

Welcome to Riva del Garda!



→ 6th COASTAL ALTIMETRY WORKSHOP



20-21 September 2012 | Riva del Garda, Italy

A little introduction to the 6th Coastal Altimetry Workshop

(...or, where are we with coastal altimetry?)

*Jérôme Benveniste, Paolo Cipollini
with the help of the CAW-6 session chairs*

Are we at a ‘hinge point’?

- coastal altimetry widely recognized (by scientists Agencies and OSTST)
- considerable technical development
 - reprocessing of old missions? how? when? funded by who?
- new data/missions coming
 - SAR altimetry, but also AltiKa
- How can this community ‘seize the day’?
 - should we keep going as we do, or get organized differently?

New Data!!

09:10

10:20

Session 1 : The New Coastal Altimetry Data

Chairs:

**Jessica Hausman (JPL),
Martín Saraceno (Univ. Buenos Aires)**

1. Is there a significant difference in products that use global or regional corrections and filtering?
2. Are the data appropriate for the entire science community, or still only experimental (algorithms are documented, peer reviewed, etc.)?
3. If they are still experimental, what can the coastal altimetry community do to help so they can be used by the entire science community?
4. Where can be found the new coastal altimetry data? Are they freely available?

Applications – old and new!

10:50 13:10

Session 2 : Applications of Coastal Altimetry

Chairs:

Joana Fernandes (Univ. Porto),
John Wilkin (Rutgers Univ.),
Soma Yenamandra (NIO)

1. Are there applications for which coastal altimetry data are particularly suited?
2. Are there applications for which coastal altimetry data should be used with particular caution?
3. What impediments are there to more wide-spread use of coastal altimetry in applications?
Can these be categorized into local/global issues (e.g. local = accurate MDT, global = real-time delivery)
4. Would studies of e.g. boundary currents or coastal trapped waves be hampered if the Jason-CS LRM and SARM operated separately without overlap?
5. Are applications making full use of coastal altimeter data in terms of maximum along-track resolution and new range corrections?

Modelling and assimilation

14:40

16:10

Session 3: Synergy with Models

Chairs:

Kaoru Ichikawa (Kyushu Univ.),
Villy Kourafalou (Univ. Miami)

1. What is the model grid resolution necessary for achieving benefits from the resolution of coastal altimetry?
2. How does the physical content of coastal models compare with coastal altimetric data (tides, atmospheric pressure, winds, vertical reference etc.)?
3. Is coastal altimetry mature enough to assimilate CA data into a coastal model simulation (in particular on the continental shelf)? Can we achieve a CA error budget?
4. How does one perform data assimilation of altimetry in the presence of internal tides, which affect both CA data and temperature/salinity observations?

Technical improvements: corrections

| | | | | |
|-------|-------|------------------------|---------|---|
| 16:40 | 17:50 | Session 4: Corrections | Chairs: | Ole Andersen (DTU), Lifeng Bao (Chinese Acad. Sciences) |
|-------|-------|------------------------|---------|---|

1. With CryoSat-2 not carrying a radiometer and being important for coastal purposes. How do we quantify the "error" for C2 in coastal regions.
2. With CryoSat-2 and Sentinel-3 measuring with even higher spatial resolution than conventional altimeters in coastal regions what demands does this put on corrections in the future.
3. There is an urgent request from the marine geophysical society with Jason-1 in a new geodetic phase to have more accurate and high resolution tide models in the coastal region.
4. Which will be the most urgent corrections to improve for C2 and S3 (wet, tide, dynamic atmosphere etc) in the coastal domain.
5. With only 2 satellites being operational in the future will this be adequate for the use of coastal altimetry i.e. for warning and safety.

Technical improvements: LRM retracking

| | | | | |
|-------|-------|---------------------------|---------|---|
| 08:30 | 10:20 | Session 5: LRM Retracking | Chairs: | Xiaoli Deng (Univ. Newcastle), Luciana Fenoglio-Marc (TU Darmstadt) |
|-------|-------|---------------------------|---------|---|

1. Which are the recent achievements in retracking **methods**? Has a „most successful“ methodology been identified?
2. **Validation** - What are the main results of the PISTACH and COASTALT dedicated studies? Do they give comparable results?
3. **Validation** – (for 1.2 and in other studies) How does improve the statistics of the „validation parameters“ near coast? (e.g. distance to coast, agreement with in-situ data)
4. Is the **Intercalibration** of retrackers (e.g. for point 1.2) still an issue, and what has been achieved?
5. Which improvements are still feasible?

