Reconciling coral-based reconstructions of tropical Pacific SST and salinity

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Large uncertainties remain in the response of the tropical Pacific to future climate change, in part due to the disagreement among historical observations and climate models regarding changes over the 20th century. Extending the instrumental record, high-resolution coral geochemical records, particularly stable isotopes, have been utilized to study low-frequency climate variability and trends within the tropical Indo-Pacific. However, interpretation of the stable oxygen isotope records ($\delta^{18}O$) is complicated by their dual dependence on surface temperature and salinity. Contemporaneous measurements of Sr/Ca and $\delta^{18}O$ have been recently employed to develop detailed reconstructions of past temperature and salinity variability, but the network of paired $\delta^{18}O$ and Sr/Ca records remains sparse, and a lack of local temperature data for calibration of the Sr/Ca thermometer adds considerable uncertainty to the resulting salinity reconstructions. Here we present new temperature and salinity reconstructions from Onotoa Atoll (2°S, 175°E), Maiana Atoll (1°N, 173°E), and Jarvis Island (0.4°S, 160°W) and compare these reconstructions with other published records from the Indo-Pacific. We find that the reconstructed salinity trends are very heterogeneous and sensitive to the assumptions of Sr/Ca-SST calibrations, which vary greatly among published records. Using a unified approach, we attempt to reconcile the wide range of slopes for the Sr/Ca-SST calibration and 20th-century salinity trends, and discuss implications for changes in mean state and ENSO variability within the basin.