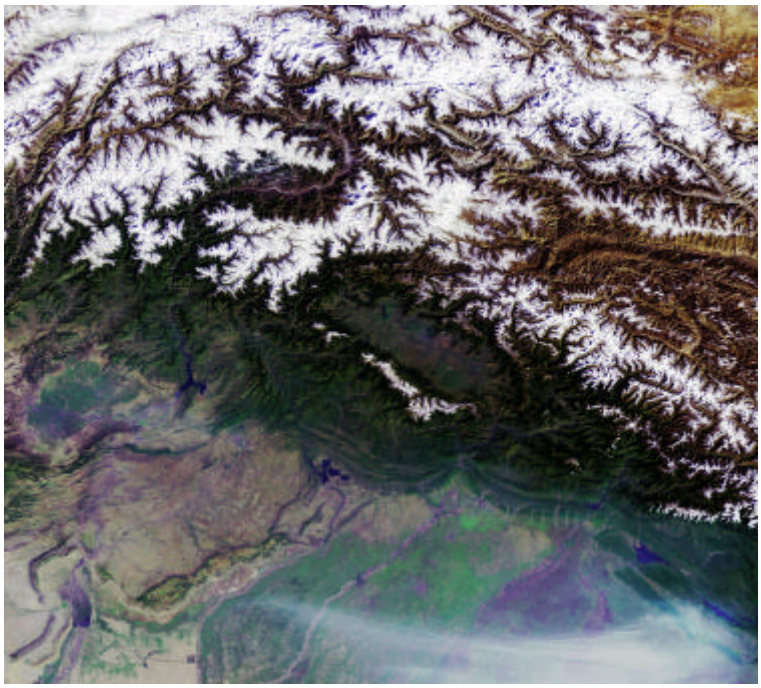
DOCUMENT

MERIS CYCLIC REPORT 42ND

24TH OCTOBER – 28TH NOVEMBER 2005



31 October 2005 – The image acquired by MERIS shows Pakistan Mountains under Snow

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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
EDAC	Error Detection And Correction
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
PEP	Payload Exploitation Plan
QC	Quality Control
QWG	Quality Control Working Group
QUARC	Quality Analysis and Reporting Computer
RGC	Radiometric Gain Calibration
RR	Reduced Resolution
SEU	Single Event Upset
SPH	Specific Product Header
SQADS	Summary Quality ADS
WV1	Wavelength type 1 calibration
WV2	Wavelength type 2 calibration

2 SUMMARY

Cycle #42 starts on the 24th of October 2005 and stops on the 28th of November 2005.

- No auxiliary files were disseminated during the reporting period.
- Three type of calibrations have been successfully executed, two RGC radiometric gain, one DAC diffuser ageing and two WV2 wavelength type 2.
- No data unavailability have occurred during the reporting period.

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

Cycle number	**42**
Start time	24 October 2005, 21:59:29
Stop time	28 November 2005, 21:59:29
Start orbit	19093
Stop orbit	19593

3 PROCESSOR VERSION AND PROCESSING CONFIGURATION

3.1 MERIS Processor Release

IPF version 4.10 is the operational processor at the MERIS processing centers (stations and PACs). The reference documents for the operational processor are listed below:

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 no new auxiliary files were disseminated during Cycle #36.

- 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_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 # 42.

3.5 Level 1/ Level 2 RR or FR products

During cycle #42 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 with IPF version 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 sections.

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 %	
	Inventoried	Missing
From 24/10 to 31/10	100.00	0.00
From 31/10 to 07/11	97.92	2.08
From 07/11 to 14/11	94.40	5.60
From 14/11 to 21/11	99.87	0.13
From 21/11 to 28/11	97.12	2.88

