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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Investigating the role of dust in ice nucleation within clouds and further effects on the regional weather system over East Asia – Part II: modification of the weather system" *by* Lin Su and Jimmy C. H. Fung

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We thank the anonymous referee for the constructive comments and suggestions. The concerns of the referee are addressed in detail as following.

General comments: Comment#1: My main question is regarding the setup of the sensitivity tests. My understanding is that in addition to dust as aerosols, there are also other aerosols included (coming from C1 ACPD Interactive comment Printer-friendly version Discussion paper the GOCART scheme, with should include as far as I know,

sulfates, sea-salts, elemental and organic carbon). When describing the NO-AER and AER runs, the authors state that NO-AER are conducted without dust, and with aerosol radiative feedback turned off. The way I read this is that radiative feedbacks for all aerosols (sulfates, carbon, seasalt and dust) are turned of. In the same manner, when aerosol radiative feedbacks are turned on (AER runs), I read this as aerosol feedbacks for all aerosols (not only dust) is turned on. If this is true, I think there is a problem with the sensitivity tests, as evaluating the differences between NO-AER and AER actually includes impacts from all aerosols, and not only dust. In this case, more sensitivity tests are needed, where only the radiative effect of dust is turned on or off, and not all aerosols. If I am misunderstanding, and the radiative effects of the remaining aerosols (sulfates, sea-salt and carbon) are always on, then this needs to be explained in the paper. For example, instead of calling the different runs for NO-AER and AER, call them NO-DUST and DUST instead.

Response: No emissions other than dust were included in the simulations, so only the effects of dust on the weather system were considered in this study. We will make a clarification, and replace "NO-AER" and "AER" with "NO-DUST" and "DUST" in the revised manuscript to avoid confusion.

Comment #2: Nothing is said about homogeneous freezing in this paper. Is homogeneous freezing of deliquesced aerosols included, which is an important part for cirrus production? Or are the NO-AER runs with a constant 1 per Liter as IN the only way to produce ice in the scheme? If homogeneous freezing is not included, I believe these runs highly overestimate the effect of dust, as increased dust concentration in cirrus regions can actually cause decreases in ice crystal concentration through the competition between homogeneous and heterogeneous freezing process. If homogeneous freezing of deliquesced aerosols are included, then please state that in the paper for clarification.

Response: Apart from heterogeneous freezing, Homogeneous freezing of deliquesced aerosols is considered and determined following the Bigg's parameterization (with the

background aerosol concentration set to 1/L). We did mention it in the first part of the paper, but omitted it in this manuscript. We will add a section to clarify the parameterization schemes used for ice nucleation process in the revised manuscript.

Comment #3: There are several citations missing in this paper. Make sure all work that is referred to are cited.

Response: Please see the responses to the specific minor comments.

Comment #4: In general, I suggest using IN (or INP) as an acronym for ice nuclei, since this is commonly used in the ice (or INP) community.

Response: Revised.

Minor comments: Comment #1: Page 3, line 45: Precipitation should be singular and not precipitations.

Response: Revised.

Comment #2: Page 4, line 60: Rephrase “very rare work”

Response: “very rare work” has been replaced by “only limited work”, with citations added.

Comment #3: Page 4, line 66: The correct name for the Thompson aerosol aware scheme is the Thompson-Eidhammer aerosol aware scheme. Further, a citation to their 2014 paper is needed here.

Response: Another referee, Dr. Gregory Thompson, also mentioned this problem. We have replaced “aerosol-aware Thompson scheme” into “Thompson-Eidhammer scheme” in both manuscripts. Also the citation has been added.

Comment #4: Page 4, Line 67: A citation is needed for the first Part of the series. After searching and finding this paper I am surprised that the authors did not cite it, as they are the authors of the first part of the series as well.

Response: Thanks for reminding. The citation has been added.

Comment #5: A short description of the calibration factor cf should be included here. Also a short description of the effect of setting RH to 100 % in relation to the ice nucleation parameterization should be explained in this paper. And which ice nucleation scheme is used? Actually, I believe the authors could include a section, summarize briefly part I of the series where they include a short description of the GOCART-Thompson implementation and their findings.

Response: We will include a short description of the calibration factor and the effect of lowering RH to 100% in the revised manuscript. And we will also include a section about the parameterization schemes used for the ice nucleation process, as well as the work done in the done in part I in the updated manuscript.

Comment #6: Page 5, line 94: A citation for Shao’s dust emission scheme is needed. Response: The citation has been added.

Comment #7: Page 8, line 171: Replace “observed” with “observations”

Response: Revised.

Comment #8: Page 8, line 190: Replace “reproducing” with “reproduced”

Response: Revised.

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