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document title/ titre du document

**MERIS CYCLIC REPORT 26<sup>TH</sup>**  
**APRIL 12<sup>TH</sup> 2004– MAY 17<sup>TH</sup> 2004**



MERIS acquired on 4<sup>th</sup> of May 2004 showing dust storm from Sahara

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prepared by/*préparé par* P. Colagrande  
reference/*référence*  
issue/*édition* 1  
revision/*révision* 0  
date of issue/*date d'édition* May 2004  
status/*état*  
Document type/*type de* MERIS Cyclic Report  
*document*  
Distribution/*distribution*

## A P P R O V A L

Title <i>titre</i>	MERIS Cyclic Report – Cycle 26 <sup>th</sup>	iss ue iss ue	revision <i>revision</i>
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author <i>auteur</i>	P.Colagrande	dat e <i>date</i>
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approved by <i>approuvé by</i>	P. Goryl	dat e <i>date</i>
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## C H A N G E L O G

reason for change / <i>raison du changement</i>	issue/ <i>issue</i>	revision/ <i>revision</i>	date/ <i>date</i>

## C H A N G E R E C O R D

Issue:1 Revision:0

reason for change/ <i>raison du changement</i>	page(s)/ <i>page(s)</i>	paragraph(s)/ <i>parag raph(s)</i>

## T A B L E O F C O N T E N T S

<b>1</b>	<b>INTRODUCTION .....</b>	<b>1</b>
1.1	Acronyms and abbreviations.....	1
<b>2</b>	<b>SUMMARY .....</b>	<b>3</b>
<b>3</b>	<b>SOFTWARE VERSION AND PROCESSING CONFIGURATION.....</b>	<b>3</b>
3.1	Software version.....	3
3.2	Auxiliary data files.....	3
3.2.1	Level 1/Level 2 Configuration (SciHiO2) .....	4
3.3	Configuration Table Interface (CTI).....	5
3.4	Level 1/ Level 2 RR or FR products .....	5
<b>4</b>	<b>PDS STATUS AND INSTRUMENT UNAVAILABILITY .....</b>	<b>6</b>
4.1	MERIS RR/FR Level 0 products .....	6
4.2	MER_CA__0P products .....	8
4.3	Instrument Unavailability.....	8
<b>5</b>	<b>CALIBRATION AND INSTRUMENT CHARACTERIZATION .....</b>	<b>8</b>
5.1	Calibration.....	8
5.1.1	Radiometric calibration.....	8
5.1.2	Spectral calibration.....	9
5.1.3	Geolocalization .....	9
5.1.4	VEU Temperature Analysis .....	9
5.1.5	Vicarious calibration results.....	10
5.2	Instrument Characterization .....	11
5.2.1	Instrument degradation.....	11
5.2.2	Diffuser ageing.....	13
5.2.3	Smile Effect.....	14
5.2.4	Spectral evolution from erbium measurements.....	14
<b>6</b>	<b>DATA QUALITY CONTROL.....</b>	<b>15</b>
6.1	Status of the Level 1 and Level 2 products quality.....	15
6.2	Anomalies and Software Problem Reporting (SPR).....	15
<b>7</b>	<b>VALIDATION ACTIVITIES AND RESULTS .....</b>	<b>15</b>
7.1	The REVAMP project.....	15
<b>8</b>	<b>PROCESSOR UPGRADE .....</b>	<b>18</b>

8.1	Level 1.....	18
8.2	Level 2.....	19
8.2.1	Major changes with respect to version IPF (Instrument Processing facility) 4.07 .....	19
8.2.2	Known Problems .....	21
8.2.3	Detailed status .....	22
<b>9</b>	<b>WATER VAPOUR AND BROWSE MAPS .....</b>	<b>30</b>
<b>10</b>	<b>GENERAL INFORMATION.....</b>	<b>30</b>

# 1 INTRODUCTION

The MERIS Cyclic Report is distributed by ESRIN-PCF (Product Control Facility) to keep the MERIS Community informed of any modification regarding the processor, updates of auxiliary products, anomalies of the instrument behaviour, data acquisition and processing, and finally the status of the calibration, validation, and quality control activities.

The Cyclic Report collects the inputs coming from different groups involved in MERIS data exploitation:

- ESRIN- Product Control Facility (PCF)
- Quality Working Group (QWG)
- MERIS/AATSR validation team (MAVT)
- Brockmann Consult (BC)
- ACRI-st
- Laboratoire d'Océanographie de Villefranche (LOV)
- Centre National d'Études Spatiales (CNES)
- Frei Universitat Berlin (FUB)
- Laboratoire Interdisciplinaire en Sciences de l'Environnement (LISE)

The main objective of the Cyclic Report is to provide the users community with useful information regarding the instrument performances, the data production chain, the results of calibration activities and validation campaigns, at the end of each ENVISAT cycle, which represents 501 orbits, about 35 days.

## 1.1 Acronyms and abbreviations

ADS	Auxiliary Data Server
ARF	Archiving Facility (PDS)
CNES	Centre National d'Études Spatiales
CTI	Configuration Table Interface
CR	Cyclic Report
DMOP	Detailed Mission Operation Plan
DS	Data Server
DSD	Data Set Descriptor
FUB	Freie Universitat Berlin
GS	Ground Segment
IAT	Interactive Analysis Tool
IDL	Interactive Data Language
IECF	Instrument Engineering and Calibration Facilities
IPF	Instrument Processing Facilities (PDS)
INV	Inventory Facilities (PDS)

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JRC	Joint Research Centre
LAN	Local Area Network
LISE	Laboratoire Interdisciplinaire en Sciences de l'Environnement
LOV	Laboratoire d'Océanographie de Villefranche-sur-mer
MERIS	Medium Resolution Image Spectrometer
MPH	Main Product Header
OP	Operational Phase of ENVISAT
PAC	Processing and Archiving Centre (PDS)
PDCC	Payload Data Control Centre (PDS)
PDHS	Payload Data Handling Station (PDS)
PDS	Payload Data Segment
QC	Quality Control
QWG	Quality Control Working Group
QUARC	Quality Analysis and Reporting Computer
SPH	Specific Product Header
SQADS	Summary Quality ADS

## 2 SUMMARY

Cycle #26 starts on April 12<sup>th</sup> 2004 and ends on May 17<sup>th</sup> 2004.

No auxiliary files were disseminated during the cycle.

Two radiometric gain calibrations have been successfully executed.

The actual status of MERIS IPF4.07 products quality is reported in details in par. 6.1 and 6.2.

Information about the start and stop of the cycle can be found in the table below.

Cycle number	26
Start time	12 April 2004, 21:59:29
Stop time	17 May 2004, 21:59:29
Start orbit	11077
Stop orbit	11578

## 3 SOFTWARE VERSION AND PROCESSING CONFIGURATION

### 3.1 Software version

The list of documents applied to the current release, IPF4.07, is given in the following.

MERIS IPF: 04.07

Prototype Version: MEGS V6.2p3

Applicable and Reference Documents:

1. ENVISAT Product Specification	Iss_3_Rev_J	PO-RS-MDA-GS-2009
2. MERIS Input/Output Data Definition	Iss_6_Rev_1a_010914	PO-TN-MEL-Gs-0003
3. MERIS Level 1b Detailed Processing Model	Iss_6_Rev_1a_010914	PO-TN-MEL-GS-0002
4. MERIS Level 2b Detailed Processing Model	Iss_6_Rev_1a_010914	PO-TN-MEL-GS-0006

Issues 6.1a consist in issue 6.1 augmented/corrected by change pages issued as 6.1a

### 3.2 Auxiliary data files

No new auxiliary files were disseminated during cycle #26.

Product description	Product name	Comment
<b>Level 1 aux files</b>		
Instrument characterization data	MER_INS	No changes

Processing Level 1 control parameters data	MER_CP1	No changes
Radiometric calibration data	MER_RAC	No changes
Digital Roughness Model	MER_DRM	No changes
Digital Elevation Model	AUX_DEM	No changes
Land Surface Map	AUX_LSM	No changes
Attitude data file	AUX_ATT	No changes
<b>Level 2 aux files</b>		
Aerosol Climatology data	MER_AER	No changes
Atmosphere Parameter data	MER_ATP	No changes
Cloud measurement parameters data	MER_CMP	No changes
Processing Level-2 control parameters data	MER_CP2	No changes
Land aerosols parameters data	MER_LAP	No changes
Land vegetation index parameters data	MER_LVI	No changes
Ocean aerosols parameters data	MER_OAP	No changes
Ocean I parameters data	MER_OC1	No changes
Ocean II parameters data	MER_OC2	No changes
Water Vapour Parameters	MER_WVP	No changes

Note: The other files not listed change every time (ECMWF).

