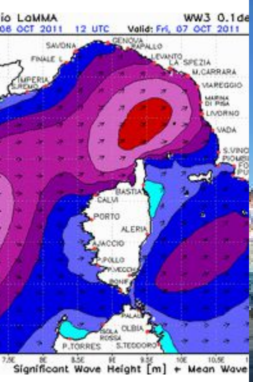
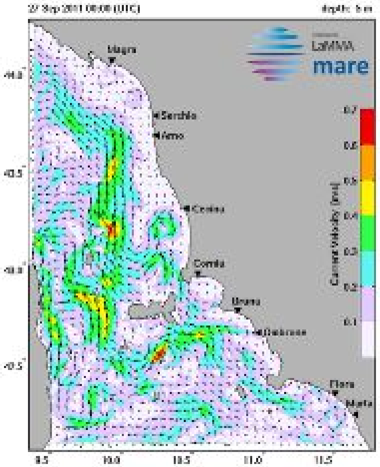
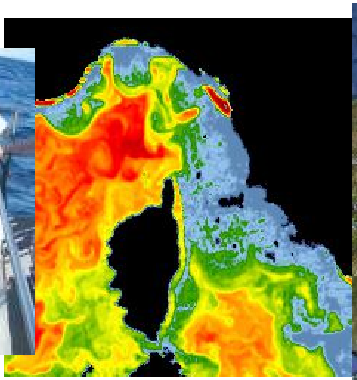
COoperative Satellite navigation for MEteo-marine MOdelling and Services

COSMEMOS

The upcoming sensor network in the North Tyrrhenian and Ligurian sea for waves and oceanography







Carlo Brandini - Consorzio LaMMA

Livorno, 23 Ottobre 2013

REGIONE TOSCANA

CONSORZIO LaMMA

From MOMAR to SICOMAR

The Directive 2008/56/EC recognizes the sea monitoring as a fundamental tool for environmental protection and for contributing to the definition of common policies through the use of integrated control systems for the transnational marine space.

Maritime emergencies

Objective: define a common path for the creation of an integrated system for monitoring marine and coastal environment in the regions bordering the North Tyrrhenian / Ligurian sea area

