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Global impact of modelled NO emission from soils on related trace gases and the atmospheric oxidizing capacity

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The emission of NO by soils (SNOx) is an important source of atmospheric NOx, with estimates ranging from 4 to 21 Tg(N)/yr. Previous studies have examined the influence of SNOx on O3 chemistry. We employ the EMAC earth system model to go further in the reaction chain and investigate the influence of SNOx on lower tropospheric NOx , O3, OH and the lifetime of CH4. We show that SNOx is responsible for a significant contribution to the NOx mixing ratio in many regions, especially in the tropics. On the other hand in some regions SNOx has a negative feedback on the lifetime of NOx through O3 and OH, which results in increases in the mixing ratio of NOx despite lower total emissions. Reducing the remaining surface NOx sources by the same amount as the soil NOx source does not lead to an increase in the NOx mixing ratio anywhere in the lower troposphere. The concentration of OH is substantially increased due to SNOx, resulting in an enhanced oxidizing efficiency of the global troposphere, reflected in a 10% decrease in lifetime of CH4 due to SNOx. On the other hand, reducing the other surface NOx sources by the same amount does not affect the OH mixing ratio and the oxidizing capacity nearly as strongly as SNOx.

This shows that NO emission from soils plays an important role in atmospheric chemistry. Together with the consideration that the most widely-used algorithm for SNOx was developed in 1995, and that many new measurements have been performed since then, this strongly suggests either an improvement of the existing algorithm or the development of a new algorithm for a better representation of NO fluxes from soils is needed.