### 3.2.1 Level 1/Level 2 Configuration (SciHiO2)

The configuration used to process MERIS data from Level 0 to Level 1/Level 2 is the following:

- Level 1 Configuration

Product name	Start Validity
MER_INS_AXVIEC20030620_120000_20020321_193100_20121008_190821	21/03/02
MER_CP1_AXVIEC20030620_120000_20020429_040000_20120920_173421	29/04/02



MER_RAC_AXVIEC20030620_120000_20021224_121445_20121224_121445	24/12/03
MER_DRM_AXVIEC20020122_083343_20020101_000000_20200101_000000	01/03/02
AUX_DEM_AXVIEC20020123_121901_20020101_000000_20200101_000000	01/03/02
AUX_LSM_AXVIEC20020123_141228_20020101_000000_20200101_000000	01/03/02
AUX_ATT_AXVIEC20020924_131534_20020703_120000_20781231_235959	03/07/02

- Level 2 Configuration

Product name	Start Validity
MER_AER_AXVIEC20030620_120000_20020321_193100_20200101_000000	21/03/02
MER_ATP_AXVIEC20030620_120000_20021224_121445_20121224_121445	24/12/02
MER_CMP_AXVIEC20030620_120000_20021224_121445_20120321_193100	24/12/02
MER_CP2_AXVIEC20031120_104149_20021224_121445_20121224_121445	24/12/02
MER_LAP_AXVIEC20030715_151450_20020321_193100_20120321_193100	21/03/02
MER_LVI_AXVIEC20030620_120000_20020321_193100_20130224_164916	21/03/02
MER_OAP_AXVIEC20030620_120001_20020321_193100_20120321_193100	21/03/02
MER_OC1_AXVIEC20030620_120000_20020321_193100_20120321_193100	21/03/02
MER_OC2_AXVIEC20030620_120000_20020321_193100_20120624_174339	21/03/02
MER_WVP_AXVIEC20030620_120000_20020321_193100_20120321_193100	21/03/02

### 3.3 Configuration Table Interface (CTI)

No Configuration Tables have been disseminated during the cycle.

### 3.4 Level 1/ Level 2 RR or FR products

During cycle #26 no changes regarding format or algorithms for L1b/ L2 products were applied.

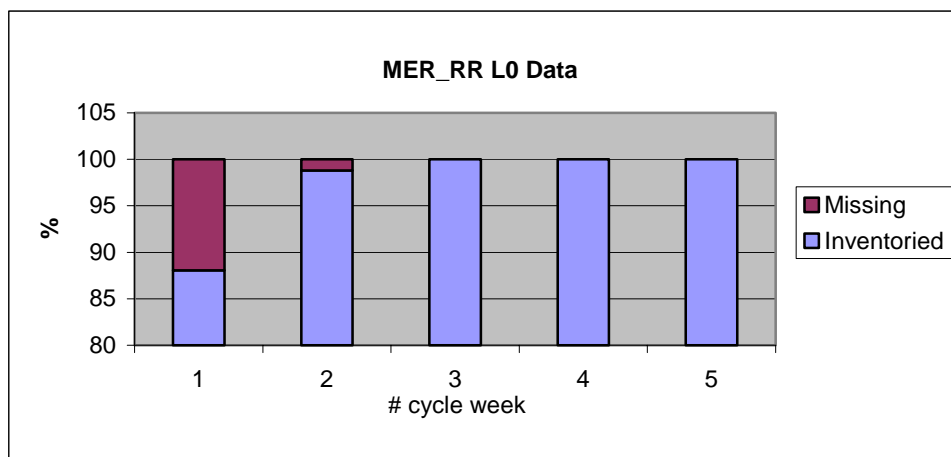
## 4 PDS STATUS AND INSTRUMENT UNAVAILABILITY

The statistics resulting from the query to the PDS inventory facility (INV) for the MERIS products availability are presented in the following.

### 4.1 MERIS RR/FR Level 0 products

Table below shows the statistics regarding the RR L0 availability (compared with the planned production).

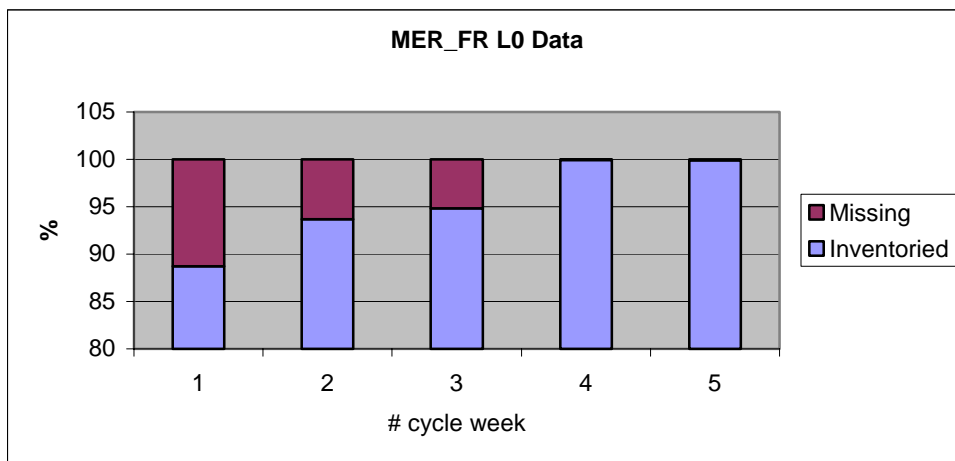
Week	MER_RR_OP	%
From 12/04 to 19/04	Inventoried	88.06
	Missing	11.94
From 19/04 to 26/04	Inventoried	98.81
	Missing	1.19
From 26/04 to 03/05	Inventoried	100.00
	Missing	0.00
From 03/05 to 10/05	Inventoried	100.00
	Missing	0.00
From 10/05 to 17/05	Inventoried	100.00
	Missing	0.00



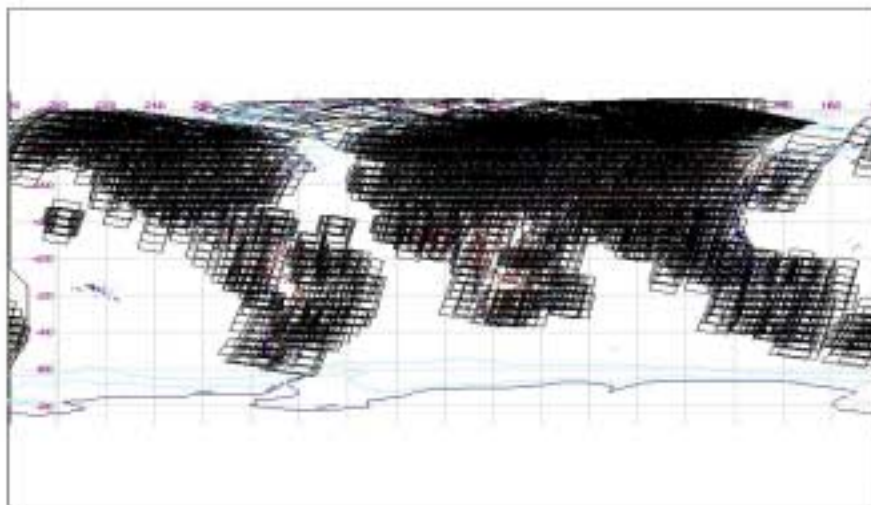
The number of RR Level 0 products acquired during the cycle is about 97.37% of the planned ones. The large part of missing products during the first week is explained by the unavailability reported in the paragraph 4.3.

Table below shows the statistics regarding the FR L0 availability (compared with the planned production).

Week	MER_FR_0P	%
From 12/04 to 19/04	Inventoried	88.72
	Missing	11.28
From 19/04 to 26/04	Inventoried	93.66
	Missing	6.34
From 26/04 to 03/05	Inventoried	94.82
	Missing	5.18
From 03/05 to 10/05	Inventoried	99.91
	Missing	0.09
From 10/05 to 17/05	Inventoried	99.88
	Missing	0.12



The number of FR Level 0 products generated during the cycle is about 95.40% of the planned ones. The global coverage of MERIS FR products for the whole cycle #26 is given in the following figure:



## 4.2 MER\_CA\_\_0P products

During cycle #26 two routine radiometric calibrations RGC Diffuser 1(1 orbit), were planned. The following calibrations:

MER\_CA\_\_0PNPDK20040425\_175655\_000001792026\_00184\_11260\_0022.N1      RGC  
 MER\_CA\_\_0PNPDK20040509\_171529\_000001792026\_00384\_11460\_0023.N1      RGC

were successfully executed on the 25<sup>th</sup> of April and on the 9<sup>th</sup> of May, in orbits respectively 11260 and 11460.

