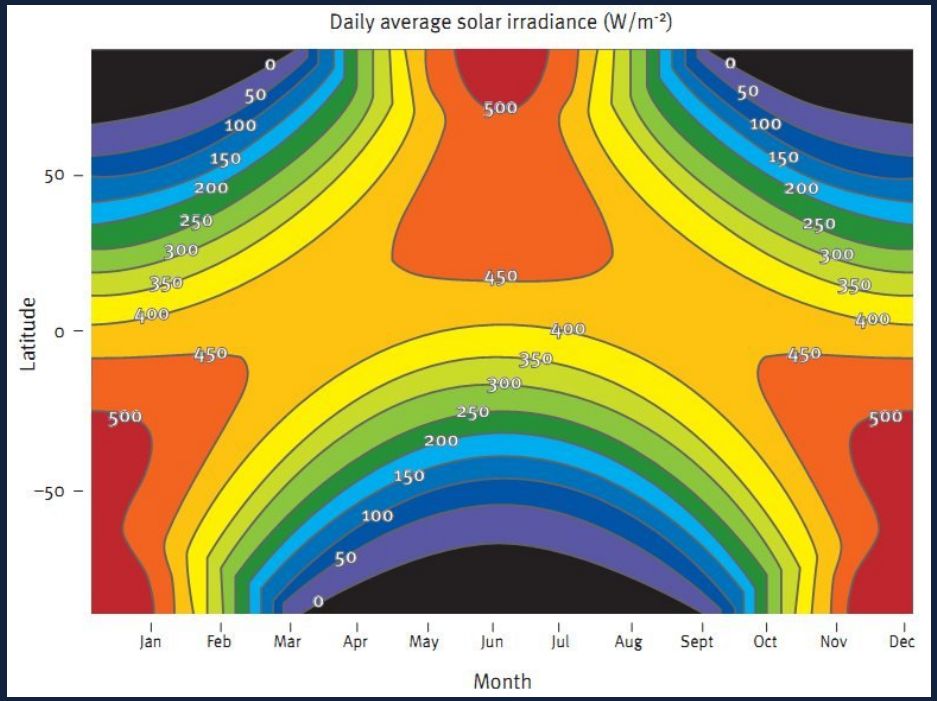
Earth–Sun relationships

~ ***Why*** do different locations (latitudes) on the Earth receive ***different*** amounts of ***solar energy*** throughout the year?



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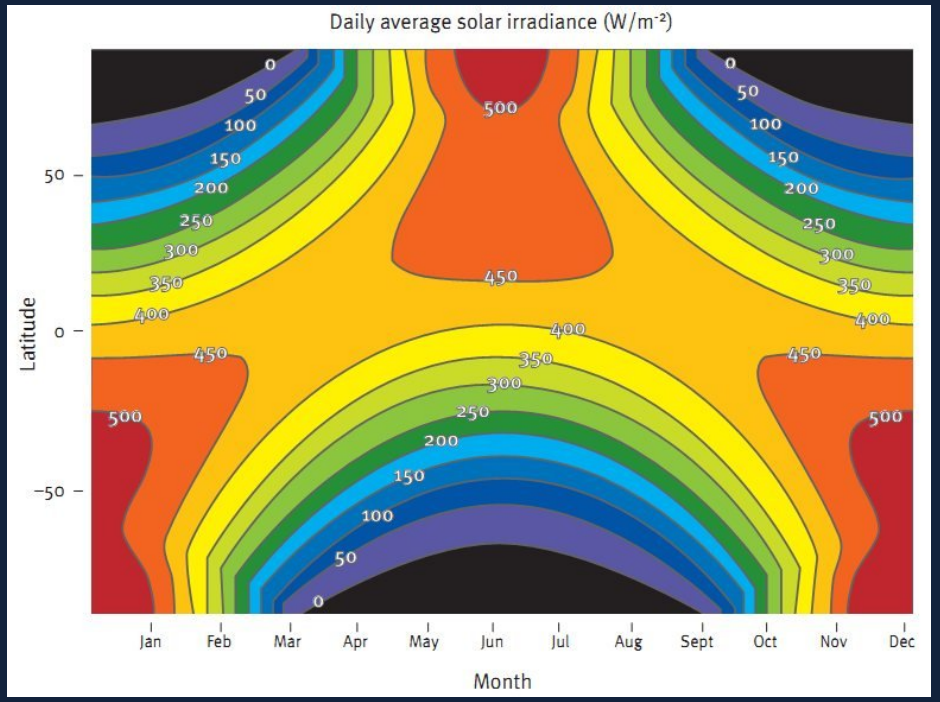

~ Because the ***Earth*** is a ***sphere*** only ***one location*** will receive the ***most direct*** (90˚ angle) and intense ***rays*** on any given day.

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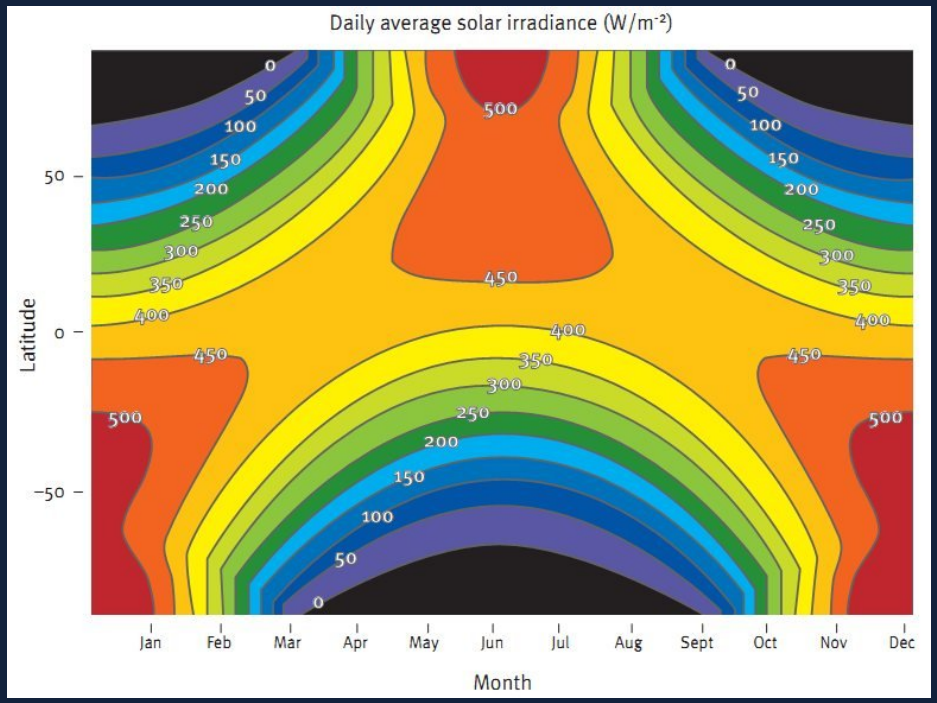

