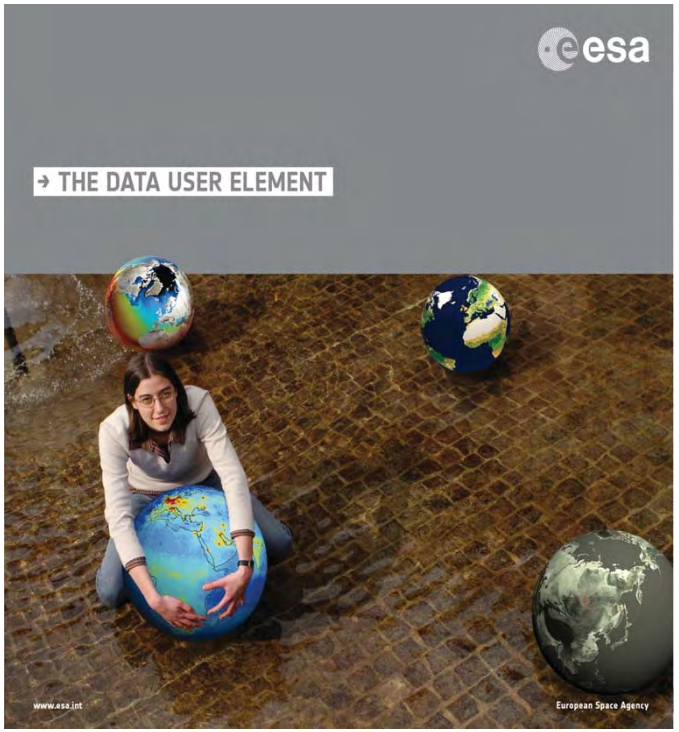
ESA DUE GlobCurrent User Consultation Meeting

IFREMER, Brest France
7-9th March 2012

Craig Donlon and Olivier Arino
European Space Agency



Outline

- Welcome!
- What is ESA?
- ESA Data User Element (DUE)
- GlobCurrent UCM Aims and Objectives
- Expected Outcomes

2 December 2011 MERIS bloom S Atlantic

Purpose of ESA

"To provide for and promote, for exclusively peaceful purposes, cooperation among European states in **space research** and **technology** and their **space applications.**"

Article 2 of ESA Convention

2012 Ministerial Council International Organisation of 19 Member States

- Chaired by Italy in November 2012
- Ministers responsible for space activities in ESA's Member States and Canada
- Invited to approve new ESA activities and continuation of existing programmes
- EOEP-4 (4th slice of the Earth Observation Envelope Programme which includes DUE) is an optional programme at ESA
- **Please ensure that your Ministers are aware of the importance of EOEP-4**


venus express
rosetta
planck
herschel
cluster
observing the earth
launchers
automated transfer vehicle
human spaceflight and exploration
esa
observing the earth
European Space Agency

ERS 1 (1991 - 2000)
ERS 2 (1995 - Sept 2011)

- **Radar Altimeter:** Ku band (13.8 GHz)
- **Wind Scatterometer :** C-band (5.3GHz VVpol)
- **Synthetic Aperture Radar:** C-band (5.3 GHz VVpol)
- **Along Track Scanning Radiometer ATSR-1/2 :** (1km imaging radiometer, 1.6, 3.7, 11 and 12μm, ATSR-2 includes 0.65, 0.85, 0.87μm)
- **Microwave Radiometer:** 20km 23.8 and 36.5GHz
- **Global Ozone Monitoring Experiment:** (GOMOS: UV & VIS spectrometer)
- **PRARE:** microwave satellite tracking system

ENVISAT (2002- and still going!)
Our workhorse platform of today

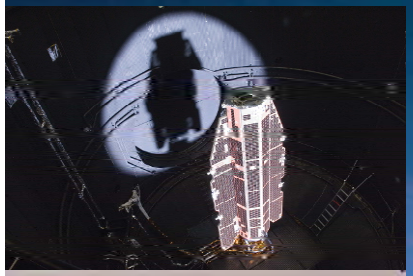
- **MERIS:**
  15 band Pushbroom spectrometer VIS/NIR bands at 390 nm to 1040 nm
- **Radar altimeter RA2:**
  2nd generation Ku & S band (13.8 /3.2 GHz)
- **Microwave Radiometer MWR:** 20km 23.8 GHz and 36.5 GHz
- **Advanced Synthetic Aperture Radar ASAR:**
  C-band 5 polarisation modes: VV, HH, VV/HH, HV/HH, or VH/VV
- **Advanced Along Track Scanning Radiometer AATSR:**
  1km imaging radiometer VIS/IR bands at 0.555, 0.659, 0.87 1.6, 3.7, 11 and 12µm

- **GOMOS:** medium resolution spectrometer covering the wavelength range from 250 nm to 950 nm.
- **MIPAS:** Michelson interferometer limb sounder for atmospheric chemistry
- **SCIAMACHY:** imaging spectrometer for trace gases in the troposphere and in the stratosphere
- **DORIS:** microwave orbit tracking system
- LRR: laser retro-reflector orbit tracking

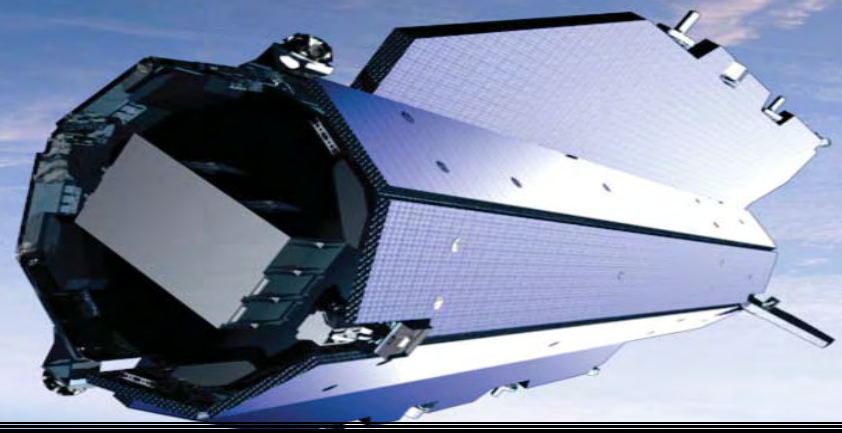
GOCE: ESA's Gravity Mission

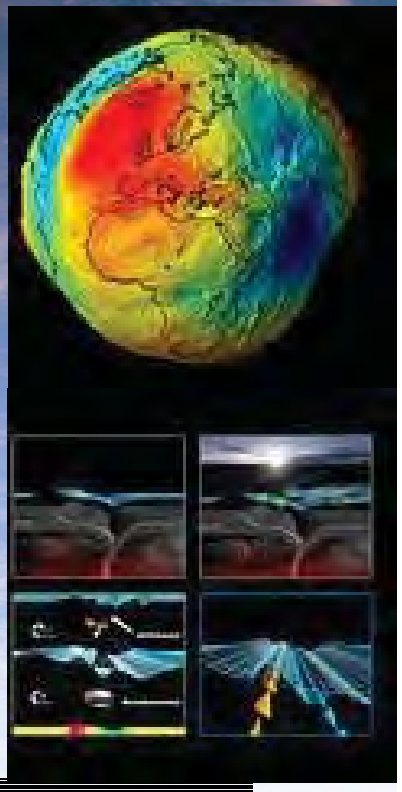
http://www.esa.int/goce
https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/goce

The Gravity field and steady-state Ocean Circulation Explorer (GOCE)



Launched 17th March 2009!!





Its objectives are to improve understanding of:

- global ocean circulation and transfer of heat
- physics of the Earth's interior (lithosphere & mantle)
- sea level records, topographic processes, evolution of ice sheets and sea level change

SMOS: Soil Moisture and Ocean Salinity Mission

http://www.esa.int/smos
https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/smos

Launched 2nd Nov 2009

Its objectives are:

- to provide global maps of soil moisture and ocean salinity for hydrological studies (Target **accuracy of 0.1 psu for a 10-30 day average for an open ocean area of 200 x 200 km)**
- to advance our understanding of the freshwater cycle
-to improve climate, weather and extreme-event forecasting
-Instrument: Microwave Imaging Radiometer with Aperture Synthesis (MIRAS)

CryoSat2: ESA's Ice Mission

http://www.esa.int/goce

https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/cryosat

Launched 8th April 2010

Its objectives are to improve our understanding of:

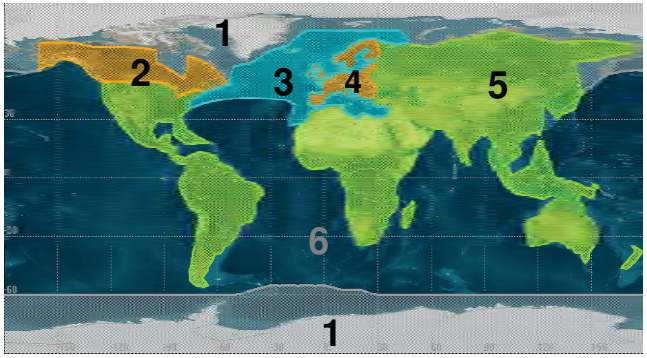
- thickness and mass fluctuations of polar land and marine ice
- to quantify rates of thinning/thickening due to climate variations
- Instrument: Ku band SIRAL (SAR Interferometric Radar Altimeter)

Also provides the first satellite ocean SAR altimetry

Sentinel–1: C-band SAR mission

http://www.esa.int/esaLP/SEMBRS4KXMF_LPgmes_0.html

- **Applications:**
  - **ice, marine and land monitoring**
  - **rapid mapping in crisis situations**
- **6-day repeat cycle (with 2 satellites)**
- **Sun synchronous orbit at 693 km mean altitude**
- **2300 Kg spacecraft mass**
- **7 years design life time, consumables for 12 years**



20 years continuous repeat observation by a C-band synthetic aperture radar constellation to completely cover:

