SWE developments in Europe as part of SeaDataNet and Eurofleets

J. Sorribas (UTM-CSIC)
SeaDataNet2 TTG & Eurofleets2 WP13
Ongoing Research Activities

➢ EuroFleets2
  ➢ WP13: Software and Tools
    ➢ [...] The introduction of SWE SensorML technologies to code Ship Sumary Report [...] 
    ➢ [...] Shore to ship e-access and e-maintenance using OGC SWE technology” 
    ➢ [...] Onboard Data Acquisition Prototype on top of SWE standards

➢ SeaDataNet2
  ➢ WP8: Defining an extended metadata format for the CDI to support operational oceanography and other specific applications
    ➢ [...] Define SensorML profiles to describe instrument and sensors [...] 
    ➢ [...] Define O&M data models adapted to the marine observation data [...] 
    ➢ [...] application of these standards will contribute to the streamlining of data and metadata from sensors systems to the data centres [...]
Existing Activity

Motivation
From instrument to User
Increase the level of information provided for:

- Instrumentation used
- Instrument history
  - Calibrations / Configuration
  - Composition
  - Operation and Maintenance
- Complex Data Structures

Use a common way to:

- Access to Real Time Data
- Access to Instrument Descriptions

Enhance existing Metadata descriptors

- Common Data Index
- EDIOS metadata
SWE Adoption

First Steps

Specific Domains

GeoSeas / SeaDataNet

- SWE adoption for Seismic Data (GeoSeas)
  - O&M and SensorML as extensions to the core CDI
  - Allow Seismic line/multiline perspective
  - Enhance Seismic data acquisition description
  - Provide fast & high resolution views
  - New common vocabulary entries
  - Ad-hoc SensorML and O&M files generated with SeaDataNet tools (Mikado)
Existing Activity

SWE Adoption

First Steps

Specific Domains

Seismic

MIKADO

Graphical User Interface
Existing Activity

SWE Adoption

Seismic SensorML

Diviacco, P. et al. 2011 Marine Seismic Metadata for an Integrated European Scale Data Infrastructure
Existing Activity

SWE Adoption

Seismic Profile O&M

Diviacco, P. et al. 2011 Marine Seismic Metadata for an Integrated European Scale Data Infrastructure
Existing Activity

SWE Adoption

Seismic Profile O&M

Diviacco, P. et al. 2011 Marine Seismic Metadata for an Integrated European Scale Data Infrastructure
Integration with existing SeaDataNet Standards

Diviacco, P. et al. 2011 Marine Seismic Metadata for an Integrated European Scale Data Infrastructure
- **Research Vessels**
  - Vessel as a platform (moving and complex instrument)
  - Underway Instrumentation
  - Cruise perspective
    - Cruise instrumentation
    - Events

- **Fixed Stations**
  - Buoys, Moorings, Shore Stations, Seafloor Obs (fixed and complex instrument)
  - Attached instrumentation
  - Project, Series perspective

- **Data**
  - Real Time
  - Historical Data Sets (Project, Cruise, Leg, Site, Sample, ...)

---

**Existing Activity**

**SWE Adoption**

**Ongoing work**
Roadmap

Research vessels & Fixed Stations

Existing Activity

SWE Adoption

Subtask Group

Definition of Scope Services

Definition of Targets

Description of Targets

Initial Decisions Design

Implement Descriptions

Implement Services

Profile formalization

SensorML O&M expression

Architecture definition

Services implementation

Test Cases

Existing Activity

Eurofleets (EARS)

SWE for Research Vessels

EARS

SSR

EVIOR
Eurofleets (Common Calibration Procedures)

Existing Activity

SWE for Research Vessels

Instrument

- Instrument type
- Instrument model
- Date of purchase
- Communication Interface
  - (FSK, Rs323, Rs422, Net)
- Transmission to shore (real time)
  - (GPRS, VSAT, UMTS, Inmarsat, UMTS, Indium)
- Data Storage
  - (PC, internal, Data Logger)
- Operational Depth
  - (Deep water, Shallow/Coastal)
- Basic Sensor (N elements <Sensor>)
- Auxiliary / External Sensor (N elements <Sensor>)

Calibration

- Date & Time
- Sensor / Parameter
- Calibration Method
  - In factory
  - Other
    - Description

Measured Parameter

- Range
- Accuracy
- Date & Time of First Calibration
- Date & Time of last Calibration

Calibration History (N elements <Calibration>)

Instrument Type

<table>
<thead>
<tr>
<th>Model</th>
<th>Date of Purchase</th>
<th>Instrument/Parameter</th>
<th>Calibration History (b/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Auxiliary or External Sensors

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Range</th>
<th>Accuracy</th>
<th>First Calibration</th>
<th>Last Calibration</th>
<th>Calibration History (b/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Choose between 'b/a', 'IKO/OI', 'IKO', and these (Inmarsat, UMTS, M/T)
2. Choose between 'b/a', 'IKO', and these (Inmarsat, UMTS, M/T)
Existing Activity

SWE for Research Vessels

Eurofleets (Calibration in SensorML)
Existing Activity

SWE for Research Vessels

Composite approach

- Calibration & Operations History
- Non-Fixed Instrumentation
- Composition History
- SensorML
- Survey & Operations History
- VESSEL
- Vessel Data
- Calibration & Operations History
- Underway Instrumentation
- Survey Data
- Real Time Data
- SensorML
- O&M
- SensorML
- O&M
Composite approach

