

ODESA



Processing & validation environment ODESA - Optical Data processor of ESA MERMAID - MERIS Matchup In-situ Database

Splinter Session 11

Satellite data file formats and tools for easy science exploitation

**International Ocean Colour Science Meeting
6th May 2013, Darmstadt**

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- ❑ **ODESA: environment for developing and validating MERIS Level 2 algorithms in the ESA Ground Segment**

- ❑ **Main feature of ODESA: a software for coding and data processing**
 - ✓ 2011: Public release with binary code
 - ✓ 2012: Public release with **source code** of 3rd MERIS reprocessing
 - Ongoing: evolution for next generation of ESA optical sensors: OLCI and SLSTR on-board Sentinel-3

- ❑ **ODESA includes other facilities:**
 - ✓ Validation: full compatibility with the **MERMAID** database
 - ✓ Remote-processing: **ODESA online processing**
 - ✓ Support: **forum, training sessions (two in 2012, two in 2013)**

Overview

ODESA



Website project <http://earth.eo.esa.int/odesa> for accessing all facilities

The screenshot shows the ODESA website interface. On the left, there is a navigation menu with the following items: Home, About ODESA, MERIS Online Processing, Software Distribution, Analysis Tools, Validation and Qualification, Forum, Mailing list, Services, Site Map, FAQ, Glossary, Credits, Terms of use, and Contact us. On the right, there is a main content area with the following sections: Optical Data processor of the European Space Agency, The ODESA system intends to provide the users a complete level 2 processing environment for the MERIS instrument as well as for the future ESA optical sensors on board Sentinel 3. ODESA supplies the user community with the MERIS Ground Segment development platform MEGS®, including source code, embedded in an efficient framework for testing and for validation activities. Validation facilities include match-up processing & analysis, data set selection & analysis, level 3 products generation & analysis and the possibility to perform remote processing, e.g. for testing purpose and for validation activities requiring large amounts of data. Below this, there are three columns of links: MERIS on-line processing (Access MERIS data from remote processing facility available to qualified processors.), Software distribution (Download the MERIS level 2 processor (MEGS®) and its operation environment), Analysis tools (Download and install the ODESA analysis tools, including the BEAM toolbox), Validation & qualification (Validate your algorithm and get him qualified to access the MERIS on-line processing), and Forum (All you want to discuss about ODESA and MERIS). On the far right, there is a 'Related Links' section with the following items: MERIS demonstration level 3, MERIS marine L3 QC, MERMAID in-situ database, and Access to Ocean Colour data. At the bottom of the page, there is a copyright notice: Copyright 2000 - 2010 European Space Agency. All rights reserved.

Online processing facility

Software distribution

Validation

Forum

Mailing list

Contact for support, help, feedback: service@odesa-info.eu

Forum: help and foster the ocean colour community with MERIS (algorithms, products...) & prepare it to S3 (data format, validation, protocols...)

ODESA software

ODESA



The ODESA software runs on Linux and is made of:

- ✓ Source codes in C language
- ✓ Auxiliary Data Files: ESA nominal + way to include new user's files
- ✓ A Java interface for managing processor + configurations + jobs
- ✓ Documentation



ODESA = Free user interface of MEGS

MEGS (ACRI)
MERIS Ground Segment
prototype

3rd reproc version: MEGS8.0

Configuration of auxiliary data, jobs,
outputs...



