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Atmospheric Chemistry and Physics
Discussions

Interactive comment on "Precipitation effects of giant cloud condensation nuclei artificially introduced into stratocumulus clouds" *by* E. Jung et al.

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Major comments:

Interesting paper, likely effect demonstrated. That said there are some unresolved questions. If only one in 9 cases showed demonstrated effects of adding GCCN, then why did the other ones not. The authors suggest that it was due to clouds already precipitating. There may have been other reasons, e.g. insufficient cloud depth, etc.

1. The critical case with adding anthropogenic aerosols, in this case GCCN, is to know or estimate the natural amount of aerosols (GCCN). This is not done here. The authors

estimate concentrations of their added GCCN, although this is at best done in a very approximate way.

2. There is no attempt at relating the injected concentrations of GCCN to drizzle drop concentrations larger that some critical size. Figure 7 shows an increase in the concentration of drizzle drops, but with tick marks as sparse as 5 orders of magnitude, there is no real way of evaluating the concentration, let alone the increase in concentration, of drizzle drops. For instance, can the injected salt particles approximately explain the increase in drizzle drop concentrations, or are there so many more drizzle drops over such a large area that the injection of GCCN acted as a catalyst that initiated a subsequently much more efficient precipitation process in a cleaner environment?

3. The authors attribute the change in cloud to seeding with GCCN, but were there other changes in the conditions experienced during the flight? For instance, did the near-surface wind speed change dramatically, thus explaining a natural increase or decrease in production of GCCN? Was the near-surface horizontal wind speed sufficient to explain wave breaking (10-m altitude speed above approx. 7 m/s)? Did the sea-surface temperature (SST) change in a way that might increase or decrease the turn-over time (residence time of cloud particles in cloud)? The manuscript does not address these causes of natural variability.

After addressing these concerns in a satisfactory way, I am happy to recommend publication of this interesting study.

Minor comments:

Page 57, line 13: "Typical time scale of 10-20 minutes." I think that is an underestimate, and anyway how was it determined? You have updraft and boundary-layer depths measurements to give much better estimates. My guess is that average updrafts were +0.4 m/s and average downdrafts were -0.4 m/s, which for a boundary-layer depth of 600 m would give t=2 x 600 / 0.4 = 3000 s or about 50 minutes.

Page 58, line 7: “Appearance of a tail of large drops”. Figure 7 does not show the generation of larger drops after seeding with GCCN; there is already a tail of large drops before seeding (all 3 boxes). However, the overall concentration of large drops certainly increases after the seeding.

Page 73, figure 6 legend: If the CAS probe can measure drops in the size range 0-60 micron diameter, then average CAS observed diameters cannot exceed 60 micron, yet the plotted data show a significant number of mean diameters above 60 micron. I suspect that the mean is calculated from a combination of CAS and CIP data.

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Interactive comment on Atmos. Chem. Phys. Discuss., 15, 47, 2015.