...including SAR alt – a great opportunity

| | | | | |
|-------|-------|--|----------------|--|
| 10:50 | 12:40 | Session 6: Waveform Analysis and SAR Retracking | Chairs: | Jesus Gómez-Enri (Univ. Cadiz), Walter Smith (NOAA) |
|-------|-------|--|----------------|--|

1. With the demise of EnviSat, ESA no longer has an altimeter mission making classical measurements. The next ESA altimeter, Sentinel-3, will make SAR measurements at the coast. Will ESA continue to support research to understand classical altimeter measurements in the coastal zone?
2. Are the inter-calibrations (e.g. sea state biases) between open ocean data (e.g. MLE3 or 4) and coastal data (e.g. RED3) sufficiently well understood?
3. The Sentinel-3 and Jason-CS baseline scenarios call for conventional (LRM) measurements in open ocean and (closed burst) SAR (CryoSat heritage) near the coasts. Given that the tide gauge calibrations are necessarily at coastlines, is this what we want? Would the (open burst) "interleaved option" under consideration for Jason-CS be a better alternative?

Cal/Val: needs more efforts

14:00 15:10

Session 7: CAL/VAL

Chairs:

Florence Birol (CTOH/OMP),
Guoqi Han
(Fisheries and Oceans)

1. How to improve validation of coastal altimetry using tide-gauge, glider, HF radar, current meter, and buoy data?
2. How to improve consistency of coastal altimetry datasets?
3. What kind of long term independent measurements is required for the validation of coastal altimetry data? What kind of strategy?
4. Do we have enough independent measurements to validate the different coastal altimetry data sets? Are they freely available?

Future missions / coordination

15:10 16:30

Session 8: Future Data and Missions

Chairs:

David Griffin (CSIRO),
Andrey Kostianoy
(P.P. Shirshov Inst.)

1. Is coastal altimetry a more cost-effective way of measuring coastal sea level and currents than in-situ obs?
2. Some nations will welcome satellite obs of their coasts, some will not. Do we have a good way of dealing with such sensitivities?
3. Which of all the new altimeters will contribute to a 'coastal altimetry' array?

Are we at a 'hinge point'?

- coastal altimetry widely recognized (by scientists, OSTST, and Agencies)
- considerable technical development
 - reprocessing of old missions? how? when? funded by who?
- new data/missions coming
 - SAR altimetry, but also AltiKa
- **can we go from scientific experiment to operational tool?**
 - **coastal dynamics / waves**
 - **hazards**
 - **sea level rise**
- **In which funding framework?**

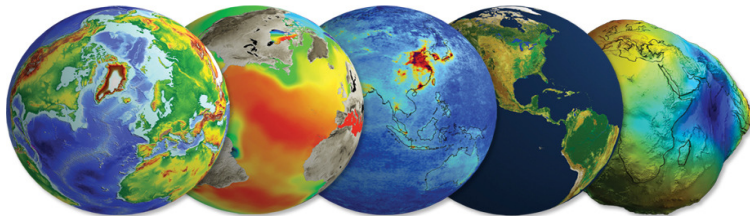
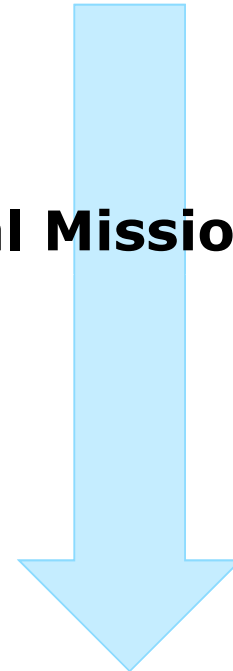
The programmatic scenario – a view from ESA

