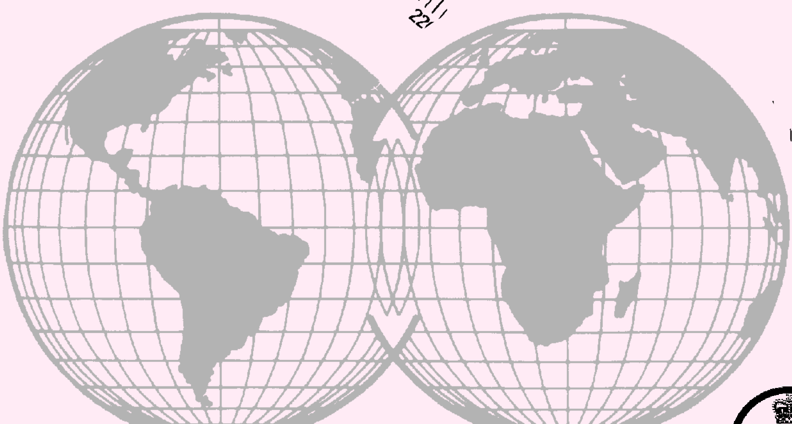
SABLE ISLAND OBSERVATORY

Monthly Geomagnetic Bulletin

JUNE 2001 WM/01/06/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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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° 6.5′N*	*13° 5.5′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 2001.5.

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.

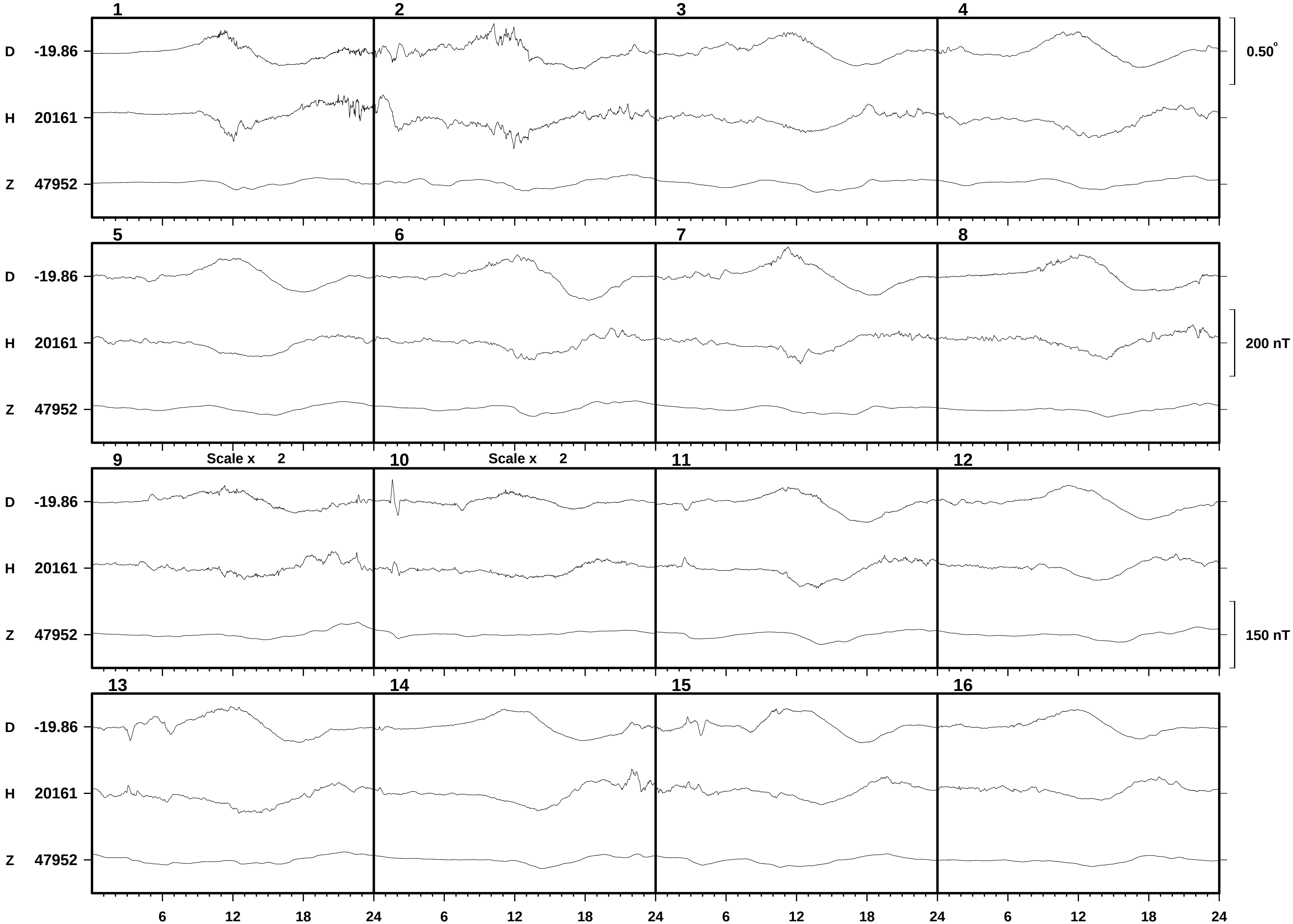
1.3.3 Hourly Mean Values

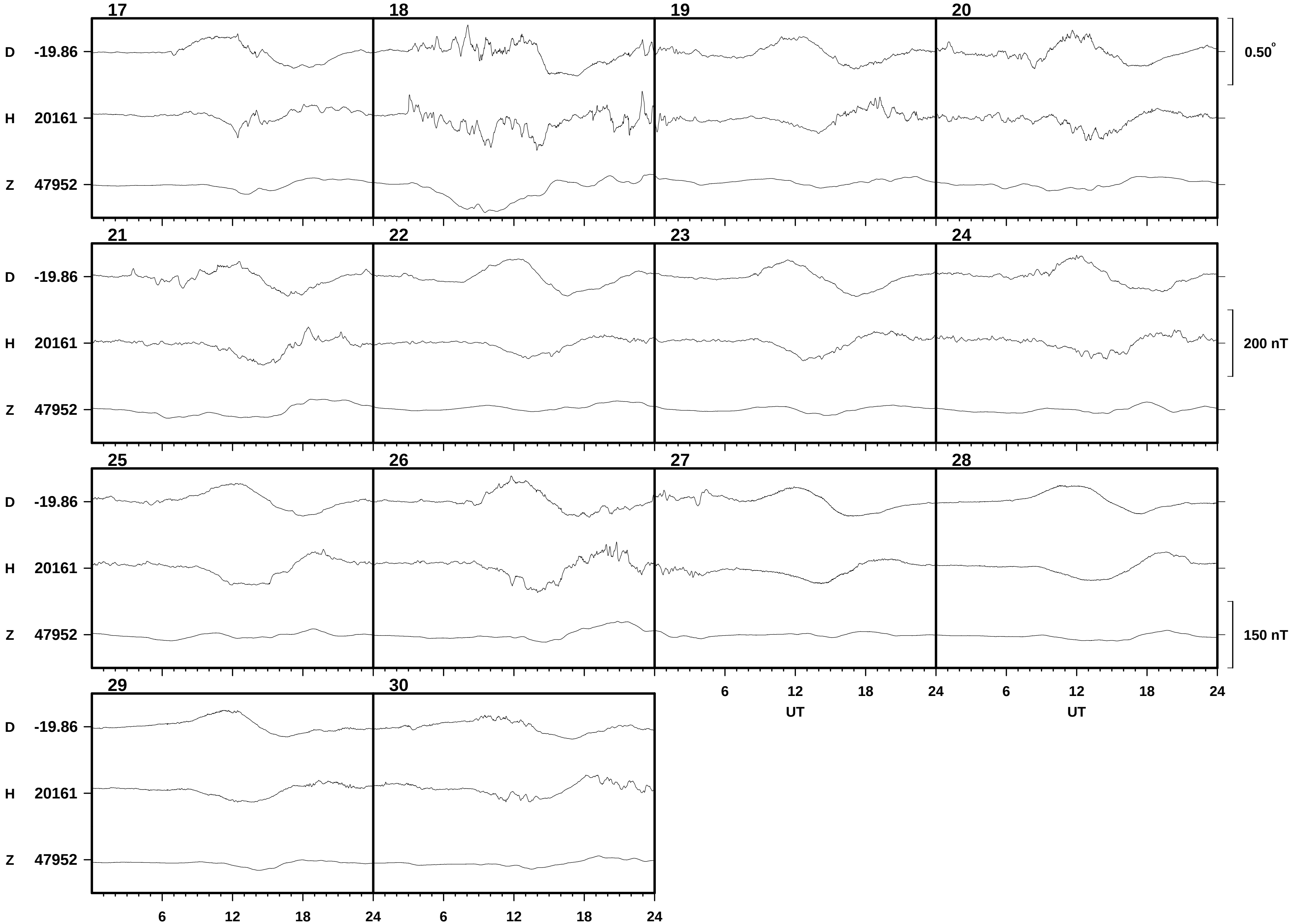
Plots of hourly mean values of *D*, *H* and *Z* for the past 12 months are plotted in 27-day segments corresponding to the Bartels solar rotation number. Magnetic disturbances associated with active regions on the surface of the Sun may recur after 27 days: the same is true for geomagnetically quiet 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.

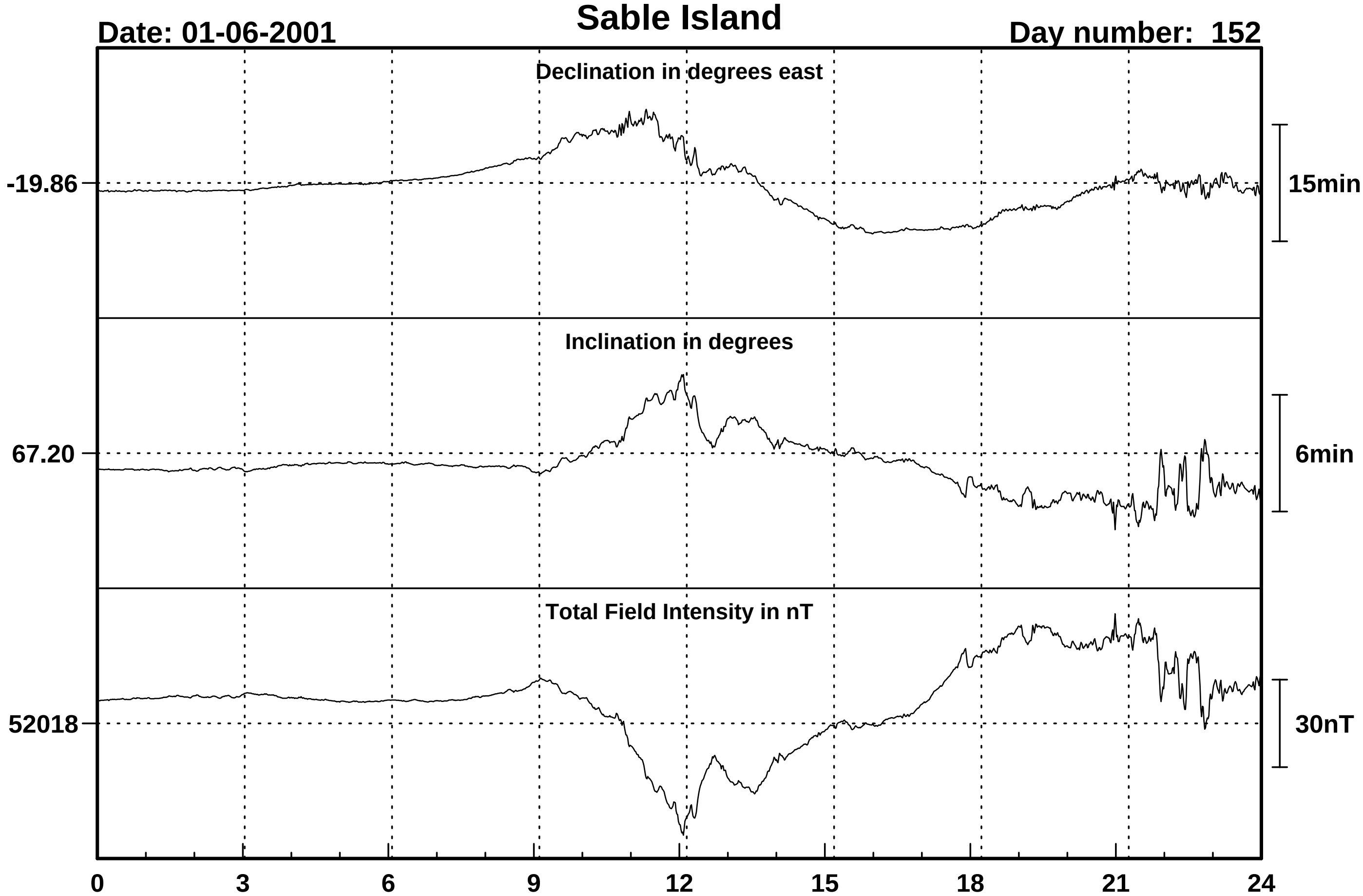
Sable Island June 2001

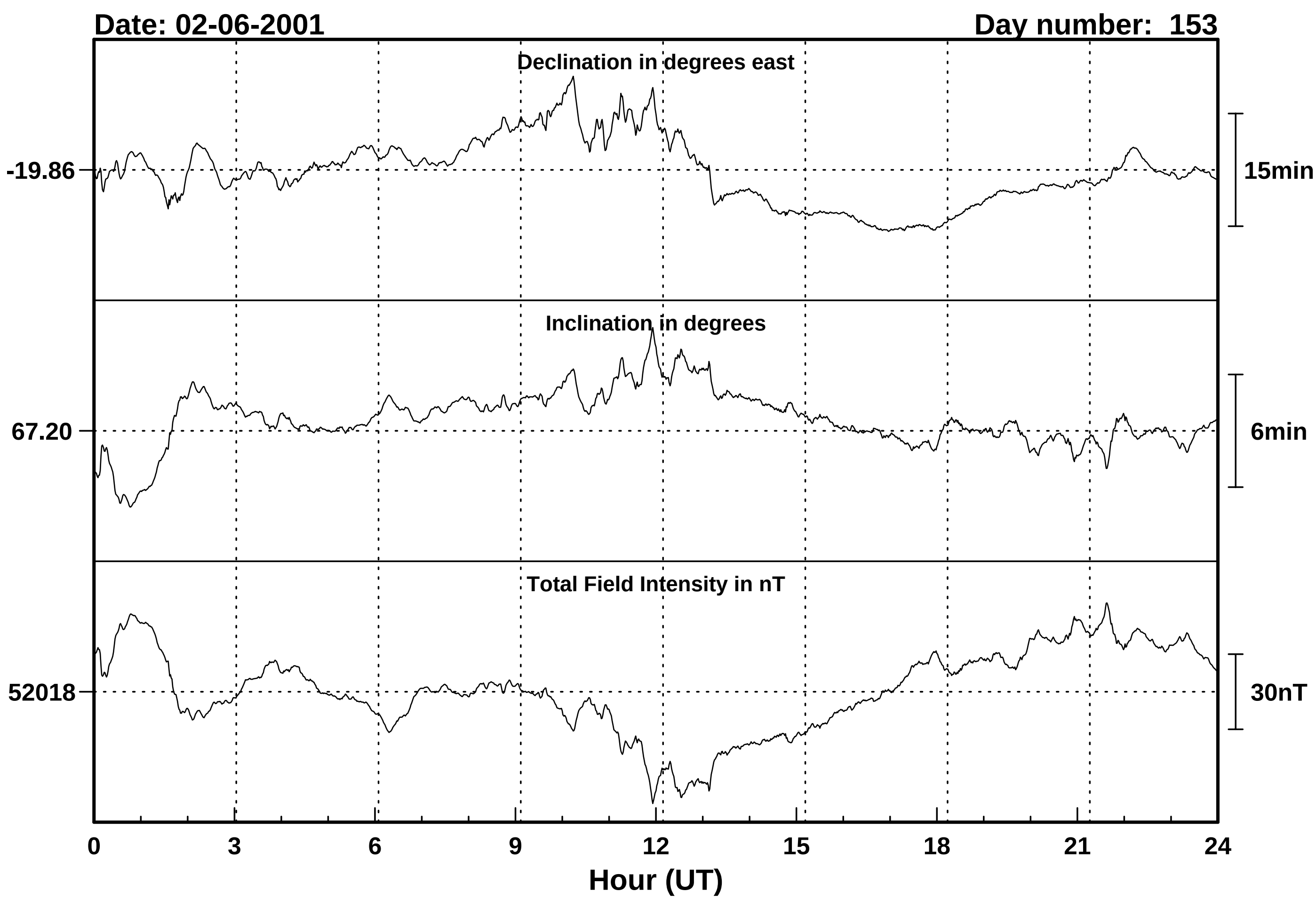




Sable Island June 2001

Sable Island





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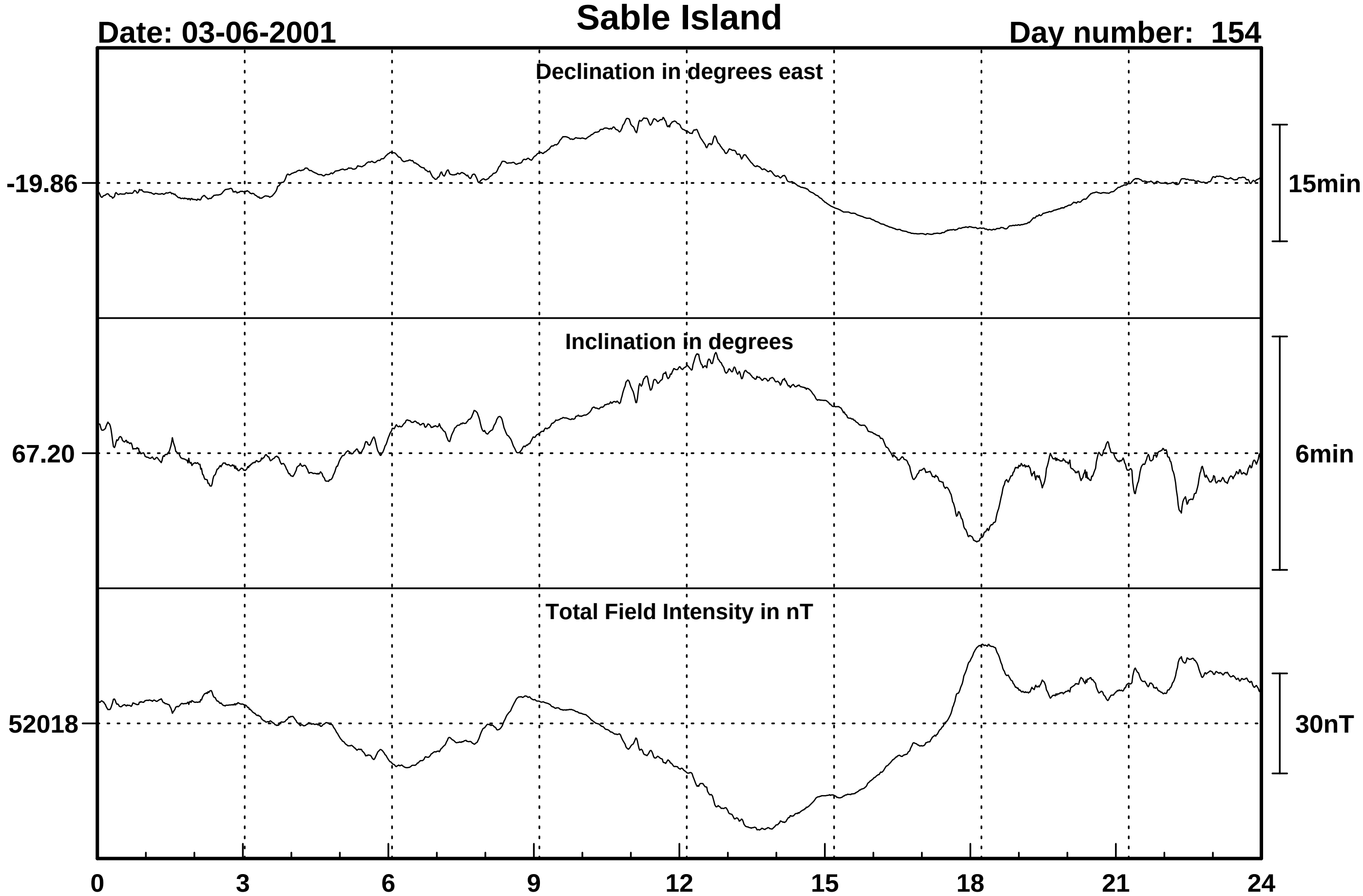

