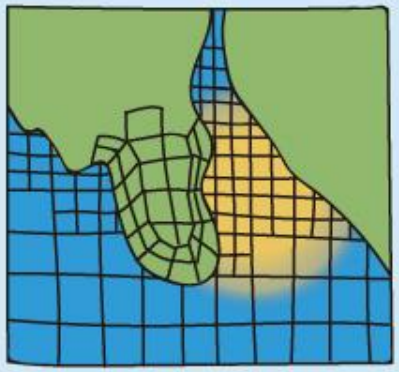


HAZRUNOFF

PROJECT

Quality of results: data and models

Instituto Superior Técnico

Lígia Pinto

Funded by
European Union
Civil Protection
and Humanitarian Aid

Outline

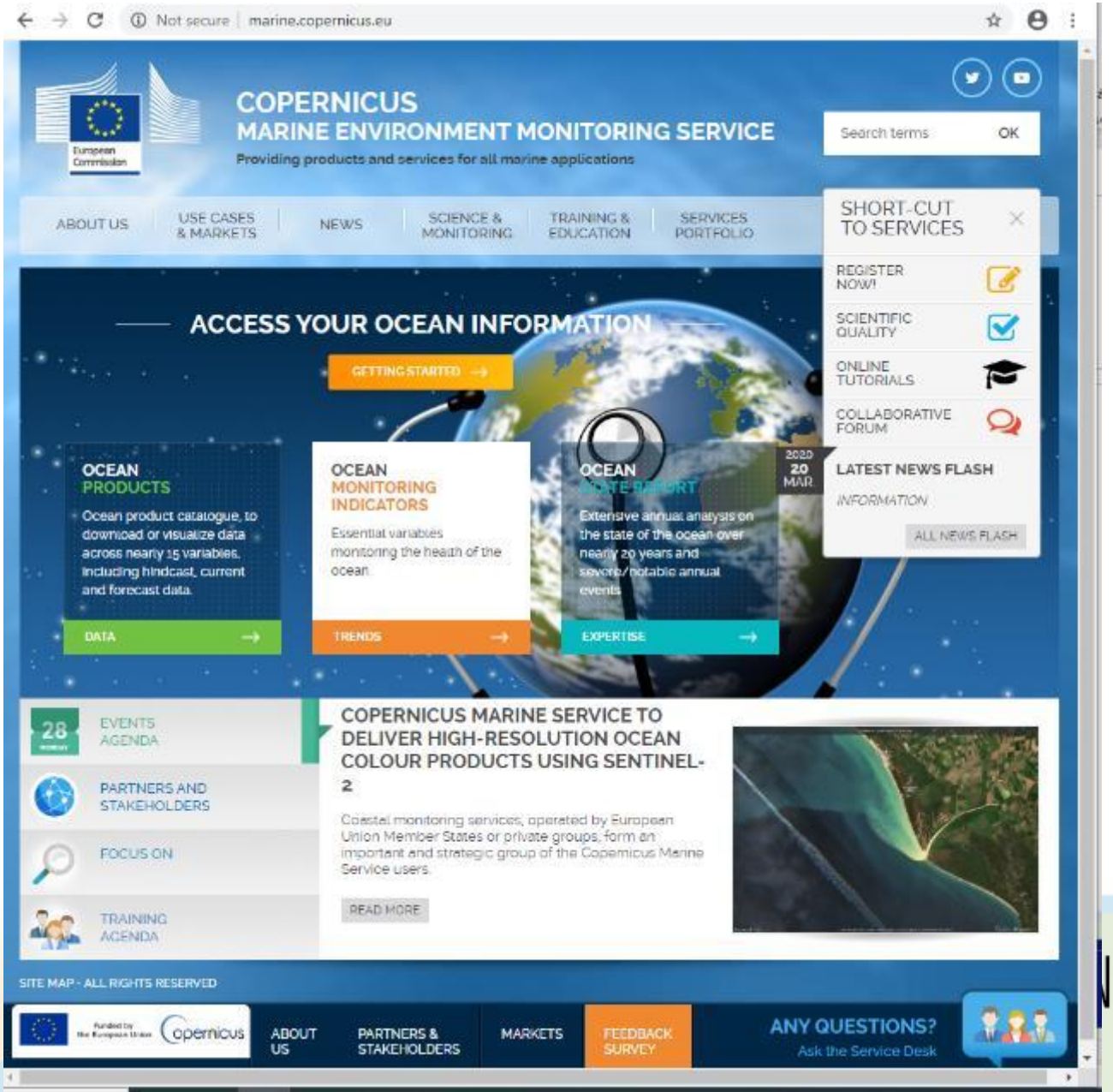
The main topics of this session will be :

- Data providers and sources in EU: Copernicus Marine service, EMODNet, local providers
- Statistical metrics to compare data and model results
- Model results versus data: examples
- Early warning pollution indicators and sentinels in monitoring stations

