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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The Chisholm firestorm: observed microstructure, precipitation and lightning activity of a pyro-Cb" *by* D. Rosenfeld et al.

Anonymous Referee #2

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1) General Comments:

The manuscript describes the characteristics of a pyro-Cb event, in particular the microphysical characteristics of the cloud, as observed by weather radar, multi-channel satellite radiances, radiosondes and lightning detectors. There is a particular focus is on the suppression of precipitation by the injected particles, which lead to a great number of small cloud droplets. The paper provides an insight into an intriguing phenomenon, and the inferences regarding precipitation release appear reasonable and interesting. Also, the comparison between this case study and other similar events is potentially valuable. The main weakness of the paper is in the clarity of the pre-

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sentation. The figures are too small, not all the relevant information is provided, and consequently, the interpretation of the figures is often difficult to follow. All in all, the paper appears rather hastily written and the material is not well organized.

Concrete examples of things to improve are the following:

Ţ Weather charts must be added (see comments below). Ţ Discussion on page 9883-9884 is extremely hard to follow (see comments below). Ţ Figures 6-7 should appear before Figures 4-5, for temporal consistency. Ţ The authors use the terms 'upshear' and 'downshear' repeatedly. According to Figure 3, above there is hardly any wind shear above 600 hPa.

2) Specific comments: Page 9880, line 25: What do you mean by 'atmospheric instability'? Are you talking about static stability? If so, are you sure that the atmosphere was truly statically unstable, or do you mean conditionally unstable? Can you document that? I suggest to replace by something like 'weak static stability'. Page 9881: The authors must show weather charts here, to allow the reader to follow the discussion concerning the approaching cold front! Page 9883, line 7: 'The emissivity of such ice clouds ĚĚ..'. Here we are not dealing with a pure ice cloud, but rather a mixture of an ice cloud and a smoke cloud. How does that affect this assumption? Page 9883, lines 10-11: '-60 to -62°C, in agreement with the temperature at 1300-1600 m above the tropopause'. This is inconsistent with the sounding in Figure 3, which indicates temperatures of -58 to -60°C at these levels. Page 9884, line 1: It sounds reasonable that the ascending cloud would cool adiabatically below the ambient stratospheric temperatures. The question that arises is: Why was this not a topic in the discussion of points C and K earlier? Page 9886, lines 10-11: Please explain the reasoning behind the following: 'According to the sounding in Fig. 3, the anvil top at 00:00 UTC was at a height of 12.5 km'. How is this inferred from the sounding? Page 9899, Fig. 4: Points D and F have a 0.65 micron reflectance greater than 1. How is this possible? Please explain.

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3) Technical corrections: Abstract, line 2, page 9878: ‘and’ must be inserted before ‘devastated’. Page 9879: ‘Fromm et al. (2006a)’ should be given as ‘personal communication’ or, by the time it is submitted, as ‘Fromm et al. (2007)’ Page 9879 and 9893: ‘Fromm et al. (2006b)’ should be ‘Fromm et al. (2006)’ Page 9879, line 18: Please define the acronym ‘TOMS’. Page 9879, lines 18 and 21: Explain AI; e.g., what does an aerosol index of ‘between 25 and 32’ mean, physically? Page 9880, lines 6 and 10: Approximately what height does a potential temperature of 450 K correspond to? Page 9880, lines 20-21: ‘occurred fortunately’ should be ‘fortunately occurred’ Page 9880, line 23: After ‘Edmonton’, add: ‘in Alberta, Canada’. Page 9880, line 26 and page 9894, line 8: ‘Luderer et al., 2006b’ should be ‘Luderer et al., 2006’. Page 9881, lines 2-9: It would be valuable to the reader if the sensible heat flux were provided in W m-2. Also, how were the fuel consumption and specific combustion energy estimated? Page 9881, line 11: ‘heights’ appears twice. Page 9881, lines 26-27: Once again a map would improve the readability greatly. A weather chart with Chisholm and the sounding site clearly indicated would do. Page 9882, lines 11-12: There is something wrong with the sentence ‘An new analysis Ě..’. Page 9883, line 17: ‘Luderer et al., 2006a’ should be ’Luderer et al., 2007’, or ’Luderer et al., pers.comm.’ Page 9883, lines 17-23: What is the conclusion here?? Page 9884, lines 6-7: Please explain better the following: ‘According to the length of the shadow and the illumination and viewing geometry ĚĚ..’ Is there a reference for the methodology used here? Page 9884, lines 11-12: What do you mean by ‘but not at their peak magnitude’? Page 9884, line 15: As was the case for the sounding, the position of the radar needs to refer to a map, which currently is missing. Page 9885, line 29: ‘sill’ should be ‘still’. Page 9886, line 4: What do you mean by ‘the saturation value of 35 microns’? Page 9886, line 19: ‘is so also’ should be ‘is also’. Page 9887, lines 4-5: The sentence ‘Figure 7 shows clearly Ě.’ is repetitive, and should be removed. Page 9888, line 14: ‘have’ should be ‘has’. Page 9888, line 25: ‘were’ should be ‘have been’. Page 9889, line 7: ‘Latham and Williams (2001)’ does not appear in the reference list. Page 9889, line 12: ‘Comet, 2002’ does not appear in the reference list. Page 9890, line 25: ‘in spite’ should be

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'despite'. Page 9897, Figure 2: The figure is so small that it is not possible to see any of the features that the authors describe. Perhaps the upper panel can be skipped, and the lower panel substantially enlarged. Also, in line 2 of the caption, 'upper part' and 'lower part' need to be swapped. Page 9898: The caption for Figure 3 is inadequate. What are the blue, green and red lines? Page 9899, Fig. 4: For clarity, it needs to be mentioned that the southernmost cloud is what is called 'phase-2' in the text. Page 9901, Fig. 6: The figure is rather small for readability, especially the inlets ('Area 1' and 'Area 2'). Page 9901, Fig. 6: In A-B reflectances (at 0.65 microns) of well above unity are shown. Please explain. Page 9902, Fig. 7: The lower two panels are far too small for readability. Page 9904, Fig. 9: Once again, the figures are too small.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 9877, 2006.