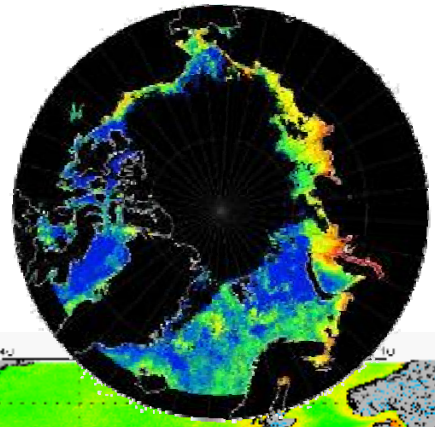
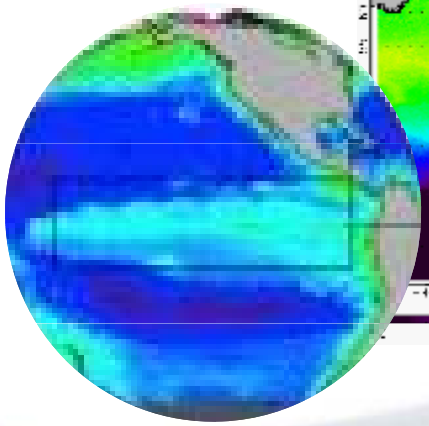
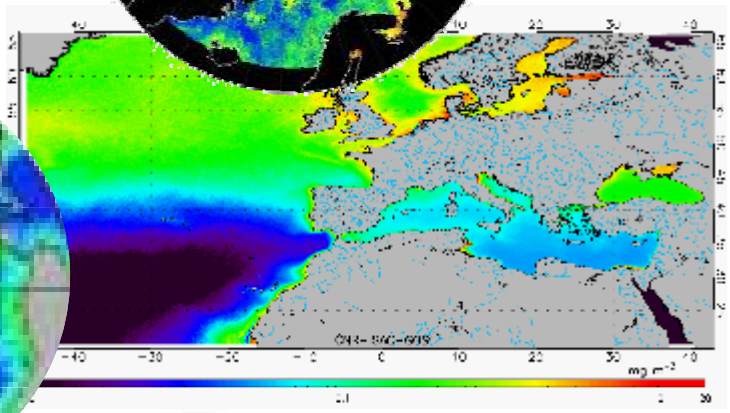
Servizio Monitoraggio dell'Ambiente Marino di Copernicus







Rosalia Santoleri
(CNR-ISAC)
9-10 Giugno, 2015
Roma

Outline

- Introduzione

- Che cosa è il Servizio Marino
- Da MyOcean a CMEMS: status dell'implementazione
- Il ruolo dell'Italia nel Servizio Marino: Passato, Presente e Futuro
- Il futuro del Servizio Marino Mediterraneo: criticità e potenzialità

Marine service implementation steps with EC

GMES Implementation (2004-2014)

- FP6 **MERSEA** (2004-2008)
  - Set up a common **R&D**, prepare a system
- FP7 **MyOcean** (2009-2012)
  - Set up a European integrated **system**, and open the service to users
- FP7 **MyOcean2** (2012-2014)
  - Develop and improve the **service**, work for sustainability

H2020 2014 Work programme

Activity 5 – Transition towards Copernicus

- **MyOcean-Follow On** (2014-2015) designed as a 6-month project in full continuity with MyOcean2 in the frame of H2020
  - Bridging between MyOcean&MyOcean2 and the Copernicus Marine Environment Monitoring Service (April 2015).

Copernicus (2015-2021)

CMEMS: Copernicus Marine Environment Monitoring Service

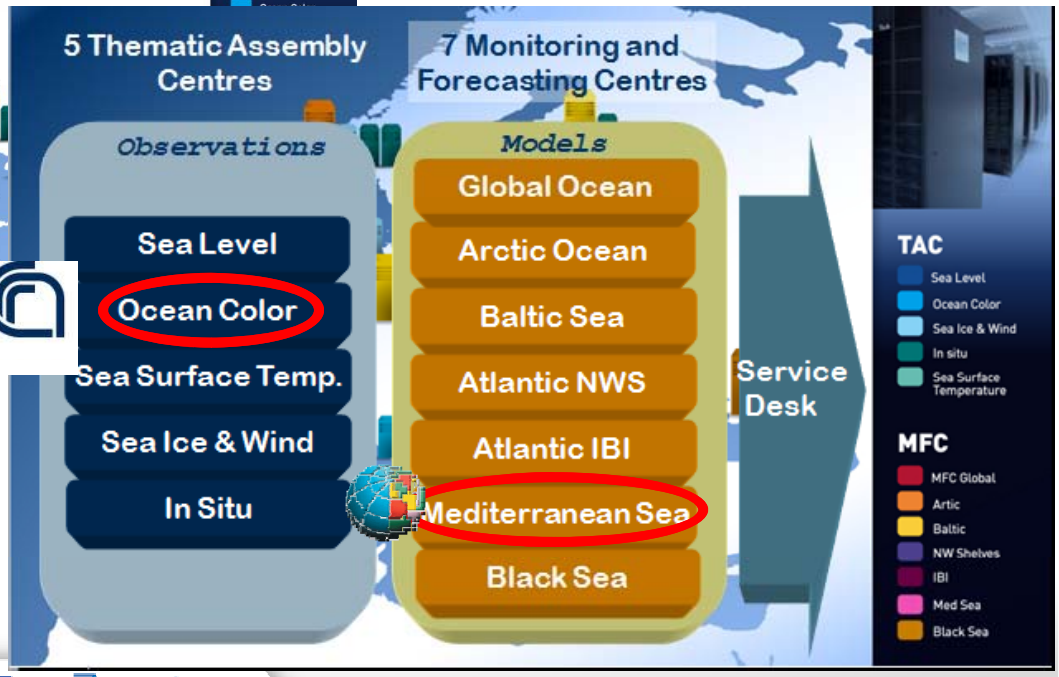
Operational service


MyOcean (3 years) & MyOcean2 (2,5 years) & MyOcean FO (6 Months)
~60 partners from ~28 countries
~11 M€/year EC Grant

