Mercator Ocean, France

MERCATOR OCEAN INTERNATIONAL

Copernicus Marine Service

Development of information services: example from the Copernicus Marine Environment Monitoring Service (CMEMS)

P.Y. Le Traon – Mercator Ocean
with Mercator Ocean and CMEMS teams

Outline

Drivers and vision

Products, services, users/applications

Service evolution activities

From phase 1 (2015-2018) to phase 2 (2018-2021)

Conclusions

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The European Copernicus Programme

Copernicus
Europe's eyes on Earth

SATELLITES

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

IN SITU

SERVICES

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

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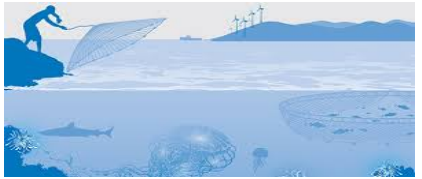
Copernicus Marine Service Drivers & Vision

Our Drivers: Ocean Observing/Forecasting – an imperative

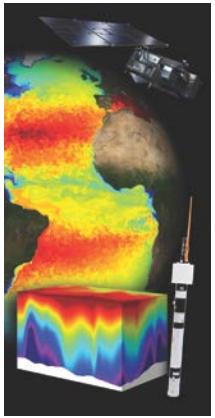
- ❑ Societal challenges (climate, ocean health)
- ❑ Sustainable management of the ocean and its resources
- ❑ Blue Growth and blue economy



SUSTAINABLE DEVELOPMENT GOALS

Our Vision: a world-leading marine environment monitoring service supporting blue growth and the blue economy for:

- ❑ Maritime safety,
- ❑ Effective use of marine resources,
- ❑ Healthy waters,
- ❑ Informing coastal and marine hazard services,
- ❑ Supporting climate services.



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Operational Oceanography integrated (observations satellite, in-situ, models) and science based approach

Copernicus Marine Service (CMEMS) : organisation

ESA - Eumetsat

EuroGOOS and EEA

Other Copernicus Services (ECWMF, EEA, EMSA, etc)

Marine Environment Monitoring

Entrusted entity: MERCATOR OCEAN INTERNATIONAL

Scientific and Technical Advisory Committee

CROSS-CUTTING COORDINATION

System | Service | Outreach | Science

CMEMS OPERATIONS PRODUCTION AND SERVICE

Service desk and service operations
Central Information System

Monitoring and Forecasting Centres (Models)

ARC	BAL	BLACK	IBI	MED	NWS	GLO

Thematic Assembly Centres (Obs)

SEA LEVEL	IN SITU	OCEAN COLOR	SST	SEA ICE	WIND	Multi OBS	WAVE

CMEMS EVOLUTIONS AND USER UPTAKE

Innovation : products & services and user uptake

Service Evolution

User Uptake

The Copernicus Marine Service

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

MULTI-YEAR
10 to 45 years

REAL-TIME
Daily, hourly

FORECAST
2 to 10 days

ESSENTIAL MARINE VARIABLES

- Physics
- Sea-ice
- Waves
- Biogeochemistry

OBSERVATIONS
In-situ & Satellites
Thematic Assembly Centers (TACs)

MODELS AND DATA ASSIMILATION
Monitoring and Forecasting Centers (MFCs)

Open and Free access

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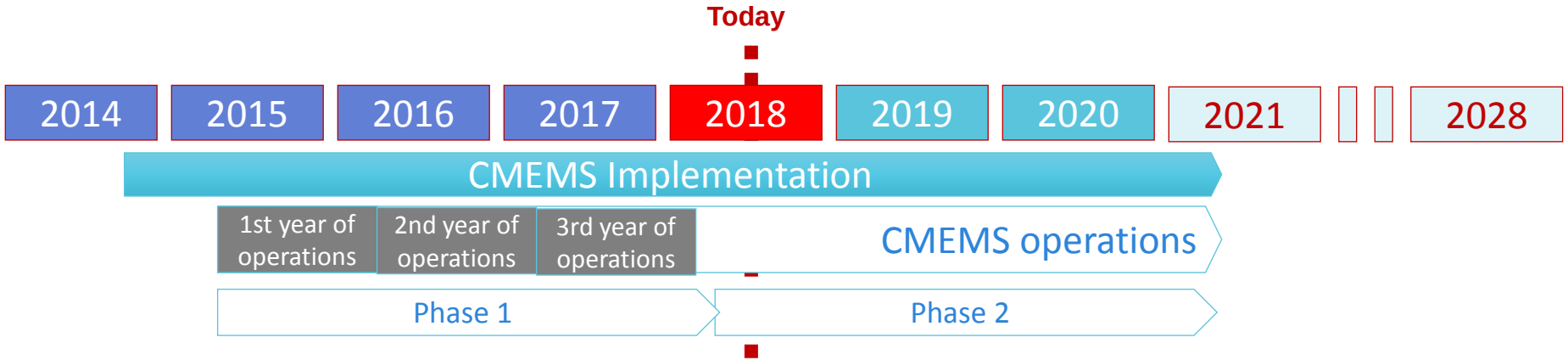
Timeline



