Geophysical Research Abstracts
Vol. 21, EGU2019-9130, 2019
EGU General Assembly 2019

Air quality variations in Moscow region and changes of ABL meteorological conditions

Nikolai Elansky (1), Vadim Rakitin (1), Andrey Skorokhod (1), Arseny Shilkin (2), Maria Makarova (3), Alexandra Rakitina (1), Natalia Kirillova (1,4), and Eugeny Grechko (1)

(1) Obukhov Institute of Atmospheric Physics, RAS, Moscow, Russian Federation (ifaran@ifaran.ru), (2) RPA "Typhoon", Roshydromet, Obninsk, Kaluga province, Russian Federation (post@rpatyphoon.ru), (3) St. Petersburg State University, Saint-Petersburg, Russian Federation(zaits@troll.phys.spbu.ru),, (4) D.I. Mendeleev RCTU, Moscow, Russia

The analysis of spectroscopic long-term datasets of CO total content (TC) in the OIAP RAS stations (Moscow and Zvenigorod scientific station, ZSS) and concentration measurements on the Obninsk tall meteorological mast (OMM) of the RPA "Typhoon" for the entire measurement period (from 1972 for Moscow and ZSS) is provided. Trends estimates of total CO and its anthropogenic part for different periods, as well as characteristics of daily and weekly cycles are given.
CO TC in Moscow has decreased during at a rate of 1.1±0.2% yr-1 for 1974-2018. Starting from about 2000 the rate of CO content decline was 2.5±0.3% yr-1. The decrease in the anthropogenic part of the CO content in Moscow for this period at a rate of 5.1±1.9% yr-1 may indicate the reduction of urban emissions and/or change of meteorological conditions in the Moscow ABL.
The declining in the duration of the temperature inversions in January-March at a rate of 3.5% yr-1 and its growth in July-September at a rate of 5.4% yr-1 for 2006–2016 were established. The average annual number of calm days in 2006-2017 decreased at a rate of 7.1 % yr-1, that indicates a general improvement in the removal conditions of pollution from the surface layer of urban air.
In the Moscow province (ZSS) the decrease of CO TC at a rate of 1.1±0.1% yr-1 from 1998–2018 was obtained. After 2008 the rate of reduction of average annual CO TC slowed down to - 0.4±0.1% yr-1. In the same period, during the summer and autumn months CO TC at ZSS increased at a rate of 0.7% yr-1. After about 2008 CO growth in the summer and autumn months has been observed in Obninsk (local CO concentrations at levels of 121 and 302 m), as well as in the suburb of St. Petersburg (Peterhof site).
Using analysis of Mosecomonitoring (Moscow air quality network) measurements trends of the major air pollutants concentrations from 2005 year were obtained. The emission fluxes of CO, NO_x, SO_2, and CH4 and their integral emissions from Moscow megacity have been estimated from multiyear measurements of their surface concentrations and both vertical air-temperature and wind stratifications using box model. During 2005-2014, the annual integral emissions of CO, NO_x, and CH4 decreased with a rate of 1.9±0.3, 1.7±0.4, and 7.8±3.1 % yr-1 respectively. SO_2 emissions increased with a rate of 3.3±2.3 % yr-1. The means of integral annual pollutant emissions from Moscow differ slightly from those for other world megacities. Comparison of the calculated emission values with EDGAR v 4.2 global inventory data yielded ambiguous results. On the one hand, the CO emission values almost coincided, and, on the other hand, the inventory data for NO_x, SO_2, and CH4 proved to be significantly higher. It follows from an analysis of contributions made by some sources that the emissions from enterprises of metallurgical and chemical industries are significantly overestimated in this inventory (especially SO_2 emissions during house heating).
This study was partially supported by Russian Foundation for Basis Research under grant № 18-55-53062.