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Drivers of Indo-Pacific upper ocean heat and freshwater variability using a synthesis of coral proxies and ocean models

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The Maritime Continent provides pathways for heat and freshwater transport from the Pacific to the Indian Ocean, serving as an important oceanic teleconnection for Indo-Pacific climate. Yet, the short length of robust observational datasets limits examination of past Maritime Continent and Indo-Pacific Warm Pool variability and the resulting implications for Indo-Pacific climate. Coral proxy records allow insights into variability on seasonal to multi-decadal timescales prior to the period of satellite and *in situ* observations. Here, we synthesize published coral $\delta^{18}O$ records, *in situ* observations, and simulated ocean variability (salinity, temperature, thermocline depth, heat content) from the Nucleus for European Modeling of the Oceans (NEMO) ocean model simulations to explore drivers of seasonal to multi-decadal variability across the Indo-Pacific Warm Pool (western Pacific, Maritime Continent and central Indian Ocean). This proxy-model synthesis allows for examination of thermohaline vertical variability along key oceanic pathways. We identify the role of key climate modes, including the Interdecadal Pacific Oscillation, in driving upper ocean Indo-Pacific variability. The proof-of-concept provided by these results suggest that the paleoproxy records capture important features of regional hydrography and the associated variability in upper ocean heat and freshwater budgets. Such proxy-model comparison at a broader spatial scale is critical for understanding the drivers of variability related to changes in Indo-Pacific oceanic teleconnections over recent centuries and provides important context for projecting future changes in the region.