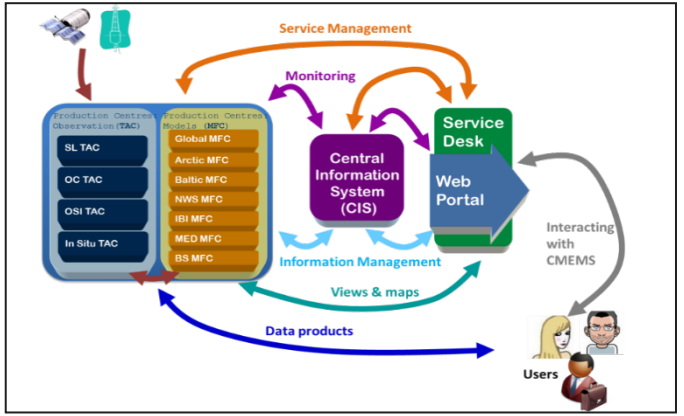
April 2018 :

- a 4th annual cycle for CMEMS implementation
- Start of the 2nd phase of the operational phase (April 2018-April 2021)

The Copernicus Marine Service - Today

A state of the art and user driven Copernicus service:

- **Operational** and **scientifically assessed**
- **Observations** (satellite, in-situ) and **models**
- **Physics** and **Biogeochemistry**
- A **network** of European producers
- A **single catalogue**: **Worldwide** and **European-wide** coverage
- A **central information system** to search, view, download products and monitor the system
- A **service desk** to support users who relies on a network of technical & marine experts
- **Generic service** to serve a **wide range of downstream applications**. **13 000 subscribers.**



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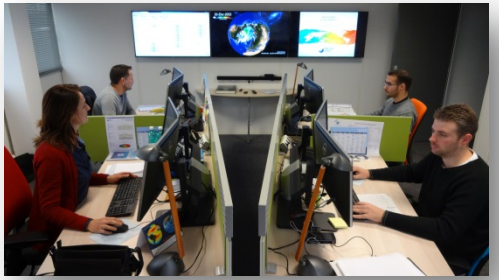
A central service desk / single interface

A Central Service Desk
(assistance, expert support, user monitoring)



marine.copernicus.eu

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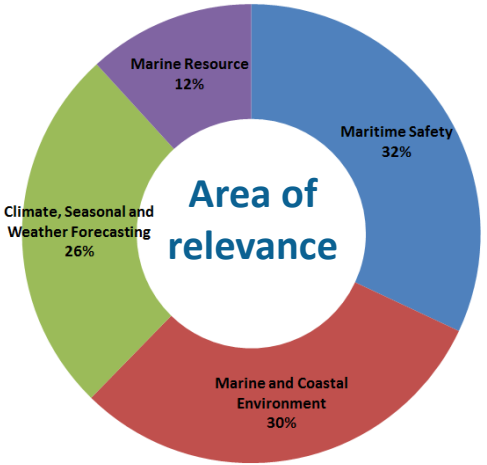
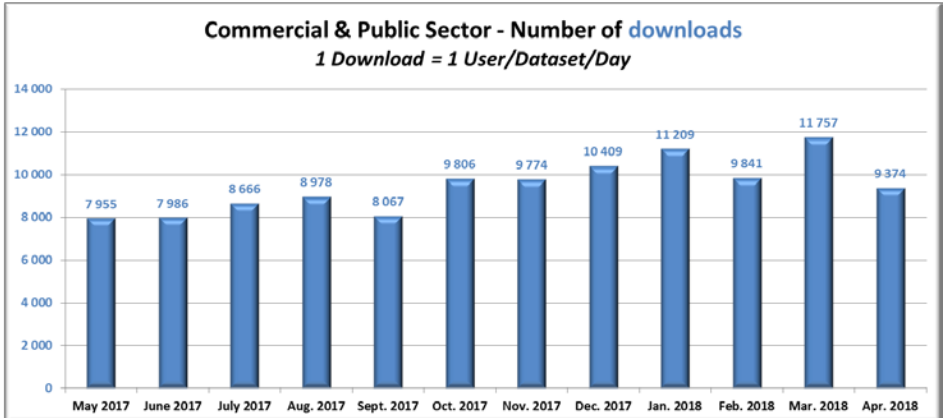
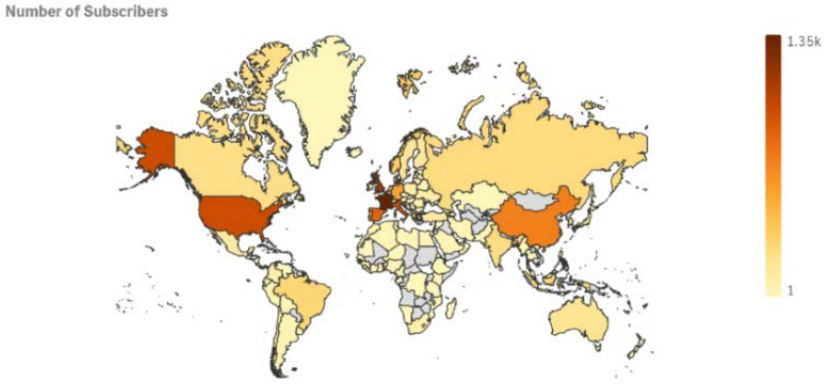
Uptake of products

