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Contribution of the coupled atmosphere–ocean–sea ice–vegetation model COSMOS to the PlioMIP2

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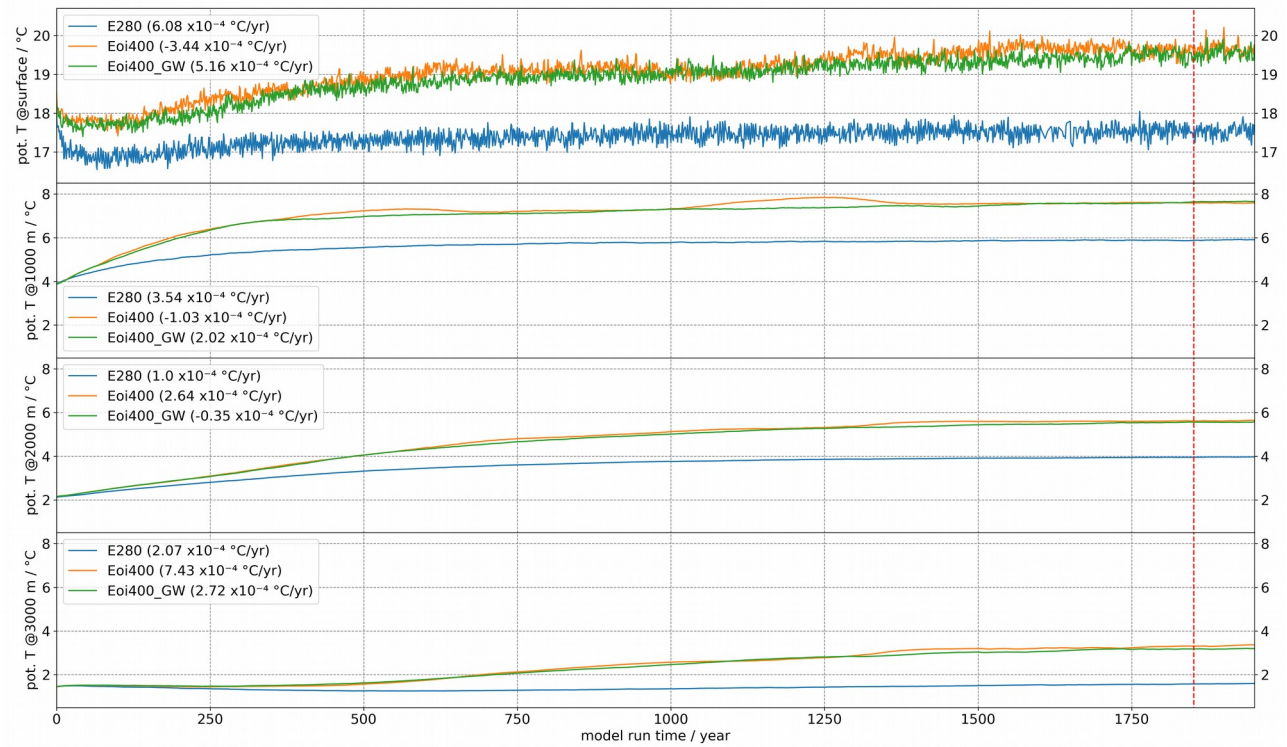

Figure S1: Time evolution of potential seawater temperature at various ocean depths between surface and 3000 m as a diagnostic for model equilibration. Shown is the evolution of temperature over the runtime of PlioMIP2 COSMOS core simulations Eoi400 and E280, and of the sensitivity study with mid-Pliocene geography but modern states of the Bering Strait, Hudson Bay, and Canadian Arctic Archipelago (Eoi400_GW). The vertical red bar denotes the start of the PlioMIP2 analysis period that ends with model year 1949 at the end of the time period shown in the illustration. Temperature trends during the analysis period are given in brackets in the legend after the respective simulation name. These indicate that simulations are in a quasi-equilibrium over the PlioMIP2 analysis period. Note the difference in scale between ocean surface and ocean subsurface temperatures.

