Product Quality Readme File for ALGOM WP4: Level 1c

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Document Title	Product Quality Readme File for ALGOM WP4: Level 1c
Reference Documents	[RD1] ESA ALGOM Level 1c Algorithm Theoretical Baseline Document (ATBD), 28-Jun-2016. [RD2] ESA ALGOM Level 1c Processing Input/Output Data Definition (IODD), 28-Jun-2016. [RD3] ESA ALGOM Technical note WP4: Level 1c studies, 28-Jun-2016.
Author(s)	Didier Fussen (didier@oma.be)
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1 Introduction

Most inversion methods in atmospheric remote sensing contain regularization methods to remove spurious oscillations produced by the amplification of the measurement noise. Therefore, very small absorbers cannot be retrieved easily because averaging many profiles leads to a mean profile contaminated by

the regularization. As transmittances are by definition normalized measurements, they are excellent candidates to statistical processing (by accumulation) with the relevant error bars. It is therefore expected that the mean or virtual transmittance will show an improved S/N ratio on which the relevant inverse model can be applied once. The goal of this work package was to develop a data processing model and to build a climatology of GOMOS averaged transmittances (also named below 'level 1c' or 'virtual transmittances') as a time-latitude series covering the entire duration of the mission (121 months from 04/2002 to 04/2012).

2 Algorithm description

The method of virtualization requires a thorough statistical analysis. The homogeneity of the data set being of primary importance, a detection of multimodal distributions is performed by fitting the distribution with theoretical models (using a curve fitting toolbox). For instance, some measurements are inside the polar vortex and others are outside. Each bimodal case will be studied separately by trying to understand why this particular bimodality and trying to properly separate each mode. All the bimodality case observed during the entire GOMOS mission are in high latitude regions during winters.

The algorithm extended description can be found in [RD3]. The climatology has been built according to the description in the ATBD document and the associated technical note. Input data used were the transmissions corrected for scintillation and dilution effects and the covariance function of the transmission (see: https://earth.esa.int/web/sppa/mission-performance/esa-missions/envisat/gomos and GOM_EXT files).

3 ALGOM Level 1c Products Characterization

The distribution of geolocations, the cases of bi-modalities and typical averaged transmittances are reported hereafter.

3.1 Spatio-temporal distribution of bins

The statistical significance of the averaged transmittances is clearly related to the population of the considered bin, that mostly depends on seasonal star availabilities.

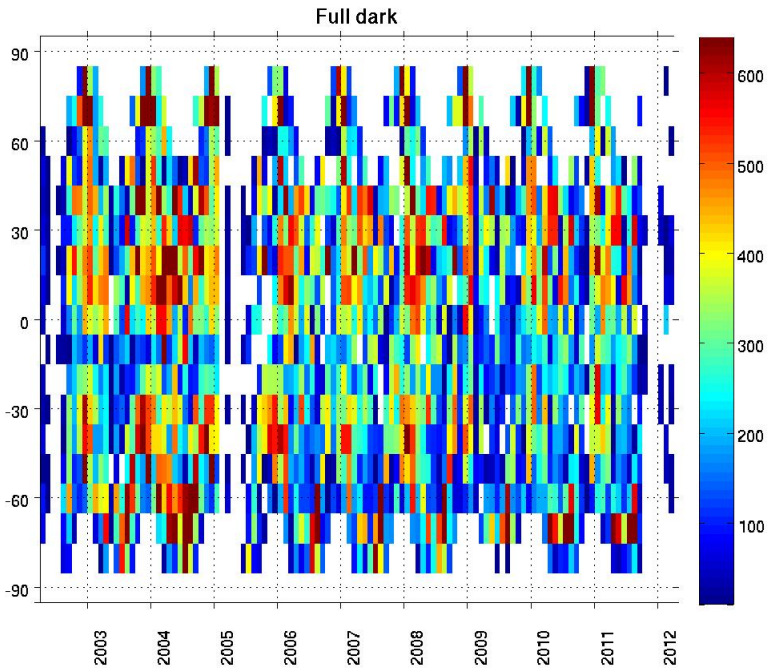

Figure 1: Monthly number of full dark limb occultation in April 2002 - April 2012 as a function of time and latitude.