MOMAR → SICOMAR

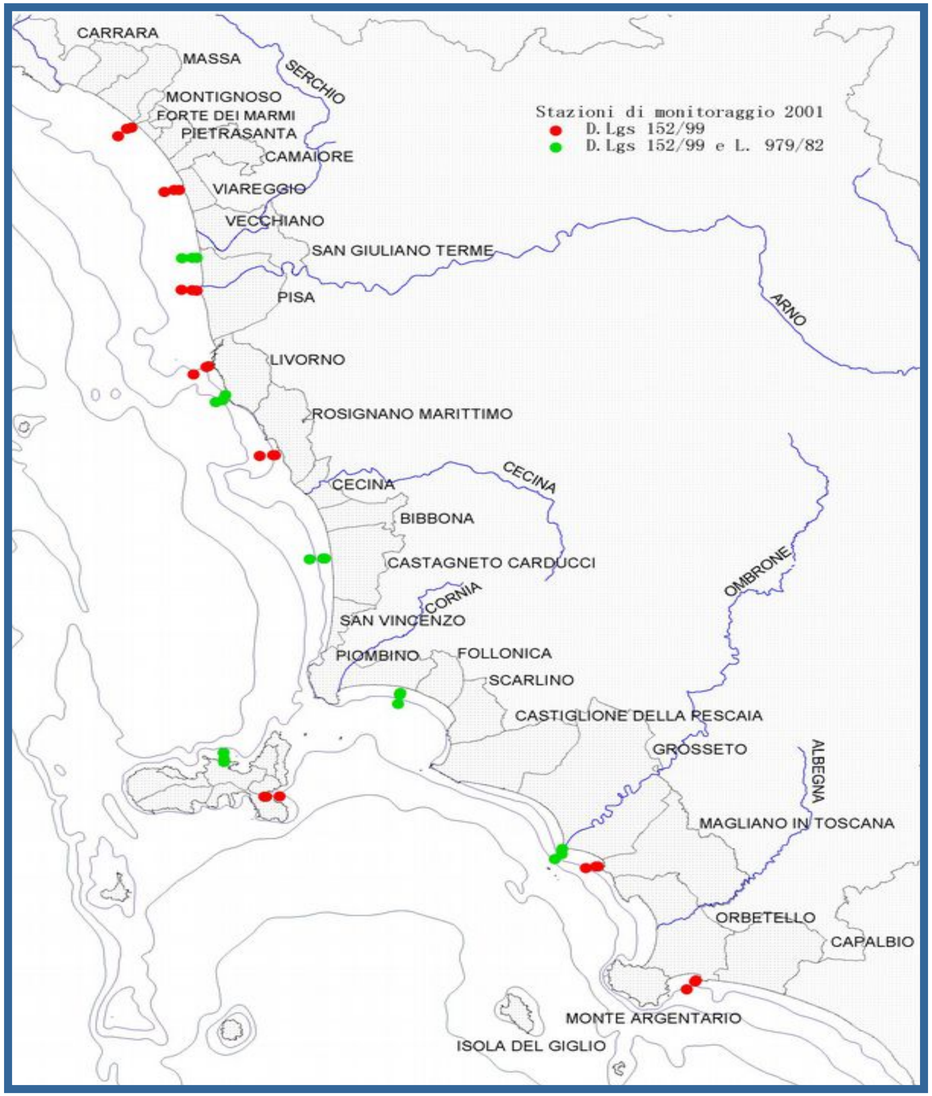
The need for coastal monitoring

Environmentalmonitoring of coastal waters

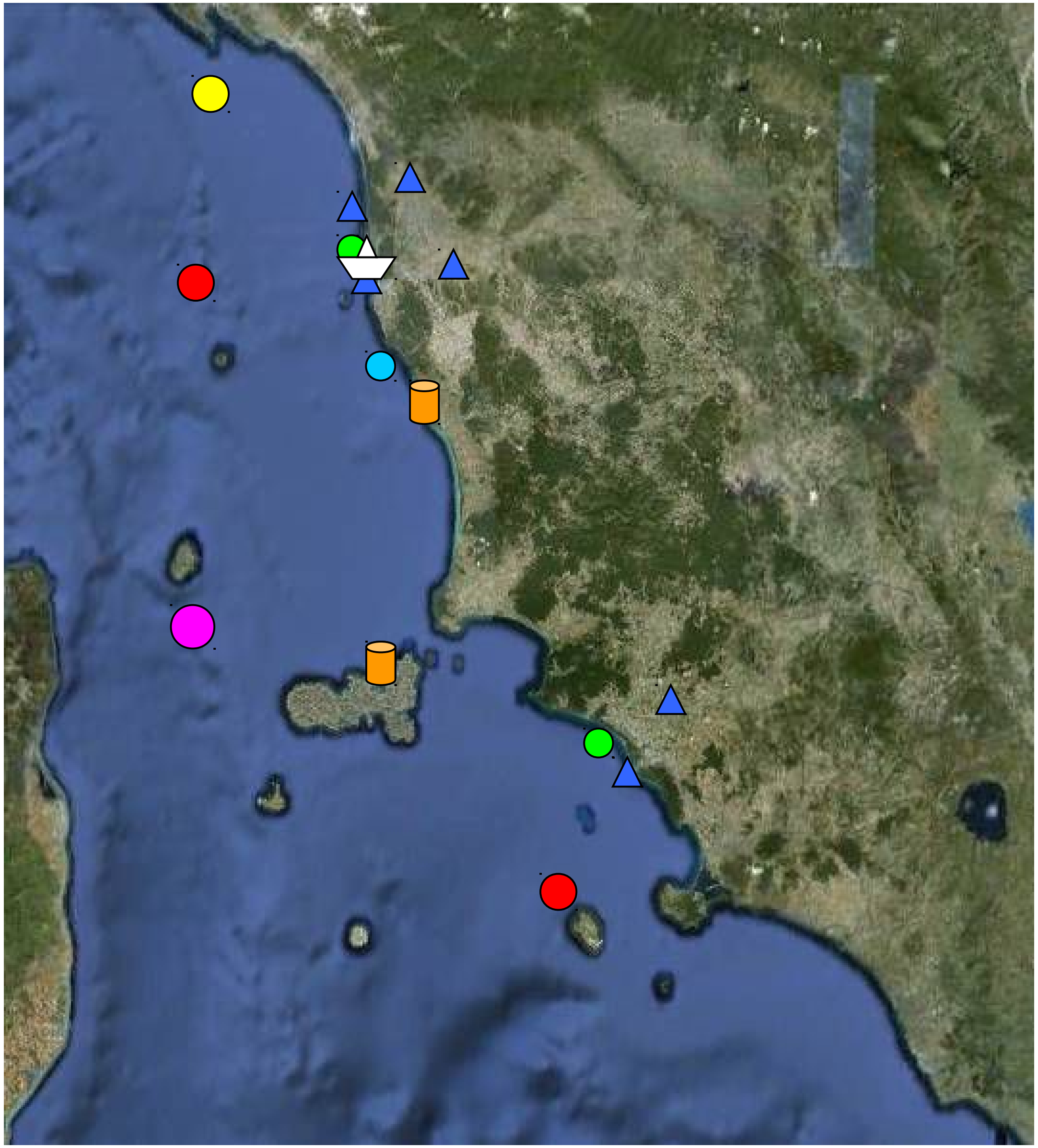
Directive 2000/60 /CE e DM 131/08

Water bodies

Costa della Versilia	Costa di Punta Ala
Costa del Serchio	Costa dell’Ombrone
Costa Pisana	Costa dell’Uccellina
Costa Livornese	Costa dell’Albegna
Costa del Cecina	Costa dell’Argentario
Costa di Piombino	Costa di Burano
Costa di Follonica	Arcipelago toscano

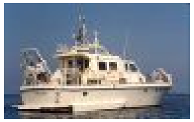


Need for improving sea monitoring procedures



The Tuscany Region marine measurement network

Oceanographic vessel



Wave buoys

ADCPs

Oceanographic buoy

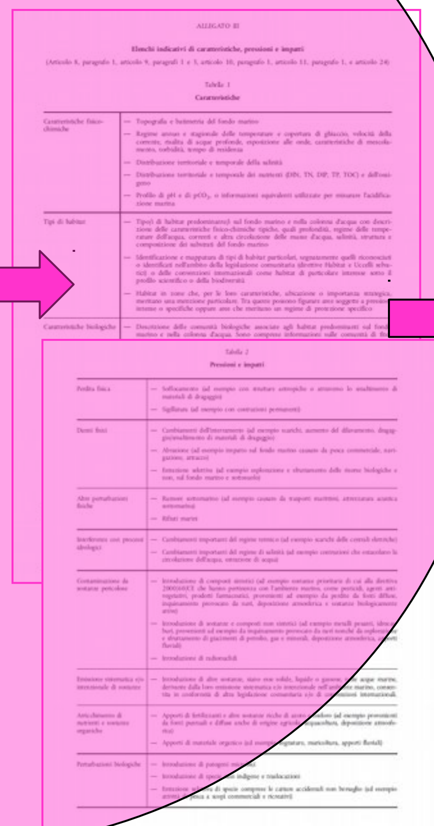
Tide gauge

Hydrometer

The Marine Strategy Framework Directive

Commission decision of 1 September 2010 on criteria and methodological standards on good environmental status of marine waters

- D1-Biodiversity
- D2-Non indigenous species
- D3-Fisheries
- D4-Food web
- D5-Eutrophication
- D6-Seafloor integrity
- D7-Hydrographic condition
- D8-Contaminants
- D9-Contaminats in seafood
- D10-Litter
- D11-Noise



ALLEGATO III

Elenchi indicativi di caratteristiche, pressioni e impatti

Tabella 1

Caratteristiche

Tabella 2

Pressioni e impatti

Defines criteria and metodological rules to define the good ecological status (Commission decision)

The MOMAR project for experimental sea monitoring

MOMAR

Centro Interuniversitario di Biologia Marina ed Ecologia applicata

Dipartimento di Sanità Pubblica Università di Cagliari

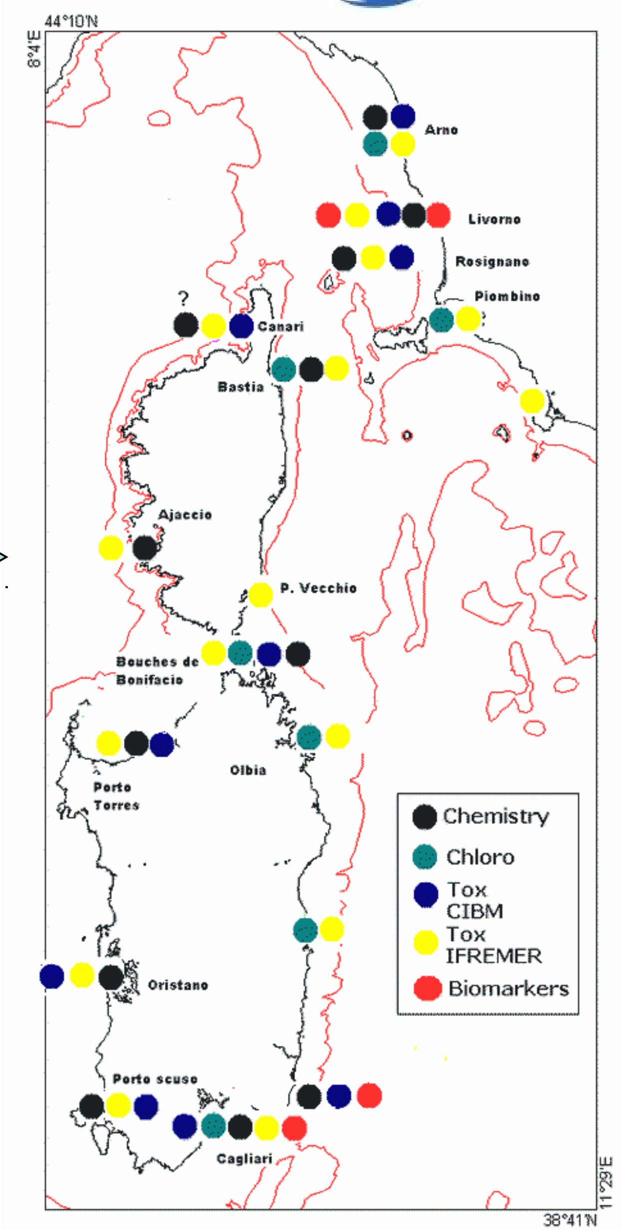
Consorzio LaMMa
Laboratorio di Meteorologia e Modellistica Ambientale

Ifremer
Istituto Oceanografico Francese
Centro per il Mediterraneo
Laboratorio Ambiente e Risorse

Main issues :

- Sea pollution monitoring by chemical and eco-toxicologic analysis

Water and sediment samples



- Remote sensing monitoring of marine coastal environment and EO products calibration/validation

- Hydrodinamic analysis of the potential diffusion/dispersion of pollutants

Oceanographic campaigns

CONSORZIO LaMMA
Ifremer
ARPAT
OGS
SCRIPPS INSTITUTION OF OCEANOGRAPHY

MILONGA

MIsure Lagrangiane OceaNoGrafiche al largo dell'Arcipelago toscano

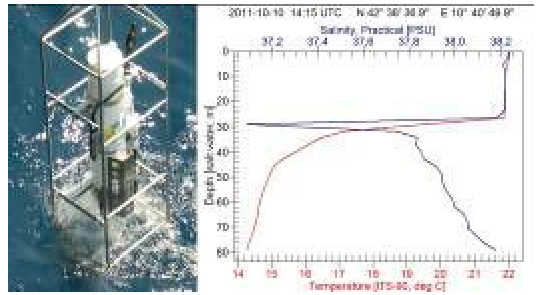
MELBA

MOMAR

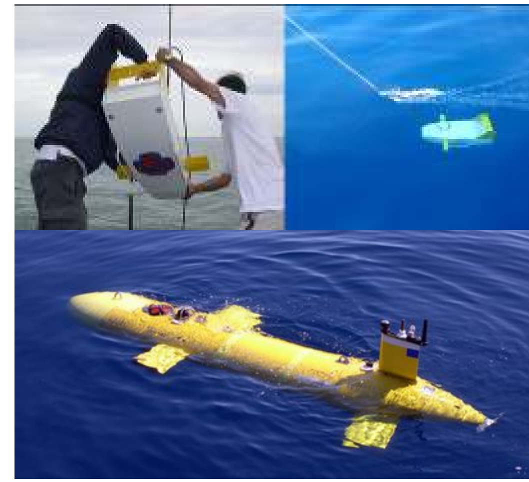
In-situ measurements in use

Water sampling/analysis

Temperature and salinity (CTD/floats)

