

Water isotopologue insights into tropical Pacific hydroclimate: seawater and precipitation $\delta^{18}\text{O}$ in the Indo-Pacific Warm Pool

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It is often assumed that mixed layer seawater $\delta^{18}\text{O}$ values ($\delta^{18}\text{O}_{\text{sw}}$), which are highly correlated with sea surface salinity, reflect changes in atmospheric moisture balance and precipitation $\delta^{18}\text{O}$ values. This is especially the case in regions of high precipitation rates, such as the Indo-Pacific Warm Pool (IPWP). Here, fossil marine carbonate $\delta^{18}\text{O}$ records, which record $\delta^{18}\text{O}_{\text{sw}}$, are thus used to provide information on past changes in salinity and atmospheric moisture balance prior to the short period of instrumental observations. However, only short, 1-3 year long $\delta^{18}\text{O}_{\text{sw}}$ time series exist from the IPWP, limiting our understanding of this key water mass tracer. Here we present 9-year long, monthly resolved records of $\delta^{18}\text{O}_{\text{sw}}$ from Malakal Harbor, along with precipitation $\delta^{18}\text{O}$ from Koror, Palau. There is a strong, negative relationship between Palau $\delta^{18}\text{O}_{\text{sw}}$, local precipitation, and gridded GPCP precipitation over Palau, and a strong positive relationship with gridded outgoing long-wave radiation (OLR) over Palau. The relationship between OLR and Palau $\delta^{18}\text{O}_{\text{sw}}$ is stronger than the relationship with precipitation, as OLR values are reflective of both local rain rates as well as the more large-scale, deep convective processes associated with isotopic fractionation in precipitation. We further find that Palau $\delta^{18}\text{O}_{\text{sw}}$ variability is positively correlated with Palau precipitation $\delta^{18}\text{O}$ values, supporting this interpretation. Palau $\delta^{18}\text{O}_{\text{sw}}$ values also record aspects of regional surface ocean circulation and water mass mixing. We find a strong negative correlation between Palau $\delta^{18}\text{O}_{\text{sw}}$ and surface meridional current strength, in the region of the Mindanao Current east of the Philippines. Further investigation of monthly anomalies of Palau $\delta^{18}\text{O}_{\text{sw}}$ will be used to assess interannual versus seasonal controls on the relationship between Palau $\delta^{18}\text{O}_{\text{sw}}$, hydroclimate, the Mindanao Current, and the El Niño-Southern Oscillation. We anticipate that results from this work will provide an interpretive framework for marine carbonate $\delta^{18}\text{O}$ records from the IPWP.