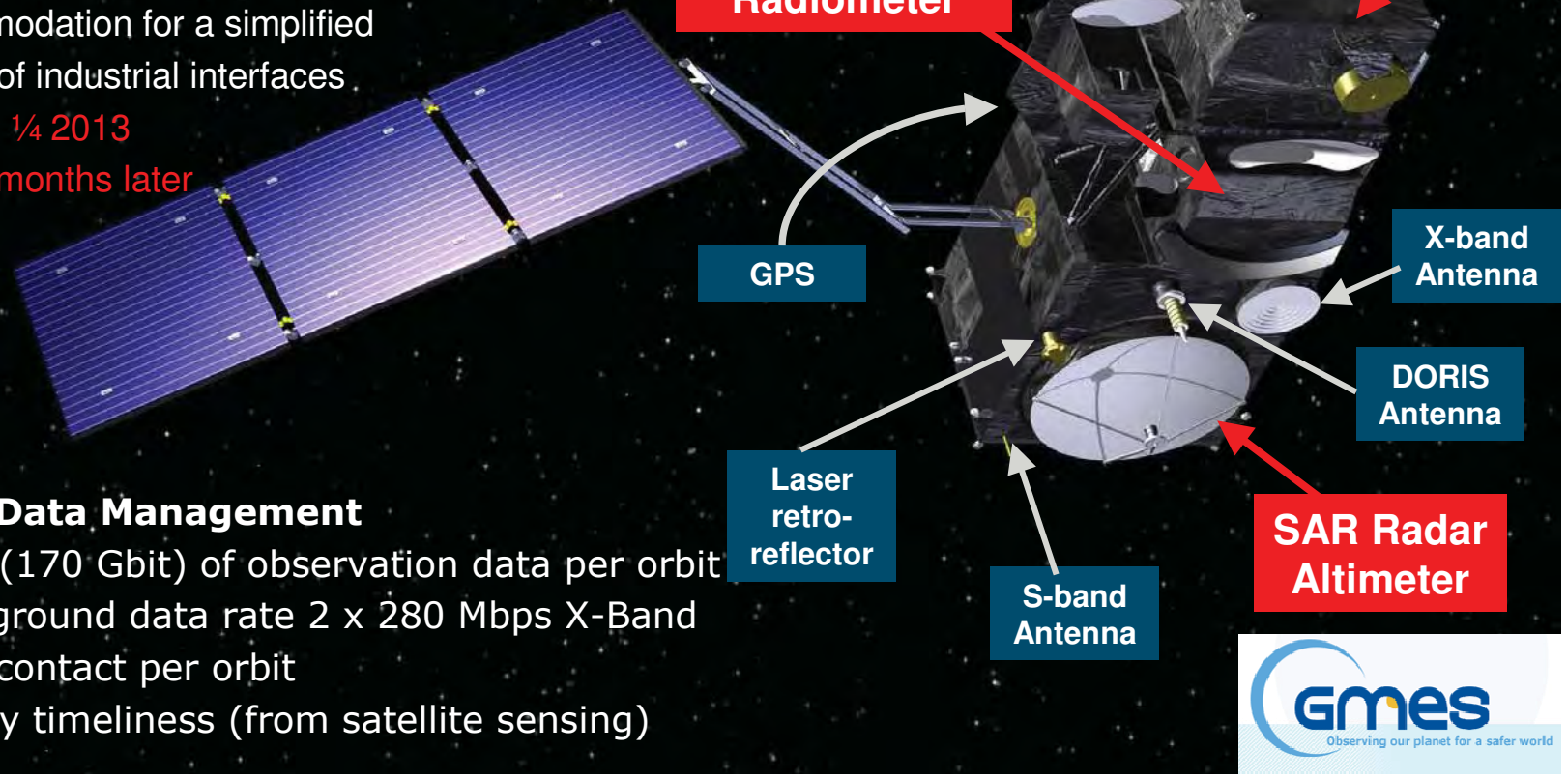
the world's land masses on a two-weekly basis
Arctic, Antarctic, coastal zones and shipping routes on a daily basis
open ocean continuously by imagettes

Sentinel-3

http://www.esa.int/esaLP/SEMTST4KXMF_LPgmes_0.html

Main satellite characteristics

- 1250 kg maximal mass
- Volume in 3.89 m x 2.202 m x 2.207 m
- Average power consumption of 1100 W
- 7.5 years lifetime (fuel for 5 add. years)
- Large cold face for optical instruments thermal control
- Modular accommodation for a simplified management of industrial interfaces
- Launch S3A last ¼ 2013
- Launch S3B 18 months later

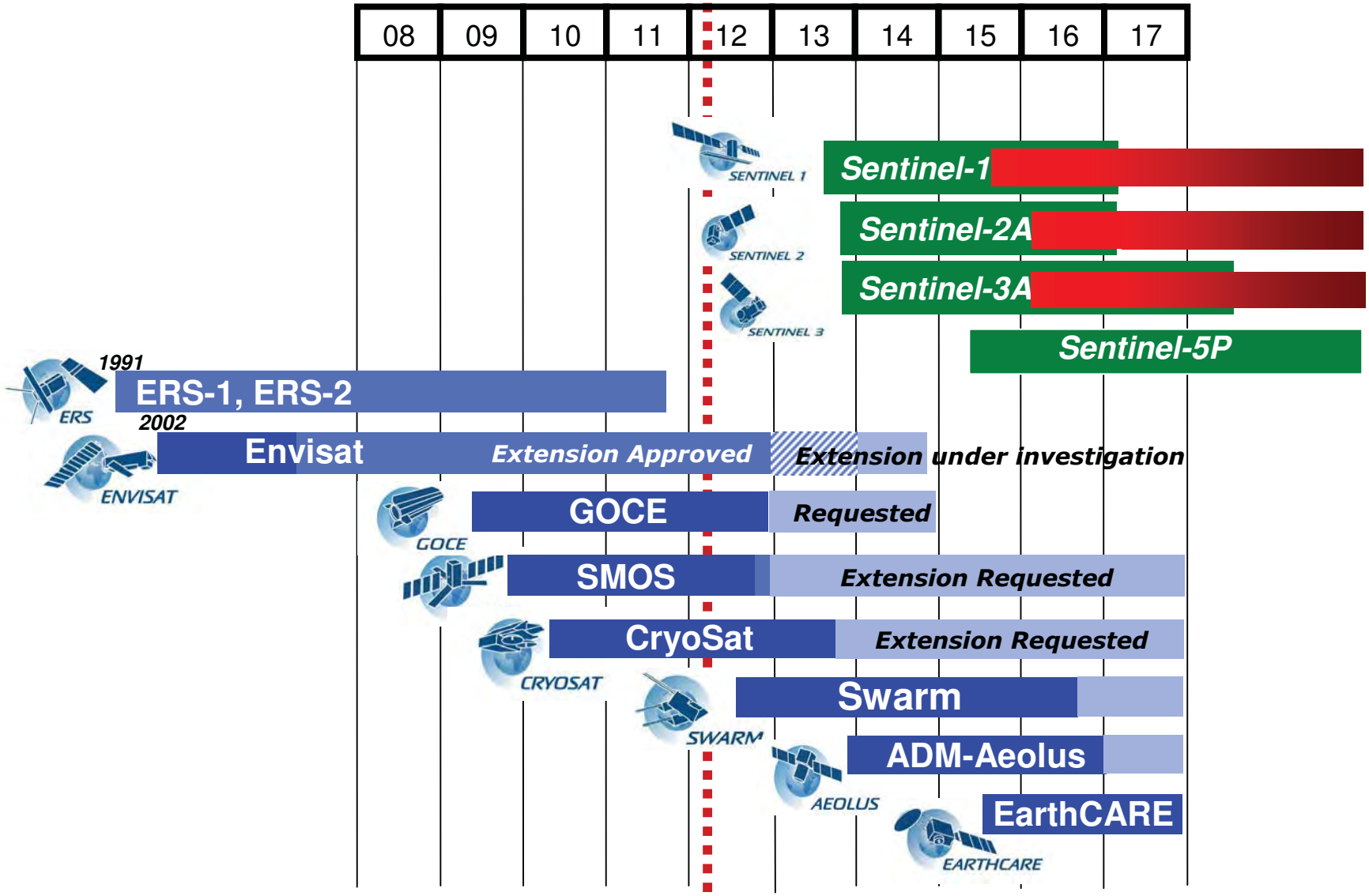


Observation Data Management

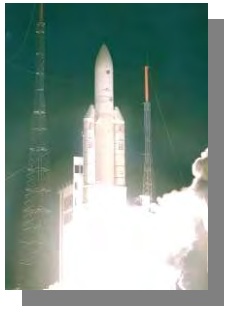
- 21.25 Gb (170 Gbit) of observation data per orbit
- Space to ground data rate 2 x 280 Mbps X-Band
- 1 ground contact per orbit
- 3h delivery timeliness (from satellite sensing)

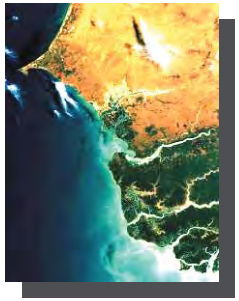
GMES
Observing our planet for a safer world

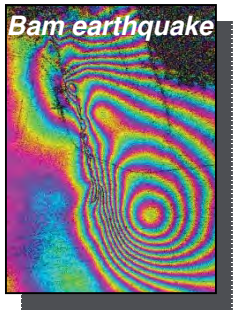
Timeline: Sentinels & other ESA missions

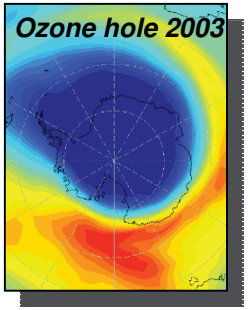


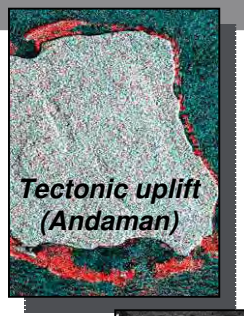
ESA EO: thousands of scientific projects

