FDR4ATMOS: New release of SCIAMACHY Level 1 and Level 2 products

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Introduction

The project FDR4ATMOS (**Fundamental Data Records in the domain of Satellite Atmospheric Composition**) has been initiated by the European Space Agency (ESA). Task A of the project covers the **improvement of the SCIAMACHY Level 1b degradation correction**, with the aim to remove ozone trends from the SCIAMACHY Level 2 data set that were introduced during the development of baseline version 9 (both data sets not released). The whole mission data were re-processed resulting in a complete new set of Level 1 and Level 2 data. Both data sets are now delivered in **netCDF version 4 format**. Aside from updates of the calibration and retrieval algorithms, we also **add calibrated lunar data to Level 1**. The data will be **released this summer.**

Level 1 - Updates since last version

Changes for phase F processors

Processor	Major Changes
V. 8 (2012)	Introduction of scan mirror model for the degradation correction of radiances
	Introduction of stray light matrix for channels 3-8
	Improvement of MEC for Limb measurements
	Improvements for hot pixel correction for Limb
	Update of key data
V. 9 (not released)	Completely new polarisation algorithm
V. 10 (2024)	New corrections for SWIR channels
	Key data updated
	Sun mean reference (SMR) calculation updated
	Update of scan mirror model
	Better pointing correction
	Switch to netCDF format
	Addition of calibrated lunar data to Level 1b

Lunar data

- ► Level 1b now contain calibrated irradiance and reflectance of the moon.
- ► Additionally we are preparing products containing all lunar data in one file
- ► We used the ROLO/GIRO (e.g. Wagner et al. 2015) as an independent validation source
- ► **Top:** Comparison full disk irradiance GIRO vs SCIAMACHY data (dots)
- ► **Bottom**: Comparison full disk reflectance GIRO vs SCIAMACHY data
- ► The data agree within the estimated error of the ROLO data (Stone, T. et al. 2004)
- ► There is no discernible trend over the mission lifetime
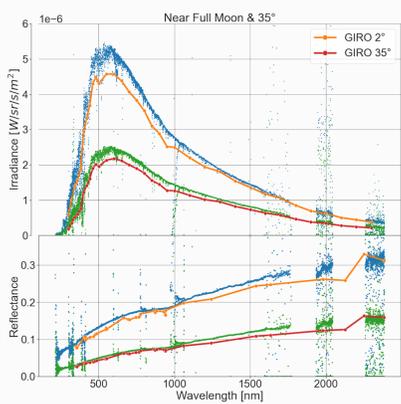
Improved Polarisation Correction

The polarisation correction of the processor is 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
- ► The plot shows determined Limb polarisation values q (top), u (bottom) vs single scattering values for the old (left) and new (right) algorithm.
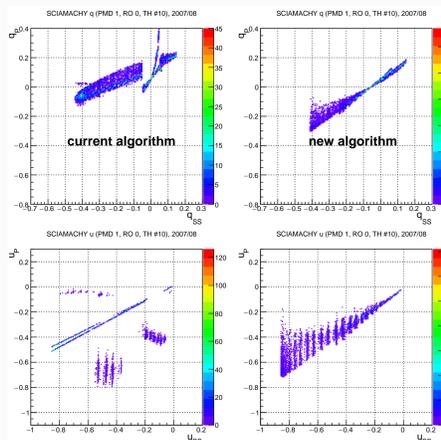
Better Pointing Correction

- ► 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 utilised for this purpose.
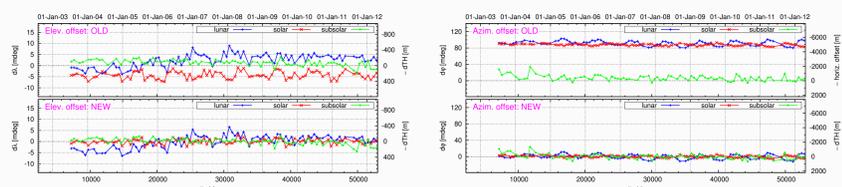
Figure: Elevation and azimuth angle offsets. OLD: Mispointing with the current processor. NEW: Remaining mispointing with the improved pointing parameters (IUP).

