

Changing Climates, Changing Earth: Global Climate Change

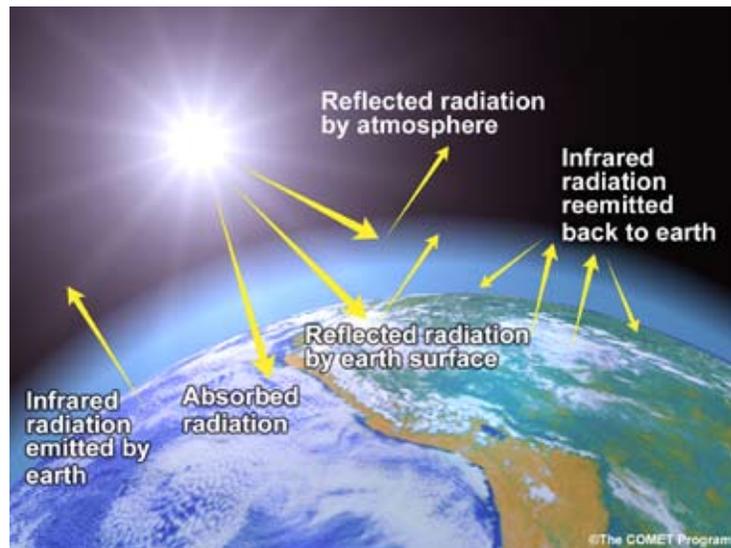
By Vicki Osis

The Greenhouse Effect

Global climate change is about much more than wearing a T-shirt on Thanksgiving Day or planting your garden a month early. Gases such as carbon dioxide (CO₂) and water vapor trap heat from the sun and create the greenhouse effect. Without it our planet would be more like Mars, with extreme temperature fluctuations. Before the industrial revolution, greenhouse concentrations in the atmosphere changed very little for thousands of years. Present energy-intensive life styles are rapidly increasing the concentration of CO₂ and other greenhouse gases, such as methane, in the atmosphere. The addition of massive quantities of CO₂ and the rapid rate at which it is accumulating are raising alarms. Instead of merely warming up, the planet is now warming up to the point that global climate patterns are being disrupted.

Is CO₂ Causing the Problem?

Global warming is definitely happening, but is the warming observed to date due to a stronger greenhouse effect? Understanding a planet as complex as



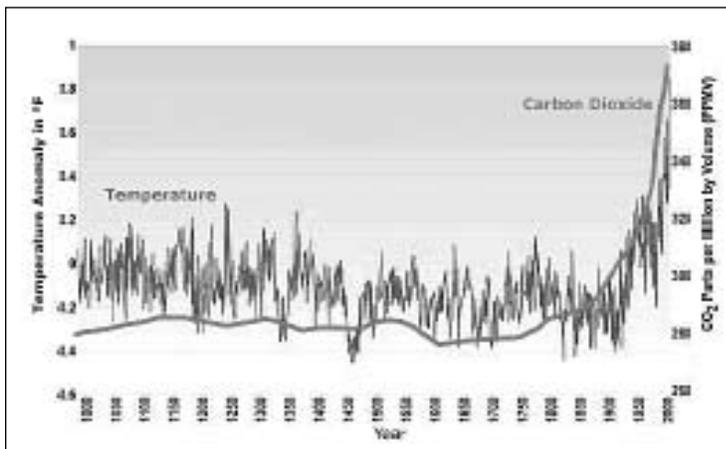
The greenhouse effect. Illustration from the University Corporation for Atmospheric Research in Boulder, Colorado.

Earth, with its climate systems and its rapidly expanding human population, is daunting. It is unlikely that in the near future all scientists will agree with 100 percent certainty that greenhouse gases are to blame for present climate changes. In addition, changing land-use patterns, economic development, lifestyle choices, technological advances, and energy alternatives make predicting future climate conditions difficult at best.