IPF (ESRIN)
Instrument Processing Facility

3rd reproc version: IPF 6.03

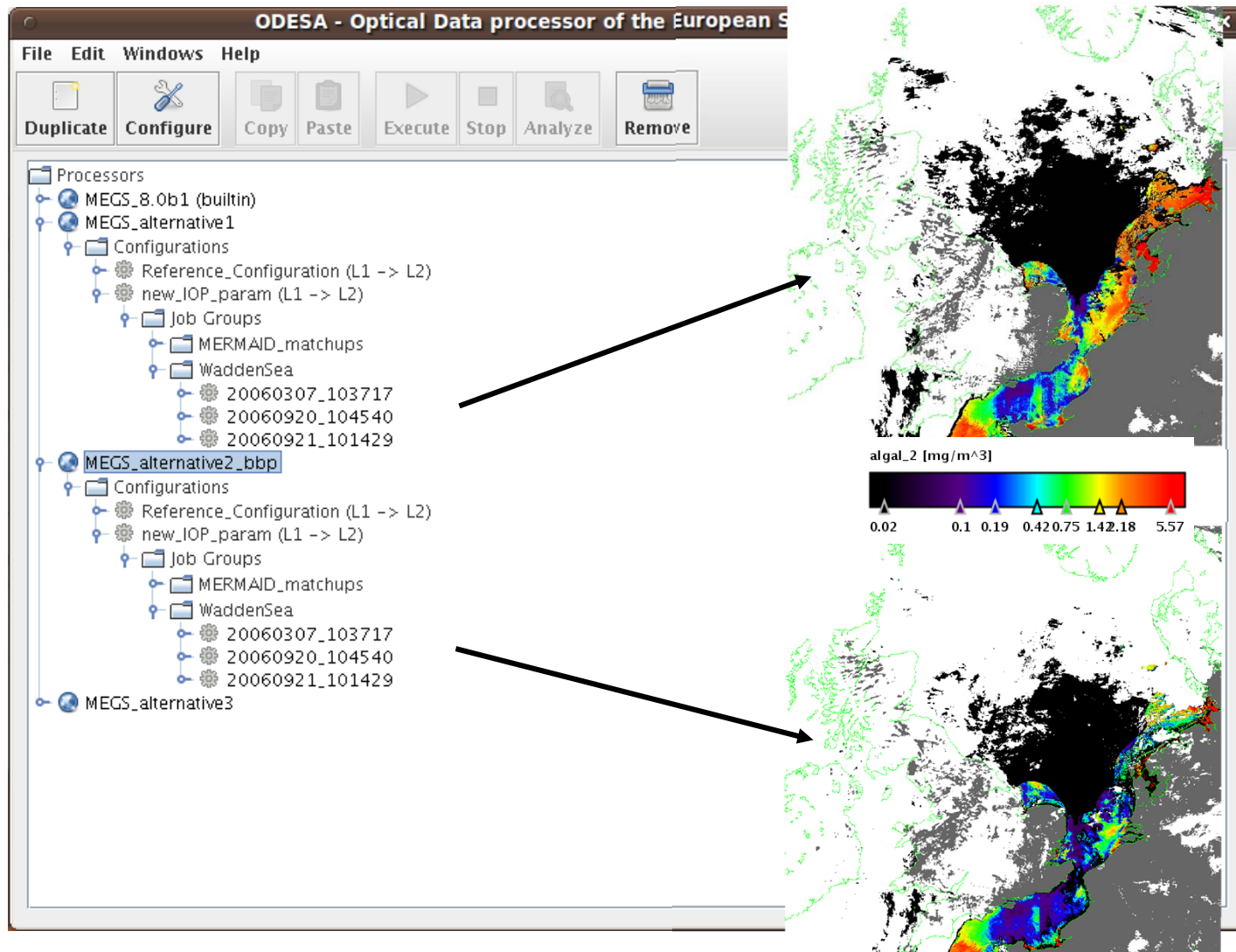
Developing in ODESA = developing in the ESA Level 2 Ground Segment

ODESA software

ODESA



ODESA architecture makes possible rigorous comparison of algorithms, in controlled configurations



ODESA software

ODESA



Algorithm development in ODESA is made easier by:

- ✓ Use of standard programming languages: C (nominal code) and Fortran/C++
- ✓ Perfect alignment between the code and the ESA documentation (DPM)

DPM related to bright pixel atmospheric correction

Calculate IOPs

```
bbp(b1)=bb_775_ie(bs)*bbp_star(b1)/bbp_star(b775) (2.6.8.4-11)
bbp(b2)=bb_775_ie(bs)*bbp_star(b2)/bbp_star(b775) (2.6.8.4-12)
a(b1)=aw(b1)+bbp(b1)*a_to_bb(b1) (2.6.8.4-13)
a(b2)=aw(b2)+bbp(b2)*a_to_bb(b2) (2.6.8.4-14)
```

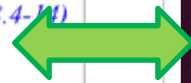
Calculate F prime factor

```
fp(b1)=F_ab(a(b1), bbw(b1), bbp(b1),  $\theta_s$ ,  $\theta_v$ ,  $\Delta\phi$ , Ws, b1) (2.6.8.4-15)
fp(b2)=F_ab(a(b2), bbw(b2), bbp(b2),  $\theta_s$ ,  $\theta_v$ ,  $\Delta\phi$ , Ws, b2) (2.6.8.4-16)
```

