

**BRITISH GEOLOGICAL SURVEY**

**Sable Island  
Observatory  
Monthly  
Magnetic  
Bulletin**

**August 2016**

**16/08/SB**



**British  
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

# SABLE ISLAND OBSERVATORY MAGNETIC DATA

## 1. Introduction

Sable Island geomagnetic observatory was established by the British Geological Survey (BGS). The installation was a joint venture between BGS, Halliburton (Sperry Drilling Services at the time), and Sable Offshore Energy in support of directional drilling programmes. The observatory became operational from 8th May 1999. Halliburton discontinued their involvement from 2011 and BGS continued the observatory operations with support from Environment Canada.

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.

Enquiries about the data should be addressed to:

Geomagnetism Team  
Earth Hazards and Systems  
British Geological Survey  
Murchison House, West Mains Road  
Edinburgh EH9 3LA  
Scotland, UK

Tel: +44 (0) 131 667 1000  
Fax: +44 (0) 131 668 2683  
E-mail: [enquiries@bgs.ac.uk](mailto:enquiries@bgs.ac.uk)  
Internet: [www.geomag.bgs.ac.uk](http://www.geomag.bgs.ac.uk)

## 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°55'55.2"N 299°59'27.6"E  
*Geomagnetic:* 53°17'07"N 015°26'17"E  
*Height above mean sea level:* 5m (approx)

The geographical coordinates are measured by a handheld GPS device, which uses WGS84 as the reference coordinate system. The height above MSL is determined from the best available contour maps. The geomagnetic co-ordinates are approximations, calculated using the 12th

generation International Geomagnetic Reference Field (IGRF) at epoch 2016.5.

On-line access to models (including IGRF), charts and navigational data are available at [http://www.geomag.bgs.ac.uk/data\\_service/models\\_compass/home](http://www.geomag.bgs.ac.uk/data_service/models_compass/home)

## 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 in cooperation with Environment Canada (EC).'

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/contactus/staff](http://www.geomag.bgs.ac.uk/contactus/staff)



