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Transport by ocean currents influences the sedimentary dinoflagellate cyst distributions: Implications for paleoceanographic reconstructions.

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Sedimentary dinoflagellate cysts (dinocysts) are a widely used tool for paleoceanographic reconstructions. As for all micropaleontological proxies, an often-used underlying assumption in dinocyst-based reconstructions is that the sedimentary assemblages represent local conditions of the overlying ocean surface water. However, any immobile particle sinking down the water column is subjected to horizontal and vertical transport by ocean currents, and the sedimentary microplankton might be transported from a location with different sea surface conditions.

We model the transport of the dinocysts in a high-resolution (0.1° horizontally) global model of the present-day ocean, and compare the local surface environment to the environment where the cysts formed and are transported from.

We find that the assumption that sedimentary dinocysts represent overlying surface water conditions is not valid in many regions of the world. The significance of cyst transport depends on ocean current strength and direction (e.g. large transport near a western boundary current), the aggregation probability which could increase the sinking speed, and the depth of a sediment sample. By using reasonable sinking speeds of dinocysts and aggregates, extreme biases of around ±16°C are found. We also identify regions where the particle transport creates an insignificant bias, e.g. in shallow seas and near the equator if cysts are related to the overlying surface temperature.

Our model results provide a way to mechanistically and statistically explain the unexpected occurrences of some dinocyst species outside of their 'normal' occurrence region, such as the northerly occurrence of the sea-ice-affiliated dinocyst *Selenopemphix Antarctica* in the Southern Ocean: all these northerly occurrences feature a 'cold tail' in their modeled particle origination regions. Exclusion of such outlier occurrences yield much better constrained ecological affinites for dinocyst species, which has implications for dinocyst-based quantitative and qualitative proxies for paleoceanographic conditions.