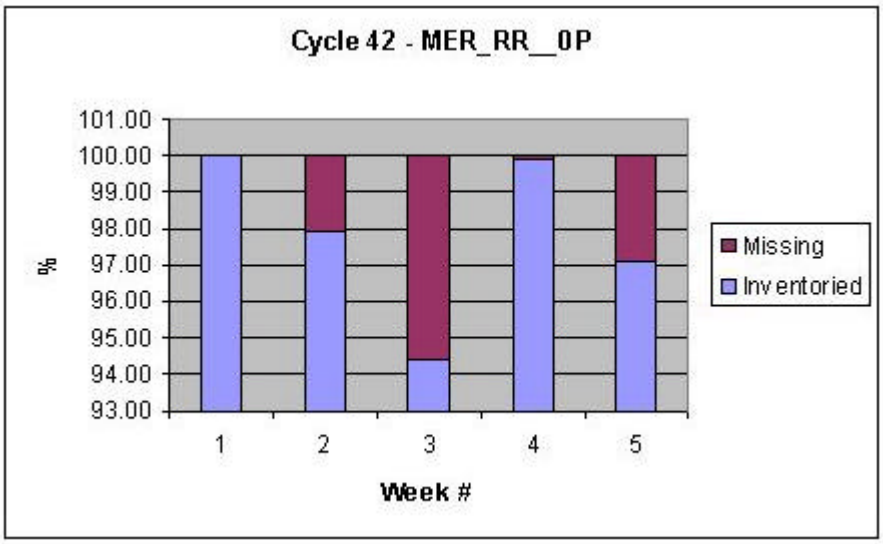

Figure 1 - MER_RR__0P generated/missing by the ground segment during cycle #42

The number of RR Level 0 products acquired during the cycle is about 97.86 % of the planned ones.

The table below shows the statistics regarding the FR L0 availability (compared to the planned production).

Week	MER_FR__0P %	
	Inventoried	Missing
From 24/10 to 31/10	99.90	0.10
From 31/10 to 07/11	99.33	0.67
From 07/11 to 14/11	90.61	9.39
From 14/11 to 21/11	99.95	0.05
From 21/11 to 28/11	92.84	7.16

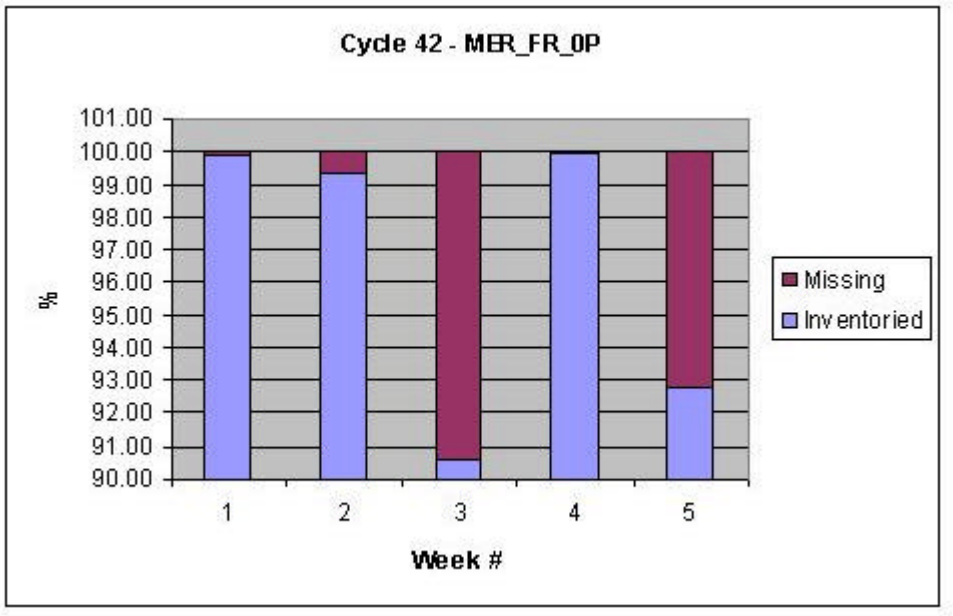

Figure 2 - MER_FR__0P generated/missing by the ground segment during cycle #42

The number of FR Level 0 products generated during the cycle is about 93.03 % of the planned ones.

