INCREASED DEMAND FOR RAPID ACCESS TO UK MAGNETIC OBSERVATORY DATA: IMPLICATIONS FOR QUALITY CONTROL PROCEDURES

British Geological Survey

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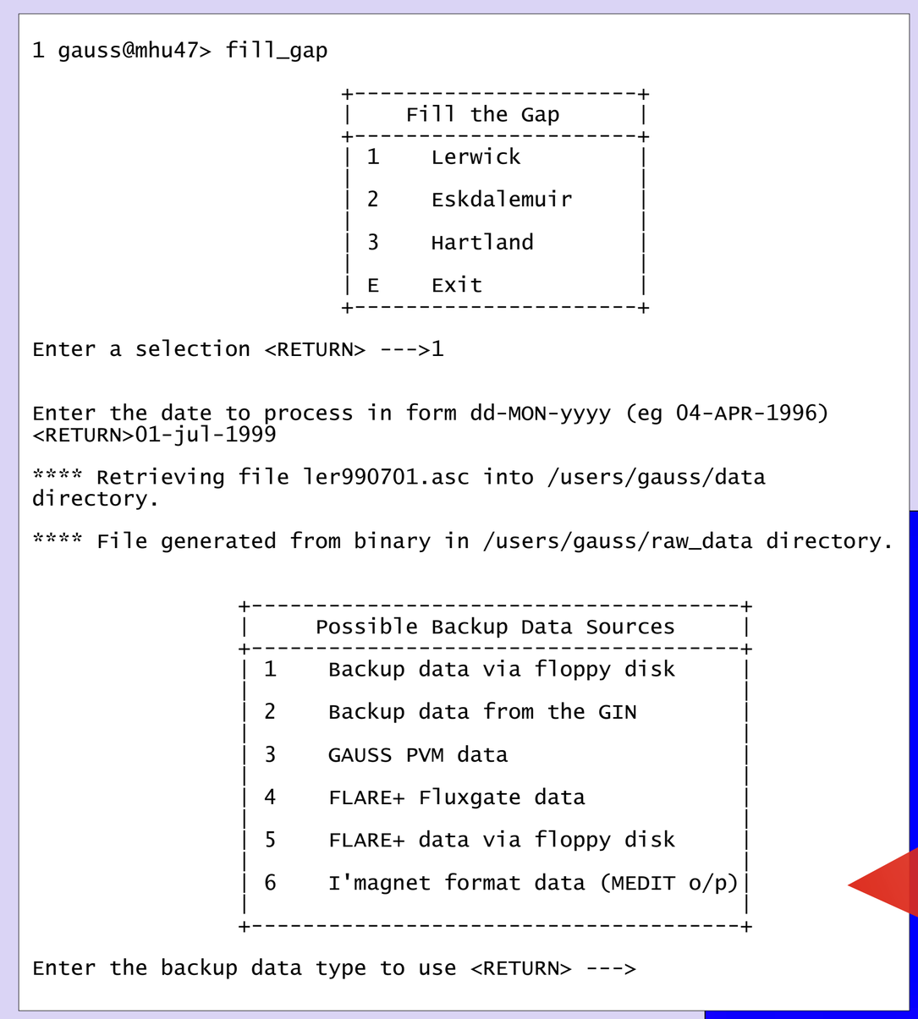
Automation & Quality



```
1 gauss@mhu47> fill_gap

                +----------------------+
                |    Fill the Gap      |
                +----------------------+
                | 1    Lerwick         |
                |                      |
                | 2    Eskdalemuir     |
                |                      |
                | 3    Hartland        |
                |                      |
                | E    Exit            |
                +----------------------+

Enter a selection <RETURN> --->1

Enter the date to process in form dd-MON-yyyy (eg 04-APR-1996)
<RETURN>01-jul-1999

**** Retrieving file ler990701.asc into /users/gauss/data
directory.