e) A pan-European system organization to produce marine information

60 PARTNERS in FP7 MyOcean & MyOcean2 & MyOcean FO projects

14 MAIN OPERATORS
for the main service functions

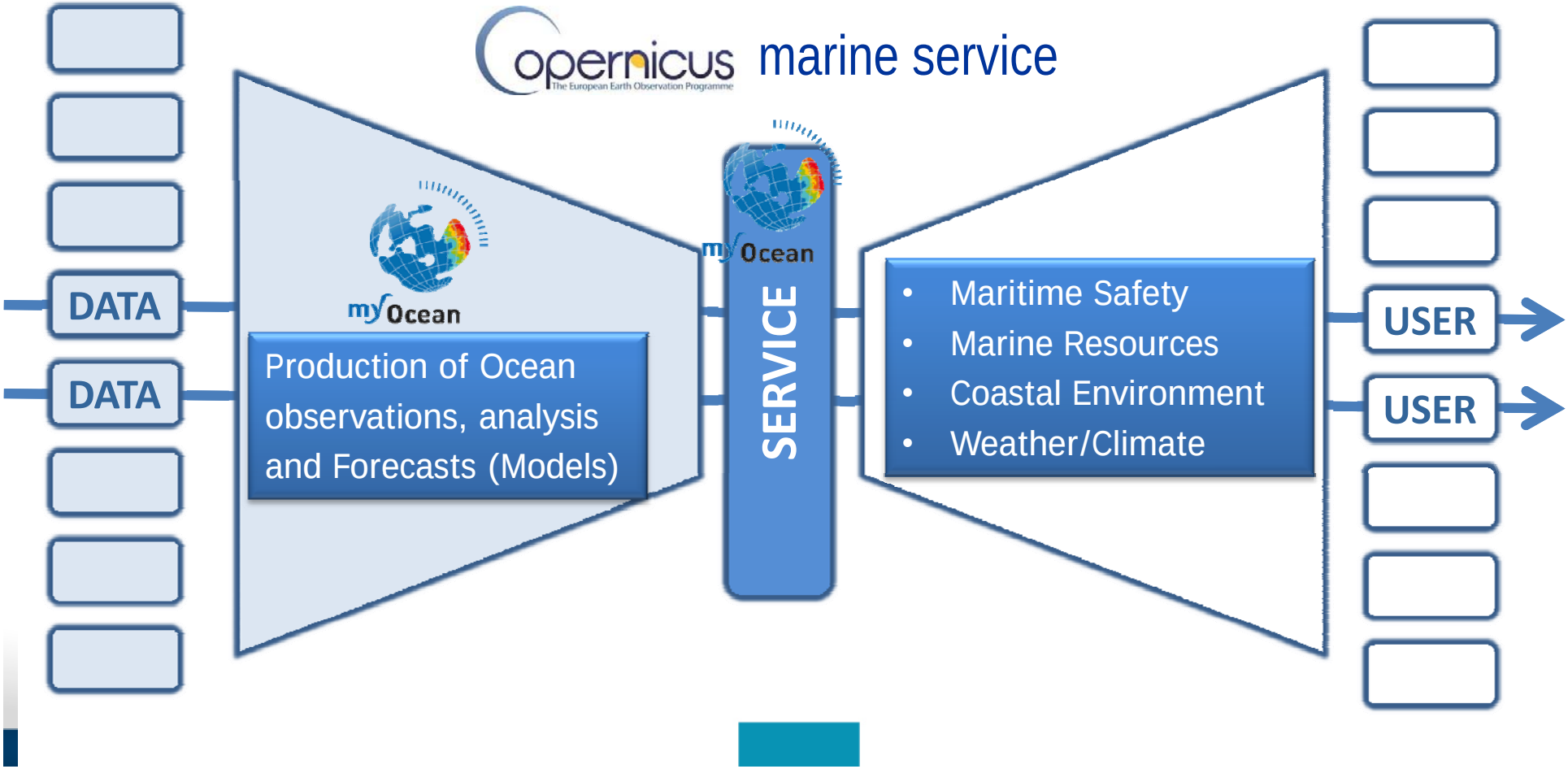


5 THEMATIC ASSEMBLY CENTRES

7 MONITORING AND FORECASTING CENTRES

2 PRODUCTION CENTRES LEAD by ITALY

A Core Service

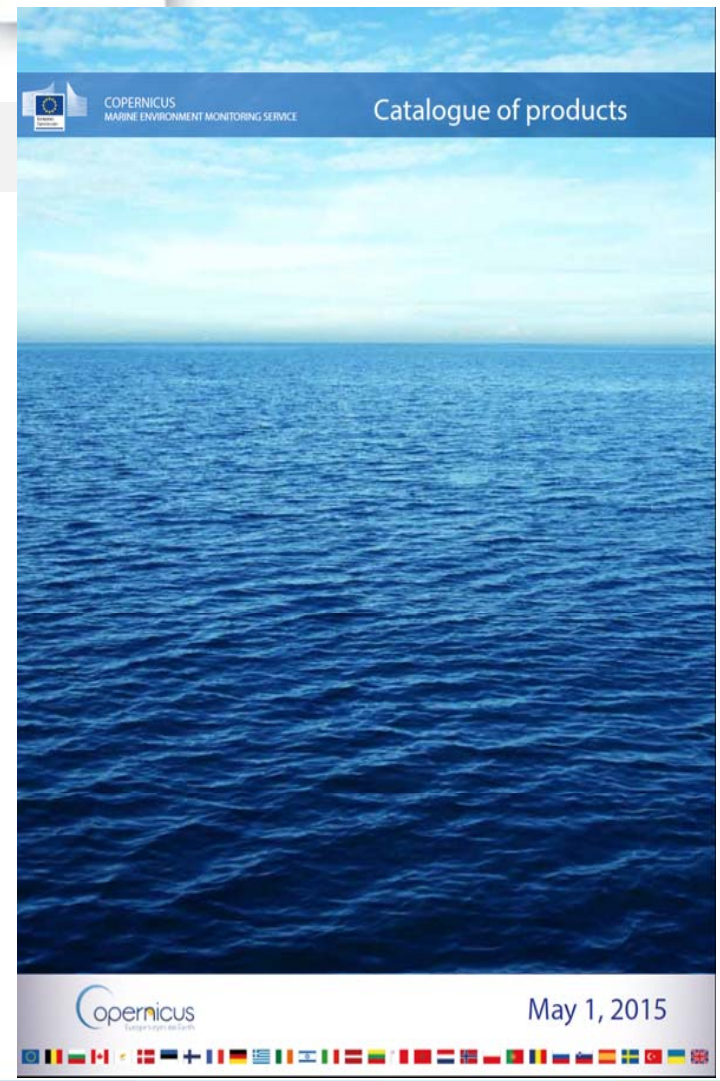


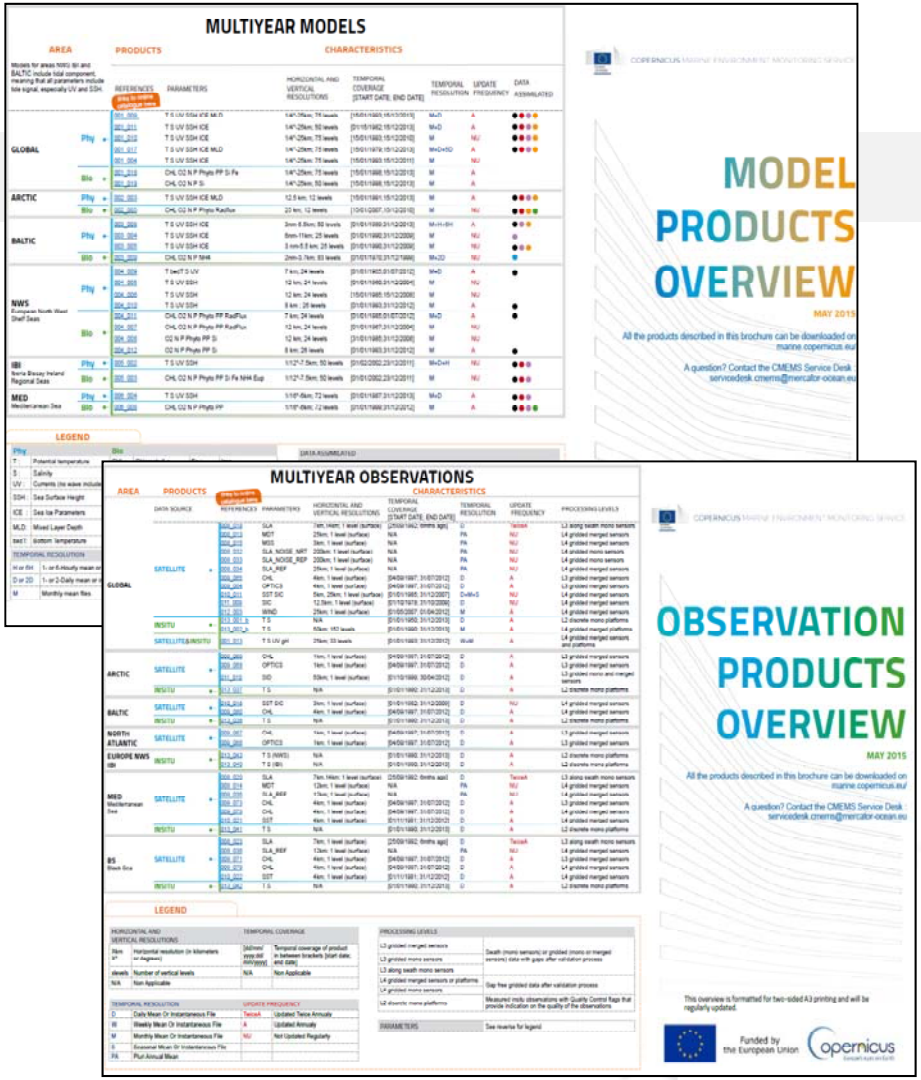
MERCATOR OCEAN
OCEAN FORECASTERS

Il Servizio Marino Copernicus

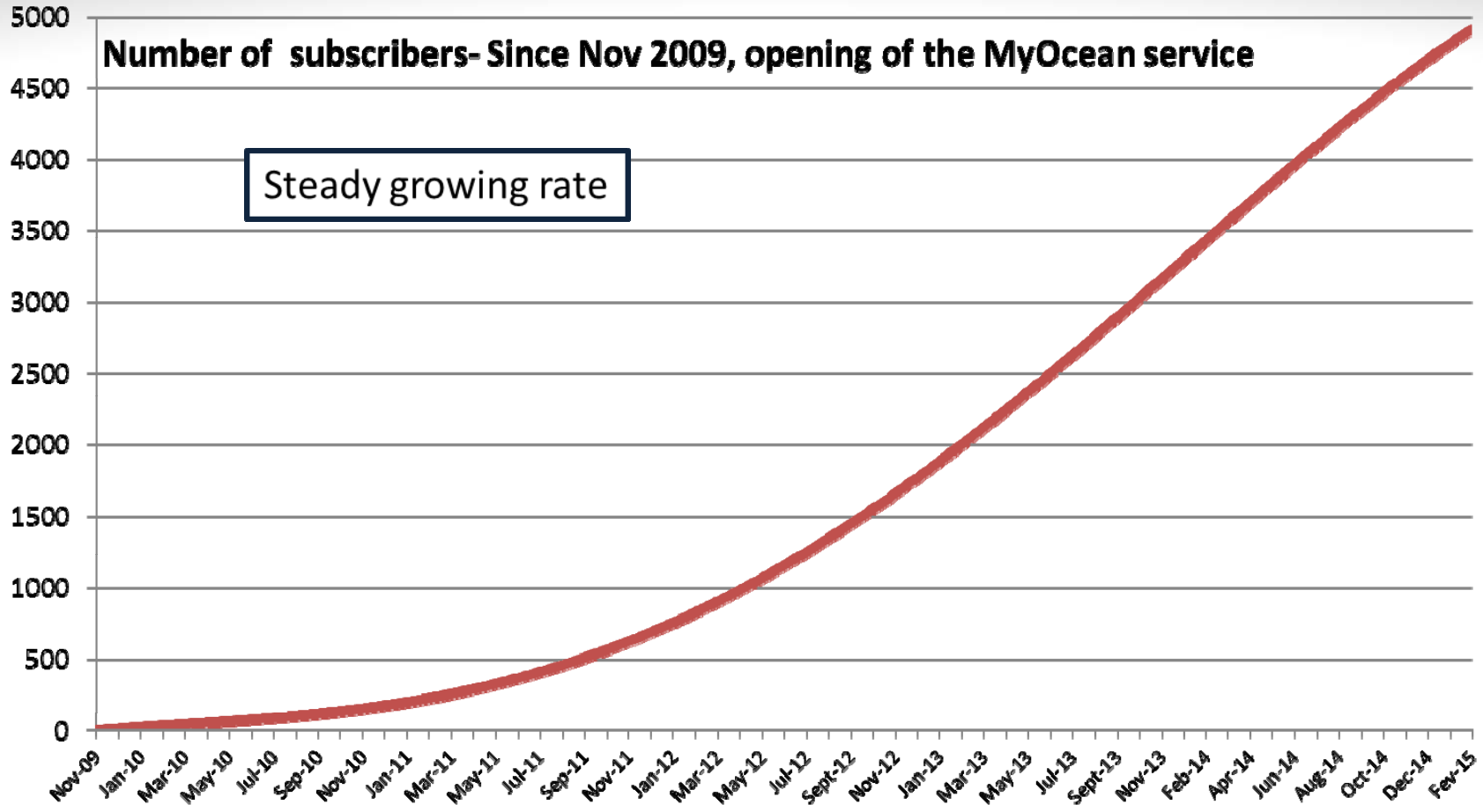
The CMEMS Web portal

I Prodotti del Servizio





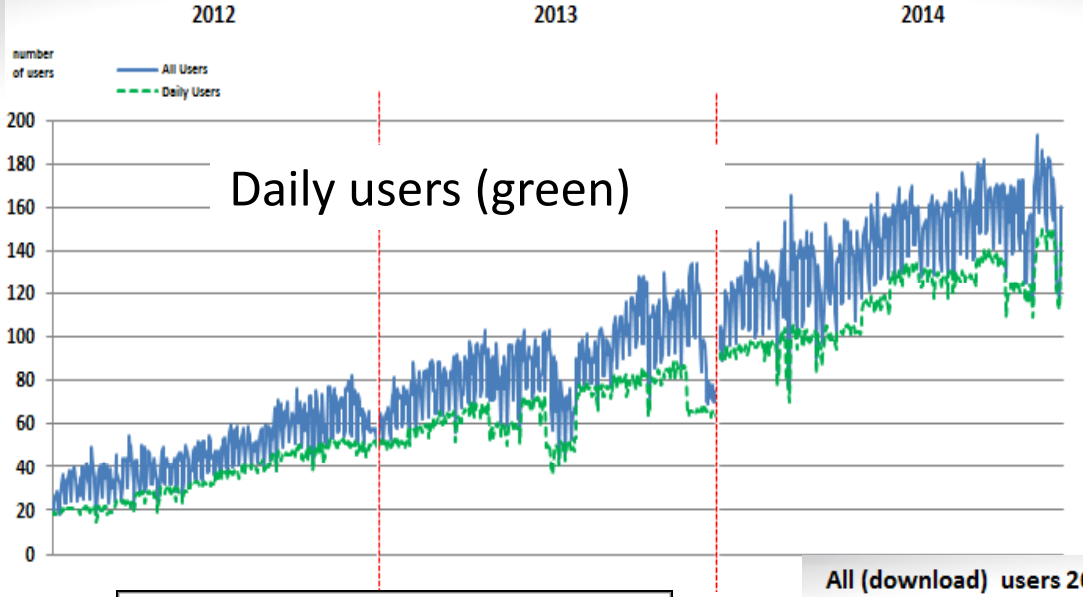
Status of the Service

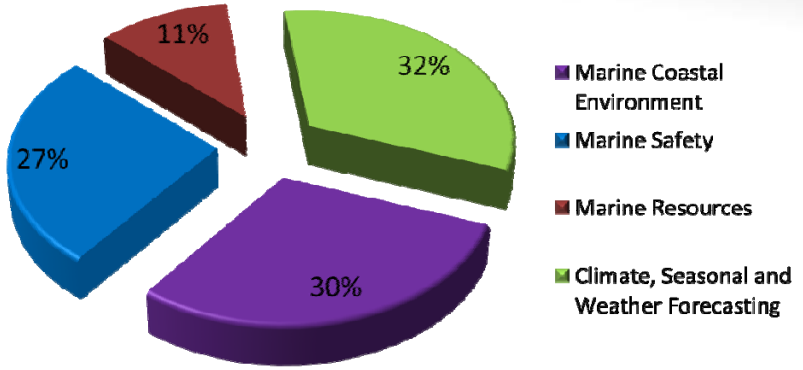


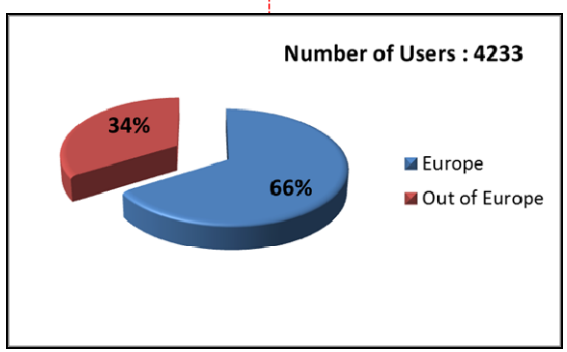
2014:

- **94 Tbytes downloaded (+78% vs 2013)**
- **14 000 000 download transactions (+200% vs 2013)**

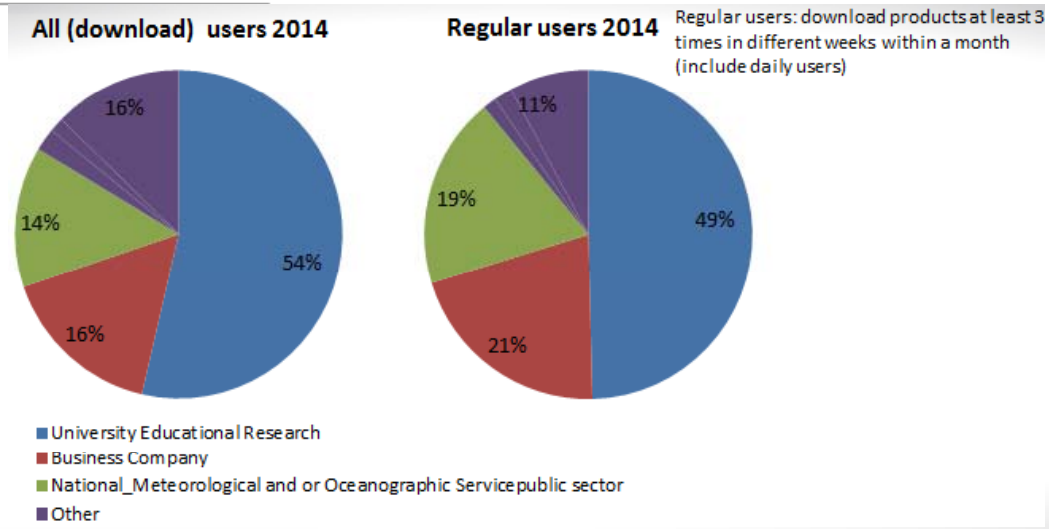
Status of the Service







364 regular users in 2014
19% National Services
21% Business Compapy



MERCATOR OCEAN
OCEAN FORECASTERS

Il Servizio Marino da MyOcean a Copernicus

CMEMES: implementazione

