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# MERIS CYCLIC REPORT 19<sup>TH</sup>

## AUGUST 11<sup>TH</sup> - SEPTEMBER 15<sup>TH</sup> 2003



MERIS image acquired on the 29<sup>th</sup> of August 2003

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prepared by/*préparé par* L. D'Alba, P. Colagrande

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author <i>auteur</i>	L. D'Alba, P.Colagrande,	dat e  <i>dat e</i>
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approved by <i>approuvé by</i>	P. Goryl	dat e  <i>dat e</i>
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# 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 behavior, 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)

JRC	Joint Research Center
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 Center (PDS)
PDCC	Payload Data Control Center (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 #19 starts on August 11<sup>th</sup> and ends on September 15<sup>th</sup>, 2003.

A new auxiliary file for the Level 2 processing has been disseminated during the cycle in order to update band 11 wavelength. Two routine and three extra radiometric calibrations have been successfully executed. One routine radiometric calibration was aborted. Two spectral campaigns required by FUB and LISE, the O2 and Fraunhofer campaigns, were successfully executed.

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

Cycle number	19
Start time	11 August 2003, 21:59:29
Stop time	15 September 2003, 21:59:29
Start orbit	7570
Stop orbit	8070

## 3 SOFTWARE VERSION AND PROCESSING CONFIGURATION

### 3.1 Software version

The list of documents applied to the current release, IPF4.06, is given in the following.

MERIS IPF: 04.06

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 1b 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

A new auxiliary product has been disseminated during the cycle. Detailed information is in the table below.

Product description	Product	Comment
---------------------	---------	---------

	name	
<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	Band 11 wavelength updated following Surface Pressure validation activities.
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_AXVIEC20030905_131635_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_120000_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 #19 no changes regarding format or algorithms for L1b/ L2 products have been applied.

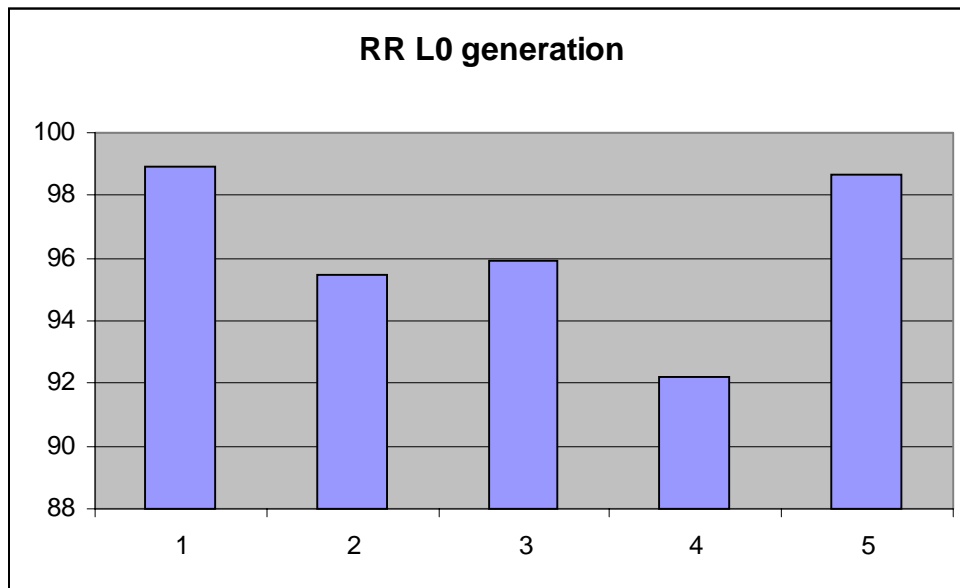
## 4 PDS STATUS

The query to the PDS inventory facility (INV) for MERIS products availability, performed with GANTT, provided the results presented in the following.

