



Interoperable Management of Air Quality Data with ArcGIS Server

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**Christoph Stasch, 52° North GmbH
Simon Jirka, 52° North GmbH**

Overview

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- e-Reporting of Ambient Air Quality
- Approach
- Server Software
- Visualising and Analysing the Data
- Outlook

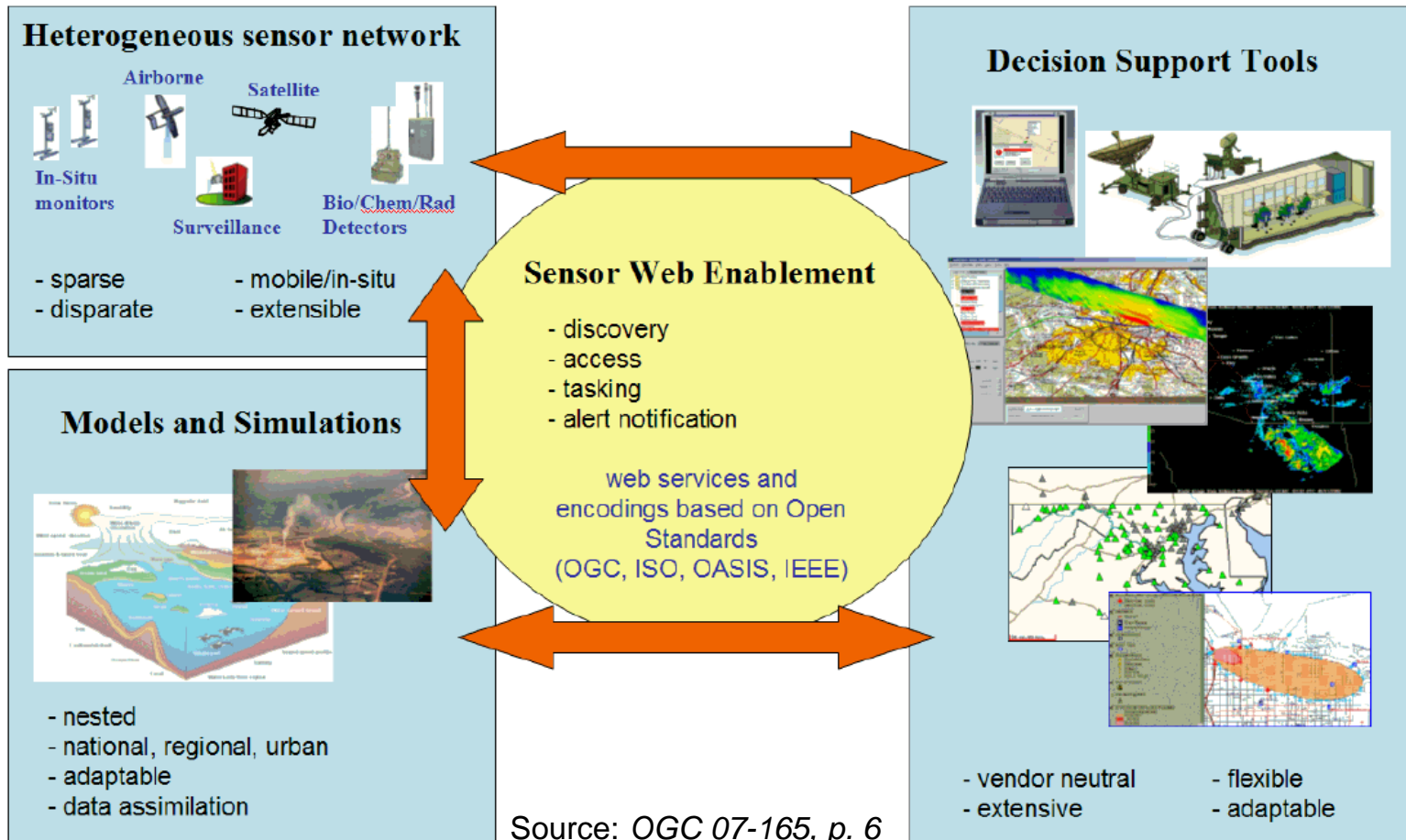
e-Reporting of Air Quality

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- Reporting of near real-time measurements (and further data) by member states to the European Environmental Agency (EEA)
- Previously: Heterogeneous data delivery processes → significant efforts for integration needed
- Use standards for facilitating data integration → Sensor Web Standards

