OCEAN DATA, A PUBLIC GOOD

Marine Monitoring

REANALYSES
~25 years

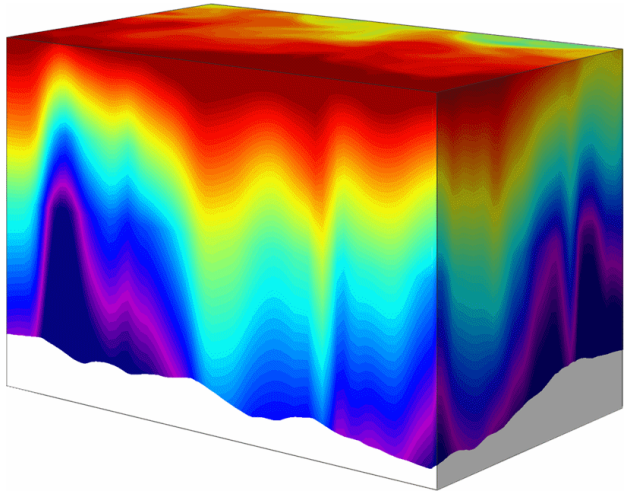
REAL-TIME
Daily, hourly

FORECAST
5 to 10 days

Ocean Energy Europe 2018, Edinburg

Marine Monitoring

PORTFOLIO GATHERS DATA FROM 3 SOURCES



SATELLITE OBSERVATION

IN SITU OBSERVATION

OCEAN MODEL COMPUTATION

Ocean Energy Europe 2018, Edinburg

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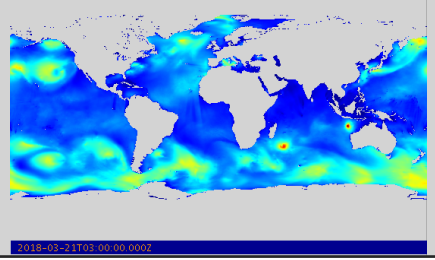
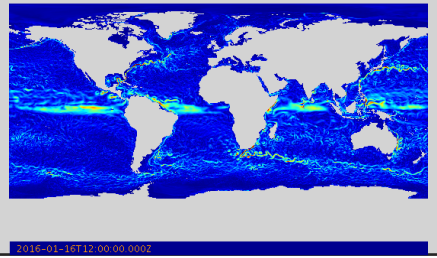
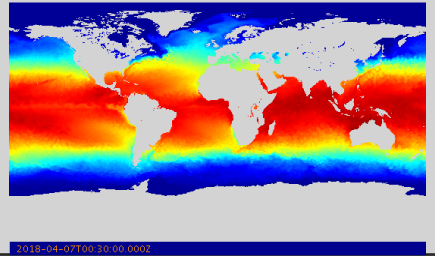
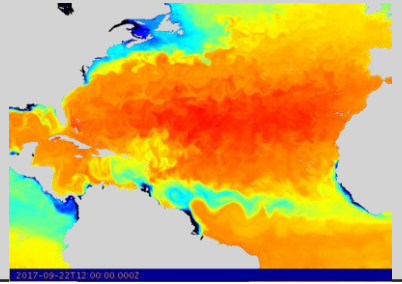
Marine Monitoring

COPERNICUS MARINE SERVICE
HIGH QUALITY OCEAN DATA

Wave height	Ocean Currents	Temperature	Salinity
			
Hourly and daily surface ocean waves GLO : 8km MED: 4km NWS: 1.5km	Hourly and daily 3D ocean currents GLO : 8km MED: 4km NWS: 1.5km	Hourly and daily 3D ocean temperature GLO : 8km MED: 4km NWS: 1.5km	Hourly and daily 3D ocean salinity GLO : 8km MED: 4km NWS: 1.5km

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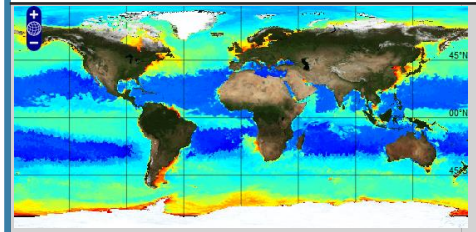
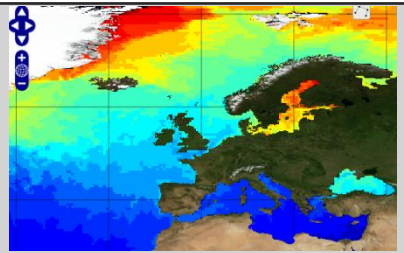
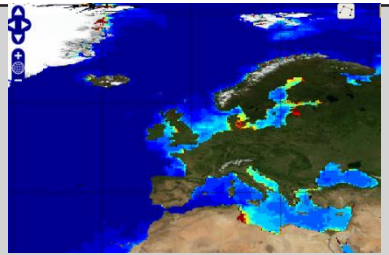
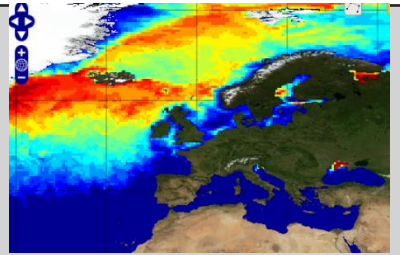
Marine Monitoring

COPERNICUS MARINE SERVICE
HIGH QUALITY OCEAN DATA

Chlorophyll-a	Dissolved oxygen	Nutrients (dissolved iron)	Nitrate
			
Weekly fields **GLO : 56km** **MED: 5km** **NWS: 7km**	**Weekly fields** **GLO : 56km** **MED: 5km** **NWS: 7km**	**Weekly fields** **GLO : 56km** **MED: 5km** **NWS: 7km**	**Weekly fields** **GLO : 56km** **MED: 5km** **NWS: 7km**

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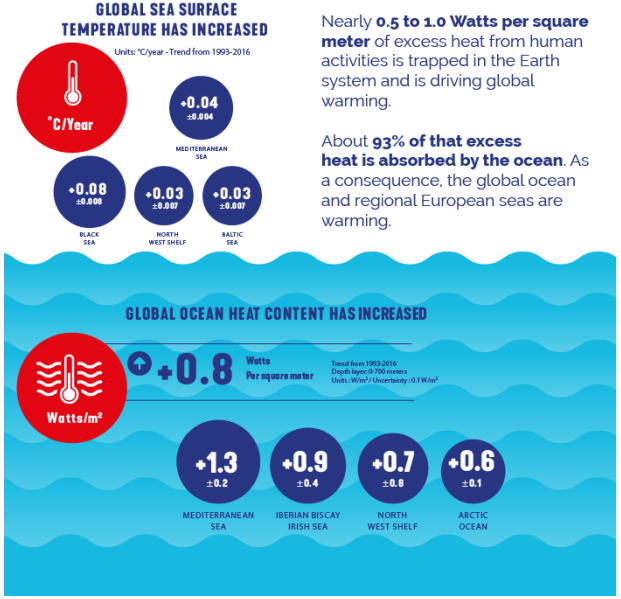
Ocean State Report 2

Marine Monitoring



Flagship publication: Ocean State Report #2

Provides a comprehensive and state-of-the art assessment of the state of the global ocean and European regional seas for the ocean scientific community as well as for policy and decision-makers.

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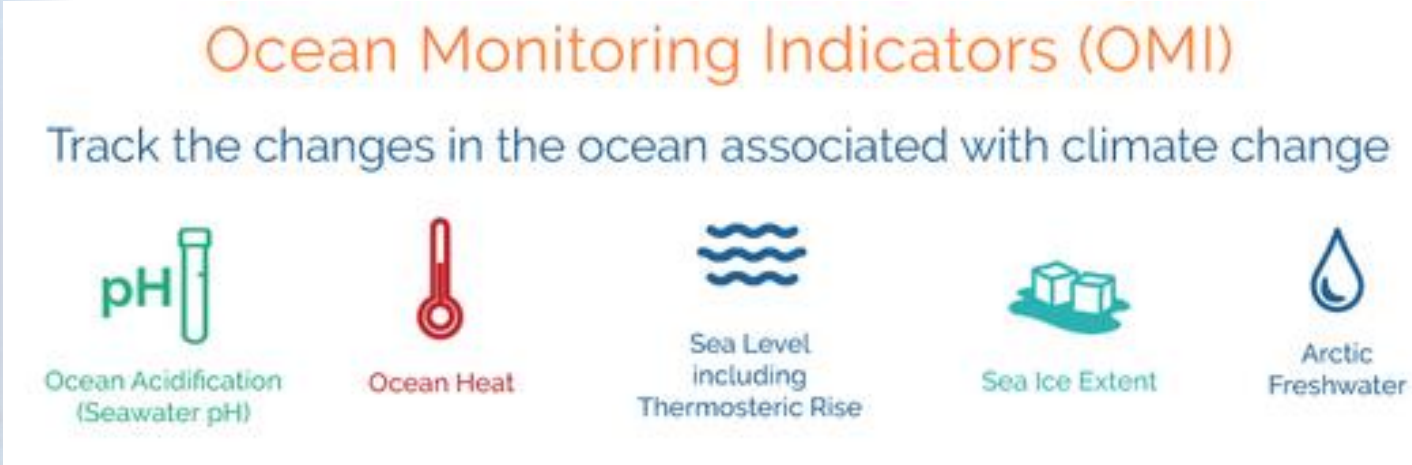
Marine Monitoring

NEW OCEAN MONITORING INDICATORS

CMEMS anchors its supports to Marine Conservations, Policies and SDGs by delivering new ocean monitoring indicators among which Ocean Acidification (e.g. used by EUROSTAT, see next slide), Sea Level including Thermosteric Rise and Arctic Freshwater.



http://marine.copernicus.eu/ocean-monitoring-indicators-acidity/
https://www.youtube.com/watch?v=0OMomKaT9fQ YouTube

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Marine Monitoring

Next portfolio release In April 16 2019

Main highligths:

- **In situ Surface currents** from High Frequency Radars in all regional basins in Near Real Time
- **Global Ocean model** surface currents now including effects from **tides and waves** (new dataset in model product 024)
- ~~7km~~ **1.5km wave forecast model** in the European North West Shelves
- **Nutrient** concentration profiles (i.e. nitrate, phosphate and silicate) (**2004 to 2018** from BGC-Argo).
- Surface ocean partial pressure of **carbon dioxide**, surface ocean downward mass flux of carbon dioxide expressed as carbon (positive for flux into the ocean) and **pH** on a regular grid (1°x1°) with a monthly resolution from 2001 to end of 2016

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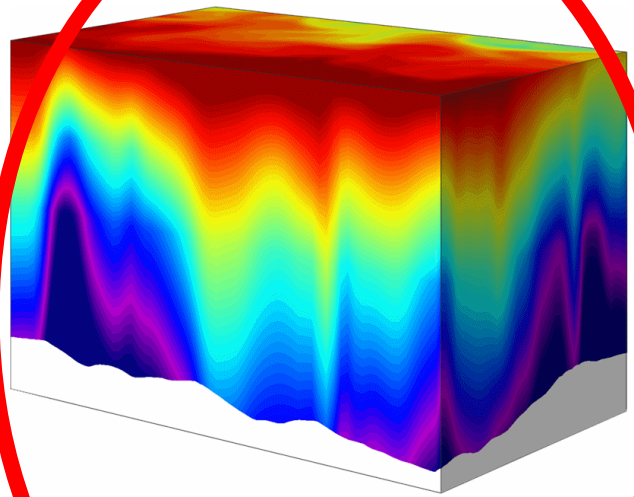
Ocean currents

