Web-based GEONETCast Data for Geochange Research

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Abstract. Geochange research heavily relies on different kinds of real-time and historical geodata. GEONETCast provides access to such relevant geodata. This article describes a conceptual approach to enable web-based access to GEONETCast data and how it can support geochange research. The approach is based on interoperable Web Services, which are accessed through browser-based clients. The resulting architecture is examined based on Meteosat Second Generation data for meteorological analysis. The components applied in this study are available as Free and Open Source Software.

1 INTRODUCTION

Geochange research heavily relies on different kinds of real-time and historical geodata, such as provided by GEONETCast. GEONETCast is a satellite-based dissemination system serving remote and in-situ sensor data with global coverage (Wolf & Williams, 2008). The data provided by GEONETCast is available at no costs and addresses domains such as Meteorology and Oceanography. Based on this broad variety of data, which is currently not available through other dissemination systems, it is promising to enable web-based access. The web is important for realizing geochange research, as it provides access to a huge variety of resources and connects research organizations. These web-accessible resources include data but also geoprocess models. Web-based geoprocess models especially play a significant role in geochange research, as they allow researchers and organizations to exchange and share analysis methods.

This article describes a conceptual approach to enable web-based access to GEONETCast products and how such data can support geochange research. The approach is based on interoperable Web Services, which are accessed through browser-based clients. The resulting architecture is examined based on Meteosat Second Generation data (MSG) for meteorological analysis (Schmetz et al., 2002). The components applied in this study are available as Free and Open Source Software.

Section 2 introduces GEONETCast and the technical setup for receiving GEONETCast data. The approach for web-based access to GEONETCast is described in Section 3. The approach is applied to the example of MSG data (Section 4). The article ends with a conclusion.

2 GEONETCast – An Overview

GEONETCast is a satellite-based dissemination system for environmental data captured by remote sensors and in-situ sensors. It is part of the Global Earth Observation System of Systems (GEOSS). In particular, GEONETCast is a task in the GEO Work Plan and is led by EUMETSAT, the United States, China, and the World Meteorological Organization (WMO). Many GEO members and participating organizations contribute to this task.

With its over 180 products GEONETCast offers a broad thematic range from spectral transmission to climate measures (i.e. surface temperature, precipitation), which are applicable for geochange research. Moreover, the data is free for use in research and education.

GEONETCast data can be received through a standard TV dish (connected through TV-card). The received data can be stored in a semi-structured way on a data server for instance by the GEONETCast Toolbox (Maathuis, Mannaerts, & Retsios, 2008). The data server is able to manage user access and provides the data through the file system to designated applications. The technical setup is also depicted in Figure 1. Over a long term it is possible to build an archive of GEONETCast data and thereby support geochange research with real-time and historical geodata.

3 Web-based GEONETCast Data

To serve geodata on the web, standardized interfaces are required to enable a customized access. Web Service interfaces as specified by the Open Geospatial Consortium (OGC) are highly applicable to serve geodata in a structured way and the portrayal of it. To serve coverage data on the web as for instance mostly provided by GEONETCast, the Web Coverage Service (WCS) has been specified[1] (OGC, 2006). It allows users to query coverage data and especially grid data regarding multiple aspects (space, time and channel).

[1] The presented examples and the implementation are based on WCS specification version 1.1.0.