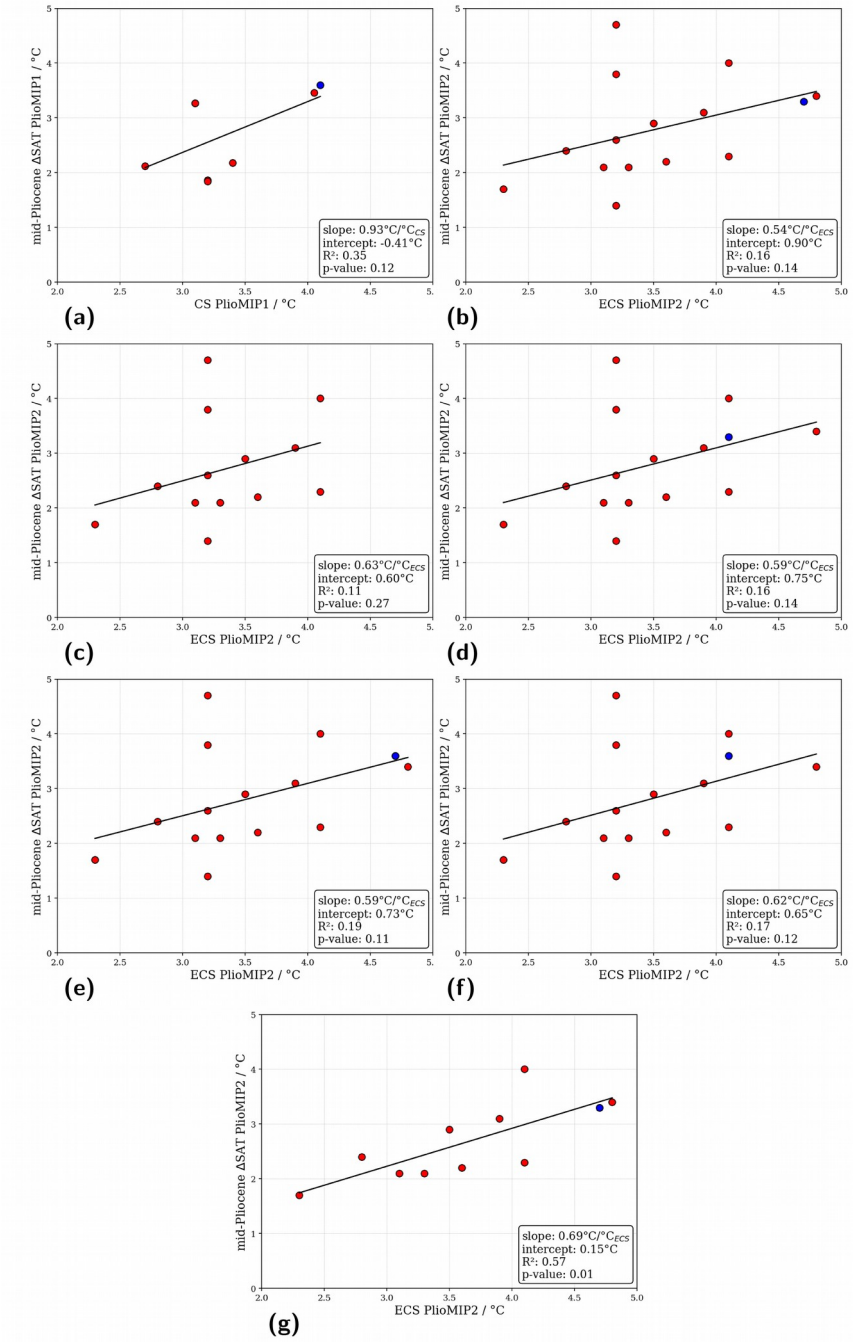

Figure S2: Regression of simulated mid-Pliocene (Eoi400) global annual mean anomaly (w.r.t. E280) of surface air temperature (SAT) at two metres above the ground versus the model Climate Sensitivity (CS) or Equilibrium Climate Sensitivity (ECS), both for PlioMIP1 and PlioMIP2 ensembles. Shown are results of the preliminary 15 model PlioMIP2 ensemble presented in the discussion paper by Haywood et al. (2020) that differs from the final PlioMIP2 ensemble shown in Fig. S3.: a) PlioMIP1 ensemble, based on data published by Haywood et al. (2013), in a similar figure as shown by Hargreaves and Annan (2016); b) PlioMIP2 ensemble, based on data published by Haywood et al. (2020), in a similar figure as shown by them; c) PlioMIP2 ensemble, but without two high ECS models (IPSLCM6A and COSMOS); d) PlioMIP2 ensemble, but plotting COSMOS with a lower ECS similar to the CS in PlioMIP1; e) PlioMIP2 ensemble, but assuming COSMOS to provide a higher simulated SAT anomaly as in PlioMIP1; f) PlioMIP2 ensemble, but assuming COSMOS with a lower ECS producing a higher SAT anomaly as in PlioMIP1; g) PlioMIP2 ensemble, but without simulations that have shown to reduce the significance of the relationship SAT anomaly / ECS (Haywood et al., 2020). Regression shown by the black line. Legends provide regression characteristics slope and intercept, as well as R-squared and p-value of the fit. Data relating to COSMOS indicated by a blue dot.

