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ERIC

EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM

ANNUAL
REPORT

2020

Observing the ocean to save the earth



EMSO ERIC **ANNUAL REPORT 2020**

European Multidisciplinary Seafloor and water-column Observatory
European Research Infrastructure Consortium (EMSO ERIC)

Observing the Ocean to Save the Earth



TABLE OF CONTENT

INTRODUCTION BY EMSO ERIC DIRECTOR GENERAL	4
EMSO ERIC Governance bodies and Organisation structure	6
EMSO ERIC Assembly of Members 2020	6
EMSO ERIC Advisory Committee 2020	8
EMSO ERIC Executive Committee 2020	10
EMSO ERIC Director General and Central Management Office CMO	12
Coordination activities for services deployment and operation	13
Supporting activities	13
EMSO-Link (H2020-RI)	13
Management of EMSO ERIC funded projects	15
HORIZON 2020 running projects	16
HORIZON 2020 upcoming projects	18
EMSO ERIC Administrative and Financial Management	20
COVID-19 pandemic effects	23
EMSO Regional Facilities 2020	26
Mission implementation	28
Access	31
Setting up the User Access System	31
Transnational Access Provision	31
Science	35
EMSO ERIC ID Cards	35
EMSO ERIC Science Services Workflows	35

Geohazards	36
Operational Climate and Oceanography	36
Statutory Marine Environmental Monitoring E.G. MSFD	37
Integrated Research	37
Training	38
Data and Information Technologies	39
Progress in enhancing the harmonisation and fairness	
Of EMSO ERIC data and interoperability	39
EMSO ERIC data services	40
Engineering and Logistic	43
Engineering, standards and interoperability implementation	43
Infrastructure access - maintenance	43
Industry & Innovation	45
Communication	47
Dissemination via EMSO Website	47
Dissemination via EMSO Social Channels	47
EMSO Conference. Preparing the Un-Decade of Ocean Science	48
Organization of events for the general public	49
Looking ahead	51
Annex 1 List of the EMSO regional teams	52
Annex 2 Detailed description of the Regional facilities by Member countries	56
FRANCE	56
GREECE	59
IRELAND	60
ITALY	61
PORTUGAL	62
ROMANIA	63
SPAIN	64
UK	66
Annex 3 List of publications	68

INTRODUCTION BY EMSO ERIC DIRECTOR GENERAL

Prof. Juanjosè Dañobeitia
EMSO ERIC Director General



The overall goals in 2020 have been the consolidation of the EMSO ERIC governance and the services' development. Promising results have been achieved towards the organization's general objective of ensuring long-term sustainability. Here we report how we progressed towards achieving our vision to be a worldwide scientific reference Infrastructure providing insights into the sources and dynamic biogeochemical processes of the deep Oceans and the water column to address critical global Marine environmental challenges of the 21st century. Last year represented the final step of the statutory Setup pha-

se. The RI successfully ended its construction in terms of governance and service development, and this process was also fortified by the full achievement of its implementation project, EMSO-Link (INFRADEV-3). The Work Programme 2020 was shaped around the RI needs to be aligned with this last year of the Setup phase. Consequently, the CMO worked as a catalyst element to harmonise all the activities and facilitate EMSO ERIC Phase II (complete operative phase in the Statutes). EMSO ERIC is now ready to move from the construction to operation phase, even though this will involve a transition period to be fully operational by 2022.

2020 was a challenging year due to the pandemic. However, the EMSO ERIC has been expanded and strengthened, with Norway's official inclusion as a full member. Besides, three new RFs (two from Italy and one from Greece) have received a favourable opinion from the Executive Committee and are now at advanced incorporation into the RI. Moreover, the EMSO-Link project has been a great success in addressing many issues contributing to the future operation and sustainability of the EMSO ERIC. The project ended with establishing Service Level Agreements (SLAs) between EMSO ERIC and each of the regional facilities' infrastructure owners. A web-based facility access system has been set

up and has been used for the first pilot EMSO ERIC Transnational Access (TA) call.

EMSO ERIC aims to increase the European ocean observation facilities' value, optimise their interrelated scientific resources, and enhance international and European collaboration. In this regard, the RI devoted a significant effort to speed up developing data open access and interoperability in 2020. The synergies between EMSO-Link activity across work packages revealed a collaboration framework between RIs and EMSO ERIC. Harmonised work has been carried out by all the EMSO Service Groups (Science, Data, Innovation, Communication and the Engineering and Logistics Service Group). The main results in this direction were the identification and promotion of best practice and the EMSO Label's groundwork that sets standards of best practice and quality for EMSO activities and outputs. Simultaneously, EMSO ERIC progressed in its data management platform for delivering world-class FAIR quality data and data services. EMSO has laid the cornerstone of a new knowledge-sharing context to support sustainable ocean governance in a co-designed process linked to SDG 17, Partnerships for the Goals. The path towards significant achievement has gone through crucial steps leading to the success of the "EMSO Conference: preparing for the UN

Decade of Ocean Science" held in Athens in February 2020. This success gave Memoranda of Understanding between EMSO ERIC and other relevant Environmental RIs and Ocean Initiatives a real substance dimension. It was marked by the subscription of different ERICs, EMSO, EMBRC, EuroArgo, ICOS-Marine, LifeWatch and EPOS, who emphasised the need for close and continuous collaboration in an integrated way to address the societal challenges outlined in the UN mission statement.

Finally, the realization of such a multidisciplinary and cross-domain approach requires developing new interdisciplinary and cross-cutting skills in the intersection of FAIR data and marine data curation and management. It requires trained people in terms of users and staff. EMSO Conference hosted a dedicated Data Training to the online data services, access to EMSO ERIC data, use of a virtual research environment and working tools like MOODA.

EMSO ERIC

Governance bodies and Organisation structure

EMSO ERIC ASSEMBLY OF MEMBERS | 2020

Chair Richard S. Lampitt (UK) | **Vice-Chairs** Didier Marquer (FR)

The highest decision-making body in EMSO ERIC is the Assembly of Members (AoM), composed of EMSO ERIC members' representatives.

The AoM met remotely four times in 2020, in compliance with the legislation applicable to such cases to minimise the risks entailed by the ongoing Covid-19 medical crisis. At the two ordinary online meetings that were convened on 27/04/2020 and 22/12/2020 (in conformity with Statutes Art. 12; 20; 28), two extraordinary meetings were added, called on 23/07/2020 and 30/09/2020.

The extraordinary meetings focused on the long-term sustainability challenges and the necessary investments in support of EMSO's transition to a fully operational phase focused on high-quality, value-added services to a wide range of primarily scientific and industrial users.

On 3rd July, the Royal Norwegian Ministry of Climate and Environment sent an official request to the Chair of EMSO ERIC AoM to become a full EMSO ERIC member, nominating a special adviser to the Norwegian Research Council. After the official consultation, the Chair of EMSO ERIC the membership procedure, closed in December 2020. From January 2021, Norway is going to be officially a Member of EMSO ERIC.

MEMBER	DELEGATE	ADVISOR
FRANCE	Didier Marquer	Delegate (AoM Vice Chair)
	Alain Lagrange	Alternate Delegate
	Nadine Lanteri	Advisor
	Laurent Coppola	Advisor
	John Picard	(AoM Secretary)
GREECE	Vasilios Lykousis	Delegate
	George Petihakis	Advisor
	Leonidas Perivoliotis	Advisor
IRELAND	Mick Gillooly	Delegate
	Alan Berry	Alternate Delegate
ITALY	Cecilia Di Carlo	Delegate
	Agata Sangianantoni	Advisor
PORTUGAL	Miguel Miranda	Delegate
	Mafalda Carapuço	Advisor
	Joana Pinheiro	Advisor
	Eduardo A. Pereira da Silva	Advisor
ROMANIA	Viorel Vulturescu	Delegate
	Vlad Radulescu	Advisor
SPAIN	Jose J. Sanchez Serrano	Delegate
	Inmaculada Figueroa	Alternate Delegate
	Eric Delory	Advisor
UNITED KINGDOM	Sophie Hodgson	Delegate
	Alexander Keeler	Alternate Delegate
	Matt Dobson	Alternate Delegate
	Richard S. Lampitt	Advisor (AoM Chair)
	Andrew Gates	Advisor

EMSO ERIC ADVISORY COMMITTEE | 2020

Chair Vito Vitale

The EMSO ERIC Advisory Committee (formerly Science, Technology and Ethics Committee – STEAC) was launched and activated in 2020.

The Advisory Committee, AC, advises the AoM on all matters of a scientific, technical, and ethical nature that may influence the scientific work carried out by EMSO ERIC, issues linked to EMSO ERIC's reputation and access to its data by research and operational users. Moreover, the AC may propose actions to promote the use of EMSO Infrastructure by a larger community. The AC suggests to the organising committee of the EMSO ERIC biannual conference.

The Advisory Committee was successfully inaugurated in a zoom kick-off video conference meeting held on April 30, 2020. Despite the impersonal online format imposed by the Covid-19 lockdown, the event was the first and extraordinarily opportunity for the AC members to meet each other, as well as the Chair of the EMSO ERIC Assembly of Members (AoM), the Director General of EMSO ERIC, and EMSO ERIC CMO. The "EMSO ERIC Advisory Committee (ex-STEAC)- Terms of Reference" was finalised in 2020, and the document complements the Implementing Rules n. 5 (Implementing Rules, First block October 2016 - as for the Statutes Art. 15). Scientists from various disciplines represent the Membership composition, together with Industry, technology and Innovation Hubs representatives, Research Infrastructure managers, and other experts whose background and specialisation can successfully contribute to the ERIC.

NAME	SCIENTIFIC EXPERTISE	ORGANIZATION
Alberto Basset	Ecology	University of Salento LifeWatch ERIC Italy
Pier Luigi Buttgieg	Marine Microbial Ecology, Data Science	Alfred Wegener Institute for Polar and Marine Research Bremerhaven Germany
Rick Donselaar	Sedimentology	Delft University of Technology The Netherlands
Carlos Duarte	Marine Ecology	Red Sea Research Center South Arabia
Peter Haugan	Geophysical Oceanography	Institute of Marine Research Norway
Shiuchi Kodaira	Geophysics	Center for Earthquake and Tsunami JAMSTEC Japan
Pierre-Yves Le Traon	Physical Oceanography	IFREMER Mercator Ocean France
Kim Juniper	Microbial Ecology	Ocean Networks Canada ONC
Monica Miguel Lago	Oceanography	European Association of Remote Sensing Companies EARSC Belgium
Nicolas Pade	Marine Biology	European Marine Biological Resource Centre EMBR CERIC
Montserrat Torne	Geophysics	National Research Council CSIC Spain
Filippos Vallianatos	Geophysics, Seismology	University of Athens Greece
Christine Valentin	Business Management & Innovation	World Ocean Council WOC
Vito Vitale	Atmospheric physics, Polar	Italian National Research Council CNR Svalbard Integrated Earth Observing System SIOS
Robert A. Weller	Physical Oceanography	Woods Hole Oceanographic Institution WHOI USA

EMSO ERIC EXECUTIVE COMMITTEE | 2020

Chair EMSO ERIC Director General

The Executive Committee (ExCom) is composed of the Director-General, the Regional Team leaders and the Service Group leaders. The Body features and functions are described in Art. 14 of EMSO ERIC Statutes and in Section 9 of the Implementing Rules, but it mainly ensures the implementation of the core mission of EMSO ERIC by coordinating activities of the Regional Teams and Service Groups.

The Regional Team (RT) is in charge of operating a Regional Facility and carries out the operational activities of EMSO ERIC. It comprises staff belonging to one or more scientific institutions, from one or more than one country. Each RT is represented by one representative, specifically by the Regional Team Leader (RTL), in the ExCom.

The ExCom met remotely three times in 2020 to minimise the risks entailed by the ongoing Covid-19 medical crisis.

The DG convened online meetings focussing on the EMSO central issues:

- **Service Level Agreements (SLAs)**
Presentation and discussion of the documentation to be submitted to the owner organisations' signature and agreement on the signature process (May 2020).
- **EMSO growth**
The meeting was around the inclusion of Norway in EMSO ERIC and the approval of new three facilities from Member Countries to be incorporated (July 2020).
- **Services sustainability**
Presentation and discussion of the Service Deployment Plan focussed on Data Services (October 2020).

NAME	EXCOM MEMBERS	ROLE AND AFFILIATION	
Azores	Pierre Marie Sarradin	Team Leader	CNRS
	Mathilde Cannat	Science Group Leader	IFREMER
	Jérôme Blandin	Service Group Leader	IFREMER
Black Sea	Vlad Radulescu	Team Leader	GEOECOMAR
Canary Islands	Eric Delory	Team Leader	PLOCAN
	Ayoze Castro	Service Group Leader	PLOCAN
Hellenic Arc	George Petihakis	Team Leader	HCMR
Iberian Margin	Zuzia Stroynowski	Team Leader	IPMA
Ligurian Sea	Laurent Coppola	Team Leader	CNRS
Porcupine Abyssal Plain	Susan Hartman	Team Leader	NOC
Western Ionian Sea	Davide Embriaco	Team Leader	INGV
	Alessandra Giuntini	Service Group Leader	INGV
Molène	Nadine Lanteri	Team Leader	IFREMER
OBSEA	Joaquin Del Rio	Team Leader	UPC
SmartBay	Alan Berry	Team Leader	Marine Institute
Nordic Seas	Fer Ilker	Team Leader	University of Bergen
Western Mediterranean Sea	Roberto Bozzano	Team Leader	CNR - IAS
South Adriatic Sea	Vanessa Cardin	Team Leader	OGS
Cretan Sea	George Petihakis	Team Leader	HCMR

EMSO ERIC

Director General and Central Management Office CMO

The Director General (DG) is the Chief Executive Officer and legal representative of EMSO ERIC and is responsible for the preparation and implementation of the decisions and programs that are submitted for approval to the Assembly of Members (AoM). The DG in the execution of the activities is supported by the staff of the Central Management Office (CMO) and for its strategic implementation functions by the Executive Committee (ExCom). The CMO, is in charge of providing support in the execution of the Annual Work Programme and the day-to-day administration and management of EMSO ERIC.