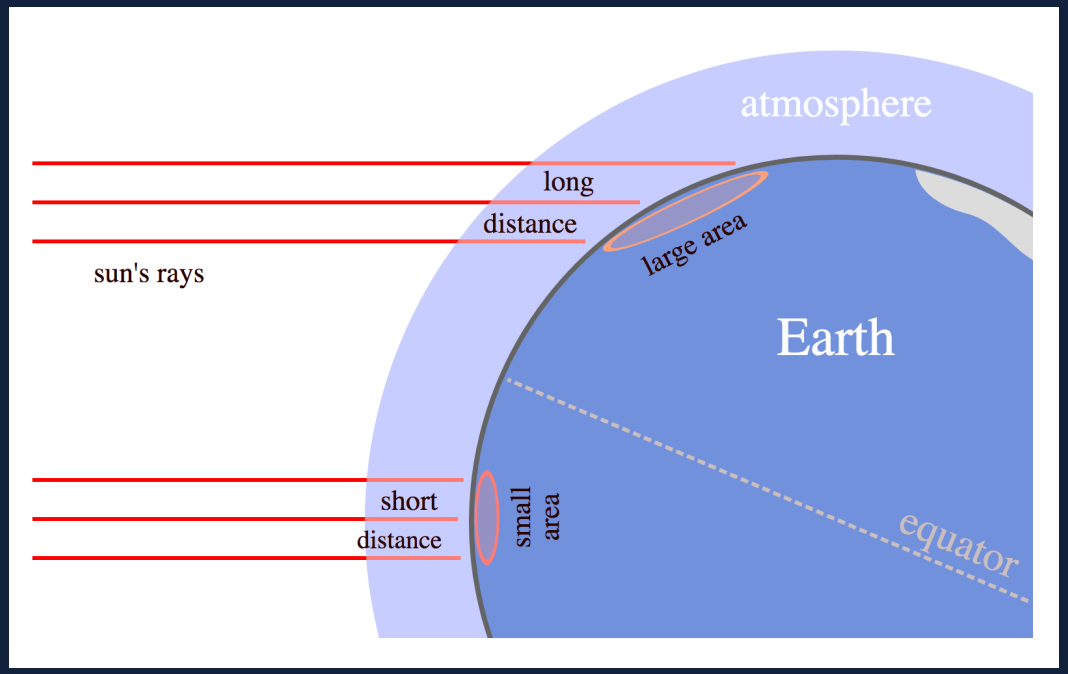

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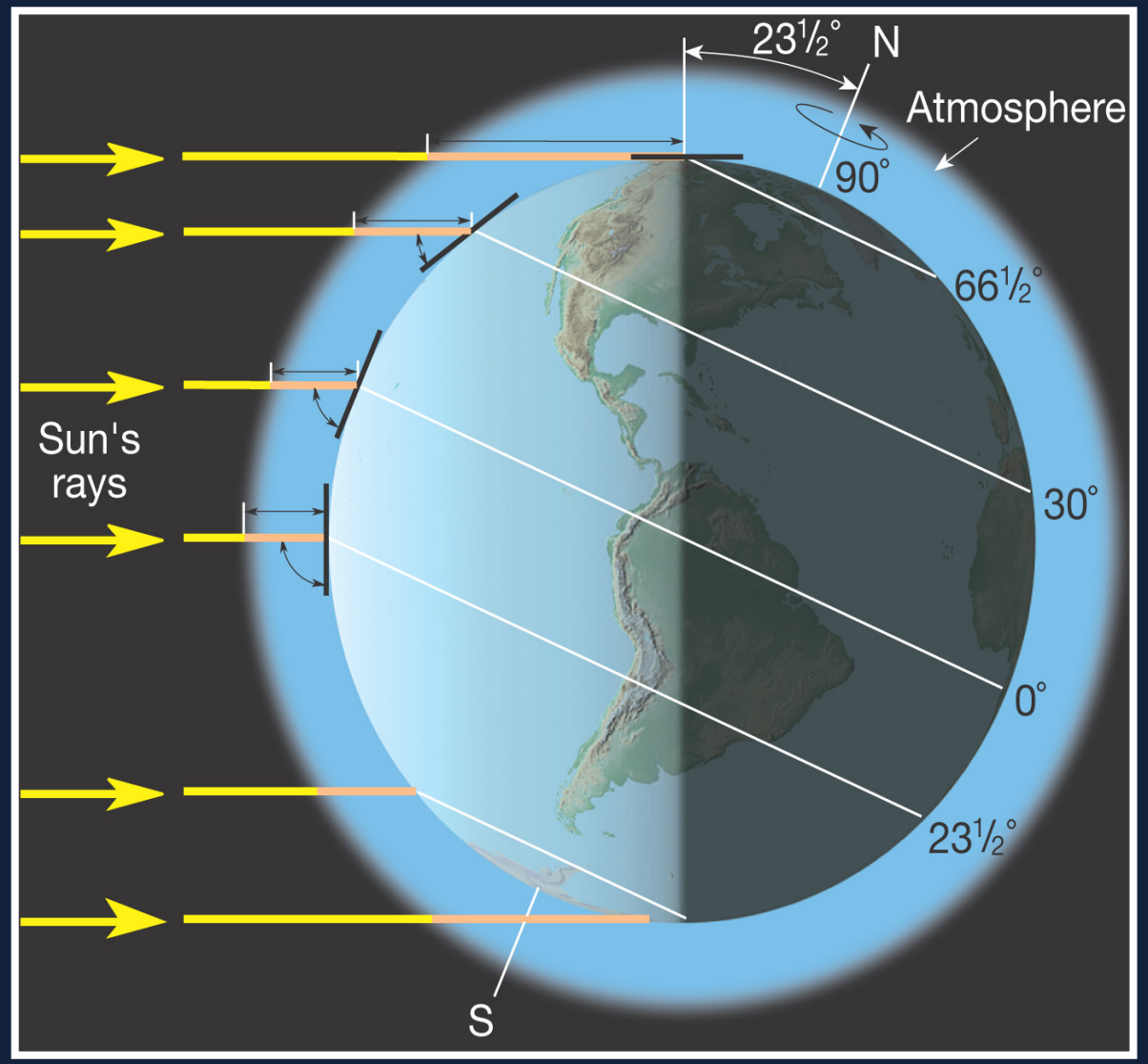
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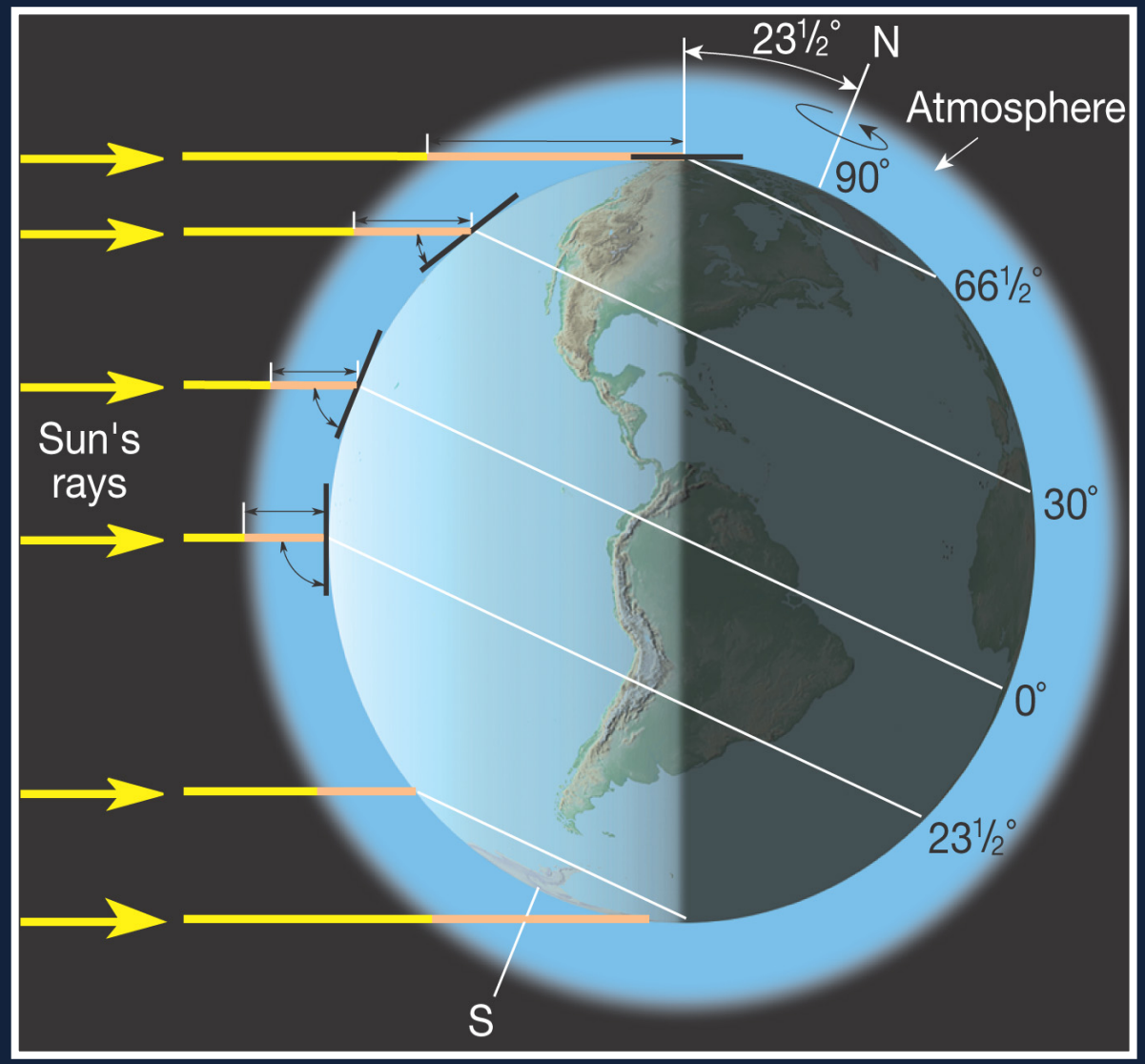
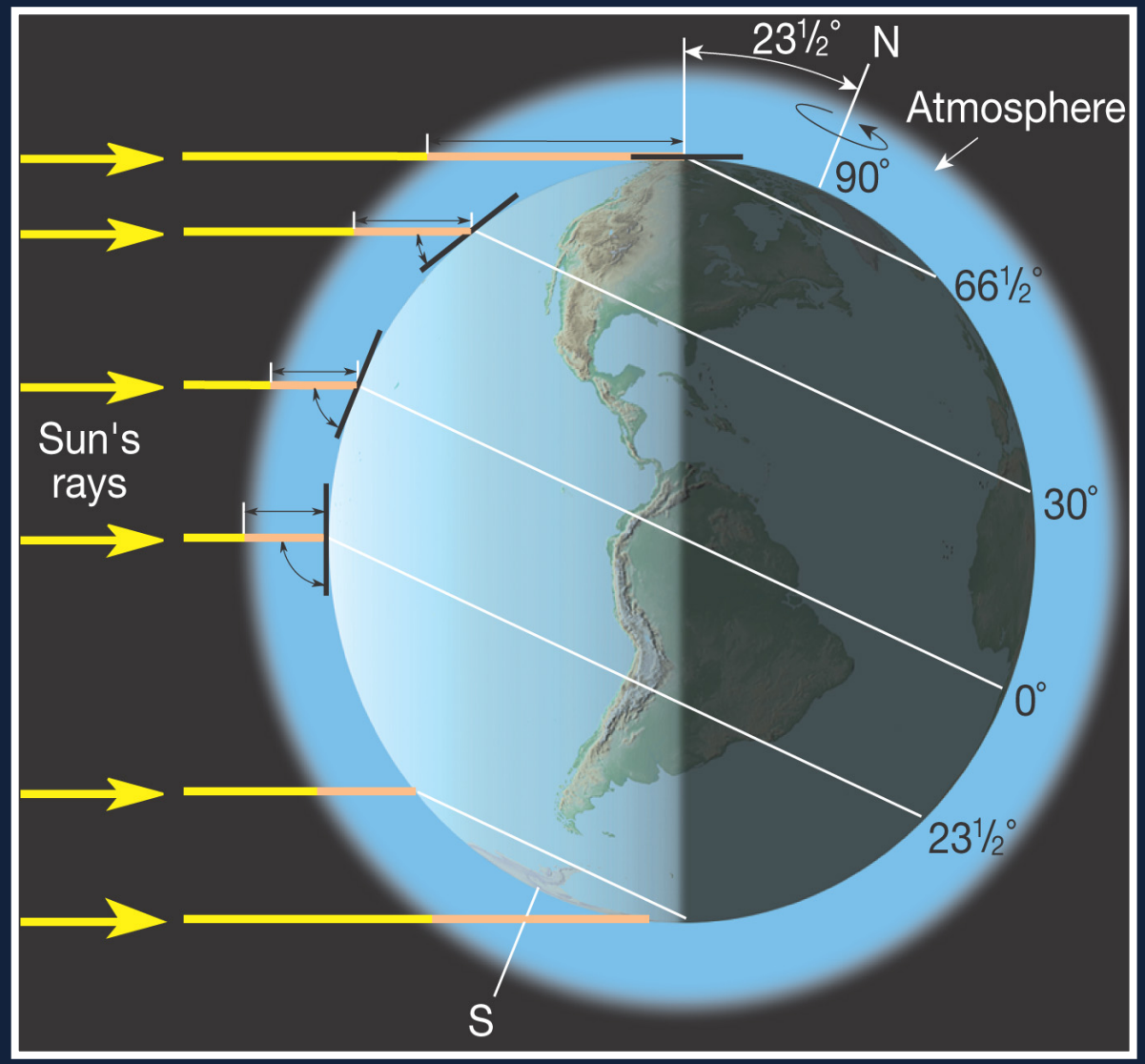


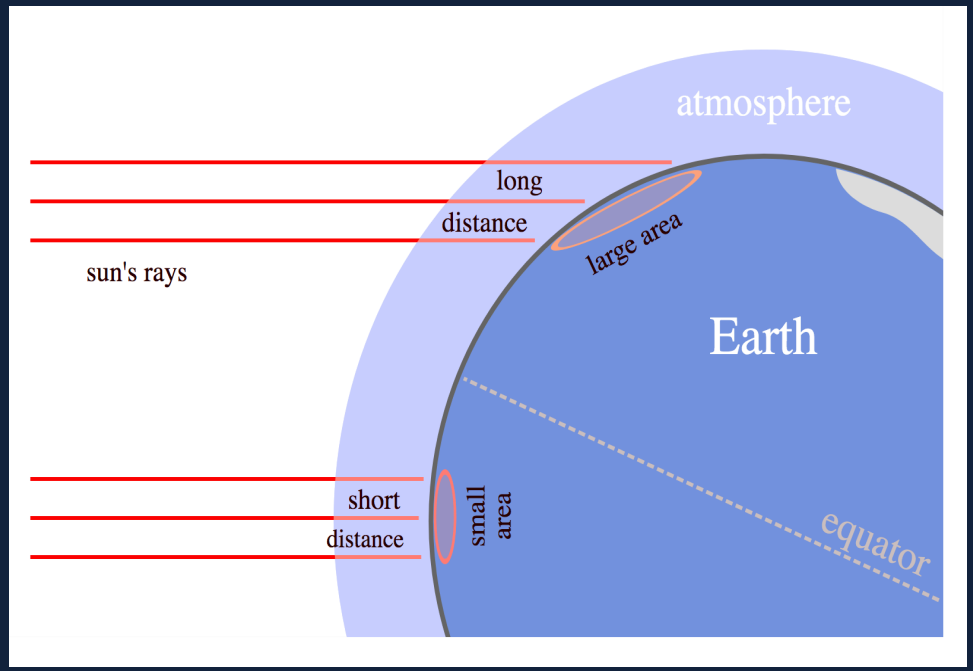
~ Each ***location north*** and ***south*** of the direct rays will have a ***smaller Sun angle*** and a receive spread out, ***less intense*** beam.



