

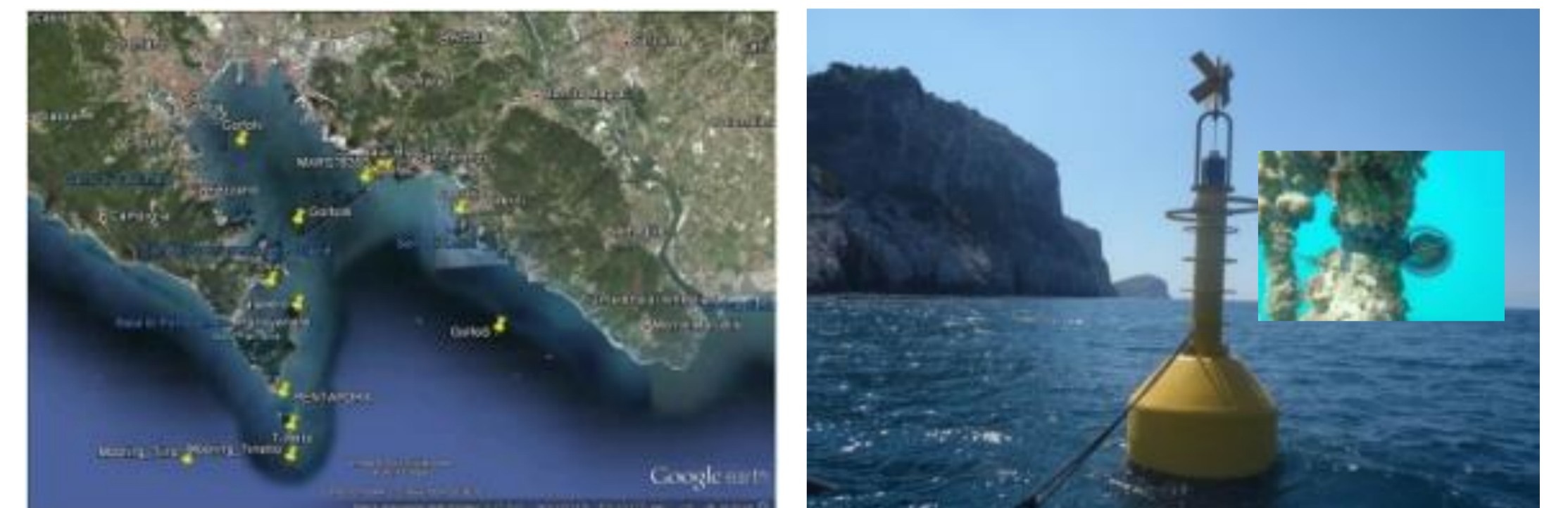
Hydrodynamic and mixing variability by experimental measurements and numerical modeling

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A) Oceanographic monitoring of the Gulf of La Spezia - Eastern Ligurian Sea

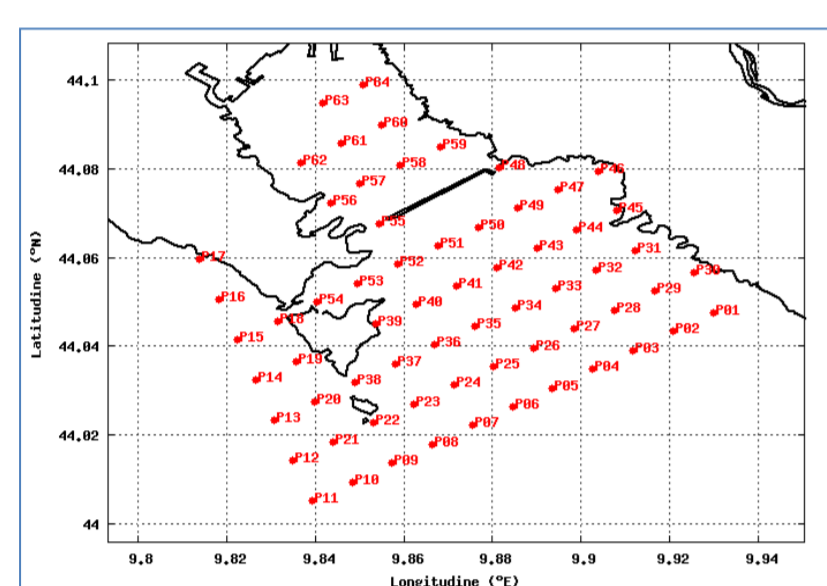
The monitoring activities of ENEA S.Teresa Centre in the Gulf of La Spezia include:

- Synoptic campaigns at seasonal scale and on different grids
- Time-series measurements for sea water temperature, salinity and currents from mooring and fixed locations
- Data collection from the on-site meteorological station

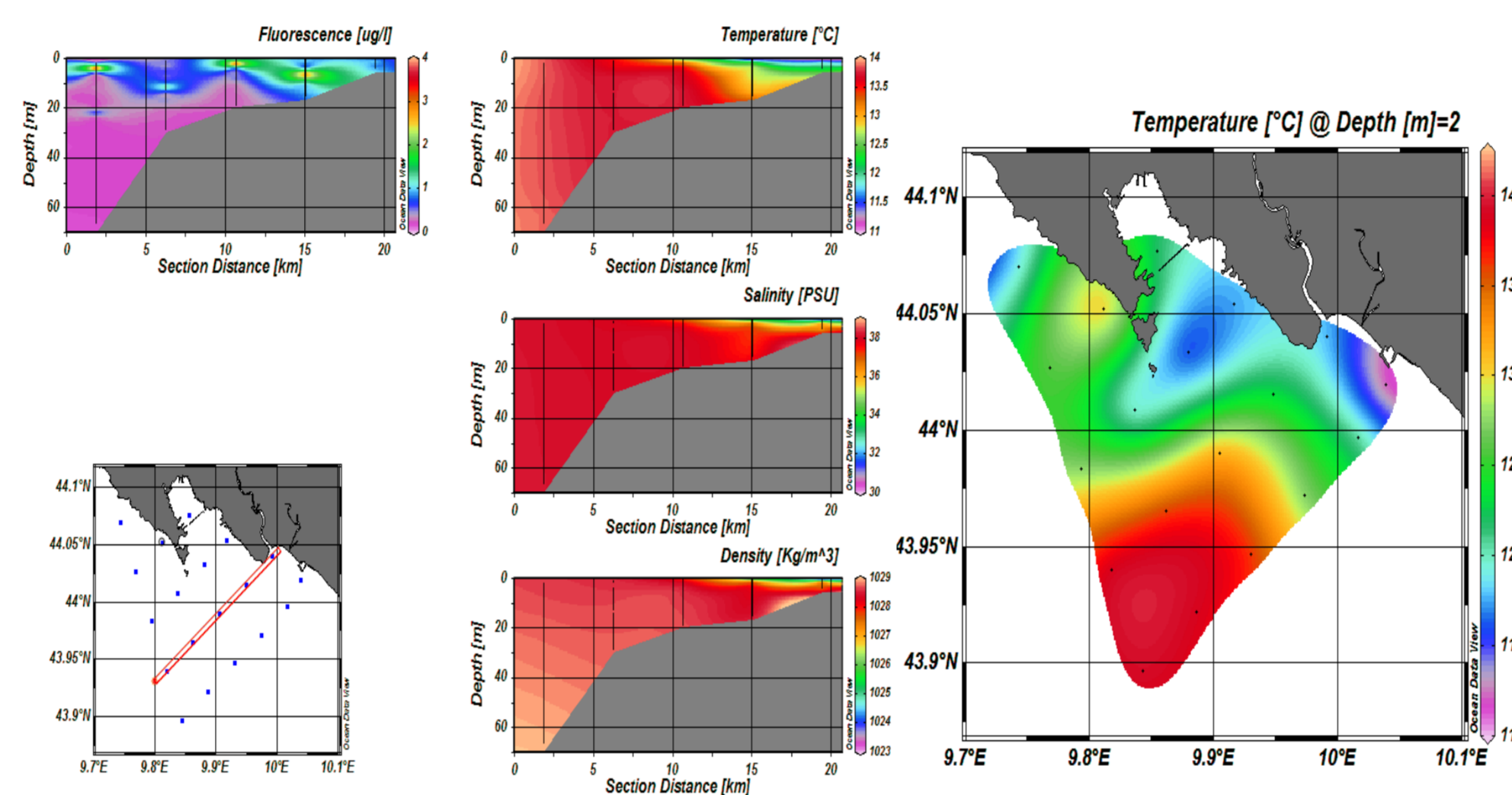
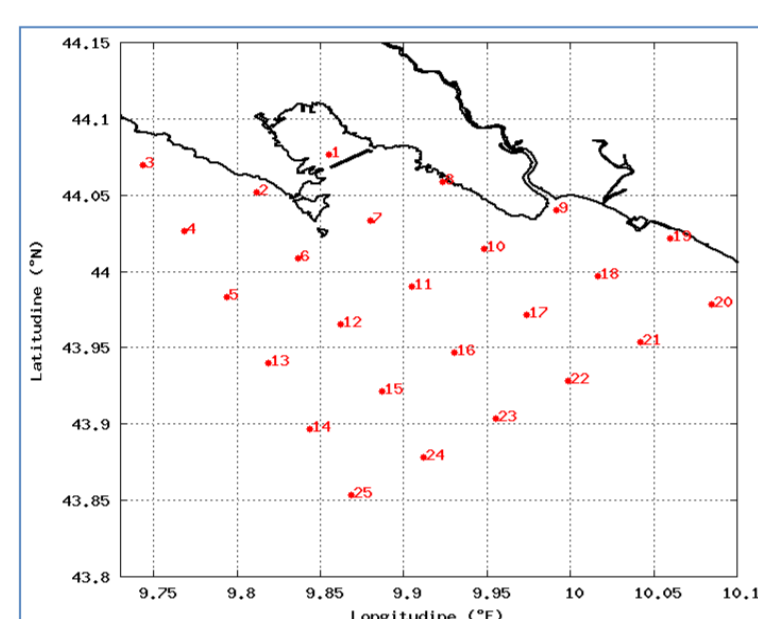


