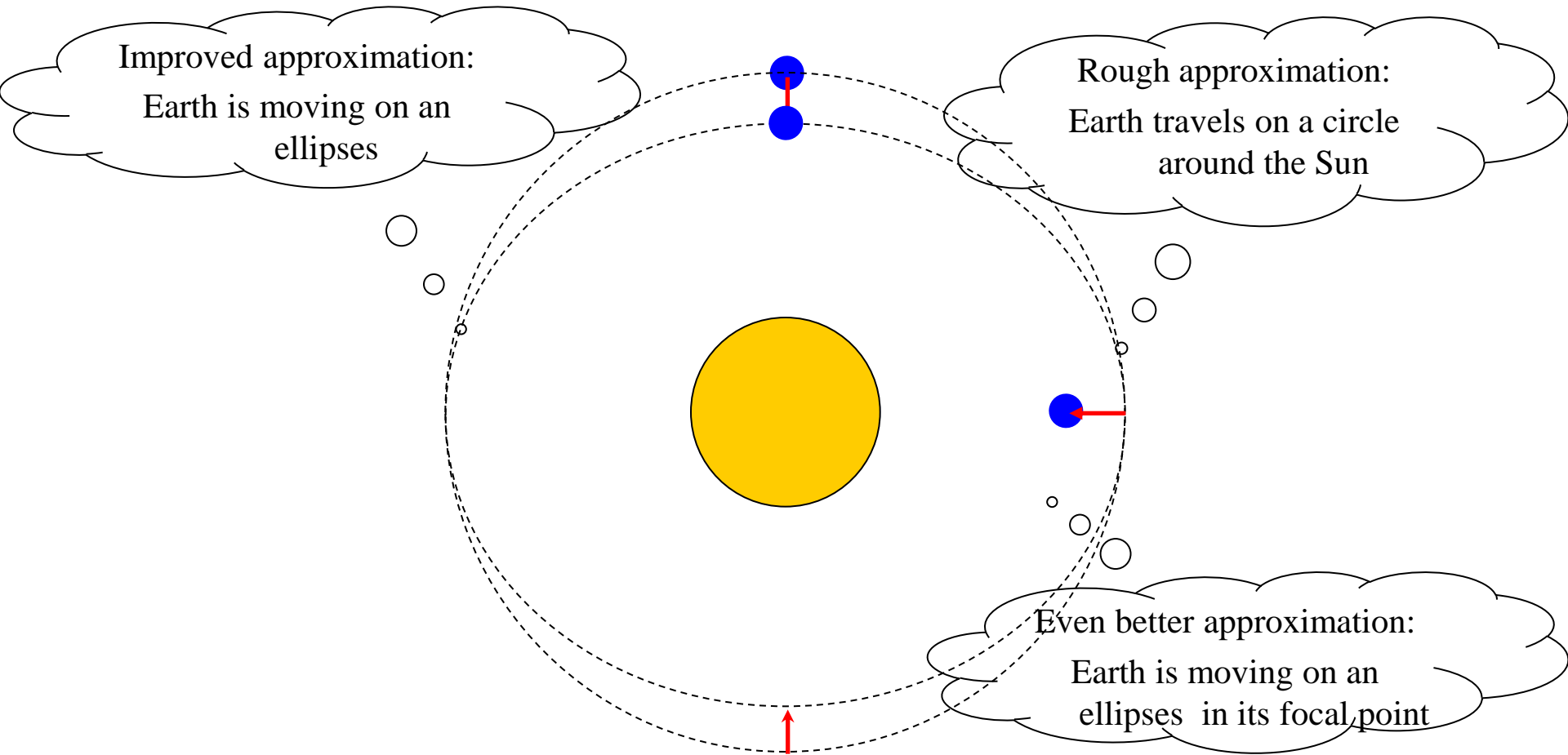


SOLAR RESOURCE

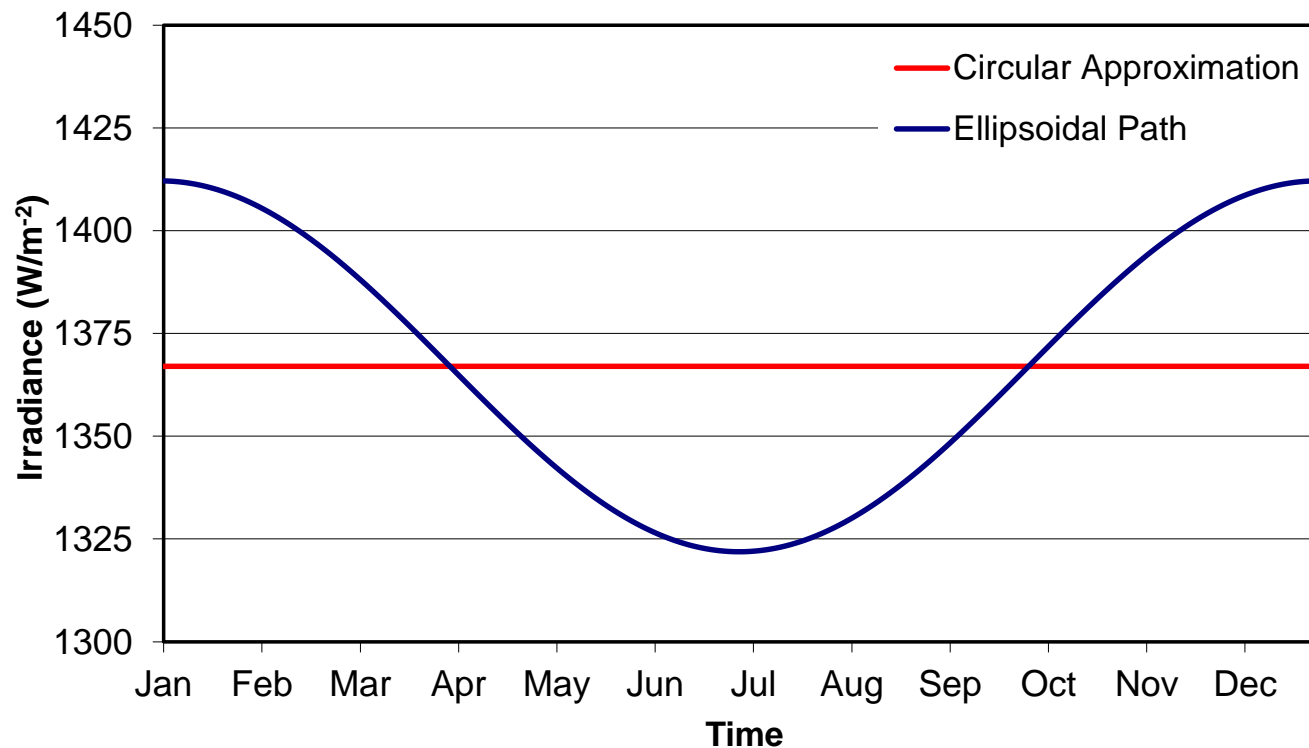
SUN PATH

Dr. Osama Ayadi

Sun-Earth Geometry



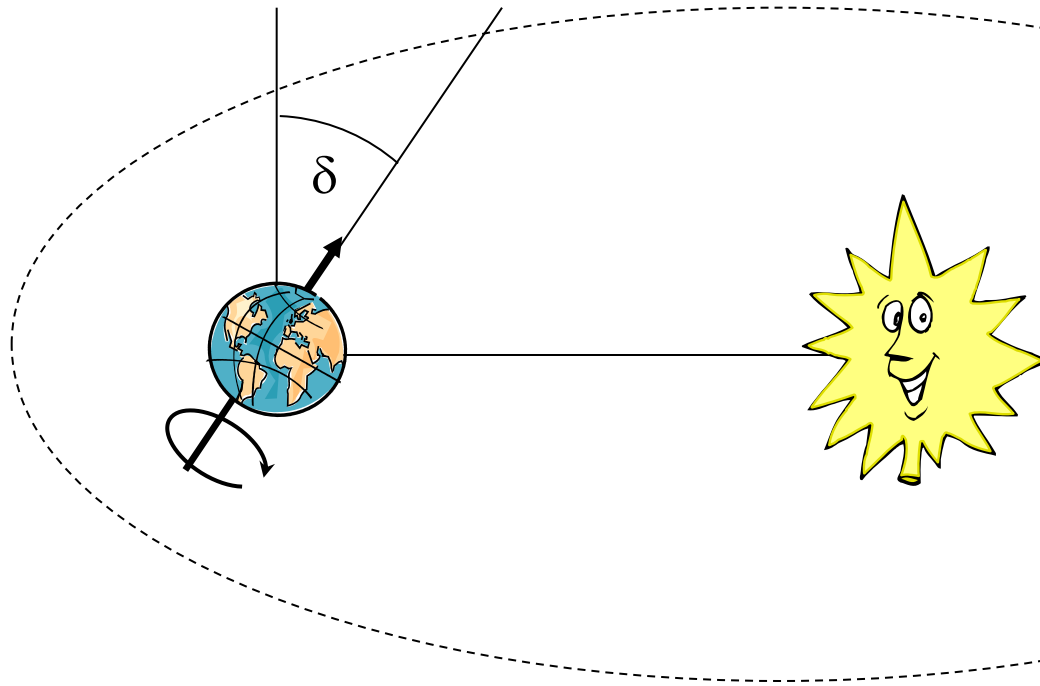
Irradiance Outside Atmosphere



Variation of extraterrestrial radiation

- When the sun is closest to the earth, on January 3, the solar heat on the outer edge of the earth's atmosphere is about 1400 W/m^2 farthest away,
- on July 4, it is about 1330 W/m^2 .
- The average value of the solar constant is 1367 W/m^2

Sun-Earth Geometry 2

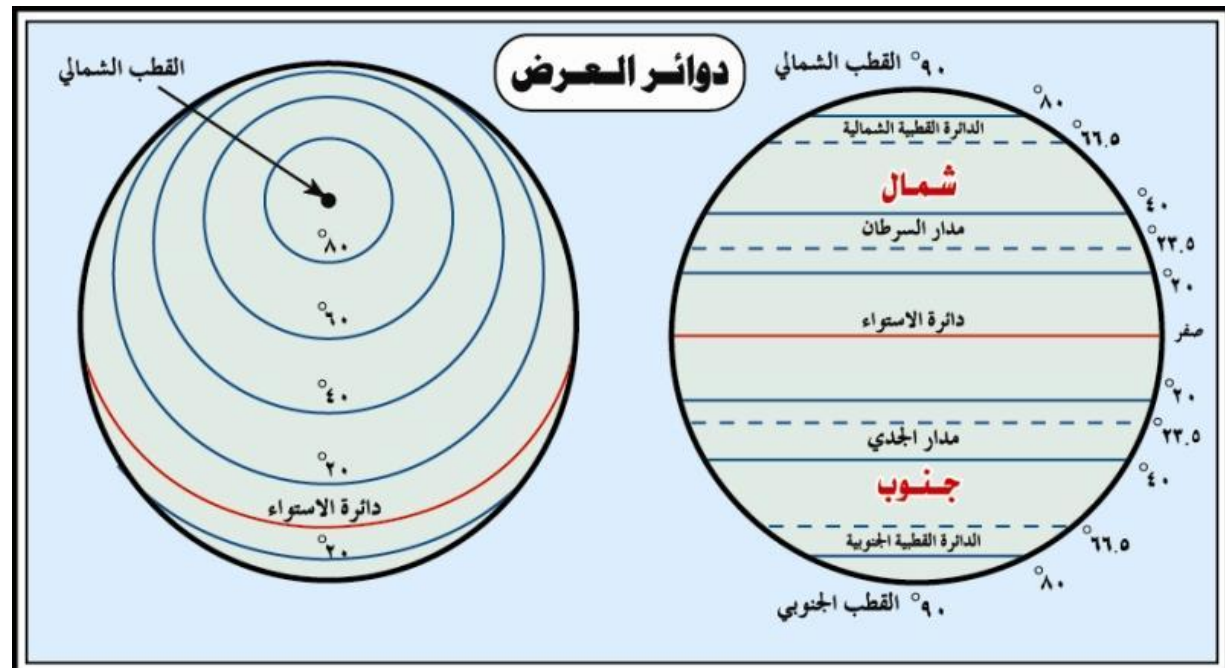


- Earth rotates around its axis
- Earth's rotational axis is angled at $\delta=23.45^\circ$ to the orbital plane around the Sun
- Ellipsoidal movement around Sun