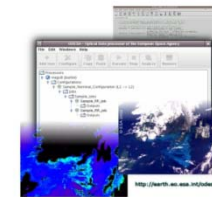
bright_water_ac.c source code

```
/* Calculate IOPs */
/** @meq 2.6.8.4-11 @oeq OP-BAC-C2RE-WI3.18 */
wd->bbp[b1] = bb_775_ie[bs] * wd->bbp_star[b1] / wd->bbp_star[bb775]
/** @meq 2.6.8.4-12 @oeq OP-BAC-C2RE-WI3.19 */
wd->bbp[b2] = bb_775_ie[bs] * wd->bbp_star[b2] / wd->bbp_star[bb775]
/** @meq 2.6.8.4-13 @oeq OP-BAC-C2RE-WI3.20 */
wd->a[b1] = aw[b1] + wd->bbp[b1] * wd->a_to_bb[b1];
/** @meq 2.6.8.4-14 @oeq OP-BAC-C2RE-WI3.21 */
wd->a[b2] = aw[b2] + wd->bbp[b2] * wd->a_to_bb[b2];

/* Calculate F prime factor */
/** @meq 2.6.8.4-15 @oeq OP-BAC-C2RE-WI3.22 */
wd->fp[b1] = fpab(pix, wd, wd->a[b1], bbw[b1], wd->bbp[b1], b1);
/** @meq 2.6.8.4-16 @oeq OP-BAC-C2RE-WI3.23 */
wd->fp[b2] = fpab(pix, wd, wd->a[b2], bbw[b2], wd->bbp[b2], b2);
```



- ✓ Makefile for quick compilation: `make install`
- ✓ Documentation: online quick start guide + tutorial
 - ✓ Tips for debugging
 - ✓ Examples for adding new code
- ✓ Forum to reply to technical questions



ODESA software

ODESA



Output options:

- Envisat and/or NetCDF format
- « breakpoint » and « intermediate » parameters, not available in Level 2 products: Rayleigh and aerosol reflectance, transmittances, internal flags, ...
- Any new variables in the code may be stored in output NetCDF
- Limit processing to a region of interest or a branch (water/land/cloud)

Compatible formats with latest versions of BEAM (Brockmann Consult)

Edit code

Process in ODESA

Visualise in BEAM

The screenshot displays the ODESA software interface. On the left, a code editor shows Fortran code for processing satellite data. In the center, a configuration window titled 'Configuration Editor: Reference_Configuration_new' is open, showing a table of Auxiliary Data Files (ADF) with columns for ADF Name, Validity Period, and ADF File. On the right, a visualization window shows a map of Europe with a color-coded overlay representing satellite data. The interface includes a terminal window at the top and a file explorer on the left.

ADF Name	Validity Period	ADF File
aeroclim	2002-03-21 - 2020-01-01	aeroclim.20.08.prd
atmosphere	2002-04-29 - 2002-12-24	atmosphere.34.02.01.prd
atmosphere	2002-12-24 - 2020-01-01	atmosphere.34.03.01.prd
case1	2002-03-21 - 2020-01-01	case1.63.02.01.prd
case2	2002-03-21 - 2020-01-01	case2.46.02.02.prd
conf_map	2002-03-21 - 2020-01-01	conf_map.20.00.prd

Validation with MERMAID

ODESA



Match-ups platform for validation of MERIS Ocean Colour products



In-situ
Pls, labs

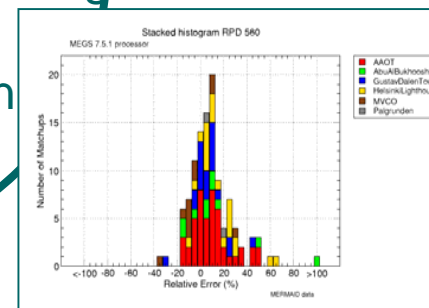
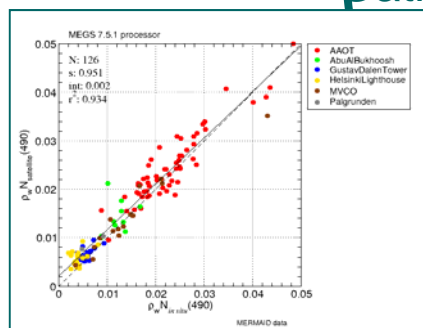
MERIS data and processings
ESA, QWG, Alg. providers