~ Each ***location north*** and ***south*** of the direct rays will have a ***smaller Sun angle*** and a receive spread out, ***less intense*** beam.

~ The ***angle*** of ***incoming*** solar ***energy determines*** the ***distance*** the beam must travel ***through*** the ***atmosphere to*** reach the ***surface***.

~ When the Sun's ***rays*** ***travel*** through more ***atmosphere***, the ***chance*** they will be ***absorbed***, ***reflected***, or ***scattered*** by the gases and aerosols in the atmosphere ***increases***.



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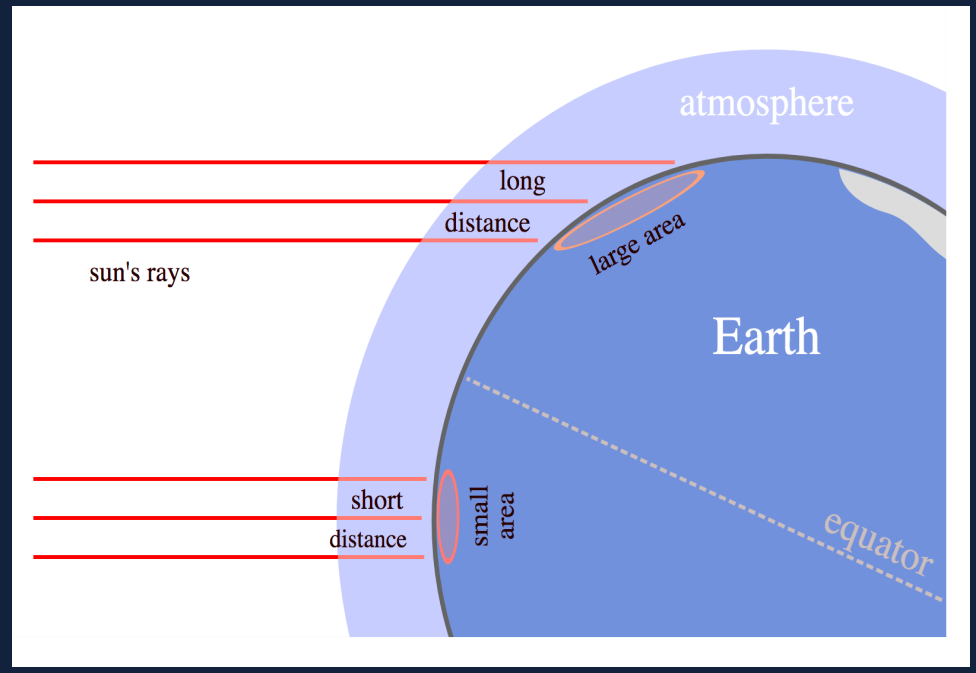
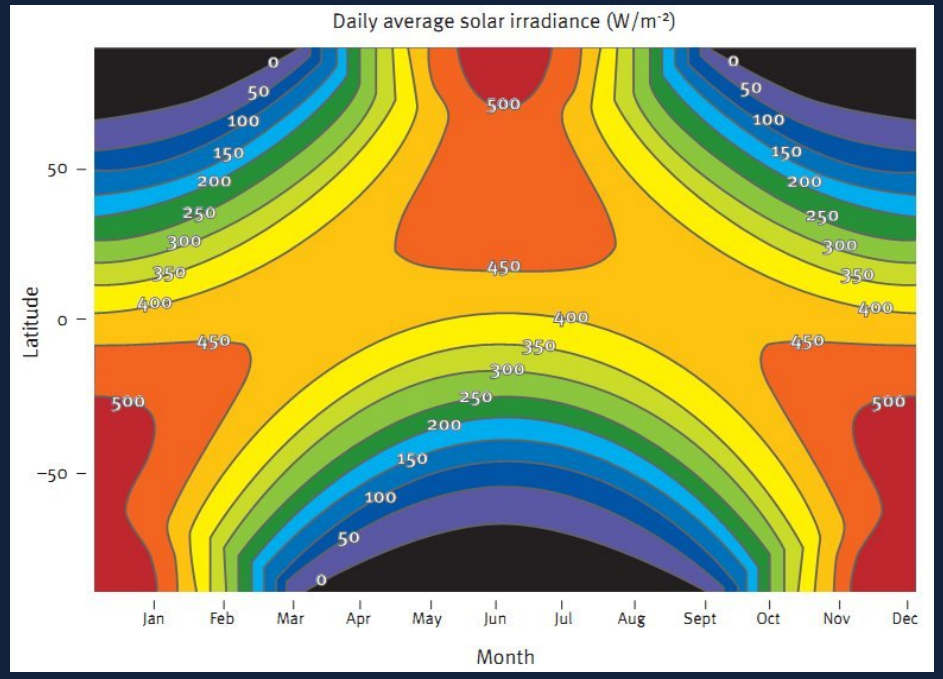
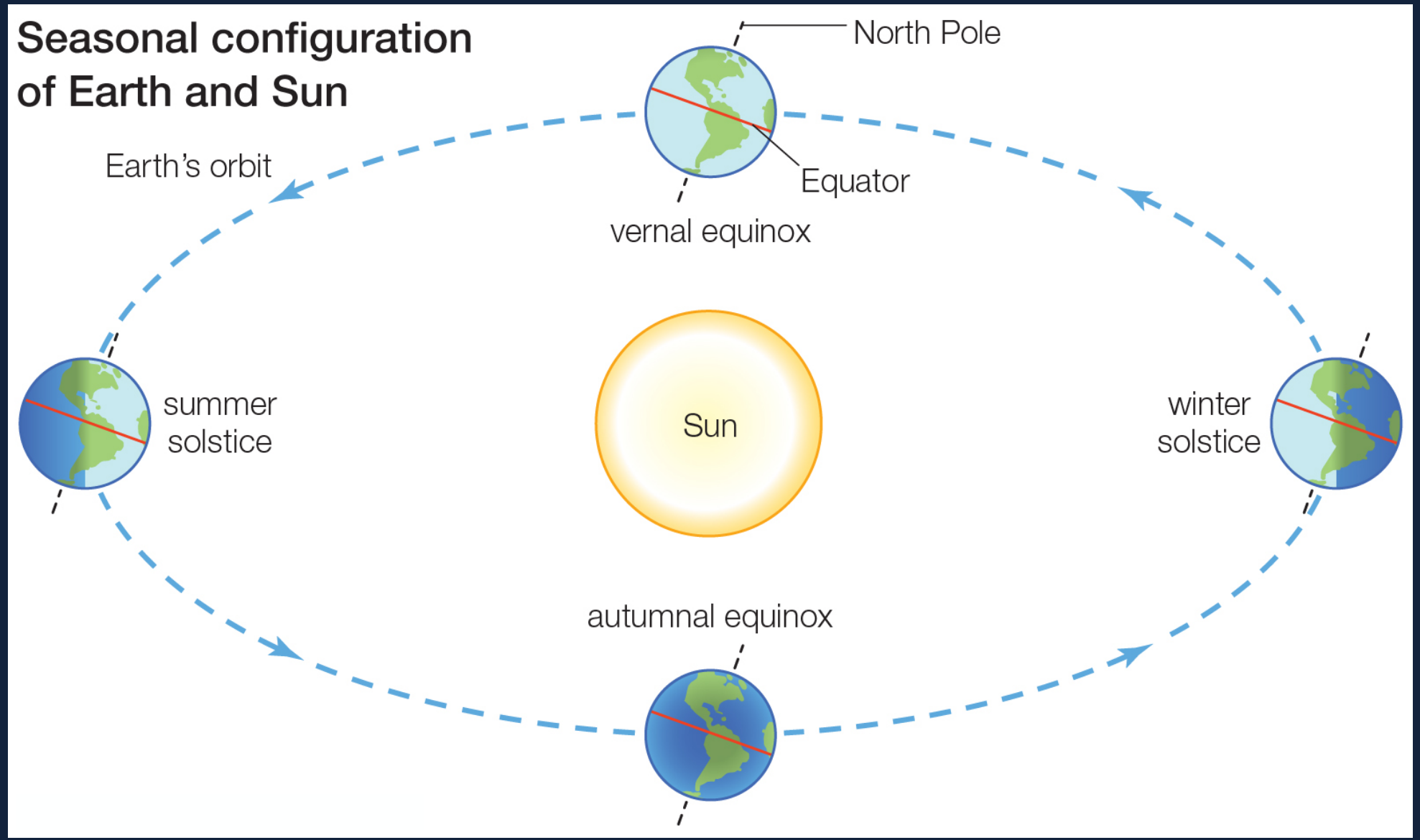




~ So if the ***angle*** of the incoming solar ***radiation*** is ***key*** in determining the ***intensity*** of the rays, ***what*** ***causes*** the ***angle*** of the ***Sun*** to ***change***?


