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Large scale features of the Pliocene climate: Results from the PlioMIP experiments

A.M. Haywood (1), D.J. Hill (1), A.M. Dolan (1), U. Salzmann (2), H.J. Dowsett (3), M.M. Robinson (3), B. Otto-Bliesner (4), N. Rosenbloom (4), M.A. Chandler (5), D.J. Lunt (6), S.J. Pickering (1), and PlioMIP Participants ()

(1) University of Leeds, School of Earth and Environment, Leeds, UK, (2) School of Applied Sciences, Northumbria University, Newcastle upon Tyne, UK, (3) Eastern Geology & Paleoclimate Science Center, US Geological Survey, Reston VA, USA, (4) National Center for Atmospheric Research, Boulder, CO, USA, (5) NASA Goddard Institute for Space Studies, Columbia University, New York, NY, USA, (6) School of Geographical Sciences, University of Bristol, UK

PlioMIP (Pliocene Model Intercomparison Project) is a recent addition to the Palaeoclimate Intercomparison Project. It represents the first time that a period with higher than pre-industrial levels of atmospheric CO_2 and global temperatures within the range predicted for 2100AD has been subjected to rigorous model intercomparison. Currently around 8 modelling groups from around the world have completed each of the two PlioMIP experiments. The first experiment is for atmospheric General Circulation Models (GCMs), utilising the sea surface temperature (SST) reconstructions of the USGS PRISM group, while the second is for coupled atmosphere-ocean GCMs.

The mid-Pliocene warm period has provided a focus for data synthesis and palaeoclimate modelling for the last two decades. Though numerous GCM simulations of the Pliocene have been conducted, rarely has any systematic attempt been made to conduct experiments in a fashion that would make direct comparisons possible, and our view of the mid-Pliocene world is still largely based on outputs from only a few GCMs. Although palaeoclimate reconstructions and climate models give a generally consistent picture of the Pliocene, significant regions of data-model mismatch remain.

Here we present the first results of the project, showing the large scale features of the mid-Pliocene climate from the PlioMIP ensemble. Particular focus is given to surface air temperature, sea surface temperature and precipitation simulations. These results are used to produce meridional and zonal profiles for the mid-Pliocene and as the basis for detailed global data-model comparisons against both terrestrial and marine records. Modelled surface air temperature data is tested against estimates from reconstructed vegetation biomes, while the SST simulations of the atmosphere-ocean GCMs are tested against the PRISM data. While all the models show a general Pliocene warming of comparable magnitude ($\sim 2 - 4^{\circ}$C), there are significant differences between the models in key regions. These regions also correspond to areas of data-model mismatch and we present initial results exploring potential causes of this mismatch.