



# COPERNICUS

## Opportunities in EO for Marine Applications

**Peter Breger**

**Copernicus programme  
DG GROW**

*Widening use of EO on Maritime Domains,  
Lisbon, 16 September 2016*

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Space



 **Copernicus**  
Europe's eyes on Earth

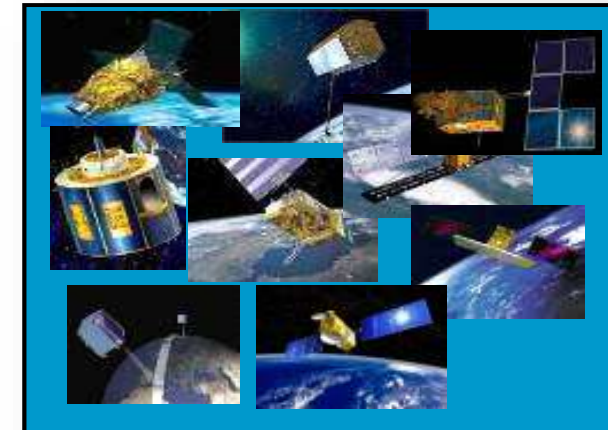
## Significance of Marine Environment

- ★ Half of the world's population lives within 100 km of coast.
- ★ The oceans are hugely important to economic activities. Many economic activities are concentrated on or close to the coastline
- ★ Europe sets itself apart in that it has a very significant seaboard, 7 times longer than that of the US and 4 times longer than that of Russia.
- ★ The marine sector represents some 5 billion jobs, and a gross added value of €500bn.
- ★ 90% of international trade is maritime.
- ★ The oceans also:
  - ★ Play a critical role in the climate system
  - ★ Represent a potential source of renewable energy that exceeds current needs
  - ★ And are geopolitically important as exemplified by the changes to the Arctic both with regard to shipping routes and access to natural resources

# Copernicus architecture

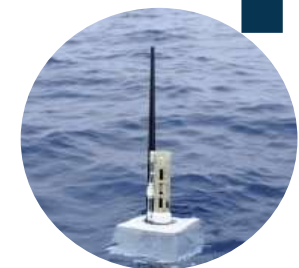
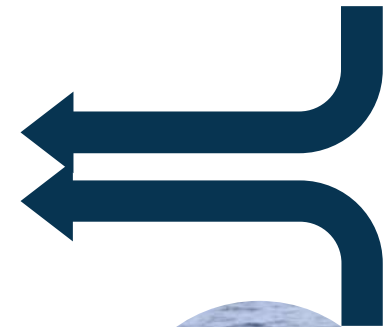


**6 services use  
Earth Observation  
data to deliver ...**



**Sentinels**

**Contributing missions**



**...added-value products**

**in-situ**



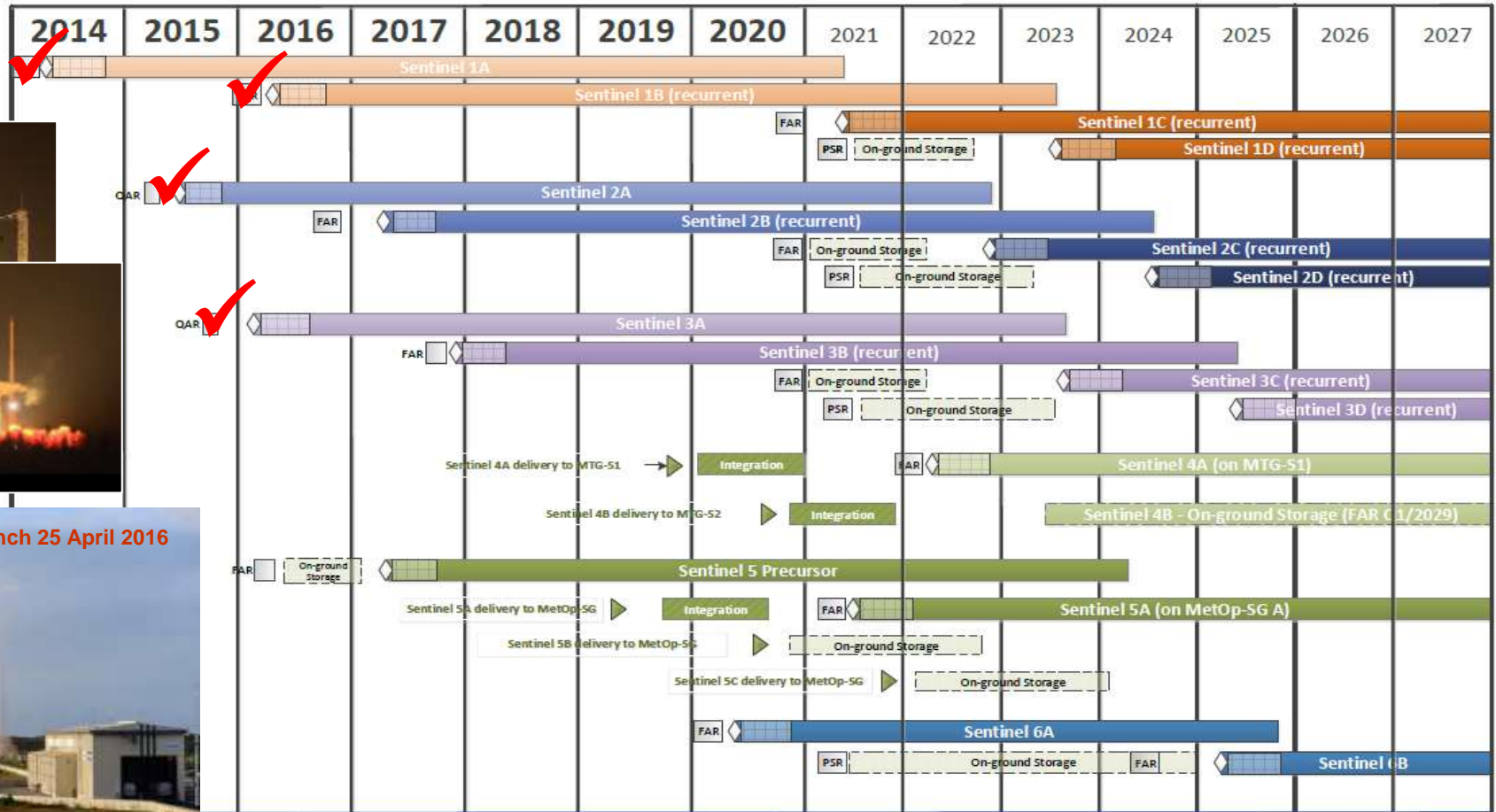
# 4 Satellites in orbit



# Continuity until 2030



## Copernicus Constellation Deployment Schedule



Legend:

- Qualification Acceptance Review (QAR)
- Flight Acceptance Review (FAR) or PreStorage Review (PSR)
- On-ground Storage
- Tentative launch date
- In-orbit Commissioning

Status: 08 September 2016

# Marine/Maritime significance of Sentinels

## ★ Sentinel 1 (A & B)

- ★ With its SAR capabilities exploited in QRT, it allows rapid detection of maritime vessels and identification of sources of oil-slicks
- ★ SAR images provide sea-ice mapping to seafarers

## ★ Sentinel 3 (A)

- ★ Copernicus' medium resolution land and ocean mission combining OLCI colour, SLSTR temperature, SRAL altimeter, and radiometry with precise orbit determination, giving access to
- ★ ocean colour data (continuation of MERIS)
- ★ sea surface temperature (continuation of AATSR)
- ★ sea-surface and sea-ice topography

# 6 operational Services



Monitoring the State of the Earth System Environment ...



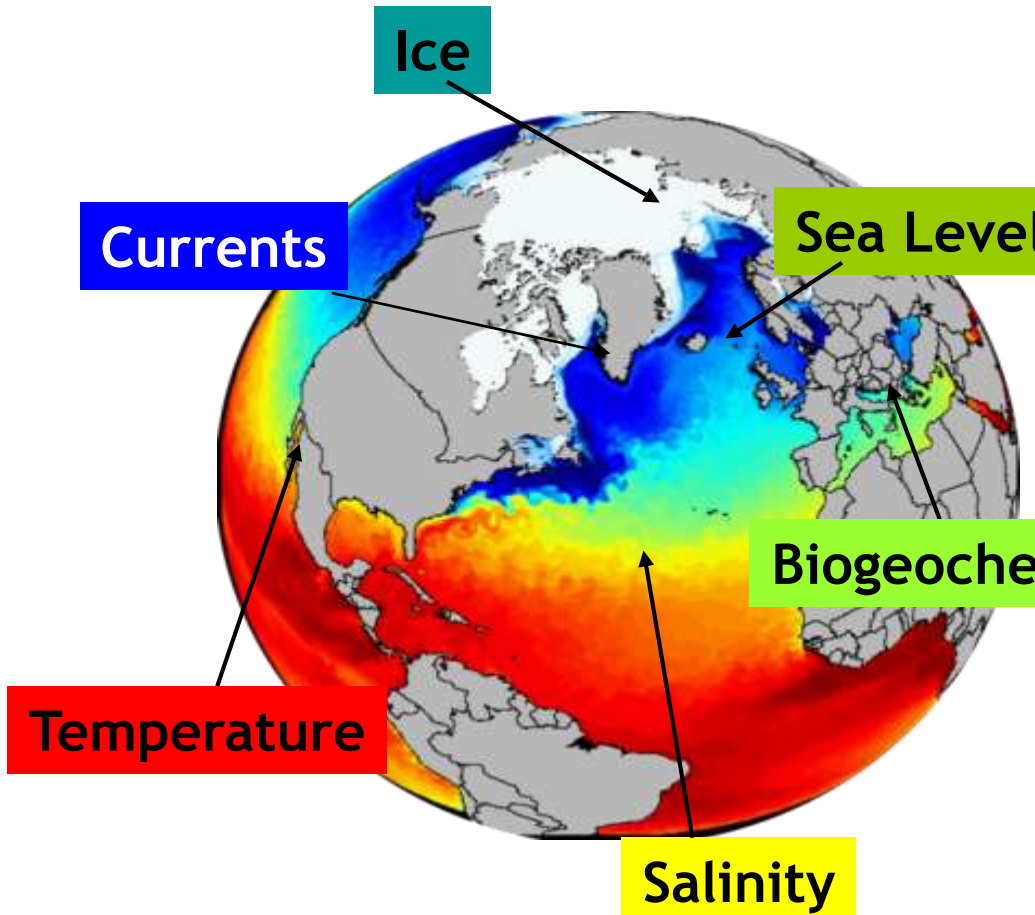
✓ = operational  
✓ = in ramp up

... cross-cutting Thematic Services



# Copernicus Marine Environment Monitoring Service

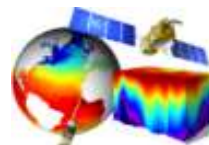
# Marine Environment Monitoring Service



- 1. Global
- 2. Arctic
- 3. Baltic
- 4. NWS
- 5. IBI
- 6. Med Sea
- 7. Black Sea

- **Global and Regional**
- Real time and **Reanalyses**
- **Satellite & In Situ** obs. and **Models**

**A 3D and consistent estimation of the ocean**



Space



**Service portfolio: 11 product groups with ~140 data products covering Ocean state, Physical & Biogeochemical variables of long time series**

## Product groups

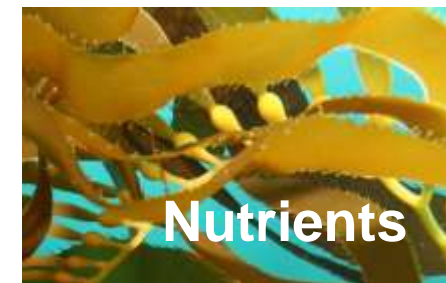
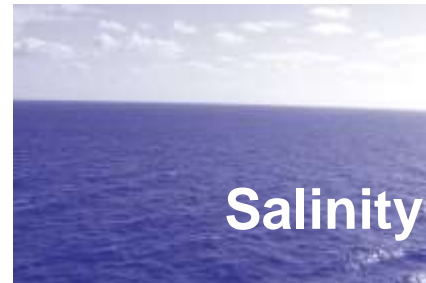
### Analysis and Forecast

- Global Ocean
- Arctic Ocean
- Baltic Sea
- Atlantic-European North West Shelf Ocean
- Atlantic-Iberian Biscay Irish Ocean
- Mediterranean Sea
- Black Sea

