

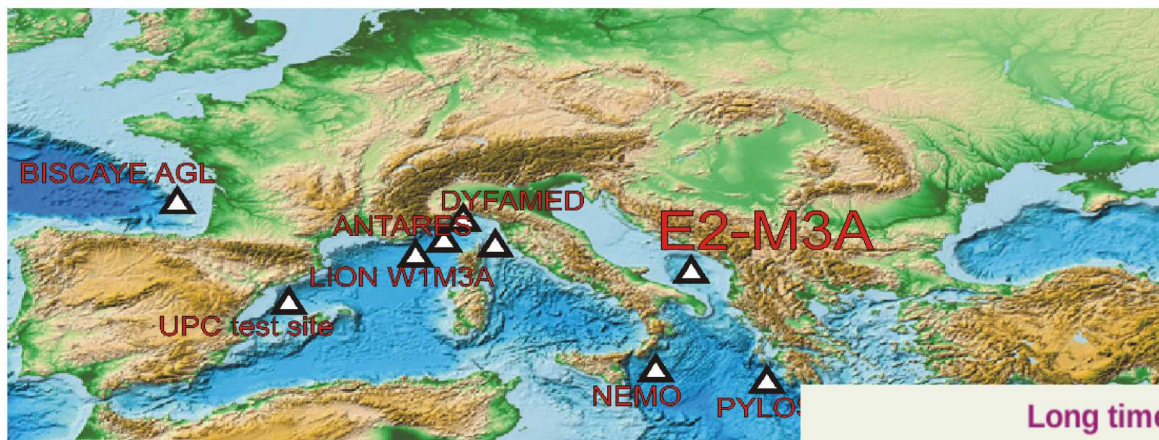
# Presentation of pilot with SWE for observation platforms in the Adriatic Sea

E. Partescano, A. Brosich and A. Giorgetti



# Device and Data

## E2-M3A

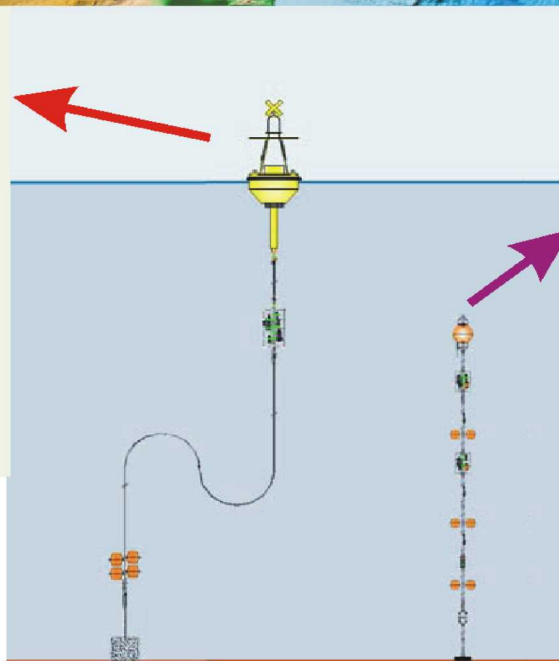


### Real time (surface data)

Oceanographic parameters	Depth	Sampling interval
Temperature and Salinity	15 m	1 h
pH	15 m	12 h
pCO2	15 m	12 h
Meteorological parameters		
Atmosferic Pressure	3.5 m asl	30 min
Wind speed and direction	4.0 m asl	30 min
Air temperature	3.5 m asl	30 min
Relative humidity	3.5 m asl	30 min
Solar radiation	2.0 m asl	30 min

### Long time series

Oceanographic parameters	Depth	Sampling interval
Temperature and Salinity	565, 1000, 1170 m	1 h
Temperature and Salinity	365, 765 m	3 h
Pressure	365, 565, 765, 1000 m	3 h
Turbidity	1204 m	1 h
Dissolved Oxygen	365, 765 m	3 h
Transmittance	365, 765 m	3 h
Currents (profiling)	150-300 m	1 h
Current	1180 m	1 h



