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Air composition over Siberian cities.

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It is typical feature of Siberian cities that the quality of the atmosphere significantly depends on the climate conditions. During more than half of year, stable atmospheric stratification dominates over Siberia with temperature inversions, favoring accumulation of pollutants of different origin in the lower atmospheric layers. In addition to severe climatic conditions, modern industrial cities experience increasingly intensifying effect of anthropogenic factors on the environment and human health. Urban conditions give rise to distinct mesoclimates favoring accumulation of pollutants. In this case, natural and anthropogenic systems (power-generating and industrial objects, traffic, etc.) interact very closely.

In this paper we present experimental results of the study the local air circulation effect on air composition of industrial cities of Siberian region.

In our studies we have used AKV-2 mobile station, designed at the Institute of Atmospheric Optics SB RAS. The instrumentation of the station provides measurements of air temperature and humidity, wind speed and direction, total solar radiation; aerosol number density in two size ranges (0.4-10 microns by use of a modernized AZ-6 optical particle counter, and from 3 to 200 nm with a diffusion spectrometer of aerosols), and concentration of trace gases (NO, NO2, O3, SO2, CO, CO2).

In addition to the continuous observations during the station motion, in Angarsk, Usol'e-Sibirskoe, Tulun, Nizhneudinsk, Taishet, Kansk, Krasnoyarsk, and Achinsk, we have carried measurements during stops at the city entry, near center, and at the exit. These observations were aimed to estimate the contribution of urban circulation to impurity accumulation on the city territory and to the change of thermodynamic regime. Such a contribution was found in all of the above-mentioned cities.

Maximum of NO concentration is observed at crossroads of the main highways and decreases away from them. It should be noted that the NO distribution almost the same as the distribution of CO, which is also of "automobile engine" origin.

In the center of cities where usually impurities are accumulated, concentration of SO2, NO2, CO, and aerosol number density as well are several times higher than in the city periphery. On the contrary, the ozone content in center is much lower.

In most of the cases, the urban samples have 2-3 times more chemical elements than the background samples.

The total concentrations of PAHs in aerosol matter of the cities varied from 20 to 30 ng/m3. PAH concentrations, as well as the percentage relation between them are determined by the place of aerosol sampling, i.e., by locations of pollution sources. Among the identified PAHs in the public green space and industrial zones of Angarsk, the predominating species are phenanthrene, pyrene, and fluoranthene, whose total amount reaches 80% of the mass of the detected PAHs.

In summer, owing to more effective atmospheric ventilation, the effects of local circulation substantially weaken. As a result, a significant pollutant accumulation in the central parts of the cities may not always be detected.