4.2 MERIS FR acquisitions

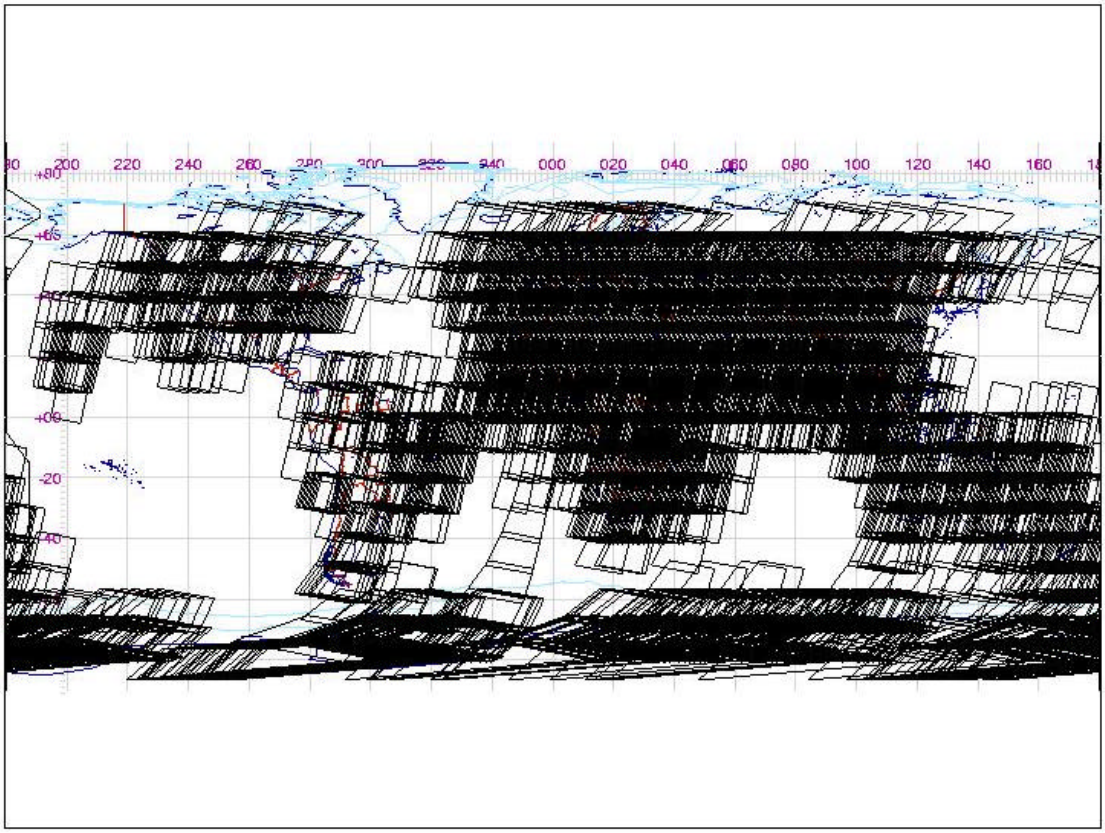

Figure 3 - MERIS FR global coverage for cycle #42

The image above shows the MERIS Full Resolution global coverage for the reporting period. As specified for this type of MERIS products, all lands and coastal areas are covered by MERIS FR acquisitions.

4.3 MER_CA__0P Products

During Cycle #42 three different type of routine calibrations have been planned, two RGC radiometric gain (one orbit each), two WV2 wavelength 2 (two orbits each) and one DAC diffuser ageing (one orbit). All the calibrations were successfully executed on the 05th and 19th of November, in orbits respectively 19258, 19259, 19260, 19261, 19262, 19263 and 19460.

The list of calibration files is reported below:

MER_CA__0PNPDK20051105_115533_000001792042_00166_19258_0039.N1	RGC
MER_CA__0PNPDK20051105_133610_000001792042_00167_19259_0040.N1	RGC
MER_CA__0PNPDK20051105_151643_000001792042_00168_19260_0041.N1	WV2

MER_CA__0PNPDK20051105_165720_000001792042_00169_19261_0042.N1	WV2
MER_CA__0PNPDK20051105_183756_000001792042_00170_19262_0043.N1	WV2
MER_CA__0PNPDK20051105_201832_000001792042_00171_19263_0044.N1	WV2
MER_CA__0PNPDK20051119_143740_000001792042_00368_19460_0069.N1	DAC

5 INSTRUMENT/DATA UNAVAILABILITY

5.1 Instrument Unavailability

No instrument unavailability was communicated by ESOC during cycle #42.
In the reporting period, 28 EDAC-corrected SEU occurred.

5.2 Data Unavailability

One data unavailability to be communicated for cycle #42.

- The Spectral WV2 type calibrations requires MERIS in Stabilization Mode during Region 1. Therefore no data acquisition should be included in the PEP from orbits #19260 to #19263.

6 CALIBRATION AND INSTRUMENT CHARACTERIZATION

6.1 Calibration

6.1.1 Radiometric calibration

During Cycle #42 three routine calibrations (DAC,WV1 and RGC type), were successfully executed on the 05th and 19th of November. For more details see section 4.3.

6.1.2 Spectral calibration

One Erbium calibration was performed during Cycle #42, on 05th of November. For more details see section 4.3.

6.1.3 Geolocation

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 (centered 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/reports/

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 #42 the VEU temperature does not show any anomalous behavior, being into the nominal operating temperature range.