Novembre 2014: EU affida ad Mercator Océan l'implementazione del «Copernicus Marine Environment Monitoring Service» (CMEMS).

- **Delegation Agreement signed: Nov 2014 –March 2021**

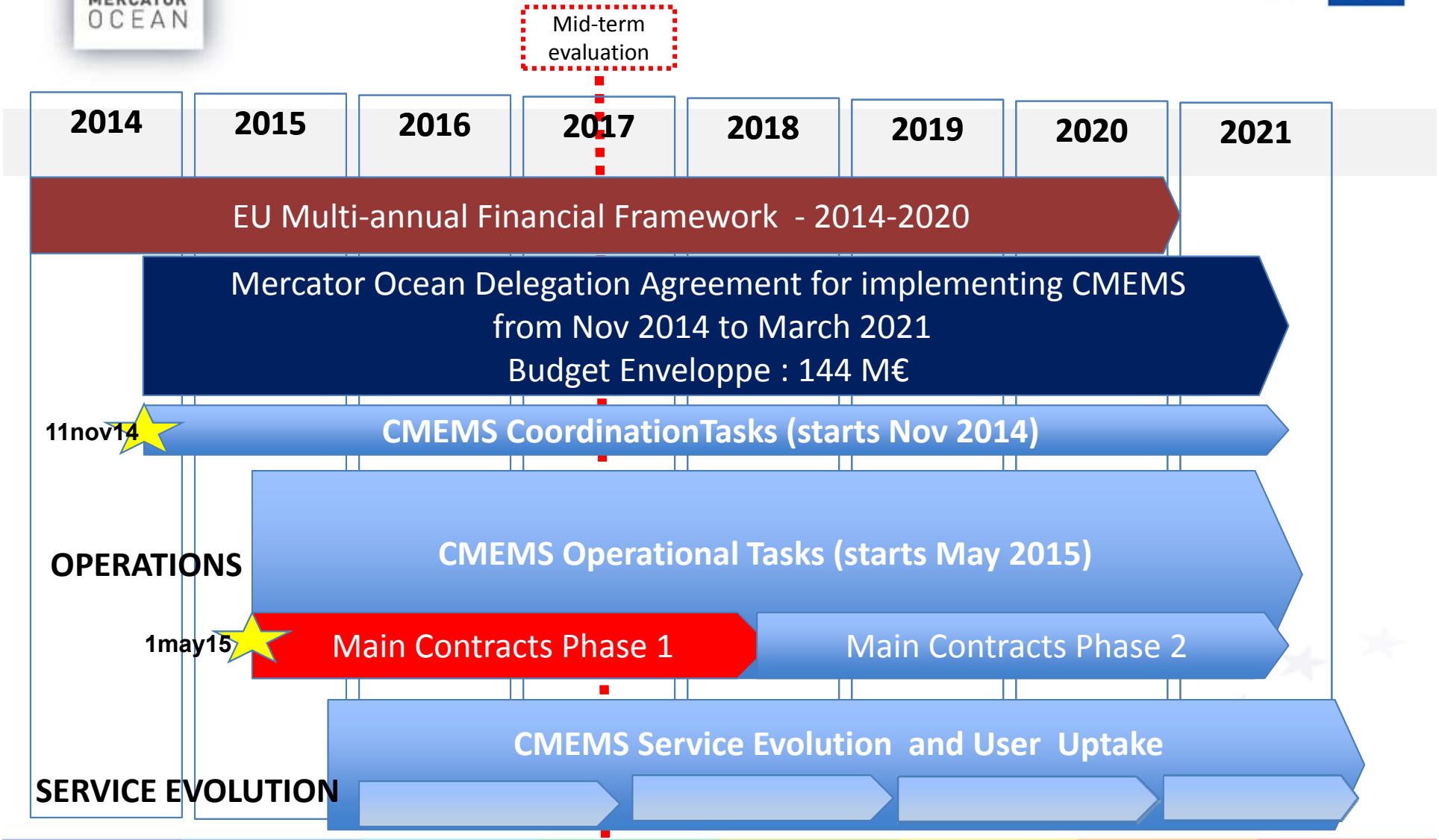
Gennaio 2015: Mercator Océan apre le tenders:

- **4 Thematic Assembly Centres ; 5 Monitoring and Forecasting Centres**
- **Open procurement procedure; publication / competition/ evaluation/ selection**
- **Contracts awarded mid-April**

May 2015: Mercator Océan da inizia al servizio CMEMS e termina il servizio MyOcean

- **Per gli utenti non cambia nulla;**
- **MyOcean V5 = CMEMS v1**

Timelines


Mid-term evaluation
2014
2015
2016
2017
2018
2019
2020
2021
EU Multi-annual Financial Framework - 2014-2020
Mercator Ocean Delegation Agreement for implementing CMEMS from Nov 2014 to March 2021
Budget Enveloppe : 144 M€
11nov14
CMEMS CoordinationTasks (starts Nov 2014)
OPERATIONS
CMEMS Operational Tasks (starts May 2015)
1may15
Main Contracts Phase 1
Main Contracts Phase 2
CMEMS Service Evolution and User Uptake
SERVICE EVOLUTION

