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The composition of pollutted air in Moscow based on surface observations

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Moscow is the one of the biggest world megacities. Population, industry, transport are strong sources of air pollution. This pollution influences on the air quality in the city and in the neighbor regions due to spreading by the wind.
Here we present an analysis of variations of atmospheric compounds in Moscow since 2002 until the present in its dependence on different atmospheric characteristics, particularly cyclonic and anticyclonic conditions, heat waves and anthropogenic factors. The following variables are considered: NO_2, NO, CO, CO_2, O_3, SO_2, NMHC. The monitoring site is located at Moscow State University meteorological observatory on the South-West of Moscow. All observations are provided by A.M. Obukhov Institute of Atmospheric Physics RAS. Due to these continuous measurements, the typical (ore basic) level of pollution as well as the extreme cases have been studied.
The temporal variability of the atmospheric compounds, and the chemical interaction of ozone and nitrogen oxides are investigated. High concentrations of nitrogen oxides are observed throughout the year. During some months the 90th NO_2 percentile exceeds 60 ppb, NO – 80 ppb. Based on surface observations, we show that extremes of pollutant concentrations correspond with anticyclonic conditions and anthropogenic processes. These often increase the impact on the weather. These situations correspond with the anomalous cold winter in 2006 and heat wave in 2002. In these periods, concentrations of air pollutions exceed MAC, but the ozone concentration usually decreases due to interaction with NO_x. Only two times, ozone concentration exceeded MAC – the heat waves 2002 and 2010.
Also in the study we obtain the logarithmic dependence between ozone mix ratio and NO_2/NO, which can be used for prediction of the surface ozone concentrations in Moscow:
$[O_3] = 12.22\mathrm{Ln}([NO_2]/[NO]) + 15.3$
However, this equation is not possible to use in smog conditions. From 29 July to 15 August Moscow was in a dense smoke screen from the forest and peat fires. In this case, even with a small value of the ratio $[NO_2]$ / [NO] the ozone concentration exceeded 100 ppb (in the average condition maximum hourly ozone concentration for the summer is about 50-60 ppb).