<http://nettuno.ogs.trieste.it/e2-m3a>

# Device and Data

## E2-M3A

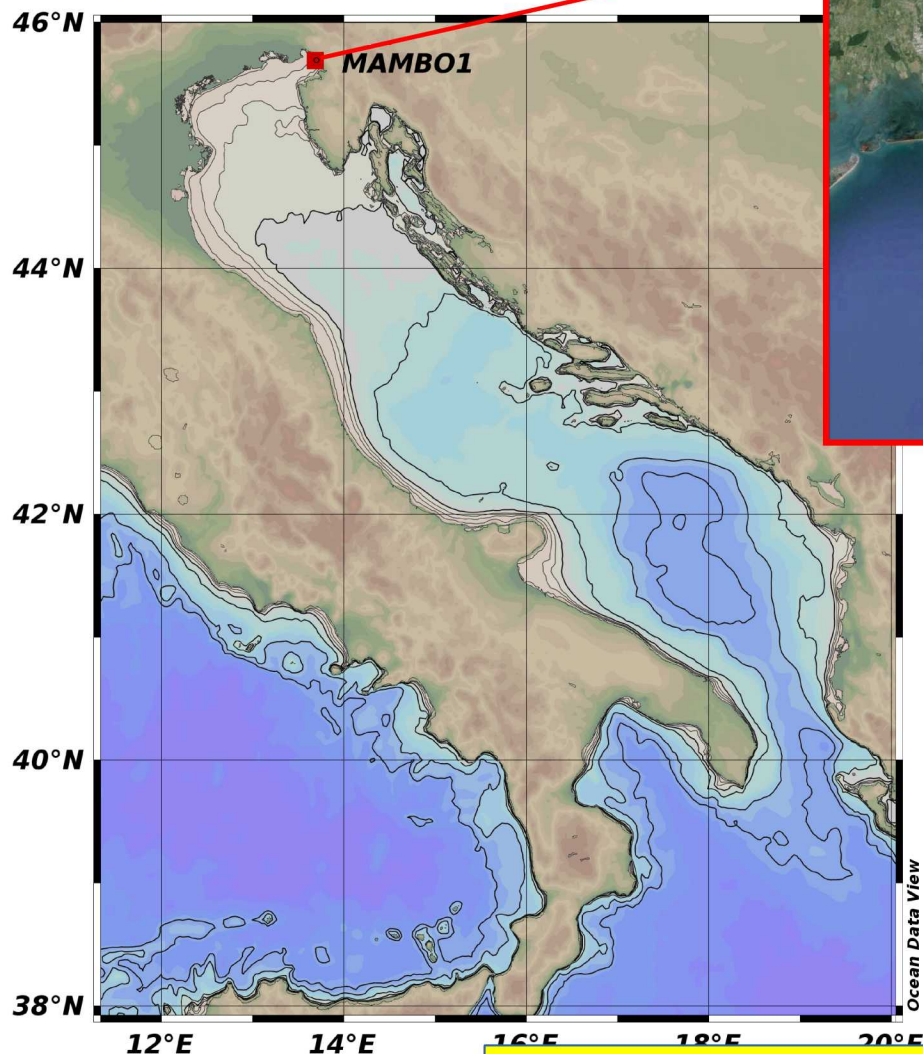


Oceanographic parameters	Depth	Sensor
Temperature and salinity	2 m	Seabird SBE37-SM
pHT	2 m	Sunburst SAMI pH
pCO2	2 m	Pro Oceanus CO2-Pro
pressure	2 m	Seabird SBE37-ODO
O2	2 m	Seabird SBE37-ODO
Temperature and salinity	15 m	Seabird SBE37-SM
Meteorological parameters	Depth	Sensor
Atmospheric pressure	3.5 m asl	Young 61202
Wind speed and direction	4 m asl	Young 04106
Air temperature	3.5 m asl	Young 41372
Relative humidity	3.5 m asl	Young 41372
Solar radiation	2 m asl	Eppley PSP
IR radiation	2 m asl	Eppley PSP



# Device and Data

## MAMBO1



**Meteo-oceanographic coastal buoy named “MAMBO1” (Monitoraggio AMBIentale Operativo) is located in the Gulf of Trieste (northern Adriatic Sea)**



<http://nettuno.ogs.trieste.it/mambo>

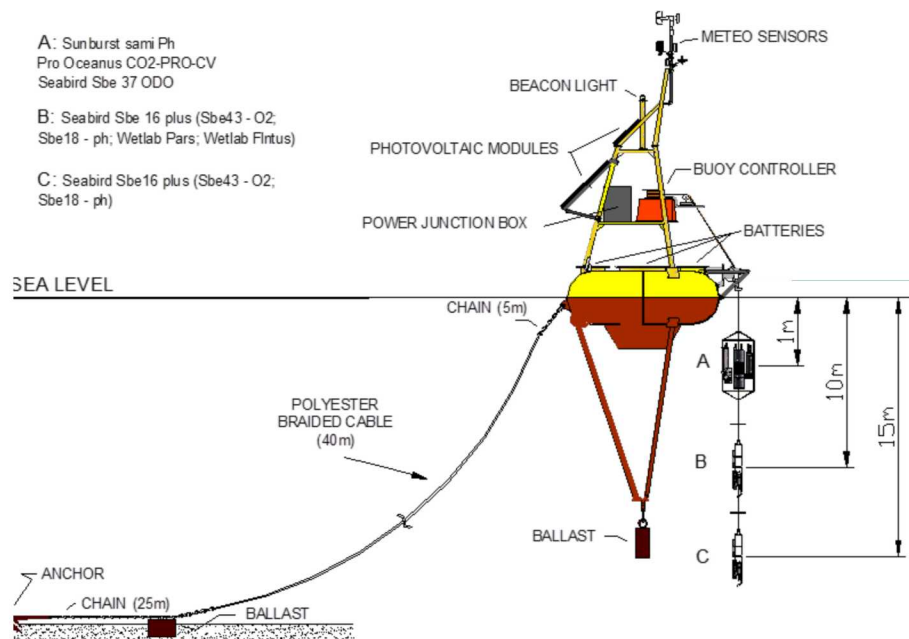
# Device and Data

# MAMBO1



Oceanographic parameters	Sensor	Depth
Atmospheric pressure	Young mod. 61201	sup
Air temperature	Young mod. 41372VC	sup
Wind speed and direction	Young Wind Monitor	sup
Relative humidity	Young mod. 41372VC	sup
Temperature and salinity	Seabird SBE37-SM	1 m
pH	Sunburst SAMI pH Pro	1 m
pCO2	Pro Oceanus CO2 Pro	1 m
O2	Seabird SBE37-ODO	1 m
Temperature and salinity	Sea Bird16	10 m
O2	Sea Bird SBE43	10 m
pH	Sea Bird SBE18	10 m
Fluorescence	Wetlab Eco-AFL/FL	10 m
Turbidity	Wetlab Eco-NTU	10 m
Solar radiation	Wetlab Eco-PAR	10 m
Temperature and salinity	Sea Bird16	15 m
pH	Sea Bird16	15 m
O2	Sea Bird16	15 m

- A: Sunburst sami Ph  
Pro Oceanus CO2-PRO-CV  
Seabird Sbe 37 ODO
- B: Seabird Sbe 16 plus (Sbe43 - O2,  
Sbe18 - ph; Wetlab Pars; Wetlab Flintus)
- C: Seabird Sbe16 plus (Sbe43 - O2,  
Sbe18 - ph)