Marine Monitoring

PORTFOLIO GATHERS DATA FROM 3 SOURCES

SATELLITE OBSERVATION

IN SITU OBSERVATION



OCEAN MODEL COMPUTATION

European Commission

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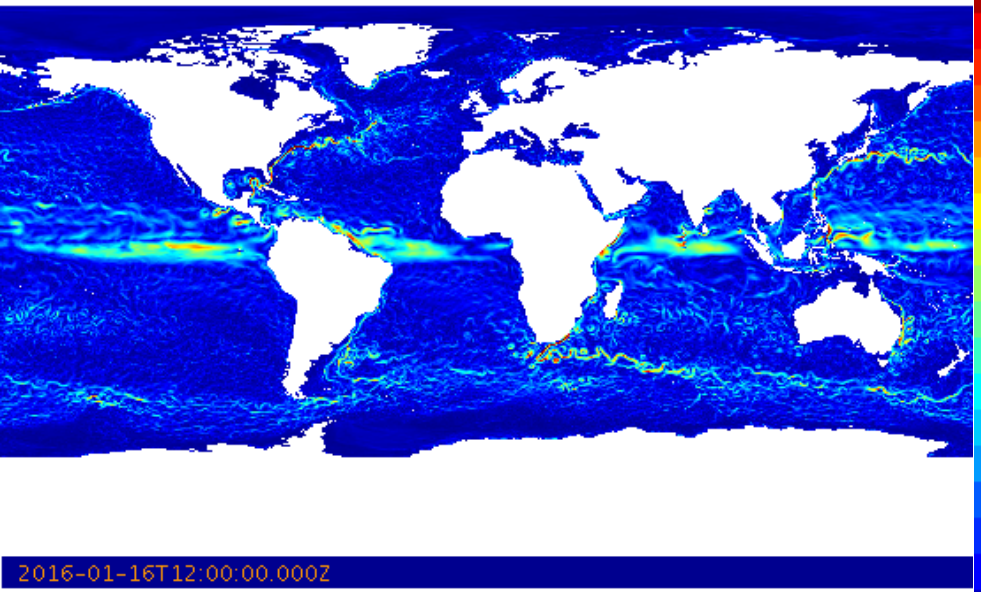
Ocean currents



1m/s

0m/s

GLOBAL CURRENT MODEL

- *Hourly and Daily files of 3D ocean currents*
- *Surface to bottom*
- *10-day forecast*
- ***Do not include wave or tidal currents***

- **9km, 2006->10-Day forecast**

GLOBAL_ANALYSIS_FORECAST_PHY_001_024

- **9km, 1993->2017**

GLOBAL_REANALYSIS_PHY_001_030

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Ocean currents

Monitoring

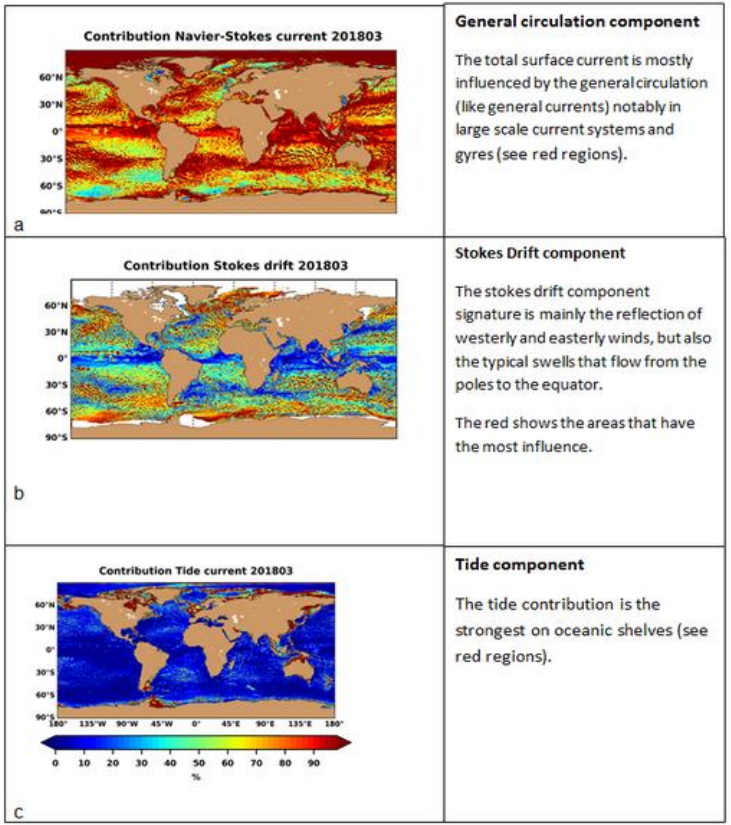
New since April 2019:

Global Ocean model

surface currents now including effects from **tides and waves** (new dataset in model product 024)

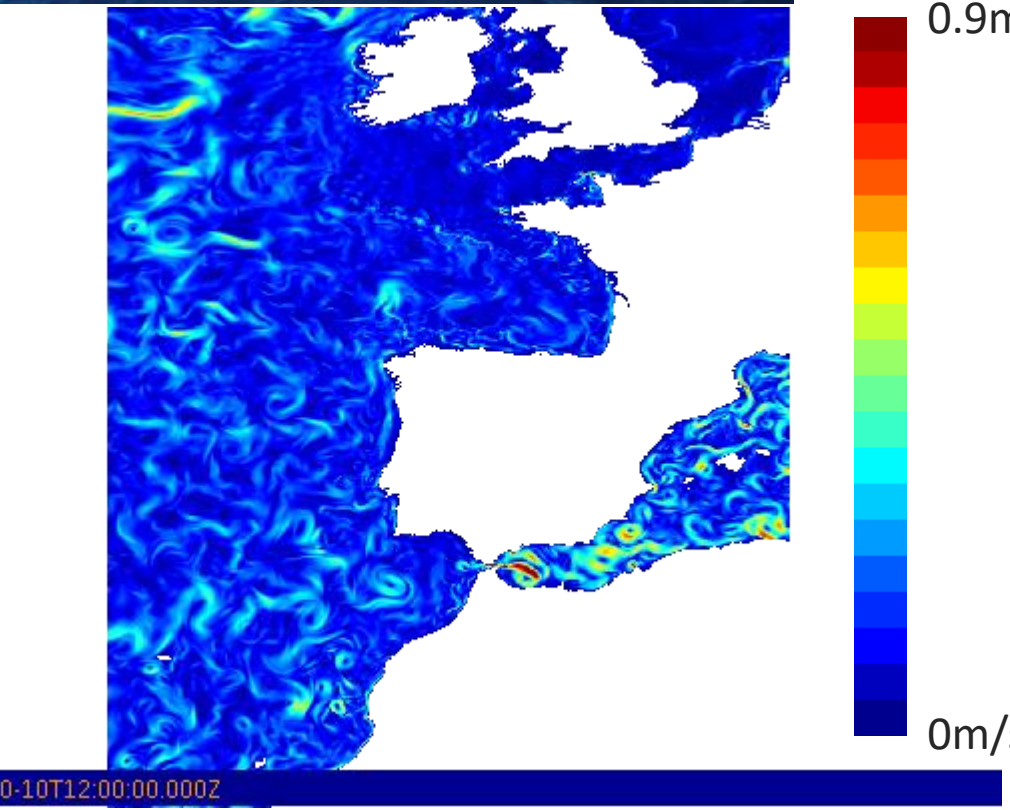
9km, 2006->10-Day forecast

GLOBAL_ANALYSIS_FORECAST_PHY_001_024



Percentage (%) of the respective contributions to the total surface current in March 2018. Credit: Copernicus Marine Service Product 001_024; S. Law Chune, Mercator Ocean

Ocean currents



EUROPEAN SOUTH WEST SHELVES CURRENT MODEL (IBI)

- *Hourly and Daily files of 3D ocean currents*
- *Surface to bottom*
- *10-day forecast*
- ***Include tidal currents***

- **3km, 2013->10-Day forecast**

IBI_ANALYSIS_FORECAST_PHYS_005_001

- **9km, 1992->2016**

IBI_REANALYSIS_PHYS_005_002

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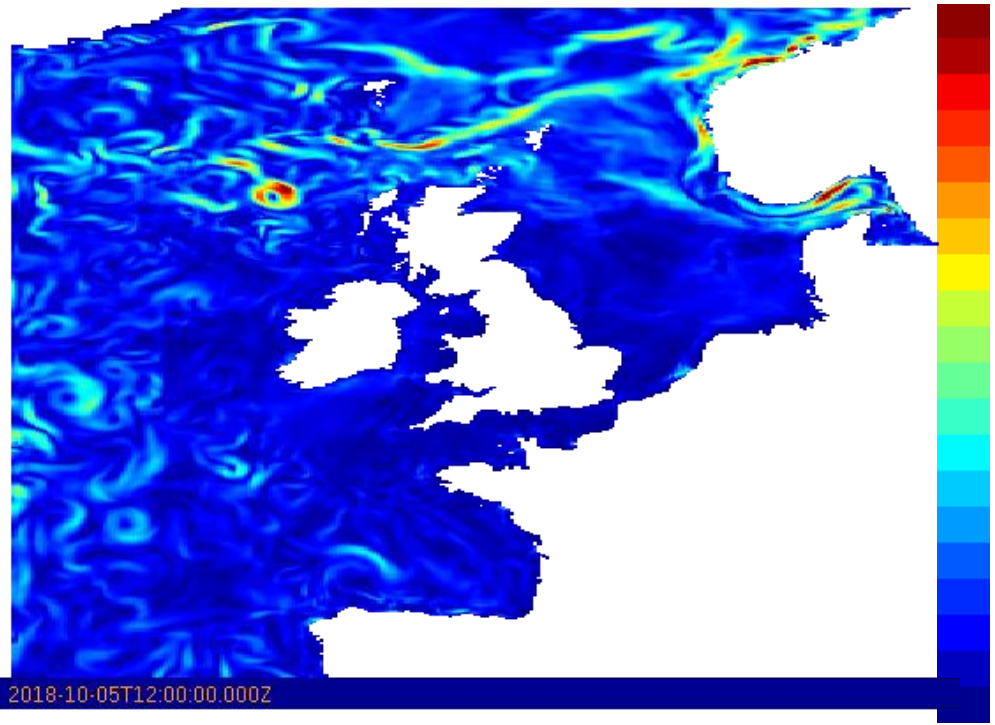
Ocean currents



EUROPEAN NORTH WEST SHELVES CURRENT MODEL (NWS)

- *Hourly and Daily files of 3D ocean currents*
- *Surface to bottom*
- *10-day forecast*
- ***Include tidal currents***

- **1.5km 2014->6-Day forecast**

NORTHWESTSHELF_ANALYSIS_FORECAST_PHYS_004_001_b

- **7km, 1985->2014**

NORTHWESTSHELF_REANALYSIS_PHYS_004_009

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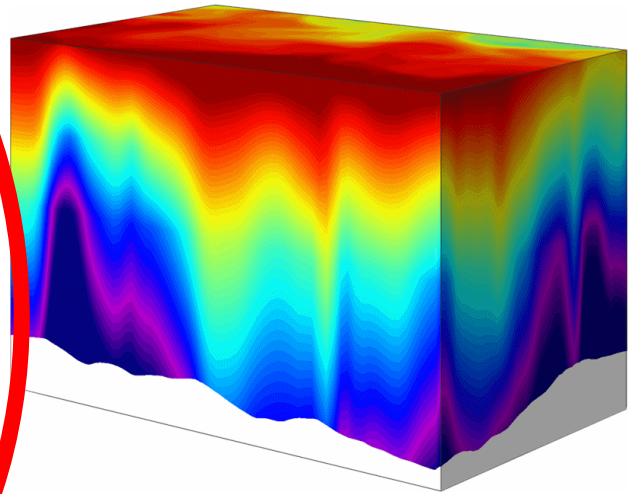
PORTFOLIO GATHERS DATA FROM 3 SOURCES

Marine Monitoring



SATELLITE OBSERVATION

IN SITU OBSERVATION

OCEAN MODEL COMPUTATION

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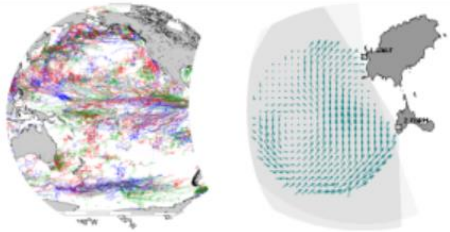
Ocean currents

Monitoring

INSITU_GLO_UV_NRT_OBSERVATIONS_013_048

GLOBAL OCEAN- IN-SITU NEAR REAL TIME OBSERVATIONS OF OCEAN SURFACE CURRENTS

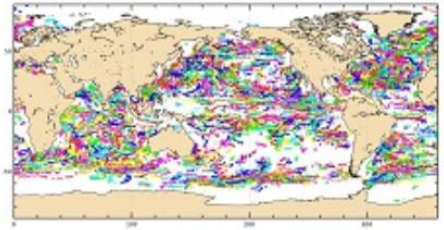
OBSERVATION	L2	GLO
undefined km x undefined km (discrete depth levels)		
From 2002-01-01 to Present		
hourly-mean		
MORE INFO ADD TO CART WMS Sub-setting		