The Director General pays particular care to the RI growth strategies. In terms of acquiring new members, he directly oversaw Norway's process in EMSO, supporting the Royal Norwegian Ministry of Climate and Environment in all official steps for inclusion since the beginning. On 3rd April 2020, the Royal Norwegian Ministry of Climate and Environment notified DG through a brief note of Norway's intention to apply to become a full member of EMSO ERIC. DG informed the Norwegian Ministry on 8th April about the procedures to follow according to EMSO ERIC statutes. Norway has officially been a Member of EMSO ERIC since January 2021.

A dedicated path to internal growth has been completed as an EMSO ERIC effort in supporting its staff' professional development. The learning and growth perspective is priority-oriented to support organizational change. Investing in employee skills is crucial to ensure the right people to the right places, especially for a Research Infrastructure. In 2020, two officers completed the EMMRI MBA program (Executive Masters on Research Infrastructure Management) provided by the University of Milan-Bicocca.

COORDINATION ACTIVITIES FOR SERVICES DEPLOYMENT AND OPERATION

EMSO ERIC service functions, deriving from the operational activities carried out by the Regional Teams managing the Regional Facilities, are provided by EMSO ERIC Service Groups, led by the Service Group Leaders (SGLs) and supported by the CMO Officers. CMO officers provide the integration and coordination of activities in EMSO ERIC to help the DG align the specific objectives and activities of the Service Groups with the objectives of the Strategic Plan.

From March 2020 to December 2020, EMSO ERIC benefited from a Deputy Director General (DDG) to the overall CMO coordination, mainly to speed up the EMSO ERIC services deployment process. Under the coordination of the DDG, Service Officers, together with the Chief of Financial Officer, dedicated a significant effort in elaborating a Service Deployment Plan for full deployment of EMSO ERIC services and operations during the 2020-2022 period. The first draft of the document focused on the Data management and was presented to the Assembly of Members on July 23rd 2020.

The launch of a comprehensive set of EMSO core services, corresponding to and delivered by the EMSO Service Groups, has been planned within the SDP 2021-23, sizing the investment expenditure items and the overall cost to identify the financial sources that cover the increasing investment expenditures. Moreover, it includes a plan to improve CMO–ExCom coordination, efficiency and effectiveness with a CMO org chart centred on CMO Service Officers as first-line support to Service Group Leaders in delivering EMSO services.

SUPPORTING ACTIVITIES

The Sustainability Strategy action supports the integration of the objectives and specific activities. It is a transversal element to the entire RI and represents the collector of all aspects of RI's sustainability. The task is accountable to ensure that the agreed work programmes are synchronized with the strategy. A specific "Governance Model" was designed in 2020. The model focuses on integrating monitoring system within RI governance to facilitate effective management and define strategy execution risks. The EMSO ERIC work programme has been built upon this methodology. The monitoring system interfaces with it, so the indicators and expected results include all planned expenditures.

EMSO-Link (H2020-RI)

In 2020 EMSO ERIC achieved specific objectives linked to the implementation project. These objectives have been mainly focused on supporting the RI's consolidation, governance, procedures, and growth. Two INFRADEV-3 projects supported EMSO ERIC Implementation Phase (2015-2020). The first was EMSODEV (H2020, 2015-2019), which focused on technology and development (to harmonise the collection of EOVS time series). This project was followed by EMSO-Link (H2020, 2017-2020), which started following the first EMSO ERIC Director General (October 2017). EMSO-Link underpinned the EMSO ERIC setting up in terms of the construction of governance and service development.

Consortium requirements to grow and ensure its long-term sustainability have been met within this framework. Consequently, most EMSO 2020 activities went through EMSO-Link success (entirely devoted to strengthening the relevance of EMSO and ensuring its durability). As for the services, user-oriented thinking is vital within EMSO ERIC, in which users often represent both the 'internal' community and primary stakeholders. EMSO-Link allowed the operations' perspective useful for general management and for understanding the "state of the art" of services. Within the project, EMSO went beyond the user perspective and involved users in the service production process dedicated to access, science, engineering and logistic and communication services (see sections below).

Furthermore, support activities aimed to consolidate EMSO as an organisation and to accelerate RI growth, together with its RFs, have been the governing and operational bodies set-up, the definition of the business model and enhancing the international and European collaboration, followed by the roadmap for maximising RI impacts on research and policy implementation, as well as innovation and value creation for Europe. Drafting cooperation and growth strategies to underpin EMSO ERIC's evolution in Europe and beyond have also been part of the EMSO-Link project. In 2020 the Consortium worked to enhance European and international use of the RI and to heighten mobility of researchers of EMSO ERIC RFs. Within the 3-year EMSO-Link project frame, EMSO ERIC kicked off the partnership with the world's leading oceanographic institutes. Expansion to similar initiatives inside and outside European Union has been established, and formal agreements through memorandums of understanding (MoUs) have been signed, emphasising infrastructural synergies and data sharing. EMSO ERIC completed its implementation phase with the following active linkages.

Furthermore, the EMSO conference went far beyond expected results and gathered input from attendees on various topics to develop fruitful synergies between large research infrastructures and international programs and maximize benefits for users and policymakers as a direct contribution to the United Nations decade. It ended with the signing of EMSO, EMBRC, EuroArgo, ICOS-Marine, LifeWatch and EPOS, to a closer and continuous collaboration to address the social challenges outlined in the United Nations declaration of intent.

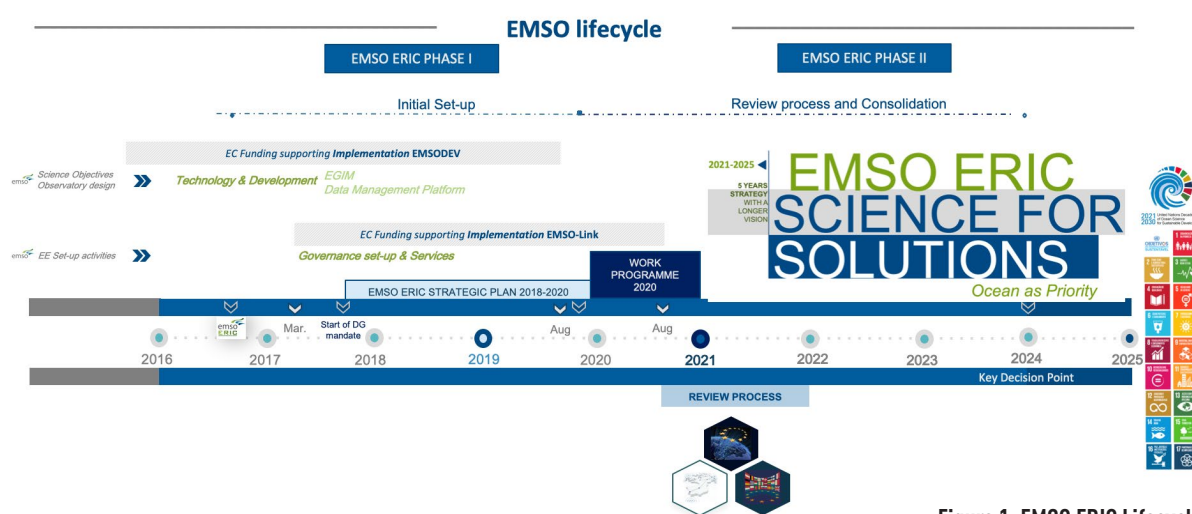


Figure 1. EMSO ERIC Lifecycle

EMBRC ERIC LIFEWATCH ERIC	SIGNED	MoUs with other ERICs
EPOS ERIC ICOS ERIC EuroArgo ERIC	IN PROGRESS	
Ocean Network Canada (ONC) EuroGOOS	SIGNED	MoUs with international counterparts
SAEON (SouthAfrica) IMOS (Australia) HAIFA UNIVERSITY (Israel) Cyprus	IN PROGRESS	

Figure 2. EMSO ERIC active linkages

MANAGEMENT OF EMSO ERIC FUNDED PROJECTS

EMSO-Link project represented a powerful and successful tool for affirming EMSO ERIC within the Environmental European RIs scenario. Nevertheless, it was not the only one. It contributed to delivering valuable results in synergy and complementarity with those associated with the other EMSO ERIC projects. This harmonised work has been possible as part of a single harmonious plan for implementing the strategy and optimising RI's resources, EMSO ERIC Work Programme 2020. EMSO ERIC participated in several proposals and EU funded projects supporting the implementation of the EMSO ERIC Strategy.

HORIZON 2020 RUNNING PROJECTS

ENVRI-FAIR (H2020-RI)

TITLE: ENVironmental Research Infrastructures building Fair services Accessible for society, Innovation and Research

COORDINATOR: FORSCHUNGSZENTRUM JULICH GMBH

PERSON MONTHS: 123,80

START DATE: 01/01/2019

DURATION: 48 months

CONNECTION WITH EMSO STRATEGY ENVRI FAIR links EMSO the environmental Research Infrastructures and EOSC. The project is supporting the implementation of EMSO Data Services and the activity of the Data Service Group.

BENEFITS REALIZED The EMSO participation in the ENVRI FAIR project was organized to optimize the resources to achieve EMSO strategic objectives. EMSO contributed to the Marine Subdomain FAIRness Roadmap, the Implementation Plan and the Technical Specification for the implementation process. All these activities are directed to improve the FAIRness of EMSO and to facilitate the connection with EOSC. The design of an architecture for harmonization according to FAIR principles enabled the development of EMSO ERIC data services, impacting EMSO ERIC's capabilities and facilitating the adoption of FAIR principles. Software components and plug-ins for the EMSO ERIC harmonization subsystem, which is a critical component for adopting FAIR principles across EMSO ERIC facilities, was developed and policy harmonization across EMSO ERIC regional facilities to enable the integration of services with the European Open Science Cloud (EOSC) was conducted.

ERIC FORUM (H2020-RI)

TITLE: ERIC Forum Implementation project

COORDINATOR: BBMRI ERIC

PERSON MONTHS: 3,75

START DATE: 01/01/2019

DURATION: 36 months

CONNECTION WITH EMSO STRATEGY The ERIC FORUM Project facilitates EMSO in the connection with the other ERICs and brings together 20 established ERICs. The life of the project runs in parallel with and supports the development of the ERIC Forum, the permanent, informal organization that brings together all ERICs

BENEFITS REALIZED The ERIC Forum is a framework dedicated to the ERICs to share knowledge and challenges and support the ERICs to have a common voice and vision on joint problems. It also increased the visibility and better positioning of the Forum towards its European stakeholders.

EUROFLEETS PLUS (H2020-RI)

TITLE: An alliance of European marine research infrastructure to meet the evolving needs of the research and industrial communities.

COORDINATOR: Marine Institute

PERSON MONTHS: 15,5

START DATE: 01/02/2019

DURATION: 48 months

CONNECTION WITH EMSO STRATEGY EUROFLEETS PLUS facilitates the dialogue with the European research vessel community, giving the opportunity to EMSO to have a privileged channel of communication to inform about the needs of the infrastructure. The project is supporting the development of the Engineering and Logistic services.

BENEFITS REALIZED The privileged dialogue with the EU vessel community is supporting EMSO ERIC in shaping the maintenance procedures of the Regional Facilities, with a close connection of the Engineering and Logistic Service Group with the EUROFLEETS PLUS community, providing the requirements regarding deployment, maintenance and equipment recovery. Further information is included in the Engineering and Logistic section of this report.

ENRIITC (H2020-RI)

TITLE: Network of research infrastructure Industrial Liaison and Contact Officers

COORDINATOR: ESS ERIC

PERSON MONTHS: 8,25

START DATE: 01/01/2020

DURATION: 36 months

CONNECTION WITH EMSO STRATEGY ENRIITC aims at establishing a European network of Industrial Liaison and Contact Officers (ILOs/ICOs) engaged with EU Research Infrastructures. The project is supporting the development of the Innovation and Industry services.

BENEFITS REALIZED The Innovation and Industry Service Group optimized the work conducted in the project to map the current state of the EMSO nodes in regard to industry engagement and collaborations, as a basis to develop the added value services of EMSO ERIC.

EuroSea (H2020-BG)

TITLE: Improving and Integrating European Ocean Observing and Forecasting Systems for Sustainable use of the Oceans

COORDINATOR: HELMHOLTZ ZENTRUM FÜR OZEANFORSCHUNG KIEL

PERSON MONTHS: 4

START DATE: 01/11/2019

DURATION: 50 months

CONNECTION WITH EMSO STRATEGY The EuroSea Project facilitates EMSO in the connection with EOOS and GOOS, as well as the development of Data services.

BENEFITS REALIZED EMSO has a dedicated task in this project for the harmonization of the RI with global Eulerian observatory network (OceanSITES) and to progress on the elaboration of the metadata catalogue for Eulerian observatories with JCOMMOPS.

AtlantECO(H2020-BG)

TITLE: Atlantic ECOSystems assessment, forecasting & sustainability

COORDINATOR: STAZIONE ZOOLOGICA ANTON DOHRN

PERSON MONTHS: 2

START DATE: 01/09/2020

DURATION: 48 months

CONNECTION WITH EMSO STRATEGY AtlantECO supports the development of the EMSO ERIC science service on the study of microbiomes and plastic.

