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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Is increasing ice crystal sedimentation velocity in geoengineering simulations a good proxy for cirrus cloud seeding?" *by* Blaž Gasparini et al.

Anonymous Referee #3

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This is a manuscript on evaluating a simplified geo-engineering simulation strategy against the more comprehensive microphysical model treatment. The authors performed both fixed-SST and mixed-layer ocean simulations and investigated the changes in cloud properties for both ice and liquid phases, and the associated changes in cloud radiative forcing, surface temperature, and precipitation, due to using different geo-engineering model setups.

The manuscript is clearly written and well organized. The designed experiments and analysis are comprehensive. The conditionally sampled/calculated CRE changes are interesting and informative. I only have several questions that need clarification and some minor suggestions for better readability. Below please find my specific com-

ments:

1. Page 2, Line 20: Cirrus seeding affects the sedimentation of ice crystals from cirrus clouds to mixed phase/warm clouds, the cloud glaciation, and therefore the ice supersaturation. Maybe change it to "cannot directly influence"?

2. Page 3, Line 12: What is the model time step? This is related to the question below about the numerical treatment of ice sedimentation.

3. Page 3, Line 26-27: If the model time step is about 20min, an ice crystal with a sedimentation velocity larger than 1m/s will fall through a 800m thick model layer (800m/1200s=0.67m/s). How does the model treat this (violation of CFL condition)?

4. Page 4, Line 5-6: What is the initial size of the nucleated ice particles? If not the size of the seeded INP, is it determined by the parameterization or by explicit microphysical calculation?

5. Page 4, Line 12: Does the seeded INP immediately freeze at RHi=105% when T<-35C? How do you consider the competition between the homogeneous freezing of solution droplets, heterogeneous freezing of natural dust, and heterogeneous freezing of the seeded INP?

6. Page 4, Line 13-14: Do you avoid the INP seeding in anvil clouds? Or in-situ ice nucleation doesn't happen in anvil clouds?

7. Page 5, Line 24-25: I don't quite understand this. Do you mean with the same amount of ice crystal mass?

8. Page 8, Line 27: The signal over topography seems pretty strong. Does the model consider the impact of orographic waves on ice nucleation?

9. Page 9, Line 28-29: This result is very interesting, but it's very likely model-dependent. Do you have extinction output as well? Would be nice to show the forcing efficiencies (&CF/&EXT) in table 3 as well.

10. Conclusion: Many points are made in the conclusion part and to me, they are a little bit scattered (very useful information though). I would recommend the authors to make it more compact and concise. Maybe in the order of 1) statement of general findings; 2) differences in microphysical responses; 3) differences in CREs; 4) differences in temperature and precipitation response; . . .?

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-1109, 2016.