HAZRUNOFF PROJECT
Funded by European Union Civil Protection and Humanitarian Aid

Data providers and sources in EU

www.marine.copernicus .eu

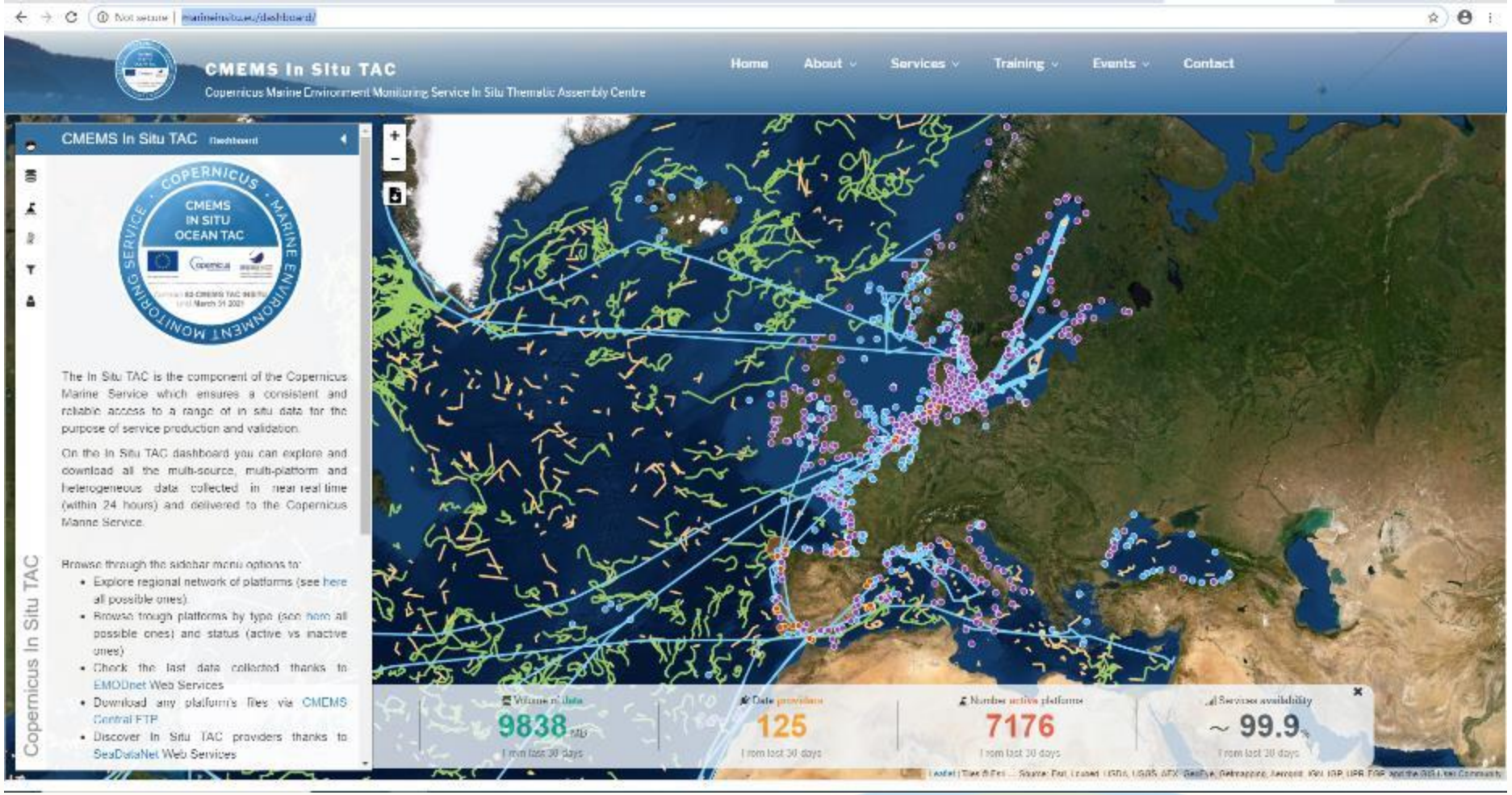


- TO ACCESS DATA USERS MUST REGISTER
- IN-SITU DATA AND MODEL RESULTS

NOFF

Funded by European Union Civil Protection and Humanitarian Aid

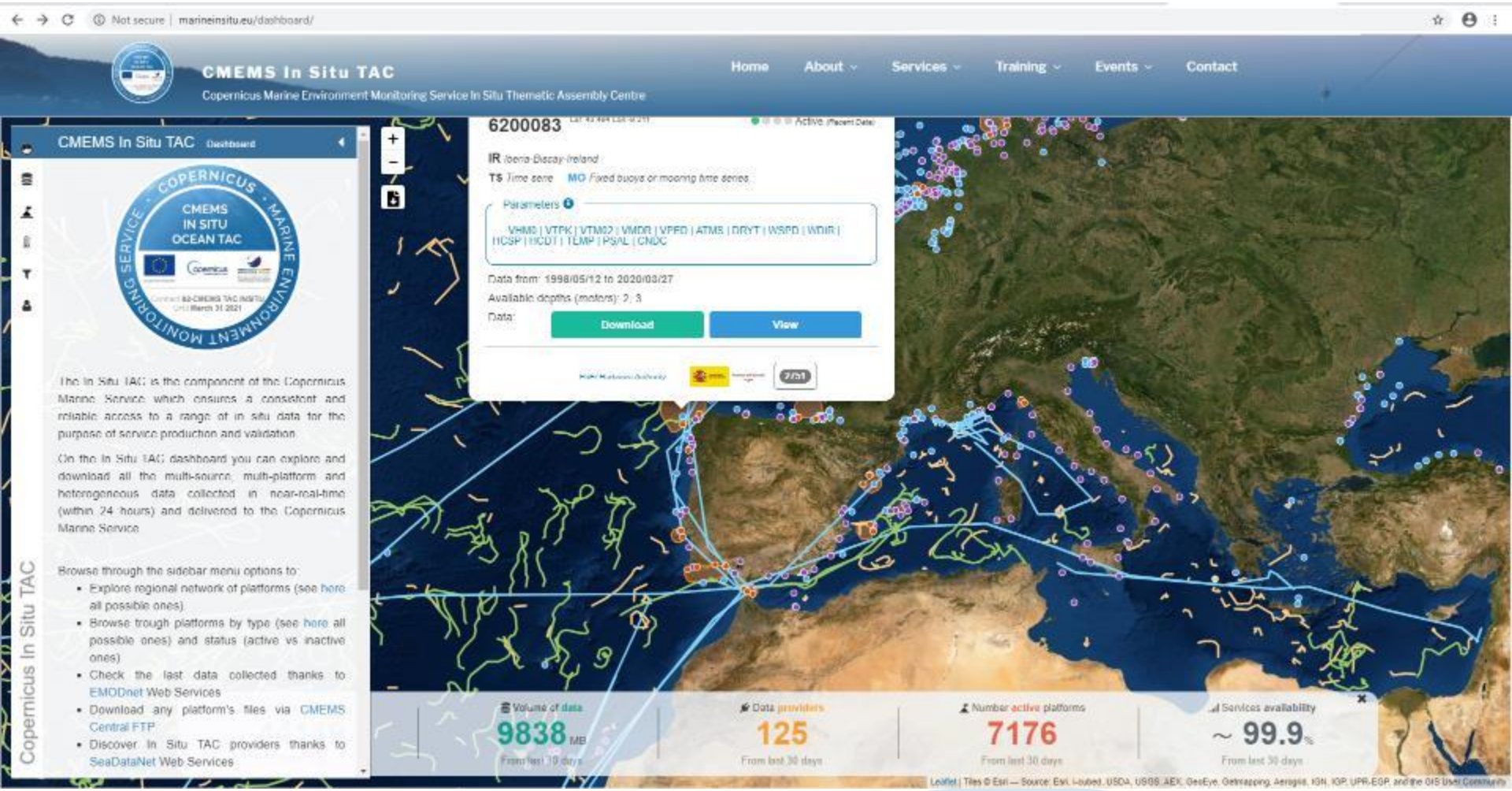
http://www.marineinsitu.eu/dashboard/



HAZRUNOFF PROJECT

Funded by European Union Civil Protection and Humanitarian Aid

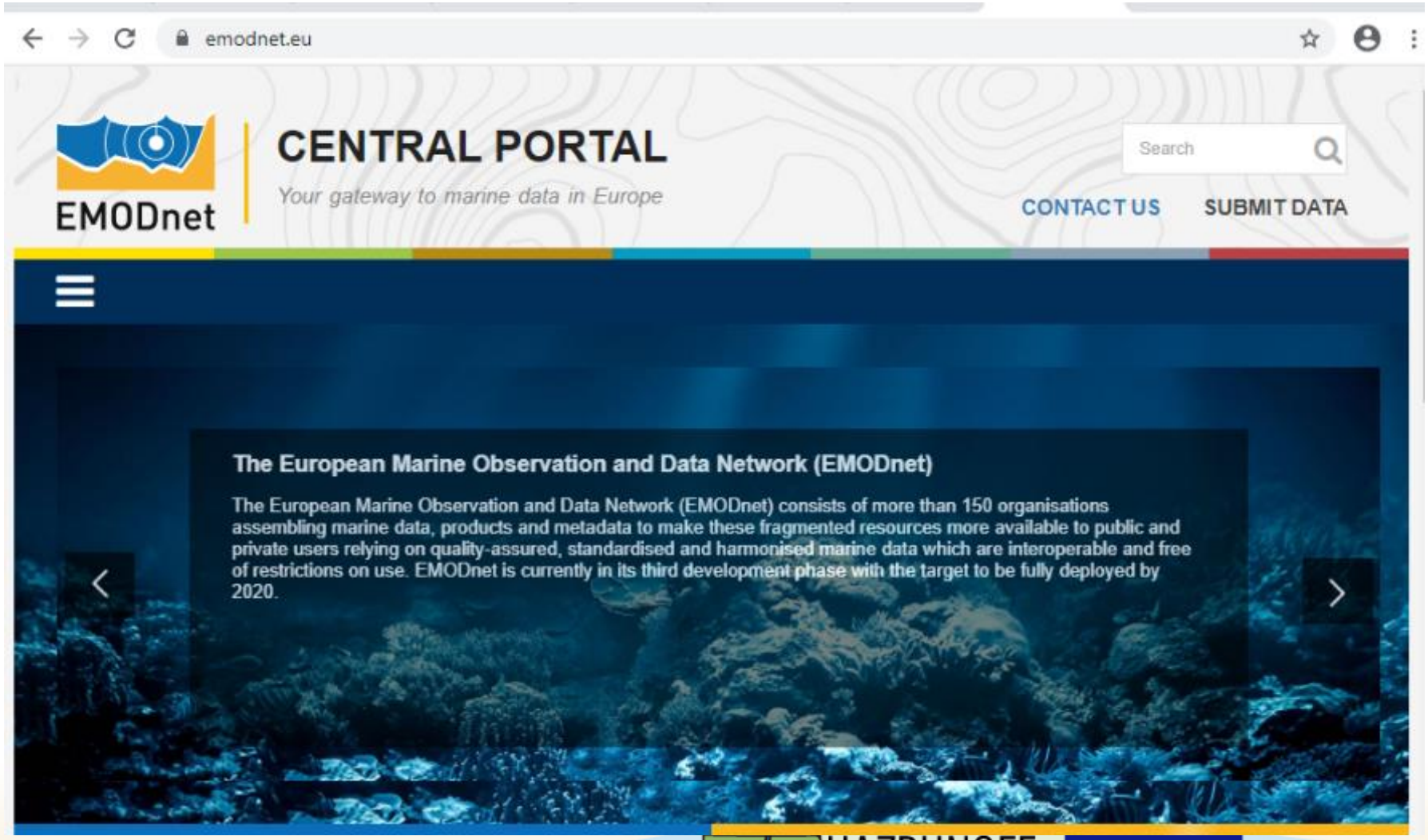
CMEMS In Situ TAC



HAZRUNOFF PROJECT

Funded by European Union Civil Protection and Humanitarian Aid

https://www.emodnet.eu/



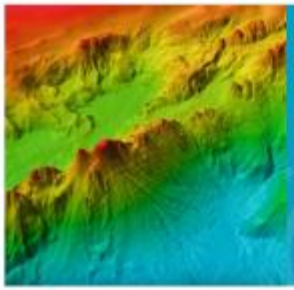
HAZRUNOFF PROJECT
Funded by European Union Civil Protection and Humanitarian Aid

ACCESS THEMATIC PORTALS

DATA INGESTION PORTAL

The EMODnet Data Ingestion portal seeks to identify and to reach out to other potential providers in order to make their data sets also part of the total offer. It aims at

READ MORE



BATHYMETRY

Data on bathymetry (water depth), coastlines, and geographical location of underwater features: wrecks

USE CASES INFO ACCESS

BIOLOGY

Data on temporal and spatial distribution of species abundance and biomass from several taxa

USE CASES INFO ACCESS

CHEMISTRY

Data on marine litter and the concentration of nutrients, organic matter, pesticides, heavy metals, radionuclides and antifoulants in water, sediment and biota.

