

## Ligurian Observatory – Mediterranean Sea

**This area is monitoring for a long time with conventional cruise. Long term series get with various tools and various sampling times are already available (SOMLIT, DYFAMED). Existing cables installed for the ANTARES neutrino detector experiment make this practical early site for development: perpetuating presently measurement with higher sampling rate and interactivity, testing of new instruments, in link with IODP.**

### Scientific context and relevance

The Ligurian Sea is a large multidisciplinary area of interest with many technical advantages for a demonstration observatory. It would play in ESONET a similar role to the Monterey Accelerated Research System (MARS) in the American NEPTUNE development. Many subsystems are already available such as the land fall station, the cable landing and one junction box from the Antares neutrino observatory project. All the technology and subsea intervention know-how is mastered by the partners. Moreover, the site is in deep water not far from important harbours and sea state conditions are well known and favourable for tests and sea operations.

Almost all scientific packages within ESONET will have a scientific interest at the Ligurian region. Long term series of data exist in many fields and scientists now require real time high frequency sampling rates to understand processes and develop predictive modelling.

The Ligurian sea is a seismic area not far from an inhabited region. The active fault in deep water cannot be monitored from shore due to propagation anomalies induced by the geologic structure.

Slopes instabilities are located on the continental slope. The last catastrophic event occurred at Nice airport (16 October 1979). One effect of this land slide was the rupture of telecommunication cables 100 km from Nice, in 2 500 m water depth.

Hyperpycnal and turbidity currents appear at the Var river mouth during overflow events and their effect is propagated down the Var canyon. The same phenomenon, at large scale, appears in major river systems like Zaire. The site is convenient to develop a scientific knowledge of this process.

In Ligurian sea, the offshore area is completely isolated from coastal influence by the “Liguro-Provençal” current. It is representative of large areas of the world ocean. Dynamics of fluxes in this region have been monitoring since 1988, participating to JGOFS programs.

More than 20 parameters are collected on a monthly basis at DYFAMED location. Since 2003, the area is used as a calibration point (BOUSSOLE buoy) for water colour satellite sensors.

Dynamics of oceanographic processes can be studied: wind driven coastal upwelling, particle plumes, nutrient benthic exchange, bottom boundary layer processes, mesoscale variabilities,....

