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The EMSO ERIC network: overview and engagement

The European Multidisciplinary Seafloor and water column Observatory (EMSO) consists, to date, of 11 regional multiple sensor-equipped platforms distributed around Europe from the Atlantic Ocean to the Mediterranean, and the Black Sea. Each system collects multidisciplinary measurements in the water column as well as at the seafloor addressing several critical questions related to ocean health, climate change, marine ecosystems and natural hazards.

EMSO is a European Research Infrastructure Consortium (ERIC) since 2016, and one of the many challenges has been to design new online services promoting marine data produced by the whole network.

Here, we report on an on-going activity to compile, control and deliver quality controlled temperature and salinity data and metadata gathered through the EMSO network from the sea surface down to 4750m.

Why...

...LOOK into the DEEP SEA?

A singularity of EMSO lies with the broad distribution of its network across different marine regional systems and beyond 1000m. Today, the abyssal ocean remains poorly known due to the lack of competitive infrastructure involved in high depth monitoring and data delivering.

Aware of this knowledge gap, the EMSO Science Service Group has engaged a pilot activity on seven facilities of its network where significant deep-sea oceanographic data have been produced since the early 2000's.

...FOCUS on TEMPERATURE and SALINITY?

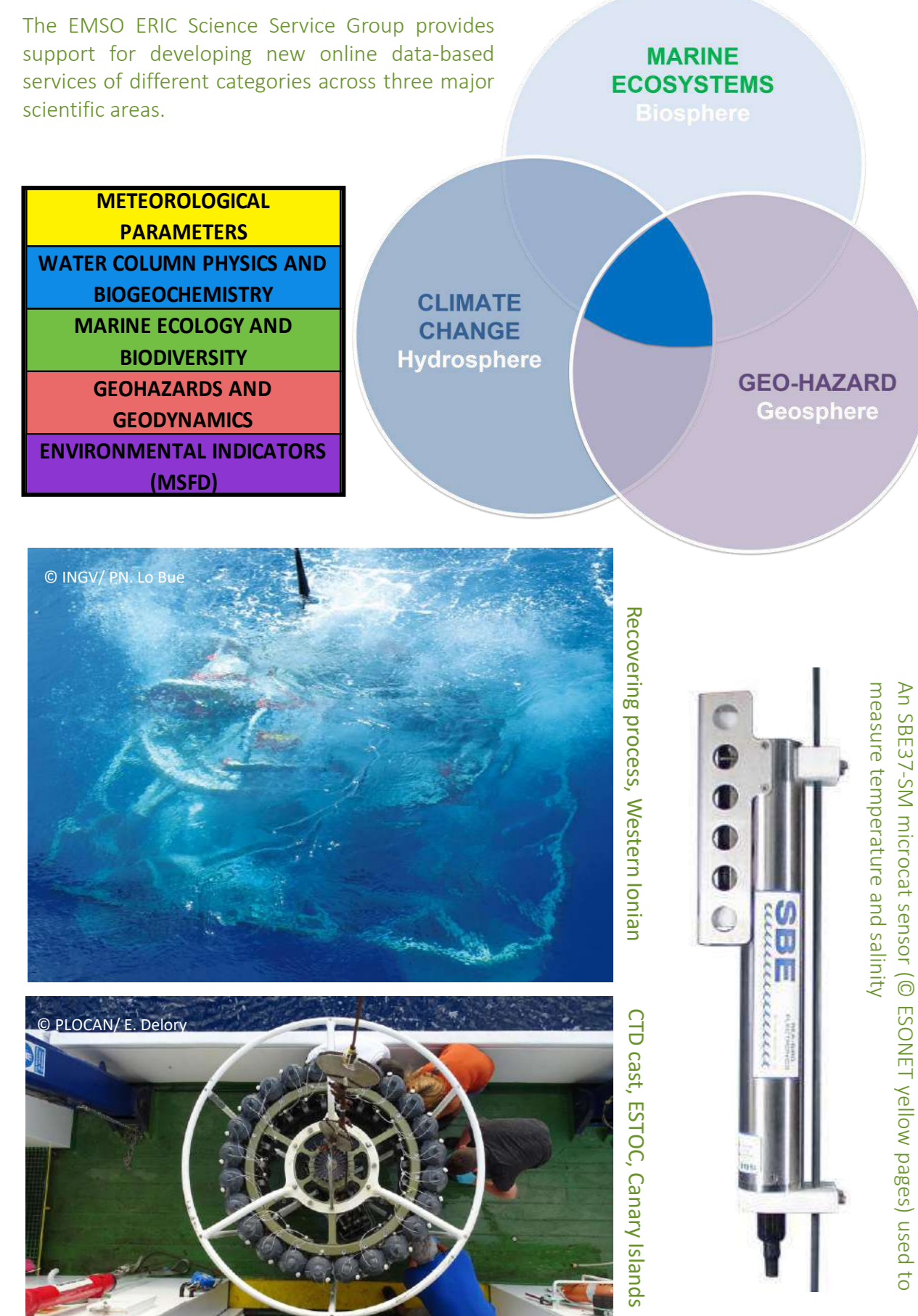
Deep temperature and salinity are the major signatures for deep oceanic overturning related to climate forcing and subsequent deep oceanic ventilation and ecosystem sustainability. Besides, the thermohaline circulation plays a crucial role in the redistribution of heat across oceans by supporting the complex Earth's climate engine.