EOEP-4

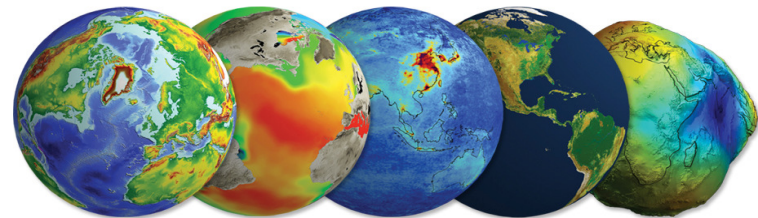
Mission Exploitation Elements



- **Support to Science Element**
- **Scientific Exploitation of Operational Missions**
- **Data User Element**
- **Value Adding Element**



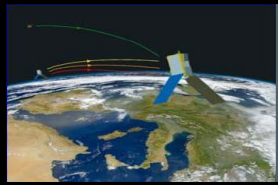
SUPPORT TO SCIENCE *ELEMENT* (STSE)



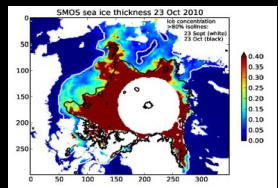
Support To Science Element



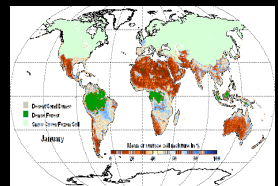
STSE provides a flexible platform for innovation across ESA EO science activities following an end-to-end approach to science addressing four major Action Lines:



Novel Mission Concepts



Novel Algorithms & Products

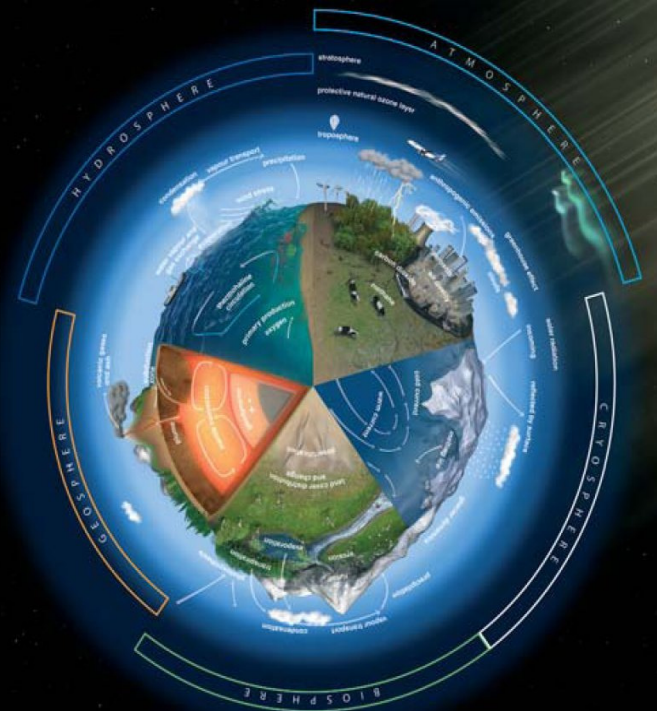


Novel Earth Science Results

Collaboration with major global science programmes



Next Generation of Earth System Scientists



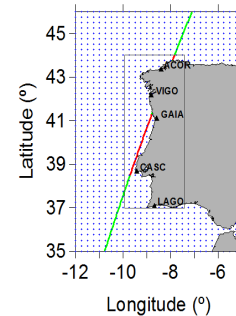


- ❑ **PROBLEM:** from 30-50 km of the coast, the Microwave Radiometer (MWR) derived wet tropospheric correction values are not longer valid (red points in the top Fig.), due to the large radiometer footprint.
- ❑ **IDEA:** GNSS coastal stations (bottom Fig.) allow an accurate computation of tropospheric delays
- ❑ **GOAL:** use GNSS-derived wet delays to derive the wet tropospheric correction at the altimeter points with invalid MWR measurement. Two methods have been developed and implemented: DLM and GPD

