Copernicus

The Copernicus programme and its full, free and open data and information policy

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Project officer - Copernicus Unit I2
DG GROW

The Bright Side of Remote Sensing, 25/10/2016

Copernicus
Europe's eyes on Earth

Space

Copernicus EU
Copernicus EU
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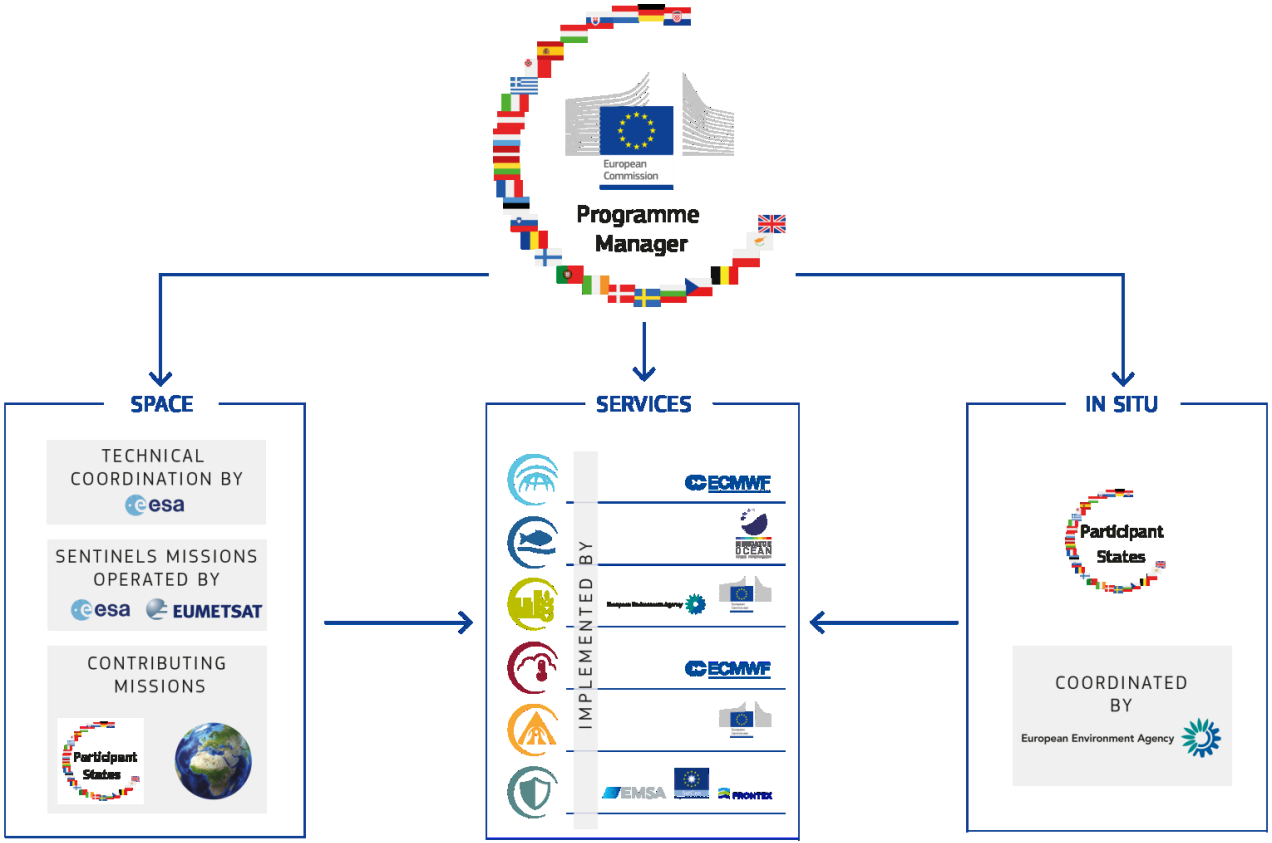
www.copernicus.eu

COPERNICUS IN BRIEF

- **The Copernicus programme** is a cornerstone of the European Union´ efforts:
  - To monitor **the Earth,** its environment and ecosystems
  - To ensure its citizens are prepared and protected for **crises, security risks** and **natural or man-made disasters**
- Places a world of insight about our planet at the disposal of citizens, public authorities and policy makers, scientists, entrepreneurs and businesses on a **full, free and open basis**
- Is a tool for **economic development** and a driver for the **digital economy**