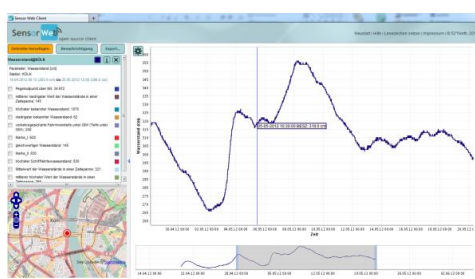


Sensor Web Overview



Sensor Web Overview

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Alerting Client

WaterLevel_Cologne

Overshoot/Undershoot

>

900

cm

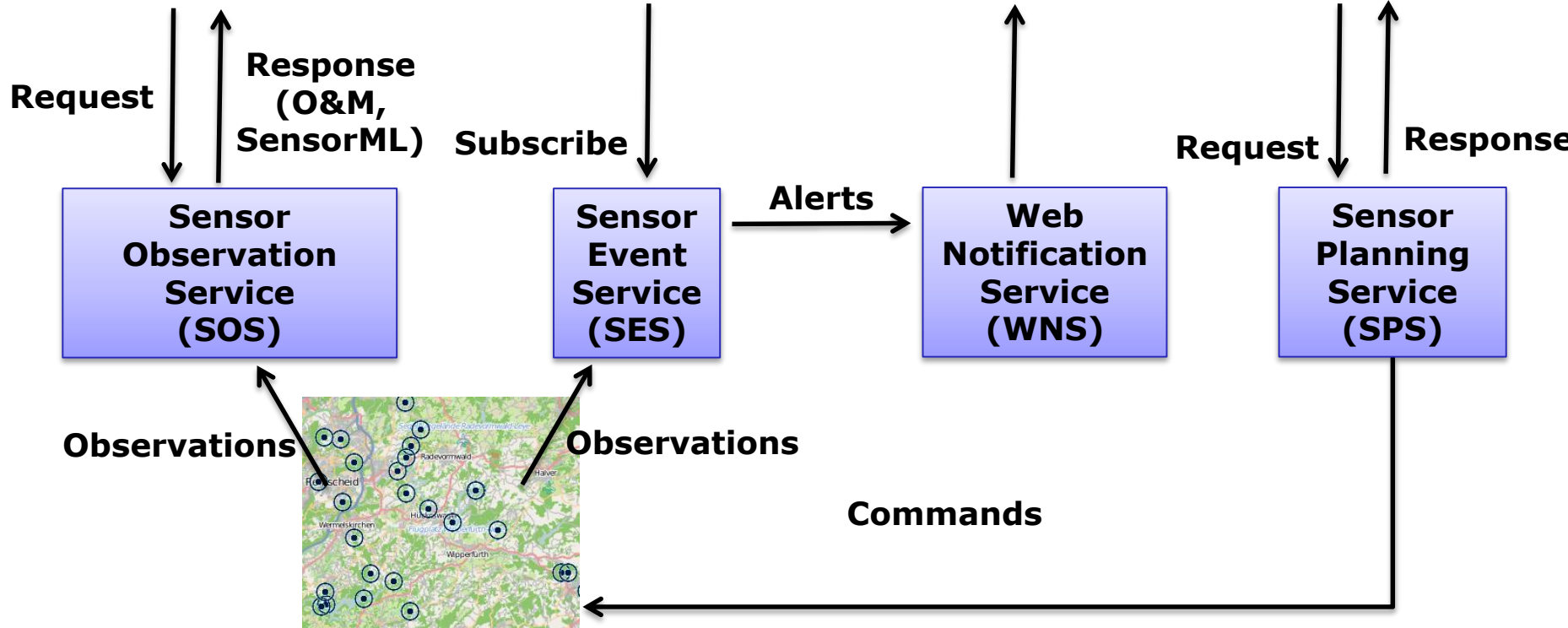
SMS
Email
Fax
Phone Call

