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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.

Anonymous Referee #2

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The manuscript presents chamber measurements of cloud droplet size distributions resulting from the addition of specially-prepared salt particles, which act as giant CCN. It is shown that the addition of this specific salt powder decreases the droplet number concentration and increases the effective radius, which is expected to increase collision/coalescence and hence precipitation. Additionally, numerical simulations of seeding warm clouds with the salt aerosol and with aerosol from hygroscopic flares are presented to quantify the enhancement in precipitation associated with both types of cloud seeds.

Specific Comments:

Pg. 10745: It would be very useful to see a figure containing representative time series of the chamber conditions (temperature, pressure, humidity/supersaturation) referred to in this section in order to better follow the description of the cloud evolution as described.

Pg. 10748, Ln. 15: What were the specifications used to produce the "specially-prepared" NaCl/SiO2 powder and how variable are the resulting dry aerosol size distributions across different experiments?

Pg. 10752, Ln. 20: Why is it necessary to assume N_F/N = (r/r_F)ˆ3 when the effective radius can be obtained directly from the measured droplet size distributions? How do the two methods of computing the effective radius ratio compare?

Pg. 10757, Lines 7-9: "The same character of cloud drop spectrum variations is observed in experimentally obtained spectra measured in the BCC at a very similar concentration of the salt powder introduced (see Fig. 3)." Can the authors comment on why the droplet distributions simulated in Figure 7 appear much narrower (toward smaller droplet sizes) than the distributions measured in Figure 3?

Pg. 10758, Lines 7-20: I don't understand this section. Are the authors trying to say here that the decreased supersaturation caused by nucleating many additional salt particles into droplets causes fewer, but larger, droplets to form? Also, on Ln. 17, it sounds like the authors are saying that the background droplet case does not necessarily apply to the atmosphere, but I don't follow why. Please consider rewording these sections to be clearer.

Pg. 10763, Lines 8-13: I agree with Reviewer #1 that this paragraph should be removed. Since only this particular salt powder was examined in detail, recommending it over others seems unjustifiable at this time. For the same reason, the word "optimal" should be removed from Line 2 of the Abstract.

Minor Comments:

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Pg. 10743, Ln 3: Remove hyphen in “Saudi Arabia”

Pg. 10743, Ln. 23: Replace “The paper” with “This paper”

Pg. 10743, Lines 25: Add were to be “Experiments were carried out. . .”

Pg. 10744, Ln. 7: Remove “s” from “particles”

Pg. 10744, Ln. 27: Add comma to be “For this, external air is pumped. . .”

Pg. 10745, Ln. 19: Replace “chamber walls. It usually makes 18-20C.” with “chamber walls (usually 18-20C).”

Pg. 10746, Ln. 6: Is this a white light instrument or one particular wavelength? Please specify.

Pg. 10747, Lines 1-2: Which device is referred to here?

Pg. 10747, Ln. 3: Instead of “solid aerosol particles microstructure” do you mean “dry aerosol size”?

Pg. 10748, Ln. 3: Replace “pressure dropping” with “pressure decrease”

Pg. 10752, Ln. 3: What is the significance of the subscript F? Perhaps consider changing it to B for background?

Pg. 10752, Ln. 29: Replace “weight” with “mass”

Pg. 10753, Lines 5-7: Consider rewording as “The measurement results in a relative droplet size dispersion (given in Table 1) that shows that the introduction of salt particles in the cloud medium causes the spectrum to be broader than in the background cloud”

Pg. 10757, Lines 18-21: “At the concentrations. . .decrease of the number of droplets. . .observed in the experimental data. . .(see Figs. 4 and 5).” It is hard to see from the droplet size distribution figures (Figs. 4 and 5) whether or not the integrated number of droplets has changed. Consider referencing Table 1 instead.

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Pg. 10758, Ln. 1: Please add a citation in support of 120 cmˆ-3 being an “optimal” concentration of particles.

Pg. 10762, Ln. 13: While the “transformation of cloud drop spectra” seems clear, I don’t follow how the simulation indicates “intense coagulation processes in clouds”.

Pg. 10762, Ln. 24: Change “no-precipitating” to “non-precipitating”

Table 1: Please indicate what the symbols mean in the table caption as well as the text.

Figures 1-8: Please consider changing the axis tick marks to extend outside the graph. It is difficult to distinguish the axis markings from the droplet distribution traces (especially in Figures 3-4).

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