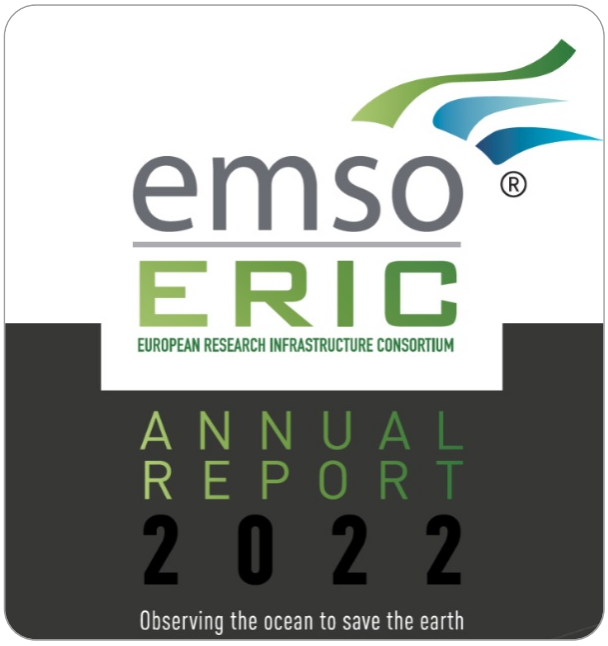
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EMSO ERIC Newsletter No. 4 - November, 2023

News



The EMSO ERIC 2022 Annual Report is now available!

We are glad to announce that the EMSO ERIC Annual Report 2022 is now available!

The document reports the **EMSO ERIC's activities** and **accomplishments** during the year 2022, providing an overview of the relevant advances of consolidation of its path of services and operations deployment in the European landscape.

Among the main core activities, the launch of the **first call for Physical Access** has been particularly successful in promoting the access of prestigious Research centres, Universities and SMEs from all over Europe to the EMSO Regional Facilities' by granting funds to facilitate and co-finance the use of infrastructures.

A major step forward was also taken in the **data harmonization** aimed at providing high-quality data and metadata in line with the FAIR principles. EMSO ERIC integrated data services into the European Open Science Cloud (EOSC) improving the connection of the EMSO ERIC's data repositories and services to it.

Furthermore, last year the first **EMSO ERIC Gender Equality Plan** was published. It embeds a precise plan of action to promote gender balance, aimed at implementing the planned recommendations both internally to the EMSO organization and externally, in the main international initiatives and projects in which the ERIC participates.

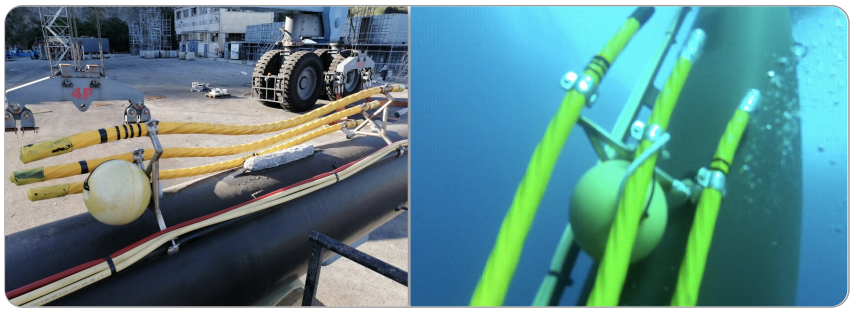
The launch of the **first issue of the EMSO External Newsletter** marked a great step forward that was also taken in communication, with the aim of

promoting innovation, knowledge-sharing and dissemination beyond the Consortium framework, reaching a wider group of audiences much broader.

Finally, the document describes the variety of **activities of the Regional Facilities**, from the Arctic in the North Atlantic across the Mediterranean to the Black Sea, and the relevant actions within the framework of the **European projects** in which EMSO ERIC participates.

Read the full Annual Report 2022 here

Author: EMSO ERIC



EMSO Physical Access: SEASNAKE Project at Western Mediterranean Sea!

The ocean is a complex biogeochemical environment for the collection of EOVs observations and data. Monitoring equipment in underwater and seabed environments must withstand cold water and high pressures in deep-sea areas, it is affected by the corrosion of seawater, and biofouling in shallower areas: the accumulation of microorganisms, plants, algae, or small animals on wet surfaces. Biofouling can make it difficult to keep platforms and equipment clean and operational: nowadays, in fact, continuous maintenance of underwater infrastructures is required.