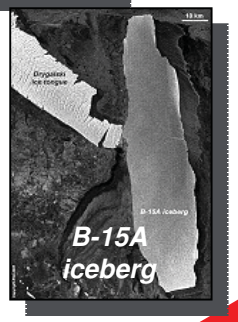


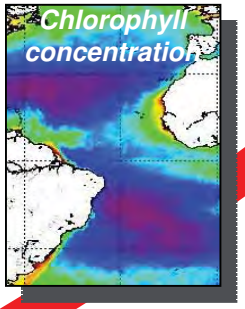


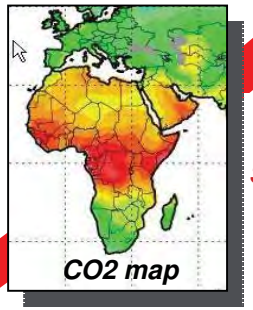


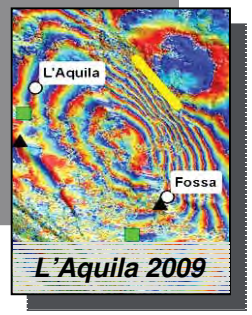


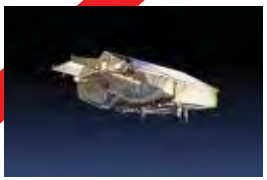




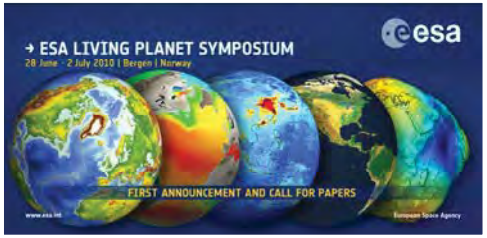








Serving 3000+ scientific projects and many operational users (including GMES Services)



Launch
Mar 02

Envisat Symposium
Salzburg (A)
Sep 04

Envisat Symposium
Montreux (CH)
Apr 07

and many workshops dedicated to specific Envisat user communities

Living Planet Symposium
Bergen (N)
Jun 10

ESA Data User Element

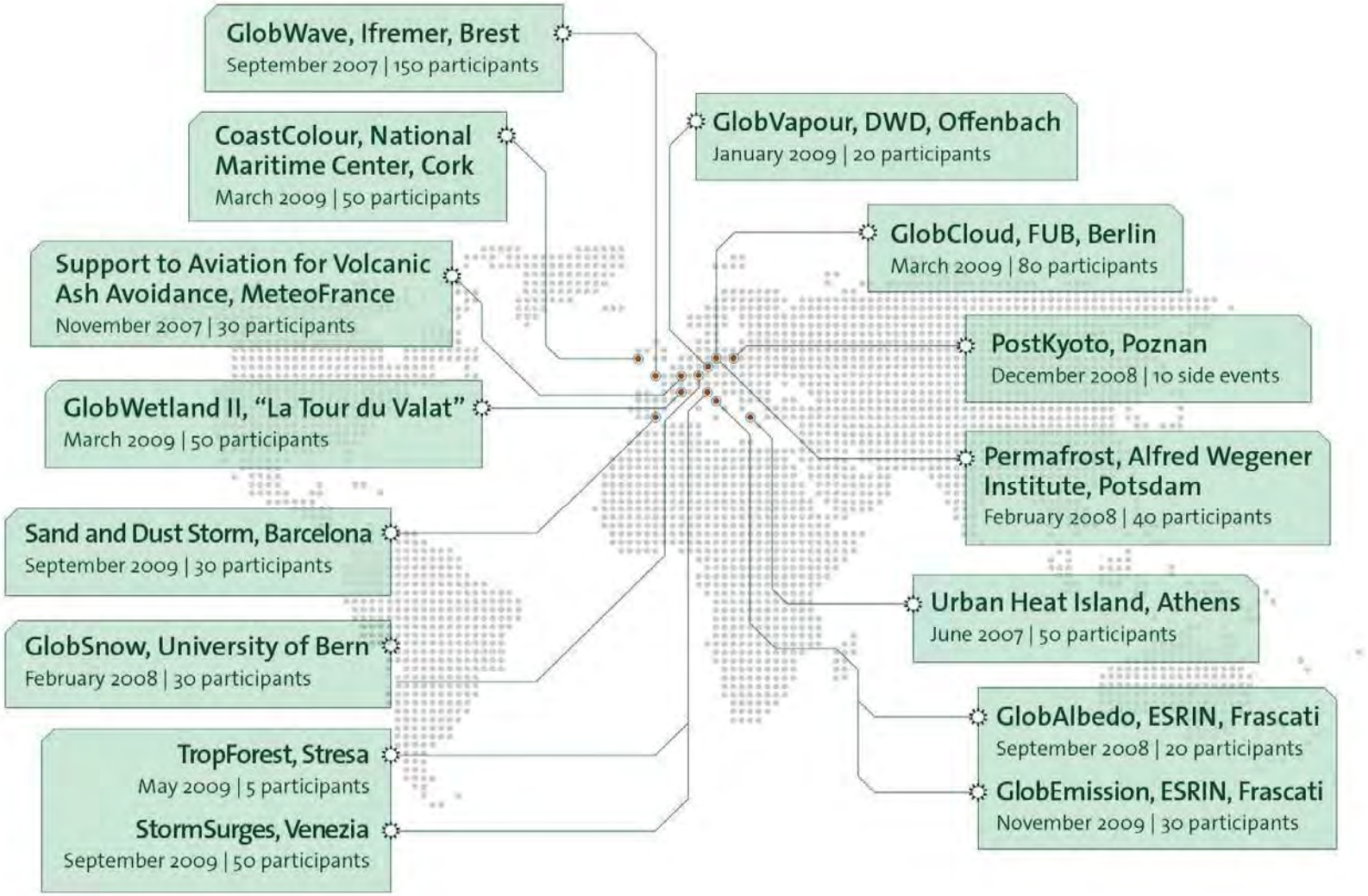
- **The mission of the Data User Element (DUE) is**
  - "…to encourage the establishment of a long-term relationship between user communities and Earth Observation..."
  - Implement user driven R&D projects to transfer research to applications
- **DUE projects are run in close collaboration with users:**
  - User Requirements are defined prior to the issue of an Invitation to Tender
  - Collection of letters of commitment from Champion Users
  - Users involved as advisors during the project (annual user consultation workshop)
  - Users assess the project results
- **We MUST have your user requirements to conduct any project**

DUE eSurge

DUE GlobWave

DUE GlobColour

DUE Consults Users



ESA StormSurge

http://www.storm-surge.info

Workshop: Satellite Data for Storm Surge Modelling and Forecasting Copenhagen, Denmark, 10-11 September 2012.Register at www.storm-surge.info/workshop.

DUE Engages Users

User Groups: National & sub-national public authorities,
European institutions, International organizations, NGOs

