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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 #1

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General comments:

This paper provides a very thorough analysis of the Chisholm pyro-Cb, paying particular attention to the cloud micro-physical and precipitation properties. This analysis furthers our knowledge of the structure of such storms which are currently a hot topic in the scientific literature, and the results deserve to be published in ACP. However before the paper is published it requires a revision, largely editorial in nature, with one or two scientific aspects that need to be clarified.

This is not the first paper to be written on the Chisholm pyro-Cb and the authors need to state clearly in the Introduction the new information provided by this study.

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Discussion Paper

Specific Comments:

1) The Glossary of Meteorology, 2nd Ed., American Meteorological Society, does not define a pyro-Cb, but defines a pyrocumulus as: A cumulus cloud formed by a rising thermal from a fire, or enhanced by buoyant plume emissions form an industrial combustion complex.

A pyro-Cb is of course a very large pyrocumulus with precipitation. In the Introduction the authors define a pyro-Cb as being specifically formed by forest fires. But is this necessarily the case? Can a pyro-Cb also be formed by a very large and hot grassland fire? It would be helpful if the authors could provide a reference for the definition of a pyro-Cb.

2) The authors claim that the Chisholm firestorm released a quantity of energy equivalent to 1200 Hiroshima-sized nuclear explosions. This is in addition to the latent heat released by the condensing of the water vapor from the burning of wood. This is the type of statistic that the media like to sensationalize, in which case the authors need to be able to clearly back up their claim. They also need to provide more supporting evidence to convince this referee. According to the text the energy released from the burning of 500 km2 of forest not only produced enough energy to loft 1200 Hiroshima-sized mushroom clouds, but also enough energy to destroy 12000 km2 of urban development (the Hiroshima bomb destroyed 10 km2 of Hiroshima), an area 14 times the size of New York City (all 5 boroughs, not just Manhattan). I just find this hard to believe. The authors arrive at the energy release as follows: 7.6 kg m-2 x 500 km2 x 18700 kJ kg-1 = 71 x 109 MJ

Where did the fuel consumption of 7.6 kg m-2 come from? Is this dry weight of wood, or does it include green wood with a high water content? Furthermore did all of the 7.6 kg m-2 totally combust? I assume that as in most forest fires, quite a bit of wood remained unburned. Is this considered in the equation? Also, where did the 18700 kJ kg-1 value come from? I assume this is for dry wood?

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Technical comments:

Many of the figures are far too small and their size needs to be increased: Figure 2 needs to be doubled in size, I can't even read the time labels in the printed version. Figures 6 and 7 have too many detailed insets for the current size and both figures need to be enlarged by at least 50% Figure 9 should also be increase by 50%

The paper needs to be thoroughly proof-read for grammatical errors as well as for writing style.

Abstract, line 5 change "massive amounts" to a large quantity

Abstract lines 11-12 change "few large graupel and hail" to small quantities of graupel and hail"

Abstract, line 15 change "small precipitation efficiency" to "low precipitation efficiency"

Introduction In the first sentence the authors treat the word pyro-Cumulonimbus as being plural when it is singular.

Page 9870, line 11 change to "shoot into the lower stratosphere, injecting large amounts of smoke..."

Page 9879 lines 14-15 This statement is repeated on page 9880

Page 9880, line 22 change "reach some insights" to "gain new insights"

Page 9881, line 20 Change to: "The precipitating frontal clouds advect over the region and help diminish..."

Page 9882, line 12 Need to merge this sentence fragment with the following sentence

Page 9883, line 22 delete "already"

Page 9885, line 29 It would be helpful to describe the "continental" classification

Page 9887, line 19 shouldn't the overshoot be "colder", rather than "warmer" than the

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lower background anvil?

Page 9892, line10-12 This last sentence is quite awkward and needs to be restructured.

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