**** File generated from binary in /users/gauss/raw_data directory.

            +-----------------------------------+
            |    Possible Backup Data Sources   |
            +-----------------------------------+
            | 1    Backup data via floppy disk  |
            |                                   |
            | 2    Backup data from the GIN     |
            |                                   |
            | 3    GAUSS PVM data               |
            |                                   |
            | 4    FLARE+ Fluxgate data         |
            |                                   |
            | 5    FLARE+ data via floppy disk  |
            |                                   |
            | 6    I'magnet format data (MEDIT o/p)|
            |                                   |
            +-----------------------------------+

Enter the backup data type to use <RETURN> --->
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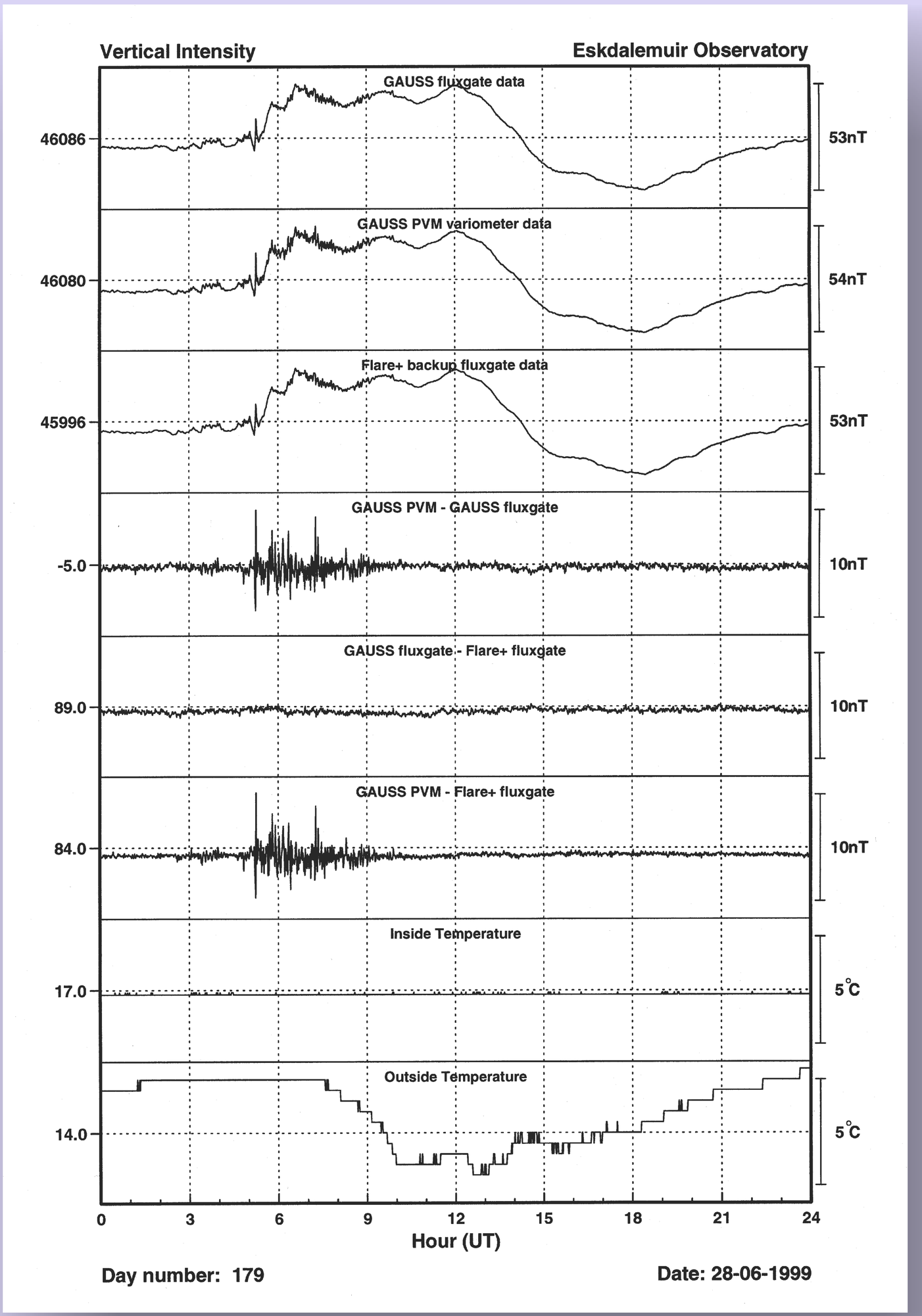
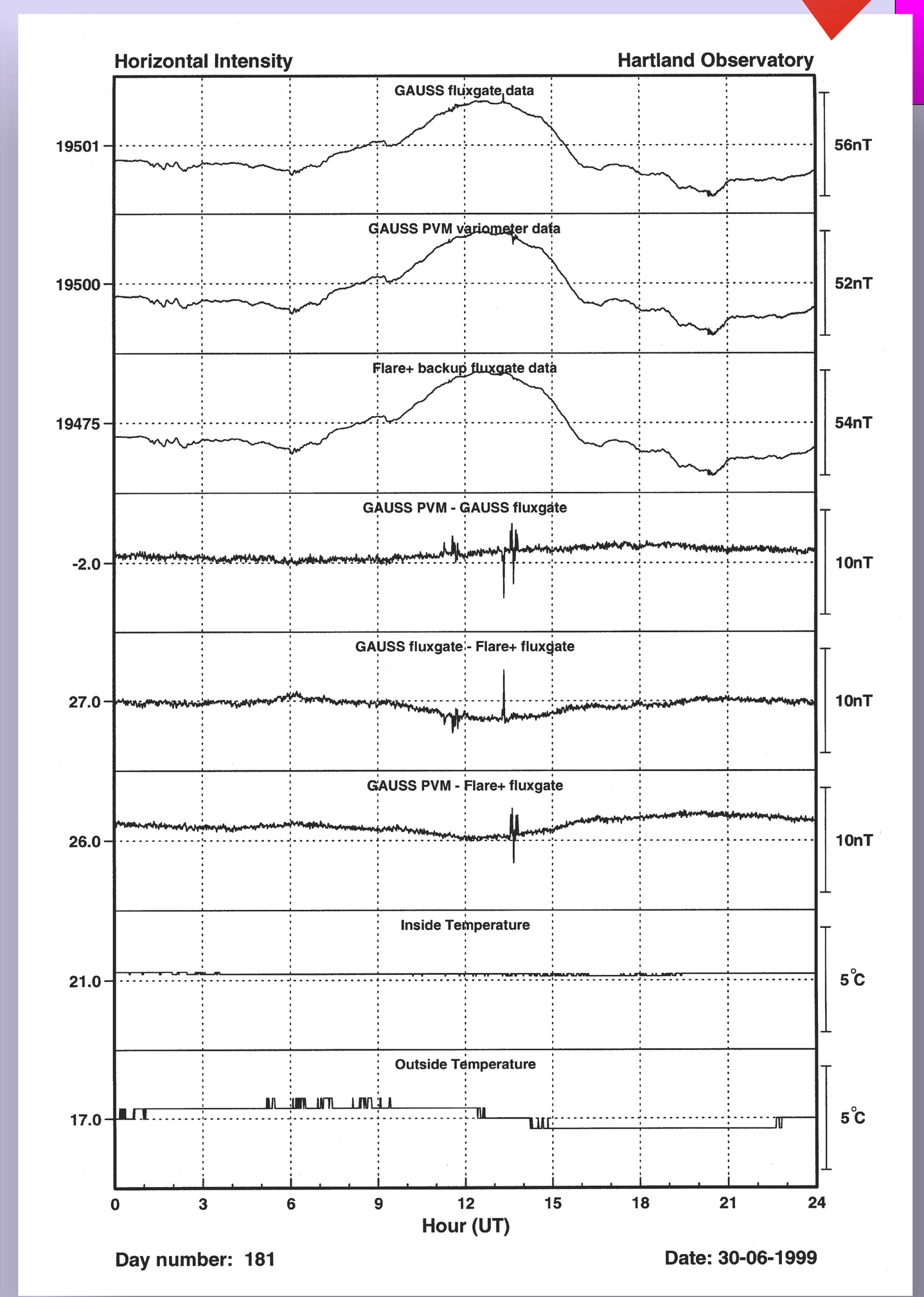
During the last decade the demand for magnetic observatory data has steadily increased both from the scientific community and in particular from commercial organisations. Not only are the quantity of data products greater now but the speed at which they are delivered is faster and the quality of the data provided better.

The modern user requirements for timely data have prompted the need for improved automatic procedures utilising the new technologies available. This has to be balanced against the user requirements for accuracy, which necessitate rigorous quality control