Latitude

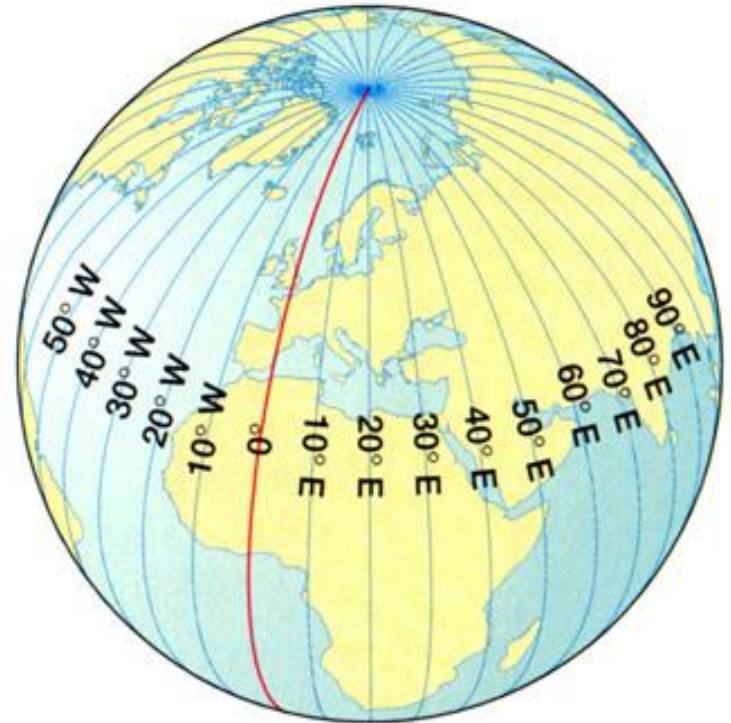
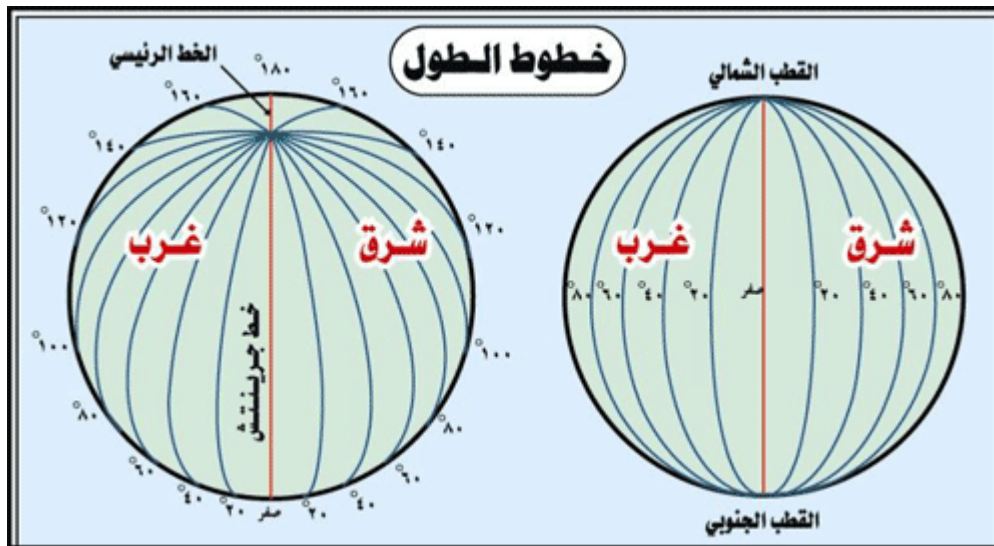
The angular location
north or south of the
equator, north positive.

$$-90 < < 90^{\circ}$$



longitude

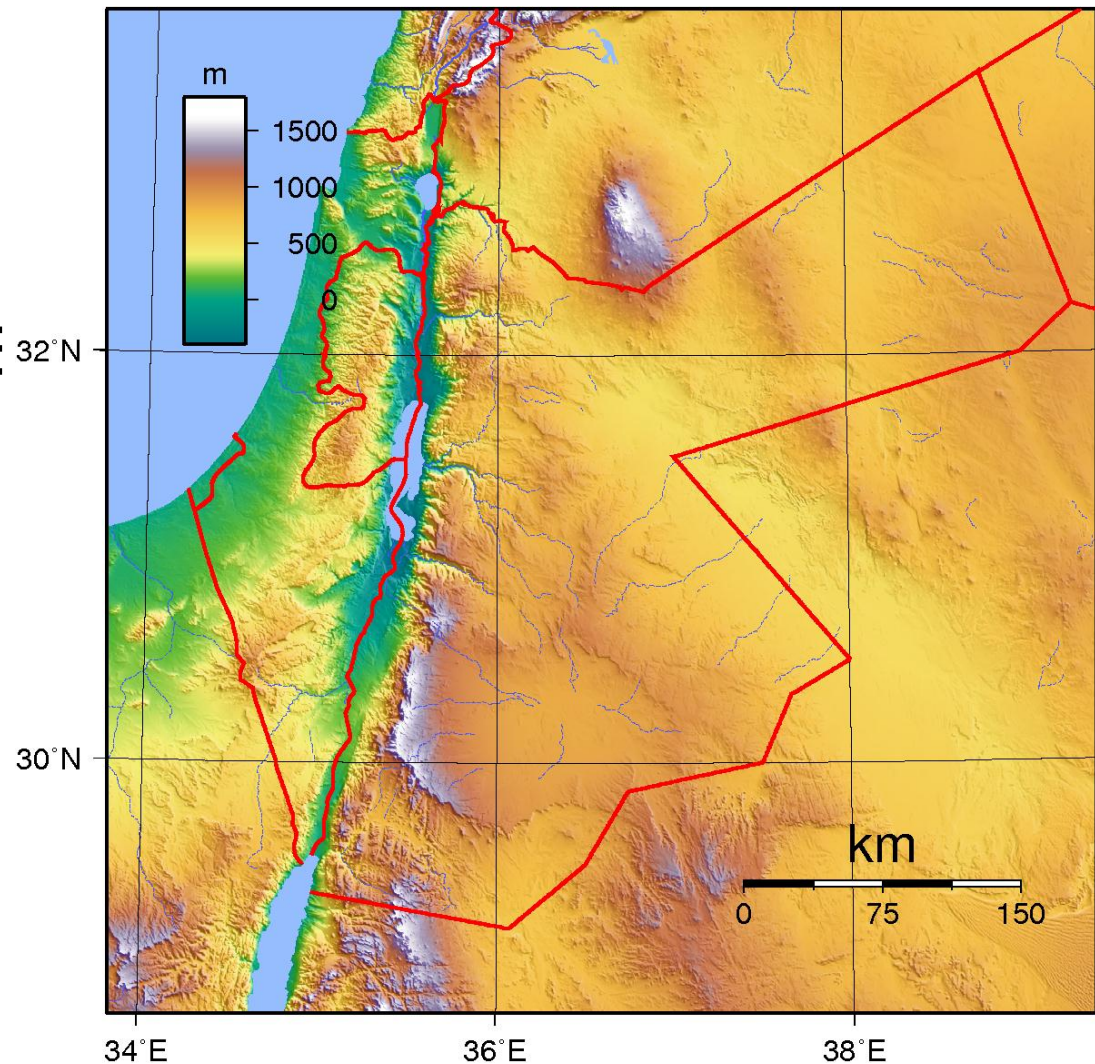
- is a geographic coordinate that specifies the east-west position of a point on the Earth's surface (λ)



