Short scale dynamics of contamination events in coastal waters:observations and models for the Costa Concordia site

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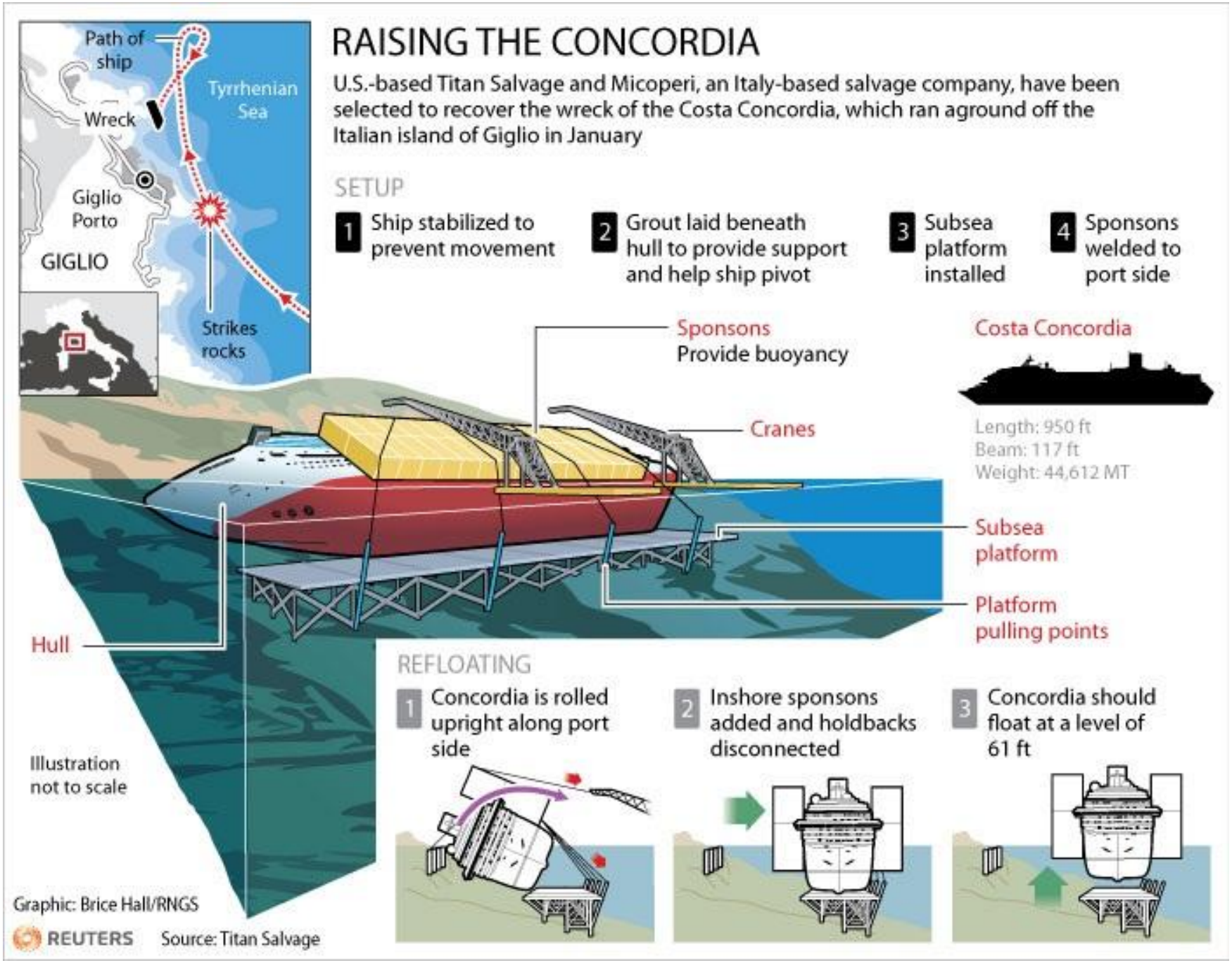
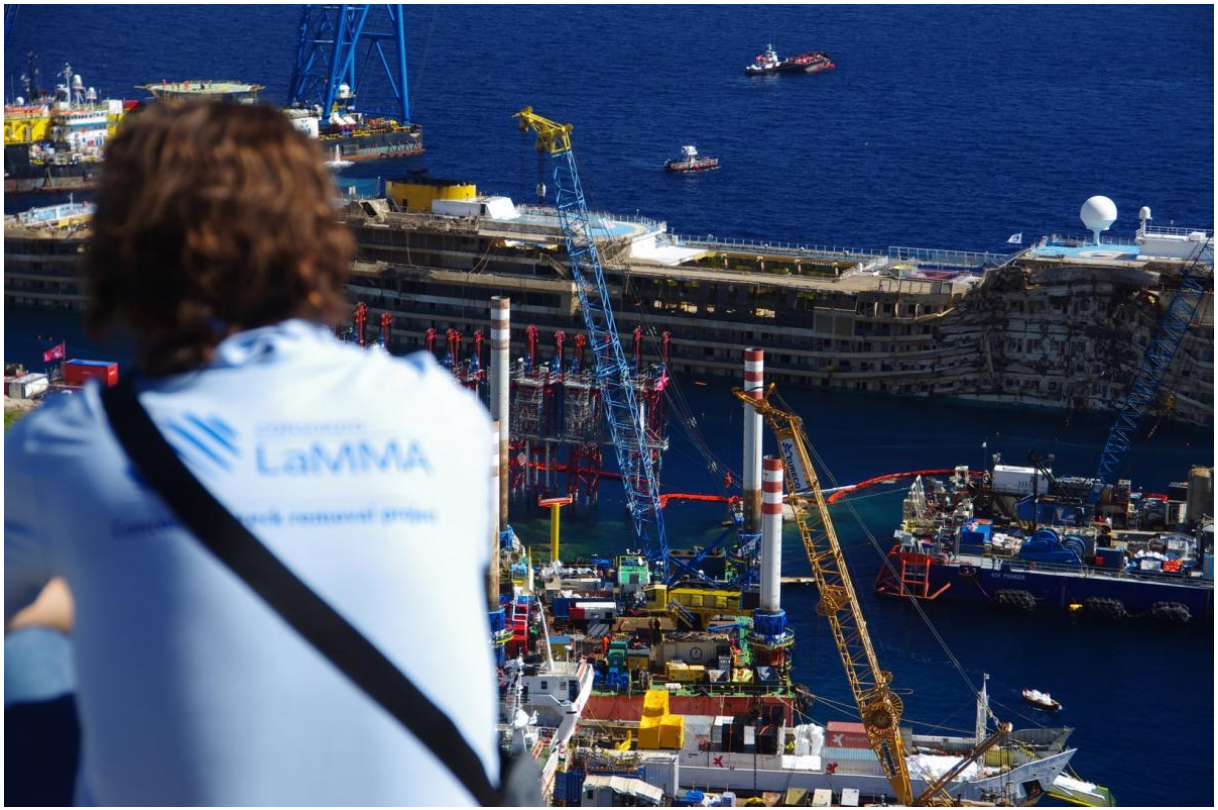
Wreck removal activities



Emergency management at sea

The LaMMA Consortium (Tuscany Region / CNR) supports TITAN-Micoperi by a dedicated weather service for the management of removal operations.

Every day a LaMMA's forecaster follows the operation from the Salvage Room at Isola del Giglio.



An integrated sea monitoring system

An important tool for supporting the removal operations is represented by a Remocean X-band RADAR system, that provides information about sea surface currents and waves.

The RADAR is part of a measurement system that includes a wave buoy, a tide gauge, and two meteorological stations.

Finally, a UV-fluorometer for hydrocarbons detection is installed in a desalination plant close to the Giglio port.

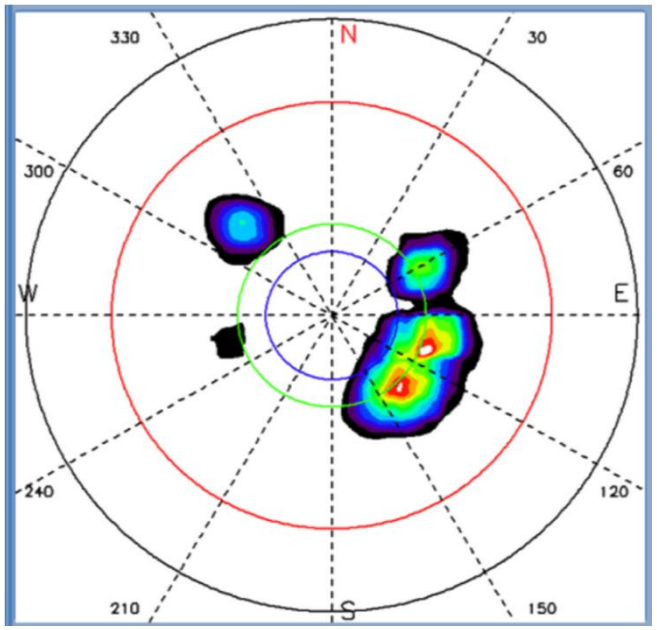
X-band RADAR

The X-band RADAR system provides information about the sea state parameters like the wave directional spectra and the current velocities and directions.

