Geophysical Research Abstracts
Vol. 16, EGU2014-14617-1, 2014
EGU General Assembly 2014

Worldwide biogenic soil NO_x emission estimates from OMI NO_2 observations and the GEOS-Chem model

Geert Vinken (1), Folkert Boersma (2,3), Bram Maasakkers (4), Randall Martin (5,6)

(1) Eindhoven University of Technology, Eindhoven, The Netherlands (g.c.m.vinken@tue.nl), (2) Royal Netherlands Meteorological Institute, De Bilt, The Netherlands, (3) Wageningen University, Wageningen, The Netherlands, (4) Harvard University, Cambridge, MA, USA, (5) Dalhousie University, Halifax, Nova Scotia, Canada, (6) Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA

Bacteria in soils are an important source of biogenic nitrogen oxides (NO_x = NO + NO_2), which are important precursors for ozone (O_3) formation. Furthermore NO_x emissions contribute to increased nitrogen deposition and particulate matter formation. Bottom-up estimates of global soil NO_x emissions range from 4 to 27 Tg N / yr, reflecting our incomplete knowledge of emission factors and processes driving these emissions. In this study we used, for the first time, OMI NO_2 columns on all continents to reduce the uncertainty in soil NO_x emissions. Regions and months dominated by soil NO_x emissions were identified using a filtering scheme in the GEOS-Chem chemistry transport model. Consequently, we compared OMI observed NO_2 observed columns to GEOS-Chem simulated columns and provide constraints for these months in 11 regions. This allows us to provide a top-down emission inventory for 2005 for soil NO_x emissions from all continents. Our total global soil NO_x emission inventory amounts to 10 Tg N / yr. Our estimate is 4% higher than the GEOS-Chem a priori (Hudman et al., 2012), but substantial regional differences exist (e.g. +20% for Sahel and India; and -40% for mid-USA). We furthermore observed a stronger seasonal cycle in the Sahel region, indicating directions for possible future improvements to the parameterization currently used in GEOS-Chem. We validated NO_2 concentrations simulated with this new top-down inventory against surface NO_2 measurements from monitoring stations in Africa, the USA and Europe. On the whole, we conclude that simulations with our new top-down inventory better agree with measurements. Our work shows that satellite retrieved NO_2 columns can improve estimates of soil NO_x emissions over sparsely monitored remote rural areas. We show that the range in previous estimates of soil NO_x emissions is too large, and global emissions are most likely around 10 Tg N/yr, in agreement with the most recent parameterizations.