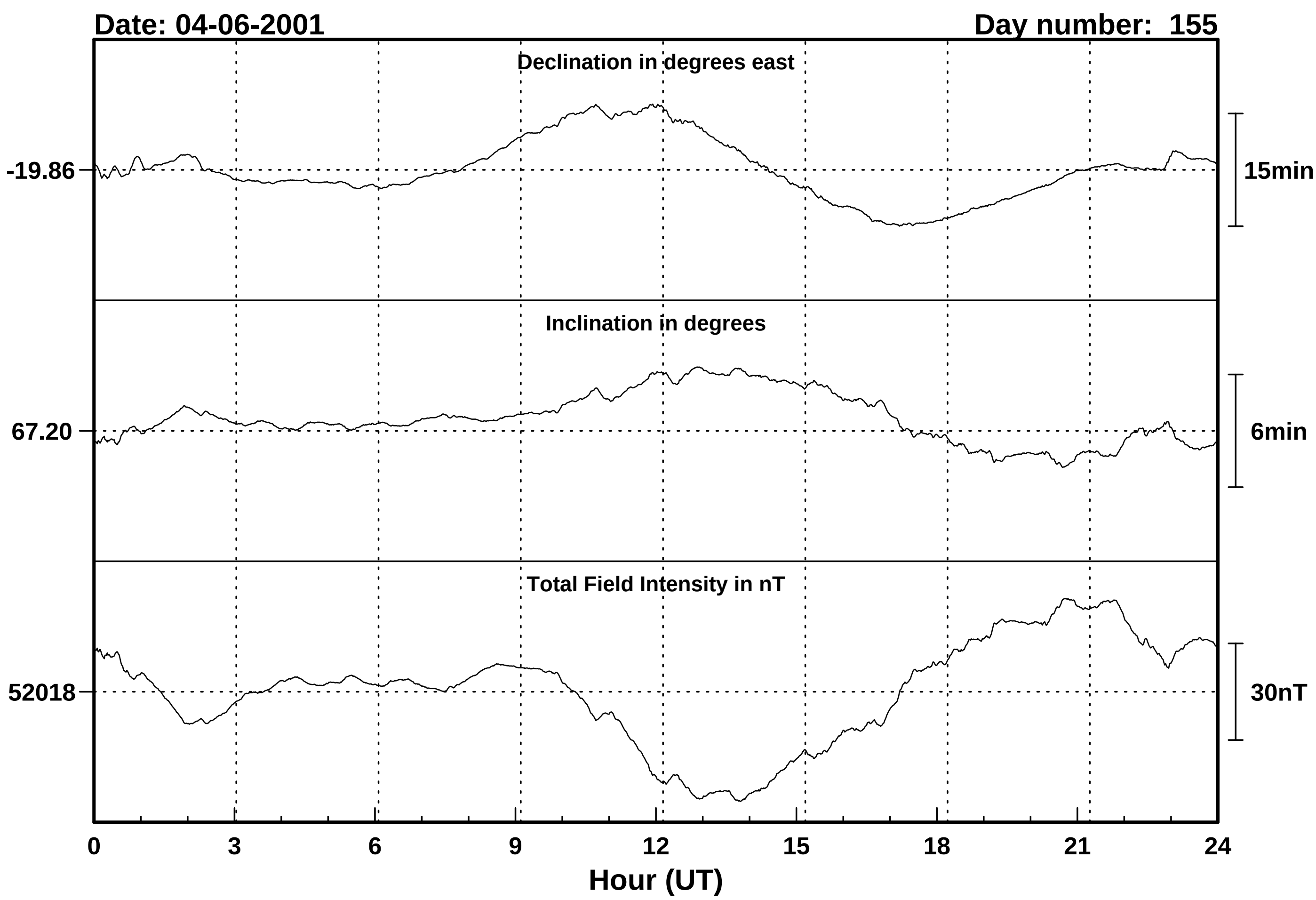

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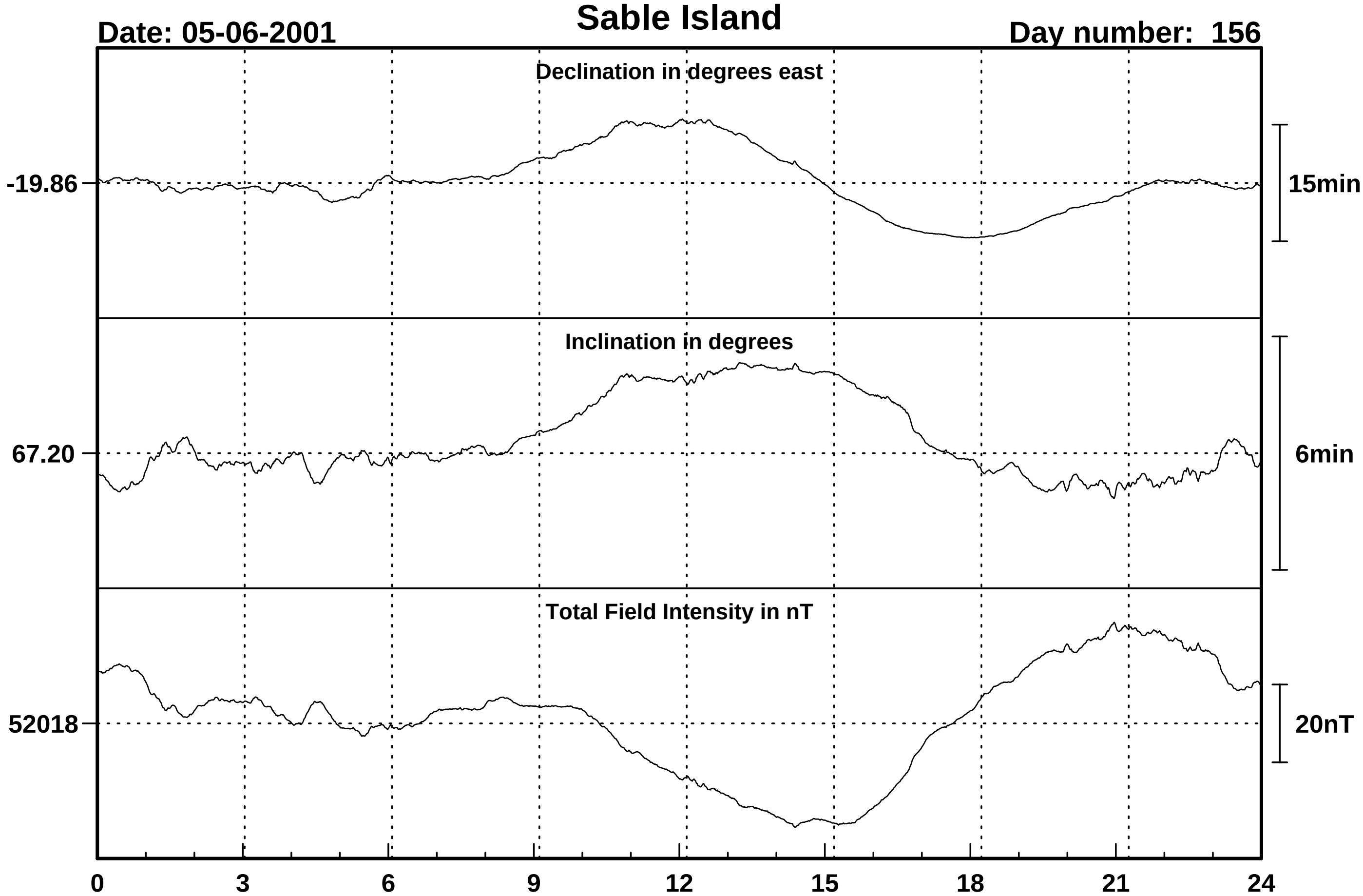

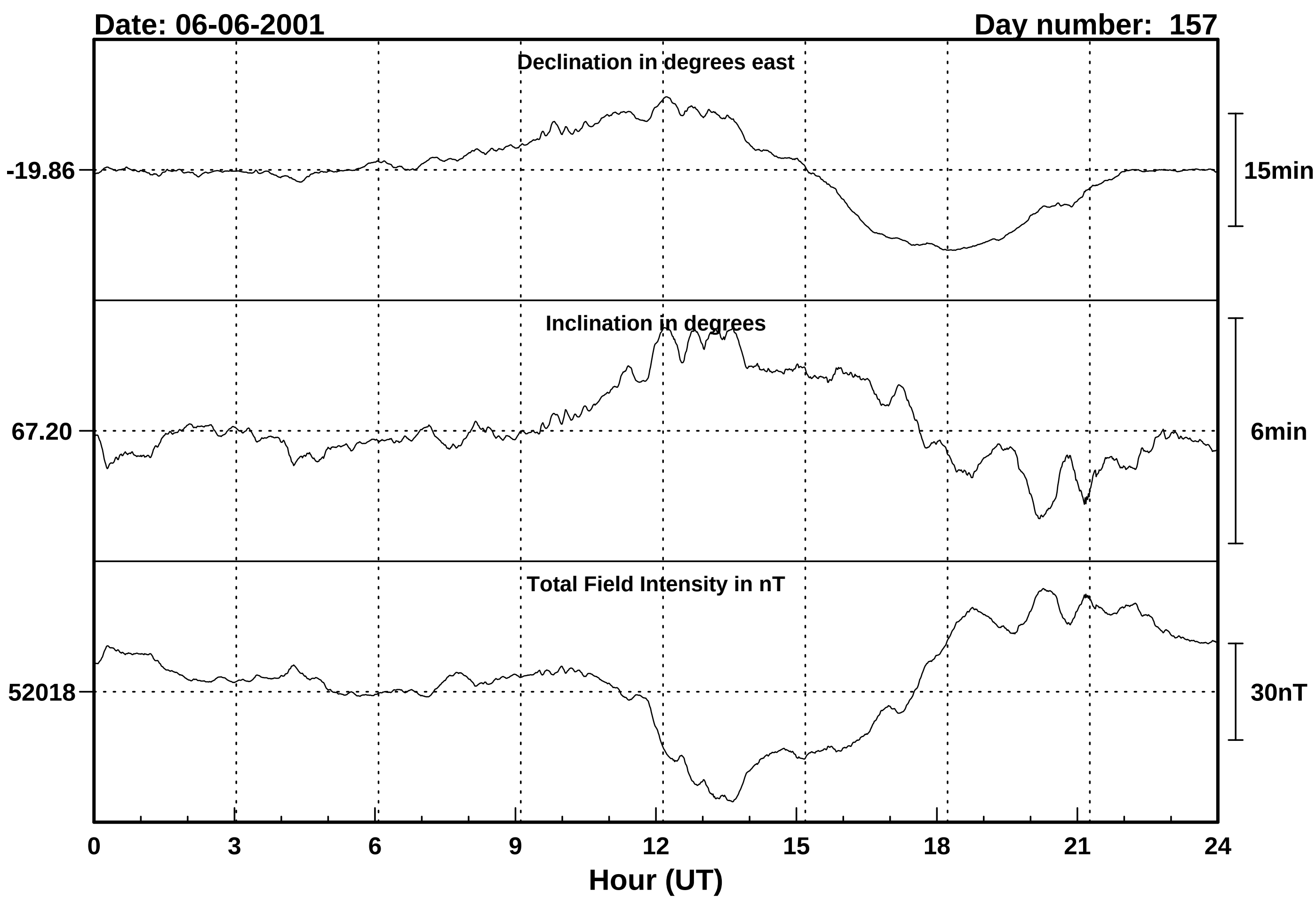

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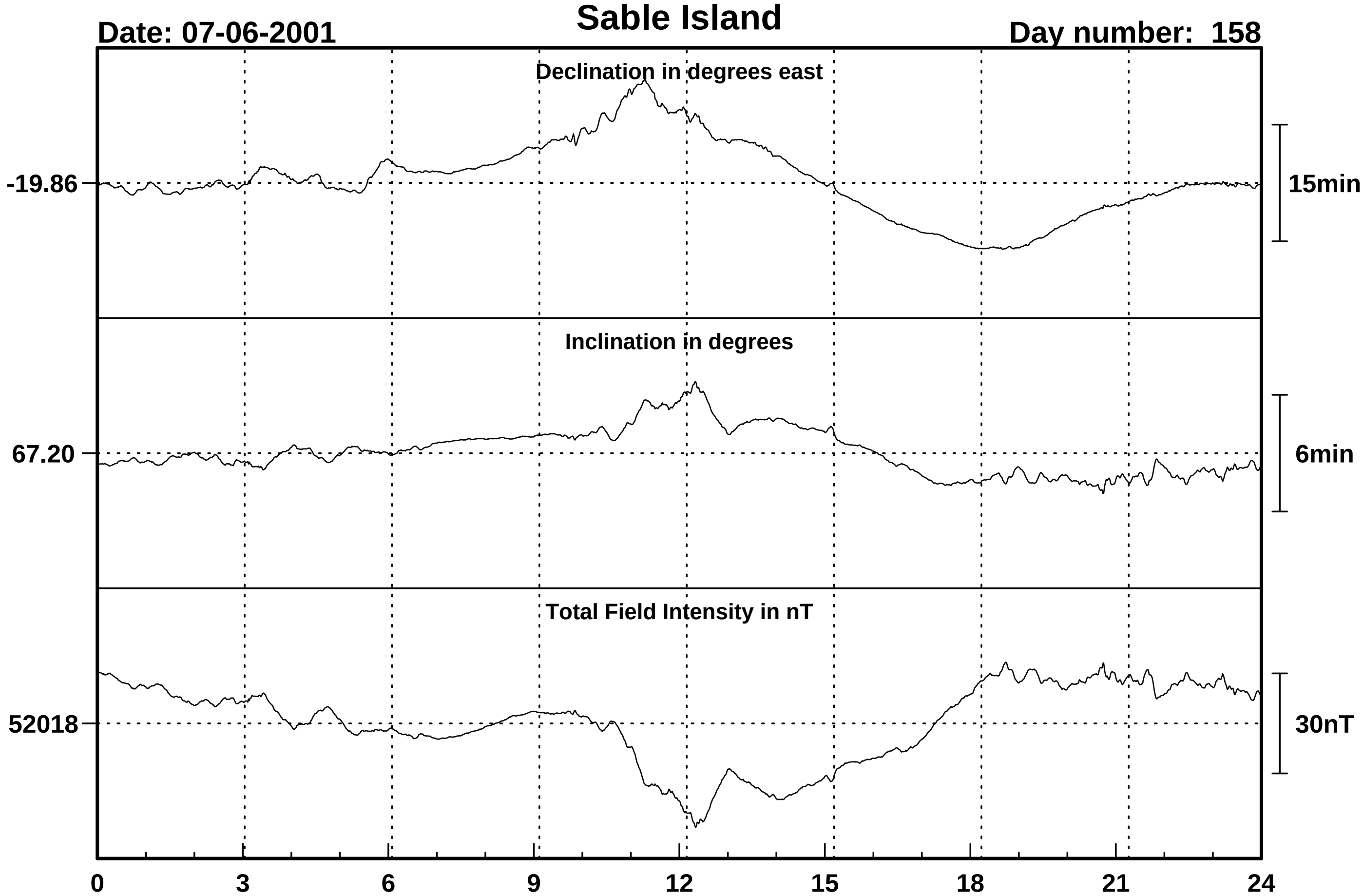

