GODAE OceanView achievements and future outlook --> OceanPredict

Pierre Bahurel, *Mercator Ocean International*

Halifax, Canada, 6 May 2019

ceanPredict '19
GODAE OceanView Symposium 2019

1997, Biarritz, France

Operational oceanography

The GODAE vision

"A global system of observations, communications, modelling and assimilation, that will deliver regular, comprehensive information on the state of the oceans, in a way that will promote and engender wide utility and availability of this resource for maximum benefit to the community"
(GODAE Strategic Plan, 2001)

A major breakthrough for oceanography

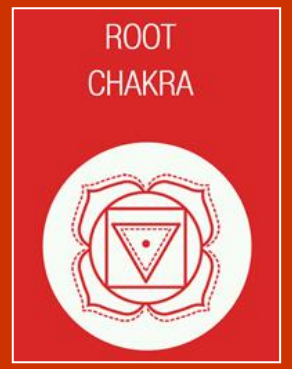
Smith, N. and M. Lefebvre (1997): The Global Ocean Data Assimilation Experiment (GODAE). In "Monitoring the oceans in the 2000s : an integrated approach". International Symposium, Biarritz, October 15-17, 1997.

2019 – 2025

2012 – 2018

2005 – 2011

1998 – 2004



1

1998 – 2004: Achievements

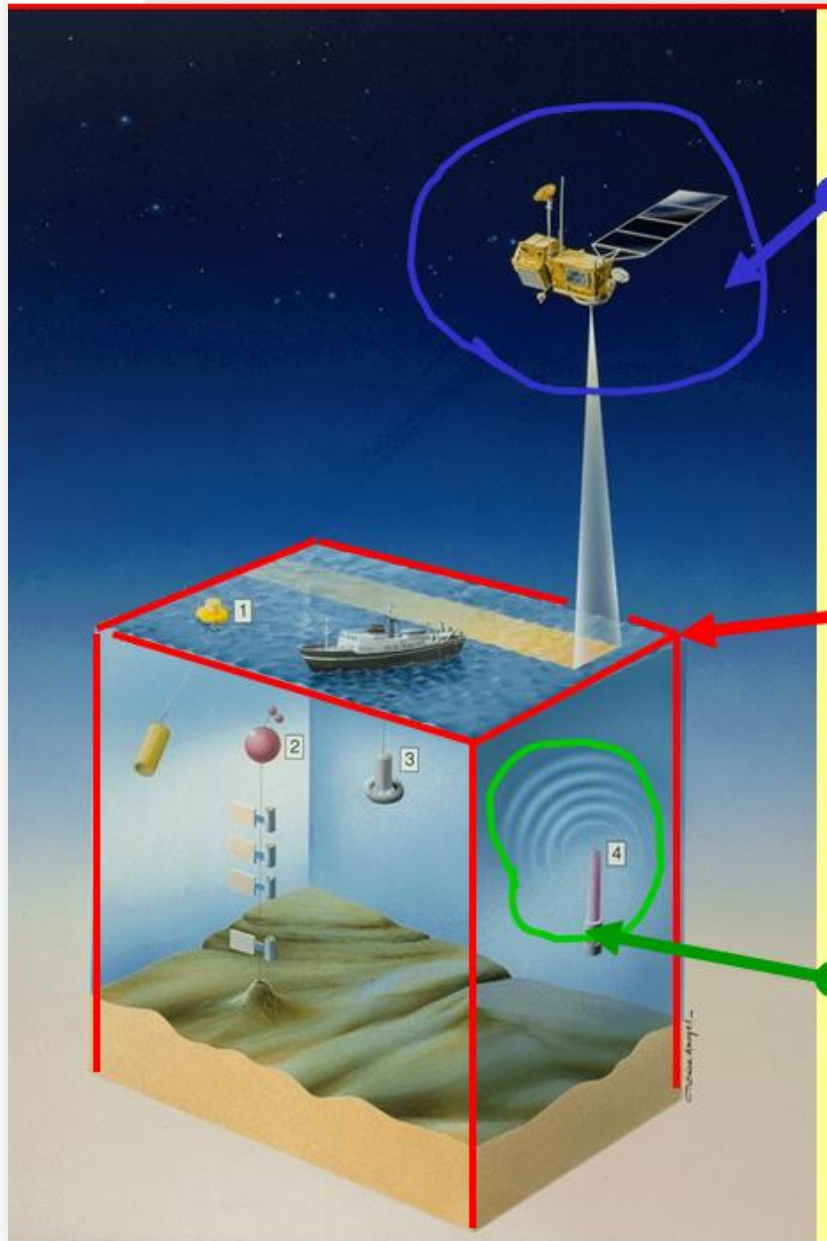
“WE ARE”

Halifax, Canada, 6 May 2019

ceanPredict ’19
GODAE OceanView Symposium 2019

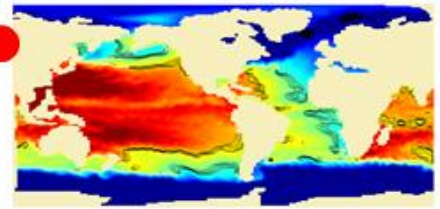
From 1998 to 2004, GODAE has quietly and strongly taken its place in the world : « we are the modern *producers* of ocean environmental data »

Integrated Oceanography



SATELLITE OBSERVATION

MODELLING ASSIMILATION



IN SITU OBSERVATION

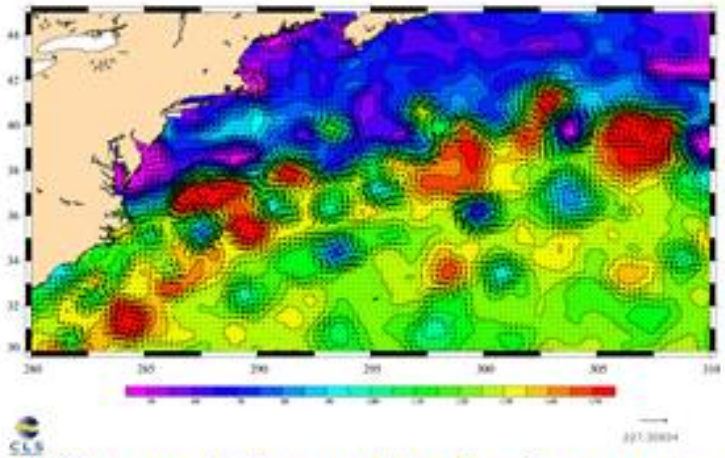
P.Bahurel - Projet MERCATOR

SSALTO/DUACS (CLS/CNES) : Real time processing of TOPEX/POSEIDON, ERS-1/2, GFO, Jason-1 and ENVISAT

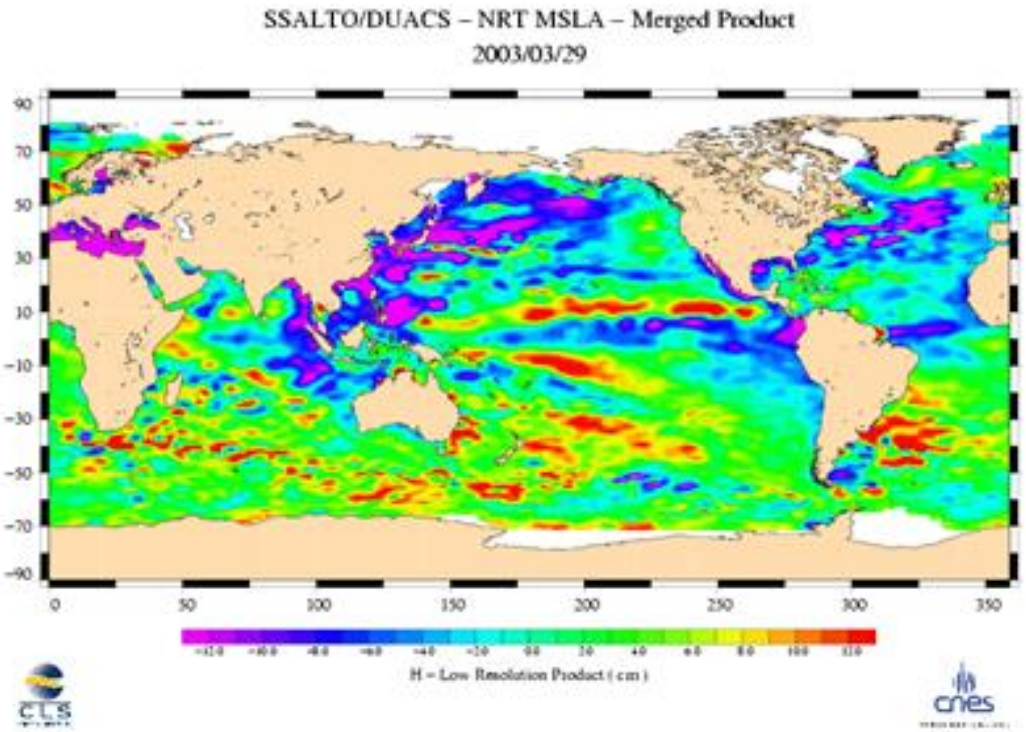
Serving (MERCATOR, FOAM, TOPAZ, MFS and GODAE), climate forecasting centers (ECMWF,...).

Improved processing and merging techniques => high resolution and high accuracy data.

Products directly useable for climate and mesoscale applications



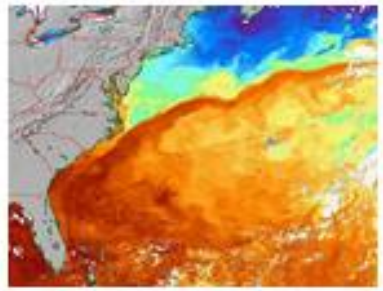
High resolution sea level and currents from Jason-1, ERS-2 and GFO

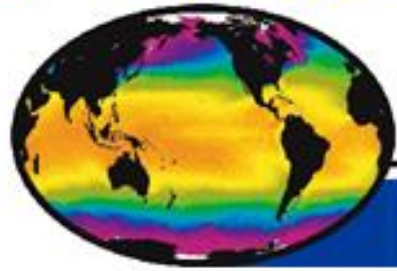


SSALTO DUACS data from April 4, 2003 processing: SLA data from Jason-1, ERS-2 and GFO from April 2 to March 26. SLA Map for March 29 from Jason-1+ERS-2+GFO.

http://www.aviso.oceanobs.com/duacs (AVISO WWW site)

SST GODAE Need = Global high resolution in time (< 1 day) and space (<10 km) = *A specific GODAE pilot project*





GHRSST-PP

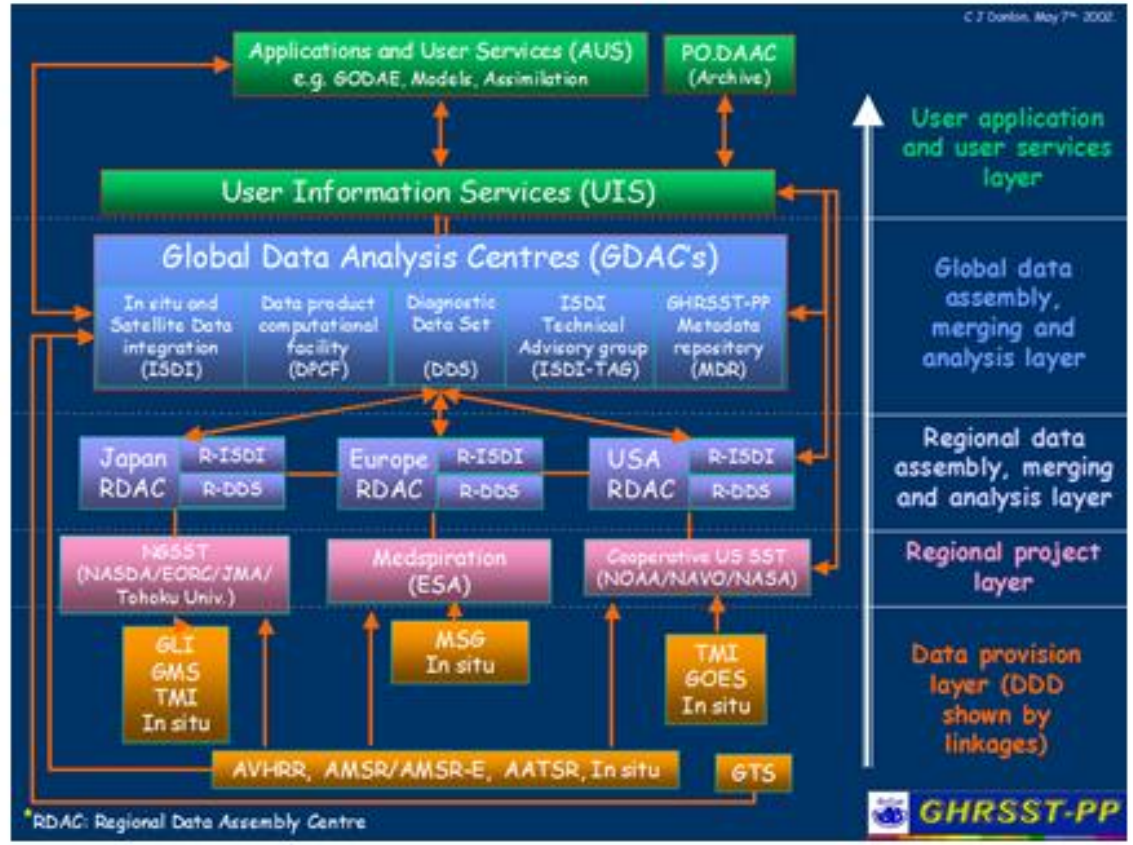
GODAE High Resolution Sea Surface Temperature Pilot Project

Global High Resolution SST pilot project (GHRSST)

- combination of data from various sources
- modern data serving
- entrain scientific expertise for quality products

http://www.ghrsst-pp.org/

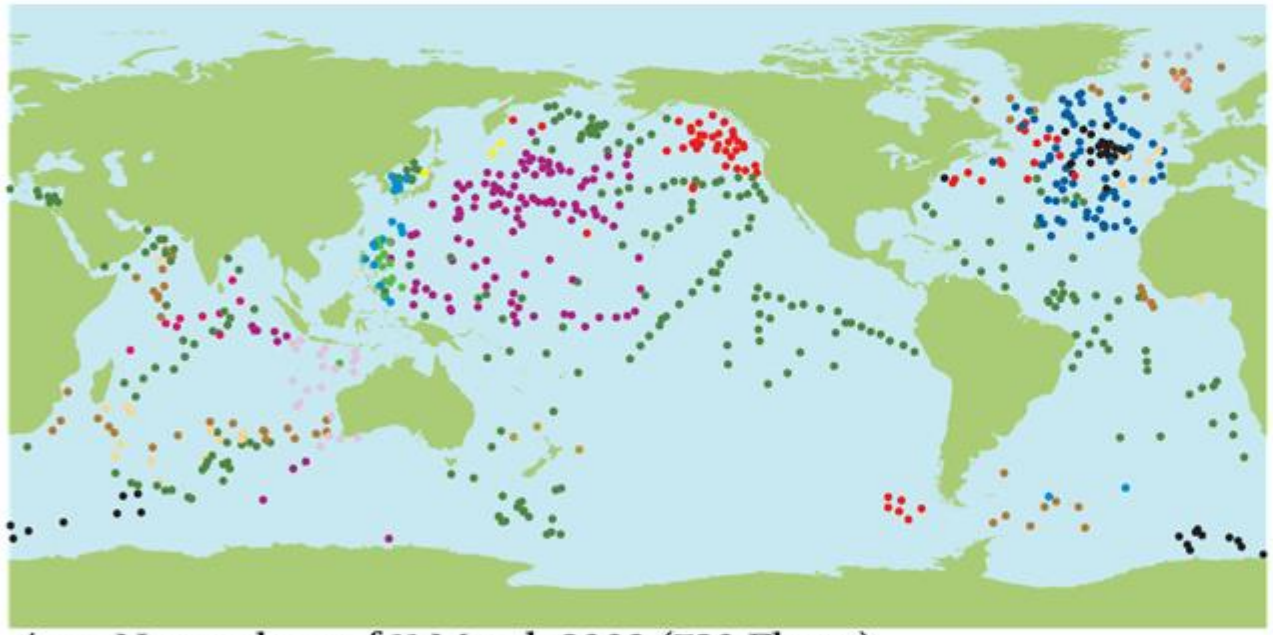
In progress : new SST products expected in early 2004



Argo
a GODAE pilot project

part of the integrated global observation strategy

The pre-GODAE in-situ ocean observing system was clearly inadequate for the global scope of GODAE => Development of Argo : a GODAE/CLIVAR project.



Argo Network, as of 11 March 2003 (720 Floats)

AUSTRALIA (23)	FRANCE (22)	NEW ZEALAND (3)
CANADA (61)	GERMANY (44)	NORWAY (3)
CHINA (14)	INDIA (9)	RUSSIAN FEDERATION (3)
DENMARK (4)	JAPAN (130)	UNITED KINGDOM (53)
EUROPEAN UNION (73)	KOREA (Rep. of) (26)	UNITED STATES (252)

+ Mozambique, Mauritius and Pacific Islands

Very good progress so far thanks to international cooperation.

A global array (3000 floats) should be achieved by 2005.

An efficient data management system is in place.

http://www.argo.ucsd.edu

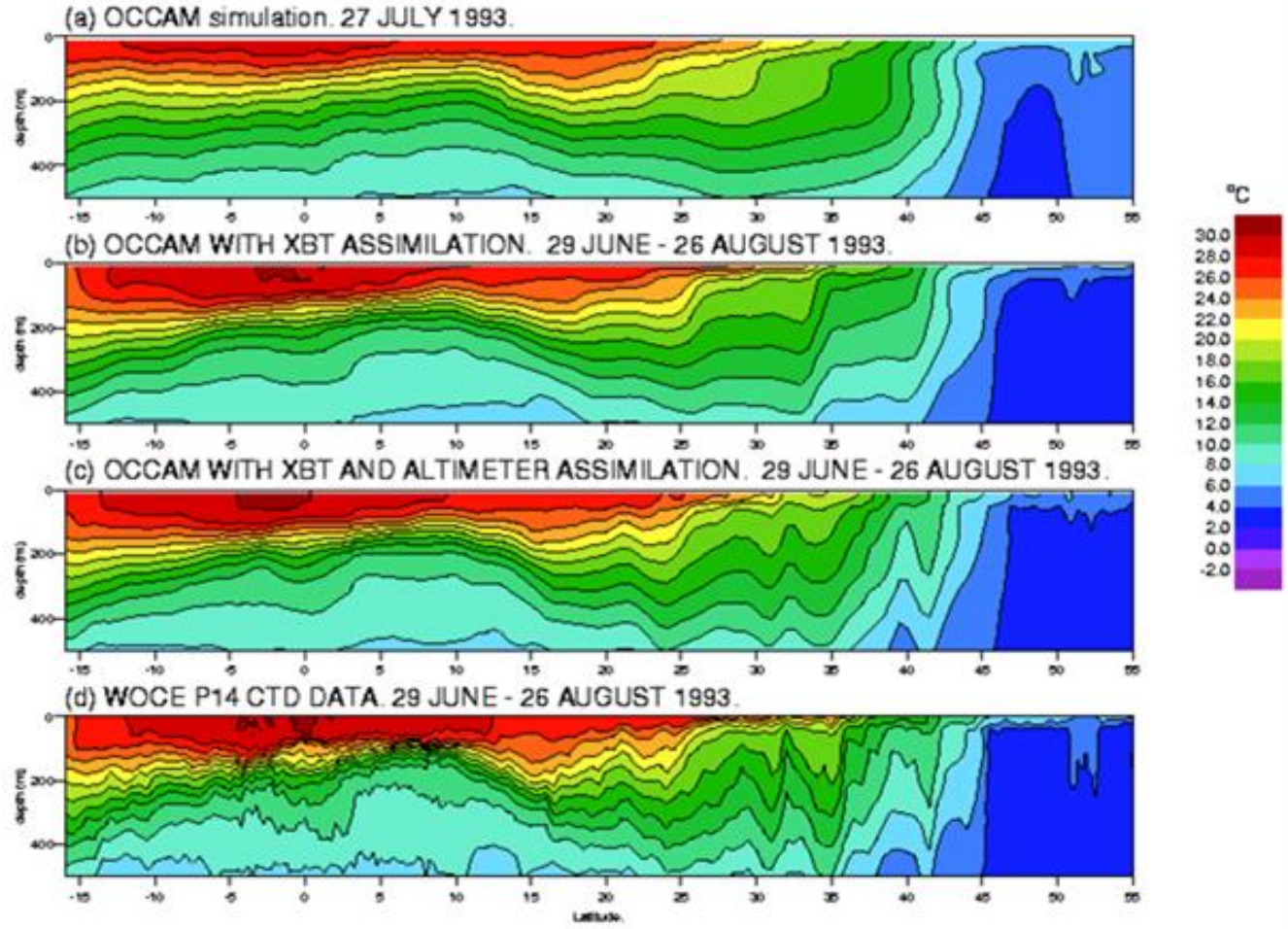
http://argo.jcommops.org

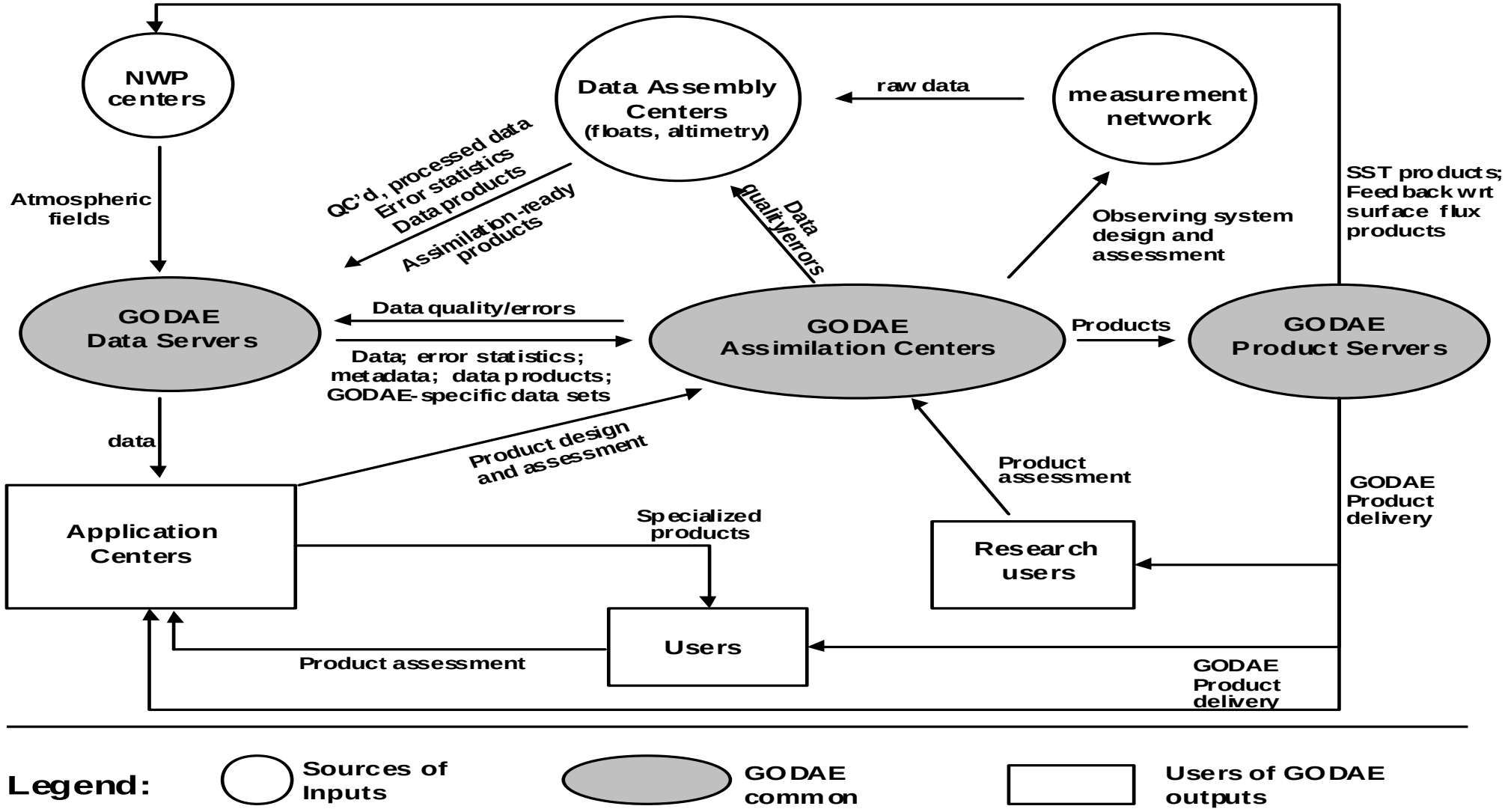
GODAE = integration of in-situ and remote sensing data with models at the global scale