CMEMS technical « internal » Framework: building blocks

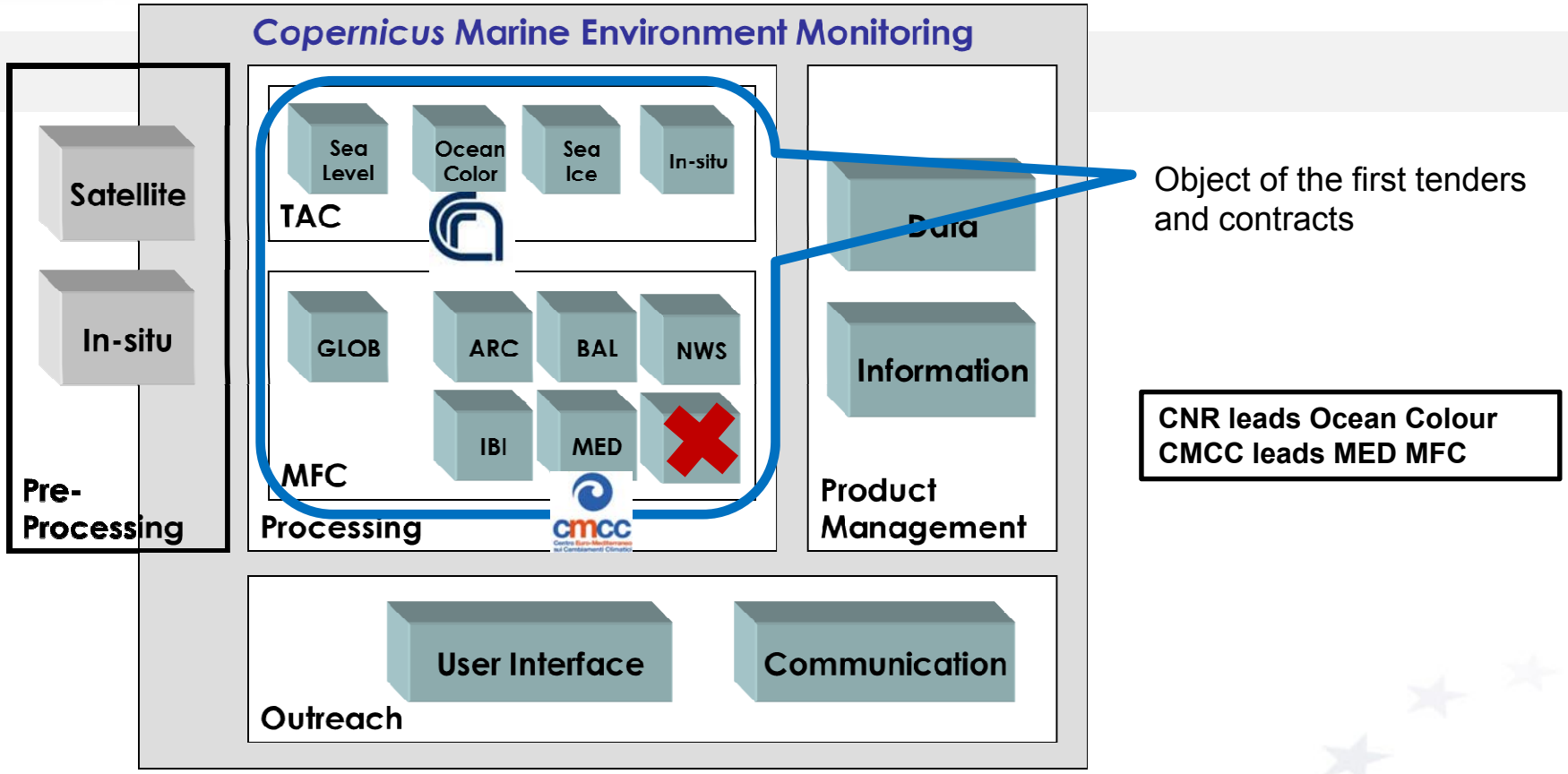


Figure 1: System overview of *Copernicus* Marine Environment monitoring service chain as presented by the European Commission to the GMES/Copernicus User Forum.

From the Technical Annex of the Delegation Agreement between the EU and Mercator Ocean

CMEMS technical Framework: Production Centres

- **9 Production Centres:**
  - 4 Thematic Assembly Centres (TACs): Sea Level, Ocean and Sea Ice, Ocean Colour, In Situ
  - 5 Monitoring and Forecasting Centres: Mediterranean, Iberia-Biscay-Ireland, North West Shelves, Arctic, Baltic
  - The Global MFC is managed by Mercator Ocean: not formally part of the contracts
- **Main short term objective: Continuity of Service with respect to MyOcean:**
  - Needs Production Centres in place, operational on 01/05/15
  - Needs stable central infrastructure (Central Information System) to perform integration. The tender for CIS will be open by end of the year
- **Going further**
  - User uptake tenders to reach new community of users (ex: downstream sector)
  - Service proposed by area of benefit (marine safety, coastal & marine environment, marine resources, weather, climate & seasonal forecasting)

Service evolution and user uptake strategy workshop – Sept. 7&8, 2015, Brussels

Scientific Vision

Principles

CMEMS must remain **state-of-the art and competitive** for its different product lines: level 3 & 4 data products, analyses and short term prediction (physics and biogeochemistry), reanalyses (physics and biogeochemistry).

This should be **regularly checked** and (independantly) assessed.

System improvements are part of service evolution activities. They are both **User** and **Science** driven. Need **a common and agreed long term service evolution strategy** (MO responsibility – inputs needed 3 year/6 year plans).

Service evolution activities should remain phased between MFCs and TACs (with specificities) (single European service).

CMEMS in Operation: resultati delle prime Tenders

Mercator Océan opererà il servizio di Copernicus Marine Service con 9 consorzi (~40 partners), coordinati da:

- **NERSC, for the ARC MFC**
- **DMI, for the BAL MFC**
- **Met Office, for the NWS MFC**
- **Puertos del Estado, for the IBI MFC**
- **CMCC, for the MED MFC**
- **CLS, for the SL TAC**
- **Met Norway, for the OSI TAC**
- **CNR, for the OC TAC**
- **Ifremer, for the In Situ TAC**

Presenza Italiana in CMEMS :

OC TAC : CNR

MED MFC: CCMC, INGV, OGS

OSI TAC: CNR

IN Situ TAC: OGS

Leadership del OC TAC e MED MFC è rimasta in Italia.

Italia è responsabile della produzione dei:

- **Prodotti di Previsione sull'Area Mediterranea (fisici e biogeochimici)**
- **Prodotti satellitari per il Mediterraneaneo e Mar Nero (SST, OC) + Baltico (OC)**
- **Prodotti in SITU (T&S) x MED**
- **Disseminazione di dati di previsione MED**
- **Disseminazione dei dati satellitari: OC, SST, Vento per l'oceano globale e per tutti mari europei**

A parte la Francia l'Italia è l'unico paese che coordina due centri di produzione di CMEMS

CMEMS: external environment Interfaces, stakeholders

CMEMS Stakeholders:
EC, DGs, European Agencies,
Users (all types)

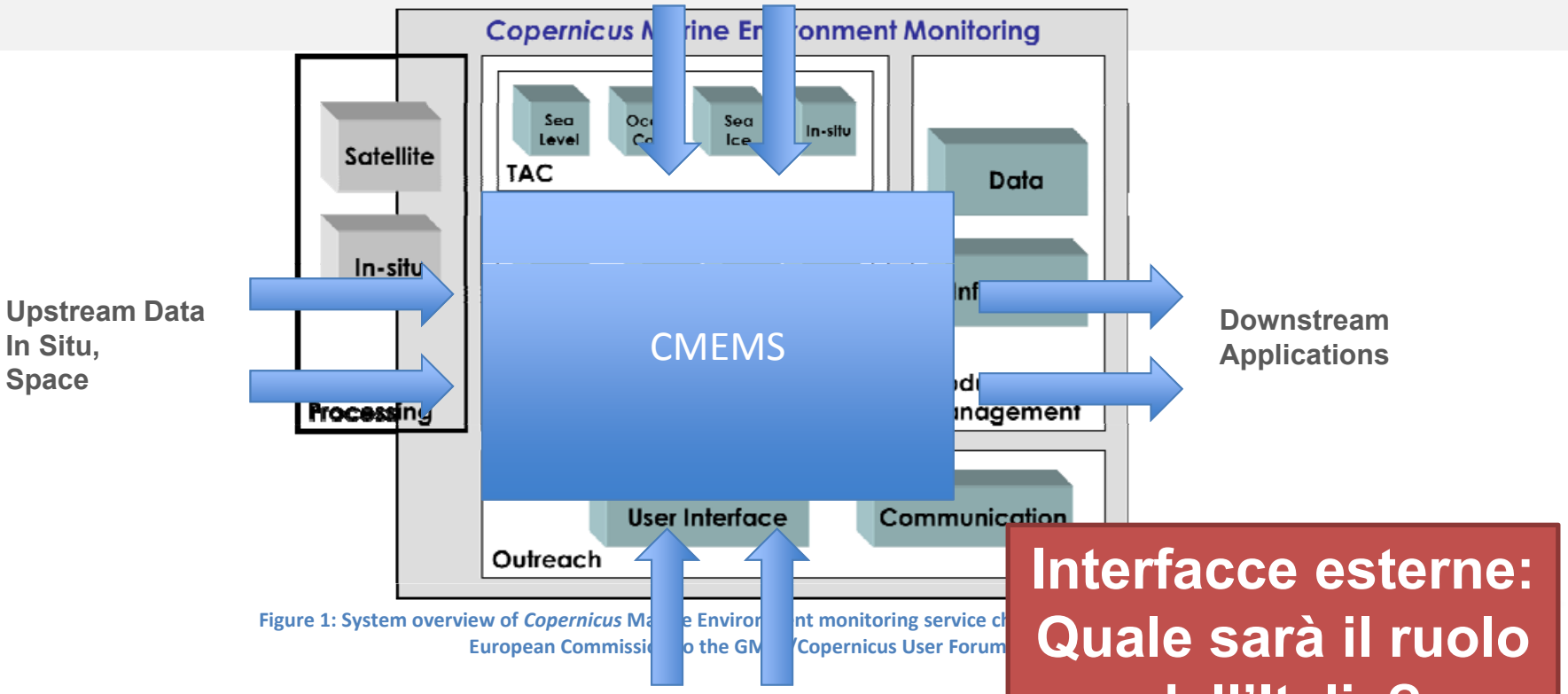


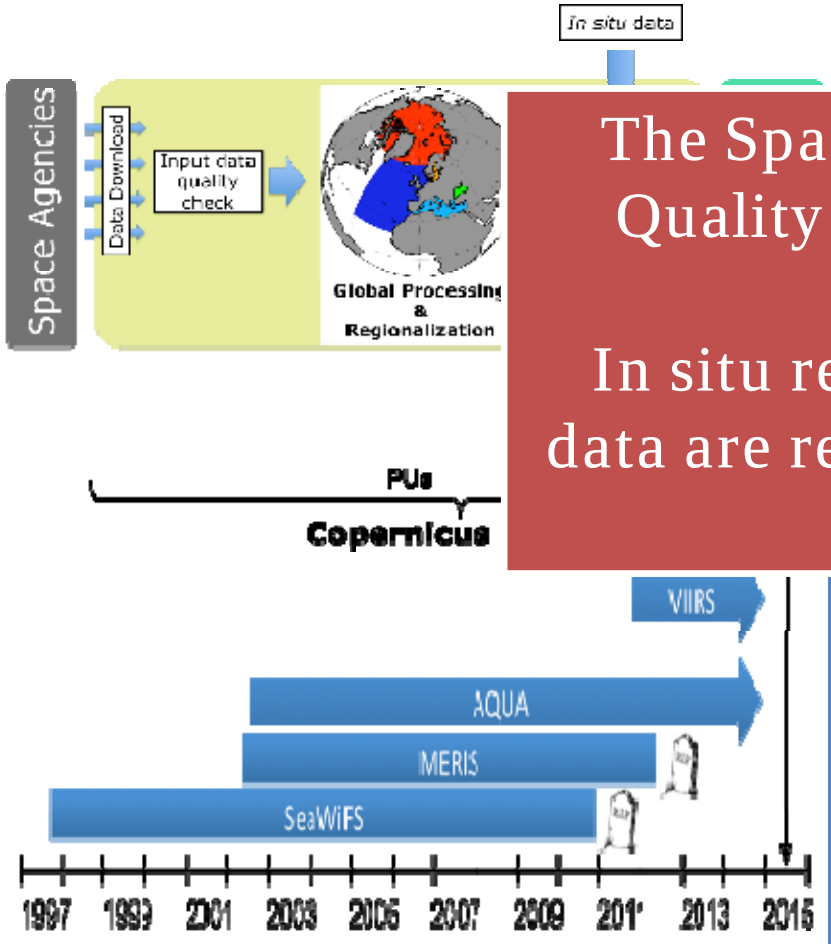
Figure 1: System overview of *Copernicus* Marine Environment monitoring service ch
European Commissio to the GM /Copernicus User Forum

Interfacce esterne: Quale sarà il ruolo dell'Italia?