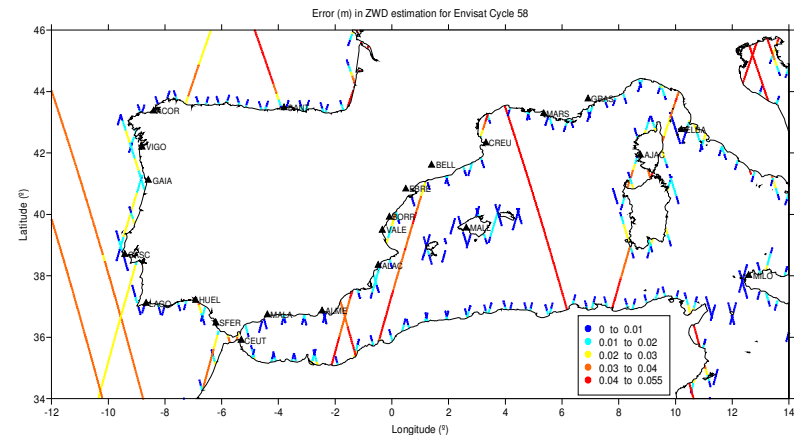
Team:

- *Faculdade de Ciências, Universidade do Porto, Portugal (Prime contractor);*
- *HIDROMOD Modelação em Engenharia Lda, Portugal (Subcontractor);*

Envisat Pass - 160

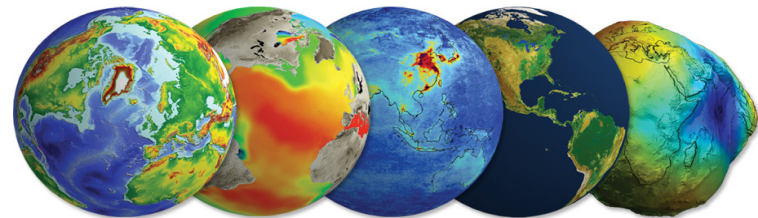


- Available data sources for the computation of the wet tropospheric correction at the altimeter points with invalid MWR values (red) along Envisat pass 160:
- valid MWR measurements (green),
 - wet delays at GNSS stations (black)
 - ECMWF data (blue)



Standard deviation (m) of the GPD estimates for all invalid MWR measurements present in Envisat cycle 58. Black triangles: GNSS stations used in the computation

SCIENTIFIC EXPLOITATION OF OPERATIONAL MISSIONS (SEOM)



European Space Agency

Scientific Exploitation of Operational Missions (SEOM)



OBJECTIVES

- **Federate, support and expand the research community** built up over the last 20 years (ERS,ENVISAT,EOEP)
- **Strengthen the leadership of European EO research community** (by enabling them to extensively exploit future European operational EO missions)
- **Enable the science community to address new scientific research** (opened by data from operational EO missions)

Ref. ESA/PB-EO(2011)122, rev. 1A, 22-23 February 2012, EOEP-4 will span the period 2013-2017, SEOM funding requested at next Ministerial level conference planned in November 2012

