

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## Comment on acp-2022-332

Anonymous Referee #1

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Referee comment on "Technical note: Identification of two ice-nucleating regimes for dust-related cirrus clouds based on the relationship between number concentrations of ice-nucleating particles and ice crystals" by Yun He et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-332-RC1>, 2022

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Comment to "Technical note: Identification of two ice-nucleating regimes for dust-related cirrus clouds based on the relationship between number concentrations of ice-nucleating particles and ice crystals" by He et al.

This study investigates the relationship between number concentrations of ice-nucleating particles and ice crystals, based on which it proposed an identification method for two ice-nucleating regimes for dust-related cirrus clouds. The findings are interesting and worthy for publication after necessary revisions.

Line 40-41, considering the shattering of ice particles which can further serve as ice nuclei to help the heterogeneous formation of ice crystals, I am not sure if the description "and later homogeneous freezing is followed due to the depletion of ice-nucleating particles and the persistence of cooling" is accurate or not.

Line 43-46, actually, at low temperature (such as below -25 degree C), even sulfate and nitrate particles can serve as IN as indicated by Che et al. (2019, doi: 10.1016/j.atmosres.2020.105196).

Line 55-57, this description is not correct in my opinion. The change of cirrus clouds here

in principle reduces the outgoing longwave radiation to space while it increases the emission of cirrus, which is why it plays a more cooling effect.

Line 89-90, considering potential variation of cirrus properties, why do the authors only choose two cases, and why do they choose these two cases?

Line 142-143, how could the authors make sure that the meteorology at the station is the same as that over the location CALIOP observes.

Line 144-148, for ice forming, only these two mechanisms play the role?

Line 178, is there any method to confirm the interaction between dust and cirrus clouds?

Line 205-209, it seems that there is a large fraction of ice particles with diameters between 5 and 25  $\mu\text{m}$  (more than 50%). Is this reasonable, and why?

Line 237, why is there a ")" here

Line 240-242, During the transport of dust, the concentration of dust aerosols could vary a lot with space. How do the authors make sure the dust obtained here can represent that contacting cirrus clouds?

Line 305, how do the authors mean "emitting back to space"?