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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Reduced efficacy of marine cloud brightening geoengineering due to in-plume aerosol coagulation: parameterization and global implications" *by* G. S. Stuart et al.

Anonymous Referee #2

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The authors report their work exploring the role of aerosol Brownian coagulation in reducing the efficacy of marine cloud brightening geoengineering by significantly reducing number concentration of sea salt particles in the intentional sea-spray injections, based on a Gaussian plume model and a fine-resolution large-eddy simulation model with detailed aerosol treatments. They also developed a parameterization scheme to account for this effect in global aerosol-climate models. The results should be of interest to ACP readers, particularly, those from the geoengineering community. The manuscript is well written and in general the scientific methods with assumptions/limitations are clearly outlined. I recommend for publication in ACP after the

following specific comments be addressed upon revision.

1) The particles were injected to an arbitrarily chosen 10-m deep box. How sensitive is the reduction to this assumption? It would be nice to also plot the size/volume evolution of the plume on Fig.2

2) It is not so clear to me how realistically the injection was done to the LES domain and in the plume. In the LES model, particles were introduced to the occupied grid boxes continuously (between model time steps) at a rate equivalent to the 30 kg/s mass flux. The crosswind was assumed to be 6m/s. Have you considered the moving speed of the ship? With the max domain dimension of 120 m, the source would move out of the model domain in a few seconds. Were the particles introduced to the plume model continuously too?

3) One technical concern is about running the WRF/Chem model as such a high spatial and temporal resolution. Is this justifiable? How was the turbulence developed in seconds? It would more convincible to show the key dynamical features produced in the simulation that described in the text (on page 18686, the first paragraph).

4) The calculations were based on dry particle sizes, but sea spray particles are water droplets (large sizes and different coagulation efficient) upon injection. The sizes will decrease as evaporation occurs, which will also induce cooling and change to the kinematics of flow. Without considering these effects in the calculations, the conclusions of the paper become less relevant to the sea-spray injections. It should be made very clear in the paper.

Technical edits:

1) P18685, line16: it doesn't make much sense to call it "longitudinal boundary" for such a small model domain.

2) p18686: the Mahesh (2013) reference is missing.

3) P18690, line5: no need to spell out LES again here

4) P18694, equation (6): needs improvement. This is for number flux Fn, not F? The “1 m/s” inside the expression is rather confusing. The equation can be much simplified, for example, by using “min(7, u)” for wind speed.

5) P18695, line15: misspelled “CDNC”

6) P18695, line16: using “non-zero” is better than “positive” here

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Interactive comment on Atmos. Chem. Phys. Discuss., 13, 18679, 2013.