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Work Package Title	WP 5 Data Management
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Submitted by	
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Approvals				
	Name	**Organisation**	**Date**	**Visa**
Coordinator	Patrick Farcy	IFREMER	20.10.2017	PF
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1. Executive Summary

This document provides details on the application profiles of Sensor Web Enablement standards in JERICO-NEXT. JERCICO-NEXT uses these standards as an internal data model and interoperability layer for the observatory operator console developed in task5.3.

The observatory operator console is based on Sensor Nanny system developed at IFREMER. It aims at providing observatory operators with online services (on the cloud), to monitor their deployments and help them in their data publication (toward Copernicus or EMODnet) and preservation (toward SeaDataNet) activities.

Depending on the type of observatory, the services provided are adapted to best fit the observatory operator requirements. In JERCIO-NEXT, as presented in D5.6 (Requirements specifications for the observatory operator console), we are focusing on 3 types of observatory:

- Fixed station (mooring or seabed observatory)
- HF Radar
- Flow cytometry

For these 3 types of observatory, SWE application profiles are proposed to describe the observatory architecture and devices (monitoring facility, platform, instruments) and the observations themselves which produces datasets, e.g. time series.
The necessary attributes for the descriptions have been deduced from the metadata requirements of data services where datasets are published downstream the observatory. Depending on the type of observatory, the metadata requirements definition and expected workflow have various readiness level. Fixed stations have been ingested by SeaDataNet or Copernicus while HF radar data management standards is being defined in newly published reference documents (including JERICO-NEXT deliverable D5.13), and flow cytometry working groups are currently active to define data standards.
Whatever, the readiness level of these data streams, the best inputs available at the time of edition have been used to define the metadata requirements. They have been directly discussed with partners involved in this activity.
The encoding of the metadata has been defined with three drivers. 1) Re-use previous experience and reference documentation on SWE encoding (OGC, INSPIRE, SWE Marine profile group, SeaDataNet…), 2) Strictly validate the proposed encoding with official XSD schemas, 3) extensively use properly defined terms for metadata properties and values with support of vocabulary services to ensure better interoperability of metadata and possible conversion to alternate Sensor Network standards (e.g. Semantic Sensor Network ontology).

This document details the reference inputs documentations and the methodology and then provide detailed descriptions, with examples, of the standard implementation of SWE proposed for JERICO-NEXT. This results in 10 templates covering the description of fixed station, HF radar and flow cytometry observatory and observation description. Examples are provided in the annex and the proposed profiles have been validated against the requirements expressed by the ad hoc standardization groups, depending on the type of observatory.

They will be used as guides for the development of the functions of the observatory console, to edit, store, explore the observatory descriptions and streamline the publication of their data and metadata to European data services and aggregators (Copernicus, SeaDataNet, and EMODnet).

2. Introduction

Sensor Web Enablement standards enable developers to make all types of sensors, transducers and sensor data repositories discoverable, accessible and useable via the web (see http://www.opengeospatial.org/ogc/markets-technologies/swe). Among them the Sensor Model Language (sensorML) and Observations and Measurements (O&M) have been chosen to implement the data model for the observatory operator console, based on Sensor Nanny infrastructure, and developed in JERCO-NEXT (see D5.6 Requirements specifications for the observatory operator console).

The sensorML is used to describe physical systems (sensor, instruments, platforms and monitoring facilities) and their deployments. The O&M is used to describe the observations. In this document, as decided and detailed in D5.6, we will focus on the application of these standards to 3 types of deployments and observations:

- Fixed platforms (moorings or sea floor observatory)
- HF radars
- Flow cytometry.

In environmental science and specifically within the marine community, a number of work has been done to define guidelines or application profiles for sensorML and O&M.
These standards are versatile and complex and the guidelines or application profiles are indeed strategic to define constraints in the usage of the standards so that different services are actually interoperable.

3. Main report

3.1. Reference documentation

3.1.1. Observation and system descriptions

For observation system descriptions, the following documentation has been used.

Fixed platform:

- EMSO-Molène complete description as maintained on the EMSO-France web site: http://www.emso-fr.org/fr/EMSO-Molene/
- The Poseïdon/Athos dataset as described by SeaDataNet infrastructure (Common Data Index): http://seadatanet.maris2.nl/v_cdi_v3/search.asp (see screenshot Figure 1)

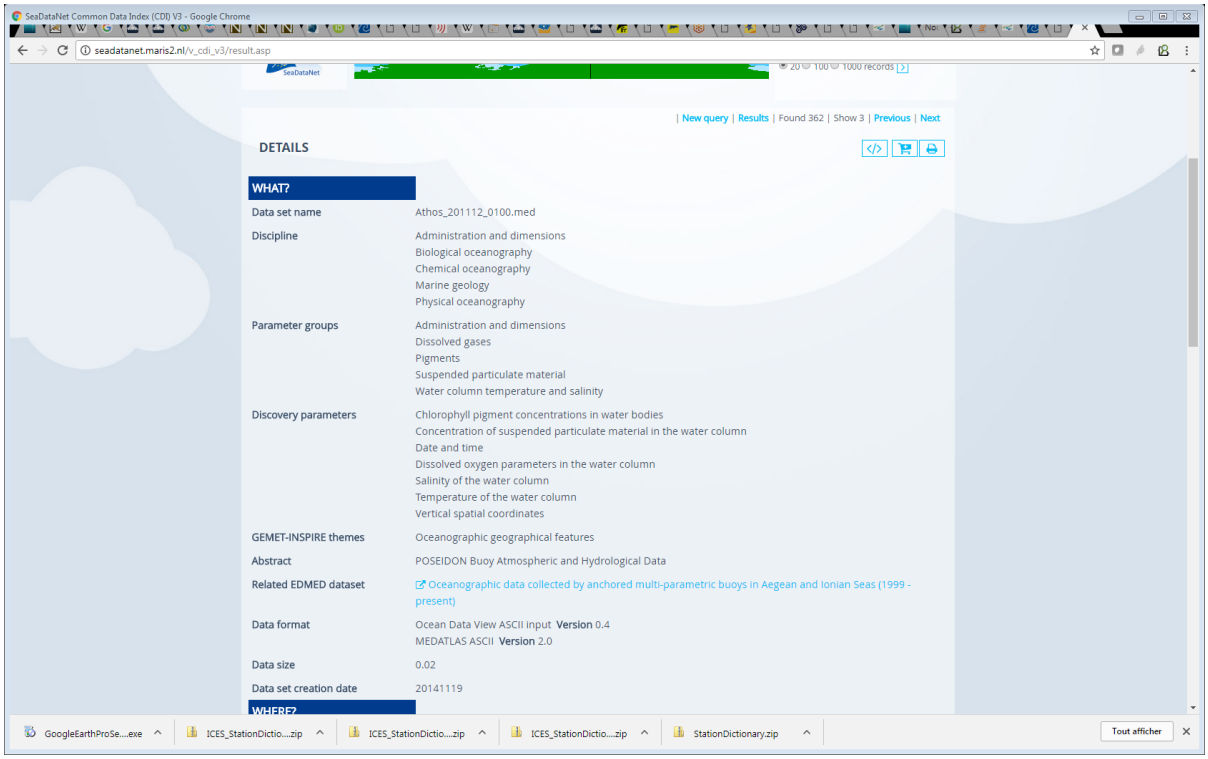


Figure 1: Athos/Poseidon dataset description in SeaDataNet CDI

HF radars:

- The Recommendation Report 1 for HF Radar data implementation in European Maine Data Infrastructure, JERCIO-NEXT D5.13
- The description of HF Radar maintained and published by SOCIB (http://www.socib.eu/?seccion=observingFacilities&facility=radar, see screenshot Figure 2) or the EMODnet-Physics web site developed by ETT (http://www.emodnet-physics.eu/Map/ see screenshot Figure 3) are also used to identify the required attributes for data and metadata. The description of the CNR ISMAR deployment has also been used (http://radarhf.ismar.cnr.it/OperatingNetwork.html).

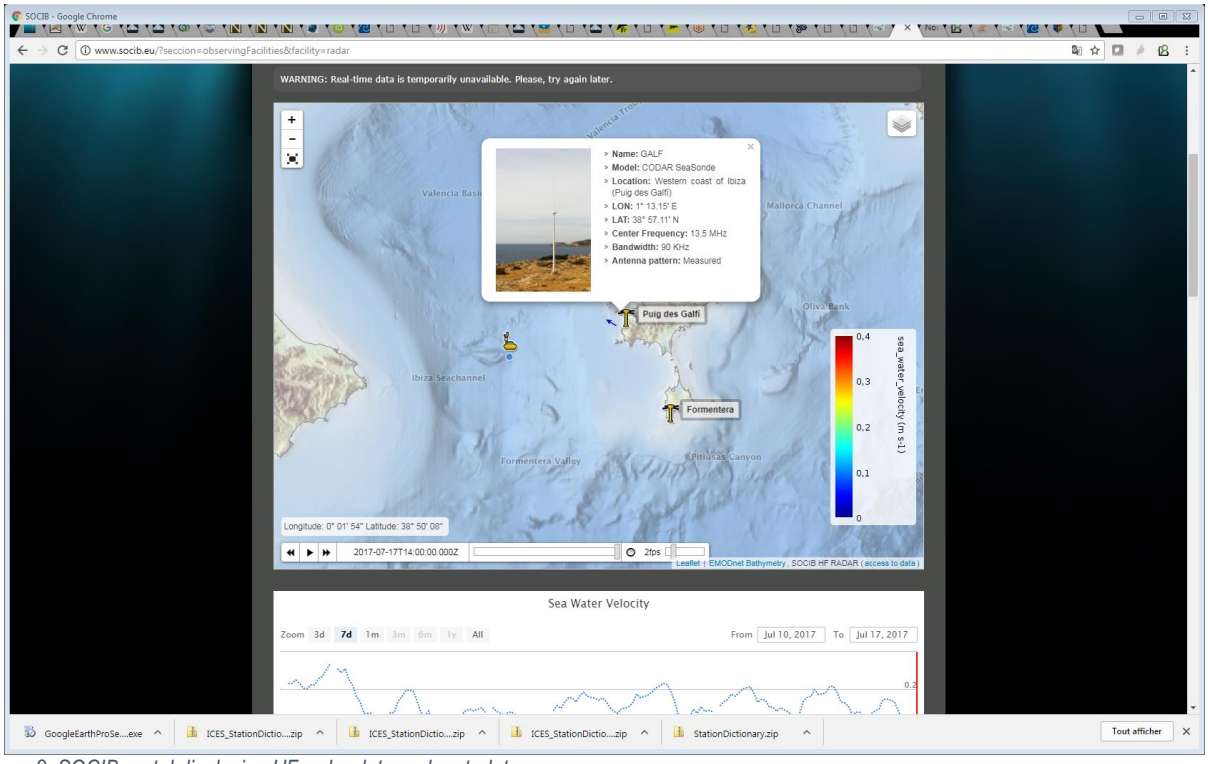


Figure 2: SOCIB portal displaying HF radar data and metadata

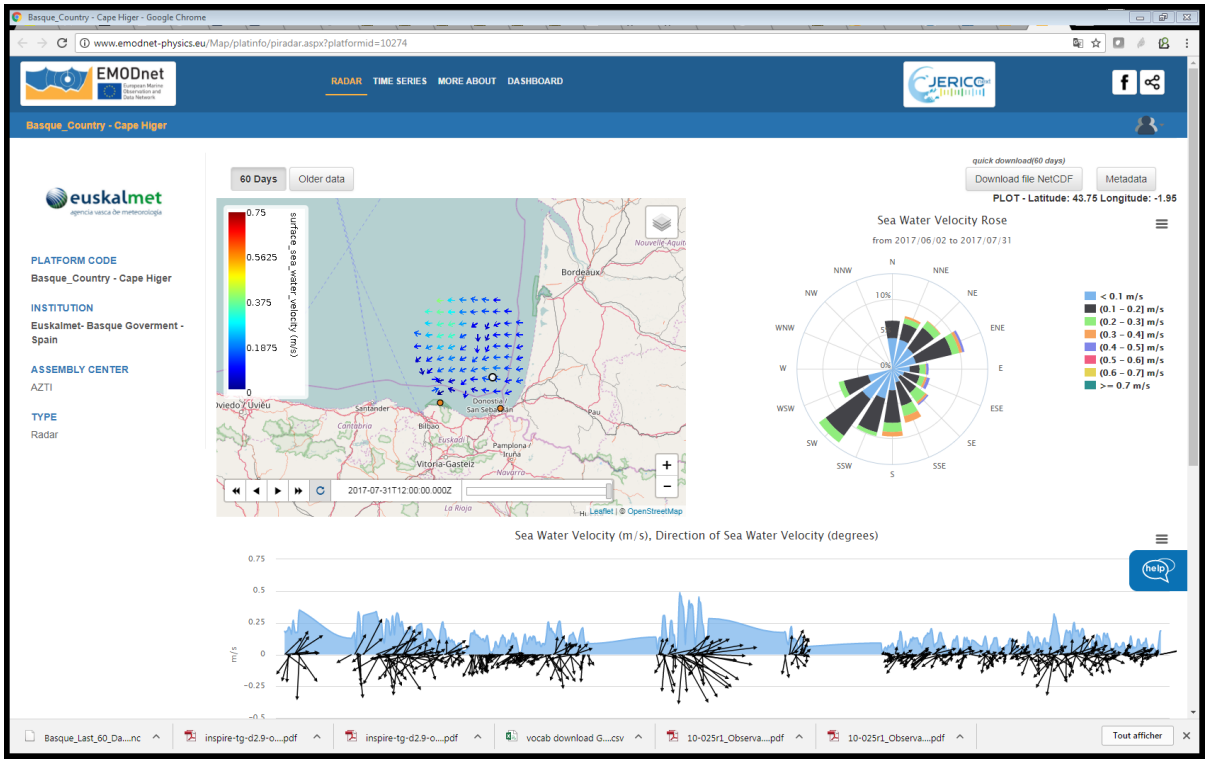


Figure 3: EMODNET-Physics portal showing JERICO HF radar datasets (ETT)

Flow cytometry:

For JERICO-NEXT and SeaDataCloud projects the standardization of Flow Cytometry observation is organized. Although not completed yet, useful material has been collected and used here to identify the most critical metadata to be encoded here in sensorML and O&M.