USE CASES INFO ACCESS

GEOLOGY

Data on seabed substrate, sea-floor geology, coastal behaviour, geological events, and minerals

USE CASES INFO ACCESS

HUMAN ACTIVITIES

Data on the intensity and spatial extent of human activities at sea

USE CASES INFO ACCESS

PHYSICS

Data on salinity, temperature, waves, currents, sea-level, light attenuation and FerryBoxes.

USE CASES INFO ACCESS

SEABED HABITATS

Data on modelled seabed habitats based on seabed substrate, energy, biological zone, and salinity.

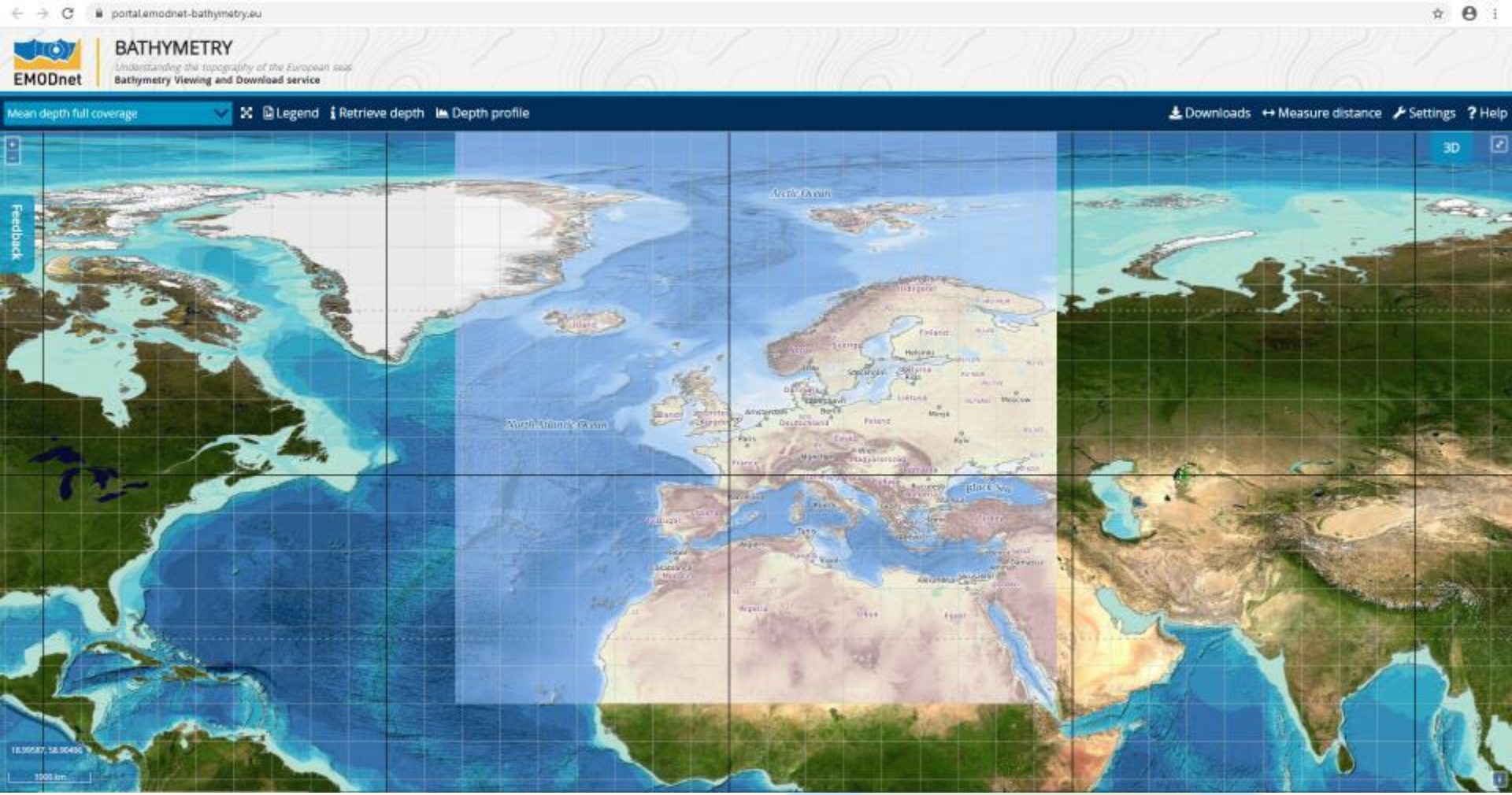
USE CASES INFO ACCESS

ACCESS THEMATIC PORTALS

PROJECT

Funded by
European Union
Civil Protection
and Humanitarian Aid

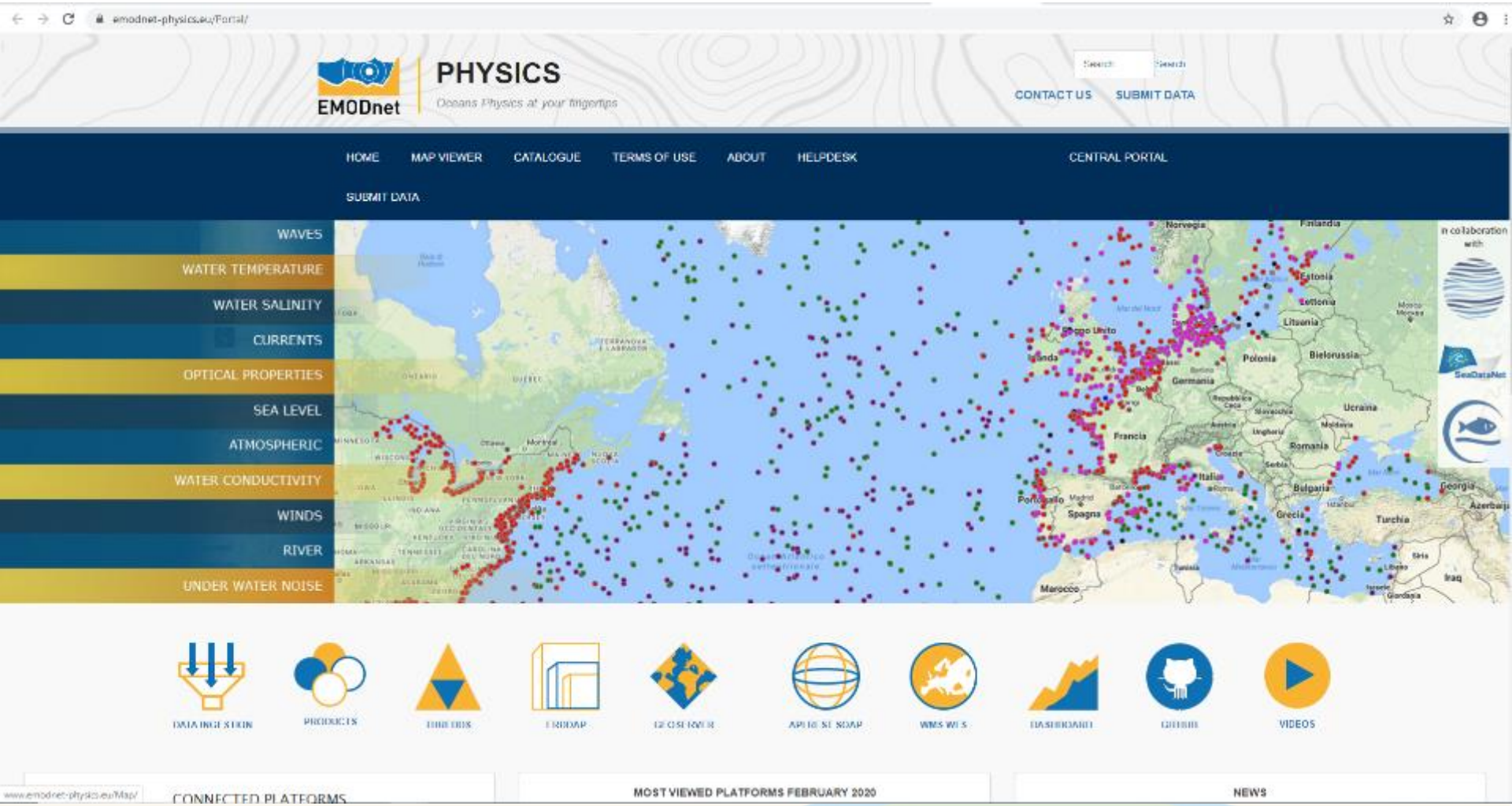
EMODnet – Bathymetry portal



HAZRUNOFF PROJECT

Funded by European Union Civil Protection and Humanitarian Aid

EMODnet - Physics portal



HAZRUNOFF PROJECT

Funded by European Union Civil Protection and Humanitarian Aid

In Situ data – local providers

- National or regional information systems:
  - France:
    - IFREMER (http://data.ifremer.fr/);
    - Meteo France (http://www.meteofrance.com);
  - Portugal:
    - SNIRH (https://snirh.apambiente.pt/);
    - IPMA https://www.ipma.pt/)
  - Spain:
    - Meteogalicia (https://www.meteogalicia.gal);
    - Puertos del estado (http://www.puertos.es)
  - UK:
    - MetOffice (https://www.metoffice.gov.uk);
    - National River Flow Archive (https://nrfa.ceh.ac.uk)
    - UK Hydrographic Office (https://data.admiralty.co.uk)