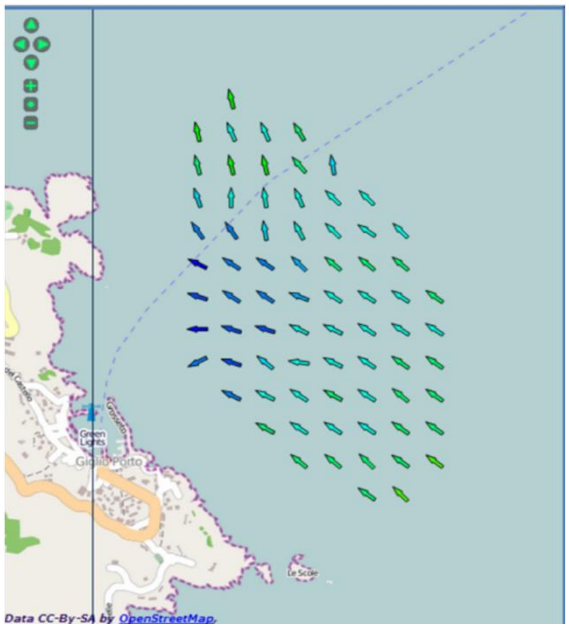
The RADAR has been installed at the Giglio port in order to obtain a very high resolution in the coastal zone near the Concordia wreck.

The range of the X-band RADAR is about 3 km.

Wave directional spectrum

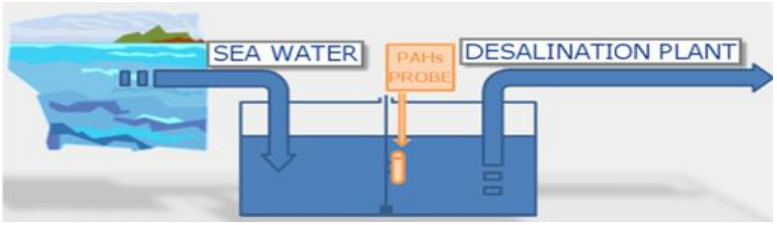


Currents



UV-fluorometer for Polycyclic Aromatic Hydrocarbons detection in water

Continuous monitoring of hydrocarbons in the desalination plant of ‘Acquedotto del Fiora’ in the Giglio island



An increase of the hydrocarbon concentration has been observed during the parbuckling operation.

Aim of the discussion

- X-band radar, and the other instruments installed near the Costa Concordia site, give a very local concentration of different kinds of measurements.

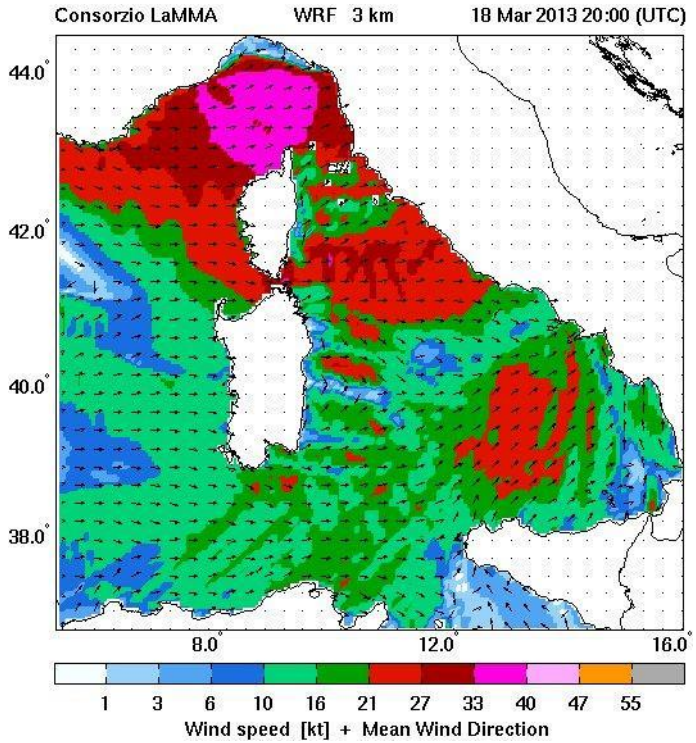
- **This system represents a unique small laboratory, and a major source of data, for testing the present forecasting capabilities of wave and current models at such local scales.**

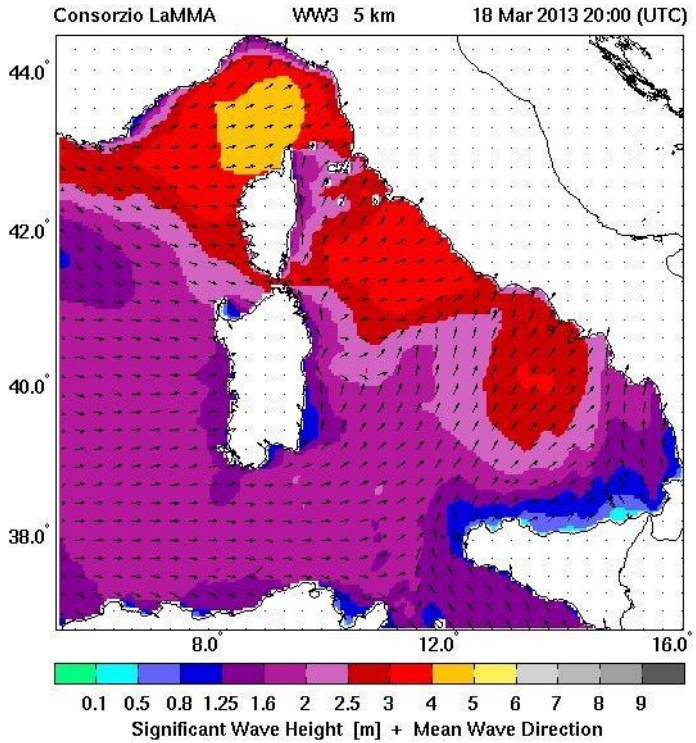
- Here we discuss the evolution of a small pollution event, probably due to the presence of many boats, that occurred during the parbuckling operation.

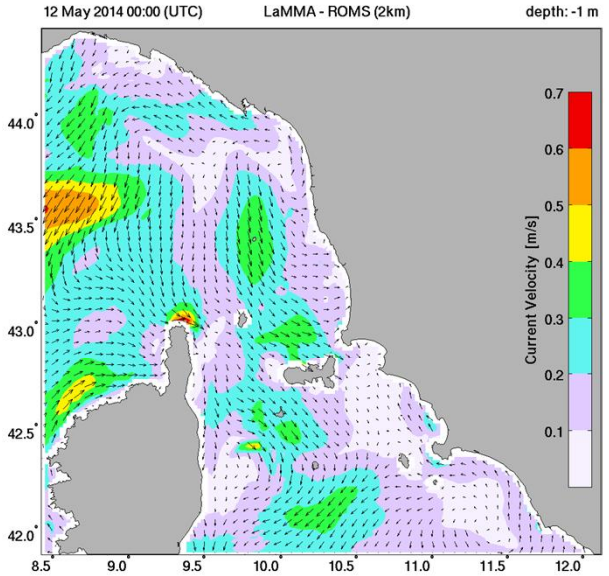
Operational meteo-marine forecasting chain

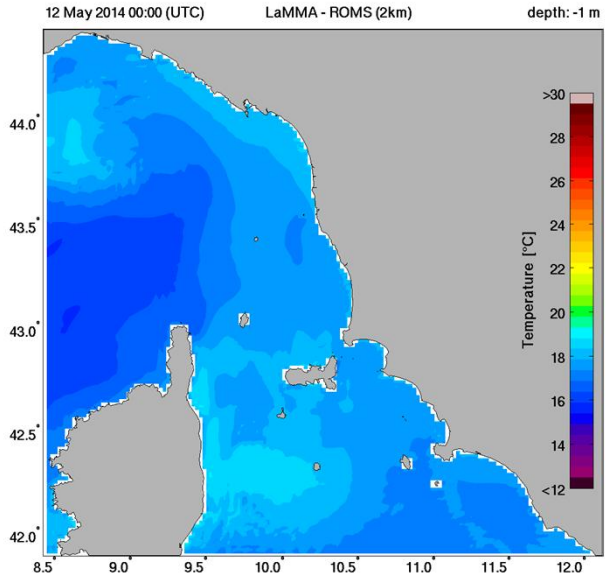
The meteorological information for supporting the wreck removal operations is obtained by meteorological and wave forecasting models.

The operational modeling chain include nested atmospheric models based on WRF code, wave forecasting models based on WW3 and SWAN codes, and hydrodynamic models based on ROMS code.

