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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Sensitivity of warm clouds to large particles in measured marine aerosol size distributions – a theoretical study" *by* Tom Dror et al.

Anonymous Referee #1

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In this paper, an axisymmetric cloud model with detailed bin–microphysics was initialized with six marine aerosol size distributions (MSD), measured in-situ in the Atlantic Ocean, Caribbean Sea and Pacific Ocean to study the effect of aerosol concentration and size distribution on warm clouds' properties. It shows that the cloud mass and precipitation change non-monotonically with the total concentration and size distribution of cloud condensation nuclei (CCN), especially when a tail of giant or ultragiant CCN (GCCN or UGCCN) is also included in the aerosol size distribution. The most interesting finding is the upper boundaries of the GCCN. This has not been reported in previous studies, to the best of my knowledge. The study is well within the scope of ACP and is generally well presented, except for a few places need to be clarified or

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corrected.

Specific comments:

1) In the abstract, the statements and explanations are mainly based on the simulation results using the deepest thermodynamic profile, a more generalized statement or results including the shallower clouds should also be included, for a more complete picture.

2) I suggest each of filled circles in Fig. 2 (c)(d) to be marked with a time. The current figures are a little bit confusing.

3) Line 183-184: “The Atlantic-1 raindrops are considerably smaller than those produced by the other clouds (Fig. S6), and their evaporation is therefore greater”: One fact might also be important is that while raindrops formed earlier in case Atlantic-1, the cloud is still in its developing stage, or the vertical velocity is still positive below cloud base, and the relative humidity is relatively low, so the raindrops spend more time and therefore evaporate more before reaching the surface. In other cases, rain was promoted by stronger downdrafts, and the relative humidity should also be higher. Therefore, it may provide more evidence to explain the differences in surface rain amount and evaporation mass between case Atlantic-1 and other cases by analyze the below-cloud vertical velocity and relative humidity.

4) Figure 4(e) and 4(f) show a little bit strange here and do not add more support to the main body of the text, may be removed?

5) In this paper, only results from the simulation with the most unstable thermodynamic profile are analyzed in detail. For shallower clouds, the rain yield and the max. cloud mass show monotonic change with CCN concentration and no significant changes with GCCN. So the conclusion should be generalized to reflect how the results change for other thermodynamic situations.

Technical corrections:

1) Line 143, change “accumulating” to “accumulated”;

2) Line 206: Figure 4b,d should be “Figures 4b-d.

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