Public Summary
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Modelling of nitrous oxide emissions from clover grass ley – wheat crop rotations in central eastern Germany An application of DNDC

In the media climate change is often linked to high emissions of carbon dioxide produced by industrial plants, plains or cars. However, the agricultural sector contributes significantly to the change of climate by emitting next to carbon dioxide also nitrous oxide. This has a 300 times greater effect on climate compared to carbon dioxide. Therefore, it is particularly important to reduce emissions of nitrous oxide and estimate emissions accurately.

This study compares typical winter wheat crop rotations in organic and conventional farming in Bad Lauchstädt, central eastern Germany, based on measurements and the computer model DNDC. Organic and conventional farming differ with respect to fertilizer application, manure amendment and tilling practice and thus by the availability of nitrogen in the soil to form nitrous oxide. The main aim was to test the capability of the computer model to simulate emissions. Furthermore, this report compares different crop rotations and investigates emissions under future climate conditions.

Overall the model showed a good performance when simulating monthly emissions, but had a great offset when compared to daily or annual observations. The central weakness of DNDC was its disability to simulate some of the main factors that control nitrous oxide emissions, such as soil moisture, plant growth and soil organic carbon. This study did not reveal differences between various organic and conventional farming practices. Nitrous oxide emissions in Bad Lauchstädt are mostly constrained by low precipitation and thus soil moisture, but not by the availability of nitrogen. The computer model does not show higher nitrous oxide emissions under future climate conditions. Due to drawbacks in DNDC this result is not reliable.

Better simulations and comparison could be achieved in several ways. The computer model was built to be applicable all-around the globe. However, this adds great uncertainty. DNDC could be improved by adjusting some parts of it as the plant growth to better fit the conditions

in Germany. More profound comparison of crop rotations could be attained by long-term series of measurements with a higher spatial and temporal resolution.

Keywords: Physical Geography and Ecosystem analysis, DNDC, N_2O, Bad Lauchstädt, clover grass ley, winter wheat, spring wheat, climate change, emission factors

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Master degrees project 30 credits in Physical Geography and Ecosystem analysis, 2014 Department of Physical Geography and Ecosystems Science, Lund University. Student thesis series INES nr 325