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# HONO (nitrous acid) emissions from acidic northern soils

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The photolysis of HONO (nitrous acid) is an important source of OH radical, the key oxidizing agent in the atmosphere, contributing also to removal of atmospheric methane (CH4), the second most important greenhouse gas after carbon dioxide ($CO_2$). There are missing sources of HONO when considering the chemical reactions in the atmosphere. Soil could be such a missing source. Emissions of HONO from soils studied in laboratory incubations have been recently reported. The soil-derived HONO has been connected to soil nitrite ($NO_2$-) and a study with an ammonium oxidizing bacterium has shown that HONO could be produced in ammonium oxidation. Our hypothesis was that boreal acidic soils with high nitrification activity could be important sources of HONO. We selected a range of dominant northern acidic soils and showed in microcosm experiments that soils which have the highest nitrous oxide (N2O) and nitric oxide (NO) emissions (drained peatlands) also have the highest HONO production rates. The emissions of HONO are thus linked to nitrogen cycle processes. In contrast to drained peatlands, natural peatlands with high water table and boreal coniferous forests on mineral soils with low nitrification capacity had low HONO emissions. It is known that in natural peatlands with high water table and in boreal coniferous forest soils, low nitrification activity (microbial production of nitrite and nitrate) limits their N2O production. Low nitrification rate and low availability of nitrite in these soils are the likely reasons for their low HONO production rates. We studied the origin of HONO in one drained peat soil by inhibiting nitrification with acetylene. Acetylene blocked NO emissions but did not affect HONO or N2O emissions, thus ammonium oxidation is not the direct mechanism for the HONO emission in this soil. It is still an open question if HONO originates directly from some microbial process like ammonium oxidation or chemically from nitrite produced in microbial processes.