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Promoting effect and mechanism of algae bloom on in situ N₂O emission: a case from Zhanjiang Bay, China

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The algae bloom in the bay can lead to a large amount of N₂O in situ production. However, the coupling relationship between N₂O and algae bloom and their mechanism in the bay remains unclear. To address this issue, N isotope culture experiment and qPCR experiment were measured in Zhanjiang Bay during the normal period and algae bloom period. The results showed that the in situ N₂O production in algae bloom is 3 times than normal period. Stable isotope rate cultivation experiments also indicated that denitrification and nitrification-denitrification were promoted in the water during algae bloom period, but the increase in nitrification-denitrification is more significant. In addition, the main way for in situ N₂O production, shifted from denitrification in the normal period to nitrification-denitrification during algae bloom period. The increase of denitrification and nitrification-denitrification during algae bloom period was attributed from the increase of fresh particulate organic matter (POM) from algae bloom organisms. The increase of fresh POM enhanced the degradation, providing the necessary anaerobic and hypoxic environment for denitrification and nitrification-denitrification. Additionally, a positive linear correlation between N₂O concentrations and ammonia-oxidizing bacteria (AOB) and denitrifying bacteria (*nirK*), provided further evidence of significant nitrification-denitrification and denitrification processes occurring in the water during algae bloom. Our findings contribute to a clearer understanding of mechanism of in situ N₂O emission during algae bloom period.