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Effects of High-frequency Winds on the Intensity of Oxygen Minimum Zones in the Bay of Bengal and the Arabian Sea

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The Arabian Sea (AS) and the Bay of Bengal (BoB) host highly productive ecosystems near the surface and poorly ventilated low-oxygen waters at intermediate depth, known as Oxygen Minimum Zones (OMZs). In both seas, the seasonal to interannual variability of local atmospheric forcing is responsible for an important fraction of the observed variability of ecosystem productivity and OMZs. However, the impact of the interannual atmospheric forcing variability on the productivity and OMZ intensity remains poorly understood in the two seas. In particular, the sensitivity of the two OMZs to high-frequency (HF) winds and storms has not yet been investigated. Here we explore the effects of HF winds on primary production and OMZs intensity in the AS and the BoB, using a series of eddy-resolving simulations of the Regional Ocean Modeling System (ROMS) coupled to a biogeochemical model. To this end, we compare a set of interannual simulations of the Indian Ocean covering the period extending from 1982 to 2010 forced by realistic 6-hourly winds and smoothed winds, respectively. In both the BoB and the AS, the simulation with HF winds simulation produces thicker mixed layers, weaker stratification, and higher primary productivity than that in the smoothed wind simulation. Furthermore, we find that the HF winds generate a substantial weakening of the modeled OMZ in the BoB driven by an enhanced ventilation of the upper ocean there. In contrast, the modeled AS OMZ shows little sensitivity to the HF winds forcing. Therefore, we suggest that HF winds are among factors contributing to weaken the OMZ intensity in the BoB compared to that in the AS.