



Nitrate sources in the catchment basin of the Rhône River

Alexander Bratek (1,2), Kirstin Daehnke (1), Tina Sanders (1), and Jürgen Möbius (2)

(1) Helmholtz-Zentrum Geesthacht, Centre for Materials and Coastal Research, Geesthacht, Germany, (2) University of Hamburg, Germany

The Rhône River is the main river flowing into the western basin of the Mediterranean Sea and is the main source of nutrients to the Gulf of Lion. High inputs of nutrients by river can cause eutrophication in coastal waters. Nitrate is an important nutrient that can have different sources such as organic or inorganic fertilizer, nitrogen fixation or atmospheric deposition.

In March 2015 we sampled surface water at 35 stations along the Rhône including the tributaries. We determined the nutrient concentrations of ammonium, nitrite, nitrate, the dual stable isotopes of nitrate ($\delta^{15}\text{N}$ and $\delta^{18}\text{O}$) and the $\Delta^{17}\text{O}$ of nitrate. Additional the $\delta^{18}\text{O}\text{-H}_2\text{O}$ were determined. Different sources of nitrate have different ranges of isotopic compositions of nitrate, so that sources like atmospheric deposition, soil nitrification or fertilizer can be distinguished. The aim of this study was to identify the sources and dynamics of nitrate at different locations in the catchment basin of the Rhône River.

The results show that catchment areas in higher altitudes in the Alpes and in the Massif Central plateau contain mixed nitrate signals. Atmospheric nitrate deposition ($\sim 3\text{--}10\%$) and soil nitrification are the sources of nitrate in these areas. Moreover, some locations in higher altitudes with high agricultural areas indicate mineral fertilizer as nitrate source. The $\delta^{15}\text{N}\text{-NO}_3^-$ values indicate that agricultural land-use and urban regions are the main source of nitrate in the lowlands and that this nitrate was nitrified because the measured $\delta^{18}\text{O}\text{-H}_2\text{O}$ and $\delta^{18}\text{O}\text{-NO}_3^-$ values correlates.

Overall, we find out that nitrate in the lowland shows an eutrophication signal and that the nitrate from agricultural land-use and urban areas in the lowland overlap the nitrate signal coming from higher altitudes.