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Sea surface temperatures across the low-latitude Indo-Pacific Ocean during the Holocene, Last Interglacial and Marine Isotope Stage 11

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The Indo-Pacific Warm Pool (IPWP) holds the largest warm water body on Earth. With sea surface temperatures (SST) above 28°C, it promotes deep atmospheric convection in the rising limb of the Hadley and Walker circulation cells, and is a major source of heat and moisture to the global atmosphere with far-reaching climate impacts. Spatiotemporal changes in SST influence the location and strength of atmospheric convection and thus the atmospheric circulation. Despite its importance for the global climate, long-term SST variability across the IPWP is not well understood yet. Compilations of proxy-based reconstructions of SST during previous interglacials combined with climate models provide ideal means to study the SST variability in response to varying astronomical forcing. Hitherto, global compilations of interglacial SST anomalies and data-model comparisons have mostly focused on the Holocene and the Last Interglacial (LIG) period. The available studies reveal a striking mismatch between proxy-derived and modelled SST anomalies across low latitudes. However, the data coverage across the low-latitude Indo-Pacific is poor with little to no data from the IPWP. Here, we compare a proxy network of SST anomalies from the low-latitude Indo-Pacific during Holocene, LIG and MIS 11 time slices to the output of CESM 1.2 climate model simulations. We find large discrepancies between the proxy network and CESM output, concerning the magnitude and pattern of SST change including zonal gradients across the tropical Pacific. For instance, proxy data indicate highest SSTs during the LIG, with a slight warming as compared to the preindustrial reference period, while CESM indicates lowest SSTs during the LIG. By performing individual forcing experiments with CESM, we disentangle the roles of astronomical forcing, greenhouse gas concentration and vegetation cover in shaping interglacial tropical SST patterns. In particular, we find that an expanded Northern Hemisphere vegetation cover during interglacials mitigates model-data discrepancies in IPWP temperatures.