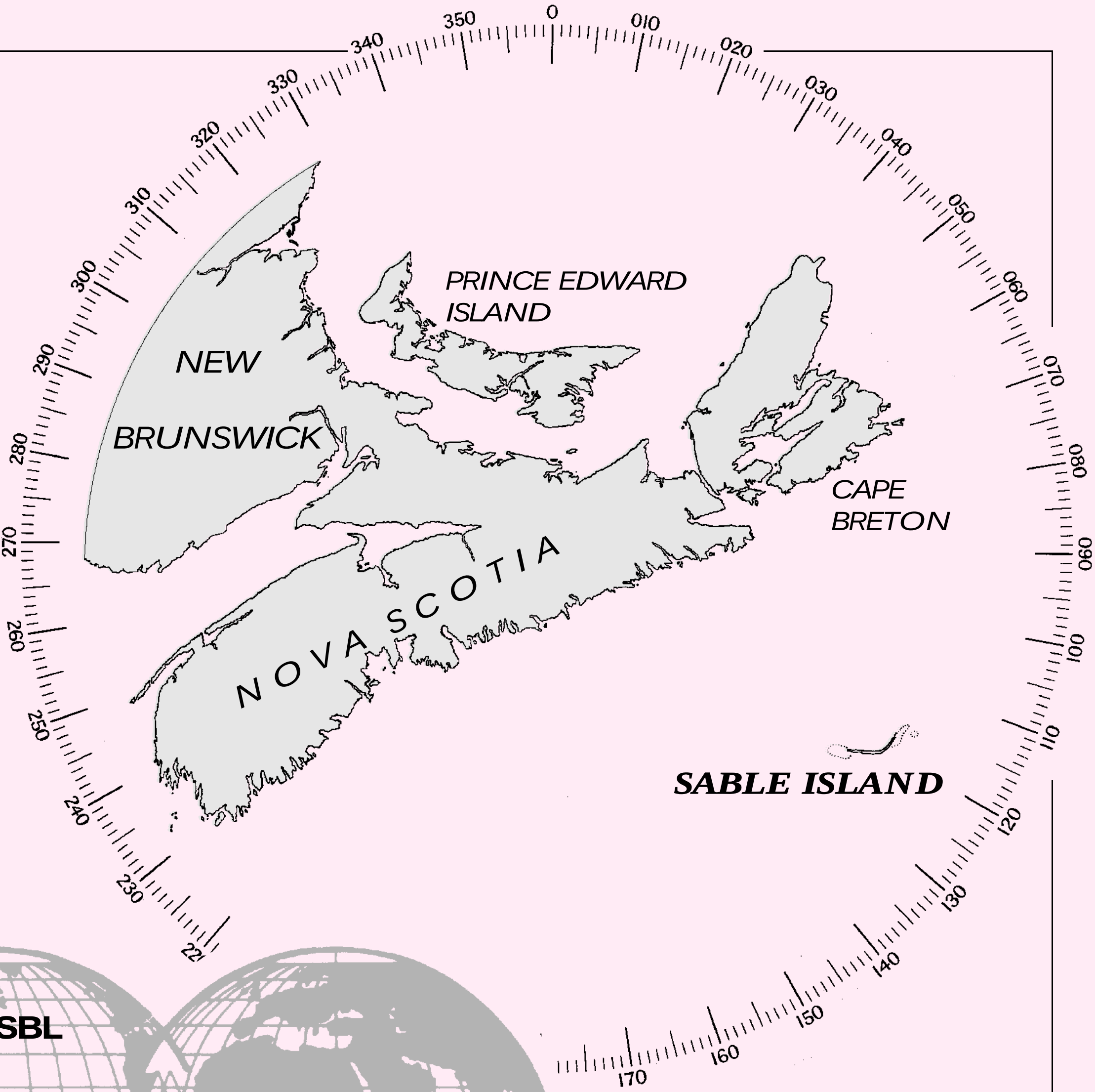
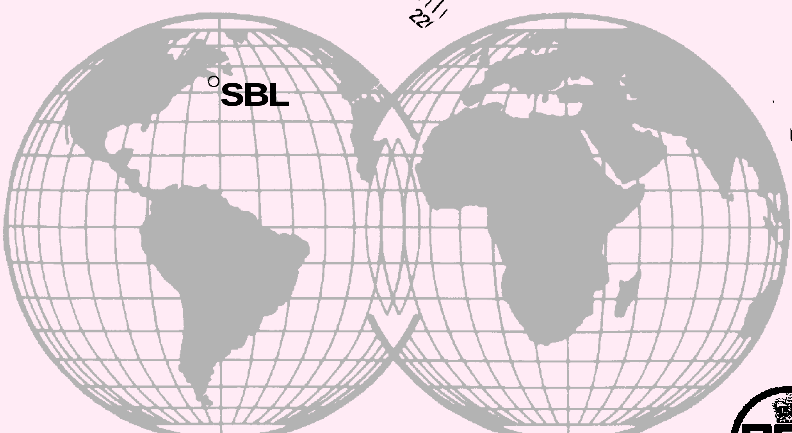
SABLE ISLAND OBSERVATORY

Monthly Geomagnetic Bulletin

DECEMBER 2002 02/12/SBL





World Observatories Series

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL
Global Seismology & Geomagnetism

1. SABLE ISLAND OBSERVATORY MAGNETIC DATA

1.1 Introduction

Sable Island is the third overseas geomagnetic observatory to be established by BGS. The installation, funded by a joint venture between BGS, Sperry-Sun Drilling Services and Sable Offshore Energy, was completed in May 1999 and the observatory became operational from 8th May 1999.

This bulletin is organised into two main sections. The first section presents the magnetic observatory results, which are described in 1.3. Section 2 provides a description of the observatory operation and quality control procedures. The absolute observations and quality control plots are presented. Enquiries about the data should be addressed to: -

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British Geological Survey
Murchison House, West Mains Road
Edinburgh EH9 3LA
Scotland, UK

Tel:	+44 (0) 131 667 1000
Fax:	+44 (0) 131 668 4368
E-mail:	s.reay@bgs.ac.uk
World-Wide Web:	*www.geomag.bgs.ac.uk*

1.2 Position

The Island is a sandbank formed by the meeting of currents from the St. Lawrence Delta and the Gulf Stream and is located approximately 290km southeast of Halifax, Nova Scotia.

The observatory co-ordinates are: -

Geographic:	*43° 55.9′N*	*299° 0.4′E*
Geomagnetic:	*54° 4.1′N*	*13° 7.4′E*
Height above mean sea level:	*5m (approx)*	

The geomagnetic co-ordinates are calculated using the 8th generation International Geomagnetic Reference Field (IGRF) at epoch 2002.5.

1.3 Data Presentation

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

1.3.1 Summary magnetograms

Small-scale magnetograms are plotted which allow the month's data to be viewed at a glance. They are plotted with 16 days on a page, showing the variations in declination (*D*), horizontal intensity (*H*) and vertical intensity (*Z*). The scales are shown on the right-hand side of the page. Occasionally the amplitude of disturbance requires that the scales be multiplied by a factor throughout the course of one day, 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.

1.3.2 Magnetograms

The magnetograms are plotted using one-minute values of *D*, inclination (*I*) and total field intensity (*F*) derived from the measurements made using the fluxgate sensors. 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.

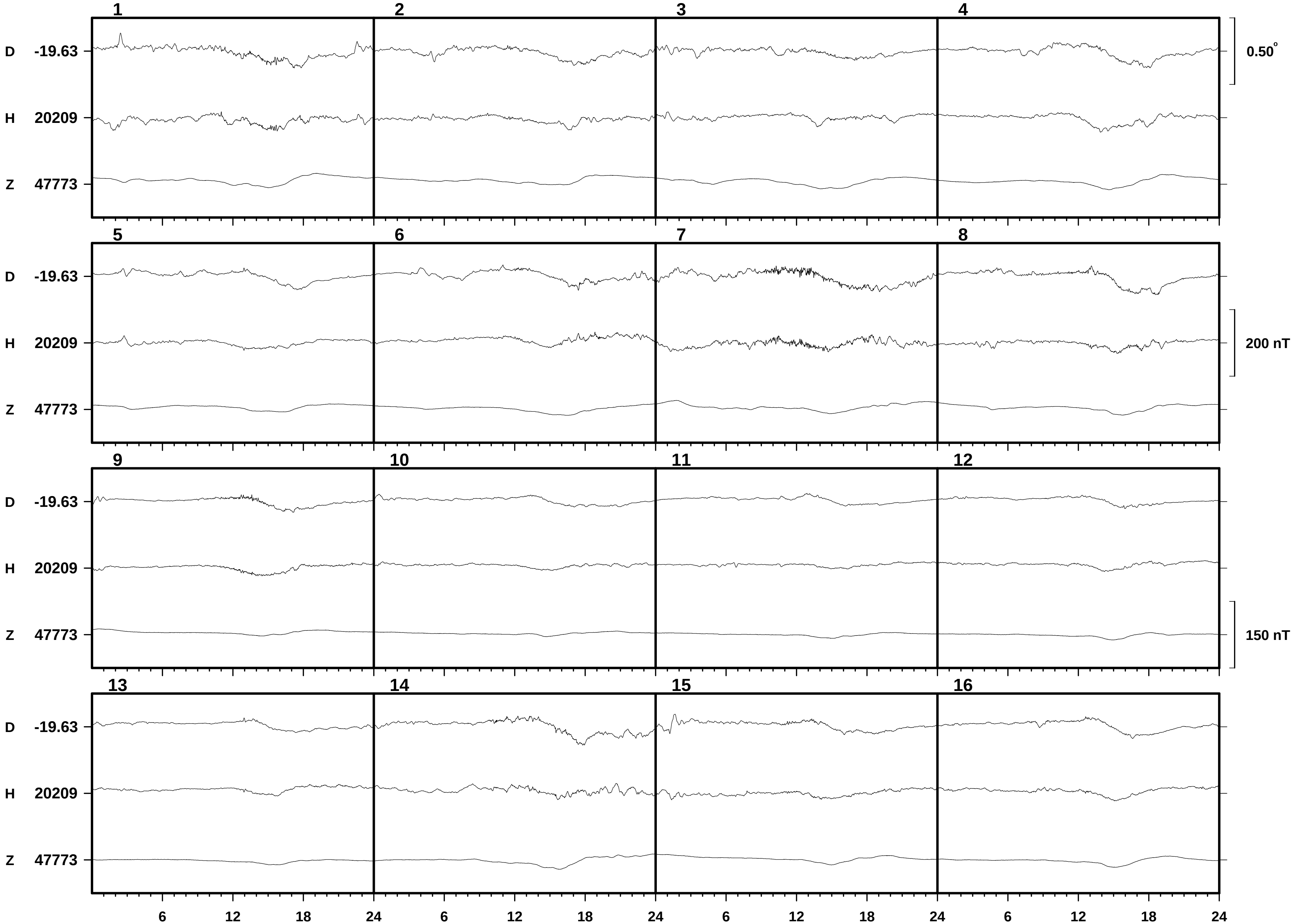
1.3.3 Hourly Mean Values

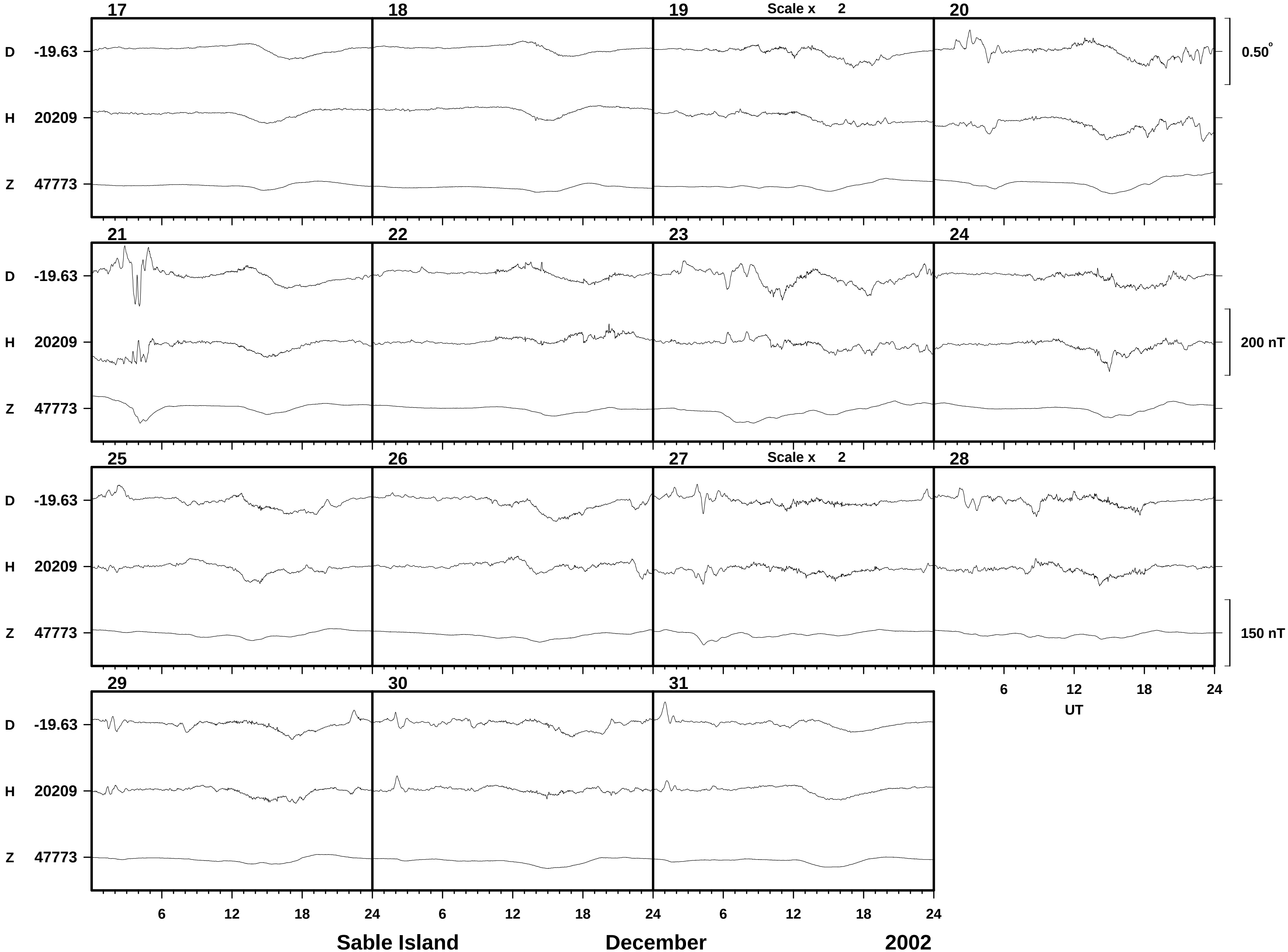
Plots of hourly mean values of *D*, *H* and *Z* for the past 12 months are plotted in 27-day segments corresponding to the Bartels solar rotation number. Magnetic disturbances associated with active regions on the surface of the Sun may recur after 27 days: the same is true for geomagnetically quiet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

1.3.4 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. Provisional and definitive values are indicated in the table as **P** or **D** respectively. It is anticipated that provisional values will not be altered by more than a few nT or tenths of arcminutes before being made definitive.

Sable Island December 2002

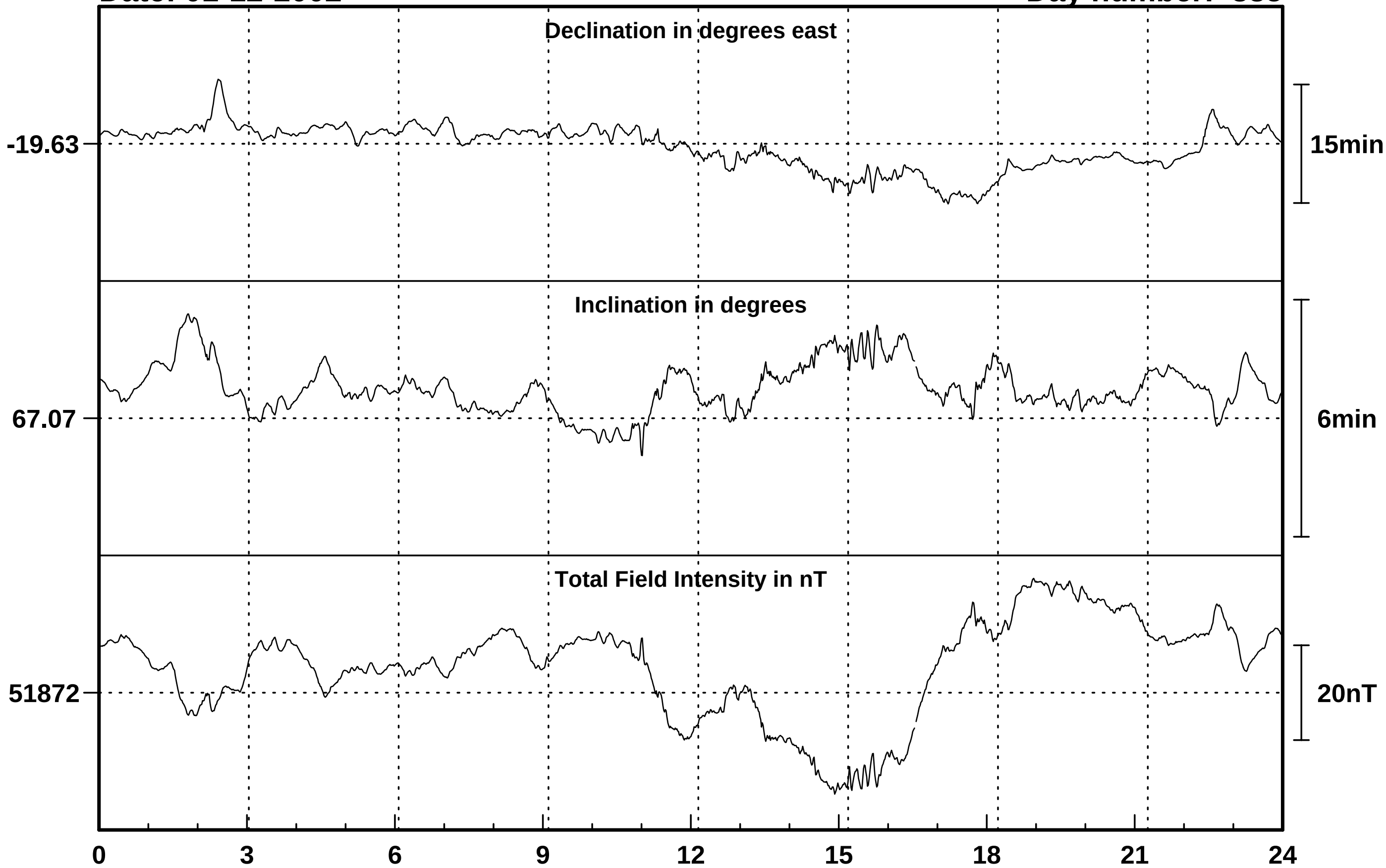




17
18
19
Scale x 2
20
21
22
23
24
25
26
27
Scale x 2
28
29
30
31
D -19.63
H 20209
Z 47773
0.50°
200 nT
150 nT
6 12 18 24
UT
Sable Island
December
2002