This is why temperature and salinity figure among the Essential Ocean Variables (EOVs) identified by the Global Ocean Observing System (GOOS) Expert Panels.

... DEVELOP Standard DATA QUALITY CONTROL and METADATA?

Quality controlled data are essential input for modeling of large-scale ocean processes, which in turn provide essential information for representing climate variability. These are significant guidance for policymakers to make decisions regarding climate change and natural hazard impacts.

While data and metadata management and quality control are today addressed independently between the regional nodes, EMSO seeks to harmonize these procedures at the scale of its network.



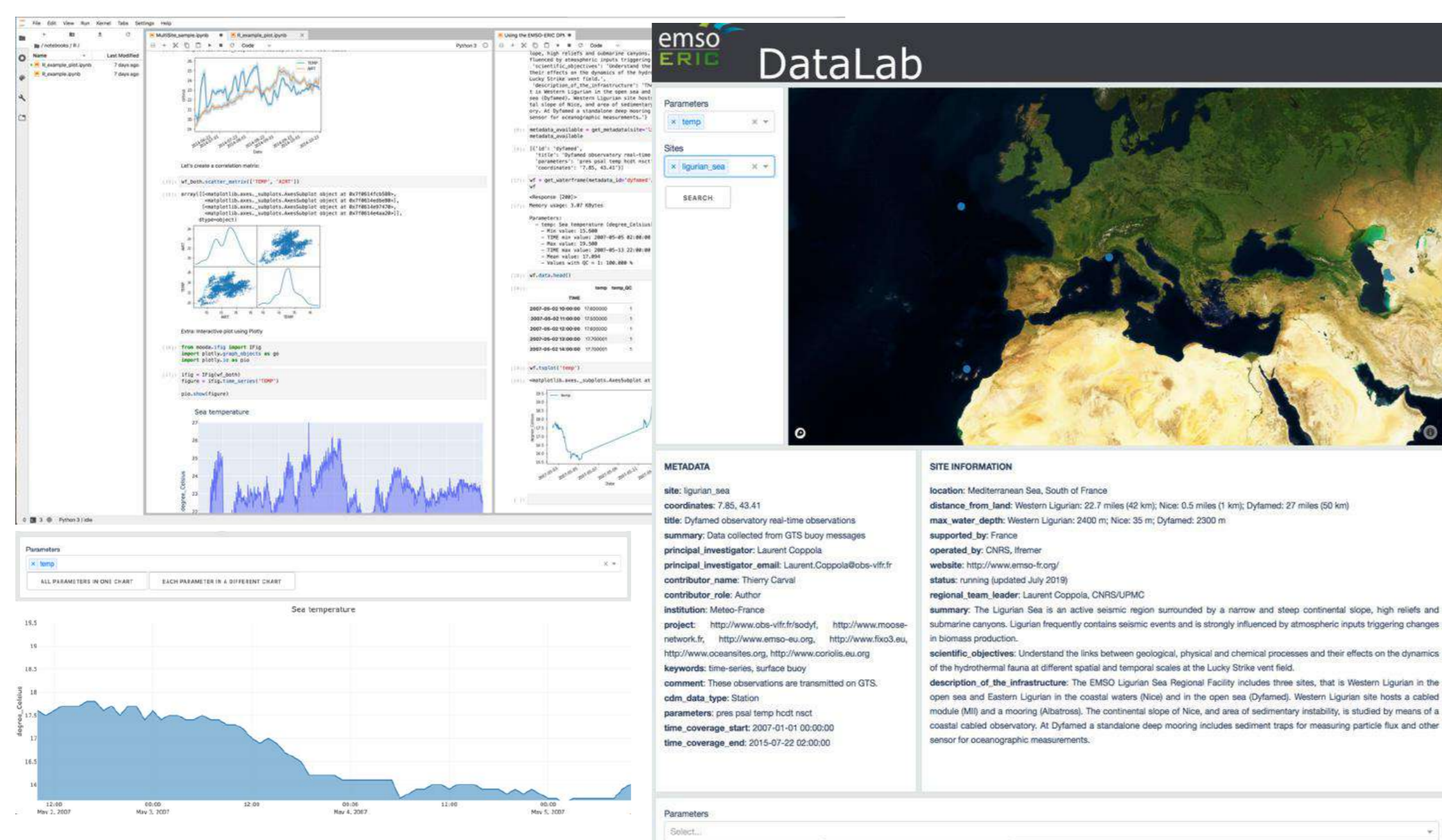
An initial inventory of DEEP SEA data produced within EMSO ERIC

