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Interactive Comment

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

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Here we present an additional response to referee 3:

Referee 3 is uncertain regarding the aim of this paper. The motivation for this paper has three elements: 1. New observational data have become available since Fromm and Servranckx (2003) that provide invaluable insights. 2. The satellite data showing the convective activity could be exploited in important ways that Fromm and Servranckx (2003) had not included (e.g., analysis of the height of the cloud top/injection) 3. There are now two modeling papers on the Chisholm firestorm (Trentmann et al., 2006; Luderer et al., 2006), which can best be assessed with the full suite of observational data now at our disposal. Motivated by these developments, we seek to lay out in detail

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as many aspects of the Chisholm pyro-Cb as the available ground and satellite data will permit. In the revised version, we will endeavor to modify the paper to state more clearly our motives and objectives.

Referee 3 seems to be troubled that we appear to be leaning too much on the aspect of precipitation suppression to distinguish the Chisholm pyro-Cb from non-pyro-Cb. Our view is that multiple extreme phenomena are in evidence, all of which are contributors to the unique strength of the pyro-Cb's vertical transport. 1. Huge sensible heat release; 2. Lots of positive lightning (feeding back to the fire/heat spread); 3. Peculiar and extreme cloud microphysics. We show and describe the evidence for all these for the first time in this paper. We intend to revise the paper so that we don't appear to be ranking them, just showing the strong evidence for each, and methodically contrasting them with the non-pyro convection.

For instance, we will be very detailed and precise in identifying the deep non-pyro convection that is occurring. We will guide the reader unambiguously to features of comparison. For example, consider the convective cell that is just to the right of the lower right corner of the text box in Figure 4. This is a tropopause-deep, "normal" Cb spawned along the cold front ˜40-60 km NNW of Carvel radar, which then moved north to ˜120 km away at 0220 UT. This is an excellent "ambient" convective cell that has lower echo tops yet stronger low-level radar reflectivities. Figure 1 here demonstrates this point.

We do not agree with referee 3's term "speculative" as a characterization for our conclusions regarding precipitation suppression. We contend that the key benefit of the radar data is to objectively assess precipitation rate and amount. In the absence of dense spatial rain-gauge data with detailed time resolution, we use radar reflectivities, which directly provide inferences as to precipitation rate. We show that pyro-Cb reflectivities are low not only at a snapshot in time (e.g., 0000 and 0220UT) but also throughout its lifecycle, as demonstrated by the added comparative radar cell tracking. By doing so, we will make a compelling case for precipitation suppression in the pyro-Cb relative to its most intense nearby non-pyro convective cell.

In our assessment, the combination of these radar data with the satellite T-Re retrieval is a powerful tool. It can be argued that one can never know just using a T-Re retrieval from the "skin" of a convective cloud what is going on inside that skin. But having both extreme types of cloud nearly side by side, and having good radar coverage, gives one the peek inside the skin needed to see how good the T-Re assumptions are. And in this case it looks like the assumptions are pretty solid.

Regarding referee 3's point #6, we agree that the point we're making is not clear. There are several issues in our text and figures we need to address in a revision. We will clarify the text, resize the figures, provide fuller captions, and correct errors in Figure callouts.

References:

Fromm, M. D. and Servranckx, R.: Transport of forest fire smoke above the tropopause by supercell convection, Geophys. Res. Lett., 30, 1542, doi:10.1029/2002GL016820, 2003.

Trentmann J., G. Luderer, T. Winterrath, M. D. Fromm, R. Servranckx, C. Textor, M. Herzog, H.-F. Graf, M. O. Andreae: Modeling of biomass smoke injection into the lower stratosphere by a large forest fire (Part I): reference simulation. Atmos. Chem. Phys., 6, 5247-5260, 2006.

Luderer G., J. Trentmann, T. Winterrath, C. Textor, M. Herzog, H. F. Graf, M. O. Andreae. Modeling of biomass smoke injection into the lower stratosphere by a large forest fire (Part II): Sensitivity studies. Atmos. Chem. Phys., 6, 5261-5277, 2006.

See Figure 1 in the following link: http://www.earth.huji.ac.il/data/pics/Radar.png

Figure 1: The radar tracked evolution of the pyro-Cb and the strongest non- pyro Cb nearby. The peak low level reflectivity (red) and echo top heights (blue) are shown for the pyro-Cb (solid lines) and for the strongest ambient Cb (broken lines). Note the

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much smaller reflectivity of the pyro-Cb despite its greater vertical development. Also note that the time for reaching maximum reflectivity of the pyro-Cb is 50 minutes after its appearance on the radar screen, whereas the reflectivity of the non-pyro Cb peaked already after 20 minutes. Both are indicative of suppressed precipitation processes in the pyro-Cb.

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

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