Sable Island

Date: 01-12-2002 Day number: 335



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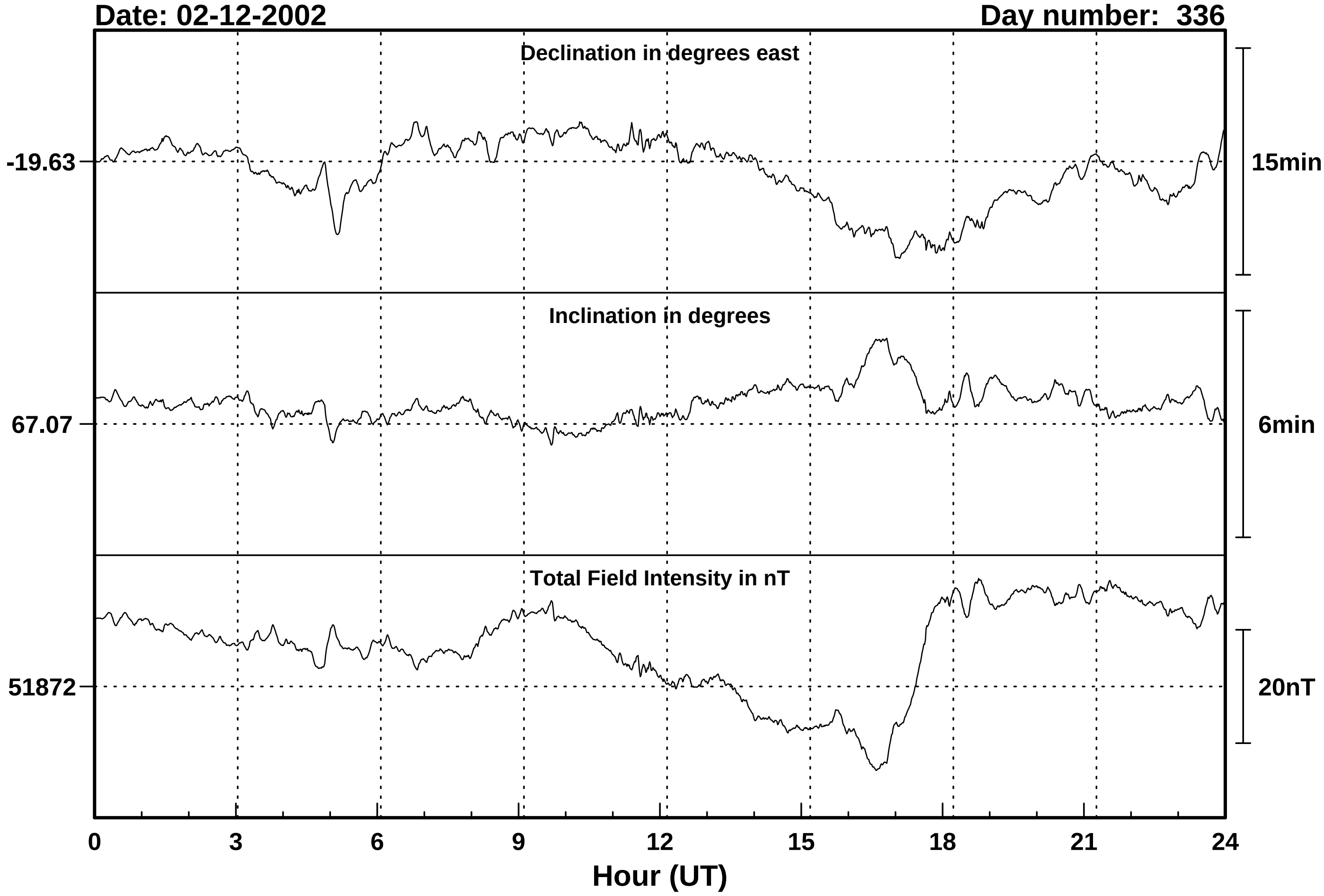
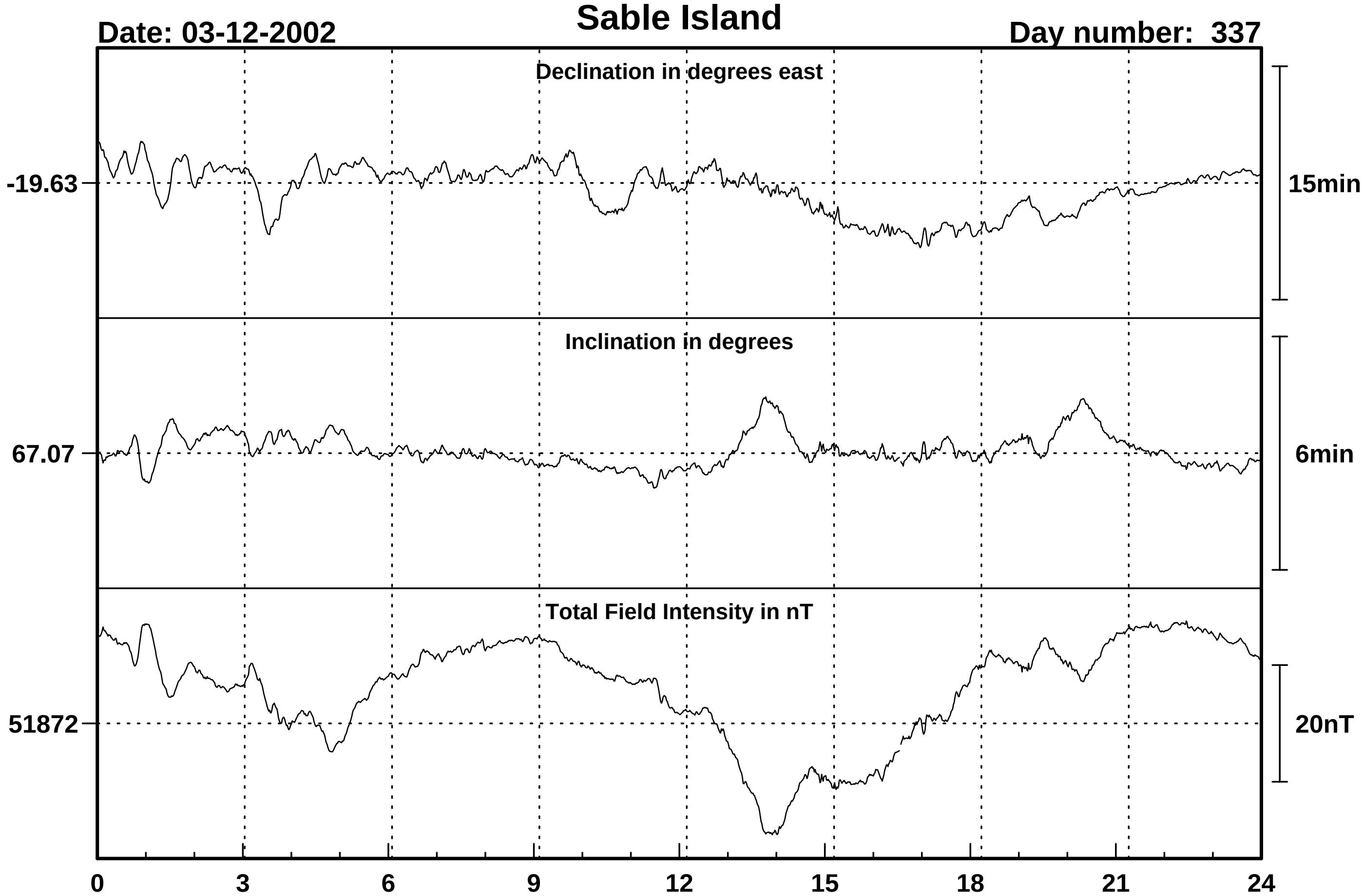
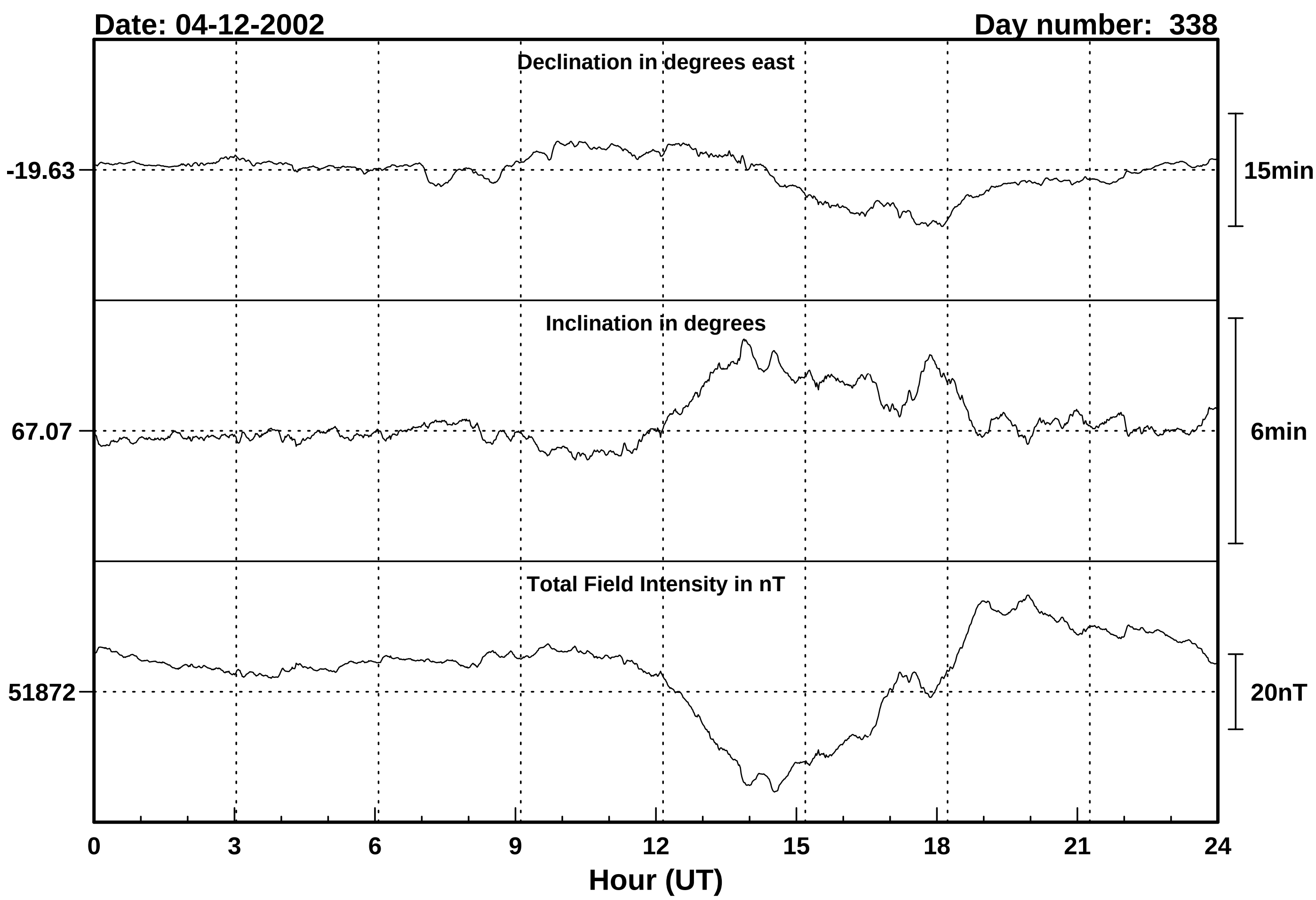
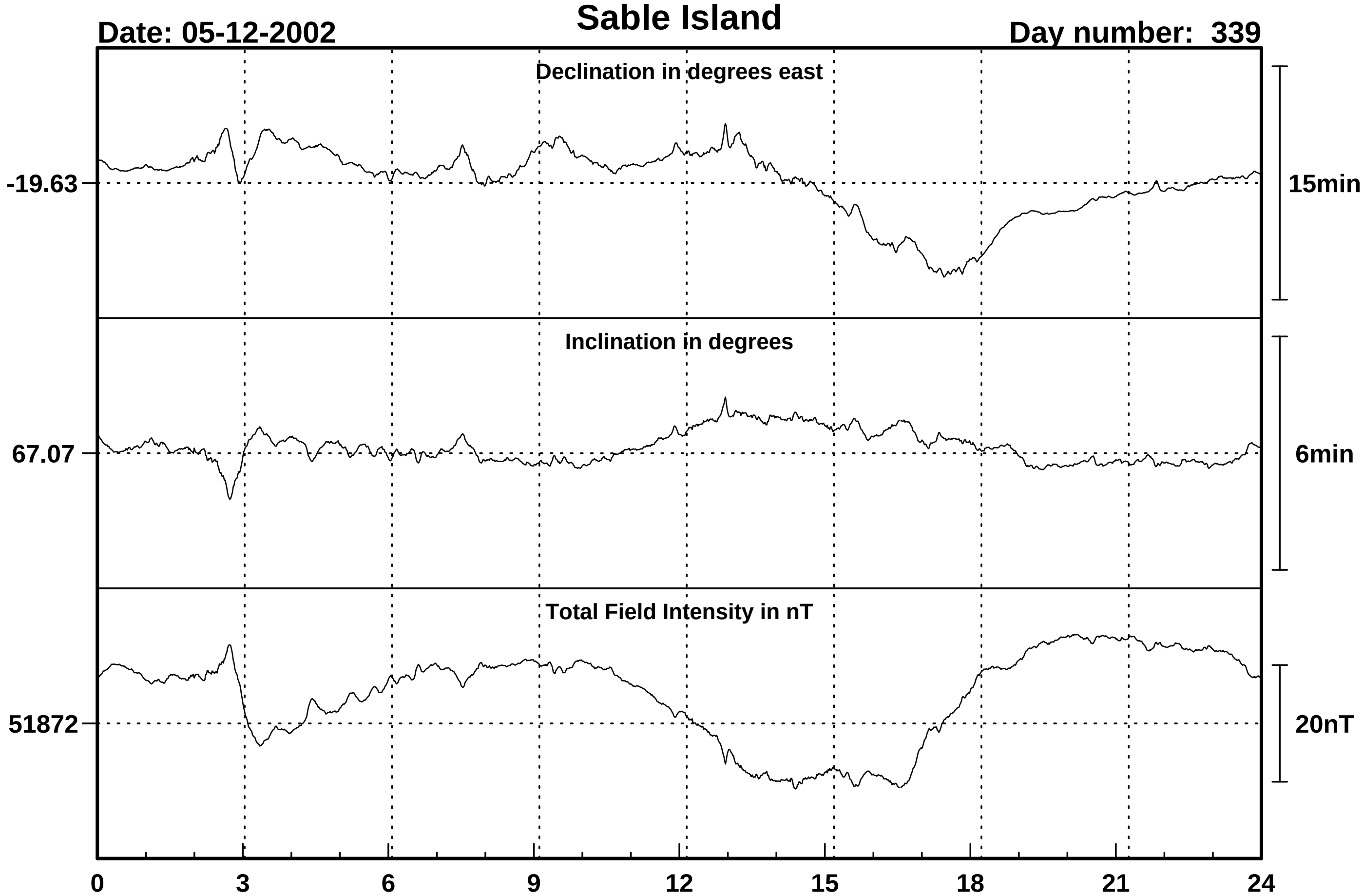


