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Development from the seafloor to the sea surface of the cabled NEMO-SN1 observatory in the Western Ionian Sea

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A prototype of cabled deep-sea observatory has been operating in real-time since 2005 in Southern Italy (East Sicily, 37°30' N - 15°06'E), at 2100 m water depth, 25 km from the harbor of the city of Catania. It is the first-established real-time node of the "European Multidisciplinary Seafloor and water column Observatory" (EMSO, http://www.emso-eu.org) a research infrastructure of the Sector Environment of ESFRI. In the present configuration it consists of two components: the multi-parametric station NEMO-SN1 (TSN branch) equipped with geophysical and environmental sensors for measurements at the seafloor, and the NEMO-OνDE station (TSS branch) equipped with 4 wideband hydrophones. A 28 km long electro-optical cable connects the observatory to a shore laboratory in the Catania harbor, hosting the data acquisition system and supplying power and data transmission to the underwater instrumentation.

The NEMO-SN1 observatory is located in an area particularly suited to multidisciplinary studies. The site is one of the most seismically active areas of the Mediterranean (some of the strongest earthquakes occurred in 1169, 1693 and 1908, also causing very intense tsunami waves) and is close to Mount Etna, one of the largest and most active volcanoes in Europe. The deployment area is also a key site for monitoring deep-water dynamics in the Ionian Sea, connecting the Levantine basin to the southern Adriatic basin where intermediate and deep waters are formed, and finally to the western Mediterranean Sea via the Strait of Sicily.

The observatory is being further developed under EMSO MedIT (http://www.emso-medit.it/en/), a structural enhancement project contributing to the consolidation and enhancement of the European research infrastructure EMSO in Italian Convergence Regions. In this framework, a new Junction Box will be connected to the TSN branch and will provide wired and wireless (acoustic connections) for seafloor platforms and moorings. This will allow the implementation of new measurement capabilities at seafloor and along the water column with sensors for measurements of physical-chemical (pressure, temperature, salinity, dissolved oxygen, turbidity, pCO_2, currents) and geophysical (magnetometer, seismometer and gravity meter) parameters. An imaging system for deep sea fauna will be deployed very soon at TSS. Furthermore, the data acquisition/elaboration system will be enhanced, and data will be shared in near real time through the Catania node of the high-speed telecommunication network for University and Scientific Research. An Open Access policy is adopted to favour the access of the international scientific community.

According to the EMSO business plan and EC recommendations, the enhanced infrastructure will be open to scientists, companies and public actors on excellence research basis, for the development of innovative scientific and technological research products. The existing seafloor module is already offering this service under the TNA program of $FixO_3$ EC Project (www.fixo3.eu).

The ongoing development of NEMO-SN1 will strengthen its capabilities to monitor long-term variability of key physical, geophysical and biogeochemical parameters, with applications, for example, in studies on modifications of the properties of water masses and the marine circulation, changes in marine chemistry, with particular emphasis on the carbon system and its role in ocean acidification, evolving trends in global sea level, and to address geo-hazards issues, such as earthquake and tsunami risks, volcanic risk, instability and collapse of the slopes.