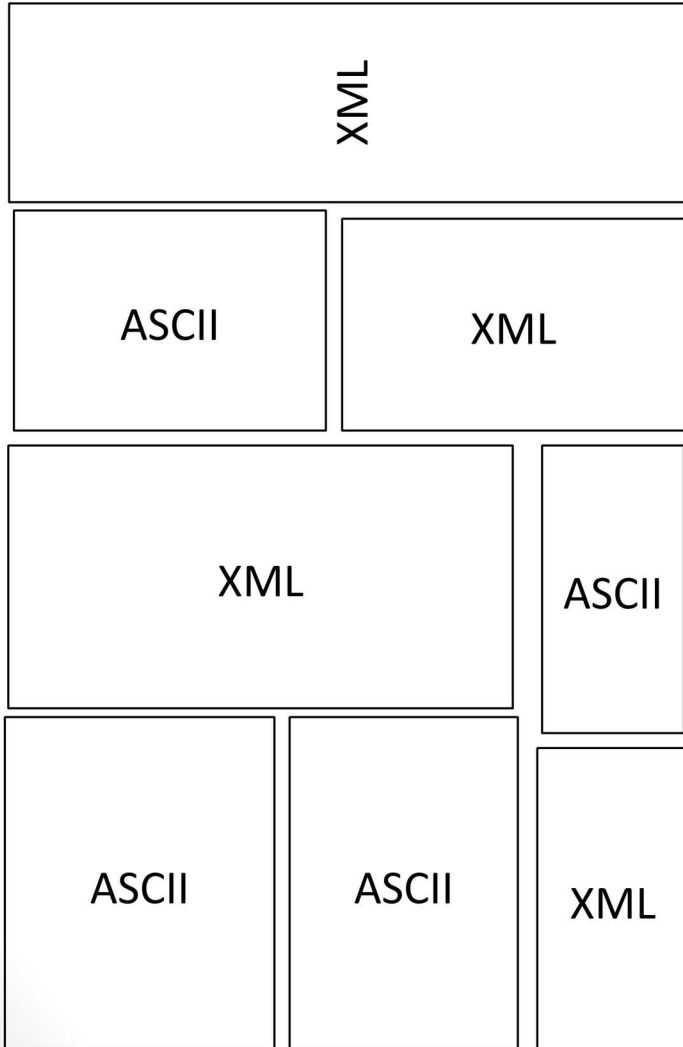


## Complexity of information:

- data are acquired using different instruments
- different matrices
- acquired with different tools and methodologies
- at different spatial and temporal resolution
- specific procedures are developed to manage and distribute real-time data

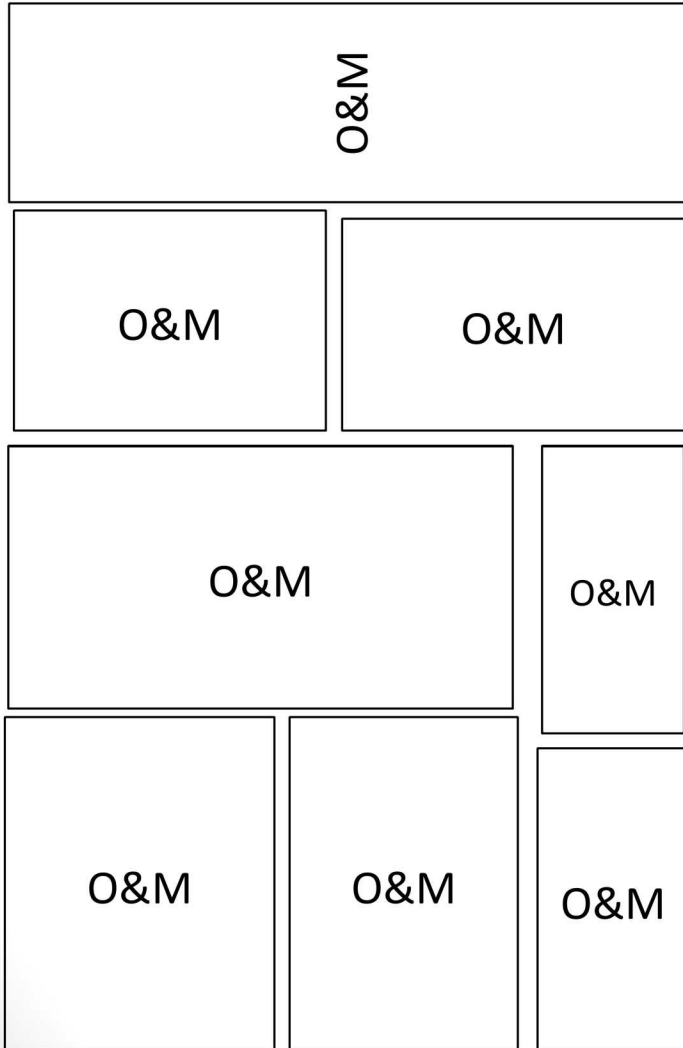


## Complexity of information:



**Transform heterogeneous data formats before to store them in the database, coming from different kind of instruments, with different formats (ASCII, XML, ...).**

