**Atmospheric
Measurement
Techniques
Discussions**

# *Interactive comment on* "Polarization data from SCIAMACHY limb backscatter observations compared to vector radiative transfer model simulations" *by* P. Liebing et al.

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General comments

This paper presents validation of SCIAMACHY polarisation values in limb geometry against SCIATRAN V3.1 radiative transfer simulations. The measurement and model values show a difference between the on-ground and in-orbit polarisation behaviour of the instrument, and in addition show a change of this behaviour over time.

The quality of the model values, combined with the large deviation from the on-ground polarisation sensitivity of the instrument, warrants in-orbit re-calibration of the PMD polarisation sensitivity using the model values. This has up to now been considered

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infeasible due to the lack of known polarisation sources of sufficient quality in-orbit. The paper changes this view and opens the door for in-orbit polarisation monitoring and addressing one of the major remaining challenges in SCIAMACHY calibration.

Specific comments

Abstract, p 2222, l 19-20, and p 2244 l 20-24: "instrumental phase shift". Please clarify this term in the paper. The effect was discovered during on-ground characterisation of the instrument, when a wavelength-dependent alignment of the PMDs was discovered. From the design it was expected only to be wavelength-independent. Further investigations revealed that the effect also scaled with instrument temperature. The name initially given to this effect was "polarisation phase shift". However, the effect seems to be best described by (thermally induced) stress birefringence. See also [1]

Introduction, p 2223, l 17-20: In addition to the described sources of polarisation sensitivity, large and strongly wavelength-dependent polarisation sensitivity is introduced through the dichroic mirrors used for channel separation.

p 2224, l 4-9: It is suggested here that SCIAMACHY has 6 PMDs, it is only on p 2227 l 23-24 that it is mentioned that there are 7 PMDs and that the one with the longest wavelength is not considered in this paper. I suggest to move the relevant passage from p 2227 to p 2224.

p 2229, l 19: "large errors": Are these errors in the derived q and u values, or in the polarisation correction term? Note that the q and u values were initially only intended for polarisation correction of the science pixels.

p 2229, l 24-25: "looking into the instrument": at the location of the spectrometer slit. The configuration of the scanner module (limb or nadir geometry) would affect the definition if it were outside of the instrument, and in order to remove this confusion the location at the spectrometer slit was chosen.

p 2253, l 13, RTS pixels: the RTS effect causes the dark current to jump between two

or more different levels. Extensive investigation of RTS effects show that the electronic offset remains constant. A significant number of RTS pixels jump slow enough to allow for accurate dark signal correction when the limb dark measurement of the same state execution is used.

References

[1] Snel, R.C.: SCIAMACHY on-ground performance: polarisation phase shift, ESAMS '99 - European Symposium on Atmospheric Measurements from Space, ESTEC, Noordwijk, The Netherlands, 18-22 January 1999, WPP-161 Volume 2, ESA, p 725-729

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