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On the potential of redox potential measurements for the characterization of greenhouse gas emissions – preliminary results

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Soil greenhouse gas (GHG) emissions contribute to global warming. In order to support mitigation measures against global warming it is important to understand the controlling processes of GHG emissions. Previous studies focused mainly on the paddy rice fields or wetlands showed a strong relationship between soil redox potential and GHG emission (e.g. N2O). Recent sensor developments open the possibility for the long-term monitoring of field scale soil redox potential changes. Here, we performed laboratory lysimeter experiments to investigate how changes in the redox potential, induced by changes in the water level, affect GHG emissions from agricultural soil. Under our experimental conditions, we found that N2O emissions followed closely the changes in redox potential. The dynamics of redox potential were induced by changing the water-table depth in a laboratory lysimeter. During saturated conditions we found a clear negative correlation between redox potentials and N2O emission rates N2O. After switching from saturated to unsaturated conditions, N2O emission quickly decreased. In contrast, the emissions of CO_2 increased with increasing soil redox potentials. The level of N2O emission also depended on the fertilization level of the soil. We propose that redox potential measurements are a viable method for better understanding of the controlling factors of GHG emission and the development agricultural management practices to reduce such emissions.