Title: A7.5-D3 Profiles for atmosphere

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Working Group:

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Short Description:

This document is the final version of atmosphere scenario. Compare to previous versions the scope has been extended. It contains the data model about air quality that is core to the HUMBOLDT Atmosphere Scenario (for this scenario also the name ‘Galileo Scenario’ is used). In addition it shortly describes a number of data models, standards and projects relevant for Atmospheric data. There is also a change in the list of available data sources: because data of the EEA is now being used in the scenario, a short explanation of this data has been added.

Keywords:

History:

Version	*Author(s)*	*Status*	*Comment*
000	Marian de Vries	new, rfc	
001	Moses Gone	update	Added text about supporting data models (chapter 4)

002	Moses Gone	update	Change in list of data sources
003	Marian de Vries	update, rfc	Extended chapter 4 (figures, examples), textual edits, added list of related projects, glossary.
004	Sisi Zlatanova	final	Check content

Table of contents

1 Introduction

The Atmosphere Scenario is based on air quality data integration and provision through a Location Based Service (LBS). This scenario, demonstrates new possibilities to provide mobile users with air quality information especially adapted to their needs. The purpose of such a service is to offer comprehensive personalized information on air quality depending on users' actual location and profile. The user has access to spatial and atmospheric information using a mobile device. In this regard, the Atmosphere scenario is intended to showcase harmonisation of atmospheric data products.

The Atmospheric Scenario overall objectives in the integration of atmospheric information are to:

- Support initiatives for informing the public on pollution or meteorological data and experts (especially in micro-climate) in collecting or accessing this data.
- Add value to other LBS services and thus promote use of atmospheric data through providing an interface for integration of live sensor data, meteorological world and other location services through a location-based service for the distribution and collection of atmospheric data from dynamic locations (pollution, pollen, weather forecast…)
- Support integration of sensor data using standards to accumulate data from mobile sensors even in urban or other obstructed environments
- Harmonisation of atmospheric and air quality data depending on the user context

The scenario testbeds are Germany and Italy. Currently data is being collected both for Italy and Germany; this data will be used in a Scenario demonstrator application, to showcase atmospheric data harmonisation for location based services. However, Atmosphere scenario is intended to demonstrate harmonisation for users of atmospheric data products anywhere as long as that data is available, including, general public users and professional LBS users who need atmospheric and air quality data. Datasets from the data different providers, i.e. communities, states, and countries are considered in the scenario use cases in order to show not only the harmonisation issues, but how these issues can be dealt with using the HUMBOLDT Framework

The scenario uses HUMBOLDT Framework tools to achieve harmonisation of air quality data and other datasets coming from different agencies, across communities, regions, states and Countries before being served to the users through the LBS. Because of inherent heterogeneities in such datasets, harmonisation is required. Depending on the users' context, the issues could be:

- The different data format and model
- The different parameters
- Different measurement units
- Language differences
- Categorization differences

This document contains the final version of the Profile for the Atmosphere application domain that was developed during the work on the Atmosphere Scenario.

The purpose of the previous versions of this document was to stay close to the Scenario. The purpose of this final version is to take a broader view: the focus is not only on the Scenario but more in general on the application domain the Scenario belongs to. For that reason a number of related data models are shortly presented in Chapter 4. These other data models are:

- OGC Observations & Measurements
- OGC Sensor Model Language (SensorML)
- Climate Science Modelling Language

There are many initiatives and projects that have comparable goals and/or use comparable data as is the case in the Atmosphere Scenario. Chapter 5 lists these related projects.

2 Scope of the Profile

Based on a previous inventory it was decided what belongs in the Profile for Atmosphere.

To summarize, the use cases of the Atmosphere Scenario had to do with:

- air quality, air pollution
- weather measurements

For the final application domain Profile (Atmosphere) the following items were added:

- a weather information model
- how to describe (with metadata) and manage sensors

3 Profile for air quality monitoring

Three kinds of geospatial data is used in the Atmosphere Scenario:

- Air quality data, in particular measurements of the concentration of: Ozone, particles, Sulphur dioxide, Carbon monoxide, Nitrogen Dioxide (and its oxides) etc.
- Secondly, the scenario uses real-time weather data collected from airports.
- As third type of information, other LBS data is used, such as point of interests and base layers.

For the first two data sources a short description follows, in sections 3.1 and 3.2. The combined data model for air quality and weather conditions, is presented in section 3.3.

3.1 Air Quality

The Air quality data used in the scenario are obtained from the European Environmental Agency (EEA). Data from more than 700 air quality measurement stations across Europe are transmitted to the EEA in Copenhagen on an hourly basis. Since the data must be as 'real-time' as possible, the data are displayed as soon as practical after the end of each hour.