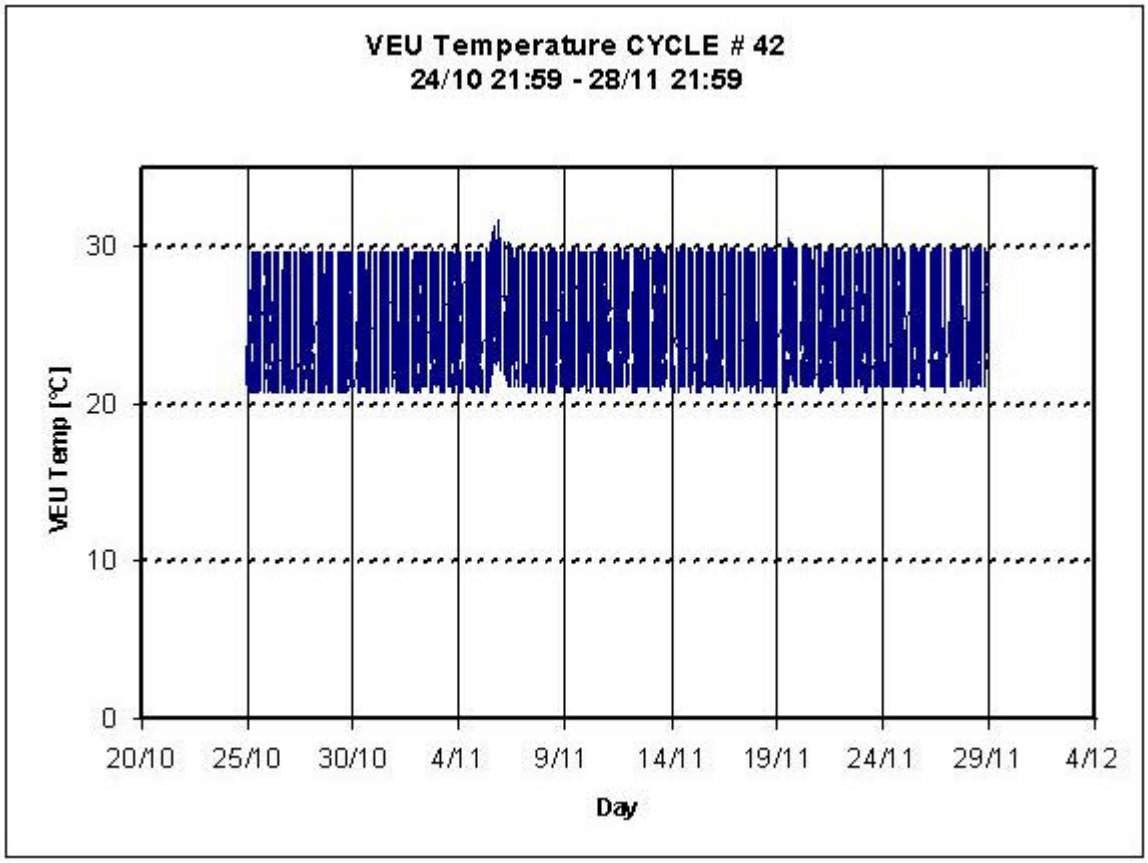

Figure 4 - VEU Temperature during cycle #42

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:

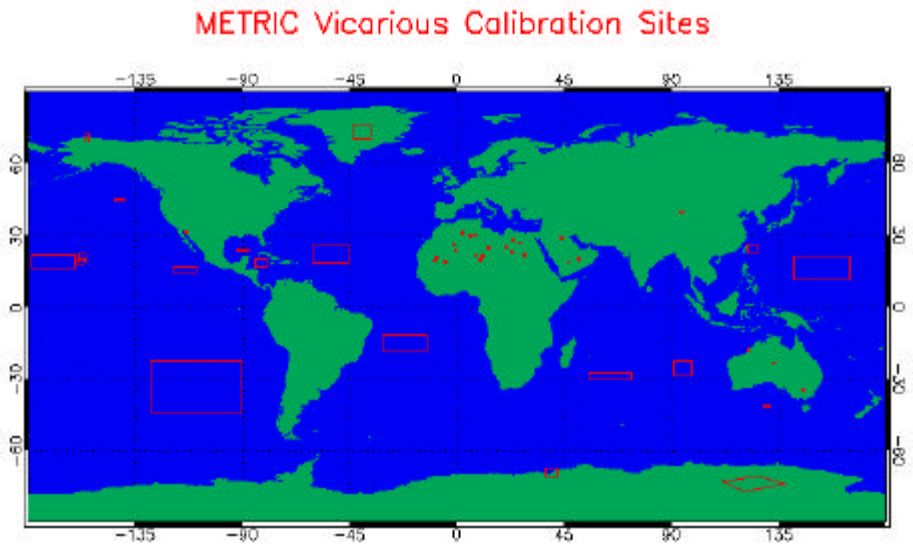

Figure 5 - METRIC calibration site map

Based on the second reprocessing dataset (see section 9), the entire METRIC sites Child products will be generated to be processed with the last version of the METRIC tool (2.0).