□ Amman

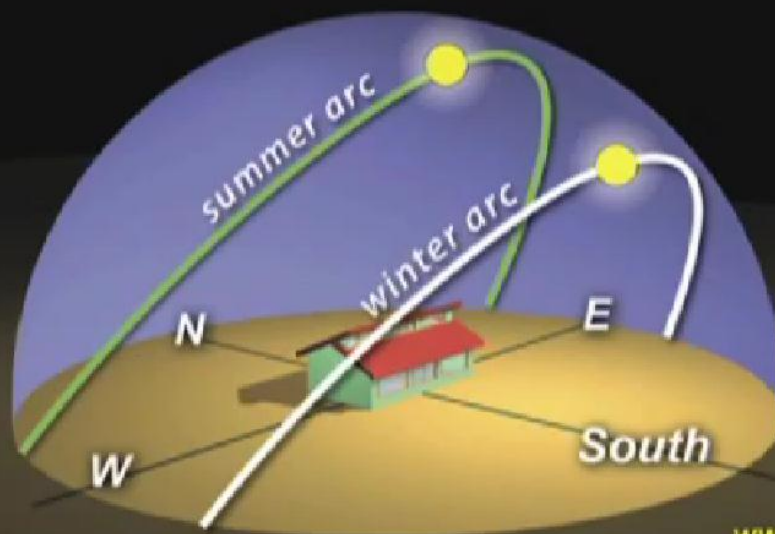
Latitude : $31^{\circ}57'N$

Longitude: $35^{\circ}52'E$



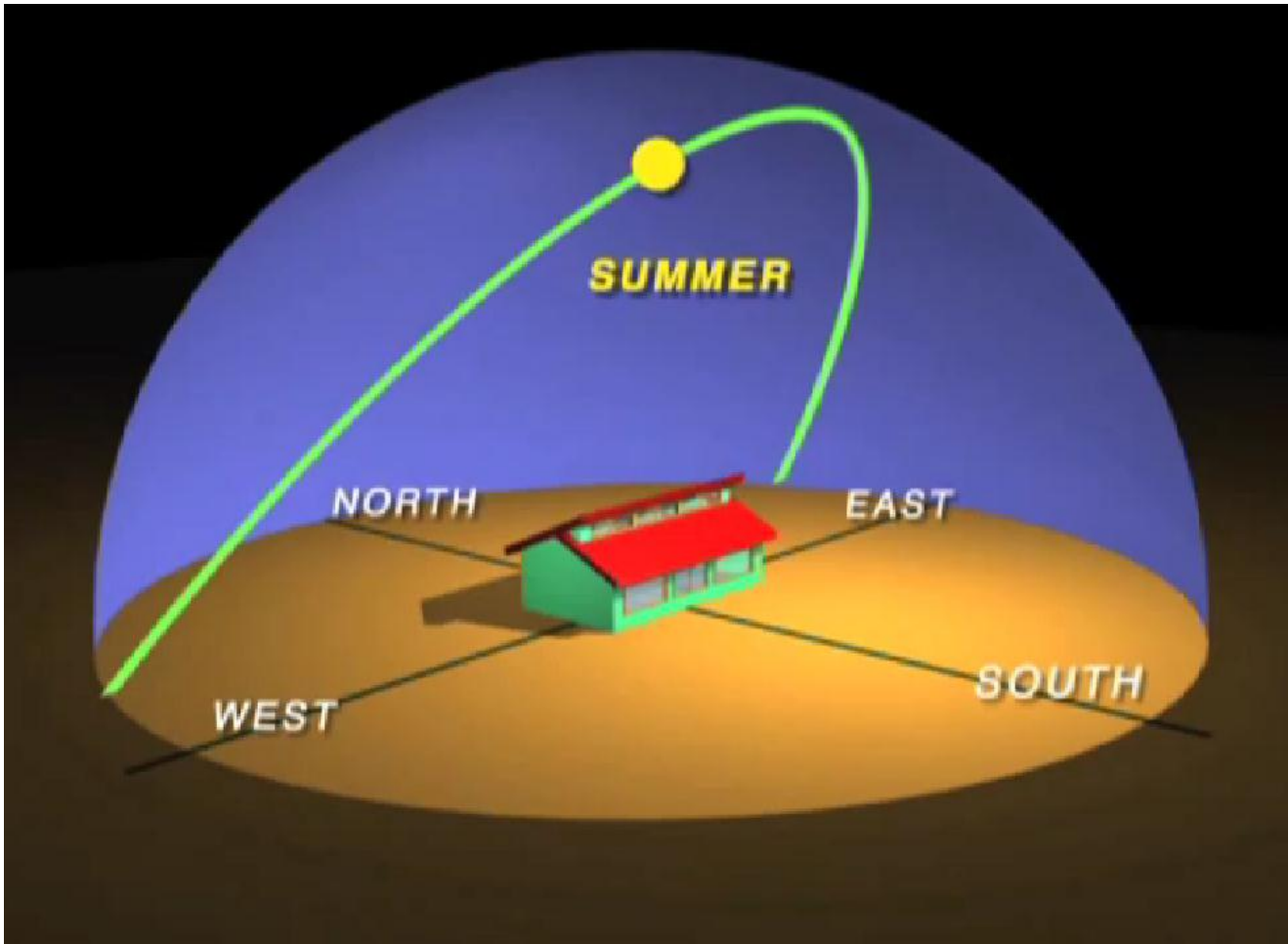
Solar Orientation:

Using Solar Energy in Any Season



***Clay Atchison
Media Director
Rahus Institute***

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The Reasons for the Seasons

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***Why is it hotter in
the summer?***



***Because the summer Sun
is higher in the sky:***

- 1. Summer days are longer.***
- 2. Summer sunlight is more intense.***

***90 degree angles give more
light & heat per unit of area.***



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***Oblique angles give less
light & heat per unit of area.***



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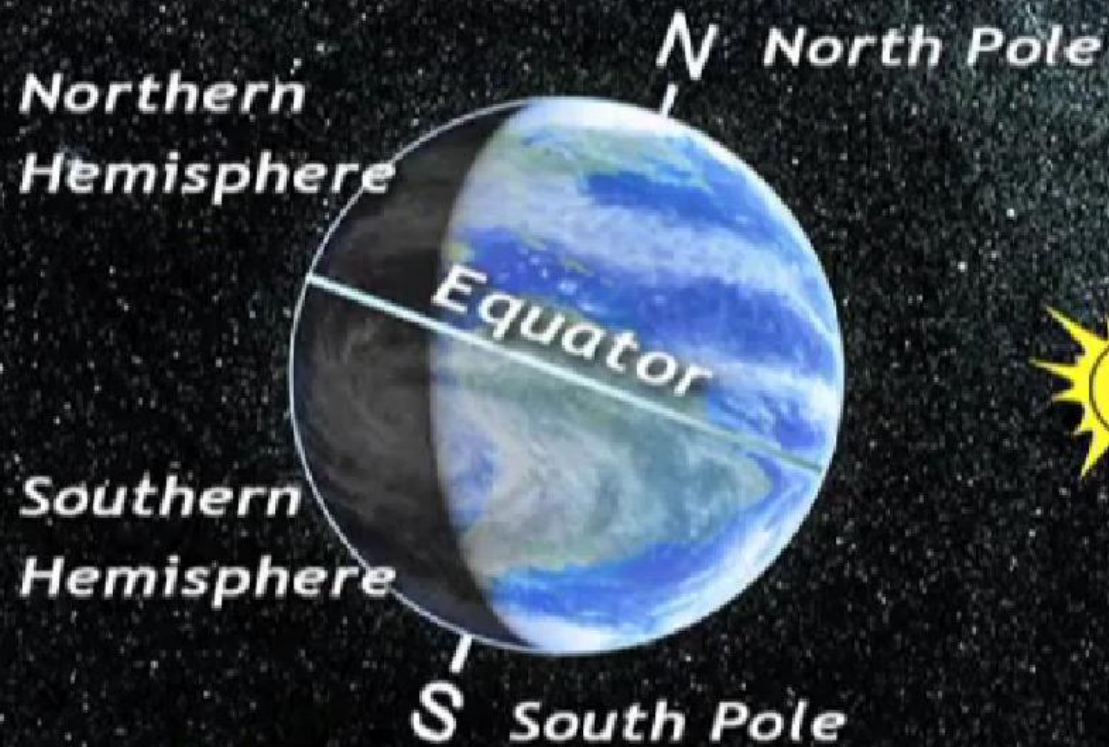


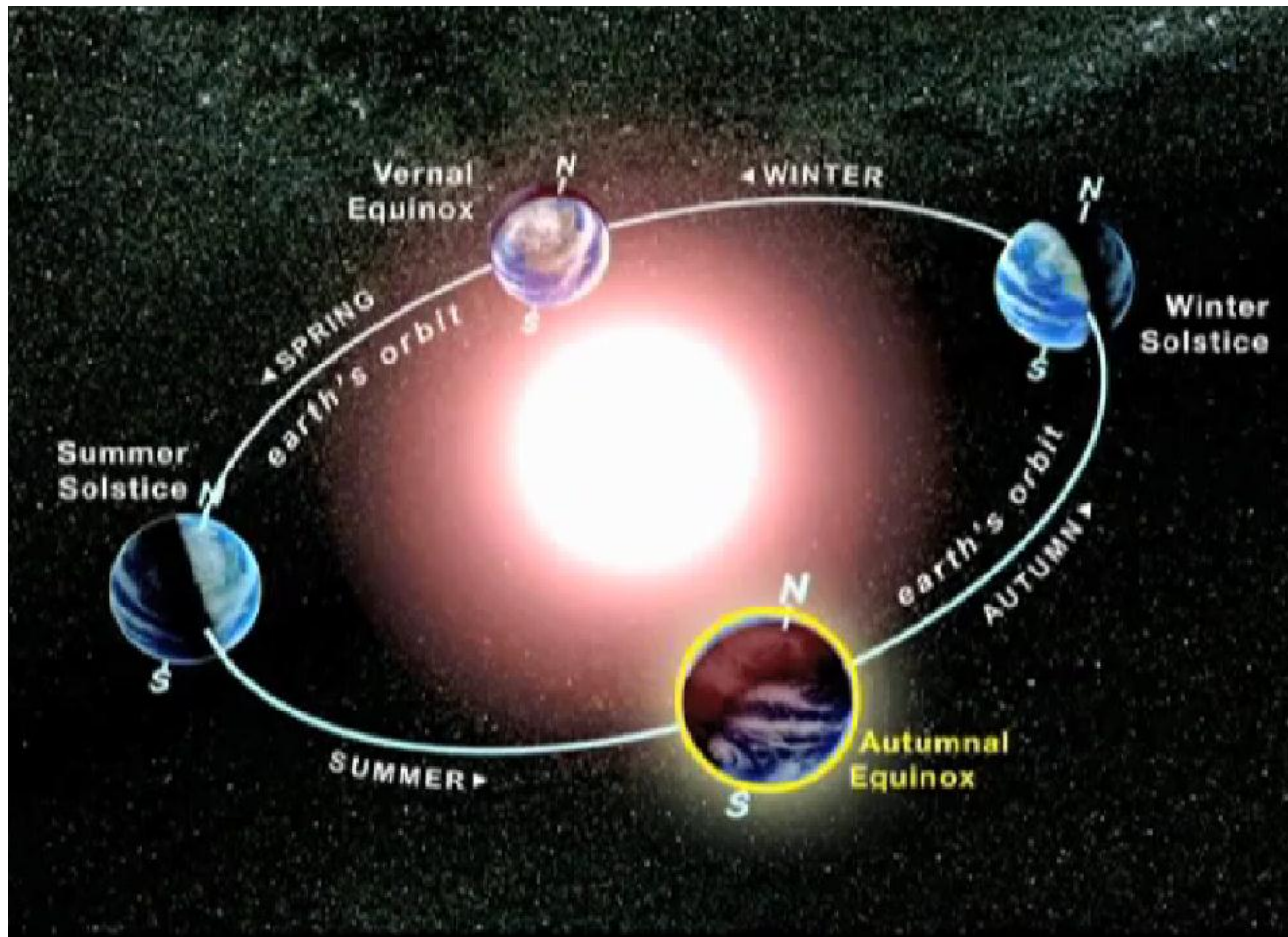


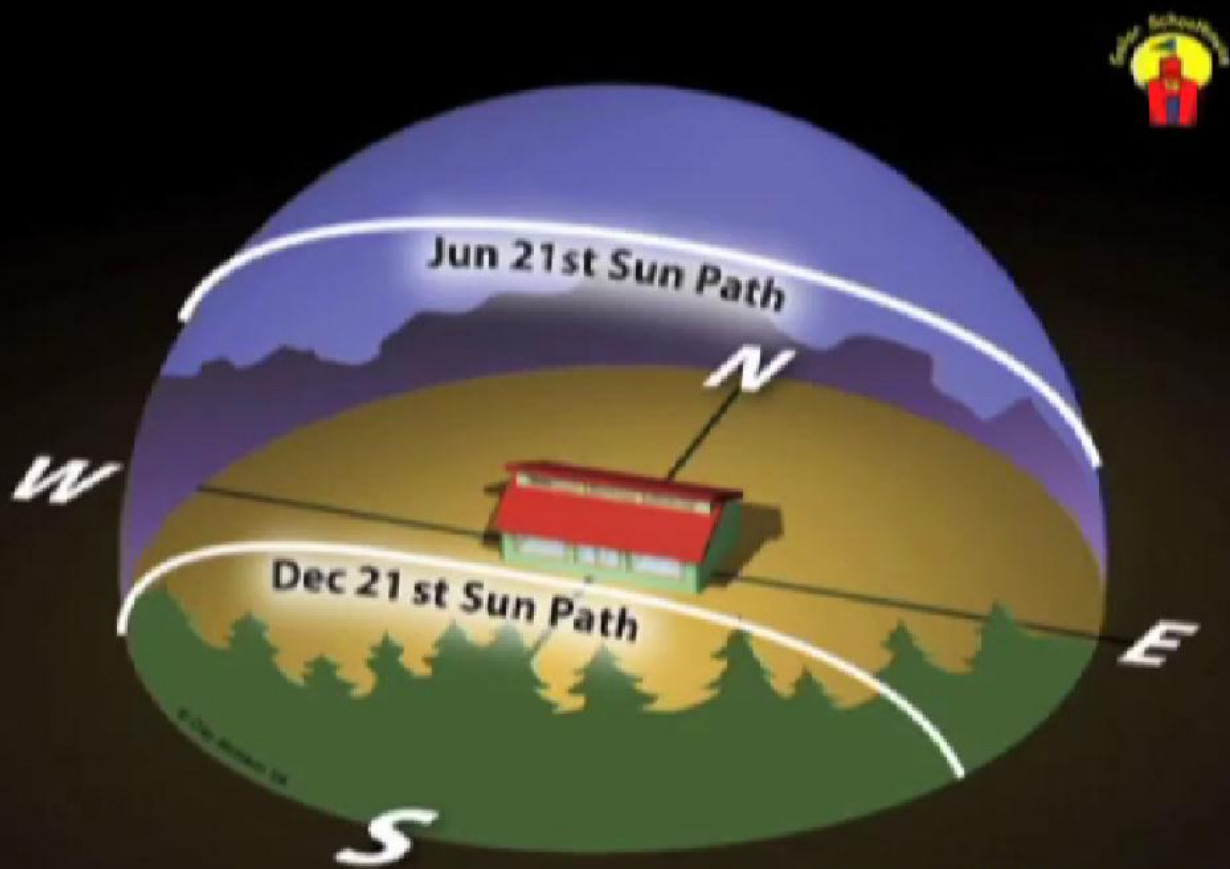
***Why is the Sun higher
in the summer sky?***