The data files are a 1-to-1 match of the files EEA receives from the data providers. Only difference is that the files have been harmonised into one xml encoding, with the same component identifier, the data provider has been validated etc. These files are then pushed to another service, that tracks and publishes the changes on an hourly basis, see
http://dataconnector.eea.europa.eu/airqualityexport/EoE/latest/current.xml

An example is the fragment below, with O3 and NO2 measurements for the centre of London:

```
- <station>
    <code>GB0743A</code>
    <name>LONDONWESTMINSTER</name>
    <type>Background</type>
    <longitude>-0.13168100</longitude>
    <latitude>51.49333200</latitude>
    <timestamp>2010-07-05 18:00</timestamp>
  - <measurements>
    - <measurement component="O3" start="2010-07-05 18:00"
        stop="2010-07-05 19:00">
        <value type="average">50</value>
      </measurement>
    - <measurement component="NO2" start="2010-07-05 18:00"
        stop="2010-07-05 19:00">
        <value type="average">29</value>
      </measurement>
    </measurements>
  </station>
```


On average the currency of the data is 30 minutes older than if the data is extracted and processed as they come in from the data providers. But, it should be noted that some data providers deliver more near-real time than others. For some, the data are 1 day old, for others it is 2 hours and the average is around 4 hours.

3.2 Weather data

As source for the weather situation the METAR reports are very useful.

METAR (METeorological Aviation Report) is a format for reporting weather information. METAR reports typically come from airports or permanent weather observation stations. A typical METAR report contains data for the temperature, dew point, wind speed and direction, precipitation, cloud cover and heights, visibility, and barometric pressure. A METAR report may also contain information on precipitation amounts, lightning, and other information that would be of interest to meteorologists.

Title:

Output produced by METARs form (2039 UTC 14 November 2008)
found at http://adds.aviationweather.noaa.gov/metars/index.php

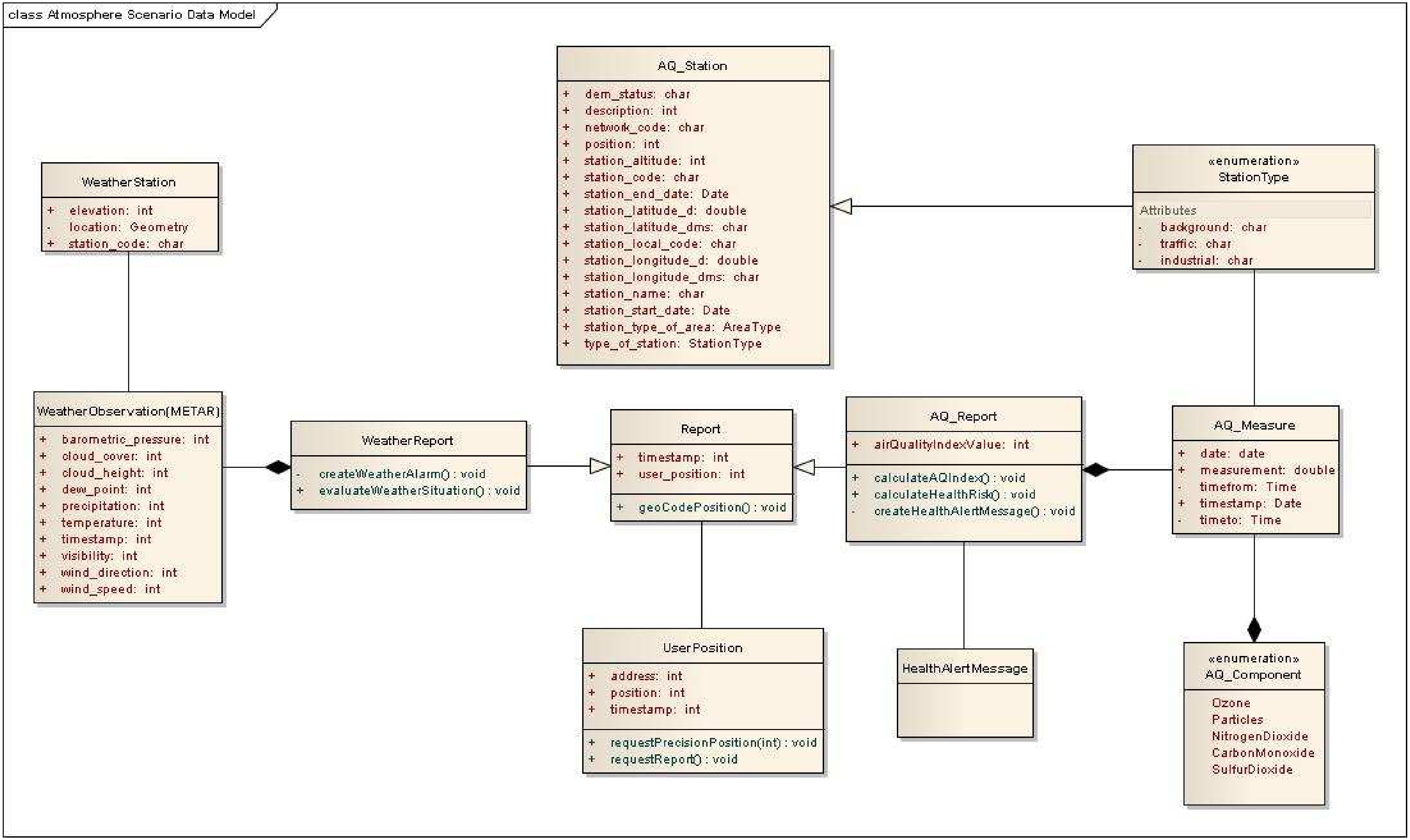
METAR text:	**EHRD 142025Z 24015KT 3800 -DZ BR SCT003 SCT004 BKN005 11/11 Q1024 TEMPO BKN004**
Conditions at:	EHRD (ROTTERDAM AIRPOR, NL) observed 2025 UTC 14 November 2008
Temperature:	11.0°C (52°F)
Dewpoint:	11.0°C (52°F) [RH = 100%]
Pressure (altimeter):	30.24 inches Hg (1024.0 mb)
Winds:	from the WSW (240 degrees) at 17 MPH (15 knots; 7.8 m/s)
Visibility:	2.36 miles (3.80 km)
Ceiling:	500 feet AGL
Clouds:	scattered clouds at 300 feet AGL scattered clouds at 400 feet AGL broken clouds at 500 feet AGL
Weather:	-DZ BR (light drizzle, mist)

