

1 PRODUCT SPECIFICATION

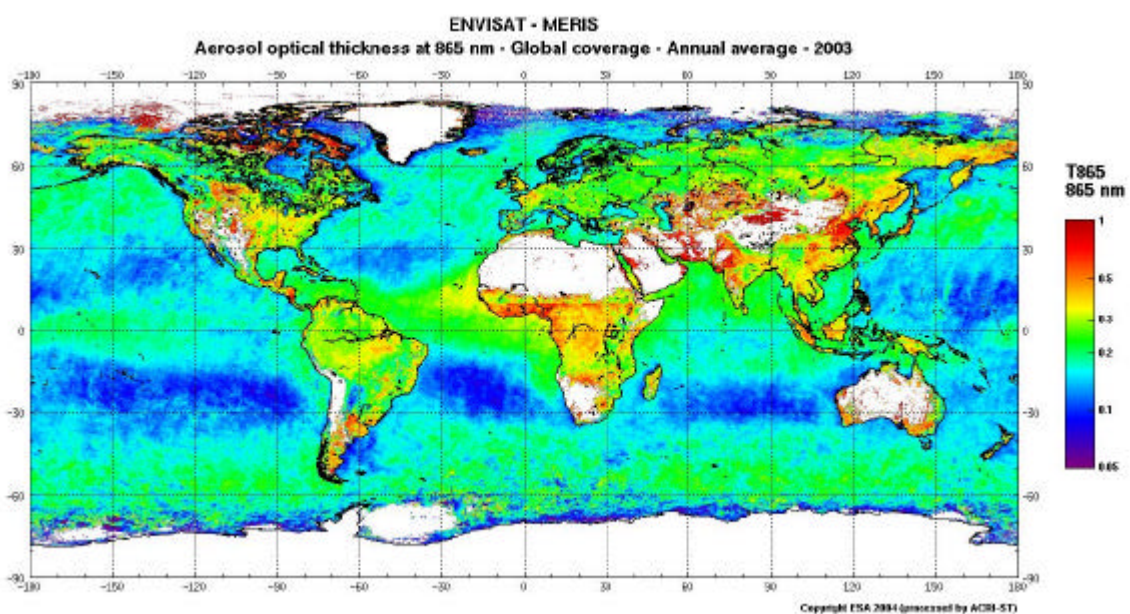
1.1.1 MERIS AOD level 3 product

The MERIS AOD level 3 service will be based on the following ingredients:

- Input data: GSE-PRO-IN-EO-13 (MERIS 1km aerosol optical depth) from MERIS level 2 products – processed with MEGS (MERIS processing prototype) , version 7.4.
- No auxiliary data are needed to generate the products.
- Output data: spatial and temporal aggregation of MERIS aerosol optical depth, and associated parameters (standard deviation, number of data per pixel, minimum, maximum).
- algorithm(s): arithmetic mean quantity which follows the recommendations of the IOCCG.

Short summary

Aerosol optical thickness is derived by two different algorithms depending on the underlying surface, land or water. In both cases however, retrieval of aerosol parameters from spectral measurements relies on the knowledge of the reflectance of the underlying surface for several bands. This allows to split the measured signal into surface and atmosphere contributions. It is then possible to further breakdown the atmosphere signal and determine aerosol properties. Regional products at 1 km resolution and on a daily basis are available in the frame of PROMOTE.



Aerosol load (optical thickness at 865 nm) : yearly average at 9 km spatial resolution.