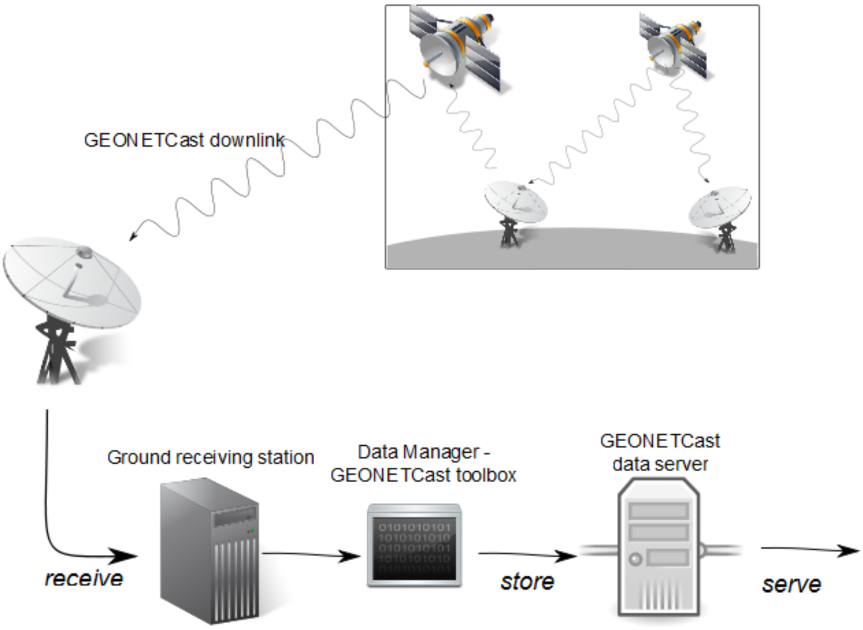

Figure 1: Technical setup for receiving, storing and serving GEONET-Cast data.

To interact with a WCS instance, three operations are required. *GetCapabilities* provides the service metadata and describes the different data available at the specific instance. To retrieve further information about a specific dataset, *DescribeCoverage* can be called by the client. The returned metadata describes the coverage including the following parameters (with OGC parameter names):

- extent (spatial domain)
- temporal resolution (temporal domain)
- the geographic layout of the grid (GridCRS)
- available channels (Axis).

Based on this metadata *GetCoverage* can be called to retrieve the designated data. Such coverage data can for instance be encoded in GeoTiff format (Ritter & Ruth, 1997).

To portray the data through a Web Service the OGC specified the Web Map Service (WMS) (OGC, 2004). It delivers plain images depicting the selected aspect of the geodata. For the given study, WMS is used, as it allows users to portray the data without downloading it.

Making GEONETCast data available through the web, it is either possible to connect such service directly to the data server, or to insert the GEONETCast data through the transactional interface of the service over the web. In both cases the changes and updates of the data need to be monitored. In the case of a direct link between the data server and the service, the configuration of the service needs to be updated to serve the data according to the latest changes. The service then directly accesses the data, whenever it is requested. This direct connection does not result in any additional computational effort and also does not result in redundant storage of data. Redundant storage, however, is the effect when updating the service through its transactional interface. For some cases, storing the data directly on the service through its transactional can be considered for performance reasons, if for instance the service manages the data internally through a database and is thereby able to apply indexing strategies. Additionally, using the transactional interface, it is possible to connect to any compliant WCS instance. No product specific function is required.

4 WEB-BASED METEOROLOGICAL DATA FOR GEOCHANGE RESEARCH

In this study, MSG-2 data received from GEONETCast data stream is made web-accessible through WCS interface. MSG-2 data consists of 12 channels of which 11 channels have a resolution of 3 kilometers. The 12 channels are collected from visible to infrared spectrum. The raw MSG-2 data received from GEONETCast is transformed into GeoTiff format and can thereby be directly served through WCS. The WCS instance serves only 11 of the 12 available channels, as GeoTiff format can only handle different channels with equal resolutions, thus the 12th band (high resolution visible light) cannot be included (resolution 1 kilometer).

We connected directly the data server with the WCS instance. We chose Map Server software[2] as Web Map Service product. Map Server allows us to serve the data through WCS interface (data access) as well as WMS interface (data portrayal). Users are thereby able to inspect the data (using WMS interface) without downloading it. An example of a browser-based application accessing the data through WMS interface is given in Figure 2. The browser-based application allows the user to specify the data regarding time, geographic extent and specific channel. In the given example, data of hurricane Karl in the Gulf of Mexico in September 2010[3] is portrayed (based on channel 1 of MSG data collected at visible spectrum). The user can now select on the map a geographic extent, of which he wants to receive data. Based on this selection, the browser-based application generates a WCS-compliant URL, which can be used to download the designated

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[2] Map Server website: www.mapserver.org.
[3] Timestamp: 17th September 2010, 12:00.

coverage from the WCS instance. This URL can be used as input for web-based geoprocess models for performing geochange research.

