The module for ocean observatory data analysis of EMSO

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Abstract

The European Multidisciplinary Seafloor and water-column Observatory (EMSO) is a large-scale, distributed, Marine Research Infrastructure (RI). EMSO consists of ocean observation systems for long-term, high-resolution, (near) real-time monitoring of environmental processes including natural hazards, climate change, and marine ecosystems. EMSO observatory nodes are at key sites around Europe, from the Arctic to the Atlantic, through the Mediterranean, to the Black Sea. To analyze the EMSO data, we develop the Module for Ocean Observatory Data Analysis (MOODA). MOODA is a software with a Graphical User Interface (GUI) developed for scientists. The software helps to facilitate data access (mainly off-line) for further analysis by the scientific community. Some of the features the MOODA offers are:

1. Direct data access with complex query capabilities;
2. Data filtering methods based on metadata information;
3. Complex visualization tools;
4. Summary reports of the validated data generated from a specific query, including event annotations;
5. Specific data analysis tools for different scientific disciplines;
6. The system will be designed to be open, adaptable and scalable allowing future contributions from researchers and developers from all the disciplines associated to the EMSO observatories.

The code language is Python, and it is available on GitHub. MOODA aims to make informative plots as a central part of exploring and understanding data.

15 EMSO observatory nodes

EMSO observatory nodes have been deployed at key locations in European seas, from the Arctic to the Atlantic, through the Mediterranean to the Black Sea.There are currently eleven deep-sea nodes plus four shallow water test nodes.

EMSO observatory node — EMSO observatory node — EMSO observatory node — EMSO observatory node

Data management Platform (DMP)

Data access

API

EMSO Portal — **MOODA**

Other portals

Data Management Platform

The **Data Management Platform (DMP)** collect and analyze data from all the SOS gateways.
DMP includes a set of services, complaint to the computational viewpoint of the ENViromental Research Infrastructure (ENVRI) Reference Model v2.0, which are:

- Data acquisition;
- Data curation (including data storage and partitioning, data quality checking and cataloging services, import/export utilities, query services);
- Data publishing (query preparation, preparation for import/export of curated data);
- Data processing services (real-time and batch processing computing capabilities);
- Data use (platform authentication and authorization).

What is EMSO?

The **European Multidisciplinary Seafloor and water-column Observatory (EMSO)** is a large scale, distributed, marine **Research Infrastructure (RI)** of fixed-point observatories serving marine science researchers, marine technology engineers, policy makers, and the public. EMSO consists of ocean observation systems for sustained monitoring of environmental processes end their interactions. The variables address natural hazards, climate change, and marine ecosystems. EMSO observatory nodes have been deployed at key sites around Europe, from the Arctic to the Atlantic, through the Mediterranean, to the Black Sea. At present it focusses on the open ocean beyond the continental shelf but strongly collaborates and complements shallow-water initiatives.

www.emso-eu.org

www.emso-eu.org/site

What is EMSODEV?

The **EMSODEV's (EMSO implementation and operation: DEVelopment of instrument module)** general objective is to catalyse the full implementation and operation of the EMSO distributed Research Infrastructure (RI), through the **development, testing and deployment** of an **EMSO Generic Instrument Module (EGIM)**. This module will ensure accurate, consistent, comparable, regional scale, long-term measurements of ocean parameters, which are key to addressing urgent societal and scientific challenges such as climate change, ocean ecosystem disturbance, and marine hazards. This will result in the increased interoperability of EMSO nodes thanks to the harmonized collection of ocean essential variable time series. In addition, EGIM will also greatly help optimize the investments and operational efficiency of the EMSO research infrastructure thus improving RI effectiveness and its attractiveness for member states and users, including for industry.