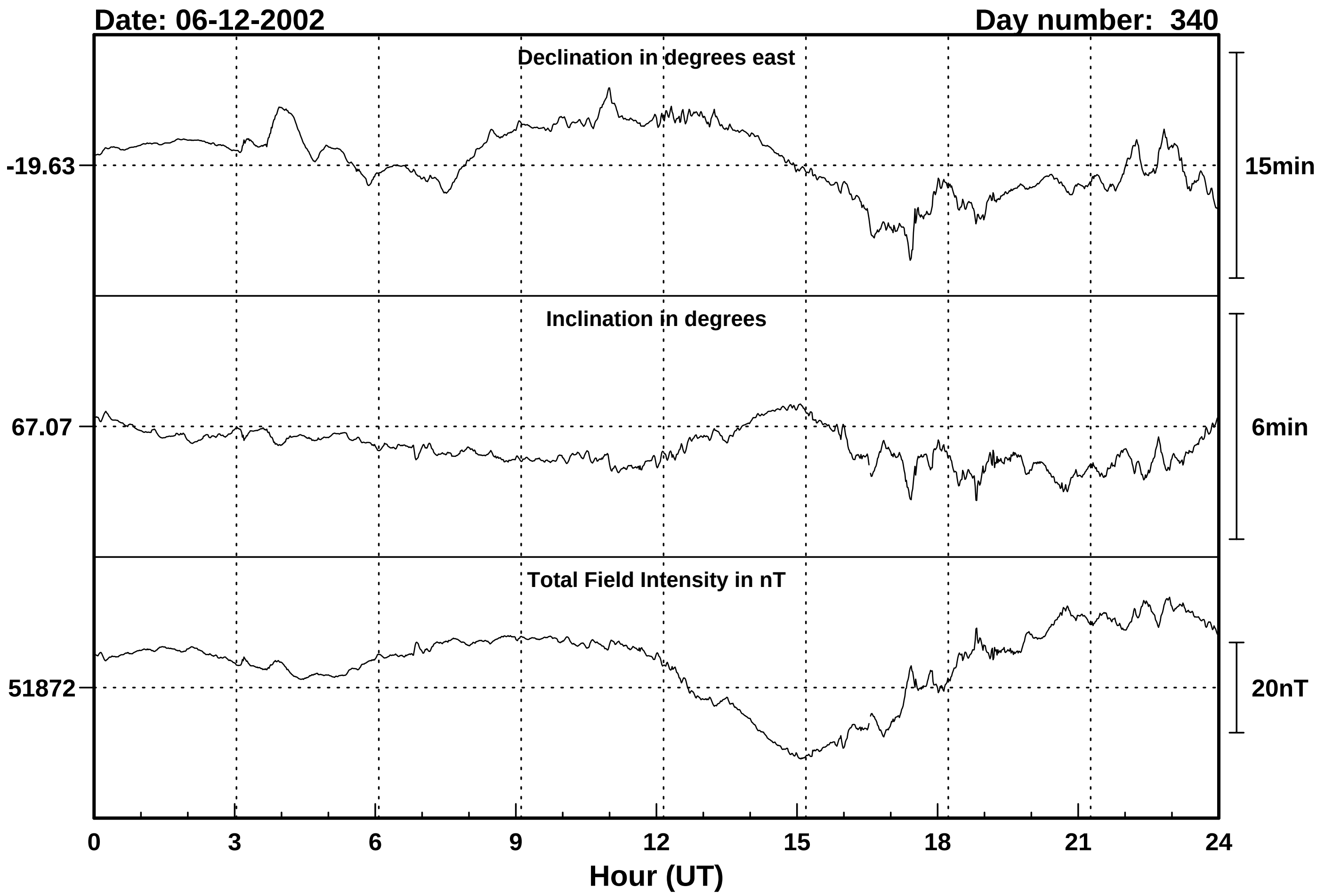
Sable Island





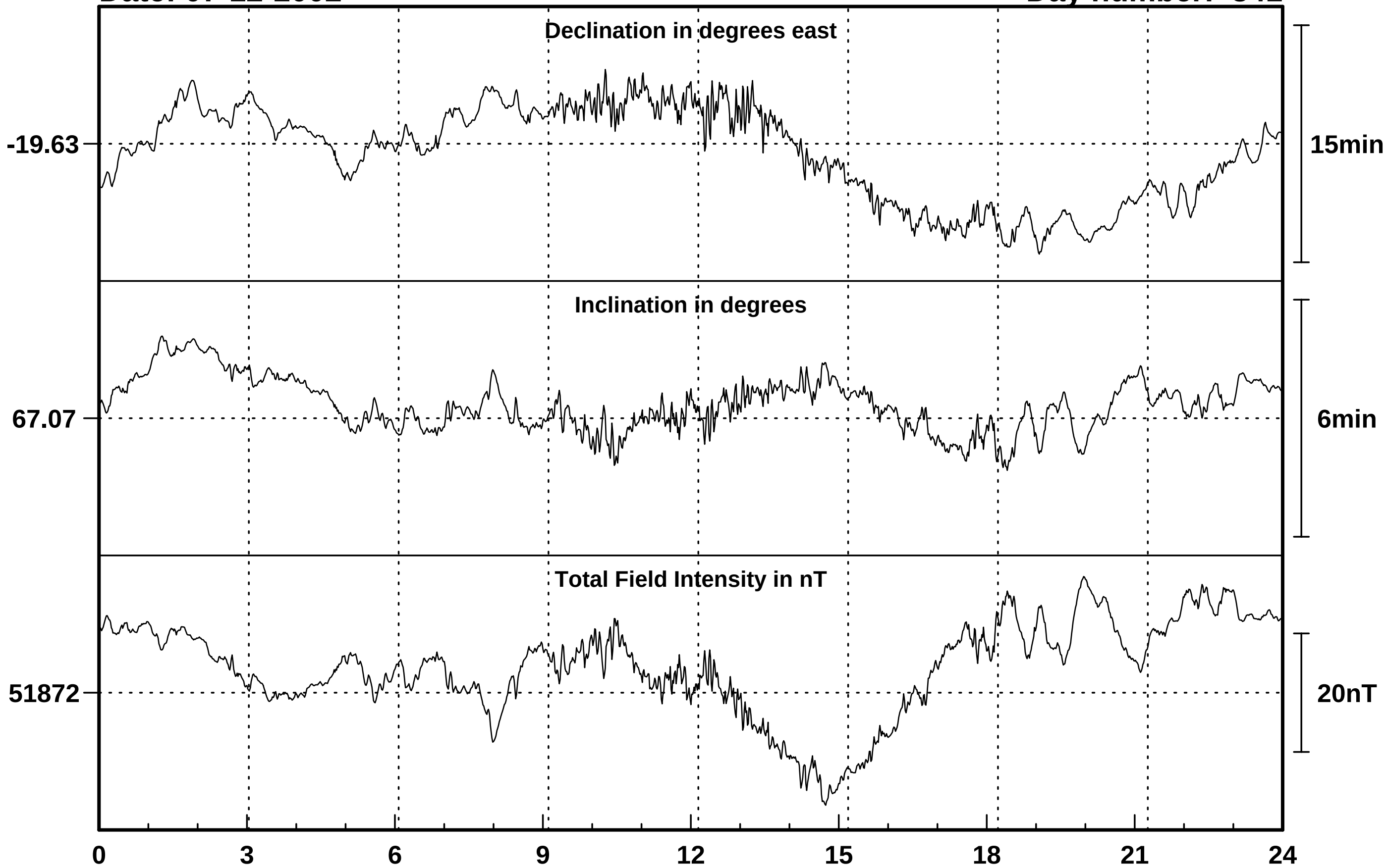
Sable Island





Sable Island

Date: 07-12-2002 **Day number: 341**



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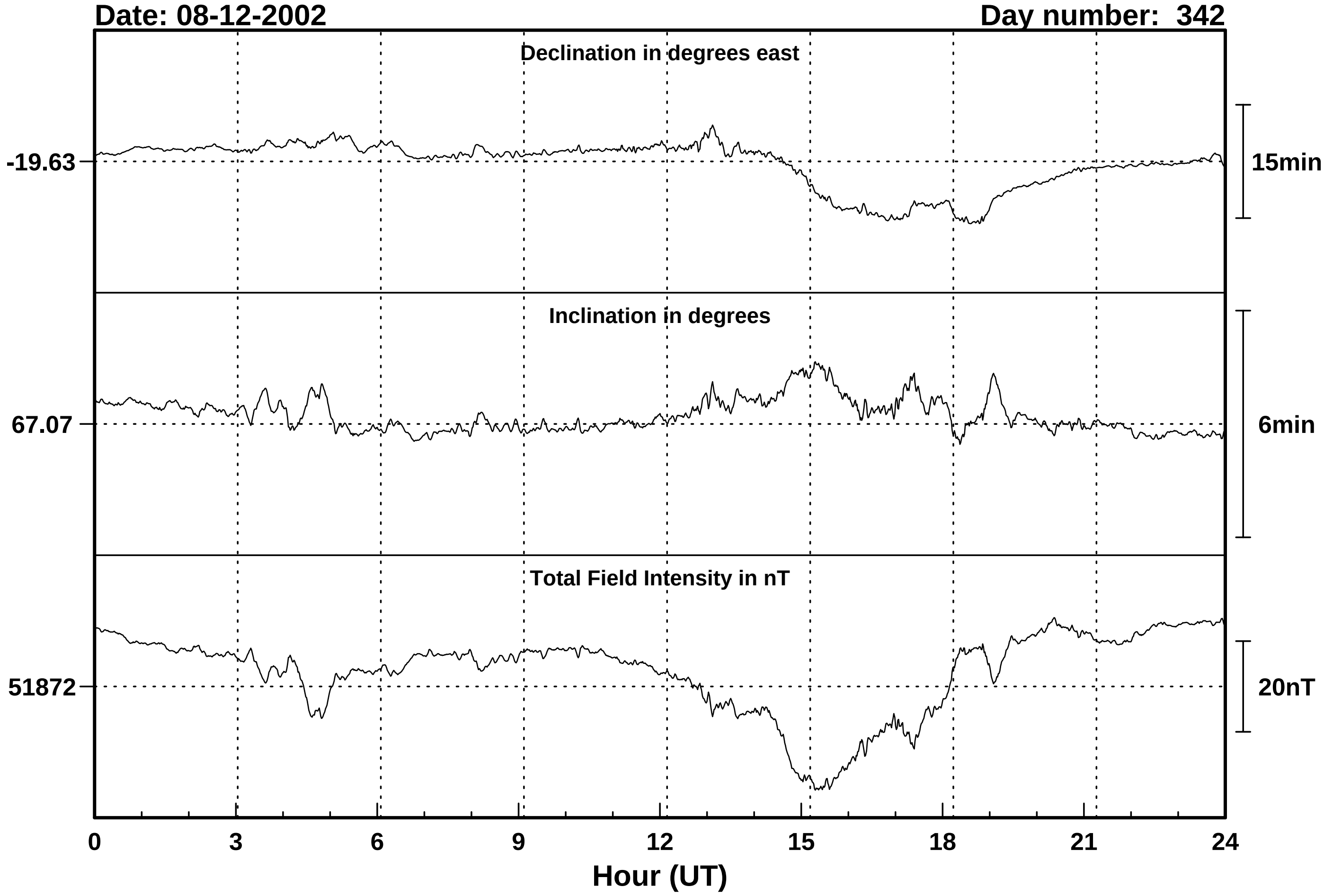
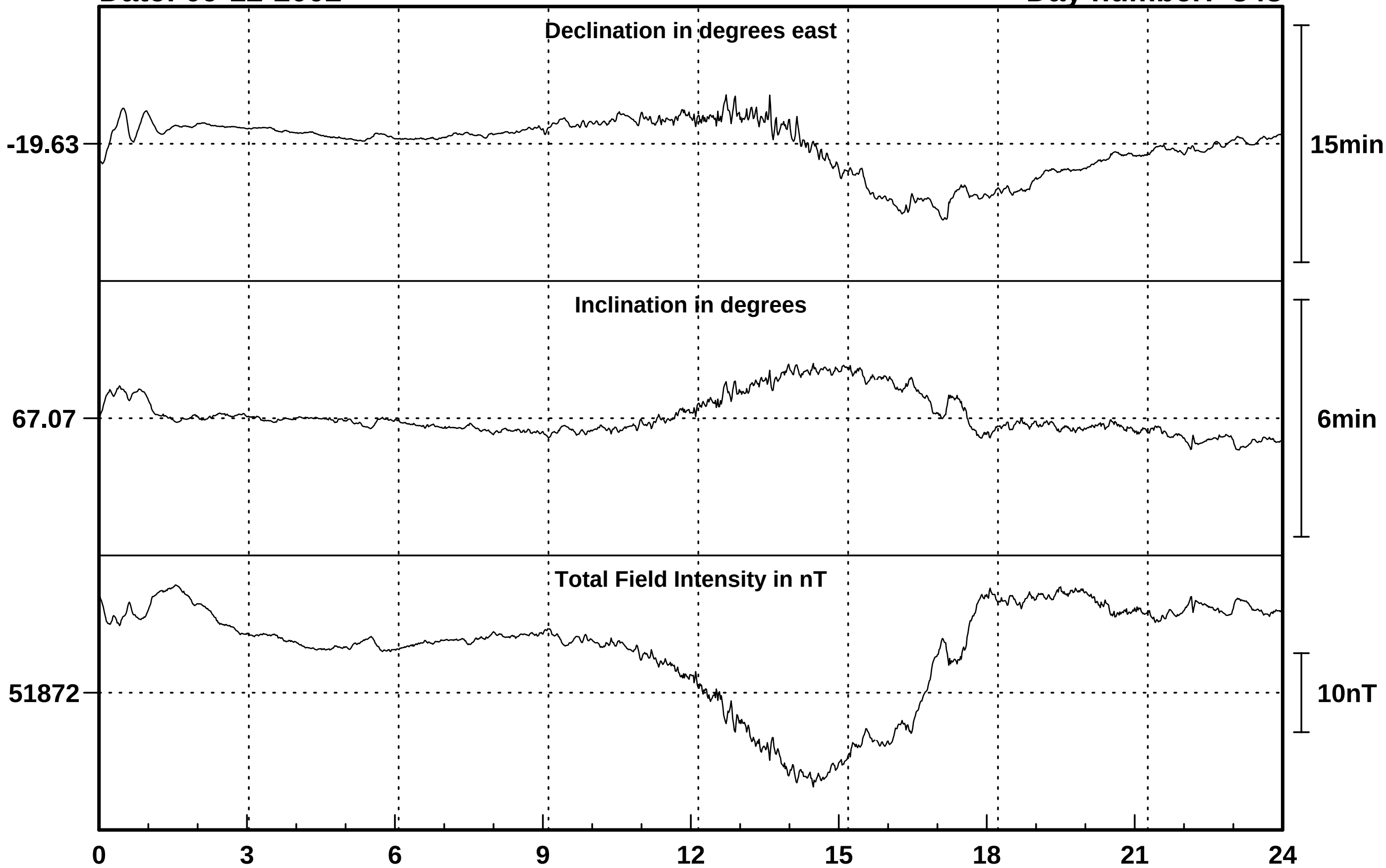


Sable Island

Date: 09-12-2002 Day number: 343



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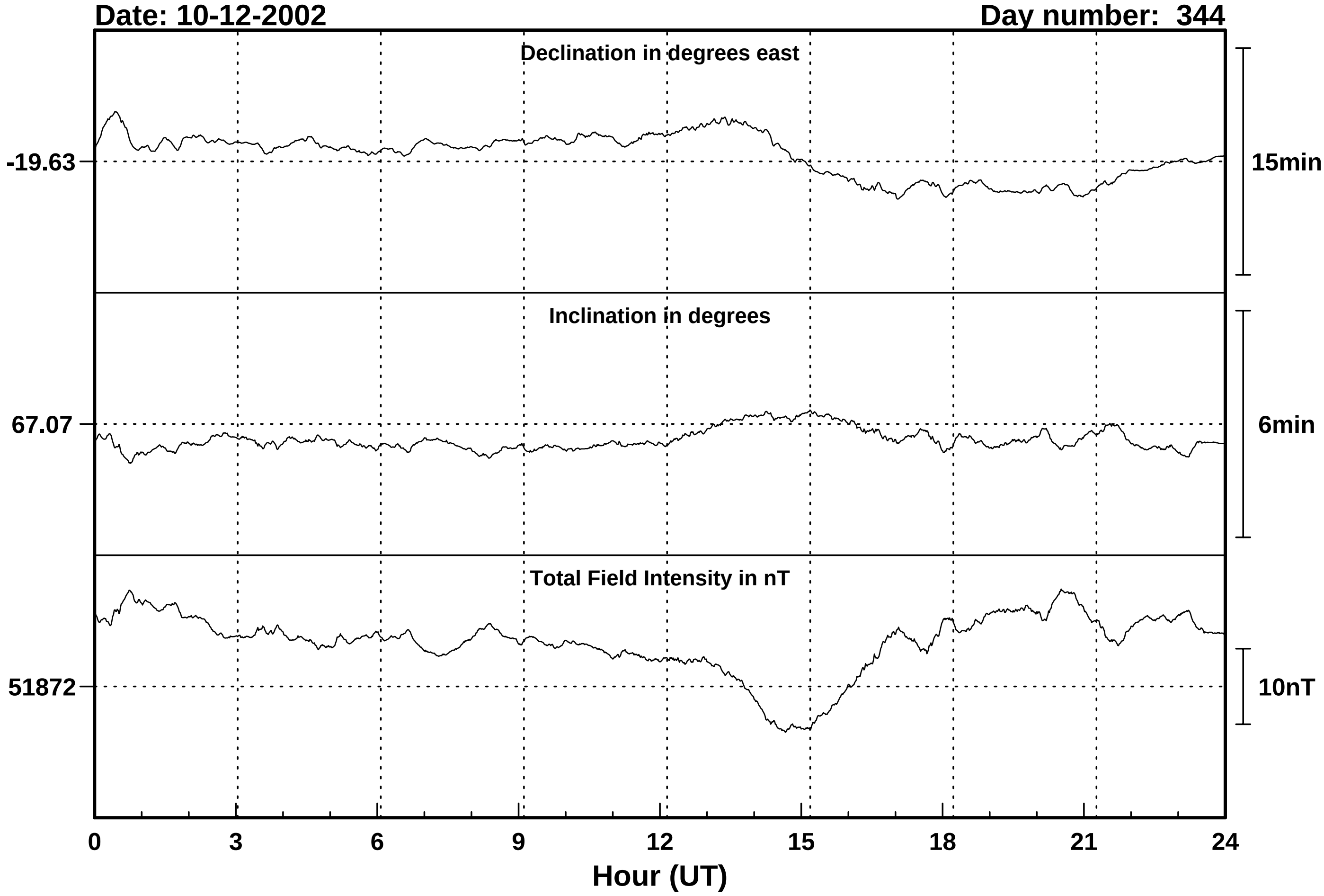
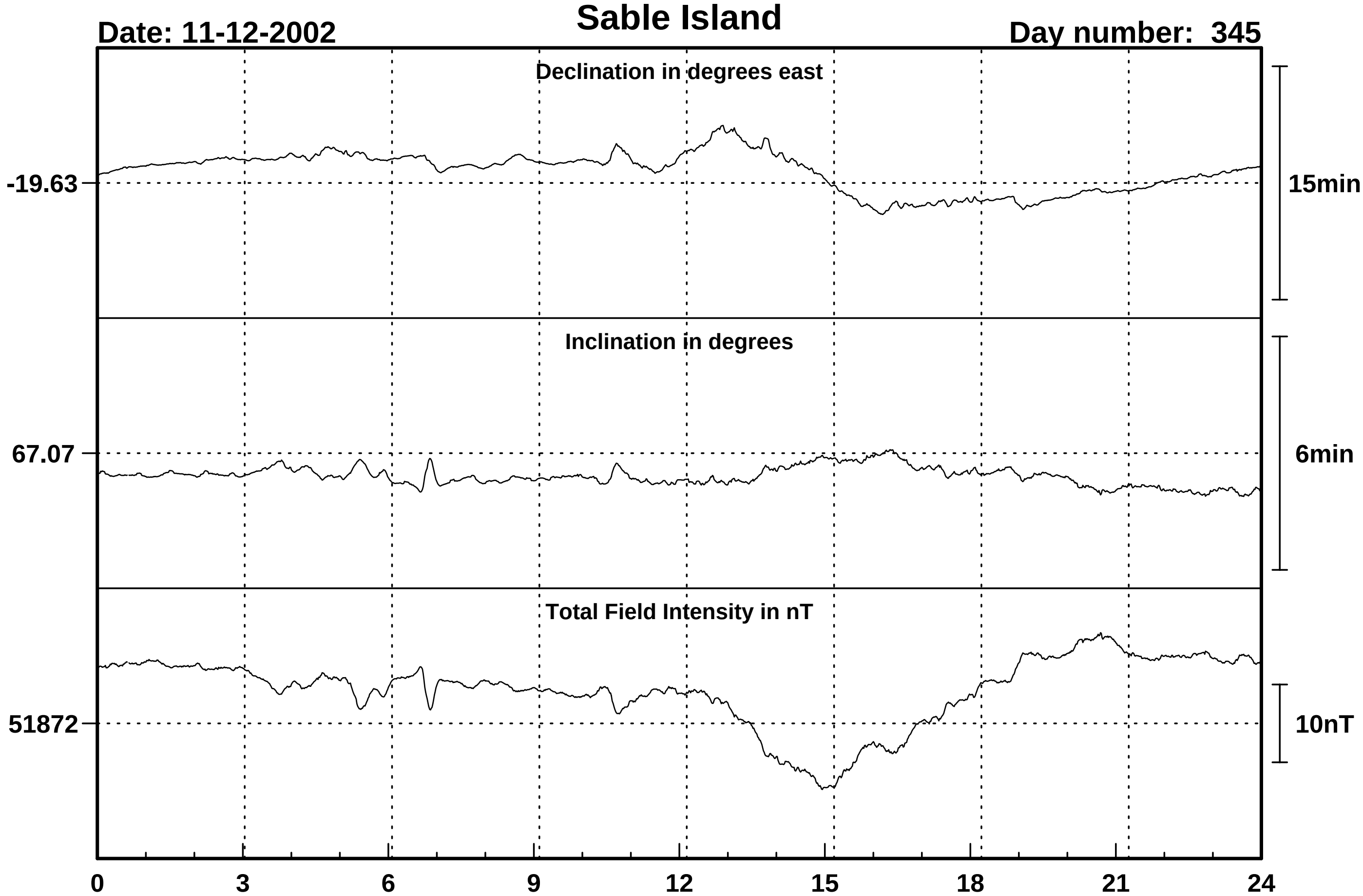
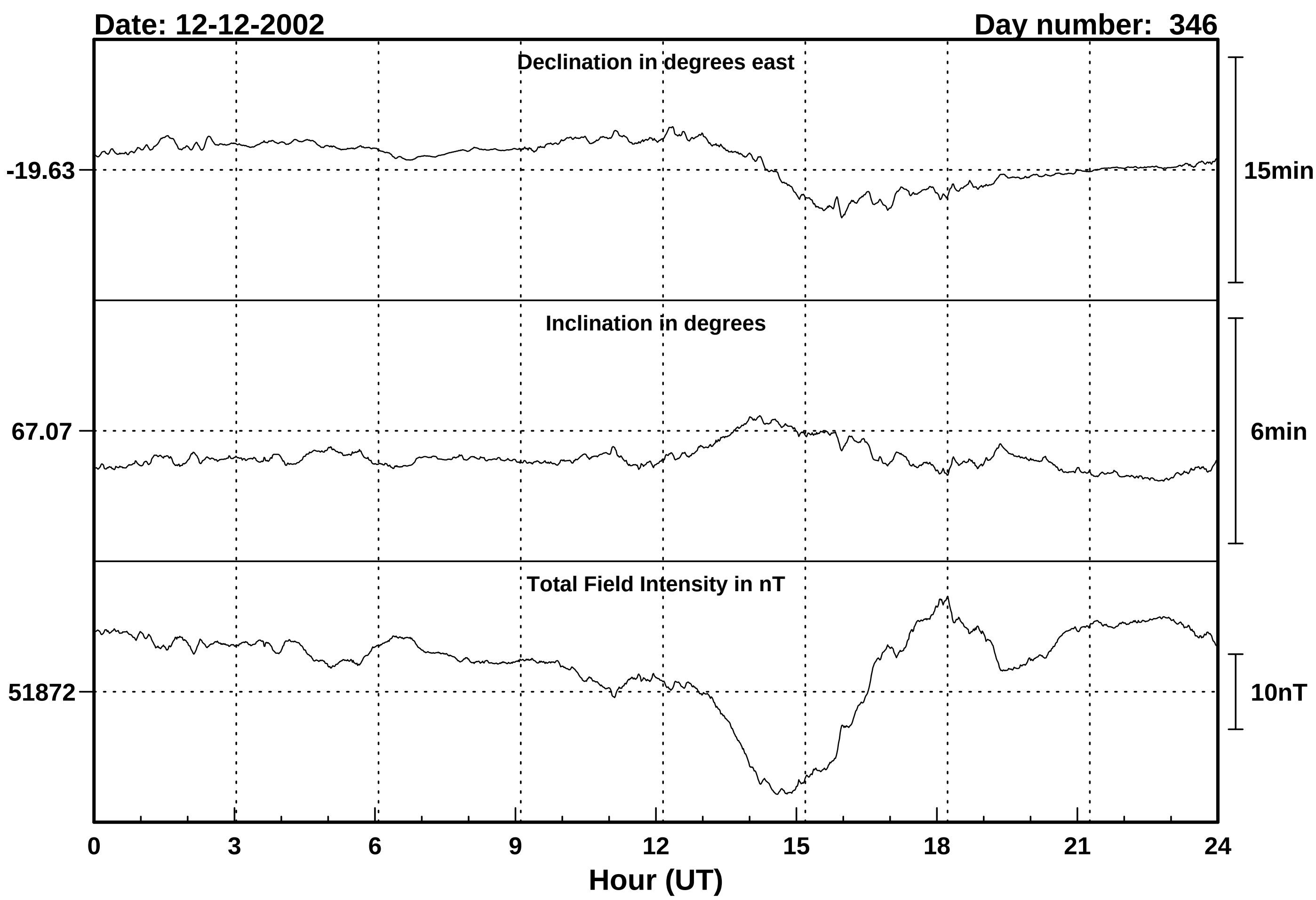
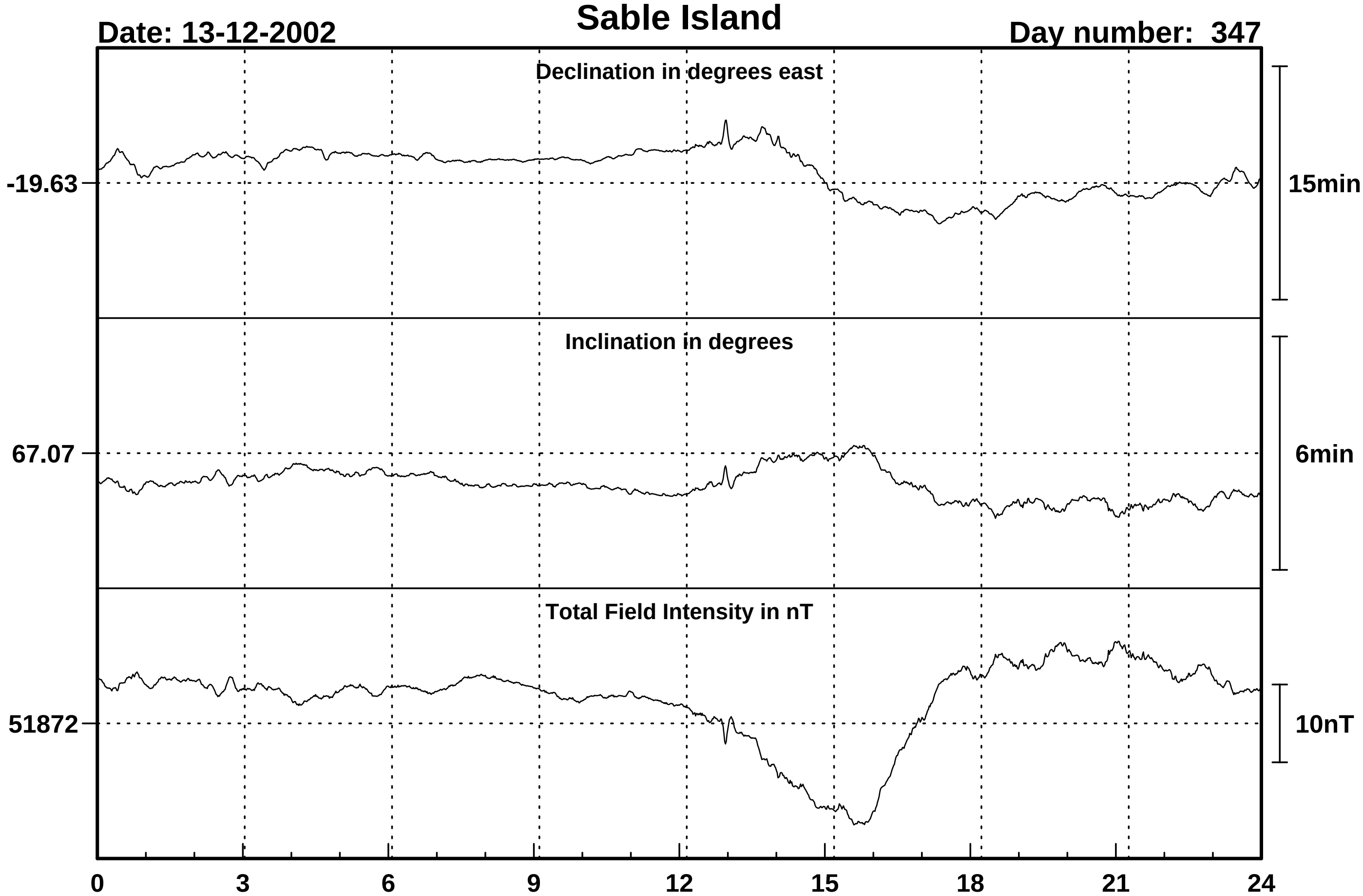