SWE for Research Vessels

Working example

http://www.utm.csic.es/SensorWeb/Descriptions
Existing Activity

SWE for Research Vessels
Starting from EDIOS and beyond

- Operational History
- Calibration History
- Instrument/Sensor Package
- EDIOS Series Data
- Real Time Data
- O&M
- SensorML

Diagram:

- Operational History
  - SensorML
- Calibration History
  - SensorML
- Instrument/Sensor Package
  - EDIOS Series Data
  - Real Time Data
  - O&M
  - SensorML
Existing Activity

Instrument SWE for Research Vessels

SWE for Fixed Stations

Instrument
Existing Activity

SWE for Fixed Stations

Data

- Revision date
- Identification
  - Id
  - Acronym
  - Name
  - EDIOS Series Reference
- Where
  - Bounding box
  - Feature of interest
  - Measurement depth
  - Bathymetry depth
- When
  - Bounding Time
- How
  - Sampling Geometry
  - Sampling Rate
  - Procedure
- What
  - Observed Property
    - Property 1
    - Property ...
    - Property N
- Result
  - Parameter Validation
  - Data
    - 1: Link to CDI
    - 2: Link to NetCDF file service
    - 3: Embeded data coded

Instrument / Sensor Package

DataSet
Integration with existing SeaDataNet Standards
Same approach “Seismic”

Existing Activity

SWE for Research Vessels & Fixed Stations
Data models adapted to specific marine observation data

- **SeaDataNet primary focus is on in-situ water column observations:**
  - Profiles: CTD, profiling floats (ARGO), ..
  - PointSeries: moorings, including moorings with different vertical levels, ..
  - Trajectories: thermo-salinometers, gliders, ..
    - Complex Data Structures

- **Should be considered in a next version:**
  - Scanning radar: waves observation with Doppler)
  - Swath: sea bottom observations with multi-beam echo sounder)
  - Grid: analysis, climatologies
  - Grid series: analysis, climatologies
  - Section: Acoustic Doppler Current Profiler, geoseismic profiles
<table>
<thead>
<tr>
<th>Sampling feature type</th>
<th>Invariant coordinates</th>
<th>Free coordinates</th>
<th>Constraint coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point</td>
<td>X,y,z,t</td>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Profile</td>
<td>X,y,t</td>
<td>Z</td>
<td>/</td>
</tr>
<tr>
<td>Profile series</td>
<td>X,y, z[0..n]</td>
<td>t</td>
<td></td>
</tr>
<tr>
<td>Point series</td>
<td>X,y, z</td>
<td>T</td>
<td>/</td>
</tr>
<tr>
<td>Trajectory</td>
<td>/</td>
<td>t</td>
<td>x(t), y(t), z(t)</td>
</tr>
<tr>
<td>Swath</td>
<td>z</td>
<td>t</td>
<td>x(t), y(x)</td>
</tr>
<tr>
<td>ScanningRadar</td>
<td>X,y</td>
<td>T</td>
<td>θ(t), r(θ)</td>
</tr>
<tr>
<td>Section</td>
<td>z[0..n], t[0..m]</td>
<td>/</td>
<td>x(t), y(t)</td>
</tr>
<tr>
<td>Grid</td>
<td>X[0..n], y[0..n], z[0..n], t</td>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>GridSeries</td>
<td>x[0..n], y[0..m], z[0..l], t[0..k]</td>
<td>/</td>
<td>/</td>
</tr>
</tbody>
</table>
Data models adapted to specific marine observation data
Existing Activity

CTD Data example

O&M

Link to CDI

Link to SensorML

Geometry

Embedded expression / point to netCDF / point to ODV
Vocabularies
- Not all terms are found in one vocabulary or term list
- Use URL/URN, better but immutable?
- Repeated terms in different vocabularies. Need mappings

References
- SensorML and O&M could contain several references to other SensorML pieces.
- Use of URL, better
- Immutable links:
  - Permanent proxies, DOI, ...
  - Link SOS service (describeSensor). URL need to be short and KVP (better ?)

ID
- Need common approach to code id values (gml:id=XXX)
Existing Activity

Profiles
- TTG deep review
- Use formal way to specify profiles (schematron, ...)
- Explore new SensorML 2.0 “typeOf” tag
- Formalize as OGC profile

O&M
- Go deep in data models definition

Tools
- Mikado to produce Vessel and Underway instrumentation files / Fixed Stations

Service
- Test over SOS implementation
- Real Time Data access.
  - Ship Summary Report ?
  - Real Time Data from buoys ?
Roles and Effort

- Compile inventory of instrument SensorML records & O&M structures
- Compile inventory of vocab and registry services
- Formalisation of test cases for vessels, fixed platforms
- Install SOS services accessing Real Time underway vessels data. Onshore / Onboard
- Working group to propose templates for SensorML and O&M profiles and data models
- Development of a (smart) client (or clients) and tools to enhance utility
Next Steps & Goal

Next Steps

- Formalize SensorML and O&M profiles
  - Use of minimum common schemas
  - Same vocabularies / mappings
  - Harmonization of implementation details (links, ids, ...)
- Test over SOS existing implementations

Goal

- Integrate SOS prototype with existing Data Services (Data Centers, Vessels, Operator's site)
• Deliver cost-efficient multifunctional sensors (WP3 to 7)
• Launch a more efficient monitoring strategy (WP1)
• Set data in a standard format (WP4 and 9)
• Implement a common data & sensor interface (WP4)
• Reduce the need for human-operated quality control (WP1)
• Calibrate and validate all new sensors and increase its reliability (e.g. antifouling management system)