Let's explore the **SEASNAKE – Sea trials for biofouling of a dynamic umbilical**, the project within the **EMSO Physical Access Program**, awarded through a competitive tender to the **RISE Research Institutes of Sweden** which is taking place at **Western Mediterranean Sea**, the **EMSO Regional Facility** located in the North-Western Mediterranean at 80km offshore, with the aim to face the biofouling issue during a long-term exposure in an offshore scenario.

With the technological and logistical support of the Western Mediterranean Sea Regional Team, the RISE group is testing the use of special materials to protect equipment that must to be deployed in the ocean. The aim is to validate at sea in operational condition new cables, with robust resistance to corrosion and fouling, of 3×30 m long designed for offshore activities.

Within the SEASNAKE project the cables will be validated simultaneously on the Western Mediterranean Sea (W1M3A) EMSO Regional Facility with three different configurations: reference sample with (1) **no protection**, (2) **painted**, and (3) **painted with antifouling protection**. The capability to assess the performances deploying at the same time three different configurations will allow for the first time to analyse the effectiveness of painting and anti-fouling painting on the thermoplastic polyester elastomer used as insulation under different oceanographic conditions due to the intrinsic variability of the ocean during different seasons.

On May 4th, a cable triplet was deployed at different depths attached to spar buoy in the Western Mediterranean Sea. Each triplet hosts three pieces of a nano cable (12 fibres) developed by NKT (NKT A/S Denmark Vibeholms Allé 202605 Brøndby). The cables are intended for permanent installation in underwater and are flexible, which makes them suitable for applications with mobile stations/platforms, as well as for offshore use.



Involved partners:

- **RISE**
- **NKT**
- **I – Tech**
- **Green Sailor**
- **Geico Taiki-Sha**

To know more about RISE, visit the website
For more details about the Western Mediterranean Sea Regional Facility, click here
Have a look at the EMSO Physical Access Call 2023, there is still time to apply!

Photo: Cables treatment (Credits: GreenSailor)

Authors: Pierre Ingmarsson (RISE), Sara Pensieri, (CNR), Sara Pero and Simò Cusì (EMSO ERIC)

Events

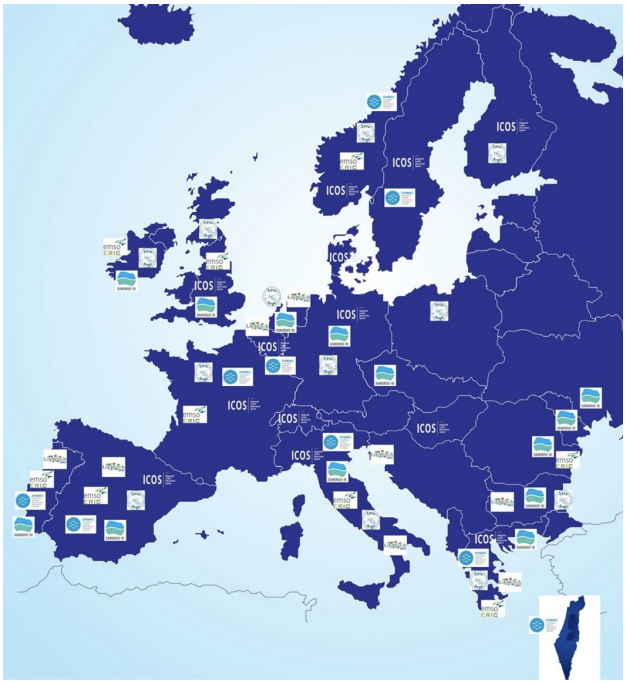


Workshop on Ocean forecasting and its applications in the Mediterranean Sea: present status, gaps and ways forward

The MonGOOS General Assembly and the “Workshop on Ocean forecasting and its applications in the Mediterranean Sea: present status, gaps and ways forward” will be held in Tangier (Morocco) from 14th to 16th November 2023. The workshop will be held in hybrid mode, except for the latter session.

https://mongoos.eurogoos.eu/events/mongoos-general-assembly-and-workshop-14-16-november-2023-in-tangier-morocco/

Papers



Emerging perspectives in European marine observation

Cooperation, coordination and integration are the main priorities to enable European Research Infrastructures (RIs) to build an **integrated multi-platform observing system** for the understanding of the ocean's interrelated processes, **reducing overlaps**, **increasing efficiency** and **promoting scientific excellence** and innovation at all levels. These are some of the main emerging needs highlighted by the representatives of the main marine RIs in European in a new policy brief paper recently published in *Frontiers in Marine Science*.