3.2 List of bimodal cases

As explained in the technical note [RD3], the possibility exists to have bimodal histograms of distributions inside a bin, which is the case for a vortex crossing situation. Here after we give the list of bins for which bimodality was detected.

year	month	latitude band	year	month	latitude band
2002	08	60°S - 70°S	2005	08	50°S - 60°S
2002	09	60°S - 70°S	2005	08	60°S - 70°S
2003	01	70°N - 80°N	2005	09	60°S - 70°S
2003	01	60°N - 70°N	2006	01	70°N - 80°N
2003	02	70°N - 80°N	2007	01	70°N - 80°N
2003	02	60°N - 70°N	2007	08	50°S - 60°S
2003	03	70°N - 80°N	2008	01	70°N - 80°N
2003	03	60°N - 70°N	2008	09	60°S - 70°S
2003	09	60°S - 70°S	2008	10	60°S - 70°S
2004	01	70°N - 80°N	2008	12	70°N - 80°N
2004	01	60°N - 70°N	2009	01	80°N - 90°N
2004	02	70°N - 80°N	2009	01	70°N - 80°N
2004	02	60°N - 70°N	2009	09	50°S - 60°S
2004	03	70°N - 80°N	2010	01	70°N - 80°N
2004	03	60°N - 70°N	2010	09	60°S - 70°S
2004	09	60°S - 70°S	2011	01	70°N - 80°N

Table 1: list of bimodal cases observed

3.3 Typical output for the 3 spectrometers

Hereafter, we present typical examples of the GOMOS climatologies for 2003.

Spectrometer A:

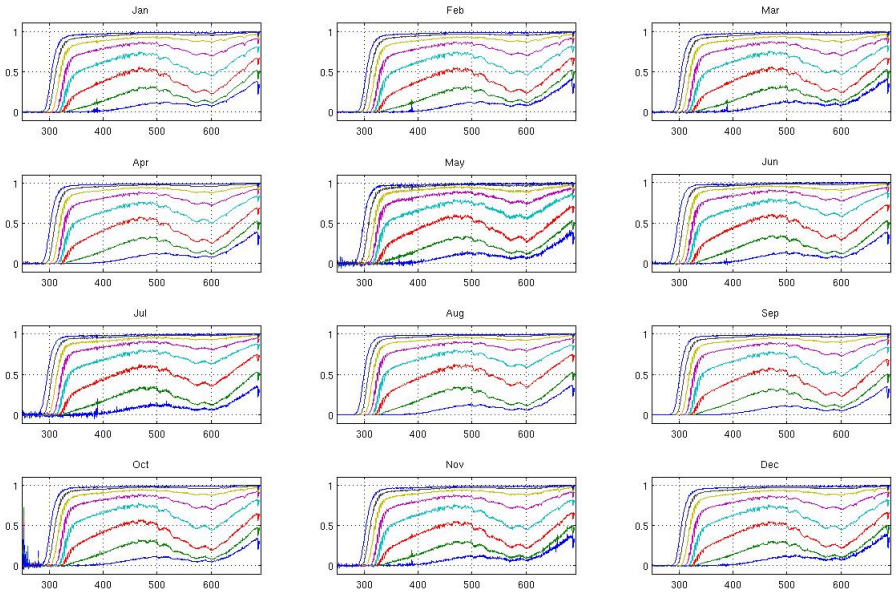

Figure 2: Climatology of averaged spectra for the year 2003 in the [50°S - 60°S] latitude band for the spectrometer A (248 nm - 690 nm) from 15 to 50 km (5 km step).

