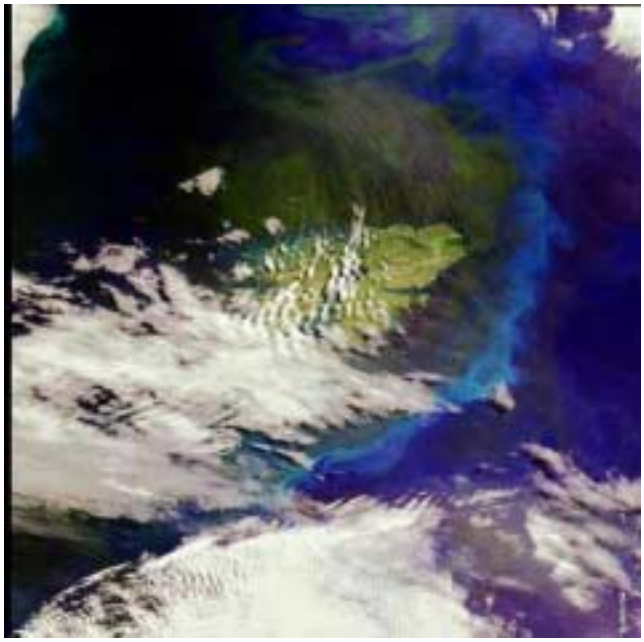
document title/ titre du document

# MERIS CYCLIC REPORT 34TH

# 17TH JANUARY – 21ST FEBRUARY 2005



17 February 2005 – MERIS acquired phytoplankton blooms in the Falklands Islands

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## A P P R O V A L

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

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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

| | |
|---|---|
| ADF | Auxiliary Data File |
| ADS | Auxiliary Data Server |
| ARF | Archiving Facility (PDS) |
| CNES | Centre National d'Études Spatiales |
| CTI | Configuration Table Interface |
| CR | Cyclic Report |
| DAC | Diffuser Ageing Calibration |
| DMOP | Detailed Mission Operation Plan |
| DS | Data Server |
| DSD | Data Set Descriptor |
| FR | Full Resolution |
| 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 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 |
| OCL | Offset Control Loop |
| 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 |
| RGC | Radiometric Gain Calibration |
| RR | Reduced Resolution |
| SPH | Specific Product Header |
| SQADS | Summary Quality ADS |
| WV1 | Wavelength type 1 calibration |
| WV2 | Wavelength type 2 calibration |

# 2 SUMMARY

Cycle #34 starts on the 17th of January 2005 and stops on the 21st of February 2005.

- One auxiliary file was disseminated during the cycle:
  MER_RAC_AXVIEC20050201_112430_20041213_220000_20121213_220000
- One routine radiometric gain calibration (RGC) has been successfully executed.

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

| **Cycle number** | **34** |
|---|---|
| Start time | 17 January 2005, 21:59:29 |
| Stop time | 21 February 2005, 21:59:29 |
| Start orbit | 15085 |
| Stop orbit | 15585 |

# 3 PROCESSOR VERSION AND PROCESSING CONFIGURATION

## 3.1 MERIS Processor Release

IPF version 4.10 has replaced IPF 4.07 at processing centers on mid January 2005. The new processor release basically corrects some minor bugs and improves the Level 2 processing time. IPF 4.10 allows the FR Full Swath processing, however, the operation of the Full Swath is not yet decided (no ordering is yet possible).
The relevant changes are listed in the following:

- Full Swath (4481 pixels per line) extension for FR Level_1, Level_2 and Browse products
- Improvement of product limit calculation for FR scenes
- Level 2 performance improvements by optimizing the Turbid Water Correction algorithm

All the documents related to the operational processor, IPF version 4.10, are reported in the following:

1. ENVISAT Product Specification Iss_4_Rev_A 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 (ADF)

| Product description | Product name | Comment |
|---|---|---|
| **Level 1 aux files** | | |
| 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 |
| **Level 2 aux files** | | |
| 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 Vapor Parameters | MER_WVP | No changes |

Note: The other files not included into the list change every time (ECMWF).

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

The current operational ADF files, used in the processing from Level 0 data to Level 1b or Level 2 products, are listed in the following tables. Note that a new auxiliary file was disseminated during Cycle #34.

- Level 1 ADF 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_RAC_AXVIEC20050201_112430_20041213_220000_20121213_220000 | 13/12/2004 |
| 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 ADF 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 |

## 3.4 Configuration Table Interface (CTI)

No new CTI disseminated during cycle # 34.

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

During cycle #34 no format changes or algorithm modifications regarding MERIS RR and FR products were implemented into the operational processor.
A new product type has been introduced by IPF 4.10: the Full Swath product (4481 pixels per line). The Full Swath format includes new FR Level 1b, Level 2 and Browse products; however the ordering is not yet possible since the Full Swath operations are not yet defined.

## 4 PDS STATUS

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 Level 0 products availability

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

| Week | MER_RR__0P | % |
|---|---|---|
| From 17/01 to 24/01 | Inventoried | 100 |
| | Missing | 0 |
| From 24/01 to 31/01 | Inventoried | 78.28 |
| | Missing | 21.72 |
| From 31/01 to 07/02 | Inventoried | 74.63 |
| | Missing | 25.73 |
| From 07/02 to 14/02 | Inventoried | 94.10 |
| | Missing | 5.9 |
| From 14/02 to 21/02 | Inventoried | 100 |
| | Missing | 0 |

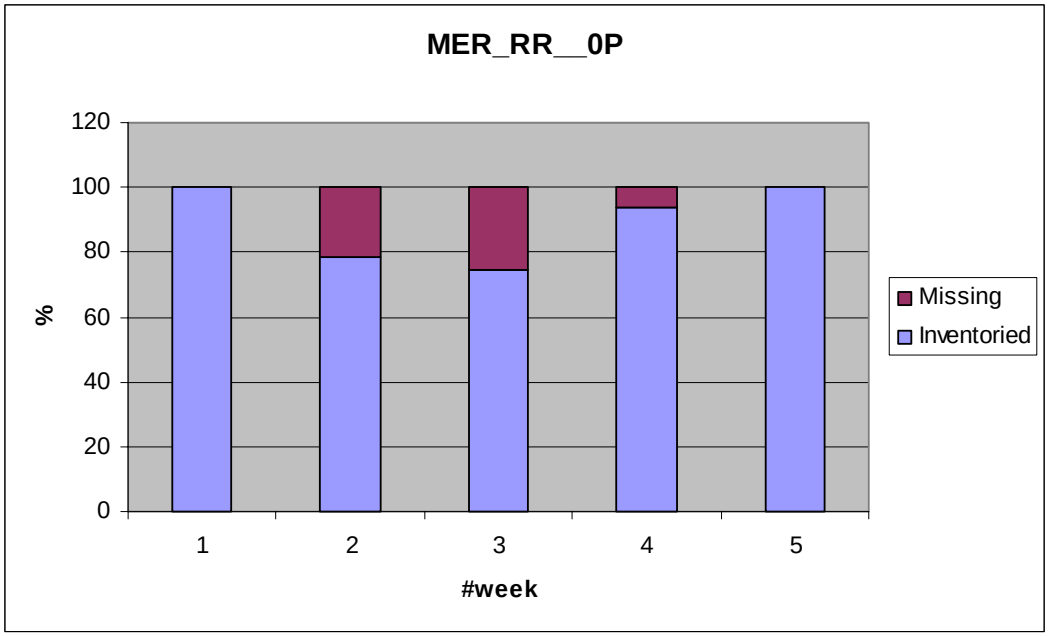



Figure 1 - MER_RR__0P generated/missing by the ground segment during cycle #34

The number of RR Level 0 products acquired during the cycle is about 89.40 % of the planned ones. The table below shows the statistics regarding the FR L0 availability (compared to the planned production).

| Week | MER_FR__0P | % |
|---|---|---|
| From 17/01 to 24/01 | Inventoried | 99.30 |
| | Missing | 0.7 |
| From 24/01 to 31/01 | Inventoried | 85.30 |
| | Missing | 14.7 |
| From 31/01 to 07/02 | Inventoried | 56.68 |
| | Missing | 43.32 |
| From 07/02 to 14/02 | Inventoried | 79.75 |
| | Missing | 20.25 |
| From 14/02 to 21/02 | Inventoried | 99.02 |
| | Missing | 0.98 |

