

***WP4: Review of ocean and coastal information  
products and services***

***Review of European products and services***

- Introduction to EU and international programs:  
GODAE, GMES and MERSEA
  
- EU organisation: Mersea project  
The data thematic Portal  
The analysis and forecasting thematic portal  
Postprocessing and validation  
Services
  
- Toward pre-operational Marine Core Service systems with MyOcean  
Consolidation and pre-operationnal effort  
Thematic Assembly Centers  
Monitoring and Forecasting Centers



## BEFORE GMES (< 2002)

- GODAE: gathers the international ocean modeling and data assimilation communities around global ocean high resolution forecast system.
- Coordination of the EU operational oceanography in 1995 (EuroGOOS): european regional strategy:
  - MOON: Mediterranean sea
  - BOOS: Baltic sea
  - NOOS: North West Shelves
- Conducting research, developing network and capacity.
- GMES: service, integrated and interoperable between regional seas and global ocean (precursor GMES FP5 EU: MERSEA Strand-1)



## GMES Scheduling



Presentation overview

GMES and MERSEA

- GMES initial period (2002-2003):

Demonstrate the european maturity of oceanography: Mersea Strand-1  
Propose a system based on existing skills and capacity (4 european regioanl seas: arctic, Baltic, NE Atlantic, Med)

→Common quality control protocols for ocean products

- GMES implementation period (2004-2008):

Building the main component of the GMES system (Mersea-IP for the Marine component)

Base on the integration of the European core of the existing systems and their networks.



## Mersea: the ocean portal for GMES

<http://www.mersea.eu.org>



### Mersea overview

Observational TEPs

Analysis and forecasting TEPs

Postprocessing and validation

Services

MERSEA deals with numerous activities (sea observations, modeling and data assimilation, information management, public information):

- done by **providers** (scientific teams, data centers, model centers, etc...) which work part of their time for MERSEA.
- MERSEA is a federation of existing systems, which are not dedicated to MERSEA purposes but offer services to MERSEA while upgrading them under the MERSEA plan of work.

Mersea activities aim to provide an integrated service for monitoring and forecasting in real time the ocean physics (temperature, salinity, currents) bio-geochemistry (carbon cycle), & eco-systems (chlorophyll, nutritives) at global and regional scales.

# Mersea: system of systems

## Observational ThEmatic Portal

## Analysis and forecasting ThEmatic Portal

## Services

Observation Systems  
**In Situ**

Observation Systems  
**Remote Sensing**

Prediction Systems  
**Numerical Ocean**

Prediction Systems  
**Numerical Weather**

**Ocean numerical modelling** provides coherent frameworks to combine or assimilate ocean observations and **monitor and forecast the ocean states.**

Research

**Discover ...**

... individual systems and search for ocean parameters, spatial data sets and services

**View ...**

... display, navigate, zoom in/out, pan or overlay viewable spatial datasets, and retrieve any descriptive information available

**Access ...**

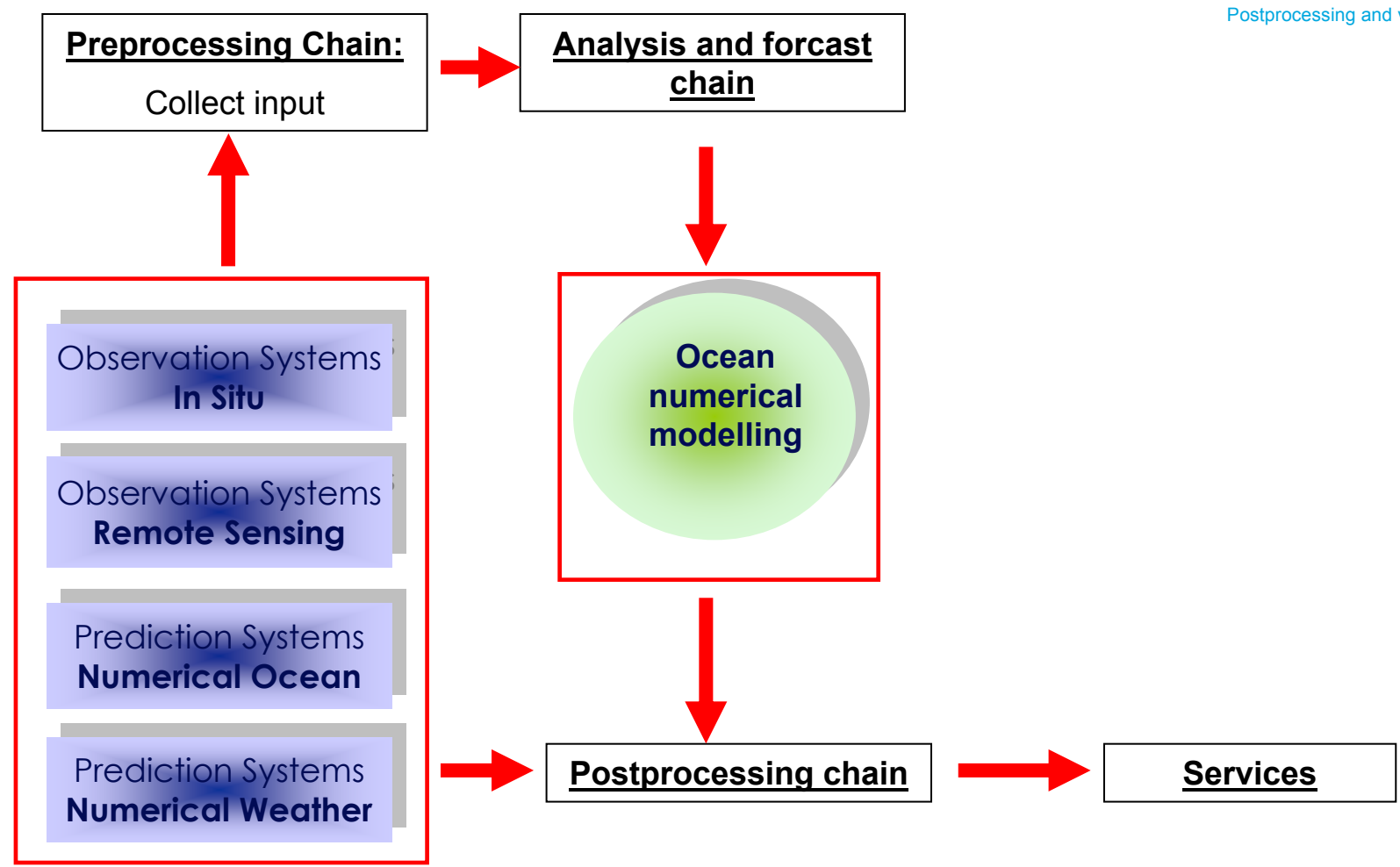
... link to direct access services, download of the spatial datasets, full time series or parts of such sets



# Mersea: production practices

## Mersea overview

- Observational TEPs
- Analysis and forecasting TEPs
- Postprocessing and validation
- Services