Some of the main European marine RIs, EMBRC, Euro-Argo, LifeWatch, DANUBIUS-RI, and EMSO, have clearly expressed their aim to strengthen collaboration favouring their synergies towards integrated multidisciplinary and cross-domain research on ocean observing systems support to address global societal challenges in the environmental field: ocean challenges are of multiple geographical scales, from local to regional or basin scale, to European and global. Europe's marine RIs cover different domains, from seafloor to sea surface, and estuarine: covering key aspects from physics, chemistry, biology and earth science establishing of strong links among them is fundamental to better play the role of essential pillar for the European Ocean Observing System (EOOS), the coordinating framework for European in-situ ocean observation, and to continue to be aligned with the key priorities of the UN Decade of Ocean Science for Sustainable Development.

Specifically, the article provides a clear analysis of the **present and future perspectives** in the European marine observation landscape, highlighting the current crucial contribution of each RI capability to support climate and environmental policies, sustainable blue economy, preserve nature, and reverse ecosystem degradation and biodiversity decline. RIs are strategically important for Europe to lead a global movement towards a data-driven, interconnected, open digital twin that brings together different disciplines, clean technologies, public and private sectors and a broad scientific/technological community, as well as education and training.

The authors of the document demonstrate that the combined expertise and assets of Europe's marine RIs can form a comprehensive and holistic framework for long-term, sustainable integrated marine observation that will play a key role providing in situ observations for operational services such as Copernicus programme.

Read the full paper here.

The picture shows the geographical distribution of the Countries involved in the ERICs and in the Research Infrastructure. (Dañobeitia JJ, Pouliquen S, Pade N, Arvanitidis C, Sanders R, Stanica A, Gourcuff C, Petihakis G, Tegas V and Favali P (2023) The role of the marine research infrastructures in the European marine observation landscape: present and future perspectives. Front. Mar. Sci. 10:1047251. doi: 10.3389/fmars.2023.1047251)

Author: EMSO ERIC



Synchronization system for multiparameter data acquired by cabled submarine observatories in the EMSO Western Ionian Sea facility

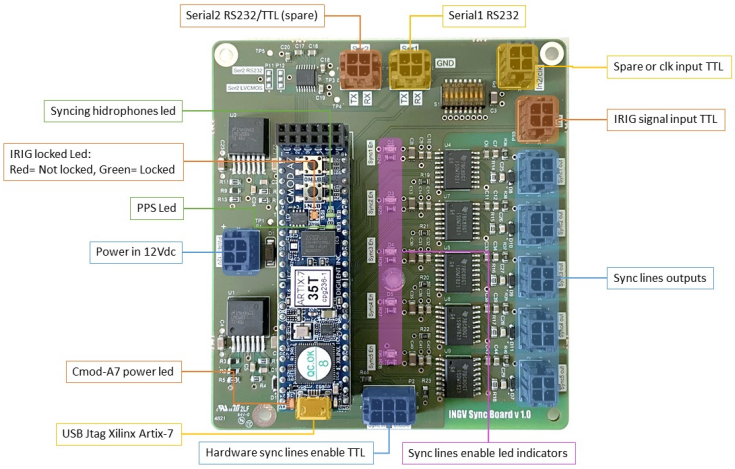
The **PON-EMSO InSea** (Initiatives in Supporting the consolidation and enhancement of the EMSO infrastructure and related Activities) **project** aims to **upgrade the seafloor infrastructures** of the **EMSO Western Ionian Sea facility** managed by **INGV**. The objective of the project is the permanent installation of several multiparametric seabed observatories, at a depth of about 2000 meters, powered by a submarine electro-optical cable connected to a shore station located in the port of Catania and managed in collaboration with **INFN** (Istituto Nazionale di Fisica Nucleare).

The infrastructure that powers the EMSO Western Ionian Sea facility is intended to provide the power to the instruments and the equipments of the facility, make available a network communication link used to acquire scientific data from the instruments and to monitor the infrastructure and distribute a common clock that allows to timestamp all data produced.

The GPS-derived reference clock is acquired onshore and distributed throughout the network by means of the Precision Time Protocol (PTP). Using commercial switches that implement the PTP in hardware, it is possible to propagate the reference time with an error of about +/-100ns. The use of PTP allows time to be distributed with a standard, reliable, internationally regulated protocol widely implemented in various commercial devices.

All the instruments and the equipment of the facility are nodes of an ethernet network and can be divided into three categories depending on their sampling frequency and synchronisation mechanism:
1. **Environmental and oceanographic instruments** without synchronisation protocol, with sample frequency <10Hz and an RS232 communication protocol;
2. **Geophysics instruments** that support PTP synchronisation protocol, sampled from few tens Hz to few kHz;
3. **High frequency hydrophones** with proprietary synchronisation protocol and sample frequency>10kHz.