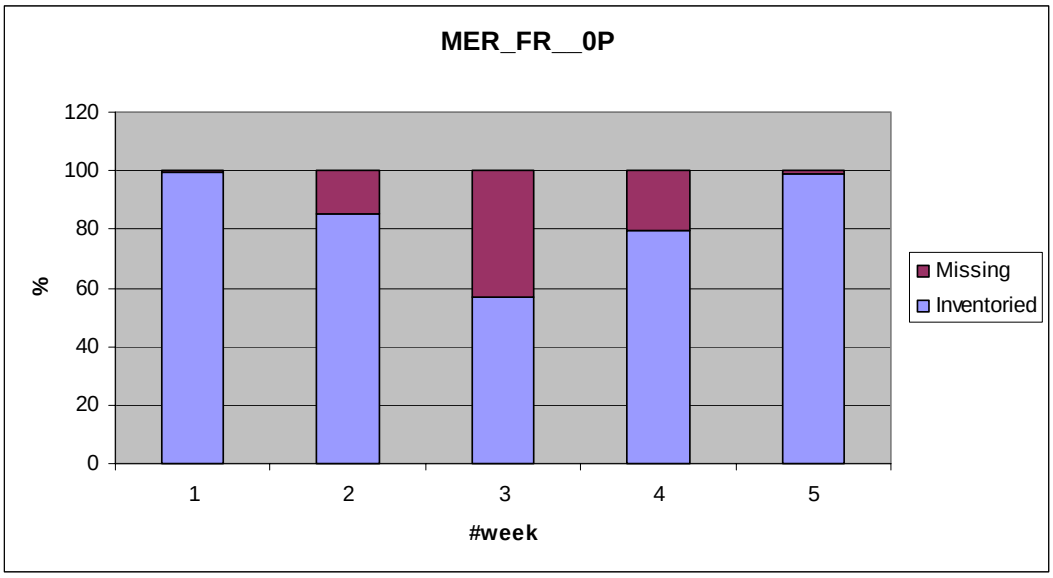
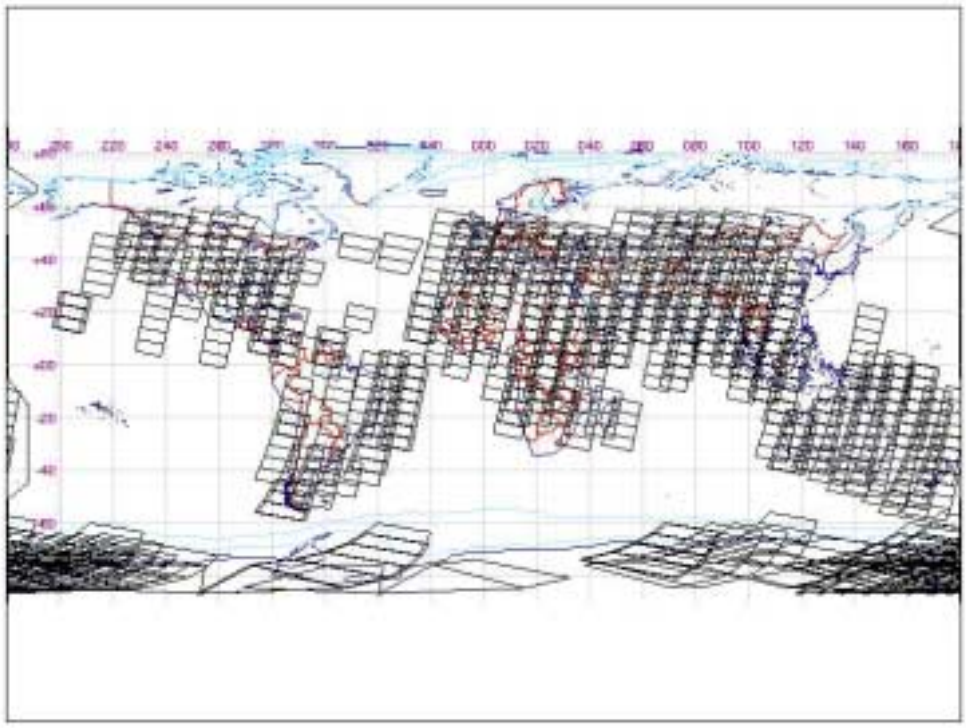



Figure 2 - MER_FR__0P generated/missing by the ground segment during cycle #34

The number of FR Level 0 products generated during the cycle is about 84.01 % of the planned ones. Note that the lack of data experienced during cycle #34 is mainly due to acquisition problems at ESRIN starting since the end of January until the mid of February.

## 4.2 MERIS FR acquisitions

The global coverage of the MERIS FR products acquired during cycle #34 is presented in the following. For each coverage map, the acquisition time per orbit wrt the orbit number is plotted. To optimize the visualization the FR acquisitions are plotted every five days.



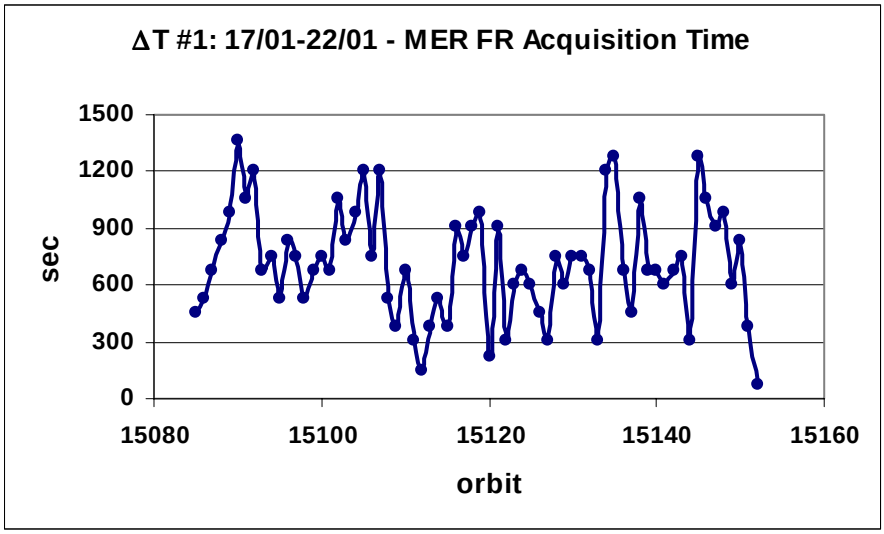
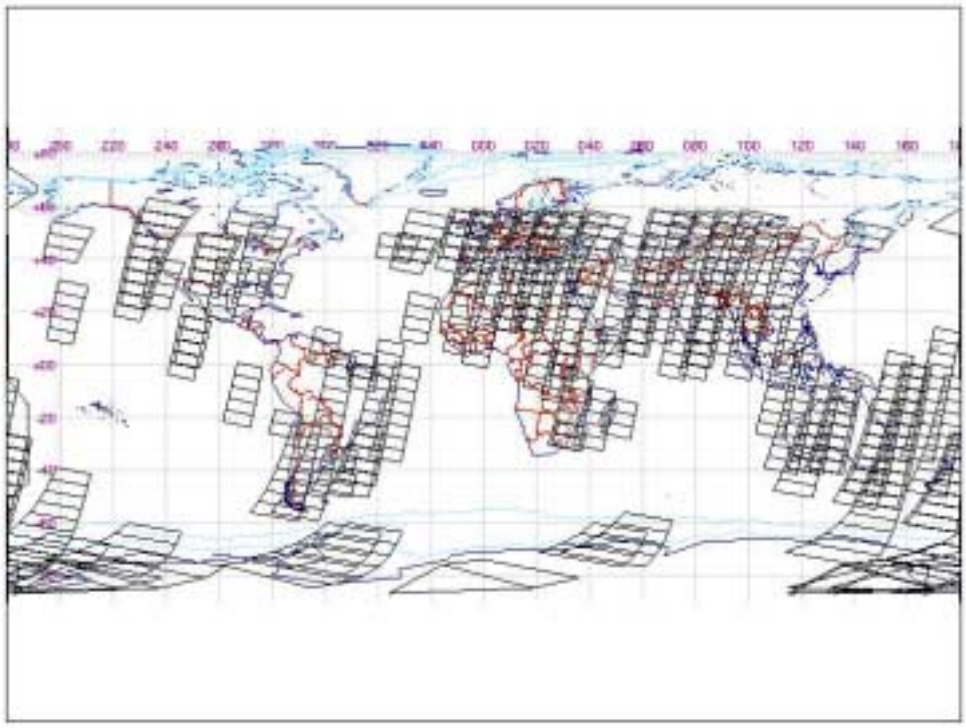