## 4.3 Instrument Unavailability

The following instrument unavailabilities (EN-UNA-2004/0116 and EN-UNA-2004/0130) were communicated by ESOC during the cycle #26:

Sub-System	From	To	Planned	Comments
PEB HSM & ESU	19 Apr 2004 06:48:45.000 Day of Year = 110 Orbit = 11168 Anx Offset = 0880.487	19 Apr 2004 15:23:00.000 Day of Year = 110 Orbit = 11173 Anx Offset = 1555.847	No	HSM reports anomalies on MERIS LBR input module. Ref: AR-828.

Sub-System	From	To	Planned	Comments
MERIS	19 Apr 2004 15:17:23.000 Day of Year = 110 Orbit = 11173 Anx Offset = 1218.847	19 Apr 2004 15:36:56.000 Day of Year = 110 Orbit = 11173 Anx Offset = 2391.847	Yes	MERIS switched down to Heater to reset the MERIS low bit rate HSM input module. Ref: AR #ENV-828.

# 5 CALIBRATION AND INSTRUMENT CHARACTERIZATION

## 5.1 Calibration

### 5.1.1 Radiometric calibration

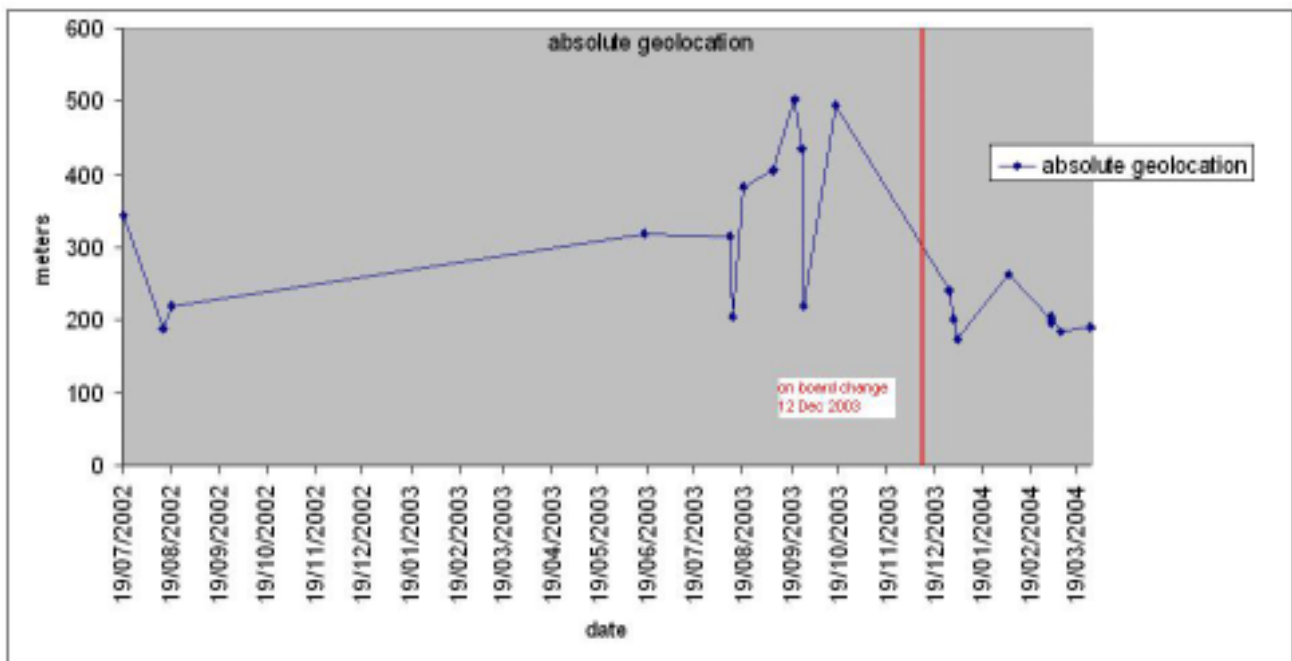
During cycle #26 two Radiometric Gain Calibrations were successfully executed on the 25<sup>th</sup> of April and 9<sup>th</sup> of May. For more details see par. 4.2.

### 5.1.2 Spectral calibration

No spectrometric calibrations were performed during cycle #26.

### 5.1.3 Geolocalization

Before the 12th of December 2003, the on-board law was not optimal. Degradation in the attitude was observed. That led to a slow degradation in the MERIS Geolocation. The mean error in the absolute geolocation was about 500 meters. The error was mainly in the across-track direction (440 meters). On 12<sup>th</sup> December 2003, the attitude onboard software change resulted in an immediate improvement of the geolocation. The current absolute geolocation accuracy is around 230 meters, as shown in the plot below:

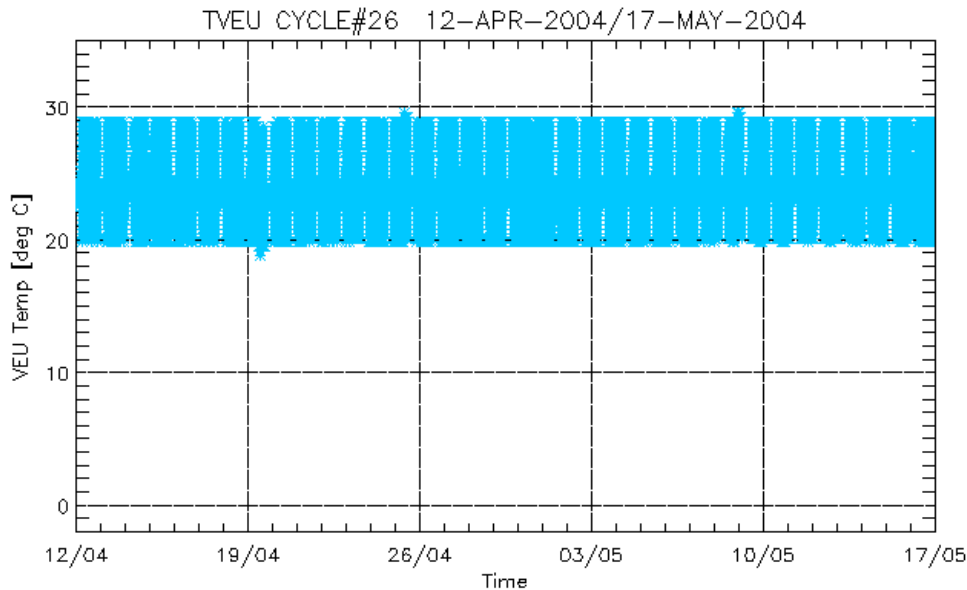


NB: The coastline provided in the product is derived from a CIA database. The accuracy of this coastline is sometime rough, and therefore it cannot be used to derive the precise MERIS geolocation accuracy.

### 5.1.4 VEU Temperature Analysis

During one of the operation modes of MERIS, Stabilization mode, a thermal regulation of VEU (Video Electronic Unit) unit is performed in order to stabilize its temperature to reach full performances and insure a safe transition towards Observation and Calibration modes.

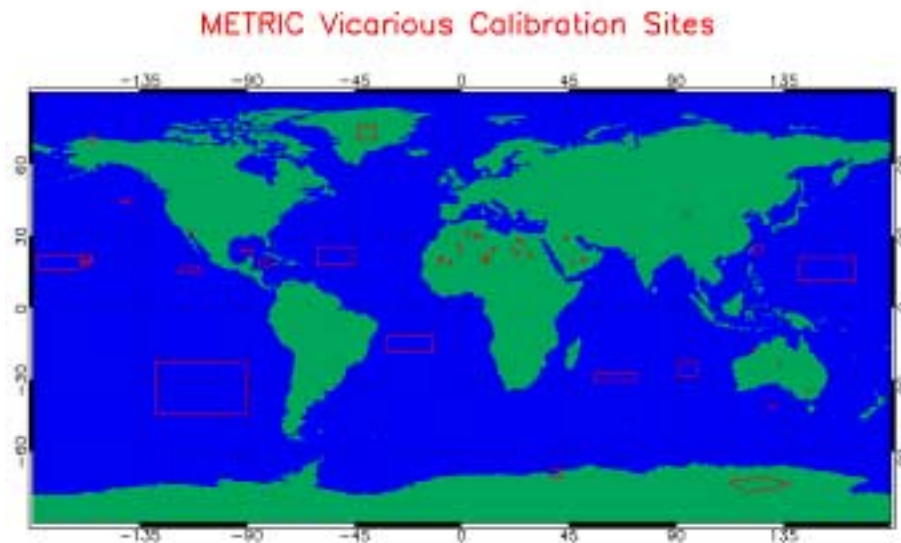
During observation, the VEU Temperature has to remain in the operational acceptance temperature range  $-10^{\circ}/+50^{\circ}$  in order to meet the image quality requirements. The VEU temperature should be maximum  $\pm 10^{\circ}\text{C}$  different from the last radiometric calibration for optimum performance. During cycle #26 the VEU temperature does not show any anomalous behaviour, being into the nominal operating temperature range.



