

Interactive comment on “Large surface radiative forcing from surface-based ice crystal events measured in the High Arctic at Eureka” by G. Lesins et al.

Anonymous Referee #2

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This paper studies the ice crystal suspended in the boundary layer air under clear sky conditions during most of the Arctic winter in Northern Canada. It shows that the ice crystal layer could have big impact on the downward infrared flux at the surface. Also the physical reasons for the high optical depth and large downward infrared flux is discussed. The paper is interesting and helps to understand the radiative influence of Arctic ice crystal. I therefore recommend publishing this paper. Generally the paper is well written I only have following minor suggestions.

1. In Page 17692 line 9 (P17692 I9), to my knowledge visible is only up to 0.69 micrometer, please check.

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2. P17692 I24, 'Crystal' should be crystal.
3. P17693 I3, it is better to say that ice crystal can enhance the forward scattering instead of 'result in forward scattering'.
4. In P17693 I17, Blanchet and Girard (1995) showed a opposite result as the downward infrared flux would reduce due to the existence of ice crystal, because of dehydration. It is not very obvious to the readers why the dehydration is a long term effect and the dehydration not affect the results shown in this paper. More discussions are needed.
5. P17696 I6, define δ_l , and δ_c , also in a few other places the clear symbol definitions should be provided. For example in (1), r_0 , r_{eff} , and $N(r)$.
6. P17696 I18, 2.5 s profile is not clear to the readers. 7. P17699 I5, this sentence is incorrect, it should be 'from 5.56 to $100\mu\text{m}$ with resolution of 25 cm^{-1} to match with ..., 20 stream discrete ordinate method is used for radiative transfer'. The authors should know 20 stream is for the radiative transfer but not for the spectral resolution.
8. P17700 Eq.(2), it is better define $I_{\lambda,model}$ clearly.
9. P17700 I15-18, the discussion for anisotropy factor needs to improve. It is not clear to me why the zenith radiance is mostly from upper troposphere or higher. The column radiation model shows the downward infrared radiance (flux) at surface is mostly contributed from the lower atmosphere, since the air density and temperature are higher there.
10. P17701, in the first paragraph, some discussions repeat the previous results.
11. P17716, in Table 2 the result of Jan + Feb + Dec is the bottom, it is better to move the results of Jan + Feb + Dec in Table 3 to the bottom.
12. The caption of Table 4 is too long. It is difficult to readers to catch the information. The authors should think about how to simplify the caption. The same is for Table 12.

13. In Figure 8, panel b shows that the extinction coefficient decreases with height, however, panel d shows that the optical depth increases with height. As we know the optical depth = extinction coefficient times local geometric path, how can the results shown in Figure 8 be correct? The same is for Figures 9 and 10.

14. The caption of Figure 12 is missing.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 17691, 2008.

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