## 3 observational TEPs

- In Situ TEP: CORIOLIS
  - global in-situ observation daily delivery
  - Global real time objective analysis
  - Atlantic delayed mode objective analysis
- Remote sensing TEP: (more than 40 products available)
  - SLA (SALTO/DUACS)
  - Sea ice concentration in Northern hemisphere (IFREMER)
  - SeaWiFS global sea surface chlorophyll-a concentration
  - GOS HR gridded SST over Med Sea
- Forcing fields TEP:
  - Blended global satellite mean wind field (6 hourly delivery)
  - Surface parameters from ECMWF model 10-day forecast

Mersea overview

**Observational TEPs**

Analysis and forecasting TEPs

Postprocessing and validation

Services





# Remote sensing products

Mersea overview

Observational TEPs

Analysis and forecasting TEPs

Postprocessing and validation

Services

**MARINE ENVIRONMENT AND SECURITY FOR THE EUROPEAN AREA**  
Ocean and Marine Applications for GMES

Access to Products | Observing systems | Core Services | Downstream Services | Research & development | Home

WELCOME

SEA SURFACE TEMPERATURE DATA FROM INFRA-RED AND MICRO-WAVE SENSORS

Overview | Satellites | **Products** | Data Access

Sensor sources | Mediterranean | European | Atlantic | Global

**SST sensor sources**

ENVISAT	NOAA16 NOAA17 NOAA18	MSG	AQUA	TRMM
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Merged: multi sensor analysis of foundation sea surface temperature

January 16, 2006: Sea Surface Temperature, Mediterranean Sea

**Mediterranean products**

Geographic coverage	30° N-46° N, 18° W-36.5° E
Temporal resolution (availability)	NRT mode : 24h to weekly DT mode : two weeks
Temporal coverage	2004-05-19 on going
Spatial resolution	2-6 km

Available Mediterranean products:

- MEDSPIRATION-MED-SST-OBS
- GOS-MED-L4-SST-DT v0-OBS
- GOS-MED-L4-SST-DT v1-OBS
- GOS-MED-L4-SST-NRT v0-OBS
- GOS-MED-L4-SST-NRT v1-OBS

**European products**

Geographic coverage	20° N-80° N, 50° W-50° E
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Available European products:



# In-situ products

Mersea overview

Observational TEPs

Analysis and forecasting TEPs

Postprocessing and validation

Services

Atlantic Network - Mozilla

http://www.mersea.eu.org/Insitu-Obs/2-Insitu-Timeseries.html

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Access to Products Observing systems Core Services Downstream Services Research & development Home

**ATLANTIC NETWORK**

- Why Timeseries Observations?
- Atlantic Stations
  - PAP Mooring Status
  - ESTOC Mooring Status
  - CIS Mooring Status
- Mediterranean Stations

Within MERSEA, the three time series stations in the Atlantic, deployed within the European ANIMATE Project, are maintained. The sites are located in very different regions (subpolar - CIS, subtropical - ESTOC, and boundary between subpolar and subtropical - PAP) in terms of their physical and biogeochemical forcing. Maintenance cruise calendar can be found [here](#).

On the figure you can see oostions of Atlantic moorings maintained under MERSEA. The red lines indicate commercial shipping routes where Volunteer Observing Ships (VOS) take measurements of Carbon Dioxide and nutrients in surface waters.

The timeseries stations are equipped with a number of physical and biogeochemical sensors that allow anonomous collecting of key parameters. Data from some sensors is send a-shore via satellite telemetry and can be directly implemented into the MERSEA assimilation models.

Typical configuration of a time series mooring as deployed for MERSEA.  
The mooring is equipped with:

- Telemetry
- SAMI-Carbon Dioxide Sensor
- Nutrient Analyser
- Backscatter and Fluorescence Sensor
- ADCP Current Speed and Direction Sensor
- CTD Conductivity and Temperature Sensor
- Traps for sinking material



# Forcing field products

Mersea overview

Observational TEPs

Analysis and forecasting TEPs

Postprocessing and validation

Services

The screenshot shows a Mozilla browser window displaying the Mersea website. The URL is <http://www.mersea.eu.org/forcing-F/3-forcingfield-blended.html>. The page features the Mersea logo and the text 'MARINE ENVIRONMENT AND SECURITY FOR THE EUROPEAN AREA Ocean and Marine Applications for GMES'. A navigation menu includes 'Access to Products', 'Observing systems', 'Core Services', 'Downstream Services', 'Research & development', and 'Home'. A sidebar on the left has a 'Blended Overview' link highlighted with a red box. The main content area is titled 'BLENDED MEAN WIND FIELD PRODUCTS' and includes tabs for 'Overview', 'Satellites', 'Products', and 'Data Access'. Under the 'Products' tab, there is a section for 'Surface Wind Sources' listing 'ECMWF', 'QuikSCAT', and 'SSM/I F13, F14, F15'. Below this is a table with the following data:

Geographic coverage	80° S-80° N, 0° E-360° E
Temporal resolution (availability)	NRT mode : 24h
Temporal coverage	April 2007 - on going
Spatial resolution	0.25°

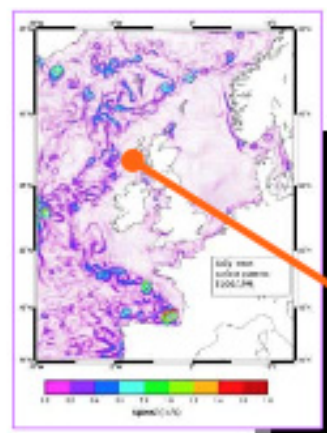
The page also contains two global maps: 'Example of Global blended Wind Vector' and 'Example of Global blended Stress'.



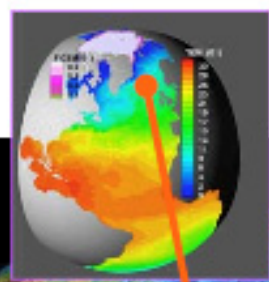
# 5 analysis and forecasting TEPs

- Mersea overview
- Observational TEPs
- Analysis and forecasting TEPs**
- Postprocessing and validation
- Services

