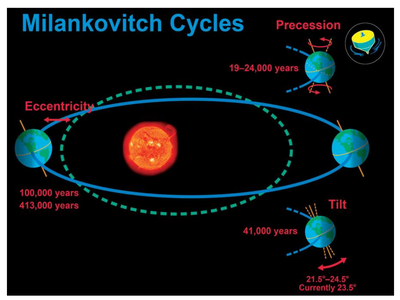
What Causes Sea Levels to Change?

Sea levels change for three main reasons:

1) As water warms and cools it expands and contracts;
2) The amount of water contained as ice on land surfaces changes over time;
3) The Earth's surface is dynamic and can move vertically.

The first two reasons are directly caused by global temperature changes.

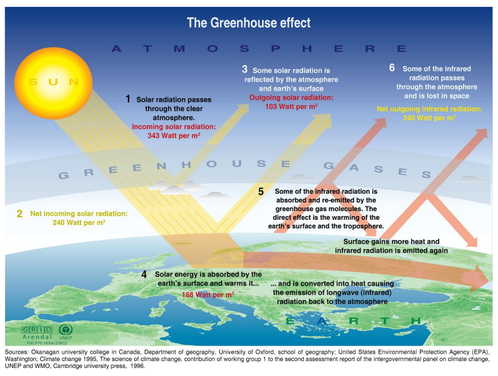


Orbital and rotational changes affect the amount and location of solar radiation reaching the Earth's surface

Contribution to temperature change:

~50% - Eccentricity
~25% - Tilt
~10% - Precession

Source: Hays et al., Science, December 1976



Sources: Okanagan university college in Canada, Department of geography, University of Oxford, school of geography, United States Environmental Protection Agency (EPA), Washington, Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996.

What Causes the Global Temperature to Change?

The Earth constantly goes through warming and cooling cycles. Over the past 400,000 years there have been four such cycles. The peak of the last glacial period was 20,000 years ago. At that time sea levels were 400 feet below present day levels.

Global temperature is determined by how much solar energy is absorbed by the Earth and its atmosphere. Eighty-five percent of the changes in the global temperature can be explained by changes in the Earth's orbit around the sun and the angle of the Earth's rotation, thereby changing the amount of solar energy available to the Earth. These changes are called the Milankovitch Cycles.

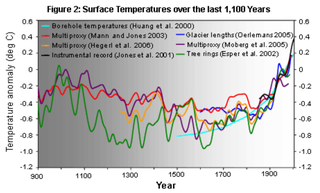
Another factor that determines the amount of energy available is the amount of sunspot activity. Scientists have documented patterns in sunspot activity and the amounts of solar energy released. These patterns correspond to recorded changes in global temperature.

The other major factor is the amount of greenhouse gases in the earth's atmosphere. Greenhouse gasses let the energy from the sun reach the earth's surface to warm it but limit the amount of warmth radiated back into space. However, there are numerous inter-relationships and feedbacks that affect these processes and therefore affect global temperature. Greenhouse gasses can be natural like water vapor, carbon dioxide, and methane or man-made like fluorocarbons. Without greenhouse gasses the earth would be 60°F cooler.

Why the concern now?

Since the beginning of the industrial age the amount of carbon dioxide and other greenhouse gasses in the atmosphere has steadily increased along with a rise in global temperatures.

It is believed by most scientists that this trend will continue at an accelerating rate and cause sea level rise from increased expansion of the oceans and hasten the melting of the ice sheets.

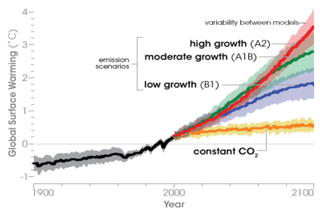


Source: National Academy of Sciences

Human activity emits 24 billion tons/year of CO2

Historic CO2 levels 180-300 ppmv

Current CO2 level 389 ppmv (Sept,2011)

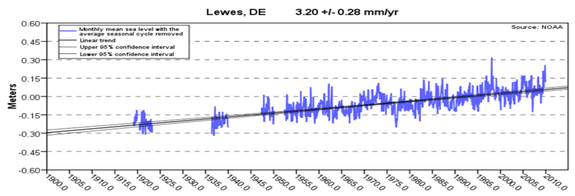


Sources; NOAA, IPCC, EPA

What about Delaware?

Delaware is experiencing sea level rise greater than the global average because the state is sinking. During the last ice age the advance of the glaciers stopped in nearby Pennsylvania. Due to their weight, the ground beneath the glaciers was pushed down while the lands in front were forced upward. As the glaciers retreated over the past 20,000 years, this process has reversed.

Over the last 100 years Delaware's local sea level has risen over 13 inches. Half of this change can be attributed to rising water levels and half to sinking land surfaces.



Tidal Gauge Data, Lewes, DE

Trend based on data 1919-2006

Source: NOAA

DELAWARE COASTAL PROGRAMS
DCMP
DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
NOAA