# Type of data The future (O&M XML Format)



**Standardized format using standardized operations.**



# Sensor Web Enablement (SWE)

Sensor Registry

Get Capabilities

GetFeatureOfInterse

Capabilities

DescribeSensor

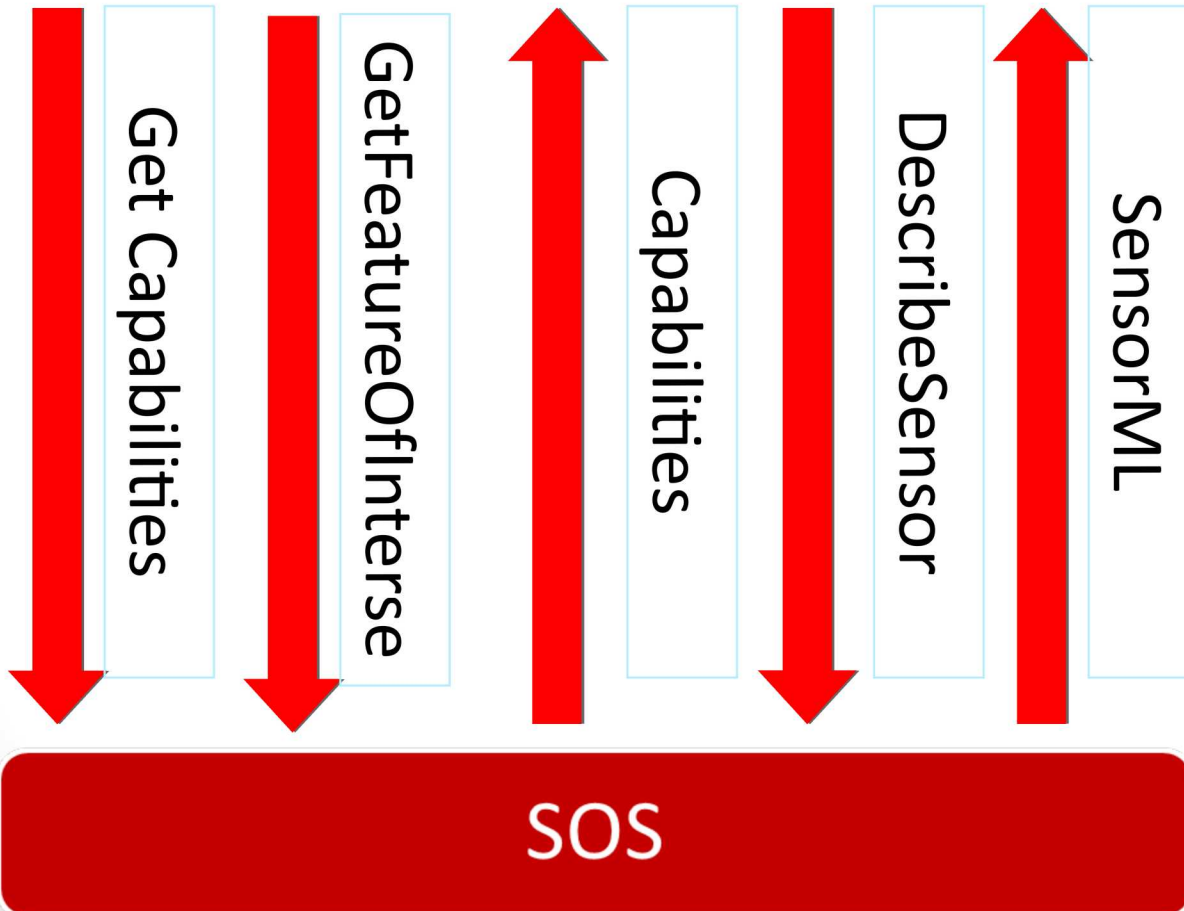
SensorML

SOS

The OGC's Sensor Web Enablement (SWE) standards enable developers to make all types of sensors discoverable, accessible and useable via the Web.

# Sensor Web Enablement (SWE)

## Sensor Registry



The Sensor Observation Service (SOS) is a **web service** that allows querying observations and sensor metadata.

The information are stored in a **PostgreSQL/PostGIS database** and they can be obtained by standard requests.

# Real – Time Oceanographic Data Management System



LOADING DATA (RT-LOADER)



REST - Request



SOS Client



WEB CLIENT



DATA VALIDATION

WEB SERVICE

DATA DISTRIBUTION  
(NetCDF)

RT-WEB



# Sensor Web Enablement (SWE): **HOW**

## 1. InsertSensor → SOS Client (52° North)

Home Client Documentation Admin

### 52° North SOS Test Client

Choose a request from the examples or write your own to test the SOS.

**Examples**

**NOTE:** Requests use example values and are not dynamically generated from values in this SOS. Construct valid requests by changing request values to match values in the Capabilities response.

**NOTE:** For security reasons, the transactional SOS operations are disabled by default and the *Transactional Security* is activated by default with allowed IPs *127.0.0.1*. The transactional operations can be activated in the [Operations settings](#) and the *Transactional Security* can be deactivated in the [Transactional Security](#) tab of the settings.

SOS: [dropdown] 2.0.0: [dropdown] POX: [dropdown] InsertSensor: [dropdown]

Load a example request ... [dropdown]

**Service URL**

http://nodc.ogs.trieste.i

**Request**

POST [dropdown] application/xml [text box] application/xml [text box] Permalink Syntax [dropdown]

```
1 <?xml version="1.0" encoding="UTF-8"?>
2 <swes:InsertSensor service="SOS" version="2.0.0"
3   xmlns:swes="http://www.opengis.net/swes/2.0"
4   xmlns:sos="http://www.opengis.net/sos/2.0"
5   xmlns:swe="http://www.opengis.net/swe/2.0"
6   xmlns:smj="http://www.opengis.net/sensorml/2.0"
7   xmlns:gml="http://www.opengis.net/gml/3.2"
8   xmlns: xsi="http://www.w3.org/1999/xlink"
9   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
10  xmlns:gco="http://www.isotc211.org/2005/gco"
11  xmlns:gmd="http://www.isotc211.org/2005/gmd" xsi:schemaLocation="http://www.opengis.net/sos/2.0 http://schemas.opengis.net/sos/2.0/sosInsertSensor.xsd http://www.opengis.net/swes/2.0 http://schemas.opengis.net/swes/2.0/swes.xsd">
12 /swes:procedureDescriptionFormat=http://www.opengis.net/sensorml/2.0/swes:procedureDescriptionFormat"
13 <swes:procedureDescription>
14 <swes:procedureDescription>
15 <swes:PhysicalSystem gml:id="sensor9">
16 <-!-unique identifier -!->
17 <gml:identifier codeSpace="uniqueID">http://www.52north.org/test/procedure/9</gml:identifier>
18 <swes:identification>
19 <swes:identification>
20 <swes:Term definition="urn:ogc:def:identifier:OGC:1.0:longName">
21 <swes:label>longName</swes:label>
22 <swes:label>longName</swes:label>
23 <swes:label>shortName</swes:label>
24 <swes:label>shortName</swes:label>
25 <swes:label>shortName</swes:label>
26 <swes:label>shortName</swes:label>
27 <swes:label>shortName</swes:label>
28 <swes:label>shortName</swes:label>
29 <swes:label>shortName</swes:label>
30 <swes:label>shortName</swes:label>
31 </swes:label>
```

*“The OGC Sensor Observation Service aggregates readings from live, in-situ and remote sensors. The service provides an interface to make sensors and sensor data archives accessible via an interoperable web based interface.”*

