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Science Panel Calls Global Warming 'Unequivocal'

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PARIS, Feb. 2 — In a grim and powerful assessment of the future of the planet, the leading international network of climate scientists has concluded for the first time that [global warming](#) is “unequivocal” and that human activity is the main driver, “very likely” causing most of the rise in temperatures since 1950.

They said the world was in for centuries of climbing temperatures, rising seas and shifting weather patterns — unavoidable results of the buildup of heat-trapping gases in the atmosphere.

But their report, released here on Friday by the Intergovernmental Panel on Climate Change, said warming and its harmful consequences could be substantially blunted by prompt action.

While the report provided scant new evidence of a climate apocalypse now, and while it expressly avoided recommending courses of action, officials from the [United Nations](#) agencies that created the panel in 1988 said it spoke of the urgent need to limit looming and momentous risks.

“In our daily lives we all respond urgently to dangers that are much less likely than climate change to affect the future of our children,” said Achim Steiner, executive director of the United Nations Environment Program, which administers the panel along with the World Meteorological Organization.

“Feb. 2 will be remembered as the date when uncertainty was removed as to whether humans had anything to do with climate change on this planet,” he went on. “The evidence is on the table.”

The report is the panel’s fourth assessment since 1990 on the causes and consequences of climate change, but it is the first in which the group asserts with near certainty — more than 90 percent confidence — that carbon dioxide and other greenhouse gases from human activities have been the main causes of warming in the past half century.

In its last report, in 2001, the panel, consisting of hundreds of scientists and reviewers, said the confidence level for its projections was “likely,” or 66 to 90 percent. That level has now been raised to “very likely,” better than 90 percent. Both reports are online at www.ipcc.ch.

The Bush administration, which until recently avoided directly accepting that humans were warming the planet in potentially harmful ways, embraced the findings, which had been approved by representatives from the United States and 112 other countries on Thursday night.

Administration officials asserted Friday that the United States had played a leading role in studying and combating climate change, in part by an investment of an average of almost \$5 billion a year for the past six years in research and tax incentives for new technologies.

At the same time, Secretary of Energy Samuel Bodman rejected the idea of unilateral limits on emissions. "We are a small contributor to the overall, when you look at the rest of the world, so it's really got to be a global solution," he said.

The United States, with about 5 percent of the world's population, contributes about a quarter of greenhouse gas emissions, more than any other country.

Democratic lawmakers quickly fired off a round of news releases using the report to bolster a fresh flock of proposed bills aimed at cutting emissions of greenhouse gases. Senator James M. Inhofe, the Oklahoma Republican who has called the idea of dangerous human-driven warming a hoax, issued a news release headed "Corruption of Science" that rejected the report as "a political document."

The new report says the global climate is likely to warm 3.5 to 8 degrees Fahrenheit if carbon dioxide concentrations in the atmosphere reach twice the levels of 1750, before the Industrial Revolution.

Many energy and environment experts see such a doubling, or worse, as a foregone conclusion after 2050 unless there is a prompt and sustained shift away from the 20th-century pattern of unfettered burning of coal and oil, the main sources of carbon dioxide, and an aggressive expansion of nonpolluting sources of energy.

And the report says there is a more than a 1-in-10 chance of much greater warming, a risk that many experts say is far too high to ignore.

Even a level of warming that falls in the middle of the group's range of projections would be likely to cause significant stress to ecosystems, according to many climate experts and biologists. And it would alter longstanding climate patterns that shape water supplies and agricultural production.

Moreover, the warming has set in motion a rise in global sea levels, the report says. It forecasts a rise of 7 to 23 inches by 2100 and concludes that seas will continue to rise for at least 1,000 years to come. By comparison, seas rose about 6 to 9 inches in the 20th century.

John P. Holdren, an energy and climate expert at [Harvard](#), said the report "powerfully underscores the need for a massive effort to slow the pace of global climatic disruption before intolerable consequences

become inevitable.”

“Since 2001, there has been a torrent of new scientific evidence on the magnitude, human origins and growing impacts of the climatic changes that are under way,” said Mr. Holdren, who is the president of the American Association for the Advancement of Science. “In overwhelming proportions, this evidence has been in the direction of showing faster change, more danger and greater confidence about the dominant role of fossil-fuel burning and tropical deforestation in causing the changes that are being observed.”

The conclusions came after a three-year review of hundreds of studies of past climate shifts; observations of retreating ice, warming and rising seas, and other changes around the planet; and a greatly expanded suite of supercomputer simulations used to test how the earth will respond to a growing blanket of gases that hold heat in the atmosphere.

The section released Friday was a 20-page summary for policymakers, which was approved early in the morning by teams of officials from more than 100 countries after three days and nights of wrangling over wording with the lead authors, all of whom are scientists.