This reprocessing will start in the current of December 2005 in ACRI premises, and will concern the data starting from the ENVISAT launch to present. The METRIC v2.0 tool has been delivered to ESRIN where it will be used in operational mode after the IPF upgrade to the last version of the processing chains (MERISv5.1)

6.2 Instrument Characterization

6.2.1 Instrument degradation

No new results to be shown for cycle #42. 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

A brief summary of Diffuser Ageing evolution since the first MERIS acquisition is shown by the plot series below. The diffuser ageing has been estimated computing the differences between Diffuser 1 and Diffuser 2 with respect to a reference orbit (#1859) acquired in the first period of MERIS life (July 2002).

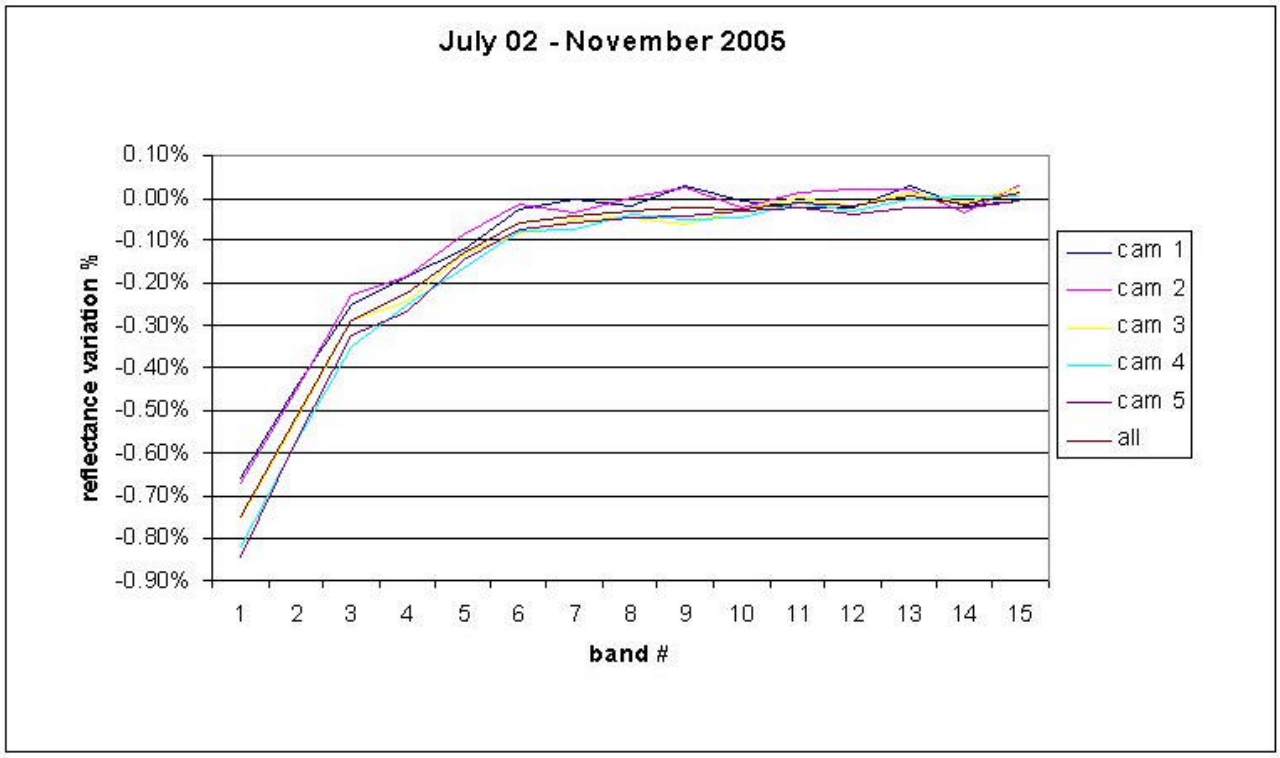

Figure 6 - Variation observed comparing Diffuser 2 vs. Diffuser 1 reflectances spectra per camera