HAZRUNOFF PROJECT
Funded by European Union Civil Protection and Humanitarian Aid

Model results versus data

Statistical metrics – model vs data

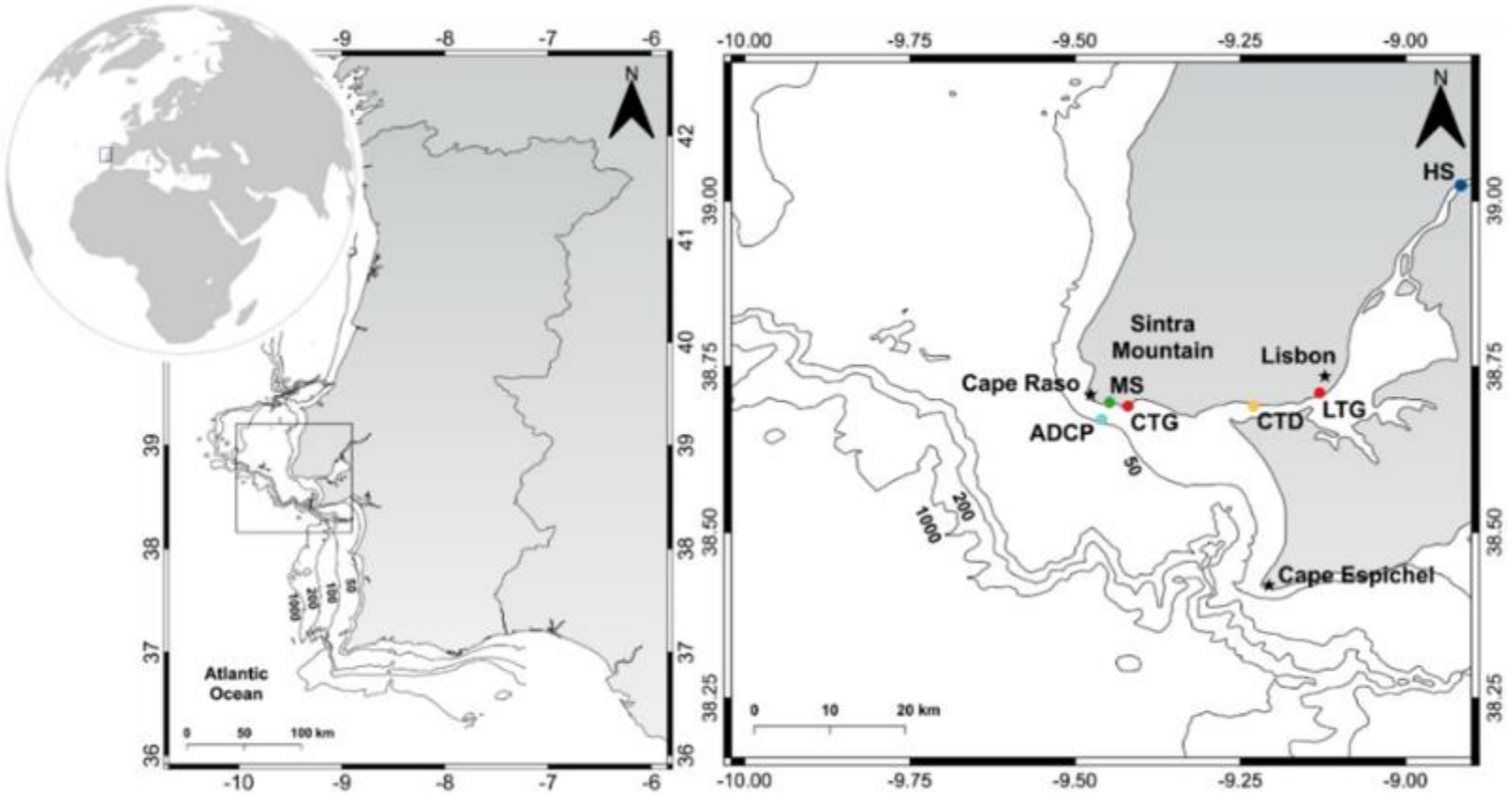
Statistical metrics used to compare two data sets x={x_1, x_2… x_N} and y={y_1, y_2…y_N} include the mean ($\bar{x}$), model mean error (bias), root mean squared error (RMSE) and scalar correlation (CORR):

- $\bar{x} = \frac{1}{N}\sum_{i=1}^{N} x_i$
- $bias = \frac{1}{N}\sum_{i=1}^{N}(x_i - y_i)$
- $RMSE = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - y_i)^2}$
- $CORR = \frac{1}{N-1}\sum_{i=1}^{N}\left(\frac{x_i-\bar{x}}{\sigma_x}\right)\left(\frac{y_i-\bar{y}}{\sigma_y}\right)$

where σ_x and σ_y are the standard deviation of x and y

HAZRUNOFF PROJECT
Funded by European Union Civil Protection and Humanitarian Aid

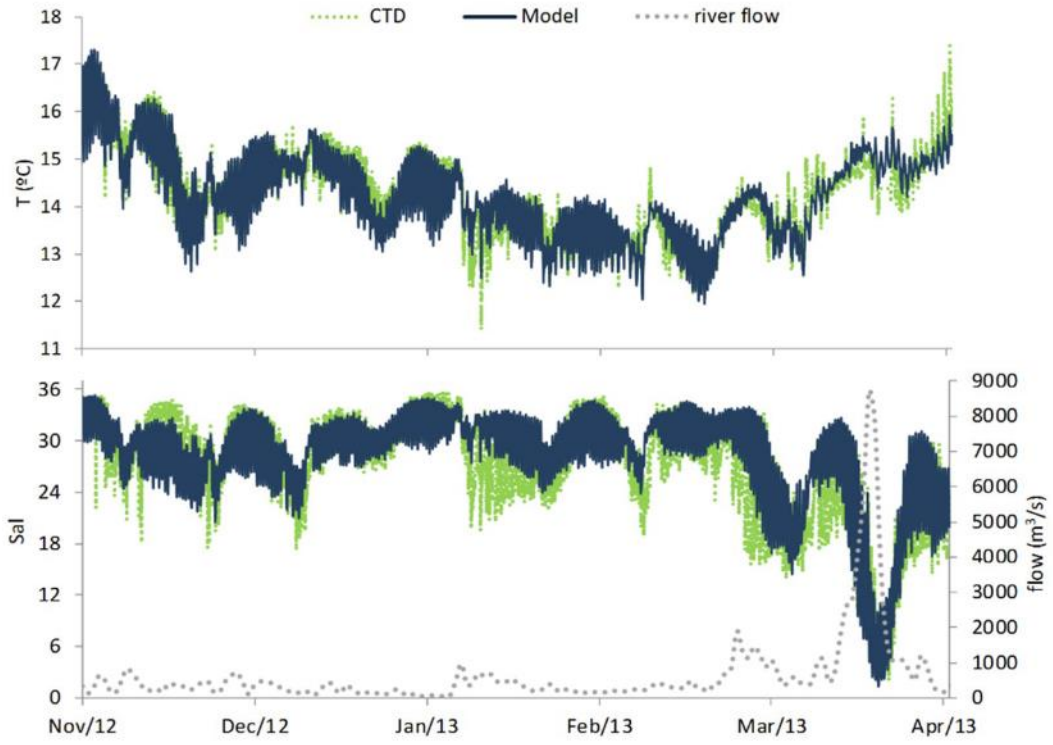
Case study - Tagus estuary

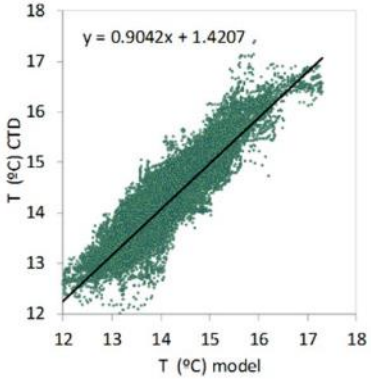


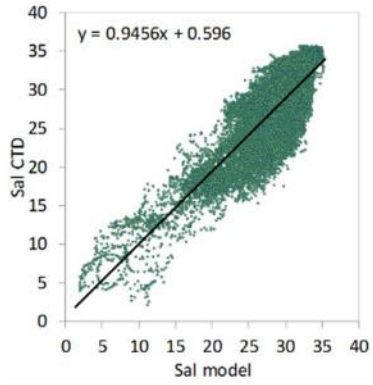
De Pablo et al (2019). *Water*, *11*(8), 1713.

