

# Observatorio Oceánico da Marxe Ibérica (RAIA)

## Oceanic observatory for the Iberian shelf (RAIA)

Interreg IV-A (2009-2011-2013)

Galicia – North of Portugal

<http://www.marnaraia.com>

COMO ESTÁ O TEU MAR?



PROGRAMA  
COOPERAÇÃO TRANSFRONTEIRIZA  
ESPAÑA - PORTUGAL  
COOPERAÇÃO TRANSFRONTEIRIZA  
2007 - 2013



# Objectives

- Improve the oceanic observation at the Western Iberian Peninsula in terms of meteorological, oceanographical and water quality data. To that end, 5 new buoys will be located at the near-coast.
- Improve operational forecasting models; hydrodynamic and biogeochemical.
- Build up a new operational server [www.marnaraia.com](http://www.marnaraia.com) where all the information will be served to the community.
- Prepare specific tools to end-users; harbors, renewable energies, fishermen, tourism, etc



# 13 initial Partners

## • Portugal

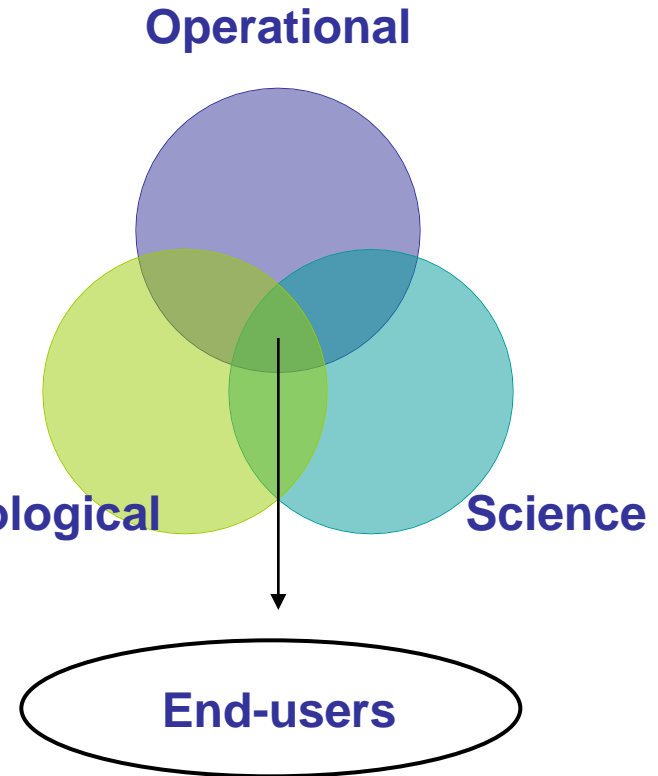
- Instituto Hidrográfico (IH)
- Universidade de Porto (UP); INEGI, INESCP, FEUP, FCUP
- Universidade de Aveiro (UA)
- CIIMAR (Porto)

## • Galicia

- Instituto Español de Oceanografía (IEO)
- Universidade de Vigo (UVigo)
- Intecmar
- CETMAR
- Instituto de Investigaciones Mariñas (IIM-CSIC)
- Consellería de Medio Ambiente. MeteoGalicia.  
(Lead partner)

### Others coming...

- Puertos del Estado
- CESGA
- Universities (Algarve, Univ. Coruña, Univ. Santiago)



# Oceanic Observatory NW Iberian Peninsula RAIA

It also incorporate on the same platform other sources of data:

- HF Radar from Marina Mercante (Fisterra-Silleiro)
- HF Radar from UVigo (Ría de Vigo)
- Soon HF Radar from Intecmar.
- Tide Gauges from IH and Puertos del Estado
- Other buoys from Xunta de Galicia, IH and Puertos.
- River outflows (real time data and forecast)



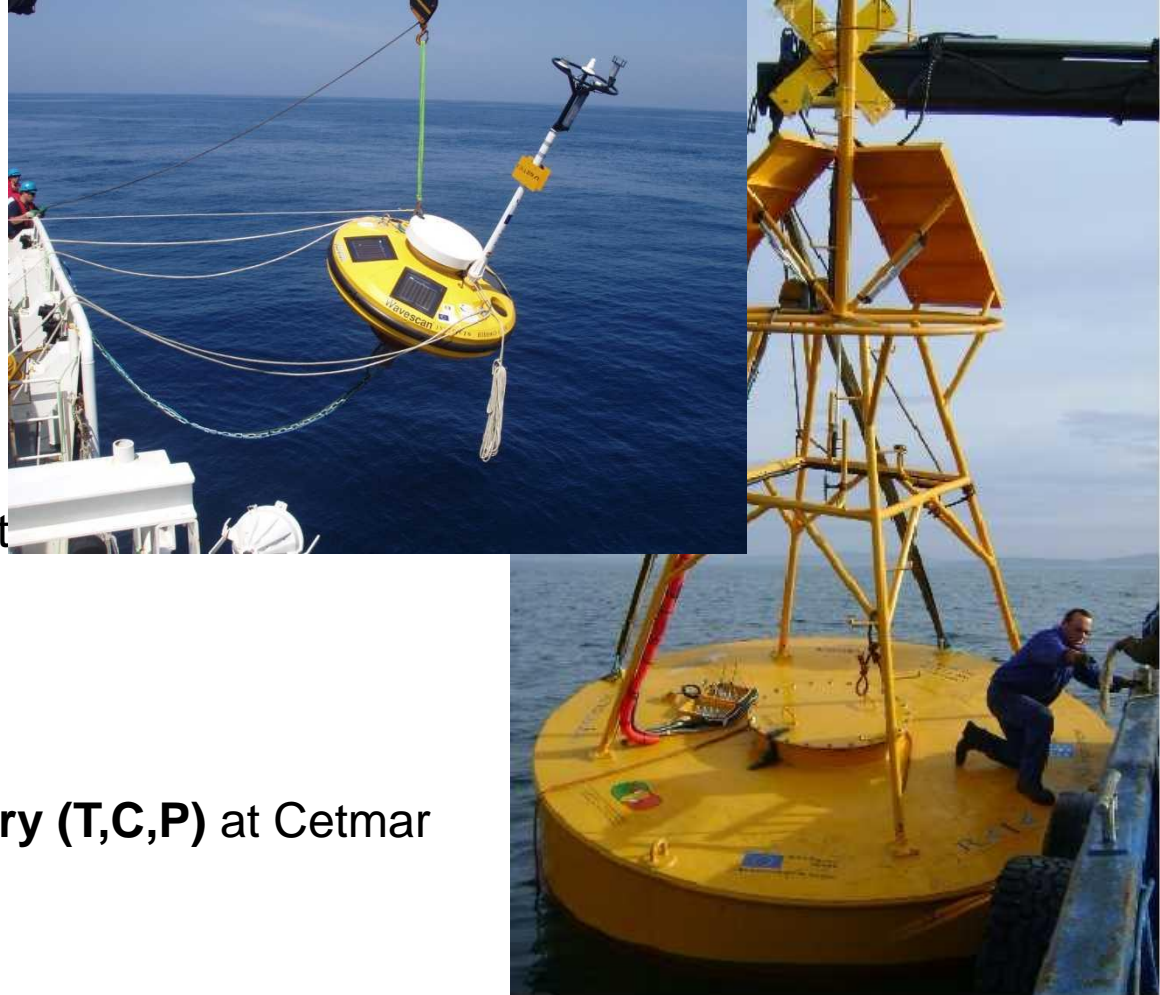


## New oceanic infrastructure

New buoys at Ons, A Guarda, Silleiro and Leixoes off-shore (Alfredo M.- Ramalho).

All these buoys have similar instruments; wind, temperature, humidity, solar radiation, sea temperature and salinity at different levels, currents, as well as oxygen and chlorophyll concentrations. Same validation methods and data quality.