In 2001, two comprehensive reports were released, summarizing the state of scientific knowledge of climate change. The reports were written by the world's leading

climate scientists, members of the Intergovernmental Panel on Climate Change and the National Academy of Sciences Panel, convened by President Bush. The IPCC's report is drawn from hundreds of leading climate scientists from around the world. That report concluded that "there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities." The National Academy of Sciences Panel endorsed the findings of the IPCC but went on to conclude that there is still uncertainty in our understanding of how the climate system varies naturally and reacts to emissions of greenhouse gases and aerosols.

Whatever uncertainties exist about climate predictions for the future, we do know that CO₂ causes warming and that its concentration has increased by 32 percent and is rising rapidly.



Increase in CO₂. Illustration from TERC, <http://earthsci.terc.edu/content/investigations/esu501/esu501page04.cfm>, February 2004.

Temperature and CO₂ Increases over the Past 1,000 Years

The biggest factor behind rising CO₂ levels is the burning of fossil fuels such as coal and gas. The United States and Australia emit more CO₂ per person than other nations because of their high dependence on fossil-fuel power plants and their high living standards. The U.S. alone pumps out a quarter of the world's CO₂ emissions.

During the 20th century, global temperature increased more than in any other century in the past 1,000 years. The average surface temperature of the earth has increased over the past 100 years by about 0.6°C. The 1990s was the warm-

est decade and 1998 the warmest year in the instrumental record, since 1861. This warming was unusual and is unlikely to be entirely natural in origin.

Deforestation is another factor that adds to the accumulation of CO₂ in the atmosphere, but it is a distant second behind the rapid releases of CO₂ from the burning of fossil fuels. Forests that once absorbed CO₂ are disappearing. We have already cut down more than half the forests that existed after the last ice age. Nations such as those in North America and Europe are now reforesting thousands of square kilometers a year, but in South America, Asia, and sub-Saharan Africa, forests are disappearing at 10 times this rate. The trees are cut to make space for agriculture and to harvest valuable hardwoods.

Changing Climates

Early models of global climate change predicted that the greatest increases in temperature would occur at the polar regions. In fact the average temperature of Anchorage, Alaska, has increased by 10 degrees Fahrenheit. Loss of ice coverage and melting of permafrost bring further worry about rapid warming. The reduction of sea ice exposes dark surfaces that absorb heat, further increases warming, and speeds the melting of ice caps. Melting permafrost releases methane, a greenhouse gas that is an even more active warming gas than CO₂, into the atmosphere. The melting sea ice also holds serious implications for wildlife, including polar bears, walrus, and seals that depend on sea ice for survival. Antarctica, however, is a different story and has not experienced a decrease in sea ice coverage. In fact, predictions are that the ice cover may even increase in Antarctica.

