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The Indian Monsoon - westerlies interaction and its influence on the environment in the northeastern Arabian Sea during the Holocene

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The Arabian Sea is known for a pronounced oxygen minimum zone (OMZ) between 100 and 1200 m water depth. Westerlies and the Indian Monsoon (IM) control sea surface temperatures (SST) and account for high productivity and a sustaining the OMZ through their influence on the winter mixed layer deepening and upwelling in summer. The complex interplay of these atmospheric systems and their combined impact on the OMZ in the northeastern (NE) Arabian Sea where the OMZ is strongest is poorly understood.
The sedimentary box core SO90-63KA was collected in the NE Arabian Sea off Pakistan (316 m depth) during RV SONNE cruise in 1993. We apply a multi-proxy approach using mineralogical (major and trace elements), biogeochemical (bulk, δ15N) and lipid biomarker (alkenones) analyses to better understand the variability and effects of the IM and westerlies on the biogeochemical environment in the NE Arabian Sea. Low alkenone-derived SSTs accompanied by high productivity and strong OMZ suggest a strong IM and increased humidity introduced by the westerlies during the early Holocene. Increasing SST associated with a decreasing productivity and weakening of the OMZ indicate a mitigation of winds and/or IM between 6.5 and 8 ka BP. While high SSTs prevail until the late Holocene the strength of the OMZ increased. A pronounced SST minima overlaid this trend between ca. 4.2 and 3.3 ka BP. It falls in the period of the early neoglacial anomalies and may be linked to a regime shift towards a stronger influence of the westerlies in the NE Arabian Sea at ca. 3.5 ka ago.