- **12 900 Subscribers (intermediate users)**
- **4300 Different Entities among which 1100 Business Companies**
- **Downloads/month: 35 000**
  - *Download = Pair User/Dataset per Day*
- **Volume/month: 58 Tb**
- **98% products on time**

User satisfaction
4,7/5







Gathering user requirements

Collect of feedback, suggestions

- Sent to service desk
- Heard during workshops& EU user forum
- Picked up from projects
- Picked up from *1 annual* questionnaire
- And from face to face, *2-3 by year*, user workshops

Record and analyze

- More than 1500 users' request
- Analyzed every 12-18 months

Develop knowledge on service improvements expected today by our users (e.g. resolution, waves, tides, quality, service)

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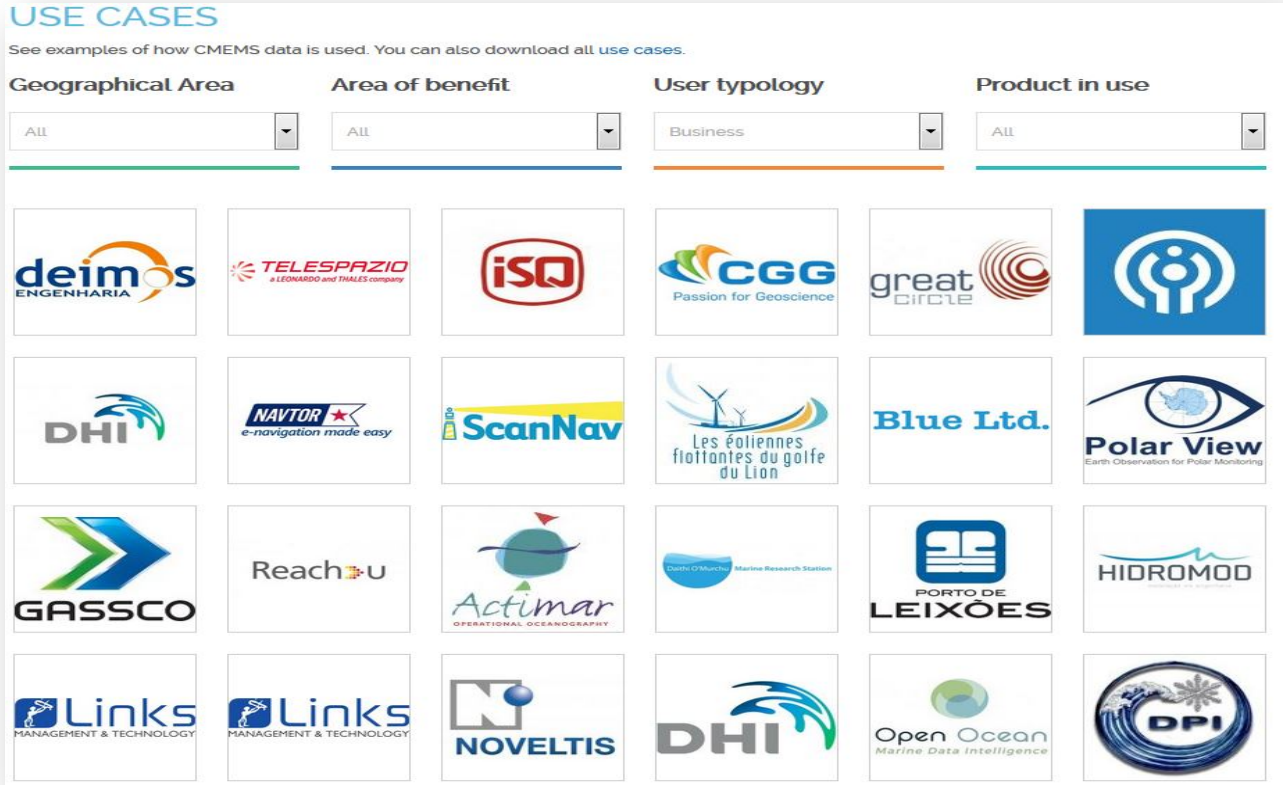
Learning from our users

