



A new data service from the World Data Centre for Geomagnetism, Edinburgh

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ABSTRACT

The British Geological Survey operates the World Data Centre (WDC) for Geomagnetism, Edinburgh providing access to observatory annual mean values, magnetic survey data and real-time magnetic activity indices online. In 2007 we took over responsibility for further geomagnetic datasets with the transfer of minute and hourly mean data for over 100 observatories from WDC Copenhagen to WDC Edinburgh.

We present a summary of our current data service, data holdings and quality control procedures. Furthermore we illustrate how we are developing a new WDC data service using up-to-date web technologies to provide an enhanced data provision for WDC users and establish new data exchange programmes with other World Data Centres.

1. Changes to our Role as a WDC

There are two World Data Centres (WDC) for Geomagnetism operating in Europe. In the past the Danish Meteorological Institute (DMI) in Copenhagen principally took responsibility for collecting, maintaining and distributing geomagnetic observatory hourly and minute mean values whilst the British Geological Survey (BGS) in Edinburgh focused on collating, storing and circulating geomagnetic observatory annual mean values and global survey data. In April 2007 the British Geological Survey took over the DMI's responsibility for the hourly and minute mean observatory data and the 'Geomagnetic Data Catalogue' website used to display and distribute these data holdings.

The World Data Centre Edinburgh now holds:

digital one-minute, hourly and annual mean geomagnetic data collected from 279 observatories comprising:

- 13,935 observatory-years of annual means from 1813 to present
- 6,579 observatory-years of hourly mean value from 1890 to present
- 1,981 observatory-years of minute mean values from 1969 to present

We also hold extensive global survey data consisting of:

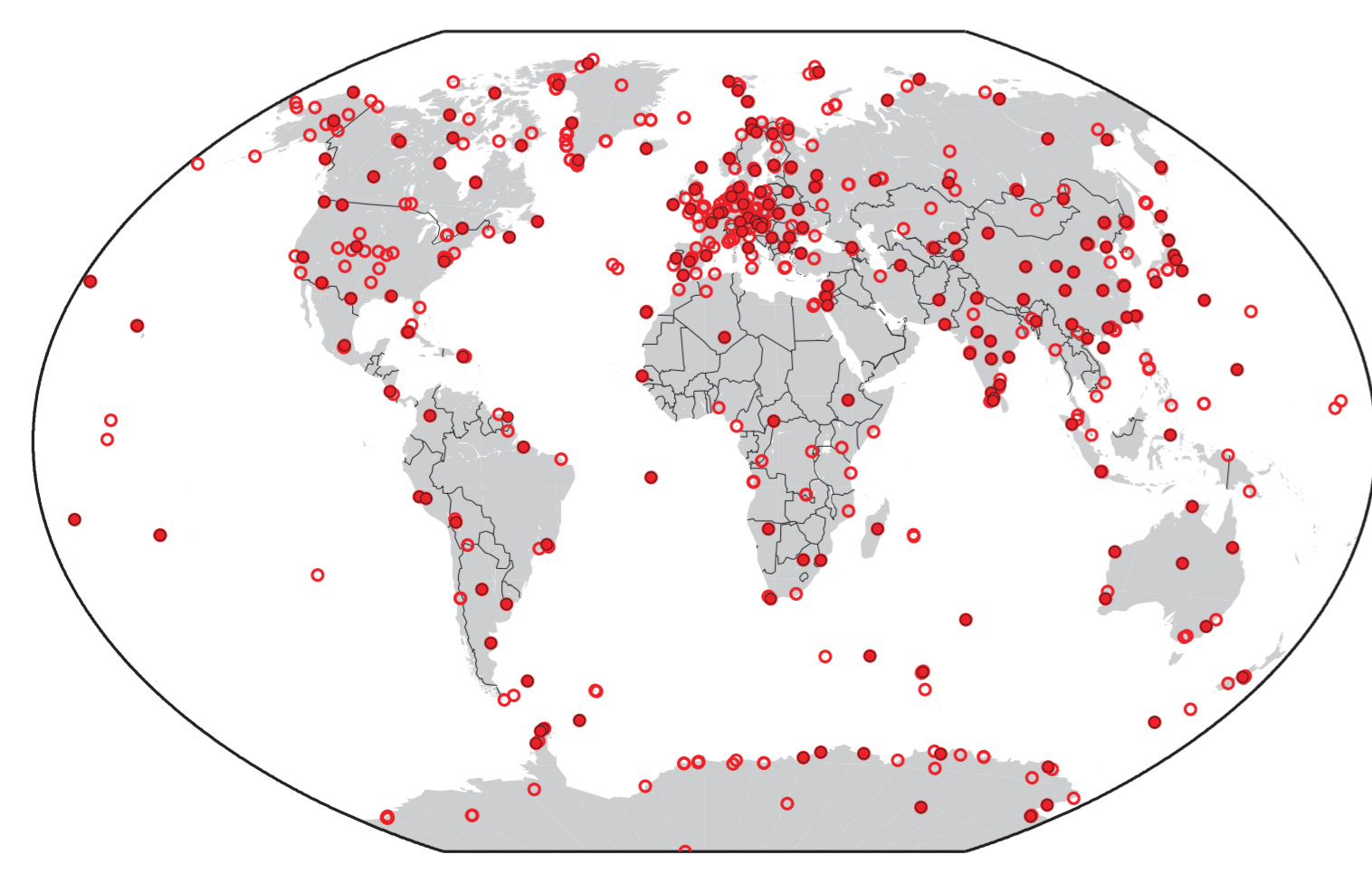
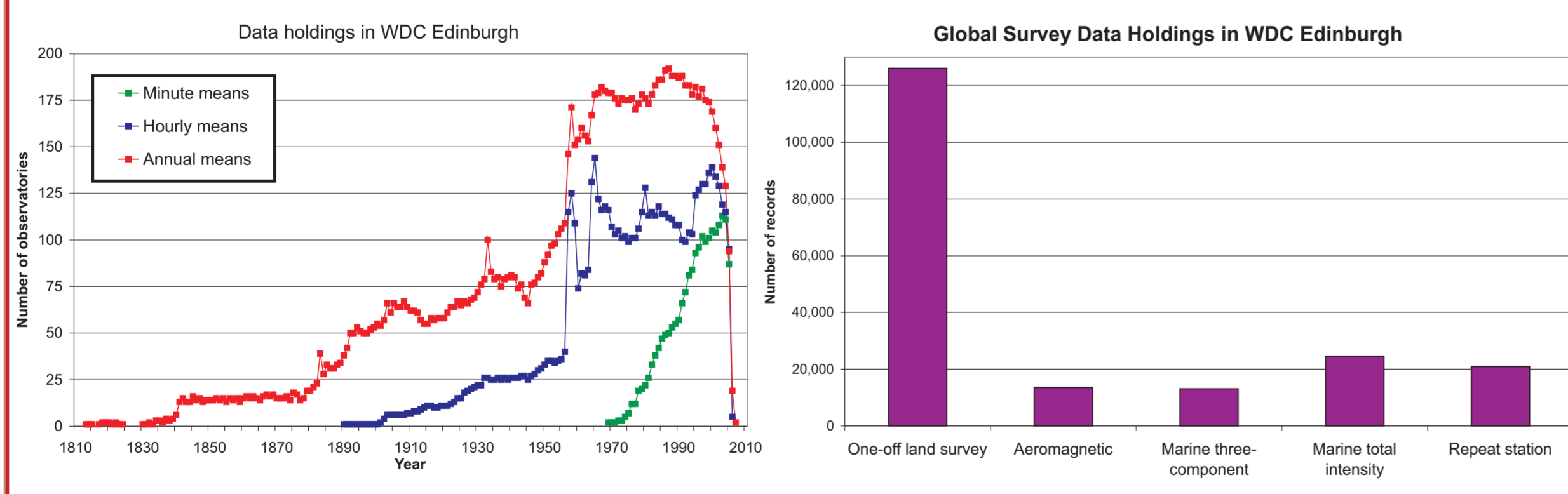
- 126,110 one-off land survey records
- 13,512 aeromagnetic survey records
- 13,087 marine three-component records
- 24,515 marine total intensity records
- 20,906 repeat station records

Users also can access global magnetic field model values, geomagnetic indices (e.g. *K*, *ap* and *aa*), solar and geomagnetic forecasts and historic ship-borne data and analogue records such as observatory yearbooks.

