

**BRITISH GEOLOGICAL SURVEY**

**Sable Island  
Observatory  
Monthly  
Magnetic  
Bulletin**

**September 2010**

**10/09/SB**



**British  
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

# SABLE ISLAND OBSERVATORY MAGNETIC DATA

## 1. Introduction

Sable Island is the third overseas geomagnetic observatory to be established by the British Geological Survey (BGS). The installation was a joint venture between BGS, Sperry Drilling Services (SDS), Halliburton and Sable Offshore Energy in support of directional drilling programmes. It was completed in May 1999 and the observatory became operational from 8th May 1999.

This bulletin is published to provide rapid access to the provisional geomagnetic observatory results. The information is freely available for personal, academic, educational and non-commercial research or use. Magnetic observatory data are presented as a series of plots of one-minute, hourly and daily values, followed by tabulations 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

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:* 43.932°N      299.991°E

*Geomagnetic:* 53.614°N      14.926°E

*Height above mean sea level:* 5m (approx)

The geomagnetic co-ordinates are approximations, calculated using the 11th generation International Geomagnetic Reference Field (IGRF) at epoch 2010.5. On-line access to models (including IGRF), charts and navigational data are available at [www.geomag.bgs.ac.uk/navigation.html](http://www.geomag.bgs.ac.uk/navigation.html)

## 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 staff, installed in April 2004 and became fully operational from May 2004. The data acquisition software, running on QNX operated computers, controls the data logging and the communications.

There are two sets of sensors used for making magnetic measurements. A tri-axial 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 (PPM) 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 and 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. One set of absolute measurements of the field are made manually once per month. 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. Observatory Results

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 to a page and show the one-minute 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 and/or coronal holes on the Sun may recur after 27 days: the same is true for geomagnetically

quiet intervals. Plotting the data in this way highlights this recurrence. Diurnal variations are also clear in these plots and the amplitude changes throughout the year highlight the seasonal changes. Longer term secular variation is also illustrated.

### 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. It is anticipated that these provisional values will not be altered by more than a few nT or tenths of arcminutes before being made definitive at the end of the year.

## 5. Conditions of Use

The data presented in this bulletin are provided for personal, academic, educational, non-commercial research or other non-commercial use and are not for sale or distribution to third parties without written permission from BGS.

Reproduction of any part of this bulletin should be accompanied by the statement: 'Reproduced with the permission of the British Geological Survey ©NERC. All rights Reserved'. Publications making use of the data should include an acknowledgment statement of the form: 'The results presented in this paper rely on the data collected at Sable Island magnetic observatory, operated by the British Geological Survey and Sable Offshore Energy with support from Sperry Drilling Services, Halliburton.'

Commercial users can contact the geomagnetism team for information on the range of applications and services offered. Full contact details are available at [www.geomag.bgs.ac.uk/staff.html](http://www.geomag.bgs.ac.uk/staff.html).



# Sable Island 2010

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

-18.96

5min

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

20357

20nT

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

47289

20nT

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

-1.0

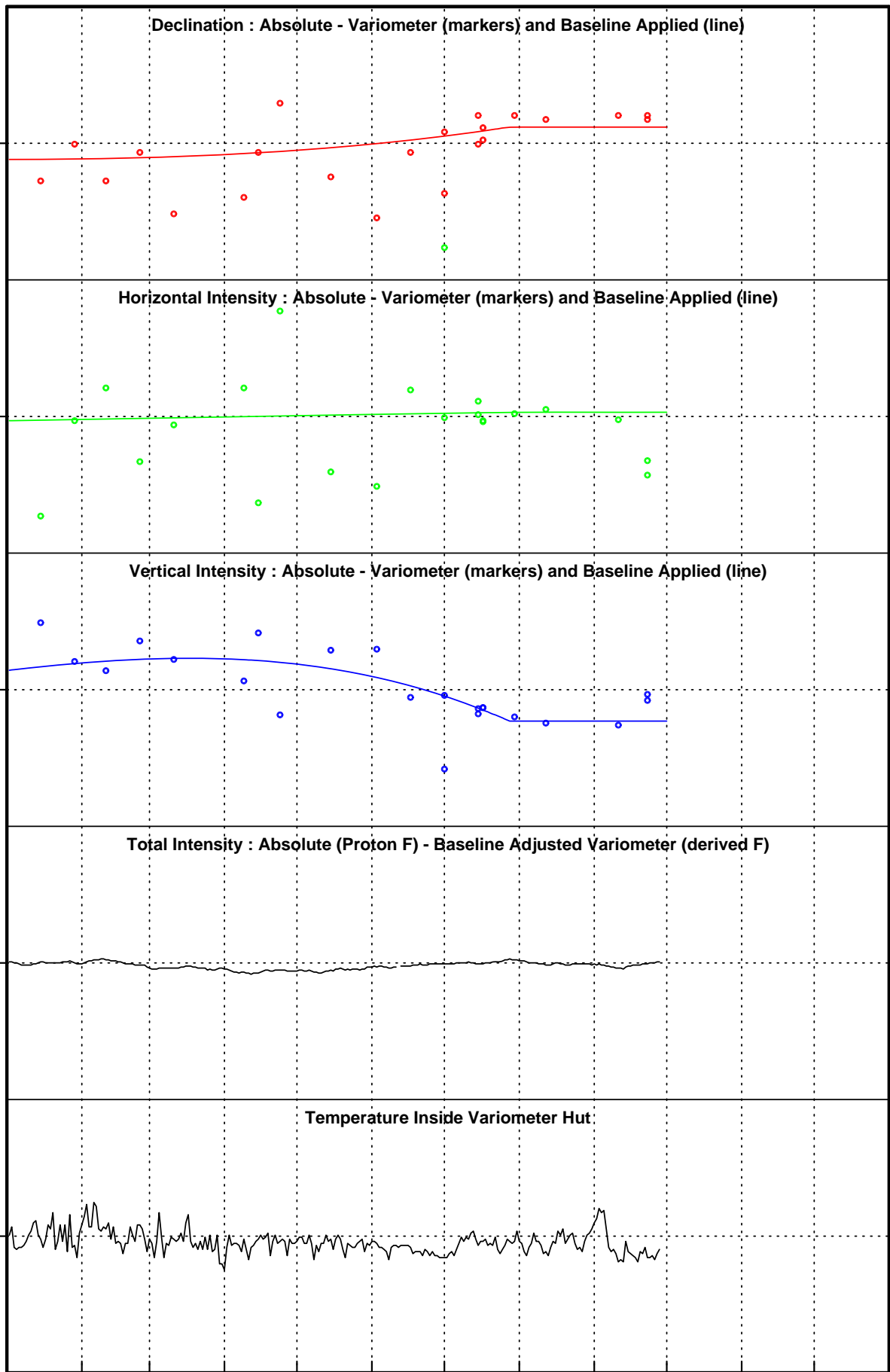
20nT

Temperature Inside Variometer Hut

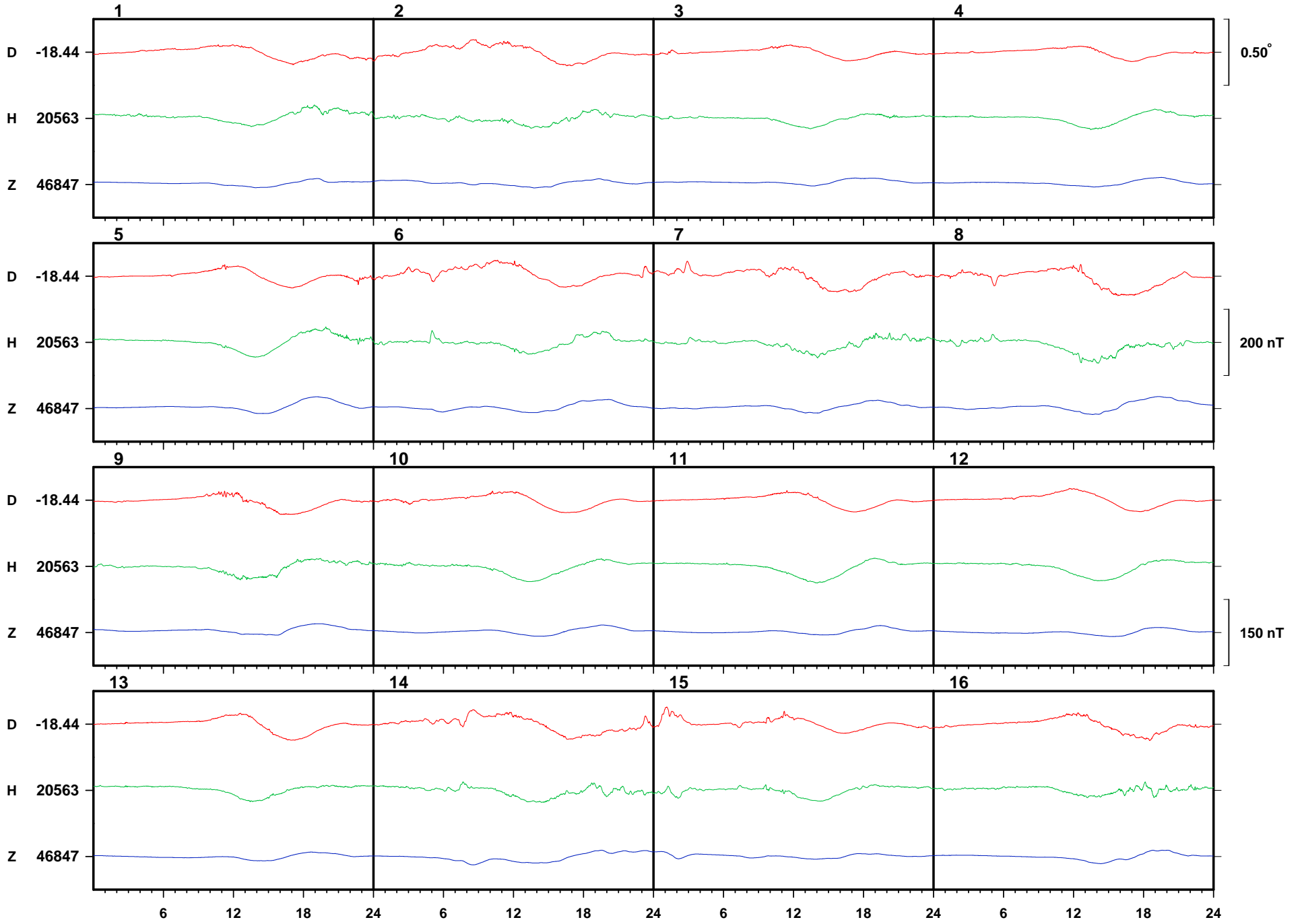
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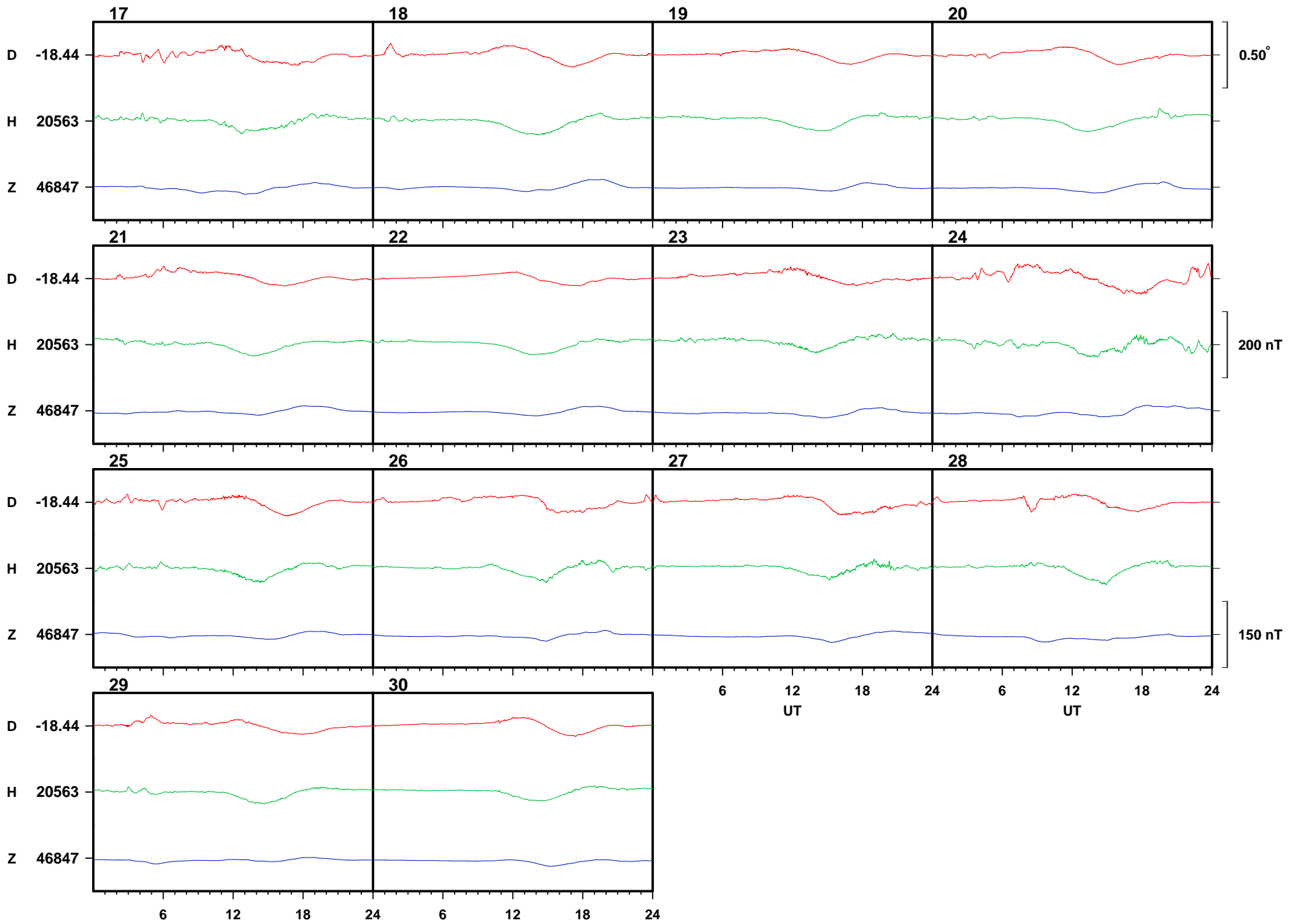
10°C

