Geophysical Research Abstracts
Vol. 15, EGU2013-1049, 2013
EGU General Assembly 2013

Spatial and temporal variability of biogenic soil NO_x emissions across Europe

Enrico Dammers (1,2), Hugo Denier van der Gon (2), Arjo Segers (2), Martijn Schaap (2), Bram Maasakkers (1,3), Folkert Boersma (1,3)

(1) Eindhoven University of Technology, Eindhoven, The Netherlands, (2) Netherlands Organization of Applied Scientific Research (TNO), Utrecht, The Netherlands (enrico.dammers@tno.nl), (3) Royal Netherlands Meteorological Institute (KNMI), De Bilt, The Netherlands

Nitrogen oxides (NO_x) are highly reactive gases present in the atmosphere and, a key factor in the chemical formation of tropospheric ozone and fine particulate matter. Nitrogen Oxides are formed during combustion processes but are also produced by biological and chemical processes in the soil. These biogenic NO_x emissions from soils have been recognized as one of the major sources of global tropospheric nitrogen oxides. Estimates of total annual NO_x emitted from soils worldwide differ widely, ranging from 5.5 to 21 Tg N Yr-1 compared to a total N emission source of 23.7-53.8 Tg N yr-1.

The soil NO_x emissions are controlled by ecosystem characteristics, climate and nitrogen availability. Nitrogen availability is in turn determined by N-deposition from the atmosphere and the application of fertilizers. These factors have been accounted for in various soil NO_x parameterizations which differ significantly in the amount of soil NO_x predicted. To constrain the magnitude of soil NO_x emissions across Europe several parameterizations, including the Yienger and Levy[1995] parameterization and the recent BDSNP [Hudman et. al. 2012] parameterization, were implemented in the LOTOS-EUROS regional chemistry and transport model and evaluated against satellite observations from the Ozone Monitoring Instrument(OMI) and in-situ data. The different simulations provide a total soil NO_x emission in the range of 0.4-0.8 Tg N Yr-1 for Europe compared to an anthropogenic source of 4.3-4.5 Tg N Yr-1, indicating that soils in Europe contribute 10-20% to total NO_x emissions. This estimate agrees with European soil NO_x emission estimates from earlier studies which give a range of 0.4-1.5 Tg N Yr-1. The simulations show significant spatial and temporal variability in the simulated concentrations of NO_x and between the different parameterizations. OMI Tropospheric NO_2 columns retrieved from the satellite observations(DOMINO v2) are used to evaluate the different estimates. In regions where soil NO_x is the dominant source, for example rural France and Ukraine, the tropospheric NO_2 columns from the OMI instrument are shown to provide useful information about the spatial and temporal differences. The model simulations that include soil NO_x emissions show an increased correlation with (satellite and in situ) observations. Furthermore, the bias between the modelled and retrieved NO_2 columns is decreased. This further ascertains the importance of soil NO_x emissions. The most promising parameterization based on evaluation of (satellite and in situ) observations, will be used to create a multiple year soil NO_x emission inventory which can be used in future modelling exercises.