British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Towards A Metadata Standard For Geomagnetic Observatory Data

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What is Metadata?

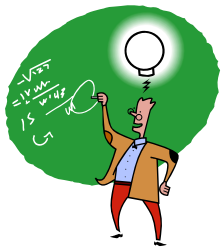
"all the information, additional to the raw data itself, which a potential user of the data would need to know to be able to make full and accurate use of the data in a subsequent scientific analysis…"

Sufi, S., & Mathews, B. (2004). CCLRC scientific metadata model: version 2. CCLRC Technical Report: DL-TR-2004-001.

Benefits of Metadata (1)

Data Archive

- Metadata preserves the value of data for posterity.
- It protects against loss of organisational knowledge as personnel or institutes change.



Data Assessment

- Metadata describes the data.
- It gives us data provenance (QC history, processing and transformation steps etc).
- It is a means of declaring data limitations.

Benefits of Metadata (2)

Data Discovery

- Metadata can help other people find your data… and then obtain and use it.

Data Transfer

- Metadata is increasingly used by software systems to ingest, manipulate and analyse data.

Data Distribution

- Standardised metadata can allow participation in global data clearinghouse initiatives
  e.g. GEOSS, INSPIRE, WDS

GROUP ON EARTH OBSERVATIONS

Metadata Standards

International Organization for Standardization

- Metadata standards are a common set of terms and definitions in a structured format.
- No standard is perfect fit for geomagnetic data.
- Standards for geospatial data (FGDC, ISO) could provide framework for a geomagnetic profile.
- Temporal aspect is difficult to handle.
- Standards are complex for data providers to populate.

Why is it important?

To improve curation of data at WDCs

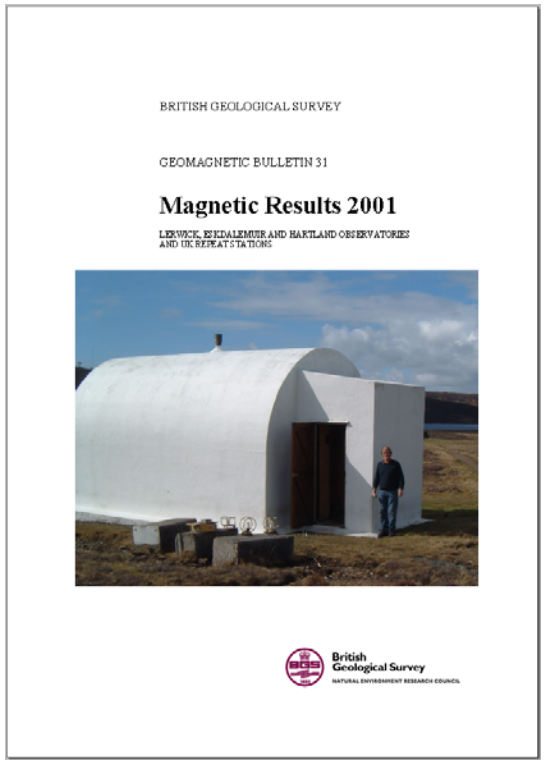
- Addressing inconsistencies within data holdings is difficult without metadata e.g. Apia observatory
- A clear ‘paper-trail’ of any transformations or corrections e.g. Eskdalemuir hourly means

To give clear quality assurance to researchers

- Assisting data selection for global models
- Negate the need for ‘preliminary’, ‘definitive’ definitions

Good data provenance is necessary for good quality science!

Current Geomagnetic Metadata Sources


BRITISH GEOLOGICAL SURVEY

GEOMAGNETIC BULLETIN 31

Magnetic Results 2001

LERWICK, ESKDALEMUIR AND HARTLAND OBSERVATORIES AND UK REPEAT STATIONS

British Geological Survey
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Observatory yearbooks