### 5.1.5 Vicarious calibration results

For absolute calibration of MERIS by vicarious methods, METRIC2.0 tools is used to perform data extraction and spatial compression from MERIS Level1b products over specified sites following site type specific radiometric and geographic criteria. The child L1b products are ordered systematically on the basis of sites definition and mission analysis. Because the list of sites can be over dimensioned and vary with season, it has a validity period of 3 months. Each L1b child product is submitted to METRIC with the correct version of auxiliary files MER\_INS\_AX and MER\_CP1\_AX used during its generation and a dedicated resource file where are stored all parameters necessary for data filtering (cloud and aerosol screening, distance from coast...). Metric generates one file for each selected site pertaining to the following categories, according to the potential use of the data in the calibration processing: Rayleigh, Glitter, Desert, Snow, and Buoy. Output files have HDF format.

For cycle 24 new overpass tables have been regenerated for all sites of interest updating the relative orbits inside the cycle. The site map is shown in the following picture:



During the cycle Metric has generated for specific sites the following results:

Sites	#Products
DESERT	560
GLITTER	95
RAYLEIGH	51
SNOW	0
BUOY	9

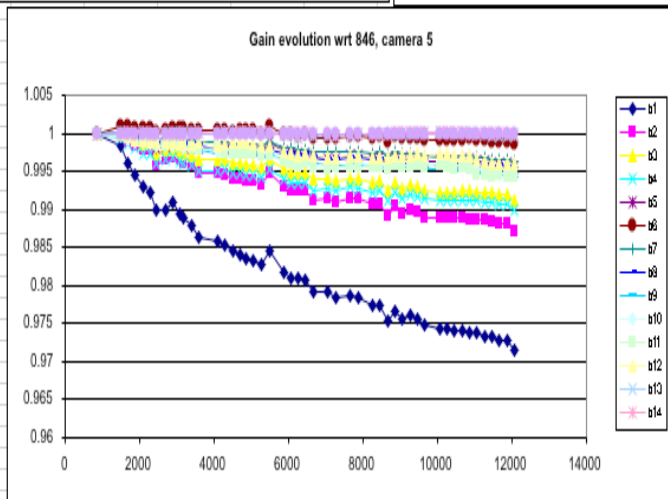
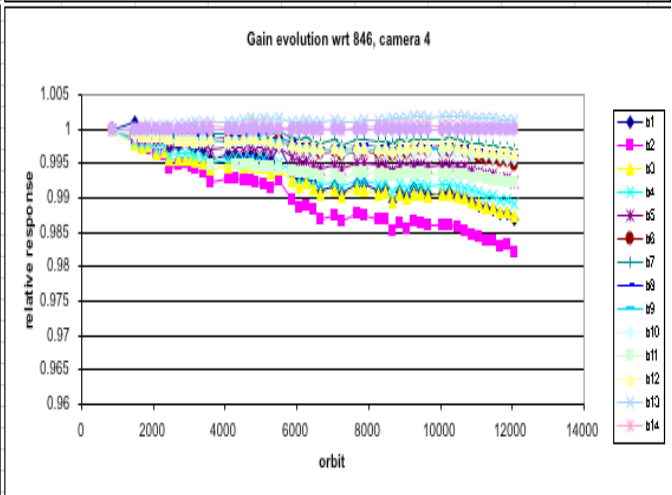
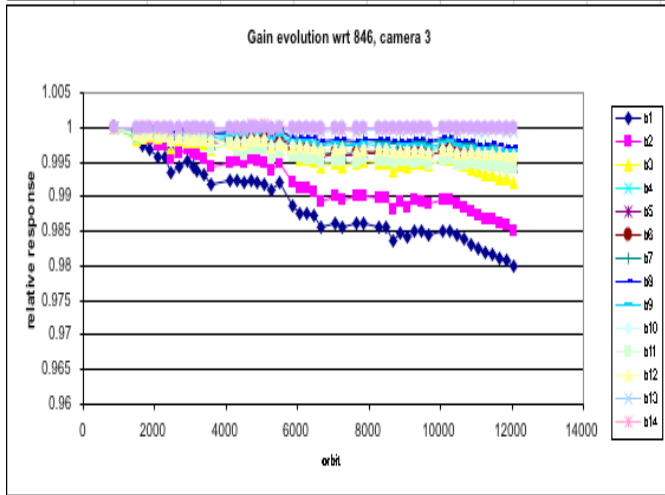
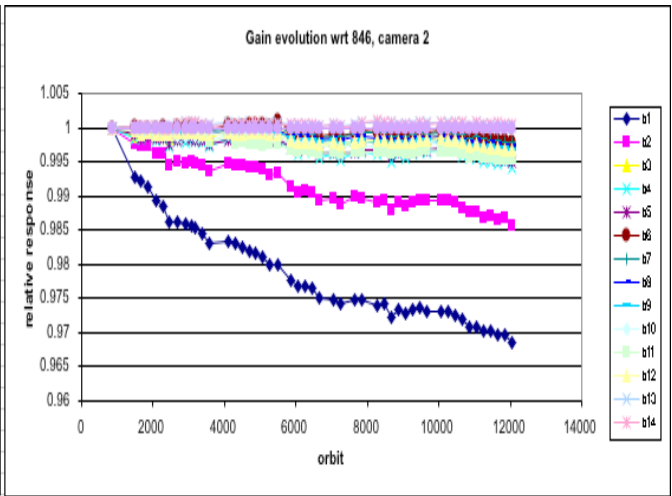
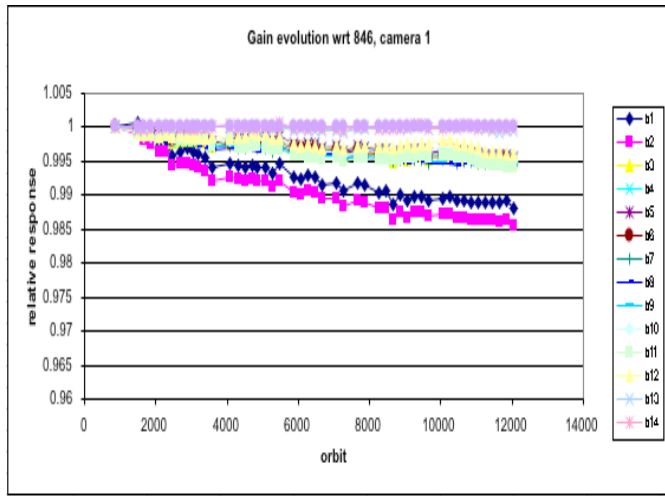
For a comparison between MERIS data and in situ measurements of natural targets, performed by CNES, refer to Cyclic Report #17. The report can be found on the ESA website:

<http://earth.esa.int/pcs/envisat/meris/reports/cyclic/>

## 5.2 Instrument Characterization

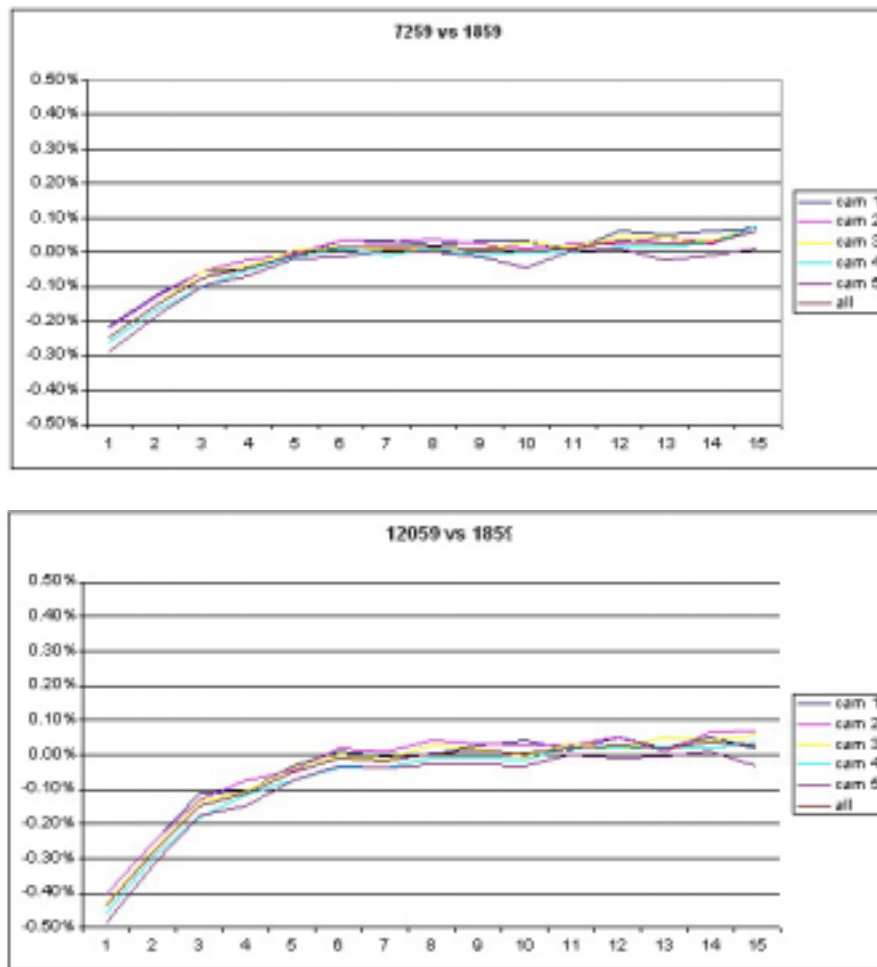
### 5.2.1 Instrument degradation

Using the on board diffuser the gain evolution is monitored through the MERIS life. From the beginning of mission until June 2004, degradation up to 3 % is observed in the blue region, especially for camera 2 and 5. The analysis results are shown below:









The degradation of diffusers seems to mainly affect the blue region of spectrum, while for higher wavelengths the degradation is less than 0.5 % after more than two years of flight.

### 5.2.3 Smile Effect

No new results to be shown for the cycle. Please refer to Cycle #23.

### 5.2.4 Spectral evolution from erbium measurements

No new results to be shown for the cycle. Please refer to Cycle #23.

## 6 DATA QUALITY CONTROL

### 6.1 Status of the Level 1 and Level 2 products quality

The quality of the IPF4.07 products is described in the previous Cyclic Report #25.

The IPF4.07 is the current processor installed at ESA Facilities and it will be upgraded during Winter 2004. At this time it will be aligned with the Prototype Processor MEGS7.0 that has been used for the MERIS Products Reprocessing. (See paragraph 8.0)

### 6.2 Anomalies and Software Problem Reporting (SPR)

1. Despite the processor upgrade done during cycle #22 to fix the problem, some MERIS FR L1 products still show the following anomalies: null radiance values for all the 15 bands and the 1<sup>st</sup> Tie Point of the product with latitude and longitude values out of the actual product geolocalization. The problem seem to be related to the Orbit State Vector, OSV: an OSV given at product start time and not at Ascending Node Cross, ANX, time prevent correct computation of the FR product limits that constrain all further processing including data extraction. A patch to IPF 4.07 is now under test to properly manage the geo-location step in FR L1 processing.
2. In MERIS RR L2 products the Water Vapour field is characterized by a vertical feature, which lies quite in the centre of the image and regards only water pixels. Above those pixels the water vapour content has negative value and both the HIGHGLINT and PCD\_14 flags are raised. The L2 processing done with the prototype, megs6.2p3, does not reproduce the same anomaly, then the problem could be due to an implementation error in the processor, which is now under investigation.

Both problems are being solved. A patch will be delivered and installed in October 2004.

## 7 VALIDATION ACTIVITIES AND RESULTS

The validation activities have been concentrated in the verification and validation of the new prototype processor (See paragraph 8.).

However, among all MERIS validation activities involving the scientific community, the project REVAMP, which aims to derive the chlorophyll products from MERIS data, is presented below.

### 7.1 The REVAMP project

REVAMP is a project aiming at Regional Validation of MERIS Chlorophyll Products in North Sea Coastal Waters. REVAMP is co-funded by the European Commission within the Fifth Framework

Programme "Energy, Environment and Sustainable Development". REVAMP was launched in February 2002 and will be completed in January 2005. REVAMP is an important contribution to the MERIS validation activities coordinated by ESA in the MAVT framework (MERIS and AATSR Validation Team). All REVAMP partners are MAVT members:

- Institute for Environmental studies (IVM, The Netherlands, Coordinator),
- Royal Belgium Institute for Natural Sciences (MUMM, Belgium),
- Brockmann Consult (BC, Germany),
- GKSS Forschungszentrum GmbH (GKSS, Germany),
- Danish Meteorological Institute (DMI, Denmark),
- Plymouth Marine Laboratory (PML, UK),
- Norwegian Institute for Water Research (NIVA, Norway),
- University of Oslo (UIO, Norway)

The basis for the work of REVAMP has been the MAVT protocol, which has been extended and improved to form the REVAMP protocol. All requirements of the MAVT protocol are still fulfilled by the REVAMP protocol. This protocol defines strictly methods for taking and analysing water samples. In intercalibration experiments this protocol has been tested and improved to be practically applicable.

Between five laboratories the measurements of

- in vivo phytoplankton absorption (Pabs),
- backscatter coefficient (bb),
- absorption of coloured dissolved organic material (CDOM),
- Chlorophyll a concentration by high performance liquid chromatography (HPLC),
- spectral sky radiance and total suspended matter concentration (TSM)

were compared. The inter-comparisons consisted of both laboratory experiments and measurements at sea and were conducted at Plymouth Marine Laboratory, in June 2002 and in November 2002 at GKSS, Germany. The field inter-comparisons were carried out at 2 to 3 stations off Plymouth Sound, UK and at 17 stations between Ostende, Belgium and Harwich, UK in the North Sea.

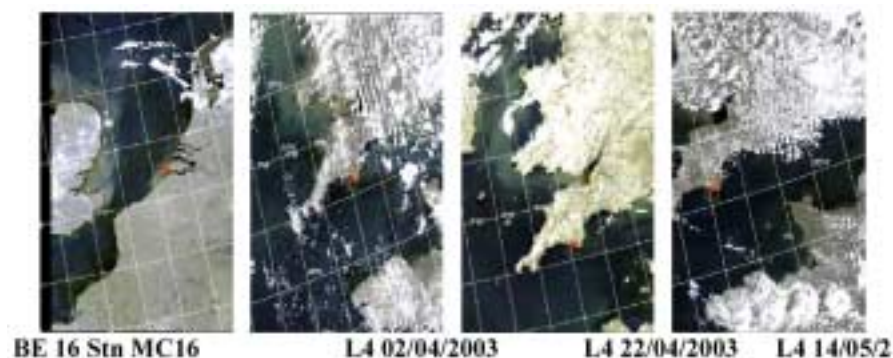


The oceanographic research vessel Belgica of MUMM (Belgium)

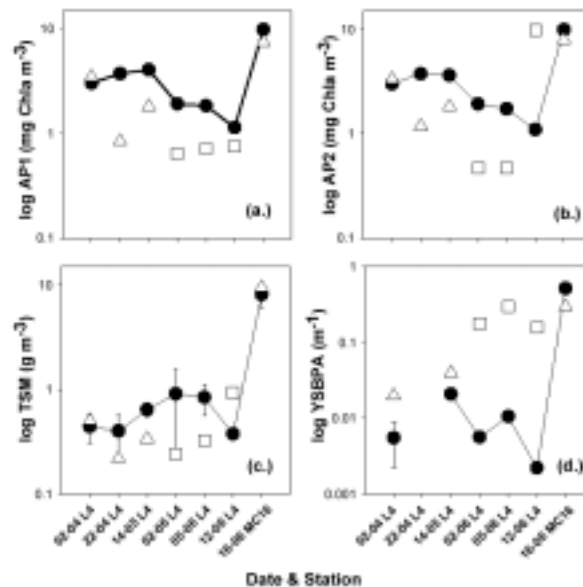
Chlorophyll a concentration by high performance liquid chromatography showed the lowest variability between laboratories (~9 %), followed by in vivo phytoplankton absorption (~14 %) and the backscatter coefficient (~13 %). The absorption of coloured dissolved organic material and total suspended matter concentration showed the highest variation between laboratories (~22 %). For CDOM this was attributed to unequal degradation of CDOM in shipped samples and for TSM incomplete washing procedures. From the laboratory experiments a number of recommendations were made to reduce the variability between laboratories.