**New Calibration Laboratory (T,C,P) at Cetmar**



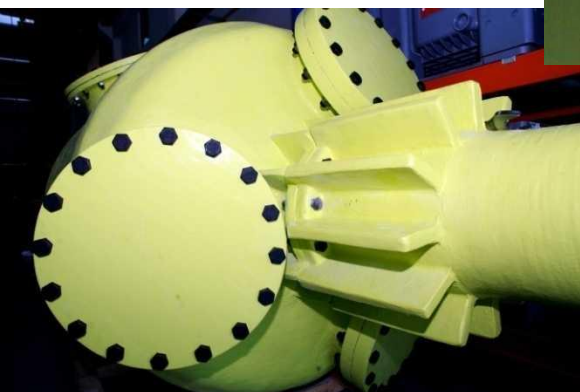
PROGRAMA  
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 **Raia**  
[www.marnaraia.com](http://www.marnaraia.com)



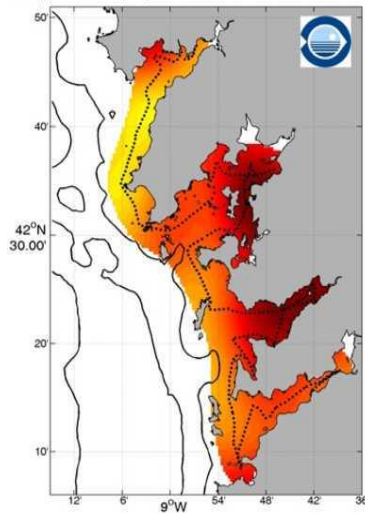
# Own designs...

- Buoys at A Guarda and Ons designed and built at Galicia. Made to fit...
- Buoy at Leixoes (Porto) for renewable energy measurements (eolic off-shore).
- Open source Datalogger Leviathan A1.
- Waves height sensor.

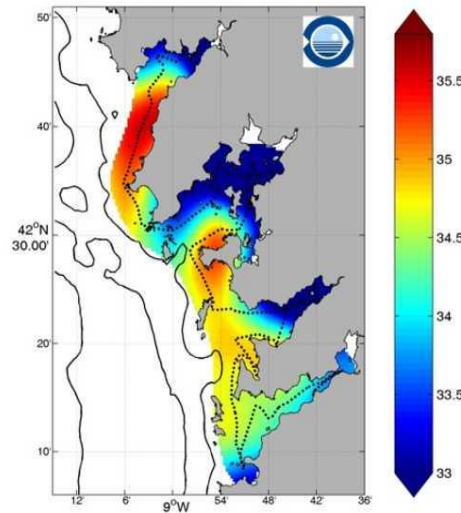


# Termosalinómetro from Navaz

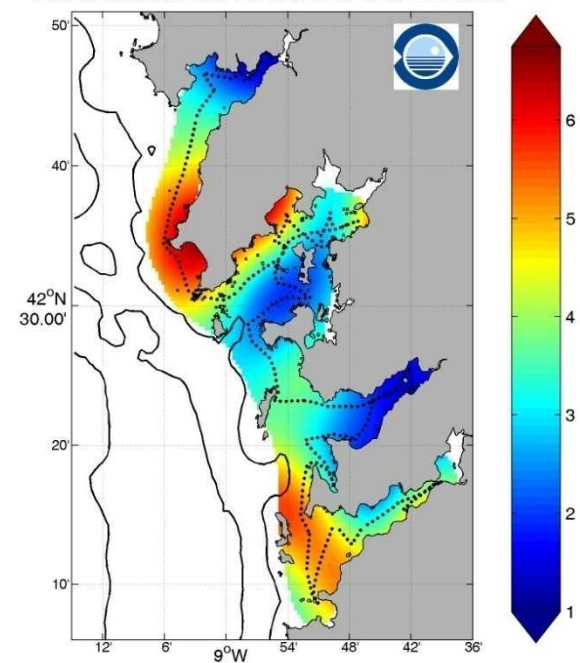
Temperatura (°C) del 31/05/2010 a 01/06/2010