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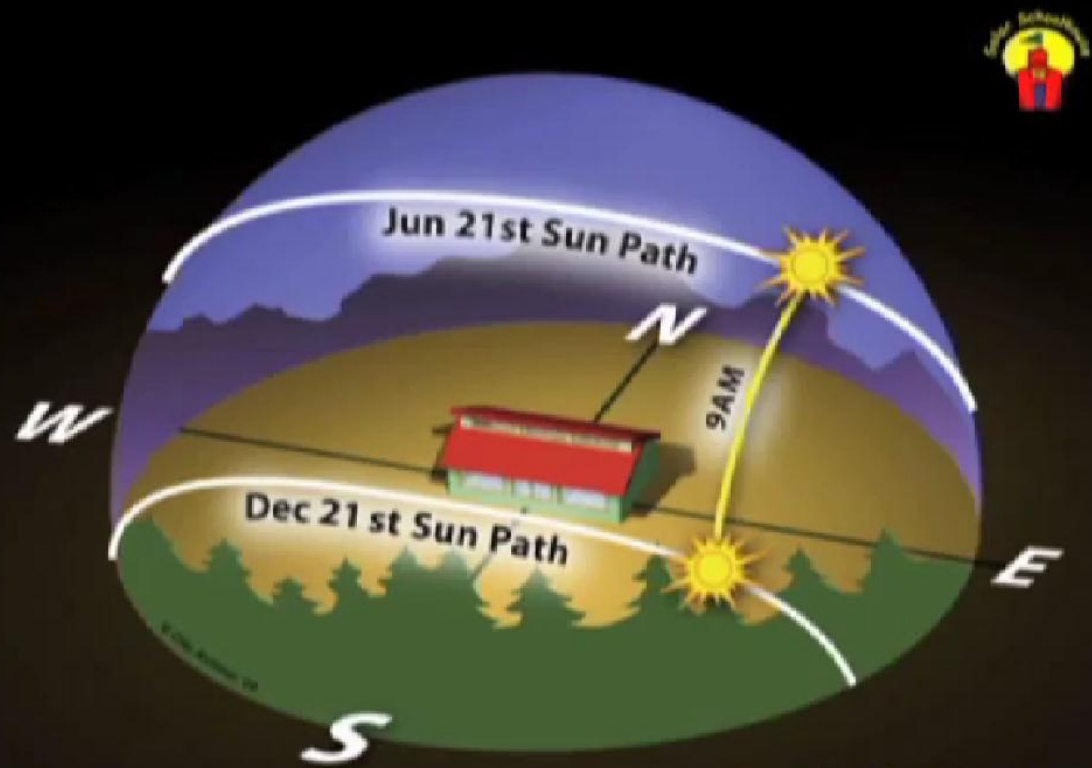
SUMMER SOLSTICE