Sensor Command Center

WaterLevel_Cologne

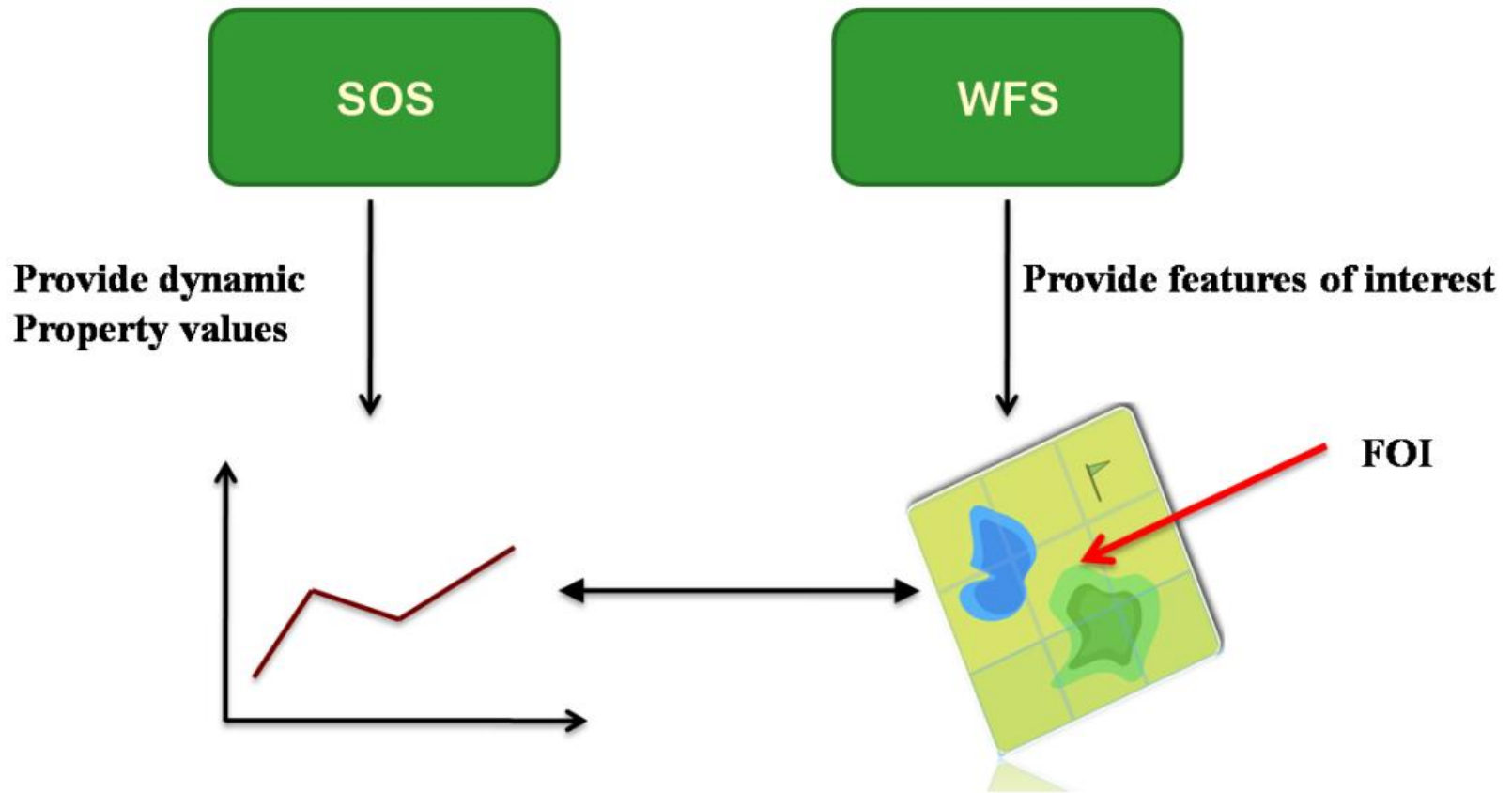
Measurements/Minute

10



Sensor Observation Service (SOS)

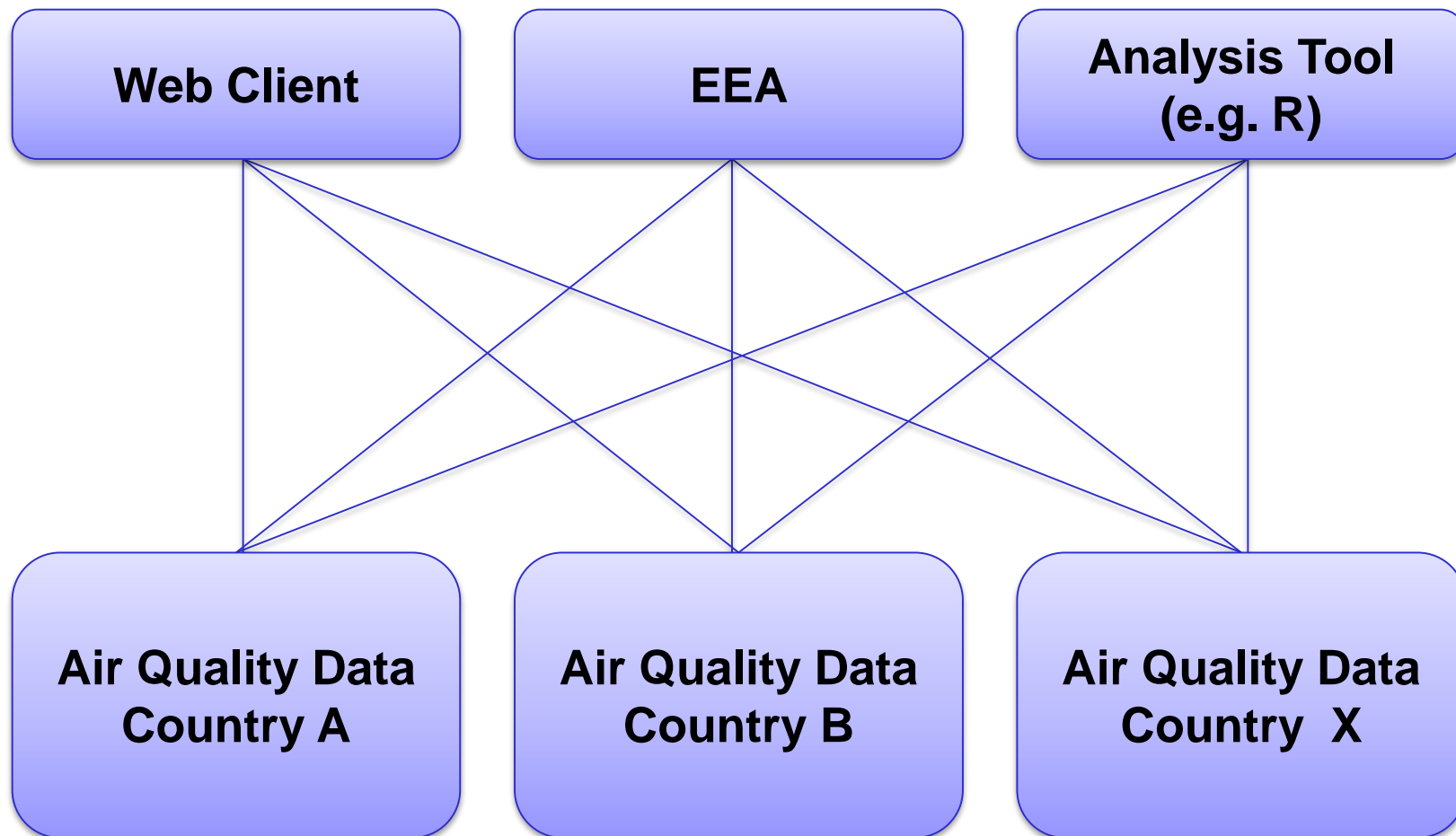
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Source: OGC 12-006, p. 147