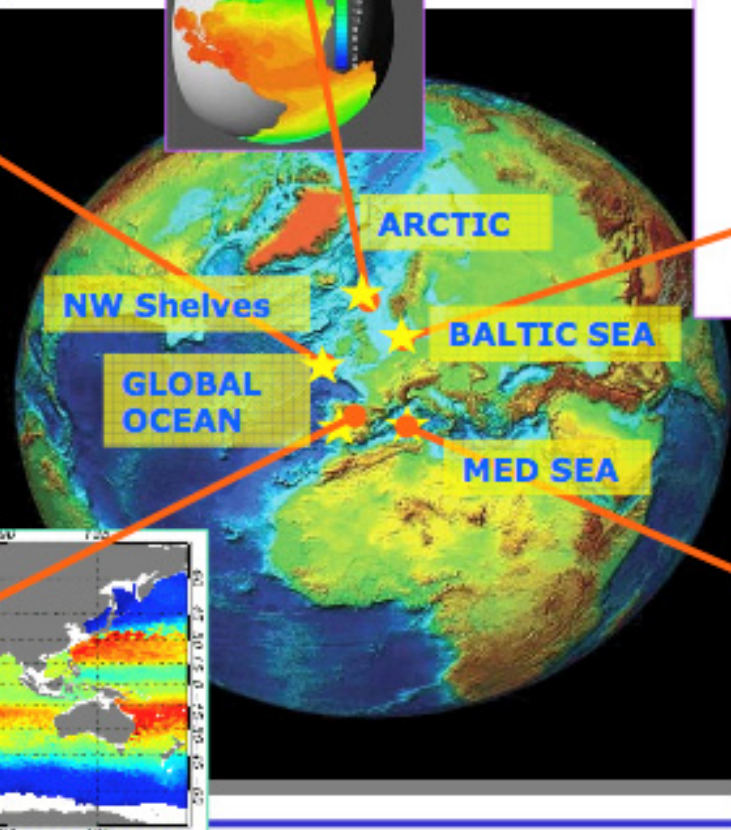
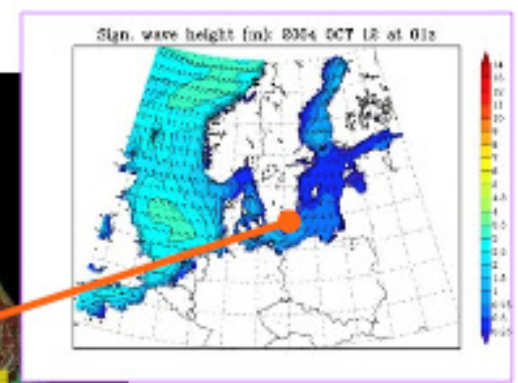
NCOF, UK



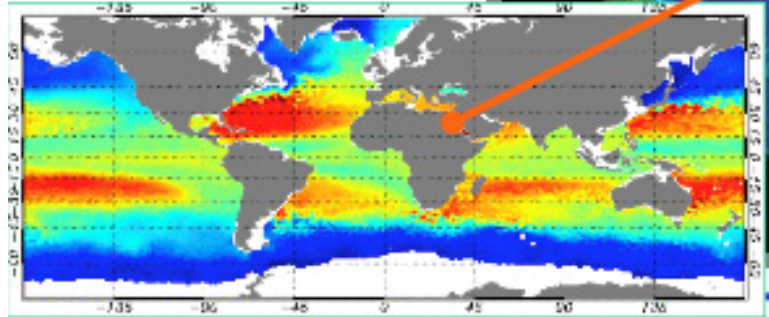
NERSC, Norway



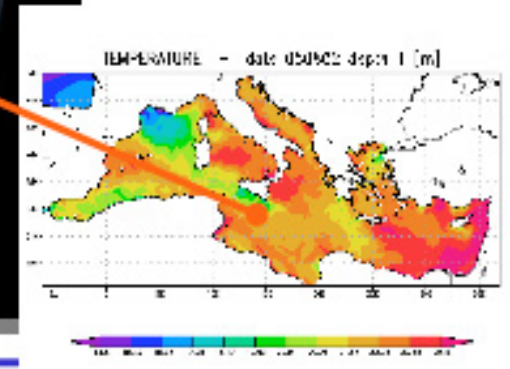
DMI, Denmark



Mercator Océan, France



INGV, Italy





# Mersea website

Mersea overview

Observational TEPs

Analysis and forecasting TEPs

Postprocessing and validation

Services

Mersea Integrated Programme - Operational systems: Global ocean portal - Mozilla

File Edit View Go File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop http://global.mersea.eu.org/html/ocean\_modelling/psy3v2\_overview.html Search Print

Home Bookmark Home Bookmarks

Top Up First Previous Next Last Document More

**MERSEA** **MARINE ENVIRONMENT AND SECURITY FOR THE EUROPEAN AREA** Ocean and Marine Applications for GMES

Access to Products Observing systems Core Services Downstream Services Research & development Home

Forecasting Systems > Global ocean TEP > Global 1/4°

MERCATOR GLOBAL 1/4°

Model Overview ID card Input data Operational Metrics R&D Products Useful links Contact

[Basic physics](#) | [Initial conditions](#) | [Boundary conditions](#) | [Assimilation](#) | [Computing](#) | [References](#)

Basic physics	
Equations	<p>NEMO (OPA9 + LIM) (Madec, Delecluse et al. 1998). The formulation is based on so-called 'primitive' equations. These equations are derived from Navier-Stokes equations in a stratified fluid with following approximations:</p> <ul style="list-style-type: none"> <li>Earth's sphericity: local gravity directed towards the centre of the Earth</li> <li>Relatively shallow water: ocean depth small in relation to the Earth's radius</li> <li>Hydrostatic: equilibrium between the vertical pressure gradient and the floatability</li> <li>Boussinesq values: variations in density are not taken into account apart from their contribution to floatability</li> <li>Incompressibility: the three-dimensional divergence of the velocity field is considered to be nil</li> <li>1.5 order closure turbulence scheme</li> <li>Non-linear equation of state couples the two active trace indices (temperature and salinity)</li> <li>Linearised and filtered free surface</li> <li>Nested with LIM sea ice model (Timmermann et al., 2004)</li> </ul>
Prognostic variables	<ul style="list-style-type: none"> <li>Temperature, salinity, zonal and meridian velocity, free surface elevation and vertical diffusivity coefficient</li> <li>Sea ice variables: thickness ice, ice concentration, ice temperature, zonal and meridional ice velocity, snow thickness on ice, ice heat content</li> </ul>
Diagnostic variables	Mixed layer depth (density diagnostic), mass transport by density class through sections, meridional heat transport
Geographical extension	Global ocean.
Initial conditions	
Boundary conditions	<ul style="list-style-type: none"> <li>Partial slip lateral boundary friction condition</li> </ul>



# Dedicated website

Mersea overview

Observational TEPs

Analysis and forecasting TEPs

Postprocessing and validation

Services





# Product portfolio

- Common
- Central
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- Product

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- Mersea overview
- Observational TEPs
- Analysis and forecasting TEPs
- Postprocessing and validation Services





## *Validation at forecasting center level*

Mersea overview

Observational TEPs

Analysis and forecasting TEPs

**Postprocessing and validation**

Services

- Quality assesment of the operational system by comparison with observations:
  - In line diagnostics
  - systematic analysis of some case studies, phenomenological studies
- Comparison with climatology
- Monitoring the data assimilation statistics
- Comparison between forecast and analysis fields
- Monitoring of integrated oceanic quantities produced by he model





## Common procedures: Mersea metrics

Mersea overview

Observational TEPs

Analysis and forecasting TEPs

**Postprocessing and validation**

Services

- Forecasting TEPs have obligation to provide normalized metrics to assess product quality (class 1,2,3) and system performance (class 4):
  - Elaboration of a common european approach for validation (equivalent quantities extracted out of the different systems for the same geographic locations.)
- Perform an overall assessment of the full integrated aspects and component
- Identify quality and drawbacks of the systems involved for each basin of the world ocean (intercomparison exercise)

The goal is to:

- Identify major errors and problems in each system
- overall assessment over a 6 month period
- evaluation of regional relative quality of each system
- definition of rules and shared methods for common assessment.