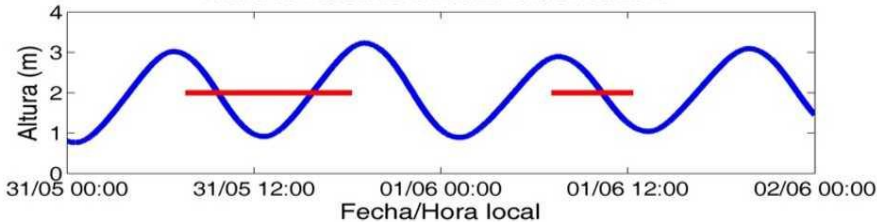
Salinidad del 31/05/2010 a 01/06/2010



Fluorescencia del 16/02/2009 a 17/02/2009

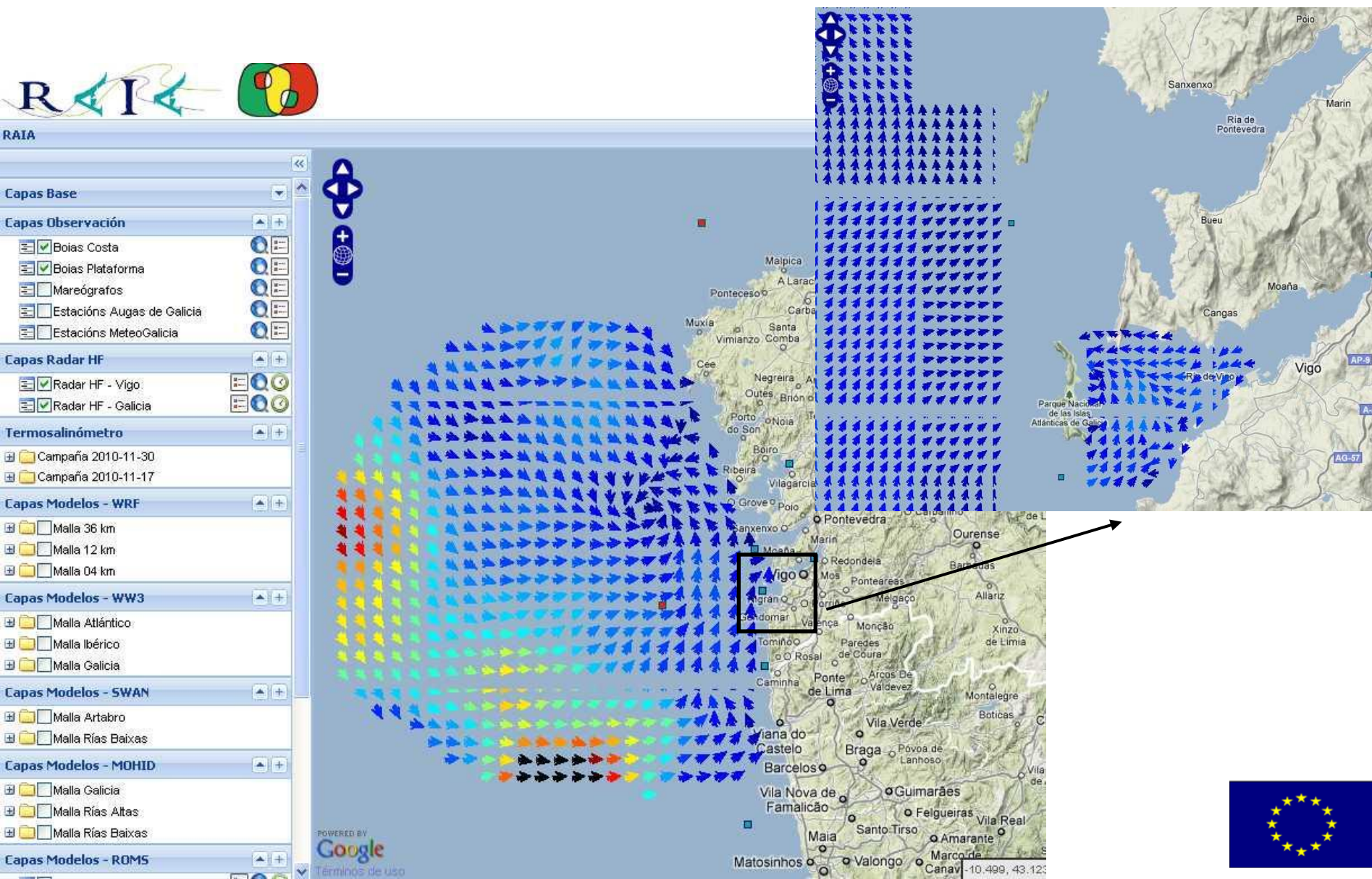


Altura de marea del 31/05/2010 a 01/06/2010





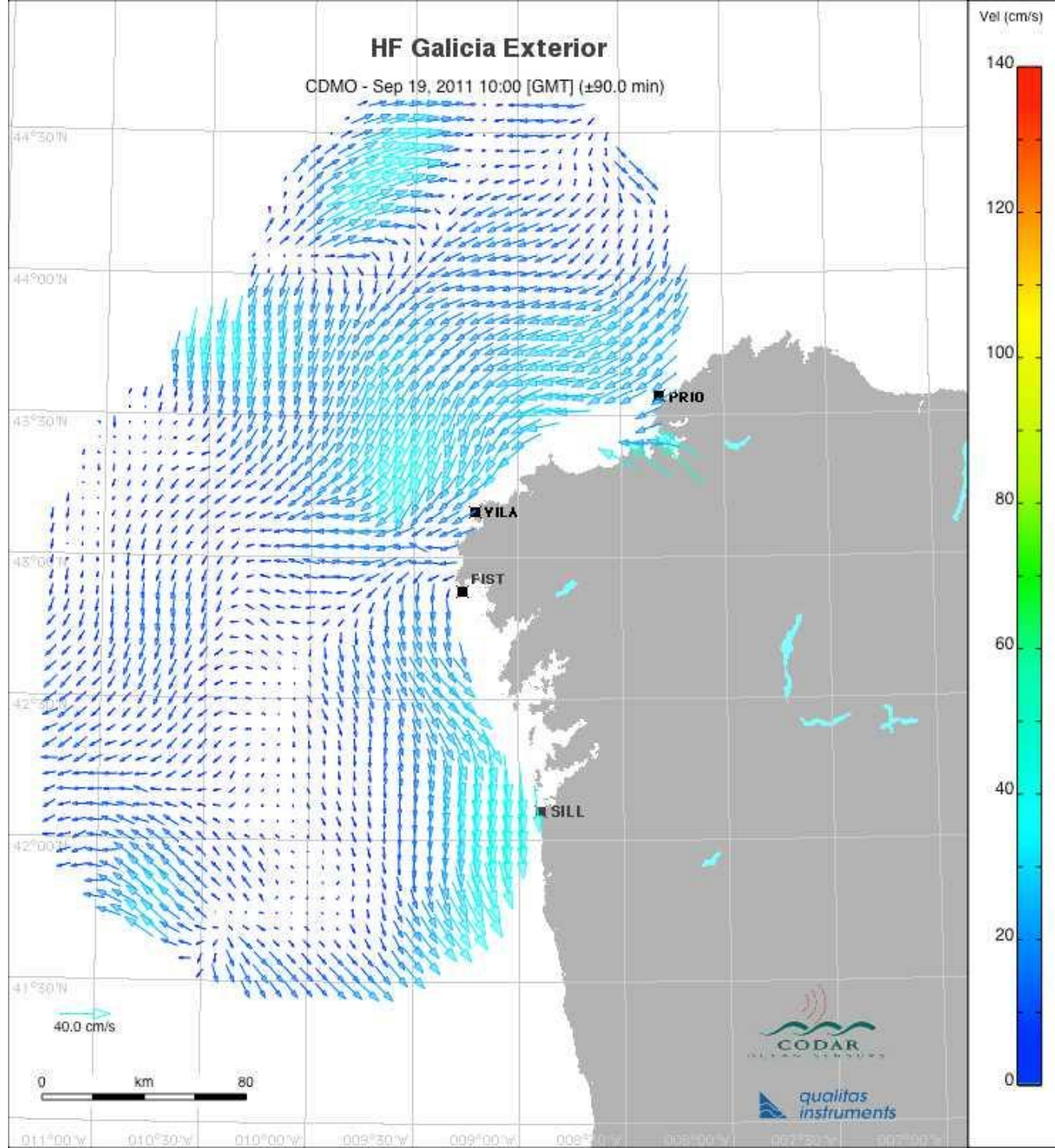
# HF Radar





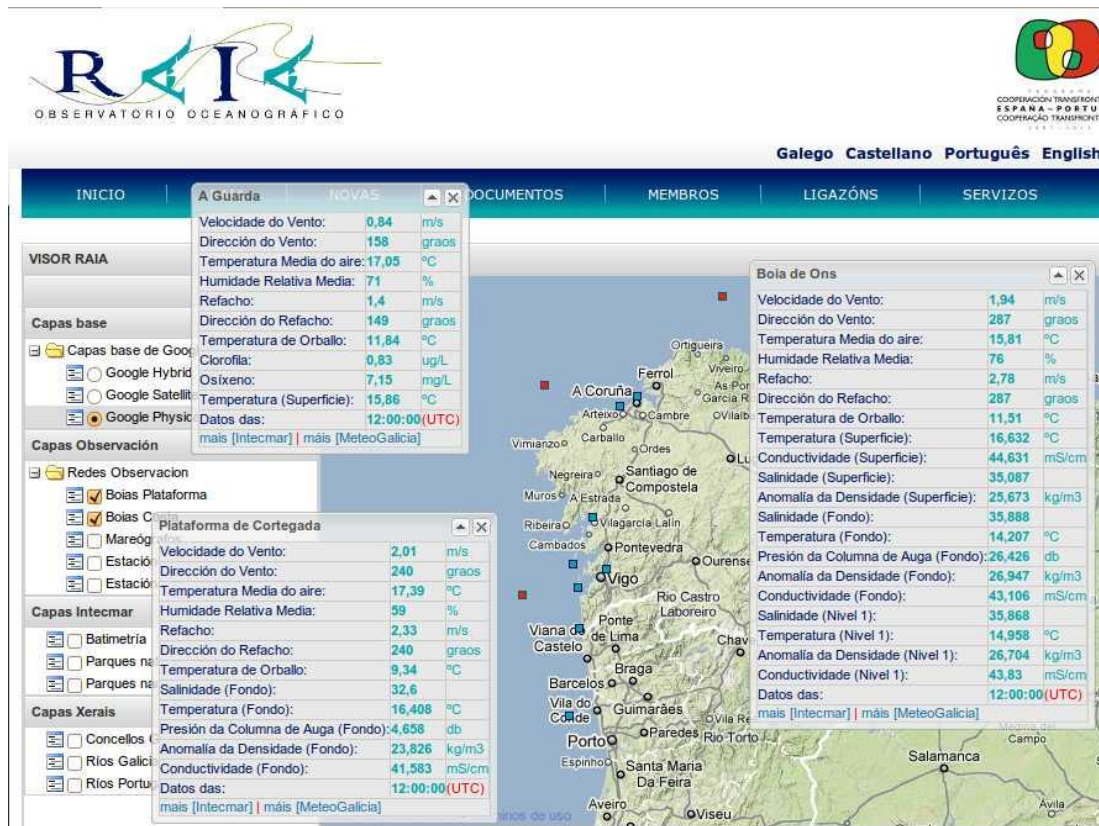
# HF Galicia Exterior

CDMO - Sep 19, 2011 10:00 [GMT] ( $\pm 90.0$  min)



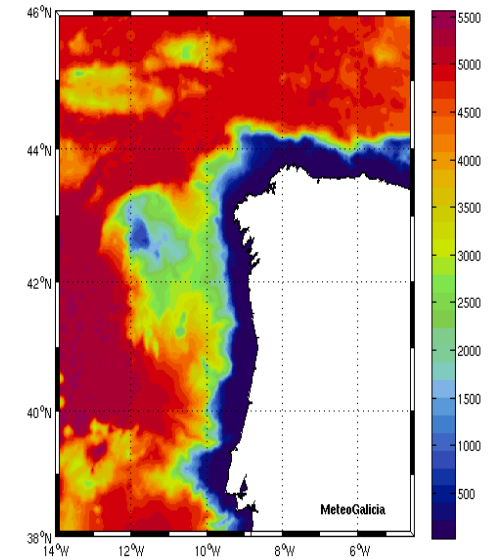
# Data availability

- All data available through RAlA web site ([www.marnaraia.com](http://www.marnaraia.com)) in real time.