MERMAID
MERIS MAtchup In-situ Database

Gathering, storage, processing

QC, protocols,
extraction, distribution

Validation



Validation with MERMAID

ODESA



MERMAID

MERIS MAtchup In-situ Database

European Space Agency

Welcome to MERMAID, the MERIS MAtchup In-situ Database

Purpose

The MERMAID project aims at making available an easy-to-use centralised database of merged in-situ optical measurements with concurrent MERIS acquisitions to Ocean Colour researchers involved in the MERIS mission. Access is open to the MERIS Validation Team (MVT), the MERIS Quality Working Group (MQWG), and to any independent collaborating Principal Investigator (PI).

The long-term objectives of this database are to:

- Enable the assessment of the MERIS Marine Level 2 products delivered by the ENVISAT ground segment.
- Support the monitoring of these MERIS products over the lifetime of the mission by providing a complete temporal coverage of the mission.

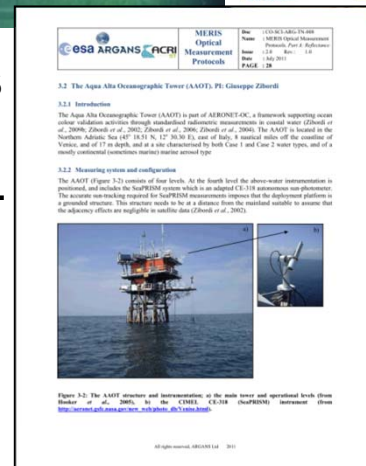
Accessible through ODESA website

The database provides text files of in situ data, matched with concurrent and comparable MERIS L2 products (including flags, auxiliary information and the intermediary outputs of the processing). The **extraction interface** allows the users to select matchups according to their own requirements for site, parameters, flags and statistical screening, and produces validation statistics and plots.

Contributing PIs get access to the full dataset, extraction facilities and validation tools.

More information about the project can be found in the [2nd MERIS\(A\)ATSR User Workshop Proceedings \(PDF\)](#).

Protocol documents on *in situ* data, written in collaboration with all PIs. It explains the methods, measured quantities, quality checks

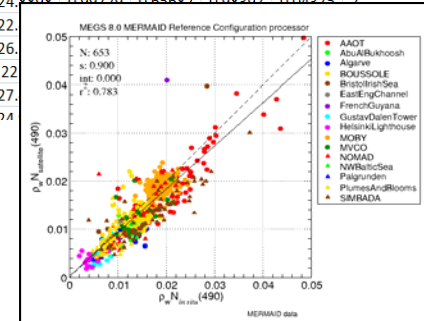


Data catalogue listing all datasets, PI, affiliation, contact. GoogleEarth map to visualise location of all matchups



Tools to build the matchup (size, flag, outliers removal...) on user's own criteria. **MERIS extractions**, stats, validation plots

1	depth	chl1	chl2	TSM	YS	1
69	23.0897	1.8888	0.8851	1.43233	0.08905	2.
70	24.2808	0.90720	0.65692	0.99207	0.04275	2.
71	22.					
72	26.					
73	22					
74	27.					
75	24					



Data policy to respect proprietary rights & acknowledgement of contributors

Validation with MERMAID

ODESA



ODESA text file processing:

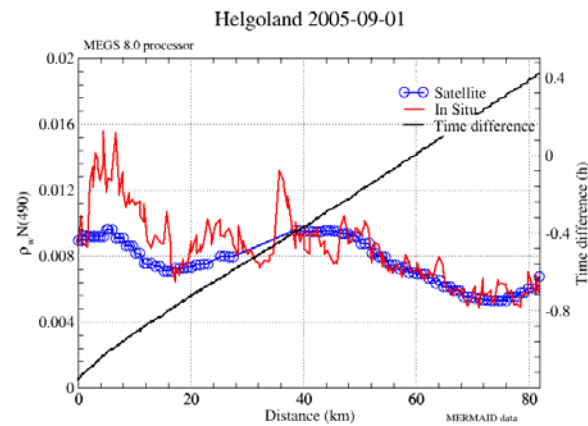
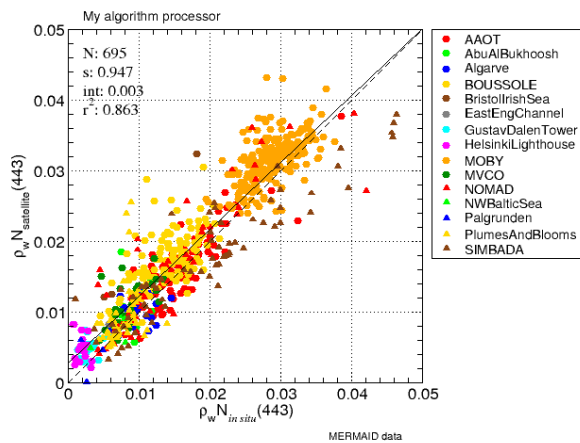
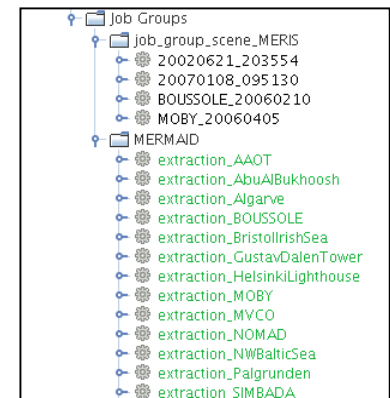
- Processing of MERMAID matchup text files, i.e. MERIS pixels matching in-situ data
- Allows a straightforward validation against in-situ data

Four steps:

- 1) Download the « Level1 extraction » from MERMAID website
- 2) Process directly in ODESA, like an ENVISAT file

Output format: MERMAID CSV

- 3) Get output « Level2 extraction » file (csv format)
- 4) Upload to MERMAID website for data screening, statistics, validation plot

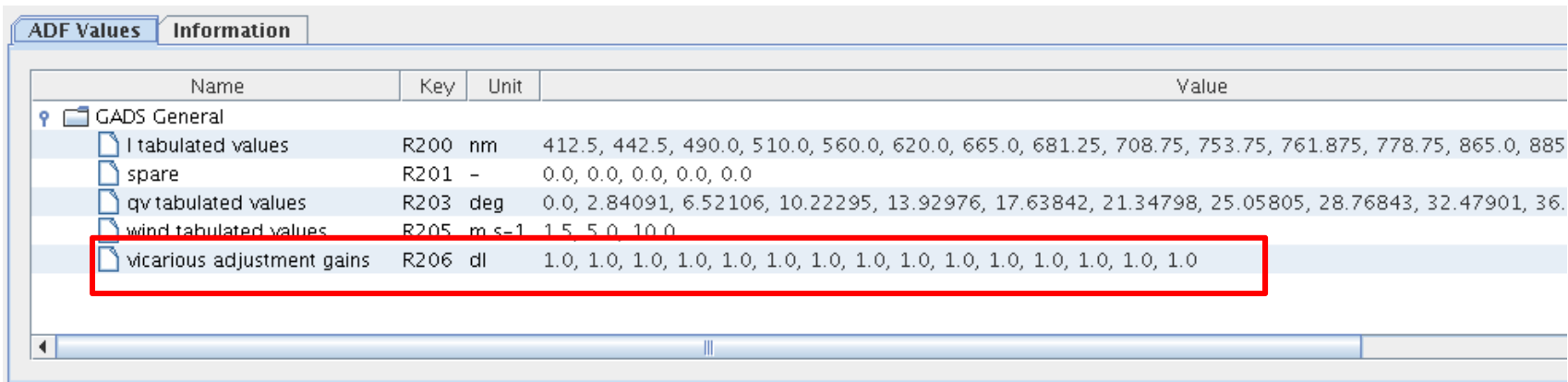


Because matchups are already extracted, this takes only few minutes

Validation with MERMAID

Simple example: what is the impact of the NIR vicarious calibration alone in MERIS 3rd reprocessing?

