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# Climate Models: How Certain are their Projections of Future Climate Change?

**USGCRP Seminar, 12 June 1995**

*How Are Climate Models Constructed and Tested?  
How Have Climate Models Advanced Our  
Understanding of the Climate System and of  
Potential Climate Change?*

**SPEAKER:** Dr. Eric J. Barron, Pennsylvania State University, College Park, PA

**INTRODUCTION:** Dr. Michael C. MacCracken, Director, Office of the U.S. Global Change Research Program

**TIME & LOCATION:** Mon., June 12, 1995, 3:15pm - 4:45pm, Rayburn House Office Bldg., Room B369 - RECEPTION FOLLOWING

## OVERVIEW

In a recent USGCRP-sponsored forum to evaluate the results of model simulations of climate change, a cross-section of leading climate and Earth system modelers and skeptics considered what is known with certainty, what is known with less certainty, and what remains uncertain. Following an introduction to what models are by Dr. Michael MacCracken, Dr. Eric Barron will describe the results of the forum's conclusions.

What is certain from observations is that the concentrations of atmospheric greenhouse gases such as carbon dioxide are increasing due to human activities. These higher levels will increase further and persist for centuries.

Projecting the future climatic effects of these increases requires models. The level of confidence in the results of thus depends on how well the climate system can be represented in the models. These models indicate that it is quite probable that the globally-averaged surface temperature will increase by about 2-4 degrees Fahrenheit (1-2 degrees Celsius) by 2050, assuming there are no significant actions to reduce emissions and no unusually large natural variations of the climate.

Along with the warming it is very likely that global mean precipitation will increase, that arctic sea ice extent will be reduced and adjacent areas will experience wintertime warming, and that global sea-level will rise at an increasing rate. Probable outcomes include: increasing summertime dryness in the Northern Hemisphere mid-latitudes, an increase in high-latitude precipitation, and occasional cooling episodes due to sporadic volcanic eruptions such as Mt. Pinatubo in 1991.

Models cannot yet tell us with confidence whether there will be changes in the day-to-day, month-to-month, or year-to-year variability or what such changes might be. While regional changes will be different than the latitudinal average changes, models also cannot yet estimate what these regional departures will be nor can they tell us whether there might be changes in tropical storm intensity. Other important details also remain uncertain, awaiting further improvements in climate models and in the understanding of fundamental processes.

## Biography of Dr. Eric J. Barron

Dr. Barron is Professor of Geosciences and Director of the Earth System Science Center at Pennsylvania State University in College Park PA. He also serves as chair of the Climate Research Committee of the National Research Council, chair

of the National Science Foundation Advisory Committee on Earth System History, and editor of Global and Planetary Change. Dr. Barron has degrees in geology from Florida State University and in oceanography and climate from the Rosenstiel School of Marine and Atmospheric Sciences at the University of Miami. He has been awarded the Smith Prize (University of Miami), the Wilson Research Award and the Provost's Award for Innovation in Teaching (PSU), and is a fellow of the American Geophysical Union. Dr. Barron served as Chair of the U. S. Global Change Research Program's Forum on Global Change Modeling held in October 1994.

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#### **Biography of Dr. Michael C. MacCracken**

Dr. MacCracken is on assignment from the National Science Foundation as director of the interagency coordinating office of the U. S. Global Change Research Program. Prior to assuming this position in 1993, Dr. MacCracken was leader of the Global Climate Research and Atmospheric and Geophysical Sciences divisions at the Lawrence Livermore National Laboratory in Livermore CA. His research involved use of climate models to study the climatic effects of volcanic eruptions, greenhouse gases, and smoke from fires ignited by a nuclear exchange. Dr. MacCracken is chair-elect of the Atmospheric and Hydrospheric Sciences section of the American Association for the Advancement of Science and has served as chair of the American Meteorological Society's Committee on Climate Variations. Dr. MacCracken has degrees in engineering from Princeton University and applied science from the University of California, Davis.