COPERNICUS GOVERNANCE



COPERNICUS IS DRIVEN BY THE USERS

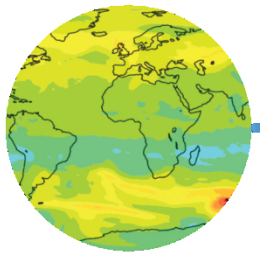
User Requirements: Strategic, Technical, Operational

Copernicus space and *in situ* data

Copernicus Services

Downstream Services "Copernicus Economy"

User Uptake



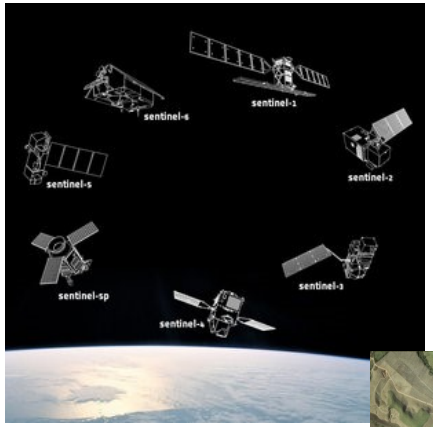
Users

Data sources

Service Information

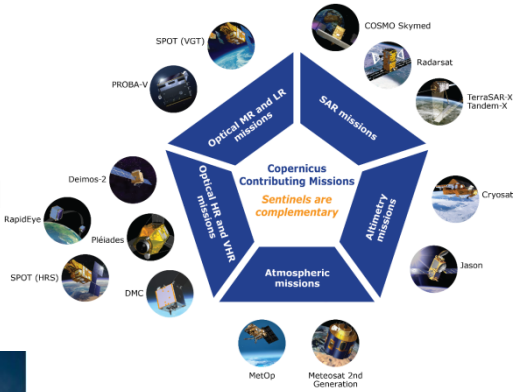
Value Added Services and Applications

COPERNICUS ARCHITECTURE

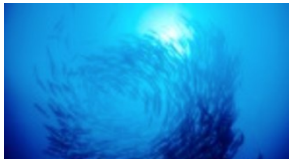


Sentinels

6 services use Earth Observation data to deliver …



Contributing missions



…added-value products

In Situ

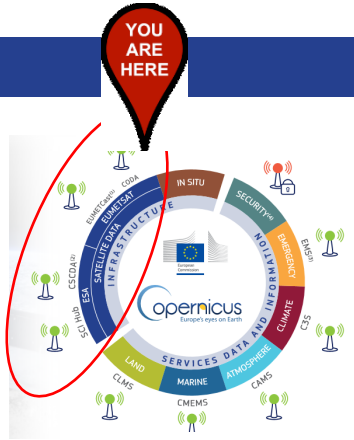
Adopted budget appropriations 2014-2020

Space component - **3.394 M€**
Service & In-situ component - **897 M€**

opernicus Data Access: Satellite Data, Services´data and information

Copernicus data and information should be discoverable, viewable and downloadable

Access to Satellite Data



- 4 data access points:

- 2 managed by ESA:
  - Scientific Data Hub (SCI Hub) : https://scihub.copernicus.eu/
  - Copernicus Space Component Data Access (CSCDA): https://spacedata.copernicus.eu/

- 2 managed by EUMETSAT:
  - EUMETCast: www.eumetcast.com
  - Copernicus Online Data Access (CODA): Soon available

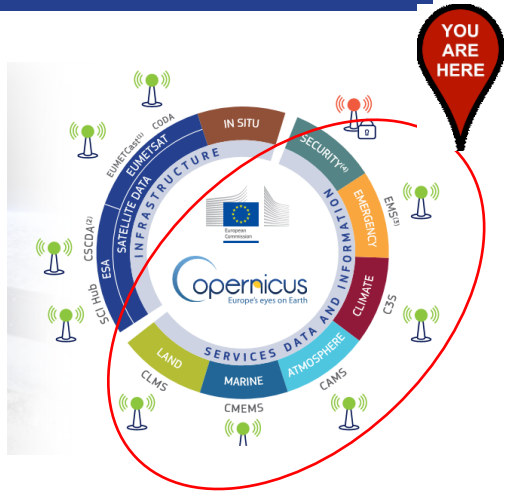
Access to Services Data and Information

- 6 Thematic Copernicus Services:

INSPIRE compliance:

- 5 are under Full, free and open access:
  - Land (CLMS)
  - Marine (CMEMS)
  - Atmosphere (CAMS)
  - Climate (C3S)
  - Emergency (EMS)

- 1 has restricted access
  - Security



COPERNICUS DATA and INFORMATION ACCESS

Data Access

Access to Satellite data: https://sentinel.esa.int/web/sentinel/sentinel-data-access

FULL, FREE AND OPEN

https://scihub.copernicus.eu/

RESTRICTED

Restricted to the Copernicus Service Projects

RESTRICTED

*Copernicus Space Component Data Access Portal**

RESTRICTED

Restricted to international partners

Access to Copernicus Services Data and Information

FULL, FREE AND OPEN

- Land-related data: http://land.copernicus.eu
- Atmosphere-related data: http://atmosphere.copernicus.eu
- Marine-related data: http://marine.copernicus.eu
- Emergency-related data: http://emergency.copernicus.eu
- Climate change-related data: http://climate.copernicus.eu (Beta version)

(*) Includes instructions on how to access Contributing Missions data

Use cases, business cases:some examples

Sentinel 2A & Sentinel 3A

Sentinel 2A

- https://sentinel.esa.int/documents/247904/2239618/Sentinel-2-Mission-Status-Report-58-Period-8-14-Oct-2016.pdf
- https://sentinel.esa.int/web/sentinel/sentinel-data-access
- Foreseen launch of S2B: Q2-2017

Sentinel 3 A

https://sentinels.copernicus.eu/documents/247904/2273285/Sentinel-3-Mission-Status-Report-28-13-20-Oct-2016

- The first Sentinel-3A OLCI Level 1 core data products have been released from the ESA and EUMETSAT data dissemination systems to the wider user community. Please see the announcements below published on the ESA webpages.
- https://sentinels.copernicus.eu/web/sentinel/news/-/article/sentinel-3-olci-level-1-products-available-in-the-data-hub
- Foreseen launch of S3B: Q4-2017

Statistics S2 & S3

Sentinel 2 – statistics

- Number of registered Belgian users (evolution on monthly basis)?
- Download statistics on a monthly basis by Belgian users of Sentinel2 data products?
- Which areas/locations do Belgian users (mostly) download?

New dashboard – Q42016

User Uptake

Use of Sentinel-2 in FP-7 SIGMA (Stimulating Innovation for Global Monitoring of Agriculture)

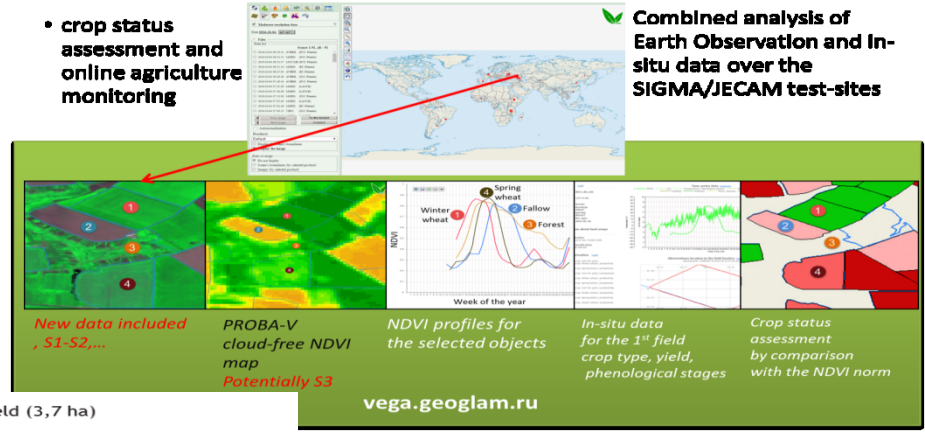
- Research collaboration with JECA
- Site Specific Analystic Tools
  - SIGMA- VEGA
- Cross site experiments
  - Sent-1-Sent-2 integration
  - Optical: sensitive to *biophysical processes*, **cloud issues**
  - SAR: sensitive to *vegetation structure*, **all-weather**

