

## Climate experts urge immediate action to offset impact of global warming

Governments and consumers in the United States and worldwide should take immediate steps to reduce the threat of global warming and to prepare for a future in which coastal flooding, reduced crop yields and elevated rates of climate-related illness are all but certain, top U.S. scientists said Tuesday.

At a meeting organized by AAAS and its journal, *Science*, the climate researchers argued that while some policy experts and sectors of the public dispute the risk, there is in fact no cause for doubt: The world is significantly warmer today than it was a century ago--and it's getting warmer. Without action now, they warned, the impact could be devastating.

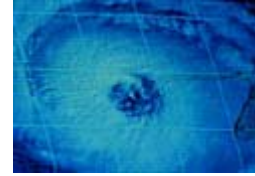


Image courtesy the  
National Hurricane Center,  
NOAA

As the Earth warms, ice sheets are melting and sea levels are rising--island and river-delta communities already are vanishing beneath the waves. Native Inuit fishermen are falling through thinning Arctic ice they've traversed many times before. In recent decades, climate change claimed some 150,000 lives in 2000 and sickened many others, especially elderly people and very young children, according to the World Health Organization.

One of the conference experts, Harvard geochemistry Professor Daniel Schrag, likened the situation to the Titanic after it hit the iceberg. "So if you're standing at the back of the Titanic, you're thinking, 'Oh, I'm going up, we can't be sinking'."

"We are performing an experiment at a planetary scale that hasn't been done for millions of years," Schrag said. "This should not be a partisan issue," he added. "We cannot wait for a catastrophe to appear before we act because by then it would be too late. The next few decades will determine our path for the next century."

Another panelist examined what is known about the interaction between the atmosphere, sea ice and the ocean in the North Atlantic from studies using observations, data and modeling. "The next 100 years will experience climate changes on a much greater scale than we've seen over the past 150 years," said David Battisti, professor of atmospheric sciences at the University of Washington. "We can reliably say that the planet will be much warmer."

Schrag and Battisti were part of an all-star panel of climate experts convened Tuesday 15 June by AAAS, the world's largest general science society, and its journal, *Science*. They and other influential researchers, including Nobel Laureate in Chemistry Sherwood Rowland of the University of California-Irvine, shared their latest findings and best temperature projections at the free, public conference. The forum--"Qs and AAAs About Global Climate Change"--was organized by *Science* Editor-in-Chief Donald Kennedy and Albert Teich, director of Science & Policy for AAAS.

In this way, the U.S. researchers took some first steps toward responding to a 9 January *Science* article by Sir David King, the United Kingdom's chief scientific adviser, which challenged America to better control greenhouse gases. (Reference: <http://www.sciencemag.org>.)

Many experts at the conference suggested that the onus is on the U.S.--and the American public--to make changes that will reduce the nation's disproportionate impact on the world environment. "You hope that somehow people will understand that we have got to do something now," Joyce Penner, an atmospheric scientist at the University of Michigan, told Reuters in an interview. "Some people get it -- some people are driving hybrids. But there is a problem with the American public."

Kennedy was among those to predict that climate change could bring potentially disastrous repercussions in communities around the world.

"It should go without saying that the vulnerability of the world's poor will be multiplied many-fold if global warming causes significant melting of one or both of the polar ice sheets," Kennedy said in an interview before the conference. "Yet exacerbation of poverty around the world--whether from flooding, reduced crop yields or increased prevalence of asthma, diarrhea, malaria or other illnesses--is part of the climate-change story that hasn't



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really been told. That is why it's important to make the science underlying climate change accessible to policymakers in parts of the world, like the United States, where much of the source of the problem lies."

Michael Oppenheimer, professor of geosciences and international affairs at Princeton University, agreed.

"By mid-century, millions more poor children around the world are likely to face displacement, malnourishment, disease and even starvation unless all countries take action now to slow global warming," he said in an interview.

"Mansions along the Hamptons of Long Island, New York, can be rebuilt further inland when the beaches erode. But imagine the difficulties faced by families in Bangladesh. An area where about 8 million people now live would be underwater if global sea level were to rise half a meter. Where are they going to go?"

The authoritative Intergovernmental Panel on Climate Change (IPCC), established by the World Meteorological Organization and the United Nations Environment Programme, has estimated that, between 1900 and 2100, temperatures will rise between 1.4 and 5.8 degrees Celsius (2.5 to 10.4 F). In the past century, the IPCC has reported, temperatures have increased between 0.2 and 0.6 degrees C-or, an increase of about 1 degree F to date, with most of the warming happening over the most recent decades.

Scientists generally agree that temperatures are rising as a result of human activities such as fossil-fuel burning, which releases carbon dioxide and other heat-trapping greenhouse gases. This warming has caused glacial melting and subsequent increases in sea levels worldwide of up to 20 centimeters, or 7.8 inches.