The technical report, "Sistema di sincronizzazione dei dati multiparametrici acquisiti dagli osservatori sottomarini cablati nella facility di EMSO Western Ionian Sea", describes the constructional and functional characteristics of the **Syncboard v1.0 synchronization board** developed by INGV. The Syncboard v1.0 distributes the timing supplied by a GPS antenna, installed at the shore station, to those instruments of the submarine observatories that do not implement the PTP synchronization protocol.



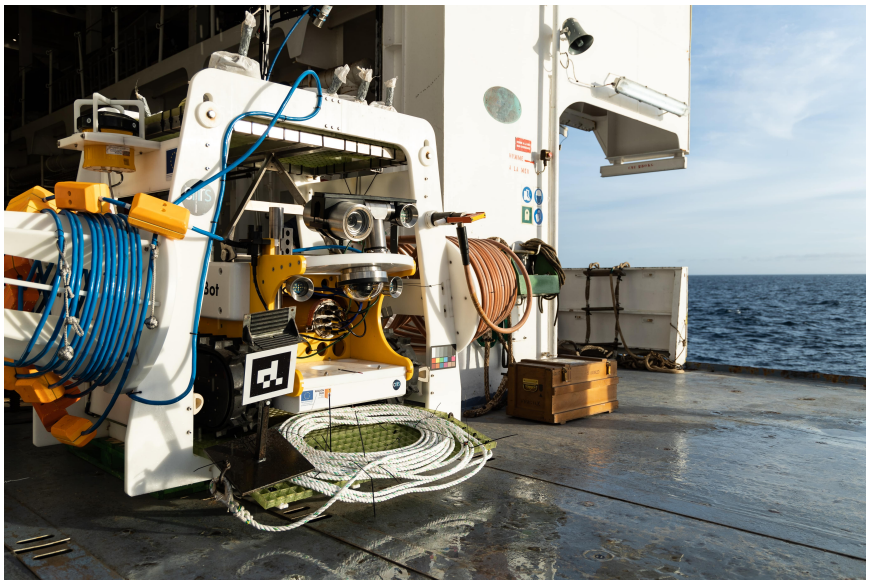
For more details:
Giacomozzi E., Simeone F., Marinaro G., (2023). Sistema di sincronizzazione dei dati multiparametrici acquisiti dagli osservatori sottomarini cablati nella facility di EMSO Western Ionian Sea. Rapp. Tec. INGV, 471: 1-20, https://doi.org/10.13127/rpt/471
Or you can email to Emanuele Giacomozzi: emanuele.giacomozzi@ingv.it

Credits of the “Rapporti Tecnici”’s Figure: INGV

Figure 2: Syncoboard and hardware interfaces. Credits: Emanuele Giacomozzi (INGV)

Author: Aleassandra Giuntini (INGV)

Updates from the EMSO Regional Facilities



BathyBot a rover to observe the EMSO-WL site

A benthic rover BathyBot connected at the EMSO-WL site for live observations and new data in real time, at 2400m depth in the Mediterranean Sea.

From April 16th to 19th, 15 months after the **BathyCruise campaign** (EMSO newsletter n°1 – April 2022), the last operation at sea took place to connect the oceanographic instruments of the **EMSO-WL site**, within the **LSPM**. Following a succession of challenging weather, the Covid-19 pandemic and authorization problems, the Scientific Pre-Junction Box (Pre-BJS), which powers these instruments, was finally deployed and connected to the main junction box. These latest operations have powered BathyBot (MIO/DT-INSU laboratory), a remote-controlled seabed robot, and its BathyDock (MIO/DT-INSU/LOV), its docking station, a broadband seismograph (GéoAzur-Nice laboratory), a germanium gamma spectrometer (CPPM laboratory) and a stereo biocamera (IP2I laboratory). A real success, thanks to the efforts of all these research laboratories, and the support of the European network of seabed and water column observatories (ERIC-

EMSO)!

New **high-frequency data** on **temperature**, **salinity**, **currents** and the **diversity of plankton organisms** are collected in **real time**, complementing the information acquired by the ALBATROSS mooring line. Indeed, ALBATROSS enables scientists to obtain information along the water column, between 500 and 2500m, while the BathyBot and BathyDock sensors provide a view close to the bottom, at 2500m. This information is vital for monitoring the long-term evolution of this site.

Currently, as BathyBot has been without power for too long, the motor enabling it to move along the seabed is no longer operational for the time being... A disappointment quickly surpassed by the exceptional images acquired through the robot's 2 cameras and colored lights, which the scientists can operate live. Numerous fish, and more discreet transparent organisms, appear on these images every day.
As for the rest, be patient, these observations and the processing of all this new data will take time. We'll keep you informed very soon!

https://twitter.com/bathybot

https://www.youtube.com/watch?v=QkdIQZ77d1s



Photo 1: (© N. Fromont): BathyBot the benthic rover is deployed at 2400m depth and dedicated to the observation of deep-sea biodiversity as well as the environment.

