Seasonal variability of Monsoon-driven hypoxia along the northern coast of Oman

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Using data from a unique, cabled ocean observatory, we found recurrent hypoxia, defined as dissolved oxygen concentrations ≤ 60 μM, in the Gulf of Oman off the northern coast of the Sultanate of Oman that is driven by the seasonal monsoon winds. The cabled ocean observatory, installed in August 2005 by Lighthouse R&D Enterprises, Inc., has real-time reporting current profilers equipped with dissolved oxygen, temperature, and salinity sensors in water depths between 65 and 1000 m. Four years of data demonstrate a strong seasonal cycle of variability of dissolved oxygen concentration throughout the water column that roughly resembles a saw-tooth pattern with an abrupt transition from low (< 10 μM) to high (~200 μM) concentrations at year end, followed by a gradual decrease during the rest of the year. This decrease manifests as a gradual but steady decline in concentration at the shallow near coast locations. Although, the variability of the dissolved oxygen is linked to the variability of the ocean currents, temperature records show that the occurrence of the low oxygen water is associated with a drop in ocean temperature, indicating that upwelling processes raise already low oxygen water higher in the water column. Wind data from the Sojar Majis meteorological station show these currents are driven by the seasonal monsoonal winds that cause intense upwelling and downwelling zones along this coastline at regular intervals during the year. The monsoonal winds from the northeast result in strong and persistent current flow to the southeast along the coast. The abrupt transition from low to high dissolved oxygen concentrations is coincident with the transition to the northeast monsoon, showing the occurrence of hypoxia is driven by the seasonal monsoon winds. Here, we report on the interannual variability associated with the timing of transition from anoxic to normoxic conditions and slope of the gradual decrease of oxygen concentrations and their relationship with timing and severity of the monsoonal atmospheric variability and seasonal oceanic response.

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