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High resolution climatology
- towards climate change services

Modeling of particulate plumes transportation in boundary layers with obstacles

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This presentation is aimed at creating and realization of new physical model of impurity transfer (solid particles and heavy gases) in areas with non-flat and/or nonstationary boundaries. The main idea of suggested method is to use non-viscous equations for solid particles transport modeling in the vicinity of complex boundary. In viscous atmosphere with as small as one likes coefficient of molecular viscosity, the non-slip boundary condition on solid surface must be observed. This postulates the reduction of velocity to zero at a solid surface. It is unconditionally in this case Prandtle hypothesis must be observed: for rather wide range of conditions in the surface neighboring layers energy dissipation of atmosphere flows is comparable by magnitude with manifestation of inertia forces. That is why according to Prandtle hypothesis in atmosphere movement characterizing by a high Reynolds number the boundary layer is forming near a planet surface, within which the required transition from zero velocities at the surface to magnitudes at the external boundary of the layer that are quite close to ones in ideal atmosphere flow. In that layer fast velocity gradients cause viscous effects to be comparable in magnitude with inertia forces influence. For conditions considered essential changes of hydrodynamic fields near solid boundary caused not only by nonslip condition but also by a various relief of surface: mountains, street canyons, individual buildings. Transport of solid particles, their ascent and precipitation also result in dramatic changes of meteorological fields. As dynamic processes of solid particles transfer accompanying the flow past of complex relief surface by wind flows is of our main interest we are to use equations of non-viscous hydrodynamic. We should put up with on the one hand idea of high wind gradients in the boundary layer and on the other hand disregard of molecular viscosity in two-phase atmosphere equations. We deal with describing high field gradients with the aid of scheme viscosity of numerical algorithm used to model near-surface phenomena. This idea is implemented in the model of ideal gas equations with variable equation of state describing particulates transportation within boundary layer with obstacles.