VEGA-GEOGLAM

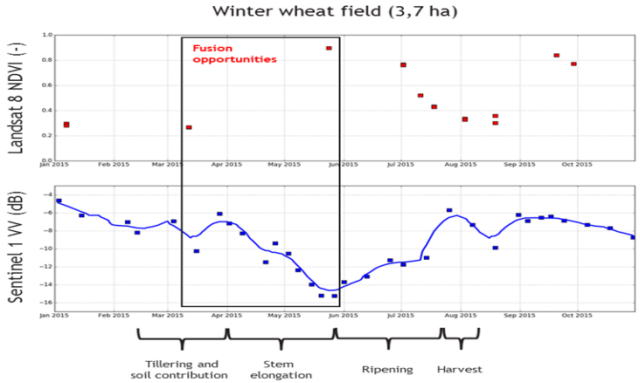
global agricultural monitoring web system

- crop status assessment and online agriculture monitoring

Combined analysis of Earth Observation and In-situ data over the SIGMA/JECAM test-sites



- **Very diverse factors influence SAR backscatter**
- **Opportunities for using machine learning to combine SAR and optical**
- **Case study of BE/FR JECAM site, based on Sentinel 2 and Sentinel 1, using**



JECAM
Joint Experiment for Crop Assessment and Monitoring

GEOGLAM
Global Agricultural Monitoring

GEO GROUP ON EARTH OBSERVATIONS

European Commission

Sentinel-2 processor for coastal waters

User Uptake

highroc.eu

FP7/HIGHROC ("HIGH spatial and temporal Resolution Ocean Colour") Project

Sentinel-2 output parameters

Parameter (units)	Symbol
Remote sensing reflectance spectrum (sr^{-1}) at water level	Rrs
Aerosol reflectance Angstrom exponent	ANG
Aerosol optical thickness	AOT
Suspended Particulate Matter (g m^{-3})	SPM
Turbidity (FNU)	TUR
Particulate backscatter at 555nm (m^{-1})	bbp555
Chlorophyll a (mg m^{-3})	CHL
Diffuse attenuation coefficient spectrum (m^{-1})	Kd
Diffuse attenuation coefficient of PAR (m^{-1})	KdPAR
Euphotic depth (m)	Ze
RGB Image (Rayleigh corrected)	RGB

Test sites for user service trials

Highroc_sites

Site

- North Sea
- French coastal Waters Gironde estuary (France)
- French coastal Waters Loire River plume and Bourgn
- French coastal Waters Rhone river plume (France)
- French coastal Waters Gironde upstream
- German coastal waters - Elbe river estuary
- German coastal waters - Northern Stockholm archipelago
- German Coastal waters - Gustav Dalen
- german Coastal Waters - Gulf of Bothnia
- German Coastal waters - Skattegat
- Norwegian waters:Bergen region
- Norwegian waters:Hvaler region
- Norwegian waters: Inner Oslofjord region
- Norwegian waters:Outer Oslofjord region
- Norwegian waters:Trondheimsfjorden region
- UK waters: north east Irish Sea including Morecamb
- UK Waters offshore windfarm sites 1
- UK Waters offshore windfarm sites 2
- UK waters: EMEC
- Southern coastline Singapore

museum Operational Directorate Natural Environment OD Nature I OD Natuur I DO Nature

UPMC SORBONNE UNIVERSITES cnrs INSU Observer & comprendre

NIVA Norwegian Institute for Water Research

Brockmann Consult

Cefas

Copernicus Europe's eyes on Earth

European Commission

Sentinel-2 processor for coastal waters

highroc.eu

Summary: Satellites for coastal water quality monitoring

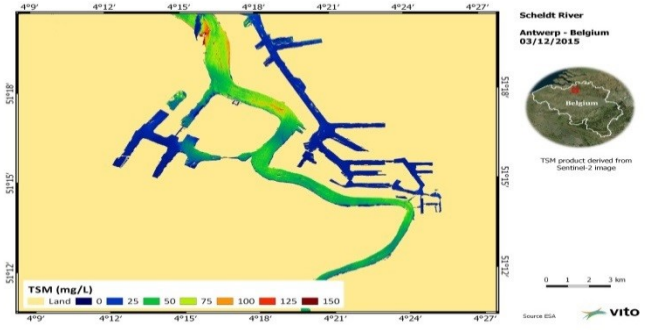
- Satellites provide much better spatial and temporal coverage than ships, e.g. 1 image/day everywhere
- Optical Satellites can only see a few parameters, e.g. chlorophyll a (algae), suspended sediments, turbidity, (and nothing when cloudy)
- Copernicus/Sentinel-3 satellites are vital to ensure continuity of data (no high quality chlorophyll data for some coastal areas since Envisat stopped in 2012)
- HIGHROC project is developing new products and services, e.g. using Sentinel-2 (high resolution!) and METEOSAT SG
- US satellites (MODIS, Landsat) also useful but not sufficient

