



Measuring the exchange of volatile reduced nitrogen compounds over grassland

J. Sintermann, U. Kuhn, C. Ammann, A. Neftel, and C. Spirig

Agroscope ART, Research Station Agroscope Reckenholz-Tänikon ART, Zürich, Switzerland (christoph.spirig@art.admin.ch, +41-(0)1-3777201)

An important part of nitrogen transfer between the atmosphere and the biosphere occurs through the exchange of reactive nitrogen compounds. Among them are alkaline gases like ammonia and amines. Atmospheric ammonia deposition represents an important fraction of nitrogen input for terrestrial ecosystems and ammonia plays an important role in aerosol formation. Despite this environmental relevance, many uncertainties on the sources and the behaviour of atmospheric ammonia persist, partly because of the challenging nature of ammonia measurements. In principle, eddy covariance (EC) methods are best suited to determine biosphere-atmosphere fluxes because of their direct nature and negligible influence on the ecosystem by instrumental installations. However, the applicability of EC is restricted to compounds for which fast and sensitive sensors are available. For measurements of ammonia, not only the principal capabilities of the sensors are critical, but also the properties of the air sampling system, because ammonia sticks to almost any kind of surfaces. We explored the possibilities of ammonia and amine measurements using a PTR-MS instrument. Although this instrument has a nominal response time well sufficient for EC measurements, its effective response time for ammonia and selected amines was only in the order of minutes apparently due to absorption effects.

A PTR-MS instrument was installed at the NitroEurope grassland site Oensingen for measuring ammonia and amines following the application of liquid cattle slurry. Air was sampled alternately from 0.5 and 1.5 m above ground through two identical tubes continuously flushed at high flow rates. In parallel, a gradient measurement system based on ammonia absorption into acidic solution and subsequent analysis in the liquid phase was operated. The liquid sampling system proved to be suited for the determination of fluxes with the aerodynamic gradient method both for high ammonia emissions after slurry application and background exchange (mainly deposition). With PTR-MS, gradients could not sufficiently be resolved apparently due to absorption effects within the instrument rather than in the sampling tubes.