HAZRUNOFF PROJECT
Funded by European Union Civil Protection and Humanitarian Aid

Model results vs time series







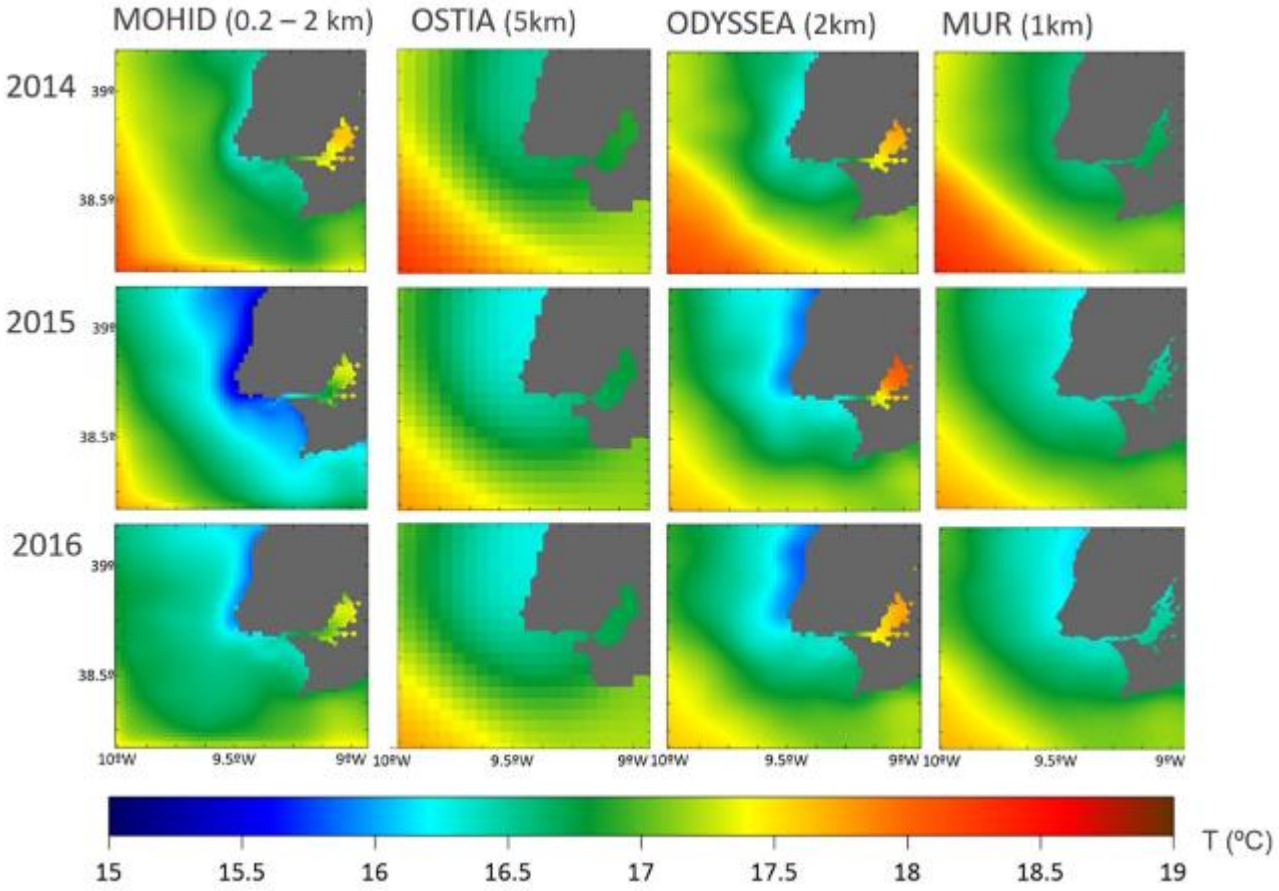
Parameter	Average (min-max) MOHID	Average (min-max) CTD	*n*	Pearson (*r*)	*BIAS*	*RMSE*
Temperature	14.2 (11.4–17.4)	14.3 (11.9–17.3)	21436	0.91	0.1	0.4
Salinity	28.0 (2.1–35.6)	27.4 (1.3–35.3)	21436	0.86	–0.9	2.9

De Pablo et al (2019). *Water*, *11*(8), 1713.

HAZRUNOFF PROJECT

Funded by European Union Civil Protection and Humanitarian Aid

Model results vs Satellite

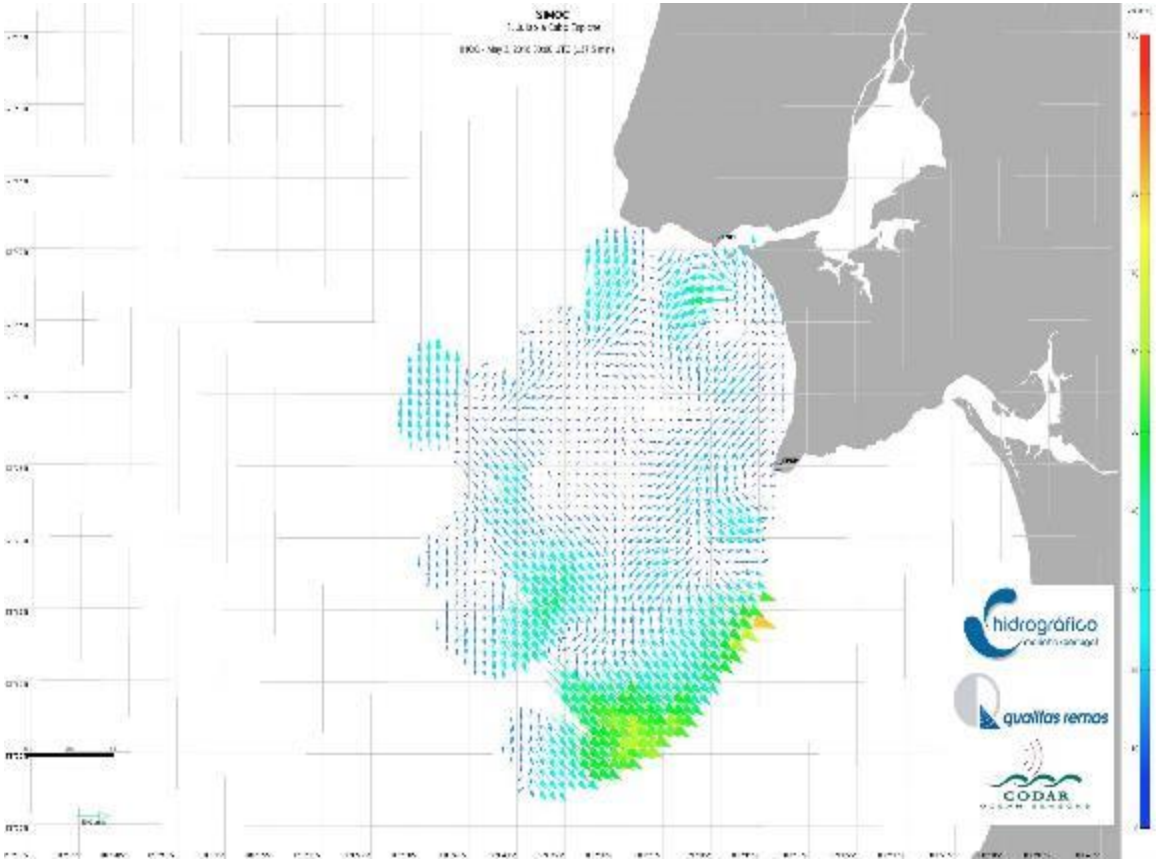


Year	Satellite	Average MOHID	Average L4 products	n (per day)	Pearson (r)	*BIAS*	*RMSE*
2014	OSTIA	17.11	17.18	355	0.937	−0.064	0.846
	ODYSSEA	17.11	17.17	2095	0.948	−0.059	0.773
	MUR	17.12	17.20	8356	0.934	−0.078	0.894
2015	OSTIA	16.50	16.91	255	0.919	−0.407	0.946
	ODYSSEA	16.51	16.83	2095	0.924	−0.320	0.889
	MUR	16.56	16.87	8356	0.912	−0.359	0.992
2016	OSTIA	16.74	16.19	355	0.930	−0.176	0.866
	ODYSSEA	16.71	16.83	2095	0.864	−0.127	0.978
	MUR	16.73	16.83	8356	0.916	−0.102	0.914

De Pablo et al (2019). *Water*, *11*(8), 1713.