Best use (scientific, applications) of data is when data are integrated using effective assimilation techniques

The value of data assimilation

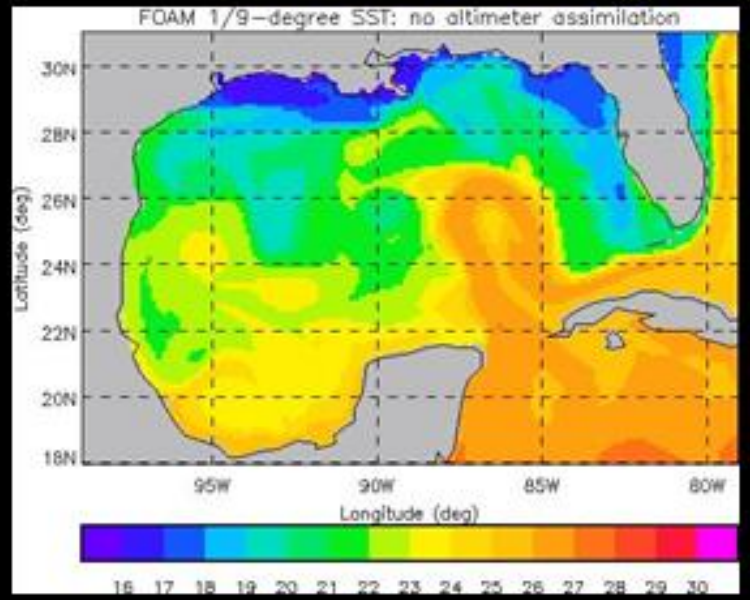
(Courtesy K. Haines)



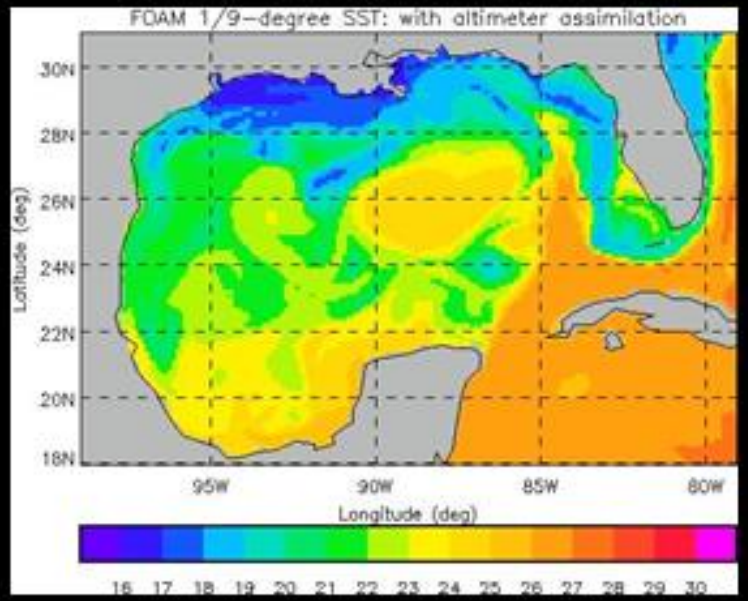


GODAE "common" shared by all partners (includes the knowledge base accumulated through joint development, intercomparison experiments and collaborations)

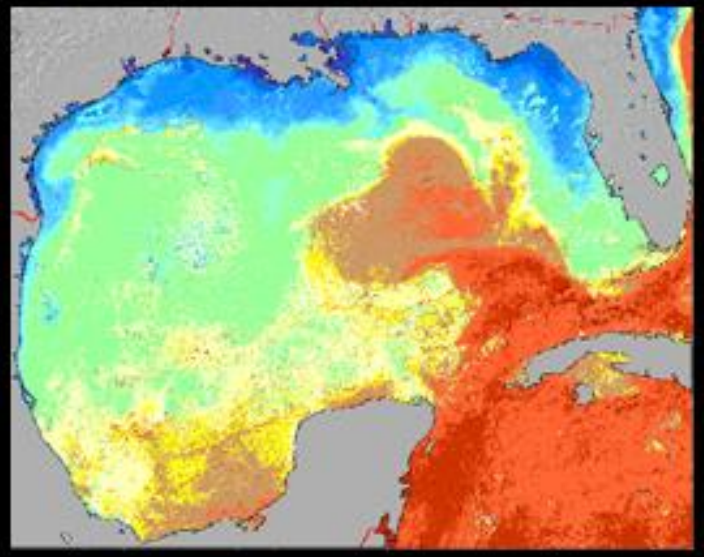
Surface temperatures 14-19 March 1998



1/9° FOAM no altimeter



1/9° FOAM with altimeter

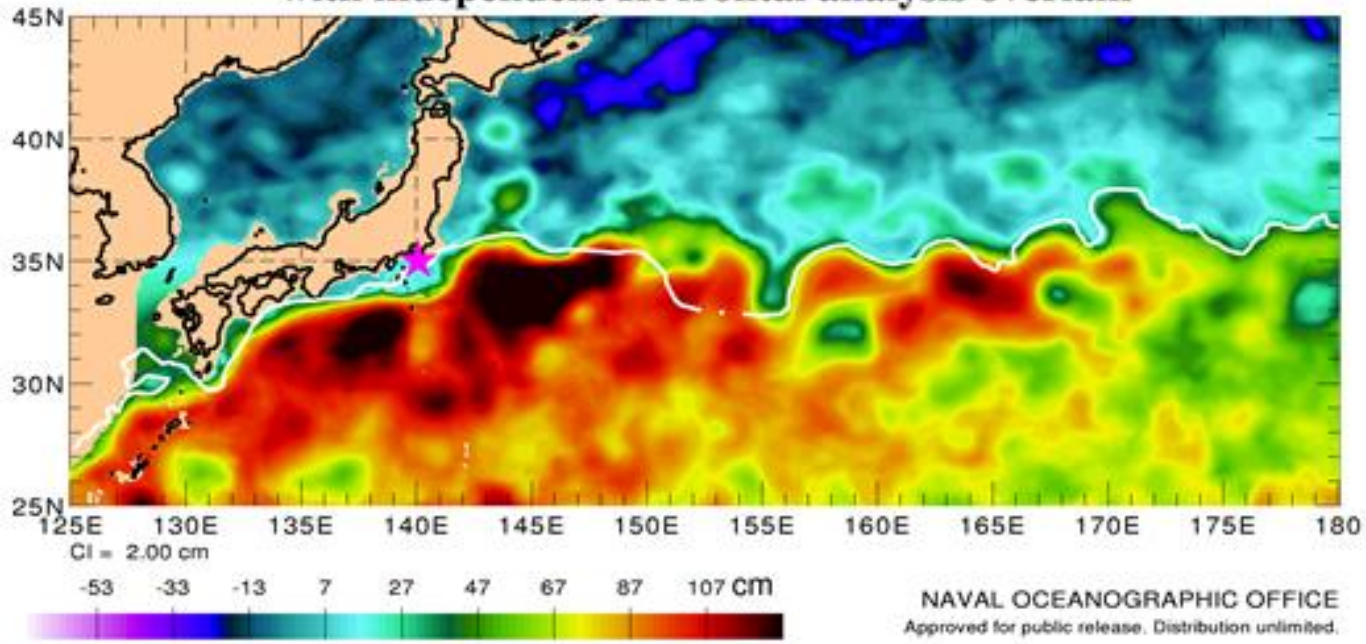


AVHRR data processed by JHU APL

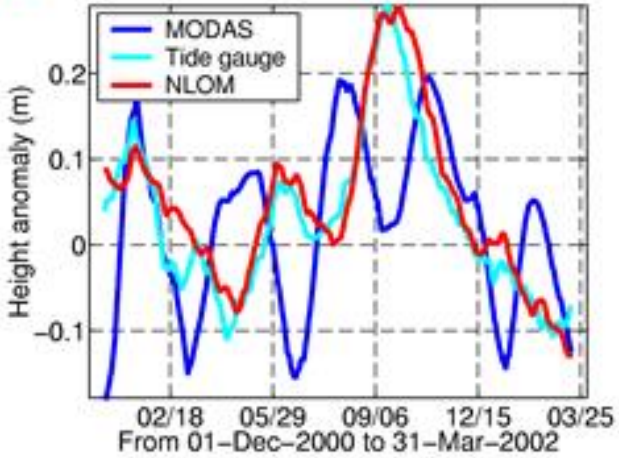
From M. Bell

Met Office

1/16° global NLOM SSH analysis for 18 February, 2002 with independent IR frontal analysis overlain



★ **Mera, Japan tide gauge comparison**



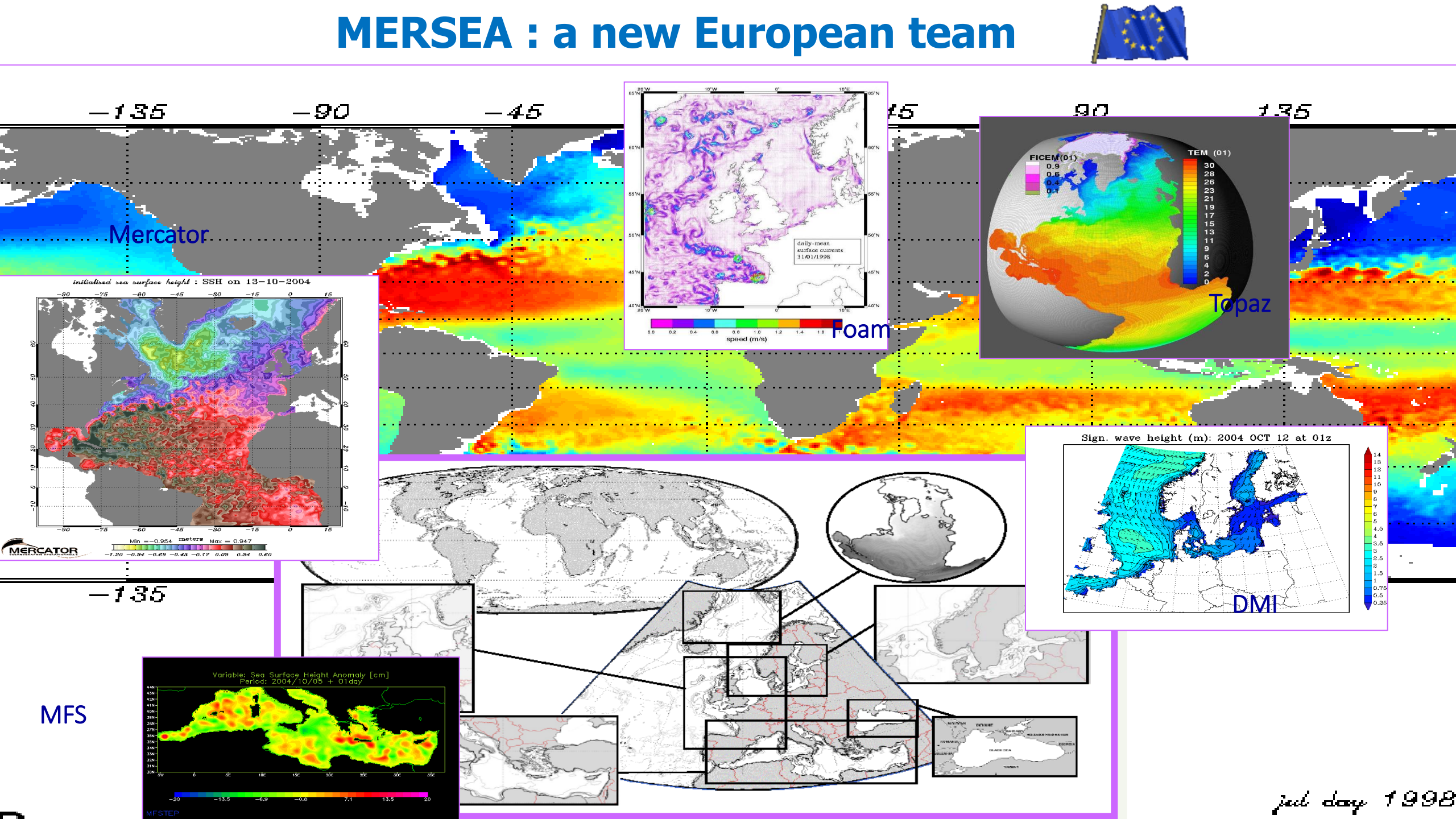
Tide gauge comparison statistics

Mera, Japan	39 concatenated worldwide		
	28 island, 11 coastal		
correlation	rmsd	correlation	rmsd
1/16° NLOM nowcast			
.96	3.2 cm	.75	5.5 cm
1/8° MODAS model-independent analysis			
.34	11.0 cm	.65	6.5 cm

30-day running mean tide gauge results

Courtesy of H. Hurlburt

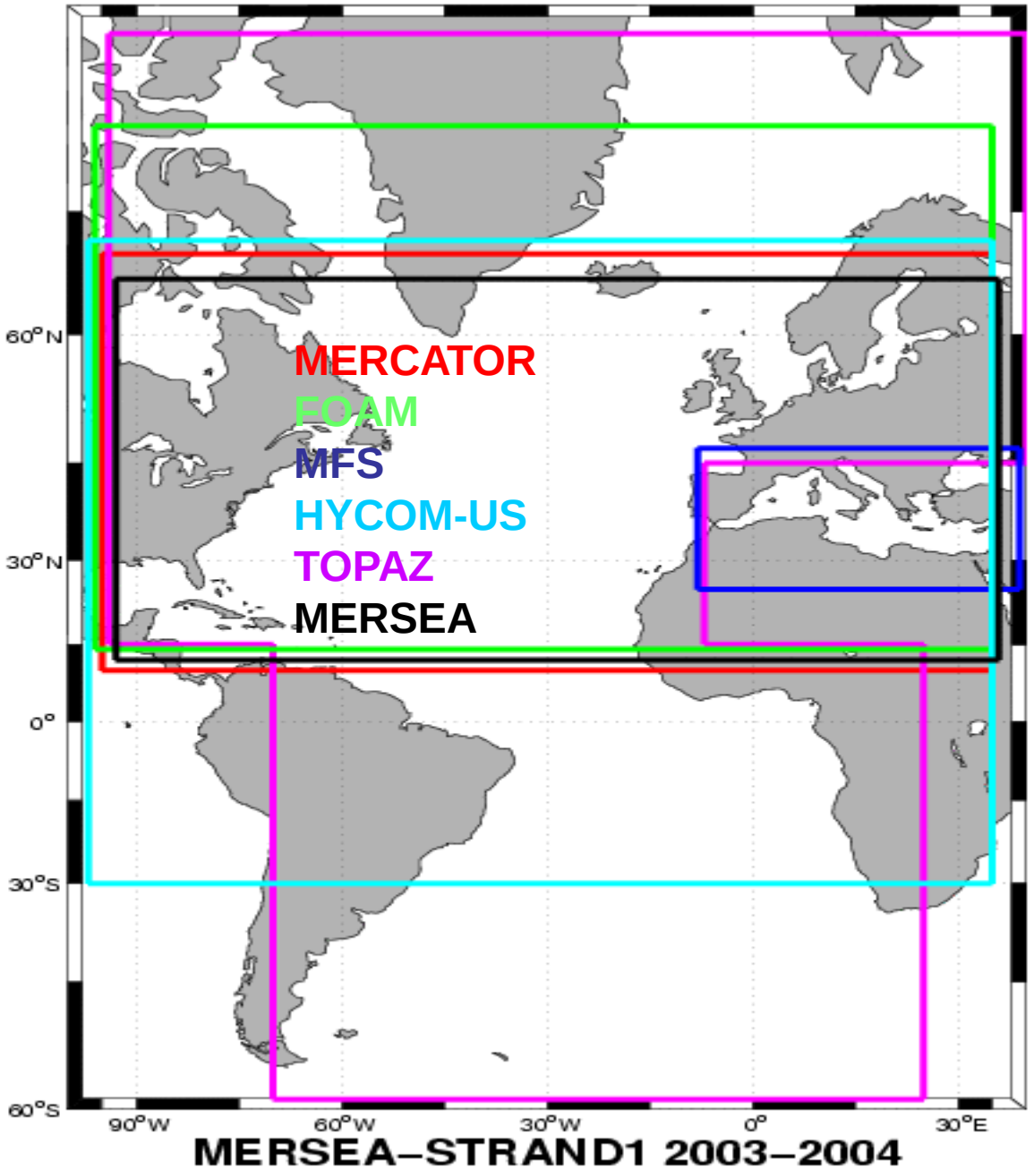
MERSEA : a new European team



Internal Metrics for the MERSEA Strand1 Inter-Comparison

Bergen, Norway,June3-5 2004

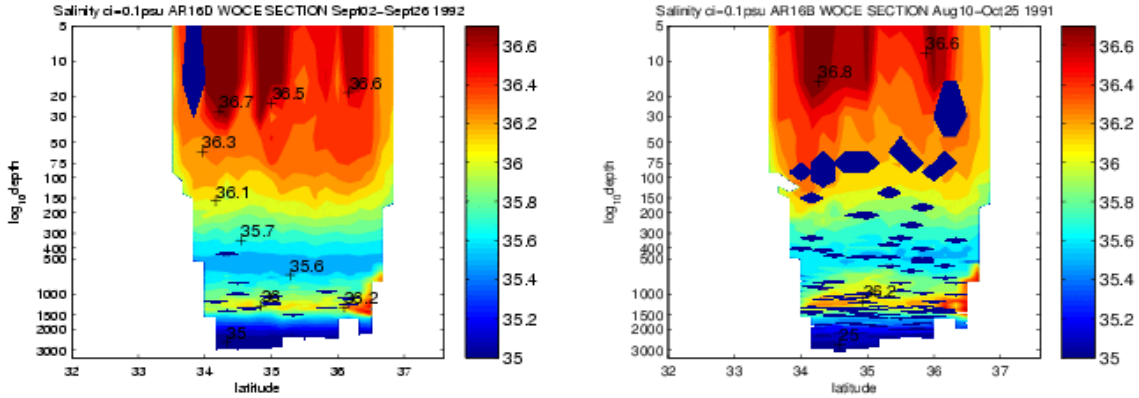
Metrics Document version5
www.mersea.eu.org
“intercomparison framework”
“Metrics Definition for the North Atlantic Ocean and the Mediterranean”



MERSEA–STRAND1 2003–2004

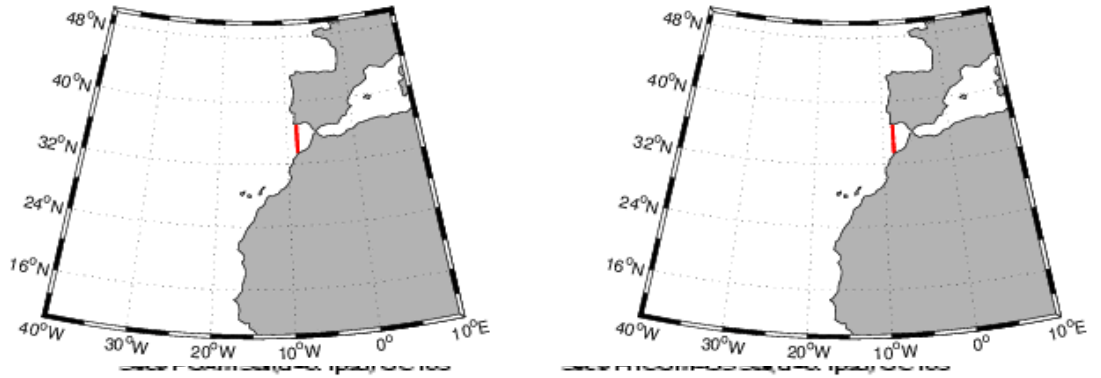
MERCATOR FR	**OPA** **-Z coord./Rigid Lid** -Simple thermo. ice model -TKE	**-horiz. 1/15° (5-7km)** **43 levels** -**Atl+Med** from 10 to 70°N.
FOAM UK	**HADLEY CENTRE** **-Z coord./Rigid Lid** -dyn./thermodynamic sea ice -Kraus-Turner	**-horiz. 1/9° (12km)** **20 levels** -**Atl+Med** from 10 to 70°N.
MFS IT	**MOM** **-Z coord./Rigid Lid** -No ice model -cst vertical mixing+vertical adjustment	**-horiz. 1/8°** **31 levels** - **Med only**
HYCOM US	**HYCOM *2.1*** **-Hybrid coord./Free surface** -No ice model -KPP mixing	**-Horiz 1/12° (6.5km)** **26 hybrid layers** -**Atl+Med** from 28°S to 70°N, 98°W to 36°W.
TOPAZ NO	**HYCOM** **-Hybrid coord/Free surface** -dyn./thermodynanic sea ice -KPP mixing	**-horiz. 20 to 30km** **22 hybrid layers** -**Artic+Atlantic** till 60°S. **No med basin.**