As an example, flow cytometry data and metadata are made available by Chrome project.

- Project description: https://chrome.mio.univ-amu.fr/
- Metadata and data visualization: https://chrome.mio.univ-amu.fr/chrome-cytobase/ (see screenshot Figure 4).

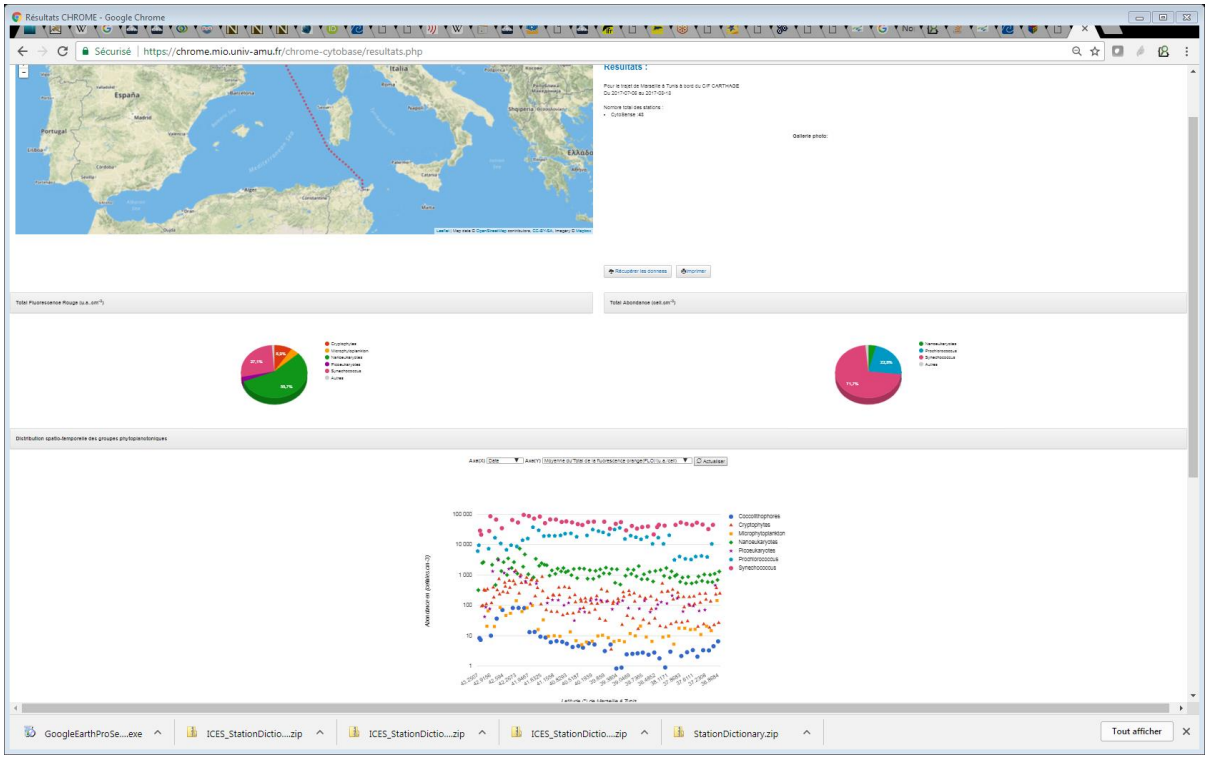


Figure 4: CHROME data and metadata portal for flow cytometry

3.1.2. Sensor Web Enablement standard applications

The sensorML and O&M standards references provided by the Open GIS Consortium (OGC) are publicly available:

- sensorML: http://www.opengeospatial.org/standards/sensorml
- O&M : http://www.opengeospatial.org/standards/om

Besides a number of activities on definition of application profiles for sensorML and O&M for the marine community have produced useful documentation despite their heterogeneous levels of readiness.

The work use as reference in the present document are:

- **SeaDataNet** : depot archimer en cours de validation
- **Fixo3** : to be completed

- **AtlantOS** : work document to propose a profile for AtlantOS observation networks : https://cloud.ifremer.fr/index.php/s/fOHyvjfdDKgqZGr/download?path=%2FWP7.1_WP7.2&files=Recommended_sensorML_profile_for_AtlantOS_marine_observation_systems.pdf

- **EMODnet Ingestion Project**: google docs
- **ODIP2/prototype3** (see SWE Marine Profile)
- **SWE marine profile community**: discussions (email list: marine-swe-profiles@52north.org) and the results of these discussion gathered by Simon Jirka (52°North) on a GitHub project: https://simonjirka.github.io/MarineProfilesForSWE/
  Community-neutral location for defining sensor semantics: http://www.sensorml.com/sensorML-2.0/examples/
- **INSPIRE** guidelines https://inspire.ec.europa.eu/id/document/tg/d2.9-o%26m-swe
- **WIGOS**, to be completed
- **ENVRIplus**, test case on sensor registry

These inputs are used and will be cited, to motivate the chosen options in the present document.

3.2. Principles and general rules

The sensorML and O&M standards allow encoding attributes in free text. However for interoperability purpose, when relevant, it is preferred to encode attributes with keywords documented in vocabulary services.
As recommended by projects SeaDataNet, AtlantOS and ODIP, the BODC vocabulary services will be used as much as possible as references for the keywords of the JERICO-Next sensorML and O&M descriptions.
The following BODC vocabulary lists are defined for sensorML descriptions (see Tableau 1).

W01	SeaDataNet Sensor Web Enablement and SensorML type vocabulary	Vocabulary in support of SeaDataNet's implementation of OGC Sensor Web Enablement. This is the top level vocabulary with many narrower concepts from other vocabularies.	SeaDataNet
W02	SeaDataNet Sensor Web Enablement and SensorML sub-type vocabulary	Vocabulary in support of SeaDataNet's (SDN) implementation of OGC Sensor Web Enablement (SWE). This is the lower level SDN SEW specific vocabulary.	SeaDataNet
W03	SensorML History Event Types	Terms used to describe events or operations that have taken place during the life of an observation system (e.g. a sensor, a platform, an instrument, a network).	Sensor Web Enablement Marine Profiles
W04	SensorML Capability Section Terms	Terms used in SensorML to describe properties of an observation system that further qualify or quantify its output values.	Sensor Web Enablement Marine Profiles
W05	SensorML Characteristic Section Terms	Terms used in SensorML to describe properties of an observation system that do not further qualify or quantify its output values.	Sensor Web Enablement Marine Profiles

W06	SensorML Classification Section Terms	Terms used in SensorML to describe aspects of an observation system (e.g. the type of process, the type of sensor, or its intended applications).	Sensor Web Enablement Marine Profiles
W07	SensorML Identification Section Terms	Terms used in SensorML to identify an observation system.	Sensor Web Enablement Marine Profiles
W08	SensorML Contact Section Terms	Terms used in SensorML to describe the role and contact information for an observation system.	Sensor Web Enablement Marine Profiles
W09	Sensor Web Enablement Observations and Measurements Section Terms	Terms used in SWE Observations and Measurements that describe the measurements made by an observing system and the features involved in this process.	Sensor Web Enablement Marine Profiles
W10	SensorML Output Section Data Interface Terms	Terms used in SensorML to describe the software interactions with an observing system. The terms are typically used in the SensorML Outputs section.	Sensor Web Enablement Marine Profiles

Tableau 1: SeaDataNet vocabulary lists dedicated to sensorML encoding (operated by BODC)

The usage of keywords as references to vocabulary services (URI) offers a better guaranty that the content encoded can be translated in alternate standard format, especially the Semantic Sensor Network ontology encoded in RDF formats.

This will also help to convert the information into standard formats handled by data management infrastructure, for example CDI ISO19115-3 in SeaDataNet or Darwin Core for OBIS.

3.3. Proposed templates

3.3.1. Introduction

3.3.1.1. sensorML organization

The platform description is composed with a hierachy of sensorML records. Each sensorML record represents one physical components or procedure (platform, instrument, sensors, e.g. bought from a manufacturer with serial number) or one component model (e.g. with model code and sensor specifications from manufacturer). The entity-relationship diagram is shown on Figure 5.

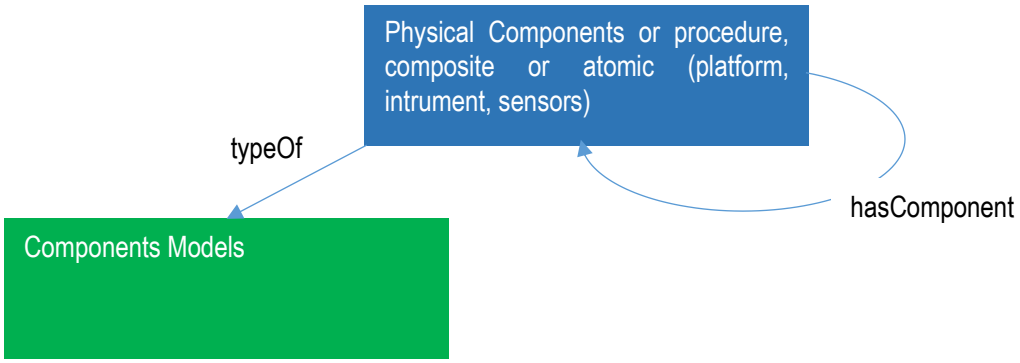


Figure 5: sensorML elements, interactions

An additionnal relationship between components is available in the standard to described „connexions“ between components. However, to limit the complexity of the descriptions it has been chosen not to use it in the context of JERICO-NEXT. In our context, three hierachy levels are considered: monitoring facilities, platforms and instruments, following the recommandation in reference documentation for the observations (see Tableau 2).

This simple scheme allows us to describe complex observatory with simple associations, for example:

The EMSO-Molene monitoring facility has 2 components which are a shore station and a submarine platform. The submarine platform has one ADCP instrument component. The ADCP instrument is type of Aquadopp® profiler 1MHz model, etc...

For this document, the requirements are at monitoring facility, platform or instrument levels. The sensor which are embedded in the instruments can be described but no recommandations are proposed here for them.

Type of observation	Monitoring facility	Platform	Instrument
Fixed platform	A common shore-based logistics or infrastructure, e.g. EMSO-Molène (submarine platform+shore station) or ISMAR HF radar TirLig	Physically integrated structure or node, e.g. EMSO-Molène submarine platform	Deployed instruments e.g. ADCP, CTD, Hydrophone...
HF radar		Antennas	Not required

Flow cytometry	N/A	Vessel or buoys where the instruement is mounted	Flow cytometer

Tableau 2: monitoring facility/platform/instrument concept hierarchy depending on the type of observation

3.3.1.2. Links between data, O&M and SensorML

One O&M record describe an observation as an act with specifically two attributes:

- Result which is the data file
- Procedure which is a physical component or procedure which has been used to produce the observation.

The entity relationship diagram is represented on Figure 6.

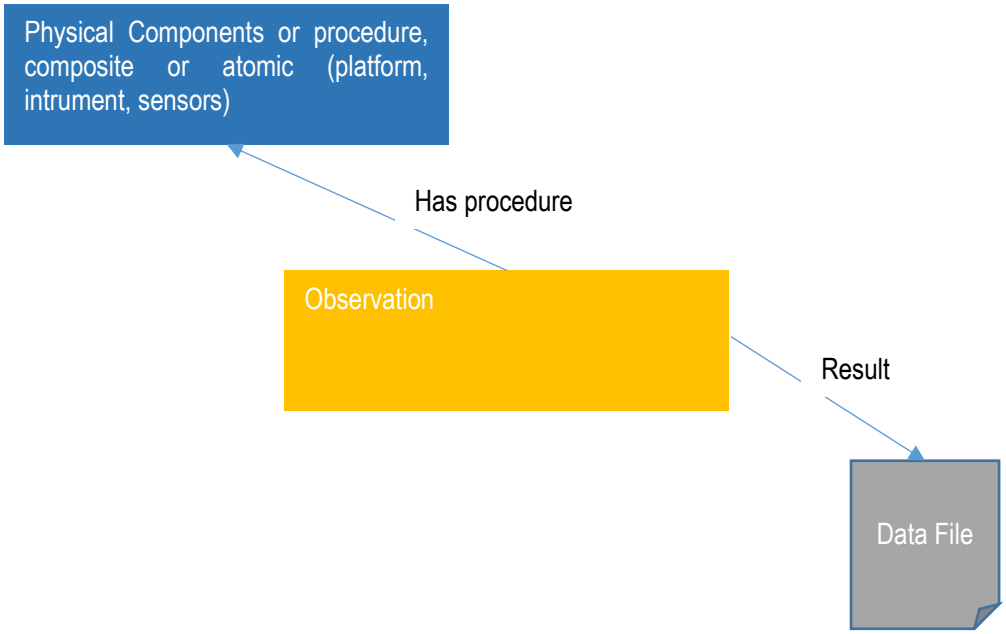


Figure 6: O&M record, links with sensorML record and data file

The data could also be encoded directly in the O&M records. However, the marine community is using and promoting formats for the datasets (ODV, netCDF) which are efficient for the data storage and access and commonly agreed in the marine community. Then in the current document, the option, called out-of-band, of having data as external references has been chosen.

The following sections give details on the sensorML and O&M records requirements for JERICO-NEXT, specifically the fixed marine platforms, HF radar and flow cytometry.