HF Radar – Tagus mouth

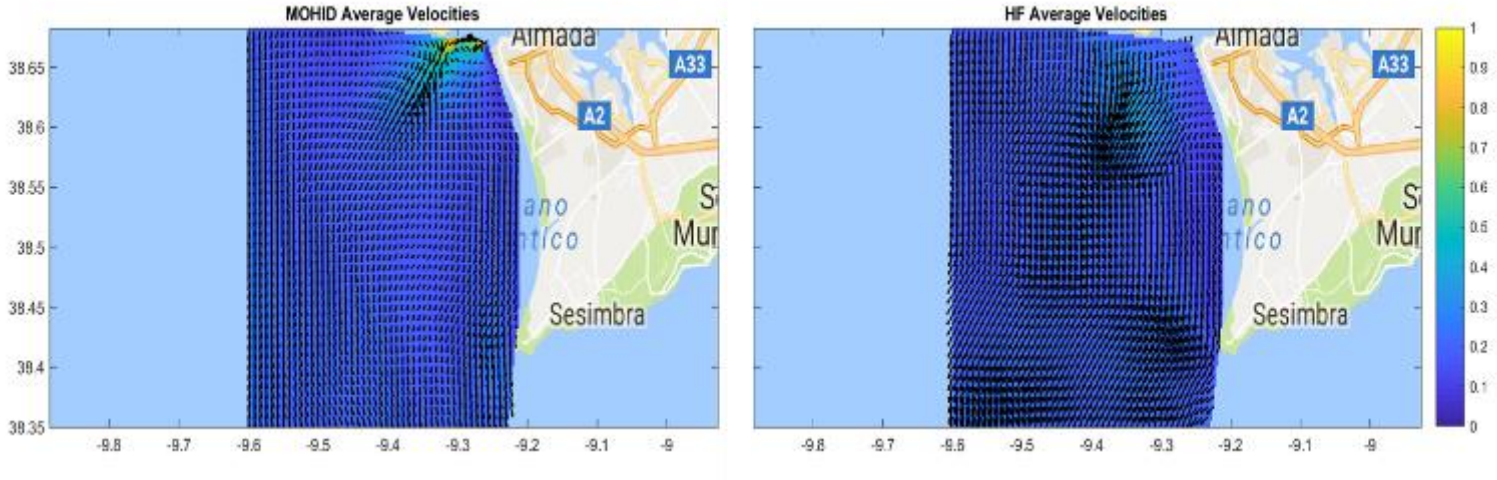
- Resource: Hidrografico
- Grid Spacing: ~1.4 Km
- Frequency: every hour
- Format .tuv (ASCII file)
- The output is already pre-processed by SeaDisplay 6.7.8
- Averaging Radius: 4.000 km
- DistanceAngularLimit: 20.0
- CurrentVelocityLimit: 100.0 cm/s



HF Data source:http://www.hidrografico.pt/simoc.php

Model vs HF Radar

- Average velocities over time (17 days)

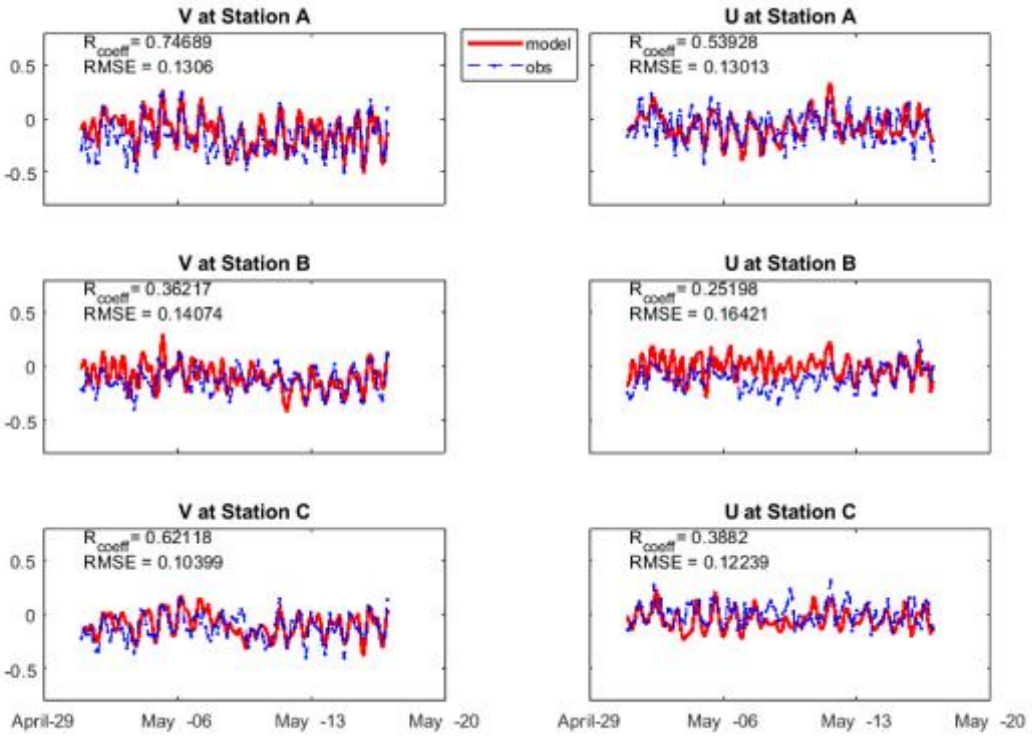


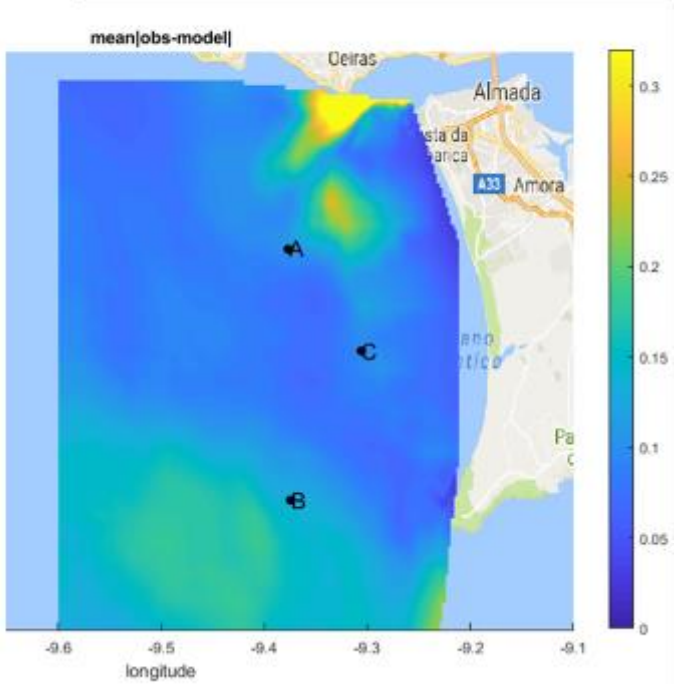
HAZRUNOFF PROJECT

Funded by European Union Civil Protection and Humanitarian Aid

Model vs HF Radar

- 17 days time series analysis (May 2018)