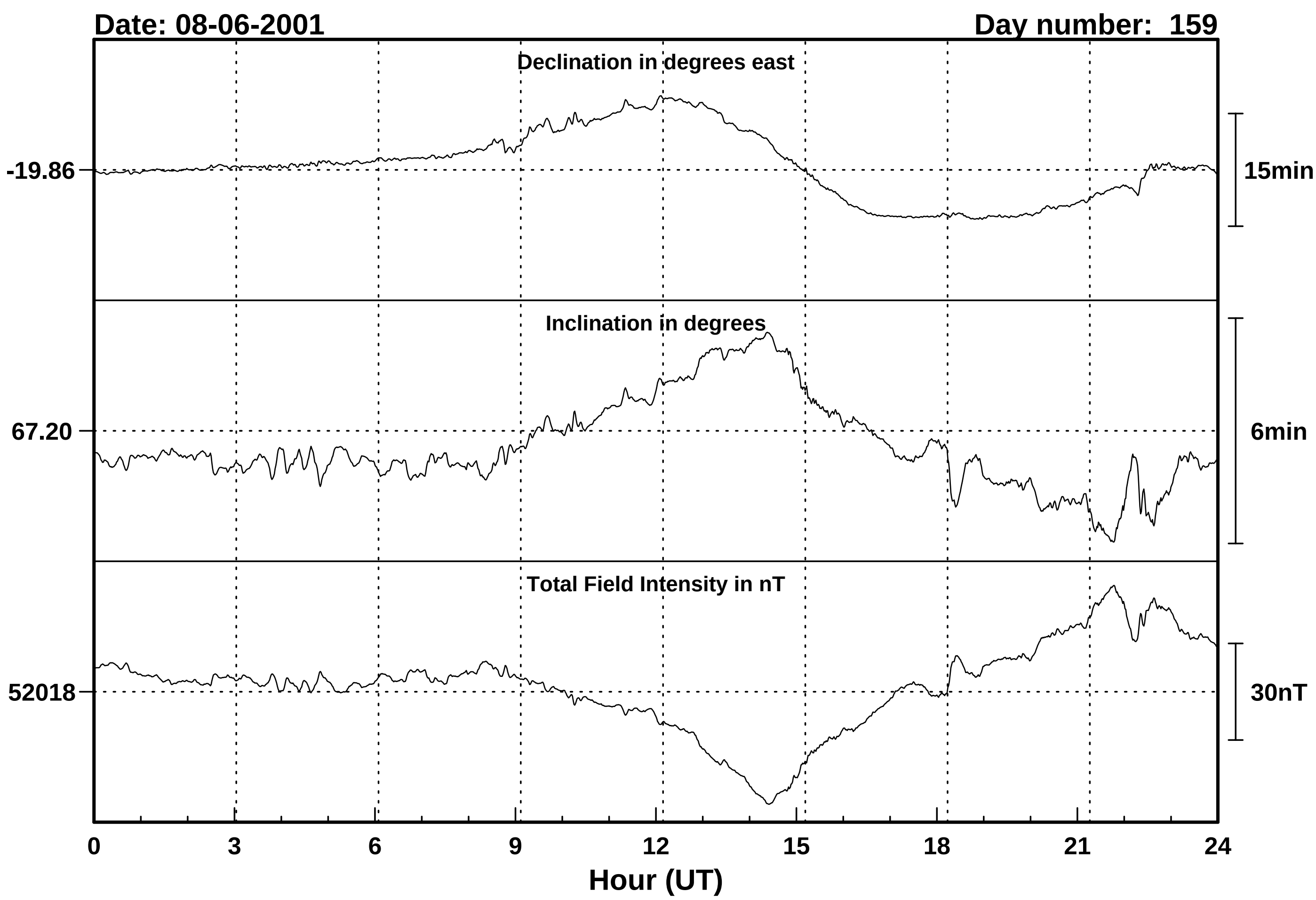

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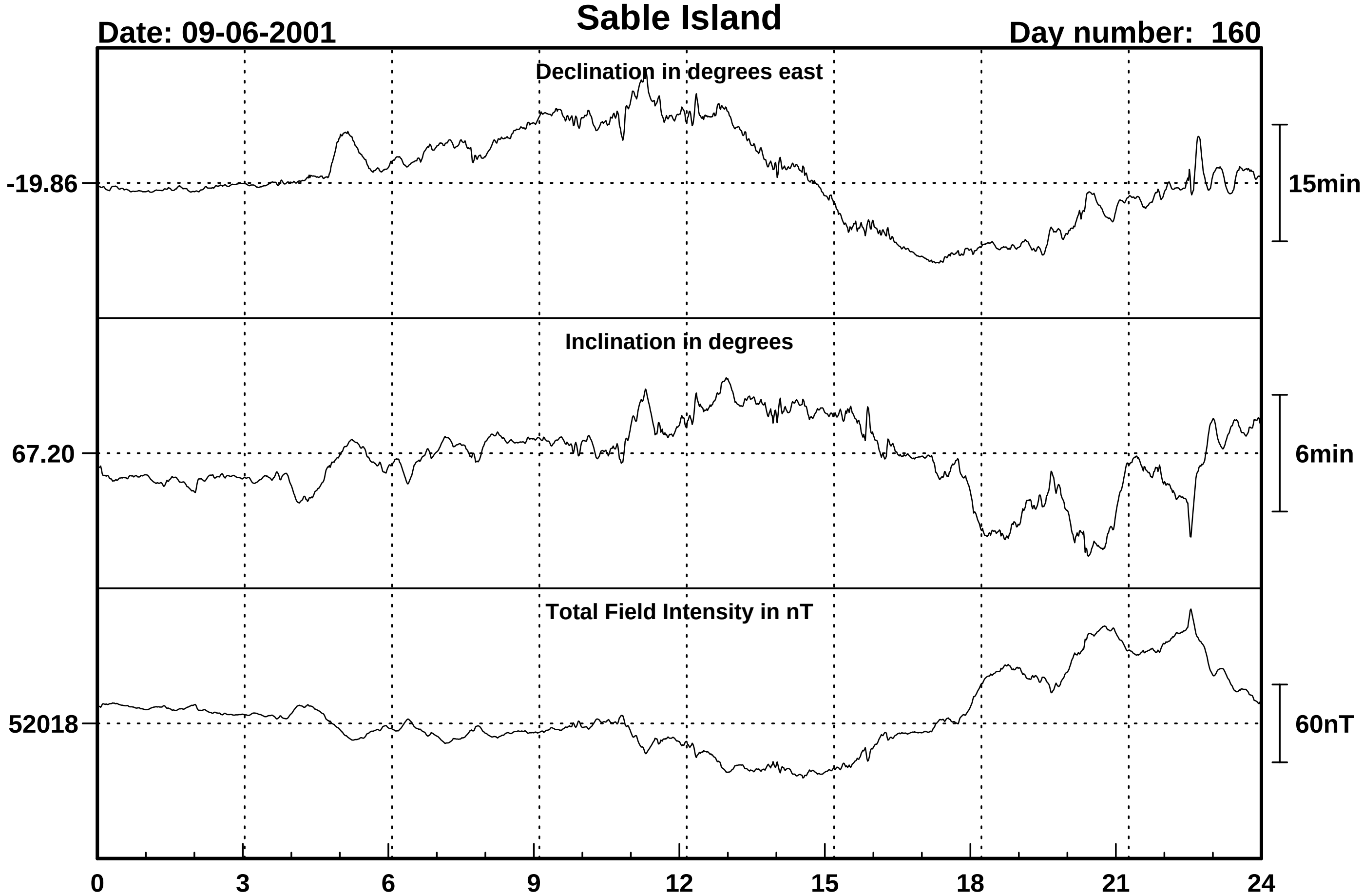

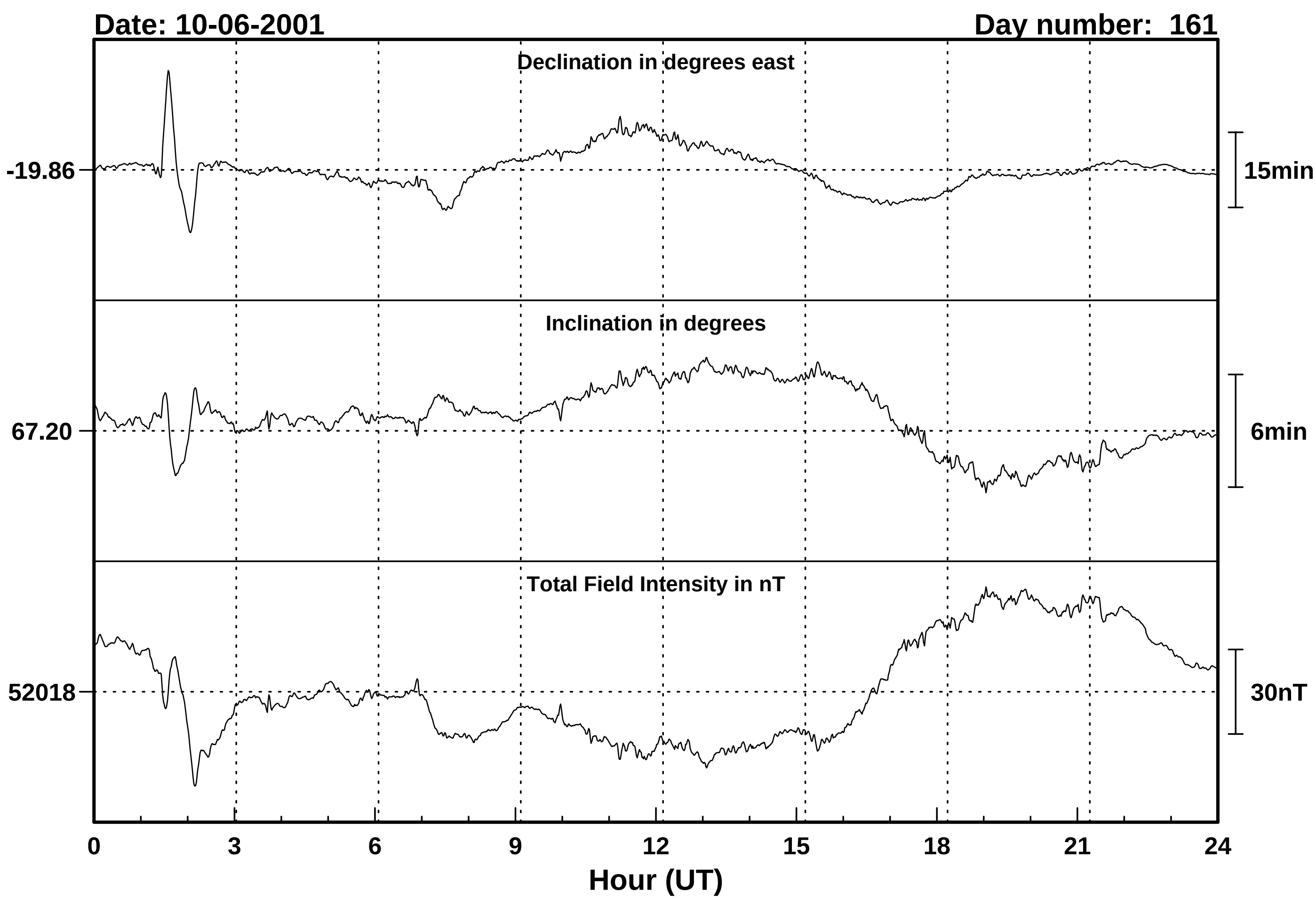

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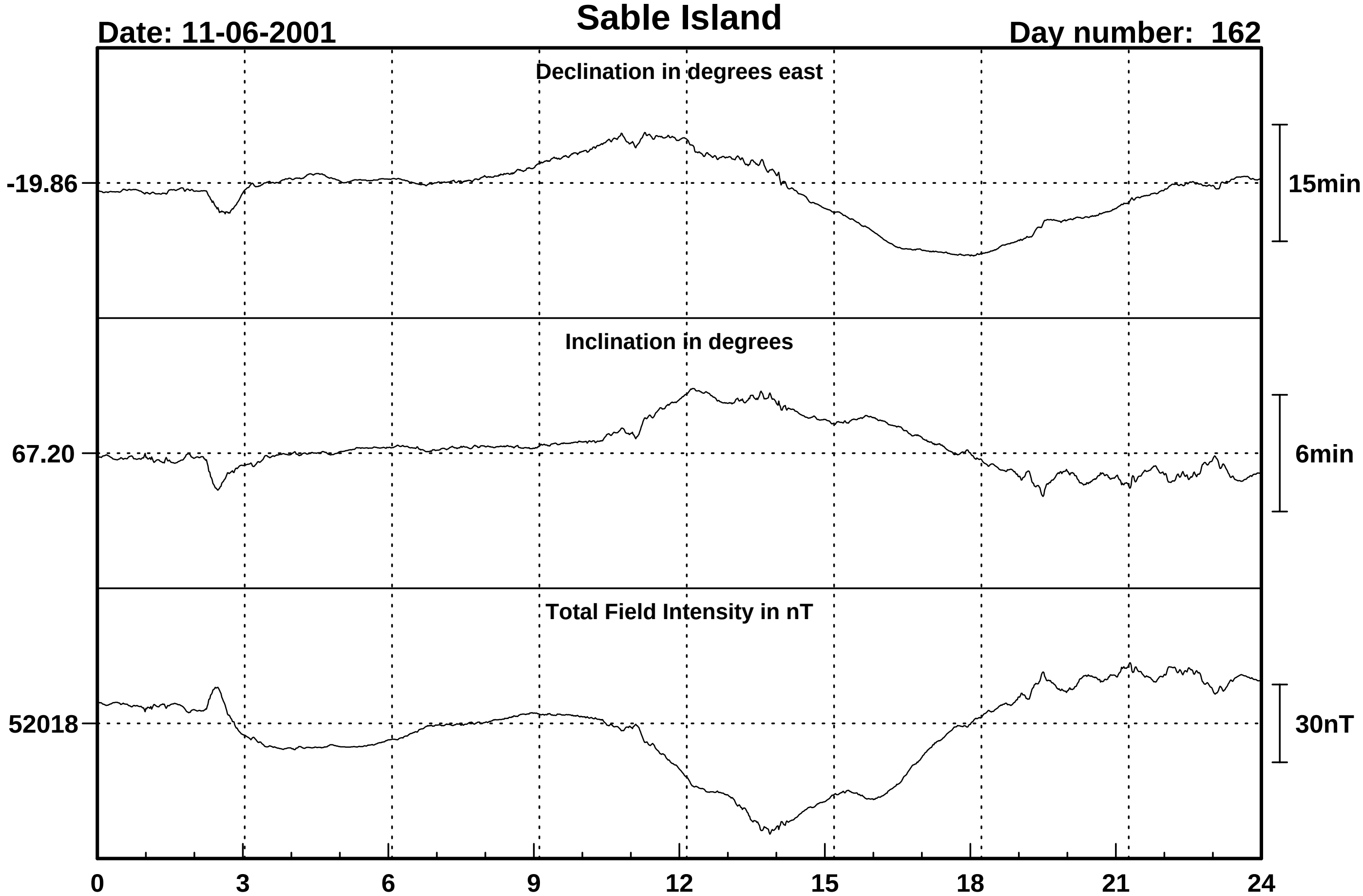

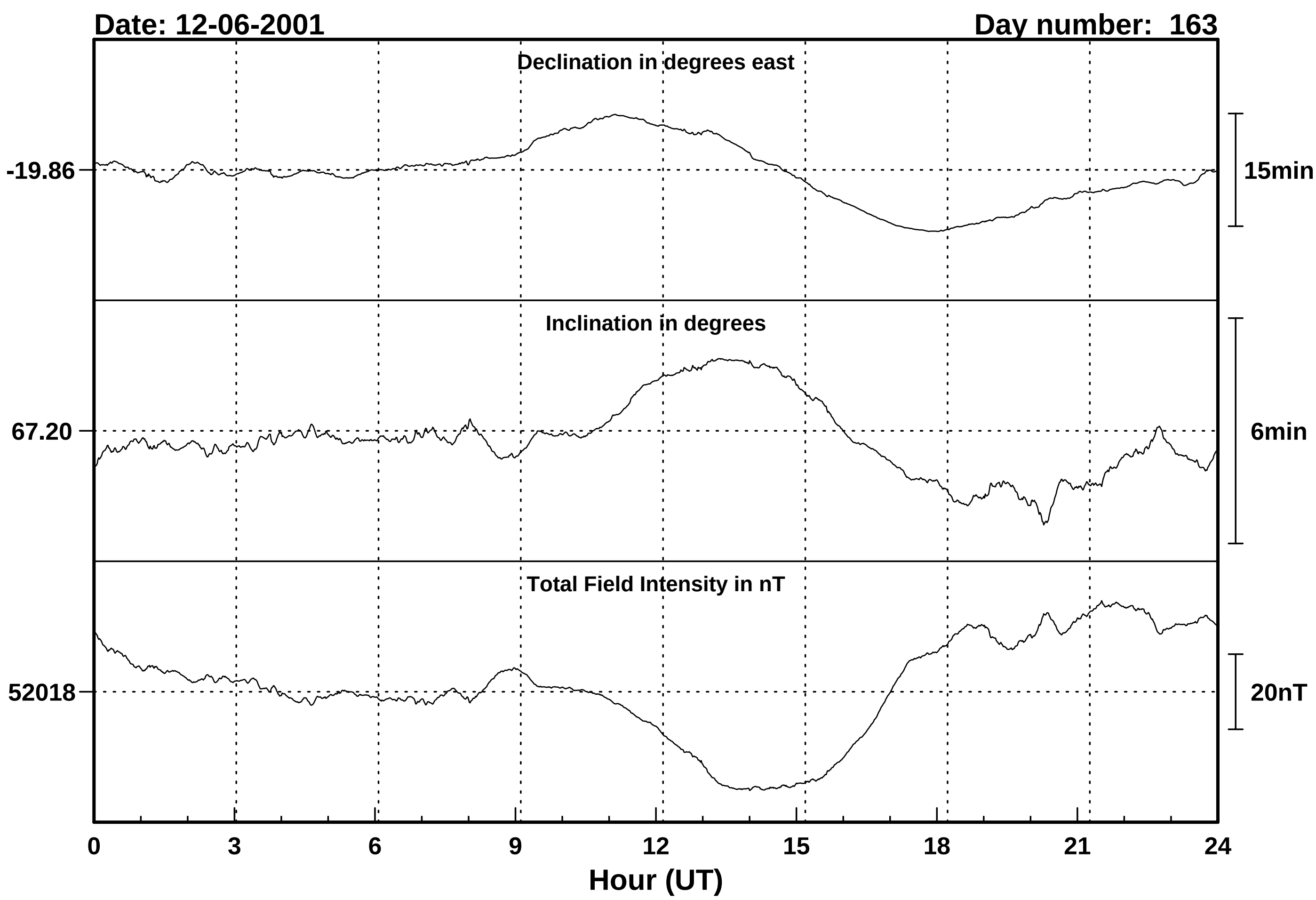

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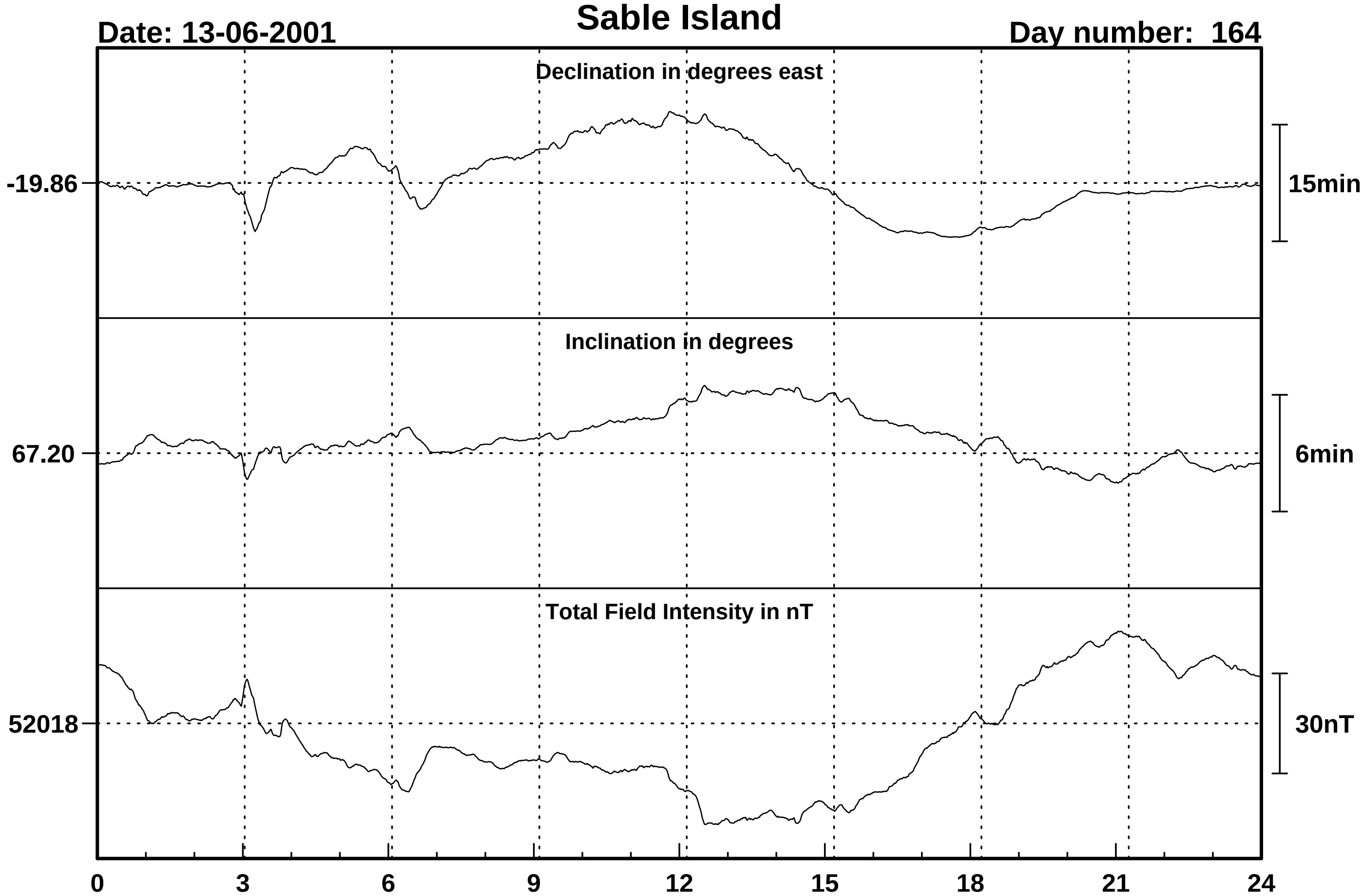