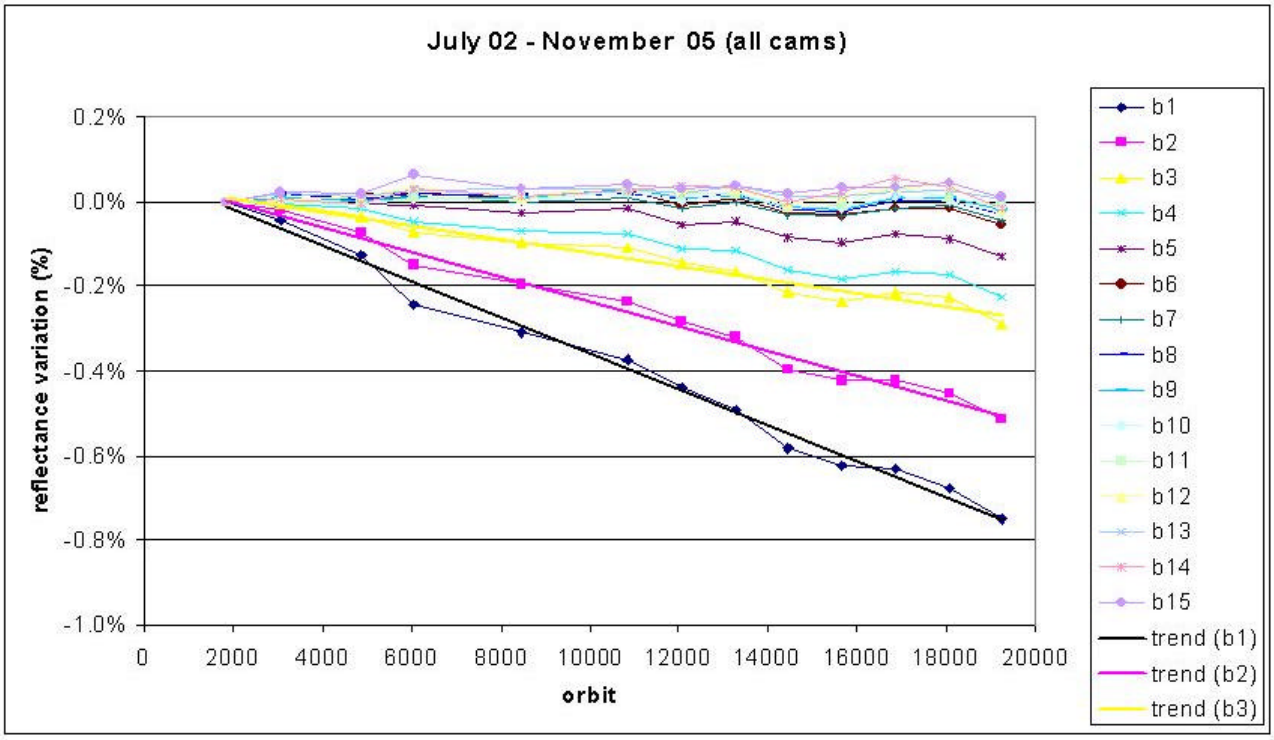

Figure 7 -Variation observed comparing Diffuser 2 vs. Diffuser 1 reflectances per MERIS spectral bands.

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 nearly three years of flight.

6.2.3 Smile Effect

No new results to be shown for cycle #42. 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 #42. Please refer to Cyclic Report #23 that can be found on the above-mentioned MERIS webpage.

7 DATA QUALITY CONTROL

7.1 MERIS products quality status

IPF version 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. Black striplines have been detected in numerous MERIS FR Level 1 and Level 2 products rejected by visual inspections using the AMALFI system. The major part of these anomalies have been classified as nominal behavior of the Data processor which completes the frames with missing data to preserve the geolocation integrity of the product. Investigations are on-going to assess the origin of data lack.

8 FIRST 2003 MERIS ARCHIVE REPROCESSING

Information concerning the 1st reprocessing of the 2003 MERIS data archive done spring 2004 can be found on the MERIS website:

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

The document explains also how to get the reprocessed data.

9 SECOND 2005 MERIS ARCHIVE REPROCESSING

Following the recommendations of the Data Quality Working Group and the Science Advisory Group, improvements of the MERIS processing resulted in the version 7.4 of the off-line processor MEGS. It is currently being used for a complete re-processing of the MERIS Reduced Resolution data archive. The corresponding time period extends from June 2002 to June 2005. 2003 and 2004 data will be made available through the MERCI (MERIS Catalogue and Inventory service) by the end of year 2005. For further information see

http://envisat.esa.int/services/catalogues.html

10 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 website:

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

11 VALIDATION ACTIVITIES AND RESULTS

This paragraph contains a summary of some studies presented during the Quality Working Group (QWG) meeting held on November 2005 in ACRI premises, Sophia-Antipolis, France.
The main goal of the meeting was to assess the modifications implemented in the last version of the MERIS prototype (MEGS v7.4) – currently in use for the 2005 Reprocessing of MERIS data (See section 9 for more details)- and to discuss of new improvements in the processing parameters if needed.

