

## ***Interactive comment on “Linking local wildfire dynamics to pyroCb development” by R. H. D. McRae et al.***

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This paper proposes to demonstrate that severe pyroconvection (specifically pyroCb development) is directly associated with “extreme local fire dynamics” and specifically in the cases examined, fire channeling. (Note, MS Word autocorrects channeling to one “l,” yet the authors consistently use two.) I believe they make their case compellingly, demonstrating the spatial and temporal alignment of the fire dynamics and subsequent pyroCb. In fact, I believe the case is stronger than they acknowledge and could be stated more strongly. At the same time, there are a couple of portions of the paper that do not advance the claim – they are not necessary to the premise and proof. These minor concerns aside, I have to say this is one of the better papers I

C2955

have encountered in some time. The subject is scientifically significant, and the methods sound. The authors clearly lay out their evidence for the fire behavior, and the subsequent pyroCb development. They do so with limited extraneous information or discussion.

I feel that the figures are so small as to be nearly useless. I had to enlarge the view to 250% on a 24” monitor to even read the text in Fig. 1. Printed copy viewed with a magnifying lens was beyond the printer’s ability to produce legible text. The figures need to be enlarged by at least that amount (250%) to be acceptable.

Specific comments: p. 7271, l. 5-14: “Extreme” and “extremely” are used 3 times in just this paragraph. In general, I encourage the authors to choose their superlatives and “extremes” carefully. At present, the abundance of extremes, verys, stronglys, etc. waters them down, and their impact in the places where they could matter most is diluted.

p. 7271, l. 16: “smoke and other emissions” – what are the other emissions? Smoke, in common usage, encompasses all of the particulates and gasses produced (emitted) by the fire.

p. 7272, l. 12: Spell out upper troposphere/lower stratosphere (UTLS.) You never use the abbreviation again, so no point using and defining it.

p. 7273, l. 18-19: A sentence does not a paragraph make, and this sentence feels adrift. Perhaps the authors should clarify just what data is obtained from the A-Train – if such data is really used later in the paper. (“A-Train” appears on fig. 4, but there is no other analysis or mention of that reference.) Otherwise, I suggest dropping these lines.

p. 7274, l. 16-20: I don’t know what the overall background is for Natural Hazards and Earth System Sciences readers, but I suspect the concept of vertical aggregated reflectivity is not common knowledge. It is not clear from these lines whether the aggre-

C2956

gation uses only the two levels (lowest elevation and nominal cloud-base) to aggregate, or any/all levels from one to the other.

p. 7275, l. 19: Define “breakout” as used here.

p. 7278, l. 11-13: This is one place I believe the authors can state their claim more strongly. “This establishes a quantitative connection. . .” could be “This establishes both spatial and temporal connections. . .”

On a lesser note, I found myself wondering “what about those other two tops > 9 km on Fig. 4?” here. I realize now they are discussed later, but perhaps there’s a way to say “stay tuned for more”?

p. 7280, l. 1-3: The list of qualifiers here is impressive – but phenomenally restrictive. They suggest that the whole list is necessary to get pyroCb, so at the least I would suggest changing “in the pyroCb blow-ups” to “in these particular pyroCb blow-ups.”

p. 7280, l. 4-8: As written, this suggests that pyroCbs require fire channeling in order to occur. I doubt this is the authors’ intent, or they would never expect pyroCbs in places like Siberia or much of Canad. I suggest simply changing “pyroCBs occurred” to “pyroCbs here occurred” on line 7.

p. 7280, l. 9-29: I do not see how this section promotes the authors’ thesis. It is a discussion of factors that other authors have blamed for blow-ups, but since the thesis of this paper is stated as showing that blow-up/extreme fire drives pyroCbs – and the specific mechanism behind these specific extreme fires is stated to be channeling – the discussion of stability, wind profiles, or atypical diurnal cycles is out of place. Indeed, the final sentence here makes it sound like these lines were more a motivation for the work in McRae and Sharples (2013), than the present work. Might I suggest that, if any of this block is retained, it be the last sentence or two, appended to p. 7281, l. 1-6? This would make a logical flow from “Thus, in terms of the tools normally applied. . .” to something like “The factors at play here (X, Y, Z from p. 7280) are more appropriate for

C2957

predicting extreme behavior, as reflected in the model framework proposed by McRae and Sharples (2013).”

p. 7281, l. 7-16: The way the paper ends feels like it gets tired and lies down, rather than resolutely declaring it has done what it proposed, or how important that finding is. We now have strong evidence that channeling initiated the pyroCbs. We do not, however, have any robust connection between pyroCb development and “significant enhancement to our capability to mitigate the threats from extreme fires and blow-up events” The introductory text proposed the possibility that the pyroCb can indicate a feedback of upper air conditions influencing fire behavior, but that was not the focus of the paper, nor was it even alluded to after p. 7271. I encourage the authors to forego the weak closure on how their results will improve operational behavior tools. Instead, firmly plant your flag on the very useful result that channeling was occurring and triggering pyroCb development. That alone is a new, and valuable finding.

Figure 3: If the legend is to be referred to as (f), then there should be an (f) on the figure. Otherwise just call it the legend when referenced in the text.

Figure 3 caption, panel (e): missing “i” in reflectivity.

Fig. 4a: No description of what the grey, horizontal dotted line indicates on the figure. Is 12 km significant here for some reason?

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C2958