More than 100 use cases available on line

See presentations on day 2 & 3



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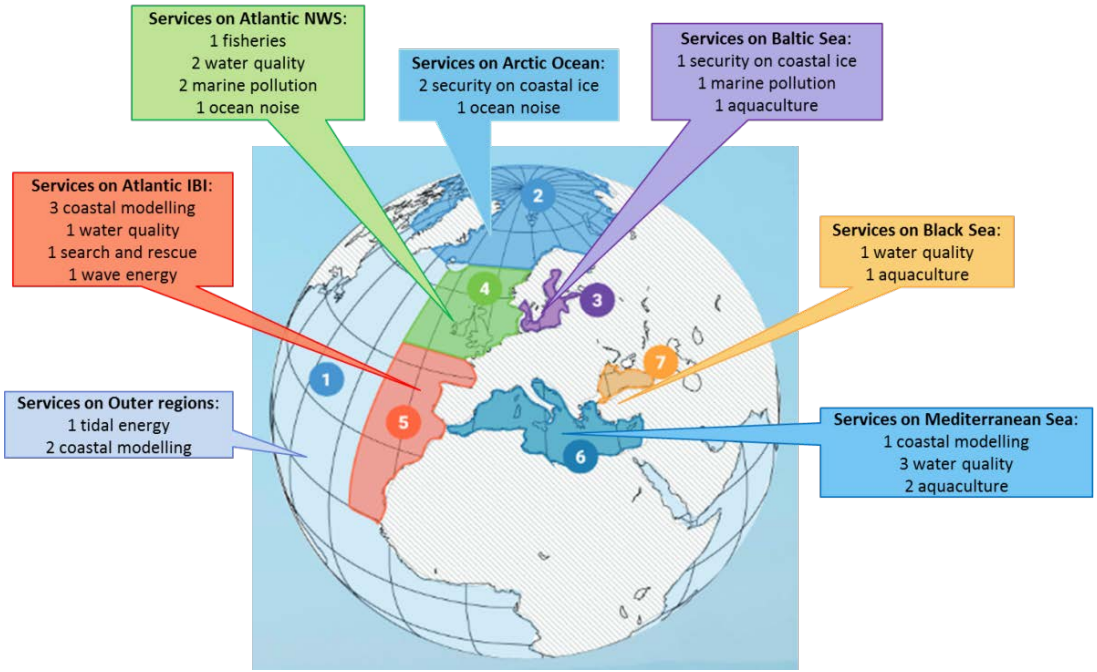
http://marine.copernicus.eu/markets/use-cases/

CMEMS user uptake activities

Overall objectives:

- To support the integration and the impact of the Copernicus Marine Service products and services for downstream applications.
- To encourage intermediate users to develop their own (private or public) downstream operational systems based on CMEMS.
- Focus on the coastal downstream sector.

D. Obaton, E. Durand

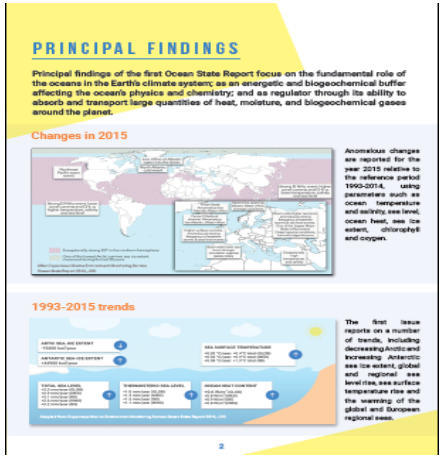


Thematical and geographical distribution of the total of 30 selected projects funded since April 2017 in the frame of the two User Uptake Component open Calls

CMEMS: Annual Ocean State Reports

State of the global ocean and the European seas, highlighting changes occurred during the previous year. Value added information based on CMEMS products (reprocessing, reanalysis) and scientific expertise. Published in a peer-reviewed journal (Journal of Operational Oceanography).

K. von Schuckmann et al.



Summary of outcomes targeted at policy makers

ISSUE #2 (in press)

ISSUE #3 (starting)