INSITU_GLO_UV_L2_REP_OBSERVATIONS_013_044

GLOBAL OCEAN- DELAYED MODE IN-SITU OBSERVATIONS OF OCEAN SURFACE CURRENTS

OBSERVATION	L2	GLO
undefined degree x undefined degree (discrete depth levels)		
From 1990-01-01 to 2016-12-31		
instantaneous		
MORE INFO ADD TO CART WMS Sub-setting		



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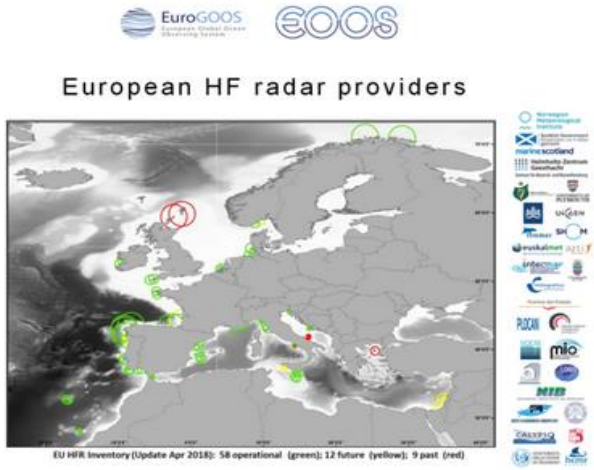
Ocean currents

- A new product (**013_048**) for the global ocean will now offer **near-real-time ocean surface currents** from in situ platforms called High Frequency (HF) Radar.
  - Such platforms are installed along coasts and scan the ocean surface currents with a nearly 6km horizontal resolution (figure f). HF radar data is now available along the European coast (see figure e) and complement the existing worldwide network (see figure g). The existing European HF Radar network has been integrated into the Copernicus Marine in situ observation network thanks to innovations through the Copernicus Marine Service Evolution programme, INCREASE, coordinated by AZTI tecnalia.
  - **This marks the first time that a Service Evolution project has led to the injection of a new product into the operational Copernicus Marine portfolio**. This will also be the case next July for a new product called Micronekton. This project looks at small living marine species in the range of one to ten centimeters.
  - Such high resolution surface current data is particularly useful for studying, for example, oil drift trajectories as in the case of the Grande America accident in the Gulf of Biscay in March, 2019.

d) Example of a High Frequency (HF) Radar platform set up along the coast



e) Location of HF Radars in Europe and their providers

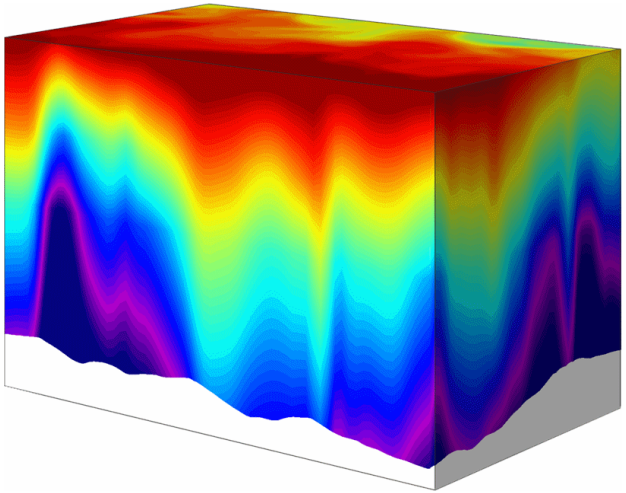
f) HR radar surface currents on April 4 2019 at 10amUTC. Credit: Emodnet

Marine Monitoring

PORTFOLIO GATHERS DATA FROM 3 SOURCES

SATELLITE OBSERVATION

IN SITU OBSERVATION



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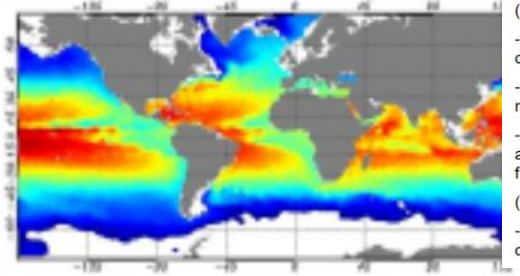
Ocean currents

MULTIOBS_GLO_PHY_NRT_015_001

GLOBAL OBSERVED OCEAN PHYSICS TEMPERATURE SALINITY HEIGHTS MLD GEOSTROPHIC CURRENTS SEA SURFACE SALINITY AND SEA SURFACE DENSITY PROCESSING

OBSERVATION	L4	GLO
T SSD S SSH 3DUV UVG MLD ⓘ		
0.25 degree x 0.25 degree (33 depth levels)		
From 2014-01-01 to Present		
weekly-mean, monthly-mean		

MORE INFO | ADD TO CART | **WMS** | **Sub-setting**



All datasets are obtained as a combination between satellite and in-situ data, processed in different steps:

(1-2)

- satellite data (SLA + SST) are projected onto the vertical via a multiple linear regression method and covariances deduced from historical observations. This step gives synthetical fields,

- combination between these synthetic fields with T/S in-situ profiles via an optimal interpolation method. This leads to combined fields.

- use of the thermal wind equation to combine absolute geostrophic current fields from satellite altimetry with the combined 3D T/S fields. This last step generates global 3D geostrophic current fields.

(3-4)

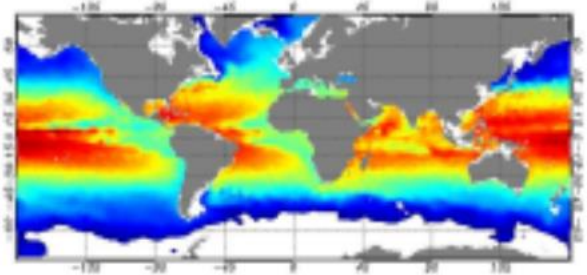
-in situ and satellite SSS are interpolated through a multivariate optimal algorithm, using SST to compute the interpolation weights.

MULTIOBS_GLO_PHY_REP_015_002

GLOBAL OBSERVED OCEAN PHYSICS TEMPERATURE SALINITY HEIGHTS MLD GEOSTROPHIC CURRENTS SEA SURFACE SALINITY AND SEA SURFACE DENSITY REPROCESSING

OBSERVATION	L4	GLO
T SSD S SSH UVG SIC ⓘ		
0.25 degree x 0.25 degree (33 depth levels)		
From 1993-01-01 to 2017-12-27		
weekly-mean, monthly-mean		

MORE INFO | ADD TO CART | **WMS** | **Sub-setting**

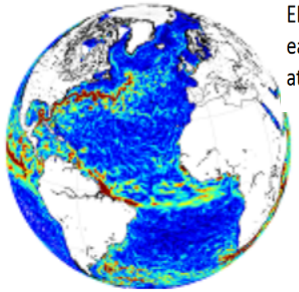


Ocean currents

MULTIOBS_GLO_PHY_NRT_015_003

GLOBAL TOTAL SURFACE AND 15M CURRENT (COPERNICUS-GLOBCURRENT) FROM ALTIMETRIC GEOSTROPHIC CURRENT AND MODELED EKMAN CURRENT PROCESSING

OBSERVATION	L4	GLO
3DUV		
0.25 degree x 0.25 degree (2 depth levels)		
From 2017-01-01 to Present		
6-hourly-instantaneous, hourly-instantaneous, daily-mean, monthly-mean		
MORE INFO ADD TO CART **WMS** **Sub-setting**		

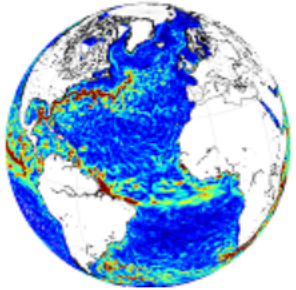


The surface and 15m ocean current velocities are obtained as the sum of the surface geostrophic current derived from altimetry and Ekman component derived applying an empirical Ekman model to ERA INTERIM wind stress . Accuracy on the total velocity field therefore depends on the accuracy of each individual component. It features an important spatial variability, with an increase of the error at the equator and in coastal area.

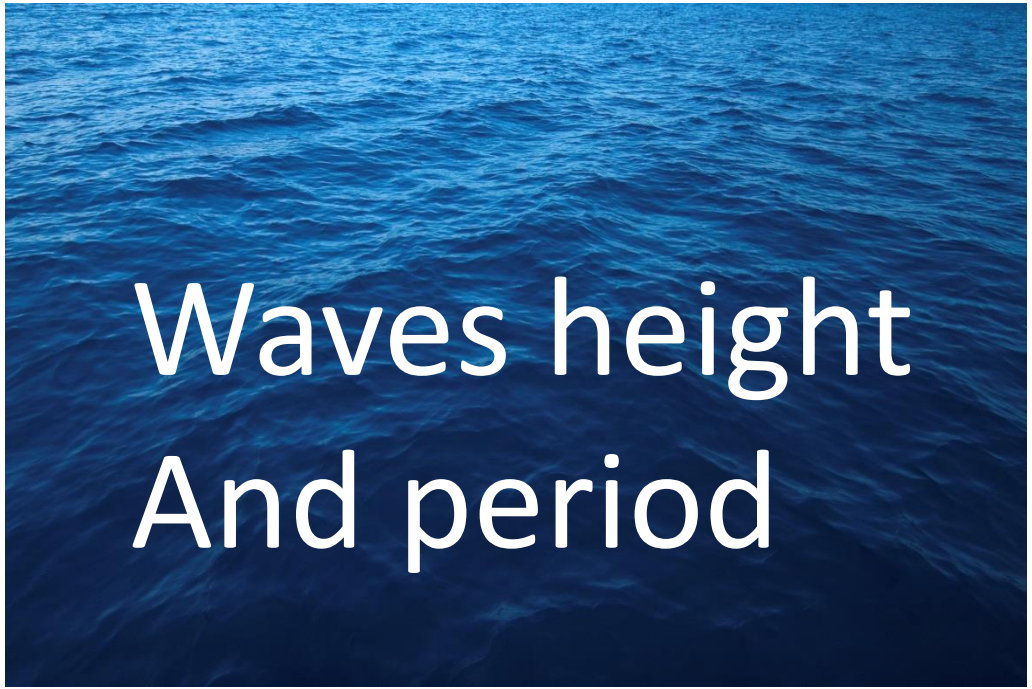
MULTIOBS_GLO_PHY_REP_015_004

GLOBAL TOTAL SURFACE AND 15M CURRENT (COPERNICUS-GLOBCURRENT) FROM ALTIMETRIC GEOSTROPHIC CURRENT AND MODELED EKMAN CURRENT REPROCESSING

OBSERVATION	L4	GLO
3DUV		
0.25 degree x 0.25 degree (2 depth levels)		
From 1993-01-01 to 2017-12-31		
6-hourly-instantaneous, hourly-instantaneous, daily-mean, monthly-mean		
MORE INFO ADD TO CART **WMS** **Sub-setting**		



Marine Monitoring



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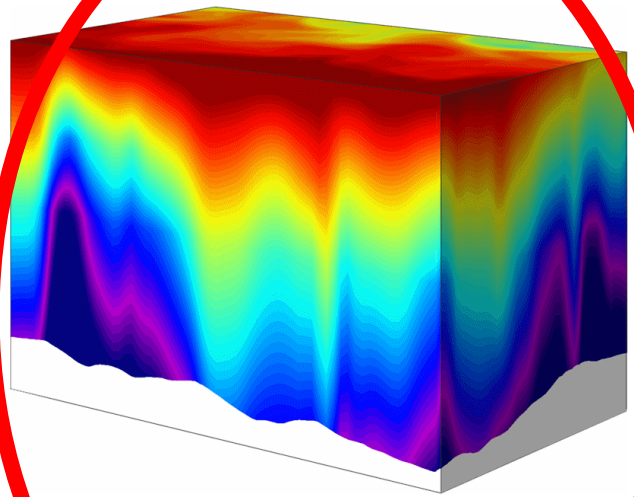
Marine Monitoring