3.3.2. Fixed station

A fixed observatory is described with following records:

type	definition	format

monitoring facility	common shore-based logistics or infrastructure, e.g. EMSO-Molène, Poseïdon	sensorML
platform	a specific node of the observatory which has a fixed location and depth for the deployment of the deployment.	sensorML
instrument	Packaged sensors as bought from a manufacturer and deployed and connected on a platform as a single component.	sensorML
observation	Data generated by an intrument or by multiple instruments	O&M

3.3.2.1. Monitoring facility

The monitoring facility is described as follow:

Name
Description
Keywords
Identification
Contacts (owner, technical coordinator, funding projects)
Sub-components (platforms)

Structure

The structure of the XML SensorML is as follow:

```
<?xml version="1.0" encoding="UTF-8"?>
<sml:PhysicalSystem xmlns:sml="http://www.opengis.net/sensorml/2.0" xmlns:gco="http://www.isotc211.org/2005/gco" xmlns:gmd="http://www.isotc211.org/2005/gmd
    <!-- Description -->
    <gml:description>EMSO-Molène is a cabled observatory dedicated to long term and high-resolution monitoring of coastal biodiversity and biomass. It is al
    <!-- Name -->
    <gml:name>emso molene</gml:name>
    <!-- keywords-->
    <sml:keywords> [5 lines]
     <!-- Identification-->
    <sml:identification> [9 lines]
     <!-- Contacts -->
     <sml:contacts> [31 lines]
    <!-- components list -->
    <sml:components> [5 lines]
</sml:PhysicalSystem>
```

Full example „fixedObservatory-sensorML-monitoring-facility.xml“ in annex 5.1.

Name, Description and keywords

The name, description and keywords are encoded as in the followinf example:

```
<sml:PhysicalSystem xmlns:sml="http://www.opengis.net/sensorml/2.0"
xmlns:gco="http://www.isotc211.org/2005/gco"
xmlns:gmd="http://www.isotc211.org/2005/gmd"
xmlns:gml="http://www.opengis.net/gml/3.2"
xmlns:swe="http://www.opengis.net/swe/2.0"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" gml:id="top"
xsi:schemaLocation="http://www.opengis.net/sensorml/2.0
http://schemas.opengis.net/sensorML/2.0/sensorML.xsd">
    <!-- Description -->
    <gml:description>EMSO-Molène is a cabled observatory dedicated to
```

```
long term and high-resolution monitoring of coastal biodiversity and
biomass. It is also a testing site for sensor and equipment in situ
qualification.

EMSO-Molène was deployed in 2012.

EMSO-Molène observatory is supported by Ifremer as a contribution to
Emso. The site is open to new collaborations, connected instruments
for near real time data transmission or autonomous
sensors.</gml:description>
    <!-- Name -->
    <gml:name>emso molene</gml:name>
    <!-- keywords-->
    <sml:keywords>
        <sml:KeywordList>
            <sml:keyword>Oceanography</sml:keyword>
            <sml:keyword>Observatory</sml:keyword>
        </sml:KeywordList>
    </sml:keywords>
    …
```

Identification

One UUID is recommanded for unique identification of the monitoring facility. It is encoded as follow:

```
  <!-- Identification-->
    <sml:identification>
        <sml:IdentifierList>
            <sml:identifier>
                <sml:Term
definition="http://vocab.nerc.ac.uk/collection/W07/current/IDEN0007">
                    <sml:label>UUID</sml:label>
                    <sml:value>fb5e3982-00a3-4360-8448-
f34086c6040d</sml:value>
                </sml:Term>
            </sml:identifier>
        </sml:IdentifierList>
    </sml:identification>
```

Contacts

Contacts can be used to encode any information related to projects, organization or individuals in complex structure

Each contact has a role defined in the W08 list of the BODC services (http://vocab.nerc.ac.uk/collection/W08/current/).

They are encoded as in the following example:

```
<!-- Contacts -->
<sml:contacts>
   <sml:ContactList>
      <sml:contact>
           <!-- URI to the defintion of the current contact:
             - organisation (SeaDataNet/EDMO),
             - person (OrcID or specific user directory
             - or projects (SeaDataNet/EDMERP)     -->
           <gmd:CI_ResponsibleParty
uuid="http://annuaire.ifremer.fr/cv/16211/">
               <!-- first name and last name of a person -->
```

```
                <gmd:individualName><gco:CharacterString>Nadine
Lanteri</gco:CharacterString></gmd:individualName>
                <!-- label of the organization or project -->

<gmd:organisationName><gco:CharacterString>IFREMER</gco:CharacterStri
ng></gmd:organisationName>
                <gmd:contactInfo>
                    <gmd:CI_Contact>
                        <gmd:address>
                            <gmd:CI_Address>
                                <gmd:electronicMailAddress>
                                    <!-- email adress -->

<gco:CharacterString>nadine.lanteri@ifremer.fr</gco:CharacterString>
                                </gmd:electronicMailAddress>
                            </gmd:CI_Address>
                        </gmd:address>
                    </gmd:CI_Contact>
                </gmd:contactInfo>
                <gmd:role>
                    <!-- here role code CONT0005 is for "technical
ooordinator" -->
                    <gmd:CI_RoleCode
codeList="http://vocab.nerc.ac.uk/collection/W08/current/"
codeListValue="http://vocab.nerc.ac.uk/collection/W08/current/CONT000
5/"></gmd:CI_RoleCode>
                </gmd:role>
            </gmd:CI_ResponsibleParty>
        </sml:contact>
    </sml:ContactList>
</sml:contacts>
```

New entry for „project“ contact role has been requested for registration in BODC vocabulary services, see Annex 5.3.→ project

Sub-components

The sbucomponent provide the list of references of the platform which belong to the monitoring facility. They are encoded as follow, with one label (name) and one URI resolved on a sensorML record:

```
   <!-- components list -->
    <sml:components>
        <sml:ComponentList>
            <sml:component name="Shore_station"
xlink:href="http://datacloud.ifremer.fr//owncloud/index.php/apps/snan
nyowncloudapi/sml/5c78af17-1b8a-4c0d-88ff-
6361f5828fda"></sml:component>
            <sml:component name="submarine_platform"
xlink:href="http://datacloud.ifremer.fr//owncloud/index.php/apps/snan
nyowncloudapi/sml/f3c8dd0d-0249-449d-a59b-
224a14b87f9a"></sml:component>
        </sml:ComponentList>
    </sml:components>
```

3.3.2.2. Platform

Each monitoring facility can have many platforms of different types (moorings, sea floor observatories, shore infrastructure...).
The platform is described as follow:

Name
Description
Keywords
Identification
Classification
Characteristics
Capabilities
Contacts (owner, technical coordinator, funding projects)
position
Sub-components (instruments)

Full example „fixedObservatory-sensorML-platform.xml“ in annex 5.1.

Structure
The structure of the XML sensorML is as follow:

```
<?xml version="1.0" encoding="UTF-8"?>
<sml:PhysicalSystem xmlns:sml="http://www.opengis.net/sensorml/2.0" xmlns:gco="http://www.isotc211.org/2005/gco" xmlns:gmd="http://www.isot
    <!-- Description -->
    <gml:description> The submarine platform lays on a sand seabed sheltered from current and swell by a rocky frame. It consists in a meta
    <!-- Name -->
    <gml:name>submarine platform</gml:name>
    <!-- keywords-->
    <sml:keywords> [5 lines]
    <!-- Identification-->
    <sml:identification> [16 lines]
    <!-- Classification -->
    <sml:classification> [10 lines]
    <!-- Characteristics -->
    <sml:characteristics name="generalProperties"> [12 lines]
   <!-- Capabilities -->
    <sml:capabilities name="generalProperties"> [19 lines]
    <!-- Contacts -->
    <sml:contacts> [43 lines]
  <!-- position -->
    <sml:position>           [9 lines]
    <sml:position> [4 lines]
    <!-- sub-Components -->
    <sml:components> [4 lines]
</sml:PhysicalSystem>
```

Name, description, keywords
Same a for the monitoring facility (See **Erreur ! Source du renvoi introuvable.**).

Identification
For identification, a UUID is recommended. Then depending on the type of platform different type of identification can be considered among World Meteorology Organization (WMO) number for surface mooring codes or ICES or OceanSites (see http://www.oceansites.org/network/index.html) station codes.

The encoding can be as follow:

```
<!--                                                    Identification-->
<sml:identification>
    <sml:IdentifierList>
        <sml:identifier>
            <sml:Term
definition="http://vocab.nerc.ac.uk/collection/W07/current/IDEN0007/"
```

```
>
                <sml:label>UUID</sml:label>
                <sml:value>f3c8dd0d-0249-449d-a59b-
224a14b87f9a</sml:value>
            </sml:Term>
        </sml:identifier>
        <!-- could consider here ICES station, WMO or OceanSites code,
here          WMO          number          of          Poseidon/ATHOS-->
        <sml:identifier>
            <sml:Term
definition="http://vocab.nerc.ac.uk/collection/W07/current/IDEN0007/"
>
                <sml:label>WMO       platform       number</sml:label>
                <sml:value>6101003</sml:value>
            </sml:Term>
        </sml:identifier>
    </sml:IdentifierList>
</sml:identification>
```

Classification

Classification must describe the platform type as defined in L06 BODC vocabulary. It is encoded as follow:

```
<!-- Classification -->
<sml:classification>
    <sml:ClassifierList>
        <sml:classifier>
            <sml:Term
definition="http://vocab.nerc.ac.uk/collection/W06/current/CLSS0001/"
>
                <sml:label>platform type</sml:label>
                <!-- code L06:48 is for mooring -->

<sml:value>http://vocab.nerc.ac.uk/collection/L06/current/48/</sml:va
lue>
            </sml:Term>
        </sml:classifier>
    </sml:ClassifierList>
</sml:classification>
```

The proposed codes for fixed platforms are:

	Platform label	URI
Fixed platforms	Fixed benthic node	http://vocab.nerc.ac.uk/collection/L06/current/11/
	Subsurface mooring	http://vocab.nerc.ac.uk/collection/L06/current/43/
	mooring	http://vocab.nerc.ac.uk/collection/L06/current/48/

Characteristics

Characteristics should provide the water depth at the position where the platform is deployed. It is used for compliance with SeaDataNet/CDI metadata format. It is encoded as follow:

```
 <!-- Characteristics -->
 <sml:characteristics name="generalProperties">
     <sml:CharacteristicList>
         <sml:characteristic name="waterDepth">
            <!-- waterDepth term need to be defined in W05 -->
```

```
            <swe:Quantity
definition="http://vocab.nerc.ac.uk/collection/W05/current/___TO BE
DEFINED___">
                <swe:label>waterDepth</swe:label>
                <!-- unit, here meters -->
                <swe:uom
xlink:href="http://vocab.nerc.ac.uk/collection/P06/current/ULAA/"/>
                <!-- value -->
                <swe:value>18</swe:value>
            </swe:Quantity>
        </sml:characteristic>
    </sml:CharacteristicList>
</sml:characteristics>
```

New entry for „water depth at the location of the deployment“ been requested for registration in BODC vocabulary services, see Annex 5.3

Capabilities

The capabilities section is used to encode the depth range where the fixed station can measure. This information is required by SeaDataNet/CDI. It is encoded as follow:

```
<!-- Capabilities -->
<sml:capabilities name="generalCapabilities">
    <sml:CapabilityList>
        <sml:capability name="verticalRange">
            <!-- reference datum for vertical coordinate -->
            <swe:Vector
referenceFrame="http://vocab.nerc.ac.uk/collection/L11/current/D09/">
                <swe:coordinate name="verticalMin">
                    <swe:Quantity
definition="http://vocab.nerc.ac.uk/collection/W04/current/___TO BE
DEFINED___">
                        <swe:uom
xlink:href="http://vocab.nerc.ac.uk/collection/P06/current/ULAA/"/>
                        <swe:value>0</swe:value>
                    </swe:Quantity>
                </swe:coordinate>
                <swe:coordinate name="verticalMax">
                    <swe:Quantity
definition="http://vocab.nerc.ac.uk/collection/W04/current/___TO BE
DEFINED___">
                        <swe:uom
xlink:href="http://vocab.nerc.ac.uk/collection/P06/current/ULAA/"/>
                        <swe:value>18</swe:value>
                    </swe:Quantity>
                </swe:coordinate>
            </swe:Vector>
        </sml:capability>
    </sml:CapabilityList>
</sml:capabilities>
```

New entry for „minimal and maximum depth of the instrument deployed“ been requested for registration in BODC vocabulary services, see Annex 5.3

Contacts

Contacts can be used to encode any information related to projects, organization or individuals in complex structure. It is used as for monitoring facilities (see **Erreur ! Source du renvoi introuvable.**)

Position
For a fixed station position is used to describe the horizontal coordinate, as well as the vertical coordinate. It is encoded as follow:

```
<!-- position -->
<sml:position>
    <!-- vertical datum -->
    <swe:Vector
referenceFrame="http://vocab.nerc.ac.uk/collection/L11/current/D09/">
        <swe:coordinate name="verticalLevel">
            <swe:Quantity>
            <!-- unit, here meters -->
            <swe:uom
xlink:href="http://vocab.nerc.ac.uk/collection/P06/current/ULAA/" />
                <!-- value -->
                <swe:value>18</swe:value>
        </swe:Quantity>
        </swe:coordinate>
    </swe:Vector>
</sml:position>
<sml:position>
    <!-- horizontal coordinates as a point in WGS84 (lat, lon) -->
    <gml:Point gml:id="stationLocation"
srsName="http://www.opengis.net/def/crs/EPSG/0/4326">
        <gml:coordinates>48.400 -4.9333</gml:coordinates>
    </gml:Point>
</sml:position>
```

Subcomponents
Subcomponent secion describe the instrument hosted by the platform. They encoed as platforms as follow:

```
<!-- sub-Components -->
<sml:components>
   <sml:ComponentList>
        <sml:component name="ADCP"
xlink:href="http://ubisi54.ifremer.fr/snanny/123412234455"/>
    </sml:ComponentList>
</sml:components>
```

3.3.2.3. Instruments

The description of instruments the following attributes are used:

Name, description, keyword
Identifiers, claissfiers, characteristics and capabilities
Contacts
TypeOf
Outputs

Full example „fixedObservatory-sensorML-instrument-optode.xml“ in annex 5.1.