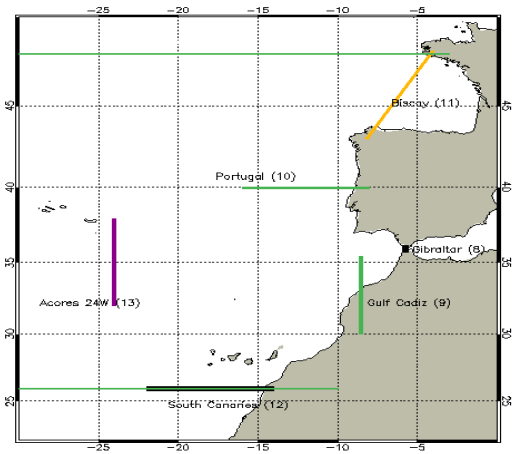
Gulf Cadiz Section 9°W Salinity

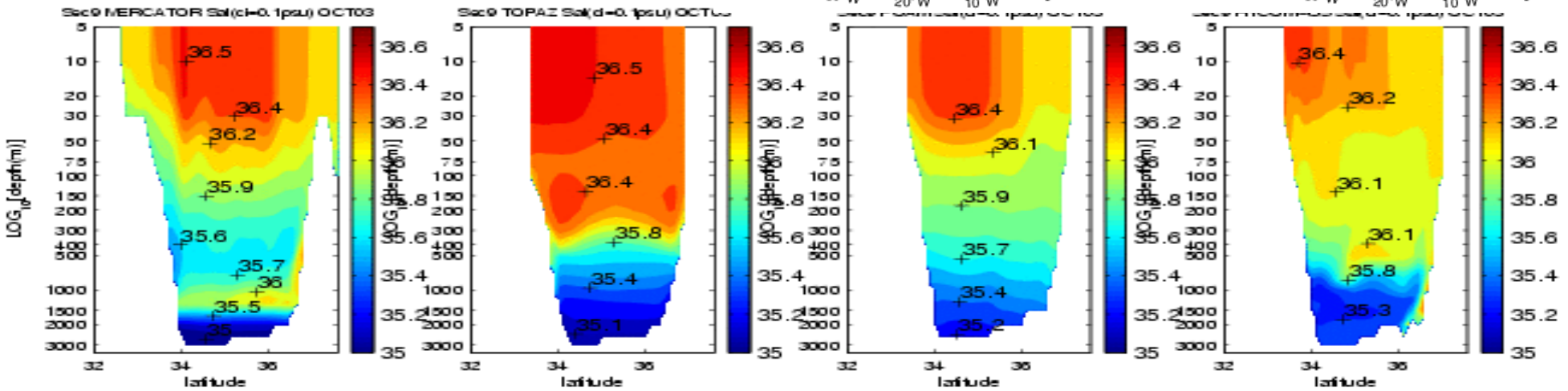


WOCE AR16D SEP 1992

WOCE AR16B AUG OCT 1991

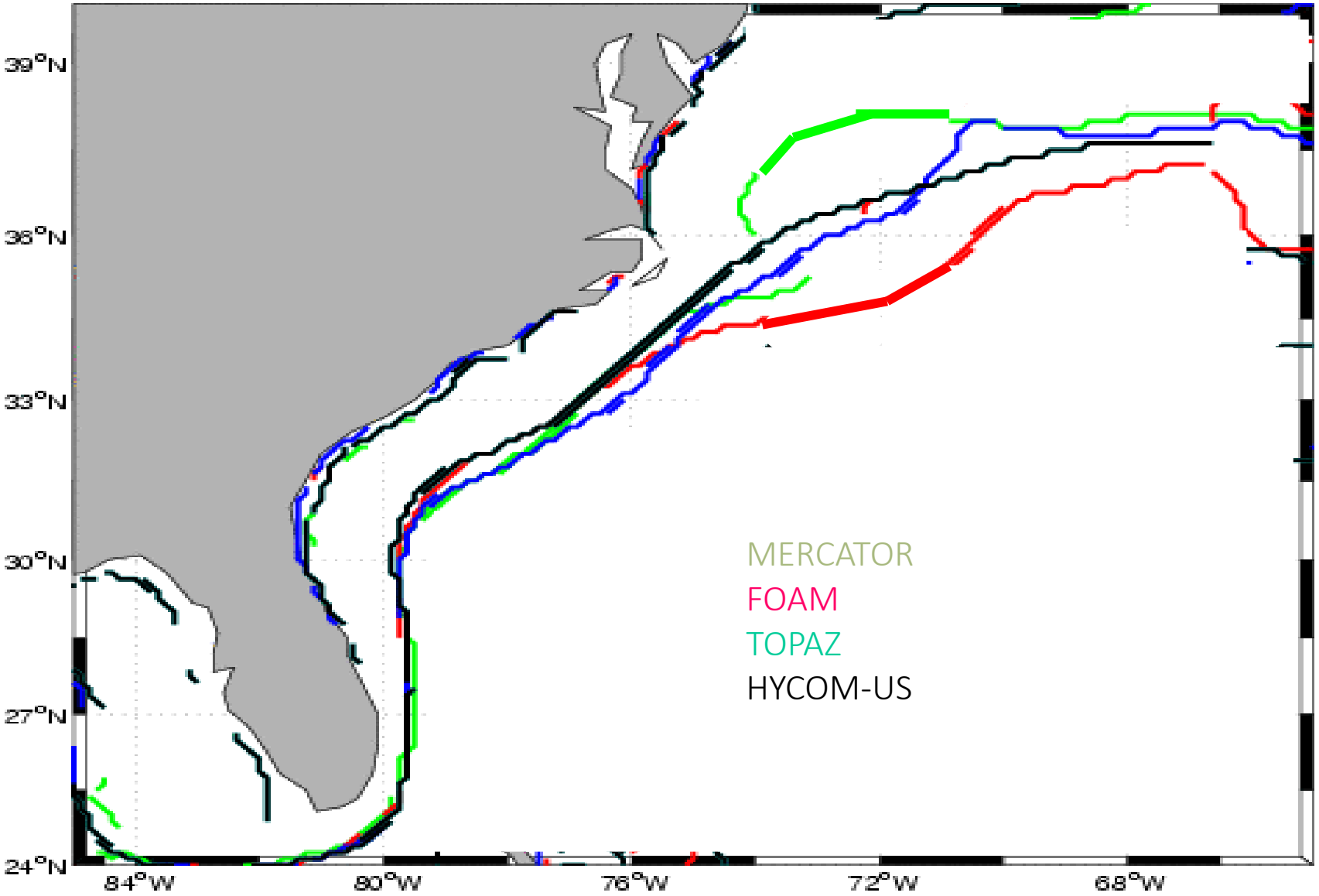






MERCATOR TOPAZ FOAM HYCOM

FRONT DETECTION for mean JUL-DEC 03 SSH



SLA Comparison with Sea Level gauge

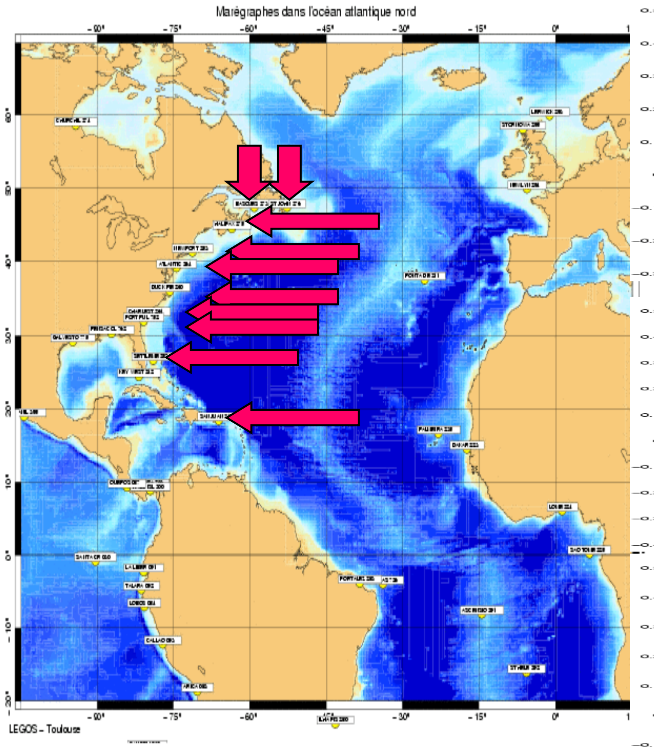
MERCATOR

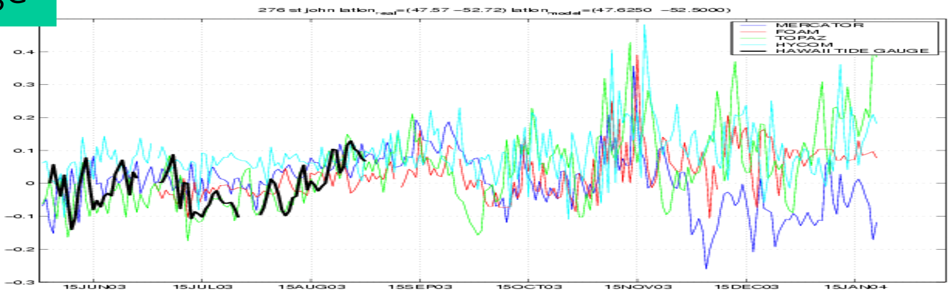
FOAM

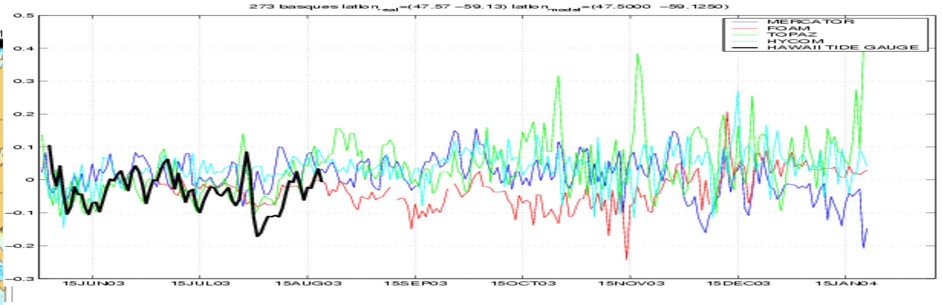
TOPAZ

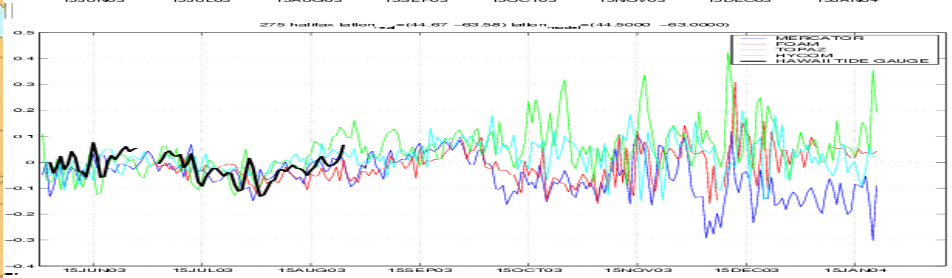
HYCOM

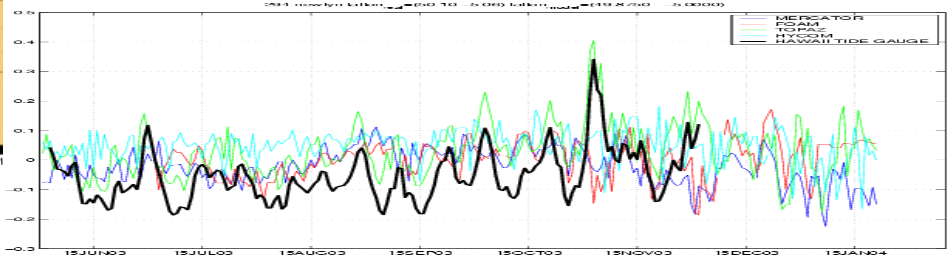
TIDE GAUGE

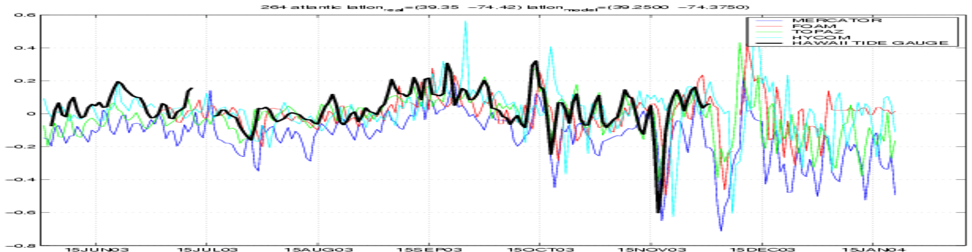


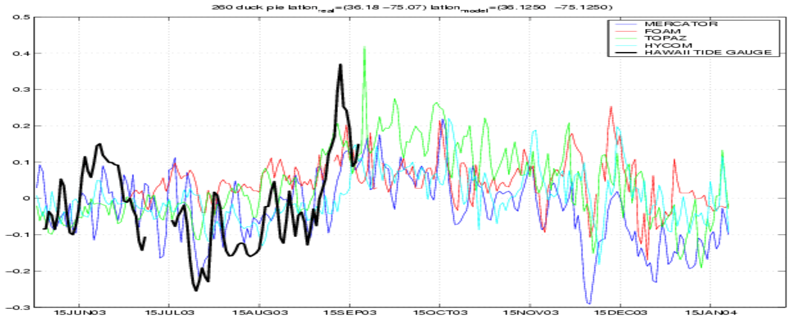


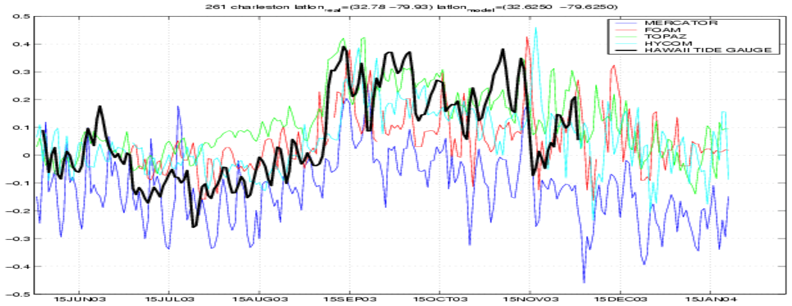


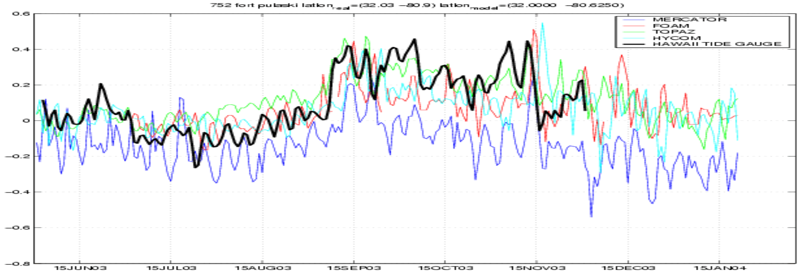


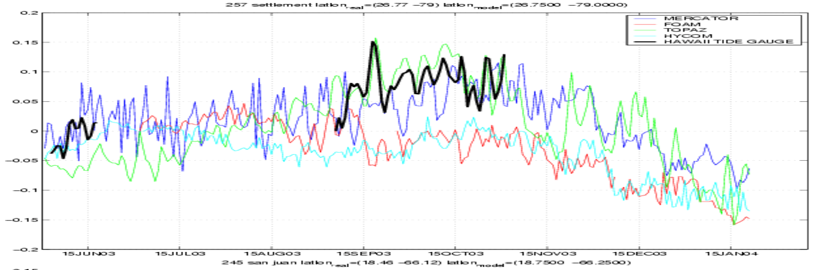


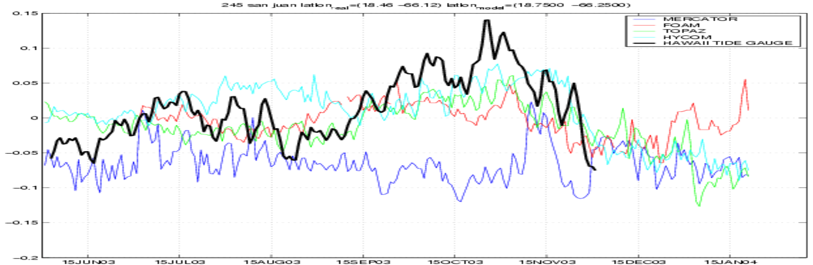












StJohn	Duckpie
Basques	Charleston
Halifax	FortPulaski
Newport	Settlement
Atlantic	SanJuan

NO SLA ASSIMILATION IN COASTAL ZONES

From 1998 to 2004, GODAE has quietly and strongly taken its place in the world : « we are the modern *producers* of ocean environmental data »

Personal GODAE achievements over this period 1998-2004

- Mercator scientists release their first ocean forecast in January 2001 over the North Atlantic
- French institutions team-up to create Mercator Ocean with a global eddy-resolving ambition
- Mercator Ocean is part of the GODAE IGST and leads the Metrics task force
- First users come to test the data

Mercator Ocean
Ocean Forecasters

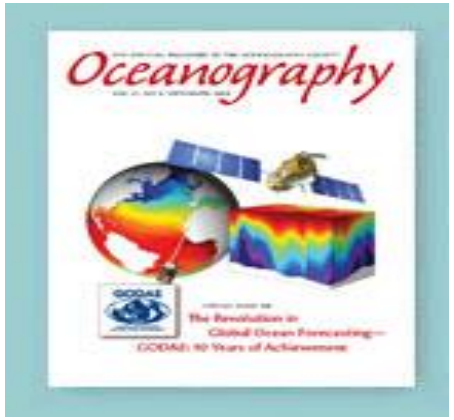
2

2005 – 2011: Achievements

“WE FEEL”

From 2005 to 2011, GODAE set a stimulating working environment for ocean monitoring and forecasting sciences and operations : « we feel part of an innovative community of ocean experts, cheerfully learning and growing »

GODAE Achievements and Successes



Implementation of observing and data processing systems

- Argo and GHRSST-PP (pilot projects), altimetry, in-situ

Implementation of global modelling and data assimilation capabilities

- high resolution and climate

Implementation of data/product serving capabilities - standardization

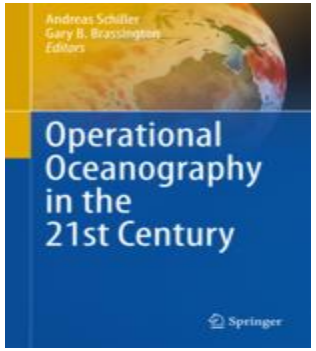
Intercomparison / validation, metrics and standardization

Demonstrations of feasibility and utility

- Mesoscale nowcasting and forecasting, ocean climate and research, marine pollution and safety, weather forecasting, marine resources, etc

Scientific advances

- Modelling, data assimilation, scientific validation

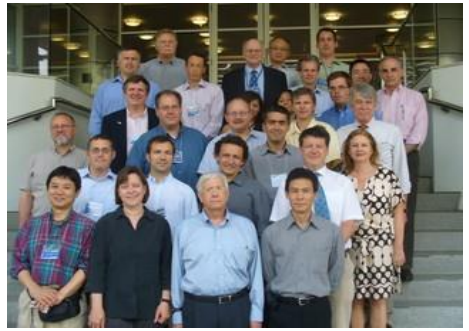


The International GODAE Steering Team



- **The IGST was formed in 1997 => responsibility for the development of GODAE.**
- **Many scientists have served as members and contributed greatly to the success of GODAE. Excellent "spirit" and willingness to share data&products, expertise and experience (GODAE common)**
- **Supported by the GODAE Patrons**


and a project office



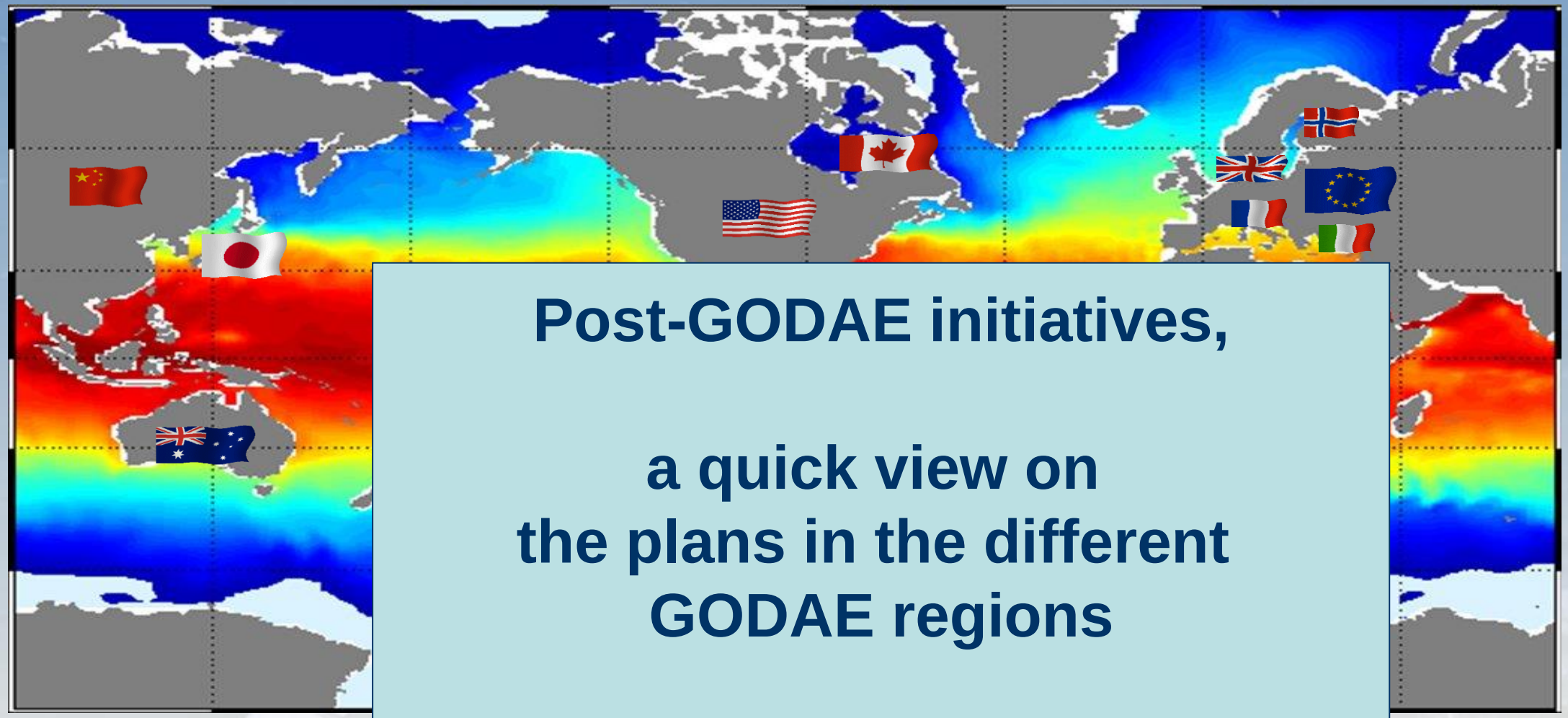
- **Symposia and Summer Schools**


- **New long term program : GODAE OceanView and its Science Team**


Eric Dombrowsky
Mercator-Ocean
France


Andreas Schiller
CSIRO
Australia

GODAE Forecasting Centres



Post-GODAE initiatives,

a quick view on the plans in the different GODAE regions

Post-GODAE initiatives

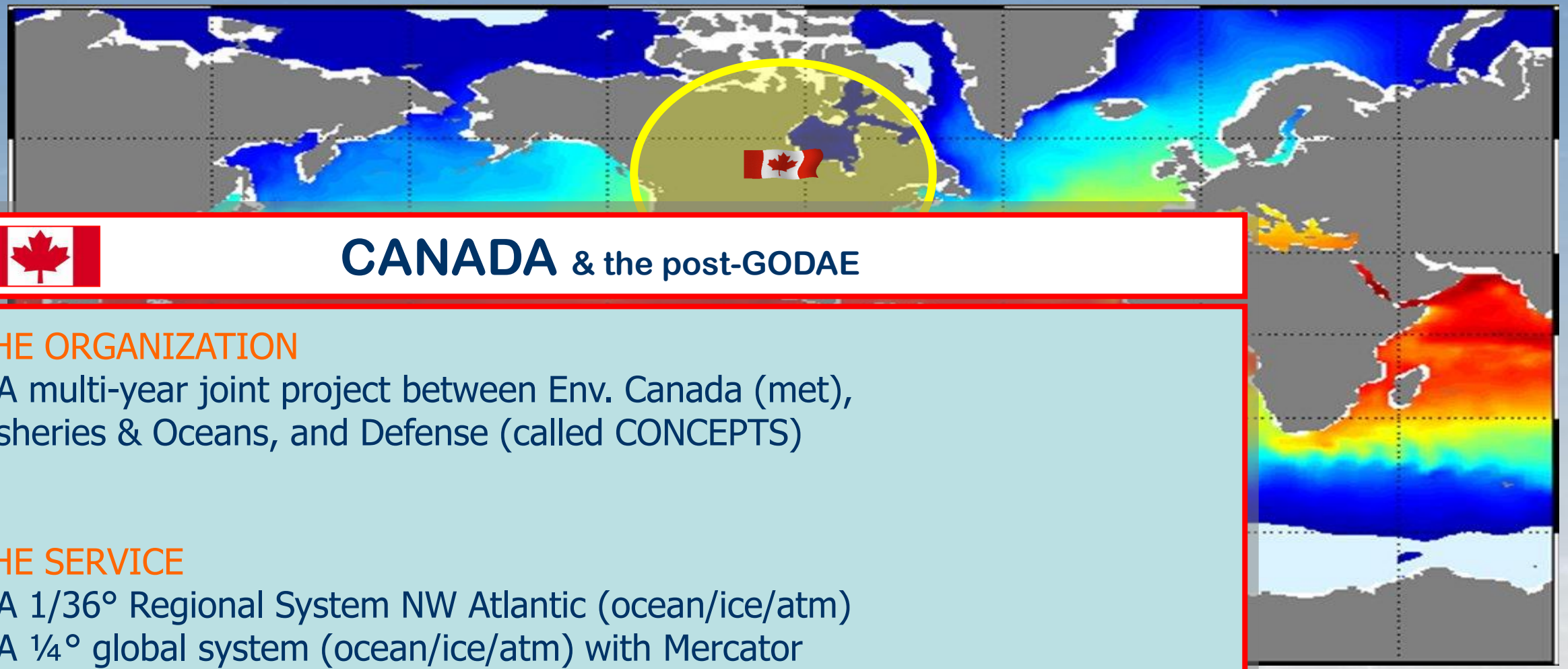
UNITED STATES & the post-GODAE

THE ORGANIZATION
- HYCOM : Navy priority
- ECCO : MIT/JPL partnership

} and a transition to come trough a new phase of the NOPP program

THE SERVICE
- HYCOM: global high resolution 1/25°, tides, ice
- ECCO: climate, improve ocean state estimations

