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Supplement of

The Pliocene Model Intercomparison Project (PlioMIP) Phase 2: scientific objectives and experimental design

Alan M. Haywood et al.

Correspondence to: Aisling M. Dolan (a.m.dolan@leeds.ac.uk)

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Supplement 1: Core Experimental Design Sheets

Pre-Industrial Experiment

Model Coupling

Atmosphere-Ocean (Vegetation)

Integration Length

At least 500 years

Oceans

Ocean Mode	Ocean Input
<i>Predicted</i>	<i>Local Pre-Industrial/Modern</i>

Geographic Boundary Conditions

Land/Sea Mask	Topography	Ice Sheets	Vegetation
<i>Local Modern</i>	<i>Local Modern</i>	<i>Local Modern</i>	<i>Pre-industrial then predicted or Pre-industrial prescribed</i>

Greenhouse Gases*

CO ₂	N ₂ O	CH ₄	CFCs	O ₃
<i>280 ppm</i>	<i>270 ppb</i>	<i>760 ppb</i>	<i>0</i>	<i>Local Modern</i>

Solar Constant*

1365 W/m²

Aerosols

Pre-industrial

Model Spin-up

Documented by individual groups

Orbital Parameters*

*[ecc = 0.016724] - [obl = 23.446°] - [peri - 180° = 102.04°]
Date of vernal equinox March 21 at noon*

*CMIP6 modelling groups should set the solar constant, orbital parameters and atmospheric greenhouse gas levels in their PlioMIP2 pre-industrial experiments to be the same as in their CMIP6 DECK pre-industrial simulation. Note that the CMIP6 1850 CO₂ is slightly higher than 280ppm so the radiative forcing difference with the PlioMIP2 higher CO₂ experiments will not be exactly the same as those non-CMIP6 groups that specify pre-industrial CO₂ at 280ppm.

Pliocene Experiment – Standard Boundary Conditions

Model Coupling

Atmosphere-Ocean-Vegetation

Integration Length

At least 500 years

Oceans

Ocean Mode	Deep Ocean Input		
<i>Predicted</i>	<i>Previously spun up Pliocene simulation or pre-industrial</i>		
Land/Sea Mask	Topography*	Ice Mask	Vegetation
<i>Plio_sdt_LSM_v1.0.nc</i>	<i>Plio_sdt_topo_v1.0.nc</i>	<i>Plio_sdt_icemask_v1.0.nc</i>	<i>Dynamic or Plio_std_mbiome_v1.0.nc</i>

Greenhouse Gases

CO ₂	N ₂ O	CH ₄	CFCs	O ₃
<i>400 ppm</i>	<i>As PI Control</i>	<i>As PI Control</i>	<i>As PI Control</i>	<i>As PI Control</i>

Solar Constant

As PI Control

Aerosols

As PI Control

Model Spin-up

Documented by individual groups

Orbital Parameters

As PI Control

* Apply using anomaly method

Pliocene Experiment – Enhanced Boundary Conditions

Model Coupling

Atmosphere-Ocean-Vegetation

Integration Length

At least 500 years

Oceans

Ocean Mode	Deep Ocean Input		
<i>Predicted</i>	<i>Previously spun up Pliocene simulation or pre-industrial</i>		
Land/Sea Mask	Topography*	Ice Mask	Vegetation
<i>Plio_enh_LSM_v1.0.nc</i>	<i>Plio_enh_topo_v1.0.nc</i>	<i>Plio_enh_icemask_v1.0.nc</i>	<i>Dynamic or Plio_enh_mbiome_v1.0.nc</i>

Greenhouse Gases

CO ₂	N ₂ O	CH ₄	CFCs	O ₃
<i>400 ppm</i>	<i>As PI Control</i>	<i>As PI Control</i>	<i>As PI Control</i>	<i>As PI Control</i>

Solar Constant

As PI Control

Aerosols

As PI Control

Model Spin-up

Documented by individual groups

Orbital Parameters

As PI Control

* Apply using anomaly method.

Figure S1: Topography, soil and ice distribution for the forcing factorisation experiments described in Tier 2 (Pliocene for Pliocene). (a) and (b) show entirely pre-industrial boundary conditions (E^{280} and E^{400}). (c) and (d) show pre-industrial topography and soil, with Pliocene conditions over Greenland and Antarctica (E_i^{280} and E_i^{400}). (e) and (f) show Pliocene topography and soil with modern ice sheets (E_o^{280} and E_o^{400}). (g) and (h) show Pliocene boundary conditions (E_{oi}^{280} and E_{oi}^{400}).

