

All these factors have “fundamentally altered the structure of the climate change debate. Aside from a small minority of hardcore skeptics, officials in Washington are no longer debating whether climate change is real or whether human activities are the primary cause. The debate has shifted to the question of what we can do that is effective, pragmatic, and economically sustainable in the context of a changing climate.”

In this author's opinion it is critical that we in the oil and gas industry recognize the status of the so-called debate over climate change. In truth, the debate is occurring only within our small corner of the world. Most other countries and essentially all other scientific organizations worldwide have accepted climate change and the role of man-made greenhouse gases in causing it as simple truth. The rest of the world has already moved on and is now planning how to position themselves for the changes coming, such as some sort of CO₂ budget which companies would be awarded so many CO₂ credits that could be traded

or sold to other companies. Those companies who are well positioned for the coming changes will do very well. Those that are not ready will do very poorly. Whatever our personal view on this issue, change is imminent.

One of the most important lessons that Cooper learned in Washington is that for politicians, scientific facts are only one ingredient that goes into the equation of what and how to legislate. It may not even be the most important ingredient. Politicians view science as what the scientific community believes. They view policy as resolving differences among what people think. Washington is a very different world indeed, one that scientists need to understand better if we are to communicate effectively with politicians. ■

Reference

Cooper C., 2007: Washington's Changing Climate. *GSA Today*, Vol. 17, No. 4, pp. 51 DOI: 10.1130/1052-5173(2007)

What Determines Earth's Temperature

by Bill Rizer

At a high level, it is not difficult to understand what controls the earth's temperature as described in a brief article by Rebecca Lindsey (2007) of NASA. If you go to the top of the earth's atmosphere (Figure 1), about 100 km above the surface, and measure the amount of incoming radiation and subtract from that the amount of outgoing radiation, what is left, the net radiative flux, is what determines earth's temperature.

That is simple indeed. However, what happens below 100 km is what determines how many photons reach the surface and how many photons radiating back from the surface and atmosphere

actually make it all the way out to space. The Sun's radiation incident on the earth is high energy and short wavelength (Figure 2). The photons that are not reflected back by the molecules and particles in the atmosphere are absorbed by the surface causing the surface to warm. The warming surface, in turn, emits photons but at much shorter wavelengths and lower energy than the visible light of the Sun (Figure 2). That is why molecules and particles that have little effect on incident visible light can block the heat radiating back the surface. We know these molecules as greenhouse gasses, and CO₂ is quite good at turning back heat.



Figure 1. At an altitude of about 100 km the earth's atmosphere is so thin that it essentially does not exist. This is where the net radiative flux (photons in minus photons out) is measured. Astronaut photograph ISS013-E-54329 courtesy NASA, JSC.

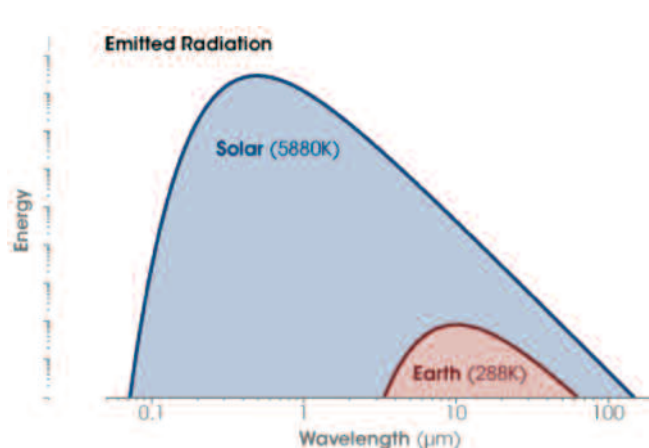


Figure 2. Energy vs. wavelength plots for incident solar radiation and the energy (heat) radiated back from the earth.

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Most of us are aware that the current warming that is occurring globally has decreased the amount of ice and snow on the planet's surface. For example the decline in sea ice since satellites began to observe it has declined dramatically (Figure 3). Most models predicted that the increased temperatures would cause a decrease in sea ice that, in turn would cause a further increase in temperature. This positive feedback is called the ice-albedo feedback and should cause a decrease in the net energy flux measured at the top of the atmosphere. Measurements, however, showed little change.

melting. Unfortunately, this is likely to be only a temporary fix. The loss of ice will eventually start accelerating because of the ice-albedo feedback. ■

Reference

Lindsey, Rebecca, 2007: Arctic Reflection, Clouds replace snow and ice as solar reflectors, Earth Observatory, NASA, can be viewed online at <http://earthobservatory.nasa.gov/Study/ArcticReflector/printall.php>

Now scientists know that the loss of surface ice and therefore the loss in surface reflectivity was compensated by an increase in cloud cover caused by the increase in available moisture due to

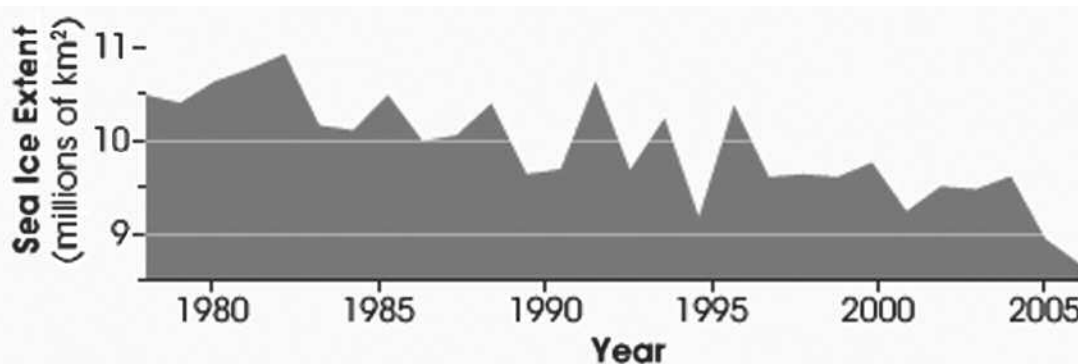


Figure 3. Decline of sea ice since 1978. Graph by Robert Simmon, can be viewed at <http://earthobservatory.nasa.gov/Study/ArcticReflector/printall.php>

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