### 4.1 MERIS RR/FR Level 0 products

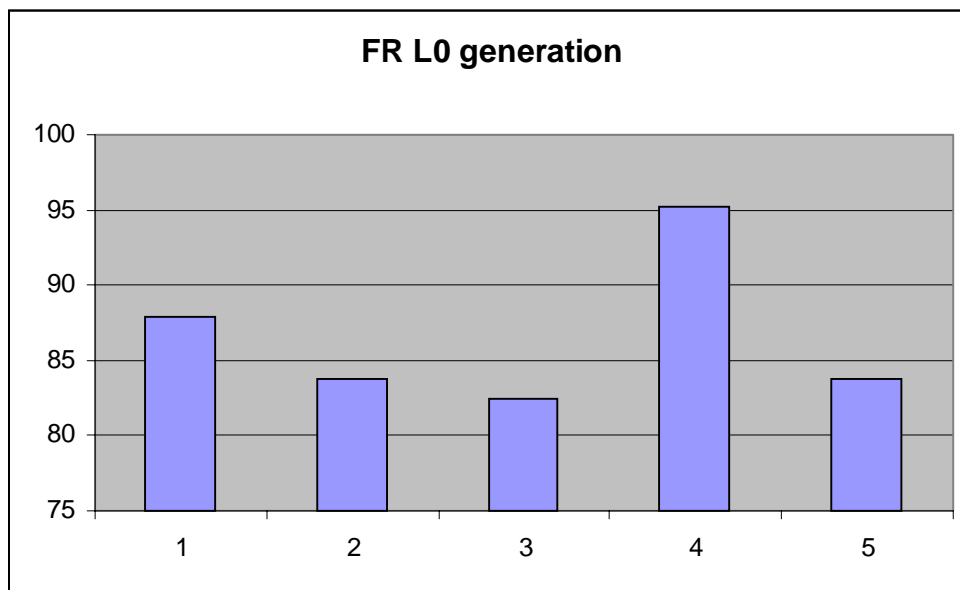
Table below shows the statistics regarding the RR L0 generation (compared with the planned ones) and missing data.

<b>Week</b>	<b>MER_RR_0P</b>	<b>%</b>
From 11/08 to 17/08	Inventoried	98.90
	Missing	1.10
From 18/08 to 24/08	Inventoried	95.45
	Missing	4.55
From 25/08 to 31/08	Inventoried	95.94
	Missing	4.06
From 01/09 to 07/09	Inventoried	92.21
	Missing	7.79
From 08/09 to 14/09	Inventoried	98.69
	Missing	1.31



The number of RR Level 0 products generated during the cycle is about 96.2% of the planned ones. Table below shows the statistics regarding the FR L0 generation (compared with the planned ones) and missing data.

Week	MER FR_0P	%
From 11/08 to 17/08	Inventoried	87.90
	Missing	12.10
From 18/08 to 24/08	Inventoried	83.80
	Missing	16.20
From 25/08 to 31/08	Inventoried	82.51
	Missing	17.49
From 01/09 to 07/09	Inventoried	95.22
	Missing	4.78
From 08/09 to 14/09	Inventoried	83.74
	Missing	16.26



The number of FR Level 0 products generated during the cycle is about 86.6% of the planned ones.

## 4.2 MER\_CA\_\_0P products

During cycle #19 three routine radiometric calibrations with Diffuser 1 were planned in orbits 7660, 7860, 8060. The following calibrations

MER_CA__0PNPDK20030818_060115_000001782019_00091_07660_0000.N1	RGC
MER_CA__0PNPDE20030901_052236_000001782019_00291_07860_0006.N1	RGC

were successfully executed on the 18<sup>th</sup> of August in orbit 7660 and on the 1<sup>st</sup> of September in orbit 7860. On September 15<sup>th</sup> the MERIS radiometric calibration planned in orbit 8060 at 04.47.00 was aborted due to a critical step failure in the 2nd calibration step. As consequence the frame averaging calibration coefficients with Diffuser 1 were not generated nor sent to ground. Since the failure occurred in the 2nd step, MERIS could continue operations, i.e. there was no transition to Standby/Refuse Mode.

Three extra calibrations have been also successfully executed on 25<sup>th</sup> and 26<sup>th</sup> of August 2003 in orbits 7769, 7772 and 7775 for Fraunhofer spectral campaigns required by FUB.

The following calibration products have been generated:

MER_CA__0PNPDK20030825_204723_000001792019_00200_07769_0007.N1	RGC
MER_CA__0PNPDE20030826_014912_000001792019_00203_07772_0001.N1	RGC
MER_CA__0PNPDK20030826_065102_000001782019_00206_07775_0012.N1	RGC

## 5 CALIBRATION AND INSTRUMENT CHARACTERIZATION

### 5.1 Radiometric calibration

During cycle #19 three Radiometric Gain Calibrations have been planned. Two of them have been successfully executed on the 18<sup>th</sup> of August and 1<sup>st</sup> of September 2003, the other one, planned on 15<sup>th</sup> of September 2003, was aborted.

