



Modelling nitrous oxide emissions from organic soils in Europe

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The greenhouse gas emission potential of peatland ecosystems are mandatory for a complete annual emission budget in Europe. The GHG-Europe project aims to improve the modelling capabilities for greenhouse gases, e.g., nitrous oxide. The heterogeneous and event driven fluxes of nitrous oxide are challenging to model on European scale, especially regarding the upscaling purpose and certain parameter estimations. Due to these challenges adequate techniques are needed to create a robust empirical model. Therefore a literature study of nitrous oxide fluxes from organic soils has been carried out. This database contains flux data from boreal and temperate climate zones and covers the different land use categories: cropland, grassland, forest, natural and peat extraction sites. Especially managed crop- and grassland sites feature high emission potential. Generally nitrous oxide emissions increases significantly with deep drainage and intensive application of nitrogen fertilisation. Whereas natural peatland sites with a near surface groundwater table can act as nitrous oxide sink.

An empirical fuzzy logic model has been applied to predict annual nitrous oxide emissions from organic soils. The calibration results in two separate models with best model performances for bogs and fens, respectively. The derived parameter combinations of these models contain mean groundwater table, nitrogen fertilisation, annual precipitation, air temperature, carbon content and pH value. Influences of the calibrated parameters on nitrous oxide fluxes are verified by several studies in literature. The extrapolation potential has been tested by an implemented cross validation. Furthermore the parameter ranges of the calibrated models are compared to occurring values on European scale. This avoid unknown systematic errors for the regionalisation purpose. Additionally a sensitivity analysis specify the model behaviour for each alternating parameter. The upscaling process for European peatland sites has been performed by using georeferenced maps. The required parameter maps are available from European climate assessment, soil database and several studies within the GHG-Europe project. Finally the uncertainty of the calculated emission map for nitrous oxide fluxes has been derived by a pixel wise Monte-Carlo simulation and has been compared to other empirical model approaches on organic soils.