BENEFITS REALIZED This activity will be developed in the course of 2021.

HORIZON 2020 UPCOMING PROJECTS

MINKE (H2020-RI)

TITLE: Metrology for Integrated marine maNagement and Knowledge-transfer nEtnetwork

COORDINATOR: CSIC

PERSON MONTHS: 22,55

START DATE: 01/04/2021

DURATION: 48 months

CONNECTION WITH EMSO STRATEGY MINKE supports the development of Engineering and Logistic services, in particular on metrology.

Doors (H2020-BG)

TITLE: Developing Optimal and Open Research Support for the Black Sea

COORDINATOR: GeoEcoMar

PERSON MONTHS: 13

START DATE: 01/06/2021

DURATION: 48 months

CONNECTION WITH EMSO STRATEGY Doors supports the collaboration of EMSO in the Black Sea region and with other ERICs (EMBRC, Lifewatch, Euro-Argo).

EGI-ACE (H2020-RI)

TITLE: EGI Advanced Computing for EOSC

COORDINATOR: EGI

PERSON MONTHS: 15

START DATE: 01/01/2021

DURATION: 30 months

CONNECTION WITH EMSO STRATEGY EGI-ACE supports the development of Data services and the connection with EOSC.



EMSO ERIC

Administrative and Financial Management

EMSO ERIC is a not-for-profit legal entity/international organization undertaking mainly non-economic R&D activities, since 2016 showed a continuous growth of revenues essentially due to the increase of the number of EC funded projects while the contributions from the Member States have been stable (See Table 1). It should be noticed that -starting as of January 1st 2021- EMSO ERIC Members Countries are 9 as a consequence of the admission of Norway as a new Member State.

ACRONYM	N.GA CONTRACT	FROM	TO	COORDINATOR	BUDGET EMSO ERIC	REVENUES 2017	REVENUES 2018	REVENUES 2019	REVENUES 2020	REVENUES (est.) 2021	BALANCE 2022-2023
EMSO-Link	731036	01/03/17	31/08/20	EMSO-ERIC	539.926	91.266	214.377	234.284	171.721	-	-
DANUBIUS-PP	739562	01/12/16	30/11/19	GeoEcoMar	47.187	7.960	16.255	22.972	11.091	-	-
ENVRIplus	654182	01/01/18	31/07/19	ICOS ERIC	68.795	-	25.392	43.403	-	-	-
ENVRI-FAIR	824068	01/01/19	31/12/22	FZJ	650.862	-	-	148.380	145.464	185.000	172.018
ERIC Forum	823798	01/01/19	31/12/22	BBMRI ERIC	44.166	-	-	3.680	21.424	12.000	7.062
Eurofleets+	824077	01/02/19	31/01/23	MI	129.000	-	-	45.198	35.778	25.000	23.024
Eurosea	862626	01/11/19	31/12/23	GEOMAR	27.500	-	-	355	1.841	8.000	17.304
ATLANTECO	862923	01/09/20	31/08/24	SZN	17.000	-	-	-	1.965	5.000	10.035
ERIITC	871112	01/01/20	31/12/22	ESS	109.531	-	-	-	25.720	50.000	33.811
Egi-ACE	101017567	01/01/21	30/06/23	EGI Foundation	134.375	-	-	-	-	70.000	64.375
MINKE	101008724	01/04/21	31/03/25	CSIC	186.750	-	-	-	-	45.000	141.750
TOTAL					1.955.092	99.226	256.024	498.272	415.004	400.000	469.379

Table 1. Evolution of on-going funded EC Projects as of December 31st 2020.

Table 2 effectively shows the overall trend in terms of financial strategy followed by the ERIC. The working capital has been guaranteed by an adequate creation of reserves (cash carry-over) which allows EMSO ERIC to finance the growth without engaging the ERIC in undertaking debts and obligations towards third parties (Banks or other providers of finance).

The cash-flow reserve – foreseen to decrease in 2020 -has been kept to a steady level due to the reduced current operational expenses (mainly travel cost) in 2020 and to the reduced expenses generated by the limited mobility of the employees/ consultants and their limited presence in the office due to COVID-19 pandemic.

YEAR	CASH-CARRYOVER	REVENUES	YEARLY
	(in Euro)	(in Euro)	CASH-CARRYOVER REVENUES
2016	104.124	125.999	0,83
2017	235.788	496.954	0,47
2018	129.299	754.625	0,17
2019	75.052	998.319	0,08
2020	133.919	880.479	0,15
2021 (est.)	128.800	900.00	0,14
Total	806.982		

Table 2. Evolution of Revenues vs Cash carry-over

However, the cash carry over is being progressively reduced up to a level which will allow EMSO ERIC to face its current and medium-term obligations and carry out its R&D and service provision institutional activities. In fact, in April 2020 EMSO ERIC has submitted and started the discussion with the AoM about the Service Deployment Plan. The present report provides an overview of the Research Infrastructure services implementation plan for the period 2021-2023 including the estimation (i) of the required Human Resources for the period, (ii) of the required capital and recurrent costs.

The activities described in the document circulated to the AoM foresee an estimation of : (i) a financial requirement to cover the equipment investments, (ii) an investment in staff and in-kind recruitment for deployment and operations.

The break-down of the available resources in EMSO ERIC is shown in Table 3.

YEAR	TOTAL FTEs	FTEs Employees	FTEs Consultants	FTEs In-Kind Contributions
2016	0,25	0	0,25	0
2017	4,95	0	2,16	2,79
2018	6,83	1,8	2,19	2,84
2019	8,63	2,88	3	2,75
2020	8	2,3	2,45	3,25
2021 (est.)	9,22	3,7	1,85	3,67

Table 3. Break-down of employee's vs consultants

The launch of the first service (Data Service) is ongoing as of the date of redaction of the present Report. 2021 will mark a key milestone in EMSO ERIC growth since the Data and Information services will be fully operational.

EMSO ERIC has strongly relied on its Host Organization (INGV) which since 2016 provided significant financial support which respect to the other Member States but also on the availability of the In-Kind Contributions which have been fully used by EMSO ERIC to guarantee the start-up phase.

In addition, since 2017 the Spanish Institution CSIC started to provide a significant In-Kind contribution covering the salary cost of the Director General (See Table 4) and other in-kind support.

Other agreements are being signed to provide additional in-kind contributions by the European Regional Facilities participating to the ERIC (Service-level Agreements).

PROFILE	2020 (in €)	2020 (FTE)	2021 (Est. in €)	2021 (FTE)
IN KIND				
CSIC	91.705	1	92.000	1
INGV	159.632	2,25 (27 MM)	207.000	2,67 (32 MM)
	251.337	3,25	299.000	3,67
PERSONNEL	457.000	4,75	481.200	5,55
TOTAL	708.347	8	780.200	9,22

Table 4. 2020 In-Kind contributions provided by INGV and CSIC

COVID-19 PANDEMIC EFFECTS

At the moment of the redaction of the present Report, EMSO ERIC is implementing all the necessary measures to foresee a short-term impact on its operations and financial positions as a result of the COVID-19 pandemic.

Measures for protecting workers from exposure to and infection with SARS-CoV-2, the virus that causes Coronavirus Disease 2019 (COVID-19), depends on exposure risk. That risk varies based on the type of work being performed, the potential for interaction (prolonged or otherwise) with people, and contamination of the work environment. EMSO ERIC adopted infection prevention and control strategies based on a thorough workplace hazard assessment, using appropriate combinations of engineering and administrative controls, safe work practices, and personal protective masks to prevent worker exposures. Some measures applied to preventing occupational exposure to SARS-CoV-2 also required EMSO ERIC to train workers on elements of infection prevention and control, including the social distancing and the use of protective masks. Nevertheless, EMSO ERIC must assume that the uncertainty will occur and an assessment of any future effects should be carried out. Among the possible assumptions to be assessed, there is the impact from new possible shutdowns or quarantines, the implication of recently issued Italian and European laws, and the status of companies within the EMSO ERIC supply chain. EMSO ERIC has assessed assumptions and included the related details regarding such assumptions in the Financial Statements projections.

Given the rapid changes, EMSO ERIC will need to be monitoring the going concern assessment, conclusion and disclosures closely up to the point of issuance. In light of the ongoing global health crisis, EMSO ERIC has promptly put in place a plan to ensure: (i) the health and safety of the employees and consultants and those of our service providers, (ii) continuity of essential internal operations, and (iii) limitation of financial impacts and protection of financial liquidity.

EMSO ERIC Regional Facilities | 2020

EMSO AZORES

EMSO-MOLÈNE

LIGURIAN SEA

HELLENIC ARC

SMARTBAY

WESTERN IONIAN SEA

IBERIAN MARGIN

BLACK SEA

EMSO CANARIAS

OBSEA

PORCUPINE ABYSSAL PLAIN



EMSO ERIC

Regional Facilities | 2020

EMSO consists of a spatially broad set of Regional Facilities (RFs) from the North Atlantic across the Mediterranean to the Black Sea, with water depths down to 4850 m. The fixed-point multi-sensor platforms are deployed in strategic environmental sites across the European seas. In the Atlantic, there are three open-ocean facilities (Azores, Porcupine Abyssal Plain, Iberian and Canaries) and two shallow-water testbed sites (SmartBay and Molène). In the Mediterranean, there are three facilities (Ligurian Sea, Western Ionian Sea and Hellenic Arc), each of which has multiple sites and one shallow water testbed facility at OBSEA, and the EuxRo buoys monitor the Black Sea.

Moreover, the Northern Atlantic represents a tremendous player in our climate system and global ocean circulation. This large gap in the EMSO coverage will be filled by the new Norway consortium, named Nordic Seas, aimed to create a comprehensive observatory network of the Northern Atlantic at the gate of the Arctic Ocean. Nordic Seas includes several of the country's major universities and research institutes, with extensive Marine research and technology experience. It will bring an excellent fleet of ocean gliders, connecting fixed point observatories with water column observations. Norway's relationship with the seafloor and water-column observatories date back to the establishment of the European Seas Observatory NETwork (ESONET), a Network of Excellence supported by the European Commission after the EMSO Preparatory Phase. Finally, Norway is on board, supported by the Research Council of Norway and the Norwegian Ministry of Climate and Environment, with a consortium led by Ilker Fer (University of Bergen) and Bénédicte Ferré (University of Tromsø).



Figure 3. Categories of data-based services at EMSO regional facilities map

RFs of the EMSO distributed infrastructure currently offer **58 scientific services**: 10 access services and 48 data-based services. Of these ten facilities, six are cabled and therefore capable of delivering real-time data, and four are equipped with buoys with near real-time satellite communication capability. A list of Services in science areas is listed in Table 5.

SCIENCE AREAS	SCIENCE SERVICE CATEGORIES
Atmosphere & Ocean	METEOROLOGICAL PARAMETERS
	WATER COLUMN PHYSICS AND BIOGEOCHEMISTRY
Biosphere	MARINE ECOLOGY AND BIODIVERSITY
Geosphere	GEOHAZARDS AND GEODYNAMICS
Across science areas	ENVIRONMENTAL INDICATORS (MSFD)

The meteorological and water column physics and biogeochemistry categories are offered at nearly all facilities. Marine ecology and biodiversity services are currently mostly offered at the Atlantic facilities, while geohazards and geodynamics services are most developed in the Mediterranean region. Several key environmental indicators are measured at each facility.

TAs identified in the 2020 EMSO Science Service catalogue (see below), science services are delivered by individual RF. RFs were designed before creating the ERIC; they are operated independently, although EMSO ERIC activities are adding value to them through inter-facility standardization and the coordination of science, data management and logistics. Moreover, these services have clear potential as components of multi-nodes ERIC-scale services.

2020 saw the growth of EMSO ERIC, both, in terms of Members, with the inclusion of Norway, and observatories.

Three facilities have been approved by the Executive Committee to be incorporated in EMSO (July 2020):

- **East Med** - Cretan Sea E1-M3A - HCMR, Greece
- **West Med** - Western Mediterranean Sea W1-M3A - CNR/IAS, Italy
- **Central Med** - South Adriatic Sea E2-M3A - OGS, Italy

In December 2020, the AoM received from the DG the information about the new facilities and the ExCom position to ratify the integration of the new RFs. The work went through all the 2020 but is still in progress concerning two others from NOC, UK :

- **North Atlantic NOG** - North Oligotrophic Gyre
- **South Atlantic SOG** - South Oligotrophic Gyre.

A detailed description of the Regional facilities provided by Member countries is included at ANNEX-2.

EMSO ERIC

Mission implementation

EMSO ERIC Service Groups (SGs) provide the service function, data and other resources generated by the EMSO RFs. These units ensure excellent research leads and promote innovation, are located in one or more countries and tasked with specific activities of transversal interest and guarantee access to data, technology, innovation expertise and scientific research. Similarly, the Central Management Office's actions reflect this approach, as the Office is structured around specific strategic elements, decisions are made based on the identified purposes and set priorities. The EMSO ERIC Work Programmes have been built around the specification of the relevant objectives, which allows the transition from the general objectives to the operational choices, activities, and subjects responsible for the executive management's goals. The objectives in EMSO are formulated referring to a multi-year period and ordered in terms of assigned priorities, time horizon and available resources. The directional objectives (relating to the year) arise from the strategic ones resulting from mediation between strategic needs and practical constraints. They are articulated in sub-objectives, achievable and measurable by an internal evaluation planned for each Office within the CMO and each Service Group. Furthermore, the Balanced Scorecard (BSC) system aligns concrete objectives with the EMSO ERIC vision and creates strategy-driven performance management.

