**DeepMIP Meeting, Tuesday 3rd September**

**13th International Conference on Paleoceanography, Sydney, 2–6 September 2019**

**Convenors: Dan Lunt and Chris Hollis**

**Attendees**

Dan Lunt, Chris Hollis, Matt Huber, Paul Valdes, Peter Bijl, Margot Cramwinckel, Nele Meckler, Tina van der Flierdt, Erica Crouch, Joe Prebble, Richard Levy, Peter Barrett, Carrie Lear, Eleanor John, Gavin Schmidt, David Hutchinson, Martin Ziegler, Stefan Rahmstorf, Deepashree Dutta, Ed Gasson, Natalie Burls, Joost Frieling, Luc Lourens, Richard Zeebe, Nicky Wright, Robin van der Ploeg, Ellen Thomas, Sevi Modestou, Katrin Meisser …[maybe others, huge apologies if we missed you off…] …

**Introduction (by Dan Lunt)**

* An overview of the aims and objectives of DeepMIP were provided, with an emphasis on improving links between data and modelling communities.
* Timeline: 1. Experimental design paper, published (Lunt et al., 2017)

 2. Proxy summary paper & preliminary DeepMIP database, published (Hollis et al., 2019)

3. Sep–Dec 2019, write 2 manuscripts on 1) global mean temperatures and meridional gradients from proxies for LP, PETM and EECO, and 2) model-data comparison overview.

4. end Dec 2019, deadline for manuscript submission to be included in IPCC document

5. Future work (2020?), expand and quality control the proxy database, expand to other time periods?, undertake new research using DeepMIP data and models.

* IPCC: Currently working on the 2nd-order draft. Chapter 2 includes estimates of PETM and EECO global mean temperature, to help give context to past observational and future climate changes. DeepMIP work may also be included in Chapters 1,2, and 6 (CO2 record) and Chapter 7 (including the Executive Summary).

**DeepMIP 2019 review paper (by Chris Hollis)**

* Includes 40 authors, 26 institutions and 7 countries. Defines the EECO. Proxy database includes 1700 SST, 510 LAT, and 539 CO2 records. Discusses differences in using the paleomagnetic versus moving hot spot reference frames for paleogeographic reconstruction.
* Some discussion of proxy mismatches. It should be expected that there is a temperature offset between land and marine temperatures. But the temperature differences are greater than would be expected? Ongoing discussion with the TEX86 community about how to best use the proxy to produce robust and believable SSTs. OPTiMAL seen as a useful option for the cooler SST range but most values in the higher range are rejected.
* CO2 proxies. There is a paucity of CO2 data for the LP and EECO in marine records. Terrestrial estimates tend to be lower than marine temperatures.
* DeepMIP SST compilation. Models can reach 10–12°C bottom water temperatures. Need >x6CO2 to obtain bottom water temperatures of 17°C (discussed in relation to the presentation by Nele Meckler at the conference, Clumped isotope thermometry in Cenozoic paleoceanography).

**Discussion (global mean surface temperature research for upcoming paper)**

* Matt Huber – aim is to estimate global mean surface temperature for the LP, PETM and EECO intervals. Multiple approaches are best, and all use the same dataset. 4–5 people have volunteered to use different approaches (Matt H, Jess T. Margot C, Eleni, Gavin, Dan). Other approaches can look at temporal and spatial variations, removing some proxies and explore sensitivities. Gordon Inglis is coordinating this paper.
* Anyone who wants to be involved should contact Dan Lunt. Send new or updated datasets to Chris Hollis to include in the DeepMIP database.

**Discussion (model-data comparison results for upcoming paper)**

* Experiment design has the same boundary conditions (e.g., paleogeography, bathymetry, vegetation). Experimental design states to use 3x and 6x CO2, but groups have done a range of CO2. Model results from CESM, GFDL, NORESM, IPSL, MIROC, for global mean surface temperature. The multi-model results are clustering a lot more than they have previously.
* Meridional temperature gradients, starting to fit better within target boxes for GMST and MTG, between 4x–6x CO2 runs seem to fit best with the SST proxy data.
* DeepMIP results are warmer than the EOMIP model results (comment by Matt H.).

**What to do next in DeepMIP – discussion**

Suggestions included:

1. Expand into different time intervals and aim to better understand proxies and use a multiproxy approach (Carrie Lear).
2. Include data from the coolest part of the Paleocene (mid Paleocene), data is sparse, narrow time window (~59.5–58.5 Ma, the PCIM onset and oxygen isotope maximum), how cold was it and how low was CO2?, comparable to lower CO2 model scenarios (Peter Bijl).
3. Be useful to generate a ‘shopping list’ of geographic areas where climate models show interesting or unusual things, know what the existing data is and what can be added to improve proxy data, know the gaps and the community can use a multiproxy approach to fill them, deep water temperatures needed (Nele Meckler).
4. Temperature has been focussed on for the LP, PETM and EECO, but no other proxies. Can look at salinity, precipitation, pH, biological response etc in a similar way to temperature. Models have limited bottom water temperature results, an area to focus on (Chris Hollis).

**Follow up areas to focus on**

1. Reconstructing ocean circulation for the LP, PETM, EECO intervals. A compilation paper would be ideal. Quantitative analyses, use multiple tracers (e.g., δ13C, Neodymium isotopes), oxygen levels/ventilation. Potential champion for this project: Tina van der Flierdt (plus a PhD student) and Dan Lunt.
2. Deep ocean temperature compilation. Important input proxy data for models. There are plenty of temperatures based on benthic foraminifera, limited data from clumped isotopes.

Potential champion for this project: Nele Meckler?

1. Terrestrial temperature proxy data. More proxy data is needed, temperature, precipitation, NLR etc, also relative temperature changes is important. Ullrich Salzman had a postdoc working on a terrestrial proxy compilation, but it isn’t yet published.

**Other time intervals to focus on in the future**

1. Miocene. Work with the Miocene modelling group. Initial collaboration underway with Matt Huber and Natalie Burls’s involvement in MioMIP.
2. Eocene/Oligocene models. At least two groups are currently working on this (Stockholm, Utrecht). The group could be incorporated into the DeepMIP project if they wished?