Photo 2 (© N. Fromont): A high sensitivity camera will allow us observing the environment without external light.

***DT-INSU**: Division technique de l'Institut des Sciences de l'Univers*
***LOV**: Laboratoire d'Océanographie de Villefranche*
***CPPM**: Centre de Physique des Particules*
***LSPM**: Laboratoire Sous-marin Provence Méditerranée*

Author: Severine Martini, Mediterranean Institute of Oceanography (MIO)



Information and Expertise Exchange

In July, the **Marine Institute** (MI) hosted Marco Francescangeli, who is a PhD candidate at **Universitat Politécnica de Catalunya** (UPC) working on **ecological monitoring of fishes** using footage from the OBSEA camera. Hosting Marco for a period of one month facilitated an invaluable information and **expertise exchange** and was made possible through collaborating with EMSO partners Jacopo Aguzzi at ICM CSIC and Joaquin Del Rio at UPC, both of whom co-tutored Marco.

While at the Marine Institute, Marco worked on **artificial intelligence techniques** with the high resolution video data from the SmartBay observatory. Marco analysed the different tools for video and imagery annotations and trained MI staff on how to use the recommended programmes. His expertise in **image annotations** will allow the team at MI to introduce AI learning for automating detection of marine activity in the large volume of EMSO SmartBay video footage.

Marco's technology review identified the **"Roboflow" image annotation tool** as the best **open source image labelling tool** because it allows the user to easily annotate videos frame by frame, giving the option to decide the frequency of the frames required (1 frame per second is recommended). This tool also permits users to divide their image dataset in the three main **datasets** for **machine learning** (training, validation and testing sets), and at the end of labelling also to train your own model with **YOLOv5** (Roboflow + YOLO partnership). The EMSO Obsea and Smartbay Observatories are also participating as EMSO affiliate partners in the iMagine Horizon Europe project - **iMagine project** -.. iMagine provides a portfolio of image datasets, high-performance image analysis tools empowered with Artificial Intelligence (AI), and Best Practice documents for scientific image analysis. EMSO observatories have developed a number of marine video observation related use cases for the application of the iMagine tools and Marco also worked on maturing and developing these use cases during his time at EMSO SmartBay.



Photo 1: An example of image annotation on SmartBay Observatory footage using Label Studio tool. The red boxes identify starfish and pouting in the image.

Photo 2: Marco Francescangeli. Universitat Politécnica de Catalunya (UPC)

Authors: Paul Gaughan, Christine Loughlin (Marine Institute)

Cruises



NorEMSO: Advancements in Arctic Research

In a series of exciting research activities, the NorEMSO project and affiliated institutions have been making significant strides in understanding the Arctic's unique ecosystems. Aboard the research vessel R/V Kronprins Haakon, they successfully recovered a K-lander and mooring, shedding light on methane seep dynamics off the coast of Svalbard. Meanwhile, in Fram Strait, the Norwegian Polar Institute had to overcome challenges to service mooring F10, crucial for monitoring Arctic water masses and sea ice fluctuations. Lastly, the Center for Deep Sea Research achieved a groundbreaking deployment of the EMSO Mohn observatory on the Mohn Ridge, ushering in a new era of deep-sea exploration with advanced sensor technology. These endeavours promise to deepen our knowledge of the Arctic's delicate balance and its responses to changing environmental conditions. Read more about NorEMSO research activities in the three articles below.

Photo 1: Mooring F10 surfacing in the central Fram Strait. Trine Lise Sviggum Helgerud, Norwegian Polar Institute

Tall oceanic mooring in the central Fram Strait from NorEMSO ready for another year

In September 2023, the central Fram Strait mooring F10 was serviced by the Norwegian Polar Institute as part of the Nordic Seas node NorEMSO. This site forms an important component of the wider observing system across the Fram Strait, the largest gateway to the Arctic Ocean, monitoring in- and outflow from the Arctic.



This mooring site is at the front of the East Greenland Current, i.e. west of it is the southward flowing cold and fresh Polar Water while on the east of it, we find warm and salty Atlantic Water. With F10, which is over a water depth of 2650 m, we monitor how these water masses vary and how the current ’s dynamics is during the year, in relation to the sea ice variations in this area. With observing the variability over longer time we have seen that there was much more Atlantic Water present in winter time in the late 2010s with big impact on the sea ice cover, while in the last two years there is more Arctic outflow again.