User requirements consolidation

Ground truthing In-situ data access

Products validation

Service assestment

EO data

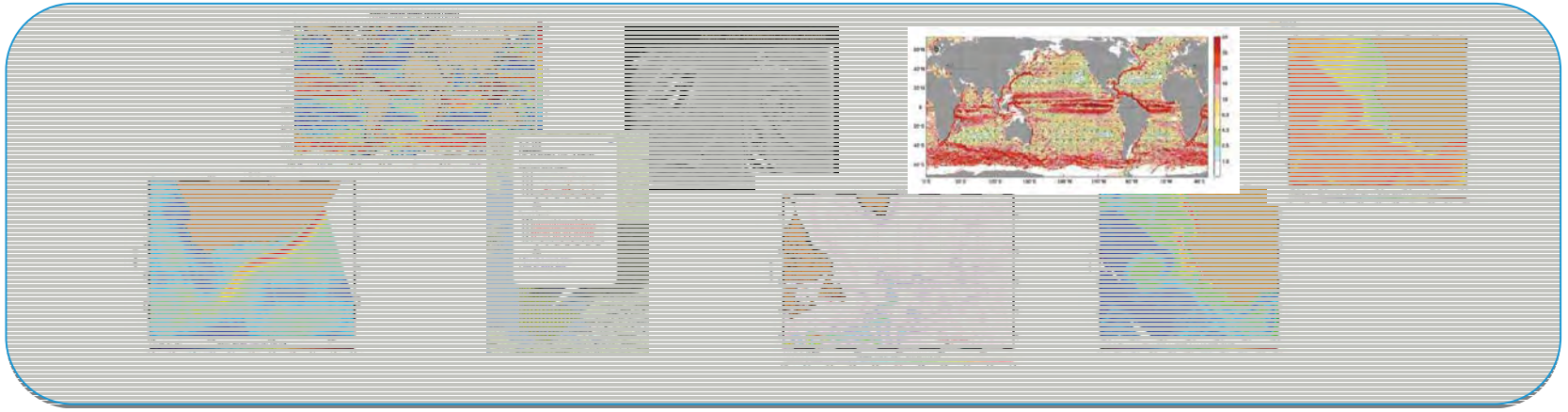
Service Development

Products

Service Demonstration

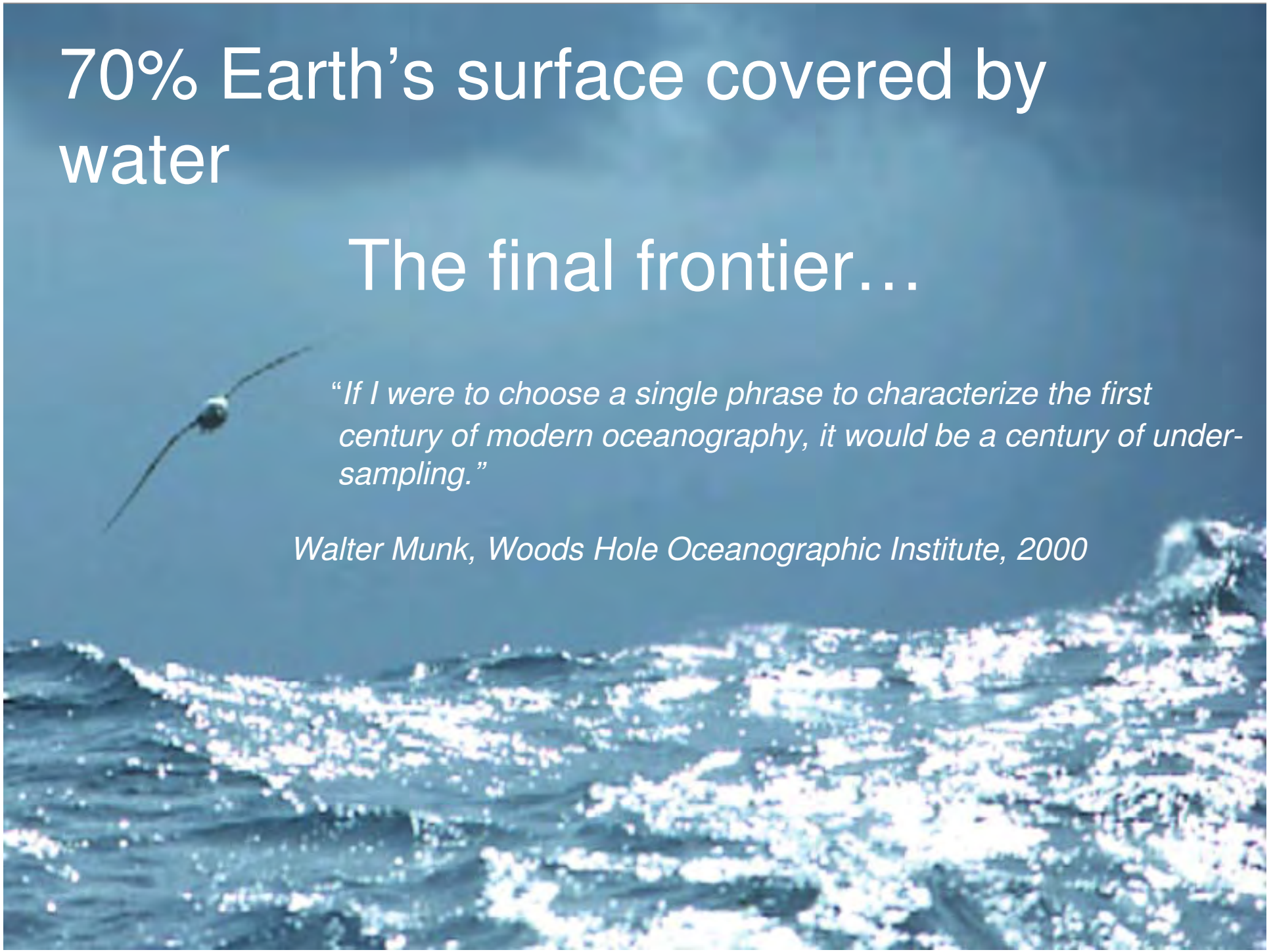
GLOBCURRENT

New potential and synergetic interpretation of upper layer dynamics from Earth Observation Products



70% Earth's surface covered by water

The final frontier…



"*If I were to choose a single phrase to characterize the first century of modern oceanography, it would be a century of under-sampling.*"

Walter Munk, Woods Hole Oceanographic Institute, 2000

First Ocean Currents…

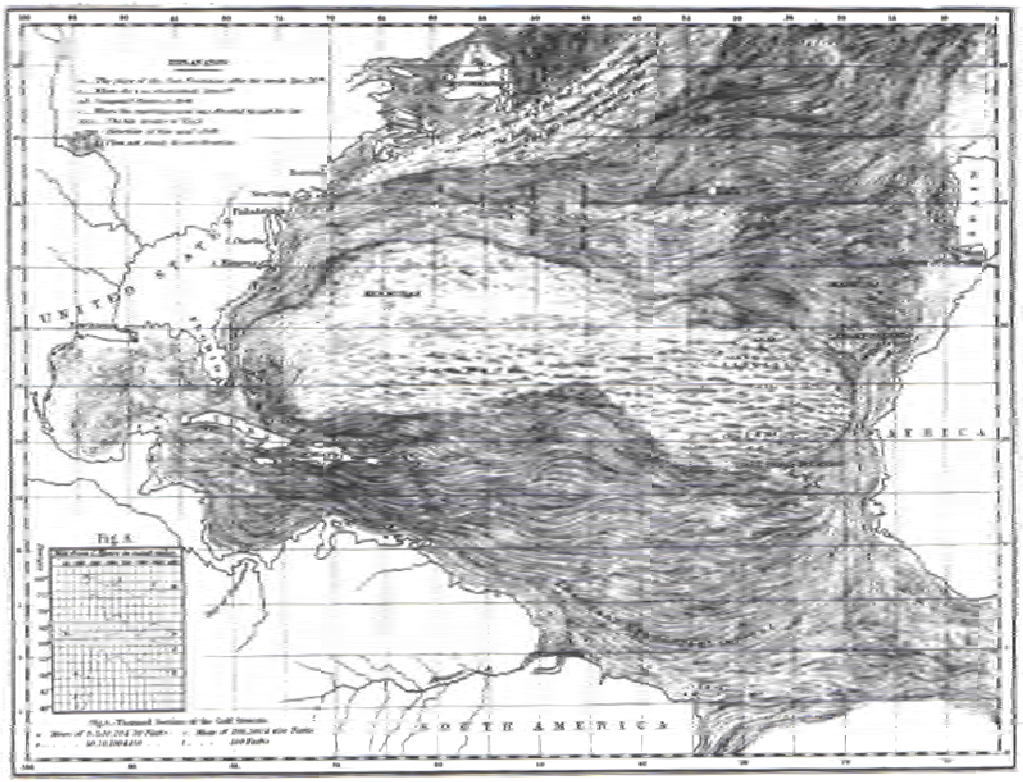
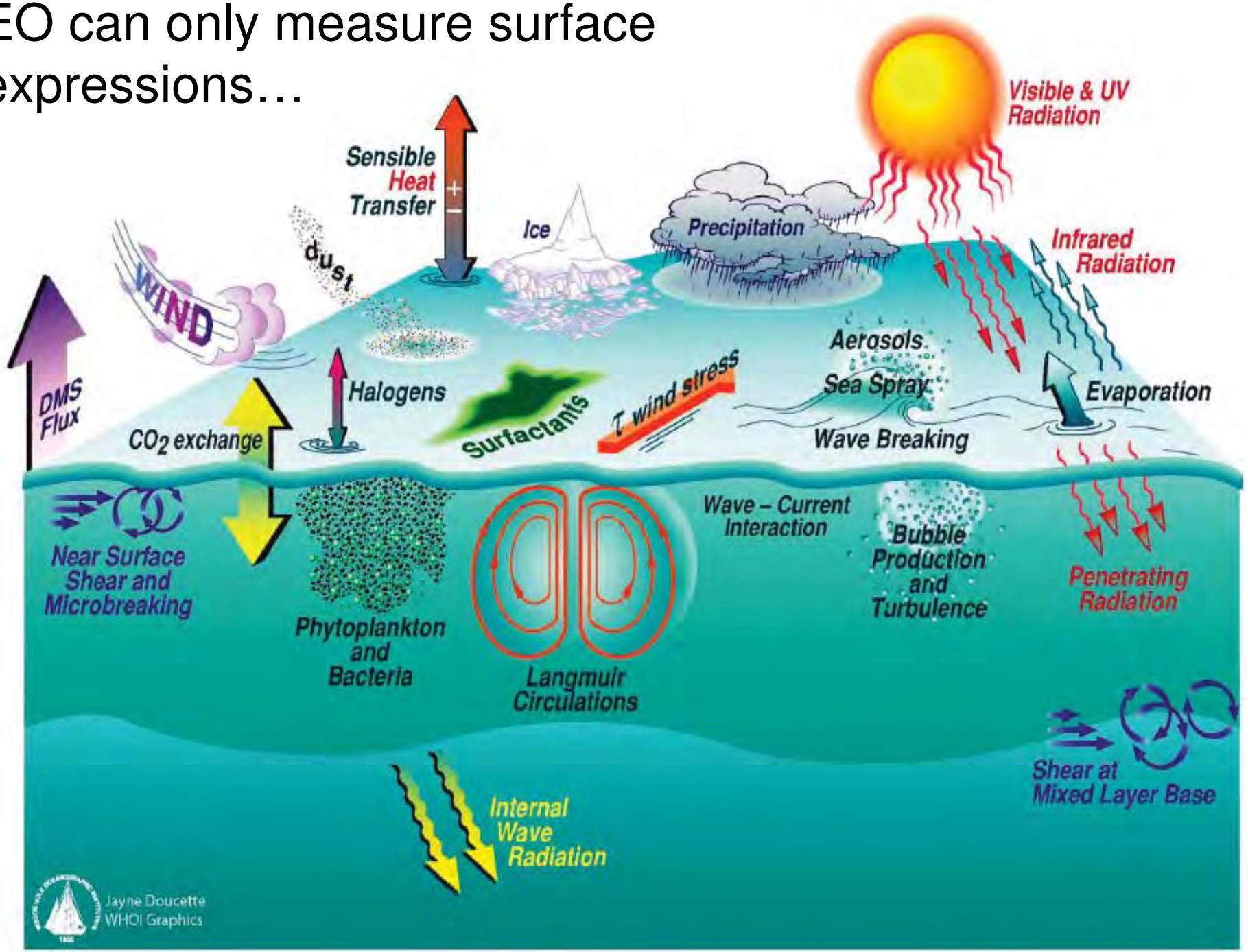