Spectrometer B1:

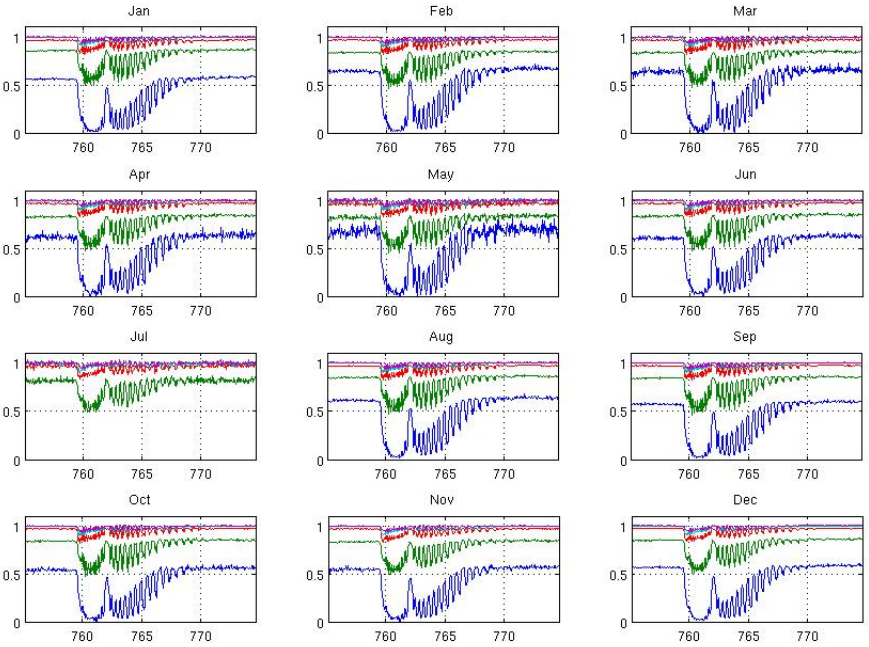

Figure 3: Same as Figure 2 but for spectrometer B1.

Spectrometer B2:

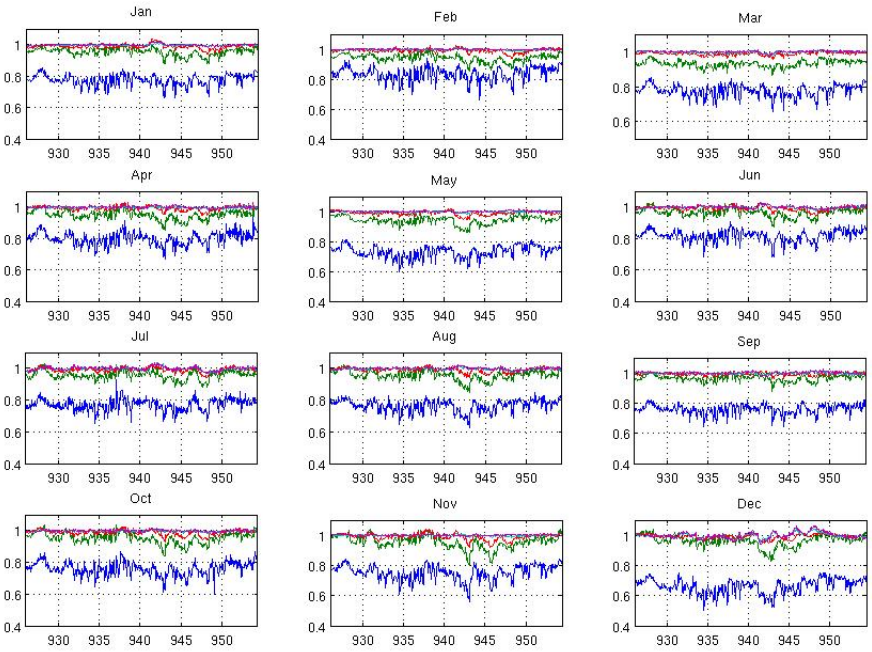

Figure 4: Same as Figure 2 but for spectrometer B2.

4 ALGOM Level 1c Products Characterization

The data format is Matlab binary files. For users not having MatLab, it is possible to convert them with scientific Python (scipy) or the "matio" library on Sourceforge.

Alternatively, it might be easier to make use of Octave (a free GNU MatLab clone), to analyze and/or to convert the data.

The data format is described in document [RD2].

5 Acronyms

- ALGOM: GOMOS Level 2 algorithm evolution studies
- ATBD: Algorithm Theoretical Baseline Document
- ESA: European Space Agency
- IODD: Input / Output Data Definition
- QWG: Quality Working Group