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Mid-Pliocene climate as simulated by the MIROC general circulation model

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The Mid-Pliocene, approximately 3 million years ago, was the most recent interval in the earth's history when global temperatures were significantly warmer than that of modern day. Partly due to a wealth of proxy data, the mid-Pliocene has become a focus of study for paleoclimate modellers who wish to understand the dynamics of warm climates of the past and gain more insight into future climate change.

To simulate the mid-Pliocene climate, we use the MIROC3.2 AGCM and AOGCM constrained by boundary conditions derived from the most up-to-date US Geological Survey data sets which include topography, land/sea mask, land vegetation and ice sheet extent. Sea surface temperatures are also prescribed in the AGCM. For simplicity, orbital parameters and greenhouse gas concentrations are fixed at pre-industrial values, although CO2 levels are increased to 405ppm.

In the AGCM, the global mean surface air temperature increases by 2.8 deg C, with the largest warming occuring at high latitudes due to reduced ice sheets, reducing the meridional temperature gradient. In the AOGCM, however, there is a global increase of 3.4 deg C because warming at low-latitudes is greater than that of the AGCM. Increased precipitation seen over parts of northern Africa and northern India agree with proxy data. There is also a small weakening of the Atlantic meridional overturning circulation.

Keywords: Pliocene, paleoclimate, climate sensitivity