With the end of the EMSO ERIC implementation project, 2020 marked the execution of the commitment in the negotiation of an agreement between EMSO ERIC and teach of the RFs owners (i.e., Service Level Agreement, SLA). The SLAs signed cover both the services provided to EMSO ERIC 2020-2021 and the estimated annual cost and commitment to ERIC EMSO 2020. This is an essential milestone achieved in planning the ERIC's ongoing and future activities and allowing EMSO to get the availability of the data acquired by the RFs and their access (physical and virtual). Moreover, the SLAs signature represented a turning point for the Consortium life cycle, impacting its sustainability and encouraging member countries' contribution for the next coming years.

The information is recorded in the diagram reporting the rate of contributions in-kind that each Country performs since the consortium establishment; it documents an increase in resources in 2020 in-kind, corresponding to the SLAs finalisation. A substantial increase in revenues is expected starting from next year, considering the leverage effect.

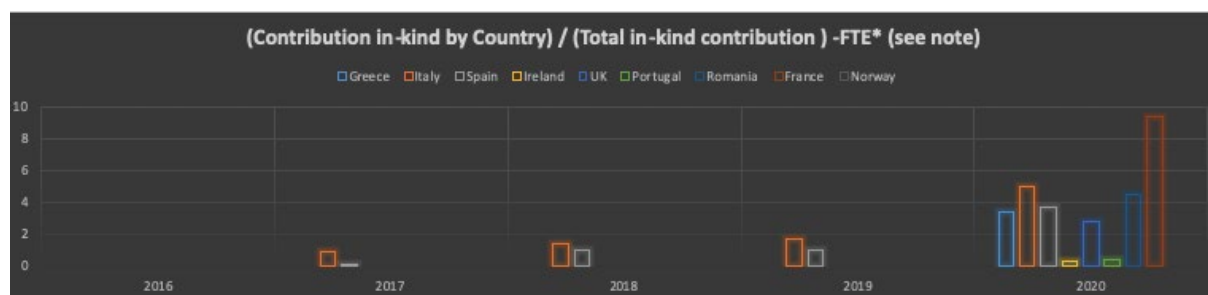


Figure 4. Percentage of contributions in-kind performed by each Country (2016-2020)



P= -8.9°

T=-29.7°

C

Imm=1699.9m

Vl=-0.1m/s

Vt=-0.1m/s

EMSO ERIC Access

Enabling access is one of the core drivers for EMSO ERIC, which in 2020 dedicated significant effort towards effective open access to RI resources and services for the science community. The Consortium defined Best Practice and set up the user access system, which includes physical access (e.g., installing new instruments) and led forward the completion of the virtual access.

SETTING UP THE USER ACCESS SYSTEM

A user access system to the EMSO ERIC infrastructure has been completed. The system includes the peer-review of the submitted applications, selection and post-assessment procedures, tools and policy to regulate and grant clear and harmonised access across the EMSO Regional Facilities. The web-based access system has been fully established following principles of clarity and transparency.

TRANSNATIONAL ACCESS (TNA) PROVISION

Through the EMSO-Link project, EMSO ERIC granted one call of multi-site TNA. The call's objective was to offer free-of-charge access to three EMSO RFs (EMSO-Pylos, EMSO Nice and EMSO SmartBay), willing to host external measuring systems, including instruments, new technologies, and ready to test/take in place new procedures/experiments. This presented a unique opportunity for scientists and engineers to avail of high-quality, interlinked instrumented infrastructures operating at open ocean observatories for carrying out research and testing activities on the one hand. And on the other hand, for EMSO to collect guidelines and recommendations gathered from End-User and Access Provider perspectives.

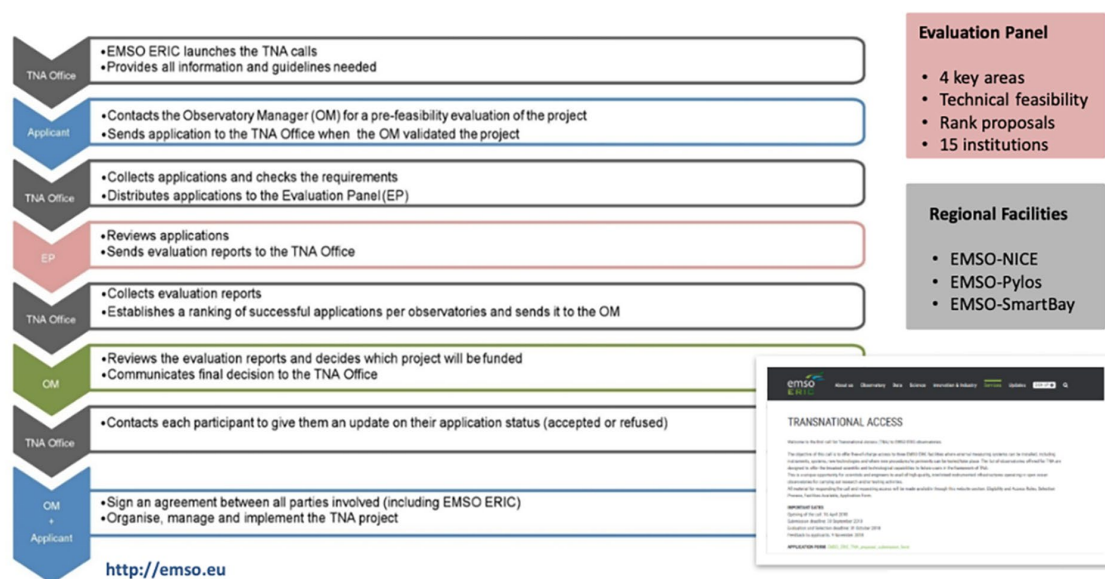


Figure 5. Transnational access process

EMSO RF	AFFILIATION	PROJECT NAME	PROJECT DESCRIPTION	THEME	LEAD INSTITUTION
EMSO NICE	IFREMER	MODAL	Monitoring seafloor Deformation and Assessing Landslide hazards associated with pressures (Nice slope)	Geohazards & Geological Processes	MARUM University of Bremen
EMSO PYLOS	HCMR	DISAG	Detection of Increased Seismic Activities by Gradients	BioGeo Chemistry & Geohazards	Aanderaa Data Instruments
		IMAPOCEAN	Integrated Multilevel Active and Passive Oceanographic Current Education Advancement Network.	Physical Oceanography	Paramount Planet Product Maine University, USA
EMSO SmartBay	MI	Smart Lobster	Norway lobster (<i>Nephrops norvegicus</i>) population dynamics from automated video-monitoring at SmartBay cabled underwater observatory	Ecology & photo/video time series	ICM-CSIC

Figure 6. TNA selection process



EMSO Nice

Access Provider: IFREMER, France

Location: Ligurian sea, Nice, France

Coordinates: 43°38.6' N, 07°13.2' E

The station is located 0.5 nautical from shore

Observatory Manager: Xavier BOMPAIS

Website: www.emso-fr.org/EMSO-Ligure-Nice



EMSO Pylos

Access Provider: Hellenic Centre for Marine Research, Greece

Location: 36°84' N, 21°61' E;

Depth: 1670m

The station is located in the South East Ionian Sea, offshore Pylos (Peloponnese), Greece

Observatory Manager: George Petihakis

Website address: www.poseidon.hcmr.gr



EMSO SmartBay

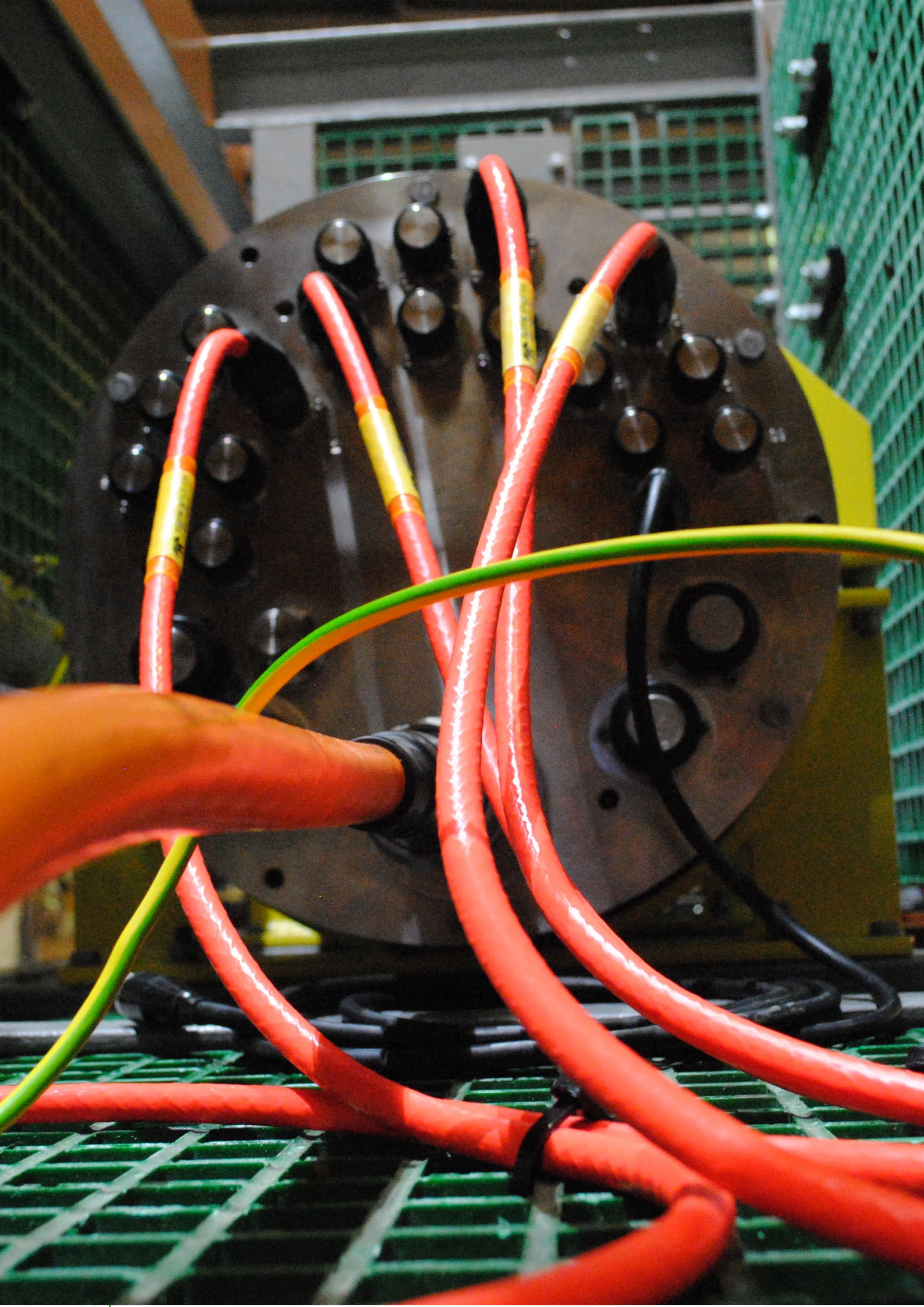
Access Provider: Marine Institute, Ireland

Location: SmartBay Observatory, Galway Bay, Galway, Ireland

The observatory is co-located at the Irish national ocean energy test site in Galway Bay

Observatory Manager: Alan Berry

Website: <http://smartbay.marine.ie>



EMSO ERIC Science

A central objective of the EMSO ERIC is to deliver the data, information and knowledge, based on continuous and sustained monitoring of environmental processes. The EMSO ERIC users include marine science researchers, marine technology engineers, and other ERICs, resource managers, policymakers, marine industries, and the public to collect and use and promote new services and RI users.

EMSO ERIC Science Service Group (SSG) carried out an impressive work , and also benefited from EMSO-Link. First of all, the mapping exercise represented the basis upon which the “EMSO Science Service Catalogue” has been built. After the catalogue’s first issue (May 2019), an updated version was finalized in September 2020, and it is going to be yearly updated. The catalogue provides a detailed description of currently offered science services. This is a crucial internal document that boosts the collective awareness of the ERIC members on the status of our widely distributed infrastructure. It also informs EMSO strategy and serves as a tool to identify the steps required to upgrade it-them to EMSO desired standards for each service or category of services.

EMSO ERIC ID CARDS

An ID card documents each service. The ID cards for data-based science services have been designed to serve the double purpose of documenting what is there and making visible what is still lacking or should be improved. The catalogue is an evolving document and provides information on services that can be labelled as fully operational (ongoing data acquisition, access to currently running infrastructure, adequate data QC, good data accessibility, active users, and adequately disseminated results).

The catalogue also lists services that fit only some of these conditions and thereby help identify the steps that need to be taken to bring this service up to EMSO desired standards (i.e., EMSO Label). In this respect, the Science Service Catalogue is a tool to regularly assess and update our roadmap toward better EMSO science services.

EMSO ERIC SCIENCE SERVICES WORKFLOWS

SSG has focused its efforts over 2020 on paving the way toward such multinode, ERIC-scale services, contributing to the three science areas’ roadmaps. EMSO-Link provided EMSO ERIC with detailed workflows for defining EMSO ERIC processes to deliver scientific services related to the four themes: Ge-

ohazards, Operational Climate and Oceanography, Statutory Monitoring such as Marine Strategy Framework Directive (MSFD) and integrative research. These activities were informed by contributions from several scientific white papers and community papers for the OceanObs'19 conference to set priorities for the next United Nations Decade of Ocean Science for Sustainable Development (2021-2030). This work formed the basis of the EMSO Science Service Group's work plan beyond the implementation phase. As early as its kick-off meeting, the SSG identified theme leaders among its members to take care of each category of services' implementation and upgrades.