Figure 3 – Top: MERIS FR Global Coverage Map for period 17/01-22/01
Bottom: MERIS FR Acquisition time segments



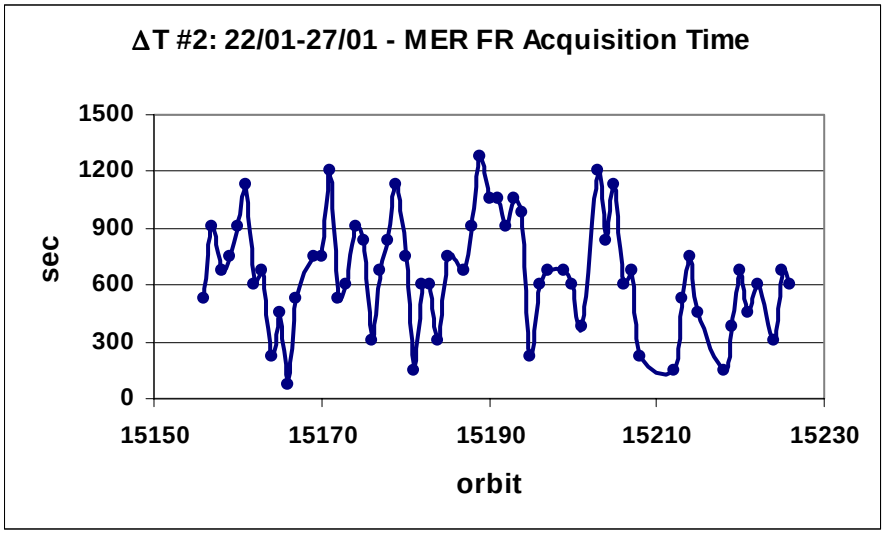
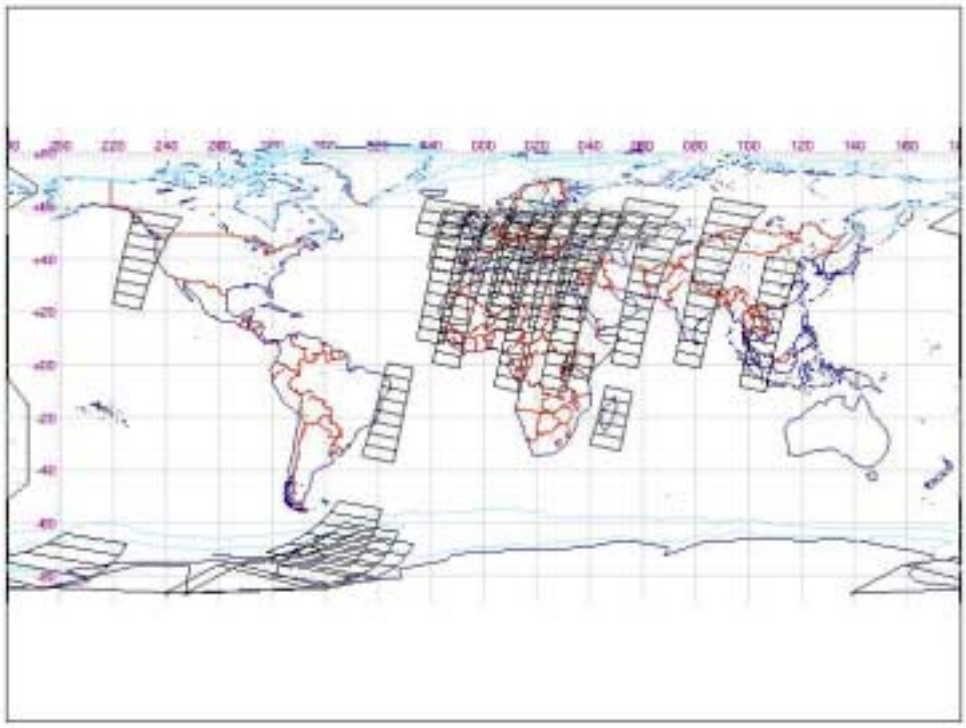



Figure 4 – Top: MERIS FR Global Coverage Map for period 22/01-27/01
Bottom: MERIS FR Acquisition time segments



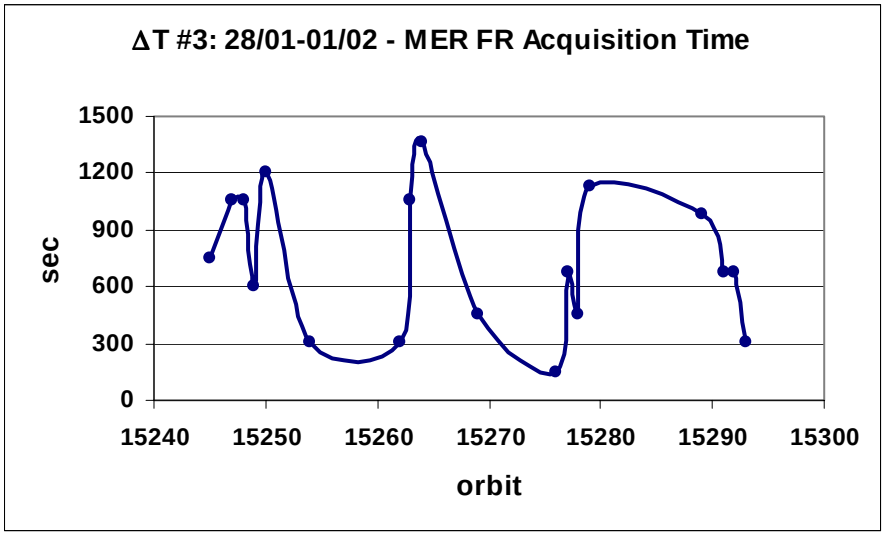
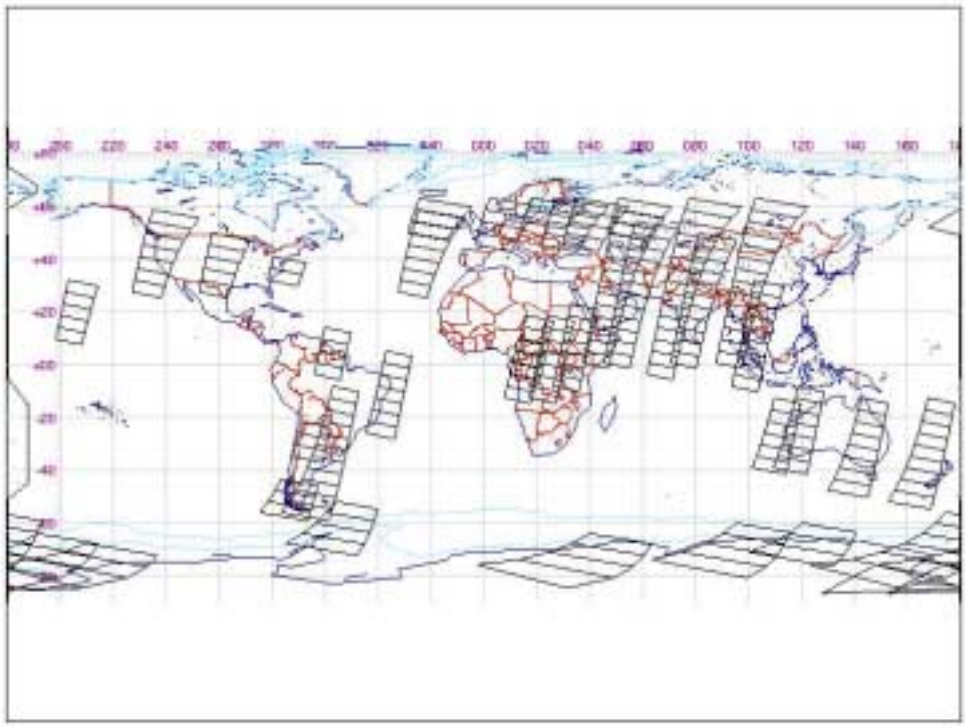



Figure 5 – Top: MERIS FR Global Coverage Map for period 28/01-01/02
Bottom: MERIS FR Acquisition time segments