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec



Sable Island September 2010





Sable Island

September

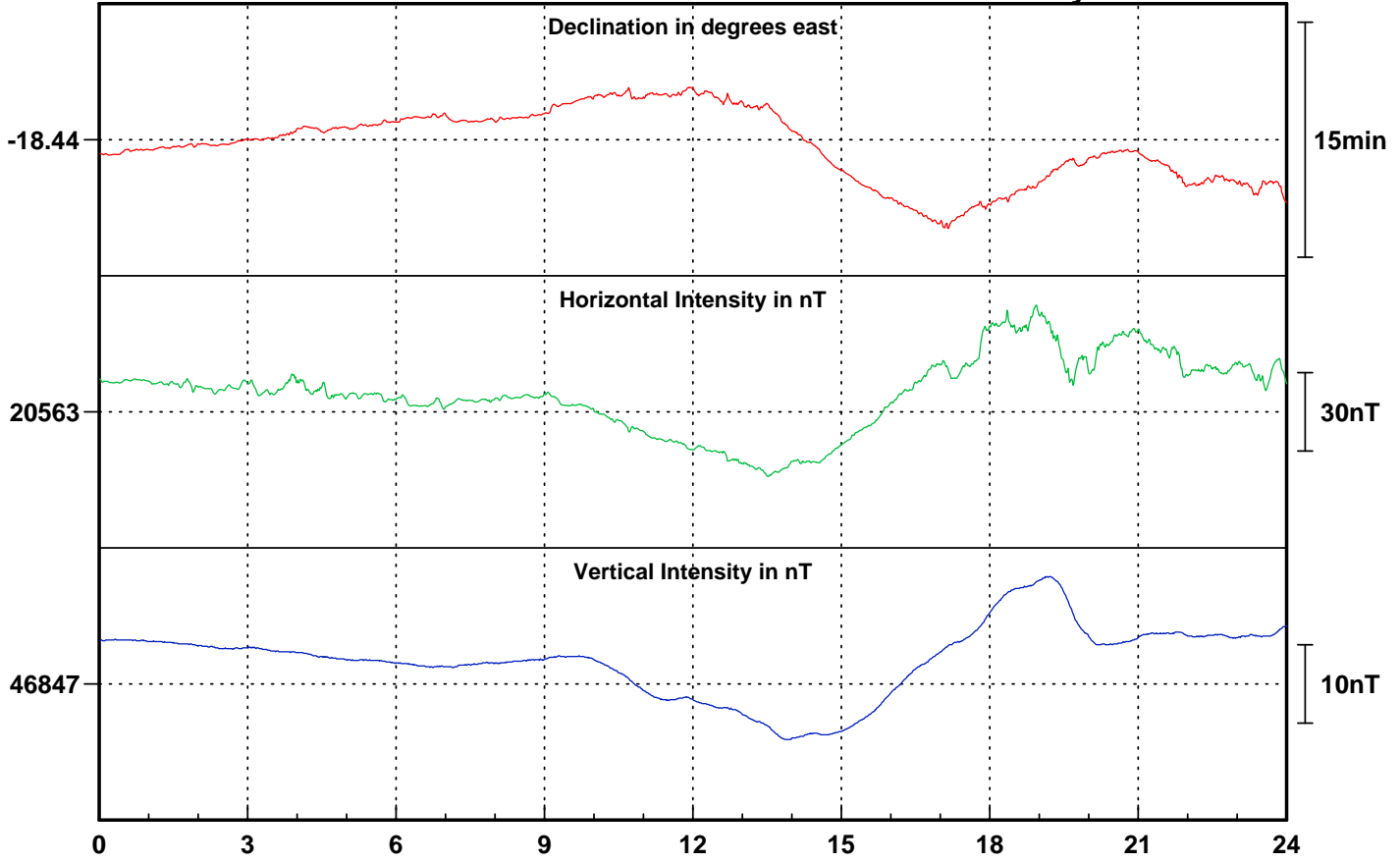
2010



Date: 01-09-2010

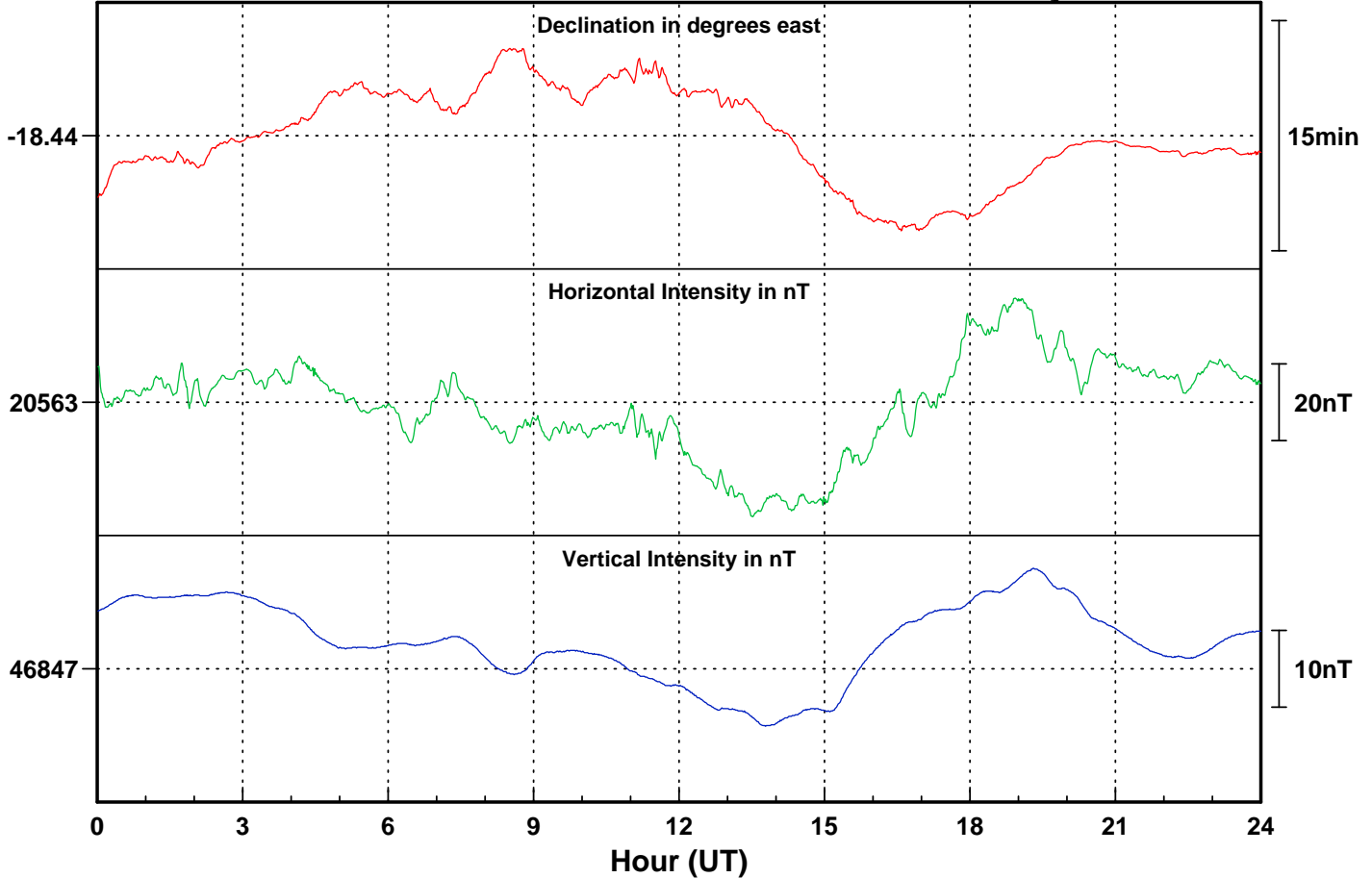
# Sable Island

Day number: 244



Date: 02-09-2010

Day number: 245

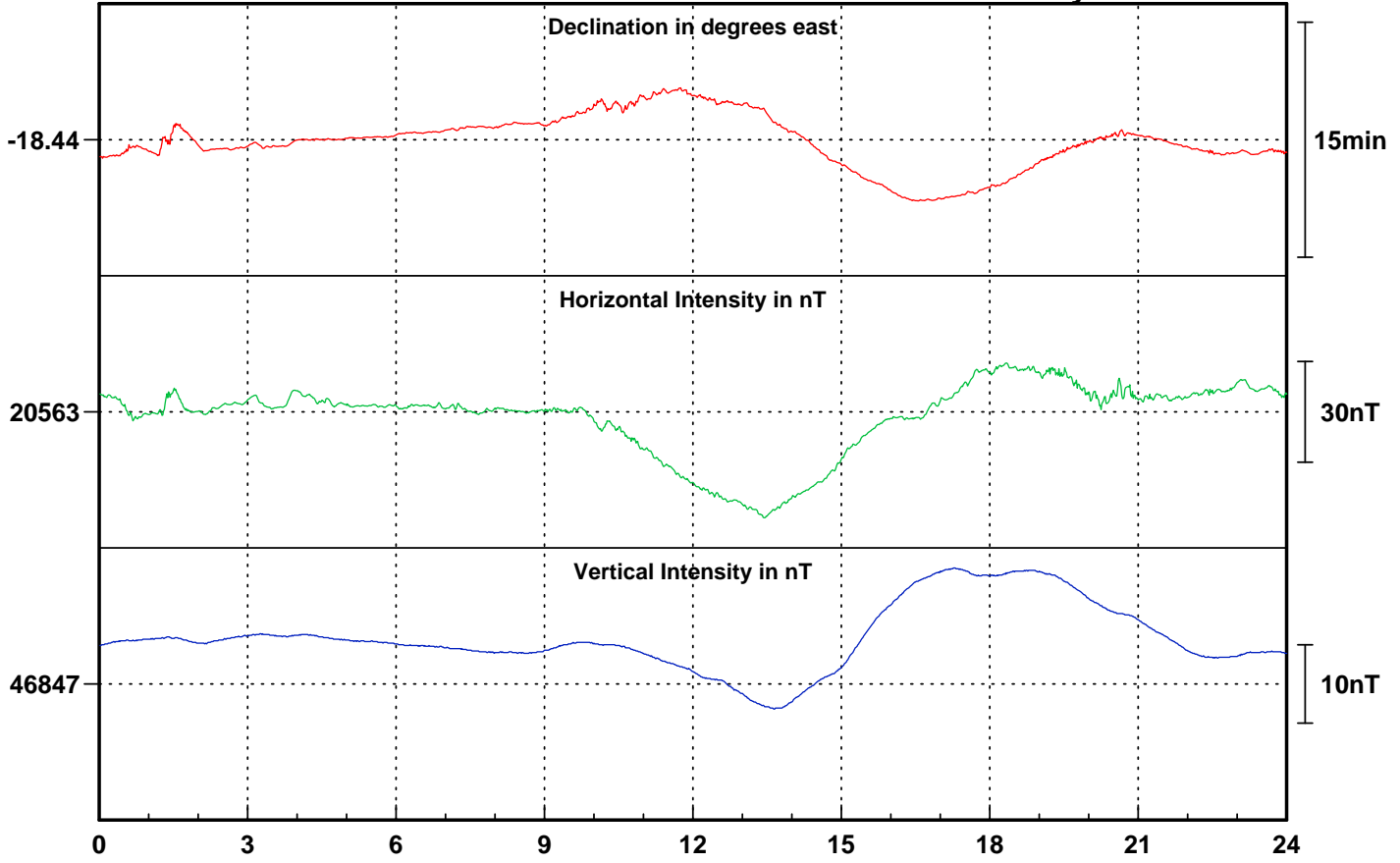




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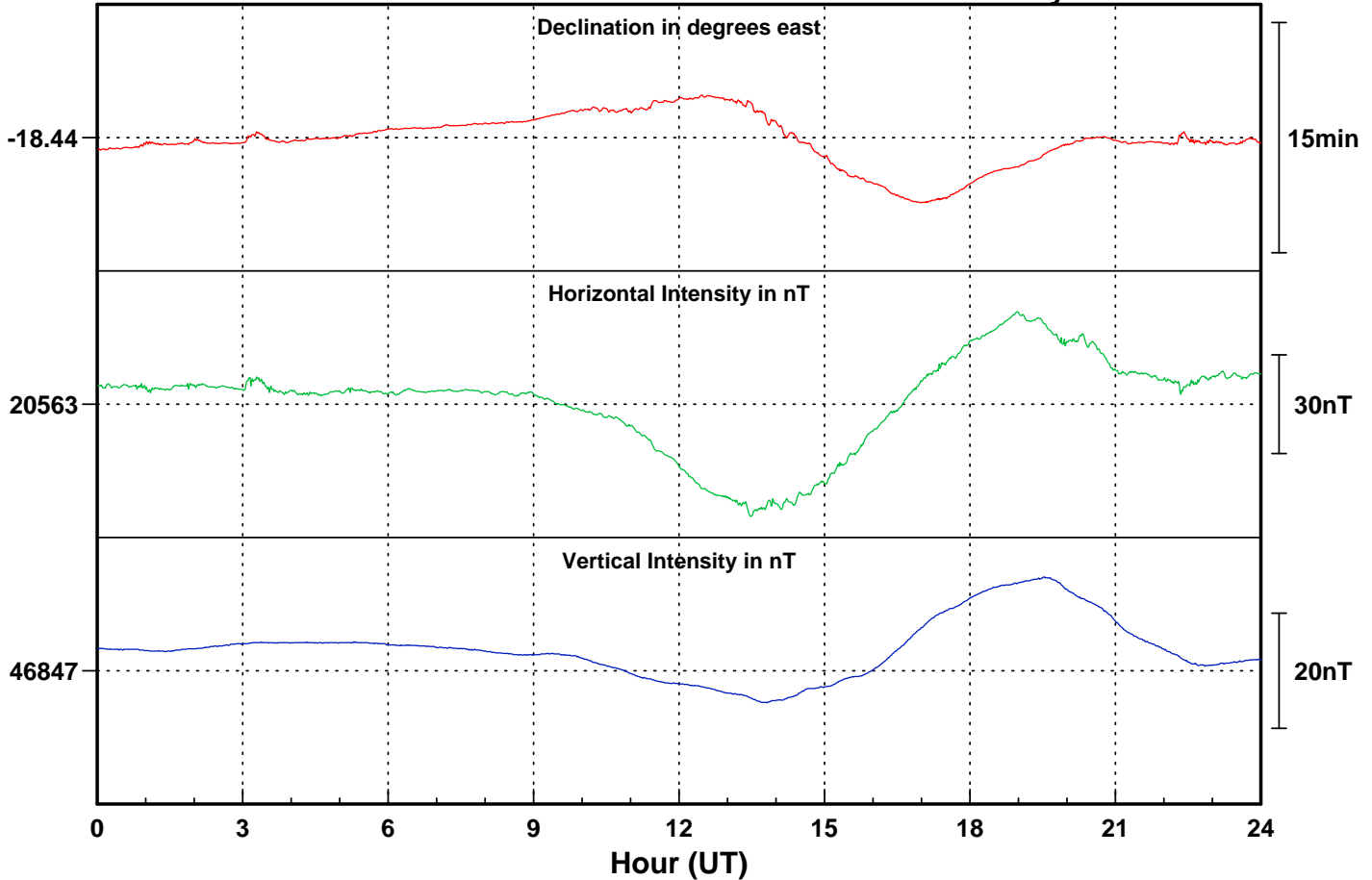
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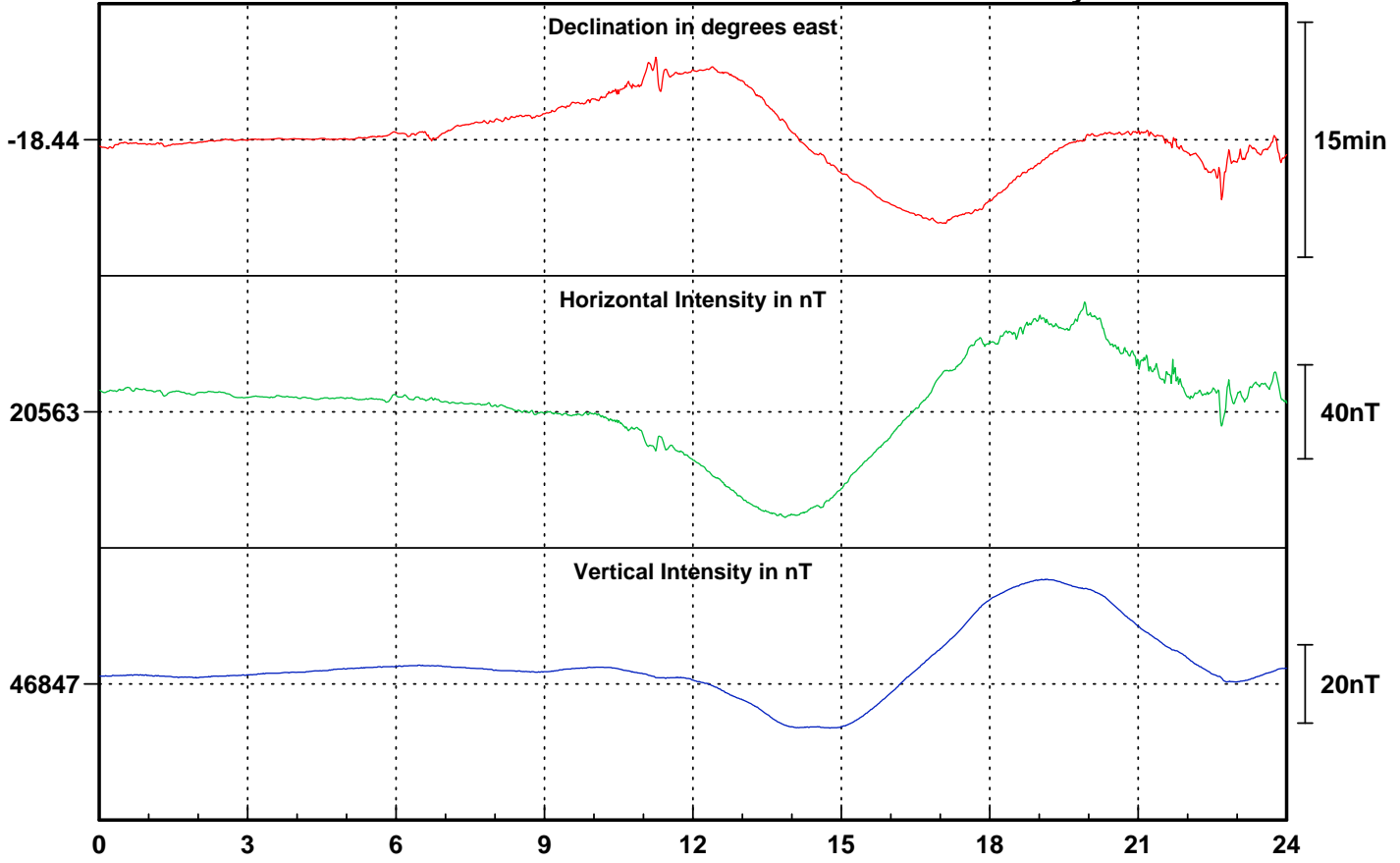
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Date: 05-09-2010