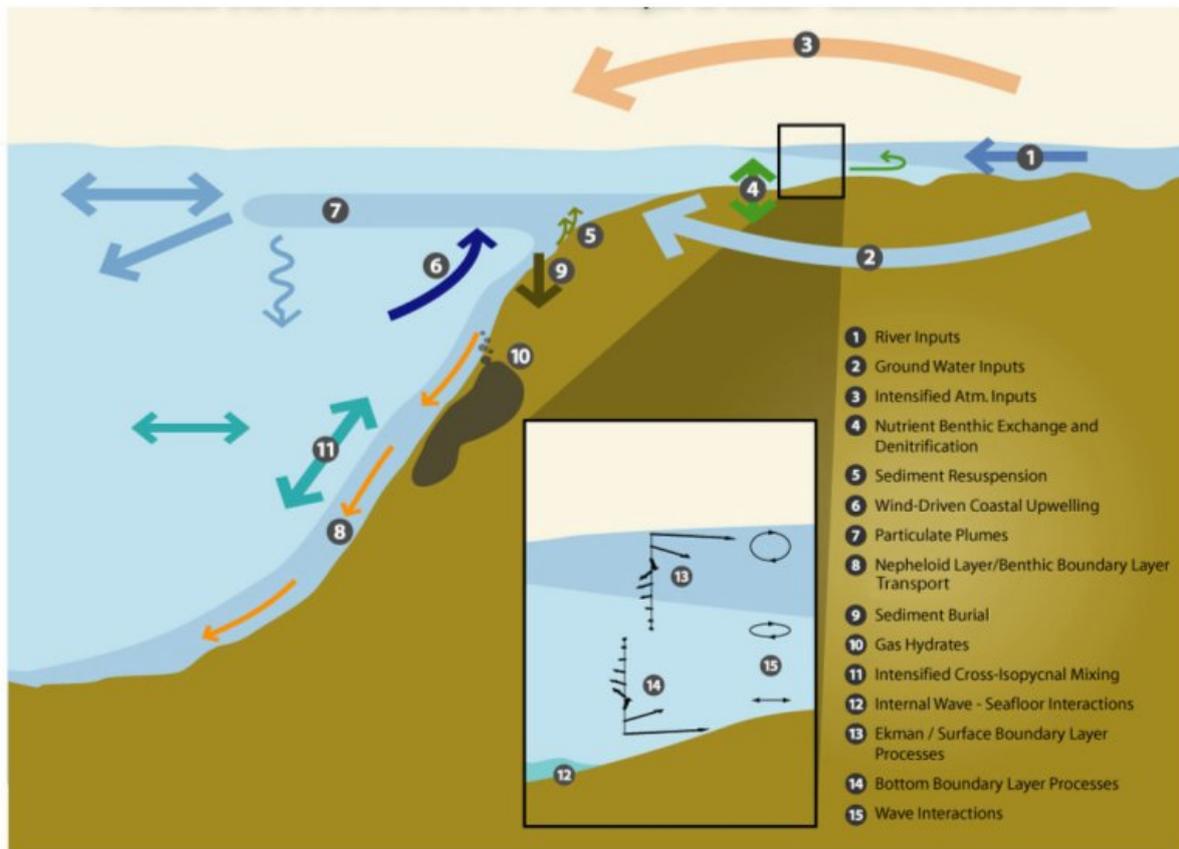


Figure 1 : Oceanographic processes which can be studied on the Ligurian sea observatory.

The 685 IODP proposal seeks to establish a test bed for offshore borehole observations and borehole-to-cable technologies. It proposes drilling at four sites to study microseismicity, the seaward extend of seismicity, noise level testing against OBS and the precursors and mechanism of landslides with hydrological experiments. Temperature, pore pressure, electrical conductivity, fluid chemistry and strain will be also monitor.

### Scientific objectives

This site gives an opportunity to test technological development in a place of high scientific interests. Long time series measurement, with low sample rates time exists. It will be possible to compare these data with those acquired at high sample cote time by a cable observatory.

The availability of ROVs and submersibles in this area will allow a “low cost” maintenance of the observatory and the deployment for testing of new instrumentation.

All scientific disciplines can find interest to use data collected by such a network.

### Existing national and international programmes on the site

The Joint Global Ocean Flux Study (JGOFS) is an international and multi-disciplinary program launched in 1987 under the auspices of the Scientific Committee of Oceanic Research (SCOR). The Ligurian Sea is one of the site monitored by this programme (DYFAMED mooring).

The ANTARES collaboration is constructing a large area water Cherenkov detector in the deep Mediterranean Sea, optimized for the detection of means from high-energy astrophysical neutrinos. The test site is implemented in deep water in the landing station of Toulon. A telecommunication cable was installed at La Seyne and joins a deep water site (2500 m depth) south of Porquerolles Island.

The ROSMARIN network (funded by INSU, PACA and EC through Interreg DEVINE project) monitors the deep sea seismic activity by deploying a semi-permanent OBS network.

### Preliminary design of the implementation and possible schedule

The Ligurian sea observatory will comprise:

- . Three stations with at least broadband seismometer, biogeochemical sensors and physical sensors (currentmeters), CTD, turbidity,... [blue square].
- . A local array with acoustic networking to monitor canyon of Var and slope stability events (piezometer, geodesic, turbidity, turbidity currents,... [yellow area].
- . Water column measurements on DYFAMED by vertical moorings monitoring the dynamic fluxes (particle samplers, fluorimeter, chemical analyses,...) [red square].
- . Four instrumented boreholes (IODP program), two in deep water to develop seismic instrumentation in borehole and two on the continental slope to study mechanism of land slides with hydrological experiments [pink point].

