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A model for multi-dimensional and formatted sensor data in OGC Observations and Measurements

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Autonomous ocean observation is massively increasing the number of sensors in the ocean. Advances in this data gathering technology mean that we are generating more data than ever before, presenting challenges in data automation, handling geospatial information and linking observations to sensor metadata, the sensor's context that supports scientists on selecting quality sensor data. The Open Geospatial Consortium (OGC) has developed the Sensor Web Enablement (SWE) standards to facilitate integration and interoperability of sensor data and metadata. Observations and Measurements (O&M), one of the core standards in the SWE suite, defines a conceptual schema encoding for observations. However, it was principally designed for handling observations on a data point-by-point basis, requiring administrators to encode data with different dimensions and formats on a case-by-case basis, thereby reducing data integration and automation.

As part of the EU project, SenseOCEAN, the Natural Environment Research Council's (NERC) British Oceanographic Data Centre (BODC) developed the Marine Linked Systems, a SWE and World Wide Web Consortium (W3C) compliant sensor web publication service that publishes sensor metadata in SensorML and Linked Data, and comprises an 'Instance Form' for users to input and manage sensor information. Here we report on an extension to the service by exposing multi-dimensional and formatted sensor observations using O&M. The model used was based on the 'out-of-band' principle which points to external data resources including Digital Object Identifiers (DOIs) whilst still enabling the response model for the OGC Sensor Observation Service (SOS), in this instance a 52north SOS. Thus, different data types were added to the system with minimal effort. In addition, semantic interoperability was enhanced by constraining values using internationally established standardised lists of terms (controlled vocabularies), such as the BODC Parameter Usage Vocabulary (P01), that were published on the NERC Vocabulary Sever (NVS). The NVS is a publicly available service for the marine community based on the W3C Simple Knowledge Organization System (SKOS) where each term has a unique URI that is resolvable through a RESTful interface to either HTML or RDF documents through content negotiation.

Supported by the EU projects, SenseOCEAN, AtlantOS, EMSODev, ENVRIplus, BRIDGES and EMODNet, this model could provide a way to easily integrate data from diverse file-based data repositories and infrastructures allowing users to rapidly discover and assess the quality of sensor data through SWE. Using established and web-resolvable controlled vocabularies helps to harmonise sensor data and information across SWE compliant environmental networks.