11.1 MERIS vicarious calibration and validation using in-situ observations (D. Antoine – LOV – http://www.obs-vlfr.fr/LOV/index_e.php)

The in-flight radiometric calibration of the MERIS instrument is checked using a vicarious calibration approach. In-situ measurements in the open ocean (Boussole and MOBY buoys) are used as input data into a Radiative Transfer Equation (RTE) code to simulate the Top Of the Atmosphere (TOA) radiance. That radiance is then compared to the one measured by MERIS (Level1B products) and a calibration correction factor is derived.
The advantage of the Vicarious calibration (to be understood as validation of the calibration) is its time independence as compared to the usage of diffusors (on-board calibration), which are exposed to the sun and space environment implying a degradation of the reflective plates. However, this latter ageing is small, particularly for the second diffusor, and the problem of the vicarious calibration is the error introduced by radiative transfer modelling.

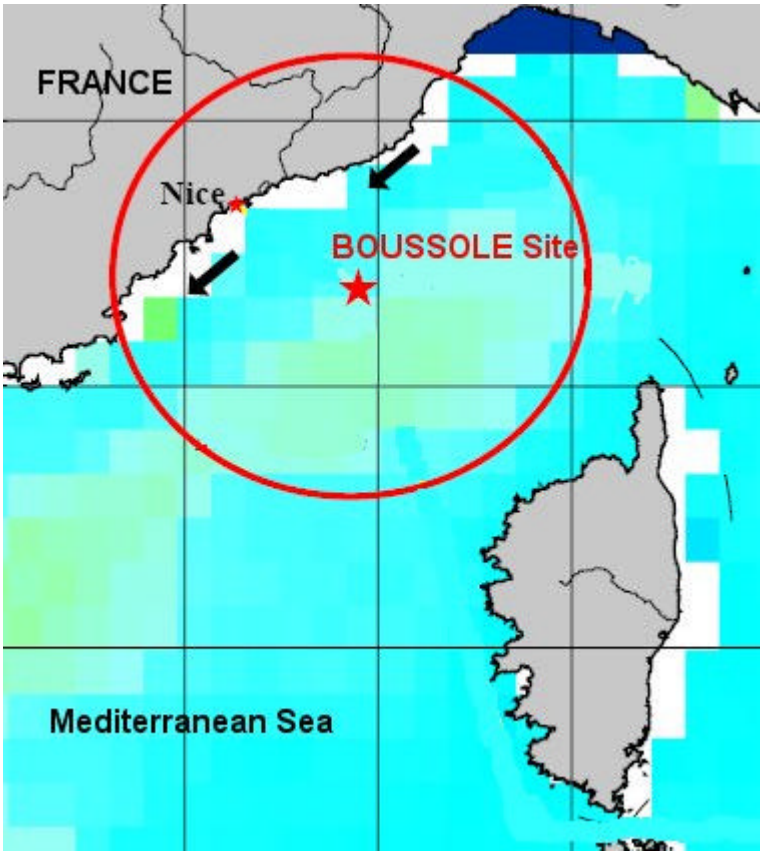

Figure 8 - The BOUSSOLE site

The BOUSSOLE ("Buoy for the acquisition of a long-term (bio)optical series") System is operational since 2002. A large dataset of in-situ bio-optical parameters (Water leaving radiances) has been collected and a methodology for vicarious calibration has been developed, based on radiative transfer modelling.

The Aerosol characterization needed for the RTE calculations have been derived from measurements using Spectrophotometers done on the BOUSSOLE site during the maintenance campaigns. A comparison of measurements in the infrared at BOUSSOLE site and at the AERONET site Cape Ferrat (Near Nice – France), together with meteo data analysis, has been performed to assess that the AERONET data can be applied to BOUSSOLE.

The goal for MERIS is a 5% error on chlorophyll in oligotrophic waters, which corresponds to 0.002 in reflectance.

The preliminary results of the study in terms of surface reflectance are summarized in the figure below:

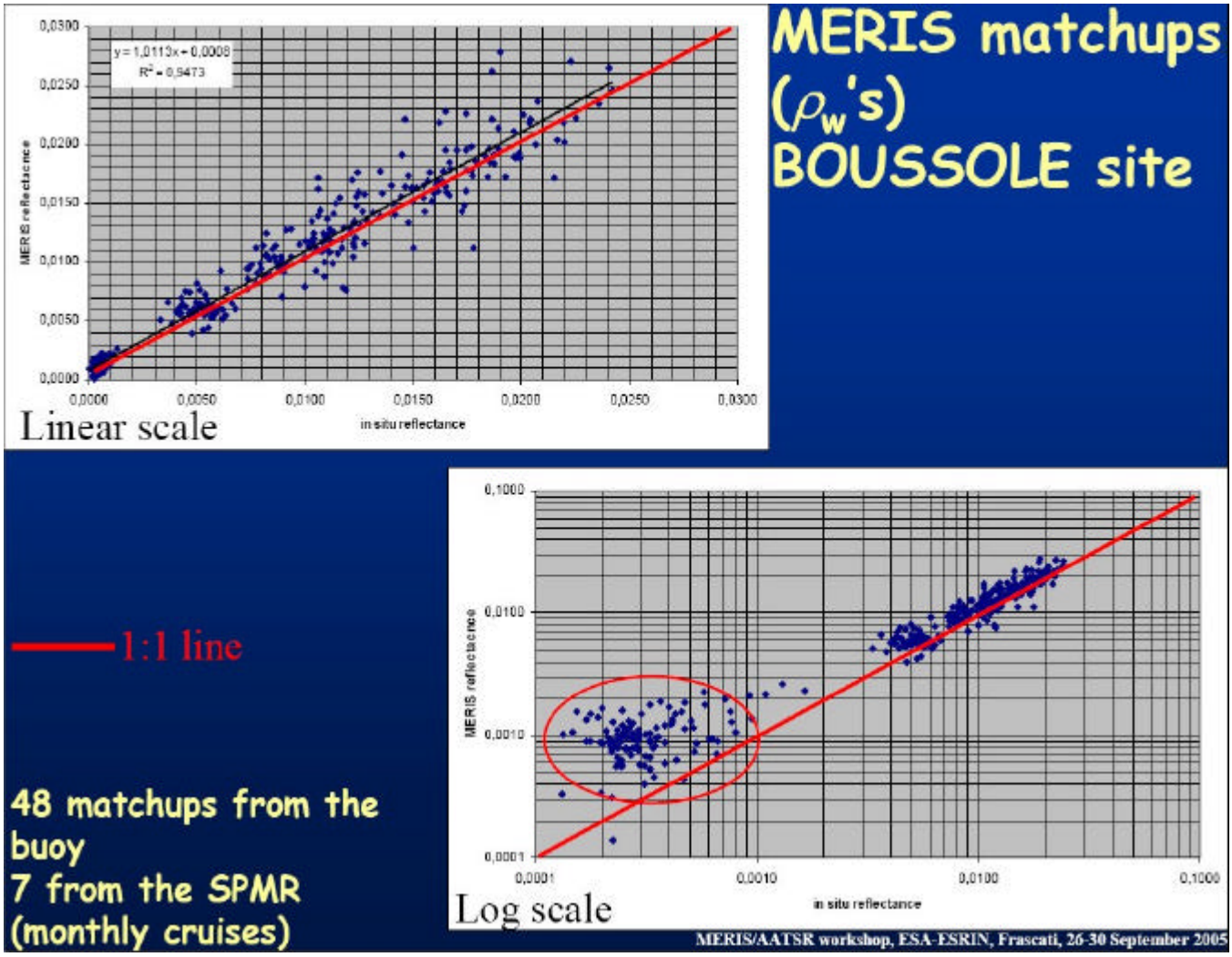

Figure 9 - Preliminary results of MERIS validation study

MERIS reflectances are plotted as a function of in-situ reflectances – on a Linear Scale for the upper left one, and Log-scale for the lower right one. MERIS slightly overestimates reflectances in the blue part of the spectrum, and improvements in both processing of MERIS data and in-situ measurements have to be done as revealed by the differences observed in the red part of the spectrum (Red circle in the figure above).

The RTE calculations so far, which are very preliminary because more data need to be analysed, have revealed an error of 5% max (in the blue) for MERIS TOA radiances versus in-situ derived ones.

The future evolutions include the completion of the time series, the improvement of data collection and quality control, and the implementation of various Radiative Transfer Codes for the Vicarious Calibration exercise.

12 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/

13 HOW TO GET MERIS DATA

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

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

14 GENERAL INFORMATION

1. The European Space Agency has organized a joint MERIS and (A)ATSR workshop, held at ESRIN, Frascati, Italy, on 26-30 September 2005. All information about the objectives of the workshop as well as the participants presentations can be found on the ESA's official page:
   http://envisat.esa.int/workshops/meris_aatsr2005/

2. Next In-Orbit Performance Meeting (IOPM) will take place on 30th of November 2005 in ESOC premises – Darmstadt , Germany.

3. Next Data Quality Working Group (QWG) meeting will take place in March 2006 in the ACRI-ST premises - Sophia Antipolis, France.

4. MERIS and AATSR Calibration and Geophysical Validation (MAVT-2006), 20-24 March 2006
   The European Space Agency is organizing a second working meeting on MERIS and AATSR Calibration and Geophysical Validation (MAVT-2006). The working meeting will be held in ESRIN (near Rome) from 20 to 24 March 2006. This meeting is primarily intended for the participants of the MERIS and AATSR Validation Program. During the MAVT-2006 scientists and other users will present the latest results from their ongoing validation activities. The presentations at the working meeting will be given by invited speakers. During an open poster session participants can present their individual validation results.