Atmos. Chem. Phys. Discuss., 8, S9970–S9972, 2008
www.atmos-chem-phys-discuss.net/8/S9970/2008/

Atmospheric Chemistry and Physics Discussions

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.

G. Lesins et al.

Received and published: 17 December 2008

Response to review by Anonymous Referee #3

Overview

We thank the referee for the helpful suggestions. We agree that blowing snow should appear more prominently and so we have changed the title of the paper to <Large surface radiative forcing from topographic blowing snow residuals measured in the High Arctic at Eureka>.

Below we have addressed each of the major and minor points that were raised.

Major Points

1. For cases when the lidar does not detect ice crystals above 75 meters but they are observed at the surface it is not possible to say definitively whether it is because the ice crystals are below the backscattering detectability limit of the lidar or are all residing below the minimum detectable height of the lidar. We suspect that both explanations either individually or together are needed. Our reasoning for the shallowness explanation is that the coldest temperatures occur at the surface and so this is where ice crystal formation (conventional diamond dust) is likely to be most frequent. For the backscattering explanation we have numerous surface observations of ice crystals in spite of the horizontal visibility being greater than 15 kilometers which suggests that the ice crystal scattering cross-section can be very small and not detectable by the lidar. Although we cannot address this question quantitatively we have added more discussion on this point at the end of Section 2.4.

We removed our speculation that the surface observer would use local light sources to detect very low concentrations of ice crystals since we cannot demonstrate that this is a consistent practice. However based on conversations with field observers ice crystals are observed in the immediate vicinity of the observer and are not typically determined by seeing a hazing up of the sky.

There were no winter cases where the lidar observed boundary layer ice crystals but the observer did not report ice crystals.

2. We have added a column of ice crystal layer height from the lidar in Table 3.

3. Figures 13 to 16 were moved forward from the Discussion section to the end of the case studies section (4.5). This required a renumbering of Figures 12 to 16.

Minor Points

1-3. We made the corrections.

4. The March 21 case study was actually added toward the end of our work on this project in order to have one case that occurred during sunlit hours allowing MODIS

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visual imagery to be used. The original climatology for the surface observations and lidar were based on the traditional winter months of December, January and February. Although in principle March could also be added, this would represent a major additional effort to include lidar measurements which is a very labor intensive task with very likely no gain in the quality of our results. We feel including March with its extensive sunshine and inclusion of the start of the spring season would not be helpful for the winter-time statistics.

5. A number of the redundant sentences at the beginning of Section 4.1 were removed.

6. Figure 3 is enlarged by arranging the subplots in a 2 x 2 array which makes the text more legible.

7. A circle was added around the blowing snow streak over Eureka to the MODIS IR image in Figure 16 (the old Figure 12).

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