### Observation

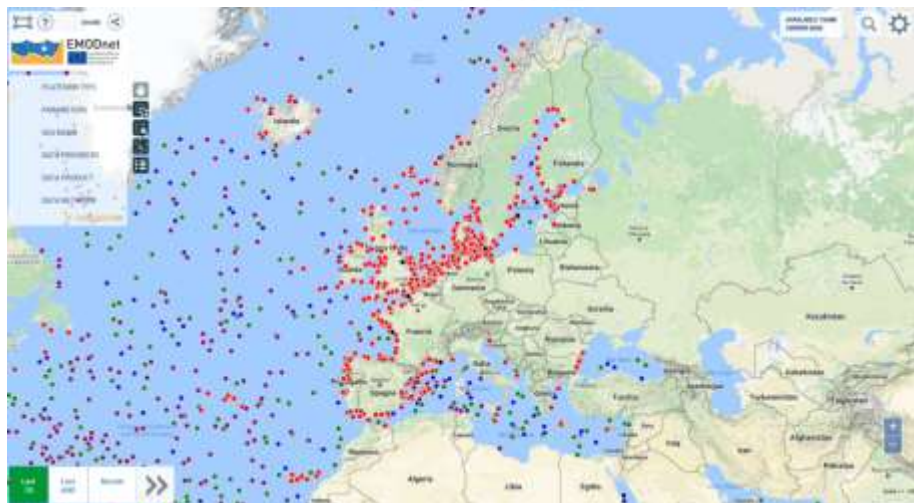
- Sea Level
- Ocean Colour
- Sea Surface Temperature, Sea Ice, Wind
- In-situ (Temperature, Salinity, Bio)







## EMODnet *physics* DG-MARE



Products by platform

→ Unlock access to in situ data

→ Customised service

- Viewing of the products
- Detailed information about producers (credit to data originators)
- Extract platforms from CMEMS products to answer user needs

In situ  
products

## CMEMS



Product by EU basins

→ Quality controlled products

→ Operational service

- Discovery & distribution of product
- Detailed data policy (commitments, licence)
- Service desk support
- Service monitoring