www.emsodev.eu/
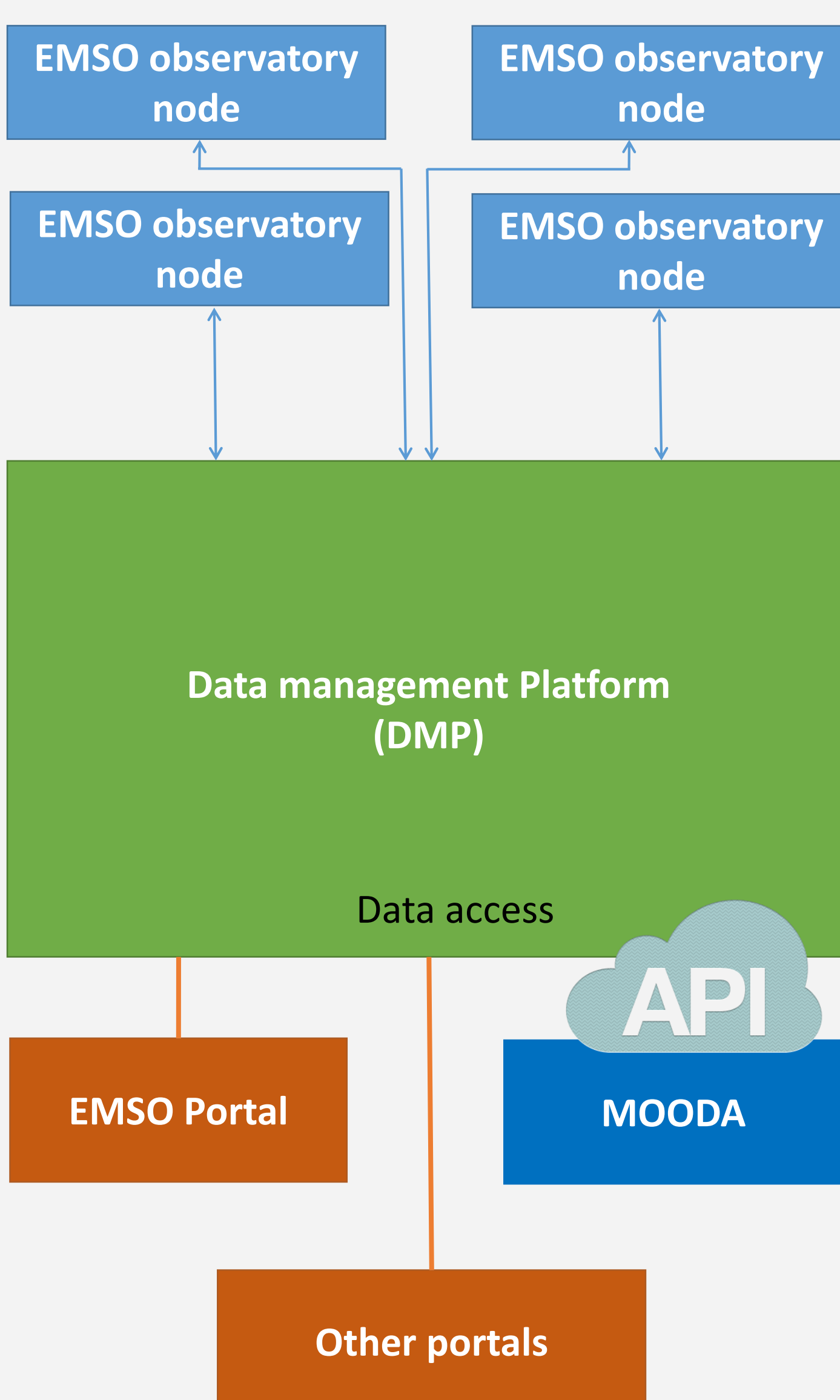
The EGIM

Generic Instrument Module (EGIM) utilize a comprehensive **set of sensors** and devices that meet particular technology readiness thresholds to collect observations including **temperature**, **pressure**, **salinity**, **dissolved oxygen**, **turbidity**, **chlorophyll fluorescence**, **currents**, **passive acoustics**, **pH**, **pCO2**, and **nutrients**.

Sensor Observation Service (SOS)

The **Sensor Observation Service (SOS)** gateway is a standard-compliant generic software to register the sensors connected to the EGIM and to **acquire data through the sensors**. The software is **OGC Sensor Web Enable standard**, which means that the **sensors of the EGIM are discoverable, accessible and useable via the Web**.