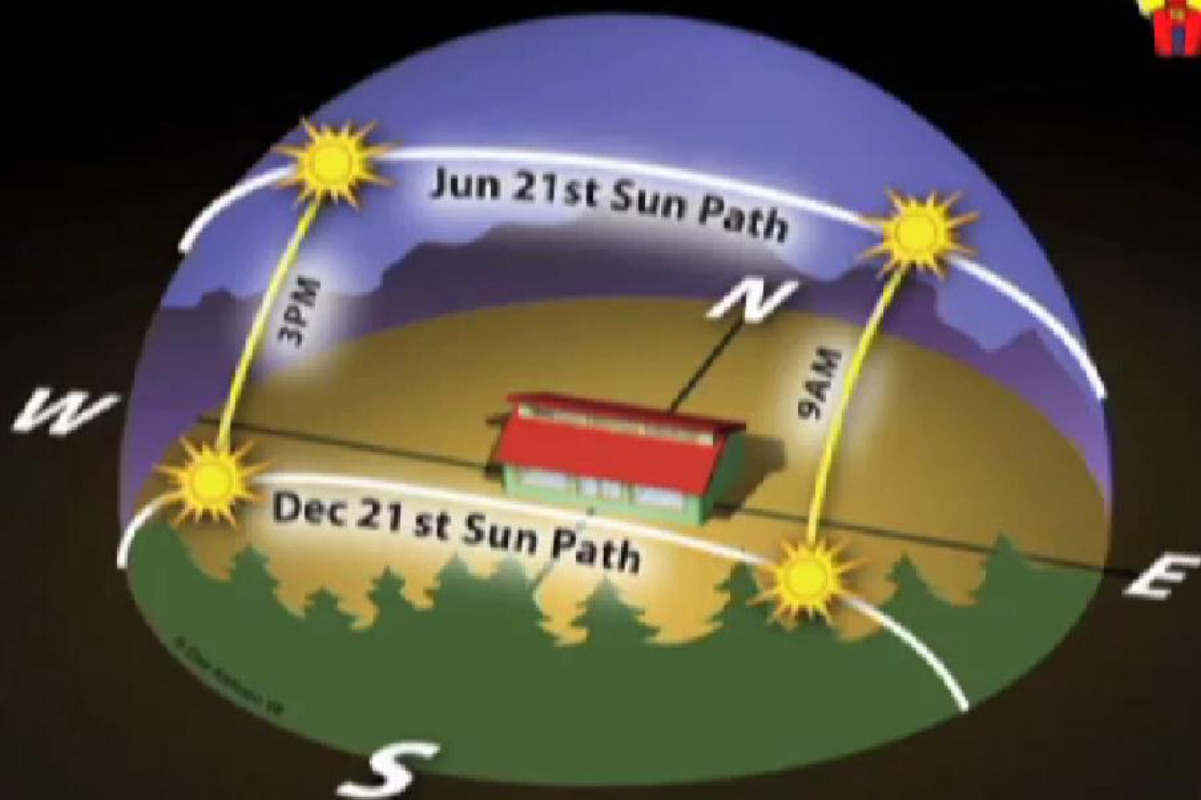




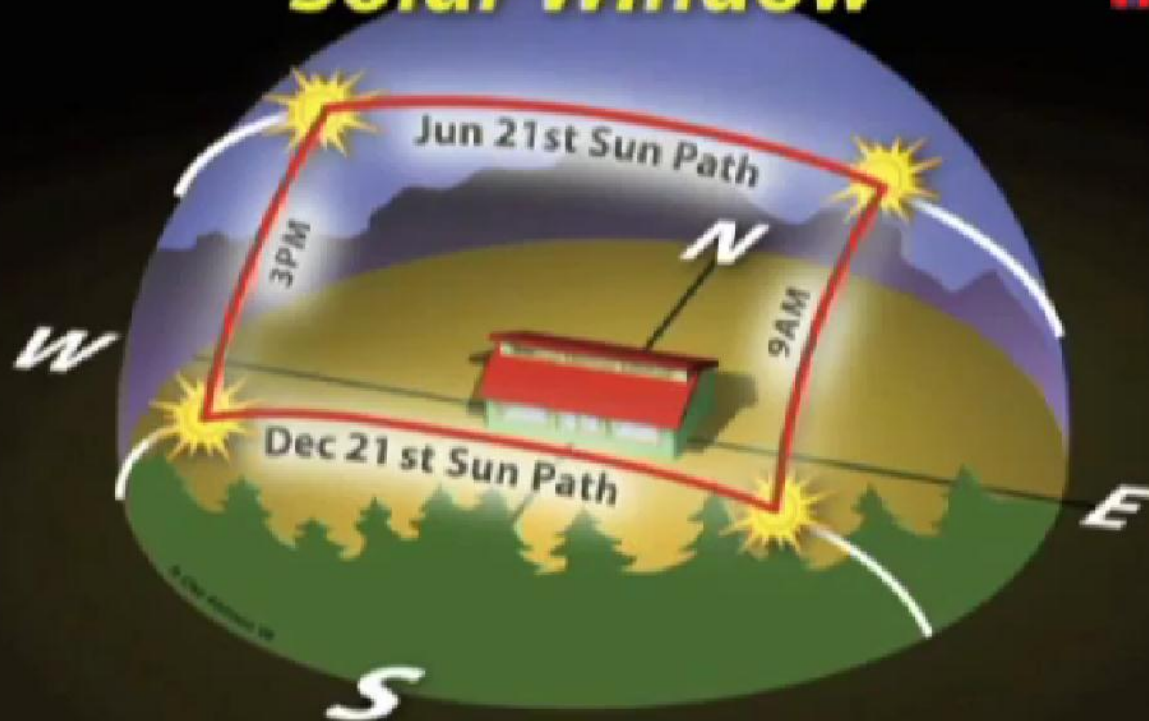


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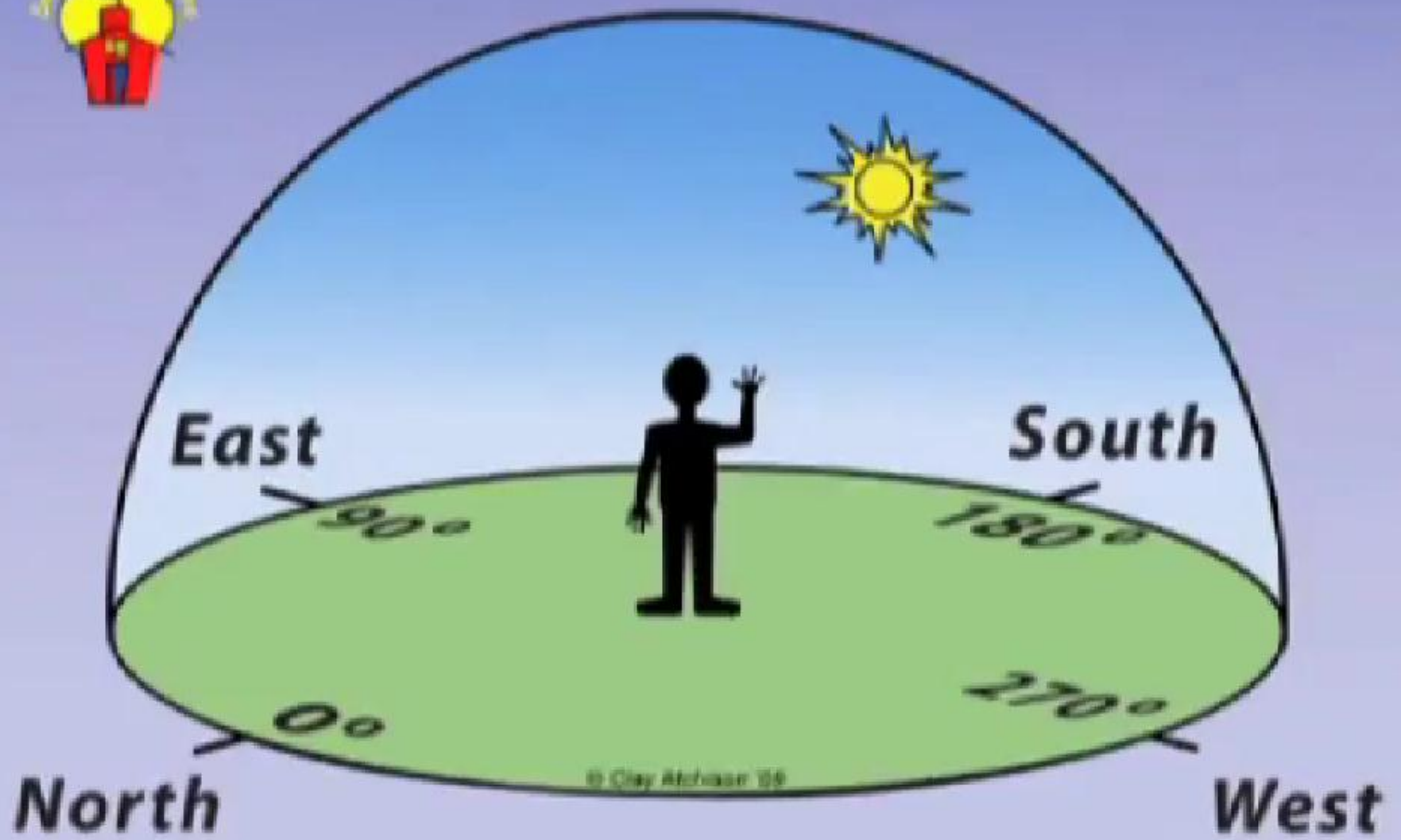


Solar Window



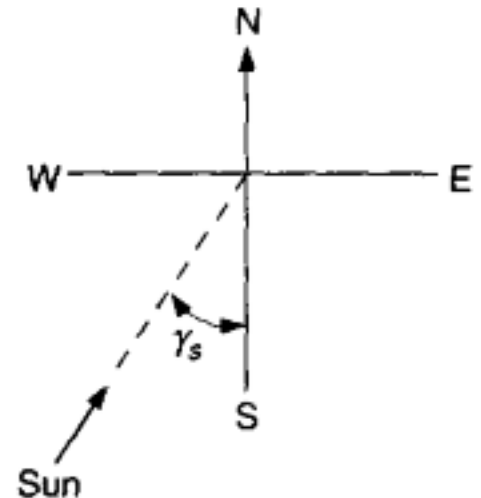
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Solar azimuth angle

- An **azimuth** ([/ˈæzɪmɐθ/](#); from [Arabic](#) السمّت *as-samt*, meaning "a way, a part, or quarter"^[1]).
- The angular displacement from south of the projection of beam radiation on the horizontal plane.
- East of south are negative and west of south are positive.



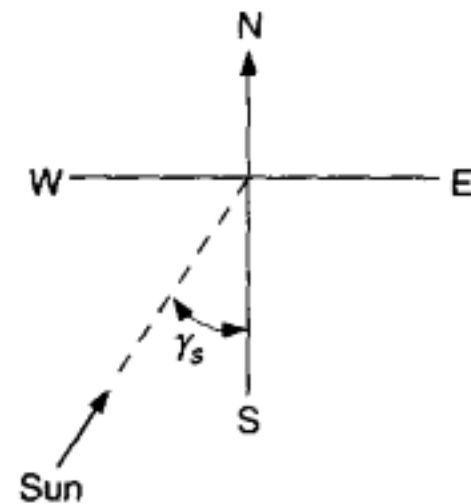
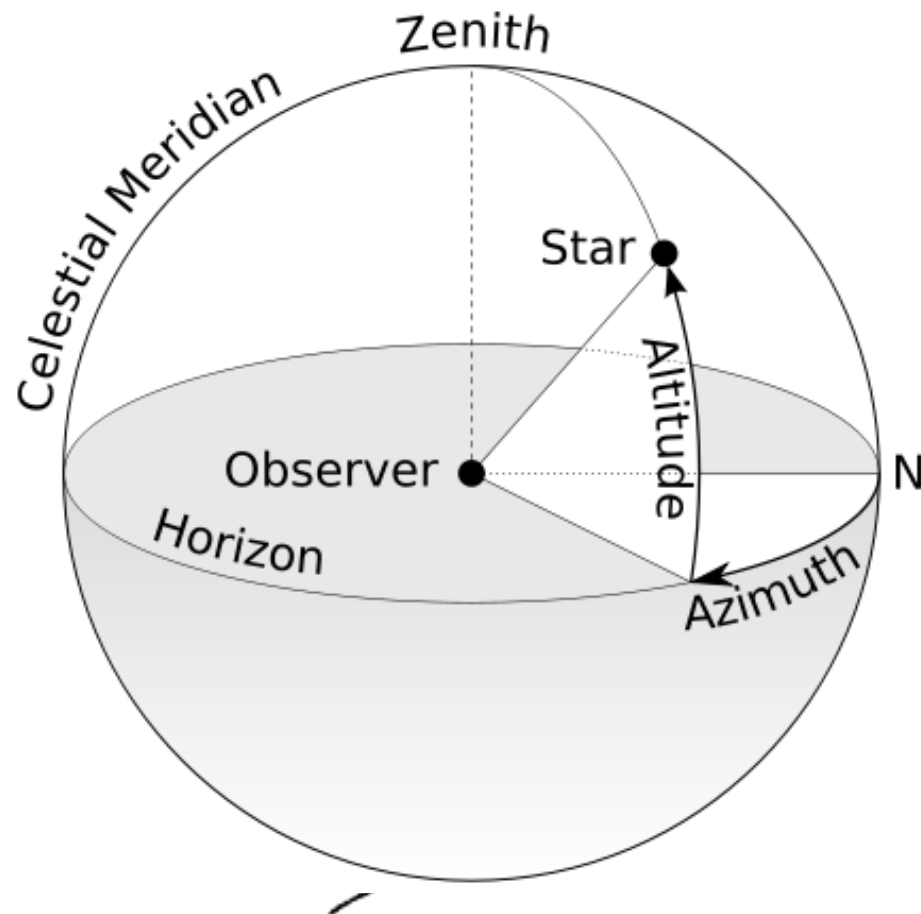
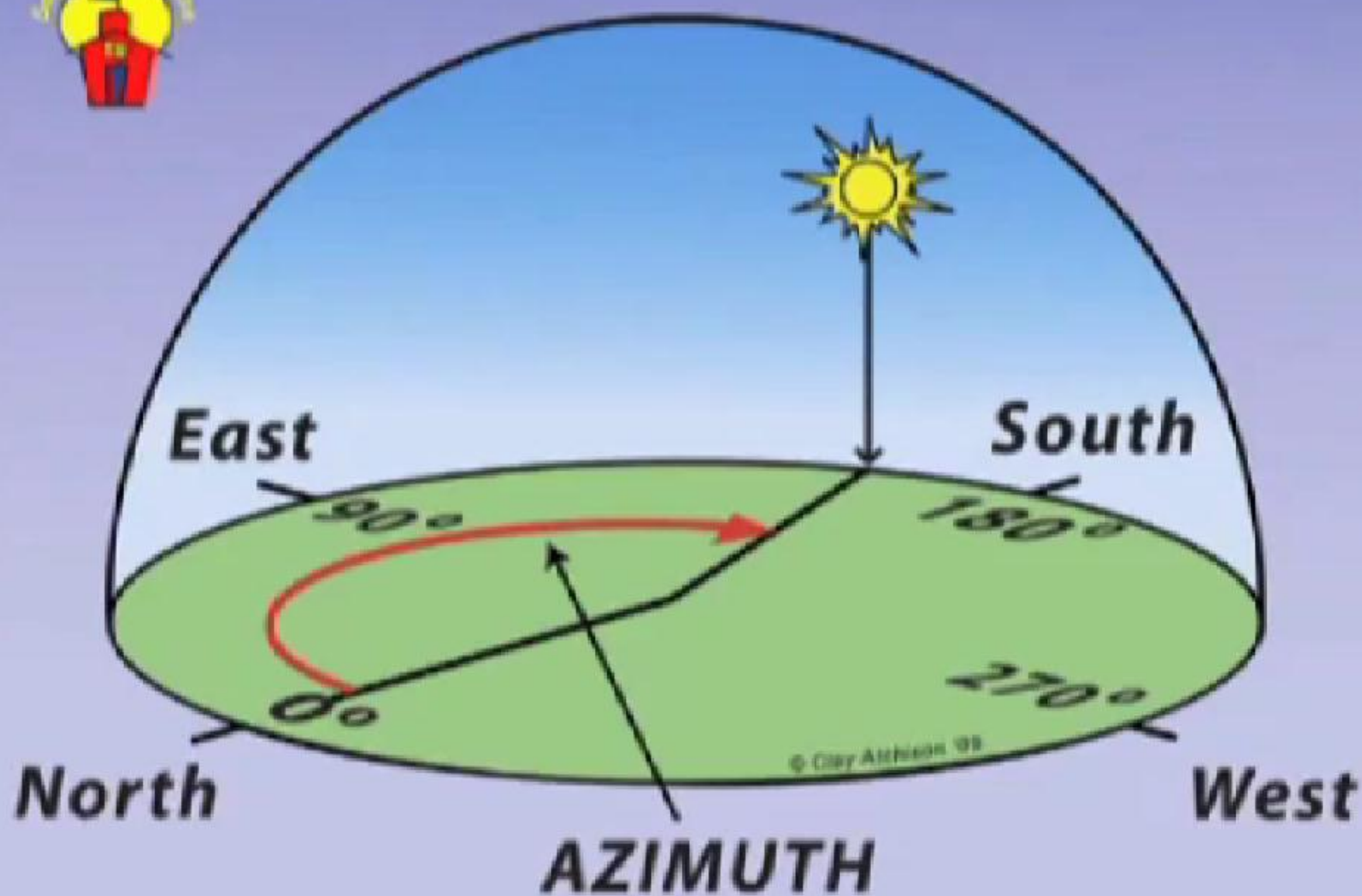
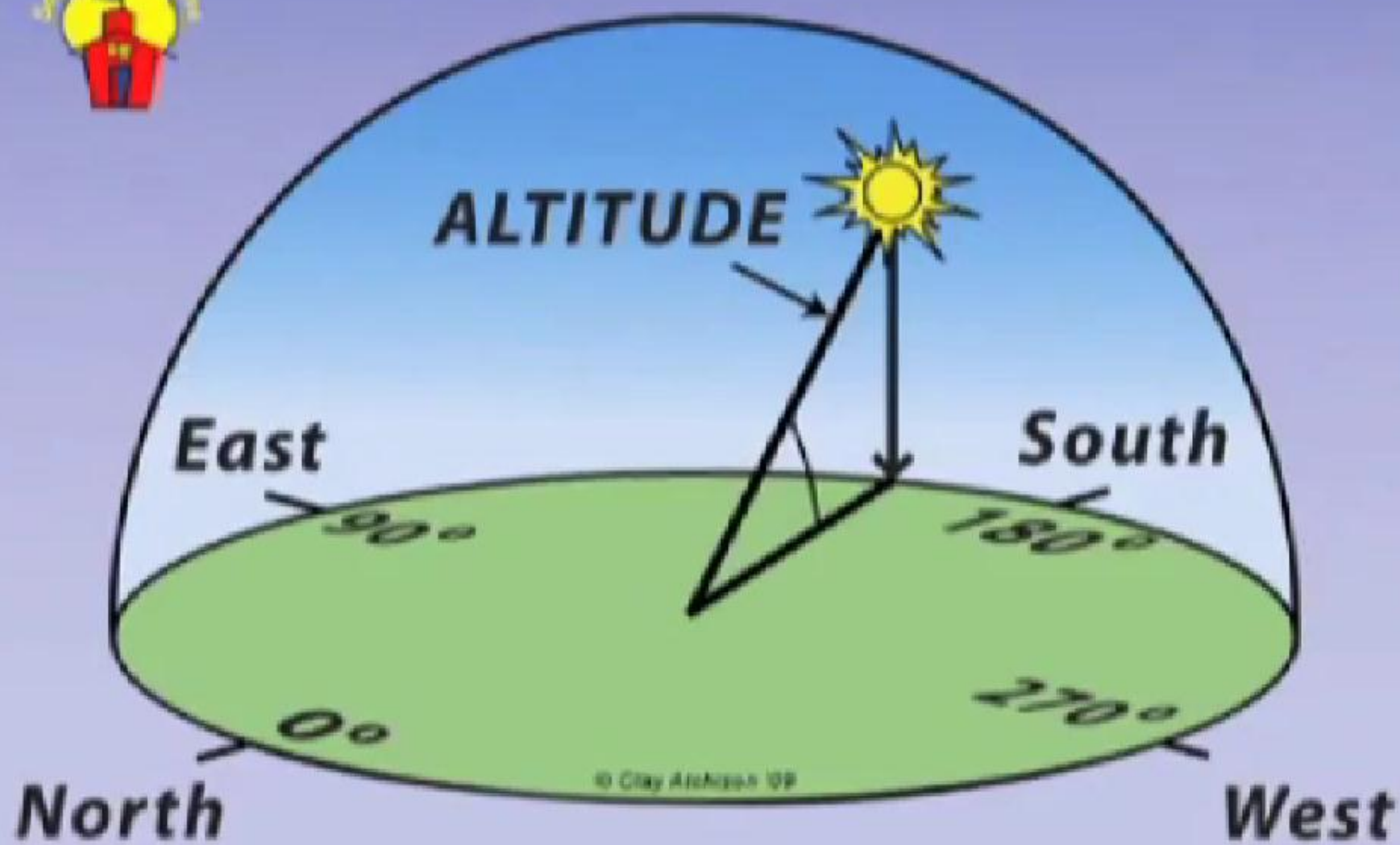


