General Comments:

I have gone over all of the author responses to my comments, and am happy to say that all have been addressed very well. The authors have done an excellent job at revising their paper, which reflects a considerable amount of additional work (e.g. the improvements on modeling). As noted in the first review, this appears to be the first combined observational-modeling study showing the impact of aerosols on cirrus cloud microphysics under various meteorological conditions. The conceptual framework of the paper is now greatly improved, and I suspect this paper will be widely referenced in regards to cirrus cloud-aerosol-radiation interactions. There are just a few outstanding issues that should be addressed, as described below. Congratulations to the authors for this significant advancement in our understanding.

Response: We thank the reviewer for the in-depth review and detailed suggestions. We have followed these comments in revising the manuscript. Point-to-point responses are given below.

Major Comments:

1) Page 8, line 33: Different investigators use different formula for calculating Rei; which equation is used here?

Response: We have revised the sentence as follows:

The N_i for a given aerosol number concentration (i.e., a sub-group of experiments) is calculated using an arithmetical mean of the 100 experiments, while R_{ei} is calculated from mean N_i and mean ice volume: $R_{ei} = (\text{mean volume}/\text{mean } N_i * 3/4\pi)^{1/3}$. (Page 8 Line 32 to Page 9 Line 2 in the revised manuscript)

2) Page 16, lines 11-12, and Fig. 5 in general: Since the model has been improved to more closely mimic natural processes now (and predicted and observed Rei agree fairly well), it would be interesting to know what fraction of INP result in an ice crystal for aerosol number concentration > 300 cm-3 (when nearly all ice crystals are produced by heterogeneous ice nucleation). This information would be useful for comparing with other cirrus cloud modeling studies.

Response: All INPs are consumed to produce ice crystals in this aerosol number concentration range (300-500 cm^{-3}). (Page 16, Line 23-26)

Combining deposition and immersion INP together, the INP to aerosol ratio is 1:10,000. For an aerosol concentration of 300 cm-3, the combined INP concentration should be 0.03 cm-3, or 30 L-1. But Fig. 5b relates this INP concentration to an ice crystal concentration (Ni) of ~ 300 L-1. It seems that either I have made a mistake in this calculation (or assumed something incorrect), or the combined INP-to-aerosol ratio should be 1:1000 to account for an Ni of 300 L-1 (assuming all INP produce an ice crystal).

Response: We apologize that we forgot to indicate that in Fig. 5b, N_i is denoted by solid lines while the fraction of ice crystal number produced by heterogeneous nucleation is denoted by dash lines. Therefore, for an aerosol concentration of 300 cm^{-3} at pv = 78 ppm, N_i is less than 30 L^{-1}. It is not exactly 30 L^{-1} because of sedimentation. We have clarified the meanings of solid and dash lines in the corrected figure shown below.

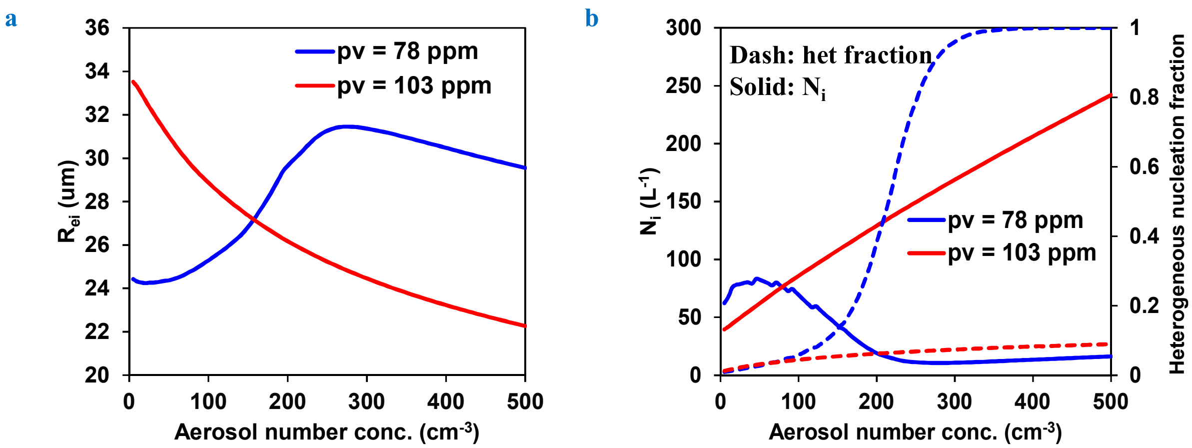

Figure 5. Simulated changes in (a) ice crystal effective radius (R_{ei}) and (b) ice crystal number concentration (N_i) and the fraction of ice crystal number produced by heterogeneous nucleation as a function of the total aerosol number concentration. Simulations are conducted for two initial water vapor mass mixing ratios (pv), an indicator of available water amount for ice formation. The ratios of externally mixed dust (deposition INP), coated dust (immersion INP), and sulfate (not INP) are prescribed with values of 0.75:0.25:10000 in all experiments.

Minor Comments:

1) Page 4, lines 12-13: Might be more accurate to say that the DARDAR Rei retrievals, corrected for the crystal habit assumption used here, lie mostly between 10 and 80 microns.

Response: Done. Thank you! (Page 4, Line 11-13)

2) Page 12, line 29: dcreases => decreases

Response: Done. Thank you! (Page 12, Line 32)