Some scientists have disputed the pessimistic climate-change forecasts, and the administration of U.S. President George W. Bush has cited concerns about the models that predict dramatic climate change and the perilous consequences. White House science adviser John H. Marburger III earlier this year defended Bush's policy and rejected critics' claims that the administration is in denial about global warming. For example, he said, Bush acknowledged in 2001 that the concentration "of greenhouse gases, especially CO<sub>2</sub>, have increased substantially since the beginning of the Industrial Revolution."

Rowland, in his remarks at the AAAS conference, said it's not just carbon dioxide concentrations that are rising. The levels of other greenhouse gases--water vapor, methane, nitrous oxide and ozone--are rising too, he said.

Water vapor is not produced by human activities in significant enough amounts to worry about, Rowland said. Even so, he noted, if human-related activity changes the temperature of the ocean, then water vapor increases.

Methane concentrations increased from 300 parts per million in 1958 to 380 ppm in April 2004, he said. Carbon dioxide concentrations were 280 ppm in 1800 and 380 ppm in 1980. Concentrations of nitrous oxide and tropospheric ozone are going up as well.

A century ago, Rowland said, only a handful of cities worldwide claimed a population of over 1 million. Today, there are more than 50 cities with multi-million populations. "Having large cities, and many motorized cities today, is an important reason why tropospheric ozone is on the rise," he said.

The scientists at Tuesday's climate conference acknowledged that questions remain about climate-forecasting models. And, they said, there will always be uncertainty about exactly what may happen and precisely how various factors exert an influence. However, the panelists also agreed that accurate predictions can be made over the long term--and that greenhouse gases released as a result of human activity are a major change agent. In fact, they said, the models are more likely making conservative predictions rather than generous ones.

"We have seen a huge increase in the capabilities of these models," said Gerald A. Meehl, a research scientist at the National Center for Atmospheric Research. "They do quite well in simulating global temperature evolution and extremes."

According to Oppenheimer, models project that if Greenland temperatures rise by another 3 degrees C, complete melting of the Greenland ice sheet would eventually result. "If the West Antarctic ice sheet becomes unstable, global sea level would rise about 5 meters and as much as seven meters if the Greenland ice sheet melts,"

The American Association for the Advancement of Science, (AAAS), is an international non-profit organization dedicated to advancing science around the world by serving as an educator, leader, spokesperson and professional association. In addition to organizing membership activities, AAAS publishes the journal *Science*, as well as many scientific newsletters, books and reports, and spearheads programs that raise the bar of understanding for science worldwide. Founded in 1848, AAAS serves some 262 affiliated societies and academies of science, serving 10 million individuals. *Science* has the largest paid circulation of any peer-reviewed general science journal in the world, with an estimated total readership of one million.



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Oppenheimer said. Although the sea level rise would largely occur in later centuries, these outcomes could be set in place within the current century.

"Antarctica is very dramatically losing ice at this point," Oppenheimer told reporters at the conference. "If Greenland or West Antarctica disintegrated, the state of Florida would disappear."

Such an outcome isn't imminent, he acknowledged. But would melting polar ice destabilize ocean circulation, pushing the relatively warm Gulf Stream southward and causing the North Atlantic to freeze as depicted in Hollywood's latest disaster movie, "The Day After Tomorrow"?

Probably not, said Battisti. "One hundred years from now, the amount of carbon dioxide in the atmosphere is likely to be at least two times greater than today," he said. "Any localized cooling that might occur in the North Atlantic will be overwhelmed by a very large warming caused by a large increase in the greenhouse effect."

Greenhouse gases are warming the Earth faster than aerosols like dust can mask them, said Penner, professor of atmospheric, oceanic and space sciences at the University of Michigan. Various types of aerosols--from soot and dust to sulfur--can either cool or warm the climate, she explained. Warming is associated with absorbing black carbon emissions such as soot, while non-absorbing aerosols are tied to cooling, which scientists call "negative forcing."

"Greenhouse gas effects are not going to be masked by aerosols," Penner said in an interview, debunking a popular myth related to climate change. "Even the best current aerosol models overestimate the cooling force of aerosols. Warming caused by greenhouse gases will overwhelm any aerosol-related cooling."

At the conference, Penner said many questions remain about aerosols. "In spite of this uncertainty," she said, "there is going to be a major change in the future. Once we're into this future, we're into it for a long time."

Alan I. Leshner, AAAS CEO and executive publisher of *Science*, joined Kennedy in co-hosting the conference, which was sponsored by the William and Flora Hewlett Foundation and the Conference Board. Among the other speakers were Thomas Crowley, Duke University; Richard Alley, Pennsylvania State University; Lonnie Thompson, Ohio State University; and Chris Field, Carnegie Institution of Washington.

—Ginger Pinholster, Barbara Rice and Monica Amarelo

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