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Particle tracking model results suggest little lateral transport bias in inorganic and organic SST proxies in the Mediterranean Sea

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Ocean currents can transport sinking particles hundreds of kilometers from their origin at the ocean surface to their burial location, resulting in an offset between sea surface temperatures (SSTs) above the burial site and the particle's origin. Quantifying this offset in particles carrying molecules used in SST proxies can reduce uncertainty in paleoclimate reconstructions. In the Mediterranean Sea, where $\delta^{18}O_{foraminifera}$, $U^{K'}_{37}$- and TEX_{86}-based SSTs can exhibit large offsets from surface conditions, understanding the possible contribution of lateral transport to proxy bias can provide additional insight when interpreting paleoclimate records.

In this study, Lagrangian particle tracking experiments are performed using the NEMO flow field to simulate transport and allow for a quantitative estimate of transport bias. The model determines the ocean surface origin locations of foraminifera and sedimentary particles that carry alkenones or GDGTs to compare with surface sediment datasets for $\delta^{18}O_{foraminifera}$, $U^{K'}_{37}$ and TEX_{86}, respectively. A range of sinking speeds appropriate for the export of organic matter (6, 12, 25, 50, 100, 250, and 500 m/d) is used in the model to represent different export modes (i.e., individual coccoliths, coccospheres, aggregates), where the three fastest sinking speeds can also represent sinking foraminifera. Results show that lateral transport bias is generally small within the Mediterranean Sea and cannot explain the large offsets in proxy-based SST reconstructions in this basin.