OCTAC Architecture evolution: interfaces

In situ Upstreams:

- **CMEMS IN SITU**
- Public data: NOMAD, SeaBass, MERMAID, **AERONET-OC**
- Partners data (eg. Cruise data, **CNR buoy data)**



Downstreams:

rtal

ıtting elements
nities
national projects

The Space component data Quality is essential for the service
In situ reference bio-optical data are required for CAL/VAL pourpose

- **NASA: SeaWiFS, MODIS and VIIRS**
- **NOAA: VIIRS data**
- **ESA: MERIS data & OC-CCI data**
- **EUMETSAT: VIIRS and OLCI data**

EumetCast interface in addition to ftp to acquire space data

CMEMS in 2021:Mercator Vision

- A « marine service », prominent component of Copernicus, recognized by stakeholders for its **unique marine information and knowledge**, demanded by MS

RECOGNITION

- A « **Europeaniz**
behalf of the ma

QUALE SARA' Il RUOLO DELL'ITALIA?
La Leadership sul settore marino deve essere mantenuta e rafforzata.
L'Italia dovrebbe entrare nel Mercator Europeo e portare la sua visione e le sue esigenze

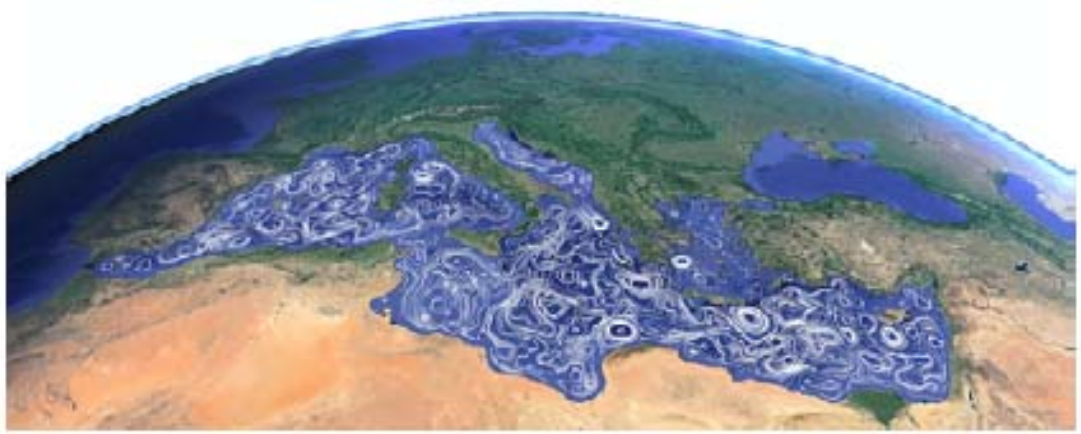
LEADERSHIP

- A **well entrench**
excellent science
strong effort on r

ENGAGEMENT

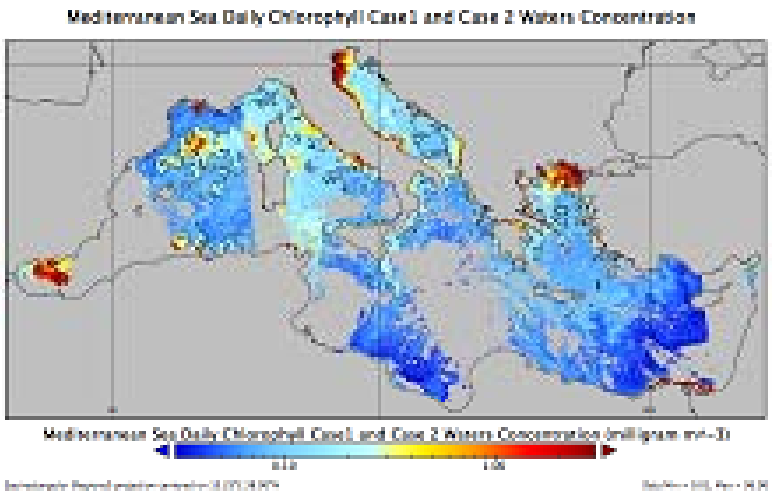
- A large number of **users in all sectors**, thanks to us and to our 1st rank users serving their own communities

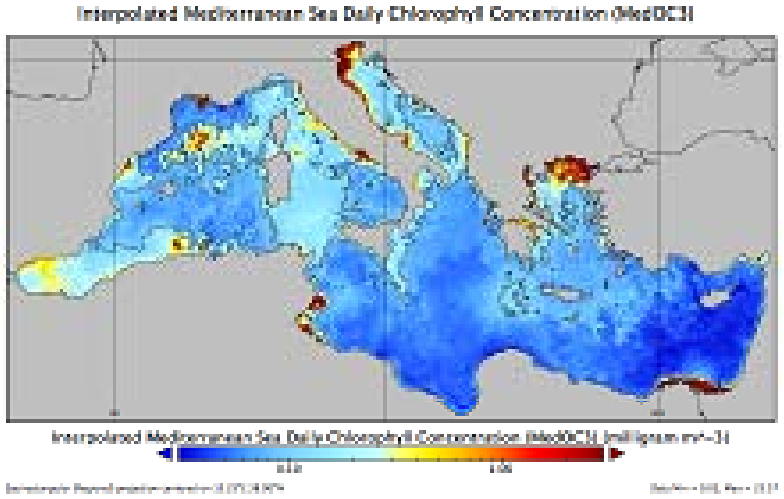
UPTAKE



I prodotti Mediterranei del servizio Marino

Ocean Colour Products

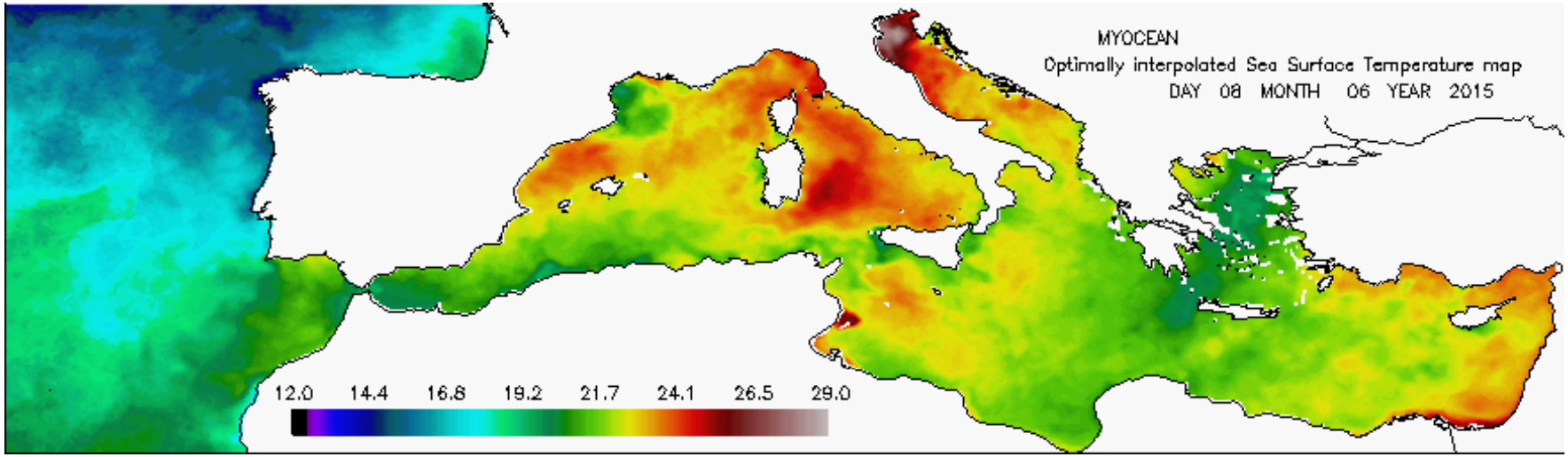




Ocean Region	NRT L3	NRT L4	REP L3	REP L4
Mediterranean Sea	single **& Multi** M0DIS & VIIRS & OLCI	Multi	Multi (SeaWIFS+MODIS+MERIS)	Multi Based on L3

NRT: products within few hours, NRT **replaced by consolidated product**
REP: consistent re-processed time series from 1997 to the 2012
L3: daily composite products; **L4** analysis (no data gaps), resolution: 1 km
Parameters: Chl, Rrs, water trasparency, IOPs, SPM

SST Products: multi sensors dataset

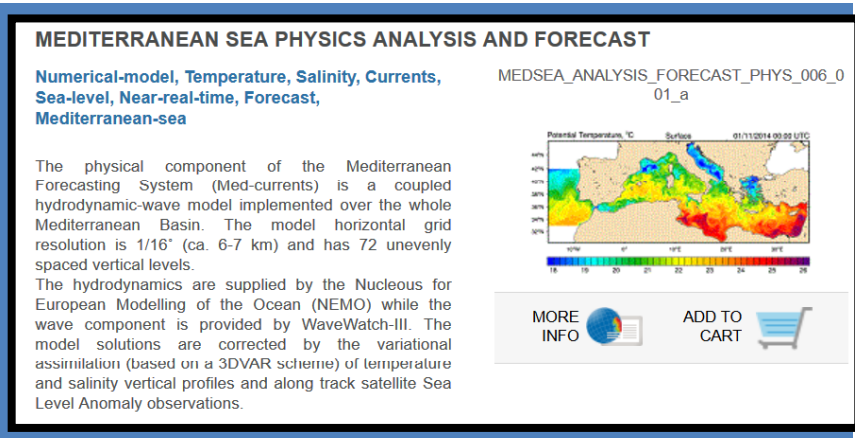


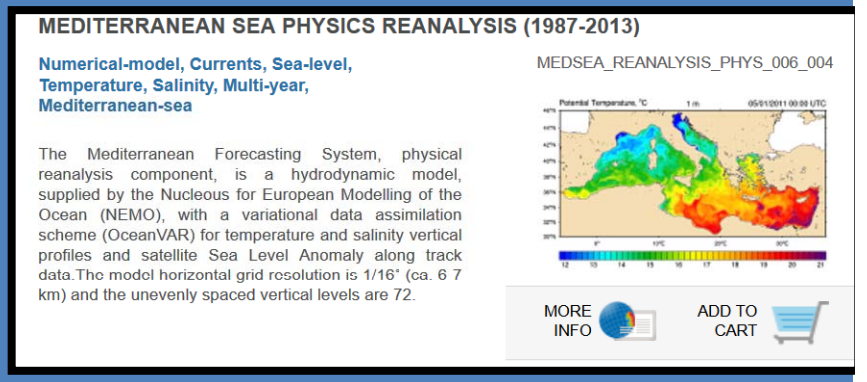
CMS Product No.	Product Description	MyOcean product name
P3	Mediterranean Sea High Resolution and Ultra High Resolution Sea Surface Temperature Analysis	SST_MED_SST_L4_NRT_OBSERVATIONS_010_004 (res: 5 km e 1 Km)
P5	Mediterranean Sea - High Resolution and Ultra High Resolution L3S Sea Surface Temperature	SST_MED_SST_L3S_NRT_OBSERVATIONS_010_012 (res: 5 km e 1 Km)
P7	Mediterranean Sea - High Resolution L4 Sea Surface Temperature Reprocessed (1981-2012) update annualy	SST_MED_SST_L4_REP_OBSERVATIONS_010_021 (res: 5 km e 1 Km)