PORTFOLIO GATHERS DATA FROM 3 SOURCES

SATELLITE OBSERVATION

IN SITU OBSERVATION



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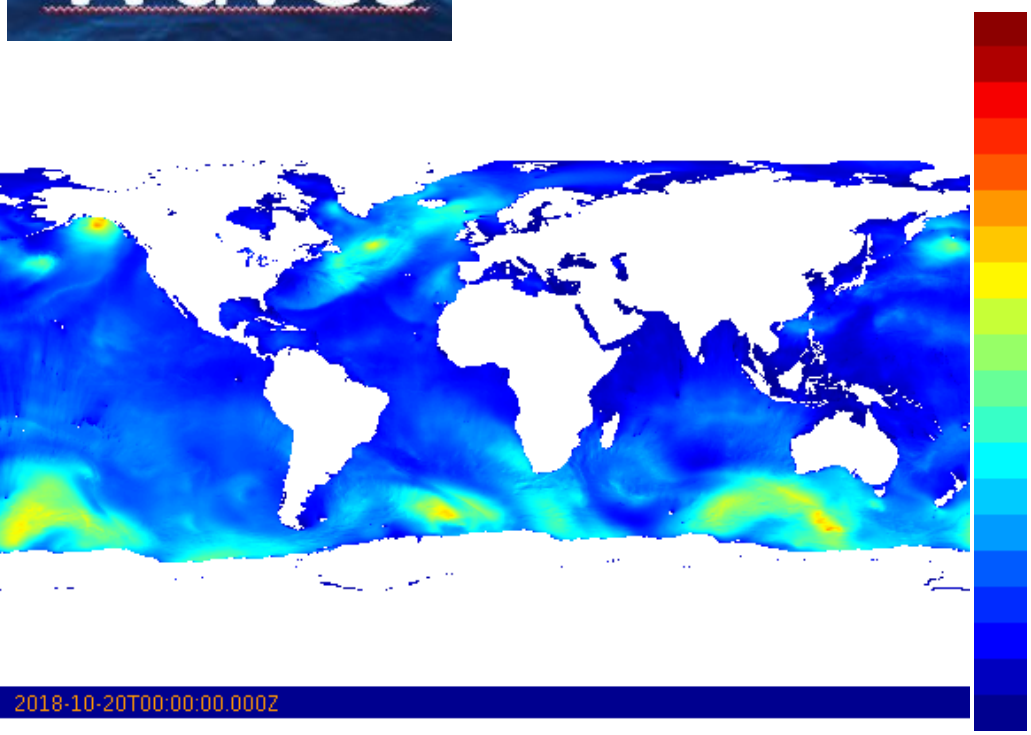
Waves



GLOBAL WAVE MODEL

- *3-Hourly files*
- *Surface only*

- **<u>9km, 2016->5-Day forecast</u>**

GLOBAL_ANALYSIS_FORECAST_WAV_001_027

✓ Data assimilation of wave height **and spectra** (from S1A-B since Dec2018)

✓ 10D fcst (planned end 2019)

✓ Online wave-ocean currents coupling (planned end 2019)

✓ Data assimilation of CFOSAT wave spectra (planned end of 2019)

- **<u>20km, 1993->2017-</u>** <u>Reanalysis updated every 6 mths</u>

✓ This product will be available end-2019

✓ Data assimilation of wave height only

✓ Forced by ERA5 (better winds than ERA-Interim)

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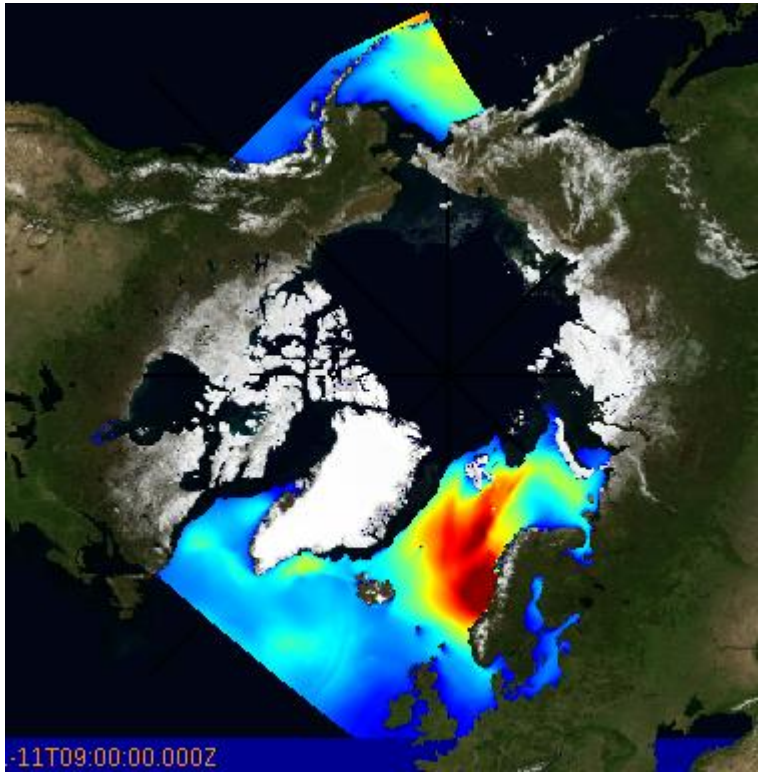
Waves

Significant Wave Height(m)



ARCTIC WAVE MODEL

- *Hourly files*
- *Surface only*

- **6km, end2016->5-Day forecast**

ARCTIC_ANALYSIS_FORECAST_WAV_002_010

✓ No data assimilation

✓ 2 fcst/day with 10D fcst (planned end 2019)

✓ Online wave-ocean currents coupling (planned end 2019)

- **1993-2017, Reanalysis**

Will be available end 2019

Reanalysis updated every 6 mths

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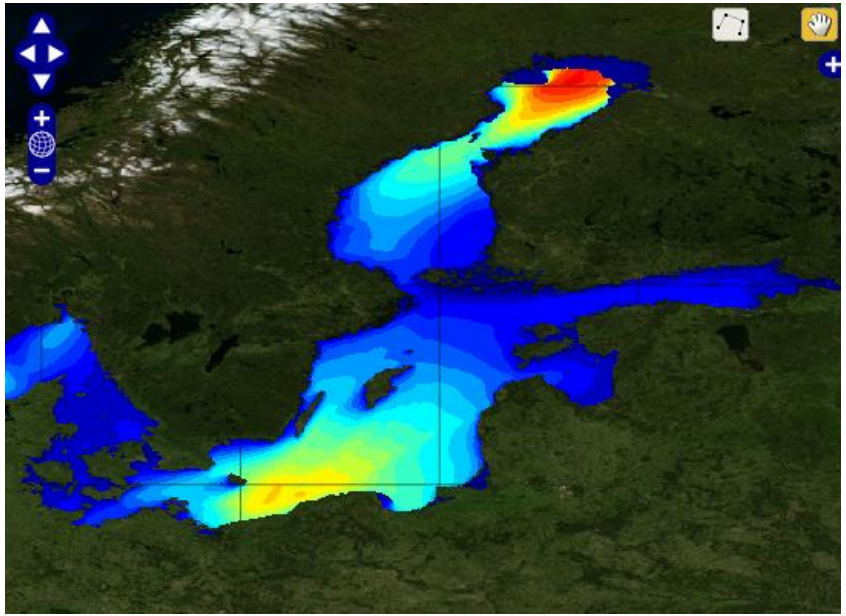
Waves

Significant Wave Height(m)



3m

0m

BALTIC WAVE MODEL

- *Hourly files*
- *Surface only*

- **2km, 2years->5-Day forecast**

BALTICSEA_ANALYSIS_FORECAST_WAV_003_010

✓ No data assimilation

✓ 2 fcst/day with 10D fcst (planned end 2019)

✓ Online wave-ocean currents coupling (planned end 2019)

- **1993-2017, Reanalysis**

Will be available end 2019

Reanalysis updated every 6 mths

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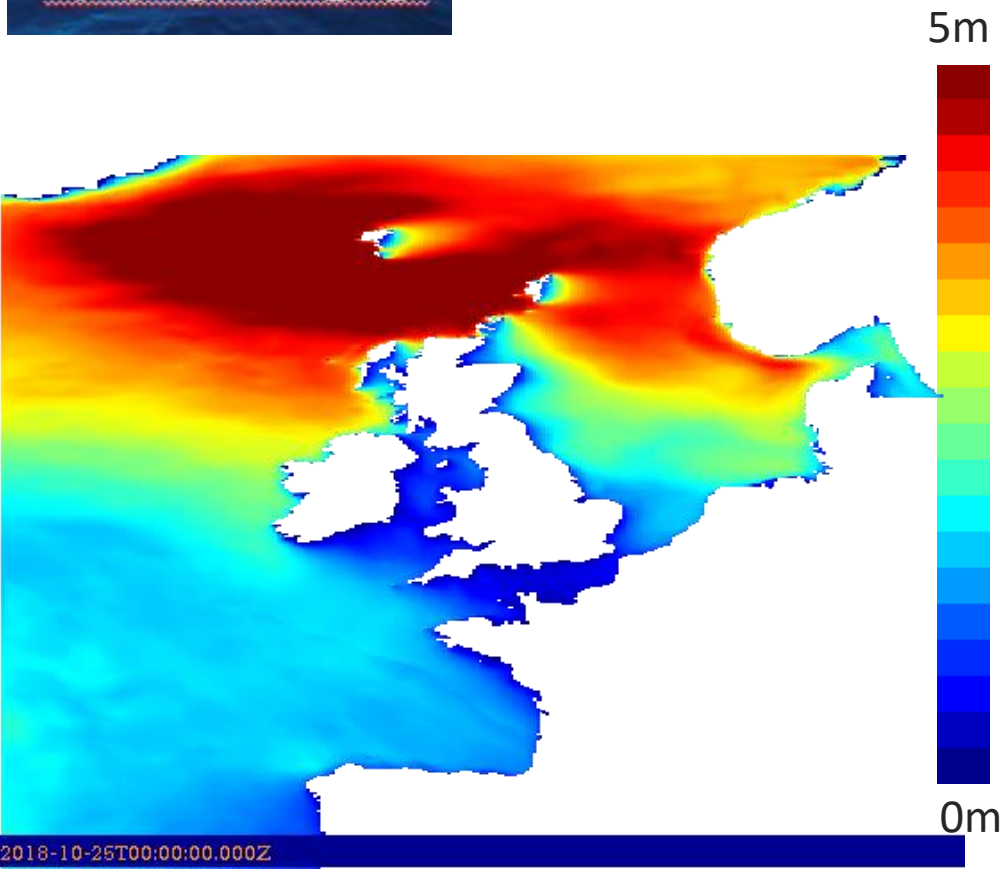
Waves

Significant Wave Height(m)



EUROPEAN NORTH WEST SHELVES WAVE MODEL (NWS)

- *Hourly files*
- *Surface only*

- **1.5km, 2014->6-Day forecast**

NORTHWESTSHELF_ANALYSIS_FORECAST_WAV_004_012

✓ No data assimilation
✓ 2 fcst/day with 10D fcst (planned end 2019)
✓ Online wave-ocean currents coupling (planned end 2019)

