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Biogenic nitrogen oxide emissions from soils – impact on NO_x and ozone over West Africa during AMMA (African Monsoon Multidisciplinary Experiment): modelling study

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Abstract. Nitrogen oxide biogenic emissions from soils are driven by soil and environmental parameters. The relationship between these parameters and NO fluxes is highly non linear. A new algorithm, based on a neural network calculation, is used to reproduce the NO biogenic emissions linked to precipitations in the Sahel on the 6 August 2006 during the AMMA campaign. This algorithm has been coupled in the surface scheme of a coupled chemistry dynamics model (MesoNH Chemistry) to estimate the impact of the NO emissions on NO_x and O_3 formation in the lower troposphere for this particular episode. Four different simulations on the same domain and at the same period are compared: one with anthropogenic emissions only, one with soil NO emissions from a static inventory, at low time and space resolution, one with NO emissions from neural network, and one with NO from neural network plus lightning NO_x. The influence of NO_x from lightning is limited to the upper troposphere. The NO emission from soils calculated with neural network responds to changes in soil moisture giving enhanced emissions over the wetted soil, as observed by aircraft measurements after the passing of a convective system. The subsequent enhancement of NO_x and ozone is limited to the lowest layers of the atmosphere in modelling, whereas measurements show higher concentrations above 1000 m. The neural network algorithm, applied in the Sahel region for one particular day of the wet season, allows an immediate response of fluxes to environmental parameters, unlike static emission inventories. Stewart et al (2008) is a companion paper to this one which looks at NO_x and ozone concentrations in the boundary layer as measured on a research aircraft, examines how they vary with respect to the soil moisture, as indicated by surface temperature anomalies, and deduces NO_x fluxes. In this current paper the model-derived results are compared to the observations and calculated fluxes presented by Stewart et al (2008).

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