Mediterranean Sea Physics: 2 products

1. Analyses and Forecat

- 6 variables (Potential Temperature, Salinity, Currents, SSH, Stokes Drift Velovity, Wavenumber)
- Res: 1/16°, 72 vertical levels;
- Daily and hourly fields





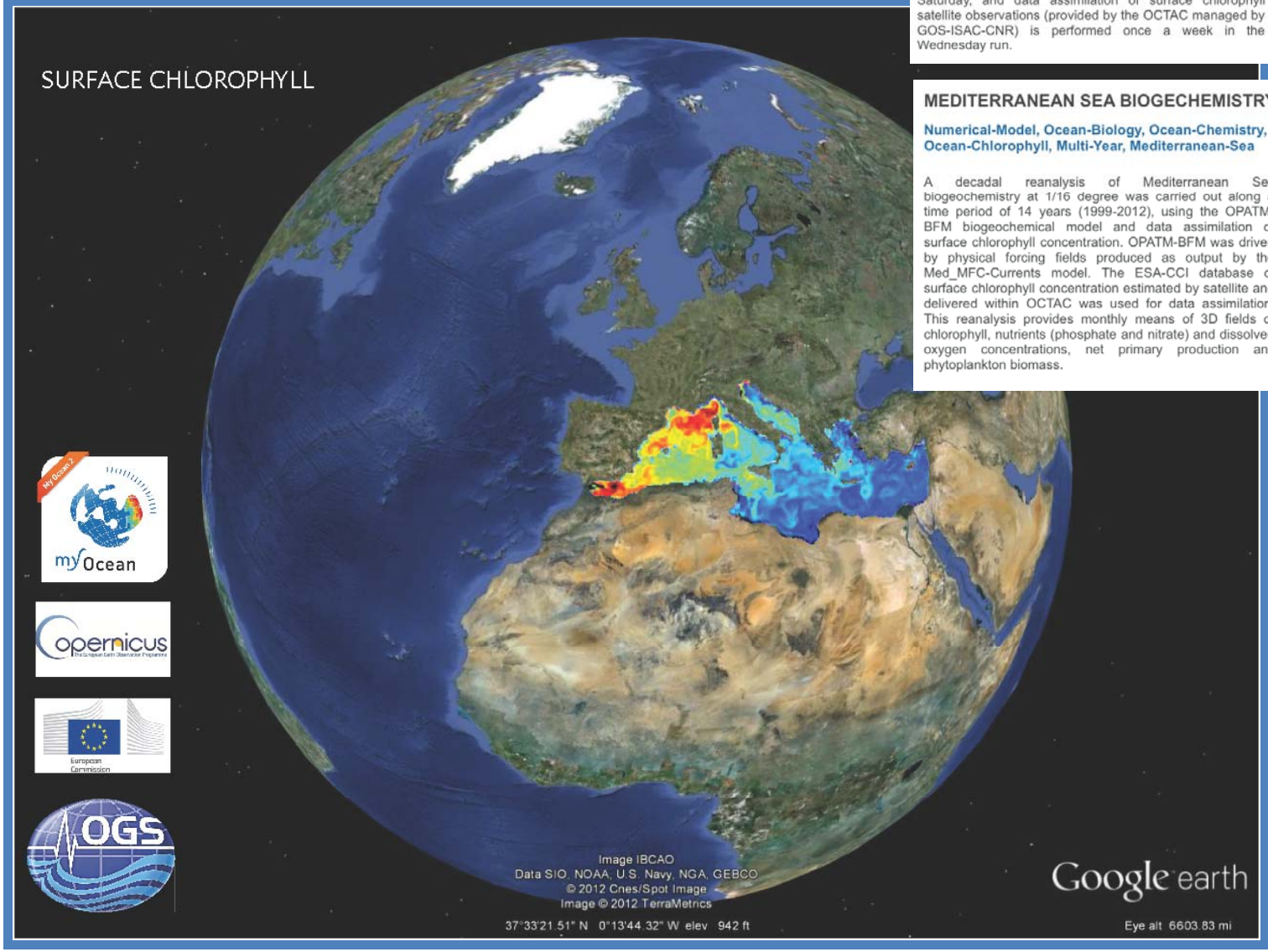
Mediterranean Sea Physics: 2 products

2. Reanalyses

- 4 variables (Potential Temperature, Salinity, Currents, SSH)
- Res: 1/16°, 72 vertical levels;
- Daily and Monthly means

Mediterranean Sea Biogeochemistry:

- 2 products (analysis and forecast, reanalysis)
- 6 variables (chlorophyll, phytoplankton biomass, N and P nutrients, primary production, oxygen)
- Res: 1/16°, daily and monthly dataset

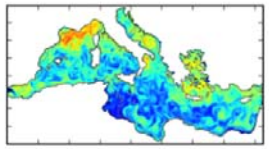


MEDITERRANEAN SEA BIOGEOCHEMISTRY ANALYSIS AND FORECAST

MEDSEA_ANALYSIS_FORECAST_BIO_006_006

Numerical-Model, Ocean-Chemistry, Ocean-Chlorophyll, Ocean-Biology, Forecast, Near-Real-Time, Mediterranean-Sea

The biogeochemical analysis and forecasts for the Mediterranean Sea are produced by the OGS Production Unit by means of the OPATM-BFM model system (described below), using as physical forcing the output of the Med-MFC-currents products managed by the INGV Production Unit. The forecasting system is automatically run at the CINECA supercomputing centre (Bologna, Italy). Seven days of analysis/hindcast and ten days of forecast are produced twice per week on Wednesday and on Saturday, and data assimilation of surface chlorophyll satellite observations (provided by the OCTAC managed by GOS-ISAC-CNR) is performed once a week in the Wednesday run.



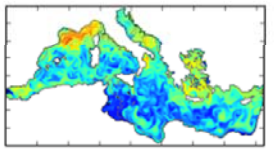
MORE INFO ADD TO CART

MEDITERRANEAN SEA BIOGECHEMISTRY REANALYSIS (1999-2012)

MEDSEA_REANALYSIS_BIO_006_008

Numerical-Model, Ocean-Biology, Ocean-Chemistry, Ocean-Chlorophyll, Multi-Year, Mediterranean-Sea

A decadal reanalysis of Mediterranean Sea biogeochemistry at 1/16 degree was carried out along a time period of 14 years (1999-2012), using the OPATM-BFM biogeochemical model and data assimilation of surface chlorophyll concentration. OPATM-BFM was driven by physical forcing fields produced as output by the Med_MFC-Currents model. The ESA-CCI database of surface chlorophyll concentration estimated by satellite and delivered within OCTAC was used for data assimilation. This reanalysis provides monthly means of 3D fields of chlorophyll, nutrients (phosphate and nitrate) and dissolved oxygen concentrations, net primary production and phytoplankton biomass.



MORE INFO ADD TO CART

Possibili settori di applicazione

Safety of navigation

Coastal protection and erosion

Search and Rescue

Pollution emergencies

Climate Change

Protection&management marine ecosystems

Off-shore activities

Military activities

Renewable energies

Fishery&acquacolture

Tourism

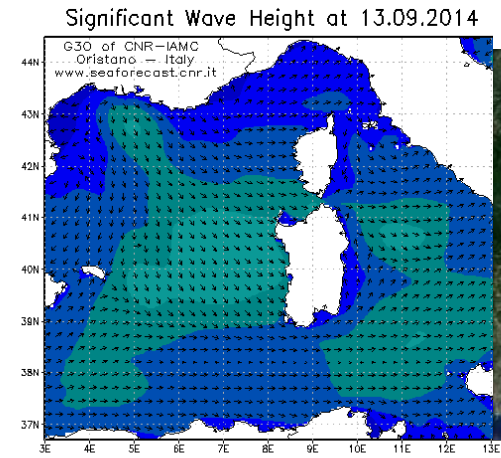
Harbours

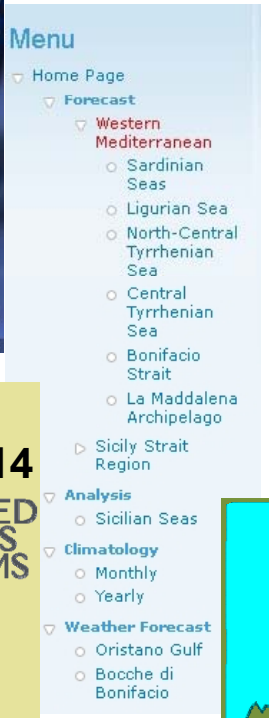
IAMC CNR PRODUCTS @ SUBREGIONAL/LOCAL SCALE

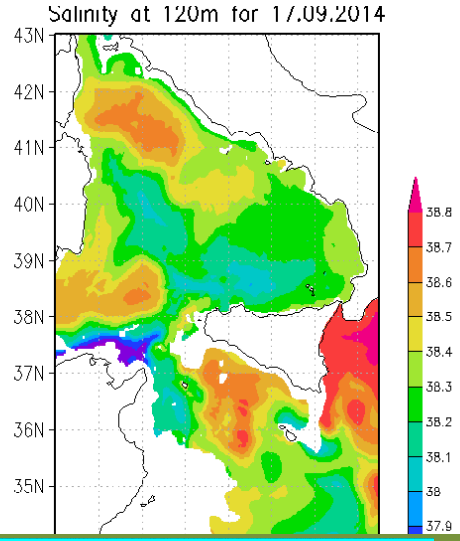
A daily 5-days forecast is produced & available @ www.seaforecast.cnr.it

