Geophysical Research Abstracts
Vol. 16, EGU2014-11387-2, 2014
EGU General Assembly 2014

Development of a model to simulate the impact of atmospheric stability on N_2O-fluxes from soil

Christoph Thieme, Christian Klein, Christian Biernath, Florian Heinlein, and Eckart Priesack
(christoph.thieme@helmholtz-muenchen.de)

The trace gas N_2O, mainly produced by microorganisms in agricultural soils, is a very stable and thus potent greenhouse gas and is the main contributor for the recent depletion of ozone in the stratosphere. Therefore N_2O-emissions need to be mitigated and thus much effort has been made to reveal the causes of N_2O-formation in soils. At present some crucial drivers for N_2O-fluxes are known, but underlying processes of N_2O-fluxes are not yet understood or described adequately. An important shortcoming is the description of the upper boundary layer at the soil-atmosphere interface.

Therefore, the aim of this study is to develop a mechanistic simulation model, which considers both the formation of N_2O in agricultural soils, and the impact of the atmospheric conditions on the transport of soil-born N_2O into the atmosphere. The new model simulates N_2O-flux as a function of meteorological values instead of a model that just releases the whole amount of N_2O into the atmosphere.

For this purpose the modular ecosystem model framework Expert-N, which allows to simulate the formation of N_2O in the soils will be extended to a model with a more detailed description of the upper boundary condition at the soil-atmosphere interface. In detail, this is realized in the form of a resistance approach, where N_2O-fluxes are constrained by a land-air resistance that depends on a Bulk-Exchange Coefficient, wind speed and a gradient of N_2O concentrations in the lower atmosphere. Descriptions of atmospheric stability follow the Monin-Obhukov Similarity Theory.

The newly developed model will be validated using Eddy Covariance measurements of N_2O-fluxes. Measurement device for the N_2O concentrations is a Quantum-Cascade-Dual-Laser produced by Aerodyne Research Inc. (Billerca, Mass., USA). The measurements were conducted on an intensively managed field at the TERENO research farm Scheyern (Germany), which is part of the TERENO Bavarian Alps / Pre-Alps observatory.