Geophysical Research Abstracts
Vol. 12, EGU2010-14925, 2010
EGU General Assembly 2010

Influence of agricultural management on nitrous oxide emissions: comparison of different modelling approaches

C. Klier (1), S. Gayler (1), C. Haberbosch (1), R. Ruser (2), R. Stenger (3), H. Flessa (4), and E. Priessack (1)

(1) HelmholtzZentrum München – German Research Centre for Environmental Health, Institute of Soil Ecology, Ingolstädter Landstra1, D-85764 Neuherberg, Germany email: christine.klier@helmholtz-muenchen.de, (2) Universität Hohenheim Department of Plant Nutrition (330) D-70593 Stuttgart, Germany, (3) Lincoln Ventures Ltd. Ruakura Research Centre, Private Bag 3062 Hamilton, New Zealand, (4) Johann Heinrich von Thünen – Institut Institute of Agricultural Climate Research, Bundesallee 50 D-38116 Braunschweig

Intensive agricultural land use is considered to be the major source of the anthropogenic contribution to the increase in atmospheric nitrous oxide (N_2O) concentration during the last decades. Mathematical models help to understand interacting processes in the nitrogen cycle and state variables affecting N_2O emissions. Most of the simulation models which have been used to estimate N_2O emissions from soils under field conditions represent the underlying processes of denitrification or nitrification by first order rates without modelling the gaseous N_2O transport process. In the first part of the study we compare two modelling approaches of the modular nitrogen modelling system Expert-N for their ability to describe and quantify the seasonal variations of N_2O fluxes in a potato-cropped soil. Model 1 assumes a fixed N_2O:N_2 ratio for N_2O production and neglects the transport of N_2O in the soil profile, Model 2 explicitly considers a N_2O transport and assumes a dynamic reduction of N_2O to N_2. Data for model evaluation arise from an experiment, where N_2O fluxes were monitored over the vegetation period, using a closed chamber technique. Experimental results showed a variation of N and O_2 supplies between the ridge soil and inter-row soil of the potato plantation and a corresponding impact on N_2O release to atmosphere. Thus, in the second part of the study we applied a multiregion modelling approach to get a spatially explicit modelling tool. In the multiregion approach a heterogeneous soil hydraulic regime is subdivided into finite, multiple, hydraulically interacting regions in the form of soil columns. Modelling results showed for the first part of the study that both modelling approaches were able to describe the observed seasonal dynamics of N_2O emissions and events of high N_2O emissions due to increased denitrification activity after heavy precipitation and fertiliser application. Extremely high emission rates from the inter-row soil of the potato plantation were underestimated by both models. The lower N_2O release from the ridge soil was mainly due to a better aeration because of a lower soil bulk density and lower water contents caused by lateral run-off and root water uptake. This could be shown by the application of the multiregion approach in the second part of the study.