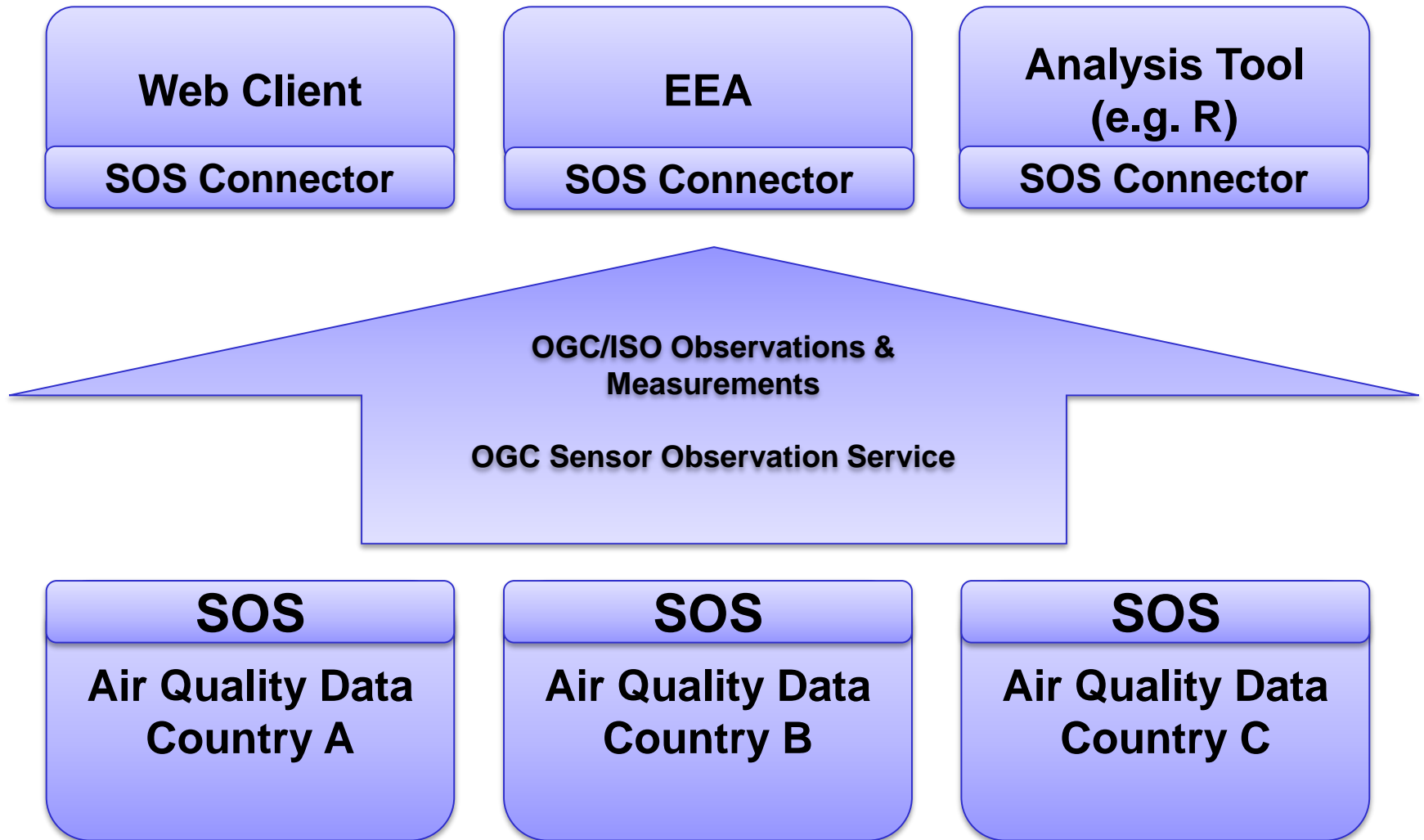
- GetCapabilities:
 - Information about
 - Registered sensors, spatial/temporal extent of observations, observed properties, etc.
- DescribeSensor
 - Retrieve descriptions for specific sensors
- GetObservation
 - Query observation data
- Further optional operations:
 - GetFeatureOfInterest, GetResult, ...

