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Estimation of integral advection influence on vertical land-air turbulent fluxes by combined ABL and SVAT modeling

A.Yu.Mikhailov(1), A.B.Shmakin(1), K.G.Rubinstein(2)

(1) Institute of Geography, Russian Academy of Sciences, (2) Hydrometeorological Centre of Russia

Two models are combined in one complex: a 3-dimensional ABL model and 1-dimensional SVAT model, to study effects of spatial heterogeneity and local transformation of atmospheric parameters above certain land cover types. The ABL model includes full thermohydrodynamical equations with constant pressure field, “l-b closure” of turbulence, non-stationary heat fluxes. The SVAT model includes all processes of energy/water transfer in the soil and vegetation, snow cover formation and melting, freezing/thawing of soil water, runoff generation, etc. The SVAT model takes part in PILPS and alike experiments. For each land cover type, the daily variations of solar and infrared radiation, as well as precipitation inputs determine heat/water balance in the SVAT system, which in turn influences vertical profiles of meteorological parameters in the ABL. Vertical and horizontal transfer of the meteorological substances are taken into consideration. The model complex is tested in Rhone basin and in Moscow region with detailed meteorological data. The evaluations allowed us to conclude on the role of land surface inhomogeneity in the integral fluxes on the scale of region. When the surface temperature is allowed to vary according to the landscape specifics, the heterogeneity effect is mostly negligible. For the cases with regular contrasts of surface temperature or humidity (e.g. due to large heat capacity of water bodies, or natural limitation due to snow or vegetation), the heterogeneity effect becomes significant and should be taken into account. The model complex also allows to downscale the weather forecasts for a complicated territory, calculating vertical profiles of meteorological variables above each of the land cover type. The study was supported by the Russian Foundation for Basic Research (grants 04-05-64745, 04-05-64151).