# Operational Oceanographic Models

- Operational models have been developed for the same area by IEO, MeteoGalicia, CIIMAR (Porto), Aveiro and IH.
- Forecasting 72 hours every day; Currents, temperature, salinity and waves.
- Redundancy. Different forcings (atmospheric, river outflows) and boundary conditions.
- Downscaling to harbors, estuaries, end-user applications etc.

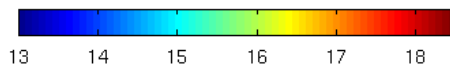
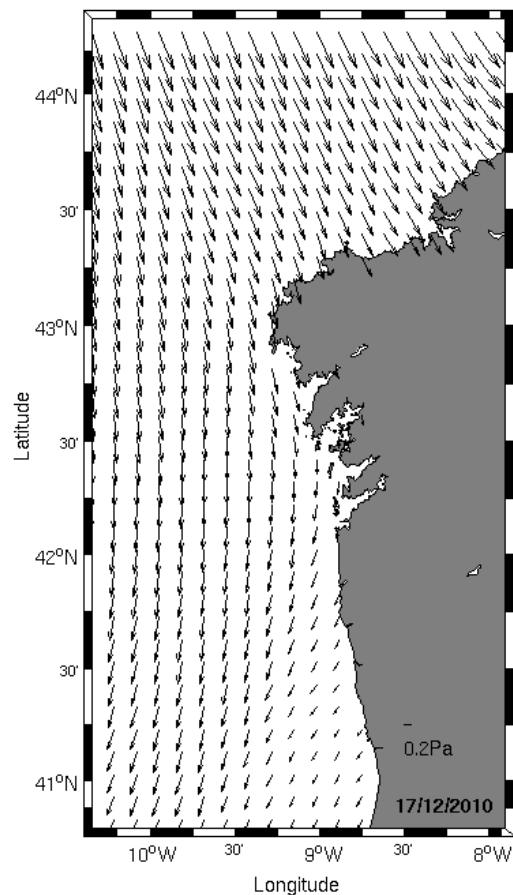




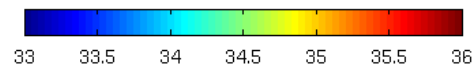
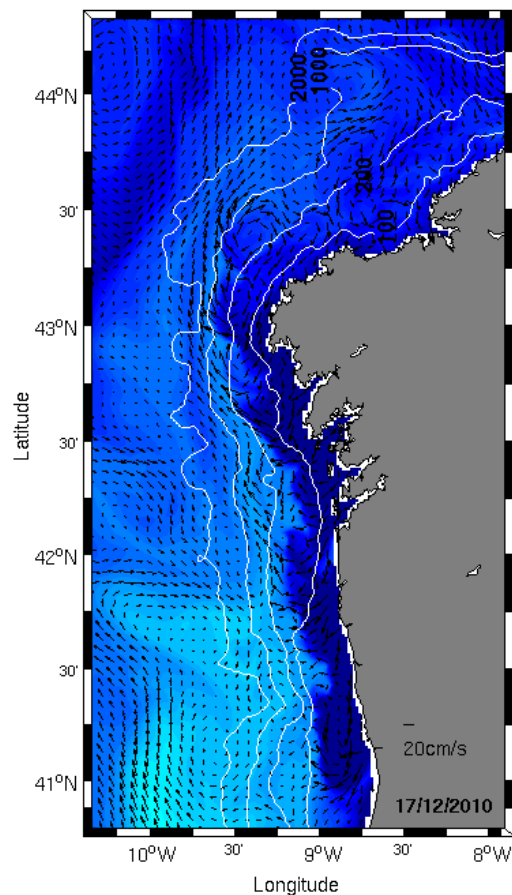
# Output model ROMS



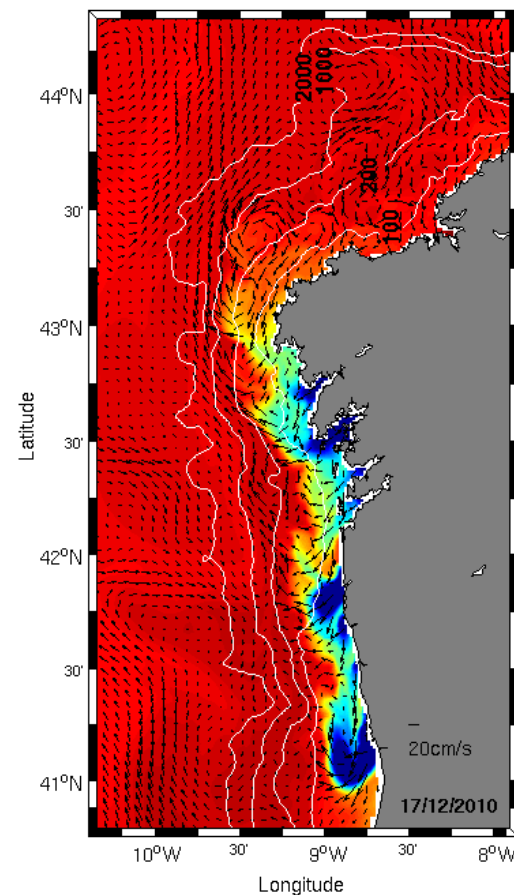
Mean Wind Stress



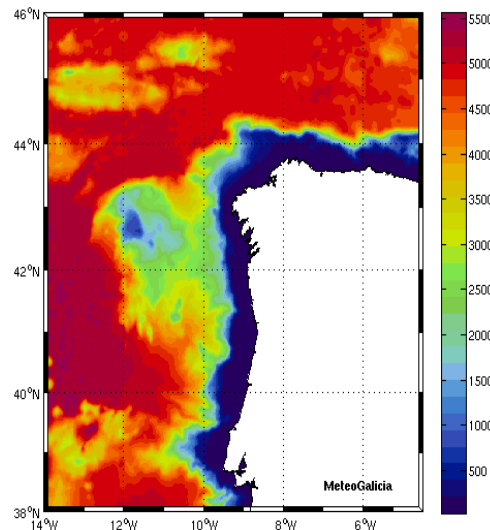
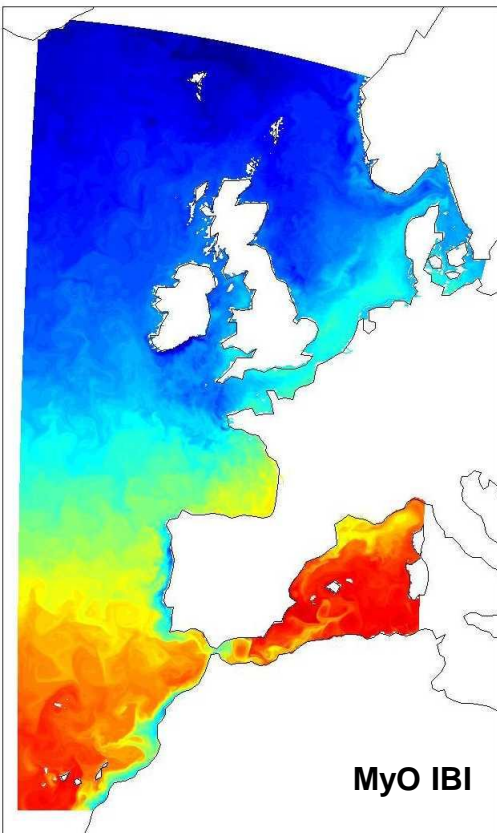
Mean Currents & Temperature - Surface



