

Understanding the mechanism behind the nitrous acid (HONO) emissions from the northern soils

Hem Raj Bhattarai, Henri MP Siljanen, Christina Biasi, and Marja Maljanen

Department of Environmental and Biological Sciences, University of Eastern Finland, Kuopio, Finland (hemb@uef.fi)

The interest of the flux of nitrous acid (HONO) from soils has recently increased. HONO is an important source of the oxidant OH- radical in the troposphere and thus results a reduction of the greenhouse gas methane (CH₄) in the atmosphere. Soils have been recently found to be potential sources of HONO as these emissions are linked to other nitrogen cycle processes, especially presence of nitrite in soils. Ammonia oxidizing archaea (AOA) and ammonia oxidizing bacteria (AOB) have been suggested as possible yet substantial sources of HONO. Along with soil pH, other physical properties such as C:N, nitrogen availability, soil moisture and temperature may effect HONO emissions.

Our preliminary results demonstrate that drained acidic peatlands with a low C:N produces higher NO, N₂O and HONO emissions compared to those in pristine peatlands and upland forest soils. This study will identify the hotspots and the process involved in HONO emissions in northern ecosystems. Along with HONO, we will examine the emissions of NO and N₂O to quantify the related N-gases emitted. These results will add a new piece of information in our knowledge of the nitrogen cycle.

Soil samples will be collected from several boreal and arctic sites in Finland, Sweden and Russia. In the laboratory, soil samples will be manipulated based on previously described soil physical properties. This will be followed by labelling experiment coupled with selective nitrification inhibitor experiment in the soils. Our first hypothesis is that northern ecosystems are sources of HONO. Second, is that the soil properties (C:N ratio, moisture, N-availability, pH) regulate the magnitude of HONO emissions from northern soils. Third is that the first step of nitrification (ammonium oxidation) is the main pathway to produce HONO. This study will show that the northern ecosystems could be sources of HONO and therefore increasing the oxidizing capacity of the lower atmosphere.