Structure
The structure of the sensorML XML record is as follow:

Name, description and keywords are described as for monitoring facility (see **Erreur ! Source du renvoi introuvable.**).
Indentifiers, classifications, characteristics and capabilities can be used extensivelly to describe details on the instrument. The property must be registered in the ad hoc BODC vocabularies:

Identifiers	http://vocab.nerc.ac.uk/collection/W07/current/
Classifiers	http://vocab.nerc.ac.uk/collection/W06/current/
Characteristics	http://vocab.nerc.ac.uk/collection/W05/current/
Capabilities	http://vocab.nerc.ac.uk/collection/W04/current/

If any is missing, send a request to enquiries@bodc.ac.uk

The properties can be encoded as follow, here for identifiers:

```
<!-- Identification-->
<sml:identification>
    <sml:IdentifierList>
        <sml:identifier>
            <sml:Term
definition="http://www.ifremer.fr/tematres/vocab/index.php?tema=66"
>
                <sml:label>UUID</sml:label>
                <sml:value>ad7ec870-2395-4a75-a38f-
ccf67fe15136</sml:value>
            </sml:Term>
        </sml:identifier>
        <sml:identifier>
            <sml:Term
definition="http://vocab.nerc.ac.uk/collection/W07/current/IDEN0005
/">
                <sml:label>serial number</sml:label>
                <sml:value></sml:value>
            </sml:Term>
        </sml:identifier>
        <sml:identifier>
            <sml:Term
definition="http://vocab.nerc.ac.uk/collection/W07/current/IDEN0012
/">
                <sml:label>manufacturer</sml:label>
                <sml:value>Aanderaa</sml:value>
            </sml:Term>
        </sml:identifier>
        <sml:identifier>
```

```
            <sml:Term
definition="http://vocab.nerc.ac.uk/collection/W07/current/IDEN0004
/">
                <sml:label>Model number</sml:label>
                <sml:value>3830</sml:value>
            </sml:Term>
        </sml:identifier>
    </sml:IdentifierList>
</sml:identification>
```

Contacts are encoded as for monitoring facility or platform (see **Erreur ! Source du renvoi introuvable.**) However here the Principal Investigator (PI) should be described. See example hereafter:

```
<!-- Contacts -->
<sml:contacts>
   <sml:ContactList>
      <sml:contact>
          <gmd:CI_ResponsibleParty
uuid="http://annuaire.ifremer.fr/cv/16604/">

<gmd:organisationName><gco:CharacterString>IFREMER</gco:CharacterSt
ring></gmd:organisationName>
              <gmd:contactInfo>
                  <gmd:CI_Contact>
                      <gmd:address>
                          <gmd:CI_Address>
                              <gmd:electronicMailAddress>

<gco:CharacterString>pierre.marie.sarradin@ifremer.fr</gco:Characte
rString>
                                  </gmd:electronicMailAddress>
                          </gmd:CI_Address>
                      </gmd:address>
                  </gmd:CI_Contact>
              </gmd:contactInfo>
              <gmd:role>
                  <!-- here role code is CONT0004 is for Principal
Investigator (PI) -->
                  <gmd:CI_RoleCode
codeList="http://vocab.nerc.ac.uk/collection/W08/current/"
codeListValue="
      http://vocab.nerc.ac.uk/collection/W08/current/CONT0004/"></g
md:CI_RoleCode>
              </gmd:role>
          </gmd:CI_ResponsibleParty>
       </sml:contact>
  </sml:ContactList>
</sml:contacts>
```

TypeOf is used to link to the manufacturer specification, specifically when they are available in sensorML also. In the following example the sensorML encoding of the manufacturer's specification is extracted for the Fixo3 yellow pages (https://www.esonetyellowpages.com/).

```
<!-- type OF -->
<sml:typeOf xlink:href="http://www.ifremer.fr/isi/sensorNanny/emso-
yp-sml/sensorDATA_DO_SENSOR_179.xml"></sml:typeOf>
```

Outputs can be used to describe the output channels of the instrument.It shoud reference well defined term in a vocabulary list for example BODC P01 as in the following example:

```
<sml:outputs>
    <sml:OutputList>
       <sml:output name="oxygen"
xlink:href="http://vocab.nerc.ac.uk/collection/P01/current/OXYOOPCT/"
></sml:output>
        <sml:output name="temperature"
xlink:href="http://vocab.nerc.ac.uk/collection/P01/current/TEMPPR01/"
></sml:output>
    </sml:OutputList>
</sml:outputs>
```

3.3.2.4. Observation

The observation is described with the following attributes:

Description, identifier, name
phenomnonTime
resultTime
Procedure
Parameter
featureOfInterest
resultQuality
Result

Full example „fixedObservatory-om.xml“ in annex 5.1.

The **structure** of the Observation & Measurement (O&M) XML file is as follow:

```
<?xml version="1.0" encoding="UTF-8"?>
<om:OM_Observation gml:id="top"
    xmlns:om="http://www.opengis.net/om/2.0"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:xlink="http://www.w3.org/1999/xlink"
    xmlns:gml="http://www.opengis.net/gml/3.2"
    xmlns:swe="http://www.opengis.net/swe/2.0"
    xsi:schemaLocation="http://www.opengis.net/om/2.0 http://schemas.opengis.net/om/2.0/observation.xsd">
    <gml:description>POSEIDON Buoy Atmospheric and Hydrological Data</gml:description>
    <gml:identifier codeSpace="uuid">579104bb51b9e9.59029106</gml:identifier>
    <gml:name>Athos_201112_0100.med</gml:name>
    <om:type xlink:href="http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_Measurement"/>
    <om:phenomenonTime> [7 lines]
    <om:resultTime> [5 lines]
    <om:procedure xlink:href="http://www.ifremer.fr/sml/ad7ec870-2395-4a75-a38f-ccf67fe15136"/>
    <om:parameter>                [5 lines]
    <om:observedProperty/>
    <om:featureOfInterest xlink:href="http://vocab.nerc.ac.uk/collection/S21/current/S21S027/"></om:featureOfInterest>
    <om:resultQuality> [21 lines]
    <om:result>                [23 lines]
</om:OM_Observation>
```

The **description, identifier and name** are encoded as follow:

```
<!-- description -->
<gml:description>POSEIDON Buoy Atmospheric and Hydrological
Data</gml:description>
<!-- identifier with a UUID -->
<gml:identifier
codeSpace="uuid">579104bb51b9e9.59029106</gml:identifier>
<!-- name -->
<gml:name>Athos_201112_0100.med</gml:name>
```

The **phenomenonTime** descibes the rangeof time when the observation is applied. It is encoded as follow:

```
<om:phenomenonTime>
        <gml:TimePeriod gml:id="temporalExtent">
            <!-- erliest time in the period (IOS8601 encoding)-->
            <gml:beginPosition>2011-07-
01T11:14:00</gml:beginPosition>
            <!-- latest time in the period (IOS8601 encoding) -->
            <gml:endPosition>2012-06-11T09:00:00</gml:endPosition>
        </gml:TimePeriod>
    </om:phenomenonTime>
```

The **resultTIme** describes the update time of the data result produced by the observation. It is encoded as follow:

```
  <om:resultTime>
        <gml:TimeInstant gml:id="updateDate">
            <!--Format ISO8601-->
            <gml:timePosition>2016-07-21T17:22:03</gml:timePosition>
        </gml:TimeInstant>
    </om:resultTime>
```

The **procedure** is very important and references the device (platform, instrument, methodology operated by a human agent) which has been used to do the observation and produce the data. This reference is critical to handle the tracability to the sensor history and calibration for example. It is encoded with a URI reference. The reference should resolve in sensorML.
It is encoded as follow:

```
<om:procedure xlink:href="http://www.ifremer.fr/sml/ad7ec870-2395-
4a75-a38f-ccf67fe15136"/>
```

The parameter section can be used to describe metadata missing otherwise. For example the frequency of measurement of a time series when timesteps are missing in the data file as in example hereafter:

```
    <om:parameter>
            <om:NamedValue>
                <!-- definition of the property -->
                <om:name
    xlink:href="http://vocab.nerc.ac.uk/collection/W04/current/CAPB00
    03/"/>
                <!-- value and unit of the property -->
                <om:value>100 Hz</om:value>
            </om:NamedValue>
    </om:parameter>
```

The **featureOfInterest** describes the matrix or sphere which is actually observed. It can use the S21 list of terms of BODC vocabulary services. For marine platform is is most of time water body, but could also atmosphere (for winds). It is encoded as follow:

```
<!-- feature of interest, here "water body" -->
<om:featureOfInterest
xlink:href="http://vocab.nerc.ac.uk/collection/S21/current/S21S027/">
</om:featureOfInterest>
```

The **resultQuality** section describes the quality control protocol applied for the observation and the control of the produced data. It is encoded as follow

```
<om:resultQuality>
    <DQ_QuantitativeAttributeAccuracy
xmlns="http://www.isotc211.org/2005/gmd">
        <result>
           <DQ_ConformanceResult>
                <specification><CI_Citation>
                    <!-- title of the quality control manual -->
                    <title><CharacterString
xmlns="http://www.isotc211.org/2005/gco">Argo Quality Control Manual
for CTD and Trajectory Data.</CharacterString></title>
                    <date><CI_Date>
                      <!-- publication or update date -->
                        <date><Date
xmlns="http://www.isotc211.org/2005/gco">2015</Date></date>
                        <dateType></dateType>
                    </CI_Date></date>
                    <!-- DOI to the QC manual -->
                    <identifier
xlink:href="http://doi.org/10.13155/33951"></identifier>
                </CI_Citation></specification>
                <explanation></explanation>
                <pass></pass>
            </DQ_ConformanceResult>
        </result>
    </DQ_QuantitativeAttributeAccuracy>
</om:resultQuality>
```

The **result** section is used the reference the data file which has been produced by the observation. As discussed in INSPIRE SWE guidelines (https://inspire.ec.europa.eu/id/document/tg/d2.9-o%26m-swe) in annex K (Discussion paper on Out-Of-Band Results), the option 6 has been selected as it was proposed in the SeaDataNet deliverable 8.2&3 on SWE marine profiles.

Two benefits are expected by adopting this option:

1. The data format standardization applied by community and optimized for their type of observation can be re-used. With the attribute xlink:role referencing the applied format, plugins (ideally developed by the community) can be applied for the visualization or conversion of these datasets.
2. The metadata in dataRecord section can be used to complete the community data format with reference information mandatory for the interoperability of the datasets beyond the community defining the out-of-band format. In the following example, the information can be used to convert from EMSO specific CSV to SeaDataNet ODV time series.

It is encoded as follow:

```
<om:result>
     <swe:DataArray>
         <swe:elementCount></swe:elementCount>
         <swe:elementType name="values">
            <swe:DataRecord>
                <swe:field name="colmun1">
                    <swe:Time>
                        <!-- column header label -->
                        <swe:label>Time_iso8601</swe:label>
                        <swe:uom xlink:href=""/>
                    </swe:Time>
                </swe:field>
```

```
                <swe:field name="colmun2">
                    <!-- column header label & definition of values
and units-->
                    <swe:Quantity
definition="http://vocab.nerc.ac.uk/collection/P01/current/TEMPPR01">
                        <swe:label>TEMP [°C]</swe:label>
                        <swe:uom
xlink:href="http://vocab.nerc.ac.uk/collection/P06/current/UPAA/"></s
we:uom>
                    </swe:Quantity>
                </swe:field>
            </swe:DataRecord>
        </swe:elementType>
        <!-- reference to the data file, role attribute is used to
specify the data format wghich can activate specific plugin to read
the data -->
        <swe:values xlink:href="files/emso/emso-azores/momar-2011-
data/optode.csv" xlink:role="txt/csv"></swe:values>
    </swe:DataArray>
    <gml:quantityType >
    </gml:quantityType>
</om:result>
```

3.3.3. *Applicable conversions for Fixed Station metadata and data*

By applying the SWE standards as described above the conversion to SeaDataNet metadata (CDI) and data (ODV time series) can be automated.

The detailed mapping is proposed in annex 5.2.

3.3.4. *HF radars*

A HF radar is described with following records:

Type	definition	format
Monitoring facility	common shore-based logistics or infrastructure, e.g. ISMAR_HFR_TirLig	sensorML
Site	a node of the monitoring facility where an antenna is deployed at a fixed location, in a given direction.	sensorML
Observation	Data generated by the antennas deployed on different sites of the monitoring facility to resolve direction uncertainties by combining different antennas observations	O&M

The definition of required or usefull attributes is motivated by requirements of data format defined in JERICO-NEXT D5.13 and the web sites proposed by SOCIB or ETT to visualize HF radar observation (see 3.1.1).

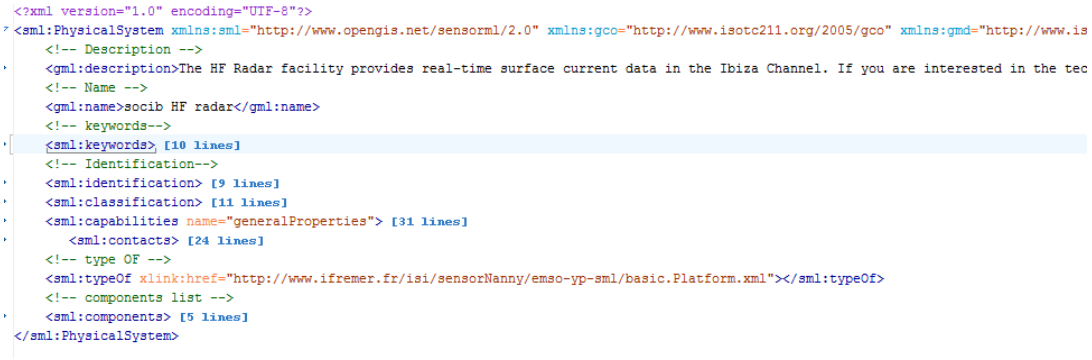
3.3.4.1. Monitoring facility

The monitoring facility is described with the following attritutes:

Name, Description, keywords
Identification
Classification
Capabilities
Contacts
Sub-components (sites)

Full example „HFRadar-sensorml-monitoring-facility.xml“ in annex 5.1.

