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Atmospheric Chemistry and Physics Discussions

Interactive comment on "ACE-FTS measurements of trace species in the characterization of biomass burning plumes" *by* K. A. Tereszchuk et al.

Anonymous Referee #2

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The authors present ACE-FTS measurements of a large number of chemical species in biomass burning plumes in the free troposphere. They are able to identify with reasonable accuracy the age and geographical origin of the biomass burning plumes and go on to present tracer-tracer correlations and normalized excess mixing ratios. This paper represents a good first step towards obtaining more detailed knowledge about biomass burning emissions in the free troposphere from space-based measurements in consideration of the age of the plume and type of material burnt, which may help in constraining atmospheric models. The following specific issues should be addressed:

- Section 2.2, p. 16616: Some more detail is needed about the processing of the ACE-FTS data. Which type of retrieval is used? Are retrievals performed using optimal estimation, for example, in which case prior constraints would need to be carefully

considered? Also, the reasons behind filtering the data in the way described in the paper are not clear. What is it that means low values less than 10% of the median value should be rejected? What is the reason behind using the criterion for rejecting data with a measurement error (do you mean retrieval error here?) of greater than 100 times the mean absolute deviation of the dataset? Do these represent retrievals that have failed to converge? How do you screen for cloud contamination? It would be useful to include a brief error budget for the retrieved species to provide an indication of the accuracy of the measurements used in the subsequent analysis.

- Section 2.3 p16616: In figure 1, the back trajectory appears about 200 km away from the nearest fires, and so in this respect this figure is not entirely convincing. Presumably the tangent point of the occultation is used as the starting point for the back trajectory calculations and so perhaps the authors could acknowledge that the horizontal resolution of ACE-FTS is poor, in common with all limb sounding instruments, on the order of hundreds of km, and that this could introduce substantial errors into the back trajectory calculations depending on how the plume is sampled. A visual check of the geolocation of the ACE occultation against IASI total column CO measurements could be helpful to check the sampling of the plumes. It is stated in the paper that the IASI CO measurements are used to 'ensure that measurements are from a singular origin and not a mixture of biomass burning outflows from different locations'. However, it's not clear to me how, by inspecting a single scene, as is implied by the inclusion of Fig 2, it can be ascertained for certain that the plume is not a mixture of biomass burning emissions from different locations. Did you use further back trajectory calculations and the corresponding IASI data from previous days to check for the convergence of air from different sources?

- Section 3: It is necessary to inform the reader of how many occultations were used. Also the units of the Std Dev in terms of the mixing ratio are not easily interpreted. The standard deviations need to be normalised according to the mean mixing ratio of each species to aid comparison of the quality of the fit.

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- Section 3.1 p. 16620: It would be helpful to extend the discussion of the chemistry of the plumes.

- There is no mention of whether the occultations used are for sunrise or sunset or a mixture of these. On p. 16621, I am concerned that this could be a hidden factor for NO_2, which is photolyzed on a short time scale in the mid-upper troposphere. Was this taken into account for the comparisons of the correlations for NO_2 between Boreal and savannah fires and Amazon fires?

-Section 3.2 p. 16624: The authors state that their values of the emission factors for HCN and OCS are an order of magnitude smaller than those reported by Akagi et al. (2010), but they only hint at an explanation. Could they be more specific about what could cause this discrepancy?

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 16611, 2011.