Seasonal configuration of Earth and Sun
North Pole
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Earth's orbit
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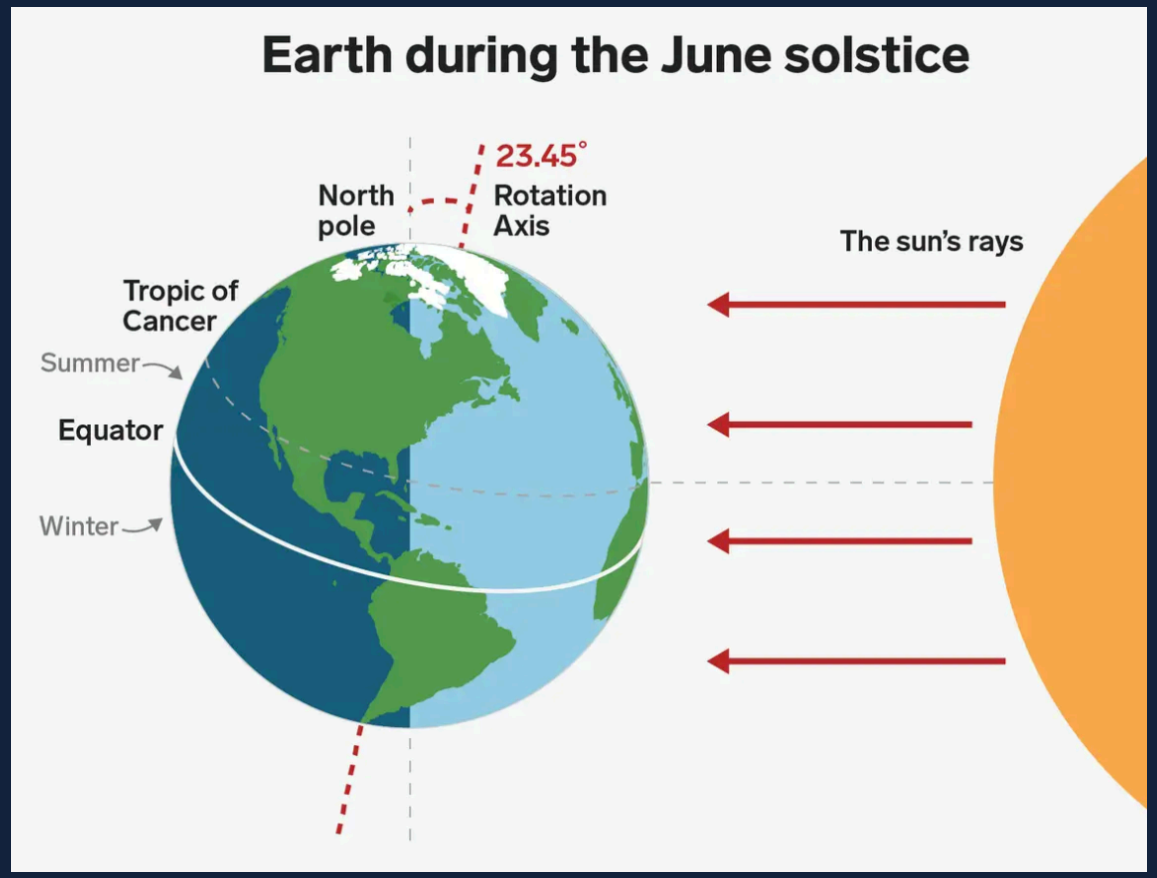
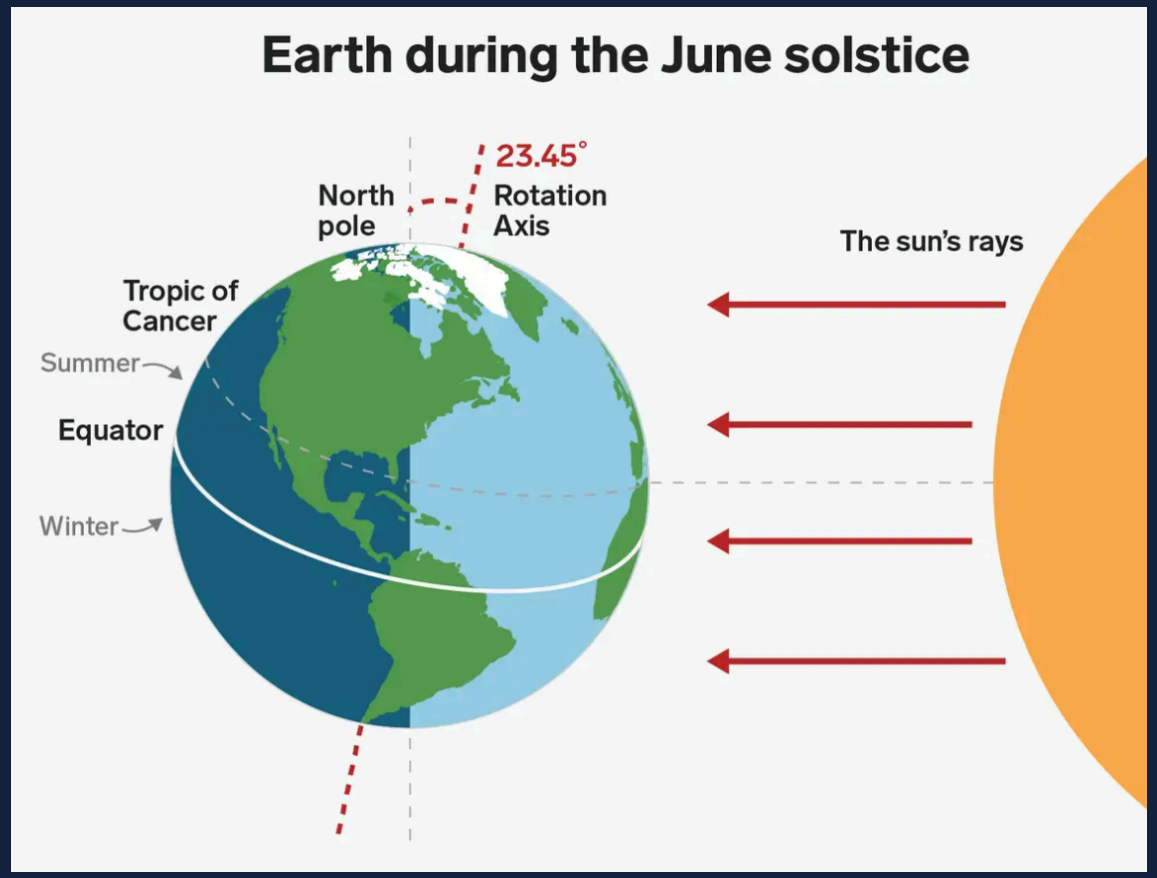
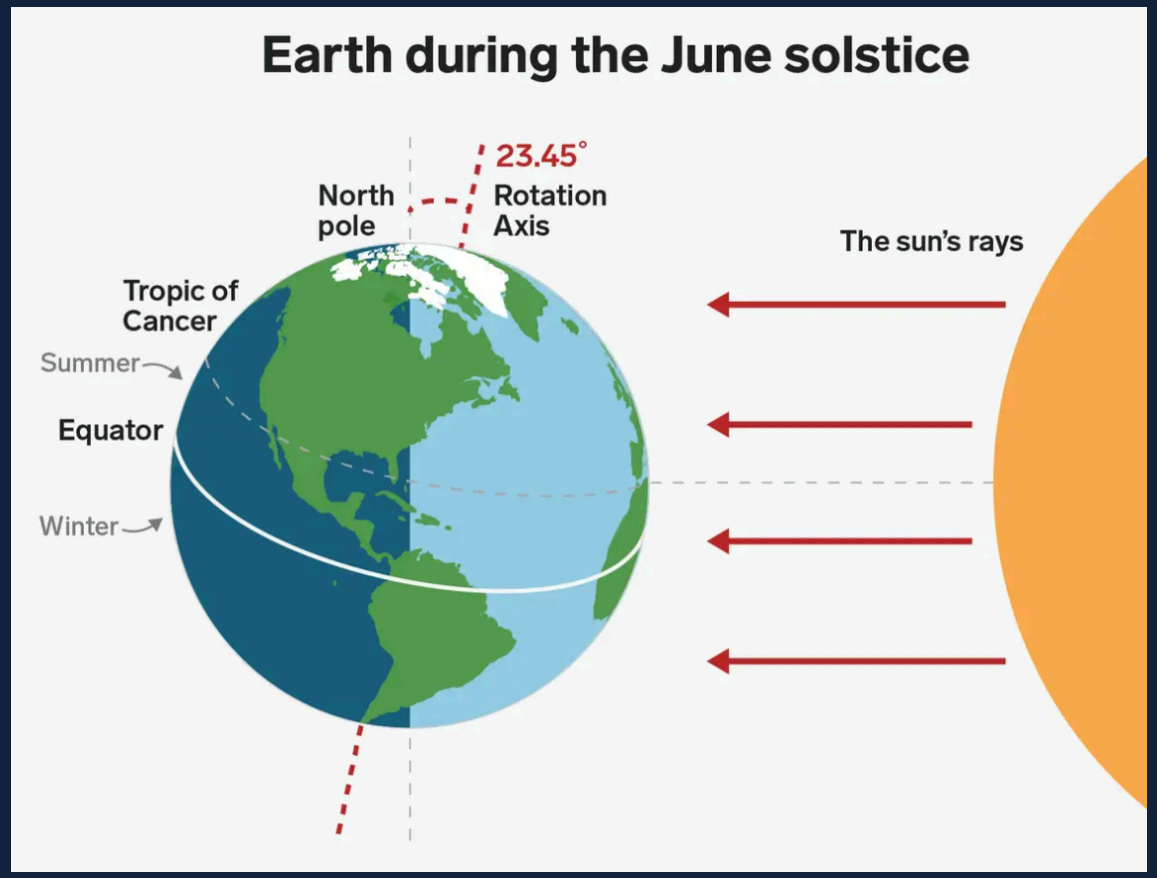

Earth during the June solstice
23.45°
North pole
Rotation Axis
The sun's rays
Tropic of Cancer
Summer
Equator
Winter



~ The ***Earth*** is ***tilted*** at a ***constant*** ***~23.5°*** from the vertical and as it revolves, its ***orientation*** to the Sun constantly ***changes***.



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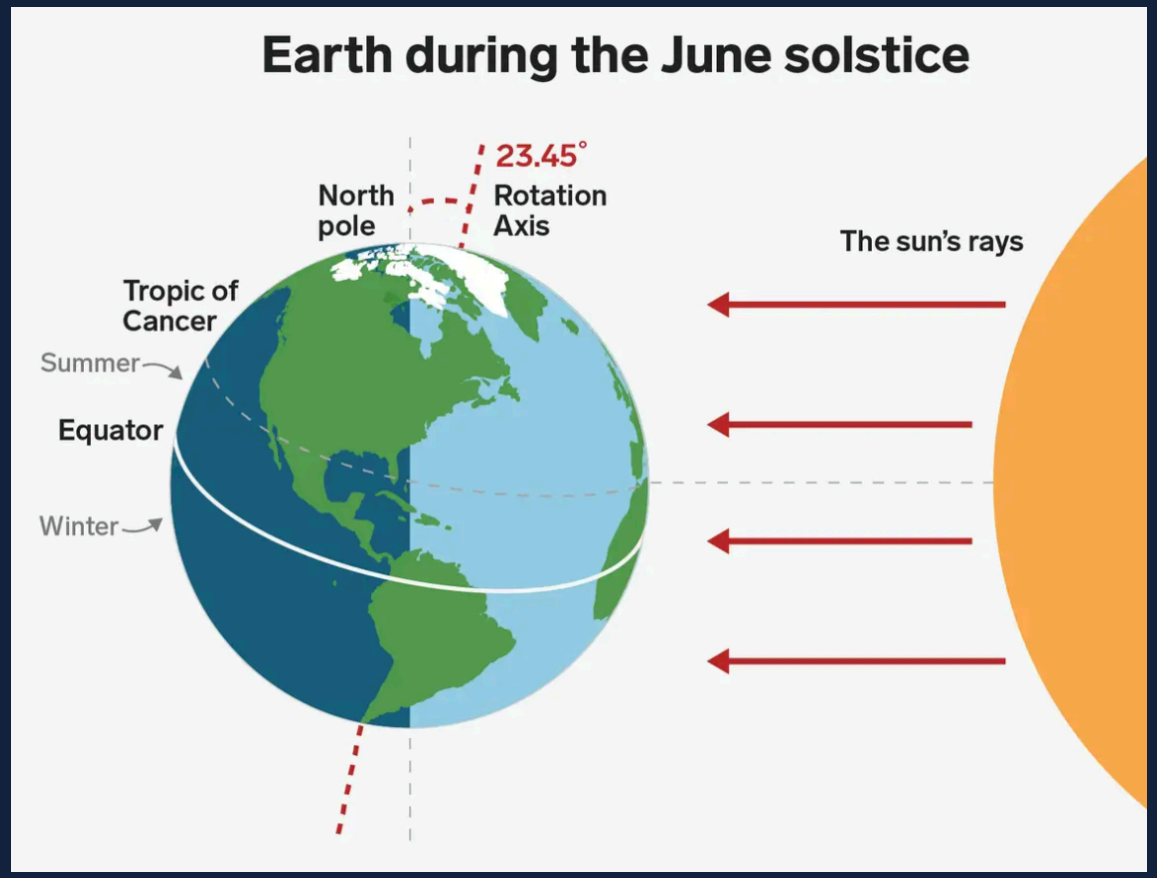
~ On ***21 or 22 June***, the ***Northern Hemisphere*** is ***tilted towards*** the Sun.