The **structure** of the sensorML description is as follow:



The **name, description and keywords** are encoded as for fixed mooring (see **Erreur ! Source du renvoi introuvable.**). In the current case, however, a few keywords are recommended and can be used the generation of netCDF in standard described in D5.13. You can see how they are encoded in the following example:

```
<!-- Description -->
<gml:description>The HF Radar facility provides real-time surface
current data in the Ibiza Channel. If you are interested in the
technical details of functioning of the HF Radar instrument, read
general information or access to the presentation at the HF Radar
National Meeting.

        All HF Radar Data has passed a battery of tests to ensure
that the data being produced is of the highest quality and
therefore, a QC fag can be displayed. Data can be downloaded in KMZ
or NetCDF format. For a wider and more complete functionality use
Lw4nc2 application.

        In this map, the latest currents available are represented
(by its direction and speed value). Use the player and the time
slider to check out the currents for previous observations (last
three months are available in this viewer). Active additional
layers (velocity components, magnitude or QC status flags) using
the layer controls located at the top right corner. Double click on
any point of the map to get a time-series plot in that point for
each one of the selected parameters.

        Automatic data processing reports are generated on a
monthly basis in order to extract useful and meaningful information
from HF radar data and system performance. Access to all monthly
reports available since September 2013 up to now.
</gml:description>
<!-- Name -->
<gml:name>socib HF radar</gml:name>
<!-- keywords-->
<sml:keywords>
    <sml:KeywordList>
        <sml:keyword>Oceanography</sml:keyword>
        <sml:keyword>Observatory</sml:keyword>
        <!-- following keywords recommended in D5.13 for netCDF -->
        <sml:keyword>OCEAN CURRENTS</sml:keyword>
        <sml:keyword>SURFACE WATER</sml:keyword>
        <sml:keyword>RADAR</sml:keyword>
        <sml:keyword>SCR-HF</sml:keyword>
```

```
    </sml:KeywordList>
</sml:keywords>
```

The **identification** contains a UUID for technical identification. No other identification is proposed for the monitoring facility.

```
<sml:identification>
    <sml:IdentifierList>
        <sml:identifier>
            <sml:Term
definition="http://vocab.nerc.ac.uk/collection/W07/current/IDEN0007/"
>
                <sml:label>UUID</sml:label>
                <sml:value>2070cc45-5300-4c6b-8604-
147fb70df66d</sml:value>
            </sml:Term>
        </sml:identifier>
    </sml:IdentifierList>
</sml:identification>
```

The **classification** defines the platform_type as recommended in D5.13, as shown in the example below:

```
<sml:classification>
    <sml:ClassifierList>
    <!-- #### PLATFORM_TYPE ############### -->
      <sml:classifier>
        <sml:Term
definition="http://vocab.nerc.ac.uk/collection/W06/current/CLSS0001/"
>
            <sml:label>platform type</sml:label>
            <!-- 17 for coastal structure as recommanded in D5.13 -->
            <sml:value>
      http://vocab.nerc.ac.uk/collection/L06/current/17/</sml:value>
        </sml:Term>
      </sml:classifier>
    </sml:ClassifierList>
</sml:classification>
```

The capabilities of the monitoring facility describes the geographical coverage of the observation produced by this monitoring facility. As follow:

```
<sml:capabilities name="generalProperties">
      <sml:CapabilityList>
          <sml:capability name="horizontalCoverage">
              <swe:Vector
referenceFrame="http://www.opengis.net/def/crs/EPSG/0/4326">
                  <swe:coordinate name="geospatial_lat_min">
                      <swe:Quantity
definition="http://vocab.nerc.ac.uk/collection/W04/current/__TO_BE_DE
FINED__">
                          <swe:uom
xlink:href="http://vocab.nerc.ac.uk/collection/P06/current/DEGN/"/>
                          <swe:value>43.5</swe:value>
                      </swe:Quantity>
                  </swe:coordinate>
                  <swe:coordinate name="geospatial_lat_max">
                      <swe:Quantity
definition="http://vocab.nerc.ac.uk/collection/W04/current/__TO_BE_DE
FINED__">
```

```
                            <swe:uom
xlink:href="http://vocab.nerc.ac.uk/collection/P06/current/DEGN/"/>
                            <swe:value>44.2</swe:value>
                        </swe:Quantity>
                    </swe:coordinate>
                    <swe:coordinate name="geospatial_lon_min">
                        <swe:Quantity
definition="http://vocab.nerc.ac.uk/collection/W04/current/__TO_BE_DE
FINED__">
                            <swe:uom
xlink:href="http://vocab.nerc.ac.uk/collection/P06/current/DEGE/"/>
                            <swe:value>9.1</swe:value>
                        </swe:Quantity>
                    </swe:coordinate>
                    <swe:coordinate name="geospatial_lon_max">
                        <swe:Quantity
definition="http://vocab.nerc.ac.uk/collection/W04/current/__TO_BE_DE
FINED__">
                            <swe:uom
xlink:href="http://vocab.nerc.ac.uk/collection/P06/current/DEGE/"/>
                            <swe:value>10.5</swe:value>
                        </swe:Quantity>
                    </swe:coordinate>
                </swe:Vector>
            </sml:capability>
        </sml:CapabilityList>
    </sml:capabilities>
```

To encode the boundingbox of the observation, new entries for „southernmost_latitude“, „northernmost_latitude“, „westernmost_longitude“, easternmost_longitude“ been requested for registration in BODC vocabulary services, see Annex 5.3

The contact section is used to store name and emails of the funding projects, the PI (assimilated to the owner) and the operational manager. It is encoded as follow:

```
<sml:contacts>
      <sml:ContactList>
          <!-- #### here the operational manager contact ####-->
          <sml:contact>
            <!-- URI for the contact, here OrcID -->
            <gmd:CI_ResponsibleParty uuid="http://orcid.org/0000-0001-
5819-7713">
                <!-- name of the person -->
                <gmd:individualName><gco:CharacterString>Lorenzo
Corgnati</gco:CharacterString></gmd:individualName>
                <!-- name of the organization -->

<gmd:organisationName><gco:CharacterString>CNR/ISMAR</gco:CharacterSt
ring></gmd:organisationName>
                <gmd:contactInfo>
                    <gmd:CI_Contact>
                        <gmd:address>
                            <gmd:CI_Address>
                               <gmd:electronicMailAddress>
                                  <!-- email of the contact -->

<gco:CharacterString>lorenzo.corgnati@sp.ismar.cnr.it</gco:CharacterS
tring>
```

```
                                </gmd:electronicMailAddress>
                            </gmd:CI_Address>
                        </gmd:address>
                    </gmd:CI_Contact>
                </gmd:contactInfo>
                <gmd:role>
                    <!-- CONT0003 is for operator -->
                    <gmd:CI_RoleCode
codeList="http://vocab.nerc.ac.uk/collection/W08/current/"
codeListValue="http://vocab.nerc.ac.uk/collection/W08/current/CONT000
3/"></gmd:CI_RoleCode>
                </gmd:role>
            </gmd:CI_ResponsibleParty>
        </sml:contact>
    </sml:ContactList>
</sml:contacts>
```

At last, the components section, provides the list and references to the description of the sites involved in the observation of the monitoring facility. It is encoded as follow. The URI in attributes xlink:href resolves to sensorML records which are described in site section (see 3.3.4.2).

```
<sml:components>
    <sml:ComponentList>
        <sml:component                                    name="puig_de_galfi"
xlink:href="http://datacloud.ifremer.fr//owncloud/index.php/apps/snan
nyowncloudapi/sml/cec31a2b-9b8c-4689-bf7c-
c50b9968ccc9"></sml:component>
        <sml:component                                     name="formentera"
xlink:href="http://datacloud.ifremer.fr//owncloud/index.php/apps/snan
nyowncloudapi/sml/b8235778-cb1f-43ce-8758-
82db97948647"></sml:component>
    </sml:ComponentList>
</sml:components>
```

3.3.4.2. Site

The site is described by the following attributes:

Name, description, keywords
Identification
Capabilities
TypeOf
Position

Full **example** „HF Radar-sensorml-site.xml“ in annex 5.1.

The **structure** of the sensorML record is as follow:

```
<?xml version="1.0" encoding="UTF-8"?>
<sml:PhysicalSystem xmlns:sml="http://www.opengis.net/sensorml/2.0" xmlns:gco="http://www.isotc211.org/2005/gco" xmlns:
    <!-- Description -->
    <gml:description></gml:description>
    <!-- Name -->
    <gml:name>GALF</gml:name>
    <!-- keywords-->
    <sml:keywords> [5 lines]
    <!-- Identification-->
    <sml:identification> [25 lines]
    <sml:capabilities name="generalProperties"> [17 lines]
    <!-- type OF -->
    <sml:typeOf xlink:href="http://www.ifremer.fr/isi/sensorNanny/emso-yp-sml/basic.Platform.xml"></sml:typeOf>
    <!-- position -->
    <sml:position> [5 lines]
</sml:PhysicalSystem>
```

The **name, description, keyword** section is encoded as seen in the previous examples (see **Erreur ! Source du renvoi introuvable.**).

The **identification** section contains the UUID technical identifier but also identifiers for the manufacturer and model name. When available in WMO or OceanSites references for platform and sites, the identification should be used. The identification can look as follow:

```
<!-- Identification-->
<sml:identification>
   <sml:IdentifierList>
       <sml:identifier>
           <sml:Term
definition="http://vocab.nerc.ac.uk/collection/W07/current/IDEN0007
/">
               <sml:label>UUID</sml:label>
               <sml:value>2070cc45-5300-4c6b-8604-
147fb70df66d</sml:value>
           </sml:Term>
      </sml:identifier>
      <!-- manufacturer -->
      <sml:identifier>
          <sml:Term
definition="http://vocab.nerc.ac.uk/collection/W07/current/IDEN0012
/">
              <sml:label>manufacturer</sml:label>
              <sml:value>CODAR Ocean Sensors. SeaSonde</sml:value>
          </sml:Term>
      </sml:identifier>
      <sml:identifier>
          <sml:Term
definition="http://vocab.nerc.ac.uk/collection/W07/current/IDEN0003
/">
              <sml:label>sensor model</sml:label>
              <sml:value>CODAR SeaSonde</sml:value>
          </sml:Term>
      </sml:identifier>
      <!-- could consider here ICES station, WMO or OceanSites
code,
          however the references are not available yet for HF
radars
          sites, stations or platform codes-->
    </sml:IdentifierList>
</sml:identification>
```

The capabilities section provides information on the technical parametrization of the antenna, as in following example, for frequency and bandwidth, as proposed on SOCIB web site (www.socib.es):

```
<sml:capabilities name="generalProperties">
     <sml:CapabilityList>
        <sml:capability name="frequency">
            <swe:Quantity
definition="http://vocab.nerc.ac.uk/collection/W04/current/CAPB0003
/">
                <swe:uom
xlink:href="http://vocab.nerc.ac.uk/collection/P06/current/UTHZ/"/>
                <!-- MegaHz -->
                <swe:value>13500000</swe:value>
            </swe:Quantity>
        </sml:capability>
        <sml:capability name="bandwidth">
            <swe:Quantity
definition="http://vocab.nerc.ac.uk/collection/W04/current/__TO_BE_
DEFINED__">
                <swe:uom
xlink:href="http://vocab.nerc.ac.uk/collection/P06/current/UTHZ/"/>
                <!-- KHz -->
                <swe:value>90000</swe:value>
            </swe:Quantity>
        </sml:capability>
    </sml:CapabilityList>
</sml:capabilities>
```

New entry for „frequency bandwidth“ has been requested for registration in BODC vocabulary services, see Annex 5.3

This section can be extended depending on the level of details relevant to the data provider. New terms can be defined with BODC by requesting enquiries@bodc.ac.uk.

typeOf can be used to link to a description of the manufacturer's instrument specifications (see example 3.3.2.3). However none is available yet to our current knowledge.

The **position** of the site is encoded as follow:

```
<!-- position -->
<sml:position>
   <!-- horizontal coordinates as a point in WGS84 (lat, lon) -->
   <gml:Point gml:id="stationLocation"
srsName="http://www.opengis.net/def/crs/EPSG/0/4326">
       <gml:coordinates>38.95183 1.21916</gml:coordinates>
   </gml:Point>
</sml:position>
```

3.3.4.3. Observation

The obsvertion is described by the following attributes:

Identifier, description, name
Phenomenon time
resultTime
Procedure
Parameters

FeatureOfInterest
ResultQuality
Result

Full **example** „HF Radar-om.xml“ in annex 5.1.

The **Structure** of the O&M file which encodes this information is as follow:

```
<?xml version="1.0" encoding="UTF-8"?>
<om:OM_Observation gml:id="top"
    xmlns:swe="http://www.opengis.net/swe/2.0"
    xmlns:gmd="http://www.isotc211.org/2005/gmd"
    xmlns:om="http://www.opengis.net/om/2.0"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:xlink="http://www.w3.org/1999/xlink"
    xmlns:gml="http://www.opengis.net/gml/3.2"
    xsi:schemaLocation="http://www.opengis.net/om/2.0 http://schemas.opengis.net/om/2.0/observation.xsd">
    <gml:description>The data set consists of maps of total velocity of the surface current in the North-Western Tyrrhenian Sea and Ligurian Sea av
    <gml:identifier codeSpace="uuid">579104bb51b9e9.59029106</gml:identifier>
    <gml:name>dep0001_hf-radar-ibiza_scb-codarssproc001_L1_2012-10</gml:name>
    <om:type xlink:href="http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_Measurement"/>
    <om:phenomenonTime>
        <gml:TimePeriod gml:id="temporalExtent"> [5 lines]
    </om:phenomenonTime>
    <om:resultTime> [5 lines]
    <om:procedure xlink:href="http://www.ifremer.fr/sml/ad7ec870-2395-4a75-a38f-ccf67fe15136"/>
    <om:parameter>     [6 lines]
    <om:parameter> [6 lines]
    <om:observedProperty/>
    <om:featureOfInterest xlink:href="http://vocab.nerc.ac.uk/collection/S21/current/S21S027/"></om:featureOfInterest>
    <om:resultQuality>                [11 lines]
    <om:result xlink:href="dep0001_hf-radar-ibiza_scb-codarssproc001_L1_2012-10.nc" xlink:role="application/hfr+x-netcdf"  />
</om:OM_Observation>
```

The **identifier, description and name, phenomenonTime, resultTime, FeatureOfInterest, ResultQuality** are described as for fixed station observation (see 3.3.2.4)

The **procedure** section should link to the monitoring facility description in sensorML (see example in 3.3.2.4).