- **7km, Reanalysis, 1993->2014**

Will be available end 2019
Reanalysis updated every 6 mths

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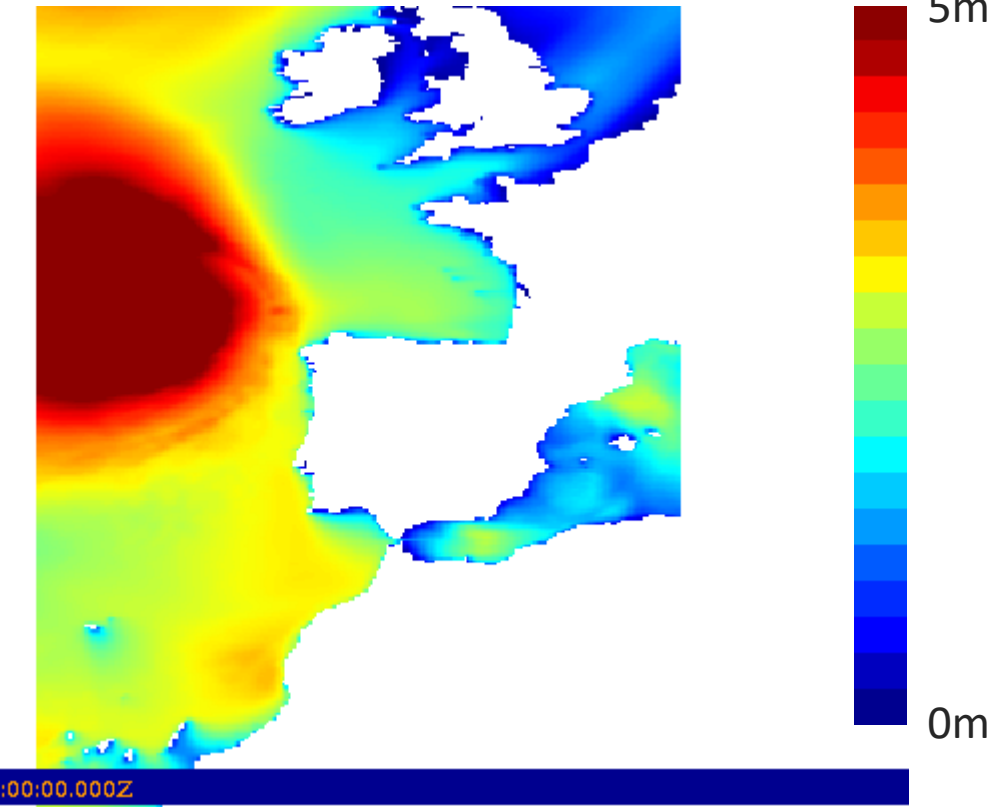
Waves

Significant Wave Height(m)



EUROPEAN SOUTH WEST SHELVES WAVE MODEL (IBI)

- *Hourly files*
- *Surface only*

- **11km, 2015->5-Day forecast**

IBI_ANALYSIS_FORECAST_WAV_005_005

✓ No data assimilation
✓ 2 fcst/day with 10D fcst (planned end 2019)
✓ Online wave-ocean currents coupling (planned end 2019)

- **11km, 1992->2016**

IBI_REANALYSIS_WAV_005_006

✓ No data assimilation
✓ Reanalysis updated every 6 mths

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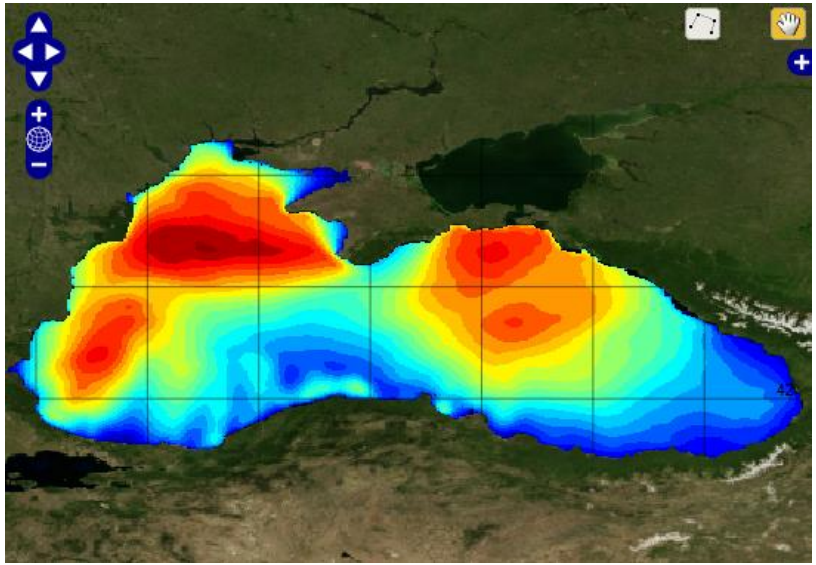
Waves

Significant Wave Height(m)



3.5m

0m

BLACK SEA WAVE MODEL

- *Hourly files*
- *Surface only*

- **3km, 2014->5-Day forecast**

BLKSEA_ANALYSIS_FORECAST_WAV_007_003

✓ No data assimilation

✓ 2 fcst/day with 10D fcst (planned end 2019)

✓ Online wave-ocean currents coupling (planned end 2019)

- **3km, 2002-2017- Reanalysis**

BLKSEA_REANALYSIS_WAV_007_006

✓ Data assimilation of wave height only

✓ Reanalysis updated every 6 mths

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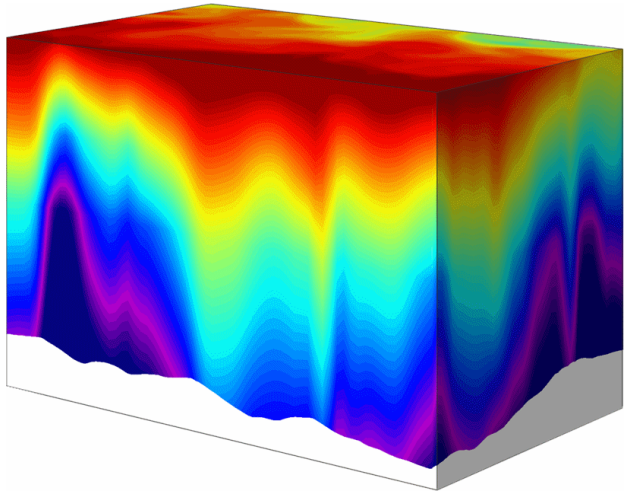
PORTFOLIO GATHERS DATA FROM 3 SOURCES

Marine Monitoring

SATELLITE OBSERVATION

IN SITU OBSERVATION



OCEAN MODEL COMPUTATION

European Commission

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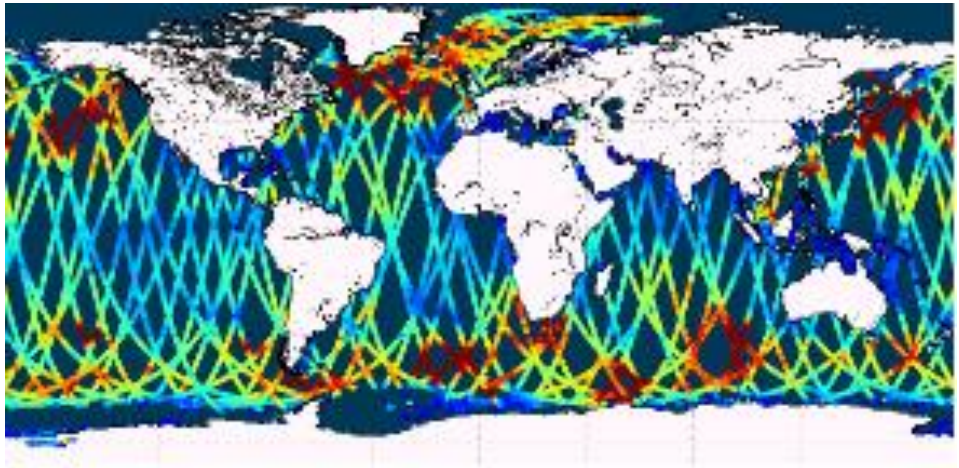
Waves

Significant Wave Height(m)



SWH from SATELLITE

- *Jason-3, Sentinel-3A and SARAL/AltiKa*
- *Sentinel-3B added in 2019*
- *3-Hourly files , 7x7km*
- *Surface only*
- No forecast
- L3 along swath
- [July2017-ongoing]
- New product: Merged L4 planned in 2019

Monomission satellite along-track significant wave height. All the missions are homogenized with respect to a reference mission which is currently Jason-3 and calibrated on in-situ buoy measurements.

WAVE_GLO_WAV_L3_SWH_NRT_OBSERVATIONS_014_001

European Commission

Copernicus Europe's eyes on Earth

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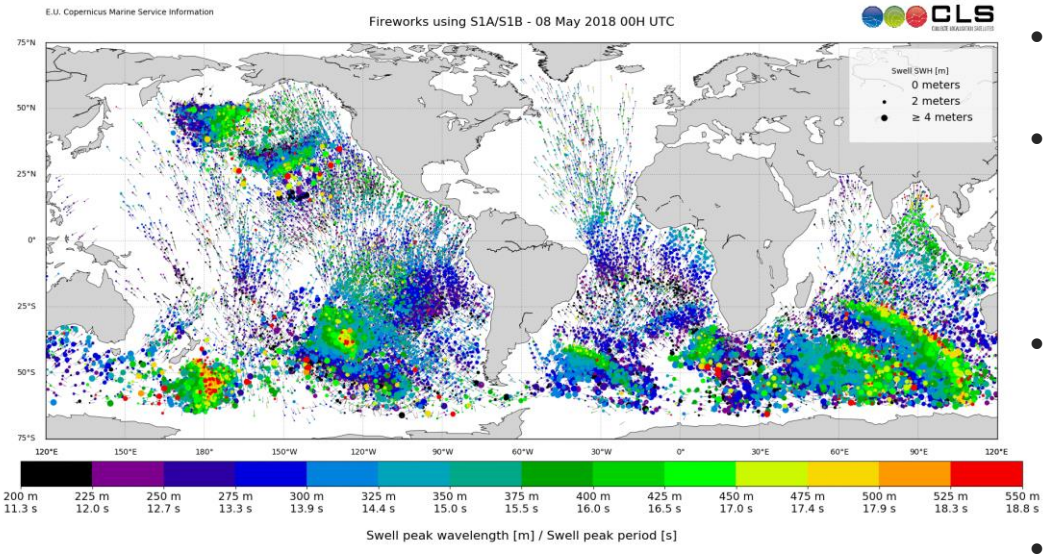
Waves

Significant Wave Height(m)



SWH from SAR SATELLITE

- *Sentinel 1A-B*
- *Surface only*
- ***No forecast***
- ***unique ability to measure the wave period and direction*** *on top of the wave height*
- *allows following each single wave train in the world ocean from the time it is generated until it reaches the coast, sometimes more than 10 days after*
- *A single digital file c****ontains an entire wave system*** *that is all the wave trains originated from the same storm event, from its generation until 10 days later*
- from 2018-03-15 to Present
- 3-hourly-instantaneous
- WAVE_GLO_WAV_L3_SPC_NRT_OBSERVATIONS_014_002

European Commission

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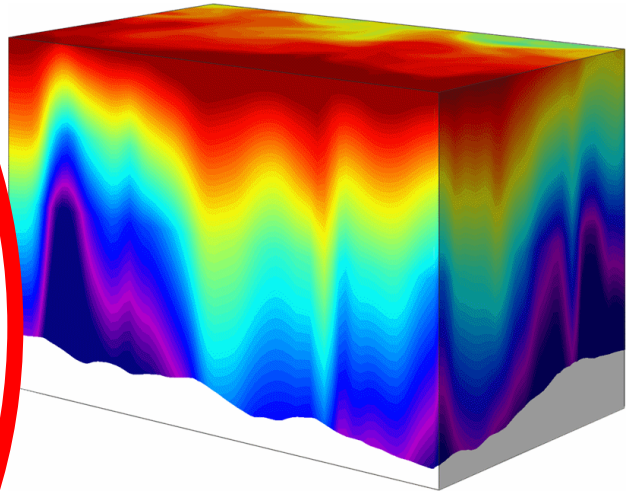
Marine Monitoring

PORTFOLIO GATHERS DATA FROM 3 SOURCES



SATELLITE OBSERVATION

IN SITU OBSERVATION

OCEAN MODEL COMPUTATION

European Commission

Copernicus Europe's eyes on Earth

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Marine Monitoring

In situ wave buoys

http://marine.copernicus.eu/wave-products-enter-copernicus-marine-service-19-april-2017/