Post-GODAE initiatives



CANADA & the post-GODAE

THE ORGANIZATION

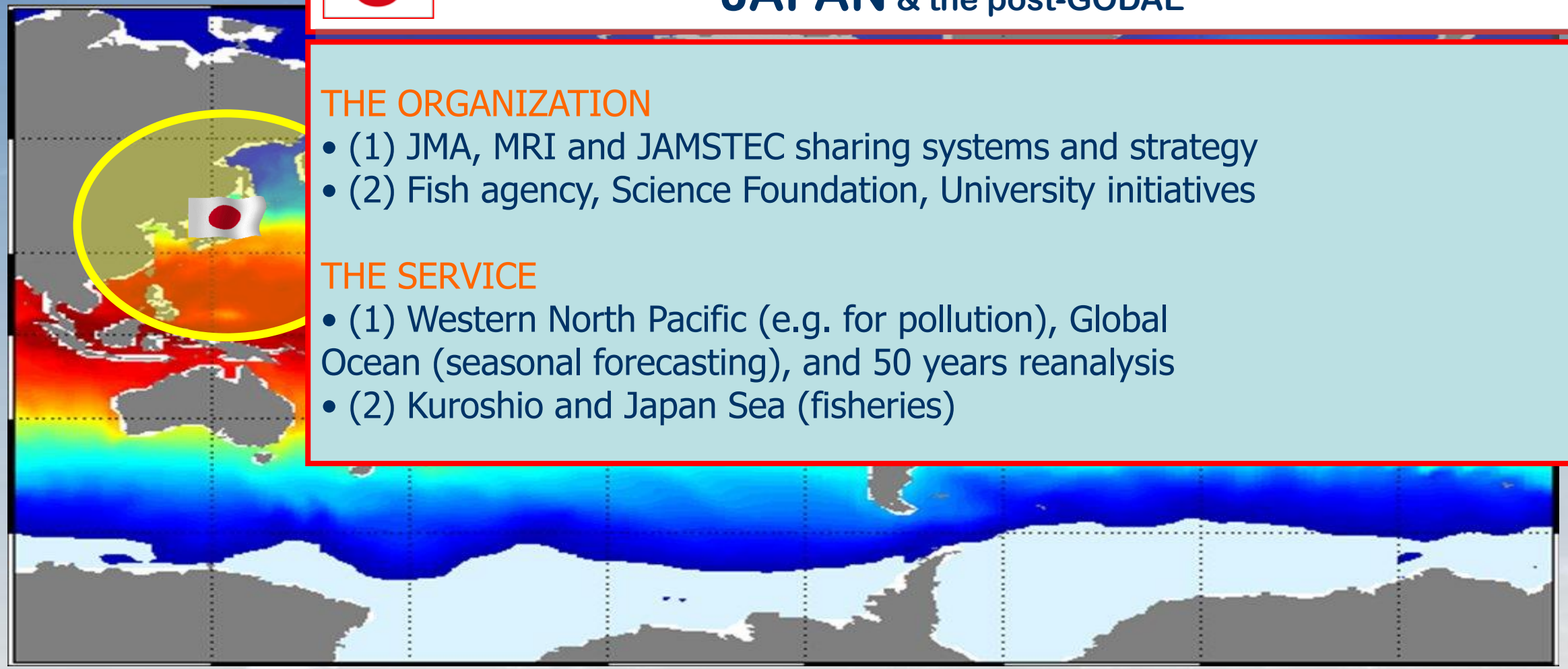
- A multi-year joint project between Env. Canada (met), Fisheries & Oceans, and Defense (called CONCEPTS)

THE SERVICE

- A 1/36° Regional System NW Atlantic (ocean/ice/atm)
- A ¼° global system (ocean/ice/atm) with Mercator

Post-GODAE initiatives

JAPAN & the post-GODAE



THE ORGANIZATION

- (1) JMA, MRI and JAMSTEC sharing systems and strategy
- (2) Fish agency, Science Foundation, University initiatives

THE SERVICE

- (1) Western North Pacific (e.g. for pollution), Global Ocean (seasonal forecasting), and 50 years reanalysis
- (2) Kuroshio and Japan Sea (fisheries)

Post-GODAE initiatives

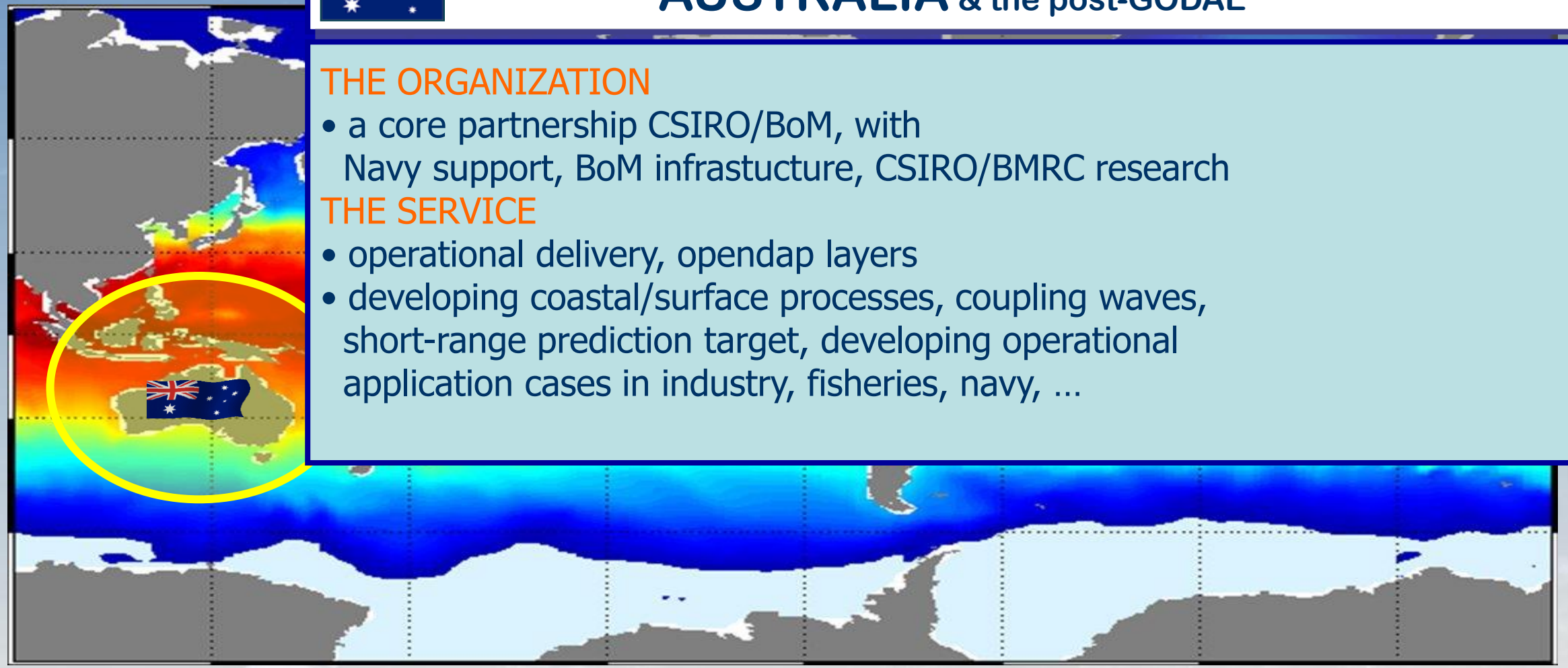
CHINA & the post-GODAE

THE ORGANIZATION
- China, an active partner of post-GODAE
- the SOA/NMEFC is the operational centre in charge

The SERVICE
- accurate and timely early warnings of severe marine ecological disasters in chinese waters

Post-GODAE initiatives

AUSTRALIA & the post-GODAE



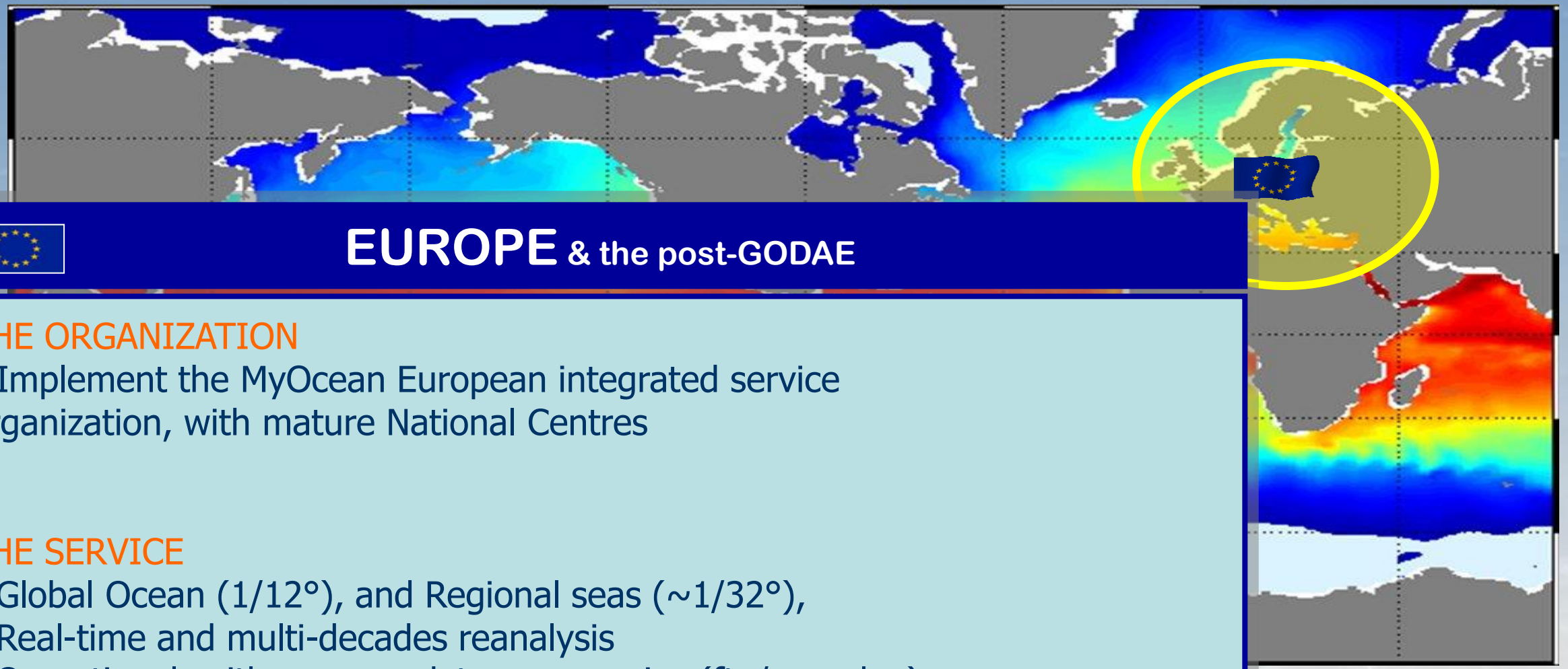
THE ORGANIZATION

- a core partnership CSIRO/BoM, with Navy support, BoM infrastucture, CSIRO/BMRC research

THE SERVICE

- operational delivery, opendap layers
- developing coastal/surface processes, coupling waves, short-range prediction target, developing operational application cases in industry, fisheries, navy, …

Post-GODAE initiatives



EUROPE & the post-GODAE

THE ORGANIZATION

- Implement the MyOcean European integrated service organization, with mature National Centres

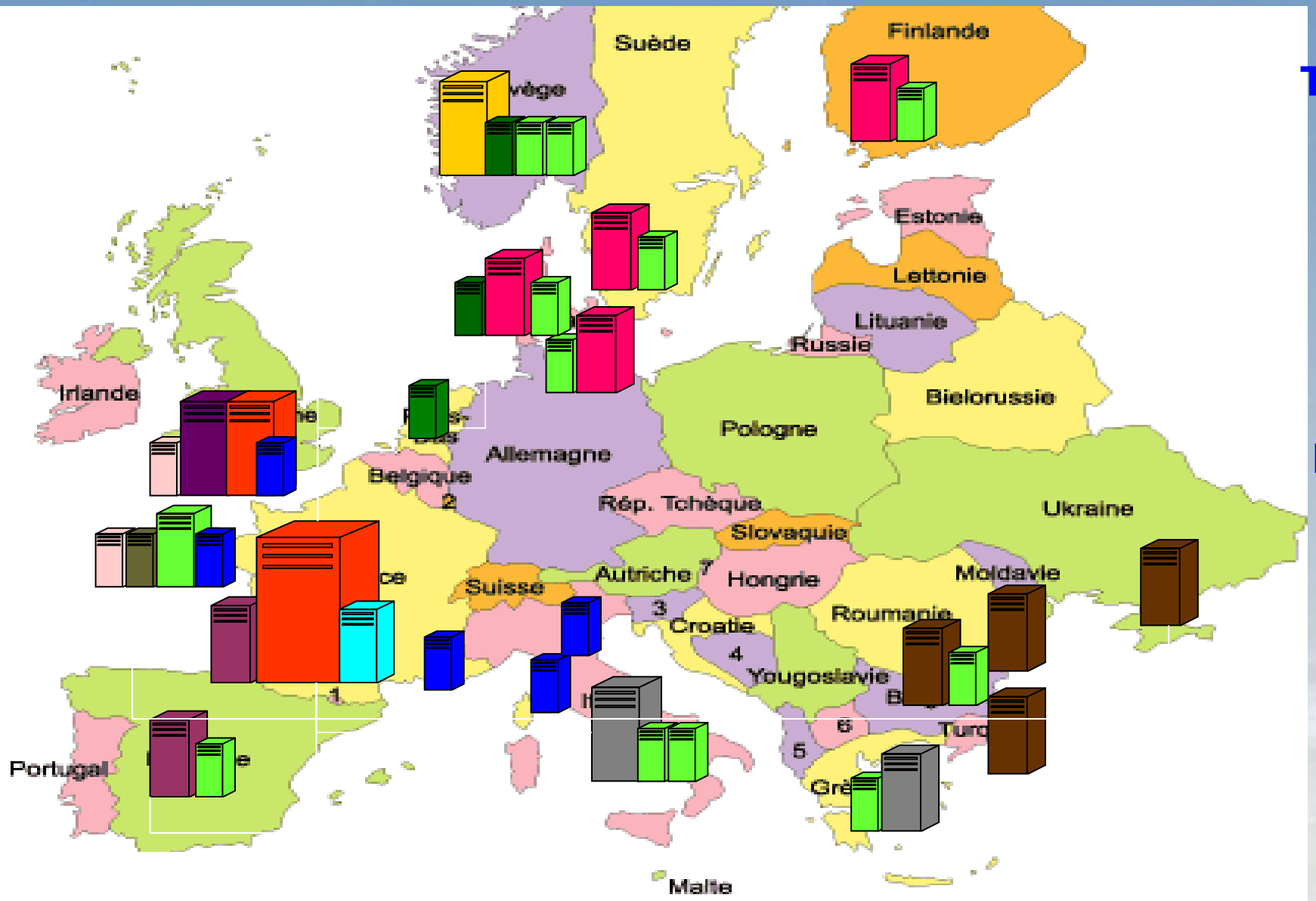
THE SERVICE

- Global Ocean (1/12°), and Regional seas (~1/32°),
- Real-time and multi-decades reanalysis
- Operational, with an open data core service (ftp/opendap)

MyOcean Partners

- MercatorOcean **FR**
- Met Office **UK**
- INGV **IT**
- NERSC **NO**
- DMI **DK**
- PUERTO **ES**
- MHI-NASU **UA**
- CLS **FR**
- IFREMER **FR**
- MF **FR**
- KNMI **NL**
- CNR **IT**
- Met.No **NO**
- CNRS **FR**
- HCMR **EL**
- SMHI **SE**
- EDISOFT **PT**
- INRH **MA**
- IOBAS **BG**
- OC-UCY **CY**
- BSH **DE**
- BC **DE**
- DNSC **DK**
- CSIC **ES**
- STARLAB **ES**
- MSI **EE**
- JRC **EU**
- ACRI **FR**
- FIMR **FIN**
- ENEA **IT**
- OGS **IT**
- USAM **IT**
- APAT **IT**
- IOLR **IL**
- IMR **NO**
- Techworks **IR**
- UMT-IOI-POU **MT**
- IST **PT**
- NIMRD **RO**
- CMCC **IT**
- NERC (POL, NOC) **UK**
- PML **UK**
- UREAD **UK**
- HRW **UK**
- CEFAS **UK**
- RBINS/MUMM **BE**
- IFM-GEOMAR **DE**
- NIVA **NO**
- IASA-UAT **EL**
- NIB-MBS **SI**
- NERI **DK**
- DTU-DIFRES **DK**
- SYKE **FIN**
- UL **LV**
- CMR **LT**
- MIG **PL**
- DFO **CA**
- UOP **UK**
- BAS **UK**
- AARI **RU**
- NIERSC **RU**
- ECMWF

A unique pan-European service organization



TAC

- SL TAC
- OC TAC
- Sea Ice & wind TAC
- In situ TAC
- SST TAC

MFC

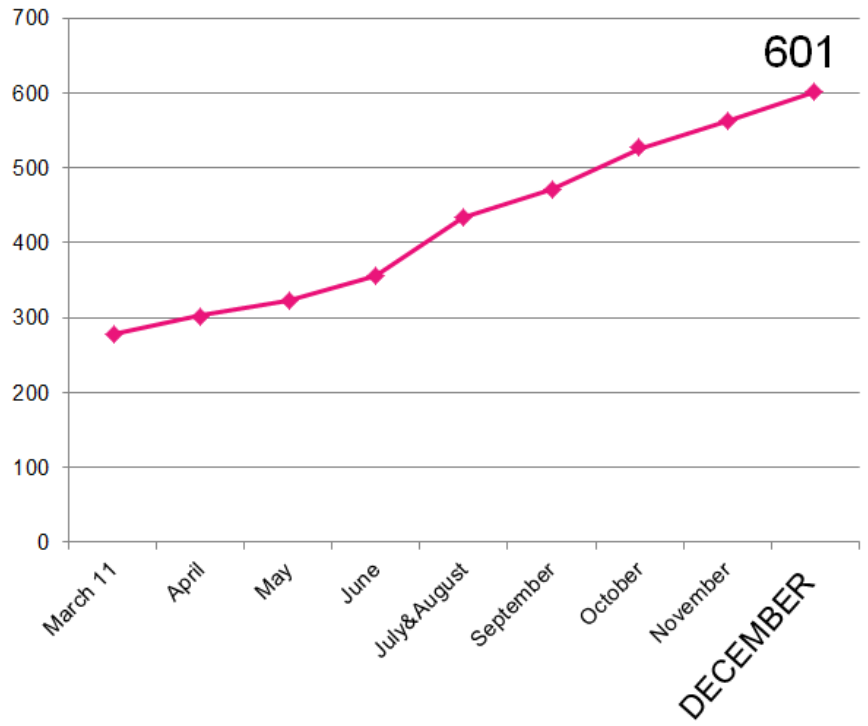
- MFC Global
- Arctic MFC
- Baltic MFC
- NW Shelves MFC
- IBI MFC
- Med Sea MFC
- Black Sea MFC

Dec 2011 : number of users registered to the European Marine Service

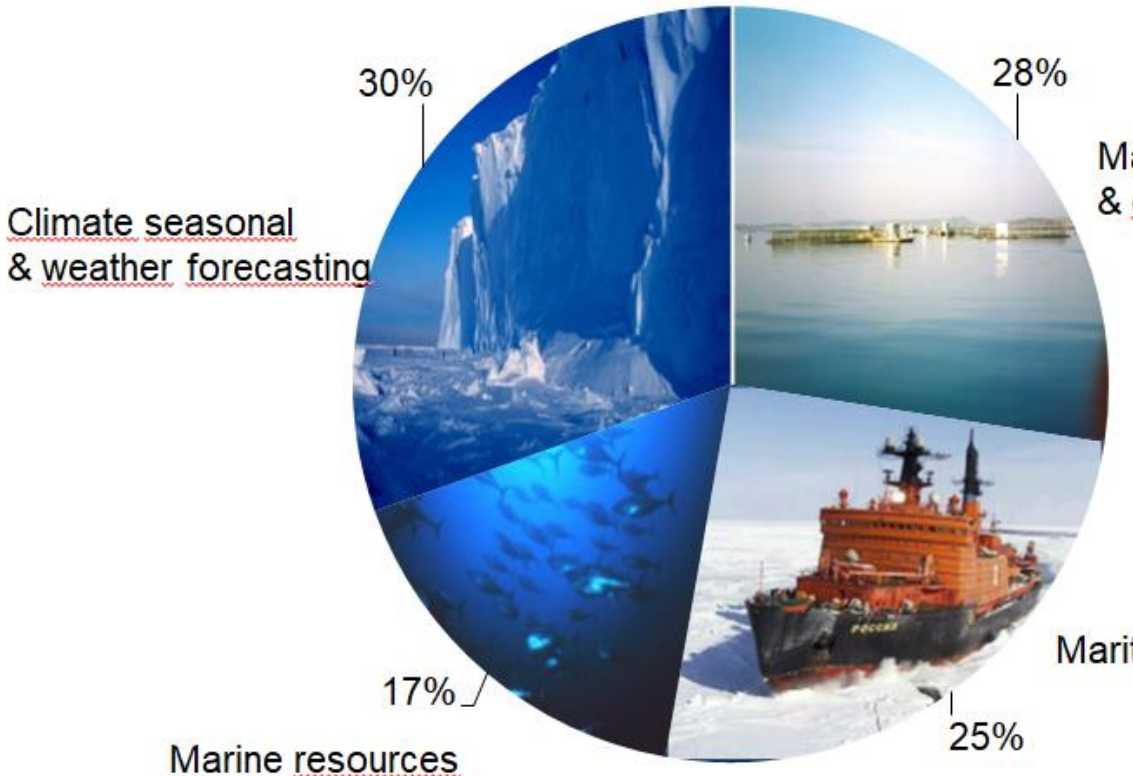
myOcean

Marine Core Service

Number of registered users
(since March 2011)



users by area of benefits



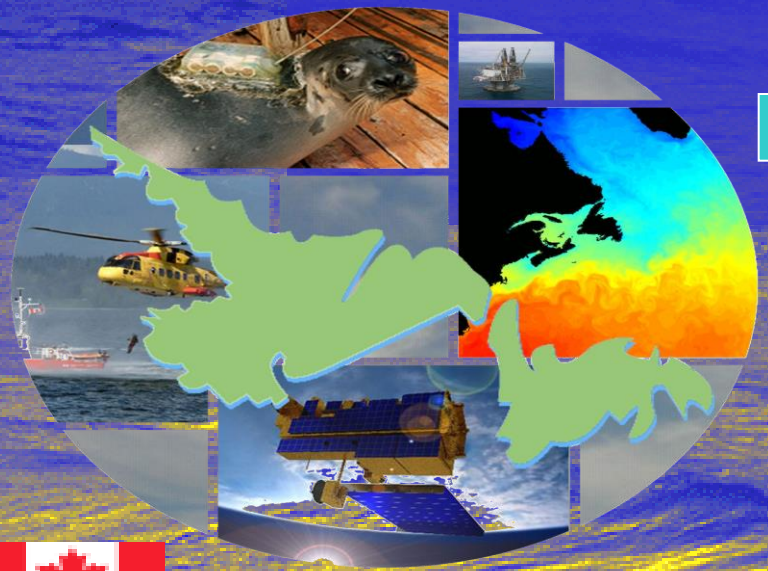
The Newfoundland Operational Ocean Forecasting System

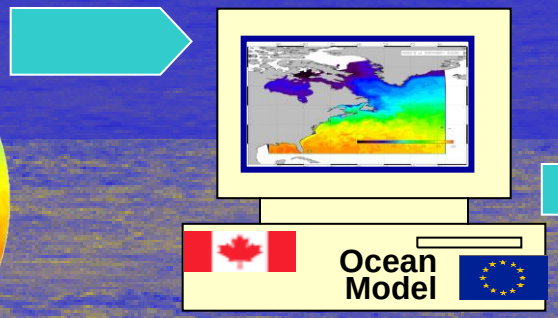
A Canadian regional operational oceanography initiative within MERSEA