Figure 1.6.1 (a) Zenith angle, slope, surface azimuth angle, and solar azimuth angle for a tilted surface. (b) Plan view showing solar azimuth angle.

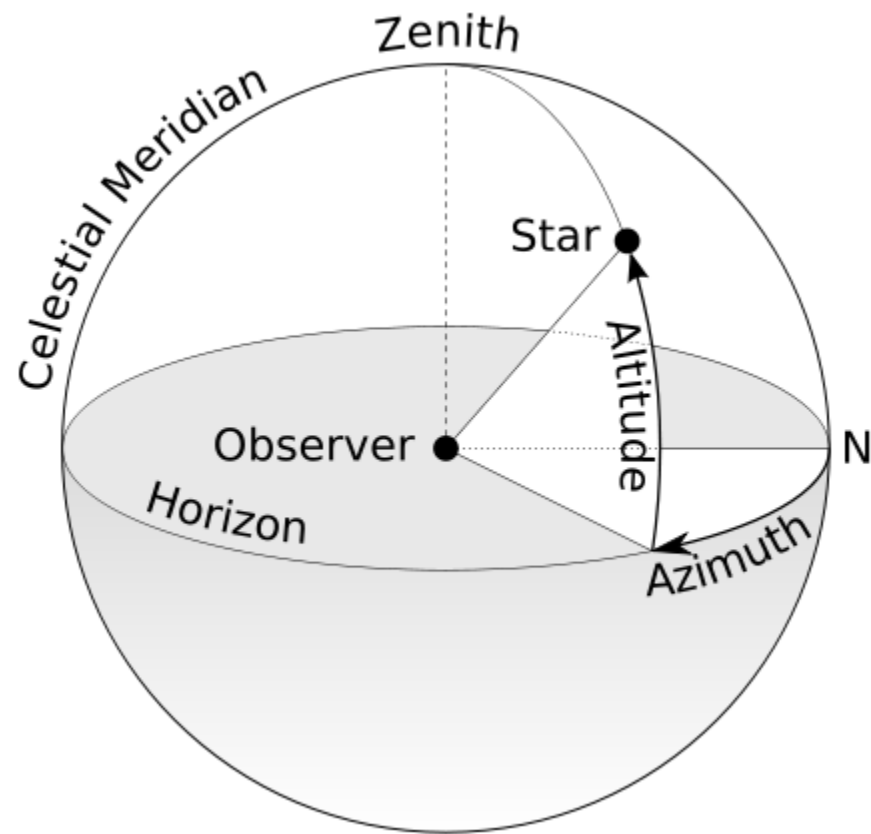




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Zenith Angle

- The word "zenith" derives from the inaccurate reading of the Arabic expression سمت الرأس) samt ar-ra's.
- The angle between the vertical and the line to the sun, that is , the angle of incidence of beam radiation on a horizontal surface.



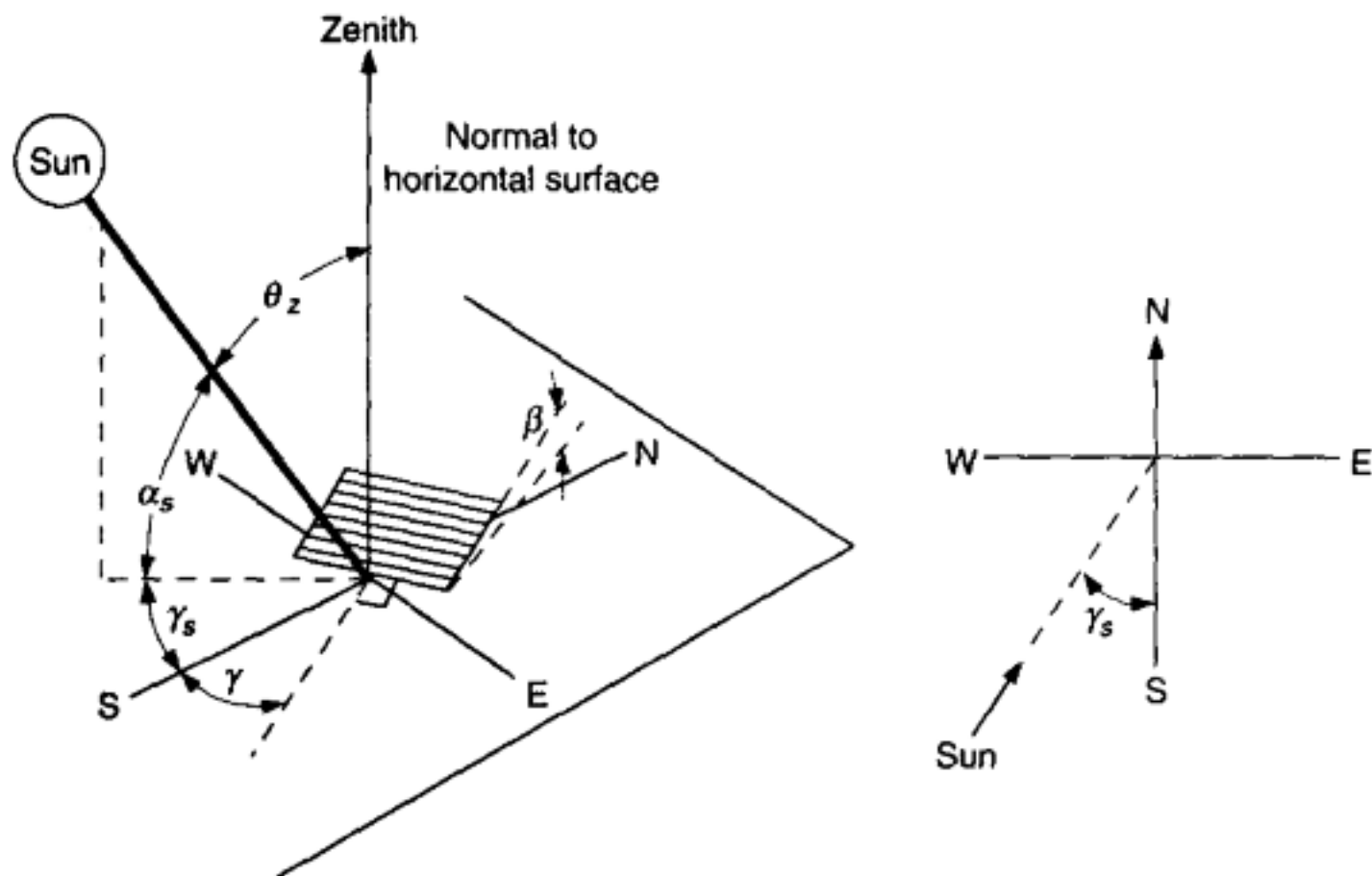
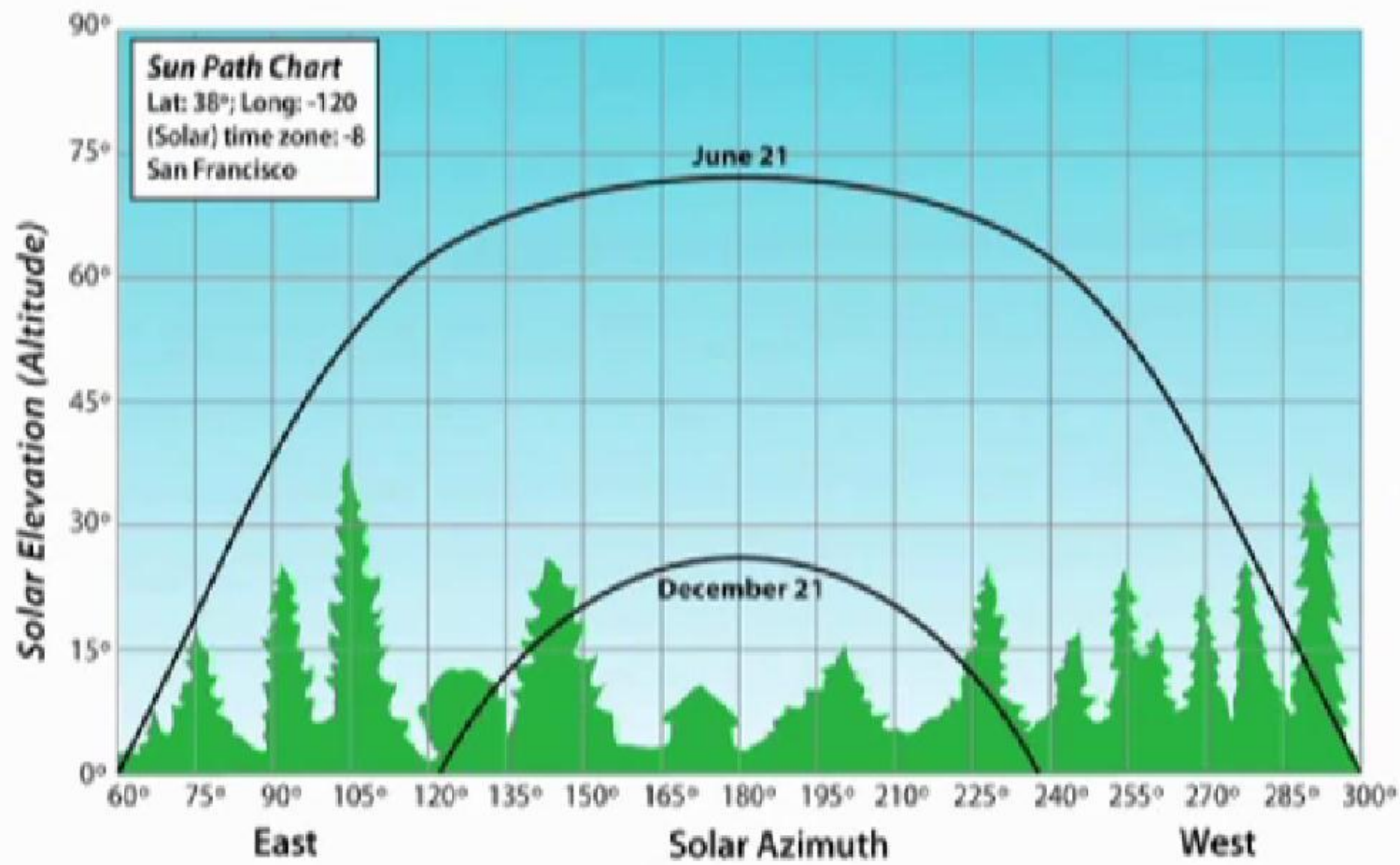