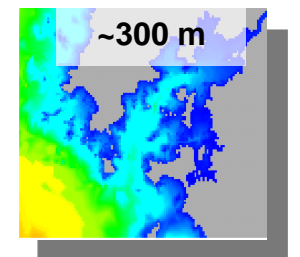
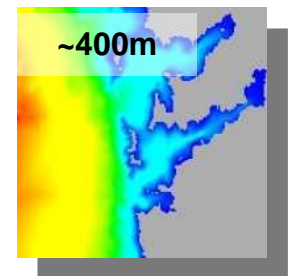
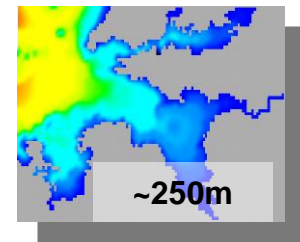
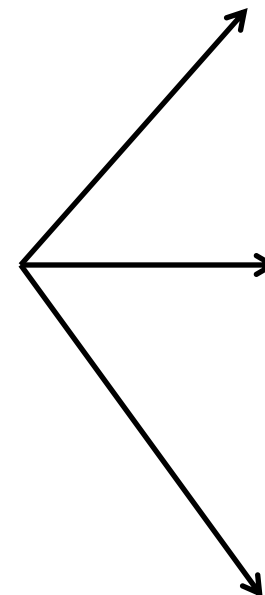
Mean Currents & Salinity - Surface



# Operational models



- $Dx = 0.02^\circ$
- $DT = 60\text{ s}$
- $Nx = 475, Ny = 401, Nz = 41$
- Ocean forcing - Mercator  $0.05^\circ$  (soon  $1/36^\circ$ )
- Meteo Forcing - WRF 12km
- Tidal - OSU Topex/Poseidon
- River - SWAT Flow forecast  
(Minho, Ulla, Tambre, Lerez, Umia, Verdugo, Douro)

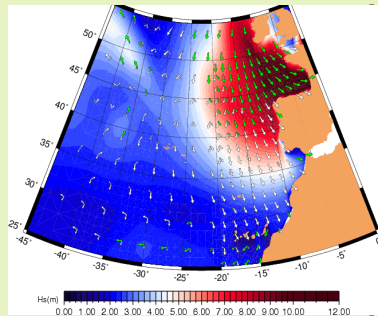


- Meteo Forcing - WRF 4km or 1,3km

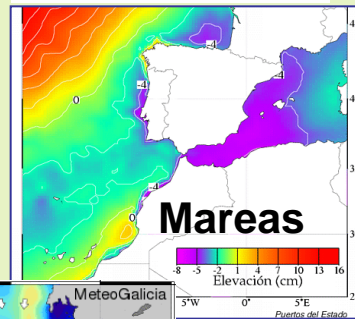
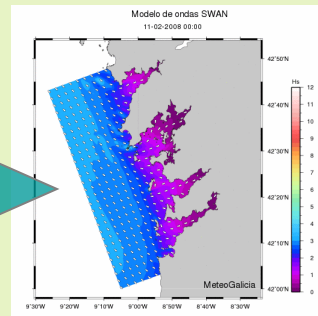


# Forecasting models: Nesting

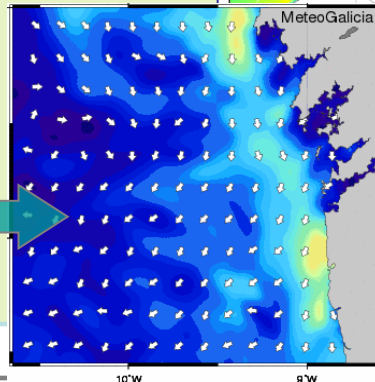
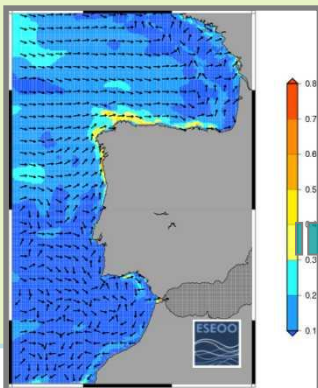
## Regional scale