Forecast for:	EHRD (ROTTERDAM AIRPOR, NL)
Text:	**EHRD 141710Z 1418/1524 23012KT 4500 BR -DZ SCT004 BKN006**
Forecast period:	1800 UTC 14 November 2008 to 0000 UTC 16 November 2008
Forecast type:	FROM: standard forecast or significant change
Winds:	from the SW (230 degrees) at 14 MPH (12 knots; 6.2 m/s)
Visibility:	2.80 miles (4.51 km)
Ceiling:	600 feet AGL
Clouds:	scattered clouds at 400 feet AGL broken clouds at 600 feet AGL

An important advantage is that the data service that output the METAR reports can be used free of charge and is therefore interesting for non-profit research and development projects. A disadvantage is that the METAR service output is not self-explanatory, as can be seen in the example below. The output is formatted as HTML in this example, to make it human readable, but the data stream consists of text records that look like the line to the right of "METAR text". Additional processing is needed to convert the text records into (geo)data that can be further used for calculation of air quality or other derived information.

3.3 Common data model

Figure 1 below shows the common data model that was developed in the Atmosphere Scenario. It combines the weather observations and air quality measurements. Another essential information item is the location of the user.


class Atmosphere Scenario Data Model
AQ_Station
+ dem_status: char
+ description: int
+ network_code: char
+ position: int
+ station_altitude: int
+ station_code: char
+ station_end_date: Date
+ station_latitude_d: double
+ station_latitude_dms: char
+ station_local_code: char
+ station_longitude_d: double
+ station_longitude_dms: char
+ station_name: char
+ station_start_date: Date
+ station_type_of_area: AreaType
+ type_of_station: StationType
WeatherStation
+ elevation: int
- location: Geometry
+ station_code: char
«enumeration»
StationType
Attributes
- background: char
- traffic: char
- industrial: char
WeatherObservation(METAR)
+ barometric_pressure: int
+ cloud_cover: int
+ cloud_height: int
+ dew_point: int
+ precipitation: int
+ temperature: int
+ timestamp: int
+ visibility: int
+ wind_direction: int
+ wind_speed: int
WeatherReport
- createWeatherAlarm() : void
+ evaluateWeatherSituation() : void
Report
+ timestamp: int
+ user_position: int
+ geoCodePosition() : void
AQ_Report
+ airQualityIndexValue: int
+ calculateAQIndex() : void
+ calculateHealthRisk() : void
- createHealthAlertMessage() : void
AQ_Measure
+ date: date
+ measurement: double
- timefrom: Time
+ timestamp: Date
- timeto: Time
UserPosition
+ address: int
+ position: int
+ timestamp: int
+ requestPrecisionPosition(int) : void
+ requestReport() : void
HealthAlertMessage
«enumeration»
AQ_Component
Ozone
Particles
NitrogenDioxide
CarbonMonoxide
SulfurDioxide

4 Related data models

For applications that measure atmospheric phenomena such as air quality, temperature or other weather conditions a number of OGC standards are relevant. In this chapter a short overview is given of the Sensor Model Language (Sensor ML), and the Observation and Measurements set of data models.

The interdependencies of these OGC standards is shown in Figure 2.