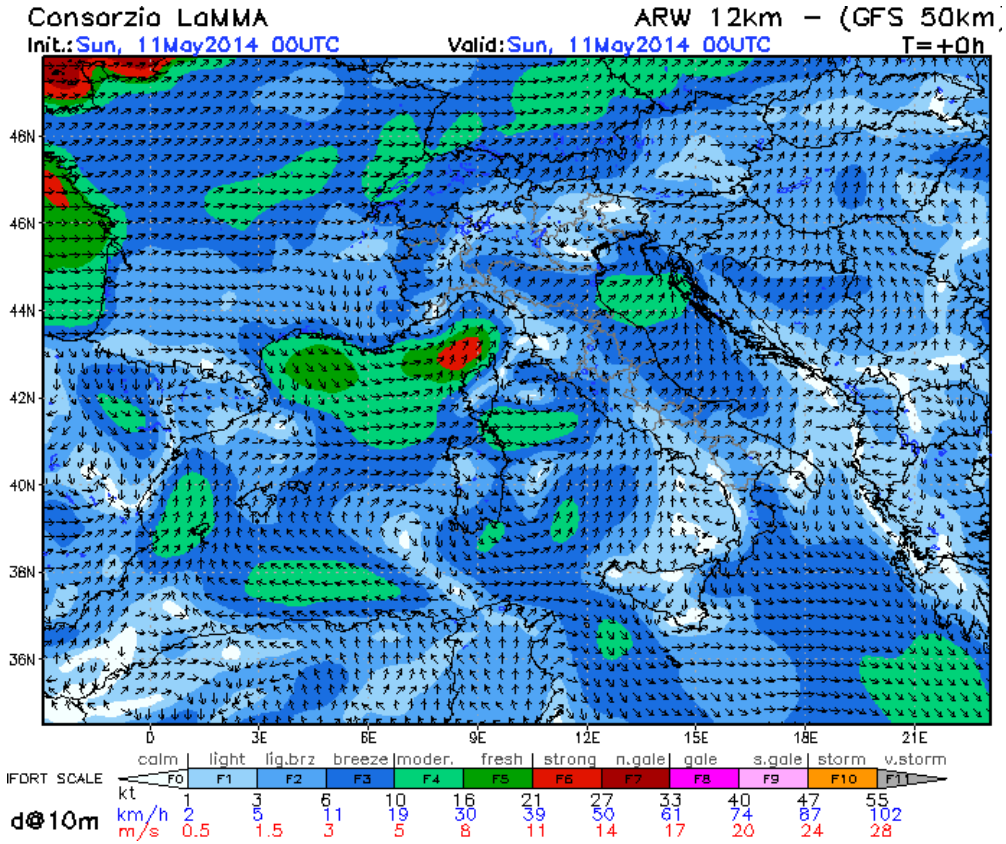




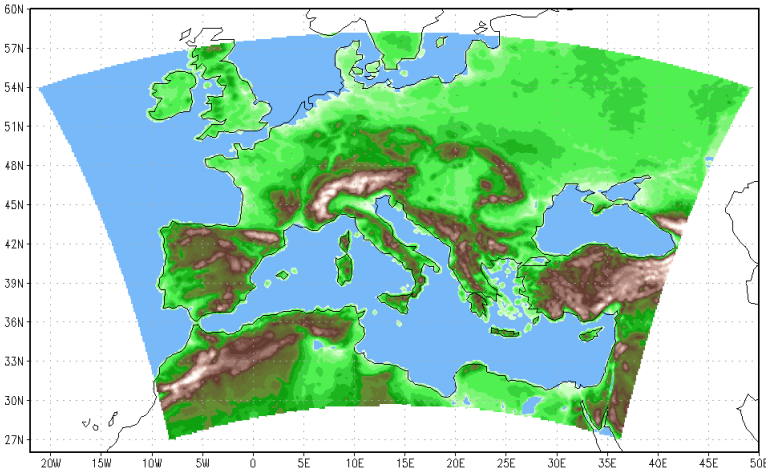




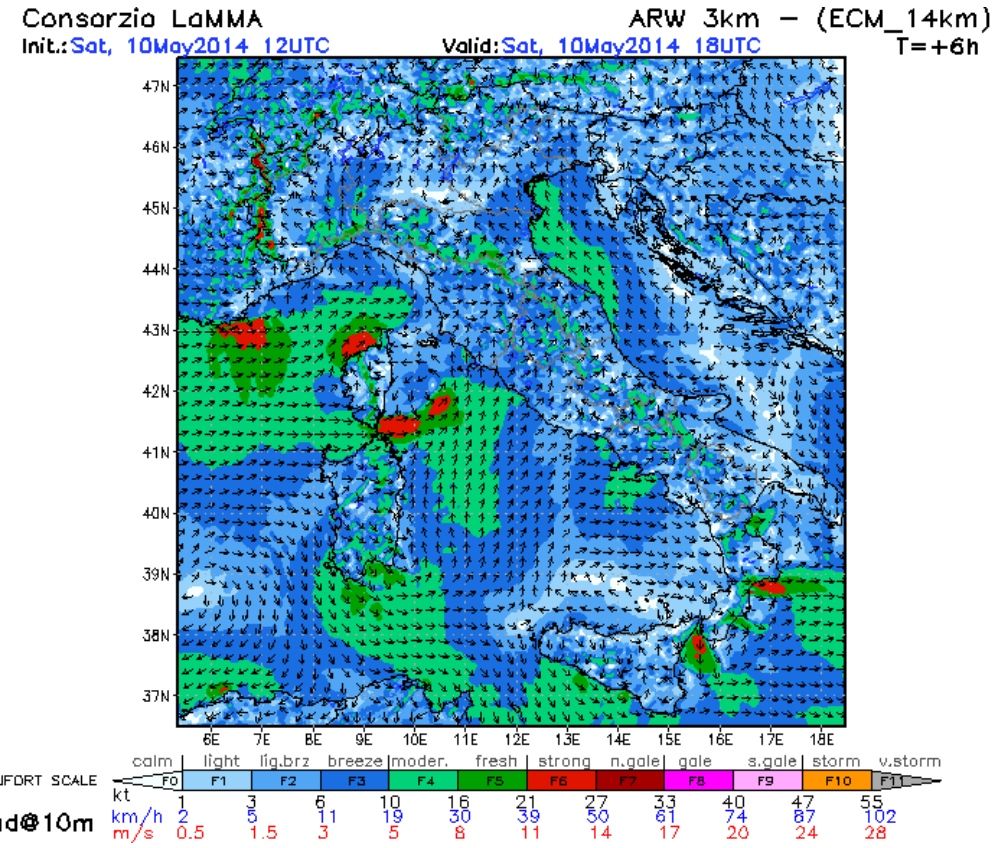
Meteorological models



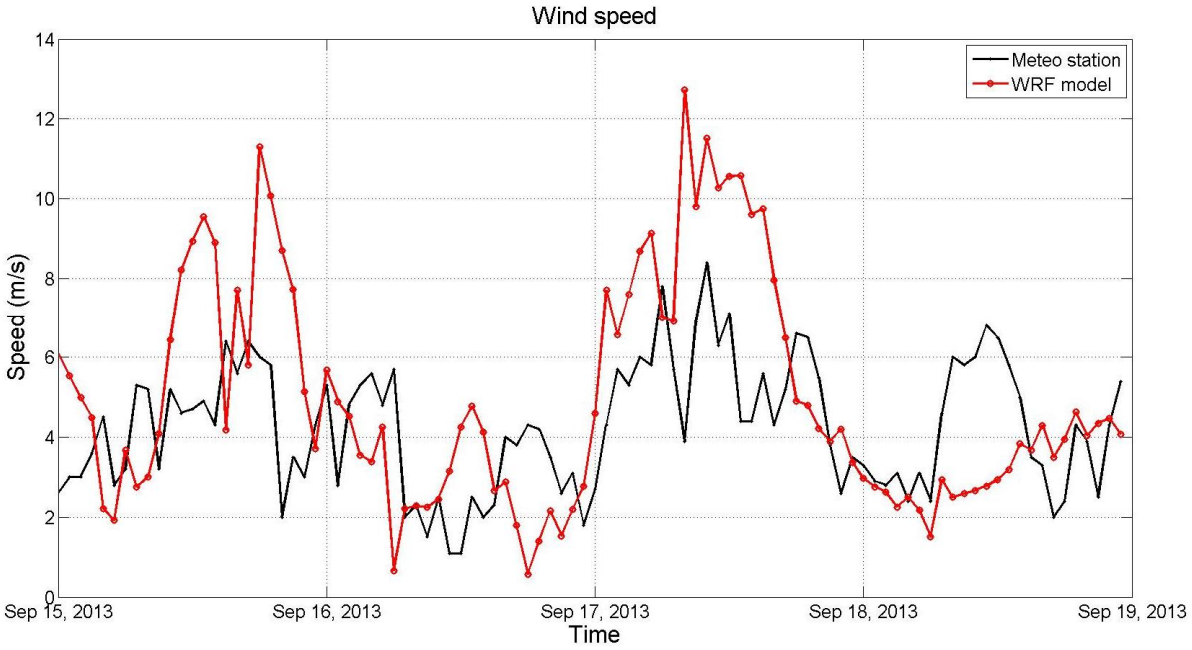
WRF 12 km - GFS

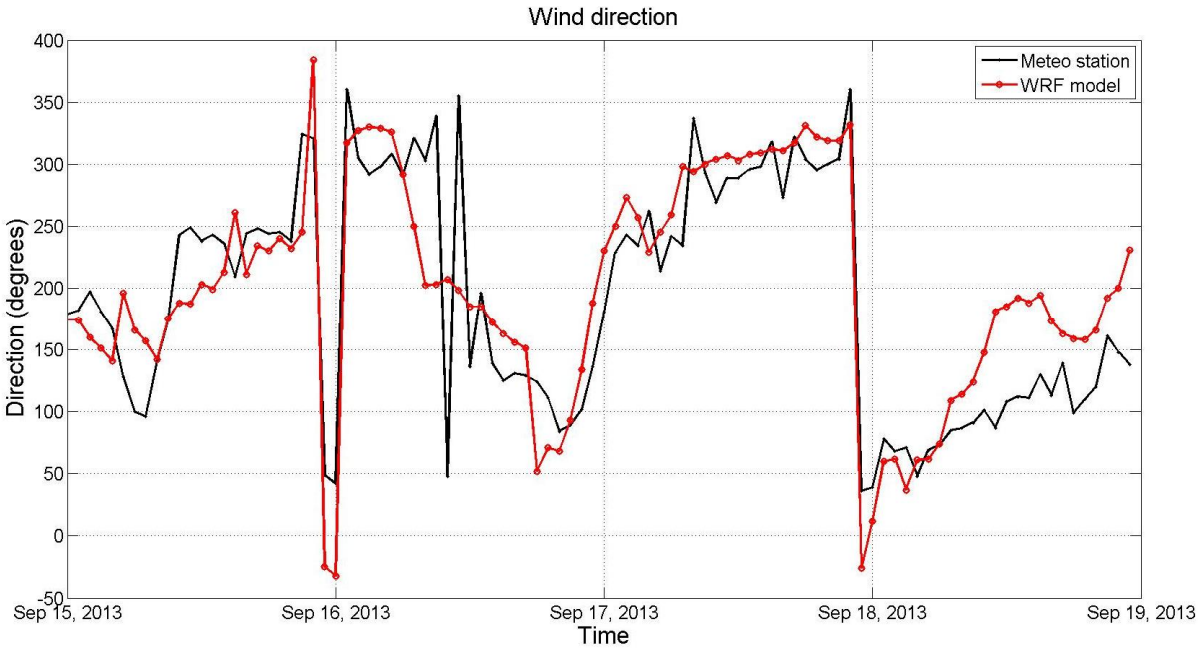