These theme leaders have been closely involved in preparing the following reports.

GEOHAZARDS

A detailed report on the critical services related to understanding geohazards has been drafted.

Several EMSO ERIC RFs (cabled and autonomous observatories) measure parameters related to seismicity and water pressure (e.g., for studying tsunami) alongside a broad selection of Essential Ocean Variables (EOVs). The most widely collected geohazard data in EMSO is seismic data at EMSO-Nice Ligurian Sea, EMSO Western Ionian Sea, EMSO Hellenic Arc, the OBSEA shallow water testbed as well EMSO Azores. The RFs provide services and data products through their own national data centres. The RI is adding value to these observations through services added at the EMSO level.

This is achieved through a series of planned activities, from the communication of data availability and standards to stakeholders to the provision of data products and multi-node science services (building time-series datasets). Building synergies with other RIs is also fundamental and linked with the primary goal of enabling access to the RI. Future steps to develop an extensive EMSO service to Orfeus include adopting and implementing the quality control on seismological data compliant with EPOS (Orfeus). This activity is supported by the ENVRI Fair project and involves EMSO Science SG and Data Management SG (see below).

OPERATIONAL CLIMATE AND OCEANOGRAPHY

EMSO ERIC researchers have actively participated in the scientific and engineering community's effort to better establish future ocean observation requirements. This also includes the examination of the Essential Ocean Variables that need to be prioritized for monitoring in the deep ocean (Levin et al., 2019), best practices in ocean observation (Pearlman et al., 2019), constraining of the flux of greenhouse gases in the ICOS network, including at EMSO Regional facilities.

EMSO Regional Facilities provide essential services that can help to address the challenges outlined above. Through EMSO ERIC, they are well placed to add value to their data sets by ensuring the data are accessible to the relevant stakeholders and constructing time-series across multiple sites in different environments distributed throughout Europe. In 2020 the SSG, in the frame of EMSO-Link, summarised the data workflows from EMSO RFs and outlined how EMSO ERIC is delivering services that add value to Operational Climate and Oceanography data collection at the RFs.

The document reports a path to add value to these observations by providing data products and mul-

ti-node science services, strengthening synergies with other research infrastructures (using the example of ICOS), and communicating data availability and standards to EMSO users. Moreover, building time-series datasets for EOVs is a crucial activity to finalize in the next coming years.

STATUTORY MARINE ENVIRONMENTAL MONITORING e.g. MSFD

The report drafted in 2020 detailed services relevant to statutory environmental monitoring (focusing on MSFD) that EMSO ERIC is preparing to deliver. EMSO RFs measure a broad range of EOVs and other parameters directly relevant to MSFD descriptors.

The workflow to provide EMSO ERIC services to improve environmental monitoring includes:

- 1** Time series on a temporal scale relevant to detect climate-driven change concerning a baseline or reveals shorter-term variability
- 2** EOVs and other parameters from large areas of MSFD marine sub-regions that RFs with a spatial footprint can cover
- 3** Access to standardized data
- 4** An outline of the EMSO ERIC plan for the improvement of services for specific MSFD descriptors (Marine Litter, Marine Sound, Biodiversity assessment from images)
- 5** Technological advances to support environmental monitoring (EGIM)
- 6** Enabling access to the infrastructure.

INTEGRATED RESEARCH

Integrated Services describes the most complex services that involve multiple variables and/or disciplines, such as biodiversity, and that is capable of offering thanks to a wide range of parameters measured by the rich suite of sensors on EMSO marine facilities. Indicators of biodiversity are essential to address the Deep Ocean Observing Strategy (DOOS) science questions representing consensus from experts in Global Ocean Observing System (GOOS), Go-SHIP, Argo, OceanSITES, the International Seabed Authority, the ICUN, and others as the key questions for deep-ocean research. EMSO and other ocean observation infrastructures and networks can produce the long time-series observations needed to detect climate-related changes.

This report has been produced in 2020 and describes how EMSO ERIC can support its Regional Facilities (RFs) to deliver complex science services such as biodiversity and ecosystem services showing steps toward an integrated biodiversity Essential Ocean Variable (EOV). It offers an integrated workflow toward producing an invertebrate abundance and distribution GOOS EOV, focusing on enhancing the use of marine imaging at EMSO RFs to help deliver the ecological EOVs.

Specifically, it is dedicated to:

- 1 Definition of the sample population in marine images
- 2 Open nomenclature for the naming of organisms in images
- 3 Use of global repositories of marine biodiversity data to meet FAIR data principles
- 4 Computer vision and machine learning to enhance data collection from images

TRAINING

EMSO approach's key element is that we did not wait for the end of EMSO-Link to transfer the coordination of training activities to the ERIC Science Service Group (SSG).

The ERIC training strategy identifies two main categories of training events: 1- ad hoc training for EMSO personnel and users; and 2-two types of recurrent training milestones: "sensor to users" Best Practices workshops and biennial Time-series Conferences. The second has been designed to address two key needs of the EMSO community of users: one needs to improve the quality and the pertinence of EMSO services. Another need of the EMSO users is to develop its capacity to produce top-quality science using ocean monitoring data.

Also, EMSO outlined the format of the training-dedicated webspace on the EMSO ERIC website.

Most EMSO ad hoc training events have been co-organized (with Regional Facilities, other ocean monitoring initiatives internationally, European projects, etc.). The SSG regularly collected suggestions on training topics from the main stakeholders and gathered input from events organized by EMSO partner institutions or other infrastructures, offering support whenever pertinent. In 2020 the SSG organized an ad hoc event, "Training on EMSO ERIC online data services, February 12th, 2020, Athens". Other events planned for 2020 have been cancelled or postponed due to COVID-19.

The biannual Time-Series Conferences (TSC), a legacy of the ESONET project we are carrying forward, is planned to address this need. In 2019, EMSO ERIC started to design the first call for proposals for an EMSO TCS. It will address the multidisciplinary uses of marine sound and will take place in the fall of 2021 in Madeira (PLOCAN RF) with a solid online component.

EMSO ERIC

Data Management and Information Technologies

PROGRESS IN ENHANCING THE HARMONISATION AND FAIRNESS OF EMSO ERIC DATA AND INTEROPERABILITY

EMSO multidisciplinary and spatially distributed measurements/time series is the core on which the data management infrastructure is built on, with the explicit goal of delivering original continental-scale service products. The interoperability, harmonisation, and FAIRness of the Regional Facilities (RFs) data are essential to providing access to multidisciplinary data and unprecedented data products. It is so clear as the challenges in achieving the full operation go through complete compliance with FAIR principles for data and services. In 2020, the Data Service Group intensely worked on the harmonisation processes and the FAIR principles adaption. In this regard, it also contributed to provide input to the broader European environmental sciences scenario by the proactive contribution to the ENVRI-FAIR project's key deliverables. Significant results:

- Designed, implemented, and deployed a federated ERDDAP system. Ongoing work on ERDDAP metadata harmonisation and data integration into ERDDAP.
- Designed an architecture for harmonisation according to FAIR principles, including a baseline harmonisation subsystem and RESTful API.
- Implemented software components and plug-ins for data harmonization and visualization tools.
- Ongoing work on policy harmonisation across EMSO ERIC regional facilities to enable the integration of services with the European Open Science Cloud (EOSC).
- AAI implementation based on the EGI Check-in service.
- Disseminated results through publications, posters and presentations.

Improve interoperability, such as more mature standardisation, better semantics, and standard metadata, have represented the yearly Data action plan's primary objective, integrated within the EMSO Work Programme 2020. The RI is expected to be fully compliant with FAIR principles by the end of 2021. Results have been reached to increase interoperability with other RIs; the ENVRI FAIR project framework represents a valid instrument for this purpose. EMSO worked together with Euro-Argo ERIC and the marine component of ICOS ERIC and LifeWatch ERIC, and SeaDataNet as a European marine data management infrastructure to improve FAIRness. This improves the RI predisposition to connect its data repositories and services to the European Open Science Cloud (EOSC). Another objective of the DSG for 2020 has

been to increase the still limited interoperability of geophysical data/metadata of EMSO ERIC and EPOS ERIC, focusing on enriching metadata of data and sensors. As for the Solid Earth domain, EMSO ERIC developed a roadmap involving a rich metadata harmonisation layer of architecture to integrate with EPOS ERIC. As for EOSC interfacing/integration, EMSO ERIC developed a plan for harmonisation with EPOS ERIC and hence via ENVRI-hub to EOSC. EMSO ERIC identified architectural solution paths for adopting FAIR principles and enhancing EMSO ERIC integration with EPOS ERIC through ORFEUS-EIDA. The full involvement of the EMSO community has been essential in the “Implementation of FAIR roadmap for Marine Solid Earth data” outlined within the framework of ENVRI FAIR Project. As part of ENVRI-FAIR, an architecture to support the implementation of cross-subdomain data and metadata APIs has been defined.

EMSO ERIC DATA SERVICES

EMSO ERIC data services leverage and complement existing networks (e.g., EMODNet, Copernicus, OceanSites) and data publishers. They fully exploit each regional facility’s designated data sources (e.g., National data centers, tools such as ERDDAP, THREDDS, and automated APIs). Devoted task groups within the DSG focused their 2020 activities on deploying software tools with data discovery capabilities widely used in the marine domain. (e.g., ERDDAP).

The deployed architecture is based on robustness and fault tolerance, including redundancy and fail-over capabilities on computing and storage resources, scalability, and security, including a distributed architecture for data access and analysis. Furthermore, solutions for large datasets’ efficient movement bring added value to the deployment of the data management platform. The already operational system provides open-access, accurate, long-term measurements of ocean parameters.

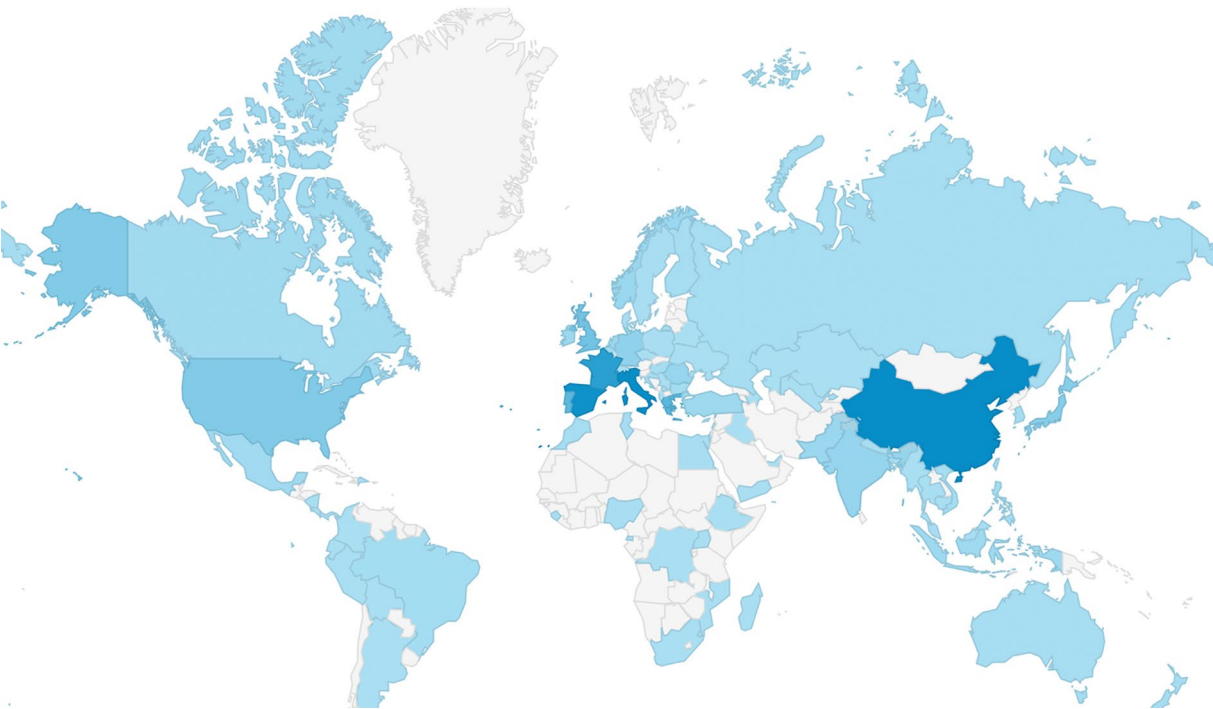
It, in turn, has led to increased interoperability of EMSO nodes and the consistent collection of ocean essential variables.

The EMSO ERIC data management platform components enabled building tools, including data portals, dashboards for data visualisation, product generation, and the integration with other tools such as ERDDAP, facilitating data discovery, access, and download. RFs are evolving to cloud-based environments where data do not need to be moved out from a repository for their use and analysis. EMSO ERIC is facing these challenges by delivering a Virtual Research Environment based on Jupyter, building upon the data management platform. Although the data services have been operated in pre-production, they already impacted the community in different ways, providing the community with access to added-value services. Key results include the deployment and operation of the data services in pre-production, including data portal (<https://data.emso.eu>), federated ERDDAP (<http://erddap.emso.eu>), API (<http://api.emso.eu>) and Jupyter-based Virtual Research Environment (<https://jupyter.emso.eu>).