DATA REGIONAL ACCESS & FORMAT: OVERVIEW

Temperature and salinity data files were obtained either on demand or from open regional repositories (SEANOE, BODC, MOIST, HNDC, PLOCAN). In the Azores and PAP cases, online access to high-depth mooring data is not possible yet but in good progress. Regional facilities are encouraged to follow the OceanSITES guidelines (last published reference manual: version 1.3) in regards with data format and Quality Control (QC) flags. The use of NetCDF format, as supported by OceanSITES, allows integrating both data and related metadata in the same file. At some Regional facilities (e.g., PAP, Hellenic Arc, Ligurian), specific metadata bases exist but are not fully linked to the data yet. An effort to link metadata to the corresponding data is foreseen at each of the EMSO regional facilities.

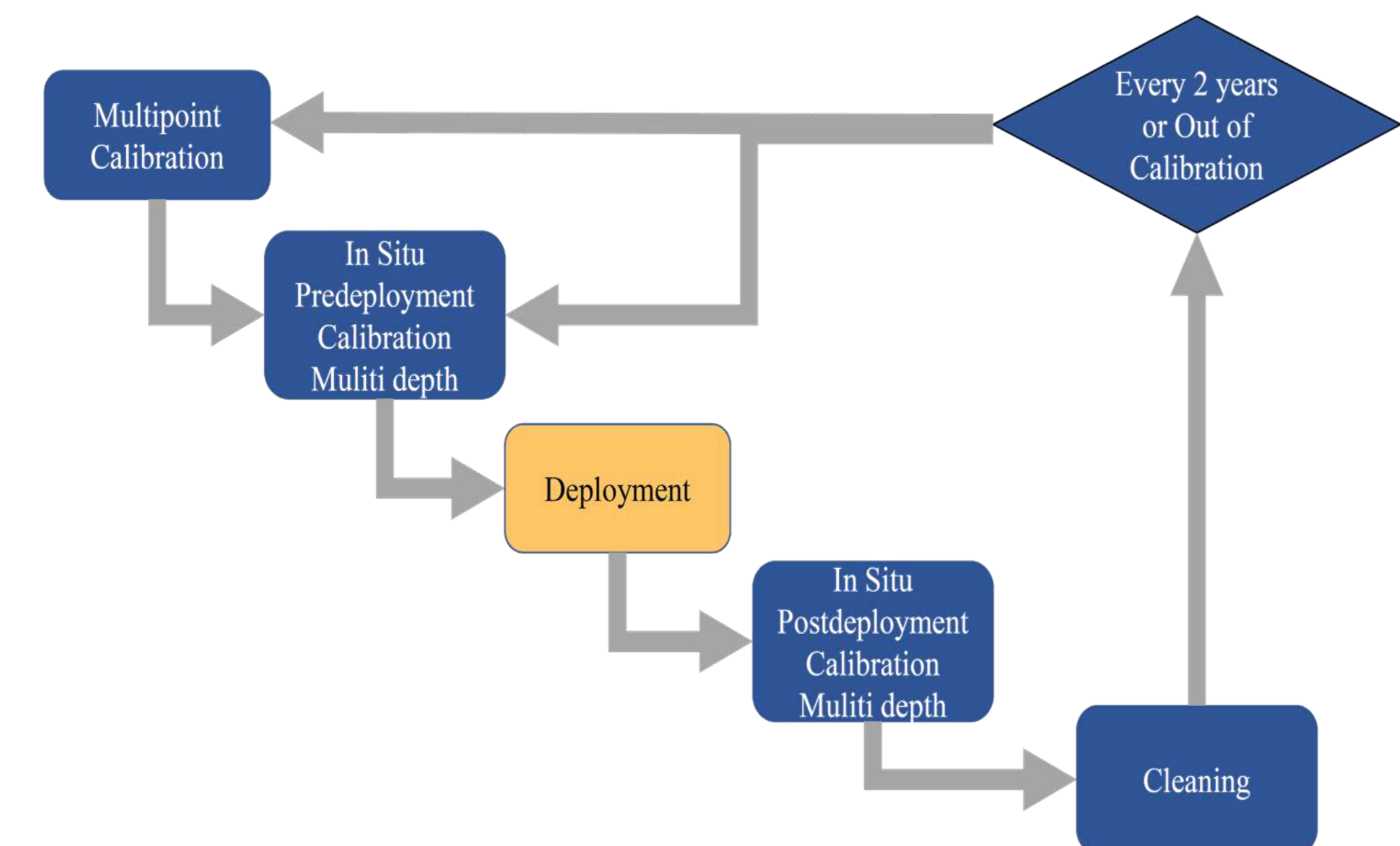
➤ Design new online data access and visualization tools

Making all EMSO data accessible online through a shared database and providing visualisation tools (either as Notebooks or interactive dashboards) facilitates transparency in the information chain that underpins the knowledge derived from these data and can lower the entry bar for those wishing to explore the data collected by the EMSO facilities.



➤ Draft a common protocol for data controlled procedures

EMSO ERIC oceanographer experts have worked on a common protocol for data controlled procedures to adopt and widespread through the all infrastructure. An harmonized multipoint calibration routine before sensor deployment and after sensor recovery is recommended.