The fixed stations for oceanographic time series

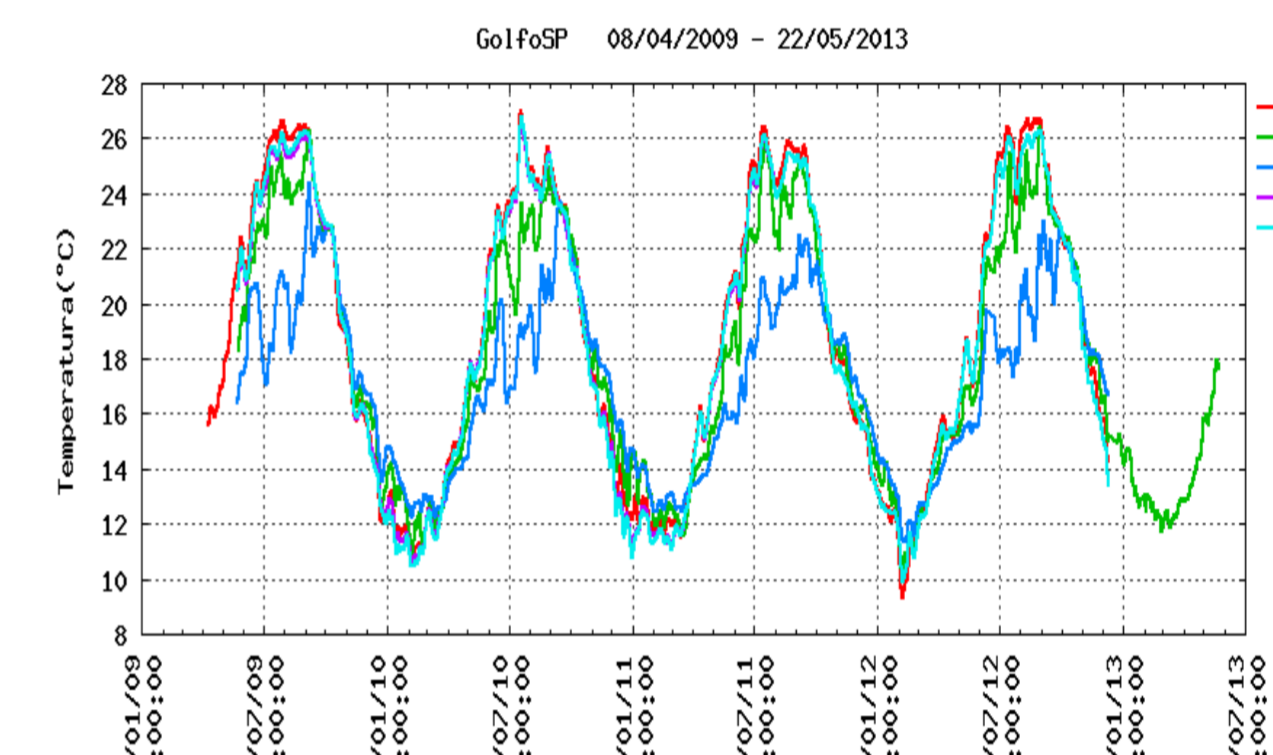
Small temperature sensors on mooring location