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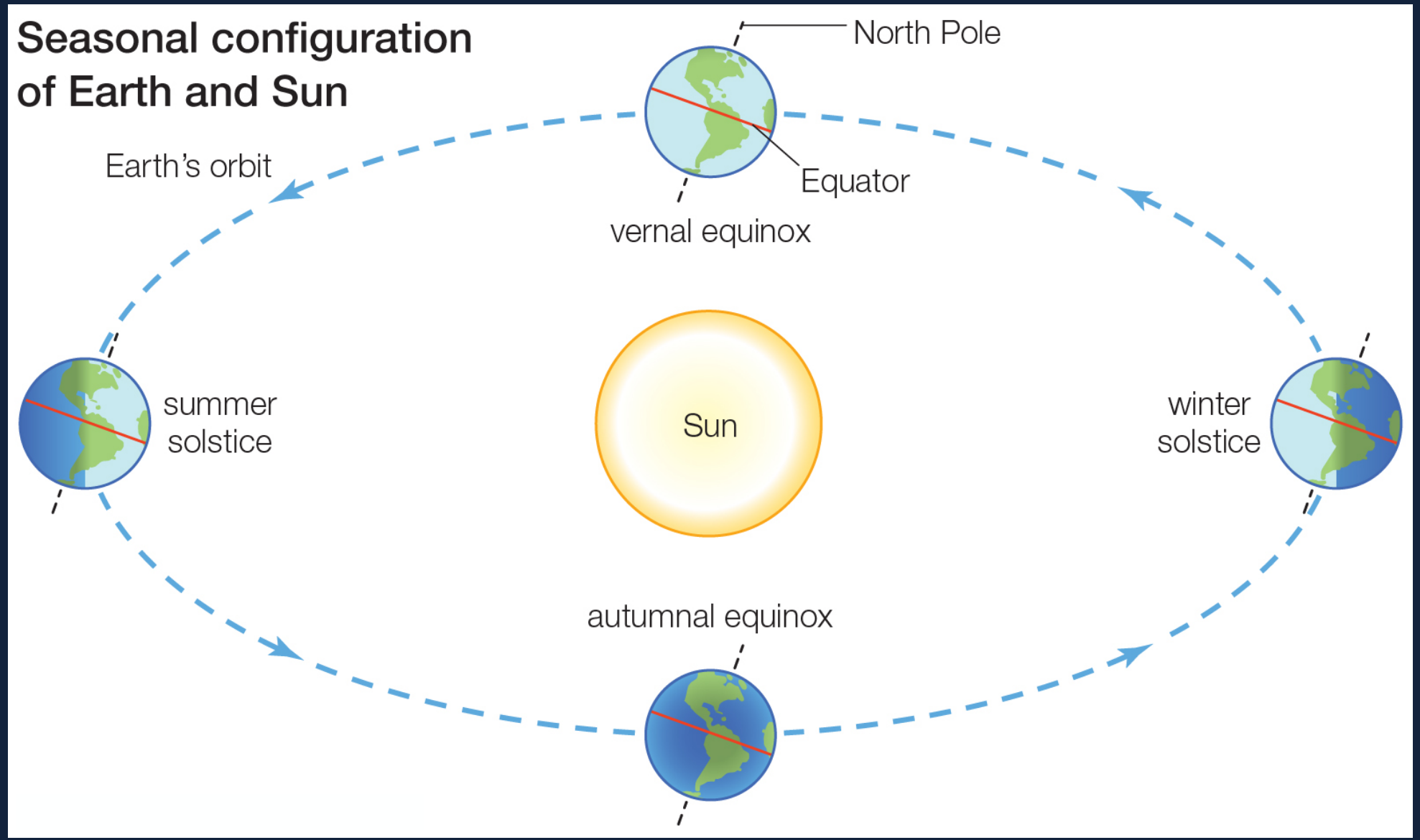
~ On ***21 or 22 June***, the ***Northern Hemisphere*** is ***tilted towards*** the Sun.

