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An automated dynamic chamber system for measuring reactive trace gas exchange of grassland ecosystems

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Grassland ecosystems cover large areas of Europe. They are important sources and sinks for various reactive trace gases and greenhouse gases (e.g. NO_x, O_3, VOCs, CO_2), which play major roles in atmospheric chemistry and radiative climate forcing. Grassland ecosystems show a pronounced dynamic behavior with respect to combination of species and growth which is increased by management practices like cutting and fertilizing.

In order to study the influence of different plant composition and management practices on the trace gas exchange of grasslands, quasi-continuous and parallel flux measurements on multiple experimental plots are necessary. For this purpose, we developed an automated and mobile dynamic chamber system, which provides minimum disturbance of the environmental and chemical conditions of the enclosed plants and soil. The system comprises a maximum of six chambers, which are measured sequentially. The chambers have a circular cross section (0.4 m) and a flexible volume (40 - 90 L). They have a modular design and are easy to mount. Therefore, they can be removed during management procedures or be used for rapid screening of different plots. The chamber walls consist of highly transparent (for PAR and photolysis frequencies) and chemically inert PFA foil to minimize wall deposition effects of reactive species (e.g. VOC). The controllable lids are closed during sampling periods (8 - 20 min) only, in order to maintain ambient conditions as frequently as possible. For keeping the exchange rate of the chamber air high, the chambers are purged with ambient air at high flow rates (60 L min^{-1}). Integrated flexible control and data acquisition units provide continuous monitoring of important parameters, e.g. in-chamber air temperature and relative humidity, soil temperature, and soil moisture for each individual chamber. The

presentation will give a detailed description of the setup of the operational chamber system. We will present examples of flux measurements for several trace gases from various field experiments. Comparisons to other flux measurement techniques, e.g. eddy covariance, will prove the applicability of the method.