Distribution of Dissolved Nitrous Oxide in an Eutrophic Estuarine System: The Pearl River Estuary, China

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Dissolved Nitrous oxide (N_2O) is an important greenhouse gas, playing a significant role in the global climate system. The world ocean is believed to be a net natural source of atmospheric N_2O, among which the estuaries are estiamted to account for approximately 60% of total marine N_2O emissions. In this presentation, we examined the spatial distribution and seasonal variations of N_2O in a large perturbed estuary, the Pearl River Estuary (PRE), based on two cruises conducted in spring (April 2007) and summer (August 2008).

In the PRE, the entire estuary was always supersaturated with N_2O during our survey seasons. Concentrations of N_2O ranged from 246 nmol kg^{-1} (42 times supersaturated) in the O_2-depleted upper estuary, down to about 7 nmol kg^{-1}(slight supersaturated) at the mouth of the estuary. The distribution of N_2O showed coherent relationships with the distribution patterns of ammonium, oxygen, nitrate and nitrification activity. Nitrification in the water column appeared to be a primary process producing N_2O. This nitrification process were relatively higher in the surface water of the upper estuary with a ammonia oxidation rate of 8.8-22.8 mol N L^{-1} d^{-1} in spring and 10.0-27.0 mol N L^{-1} d^{-1} in summer. We estimated that the total N_2O production rates in the upper PRE from nitrification and denitrification in the water column and sediment would range 200-325 mol m^{-2} d^{-1}, which is equivalent to a water-air N_2O flux of 120-400 mol m^{-2} d^{-1}. Based on the zonal distribution of N_2O, we estimated a net water-air N_2O flux in the PRE at a level of 139±81×ı^{3}mol d^{-1} in spring and 78±48×^{3}mol d^{-1} in summer.