ThePaleoclimateModellingIntercomparisonProject(PMIP)isalong-standing
initiativeendorsedbyboththeWCRP/CLIVAR(WorldClimateResearchProgramme/
ClimateVariabilityandPredictability)WorkingGrouponCoupledModelling
(WGCM)andPAGES.Ithasprovidedanefficientmechanismforcoodinatingpaleo-
climate modeling activities, which provide valuable information on the mechanisms of
climatchange, the identification of key feedbacks operating in the climate
system, and 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 (ca. 6 kyr BP) and the Last Glacial Maximum
(LGM; ca. 21 kyr BP) are now recognized as benchmark periods for climate models.
Although the main focus is on model-model intercomparison and evaluation, PMIP has
acted as an important discussion forum, promoting the understanding of past cli-
mate changes as a necessary basis for confidence in future predictions. As a result,
PMIP has contributed significantly to the last two IPCC assessments.

In the last 10 years, climate models have moved from atmosphere-only to
coupledocean-atmosphere models and ocean-atmosphere-vegetation models.
Models that include the coupling between the physical climate and biogeochemical
cycles, such as the carbon cycle, have also been developed. These couplings, and the
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PMIP (Paleoclimate Modelling Intercomparison Project)
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Forfullreferencepleaseconsult:
www.pages-ijop.org/products/newsletter/edObII_2.html

PMIP has evolved to become a source of
data and information for specific themes,
such as drought and abrupt climate
change PANGAEA® has “special emphasis on environmental, marine and geological
basic research”, with the potent notion of
being an exemplary publication and li-
brary system for scientific, geo-referenced
data. Whether you prefer the one or the
other World Data Centre may depend on your
personal needs, or your fondness for
(1) more focused data collections (WDC-
Paleoclimatology), or (2) data mining in a
billion data points warehouse (PANGAEA®/
WDC-MARE).

To realize the digital library-of-data
concept, data sets are perceived as data
entities. A data entity consists of meta-
information and data. Meta-information
is any information describing a data set.
Data is the pure, primary scientific in-
formation, which can be numbers, text,
graphics, logging, audio and video re-
cording and reproduction, etc. Where a
dendrochronological record provides a
few bytes of data only, CTD profiles can
deliver some kilobytes of data, and sat-
ellite information measure beyond the
megabyte border. Whether a single data
point is recorded or a gigabyte mass
data stream, it is not size that matters. It
is rather the data set’s scientific value and
its unconfined availability (cf., panFMP,
Schindler and Diesenbroek, 2008), and
the standard assignment of one unique
persistent, bibliographic identifier per
data set to turn a plain data set into an
autonomous data publication, cross-refer-
ced with its original scientific paper.
Data archiving is carried out in close co-
ordination with the principal investigator.
Owing to networking with other systems,
database contents can be tracked down
by means of search engines, portals, and
online library catalogs. The technique of
data citation gives a strong motivation for
scientists to publish their data, which in
the long range will improve data quality
and availability.

Some data publications relate to indi-
vidual papers or studies, while others are
rather the data set’s scientific value and
its unconfined availability. They are required to enable un-
known
them have already produced publications
for their unusual content. Müller et al. (2005) have archived harmonic
tremor signals of the so-called ‘singing iceberg’.

Paleo data give us the window on the
past. Beyond their presentation in indi-
individual publications, paleo data form a
rich tapestry of the four-dimensions we
inhabit (time, latitude, longitude, and el-
vation). They tell us when, for how long,
and for what reasons, the climate has
changed. Digital data libraries make it all
possible.

Role of the different feedbacks using these
coupled models (Harrison et al., 2002; Cru-
cièf et al., 2005).