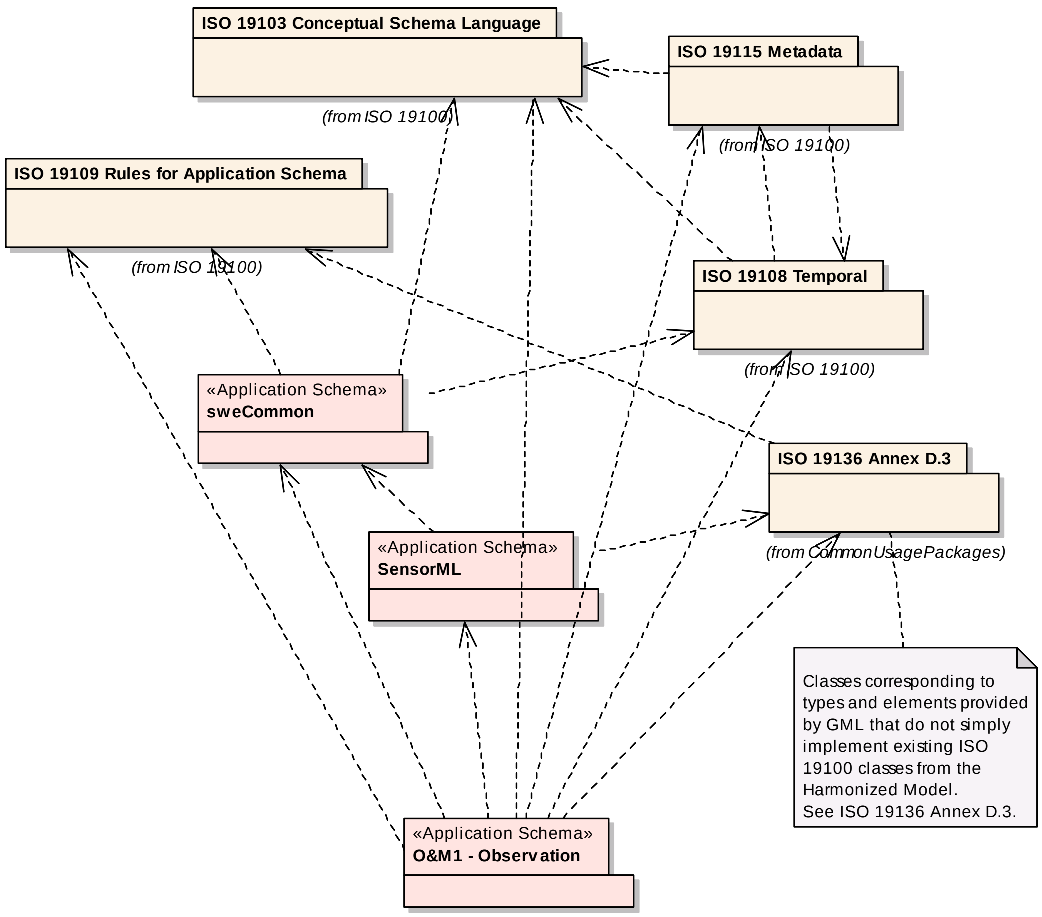


Figure 2: Dependencies between application schemas in Sensor Web context, source: OGC 2007b

As can be seen in this figure, both SensorML and Observations & Measurements are based on the ISO 19xxx set of standards.

4.1 OGC Observations & Measurements

Observations & Measurements (OM) provides general models and schema for supporting the packaging of observations from sensor system and sensor-related processing. The O&M Observation XML encoding is very general in the sense that the result can be packaged in any structure specified in XML. The Observation and Measurement (O&M) standard defines an abstract model and an XML schema encoding for observations and measurements. This framework is required for use by other OGC Sensor Web Enablement (SWE) standards as well as for general support for OGC compliant systems dealing in technical measurements in science and engineering.