e-Reporting of Air Quality



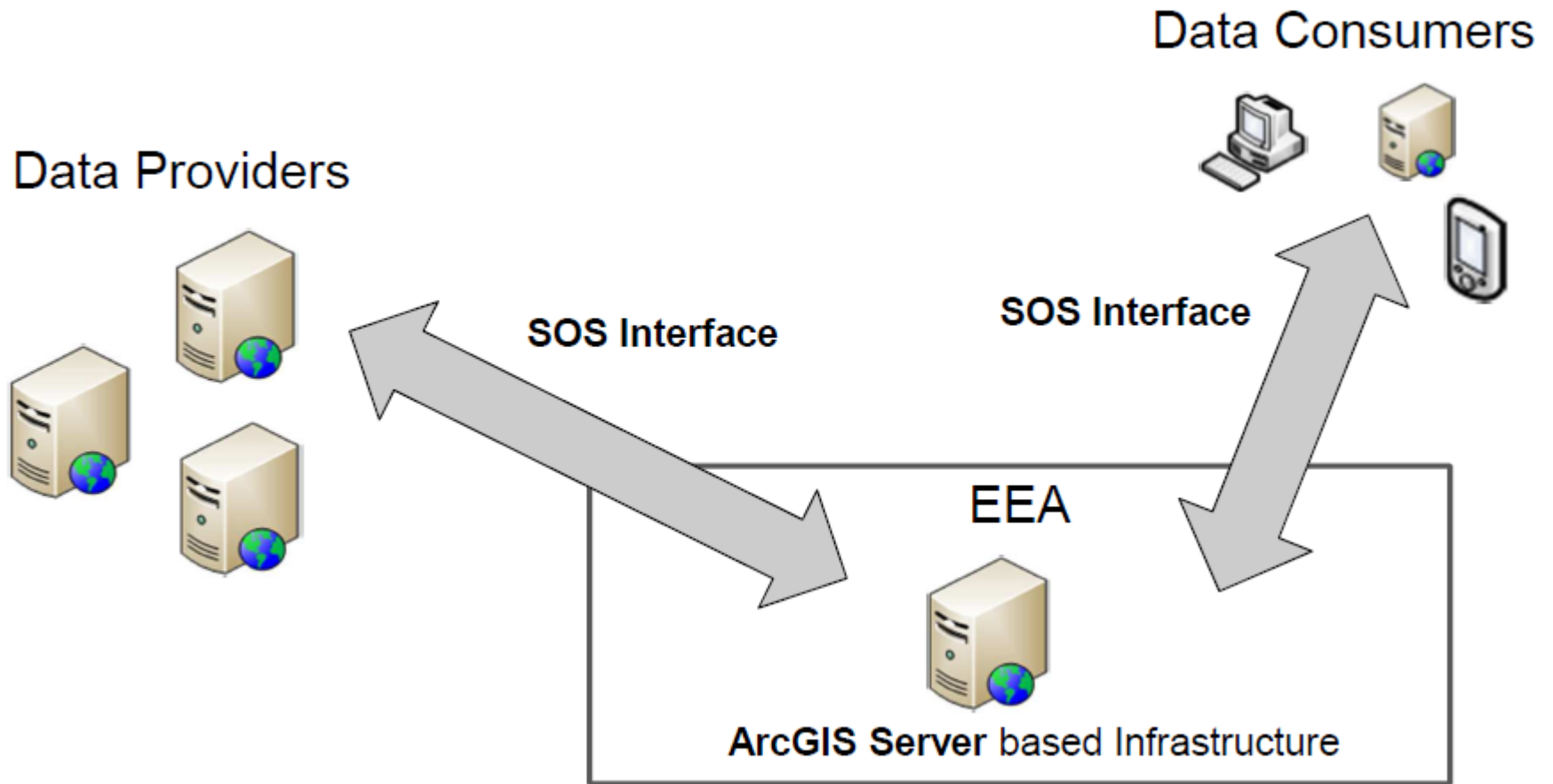
Approach

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Approach

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Approach

- Define a common data model and format → E-Reporting XML Schemas
 - Based on the ISO/OGC Observations and Measurements standard
- Allow the harvesting of air quality data through a common interface (Web service)
 - Based on the OGC Sensor Observation Service 2.0 interface standard
 - Ensure INSPIRE compliance
- Develop server-side implementations for the use by member states
 - 52° North SOS
 - ArcGIS Server SOS Extension
- Develop client software to consume SOS servers operated by the EEA and its member states
 - EEA import tools (Python scripts, FME)
 - Web clients
 - Analysis tools such as R