## Class 1 metrics

Mersea overview

Observational TEPs

Analysis and forecasting TEPs

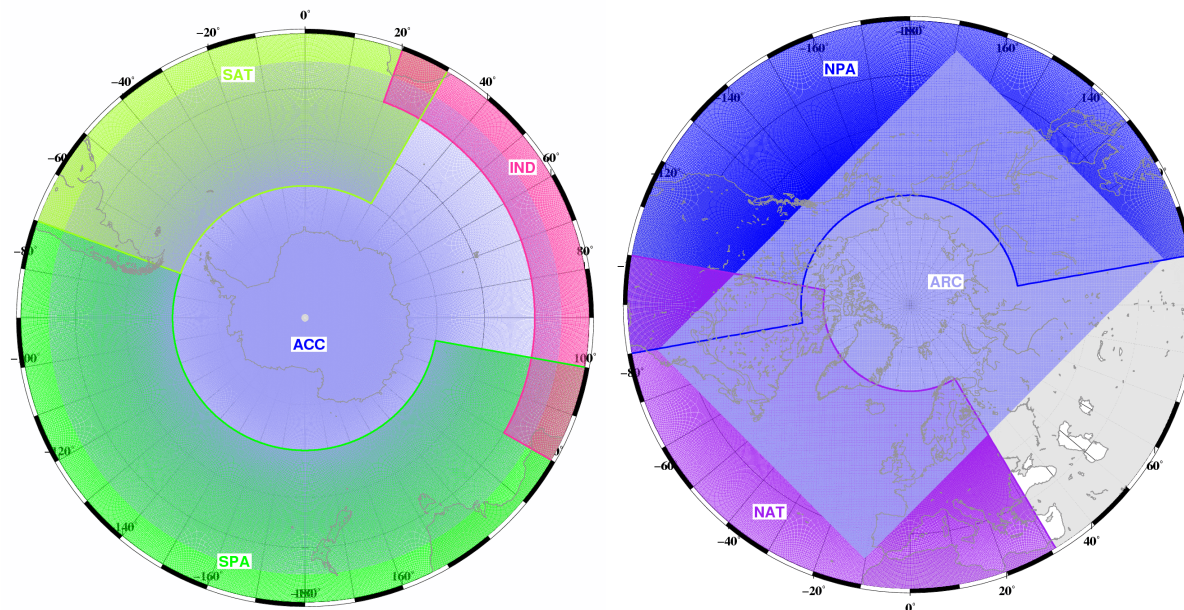
Postprocessing and validation

Services

- Provide general overview of the ocean and sea ice dynamics:

Interpolation on the GODAE grids and daily average of 2D and 3D outputs

→ Designed for consistency assessment and comparison to climatology.





# Class 2 metrics

Mersea overview

Observational TEPs

Analysis and forecasting TEPs

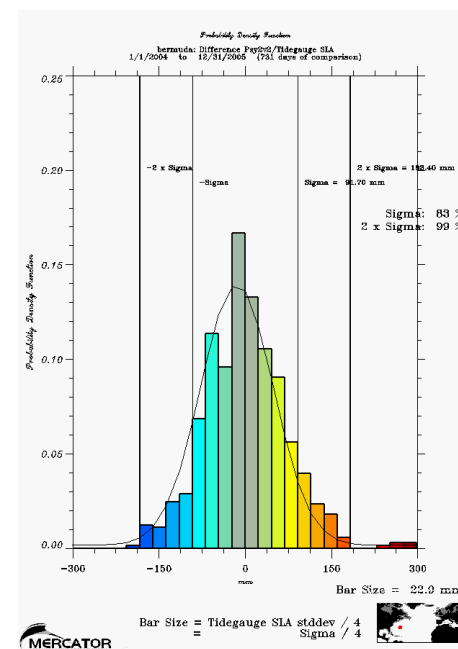
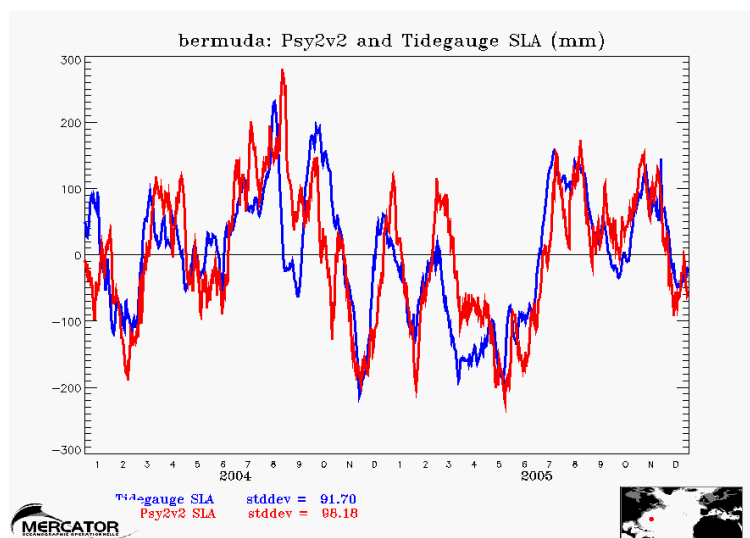
Postprocessing and validation

Services

- Designed to monitor system outputs:

Virtual mooring and sections into the model domain computed every 10 km for global metrics, 15 km for arctic metrics

Some of the tracks coincide with oceanographic or ship of opportunity tracks, repeating survey or glider tracks.