Upon arrival on the mooring site in September 2023, it first appeared impossible to retrieve the mooring as it was fully covered by the drift ice of the East Greenland Current. Later during the cruise, by checking carefully the satellite images, we noted a short period with less sea ice and headed out directly to recover it. This went smooth and within one hour it was all on deck - a new record. Unfortunately, one CTD with oxygen sensor had stopped working mid-way through. Now all temperature, salinity, oxygen, current meter sensors, and also pH and pCO2 sensors have been redeployed for another year until September 2024.

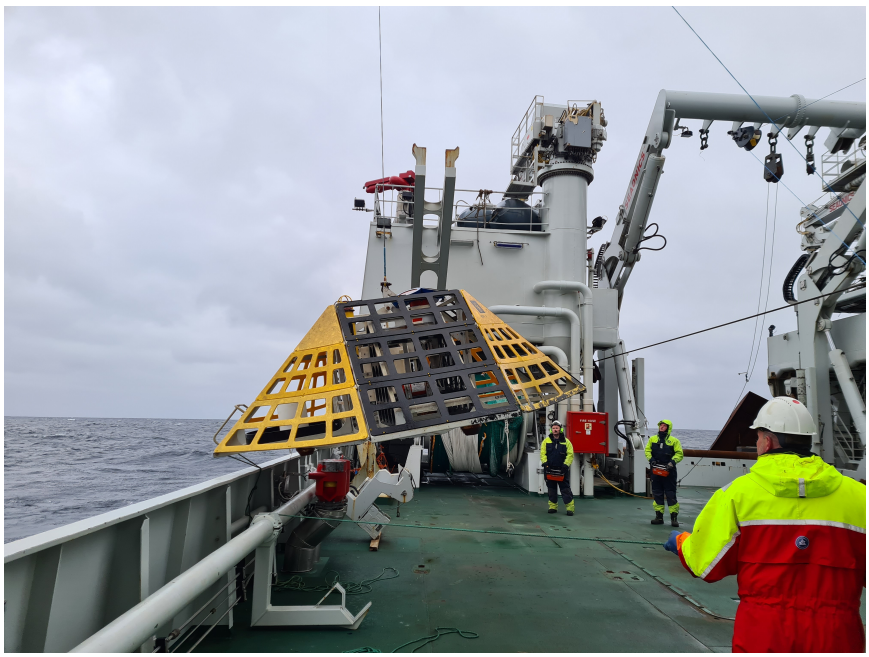
Photo 2: An RBR CTD with oxygen sensor is recovered from the Fram Strait. Trine Lise Sviggum Helgerud, Norwegian Polar Institute.

Author: Laura de Steur, Norwegian Polar Institute

Mooring and lander recovery at Sørkapp

A research cruise was conducted onboard the research vessel Kronprins Haakon from April 17th to April 24th 2023. The main objective was to recover a K-lander deployed on 14 April 2022 and a mooring deployed on 7 March 2023 to observe the intense methane seep at the pingo south in Storfjordrena. The scientific objectives of the K-lander and the mooring are to estimate i) the seasonal and inter-annual variability of methane release from an intense methane release site south of Svalbard; ii) how high methane is transported; iii) the influence of oceanic setting in this potential variability.

The K-lander was designed in a collaboration between Kongsberg Maritime and CAGE (Centre of Excellence for Arctic Gas Hydrate, Environment and Climate) in 2015 and was deployed several times offshore Svalbard and in the Barents Sea. It is an infrastructure of 3.6m in diameter and 1.6m in height. Its centre is the most protected and robust, and therefore contains all instruments: an ADCP (Acoustic Doppler Current Profiler Workhorse Long Ranger 75 Khz) to measure the current in the water column as well as the backscatter signal, a methane and a CO2 CONTROS sensors, and a SeapHOx (Seabird) to measure temperature, salinity, oxygen and pH.



The mooring is 300m and includes an ADCP Workhorse 300 kHz from Teledyne looking upward, two Seabird CTDs and a CONTROS methane sensor connected by fishing grade floating polypropylene ropes, steel wires and chains and balanced by buoyancy (Vitrovex FS-6700-17 glass spheres from NAUTILUS MARINE SERVICE).

Photo 3: K-Lander recovery. Benedicte Ferré, University in Tromsø.

Author: Benedicte Ferré

EMSO-Mohn deployed at the Fåvne site along the Mohn Ridge

Last June, during the scientific cruise led by the center for deep sea research at University of Bergen onboard the G.O. Sars, we deployed the observatory EMSO Mohn on Mohn Ridge at Fåvne. Within 6 hours after launching the observatory from the mother ship it was positioned less than 2 meters from target location. The world's deepest (3050 m) and northern most ridge crest observatory is in place at the Fåvne vent field on the Mohns ridge.