These results are very important for the next step of validating MERIS chlorophyll products, the comparison of MERIS measurements with in-situ data (match-ups). If the in-situ data are not taken properly or inconsistently among the participating partners, the comparison with MERIS data becomes meaningless. The intercalibration experiment quantifies the variability or error associated with the in-situ measurements, which has to be taken into account when the comparison with the MERIS measurements is made.

An example of this comparison is shown below for 4 match-ups of the year 2003 in the Western English Channel. Chlorophyll a (*Chl a*) was underestimated by a 20%, Yellow substance + bleached particulate material absorption (YSBPA) was underestimated by 42% and total suspended material (TSM) was overestimated by a 16%. These errors fall within the specifications of the MERIS products for complex waters, but were not satisfying. This comparison was made in 2003 with a MERIS processor configuration available for the MAVT team. The results of this match-up analysis have contributed to the definition of improvements for the latest MERIS processor. The quality of the reprocessed match-ups with this new processor is currently being studied by the REVAMP team.



*RGB MERIS image for match-ups with valid (i.e. no PCD flags, no high glint) and in-situ measurements available.*



Validation of MERIS geophysical products with in situ data collected in 2003: (a.) Algal Pigment 1 - API, (b.) Algal Pigment 2 - AP2 (c.) total suspended material - TSM (d.) absorption of coloured dissolved organic material & bleached particulate material - YSBPA. Filled circles - in situ data; open triangles - MERIS quality 0 products; open squares - MERIS quality 1 products.  $\pm$  bars are standard deviations from replicate samples.

## 8 PROCESSOR UPGRADE

A new operational processor upgrade is foreseen for Winter 2004 including several changes in the Level 2 processing chain as suggested from the MAVT and the QWG.

Today, all changes have been implemented only into the prototype MEGS7. This prototype MEGS7 was used for the 1<sup>st</sup> MERIS data reprocessing. The reprocessed data for 2003 will be made available by Summer 2004.

The chapter below gives an overview of the modifications introduced in the new version of the processor and the Data Quality assessment:

### 8.1 Level 1

#### Radiometric quality:

The accuracy observed is better than 4% over ocean surfaces, but some discrepancies still exist with CNES method over Deserts. Since the beginning of mission, the degradation is less than 3% in the blue, and negligible in the NIR.

### **Spectral calibration quality:**

The spectral bands central wavelengths vary within the cameras field of view ( $< 1\text{nm}$ ). This so-called smile effect is present in the Level 1b product where all bands are calibrated with the exact spectral characteristics of each pixel. All processing needed to minimise its impact on the geophysical products is performed in the Level 2 processing.

In order to minimize the overall spectral dispersion within the field of view, in particular in the blue, camera four was re-aligned by 1.25 nm (one pixel) toward the NIR with respect to the other cameras. This was done at orbit 846 (29-Apr-2002), after analysis of the first in-flight spectral calibration data.

In order to achieve a better accuracy for the pressure retrieval, band 11, centered on the Oxygen absorption feature (761 nm), has been shifted by one pixel towards the NIR on 24-Dec-2002.

## **8.2 Level 2**

### **8.2.1 Major changes with respect to version IPF (Instrument Processing facility) 4.07**

Following the recommendations from various forums (Science Advisory Group, MERIS User Workshop, MERIS AATSR Validation Team (MAVT)), the MERIS Quality Working Group has ratified a certain number of changes in the initial MERIS processing. Those changes have been implemented in the processor and associated auxiliary files. The changes being important enough, we decided to reprocess the complete archive of MERIS data (2002-2003).

The chapter below describes at high level the changes performed.

- **Classification:**

The classification at Level 1 basis is performed using a predefined land/sea mask. At Level 2, the data are re-classified using the pixel radiometry at two wavelengths (665 and 865 nm). The re-classification is now performed for each pixel over land, and not only for which ones closed to the coastline as in the previous processor. It allows well classifying the inland waters. The reclassification of water pixel is still restricted to those close to the coastline. Anew algorithm has been introduced to better reclassify dark land surfaces, which are classified as water in Level 1b.

- **H2O absorption:**

The smile effect within the H2O absorption correction (at 709nm) is taken into account.

- **Surface pressure:**

The surface pressure is now retrieved through a polynomial expression of  $\log(\text{MP}^2)$  instead of  $\text{MP}^2$  as before.

- **Water Vapour:**

The water vapour Look Up Table over water has been updated in order to include the wind speed dimension.

- **Land branch:**  
The Dark Dense Vegetation concept has been extended. The aerosol family has been extended. The cloud shadow is now screened out.
- **Water branch:**  
A High Aerosol/Ice screening was added to the medium glint sub-branch.  
An additional test at 412 nm was added to screen out the remaining bright target.
- **Atmospheric correction above bright water:**  
Based on Infra Red data, the Bright Pixel Atmospheric Correction (BPAC) is now forced for all pixels.  
The CASE\_2S flag has been modified. It is raised now when the BPAC is on and when Total Suspended Matter (TSM) is above a certain threshold.
- **Case 2 water processing:**  
A new neural net has been trained with an optimised set of inherent optical properties based on MAVT measurements. The concentration range was extended to lower and higher concentration ranges. A white scatterer was introduced meet the scattering effect of Cocolithophorides. The net has been further trained to work also in cases when some reflectance measurements are below a reliable value or even negative.
- **Atmospheric Correction above clear water:**  
The aerosol database has been revised according to recent publications and MAVT findings. It includes, in addition to the well-known Maritimes Coastal and Rural families, three families of Dust-like (absorbing) aerosols (Moulin et al, JGR, 2001) and the so-called Blue family of theoretical Junge distribution aerosol with steep spectral dependency.  
The logic of atmospheric correction over ocean has been reviewed. Basically, it allows all aerosols except absorbing ones in the first pass. Absorbing aerosols are used in additional passes, over Case 1 waters only, if triggered by a test on the water leaving reflectance at 510 nm as compared to a climatology of rectified marines reflectances at 510 nm.
- **Aerosol**  
The Angstrøm coefficient replaces the Epsilon coefficient.  
The Angstrøm coefficient is defined as follow:  
$$\alpha = \log(\tau_a(775)/\tau_a(865)) / \log(\lambda(865)/\lambda(775))$$
- **Flags:**  
The check on the solar angle (> 70 deg) has been removed from all the PCD. This condition is now available as a science flag LOW\_SUN.  
The flag ABSOA\_CONT has been removed and is replaced by a new flag AERO\_BLUE to indicate the selection of "blue" aerosol.  
The ABSOA\_DUST flag is now raised only if an absorbing aerosol has been used in the atmospheric correction. In the previous processing, it indicated the potential of the existence of an



absorbing aerosol. The CASE2\_S flag is now indicating sediment loaded Case 2 water. It is triggered if the suspended sediment concentration is likely to be above a certain threshold.

The meaning of the DDV flag has been extended to include less dark vegetation and now indicates that aerosol retrieval over land has been attempted.

A new flag BPAC\_ON has been introduced which indicates that the bright pixel atmospheric correction over water has been activated. In the current setting, this is the case for all water pixels (see above) so that this flag is raised everywhere.

The flag P\_Confidence has been deleted.

### 8.2.2 Known Problems

Despite the major improvement with respect to the IPF4.07, some problems are still present within this processor version.

The major problems are:

- Slightly negative reflectances occur at 620 nm over Case-I water, especially in conditions favourable to whitecapping, probably due to the limitation in the aerosol family, but it does not seem to affect the chlorophyll products.
- Over Case-II waters the short wavelengths bands are sometimes overcorrected, leading partially to negative reflectances. This affects the quality of the Case-II water constituents Algal-2, TSM and Yellow Substance.
- In a coastal fringe approximately 10 km wide the atmospheric correction may be invalid due to adjacency effects.
- The field named “BOAVI, Bottom Of Atmosphere Vegetation Index” is currently empty. It will contain the MERIS Terrestrial Chlorophyll Index (MTCI) in a future version.
- A coding error has been identified in the PAR retrieval. It will be corrected in the next version of the processor.
- A coding error in PCD16 has been identified for water pixels. PCD17 should be used instead as they are supposed to be identical for water pixels.