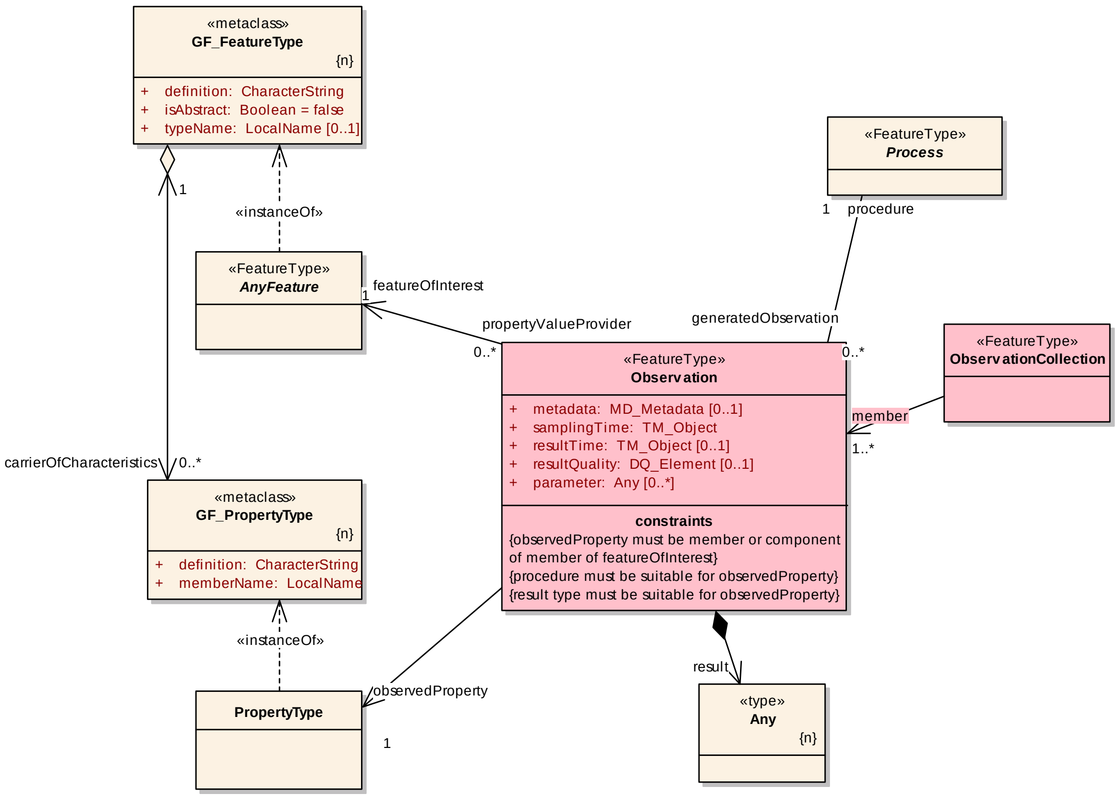


Figure 3: Core of the O&M data model: the Observation feature class (source: OGC 2007b)

The aim of O&M is to define terms used for measurements and the relationships between them, mainly to improve the ability of software systems to discover and use live and archived digital data produced by measuring systems. The scope of the specification covers observations and measurements whose results may be quantities, categories, temporal and geometry values, coverages, and composites and arrays of any of these.

Figure 3 shows the core class of the O&M data model: the 'Observation' feature type.

4.2 SensorML

SensorML (Sensor Model Language) is an OGC implementation standard that provides data and process models and an XML encoding for sensor measurements and processes, including methods for deriving higher-level information from sensor observations.

Processes described in SensorML define their inputs, outputs, parameters, and methods, as well as provide relevant other metadata. With SensorML detectors and sensors can be modeled as processes that convert measured phenomena into (geo)data.

Applications that use sensor data as input have to be able to process series of data items that somehow have to be kept together in aggregate data types. The DataArray data type is an example of this, see Figure 4.

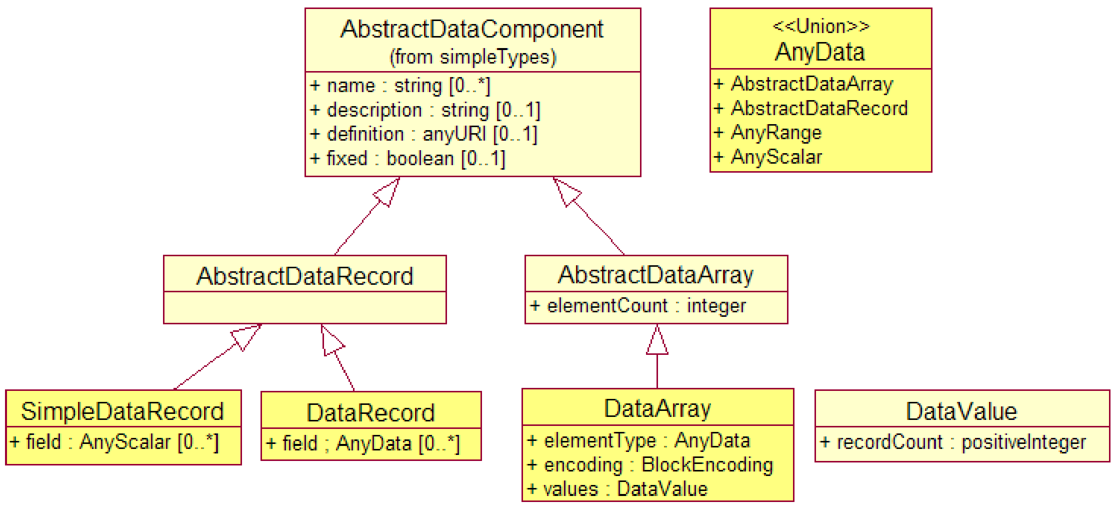


Figure 4: SensorML: model elements for data aggregates (source: OGC 2007a)

