Herold et al. supplementary material

All datasets are provided as NetCDF[1] files and scripts were created using the National Center for Atmospheric Research (NCAR) Command Language[2]. These products are freely available. See paper for methods and source datasets used in the construction of these files. All datasets are at 1°x1° resolution.

Topography

herold_etal_eocene_topo_1x1.nc
Eocene topography and bathymetry.

Standard deviation of sub grid cell elevations

herold_etal_stddev_subgrid_etopo1_to_eocene_1x1.nc
Eocene estimate of the variation of sub grid scale elevations (file variable paleo_stddev_subgrid_topo). Created with the following NCL script.

herold_etal_stddev_subgrid_topo_regression.ncl
Uses the ETOPO1 dataset[3] and a provided paleotopography to create an estimate of the variability of sub grid cell elevations.

Tidal dissipation

Green_Huber_eocene_tidal_dissipation_1x1.nc
Modern and Eocene simulated tidal dissipation (mod_tidal_dissipation and eo_tidal_dissipation respectively) from Green and Huber (2013).

Vegetation

herold_etal_eocene_biome_1x1.nc
Five BIOME4 vegetation datasets are stored in this file;

- <u>prei_biome_hp</u> represents the pre-industrial distribution of biomes simulated by BIOME4 and simplified to the 10 mega biomes of Harrison and Prentice (2003).
- <u>eocene_biome_hp</u> represents the Eocene distribution of biomes simulated by BIOME4, using climate output from the CESM (see manuscript for details), and simplified to the 10 mega biomes of Harrison and Prentice (2003).
- <u>eocene_biome_zonal_hp</u> represents a zonally constant biome distribution based on eocene_biome_hp, where the most common (mode) biome for each latitude is used, with minor adjustments based on statistical artefacts (Fig. S1). This variable allows users to represent the broad characteristics of Eocene vegetation – namely, the effect of a much lower equator to pole temperature gradient and warmer global climate – without representing the finer, zonal details simulated by BIOME4.
- <u>prei_biome</u> represents the pre-industrial distribution of biomes simulated by BIOME4.
- <u>eocene_biome</u> represents the Eocene distribution of biomes simulated by BIOME4, using climate output from the CESM (see manuscript for details).

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[1]http://www.unidata.ucar.edu/software/netcdf/
[2]http://www.ncl.ucar.edu/
[3]http://www.ngdc.noaa.gov/mgg/global/relief/ETOPO1/data/ice_surface/cell_registered/netcdf/ETOPO1_Ice_c_gmt4.grd.gz

The 27 biomes simulated by BIOME4 (excluding ice) and available in prei_biome and eocene_biome are listed below.

1 ’Tropical evergreen forest’
2 ’Tropical semi-deciduous forest’
3 ’Tropical deciduous forest/woodland’
4 ’Temperate deciduous forest’
5 ’Temperate conifer forest’
6 ’Warm mixed forest’
7 ’Cool mixed forest’
8 ’Cool conifer forest’
9 ’Cold mixed forest’
10 ’Evegreen taiga/montane forest’
11 ’Deciduous taiga/montane forest’
12 ’Tropical savanna’
13 ’Tropical xerophytic shrubland’
14 ’Temperate xerophytic shrubland’
15 ’Temperate sclerophyll woodland’
16 ’Temperate broadleaved savanna’
17 ’Open conifer woodland’
18 ’Boreal parkland’
19 ’Tropical grassland’
20 ’Temperate grassland’
21 ’Desert’
22 ’Steppe tundra’
23 ’Shrub tundra’
24 ’Dwarf shrub tundra’
25 ’Prostrate shrub tundra’
26 ’Cushion-forbs, lichen and moss’
27 ’Barren’
28 ’Land ice’

In prei_biome_hp, eocene_biome_hp and eocene_biome_zonal_hp the 27 biomes simulated by BIOME4 (listed above) are simplified to 10 mega biomes based on Harrison and Prentice (2003) and are listed below.

1 ’Tropical forest’
2 ’Warm-temperate forest’
3 ’Temperate forest’
4 ’Boreal forest’
5 ’Savanna and dry woodland’
6 ’Grassland and dry shrubland’
7 ’Desert’
8 ’Dry tundra’
9 ’Tundra’
10 ’Land ice’

herold_etal_eocene_sewall_biomes_1x1.nc
We provide the vegetation distribution of Sewall et al. (2000) interpolated and mapped to the Eocene topography presented in section 2.1 (Fig. S2), and assigned based on the plant functional types of the Community Land Model (Oleson et al., 2010). For this we utilize a land mask of our new Eocene topography and for each land grid cell we select the vegetation from the closest grid cell in latitude and longitude from Sewall et al.’s (2000) original 2°x2° dataset. Substantial efforts have been made in recent years at synthesising data globally (Utescher and Mosbrugger, 2007) and regionally (Quan et al., 2012a, b) using robust methodologies, and ideally such information would be integrated into data-derived boundary conditions such as that provided by Sewall et al. (2000).

Aerosols

herold_etal_eocene_CAM4_BAM_aerosols.nc
Eocene aerosol concentrations (sea salt, dust, SO_4, organic and black carbon) simulated with the Community Earth System Model configured with the Community Atmosphere Model 4 and Bulk Aerosol Model (Neale and Co-authors, 2010).

herold_etal_eocene_CAM4_BAM_optical_depth_1x1.nc
Eocene aerosol optical depth calculated by CAM4 based on above aerosol concentrations.

River runoff

herold_etal_eocene_runoff_1x1.nc
Eocene river directions stored as integers indicating directions rotating clockwise in 45° intervals, with north indicated by 1, northeast by 2 and so forth.

8 ↖	1 ↑	2 ↗
7 ←	ref	3 →
6 ↙	5 ↓	4 ↘

Supplementary references

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