The British Geological Survey's new geomagnetic data web-service

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Introduction

The British Geological Survey (BGS) operates eight geomagnetic observatories around the world. The data from these observatories are disseminated to Edinburgh INTERMAGNET Geomagnetic Information Node (GIN), and BGS’s own public website.

Increasing demand for real-time or near-real-time observatory data means there is a need for institutes to have a robust and scalable data-processing architecture capable of delivering geomagnetic data products over the internet in a variety of commonly-used formats. As a consequence, BGS has spent the past year developing a new web-service system for the processing and distribution of our geomagnetic observatory data.

Why develop web-services?

A web-service is simply a way for computers to communicate information to each other over the internet. The communication is usually done using the HTTP protocol (as used by web-browsers), and the information transmitted is usually in some well-specified format, typically XML.

Providing a web-service as the primary means of accessing observatory data, both publicly and internally, brings a number of benefits:

- **Ease of access**: clients need only know how to access a URL and parse the data received; they need know nothing of how the data is formatted and stored in the repository.
- **Reduction of code duplication**: low-level data access code is isolated in the web-service – client software need not duplicate this code. This leads to faster and more reliable client development.
- **Increased resilience to change**: since the low-level data access details are abstracted away by the web-service, changes to the data repository (location, storage format, structure) need only be reflected in a single place – the web-service – while clients using the data are unaffected.
- **Increased security**: client authentication and authorisation can be managed at a single point, simplifying the protection of commercially sensitive data.
- **Interoperability**: the web-service can provide data in a number of standard formats (e.g. XML, JSON), so it becomes much easier to integrate BGS geomagnetism data into existing software and systems.

System architecture

The web-services software was developed as a Java web-application, using the Restlet framework. The Restlet framework provides an abstraction on top of the standard J2EE Servlet 2.5 specification, and enables the rapid development of RESTful web-services applications. The entire web-service runs in a standard Tomcat web-application container on a dedicated Linux machine.

Using the web service

Our geomagnetic data web service exposes a number of data products:

- Second-, minute- and hour-cadence data from the observatory vector and scalar magnetometers.
- Derived quality control products, for example the comparison of two co-located systems, the rate of change in each component, etc.
- For each data product, we can access the raw variation data or the absolute data (variation data with a baseline correction applied).

Each data resource is identified by and retrieved via a URL. The data may be retrieved by any software capable of making an HTTP request. This provides a very simple interface to the data, accessible by a wide range of systems. The data can easily be made accessible to both observatory operations staff and public users wherever they have access to the internet.

Data analysis and QC software

We have already taken advantage of the ability to rapidly build and deploy applications utilizing web-services by developing software to aid observatory operations staff in data analysis and quality control.

We developed this browser-based application using the JavaScript libraries jQuery (for the user interface) and flot (for plotting).

When the user navigates between the different data products using the buttons at the top of the screen, the application makes the appropriate requests to the web-service and plots the responses.

Because the web-service generates the data dynamically in response to each request, the latest data are always available. Thanks to the various performance optimisations (see “System architecture”), the time taken from mouse-click to the data being plotted on-screen is typically less than 1 second, even when displaying a day of second-cadence data with numerous transformations applied.

Next steps

The web-service is currently not available publicly. We plan to make a subset of the data products described above available to the geomagnetism community in the near future via the BGS website. In addition, we will expand the range of formats in which the data may be accessed, to include WDC, INTERMAGNET CD-ROM binary (IAF), and NetCDF.

Reference


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