The **parameter** section give details data processing conditions, as shown in the example hereafter:

```
<om:parameter>
        <om:NamedValue>
            <!-- data mode -->
            <om:name xlink:href="to be defined"/>
            <om:value>R</om:value>
        </om:NamedValue>
</om:parameter>
<om:parameter>
        <om:NamedValue>
            <!-- processing level -->
            <om:name xlink:href="to be defined"/>
            <om:value>3B</om:value>
        </om:NamedValue>
</om:parameter>
```

New entries for „data mode“ and „processing level“ have been requested for registration in BODC vocabulary services, see Annex 5.3

The **result** directly links to data file as proposed by INSPIRE, option 2. This option is chosen because the data file is very well self-described. The file type is encoded in the xlink:role attribute which will be useful to activate specific plugin for this type of datasets.

The result is then encoded as follow:

```
<om:result xlink:href="dep0001_hf-radar-ibiza_scb-
codarssproc001_L1_2012-10.nc" xlink:role="application/hfr+x-netcdf"
/>
```

3.3.4.4. Applicable conversions

The tasks on integration of HF radars data and metadata in Copernicus CMEMS or SeaDataCloud have not been initiated yet so the possible mapping of SWE metadata and data to the standard formats of these infrastructures is not defined yet.

However by relying on the documentation written by the HF radar community in the context of the INCREASE project and JERICO-NEXT (D5.13), one can be confident in the possibility of automatically publishing the SWE records to Copernicus or SeaDataNet at a later stage.
The mapping between JERCIO-NEXT D5.13 file format and the proposed SWE profiles is available in annex 5.35.3
.

3.3.5. Flow cytometry

A Flow cytometry observations we consider 2 types of set up:

- In-situ automated analysis (e.g. cytosense instrument)
- Ex-situ analysis, from water samples collected at sea.

They are described with the following records:

Type	Definition (in-situ)	Definition (ex-situ)	format
Platform	A vessel or a buoy hosting	N/A	sensorML
Instrument	Device used to process the water samples, on-board the platform (e.g. cytosense)	Device used to process the water samples, in the laboratory (e.g. BD Influx, FACS Calibur)	sensorML
Observation	Data generated by the analysis of a collection of water samples	Data generated by the analysis of a collection of water samples	O&M

3.3.5.1. Platform

The platform can be a fixed platform, it is then described as detailed in 3.3.2.2. The platform can also be a vessel, for example a research vessel, as in following example:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<sml:PhysicalSystem xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:gmd="http://www.isotc211.org/2005/gmd" xmlns:gco="http://www.isotc211.org/2005/gco"
    xmlns:sml="http://www.opengis.net/sensorml/2.0" xmlns:xlink="http://www.w3.org/1999/xlink"
    xmlns:gml="http://www.opengis.net/gml/3.2" xmlns:swe="http://www.opengis.net/swe/2.0"
    xsi:schemaLocation="http://www.opengis.net/sensorml/2.0 http://schemas.opengis.net/sensorML/2.0/sensorML.xsd"
    gml:id="top">
    <gml:description>THALASSA, IFREMER Research Vessel operated by GENAVIR</gml:description>
    <gml:name>THALASSA</gml:name>
    <sml:identification>        [22 lines]
    <sml:classification> [11 lines]
    <!-- Periode pendant laquelle la description la description courante est applicable -->
    <sml:validTime> [5 lines]
    <sml:contacts> [21 lines]
    <sml:documentation> [20 lines]
    <sml:components>
        <sml:ComponentList>
            <sml:component name="TSG" xlink:href="http://ubisi54.ifremer.fr:8080/sensornanny/record/fc4fe80f-e67f-44be-8a50-2130dc987b4d">
            </sml:component>
            <sml:component name="CINNA" xlink:href="http://ubisi54.ifremer.fr:8080/sensornanny/record/9e6d24d0-bc76-4aef-9d7d-f2bc052dde34">
            </sml:component>
            <sml:component name="CYTOMETER" xlink:href="http://ubisi54.ifremer.fr:8080/sensornanny/record/9e6d24d0-bc76-4aef-9d7d-f2bc052dde38">
            </sml:component>
        </sml:ComponentList>
    </sml:components>
</sml:PhysicalSystem>
```

The example is not detailed here (the file „research-vessel-thalassa.xml“ is availabe in annex 5.1), except for the sub-components which provides links to the descriptions of the instruements hosted on the current platform, including the cytometer when it is deployed on-board a vessel or a fixed platform.

Note that the „country“ characteristic is specifically required by the flow cytometry standardization group (Lahbib et al.). It is encoded using the owner's country in the contact section.

3.3.5.2. Instrument

The cytometer instruement is described by the following attributes:

Description, name, keywords
Identification
Classification
Capabilities
Contacts
TypeOf

Full **example** „cytometer-sensorml-instrument.xml“ in annex 5.1.

The structure of the sensorML XML record is a shown on picture here after:

```
<?xml version="1.0" encoding="UTF-8"?>
<sml:PhysicalSystem xmlns:sml="http://www.opengis.net/sensorml/2.0" xmlns:gco="http://www.isotc211.org/2005/gco" xmlns:gmd="http://www.isotc211.org/2005/
    <!-- Description -->
    <gml:description>Avant toute installation du Cytomètre, l'équipe assure le branchement du système BST (billes, liquide de gaine et toxine) qui permet
    <!-- Name -->
    <gml:name>cytosense de cytobuoy</gml:name>
    <!-- keywords-->
    <sml:keywords> [5 lines]
    <!-- Identification-->
    <sml:identification> [15 lines]
    <sml:classification> [10 lines]
    <sml:capabilities name="generalProperties"> [9 lines]
    <sml:contacts> [35 lines]
    <!-- typeOf, when manufacturer specifications are available in sensorML -->
    <sml:typeOf xlink:href="http://www.ifremer.fr/isi/sensorNanny/emso-yp-sml/basic.Platform.xml"></sml:typeOf>
</sml:PhysicalSystem>
```

The **description, name and keyword** are encoded as usual (see **Erreur ! Source du renvoi introuvable.**).
The **identification** section is used to define a UUID and the serial number of the instrument, as shown on example hereafter:

```
<!-- Identification-->
<sml:identification>
    <sml:IdentifierList>
```

```
        <sml:identifier>
           <!-- UUID -->
           <sml:Term
definition="http://vocab.nerc.ac.uk/collection/W07/current/IDEN0007
">
             <sml:label>UUID</sml:label>
             <sml:value>f3c8dd0d-0249-449d-a59b-
224a14b87f9a</sml:value>
           </sml:Term>
        </sml:identifier>
        <sml:identifier>
            <!-- serial number -->
            <sml:Term
definition="http://vocab.nerc.ac.uk/collection/W07/current/IDEN0005
/">
                <sml:label>serial number</sml:label>
                <sml:value>12345AZ12</sml:value>
             </sml:Term>
         </sml:identifier>
     </sml:IdentifierList>
</sml:identification>
```

The identification might also be used to describe manufacturer or instrument model as shown in 3.3.2.3 alothough not identified as a requirement yet by the group working on cytometer data & metadata standardization in JERICO-NEXT and SeaDataCloud.

The **classification** section is used to identity the type of instrument. The BODC vocabularies are currently being reviewed by the cytometry group, however one can foresee a classification section as follow:

```
<sml:classification>
   <sml:ClassifierList>
       <sml:classifier>
           <sml:Term
definition="http://vocab.nerc.ac.uk/collection/W06/current/CLSS0002
/">
               <sml:label>instrument type</sml:label>
               <!-- code L22:TOOL1102 is for Sysmex Partec CyFlow
Space flow cytometer -->

<sml:value>http://vocab.nerc.ac.uk/collection/L22/current/TOOL1102<
/sml:value>
           </sml:Term>
       </sml:classifier>
   </sml:ClassifierList>
</sml:classification>
```

The **capabilities** section is used to encode the water intake depth, as described here:

```
<sml:capabilities name="generalProperties">
    <sml:CapabilityList>
        <sml:capability name="intakeDepth">
            <swe:Quantity
definition="http://vocab.nerc.ac.uk/collection/W04/current/__TO_BE_
DEFINED___">
                <swe:uom
xlink:href="http://vocab.nerc.ac.uk/collection/P06/current/ULAA/"/>
                <swe:value>2</swe:value>
            </swe:Quantity>
        </sml:capability>
```

```
    </sml:CapabilityList>
</sml:capabilities>
```

New entry for „water intake depth“ has been requested for registration in BODC vocabulary services, see Annex 5.3

The contact section should be used to define the funding projects and the Principal Investigator (called person of interest by the cytometer standardization group, S. Lahbib et al.). They can be encoded as follow:

```
<sml:contacts>
  <sml:ContactList>
     <sml:contact>
        <!-- EDMERP project code -->
        <gmd:CI_ResponsibleParty uuid="12227">
           <gmd:individualName><gco:CharacterString>Patrick
Farcy</gco:CharacterString></gmd:individualName>
           <gmd:organisationName><gco:CharacterString>JERICO-
NEXT</gco:CharacterString></gmd:organisationName>
           <gmd:contactInfo>
              <gmd:CI_Contact>
                 <gmd:address>
                    <gmd:CI_Address>
                       <gmd:electronicMailAddress>
                          <gco:CharacterString>
      Patrick.Farcy@ifremer.fr</gco:CharacterString>
                       </gmd:electronicMailAddress>
                    </gmd:CI_Address>
                 </gmd:address>
              </gmd:CI_Contact>
           </gmd:contactInfo>
           <gmd:role>
             <gmd:CI_RoleCode
codeList="http://vocab.nerc.ac.uk/collection/W08/current/CONT0002"
codeListValue="http://vocab.nerc.ac.uk/collection/W08/current/__TO_
BE_DEFINED__"></gmd:CI_RoleCode>
           </gmd:role>
        </gmd:CI_ResponsibleParty>
    </sml:contact>

    <sml:contact>
       <!-- orcID or any stable URL describing the contact -->
       <gmd:CI_ResponsibleParty uuid="https://www.mio.univ-
amu.fr/spip.php?page%3Dpageperso%26id_user%3D5948">
         <gmd:individualName><gco:CharacterString>Melilotus
Thyssen</gco:CharacterString></gmd:individualName>

<gmd:organisationName><gco:CharacterString>MIO/CNRS</gco:CharacterS
tring></gmd:organisationName>
        <gmd:role>
           <gmd:CI_RoleCode
codeList="http://vocab.nerc.ac.uk/collection/W08/current/CONT0002"
codeListValue="http://vocab.nerc.ac.uk/collection/W08/current/CONT0
004/"></gmd:CI_RoleCode>
        </gmd:role>
      </gmd:CI_ResponsibleParty>
    </sml:contact>
  </sml:ContactList>
</sml:contacts>
```

At last, the typeOf tag can be used to link to manufacturer's specification when available in sensorML format (which is not the case yet). An example has been shown at 3.3.2.3.

3.3.5.3. Observation

The observation and analysis for flow cytometry can be in-situ or ex-situ.
When the observation and analysis is in-situ, thanks to a device deployed onboard a vessel or a fixed platform with automated sample of the sea water through an intake, the observation will be considered as a direct measurement of the environment here the water body (feature of interest). The water samples analysed are actually not preserved so there is no meaning in describing them in this case.
When the observation and analysis is ex-situ, then it is done through the analysis of water samples which have been collected in the previous step of the observation (as described in Figure 7). Then the sample or collection of sample is considered as the featureOfInterest of the observation. The sample collection is not described here.

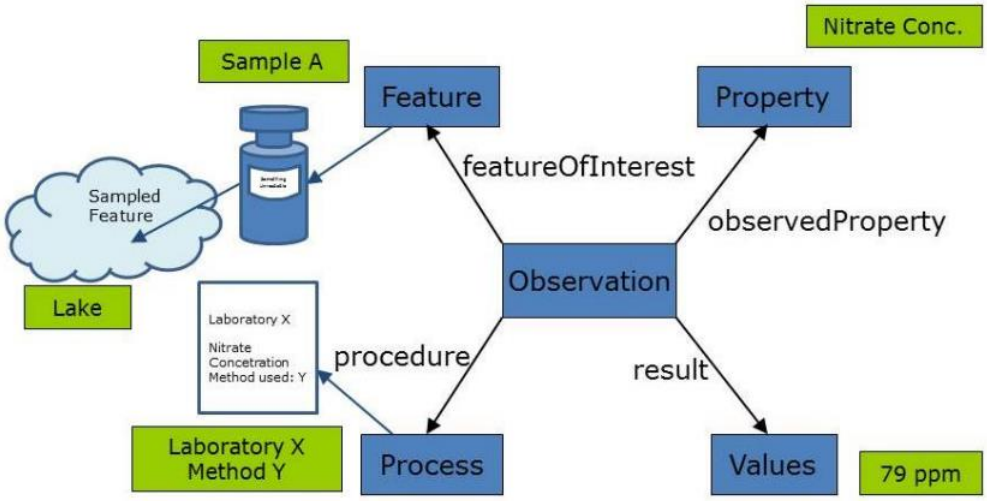


Figure 7:Specimen observation, from INSPIRE recommendation, figure 18

In both cases, the attributes to describe the observation are:

Description, identifier, name
Phenomenon and resultTime
Procedure
Parameters
FeatureOfInterest
Result

The **examples** for both in-situ or ex-situ analysis, „cytometer-om_insitu.xml" and „cytometer-om_exsitu.xml" can be found in annex 5.1.

The **structure** of the SensorML file is as follow. Note that, to handle the sample descriptions, ad-hoc extensions of the standard are added to the namespaces (sampling, samplingSpecimen).

