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

### **Anonymous Referee #2**

Received and published: 5 May 2014

#### 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.

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The physical/effective age metric is calculated using a constant lifetime of 60 days, equivalent to  $\text{OH}=1.9\text{e}6$  molecules/cm<sup>3</sup>. 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.

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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 to 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.

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

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