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Spatio-temporal climate fingerprint in palaeoclimate data vs models

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Knowledge on natural climate variability is pivotal for making future climate projections. Previous studies demonstrated that centennial to millennial temperature variability is lacking in climate model simulations and that this bias is spatially heterogeneous. Various mechanisms have been proposed that might be important to modulate this low-frequency variability such as the ocean circulation, the meridional temperature gradient or external forcing and climate sensitivity to that forcing, but the evidence to identify the main driver(s) is still debated. Here, we provide preliminary insights on the respective importance of those mechanisms in driving long-term climate variability by investigating spatial patterns of low-frequency climate variability.

Low-frequency variability beyond multi-decadal timescales cannot be studied using only instrumental data due to data limitations and the confounding impact of anthropogenic forcing. Consequently, noisy and biased palaeoclimate proxy observations have to be utilised in order to investigate spatio-temporal patterns of climate change. Using a multi-archive and -proxy approach, we characterise the first-order spatial pattern of low-frequency climate variability of interglacial periods. By combining information on the spatio-temporal fingerprint derived from various archives and proxies with different characteristics, we aim to identify the common climate variability signal and assess the ability of climate models to explain the proxy-based spatial pattern of low-frequency variability.