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 Couleur Science Meeting
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Overview

- **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

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

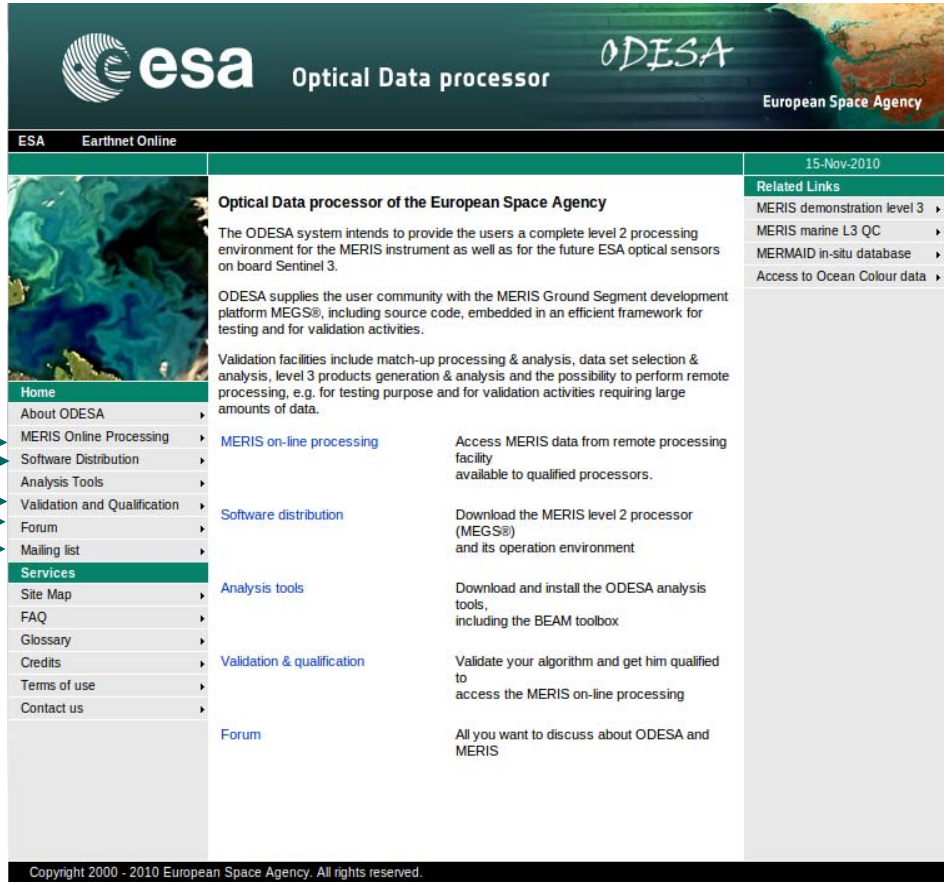
Online processing facility

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

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…

=

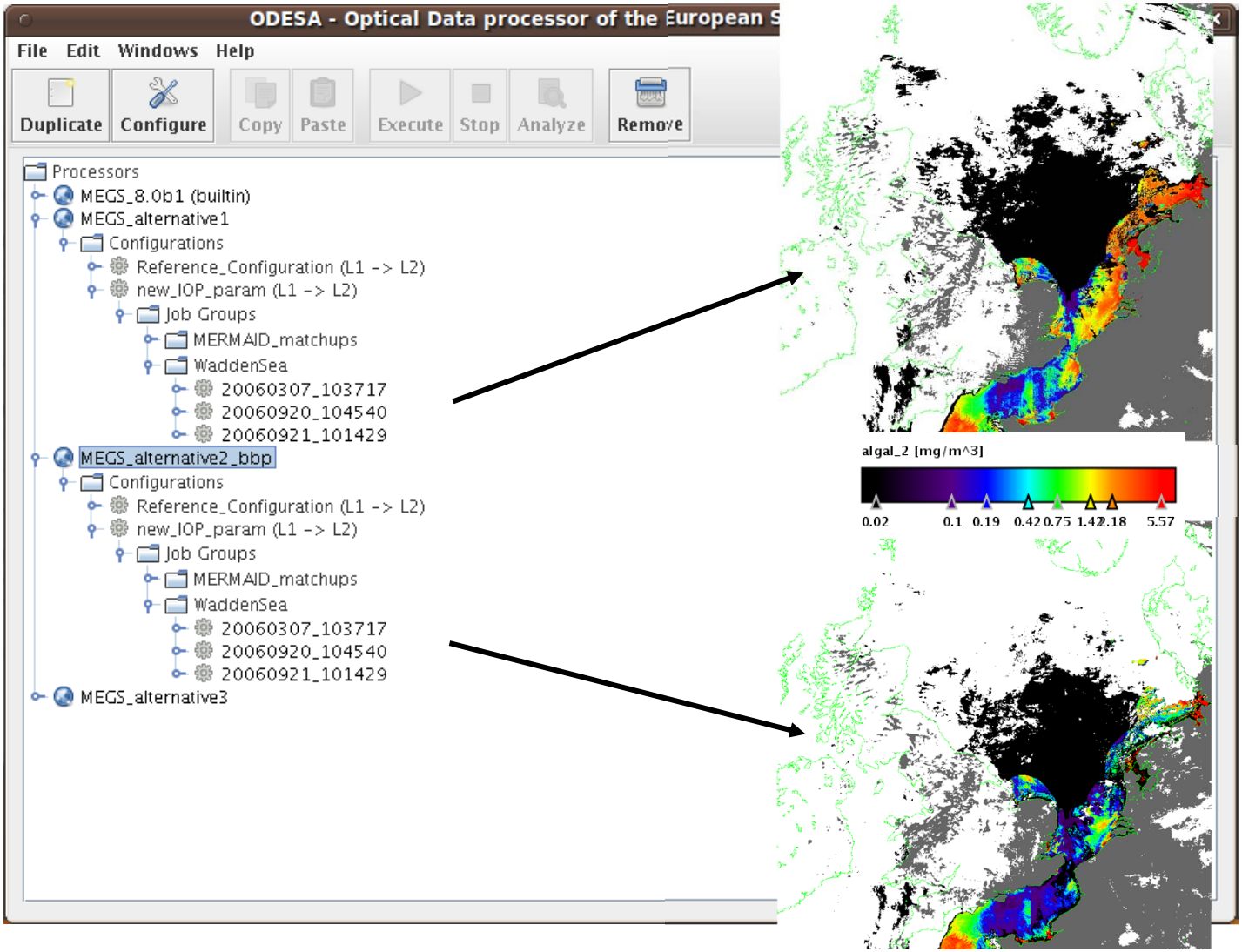
IPF (ESRIN)
Instrument Processing Facility

3rd reproc version: IPF 6.03

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

ODESA software

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



ODESA software

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), θ_S, θ_V, $\Delta\phi$, Ws, b1) *(2.6.8.4-15)*

fp(b2)=***F_ab***(a(b2), bbw(b2), bbp(b2), θ_S, θ_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_bbp[b1];
/** @meq 2.6.8.4-14 @oeq OP-BAC-C2RE-WI3.21 */
wd->a[b2] = aw[b2] + wd->bbp[b2] * wd->a_to_bbp[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