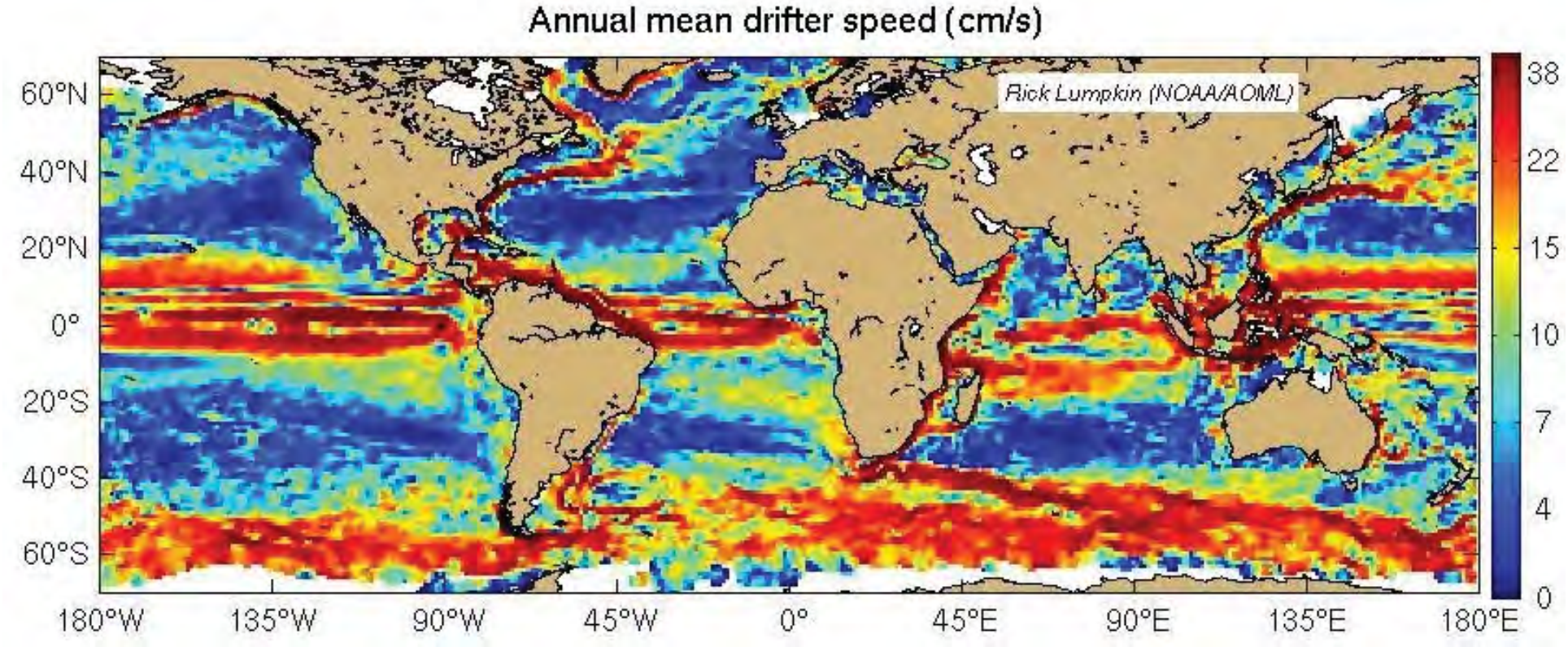
Chart of the Gulf Stream and North Atlantic Drift from ship logs
(M. Maury)

Matthew Fontaine Maury (1806 –1873): 1853 Brussels Conference on Observation Practice

EO can only measure surface expressions…



Global Mean currents from Drifting buoys

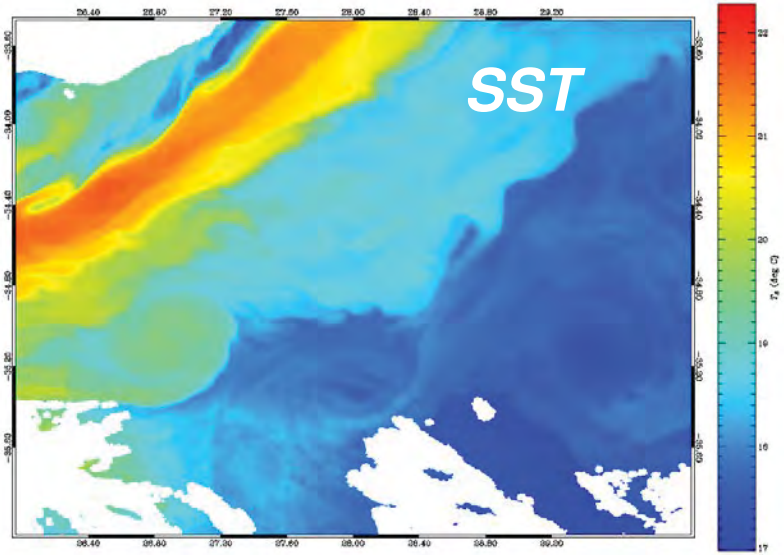


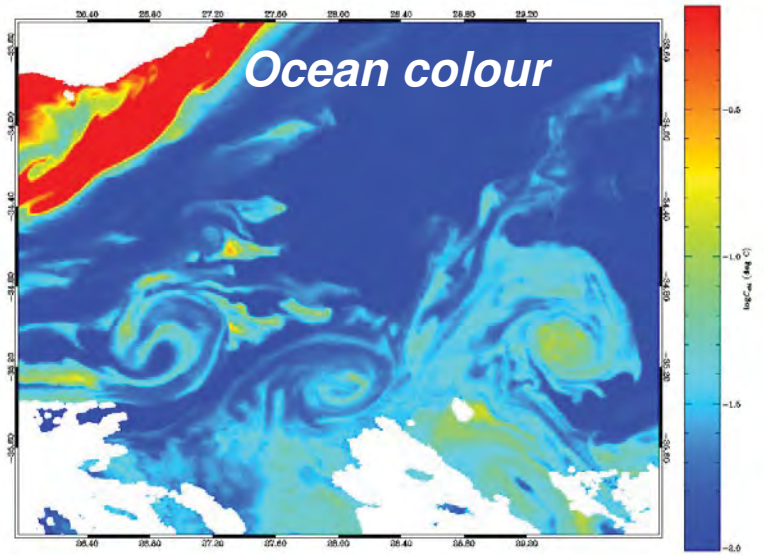
Climatology of near-surface currents for the world, at one degree resolution, derived from satellite-tracked surface drifting buoy observations.

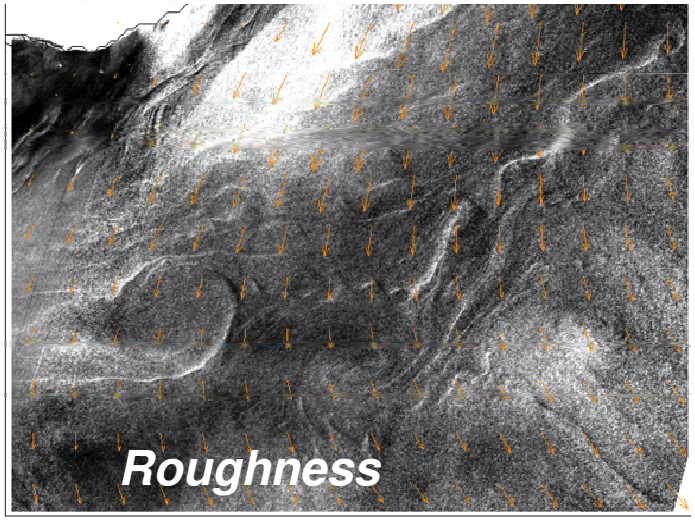
Lumpkin, R. and Z. Garraffo, 2005: Evaluating the Decomposition of Tropical Atlantic Drifter Observations. J. Atmos. Oceanic Techn. I 22, 1403-1415.

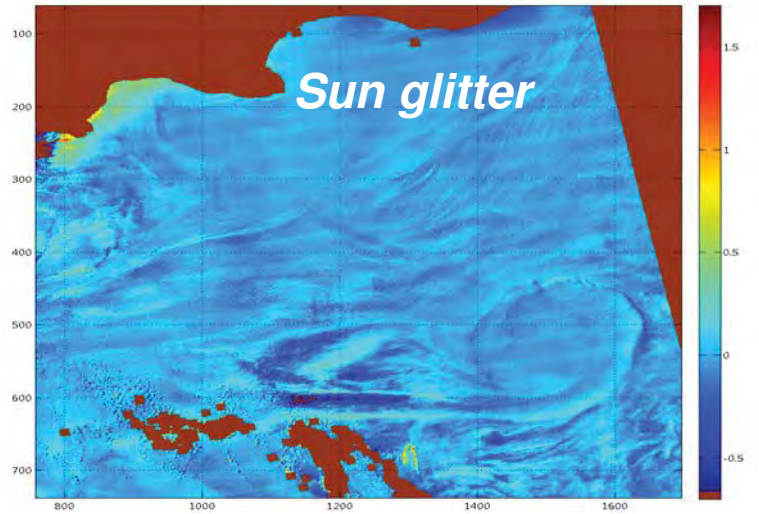
Challenge: To Exploit Synergy and Mesoscale Processes

(Kudryatsev et al, JGR 2012 in press)