WRF 3 km - ECMWF

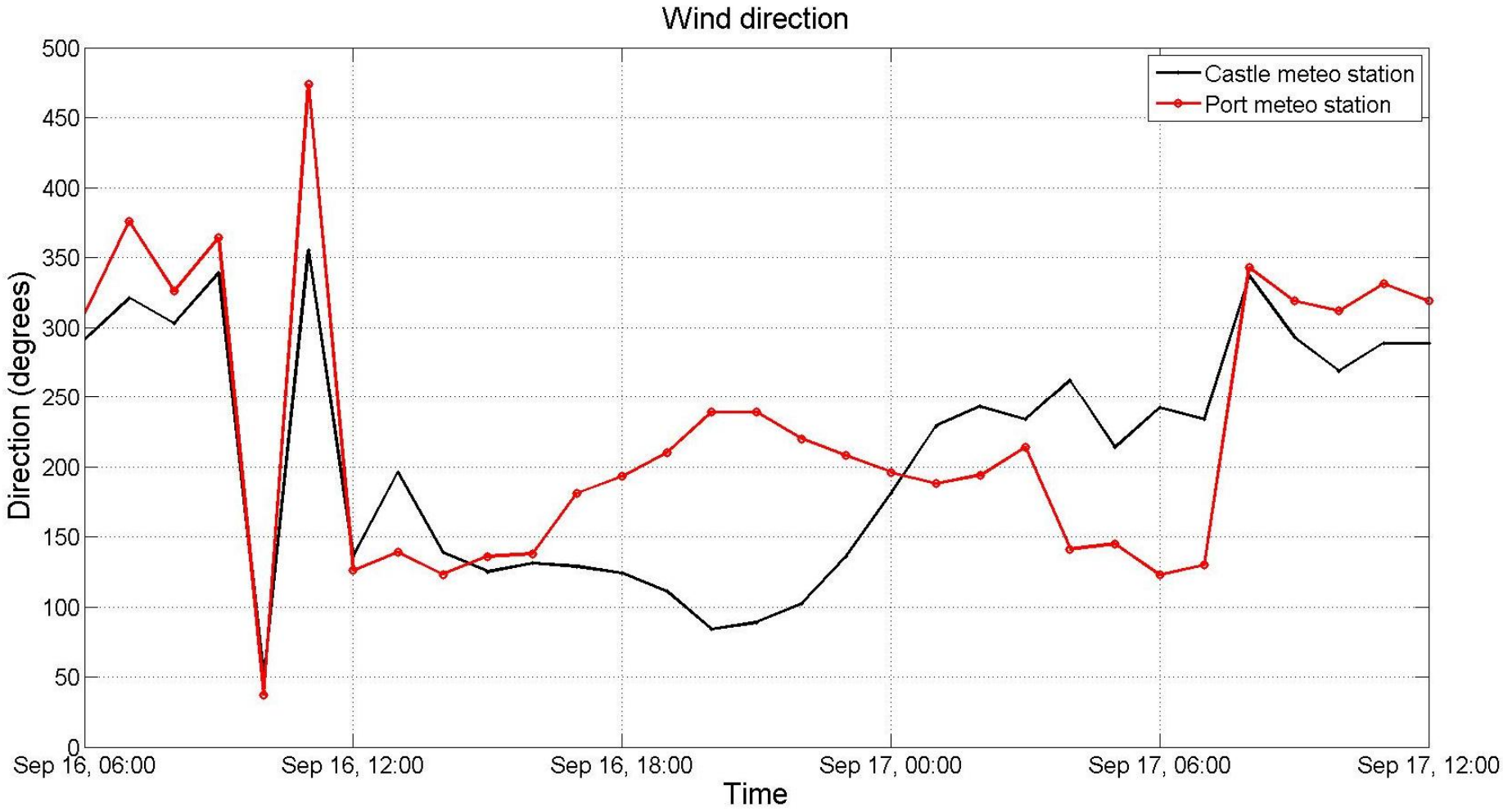


WRF 3 km vs Castle meteo station

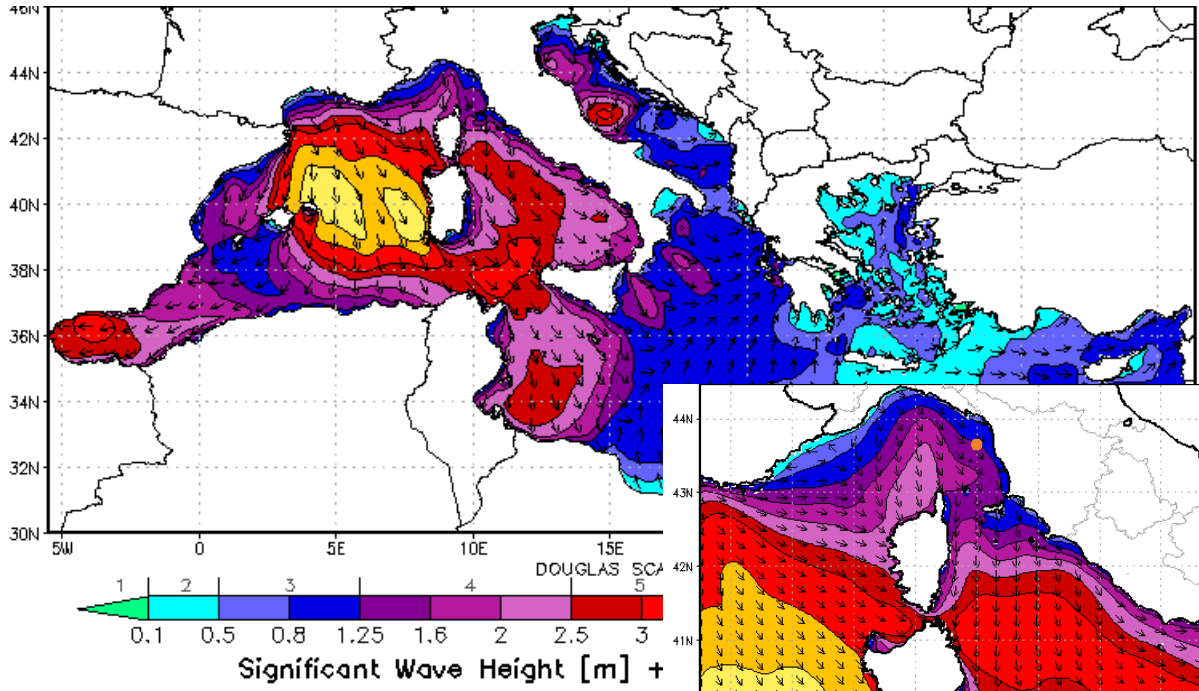




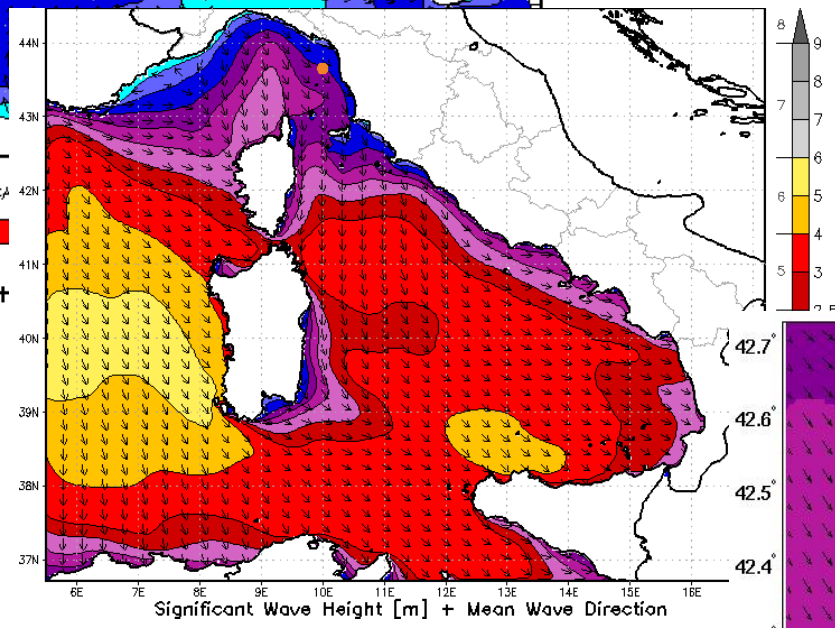
Castle meteo station vs Port meteo station



