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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Middle atmosphere water vapour and dynamical features in aircraft measurements and ECMWF analyses" *by* D. G. Feist et al.

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Thank you for the detailed comments and the recommendation for publication in ACP. In the following, I will try to provide answers to the not-so-minor comments. The minor ones would be clarified in a revised version for ACP.

AMSOS' ability to detect filamentation This may of course depend on the structure of the observed filament. In the data that we used for this article we did not have many situations where AMSOS clearly flew under some filament. And we also do not know how well the one filament that we analyzed was captured by ECMWF. I could certainly provide a separate vertical plot of the filament for the ACP version. However, we now

have good reason to believe that in principle AMSOS can capture filaments well. In the November 2005 flight mission from Switzerland to Darwin AMSOS underflew a filament over the Mediterranean. Co-author Stefan Müller has analyzed this event in detail and is currently preparing a separate publication on this issue.

Why does the quality of AMSOS retrievals decline near the tropopause? There are basically two reasons for this. First of all the relatively broad vertical weighting functions of the AMSOS retrieval cannot capture the sharp change in water vapor mixing ratio near the tropopause well. Secondly, the lowermost vertical weighting function is cut off sharply at the flight altitude which is typically near the tropopause region. Therefore, we consider this lowermost weighting function unreliable.

Why are the operational analyses drier than ERA-40? I do not know enough about the internals of the ECMWF model to answer this question.

The issue of high MIPAS water vapor values I have not read the mentioned PhD thesis of Vivienne Payne but we have had our own experience with biases in the AMSOS data. The earlier versions suffered from a dry bias compared to instruments like HALOE by about 20–25%. A change of our retrieval code and a better correction of some instrument artifacts basically removed this bias. We are now much close to HALOE values (who have seen their own history of biases through the different versions). I think it is very difficult to get remote-sensing instruments to agree better than within roughly 10–15% simply because the spectroscopic data bases are not good enough and different spectral lines for the same species are not consistent (see D.G. Feist, J. Quantitative Spectrosc. Radiative Transfer 85, pp 57-97, doi: 10.1016/S0022-4073(03)00196-1, 2004). If MIPAS is close to this region I would not worry. I cannot judge from our measurements whether MIPAS or the climatology is closer to the truth. Our own values are

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now closer but still a little lower than the climatology.

P. 268, L. 16-20 Did we not say what we have learnt in the conclusions? It was certainly our intention to do so. I'll check the conclusions if they are not specific enough.

P. 269, L. 5-6 In this case we mean both ERA-40 and operational analyses by "ECMWF". I would clarify this in the revised version.

P. 270, L. 5-8 It was surprising as we expected that the AMSOS retrieval would basically stay close to its a priori profile in the lowermost layers. Since the a priori profile does not provide any features similiar to a tropical tropopause above the aircraft we expected to see only artifacts or oscillating profiles in the region below 20 km when we flew through the tropics.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 247, 2007.