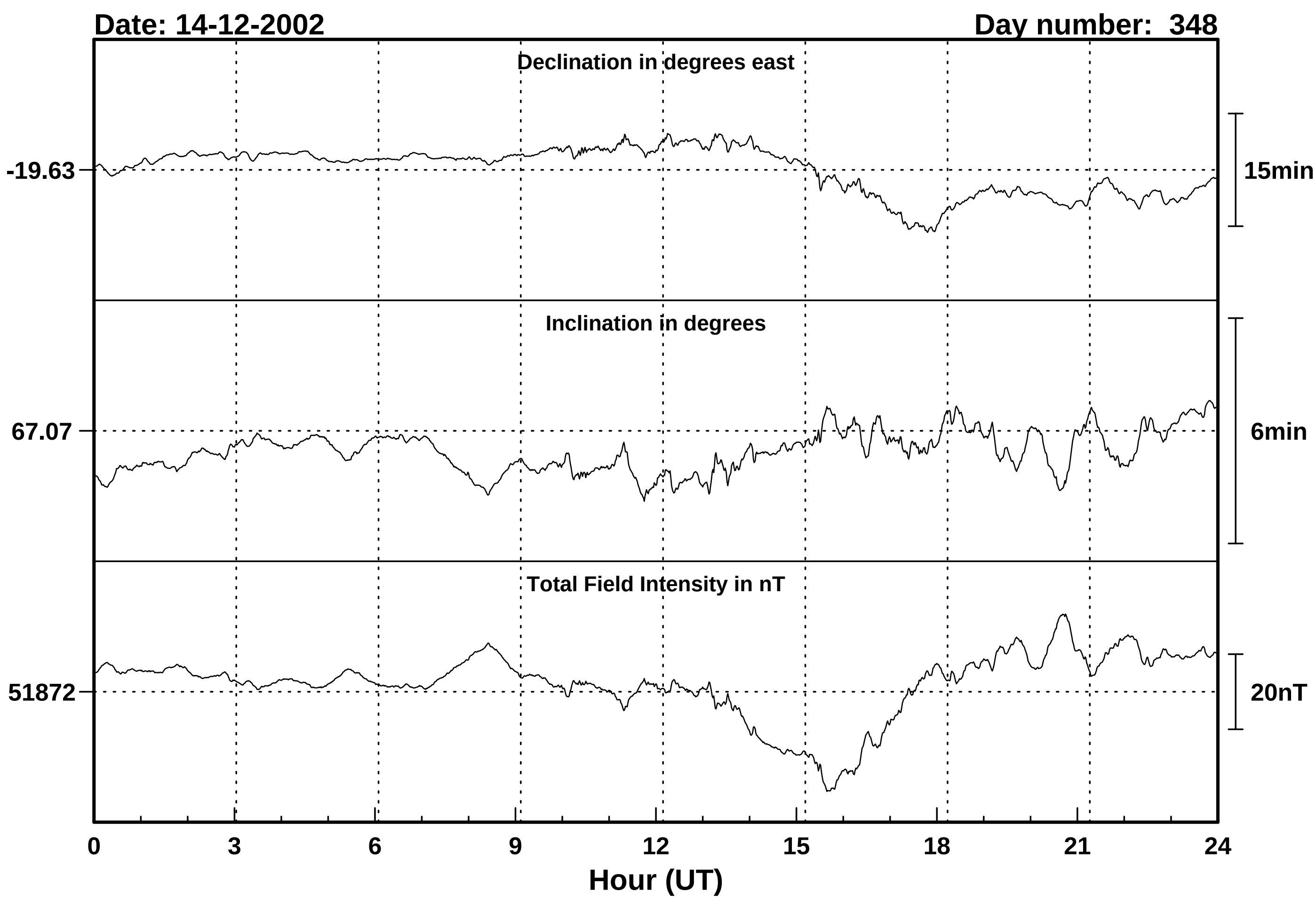
Sable Island





Sable Island





Sable Island

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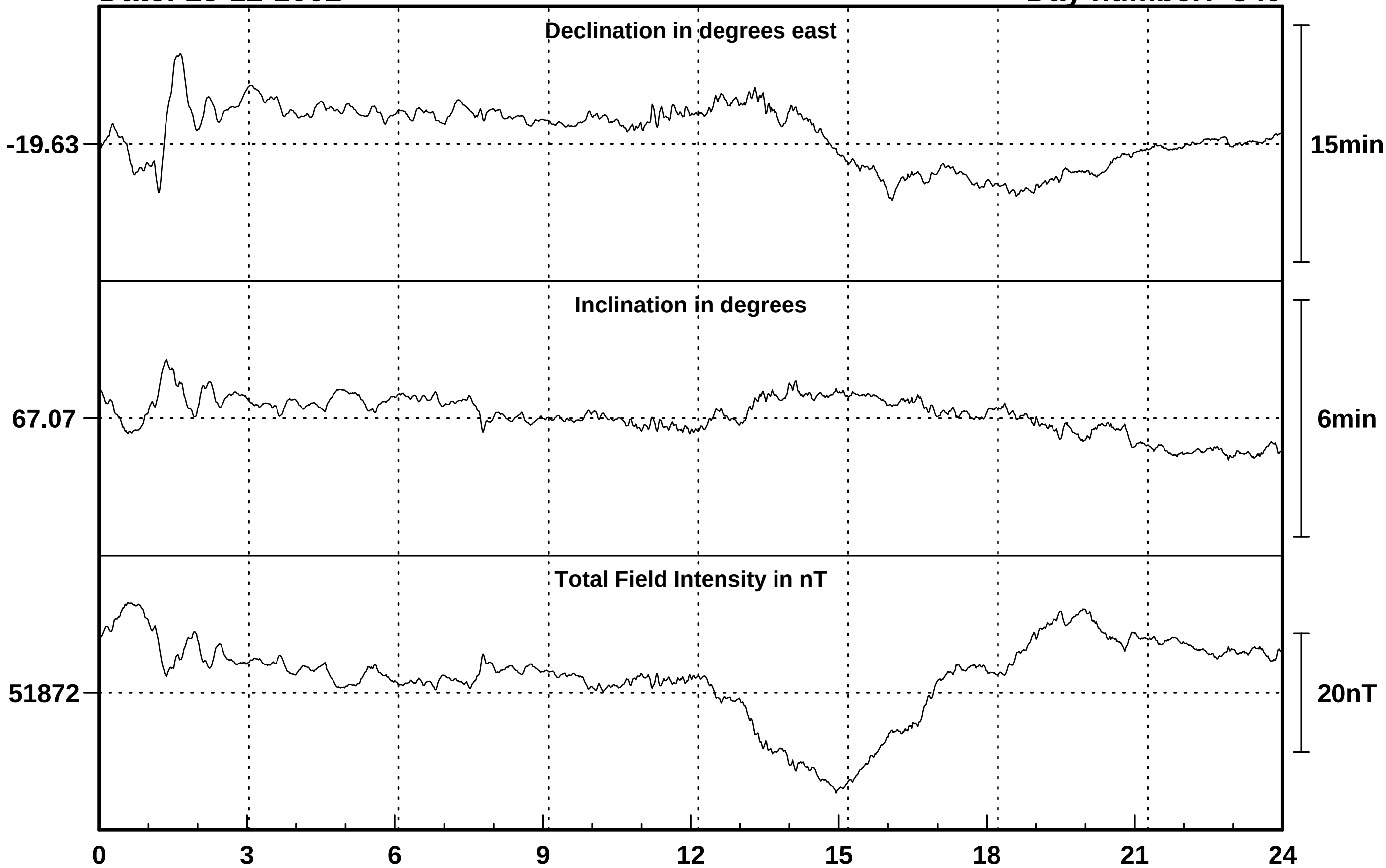

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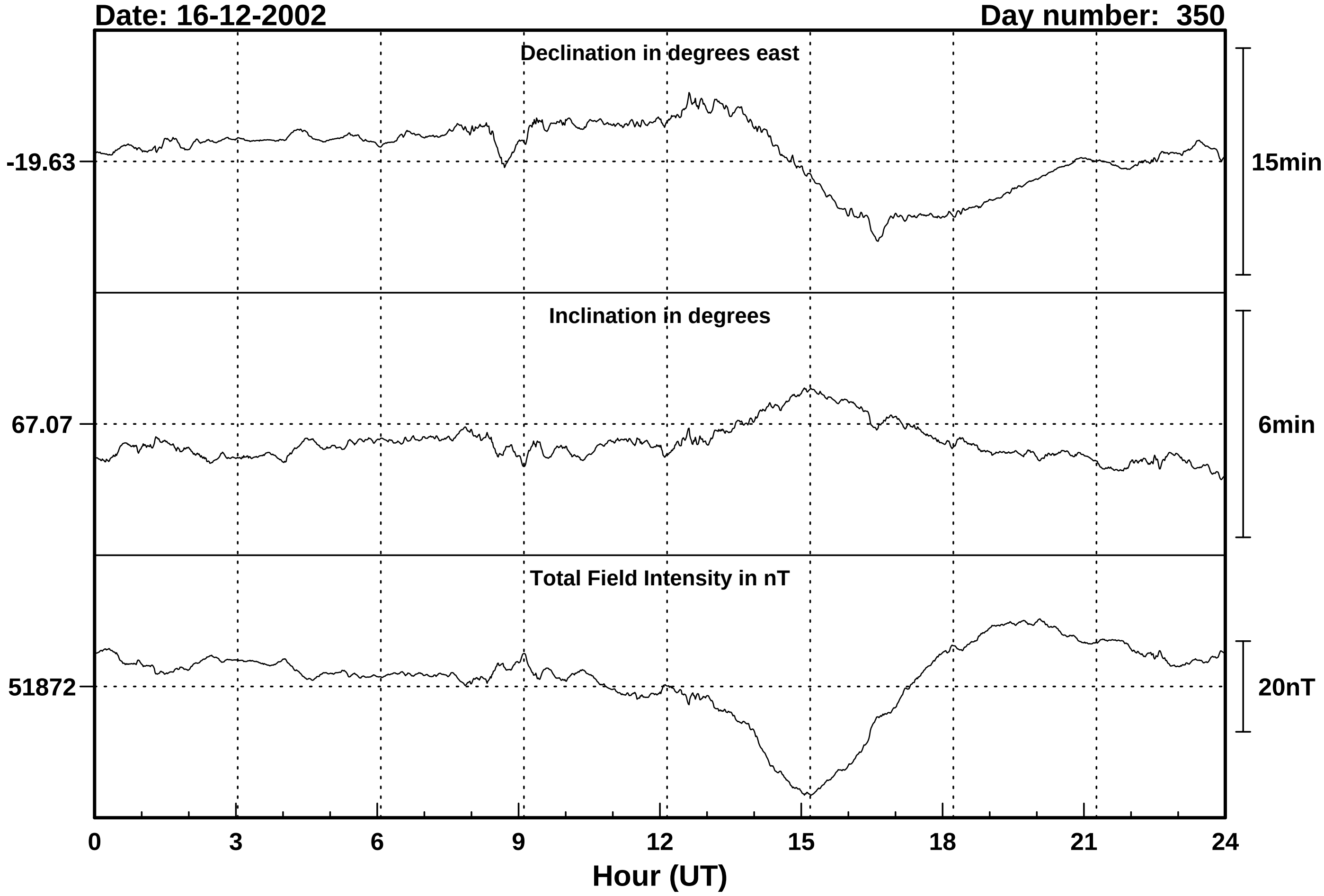
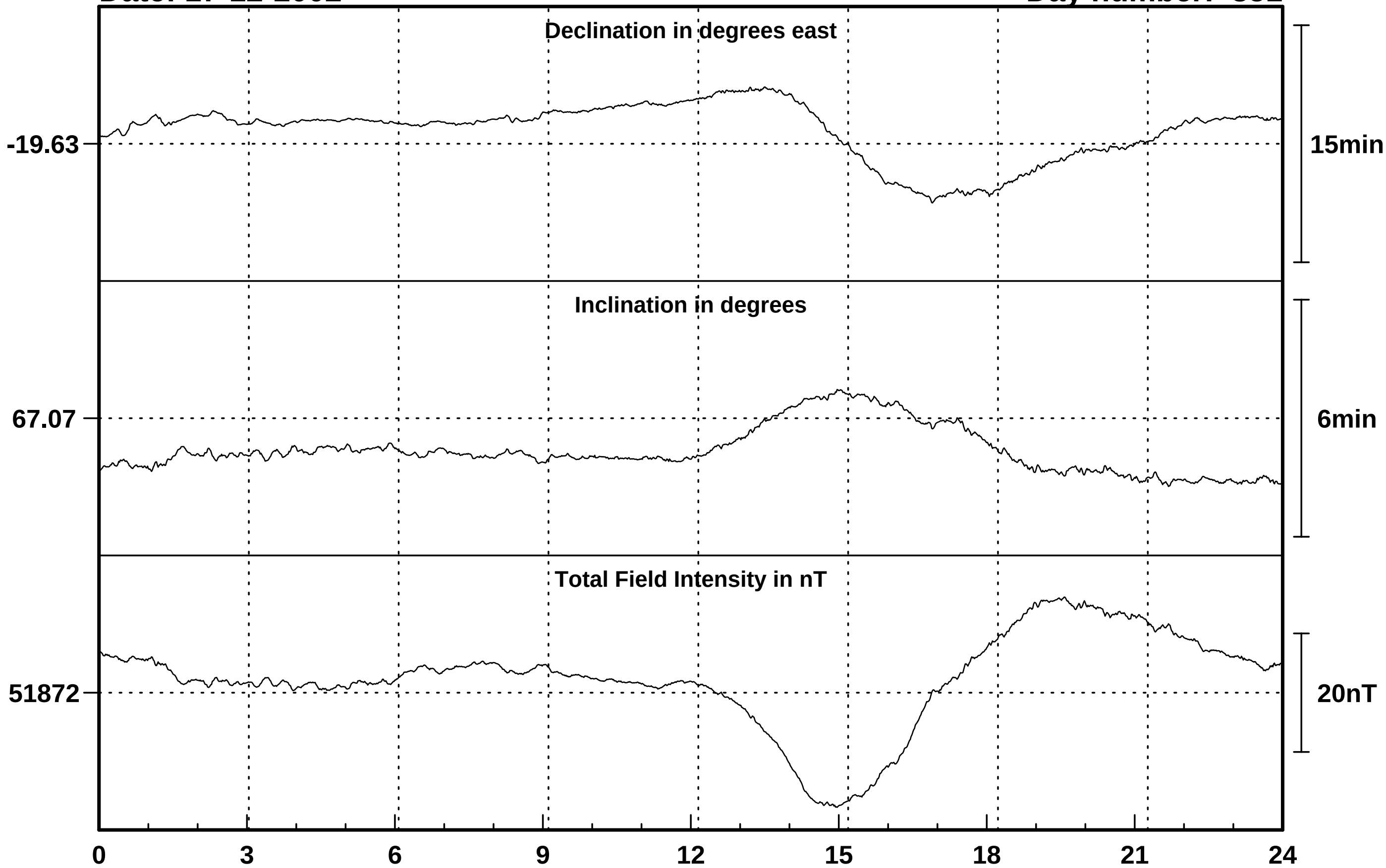


