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Page: 1/6

Product Specification Document for SCIAMACHY water vapour column swath data derived using the AMC-DOAS method

S. Noël

Institute of Environmental Physics (IUP)

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Stefan Noël
Institute of Environmental Physics (IUP)
University of Bremen, FB 1
P O Box 330440
D-28334 Bremen
Germany
Fax: +49-421-218-9666
Fax: +49-421-218-4555
eMail: stefan.noel@iup.physik.uni-bremen.de

Contents

1	Product description	3
2	Product format specification	3
3	Software release history	5
4	Implementation details	6
5	List of known issues	6
	References	6

1 Product description

The AMC-DOAS H₂O swath data are a scientific data product derived using the Air Mass Corrected Differential Optical Absorption Spectroscopy method. The algorithm is described in Noël [2007].

The product provides for each SCIAMACHY ground pixel the derived total column of water vapour and the associated error, together with geolocation and timing information. The coverage of the data is therefore global, although certain regions may be masked out by quality criteria (see below).

The AMC-DOAS results do not rely on additional external measurements; they therefore provide a completely independent data set.

Currently, all SCIAMACHY near-real-time (NRT) Level 1b products since January 2003 have been processed. The retrieval is on-going.

The SCIAMACHY AMC-DOAS water vapour products are produced at and available via the Institute of Environmental Physics/Remote Sensing, University of Bremen, Germany.

In case of questions feel free to contact

Stefan Noël
Institute of Environmental Physics/Remote Sensing
University of Bremen, FB 1
P.O.Box 33 04 40
D-28334 Bremen, Germany
Email: Stefan.Noel@iup.physik.uni-bremen.de

or look at the AMC-DOAS web site:

<http://www.iup.uni-bremen.de/amcdoas/>

2 Product format specification

The SCIAMACHY AMC-DOAS water vapour product format is plain ASCII. There is one file for each input Level 1b file (i.e. for consolidated data this means one file per orbit).

The name of each product file is identical to the Level 1b file name, except for the additional extension `‘.child.h2o.amcdoas’`. The files are usually delivered in (gzip) compressed form.

The file format is explained in the header; header lines start with '#'. An example for a header is given in Listing 1.

There is one line per ground pixel, containing the following entries:

- readout no.
- L1 product name
- date & time of measurement
- state ID
- solar zenith angle (degree)
- retrieved H₂O column (in g/cm²)
- error of retrieved H₂O column (in g/cm²)
- AMF correction factor *a*
- shift & squeeze values (currently unused)
- centre latitude/longitude
- four corner latitude/longitude pairs (in drawing order)
- status flag (≥ 0 means OK)
- scan flag (1=forward scan, 0=backward scan)

Listing 1: Example header of the AMC-DOAS data product

```
# SCIAMACHY Nadir AMC-DOAS Total Water Vapour Column Product
# Version: 1.0
# Contact: Stefan.Noel@iup.physik.uni-bremen.de
# No., Product, Date, Time, State ID, SZA (deg), H2O Column (g/cm2), Error (g/cm2), AMF Corr., \
  shift, squeeze, center lat/lon, (4x) corner lat/lon, status ( $\geq 0$  OK), scan flag (1=forward scan)
```

3 Software release history

Version 0.9.1

- This is the first officially released version; previous versions (see header of data files) should not be used!
- A fixed Doppler shift for the solar reference spectrum is considered (0.01 nm at 500 nm).
- The water vapour data are derived from both SCIAMACHY NRT and consolidated Level 1b data products of Versions 4 and 5.
- All data have been processed using a dedicated solar reference spectrum based on SCIAMACHY measurements provided by ESA (J. Frerick).
- For the radiances, all calibration steps have been switched on during the extraction of the L1c product except polarisation correction.
- The status flag in the product is currently unused.

Version 1.0

- Uses updated radiative transfer data base (parameters b , c , τ_{O_2}) which is based on HITRAN2004.
- The Doppler shift for the solar reference spectrum is read from the Level 1b product.
- In the extraction of the Level 1b radiances only memory effect correction, dark current correction and wavelength calibration are applied.
- All data have been processed using the actual uncalibrated ASM diffuser solar reference spectrum from the Level 1b product. When no actual ASM diffuser spectrum was available (like for 2002 data), the ASM diffuser spectrum of 9 April 2003 (also provided in the Level 1b product) was used.
- The water vapour data are mainly derived from the SCIAMACHY reprocessed Level 1b V5 data set. Gaps in this data set have been filled (if possible) by NRT data of either V5 or V6 (since May 2006).
- The calculation of errors has been corrected; it now also considers a correction factor for unweighted data.

- The status flag in the product is used.
- Note: The combination of the new HITRAN data base with the reprocessed Level 1b data results in typically smaller water vapour columns as in previous versions.

4 Implementation details

The following implementation details apply to all product versions since V0.9:

- No shift & squeeze correction is performed.
- The retrieval assumes a Gaussian instrument slit function of FWHM 0.4 nm, which is smaller than for previous versions. By using this new slit function no additional correction factor for the retrieved columns is required any more.
- The data set contains only retrieval results which passed the AMC-DOAS inherent quality check, i.e. data with an air mass factor correction ≥ 0.8 and a solar zenith angle ≤ 88 degree.

5 List of known issues

- There may be gaps in the coverage resulting from e.g. cloudy scenes. Especially, there are no data for high mountain regions like the Himalaya because these are masked out by the AMC-DOAS quality check.
- The vertical column errors given in the product are derived from the covariance matrix resulting from the fit and thus do not contain any systematic errors.
- Comparisons with correlative data sets showed in general a good agreement (typical mean deviations to e.g. SSM/I or ECMWF data in the order of 0.2 g/cm^2), but also a considerably large scatter of about 0.5 g/cm^2 [see Noël, 2007, and references therein for details] .
- Larger deviations to correlative data may occur for regions of high surface albedo.

References

Noël, S., Description of the AMC-DOAS algorithm, *Tech. Rep. IFE-TN-AMCDOAS-001, Issue 1.0 (Rev. 1)*, IFE/IUP University of Bremen, 2007.