## Class 3 metrics

Mersea overview

Observational TEPs

Analysis and forecasting TEPs

Postprocessing and validation

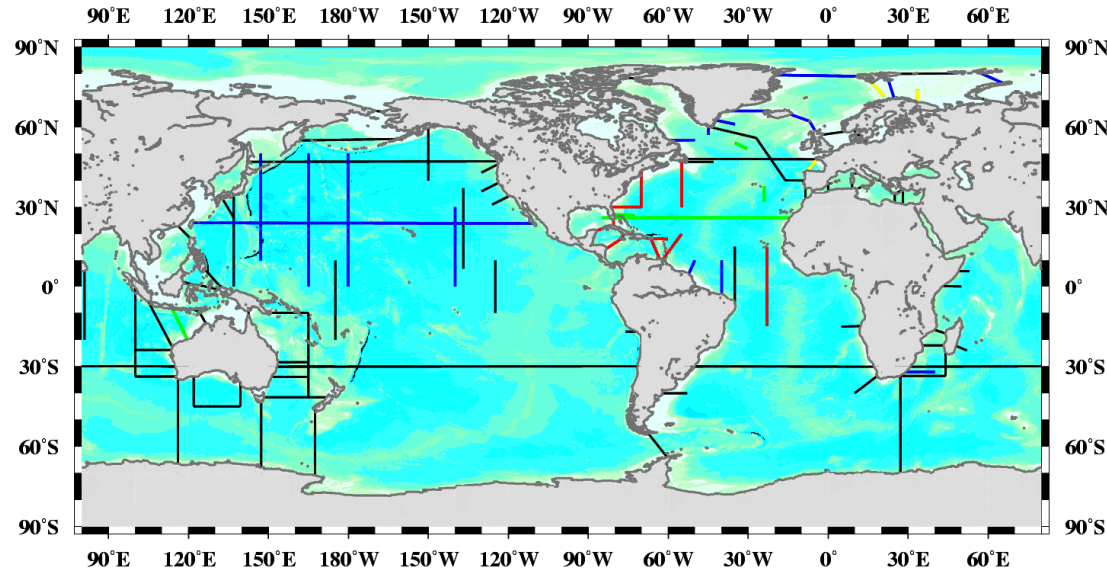
Services

- Physical quantities computed using the model variables:

→ Need to be computed in line during the model run on the native grid every time step

They are integrated quantities such as daily volume transport through chosen sections.

They are designed to check model behaviour through physical point of view





## Class 4 metrics

Mersea overview

Observational TEPs

Analysis and forecasting TEPs

Postprocessing and validation

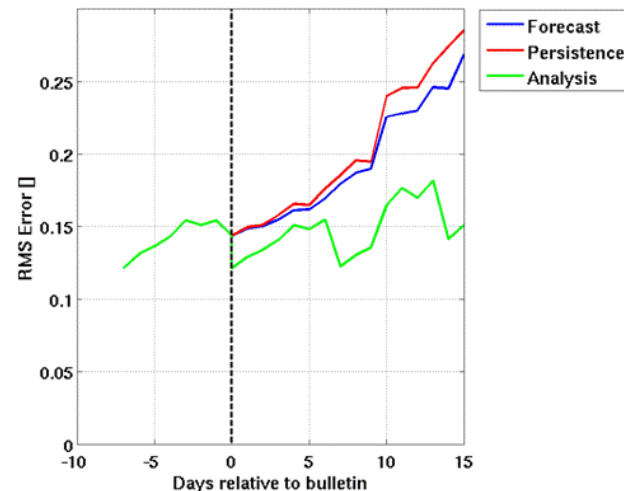
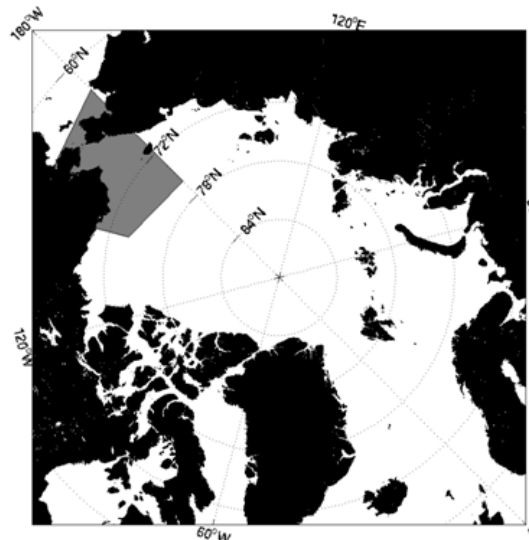
Services

- Aims to measure the performance of the forecasting system:

Capability to describe the ocean (hindcast mode)

Forecasting skill (analysis and forecast mode)

→ All fields are evaluated using identical criteria (for a given day, hindcast, forecast, analysis, persistence and climatology are compared.)





## 3 kind of services at Mersea level

Mersea overview

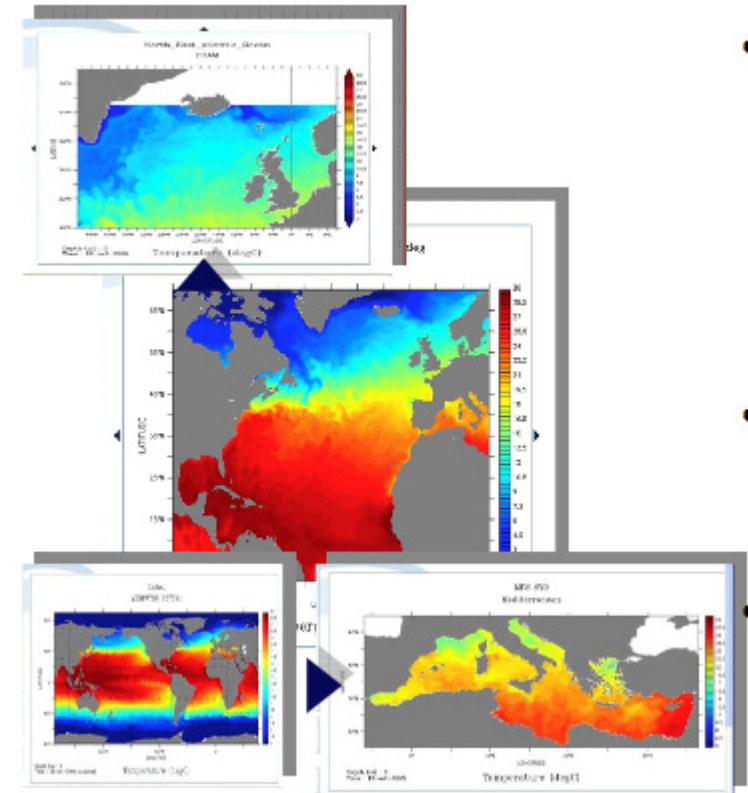
Observational TEPs

Analysis and forecasting TEPs

Postprocessing and validation

Services

- A central catalog to support the **discovery** function
- Common format and tools for data management to support the **downloading** function (Netcdf, openDAP)
- Shared **viewing** systems (Live Access Server, Web service, google-earth...)





# Discovery

- Mersea overview
- Observational TEPs
- Analysis and forecasting TEPs
- Postprocessing and validation

Services

the basis of  
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(MERSEA)  
omogeneous





# Downloading

- Mersea overview
- Observational TEPs
- Analysis and forecasting TEPs
- Postprocessing and validation
- Services

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# Viewing

Mersea overview

Observational TEPs

Analysis and forecasting TEPs

Postprocessing and validation

Services

The screenshot shows the Mersea web application interface in a Mozilla browser window. The browser address bar contains the URL: [http://bulletin.mersea.eu.org/html/produits/mersea\\_vs/view.php3?nom=mersea\\_vs-20080910&zone=glo-glo](http://bulletin.mersea.eu.org/html/produits/mersea_vs/view.php3?nom=mersea_vs-20080910&zone=glo-glo). The page header features the Mersea logo and the text "MARINE ENVIRONMENT AND SECURITY FOR THE EUROPEAN AREA" along with the European Union flag. A navigation menu includes "Access to Products", "Observing systems", "Core Services", "Downstream Services", "Research & development", and "Home".

