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CLIMATE MODELS: ISSUES AND CHALLENGES

The views of the Global Climate Coalition

SCIENCE: "The observation, identification, description, experimental investigation, and theoretical explanation of phenomena." The science of climate change is in its infancy.

Computer climate models are the primary tools employed to measure the complex variables that constitute the earth's climate system and to estimate the impact of these variables on climatic change. They are imperfect at best and have produced highly inaccurate projections of climate change.

Climate models consist of mathematical equations designed to simulate climate processes. A model incorporating every possible climate variable would be too complex to run on even the most advanced computer. Adjusting for this level of complexity calls for the use of a variety of simplifications, approximations and assumptions in the models.

Gerald Meehl of the National Center for Atmospheric Research described the difficulty of creating accurate climate models this way: "You can put...components [of climate] together if you have a lot of computing power, but we know from our own experience with ocean, atmosphere, and ice components that it's a major step from components to having it look like the planet Earth."

These challenges are echoed by an international panel of climate experts assembled by the United Nations. According to the Intergovernmental Panel on Climate Change (IPCC):

"The current generation of models are simplistic and are poor representations of dynamic processes. The effect of climate change adaptation in particular is poorly understood." (WGIII, FSM, section 6.5.2.5)

"GCM [Global Circulation Models] outputs, though physically plausible, often fail to reproduce even the seasonal pattern of present-day climate observed at a regional scale. This naturally casts some doubt on the ability of GCMs to provide accurate estimates of future regional climate. Thus



GCM outputs should be treated, at best, as broad-scale sets of possible future climatic conditions and should not be regarded as predictions." (WGII FSM (Chapter 26, Technical Guidelines), section 6.5.3)

Weaknesses in the climate models have led to inaccurate forecasts predicting that increases in greenhouse gases would bring a relatively rapid warming trend across the globe, on the order of 0.3 degrees Celsius to 0.5 degrees Celsius during the past 15 years. Highly accurate satellite temperature readings analyzed by the National Aeronautics and Space Administration (NASA) indicate that the observed warming trend is within the range of natural variation and that the computer models are overestimating global warming trends by as much as 400%.

Also, according to some computer simulations of the greenhouse effect, the average temperature in the United States should have increased by approximately 1.5 degrees Celsius during the past 100 years. Information collected by the National Climatic Data Center shows no significant warming in the U.S.

As for the future, according to the IPCC, much work remains to be done before the predictive capacity of computer climate models can be reliably used by policy makers.

"It is worth noting here that while predictive models offer the most promising means of obtaining estimates of possible future impacts of climate change, in some sectors these are not yet sufficiently developed to be used for this purpose. Where the systems are complex and/or poorly understood (e.g., marine ecosystems), considerable efforts are still required to obtain an understanding even of variations in the present-day system. Only after such basic research is completed can meaningful projections be made in the future." (WGII FSM (Chapter 26, Technical Guidelines), section 5.3)

Currently no science exists to accurately forecast long-term climate change. Using the computer models to provide one layer of insight into the study of climate change—while monitoring the more accurate satellite measurement systems—and continually striving for improvement in the field of computer climate modeling, are responsible ways to narrow uncertainties in forecasting to better understand our variable weather. In the meantime, policy makers should recognize that current GCM projections cannot provide reliable information for policy purposes.

The Global Climate Coalition is an organization of business trade associations and private companies established in 1989 to coordinate business participation in the scientific and policy debate on global climate change.

WGI, WGII, WGIII = IPCC Working Groups One, Two and Three.

FSM = Full Supporting Material, the peer reviewed portion of IPCC's work.

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