Product description	
Summary	MERIS 1km aerosol optical depth
Product properties	
Parameter(s)	Aerosols Optical Thickness at 865 nm over water and land. Product : MERIS AOD at 865 nm mean quantity Auxiliary products: index of the bins, standard deviation, number of data

	per pixel, min, max.
Accuracy	TBD
Geometric resolution	Regional : 1 km Global : 9 km
Grid / projection	Sinusoidal / Plate-carré (on user request)
Spatial coverage	Regional, Global
Temporal coverage	Decadal, monthly, yearly (archive) Daily (NRT)
Data format	NetCDF, TIFF (on user request)
availability	July 2002 – present Austria and surroundings, at least the area Lat: 44-50 deg; Lon: 8-20 deg (NRT + 2003-2004) Others: TBD by the users
Production process	
Method/algorithm	<p>Aerosol optical thickness is derived by two different algorithms depending on the underlying surface, land or water. In both cases however, retrieval of aerosol parameters from spectral measurements relies on the knowledge of the reflectance of the underlying surface for several bands. This allows to split the measured signal into surface and atmosphere contributions. It is then possible to further breakdown the atmosphere signal and determine aerosol properties. Over ocean, these bands are in the near infra-red (779 nm and 865 nm) and in the green (510 nm), while over land – restricted to relatively densely vegetated areas, to ensure this condition – the useful bands are in the blue (412 and 442 nm) and in the red (665 nm).</p> <p>In both algorithms, aerosol parameters determination is based on comparisons of measurements in the above mentioned bands with values extracted from pre-computed look-up tables for a representative set of aerosol models under varying conditions. Those look-up tables, or sub-sets determined according to local conditions, are scanned until the model(s) – and its (their) optical thickness(es) – that best fits the measurements at all bands is (are) found. In a last step, optical thickness at 865 nm is derived either directly, over water the algorithm relies on the measurement at 865 nm, or using the optical properties of the selected model(s) to extrapolate the optical thickness at the measured wavelength to 865 nm (land algorithm is based on measurements in the blue and red parts of the spectrum).</p> <p>The level 3 algorithm follows the recommendations of the IOCCG. The algorithm can be briefly described as :</p> $AVG_i = \frac{1}{N_p} \sum_{n=1}^{N_p} \delta_n$ <p>Where N_p is the number of valid pixels (i.e. assessed as of good quality) in the cell i.</p> <p>Similar data-day definition as AVHRR-SeaWiFS</p>

Model/ assimilation	Direct retrieval, no model needed
reference	See : http://envisat.esa.int/instruments/meris/pdf/atbd_2_15.pdf (land) http://envisat.esa.int/instruments/meris/pdf/atbd_2_07.pdf (water)
Quality standards	
Production	Quality checks to identify outliers
Product validation	Large scale validation performed by MAVT (MERIS & AATSR Validation Team) Over land, the benefit needs to be evaluated
Input data	
EO data	GSE-PRO-IN-EO-13 (MERIS 1km aerosol optical depth) from MERIS level 2 products – processed with MEGS (MERIS processing prototype) , version 7.4
Other data	None
Optional or other specific properties (if applicable)	
Historical archive	Data access is off line on a website for archived data
Offline/NRT	Global: offline Specific Campaigns for selected regions: NRT via ftp (acri server)
Visualization standards	Through GIF, TIFF etc.
Underlying primary user requirement(s)	
Key requirement	Monitoring information in complement to other sources over Austria
Originator(s)	Dr. Robert Höller Umweltbundesamt GmbH / Federal Environment Agency Spittelauer Lände 5 1090 Wien, Austria

