

# Experts on Climate Change Pondering: How Urgent Is It?

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## ABSTRACT (ABSTRACT)

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The average surface temperature of the globe has risen by about 1 degree Fahrenheit in the 20th century, and about half a degree in the last 40 years -- with temperatures generally rising more the farther away one gets from the Equator. A warmer atmosphere sucks up more water from the oceans and in general makes more moisture available to developing storms. Observations show that atmospheric water vapor has increased. Therefore, the scientists say, global warming may well be revving up the planet's rainmaking machine.

## FULL TEXT

WITH the nations of the world counting down to a Dec. 10 deadline for negotiating cuts in emissions of heat-trapping greenhouse gases that many scientists say are altering the earth's climate, a fundamental question continues to pervade the debate:

Just how urgent is the problem of climate change?

The problem has often been perceived as lying off in the dim future -- a century away, say, since that is the time scale on which most analysis of the question has been based. It can be very hard to get excited about something that seems so remote. "We see the train coming," President Clinton said not long ago, "but most ordinary Americans in their day-to-day lives can't hear the whistle blowing."

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Other parts of the world have also experienced increases in precipitation in this century. And while the trend's

association with global warming is not yet firmly nailed down, mainstream scientists say it is precisely, and unsurprisingly, what would be expected as the earth's atmosphere heats up.

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A rainier world is just one of several climatic changes already observed that are associated with the warming, scientists say. Temperatures have risen more at night than in the day, portending milder winter evenings but also more deadly heat waves. Experts, for instance, attributed the record death toll in Chicago's 1995 heat wave mainly to a combination of unusually high nighttime temperature and humidity.

The area of the Northern Hemisphere covered by snow has generally declined in the last 25 years. Mountain glaciers have receded in many areas. Sea level has risen as warmth has caused the water to expand. Spring comes earlier and fall arrives later in Northern latitudes, which have become about 10 percent greener.

"The climate reality is that if you look out your window, part of what you see in terms of the weather is produced by ourselves," said Thomas R. Karl, senior scientist at the National Climatic Data Center in Asheville, N.C. "If you look out the window 50 years from now, we're going to be responsible for more of it."

Mr. Karl has not been known as a doomsayer on the question of global warming. It was he and his colleagues who analyzed 20th-century climatic data for the United States and southern Canada and found that both overall precipitation and the frequency of intense rainstorms and snowstorms had, on average, increased by about 10 percent over the century. Intense storms were defined as those in the top 10 percent, in terms of the amount of precipitation delivered, at the start of the century.

The trend, said Mr. Karl, is consistent with what would be expected in a world made warmer by greenhouse gases – principally carbon dioxide, which is produced by the burning of coal, oil and natural gas.

This is only the beginning, if a panel of more than 2,000 scientists advising the world's governments is right. While no one is predicting apocalypse any time soon, the scientists' best estimate is that the world will warm by more than another half degree in the next 20 years if greenhouse emissions are not reduced (although the underlying trend would surely be modified from time to time by natural climatic variations). With another half degree of warming, the average global temperature would approach the highest experienced in the 10,000 years since the last ice age, said Dr. Thomas J. Crowley, a paleoclimatologist at Texas A & M University.

A century from now, according to the scientific panel's best estimate, the earth's surface will be some 3.5 degrees warmer than in 1990. "You have to go back millions of years to find global temperatures like that," said Dr. Crowley. By way of comparison, it was 5 to 9 degrees colder in the depths of the last ice age.

The panel predicted that the warming would bring widespread climatic, environmental and economic dislocation. Some benefits are expected to result, including longer growing seasons in Northern Hemisphere breadbaskets and more robust plant growth stimulated by increased carbon dioxide. But many effects would be adverse, including intensified cycling of water through the ocean-atmosphere system that would result in both more frequent and severe floods and droughts; it would rain harder but things would dry out more and faster between storms. Sea

level is expected to rise by about a foot and a half, inundating many low-lying coastlines. Climatic zones would shift away from the Equator, upsetting natural ecosystems. Entire forest types might disappear. Agriculture in some parts of the world, especially Africa, might be devastated. The geographical range of tropical diseases would expand.

Not all scientists agree with Mr. Karl and the international scientific panel, and the disagreement is symptomatic of a more general, nagging uncertainty that plagues all efforts to gauge the urgency of the climate problem. The uncertainty also complicates the task of negotiators from around the world as they struggle to determine how much and how rapidly greenhouse gas emissions should be cut. The negotiators' next session is in Bonn in late October, with a final session in Kyoto, Japan, in the first 10 days in December.

"Yes, there have been these big climate changes, but I think they're all natural," said Dr. William M. Gray, a climatologist at Colorado State University in Fort Collins who has been skeptical that greenhouse gases are altering the climate. "I respect Tom Karl a lot, but I don't agree with his interpretation of his data." Another skeptic, Dr. Richard S. Lindzen of the Massachusetts Institute of Technology, says that the natural system has built-in resilience -- "it has to wobble a bit" -- and that the observed changes are an expression of this. Since he believes that global warming is expected to amount to little, Dr. Lindzen believes there is little or no urgency.

The potential Achilles' heel in the mainstream scientists' projections of future climate is that they are based on computerized models of the atmosphere's response to estimates of future greenhouse gas emissions. Everyone agrees that the models are imperfect, and Dr. Lindzen goes so far as to liken them to Ouija boards, but many experts believe they are steadily improving and becoming more realistic. In any case, they say, there is no other way to even begin to cope with the atmosphere's complexities.

The international panel of scientists, which was established by the United Nations and is called the Intergovernmental Panel on Climate Change, relied heavily on the models in rendering its landmark judgment, two years ago, that "the balance of evidence suggests a discernible human influence on global climate." The cautiously phrased statement, a compromise product of intense discussions, was a watershed in the climate debate because until then the panel had always said the observed warming and attendant climate changes could have been a result of natural variability.