The table in chapter below will detail the quality status for each parameter:

## 8.2.3 Detailed status

Parameter	Quality				Comment
	Goal <sup>1</sup>	Source <sup>2</sup>	Status <sup>3</sup>	Date <sup>4</sup>	
<b><i>Pixel Classification</i></b>					
Land flag	Reclassification of uncharted inland waters and islands, tidal flats and correction of map inaccuracies	ATBD 2.17 Iss. 4 Dec. 1997	The reclassification is now performed over each land pixel using the radiometry. The inland waters are now well classified. There is no distortion by high glint.	25.06.04	The reclassification is based on the Level 2 radiometry that is corrected from Rayleigh and gaseous absorption. Over land, at high altitude, this correction may be wrong introducing wrong classification (ex: Top of Hawaii mountain classified as water).
Water flag	As land flag		As land flag	25.06.04	
Cloud flag (over ocean)	Detection of clouds		Thin clouds are hardly detected.	25.06.04	Separation of ice from clouds works well. The purpose of this flag is to identify clouds, which are useful for the cloud processing. In order to dismiss any cloudy pixel this flag should be used in complement with the ICE/HAZE flag that detects the thin clouds.
Cloud flag (over land)			Thin clouds are hardly detected.	25.06.04	Ice, snow often detected as clouds.
<b><i>Pixel classification science flags</i></b>					
Pressure confidence			no longer available in the product It has been reused for LOW_SUN	25.06.04	Removed from the product
Low pressure			OK	25.06.04	It is raised mainly over clouds pixel.
<b><i>Cloud parameters</i></b>					

<sup>1</sup> The accuracy that shall be achieved.<sup>2</sup> The origin of the quality goal.<sup>3</sup> Present status of quality<sup>4</sup> Date of the present status

Parameter	Quality				Comment
	Goal <sup>1</sup>	Source <sup>2</sup>	Status <sup>3</sup>	Date <sup>4</sup>	
Surface reflectance 1-13	See L1b radiometry	QWG 25.9.03	over clouds simple conversion into TOA reflectances works well. Saturation in bands 779 and 865 can be observed – correctly flagged.	25.06.04	An analysis of the statistics of saturated pixels.
PCD_1_13			OK	25.06.04	
Cloud top pressure (CTP)	20 hPa	ATBD 2.3, Iss 4.1 Feb 2000	Goal is reached over strato cumulus clouds in the Passat region (30°-40°N). Elsewhere needs further validation. At low clouds camera transitions, with a step ~40 hPa, are observed.	25.06.04	Validation campaign, e.g. with Lidar, is still required.  The problem of camera interfaces still needs to be further investigated.
PCD_15			Ok	25.06.04	
Cloud albedo	accuracy of 0.01 albedo	ATBD 2.1, Iss 4.1 Feb 2000	Ok		The accuracy of the products is determined by the radiometric accuracy.
PCD_18			OK	25.06.04	
Cloud optical thickness	accuracy of 0.1 – 5.0 (worse with increasing OT)	ATBD 2.2, Iss. 4.2 Feb 2000	OK	25.06.04	In situ measurements validation is on going (aircraft campaign).
Cloud type			OK	25.06.04	Verification ongoing. It needs a statistically significant number of products.
PCD_19 (cloud opt. th. and type)			OK	25.06.04	
<b>Water Vapour parameter</b>					
Water vapour content (ocean)	Less than 20% rel. to WV over glint: 10%	ATBD 2.4, Iss 4.0 Dec. 1997	OK	25.06.04	
PCD_14 (ocean)			Ok but strange setting on the transition to glint	25.06.04	

Parameter	Quality				Comment
	Goal <sup>1</sup>	Source <sub>2</sub>	Status <sup>3</sup>	Date <sub>4</sub>	
Water vapour content (land)	10% relative. to WV amount		OK	25.06.04	The water vapour products show a good agreement when comparing with GPS, radio sounding data, Microwave radiometers or MODIS data.
PCD_14 (land)			OK	25.06.04	
Water vapour content (cloud)	Not specified in ATBD		OK	25.06.04	
PCD_14 (cloud)			OK	25.06.04	
PCD_19 (cloud opt. th. and type)			OK	25.06.04	
<b><i>Ocean parameter</i></b>					
Surface reflectance 1-13	Case1: accuracy 0.002 marine reflectance in the blue.  Case2: accuracy 5%	ATBD 2.7 Iss 4.1 Feb 2000  ATBD 2.6 Iss 4.1 Feb 2000	Negative reflectances occur at 620 nm over case I water probably due to the limitation in the aerosol family, but it does not seem to affect the chlorophyll products.  Overcorrection of the first 3 bands in Case-II water occurs sometimes. A fringe of negative reflectances exists around most coastlines.  Reflectance at 681 is not corrected for smile and may be affected diversely depending on the fluorescence activity.  Reflectance at 709 is corrected for smile, however gaseous absorption	25.06.04	The atmospheric correction above bright water in the Infra Red works well, however the extrapolation seems to overestimate sometimes the path radiance with decreasing wavelengths leading even to negative reflectances under some atmospheric conditions. The retrieval of water constituent in the water, which is dark in the blue, is limited by the accuracy of the atmospheric correction.  The negative reflectances in the pixels next to the coast are probably due to neighbouring effect.

Parameter	Quality				Comment
	Goal <sup>1</sup>	Source <sub>2</sub>	Status <sup>3</sup>	Date <sub>4</sub>	
			correction does not account for smile, which may lead to erroneous values at low reflectance levels.		
PCD_1_13			OK	25.06.04	The PCD_1_13 is raised in most cases for good reasons: high sun glint or thin clouds (ICE_HAZE flag) are the cause in ~80% of the cases when PCD_1_13 is raised.  In the coastal area due PCD_1_13 could be raised due to environmental effect.
Aerosol optical thickness	Accuracy 15% or 0.02 for moderate values (~0.1 – 0.2)	ATBD 2.7 Iss 4.1 Feb 2000	OK	25.06.04	
Aerosol Angström coefficient (alpha)	Not specified in ATBD	ATBD 2.6 and 2.7 Iss 4.1 Feb 2000	OK	25.06.04	
PCD_19 (aer. opt. thk. and epsilon)			OK	25.06.04	
Algal pigment index 1	Accuracy 10 classes per decade (~13%), covered range: 0.01 – 30 mg/m <sup>3</sup> over Case1 waters	ATBD 2.9 Iss 4.2 Feb 2000	OK	25.06.04	Quantitative error accuracy assessment is on going.
PCD_15			OK	25.06.04	PCD15 is raised (among other reasons) if any of the reflectances used in the Chlorophyll 1 retrieval is out of range (e.g. negative), which makes it less restrictive than PCD1_13.
Yellow substance	Depends on combination of YS, SPM and chlorophyll. See ATBD for details.	ATBD 2.12 Iss 4.0 Dec 1997	Values are in the expected range. Quantitative error assessment not completed	25.06.04	Case2 algorithm uses band 1-7 and 9, which makes it more sensitive to PCD1_13. It is very important not to use the products when PCD17 is raised!
Total suspended matter			OK	25.06.04	

Parameter	Quality				Comment
	Goal <sup>1</sup>	Source <sub>2</sub>	Status <sup>3</sup>	Date <sub>4</sub>	
PCD_16 (YS and TSM)			A coding error in PCD16 has been identified. PCD17 should be used instead.		PCD17 is raised almost everywhere in Case1 waters, which is in agreement with the definition range for the algorithm. Presently the range of the yellow substance absorption is linearly scaled over the available 8 bit in the data product. Instead of this the log of the absorption should be used (as it is the case for all other water constituents). This would provide much more detail in particular in case 1 water where the yellow substance values are now fixed to the minimum threshold of the 8 bit range (i.e. 0.0196). By this we simply throw away very valuable information. The corresponding loss of resolution at higher concentrations is no problem.
Algal pigment index II			OK	25.06.04	
PCD_17			OK	25.06.04	
PAR	Accuracy +/- 3%	ATBD 2.18 Iss 4.0 Dec 1997	A coding error has been identified in the PAR retrieval. It will be corrected in the next version of the processor.	25.06.04	
PCD_18			See above.	25.06.04	

Parameter	Quality				Comment
	Goal <sup>1</sup>	Source <sub>2</sub>	Status <sup>3</sup>	Date <sub>4</sub>	
<b><i>Ocean Science Flags</i></b>					
Blue aerosol			OK	25.06.04	
Dust aerosol			OK	25.06.04	Investigation in progress. The dust aerosol flag is now raised when an absorbing aerosol has been selected for the atmospheric correction
Case2_S			Ok.	25.06.04	The Case2S flag is now indicating that a sediment loaded water is present. It does no longer indicate that the turbid water (=bright pixel) atmospheric correction is activated. This is now indicated by the BPAC_ON flag.
Case2_anom			OK	25.06.04	Visually inspected.
Case2_Y			Not activated	25.06.04	
Ice and haze			OK	25.06.04	This flag has been redefined and is now also triggered in case of thin clouds, which are not correctable by the atmospheric correction. First verification results are very promising.
Medium glint	Indicate atmospheric correction could still be possible.	QWG 25.9.03	OK	25.06.04	Large portions of the images over water surfaces are affected by sun glint.
High glint	Indicate that atmospheric correction cannot be performed with the claimed accuracy.	QWG 25.9.03	OK	25.06.04	Threshold for glint is based on simulated data. Users should use the products with EXTREME CAUTION under medium glint conditions. The accuracy of the results in the medium glint is not validated. Users should NOT use Level 2 data when the high glint flag is raised
<b><i>BPAC_ON</i></b>	Indicate that the Bright Pixel Atmosphere Correction was enabled		OK	07.04	

