1. JIM CARRIGAN OBSERVATORY MAGNETIC DATA

1. Introduction

Jim Carrigan Observatory is the fourth overseas geomagnetic observatory established by the British Geological Survey (BGS). The installation is a joint project between BGS and Sperry Drilling Services (SDS) in support of directional drilling programmes. SDS has operated a prototype station since 1997 which was upgraded by the BGS to a standard high-quality observatory in October 2003.

This bulletin is published to meet the needs of users of geomagnetic data. Magnetic observatory data is presented as a series of plots of one-minute, hourly and daily values, followed by a tabulation of monthly values. The operation of the observatory and presentation of data are described in the rest of this section.

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2. Position

Jim Carrigan Observatory is situated at T-Pad, a man-made gravel bed close to the drilling sites at Prudhoe Bay, Alaska, USA.

The observatory co-ordinates are:

**Geographic**: 70° 21.36′N 211° 12.06′E
**Geomagnetic**: 70° 04.2′N 254° 00.36′E
**Height above mean sea level**: 10m (approx)

The geomagnetic co-ordinates are calculated using the 10th generation International Geomagnetic Reference Field (IGRF) at epoch 2009.5.

3. The Observatory Operation

3.1 GDAS

The observatory operates under the control of the Geomagnetic Data Acquisition System (GDAS), which was developed by BGS and became fully operational from 27th October 2003. The system operates under the control of data acquisition software running on QNX computers, which controls the data logging and communications.

There are two sets of sensors used for making magnetic measurements. A triaxial linear-core fluxgate magnetometer, manufactured by the Danish Meteorological Institute, is used to measure the variations in the horizontal (H) and vertical (Z) components of the field. The third sensor is oriented perpendicular to these, and measures variations, which are proportional to the changes in declination (D). Measurements are made at a rate of 1 Hz.

In addition to the fluxgate sensors there is a proton precession magnetometer making measurements of the absolute total field intensity (F) at a rate of 0.1Hz.

The raw unfiltered data are retrieved automatically via internet connections to the BGS office in Edinburgh in near real-time. The fluxgate data are filtered to produce one-minute values using a 61-point cosine filter whilst the total field intensity samples are filtered using a 7-point cosine filter.

3.2 Absolute Observations

The GDAS fluxgate magnetometers accurately measure variations in the components of the geomagnetic field, but not the absolute magnitudes. Regular manual absolute measurements of the field are made throughout the year. A fluxgate sensor mounted on a theodolite is used to determine D and inclination (I); the GDAS PPM measurements, with a site difference correction applied, are used for F. The absolute observations are used in conjunction with the GDAS variometer measurements to produce a continuous record of the absolute values of the geomagnetic field elements as if they had been measured at the observatory reference pillar.

4. Data Presentation

The data presented in the bulletin are in the form of plots and tabulations described in the following sections.

4.1 Absolute Observations

The absolute observation measurements made during the month are tabulated. Also included are the corresponding baseline values, which are the differences between the absolute measurements and the variometer measurements of D, H and Z (in the sense absolute–variometer). These are also plotted (markers) along with the derived preliminary daily baseline values (line) throughout the year. Daily mean differences between the measured absolute F and the F computed from the baseline corrected H and Z values are plotted in the fourth panel (in the sense measured–derived). The bottom panel shows the daily mean temperature in the fluxgate chamber.
4.2 Summary magnetograms
Small-scale magnetograms are plotted which allow the month's data to be viewed at a glance. They are plotted 16 days a page and show the variations in $D$, $H$ and $Z$. The scales are shown on the right-hand side of the page. On disturbed days the scales are multiplied by a factor, which is indicated above the panel for that day. The variations are centred on the monthly mean value, shown on the left side of the page.

4.3 Magnetograms
The daily magnetograms are plotted using one-minute values of $D$, $H$ and $Z$ from the fluxgate sensors, with any gaps filled using back-up data. The magnetograms are plotted to a variable scale; scale bars are shown to the right of each plot. The absolute level (the monthly mean value) is indicated on the left side of the plots.

4.4 Hourly Mean Value Plots
Hourly mean values of $D$, $H$ and $Z$ for the past 12 months are plotted in 27-day segments corresponding to the Bartels solar rotation number. Magnetic disturbances associated with active regions on the surface of the Sun may recur after 27 days: the same is true for geomagnetically quiet intervals. Plotting the data in this way highlights this recurrence, and also illustrates seasonal and diurnal variations throughout the year.

