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Dissolved organic nitrogen in the Elbe River and estuary: Results of nitrogen isotope investigations

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Eutrophication caused by river- and airborne nutrients is a major problem of coastal regions. The main nutrients causing eutrophication are nitrogen and phosphorus. In the Water Framework Directive of the EU therefore the North Sea bordering countries decided to reduce the nutrient load of these regions to pristine conditions. In case of phosphorus this has led to reductions of the emissions by more than 50 %. However, in the case of nitrogen the emission rate was only reduced by about 30 %.

Nitrogen can be found both in inorganic and organic form in river and ocean water. In rivers dissolved organic nitrogen (DON) comprises up to 70 % of total dissolved nitrogen (TDN). The role of the DON in biogeochemical cycling of TDN is unclear.

By measuring the isotope ratio δ^{15}N of DON it is possible to determine if the DON is either recalcitrant or a subject to biological transformations. During biological processes isotopic fractionation leads to changes in the isotope ratio, while recalcitrant DON remains unchanged.

For a better understanding of the marine biogeochemical cycle of nitrogen in the North Sea we measured the concentration and δ^{15}N of DON in the Elbe River at the weir at Geesthacht (Germany) on a monthly basis for riverine source signal signal, while in the estuary of the Elbe River samples were taken on a seasonal basis along a salinity gradient from < 5 to > 28.

To measure DON we oxidised the dissolved organic matter to nitrate using the persulfate method and recalculated from measurements of TDN and dissolved inorganic nitrogen (DIN). The δ^{15}N values of TDN and DIN were measured using the denitrifier

method. The δ^{15}N values of DON were calculated from the differences.

The river signal at the weir at Geesthacht showed no significant seasonal change in the DON concentration. However, there is an indication for a seasonal dependence in the isotope ratio of DON. The concentration varies between 30 - 60 μmol/l, the isotope ratio δ^{15}N between 2 - 9 ‰ with higher values in winter. The estuary gradient will be presented for a fall (October 2005) and early summer (June 2006) situation.