Geophysical Research Abstracts
Vol. 20, EGU2018-1153, 2018
EGU General Assembly 2018

Regional sources of tropospheric ozone

Yury Shtabkin, Konstantin Moiseenko, Andrey Skorokhod, and Elena Berezina

A.M.Obukhov Institute of Atmospheric Physics RAS, Department of Atmospheric Chemistry, Moscow, Russian Federation (yuryshtabkin@gmail.com)

Air transport from industrial regions of Northern Eurasia (Europe and southern Siberia) and the associated plume of polluted air traced in the surface CO field has significant effect on the background tropospheric photochemical system, including ozone generation in the mid-latitude lower troposphere of the North Eurasia. Such impact of upwind sources of atmospheric contamination is clearly seen, as an example, in the ZOTTO Tall Tower observation data showing synoptic time scale increase in CO, NO_x, and O_3 concentrations as air masses move from industrial areas of Ural and southern Siberia.

Using GEOS-Chem chemical transport model, we conduct a series of numerical experiments to assess the impact of anthropogenic NO_x and biogenic volatile organic compounds (VOC) emissions on surface ozone production efficiency as well as total ozone production under various emission scenarios. We show that anthropogenic NO_x emissions, being a major precursor for ozone formation, contribute up to 20 ppbv of ozone ($\sim$50% of background concentrations) on the primary dispersal axis of across-continent plume of polluted air. In the cold season, anthropogenic NO_x emissions are responsible for 10 ppbv of ozone depleting due to titration of ozone by NO under low sun light conditions. Hence, the primary contribution of local anthropogenic pollution sources and regional biogenic VOC emissions compared to long-range air transport from Western Europe is evidenced for the most part of the mid-latitude of Northern Eurasia.

Ozone production efficiency (OPE) as function of latitude, longitude, and season is also estimated basing on correlations between ozone and reactive nitrogen species (NO_y) within a lagrangian approach. We show that high OPE values are a common feature of the photochemically aged air mass with atmospheric transport time comparable to the characteristic time for the NO_y surface deposition ($\sim$ 1 day).

This work was supported by the Russian Scientific Fund under grant 14-47-00049-p.