Controlling Earth's Temperature

By Grant Wales

The Earth is a celestial object, a planet, in our sun's galaxy. It has a biosphere which ensures that temperature changes between day and night are not dramatic. The biosphere restricts the inflow and outflow of heat, thus keeping the temperature in a habitable range.

The temperature of a celestial object

The object exchanges heat only by means of radiant energy. It receives heat input from its sun by absorbing some of the impinging rays of energy that contact it's surface or it's biosphere. It releases heat into space by radiation from its surface or it's biosphere. A stable temperature will be achieved when the difference between the incoming heat and the outgoing heat remains small.

The incoming radiant energy is intense, and occurs over a range of short wavelengths. The portion of this heat that is absorbed depends on the absorption characteristics that apply across this range of wavelengths. (Other factors may apply, such as local effects determined by angle of arrival upon a surface.) The object will lose some of its heat by radiating energy of less intensity into cold space, over a range of longer wavelengths. The net ability of the object or its biosphere to absorb and to emit radiant energy determines the balance point for its temperature. It should be noted that greenhouse gases serve to limit the amount of escaping radiant energy by virtue of their ability to absorb some of this energy. It is a characteristic of gases that their relative transparency or opacity to radiant energy is dependent on wavelength. Their ability to emit radiative energy is also dependent on wavelength.

Issues specific to the Earth

In the case of Earth and its biosphere, the most prominent variables for heat input are net cloud cover, and variations in sun activity (these two factors may be interrelated*). Regional effects may occur due to changes of land use, such as deforestation or the urban heat island effect. Certain events like a volcanic eruption of a huge quantity of sulfur dioxide and/or particulates, or the occurrence of an El Niño or a La Niña also make occasional contributions to this variation. The mechanisms contributing to El Niño and La Niña are not well known.

** There is an emerging body of evidence that recognizes a relationship between sunspot activity and Earth temperature. Further evidence recognizes a relationship between the extent of low-level clouds and recent sunspot activity.*

There are no known prominent variables in the ability of the Earth to radiate energy from its biosphere, even when considering a wide range of carbon dioxide concentrations. It should be noted that carbon dioxide is one minor greenhouse gas, being far less prominent than water. There is only one narrow range of wavelengths, around 15

micrometers, where carbon dioxide could make a recognizable contribution in reducing radiative heat loss. (There are two CO2 absorption lines at somewhat shorter wavelengths, but the emitted energy level is much less there). Most of the radiative heat loss that can be controlled by carbon dioxide in the 15 micrometer range of wavelengths has already been occurring for centuries. Further increases of atmospheric carbon dioxide can only make a miniscule difference in this heat loss.

Summary

Earth temperature varies as a result of natural changes within our solar system. Apart from localized changes of temperature or humidity due to large-scale projects, there is no known evidence that human activities have had, or likely will have, a recognizable effect on temperature or climate on a planetary scale.