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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Observations of peroxyacetyl nitrate (PAN) in the upper troposphere by the Atmospheric Chemistry Experiment Fourier Transform Spectrometer (ACE-FTS)" *by* K. A. Tereszchuk et al.

Anonymous Referee #2

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Summary: The manuscript by Tereszchuk et al. analysis limb sounding measurements of PAN. Details of the ACE-FTS and MIPAS PAN retrieval processes are presented. The goal is understanding the impacts of biomass burning on UTLS atmospheric chemistry, hence data is filtered using HCN retrievals to focus on biomass burning impacted samples. Coincident samples between ACE-FTS and MIPAS are compared. The paper concludes with a discussion of the seasonality of global-scale PAN profiles from ACE-FTS. Overall the quality and clarity of the manuscript is quite high. My main concern would be the discussion of the results in the context of the scientific questions motivat-

ing the BORTAS field experiment is a bit thin, and the paper a bit short. I wonder if it is more appropriate for a remote-sensing focused journal.

General comments:

The paper focuses primarily on the background of PAN chemistry and the retrieval algorithms and error assessments. Only a single printed page is devoted to results (sections 5 and 6), followed by a short conclusions. This work thus falls short of addressing the science questions raised in the introduction, such as how the measurements here provide constraints on the role of biomass burning impacting UTLS chemistry. The authors could easily have dug deeper to assess questions such as how their measurements compare to e.g., the GEOS-Chem modeling work from the BORTAS campaign, or other modeling analysis on the global scale in comparison to the ACE-FTS global retrieval set. They could have also examined the impact of biomass burning on global PAN distributions via their HCN indicator rather than simply presenting global PAN distributions, which at the moment are a bit disconnected from the themes of the paper laid out in the introduction.

Specific comments:

The authors discuss retrieval error in detail, but what are the lower detection limits of PAN measurements from ACE-FTS and MIPAS?

throughout: italicize subscripts x and y on NOx and NOy

1588.9: Rather, these are measurements of biomass burning impacted air masses, not the emissions themselves.

Fig 3: This might be better presented with the panels side by side, rather than attempting a single column layout.

1591.25: Can the authors provide an example of the back trajectory analysis? Also, regarding the attribution of plumes to specific biomass burning events / locations, how would the impact of multiple plumes beneath the trajectory be disentangled?

Section 6: Why do the authors only construct a global PAN distribution from ACE-FTS and not MIPAS?

Section 5: The inter comparison between the ACE-FTS and MIPAS coincident profiles provides a nice opportunity. However, the treatment is a bit lax. Can the agreement be statistically quantified, rather than just referred to qualitatively as "good", and then later as "excellent"? Further, the authors state that the profiles lie with the associated measurement errors, but from the plots this does not always appear to be the case. Please explain. Lastly, there is one MIPAS profile in the second and third comparison that is wildly different. What is happening there?

1591.10: Given that the authors are showing here the influence of biomass burning on PAN, and biomass burning can have substantial annual variability, it is surprising to read that PAN does not. Also, it wasn't clear if they were referring to the TOMCAT simulations or MIPAS measurements here with regards to the small variability.

1591.14: derived from the

1591.14: Can degrees of freedom be calculated to quantify the fraction of information coming from the retrieval vs a priori, as are done for e.g., TES nadir retrievals?

Fig 4: What is the origin of the mid trop and UTLS local maximums in the PAN concentrations over Antarctica in JJA?

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 1575, 2013.