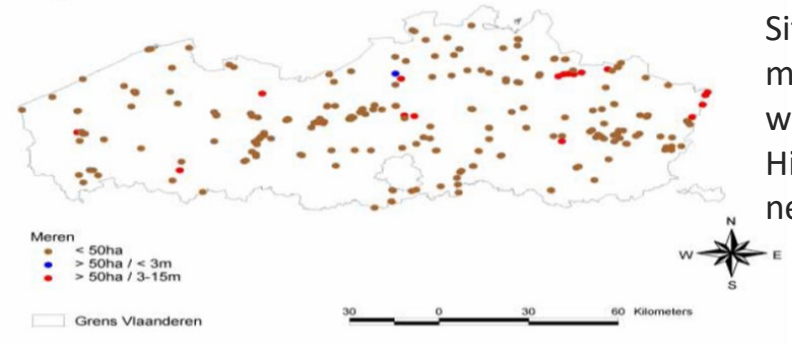
Sentinel-2 supporting the water framework directive reporting in Flanders

User Uptake

INFORM

Scheldt river

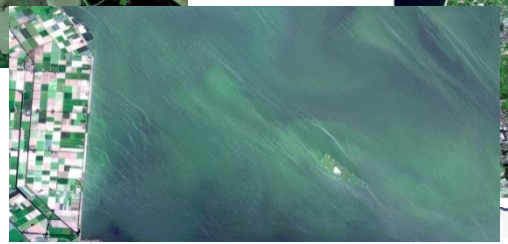




(source: http://www.ciwvlaanderen.be/)

Situation in Flanders:
many small inland waters
High spatial resolution needed

Markermeer, IJsselmeer

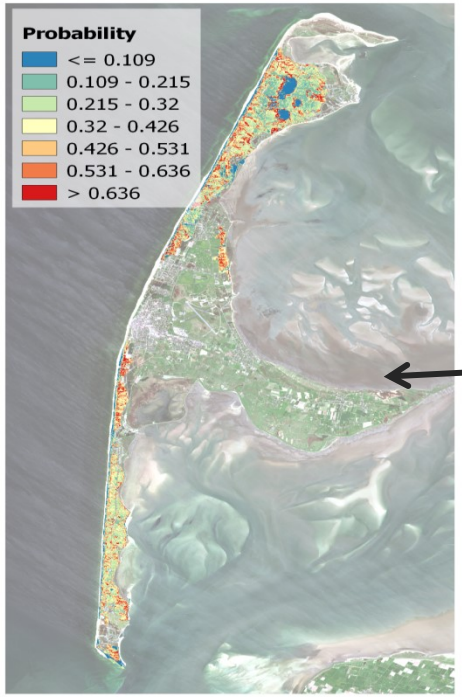


Europe's eyes on Earth

Commission

User Uptake

Sentinel-2 supporting the EU Regulation on Invasive Alien Species

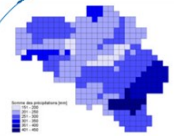


Probability of occurrence

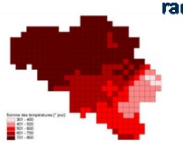
Campylopus introflexus
(Heath star moss)

User Uptake

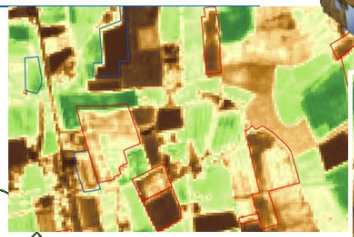
Potato monitoring with Sentinel-2

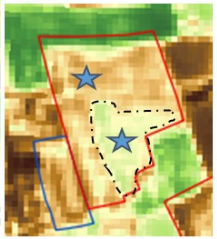


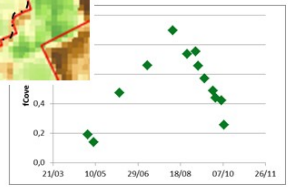
- Photosyntethic activity of the crop
- Vegetation moisture
- Soil moisture
- Temperature, rainfall, solar radiation



Risk of yield or quality losses?