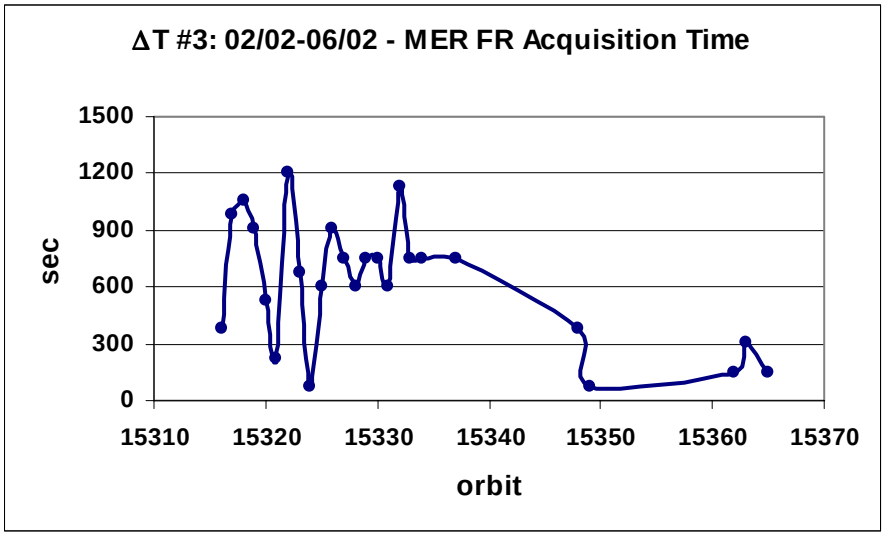
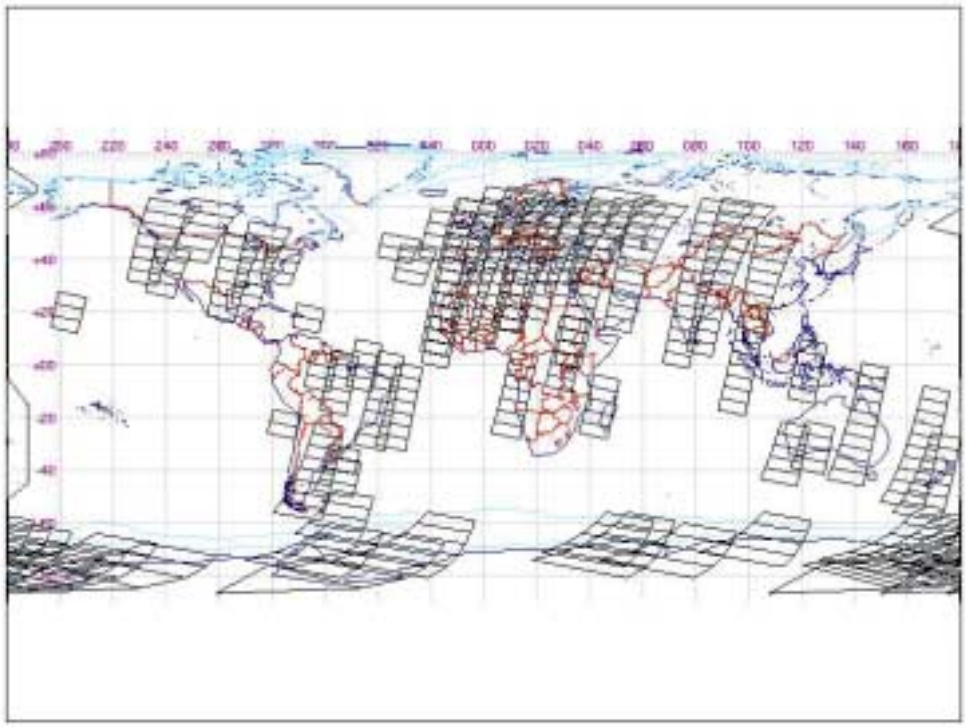



Figure 6 – Top: MERIS FR Global Coverage Map for period 02/02-06/02
Bottom: MERIS FR Acquisition time segments



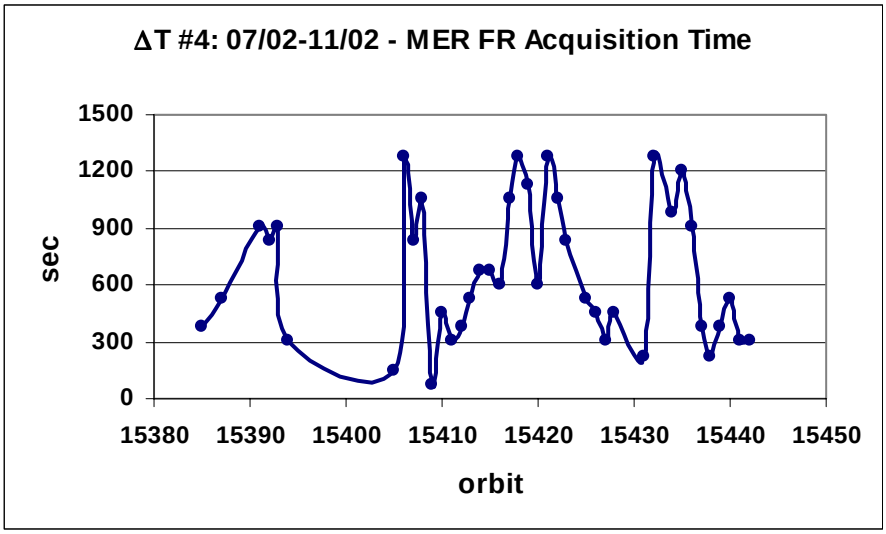
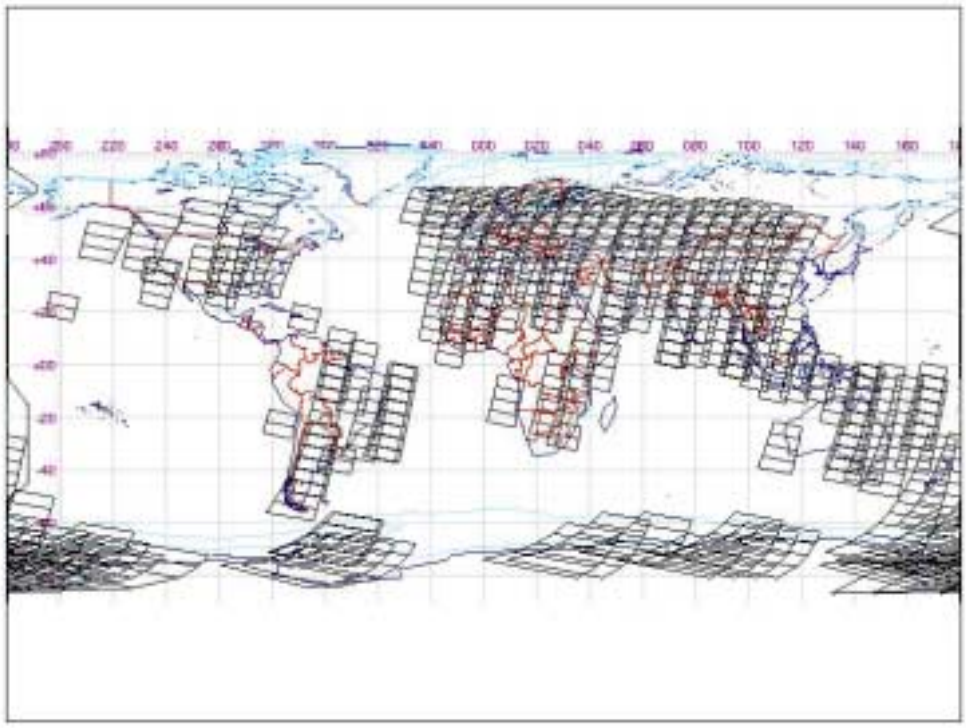



Figure 7 – Top: MERIS FR Global Coverage Map for period 07/02-11/02
Bottom: MERIS FR Acquisition time segments