```
<?xml version="1.0" encoding="UTF-8"?>
<om:OM_Observation gml:id="top"
    xmlns:sos="http://www.opengis.net/sos/2.0"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:om="http://www.opengis.net/om/2.0"
    xmlns:gml="http://www.opengis.net/gml/3.2"
    xmlns:xlink="http://www.w3.org/1999/xlink"
    xmlns:sams="http://www.opengis.net/samplingSpatial/2.0"
    xmlns:sf="http://www.opengis.net/sampling/2.0"
    xmlns:swe="http://www.opengis.net/swe/2.0"
    xmlns:spe="http://schemas.opengis.net/samplingSpecimen/2.0"
    xsi:schemaLocation="http://www.opengis.net/sos/2.0 http://schemas.opengis.net/sos/2.0/sosGetObservation.xsd
    http://www.opengis.net/gml/3.2 http://schemas.opengis.net/gml/3.2.1/gml.xsd
    http://www.opengis.net/om/2.0 http://schemas.opengis.net/om/2.0/observation.xsd
    http://www.opengis.net/samplingSpatial/2.0 http://schemas.opengis.net/samplingSpatial/2.0/spatialSamplingFeature.xsd
    http://schemas.opengis.net/samplingSpecimen/2.0 http://schemas.opengis.net/samplingSpecimen/2.0/specimen.xsd
    http://www.opengis.net/sampling/2.0 http://schemas.opengis.net/sampling/2.0/samplingFeature.xsd">
    <!--http://www.opengis.net/sos/2.0 http://schemas.opengis.net/sos/2.0/sosGetObservation.xsd-->
    <gml:description>cytometer analysis done with FACS Calibur on 21/12/2012</gml:description>
    <gml:identifier codeSpace="uuid">579104bb51b9e9.59029106</gml:identifier>
    <gml:name>cytometer analysis 21/12/2012</gml:name>
    <om:type xlink:href="http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_Measurement"/>
    <om:phenomenonTime> [7 lines]
    <om:resultTime> [5 lines]
    <om:procedure xlink:href="http://www.ifremer.fr/sml/ad7ec870-2395-4a75-a38f-ccf67fe15136"/>
    <om:parameter>                [6 lines]
    <om:parameter> [6 lines]
    <om:parameter> [6 lines]
    <om:parameter> [6 lines]
    <om:parameter> [6 lines]
    <om:parameter> [6 lines]
    <om:parameter> [6 lines]
    <om:parameter> [6 lines]
    <om:parameter> [6 lines]
    <om:parameter> [6 lines]
    <om:observedProperty/>
    <om:featureOfInterest> [45 lines]
    <om:result>                [25 lines]
</om:OM_Observation>
```

The **name, identifier and description** are used an detailed in 3.3.2.4..

The phenomenonTime is used to describe the period during which the sample collection has been done. As follow:

```
<om:phenomenonTime>
        <gml:TimePeriod gml:id="temporalExtent">
            <!-- RES_DATEDEB -->
            <gml:beginPosition>2016-12-
10T11:14:00</gml:beginPosition>
            <!-- RES_DATEFIN -->
            <gml:endPosition>2016-12-14T09:00:00</gml:endPosition>
        </gml:TimePeriod>
</om:phenomenonTime>
```

The **resulttIme** is used to describe the data update time. In the current context, for raw data, it is the analysis time. The section is encoded as follow:

```
<om:resultTime>
        <gml:TimeInstant gml:id="updateDate">
            <!--Format 2014-04-04T08:30:29.021042-->
            <gml:timePosition>2017-01-
21T17:22:03</gml:timePosition>
        </gml:TimeInstant>
</om:resultTime>
```

The **procedure** tag provides a reference to the sensorML description of the cytometer instrument. As follow:

```
<om:procedure  xlink:href="http://www.ifremer.fr/sml/ad7ec870-2395-4a75-a38f-ccf67fe15136"/>
```

The **parameter** section is used to encode the different characterics or configuration values of the analysis. The definiition of the common parameters are currently under-definition by the flow cytometry group, a intermediate version of the parameter has been used to propose an example hereafter:

```
    <om:parameter>
        <om:NamedValue>
            <!-- study area, C19 term -->
            <om:name  xlink:title="study area" xlink:href="http://vocab.nerc.ac.uk/collection/__TO_BE_DEFINED__/current/__TO_BE_DEFINED__"/>

<om:value>http://vocab.nerc.ac.uk/collection/C19/current/3_1_1</om:value>
        </om:NamedValue>
    </om:parameter>
    <om:parameter>
        <!-- observation type: in-situ or ex-situ analysis -->
        <om:NamedValue>
            <om:name xlink:title="observation type" xlink:href="http://vocab.nerc.ac.uk/collection/__TO_BE_DEFINED__/current/__TO_BE_DEFINED__"/>
            <om:value>ex-situ</om:value>
        </om:NamedValue>
    </om:parameter>
    <om:parameter>
        <!-- standard reference: the beads used as standard reference for calibration/counts beads  -->
        <om:NamedValue>
            <om:name xlink:title="standard reference" xlink:href="http://vocab.nerc.ac.uk/collection/__TO_BE_DEFINED__/current/__TO_BE_DEFINED__"/>
            <om:value>ref1</om:value>
        </om:NamedValue>
    </om:parameter>
    <om:parameter>
        <!-- clustering method: The method used for clustering  -->
        <om:NamedValue>
            <om:name xlink:title="clustering method" xlink:href="http://vocab.nerc.ac.uk/collection/__TO_BE_DEFINED__/current/__TO_BE_DEFINED__"/>
            <om:value>method2</om:value>
        </om:NamedValue>
    </om:parameter>
    <om:parameter>
        <!-- trigger channel  -->
        <om:NamedValue>
            <om:name xlink:title="trigger channel" xlink:href="http://vocab.nerc.ac.uk/collection/__TO_BE_DEFINED__/current/__TO_BE_DEFINED__"/>
            <om:value>channel3</om:value>
        </om:NamedValue>
    </om:parameter>
    <om:parameter>
        <!-- trigger level  -->
        <om:NamedValue>
```

```
            <om:name xlink:title="trigger level"
xlink:href="http://vocab.nerc.ac.uk/collection/__TO_BE_DEFINED__/cu
rrent/__TO_BE_DEFINED__"/>
            <om:value>12.1</om:value>
        </om:NamedValue>
    </om:parameter>
    <om:parameter>
        <!-- amplification: the amplification used for anaylisis --
>
        <om:NamedValue>
            <om:name xlink:title="amplification"
xlink:href="http://vocab.nerc.ac.uk/collection/__TO_BE_DEFINED__/cu
rrent/__TO_BE_DEFINED__"/>
            <om:value>100</om:value>
        </om:NamedValue>
    </om:parameter>
    <om:parameter>
        <!-- smart trigger -->
        <om:NamedValue>
            <om:name xlink:title="smart trigger"
xlink:href="http://vocab.nerc.ac.uk/collection/__TO_BE_DEFINED__/cu
rrent/__TO_BE_DEFINED__"/>
            <om:value>yes</om:value>
        </om:NamedValue>
    </om:parameter>
    <om:parameter>
        <!-- smart trigger level -->
        <om:NamedValue>
            <om:name xlink:title="smart trigger level"
xlink:href="http://vocab.nerc.ac.uk/collection/__TO_BE_DEFINED__/cu
rrent/__TO_BE_DEFINED__"/>
            <om:value>2.3</om:value>
        </om:NamedValue>
    </om:parameter>
```

New entries have been requested for registration in BODC vocabulary services, as shown in Annex 5.3. While the standardization of the datasets is under definition in JERICO-NEXT and SeaDataCloud, the discussion on these term definitions will be refined and validated this expert group. The list of terms currently identified for observation metadata is, as proposed by the cytometer standardization group (S. Lahbib et al.):
Study area
Observation type
Standard reference
Clustering method
Trigger channel
Trigger level
Amplification
Smart trigger
Smart trigger level

The **featureOfInterest**, when observation type is „in-situ“ is encdoed as follow:

```
<!-- feature of interest is "water body" -->
<om:featureOfInterest
xlink:href="http://vocab.nerc.ac.uk/collection/S21/current/S21S027/
"></om:featureOfInterest>
```

When observation type is „ex-situ“, the featureOfInterest describes as Specimens the collection of samples which are analysed. For each the time of analysis and the operator can be described. Other attributes could be also described and should be defined in relation with the information system used to manage the collection of samples. An example is shown below:

```
<om:featureOfInterest>
        <sf:SF_SamplingFeatureCollection gml:id="sampleCollection">
            <sf:member>
                <SF_Specimen
xmlns="http://www.opengis.net/samplingSpecimen/2.0"
gml:id="sample1">
                    <gml:identifier codeSpace=""></gml:identifier>
                    <gml:name>bottle #23456</gml:name>
                    <sf:sampledFeature
xlink:href="http://vocab.nerc.ac.uk/collection/S21/current/S21S027/
"/>
                    <materialClass/>
                    <samplingTime><gml:TimeInstant
gml:id="sample1SamplingDate"><gml:timePosition>2016-01-
12T12:13:14</gml:timePosition></gml:TimeInstant></samplingTime>
                    <processingDetails>
                        <PreparationStep>
                            <time><gml:TimeInstant
gml:id="sample1ProcessingDate">
                                <gml:timePosition>2017-01-
12T12:13:14</gml:timePosition>
                            </gml:TimeInstant></time>
                            <processOperator><CI_ResponsibleParty
xmlns="http://www.isotc211.org/2005/gmd"
uuid="http://annuaire.ifremer.fr/cv/16987/">
                                <individualName><CharacterString
xmlns="http://www.isotc211.org/2005/gco">Marc
Sourissau</CharacterString></individualName>
                                <!-- operator of the sample -->
                                <role><CI_RoleCode
codeList="http://vocab.nerc.ac.uk/collection/W08/current/"
codeListValue="http://vocab.nerc.ac.uk/collection/W08/current/CONT0
003/"></CI_RoleCode></role>

</CI_ResponsibleParty></processOperator>
                            <processingDetails/>
                        </PreparationStep>
                    </processingDetails>
                </SF_Specimen>
            </sf:member>
            <sf:member>
                <SF_Specimen
xmlns="http://www.opengis.net/samplingSpecimen/2.0"
gml:id="sample2">
                    <gml:identifier codeSpace=""></gml:identifier>
                    <gml:name>bottle #23457</gml:name>
                    <sf:sampledFeature
xlink:href="http://vocab.nerc.ac.uk/collection/S21/current/S21S027/
"/>
                    <materialClass/>
                    <samplingTime/>
                    <processingDetails>
```

```
                        <PreparationStep>
                            <time></time>
                            <processOperator><CI_ResponsibleParty
xmlns="http://www.isotc211.org/2005/gmd"
uuid="http://annuaire.ifremer.fr/cv/16987/">
                                <individualName><CharacterString
xmlns="http://www.isotc211.org/2005/gco">Marc
Sourissau</CharacterString></individualName>
                                <!-- operator of the sample -->
                                <role><CI_RoleCode
codeList="http://vocab.nerc.ac.uk/collection/W08/current/"
codeListValue="http://vocab.nerc.ac.uk/collection/W08/current/CONT0
003/"></CI_RoleCode></role>

