The accumulation of nitrous oxide in the euphotic zone

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Marine is one of the major source of nitrous oxide, 300x CO_2 in term of greenhouse potent, to atmosphere. However, the emission estimate shows great uncertainty in the euphotic zone, where light and phytoplankton competition may inhibit nitrification. The rigorous physical mixing in the surface ocean prevents N_2O accumulation thus masking the potential role of biological N_2O production. Here we presented high vertical resolution N_2O profiles in the euphotic zone from the oligotrophic South China Sea and mid-latitude northwestern Pacific Ocean. Distinctive N_2O peaks, which deviated from the vertical mixing curve, were observed near the nitracline, of which the maximum of *Chl*-a and nitrite appeared correspondingly. The intimate association between N_2O excursion and biological parameters suggests that extra source in the euphotic zone is required to support such an offset of N_2O. By adding $^{15}NH_4^+$ and $^{15}NO_2^-$ tracers, we measured rates and explored the potential processes associated with N_2O production. More high vertical resolution observation and process studies are urgently needed to explore the spatial-temporal distribution of euphotic zone N_2O production and its controlling mechanisms to fill the knowledge gap. In addition, innovative methods are required to discern pathways biologically produced N_2O in mixed layer from physical supply from deeper ocean.