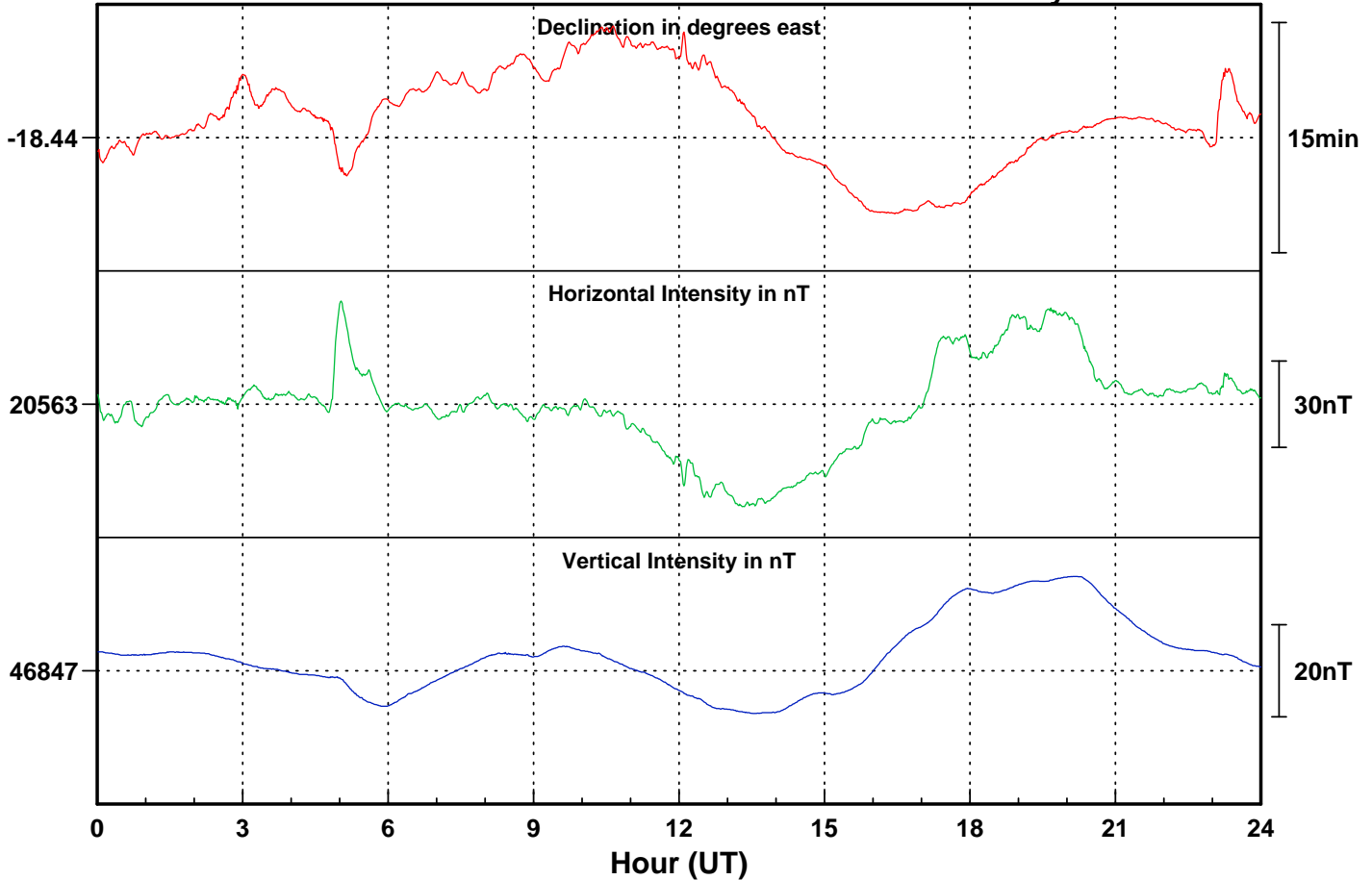
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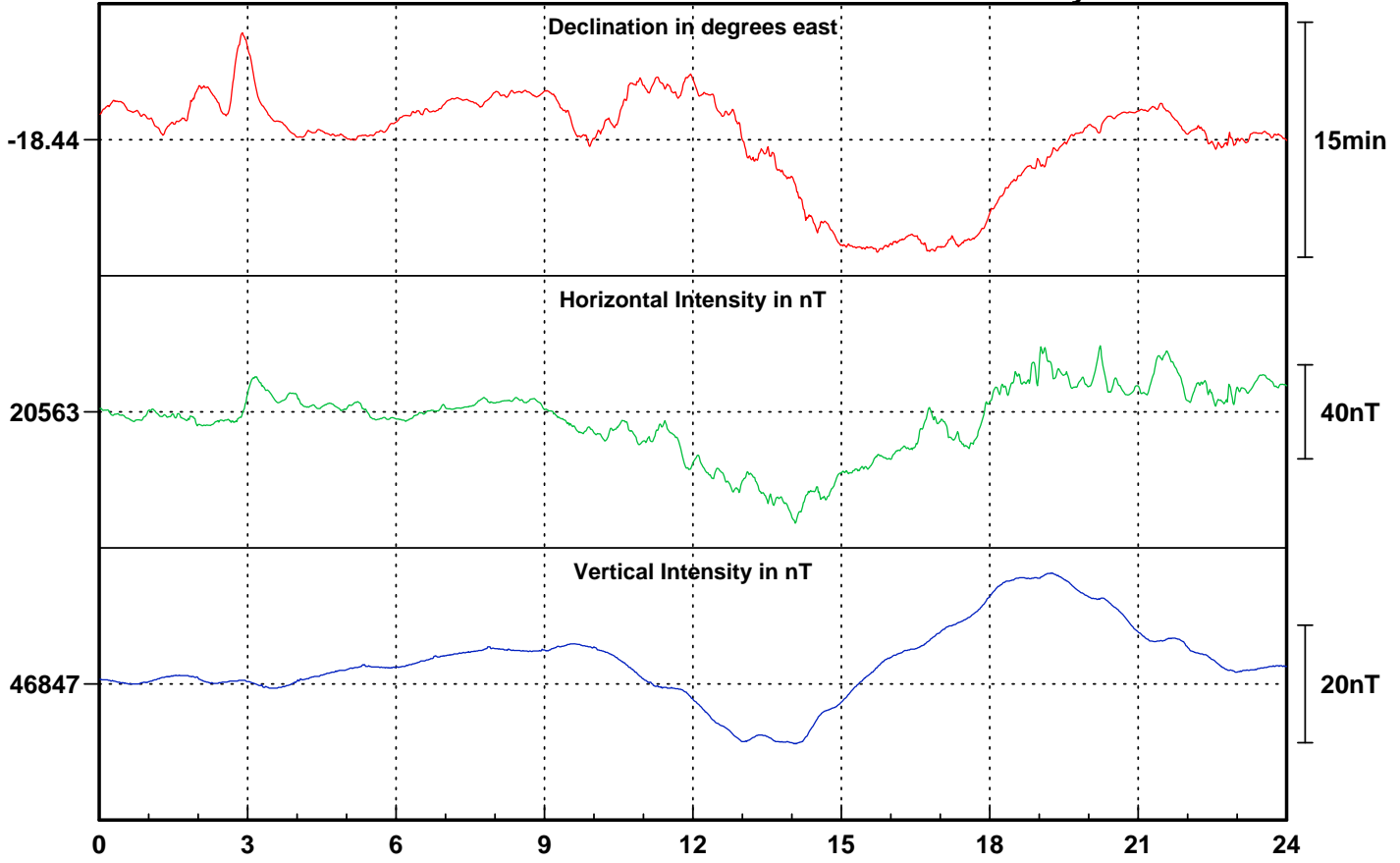
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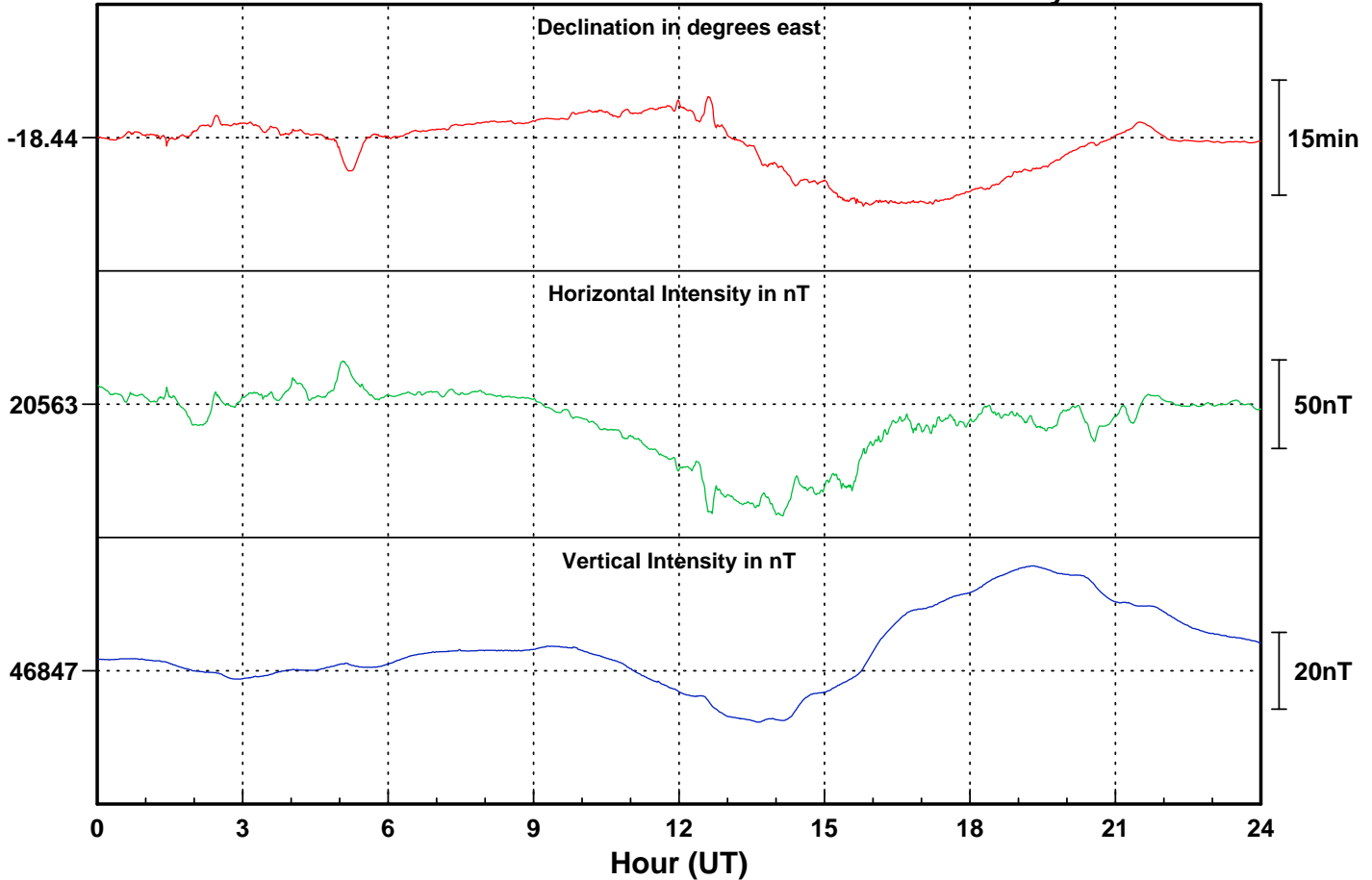
# Sable Island

Day number: 250



Date: 08-09-2010

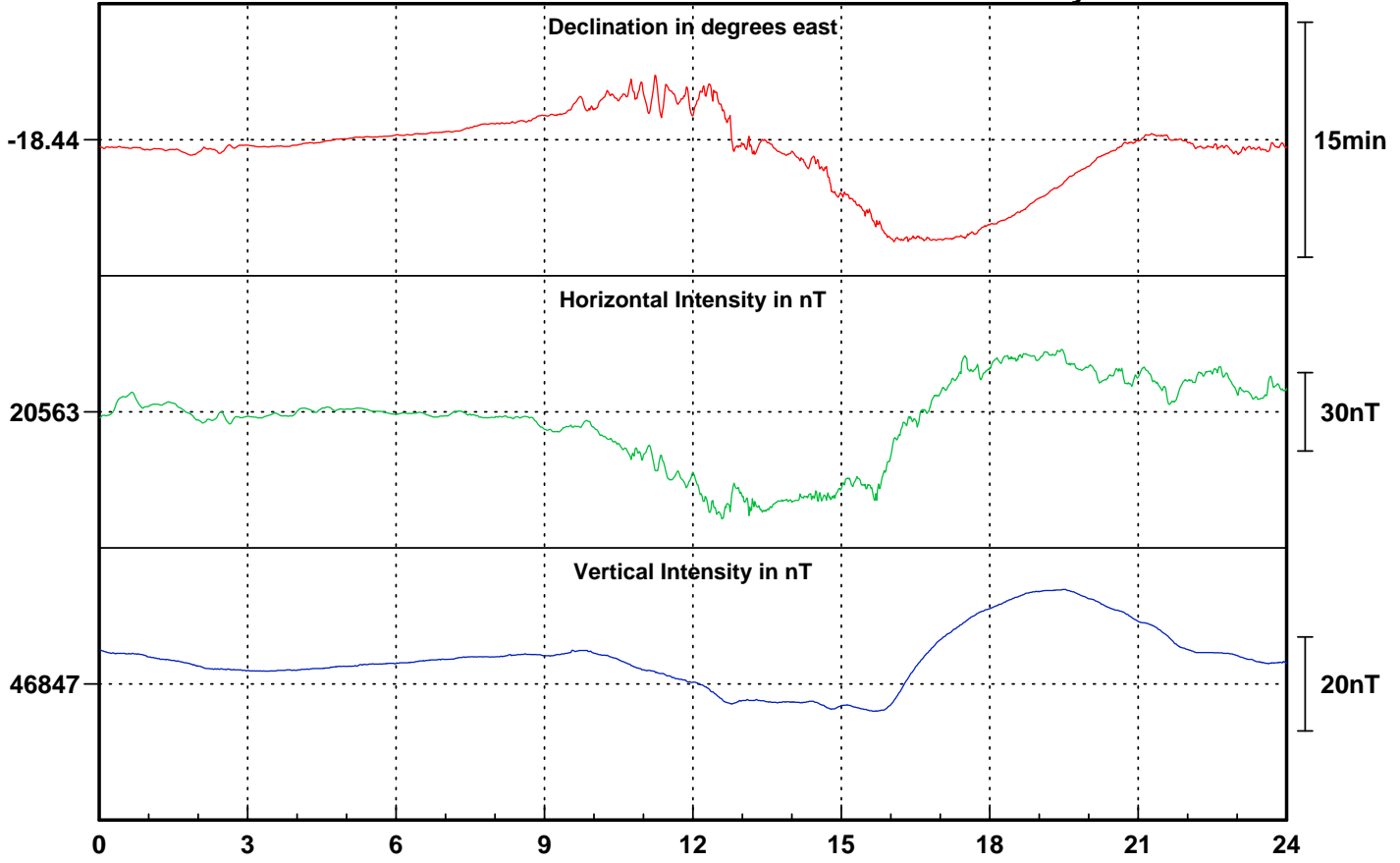
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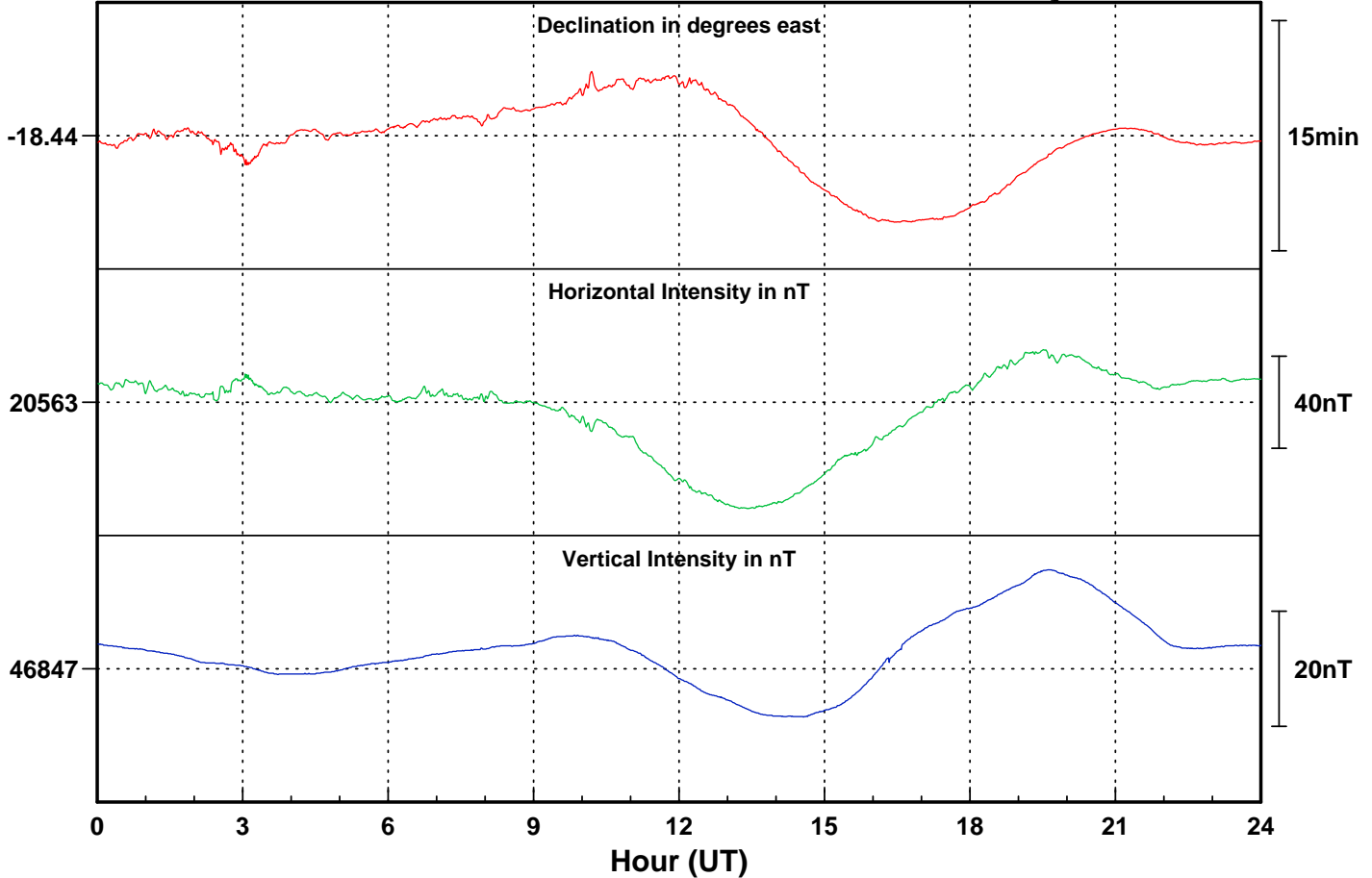
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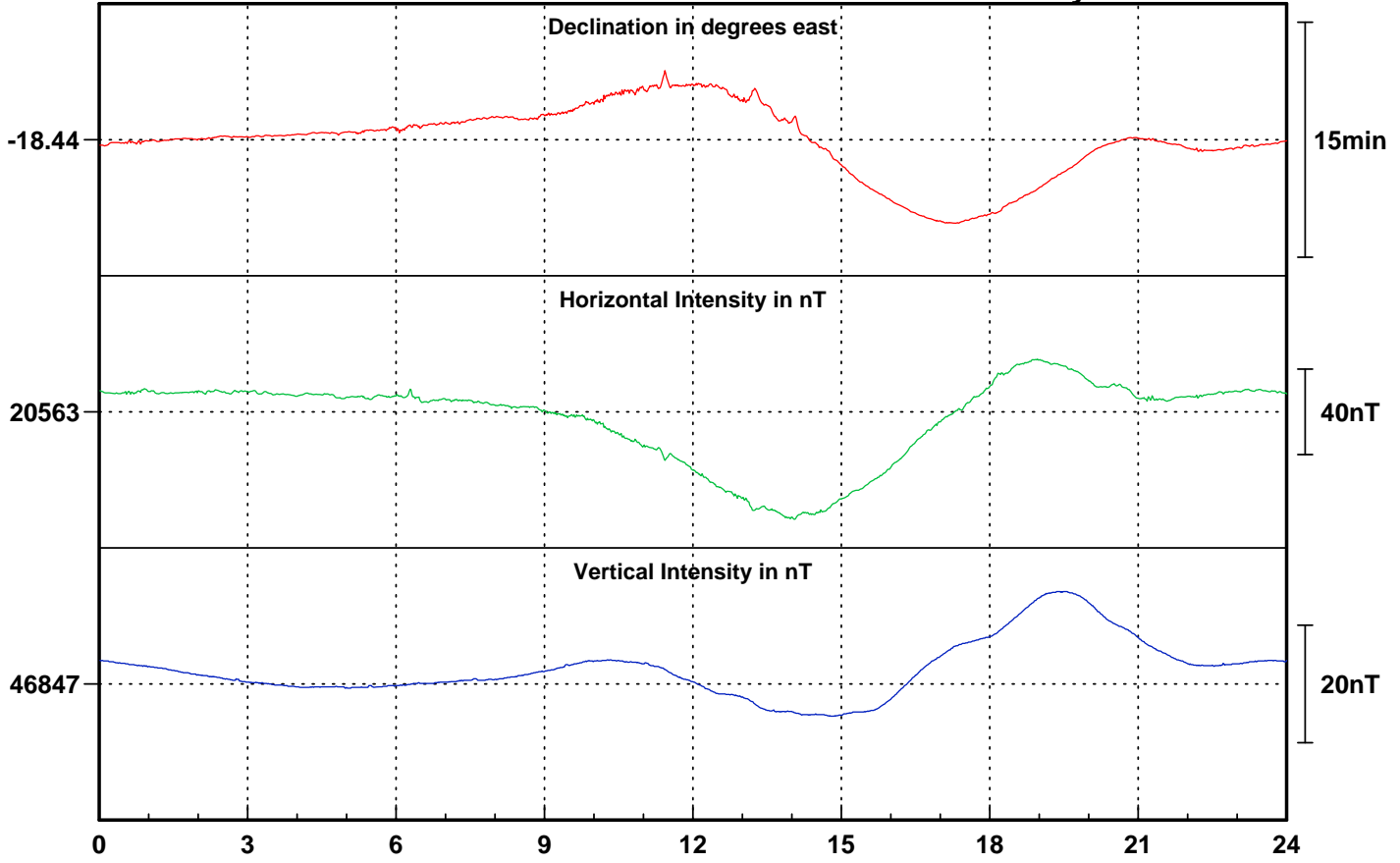
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Date: 11-09-2010