README.HAD - WordPad

File Edit View Insert Format Help

```
                                HAD
                HARTLAND OBSERVATORY INFORMATION

ACKNOWLEDGEM : British Geological Survey
STATION ID   : HAD
LOCATION     : Hartland, Bideford, Devon, United Kingdom
ORGANIZATION : British Geological Survey
WEB-ADDRESS  : www.geomag.bgs.ac.uk
CO-LATITUDE  : 39.000s
LONGITUDE    : 355.517s
ELEVATION    : 95 meters
ABSOLUTE
INSTRUMENTS  : DI-flux (Zeiss theodolite with Bartington
               MAG 01H fluxgate)
               GDAS (Geomag SM90R) PPM
RECORDING
VARIOMETER   : Three component DMI suspended fluxgate
ORIENTATION  : HDZ
DYNAMIC RANGE: +/-4,000nT
RESOLUTION   : 0.1nT
SAMPLING RATE: 1s
FILTER TYPE  : 61-point cosine
BACKUP
VARIOMETER   : Three component DMI suspended fluxgate
K-NUMBERS    : ASM method
K9-limit     : 500 nT
GINS         : Edinburgh
COMMUNICATION: INTERNET Communication, 1 second data
               transferred to Edinburgh every minute
OBSERVERS    : Regular absolute observations were made by
               Mr S. Tredwin.

CONTACT      : C.W. Turbitt
               British Geological Survey
               West Mains Road
               EDINBURGH, EH9 3LA
               UNITED KINGDOM

               TEL: +44 131 667 1000
               FAX: +44 131 650 0265
               e-mail: cwtu@bgs.ac.uk

                        < END >
```

INTERMAGNET readme

File Edit Search Preferences Shell Macro Windows Help

```
Format                  IAGA-2002
Source of Data          British Geological Survey (BGS)
Station Name            Hartland
IAGA code               HAD
Geodetic Latitude       50.995
Geodetic Longitude      355.518
Elevation               95
Reported                DHZF
Sensor Orientation      HDZF
Digital Sampling        1-second
Data Interval Type      1-minute (00:30 - 01:30)
Data type               provisional
# This data file was created by the BGS geomagnetic data
# processing software running on a Sun workstation.
# D and I are reported in angular units of minutes of arc
# and H, X, Y, Z and F are reported in nanotesla.
# 1-minute values are derived from 1-second samples using
# a 61-point cosine filter.
# Missing data are denoted by 99999.00
# CONDITIONS OF USE: For scientific/academic studies only.
# For all other applications please contact the Geomagnetism
# team of BGS, Edinburgh. Contact details are given in the
# yearbook included on the CD and are available on the BGS
# geomagnetism web site - www.geomag.bgs.ac.uk
DATE       TIME         DOY     HADD      HADH      HADZ      HADF
2009-08-10 00:00:00.000 222      -198.67  19663.20  44238.80  48411.90
2009-08-10 00:01:00.000 222      -198.62  19663.80  44239.00  48412.30
2009-08-10 00:02:00.000 222      -198.78  19664.80  44238.90  48412.60
2009-08-10 00:03:00.000 222      -198.90  19664.00  44238.30  48411.80
2009-08-10 00:04:00.000 222      -198.78  19665.90  44238.90  48413.10
```

IAGA-2002 file header

Requirements for geomagnetic metadata

- **Contact Information**
  Name, address, institute information, responsible persons.
- **Data Description**
  Type of data, nature of the data, possible applications.
- **Station Description**
  Coordinates, elevation, possibly photographs and maps.
- **Instrumentation**
  Types of instruments in use.
- **Data Processing**
  Processes and methodology used to process the data from instrument recordings to the final definitive values.
- **Data Quality**
  Assessing the quality of the data set.
- **Distribution**
  How and where the data may be acquired.

WDC efforts in metadata

- WDCs at Edinburgh, Boulder and Kyoto have begun to discuss what is required in a metadata standard.
- WDC hold limited metadata currently:

Edinburgh

- Holds simple metadata
- Requested further basic information from data providers with annual ‘call-for-data’

Boulder

- Beginning to use a FGDC standard for data held in SPIDR
- Complex for data providers to fill-in

Next Steps? “Don't Duck Metadata”

- Documenting data is part of the scientific process
- Data providers are encouraged to keep metadata records of some form: yearbooks, free-form text
- WDCs will gradually request and this store metadata
- Better records of data provenance and interoperability will lead to better science!

Questions?

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Acknowledgments

World Data Centre, Boulder and World Data Centre, Kyoto

References

- Institutionalize Metadata *Before It Institutionalizes You,* Lynda Wayne, GeoMaxim / Federal Geographic Data Committee, Nov 2005
- Geospatial Metadata, Federal Geographic Data Committee, February 2005
- The British Atmospheric Data Centre: Curation and Facilitation, Bryan Lawrence, NCAS/BADC, Rutherford Appleton Laboratory, CCLRC http://www.dpconline.org/graphics/events/presentations/pdf/BryanLawrence.pdf
- Martini, D. and Mursula, K., 2006. Correcting the geomagnetic IHV index of the Eskdalemuir observatory, Ann. Geophys., 24, 3411-3419