The World Data Centre Copenhagen now holds:

Digital data from the Greenland magnetometer chain, PCN-index values and a mirror of the *Kp*-index. Also analogue data consisting of:

- 4,300 observatory-years of magnetograms from 280 geomagnetic observatories on microfilm or microfiche
- 3,200 observatory-years of tabulated annual means from 230 geomagnetic observatories
- 790 observatory-years of quick-run or pulsation magnetograms from 90 geomagnetic observatories
- 1400 records of special events, from 90 different geomagnetic observatories
- 330 observatory-years of *K*-indices from 180 observatories and 100 observatory-years of *Q*-index and 22 geomagnetic observatories



Above: A summary of all data holdings in WDC Edinburgh. Observatory data (Top left) and global survey data (Top right)

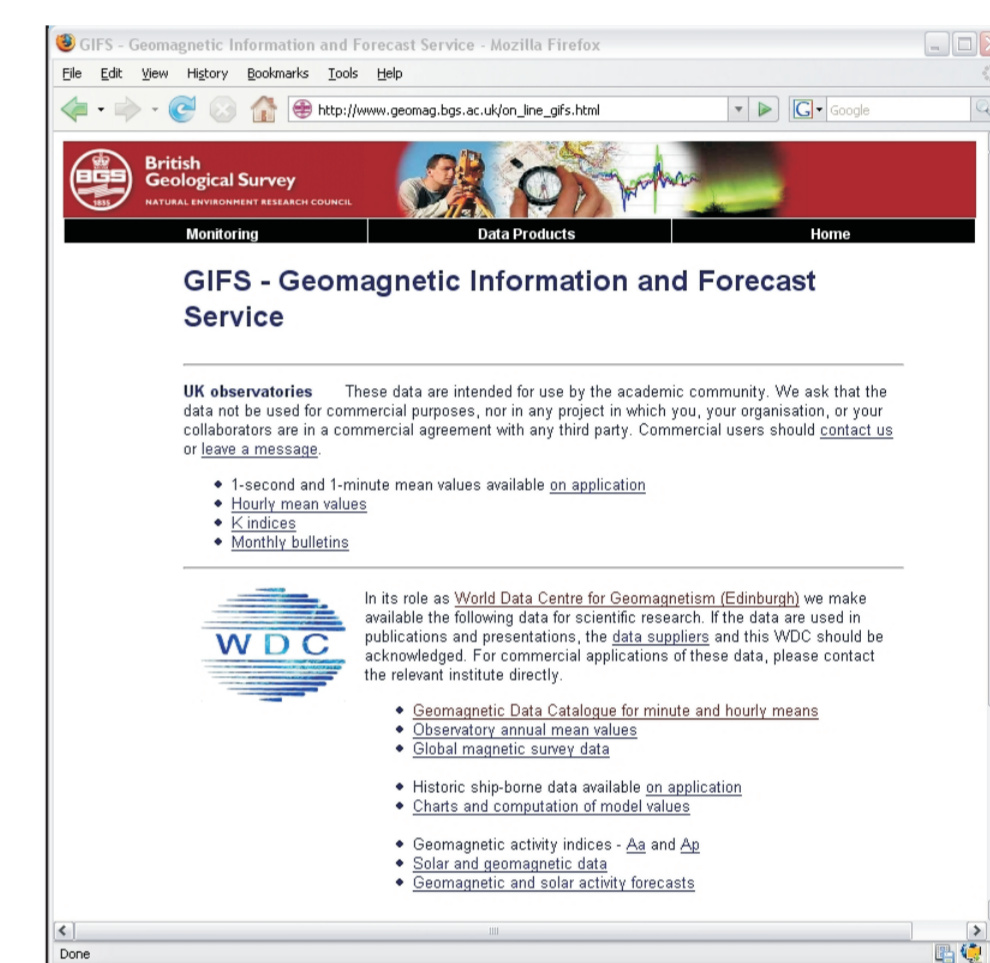
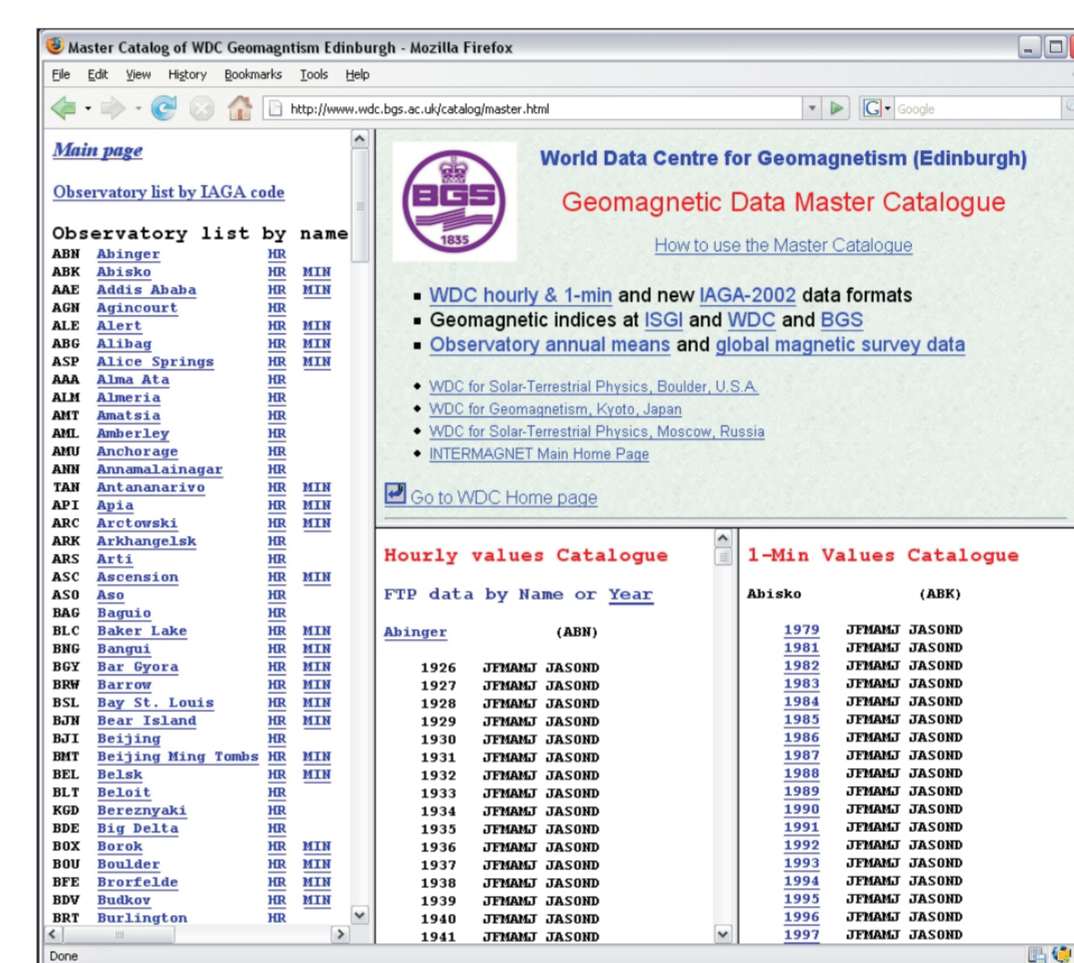
Left: Plot of all (circle) and currently operating (dot) observatories with data held by WDC Edinburgh

