Updates and Future Plans at the World Data Centre for Geomagnetism, Edinburgh

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ABOUT THE WORLD DATA CENTRE FOR GEOMAGNETISM, EDINBURGH

The World Data Centre for Geomagnetism, Edinburgh (WDC) is a long-standing repository of geomagnetic data and data products (wdc.bgs.ac.uk) operated by the British Geological Survey (BGS). Its holdings include geomagnetic observatory time-series data, magnetic survey records, geomagnetic indices and models. Analogue records in the form of paper magnetograms, observatory yearbooks and other publications are also archived.

The WDC holds data from approximately 500 magnetic observatories (current and former) from around the world. Data records span more than two centuries; annual means (from 1813), hourly means (from 1883) and minute means (from 1969).

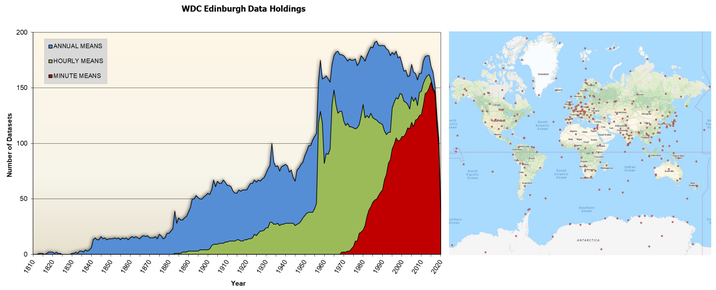


Figure 1: Left: Chart showing the number of datasets (annual [blue], hourly [green], and minute [red] the WDC for Edinburgh holds for each year from 1810.
Right: Map showing global coverage of magnetic observatory data.

The WDC is active in collecting and receiving new datasets and making these available to the geomagnetism scientific community for studies of the Earth's magnetic field. One way the WDC does this is by an annual 'call for data' mailshot which is sent to current observatory operators. The WDC also works with INTERMAGNET to make available datasets submitted to and verified by INTERMAGNET available from the WDC in additional to data directly submitted to the WDC.

We want your data!

Do you operate a geomagnetic observatory or conduct magnetic surveys? Would you like to share your data with the scientific community?

Contact us at : wdcgeomag@bgs.ac.uk

We accept definitive geomagnetic data from absolute-controlled magnetic observatories. Data can be submitted in IAGA-2002, INTERMAGNET binary, or WDC format.

We accept magnetic survey records from any repeat station observations.

Observatory yearbooks or updates to existing metadata records are also welcomed.

METADATA SCHEMA FOR GEOMAGNETIC OBSERVATORY DATA

Over the past few years BGS have compiled more detailed metadata for the WDC into a community metadata database. The database holds information about several hundred magnetic observatories stored in the WDC. This database contains approx. 40 tables consisting of entities such as observatory name, location, contact details, instrumentation in use, and data sets contributed to.

Metadata from this data base are already provided to other geomagnetism organisations for example, INTERMAGNET - https://intermagnet.github.io/metadata/.

The WDC metadata database also contributes to the Earth Plate Observing System (EPOS) project. Metadata are provided by the WDC in Data Catalogue Vocabulary (DCAT) format and ultimately ingested into EPOS' CERIF (a Common European Research Information Format) database, where it will be available for harvesting.

A tool to allow institutes to review and update the data held about them in the metadata database is also under development.

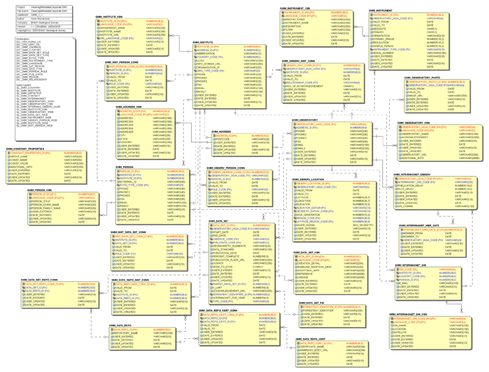


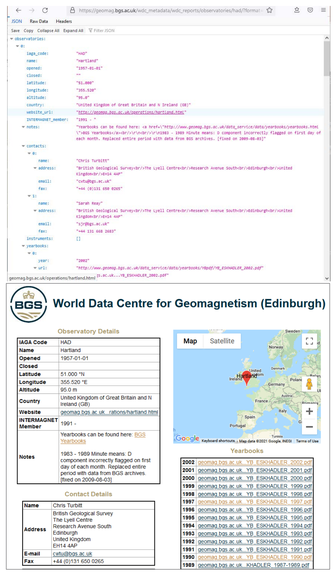
Figure 2: The current metadata schema for geomagnetic observatory metadata

APPLICATION PROGRAMMING INTERFACE (API) FOR THE WDC

An extended Application Programming Interface (API) for the WDC is in active development.