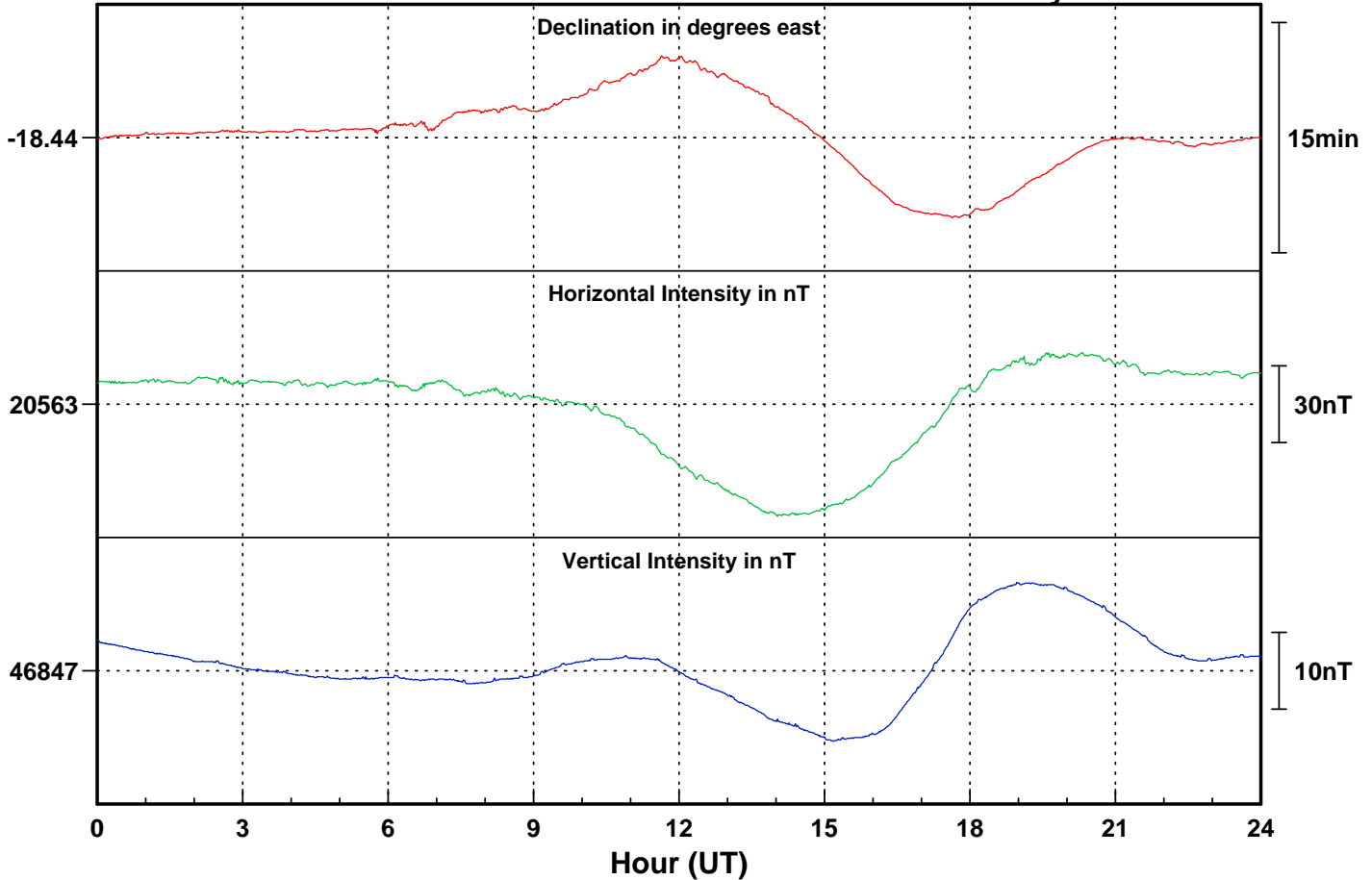
# Sable Island

Day number: 254



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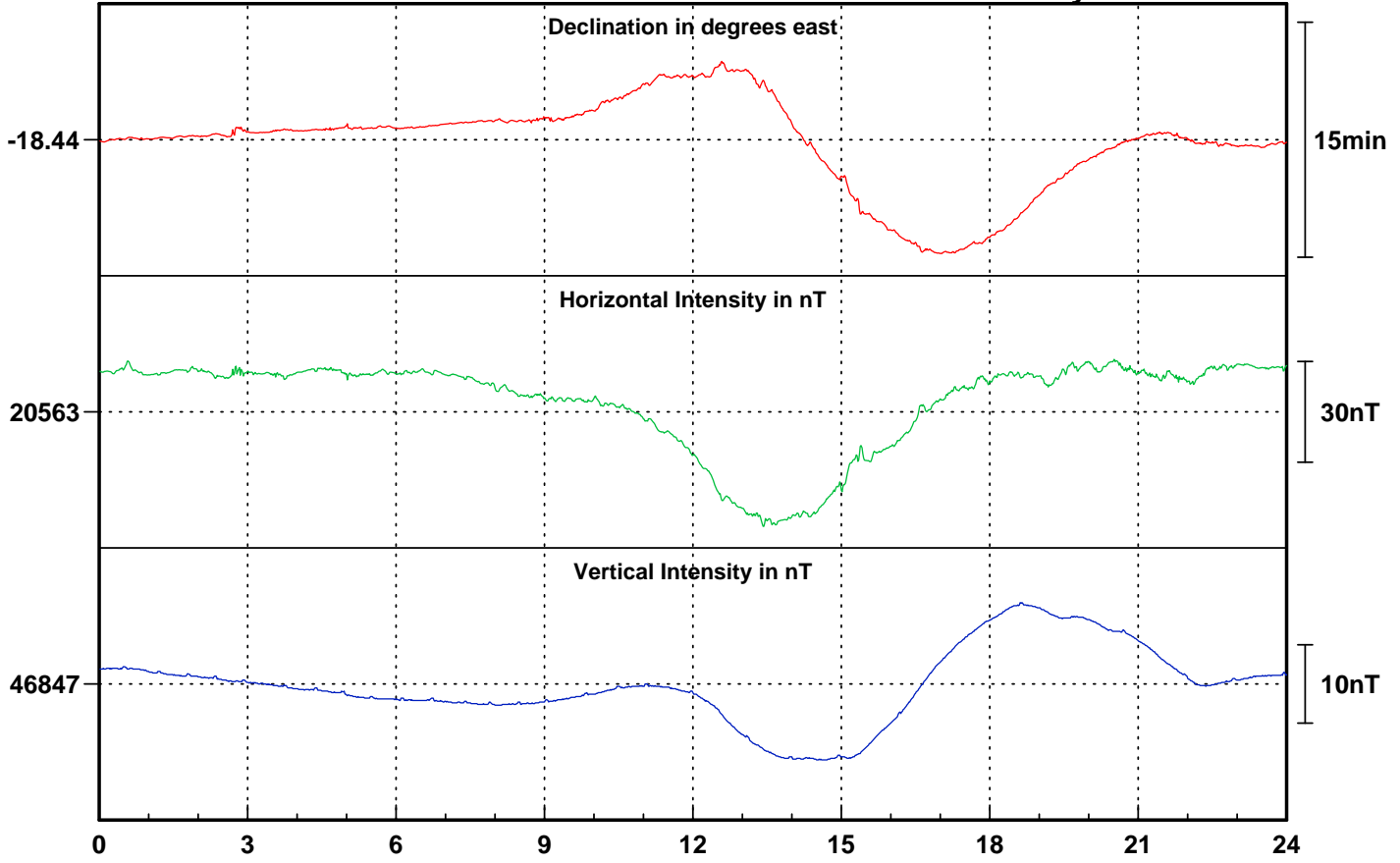
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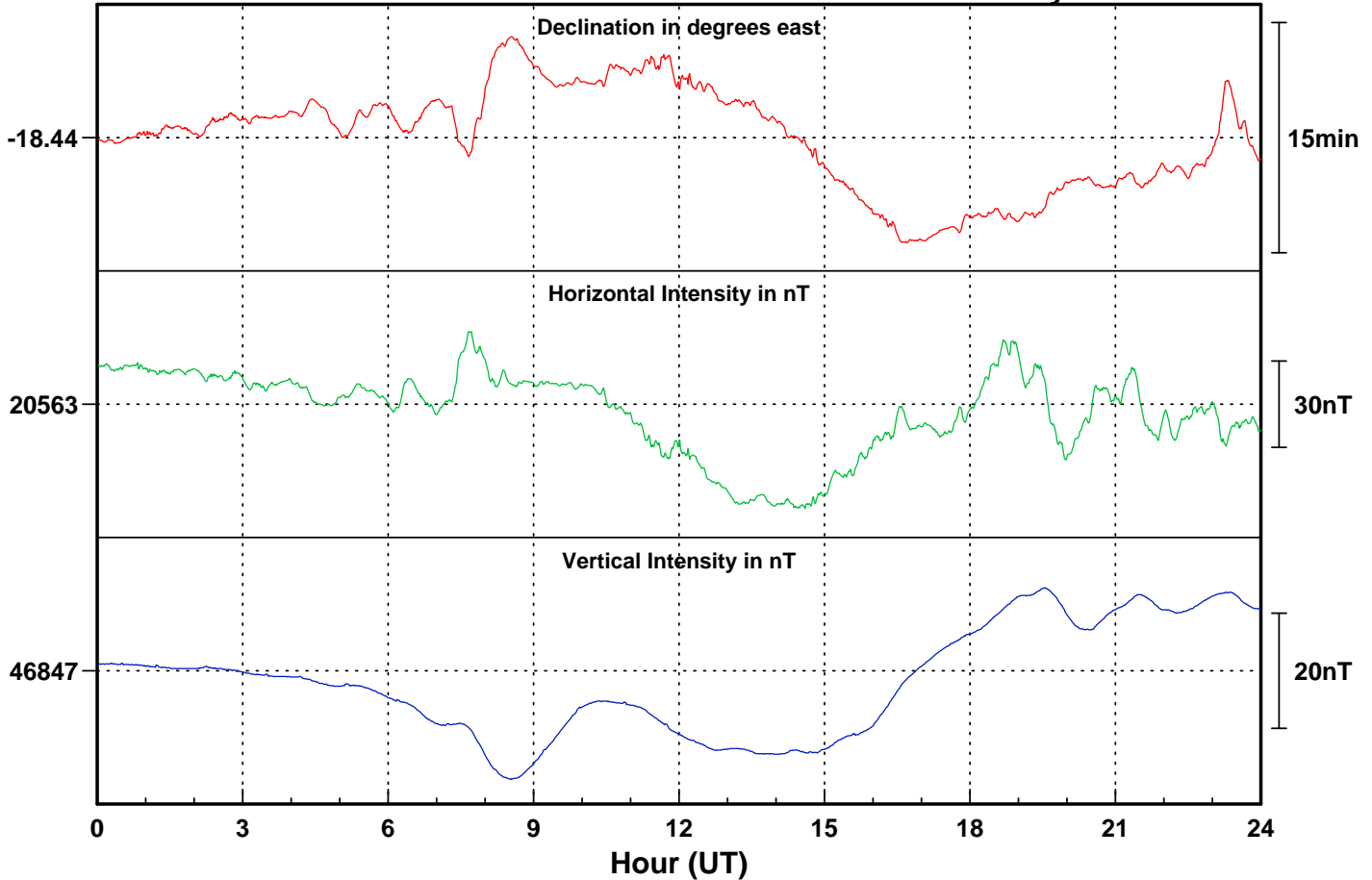
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Day number: 256



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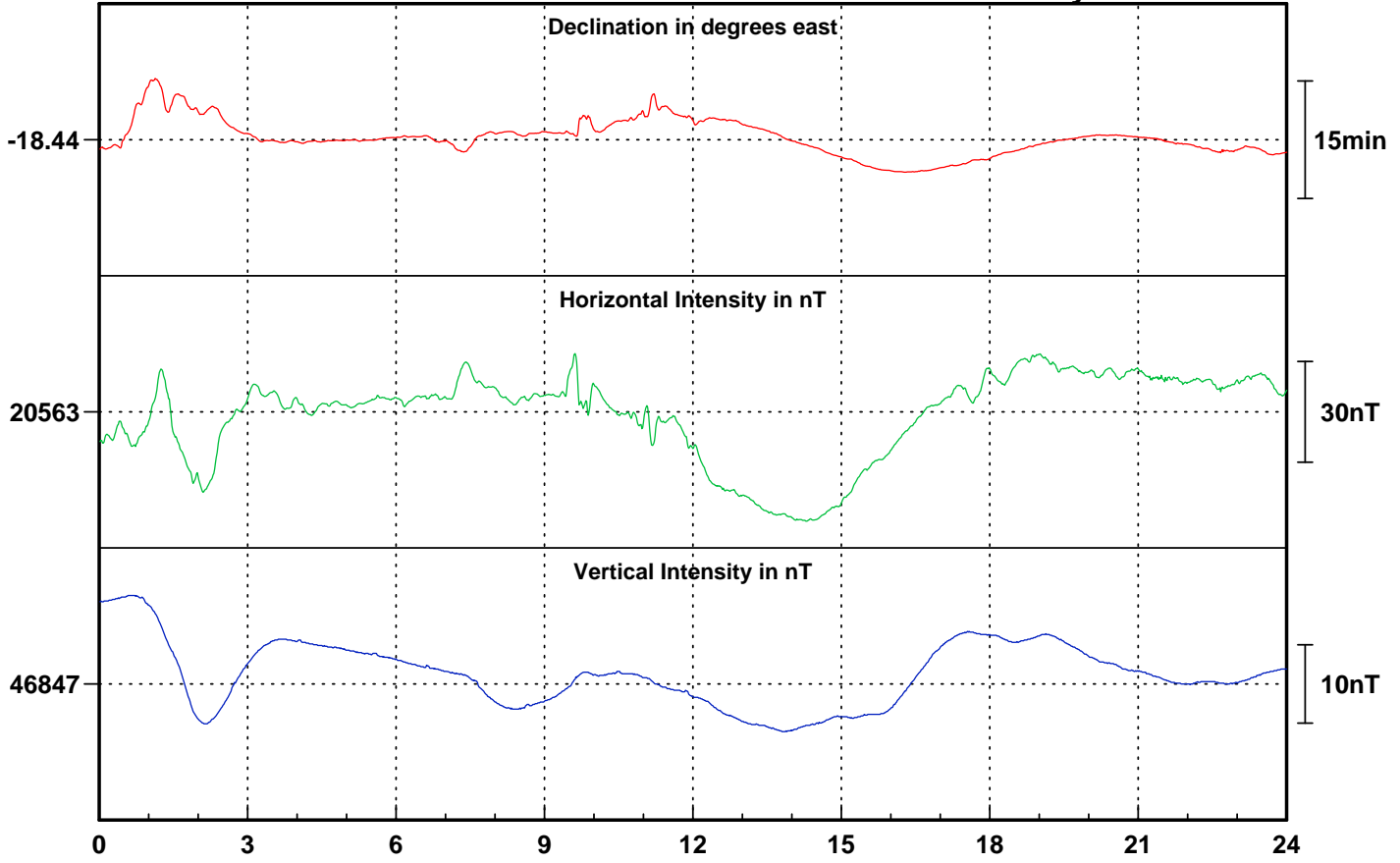
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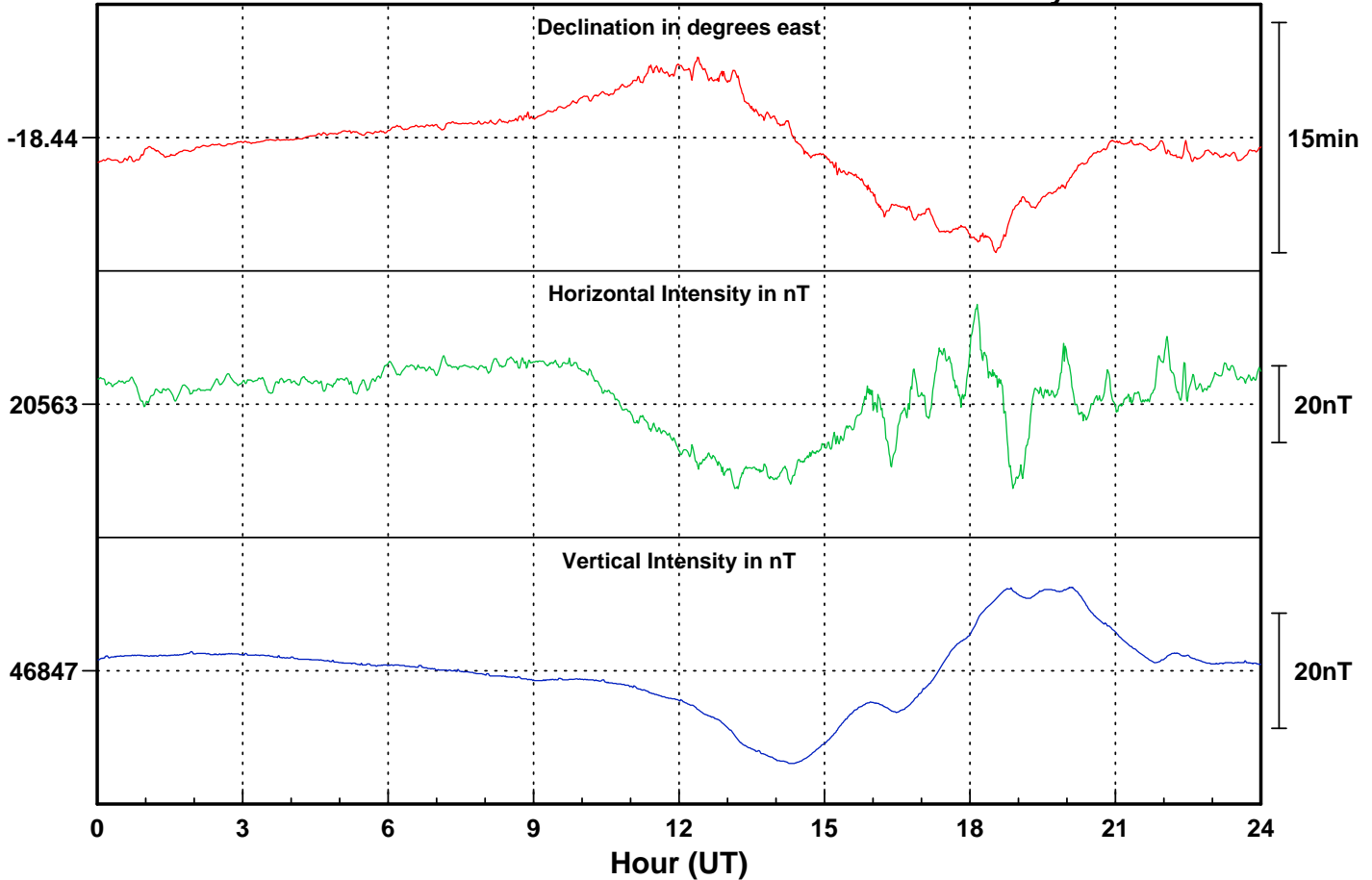
# Sable Island