With SensorML there are several options when it comes to the actual data format (the encoding). For singular values there is a 'value' element:

```
<swe:DataRecord definition="urn:ogc:def:property:OGC:atmosphericConditions">
    <swe:field name="AirTemperature">
        <swe:Quantity definition="urn:ogc:def:property:OGC:AirTemperature">
                <swe:uom code="Cel"/>
                <swe:value> 35.1 </swe:value>
        </swe:Quantity>
    </swe:field>
    <swe:field name="WindSpeed">
        <swe:Quantity definition="urn:ogc:def:property:OGC:WindSpeed">
                <swe:uom code="m/s"/>
                <swe:value> 6.5 </swe:value>
        </swe:Quantity>
    </swe:field>
```

Series of measurements can however be encoded as text block, with the 'header' information included in the DataArray element (see Annex C for the complete fragment):

```
    <swe:values>
        2006-10-05T12:30:00Z 35.1 950.0 32.0 clear,
        2006-10-05T13:00:00Z 35.8 940.0 331 clear,
        2006-10-05T13:30:00Z 36.5 938.0 35.8 hazy,
        2006-10-05T14:00:00Z 38.0 935.0 37.0 cloudy
    </swe:values>
</swe:DataArray>
```

4.3 CSML (Climate Science Modelling Language)

CSML is a standards-based data model and GML (Geography Markup Language) application schema for atmospheric and oceanographic data. The key subcomponents of CSML are:

- Feature Type Definitions: A set of UML conceptual models ('feature types') for a range of atmospheric and oceanographic data types, based on the framework and components provided by ISO standards for geospatial information modelling.
- CSML itself (an application schema of GML), built around these feature types providing a standards-based reference encoding for atmospheric and oceanographic datasets.

See the CSML user guide for further information about the CSML data model and XML encoding (Woolf and Lowe, 2007).

5 Related projects

Air4EU, http://www.air4eu.nl/index.html

APNEE (Air Pollution Network for Early warning and information Exchange) (FP5), see e.g. Peinel and Rose, 2004

CITEAIR (Common Information to European Air) (INTERREG IIIC), http://citeair.rec.org/ and http://www.airqualitynow.eu/

COST (2003). Format Specification for COST-716 Processed GPS Data. Version 2.0, COST Action 716.

European Environment Agency (EEA), Ozone map (see: links to national data providers), http://www.eea.europa.eu/maps/ozone/resources/about-the-data

Elshout, S. v. d. and K. Léger (2007). Comparing Urban Air Quality Across Borders. A review of existing air quality indices and the proposal of a common alternative, DCMR, Environmental Protection Agency Rijnmond.

EMEP (European Monitoring and Evaluation Programme), http://www.emep.int/

European Commission, DG Environment, Air policy, http://ec.europa.eu/environment/air/index_en.htm

European Topic Centre on Air and Climate Change (ETC/ACC), http://air-climate.eionet.europa.eu/

EUMETNET (Network of European Meteorological Services), http://www.eumetnet.eu/

FAIRMODE (Forum for Air Quality Modelling in Europe), http://pandora.meng.auth.gr/modnet/

Met Office (UK), Air quality forecasts, http://www.metoffice.gov.uk/environment/aq/index.html

NOAA's National Weather Service Air Quality Forecast (USA), http://www.nws.noaa.gov/aq/

Peinel, G. and T. Rose (2004). Dissemination of Air Quality Information: Lessons Learnt in European Field Trials. EnviroInfo 2004, 18th International Conference "Informatics for Environmental Protection"

CERN, Geneva, Switzerland.

TOUGH (Targeting Optimal Use of GPS Humidity Measurements in Meteorology), http://web.dmi.dk/pub/tough/

WMO (2010). WIGOS standardization framework for data and associated metadata.

6 References

OGC (2007a). OpenGIS® Sensor Model Language (SensorML) Implementation Specification, Version: 1.0.0. OGC® 07-000

OGC (2007b). Observations and Measurements – Part 1 - Observation schema. Version: 1.0. OGC 07-022r1

Woolf, A. and D. Lowe (2007). Climate Science Modelling Language, Version 2. User's Manual.

7 Glossary

CSML = Climate Science Modelling Language

CSV = ‘Comma Separated Values’ file format

ephemeris (plural: ephemerides) = data about satellite's position and velocity

E-GVAP = EUMETNET GPS water vapour programme

EUREF = the IAG Reference Frame Subcommission for Europe, http://www.euref-iag.net/

GNSS = Global Navigation Satellite System (generic term for satellite-based navigation/positioning systems)

GPS = Global Positioning System

IGS = International GNSS Service (formerly the International GPS Service)

ITRF = International Terrestrial Reference Frame

METAR (METeorological Aviation Report) = format for reporting weather information

RINEX = Receiver INdependent EXchange format = for exchange of GPS data (including time, phase and range)

SINEX = Solution (Software/technique) INdependent EXchange Format

TEC = Total Electron Content

WIGOS = WMO Integrated Global Observing System

WMO = World Meteorological Organization

ZTD = Zenith Total Delay

ZWD = Zenith Wet Delay (component of ZTD due to water vapour)

Annex A: Data harmonisation requirements

The specification of the Profile for Atmosphere that is presented in this document took place in the context of the development of use cases in the HUMBOLDT scenario with that name. As part of the information analysis phase also the main data harmonisation issues in the scenario were identified. For documentation purposes this list is included below.