SEOM: Federate scientific users



Norsk Romsenter
NORWEGIAN SPACE CENTRE

NERSC

→ **SEASAR 2012**

Advances in S

18-22 June 20

→ **ATMOS 2012**

Advances in Atm

18-22 June 2012 | B

National Oceanography Centre

OSU
Ohio State

UNIVERSITY
of NEW HAMPSHIRE

cnnes

esa

→ **6th COASTAL ALTIMETRY WORKSHOP**

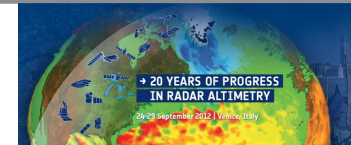
20-21 September 2012 | Riva del G

→ **3rd MERIS/(A)ATSR & OLCI/SLSTR
PREPARATORY WORKSHOP**

15-19 October 2012 | ESA-ESRIN | Frascati (Rome), Italy

esa

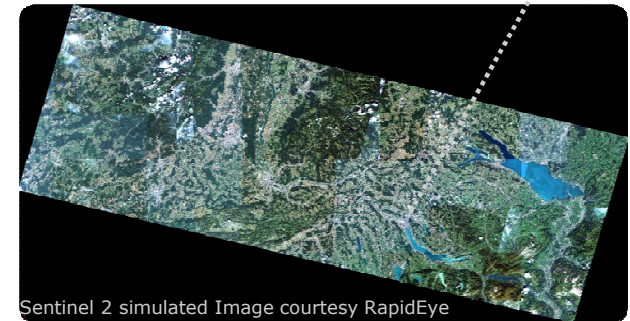
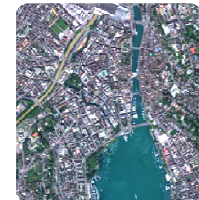
SEOM Major Lines of action (1)



A.L.2: Development and validation of advanced EO methods and observation strategies

SEOM annual workplan, based on recommendations from Scientists/Users consultations, to be presented to PB-EO. Examples of activities :

- Sentinel 1
 - TOPSAR simulated data with Terrasar X and Radarsat 2
 - TOPSAR Oceanography in Extended Wide swath
 - Advanced exploitation for interferometric mode with dual polarisation data
- Sentinel 2
 - Atmospheric corrections
 - Simulated products ,Synergy products
- Sentinel 3
 - Exploitation of new SAR Altimetry measurements
 - Advanced Rivers and lakes monitoring
 - SLSTR and OLCI advanced exploitation
- Sentinel 5P advanced exploitation
 - Improved global ozone, air quality, greenhouse gases
 - Sentinel 1/2/3 Synergy studies (follow-up SEN4SCI)



Sentinel 2 simulated Image courtesy RapidEye

SEOM Major Lines of action (2)



A.L.3: Promoting widespread scientific use of data

Sentinel 1/2/3 opportunities for scientific use
New EO Exploitation portal for scientists
Sentinel Handbooks preparation

A.L.4: Developing, validating and maintaining scientific software toolboxes

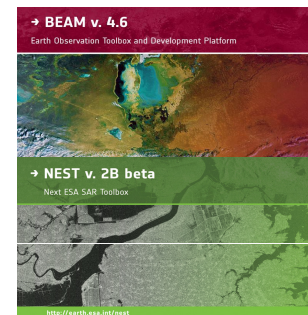
Sentinel 1/2/3 Toolboxes
Sentinel 4/5/5P Toolbox
Tutorial and Practicals for Scientific Training with operational mission data products

A.L.5 Training next generation of European EO scientists

Advanced training in Remote Sensing hosted every year in European Universities and Institutes and focused on theory and data exploitation from operational missions with practicals and tools: Ocean / Land/Atmosphere/Cryosphere RS, Advanced techniques (e.g. Radar Polarimetry , Interferometry), Summer School on Earth System and Modelling, Climate Monitoring and Variables

A.L.6 Scientific Outreach

Ensuring a responsive ESA channel through which EO scientists can make regular, timely, high-quality scientific publications linked to these research domains



Advanced training courses



→ **ESA ADVANCED TRAINING COURSE
IN LAND REMOTE SENSING**



12-16 September 2011 | Kraków, Poland
www.esa.int



ESA-MOST Dragon 2 Programme

→ **ADVANCED TRAINING COURSE
IN OCEAN REMOTE SENSING**



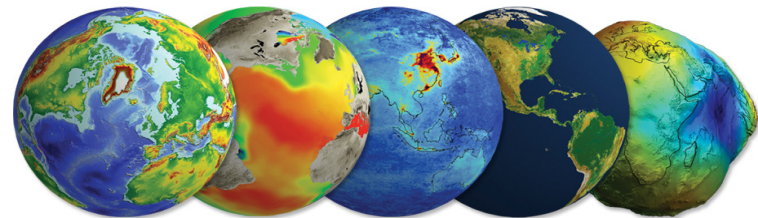
24-29 October 2011 | State Key Laboratory of Estuarine and Coastal Research
East China Normal University

