Geophysical Research Abstracts, Vol. 8, 09335, 2006
SRef-ID: 1607-7962/gra/EGU06-A-09335

Modelling of the pollutants dispersion with sodar data assimilation

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Modelling of the pollutants dispersion in the urban boundary layer remains a complex problem, which is far from its solution. Despite of the development of complicated numerical models of boundary layer dynamics and city environment description we always have to search for compromise between scales. Topography and building structure is individual for each city and their description needs much time. At the same time, general description and well known parameterizations often give results far different from reality.

Measurements data of the wind fields over buildings are quite poor unlike the data of mean geostrophic wind in the upper air. The measurements of the wind profile and the turbulence characteristics in the ABL over the city by sodar placed at MSU Physics Faculty building roof and by sodar placed in Obukhov Institute of Atmospheric Physics showed, that thermal and dynamic instability of the ABL and “heat island” formation over the big city change substantially the conditions of the turbulent mixing in comparison with rural areas. These differences can be taken into account in numerical modeling only by assimilation of the real measurements data.

The first attempts of assimilation of the wind field characteristics measured by sodar showed the necessity of compromise search between the model complexity and real availability of measurements data and their time and space resolution.

An experience of long-term continues exploitation of acoustic locators LATAN-3 in Moscow center and at the south-west of the Moscow megalopolis showed good accuracy of the wind speed profiles measurements in the lower part of ABL (200 - 500 m altitude) to be used in numeric models of pollutants diffusion. At the same time, an attempt of the detailed reconstruction of vertical profile of the turbulent diffusion

coefficient met the difficulties connected with insufficient spatial (vertical) resolution of original sodar measurements, stochastic properties of the registered echo-signal and high level of urban noise.

Analysis of experimental data show that the better description of the boundary layer properties could be constructed by the real data approximation (or parameterization) based on atmospheric stability conditions. Higher accuracy of the mean profiles of the horizontal wind speed and dispersion of vertical component gives estimates of the mean parameters of turbulent exchange in ABL not only qualitatively but also quantitatively.

The work was supported by Russian Foundation for Basic Research (project nos. 04-05-64167, 05-05-64786).