# Areas of benefits



**Coastal & marine environment**



**Marine resources**

**Weather, climate & seasonal forecasting**



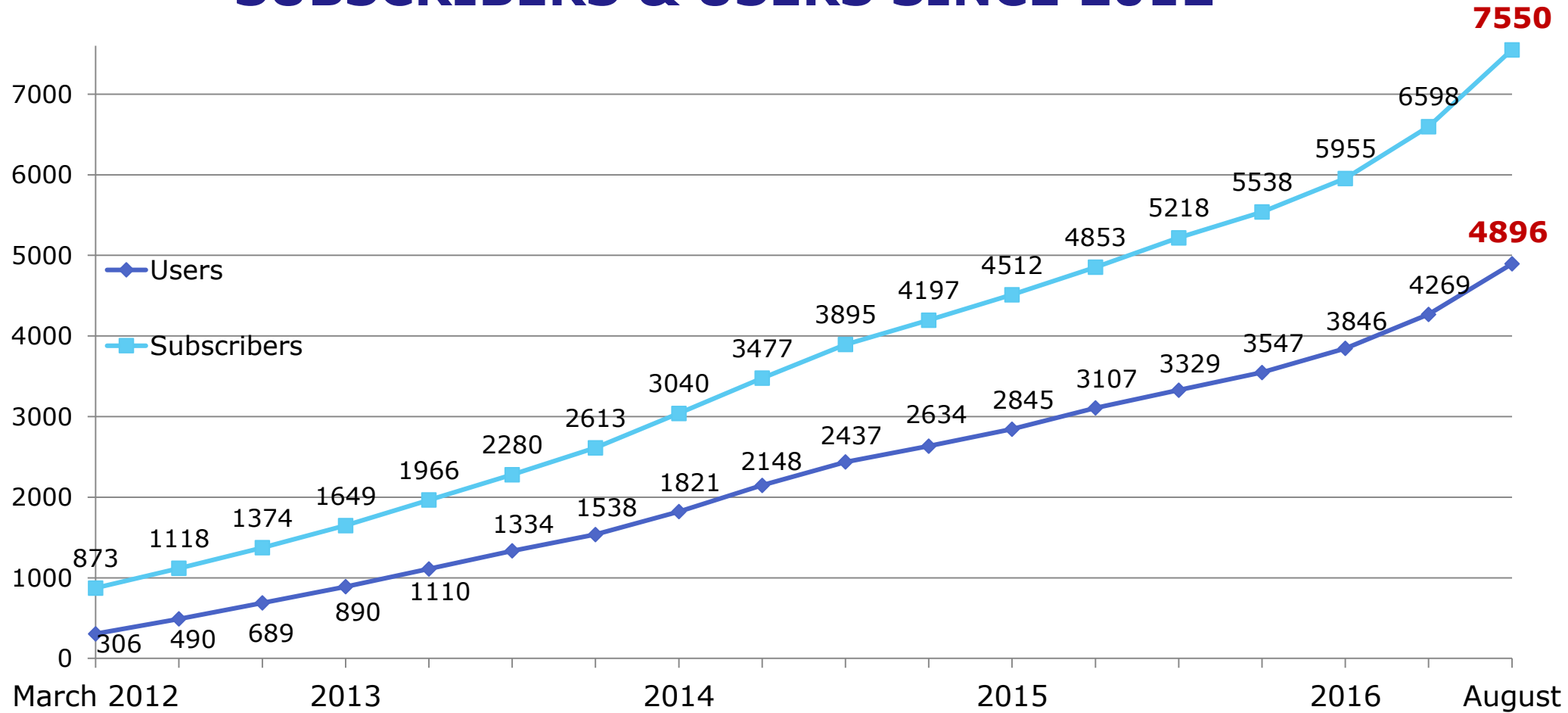
**Maritime safety**



# Service Status : Subscription



## SUBSCRIBERS & USERS SINCE 2012



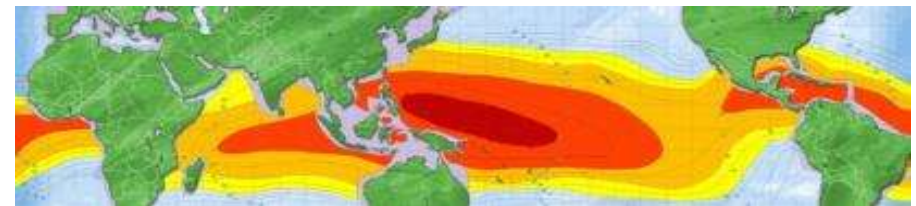
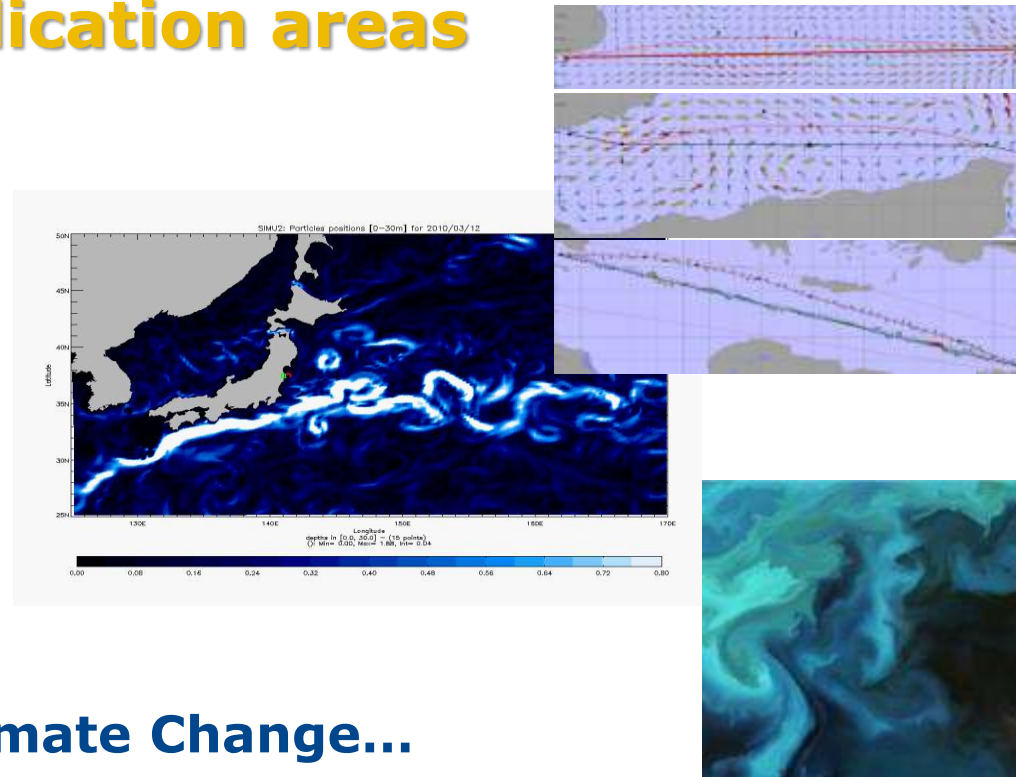


## Examples of Marine application areas

- ★ Ship routing
- ★ Support to offshore activities
- ★ Coastal management
- ★ Oil-drift forecasting
- ★ Search and rescue
- ★ Fisheries
- ★ Algal bloom
- ★ Water-quality management
- ★ ...

**But also Climate Change...**

- ★ Sea-level rise (one of the main indicators for Climate Change)
- ★ ...



# Saving Fuel / Shipping Company

To reduce fuel consumption for ecological & economical reasons

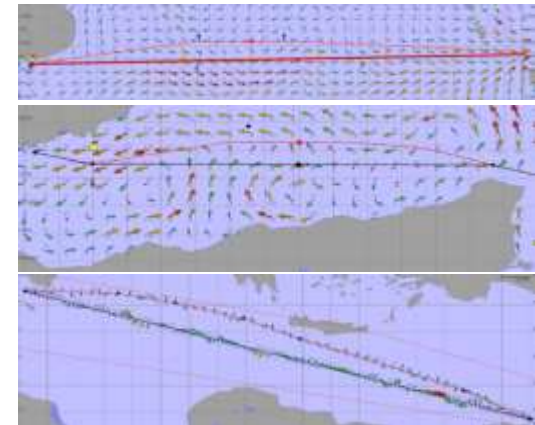
## 3 options:

- ✓ Optimize engines, propellers, hulls...
- ✓ Improve organization...
- ✓ Take benefit of Meteorology/ Operational Oceanography( **current observations and forecast**)



**0,4 % = Average level of savings thanks to « current routing »**  
(Line Europe-China Q2 2015)

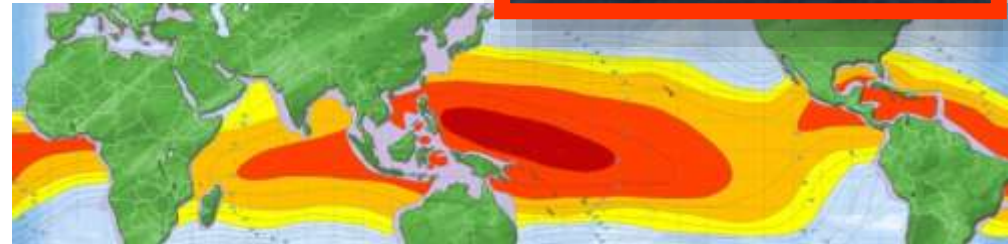
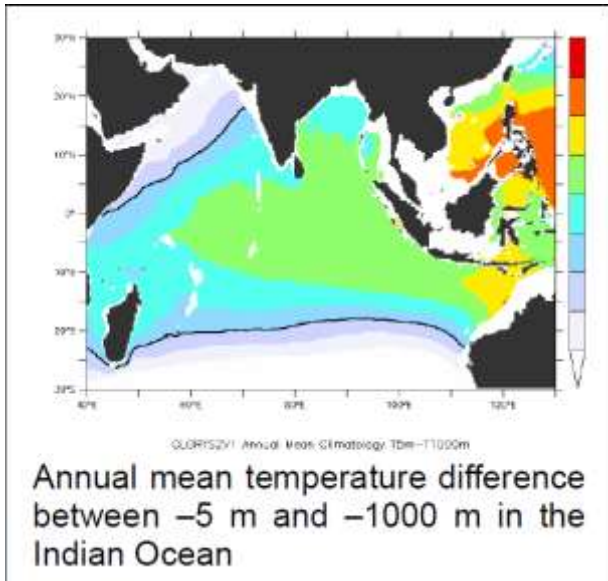
**Target : To save 1% thanks « current routing » ( current forecast reliability) would lead to 60 000t fuel saving for the whole CMA-CGM fleet so as 180 000t CO<sub>2</sub>.**



