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Seasonal and interannual variation of the isotopic composition of nitrate in five German rivers discharging into the North Sea

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N-isotope signatures and concentrations of nitrate and particulate nitrogen in five German rivers that discharge into the North Sea were determined on a biweekly to monthly basis from 2006 to 2008. The rivers under study (Rhine, Elbe, Weser, Ems and Eider) varied considerably in their monthly nitrate loads, and in values of 15N-$NO3^-$ and 18O-$NO3^-$. Seasonal variations can be attributed to biological turnover processes in the water column and sources of reactive nitrogen in the catchment area. A highly significant inverse correlation exists between increasing 15N-$NO3^-$ values and decreasing $NO3^-$concentrations; this inverse relationship is observed in each seasonal cycle, as well as in interannual trends, when comparing the datasets of the two years. For both years, load-weighted 15N-$NO3^-$ of the river-borne input to the German Bight coastal water mass (before estuarine mixing and processing) was between 8%■ and 12%■, representing the source signature of nitrate from rivers entering the German Bight.