# Sensor Web Enablement (SWE): **HOW**

## SensorML

### 1. InsertSensor → SOS Client (52° North)

```
<!-- ===== -->
<!-- Created By: Elena Partescano NODC-OGS Trieste - 2015-03-25T18:00:00Z -->
<!-- ===== -->

<!-- ===== -->
<!-- System Search Keywords -->
<!-- ===== -->
<sml:keywords>
  <sml:KeywordList definition="http://vocab.nerc.ac.uk/collection/P03/current/D020">
    <sml:keyword>Other physical oceanographic measurements</sml:keyword>
  </sml:KeywordList>
</sml:keywords>
<!-- ===== -->
<!-- System Identifiers -->
<!-- ===== -->
<sml:identification>
  <sml:IdentifierList>
    <sml:identifier>
      <sml:Term definition="urn:ogc:def:identifier:OGS:uniqueID">
        <sml:label></sml:label>
        <sml:value>urn:ogc:object:feature:Sensor:OGS:CT_10597_E2M3A</sml:value>
      </sml:Term>
    </sml:identifier>
    <sml:identifier>
      <sml:Term definition="description">
        <sml:label>description</sml:label>
        <sml:value>The SBE 37-SMP-ODO MicroCAT is a high-accuracy conductivity and temperature (pressure optional) recorder with Serial interface, internal batteries, Memory, integral Pump, and Optical Dissolved Oxygen sensor. Constructed of titanium and other non-corroding materials for long life with minimal maintenance, the MicroCAT is designed for moorings or other long duration, fixed-site deployments. Calibration coefficients are stored in EEPROM, allowing output of C, T, P, DO, and time in ASCII engineering units (decimal or XML; raw output available); salinity, sound velocity, and specific conductivity can also be output.
      </sml:value>
      </sml:Term>
    </sml:identifier>
    <sml:identifier>
      <sml:Term definition="http://vocab.nerc.ac.uk/collection/L22/current/TOOL0018">
        <sml:label>Short_Name</sml:label>
        <sml:value>SBE 37-SMP MicroCAT</sml:value>
      </sml:Term>
    </sml:identifier>
    <sml:identifier>
      <sml:Term definition="http://vocab.nerc.ac.uk/collection/L22/current/TOOL0018">
        <sml:label>Long_Name</sml:label>
        <sml:value>Sea-Bird SBE 37-SMP MicroCAT C-T Sensor</sml:value>
      </sml:Term>
    </sml:identifier>
  </sml:IdentifierList>

```

Sensor Model Language (SensorML) is a OGC's XML standard models used to describe sensors and measurement processes.

# SWE: metadata -> SensorML

```
<sml:Term definition="http://geossregistries.info/geosspub/resource_details_ns.jsp?compId=urn:geoss
  <sml:label>GEOSS_Resource_Details</sml:label>
  <sml:value>urn:geoss:csr:resource:urn:uuid:bc49af8b-573d-ea9a-ce8c-525be30a680a</sml:value>
</sml:Term>
</sml:identifier>
</sml:IdentifierList>
</sml:identification>
<!-- =====>
<!-- System Classifiers -->
<!-- =====>
<sml:classification>
<sml:ClassifierList>
  <sml:classifier>
    <sml:Term definition="http://vocab.nerc.ac.uk/collection/P02/current/TEMP">
      <sml:label>Intended Application1</sml:label>
      <sml:value>Temperature of the water column</sml:value>
    </sml:Term>
  </sml:classifier>
  <sml:classifier>
    <sml:Term definition="http://vocab.nerc.ac.uk/collection/P02/current/PSAL">
      <sml:label>Intended Application2</sml:label>
      <sml:value>Salinity of the water column</sml:value>
    </sml:Term>
  </sml:classifier>
  <sml:classifier>
    <sml:Term definition="http://vocab.nerc.ac.uk/collection/P02/current/AHGT">
      <sml:label>Intended Application3</sml:label>
      <sml:value>Vertical spatial coordinates</sml:value>
    </sml:Term>
  </sml:classifier>
  <sml:classifier>
    <sml:Term definition="http://vocab.nerc.ac.uk/collection/P02/current/DOXY">
      <sml:label>Intended Application4</sml:label>
      <sml:value>Dissolved oxygen parameters in the water column</sml:value>
    </sml:Term>
  </sml:classifier>
  <sml:classifier>
    <sml:Term definition="http://vocab.nerc.ac.uk/collection/L05/current/130">
      <sml:label>Sensor Type</sml:label>
      <sml:value>CTD</sml:value>
    </sml:Term>
  </sml:classifier>
  <sml:classifier>
    <sml:Term definition="http://vocab.nerc.ac.uk/collection/L19/current/SDNKG01">
      <sml:label>Deployment Role</sml:label>
      <sml:value>instrument</sml:value>
    </sml:Term>
  </sml:classifier>
</sml:ClassifierList>
</sml:classification>
```

## SensorML

- WHAT
- WHERE
- WHEN
- HOW
- WHO

*We developed a SensorML and O&M profiles using BODC vocabs: P01, P02, P03, P06, L05, L19, L22, L23 and connection to EDIOS catalog.*