Selected monitoring grids



Vertical and horizontal data contouring from the oceanographic campaign on the 25th of January 2013



Sea temperature trends at representative fixed stations (2009-2013)

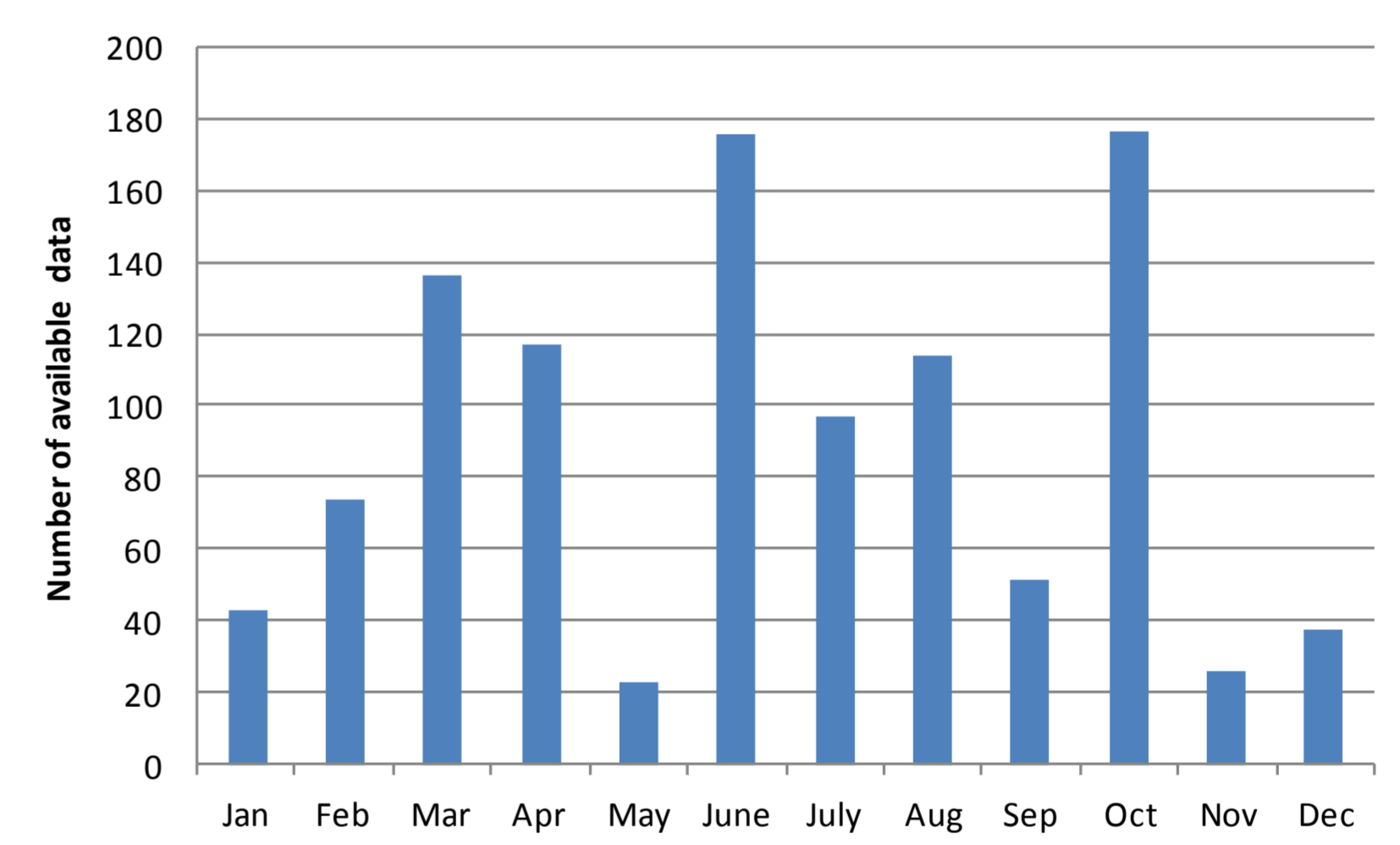
B) Oceanographic database and web data tools

The oceanographic database has been developed using all the available measurements for the investigated area (1973-2013). This database is specifically devoted to define the environmental conditions of the area and to support the modeling activities (e.g. initial and boundary conditions, calibration, validation) as well as marine process studies.

