Using the OGC SOS Interface for Reporting Ambient Air Quality Data

Simon Jirka, Carsten Hollmann, Matthes Rieke
52°North Initiative for Geospatial Open Source Software GmbH
Münster, Germany
jirka@52north.org

Hans Berkhout
Centre for Environmental Monitoring (MIL)
Rijksinstituut voor Volksgezondheid en Milieu (RIVM)
Bilthoven, The Netherlands
hans.berkhout@rivm.nl

Håkan Blomgren
IVL Svenska Miljöinstitutet
Stockholm, Sweden
hakan.blomgren@ivl.se

Tony Bush
Ricardo-AEA
Harwell, Oxon, United Kingdom
Tony.Bush@ricardo-aea.com

Michel Grothe
Geonovum
Amersfoort, The Netherlands
m.grothe@geonovum.nl

Olav Peeters
Intergewestelijke Cel voor Leefmilieu (IRCEL)
Brussels, Belgium
peeters@irceline.be

Matthew Ross-Jones
Naturvårdsverket
Stockholm, Sweden
Matthew.Ross-Jones@naturvardsverket.se

***Abstract*—This contribution describes experiences gained with the practical application of the OGC Sensor Observation Service (SOS) standard for reporting air quality information of member states to the European Environment Agency (EEA). It is not only shown how the member states are enabled to fulfil environmental reporting obligations but it is also explained how the EEA is able to benefit from the use of the SOS interface.**

Keywords—Sensor Web; OGC, Sensor Observation Service; air quality; e-Reporting

I. Extended Abstract

Over the past years, significant efforts to collect observation data about ambient air quality in Europe have been expended [1], [2]. National air quality measurements have been set-up across the EU since the 1990's and European policies requiring the exchange of the measured data have been established, since a recent revision of the Implementing Provisions for Reporting [3] this also includes "primary up-to-date assessment data". These Implementing Provisions also explicitly refer to a "standardised machine-readable form in line with the requirements of Directive 2007/2/EC" (INSPIRE) [4], hence implicitly mentioning using (Web) services for data transmission. In this context, the European Environment Agency has the task to collect, assess and integrate the measured data of the different member states.

To perform this data collection across political and organizational borders, interoperability is a key factor to reduce the efforts necessary during data integration. For this purpose, a specific data model and encoding - a profile of the ISO/OGC Observations and Measurements (O&M) 2.0 standard - was developed. This data specification is mandatory for all member states when delivering air quality data to the EEA.

However, to ensure the full benefits of interoperability, not only the data model/format but also the way, how this data can be accessed, is important. Although there are no legally binding requirements regarding the specific data access interface, several member states (Belgium, The Netherlands, Sweden and the United Kingdom) as well as the EEA have decided to implement the OGC Sensor Observation Service (SOS) 2.0 interface [5] as a way to exchange and publish the measured air quality data.

The member states are not only intending to use the SOS interface - in this case the open source stand-alone SOS implementation of 52°North - to make their data available for harvesting by the EEA. There are also on-going activities to

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use the SOS interface for building Web applications for visualization and analysis of near-real time information about the collected air quality data. An example for such an application is a project of IRCEL-CELINE (Belgium) that enhances the 52°North JavaScript SOS Client with functionality to process and analyse air quality data with the statistics framework R (see Fig. 1). It is important to state that the underlying SOS framework offers a high degree of flexibility to set-up the SOS interface on top of existing data sources. Different ways how to SOS-enable existing databases (e.g. through database views, abstraction layers such as Hibernate, etc.) are available.

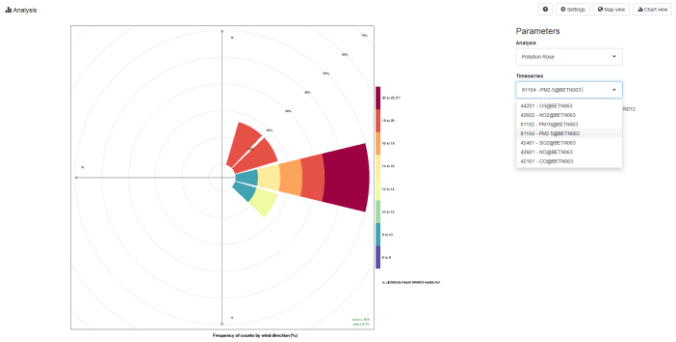

Fig. 1. Pollution rose plot of $PM_{2.5}$ data measured by a Belgian station

At the same time, the EEA is able to connect to the SOS interface offered by the member states for periodically querying new available measurements and to harvest and store this data in the central database of the EEA. In addition, the EEA operates a Sensor Observation Service (based on ArcGIS Server) to publish the quality assured observation data.

Currently, the data of several member states is already available through the SOS interface while further member states are currently investigating how this technology could also be applied in their infrastructures. Thus, there is a good chance that further SOS implementations serving air quality measurements will become available soon.

In summary, this article shows how environment agencies may benefit from the OGC SOS interface. This comprises not only a convenient way to fulfil reporting obligations for environmental data but also a good opportunity to enable the use of collected measurement data to build applications for informing the public or to offer scientists a convenient way to work with and analyse the data coming from multiple sources.

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