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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Studying an effect of salt powder seeding used for precipitation enhancement from convective clouds" *by* A. S. Drofa et al.

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We thank the reviewer for the constructive comments. Following are our responses:

Pg. 10745:

The graph of temporal trends of temperature and pressure in the BCC (humidity = 100%) appears to be of low information value. So we considered it unnecessary to present it. These data described in (Romanov, Zhukov, 2000). If the Reviewer does not find this article we can send to him a copy.

Pg.10748:

The following text was added to the article: "The powder was designed to reproduce the optimal size distribution for most efficient acceleration of warm rain processes, as calculated by Segal et al. (2004)."

Pg. 10752:

The value of r is varied during an experiment. Therefore, to estimate the value of r/r_B accurate synchronization of experimental data with time is necessary. At the same time, N is a constant value (on the average) after condensation nuclei activation. Thus the value of N/N_B can be easily estimated. In theoretical studies it is more suitable to use the value of N/N_B. In the final analysis the results of comparison appear identical. Besides, the comparison of experimental values of r/r_B and N/N_B may serve as controlling factors of measurements.

Pg. 10757:

The following addition was made in the article: "The difference is observed only toward smaller droplet sizes – the experimental spectra are broader. On the whole, the problem "to broaden spectra" needs special detailed studies. One of possible causes of such a discrepancy may be in differences of physical and chemical characteristics of atmospheric condensation nuclei in particle size distributions. In the BCC only the size distributions of all aerosol particles were measured. But this distribution can concern a mixture of particles with rather different properties."

Pg. 10758:

The paragraph was clarified. Now it reads as follows: "The studies of the modification effect induced by such particles have shown (Segal et al., 2004; Drofa, 2006; Segal et al., 2007) that the introduction of salt particles can accelerate warm rain processes by the competition effect, which decreases the water vapor supersaturation in the cloud. In turn, the number of atmospheric nuclei is activated (i.e. they turn into cloud drops) to a lesser degree than in the background not seeded cloud. As a result, the total concen-

tration of cloud drops formed on the background and additional seeded nuclei appears less than in the case when additional seeded particles are absent. Average sizes of the seeded cloud drops become larger. Due to this, a positive effect of modification by hygroscopic particles on a cloud with narrow drop size distributions is attained, because the enlargement of cloud drops is the major factor stimulating gravitation-induced coagulation in clouds and subsequent precipitation formation. One should pay attention to the fact that the cloud drops formed on the background aerosol particles in the seeded cloud are smaller in size as compared to those in the not seeded cloud. It means that in this case the impact of salt particles leads to changes in the conditions of cloud drop formation on background condensation nuclei."

Pg. 10763:

The statement that this particular salt powder should be used was removed. But the superiority of this salt powder on hygroscopic flares was presented and supported by the findings of this study. The paragraph in question was rewritten, and now reads as: "In summary, the experimental data and the results of numerical simulations presented here and elsewhere show that a salt powder milled to size of several microns is more effective in initiating warm rain than hygroscopic flares. The calculated amounts of seeding material reach an order of 10 kg salt per km^2 of seeded cloud. The needed mass is even larger for a smaller effect when using hygroscopic flares. This requires seeding amounts of hundreds of kg per a seeding flight. Dispersion of such quantities is not feasible with hygroscopic flares, but has been demonstrated practical with salt powder (Rosenfeld et al., 2010)."

The word "optimal" is not removed from the abstract, because the salt powder size distribution was sized to replicate an optimal distribution, as calculated by Segal et al. (2004).

Pg. 10746, Ln.6:

The addition is made in the text: "An electric filament lamp is used as a white light

source."

Pg. 10758, Ln.1:

The addition is made in the text: "The number concentration of the particles introduced is 120 cm^{-3}. This is an optimal concentration of particles of the given sizes for obtaining maximum effect of modification (Drofa, 2008). At higher or lower concentrations the modification effect decreases."

Other technical corrections of the Reviewer are taken into account and necessary corrections are introduced into the article.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 10741, 2010.