Day number: 258



Date: 16-09-2010

Day number: 259

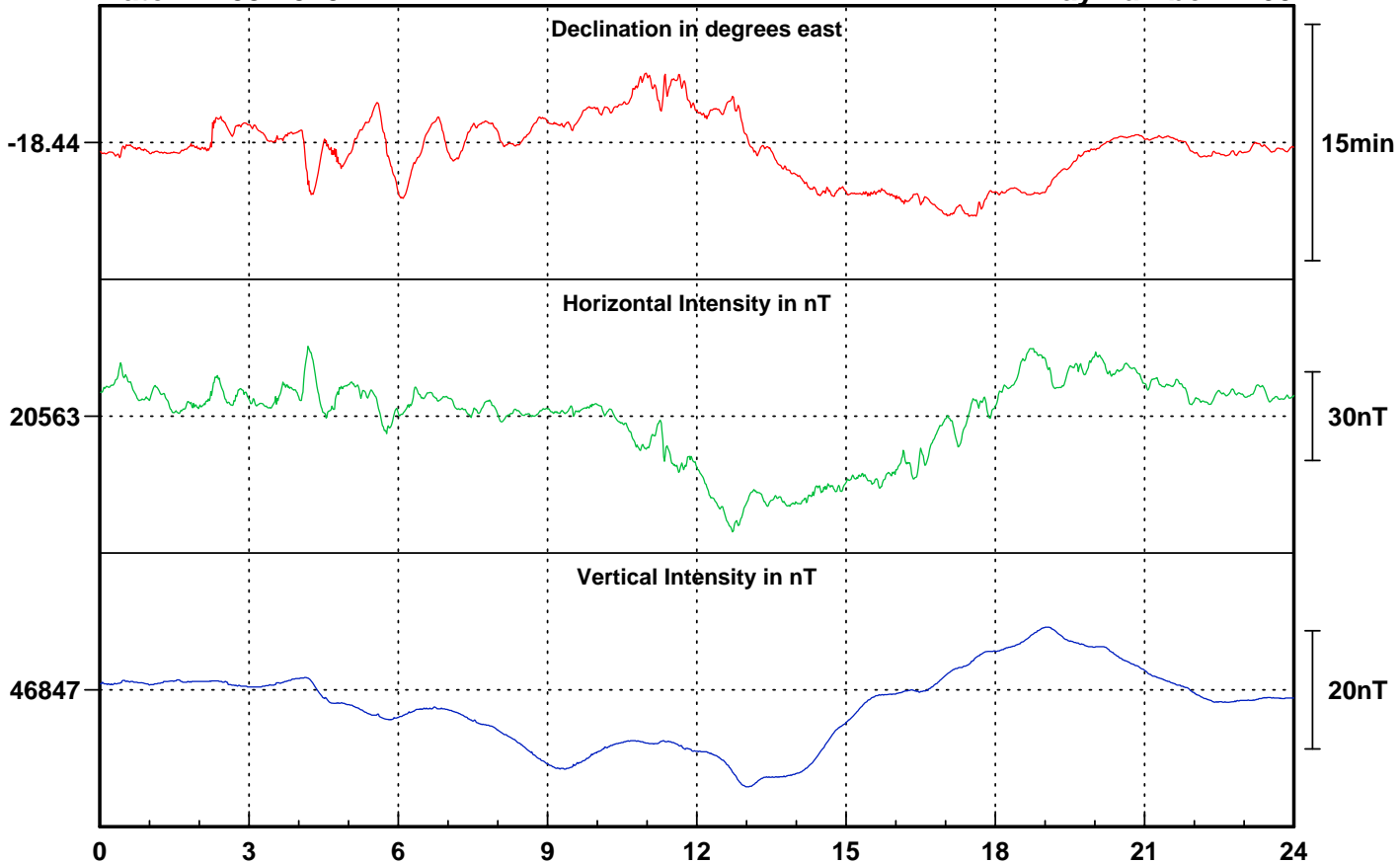




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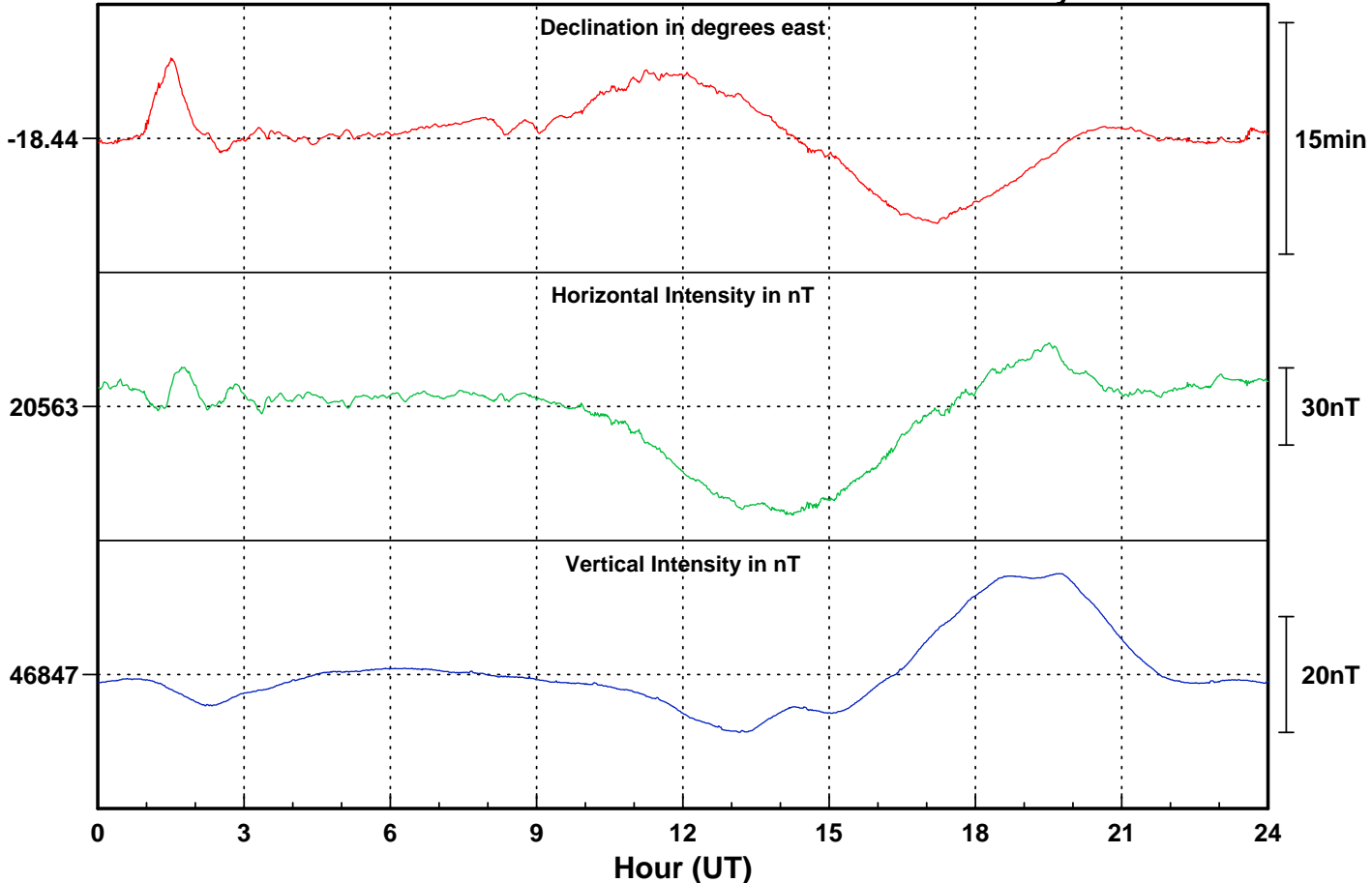
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Day number: 260



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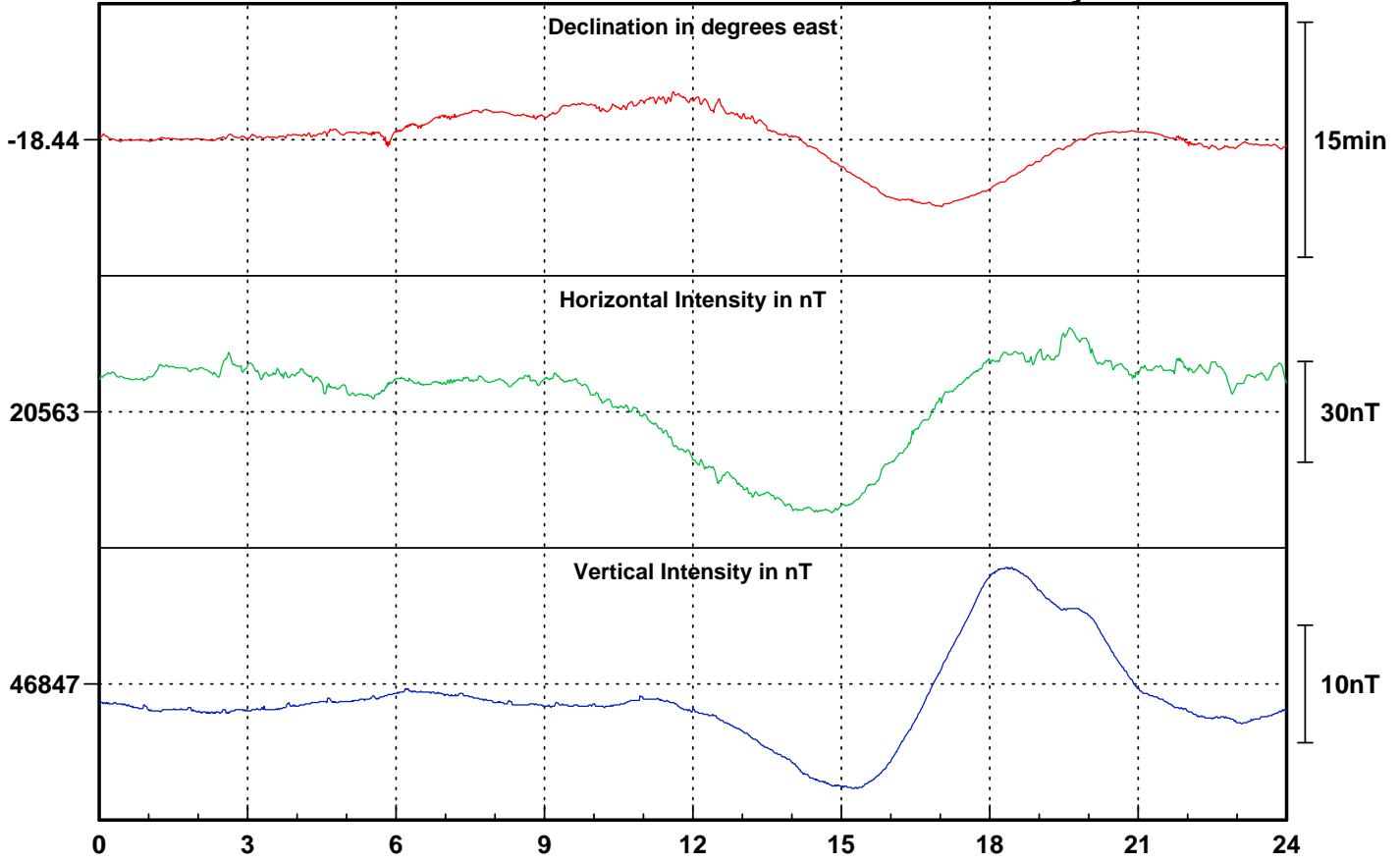
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Date: 19-09-2010