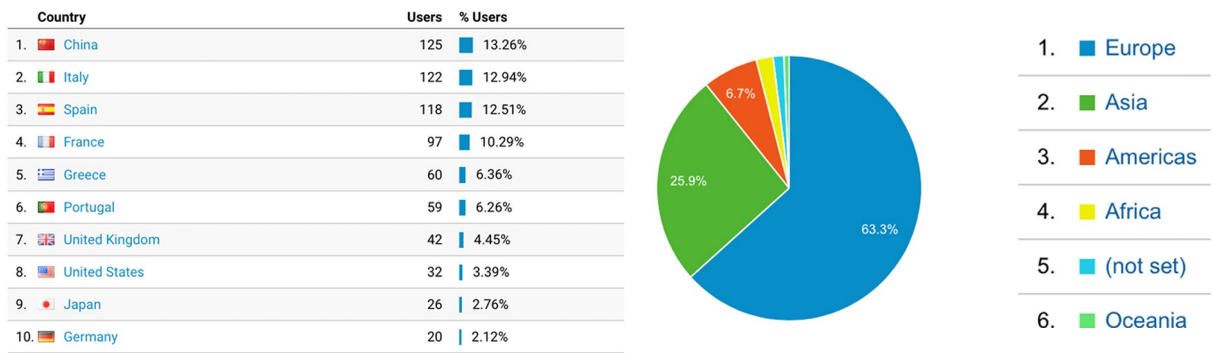
Open-access data and its integration with EOSC impact researchers, educators, policy-makers, and the general public from European communities and beyond.

During the course of 2020, the quality of service has been very close to 100% uptime without any significant incident. During that time, only the EMSO ERIC data portal received 4,038 portal visits and

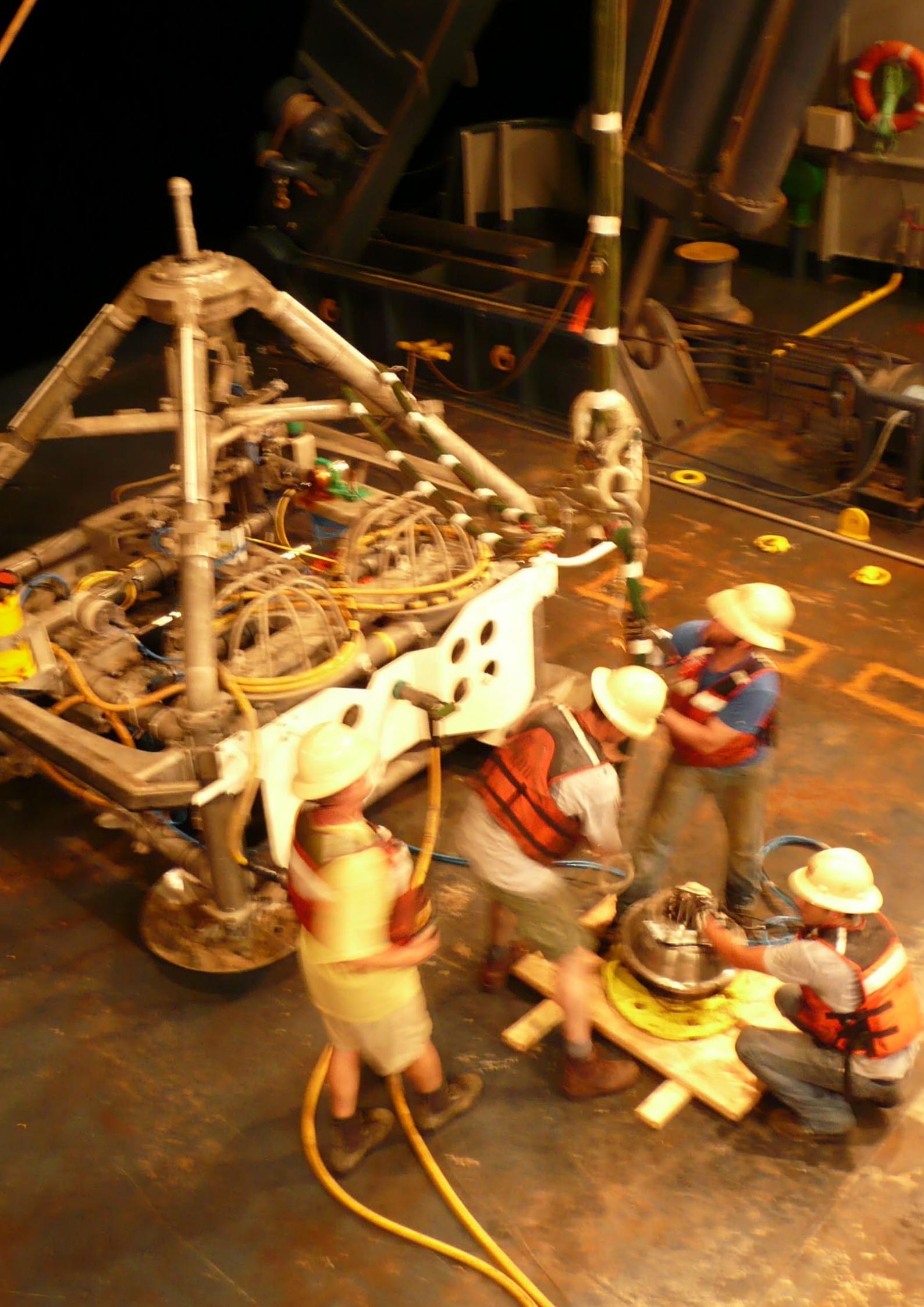
31,438 requests from 916 distinct users from 85 countries. The countries with a larger number of visits include China, Italy, Spain, France, Greece, Portugal, United Kingdom, United States, Japan, and Germany, as shown in the statistics below.



Distribution of accesses per country



User distribution per country (left) and continent (right)



EMSO ERIC

Engineering and Logistic

ENGINEERING, STANDARDS AND INTEROPERABILITY IMPLEMENTATION

EMSO ERIC reached a milestone towards EMSO Label criteria development within its implementation project, EMSO-Link. The work ended in July 2020, integrated the EMSO Handbook of Best Practice (Delivered in February 2020), and incorporated ESONET NoE and Fix03 legacy; it describes the EMSO Label implementation workflow. The EMSO Engineering and Logistic Service Group, ELSG, defined and detailed technical criteria for Label attribution. The technical convergence between the EMSO labelled RFs increases interoperability and facilitates the integration of EMSO in a broader scenario. The definition of EMSO Label criteria has required synergistic work between the EMSO implementation project activities, RFs and CMO. Moreover, each aspect related to the EMSO services delivering process, from the measurement stations deployment and maintenance to the calibration of the sensors to the data curation and repository, data flows and processes to the data access from the users (unique virtual entry point), has been faced from specific user perspectives. To this end, harmonised work has been carried out by all the EMSO Service Groups (Science, Data, Innovation, Communication) under the leadership of the Engineering and Logistics Service Group. The Label implementation process has been defined together with the Handbook Best Practices updating process. They are part of the planned Label evolution cycle, which comprises and defines the standards and Best Practices adoption, criteria and recommendations, the mapping and gap analysis process, Label attribution and standards and Best Practices update. Indeed, the periodic mapping of the RF capabilities already carried on as a best practice within EMSO is a powerful tool to have an updated picture of the facilities' alignment status for the Label criteria. The adoption of the EMSO Label for the Water-mass characterisation by all the RFs is expected by 2021. It will be incorporated in the yearly update of the Service Level Agreements already in force between EMSO ERIC and the individual RFs. The Label progressive development concerning the other EMSO disciplinary and managerial sectors will be progressively developed and incorporated in the SLAs. The Label first implementation on the whole data production chain is expected by 2022.

INFRASTRUCTURE ACCESS - MAINTENANCE

Optimise was the central word in 2020 for the Consortium's Engineering and Logistics services development. The ELSG dedicated significant effort to defining models and operative procedures to reduce the cost of maintenance cruises by avoiding heavy submersibles. These activities respond to the prioritarian need from the RFs of optimising resources by fewer and cheaper maintenance cruises. Harmonizing

EMSO efforts across RFs contributes to enhancing each Regional Facility from the existing capabilities to achieve their main goals by impacting their operational costs efficiently.

The need for an integrated approach led the ELSG to maximise synergies across the RFs. Advancing in this regard required applying the 3-phase capability model focussing on the gap analysis aimed at:

- improvements at the RF level, regarding the observatory design and the maintenance procedures and by mutualising equipment and means at the RI level;
- identifying factors setting the maintenance periods in a systematic approach.

Detailed mapping of maintenance procedures currently applied in EMSO RFs and other RIs preceded the gap analysis. Concrete results have been poured around to a short-term actions plan to coordinate logistic activities and future optimisation plans for ordinary/extraordinary maintenance procedures. This work supported EMSO-Link activities towards operational optimisation and capital expenditure. To this end, EMSO also got more fixed its link with the European Research Vessel Operators, including fruitful cooperation with the EUROFLEETS PLUS community. The ELSG has been highly engaged in a dedicated joint activity to end-developing new equipment for deployment and sampling. This task aimed to gather information on the deep-sea research communities' current and future technical requirements regarding deployment, maintenance, and equipment recovery. The operation required a detailed review of deepwater observatories' requirements, deep water moorings and deepwater research in use currently and based on future needs. An outstanding result has been achieved in terms of both community engagement and contents. All EMSO RFs , under the coordination of the ELSG leadership, actively contributed to reaching the final goal of providing information to the EMSO stakeholders and users about the possibility of carrying out joint deep-sea works. Besides that, the industry's direct involvement in developing tools turned a mapping exercise into real action to liaise industry. Indeed, the work carried out leveraged EMSO working together with the participating industrial partners to EUROFLEETS PLUS.

EMSO ERIC

Industry & Innovation

Many companies consolidate their research investments; big ones, large research-intensive, and SMEs are interested in developing a core set of strategic, longer-term partnerships with selective groups of research centres. Providing EMSO ERIC with an industrial perspective is the primary goal of the EMSO Industry and Innovation Service Group (IISG), set up at the end of 2019. It operates on a range of issues, including marketing challenges, the growth potential, partnerships, and technological challenges involved in integrating equipment, for instance, with the EGIM. In 2020 this service group kicked off its activities, starting from the primary goal of valorising the technology behind EMSO ERIC and the possibilities offered by marine observatories. First of all, a map of the current state of EMSO nodes regarding industry engagement and collaborations has been carried out. To this end, the service group worked in close cooperation with the Innovation Officer, following the ENRIITC project's progress with the participation of EMSO. The project produced an instrumental report on the Mapping of Industry as RI-supplier and RI-user (December 2020). Based on the excellent work performed in the ENRIITC project, the Innovation Officer and the IISG Leader have prepared and adapted a detailed questionnaire Industry/Innovation capacities and collaboration developed to be submitted to EMSO ERIC RFs. The outcomes will be collated in 2021 to plan Industry and Innovation activities to support the development of added value services EMSO ERIC could offer to industry.

Moreover, the IISG contributes to design and develop contents of the Innovation and Industry section of the EMSO website. A specific area for Innovation and Industry activities has been opened. A dedicated task force group was set up to polish and improve content and sections production/reorganization. In addition, several initiatives have been initiated and finalized between September and December 2020.

The endorsement by EuroGOOS for the existing ESONET Yellow Pages (www.esonetyellowpages.com), supported in the past by JERICO and Fix03 projects, signed another milestone achieved in 2020. Yellow pages are a unique opportunity for EMSO providers to foster relations with the larger EMSO scientific community. EMSO ERIC devoted yellow pages to connect with the SMEs and support the EMSO ERIC SME policy. This activity also feeds the agreement between EuroGOOS and EMSO ERIC to jointly coordinate the EuroGOOS Task Team on ocean observing fixed platforms, strengthening the oceanographic research cooperation within the EOOS framework.

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emso ERIC

EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM



GEOHAZARD



CLIMATE CHANGE

emso.eu



This work is a result of the EMSO-Link project that has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731036.

EMSO ERIC Communication

Communication aims to foster awareness of EMSO ERIC's activity and to enhance the socio-economic impact of EMSO. EMSO ERIC is also working on communication key actions to inform the scientific community and increase the collaboration with other sister initiatives to encourage the birth of new partnerships are, to increase the visibility of the Marine RIs sector.

Unfortunately, 2020 has been affected by the COVID-19 crisis, hugely impacting the communications activities planned as in person events.

DISSEMINATION VIA EMSO WEBSITE

The EMSO website is the primary source for public information, and it is conceived as a living instrument describing the overall activities and results achieved within EMSO ERIC. The number of viewers has been growing in 2020, and their spatial distribution also spread all over the world. In Table 6, the viewers' number, the sessions' number (interaction's numbers with the web pages) and average duration for the sessions are reported. Here below a comparison about the first semesters of 2019 and 2020:

DISSEMINATION VIA EMSO SOCIAL CHANNELS

The EMSO social media channels (Facebook, Twitter and LinkedIn) have been permanently updated during the year to share information about consortium activities, updates on observatories' activity, scientific results achieved by the EMSO community, funding call opportunities, job opportunities, events of interest for the community and other topics of interest.

Here is a short summary for each EMSO social.

	2019	2020
USERS	4.335	6.834
SESSIONS	7.146	10.333
AVERAGE SESSION DURATION	00:02:03	00:02:10

Table 6 | Web users' comparison between the first half of 2019 and 2020.

• Facebook | 2020

Four hundred sixty-three people follow the page, and this number has continuously grown since January 7th, 2017. The posts recorded the different activities developed by the whole partnership from conferences to the great success of a publication and outcomes of the projects and also advertised the subscription of a memorandum of understanding between EMSO ERIC and other Organizations.

• Twitter | 2020

EMSO Twitter account at the end of 2020 counts 1177 followers compared to 790 in March 2017. This channel has been used to share mainly the partner's activities abroad and spread information about international activities and "sister infrastructures" to the EMSO community. All the partners have been invited to cite the EMSO Twitter account and the EMSO Facebook account giving them the chance to increase the visibility.