Since then, some opponents of action to cut greenhouse gases have seized on an article in the May 16 issue of the journal *Science*, which dealt with uncertainties surrounding the panel's conclusion that humans are probably altering the climate, to suggest that the uncertainty has grown.

But that is disputed by the chief author of the intergovernmental panel's chapter on detection of human influence on climate. The scientist, Dr. Benjamin D. Santer of the Lawrence Livermore National Laboratory, who was quoted in the *Science* article, said in a recent interview that further studies have not only reinforced the original conclusion, but might even strengthen it. And in a recent open letter, he said that despite large uncertainties, "the question is not whether, but rather to what extent" greenhouse gases are influencing the climate. The best evidence, he wrote, "suggests that the human component of climate change is not trivially small."

The size of that component remains, perhaps, the major uncertainty in gauging how urgent the climate change problem is.

But if the intergovernmental panel is right, the average global surface temperature will rise by about a third of a degree Fahrenheit per decade over the next century if greenhouse gases are not reduced.

Many scientists believe that no matter what action is taken in Kyoto, some substantial measure of future warming is already assured.

"We haven't seen the full ramifications" of the greenhouse gases already emitted, said Dr. Kevin Trenberth, a climatologist at the National Center for Atmospheric Research in Boulder, Colo. The reason is that built-in inertia, mainly stemming from a drag on heating exerted by the oceans, prevents the climate system from reacting immediately to the emissions. Only about half the warming potential of greenhouse gases already in the atmosphere has been realized, said Dr. James E. Hansen, a climatologist who directs the NASA Goddard Institute for Space Studies in New York.

What this means, he said, is that even if greenhouse gas emissions suddenly ceased today, "you'd get a few tenths of a degree" of global warming in the next quarter century.

But emissions are not going to cease now, since any policy adopted in Kyoto would require some time to have any appreciable effect. This means that atmospheric concentrations of greenhouse gases would continue to grow. "You can't turn that off" right away, said Dr. Trenberth. He noted that even if emissions were reduced to 1990 levels – a target that most industrialized nations are already failing to meet – atmospheric concentrations would continue to rise indefinitely. This is because the 1990 levels were already so high.

Dr. Hansen says that "what we do now is not going to have much influence on climate change in the next couple of decades; the main impact of changes we make now will be 50 and 100 years downstream." Consequently, he believes, climatic change is going to become "more apparent over the next decade or so." Dr. Hansen has long been a firm adherent of the view that greenhouse gases are the major cause of the observed warming.

Some scientists, while convinced that humans are changing the climate in important ways and that greenhouse warming is a serious issue, believe that taking no action now would have little appreciable climatic effect. One is Dr. Tom Wigley of the National Center for Atmospheric Research, who said, "Just from a pure climate point of view, another 20 years of doing nothing is unlikely to mess things up." He acknowledged that many experts would not agree, and quickly added, "I'm not saying we should do nothing for 20 years." For one thing, he said, "the longer we delay, then the more we have to do later."

How much to do now is the crux of the discussions that will culminate in Kyoto. The decision is complicated by the fact that while the intergovernmental panel estimated a 3.5-degree increase in average global temperature by 2100, it also said the increase could be as low as 2 degrees and as high as 6.

This poses a dilemma, in the view of Dr. Michael E. Schlesinger, a climatologist at the University of Illinois at Urbana-Champaign: If the warming is on the low end of the panel's estimate and the Kyoto delegates decide to do too much, it will be too costly to the world economy. But if it is on the high end and they decide to do too little, climatic damage will be too high and it will still be too costly.

What should governments do? "We should not do nothing and hope for the best; that's crazy," Dr. Schlesinger said. "On the other hand, we shouldn't do everything, either; we don't want to squander resources on something that might turn out to be a nonproblem." He and others call for an adaptive strategy in which at least some action is taken now, and then both the climatic effects and the economic cost of acting are periodically reassessed. Mid-course corrections would be made as needed. This principle is, in fact, built into the 1992 Rio treaty on climate change, under which the present negotiations are proceeding.

But then a further difficulty arises, in Dr. Schlesinger's view. Since the effects of any emissions reductions undertaken now would not be apparent in the next two decades, it would be impossible to tell for some time whether the right thing was done. And if the reductions did subsequently succeed in mitigating the warming, that very fact would make it harder to know how serious the warming would otherwise have been, and therefore what further action might or might not be needed.

"That," said Dr. Schlesinger, "is what's so difficult about this cockamamie problem."

## Illustration

Map/Diagram: "Evidence Of Disruption"

As governments negotiate cuts in emissions of heat-trapping greenhouse gases, scientists look for signs of climate change. The map at right shows a trend toward more precipitation at higher latitudes and less in the tropics over the last century – the kind of change computer models predict would occur in a warming world.

Further Signs of Change

### GLOBAL MEAN TEMPERATURE

The atmosphere has warmed by about 1 degree Fahrenheit in the 20th century, according to the Intergovernmental Panel on Climate Change.

### SEA LEVEL RISE

The global sea level has risen by up to 10 inches in the last 100 years, and much of the rise may be related to the increase in global mean temperature.

### PRECIPITATION PATTERNS

Intense rainstorms and snowstorms have become about 10 percent more frequent in the United States and southern Canada in the 20th century, Government scientists say.

### FREQUENCY OF WINTER CYCLONES

The number of intense cyclone events per winter has been on the upswing in recent years.

(Source: National Climatic Data Center; Scientific American; Intergovernmental Panel on Climate Change)(Illustrations by Baden Copeland)

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