Waves

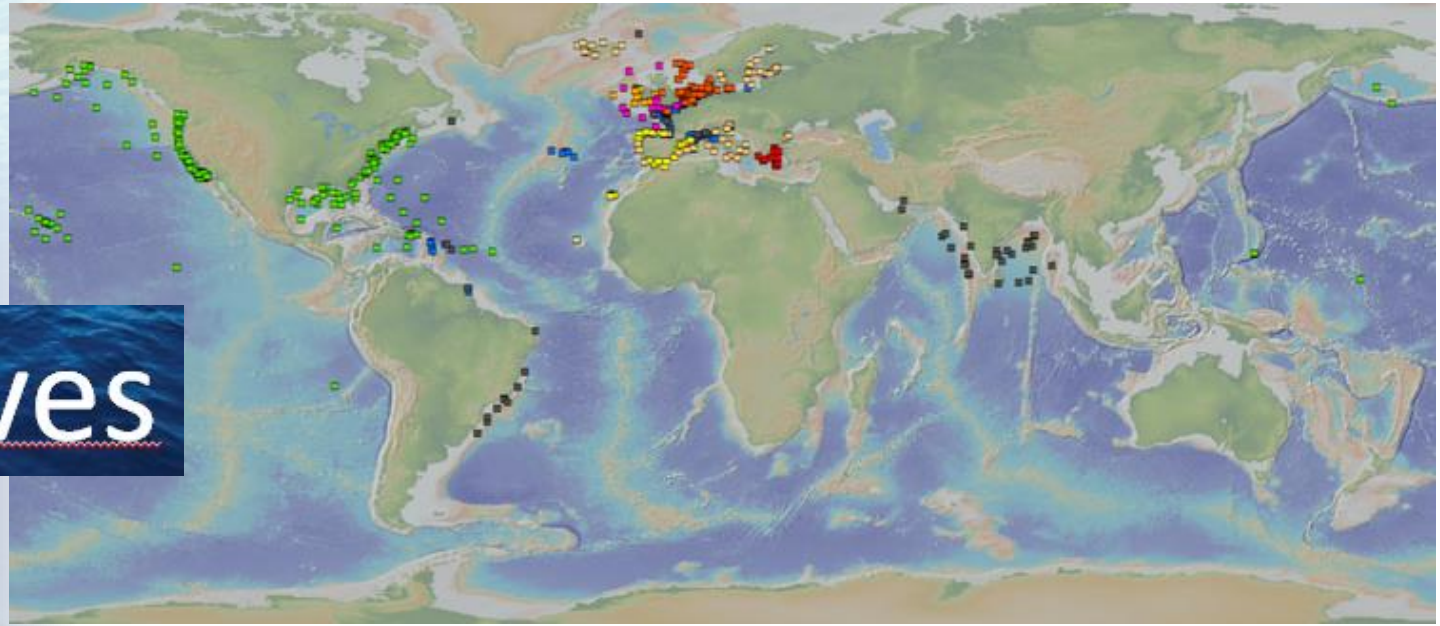

Figure 3: Global ocean (top figure) and European regional seas (bottom figure) in situ platform locations for real time wave observations, available in the Copernicus Marine Service from April 19th 2017. Colors denote the origin of the data (i.e. data originating from NDBC/USA in **green**, from Météo France/France in **dark grey**, from Copernicus Marine Service in situ TAC partners/EU in **blue**, **red**, **magenta**, **orange**, **beige**, **yellow**). Credits: Coriolis-Ifremer/EU Copernicus Marine Service.

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INTERNATIONAL

Marine Monitoring

In situ wave buoys

Waves

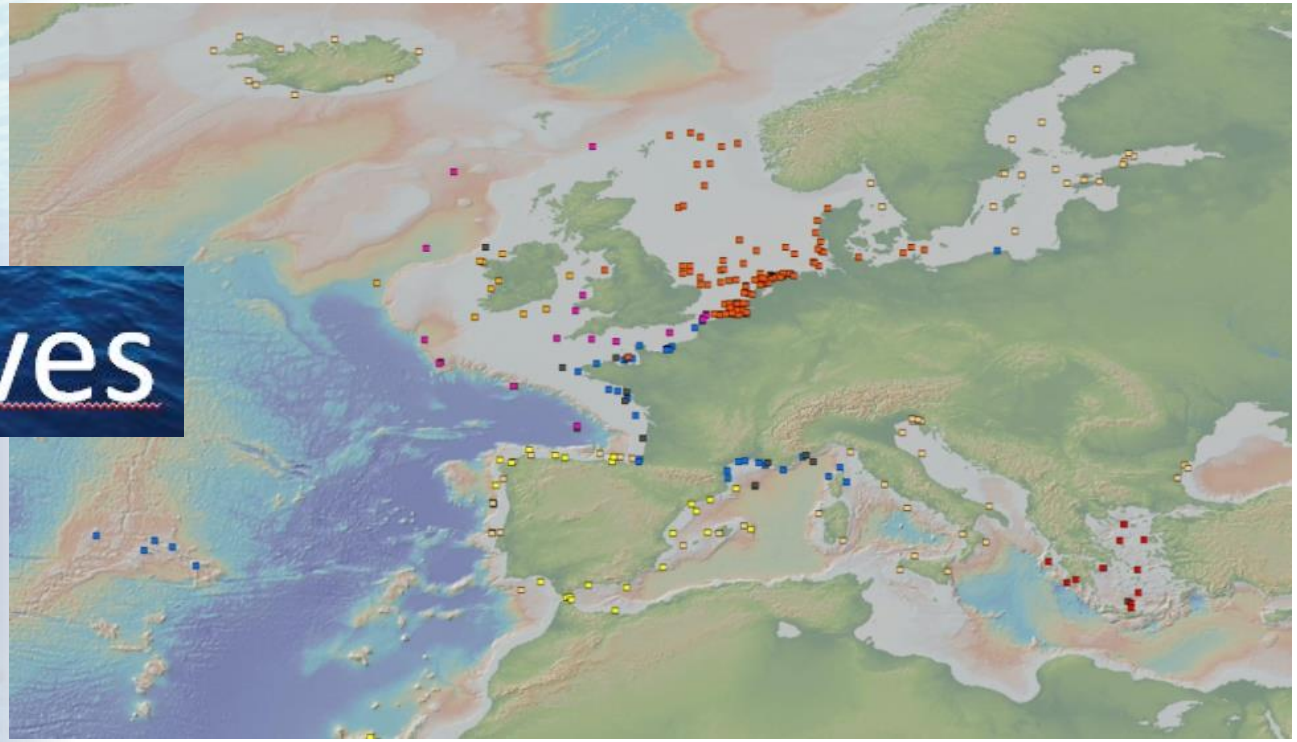

Figure 3: Global ocean (top figure) and European regional seas (bottom figure) in situ platform locations for real time wave observations, available in the Copernicus Marine Service from April 19th 2017. Colors denote the origin of the data (i.e. data originating from NDBC/USA in **green**, from Météo France/France in **dark grey**, from Copernicus Marine Service in situ TAC partners/EU in **blue**, **red**, **magenta**, **orange**, **beige**, **yellow**). Credits: Coriolis-Ifremer/EU Copernicus Marine Service.

Marine Monitoring

INSITU_GLO_NRT_OBSERVATIONS_013_030		
GLOBAL OCEAN- IN-SITU NEAR-REAL-TIME OBSERVATIONS		
OBSERVATION	L2	GLO
T S SSH 3DUV CHL SWH MWP VMDR ⓘ		
undefined km x undefined km (undefined depth levels)		
From 2010-01-10 to Present		
instantaneous		
MORE INFO ADD TO CART **WMS** **Sub-setting**		

INSITU_GLO_WAVE_REP_OBSERVATIONS_013_045		
GLOBAL OCEAN - DELAYED MODE WAVE PRODUCT		
OBSERVATION	L2	GLO
SWH ⓘ		
undefined km x undefined km (discrete depth levels)		
From 1990-01-01 to 2016-12-31		
instantaneous		
MORE INFO ADD TO CART ~~**WMS**~~ ~~**Sub-setting**~~		

European Commission

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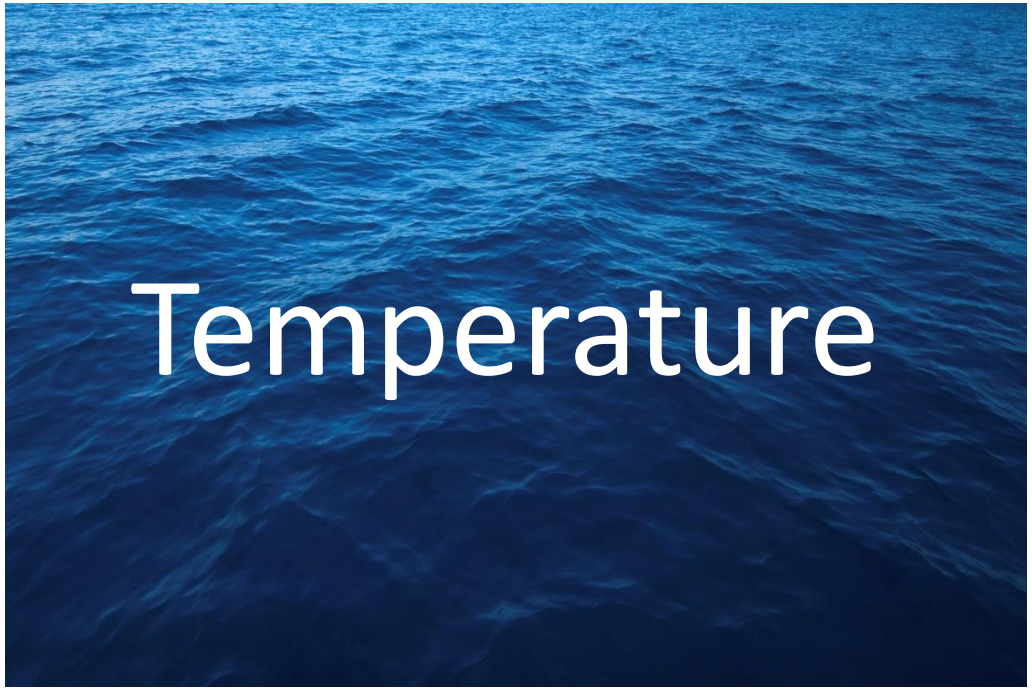
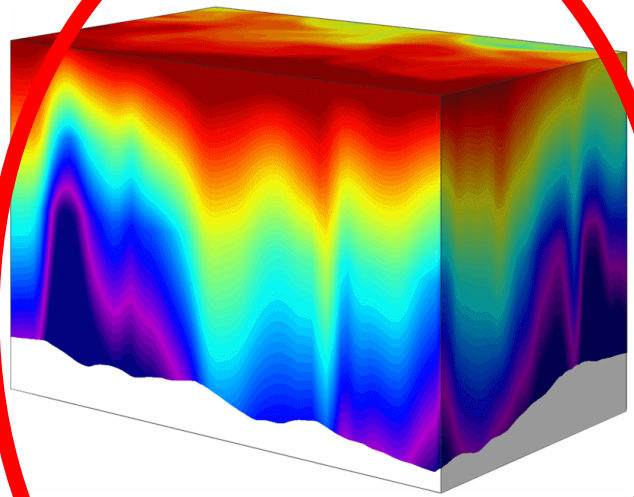

Temperature

Marine Monitoring

PORTFOLIO GATHERS DATA FROM 3 SOURCES

SATELLITE OBSERVATION

IN SITU OBSERVATION



OCEAN MODEL COMPUTATION

European Commission

opernicus

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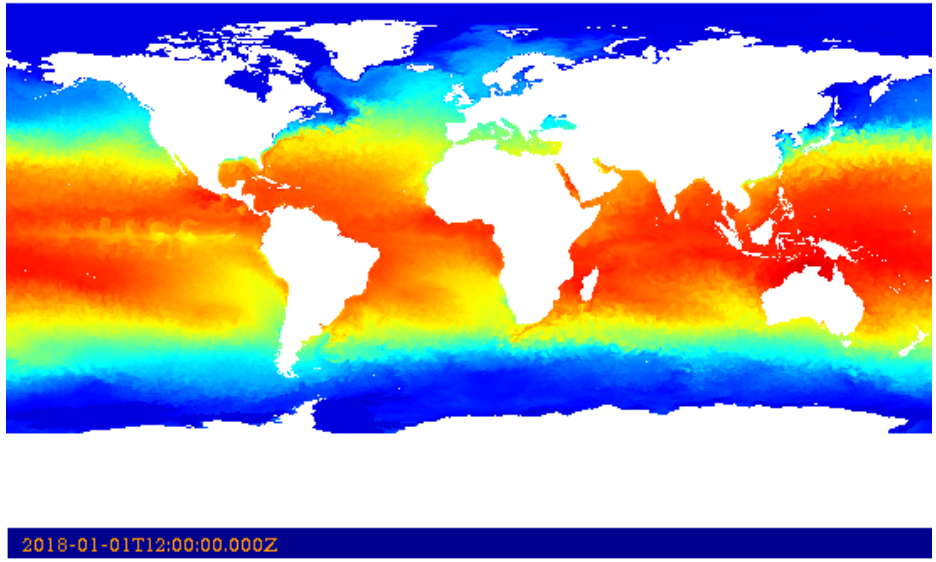
Temperature



