

Climate Change --- Part Three

Astronomy

The Earth spins around on an axis that is tilted 23.5 degrees from the vertical. Of course, that is the reason we have seasons, as it maintains this angle during its entire 365 day orbit around the sun. That means for half of the year, the sun is shining much more directly on the Northern hemisphere of Earth than it is the other half of the year. Because of this tilt, the sun is directly overhead at latitude 23.5 North around June 21st (Summer solstice). The opposite is true, when the Earth has orbited halfway around the sun, so that the sun is directly overhead at latitude 23.5 South on Dec 21st. The mid points between these 2 positions we call the equinoxes (Spring equinox about Mar 21st, and Autumn equinox about Sep 21st.) On these dates, the sun is directly overhead at the equator, and the length of day and night is approximately equal at all locations on Earth.

The Earth is actually “wobbling” though as it spins on its’ axis. This wobble takes 19,000-23,000 years to make a complete cycle. That would not have an impact if the Earths orbit around the sun was perfectly circular, however the Earths orbit is elliptical. Therefore, the Earths wobble causes the Northern Hemisphere to alternate between being closest to the sun in Summer and closest to the sun in Winter, roughly every 10,000 years. Currently, the wobble cycle has the Earth closer to the sun in the Northern Hemisphere in Winter, and farthest from the sun in Summer, which has a moderating effect on both seasons. The opposite is true in the Southern Hemisphere now, but the large area of ocean in the Southern Hemisphere is a much greater modifying effect than is the distance to the sun.

The 23.5 degree tilt of the Earth on its’ axis also has a cycle. This tilt varies from 22.0 to 24.5 degrees, and takes 41,000 years to make a complete cycle. The effect of this is to vary the differences between Summer and Winter more. Currently, we are close to the middle of this cycle. When the tilt reaches 24.5 degrees, the differences of the seasons are more pronounced than when the tilt is less.

While the Earths’ orbit is slightly elliptical, this also varies from a nearly circular orbit, to a more elongated elliptical one. This cycle takes 100,000 years to complete, and there is also a longer cycle as well, that takes 433,000 years to complete. When the orbit is more elliptical, parts of the globe receive less sunlight at certain times of the years. This more elliptical orbit has been closely correlated with past ice ages. Currently, the orbit is quite close to circular, which tends to be a moderating influence.

While these astronomical factors are not believed to cause sudden climate change by themselves, all three are major players in long-term climate change. And when acting together, or with other factors, they have been responsible for major long term ice ages or widespread tropical conditions throughout the history of planet Earth, and will no doubt play a huge role in the future.