Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.23881

Making sense of inter-proxy and proxy-model discrepancies in ocean temperature reconstructions

SZE LING HO

National Taiwan University

Presenting Author: slingho@ntu.edu.tw

Knowledge of past warm climates provides constraints for the projection of future climate under high CO_2 forcing. Given the importance of ocean temperature in climate dynamics, past ocean temperatures are routinely reconstructed using geochemical proxies, including the alkenone-based $U^{K'}_{37}$ index, the foraminifera-based Mg/Ca ratio, and the archaea-based TEX_{86}. However, temperature estimates based on these proxies do not always agree due to differences in the biology, ecology and chemistry of the proxy carriers, as well as the analytical protocols used. For instance, the foraminifera Mg/Ca-inferred temperatures for Late Pliocene KM5c interglacial are generally lower on average than those based on the $U^{K'}_{37}$ index and PlioMIP2 model output. Another notable example is the overall higher variability in TEX_{86}-based temperature records compared to other temperature proxies at millennial to orbital time scales. These proxy discrepancies complicate the interpretation of proxy-derived temperature estimates and their derived products, such as global/regional averages, latitudinal/zonal gradients, climate sensitivities, and data assimilation products.

In this talk, I will discuss a set of ongoing and published studies aimed at addressing the proxy mismatches mentioned above. The ongoing studies adopt a systematic multi-proxy and multi-site approach, and critically assess potential caveats such as the proxy sensitivity at high temperatures, non-thermal factors, recording depth and seasonality of proxies. Additionally, state-of-the-art model outputs from PMIP and PlioMIP are employed for proxy-model comparison of ocean temperature changes during past high and low pCO_2 climates. Overall, the results highlight the advantages of a multi-proxy approach and indicate that our current understanding of widely used proxies remains incomplete. This underscores the necessity for further research to improve our understanding of proxies, a critical aspect for accurate quantitative reconstructions of ocean temperatures across time scales.