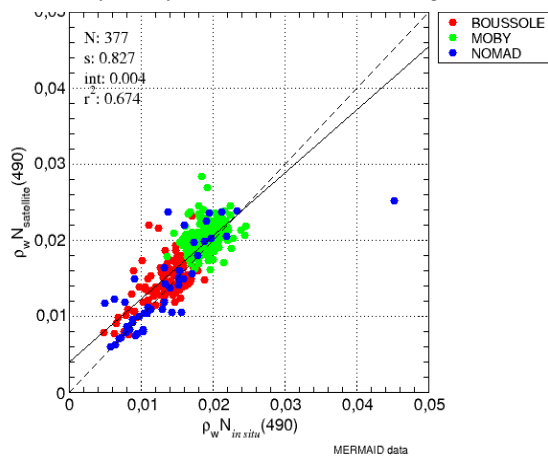
- ✓ In ODESA, create two configurations with different vicarious gains



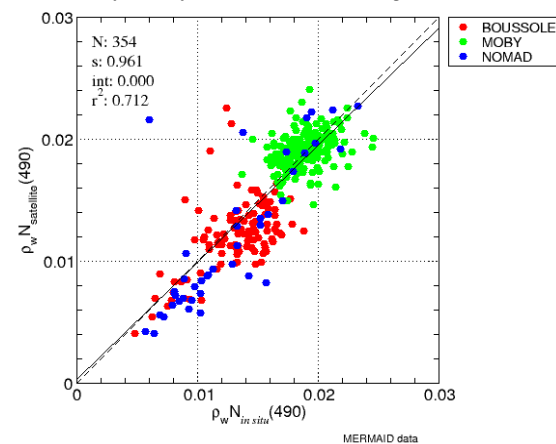
Name	Key	Unit	Value
GADS General			
l tabulated values	R200	nm	412.5, 442.5, 490.0, 510.0, 560.0, 620.0, 665.0, 681.25, 708.75, 753.75, 761.875, 778.75, 865.0, 885
spare	R201	-	0.0, 0.0, 0.0, 0.0, 0.0
qv tabulated values	R203	deg	0.0, 2.84091, 6.52106, 10.22295, 13.92976, 17.63842, 21.34798, 25.05805, 28.76843, 32.47901, 36.
wind tabulated values	R205	m s ⁻¹	1.5, 5.0, 10.0
vicarious adjustment gains	R206	dl	1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0

- ✓ Launch the jobs on matchups, upload results on the website and get results

rhow(490) without NIR adjustment



rhow(490) with NIR adjustment only



Online processing

ODESA



1) Register / log in

2) Select area,
Level, period
Processing version

3) Receive confirmation
by email and get data
on a dedicated ftp

esa Optical Data processor ODESA European Space Agency

You must log in first

email:

Password:

Submit

Register
Password lost

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Credits

Terms of use

Contact us

Registration is very easy. It consists in providing an Email address. The access is immediately granted with a password supplied by e-mail.

MERIS Online processing

Select an area on map or enter coordinates

North 90°N

West 180°W 180°E East

South 90°S

Reset

Due to ENVISAT orbit change, products after 19/10/2010 are not available. They will be integrated as soon as possible.

Level Level1b level 2

Select a period From 15/10/2010 to 18/10/2010

an orbit range (*)

Version MEGS_8.0 3rd reprocessing approved by QWG.

(*) Date format must be dd/mm/yyyy -Available period: 01/03/2002 to 19/10/2010
Orbit range: the value of the first and last absolute orbit -Available orbits: 1 to 45160

NB: the total size of generated products is limited to 50 GB

- **This facility gives possibility to distribute data of alternative processing**
 - Today for MERIS 2nd and 3rd reprocessing
 - Possibly for any user' alternative, after qualification by MERIS QWG, when coded in ODESA

Conclusion

ODESA



- **ODESA software**
 - Linux interface of the ESA MERIS Level2 ground segment
 - Environment to implement and test new algorithms:
 - New auxiliary data files (e.g. aerosol models, physical parameters ...)
 - Modified algorithm
 - New algorithm (new L2 products)
 - Processing in controlled configuration
 - Documentation: DPM, quick start guide, tutorial
- **ODESA can process MERMAID text files (matchup with in-situ)**
 - Beneficiate from strong quality of MERMAID matchups, documentation
 - Easy to assess immediately impact of algorithmic changes
- **Alternative algorithms qualified by MERIS Quality Working Group can be transfered to the online facility for test and distribution**
 - Proposed method to ESA for preparation of MERIS 4th reprocessing
- **Next training session: 31st August 2013, Baltic Sea Science Congress, Klaipeda, Lithuania. See <http://www.nordbaltrems.org>**