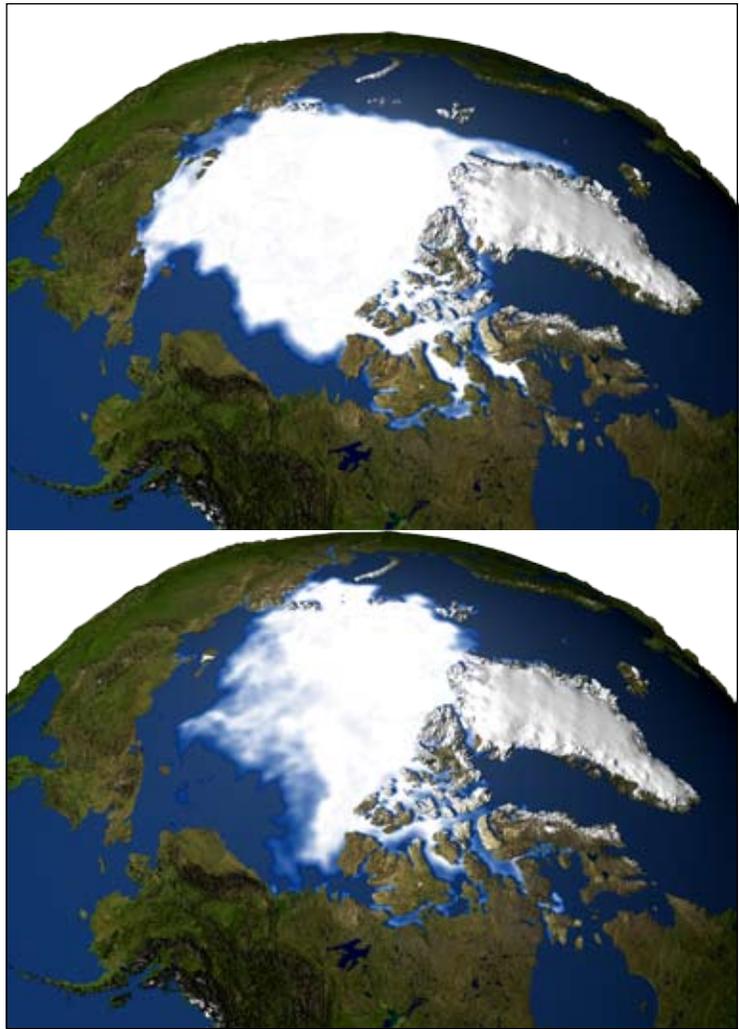
Predicted Impacts Worldwide

The increase in warming will have widespread impacts on society and the environment. The likely result is more frequent heat waves, droughts, extreme precipitation events, and related impacts—for example, wildfires, heat stress, and vegetation changes. The expansion that occurs when water warms, coupled with added water from melting Arctic ice caps and glaciers, will raise sea levels, resulting in erosion and flooding of the world's coasts. For regions with low-lying coastal areas, this change in sea level will be catastrophic. Loss of property caused by flooding and erosion spells disaster for heavily developed shorelines and dense populations. Especially under threat are low-lying islands and countries such as Bangladesh and the Netherlands.

In this period of rapid population growth (81 million people are added to the planet annually), world food output must double by 2050. During the next 50 years, projected temperatures will lead to higher maximum temperatures, more hot days, and heat waves over nearly all land areas. There will be increased risk of damage to a number of crops. This damage, coupled with changes in freshwater supplies, which are already stretched to their limits, will have negative impacts for most regions of the planet and reduce the earth's ability to support increasing populations.

Predicted Impacts on the Pacific Northwest

The Climate Impacts Group at the University of Washington reviews current climate research to establish trends for the Pacific Northwest. Using current global-warming projections, they predict that much of our snowpack could



Melting Arctic ice caps. Above, 1979; below, 2003. Illustration from the Scientific Visualization Studio, Goddard Space Flight Center; <http://www.gsfc.nasa.gov/topstory/2003/1023esuice.html#top>, April 2004.

be gone within 50 years. Each 1-degree rise in temperature raises the snow level—the altitude below which it melts—about 300 feet, and researchers expect a 5-degree rise by 2050, enough to eliminate snow from much of the area where it now accumulates. Later freshets and reduced summer flows will affect freshwater supplies, irrigation, fisheries protection, and energy production.

If fish, energy, and water supplies are important to the Northwest, what about forests, our other major resource? According to the best information available, the Northwest will experience wetter winters and dryer, hotter summers. The heat will turn new spring growth into dry tinder, increasing the threat of forest and wildfires.

What Is Being Done to Address the Problem?

In 1997, 38 countries signed an international accord setting limits on greenhouse gas emissions. The countries signing the Kyoto accord agreed to reduce their emission of greenhouse gases by the year 2012. The U.S. signed the agreement in 1998 during the Clinton administration, but the Senate balked at ratifying it, and the Bush administration has not supported the pact. Today there are few incentives to reduce greenhouse gases, and efforts are left to individual decisions and actions.

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