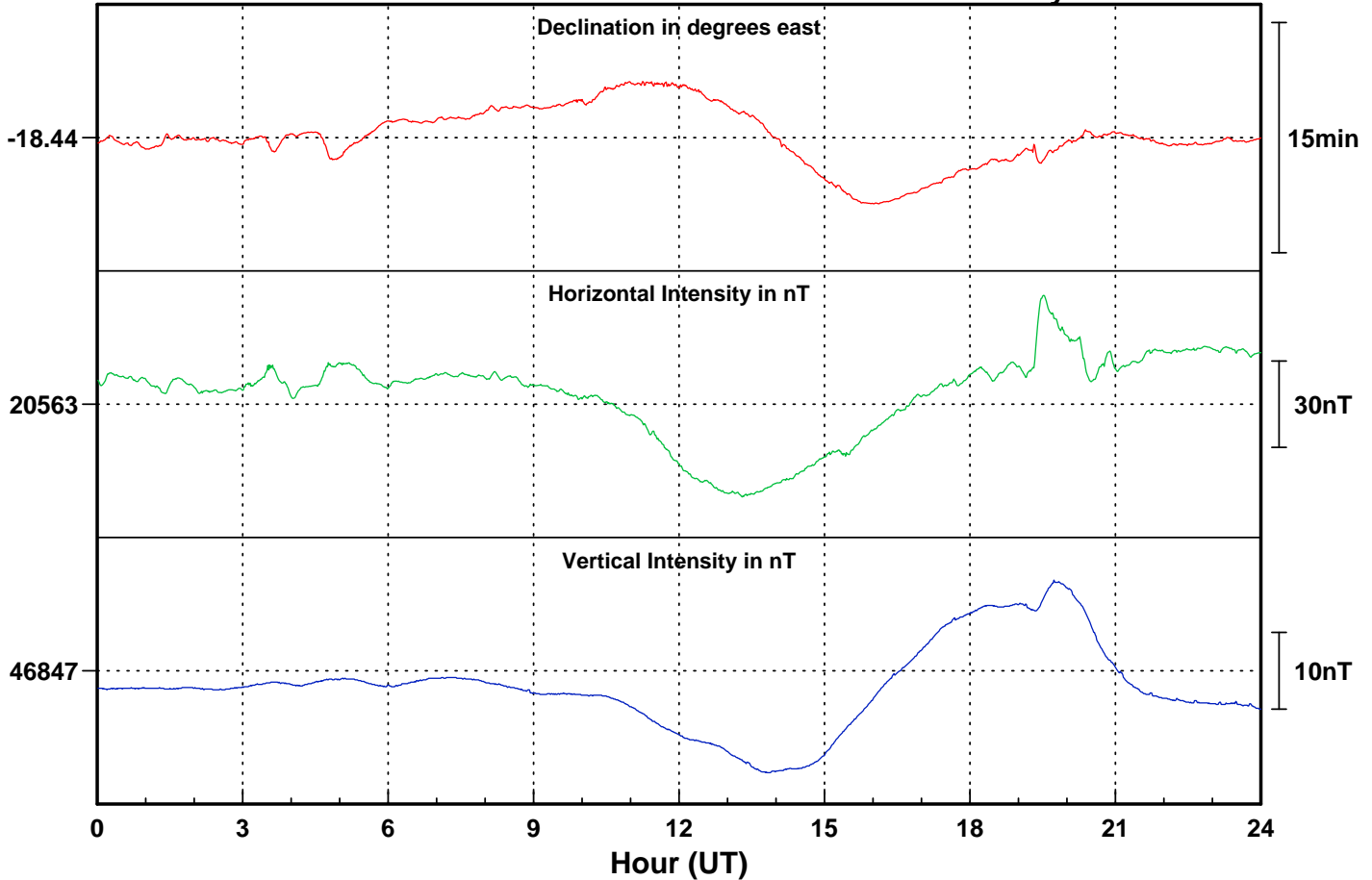
# Sable Island

Day number: 262



Date: 20-09-2010

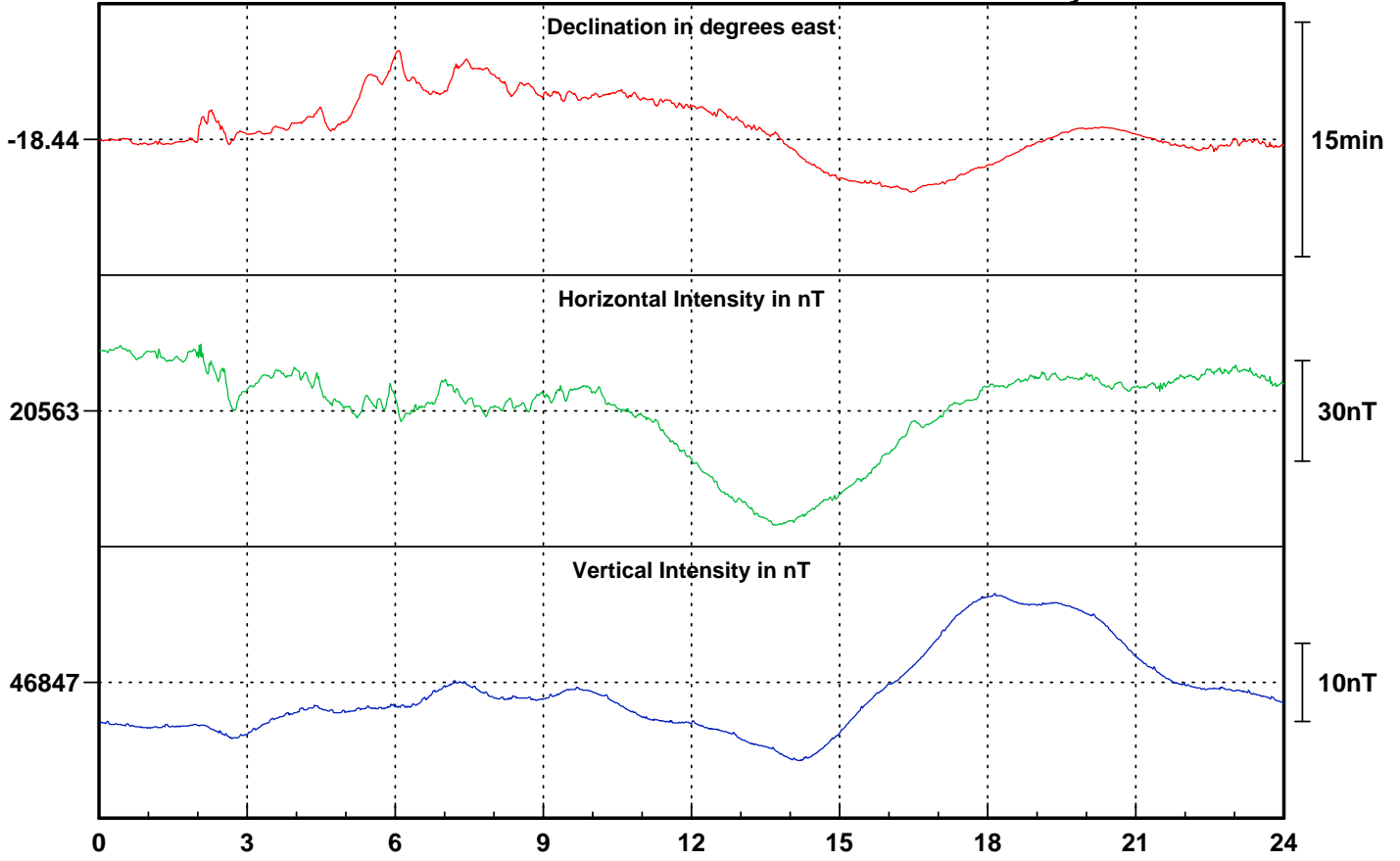
Day number: 263



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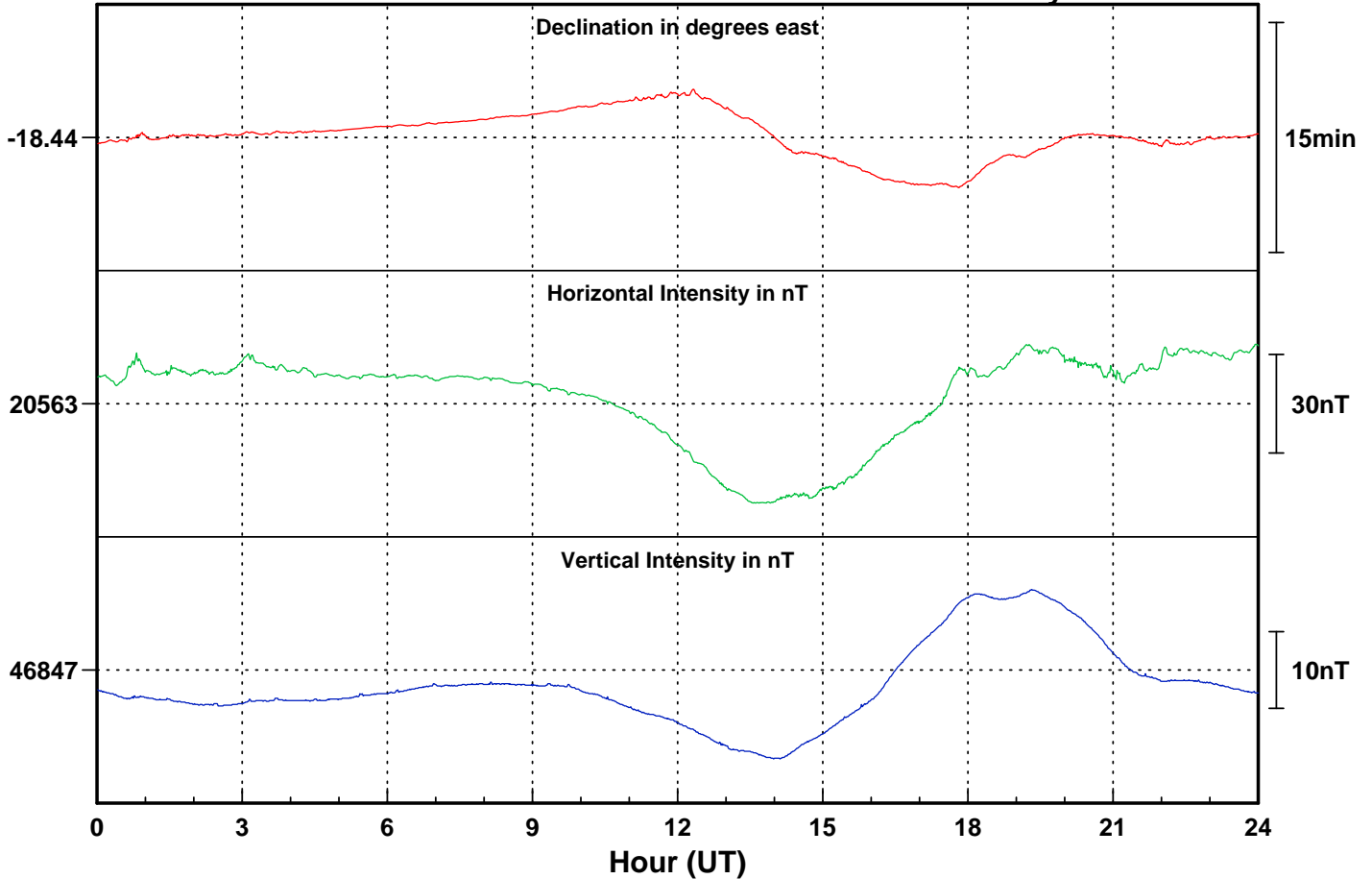
# Sable Island

Day number: 264



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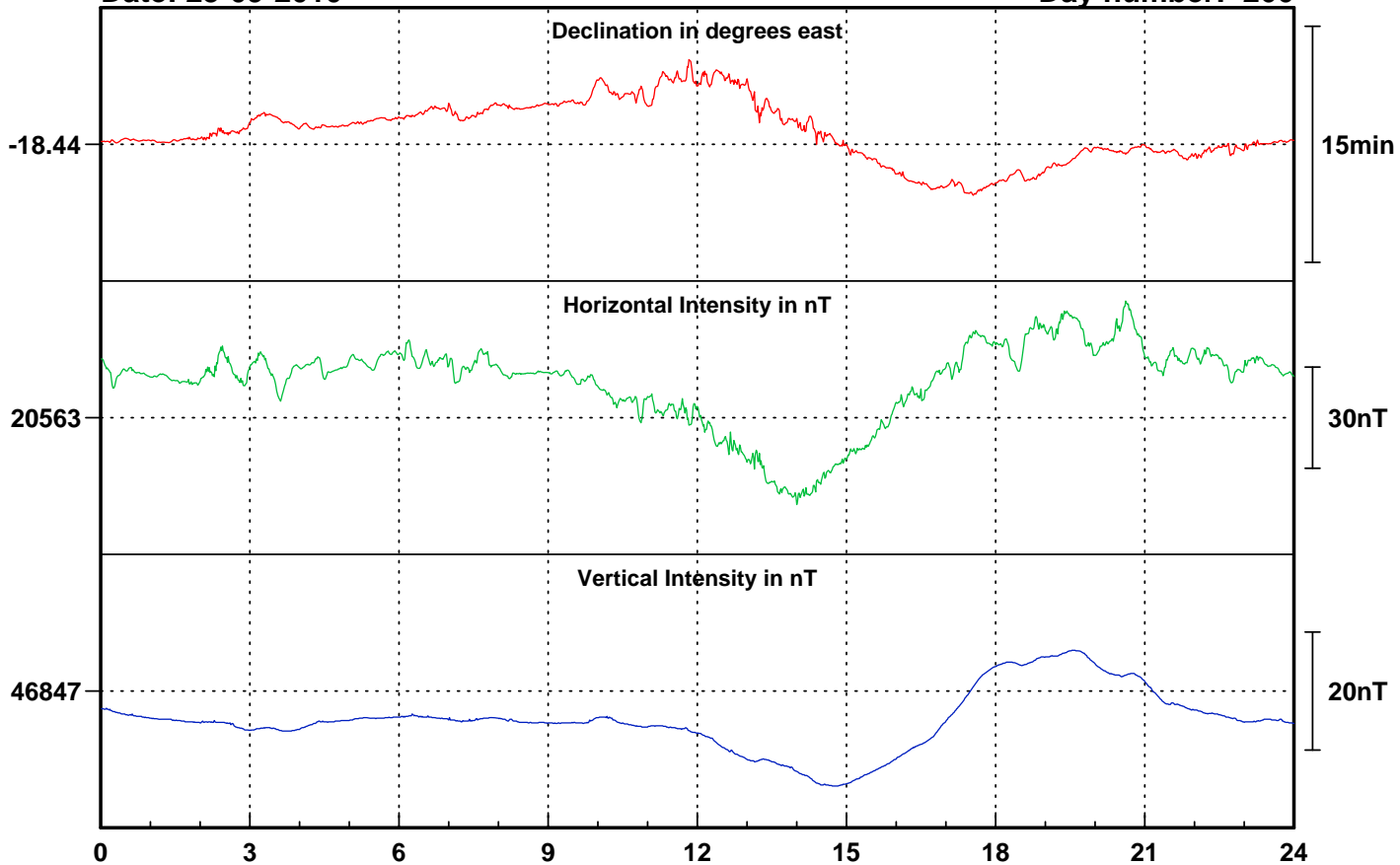
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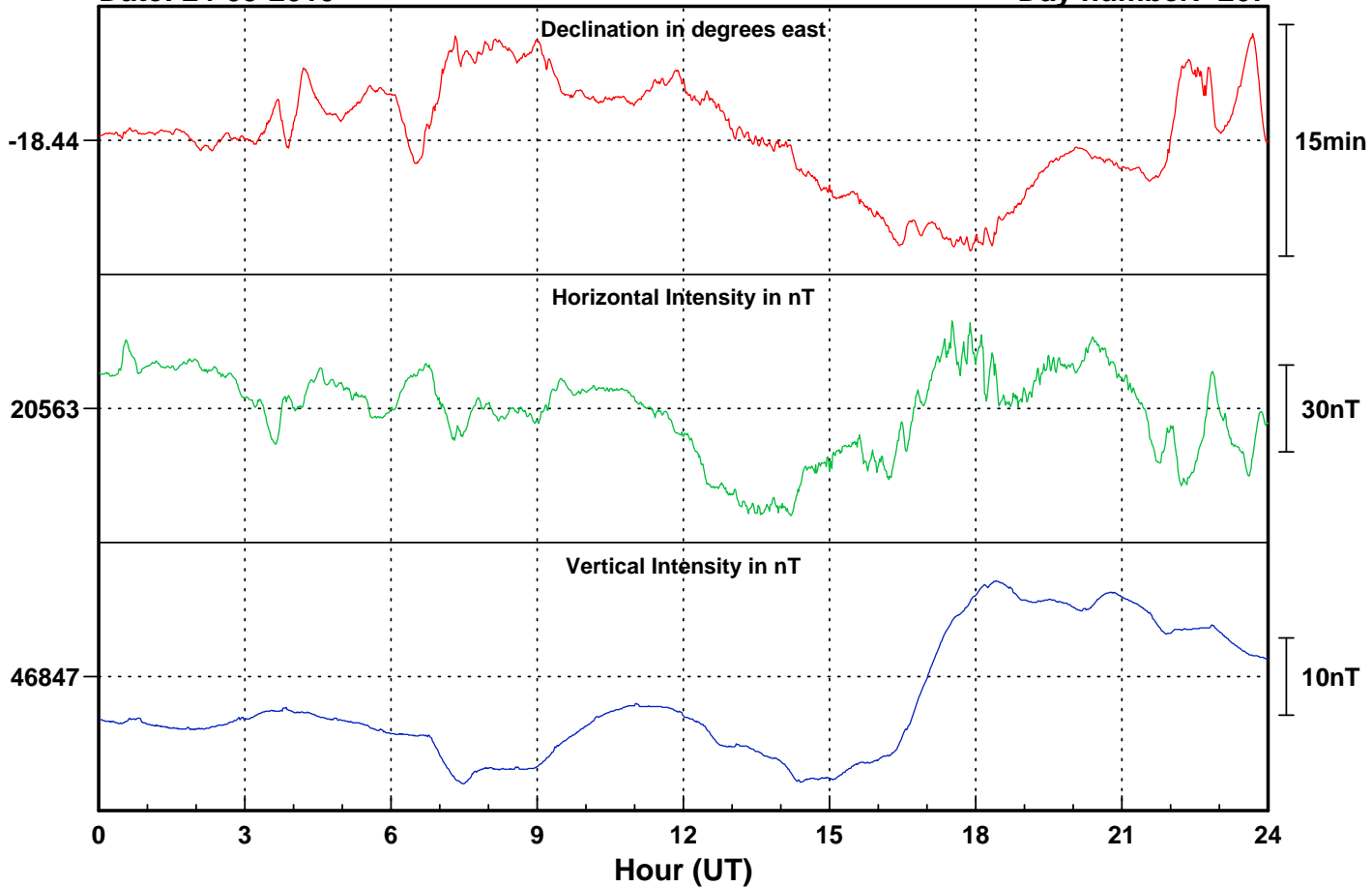
# Sable Island

Day number: 266



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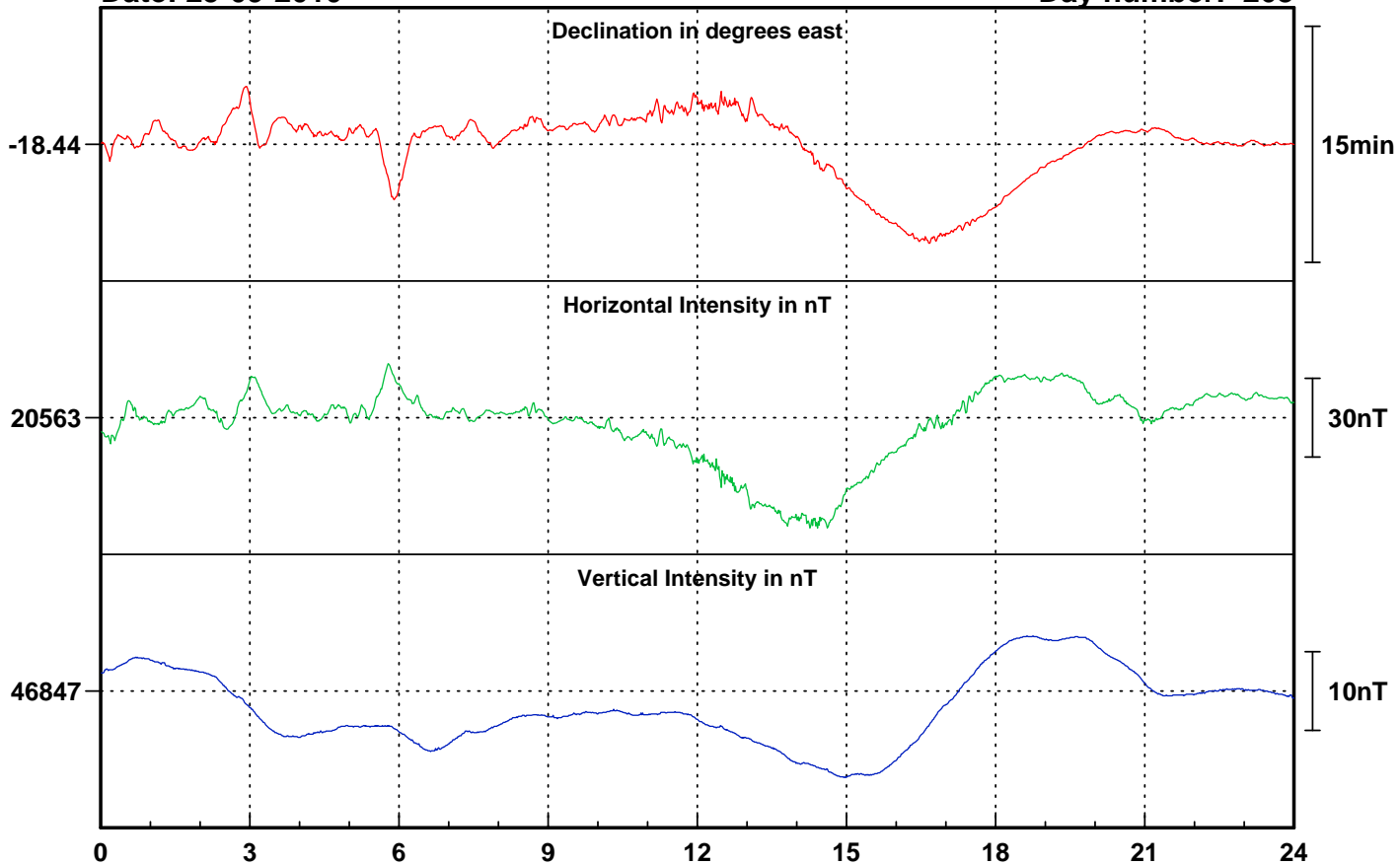
Day number: 267