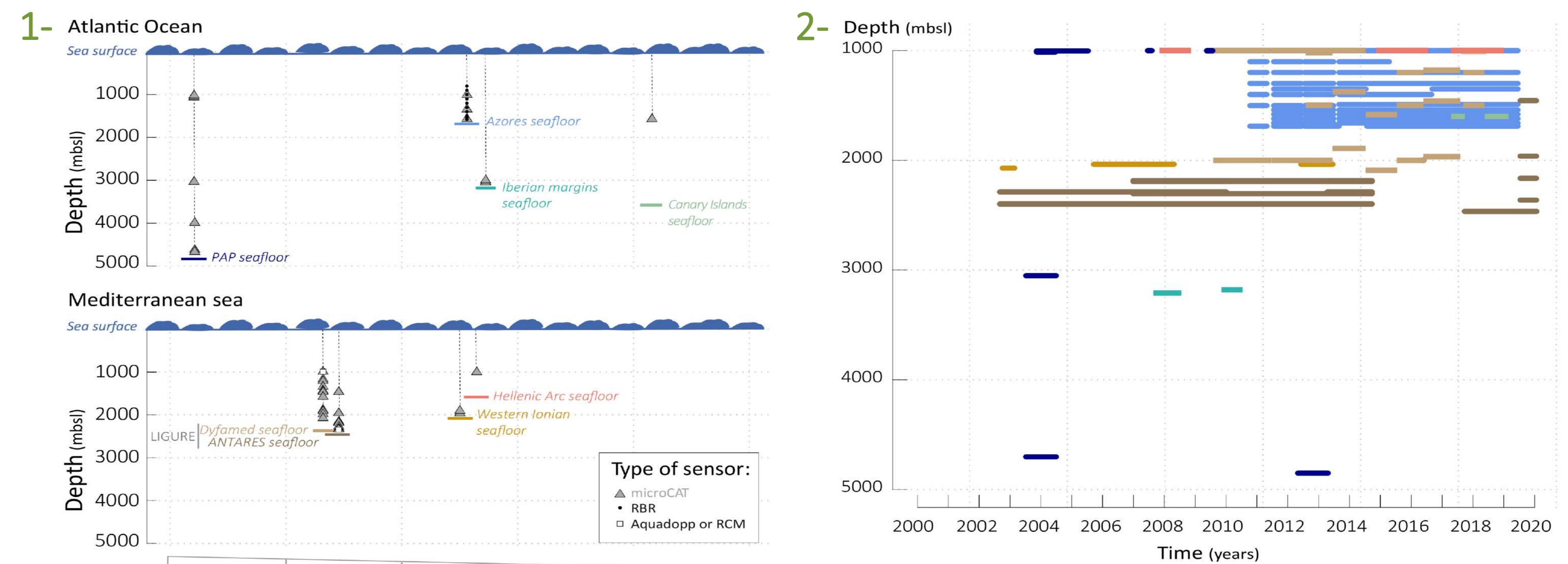


+ Implement Science Service Activity workflow (EMSO-link WP4)

The EMSO ERIC Science Service Group (SSG) has developed workflows to enhance the value of the individual Regional Facilities (RF) by ensuring that data from multiple RFs is provided to stakeholders in a timely and efficient manner in a way that is directly useful. This aims at reducing human intervention where possible (e.g., signal processing, computer vision and machine learning) and translate time-series data into scored metrics and indicators.