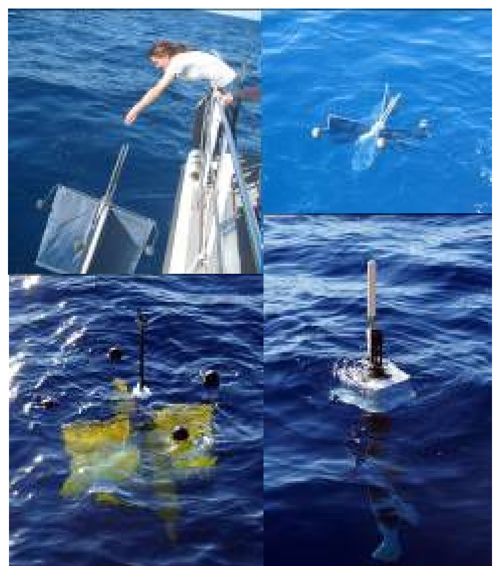


Currents (ADCP)



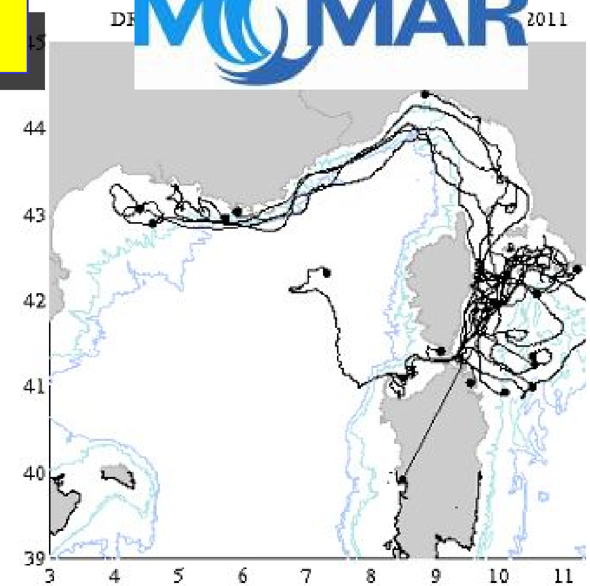
Sediments

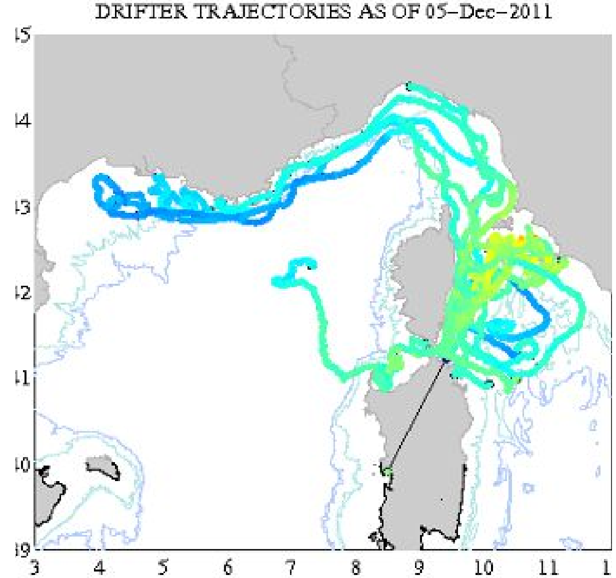
Currents (drifters/floats)



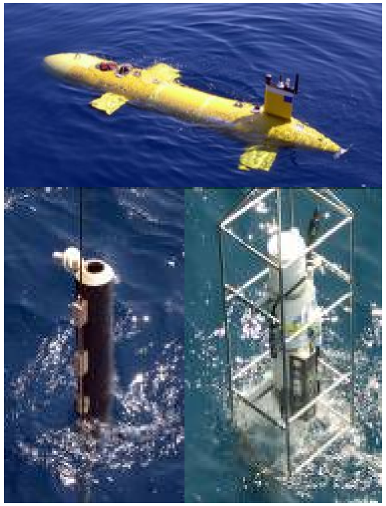
Waves (Buoy)

Lagrangian measurements

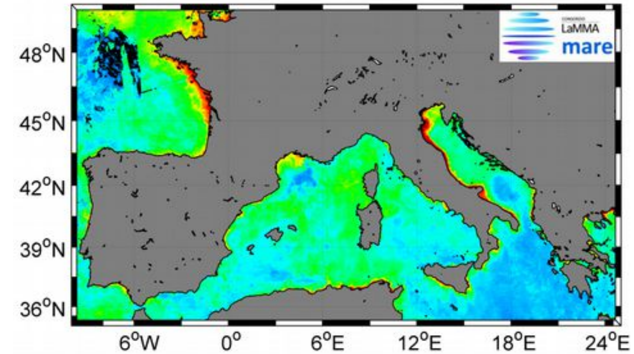




Data integration → the Operational Oceanography activity



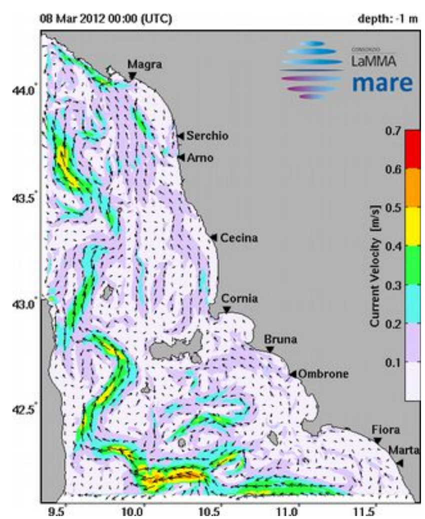
Satellite data



Towards an integrated monitoring system ?

