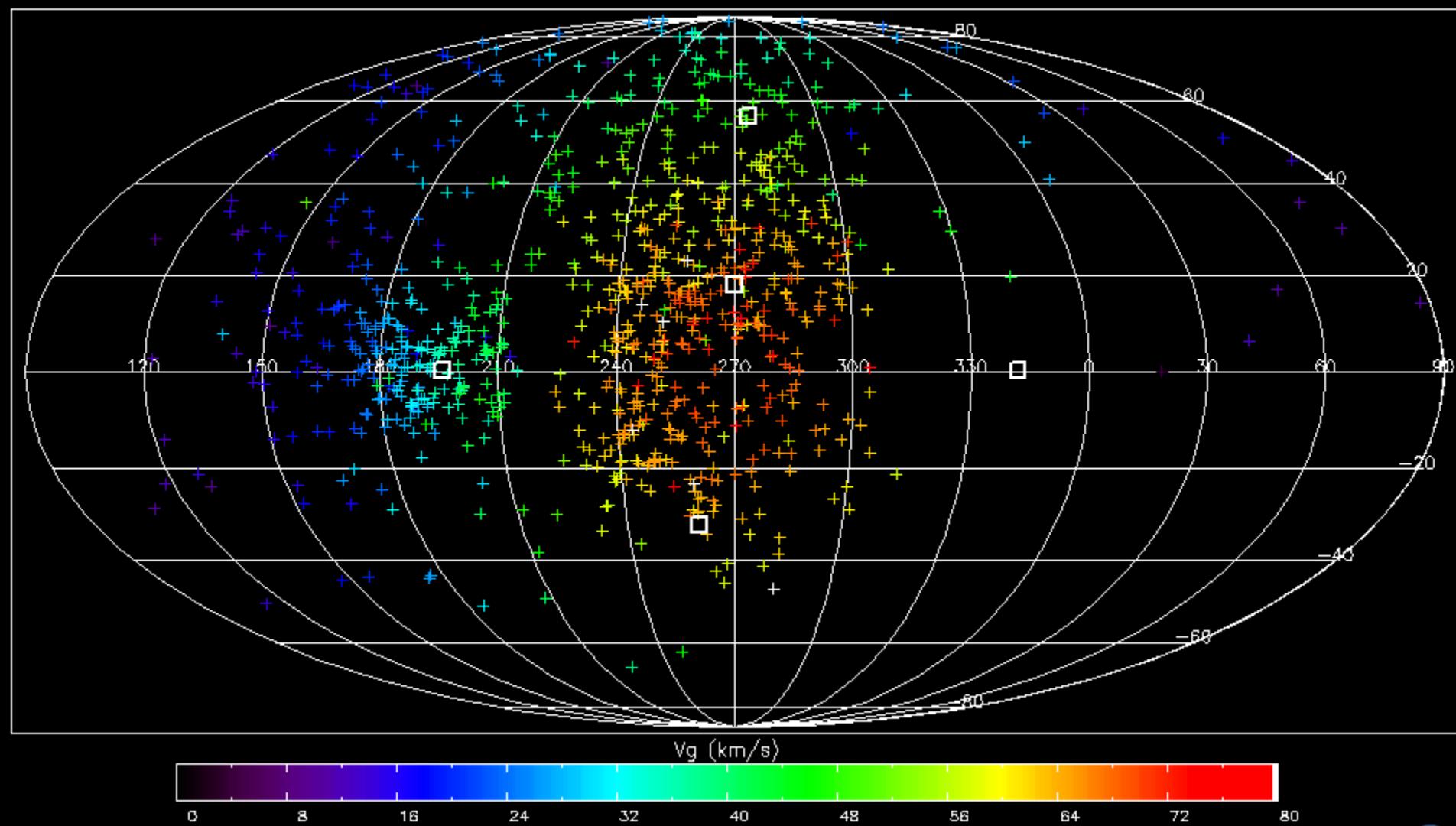
Sporadic Velocity Distribution

Sporadics
Q*>15, outlier removed

2010 Perseids

NASA Wo

2010 Perseids

Height (km) (vertical axis, values from 114 down to 75)