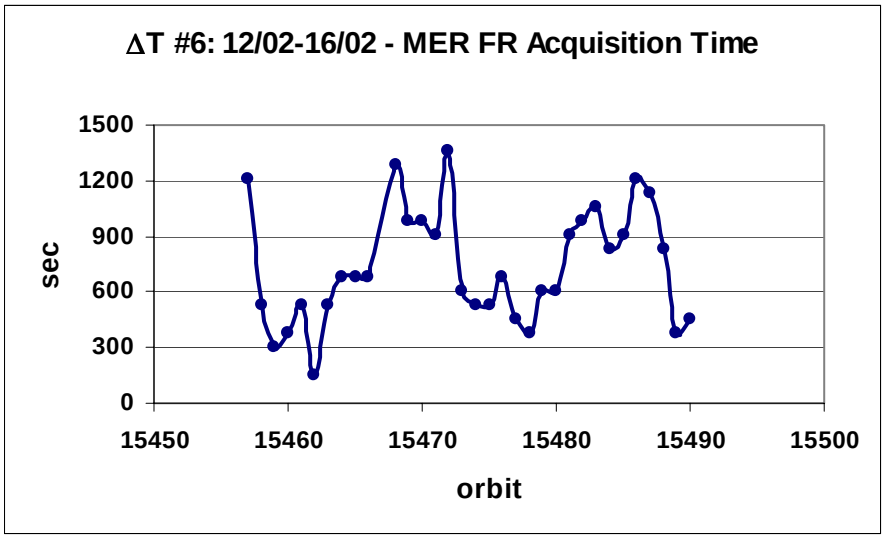
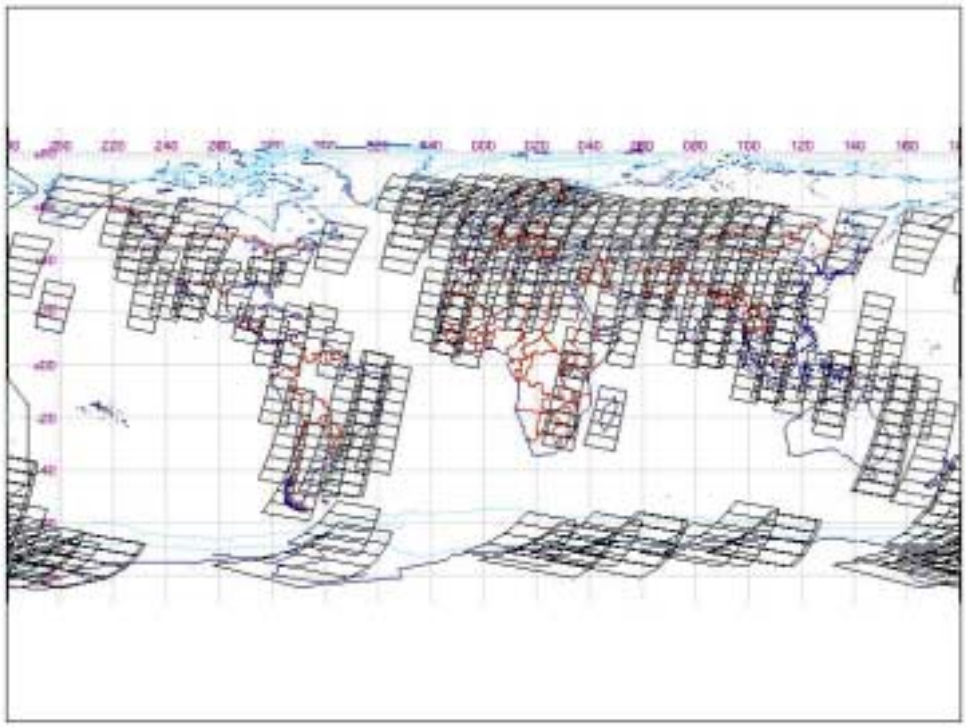



Figure 8 – Top: MERIS FR Global Coverage Map for period 12/02-16/02
Bottom: MERIS FR Acquisition time segments



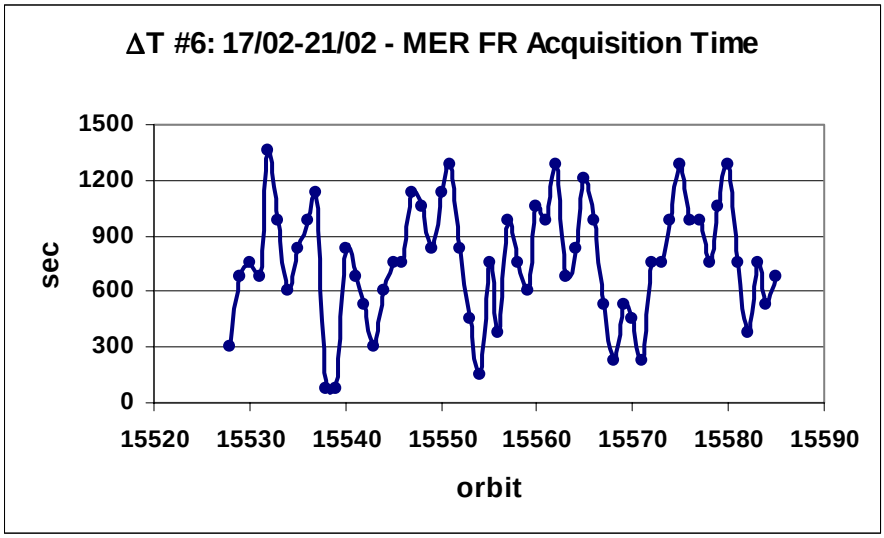



Figure 9 – Top: MERIS FR Global Coverage Map for period 17/02-21/02
Bottom: MERIS FR Acquisition time segments

During cycle # 34 the mean time per orbit dedicated to FR acquisitions is 7.4 min.

### 4.3 MER_CA__0P Products

During cycle #34 two routine RGC radiometric gain calibrations have been planned. All the calibrations were successfully executed on the 30th of January 2005 and 13th of February, in orbits respectively 15260 and 15460.
The list of calibration is reported below:

MER_CA__0PNPDE20050213_040015_000001792034_00376_15460_0031.N1 RGC

The calibration executed on 30th of January was executed but not acquired at the ESRIN station due to acquisition chain unavailability. For more details see par. 5.2.

# 5 INSTRUMENT/DATA UNAVAILABILITY

## 5.1 Instrument Unavailability

No instrument unavailability was communicated by ESOC during cycle #34.

## 5.2 Data Unavailability

Since the 26th of January until the 7th of February 2005, it has been experienced a long period of unavailability or faultiness for almost all the MERIS products that should have been acquired at ESRIN. The product lost/corruption has been caused by serious problems in the ESRIN acquisition chain, fixed only on the 9th of February.

# 6 CALIBRATION AND INSTRUMENT CHARACTERIZATION

## 6.1 Calibration

### 6.1.1 Radiometric calibration

During cycle #34 two routine RGC calibrations were successfully executed on the 30th of January and 13th of February 2005. For more details see par. 4.2.

### 6.1.2 Spectral calibration

No spectral calibration was performed during cycle #34.

### 6.1.3 Geolocalization

The accuracy specification for MERIS geolocation is 2000 m, with an operational goal of 150 m.
The 290 m (nadir) bands 2, 5, 8 are used to estimate the absolute geolocation accuracy.
This analysis shows significant improvements since launch, with one major upgrade, which occurred in 2003 DOY (Day of Year) 343. The update of the star tracker has been performed to reduce the systematic offset and improve orientation parameters. Global absolute geolocation error (North and South hemispheres) for the three consecutives periods can be summarized as follow:

(I) Initially, after the launch, according to results related to the 2002 period, the geolocation accuracy is on the order of ±135 m along-track and ±207 meters across-track. The RMS absolute geolocation error stays within the range of **251.24 ± 81** m.

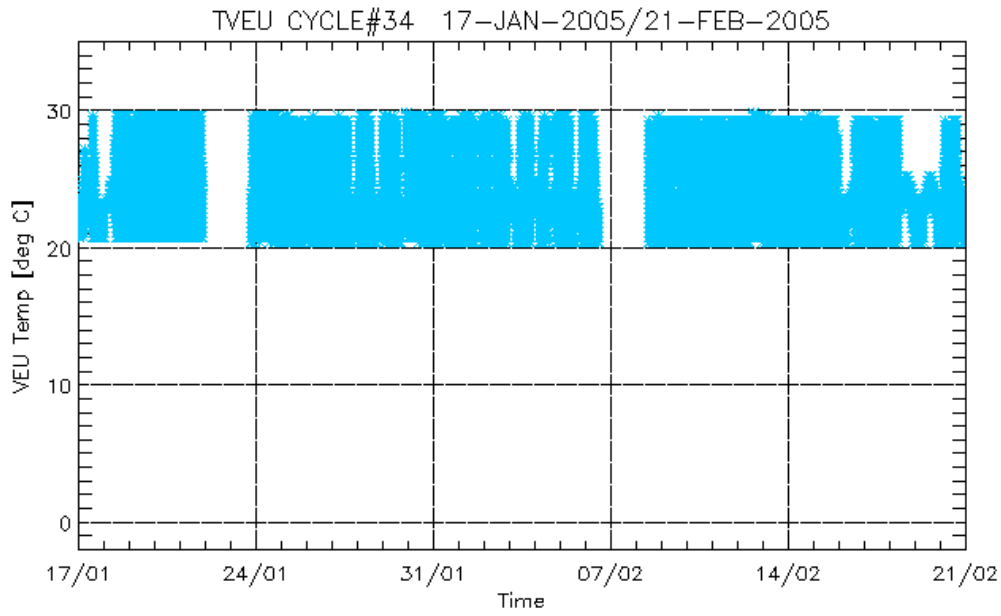
(II) The 2003 period is characterized by a degradation of the absolute geolocation accuracy where error is around ±209 meters along-track and ±295 meters across-track. For this period, the RMS absolute geolocation error stays within the range of 368.39 ± 67 m.