The observatory was designed, and tested in collaboration with Develogic and consists of a lander and a 500 m mooring line (inductive cable), with 15 SBE 39 plus IM temperature sensors, 2 ADCP Nortek Signature 500, 5 Aanderaa Turbidity sensors, 5 CTD SBE IM 37 SMP, and a pressure sensor Aanderaa. The observatory also includes 5 Data Processing Units (DPU) responsible for transmitting data through the inductive mooring line. At the lander there is an acoustic release, and an acoustic modem to transmit data to the surface unit deployed from the boat. After deployment, the boat was able to connect to the lander and was able to download some data.

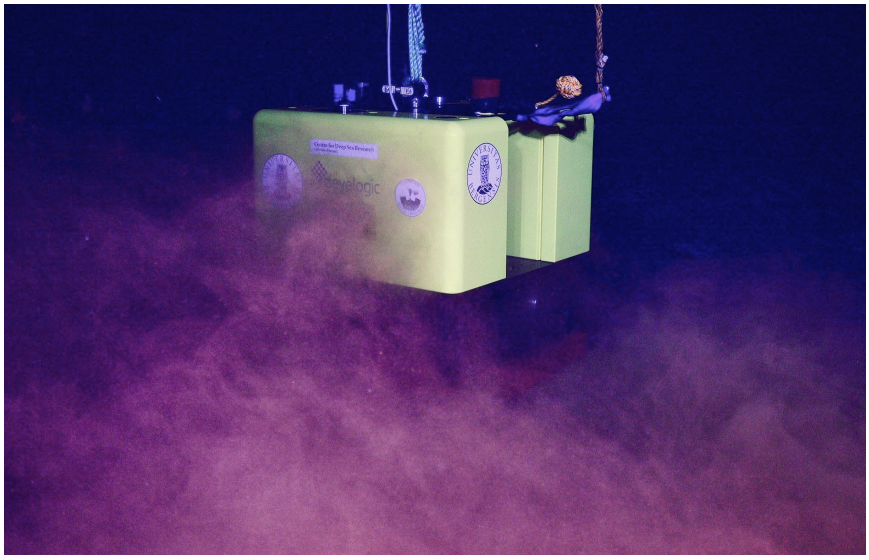


Photo 4: Deployment of the EMSO Mohn Observatory: lander touching the sea floor at 3050 m below sea surface. Snapshot taken from ROV Ægir 6000 camera shot.

Authors: Beatrice Tomasi, Steffen L. Jørgensen, Thibaut Barreyre, NORCE and University of Bergen

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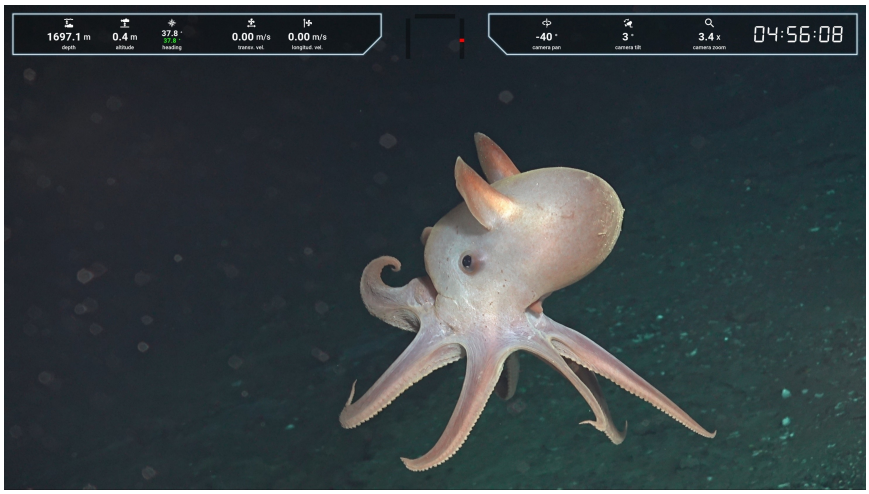


Momarsat 2023: A challenging but successful cruise!

The **Momarsat 2023 cruise** was held from July 9 to July 28th 2023 onboard the **French research vessel L'Atalante** with the ROV Victor6000 at the **Lucky Strike vent field** - northern Mid-Atlantic Ridge - to carry out the yearly maintenance of the **EMSO-Azores observatory**.