The MOIS (Mediterranean Oceanographic Information System), used by ENEA centre to manage marine data, has been updated in accordance with the INSPIRE directive, after a quality control procedure. MOIS allows visualization and download of in-situ oceanographic data, from the website: <http://www.santateresa.enea.it>.



The Mediterranean Oceanographic Information System web interface



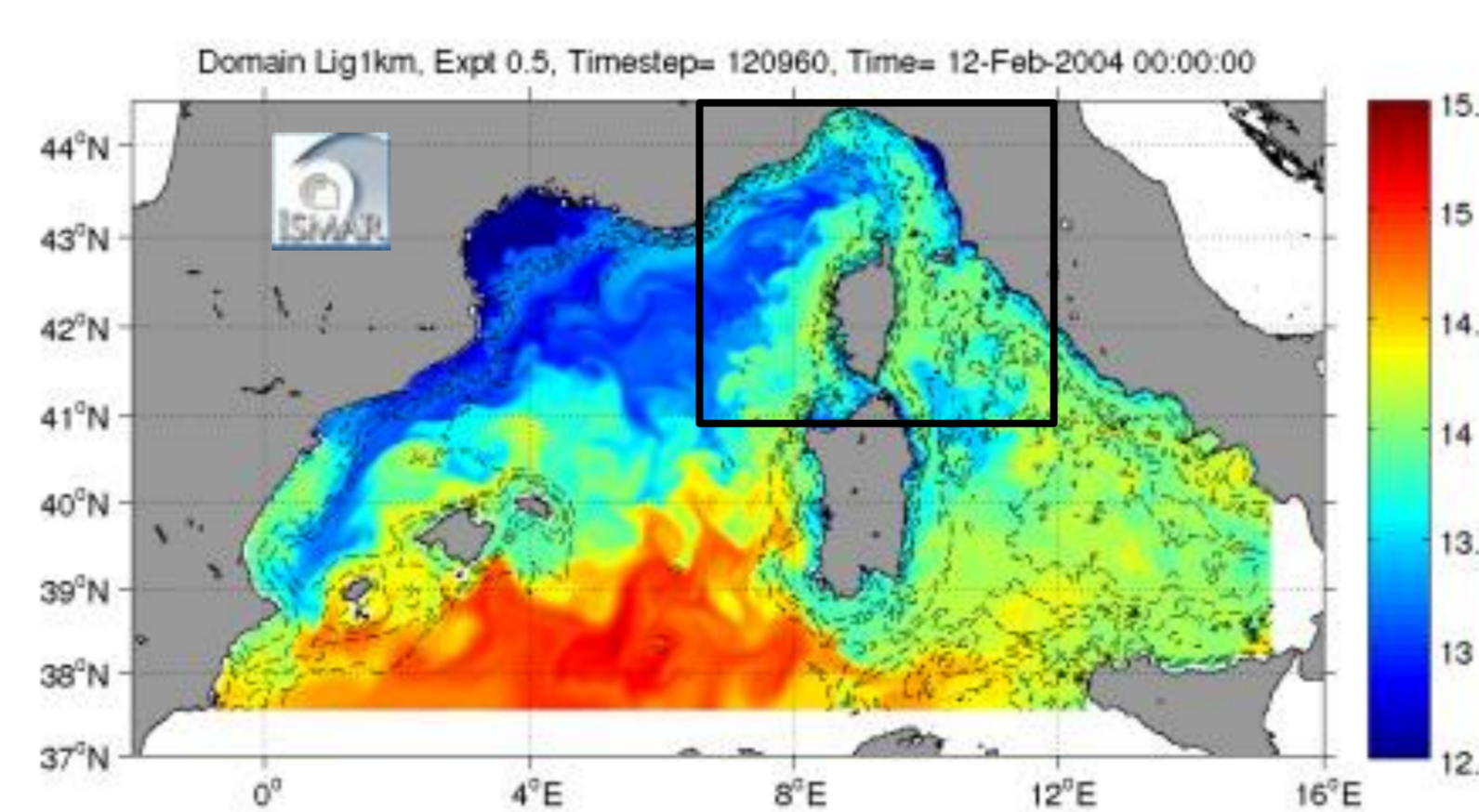
Monthly distribution of measurements in the Gulf of La Spezia area