The main content area is titled "Viewing service > Global" and includes a sub-menu: "Arctic | Baltic | Mediterranean | North East Atlantic | Global". The analysis date is set to "GLOBAL: SEPTEMBER 10, 2008". On the left, there are several configuration sections:

- Analysis date:** A dropdown menu showing "2008-09-10".
- Maps:** Radio buttons for "Maps" (selected), "Sections", and "Mooredings".
- Analysis / Forecast:** Radio buttons for "Analysis" (selected) and "1 week forecast".
- Parameter:** A list of parameters with radio buttons: "M" (3D Temperature, selected), "O" (3D Current), "D" (3D Salinity), "E" (2D Sea Surface Height), "L" (Mixed Layer Depth), "S" (Sea Level Anomaly), "T" (Sea Surface Temperature), "I" (Sea Ice), "A" (In situ Temperature), and "N" (In situ Salinity). There are also checkboxes for "Anomaly".
- Depth:** Radio buttons for "Surface" (selected), "100 m", and "1000 m".
- Provider:** The Mercator logo is displayed.

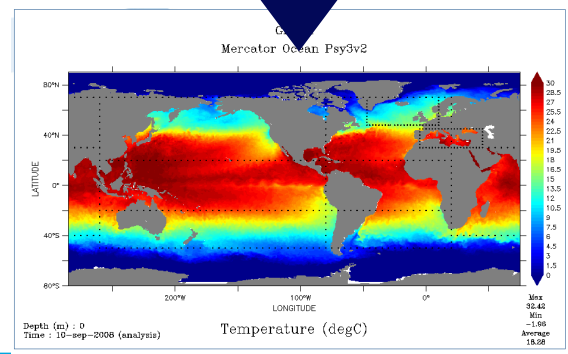
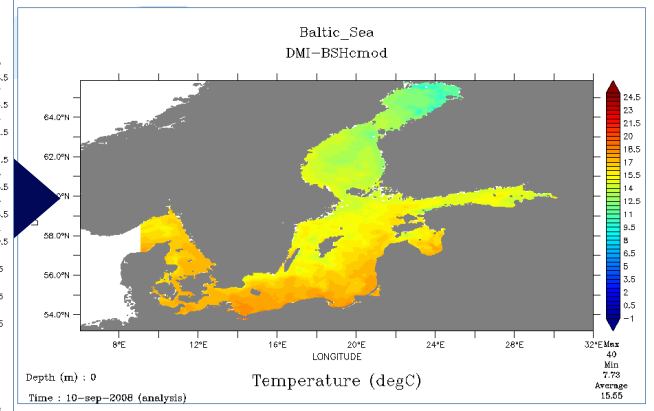
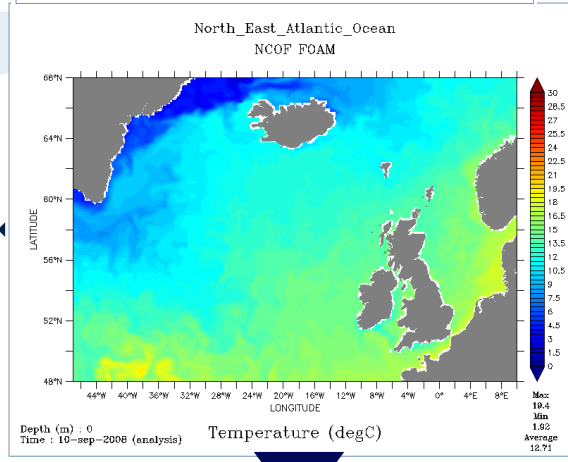
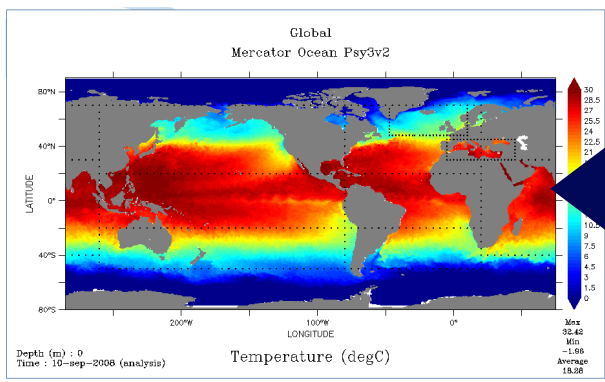
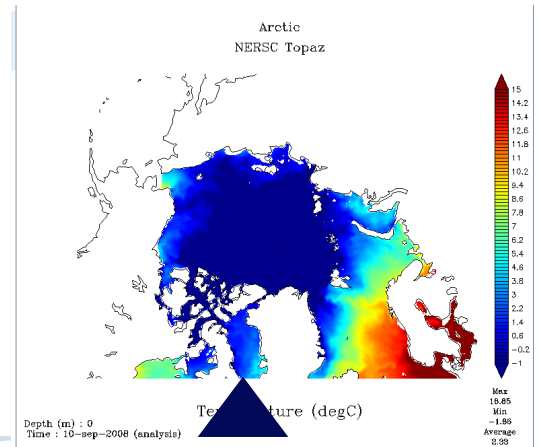
The central part of the interface displays a global map titled "Global Mercator Ocean Psy3v2". The map shows ocean temperature in degrees Celsius, with a color scale on the right ranging from 0 (dark blue) to 30 (dark red). The map axes are labeled "LATITUDE" (from 80°N to 80°S) and "LONGITUDE" (from 200°W to 0°). Below the map, the following information is provided: "Depth (m) : 0", "Time : 10-sep-2008 (analysis)", and "Temperature (degC)". A summary box on the right side of the map indicates: "Max 32.42", "Min -1.06", and "Average 18.28".



# Viewing

## From global to regional

- Mersea overview
- Observational TEPs
- Analysis and forecasting TEPs
- Postprocessing and validation
- Services





# Viewing observations

Mersea overview

Observational TEPs

Analysis and forecasting TEPs

Postprocessing and validation

Services

The screenshot shows a Mozilla browser window displaying the Mersea web application. The URL is [http://bulletin.mersea.eu.org/html/produits/mersea\\_vs/view.php3?nom=mersea\\_vs-20080903&zone=glo-glo](http://bulletin.mersea.eu.org/html/produits/mersea_vs/view.php3?nom=mersea_vs-20080903&zone=glo-glo). The page header includes the Mersea logo and the text "MARINE ENVIRONMENT AND SECURITY FOR THE EUROPEAN AREA Ocean and Marine Applications for GMES". A navigation menu is visible with options like "Access to Products", "Observing systems", "Core Services", etc. The main content area shows "Viewing service > Global" and "GLOBAL: SEPTEMBER 03, 2008". A left sidebar contains a vertical menu with labels like "Acc", "Vie", "A", "P", "M", "O", "D", "E", "L", "O", "B", "S", "E", "R", "V", "A", "T", "I", "O", "N", "D", "P", "r", "o". The central panel features a "Global Coriolis : In-Situ Measurements" map of salinity (psu) with a color scale from 25 to 39. The map shows a global distribution of salinity data points. Below the map, it specifies "Depth: 0 m" and "Time: 2008-09-03". A "Provider: Coriolis" logo is also present. The bottom status bar indicates "Transferring data from bulletin.mersea.eu.org...".