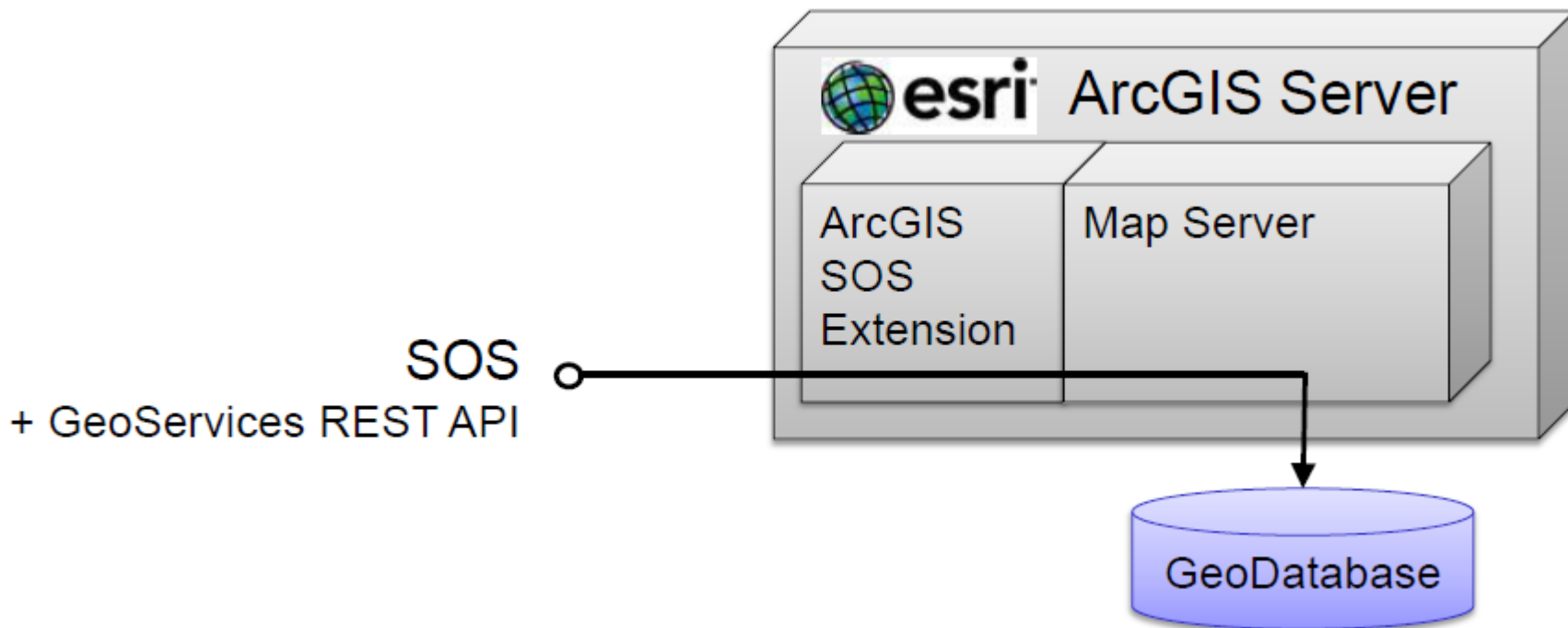
ArcGIS Server SOS Extension

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- Implements the SOS 2.0 standard
- Extension of ArcGIS Server
- Relies on optimised Microsoft SQL Server database
- Optimised to support the XML schemas for e-Reporting of ambient air quality
- Deployed at EEA for serving the air quality data collected from all member states → allows EEA to distribute the data

ArcGIS Server SOS Extension

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52° North e-Reporting SOS

- Complementary to ArcGIS Server implementation
- Enhance the 52° North SOS 4.x to support the e-Reporting XML schemas for ambient air quality
- SOS interface will be used by the EEA to harvest observation data from member states
- Support of
 - Up-to-date measurements (flow E2a)
 - Validated measurements (flow E1a)
- Partners
 - IRCEL-CELINE (Belgium) → PostgreSQL
 - IVL Swedish Environmental Research Institute (Sweden) → MS SQL Server
 - RIVM (The Netherlands) → PostgreSQL
 - Ricardo-AEA (UK) → MySQL

Visualising the Data

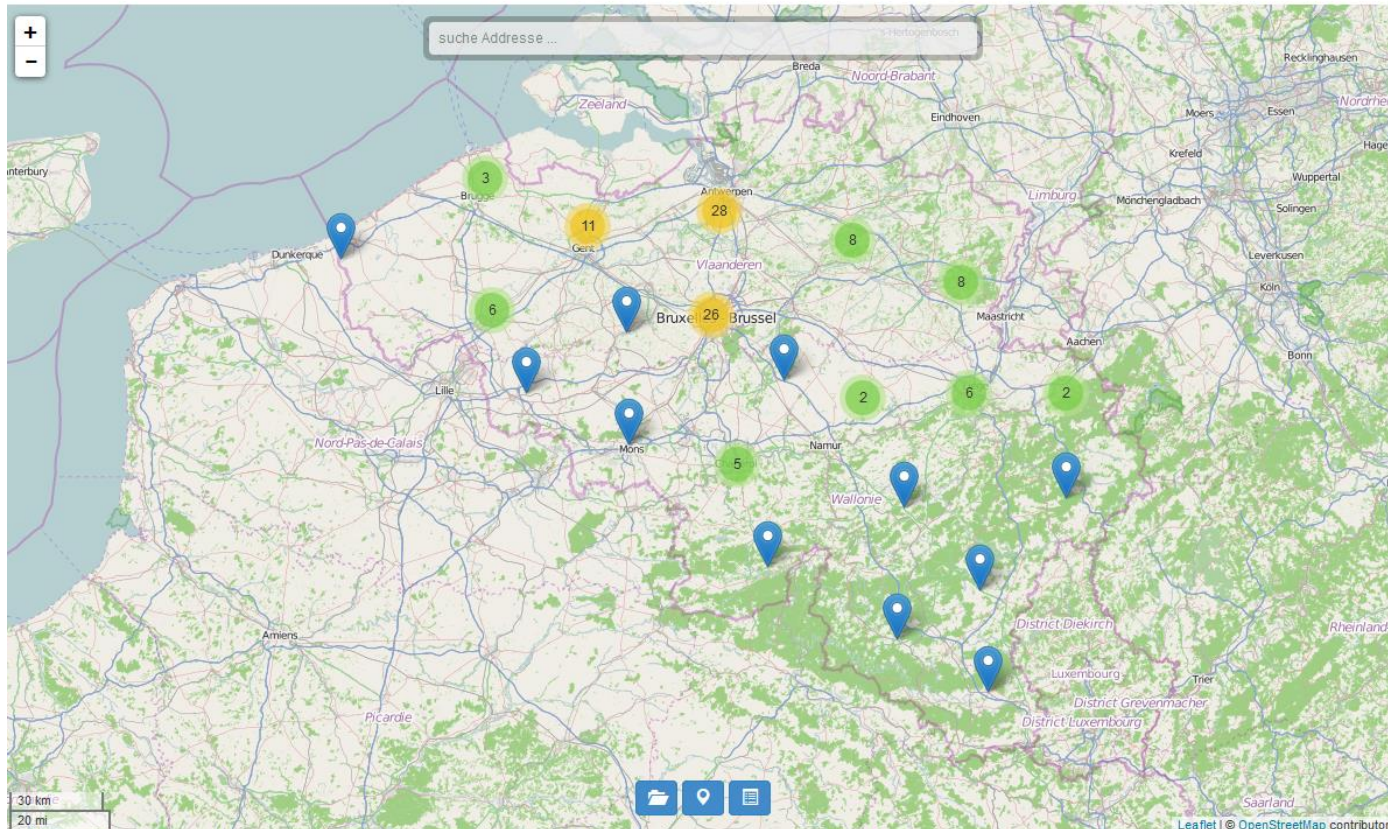
- Example: JavaScript SOS Client
- Functionality:
 - Map view
 - Diagram view
 - Table view
- Responsive design → support of different device types
- Uses the SOS interface to discover and access observation data
- Cooperation of 52° North with IRCEL-CELINE, Wupperverband, University of Leicester
- Available as open source software
- Demo: <http://sensorweb.demo.52north.org/jsClient>