→ **ESA EARTH OBSERVATION SUMMER SCHOOL
ON EARTH SYSTEM MONITORING & MODELLING**

30 July - 10 August 2012

**Planned: training course on altimetry – and coastal altimetry – for India
(links well with AltiKa)**

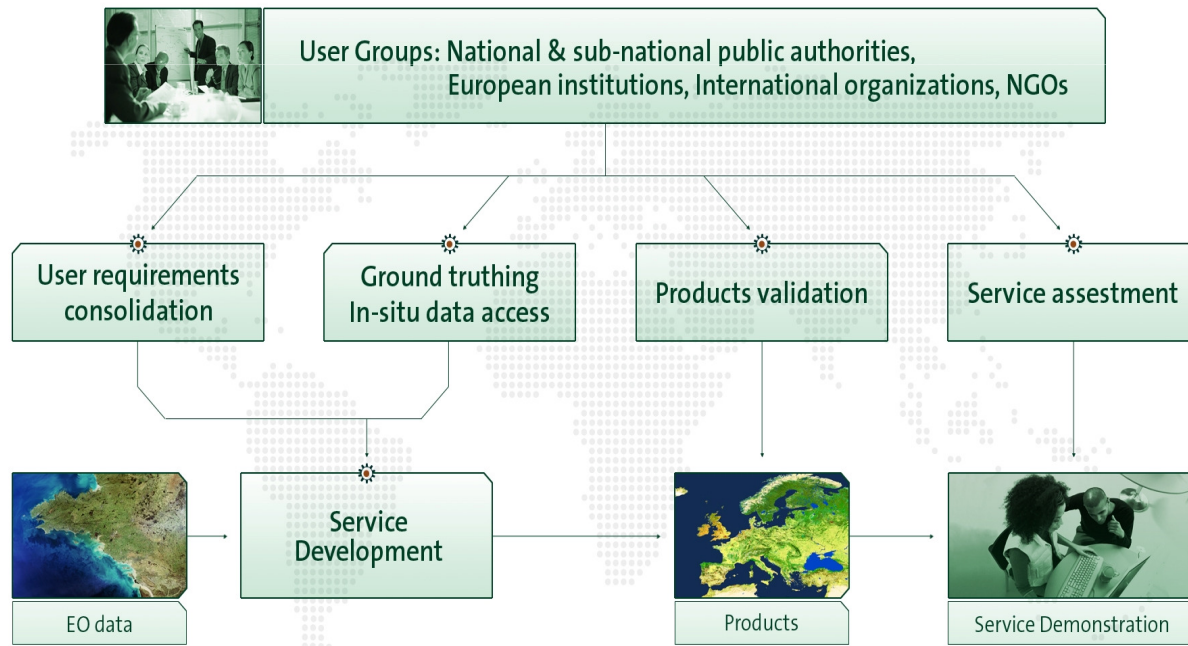
EOEP DATA USER ELEMENT (DUE)