• LinkedIn | 2020

EMSO LinkedIn account has 256 followers. Most of these followers work in the research field, but many different workers are educators, media and communication experts and business developers.

EMSO CONFERENCE. PREPARING THE UN-DECADE OF OCEAN SCIENCE

The conference organized by INGV, EMSO ERIC, MI and HCMR was held in Athens from 12th to 14th of February 2020. It aimed at offering an international scientific framework to increase the coordination and the effectiveness between different European environmental Research Infrastructures and other worldwide organizations, helping to develop a common system with the European observation systems like EOOS and global like GOOS.

Figure 6 reports one of the Conference emails shared within the Community some photos of the event.

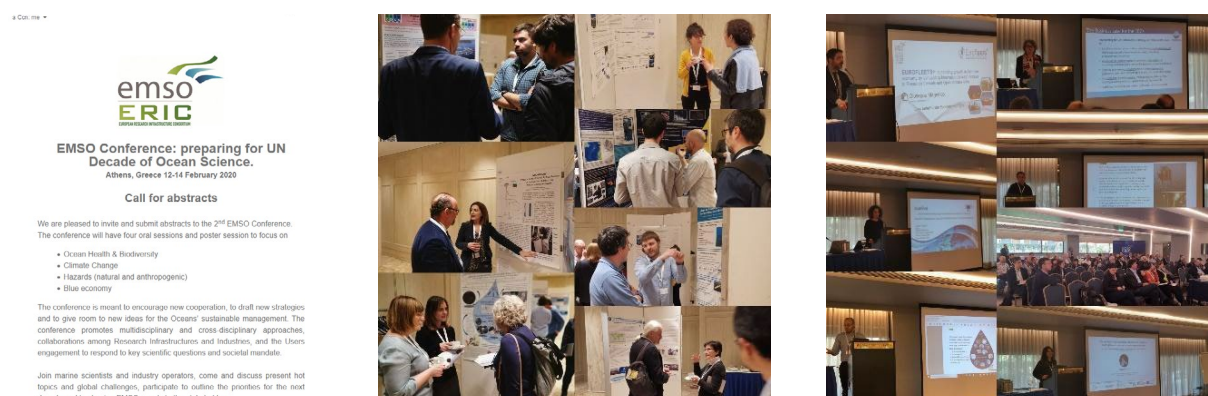


Figure 6. EMSO Conference. Preparing the UN-Decade of Ocean Science. On the left, the Call for abstract's email and in the middle and on the right some snapshots made during the presentations and the poster session.

Over 50 leaders of the international ocean science community - scientists, research infrastructure (RI) managers, funding agency representatives, data service providers and industry leaders - gathered in Athens in for the conference to discuss innovative ways by which the science community can coordinate activities to address the United Nations ambitious Sustainable Development Goals (SDGs) and support the Horizon Europe mission on “Healthy Oceans, Seas, Coastal and Inland Waters”. The event stimulated the exchange of information, best practices, and strategy alignment to improve the conditions for sustainable development and fulfil societal needs, increasing awareness of the importance of the Ocean’s health.

ORGANIZATION OF EVENTS FOR THE GENERAL PUBLIC

Public engagement is fundamental to increase the awareness of the influence of the marine domain on Earth’s health and global process as well as to attract the youngest generation to a career in environmental science. To this end, EMSO planned to implement a temporary EMSO stand at the CretAquarium and during the Easter period 2020. Due to the global sanitary crisis triggered by COVID-19, and complying with the civil protection prescriptions the event has been postponed.



EMSO ERIC

Looking ahead

2020 confirmed EMSO ERIC as a European organisation coordinating a set of Regional Facilities strategically distributed at critical locations in the deep sea around Europe. In the next future, EMSO ERIC has to address the needs of the fully operational phase. The challenge dresses twice in value. If, on the one hand, the Consortium has to be robust to the funders, on the other hand, the transition to full operation requires additional investments, and also it has to attract new Members. Governance and management have been organised to focus on activities capable of repaying the investments in terms of efficiency and effectiveness of the undertaken actions so that the RI can be up against the long-term sustainability issues.

EMSO is starting its path towards sound management, strengthening the principle of autonomy by analysing all the factors that contribute to it, risk forecasting and revenue diversification, increasing funders trust that it can safely invest in its strategy and activities. The differentiation of financial resources inevitably corresponds to the diversification of activities.

A big challenge to consider is the maintenance and upgrade of physical infrastructures that require a large re-investment to the benefit of the RFs and maintain scientific excellence. Moreover, strengthening the linkage between the RFs and the hub is the key to develop the potential of innovation of the Consortium, fostering the role for RI to contribute to Regional development. To this end, the political perspective to monitor and increase the synergies between the Regions' needs to develop growth through knowledge. However, our primary goal is to advance the knowledge of the complex processes of interactions between the geosphere, the biosphere and the hydrosphere, and the anthropogenic effects in the ocean. All this information and knowledge provide integrated solutions to promote blue growth and strengthen international collaboration with other Ocean Observing Systems (OOS).

Over the past few decades, research has highlighted the marine ecosystem's complexity and how it affects global biogeochemical cycles, ecosystem services, and long-term sustainability. The current increasing sensitivity of the global audience concerning global changes affecting all the environments, from the polar to tropical ones, and the natural resources therein, and the occurrence of extreme events with shorter and shorter recurrence times, offers EMSO an excellent opportunity to disseminate the value of the knowledge-based information originated by observatory data. EMSO ERIC ambition is to grow in contributing to give replies to the questions above. To do this, the organisation purses its long-term strategic goals (as for the EMSO ERIC Long term strategic plan 2021-2023).

EMSO ERIC

Annex 1

List of the EMSO regional teams

Regional Team	Team members	Name	Affiliation
Azores	Team Leader	Sarradin Pierre Marie	Ifremer
	Science SG	Cannat Mathilde	CNRS
	Data SG	Van Iseghem Sylvie	Ifremer
	Eng&Log SG	Blandin Jérôme	Ifremer
	Comm SG	Sarrazin Jozée	Ifremer
	IISG	Helen Leau	Ifremer
Black Sea	Team Leader	Radulescu Vlad	GeoEcoMar
	Science SG	Raluca Tutuianu	GeoEcoMar
	Data SG	Raluca Radulescu	GeoEcoMar
	Eng&Log SG	Rucihan Ali Deversi	GeoEcoMar
	Comm SG	Dinicoiou Mirela	GeoEcoMar
	IISG	Ivan Iulia	GeoEcoMar
Canary Islands	Team Leader	Delory Eric	PLOCAN
	Science SG	Delory Eric	PLOCAN
	Data SG	Gonzalez Javier	PLOCAN
	Eng&Log SG	Monagas Vidina	PLOCAN
	Comm SG	Loustau Josefina	PLOCAN
	IISG	Castro Ayoze	PLOCAN
Hellenic Arc	Team Leader	Petihakis George	HCMR
	Science SG	Perivoliotis Leonidas	HCMR
	Data SG	Sotiropoulou Maria	HCMR
	Eng&Log SG	Pagonis Paris	HCMR
	Comm SG	Christodoulaki Sylvia	HCMR
	IISG	Frangoulis Costas	HCMR

Regional Team	Team members	Name	Affiliation
Iberian Margin	Team Leader	Zuzia Stroynowski	IPMA
	Science SG	Colaço Ana	University of the Azores -IMAR
	Data SG	Relvas Paulo	Universidade do Algarve (CCMAR/FCT)
	Eng&Log SG	Silva Eduardo	INESC TEC
	Comm SG	Sebastião Luis	ISR- Instituto Superior Tecnico, Portugal
	IISG	Vilhena Lourenco Nuno	IPMA
Ligurian Sea	Team Leader	Coppola Laurent	Lab. Océanographique de Villefranche
	Science SG	Lefevre Dominique	MIO- CNRS
	Data SG	Carval Thierry	ifremer
	Eng&Log SG	Gojak Carl	Division Technique de l'INSU
	Comm SG	TBD	
	IISG	Hello Yann	Geoazur - Université Côte d'Azur
Porcupine Abyssal Plain	Team Leader	Hartman Susan	NOC
	Science SG	Gate Andrew	NOC
	Data SG	Snaith Helen	NOC
	Eng&Log SG	Cardwell Chris	NOC
	Comm SG	Pebody Corinne	NOC
	IISG	Alexiou Sofia	NOC
Western Ionian Sea	Team Leader	Embriaco Davide	INGV
	Science SG	Lo Bue Nadia	INGV
	Data SG	Fратиanni Claudia	INGV
	Eng&Log SG	Marinaro Giuditta	INGV
	Comm SG	Giuntini Alessandra	INGV
	IISG	Papaleo Riccardo	INGV - INFN
Molène	Team Leader	Lanteri Nadine	Ifremer
	Science SG	Garziglia Sébastien	Ifremer
	Data SG	Libes Maurice	OSU Pytheas - CNRS
	Eng&Log SG	Ciausui Viorel	Ifremer
	Comm SG	Chloé Batissois	Ifremer
	IISG	Barbero Aurore	Ifremer

Regional Team	Team members	Name	Affiliation
OBSEA	Team Leader	Del Rio Joaquin	UPC
	Science SG	Mihai Toma Daniel	UPC
	Data SG	Martinez Enoc	UPC
	Eng&Log SG	Nogueras Marc	UPC
	Comm SG	Neus Vidal	UPC
	IISG	Del Rio Joaquin	UPC
SmartBay	Team Leader	Berry Alan	MARINE INSTITUTE
		Gaughan Paul	MARINE INSTITUTE
	Data SG	Thomas Rob	MARINE INSTITUTE
	Eng&Log SG	O'Malley Conall	MARINE INSTITUTE
	Comm SG	Felicity Donnelly	MARINE INSTITUTE
	IISG	Reilly Kieran	MARINE INSTITUTE
Nordic Seas	Team Leader	Ilker Fer	University of Bergen
	Science SG	Ingunn Skjelvan	Norwegian Research Centre and Bjercknes Centre for Climate Research
	Data SG	Rocio Castano Primo	University of Bergen
	Eng&Log SG	Beatrice Tomasi	
	Comm SG		
	IISG	TDB	
Western Mediterranean Sea	Team Leader	Bozzano Roberto	CNR Istituto per lo studio degli impatti Antropici e Sostenibilità in ambiente marino
	Science SG	Bozzano Roberto	CNR Istituto per lo studio degli impatti Antropici e Sostenibilità in ambiente marino
	Data SG	Pensieri Sara	CNR Istituto per lo studio degli impatti Antropici e Sostenibilità in ambiente marino
	Eng&Log SG	Pensieri Sara	CNR Istituto per lo studio degli impatti Antropici e Sostenibilità in ambiente marino
	Comm SG	Evangelista Lorenza	CNR
	IISG	Magnifico Giuseppe	CNR

Regional Team	Team members	Name	Affiliation
South Adriatic Sea	Team Leader	Cardin Vanessa	OGS Istituto Nazionale di Oceanografia e Geofisica Sperimentale
	Science SG	Miserocchi Stefano	CNR - Istituto per le Scienze Polari
	Data SG	Partescano Elena	OGS Istituto Nazionale di Oceanografia e Geofisica Sperimentale
	Eng&Log SG	Brunetti Fabio	OGS Istituto Nazionale di Oceanografia e Geofisica Sperimentale
	Comm SG	Petrera Francesca	OGS Istituto Nazionale di Oceanografia e Geofisica Sperimentale
	IISG	TBD	
Cretan Sea	Team Leader	Petihakis George	HCMR Hellenic Centre for Marine Research - Institute of Oceanography
	Science SG	Petihakis George	HCMR Hellenic Centre for Marine Research - Institute of Oceanography
	Data SG	Perivoliotis Leonidas	HCMR Hellenic Centre for Marine Research - Institute of Oceanography
	Eng&Log SG	Pagonis Pagonis	HCMR Hellenic Centre for Marine Research - Institute of Oceanography
	Comm SG	Christodoulaki Sylvia	HCMR Hellenic Centre for Marine Research - Institute of Oceanography
	IISG	Frangoulis Constantin	HCMR Hellenic Centre for Marine Research - Institute of Oceanography

EMSO ERIC

Annex 2

Detailed description of the Regional facilities by Member countries

FRANCE

REPRESENTING ENTITIES:

Institut Français de Recherche pour l'exploitation de la Mer | IFREMER

Centre National de la Recherche Scientifique | CNRS

REGIONAL FACILITIES 3

EMSO AZORES

SCIENTIFIC OBJECTIVES

Understand the links between geological, physical and chemical processes and their effects on the dynamics of the hydrothermal fauna at different spatial and temporal scales at the Lucky Strike vent field.

GENERAL INFORMATION

Location: Mid-Atlantic ridge near Azores

Distance from land: 200 NM

Max water depth: 1700 m

Date 1st deployment: October 2010

Operated by: IFREMER, CNRS

Website: www.emso-fr.org

Status: running (updated November 2017)

Regional Team Leader: Pierre-Marie Sarradin, Ifremer

SCIENCE SERVICE CATEGORY	SCIENCE SERVICE NAME
Access	Access
METEOROLOGICAL PARAMETERS	Meteorological parameters
WATER COLUMN PHYSICS AND BIOGEOCHEMISTRY	Water mass characterisation
MARINE ECOLOGY AND BIODIVERSITY	Hydrothermal vents faunal and ecosystem response
GEOHAZARDS AND GEODYNAMICS	Seafloor geodesy
GEOHAZARDS AND GEODYNAMICS	Local seismicity
GEOHAZARDS AND GEODYNAMICS	Dynamics of mid atlantic ridge hydrothermal system
ENVIRONMENTAL INDICATORS (MSFD)	Underwater sound monitoring
ENVIRONMENTAL INDICATORS (MSFD)	Seafloor environmental parameters

EMSO-MOLÈNE

SCIENTIFIC OBJECTIVES

Test of marine sensors to help manufacturers, platform operators and scientists to validate instruments.

