

Modeling and Data Syntheses of Past Climates

Paleoclimate Modelling Intercomparison Project Phase II Workshop; Estes Park, Colorado, 15–19 September 2008

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The Paleoclimate Modelling Intercomparison Project (PMIP) is a long-standing initiative that provides coordinated paleoclimate modeling and data activities to facilitate valuable discoveries on the mechanisms of climate change. At its recent workshop in Colorado, sponsored by the U.S. National Science Foundation, the U.S. National Oceanic and Atmospheric Administration, and International Geosphere-Biosphere Program Past Global Changes, more than 70 scientists met to review past successes and discuss future efforts. Participants included atmospheric scientists, oceanographers, and paleoclimatologists from the data and modeling communities.

The climate from the mid-Holocene (~6000 years before present) and the Last Glacial Maximum (LGM; ~21,000 years before present) have been the focus of PMIP and are recognized as benchmark periods for climate models. For the past 5 years, 12 modeling groups have participated in simulations of these time periods with ocean-atmosphere or ocean-atmosphere-vegetation models (PMIP 2). Several hundred scientists were involved in running and analyzing the simulations, in producing paleo data sets for model evaluation, and in model-model and model-data comparisons. The LGM simulation was

conceived as an experiment to examine the climate response to the presence of large ice sheets and low greenhouse gas concentrations, and the mid-Holocene simulation was designed to examine the climate response to a change in the distribution of incoming solar radiation caused by known changes in orbital forcing.

PMIP results presented at the workshop demonstrated that models that are capable of adequately reproducing modern and historical climates nevertheless can fail to reproduce observed changes in the past. For example, PMIP 2 models give similar and realistic simulations of modern Atlantic Ocean thermohaline circulation, but some give much different realizations for thermohaline circulation during the LGM in comparison with interpretations from paleoclimate data proxies. New results were also shown that improved on the methods of reconstructing climate parameters from paleoclimate proxies. These new strategies, which use pollen assemblages with inverse vegetation modeling that accounts for the known carbon dioxide decrease at LGM, have resulted in much better agreement between simulated and observed LGM winter cooling over western Europe and the Mediterranean area.

PMIP results have been used extensively in the last two Intergovernmental Panel on Climate Change assessments. An outcome

of the workshop was the identification of key climate targets for PMIP 3 model simulations and data synthesis that can help reduce uncertainties in future climate projections. It was proposed that a very high priority for international modeling groups participating in Phase 5 of the Coupled Model Intercomparison Project (CMIP-5) of the World Climate Research Program's Working Group on Coupled Modelling (WGCM) should be to perform simulations for mid-Holocene and LGM with the same model components and at the same resolution as the projections of future climate. The workshop participants identified several additional coordinated experiments of high priority, including modeling the last millennium, the mid-Pliocene (~3 million years ago), and the last interglacial (~125,000 years ago). Working groups have also been established for studying the transient behavior of the Earth system of the past 21,000 years. PMIP 3 will continue to provide a forum for modelers and observationalists to discuss experiments for other past time periods.

For further information on the meeting, please visit <http://www.cgd.ucar.edu/ccr/paleo/pmip2/workshop.html>.

—BETTE L. OTTO-BLIESNER, National Center for Atmospheric Research, Boulder, Colo.; E-mail: ottobli@ucar.edu; SYLVIE JOUSSAUME and PASCALE BRACONNOT, Laboratoire des Sciences du Climat et l'Environnement, Gif-sur-Yvette, France; SANDY P. HARRISON, University of Bristol, Bristol, UK; and AYAKO ABE-OUCHI, University of Tokyo, Tokyo, Japan