Field inter-comparison of three systems for NH3 concentration and flux measurements

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Ambient air ammonia analyzer systems that are not only used for concentration but also for flux measurements have to meet special requirements. They either have to provide a fast response detection (c. 1 sec) for the application of the eddy covariance technique (EC) or they have to resolve relatively small horizontal or vertical concentration gradients.

The Posieux intercomparison experiment in fall 2015 was designed to compare three advanced and different approaches to determine concentration and fluxes of NH3 of a grazed pasture during several weeks.

The methods involved: [1] a two channel reactive N converter measuring in parallel the sum of oxidized N species with the exception of N2O and the sum of the total reactive N species. The difference of the two channels corresponds to the sum of reduced reactive N species; [2] a QC laser analyzer with a special designed inlet system that minimize wall effects and separates particles from the gas sampling stream; [3] two MiniDOAS instruments for line integrated concentration without any inlet system.

The experimental setup and the environmental conditions resulted in a high temporal and spatial dynamic of NH3 concentrations and fluxes. Systems [1] and [2] are designed to perform flux measurements by the Eddy Covariance technique, whereas the DOAS technique has a temporal resolution of 1 min. Fluxes are calculated from the horizontal concentration increase across an emitting surface with back lagrangian stochastic trajectory dispersion model.

We present a comparison of the measured concentrations and fluxes and discuss the advantages and limitations of the three chosen systems.