The earth is in orbit around the sun. It takes one year for the earth to complete one orbit. At the same time the earth rotates on its axis. It takes one day for the earth to complete a rotation. At the same time the earth is not perfectly perpendicular to the sun. It is pitched or tilted in relationship to the sun. The change of seasons is directly related to the earth's tilt and movement, including rotation, orbit and wobble. All of this effects the amount of solar radiation that is received on the earths surface at any given place or moment.

Three things that affect the path of the sun:

1. The Earths yearly revolution around the sun

2. The daily rotation of the earth on its axis

3. The tilt or wobble of the earth during the yearly revolution

Wobble

The earth wobbles on its axis. 23 1/2 degrees N. in summer and 23 1/2 degrees S. in winter. At the 2 extremes of this wobble are the winter and summer Solstice.

> At the **Winter Solstice** the sun is at its lowest point above the horizon, and it is the shortest day, in terms of day light, of the year. This point is 23 1/2 degrees below the equator (for the Northern hemisphere).

> At the **Summer Solstice** the sun is at its highest point above the horizon, and it is the longest day, in terms of day light, of the year.

> As the Earth wobbles north or south of equator it completes a one year cycle. Two times during the year the sun passes directly over the equator. These two instances are the **Spring and Fall Equinox**.

The change of seasons is directly related to these variables. Also, how much radiation is received on the earths surface is dependent on:

1. Earths revolution around the sun

2. Daily rotation of the earth on its axis

3. Tilt of the Earth in relationship to the sun at any given time

During the summer solstice, or longest day, the sun is at its highest point in the sky for the year. This day gives the longest solar window of the year.

During a solar day, the highest point of the sun in the sky is called the Zenith Angle. This gives the most intense sunlight of a given day.

This is because the sun is most directly overhead and at a 90 degree angle to the ground beneath. Because the earth and sun are constantly in motion this angle will be different or unique for any given location on the planet.

During Zenith the sun gives the most irrandiance possible for that site.

Solar Noon - Is when the sun reaches its Zenith for a particular location. Solar noon is not clock noon but is half way between sun up and sun down.

Azimuth - Is the orientation of a structure or solar array in relationship to true South.

Altitude - Is the suns position above the horizon. This changes throughout any given day.

>*Altitude and Azimuth describe the location of the sun on a given site* <

Air Mass - Atmospheric effects can absorb or scatter solar radiation. Pollutants in the air like carbon dioxide and other gases can cause this, as can clouds and fog.

The amount of solar radiation that is absorbed or scattered in the atmosphere depends on how much atmosphere the sun light has to pass through before it reaches the Earth's surface.

During Zenith, sun light has to pass through the least amount of gases and pollutants.

Installations at higher elevations have less air mass to pass through and higher insolation can result.

note: As a rule of thumb, for our latitude, or 38 degrees N, we receive 1,000 watts per sq. meter at solar noon.