



## **Isotopomer investigations to identify nitrous oxide sources in the Elbe Estuary**

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The Elbe Estuary is a hot-spot of active nitrogen recycling, with a strong potential for nitrate regeneration via nitrification as well as denitrification. These two processes, while counteracting each other in terms of the dissolved inorganic nitrogen budget of the river, are both potential sources of the greenhouse gas N<sub>2</sub>O. Despite significant water quality improvements, previous investigations revealed that the level of nitrous oxide emissions in the estuary today is persistently high, releasing approx. 0.18 Gg N<sub>2</sub>O per year. The source process of this emission, however, was open to speculation.

To elucidate the relative role of nitrification and denitrification in the generation of nitrous oxide, we performed high-resolution measurements of nitrous oxide concentration and the isotope site preference of the linear nitrous oxide molecule in a transect cruise along the Elbe Estuary. Additionally, we determined nitrification and nitrate-consumption rates in sediment samples via isotope-dilution experiments.

In the upper estuary and in the reach downstream the city of Hamburg, at intermediate oversaturation of nitrous oxide, the site preference is in the range of -30‰ i.e. typical of nitrification-dominated production. At highest oversaturation (~500 ‰), in the port of Hamburg, however, the site preference approaches values near 0‰ indication progressive importance of denitrification. The area of highest oversaturation is also that of highest nitrification and nitrate consumption rates in sediments, the latter can be construed as denitrification rates.

Our data thus show that 1) either is the signal of sedimentary denitrification in anoxic sediments transported through the entire water column, or b) denitrification may be taking place at anoxic (micro)-sites in an overall oxic water column.