Fisheries and Oceans Canada

Fraser Davidson, Andry Ratsimandresey, Mathew Warren

DavidsonF@dfo-mpo.gc.ca



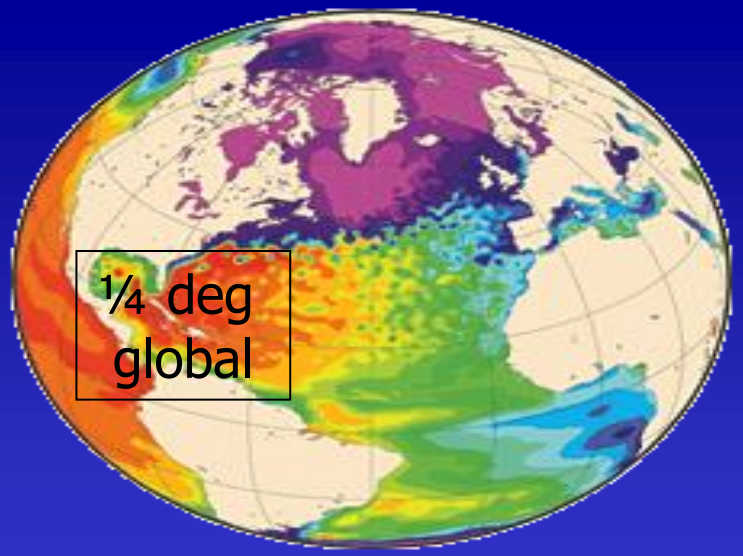


Canadian Coast Guard

MERSEA

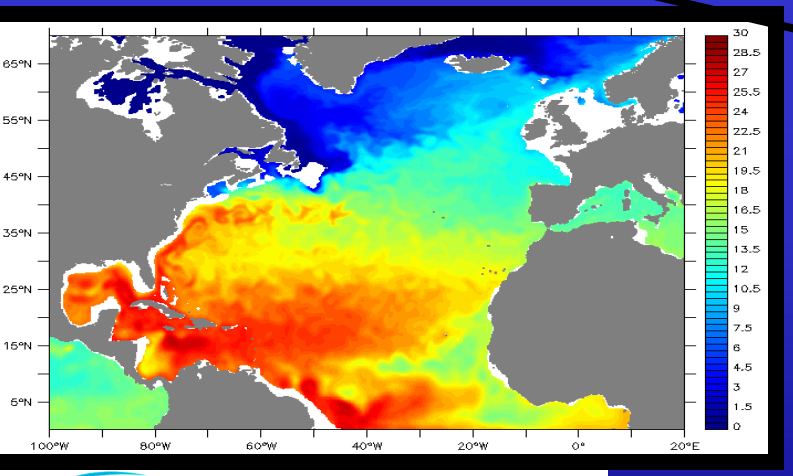
MERCATOR
OCÉANOGRAPHIE OPÉRATIONNELLE

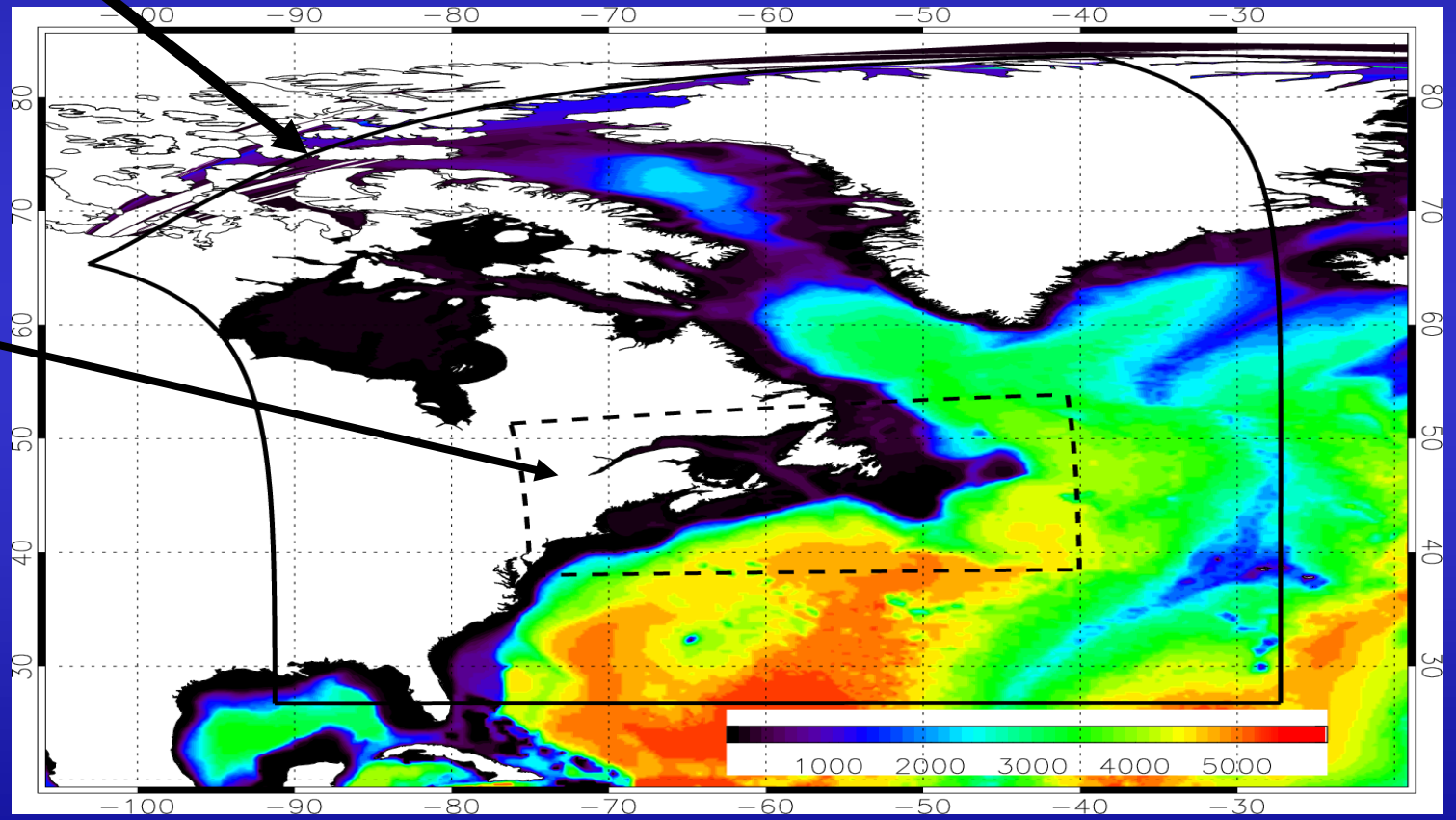
The NOOFS system



1 way nesting

High Res Domain

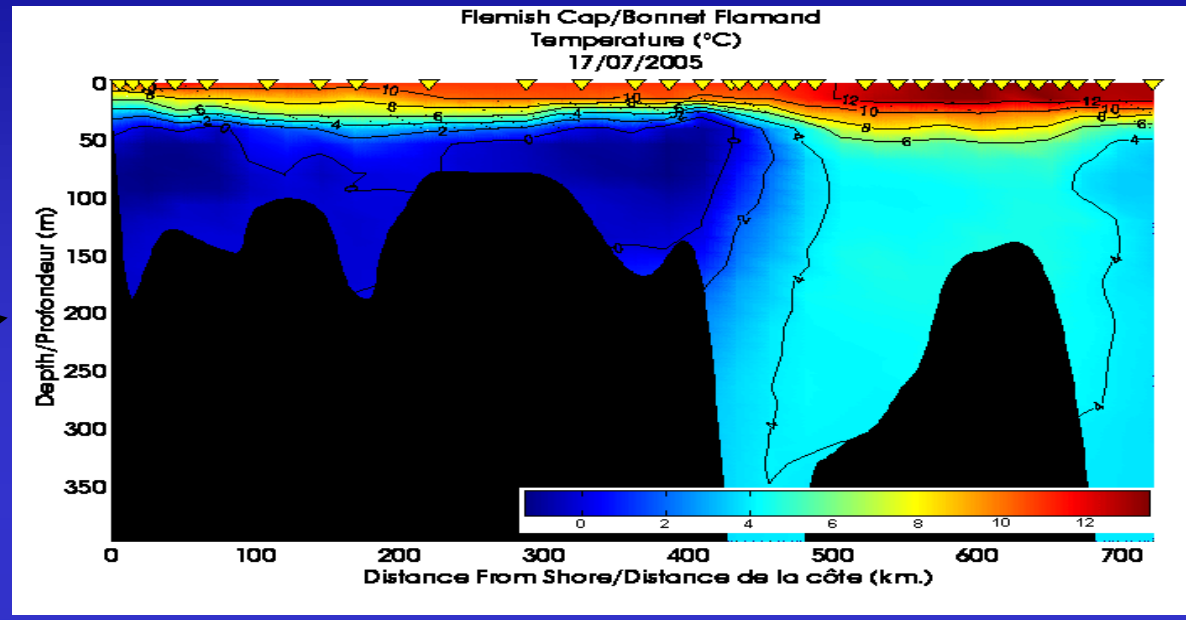




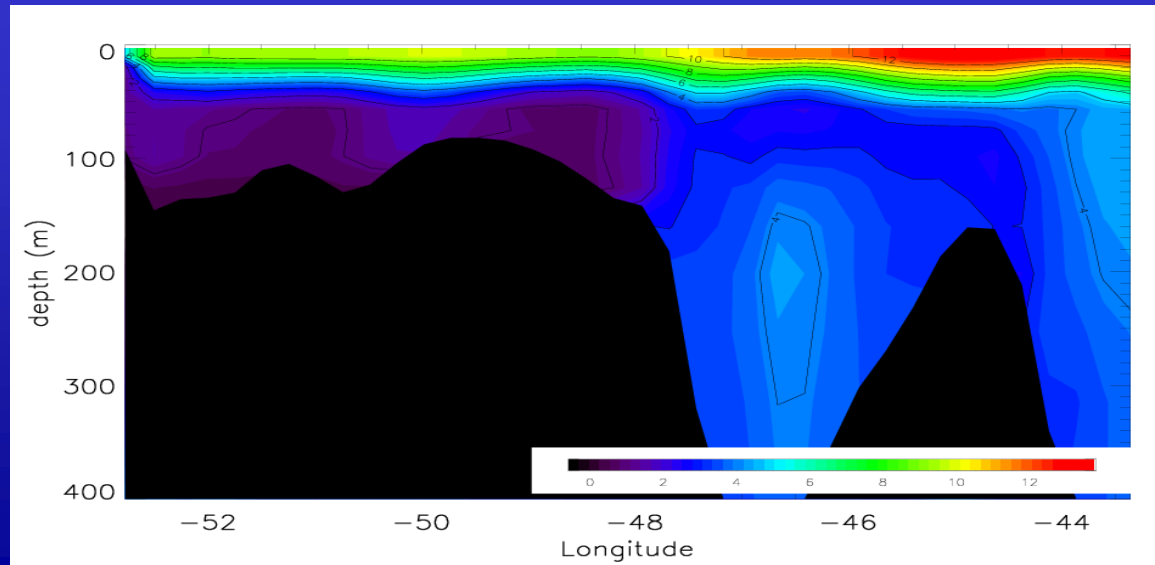
MERCATOR
OCEANOGRAPHIE OPERATIONNELLE

Fisheries and Oceans Canada
MERSEA AGM 2006

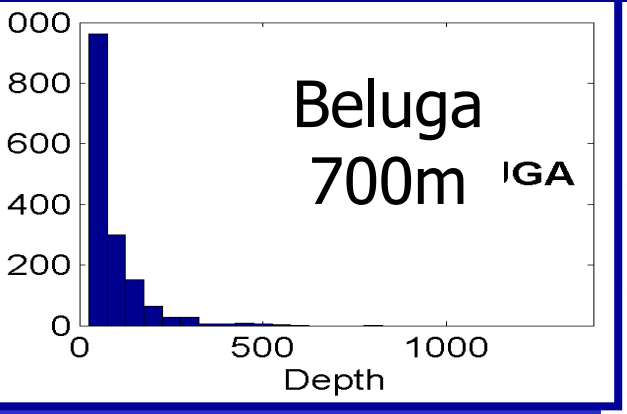
Example of Obs / Model comparison



- Obs AZMP transect comparison to MERCATOR PSY2
- REALTIME transmission capability Dec 2006
- **NEED MORAL SUPPORT**

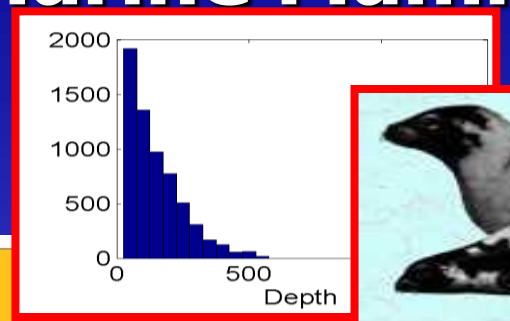


Data collection by Marine Mammals: 2004 Review

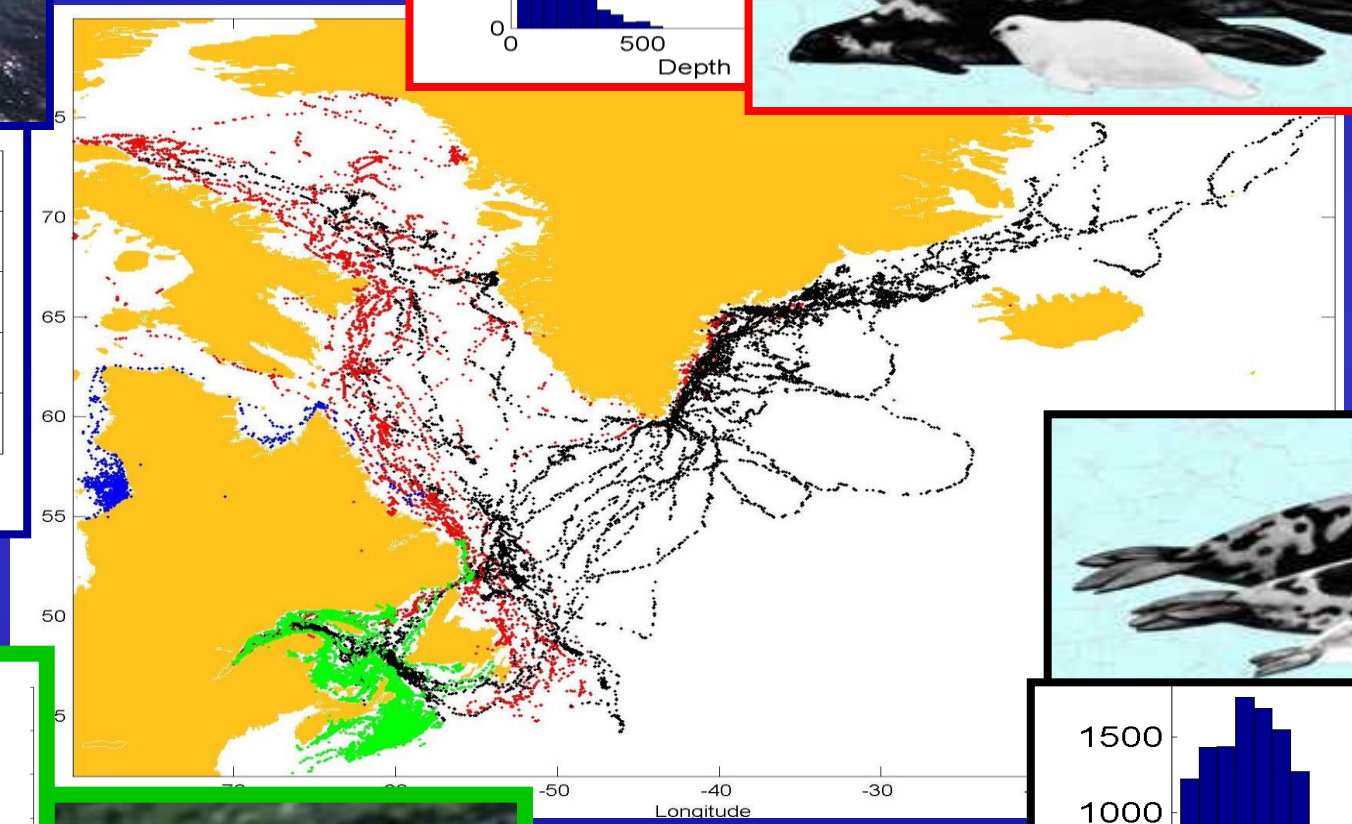


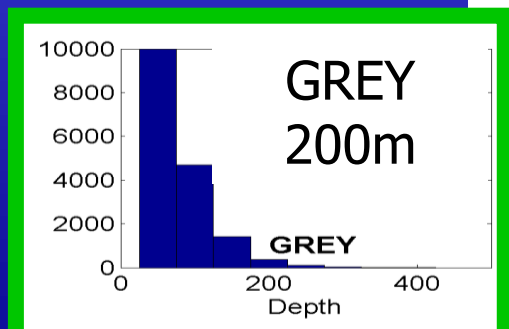
Beluga
700m

IGA

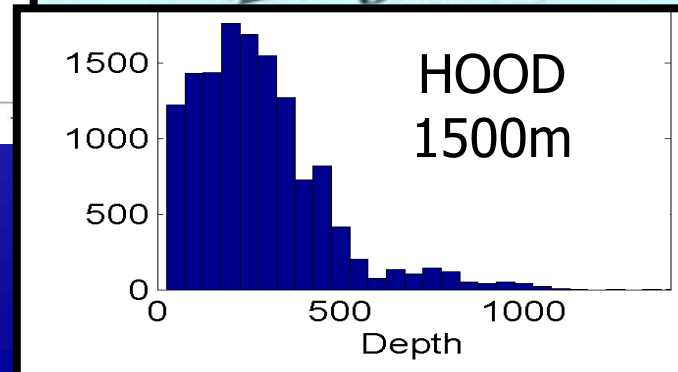


Harp 500m





GREY
200m

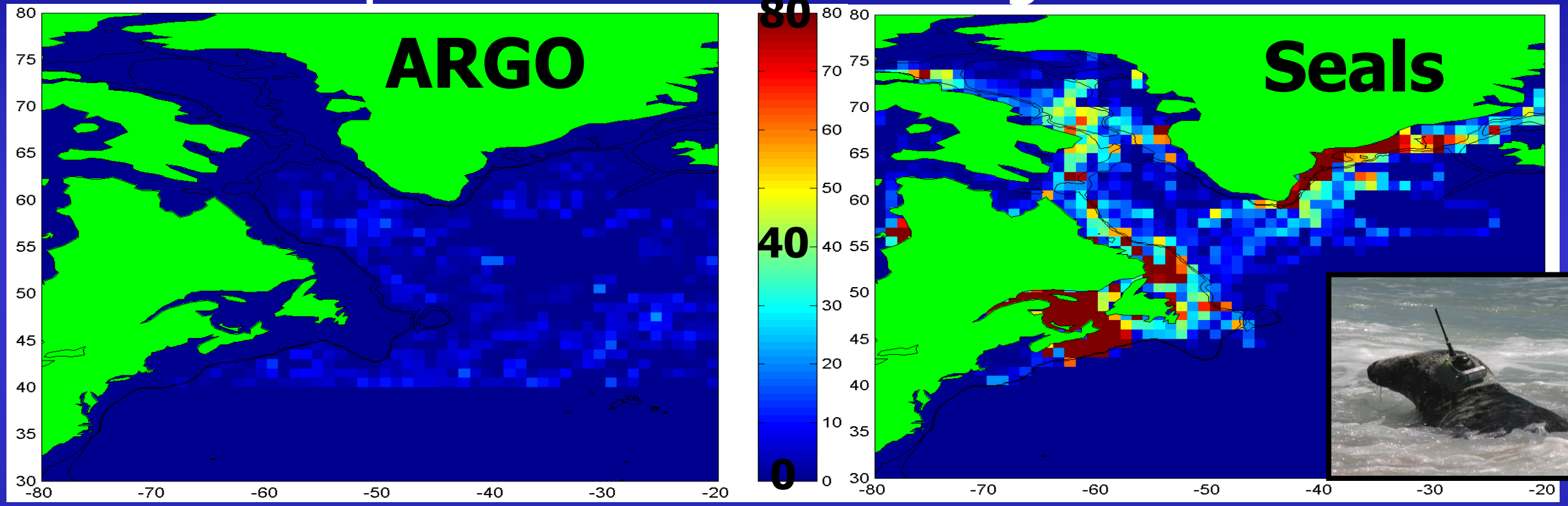


HOOD
1500m

ns Canada
6

ARGO vs Seals

of profiles 2004 --- 1 deg BOX



2004 → 100 seal tags (4 species)
2005 → 18 seal tags deployed Greenland Hoods
2006 → 18 tags for deployment Greenland Hoods
2007 → 100 seal tags

Search and Rescue

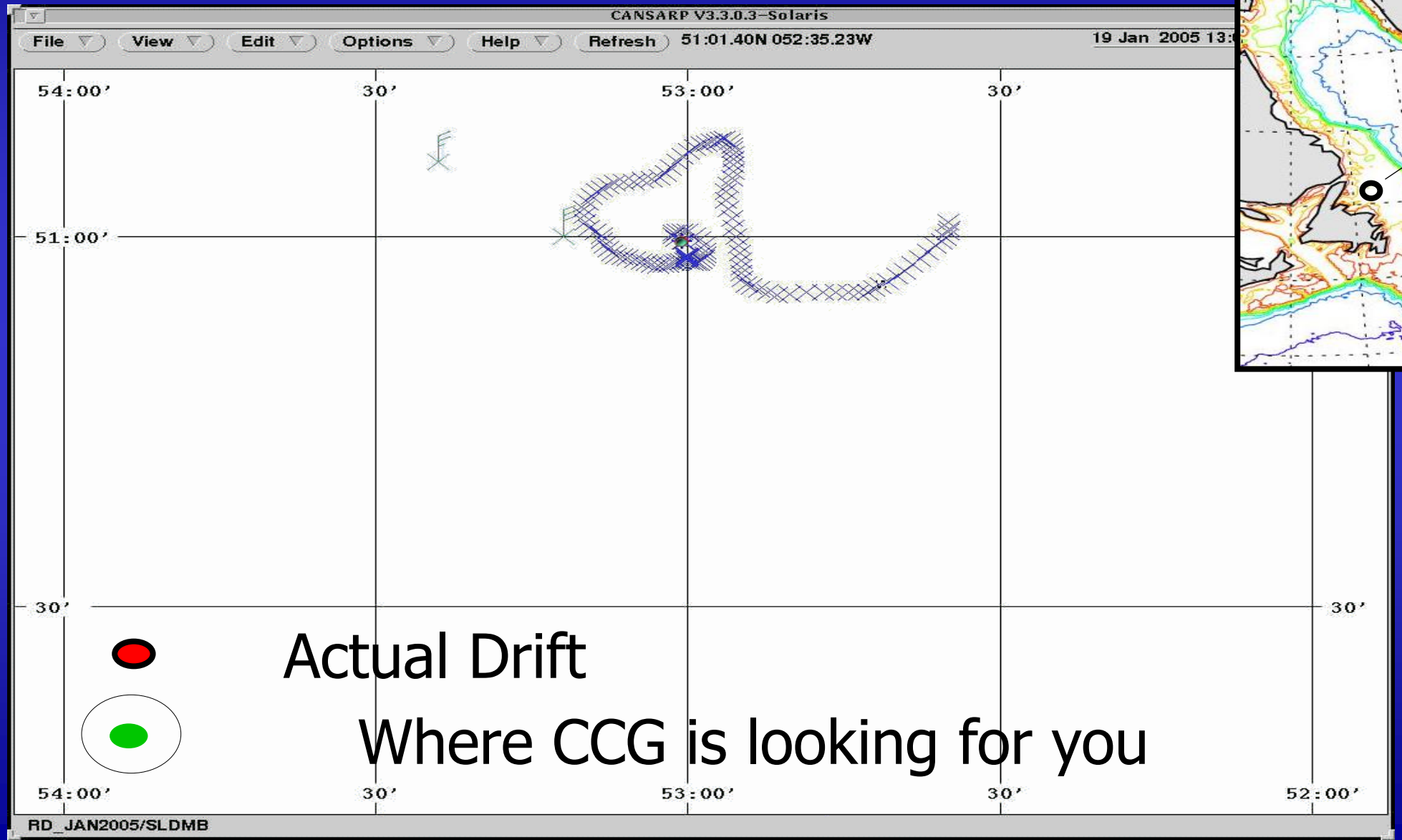
Canada SPENDS 5 M$ annually on Fuel for Searching

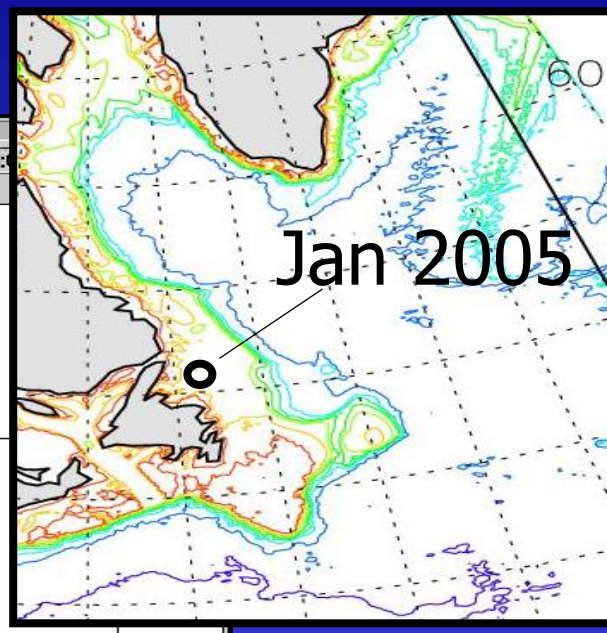
CANadian
Search And Rescue Program

4,300 hrs /year
47,300 hrs /decade ➔ 5 years
***transit times not included**

Less Search
More Rescue

WHY Forecast currents on the shelf?