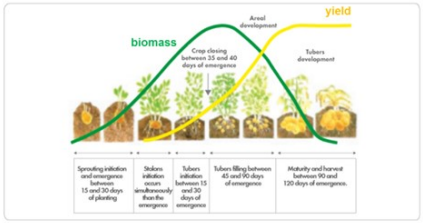


Problems? Where? Priority list for field visits?

Contract negociations! Expected yield?

- Early yield estimates

Planning! Crop development stage?



- Development stage
- Emergence: Emergence date & degree of canopy closure
- Senescence: % of non-photosynthetically active vegetation

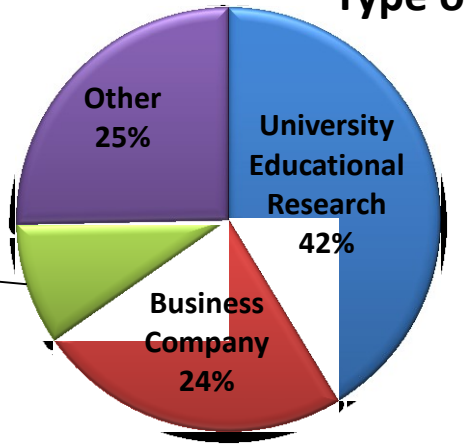
Data access via iPot web application

belspo belgapom vito vision on technology cra-w Université de Liège ernicus Europe's eyes on Earth European Commission

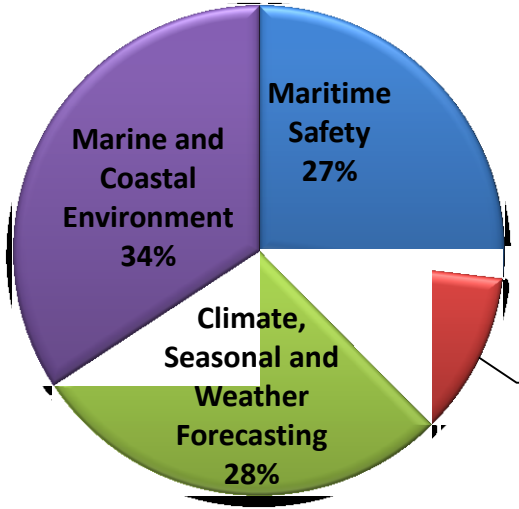
Belgian CMEMS subscribers (80)

Marine Monitoring

Belgian Subscribers – Type of Organisation



Belgian Subscribers Areas of Benefits



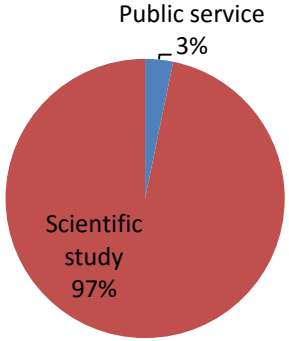
MERCATOR OCEAN

Copernicus Europe's eyes on Earth

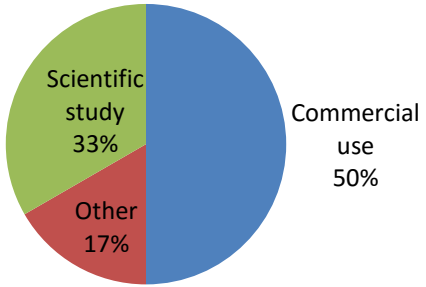
European Commission

Belgian CMEMS subscribers – use of data & info

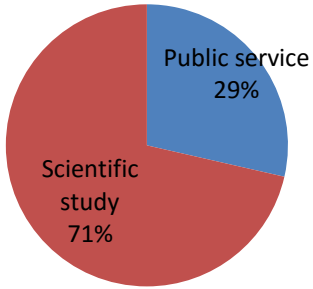
University Educational Research



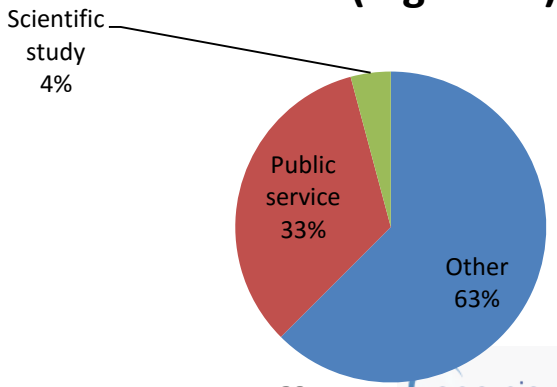
Business company



Public sector



Other (e.g. NGO)