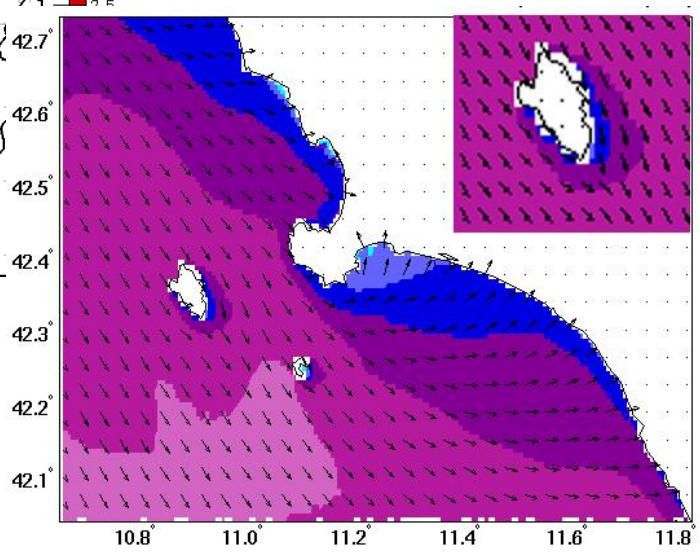
Wave models



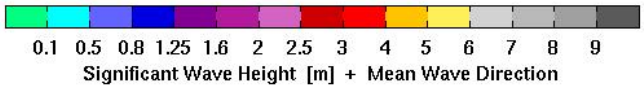
WW3 - 12 km



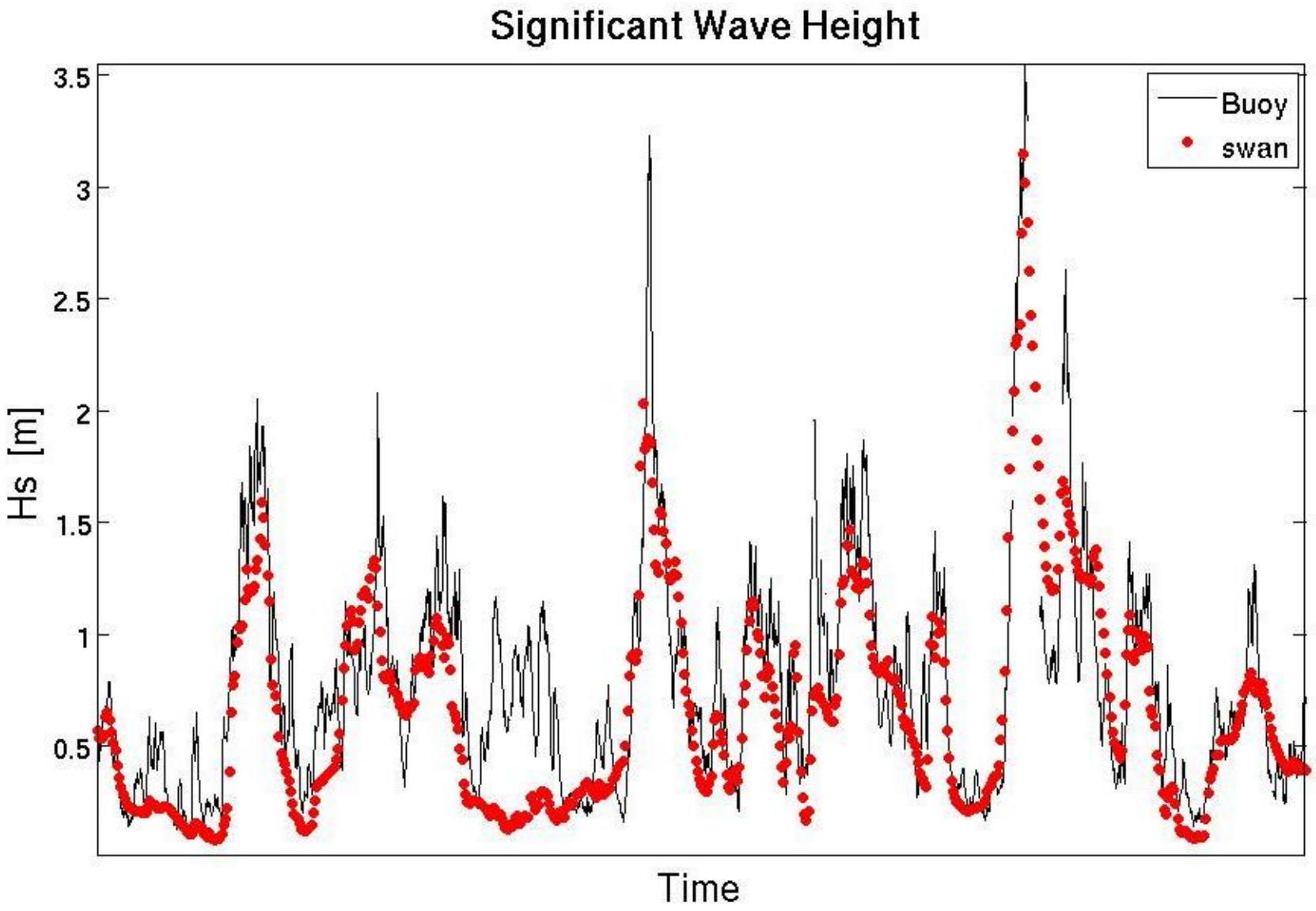
WW3 - 5 km



SWAN – 600 m

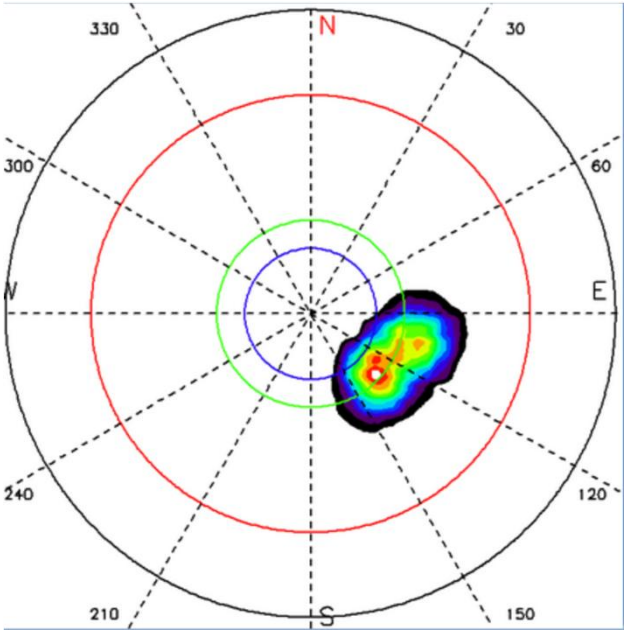


SWAN vs Giglio buoy

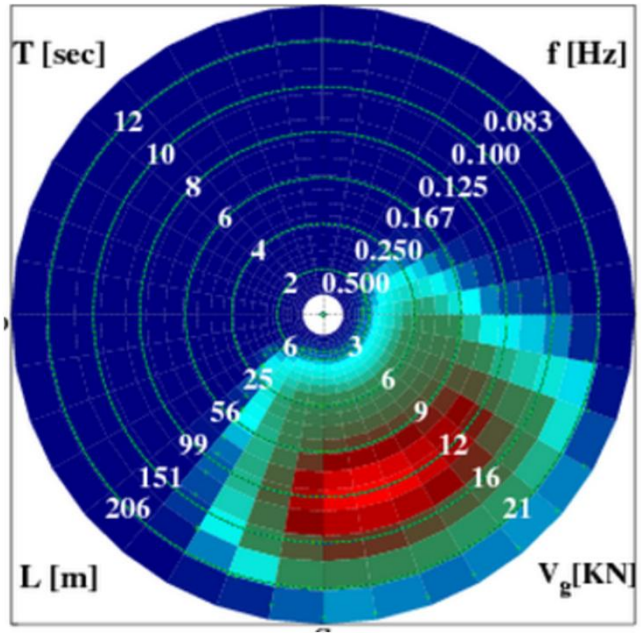


Wave model vs RADAR spectra

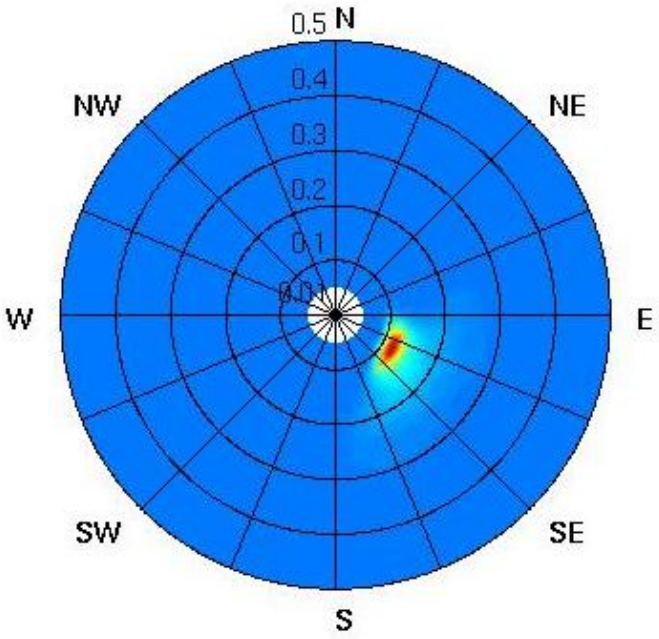
RADAR



WW3



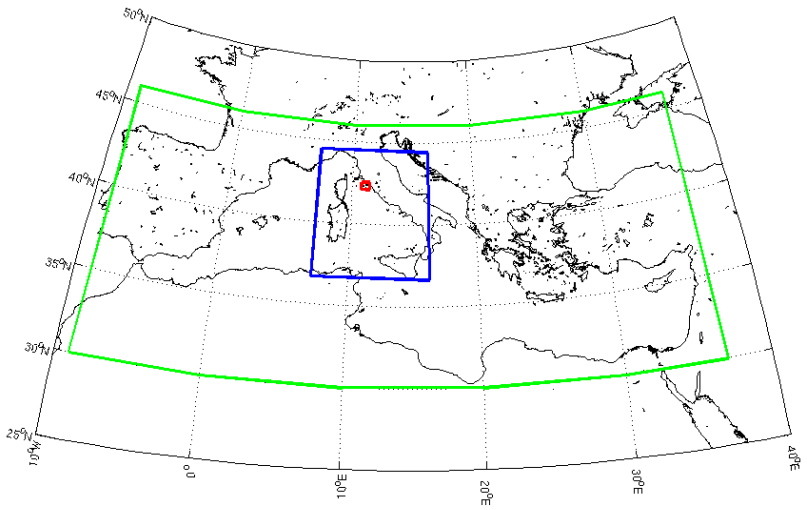
SWAN



- Measured wave spectra are compared with corresponding wave spectra from an operational WW3 model at 5 km resolution and a SWAN model at 600 m resolution.