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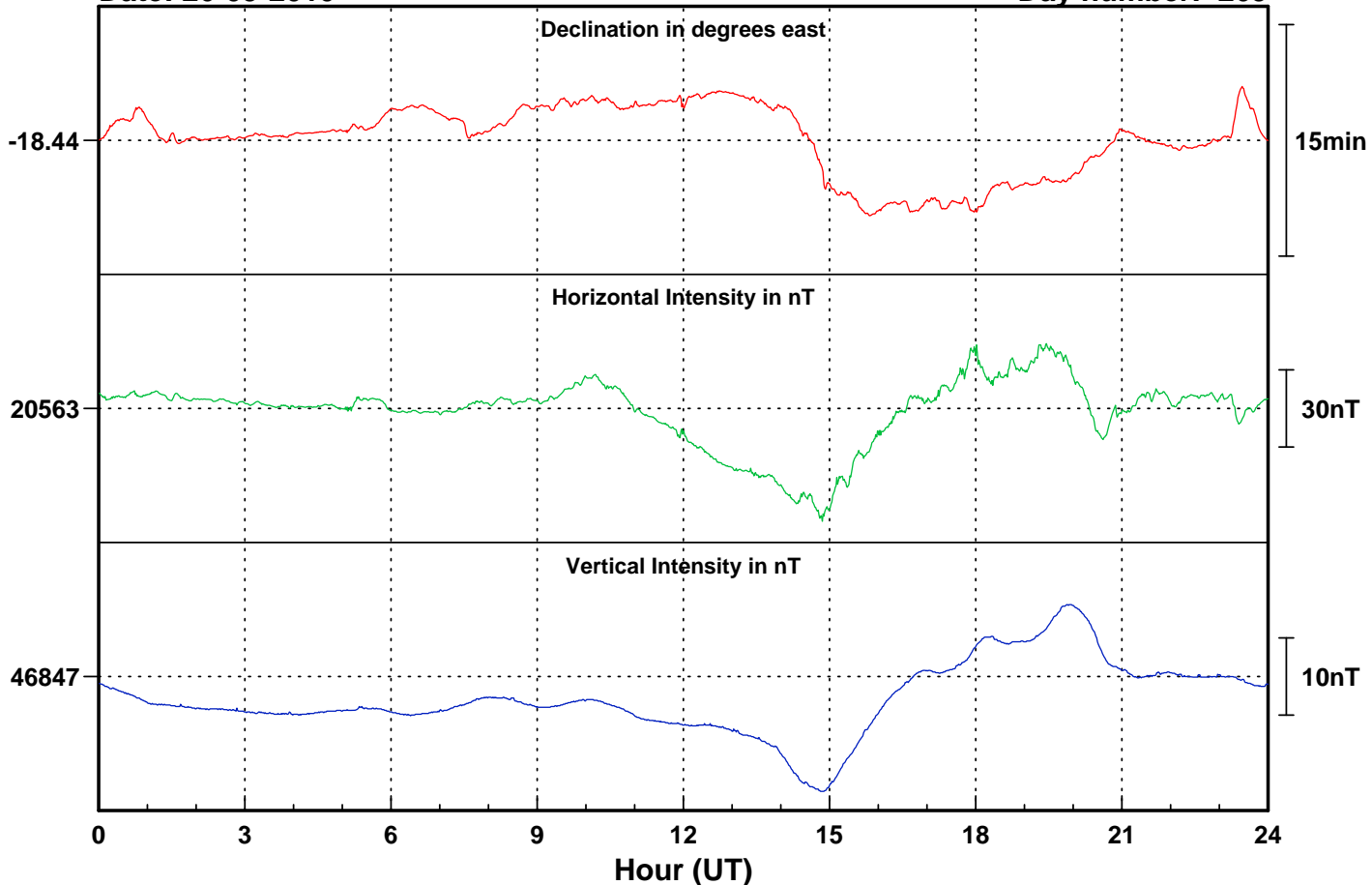
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Day number: 268



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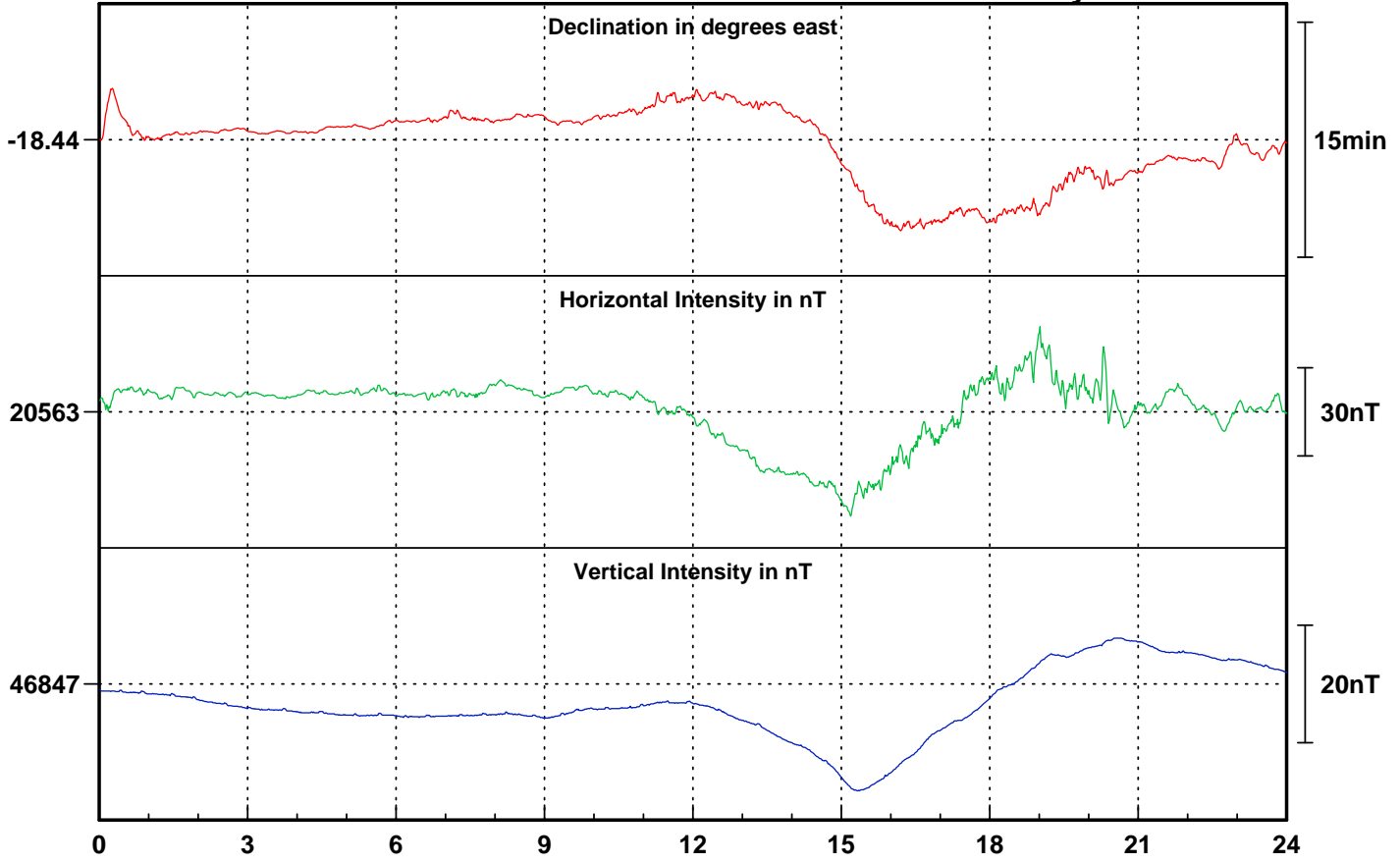
Day number: 269



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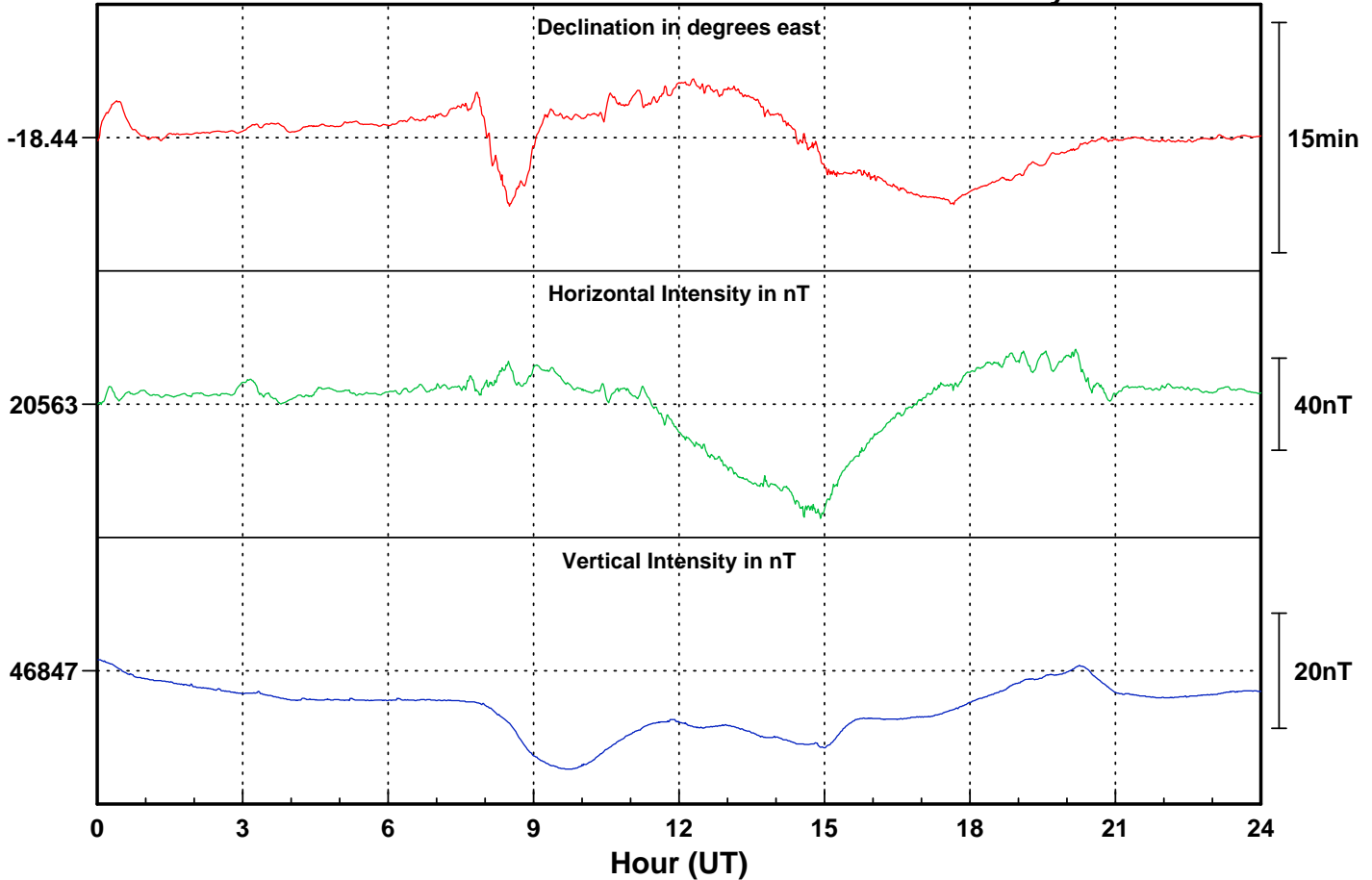
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Day number: 270



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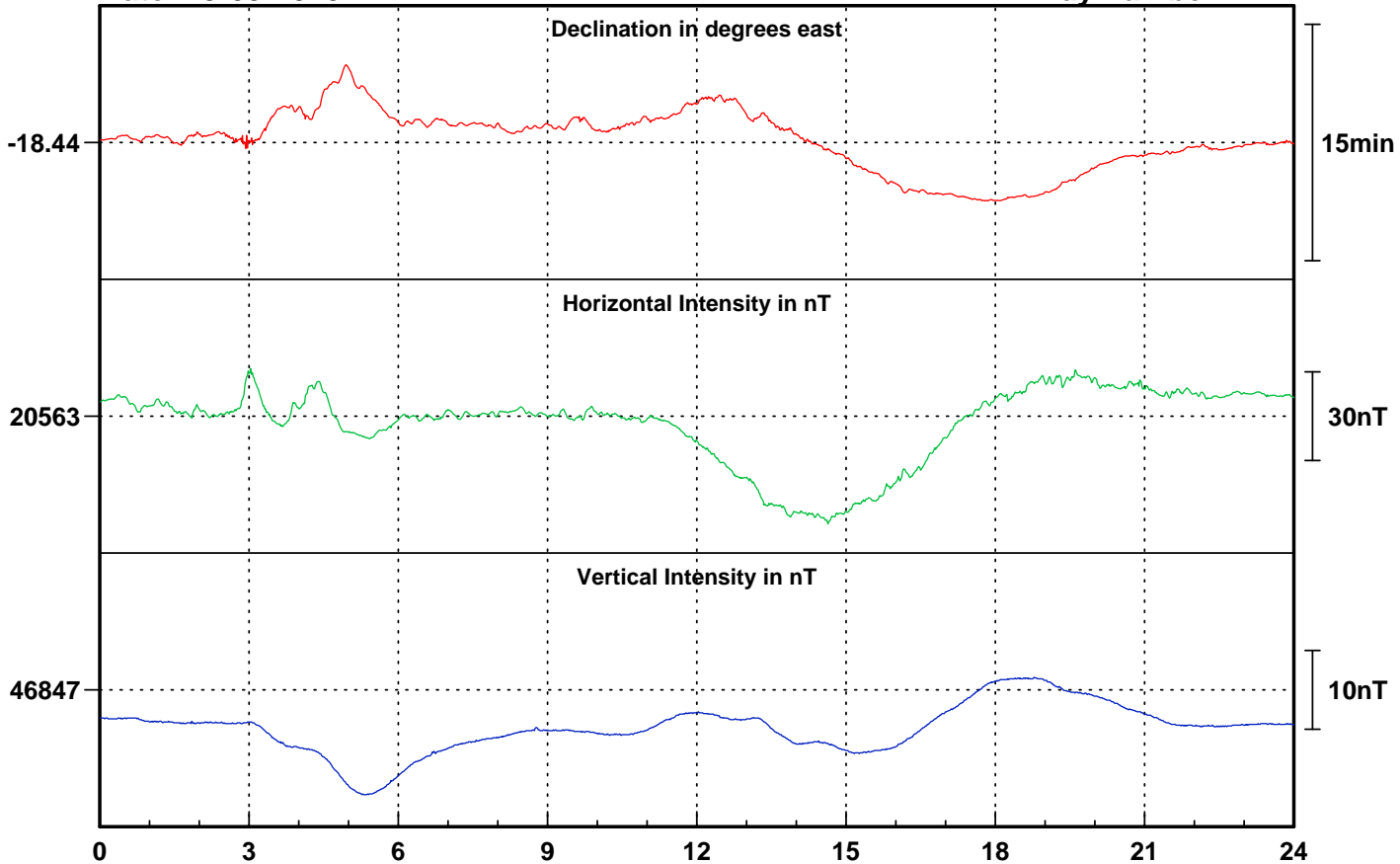
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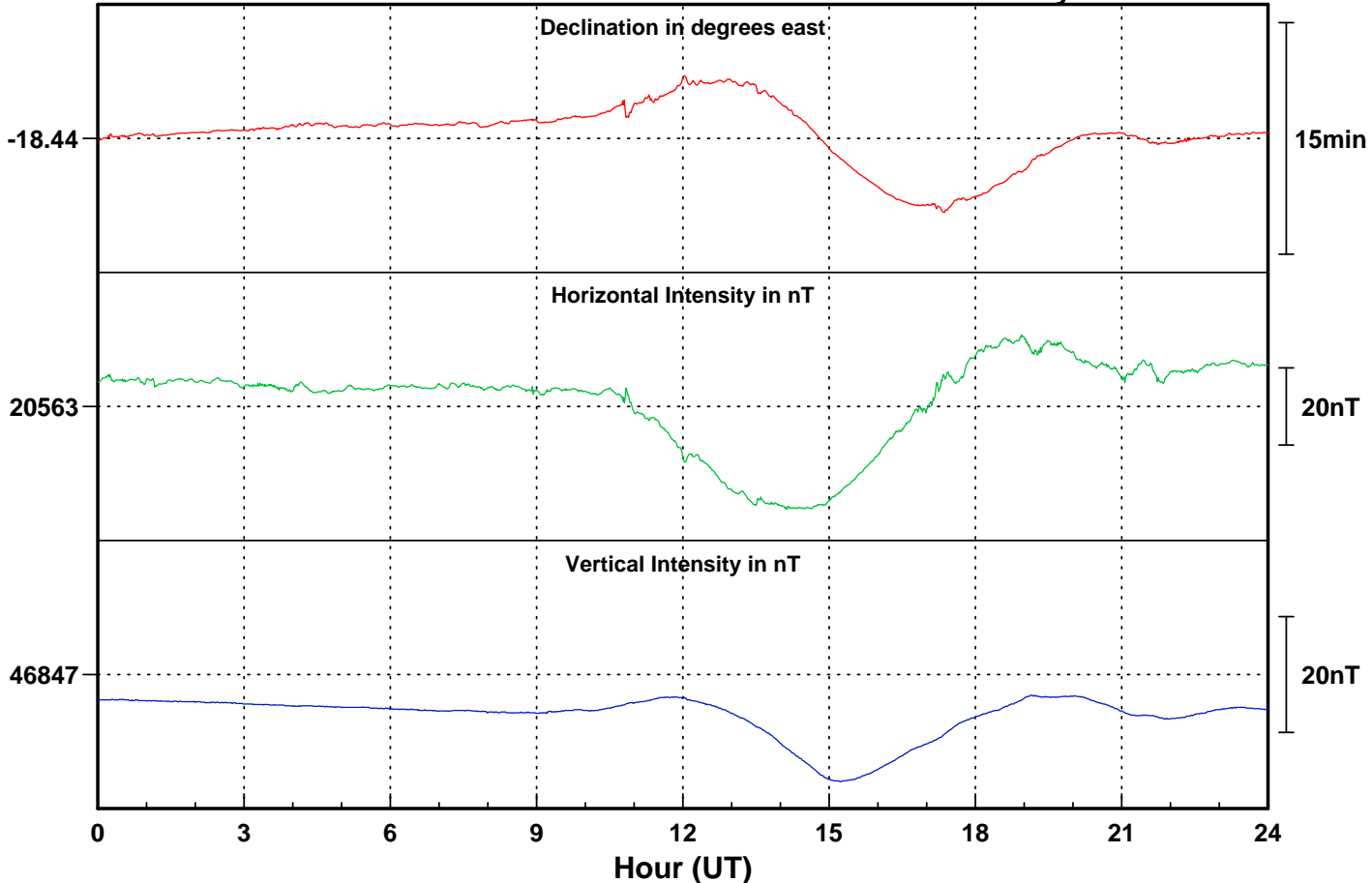
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Day number: 272