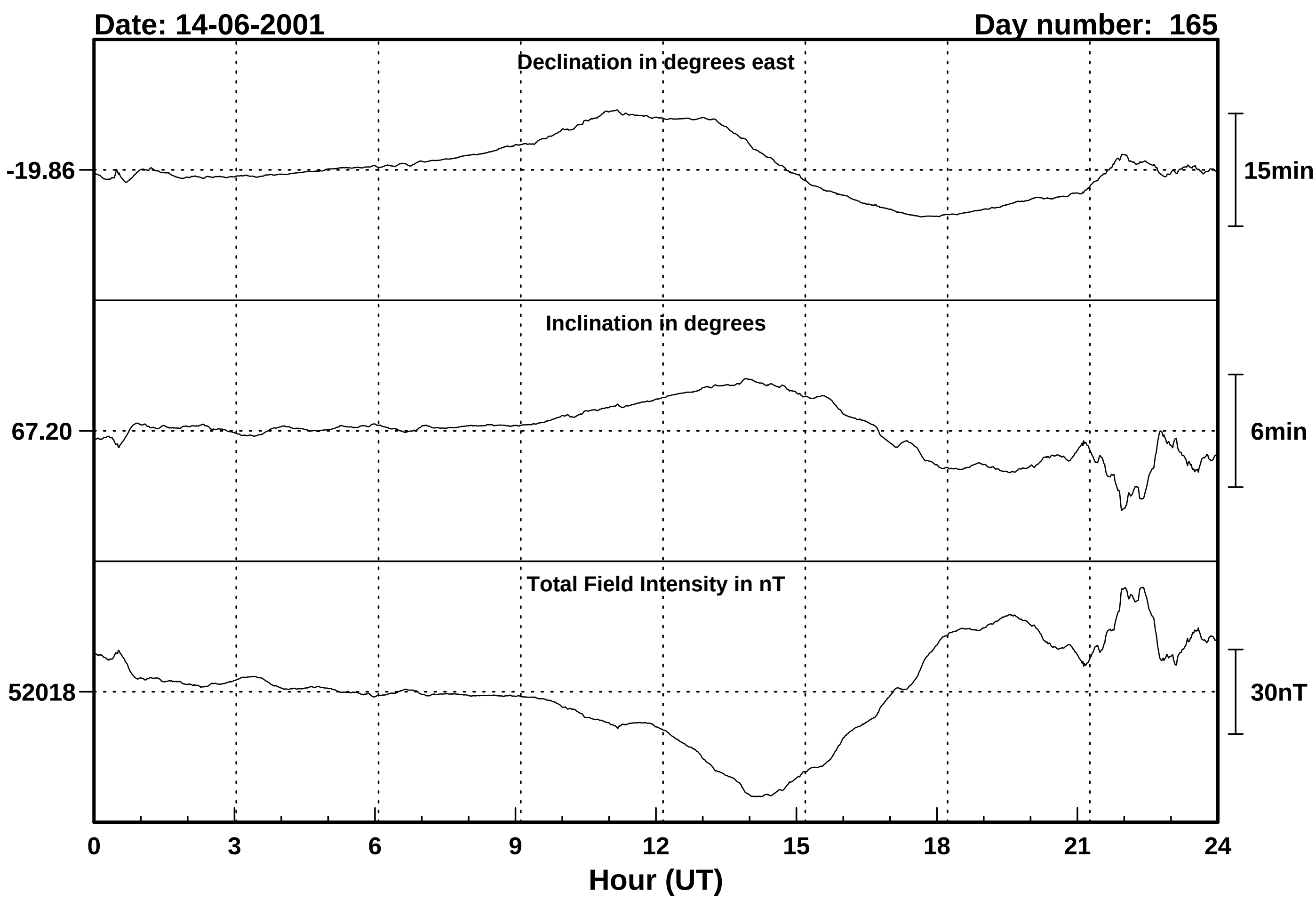

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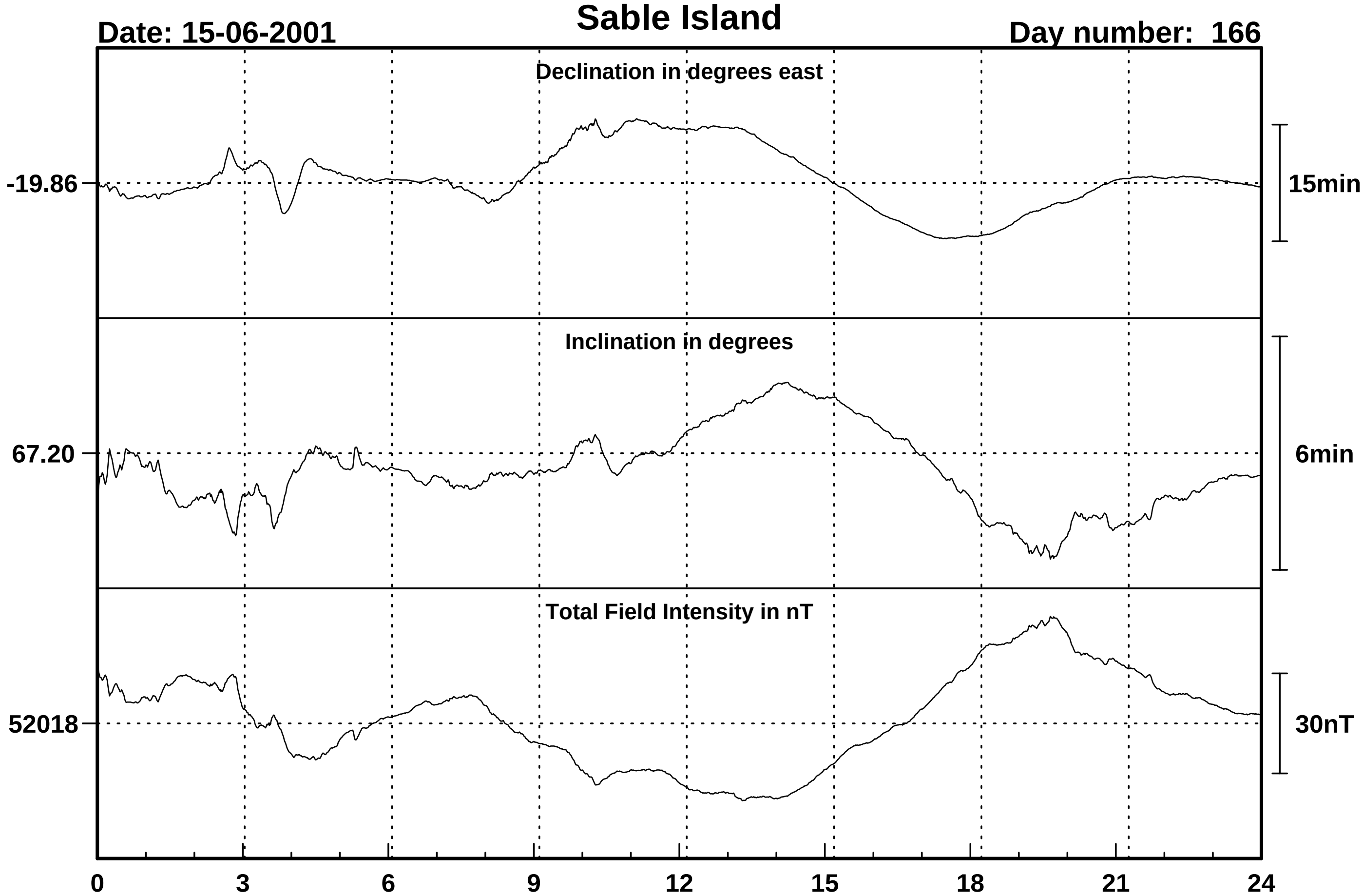

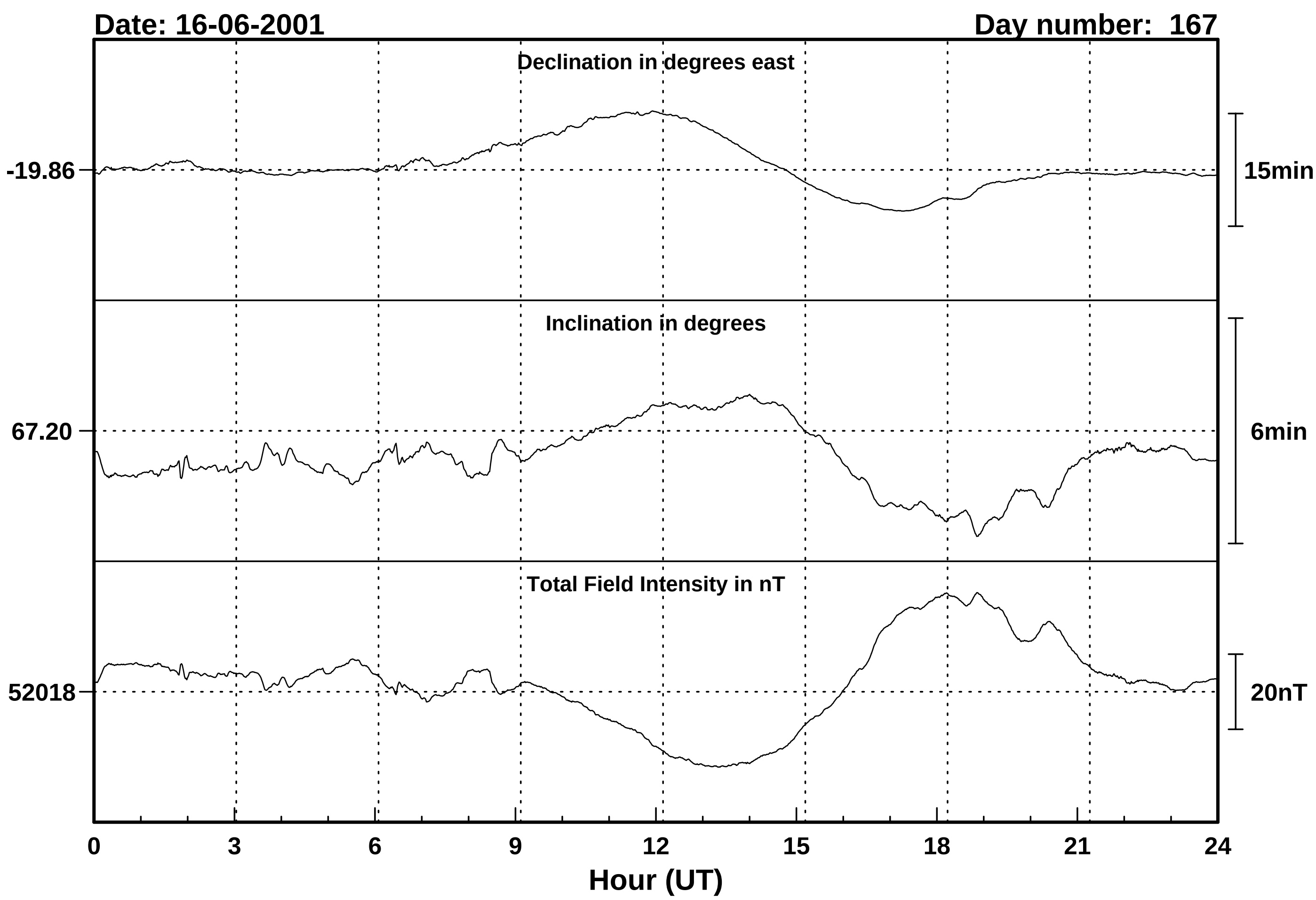

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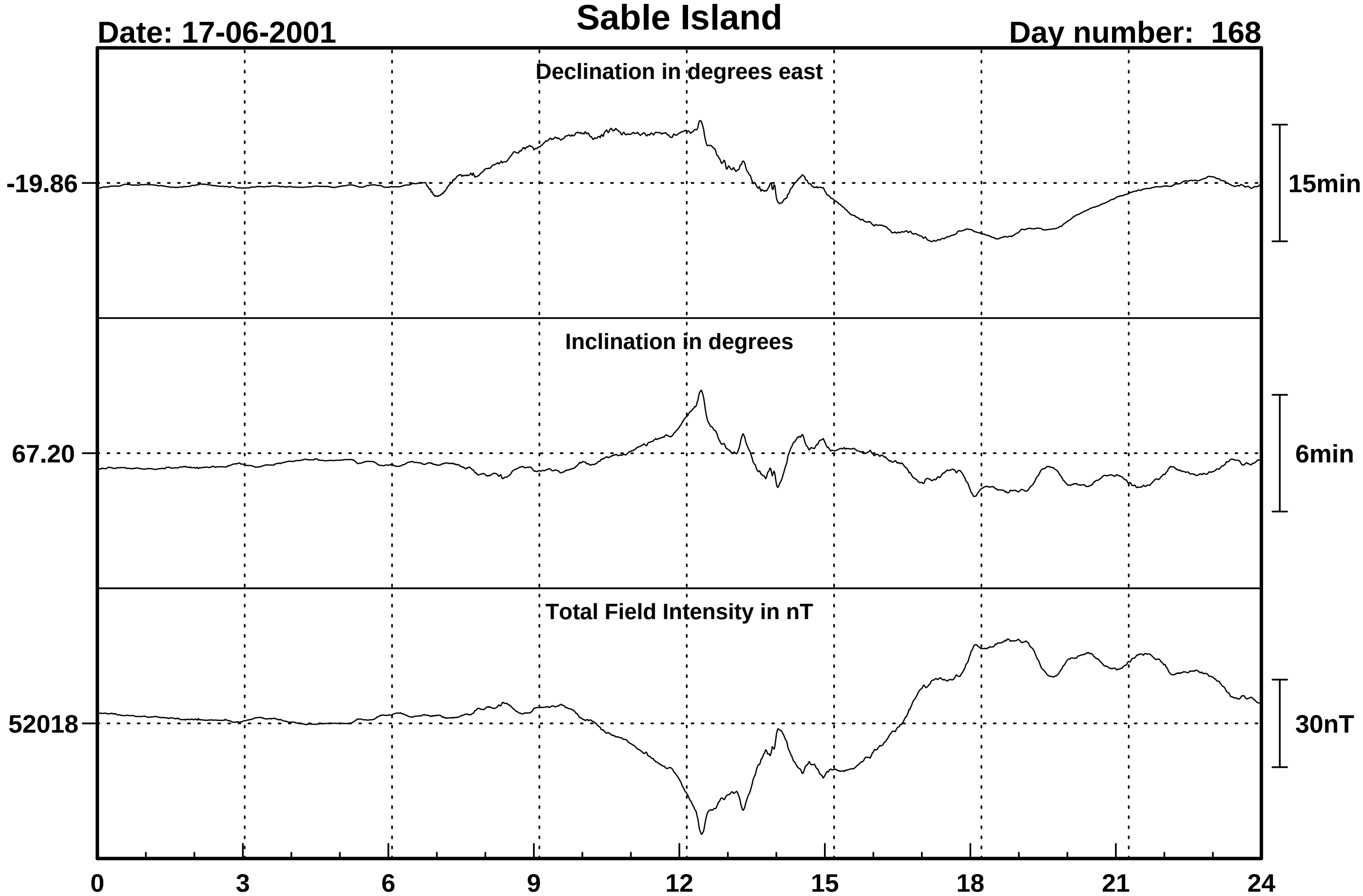