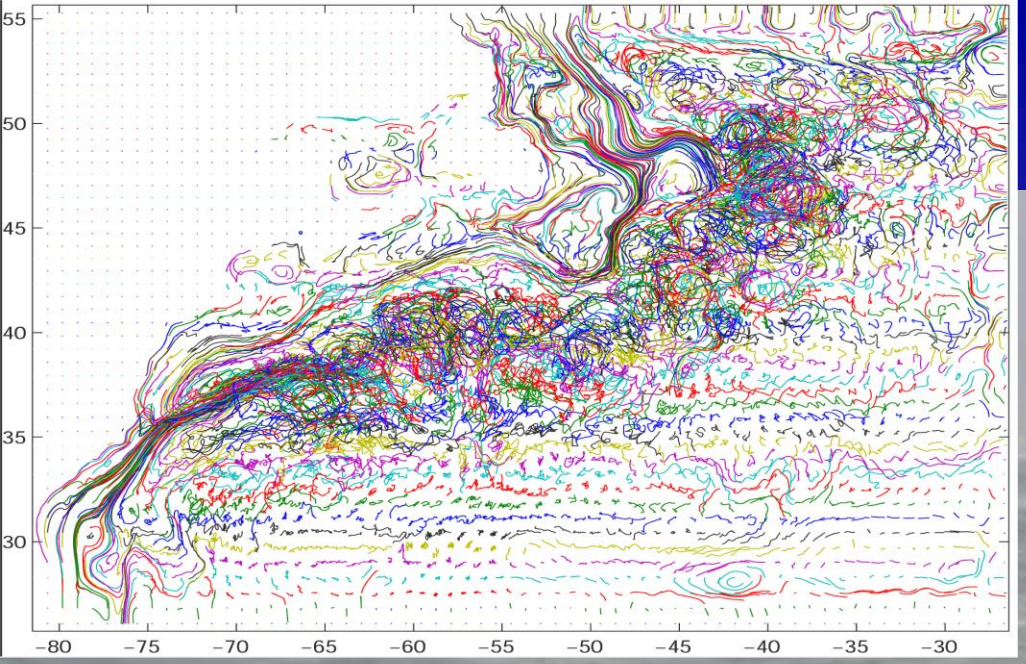




Actual Drift

Where CCG is looking for you

FINAL WORD



Marine currents are complex

We need to forecast currents, temperatures, salinity, sea surface heights, ….

Team work is fundamental

OIL SPILL

Cleanup underway

BY MOIRA BAIRD
The Telegram

Petro-Canada began using oil-absorbing booms Tuesday afternoon to soak up the Terra Nova spill.

The company expects to continue that work today as wave heights were forecast to remain below three metres.

So far, the company has not used skimmers to vacuum the oil, and said that tool would not be as effective as booms.

"What type of equipment they will deploy depends on, basically, the volume," said John Downton, spokesman for Petro-Canada in St. John's.

"In this case, they determined that the absorbent booms would be more effective."

By Tuesday morning, the oil slick was 40 kilometres south-southeast of Terra Nova, and Downton said it is expected to turn northeast. That broken slick covered a rectangular area 6.1 kilometres by 5.5 kilometres.

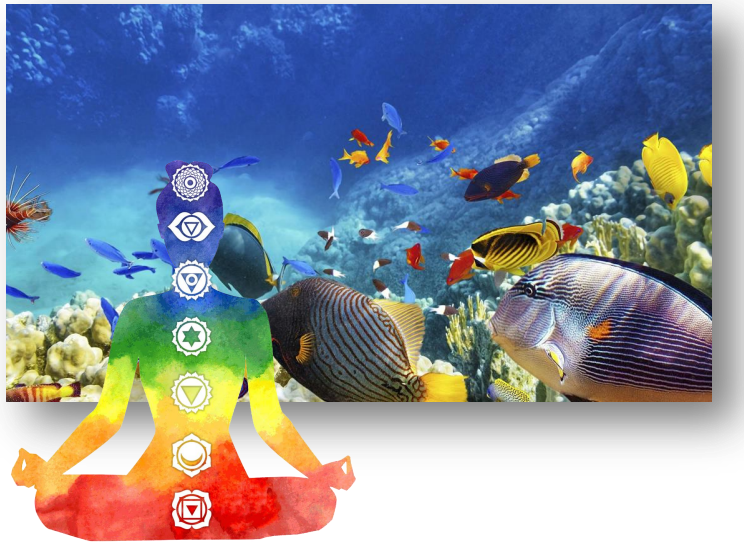
"They were focusing on the larger

Oil still drifting

Continued from page A1

CNOPB spokeswoman Si
Keough could not say exactly
long it will take to conclude th
tion of the investigation.
She did say the investigation
will be made public.
Robert Stuckes, planning m
for Eastern Canada Respons
(ECRC), said there's no way t
how much oil has been cleane
til those booms are brought as
"It's packaged up once it
aberrd and we don't actually c
the volume until it comes back
"For the most part, they'
around the slick area lookin
cific spots. This is not contin

From 2005 to 2011, GODAE set a stimulating working environment for ocean monitoring and forecasting sciences and operations : « we feel part of an innovative community of ocean experts, cheerfully learning and growing »



Personal GODAE achievements over this period 2005-2011

- Mercator Ocean reaches a global ocean coverage capacity, eddy-resolving, assimilating space & in situ observations
- The EU MyOcean project gathers all marine data providers in Europe, and create a unique collaboration and operational service for marine
- Mercator Ocean and MyOcean sign for a general interest service, with a fully open & free data policy
- 1000 users trust our service

MERCATOR OCEAN
OCEAN FORECASTERS

3

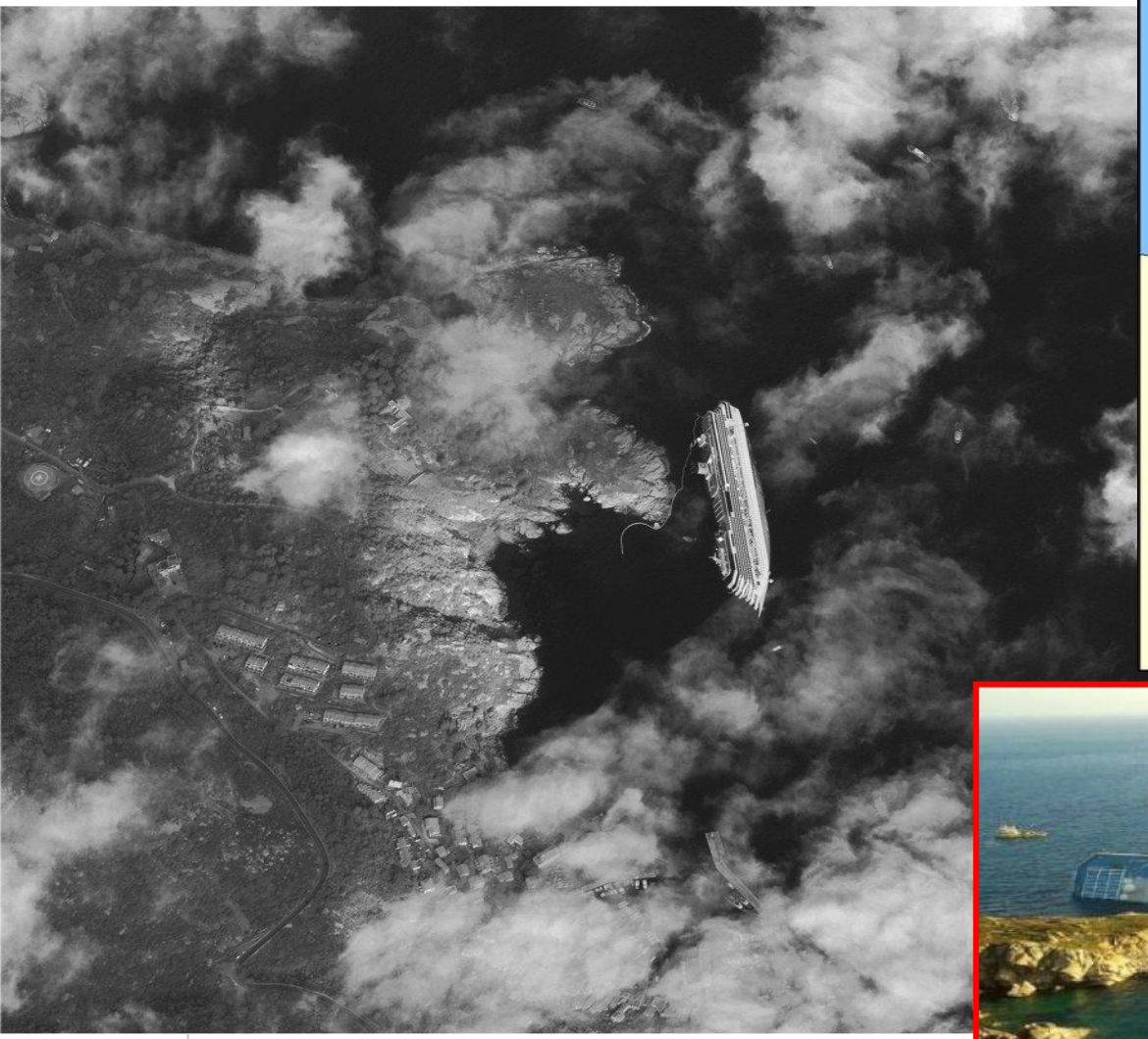
2012– 2018: Achievements

“WE WANT”

From 2012 to 2018, we focussed our energy to build strong foundations to the future we want : « we want the GODAE-like ocean monitoring and forecasting to be a sustained service »

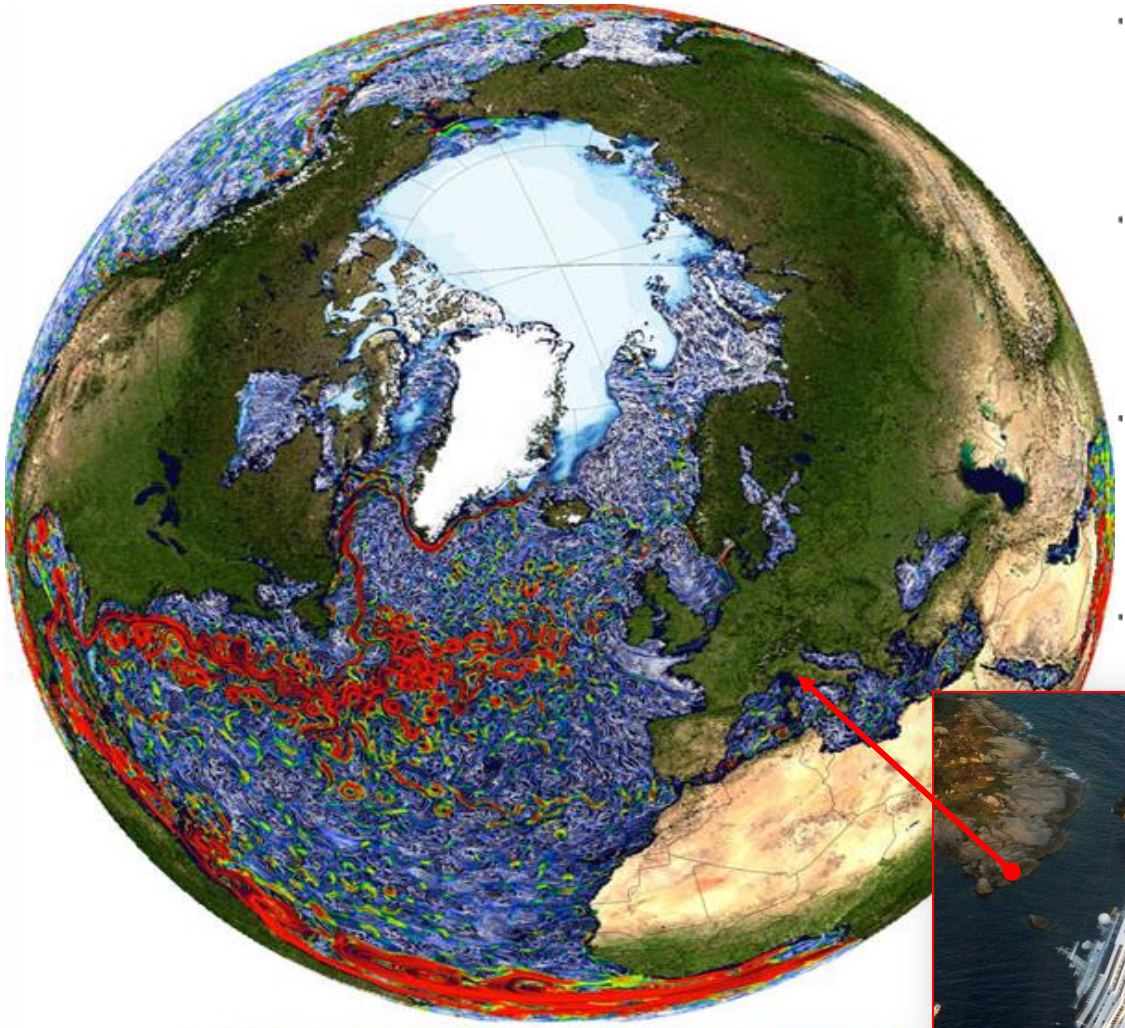
13 January 2012

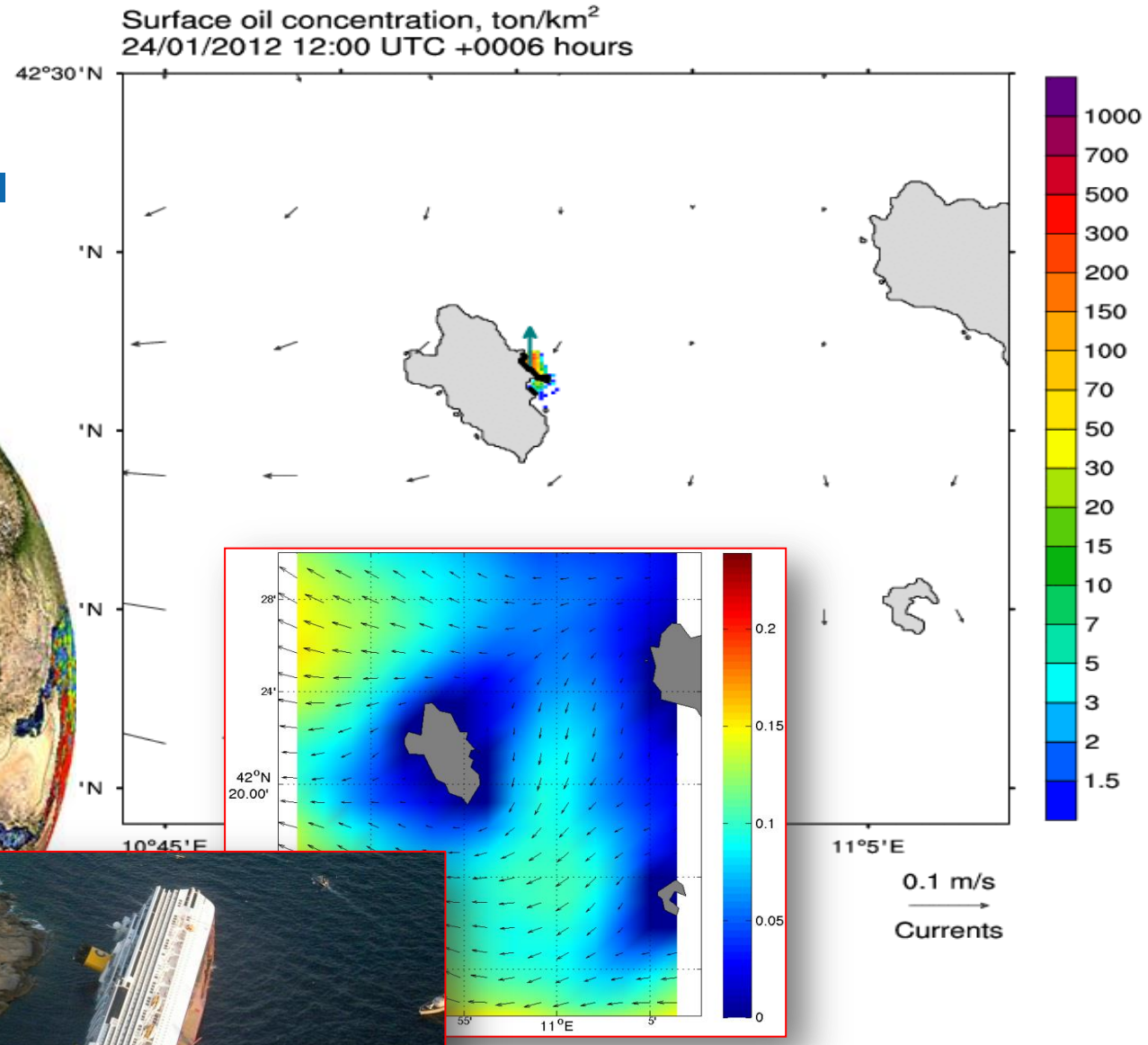
Costa Concordia accident



myOcean

www.myocean.eu





CURRENT STATUS OF DEVELOPMENT OF OCEAN ENVIRONMENTAL INFORMATION SERVICES

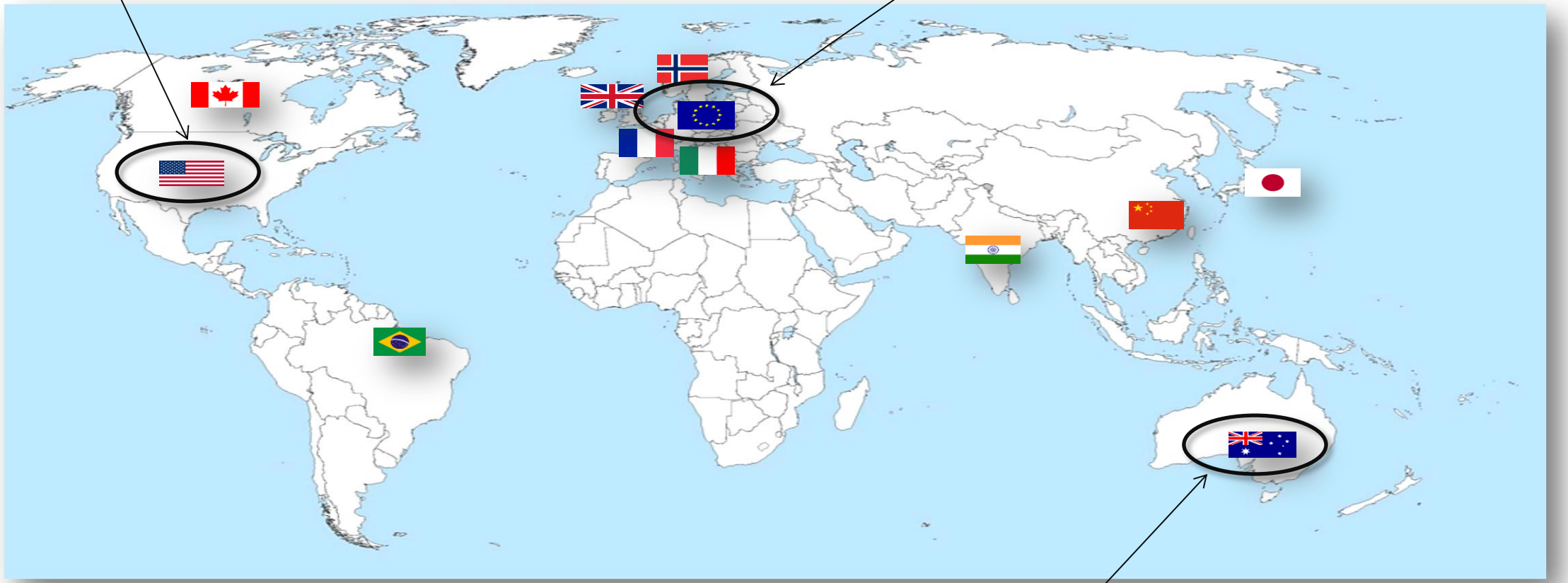
Pierre Bahurel, Mercator Ocean, France
Frank Aikman, NOAA, US
Tim Moltman, IMOS, Australia