In-situ measurements

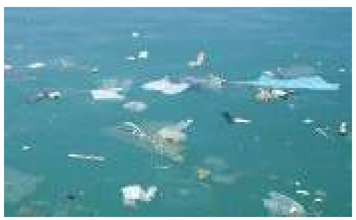
Models

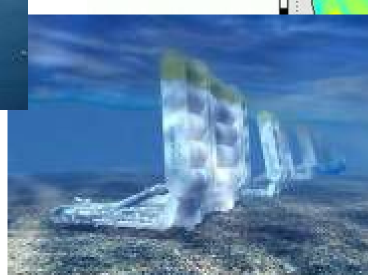


Marine Services → impact on Society

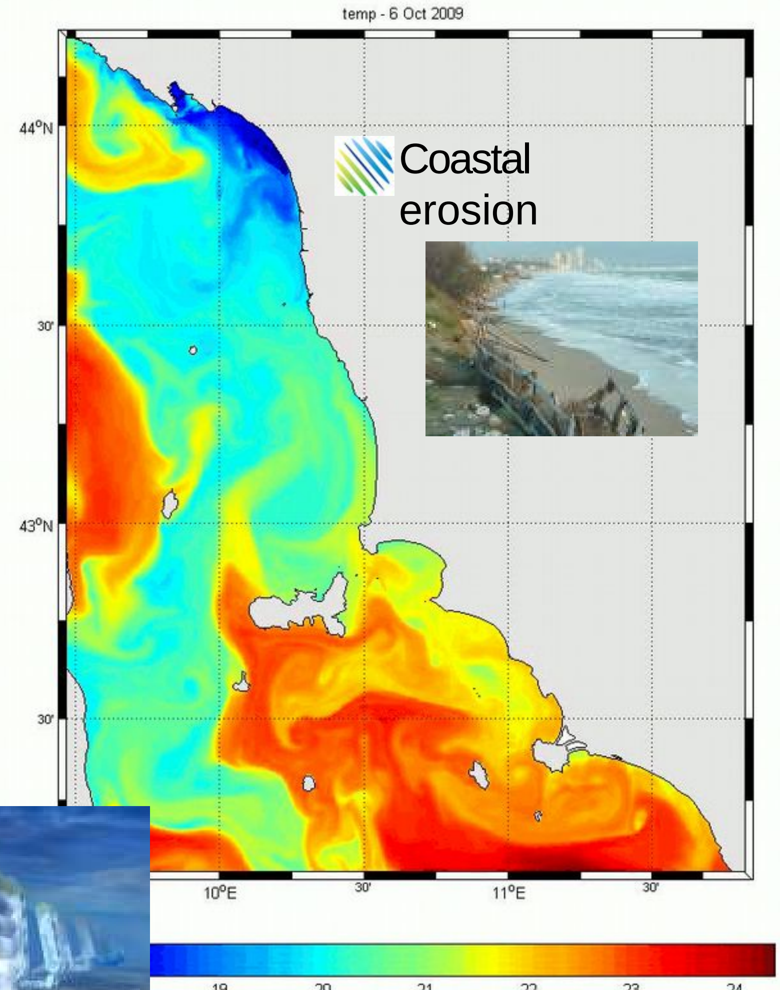
Navigation

Litter, spills, contamination





Energy



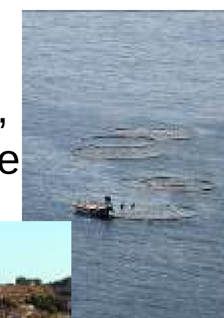
Coastal erosion

Tourism

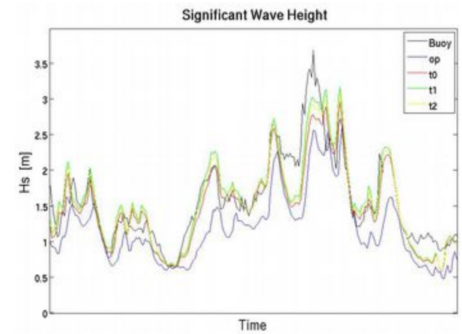
Marine Technologies

Biodiversity

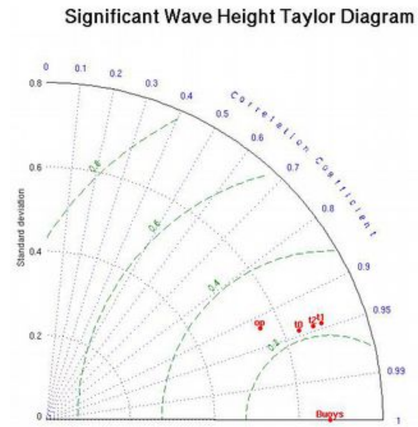
Fishing, aquaculture



Data & models

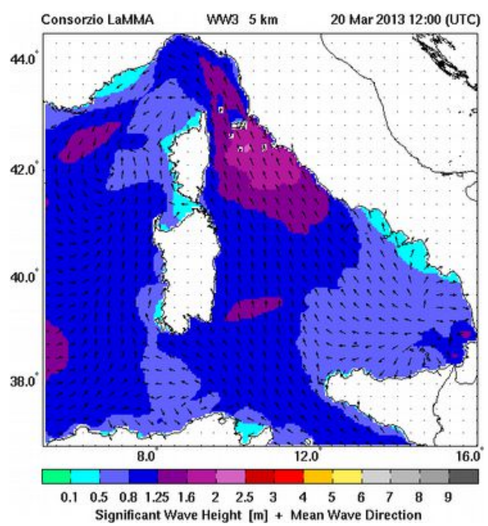


Validation: how good is my model when compared to measured data?



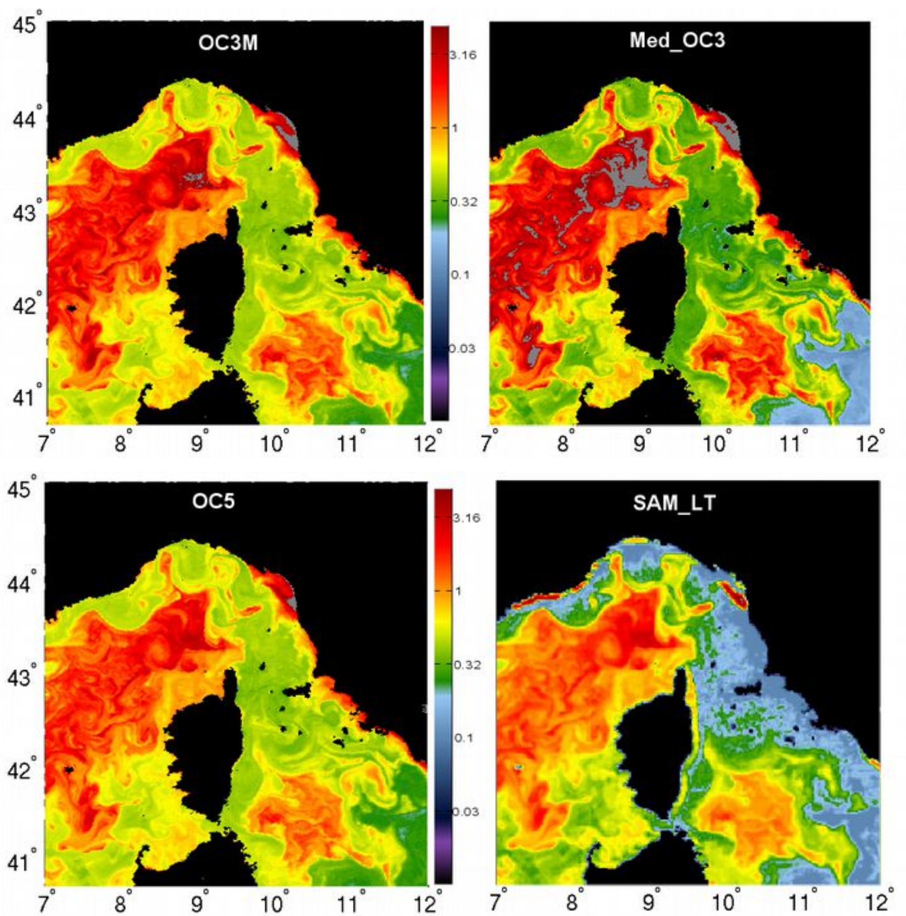
Calibration / configuration: how can model parameters be improved so that we ca have better forecast?

Assimilation: how can I use my data, in a dynamical way, ingesting them into models to improve their reliability?



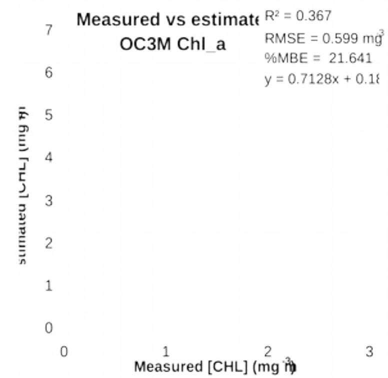
Integration of observed data : remote sensing

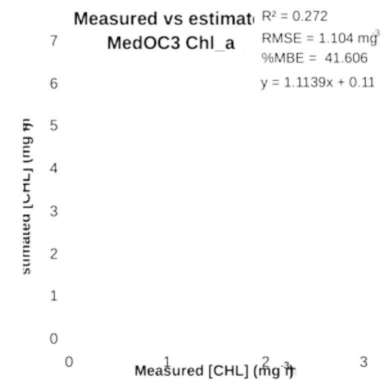
Clorofilla-a

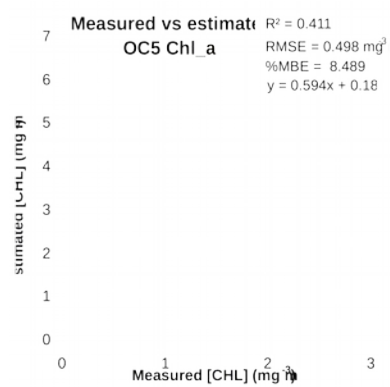


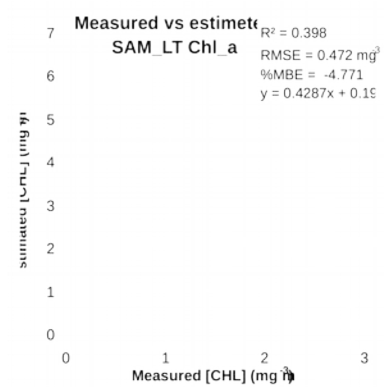
17 March 2009

Campaign	Period	Number of	
MOMAR	April 2010 July 2011	28	CIBM
MELBA	May 2011	11	LaMMA, Ifremer, CIBM
MILONGA	September October 2011	18	LaMMA, Ifremer, CIBM, ARPAT