1 Data format

The Air Quality data for both Italy and Germany are available as text files (CSV and XML). During extraction, these datasets are modelled into point features in a spatially enabled MYSQL database. Thus after extraction the data is available as vector (GML) data sets (e.g. AQ_Measures). This is also the case with METAR information, which is obtained as an XML file format, and which is then extracted in the same way as the Air quality data into a common target schema. Since data for both Italy and Germany are sourced from the same data provider, the issue of format heterogeneity does not arise. These point vector data is what is used to generate the raster data formats include geoTIFF to represent a continuous surface coverage for a given air quality component. Thus, any mismatches between the raw source data are handled during extraction to a common target schema.

2 Spatial and temporal reference systems

The spatial reference systems (SRS) used in both data sources (Air Quality and METAR) is WGS84 (EPSG 4326), there coordinate transformation is not required. However, this might not be the case with other base layers required in the scenario.

3 Conceptual data model

The conceptual data models for the Air quality datasets do not differ between the two countries focused in the Scenario. Currently, row measures for data quality are extracted and 'harmonized' before being stored in a common database schema. Thus even though the source data are different in terms of schemas, once extracted the differences are removed and only a common model exists.

3.1 Geometry types

The air quality measures are modelled as point geometry types. During interpolation, the point datasets are used to generate surfaces (coverages).

3.2 Identification and Versioning

The scenario is based on real time data provision, so the interest is only on the most current data. However, it might also be useful to provide trend maps, to show how the air quality improves or degenerates along a given timeline. Consequently, at the moment, it is not clear yet, if it's important to keep versions (history) of data.

3.3 Importance of time (temporal attributes)

There are timestamp attributes for the air quality measurements and weather measurements. However this information is only important for determining the most current data, as the scenario is based on real time data provision

4 Classification

There are a number of codelists and enumerations in the source as well as the target data model. For instance the ISO air quality component codes. However, since these are already standardised, both data sources are coded using the same codes hence problem of classification do not arise. However what is not clear yet is the classification of different categories of component concentration

5 Terminology

Same terminologies are used.

6 Metadata

Currently metadata exists but is not described in a standardised way. For instance information on the air quality component is described in the Air quality directive.

7 Scale/resolution, level-of-detail, aggregation

The raster data representing each component is generated from the same process hence the outcome is the same in terms of resolution, and level of detail.

8 Portrayal

Only individual values are returned to the users, so no portrayal is required.

9 Processing functions

Point data are interpolated to generate surfaces. This is achieved via a Interpolation surface generator WPS)

10 Multi-linguality

All source data is available in English, however in the application since we have different categories of users with different language requirements, attribute values may need to be translated to another language according to the user language requirements.

11 Priorities

The following table summarizes the harmonisation needs and their priority for the Atmosphere Scenario.

Issue	Relevance/priority	Existing solution	Harmonisation strategy
Data/Exchange format	medium	Currently, raw dataset is translated to the internal format	Harmonisation is dealt with during data retrieval(The Data retrieval system only retrieves the datsets as defined by the application schema)
Spatial reference system, reference grids	very important	Conversion-transformation tools	Italian data is based on the Gauss Boaga Datum Roma 40 reference, while German Data is in Gauss Krüger zone 3. Harmonisation approach: choice between: - Rely on transformation capabilities of the GIS client; - Common reference system / Coordinate transformation beforehand.
Conceptual data model	important	Germany and Italian datasets currently are not explicitly defined in a data model.	
Classification systems/schemes	Important	Common nomenclature and classification	German and Italian datasets have different classification schemes especially the generated air quality map.
Terminology/vocabulary	Medium/low		Harmonisation approach: shared terminology on threat levels
Multi-linguality	High		Harmonisation approach: Air quality information reported to users in different languages (Italian and German). Choice must be made between automatic translation using generic translation software, or translation based on classification mappings done by experts beforehand.
Processing functions (parameters and formulas/algorithms)	High	Web Processing Services	All the measured components need to be interpolated to generate a continous surface feature representation. This will be achieved via an Interpolation WPS

Positional Accuracy consistency between datasets	important	Data quality actions	Because the air quality map is derived from point data. The result of interpolation must give an accurate representation for air quality in any given location.