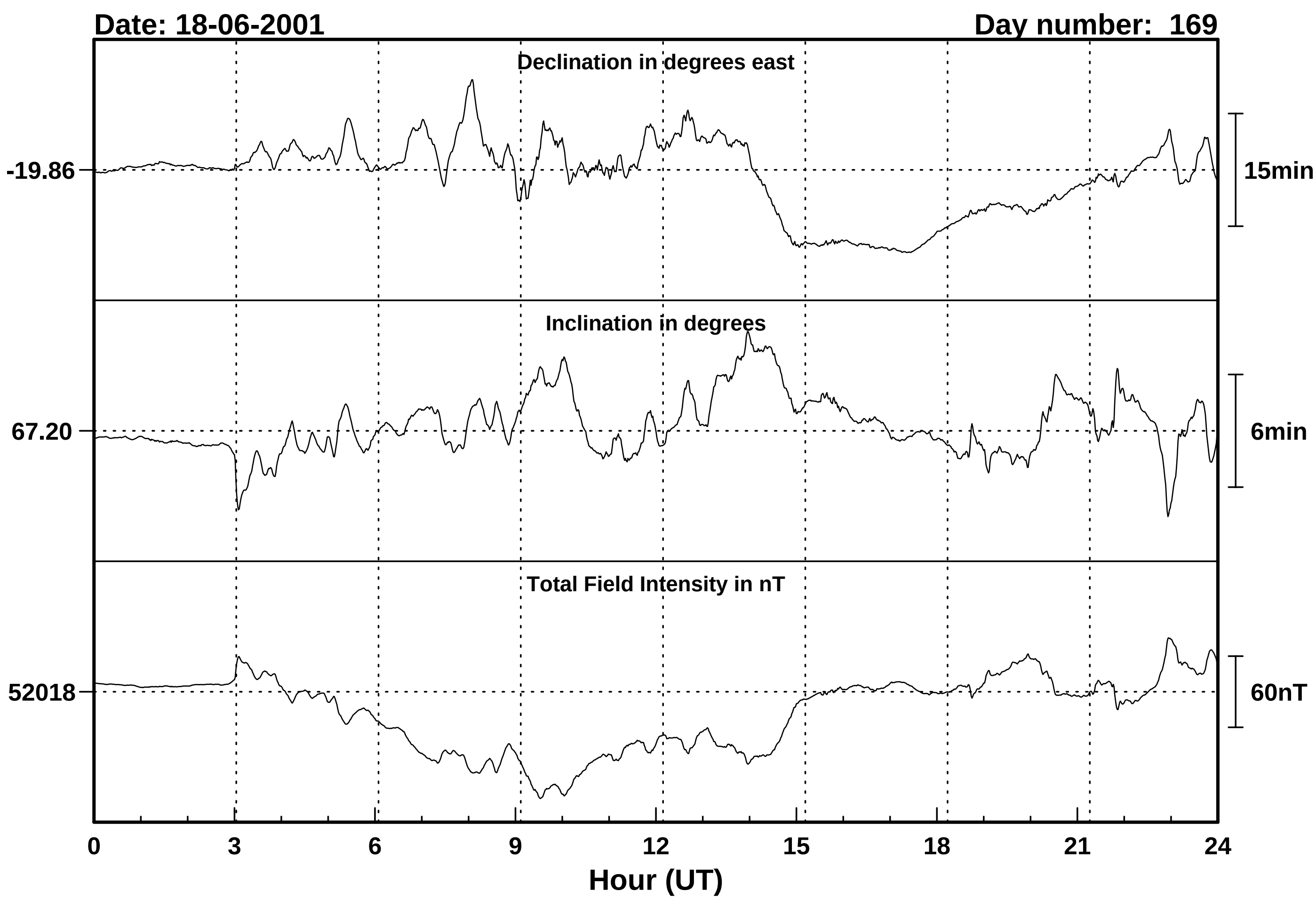

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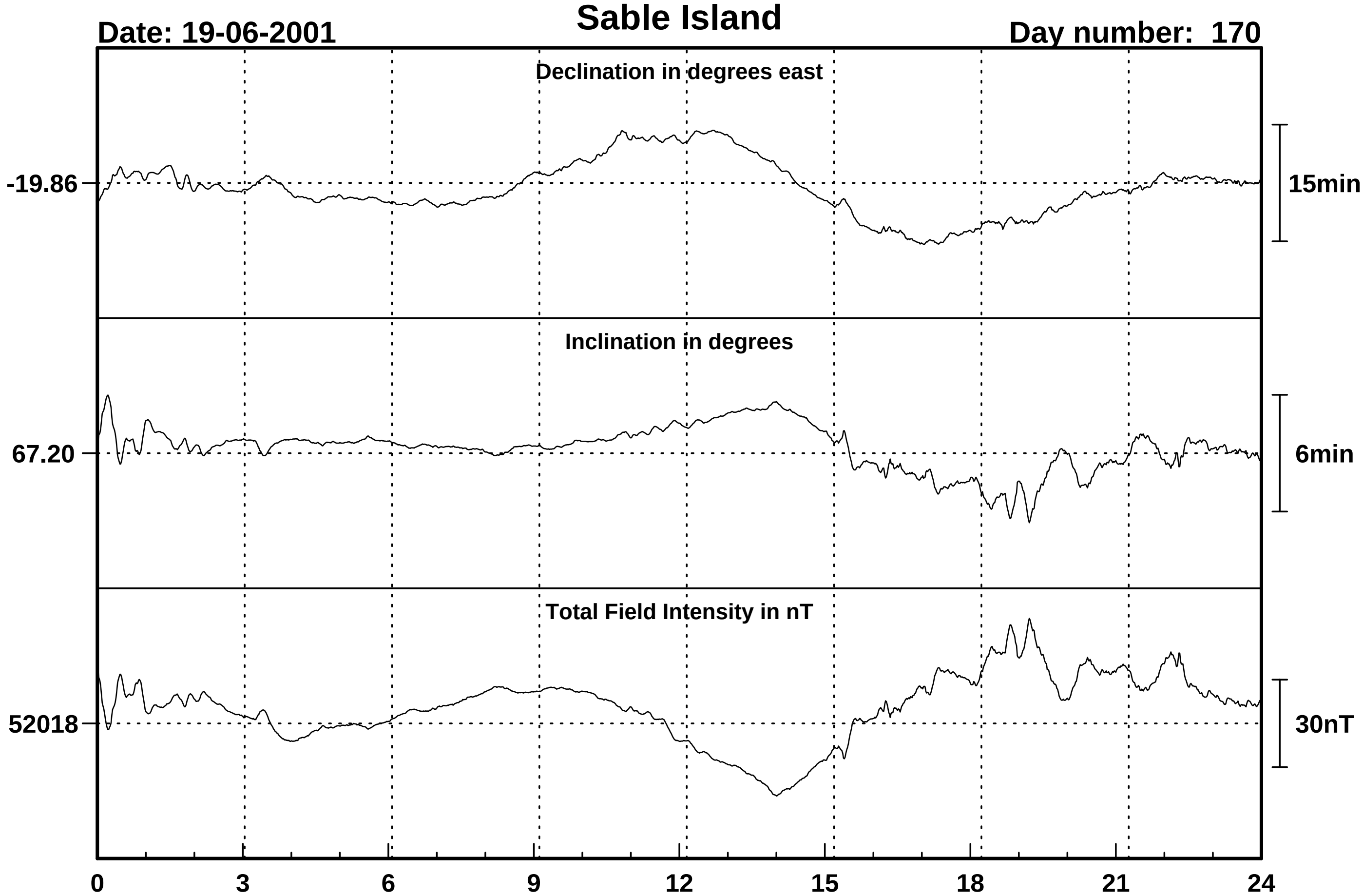

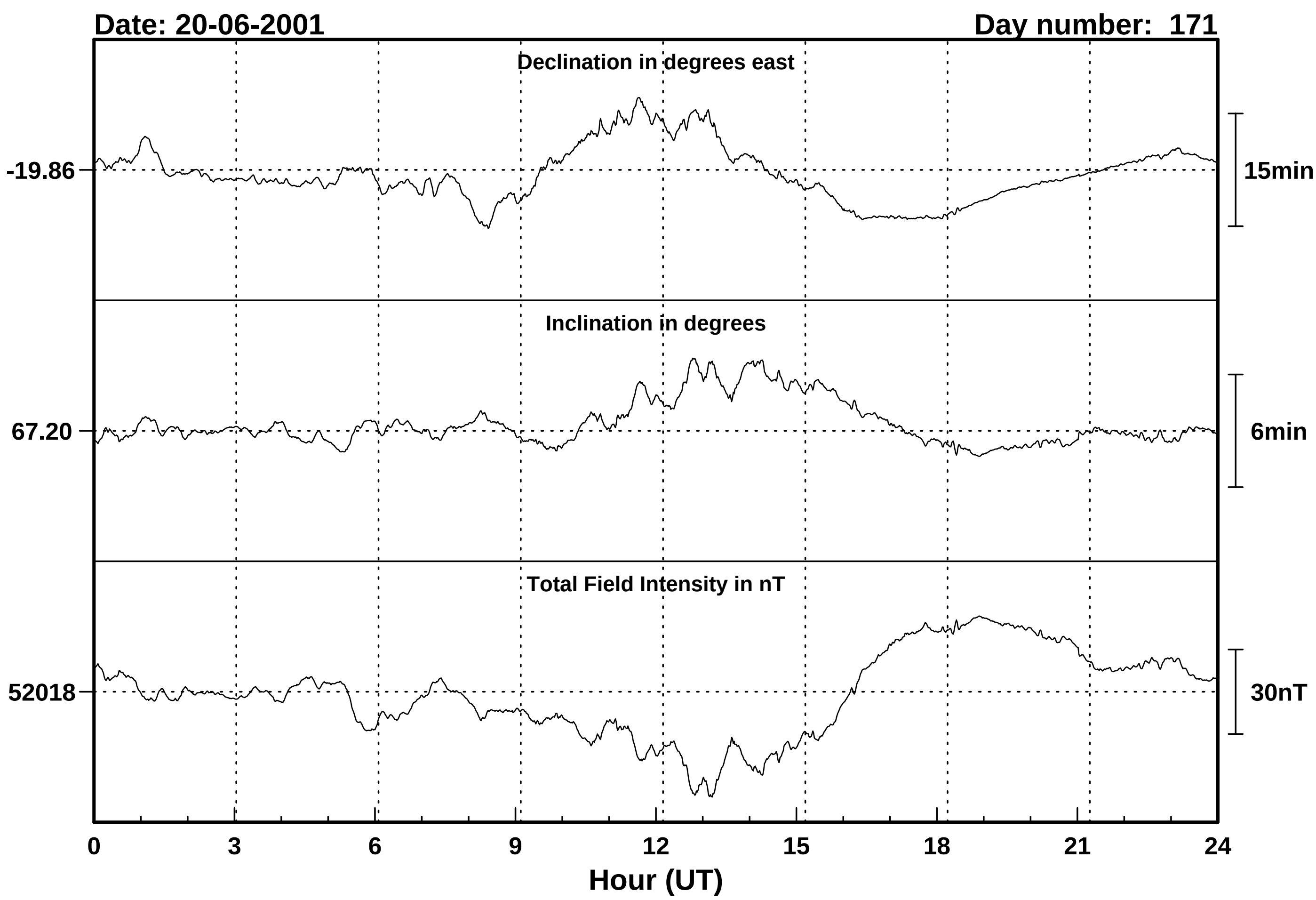

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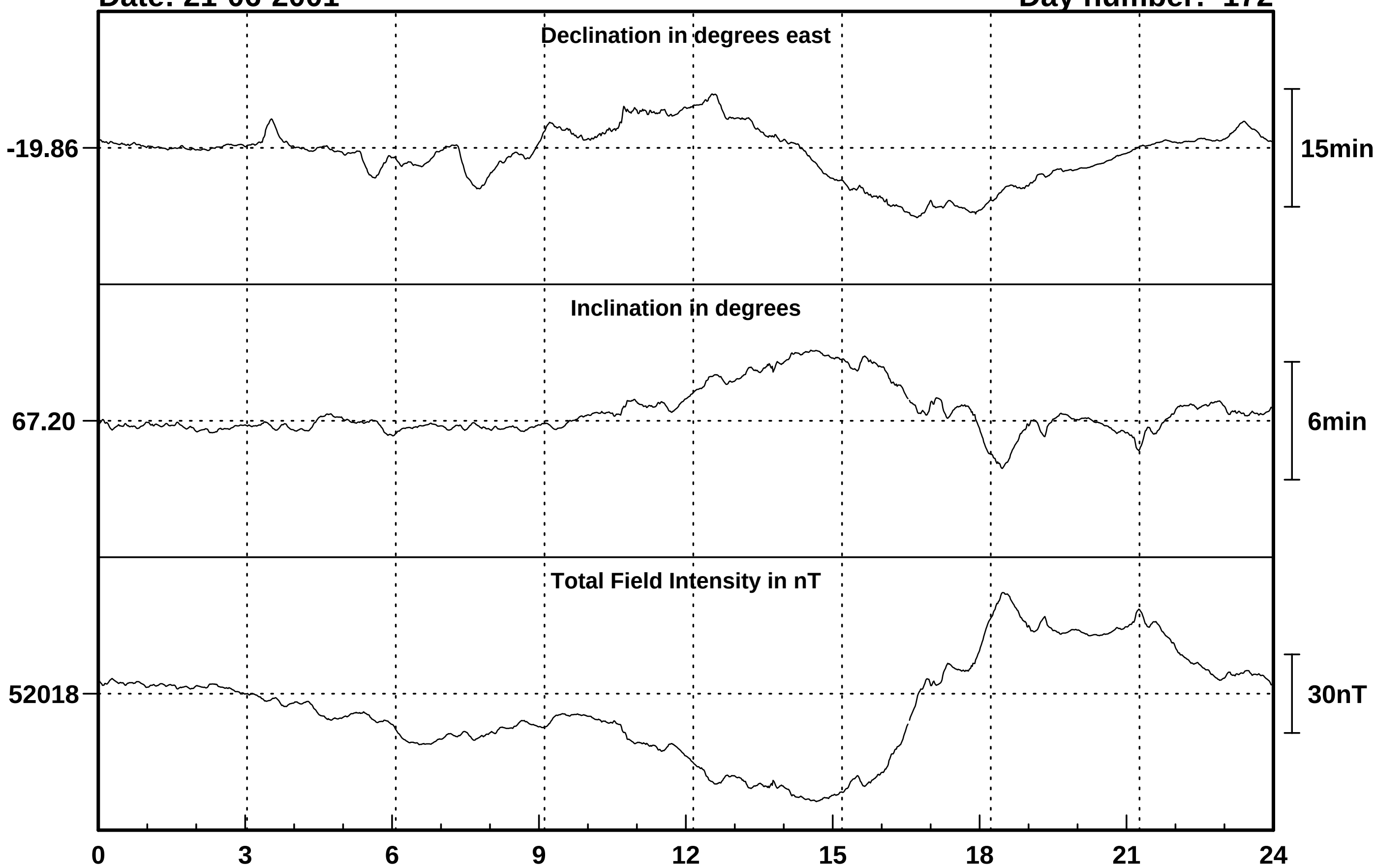

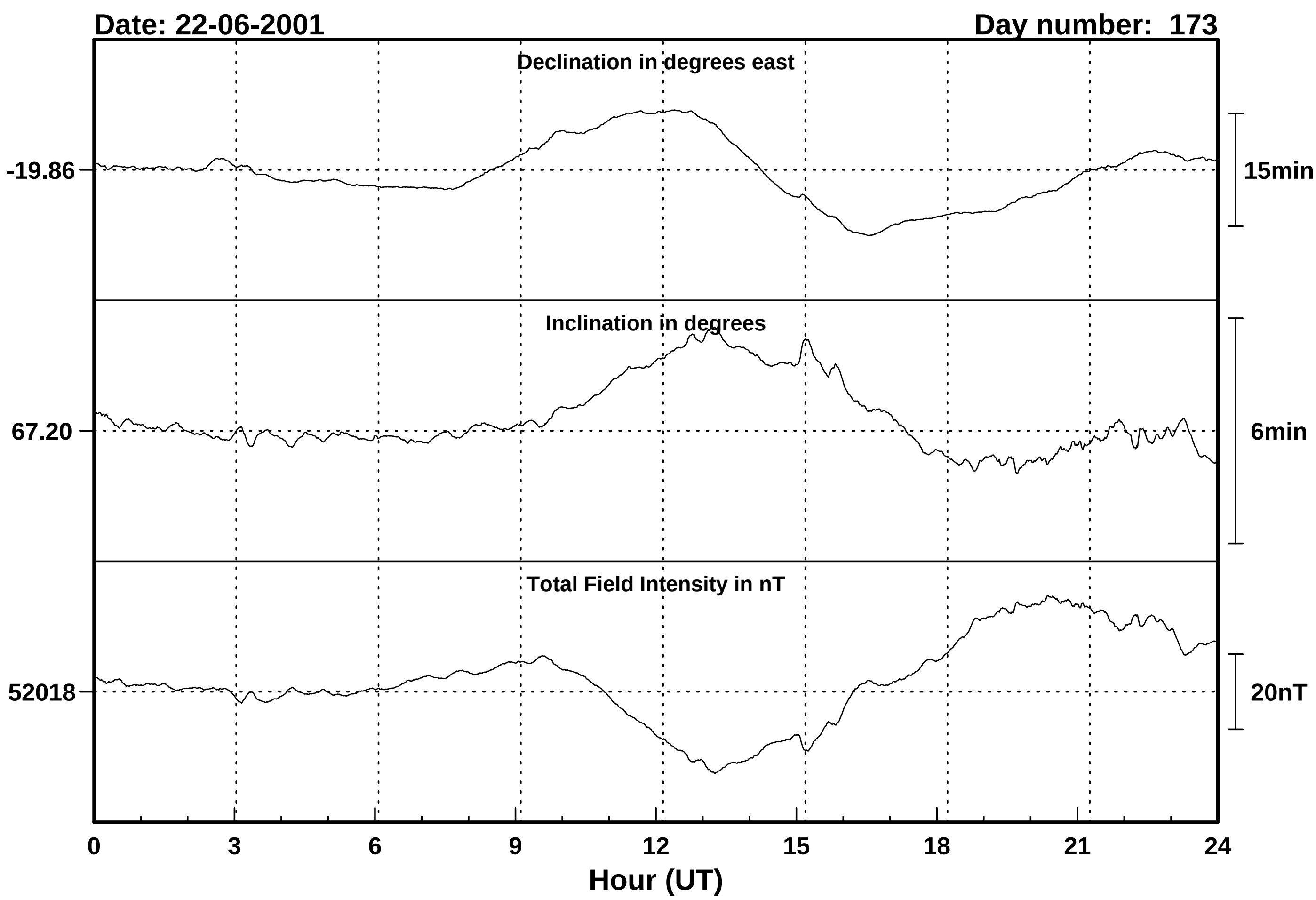

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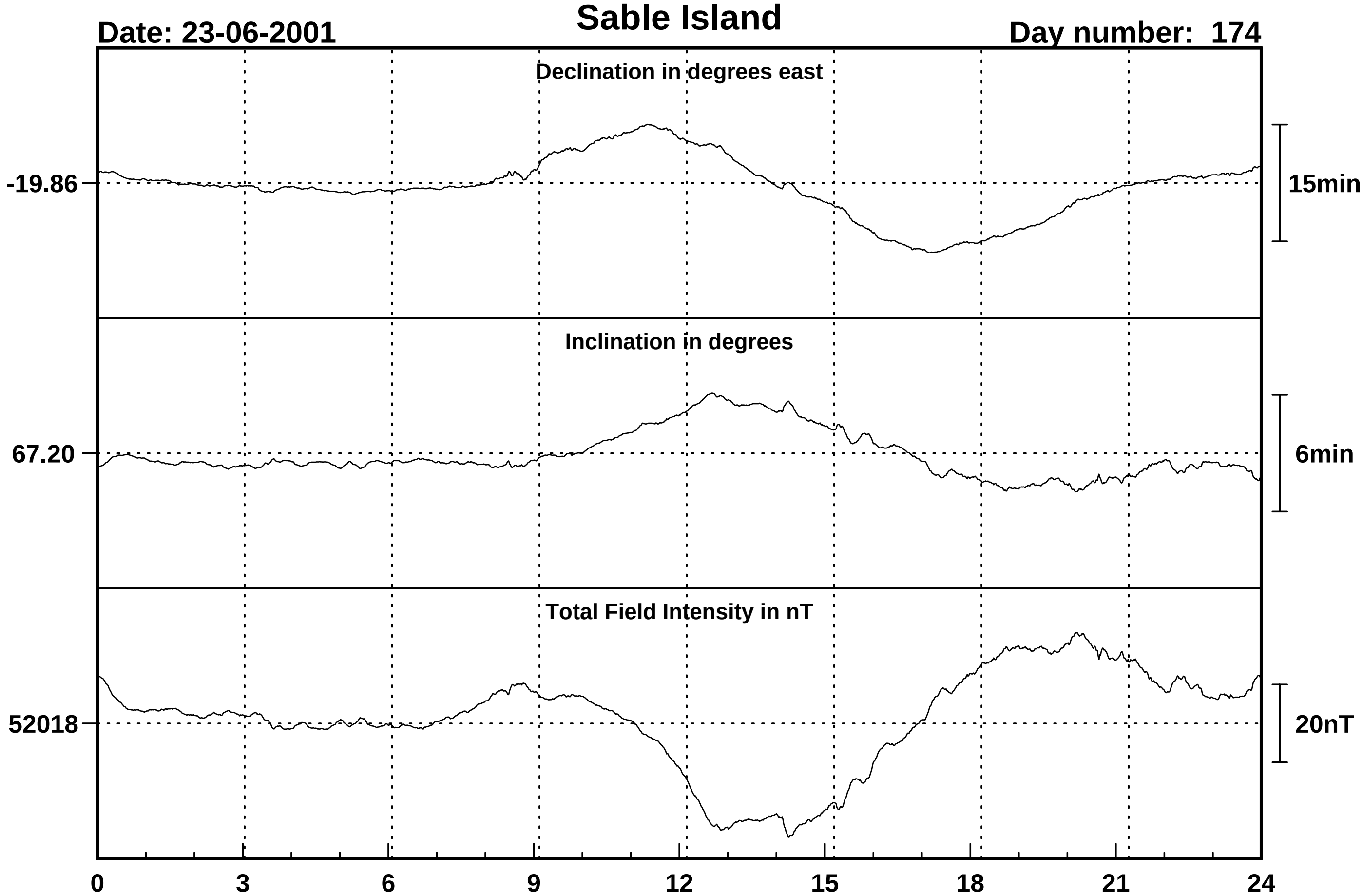