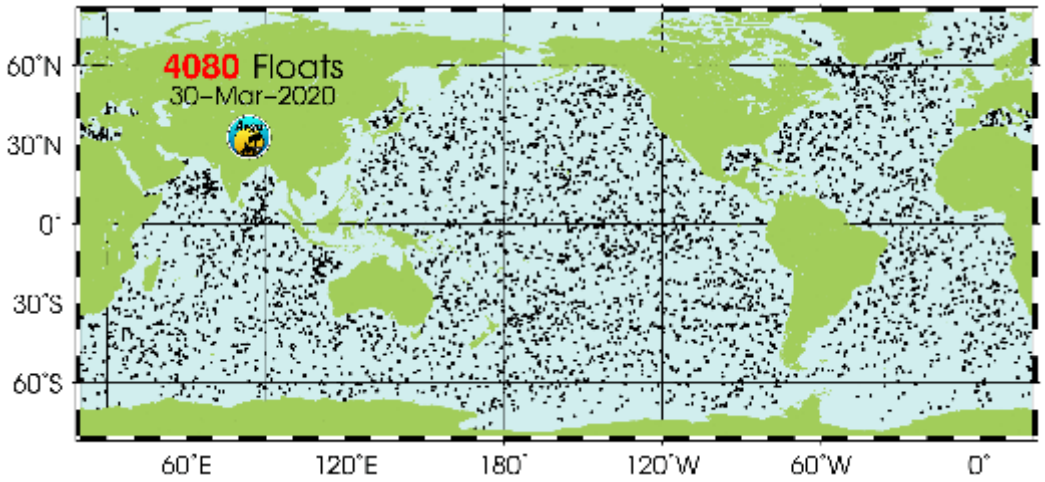


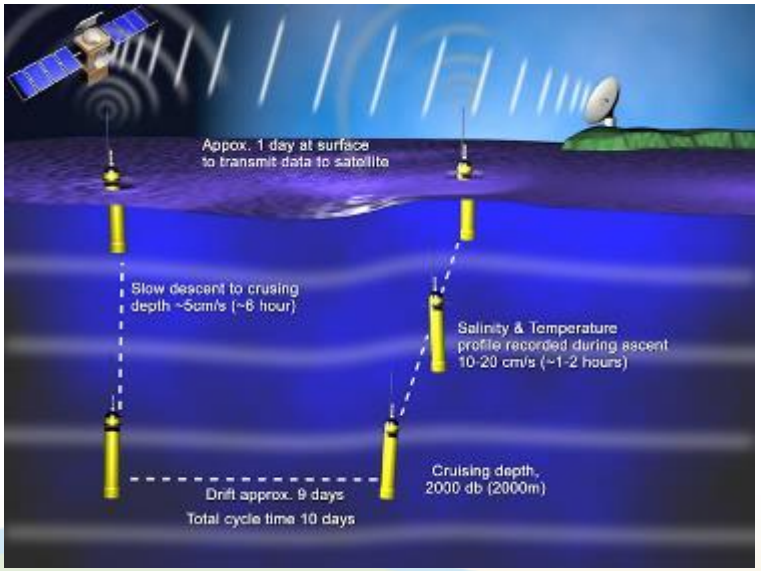
HAZRUNOFF PROJECT

Funded by
European Union
Civil Protection
and Humanitarian Aid

Argo floats

- Argo is a global array of about 4,000 free-drifting profiling floats that measures the temperature and salinity of the upper 2000 m of the ocean.





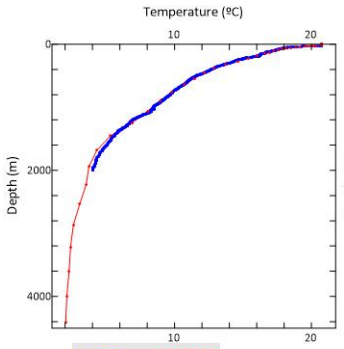
http://www.argo.ucsd.edu/

HAZRUNOFF PROJECT
Funded by European Union Civil Protection and Humanitarian Aid

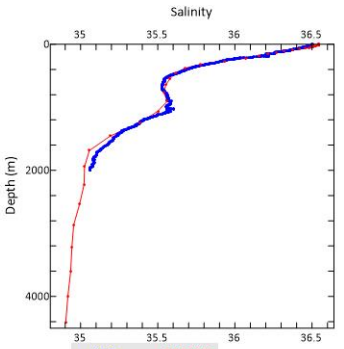
Model vs Argos

ARGO
MOHID

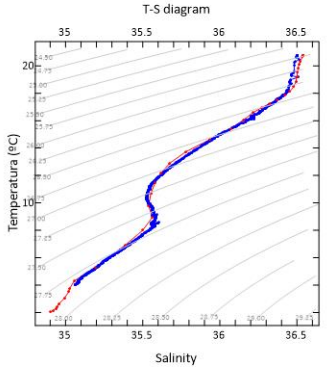
Time: 28-May-2019 11:20
Location: 33.16ºN , 25.238ºW
Id: 3901841 Cycle No. 104(A)

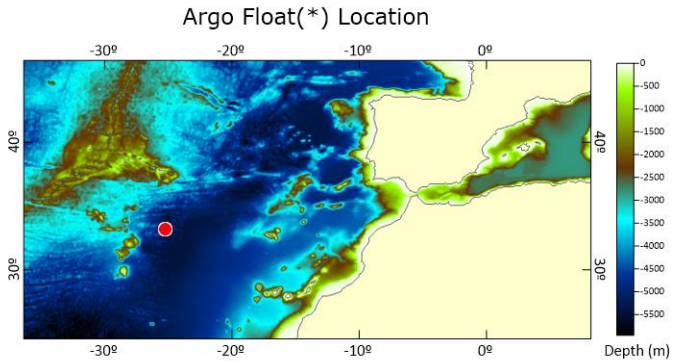


n=969	MOHID
Correlation:	0.999
Bias:	-0.002
RMSE:	0.199
Skewness:	-0.388



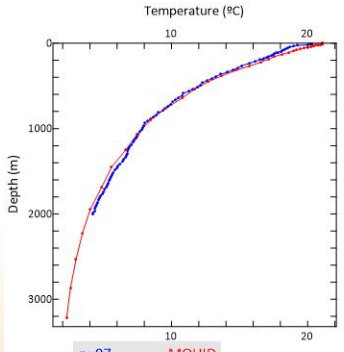
n=969	MOHID
Correlation:	0.998
Bias:	-0.012
RMSE:	0.034
Skewness:	-0.006



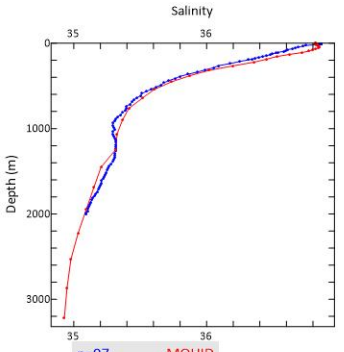


ARGO
MOHID

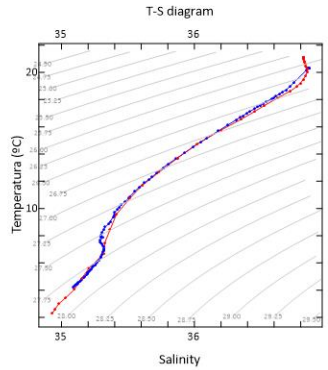
Time: 28-May-2019 5:41
Location: 27.522ºN , 18.374ºW
Id: 6901271 Cycle No. 29(R)

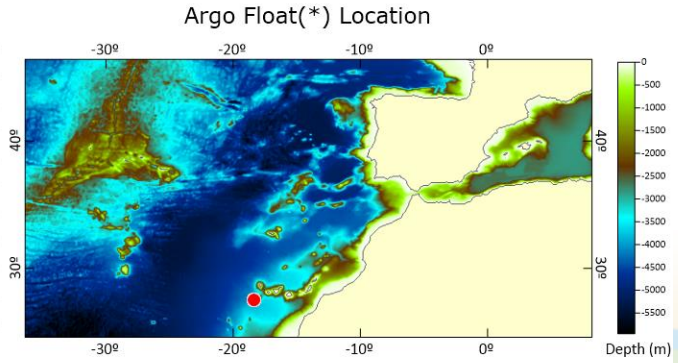


n=97	MOHID
Correlation:	1
Bias:	0.166
RMSE:	0.498
Skewness:	0.664



n=97	MOHID
Correlation:	0.996
Bias:	0.032
RMSE:	0.076
Skewness:	0.696



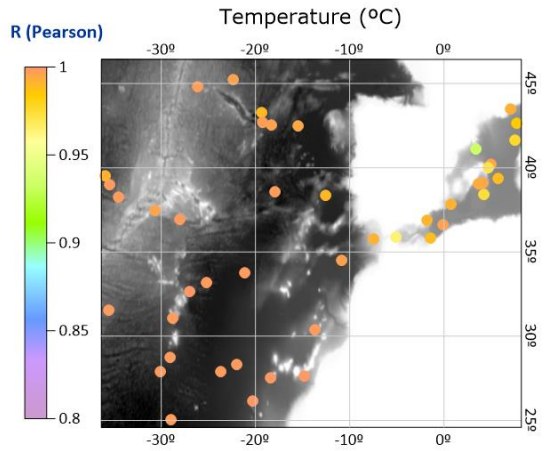


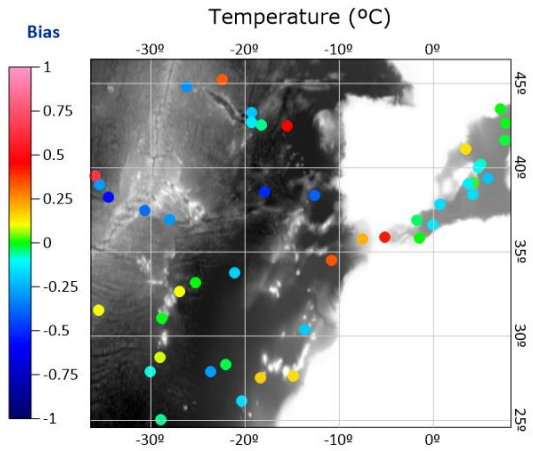
Model vs Argos

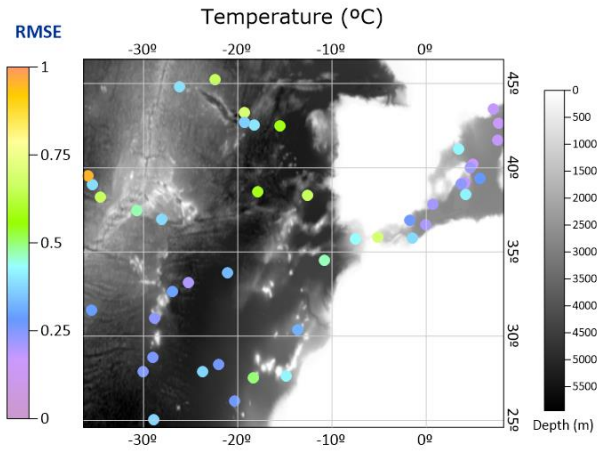
MOHID vs Argo floats

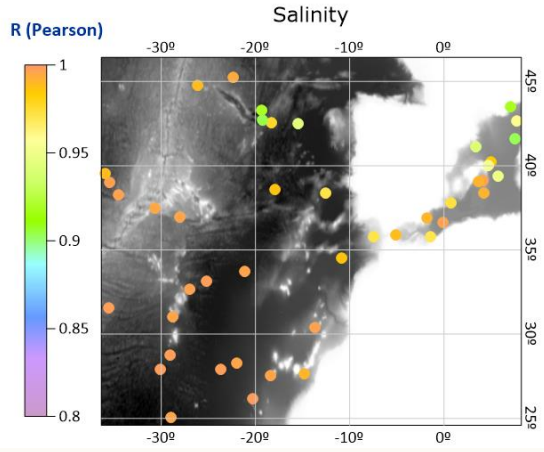
Total floats for Temperature: 44
Total floats for Salinity: 44

