Variability of surface climate in simulations of past and future

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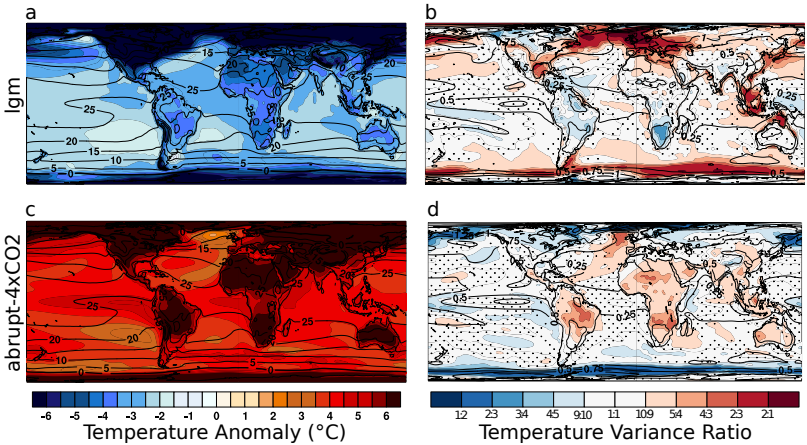
This study explores changes in climate variability over the large range of climates simulated by the Coupled Model Intercomparison Project Phases 5 and 6 (CMIP5/6) and the Paleoclimate Modeling Intercomparison Project Phase 3 (PMIP3).

Full paper: Rehfeld et al. (accepted)
www.earth-syst-dynam-discuss.net/esd-2019-92/

Key findings

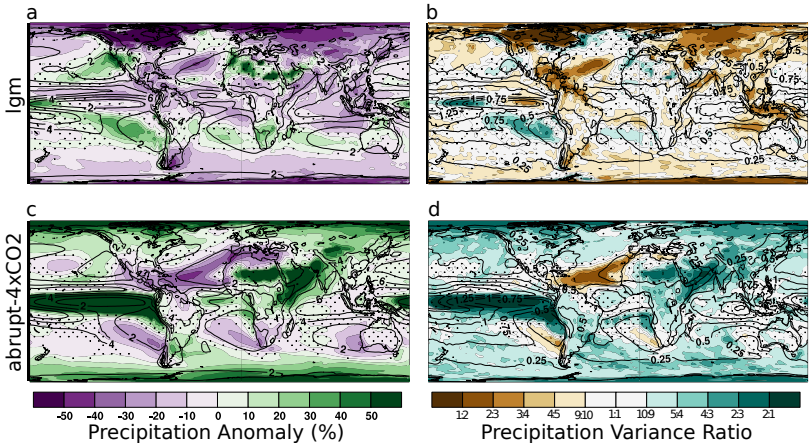
- Changes in climate variability are evaluated in time slices of the Last Glacial Maximum, the Mid Holocene and idealized warming experiments (1% CO_2 and abrupt4$\times CO_2$), hence across 12°C of global mean temperature change.
- Slide 2: At the global scale, temperature variability is inversely related to mean temperature change on intra-seasonal to multi-decadal timescales. This decrease is stronger over the oceans, while there is an increased temperature variability over subtropical land areas (40° S - 40° N) in warmer simulations.
- Slide 3: The change in the interannual variability of precipitation is strongly dependent upon the local change in the total amount of precipitation.
- Slide 4: Several climate modes do show consistent relationships (most notably the Atlantic Zonal Mode), but no generalisable pattern emerges.
- Paper: Large-scale modes influencing rainfall variability in Mediterranean climates persist throughout palaeoclimate and future simulations.

Temperature variability



Multi-model mean (a,c) and variability (b,d) change in surface temperature from the preindustrial conditions for the LGM (a,b) and the abrupt4xCO2 simulations (c,d). Variability change is given by the standard deviation ratio.

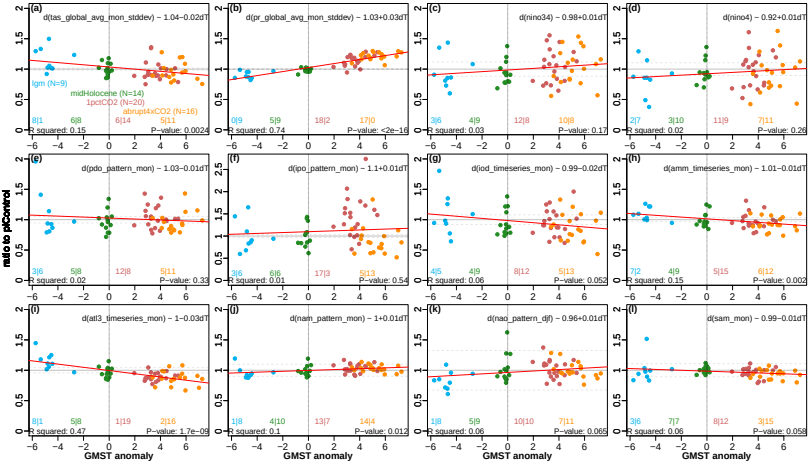
Precipitation variability



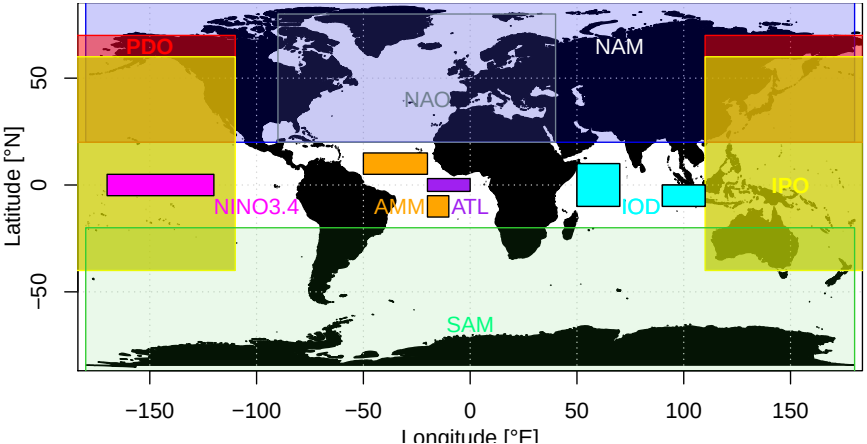
Multi-model mean (a,c) and variability (b,d) change in precipitation rate from the preindustrial conditions for the LGM (a,b) and the abrupt4xCO2 simulations (c,d). Variability change is given by the standard deviation ratio.

Change of mode variability

(a) Change in the standard deviation (SD) of the global, annual mean surface temperature and (b) of the global, annual mean precipitation rate. Changes in the SD (i.e. amplitude of the mode) of (c) ENSO based on the NINO3.4 index and (d) based on the NINO4 region, (e) the PDO, (f) the IPO, (g) the IOD, the meridional (h, AMM) and zonal (i, ATL3) modes of equatorial Atlantic SST variability, and (j) the Northern Annular Mode, (k) the boreal winter NAO and (l) the Southern Annular Mode. See paper for full caption.



Regional areas used in the computation of modes of variability



Overview of mode locations for the Climate Variability Diagnostics Package (Phillips, Deser and Fasullo, 2014, doi:10.1002/2014EO490002) that was used to diagnose modeled variability.

Acknowledgements

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www.earth-syst-dynam-discuss.net/esd-2019-92/