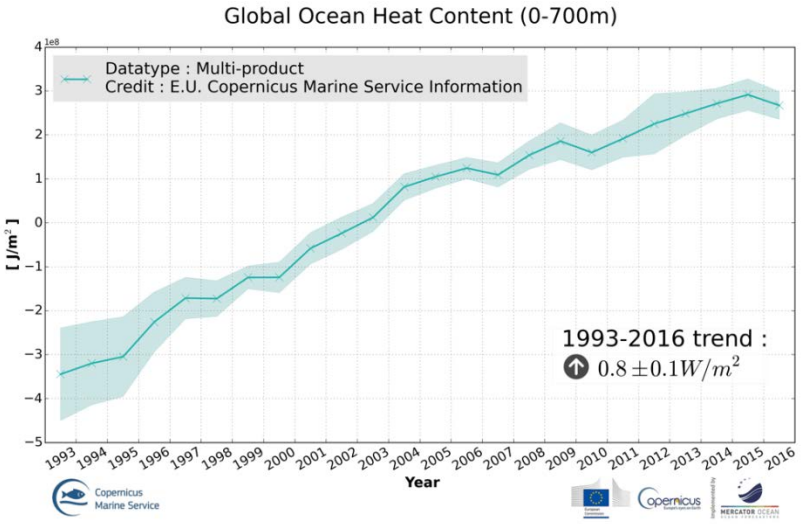
CMEMS: Ocean Monitoring Indicators

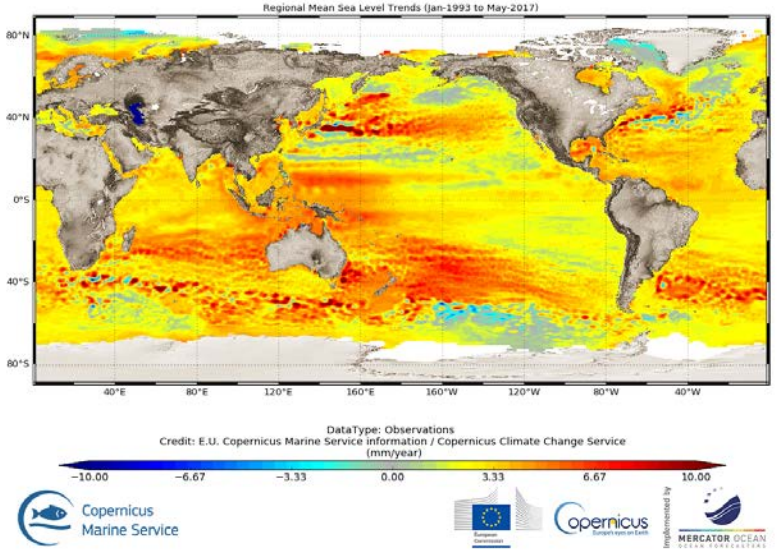
VISUALISATION

DOCUMENTATION

DATA DISTRIBUTION

From climate to ocean health assessment and applications





From observations to information and users
A complex added value chain

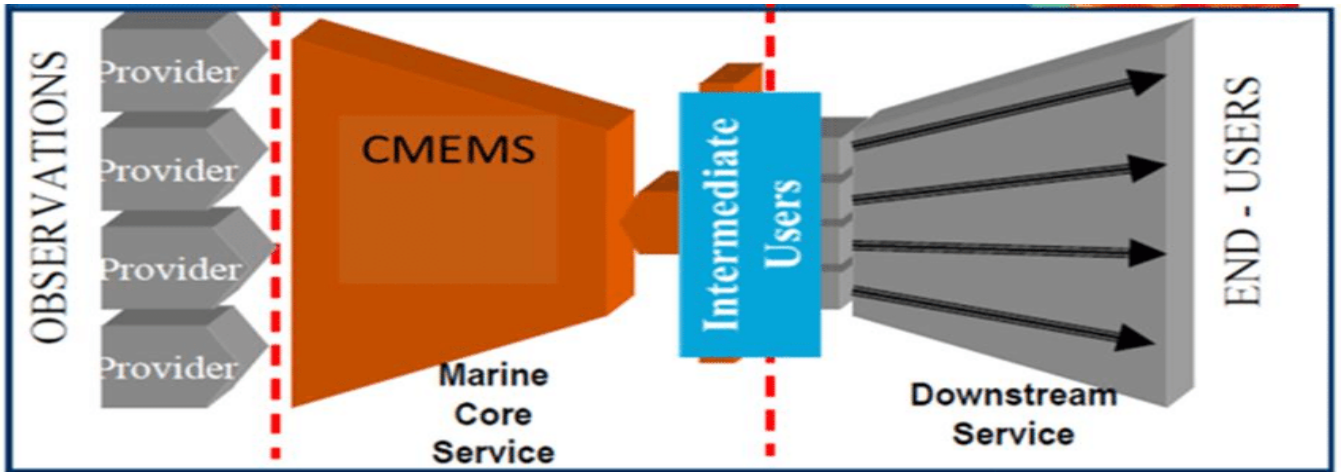
Observations (satellite, in-situ)

Modelling/data assimilation to transform observation into information (incl. ocean forecasts)

Ocean Monitoring Indicators – Ocean State Reports - Assessment

From information to user service – the service layer

Core (generic & European added value) versus Downstream services

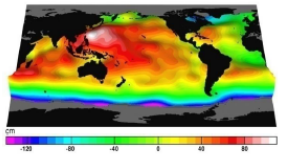


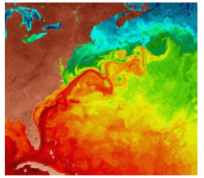
The essential role of (upstream) observations

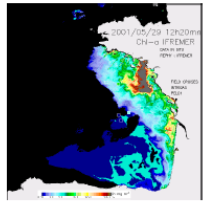
CMEMS offer is highly dependent on the satellite (e.g. Sentinels) and in-situ observing capabilities (validation, assimilation).

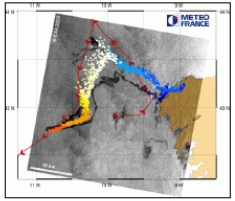
CMEMS has defined its present/future requirements both for satellite and in-situ observations.

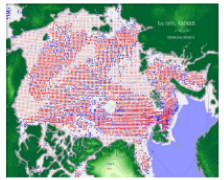
Service and Service evolution require 1/ continuity and 2/ significant improvements of ocean observing capabilities

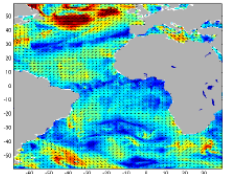

Altimetry and gravimetry
(sea level and ocean currents)

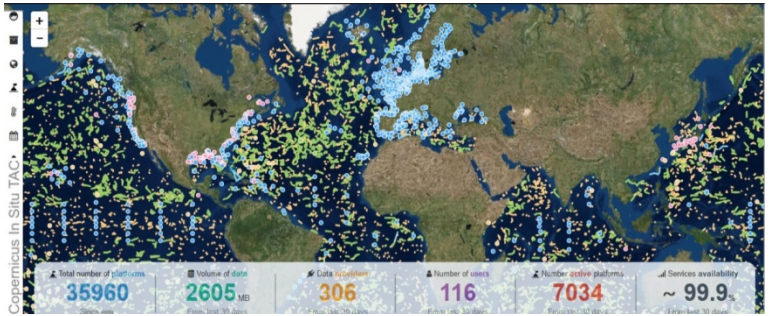

Sea Surface Temperature

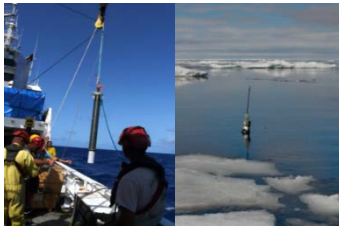

Ocean Colour
(Chl-a, SPM)


