**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Seasonality of
Peroxyacetyl nitrate (PAN) in the upper
troposphere and lower stratosphere using the
MIPAS-E instrument" *by* D. P. Moore and
J. J. Remedios

Anonymous Referee #2

Received and published: 7 December 2009

General comments:

This paper presents new and interesting results on the global seasonality of peroxy-
acetyl nitrate (PAN), measured from space and thus is suited for publication in ACP.

However, I am also somewhat concerned about the retrieval approch. The authors re-
trieve PAN in a rather small microwindow, where the signature of the target is flat and
joint-fit of any atmospheric continuum seems hardly possible. How can they be sure
to properly distinguish between PAN signatures and other continuum-like signatures,

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caused by, e.g., aerosols or water vapor? The authors should report in their manuscript more in detail how they handle this issue, e.g., if they jointly fit an atmospheric continuum and/or instrumental offset in their PAN-retrievals or if they use prefitted quantities. Why do they not use a wider region of the PAN signature exhibiting more spectral variation?

Specific comments:

P22508, L8-9:

I think the unapodized spectral resolution (in terms of FWHM) is 0.035 cm^{-1} (like the authors themselves state on P22509, L18-19).

P22508, L12:

The same here: 0.0875 cm^{-1} instead of 0.0625 cm^{-1}.

P22509, L7-8:

The authors should mention here, if they use the plotted range of 787–790 cm^{-1} for PAN retrieval.

P22512, last paragraph of Section 2.1:

As mentioned above, the authors should explain the PAN-retrieval more in detail: Which microwindows did they use? What is their state vector used for retrieval (e.g. did they joint-fit continuum or offset)?

P22512, last paragraph:

I do not fully understand the applied error calculation. What did the authors do by "using measured biases"? How do the cited uncertainties, e.g. 20% for H$_2$O and 10% for O$_3$, map onto their PAN uncertainty? What means "The errors due to uncertainties in these gases were likely to be lower in the real measurements than calculated here"? If they

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used a prefitted continuum: How does its uncertainty contribute to the uncertainty of the PAN volume mixing ratio?

P22513, L5:

The cross-section data set of Allen et al. covers the temperature region 250–295K. Does extrapolation to much colder temperatures at the tropical tropopause (the authors state 180–200K) result in a bias of 5.2% only?

P22513, L19-20:

The sentence "Figure 3 shows ..." is more or less a repetition of the sentence in L14-15 and should be removed.

P22513, L24-25:

I think the number of degrees of freedom is also strongly dependent on the number of used tropospheric tangents.

P22514, Section 3.1:

Which fit parameters are used for the fit without PAN? From inspection of Figure 4 it seems as if the authors simply model the atmosphere using all joint-fitted, prefitted and climatological profiles and assume zero PAN mixing ratio.

P22515, L8-12:

There was also strong biomass burning in South America from August to October 2003.

P22516, L25 – P22517, L12:

Are there other measurements to confirm high Arctic summertime PAN amounts and other references for considerable biogenic production of PAN? Besides, boreal forest fires or long-range transport might be other possible reasons for elevated Arctic PAN.

P22518, L1 and L3:

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Please change "PV" into "PVU" and explain the definition of 1 PVU.

P22518, L19:

Low PAN at 10N: Why are the "PAN vmrs suppressed" here due to temperature. Is it warmer than at 0N and 20N?

P22518, L5-7:

Cross-isentropic transport inferred from Fig. 10: For me it looks rather like a troposphere-to stratosphere gradient than like similar PAN values in the upper troposphere and lower stratosphere. Did the authors check, if enhanced stratospheric PAN might, at least to a certain degree, be mocked by tropospheric PAN by smearing by the averaging kernels.

P22518, L19-24:

Is a similar pool south of 70S also visible in other tropospheric tracers?

P22519, L8-9:

I think, the Sahel region is not in Central-Southern Africa but south of the Sahara, where nearly no fire counts were made in August.

P22519, L22ff:

Do the authors mean here, that on 18 October the average in the biomass burning region on 180 hPa is comparable to the average over the South Pacific on 275 hPa?

P22536, Figure captions:

The authors should explain that the white, red and blue curves indicate theta levels and ± 2 PVU.

Technical corrections:

P22507, L8-9:

"(Singh and Hanst, 1981)" instead of "Singh and Hanst (1981)".

P22510, L7:

"(**y**)" instead of "(y)".

P22511, L26:

Replace "... the scheme then analysis the next gas and/or scan" by "... the scheme then analyses the next gas and/or scan" (?)

P22512, L7:

Replace "analyses" by "analysis" (?)

P22512, L14:

Replace "the the" by "the".

P22513, L20:

It says "281 hPa" here, but "260.9 hPa" in Figure 3.

P22513, L24:

The authors state "almost 3.7" degrees of freedom here, but "2.7" degrees of freedom in Figure 3 as well as in the captions of Figure 3.

P22515, L16:

Replace "tropospause" by "tropopause".

P22519, L12,23:

Replace "biomass" by "biomass burning"

P22520, L18:

Replace "Meditteranean" by "Mediterranean".

P22529, Figure caption:

Replace "Orbit" by "orbit" and "almost" by "∼"

P22531, Figure caption:

Replace "are 19 nW ..." by "is 19 nW ..." (?)

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