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ELECTRODYNAMIC PROPERTIES AND HEIGHT OF ATMOSPHERIC CONVECTIVE BOUNDARY LAYER

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Abstract

We consider the relations between the mixed layer height and atmospheric electric parameters affected by convective mixing. Vertical turbulent transport of radon, its progeny and electrically charged particles is described under Lagrangian stochastic framework, which is the next step to develop a consistent model for the formation of electrical conditions in the atmospheric boundary layer. Using the data from detailed and complex measurements of vertical profiles of the temperature and turbulence statistics as input, we calculated non-stationary vertical profiles of radon and its daughter products concentrations, atmospheric electric conductivity and intensity of electric field in the convective boundary layer from the morning transition through early afternoon quasi-stationary conditions. These profiles demonstrate substantial variability due to the changing turbulent regime in the evolving boundary layer. We obtained quantitative estimates of the atmospheric electric field variability range essentially related to the sunrise and convection development. It is shown that the local change in the electrical conductivity is the only factor that can change the intensity of electric field at the earth's surface more than twice during the transition from night to day. The established relations between electric and turbulent parameters of the boundary layer indicate that the effect of sunrise is more pronounced in the case when development of convection is accompanied by an increase in aerosol concentration and, hence, a decrease in local conductivity.