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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Longwave indirect effect of mineral dusts on ice clouds" *by* Q. Min and R. Li

Anonymous Referee #2

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This paper studies the micro-physical impact due to mineral dusts on ice clouds and thus the change of longwave indirect radiative forcing. Aerosol radiative indirect forcing has been paid a lot of attention in the last two decades. This is one of the most uncertain factor for global warming issue. However most of aerosol indirect studies focused on the shortwave related to low clouds. Much less attention is paid to the longwave effect on high clouds. The work by Min and Li is in time. This paper is interesting and helps to understand the longwave indirect forcing due to dusts on ice clouds I therefore recommend publishing this paper with following suggestions.

1. Page 764 Line 2 (P74-2), it is not clear what is the cloud top distribution. Please modify it.

2. P764-26, could the authors provides a very simple description why the dusts can lower the threshold temperature and relative humidity, which helps the readers to un-

derstand the physics without reading a lot of reference.

3. P766-6, please double check that the resolution is 20km. Can the micro-physics properties be detected well with such resolution?

4. P766-11, should it be called blackbody temperature? The cloud emissivity is generally lower than one especially for high cloud.

5. P767-16, and Fig. 2b, the authors showed that there is a trend that CET decrease with increase of AOD. However, most of ice clouds appear in the very low AOD region (<0.5). The authors might need to emphasize that kind of trend still exists in the small AOD region. Using a logarithm scale might demonstrate the problem more clearly for the result of small AOD.

6. P767-24-27, I hope the authors will rephrase the this sentence. 'IWP is an indicator of dynamic and thermodynamic conditions', why this suggests that the tendency of CET with AOD is not attributed to dynamics and thermodynamics. I can not follow this. Also the authors need to discuss the results of Fig.2c.

7. P768, second paragraph, to my knowledge nobody had mentioned that aerosol can invigorate the convection. Aerosol can slightly change the cloud heating rate, but that is negligible in comparison with the convective heating. I believe there is some physics behind the correlation between dust and convection. For example, stronger boundary turbulence, stronger surface wind, etc. might be benefit to both of the dust loading and convection strength.

8. P769 first paragraph and Fig.3, the authors had investigated various possible impacts of large scale dynamics on clouds. However, there is not enough discussions for related physics. I don't see any trend from the figures. For example, let us look the relation between CET and SST. Most cloud cases have CET from -30K to -50K, this seems true for the whole range of SST. I hope the authors can provide more detailed discussions.

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In addition, how about the results between the chosen physical quantities and IWP? I guess CAPE and IWP should have correlation.

9. P770 and Fig.4, the first column of Fig.4 seems be the same as that of Fig.2(a), both plot the CET against IWP. However, the IWP is about two order larger in Fig.4. I don't understand. Please check.

10. Fig.5, Fu-Liou model (at least its early version) is not accurate in comparison with some other models, like the radiation mode created by AER.

11. P772 last paragraph and Fig.6, in comparison with the model calculations and observations, how can the authors be sure there is no low liquid cloud existing in the observation cases. Brief discussion is needed.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 763, 2010.