procedures. While some of these have been automated, as is shown in the flow diagram, there remains a requirement for human interpretation and action if and when the data contain errors. Software development to reduce this human intervention is on-going.

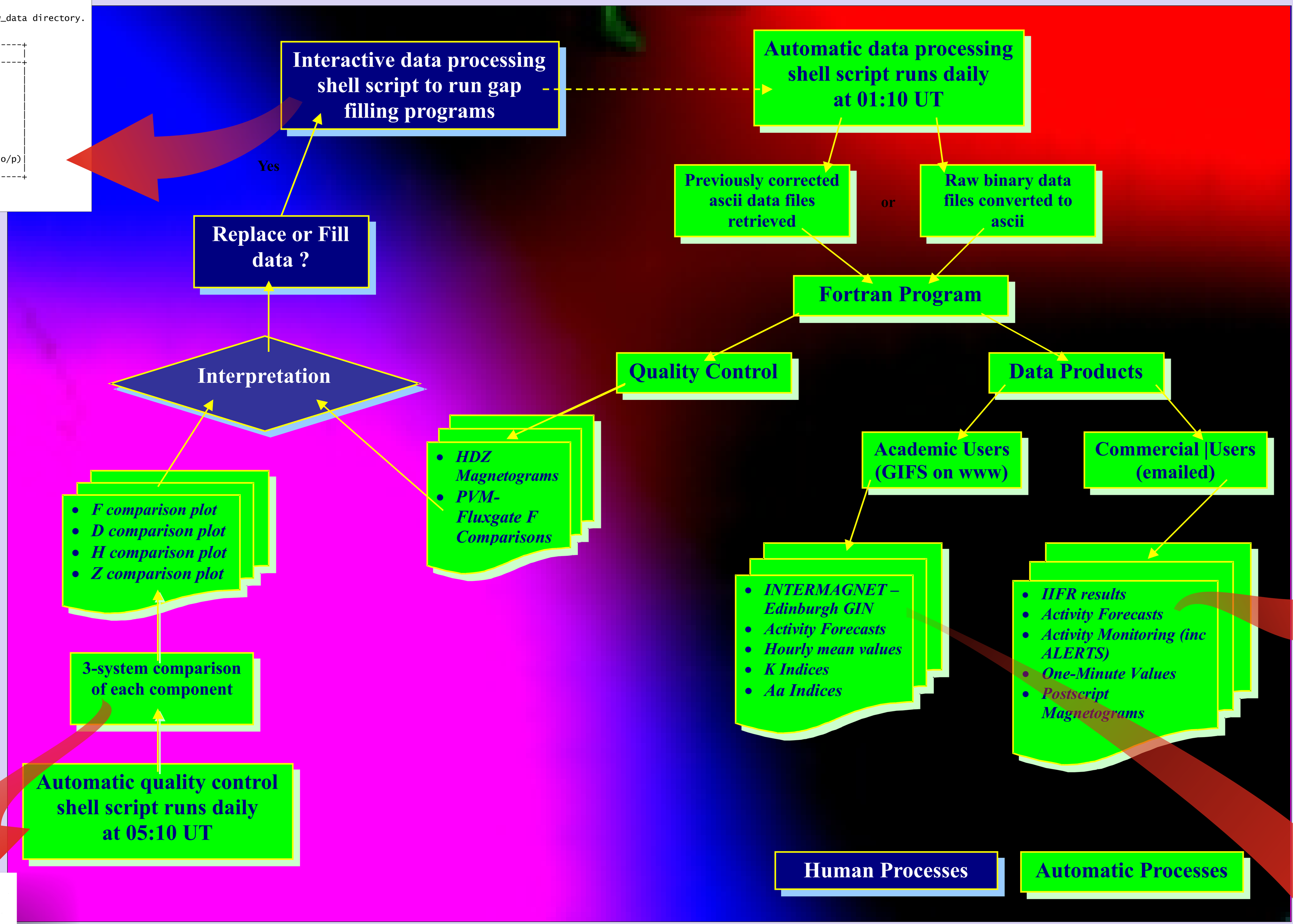
Two examples of the quality control plots that are automatically



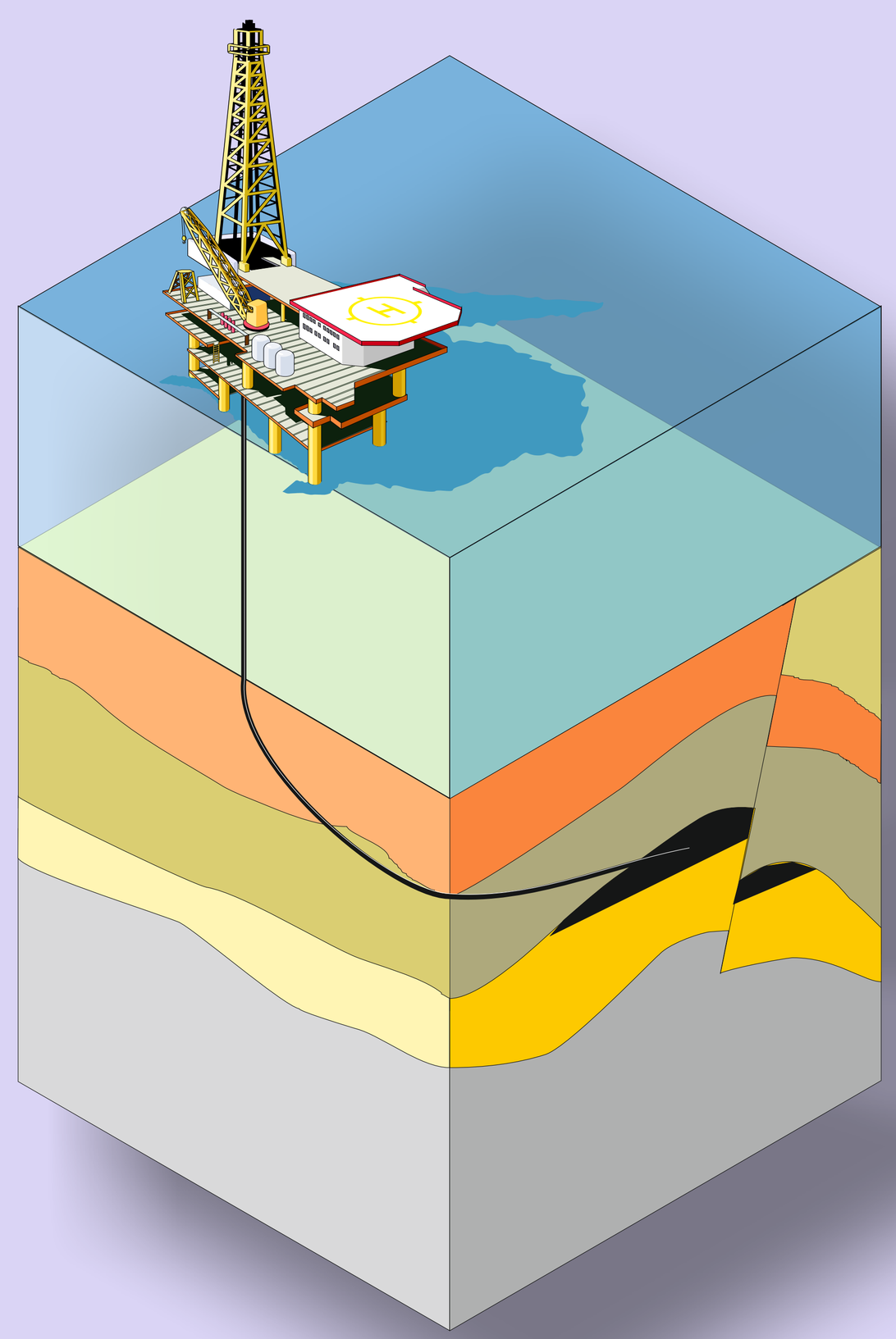


printed each day are shown above. These show small errors in the data that would not otherwise be noticed. The left hand plot shows errors in the timing of the proton vector magnetometer (PVM) system and the other shows errors from both the standard observatory fluxgate and the PVM. In this case the erroneous data would be replaced with the backup fluxgate data, which from the evidence shown is error free.

