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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Time dependent, non-monotonic response of warm convective cloud fields to changes in aerosol loading" *by* Guy Dagan et al.

Anonymous Referee #1

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General Comments:

This article investigated the response of thermodynamic properties of cloud fields to changes in aerosol loading, using aLarge Eddy Simulations (LES) with bin microphysics. The results that pollution acts to suppress rain andincrease atmospheric instability, that is, warming of the lower part of the cloudy layer and cooling of the upper part, are very important and add some new insights into the understanding of aerosol-cloud-radiation interactions. The article is generally well written, concise and should be publishable if the following specific comments and suggestions can be considered in revision.

Specific Comments:

1. Since I did not see the article by Dagan et al. (2016), but from the title and introduction in this manuscript, it seems to me that the results and conclusions of these two paper are similar. What are the main differences between them?

2. Different initial concentrations of aerosol particles are used in the simulation. How the initial aerosols are distributed vertically, uniform or decrease according to a certain function? Whether they change with time? What are the altitudes of these aerosol concentrations referred to? Did you consider aerosol regeneration after evaporation of cloud particles? This could be avery important source of aerosols, especially in polluted conditions, and could be of important effects to the subsequently developed clouds and precipitation (e.g., Yin et al. 2005).

3. Whether the reversing point (line 182) change with thermodynamic and dynamic conditions?

4. Some of the results (Line 189-190, 201)for more polluted simulations contradict with the Twomey effects. Is there any observational evidence to support these results? 5. Line 198-200: Is the invigoration effect limited to aerosol concentration lower than 500 cm-3?

6. Line 251-252: Similar trend is also seen for maximum cloud top height. Is the decrease in COG height for larger aerosol concentration related to the inversion layer above cloud which prohibited the further growth of clouds?

7. Line 259-260: The LWP is decreasing with larger aerosol concentration. Is the water loading larger?

8. Line 297-299: Suggest to show 1-2 figures related the time variations of cloud fields to support the statements.

9. Line 331-335: Suggest to add more explanations to the results.

Technical corrections:

1. Line 35: add “water vapor and” at the end of this line;

2. Line 63: remove “,”between the parentheses;

3. Line 158: “in (Siebesma et al., 2003)”should be replaced by “by Siebesma et al. (2003)”;

4. Line 184-185: remove ();

5. Line 295: change “less” to “minus”;

6. Line 625: Add the variable for the abscissa.

References:

Yin, Y., K. S. Carslaw, and G. Feingold, 2005: Vertical transport and processing of aerosols in mixed-phase convective cloud and the feedback on cloud development. Q. J. R. Meteorol. Soc., 131, 221-246.

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