

Energy Transfer Mechanisms

- Energy can be transferred from one place to another via three processes: conduction, convection, and radiation.
- Conduction is the movement of heat through a substance without molecules moving in the direction of the heat transfer.
 - Heat moving from the hotter to the colder part of the rod is conduction.
 - Most effective in solid materials.
- Convection is heat transfer via the mixing of a fluid.
 - An example would be a pot of water boiling on a kitchen burner.
- Radiation is heat transfer via empty space.
 - *All* matter emits radiation.

Earth's Revolution and Rotation

- Earth orbits the Sun once every 365 $\frac{1}{4}$ days.
 - This is known as its 'revolution'.
- The Earth's orbit is elliptical, *not* circular.
 - As a result, the Earth is closest to the Sun on January 3rd.
 - This is known as 'perihelion'.
 - Earth is farthest from the Sun on July 3rd.
 - This is known as 'aphelion'.
- In addition, Earth undergoes a spinning motion called 'rotation'.
 - Earth rotates once every 24 hours on its axis, connecting the North and South Pole.
 - The axis is tilted 23.5° from the plane of the Earth's orbit around the Sun.
- Because of the tilt of the Earth's axis, the Northern Hemisphere is tilted *toward* the Sun for six months a year, and is tilted *away* from the sun for the remaining six months of the year.
 - This and only this, is the cause of the seasons.
- For six months of the year, the Northern Hemisphere receives more sunlight than the Southern Hemisphere and vice versa.
- The maximum tilt of the Northern Hemisphere toward the Sun occurs on or about June 21st.
 - This is known as the 'Northern Hemisphere summer solstice'.
- The minimum tilt of the Northern Hemisphere toward the Sun occurs on or about December 21st.
 - This is known as the 'Northern Hemisphere winter solstice'.
- In between the two solstices are the equinoxes.
 - The 'Northern Hemisphere vernal equinox' occurs on or about March 21st.
 - The 'Northern Hemisphere autumnal equinox' occurs on or about September 22nd.

- On the equinox, each place on Earth receives 12 hours of day and night.
- Because of the 23.5° tilt of the Earth's axis, the Sun *appears* to be directly overhead any location at 23.5°N on the Northern Hemisphere Summer Solstice.
 - That latitude is known as the 'Tropic of Cancer'.
- On the Northern Hemisphere Winter Solstice, the Sun *appears* to be directly overhead any location at 23.5°S .
 - That latitude is known as the 'Tropic of Capricorn'.
- The latitudinal position at which the noontime Sun *appears* directly overhead is the 'solar declination'.
- Because of the tilt of the Earth's axis, during the Northern Hemisphere summer solstice, any location north of 66.5°N receives 24 hours of sunlight (90° minus 23.5°).
 - The latitude of 66.5°N is known as the 'Arctic Circle'.
 - During the Northern Hemisphere winter solstice, any location north of the Arctic Circle is in darkness for 24 hours.
- 'Beam spreading' is defined as the increase in surface area over which radiation is distributed in response to a decrease in solar angle.
 - This impacts the seasons in that during the summer, with a higher sun angle as opposed to winter, there is less beam spreading which results in warmer temperatures.

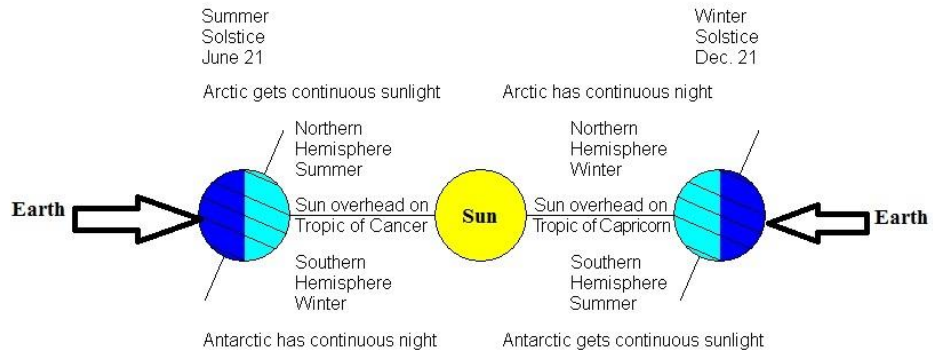
Helpful Links:

<http://www.mansfieldct.org/Schools/MMS/staff/hand/convcondrad.htm>

<http://okfirst.mesonet.org/train/meteorology/Seasons.html>

https://courseware.education.psu.edu/courses/meteo101/javascript/Lesson2/contour_tool_t.html
[Practice for plotting isotherms]

https://www.weather.gov/jetstream/ll_analyze_temp [Practice for plotting isotherms]



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