Interactive comment on the revised manuscript: "Investigating the role of dust in ice nucleation within clouds and further effects on regional weather system over East Asia - Part I: model development and validation" by Lin Su and Jimmy C. H. Fung

I think that the manuscript has substantially improved at this stage. I have just one comment. I would ask again the authors to explain more clearly how the heterogeneous nucleation occur in the CTRL simulation where no aerosol emissions are considered. In the manuscript, the authors write that "...the freezing of deliquesced aerosols using the hygroscopic aerosol concentration is parameterized following Koop et al. 2000, with the background aerosol concentration set to be 1/L." at lines 256-257. However, they should explain this concept better in Section 4 so, please, review the lines 253-258. For example, it would be clearer if they could explain similarly to their answer to the Editor's comment, i.e.: "By the default setting in the aerosol-aware Thompson microphysics scheme, heterogeneous nucleation is still activated in the control simulation, but with a constant ice nuclei concentration of 1 per Liter."
I think that all the other comments I wrote in my previous report have been addressed properly by the authors. Below, I list only some minor comments.

Assuming a final revision by the authors, I consider the manuscript suitable for the publication.

Minor comments

(Line numbers refer to the last version of the manuscript.)

Line 66: "is the most abundant aerosols": aerosols $\longrightarrow$ aerosol.

Lines 70-83: Thanks for the additional information about WRF and WRF-Chem. I personally find the order of the information not super clear, I mean: the authors say that the aerosol-aware Thompson-Eidhammer microphysics scheme has been implemented in WRF, however, in lines 74-75 they make a contrast mentioning WRF-Chem, which is not introduced yet. It would be sufficient to write before (e.g. at line 72, after the citation) that the aerosol-aware Thompson-Eidhammer microphysics scheme has been implemented ALSO in "WRF-Chem, the Weather Research and Forecast model coupled with Chemistry".

Line 79: "or couple" $\longrightarrow$ "or by coupling".

Lines 90-94: The paragraph has to be corrected according to the new structure of the manuscript (there is a new Section now).

Line 110: Why is "model" moved from line 111 (after "GOCART aerosol") to line 110 (after "scheme")? I would leave "GOCART aerosol model".

Line 134: "ice crystal" should be changed with "INP".

Lines 154-156: In my opinion, the sentence "...WE APPLY the DeMott2015 ice nucleation scheme in the GOCART-Thompson microphysics scheme TO BE IMPLEMENTED, instead of the DeMott2010 scheme, in the default aerosol-aware Thompson-Eidhammer microphysics scheme to simulate the ice nucleation involving dust." is not as clear as the explanation the authors wrote in their answers: "Although the DeMott2015 scheme has been implemented in the code of the Thompson-Eidhammer scheme, it cannot be used without modifying the code. We modified the code to call the DeMott2015 scheme in Thompson-Eidhammer scheme for the condensation and immersion freezing in our simulations."

Line 161: Please, adjust the sentence "...it is treated as deposition nucleation, and determined by the parameterization of Phillips et al. (Phillips et al., 2008) is applied to account for deposition nucleation.". It could be: "...it is treated as deposition nucleation, and determined by the parameterization of Phillips et al. (2008)" or "...it is treated as deposition nucleation, and the parameterization of Phillips et al. (2008) is applied to account for deposition nucleation.". Check how the citation Phillips et al. (Phillips et al., 2008) is written.

Line 163: Check how the citation "Koop et al. (Koop et al., 2000)" is written.

Line 164: I would have kept "WRF-Chem", instead of "WRF", as WRF-Chem is the model used for the simulations.

Lines 233-236: The word "conducted" is repeated 4 times... it does not sound very nice.

Line 254: The sentence "The newly-implemented GOCART-Thompson microphysics scheme." lacks a verb. Maybe it has been forgotten.

Lines 255-257: Check how the citations "Phillips et al. (Phillips et al., 2008)" and "Koop et al. (Koop et al., 2000)" are written.

Line 328: "The number concentrationS of dust particles over East Asia were vertically integrated..."

Lines 325-327: In the sentence "The dust particles in the fourth and fifth bins with effective diameters ranging from 6 to 20 μm account for around 60% of the total mass of dust aerosols, and dust particles with diameters smaller than 6 μm account for around 40% of the total mass of dust aerosols.", it is obvious that the second percentage is 40%. The authors could simply write: "The dust particles in the fourth and fifth bins with effective diameters ranging from 6 to 20 μm account for the major part (around 60%) of the total mass of dust aerosols."

Line 340: "...the simulated PM_{10} concentrationS were extracted...".

Line 342: The sentence "...thus here were five groups in Figure 3." does not sound completely correct.

Line 344, 348: "PM10" $\longrightarrow$ "PM_{10}".

Line 345: Just as reminder to the reader: "...as no other emissions were considered in the simulations APART FROM DUST.".

Line 346: I am sorry, I do not see overestimations in Fig. 3e, rather in Fig. 3g and 3h.

Line 375: Please, add the reference to Fig. 5 already here: "...from MODIS and MISR products IN FIGURE 5.", otherwise, the high values of AOD are described before any reference to the figure.

Lines 382-383: It is not clear if "respectively" refers to March and April. Please, check the sentence.

Lines 482-485: There is a repetition. Please, delete "by considering the effects of dust on ice nucleation process," or "by taking in to account the effect of dust in the ice nucleation process".

Line 519: "ro" $\longrightarrow$ "to".

Lines 540-551: Better "relative humidity threshold" instead of "threshold relative humidity". Also at lines 579 and 580. Also in the abstract at line 30.

Line 540: Here, which is the beginning of a new subsection, I would repeat "with respect to ice" (i.e. "...relative humidity threshold with respect to ice to trigger...").

Lines 569-572: I think that this paragraph refers to the old Fig. 8, which has been removed.

Line 579: "3 or 4" is not consistent with "4 or 5" at line 529 (in my opinion the second option is better).