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## Multi-site Sensitivity analysis of DNDCv.Can model to predict N<sub>2</sub>O emissions from German croplands with maize, rapeseed and wheat

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Nitrous oxide is an important greenhouse gas. In Germany, around 50% of annual nitrous oxide emissions originate from managed agricultural land. Among other options, the mitigation of nitrous oxide emissions from arable land is one important measure to reduce greenhouse gas emissions of the agricultural sector. Several mitigation options have been examined including reduced application of nitrogen fertilizers, timing of fertilizer applications, crop residue management, pH management or application of nitrification inhibitors. Depending on the underlying natural conditions (soil, climate), these measures vary in their mitigation efficiency.

Suitable methods are required to evaluate and quantify mitigation strategies for nitrous oxide emissions at a regional and national scale. For this purpose, several model approaches have been developed ranging from simple stochastic equations to sophisticated process-based models. Because of their reduced input requirements, stochastic approaches like emission factor approaches are common to quantify nitrous oxide emissions and mitigation effects while process based models are promising tools to describe interactions of natural conditions and anthropogenic activities. They have the potential to be more accurate and informative.

However, due to the complex nature of N<sub>2</sub>O producing processes in croplands and the high spatial and temporal variability of N<sub>2</sub>O fluxes the portability of model developments from one site to another site or the validity of upscaling methods are questionable. We collected available field experimental data measuring nitrous oxide emissions to improve and analyze the prediction accuracy of model approaches in Germany, recently with data of 19 sites and 1251 site years in total and focus on the crop types wheat, maize and rape.

Here, we present this data set and show results of model applications and a multi-site sensitivity analyses with the process based model DNDCv.Can. Contrary to other DNDC versions, DNDCvCAN allows to modify a range of internal parameters.

We performed sensitivity analyses based on the Morris method by varying 45 model parameters. Each participating site was modeled for a three years period and the simulations were repeated for each parameter 500 times, resulting to 23000 simulations per site. Highest impact on N<sub>2</sub>O emissions were caused by soil concentrations of humads, humus and black carbon and their related C/N ratios. Surprisingly, N<sub>2</sub>O emissions showed only minor sensitivites in general on hydrological parameters and

on parameters related to N cycling in soil profile. Parameters controlling macropore flow, nitrifier growth and denitrifier growth made here an exception. Sets of ranked most sensitive parameters varied between sites showing that multi-site sensitivity analyses might be helpful to identify global and local parameters for model calibration and help to assess regional mitigation effects.