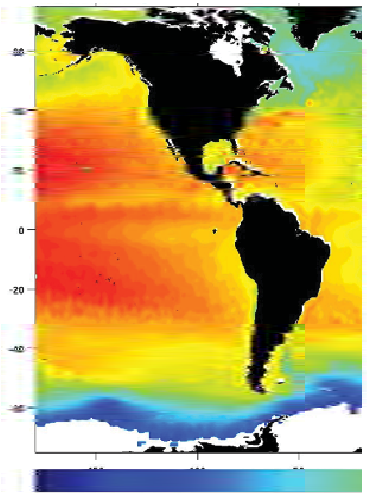




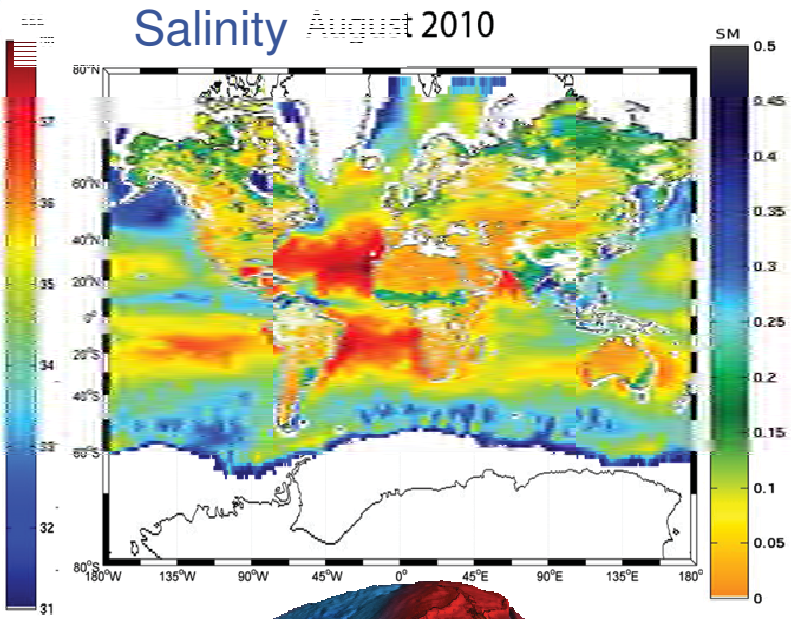


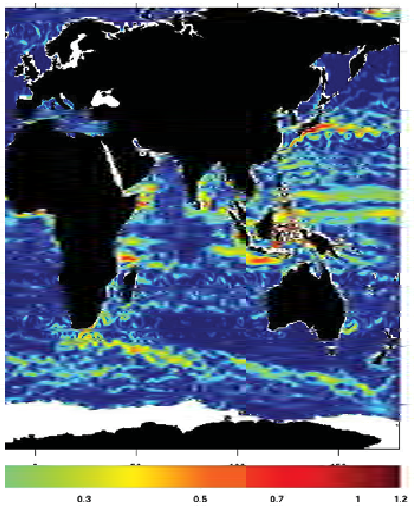


Global Ocean Products

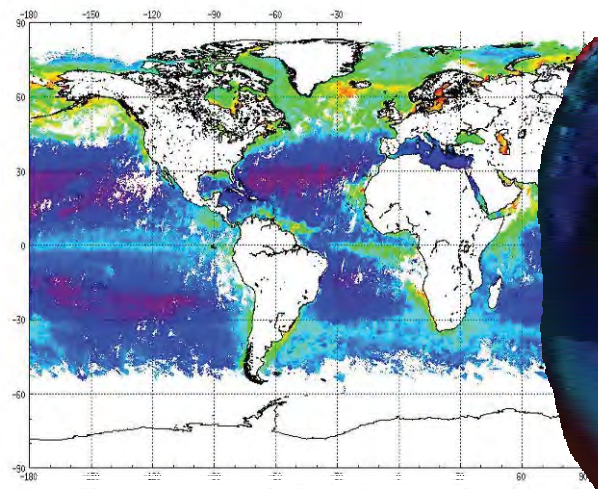


Dynamic Topography

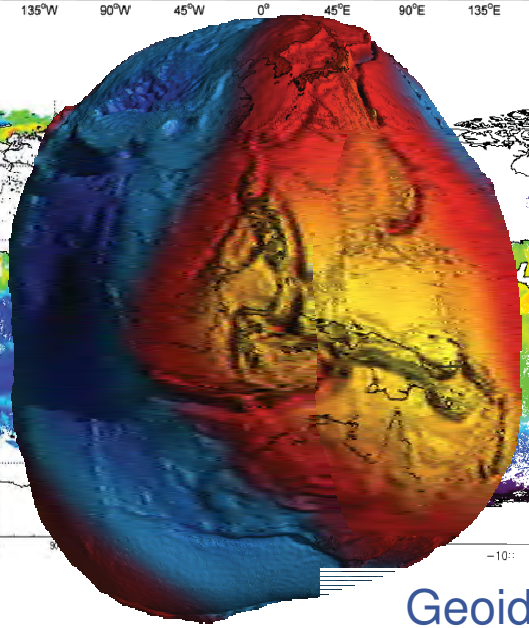




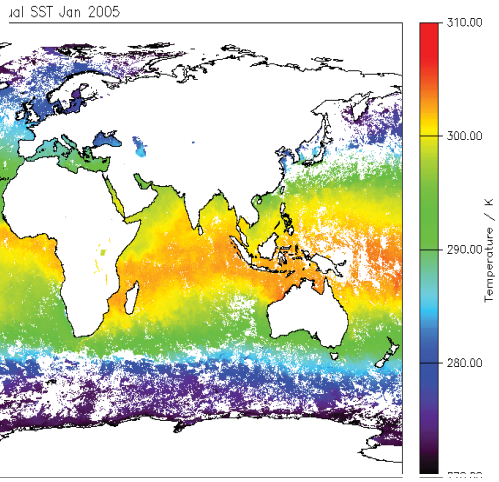
Geostrophic Ocean Currents



Ocean Colour



Geoid



Sea Surface Temperature

ESA Globcurrent Project

- **A new ESA Data User Element project for 2013**
- **€1.5 Million earmarked for a 2 year project**

Aim:

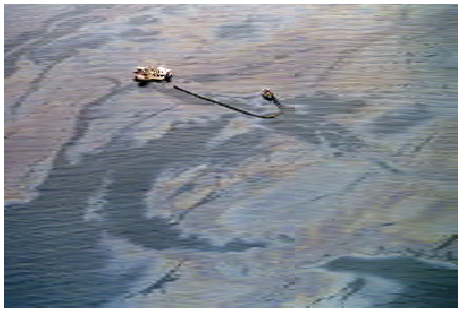
- Develop and demonstrate R&D activities for ***EO derived*** ocean surface currents…
- over a 2 year period…
- based on the innovative use of satellite and in situ data…
- linked to **external user applications** that will demonstrate their utility.
- ***Increase the use of ESA and ESA Third Party Mission EO data***.

User Communities…

- Shipping
- Offshore energy
- MetOcean Services
- Oil and Gas Industries
- Numerical Weather Prediction and Numerical Ocean Prediction (NWP/NOP)
- Coastguard, Search and Rescue (GMDSS)
- Maritime Pollution services
- Ports and Harbours
- Hydrographic survey
- Aquaculture and fisheries
- Insurance Industry
- Offshore sailing
- Ice Services
- Local authorities
- Space Agencies
- Defence agencies







Potential GlobCurrent scope (defined by user requirements – in part at this meeting)

- ***Data:*** Integration, harmonisation and cataloguing of existing (satellite and in-situ) data streams,
- ***Products:*** processing and delivery of new types of products, based on existing research,
- ***R&D:*** Development and testing of new retrieval techniques for ocean surface currents from EO data including the use of complementary EO data in synergy,
- ***R&D:*** development of uncertainty estimates for EO ocean surface current estimates,
- ***R&D:*** activities supporting data inter-comparisons and validation,
- ***Demonstration:*** Products and activities supporting the needs of surface drift applications, ocean modelling teams, data assimilation schemes, model validation, scientific research or commercial exploitation.
- ***Communication:*** Development of a web portal, a data archive, or software tools to assist the user community in the discovery and application of EO derived surface ocean current data,

The User Consultation Meeting

- The purpose of this ting, is to bring users and experts togethe
  - ***Define us ject, identify the priority E n, innovative EO products, regions of interest.***
- A set of templates a dback what you need
- We also need a num use the outputs of the project, help to guid t outcomes and to provide ESA with ad
- **Without your user requirements there can be no ESA GlobCurrent Project – so please fill in the UCM feedback forms**

- What does your user application want?
  - Products, data delivery, timeliness, tools, documentation, access, product uncertainties?

- What can be done?
  - Develop/Implement/Transfer R&D activities/products to consolidated, systematic, robust demonstration activities with user engagement.

- What are the project boundaries?

  Location, duration, reprocessing, interfaces, access, data amount…

GlobCurrent ITT Process Logistics

- March 2012: UCM
- July 2012: Return of User Requirements
- Sept 2012 Consolidated Public URD
- Early 2013: Issue of Invitation To Tender (ITT)
- 1st qtr 2013: Selection of one winning bid
- Spring 2013: Project Kick Off (2 year project with 2+ UCM)

We are here to listen to your needs…

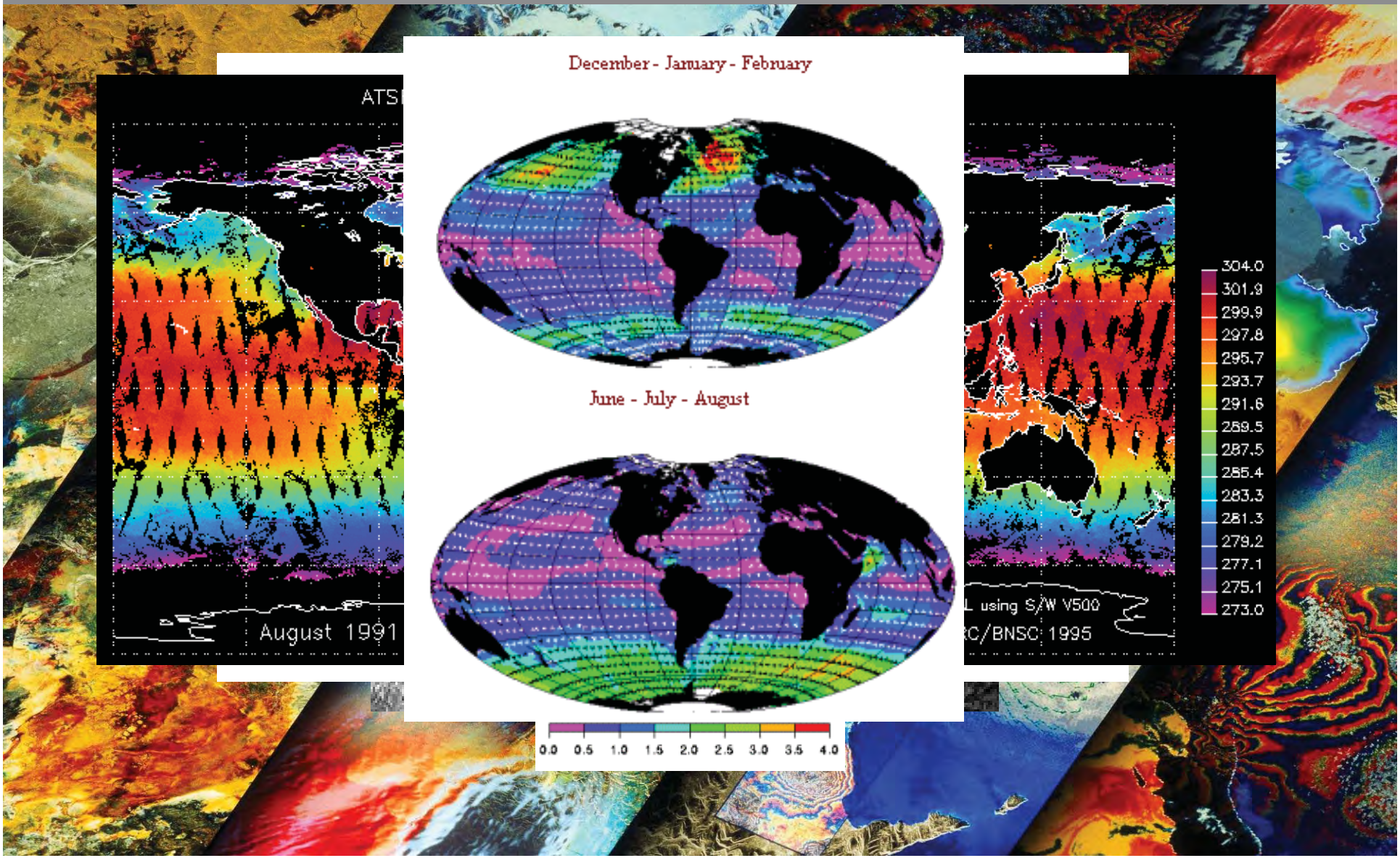
Thank you - any questions?

