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Variability of the Arabian Sea upwelling and intensity of the oxygen minimum zone over the late Pleistocene and Holocene

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The northern Arabian Sea is one of the main oceanic regions with a permanent low oxygen layer at intermediate water depth that results in water column denitrification. While glacial/interglacial variations in the Arabian Sea oxygen minimum zone (OMZ) are relatively well studied, little is known about the spatial and temporal extent of mid-water oxygen throughout the Holocene. We compared alkenone derived sea surface temperatures of the last 25 kyrs from a core in the northern Arabian Sea with a core from the monsoonal upwelling area off Oman. The difference between the two temperature reconstructions indicates that monsoonal upwelling occurred during warm interstadials and during the entire Holocene. δ15N curves show that denitrification also matched with monsoonal upwelling. Comparison of δ15N records from different locations in the Arabian Sea reveal a Holocene shift in the location of the core OMZ from the northwestern (early Holocene) to the northeastern Arabian Sea (late Holocene). This shift was caused by (i) spatial differences in oxygen demand, caused by changes in SW- and NE-monsoon intensities and associated productivity changes, as well as (ii) changes in mid-water ventilation facilitated by sea level rise and inflow of Persian Gulf and Red Sea Water leading and changes of ventilation by Indian Ocean Central Water .