Surface roughness from SAR
(e.g. waves, winds, oil slicks)


Sea Ice (concentration, drift, thickness)


Winds
(speed and direction)

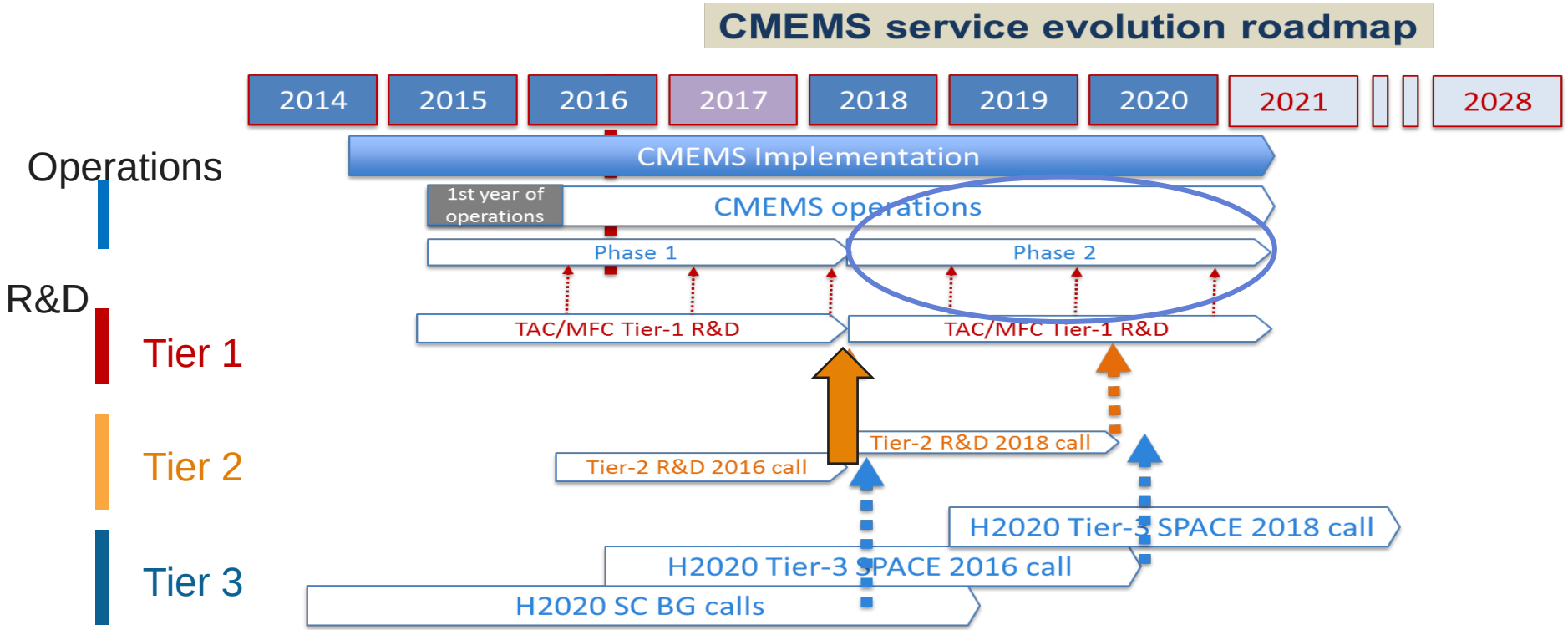




CMEMS Service Evolution – Principles

- **Users are explicitly and transparently involved:**
  - Users needs drive service evolution,
  - User feedbacks and needs are regularly monitored and collected,
  - Work to translate user requirements into achievable service evolution objectives.
- **Scientific** (satellite and in-situ observations, modelling, data assimilation) **and technological** (e.g. computing capabilities, information systems & big data) **advances** relevant for the CMEMS are to be fully taken into account.
- **Innovation capacity** required to attract new users.
- **Delineation with downstream activities**:
  - The core service focuses on activities best performed at pan-European scale.

Service Evolution: Roadmap



CMEMS Service Evolution R&D projects

Evaluation of projects by the STAC after external reviews.
1st Call (2016-2018), 2nd Call (2018-2020).

Tier-2 R&D: aiming at improving the operational service within 2 to 3 years

First call - 12 projects

A. Melet, I. Garcia Hermosa

2nd call - 18 projects

Main Topics

Ocean, Wave, Ice, Atmosphere coupling

Data assimilation (BGC)

Coastal (downscaling, river inputs, observations)

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http://marine.copernicus.eu/science-learning/service-evolution/rd-projects-funded-cmems/

Phase 1 R&D Achievements - Highlights

Important R&D advances have been achieved during CMEMS Phase 1 (April 2015 – April 2018) and significantly improved service is or will be soon proposed to the users:

- wave observations and models,
- improved resolution,
- wave/circulation coupling,
- better use of existing satellite and in-situ observations,
- uptake of Sentinel 1 data (sea ice, wave) and Sentinel 3 (altimetry, sea surface temperature, ocean colour) data,
- longer time series of reprocessed in-situ and satellite data and ocean reanalyses,
- improved and more homogenized product quality assessments,
- ocean monitoring indicators and ocean state report.

