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Introduction to the issue on heterogeneous data access and use for geospatial user communities

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Abstract

The four articles in this special section are devoted to the deployment of analytical data models for geospatial user communities.

Introduction to the Issue on Heterogeneous Data Access and Use for Geospatial User Communities

THE INCREASING open access of heterogeneous datasets creates windows of opportunity for the steadily growing data needs within the Earth Sciences. For example, when attempting to further quantify climate change results, a main challenge remains the re-analysis of large, interdisciplinary data sets and model outputs. Challenges include integration of complex physical processes into weather forecast and climate system models, understanding the interactions between climate, environment, and society, and integrating social and environmental information with weather and climate. Therefore, it is absolutely necessary that data providers (such as space agencies, governmental institutions, etc.) make all publicly acquired data easily accessible to all potential users.

We observe a trend towards a more open attitude to distribute spatial data, supported by initiatives like INSPIRE (Infrastructure for Spatial Information in Europe), GMES (Global Monitoring for Environment and Security), and GEOSS (Global Earth Observation System of Systems). The INSPIRE directive aims at optimizing the way in which spatial data is held by public authorities by improving the harmonization of data and the interoperability of spatial services. The GMES initiative aims at providing operational information services based on Earth monitoring data obtained from satellites and *in-situ* observations on water, air, and land. Finally, GEOSS pursues similar goals as GMES does, but with a focus on broader to global scales.

The development of interoperable Spatial Data Infrastructures (SDI) is a crucial aspect. Challenging topics related to SDIs are the interoperable interface specifications that are promoted by the Open Geospatial Consortium (OGC), (meta)data standardization, discovery and use of data and metadata, data exchange formats, data optimization, semantic interoperability, Service-Oriented Architectures (SOA), visualization tools, and web services.

This special issue addresses the topics mentioned above. The special issue is initiated by a national initiative of the Dutch "Space for Geo-Information" program. Within this program, the project "Atmospheric Data Access for the Geospatial User Communities" (ADAGUC - http://adaguc.knmi.nl) organized a workshop bringing together a large international geospatial and atmospheric research community discussing advances in multidisciplinary use of geo-, meteo-, and climate data, as well as advances in multidisciplinary spatial data exchange. The workshop formed the basis for this special issue. Within ADAGUC,

a software framework was developed to provide spaceborne atmospheric and land surface datasets using interactive web services that can be used for data comparison, resampling, selection, manipulation, and visualization in GIS (Geographic Information Systems). The implemented spatial data infrastructure is based on an OGC (Open Geospatial Consortium) compliant web service using Web Mapping Services (WMS) for online visualization, Web Feature Services (WFS) for downloading vector data, and Web Coverage Services (WCS) for downloading raster data. The ADAGUC web services are built on UMN Mapserver (http://mapserver.org/). Following a user requirement definition phase, NetCDF4 was evaluated as the data carrier for the ADAGUC datasets. NetCDF4 uses HDF5 as the storage layer of netCDF, combining the best of netCDF3 and HDF5 in one format. We supplied an OGR/GDAL driver for easy conversion between the NetCDF4 format and the file formats that were required by the use cases. GDAL/OGR is an open source translator library for geospatial data formats and is used in many software products including UMN Mapserver and mainstream GIS applications.

ADAGUC is only one example of comparable developments worldwide (cf., ESA HMA, Eumetsat SAFs, INSPIRE, etc.). However, operational use of connecting relevant web services through catalogues, removing data policy barriers, exchange of 3-D datasets and handling of complex temporal datasets is still in a preoperational stage. The scientific challenges are related to the proper combination of datasets at different spatial, spectral and temporal scales, their related quality of and semantic analysis of combined, large datasets.

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