(III) After the update, 2004 period, MERIS geolocation is achieving the goal of 300 m with accuracy of ± 132 m along-track and ± 165 m across-track. The RMS absolute geolocation error remains within the range of **212 ± 22** m.

When correcting products from the systematic offset (centred results), for 2004 period the RMS absolute geolocation error stays within the range of **166 ± 18** m. Products collection located on northern hemisphere is much larger than the one from the Southern hemisphere. Comparison between the two sets of results is not trivial. For the 2004 period, this study demonstrated the temporal stability of the absolute geolocation. More results are now needed to confirm this trend.
For more details, refer to the Gael Consultant (Fr) report available on the ESA website:
http://earth.esa.int/pcs/envisat/meris/documentation/

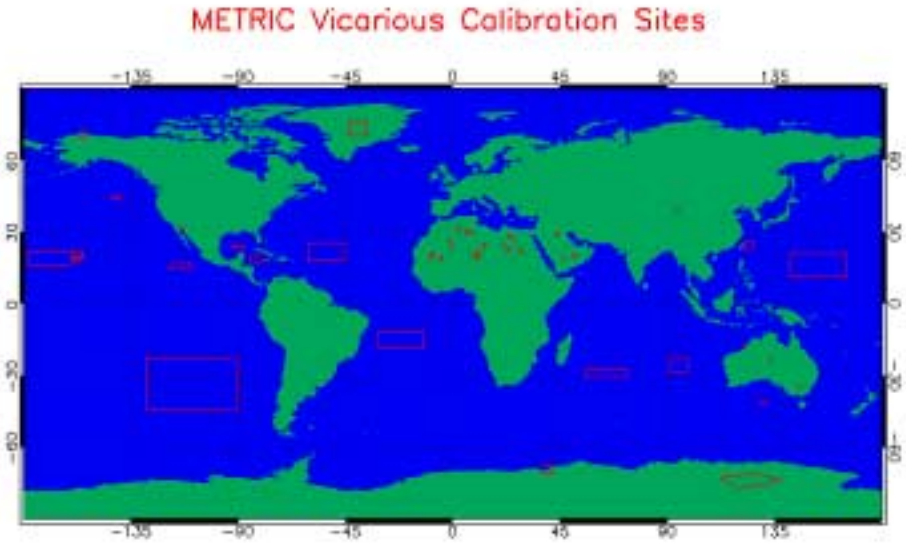
### 6.1.4 VEU Temperature Analysis

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°/+50° in order to meet the image quality requirements. The VEU temperature should be maximum +/- 10°C different from the last radiometric calibration for optimum performance.
During cycle #34 the VEU temperature does not show any anomalous behavior, being into the nominal operating temperature range apart from lack of data from FOCC occurred during the cycle.




### 6.1.5 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.
During 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 | 325 |
| GLITTER | 1 |
| RAYLEIGH | 42 |
| SNOW | 15 |
| BUOY | 15 |

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/

## 6.2 Instrument Characterization

### 6.2.1 Instrument degradation

No new results to be shown for cycle #34. For the last updates, refer to Cyclic Report #26 that can be found on the MERIS website:

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

### 6.2.2 Diffuser ageing

No new results to be shown for cycle #34. For the last updates, refer to Cyclic Report #26 that can be found on the above-mentioned MERIS website.

### 6.2.3 Smile Effect

No new results to be shown for cycle #34. For the last updates, refer to Cyclic Report #23 that can be found on the above-mentioned MERIS website.

### 6.2.4 Spectral evolution from erbium measurements

No new results to be shown for cycle #34. Please refer to Cyclic Report #23 that can be found on the above-mentioned MERIS website.

# 7 DATA QUALITY CONTROL

## 7.1 MERIS products quality status

The replacement of IPF 4.07 with IPF 4.10 did not have any impact on the MERIS products quality but on the Level 2 processing time; moreover some minor bugs related to the FR production and specifically to the water vapor product have been fixed (for details see Par. #6.2 of Cyclic Report #32).

## 7.2 Anomalies and Software Problem Reporting (SPR)

1. Blank records have been identified in some MERIS FR products rejected by visual inspections using the AMALFI system. An Anomaly Report has been opened and the problem is still under investigation.
2. At ESRIN acquisition station, a broken demodulator caused a not operational Low Rate (LR) acquisition chain since 27$^{th}$ of January until 8$^{th}$ of February and then determined a lot of missing or corrupted RR data.

# 8 FIRST 2003 MERIS ARCHIVE REPROCESSING

Information concerning the 1$^{st}$ reprocessing of the 2003 MERIS data archive done Spring 2004 can be found on the MERIS webpage:

http://earth.esa.int/pcs/envisat/meris/documentation/First_2003_MERIS_Reprocessing.pdf

The document explains also how to get the reprocessed data.

# 9 MERIS PROCESSOR EVOLUTION

**A** detailed description of the MERIS IPF evolution since March 2002 until present, in terms of data format changes and algorithm modifications, can be found on the MERIS webpage:

http://earth.esa.int/pcs/envisat/meris/documentation/MERIS_IPF_evolution.pdf.

# 10 VALIDATION ACTIVITIES AND RESULTS

In the following paragraphs are presented the more recent results regarding the validation of MERIS atmospheric products shown by FUB during the QWG held on December 2004.

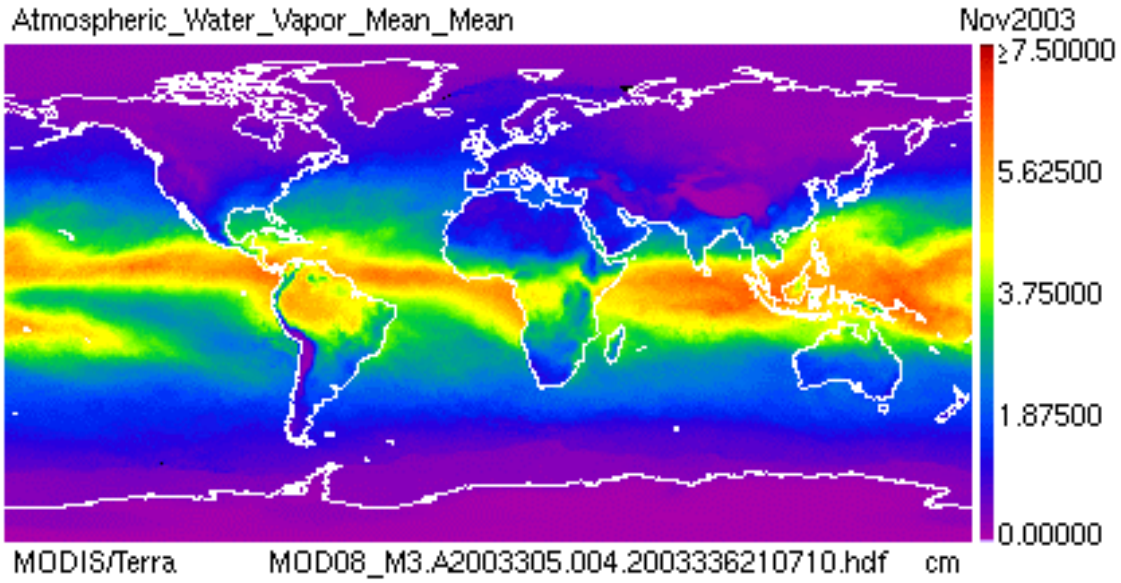
## 10.1 Validation of MERIS Water Vapour

The procedure applied for the validation of MERIS Water Vapour is the following:

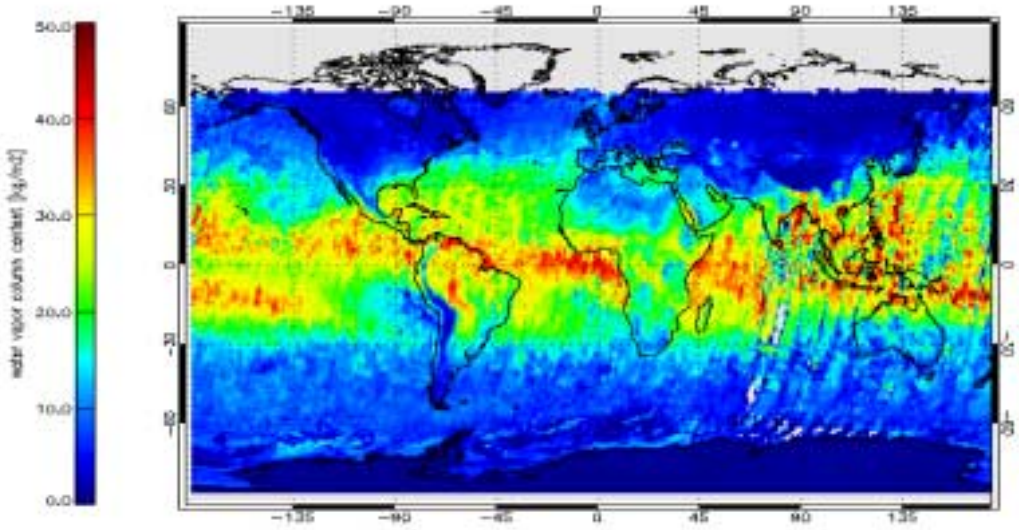
- Data extracted from the MERIS Meteo products received from ESRIN and KIRUNA
- Consider only cloud-free pixels detected using the cloud mask included in the MERIS products.
- Average of pixel values over a map of resolution 1° x 1°.

### 10.1.1 Validation of Water vapour above land

The comparison of MERIS data with MODIS (Terra) and MSG (SEVIRI) shows that above land the MERIS water vapour content is underestimated; see plots below.




Water Vapour map by MODIS averaged on Nov 2003

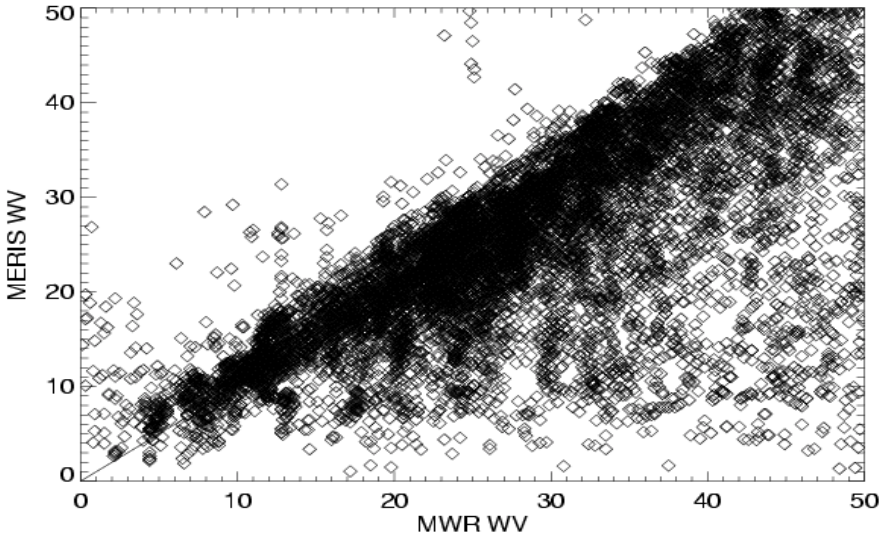



Water Vapour map by MERIS averaged on Nov. 2003

The analysis of camera dependencies for MERIS data shows that no systematic camera effect is visible.

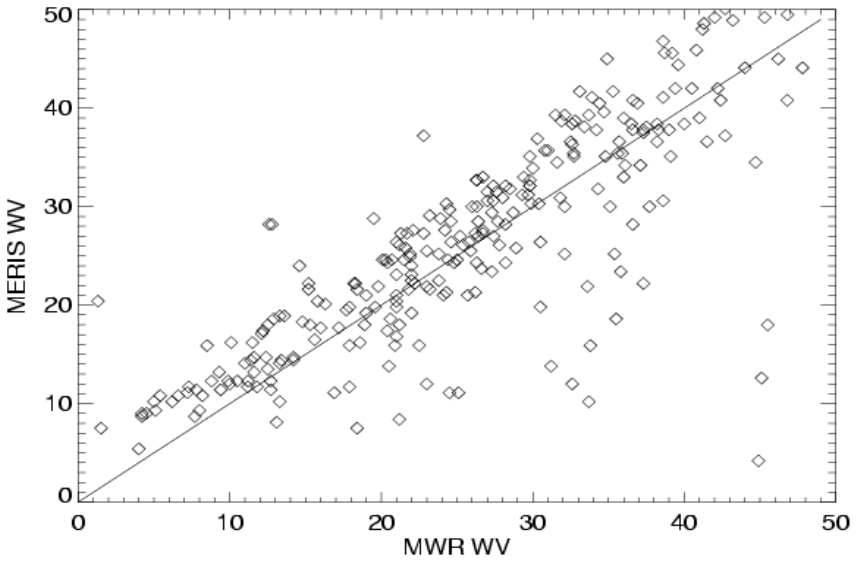
### 10.1.2 Validation of MERIS Water Vapour above ocean

The comparison of MERIS water vapour data and the complete archive of measurements collected with the Microwave Radiometer (MWR) is shown below:




Note that 19 MERIS pixels (resolution of 1 Km) are included in 1 MWR pixel (resolution of 20 Km).

Then, considering only those cases for which at least 16 MERIS pixels are cloud-free the plot above becomes:



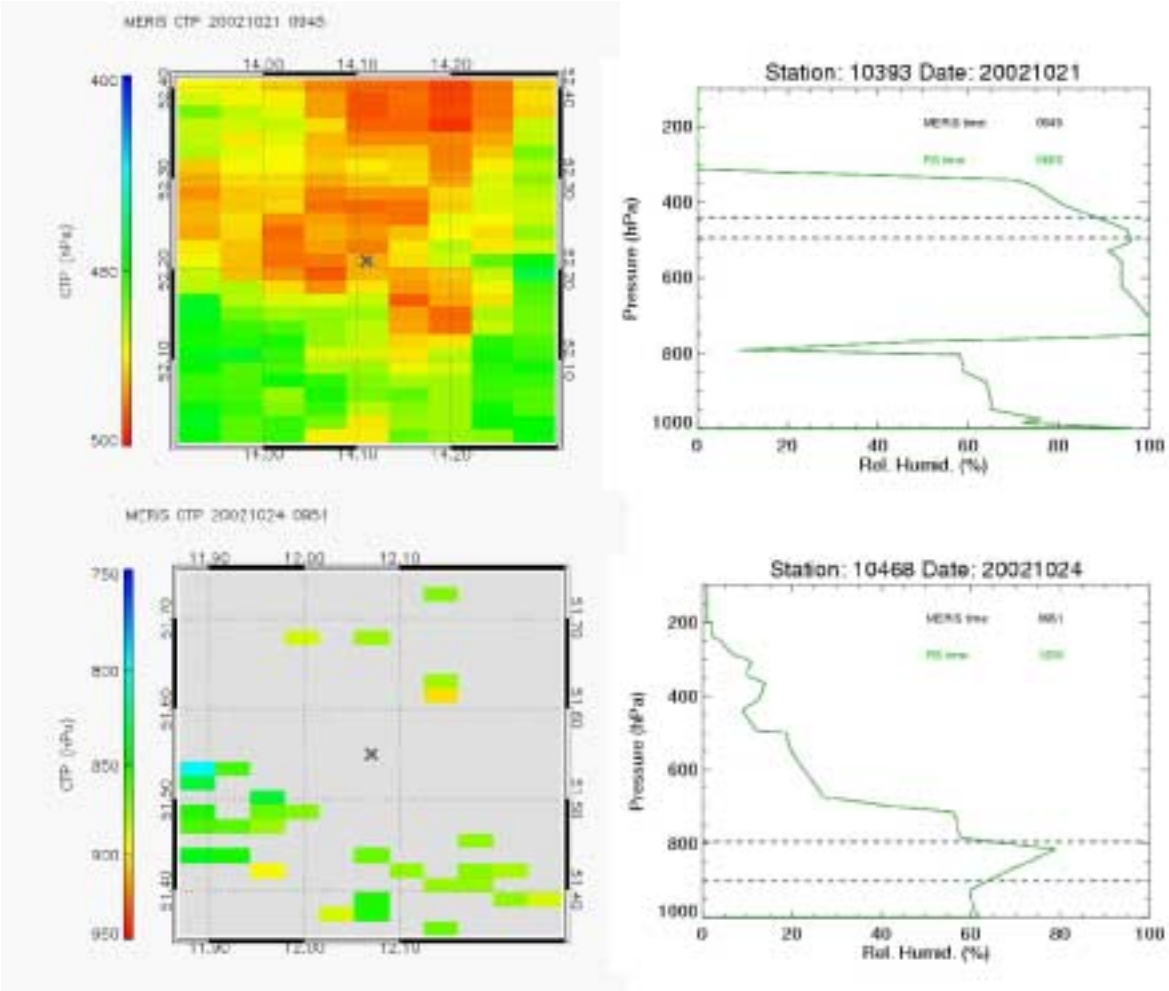

In the graph above: rms: 6.5 Kg/m^2; bias: 1.8 Kg/m^2

In conclusion, the comparison between the MERIS Water Vapour and the measurements of the microwave radiometer shows that above ocean there is a moderate agreement.