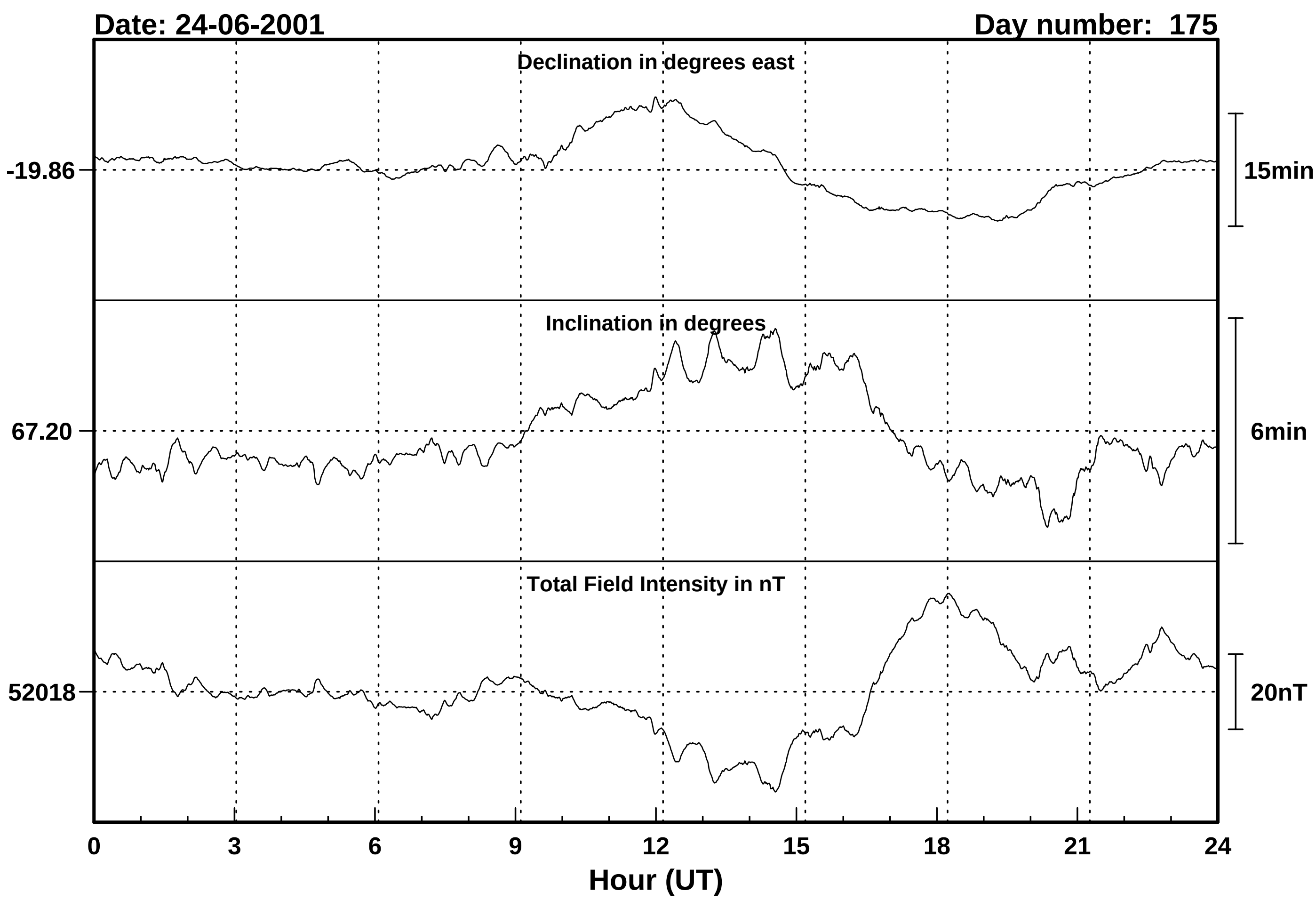

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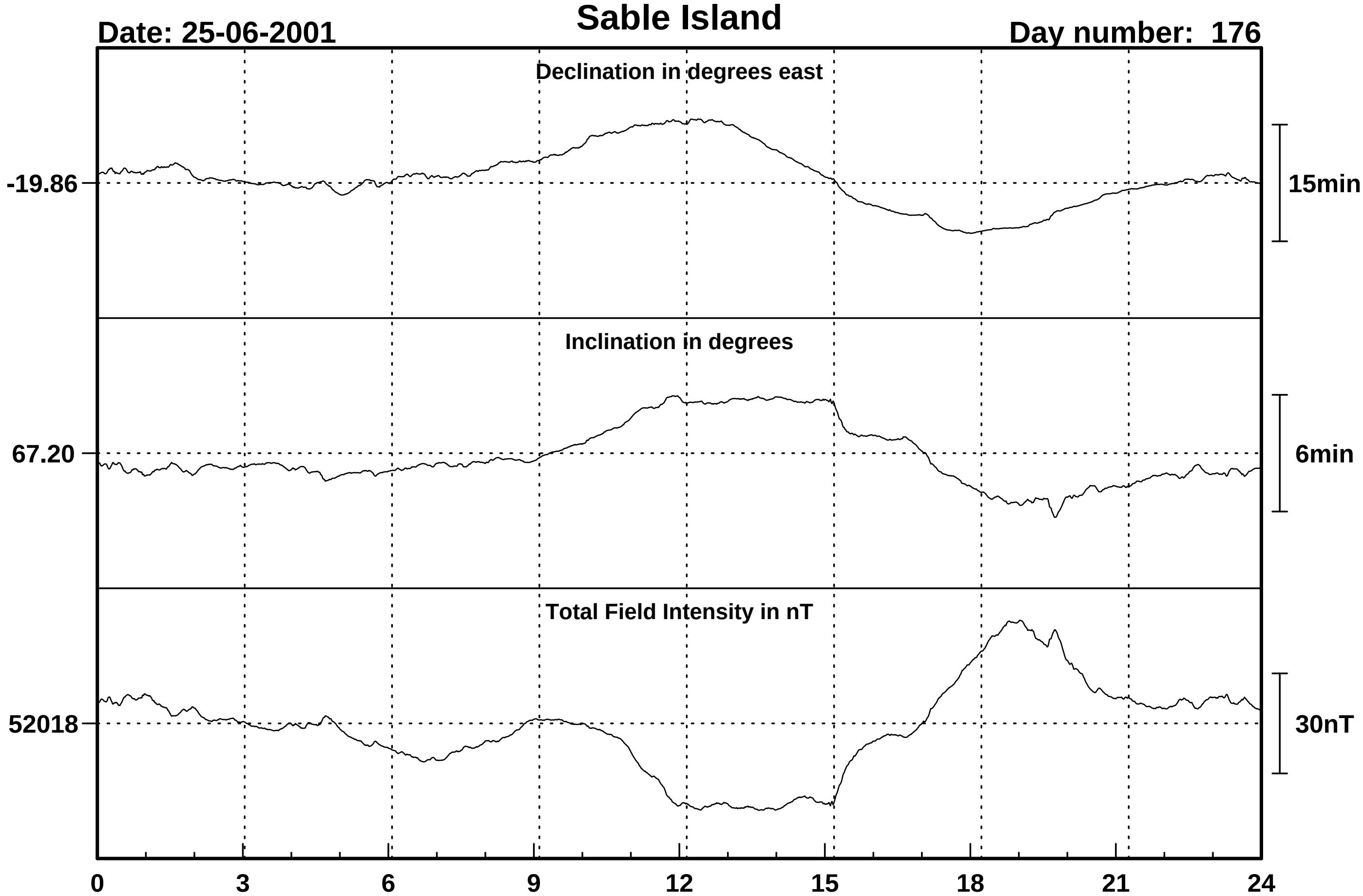
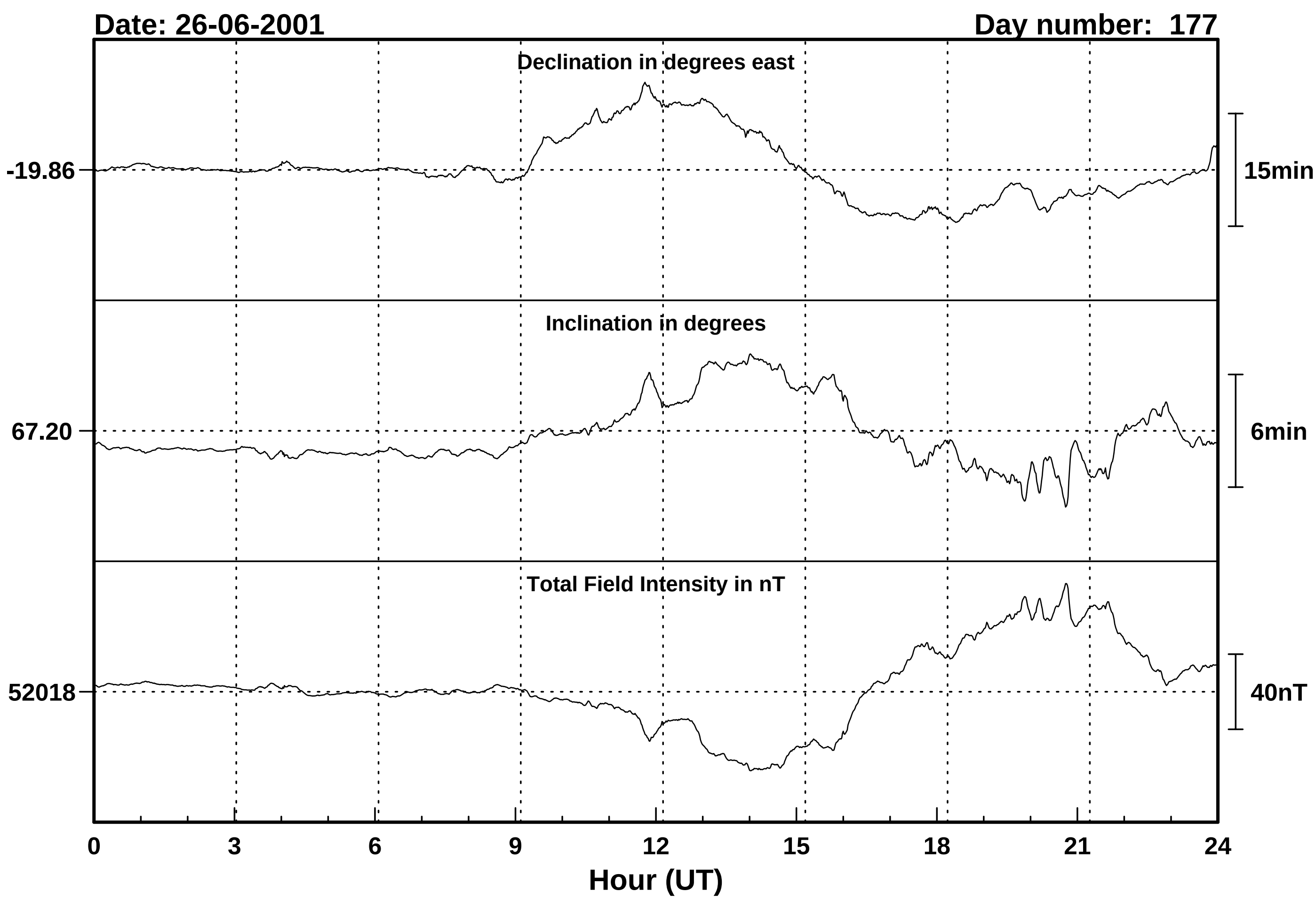
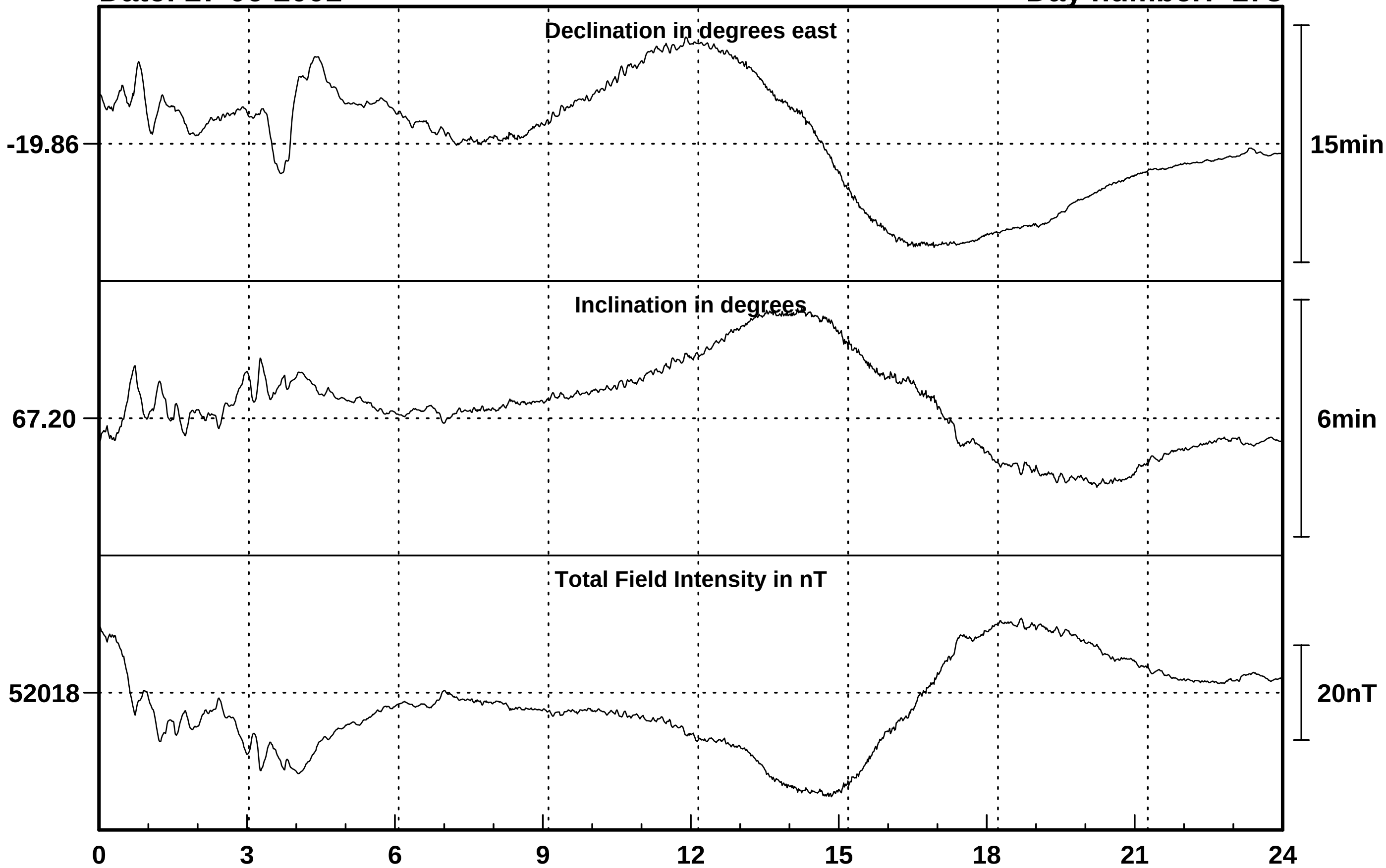




Sable Island

Date: 27-06-2001 Day number: 178



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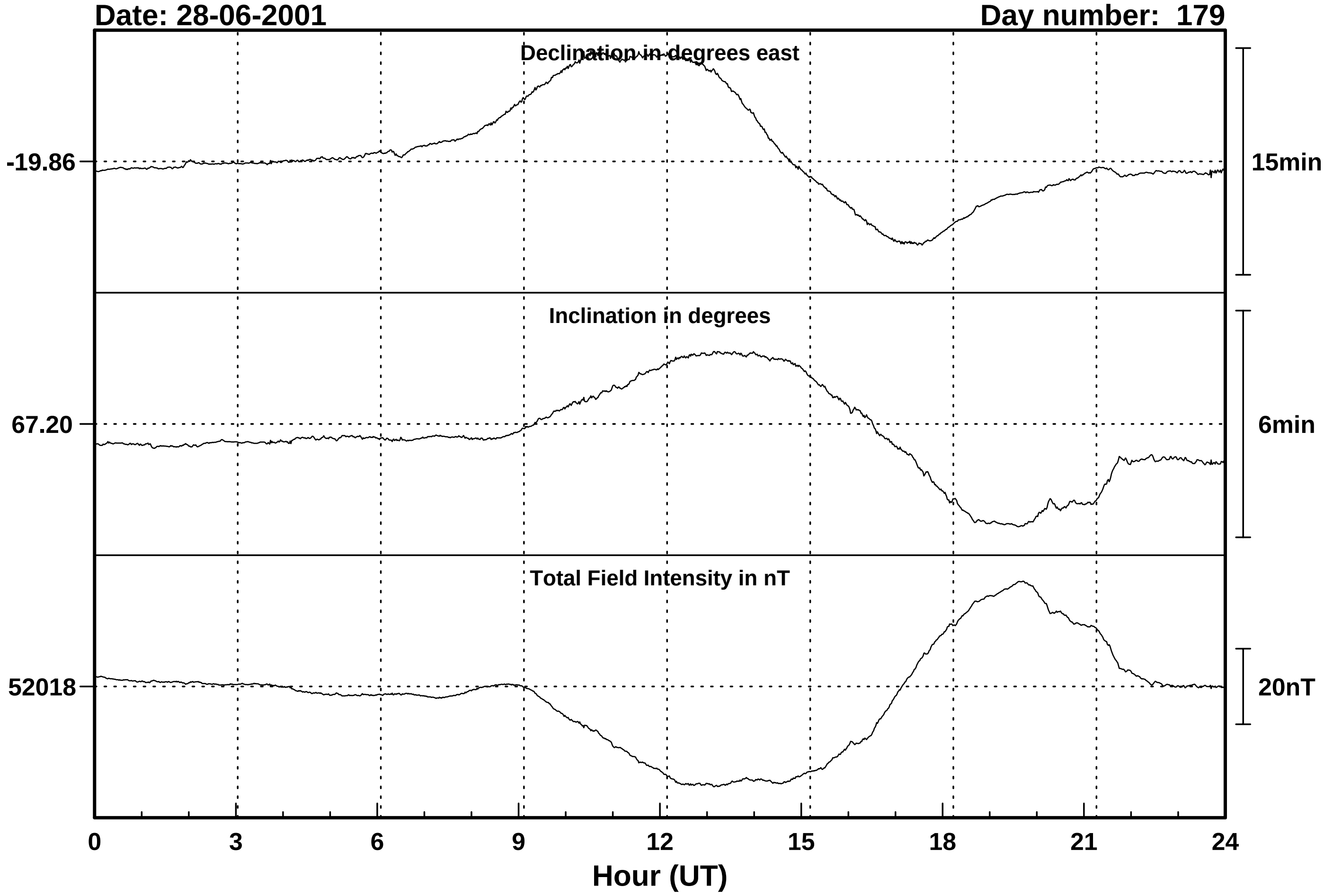

