Studying an effect of salt powder seeding used for precipitation enhancement from convective clouds

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Experimental and theoretical studies of cloud microstructure modification with hygroscopic particles for obtaining additional precipitation amounts from convective clouds are performed. The experiment used salt powder with the particle sizes that gave the greatest effectiveness according to the simulations of Segal et al. (2004). The experiments were carried out in a cloud chamber at the conditions corresponding to the formation of convective clouds. The results have shown that the introduction of the salt powder before a cloud medium is formed in the chamber results in the formation on a "tail" of additional large drops. In this case seeding with the salt powder leads also to enlargement of the whole population of cloud drops and to a decrease of their total concentration as compared to a cloud medium that is formed on background aerosols. These results are the positive factors for stimulating coagulation processes in clouds and for subsequent formation of precipitation in them. An overseeding effect, which is characterized by increased droplet concentration and decreased droplet size, was not observed even at high salt powder concentrations.

The results of numerical simulations have shown that the transformation of cloud drop spectra induced by the introduction of the salt powder results in more intense coagulation processes in clouds as compared to the case of cloud modification with hygroscopic particles with relatively narrow particle size distributions, and for the distribution of the South African hygroscopic flares. The calculation results obtained with a one-dimensional model of a warm convective cloud demonstrated that the effect of salt powder on clouds (total amounts of additional precipitation) is significantly higher than the effect caused by the use of hygroscopic particles with narrow particle size distributions at comparable consumptions of seeding agents, or with respect to the hygroscopic flares. Here we show that seeding at rather low consumption rate of the salt powder initiates precipitation from otherwise non precipitating warm convective clouds, mainly by the effect of adding large cloud drops to the tail of the distribution.

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