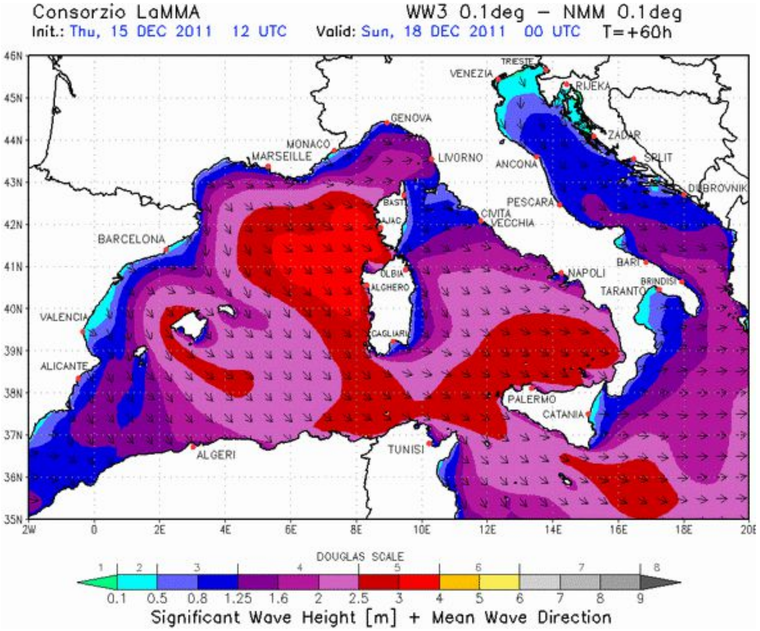


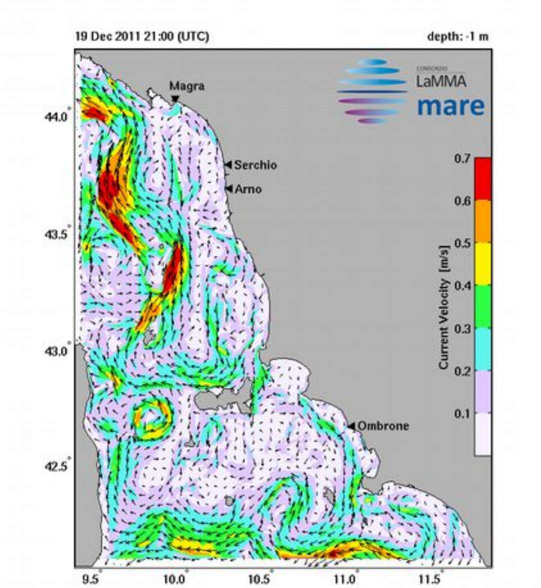
Applications and case studies

Polluttant dispersion at sea: paraffin dispersed offshore Livorno towards Livorno.

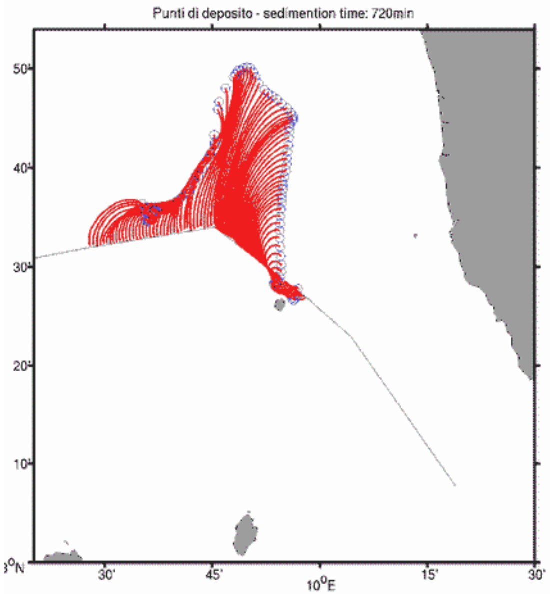
Simulation of paraffin spill (Livorno, 28/02/2012)

Applications & case studies





Drums containing heavy metals and hazardous materials, fallen off the Gorgona.



The challenges of operational oceanography: observe, analyze, predict, provide services to society

- Oceanic deformation radius O(10-200) km << Atmospheric O(1000s) km, → significantly higher resolution is needed to resolve ocean "weather".
- The observing network should be as comprehensive as possible in order to resolve time and space scales of motion and number of field state variables
- The system of observations be available in real time, consistent with the analysis/prediction system (the prognostic component).
- The diagnostic/analysis component should be developed to bring observations into a 'regular grid' representation consistent with the prognostic component (objective analysis and data assimilation techniques)
- Development of downstream services and value-added applications to:
  - allow better knowledge of uncertainty limits
  - ensure the presence of data of great impact to society (for example, planning of activities at sea, security, search and rescue, etc.)

SICOMAR, at a glance

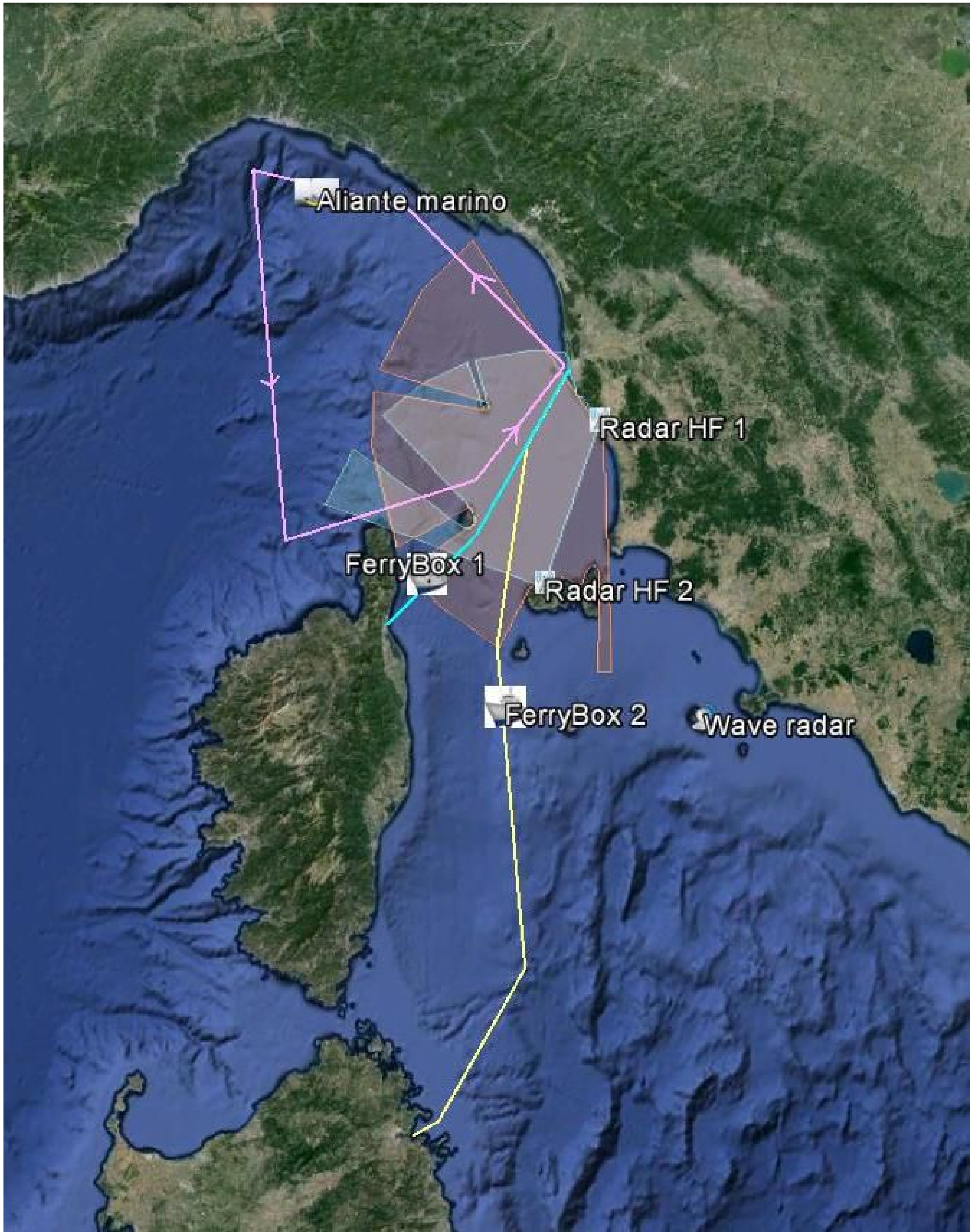
Distributed information, in space and time

A “fully” integrated system: for integrated marine monitoring (multiplatforms) + that can be integrated with a minimal effort with further sensors and instruments

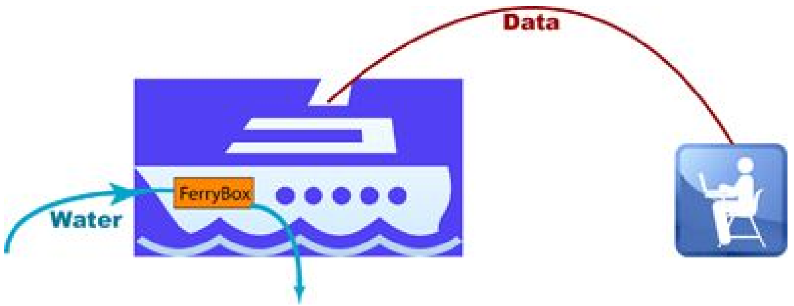
Complementary tools and platforms, even compared to the existing measurement networks

