(1) GEOS-Chem – Goddard Earth Observing System Chemical Model

(2) OIAP-RAS – Obukhov Institute of Atmospheric Physics, Russian Academy of Sciences, Russia
Konstantin Moiseenko <konst.dvina@gmail.com>
&
MPIC – Max Planck Institute for Chemistry, Germany
Hang Su <h.su@mpic.de> & Siwen Wang

(3) Available modes for the model runs: Research

(4) Components & processes: Atmosphere & Physical, Chemical

(5) Brief model description

GEOS-Chem is a global 3-D model of atmospheric composition driven by assimilated meteorological observations from the Goddard Earth Observing System (GEOS) of the NASA Global Modeling Assimilation Office (GMAO). See info at web-page for GEOS-Chem at http://acmg.seas.harvard.edu/geos. The model is developed and used by a substantial amount of research groups worldwide as a versatile tool for application to a wide range of atmospheric composition problems. The input GEOS data on 3D meteorological fields, 2D land use and surface characteristics data, 2D arrays of various anthropogenic and natural emissions of various gas and aerosol compounds are available from the NASA Global Modeling Assimilation Office as a continuous archive from 1979 to present. The operational GEOS-Forward Processing product (GEOS-FP 3D and 2D input data fields) has a horizontal resolution of 0.25° latitude × 0.3125° longitude, with 72 levels in the vertical. The consistent MERRA-2 reanalysis product for 1979-present has a horizontal resolution of 0.5° latitude × 0.625° longitude, with 72 levels in the vertical.

The **OIAP-RAS** team uses the model to study impact of regional and long range atmospheric transport of various pollutants on the near surface chemical processes with a special emphasis to the problems of regional high pollution events, ozone photochemistry, impact of wildfire emissions, and anthropogenic NOx – VOC – O3 interactions. Particularly, contributions of climatically significant natural and anthropogenic emission sources in northern Eurasia to seasonal carbon monoxide (CO) variations observed at the Zotino Tall Tower Observatory (ZOTTO) in central Siberia in 2007–2011 have quantitatively been estimated using the GEOS-Chem chemical transport model (Figs.1 and 2). It is shown that the formation of a stable continental pollution plume from sources in Western Europe, European Russia, and southern Siberia during winter plays an important role in the regional balance of surface CO and allows one to explain 55%–80% of the amplitude of the CO annual cycle observed at the ZOTTO station (~70–90 ppbv). During the warm period, the effect of the anthropogenic factor is weakly pronounced, and the background concentration of CO is regulated, first and foremost, by the oxidation of biogenic volatile organic compounds and fire activity in the region.

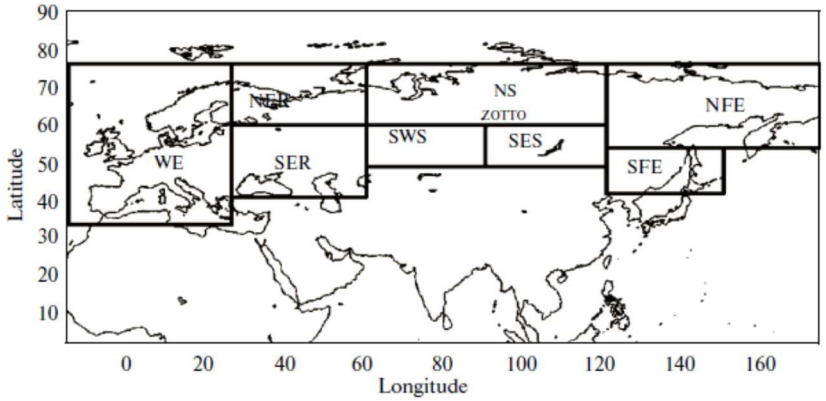

Fig. 1. Geographic regions chosen for AR calculations: NER – north of the European territory of Russia and European countries.

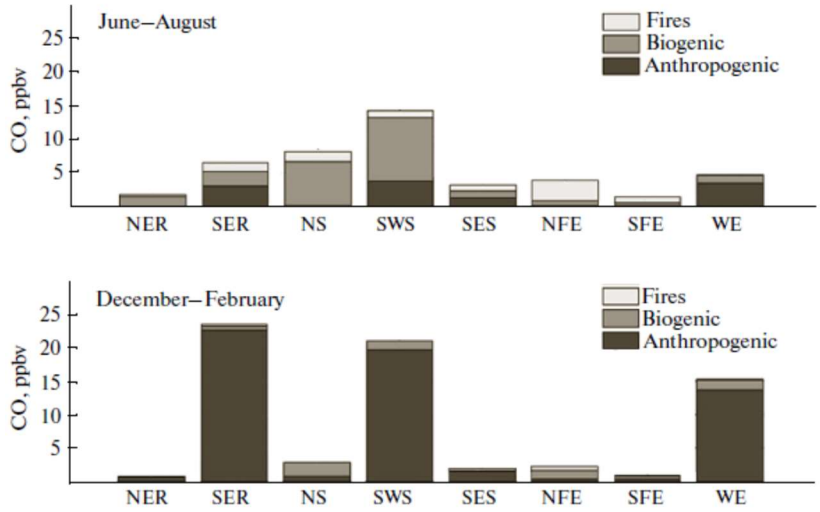

Fig. 2. Cumulative diagram of the values of AR (for the ZOTTO station) to CO emissions in some regions (the mean values for the summer and winter months of 2007–2011).

Key OIAP-RAS team references:

Shtabkin Yu. A., K. B. Moiseenko, A. I. Skorokhod, A. V. Vasileva, M. Heimann (2016) Sources of and variations in tropospheric CO in Central Siberia: Numerical experiments and observations at the Zotino Tall Tower Observatory. Izvestiya, Atmospheric and Oceanic Physics. V. 52(1), 45–56.