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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Quantifying pyroconvective injection heights using observations of fire energy: sensitivity of space-borne observations of carbon monoxide" *by* S. Gonzi et al.

**Anonymous Referee #1**

Received and published: 14 October 2014

I read, with great interest, the manuscript by Gonzi et al. in ACPD that analyzed the plume injection heights (from biomass burning) using satellite estimates of fire heat flux and fire size, and quantified the sensitivity of the vertical distribution of carbon monoxide to injection heights, constrained by MOPITT observations. In general, the paper is scientifically sound and adds to the growing body of work on fire injection heights. The methods are generally clear, the results concise and informative, and the conclusions appropriate. One caveat: the entire paper will need to be proofread carefully for grammatical errors. On many occasions I identified run-on sentences,



wrong verb tenses, and missing commas, etc. Overall, with a few minor revisions, I think the manuscript is appropriate for publication in ACP.

Specific revisions:

Pg. 22550 – lines 15-16: In addition to Ichoku and Kaufman and Kaiser et al., relevant work by Vermote et al. (2009, JGR) has outlined an approach for calculating smoke emissions (black and organic carbon) from FRP. You may consider referencing this recent work as well.

pg. 22552 – line 12-13: You compare FRP and AF to previous work; was the comparison good? Inclusion of a sentence or two on how well the your analysis in this paper compared with your previous publication from 2011 (a correlation, figure, etc.) would strengthen your claim.

Pg. 22552 – line 25-26, I think you mean to say "these MOPITT CO profiles are biased when compared to North American . . ."

Pg. 22552 – line 28: how did you "thin" the data? Which data was selected for removal?

Pg. 22553 – lines 5-6 – Can you "prove" that it does not affect your final analysis? A figure or number may be helpful here.

Pg. 22553-4 - the description of the calculation of 'heat flux' is a bit confusing to follow. You are asking the reader to make a leap from FRP to 'heat flux', but the description of this leap is scattered throughout sections 2 and 3. It may be worth considering moving this description to its own paragraph in the previous section (2.1) where FRP is discussed. Or, moving it to the beginning of section 3.1, i.e. line 23, right before "We drive the model. . ."

Pg. 22555 – lines 23-28 – In the control run –are total emissions the same in each of the 15 boundary layer levels or is there a gradient from the surface to the top of the BL? If the distribution is uniform, you should explain why you chose to distribute this way. In general, a bit more detail is necessary.

Pg. 22558-60 – This is a very strong section (and Figure 6 is very strong as well) comparing your plume rise model to the Val Martin work (though Ralph Kahn's short comment should be considered for technical corrections to the description of Maria's work). You could also consider strengthening your argument by comparing your results with a similar paper- Tosca et al., 2011 (JGR)- that quantified plume injection heights over an entirely different region of the world – Indonesia.

Pg. 22563 – line 6 – Do you mean Figure 8 instead of Figure 7?

Figures:

Figure 3: Each panel in this figure needs to be labeled (e.g. "A", "B", etc.) Additionally - something seems "off" with the x-axis on the figure on the bottom right. In the panel directly above it, it seems hat A (ha) maxes out at 10,000, but the axes on the bottom right panel only maxes out at 1,000.

Figure 4 is very confusing to the reader. I think at a bare minimum the color labels need to be included in the actual figure and not just the caption. I also think it is confusing to have so many axes on a single figure. Consider breaking up each figure into separate figures: e.g. Potential temperature, Temperature and Humidity, and perhaps two columns: A "low ZTOP" and "high ZTOP" and instead of plotting the actual ZTOP, just list it as a number.

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Interactive comment on Atmos. Chem. Phys. Discuss., 14, 22547, 2014.