Atmos. Chem. Phys. Discuss., 5, S2364–S2367, 2005
www.atmos-chem-phys.org/acpd/5/S2364/
European Geosciences Union

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Spatial and temporal characterization of SCIAMACHY limb pointing errors during the first three yearsof the mission" *by* C. von Savigny et al.

C. von Savigny et al.

Received and published: 2 September 2005

Reply to comments by Referee #2 (Anonymous)

1) Estimate of the errors introduced by a wrong atmospheric density profile

A sensitivity study for the limb pointing retrievals was presented in Kaiser et al. [2004] which also included an assessment of the impact of errors in the atmospheric density profiles on the retrieved TH offsets. Perturbing the entire atmospheric density profile by 5 % leads to TH offset differences of 400 m at the most. Please note, that the mean difference was about 20 m with a standard deviation of 120 m. Thus, the mean impact of errors in the atmospheric density profile is generally relatively small. A few

Full Screen / Esc
Print Version
Interactive Discussion
Discussion Paper

EGU

sentences describing the sensitivity of the pointing retrievals to the atmospheric density profile have been included in Section 2.

Yes, we have considered using UKMO or ECMWF background density data, but these density profiles only extend to about 50 km, which would pose a problem for the retrievals, since the middle mesosphere contributes a significant amount of the scattering signal.

Perhaps one could use the daily atmospheric density field and then extrapolate it above 60? We will test that in the future.

2) Cyclical argument

We realize that the whole setup appears somewhat cyclical: The main purpose of the limb measurements is to retrieve profiles of ozone and other minor constituents, but to do this we have to rely on an ozone climatology in order to perform the pointing retrievals. This is of course not ideal. However, at present, this is the best we can do. Under ideal circumstances the pointing retrievals would not be necessary, because the engineering pointing information is accurate to within a few seconds of arc. We still hope that the quality of the engineering pointing information can be significantly improved so that the TRUE retrievals will not be necessary. TRUE is well suited as a diagnostic tool to investigate the quality of the engineering tangent height information and to identify pointing error s that exceed a certain threshold. But it is not suited to globally provide pointing retrievals with an accuracy of below 200 m. We are completely aware of this. Yet, the validation studies [e.g., Brinksma et al.] clearly show that we can significantly improve the quality of the ozone profile retrievals if the TRUE pointing retrievals are used, and we believe, that this - at present - justifies our approach. We now discuss this aspect specifically at the end of section 4.

3) What if the TH error varies with altitude? Discussion of pointing accuracy specs. Discussion of possible causes of the pointing errors.

ACPD

5, S2364–S2367, 2005

So far we do not have any indications for pointing errors that are a function of tangent height. However, in principle this may of course be possible. All the present evidence indicates that incorrect knowledge of the satellite plattform causes the SCIAMACHY limb pointing errors. The ESA satellite engineers confirm that the plattform attitude was/is calculated incorrectly. Therefore, the December 2003 update of the orbit propagator model led to the significant reductions in the seasonal variations. Unfortunately, it is not possible to use a knee method to retrieve the tangent heights independently for each tangent height step.

We included a description of the pre-launch pointing accuracy estimates as well as a list of the relevant sources of pointing errors in the introduction.

Furthermore, we included discussions of the possible reasons for the pointing errors (some of them have been identified and resolved already (inconsistency between coordinate systems)) in several subsections. We hope this will improve the paper.

4) Agreement with GOMOS and MIPAS

The seasonal variation of the retrieved TH offset is in very good agreement with GOMOS and MIPAS pointing retrievals. This has been documented recently in an ESA technical note [Saavedra et al., 2005]. Pointing information can be retrieved with MIPAS and GOMOS using entirely different methods. GOMOS is a stellar occultation instrument with a CCD detector and the difference between the actual and the predicted position of the image of a star can be used to determine pointing errors with high accuracy. MIPAS is also capable of measuring the positions of sufficiently bright stars. The amplitudes of the seasonal variations seen in the MIPAS and GOMOS pointing measurements are in very good quantitative agreement with the SCIAMACHY amplitude. However, the absolute offsets differ by constant terms. The GOMOS pointing retrievals show now the best agreement with the AOCS (Attitude Orbit Control System). The MIPAS TH retrievals show a bias (absolute value) of 26 mdeg (about 1.5 km) compared to the AOCS, and SCIAMACHY is biased by 17 mdeg (about 1 km; that's the offset we

ACPD

5, S2364–S2367, 2005

also report on in this paper). A short paragraph was added to section 3.2

5) Has the coordinate system inconsistency that led to the strong seasonal variation before December 2003 now been corrected?

Yes, the coordinate system inconsistency has been corrected in December 2003. This was the main change of the orbit propagator model change in December 2003. Apparently this point was not properly explained in the manuscript. A sentence explicitly stating that the correction was made was added at the end of section 3.2.

6) Has a more comprehensive validation study been done?

A more comprehensive comparison of SCIAMACHY O3 profile retrievals with independent methods is presented in Brinksma et al. 2005. A paragraph on the main findings of Brinksma et al. was added to Section 4.

7) Are the pointing retrievals presented here applied to the operational SCIAMACHY data products?

No, they are not applied to the operational SCIAMACHY data processor. The approach for the operational SCIAMACHY data products is to reprocess the Level 0 data set with an updated version of the Level-0-to-1 processor, that includes a correction for the coordinate system inconsistency, which lead to the strong seasonal variation of the TH offsets before the December 2003 orbit model update. A comment on this was added to the conclusions.

We wish to thank all three referees for really good and constructive reviews and hope that our changes have improved the manuscript.

References:

Saavedra, L., Mantovani, R., and Dehn, A., Envisat restituted pitch assessment, Document-No. ENVI-SPPA-EOPG-TN-05-0011, 2005.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 3701, 2005.