Waves

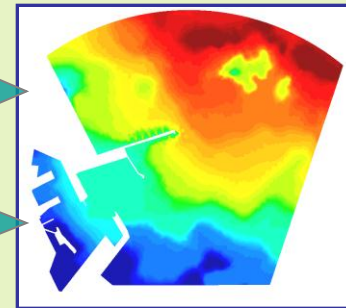


Currents

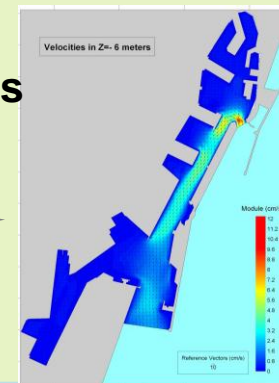


## Local scales Harbors

Waves



Currents



Water quality

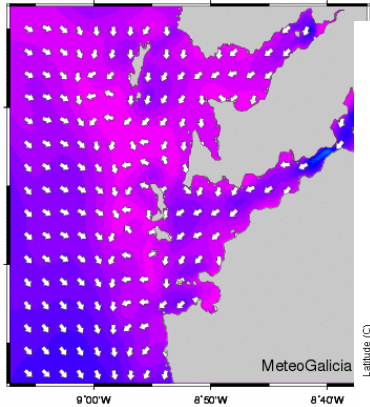
Coruña  
Vigo  
Viana  
Leixoes





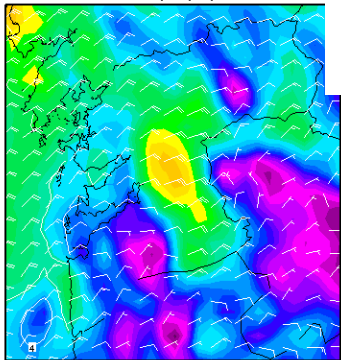
# Nesting - Vigo

Vigo/Pontevedra  
(MeteoGalicia)  
Dx=500m



Galicia(MeteoGalicia)  
Dx=4000m

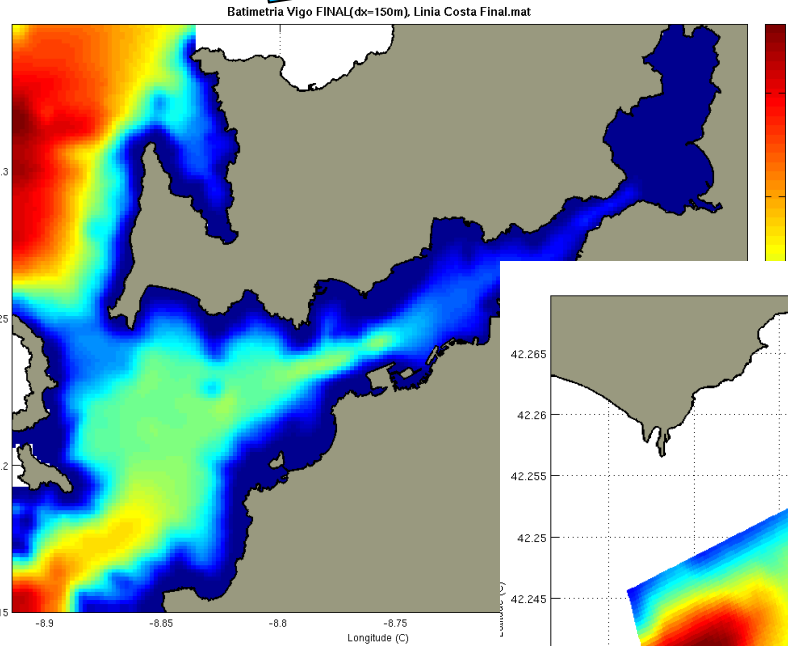
wrf\_arw - Vento a 10m (km/h) 2011-04-1



MeteoGalicia - Consellería de Medio Ambiente - Xunta de Galicia

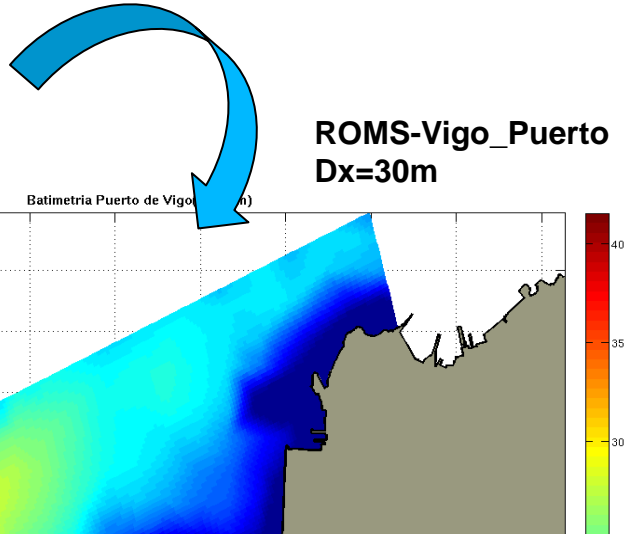


Nesting factor: 500/150 (aprox.= 3,3)

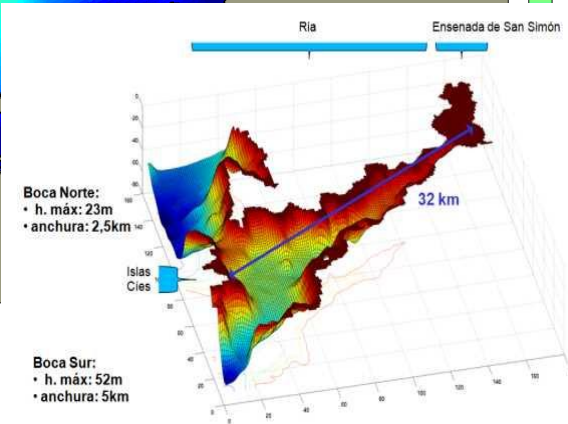


ROMS-Vigo\_Ria  
Dx=150 m

Nesting factor: 150/30  
(aprox.= 5)



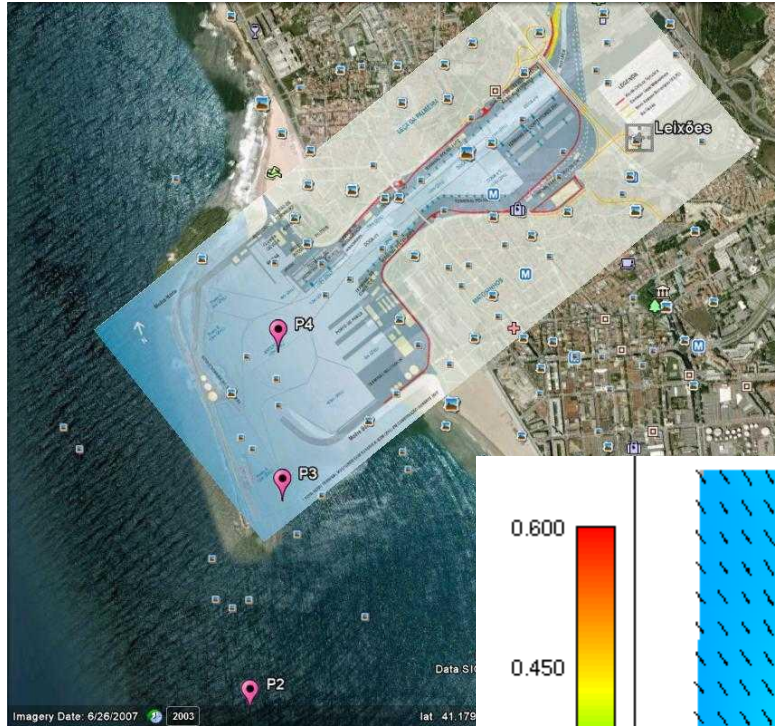
ROMS-Vigo\_Puerto  
Dx=30m



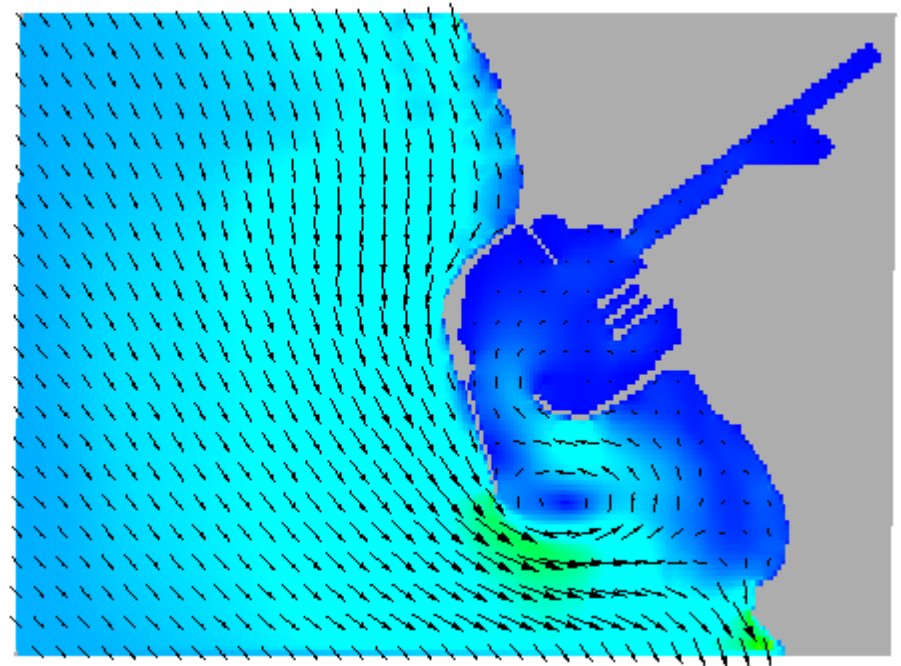
Profundidad media: 26m en su zona intermedia

- Séries temporais de nos pontos P1 a P4 (apoio à navegação)
- Mapas de Correntes
- Inclusão de outros parâmetros

