Western North Pacific Monsoon Variability since the Last Glacial Maximum

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Our study analyzes the response of the Western North Pacific Summer Monsoon (WNPSM), a division of the Asian-Australian monsoon system to changes in orbital forcing. Here, we combine new hydroclimate reconstructions based on the $\delta^{18}O$ composition of stalagmites that were collected from sites across the Philippines with published proxy data and compare the compilations with climate model output to understand the mechanisms that drive changes in the monsoon system from the Last Glacial Maximum (LGM) to present. Over the Holocene, we expected Philippine stalagmite $\delta^{18}O$ records to have a similar response to changing summer insolation and hence, a trend of decreasing monsoon rainfall over the Holocene. However, the Holocene trend in two partially replicated stalagmite $\delta^{18}O$ records is opposite to that expected: inferred rainfall increases in the WNPSM over the Holocene, despite the decrease of summer insolation over the Holocene. Climate models suggest that the rainfall anomalies are due to the land-ocean thermal response over the Holocene, which drives the atmospheric reorganization. During the LGM, stalagmite $\delta^{18}O$ in the Philippines suggests drier conditions in the WNPSM, in agreement with other proxy data as well as climate model output. Climate models attribute the drying in the western tropical Pacific to ice sheet albedo and elevation, as well as exposure of the Sunda and Sahul shelves due lower sea level.