C) Hydrodynamic model: Li-ROMS

The Regional Ocean Modeling System has been configured at the ISMAR/CNR of Pozzuolo di Lerici (SP) to explicitly resolve mesoscale dynamics in the Ligurian and Northern-Tyrrhenian Seas.

The grid covers the whole domain shown in the middle figure, for a total of 590x314 points. To reduce boundary effects, the mesh is telescopic and reaches a nominal resolution of 1/64° (about 1.5 km) in the area of interest (black box in the figure). 50 "sigma"-levels are used in the vertical.

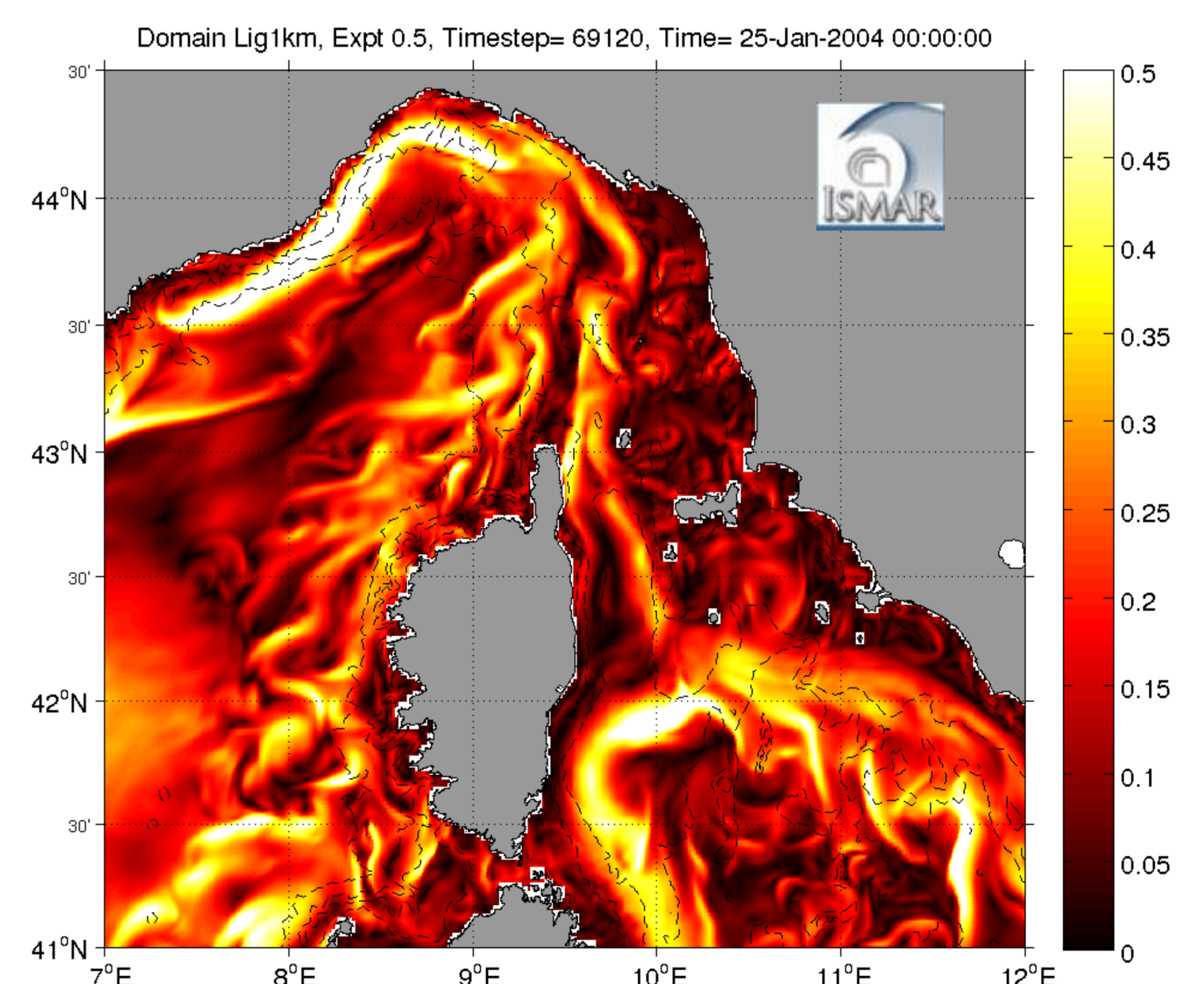
Initial conditions are from a spin up run, which begins with a climatological month of January and lasts for two years. Surface forcing comes from the 1/10° WRF simulations run at the University of Genoa/PM_TEN spinoff. Boundary conditions are from the 1/16° Mediterranean Forecasting System product.