Marine Monitoring

Belgian CMEMS subscribers

Most downloaded products within the Belgian community

1. GLOBAL_ANALYSIS_FORECAST_PHYS_001_002

Includes temperature, salinity, currents, sea level, mixed layer depth and ice parameters over global ocean (entire water column)

2. North West Shelf seas

same product on the regional area

Belgian CMEMS users: business case Great Circle-Forecast & Marine Weather

Marine Monitoring

- Great Circle (SME) offers

weather forecasting support for top ranking offshore sailing teams and racing managements;

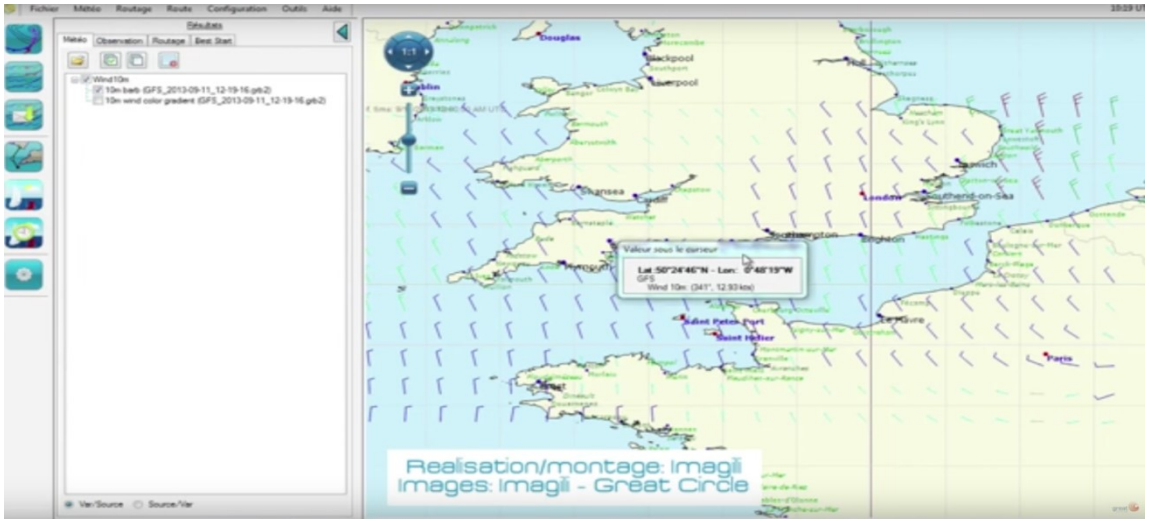
http://www.greatcircle.be/

- SQUID: Weather software for sailing boats used to download and watch weather grib files and make routing

- BEST START : decision supporting tool to help skippers to determine best weather window to attempt to break a record

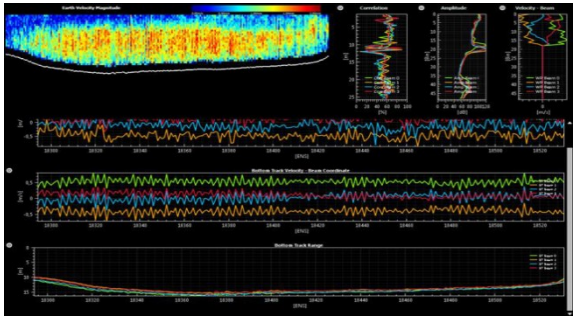
CMEMS contributes

with currents product and sea surface temperature



Belgian CMEMS users: business case

Marine Monitoring



COCHIN PORT (India): analysis of the siltation processes and feasibility study for possible solutions
The port of Cochin has the largest siltation rate among Indian ports: more than 20 million m^3 per year

The key objective: to develop trustworthy decision support tools to study hydrodynamics of all variables involved (sediments, tidal circulation, salinity etc)

Monitoring and maintenance methods are investigated as well as the implications for dredging

- CMEMS contributes with Global Ocean Wind product

COPERNICUS IN ACTION

https://www.youtube.com/watch?v=MGJss4lDaBo

Thank you!

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https://www.facebook.com/Copernicus

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