Flow diagram illustrating the main procedures involved in the automatic data processing and quality control.



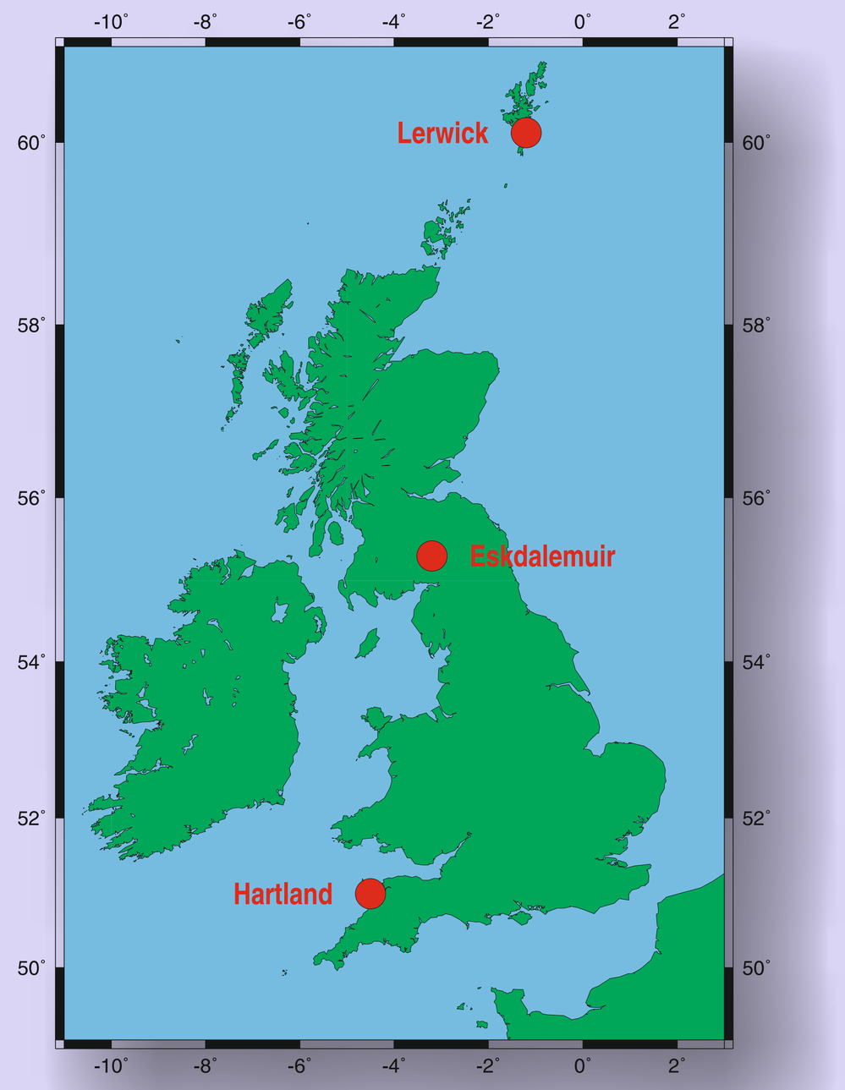
Applications in Industry



The offshore oil industry use magnetic data in borehole surveying as a cheaper alternative to using gyros. A technique known as Interpolated In-Field Referencing (IIFR) has been jointly developed by BGS and Sperry-Sun Drilling Services to give accurate one-minute magnetic values at the oil well locations, enabling the technique of measurement-while-drilling to be used.

For IIFR purposes errors of the order of 10nT and two minutes of arc would not be significant. Larger data spikes or baseline shifts however must be detected by the quality control process and corrected before IIFR data can be issued. Updated IIFR data are now made available to customers hourly.