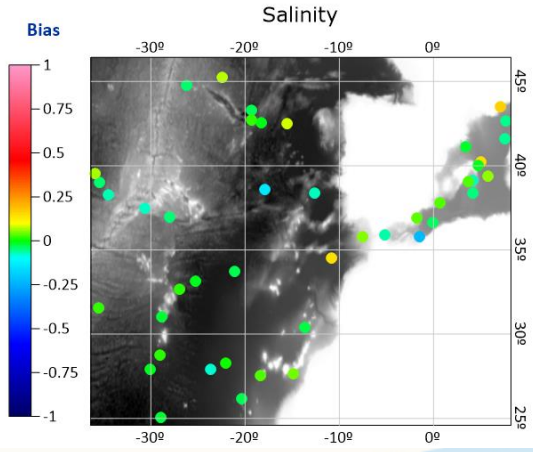
27-May-2019 to 31-May-2019

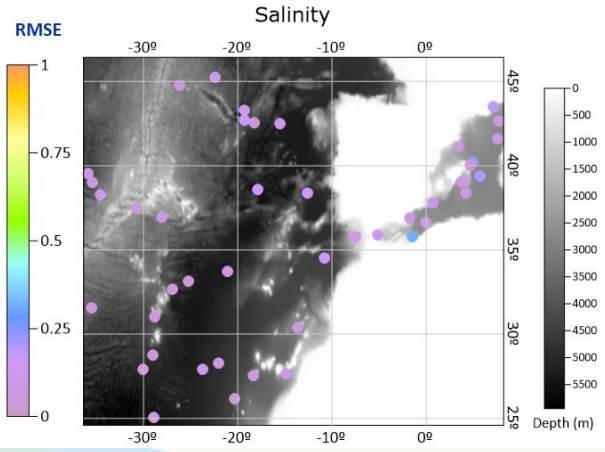












HAZRUNOFF PROJECT

Funded by European Union Civil Protection and Humanitarian Aid

Early warning pollution indicators and sentinels in monitoring stations

Assessment of sentinels and indicators

- During incident response it is important to have knowledge of the chemicals that have been released to aid forecasting and inform the risk assessment

- Likewise it is important to be able to interpret data to assess potential impact on health and the environment

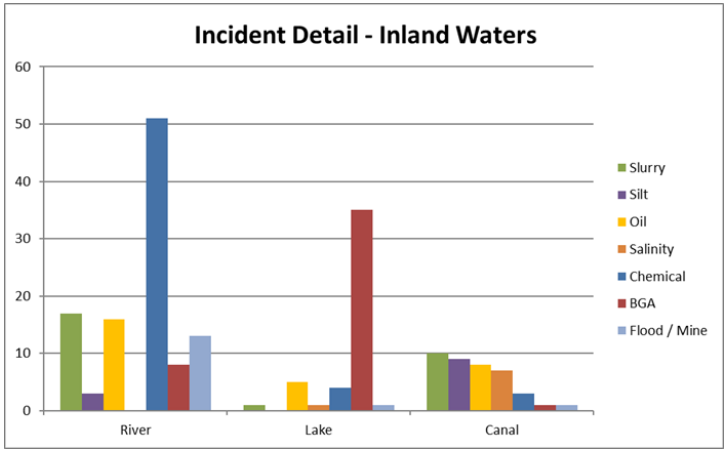
- Real-time (or near real-time) environmental monitoring offers: Rapid; clear characterization; Inform detailed monitoring

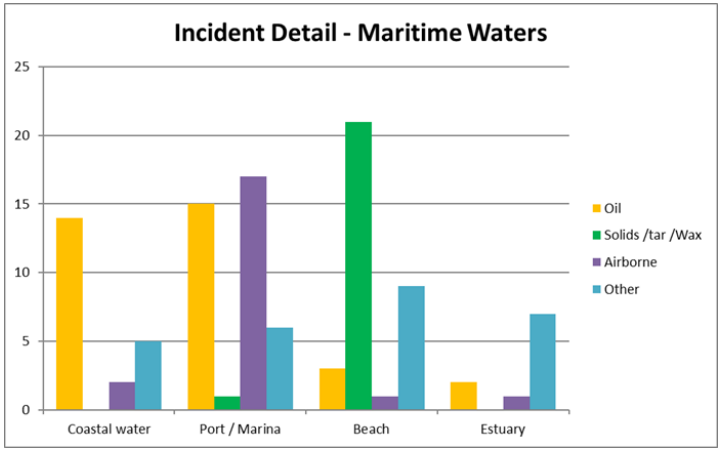
- To determine incident scale and impact it may be necessary to monitor the environment at multiple locations utilizing several types of monitoring equipment capable of monitoring a range of parameters

HAZRUNOFF PROJECT
Funded by European Union Civil Protection and Humanitarian Aid

Selection of proxies and indicators

- Reviewed incidents for UK and Wales inland, estuarine and coastal waters (2011 - 2018) and categorised by:
  - pollutant (type and substance),
  - location (river, lake, canal, port, marina, beach and coastal),
  - principal target of impact (human, environment),
  - scale (small, medium, large by estimate of release volume).





HAZRUNOFF PROJECT
Funded by European Union Civil Protection and Humanitarian Aid

Identified key parameters

Pollutant incident type	Pollutant*	Indicators/proxies*
Slurry	Ammonia, TOC	Ammonia, turbidity
Oil Spill	TPH, VOC	BTEX (Benzene)
Chemical	Various including pesticides	pH, PAH, conductivity, DO
BGA	Toxin	Cells, DO
Palm Oil / Wax	VFA, TPH	DO, BTEX, pH
Flooding	TOC, turbidity, salinity, metals	pH, DO, turbidity, conductivity

*** (TOC – Total Organic Carbon, BTEX – Benzene, Toluene, Ethylbenzene and Xylene, DO - Dissolved Oxygen, TPH – Total Petroleum Hydrocarbons, VOC – Volatile Organic Compounds, VFA – Volatile Fatty Acids, PAH – Polyaromatic hydrocarbons.)**

HAZRUNOFF PROJECT

Funded by European Union Civil Protection and Humanitarian Aid

Water monitoring

- Most frequently occurring substances reported are:
  - slurry/sewage, oil hydrocarbons, blue-green algae, other organic chemicals (largely pesticides) and solid tar/wax

- Potential proxy/indicator substances for these incidents were identified as ammonia, turbidity, BTEX, pH, PAH, conductivity and DO

- The market currently supports real-time monitoring of all the proxy/indicator substances. Monitoring and identification can be achieved through optical, fluorescence, photometric, non-dispersive infrared sensor, mid infrared, electrochemical, microfluidic lab-on-chip and ion selective electrode methods

HAZRUNOFF PROJECT
Funded by European Union Civil Protection and Humanitarian Aid

Water quality standards and guidelines

		BTEX	PAH	Conductivity	pH	Ammonia	Total Pesticides
		µg/l	µg/l	µS/cm at 20°C		mg/l	µg/l
EU Drinking water standard		1*	0.1				0.5
WHO drinking water guideline		10*					
EU Environmental Quality Standards AAs	Inland surface waters	10*					
	Other surface waters	8*					
EU Environmental Quality Standards MACs	Inland surface waters	50*					
	Other surface waters	50*					
UK Private Water Supply Regulations (indicators)	Max	1*		2500	9.5	0.5*	
	Min				6.5		

HAZRUNOFF PROJECT
Funded by European Union Civil Protection and Humanitarian Aid

Obrigada

Thank you

Questions?

Lígia Pinto
ligia.pinto@tecnico.ulisboa.pt

TÉCNICO LISBOA

HAZRUNOFF PROJECT

Funded by
European Union
Civil Protection
and Humanitarian Aid