# Exploring new sources of energy : OTEC

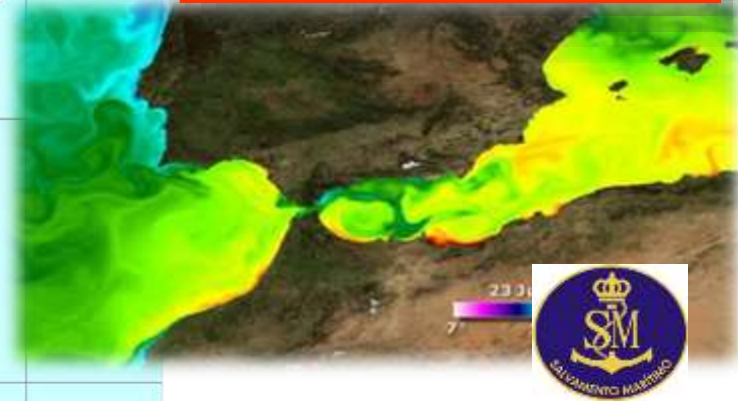
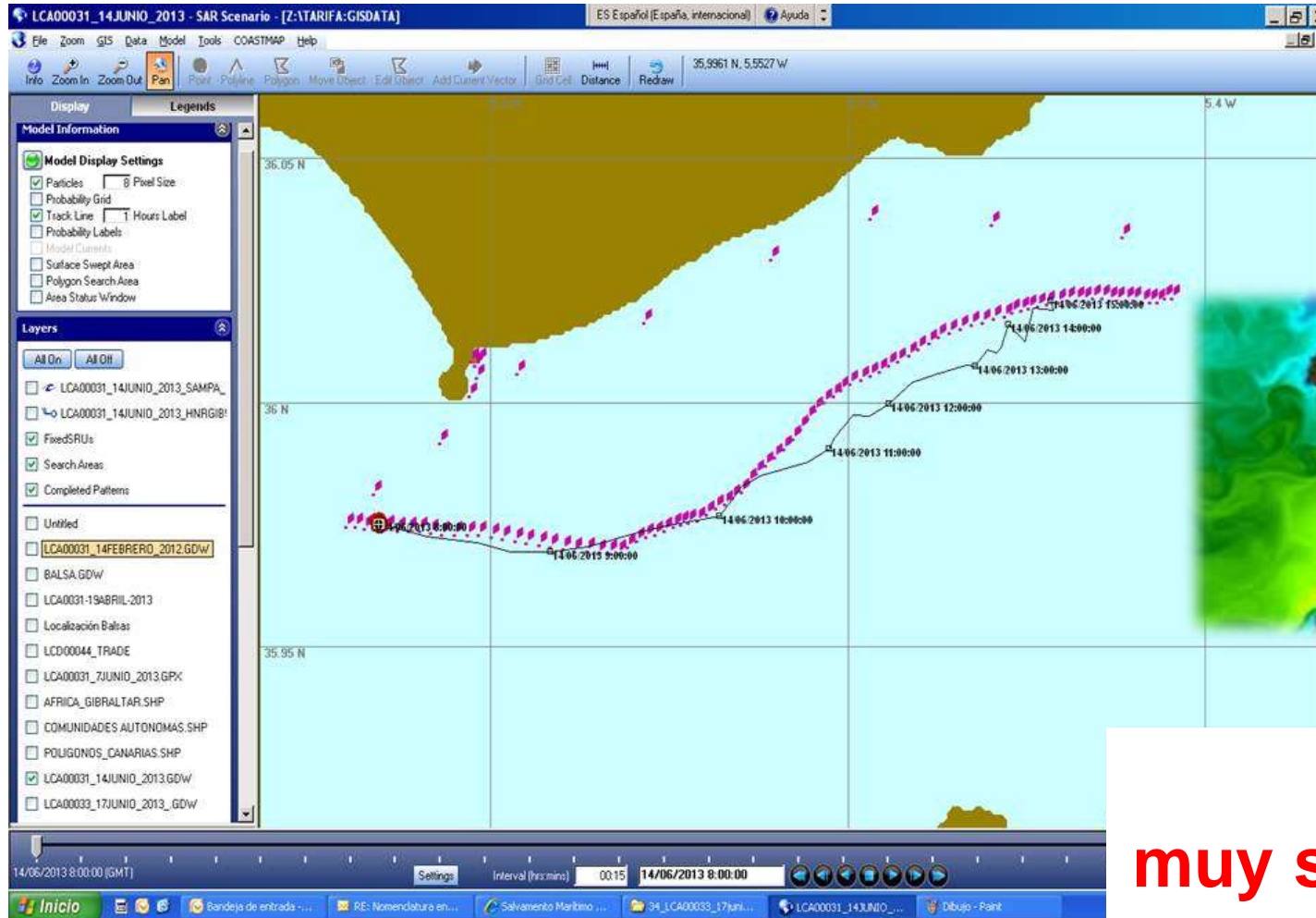
Seas and oceans cover two thirds of the surface of the globe and store immense amounts of potentially usable energy.

**Ocean Thermal Energy Conversion (OTEC) exploits the difference in temperature between warm surface waters and cooler deep water. To be economically feasible there must be a difference in temperature of more than 20 °C between the water at the surface and at depth. OTEC brings value in tropical regions.**





