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The EMSO-Azores deep-sea observatory – 8 years of operation
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Abstract : The EMSO-Azores deep sea observatory is a component of the EMSO ERIC. It focuses on two main questions: What are the feedbacks between volcanism, deformation, seismicity, and hydrothermalism at a slow spreading mid-ocean ridge and how does the hydrothermal ecosystem couple with these sub-seabed processes? The infrastructure comprises 2 sea monitoring nodes, autonomous instruments and a set of site studies experiments. It has been deployed in 2010 in the Lucky Strike vent field and acquires multidisciplinary data since then.
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The MoMAR "Monitoring the Mid-Atlantic Ridge" project was initiated by InterRidge in 1998 to study the environmental instability resulting from active mid-ocean-ridge processes at hydrothermal vent fields south of the Azores. It is a component of the EMSO (European Multidisciplinary Seafloor and water-column Observatory) European Research Infrastructure Consortium, which coordinates observatory regional facilities in European seas (http://emso.eu). The EMSO-Azores observatory focuses on two main questions: What are the feedbacks between volcanism, deformation, seismicity, and hydrothermalism at a slow spreading mid-ocean ridge and how does the hydrothermal ecosystem couple with these sub-seabed processes?

The uncabled observing system (Figure 1) was first deployed in 2010 in the Lucky Strike hydrothermal vent field (Mid Atlantic Ridge) at 1700 m depth. It comprises two Sea Monitoring Nodes (SeaMoN – Figure 2) providing the energy, controlling the sensors, archiving and transmitting the data. The first node is deployed on the Lucky Strike fossil lava lake and measures the seismic activity and the vertical deformation of the sea floor. The second one is deployed at the base of the Tour Eiffel active edifice. It allows the study of the variability of a mussel assemblage and its environment (HD camera and chemical sensors, thermistor string), the microbial colonization and the chlorinity of an active vents (Colonization module and BARS sensor) and the localized micro seismicity (seabed array of 4 hydrophones). The two nodes are acoustically linked to a surface relay instrumented buoy, ensuring satellite communication to a land base station in Brest -France.

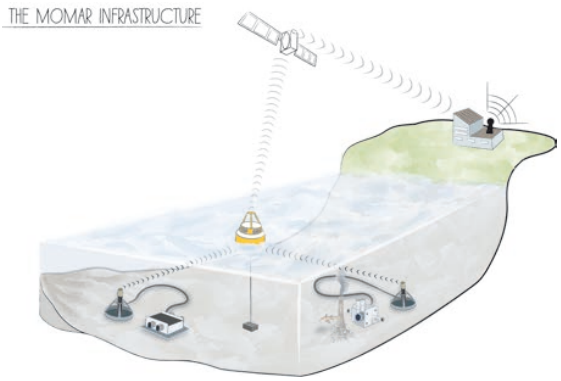

Figure 1- The EMSO-Azores infrastructure

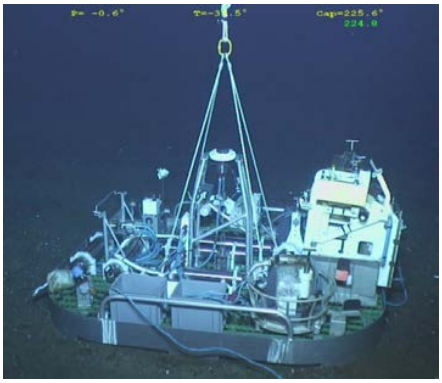
Figure 2: The Sea Monitoring node prior the deployment of the sensors

The observing capacity of the marine infrastructure was upgraded in 2016 and 2017 thanks to the development of a new electronic core called COSTO2 based on Ethernet communication and implemented on the 2 monitoring nodes. This upgraded infrastructure was successfully redeployed and tested in situ using a WIFI link allowing communication at 50Mbits/sec between the ROV and the Sea monitoring station. Great improvement were done on the data management process. Data are archived, published with a doi and are available on the EMSO-Azores web page: http://www.emso-fr.org/EMSO-Azores.
In addition, the observatory setup comprises several sets of autonomous instruments, whose data are collected during the yearly maintenance cruises. These data will also be made available on the web after quality and format validation by the EMSO-Azores team. The autonomous instruments deployed in the area comprises 4 OBS, 2 pressure gauges, a physical oceanography mooring near the vent field, an array of temperature probes distributed in hot and diffuse vents, 3 bottom

currentmeters, and a prototype of sequential hot fluid sampler (DEAFS). In 2017, the EMSO Generic Instrumentation Module was also deployed in the vicinity of Tour Eiffel.

Figure 3 : BARS monitors the temperature and chlorinity of the hot hydrothermal fluid

Figure 4 : he EMSO Generic Instrumentation Module

A complementary site studies program is implemented during the maintenance cruises and contributes to increase the set of accessible parameters (fluid sampling, ecological studies, survey of active and inactive areas, in situ experimentations…) and to extend the spatial coverage of the study.
The observatory is maintained every year during the Momarsat cruises (https://doi.org/10.18142/130). During these 2.5 week cruises, all the components of the system are recovered, serviced on board and redeployed using the ROV Victor 6000.
The studied area is part of a Marine Protected Area in the Portuguese EEZ.

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