Visualising the Data

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Wähle eine Station aus

★ ⓘ ⚙ Einstellungen 📊 Diagrammansicht



Phänomen

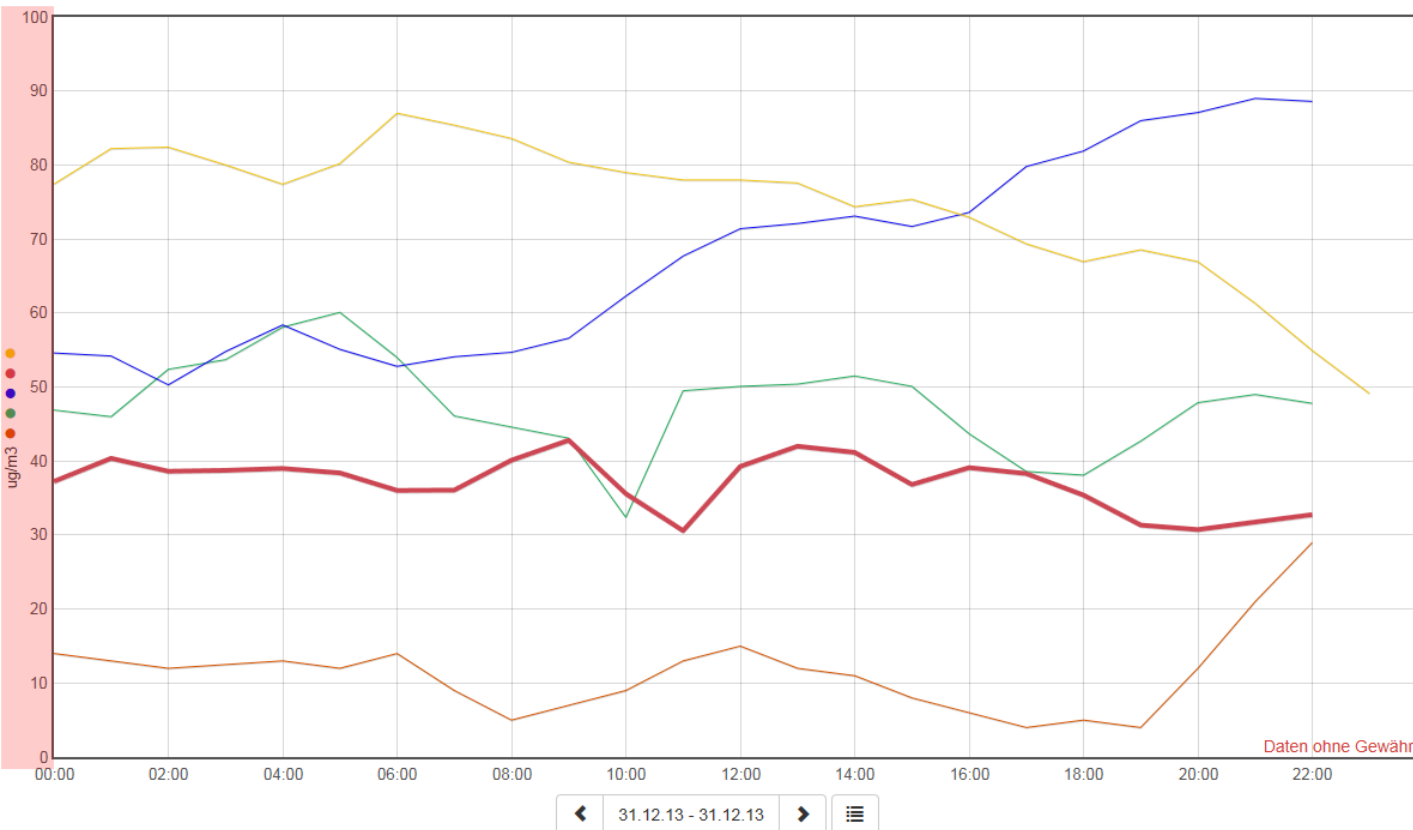
Phänomene

- 16111 - Black Carbon
- 42101 - CO
- 42102 - CO2
- 42242 - Hg
- 42401 - SO2
- 42601 - NO
- 42602 - NO2
- 44201 - O3
- 45109 - m,p-C6H4(CH3)2
- 45201 - C6H6
- 45202 - C6H5-CH3
- 45203 - C6H5-C2H5
- 45204 - o-C6H4-(CH3)2
- 61102 - DD
- 61110 - WSP-SCA
- 62101 - TT
- 81102 - PM10
- 81104 - PM2.5
- 89101 - PM1
- 90500 - PN1