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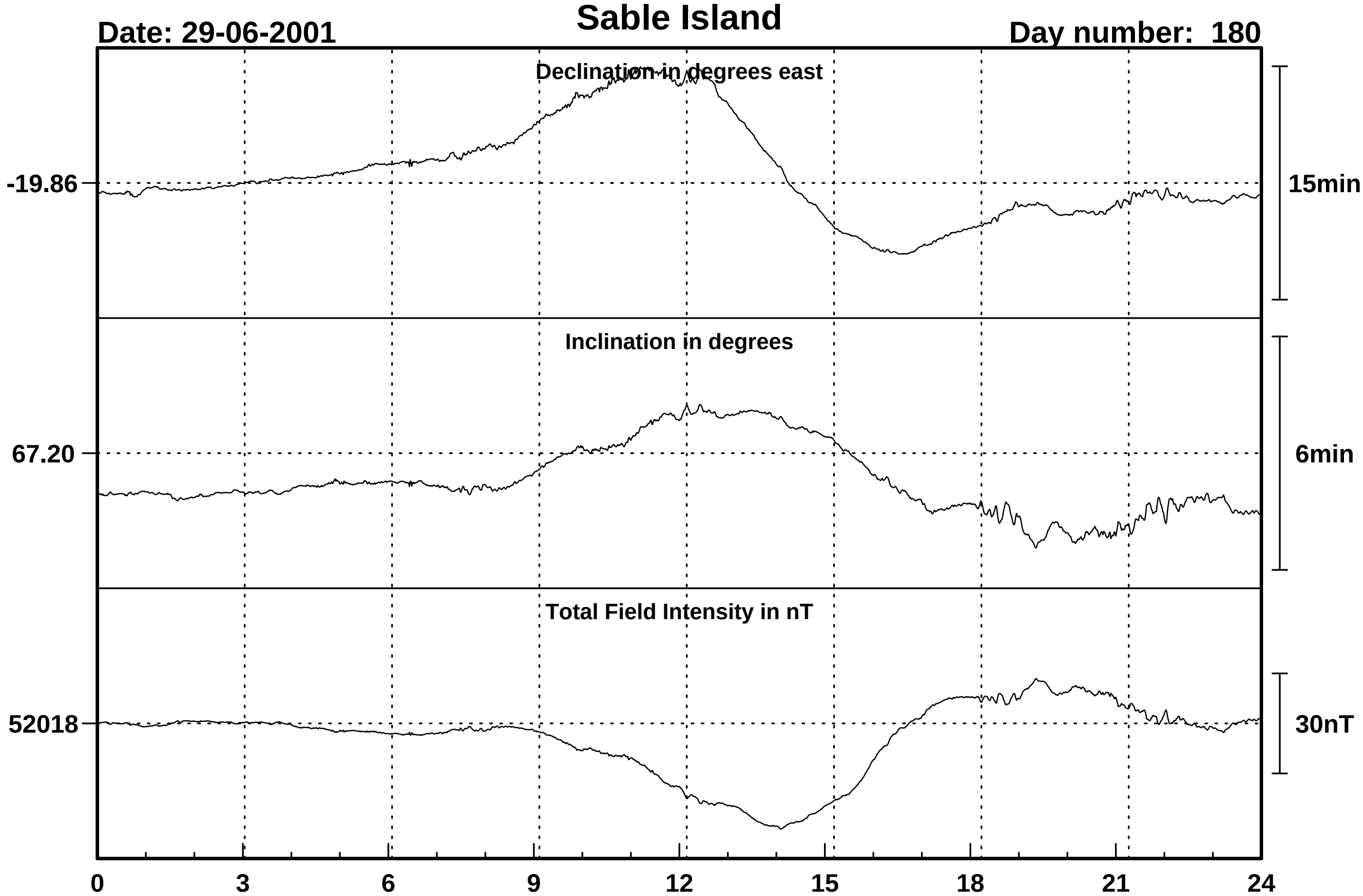
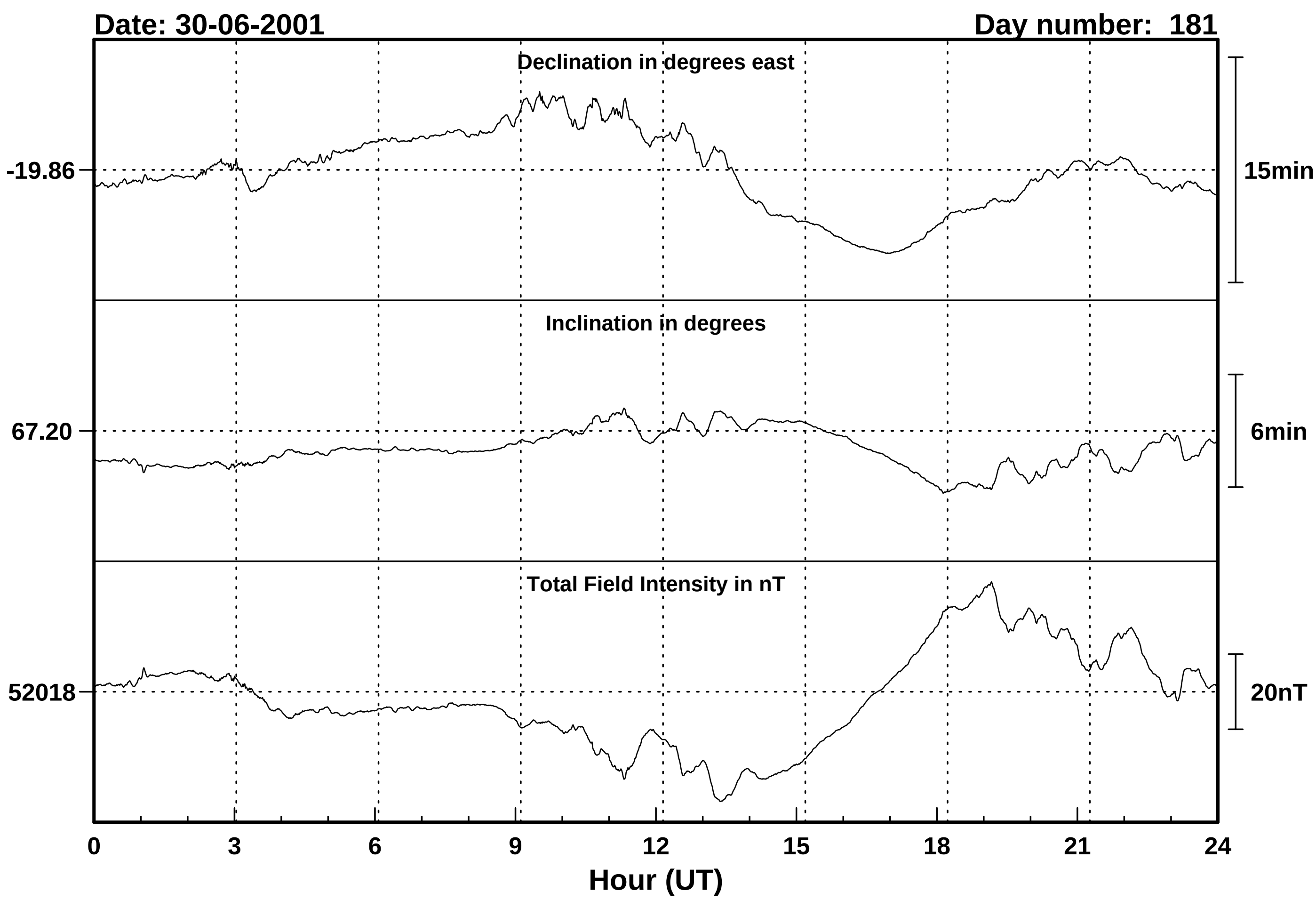
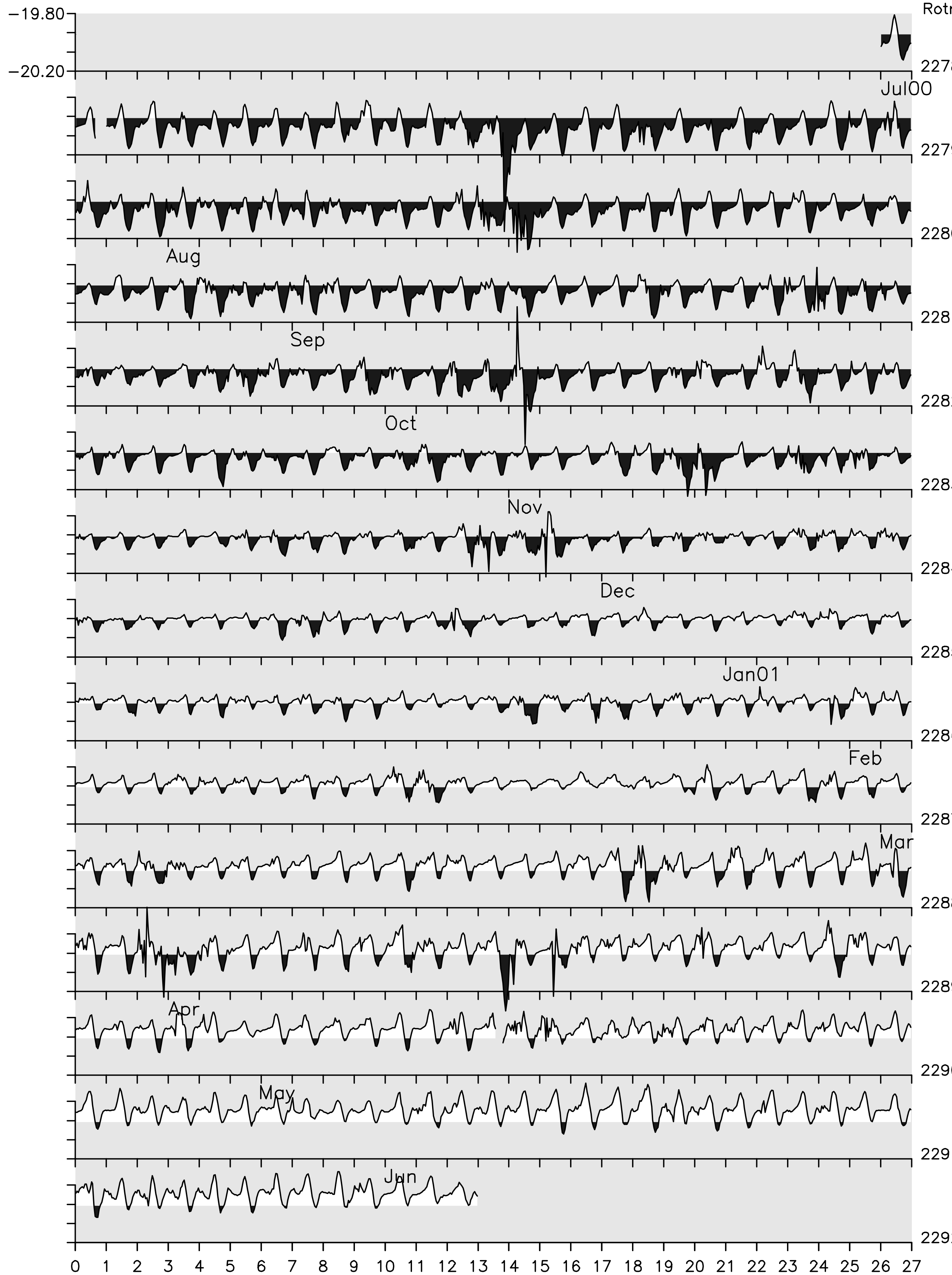


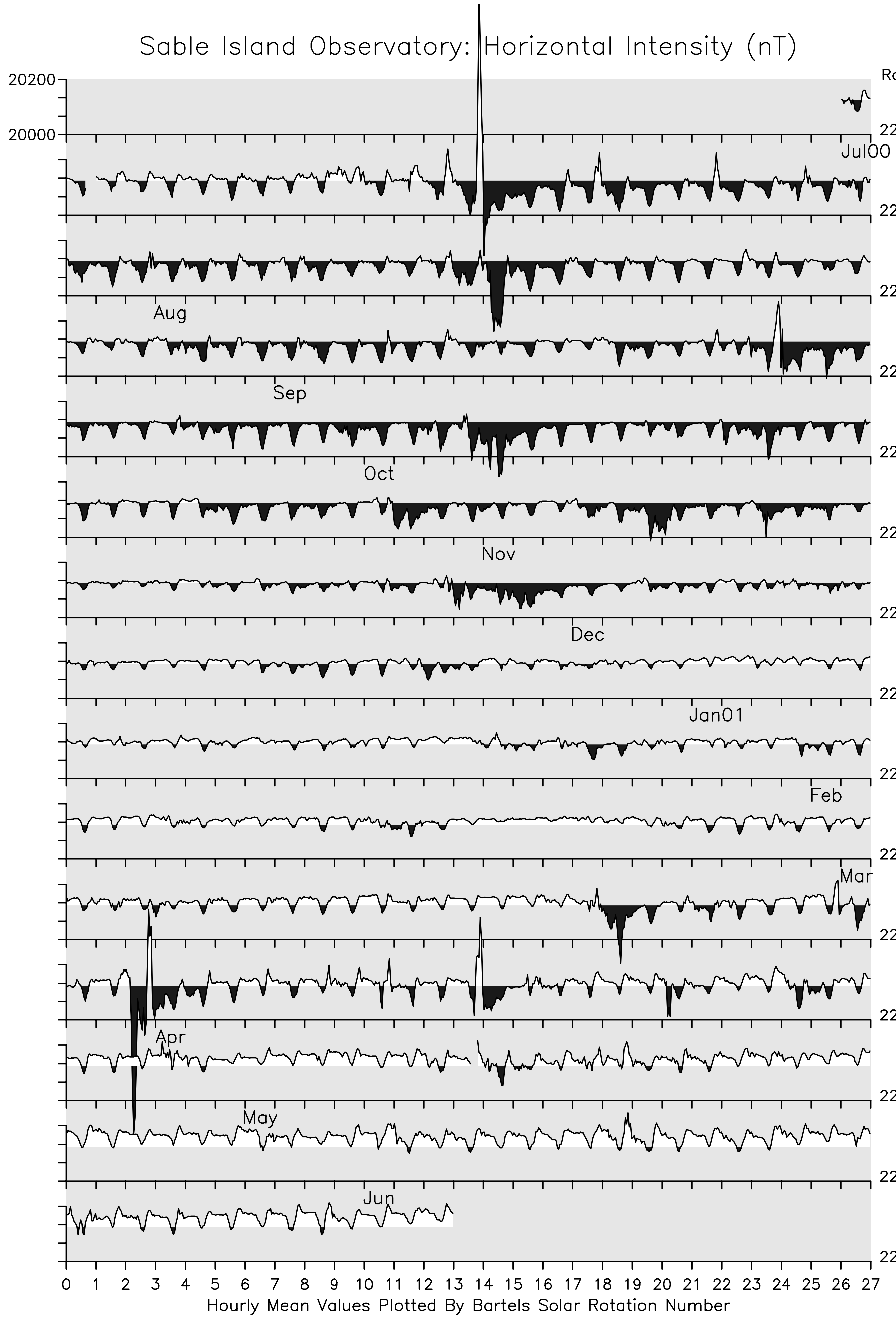


Sable Island Observatory: Declination (degrees)

