PMIP2 Workshop

Estes Park, USA, 15-19 September 2008

Bette L. Otto-Bliesner[1], S. Joussaume[2], S.P. Harrison[3], A. Abe-Ouchi[4] and P. Braconnot[2]

[1]Climate and Global Dynamics Division, National Center for Atmospheric Research, Boulder, USA; ottobli@ucar.edu
[2]Laboratory for Climate and Environment Sciences, Gif-sur-Yvette, France; [3]School of Geographical Sciences, University of Bristol, UK; [4]Center for Climate System Research, University of Tokyo, Japan

The Palaeoclimate Modelling Intercomparison Project (PMIP) is a long-standing initiative endorsed by both WCRP/CLIVAR/WGCM and PAGES. It has provided an efficient mechanism for coordinating paleoclimate modeling activities. These activities provide valuable information on the mechanisms of climate change, the identification of key feedbacks operating in the climate system and, through model evaluation, the capability of climate models to reproduce climates different from today. Thanks to the production of data syntheses and to rigorous model-data comparisons, the mid-Holocene climate (ca. 6 kyr BP) and the Last Glacial Maximum (LGM; ca. 21 kyr BP) are now recognized as benchmark periods for climate models.

Drawing on its past experience, PMIP will continue to combine simulations made with climate models and paleoenvironmental data syntheses. At its recent workshop in Estes Park, USA, over 70 scientists, including atmospheric scientists, oceanographers, and paleoclimatologists from the data and modeling communities, met to review past successes and discuss future efforts. The first day of the workshop focused on the analyses by PMIP2 subprojects of the coupled atmosphere-ocean and atmosphere-ocean-vegetation model simulations for the LGM and mid-Holocene, and the evaluation of these results using new and existing data syntheses (Fig. 1).

The workshop participants then concentrated on the science and implementation plans for the four new priority themes of PMIP Phase 3: 1) Evaluation of Earth System Models for mid-Holocene and LGM, 2) Interglacials and warm periods, with emphasis on the last interglacial, the mid-Pliocene, and last millennium, 3) Abrupt climate changes, particularly the last deglaciation and thresholds in the hydrologic cycle, and 4) Characterization and understanding of uncertainties. An outcome of the workshop was the identification of key climate targets for model simulations and data synthesis that could help reduce uncertainties in future climate projections. The workshop participants adopted a set of coordinated climate model experiments of past time periods that will become the basis for future internationally mandated assessments of climate science (e.g., the IPCC's AR5, scheduled to be published in early 2013).

It was proposed that a high priority for international modeling groups participating in the Coupled Model Intercomparison Project CMIP5 of the WCRP's Working Group on Coupled Modelling (WGCM) was to perform mid-Holocene and LGM simulations with the same model components and at the same resolution as the preindustrial and future projection simulations. The mid-Holocene experiment evaluates responses of the monsoons to vegetation feedbacks and patterns of ocean warming, as well as high latitude to poleward expansion of boreal forests. The LGM experiment considers the sensitivity of tropical oceans and continents to lowered CO_2, and improves our understanding of feedbacks between sea ice and ocean thermohaline circulation.

The workshop participants identified several additional coordinated experiments of priority, though it was recognized that these might be run with different model components and resolutions than CMIP5. The experiments proposed are the last millennium, for detection and attribution studies of decadal to centennial climate variability; the mid-Pliocene, an equilibrium world of 400 ppm CO_2 and reduced Greenland and Antarctic ice sheets; and the last interglacial, with Arctic summer warmth comparable to projections at the end of this century. The last interglacial experiment is also relevant for coupled climate-ice sheet models, to assess the stability of the polar ice sheets and sea level rise. PMIP3 will continue to provide a forum for modelers and observationalists to discuss experiments for other past time periods. Working groups have been established to study the transient behavior of the Earth System during deglaciation and the 8.2-kyr event.

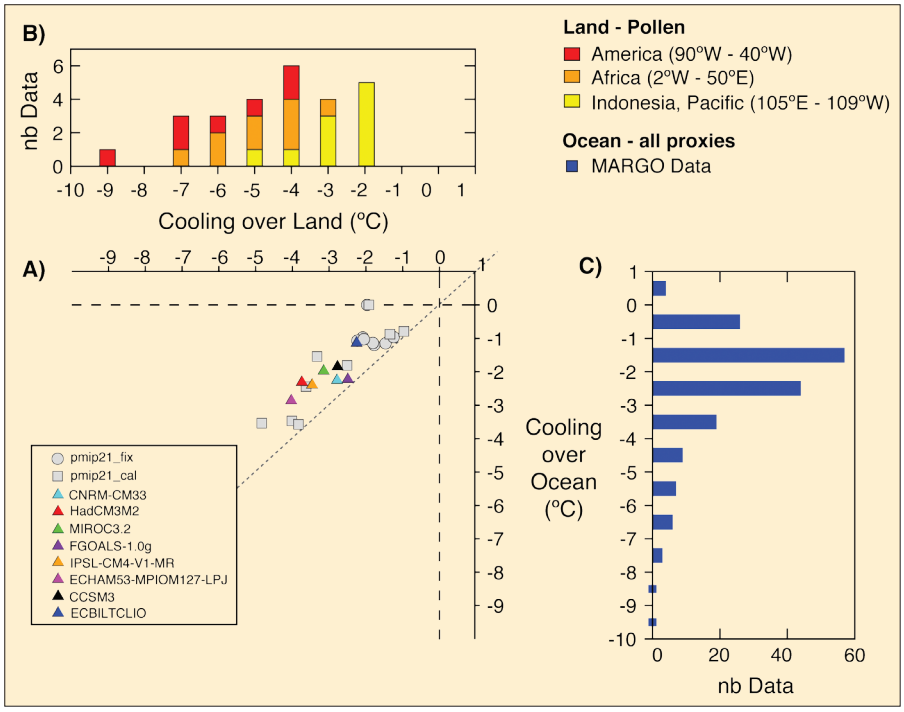

*Figure 1: Comparison between model results and paleodata of annual mean tropical cooling (°C) at the LGM. **A**) Simulated surface air temperature changes over land, displayed as a function of surface air temperature changes over the oceans, both averaged in the 30°S to 30°N latitudinal band, for the PMIP1 simulations (gray) and all the PMIP2 OA simulations (color). In comparison to the PMIP1 models, the PMIP2 models include a fully predictive 3D ocean (for details on model abbreviations used see Braconnot et al., 2007). The comparison with paleodata uses two reconstructions: **B**) Distribution of temperature change over land, estimated from various pollen data (Farrera et al., 1999); **C**) Distribution of sea surface temperature change estimated from Multiproxy Approach for the Reconstruction of the Glacial Ocean surface (MARGO; http://margo.pangaea.de/). Note, "nb data" is the number of data points for each temperature change. Figure courtesy of M. Kageyama.*

Subgroups have been organized to provide the model simulation design and identify the relevant datasets for the PMIP3 coordinated experiments. For further information, see http://pmip2.lsce.ipsl.fr/

Acknowledgements

The workshop was sponsored by PAGES and the U.S. National Science Foundation and National Oceanic and Atmospheric Administration.

References

Braconnot, P., et al., 2007: Results of PMIP2 Coupled Simulations of the Mid-Holocene and Last Glacial Maximum - Part 1: Experiments and Large-Scale Features, *Climate of the Past*, **3**: 261-277.

Farrera, I., et al., 1999: Tropical climates at the Last Glacial Maximum: a new synthesis of terrestrial palaeoclimate data. I. Vegetation, lake-levels and geochemistry, *Climate Dynamics*, **15**: 823-856.