# SWE: metadata -> Observations and Measurements (O&M)

## 2. InsertObservations → REST – POST - request

```
</swe:Boolean>
</swes:extension>
<!-- multiple offerings are possible -->
<sos:offering>CT_E2M3A</sos:offering>
▼<sos:observation>
  ▼<om:OM_Observation gml:id="01">
    <om:type xlink:href="http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_SWEArrayObservation"/>
    ▼<om:phenomenonTime>
      ▼<gml:TimePeriod gml:id="phenomenonTime">
        <gml:beginPosition>2015-02-13T13:35:14Z</gml:beginPosition>
        <gml:endPosition>2015-07-29T07:58:08Z</gml:endPosition>
        </gml:TimePeriod>
      </om:phenomenonTime>
    ▼<om:resultTime>
      ▼<gml:TimeInstant gml:id="resultTime">
        <gml:timePosition>2015-08-06T14:40:13Z</gml:timePosition>
        </gml:TimeInstant>
      </om:resultTime>
    <om:procedure xlink:href="urn:ogc:object:feature:Sensor:OGS:CT_10597_E2M3A"/>
    <om:observedProperty xlink:href="http://vocab.nerc.ac.uk/collection/P01/current/DOXYZZXX"/>
    ▼<om:featureOfInterest>
      ▼<sams:SF_SpatialSamplingFeature gml:id="ssf_E2M3A">
        <gml:identifier codeSpace="">E2M3A</gml:identifier>
        <gml:name>E2M3A</gml:name>
        <sf:type xlink:href="http://www.opengis.net/def/samplingFeatureType/OGC-OM/2.0/SF_SamplingPoint"/>
        <sf:sampledFeature xlink:href="E2M3A_1"/>
        ▼<sams:shape>
          ▼<gml:Point gml:id="E2M3A">
            <gml:pos srsName="http://www.opengis.net/def/crs/EPSG/0/4326">41.5225 18.0895</gml:pos>
            </gml:Point>
          </sams:shape>
        </sams:SF_SpatialSamplingFeature>
      </om:featureOfInterest>
    ▼<om:result xsi:type="swe:DataArrayPropertyType">
      ▼<swe:DataArray>
        ▼<swe:elementCount>
          ▼<swe:Count>
            <swe:value>2828</swe:value>
          </swe:Count>
        </swe:elementCount>
        ▼<swe:elementType name="defs">
          ▼<swe:DataRecord>
            ▼<swe:field name="phenomenonTime">
              ▼<swe:Time definition="http://www.opengis.net/def/property/OGC/0/PhenomenonTime">
                <swe:uom xlink:href="http://www.opengis.net/def/uom/ISO-8601/0/Gregorian"/>
                </swe:Time>
              </swe:field>
            ▼<swe:field name="observable_property_oxy_E2M3A">
              ▼<swe:Quantity definition="http://vocab.nerc.ac.uk/collection/P01/current/DOXYZZXX">
                <swe:uom xlink:href="http://vocab.nerc.ac.uk/collection/P06/current/UMLL" code="mL/l"/>
                </swe:Quantity>
              </swe:field>
            </swe:DataRecord>
          </swe:elementType>
        </swe:encoding>
        <swe:TextEncoding tokenSeparator="#" blockSeparator="@"/>
      </swe:encoding>
    </om:result values>
    2015-02-13T13:35:14Z#5.26@2015-02-13T14:35:15Z#5.2@2015-02-13T15:35:14Z#5.15@2015-02-13T16:35:14Z#5.18@2015-02-13T17:35:
```

O&M

This standard defines XML schemas for observations. These provide document models for the exchange of information describing observation between different scientific and technical communities

# Sensor Web Enablement (SWE): **HOW**

## 3. Data Visualization → Web Client (52° north)

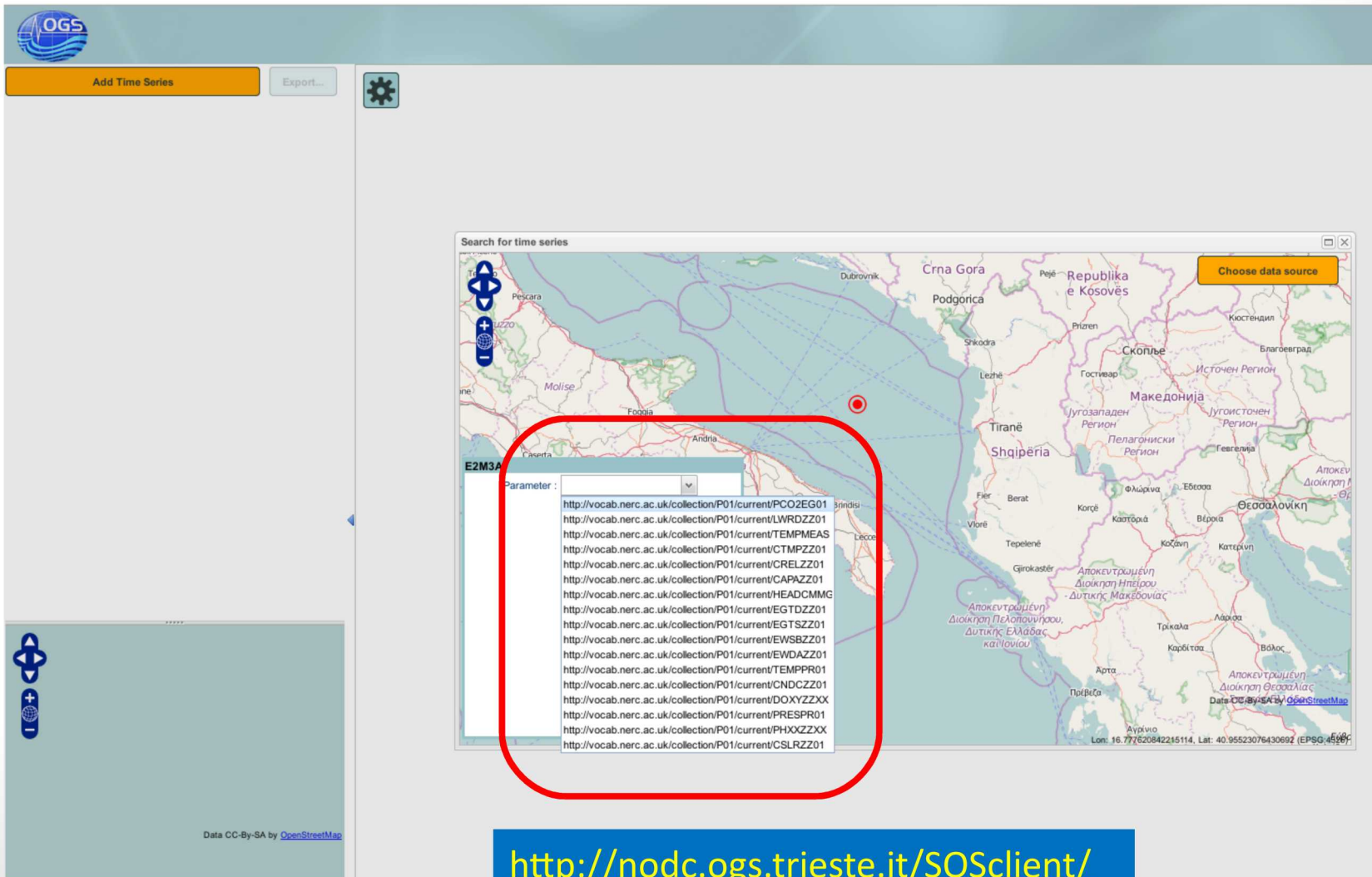
The screenshot displays the SWE Web Client interface. At the top left, there is a logo for OGS (Operational Geospatial Services). Below the logo, there is a navigation bar with a yellow 'Add Time Series' button and a grey 'Export...' button. A gear icon for settings is located to the right of the 'Export...' button. The main area of the interface is a map showing the Balkans and Southern Europe. A search bar at the top of the map area contains the text 'Search for time series'. A yellow 'Choose data source' button is located in the top right corner of the map area. The map shows various countries and regions, including Albania, Greece, and parts of Italy and the Balkans. The map is overlaid with a grid of latitude and longitude lines. At the bottom left of the map area, there is a small inset map showing the location of the main map area within the context of the Mediterranean region. At the bottom right of the map area, there is a small text box containing the text 'Data CC-BY-SA by OpenStreetMap'.