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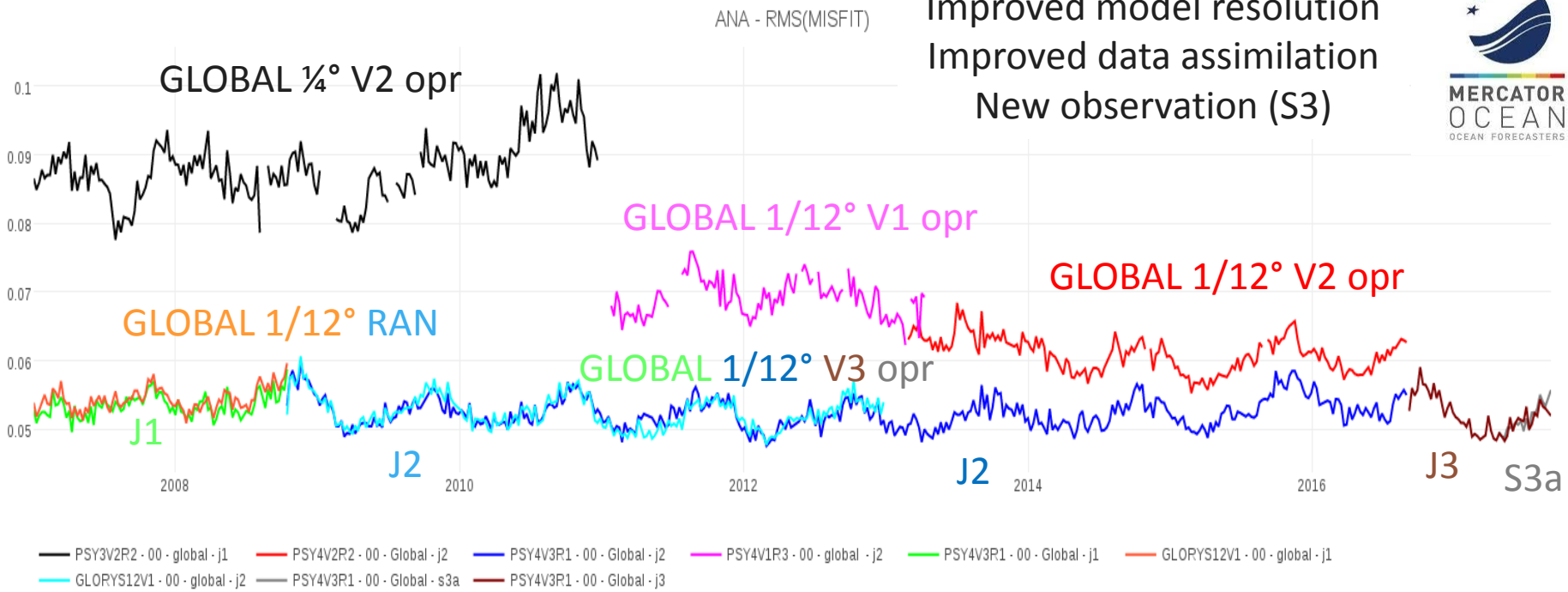
Evolution of sea level analysis errors - global system



Improved model resolution
Improved data assimilation
New observation (S3)

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OCEAN FORECASTERS

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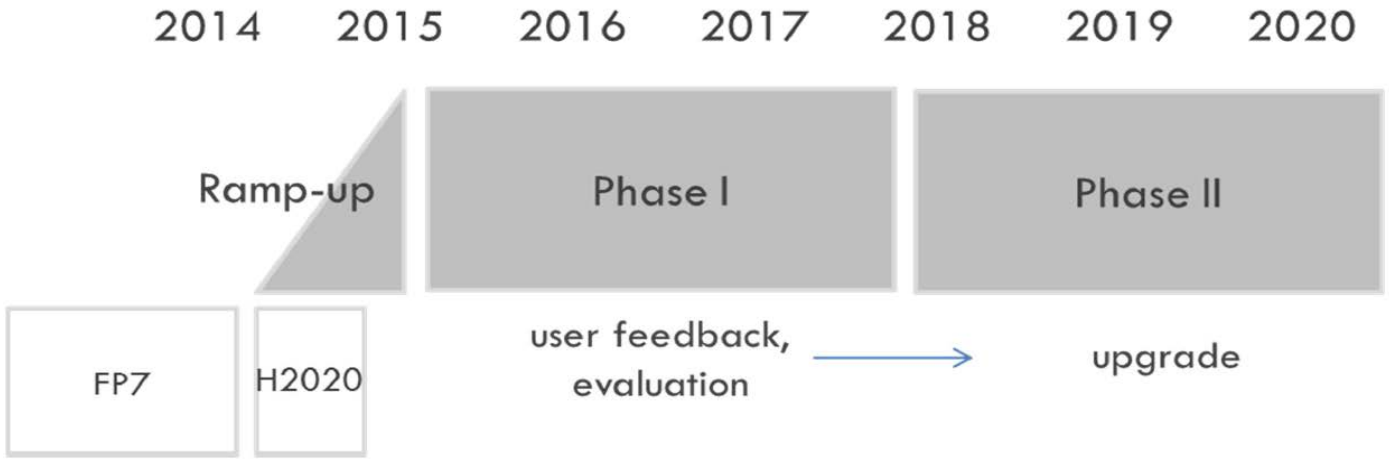
GLO MFC team

From CMEMS Phase I to CMEMS Phase II

Main objectives : ensure continuity of service, increase user uptake, continuous improvements, full uptake of Sentinel capabilities, upgrade of products and services based on phase I outcomes and user feedbacks.