Sable Island

Date: 17-12-2002 Day number: 351



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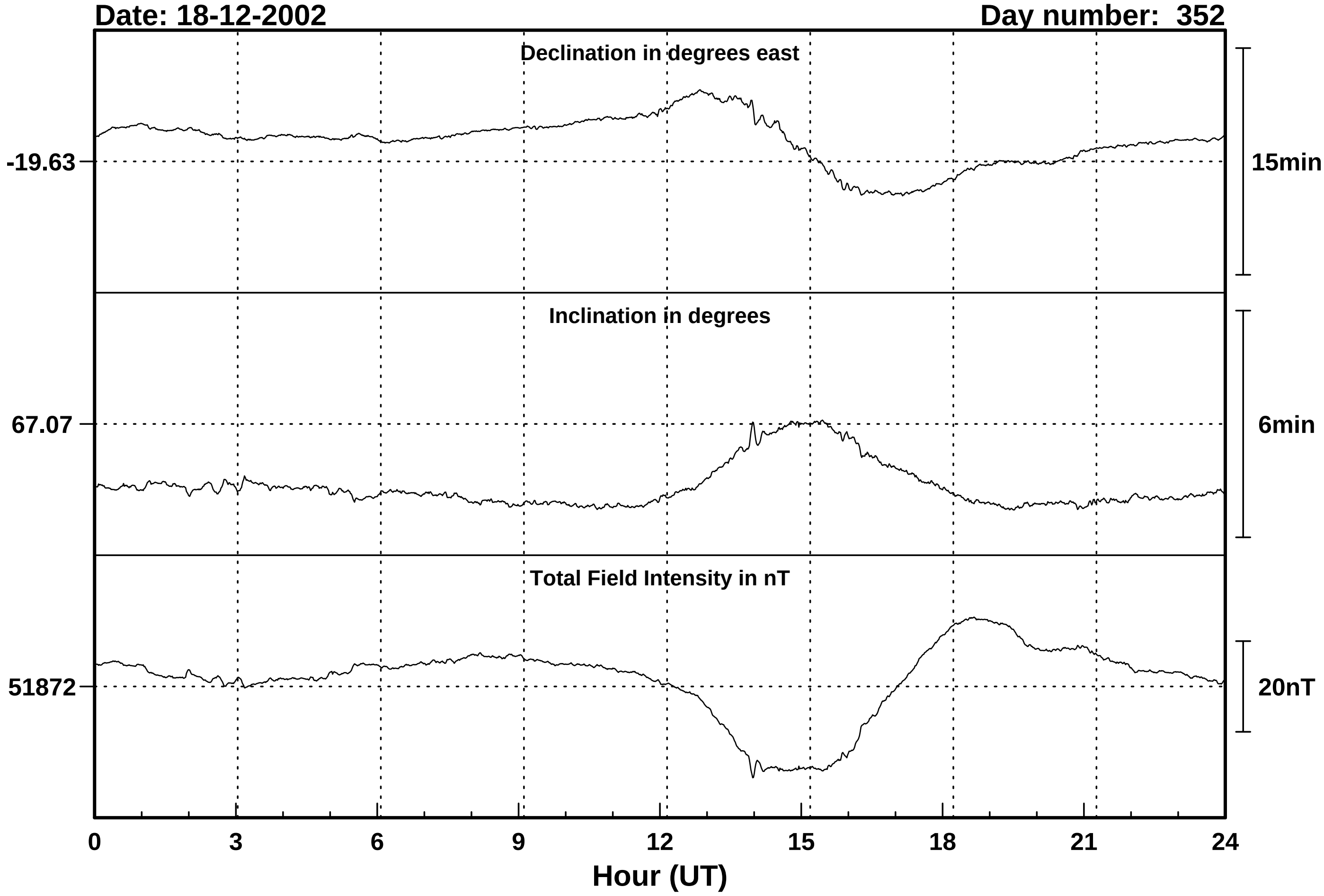
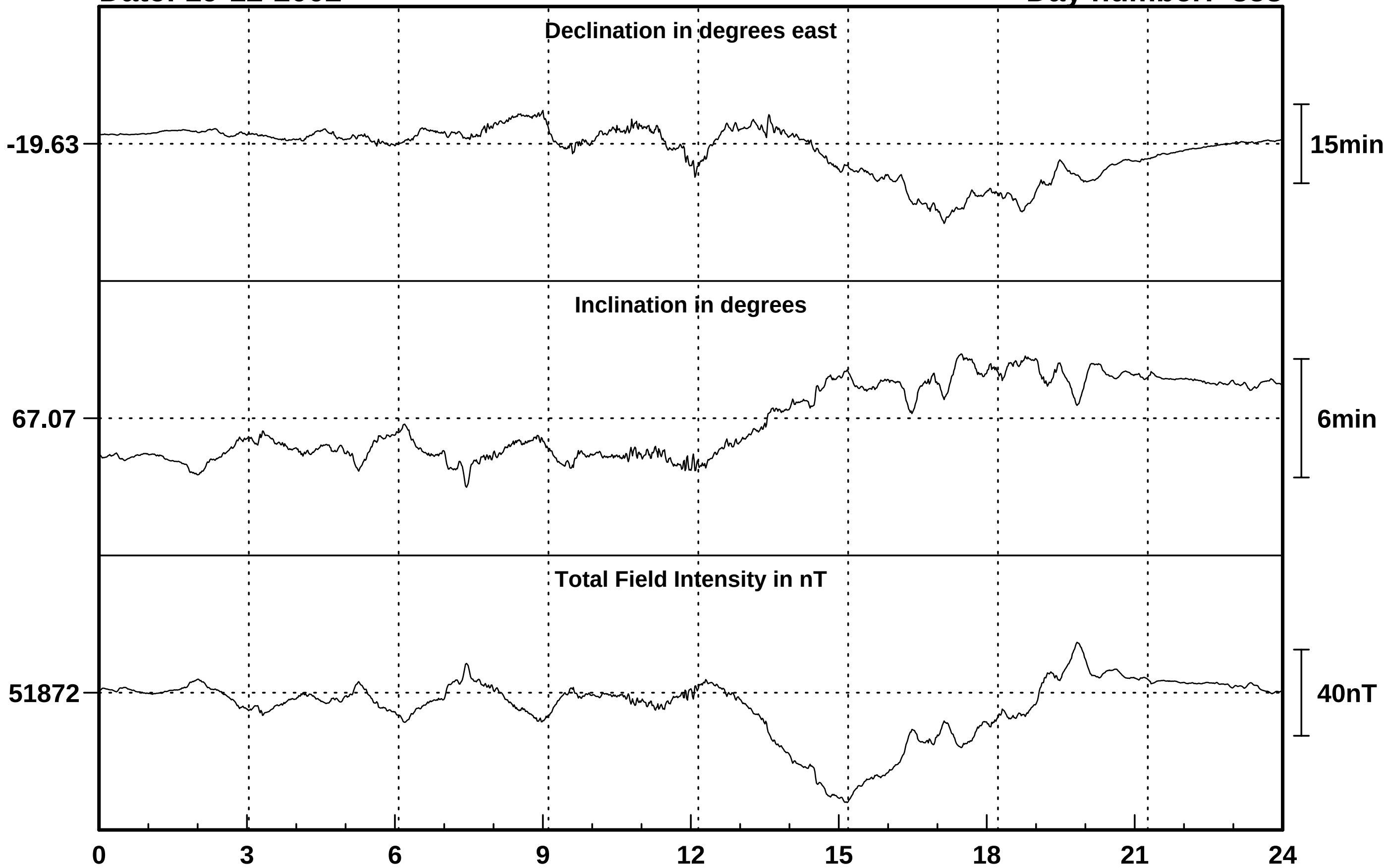


Sable Island

Date: 19-12-2002 Day number: 353



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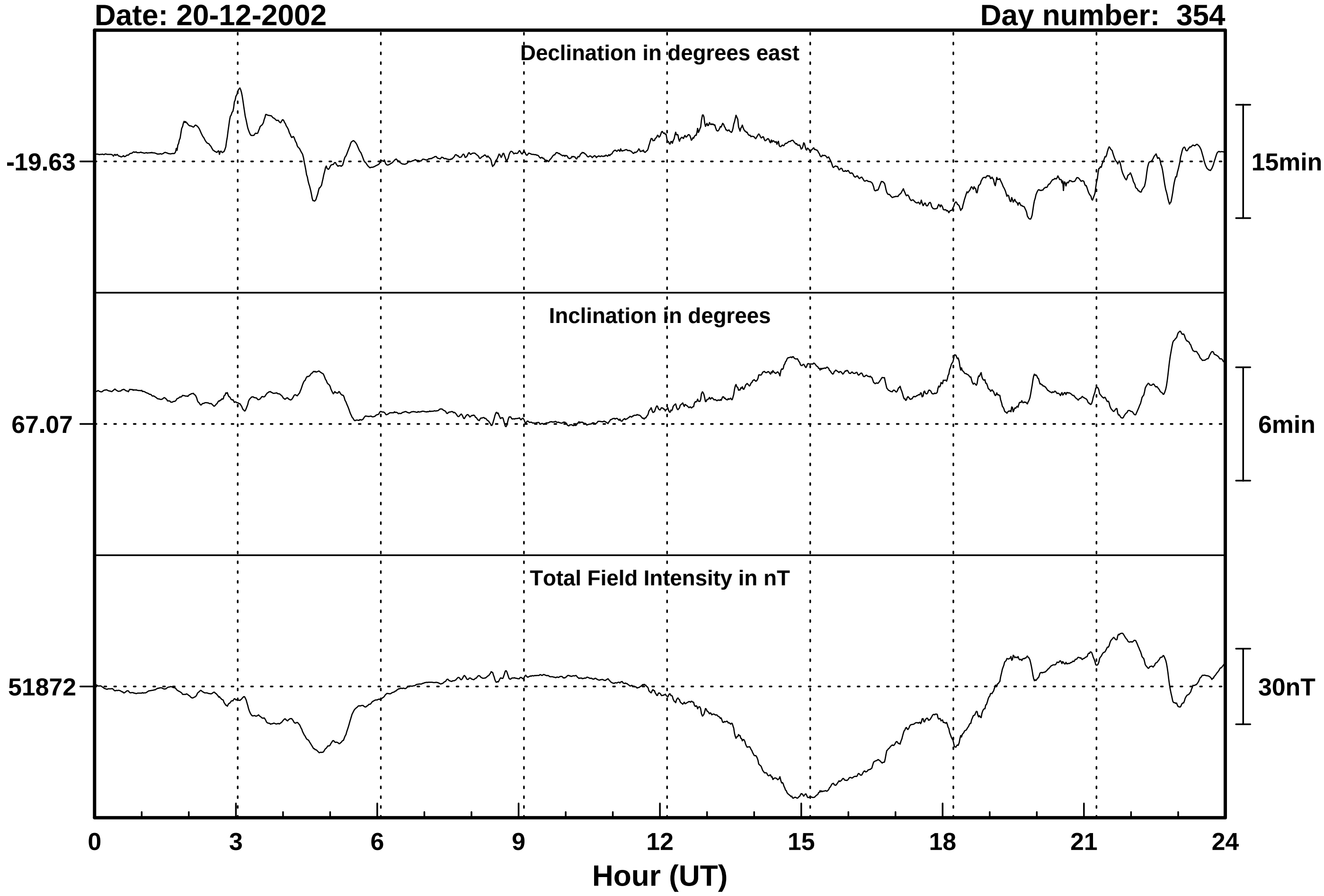

Sable Island

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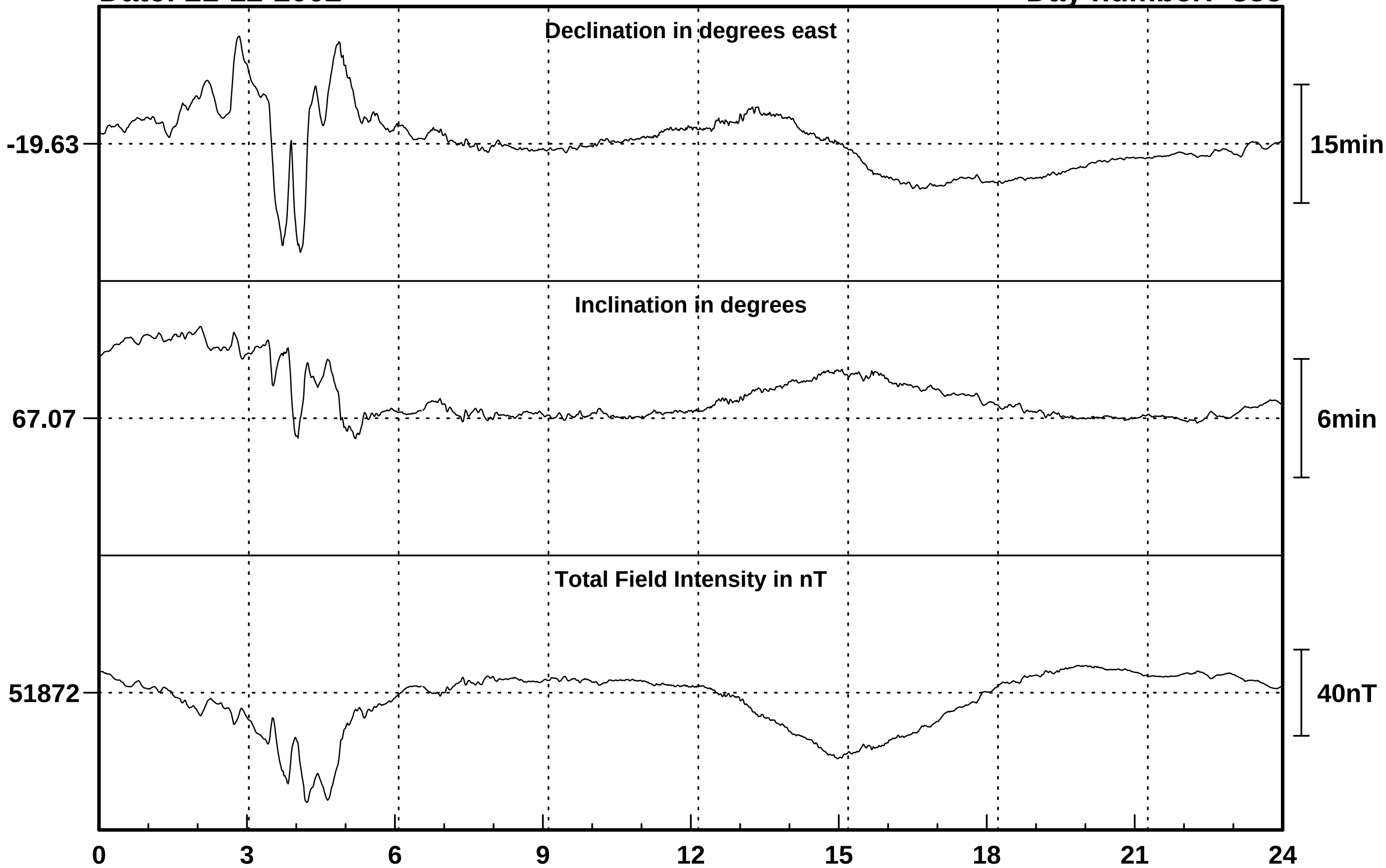

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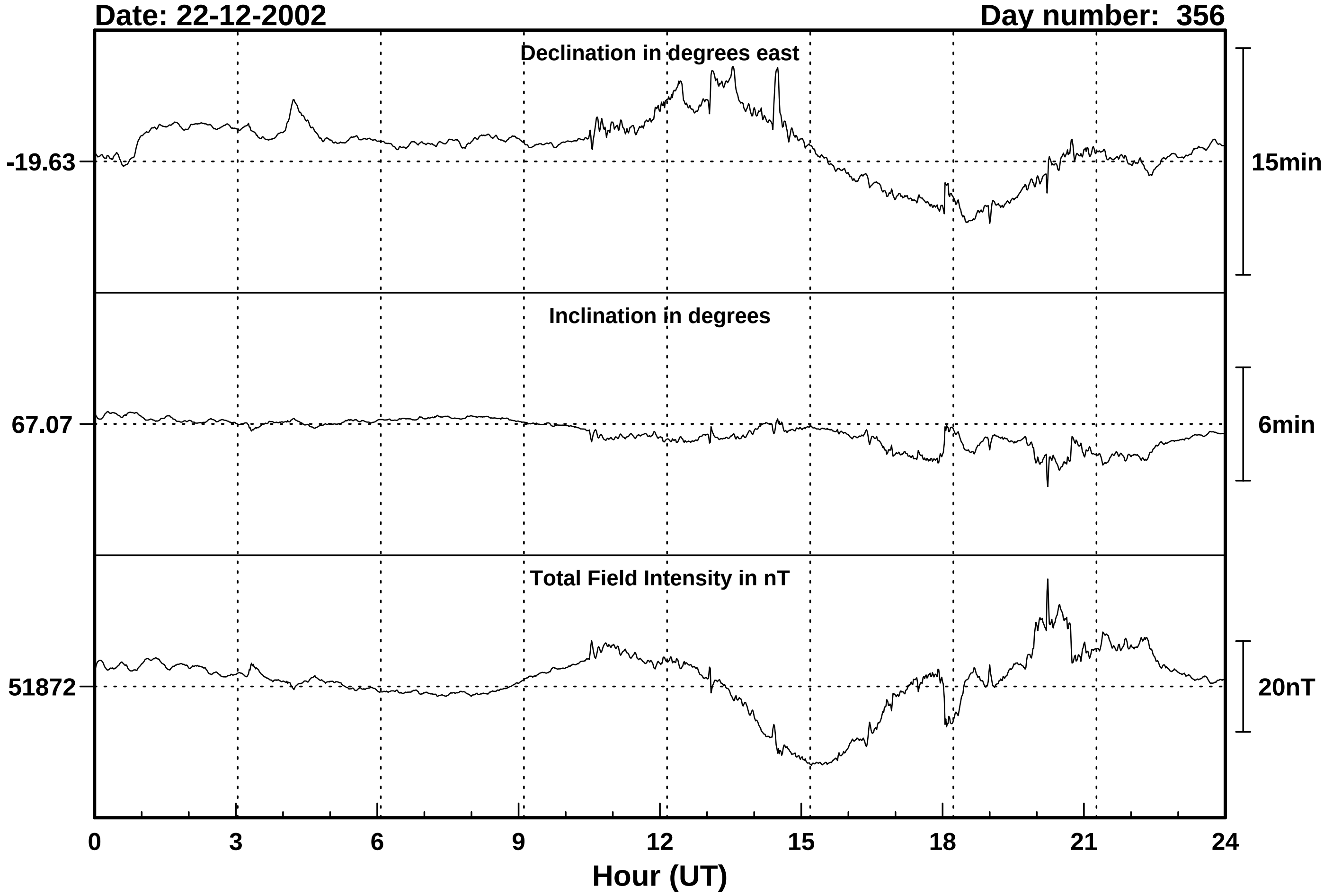
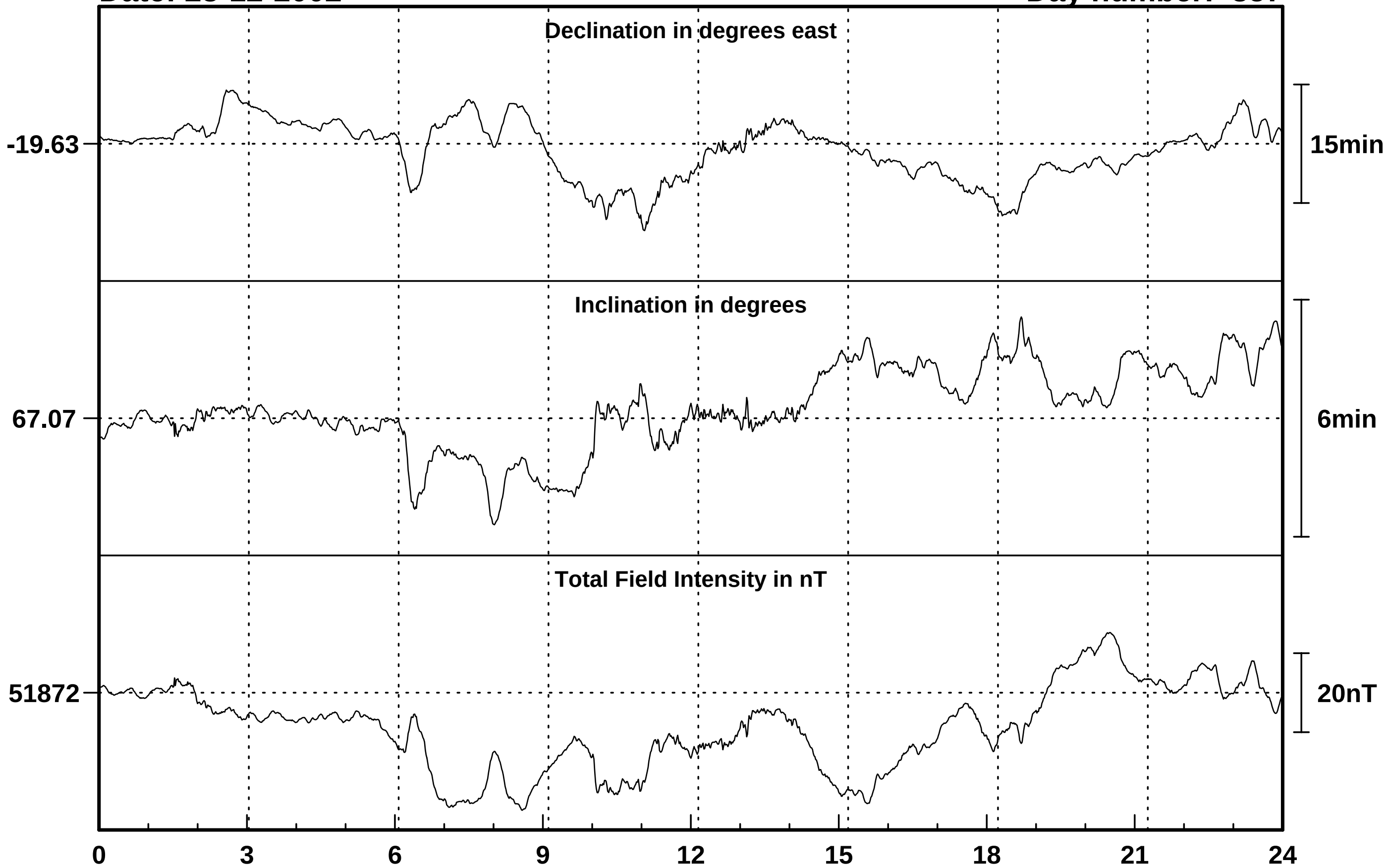