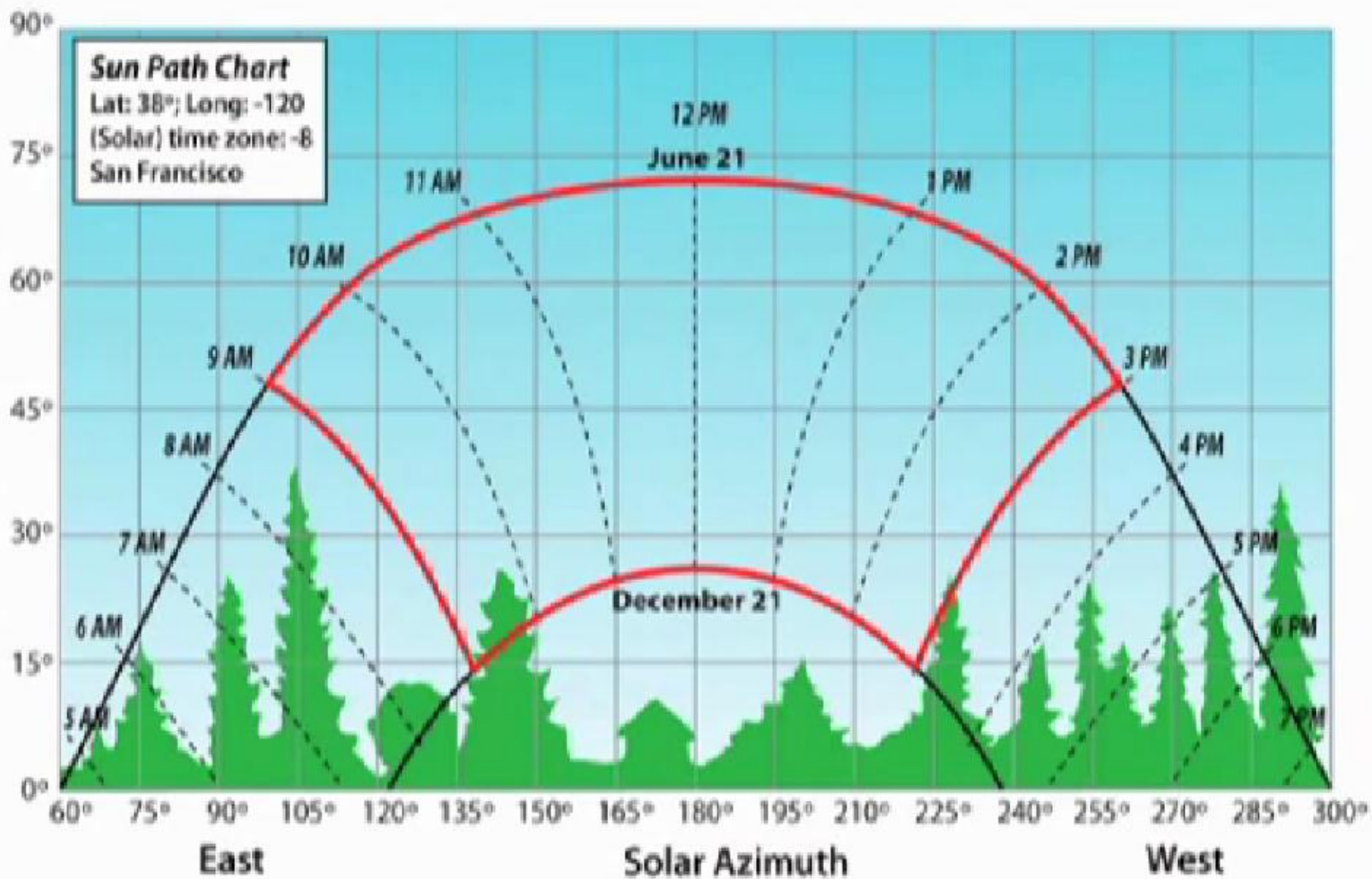
Figure 1.6.1 (a) Zenith angle, slope, surface azimuth angle, and solar azimuth angle for a tilted surface. (b) Plan view showing solar azimuth angle.

Sun Path Chart
Lat: 38°; Long: -120
(Solar) time zone: -8
San Francisco



Sun Path Chart
Lat: 38°; Long: -120
(Solar) time zone: -8
San Francisco

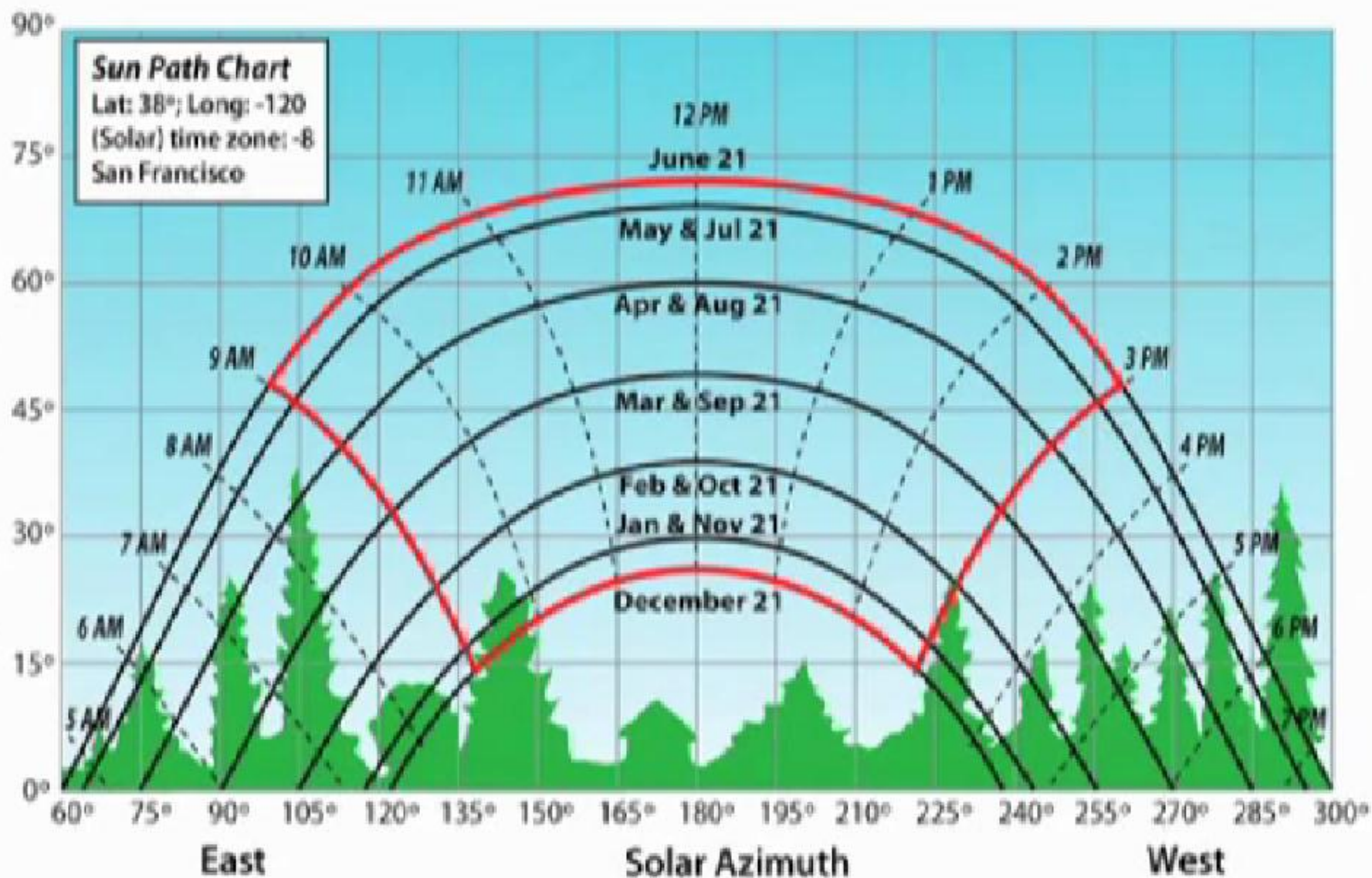
Solar Elevation (Altitude)