- In all cases we observe similar spectrum shapes but SWAN shows a better agreement in terms of directions, due to a better capability of the model to describe wave refraction.

Hydrodynamic models

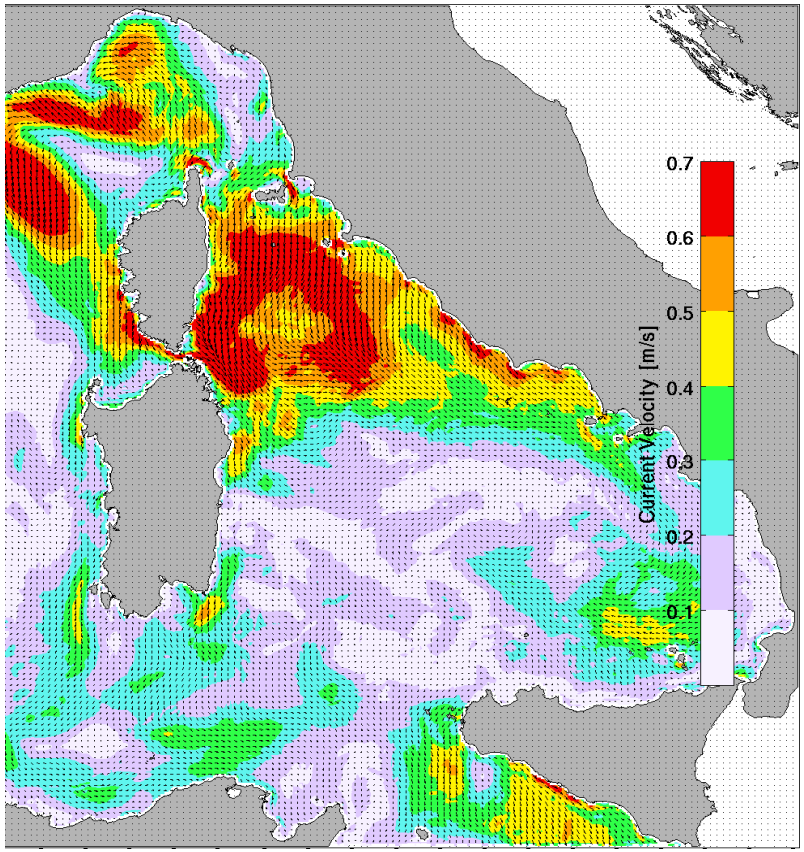


ROMS model configurations:

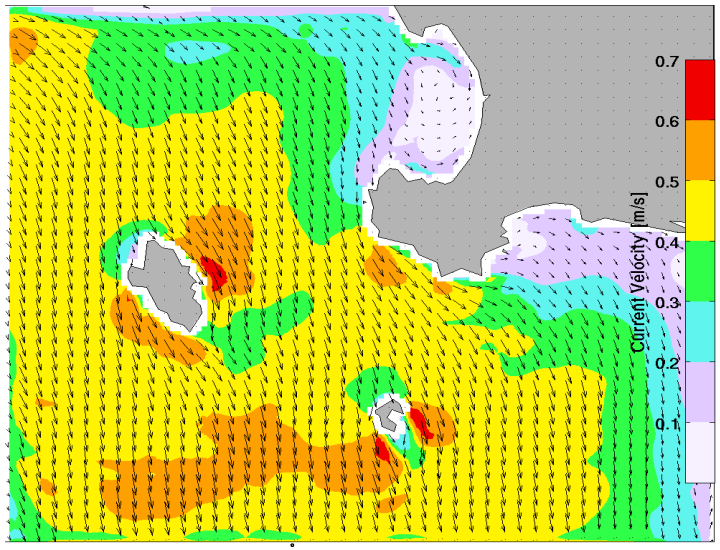
- TYRRENO ROMS
  - Nested on MFS MyOcean (6 km resolution, daily averaged data)
  - 2 km resolution
  - 30 vertical levels
  - One day spin-up
  - LaMMA-WRF 3 km atmospheric model (nested in ECMWF)

- GYGLIO ROMS
  - Nested on TYRRENO ROMS
  - 400 m resolution
  - 30 vertical levels