Sable Island

Date: 23-12-2002 Day number: 357



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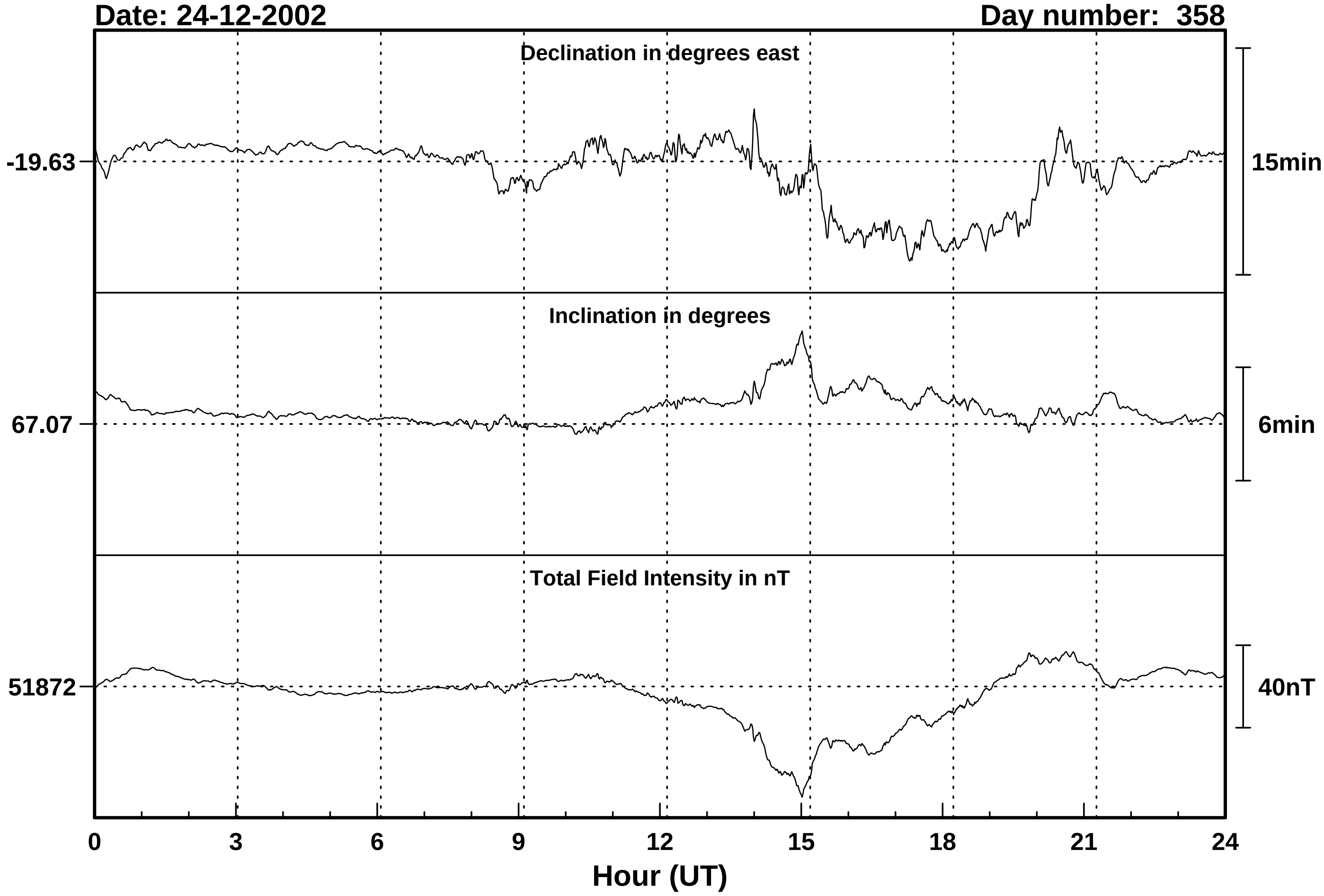
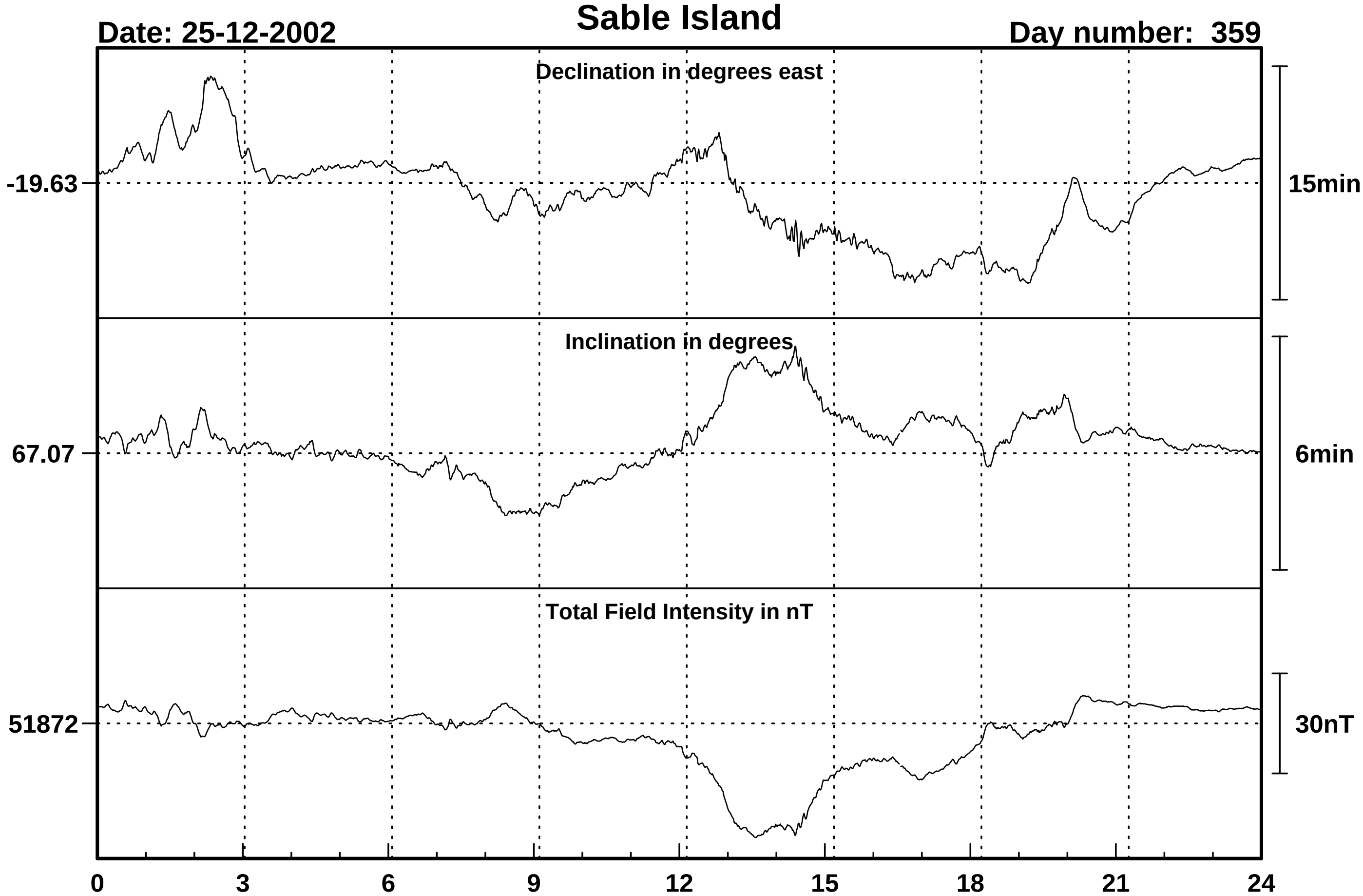
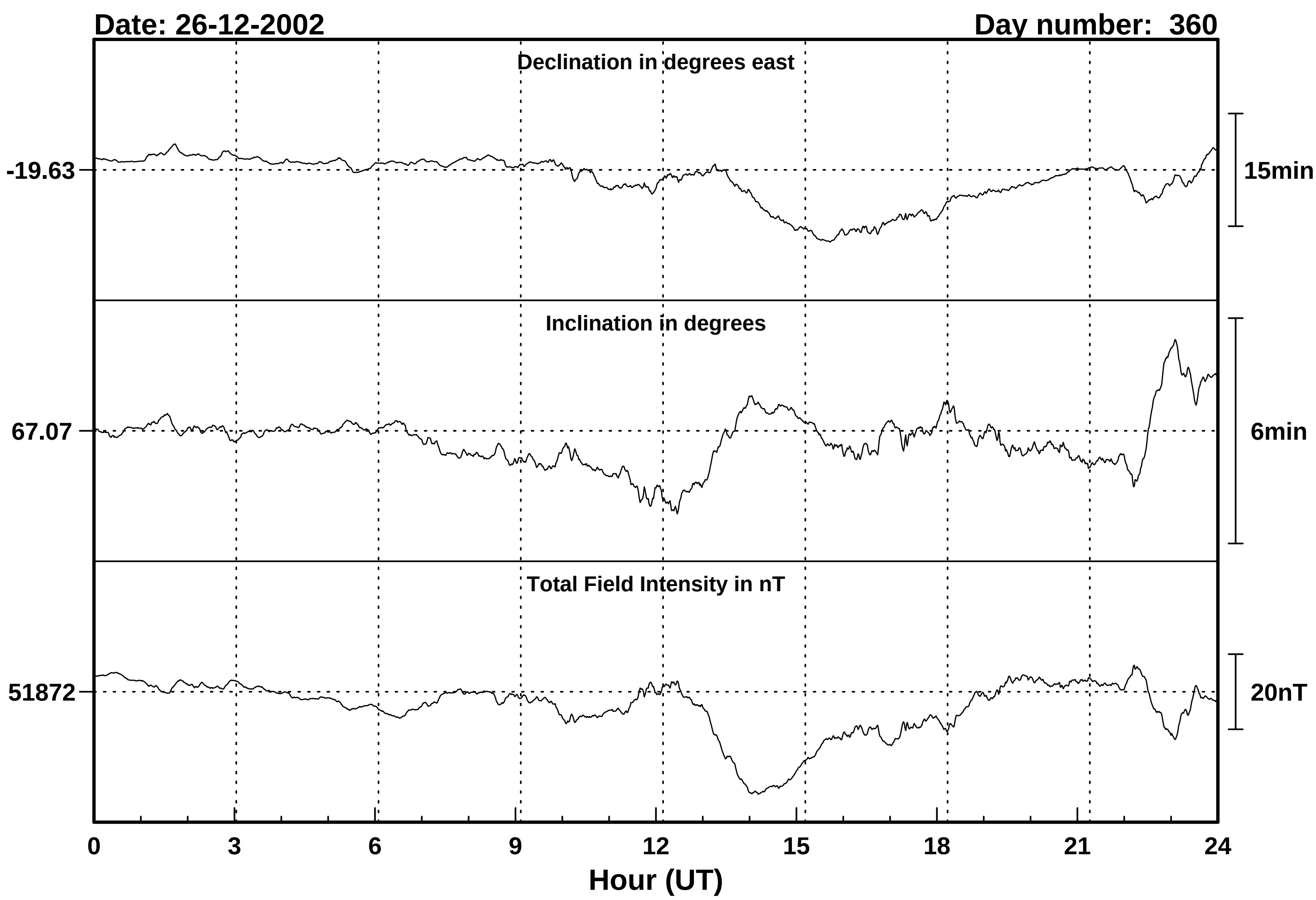


Sable Island





Sable Island

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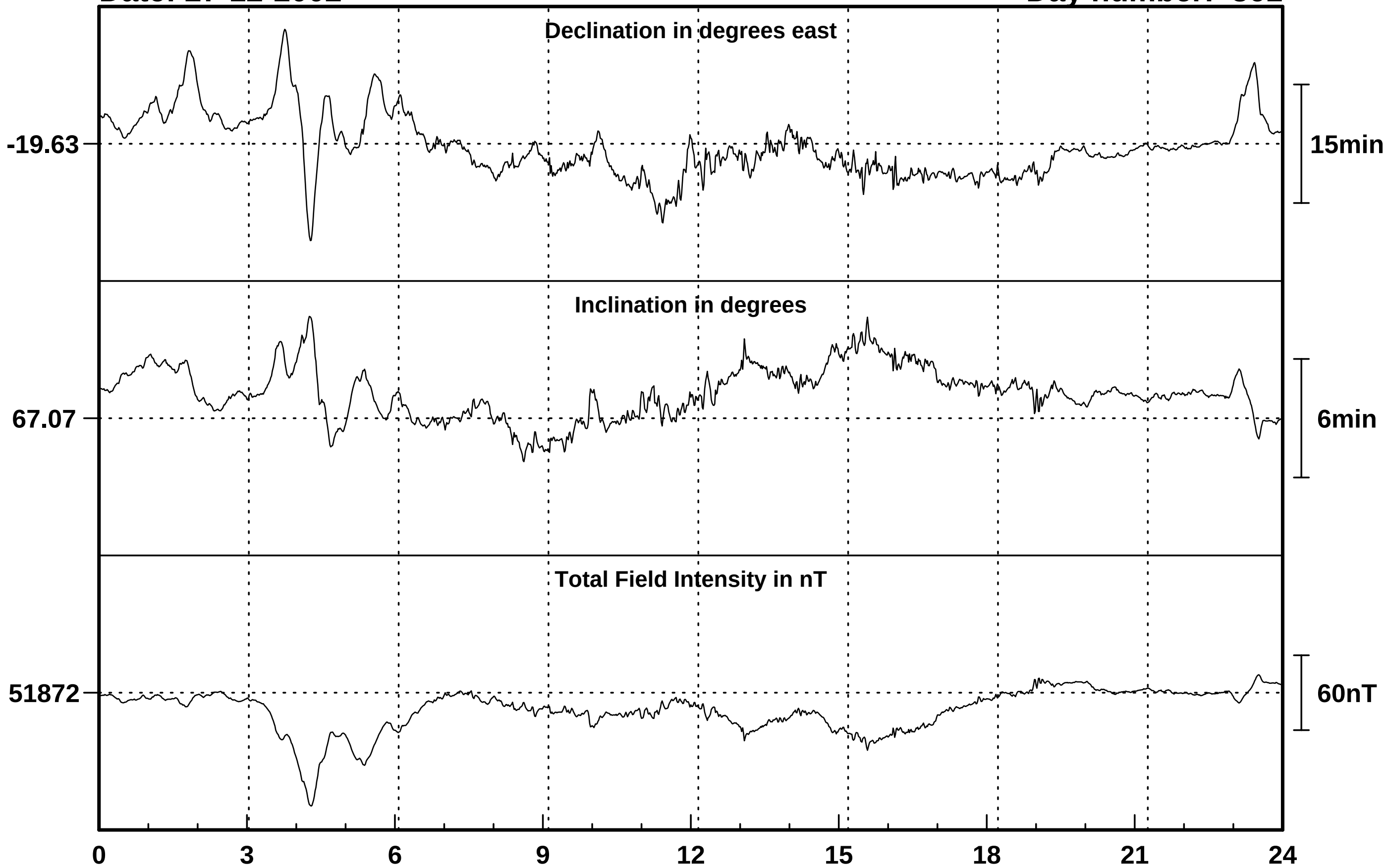

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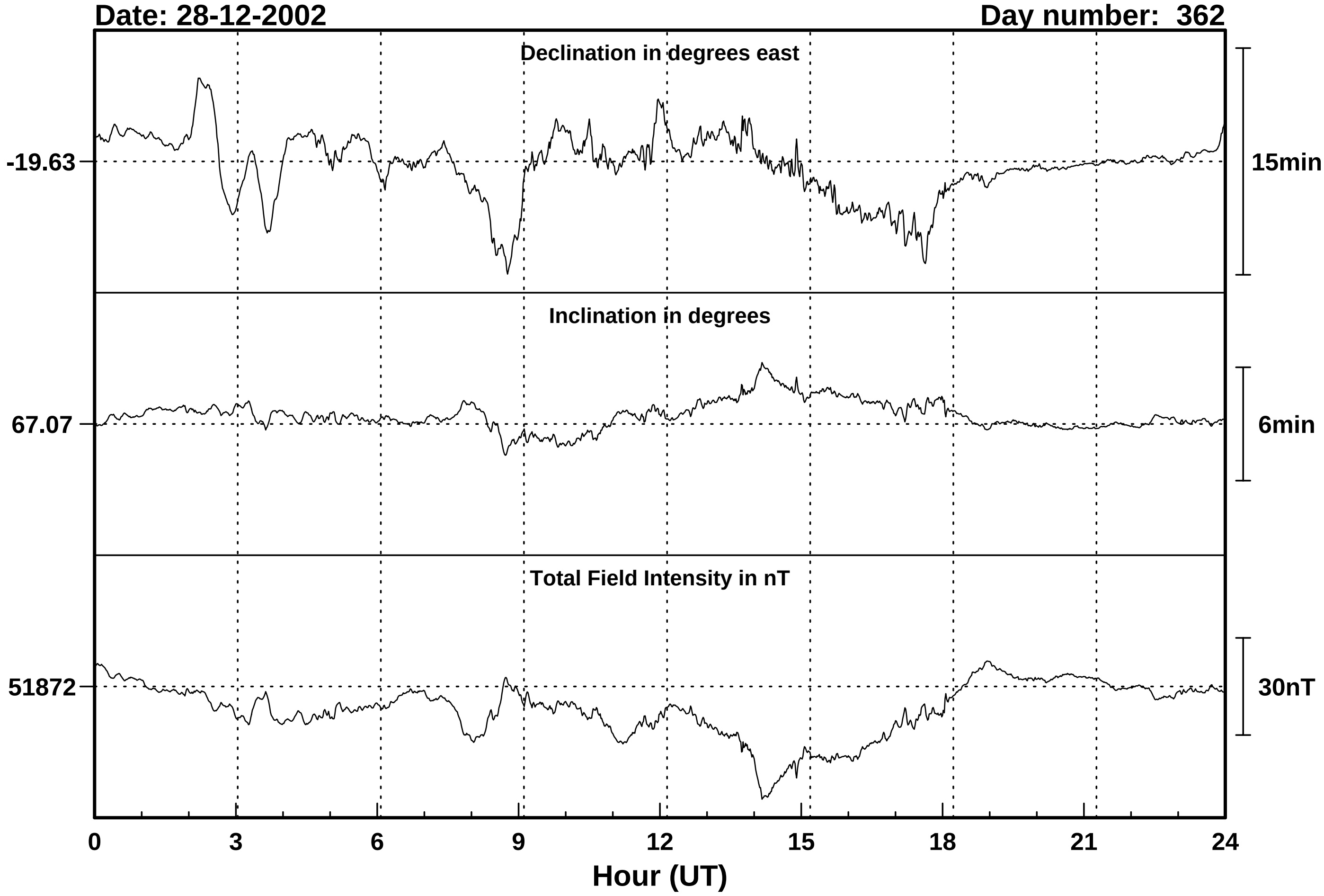
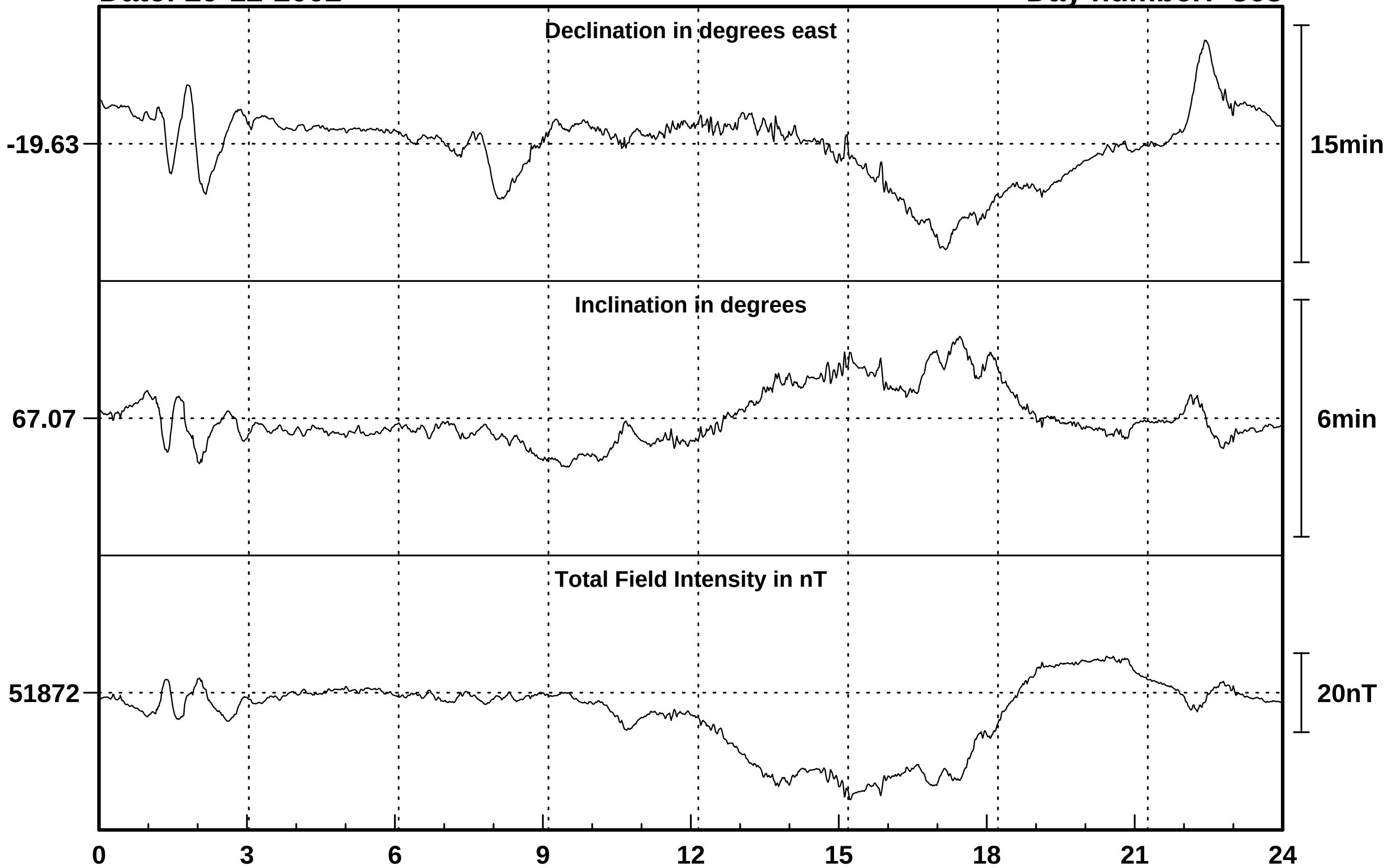


