

**GREENHOUSE GASES WARM GLOBAL CLIMATE AS POLICY IS DEBATED**  
**(From Melanie Lenart) -- Sent Sept. 11, 1997 --**

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What would happen to Brazil's climate if settlers cut down all the Amazon's forests? University of Arizona atmospheric sciences Regents Professor Robert Dickinson got to wondering about that.

So he and departmental colleague Andrea N. Hahmann set up a computer program to simulate the Amazon region's current climate. Then they electronically turned the forest into rangeland and put the program through its paces.

Within a few simulated years, average rainfall in this cyberland without trees dropped by about 14 inches a year -- more than Tucson's total annual rainfall even in a wet year.

The Amazon computer model, described in the August Journal of Climate, is just one example of how Dickinson's research is helping researchers recognize links between climate and human activity such as deforestation and fossil fuel use.

An eminent climate modeler who worked at the National Center for Atmospheric Research (NCAR) in Boulder for 22 years before joining the University of Arizona faculty in 1990, Dickinson was among the group of international scientists who concluded in 1995 that the planet has already begun to warm up due to human activity.

"The balance of evidence indicates we're already observing global warming because of greenhouse gases," he explained during the Southwest Regional Climate Change Symposium held in Tucson last week. "We're almost certain to get much warmer temperatures in 100 years if we keep going the way we're going now."

The higher temperatures also are likely to usher in more extreme events such as droughts and floods in general, he noted. However, as usual these will be difficult to predict beyond a few days in advance.

Regional temperature changes are also difficult to predict, but researchers almost all agree that the average global temperature will rise along with the level of greenhouse gases.

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Most computer models predict a global temperature increase of two to eight degrees Fahrenheit once the carbon dioxide levels in the air reach twice their pre-industrial level, an event projected to occur in the latter part of the coming century, Dickinson said.

Carbon dioxide, the greenhouse gas most responsible for the projected warming, comes from the removal of forests as well as the burning of fossil fuels in cars and factories. Nitrous oxide from fossil fuels also acts as a greenhouse gas, as does methane.

However, some consequences of fossil fuel emissions actually have a cooling effect, such as the production of sulfate aerosols. Whereas greenhouse gases warm the planet by preventing heat from the sun from escaping back into space, sulfate aerosols cool the planet by blocking solar radiation from reaching the Earth's surface in the first place.

These sulfate aerosols can have a global effect -- as when Mount Pinatubo spewed out enough of them during its 1991 eruption to cool the planet by about a full degree for a year or so -- or the effect may be more localized.

"Probably the eastern part of the United States has a lot more cooling from sulfate aerosols than warming from greenhouse gases," Dickinson reasoned. "Whereas here in Tucson, we don't have as much smog, so we might expect to see the warming more."

Another confounding factor involves clouds. Cloud droplets can prevent solar radiation from reaching the ground, while water vapor, a powerful greenhouse gas, and the clouds themselves trap infrared heat on the planet.

It's difficult to capture the whimsical quality of clouds in computer models, although they tend to have an overall cooling effect, as common sense would predict.

"Clouds seem to be a remarkable non-breakthrough," Dickinson said dryly. "We don't quite know how to write them down in equations to put in climate models."

He suspects some international policy makers will use the unavoidable uncertainties as an excuse to avoid restricting greenhouse gases when they meet in Kyoto this December. The meeting is part of a United Nations-sponsored series, with this one designed to consider whether the conclusions reached in 1995 by Dickinson and his colleagues on the Intergovernmental Panel on Climate Change warrant political action.

"Some people want to wait until we get everything perfect before they'll believe it," he said.

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