It described far-flung ramifications for both humans and nature.

“It is very likely that hot extremes, heat waves and heavy precipitation events will continue to become more frequent,” said the summary.

Generally, the scientists said, more precipitation will fall at higher latitudes, which are also likely to see lengthened growing seasons. Semi-arid subtropical regions, already chronically plagued by drought, could have a further 20 percent drop in rainfall under the panel’s midrange outlook for increases in the greenhouse gases.

The summary added a new chemical consequence of the buildup of carbon dioxide to the list of mainly climatic and biological effects foreseen in its previous reports: a drop in the pH of seawater as oceans absorb billions of tons of carbon dioxide, which forms carbonic acid when partly dissolved. The ocean would stay alkaline, but marine biologists have said that a change in the direction of acidity could imperil some kinds of corals and plankton.

The report essentially caps a half-century-long effort to discern whether humans, through the buildup of carbon dioxide and other gases released mainly by burning fuels and forests, could influence the earth’s climate system in potentially momentous ways.

The group operates under the aegis of the United Nations and was chartered in 1988 — a year of record heat, burning forests and the first big headlines about global warming — to provide regular reviews of climate science to governments to inform policy choices.

Government officials are involved in shaping the summary of each report, but the scientist-authors, who are unpaid, have the final say over the thousands of pages in four underlying technical reports that will be completed and published later this year.

Big questions remain about the speed and extent of some impending changes, both because of uncertainty about future population and pollution trends and the complex interrelationships of the greenhouse emissions, clouds, dusty kinds of pollution, the oceans and earth's veneer of life, which both emits and soaks up carbon dioxide and other such gases.

But a broad array of scientists, including authors of the report and independent experts, said the latest analysis was the most sobering view yet of a century of transition — after thousands of years of relatively stable climate conditions — to a new norm of continual change.

Should greenhouse gases continue to accumulate in the atmosphere at even a moderate pace, average temperatures by the end of the century could match those last seen 125,000 years ago, in the previous warm spell between ice ages, the report said.

At that time, the panel said, sea levels were 12 to 20 feet higher than they are now. Much of that extra water is now trapped in the ice sheets of Greenland and Antarctica, which are eroding in some places.

The panel said there was no solid scientific understanding of how rapidly the vast stores of ice in polar regions will melt, so their estimates on new sea levels were based mainly on how much the warmed oceans will expand, and not on contributions from the melting of ice now on land.

Other scientists have recently reported evidence that the glaciers and ice sheets in the Arctic and Antarctic could flow seaward far more quickly than estimated in the past, and they have proposed that the risks to coastal areas could be much more imminent. But the climate change panel is forbidden by its charter to enter into speculation, and so could not include such possible instabilities in its assessment.

Michel Jarraud, the secretary general of the United Nations World Meteorological Organization, said the lack of clarity should offer no one comfort. "The speed with which melting ice sheets are raising sea levels is uncertain, but the report makes clear that sea levels will rise inexorably over the coming centuries," he said. "It is a question of when and how much, and not if."

The warming and other climate changes will be highly variable around the world, with the Arctic in particular seeing much higher temperatures, said Susan Solomon, the co-leader of the team writing the summary and the section of the panel's report on basic science. She is an atmospheric scientist for the National Oceanic and Atmospheric Administration.

The kinds of vulnerabilities are very much dependent on where you are, Dr. Solomon said in a telephone interview. "If you're living in parts of the tropics and they're getting drier and you're a farmer, there are some very acute issues associated with even small changes in rainfall — changes we're already seeing

are significant,” she said. “If you are an Inuit and you’re seeing your sea ice retreating already, that’s affecting your life style and culture.”

The 20-page summary is a sketch of the findings that are most germane to the public and world leaders.

The full report, thousands of pages of technical background, will be released in four sections through the year — the first on basic science, then sections on impacts and options for limiting emissions and limiting inevitable harms, and finally a synthesis of all of the findings near year’s end.

In a news conference in Paris, Dr. Solomon declined to provide her own views on how society should respond to the momentous changes projected in the study.

“I honestly believe that it would be a much better service for me to keep my personal opinions separate than what I can actually offer the world as a scientist,” she said. “My stepson, who is 29, has an utterly different view of risks than I do. People are going to have to make their own judgments.”

Some authors of the report said that no one could honestly point to any remaining uncertainties as justification for further delay.

“Policy makers paid us to do good science, and now we have very high scientific confidence in this work — this is real, this is real, this is real,” said Richard B. Alley, one of the lead authors and a professor at [Pennsylvania State University](#). “So now act, the ball’s back in your court.”

Elisabeth Rosenthal reported from Paris, and Andrew C. Revkin from New York. Felicity Barringer contributed reporting from Washington.

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