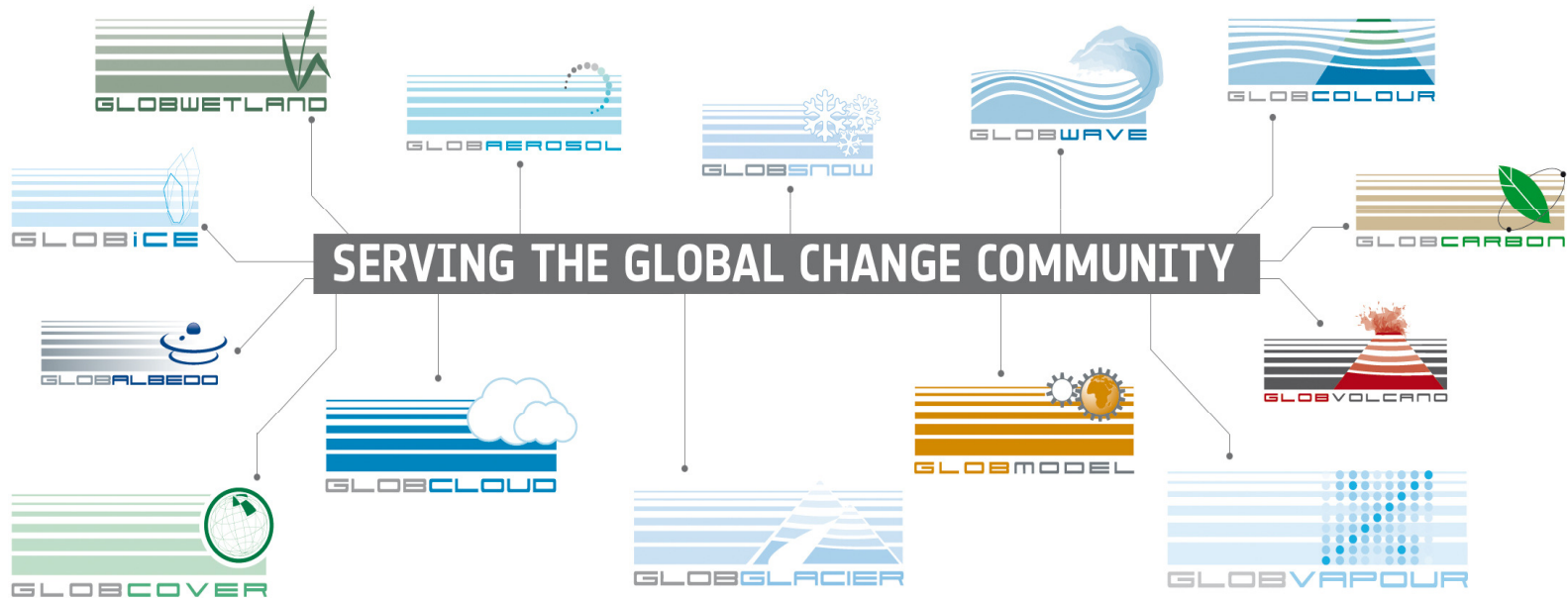
DUE, a user driven process



“The DUE - like its forerunner DUP - is an instrument to support the development of operational EO applications. It is in particular working to support the users of such applications along with the EO service industry, and is instrumental also to encourage the cooperation between parties in the various participating states.”
Dr. Nico Bunnik - Former National Delegate to the Earth Observation (EO) Programme Board



DUE, working with the global change community



- **2 major axes of DUE actions:**

- ◆ **Preparing** for the large-scale production of global data sets in relation principally but not exclusively to the Essential Climate Variables.

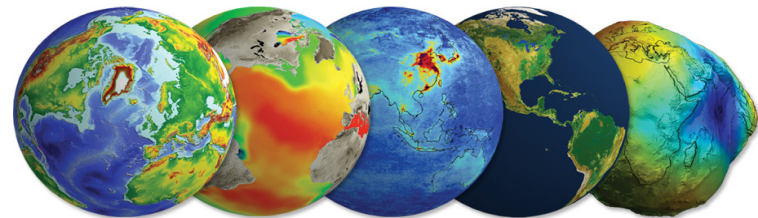
→ a global coastal altimetry dataset?

- ◆ **Reinforcing** the ESA contribution to the implementation of the International Environmental Conventions (UNFCCC, UNCCD, CBD, Ramsar and WHC)



- with an **Innovation element**, allowing innovative EO-based information services to be developed
- 12 projects of 1.5 MEUR | 12 innovator projects of 100 KEUR

VALUE ADDING *ELEMENT* (VAE)



Innovation & Growth *for EO services*

- **New methods / algorithms**
- **New technologies**
- **New EO data sources**
 - Rsat-2, Cosmo, T-SAR-X, RapidEye, Deimos, DMC
- **For EU & International Agencies, already exploiting EO information**
 - EMSA, EEA, FRONTEX, UN

- **Mature Services**
- **Customised to new user needs**
 - Oil & Gas, Insurance, Corporate Sustainable Development, International Development Banks

EOEP Exploitation *summary*



- **Innovation in EO science, methods and applications**
- **New methods developed with data from research and operational missions**
- **New applications developed in cooperation with users**
- **Value-added services developed in cooperation with industry**
- **industry and international stakeholders engaged**
- **Foundation for future operational services**

Coastal altimetry already ticks most of those boxes.....

...one of the purposes of this workshop is to make sure that we keep the momentum and tick them all

Enjoy CAW-6!