For more information

http://www.esa.int

Contact: craig.donlon@esa.int

ERS Ocean Highlights



Outputs: User Commitments

ESA GlobCurrent User Consultation Meeting

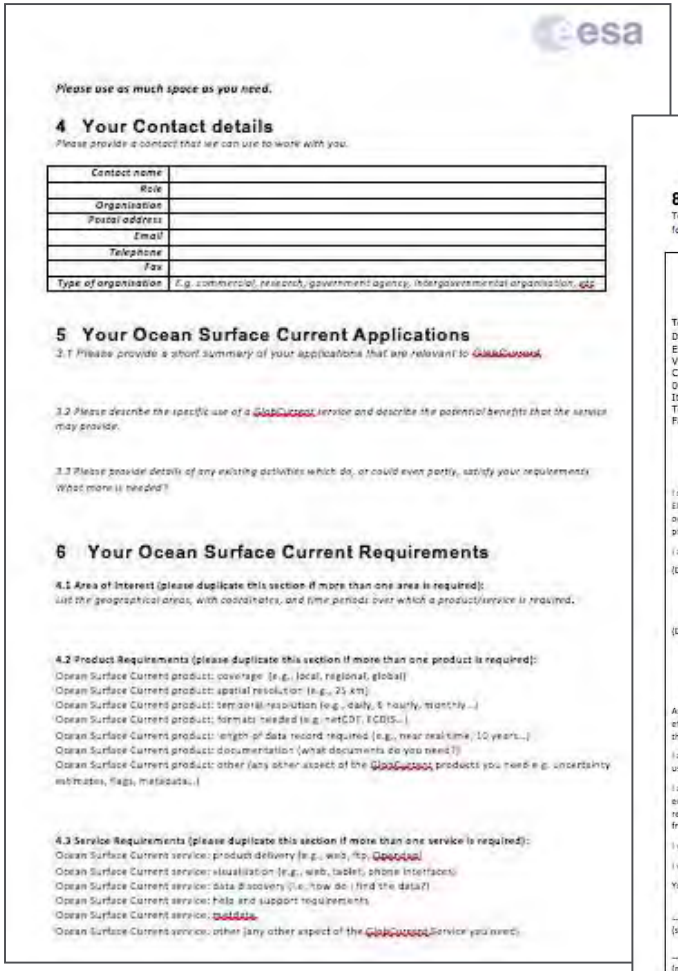
IFREMER, Brest, France, 7-9 March 2012

Lucien Laubier Conference Room

User Requirements User Inputs

(Version 1.2)

Released 5th March 2012



Please use as much space as you need.

4 Your Contact details

Please provide a contact that we can use to work with you.

Contact name	
Role	
Organisation	
Postal address	
Email	
Telephone	
Fax	
Type of organisation	*E.g. commercial, research, government agency, intergovernmental organisation, etc*

5 Your Ocean Surface Current Applications

5.1 Please provide a short summary of your applications that are relevant to GlobCurrent.

5.2 Please describe the specific use of a GlobCurrent service and describe the potential benefits that the service may provide.

5.3 Please provide details of any existing activities which do, or could even partly, satisfy your requirements. What more is needed?

6 Your Ocean Surface Current Requirements

4.1 Area of interest (please duplicate this section if more than one area is required):
List the geographical areas, with coordinates, and time periods over which a product/service is required.

4.2 Product Requirements (please duplicate this section if more than one product is required):
Ocean Surface Current product: coverage (e.g., local, regional, global)
Ocean Surface Current product: spatial resolution (e.g., 25 km)
Ocean Surface Current product: temporal resolution (e.g., daily, 6 hourly, monthly...)
Ocean Surface Current product: formats needed (e.g. netCDF, ECOS...)
Ocean Surface Current product: length of data record required (e.g., near real time, 10 years...)
Ocean Surface Current product: documentation (what documents do you need?)
Ocean Surface Current product: other (any other aspect of the GlobCurrent products you need e.g. uncertainty estimates, flags, metadata...)

4.3 Service Requirements (please duplicate this section if more than one service is required):
Ocean Surface Current service: product delivery (e.g., web, ftp, OpenDap)
Ocean Surface Current service: visualisation (e.g., web, tablet, phone interfaces)
Ocean Surface Current service: data discovery (i.e., how do I find the data?)
Ocean Surface Current service: help and support requirements
Ocean Surface Current service: metadata
Ocean Surface Current service: other (any other aspect of the GlobCurrent service you need).

8 Letter of Commitment

To take part in the *ESA GlobCurrent project* as a Champion user we ask you to send us a letter of commitment following the template below:

From: <your name>

<your address>

To: Dr. Olivier Arino
Data User Element Programme Manager
ESA/ESRIN
Via Galileo Galilei
Casella Postale 64
00044 Frascati (Roma)
Italy
Tel: +39 06 941801
Fax: +39 06 94180280

Re. ESA GlobCurrent Project: CHAMPION USER COMMITMENT LETTER

I send you this commitment letter to indicate my agreement to collaborate with ESA as a champion user in the Data User Element GlobCurrent project, which will define, develop and demonstrate an earth observation service supporting the ocean surface current user community. I understand that the GlobCurrent project will be a project funded by ESA with the primary objective of fulfilling the user requirements of the ocean surface current user community.

I agree to take the responsibility for:

(During the preparation of the project):

- Delivering a User Requirements Document following the template provided by ESA;
- Providing expert advice in the definition of the project activities

(During the project lifetime)

- Facilitating access to existing data (e.g., *in-situ* data) that may be useful for the project;
- Advising the contractor in the consolidation of the User Requirements during the initial phase of the project;
- Performing an evaluation of the project outcomes at the mid-term and final reviews;

As a user and potential beneficiary of the outcomes of the GlobCurrent project, I agree to contribute **three man-months** of effort to the project (or an equivalent in-kind contribution, such as providing access to existing data or services on which the project can build – to be specified in an annex to this letter).

I am aware that the project is scheduled to start in mid 2010, will last for **three** years, and that ESA will provide me and the user community with free access to the results of the project.

I accept that this collaboration does not imply any exchange of economic resources between ESA and my organization. I equally accept to collaborate during the project with the consortium that ESA selects following evaluation of the proposals received in answer to the open and competitive GlobCurrent project invitation to Tender (ITT), and that I will withdraw from my role as a GlobCurrent project champion user if I am involved in the successful bid.

I will respect the scheduling of delivery dates, to be agreed during the kick-off of the project;

I will encourage and promote use of the project results;

Yours sincerely,

....
(signature) (date)

.....
(name)

US Coast Guard (A. Allen)

United States Coast Guard
U.S. Department of Homeland Security

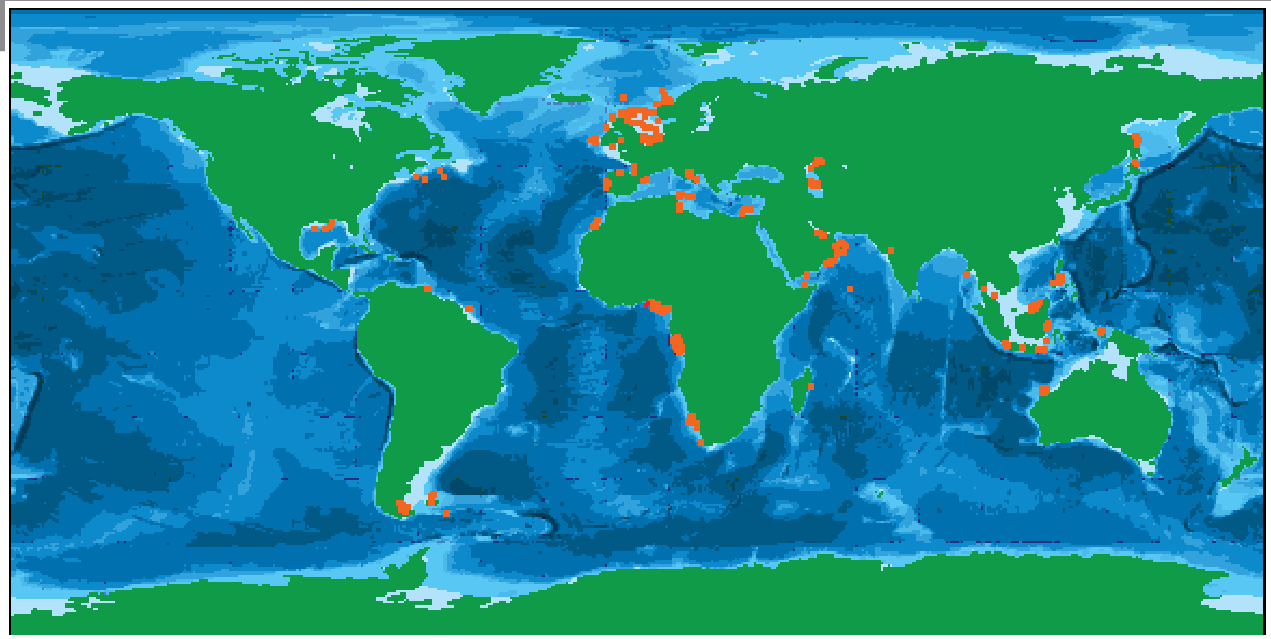
- 1) Explain surface current data they need for their applications:
- 2) How it should be delivered:
- 3) How accurate should the products be.

- Answer to 1) Search And Rescue missions require surface current (top 1- meter) fields now casted and forecasted an minimum of 24 hours. While longer forecasts are generally better, we don't plan further ahead than 24 hours, the extra forecasted fields provide 'cover' when the source goes down, and we rely on the forecasted fields until the source is recovered. If you are providing data vs. models, then we prefer that your data be assimilated into a model or models to fill in the nowcasted fields and produce the forecasted fields.

- Answer to 2) NetCDF is preferred, but we have converters for GRIB 1 and 2 and other formats. I have cc Eoin Howlett of ASA, and he can provide further clarification on formats or delivery methods. The Environmental Data Server is very powerful and can handle a variety of format and methods for accessing the data in its native format.

