Urban Air Pollution in Russia: Observations and Assessment

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Urban air pollution is actual topic because of its influence on air quality and climate processes on both regional and global scale. There is a lack of up-to-date information about real state of air quality in Russian cities because of very few contemporary observations. Obukhov Institute of Atmospheric Physics possesses significant database of automated measurements of air composition including data of train-based TROICA experiments in 1995-2010 as well as permanent observations in Moscow since 2002. In general numerous crosses of about 100 urban settlements of different size and location have been performed that allowed us to compose detailed pattern of urban air pollution in Russia nowadays.

All cities were separated at three groups: megacities (more then 500 000 citizens), middle cities (50 000-500 000 citizens) and little cities (less then 50 000 citizens). Each urban settlement has been divided into railway station area, urban zone and city (or town) surroundings. Concentrations of main polluting gases (NO, NO_2, CO, SO_2, NMHC, O_3) and aerosols have been averaged for each settlement as well as for each group of urban settlements for day and night, and for winter and summer.

Main features of air urban pollution in Russia are presented. Variations of main pollutants including anthropogenic VOCs because of daytime and seasons, as well as temperature vertical structure are studied. Concentrations of O_3, CO, SO_2 and NMHC are usually below MPC level. NO_2 is often enhanced especially near auto-roads. In general, polluting gases have greater concentrations in winter time due to heating and stronger temperature inversions. Particulate matter is likely to be the most persistent pollutant that determines more than 90% of pollution cases. Strong pollution cases are often caused by extraordinary situations like fires, industrial pollution under unfavorable meteorological conditions. High ozone photochemical generation is quite rare. Spatial pollution structure is usually in good agreement with so called "heat islands" revealed over cities due to mobile observations. From 50 to 75% of all cases temperature growth over cities makes up from 0 to 1 ° C, while in large cities there is substantial proportion of higher values of temperature growth - from 4 to 12% is in the range 2-3 ° C of the temperature rise, and almost as many (from 4 to 9%) cases reveal temperature increase of more than 3 ° C.

Air quality level was assessed on base of new approach elaborated at OIAP to assess air quality in Russian cities. It accounts for both world famous methods and official Russian legislation. General level of air pollution in Russian cities is low or moderate mostly due to favorable location and climate conditions. Extreme concentrations can happen in warm period because of wild and anthropogenic fires and other severe pollution cases. Most of high concentrations within cities during TROICA campaigns were observed near railway stations where influence of local pollution sources (diesel trains, train stoves, boiler rooms and so on) is very large.