Other three Radiometric Gain Calibrations have been executed in support of Fraunhofer Spectral Campaigns required by users. For more details see par. 4.2.

### 5.2 Spectral calibration

No spectral calibrations were performed during cycle #19.

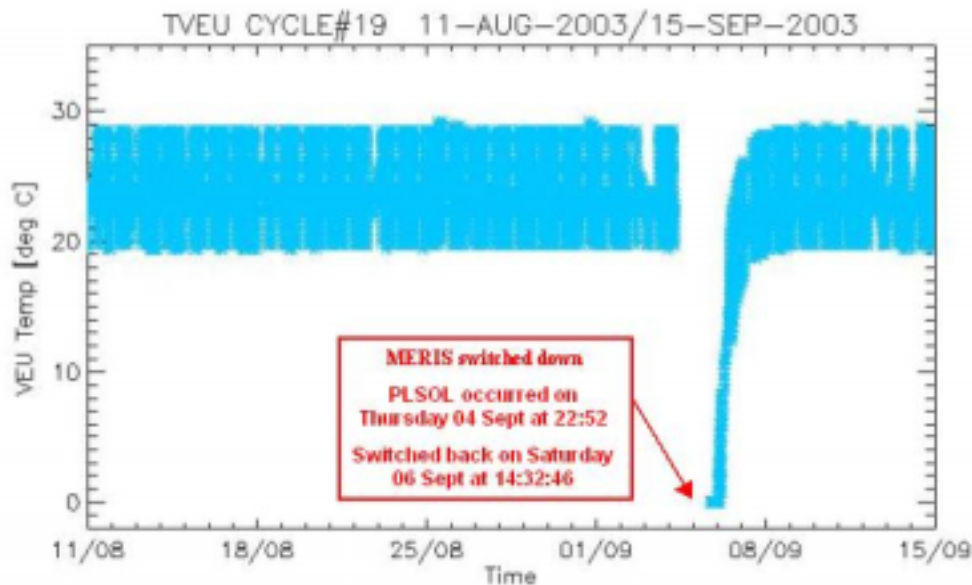
### 5.3 VEU Temperature Analysis

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 #19, MERIS status was nominal over the entire period, until it was switched off upon the PLSOL that occurred on Thursday September 4<sup>th</sup> at 22:52. MERIS was switched back on to Heater mode on Saturday September 6<sup>th</sup> at 14:32:46.

The VEU temperature does not show any anomalous behavior, being into the nominal operating temperature range apart from the switch down of the instrument.

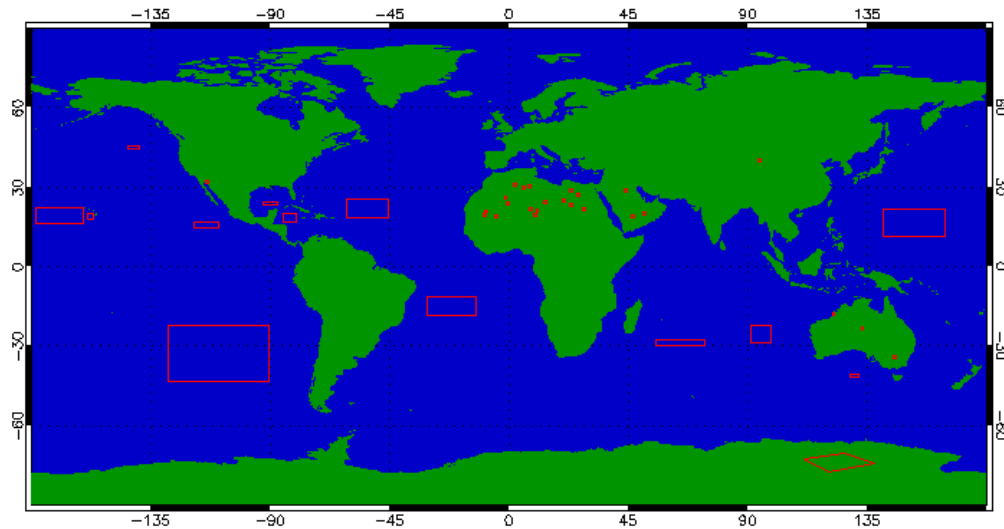


#### 5.4 Vicarious calibration results

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.