# Search & Rescue in the Gibraltar Straits



**« Resultados muy satisfactorios ! »**

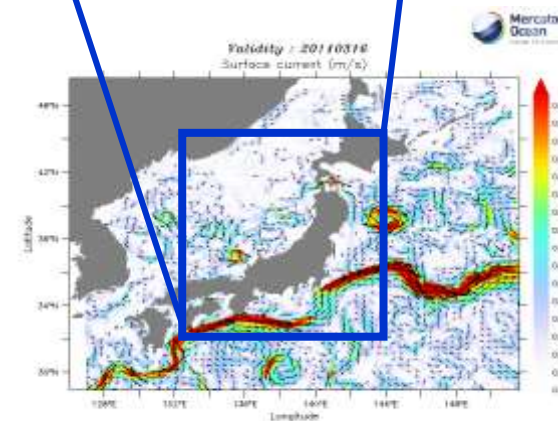
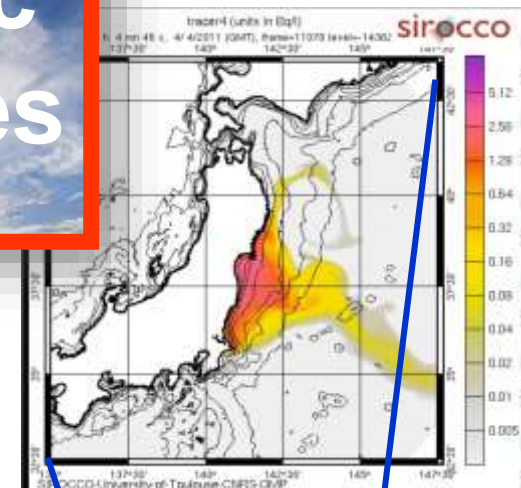
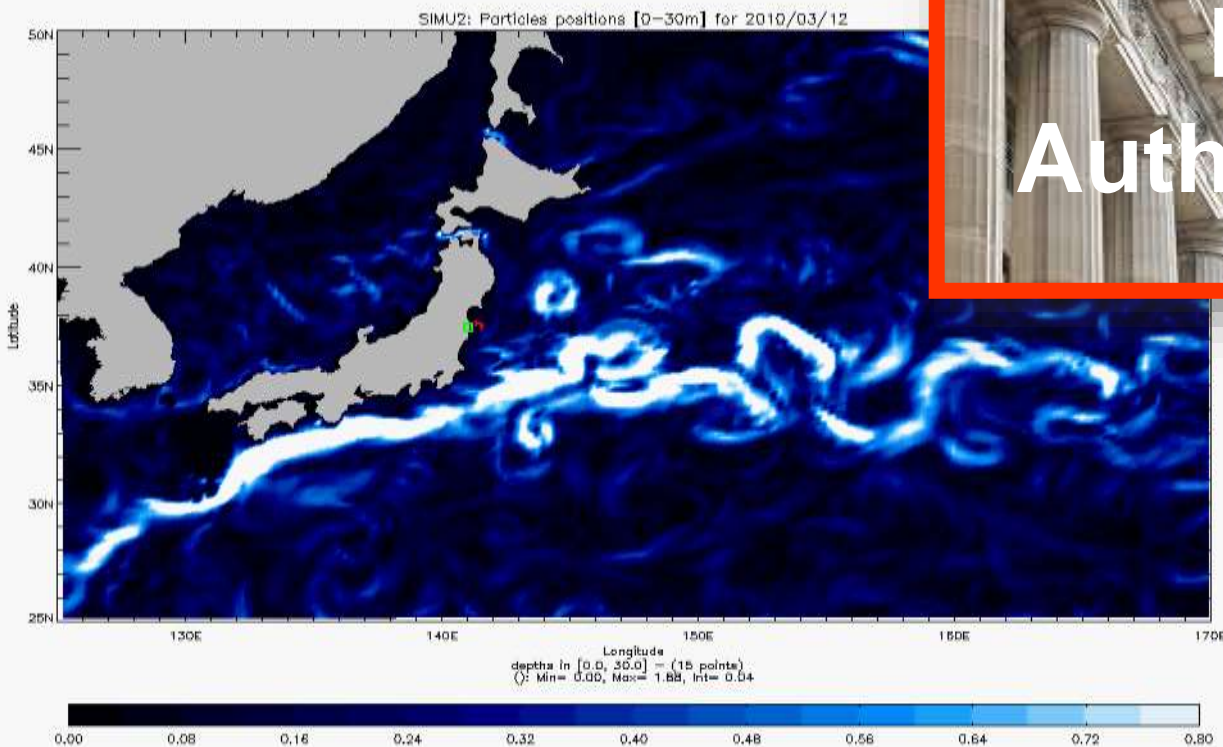
**José C. Maraver Romero ,  
SaseMar controller in Tarifa**

**Reliability assessment of Copernicus Marine Service  
Forecast during a SAR exercise**



# Contributing to Risk Mitigation Plan (Fukushima)

## Immediate overview of the pollution drift



European Commission



# Combatting Marine Litter and plastic pollution

Drift computation based on CMEMS reanalysis over 10 years help the expedition optimize and finetune the itinerary in order to detect the potential pollution convergence areas in the North Atlantic.



NGO

**EXPÉDITION  
7<sup>e</sup> CONTINENT**

Name of the



European  
Commission



|

# Feeding Harmful algal bloom warning system



## End Users:

- Fish Farmers,
- Biotoxin national monitoring organisations,
- Scientists,
- Regulators,
- Environmental NGOs,
- Community groups.



