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Scientists Detail Climate Changes, Poles to Tropics

By **JAMES KANTER** and **ANDREW C. REVKIN**

BRUSSELS, April 6 — From the poles to the tropics, the earth's climate and ecosystems are already being shaped by the atmospheric buildup of greenhouse gases and face inevitable, possibly profound, alteration, the world's leading scientific panel on [climate change](#) said Friday.

In its most detailed portrait of the effects of climate change driven by human activities, the panel predicted widening droughts in southern Europe and the Middle East, sub-Saharan Africa, the American Southwest and Mexico, and flooding that could imperil low-lying islands and the crowded river deltas of southern Asia. It stressed that many of the regions facing the greatest risks were among the world's poorest.

And it said that while limits on smokestack and tailpipe emissions could lower the long-term risks, vulnerable regions must adjust promptly to shifting weather patterns, climatic and coastal hazards, and rising seas.

Without such adaptations, it said, a rise of 3 to 5 degrees Fahrenheit over the next century could lead to the inundation of coasts and islands inhabited by hundreds of millions of people. But if steady investments are made in seawalls and other coastal protections, vulnerability could be sharply reduced.

The group, the [United Nations' Intergovernmental Panel on Climate Change](#), also noted that the climate shifts would benefit some regions — leading to more rainfall and longer growing seasons in high latitudes, open Arctic seaways and fewer deaths from the cold.

The 1,572-page report, finished here on Friday, was prepared by more than 200 scientists, and a 21-page summary was endorsed by officials from more than 120 countries, including the United States.

The conclusions came after four days of revisions by scientists and then an often rancorous all-night debate with government officials. In a sign of shifting geopolitics on global warming, scientists who worked on the report criticized China for weakening some language in the summary, while they credited the United States, which had for years stressed uncertainty in the science, with playing a mostly constructive role.

The panel, which has tracked research on global warming since it was created under United Nations auspices in 1988, has sometimes been criticized for allowing governments to shape the summaries of its periodic reviews of climate science.

But by many accounts, it remains the closest thing to a barometer for tracking the level of scientific understanding of the causes and consequences of global warming. In February, the panel released its fourth summary of basic climate science, concluding with 90 percent certainty that humans were the main cause of warming since 1950.

The new report, focusing on the effects of warming, for the first time describes how species, water supplies, ice sheets and regional climate conditions are already responding to the global buildup of heat. While the report said that assessing the causes of regional climate and biological changes was particularly difficult, the authors concluded with “high confidence” — about an 8 in 10 chance — that human-caused warming “over the last three decades has had a discernible influence on many physical and biological systems.”

At a news conference here, Martin Parry, the co-chairman of the team that wrote the new report, said widespread effects were already measurable, with much more to come.

“We’re no longer arm-waving with models,” he said. “This is empirical information on the ground.”

Reports from the panel are released only every half-decade or so, and this year’s suite of three studies — on basic science, the effects of warming, and options for cutting emissions — are likely to guide policymakers for years to come.

The panel’s reports are particularly influential in international talks over climate treaties, especially the Kyoto Protocol, whose binding limits on emissions expire in 2012. Those limits have been rejected by the United States and China.

The report also is expected to be discussed at a summit meeting of the [Group of 8](#) industrial powers in Germany in June, when the [European Union](#) has said it plans to renew efforts to get the United States to do more to cut greenhouse gas emissions.

The report said that given the current buildup of carbon dioxide and other long-lived greenhouse gases in the atmosphere, temperatures and seas would inevitably rise for decades. The worst effects would be felt in regions that are mainly poor and already facing dangers from existing climate and coastal hazards.

“It’s the poorest of the poor in the world, and this includes poor people even in prosperous societies, who are going to be the worst hit,” said Rajendra K. Pachauri, the chairman of the panel. “People who are poor are least-equipped to be able to adapt to the impacts of climate change, and therefore in some sense this does become a global responsibility in my view.”

Some authors said the report removed any doubt about the urgency of acting to curb emissions of greenhouse gases.

“The warnings are clear about the scale of the projected changes to the planet,” said Bill Hare, an author of the report and a visiting scientist at the Potsdam Institute for Climate Impact Research in Germany. “Essentially there’s going to be a mass extinction within the next 100 years unless climate change is limited,” added Dr. Hare, who previously worked for [Greenpeace](#).

“These impacts have been known for many years, and are now seen with greater clarity in this report,” he said. “That clarity is perhaps the last warning we’re going to get before we actually have to report in the next I.P.C.C. review that we’re seeing the disaster unfolding.”

James L. Connaughton, the chairman of the White House Council on Environmental Quality, said some of

the findings in the report, particularly the prospect of intensifying coastal damage from rising seas, were “of high concern,” but noted the panel also foresaw benefits to agriculture in temperate regions as well.

Over all, he said, the analysis reinforced the need of industrialized countries to foster economic growth in developing countries and thus help them to reduce their vulnerability to climate shocks. He said billions of dollars were already flowing in development assistance.

Michael Oppenheimer, a climate scientist at Princeton and an author of the report, said it underlined the need to deal with climatic changes already under way.

“The actual outcome in terms of damages and ruined lives and costs depends heavily on the response — the response of individuals to deal with the changes and governments to organize and anticipate and deal with this in advance,” he said.

The meeting here dragged on in a marathon session Thursday night before Dr. Pachauri emerged midmorning on Friday and stood on a blue armchair in front of reporters to announce that agreement had been reached between scientists and government officials over the final details of a 21-page summary.

Under pressure from nations including Russia, China and Saudi Arabia, the authors said, sections on coral damage and tropical storms were softened in the summary. They also got the authors to drop parts of an illustration showing how different emissions policies might limit damage. Officials from those countries argued that data in the report did not support the level of certainty expressed in the final draft.

But some authors were not assuaged. The final document was “much less quantified and much vaguer and much less striking than it could have been,” said Stéphane Hallegatte, a participant from France’s International Center for Research on the Environment and Development.

Negotiations were also prolonged by European delegates’ demand that the final report reflect the need to cut back on greenhouse gases — and not just adapting to new conditions.

“Adaptation will only work if climate change is not too large and not too fast,” Mr. Hallegatte said.

Next month, the panel will release a report on options for limiting emissions of the greenhouse gases, and late in the year it will publish a final synthesis of its findings.

James Kanter reported from Brussels, and Andrew C. Revkin from New York.

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