PMIP4 Papers

There are many researchers involved with PMIP4, so we expect that there will be many papers associated with it. There is no desire for PMIP to restrict or proscribe the manuscripts that researchers work upon. However there is clearly a role for some synthesis across various PMIP4 which may need a bit of coordination and support. Functionally we see that there is a pyramid of research activities with 3 different tiers of synthesis and coordination needed.

1. The lowest tier is individual authors or modelling research groups writing manuscripts focussing specifically on what interests them within particular model runs. Involvement from the wider PMIP4 community will probably only slow down the creation these mansucripts
2. The second tier consists of papers that look at aspects of climate across multiple models within a specific time period. The initial papers in this category are likely coordinated by the relevant working group - to ensure both that the whole community is invovled and that the paper is completed fairly quickly.
3. The third tier is research that looks at multiple models across multiple time periods. The first one or two manuscripts at this level will be coordinated to provide an initial synthesis of PMIP4. Once all the data is uploaded onto the ESGF, we hope that further research teams self-organise around interesting topics. The PMIP4 leadership can assist with this, if the authors request help.

Note for proper assessment in IPCC AR6 papers should be submitted by September 2019, and certainly no later than the end of December 2019 to allow for citation in IPCC AR6.

Tier 2 & 3 Papers (planned for Dec 2019)

Experiment(s)	**Subject**	**Contact**	**Working Group**	**Notes**
lig127k & midHolocene	Interglacial warmth	Bette Otto-Bleisner	QUIGS	*meeting in July to write*
midPliocene-eoi400	Large-scale features	Alan Haywood (Leeds)	PlioMIP	*1st from PlioMIP2 plans*
midPliocene-eoi400	Vegetation/climate interactions	Qiong Zhang (Stockholm)	PlioMIP	*2nd from PlioMIP2 plans*
lgm	Global patterns and Benchmarking	Sandy Harrison & Masa Kageyama	Data	*using doi.org/10.17864/1947.197*
midHolocene	bnechmarking	Sandy Harrison	Data	-
past1000	*sufficient simulations unlikely*	-	-	-

Planned P2FVar Analyses

There were several collaborations that emerged during the UCL Workshop (May 2019). Briefly these were:

1. **How do the dynamics of the monsoons change throughout the Holocene?** This will mainly analyse Holocene transient simulations coming out of France and Germany, and compare them to proxy records (mainly speleothems). There was a focus on low-frequency variability. This effort is closely connected to the PACMEDY consortium, and lead by Roberta D'Agostino.
2. **Methodological developments for emergent constraints**. Thinking about priors for Bayesian analysis. This effort was spearheded by Stockholm in combination with BlueSkiesResearch. It's unclear whether there will be sufficient LGM or Pliocene runs ready in time to provide an updated climate sensitivity estimate.
3. **Transient behaviour of AMOC**. This group had two possible foci, the last millennium simulations or other Holocene transient runs. There is so far no multi-model paper focused on AMOC behaviour in all the past1000 runs. Elements of this research have been published elsewhere though (say in single model papers) and there are data availability issues. A paper comparing transient runs performed outside of PMIP to proxy data shall be worked on (led by UCL with MPI and IPSL involved).
4. **Local, interannual variability**. This built on some work by Chris and Kira analysing changes in interannual variability across PMIP3 simulations. An additional stream of analysis showed that the modes of climate variability appear fairly consistent across multiple climate states (with a focus on mediterranean climates). This is being coordinated by Heidelberg, with contributions from Arizona, AWI, UCL & Yale.

Other efforts we're aware of...

- **Holocene ENSO.** There is an effort by the paleo-ENSO community to collate together different proxy records of ENSO. This will look at reconstructed variability in different regions of the Pacific. Efforts so far have compared these to non-PMIP transient simulations, although there is may emerge an attempt to benchmark the midHolocene simulations. This is led by ISPL, and attached to the PACMEDY consortium. There is a relevant workshop in August 2019 on this topic.

Collaborative P2FVar Analyses

El Nino - Southern Oscillation

There has been much work looking at ENSO changes in different experiments (see review by Lu et al., 2018). Looking across these simulations in PMIP3/4 would be interesting. This was done for PMIP2 (Zheng et al., 2008). An update that includes the lig127k, midPliocene-Eoi400 and, most importantly, the future would be warranted. Sufficient post-processed fields are likely available from the working group's archive at www2.geog.ucl.ac.uk/~ucfaccb/PMIPVarData to fuel a paper. A collective is being pulled together at present: contact Chris for more information.

Potential Research Outline...

1. Introduction and literature review
2. Model Evaluation (piControl or historical vs. obs)
    1. climatological temperature and precipitation patterns [ens. mn.]
    2. ENSO composite pattern [obs., ens. mn., ensemble bias]
    3. Nino3.4 std dev. in piControl and historical runs
3. Mean state changes
    1. SST changes in the Tropical Pacific [all expts, ens. mn.]

    2. Change in annual cycle in Tropical Pacific [all expts, ens. mn.]
4. Nino3.4 changes
    1. Barchart showing each std dev. changes in individual simulations
    2. Ensemble mean changes in power spectra
5. Patterns and impacts
    1. precipitation ENSO composite patterns [ens. mn.; should these be normalised to remove amplitude effect?]
    2. temperature ENSO composite patterns [ens. mn.; should these be normalised to remove amplitude effect?]
6. Diversity
    1. CVDP, and therefore www2.geog.ucl.ac.uk/~ucfaccb/PMIPVarData, doesn't compute CP vs EP Ninos
    2. Could use the Ren & Jin (2011) decomposition of Nino3 and Nino4 though
7. Discussion
    1. Projection onto mean state changes (El Nino-like?)
    2. Is there a consistent relationship with changes in the annual cycle across past2future states?

North Atlantic Oscillation

This would focus on describing changes in the North Atlantic Oscillation across past and future equilibrium simulations. It would use PMIP3/CMIP5 and whatever is available for PMIP4/CMIP6. It would look at the piControl, midHolocene, lig127k, lgm, midPliocene-Eoi400 and abrupt-4xCO2 experiments. Could base all the analysis on DJF season. Is there a role for analysing the past1000 simulations?
Potential Research Outline...

1. Introduction and literature review
2. Model Evaluation (piControl or historical vs. obs)
    1. climatological psl gradient [ens. mn.]
    2. NAO pattern [ens. mn.]
    3. surface temperature and precipitation impacts [ens. mn.]
3. Mean state changes
    1. Sea ice edge and temperature changes over the North Atlantic in [all expts, ens. mn.]
    2. Changes in temperature gradients over N. Atl. [all expts, ens. mn.]
    3. Sea level pressure gradients [all expts, ens. mn.]
4. NAO Amplitude changes
    1. Barchart showing each individual simulation changes
5. NAO pattern
    1. Ensemble mean changes in the NAO pattern (?needs renormalisation after Power et al., 2013?)
6. NAO impacts
    1. Ensemble mean changes in precipitation teleconnections
    2. Ensemble mean changes in surface temperature teleconnections
7. Discussion
    1. Projection of midHolocene mean European temperatures onto NAO patterns
    2. Relationships with NAO variability and sea ice cover

Personal Contributions

Please add your interest in leading or contributing to research on individual topics relating to Past2Future and/or variability below…