Nat. Hazards Earth Syst. Sci. Discuss., 2, C2783–C2788, 2014
www.nat-hazards-earth-syst-sci-discuss.net/2/C2783/2014/

Natural Hazards and Earth System Sciences
Discussions

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

R. H. D. McRae et al.

rick.mcrae@act.gov.au

Received and published: 22 December 2014

REPLY

Interactive comment on "Linking local wildfire dynamics to pyroCb development" by R. H. D. McRae et al. Anonymous Referee #1 Received and published: 10 December 2014

The following responses are agreed by the three co-authors.

We thank the reviewer for providing helpful suggestions. We feel that they will improve the clarity of the paper. Below are our detailed replies to each of the comments provided.

General comments:

Anonymous Reviewer (AR): This compact paper presents a detailed analysis of a fire channelling event that occurred during the Grose fire event in Australia 2006. The authors had the chance to analyse multiple sources of observations, leading to good understanding of the phenomenon.

-and-

The paper is well written, with compact sentences easily understandable. As a non English speaker, I did not find obvious corrections to be made in this paper.

-and-

Abstract and Introduction are well referenced, precise and easy to read.

Reply: Thank you.

AR: The paper is well referenced, with a good review on pyro convection in atmospheric science but maybe lacks a link to more fundamental studies in combustion that may be found in [1].

1] Mark A. Finney and Sara S. McAllister, "A Review of Fire Interactions and Mass Fires," Journal of Combustion, vol. 2011, Article ID 548328, 14 pages, 2011. doi:10.1155/2011/54832

Reply: As will be detailed below, we will insert a reference to this paper.

AR: Only one event is analysed, so it may be difficult to validate assumptions made for

a link between local dynamics and pyroCb based on this sole event. Nevertheless, the event is well documented and the numerous references helps to corroborate the link demonstrated here, making it acceptable.

Reply: As was noted by Fromm et al 2010 there is a shortage of case study papers relating to violent pyroconvection. I think that we would all agree that more case studies will clarify the dynamics of these events. We feel that it is worth reinforcing this need by adding the following sentence after the end of 7281L16:

"As noted by Fromm et al. (2010) there is a need for more case studies of blow-up events to improve our understanding, but, as we have shown here for this event, these must be based on sound fire and weather data."

Specific comments:

AR: 7272L5 Canberra fire resulted from large fire interactions, the authors are probably the most appropriate persons to comment on that. It is maybe somehow explained in the very dense sentence, but it may be worth explaining it a bit more as this event is the only other one explicitly cited in the text and would be a good introduction to the rest of the paper.

Reply: We believe that the following revisions of the text between 7271L26 and 7272L5 will address the reviewer's issue.

"In their analysis of the 2003 Canberra bushfires, Sharples et al. (2012) demonstrated several cases where interactions between strong winds and rugged topography resulted in rapid wildfire development. The resulting process, which they termed "fire channelling", resulted in a transition from the usual frontal burning pattern to an areal burning pattern caused by a combination of rapid lateral fire propagation (transverse to the prevailing winds) and downwind in-fill by short- to medium-range spotting. For

the Flea Creek event (Sharples et al., 2012, p288) they showed a direct link between the lateral spread and the pyroCb development, which Fromm et al. 2006 has shown reached to 15 km a.g.l."

AR: 7272L23, what anomaly ? please explain.

Reply: To clarify that sentence we propose revising it (7272L20 to 7272L24) to:

"Based on remotely sensed data from a range of satellites and weather radar, and surface and profile data from official weather observation sites, Fromm et al. (2012) concluded that the factors of significance for the development of the pyroconvection were significant departures from the norm in boundary layer temperature and wind speed."

AR: 7274L10, Is there a possibility to have some overview of the weather analysis maps to illustrate the phenomenon. Or at least a clearer view on figure 3 on where these stations are located and some lines about the general meteorological conditions (any fronts coming ? heat wave) that will make it more understandable for the non-meteorologist specialist that may not draw conclusions from these graphs.

Reply: Fromm et al. 2012 included a detailed review of the synoptic situation. We agree that some synoptic assessment would improve the paper under review, and propose addressing this matter by adding a new sentence after 7274L12:

"Fromm et al. (2012, especially Figure 15c) discussed the synoptic situation, dominated by the passage, from the west, of a pressure trough linked to a cold front further south."

AR: 7276L15, It is unclear what is linked to the fire, and what is related to global

meteorological condition over east Australia. It is referenced, but please put a sentence explaining why these foen winds are present (warm lee winds over east Australian alps?).

Reply: We agree that this needs clarification and propose adding the flowing sentence after the one that ends part way into 7276L17:

"They identified that in southeast Australia the approach of a synoptic front causes winds to align nearly perpendicular to parts of the Great Dividing Range. This primarily produces blocking foehns with resultant elevated temperatures and depressed humidity levels in the lee of the terrain."

AR: Considering the interesting phenomenon described, a major problem is the Figure 3 that is small and somehow unclear, probably requiring to be spitted and made larger (3a larger then the 4 others in 2 columns) so the text would be large enough to be read.

Reply: We agree with the reviewer that it is difficult to extract some details from the figures as rendered. The original material is designed to be viewed at higher resolution. We intend asking the editor to render the images in larger form in the final paper.

AR: 7278L12, There is definitely a simultaneity in events, but I do not understand what is quantitatively linked here, please be a bit more clear.

Reply: We agree with the reviewer that this needs clarification. We reply in three parts: a) Modify and add to the sentence that starts on 7278L11 to read:

"This establishes a compelling connection between the intense, lateral spread associated with fire channelling and the violent pyroconvective activity detected by the radar. As discussed by Finney and McAllister (2011), a fire with a large diameter will produce a plume which experiences less entrainment and is thus able to reach greater heights.

This is consistent with the GV-N situation."

b) Add new text after 7279L17:

"It is estimated that 650ha burnt within 2 hours at GV-S, yielding an estimated energy release of around 2 X 1011 kJ, broadly comparable to values estimated for the Canberra Fire in 2003 (Fromm et al. 2006). This and the entrainment concepts in Finney and McAllister 2011 support the connection between the fire and the pyroCb."

c) Insert a new reference (at 7282L6):

Finney, M.A. and McAllister, S.S.: A Review of Fire Interactions and Mass Fires, Journal of Combustion, Article ID 548328, 14 pp, doi:10.1155/2011/54832, 2011.

AR: 7280L28, which atmospheric features, a jet point in the wind profile is one, prevailing wind too somehow, please be more specific or remove the comment.

Reply: We agree that the sentence, which is inevitably going to be complex, needs more clarity in its final parts. We propose revising the paragraph running from 7289L23 to 7280L29) with:

"The preceding analyses indicate that future forecasts of the occurrence of a blow-up event may need to consider some combinations of the fire, weather and terrain factors identified here (and their interactions), namely: the absence of a fine fuel moistening phase during the preceding night; the maximum fire danger at the surface, and its relation to the typical diurnal cycle; a jet point in the wind profile; the terrain on which the fire is burning (ruggedness) with respect to its orientation to the prevailing wind; the time of arrival of fire in critical parts of the landscape; and the passage of pressure troughs, or other sources of atmospheric instability, that might exacerbate fire intensity. This is reflected in the model framework proposed by McRae and Sharples (2013)."

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 2, 7269, 2014.