The site map is shown in the following picture:

## METRIC Vicarious Calibration Sites



During cycle #19 Metric has generated the following results for each specific site:

Sites	#Products
DESERT	130
GLITTER	58
RAYLEIGH	71
SNOW	15
BUOY	2

For the comparison between MERIS data and in situ measurements of natural targets provided by CNES refer to Cyclic Report #17.

## 5.5 Instrument Characterization

### 5.5.1 INSTRUMENT DEGRADATION

No new results to be shown for the cycle.

### 5.5.2 DIFFUSER AGEING

No new results to be shown for the cycle.

### 5.5.3 SMILE EFFECT

No new results to be shown for the cycle.

## 6 DATA QUALITY CONTROL

### 6.1 Anomalies

Some MERIS FR L1 products have been identified with null radiance values for all the 15 bands. It has been noticed that when the problem occurs the 1<sup>st</sup> Tie Point of the product is corrupted since it contains latitude and longitude values out of the product geolocalization.

The anomaly has been investigated and fixed: a bad variable type definition in the processor, IPF 4.06, causes the 1<sup>st</sup> record of the 1<sup>st</sup> Tie Point to have wrong latitude/longitude values depending on the center of the requested FR scene. This is the reason why the problem is affecting not all the FR L1 products. A patch for the processor is now under test.

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### 6.2 Software Problem Reporting (SPR)

Open anomaly/observation reports:

1. MER\_FR\_L1 products: all radiometric data set to zero.  
Received 5 CDs from E-PAC (production date 15/7/2003) and 1 CD from UK-PAC (production date 11/08/2003) containing some MER\_FR\_L1 products with all the records of the 15 radiometric bands set to zero. The structure and format of the products seem to be OK. For more details refer to par. 7.1.
2. MERIS Child products: problem in number of frames.  
Some MERIS Child products have an incomplete granule at the end (last tie frame corresponds to frame Nf-16 if Nf is the total number of frames). The missing last tie point leads an interpolation problem.
3. MERIS Child Level 1 products: GADS scaling factor variable.  
The number of records for the GADS "scaling factor" of some MERIS Child products is variable, 1 or 2! . We assume that the number of records is always 1, as it should be according to specifications we have. Note that the DSR size and offsets seem to be correct with respect to the number of records.
4. MERIS FR Level 0 product: no temporal continuity between valid sequences.



The FR L0 product contains 4 valid sequences (0,2,4,6) that are alternated with 4 invalid sequences (1,3,5,7). The comparison of the Start and Stop OBT of two consecutive valid sequences shows that they are partially overlapped. This means that there are events of TEMPORAL INVERSION in the complete valid dataset of the FR Level 0 product!

5. MERIS Child Product: various problems

- SPH:

Out of range values of latitude and longitude: from FIRST\_FIRST\_LAT to LAST\_LAST\_LONG

Wrong DS\_SIZE in each DSD and consequently wrong DS\_OFFSET

Tie Points ADS not attached

- MDS:

Wrong dsr\_time in all the records of each MDS: not corresponding to the acquisition time in MPH

- Summary Quality ADS

Wrong dsr\_time and strange values in ADS record # 10

- GADS Scaling factor

2 records instead of 1 record, as from the products specifications

Scaling factors values different from the expected ones in each record

### 6.3 Status of the Level 2 processing parameters

The quality status for the Level 2 processing parameters will be soon presented in a table, now under revision.

