Importance of soil NO emissions for the total atmospheric NO\textsubscript{x} budget of Saxony, Germany

Soils are a significant source for the secondary greenhouse gas NO and assumed to be a significant source of tropospheric NO\textsubscript{x} in rural areas. Here we tested the LandscapeDNDC model for its capability to simulate magnitudes and dynamics of soil NO emissions for 22 sites differing in land use (arable, grassland and forest) and edaphic as well as climatic conditions. Overall, LandscapeDNDC simulated mean soil NO emissions agreed well with observations ($r^2 = 0.82$). However, simulated day to day variations of NO did only agree weakly with high temporal resolution measurements, though agreement between simulations and measurements significantly increased if data were aggregated to weekly, monthly and seasonal time scales. The model reproduced NO emissions from high and low emitting sites, and responded to fertilization (mineral and organic) events with pulse emissions. After evaluation, we linked the LandscapeDNDC model to a GIS database holding spatially explicit data on climate, land use, soil and management to quantify the contribution of soil biogenic NO emissions to the total NO\textsubscript{x} budget for the State of Saxony, Germany. Our calculations show that soils of both agricultural and forest systems are significant sources and contribute to about 8\% (uncertainty range: 6–13\%) to the total annual tropospheric NO\textsubscript{x} budget for Saxony. However, the contributions of soil NO emission to total tropospheric NO\textsubscript{x} showed a high spatial variability and in some rural regions such as the Ore Mts., simulated soil NO emissions were by far more important than anthropogenic sources.