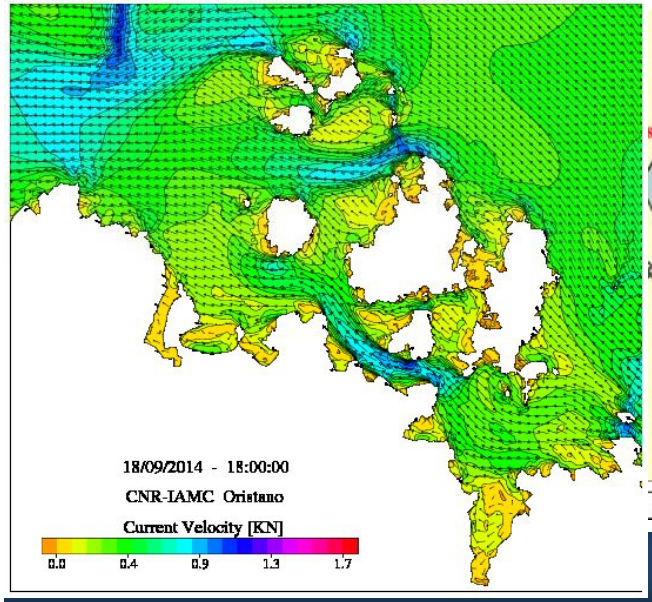
Every day 3-hourly plots of Significant WH & WD and daily of T, S and current on 30 sigma levels

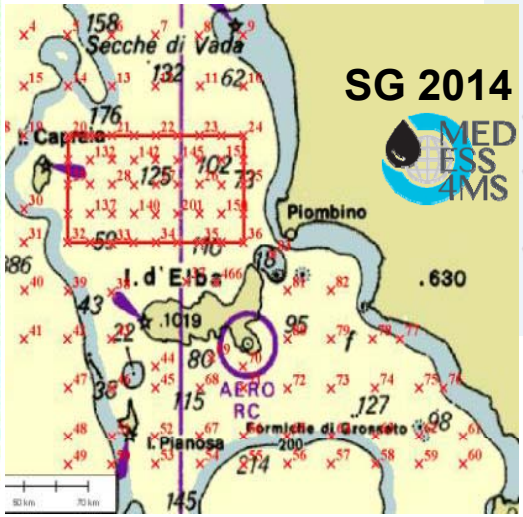
Data are used by ferries for the best route, during emergencies & international coordinated operations at sea, by local (Sardinian) stakeholders



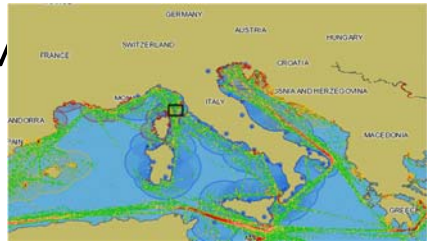








Oil Spill response



First CTD survey

Acquisition of the CleanSeaNet/COSMOSKYMED or optical images available in the area.

METEO MODELS
OCEAN MODELS
WAVE MODELS
OIL SPILL MODELS

Aerial survey to confirm the forecast
- ITCG vessel/airplane -

Second CTD survey

DRIFTERS RELEASE ON THE OIL SLICK

Collection of oil/water samples

Aerial Survey or/and
second observation of the oil slick
by satellite (CleanSeaNet or Optical images)

DRIFTERS RECOVERY

CTD data

OCEANOGRAPHIC EULERIAN MODELS
(Currents, Sea Surface Temperature)

Waves

ATMOSPHERIC EULERIAN MODELS
(Winds)

RELOCATABLE MODEL

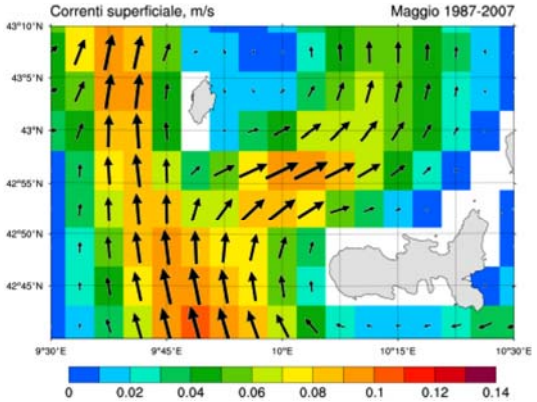
Relocatable wave model

MEDSLIK-II

Oil slick position from satellite (CSN/COSMOSKYMED or optical images)

Forecast of oil spill position

SEARCHING OF THE OIL SLICK IN THE AREA PREDICTED BY THE OIL SPILL MODEL



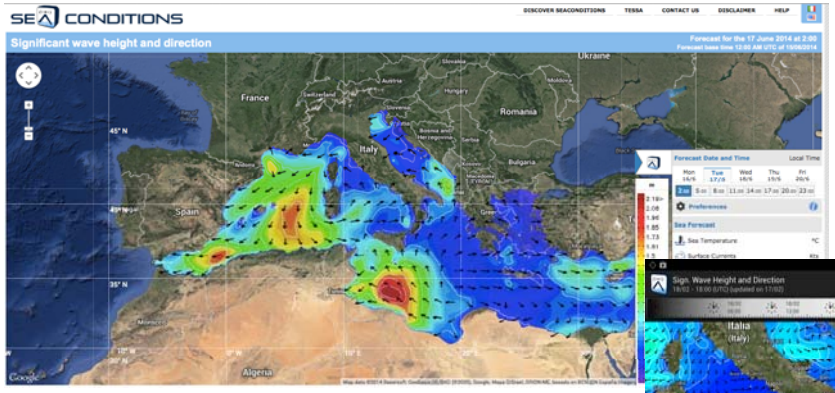
Downstream services from MyOcean: situational sea awareness services

- TESSA Project: Situational Sea Awareness technology develops multi-channel services, customized for general public and special users

myOcean

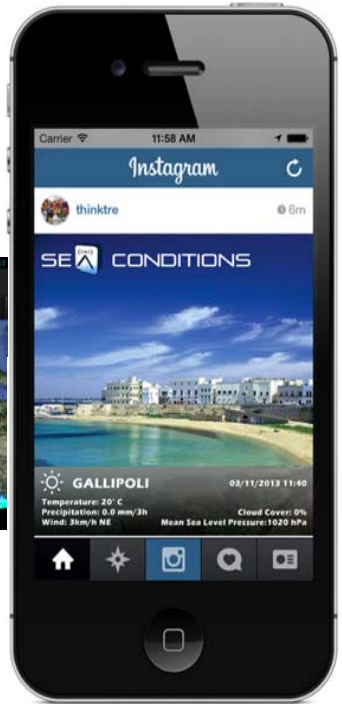
Currents, waves and winds forecasted in the area

Web Portal…



Tablet…

Smartphone…

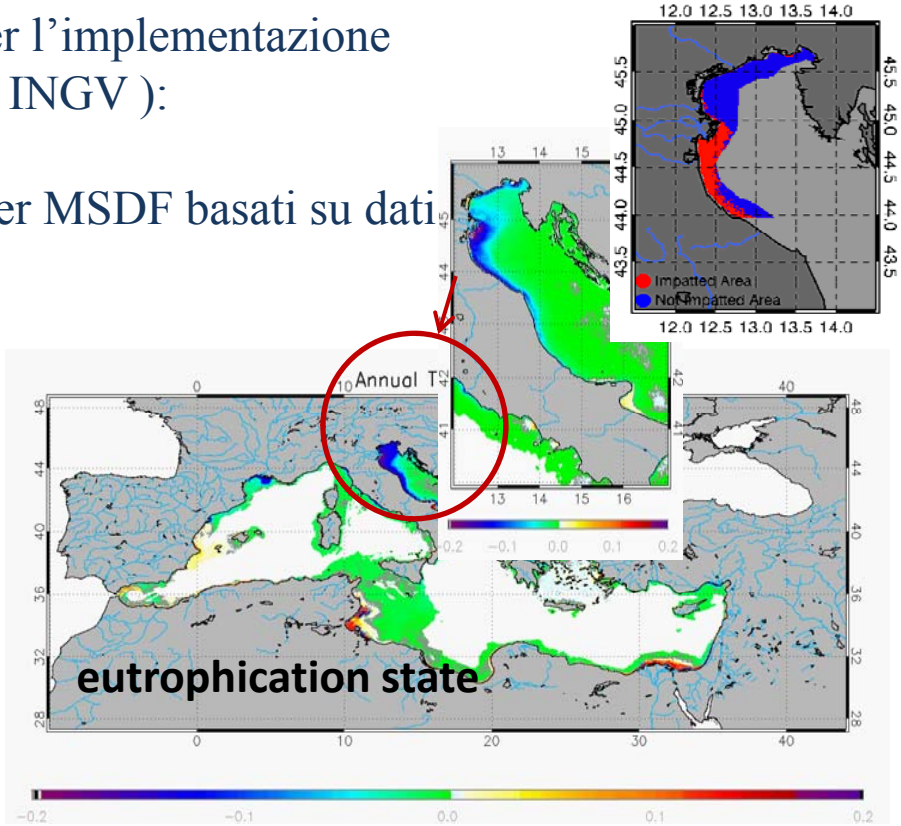


Implied blue economy sectors : IT companies, transport, tourism

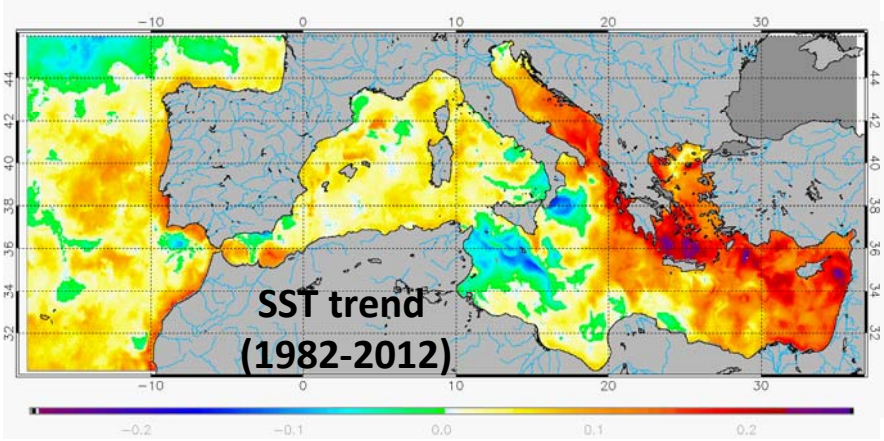
MSFD: implementazione nazionale

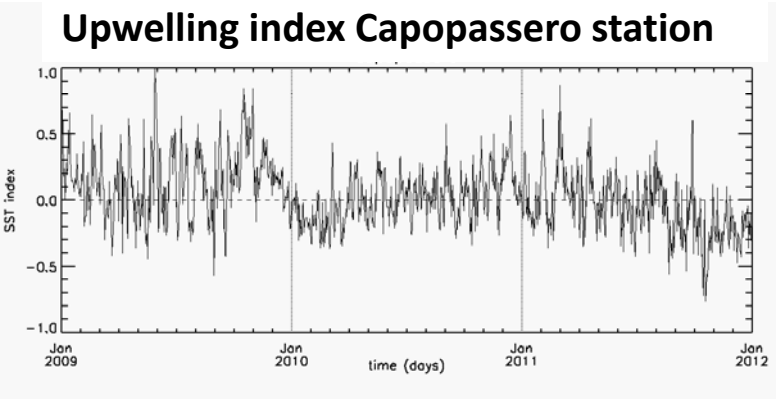
I Prodotti MyOcean sono stati usati per l'implementazione della MSFD (ISPRA & CNR-ISAC & INGV):

