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Software Tools zum interoperablen Austausch und zur Visualisierung von Geodatensätzen über das Internet

Martin Schultz, Michael Decker, Sebastian Lührs

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Introduction

By Martin G. Schultz

Monitoring of the Earth and its atmosphere is essential for assessing the state of the environment and for measuring success of political measures to curb air pollution or mitigate climate change. The modern concept of monitoring the chemical composition of the atmosphere goes beyond the classical set-up of individual observational sites and involves a variety of measurement platforms (ground-based, ships, aircraft, satellites) and principles (chemical analysis, active and passive remote sensing, etc.). Numerical models play an increasingly important role for the interpretation of observations and their integration into a consistent global picture.

The exchange of data, from simple time series at point locations to complex multi-dimensional data sets from remote sensing instruments and numerical models, is a fundamental aspect for building a system of systems for global earth observations (GEOSS). Different data formats, data protocols and access restrictions limit the availability of earth observation data and create great technical and management challenges for building operational services like the European atmosphere service (http://www.gmes-atmosphere.eu) which shall provide daily forecasts and retrospective analyses to decision makers, environmental agencies and the common user. New technologies and the development of international standards for the description of geospatial data (http://www.opengeospatial.org/) open up new possibilities and bring the vision of truly interoperable data exchange closer to reality. The concept of interoperability means that computer systems can interact autonomously and exchange information about the availability of data sets and their details without direct human intervention. This changes the way how data are accessed, processed and visualized (Figure 1) and can lead to much faster turnaround times for the analysis of specific episodes or scientific studies in general.

The global network of air quality data is still in its infancy. A GEOSS community of practice (http://wiki.esipfed.org/index.php/GEO_AQ_CoP) has been established to foster exchange of ideas around this topic and to establish a set of real data nodes which can form the backbone of global interoperable AQ data exchange. Several challenges remain on both the technical side and on the management and governance level. These issues have been discussed at a recent workshop in Croatia (http://wiki.esipfed.org/index.php/Air_Quality_Data_Network_Solta_2011) which was organized under the title “from virtual to real” with participation of the Forschungszentrum Jülich.

This report collects two academic theses which were recently accepted at the Fachhochschule Aachen and which address two of the core aspects of interoperable data exchange: the master thesis by Michael Decker describes the development of a web coverage service (WCS) server

for atmospheric composition data in the netcdf data format. This development was performed jointly with Kari Hoijarvi and Rudolf Husar from Washington University, Louisiana. This server software forms the essential interface between the actual storage location of the data and the web-based access through automated systems or via human-controllable web interfaces. Such a web interface, which allows for flexible selection of individual data sets, their variables or specific geographical regions, download of the selected data or their visualisation, is described in the bachelor thesis by Sebastian Lührs, which forms part 2 of this report. Both pieces of software are freely available to the community and are put to regular use in the MACC project's global boundary condition service at http://macc.icg.kfa-juelich.de:50080.

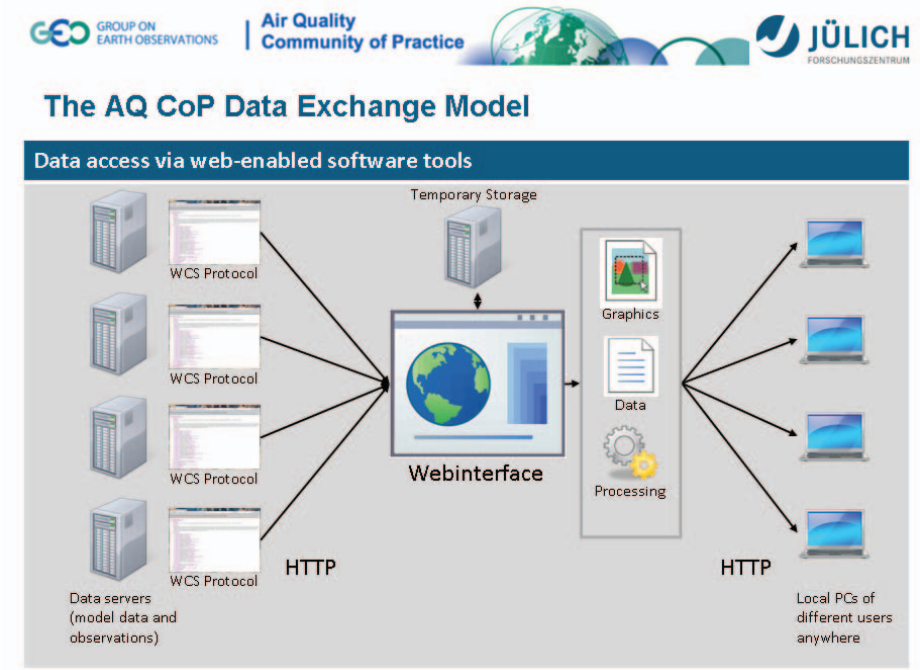

Figure 1: Simplified representation of the flow of earth observation data in a fully interoperable framework. Compared to the current "classical" model, where users must know individual data servers, their access protocols and data formats, the new concept allows for uniform access to all data through community web interfaces or via automated shell scripts. In reality the set-up needs to be more complex because of the need to identify and find data sets and maintain the relations between data servers and web interfaces.