Table -1: Characteristics of the MERIS AOD level 3 product

4 PRODUCT GENERATION

4.2.1 MERIS AOD level 3 service

4.2.1.1 System overview

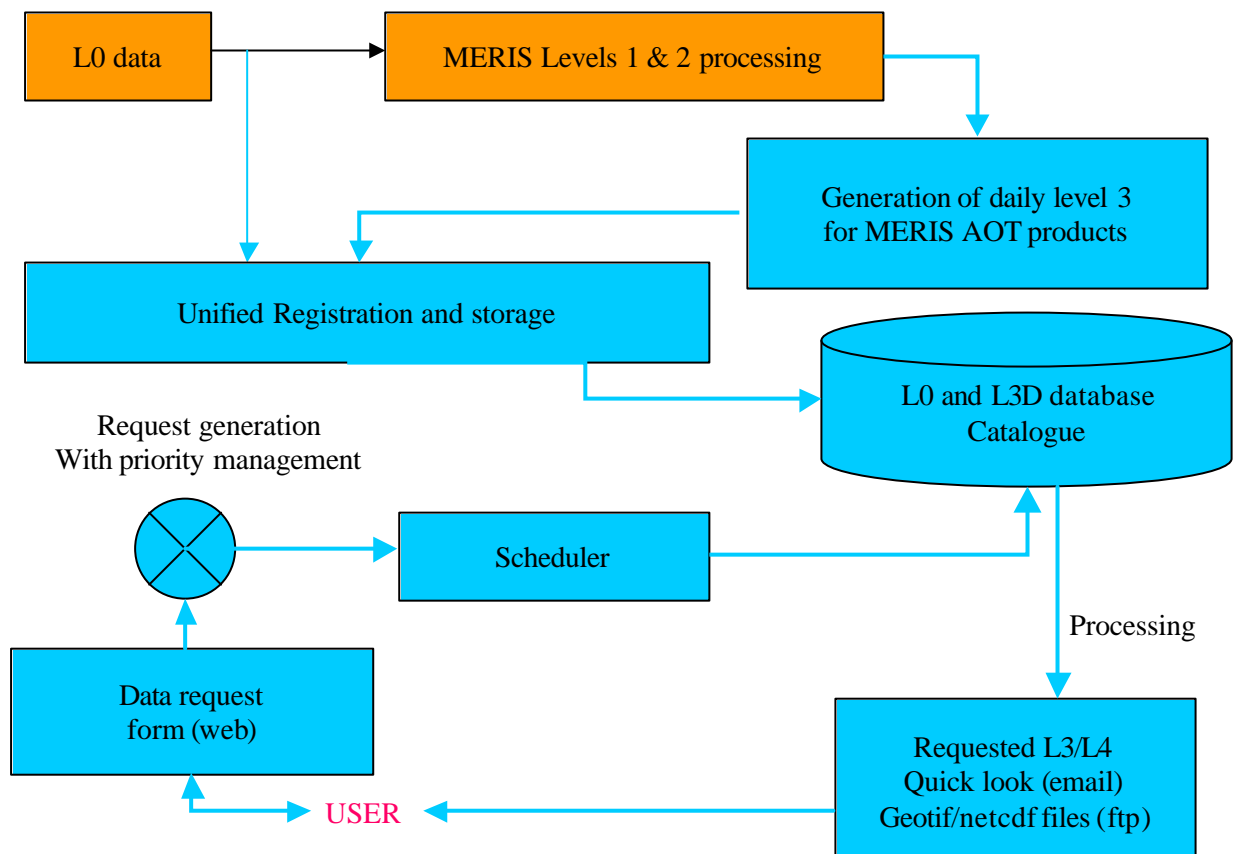


Figure -1: Overview of MERIS AOD level 3 process

The diagram summarises the MERIS AOD level 3 process. The MERIS AOD level 3 elements are:

1. Extraction of the MERIS AOD over land and sea at orbit level (sub-set of the MERIS level 2 product)
2. Generation of daily MERIS AOD product
3. Spatial and temporal aggregation of MERIS AOD products over the selected area and temporal window.
4. Data dissemination (file format, Quick look) according to user selection.

Number	Origin	Short name	Description	Backup
1	EO	GSE-PRO-IN-EO-13	MERIS 1km aerosol optical depth	n.a.
2	User	MERIS AOD Level 3 parameters	Area, temporal window, aggregation parameters, projection, format, QL dissemination, ... as defined in SLA	n.a.