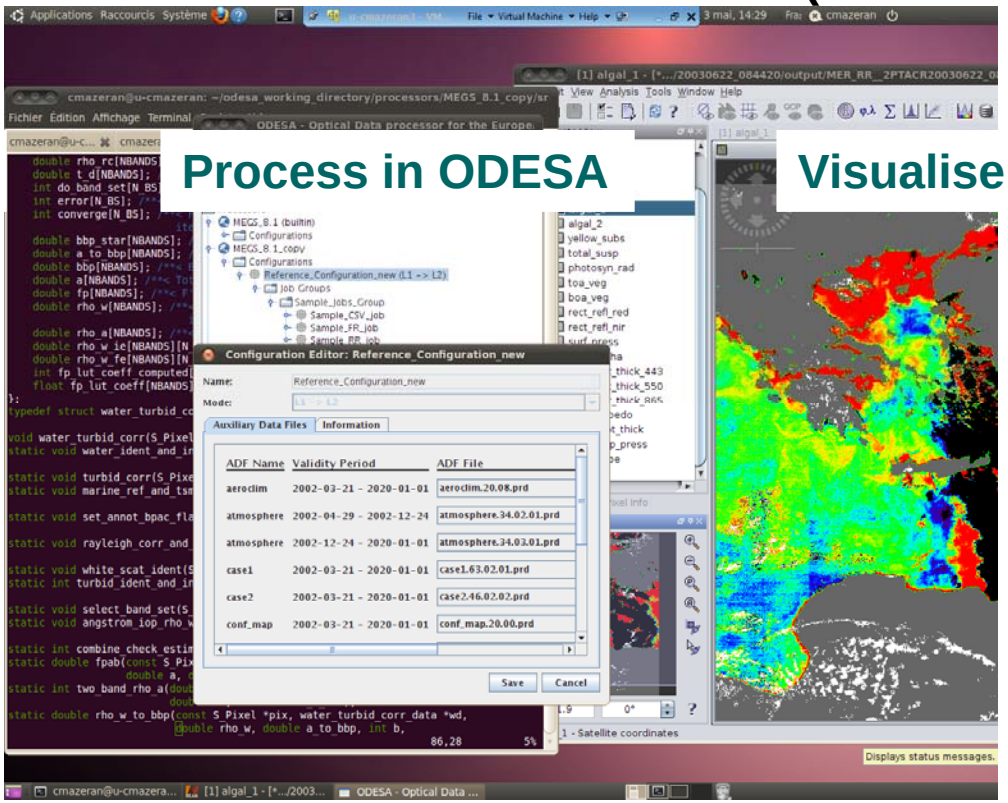
ODESA software

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)

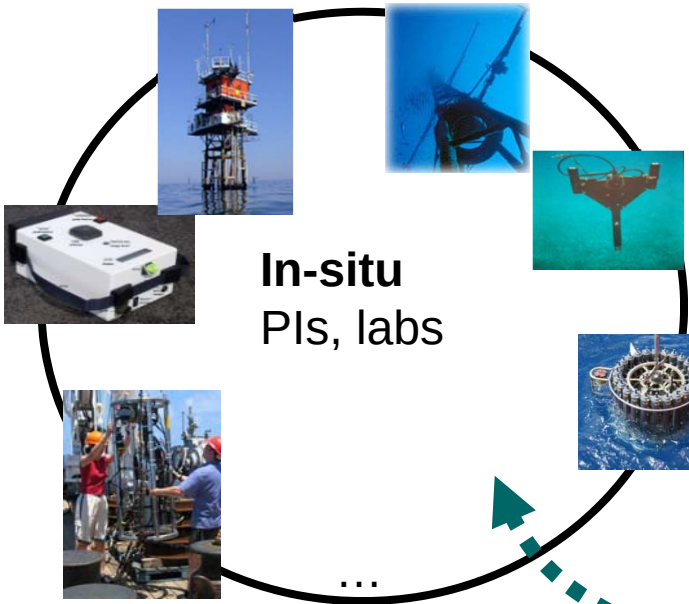
Compatible formats with latest versions of BEAM (Brockmann Consult)

