Comments on 'Additional Global Climate Cooling by Clouds due to Ice Crystal Complexity'

By Järvinen et al.

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In this article, ice particle complexity was derived from field campaigns spread over the globe, and it was further compared to chamber study. Angular light scattering functions from measurements were compared to Ping Yang's models, and it was concluded that roughened column aggregates model is the best representative of measurements. The new asymmetric factor derived from roughened column aggregates was explored in changing cloud radiative effects using a climate model. Overall, this article is well constructed and novel. Particularly, comparison of phase function between measurement and theoretical model will benefit other research areas such as model parameterization or remote sensing. My general comments: 1) explain how to obtain SWCRE from ECHAM model; 2) indicate how large biases of phase function exist between smooth and roughened particles.

Suggestion is to accept after a minor revision.

Specific comments:

Page 2

Lines 15-17: ' reduce the SWCRE by 1-2 W m^{-2}' is confusing. It reads like that the magnitude of SWCRE is reduced, i.e. SW cooling is reduced by lowering g. This is conflicted with your conclusion. Please double check Yi et al. 2013 and make it clear.

Line 29: Please indicate what are 'two instruments'.

Figure 1" upper penale → upper panel ; In lower panel, some scales are not clear.

Page 5 line 29: 'In these campaigns', do you mean all arctic campaigns ? Are there mixed phase clouds in SOCRATES campaign or midlatitude campaigns such as ARISTO 2017 and CONCERT with relatively high temperatures?

Page 6, section 2.5: Could you explain clearly how do you obtain SWCRE from ECHAM? Is it a parameter output from ECHAM, or do you run a radiative transfer model using ice clouds output from ECHAM?

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Line 20: 'For generation of the theoretical phase functions…..', do you mean that the phase function here is not for only one particle, instead for integration of a series of particles like bulk property?

Figure 4 and Figure 5: are the measured 'angular light scattering functions' the same in both figures? If yes, please indicate. Also, roughened particles are used here for comparison because studies indicate that they perform well in many applications. How would the smooth particle model curve look like if they are overplotted in Figures 4 and 5?

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Line 8: ‘ the global mean change in the SWCRE is -1.12 W m^{-2}’, please indicate that more cooling is brought in using new g parameterization.

Line 9: ‘ the change in global SWCRE is small compared to ….’, yes, it is right. However, based on Section 2.5, SWCRE is for ice clouds only. Is the change significant relative to your simulated SWCRE with new and old parameterizations? How about compare to SWCRE by ice clouds from [*Gasparini and Lohmann*, 2016] and [*Hong et al.*, 2016] where show ice cloud radiative effect using ECHAM-HAM model and from observations?

Line 11: ‘ the decrease in SWCRE…’, please indicate cooling is enhanced.

‘cirrus CRE’, please explain what ice clouds have been used for CRE studied? Thin cirrus only?

References

Gasparini, B., and U. Lohmann (2016), Why cirrus cloud seeding cannot substantially cool the planet, *J. Geophys. Res. Atmos.*, 1–17, doi:10.1002/2015JD024666.

Hong, Y., G. Liu, and J.-L. F. Li (2016), Assessing the Radiative Effects of Global Ice Clouds Based on CloudSat and CALIPSO Measurements, *J. Clim.*, (2011), In press, doi:10.1175/JCLI-D-15-0799.1.