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Interannual variability in palaeoclimate simulations

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Changes in climate variability exist in model simulations of the past and future. Here we investigate the spatial patterns of the changes in the Paleoclimate Model Intercomparison Project. We initially collate the changes in common modes of climate variability (such as El Niño) across the mid-Holocene, Last Glacial Maximum and the 1% CO_2 increase simulations. We then investigate changes in local interannual variability across the globe. There are changes in both temperature and precipitation variance that are robust across the multimodel ensemble, although these are only regional in extent. Recent authors have suggested two different explanations for the changes in surface temperature variance. Huntingford et al (2013) suggest that future reductions in temperature variability are driven by future sea ice loss. Meanwhile, Rehfeld et at (2018) suggests that greater variance during the last glacial was related to the greater climatological temperature gradients. Here we test both these hypotheses across the ensemble of CMIP5/PMIP3 experiments and available CMIP6/PMIP4 simulations. No models appear to capture full scale of reduction in variance implied by climate proxies for the Last Glacial. We also investigate interannual precipitation variability for the first time across these simulations. They provide a very robust, and seemingly linear, relationship between the relative change in regional variance and the relative change in the mean precipitation. This relationship means that hydroclimate proxy reconstructions could provide an additional constraint on future precipitation variability changes.