Data immediately usable by itself, with real time transmission, to improve the reliability of the models for sea state analysis and forecast

Sustainability



FerryBox



Ferry ships operate regular routes in many areas of the world

Boxes of sensors that work automatically can be installed

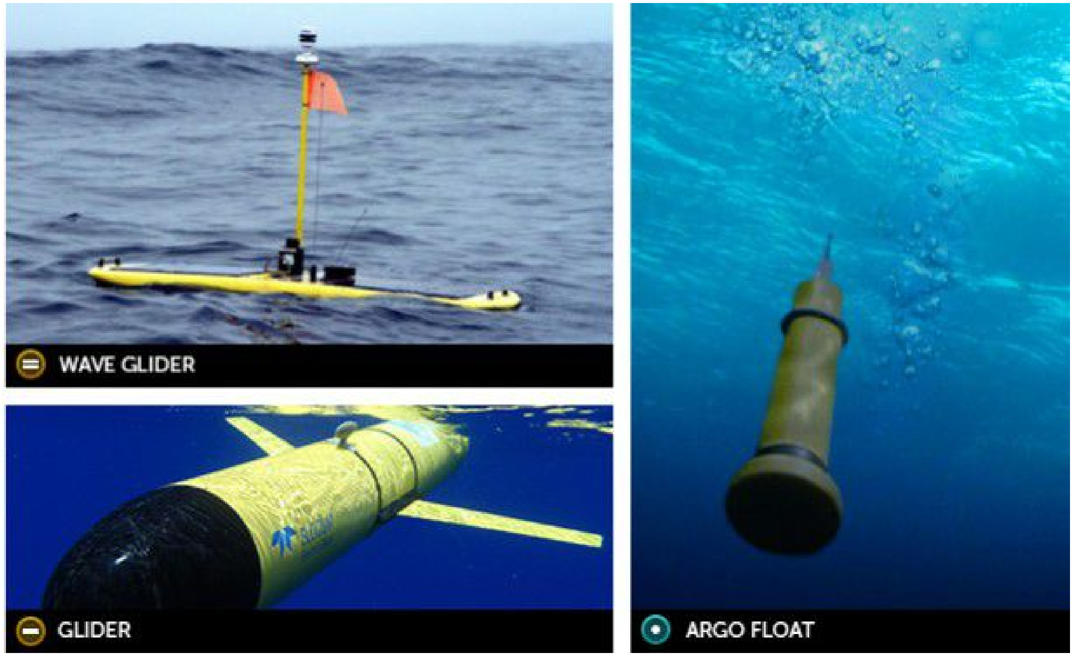
To collect physical, chemical and biological data using commercial ships

Cost effective data collection

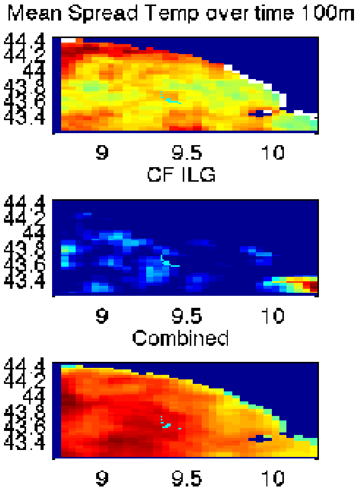
Voluntary Observing Ships → Cooperative data collection

Ocean Robots

- Tools easy to deploy, significantly more affordable than multi-million dollar moorings
- Suitable for environmental monitoring (capability for host multiple sensors)
- Different mechanisms for propulsion: electric motor feeded by rechargeable batteries, buoyancy, wave power



- The most interesting aspect is that you can drive the tool remotely and, in particular, trying to capture data where the model uncertainty is greater



HF radar

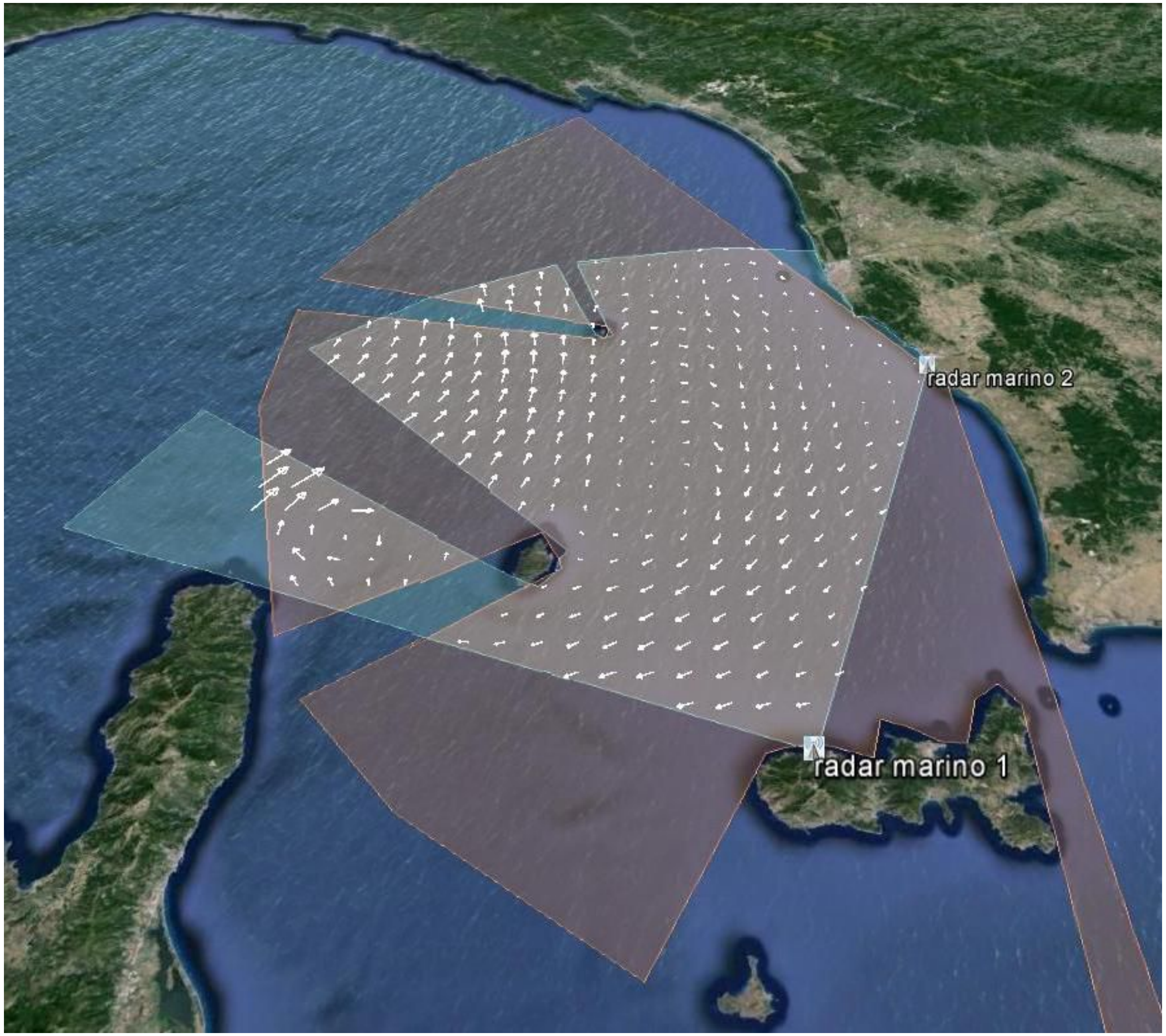
Wide cross-border area covered

Reduced environmental impact

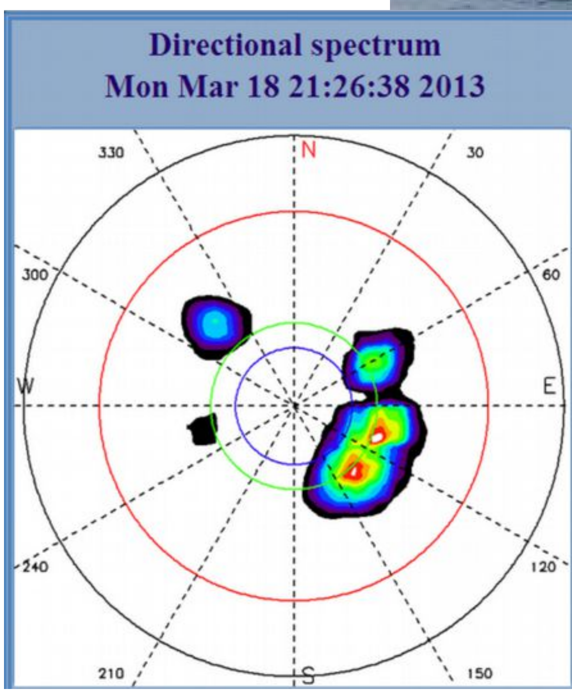
Integration with existing mo itoring network

