

Large contribution of nitrous acid to soil-emitted reactive oxidized nitrogen and its effect on air quality

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Soil emissions have been recognized as an important source of nitric oxide (NO), which regulates atmospheric oxidative capacity and the production of air pollutants. Recent research has also indicated that nitrous acid (HONO) can be emitted in significant quantities from soil microbial activities. However, only few studies have quantified emissions of HONO along with NO from a wide range of soil types. In this study, we measured emissions of HONO and NO from soil samples collected from 48 sites across China. We found much higher HONO emissions than those of NO, especially for samples from northern China. We performed a meta-analysis of 52 field studies in China, which revealed that long-term fertilization increased the abundance of nitrite-producing genes much more than the abundance of NO-producing genes. This promotion effect was greater in northern China than in southern China. In simulations using a chemistry transport model with laboratory-derived parametrization, we found that HONO emissions had a greater effect than NO emissions on air quality. Moreover, we determined that with projected continuous reductions in anthropogenic emissions, the contribution from soils to max 1-h concentrations of hydroxyl radicals and ozone, and daily average concentrations of particulate nitrate in the Northeast Plain will increase to 17%, 4.6%, and 14%, respectively. Our findings highlight the need to consider HONO in the assessment of reactive oxidized nitrogen loss from soils to the atmosphere and its effect on air quality.