35 degC

-5degC

GLOBAL MODEL

- *Hourly and Daily files of 3D temperature*
- *Surface to bottom*
- *10-day forecast*

- **9km, 2006->10-Day forecast**

GLOBAL_ANALYSIS_FORECAST_PHY_001_024

- **9km, 1993->2017**

GLOBAL_REANALYSIS_PHY_001_030

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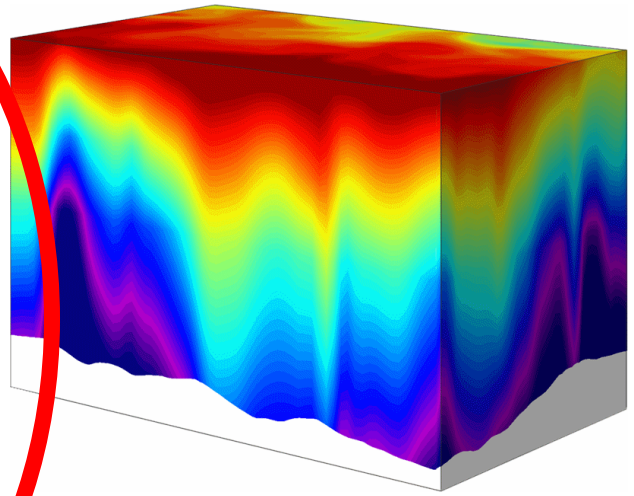
PORTFOLIO GATHERS DATA FROM 3 SOURCES

Marine Monitoring



SATELLITE OBSERVATION

IN SITU OBSERVATION

OCEAN MODEL COMPUTATION

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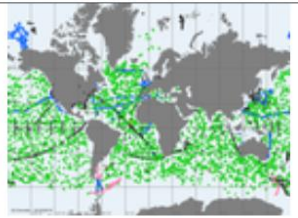
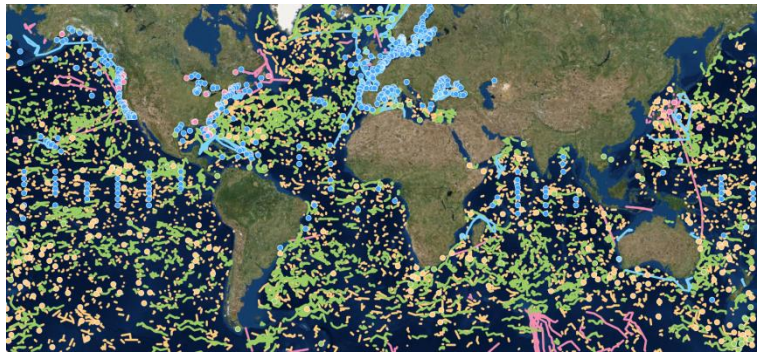
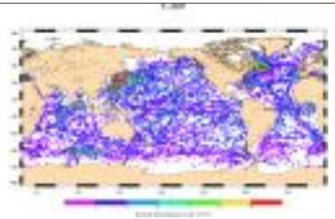
Marine Monitoring

INSITU_GLO_NRT_OBSERVATIONS_013_030		
GLOBAL OCEAN- IN-SITU NEAR-REAL-TIME OBSERVATIONS		
OBSERVATION	L2	GLO
T S SSH 3DUV CHL SWH MWP VMDR ⓘ		
undefined km x undefined km (undefined depth levels)		
From 2010-01-10 to Present		
instantaneous		
MORE INFO ADD TO CART WMS Sub-setting		



INSITU_GLO_TS_REP_OBSERVATIONS_013_001_B		
GLOBAL OCEAN- CORA- IN-SITU OBSERVATIONS YEARLY DELIVERY IN DELAYED MODE		
OBSERVATION	L2	GLO
T S ⓘ		
undefined km x undefined km (discrete depth levels)		
From 1950-01-01 to 2018-06-30		
instantaneous		
MORE INFO ADD TO CART ~~WMS~~ ~~Sub-setting~~		

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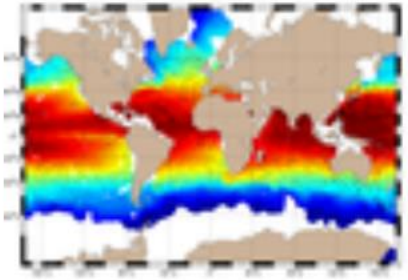
Marine Monitoring

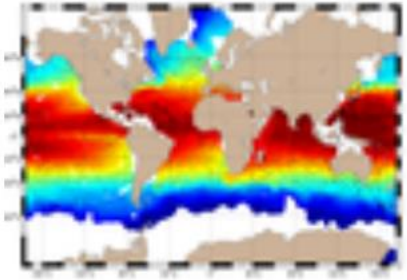
INSITU_GLO_TS_OA_NRT_OBSERVATIONS_013_002_A

GLOBAL OCEAN- REAL TIME IN-SITU OBSERVATIONS OBJECTIVE ANALYSIS

OBSERVATION	L4	GLO
T S ⓘ		
0.5 degree x 0.5 degree (152 depth levels)		
From 2010-01-15 to Present		
monthly-mean		
MORE INFO ADD TO CART **WMS** **Sub-setting**		

INSITU_GLO_TS_OA_REP_OBSERVATIONS_013_002_B

GLOBAL OCEAN- DELAYED MODE GRIDDED CORA- IN-SITU OBSERVATIONS OBJECTIVE ANALYSIS I DELAYED MODE

OBSERVATION	L4	GLO
T S ⓘ		
0.5 degree x 0.5 degree (152 depth levels)		
From 1990-01-01 to 2018-06-30		
monthly-mean		
MORE INFO ADD TO CART **WMS** **Sub-setting**		

European Commission

Europe's eyes on Earth

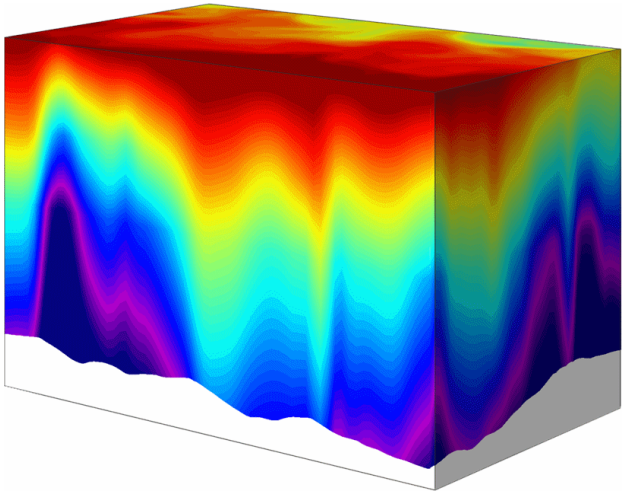
INTERNATIONAL

PORTFOLIO GATHERS DATA FROM 3 SOURCES

Marine Monitoring

SATELLITE OBSERVATION

IN SITU OBSERVATION



OCEAN MODEL COMPUTATION

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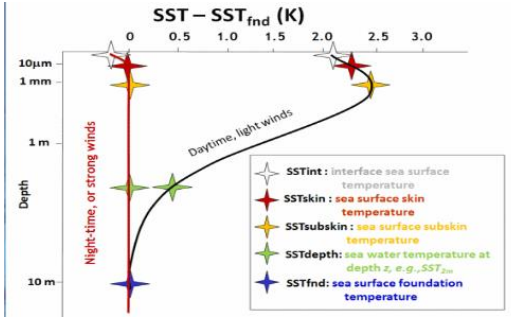
Marine Monitoring

In order to avoid confusion between various SST at different depth, CMEMS SEA SURFACE TEMPERATURE Satellite products provide with the following information:

- **SEA SURFACE TEMPERATURE (SST):**
  - Foundation SST (SST at a depth of about 10 meters, i.e. **not influenced by diurnal cycle**) (all SST products except one)
  - Skin SST (SST at a depth of about 10 micrometers, i.e. **influenced by diurnal cycle**) (only 1 product SST_GLO_SST_L4_NRT_OBSERVATIONS_**010_014**)



European Commission

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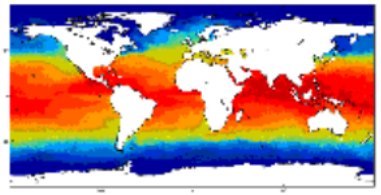
Marine Monitoring

FOUNDATION SST

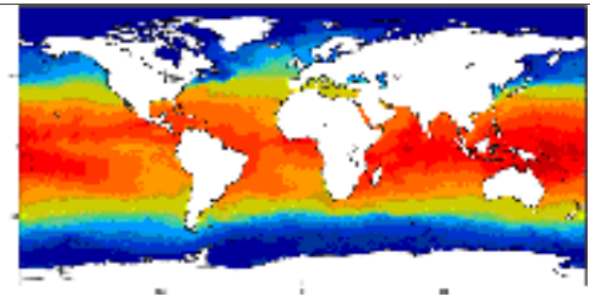
SST_GLO_SST_L4_NRT_OBSERVATIONS_010_001

GLOBAL OCEAN OSTIA SEA SURFACE TEMPERATURE AND SEA ICE ANALYSIS

OBSERVATION	L4	GLO
SST SIC		
0.05 degree x 0.05 degree (Surface only)		
From 2016-01-01 to Present		
daily-mean, monthly-mean, seasonal-mean		
MORE INFO ADD TO CART **WMS** **Sub-setting**		

SST_GLO_SST_L4_REP_OBSERVATIONS_010_011

GLOBAL OCEAN OSTIA SEA SURFACE TEMPERATURE AND SEA ICE REPROCESSED

OBSERVATION	L4	GLO
SST SIC		
0.05 degree x 0.05 degree (Surface only)		
From 1985-01-01 to 2007-12-31		
daily-mean, monthly-mean, seasonal-mean		
MORE INFO ADD TO CART **WMS** **Sub-setting**		

European Commission

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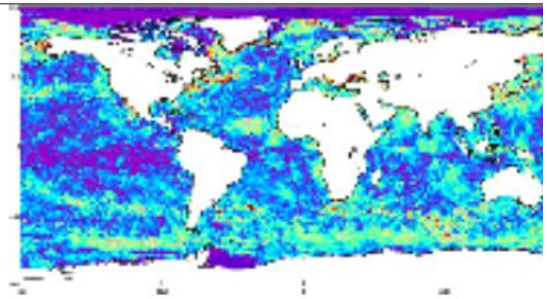
Marine Monitoring

SST_GLO_SST_L4_NRT_OBSERVATIONS_010_005		
GLOBAL OCEAN SEA SURFACE TEMPERATURE MULTI PRODUCT ENSEMBLE (GMPE)		
OBSERVATION	L4	GLO
SST		
0.25 degree x 0.25 degree (Surface only)		
From 2009-09-17 to Present		
daily-mean		
MORE INFO ADD TO CART WMS Sub-setting		

FOUNDATION SST

European Commission

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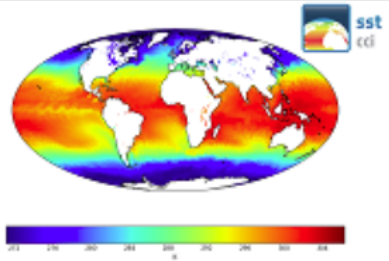
Marine Monitoring

SST_GLO_SST_L4_REP_OBSERVATIONS_010_024		
ESA SST CCI REPROCESSED SEA SURFACE TEMPERATURE ANALYSES		
OBSERVATION	L4	GLO
SST SIC		
0.05 degree x 0.05 degree (Surface only)		
From 1991-09-01 to 2010-12-31		
daily-mean		
MORE INFO ADD TO CART **WMS** **Sub-setting**		

FOUNDATION SST

European Commission

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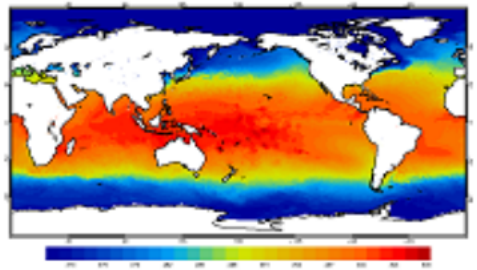
Marine Monitoring