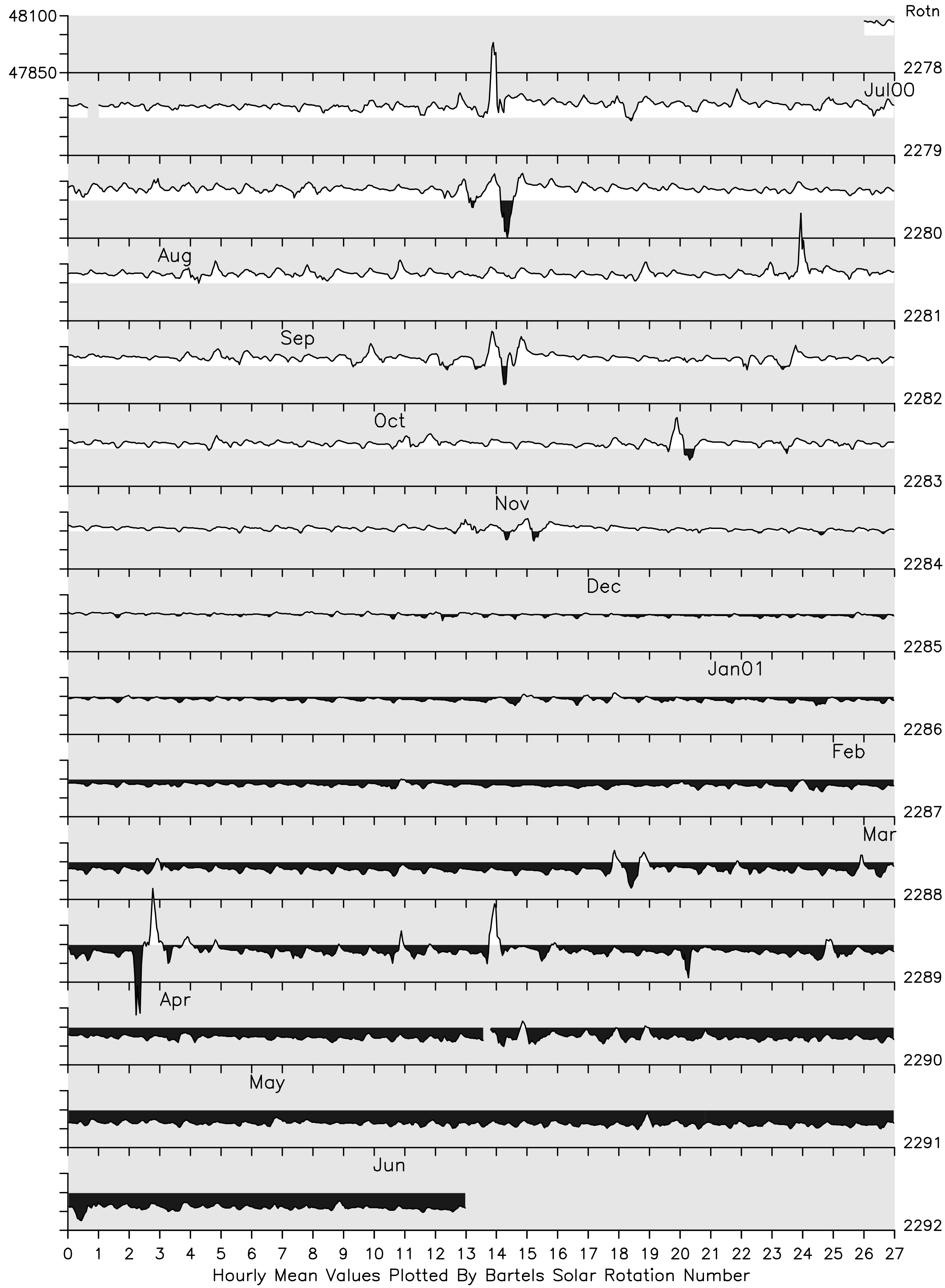


Hourly Mean Values Plotted By Bartels Solar Rotation Number

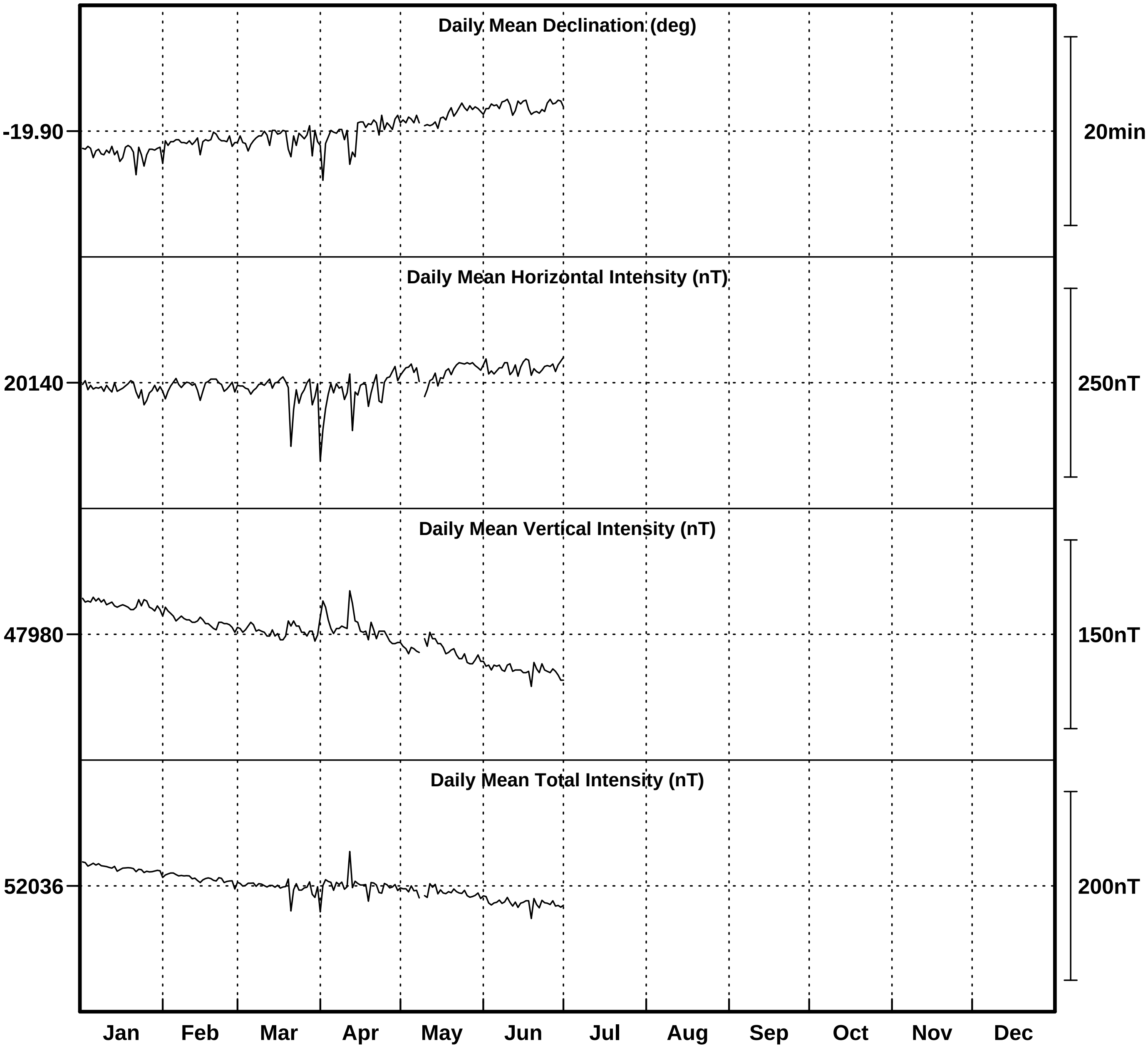
Sable Island Observatory: Horizontal Intensity (nT)



Sable Island Observatory: Vertical Intensity (nT)



Sable Island Daily Mean Values 2001



Monthly Mean Values for Sable Island Observatory 2001

Month	*D*	*H*	*I*	*X*	*Y*	*Z*	*F*	Data
January	-19° 56.3´	20132 nT	67° 14.9´	18925 nT	-6865 nT	48004 nT	52055 nT	**P**
February	-19° 55.0´	20136 nT	67° 14.3´	18932 nT	-6860 nT	47991 nT	52044 nT	**P**
March	-19° 54.8´	20128 nT	67° 14.6´	18924 nT	-6855 nT	47983 nT	52034 nT	**P**
April	-19° 54.1´	20131 nT	67° 14.5´	18929 nT	-6853 nT	47986 nT	52037 nT	**P**
May	-19° 52.4´	20155 nT	67° 12.5´	18955 nT	-6852 nT	47968 nT	52030 nT	**P**
June	-19° 51.3´	20161 nT	67° 11.8´	18962 nT	-6847 nT	47952 nT	52018 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 incorporporating 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, *d* is the collimation error about the vertical axis and *e* 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 Absolute Observations were obtained			
Inclination (fuxgate theodolite)	No Absolute Observations were obtained			
Total Field Intensity (PPM)	No Absolute Observations were obtained			
Horizontal Intensity (fluxgate theodolite and PPM)	No Absolute Observations were obtained			
Vertical Intensity (fluxgate theodolite and PPM)	No Absolute Observations were obtained			

Figure 1 : Sable Island Baseline Values and F Comparisons 2001

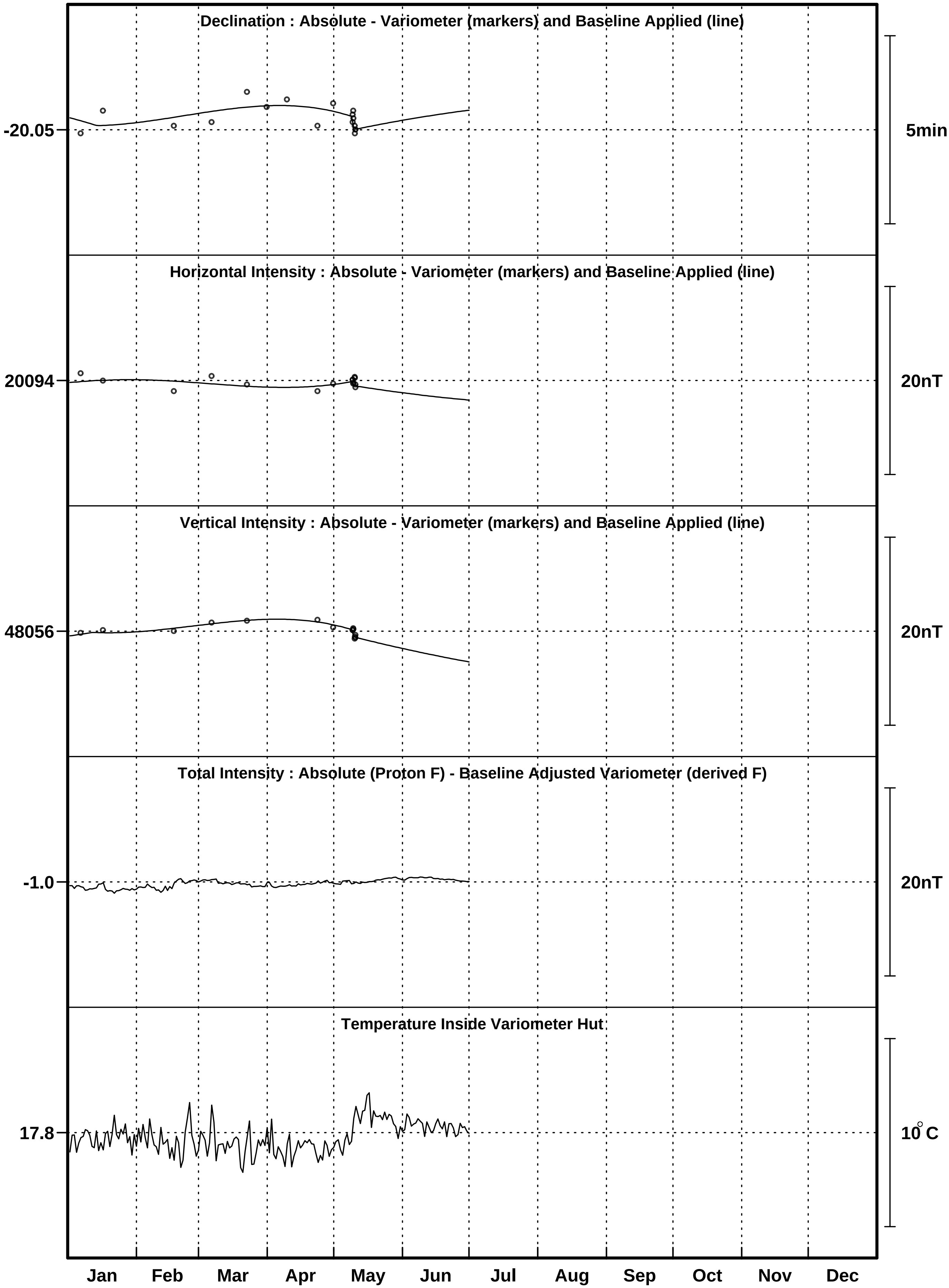


Figure 2 : Sable Island Monthly F Comparison June 2001

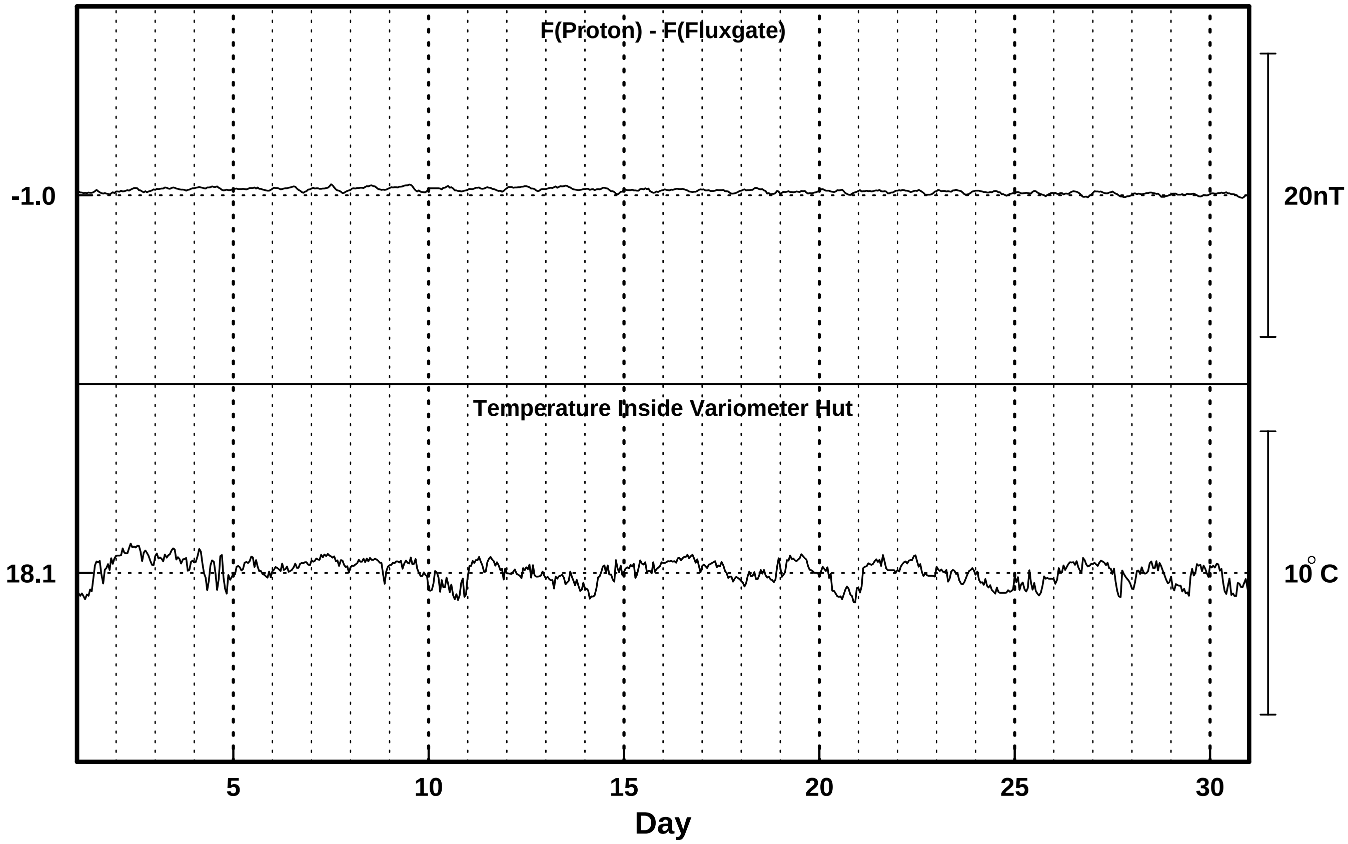
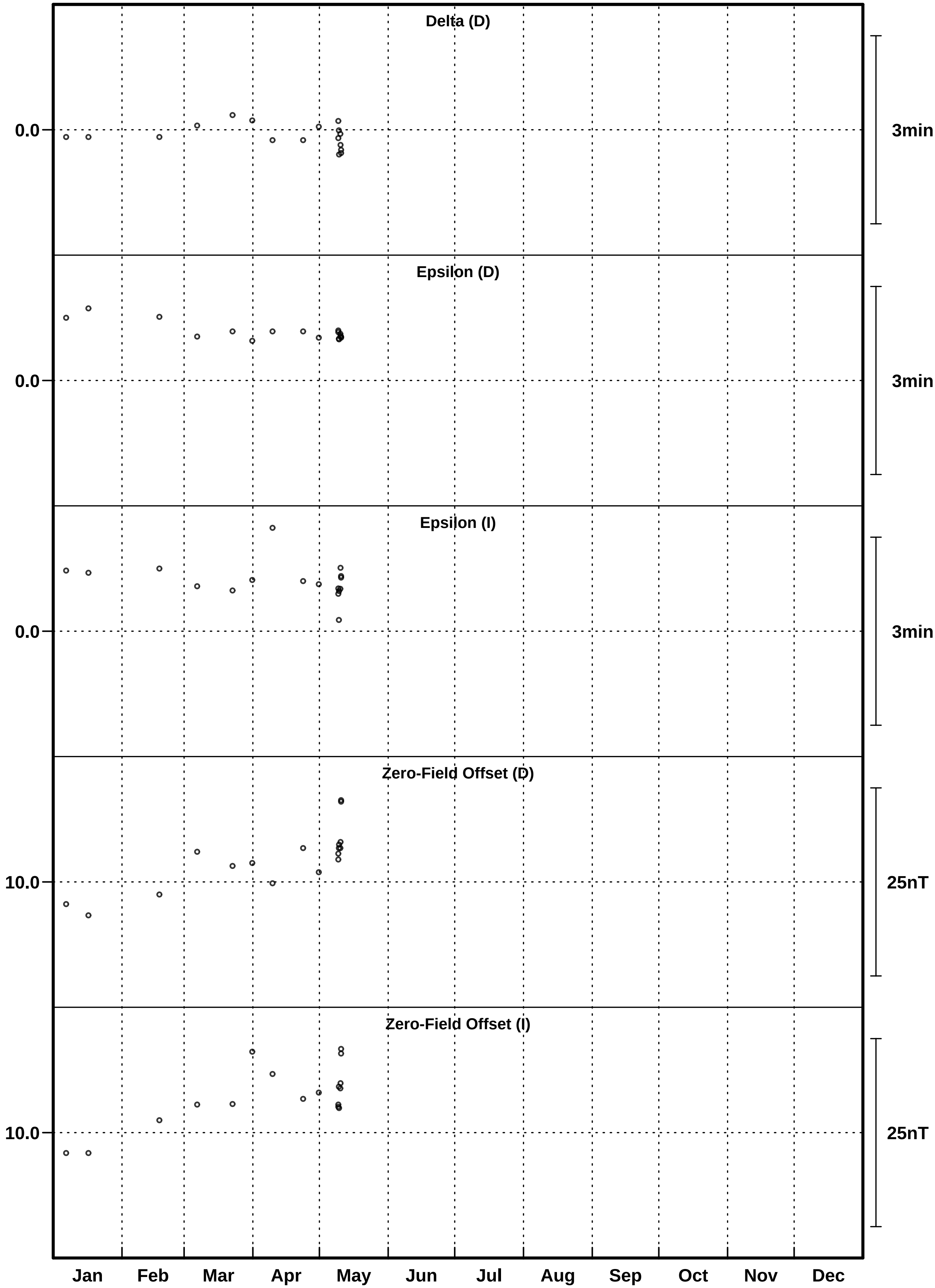


Figure 3 : Sable Island Collimation Errors 2001



SABLE ISLAND OBSERVATORY DIARY

Various There were one occasion when a single one-minute value was missing. The date and time of this is listed in the table below. During processing this was filled using values interpolated from the surrounding data.

MISSING OR CORRUPT DATA

Start (UT)		End (UT)		Total	Comments
Date	**Time**	**Date**	**Time**	**Loss**	
21-06-01	16:32	21-06-01	16:32	0:01	One-minute value not recorded