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Long-range air transport in Northern Eurasia: Seasonal ozone variations and implications for regional ozone budget

Yury Shtabkin, Konstantin Moiseenko, Andrey Skorokhod, and Elena Berezina
A.M.Obukhov Institute of Atmospheric Physics Russian Academy of Sciences, Department of Atmospheric Chemistry, Moscow, Russian Federation (yuryshtabkin@gmail.com)

Effect of photochemically active species emissions on near-surface air composition in industrial regions is non-local and in many cases can be traced in transcontinental scale. Largescaled plumes of polluted air defined by observations of tracer species on background stations and calculations with chemical-transport models are examples of this effect. In this work we use GEOS-Chem chemical transport model to make an assessment of influence have anthropogenic and biogenic emissions in Europe, European territory of Russia (ETR) and Siberia on total ozone generation taking into account common non-linear properties of O_3–NO_x–CO–VOC system. It is shown that increasing of ozone production rate due to regional anthropogenic emissions of NO_x leads to substantial (up to 20 ppbv) increase of near-surface ozone concentrations in mid-latitudes traced up to 120E. The predominant role of long-range air transport against regional sources of photochemical ozone production was determined for the most part of European Russia and Siberia.
We also make a numerical assessment of ozone balance in Europe, ETR and Siberia. Annual ozone total mass in lower troposphere (from surface to 800 hPa) for Europe, ETR and Siberia depending on region is 1.5–2.4 Tg in warm period (1 April – 30 September) and 1.3–2.2 Tg in cold period (1 October - 31 March). Ozone production in chemical processes with a high degree of accuracy (about 99%) is balanced by total atmospheric transport, while absolute variations in O_3 total mass do not exceed 0.5 Tg/year in Europe and 0.4 Tg/year in Siberia.
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