SST_GLO_SST_L4_NRT_OBSERVATIONS_010_014		
GLOBAL OCEAN OSTIA DIURNAL SKIN SEA SURFACE TEMPERATURE		
OBSERVATION	L4	GLO
SST SIC ⓘ		
0.25 degree x 0.25 degree (Surface only)		
From 2016-01-16 to Present		
hourly-mean		
MORE INFO ADD TO CART **WMS** **Sub-setting**		

SKIN SST

European Commission

Copernicus Europe's eyes on Earth

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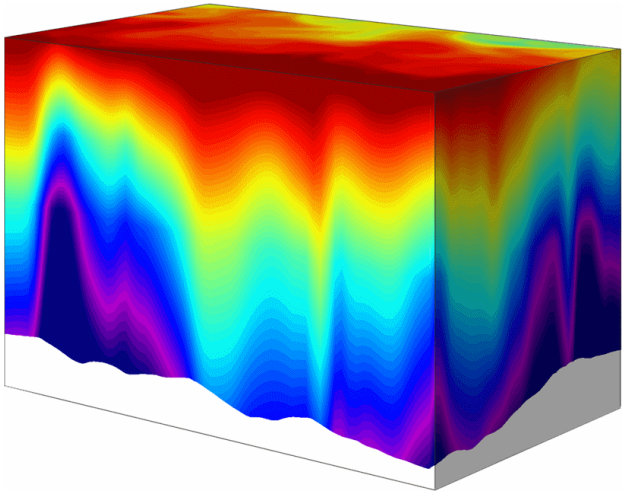
Marine Monitoring

PORTFOLIO GATHERS DATA FROM 3 SOURCES



SATELLITE OBSERVATION

IN SITU OBSERVATION

OCEAN MODEL COMPUTATION

European Commission

Copernicus Europe's eyes on Earth

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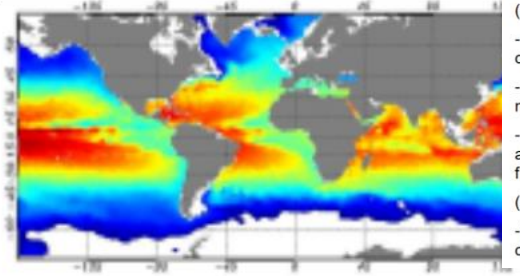
MULTIOBS_GLO_PHY_NRT_015_001

GLOBAL OBSERVED OCEAN PHYSICS TEMPERATURE SALINITY HEIGHTS MLD GEOSTROPHIC CURRENTS SEA SURFACE SALINITY AND SEA SURFACE DENSITY PROCESSING

OBSERVATION	L4	GLO
T SSD S SSH 3DUV UVG MLD ⓘ		
0.25 degree x 0.25 degree (33 depth levels)		
From 2014-01-01 to Present		
weekly-mean, monthly-mean		

MORE INFO ADD TO CART **WMS** **Sub-setting**



All datasets are obtained as a combination between satellite and in-situ data, processed in different steps:

(1-2)

- satellite data (SLA + SST) are projected onto the vertical via a multiple linear regression method and covariances deduced from historical observations. This step gives synthetical fields,

- combination between these synthetic fields with T/S in-situ profiles via an optimal interpolation method. This leads to combined fields.

- use of the thermal wind equation to combine absolute geostrophic current fields from satellite altimetry with the combined 3D T/S fields. This last step generates global 3D geostrophic current fields.

(3-4)

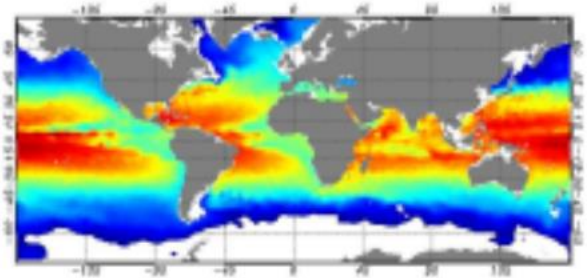
-in situ and satellite SSS are interpolated through a multivariate optimal algorithm, using SST to compute the interpolation weights.

MULTIOBS_GLO_PHY_REP_015_002

GLOBAL OBSERVED OCEAN PHYSICS TEMPERATURE SALINITY HEIGHTS MLD GEOSTROPHIC CURRENTS SEA SURFACE SALINITY AND SEA SURFACE DENSITY REPROCESSING

OBSERVATION	L4	GLO
T SSD S SSH UVG SIC ⓘ		
0.25 degree x 0.25 degree (33 depth levels)		
From 1993-01-01 to 2017-12-27		
weekly-mean, monthly-mean		

MORE INFO ADD TO CART **WMS** **Sub-setting**



Marine Monitoring

EXAMPLE OF USE IN VARIOUS SECTORS OF THE BLUE ECONOMY

European Commission

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Marine Monitoring

CMEMS SECTORAL APPROACH

http://marine.copernicus.eu/markets/

1. SEA ICE MONITORING
2. MARINE CONSERVATION & POLICIES
3. SCIENCE & CLIMATE
4. NATURAL RESOURCES & ENERGY
5. WATER QUALITY
6. COASTAL MONITORING
7. SOCIETY & EDUCATION
8. MARINE FOOD
9. MARINE NAVIGATION
10. SAFETY & DISASTER

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ENERGY: Renewable Energy TEST SITE

The Biscay Marine Energy Platform (**BiMEP**) is an open sea test site with grid connection for demonstrating and validating **wave energy collectors and floating wind** platforms. BiMEP provides manufacturers with ready-to-use facilities to test technical and economic feasibility of their prototype.

BiMEP and IH Cantabria have developed a Prediction System to forecast wind, wave, currents and sea level conditions to be considered in the **planning of marine operations at BiMEP** and feed the Decision Support System developed in TRL+ project. The Copernicus Marine Service **physics and wave** models are used as forcing conditions in a very high resolution model.

bimep

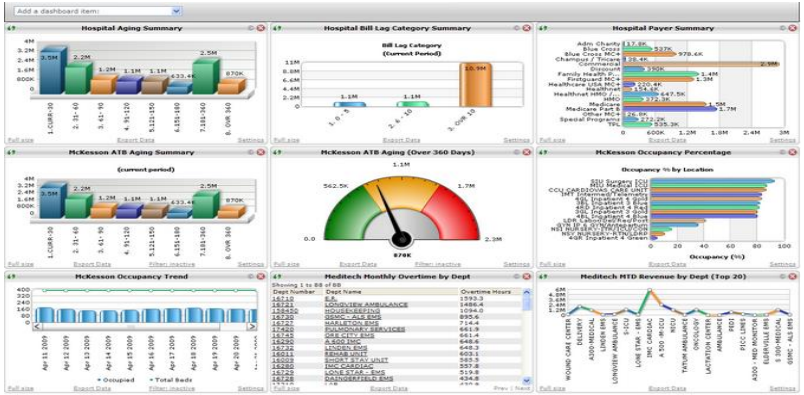
IH cantabria
INSTITUTO DE HIDRÁULICA AMBIENTAL
UNIVERSIDAD DE CANTABRIA

Marine Monitoring

ENERGY: Offshore platforms

Offshore platforms and related ships need to be fully operational 24/7 whatever the weather and sea conditions.

CMEMS ocean model currents and waves products are used to build a met/ocean dashboard. Offshore platform operators rely on such dashboard to plan operations at sea and publish warning messages.



Open Ocean
Marine Data Intelligence

European Commission
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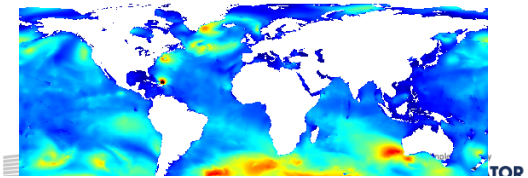
RISK AT SEA: CONSTRAINT EVALUATION ON SEA-EXPOSED MATERIAL

A harsh ocean environment with strong winds and waves over decades of use causes significant wear and tear on offshore structures. The angle from which waves hit a platform, and the wave height are important factors, but in addition the wave frequency is an important factor due to the resonance frequency of the structure itself.

AHPA, Asset Health and Probabilistic Analyses, focuses on **probability analyses of fractures and strains on offshore structures**. The Copernicus Marine Service wave height combined with period is used to predict the 3-dimensional motion of floating bodies.

AHPA



Wave Height (meter) Evolution during 5days in October 2017

Marine Monitoring

MARITIME NAVIGATION

CMA CGM and ACTIMAR use Ocean Current Observations and Forecast to find the best possible route and guide its fleet thanks to its Fleet Navigation & Support Centre.

Their Target : Save 1% thanks « current routing » (60 000t fuel or 180 000t C02 for the whole fleet).

Actimar

CMA CGM

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MARITIME NAVIGATION IN HARBORS

SAMOA: MET-OCEAN CONDITIONS FOR SPANISH PORT AUTHORITIES

In the SAMOA project, led by Puertos del Estado, Spain, a total of 18 port authorities are participating. The service consists of several modules including met/ocean dashboard. CMEMS model products are used as boundary conditions to local coastal models.

GOBIERNO DE ESPAÑA MINISTERIO DE FOMENTO

Puertos del Estado

European Commission

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WATER QUALITY

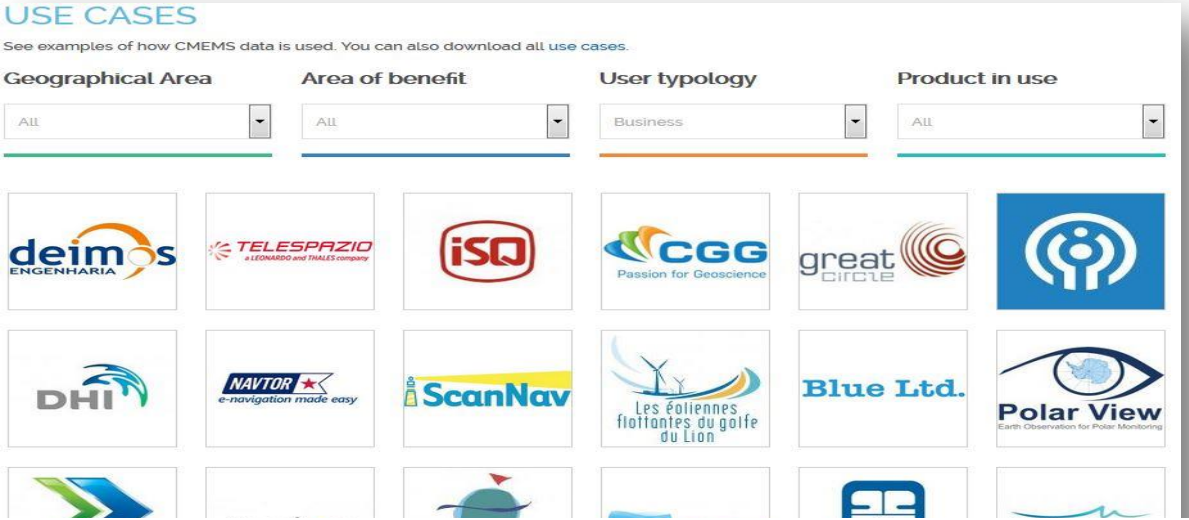
MONITORING AND FORECASTING WATER QUALITY IN THE BAY OF MARSEILLE

The SUEZ subsidiary SERAMM and SUEZ center Rivages Pro Tech develop tools and services for real-time monitoring and forecasting of the nearshore environment. Local authorities in the Marseille area in charge of bathing and coastal water quality have requested the SERAMM and Rivages Pro Tech services. CMEMS ocean models used as boundary conditions allow to better represent the local impact of ocean circulation features like upwelling episodes in the bay.

Marine Monitoring

(USE CASES) SHOWCASING USERS AND USAGES

SHOWCASING USE CASES ONLINE (marine.copernicus.eu)



SUBMIT YOUR USE CASE

http://marine.copernicus.eu/markets/submit-your-use-case/

lcrosnier@mercator-ocean.fr

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Collaborative Forum
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Linkedin CMEMS partnership Meeting place
https://www.linkedin.com/groups/8243515

Tutorials on CMEMS YouTube channel
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THANK YOU

Ocean Energy Europe 2018, Edinburg

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