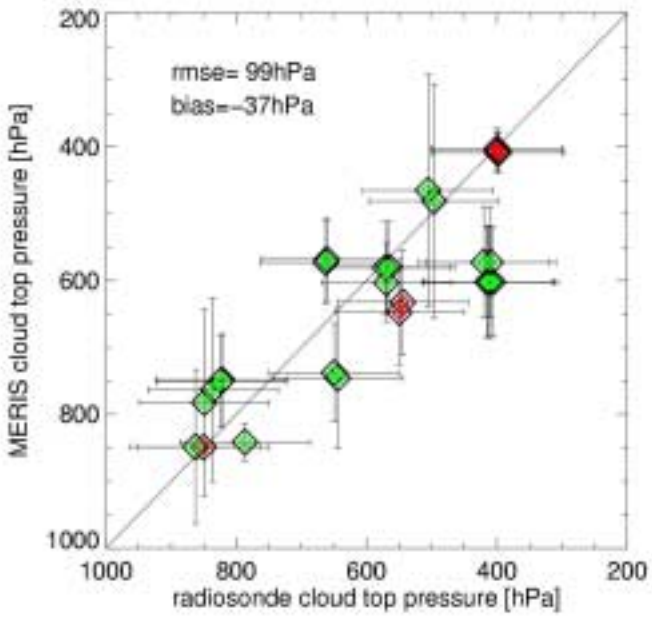
## 10.2 Validation of MERIS Cloud Top Pressure

### 10.2.1 Validation with Radiosondes

The comparison between the measurements from Radiosondes and the MERIS Cloud Top Pressure (CTP) data at Radiosondes overpass time is shown in the plot below: are visible the MERIS cloud top pressure and the profile of relative humidity for a high level cloud (upper; 21.10. 2002 above Lindenberg, Germany) and for a low level cloud (lower; 24.10. 2002 above Oppin, Germany).




For the scatter diagram of all the retrieved cloud heights, see plot below. The median cloud top in the 0.5° square around the radiosondes launch point is taken as the MERIS cloud top height, the error-bar is the standard deviation within this area.

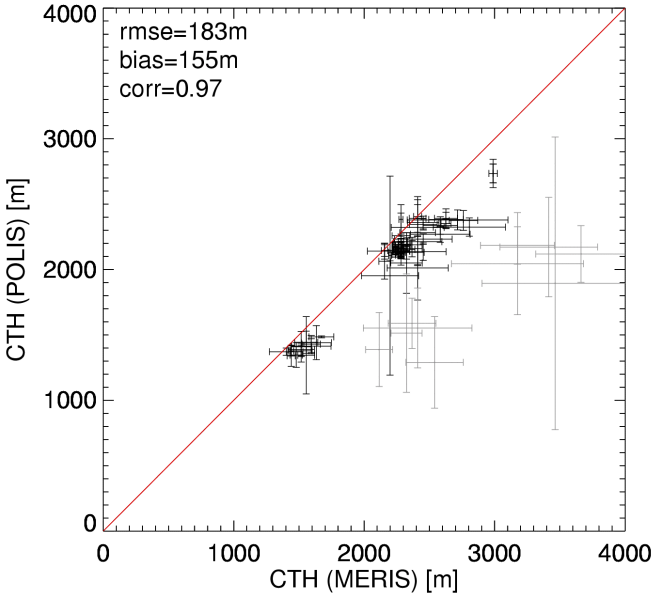



### 10.2.2 Validation with aircraft campaign

An aircraft campaign for CTP validation has been done, with POLIS (Portable Lidar System) on board having the following properties:

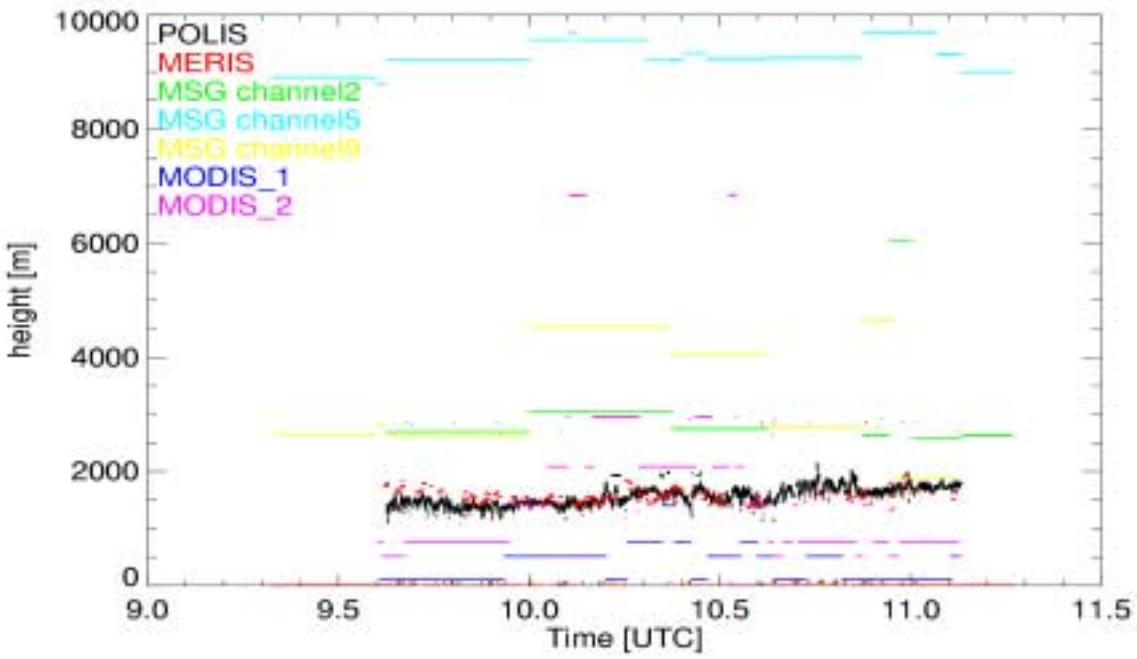
- Wavelength: 355nm
- Repetition rate: 5Hz.
- Vertikal resolution: 7.5m.
- Horizontal resolution: ~10m (vaircraft = 50 m/s).

The comparison between POLIS measurements and MERIS CTP data is shown in the plot below:




Legend: grey with cirrus; black without cirrus

The comparison with other instruments is shown in the following plot:




In conclusion, the accuracy achieved for the MERIS cloud top height is ~ 180m (rmse, that corresponds to ~ 17 hPa at 2000m; bias: 155m) in case of low clouds without cirrus. This result shows that MERIS is more accurate than expected (30 hPa). On the contrary, some problems have been identified in MERIS data in presence of Cirrus and scattered Cumuli.

# 11 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/

# 12 HOW TO GET MERIS DATA

Information concerning the different ways to access the MERIS data can be found on the MERIS webpage:

http://earth.esa.int/pcs/envisat/meris/documentation/Access_to_MERIS_data.pdf

# 13 GENERAL INFORMATION

1. The European Space Agency is organizing a joint MERIS and (A)ATSR workshop that will be held at ESRIN, Frascati, Italy, **26-30 September 2005**. All information about the participation and objectives of the workshop can be found on the ESA's official page:

   http://envisat.esa.int/workshops/meris_aatsr2005/