Number of meteors (horizontal axis, 0 to 14)

Legend:
- beginning height (green)
- end height (dark red)

NA
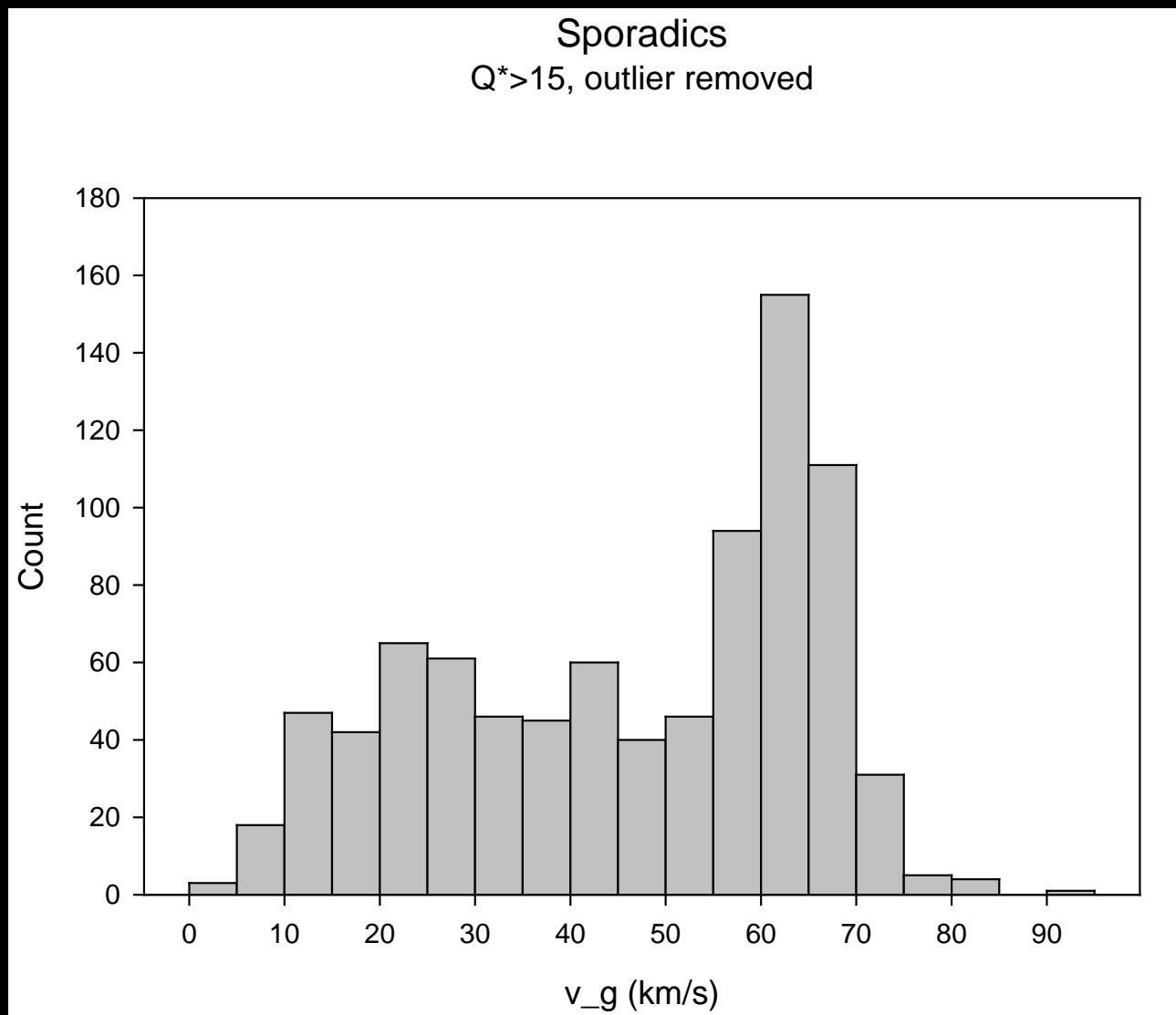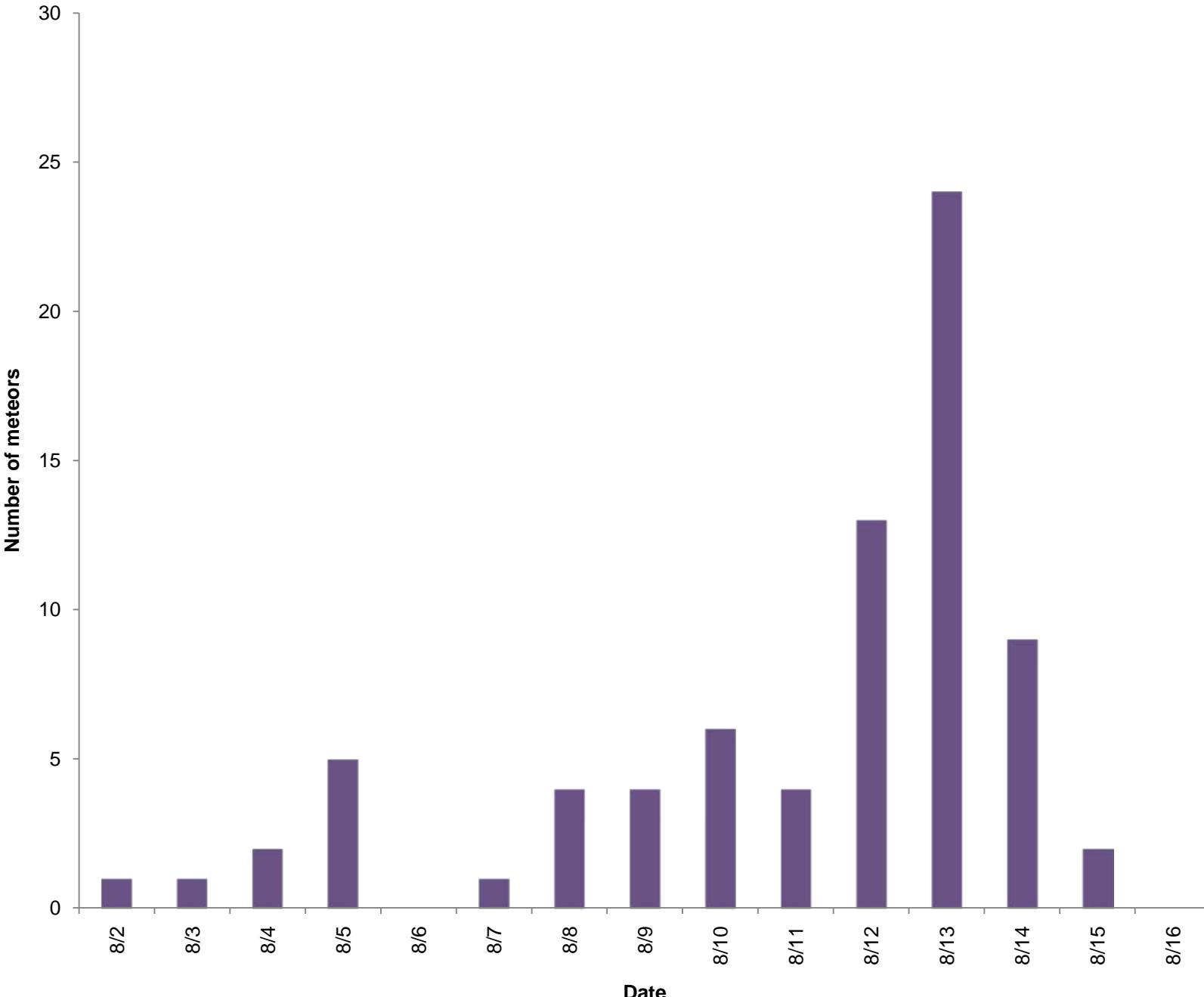