GODAE OceanView

GODAE OceanView

National Ocean Service, US

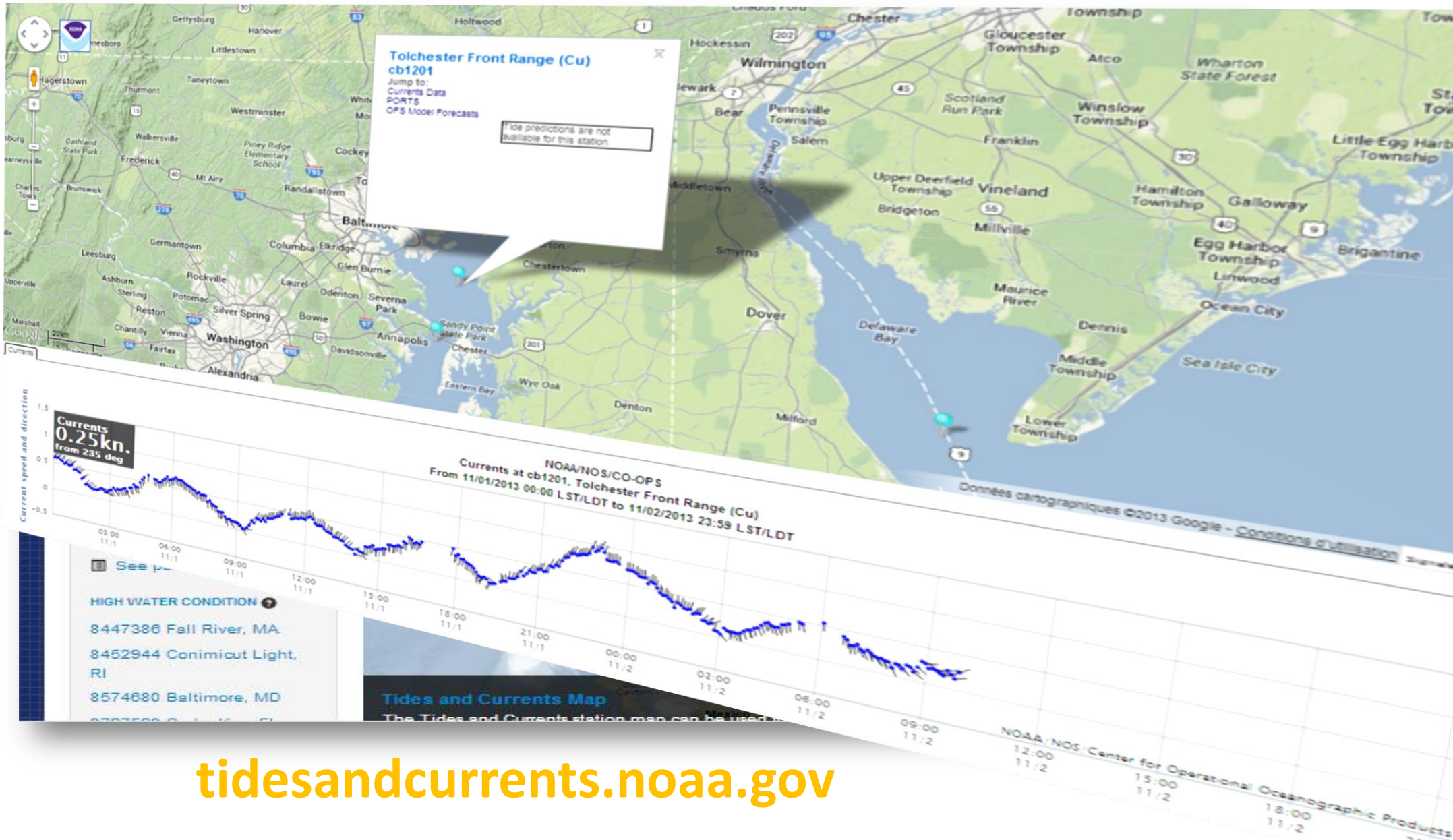
MyOcean Copernicus, Europe



IMOS, Australia

GODAE OceanView

NOS

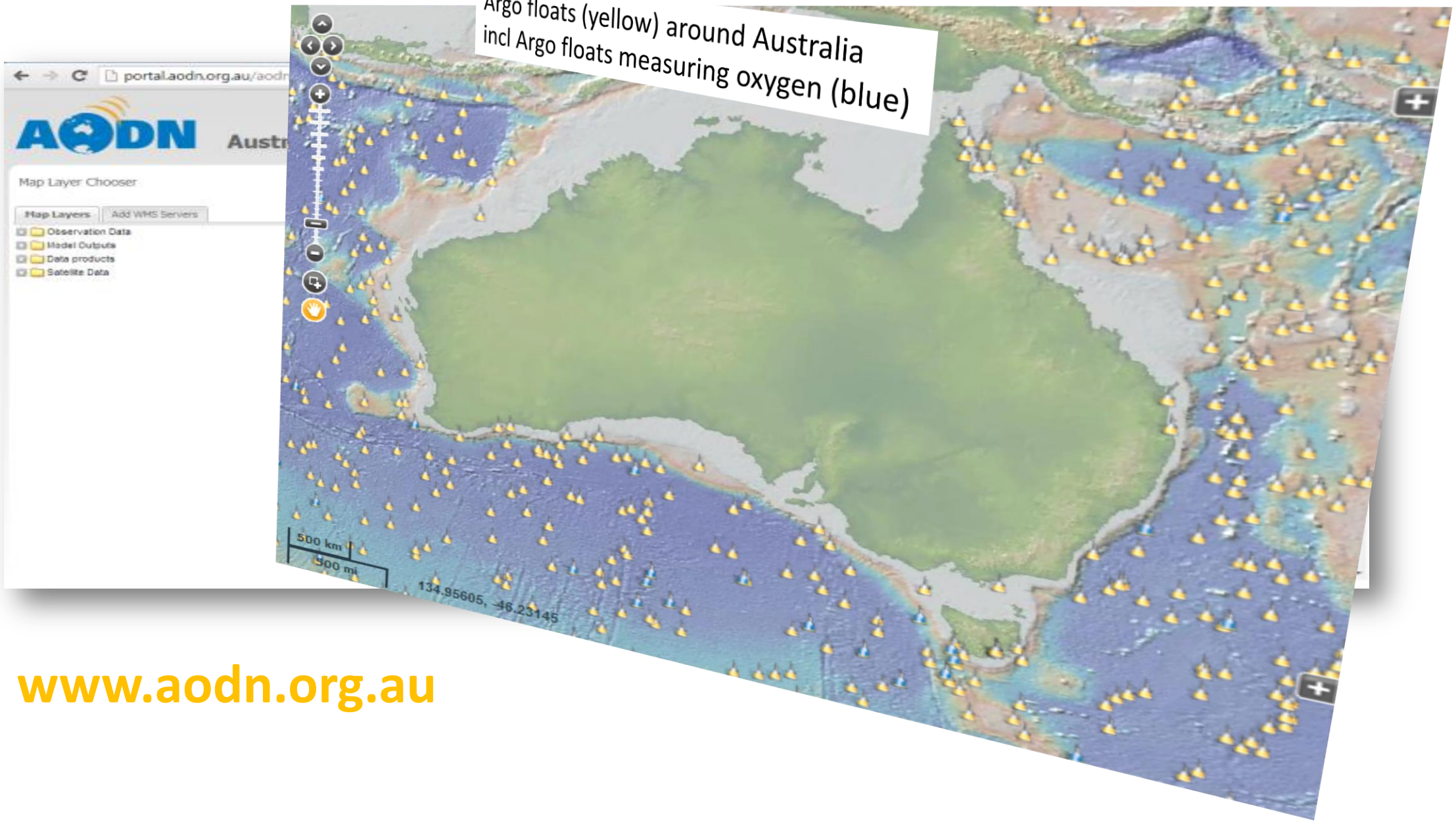


tidesandcurrents.noaa.gov

IMOS

Symposium 2013
4-6 November 2013, Baltimore

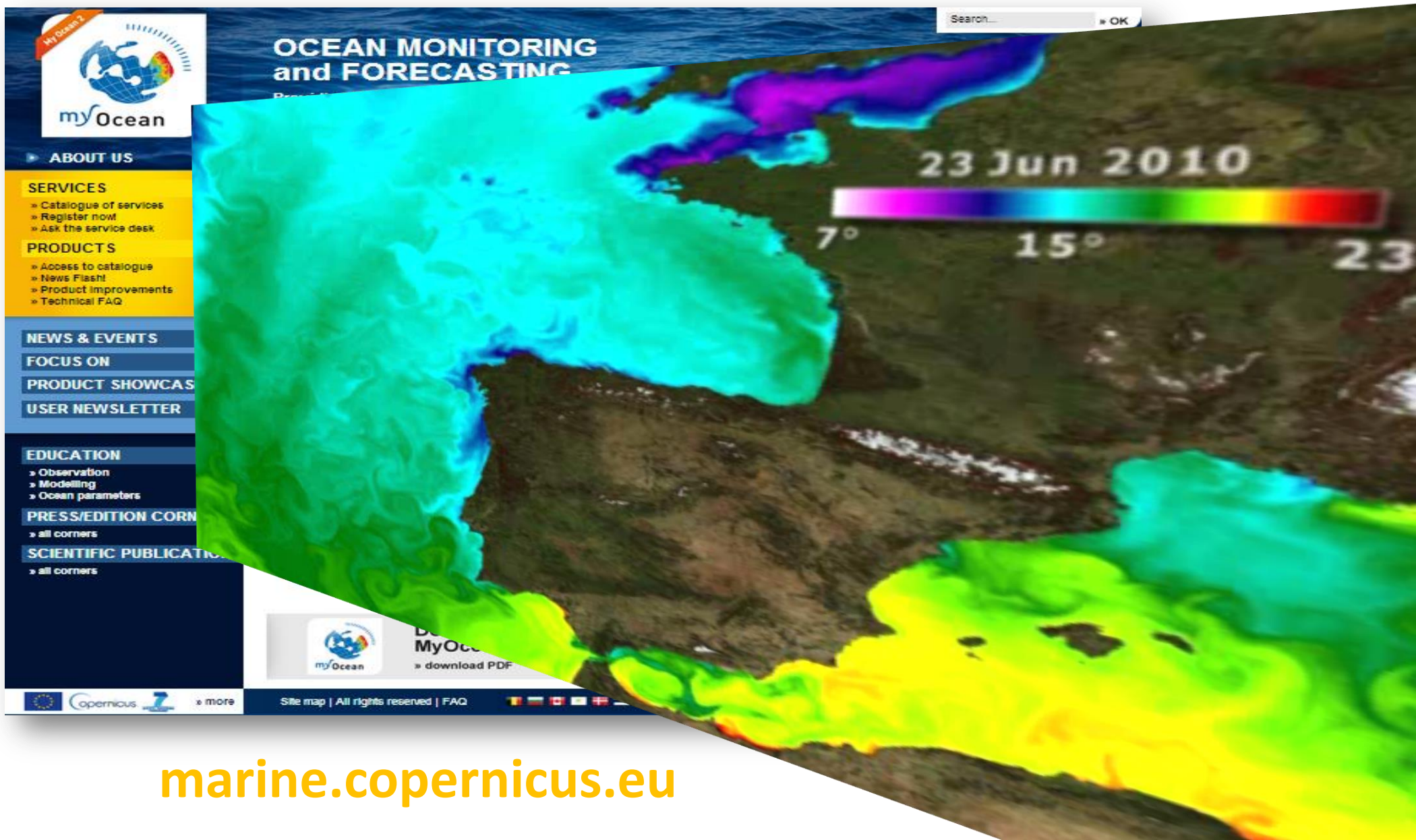
GODAE OceanView



www.aodn.org.au

GODAE OceanView

MyOcean Copernicus



marine.copernicus.eu

Conclusion

Operational oceanography **is moving** from successful R&D demonstrations to operational core services.

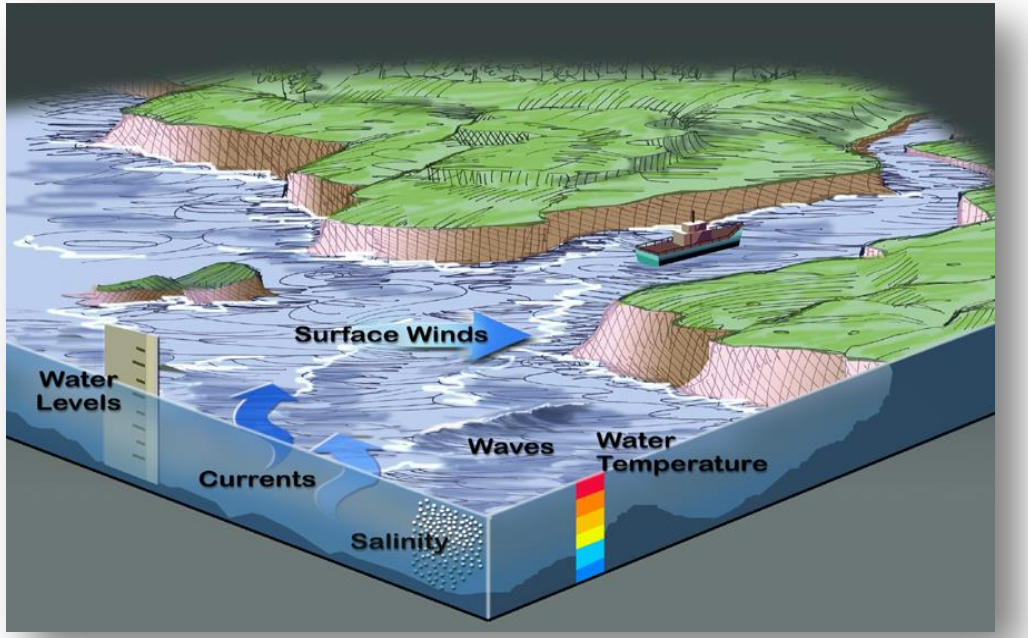
There are different types of core services, with different scopes, but they always **come from** a successful R&D

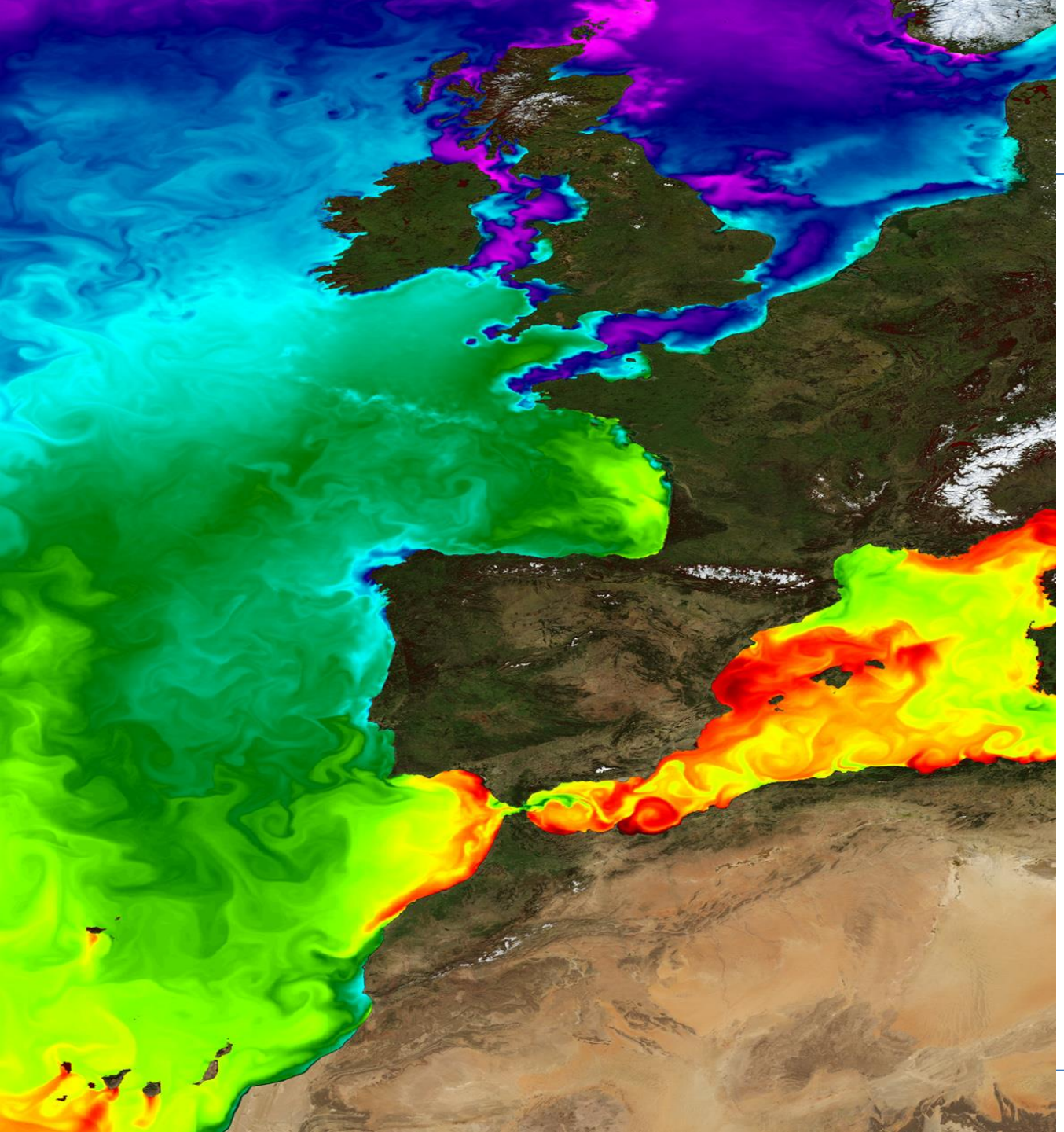
Core services in operation

- prove their capacity to meet users' first expectations (**simplify, deliver, assess, secure**)
- are based on '**public-good**' business models
- create value by securing a '**network** organization with a simple **focal point**' for users

There is a lot to do, and great **expectations**.

Sustainability is a key issue.





eu2013.ie

The Atlantic
A shared Resource
23-24 may 2013, Galway

Current status of Operational Oceanography Forecasting - Europe

Pierre Bahurel, Mercator Ocean, France

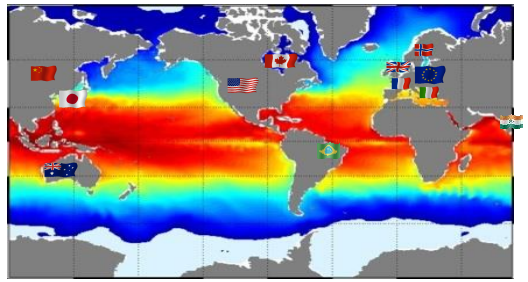
(coordinator FP7 Project MyOcean)

Mercator Ocean Ocean Forecasters

Copernicus

European Global Ocean Observing System

Ocean Forecasting in Europe: **Framework**



At the international level, **GOOS** and the « **GODAE Ocean View** » program.

United States, Canada and Europe major partners. North Atlantic a key area.

At the European level, **EuroGOOS**.

→ The **European Union** priority for marine environment monitoring.

The Copernicus « marine service » and its pilot FP7 project **MyOcean.**

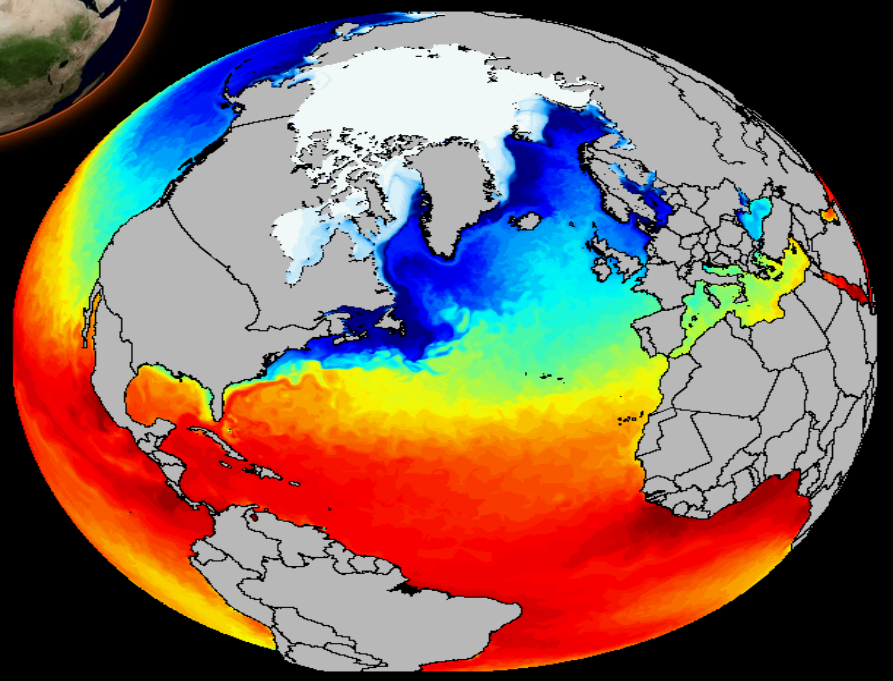
Ocean Forecasting in Europe: **Status**

Challenge 0: SUSTAINABILITY

A successful European service for the mesoscale

- **All European seas and the global ocean equipped today with *ocean monitoring and forecasting systems*.**
- Single, simple, open and free access point to users: **www.myocean.eu.** More than 2000 users so far.

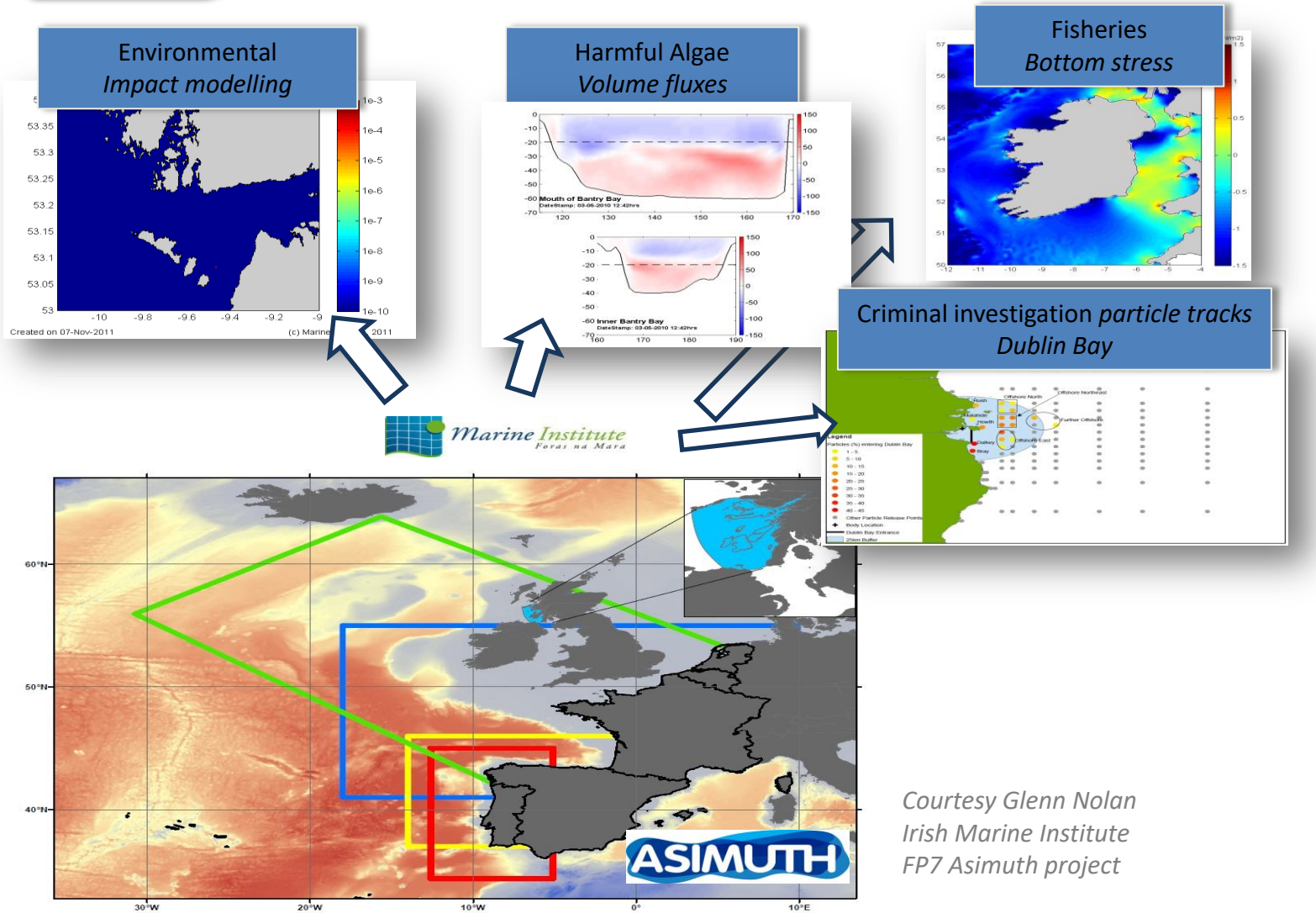
Temperature and ice fraction, 1/12°, global



European Marine Service (MyOcean) providing real time analysis and forecasts all around the globe at 1/12° horizontal resolution, 50 vertical levels, thanks to the assimilation of satellite and in situ observations in the NEMO 3D model (physics & ice). *MyOcean FP7 / Copernicus / Mercator Ocean*

[1] Ocean forecasting … mesoscale to coastal

Scientific Challenge #1



Courtesy Glenn Nolan
Irish Marine Institute
FP7 Asimuth project

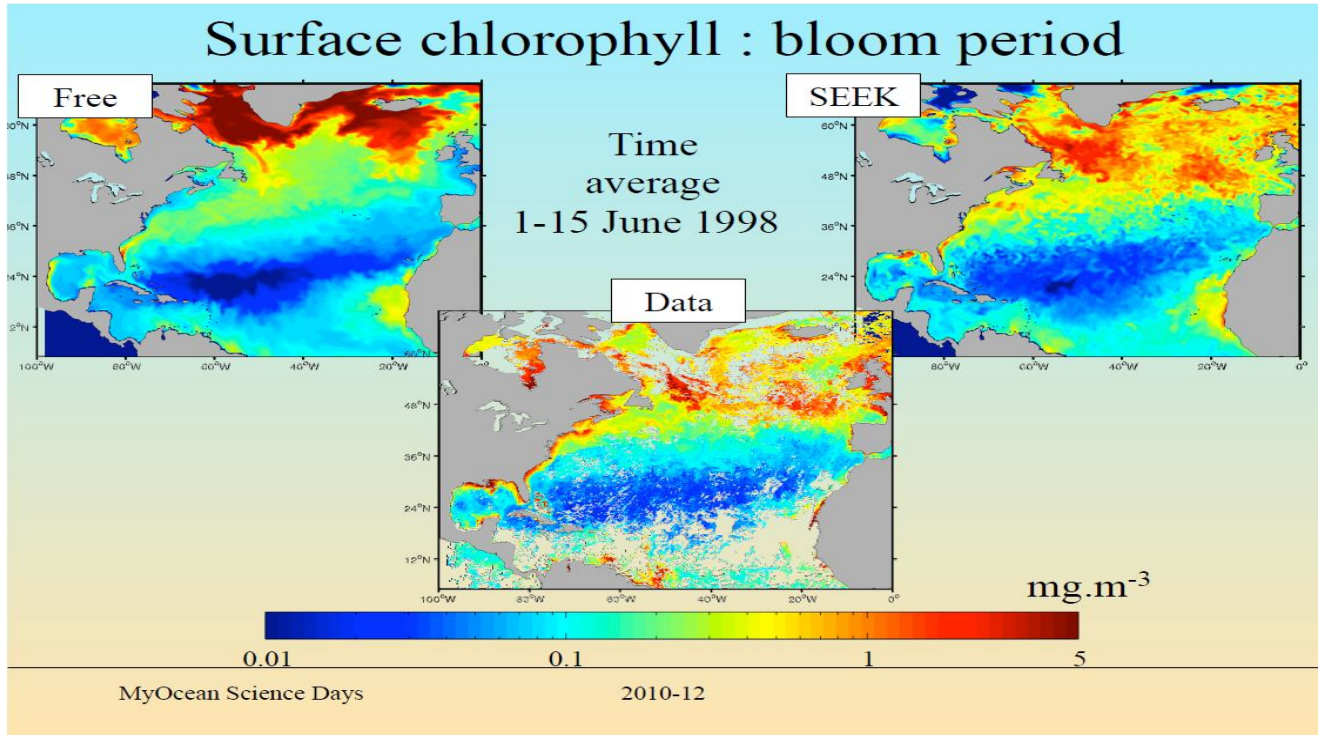
- **European coastal areas are mapped with a series of coastal systems**
- Wide variety of applications.
- Major achievements made to **connect large ocean and coastal waters** systems

- *Lack of observations, biogeochemistry modelling, accurracy and adequacy of information …*

[2] Ocean forecasting
… physics to biogeochemistry

Scientific Challenge #2

North Atlantic



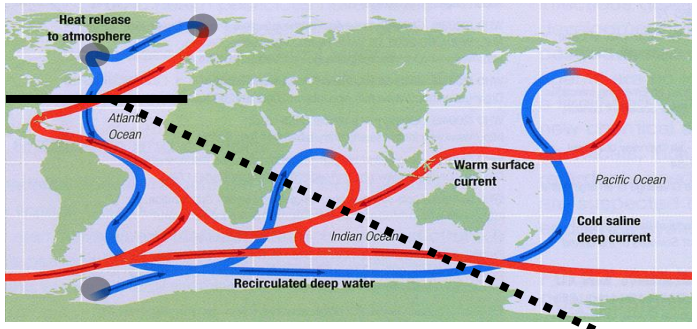
Ocean color data assimilation experiment into a 3D coupled physics / biogeochemistry model of the North Atlantic, presented during the MyOcean Science Days, by C.Fontana (CNRS).