The UK Geomagnetic Observatories

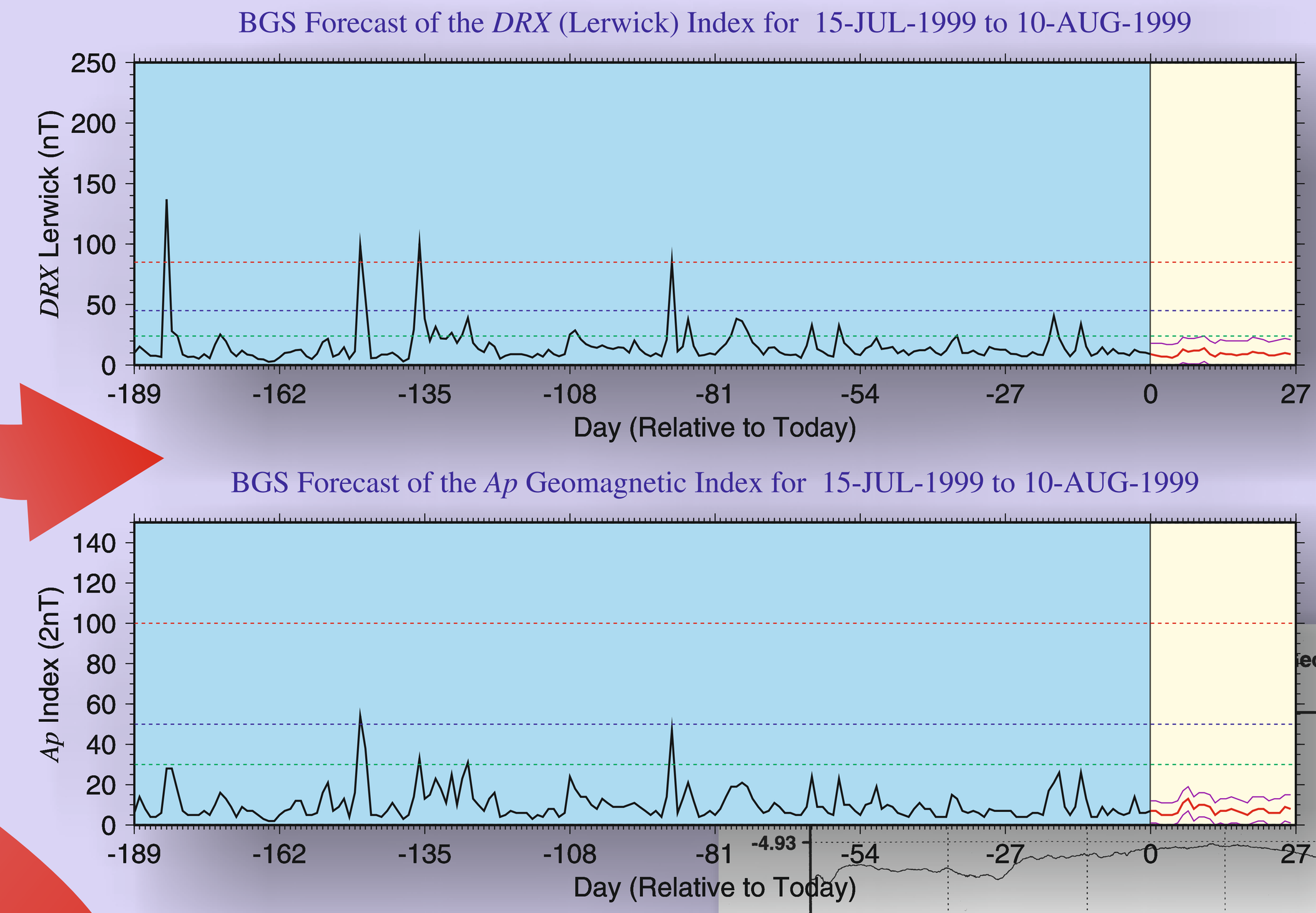


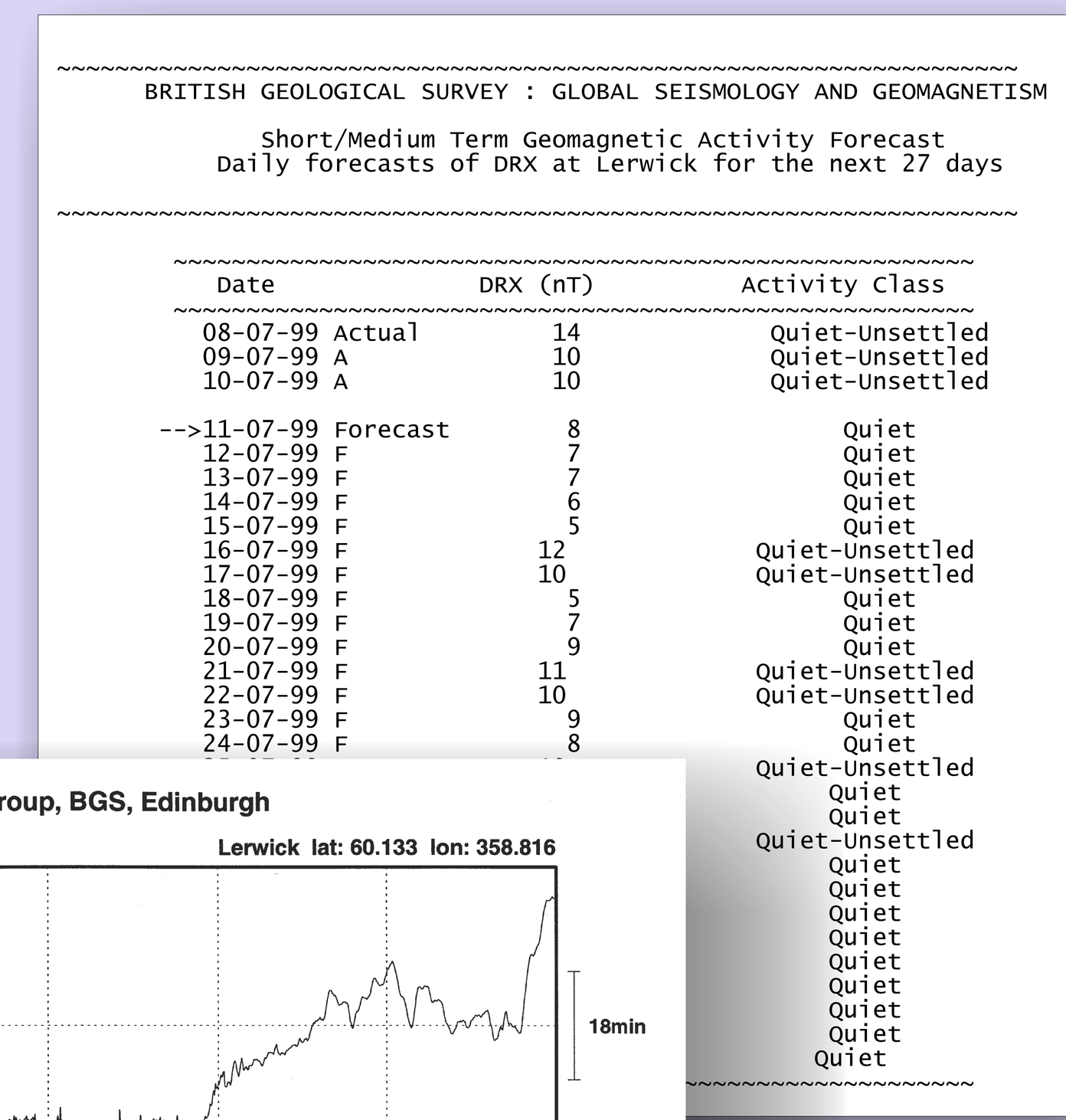
The British Geological Survey operates three permanent magnetic observatories in the UK:

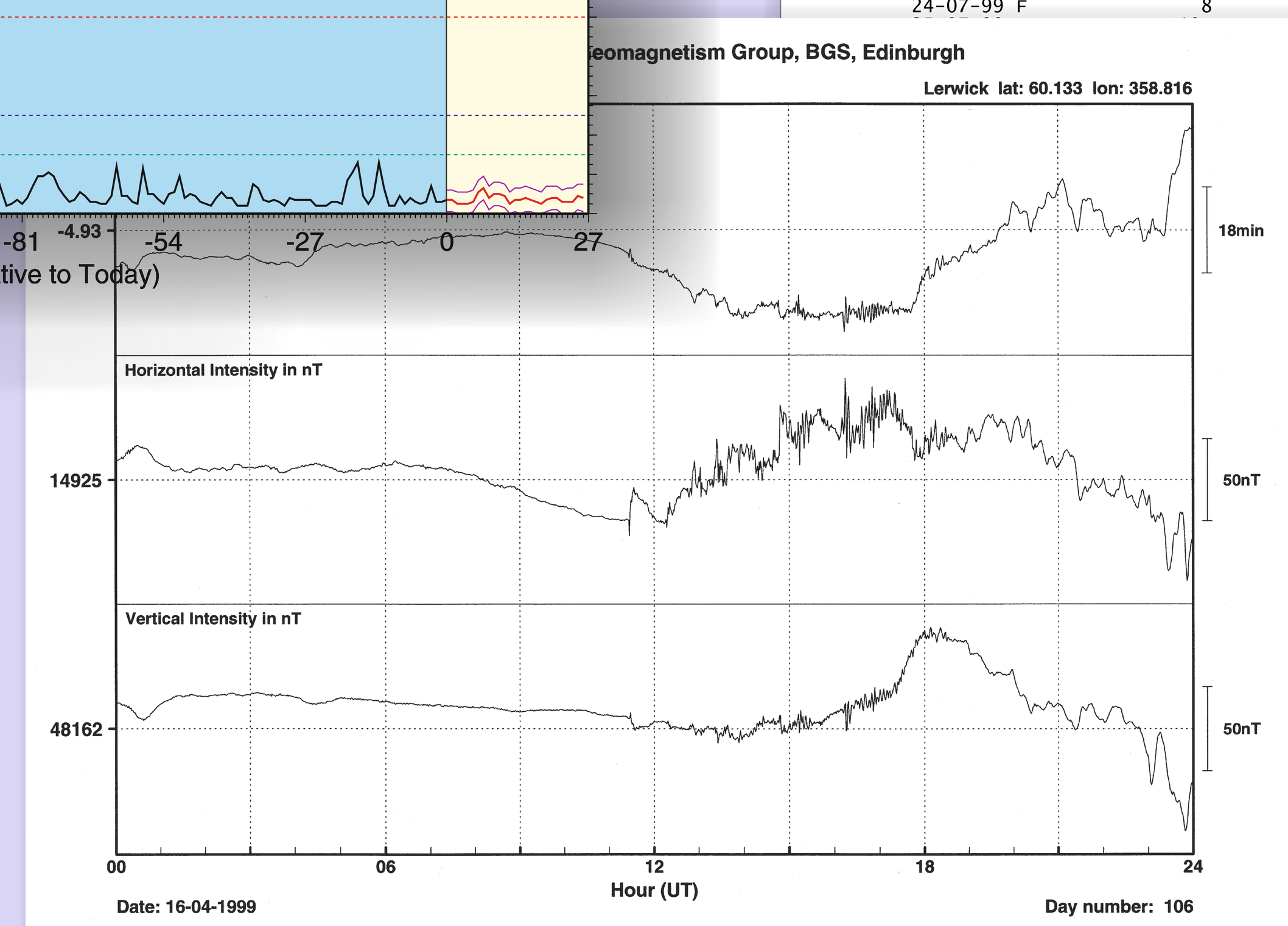
Lerwick in the Shetland Isles
Eskdalemuir in the Scottish Borders
Hartland in North Devon

Since 1987 the operation of the instruments and the data sampling procedures at the observatories have been fully automatic. The data are also retrieved automatically to the BGS office in Edinburgh, where they are processed and various

