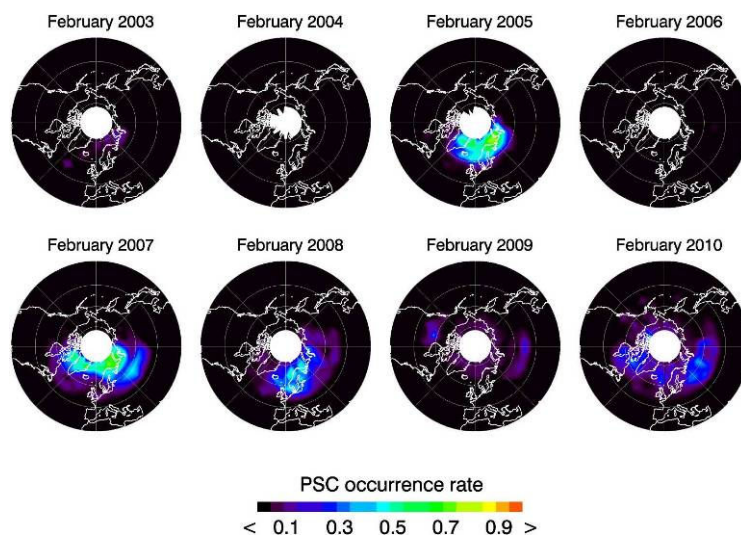




Product Specification Document for SCIAMACHY Polar Stratospheric Cloud Detections

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1. Product description

The data product essentially consists of a binary PSC presence indicator (0 = no PSC detected / 1 = PSC detected) and the highest SCIAMACHY Limb tangent height, where an aerosol signature (stronger than that of stratospheric background aerosol) can be detected. This tangent height is a measure for the PSC top height. The solar angles listed in the output files are given at the tangent point, not at the top of atmosphere (*i.e.* the point where the line of sight intersects the 100 km altitude layer). The solar azimuth angle is given with respect to the line of sight. The geographical coordinates listed in the output files correspond to the coordinates of the tangent point averaged over the detector integration time for each state or subpixel at a tangent height of 30 km. The PSC detections are of course only possible on the dayside of the Earth and measurements with solar zenith angles (at the tangent point) exceeding 88° are ignored.

The PSC detection algorithm is described in the Algorithm document for SCIAMACHY Polar Stratospheric Cloud Detections (*von Savigny*, 2011) and in more detail in *von Savigny et al.* (2005).

2. Product format specification

The data is stored in zipped ASCII files containing data for a single day. The names of the unzipped ASCII files have the following form:

```
psc_YYYYMMDD_00000_NNNN.dat
```

<u>with:</u>	YYYY:	Year
	MM:	Month
	DD:	Day
	00000:	orbit number (5-digits)
	NNNN:	secondary orbit number (4-digits)

The orbit number as well as the secondary orbit number are extracted from the names of the SCIAMACHY Level 1b files used for the analyses, *e.g.*:

```
                                00000  NNNN  
SCI_NL__1PUDPA20071001_045400_000060322062_00091_29203_1927.N1
```

The 5-digit and 4-digit numbers at the end of the filename correspond to the orbit number and the secondary orbit number, respectively.

File format:

The individual lines of the data files contain the following pieces of information: date, orbit number, secondary orbit number, number of limb state in SCIAMACHY level 1 file, total number of azimuthal subpixels (N_{total}), present number of azimuthal subpixels ($1, N_{\text{total}}$), Start time of limb measurement (UTC), PSC detection flag (1 = yes, 0 = no), tangent point latitude, tangent point longitude, solar zenith angle at tangent point, solar azimuth angle at tangent point, the lower one of two adjacent tangent heights between which the colour index ratio exceeds the PSC detection threshold, the corresponding colour index ratio.