~ This is the ***summer solstice*** (first day of summer) in the Northern Hemisphere and the ***direct*** (90°) ***rays*** of the Sun are pointed at ***23.5° N*** latitude (the ***Tropic of Cancer***).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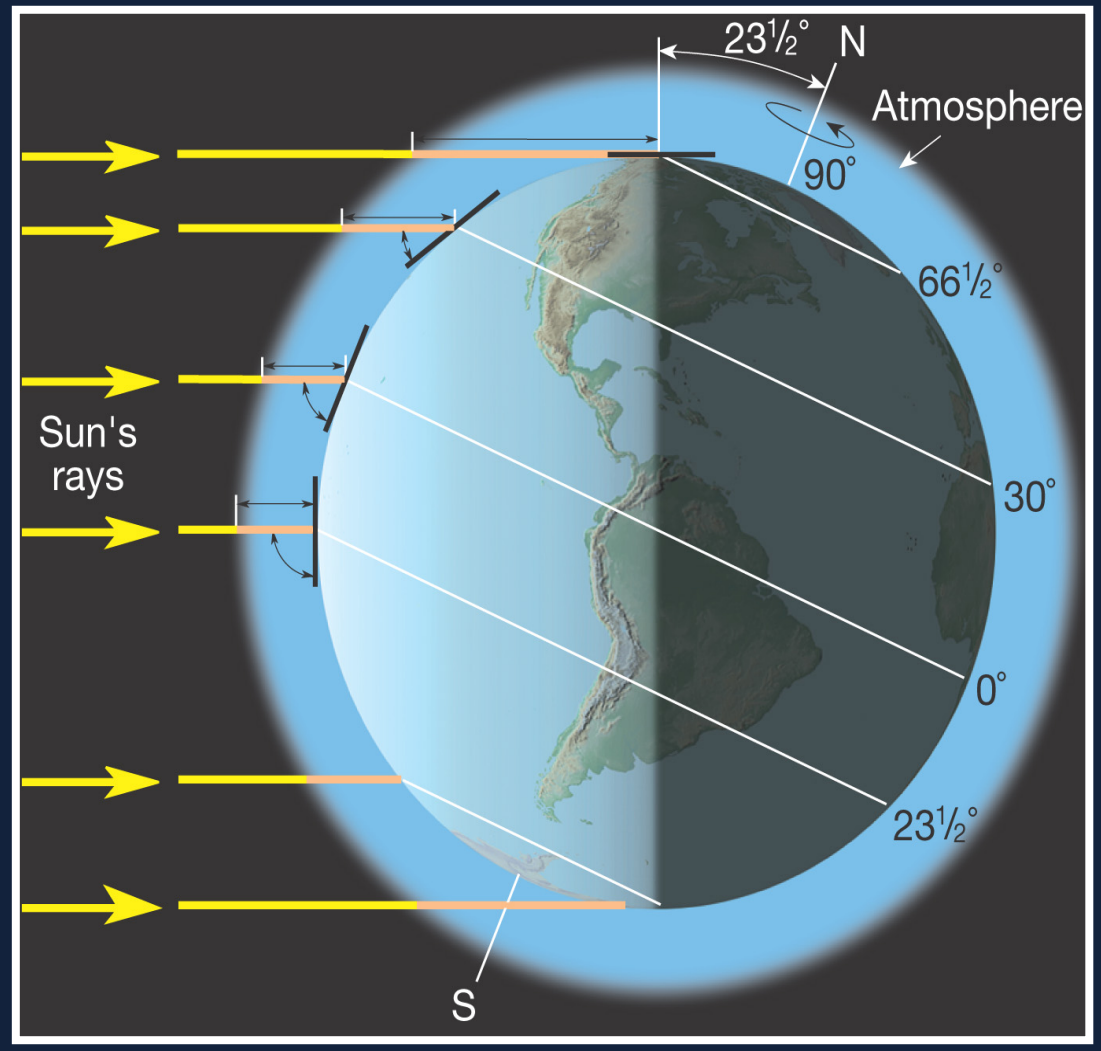
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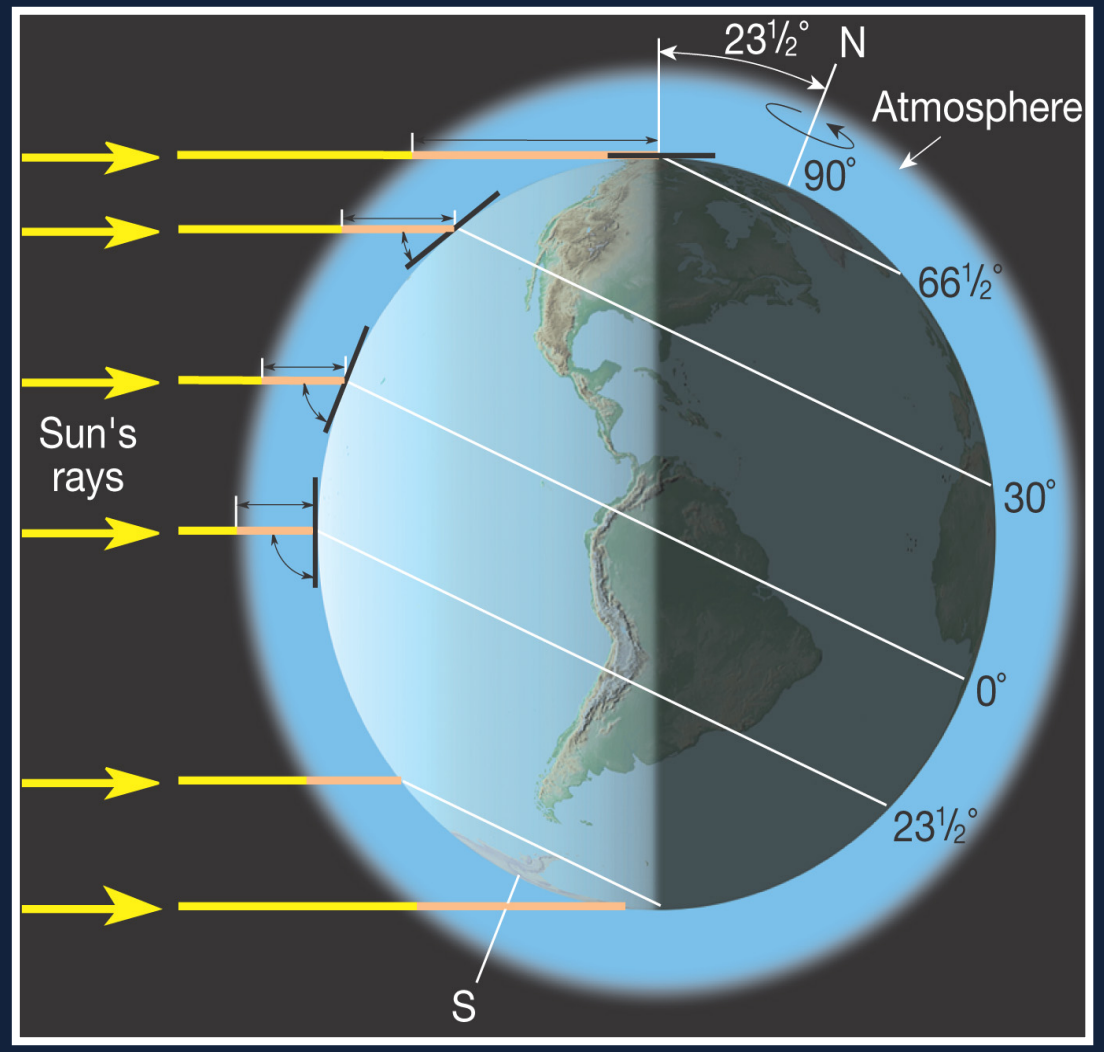
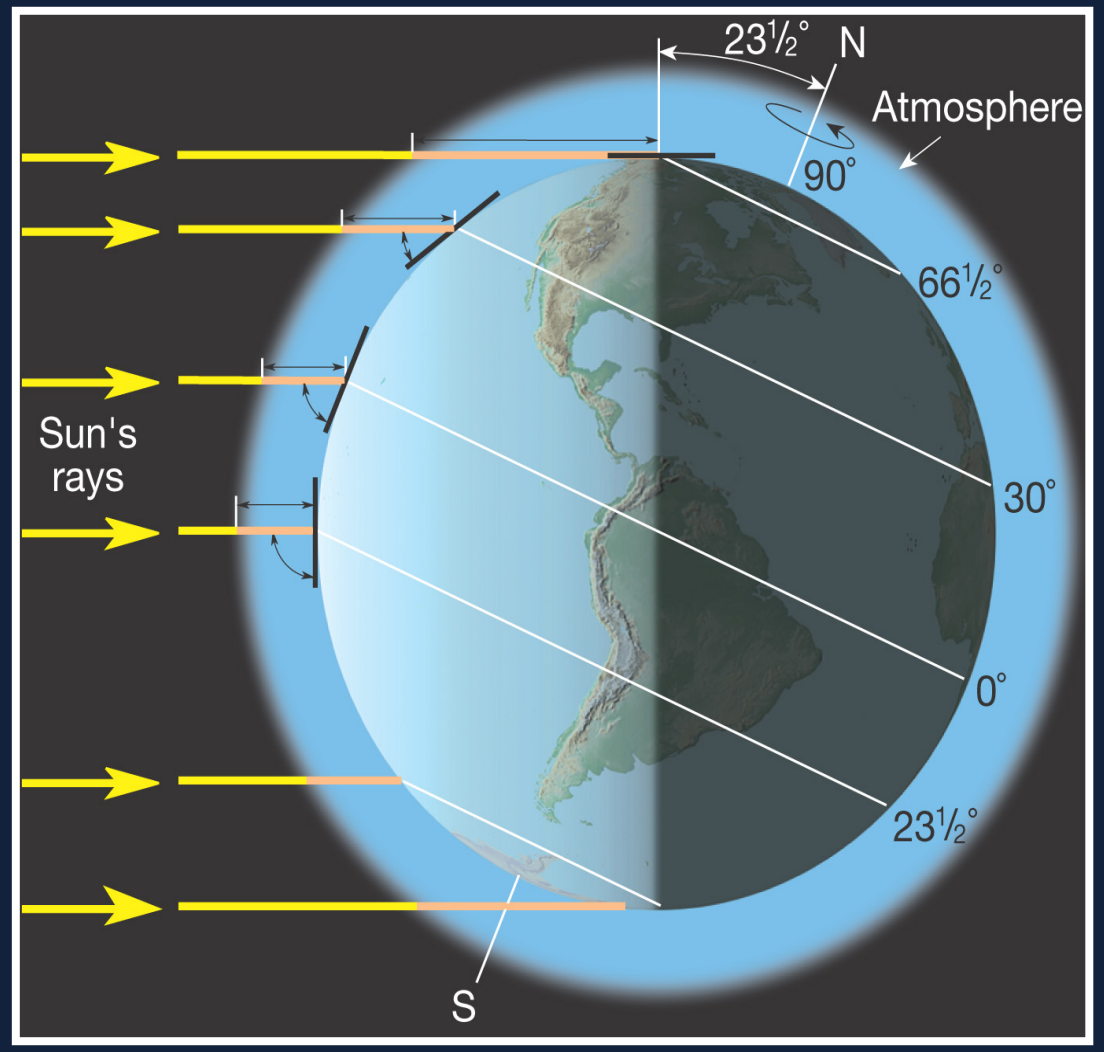
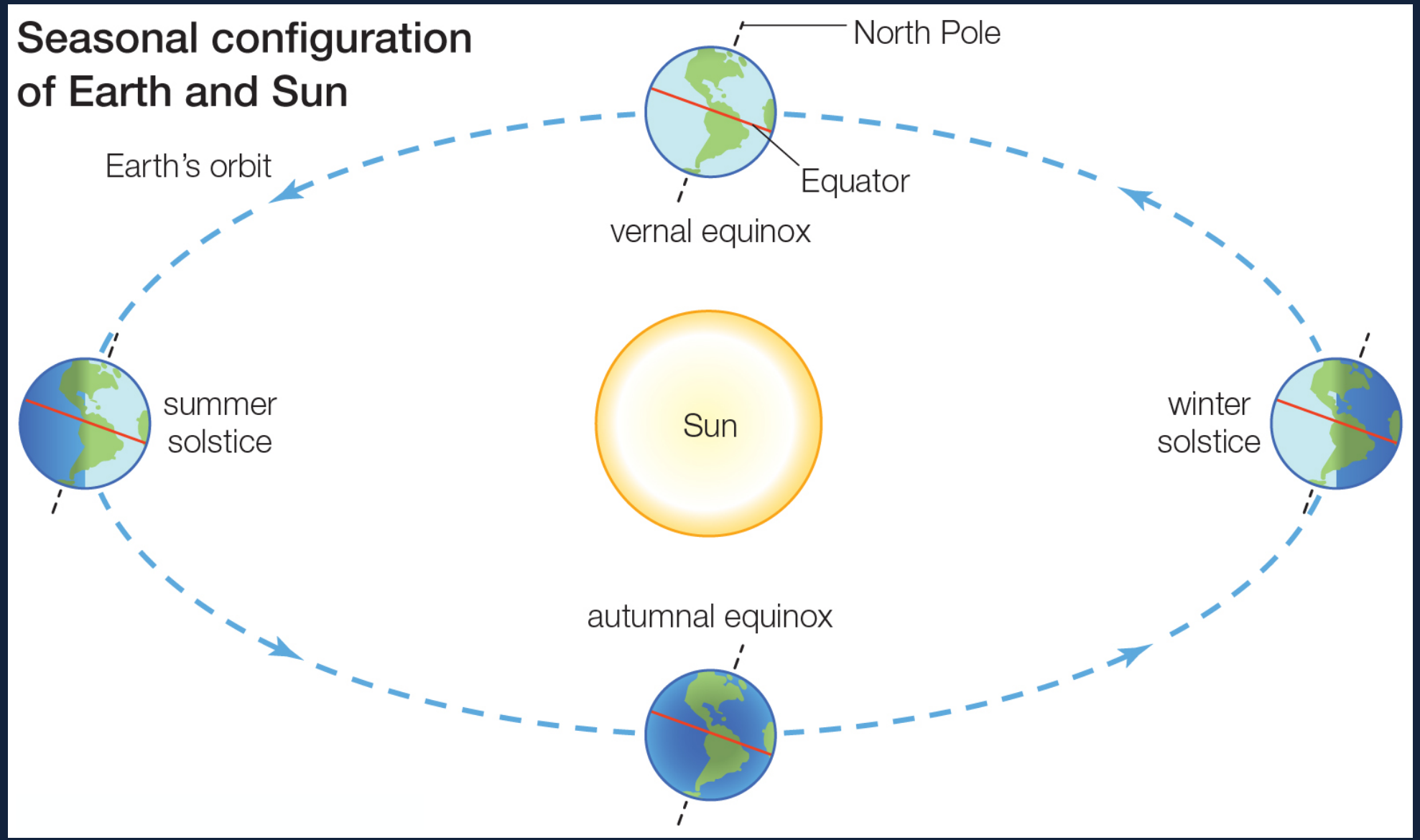
~ On ***21 or 22 December***, the ***Northern Hemisphere*** is ***tilted away*** from the Sun (winter solstice) and the ***most intense rays*** are directed at ***23.5° S***, the ***Tropic of Capricorn***.



~ On ***21 or 22 December***, the ***Northern Hemisphere*** is ***tilted away*** from the Sun (winter solstice) and the ***most intense rays*** are directed at ***23.5° S***, the ***Tropic of Capricorn***.

~ At the ***midpoint*** between the ***solstices*** (21 or 22 March and September), the ***Earth*** is ***neither*** tilted ***towards or away*** from the Sun and the ***direct rays*** are pointed at the ***equator***.

