Interactive comment on “Origin, variability and age of biomass burning plumes intercepted during BORTAS-B” by D. P. Finch et al.

Anonymous Referee #2

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General comments:

This is an interesting paper, and introduces a new metric for analyzing biomass burning plumes. It could, however, be improved by presenting the evidence and discussion more clearly.

The paper interprets biomass burning plumes from BORTAS-B by calculating two different plume age metrics: an effective age of air metric and a photochemical age. They find that the former is generally longer than the latter, implying that aerosol from the BB plume retards the chemical evolution. I would like to see a bit more motivation/discussion of the effective age of air metric, as it is unfamiliar to me. Also, consistency in referring to it as ‘physical’ or ‘effective’ would help.

The physical/effective age metric is calculated using a constant lifetime of 60 days, equivalent to OH=1.9e6 molecules/cm3. Presumably if an OH concentration was modeled in-plume, it would not be constant and it could be lower than average due to the reduced sunlight in the plume. What effect would having a lower OH value have on your conclusions? Is it sensitive to OH?

If the “correct” OH were used, would this mean that the physical/effective age of air would be the same as the photochemical age? Is this a way of deducing mean OH concentration?

A brief description when it is introduced of how photochemical age was calculated would help, so that readers have a better idea of what they are comparing.

Specific/technical comments:

Abstract: Line 5-6: and elsewhere in the text (p8728, 8733): contradictory descriptions of the CO in the plume being under/overestimated. From what I can see, the abstract and p8733 are incorrect.

Line 15-16: how can a median be a range? A median is a single number.

Page 8729 Line 3: the most frequent is called the mode. The median is the 50th percentile. Which is it, and why is it a range of values and not a single number?

Page 8730 Line 12: should be “are due” not “is due”

Page 8731 Line 11: add a “W” after 50 degree Line 15 onwards: confusing section. When I tried to check the numbers quoted in this section of text against fig 6, I did not get the same numbers. Possibly there is some ambiguity in which numbers specifically you are referring to. Eg line 16: what do you mean by typically? The 2009 median looks about 10 days, and the previous line implies that you “typically” refers to the median. Line 23/24: is 2010 an exception to this? Line 28: define “lower altitudes” as it is ambiguous. Suggest editing this section to make it clear and unambiguous.
Page 8732 Line 10: give co-ordinates for Thunder Bay or mark on figure. Line 11: does 16-17 July equate to the 3-4 day contour on the plot? It would be easier to follow if the text and the figure matched up. Suggest referring to 3-4 days in the text, so that it matches with the colour bar.

Page 8733 Line 1-2: explain this “mean fractional difference”. I would also expect it to be a value between 0 and 1, as it’s called fractional. Line 18-19: I think this is the first mention of the sub-grid scale vertical mixing. Why do you come to this conclusion? May be better o explain why earlier in the manuscript, or at least explain it here.

Page 8734 Line 12-15: have you described this HYSPLIT evidence earlier in the text? Explain this bit more clearly.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 8723, 2014.