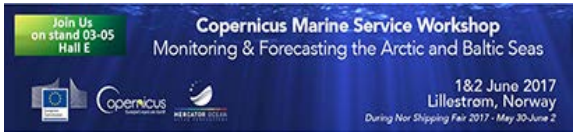


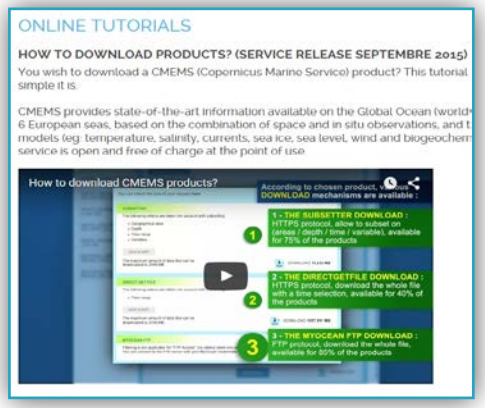
CMEMS Phase I and Phase II from Technical Annex of the EU-Mercator Ocean Delegation Agreement for the implementation of the Copernicus Marine Service (2014)

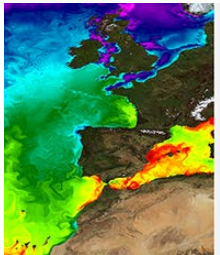
Increase user uptake, gain new users, competitiveness of the downstream sector

Strengthen our interactions with users and our training, outreach and market development activities

Workshops / Info Sessions / External Meetings / User Uptake programme







CMEMS
Regional User Training and Workshop
IBI

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CMEMS Phase II (2018 – 2021)

Main foreseen evolutions /products

Maritime transport and marine safety

- Improved models (resolution, tides), ocean/wave coupling.
- improved assimilation schemes (e.g. ensemble approaches).
- new observed surface current products.
- new ice products (thickness) and assimilation.

Biogeochemistry: ocean health monitoring and marine resource management

- Improved CMEMS biogeochemical (BGC) products (satellite, in-situ, models).
- Assimilation of ocean colour in all BGC models. Assimilation of BGC Argo.
- Carbon, CO2 fluxes and pH from in-situ observations and models.
- New micronekton products (off line).

Coastal : better meet requirements from coastal zone users

- Improving satellite products (e.g. OC), new in-situ observations (HF Radars)
- Improved models (e.g. resolution) to facilitate the coupling with downstream coastal models.
- Strengthening interfaces with downstream coastal models.

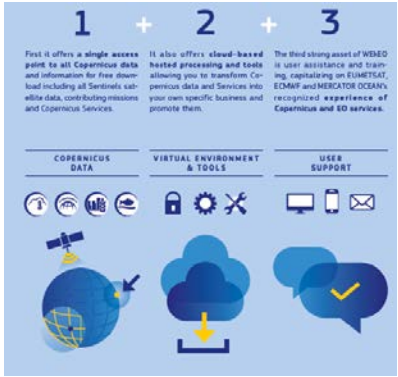
CMEMS Phase II (2018 – 2021)

Main foreseen evolutions /services

New paradigm for services and users thanks to DIAS platforms

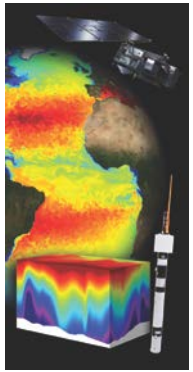
EUMETSAT/ECMWF/MERCATOR OCEAN DIAS platform : WEkEO (see wekeo.eu)

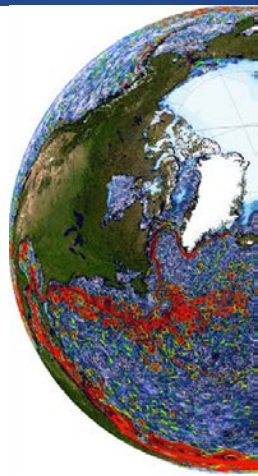
- Discover, search and access all Copernicus data and information (Sentinels, Services).
- Access cloud-based processing capabilities.
- Users can develop and execute their own applications.
- Front-offices providing value-added services.



Conclusions

- **The Copernicus Marine Service:** from observation to information and service => **an integrated and science based approach** to describe and forecast the ocean.
- **A user driven service:** user requirements collected and translated into upstream observation and service evolution requirements.
- **A successful initial phase (2015-2018):** operational, user uptake, service evolution, R&D achievements. **CMEMS Phase II (2018-2021) and beyond:** service **continuity and evolutions** based on R&D and IT advances and evolution of observing systems (Sentinels).
- **International collaboration** (sharing knowledge, best practices) essential for all components of the added value chain: observations, modelling&data assimilation, users. **Essential role of GEO Blue Planet** to strengthen the interaction with the wide range of user communities.





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