TYRRENO ROMS



GYGLIO ROMS

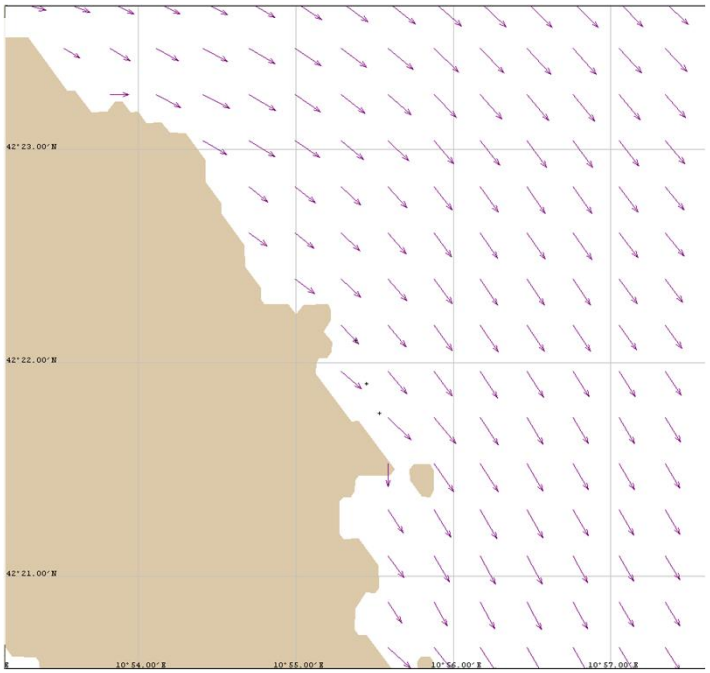


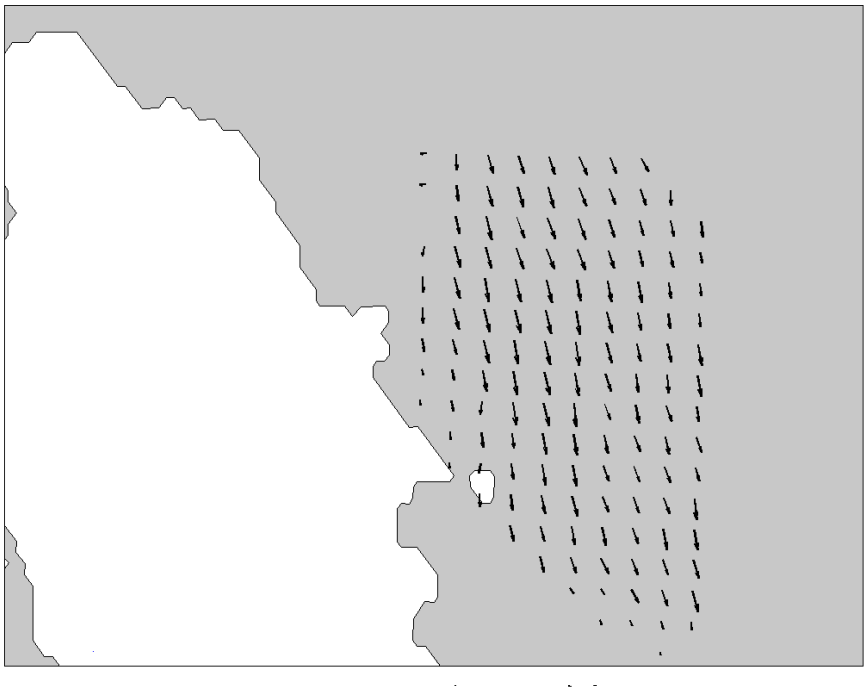
ROMS vs RADAR

ROMS – 400 m

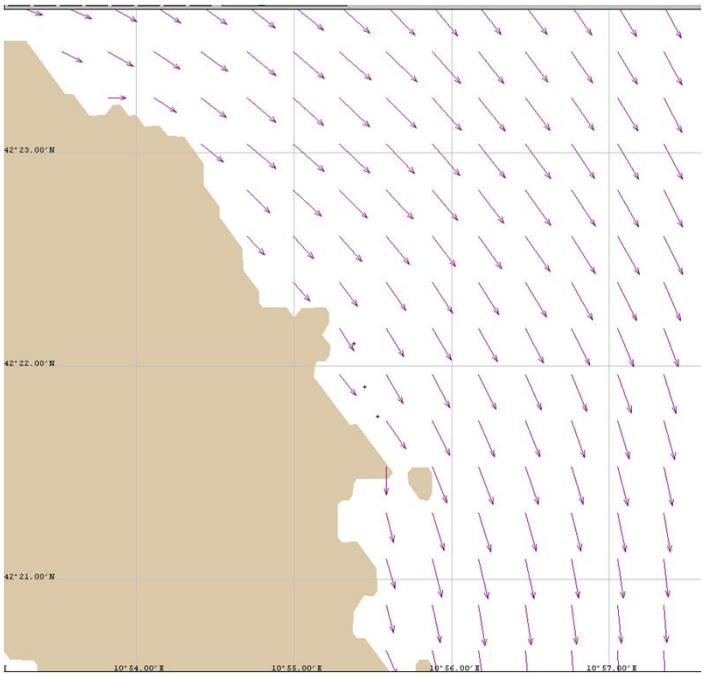
RADAR

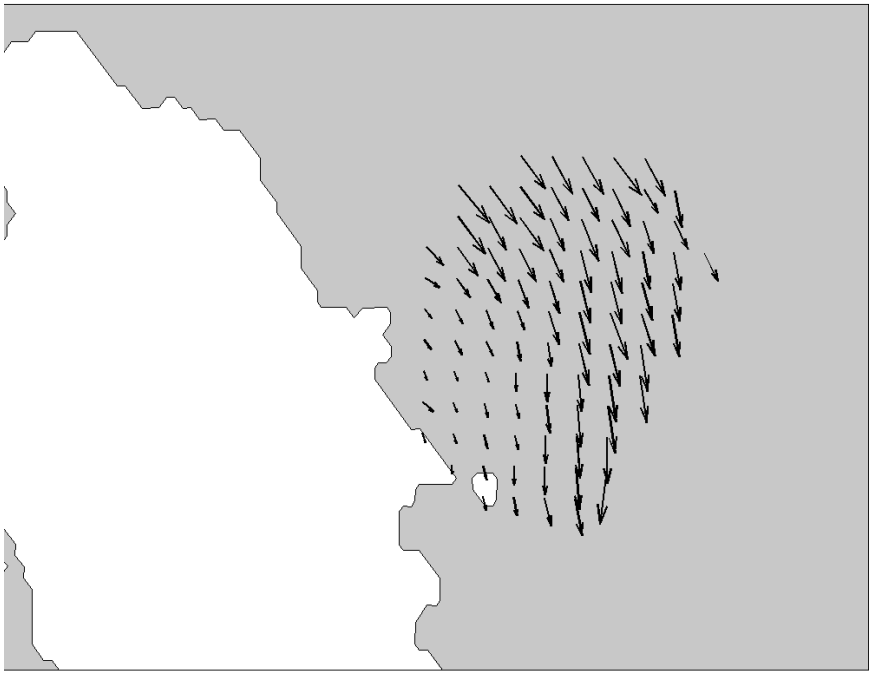
17/9/2013 - 08:00



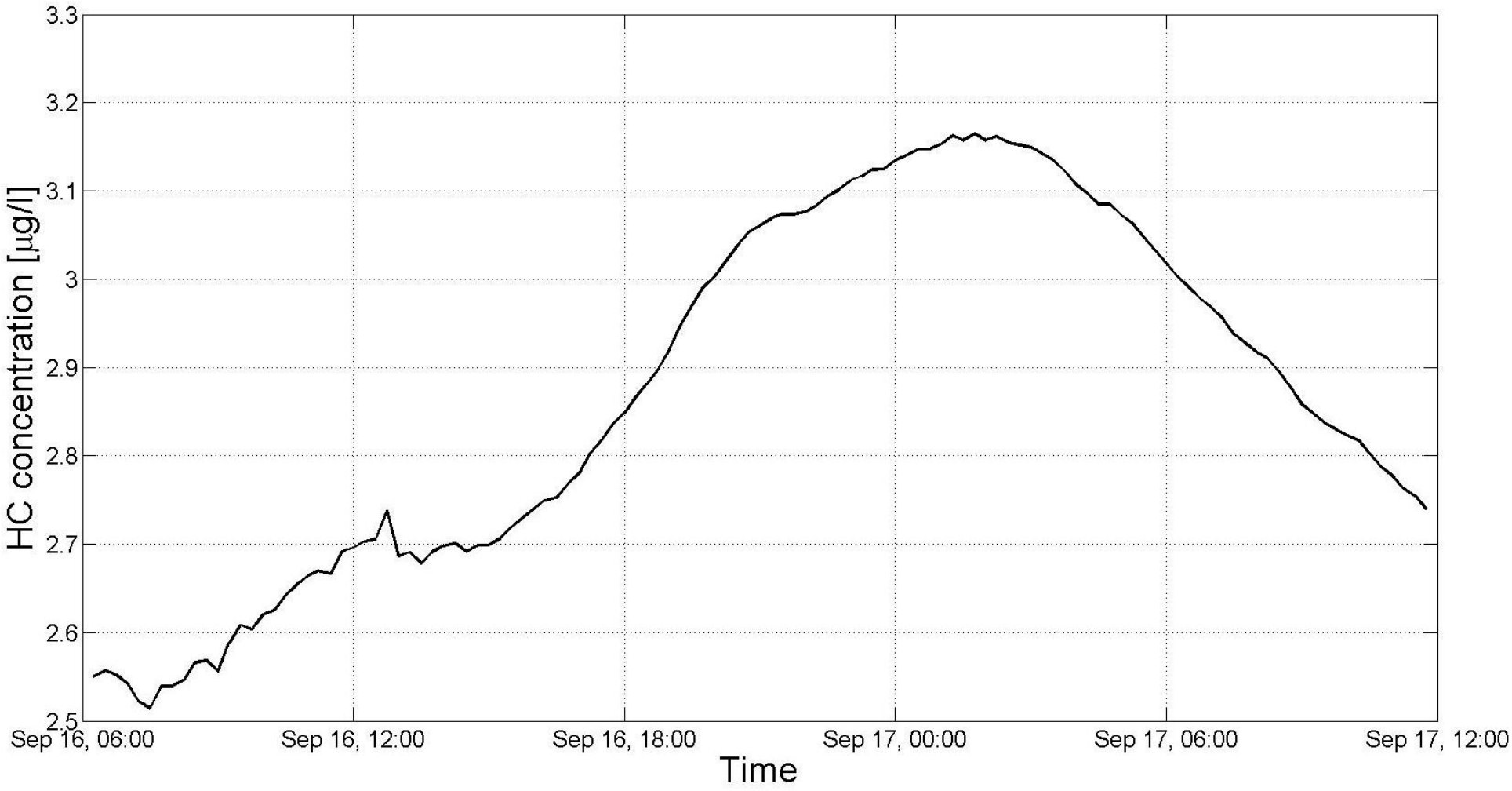


17/9/2013 - 11:00





UV-fluorometer data



GNOME (NOAA) simulation

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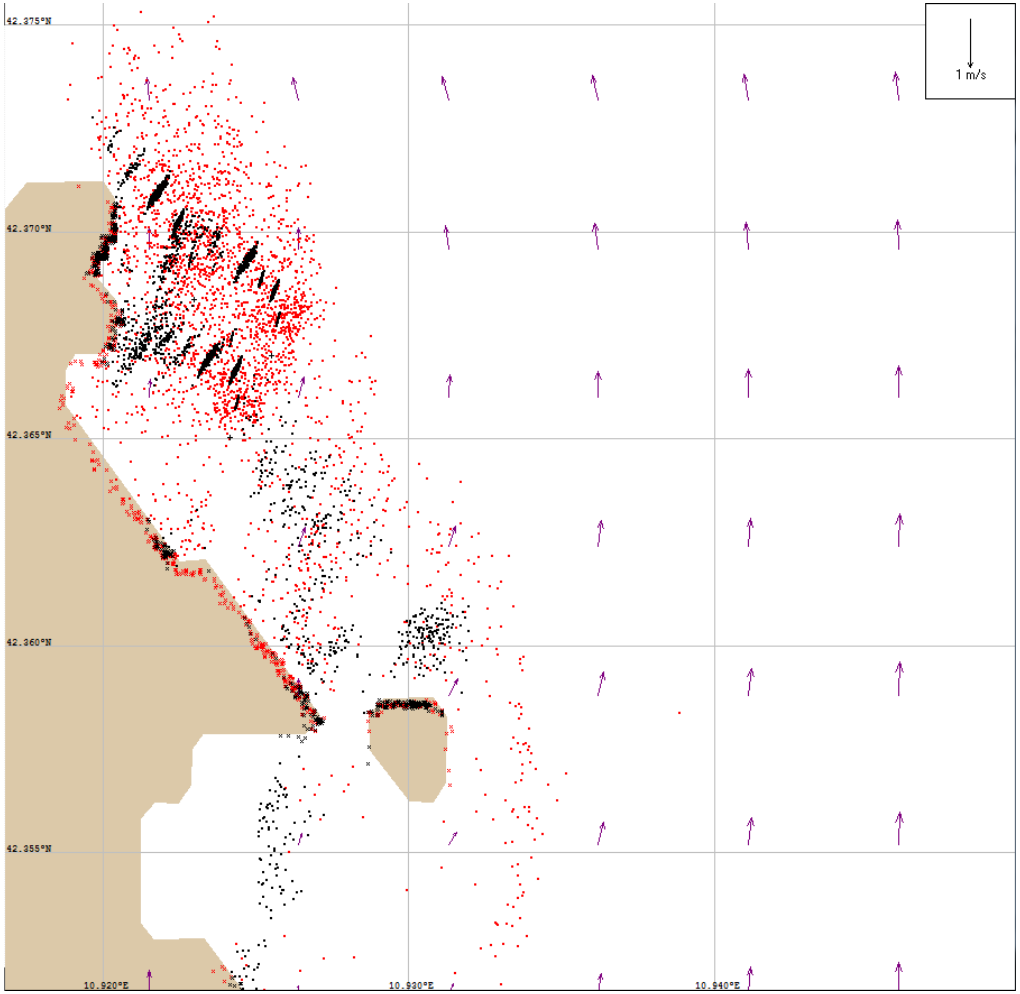