</CI_ResponsibleParty></processOperator>
                            <processingDetails/>
                        </PreparationStep>
                    </processingDetails>
                </SF_Specimen>
            </sf:member>
        </sf:SF_SamplingFeatureCollection>
        </om:featureOfInterest>
```

The **result** section is used to store a link with the data file, following examples detailed in 3.3.2.4, for simple CSV or in 3.3.4.3 for self decribing data format (e.g. ODV as it will be defined in SeaDataCloud project). The pictures assicated to the measruement process are referenced with URI in the data file and are not considered then in the O&M.

3.3.5.4. Applicable conversions

The tasks on integration of Flow Cytometry data and metadata integration in JERICO-NEXT and SeaDataCloud have not been finalized yet so the possible mapping of SWE metadata and data to the standard formats of these infrastructures is not defined yet.

However, by relying on the survey and draft documentation written by the flow cytometry data and metadata standardization group (Lahbib et al.) in these projects, one can be confident in the possibility of automatically publishing the SWE records SeaDataNet or OBIS later on.

The mapping between attributes proposed by the standardization group and the proposed SWE profiles is available in annex 5.4.

4. Conclusions

This document provides 10 Sensor Web Enablement templates which will be used to implement the data model of the observatory operator console for the following type of observation: fixed station, HF radar and flow cytometry. They have been validated with the observation experts inputs and the SWE Marine application experts and will be also useful to enable interoperability and streamline the data stream from the data providers operating the observatory to the downstream data services where the data is published (SeaDataNet, Copernicus, EMODnet).
The work done here contributes to the SWE standard implementation in the marine community. Specifically, the model defined in 3.3.5.3 for exsitu flow cytometry is the first attempt of standardization of indirect (through samples) observation procedure description in the marine community.
By embedding this activity in wider perspectives (SWE Marine standardization group, IOC workshop on *Evolving and Sustaining Ocean Best Practices*) this work contributes to the improvement of data sharing practices with solutions for detailed observation context documentation. This is critical for the transparency of environmental research and monitoring.

5. Annexes and references

5.1. Fixed station sensorML and O&M examples

The file used to demonstrate and validate with official OGC schemas the profiles are available on GitHub:

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Project coordinator: Ifremer, France.

5.2. Fixed station SWE mapping to SeaDataNet

sensorML	CDI mapping
Platform/Deployment	
/sml:PhysicalSystem/sml:classification/sml:ClassifierList/sml:classifier/sml:Term[@definition="http://vocab.nerc.ac.uk/collection/W06/current/CLSS0001/"]/sml:value	platform type
/sml:PhysicalSystem/gml:name	station name
-	Alternative station name
/sml:PhysicalSystem/sml:position/gml:Point[@gml:id="stationLocation"]/gml:coordinates	where, lat,lon
/sml:PhysicalSystem/sml:position/gml:Point[@gml:id="stationLocation"]/@srsName	datum
/sml:PhysicalSystem/sml:characteristics/sml:CharacteristicList/sml:characteristic/swe:Quantity[@definition="to be defined"]/swe:value	water depth
/sml:PhysicalSystem/sml:capabilities/sml:CapabilityList/sml:capability/swe:Vector/@referenceFrame	depth reference
/sml:PhysicalSystem/sml:capabilities/sml:CapabilityList/sml:capability/swe:Vector/swe:coordinate/swe:Quantity[@definition="to be defined"]/swe:value	min intrument depth
/sml:PhysicalSystem/sml:capabilities/sml:CapabilityList/sml:capability/swe:Vector/swe:coordinate/swe:Quantity[@definition="to be defined"]/swe:value	max intrument depth
/sml:PhysicalSystem/sml:contacts/sml:ContactList/sml:contact/gmd:CI_ResponsibleParty[./gmd:role/gmd:CI_RoleCode/@codeListValue="http://vocab.nerc.ac.uk/collection/W08/current/CONT0002/"]/gmd:organisationName/gco:CharacterString	contacts/project

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H2020 Framework Programme under grant agreement No. 654410
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/sml:PhysicalSystem/sml:contacts/sml:ContactList/sml:contact/gmd:CI_ResponsibleParty[./gmd:role/gmd:CI_RoleCode/@codeListValue=" http://vocab.nerc.ac.uk/collection/W08/current/CONT0004/"]/gmd:organisationName/gco:CharacterString	contact/originator
Instruments	
/sml:PhysicalSystem/sml:components/sml:ComponentList/sml:component/@name	instrument type
or	
/sml:PhysicalSystem/sml:components/sml:ComponentList/sml:component/@xlink:href > /sml:PhysicalSystem/sml:typeOf/@xlink:href > /sml:PhysicalSystem/gml:name	
Observation (O&M)	
/sos:InsertObservation/sos:observation/om:OM_Observation/gml:name	dataset name
/sos:InsertObservation/sos:observation/om:OM_Observation/gml:description	abstract
	edmed link (completed after ingestion process)
/sos:InsertObservation/sos:observation/om:OM_Observation/om:result/swe:DataArray/swe:values/@xlink:role	data format

	data size (computed)
/sos:InsertObservation/sos:observation/om:OM_Observation/om:result/swe:DataArray/swe:elementType/swe:DataRecord/swe:field /swe:Quantity/@definition	p01 and computed P02, P03, P08
featureof Interest	
/sos:InsertObservation/sos:observation/om:OM_Observation/om:resultTime/gml:TimeInstan/gml:timePosition	dataset creation date
	start date (computed)
	end date (computed)
	temporal resolution (computed)
	sea region (computed)
	quality info (completed after ingestion process)

	lineage (completed after ingestion process)
	contacts/data holding center (completed after ingestion process)
	contact/data publisher (completed after ingestion process)
/sos:InsertObservation/sos:observation/om:OM_Observation/om:result/swe:DataArray/swe:values/@xlink:href	data (ODV time series)

5.3. SWE profile mapping to HF Radar file format (JERICO-NEXT, D5.13)

	JERICO-Next format
sensorML	
monitoring facility	
/sml:PhysicalSystem/gml:name	monitoring facility

/sml:PhysicalSystem/sml:keywords/sml:KeywordList/sml:keyword	keywords
/sml:PhysicalSystem/sml:capabilities/sml:CapabilityList/sml:capability/swe:Vector/swe:coordinate/swe:Quantity[@definition="to be defined"]/swe:value	bounding box, lat min
/sml:PhysicalSystem/sml:capabilities/sml:CapabilityList/sml:capability/swe:Vector/swe:coordinate/swe:Quantity[@definition="to be defined"]/swe:value	bounding box, lat max
/sml:PhysicalSystem/sml:capabilities/sml:CapabilityList/sml:capability/swe:Vector/swe:coordinate/swe:Quantity[@definition="to be defined"]/swe:value	bounding box, lon min
/sml:PhysicalSystem/sml:capabilities/sml:CapabilityList/sml:capability/swe:Vector/swe:coordinate/swe:Quantity[@definition="to be defined"]/swe:value	bounding box, lon max
/sml:PhysicalSystem/sml:classification/sml:ClassifierList/sml:classifier/sml:Term[@definition="http://vocab.nerc.ac.uk/collection/W06/current/CLSS0001/"]/sml:value	source
/sml:PhysicalSystem/sml:contacts/sml:ContactList/sml:contact/gmd:CI_ResponsibleParty[./gmd:role/gmd:CI_RoleCode/@codeListValue="http://vocab.nerc.ac.uk/collection/W08/current/CONT0002/"]/gmd:organisationName/gco:CharacterString	project (contact)
/sml:PhysicalSystem/sml:contacts/sml:ContactList/sml:contact/gmd:CI_ResponsibleParty[./gmd:role/gmd:CI_RoleCode/@codeListValue=" http://vocab.nerc.ac.uk/collection/W08/current/CONT0004/"]/gmd:organisationName/gco:CharacterString	insitution (of the PI)
/sml:PhysicalSystem/sml:contacts/sml:ContactList/sml:contact/gmd:CI_ResponsibleParty[./gmd:role/gmd:CI_RoleCode/@codeListValue=" http://vocab.nerc.ac.uk/collection/W08/current/CONT0004/"]/gmd:individualName/gco:CharacterString	operational manager
/sml:PhysicalSystem/sml:contacts/sml:ContactList/sml:contact/gmd:CI_ResponsibleParty[./gmd:role/gmd:CI_RoleCode/@codeListValue=" http://vocab.nerc.ac.uk/collection/W08/current/CONT0004/"]/gmd:contactInfo/gmd:CI_Contact/gmd:address/gmd:CI_Address/gmd:electronicMailAddress/gco:CharacterString	operational manager email
Site	
	site code (to be defined in oceanSites)
	platform_code (to be defined in WMO)
/sml:PhysicalSystem/sml:position/gml:Point[@gml:id="stationLocation"]/gml:coordinates	location

/sml:PhysicalSystem/gml:name	site
/sml:PhysicalSystem/sml:capabilities/sml:CapabilityList/sml:capability/swe:Quantity[@definition="http://vocab.nerc.ac.uk/collection/W04/current/CAPB0003/"]/swe:value	frequency (exemple SOCIB)
/sml:PhysicalSystem/sml:capabilities/sml:CapabilityList/sml:capability/swe:Quantity[@definition="to be defined"]/swe:value	bandwidth (exemple SOCIB)
/sml:PhysicalSystem/sml:identification/sml:IdentifierList/sml:identifier/sml:Term[@definition="http://vocab.nerc.ac.uk/collection/W07/current/IDEN0012/"]/sml:value	manufacturer
/sml:PhysicalSystem/sml:identification/sml:IdentifierList/sml:identifier/sml:Term[@definition="http://vocab.nerc.ac.uk/collection/W07/current/IDEN0003/"]/sml:value	sensor
O&M	
	data_mode
/om:OM_Observation/gml:identifier[@codeSpace="uuid"]	UUID
/om:OM_Observation/gml:name	title
/om:OM_Observation/gml:description	summary
/om:OM_Observation/om:resultTime/gml:TimeInstant/gml:timePosition	dataset creation date
_	start date (computed)
_	end date (computed)
_	temporal resolution (computed)
_	sea region (computed)
_	quality info (completed after ingestion process)

_	lineage (completed after ingestion process)
_	contacts/data holding center (completed after ingestion process)
_	contact/data publisher (completed after ingestion process)
/sos:InsertObservation/sos:observation/om:OM_Observation/om:result/@xlink:href	data
/sos:InsertObservation/sos:observation/om:OM_Observation/om:result/@xlink:role	format

5.4. SWE profile mapping to flow cytometry common attributes (JERCIO-NEXT, SeaDataCloud, Lahbib et al.)

		shared param synthesis (S.	

		Lahbib et al.)	
SensorML		category	field name
Platform			
	/sml:PhysicalSystem/sml:classification/sml:ClassifierList/sml:classifier/sml:Term[@definition="http://vocab.nerc.ac.uk/collection/W06/current/CLSS0001/"]/sml:value	metadata	platform type
	/sml:PhysicalSystem/sml:identification/sml:IdentifierList/sml:identifier/sml:Term[@definition="http://vocab.nerc.ac.uk/collection/W07/current/IDEN0010/"]/sml:value		platform id
	/sml:PhysicalSystem/sml:classification/sml:ClassifierList/sml:classifier/sml:Term[@definition=""http://vocab.nerc.ac.uk/collection/W06/current/__TO_BE_DEFINED__]/sml:value		platform nationality
	/sml:PhysicalSystem/sml:position/gml:Point[@gml:id="stationLocation"]/gml:coordinates		latitude
	/sml:PhysicalSystem/sml:position/gml:Point[@gml:id="stationLocation"]/gml:coordinates		longitude
Instrument deployed			
	/sml:PhysicalSystem/sml:identification/sml:IdentifierList/sml:identifier/sml:Term[@definition="http://vocab.nerc.ac.uk/collection/W07/current/IDEN0005/"]/sml:value		cytometer id
	/sml:PhysicalSystem/sml:classification/sml:ClassifierList/sml:classifier/sml:Term[@definition="http://vocab.nerc.ac.uk/collection/W06/current/CLSS0002/"]/sml:value		instrument type*
	/sml:PhysicalSystem/sml:capabilities/sml:CapabilityList/sml:capability/swe:Quantity[@definition=""http://vocab.nerc.ac.uk/collection/W04/current/__TO_BE_DEFINED___]/swe:value		intake depth
	/sml:PhysicalSystem/sml:typeOf/@*[namespace-uri()='http://www.w3.org/1999/xlink' and local-name()='href']		manufacturer specifications*

	/sml:PhysicalSystem/sml:contacts[1]/sml:ContactList/sml:contact/gmd:CI_ResponsibleParty[.gmd:rol/gmd:CI_RoleCode/@codeListValue="http://vocab.nerc.ac.uk/collection/W08/current/CONT0004/"]/gmd:individualName/gco:CharacterString		person of interest
	/sml:PhysicalSystem/sml:contacts[1]/sml:ContactList/sml:contact/gmd:CI_ResponsibleParty[.gmd:rol/gmd:CI_RoleCode/@codeListValue="http://vocab.nerc.ac.uk/collection/W08/current/__TO_BE_DEFINED___"]/gmd:individualName/gco:CharacterString		project
O&M (observation)			
	/om:OM_Observation/om:parameter/om:NamedValue[./om:name/@xlink:href="http://vocab.nerc.ac.uk/collection/__TO_BE_DEFINED__/current/__TO_BE_DEFINED__"]/om:value		study area
	/om:OM_Observation/om:featureOfInterest/sf:SF_SamplingFeatureCollection/sf:member/SF_Specimen/processingDetails/PreparationStep/processOperator/CI_ResponsibleParty/individualName/CharacterString		samples operator
	/om:OM_Observation/om:parameter/om:NamedValue[./om:name/@xlink:href="http://vocab.nerc.ac.uk/collection/__TO_BE_DEFINED__/current/__TO_BE_DEFINED__"]/om:value		observation type
	/om:OM_Observation/om:parameter/om:NamedValue[./om:name/@xlink:href="http://vocab.nerc.ac.uk/collection/__TO_BE_DEFINED__/current/__TO_BE_DEFINED__"]/om:value		standard reference
	/om:OM_Observation/om:parameter/om:NamedValue[./om:name/@xlink:href="http://vocab.nerc.ac.uk/collection/__TO_BE_DEFINED__/current/__TO_BE_DEFINED__"]/om:value		clustering method
	/om:OM_Observation/om:parameter/om:NamedValue[./om:name/@xlink:href="http://vocab.nerc.ac.uk/collection/__TO_BE_DEFINED__/current/__TO_BE_DEFINED__"]/om:value		trigger channel
	/om:OM_Observation/om:parameter/om:NamedValue[./om:name/@xlink:href="http://vocab.nerc.ac.uk/collection/__TO_BE_DEFINED__/current/__TO_BE_DEFINED__"]/om:value		trigger level
	/om:OM_Observation/om:parameter/om:NamedValue[./om:name/@xlink:href="http://vocab.nerc.ac.uk/collection/__TO_BE_DEFINED__/current/__TO_BE_DEFINED__"]/om:value		amplification
	/om:OM_Observation/om:parameter/om:NamedValue[./om:name/@xlink:href="http://vocab.nerc.ac.uk/collection/__TO_BE_DEFINED__/current/__TO_BE_DEFINED__"]/om:value		smart trigger
	/om:OM_Observation/om:parameter/om:NamedValue[./om:name/@xlink:href="http://vocab.nerc.ac.uk/collection/__TO_BE_DEFINED__/current/__TO_BE_DEFINED__"]/om:value		smart trigger level

	/om:OM_Observation/om:featureOfInterest/sf:SF_SamplingFeatureCollection/sf:member/SF_Specimen/samplingTime/gml:TimeInstant/gml:timePosition		sampling date
	/om:OM_Observation/om:featureOfInterest/sf:SF_SamplingFeatureCollection/sf:member/SF_Specimen/processingDetails/PreparationStep/time/gml:TimeInstant/gml:timePosition		analysis date
	/om:OM_Observation/om:result/swe:DataArray/swe:values/@xlink:href		file name
data file			
	data file	data	station
	data file		depth
	data file		latitude
	data file		longitude
	data file		
	data file		standardize name
	data file		slection set
	data file		volume
	data file		abundance
	data file		particule number
	data file		mean tot FWS
	data file		SD tot FWS
	data file		Mean tot SWS
	data file		SD tot SWS
	data file		Mean tot FLR
	data file		SD tot FLR
	data file		Mean toto FLO
	data file		SD tot FLO
	data file		Total FL Red HS/ml

	data file		link pic

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