4.5 Daily and Monthly Mean Values
Daily mean values of $D$, $H$, $Z$ and $F$ are plotted throughout the year. In addition, a table of monthly mean values of all the geomagnetic elements is provided. These values depend on accurate specification of the fluxgate sensor baselines.
### JIM CARRIGAN OBSERVATORY

#### ABSOLUTE OBSERVATIONS

<table>
<thead>
<tr>
<th>Date</th>
<th>Day Number</th>
<th>Time (UT)</th>
<th>Absolute (°)</th>
<th>Baseline (°)</th>
<th>Time (UT)</th>
<th>Inclination (°)</th>
<th>Total Field Intensity (nT)</th>
<th>H Absolute (nT)</th>
<th>H Baseline (nT)</th>
<th>Z Absolute (nT)</th>
<th>Z Baseline (nT)</th>
<th>Observer</th>
</tr>
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<tr>
<td>14-Dec-09</td>
<td>348</td>
<td>21:35</td>
<td>21.2573</td>
<td>20.4417</td>
<td>21:52</td>
<td>80.9869</td>
<td>57609.3</td>
<td>9025.1</td>
<td>9135.1</td>
<td>56898.0</td>
<td>56867.5</td>
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<td>22:22</td>
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<td>9025.8</td>
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<td>56900.4</td>
<td>56867.1</td>
<td>PS</td>
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</tbody>
</table>
Jim Carrigan Obs 2009

Declination: Absolute - Variometer (markers) and Baseline Applied (line)

Horizontal Intensity: Absolute - Variometer (markers) and Baseline Applied (line)

Vertical Intensity: Absolute - Variometer (markers) and Baseline Applied (line)

Total Intensity: Absolute (Proton F) - Baseline Adjusted Variometer (derived F)

Temperature Inside Variometer Hut:
Jim Carrigan Observatory: Vertical Intensity (nT)

Hourly Mean Values Plotted By Bartels Solar Rotation Number
## Monthly Mean Values for Jim Carrigan Observatory 2009

<table>
<thead>
<tr>
<th>Month</th>
<th>D</th>
<th>H</th>
<th>I</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>F</th>
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<tbody>
<tr>
<td>January</td>
<td>22° 45.9´</td>
<td>9018 nT</td>
<td>80° 59.6´</td>
<td>8316 nT</td>
<td>3490 nT</td>
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<td>57603 nT</td>
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<td>22° 43.5´</td>
<td>9019 nT</td>
<td>80° 59.6´</td>
<td>8319 nT</td>
<td>3484 nT</td>
<td>56896 nT</td>
<td>57606 nT</td>
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<td>22° 40.6´</td>
<td>9019 nT</td>
<td>80° 59.6´</td>
<td>8322 nT</td>
<td>3477 nT</td>
<td>56898 nT</td>
<td>57608 nT</td>
</tr>
<tr>
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<td>22° 38.1´</td>
<td>9020 nT</td>
<td>80° 59.5´</td>
<td>8325 nT</td>
<td>3471 nT</td>
<td>56898 nT</td>
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<td>May</td>
<td>22° 34.7´</td>
<td>9028 nT</td>
<td>80° 59.0´</td>
<td>8336 nT</td>
<td>3467 nT</td>
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<td>57608 nT</td>
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<tr>
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<td>22° 31.9´</td>
<td>9035 nT</td>
<td>80° 58.6´</td>
<td>8345 nT</td>
<td>3462 nT</td>
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<td>80° 59.3´</td>
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<td>3451 nT</td>
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<td>57615 nT</td>
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<td>22° 26.3´</td>
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<td>80° 59.5´</td>
<td>8338 nT</td>
<td>3443 nT</td>
<td>56905 nT</td>
<td>57616 nT</td>
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<tr>
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<td>80° 59.7´</td>
<td>8336 nT</td>
<td>3437 nT</td>
<td>56902 nT</td>
<td>57612 nT</td>
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<tr>
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<td>80° 59.6´</td>
<td>8340 nT</td>
<td>3432 nT</td>
<td>56901 nT</td>
<td>57611 nT</td>
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<tr>
<td>November</td>
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<td>9012 nT</td>
<td>81° 0.0´</td>
<td>8337 nT</td>
<td>3424 nT</td>
<td>56902 nT</td>
<td>57611 nT</td>
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<td>8348 nT</td>
<td>3419 nT</td>
<td>56898 nT</td>
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### Note

i. The values shown here are provisional.