Edit code **Process in ODESA** **Visualise in BEAM**



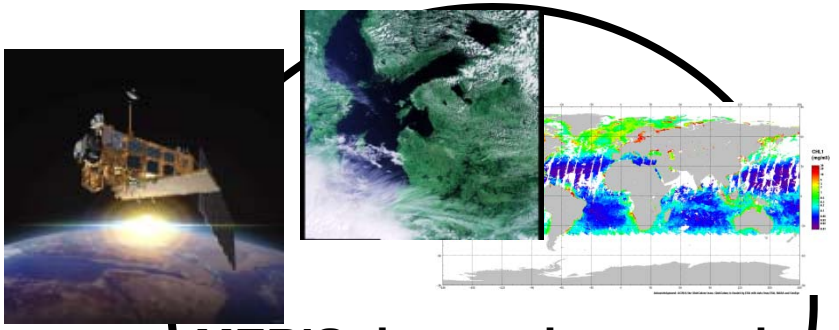
Validation with MERMAID

Match-ups plateform for validation of MERIS Ocean Colour products



In-situ
PIs, labs

…

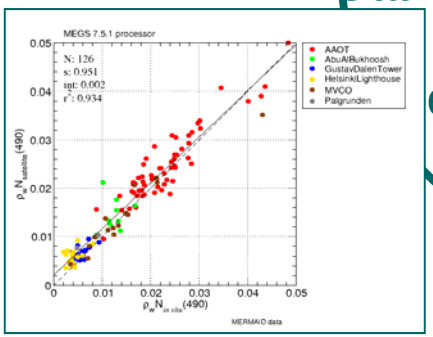


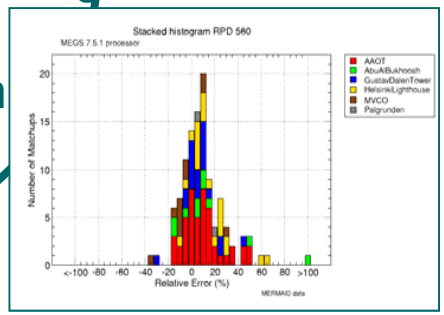
MERIS data and processings
ESA, QWG, Alg. providers

MERMAID
MERis MAtchup In-situ Database

Gathering, storage, processing
QC, protocols,
extraction, distribution

Validation

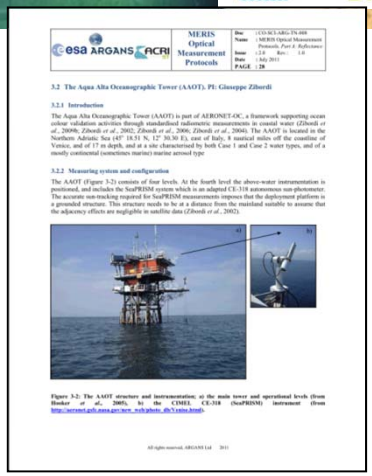




Validation with MERMAID

Accessible through ODESA website

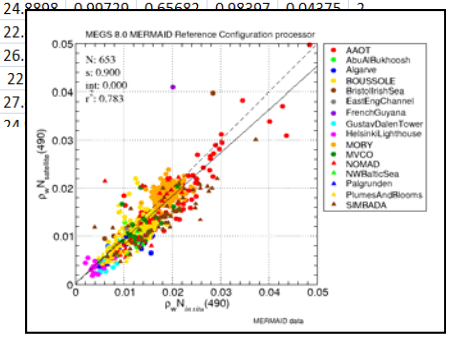
Protocol documents on *in situ* data, written in collaboration with all PIs. It explains the methods, measured quantities, quality checks



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
69	23.0897	1.8888	0.8851	1.43233	0.08905
70	24.8808	0.90729	0.65683	0.98307	0.04375
71	22.				
72	26.				
73	22				
74	27.				
75	24				