2. Current Data Service

Data are currently distributed through two websites (shown below). One-minute and hourly mean data are available through an FTP helper website called the Geomagnetic Data Master Catalogue. This was originally set up by the DMI and transferred to the BGS in 2007. Other data sets (annual means, global survey data, indices etc.) are available from our BGS website where users can access data via CGI web forms.

We receive most of our data via FTP and email but also get data on CD, DVD and paper records through the mail. We are in the process of establishing data mirroring between ourselves and the WDCs for Geomagnetism in Japan and the USA. We hold a complete record of observatory metadata (location, dates of operation etc.) and associated contact and acknowledgement information. Catalogues of our data holdings are available: the online Geomagnetic Data Catalogue is available for one-minute and hourly mean data and a user-generated catalogue of annual means is available from the BGS website.

All data are checked for integrity and converted into a standard format before distribution. Hourly means are stored and distributed in WDC exchange format. One-minute data are stored in INTERMAGNET binary format to retain a sub-nanotesla resolution of data. This is then converted to WDC exchange format for distribution online.

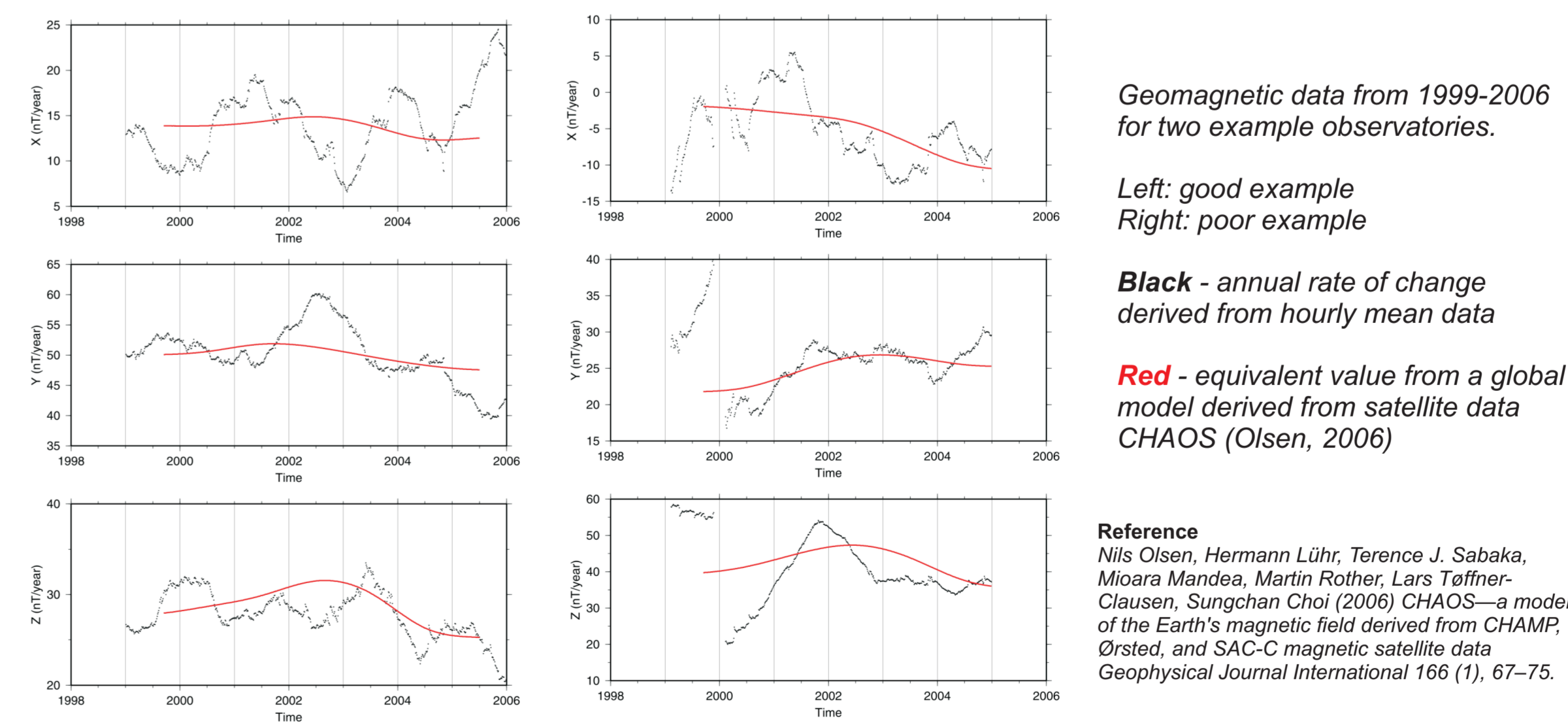


www.wdc.bgs.ac.uk/catalog/master.html www.geomag.bgs.ac.uk/on_line_gifs.html

3. Quality Control Assessment

We examine the quality of data received at our WDC. As well as simply plotting the data over several years to detect discontinuities which should, but do not always, occur at year-ends, we plot the annual rate of change of moving annual average time series derived from the hourly mean values. These are then compared with independent equivalent values from the CHAOS model derived from satellite data only (Olsen, 2006). Examples of good and poor data quality are shown below. The black line shows the observatory data and the red the equivalent model values. In the left-hand example the observatory data agree well with those from CHAOS (the red line being close to a best fit line through the data) but the right-hand example shows jumps in the observatory *Y* and *Z* data. In addition, as data are stored in INTERMAGNET format we can also use the data quality checking tools used to assess the observatory data submitted to the INTERMAGNET annual CD-ROM.

GeoForschungsZentrum Potsdam (GFZ) is undertaking a comprehensive comparison of hourly mean values, comparing the reported results with nearby observatories. The results of this work are available online and we encourage observatory operators to consider these results, correct any errors in the data and resubmit these data to our WDC or GFZ. See http://www.gfz-potsdam.de/pb2/pb23/COM/comparison_obs.html



Geomagnetic data from 1999-2006 for two example observatories.

Left: good example Right: poor example

Black - annual rate of change derived from hourly mean data

Red - equivalent value from a global model derived from satellite data CHAOS (Olsen, 2006)

Reference
 Nils Olsen, Hermann Lühr, Terence J. Sabaka, Mioara Mandea, Martin Rother, Lars Tøffner-Clausen, Sungchan Choi (2006) CHAOS—a model of the Earth's magnetic field derived from CHAMP, Orsted, and SAC-C magnetic satellite data Geophysical Journal International 166 (1), 67–75.

4. Future Developments

Our WDC's current challenge is to consolidate all our newly acquired and previously held data holdings into one single point of reference for the user. We intended to use new and emerging technologies to help us provide data over the internet to users in a form that is convenient to them. We plan to build on a proto-type system recently developed for INTERMAGNET that allows the user to select the required observatories and dates and either bulk download, view in Excel, XML, ASCII etc. or view a plot of the data and export as a JPEG, PNG, PDF for example.