- Primo GES reporting Nazionale
- Sviluppo di indicatori ambientali per MSDF basati su dati da satellitari e output di Modelli



- *Upwelling index*
- *Chlorophyll trend*
- *Water Trasparency trend*
- *SST Trend*
- *satellite basedclimatologies*
- *Chl P90*
- *Eutrphication impacted areas*

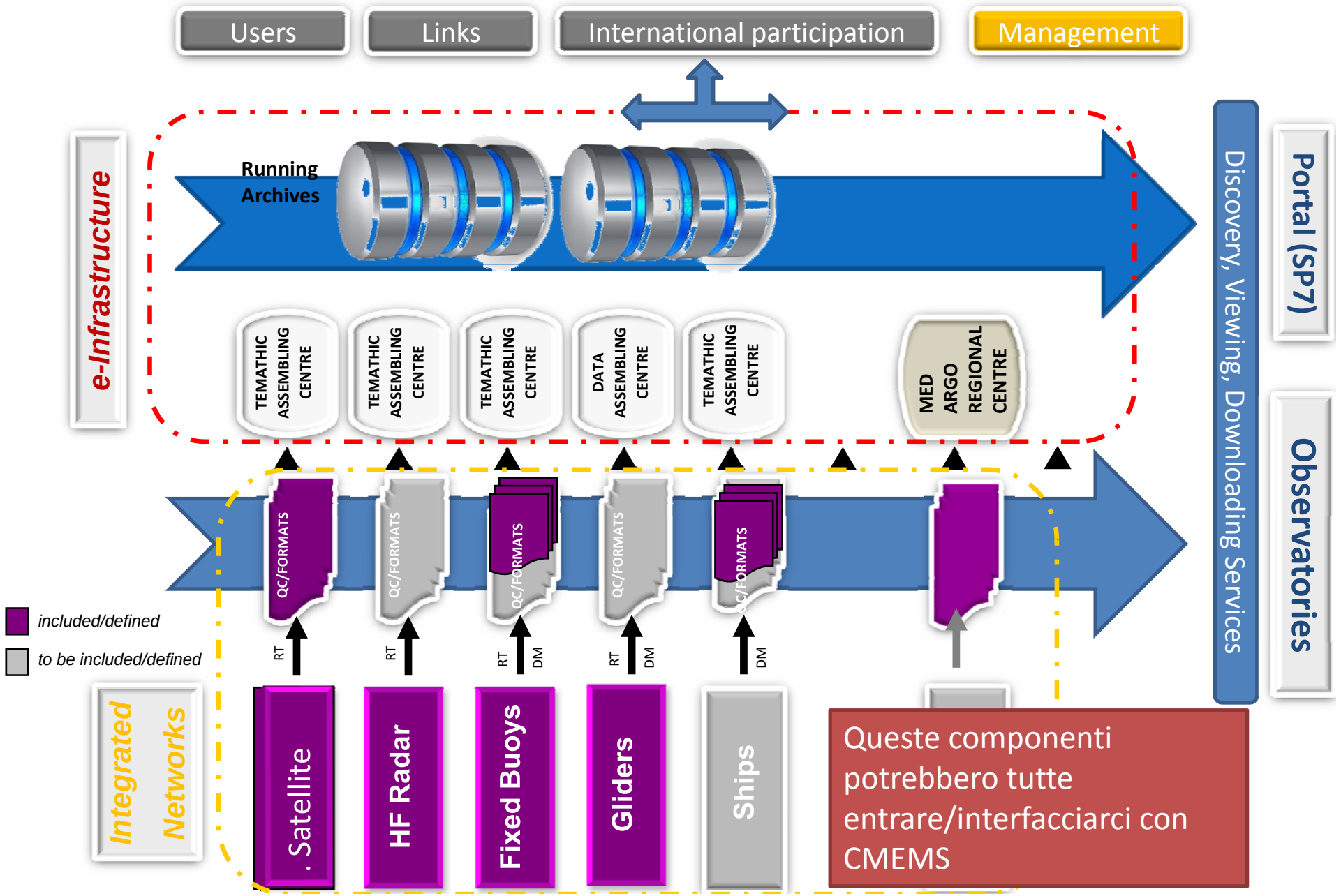




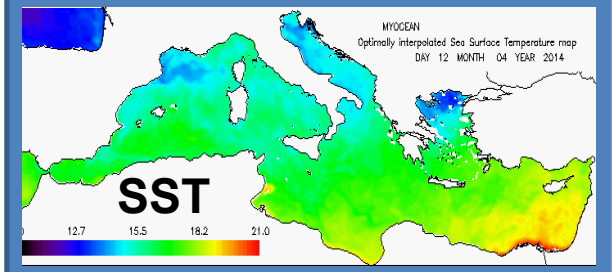
ISPRA
Istituto Superiore per la Protezione e la Ricerca Ambientale

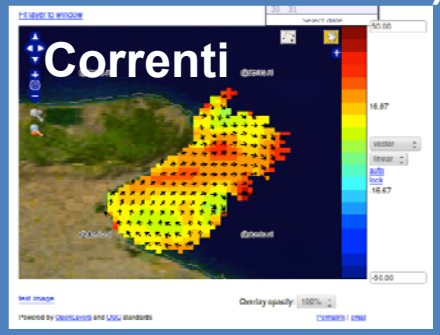
ISAC
National Research Council of Italy

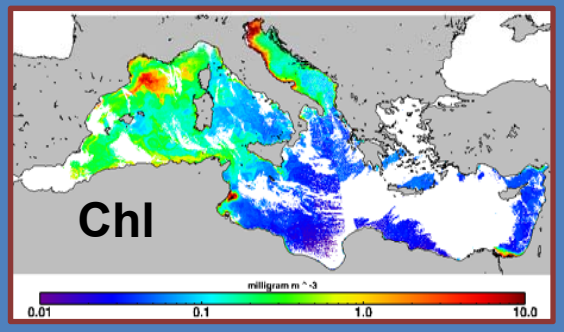
Ritmare Observing System

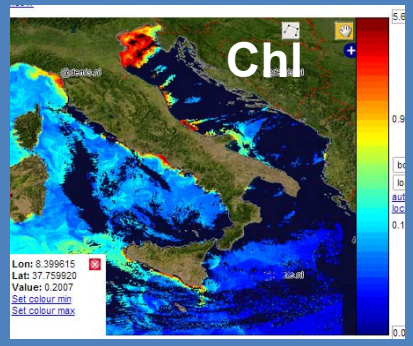


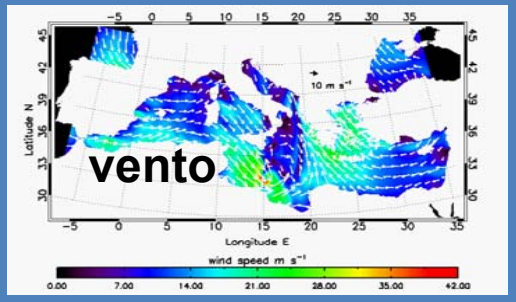
Sistema Osservativo Mediterraneo e dei Mari Italiani : prodotti operativi ad Aprile 2014 (include prodotti CMEMS e RITMARE)

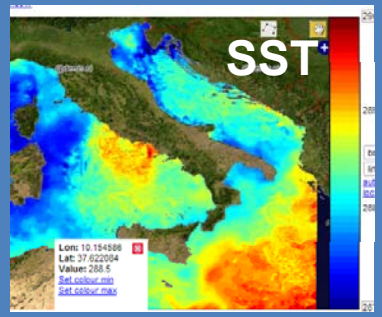






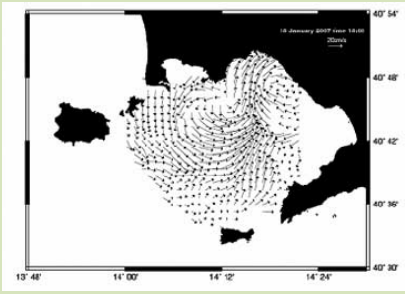




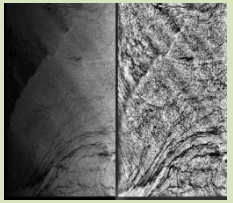


Componenti da includere per test pre-operativo RITMARE

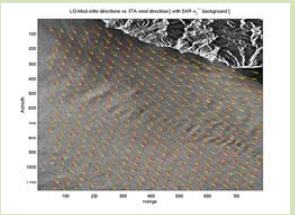
Correnti (altri siti radar)



Onde



vento



- **SST oraria**
- **Correnti da satellite**
- **Altri parametri da dati OC: Trasparenza, TSM, CDOM, PSC…**

NRT VAL e QC continuativo dei prodotti satellitari e da radar costieri

Criticità

- **Qualità dei prodotti dipende fortemente dai dati in input:**
  - Acquisizione dei dati in situ non è garantita (GMES IN SITU & RI)
  - Qualità e continuità dei dati Sentinel missions e di altre missioni satellitari
  - Le attività di continuative di CAL/VAL space component non sono previste (SPACE Component & Inf Ric)
  - CMEMS REP utilizzano in input ESA CCI products -> Copernicus Climate service
- **Il mantenimento dei prodotti allo stato dell'arte dipende dalla ricerca che non è finanziata:**
  - sinergia con programmi Horizon 2020, DG Program, programmi nazionali
  - Programmi ricerca spaziale nazionali che preparino l'exploitation di dati Sentinel e permettano di mantenere e rafforzare la leadership italiana nel settore spazio

Criticità

- **Lo sviluppo di servizi marini dipende dall'esploitation dei prodotti e dalla capacità dell'Italia di contribuire a definire il servizio marino:**
  - Sviluppo di programmi/progetti per lo sviluppo dei downstream services (blue growth)
  - Preparazione di una risposta italiana alla CMEMS call tender per user uptake
  - Incidere nella definizione dei requisiti del servizio e nelle definizione dell'effort da dedicare sua ciascuna componente del sistema
  - Collaborazione tra ricerca-agenzie-impresa
  - Miglioramento della risoluzione spazio temporale dei prodotti per rispondere ai requisiti della sorveglianza e gestione dell'ambiente costiero (es. MSFD, MSP,...) e dello sviluppo dei servizi costieri (es: pesca, turismo costiero, ect)

GRAZIE