EGU24-8966, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-8966
EGU General Assembly 2024

Reconstructing South Pacific Convergence Zone precipitation over the past 60 ka using plant wax biomarkers

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Hydroclimate in the tropical South Pacific is dominated by the South Pacific Convergence Zone (SPCZ), a region of low-level atmospheric convergence responsible for providing fresh water to 11 million people. The SPCZ is known to change in orientation and intensity in response to interannual climate phenomena, including El Niño Southern Oscillation (ENSO) and the interdecadal Pacific Oscillation (IPO), principally through modulation of trade wind strength (i.e., Walker circulation strength), and the resultant moisture inflow. Understanding how the orientation and intensity of the SPCZ changed under past climate states is important to predict future SPCZ changes, currently poorly represented in existing GCM's. However, our knowledge of the dynamics of the SPCZ beyond the last 1000 years is limited by a lack of proxy archives and a large spread in climate model ensembles. We present a 60 ka plant wax record of paleoprecipitation collected from a peat sediment core from the island of Nuku Hiva, French Polynesia, located in the northeastern margin of the SPCZ. We demonstrate that Nuku Hiva was drier during the last glacial maximum (LGM) and wetter during the early Holocene compared to modern conditions. This indicates that the SPCZ was located further to the south during the LGM and further to the north during the early Holocene. We find a strong correlation between our SPCZ precipitation record and foraminifera based reconstructions of western Pacific warm pool thermocline depth. Given that both modern western Pacific thermocline depth and Nuku Hiva precipitation are influenced by easterly trade wind speed, we deduce that trade wind speeds were likely lower during the LGM and higher during the early Holocene, highlighting the long term dependence of SPCZ orientation on Walker circulation strength. This study, will help constrain future predictions of SPCZ precipitation change.