Visualising the Data



Diagramm



★ ⓘ ⚙ Einstellungen 🗺 Kartenansicht

Legende

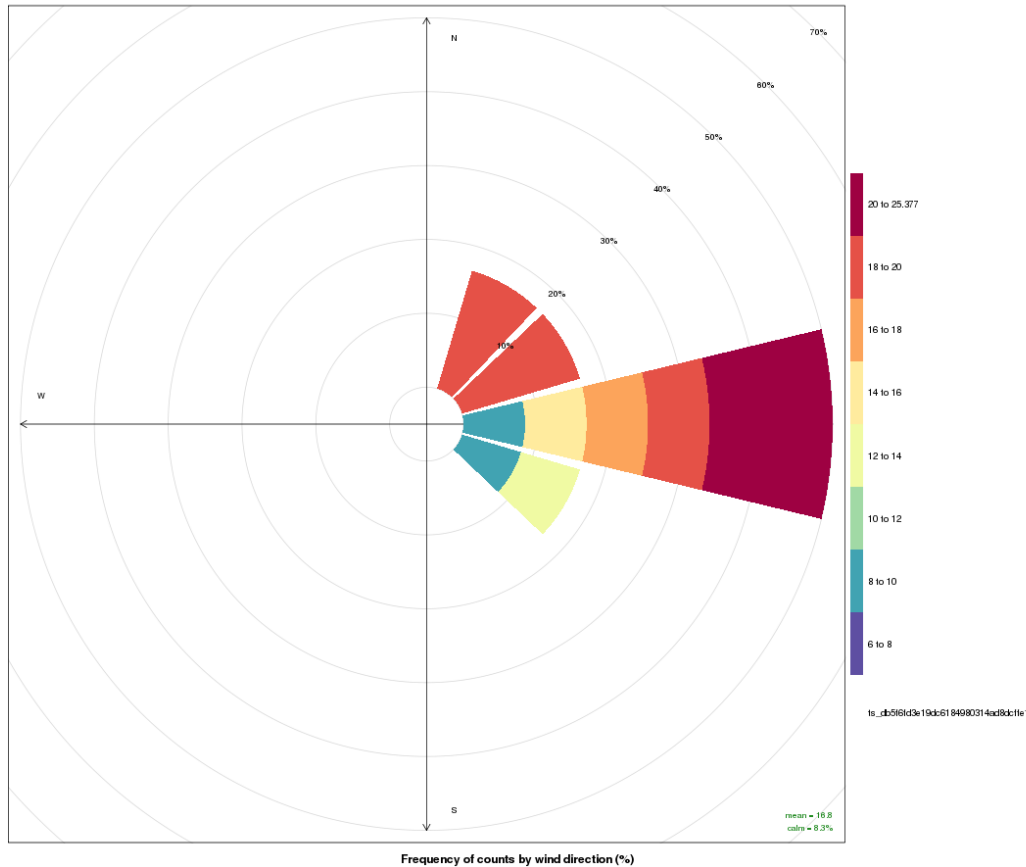
- SPO_S_PL0121A_7_001 ☆
Ozone (air) (ug/m3)
SPO_P_PL0121A_7_001
air
- SPO_F-FI00301_00007_100_100 ☆
Ozone (air) (ug/m3)
SPP-FI_UV-P_API400
air
- SPO_F-CY0002R_00007_101_102 ☆
Ozone (air) (ug/m3)
SPP-CY_A_UV-P_D9042
air
- SPO_F-BG0075A_00007_100_100 ☆**
Ozone (air) (ug/m3)
SPP-BG_A_UV-P_horibaAPOA370
air
- SAM_NO0052R_7_699 ☆
Ozone (air) (ug/m3)
SPP_NO0052R_7_699
air

Visualising the Data



Analysis

- Settings
- Map view
- Chart view



Parameters

Analysis

Pollution Rose

Timeseries

- 81104 - PM2.5@BETN063
- 44201 - O3@BETN063
- 42602 - NO2@BETN063
- 81102 - PM10@BETN063
- 81104 - PM2.5@BETN063
- 42401 - SO2@BETN063
- 42601 - NO@BETN063
- 42101 - CO@BETN063

R012.

- Conclusion
 - Works operationally
 - Deployed in different types of architectures
 - Increased efficiency to support e-Reporting data flows
 - Added value beyond e-Reporting
 - Further countries are working on supporting the SOS interface
- Outlook
 - Add support for further data flows
 - Information about station networks (Flow D)
 - Extend the community
 - Enhance the data analysis functionality

Thank You for Your Attention!

The logo for 52north, consisting of the text '52n' in white on a blue square background.

Further Information:

<http://52north.org/>

c.stasch@52north.org

jirka@52north.org