- Answer to 3) The challenge back to ESA GlobCurrent is to provide the accuracy of the currents that are being delivered to the user. If you provide measurements or estimates of accuracy or uncertainty either globally, by region, by season, or on grid cell by grid cell then the SAROPS tool can directly use those values. SAROPS uses a random flight model (variance and half life estimate are required). If your data is not or cannot be assimilated into models, then your data should be used to estimate the accuracy of the surface currents generated by models. And this may require first establishing the accuracy of the ESA data.

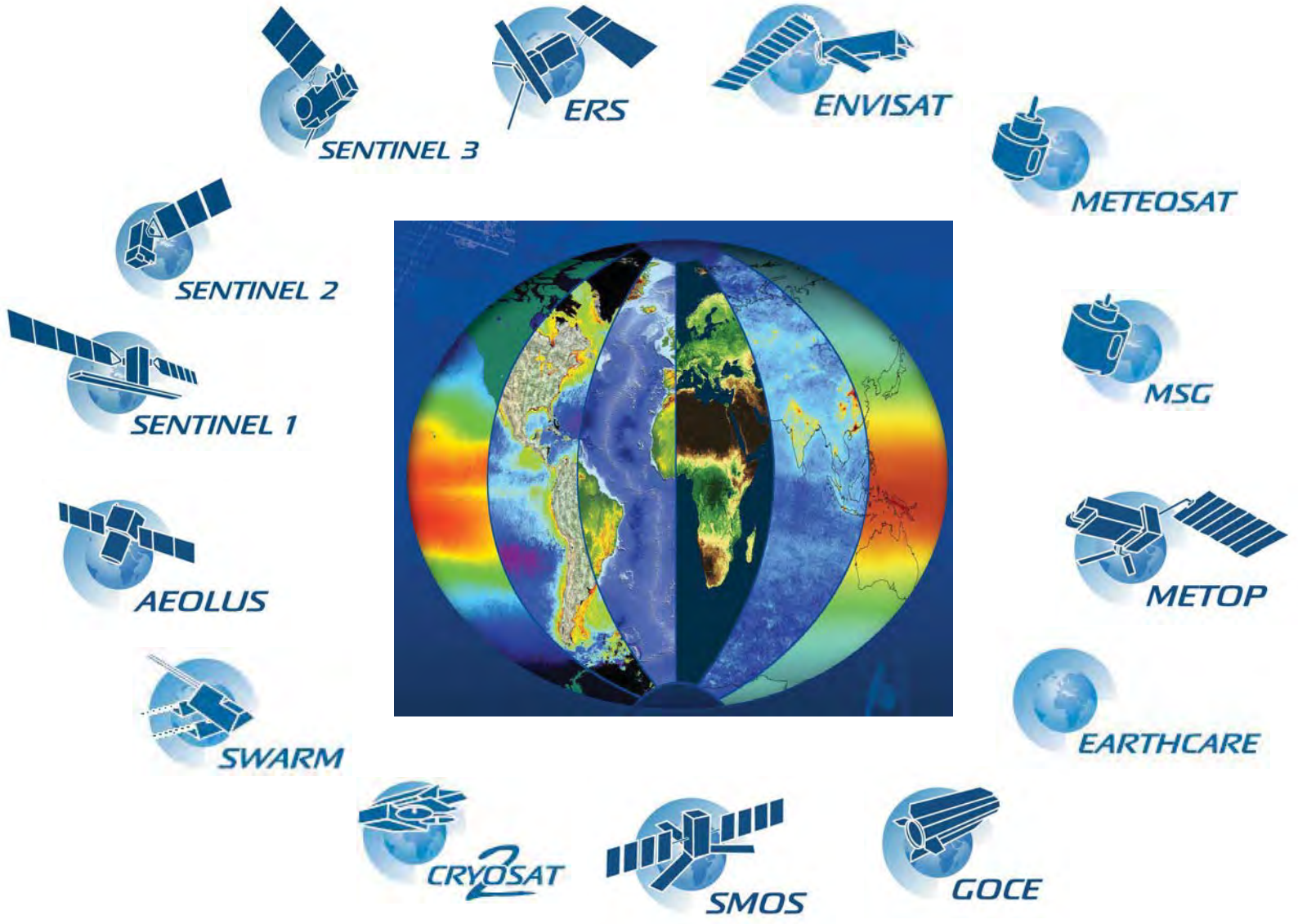
SIMORC (



- Data is now available from SIMORC commercial data release project.
- QC and dissemination funded jointly by EC & OGP Limited Interest Project (OGP LIP funding since EC project ended).
- At collection costs, it represents many millions of $/£ of data so please use it!

- Main contributing companies to LIP to date have been TOTAL, BP and SHELL but we hope more companies will join.
- Mainly multi-month or annual moored currents (through water column) and marine met but some T&S* (* not WOCE standard)
- Data license on restricted basis to avoid inter-company use of data.
- Apologies if you were already aware of this data

ESA's Earth Observation Toolkit – how can we use it for better data on ocean surface currents?



GlobWave, an Overview

Objectives:

To improve the uptake of satellite-derived wind-wave and swell data by the scientific, operational and commercial user community

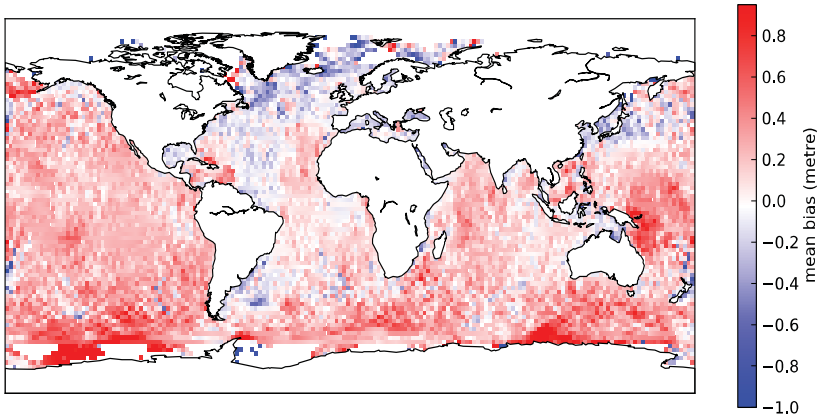
- Harmonised multi-mission wave data from 11 instruments (1985-present), NRT and Archive
- Uniform Quality Control and Error Statistics
- Wave Forecast Verification (UKMO, ECMWF, SHOM ...)

Budget: 1 Meuro

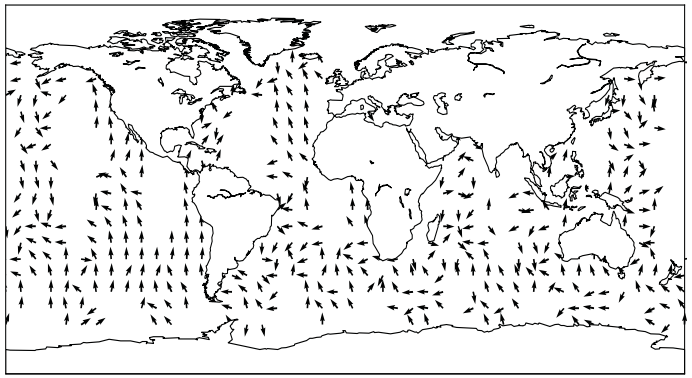
Project Team

- Logica, Ifremer, CLS, SatOC, NOC Southampton

Model vs. Satellite Wave Height



Model vs. Satellite Swell Direction



CoastColour, Demonstrating the value of MERIS in Coastal Waters

Objective:

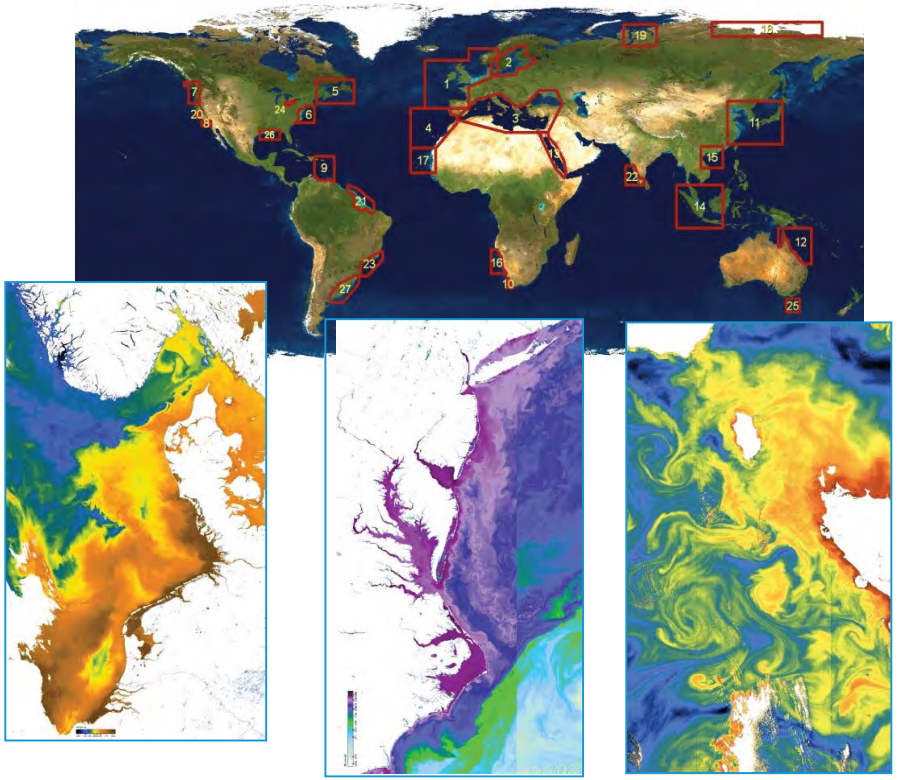
- Improve the uptake of MERIS-FR for coastal water monitoring by demonstrating it's unique capabilities using regionally optimised ocean-colour algorithms.

Products:

- Regionally optimised coastal ocean colour products at 300m resolution, derived from the full archive of MERIS-FR data, over 24 test sites globally.

User Organisations:

- 34 user organisations from all over the world.
- Mainly research institutes and small companies.



2010-2012 | 1,500 KEUR | in progress

Project Team:

- Prime: BC (D)
- Subs: GKSS (D), U. Lisbon (P), PML (UK), MUMM (B), LISE (F)

Straits of Florida with sunglint showing dynamic features

ENVISAT MERIS

Meso- and submeso-scale details