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PMIP3 in brief

- Currently: 21 modelling groups, 26 models
- PMIP3-CMIP5 simulations (# in CMIP db/# final number in CMIP/PMIP db):
  last millenium (8/15), mid-Holocene (13/21), Last Glacial Maximum (8/15)
- PMIP3 non CMIP5 simulations:
  last interglacial, Mid Pliocene, ...
- Scientific discussions organised with 11 working groups:
  - 5 on specific periods: past 2 millenia, Quaternary Interglacials, Mid-Pliocene, Pre-Pliocene climates, Last Glacial Maximum (ice-sheet uncertainties)
  - 3 on model-data comparison or proxy-modelling: isotopic modelling, paleo-data assimilation, ocean model-data comparison, benchmarking
  - 2 cross-cutting across periods: past2future, variability
### Periods and Main Forcing(s)

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<tr>
<th>Period</th>
<th>Main forcing(s)</th>
<th>Scientific interest</th>
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| Last Millenium                 | • Solar variability  
   • Volcanic activity                                                        | • Natural climatic variability  
   • Sensitivity to volcanic and solar forcings                                   |
| Mid-Holocene (6000 years ago)  | • Insolation  
   (amplification of seasonal cycle in northern hemisphere)                    | • Changes in hydrological cycle (e.g. monsoons)  
   • Changes in variability (e.g. ENSO)                                           |
| Last Glacial Maximum (21,000 years ago) | • Lower CO2 (and other GHG)  
   • Northern hemisphere ice-sheets                                                | • Climate changes comparable to predicted future climate changes in amplitude  
   • Potential constraints on climate sensitivity                                 |

*All three periods are well documented, with strong chronological constraints*
Contribution to AR5

- 6 figures in paleoclimate chapter, 4 in evaluation chapter
- PMIP-CMIP and PMIP-non-CMIP simulations

WGCM17 - October 2013
PMIP-CMIP papers

- Officially in CMIP5 publication database:
  - 14 under « Paleoclimate » keyword
  - 12 for « lgm » experiment, 9 for midHolocene, 5 for past1000

- But there are more papers
  - Climate of the Past Special Issue on « Progress in Paleoclimate Modelling »
  - Wider search (ISI web of science, citeulike) gives ~32 papers + a number in discussions in EGU journals + some « regional » reports
  - Generally, « climate/paleoclimate papers » but 6 papers on impact on regional vegetation (Brazil)
  - A few papers from authors outside PMIP community

- Grand Challlenges will be a good opportunity to share paleodata/paleoclimate simulation analyses with people from outside the paleo community
Example 1: deep ocean LGM

Fig 9.18 from IPCC AR5
Example 2: $\Delta$precip vs $\Delta$temperature

Figure 2. The change in precipitation (%) as a function of the change in global temperature (°C) as simulated by each of the six CMIP5 models (IPSL-CM5A-LR, MPI-ESM-P, MIROC-ESM, CCSM4, MRI-CGCM3, and GISS-E2-R) at the Last Glacial Maximum (LGM), from the historical run (average for period 1979–2005 CE), the 1% CO$_2$ run (1pctCO$_2$, average for model years 86–115), and the 4xCO$_2$ run. The left-hand plot shows the global relationship, while the right-hand plots show the change in global precipitation (%) over (red) land and (blue) ocean as a function of the change in global land and ocean temperature (°C).
Summary of CMIP5 survey

- Real added value of having the same model versions used for past, present and future simulations
- Real added value of having all data on same « archive » system, including « PMIP3 but not CMIP5 » runs (although this was a little hard to achieve + some groups couldn’t have access to some nodes « because they were not CMIP5 »)
- Next time, need to be more careful about transition between past1000 and historical (in terms of forcing)
- Simulations with carbon cycle included interesting for comparing to data (e.g. ocean biogeochemistry)

→ A wealth of results which have just started to be analysed

- Need more time for analyses
  - In particular, need to get more « non paleo » groups involved in the analyses
Thoughts for CMIP6 -1

- Great benefit of running same models for all time periods, past, present & future → we should keep this approach
- For better comparison of past vs future climates, we would need one stabilized scenario (e.g. 4xCO2, for several hundred years). This would also be useful for studying changes in variability.
- Need to improve quantification of the forcings and their impact for each period and compare to forcings for other periods/future climate
  Sensitivity experiments to be designed in coordination with other MIPS: e.g. AMIP runs → AMIP4xCO2,
  but also AMIP_lgmCO2, AMIP_midHolocene insolation
Thoughts for CMIP6 -2

- New/interactive components?
  Vegetation (fully dynamical), aerosols, ice-sheets, « proxy modelling »
  → Discussion at next PMIP meeting

- Regional modelling:
  Interesting for model-data comparisons, already used to compute impact
  of climate change on paleo-environments and early humans
  → to be coordinated with CORDEX activities?

- New periods:
  Mid-Pliocene? Last Interglacial ?
  → to be discussed next May in PMIP3 general meeting
Thoughts for CMIP6 – contributions from paleo-modelling

- Evaluation: Climate sensitivity, benchmarking (including by modelling paleoclimate proxies) → link with future climate prediction
- Evaluation/understanding: hydrological cycle changes w.r.t temperature/circulation changes
- Evaluation/understanding: carbon cycle (proxies + feedbacks)
- Better quantification of the forcings/feedbacks via sensitivity experiments.
  - « new » feedbacks from components added in ESMs
  - Sensitivity experiments, to be coordinated with those run for other MIPs

→ Questions addressed in nearly all other MIPs are valid for paleoclimate simulations too.
Upcoming events

- Main PMIP plans to be discussed at next PMIP meeting in Namur (Belgium) in May 2014
- Workshops until then:
  - Last millenium: Madrid, November 2013
  - COMPARE (ocean model-data comparisons): Corvallis, December 2013
  - PaleoVar, February 2014
  - Grand Challenge on clouds, circulation, climate sensitivity, March 2014