## 7 VALIDATION ACTIVITIES AND RESULTS

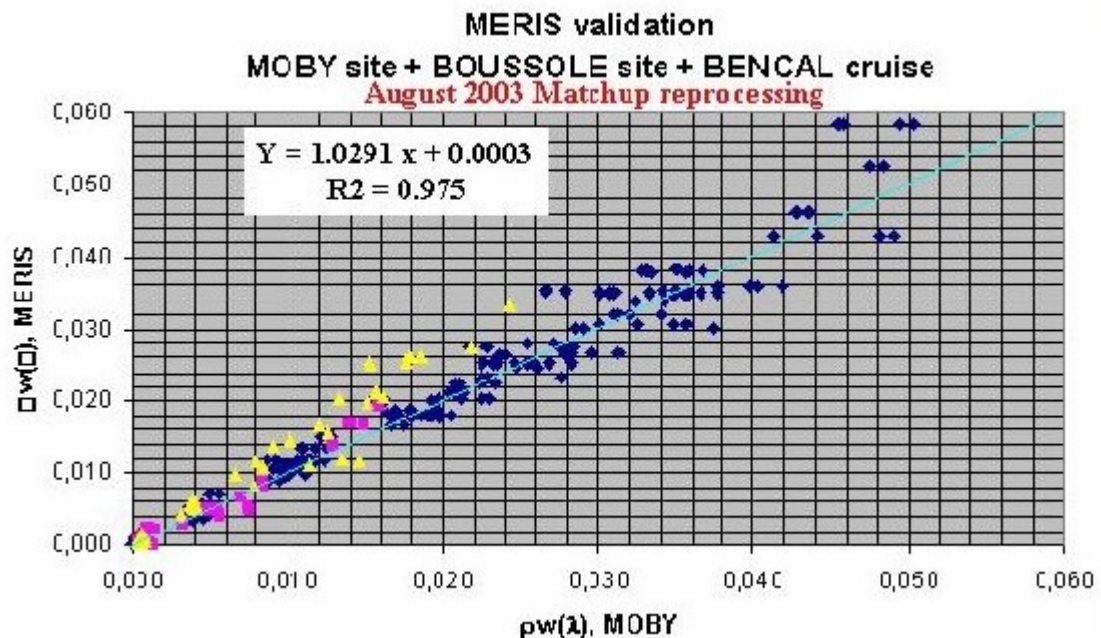
During the last MERIS Validation Workshop, held at ESA-ESRIN in October 2003, the scientific community involved in the MERIS products validation has presented new results. The discussed issues and further conclusions are briefly reported below.

### 7.1 Results for marine products

The most important observations/conclusions of the community for marine products can be summarized as follows:

- The marine reflectance is good in Case 1 water at MOBY site (+/- 15% at AAOT site) when the quality flags are not raised. See plot below for validation results presented by D. Antoine, A. Morel et al. over MOBY, BOUSSOLE and BENCAL sites.

- The Algal Pigment 1 is good when reflectance is good. More investigation is expected in order to establish the validity wrt TSM (Total Suspended Matter) and YS (Yellow Substance) concentrations and the Case2\_anomalous flag.
- YS is not yet good.
- Case 2 water validation should include the verification of the scope and confidence of the algorithm
- The status of PCD\_1\_13 flag improves when the threshold for BPAC (Bright Pixel Atmospheric Correction) is lowered.
- The Glint correction must be improved.
- The cloud detection above ocean must be improved.
- The coastal aerosols model needs to be further validated.
- The match-ups list must be revised in order to include new sites.



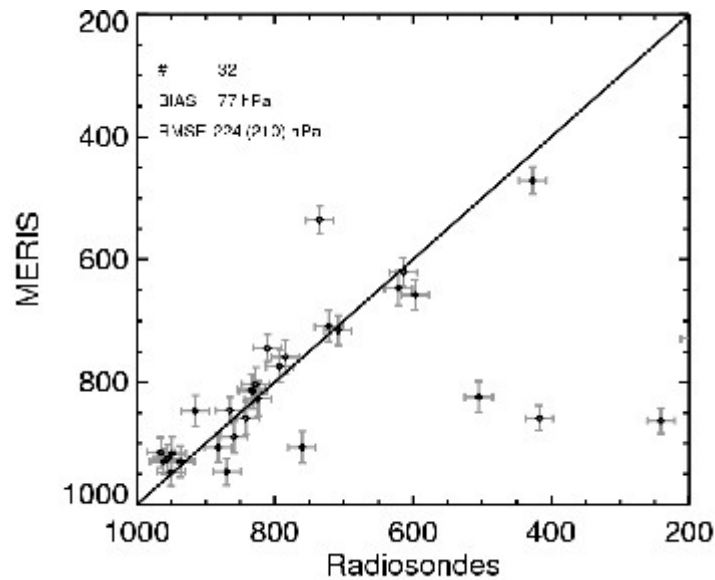
Marine reflectance in Case 1 water validation: Moby in blue, Boussole in yellow, Bencal in red