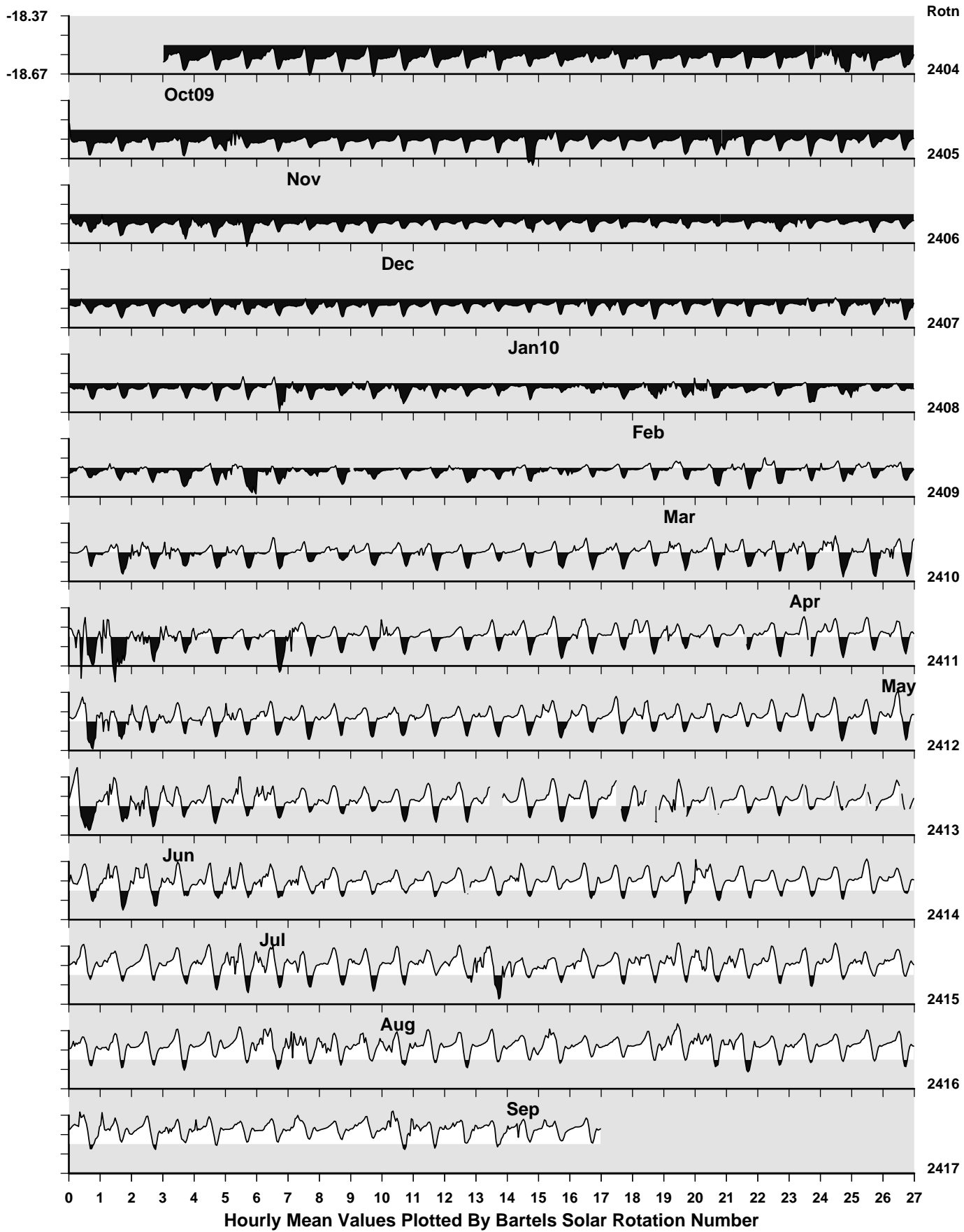
Date: 30-09-2010

Day number: 273

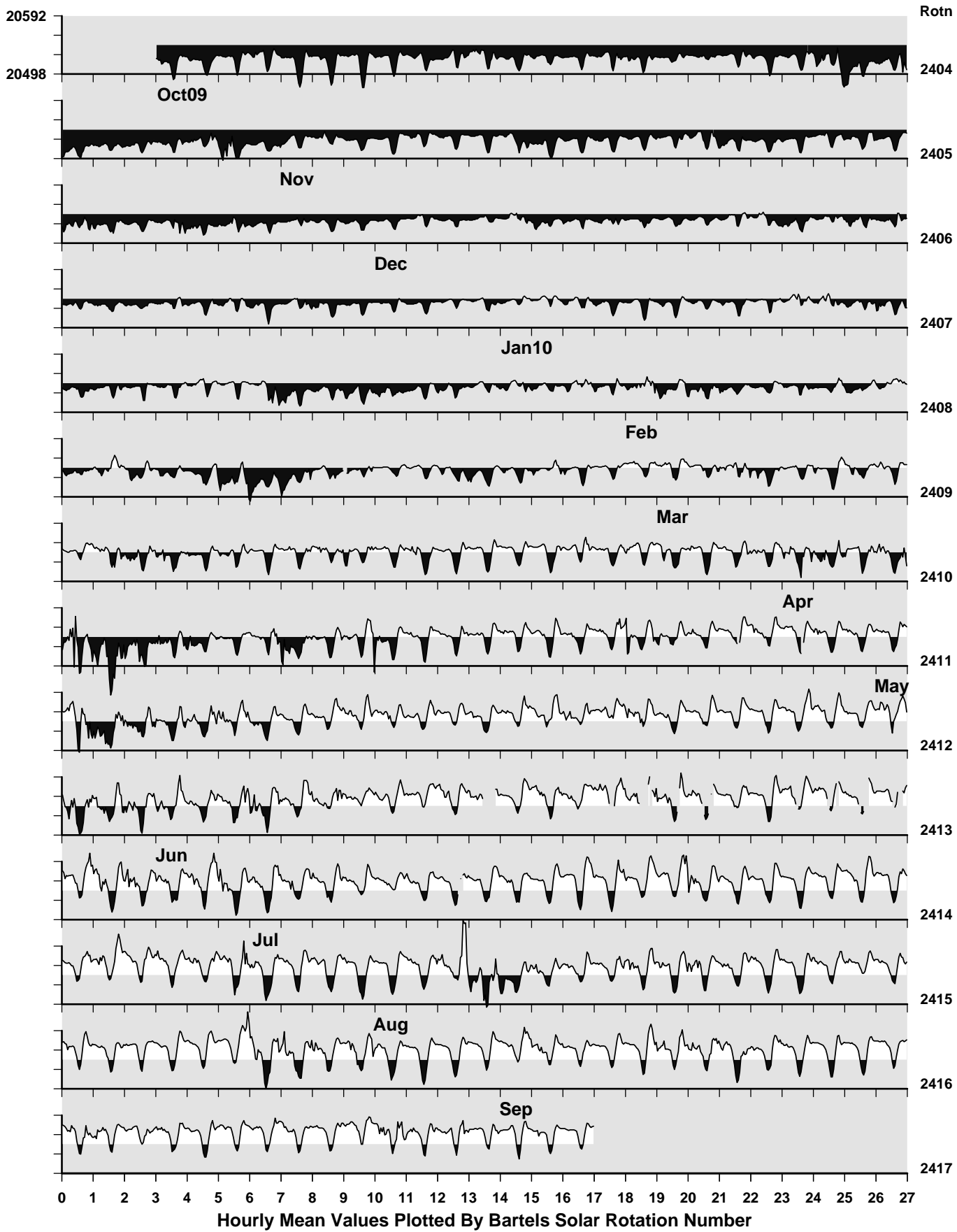




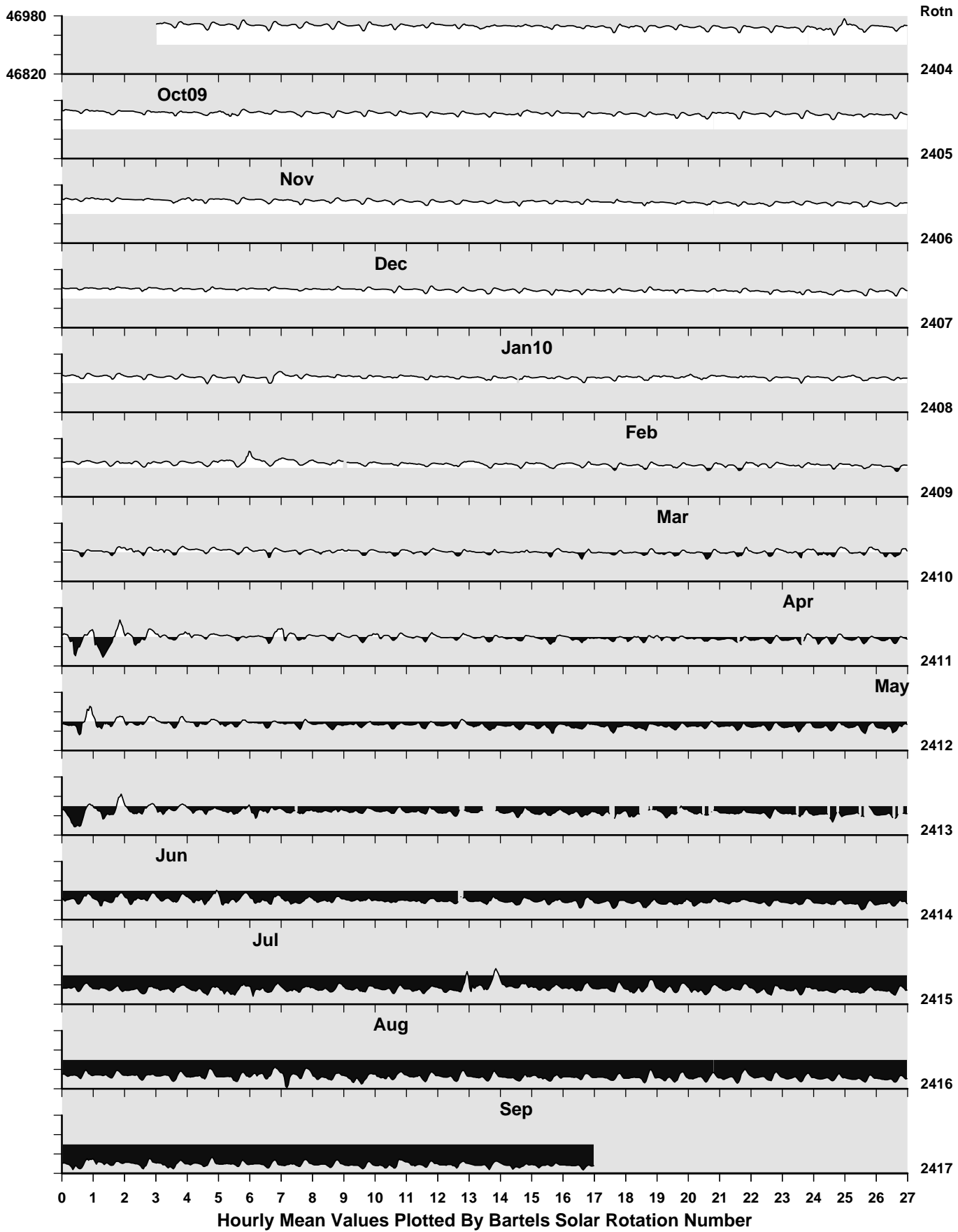
# Sable Island Observatory: Declination (degrees)



# Sable Island Observatory: Horizontal Intensity (nT)

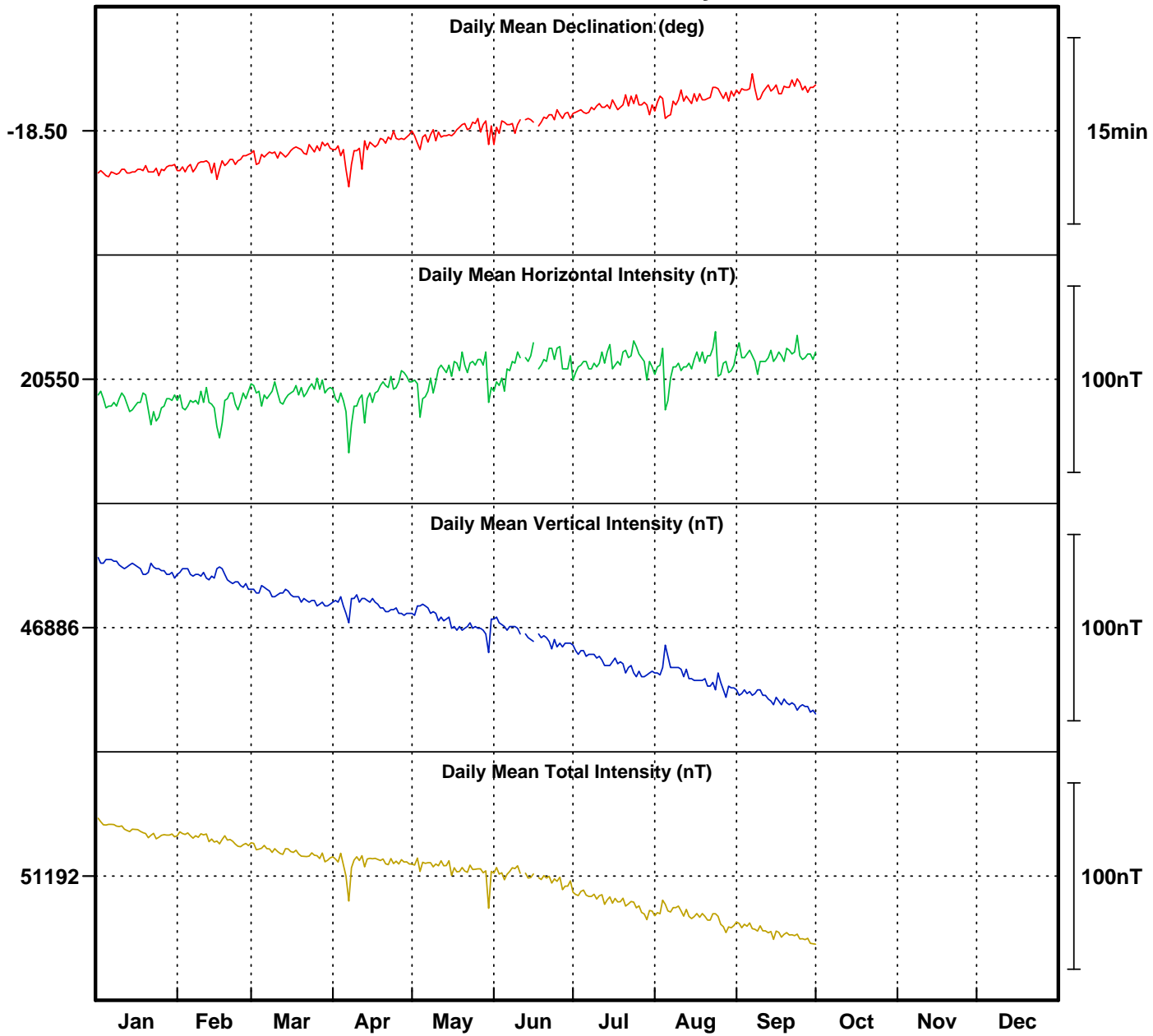


# Sable Island Observatory: Vertical Intensity (nT)



Hourly Mean Values Plotted By Bartels Solar Rotation Number

# Sable Island Observatory 2010



### Monthly Mean Values for Sable Island Observatory 2010

Month	<i>D</i>	<i>H</i>	<i>I</i>	<i>X</i>	<i>Y</i>	<i>Z</i>	<i>F</i>
January	-18° 33.3′	20537 nT	66° 21.6′	19470 nT	-6535 nT	46919 nT	51217 nT
February	-18° 32.8′	20538 nT	66° 21.4′	19471 nT	-6532 nT	46913 nT	51212 nT
March	-18° 31.8′	20544 nT	66° 20.8′	19479 nT	-6529 nT	46903 nT	51205 nT
April	-18° 31.4′	20542 nT	66° 20.7′	19478 nT	-6526 nT	46898 nT	51199 nT
May	-18° 30.2′	20553 nT	66° 19.9′	19490 nT	-6523 nT	46890 nT	51196 nT
June	-18° 29.2′	20559 nT	66° 19.3′	19498 nT	-6519 nT	46882 nT	51191 nT
July	-18° 28.1′	20560 nT	66° 18.8′	19501 nT	-6513 nT	46867 nT	51179 nT
August	-18° 27.5′	20558 nT	66° 18.7′	19500 nT	-6509 nT	46860 nT	51171 nT
September	-18° 26.7′	20563 nT	66° 18.1′	19507 nT	-6506 nT	46847 nT	51162 nT

#### Note

i. The values shown here are provisional.