Initially this provides access to observatory metadata through url endpoints e.g. https://geomag.bgs.ac.uk/wdc_metadata/wdc_reports/
The WDC currently use this API to generate webpages of observatory details for our website and the annual call-for-data mailshots.

The next phase will implement a query interface that also delivers datasets from the WDC repository. The API will serve as the back end for an updated and improved website.



Figures 3:
Top: Example metadata in JSON format
Bottom: Example metadata webpage in the WDC

CORE TRUST SEAL CERTIFICATION

The World Data Centre for Geomagnetism, Edinburgh is a Regular Member of the World Data System (https://www.worlddatasystem.org/). Over the past few years the WDS and the Data Seal of Approval have aligned their criteria for certifying trustworthy data repositories. Data Centres are now required to undergo a CoreTrustSeal certification process where a data centre is assessed against 16 requirements. These include detailing a data centres authenticity, integrity, security, trustworthiness, and expertise.

The WDC for Geomagnetism Edinburgh have recently (July 2021) submitted an application for review under the CoreTrustSeal principles. We await feedback and will use the certification process to help guide improvements to our data management methodologies in future developments.

MONTHLY MEAN DATABASE

The introduction of a monthly mean database to the WDC is planned. Previously, this was initiated by IPGP (*Chulliat and Telali, 2007*) collecting input data from INTERMAGNET observatories. However further updates have not been made since 2017. Scientific usefulness of observatory monthly means has not diminished, especially with the introduction of a monthly means "Virtual Observatory" data product from Swarm data (*Hammer et al, 2021*), so BGS and IPGP have agreed to transfer the monthly means database project to the Edinburgh WDC. The plan is to continue with the same formatted files, which are in XYZ orientation, and to include any discontinuity values, similar to that of the annual mean data set.

Additionally, there are plans to:

- include good quality data from non-INTERMAGNET observatories
- include INTERMAGNET quasi-definitive data until definitive data are available
- update regularly, eventually automatically

Input data will comprise WDC hourly means (which include INTERMAGNET definitive data), INTERMAGNET quasi-definitive data and discontinuity data, held as part of the WDC annual mean data set, applicable to the hourly means.

Monthly means from other sources will be welcome. For example, we hope to also make available monthly means derived from a small digitising project undertaken during the pandemic with the Greenwich observatory yearbooks going back to the 1840s (*Maume et al, 2021*). The idea is to generate monthly mean series which are as long and homogeneous as possible and which will be applicable in studies of core processes.

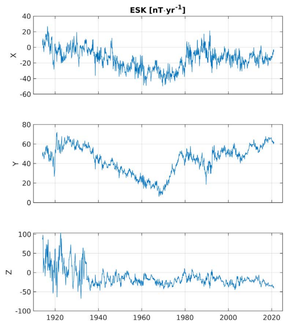


Figure 4: The monthly mean secular variation (SV) at Eskdalemuir (ESK) observatory.

DIGITISED HISTORIC DATA SETS

Within the geomagnetic community there are many efforts to digitise historic analogue records from long-running, or former observatories. These may be in the form of digitised tables of measurements taken from yearbook publications, scans of paper magnetograms or even digitised values from these scans.

Currently the WDC hold records of historic UK magnetograms (from 1850) with high definition images available at https://www.bgs.ac.uk/information-hub/scanned-records/magnetograms/ The WDC also have an archive of historic observatory yearbooks. Most of these are analogue but scanned copies of the UK series are available at http://www.geomag.bgs.ac.uk/data_service/data/yearbooks/yearbooks.html

In the future the WDC aims to expand our ability to host and make available all digitised historic datasets from observatories worldwide.

References

- Chulliat, A. and K. Telali, World Monthly Means DataBase Project,, Publ. Inst. Geophys. Pol. Acad. Sc., C-99 (398), 2007
- Hammer, M.D., Cox, G.A., Brown, W.J., Beggan, C.D., Finlay, C.C., Geomagnetic Virtual Observatories: monitoring geomagnetic secular variation with the Swarm satellites. Earth Planets Space 73, 54 (2021). https://doi.org/10.1186/s40623-021-01357-9
- Maume, E., Eaton, E. and Macmillan S. (2021). Digitising Historic Datasets: Greenwich Magnetic Yearbooks 1841-1925. British Geological Survey Internal Report, 20/04/2021