Sample file content:

20071001	29203	8470	1	4	2	05:54:46.031477	0	-65.620	38.330	71.864	153.088	0.000	0.000
20071001	29203	8470	1	4	3	05:54:46.031477	0	-66.340	42.560	70.961	149.963	0.000	0.000
20071001	29203	8470	1	4	4	05:54:46.031477	0	-66.820	47.070	69.972	146.871	0.000	0.000
20071001	29203	8470	2	4	1	05:56:50.457251	1	-71.090	23.700	79.070	157.182	15.490	1.316
20071001	29203	8470	2	4	2	05:56:50.457251	1	-72.270	28.310	78.279	153.847	15.410	1.331
20071001	29203	8470	2	4	3	05:56:50.457251	1	-73.230	33.740	77.387	150.530	15.355	1.370
20071001	29203	8470	2	4	4	05:56:50.457251	1	-73.910	39.850	76.405	147.247	15.325	1.363
20071001	29203	8470	3	4	1	05:58:54.886931	1	-76.390	4.180	85.513	157.595	15.540	2.031

3. Software release history

The data product version available on the *scia-arc* website (www.iup.uni-bremen.de/scia-arc/) is still the initial data product version 1.0.

4. Implementation details

The SCIAMACHY Level 1 data are calibrated using the *sciaL1c* flags 0,1,2,3,4,5, corresponding to: memory effect correction, leakage current correction, straylight correction, pixel-to-pixel-gain correction, etalon correction, and wavelength calibration. Flags 6 and 7 corresponding to polarization correction and absolute calibration are omitted. The data set currently available in the IUP Bremen *scia-arc* (www.iup.uni-bremen.de/scia-arc/) data archive is based on SCIAMACHY Level 1 data version 7.03 or higher. This data version includes the most up-to-date correction for limb pointing errors (AUX_FRA satellite attitude correction as well as the SCIAMACHY extra misalignment correction).

5. List of known issues

5.1 False PSC detections due to volcanic eruptions

Volcanic eruptions may also lead to detectable aerosol signatures in the SCIAMACHY limb radiance measurements. This is so far not an issue for the southern hemisphere, but the northern hemisphere PSC seasons 2008/2009 and 2009/2010 were affected by volcanic aerosol.

5.2 Limb pointing:

The limb pointing issue most likely poses a negligible problem for this data product, because according to the most recent studies, the accuracy of the limb tangent height knowledge is on the order of a few hundred meters. While several limb data products (e.g. the stratospheric minor constituent profiles) may still be negatively affected by the remaining tangent height issues, tangent height errors of 100 m or 200 m are not critical for the PSC data product.

6. Data quality assessment

The performance of the PSC detection algorithm is very good in the southern hemisphere. As shown in *von Savigny et al. (2005)* as well as the corresponding algorithm document for this data product (*von Savigny (2011)*) there are essentially no false PSC detections, *i.e.* detections above the PSC formation threshold of about 195 – 198 K in the southern hemisphere. The altitudes of the detected PSCs nicely follow the altitude of the lower stratospheric temperature minimum and show descent rates of about 1 – 2 km / month, in very good agreement with independent studies. The northern hemispheric PSC seasons also show PSC detections at temperatures above 200 K, particularly in the years 2009 and 2010. For these years the measurements are affected by the residual stratospheric aerosol loading originating from the volcanic eruptions of Kasatochi in 2008 and Sarychev in 2009. Any obvious errors or unrealistic features in the data product should be reported to csavigny@iup.physik.uni-bremen.de.

7. References

von Savigny, C., Ulas, E. P., Eichmann, K.-U., Bovensmann, H., and Burrows, J. P.: Detection and Mapping of Polar Stratospheric Clouds using Limb Scattering Observations, ***Atmos. Chem. Phys.***, 5, 3071 – 3079, www.atmos-chem-phys.org/acp/5/3071/, 2005a.

von Savigny, C., Algorithm document for SCIAMACHY Polar Stratospheric Cloud Detections, 2011.