<http://nodc.ogs.trieste.it/SOSclient/>



# Sensor Web Enablement (SWE): **HOW**

## 3. Data Visualization → Web Client (52° north)



The screenshot shows a web client interface for data visualization. The interface includes a search bar, a map of the Balkans region, and a list of data sources. A red circle highlights a specific data source in the list.

Search for time series

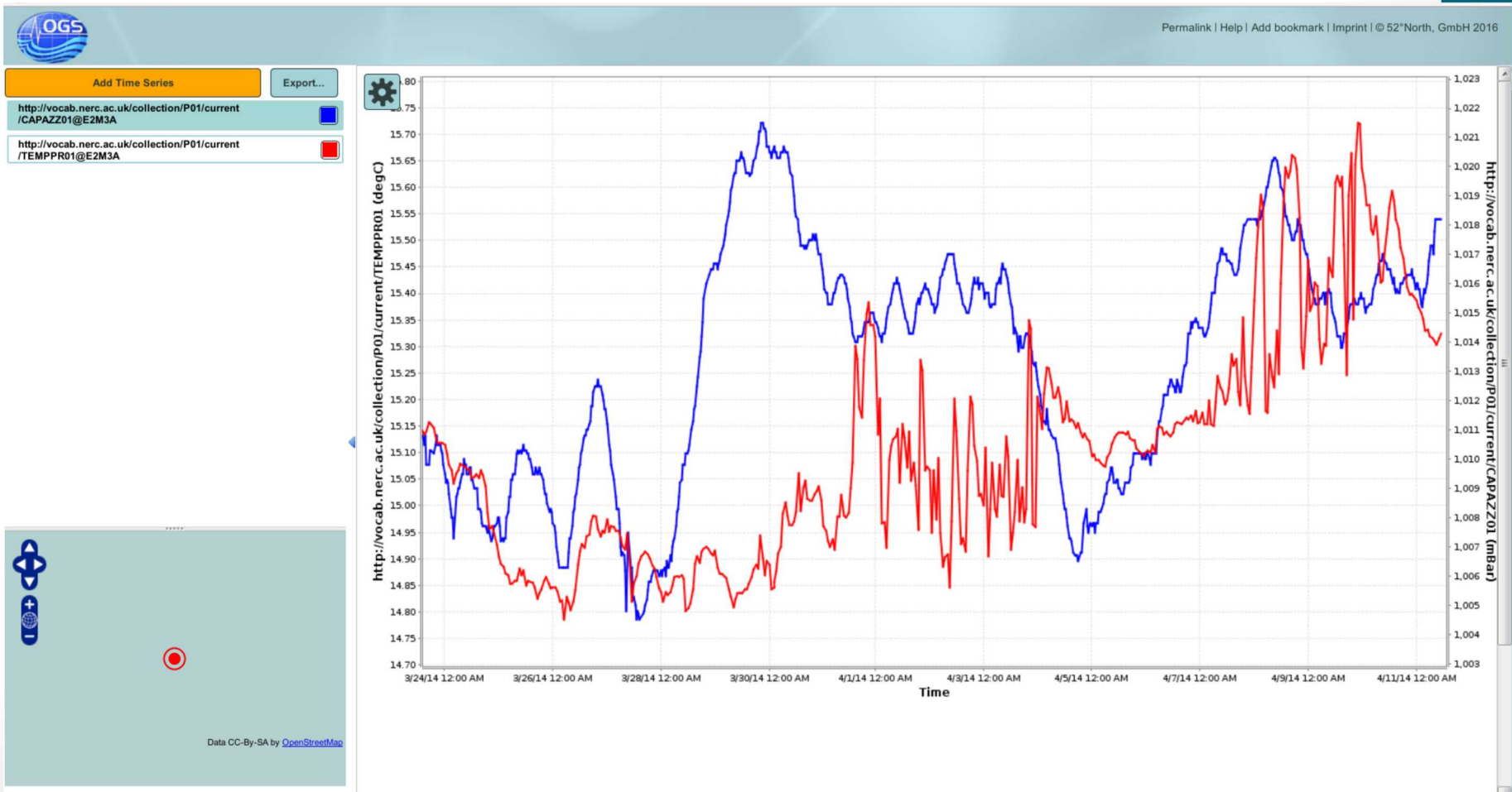
Parameter :

- <http://vocab.nerc.ac.uk/collection/P01/current/PCOZEG01>
- <http://vocab.nerc.ac.uk/collection/P01/current/LWRDZZ01>
- <http://vocab.nerc.ac.uk/collection/P01/current/TEMPMEAS>
- <http://vocab.nerc.ac.uk/collection/P01/current/CTMPZZ01>
- <http://vocab.nerc.ac.uk/collection/P01/current/CRELZZ01>
- <http://vocab.nerc.ac.uk/collection/P01/current/CAPAZZ01>
- <http://vocab.nerc.ac.uk/collection/P01/current/HEADCMMG>
- <http://vocab.nerc.ac.uk/collection/P01/current/EGTDZZ01>
- <http://vocab.nerc.ac.uk/collection/P01/current/EGTSZZ01>
- <http://vocab.nerc.ac.uk/collection/P01/current/EWSBZZ01>
- <http://vocab.nerc.ac.uk/collection/P01/current/EWDAZZ01>
- <http://vocab.nerc.ac.uk/collection/P01/current/TEMPPR01>
- <http://vocab.nerc.ac.uk/collection/P01/current/CNDGZZ01>
- <http://vocab.nerc.ac.uk/collection/P01/current/DOXYZZXX>
- <http://vocab.nerc.ac.uk/collection/P01/current/PRESPR01>
- <http://vocab.nerc.ac.uk/collection/P01/current/PHXZZXX>
- <http://vocab.nerc.ac.uk/collection/P01/current/CSLRZZ01>