Porto de Leixões



0.600  
0.450  
0.300  
0.150  
0.000

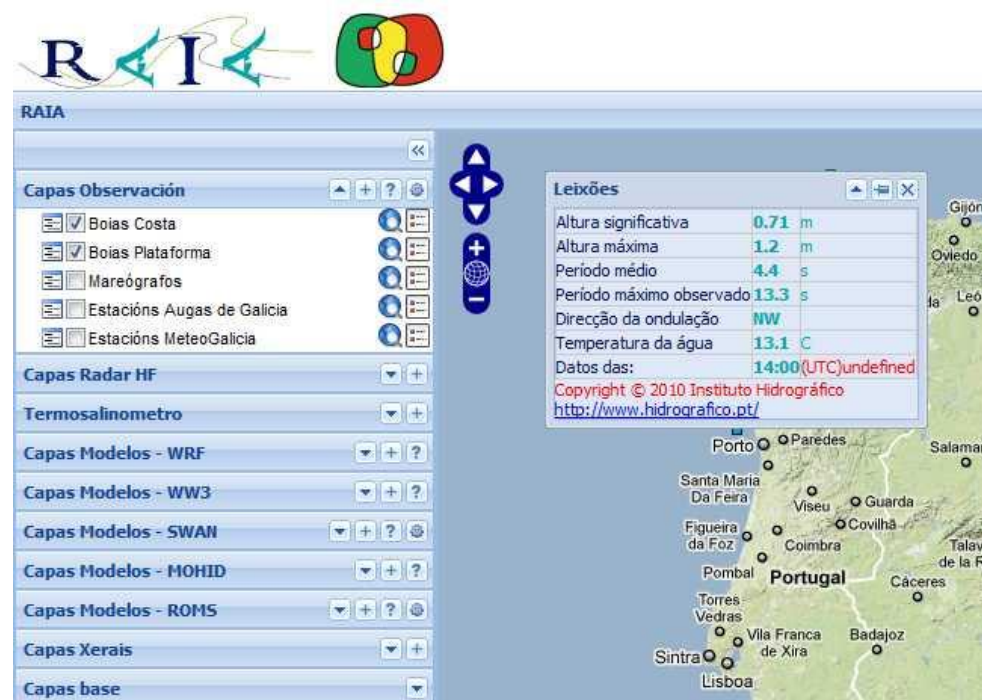


www.marnaraia.com



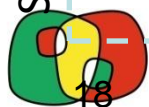
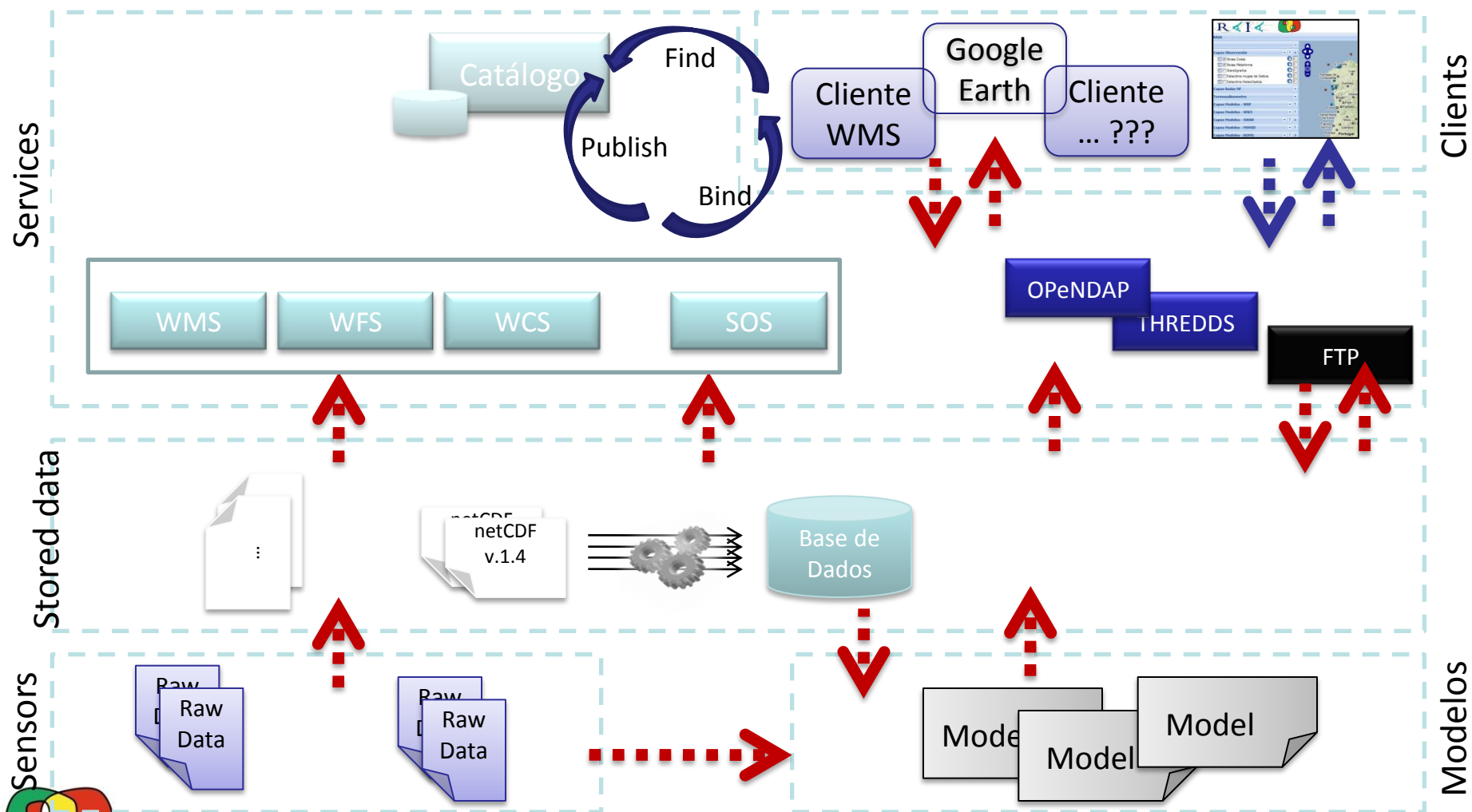
# Data dissemination

- Both, observations and model forecasts, available through the web site. Real time data from buoys are shown every 10 min. Same criteria for data acquisition.
- Model and observational data are supplied on other operational useful formats through web based access and THREDDS server.





# Data dissemination



# ARCOPOL

- Monitoring, Observations, Predictions & Communications. A Practical Guide
- **Activity 4**

[www.arcopol.eu](http://www.arcopol.eu)

Documentation (Activity 4)