Title:

Annex B: EEA Air Quality application schema

```xml
<?xml version="1.0" encoding="utf-16"?>
<xs:schema xmlns="http://OzoneData.MeasurementExchangeFormat_v2_extern_combined"
xmlns:b="http://schemas.microsoft.com/BizTalk/2003"
targetNamespace="http://OzoneData.MeasurementExchangeFormat_v2_extern_combined"
xmlns:xs="http://www.w3.org/2001/XMLSchema">
 <xs:element name="Root">
  <xs:complexType>
   <xs:sequence>
    <xs:element minOccurs="1" maxOccurs="1" name="Header">
     <xs:complexType>
      <xs:sequence>
       <xs:element name="version" type="xs:string" />
       <xs:element name="name" type="xs:string" />
       <xs:element name="description" type="xs:string" />
       <xs:element minOccurs="0" name="organisation_url" type="xs:string" />
       <xs:element minOccurs="0" maxOccurs="1" name="logo_url" type="xs:string" />
       <xs:element minOccurs="0" maxOccurs="1" name="contact" type="xs:string" />
       <xs:element minOccurs="0" maxOccurs="1" name="timezone" type="xs:string" />
       <xs:element minOccurs="0" maxOccurs="1" name="country_isocode" type="xs:string" />
      </xs:sequence>
     </xs:complexType>
    </xs:element>
    <xs:element minOccurs="1" maxOccurs="1" name="Data">
     <xs:complexType>
      <xs:sequence>
       <xs:element minOccurs="0" maxOccurs="unbounded" name="station">
        <xs:complexType>
         <xs:sequence>
          <xs:element minOccurs="0" name="name" type="xs:string" />
          <xs:element name="code" type="xs:string" />
          <xs:element minOccurs="0" name="type" type="xs:string" />
```

```
                <xs:element name="area" type="xs:string" />
                <xs:element minOccurs="0" name="longitude" type="xs:string" />
                <xs:element minOccurs="0" name="latitude" type="xs:string" />
                <xs:element minOccurs="0" name="altitude" type="xs:string" />
                <xs:element minOccurs="0" maxOccurs="unbounded" name="measurement">
                  <xs:complexType>
                    <xs:sequence>
                      <xs:element name="component" type="xs:string" />
                      <xs:element minOccurs="0" maxOccurs="1" name="datetime_from" type="xs:string"
/>
                      <xs:element minOccurs="0" maxOccurs="1" name="datetime_to" type="xs:string" />
                      <xs:element minOccurs="0" maxOccurs="1" default="60" name="averaged_time"
type="xs:string" />
                      <xs:element name="value" type="xs:string" />
                      <xs:element default="1" name="quality_assurance" type="xs:string" />
                      <xs:element default="1" name="quality_control" type="xs:string" />
                    </xs:sequence>
                  </xs:complexType>
                </xs:element>
              </xs:sequence>
            </xs:complexType>
          </xs:element>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
  </xs:sequence>
 </xs:complexType>
</xs:element>
</xs:schema>
```

Annex C: SensorML example

Source: OGC 2007a

```
<swe:DataArray>
    <swe:elementCount>
        <swe:Count definition="urn:ogc:def:property:OGC:timeSteps">4</swe:Count>
    </swe:elementCount>
    <swe:elementType>
        <swe:DataRecord definition="urn:ogc:def:property:OGC:atmosphericConditions">
            <swe:field name="Time">
                <swe:Time definition="urn:ogc:def:property:OGC:Time">
                        <swe:uom xlink=" urn:ogc:def:unit:ISO:8601"/>
                </swe: Time>
            </swe:field>
            <swe:field name="AirTemperature">
                <swe:Quantity definition="urn:ogc:def:property:OGC:AirTemperature">
                        <swe:uom code="Cel"/>
                </swe:Quantity>
            </swe:field>
            <swe:field name="AtmosphericPressure">
                <swe:Quantity definition="urn:ogc:def:property:OGC:AtmosphericPressure">
                        <swe:uom code="hPa"/>
                </swe:Quantity>
            </swe:field>
            <swe:field name="RelativeHumidity">
                <swe:Quantity definition="urn:ogc:def:property:OGC:RelativeHumidity">
                        <swe:uom code="%"/>
                </swe:Quantity>
            </swe:field>
            <swe:field name="Visibility">
                <swe:Category definition="urn:ogc:def:property:OGC:SkyCondition"/>
            </swe:field>
        </swe:DataRecord>
    </swe:elementType>
    <swe:encoding>
        <swe:TextBlock tokenSeparator="&#x20;" blockSeparator="," decimalSeparator="."/>
    </swe:encoding>
    <swe:values>
        2006-10-05T12:30:00Z 35.1 950.0 32.0 clear,
        2006-10-05T13:00:00Z 35.8 940.0 331 clear,
        2006-10-05T13:30:00Z 36.5 938.0 35.8 hazy,
        2006-10-05T14:00:00Z 38.0 935.0 37.0 cloudy
    </swe:values>
</swe:DataArray>
```