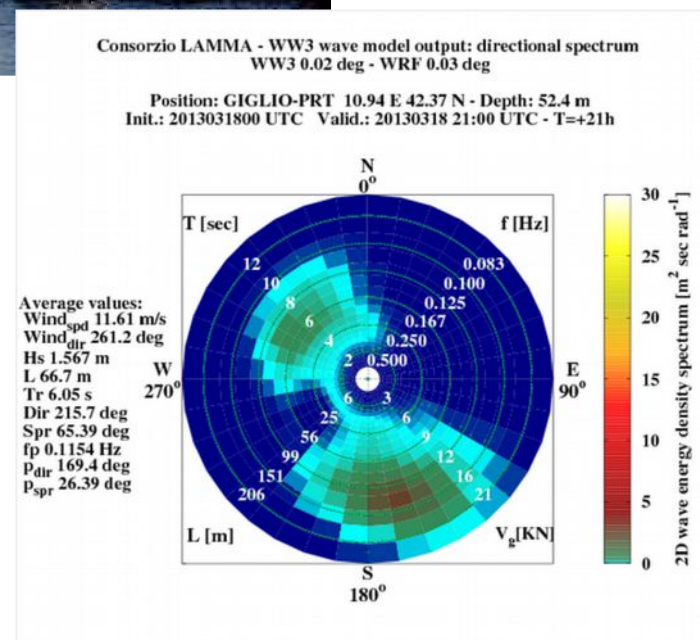
Multi-purposes data: surface currents (on a wide range), waves (on a reduced range) + research development

Sustainability

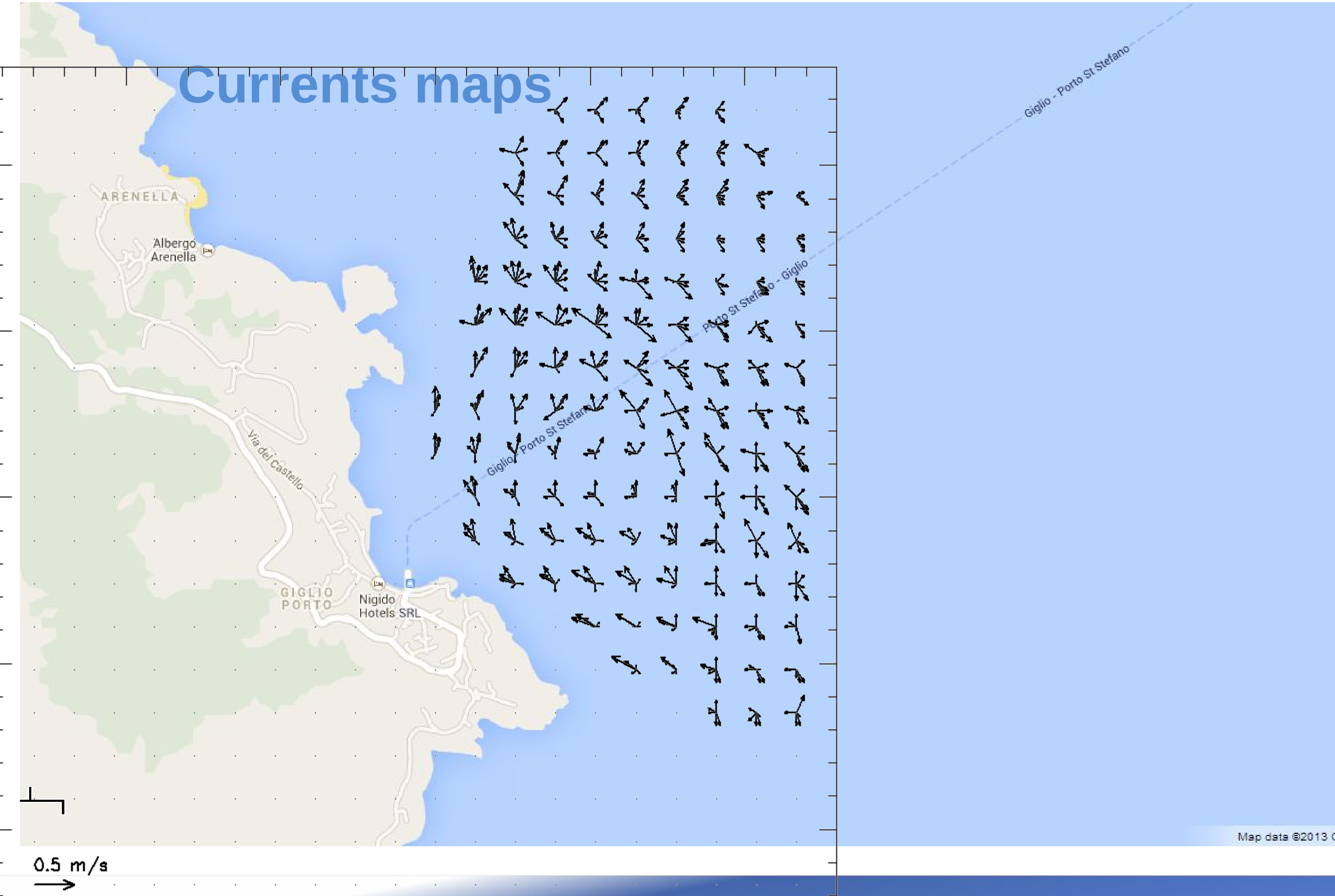


The Giglio wave radar, a tool for emergency support and work planning.