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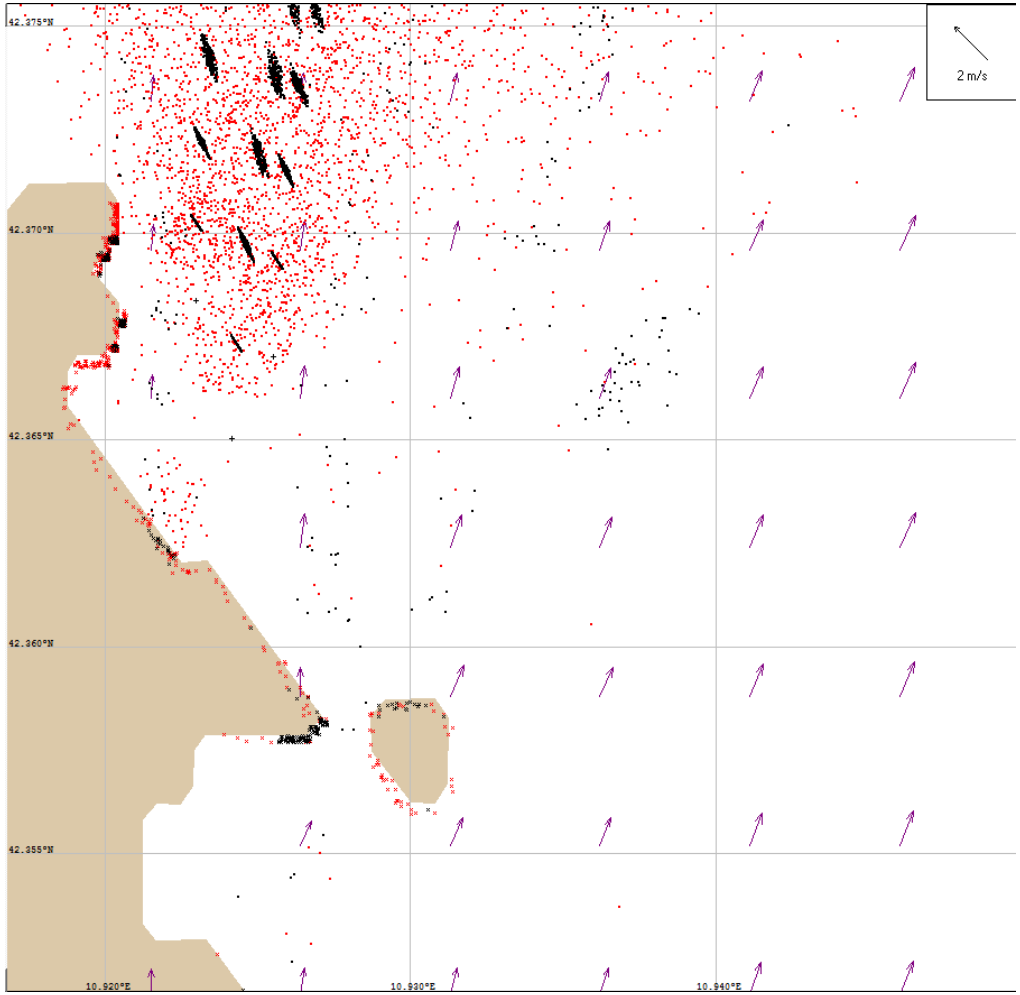

GNOME (NOAA) simulation

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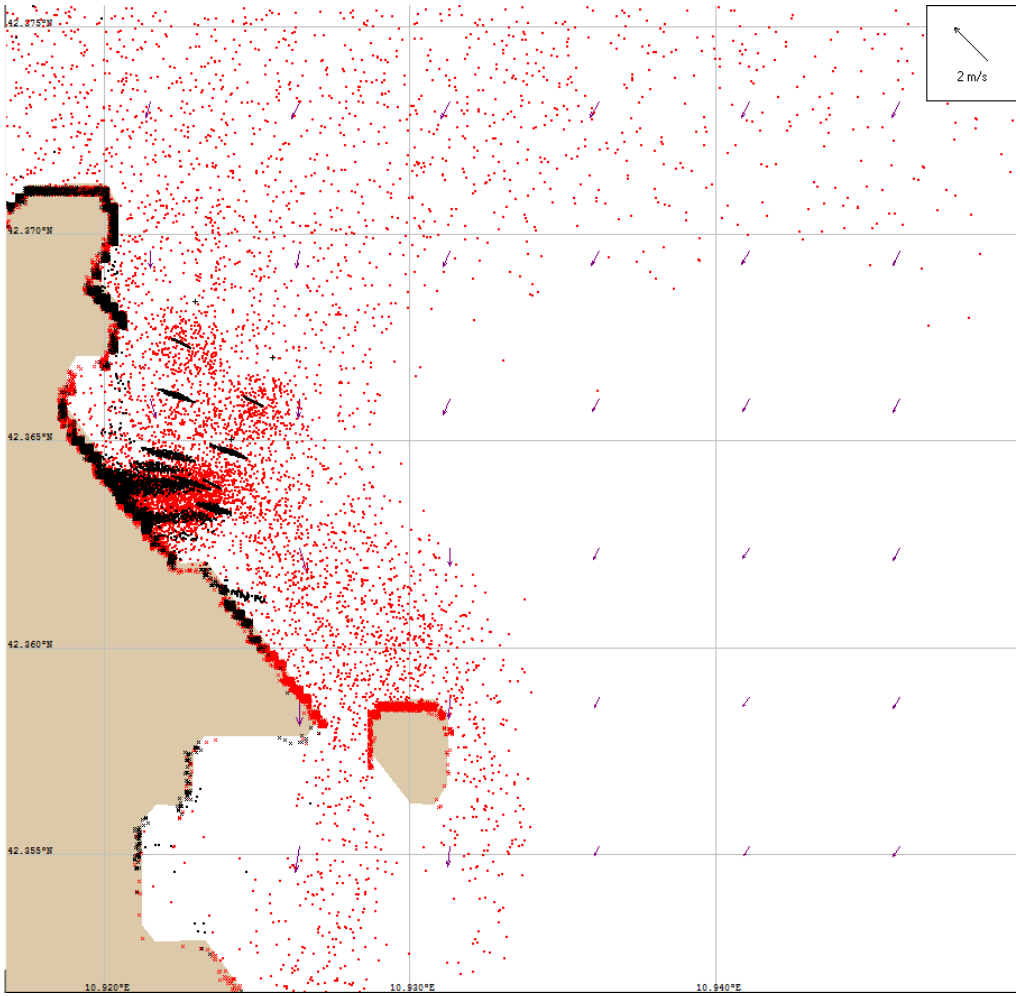

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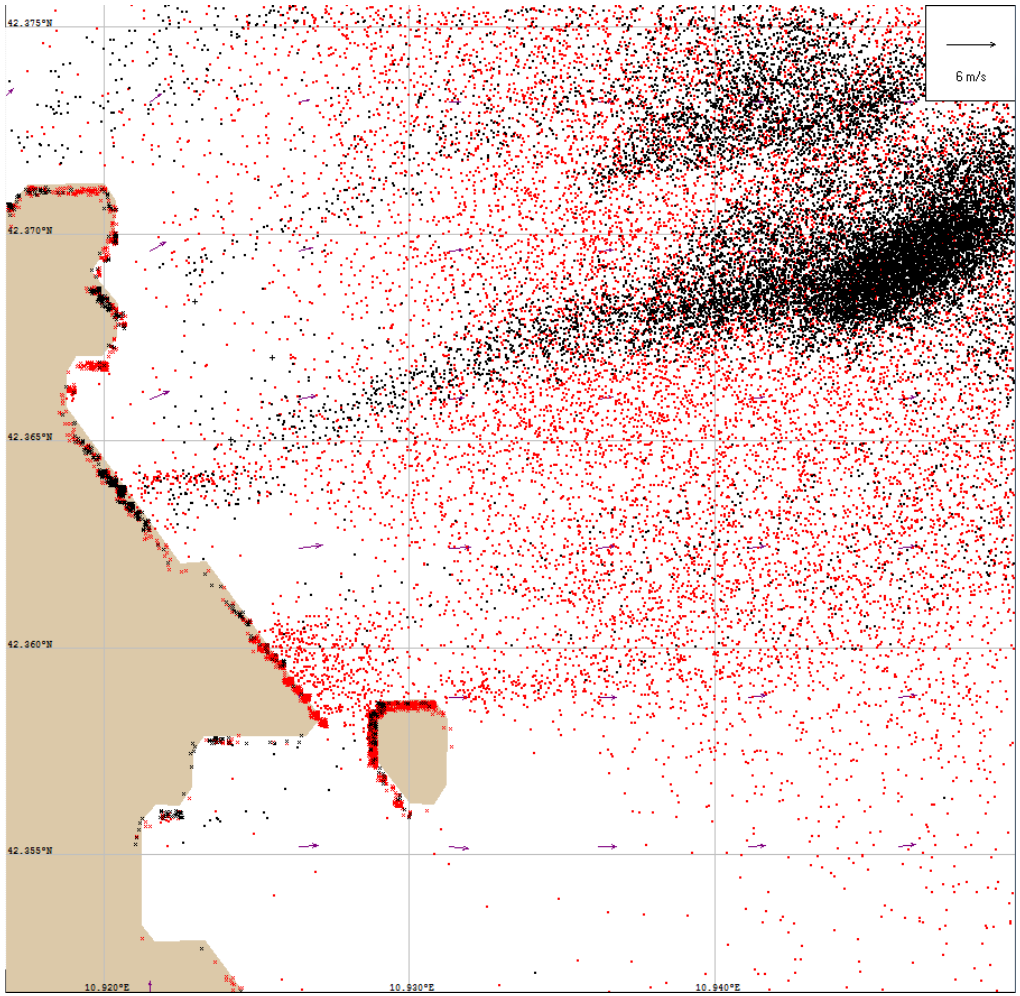

THANK YOU!

We also thank the COSMEMOS project
for a partial contribution to this work.

COSMEMOS

Innovation in meteorology for maritime navigation

European GNSS Agency