Parameter	Quality				Comment
	Goal <sup>1</sup>	Source <sub>2</sub>	Status <sup>3</sup>	Date <sub>4</sub>	
<b><i>Land Parameter</i></b>					
Surface reflectance 1-13			OK	25.06.04	Correction includes Rayleigh but not aerosol correction.
PCD_1_13			OK	25.06.04	Cloud shadows are not included in PCD1_13 but in TOAVI_WS
Aerosol optical thickness			OK (see comment)	25.06.04	When the PCDs are raised, the Optical Thickness that is given at 865 nm is wrong, but its propagation at 443 nm, using the Angström coefficient given in the product is valid. However, in this case the Angström coefficient is invalid.
Aerosol Angström coefficient (alpha).			OK (see comment)	25.06.04	
PCD_19 (aer. opt. thk. and eps)			OK	25.06.04	
TOAVI (MGVI)	Not specified in ATBD	ATBD 2.10 Iss 4.1 Feb 2000	OK	25.06.04	
PCD_15			OK	25.06.04	
BOAVI	Not specified	No ATBD for BOAVI available	This field is currently not available	25.06.04	This field will provide with the MERIS Terrestrial Chlorophyll Index (MTCI) in the next version of the processor.
PCD_17			OK	25.06.04	
Rectified reflectances			OK	25.06.04	
PCD_16			OK	25.06.04	
Surface pressure			Generally ok, but camera interfaces and striping visible	25.06.04	The problem of camera interfaces is further investigated.
PCD_18			Ok	25.06.04	Could be more "sharp": only P_surf>1047 are flagged by the out-of-range criterion, but 1030 < P < 1047 is also quite high and can be found not rarely in images. TBC
<b><i>Land Science Flags</i></b>					



Parameter	Quality				Comment
	Goal <sup>1</sup>	Source <sub>2</sub>	Status <sup>3</sup>	Date <sub>4</sub>	
DDV (keep DDV)			OK	25.06.0 4	The concept of DDV has been extended to less dark vegetation in order to increase the temporal and spatial extend, so that aerosol properties is retrieved over more pixel. In that sense the term DDV is abusive. This flag will be renamed to LARS = Land Aerosol Remote Sensing On in future releases.
TOAVI_Bright			OK	25.06.0 4	
TOAVI_Bad			OK	25.06.0 4	
TOAVI_CSI			OK	25.06.0 4	
TOAVI_WS			OK	25.06.0 4	
TOAVI_Invalid_Rec			OK	25.06.0 4	
<b><i>Additional Flags</i></b>					
Coastline			OK	25.06.0 4	Coastline is taken from a static map and not reclassified using radiometry. The accuracy of the current database is not optimum. It should not be used to precisely characterise the geolocation accuracy, which is known to be better than 400m irrespective of the coastline flag information.
Cosmetic			OK	25.06.0 4	
Suspect			OK	25.06.0 4	
LOW_SUN			OK	25.06.0 4	Should be available on all surfaces, but is not set for cloud pixel.

## 9 WATER VAPOUR AND BROWSE MAPS

Water Vapour data, retrieved from MER\_LRC\_2P products, have been used to generate global coverage maps for each day of the cycle. Maps are available on the ESA website:

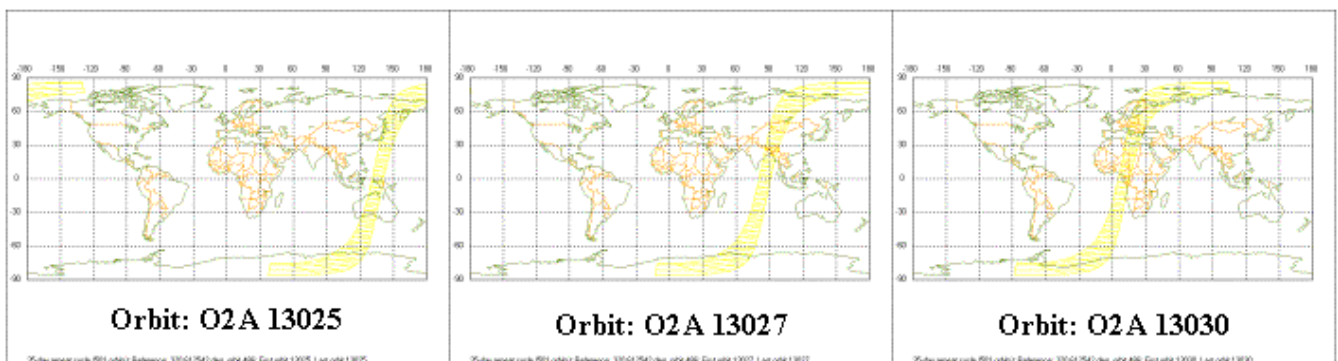
<http://earth.esa.int/pcs/envisat/meris/maps/watervapour/>

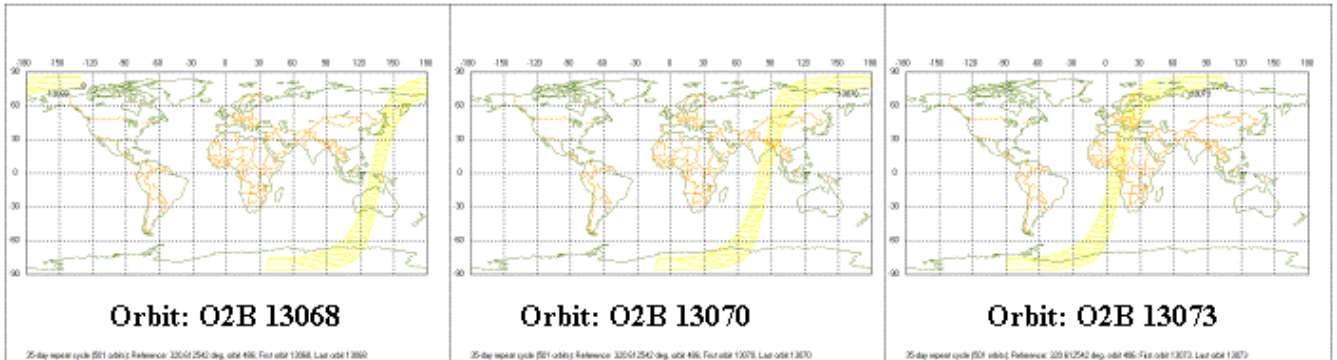
MERIS tracks for each day of the cycle have been plotted using Browse products. Maps are available on the ESA website:

<http://earth.esa.int/pcs/envisat/meris/maps/browse/>

## 10 GENERAL INFORMATION

1. The 2004 ENVISAT Symposium follows the previous successful Symposia in Gothenburg (2000), Florence (1997), Hamburg (1993) and Cannes (1992). ESA would like to invite you to participate in the ENVISAT Symposium, to be held in Salzburg (Austria) from 6 to 10 September 2004. For detailed information see the ESA's official conference page: <http://www.congrex.nl/04a06/>
2. CEOS-IVOS Workshop: Inter-Comparison of large Scale Optical Sensors The Workshop is confirmed to take place at ESA - ESTEC in the Netherlands on Tuesday to Thursday 12 - 14. October 2004. A short webstory introducing the workshop and its objectives can be found on ESA's Living Planet website under the following address: <http://www.esa.int/livingplanet>  
The website for registration and submission of abstracts can be accessed through the above webstory or directly under: <http://www.congrex.nl/04c32/>
3. New MERIS Spectral campaigns, with special band settings for Oxygen O<sub>2</sub>A band and O<sub>2</sub>B band and Fraunhofer, have been planned on 27<sup>th</sup> and 30<sup>th</sup> of August 2004, as required by the Cal/Val Team. The orbits selected for O<sub>2</sub> Spectral Campaigns are shown in the plots below:





For Fraunhofer Campaign only MERIS Calibration products MER\_CA\_\_0P have been planned.