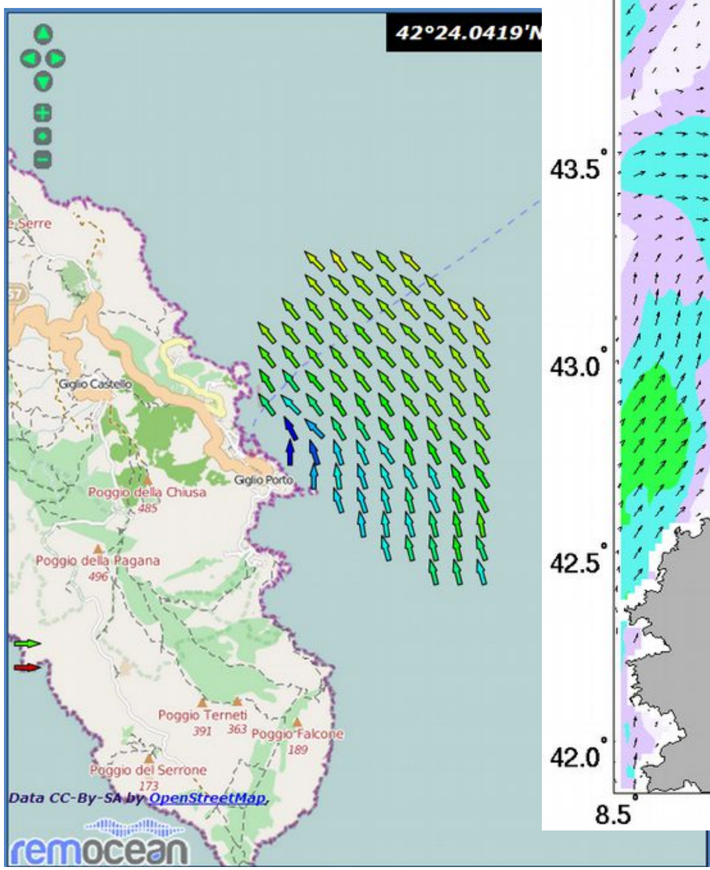


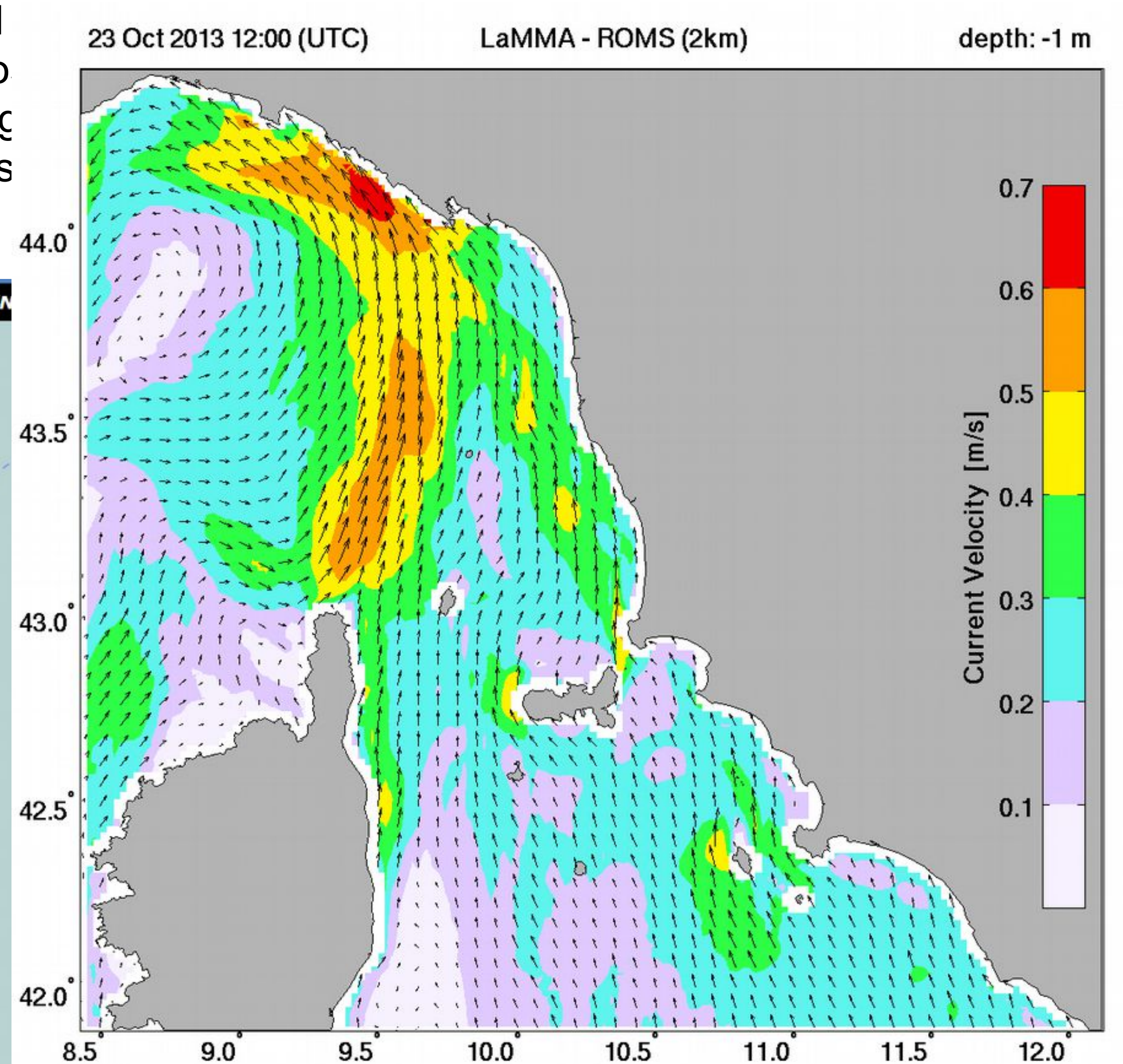
Currents maps



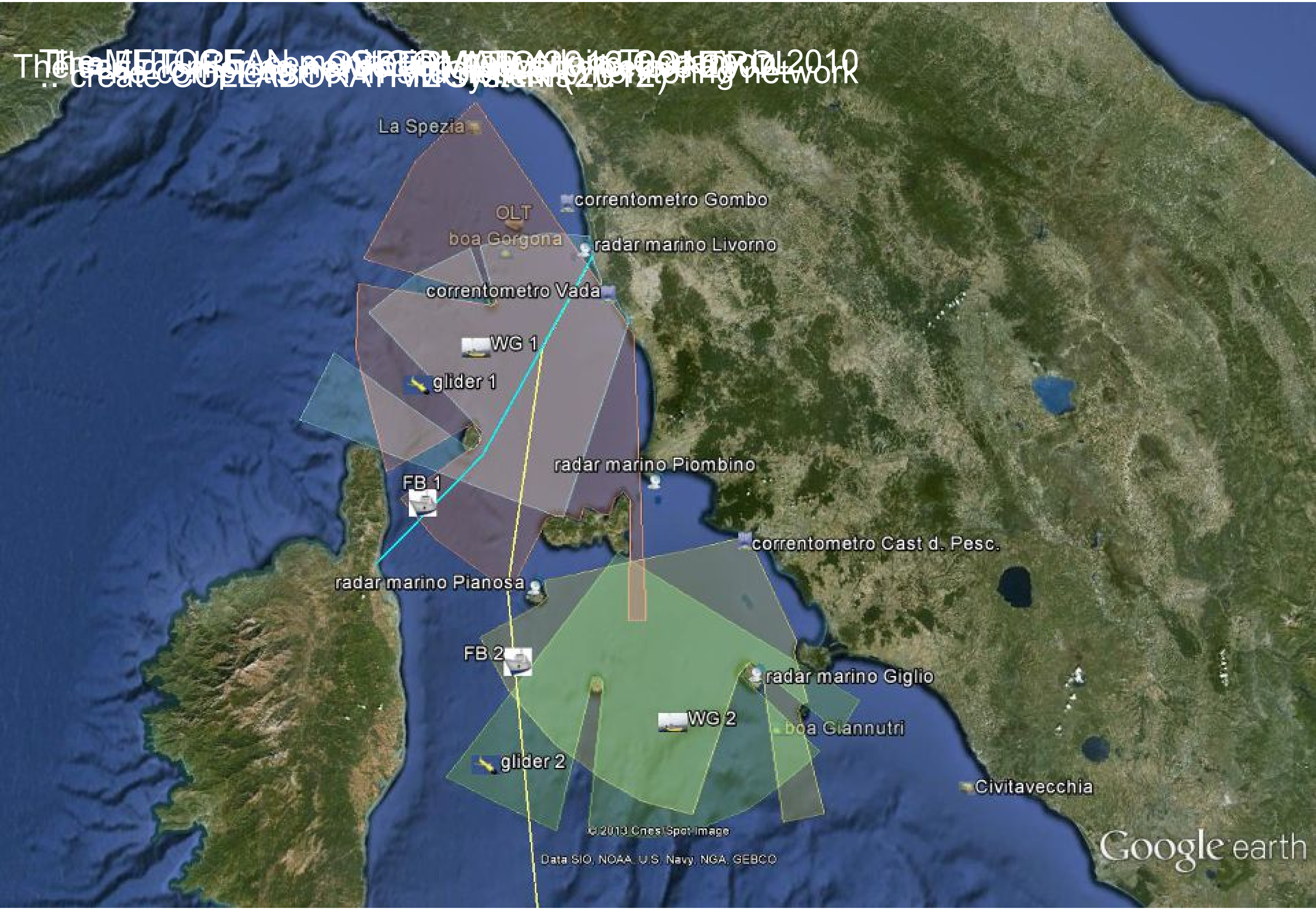
Verification of surface currents

The coastline shape and
observation of sub-meso
patterns that are challeng
observation/forecasting s
is very significant.





Building a measurement network for sea observation and control



Conclusions

- The design of a state-of-art sea measurement network asks for monitoring methodologies well beyond the traditional concept of sampling → need for approaches to spatial and temporal data integration (eg passive sampling, monitoring of opportunities along the routes, integration with the products of remote monitoring and modeling).

- The information on the physical and biological environment, within and outside the ecosystem point of view adopted by the MSFD, appear inextricably linked → need to improve relations between experts from different sectors but also between institutions and research;

- Need to promote and exploit the opportunities that come from the real economy: marine data (physical, biogeochemical, pollutants), are of great value even for non-public entities (commercial users): they are the basis for the realization of economies of scale, and they can help public (institutions, research organizations) to reach monitoring objectives through cooperative data collection systems.

SICOMAR

COoperative Satellite navigation for MEteo-marine MOdelling and Services

COSMEMOS

Thank you!

REGIONE TOSCANA

CONSORZIO LaMMA

Consiglio Nazionale delle Ricerche

MOMAR

SICOMAR