The EMSO observatory node

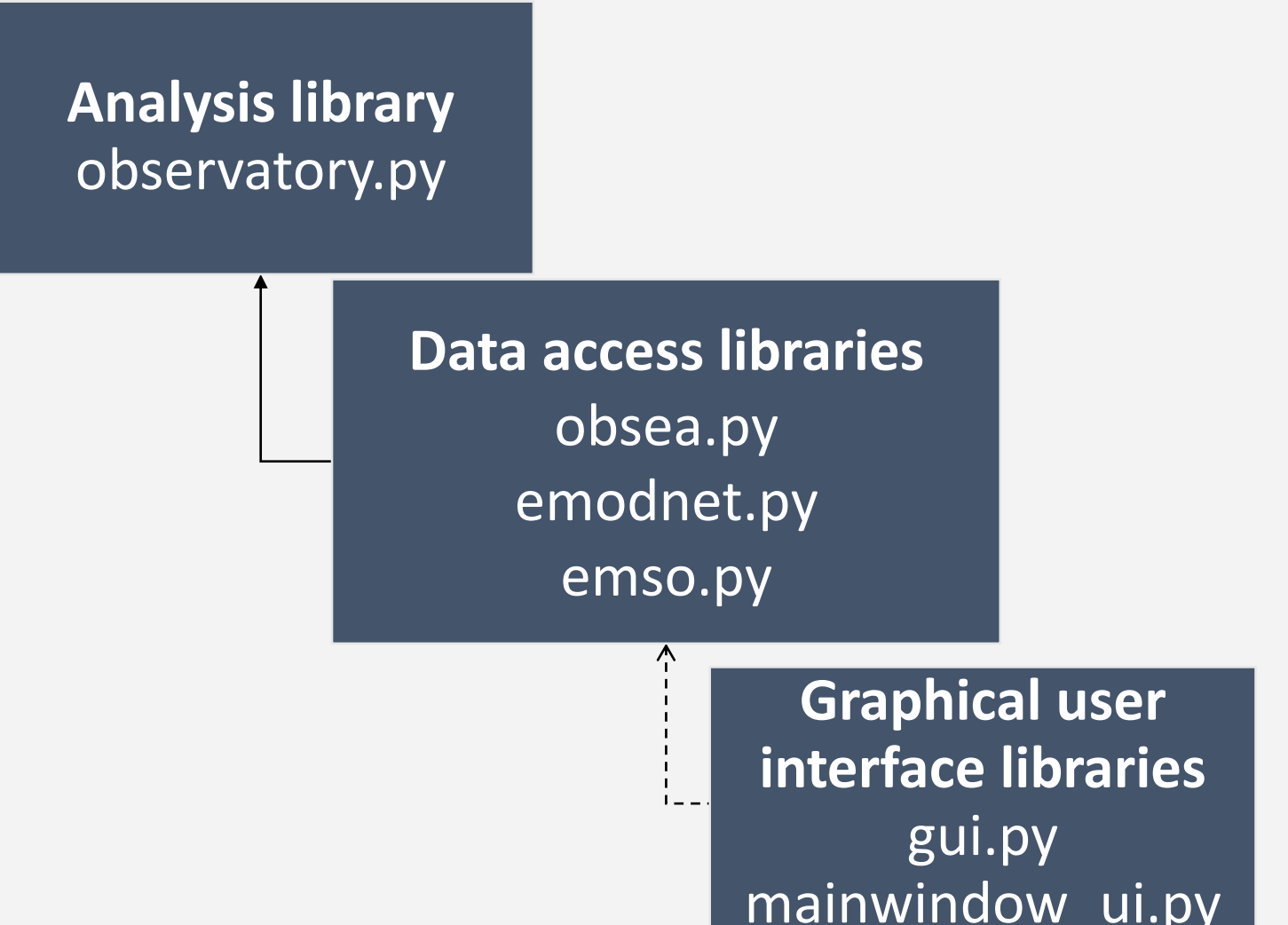The EGIM

Acquisition system and SOS Gateway

To DMP
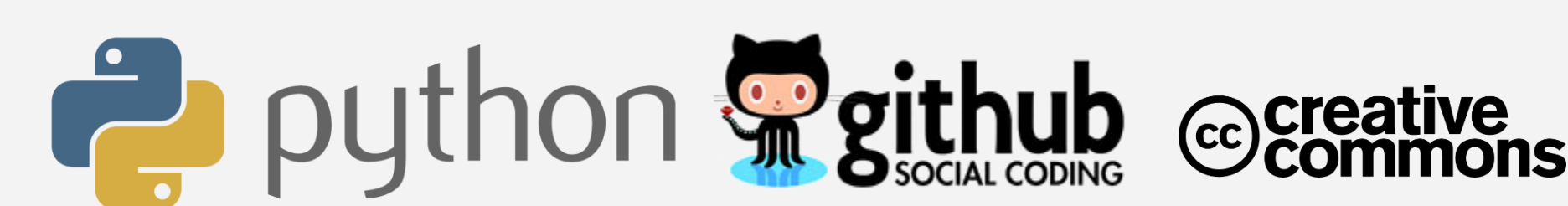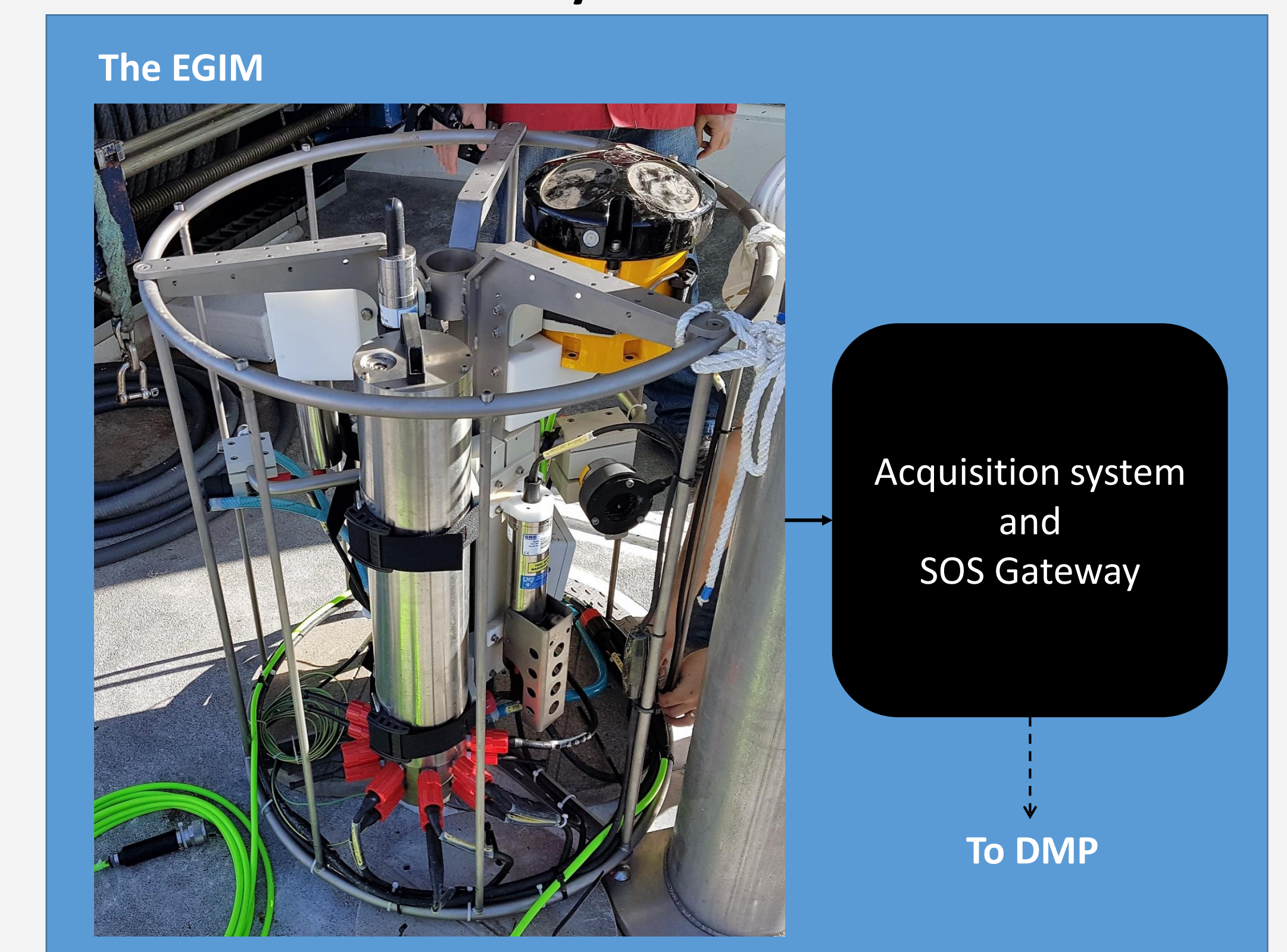
The Module for Ocean Observatory Data Analysis (MOODA) and the oceanobs Python library

oceanobs is a **Python package** for **analyzing data from marine observatories**. This work is performed in the framework of the **EMSOdev**. The package **accepts data coming from** international Ocean Observatories, such as **OBSEA**, **EMODnet**, **JERICO** and **EMSO**. **oceanobs** consist of a **set of libraries**. Libraries are classified into tree types:

- **Analysis libraries**: Libraries that contains a set of functions and classes for processing and analyzing data.
- **Data access libraries**: Libraries that contains a set subclasses for reading data from a particular marine observatory. The subclasses inherit from classes from analysis libraries, and their functions consist of translating the particular observatory data to the standard oceanobs data frame to be analyzed easily.
- **Graphical User Interface (GUI) libraries**: Libraries that contains a set of classes and functions to create and use a GUI called **MOODA**. **MOODA helps you to open and analyze data**, but you can do everything also with Python code.
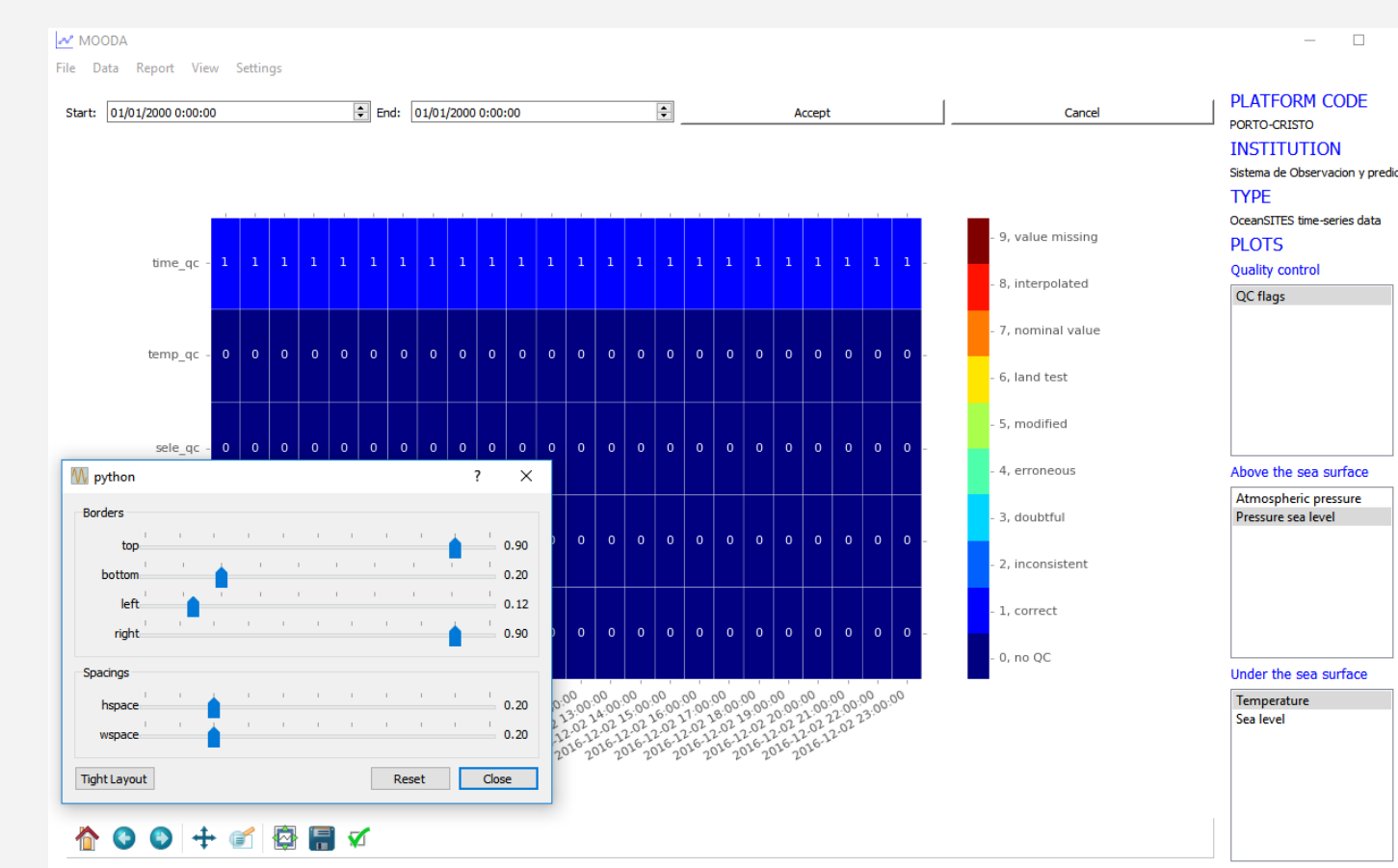
- **Easy to install,** with PIP:
  $ *pip install oceanobs*
- **Download**, **open** and **analyze data easily**, with few lines of **code** or with the **MOODA**.
- - The code includes algorithms to **generate** the **SeaDataNet** standard **Quality Control flags** for the data**.

Analysis library
observatory.py

Data access libraries
obsea.py
emodnet.py
emso.py

Graphical user interface libraries
gui.py
mainwindow_ui.py

Source code available in GitHub: https://github.com/EMSODEV/oceanobs

More information and **code examples** in Read *the* Docs: http://oceanobs.readthedocs.io/

ASLO — Association for the Sciences of Limnology and Oceanography

ICM Institut de Ciències del Mar

UTM UNIDAD DE TECNOLOGÍA MARINA