<http://nodc.ogs.trieste.it/SOSclient/>

# Sensor Web Enablement (SWE): **HOW**

## 3. Data Visualization → Web Client (52° north)

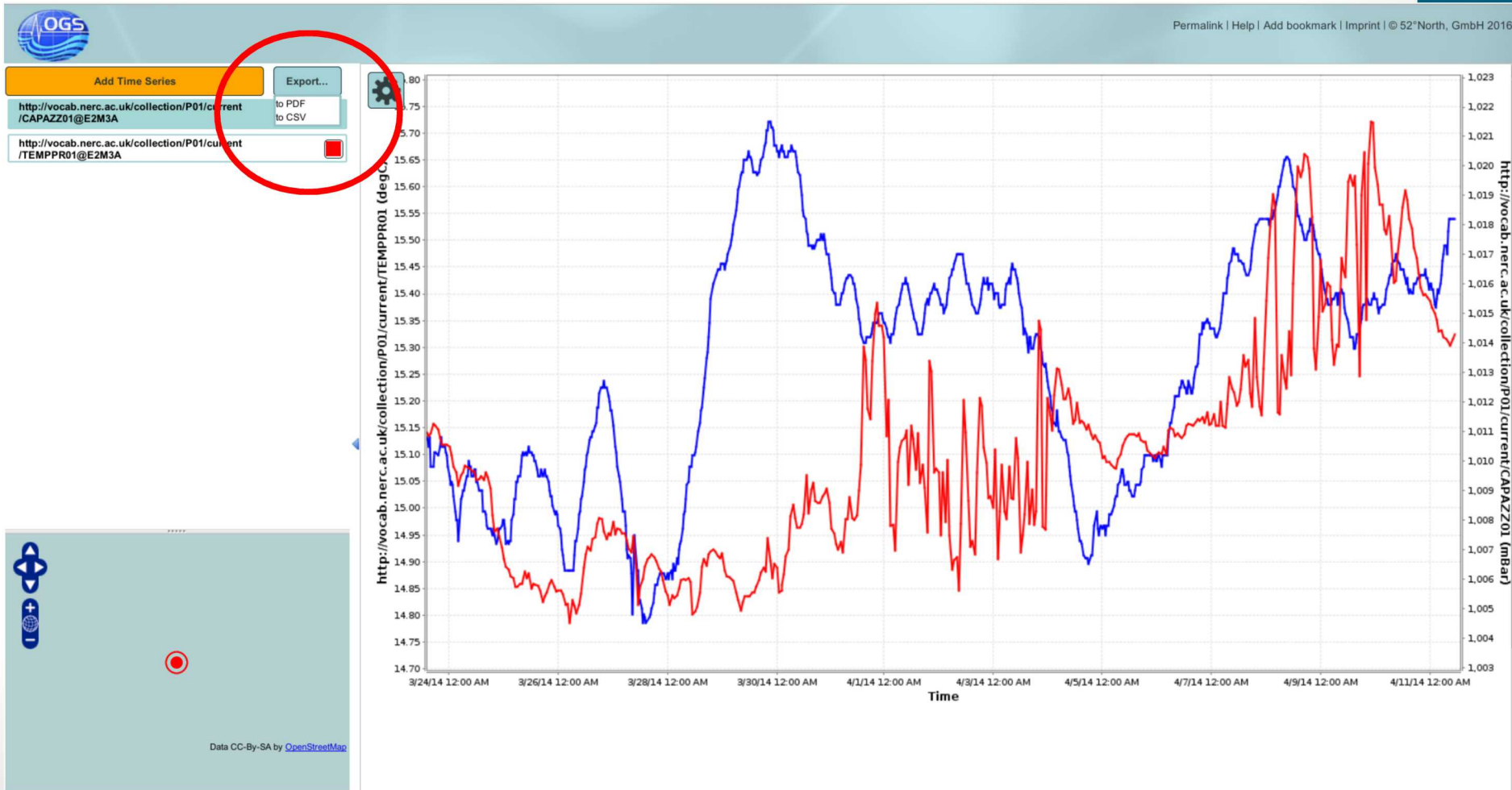


<http://nodc.ogs.trieste.it/SOSclient/>



# Sensor Web Enablement (SWE): **HOW**

## 3. Data Visualization → Web Client (52° north)



<http://nodc.ogs.trieste.it/SOSclient/>

# Sensor Web Enablement (SWE): E2-M3A

## SensorML

- AIR\_METEO
- AIR\_PRESS
- CT
- GPS
- pCO2
- pH
- PIR
- PSP
- WIND

## O&M

- AIR\_PRESS
- CT\_cond
- CT\_oxy
- CT\_press
- CT\_temp
- GPS\_lat
- GPS\_lon
- HUMID
- pCO2
- pH
- PIR\_INFRA
- PIR\_TEMP
- PSP
- TEMP\_AIR
- WIND\_DIR
- WIND\_DIR\_GUST
- WIND\_ORIENTATION
- WIND\_SPEED
- WIND\_SPEED\_GUST

# Sensor Web Enablement (SWE)

## In conclusion:

### PROS

- Use of widely adopted standards for data, metadata and for management procedures
- Possible connection with different systems (e.g. Delayed-Mode, SeaDataNet experience)
- In a near future, will be possible a direct link to newly developed sensors speaking O&M

### CONS

- Demanding adaptation of previous system
- Currently, few choices of server and client softwares and libraries
- Lack of user friendly management interface: manual metadata compilation

# Thanks for the attention!