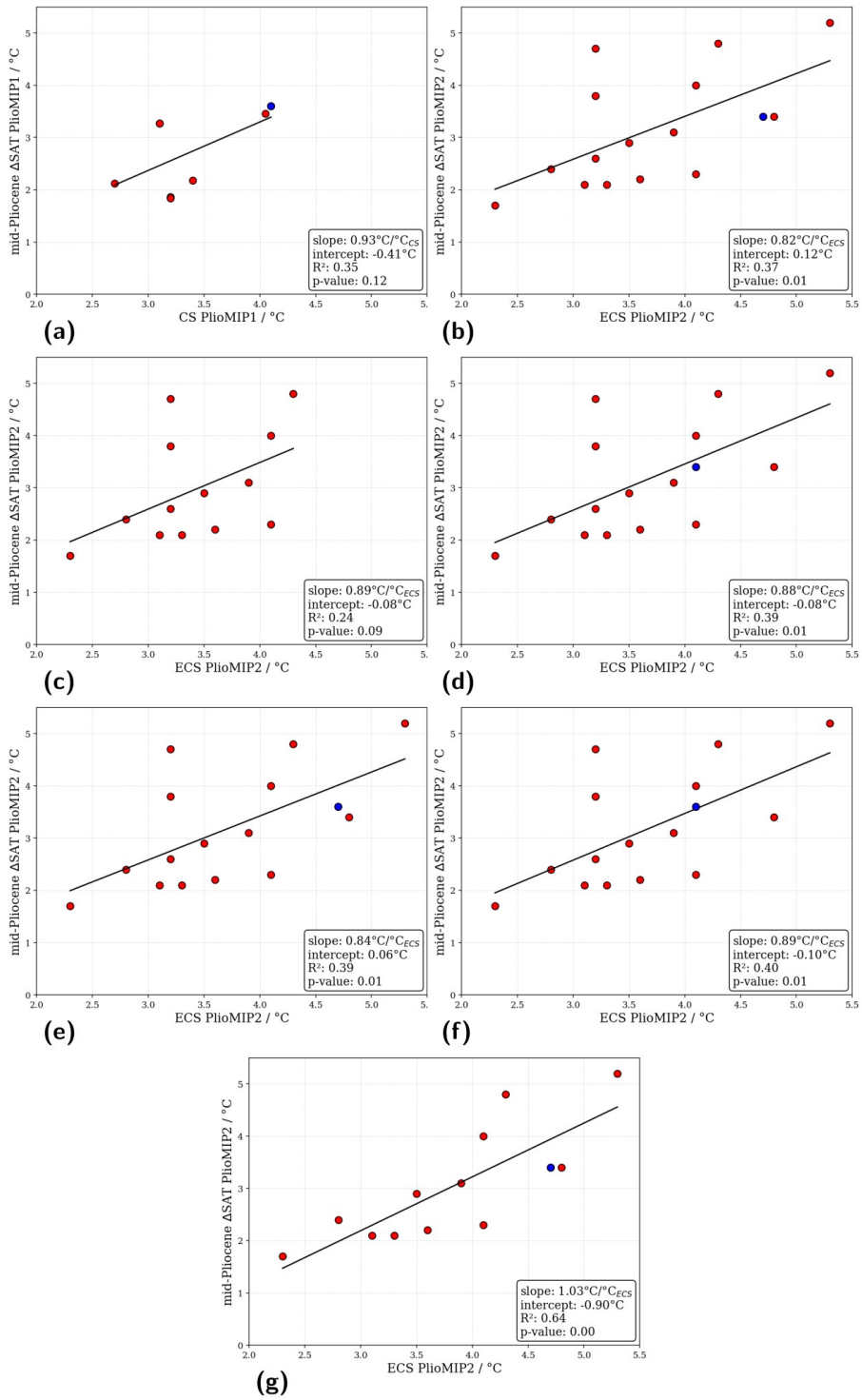

Figure S3: As in Fig. S2, but for the modified 16 member PlioMIP2 ensemble presented by Haywood et al. (2020) in their revised manuscript. Shown are: a) PlioMIP1 ensemble, based on data published by Haywood et al. (2013), in a similar figure as shown by Hargreaves and Annan (2016); b) PlioMIP2 ensemble, based on data published by Haywood et al. (2020), in a similar figure as shown by them; c) PlioMIP2 ensemble, but without three high ECS models (CESM2, IPSLCM6A and COSMOS); d) PlioMIP2 ensemble, but plotting COSMOS with a lower ECS similar to the CS in PlioMIP1; e) PlioMIP2 ensemble, but assuming COSMOS to provide a higher simulated SAT anomaly as in PlioMIP1; f) PlioMIP2 ensemble, but assuming COSMOS with a lower ECS producing a higher SAT anomaly as in PlioMIP1; g) PlioMIP2 ensemble, but without simulations that have shown to reduce the significance of the relationship SAT anomaly / ECS (Haywood et al., 2020). Regression shown by the black line. Legends provide regression characteristics slope and intercept, as well as R-squared and p-value of the fit. Data relating to COSMOS indicated by a blue dot.

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