European  
Commission



# Adding Value to mobile expert information (smartphone app)

**SEA CONDITIONS** DISCOVER NEWS

## Surface Currents

Ελλάς Greece

Κύπρος Cyprus

Αθήνα Athens

Ισπάρτα Isparta

Ανταλία Antalya

Κόνια Konya

Αϊνιόλη Aydin

Δενιζλί Denizli

Ιζμύρ Izmir

Χανιά Chania

Κρήνη Crete

Αλάνια Alanya

Κύπρος Cyprus

2.0>

1.8

1.5

1.3

1.0

0.8

0.5

0.2

0.0

Preferences

Sea Forecast

Sea Level cm

Sea Temperature °C

Surface Currents Kts

Sign. Wave Height and Direction m

Wave Period and Direction s

Sea Satellite Observations

Weather Forecast

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European Commission



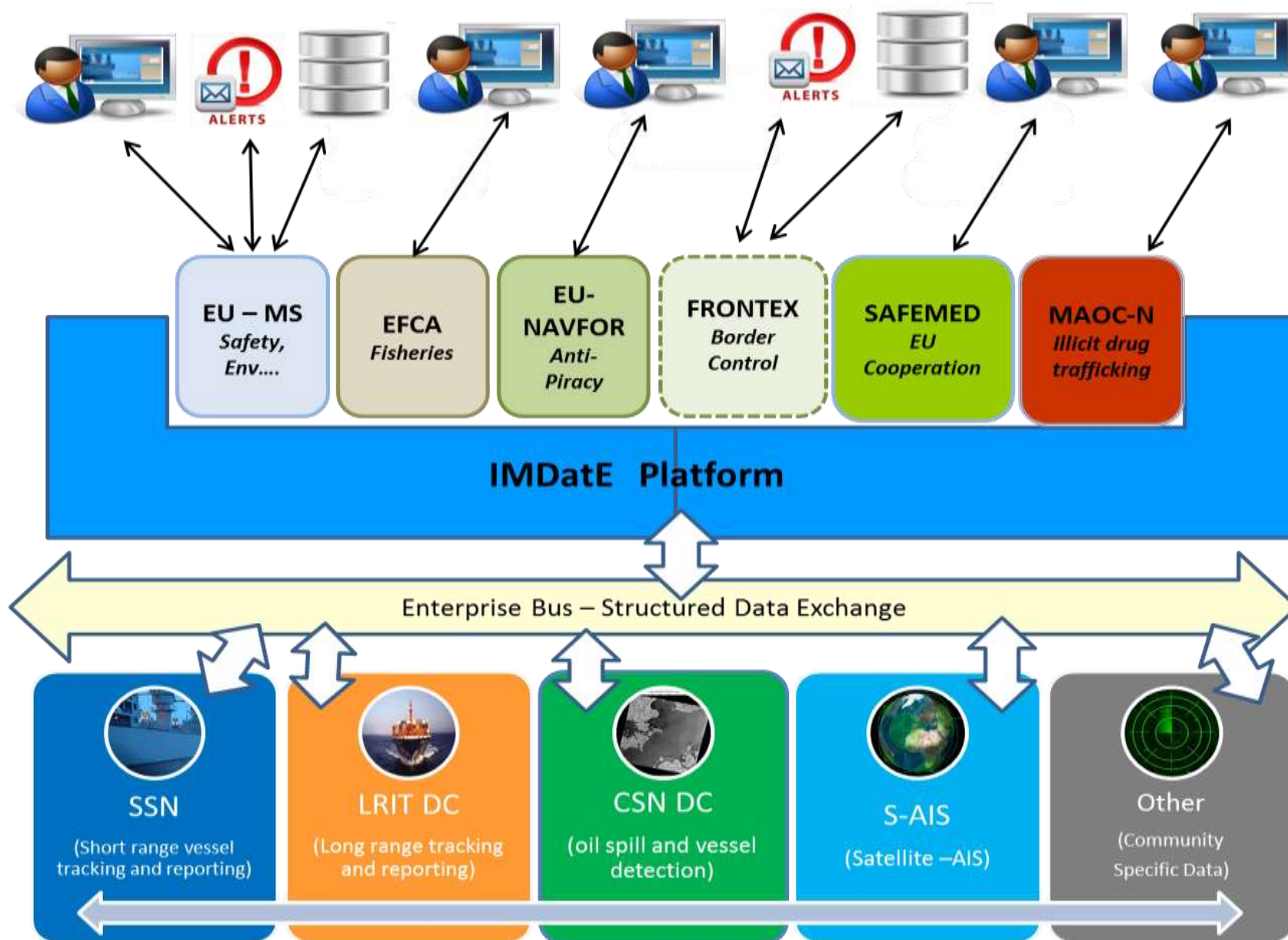


# Copernicus Security Service



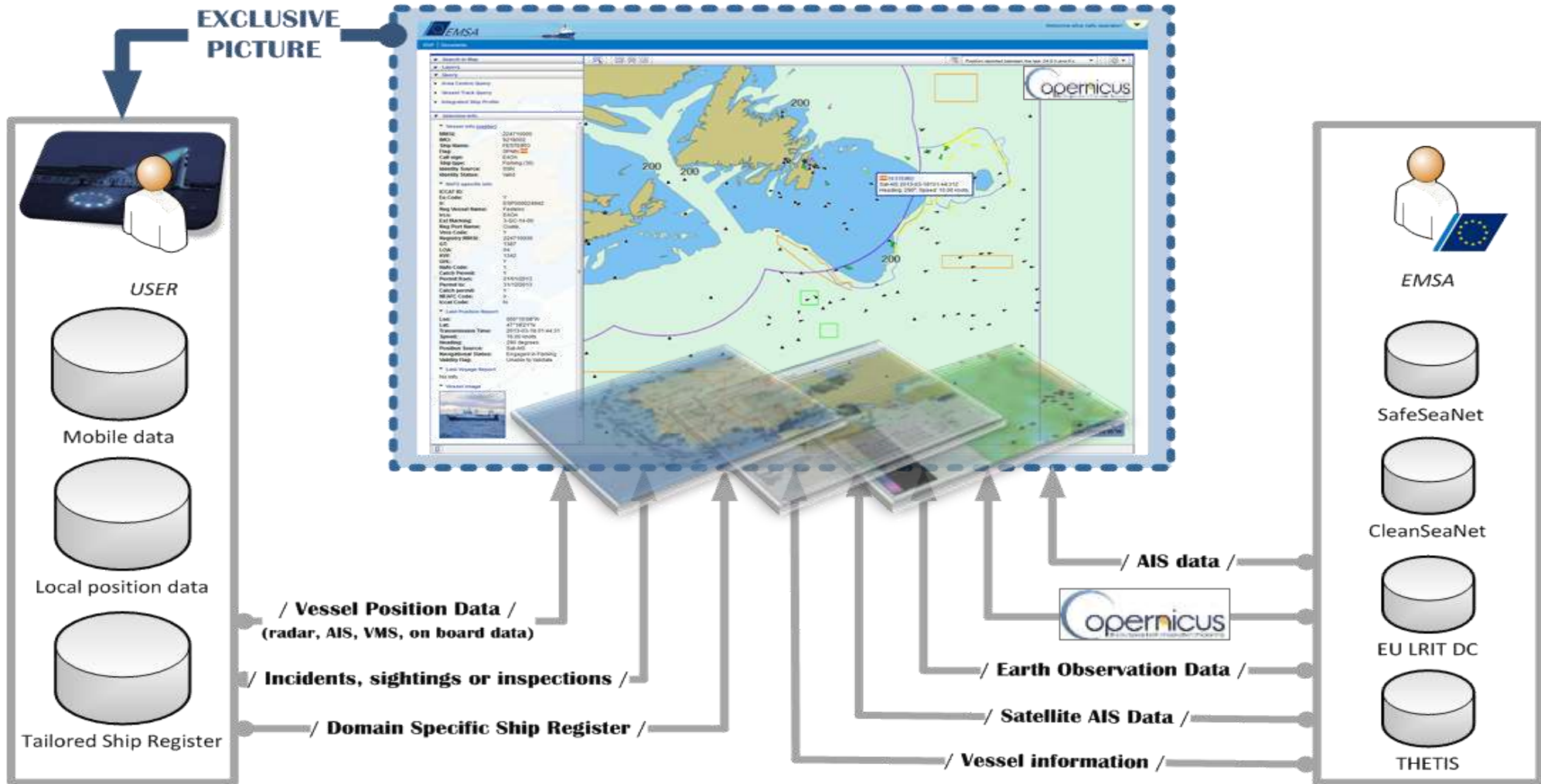
A service realised in Inter-Agency cooperation