Sable Island

Date: 29-12-2002 Day number: 363



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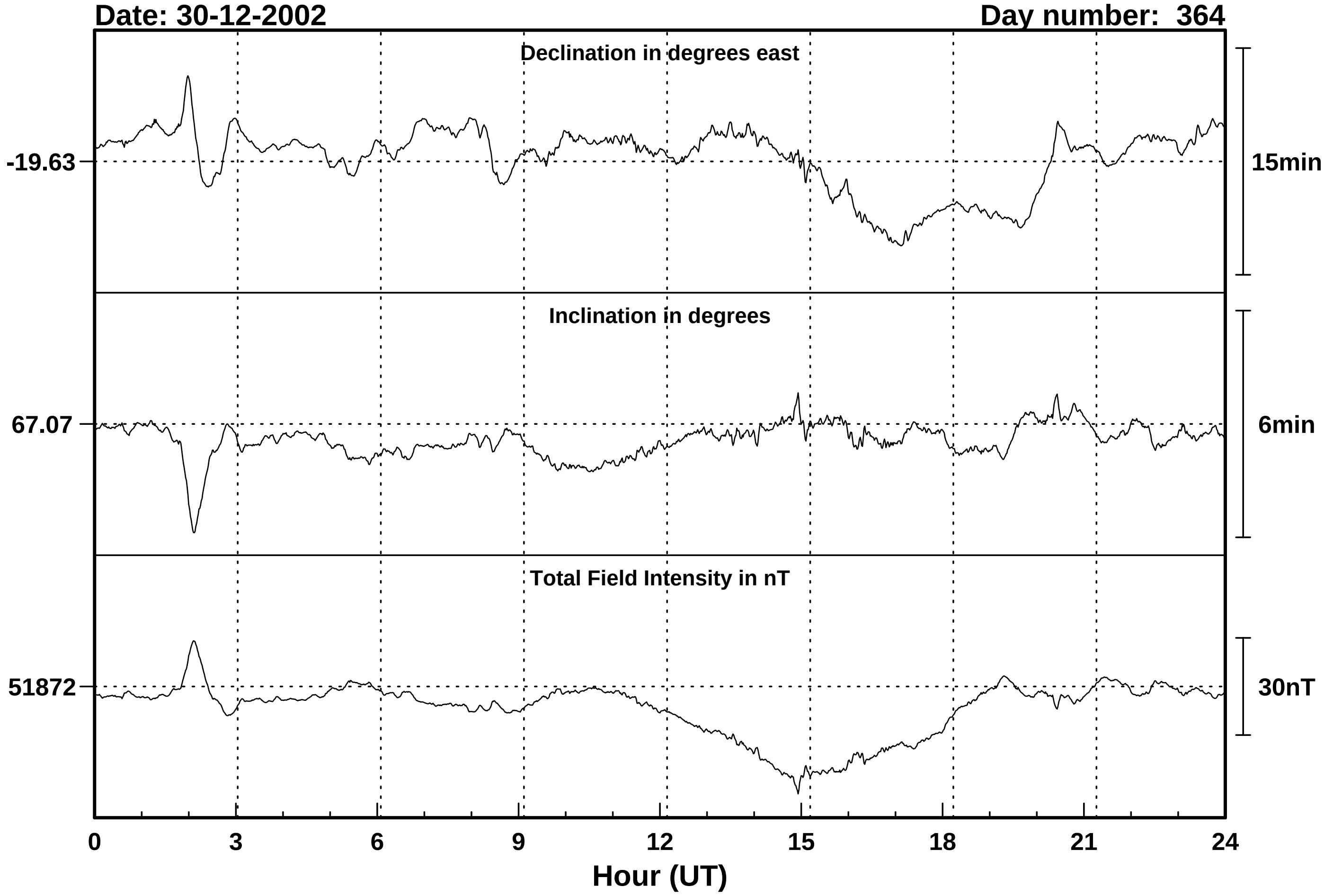
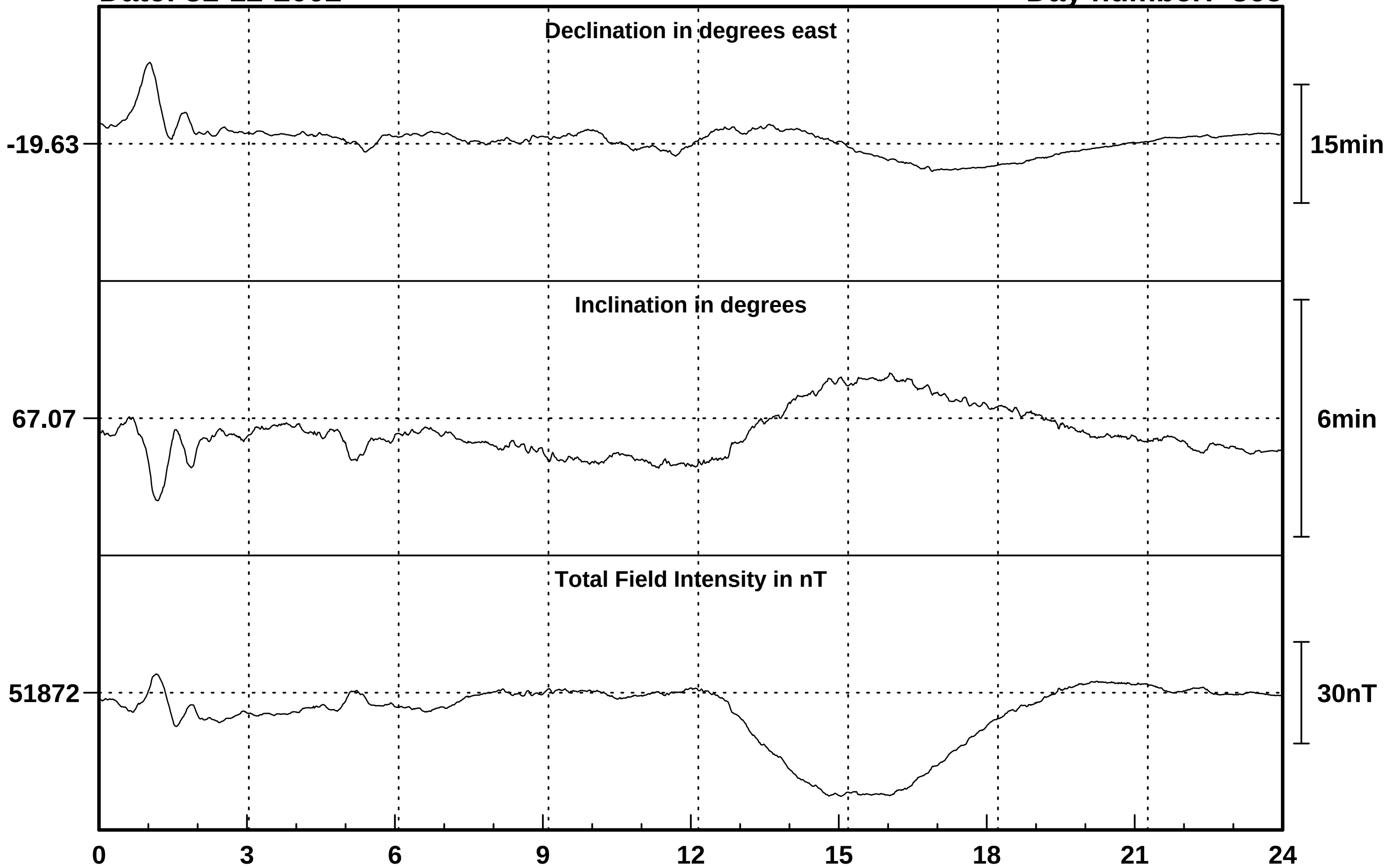
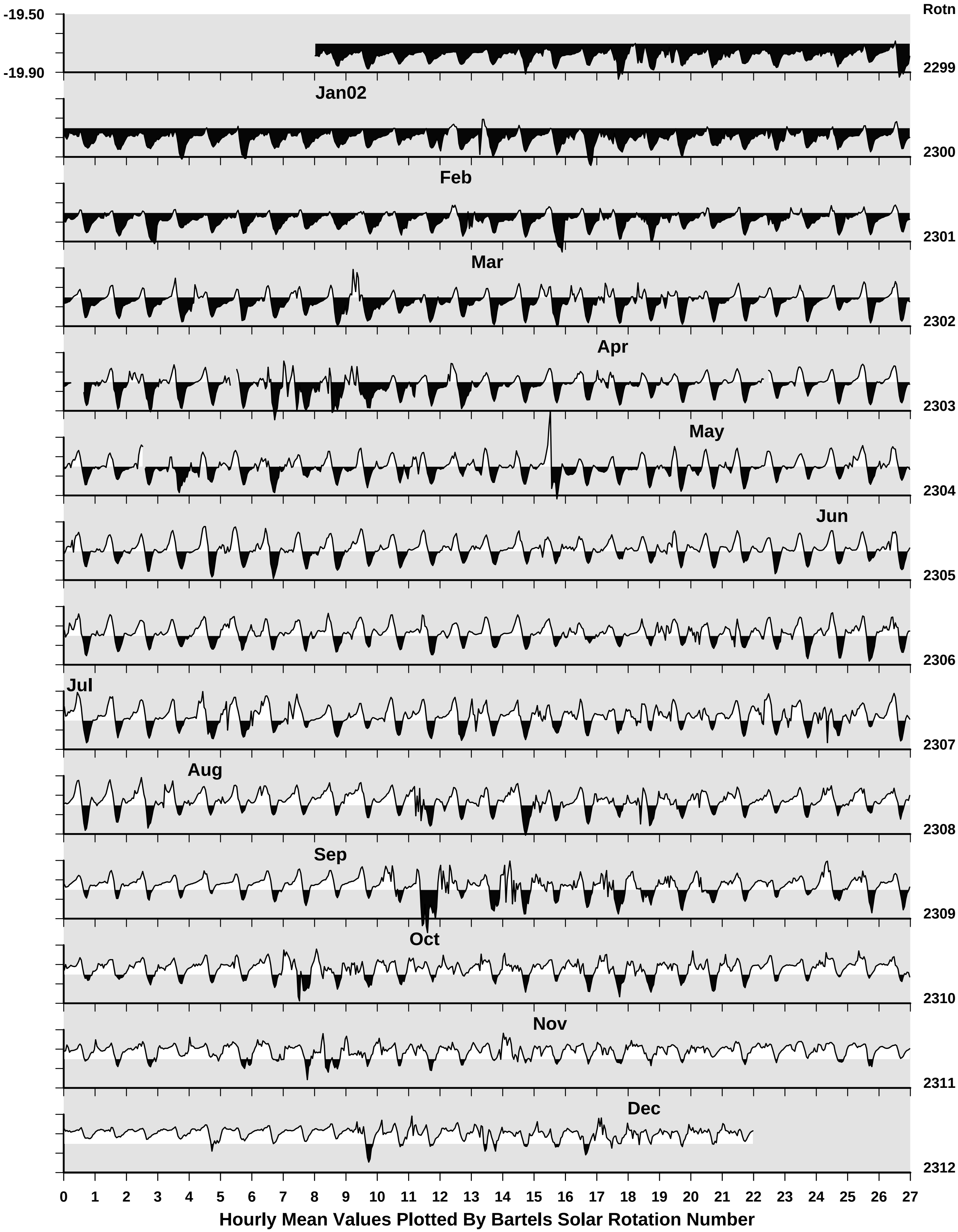


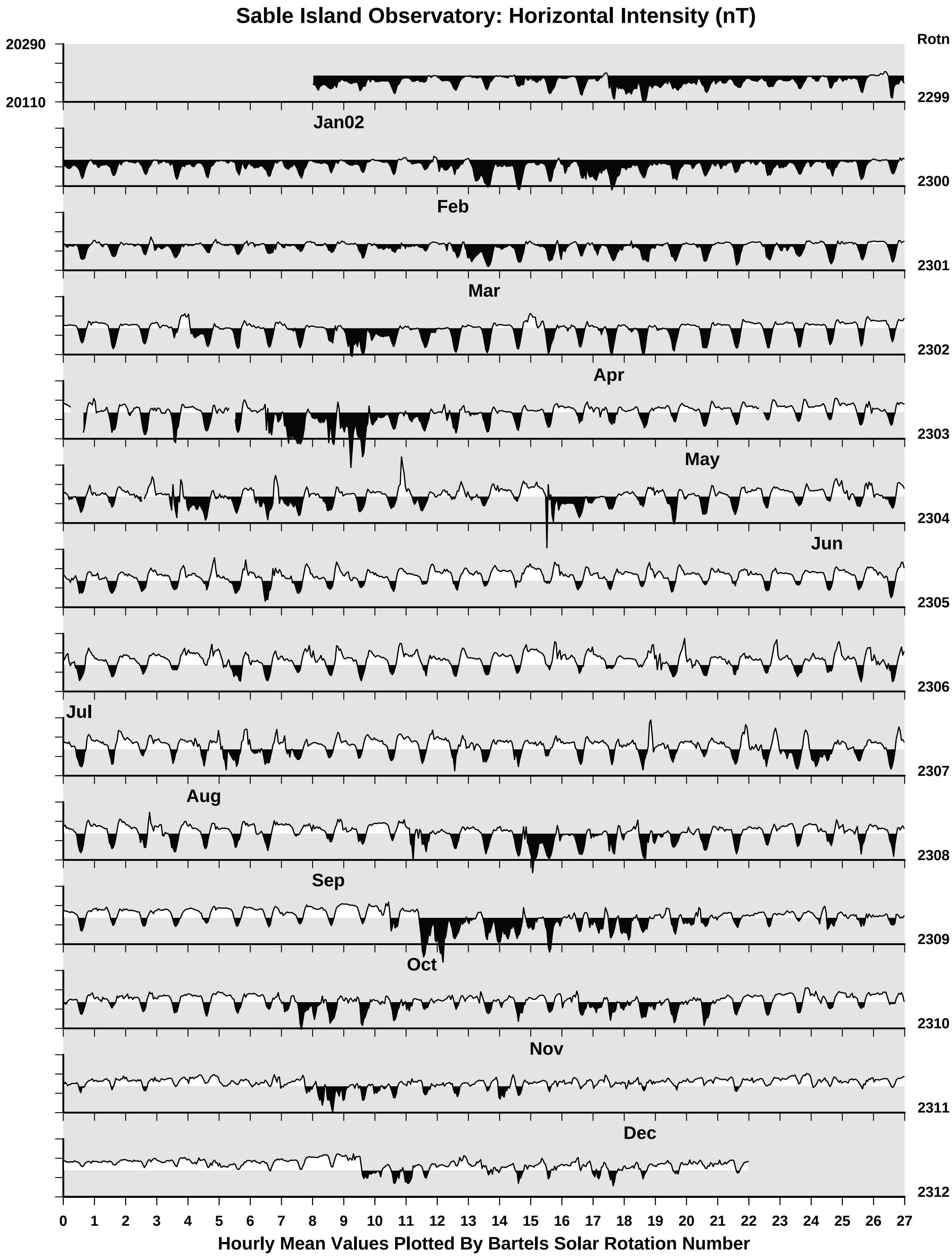
Sable Island

Date: 31-12-2002 Day number: 365

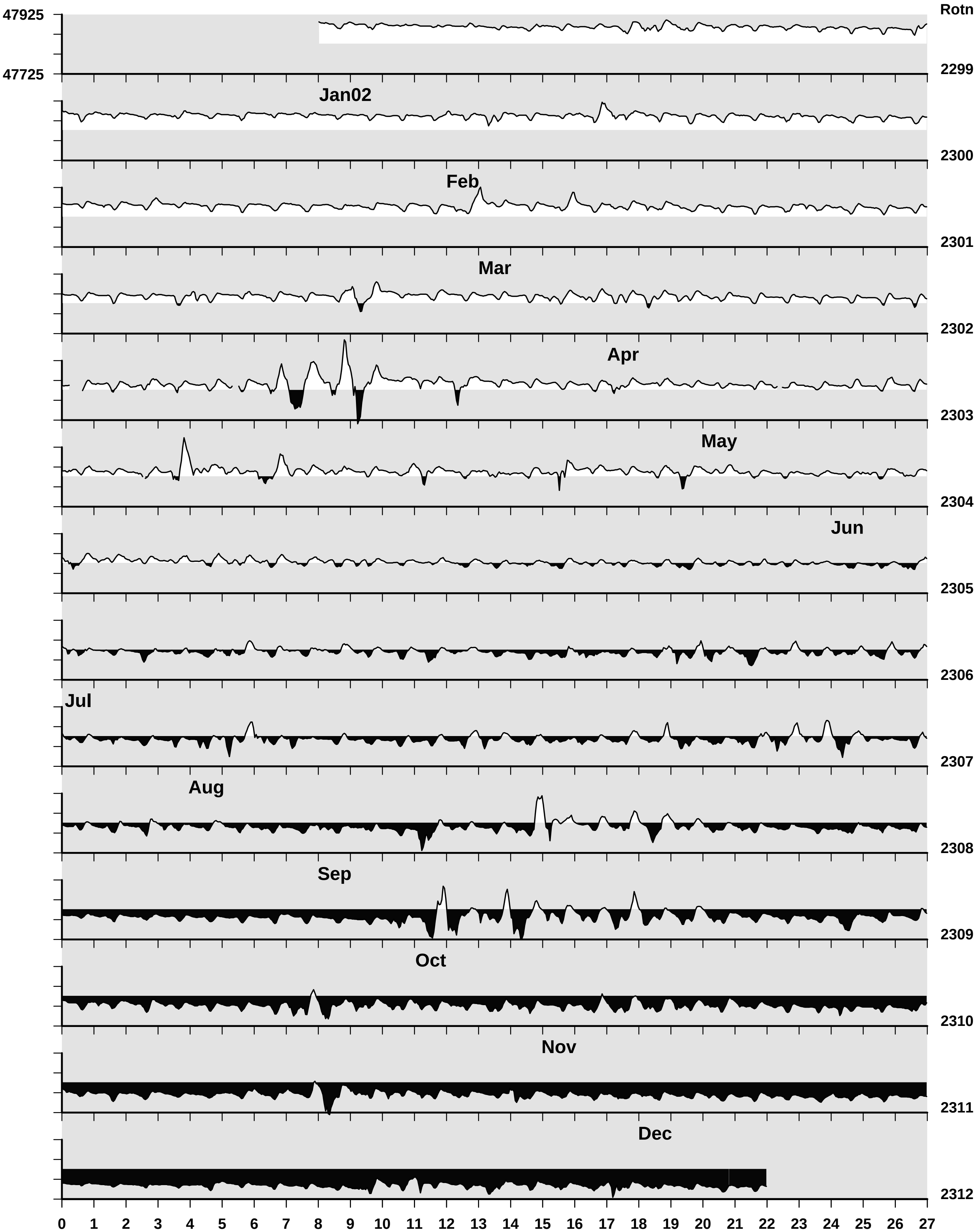


Sable Island Observatory: Declination (degrees)



