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NASA Study Predicts Warming Even With Emission Reductions

Warming trends could diminish if nations curb use of fossil fuels

A new study funded by the National Aeronautics and Space Administration (NASA) predicts that the world's climate will warm over the next 50 years regardless of whether nations soon curb their greenhouse gas emissions, such as carbon dioxide (CO₂) from the burning of fossil fuels.

A September 19 release says the study was based on the findings of a new computer climate model that used data from the last 50 years to project warming over the next 50 years. The research was a collaborative effort of 19 institutions, including universities, federal agencies and private industry.

The study found that global temperatures may increase by 1 to 2 degrees Celsius if no reductions in greenhouse gas emissions are made and they continue to increase at the current rate. But if the growth rate of carbon dioxide does not exceed its current rate and if the growth of true air pollutants – substances that are harmful to human health – is reversed, temperatures may rise by only 0.75 degrees Celsius.

"Some continued global warming will occur ... even if the greenhouse gases in the air do not increase further, but the warming could be much less than the worse case scenarios," said Jim Hansen, the study's lead researcher at NASA's Goddard Institute for Space Studies.

Hansen cautioned that the "alternative" scenario, in which air pollution is decreased and fossil fuel CO₂ emissions are stabilized, will not be easy to achieve. It requires that the world begin to reverse emissions of air pollutants such as soot, methane and carbon dioxide.

The study said achievement of stable CO₂ emissions is likely to require some combination of increased energy efficiencies, a growing role for renewable energies, capture and sequestration of CO₂ emissions, and/or increased use of nuclear power. It adds that all these possibilities are being addressed by the administration's National Climate Change Technology Initiative.

Researchers said the computer climate model, called GISS SI2000, also provided a convincing demonstration that the global temperature change of the past half century was a response to the release of greenhouse gases, such as carbon dioxide and methane, which trap the Earth's heat radiation as a blanket traps body heat.

Following is the text of the NASA release:

(begin text)

National Aeronautics and Space Administration Goddard Institute for Space Studies
September 19, 2002

CLIMATE CHANGE: 50 YEARS PAST AND POSSIBLE FUTURES

A new NASA-funded study used a computer climate model to simulate the last 50 years of climate changes, projects warming over the next 50 years regardless of whether or not nations curb their greenhouse gas (GHG) emissions soon. If no emission reductions are made and they continue to increase at the current rate, global temperatures may increase by 1-2° Celsius (1.8°-3.6° Fahrenheit). But if the growth rate of carbon dioxide does not exceed its current rate and if the growth of true air pollutants (things that are harmful to human health) is reversed, temperatures may rise by only 0.75C (1.35F).

"Some continued global warming will occur, probably about 0.5C (0.9F) even if the greenhouse gases in the air do not increase further, but the warming could be much less than the worst case scenarios," said Jim Hansen, lead researcher on the study from NASA's Goddard Institute for Space Studies (GISS), N.Y. This research was a collaborative effort of 19 institutions, including 7 universities, federal agencies, private industry and other NASA centers.

The GISS "SI2000" climate model provided a convincing demonstration that global temperature change of the past half-century is mainly a response to climate forcing agents, or imposed perturbations of the Earth's energy balance. This is especially true of human-made forcings, such as carbon dioxide and methane, which trap the Earth's heat radiation as a blanket traps body heat; thus they cause warming.

The computer model's ability to simulate the past 50 years of global temperature change provided confidence in understanding the causes behind climate changes that have occurred over that time period. The sensitivity of the "SI2000" model to a climate forcing is comparable to that of other climate computer models. Model results from 1951-2000 are in close agreement with observed changes; the surface has warmed by about .5°C (0.9°F) while the upper atmosphere (10-15 mile altitudes) has cooled by about 1°C (1.8°F).

The climate model was then used to simulate global temperature change during the next 50 years, under two contrasting assumptions for future growth of human-made forcings.

The first assumption for the emissions of GHGs is the "business-as-usual" scenario where GHGs continue to increase rapidly. This scenario leads to an accelerating rate of global warming, raising global temperature to levels that have not existed during the past several hundred thousand years.

In the "alternative" scenario, in which air pollution is decreased and fossil fuel CO₂ emissions are stabilized, further global warming is limited to 0.75°C (1.35°F) in the next 50 years. Hansen cautioned that the 'alternative' scenario will not be easy to achieve. It requires that the world begin to reverse the growth of true air pollution (especially 'soot' and the gases that control surface ozone, including methane) and also that we flatten out and eventually begin to decrease CO₂ emissions.

The climate forcing agents that Hansen and his co-authors include in their climate simulations are: (1) long-lived greenhouse gases such as carbon dioxide, methane and the chlorofluorocarbons; (2) stratospheric aerosols (fine particles) from volcanic eruptions; (3) variations in the Sun's energy indicated by sunspots; (4) ozone changes - both at the surface (a pollutant) and upper atmosphere (protects from the Sun's ultraviolet rays); (5) stratospheric water vapor and; (6) tropospheric air pollution aerosols, including black and organic carbon (soot) and sulfates.

Achievement of stable CO₂ emissions, as required in the alternative scenario that yields minimal climate change, it is likely to require some combination of increased energy efficiencies, a growing role for renewable energies, capture and sequestration

of CO2 emissions, and/or increased use of nuclear power. All of these possibilities are being addressed by the National Climate Change Technology Initiative.

"Decision-makers, including the public, may need to consider all of these options as climate change becomes more apparent and as our understanding of the climate forcing agents improves," Hansen said. "Halting and reversing the growth of air pollution is possible with existing and developing technologies. It would have other benefits, especially for human health and agricultural productivity."

This research was funded by NASA, and appears in the next issue of the Journal of Geophysical Research --Atmospheres.

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