This service can also be integrated into other applications based on the standardized WCS interface. For designated applications metadata is available through WCS DescribeCoverage operation. Based on this metadata the application can integrate the data accordingly through WCS GetCoverage operation.

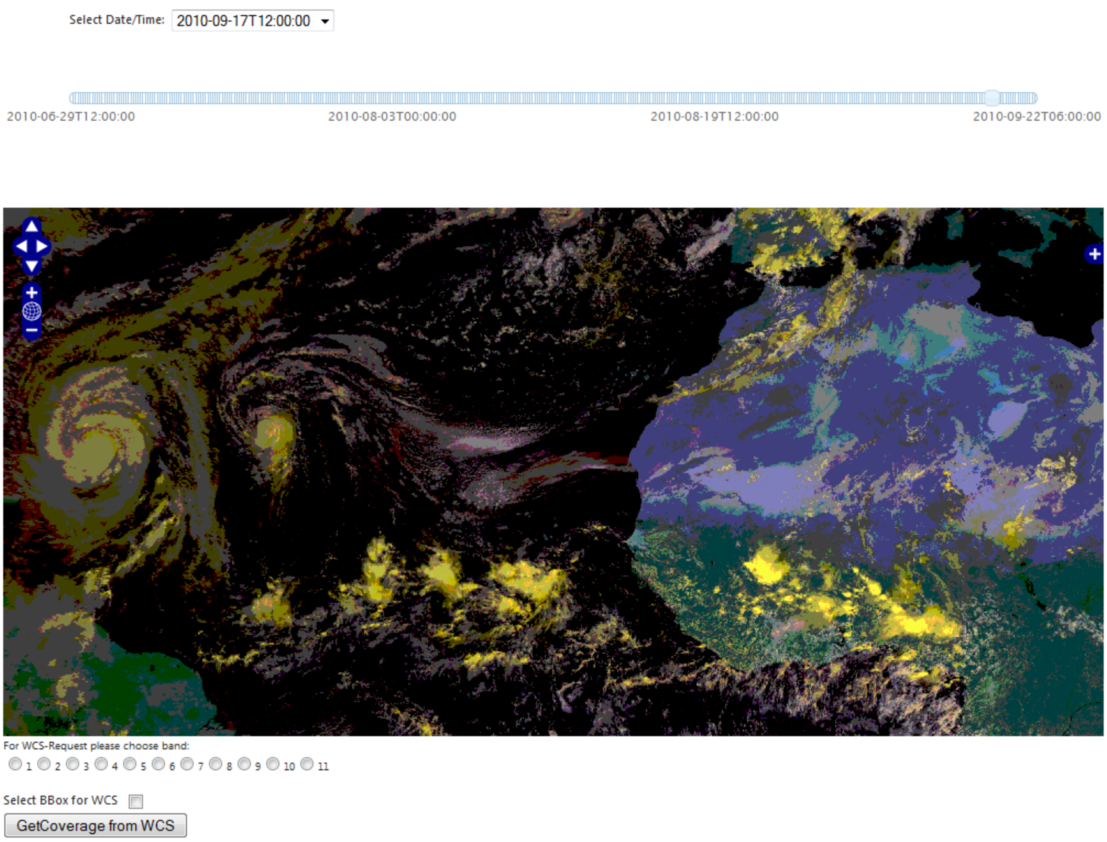

Figure 2: The browser-based client accesses meteorological data through WMS interface - example with MSG-2 data of hurricane Karl in the Gulf of Mexico in September 2010.

5 Conclusion

Geochange research requires real-time and historical geodata, such as available through GEONETCast. Enabling web-based access to such geodata releases its potential for geochange research. Web Service-based access allows users to query the data through the web regarding different aspects (space, time and channels). For serving meteorological data such as MSG-2, WCS has been selected as the appropriate specification. A browser-based application allows the users to first visualize the data. The according WCS URL generated by the client allows users to directly incorporate the data into web-based geoprocess models. Based on the combination of web-based GEONETCast data and web-based geoprocess models, it is possible to perform geochange research.

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