# Ocean indicators

Mersea overview

Observational TEPs

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Postprocessing and validation

Services

Indicators with B4G - Mozilla

File Edit View Go Bookmarks Tools Window Help

http://www.mersea.eu.org/Indicators-with-B4G/Remote-sensing-SST-TAC.html

MERSEA MARINE ENVIRONMENT AND SECURITY FOR THE EUROPEAN AREA Ocean and Marine Applications for GMES

B4G

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**MERSEA AND BOSS4GMES SEA SURFACE TEMPERATURE TAC (CERSAT)**

Sea Surface Temperature from ODYSSEA, the high resolution global SST analysis of MERSEA

The high resolution global sea surface temperature analysis of MERSEA is produced at IFREMER/CERSAT. It provides a daily gridded map of the foundation sea surface temperature (e.g. without diurnal cycle effect) at 10km resolution, using all available infrared and microwave spaceborne sensors.

The ODYSSEA (Ocean Data analysis System for merSEA) processing chain developed to produce this dataset is based on a careful selection and correction of available observations, using adjustment to in-situ and AATSR sensor observations, and an optimal interpolation method to fill the gaps (More informations on [http://www.mersea.eu.org/Satellite/sst\\_validation.html](http://www.mersea.eu.org/Satellite/sst_validation.html)).

Monthly anomalies of SST:

Monthly global anomalies are evaluated from the near real time global SST product ODYSSEA. The maps presented below show the difference between the daily SST averaged over a given month and the monthly climatology derived from the Pathfinder V5 climatology (from NODC/RSMAS AVHRR Version 5.0 Pathfinder SST data from 1985-2001 : [ftp://data.nodc.noaa.gov/pub/data.nodc/pathfinder/Version5.0\\_Climatologies/README.txt](ftp://data.nodc.noaa.gov/pub/data.nodc/pathfinder/Version5.0_Climatologies/README.txt)).

**ODYSSEA SST anomaly - 10 2007**

deg. C

60N  
30N  
0  
30S  
60S

180 150W 120W 90W 60W 30W 0 30E 60E 90E 120E 150E 180

-2 -1 0 1 2

Figure 1 - SST global anomalies in october 2007

MFS Indicators

Indicators

SST

SST Anomaly

SSS

HC

HC Anomaly

Net Volume Transports

Net Volume Transports Anomaly

mean: 25.36

The table presents (maximum) of the

Monthly Ter



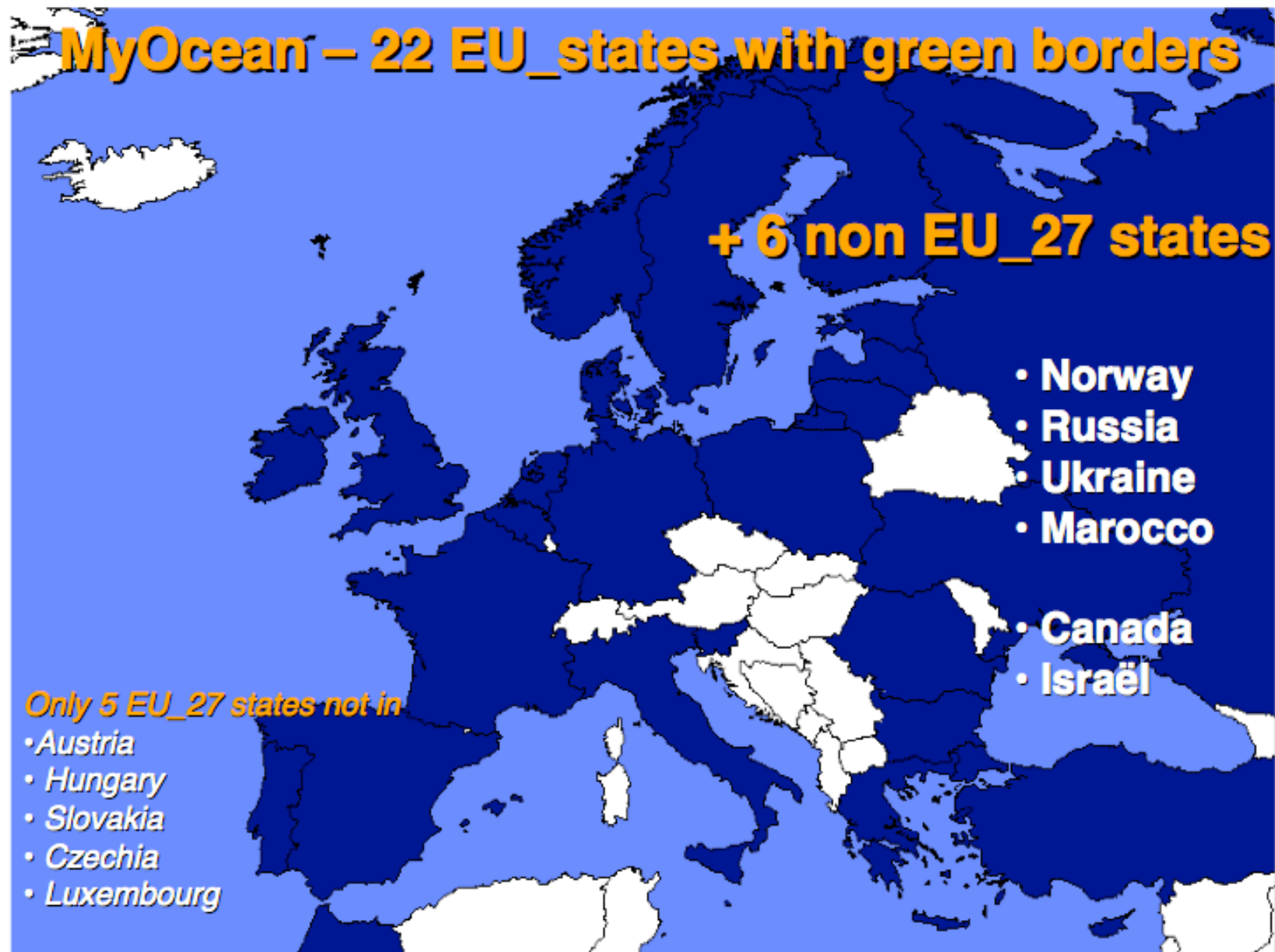
## Next step: MyOcean

- Consolidating previous effort in pre-operational ocean monitoring and forecasting
  - Move from science-push to **user-pull**
  - Move from demonstration to full scale operations
  - We have different definitions of operationality for our operational oceanography systems
  - The ocean community has multiple faces (Ocean Centers, Research & operational, Public & private, data only & model only ...)
- Work on common approach for developpement and operations of the different components
- Strengthen the internal links between component



## Organisation:

- TEPs have openend the route to the TACs (data) and MFCs (models):
  - Moving from portal to full production systems
  - MFC: improve mappng of the production areas (7 areas)
  - TAC: new finer description per type of observations (5 centres)
- MyOcean will serve as the European focal point for ocean monitoring and forecasting capacity for
  - the EU agencies (EEA, EMSA, EDA...)
  - member states legally mandated agencies (Navies, coast-guards, research centers...)
  - intergovernmental bodies (OSPAR, ICES, HELCOM ...)



