Hydroxylamine (NH_2OH) contribution to soil N_2O spatial variability in a Norway spruce forest

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Hydroxylamine (HA, NH_2OH) is a potential precursor of abiotic nitrous oxide (N_2O) formation in the soil. However, the contribution of soil HA to soil N_2O emission rates in natural ecosystems is still unclear. Here, we determined the spatial variability of HA content and potential N_2O emission rates of organic (Oh) and mineral (Ah) soil layers of a Norway spruce forest (Wüstebach, Eifel National Park, Germany), where dry and wet areas coexist due to a small brook flowing through the sampling area. A newly developed analytical method was applied for the determination of HA content in soil [1], combined with a kriging approach and stepwise multiple regression analysis to demonstrate the spatial distribution of HA and the contribution of HA to soil potential N_2O emissions, respectively. Soil potential N_2O emission rates were determined by aerobic laboratory incubations. Soil properties such as pH, C, N, Mn, Fe, NH_4^+ and NO_3^- content were also determined. The results demonstrated that potential N_2O emission rates, HA and nitrate content were spatially highly correlated, with hotspots for all three parameters observed in the headwater (the wet area) of the small brook. However, soil NH_4^+ showed only small contribution to the potential N_2O emission rates, and was not included in the multiple regression models for soil N_2O prediction. Soil HA content explained the potential soil N_2O emission rates best for both layers, as well as for both dry and wet areas. Soil Mn content was the most crucial factor for the conversion of HA to N_2O emission rates, followed by soil water content, soil C content, and soil pH. These results provide the evidence that HA plays a crucial role in prediction of the spatial variability of soil N_2O emissions.

[1] Liu *et al.* (2014) *Geoderma* **232–234(0)**: 117-122.