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Eddy covariance flux measurements of oxidized and reduced reactive nitrogen compounds using a 2-channel converter

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The exchange of reactive nitrogen (Nr) compounds between the atmosphere and the biosphere is a crucial part of the atmospheric N budget and chemistry, and it can also represent an important or problematic nutrient input/loss for natural and managed ecosystems. Since the various oxidized and reduced airborne Nr compounds can undergo fast chemical reactions and have differing chemical and physical characteristics, a variety of different techniques is usually necessary to detect them all. Here we show the application of a new 2-channel converter system in combination with a fast response 2-channel chemiluminescence detector for NO. The combination of two different inlet converters (gold catalyst converter, and high-temperature steel converter) allows the simultaneous measurements of NO_y (the sum of oxidized Nr compounds) and the sum of all Nr compounds. The difference between the two channels represents the reduced Nr compounds (NHx) mainly represented by NH3.
In an optimized configuration with the converter located directly at the sampling inlet, the system is fast enough to be used for eddy covariance (EC) flux measurements. This technique allows to quantify bi-directional biosphere-atmosphere exchange of ecosystems and thus to identify emission and deposition processes. The measurement system was applied over several months over a managed pasture field. It showed predominant deposition fluxes for oxidized Nr and emission fluxes for reduced Nr. While the NO_y deposition was mainly controlled by the magnitude of the ambient concentration, the emission of NH3 was influenced by recent grazing activities as well as temperature and rainfall. The measurement system needs a careful check and correction for high-frequency damping that was performed by analysis of the covariance spectra and ogives.