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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Direct measurements of the effect of biomass burning over the Amazon on the atmospheric temperature profile" *by* A. Davidi et al.

Anonymous Referee #3

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General Summary

This is a study, based on AIRS remote sensing data, which links biomass burning aerosol with the atmospheric temperature profile. This is an interesting and important study, and I would like to compliment the authors for their efforts. There are however some issues that I'd like to see addressed before the manuscript is published in ACP.

Major Comments

Page 12009, Disucssion of AIRS: AIRS is of central importance to the paper, yet little is discussed about it. The authors refer to published literature for evaluations, but I'd like to see a summary of AIRS performance in the region of interest. For example,

what is meant by "biases and variations in the temperature profiles do not correlate significantly with cloud fraction"? (I am referring to quantitative statistical measures).

Page 12010, Line 23: "expected to be smooth in our region of interest": Please explain why (especially since temperature spikes are filtered out).

Page 12011, Definition and interpretation of ΔT. The authors should provide arguments on why the correlation of ΔT versus AOD defines a functional relationship, and why the similarity between <T>$_{daily}$ – AOD and ΔT – AOD suggest variances from meteorology is small (and not vice versa). Since the functional relationship was defined as "ΔT versus AOD", why did you use T vs. AOD in the end? (even if the two relationships are similar, it seems better to stay with the former).

Page 12013. I was very pleased to see a confirmation of aerosol layers being collocated with the temperature profile change; was this analysis repeated for more cases than those shown in Fig. 5?

Page 12014, Line 7. "associated with increasing AOD are larger than expected". Can you be a little more quantitiative? What is "expected" and why?

Page 12014, Lines 10-15. This is an important and insightful discussion. I would like to see a little more detail (and quantitative arguments presented) in the analysis. Would AOD $\sim$ 0.3 correspond to some set of aerosol/cloud microphysical conditions that explains why the saturation is observed?

Page 12014, Lines 16-18. This discussion seems a bit too vague. Can you elaborate (with numbers and appropriate citations) on the "magnitudes are consistent with expectations".

Page 12014, Line 25. "cloud cover to narrow range. . . ": how narrow? Is the narrowing enough so that AOD signals dominate? (a scaling argument could show this).

Page 12014, Line 27. Keeping cloud cover is insightful, but does not constrain LWP or COD to a similar degree. Because of this, you can have very different cloud mi-

crophysical states, and introduce larger uncertainty in the analysis. Although this is acknowledged by the authors in the conclusion section, would it be useful to repeat the calculation with COD (or LWP) bins instead? Combined with the "cloud cover-bin" analysis, one might be able to say a little more about the "direct" and "indirect" radiative effects on the temperature profile.

Page 12015, Line 2. I would like to see a few more arguments presented on why AOD$\sim$0.3 really corresponds to a transition point. Is this consistent with known theory? (a scaling argument based on cloud droplet number concentration impacts on autoconversion timescale and/or cloud optical depth could be useful).

Minor comments

The authors should try to reference more of the published literature, especially in the introduction when discussing aerosol-cloud interactions and absorption (for example, Albrect,1989).

Page 12009, Line 20: "Amazon basin due to the presence". The "due to" seems a bit too absolute. Perhaps "consistent with" or "can be explained by".

Page 12009, Line 22-33: This is an important paragraph, but seems to be out of place; I suggest placing it in section 2.

Page 12010, Line 14-15: replace "and unless otherwise specified, all AOD" with "unless specified, all AOD"

Page 12010, Line 23: "we screen out outliers that show sharp changes in temperature relative. . . ": For completeness, describe quantitatively how the sharp temperature gradient filter was applied.

Page 12010, Line 26: "to maintain similar temperature variances": This is not clear to me. Do you mean that you ensure sample size is the same so you have variances that can be compared (in a statistical sense)?.

Page 12011, Line 26: "standard error of the mean": Do you mean standard deviation?

Page 12015, Line 12. "combination of both processes." Which processes?

Page 12015, Line 15. "surpass moderate levels." Give indicative .range

Page 12015, Line 18. Replace "affected similarly" with "affected similarly by the smoke"

Page 12015, Lines 20-21. I had a hard time understanding the point of this sentence. Can it be further elaborated?

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 12007, 2009.