# Data standards; why are they important and what can they do for oceanography?

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**Abstract**

As oceanographic data volumes and complexity grow with the development of new sensors and observing technologies it is becoming increasingly important to process and distribute data efficiently. To this end the British Oceanographic Data Centre work on the application of oceanographic data and software standardisation at levels from sensor to data delivery, is on-going across a range of European projects. This paper presents a solution which enables exposure of data as both Linked data and by applying the Open Geospatial Consortium Sensor Web Enablement standards and introduces semantic interoperability in the data output formats. The result of this work is to remove the barriers hindering the effective sharing of data across scientific domains and international boundaries.

**Paper**

As oceanographic data volumes and complexity grow with the development of new sensors and observing technologies, it is becoming increasingly important to process and distribute data efficiently. To this end the application of oceanographic data and software standardisation at levels from sensor to data delivery is on-going across a range of European projects. This will make the ingestion and data processing of oceanographic data more efficient and serve new users such as the producers of 'big data' data products and operational data assimilation/ingestion who require data to be unambiguously ingestible and served via APIs that enable machine to machine interaction. The two primary standards being implemented are the application of World Wide Web Consortium (W3C) Linked Data and Open Geospatial Consortium (OGC) Sensor Web Enablement (SWE) standards[1,2].

The implementation of both standards at BODC is on-going via the EU Horizons 2020 BRIDGE, SenseOCEAN and AtlantOS projects and UK funded Celtic Seas project. The solution uses open source tools including ERDDAP, 52North SOS service and linked data software, which operate on top of an internal database holding sensor metadata.

Data modelling, which constitutes a step during Linked data publication, entails data modelling through the use of standardised domain and/or upper ontologies. Sensor metadata and sensor observation data are modelled through the fusion of a set of W3C ontologies namely: The Semantic Sensor Network ontology, the om-lite ontology, the GoodRelations ontology, the Time ontology, the GeoSPARQL ontology, the Provenance ontology and the SKOS ontology. All metadata is then semantically annotated using NERC Vocabulary Server vocabularies and concepts. The fusion of ontologies is shown in figure 1. This enables the storage of metadata sufficient for OGC SensorML, OGC Observations and Measurements, and Linked data based formats such as Semantic Sensor Network (SSN) and JSON-LD.
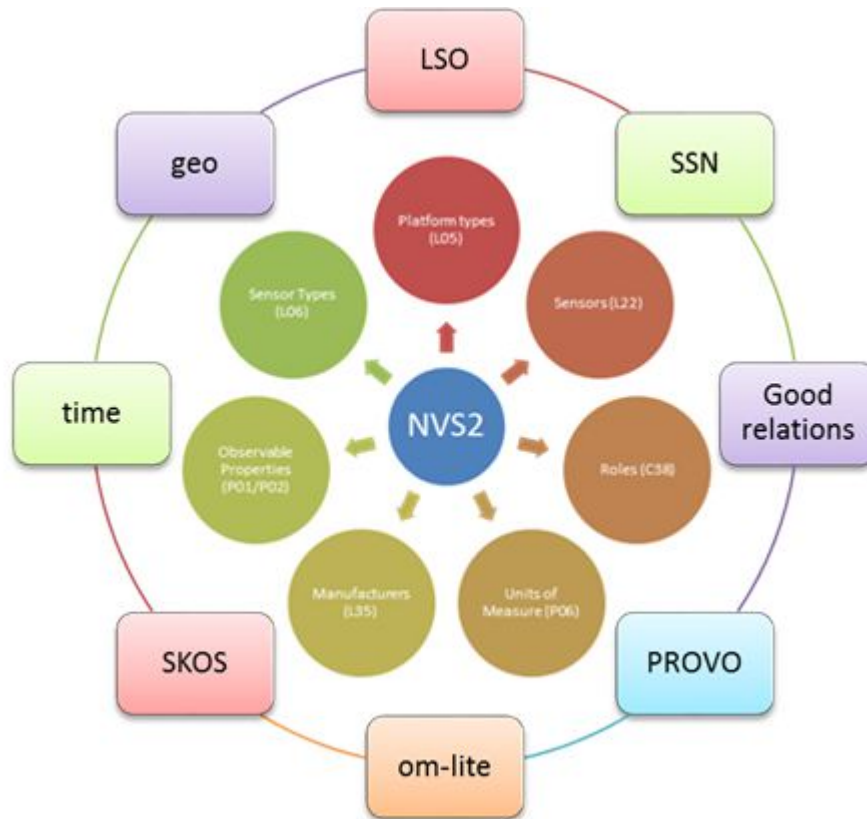
Figure 1: The ontological model used to stored metadata sufficient for production of both SSN and SensorML data descriptions.

In addition to exposing data to new users the application of such standards will make it possible to readily share data internationally via collaborations such as the Ocean Data Interoperability Platform (ODIP). World standards tend to be open and flexible to accommodate several scientific domains and applications, which can result in various incompatible implementations. To overcome this problem, international collaboration is essential, to enhance communication and specialise the standards across the domain. Collaboratively implementing data standards removes the barriers hindering the effective sharing of data across scientific domains and international boundaries.

References:
1.	World	Wide	Web	Consortium.	(2013).	Linked	Data.	Available: http://www.w3.org/standards/semanticweb/data. Last accessed 8th October 2014.
 2.	Open	Geospatial	Consortium.	(2014).	Sensor	Web	Enablement	(SWE).	Available: http://www.opengeospatial.org/ogc/markets-technologies/swe. Last accessed 8th October 2014