Sun Path Chart

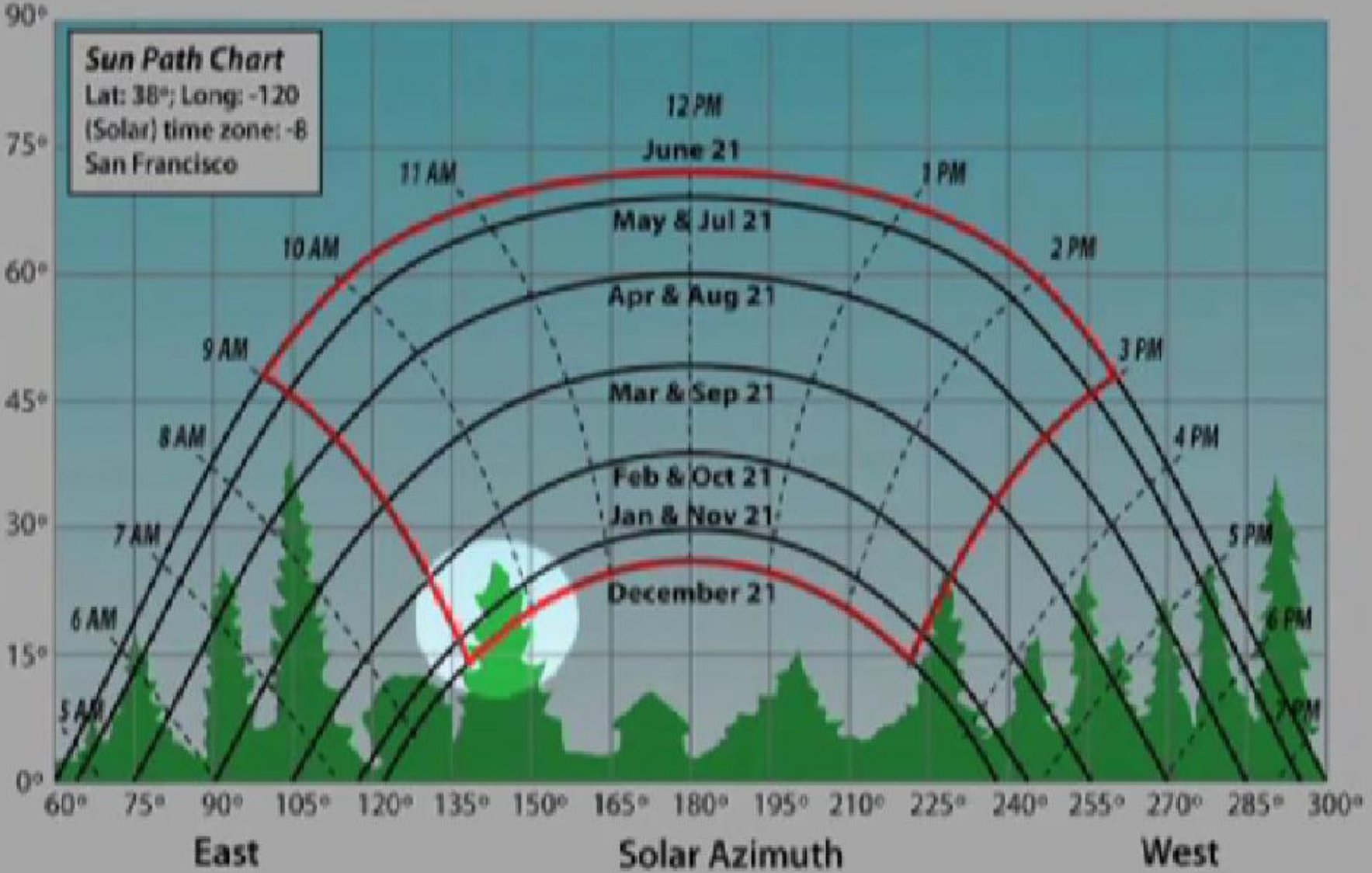
Lat: 38°; Long: -120
(Solar) time zone: -8
San Francisco

Solar Elevation (Altitude)



Sun Path Chart
Lat: 38°; Long: -120
(Solar) time zone: -8
San Francisco

Solar Elevation (Altitude)

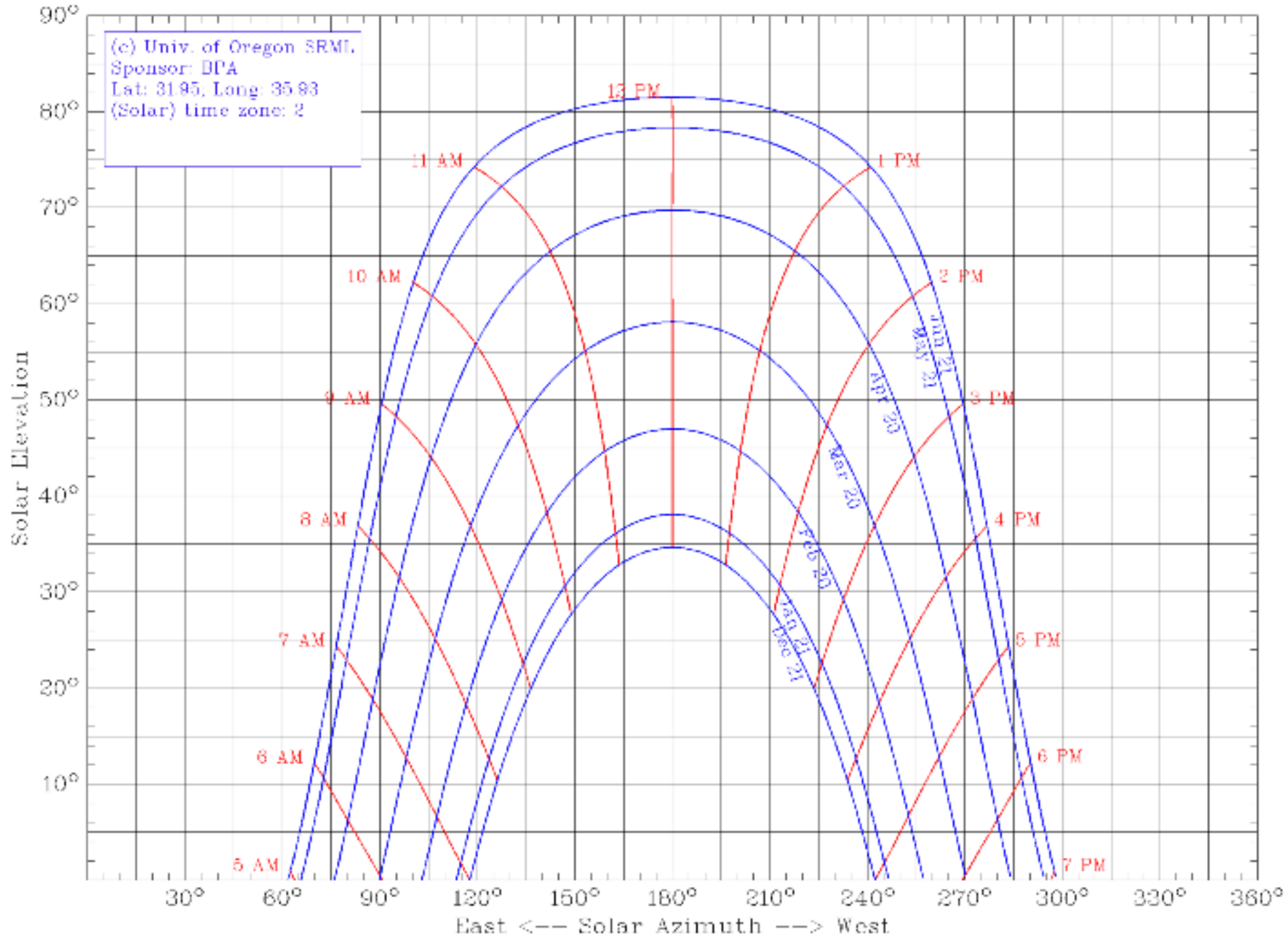




***[http://solardat.uoregon.edu/
SunChartProgram.html](http://solardat.uoregon.edu/SunChartProgram.html)***

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(c) Univ. of Oregon SRML.
Sponsor: DPA
Lat: 31.95, Long: 35.93
(Solar) time zone: 2



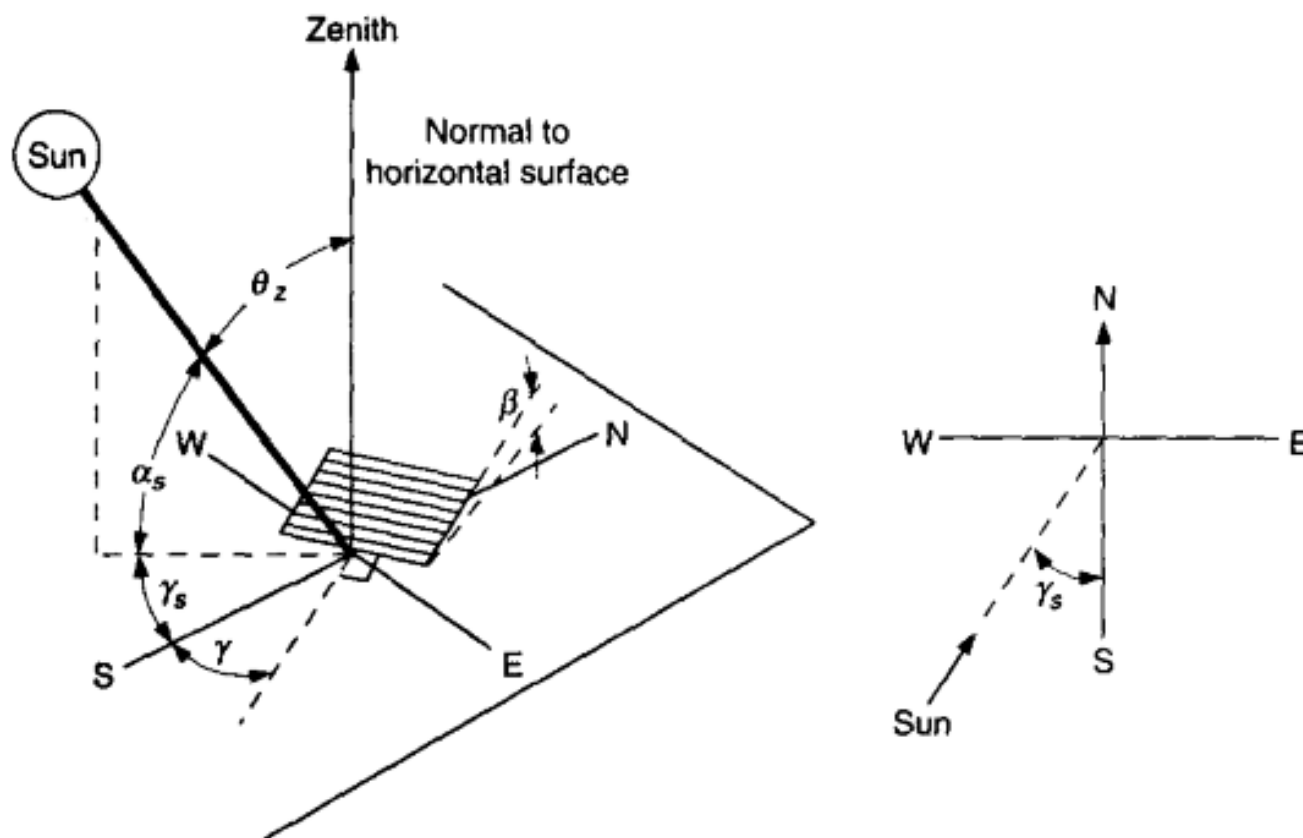


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