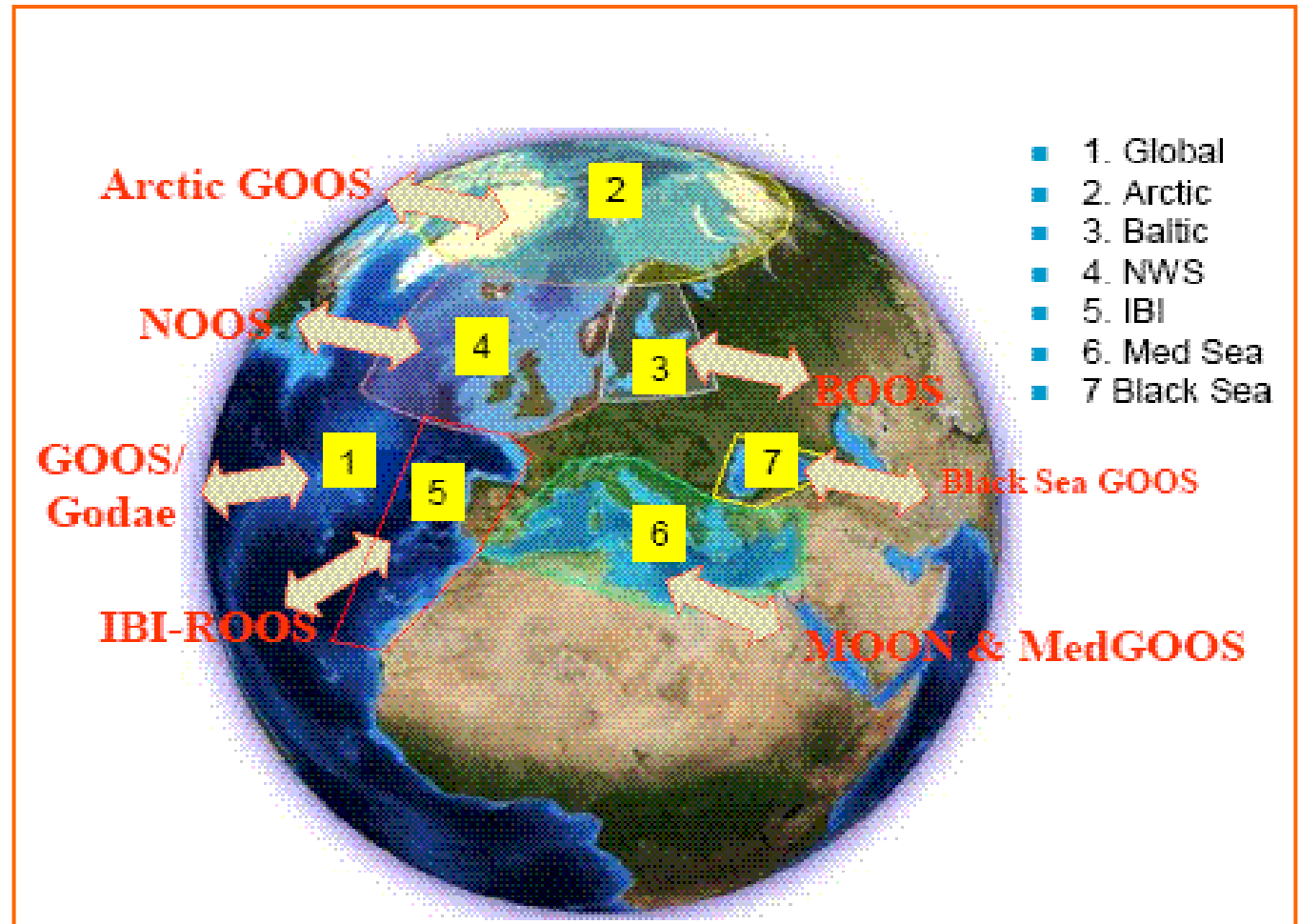


## TAC and MFC:

### 5 TACs

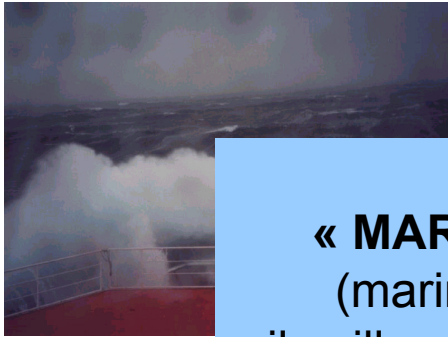


### 7 MFCs





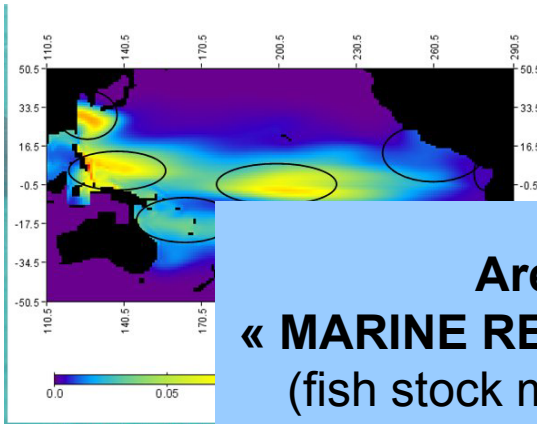
## Areas of benefit:



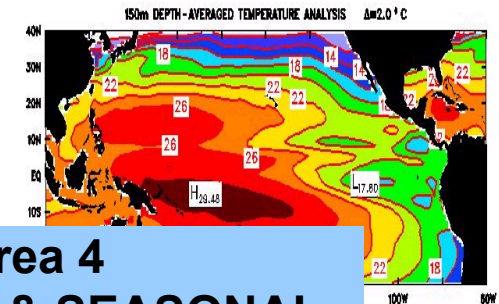
**Area 1**  
**« MARINE SAFETY »**  
 (marine operations,  
 oil spill combat, ship routing,  
 defense, search & rescue, ...)



**Area 3**  
**« MARINE & COASTAL ENVIRONMENT »**  
 (water quality, pollution,  
 coastal activities, ...)



**Area 2**  
**« MARINE RESSOURCES »**  
 (fish stock management,  
 ICES, FAO, ...)



**Area 4**  
**« CLIMATE & SEASONAL FORECASTING »**  
 (climate monitoring, ice,  
 seasonal forecasting, ..)