Data policy to respect proprietary rights & acknowledgement of contributors

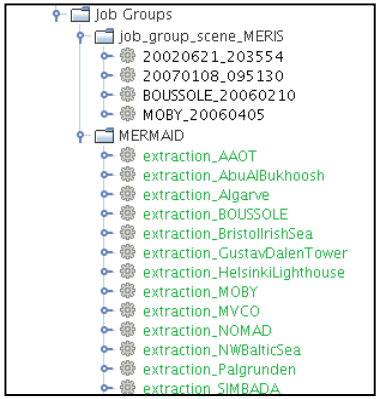
Validation with MERMAID

ODESA text file processing:

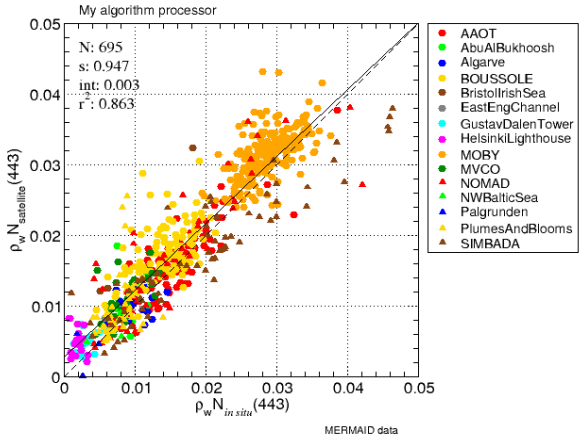
- Processing of MERMAID matchup text files, i.e. MERIS pixels matching in-situ data
- Allows a straightforward validation against in-situ data

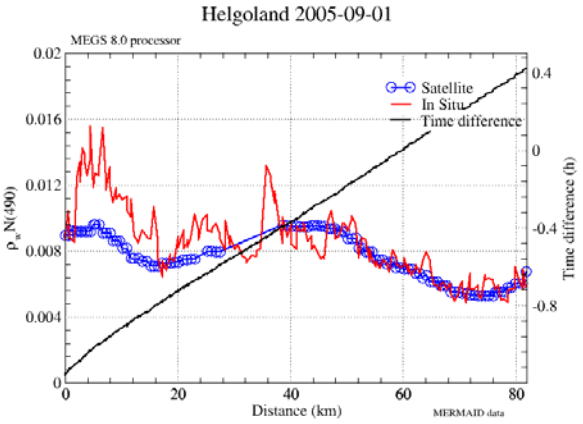
Four steps:

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



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?

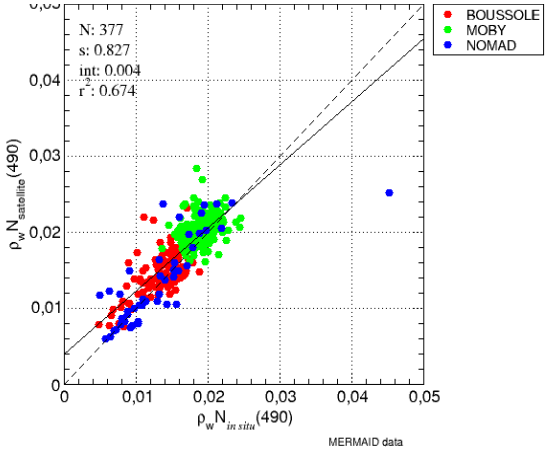
- ✓ In ODESA, create two configurations with differents vicarious gains