GENERAL INFORMATION

Location: Near Molène Island

Distance from land: 2 km

Max water depth: 1 m

Date 1st deployment: 2012

Operated by: IFREMER

Website: www.emso-fr.org

Status:

Regional Team Leader: Nadine Lantéri, Ifremer

SUMMARY

The Molène archipelago is part of the Natural Marine Parc d'Iroise, a marine protected area hosting a rich biodiversity and biomass with the largest seaweed field in Europe, a wide range of benthic organism, endangered bird species and marine mammals, including bottlenose dolphins and seals. EMSO-Molène is a pilot for a new generation of multidisciplinary cabled and coastal observatories, based on reliable proven off the shelf technologies. The technologies were used in the design of the observatory EMSO-Ligure Nice.

LIGURIAN SEA

SCIENTIFIC OBJECTIVES

Multidisciplinary long-term eulerian monitoring to study the slope failure processes on the continental slope (Nice site), water mass properties, biogeochemical cycles and biological communities modifications in response to climate change and anthropogenic pressure (open sea platforms) and geo-hazards assessment with the monitoring of earthquakes and tsunamis.

GENERAL INFORMATION

Location: Mediterranean Sea, South of France

Distance from land: 42 km (Western Ligurian); 1 km (Nice); 50 km (Dyfamed)

Max water depth: 2400 m (Western Ligurian); 20-35 m (Nice); 2300 m (Dyfamed)

Date 1st deployment: October 2015 (Nice); 1998 and 1999 (Dyfamed); 2007 and 2010 (Western Ligurian)

Operated by: CNRS, IFREMER

Website: www.emso-fr.org

Status: running/in maintenance/in development (updated November 2017)

Regional Team Leader: Laurent Coppola, CNRS/UPMC

SCIENCE SERVICE CATEGORY	SCIENCE SERVICE NAME
Access	Access
WATER COLUMN PHYSICS AND BIOGEOCHEMISTRY	Water mass characterization: Hydrodynamic changes in the water column
	Biogeochemical cycles: Impacts of the deep and dense water formation and Evolution of the carbon pump
GEOHAZARDS AND GEODYNAMICS	Geohazard: Slope failure processes on a steep continental slope
	Geohazard: Seismic hazard, tsunami generation

GREECE

REPRESENTING ENTITY:

Hellenic Centre for Marine Research | HCMR

REGIONAL FACILITY 1

HELLENIC ARC

SCIENTIFIC OBJECTIVES

Real-time long-term monitoring of oceanic circulation, deep-sea processes and ecosystems evolution. Study of episodic events such as earthquakes, submarine slides, tsunamis, benthic storms, biodiversity changes, pollution. Simultaneous data are relative to: seismology, geodesy, sea level, fluid and gas vents, physical oceanography and biodiversity imaging at different scales.

GENERAL INFORMATION

Location: Mediterranean Sea, Hellenic Arc

Distance from land: 12 NM

Max water depth: 1700 m

Date 1st deployment: May 2007

Operated by: HCMR

Website: poseidon.hcmr.gr

Status: running/in development (updated November 2017)

Regional Team Leader: George Petihakis, HCMR

IRELAND

REPRESENTING ENTITY:
Marine Institute | MI
REGIONAL FACILITY 1

SMARTBAY

SCIENTIFIC OBJECTIVES

Test of marine sensors to help manufacturers, platform operators and scientists to validate instruments.

GENERAL INFORMATION

Location: Galway Bay, Ireland
Distance from land: 1.5 or 5 km
Max water depth: 27 m
Date 1st deployment: August 2015
Operated by: Marine Institute
Website: smartbay.marine.ie
Status: test site, fully operational (updated November 2017)
Regional Team Leader: Alan Berry, MI

SCIENCE SERVICE CATEGORY	SCIENCE SERVICE NAME
Access	Access
MARINE ECOLOGY AND BIODIVERSITY	Benthic Monitoring
ENVIRONMENTAL INDICATORS (MSFD)	Environmental parameters
	Underwater Noise Monitoring and BioAcoustics

ITALY

REPRESENTING ENTITY:

Istituto Nazionale di Geofisica e Vulcanologia | INGV

REGIONAL FACILITY 1

WESTERN IONIAN SEA

SCIENTIFIC OBJECTIVES

Geo hazards assessment with the real-time monitoring of earthquakes and tsunamis. Physical oceanographic parameters and water mass properties at the seafloor and along the water column. Time variations of terrestrial potential fields and electrical properties. Marine acoustic noise characterization and bio-acoustic tracking. Rheological properties of solid matter.

GENERAL INFORMATION

Location: Mediterranean Sea, East of Sicily

Distance from land: 25 km

Max water depth: 2100 m

Date 1st deployment: 2001

Operated by: INGV, INFN, CNR

Website: www.moist.it/sites/western_ionian_sea/2

Status: running for ONDE-SMO; NEMO-SN1 recovered in 2013; mooring recovered in 2017 (updated November 2017)

Regional Team Leader: Davide Embriaco, INGV

SCIENCE SERVICE CATEGORY	SCIENCE SERVICE NAME
Access	Access
WATER COLUMN PHYSICS AND BIOGEOCHEMISTRY	Water masses characterization: monitoring of deep dynamics and variability of the water column
GEOHAZARDS AND GEODYNAMICS	Geohazards: quality check through probability PSD tool
	Geohazards: trigger for seismic events
	Geohazards: trigger for volcanic fall-out
	Tsunami detection
ENVIRONMENTAL INDICATORS (MSFD)	Underwater Acoustic Noise Monitoring

PORTUGAL

REPRESENTING ENTITY:

Fundação para a Ciência e a Tecnologia | FCT

REGIONAL FACILITY 1

IBERIAN MARGIN

SCIENTIFIC OBJECTIVES

GENERAL INFORMATION

Location: Gulf of Cadiz and North Portugal continental shelf

Distance from land: to be defined

Max water depth: to be defined

Date 1st deployment: July 2020

Operated by: EMSO Portugal

Website: emso-pt.pt

Status: in procurement (updated December 2019)

Regional Team Leader: Zuzia Stroynowski, IPMA

SUMMARY

The area of Cadiz is very important for geo-hazards. It was the site where one of the worst earthquakes that hit Europe occurred in 1755, coupled with a destructive tsunami. Here African and European tectonic plates converge. It is a seismic volcanic region. It is also the site to investigate the flow that from Mediterranean moves into the Atlantic and affects the deep-water circulation on a global scale. The geologic and oceanographic features of this region favour the presence of highly diverse benthic communities and have also a central role in the distribution of several marine mammals and fish species.

Planned EMSO scientific disciplines: geosciences, physical oceanography, biogeochemistry, marine ecology.

ROMANIA

REPRESENTING ENTITY:

Institutul National de Cercetare

Dezvoltare Pentru Geologie si Geoecologie Marina | GEOECOMAR

REGIONAL FACILITY 1

BLACK SEA

SCIENTIFIC OBJECTIVES

Long-term environmental monitoring and for the prevention/mitigation of the marine geo hazards.

GENERAL INFORMATION

Location: Three sites in the Black Sea

Distance from land: 180 km

Max water depth: 95 m

Date 1st deployment: June 2013

Supported by: Romania

Operated by: GeoEcoMar

Website:

Status: running (updated November 2017)

Regional Team Leader: Vlad Rădulescu, GeoEcoMar

SCIENCE SERVICE CATEGORY	SCIENCE SERVICE NAME
Access	Access
METEOROLOGICAL PARAMETERS	Meteorological characterization
ENVIRONMENTAL INDICATORS (MSFD)	Hydrodynamic changes on the seafloor

SPAIN

REPRESENTING ENTITY:

Plataforma Oceánica de Canarias | PLOCAN

REGIONAL FACILITIES 2

EMSO CANARIAS

SCIENTIFIC OBJECTIVES

Long-term changes of stratification and circulation on seasonal and inter-annual times scales of the subtropical Central-Eastern waters of the Atlantic Ocean.

GENERAL INFORMATION

Location: Atlantic Ocean near Canary Islands

Distance from land: 112 km

Max water depth: 3630 m

Date 1st deployment: 1994

Operated by: PLOCAN

Website: plocan.eu/en/open-ocean-observatory

Status: running (updated May 2020)

Regional Team Leader: Eric Delory, PLOCAN

SCIENCE SERVICE CATEGORY	SCIENCE SERVICE NAME
Access	Access
METEOROLOGICAL PARAMETERS	Meteorological parameters
WATER COLUMN PHYSICS AND BIOGEOCHEMISTRY	Hydrography (Currents, Salinity, Temperature, Pressure)
	Biogeochemistry (Oxygen, Nutrients, Chlorophyll, Turbidity, Carbon system, Particle flux)
ENVIRONMENTAL INDICATORS (MSFD)	PLOCAN Underwater Sound service

OBSEA

SCIENTIFIC OBJECTIVES

Test of marine sensors to help manufacturers, platform operators and scientists to validate instruments.

GENERAL INFORMATION

Location: Balearic Sea, South of Spain coast

Distance from land: 4 km

Max water depth: 20 m

Date 1st deployment: 2009

Operated by: Universitat Politècnica de Catalunya, UPC

Website: www.obsea.es

Status: test site running (updated November 2017)

Regional Team Leader: Joaquin del Rio Fernandez, UPC

SCIENCE SERVICE CATEGORY	SCIENCE SERVICE NAME
Access	Access
METEOROLOGICAL PARAMETERS	Meteorological parameters
MARINE ECOLOGY AND BIODIVERSITY	Seafloor environmental parameters
GEOHAZARDS AND GEODYNAMICS	Geohazard (earthquake)
ENVIRONMENTAL INDICATORS (MSFD)	Underwater sound monitoring
	Seafloor environmental parameters

UK

REPRESENTING ENTITY:

National Oceanography Centre | NOC

REGIONAL FACILITY 1

PORCUPINE ABYSSAL PLAIN

SCIENTIFIC OBJECTIVES

Study the connections between the lower atmosphere, water column and seafloor at a deep ocean site in the Northeast Atlantic, understanding ecosystem function especially related to carbon sequestration dynamics.

GENERAL INFORMATION

Location: North East Atlantic Ocean, abyssal plain

Distance from land: 300 miles

Max water depth: 4850 m at the PAP-SO

Date 1st deployment: First operations 1985 (RRS Challenger 6A/85); First long-term moored instrumentation 1991 (Bathysnap, RRS Challenger 79); PAP3 sediment traps from 1989; PAP1 mooring from 2002

Supported by: United Kingdom

Operated by: NOC

Website: projects.noc.ac.uk/pap

Status: running (updated May 2020)

Regional Team Leader: Sue Hartman, NOC

SCIENCE SERVICE CATEGORY	SCIENCE SERVICE NAME
Access	Access
METEOROLOGICAL PARAMETERS	Meteorological parameters
WATER COLUMN PHYSICS AND BIOGEOCHEMISTRY	Ocean physics and biogeochemistry
MARINE ECOLOGY AND BIODIVERSITY	Ecosystem function: surface to seafloor
	Dynamics of the benthos of the porcupine abyssal plain
ENVIRONMENTAL INDICATORS (MSFD)	Anthropogenic impacts on open ocean systems



EMSO ERIC

Annex 3

List of publications

Abstracts congress and scientific articles

EMSO Conference: Preparing the UN-Decade of Ocean Science 12-14/02/2020 Athens - Greece

- Cannat M. "Developing EMSO geo-hazard services" - oral
- Gates A. "Biodiversity and ecosystem observation at EMSO Regional Facilities" - oral
- Lampitt R. "Opening address and Conference statement" - oral
- Hartman S. "Potential areas of overlap and synergy between EMSO and ICOS" - oral
- LoBue N. "EMSO Eric to tackling the climate variability knowledge gap" - oral
- Reilly K. "The Role of EMSO ERIC as an Enabler for Innovation and Growth in the Blue Economy" - oral
- Gaughan P. "Integration of EMSO SmartBay Observatory Data processes into an International Oceanographic Data and Information Exchange accredited Data Management Quality Management Framework" - oral
- Sarrazin P. M. "EMSO Azores Deep-sea Observatory Anthropogenic hazards and Environmental monitoring" - oral
- Gates A. "The Porcupine Abyssal Plain Sustained Observatory" - poster
- Novello A. et al., "Towards new online services for the EMSO ERIC temperature and salinity data" – poster
- Cannat M. et al., "Magma chamber to micro-habitats: near seafloor dynamics of mid-ocean ridge hydrothermal systems" - poster
- Italiano F. et al., "Joint Research Unit EMSO-Italia: The Italian Contribution to EMSO for the Long-term Observation of the Central Mediterranean deep environment" - poster

EGU General Assembly 2020 4-8 May 2020 - online

- Novello A. et al., "Towards new online services for the EMSO ERIC temperature and salinity data"
- Fourrier et al., "New insights into nutrient dynamics and the carbonate system using a neural network approach in the Mediterranean Sea"
- Bardaji R. et al. "Using and acquiring time-series data with the EMSO ERIC DataLab"
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Juanjo Dañobeitia | DG | EMSO ERIC

Maria Incoronata Fredella | EMSO ERIC

Marco Galeotti | EMSO ERIC

Alessandra Giuntini | INGV

Francesca Di Laura | INGV

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