Table -1: Input data of the MERIS AOD level 3 service

Number	type	Process name
1	Pre-processing	Extraction of the MERIS AOD over land and sea at orbit level
2	Retrieval	Generation of daily MERIS AOD product including Quality check (flag, outliers etc.)
3	Post-processing	Spatial and temporal aggregation of MERIS AOD products over the selected area and temporal window
4	Dissemination	Data dissemination (file format, Quick look) according to user selection

Table -2: Sub-processes of the MERIS AOD level 3 service

Number	Short name	description	Key features
1	MERIS AOD	MERIS AOD at 865 nm mean quantity	Main output of the service
2	Index	Index of the cells	For sinusoidal projection
3	Std	Standard deviation	Computed on the number of data per cell
4	Ndata	Number of data per cell	Number of valid data used to compute the average
5	Min	Minimum value (in the cell)	Minimum value among Ndata values
6	Max	Maximum value (in the cell)	Maximum value among Ndata values

Table -3: Output of the MERIS AOD level 3 service

Technical requirements

External interface(s)

MERIS level 0 data are available via ESA DDS satellite link. The historic data will be available by the end of 2005 after reprocessing with the up-to-date nominal processing chain. ECMWF data, needed for processing up to level 2, are routinely available.

Verification and quality control

Quality control is systematically applied at all stages of the processing steps. Flagged data are not considered in the level 3 generation process.

Hardware

The system is based on a PC linux 2.4 GHz, 2 Gb RAM, 240 Gb disk space, part of a cluster of EO data processing connected to two NetApp file servers F85 (0.5 Tb) and F825 (20 Tb).

Software

Level 2 Processing version : MEGS 7.4

Level 3 Processing version : mklv3 2.0

“MERIS level 2 DPM”, issue 7.4, May 2005.

4.2.1.1.1 Process 1: . Extraction of the MERIS AOD over land and sea at orbit level

The MERIS segment processes the MERIS level 0 up to level 2 data that are transmitted to an internal archive; this first preliminary step is performed outside the proper MERIS AOD service chain. The MERIS AOD service chain extracts from the level 2 stored in the internal archive the MERIS AOD over land and sea, together with the appropriate annotation (geolocation, quality flags).

4.2.1.1.2 Process 2: . Generation of daily MERIS AOD product

The data management element :

- prepares daily tailored products and sends them to archive,

Two separated computing chains process the data in NRT from raw level up to level 2 on a large European area. These data are binned every day on a fixed fine grid to form the daily basic level 3 product that are stored in the archive. These level 3 products are used to build the tailored products on a similar way (daily data with same elementary spatial resolution). They are also processed in NRT and stored in the archive.

A parallel chain processes and archives the analysis products (www.enviport.org/meris).

4.2.1.1.3 Process 3: Spatial and temporal aggregation

At this level, the user specifications are needed to compute the appropriate product (right type of product, projection type, time integration and spatial scale).

The data extraction element :

- combines archived data on the requested time frame and spatial area to process the appropriate products to be delivered

4.2.1.1.4 Process 4: Data dissemination

Once successfully processed, the user is informed via email and - according to the kind of data - can receive a quick-look of it. The final product is then automatically copied on an ftp server to be downloaded.

The data dissemination element :

- Generate the product in the right file format,
- Puts the final products on a ftp server from where users can download them.

The link between this element and the user's order is done via an operator who introduces the user request (after analysis) into the operational procedure.

4.2.1.2 References

- “Guide to the creation & use of ocean color level 3 product”, IOCCG final report, April 2004.

4 SOURCE DATA AND PRODUCTS TYPE

Data input	Owner	Short description
MERIS	ESA	<p>The MEDium Resolution Imaging Spectrometer Instrument, MERIS, is a 68.5° field-of-view pushbroom imaging spectrometer that measures the solar radiation reflected by the Earth, at a ground spatial resolution of 300m, in 15 spectral bands, in the visible and near infra-red. MERIS allows global coverage of the Earth in 3 days. The primary mission of MERIS is the measurement of ocean colour in the oceans and in coastal areas. Knowledge of the ocean colour can be converted into a measurement of chlorophyll pigment concentration, suspended sediment concentration and of aerosol loads over the marine domain.</p> <p>MERIS is on board ENVISAT, currently in operation since March 2002.</p> <p>For more information on MERIS: http://envisat.esa.int/instruments/meris/</p>

Table 1 : Description of the Data inputs