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Development and Validation of Instrumentation to determine the atmosphere-biosphere Exchange of reactive Nitrogen by Eddy-covariance Flux Measurements

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A commercial NO_y-converter (Ecophysics) was redesigned to allow the measurement of gaseous eddy-covariance fluxes of reactive nitrogen. The instrument utilizes the conversion of NO_y to NO in the presence of CO on a heated gold catalyst (300 ˚C). Subsequently, the NO is detected by chemiluminescence. Using NO as test gas, a laboratory evaluation showed linearity, precision, and robustness in the working range between 0.28 ppbv and 50.0 ppbv. The conversion efficiencies for the most important NO_y species NO_2, HNO_3, and PAN were found to be adequate. Water vapor, particulate nitrate, and ammonia in high concentrations can interfere with the NO_y-measurements, N_2O, HCN, and ozone are no interferents. The trueness of measurements was proved during an intercalibration experiment. The eddy-covariance performance of the system was examined in laboratory and field tests. First flux measurements were performed during SALSA campaign in autumn 2005.

A total reactive atmospheric nitrogen converter (TRANC) was developed for eddy covariance measurement of total atmospheric nitrogen dry deposition to ecosystems. The instrument consists of a heated (870 ˚C) stainless alloy followed by a heated (300 ˚C) gold catalyst. Airborne oxidized nitrogen compounds are thermally decomposed to nitric oxide, reduced nitrogen compounds are oxidized, and nitrogen containing particles are vaporized and subsequently oxidized or reduced to nitric oxide respectively. Because of the high temperature even some nitrogen dioxide is formed, that has to be

reduced to nitric oxide using carbon monoxide on the following gold catalyst. The NO is detected by chemiluminescence. First results of the laboratory evaluation concerning the quality assurance of calibration and the conversion efficiencies for important species are shown. As well eddy covariance flux measurement data gained during the first field evaluation will be presented.