Benthic respiration exacerbates hypoxia in coastal seas: New insights derived from ^{224}Ra-^{228}Th disequilibrium

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Hypoxia in coastal seas is a worldwide environmental issue and oxygen consumption through sediment organic degradation or microbial remineralization was proposed to be one of the drivers. In this study, benthic oxygen exchange across the sediment-water interface was investigated in two China hypoxia areas, the Pearl River Estuary and the inner shelf of the East China Sea adjacent to the Yangtze River Estuary, by utilization of ^{224}Ra-^{228}Th disequilibrium in sediments. The benthic dissolved oxygen consumption rates are 1~2 orders of magnitude higher than the values computed based on the traditional molecular diffusion method. In the Pearl River estuary, benthic oxygen flux ranged from 240 to 1400 mmol m^{-2} d^{-1}, and exhibited a seaward decreasing trend. In comparison, the inner shelf of the East China Sea had a lower rate of 8 ~ 30 mmol m^{-2} d^{-1}. In combination with the DO mass balance in the bottom water and the residence time estimated from ^{224}Ra, benthic respiration could account for up to 30% of the total loss of O_2. Moreover, the extension of residence time induced by the change of physical circumstances, e.g. seasonal intense stratification, would highlight the benthic impact, and further aggravate the oxygen consumption of bottom water.