ADF Values | Information

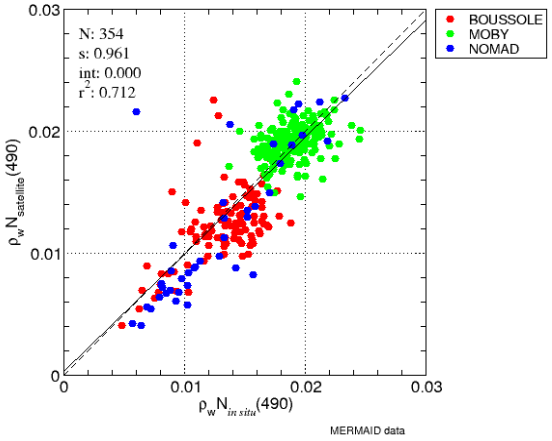
Name	Key	Unit	Value
GADS General			
l tabulated values	R200	nm	412.5, 442.5, 490.0, 510.0, 560.0, 620.0, 665.0, 681.25, 708.75, 753.75, 761.875, 778.75, 865.0, 885
spare	R201	-	0.0, 0.0, 0.0, 0.0, 0.0
qv tabulated values	R203	deg	0.0, 2.84091, 6.52106, 10.22295, 13.92976, 17.63842, 21.34798, 25.05805, 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

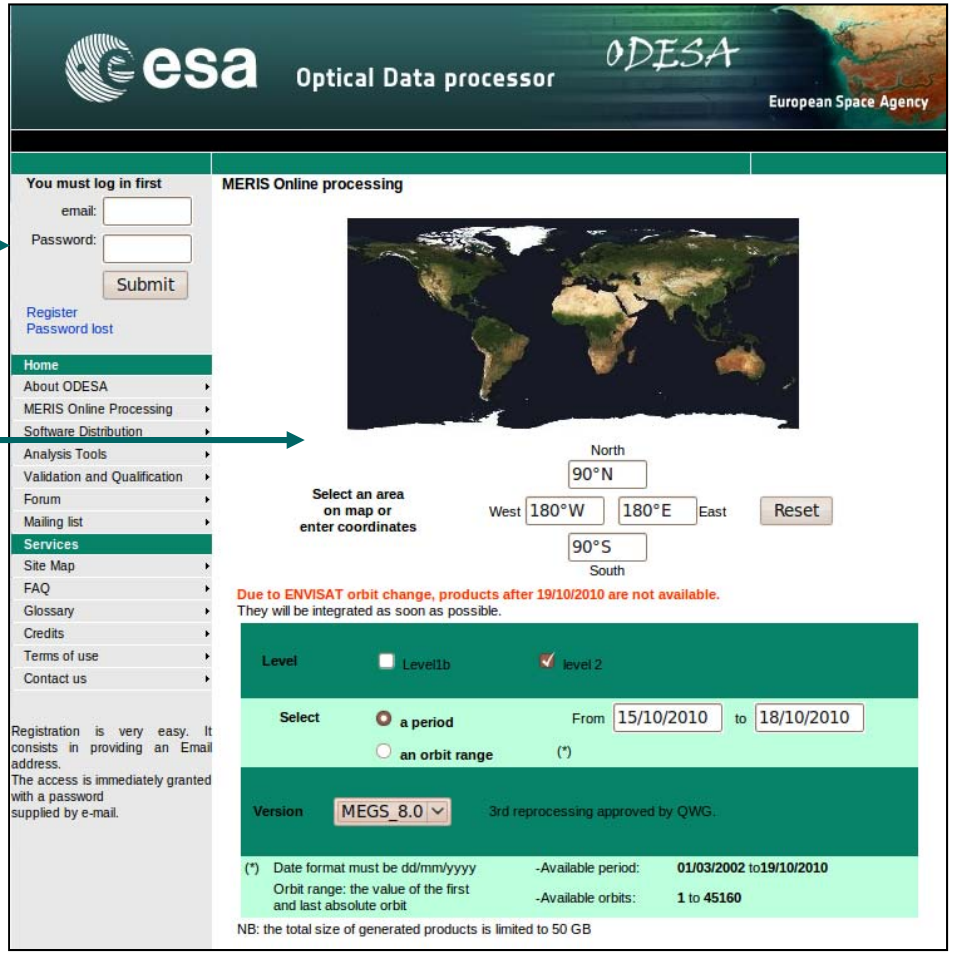


Online processing

1) Register / log in

2) Select area, Level, period Processing version

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



- **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 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**