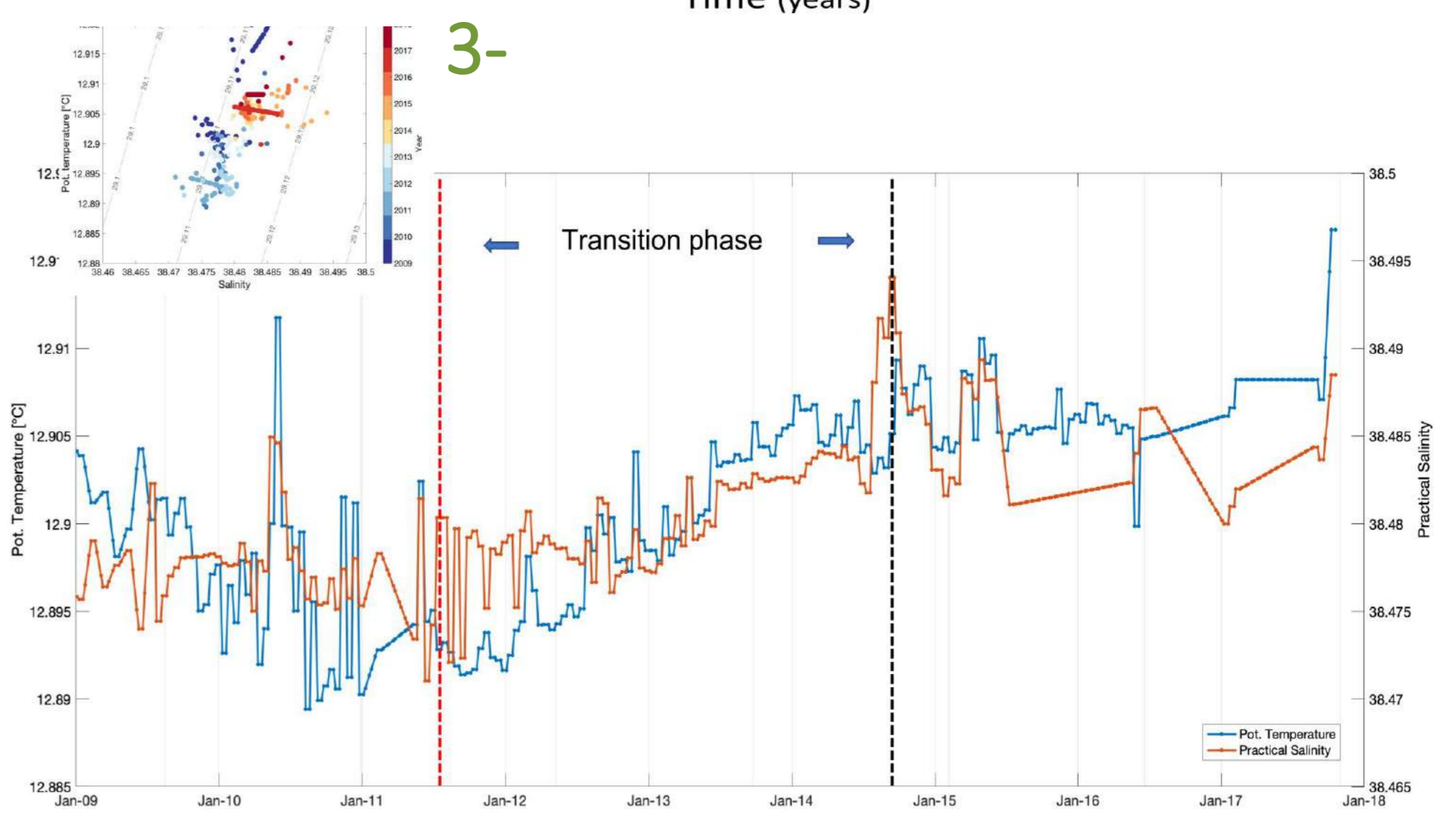
+ Provide material for EMSO Label development initiative (EMSO-link WP2)

The setup of this service is a substantial contribution to the EMSO Label, the provision of temperature and salinity data being chosen as pilot services for Label attribution.



1- Geographic coordinates and bathymetric location of the sensors which have so far provided temperature and salinity time-series within the EMSO network; 2- Time and depth ranges of these time-series. Comments: Temperature and salinity data are being produced at four EMSO nodes in the Atlantic Ocean: Azores, Canary Islands, Iberian, and Porcupine Abyssal Plain (PAP) and three EMSO nodes in the Mediterranean Sea: Hellenic Arc, Ligure, and Western Ionian, by sensors deployed during annual mooring campaigns or part of fixed-point platforms standing on the seafloor. The oldest data recorded date to 2002 (Ligurian Sea). Most data are associated with depths ranging from 1000 to 2500m; a few data were recorded at higher depths up to 4750m (PAP facility). Additional data associated with a pilot site in South Rockall (Northeastern Atlantic) managed by the Smartbay regional facility will soon complete this inventory; they correspond to a mooring deployed since 2018 up to 3000m depth.

3- Potential temperature (°C) and salinity time-series at the EMSO DYFAMED Site (Ligurian Sea) at 2000m for the period 2009-2018. Comments: This time-series displays three phases between 2009-2011, 2011-2015 and 2015-2018. An increase of 0.02 units is observed between 2009-2018 for each of these variables, with a transition phase between 2011-2015 (interpolated data from <https://doi.org/10.17882/43749>).



EMSO COUNTRIES AND INSTITUTIONS

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Ifremer - L'Institut Français de Recherche pour l'Exploitation de la Mer
CNRS - Le Centre National de la Recherche Scientifique
- IRELAND**
MI - Marine Institute
- ITALY**
INGV - Istituto Nazionale di Geofisica e Vulcanologia
- GREECE**
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GeoEcoMar - National Research and Development Institute for Marine Geology and Geoecology
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NOC - National Oceanography Centre