Once again, we ensured the **turnover of the full platform** and sensor array and started another year of data acquisition! Led by Marjolaine Matabos, the team of 18 scientists from Ifremer, CNRS (IPGP, GET, MIO), University of Western Brittany (UBO) and the University of the Azores worked together to achieve the substantial sampling plan paramount to the **long-term monitoring** of the vent field. Despite the delayed departure of the ship, numerous breakdowns and technical issues with the submersible and the observatory infrastructure, all objectives were achieved. This success would not have been possible without the adaptability, support and flexibility of all teams and more particularly the ship crew, which had to adapt continuously to a changing program.

Image acquisition will allow the continuation of the mapping work conducted during the iAtlantic project: a **new 3D reconstruction of the Eiffel Tower edifice** will complete the time-series analysed within Work Package 3, and additional OTUS still image acquisition will fill in gaps for the mapping of the entire vent field, started as part of Work Package 2. In addition, this year, as part of the Deep-Rest project, we conducted new experimentations. The deposition of sulphide particles on vent assemblages using the **SPIDER benthic chamber** was used to examine their impacts on vent faunal biodiversity and physiology. On-board and in-situ incubations of the *Bathymodiolus azoricus* mussel to a fluorochrome aimed to assess their growth rate. Finally, a new diffuse-flow site spotted to the south of the Cimendef sulphide structure appears promising for future integrated multidisciplinary studies.
Marine life accompanied us all along the cruise with dolphins, sharks, tuna and whales. At the bottom, we had a nice and rare encounter...



On the way back to Horta, cruise participants Jozée Sarrazin and Marjolaine Matabos, with Ana Colaço, were invited by the **Azorean government** to give a **conference** following the exhibition of Damien Roudeau drawings (from Momarsat 2022 cruise) at the **Fabrica Baleia**.





The EMSO-Azores observatory is part of the One Ocean Network for Deep Observation action of Ifremer endorsed by the UN Ocean Decade program (https://www.oceandecade.org/actions/one-ocean-network-for-deep-observation/).

Photo 1: The Momarsat 2023 great team on the R/V L'Atalante on the Lucky Strike vent field.
© Eloi de L'Estourbeillon/Momarsat 2023

Photo 2: The encounter of Victor6000 with a *Grimpotheutis* octopus at 1697 m depth.
©Victor6000/Momarsat 2023

Photo 3: Drawings from the Momarsat 2022 cruise by the artist Damien Roudeau were shown at the Fabrica Baleia in Horta during the whole month of July. © J. Sarrazin/Momarsat 2023

Photo 4: Marjolaine Matabos, Jozée Sarrazin and Ana Colaço giving a conference for the general public at the Fabrica Baleia on July 30th 2023.

Authors: Jozée Sarrazin and Marjolaine Matabos

EU Projects

A strategic action plan for enhancing uptake of ENVRI data by the private sector

A new **deliverable report** within the **ENVRI FAIR EU-funded project**, "A strategic action plan for enhancing uptake of ENVRI data by the private sector", is now available. The document, realized by EMSO ERIC with the great contribution of CNRS, PLOCAN and LifeWatch ERIC, is developed to address private sector clients/users of ENVRI services by defining and implementing strategies for strengthening RI innovation-cooperation awareness and preparedness and promoting industry uptake of ENVRI data and services in compliance with FAIR standards.

In the first part, the document presents the work that has been done in the recent past in EU funded projects to develop common procedures and best practices in building fruitful relationships with the private sector.
In particular, the experience gained during the H2020 projects, ENVRIPlus, ENRIITC and ECCSELERATE, is presented to lay the foundation of the ENVRI

Strategic Action Plan for enhancing the uptake of ENVRI data by the private sector.

The plan is built on four main steps ranging from the identification of the key stakeholders potentially interested in using ENVRI services and data, to setting specific goals, aimed at increasing the awareness and partnerships between the private sector and research institutions to facilitate the co-creation of environmental data products, adopting the RI Preparedness Roadmap and monitoring the outcomes.
The strong relations of the ENVRI community with the EOSC Hub and EOSC Digital Innovation Hub are as well further explored to guarantee full exploitation of the ENVRI data and services innovation potential.

The document acknowledges the need for a **systematic approach** to enhancing the uptake of **ENVRI data** by the **private sector**, which is based on four specific steps:

- **Step 1: Identify and engage key stakeholders**
- **Step 2: Set specific goals**
- **Step 3: Develop and adopt a roadmap**
- **Step 4: Monitor and evaluate progress**

The above-mentioned steps could be implemented individually by each ENVRI Research Infrastructure as well as jointly, such as a collaborative activity to be included in future projects.

Further information here

Authors: Marco Galeotti and Sara Pero (EMSO ERIC)

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