Geophysical Research Abstracts
Vol. 15, EGU2013-2601, 2013
EGU General Assembly 2013

The Exchange of Soil Nitrite and Atmospheric HONO: a Missing Process in the Nitrogen Cycle and Atmospheric Chemistry

Yafang Cheng, Hang Su, Robert Oswald, Thomas Behrendt, Ivonne Trebs, Franz X. Meixner, Meinrat O. Andreae, and Ulrich Pöschl

Max Planck Institute for Chemistry, Mainz, Germany (yafang.cheng@mpic.de)

Hydroxyl radicals (OH) are a key species in atmospheric photochemistry. In the lower atmosphere, up to ∼30% of the primary OH radical production is attributed to the photolysis of nitrous acid (HONO), and field observations suggest a large missing source of HONO. The dominant sources of N(III) in soil, however, are biological nitrification and denitrification processes, which produce nitrite ions from ammonium (by nitrifying microbes) as well as from nitrate (by denitrifying microbes).

We show that soil nitrite can release HONO and explain the reported strength and diurnal variation of the missing source. We also show that the soil-atmosphere exchange of N(III), though not considered in the N cycle, might result in significant amount of reactive nitrogen emission (comparable to soil NO emissions). Fertilized soils with low pH appear to be particularly strong sources of HONO and OH. Thus, agricultural activities and land-use changes may strongly influence the oxidizing capacity of the atmosphere. Because of the widespread occurrence of nitrite-producing microbes and increasing N and acid deposition, the release of HONO from soil may also be important in natural environments, including forests and boreal regions. In view of the potentially large impact on atmospheric chemistry and global environmental change, we recommend further studies of HONO release from soil nitrite and related processes in the biogeochemical cycling of N in both agricultural and natural environments.

Reference:
Su, H., Cheng, Y., et al., Soil Nitrite as a Source of Atmospheric HONO and OH Radicals, Science, 333, 1616-1618, 10.1126/science.1207687, 2011.

Su, H., et al., The Exchange of Soil Nitrite and Atmospheric HONO: A Missing Process in the Nitrogen Cycle and Atmospheric Chemistry, NATO Science for Peace and Security Series C: Environmental Security, Springer Netherlands, 93-99, 2013.