In a first step, a cable will be deployed in deep water from Antares site, to raise its landing station. Two junctions would be deployed, with a secondary one on station A and on DYFAMED area.

In a second step, a dedicated landing station would be installed (Saint Jean Cap Ferrat?), the ANTARES being used again to increase reliability of the system.

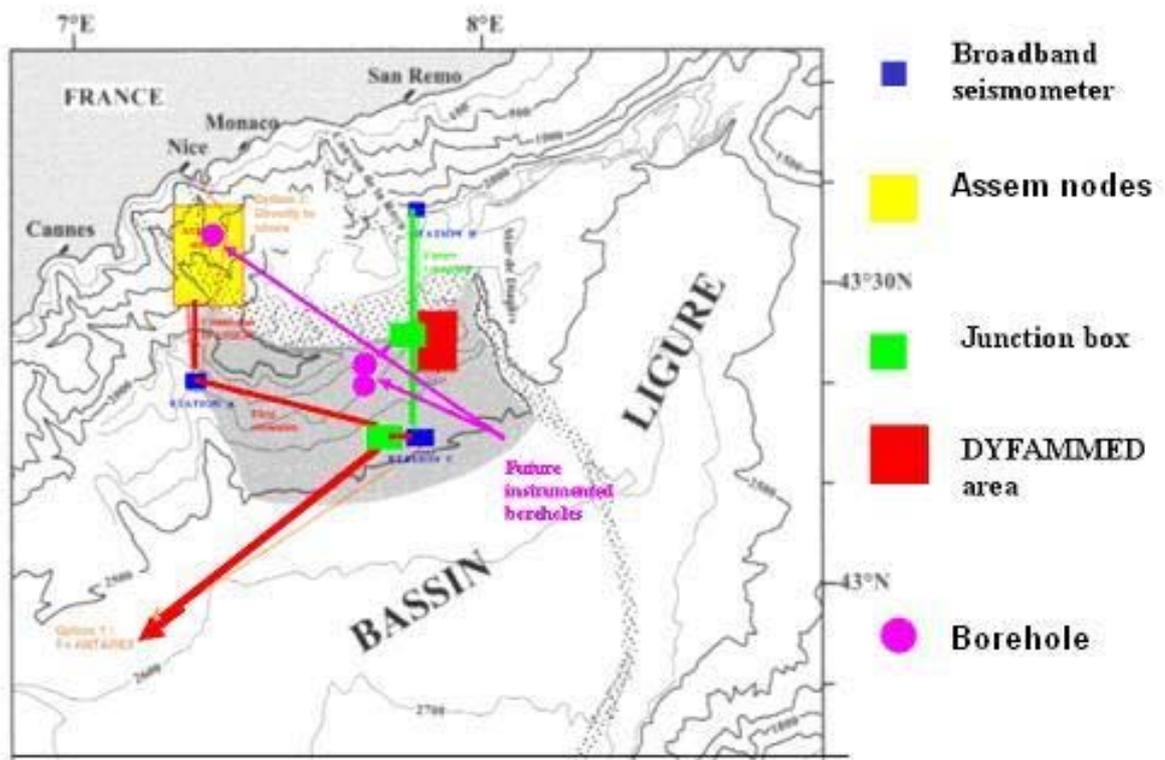


Figure 2 : Preliminary design of the Ligurian sea observatory.

### Regional consortium of users and financing institutions

The observatory is at present predominantly support by GEOAZUR, INSU/CNRS and Ifremer. PACA regions supporting this project. A cooperation with Italy is running about monitoring of the Ligurian Sea. European scientists (Germany, Spain) and international scientists (US, Japan) are supporting the IODP project.

A regional implementation committee will be constituted in the first months of 2007.

### Participants

Ifremer, CNRS (GEOAZUR, CEREGE, LOV, IUEM), IPGP, INGV, CSIC, UniHB Germany, WHOI.