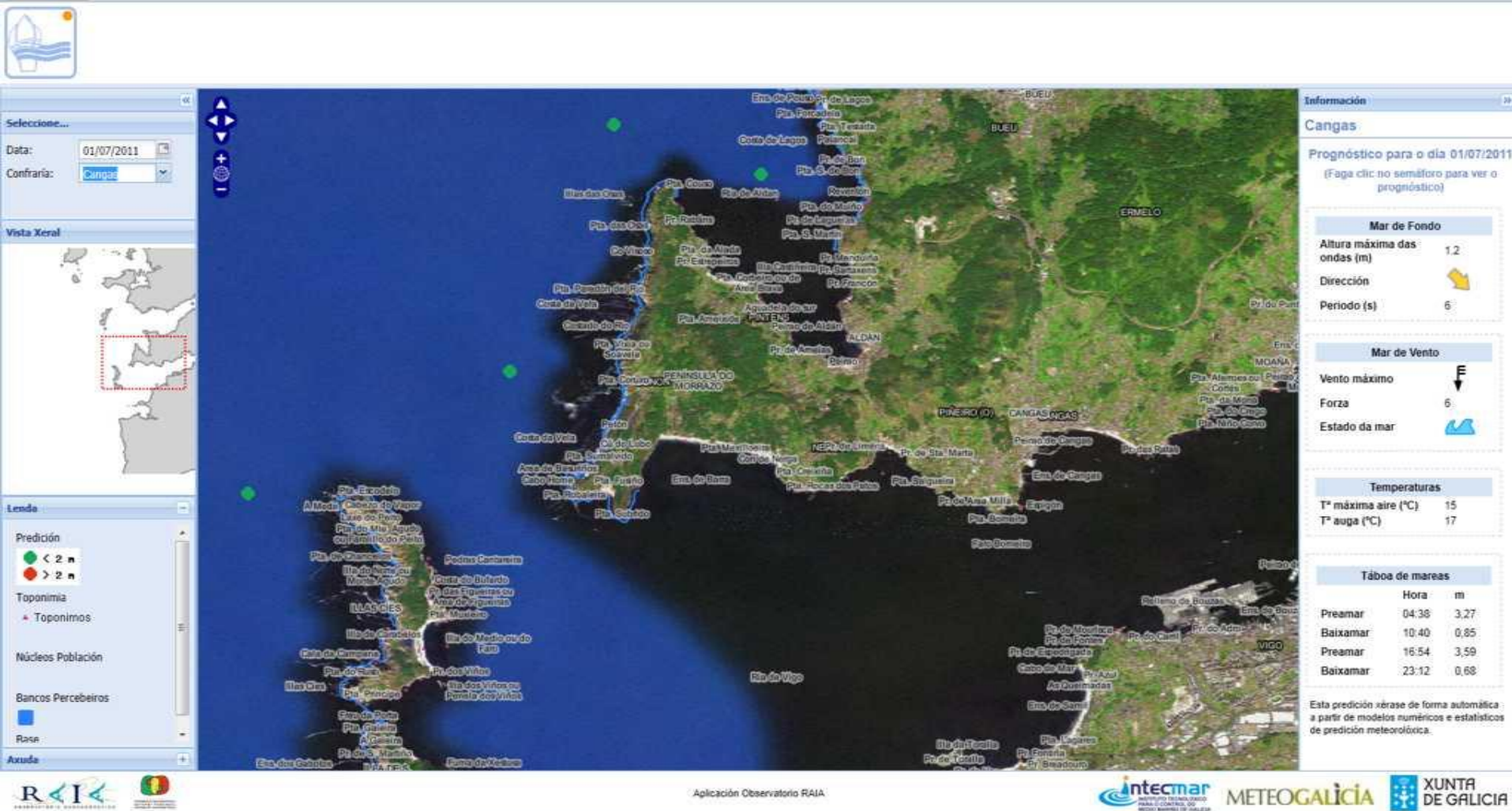
# ARCOPOL

- **DISCUSSIONS ON MODEL DATA EXCHANGE**
- **DATA EXCHANGE**
- **INPUT DATA GUIDELINES**
- **OUTPUT DATA GUIDELINES**
- **....**
- **THREDDS DATA SERVER**
- **DOCUMENTATION**
- **SYSTEM REQUIREMENTS**





# Products for end users



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 **Raia**  
www.marnaraia.com





## Ver táboa de predición marítima



### A GUARDA - SANTA TECLA (41° 53' 49" - 8° 52' 29")

METEOGALICIA

Creada o martes, 5 xullo 2043

05 xullo 2011	00:00	03:00	06:00	09:00	12:00	15:00	18:00	21:00
Estado do ceo								
Vento								VAR
Temperatura do aire (°C)						17°	16°	16°
Altura significativa (m)	1.02	0.93	0.9	1.01	1.09	1.12	1.13	1.16
Dirección do mar								
Temperatura da auga (°C)	14°	14°	14°	14°	14°	14°	14°	14°
Período da onda	9	9	9	8	8	8	8	8
06 xullo 2011	00:00	03:00	06:00	09:00	12:00	15:00	18:00	21:00
Estado do ceo								
Vento	VAR							
Temperatura do aire (°C)	16°	17°	16°	16°	16°	16°	16°	16°
Altura significativa (m)	1.21	1.31	1.49	1.62	1.69	1.76	1.89	2.18
Dirección do mar								
Temperatura da auga (°C)	14°	14°	14°	14°	14°	15°	15°	14°
Período da onda	8	8	9	9	9	9	9	9
07 xullo 2011	00:00	03:00	06:00	09:00	12:00	15:00	18:00	21:00
Estado do ceo								
Vento								
Temperatura do aire (°C)	16°	16°	16°	16°	16°	16°	16°	17°
Altura significativa (m)	2.53	2.86	3.07	3.18	3.21	3.19	3.13	3.04
Dirección do mar								
Temperatura da auga (°C)	14°							
Período da onda	11	12	12	12	12	12	11	11

Vento: a dirección en graos meteorolóxicos ó nivel do mar.  
Altura significativa (m): altura característica da distribución da  
Dirección do mar: dirección media de propagación de ondas.  
Período da onda: período pico.

#### Aviso para navegación

Os datos proporcionados son resultado da utilización dos modelos de predición de ondas WaveWatch III e SWAN e do modelo de predición meteorolóxica WRF.  
As horas amosanse en horario UTC.  
Para ver máis detalles sobre a operativa e a fiabilidade dos modelos e da predición consulte a páxina web: [www.meteogalicia.es](http://www.meteogalicia.es)



### Confraría

- Burela - San Juan Bautista
- Celeiro - Santiago Apostol
- Malpica
- Corne
- Camelle
- Muros
- Carreira Y Aguño
- O Grove - San Martiño
- Bueu - San Martiño
- Aldan - Hio - San Cipriano
- Baiona - La Anunciada
- A Guarda - Santa Tecla



### Porto

- Coruña
- Vilagarcía
- Vigo
- Ferrol
- Viveiro
- Pontevedra
- Sanxenxo
- Lira



### Boia

- Boia De A Guarda
- Boia De Ons
- Pilar De Rande
- Boia De Cies
- Plataforma De Cortegada



### Outras

- Asociación Lajareu Por Barlovento

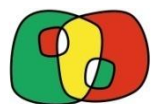
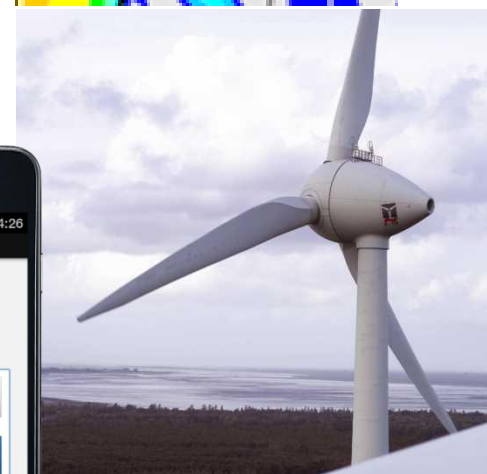
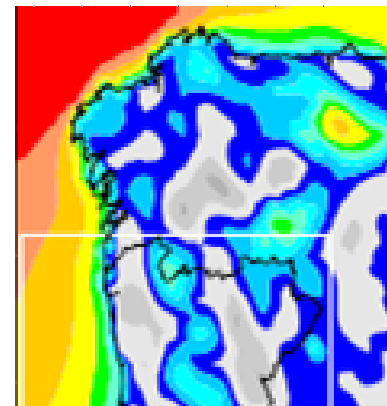
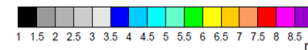
Envío por mail a los  
patrones mayores y  
puertos deportivos

20 km  
10 mi



# More end users applications

- Distribution of faecal pollution
- Dynamic maps for fronts and eddies.
- Prediction of avenues and their influence for shell fishing areas.
- Predictions of wind and wave energy offshore (Portugal)
- Models of sediment transport.
- Prediction of episodes of coastal pollution from residual waters improperly debugged.
- Forecast of waves and wind in the defeats of entrance and exit of the estuaries and ports.
- Apps for smartphones and smartTVs.





# Conclusions

- The Euroregion Galicia-North of Portugal has at present an infrastructure of oceanic measurement of very high density; points of measurements, number of observations, etc.
- The network of observation provides reliable information and of quality.
- The operational models allow to give forecastings up to 72 hours of the state of the sea.
- We have developed specific applications for end users using the capacity of the Observatory to provide forecastings and observations in real time; harbors, fishermen, percebeiros, etc.
- The observatory RAIA pretends to be the site of reference of the Euroregión in terms of observation and oceanic prediction.
- Improve the presence of RAIA in different socioeconomic sectors of activity (energy, fishing, recreational boating, tourism, etc) of the Euroregion North of Portugal – Galicia.
- RAIA will be the initial seed for a **future oceanic observatory at the Western Iberian Peninsula.**



# Gracias, Obrigado, Thanks



<http://www.marnaraia.com>



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