Sea surface temperature (°C) on the whole Li-ROMS domain

High-resolution surface temperature and velocity fields show the usual, well-known circulation pattern but also a well-developed turbulent flow, as show in the right figure.

Smaller mesoscale coherent structures are mainly due to the high-frequency (1-hr) surface forcing and impact transport.



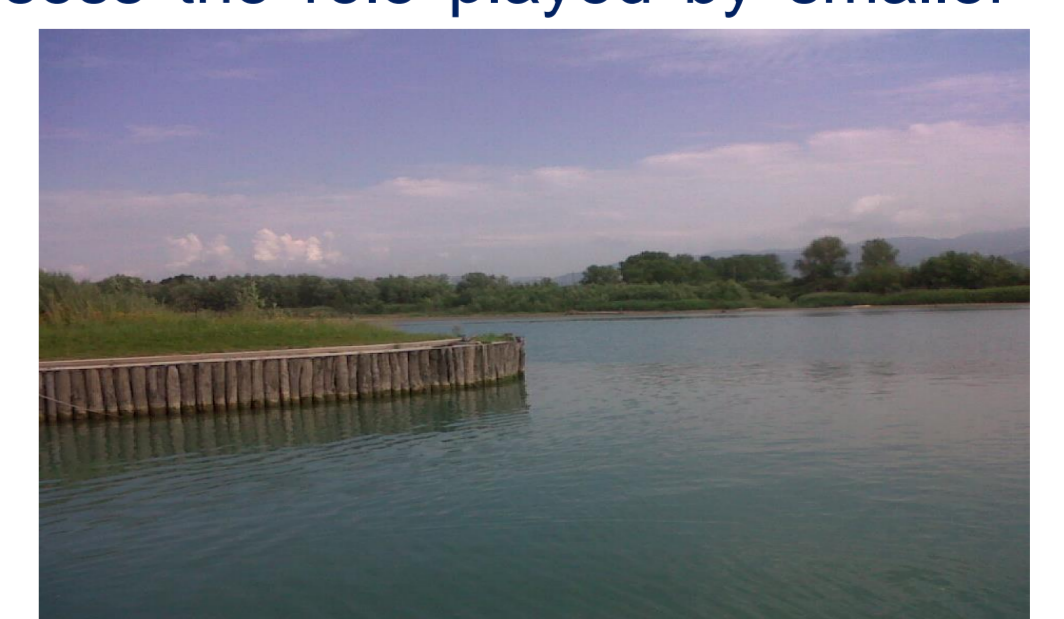
Surface velocity (m/s) in the area of interest

Future activities

Additional oceanographic campaigns are scheduled across the 2013 to define the seasonal cycle and to focus on river input processes.

An oceanographic mooring located close to the RON wave buoy (43.93°N, 9.82°E) will collect long-term time series of CTD and currents and aim to provide a more complete picture on the hydrodynamic and wave conditions of the investigated area. Numerical simulations at the ISMAR/CNR will include available runoff data and assess the role played by smaller mesoscale eddies in the local transport of substances.

Suspended sediment transport will be long-term monitored using an optical fully equipped turbidimeter to investigate the continental outflow (from Autumn 2013 to the end of the Project). The sensor will be installed in proximity of the estuary of the Magra river. These data will be helpful to overcome the shortage of turbidity measurements in the area, as only few fixed stations are available in the upper part of the river. These stations, managed by local hydrographic services, are not representative of the river outflow at the estuary and only cover a short period of time.



Selected site for the suspended sediment monitoring at the estuary of the Magra river