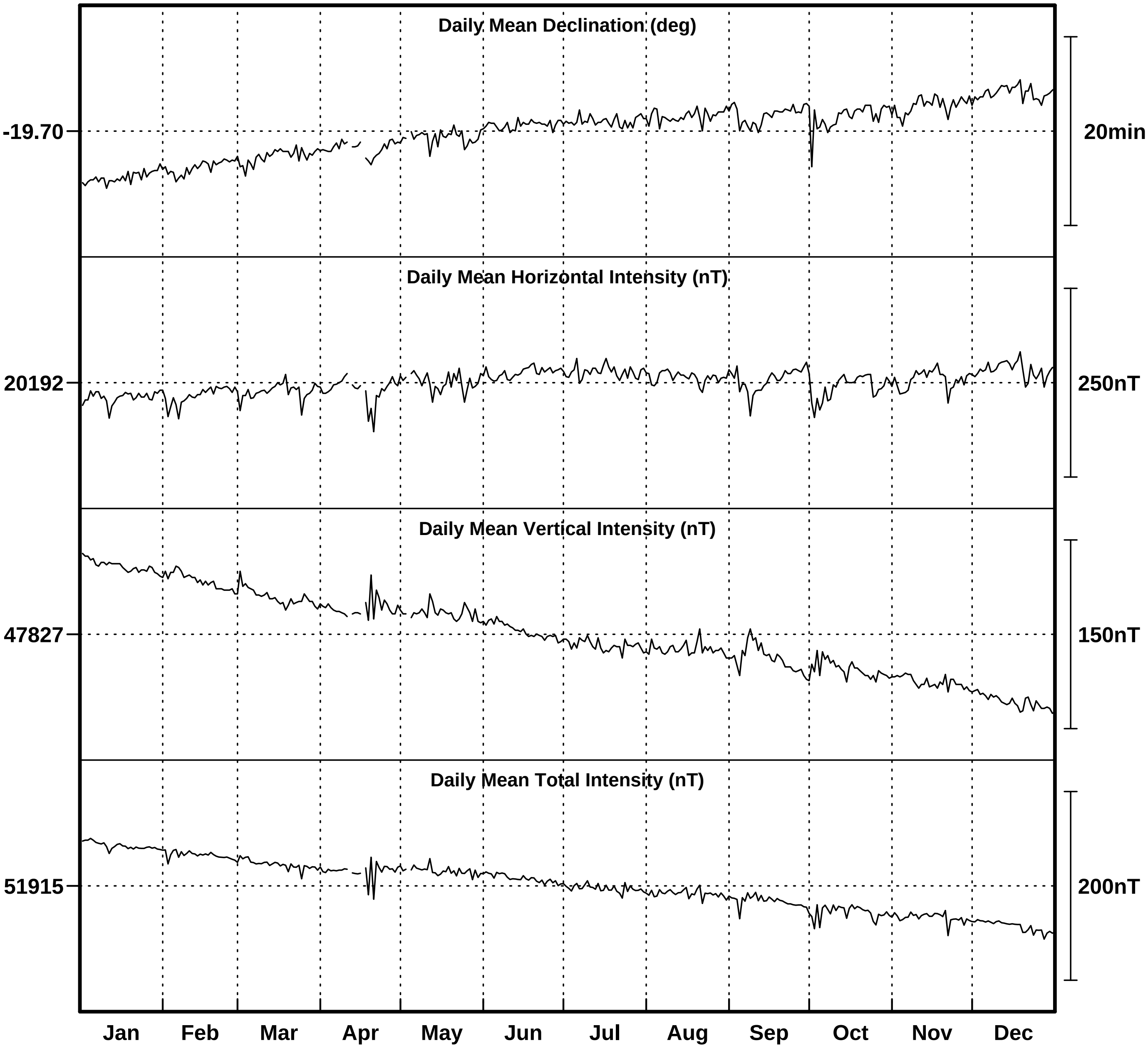

Sable Island Observatory: Horizontal Intensity (nT)
20290
20110
Rotn
2299
2300
2301
2302
2303
2304
2305
2306
2307
2308
2309
2310
2311
2312
Jan02
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Hourly Mean Values Plotted By Bartels Solar Rotation Number

Sable Island Observatory: Vertical Intensity (nT)



Hourly Mean Values Plotted By Bartels Solar Rotation Number

Sable Island Daily Mean Values 2002



Monthly Mean Values for Sable Island Observatory 2002

Month	*D*	*H*	*I*	*X*	*Y*	*Z*	*F*	Data
January	-19° 47.0´	20173 nT	67° 9.2´	18982 nT	-6828 nT	47881 nT	51957 nT	**P**
February	-19° 45.9´	20175 nT	67° 8.8´	18986 nT	-6823 nT	47869 nT	51947 nT	**P**
March	-19° 44.8´	20180 nT	67° 8.1´	18994 nT	-6818 nT	47856 nT	51937 nT	**P**
April	-19° 44.0´	20183 nT	67° 7.8´	18997 nT	-6814 nT	47848 nT	51930 nT	**P**
May	-19° 42.8´	20193 nT	67° 7.1´	19009 nT	-6811 nT	47844 nT	51930 nT	**P**
June	-19° 41.5´	20205 nT	67° 5.9´	19024 nT	-6808 nT	47829 nT	51922 nT	**P**
August	-19° 40.5´	20199 nT	67° 5.9´	19020 nT	-6801 nT	47815 nT	51906 nT	**P**
September	-19° 40.4´	20196 nT	67° 5.9´	19017 nT	-6799 nT	47807 Nt	51898 nT	**P**
October	-19° 40.6´	20186 nT	67° 6.3´	19007 nT	-6797 nT	47799 nT	51886 nT	**P**
November	-19°39.4´	20196 nT	67° 5.4´	19019 nT	-6794 nT	47789 nT	51881 nT	**P**
December	-19° 38.1´	20209 nT	67° 4.2´	19034 nT	-6790 nT	47773 nT	51872 nT	**P**

2. OBSERVATORY OPERATION AND QUALITY CONTROL

2.1 The Observatory Operation.

2.1.1 FLARE *Plus*

The observatory operates under the control of the Fluxgate Logging Automatic Recording Equipment incorporating a proton magnetometer (FLARE *Plus*), which was developed by BGS. The system is based on a PC, which controls the data- logging and communications. The measurements are made using two types of magnetometers: a triaxial linear-core fluxgate magnetometer manufactured by the Danish Meteorological Institute; and a Geomag SM90R Overhauser effect proton precession magnetometer (PPM). Two of the fluxgate sensors are orientated to measure the variations in *H* and *Z* and the third is orientated perpendicular to these and measures variations that are proportional to the changes in *D*. Measurements are made every 5 seconds and are filtered using a 19-point Gaussian filter to produce one-minute values centred at 0 seconds past the minute. The PPM is used to make measurements of *F* every minute, also at 0 seconds past the minute. Accurate timing of the data is established using GPS. The one-minute values are stored both in memory (up to 2 days) and on a floppy disk (up to 40 days). The FLARE *Plus* system is described in more detail by Turbitt *et al* (BGS Technical Report WM/97/16).

2.1.2 Data Retrieval

The data are retrieved to the BGS office in Edinburgh by a modem connected to a dedicated collection PC. This calls a NERA Worldphone satellite modem, which is connected to the FLARE *Plus* system at the observatory. In normal operation this is performed automatically four times per day, but data can be retrieved on demand if required. A backup procedure of regularly changing the floppy disks and returning them to Edinburgh by post is also carried out.

2.2 Absolute Observations

The fluxgate magnetometers are designed to accurately monitor the variations in the components of the geomagnetic field. They do not measure the absolute magnitudes of the components. Absolute measurements of the field are made typically once a week, and are tabulated in this bulletin. A fluxgate sensor (Bartington MAG-01H) mounted on a non-magnetic theodolite (Carl Zeiss 010B) is used to determine *D* and *I*; *F* values are obtained from the PPM. The absolute observations are used in conjunction with the FLARE *Plus* 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.

2.3 Quality Control

2.3.1 F Differences and Baselines

A plot of the differences between the absolute observations and the variometer measurements of *D*, *H* and *Z* throughout the year is shown along with the derived baseline values (Fig 1). These daily values have been added to the variations to derive the quasi-absolute values of *D*, *H* and *Z*. Daily mean differences between the measured absolute *F* and the *F* computed from the final *H* and *Z* values are also shown on this plot. The *F* comparisons are also presented as hourly mean differences during the month (Fig 2). The hourly means of the temperature inside the variometer room throughout the month are displayed in the second panel of this plot.

2.3.2 Collimation Errors

In an ideal fluxgate-theodolite the magnetic axis of the sensor core would be parallel to the optical axis of the telescope. However, this situation is impossible to achieve and small alignment errors called collimation errors are the result. These are systematic errors and should remain roughly constant. With the telescope horizontal, δ is the collimation error about the vertical axis and ε is the collimation error about the horizontal axis, both expressed as angles. A third error, measured in nT, is the zero-field offset, Z_0. This represents the output if the instrument was placed in a zero field and is due to permanent magnetisation of the core or to features of the electronics. The collimation and zero-field offset values for throughout the year are plotted (Fig 3) to check that they do remain reasonably constant. Departures from a long-term mean value may be caused by changes to the fluxgate-theodolite or by errors in recording the measurements, and so monitoring the collimation errors is a means of quality control.

2.3.3 Diary and FLARE *plus* reliability

A narrative describing work carried out at the observatory during the month and any effects on the data collected is given in the diary. If known, the reasons for any data loss are described.

The reliability of the system is constantly monitored. The times of any failure which resulted in loss or corruption of data are tabulated.

SABLE ISLAND OBSERVATORY ABSOLUTE OBSERVATIONS

	Date	Day	Time (UT)	Value
Declination (fluxgate theodolite)	No observations were made			
Inclination (fluxgate theodolite)	No observations were made			
Total Field Intensity (PPM)	No observations were made			
Horizontal Intensity (fluxgate theodolite and PPM)	No observations were made			
Vertical Intensity (fluxgate theodolite and PPM)	No observations were made			

Figure 1 : Sable Island Baseline Values and F Comparisons 2002

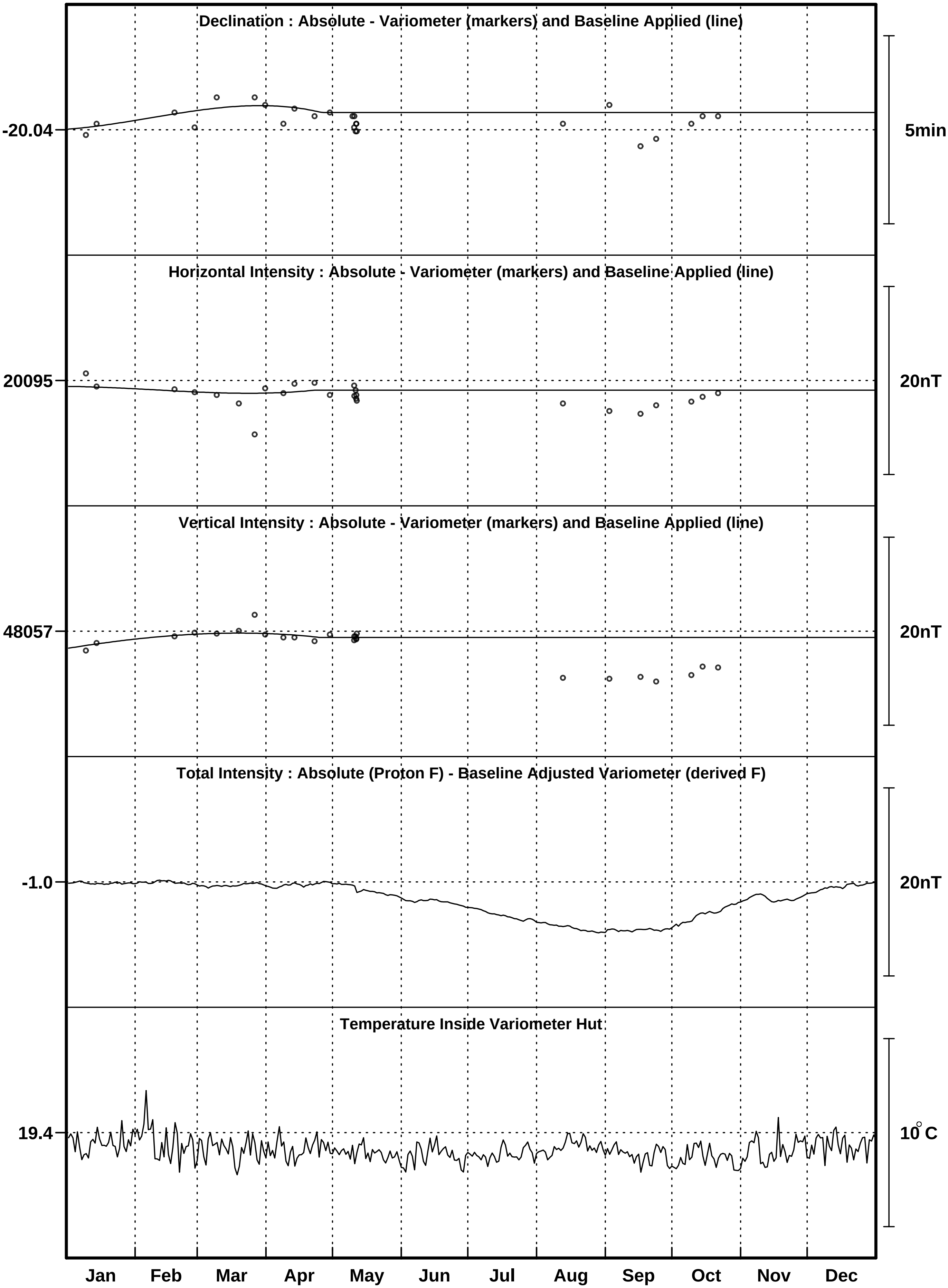


Figure 2 : Sable Island Monthly F Comparison December 2002

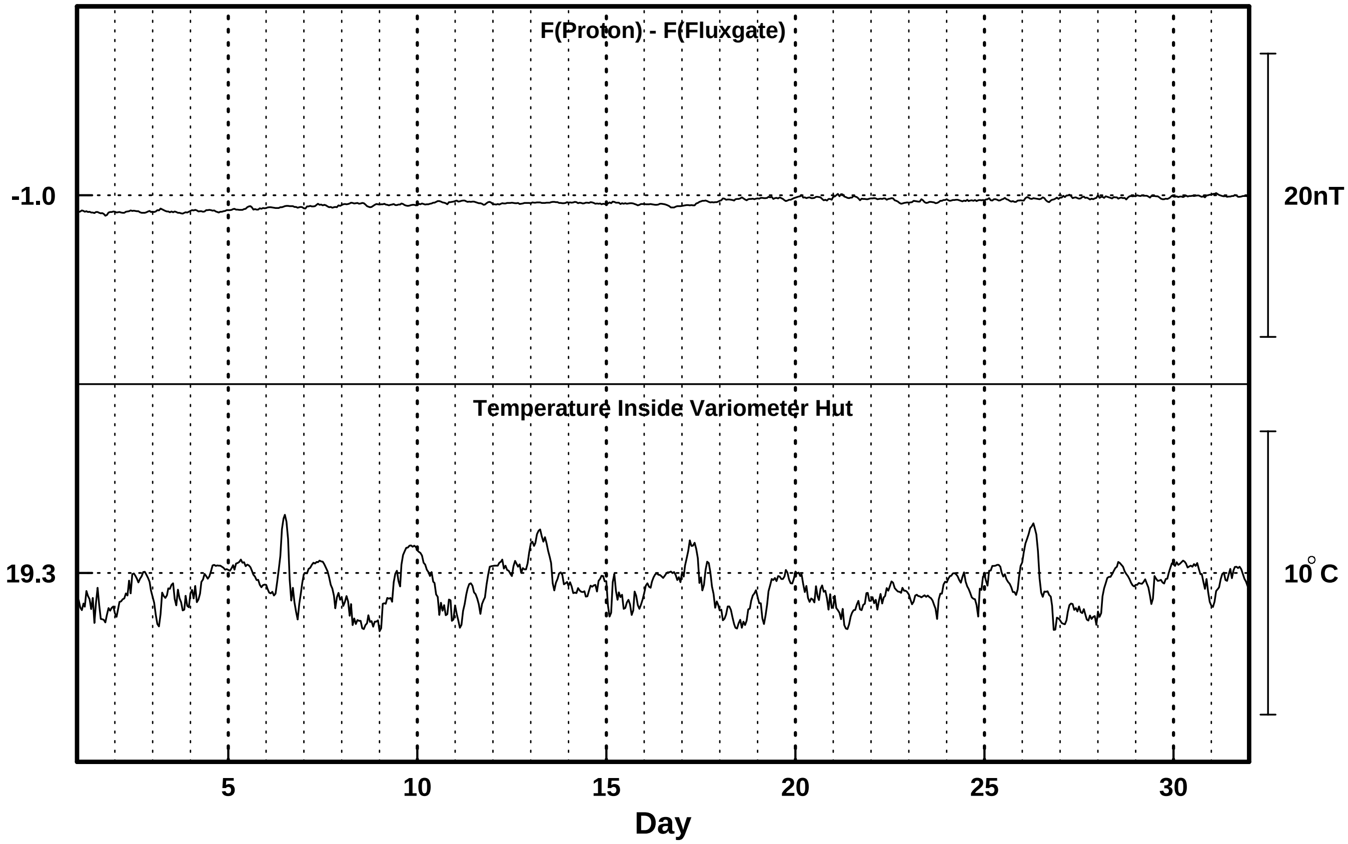
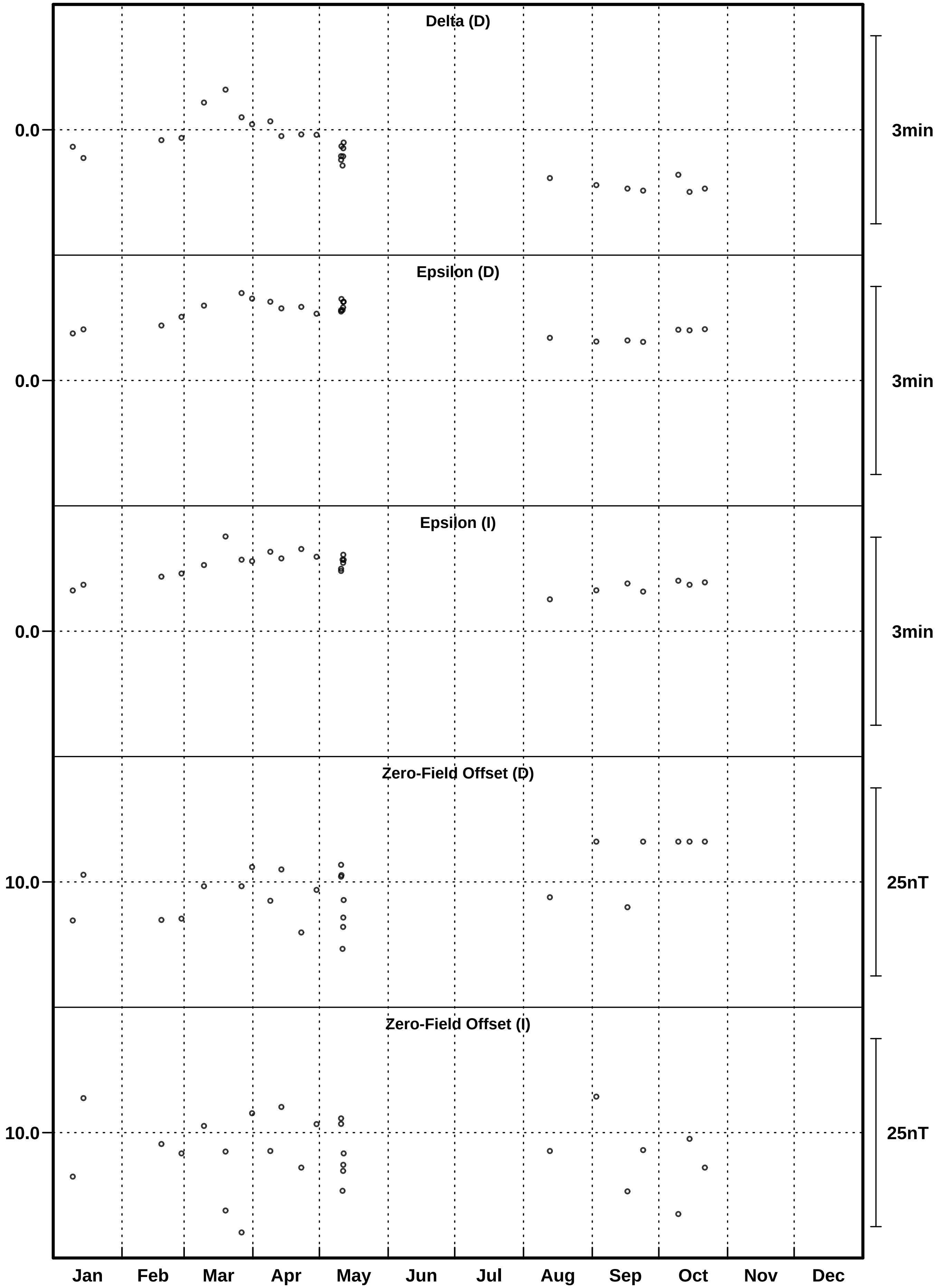


Figure 3 : Sable Island Collimation Errors 2002



SABLE ISLAND OBSERVATORY DIARY

various There were nine occasions when a single one-minute value was missing. The dates and times of these are listed in the table below. During processing these were filled using values interpolated from the surrounding data.

MISSING OR CORRUPT DATA

Start (UT)		End (UT)		Total	Comments
Date	Time	Date	Time	Loss	
01-12-02	16:32	01-12-02	16:32	1 min	One-minute value not recorded
03-12-02	16:32	03-12-02	16:32	1 min	One-minute value not recorded
04-12-02	16:32	04-12-02	16:32	1 min	One-minute value not recorded
05-12-01	16:32	05-12-02	16:32	1 min	One-minute value not recorded
06-12-02	16:32	06-12-02	16:32	1 min	One-minute value not recorded
09-12-02	15:44	09-12-02	15:44	1 min	One-minute value not recorded
11-12-02	00:37	11-12-02	00:37	1 min	One-minute value not recorded
21-12-02	06:32	21-12-02	06:32	1 min	One-minute value not recorded
25-12-02	16:32	25-12-02	16:32	1 min	One-minute value not recorded