# Integrated data / data fusion

## Tailor-made Integrated Maritime Awareness Picture



Integrated maritime services with a Copernicus Component



# Copernicus component to Maritime Surveillance Services

## ■ Maritime picture composed of different data sources

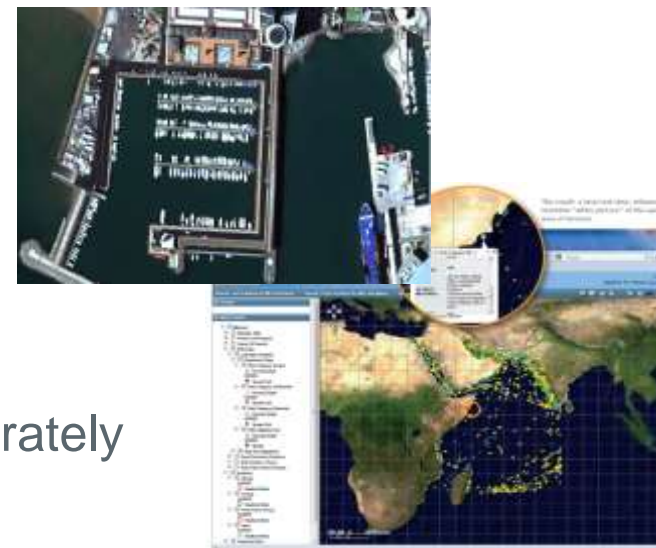
- ✓ Vessel positioning: LRIT, Terrestrial AIS, S-AIS, VMS, etc.



- ✓ Earth observation data: Synthetic Aperture Radar (SAR) Optical

## ■ Copernicus is a component of EMSA Integrated Services

- ✓ Service value proposition to end-users requires fusing of EO data with domain specific information (vessel position, information, etc.)



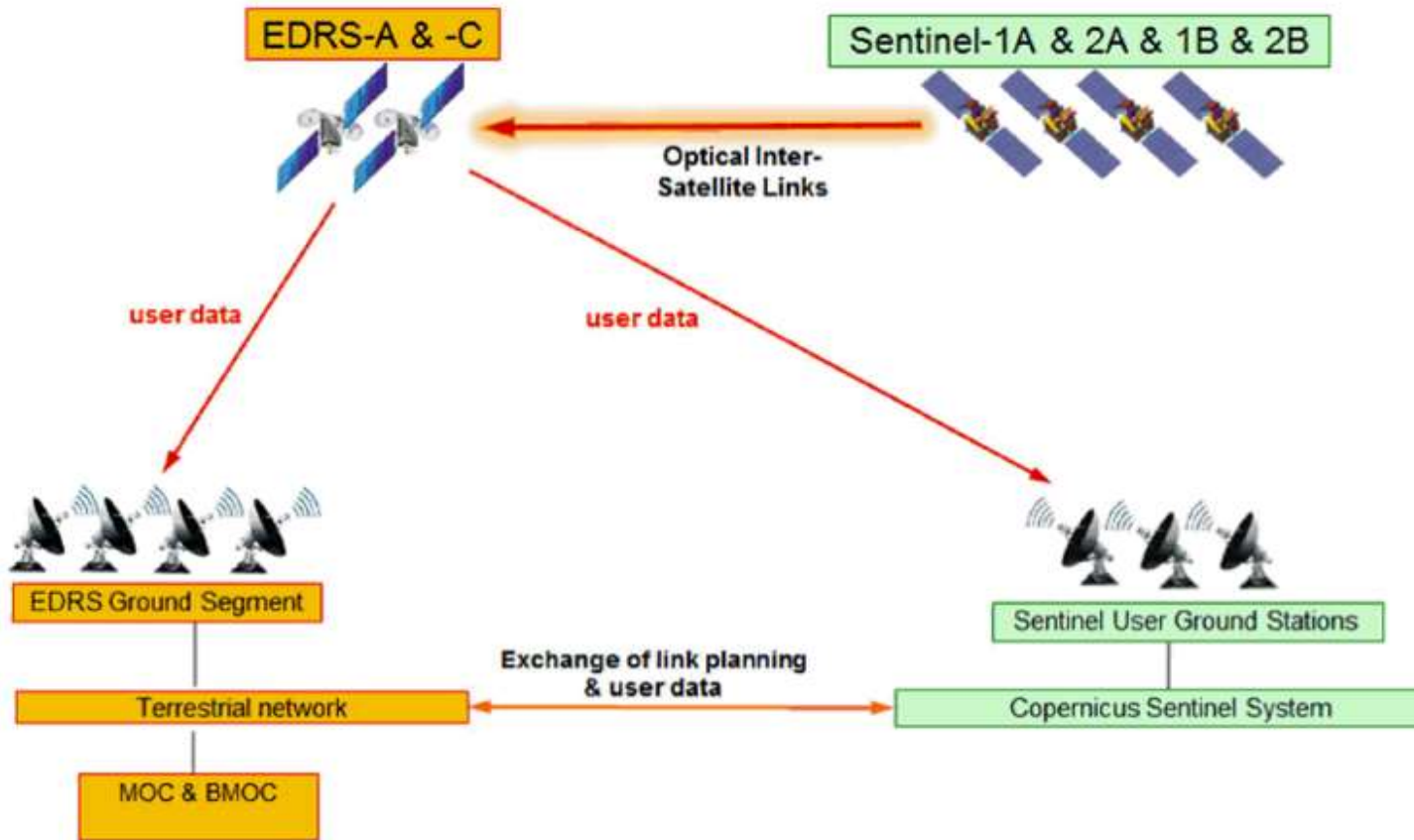
## ■ Copernicus Security services

- ✓ Areas of interest are confidential
- ✓ Full, free and open Data Policy for Copernicus data cannot be applied automatically
- ✓ Data access model and governance is defined separately

# Next: EDRS



A key tool for achieving global QRT capability



- ❑ offers a QRT solution for global access through Copernicus core ground segment
- ❑ rapid access to image data has been demonstrated
- ❑ operational deployment for EMSA is in its test phase
- ❑ could be a game changer for maritime surveillance beyond Copernicus EO capacity



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<http://www.copernicus.eu/>

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