## 7.2 Results for atmospheric products

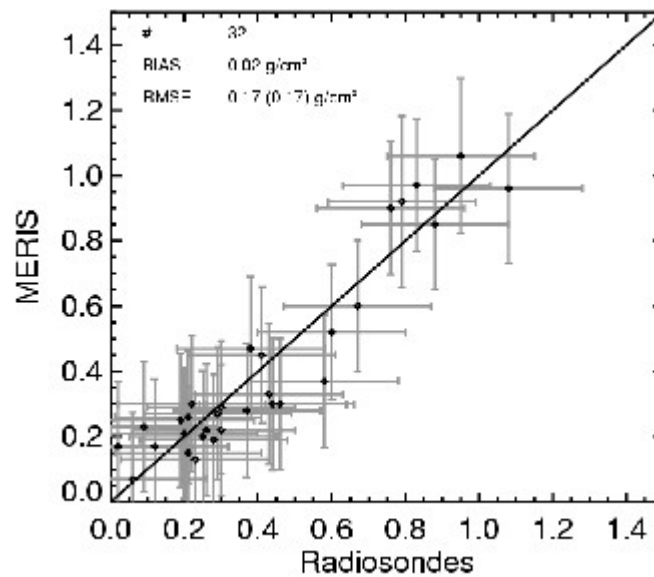
The most important observations/conclusions of the community for atmospheric products can be summarized as follows:

- CTP (Cloud Top Pressure) is slightly lower than in MODIS and radiosoundings, while there is a better agreement with radar measurements (see plot below). New aircraft campaigns are foreseen to improve the validation.
- Water Vapour over land and clouds (when compared with microwave radiometer and GPS measurements) is very encouraging (see plot below). Additional validation needed above ocean.

- Cloud Albedo and COT (Cloud Optical Thickness) needs additional validation effort.
- The use a MERIS Albedo map is recommended.
- Synergy of MERIS and AATSR for the cloud detection has to be investigated.



Cloud Top Pressure validation by FUB

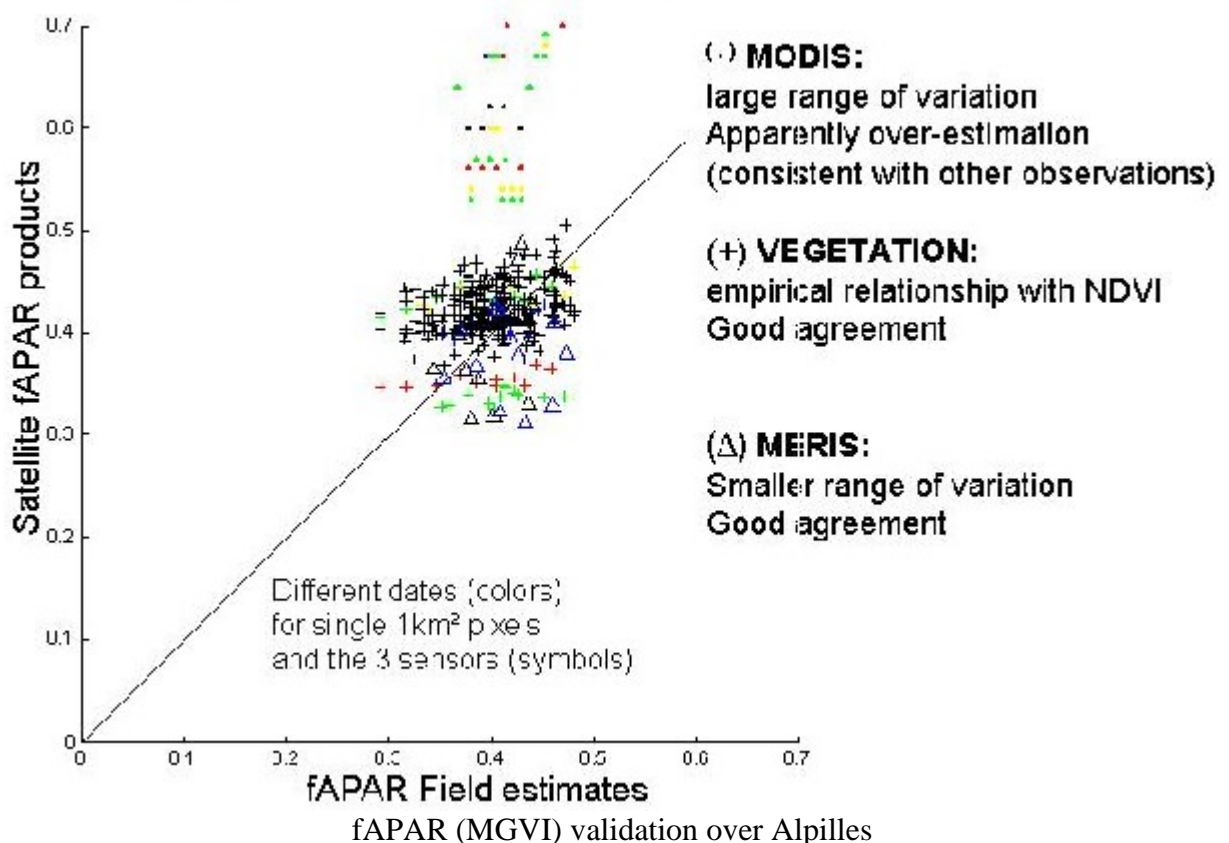


Water Vapour validation by FUB

### 7.3 Results for land products

The most important observations/conclusions of the community for land products can be summarized as follows:

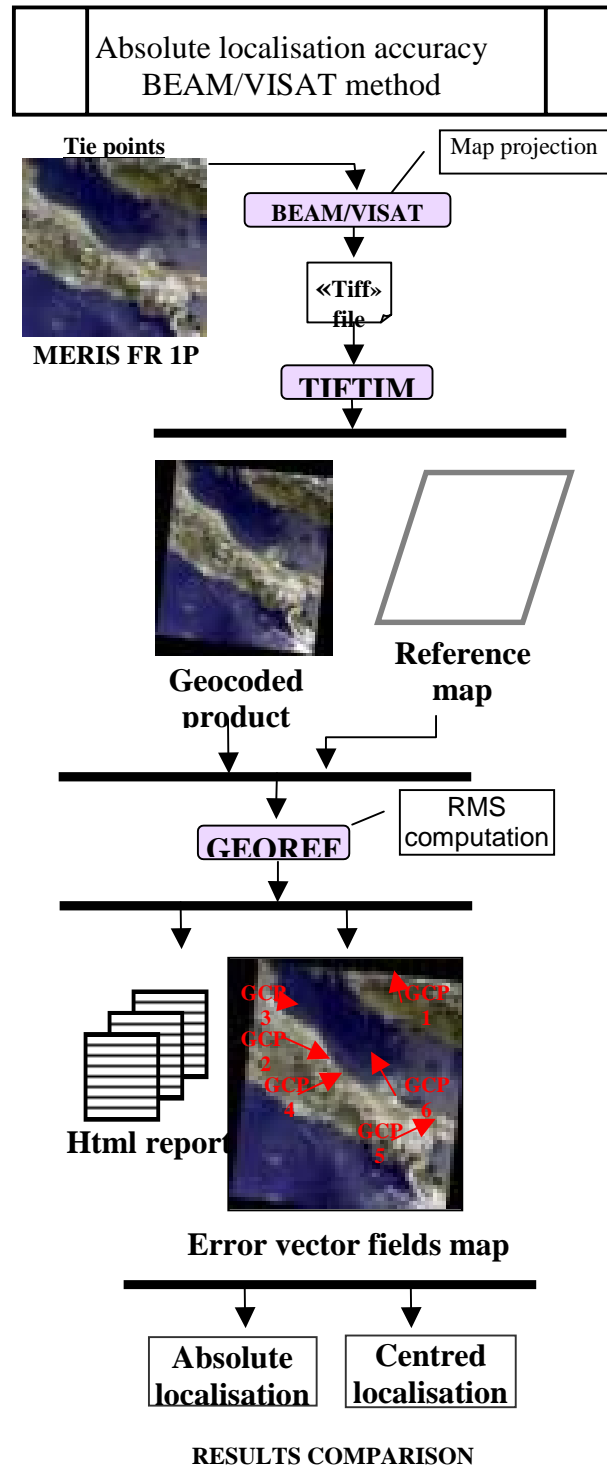
- The aerosol sensitivity range for reflectances should be extended.
- The cloud shadow detection should be implemented.
- A thin cloud flag over water based on pressure should be introduced.
- Introduction of a level 3 tool to see improvements in evolution of algorithms is strongly recommended.
- MGVI (MERIS Global Vegetation Index) applications have to be deeper investigated.
- Validation of a new Neural Network to retrieve other vegetation parameters is suggested.
- Extend the intercomparison with MODIS, POLDER, VEGETATION, SEAWIFS, SEVIRI. See plot below for validation results presented by F. Baret et al. over Alpilles site.
- Extend the number of sites with ground measurements in order to obtain a reasonable statistic.



### 7.4 The Geolocalization study of MERIS FR products

GAEL consultant analysed the absolute location accuracy of MERIS FR L1b products.