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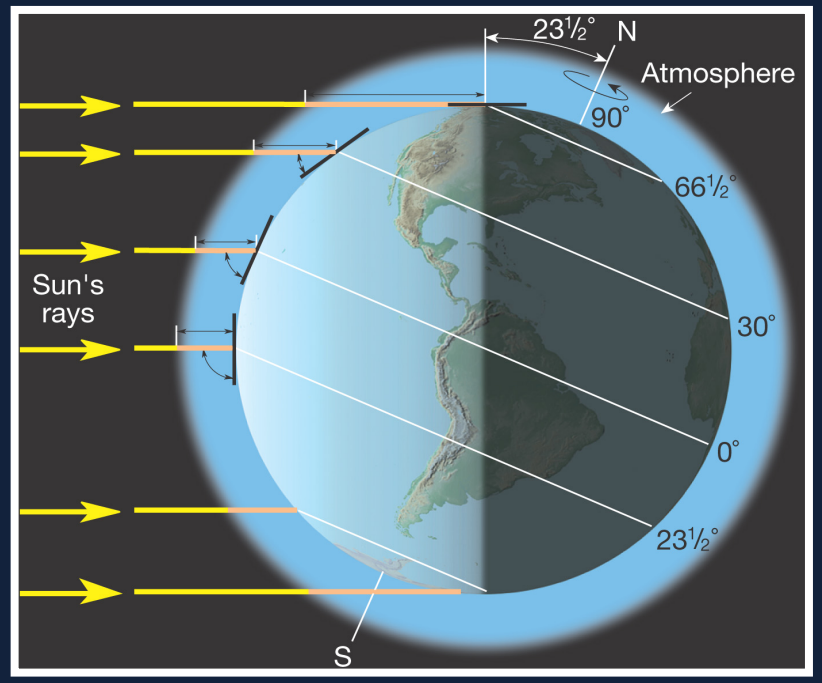
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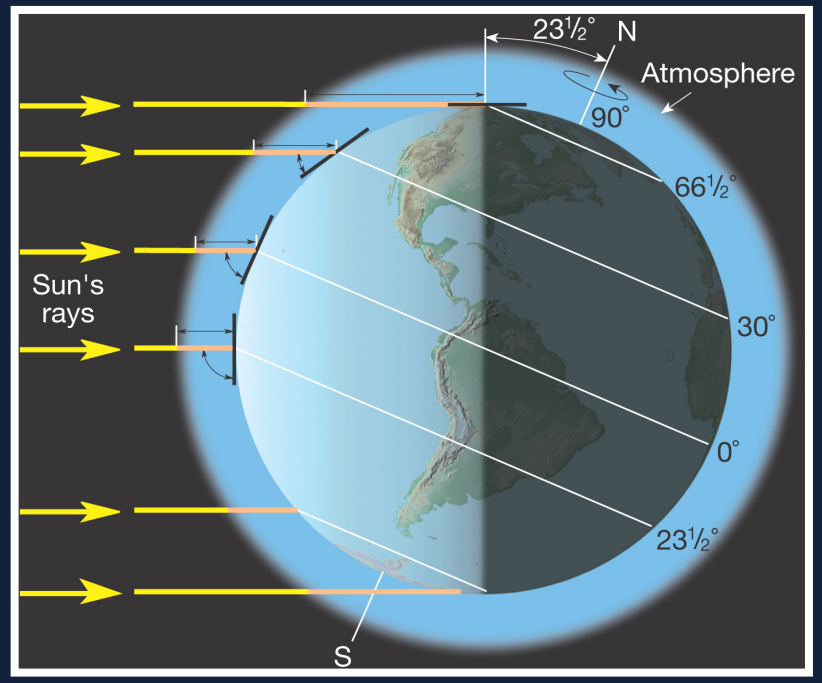
~ In addition to the angle of Sun's rays, the ***length*** of ***daylight*** is ***determined by*** the Earth's ***position*** around the Sun.



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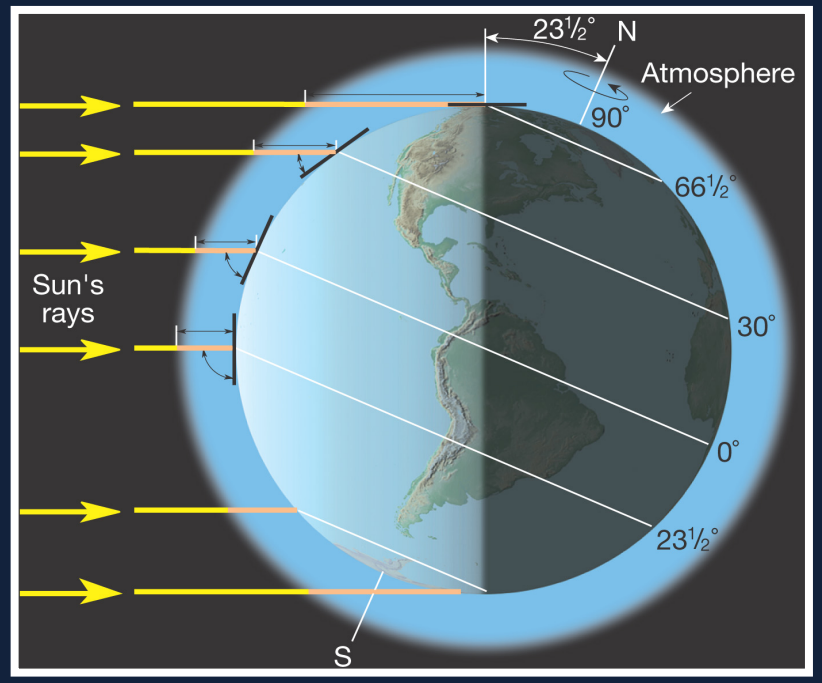

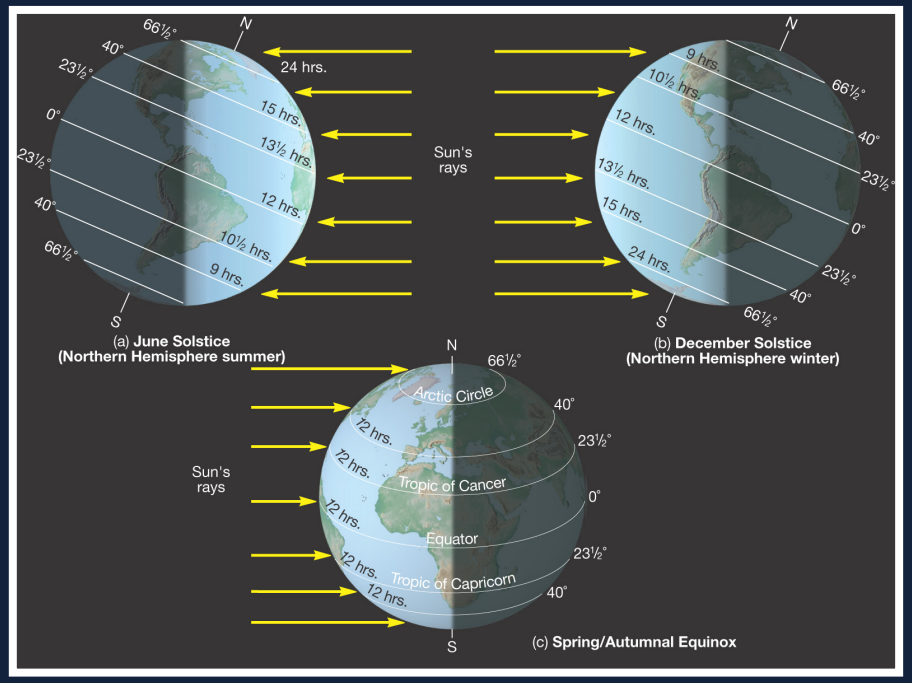

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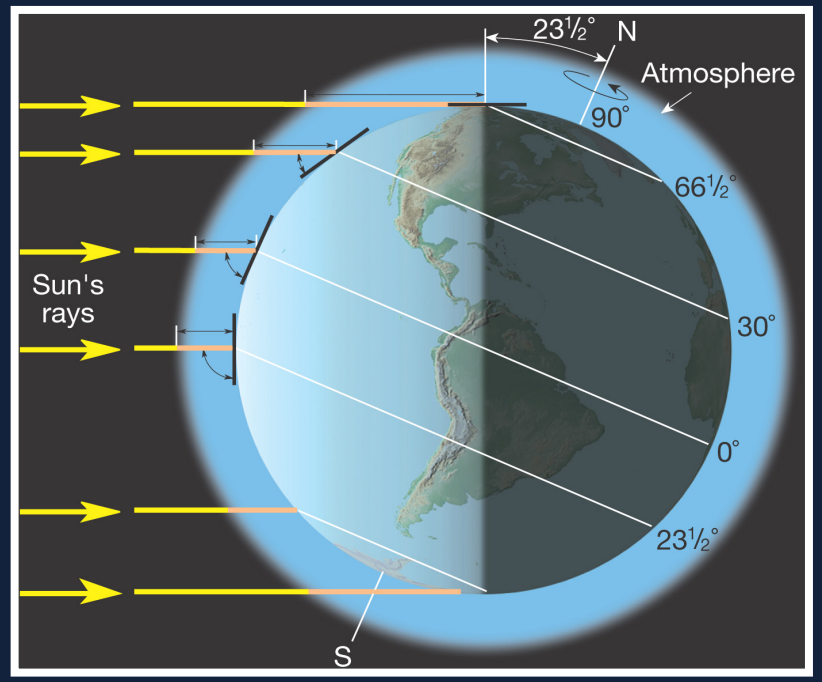
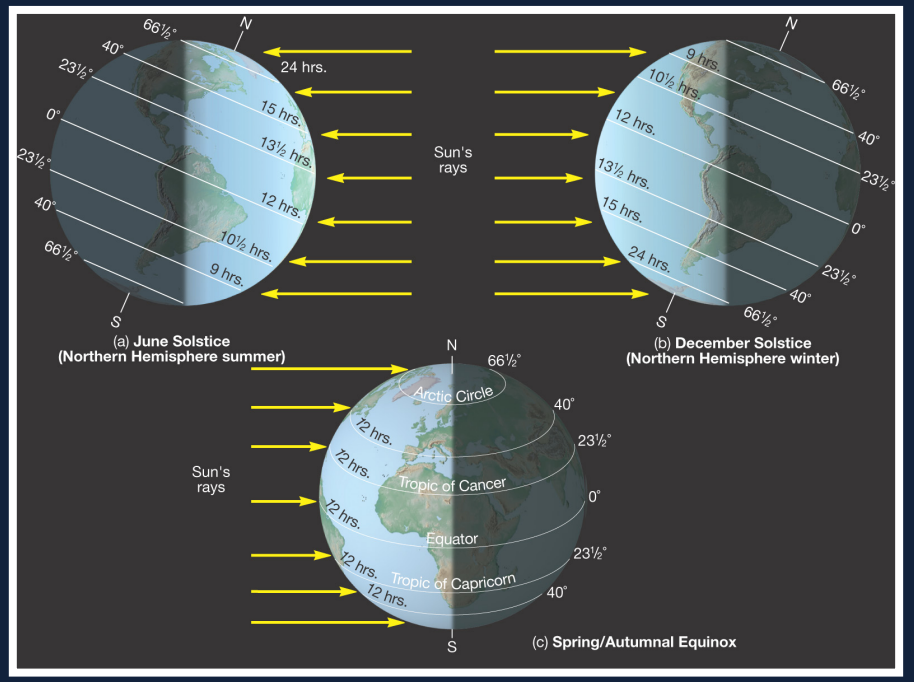
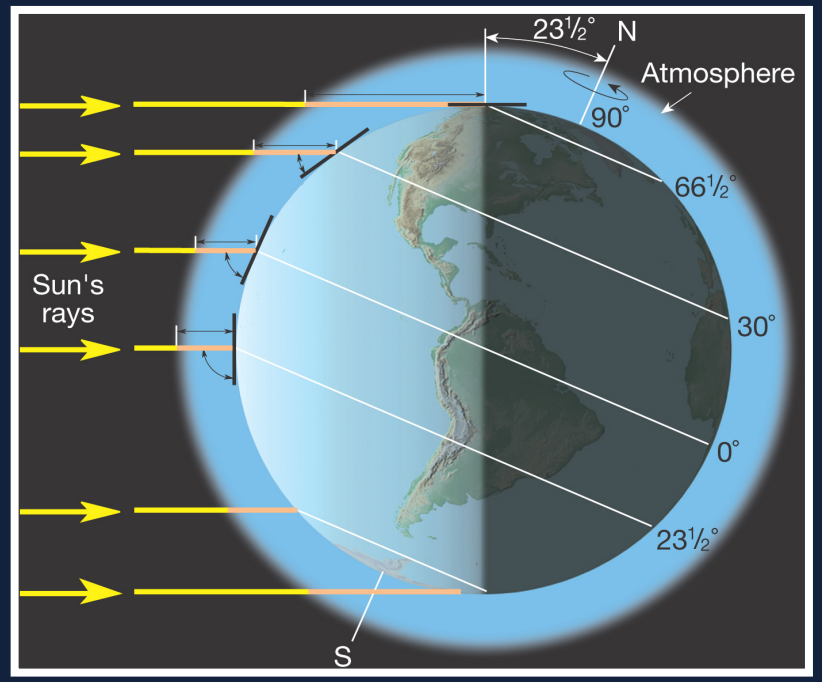
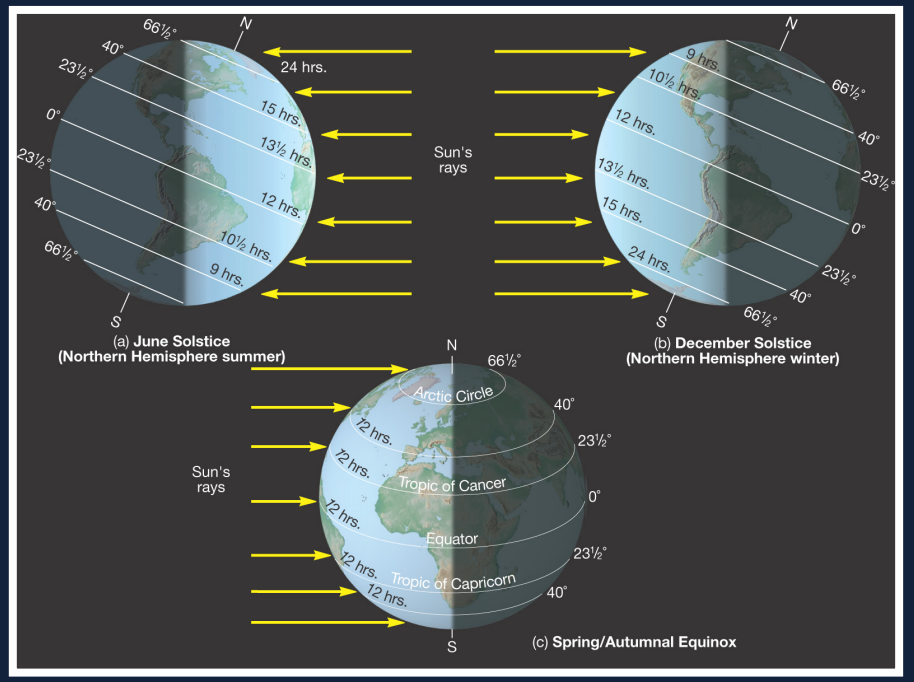