Contact Information

If you like to have further information, you can reach me at guenter.lichtenberg@dlr.de

Level 2 - Updates since last version

Changes for phase F processors

Product	Since	V6.0 (2013)	V7.0/V7.1 (2024)
Nadir			
AAI	V.3.01	Usage of calculated O3 VCD	Maintenance
O3	V. 3.01	improvements w.r.t. trends	Maintenance (L1 improvements V7.1)
NO2	V. 3.01	Maintenance	Maintenance
trop. NO2	V. 6	new product	Maintenance
BrO	V. 4	Maintenance	AMF Improvements
trop. BrO	V. 7		new product
SO2	V. 4	Maintenance	VCD, AMF improvements
OClO	V. 5	SCD & Maintenance	Maintenance
HCHO	V. 6	new product VCD	Maintenance
CHOCHO	V. 6	new product VCD	Maintenance
H2O	V. 6	Maintenance	Maintenance
CO / xCO	V. 5	xCO improvements	Maintenance
xCH4	V. 6	new product	Maintenance
Clouds	V. 3.01	ice/snow/ clouds discrimination	Maintenance
Limb			
O3	V. 3.01	extension to upper stratosphere and lower mesosphere	Maintenance
NO2	V. 3.01	Maintenance	Maintenance
BrO	V. 5	Maintenance	Maintenance
Clouds	V. 5	NLC detection	Better retrieval parameters and spectral ranges

Fixing Nadir O$_3$ Trend
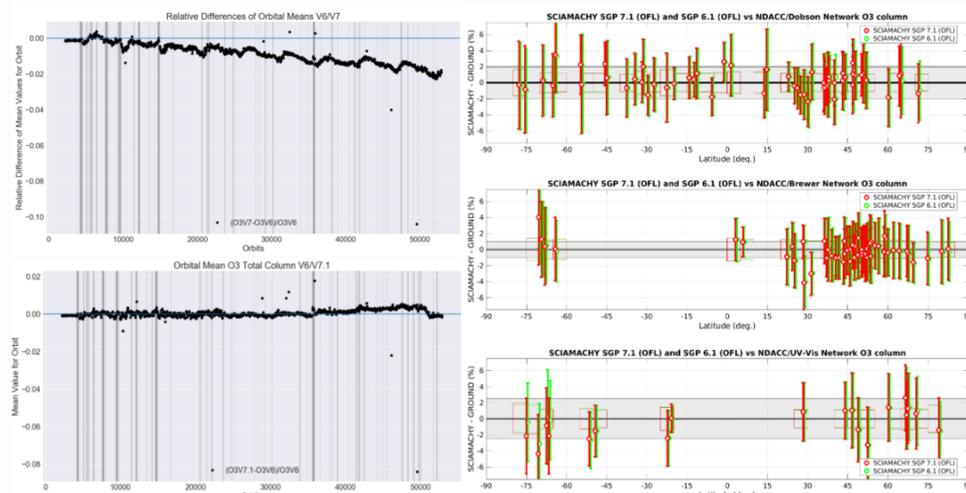
Figure: Comparison of orbit averages of O3 vs time. Left: Comparison of data V7 (top) and V7.1 (bottom) compared with previous V6.01. Right: Validation of O_3 values using ground based stations. Green squares show satellite measurement uncertainties. The bias is mostly within ± 1% and well within ± 2%, the long term drift is well below 1%/decade. The trend caused by Level 1 has disappeared in the new version.

Level 2 Regression Test V7/V7.01
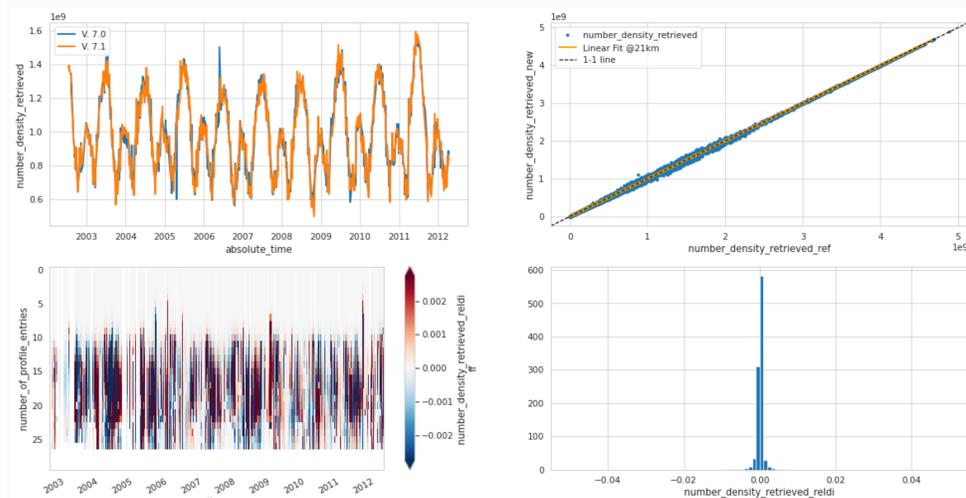
Figure: For all retrieved species that were not directly affected by the Level 1 change we did a comparison with the previous, validated Level 2 version 7. Above an example for Limb profile of NO2.

Further Information

Deutsches Zentrum für Luft- und Raumfahrt
German Aerospace Center