See also e.g. SANGOMA, OSS2015, OPEC FP7 projects

- Major objective for CO2 cycle and primary production
- Strong research efforts
- Some pilot services (e.g. algae blooms)
- *Still a long route to go from current op. oceanography to ecosystem management*

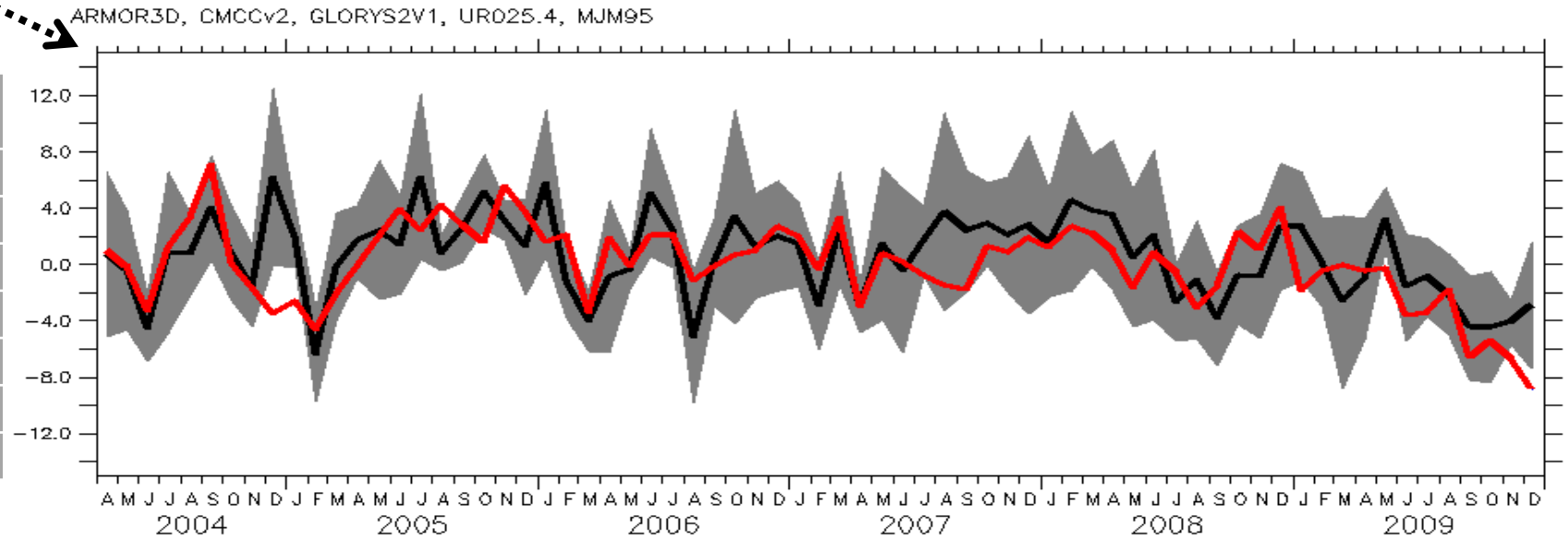
[3] Ocean forecasting
… real time to ocean climate

Scientific Challenge #3



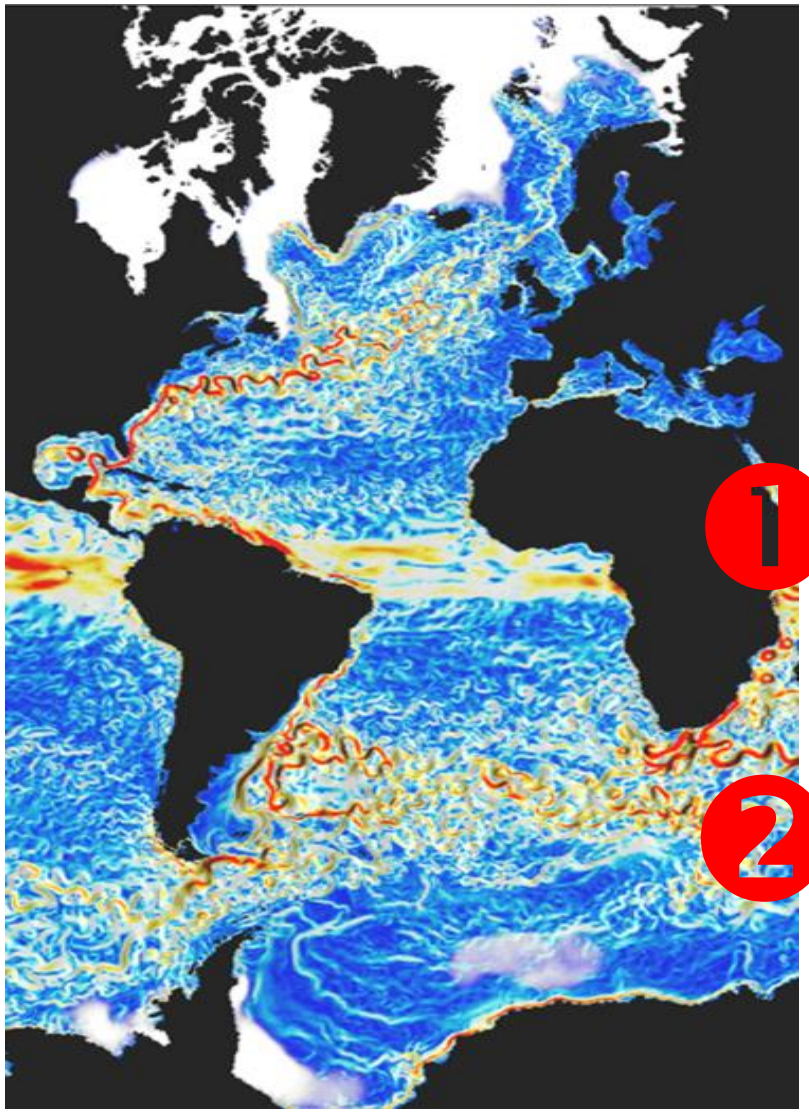
- Operational oceanography systems enable multi-year assesment of ocean climate variations (sea level, heat content, transports, …).
- Demands the use of high quality data sets, advanced data assimilation methods and fine tuning of models.
- Co-operative efforts on **Ocean reanalyses**, incl. **ensemble** approaches, prove their value

Reanalysis	Correlation
Reanalysis 1: Mercator	**0.39**
Reanalysis 2: CMCC	**0.42**
Reanalysis 3: Univ. Reading	**0.36**
Combined obs: CLS	*0.25*
Control Run MJM95 (LEGI)	*0.63*
REA ENSEMBLE	0.57
REA ENSEMBLE no MJM95	**0.53**



North Atlantic Meridional Overturning Circulation at 26.5 N (anomaly, in Sv)

Conclusion & Recommendations



- In Europe, a common « core service » (Copernicus, www.myocean.eu) fed by research and feeding expert services.

Lessons learned, key factors

- Openness and international cooperation (e.g. GODAE)
- **Free** access to ocean observations, **free** access to « core information » products, use of **common** modelling tools, **common** formats, **common** quality metrics and methods, ...

Recommendations for EU-CAN-US cooperation

1

Decide on joint commitments for operations and sustainability of the Atlantic observing & forecasting « core » infrastructures

Action plan on : obs & modelling systems, data & product sharing, quality check, co-operation and co-production

2

Share a common plan for research & innovation for the ocean

Research Plan on: on modelling & data assimilation, coastal areas, reanalyses and multi-year assessments, biogeochemical modelling, quantification and reduction of uncertainties.


opernicus
The European Earth Observation Programme

The EU Copernicus Programme

With Copernicus, the European Union took long-term commitments for funding space observation (Sentinel missions) and service infrastructures (Copernicus Marine Service).

~2500 M€

SATELLITES

(S1, S3, Jason-3, S6, S2)

IN SITU

Copernicus
Europe's eyes on Earth

~800 M€

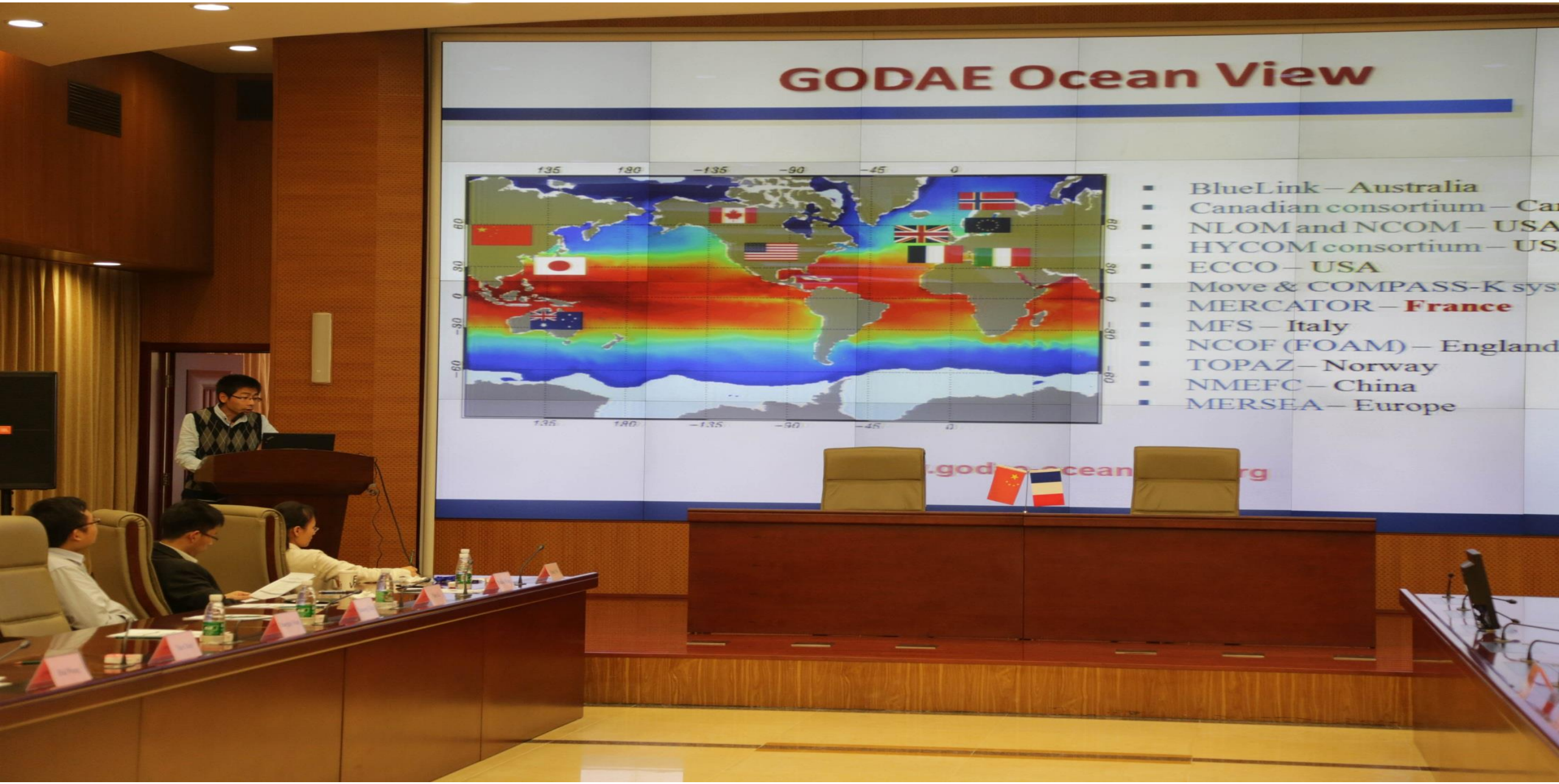
SERVICES

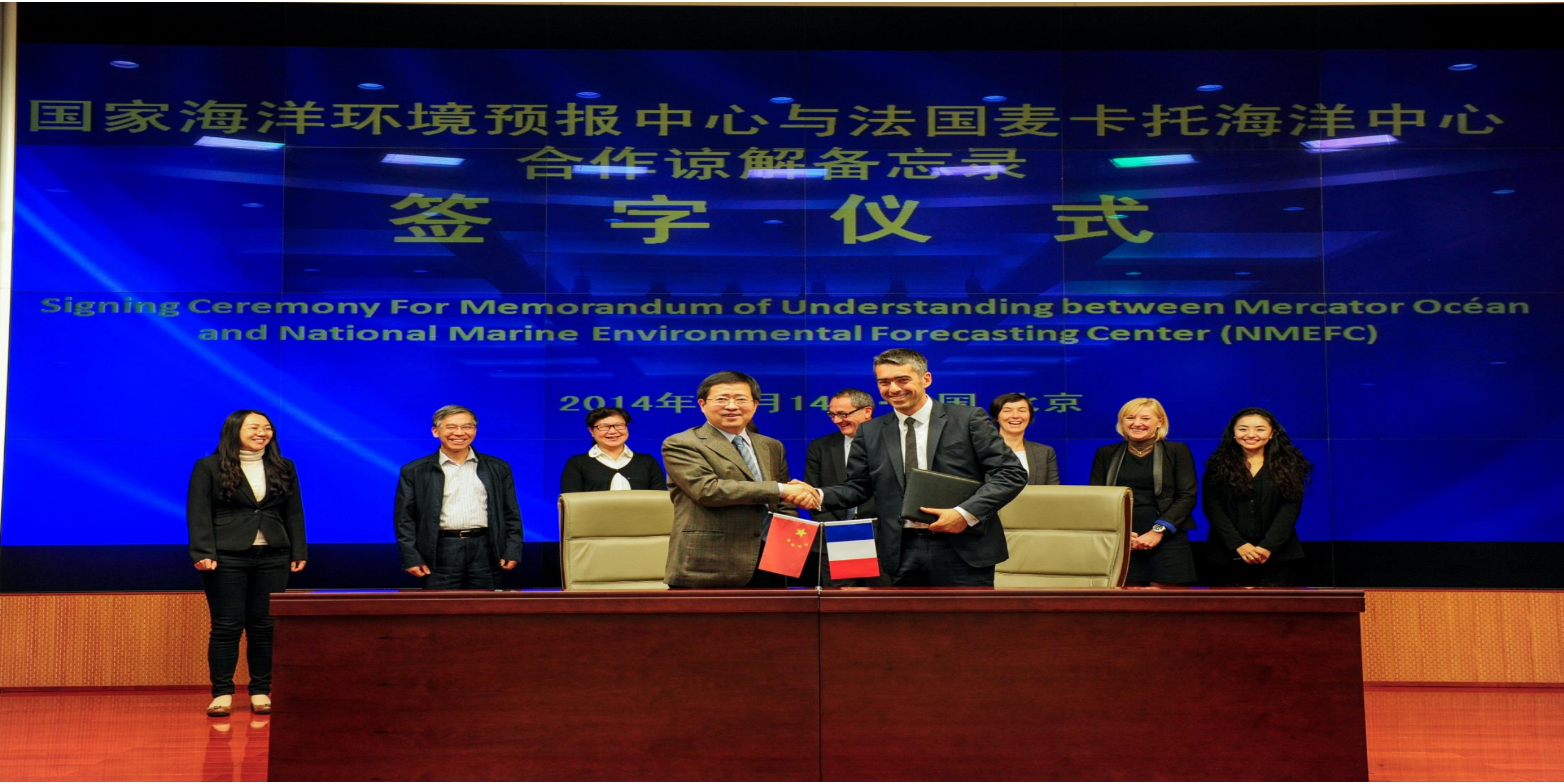
144 M€

- MARINE
- ATMOSPHERE
- LAND
- SECURITY
- EMERGENCY
- CLIMATE

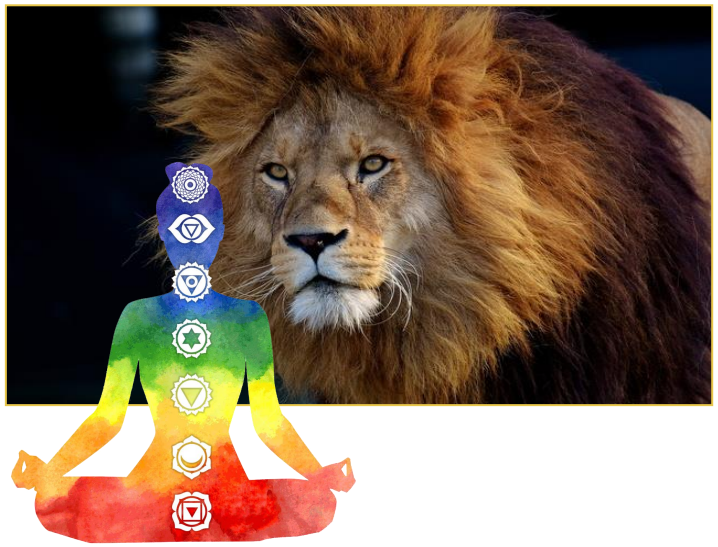
How GODAE stimulates structuring bilateral cooperations


国家海洋环境预报中心与法国麦卡托海洋中心
合作谅解备忘录
签 字 仪 式
Signing Ceremony For Memorandum of Understanding between Mercator Océan and National Marine Environmental Forecasting Center (NMEFC)
2014年10月14日-中国 北京


GODAE Ocean View
BlueLink – Australia
Canadian consortium – Ca
NLOM and NCOM – USA
HYCOM consortium – US
ECCO – USA
Move & COMPASS-K sys
MERCATOR – France
MFS – Italy
NCOF (FOAM) – England
TOPAZ – Norway
NMEFC – China
MERSEA – Europe


国家海洋环境预报中心与法国麦卡托海洋中心
合作谅解备忘录
签 字 仪 式
Signing Ceremony For Memorandum of Understanding between Mercator Océan
and National Marine Environmental Forecasting Center (NMEFC)

From 2012 to 2018, we focussed our energy to build strong foundations to the future we want : « we want the GODAE-like ocean monitoring and forecasting to be a sustained service »



Personal GODAE achievements over this period 2012-2018

- The European Union votes a long-term support to Earth Observation (Copernicus) and Marine Environment.
- The Copernicus Marine Service (CMEMS) is implemented by Mercator Ocean and European GODAE partners
- Mercator Ocean becomes Mercator Ocean International
- 17 000 users subscribe to our service

4

2019 – 2025: Outlook

“WE SOCIALIZE”

Halifax, Canada, 6 May 2019

ceanPredict ’19
GODAE OceanView Symposium 2019

From 2019 , GODAE Ocean Predict shall be the voice of ocean data producers and innovation players to support stakeholders in their long-term vision: « we socialize to support a sustainable ocean»


Ocean Predict


Ocean Predict
OCEAN OBS
OCEAN
OBS'19


Ocean Predict
GEO
BLUE PLANET
Oceans and Society

Ocean Predict

UN Sustainable Development Goals


Ocean Predict
UN Decade of Ocean Science
UNESCO
United Nations
Educational, Scientific and
Cultural Organization
Intergovernmental
Oceanographic
Commission
2021
2030
United Nations Decade
of Ocean Science
for Sustainable Development

Ocean Predict

JCOMM

Maritime Safety Services

Expert Team on Maritime Safety Services (ETMSS)

» **MetOcean Information for GMDSS**
» ETMSS publications
» ETMSS meeting list

Sea Ice

Expert Team on Sea Ice (ETSI)

» **Ice Services of the World**
» ETSI publications
» ETSI meeting list

Disaster Risk Reduction

Expert Team on Disaster Risk Reduction (ETDRR)

» ETDRR ToR and Members

» Dynamic part of the Guide to Wave Analysis and Forecasting (WMO-No.702)

Worldwide Met-ocean Information and Warning Service

Committee for Worldwide Met-ocean Information and Warning Service (WWMIWS)

» METAREA Coordinators – Roles and responsibilities
» METAREA Coordinator contact list
» SafetyNet and Navtex product

SFSPA progress

» SFSPA workplan
» SFSPA Projects
» WMO Survey of National Marine and Coastal Services 2018

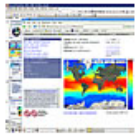
Waves & Coastal Hazards

Expert Team on Waves and Coastal Hazards Forecasting Systems (ETWCH)

» **Forecasting Coastal Hazards**
» **Wave Forecast Verification**
» ETWCH publications
» ETWCH meeting list

Ocean Forecasting

Expert Team on Operational Ocean Forecasting Systems (ETOOFS)



» ETOOFS inventory
» ETOOFS publications
» ETOOFS meeting list

Environmental Emergency Response

Expert Team on Marine Environmental Emergency Response (ETMERR)

» ETMEER ToR and Members

National Marine Services Focal Points

National Marine Services Focal Points (NMSFP)

» NMSFP – Roles and responsibilities

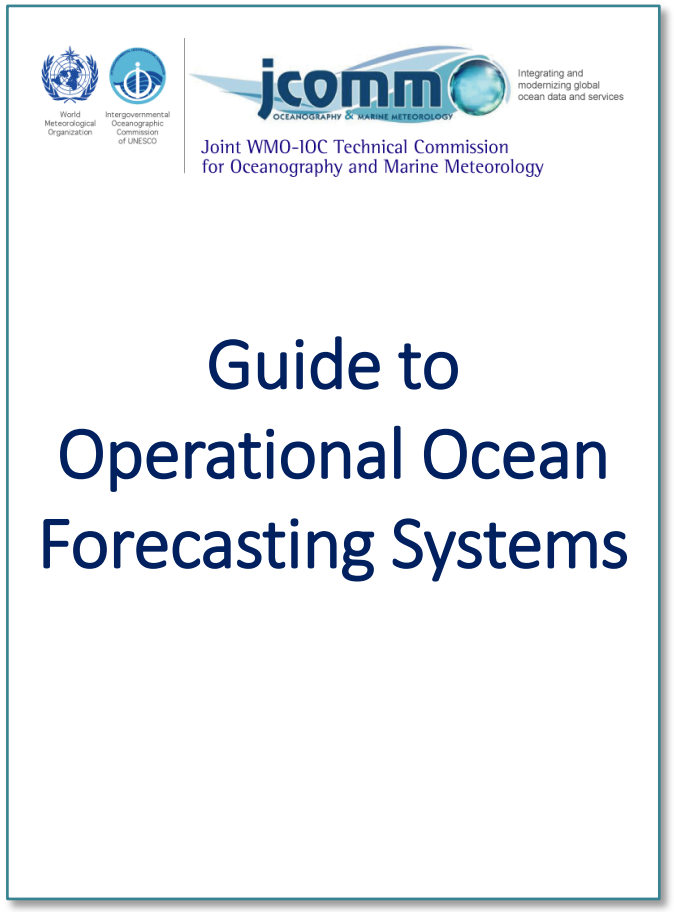
Services Coordination Group

» Terms of Reference and Membership
» SCG meeting list
» All SFSPA-related Meetings & Scientific Fora
» All SFSPA publications
» All SFSPA publications

www.jcomm.info

Services and Forecasting Systems Program Area (SFSPA)

ETOOFS - Expert Team on Operational Ocean Forecasting Systems



1. **Pierre BAHUREL**, Mercator Ocean International, France
2. **Enrique ALVAREZ FANJUL**, Puertos del Estado, Spain
3. **Stefania CILIBERTI**, CMCC, Italy
4. **Shiro ISHIZAKI**, JMA, Japan
5. **Sudheer JOSEPH**, INCOIS, India
6. **Guimei LIU**, NMEFC, China
7. **Dakui WANG**, NMEFC, China
8. **Avichal MEHRA**, NOAA, US
9. **Aihong ZHONG**, BoM, Australia
10. **Lotfi AOUF**, Météo-France, France
11. **Mouhamadou KAMARA**, ANACIM, Senegal
12. **Ahisset Axelle Candice KÉKÉ**, DMN, Côte d'Ivoire

- **Denis CHANG SENG**, IOC & **Sarah GRIMES**, WMO

Last Slide

GODAE OceanView achievements and future outlook --> OceanPredict

Halifax, Canada, 6 May 2019

ceanPredict '19
GODAE OceanView Symposium 2019


GODAE
WE ARE
OCEAN DATA PRODUCERS


GODAE OCEAN VIEW
WE FEEL
GOOD , INNOVATIVE AND OPEN


GODAE OCEAN VIEW
WE WANT
LONG-TERM VISION AND ACTIONS


GODAE OCEAN PREDICT
WE SOCIALIZE
FOR A SUSTAINABLE OCEAN