All the information to run a PMIP2
simulation is available on the PMIP2 web-
site (http://pmip2.lsce.ipsl.fr/; see Bracon-
not et al., 2007 for an overview). Model
results are stored in a common database
hosted at LSCE on raid disks and the data
is distributed through a Linux file server.
Guidelines, file format convention, vari-
able names and structures, and utilities fol-
low the requirements of the WCRP CMIP3
multi-model dataset. Participation in PMIP
analyses is an open process. About 80 sub-
projects are now registered and most of
them have already produced publications
in high-level international journals (see,
e.g., Fig. 1, and Otto-Bliesner and Brady,
p. 18-20 this issue). Several data syntheses
have also been released through the web-
site, as well as a subset of maps showing

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results of the different models. Systematic model-data comparisons are a key element of the program. PMIP will continue to foster the development of improved methods of reconstructing climate parameters from paleo-observations, and of rigorous statistical approaches for comparing simulated and observed climates. This will ensure that these comparisons focus on appropriate variables and scales.

PMIP is now also interested in new periods, such as the early Holocene and the last glacial inception, and in new topics, such as “water-hosing experiments” (testing the sensitivity of the Atlantic meridional overturning to surface water flux forcing). State-of-the-art models can now be used to examine changes in short-term climate variability and in climate extremes, such as droughts or storms. PMIP has also started to promote the development of “forward models” for use in model evaluation and, increasingly, for coupling directly within a climate-model framework. These new challenges will require new data syntheses, including syntheses of high-resolution indicators.

PMIP has developed a new Science and Implementation Plan to help prepare for the next IPCC assessment. The plan (available from the PMIP2 website) is structured around four themes: 1) evaluation of Earth System models for 6 kyr BP and LGM, 2) interglacials and warm periods, 3) abrupt climate change, and 4) measures of model skill in simulating palaeoclimate conditions. Details will be discussed at the next PMIP2 workshop (14-19 Sept 2008, Colorado, USA). This workshop will also showcase ongoing sub-projects and explore linkages between climate and environmental studies.

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An overview of some current CLIVAR modeling activities

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Modeling activities form a key component of CLIVAR, the World Climate Research Programme’s Climate Variability and Predictability Project. From the global modeling perspective, these activities are carried out and coordinated through the joint WCRP/CLIVAR Working Group on Coupled Modelling (WGCM) and the CLIVAR Working Groups on Ocean Model Development (WGOMD) and on Seasonal to Interannual prediction (WGSIP). A key task for all of these groups is to maintain an oversight, and encourage developments in the component and coupled models needed for climate prediction (e.g., see Fig. 1). CLIVAR’s regional monsoon and ocean basin panels also have modeling foci, often linked to results from CLIVAR-sponsored field programs such as the North American Monsoon Experiment (2004) or the current Tropical Atlantic Climate Experiment (2006-10), which has brought improved coverage of surface and subsurface data and dedicated process studies in the eastern tropical Atlantic. In addition, CLIVAR’s Global Synthesis and Observation Panel (GSOP) has a key activity to inter-compare the outputs of current global ocean synthesis efforts that use data assimilation of the historical dataset of ocean observations to produce consistent ocean analyses.

An important activity for the WGCM has been the coordination, under the Coupled Model Intercomparison project (CMIP-3), of the global coupled climate

Figure 1: Biome and precipitation changes in Africa for the mid-Holocene. a) Biome distribution during the mid-Holocene. b) Zonal mean biome distribution for mid-Holocene (6kyr) and pre-industrial (0kyr) periods, and c) change in annual mean precipitation (mm/yr) as simulated by the PMIP1 atmosphere alone models (red) and the PMIP2 coupled ocean-atmosphere models (black dashed). The model envelope is the range of precipitation covering 50% of the simulations around the median simulation. Blue band indicates the amount of precipitation that would be needed to replace modern desert by steppe. d) Ensemble mean change of annual mean precipitation (mm/yr) estimated from PMIP2 coupled ocean-atmosphere simulations. These figures show that PMIP2 coupled simulations are in better agreement with data than PMIP1 atmosphere alone simulations but that they still fail to produce enough precipitation to sustain steppe as far as 23°N, as suggested by pollen data. These figures are adapted from Jolly et al., 1998, Joussaume et al., 1999 and Braconnot et al., 2007.