The localization study requires an accurate reference map fully validated in terms of geometry accuracy. For this reason the study over Europeans regions is performed using a Landsat panchromatic European mosaic as reference map (resolution of 12.5 m at nadir), while the study of southern hemisphere scenes is based on GMT (Greenwich Mean Time) layers (resolution from 200 to 300 m). The selected scenes have been chosen according to several criteria such as the cloud cover, ground level, and sea portion. The applied method is outlined in the following figure.



The absolute localization control is done using a tool, GEOREF, that provides an assessment of the scene localization quality, giving an estimate of the RMS value respect to a reference model. As result, the error vector layer, which is superimposed on the image, gives a global appreciation of the scene shift. The vector coordinates are the RMS error along the image X/Y axis.

The centered localization control is done subtracting from the image the error due to the global shift (mean RMS error value) in order to put in evidence the error due to internal geometry.

In the following tables are shown the results obtained with the two methods.

**Table 1 - Absolute localization results**

Scene	MERIS file name	<i>Algebraic mean <math>\delta X</math> (m)</i>	<i>Algebraic mean <math>\delta Y</math> (m)</i>	<i><b>Quadratic mean (RMS) (m)</b></i>
France 1	MER_FR__1PNEPA20030708_102046_000000982018_00008_07076_0220.N1	-379.731	65.250	<b>487.748</b>
France 2	MER_FR__1PNUPA20030423_100908_000000982015_00423_05988_0461.N1	-345.074	99.903	<b>471.831</b>
France 3	MER_FR__1PNUPA20030714_103037_000000982018_00094_07162_0284.N1	-320.857	33.790	<b>455.057</b>
Italy 1	MER_FR__1PNEPA20030604_094836_000000982017_00022_06589_0138.N1	-352.735	60.419	<b>459.038</b>
Italy 2	MER_FR__1PNIPA20020819_093228_000000982008_00394_02452_0022.N1	-159.516	-55.596	<b>265.826</b>
Italy 3	MER_FR__1PNUPA20030513_094117_000000982016_00208_06274_0417.N1	-268.061	223.909	<b>448.702</b>
Southern Hemisphere 1	MER_FR__1PNEPA20030106_131520_000000982012_00396_04458_0011.N1	-501.058	101.515	<b>978.359</b>
Southern Hemisphere 2	MER_FR__1PNUPA20030331_073019_000000982015_00092_05657_0266.N1	-188.279	-61.129	<b>607.165</b>

**Table 2 - Centered localization results**

Scene	MERIS file name	<i>Algebraic mean <math>\delta X</math> (m)</i>	<i>Algebraic mean <math>\delta Y</math> (m)</i>	<i><b>Quadratic mean (RMS) (m)</b></i>
France 1	MER_FR__1PNEPA20030708_102046_000000982018_00008_07076_0220.N1	0.922	6.641	<b>297.493</b>
France 2	MER_FR__1PNUPA20030423_100908_000000982015_00423_05988_0461.N1	45.991	-13.317	<b>308.635</b>
France 3	MER_FR__1PNUPA20030714_103037_000000982018_00094_07162_0284.N1	0.147	3.994	<b>319.645</b>
Italy 1	MER_FR__1PNEPA20030604_094836_000000982017_00022_06589_0138.N1	-10.017	-35.724	<b>287.154</b>
Italy 2	MER_FR__1PNIPA20020819_093228_000000982008_00394_02452_0022.N1	3.017	-22.529	<b>203.510</b>
Italy 3	MER_FR__1PNUPA20030513_094117_000000982016_00208_06274_0417.N1	-23.524	22.707	<b>282.986</b>

	000000982016_00208_06274_0417.N1			
Southern Hemisphere 1	MER_FR__1PNEPA20030106_131520_000000982012_00396_04458_0011.N1	-188.279	-61.129	<b>607.165</b>
Southern Hemisphere 2	MER_FR__1PNUPA20030331_073019_000000982015_00092_05657_0266.N1	0.002	0.184	<b>574.103</b>

The RMS values retrieved for the Southern Hemisphere have to be refined because of the low resolution of the used reference map, however the centered location method gives interesting results in the assessment of internal geometry results. An important step would be to assess errors due to the followed method; another important issue would be to distinguish between the positioning error due to the MERIS sensor to the one due to the ENVISAT platform using another instrument (e.g. AATSR).

## 7.5 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 will be soon 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 will be soon available on the ESA website:

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

## 8 GENERAL INFORMATION

The “ENVISAT & ERS Symposium” to be held in Salzburg (Austria) from 6 to 10 September 2004.