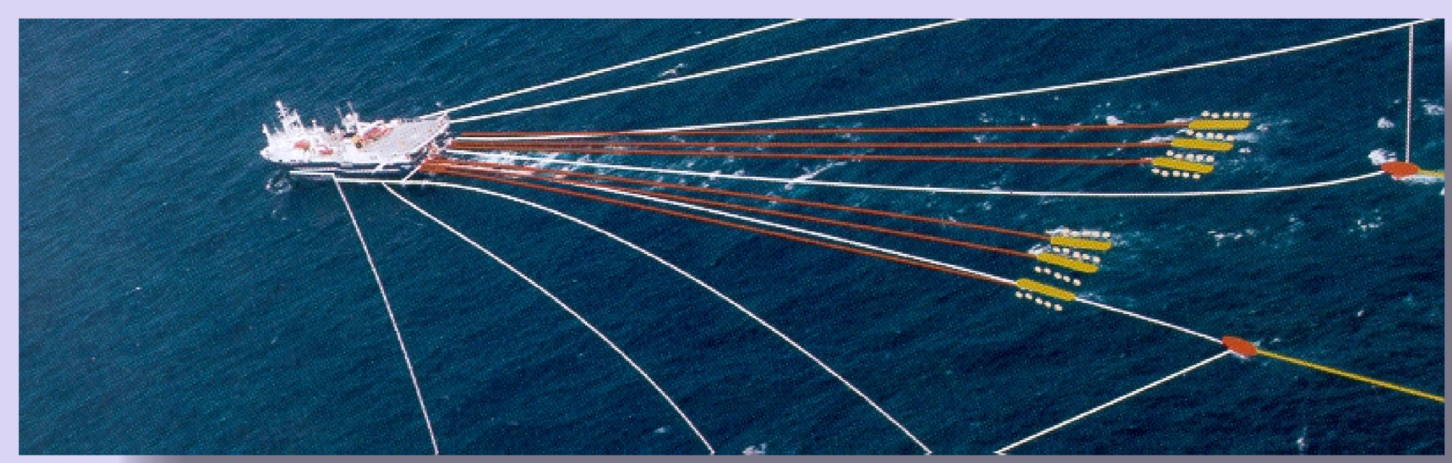
Some examples of daily data products are shown below - a text file and a plot of the activity forecast and a magnetogram showing variations in declination and the horizontal and vertical intensities.







The International Real-time Magnetic observatory Network



Some geophysical survey operators, such as the one carrying out the seismic survey shown, also rely on geomagnetic data. Geomagnetic variations are required on a next day basis for the quality control of their streamer compass data.

Magnetic storms can cause geomagnetically induced currents (GICs) in power transmission systems. In March 1989 a large magnetic storm caused a power black-out in Quebec, Canada. The risk of GICs to power companies in the UK has been assessed by BGS using UK observatory data.

For an effective GIC warning program using UK magnetic data the quality control procedures would need to be strengthened. Data errors such as spikes would have to be detected automatically, otherwise unwanted false alarms could occur. Spike detection in geomagnetic data is not a straightforward operation.