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Seasonality of atmospheric nitrogen deposition at a semi-natural peatland site

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Large areas of natural peat bogs in Northwestern Germany have been converted to arable land and are characterised by decades of draining and peat cutting. Our study site – a semi-natural raised bog – is one of only very few remaining protected peatland areas. However, it is surrounded by highly fertilized agricultural land and poultry farms. In this study, we use a combined approach of independent methods to quantify seasonal variations of atmospheric nitrogen deposition most likely originated from agricultural practices.

Concentrations and fluxes of ammonia and its atmospheric reactants are measured by a KAPS-denuder system integrated over one-week periods. Additionally, total nitrogen input from the atmosphere into a soil-plant model ecosystem is investigated by a ^{15}N dilution method called 'Integrated Total Nitrogen Input' (ITNI). With this approach, we aim to allocate atmospheric nitrogen after its uptake by the ecosystem in aboveground biomass, roots and soil.

First results from April to November 2011 show average ammonia concentrations ranging from 0.9 to 13.0 μg m^{-3}. A first maximum of 8.8 μg m^{-3} could be observed in spring followed by relatively stable concentrations (mean: 3.7 μg m^{-3}) in summer. Autumn ammonia concentrations reached a second peak of 13.0 μg m^{-3}. By now, winter concentrations tend to be lower than those during the rest of the measuring period.

Using the KAPS-denuder system within a gradient setup, deposition of ammonia was found to be between 0.08 to 0.25 kg NH_3-N ha^{-1} week^{-1}. The proportion of concentrations and fluxes of other N compounds such as HNO_3, aerosol NH_4 and NO_3 was usually around 20 % of total measured nitrogen. During the first months of investigation, we found a total dry N deposition of about 5.4 kg ha^{-1}. Extrapolation of data to one year amounts approximately to 9 kg ha^{-1} yr^1.

Our results suggest that the intensive agricultural land management of surrounding areas most likely leads to increasing N input into the protected peatland area. The critical load for this nutrient-poor ecosystem might be exceeded and a future change in vegetation and hydrology is expected.

Key words: nitrogen deposition, raised bog, ^{15}N isotopes, KAPS denuder