

A simulation on seasonal variation of bottom oxygen in the Bohai Sea

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In recent forty years, bottom low dissolved oxygen (DO) conditions (< 3 mg/L) in summer have indicated an intensifying trend in the Bohai Sea (BS). Recent observations reveal that oxygen deficit is a seasonal phenomenon occurring in the bottom water in the depressions northwest and southwest of the Liaodong Bank. In addition, low DO conditions in the BS are accompanied by low pH, suggesting a close coupling between oxygen deficit and acidification, which imposes great stress on marine ecosystems and implies the need for effective management to improve eco-environments. To explore oxygen dynamics and low-oxygen formation mechanisms, a coupled physical-biological model (ROMS-CoSiNE) covering the BS and the Yellow Sea (YS) is established. The model reproduces seasonal evolution of low-oxygen conditions in the BS, and capture the two observed low DO centers, near Qinhuangdao (QHD) and the Yellow River estuary (YRE) respectively. DO becomes unsaturated in June, and reaches a minimum in August. Relatively strong remineralization but weak stratification result in relatively higher DO near YRE compared to QHD. Low DO off QHD could extend northeastward to the northern depression where the DO is relatively high due to weak remineralization. Oxygen budget is evaluated to quantify the contribution of physical and biological processes. Oxygen diffusion across the thermocline is prohibited which favors oxygen deficit in the bottom waters. Water column respiration (WR) is a major oxygen sink for simulated low DO conditions, while more observations are required to figure out the relative importance of WR and sediment oxygen consumption (SOC) and improve models.

Keywords: Oxygen deficit; , Low oxygen conditions; , Bohai Sea;