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Nitrification and its oxygen consumption along the turbid Changjiang River plume

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Enhanced nutrients and organic material export from rivers cause severe oxygen consumption, subsequently, hypoxia at the land-ocean boundary resulting in disruption of coastal ecosystem and potentially increasing emission of greenhouse gas. Nitrification is thought to be one of the important oxygen consuming process and the dominant N_2O contributor in aquatic environment. By using stable isotope tracer method we determine the nitrification rate (bulk water and >3 μm particle free) and N_2O production rate along Changjiang River plume in 2011 August. Community respiration rate was measured to identify the role of nitrification in oxygen consumption. Total suspended material, nutrients, dissolved oxygen, and particulate iron /manganese(acid-leacheable) were measured to explore controlling factors for nitrification. The bulk nitrification rate ranged from undetectable to 4586 nmol L^{-1} day^{-1} and peaked at inter salinity (S=29). The nitrous oxide was produced only in river mouth, but the production rate was not high enough to support the water column nitrous oxide concentration. Results implied that the water column nitrification was not the main source of nitrous oxide. The determination of nitrification rate and β-proteobacterial AmoA gene abundance on particle or particle-free fraction showed that nitrification preferred to occur on particles in turbid region. Moreover, the amount of reactive Fe/Mn on suspended particles was found linearly correlated to nitrification rate separately in inner shelf and river mouth. In previous study in sediment Fe/Mn were proposed to be alternative oxidant when oxygen was exhausted. However, in this survey we didn't observe hypoxia. In inner shelf region, the estimated oxygen consumption by nitrification ranged from 0.4% to 317% of total community respiration.The excess oxygen demand indicates the oxygen might not be the only oxidant. Stoichiometrical calculation suggests reactive Fe was sufficient to support nitrification along all regions of the plume. This is the first report to reveal the relationship between reactive Fe/Mn and measured nitrification rate and oxygen consumption rate in aerobic water column.