SCIAMACHY: The new Level 0-1 Processor

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Introduction

The SCIAMACHY Quality Working Group (SQWG) was founded in 2007 to improve the quality of the existing products and to implement retrievals of new data products. The SQWG consists of the experts from University of Bremen (lead), Belgian Institute for Space Aeronomy (BIRA), Remote Sensing Technology Institute at German Aerospace Center (DLR), Netherlands Institute for Space Research (SRON) and Royal Netherlands Meteorological Institute (KNMI). Level 0-1 processing provides calibrated retrievals. The calibration of the data is done with a combination of on-ground thermal vacuum measurements, on-ground ambient measurements (to correct for the different incidence angles of light) and in-flight measurements. Currently version 9 of the processor is implemented. The Level 1 products with the updates shown here will be released in 2017 after thoroughly testing the changes on the basis of retrieval results.

Updated Degradation Correction

The degradation correction is based on a scan mirror model that fits the thickness of contaminating layers. The reflectivity of the mirror with the contaminant on top is calculated with the Fresnel equations. Regular monitoring measurements using the sun and the white light source with different light paths are used during processing to determine a degradation correction factor for the appropriate time and incidence angles on the mirrors. The scan mirror model was first implemented in Version 8 of the processor. In version 9 several improvements were added that lead to a better correction of the optical bench degradation. Together with the re-calculated polarisation and radiometric calibration data from on-ground measurements it is expected that the calibrated radiiances will be improved over the whole mission lifetime.

Figure 1: Top: Measured and modeled degradation of SCIAMACHY at 350 nm for 4 different lightpaths: Subsolar, limb, extra mirror and diffuser, from left to right over 9 years of data. Bottom: Ratio of measured and modeled m-factors at 350 nm. (SRON)

Better Pointing Correction

- Limb and occultation retrievals need very accurate pointing information for proper tangent heights.
- First update of mispointing parameters was already applied in 2007.
- IUP fitted new correction parameters by adjusting calculated solar and lunar positions to measured ones.
- For the first time, lunar measurements have been utilized for this purpose.
- New pointing correction parameters implemented in the initialisation file of the processor.

Figure 2: Elevation and azimuth angle offsets. OLD: Mispointing with the current processor. NEW: Remaining mispointing with the improved pointing parameters (IUP).

Figure 3: Plot of determined Limb polarisation values q (top), u (bottom) vs single scattering values for the old (left) and new (right) algorithm (IUP).

Improved Polarisation Correction

The polarisation correction for V. 9 of the processor will be improved by implementing several additions and revisions to the polarisation correction:

- Implementation of the CHEOPS correction already used in GOME-1 for a better correction in the UV
- Addition of a retarder matrix to the scan mirror model to consistently handle the phase shift that is caused by the OBM of SCIAMACHY
- Better handling of anomalous PMD data (spike filtering and electronic delays)
- Better handling of cases where U cannot be measured because of insufficient instrument sensitivity
- Complete Revision of the Limb polarisation calculation

Figure 4: Prediction and measurement of the orbital variation of the dark signal in channel 8 (SRON).

Further Information

- ACVE 2016 L2 Poster: Gretschany & SQWG: New Developments in the SCIAMACHY L2 Ground Processor
- Level 0-1c ATBD: http://atmos.calif.de/sciamachy/documents/level_0/1b/sca101b_atbd_master.pdf (will soon be updated for Version 9)