~ The ***length of day*** is determined by comparing the ***fraction*** of a ***latitude circle*** on the ***illuminated*** side of the Earth ***to*** the ***fraction*** that's on the ***dark*** side.

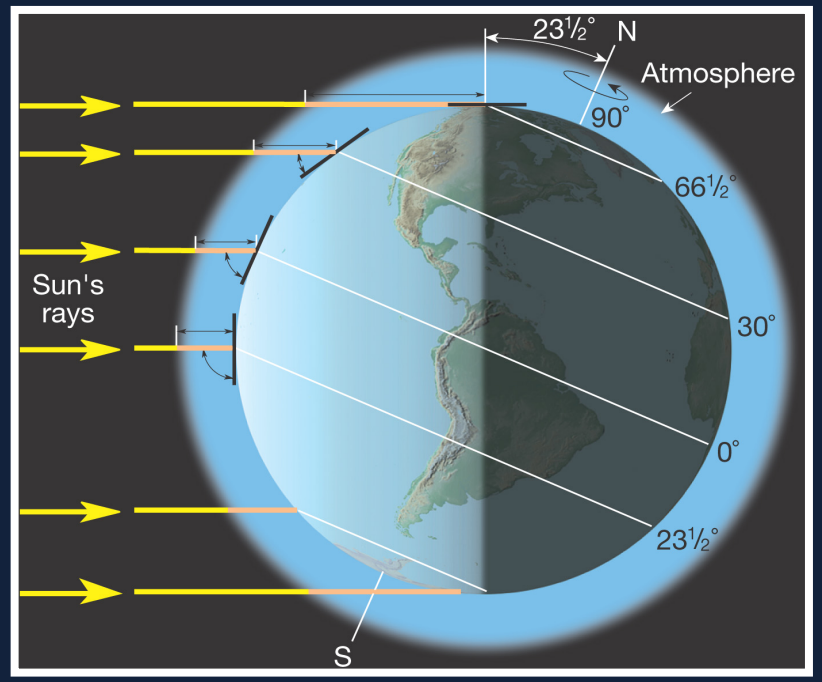
~ In addition to the angle of Sun's rays, the ***length*** of ***daylight*** is ***determined by*** the Earth's ***position*** around the Sun.

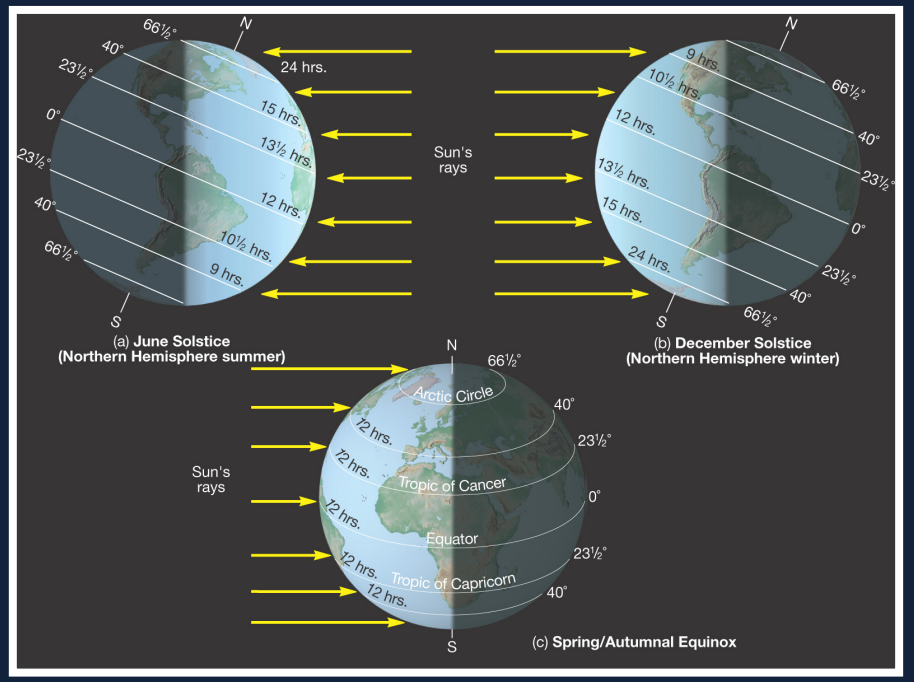




~ For example, on ***winter solstice*** (21 or 22 December), the ***length*** of ***day*** is ***greater than*** the length of ***night*** everywhere in the ***Southern Hemisphere***.

~ It is ***colder*** in the ***Northern Hemisphere*** because the Sun ***angle*** is <90˚ and the ***length*** of ***day*** is ***shorter***.





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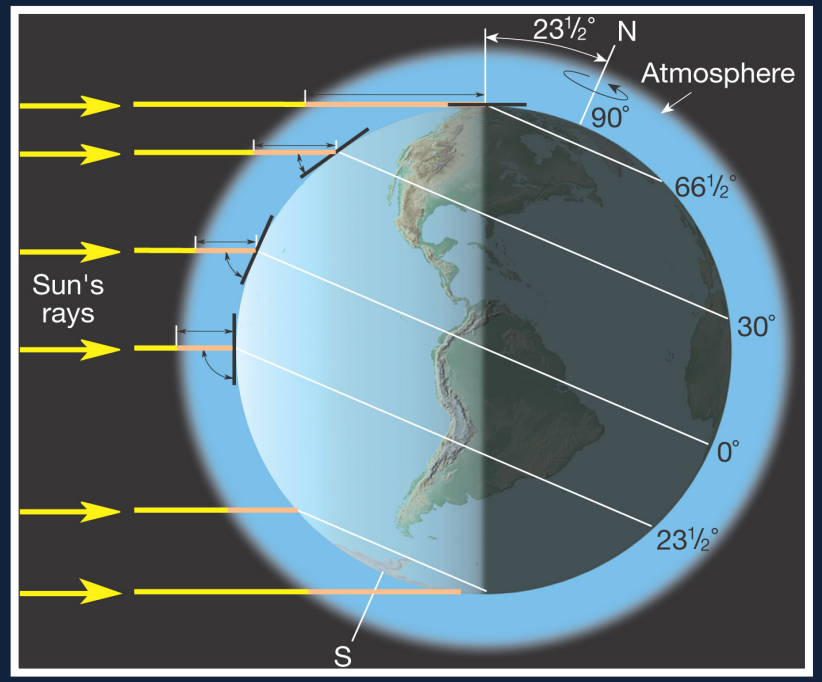

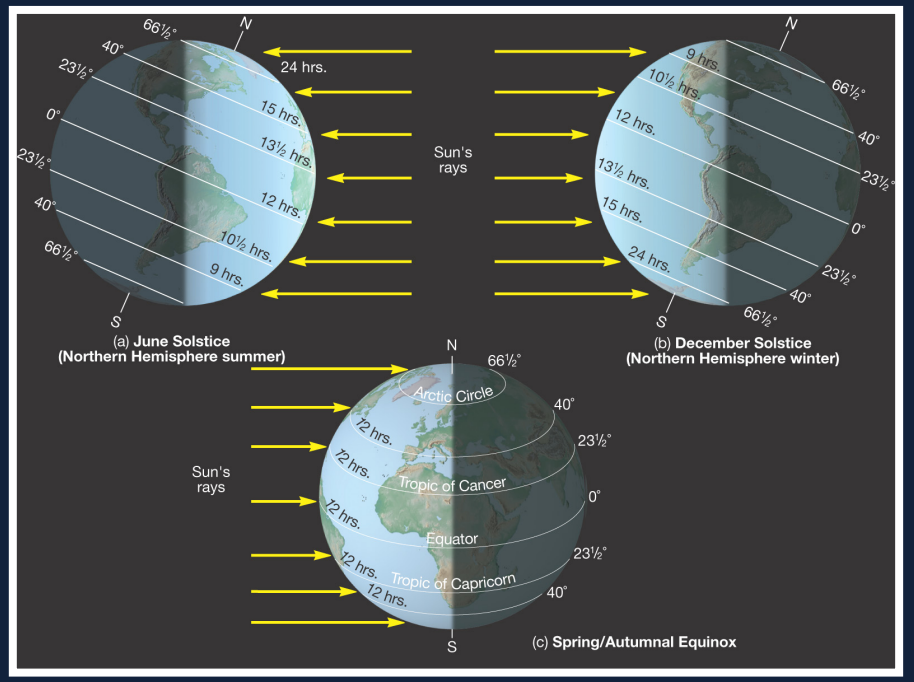

~ We can also appreciate the true ***meaning*** of an ***"equinox"*** (equal night) as the ***length*** of the ***night*** (and day) is ***12 hours everywhere*** as neither hemisphere points towards the Sun.