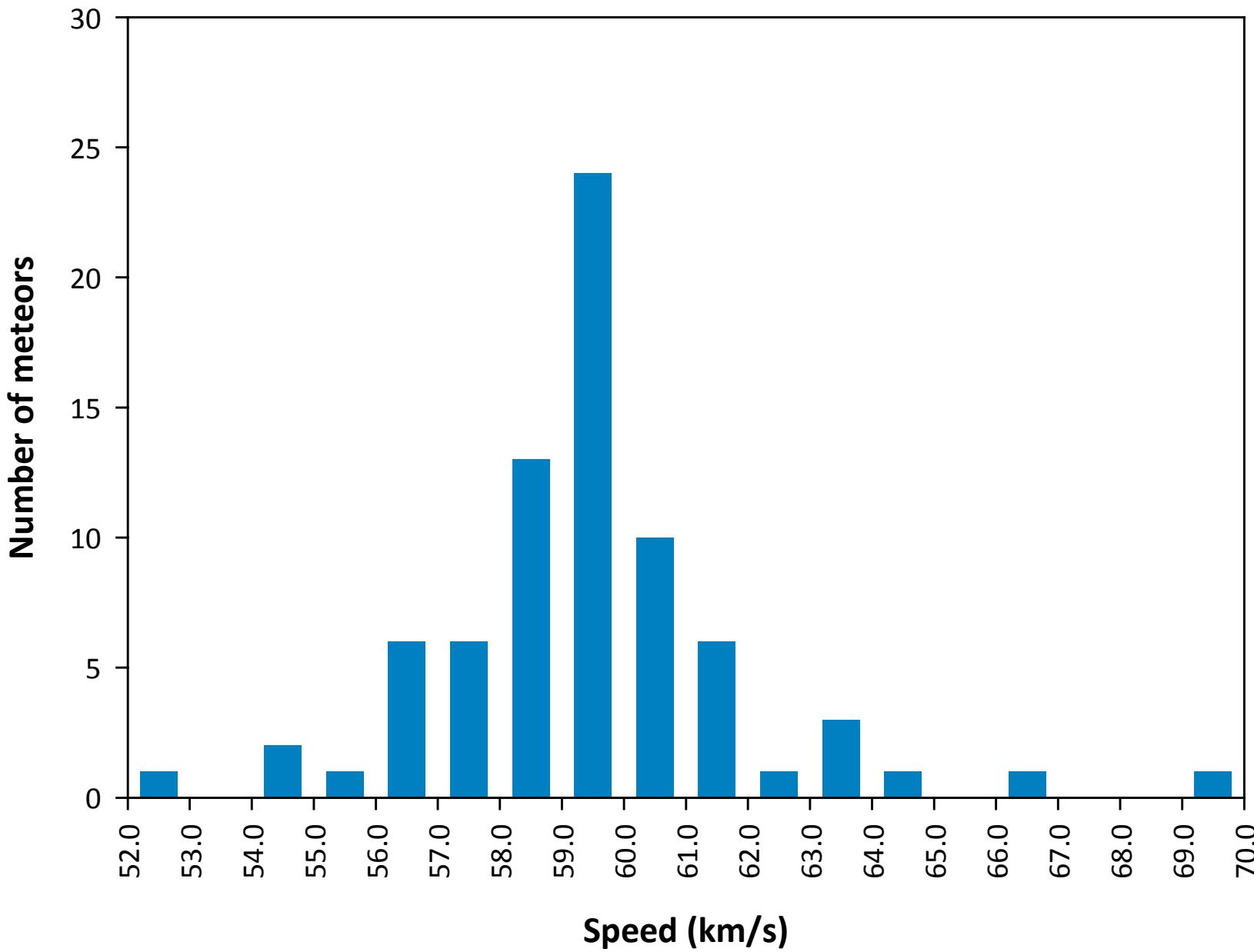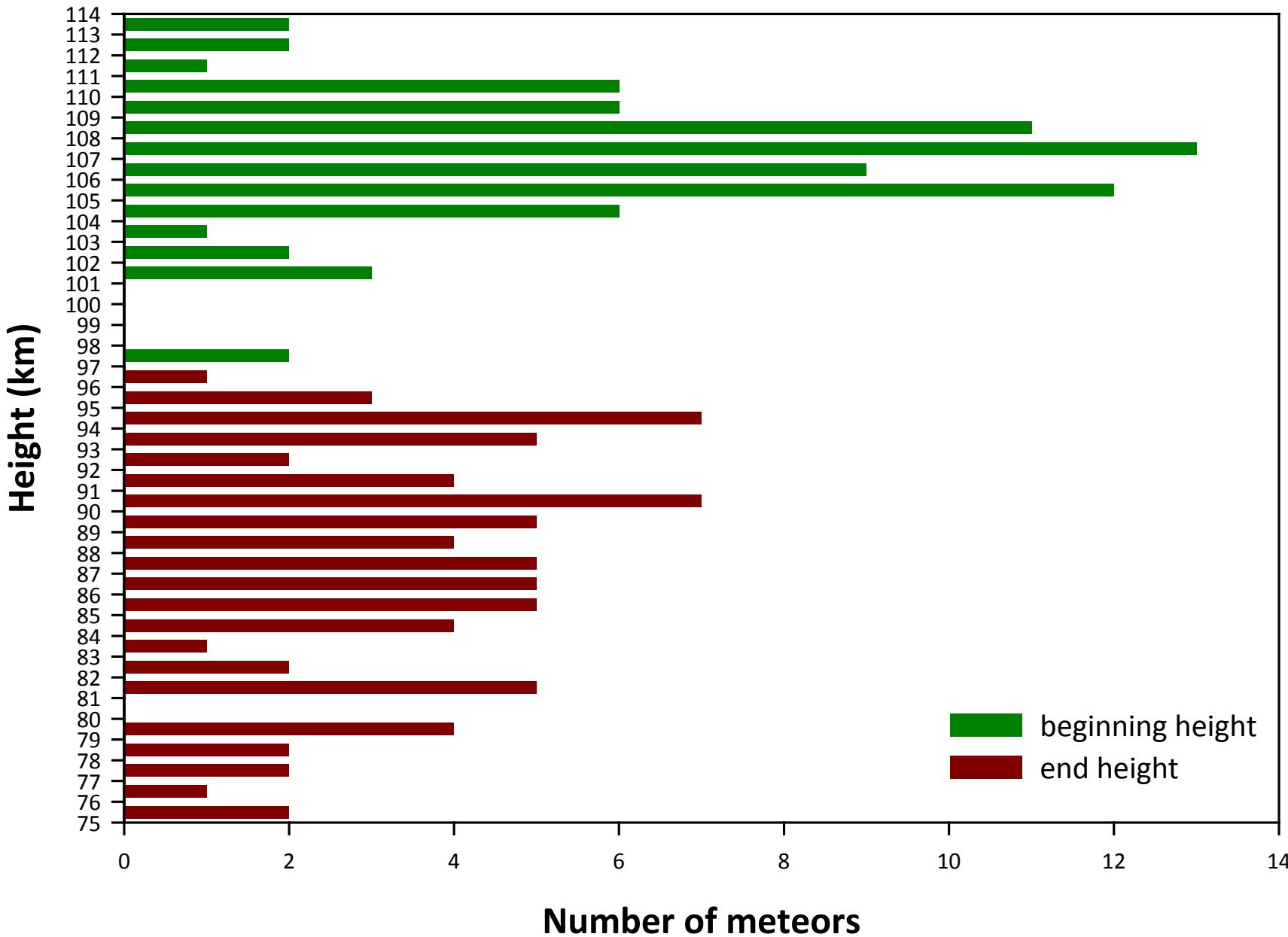
Future Work

- Data quality assurance

- Magnitude estimates

- Database auto-update