# Sable Island 2016

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

-18.02

5min

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

20613

20nT

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

46518

8nT

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

0.0

20nT

Temperature Inside Variometer Hut

23.4

20°C

Jan

Feb

Mar

Apr

May

Jun

Jul

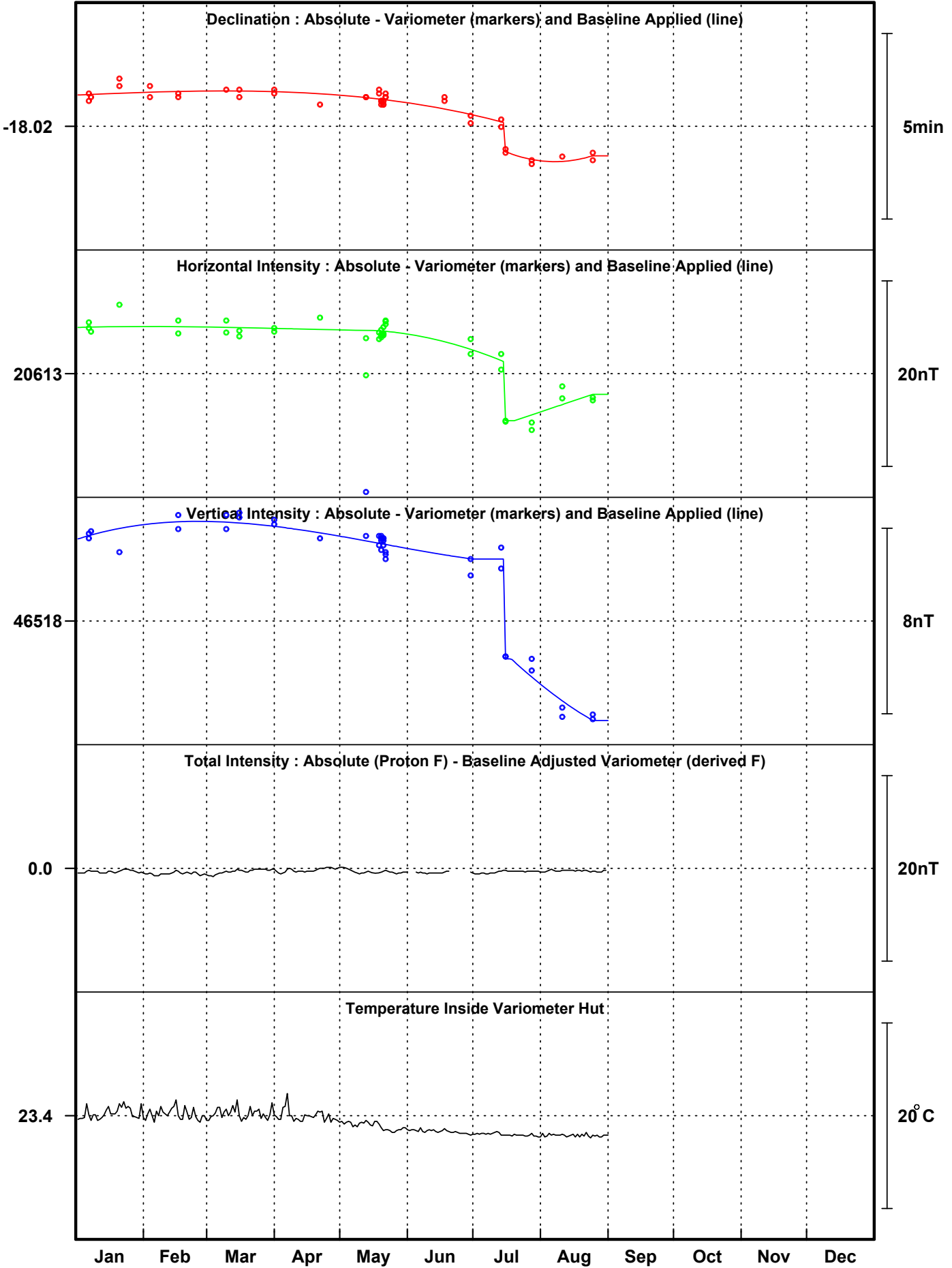
Aug

Sep

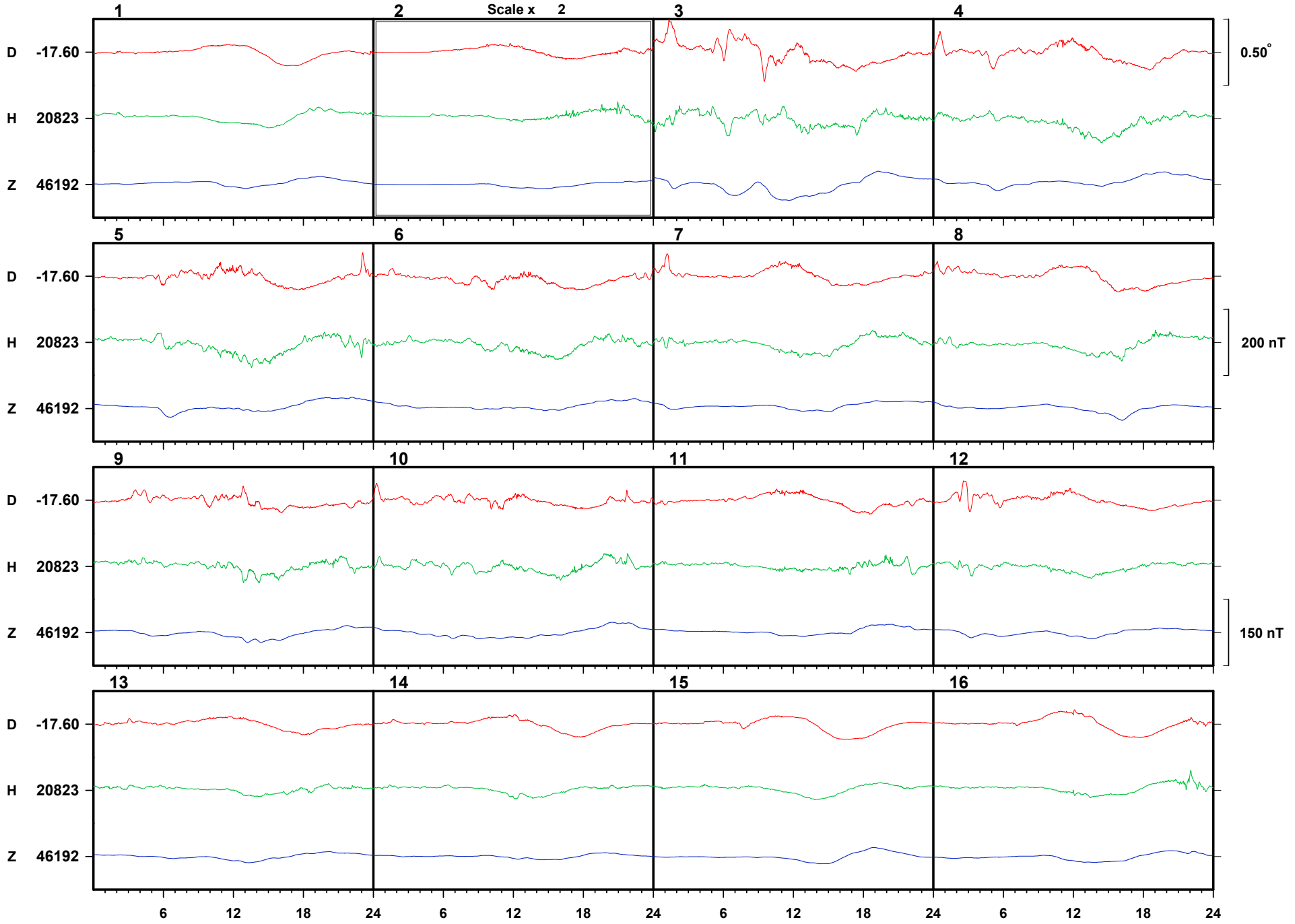
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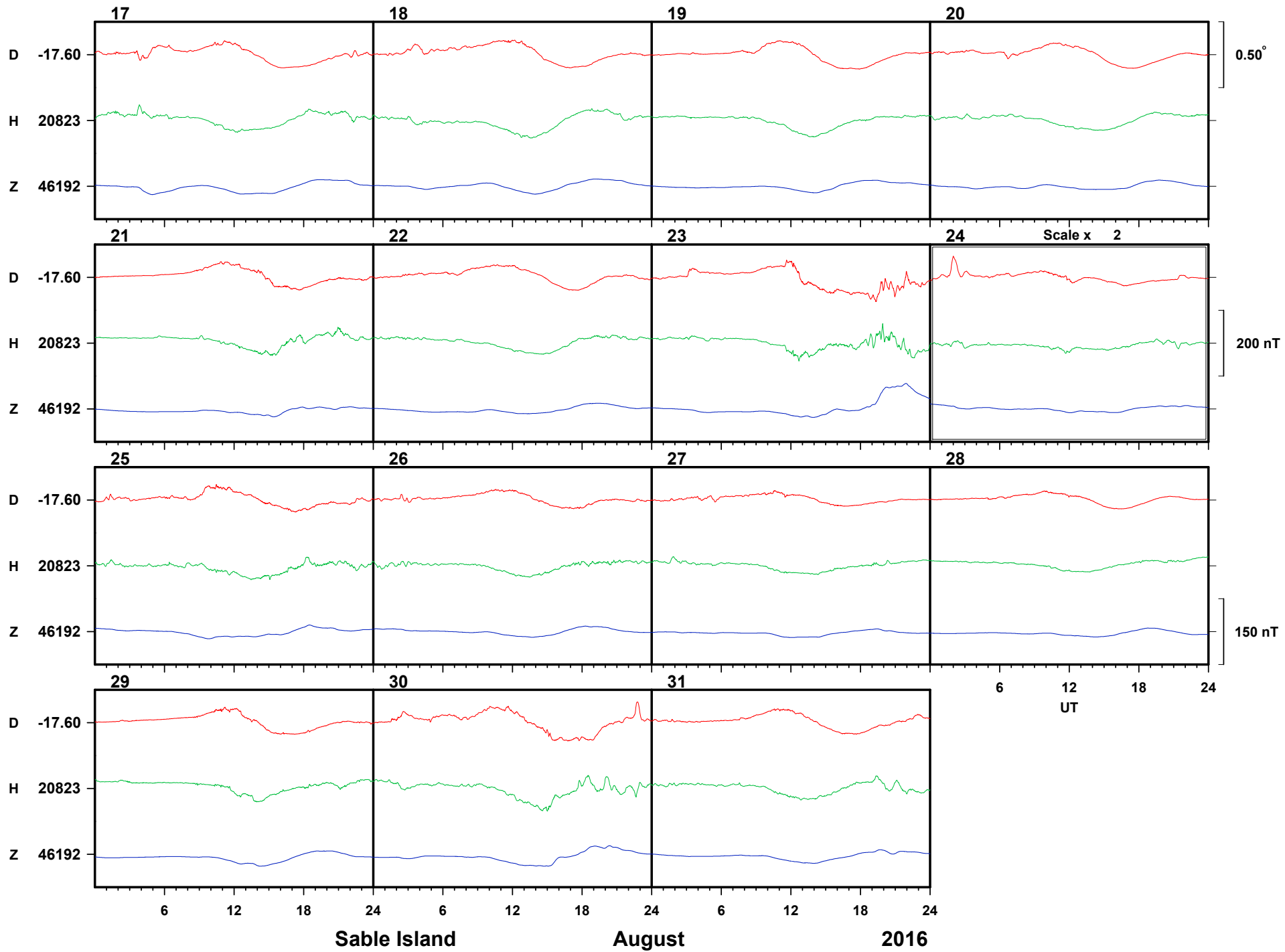
Nov

Dec



Sable Island August 2016



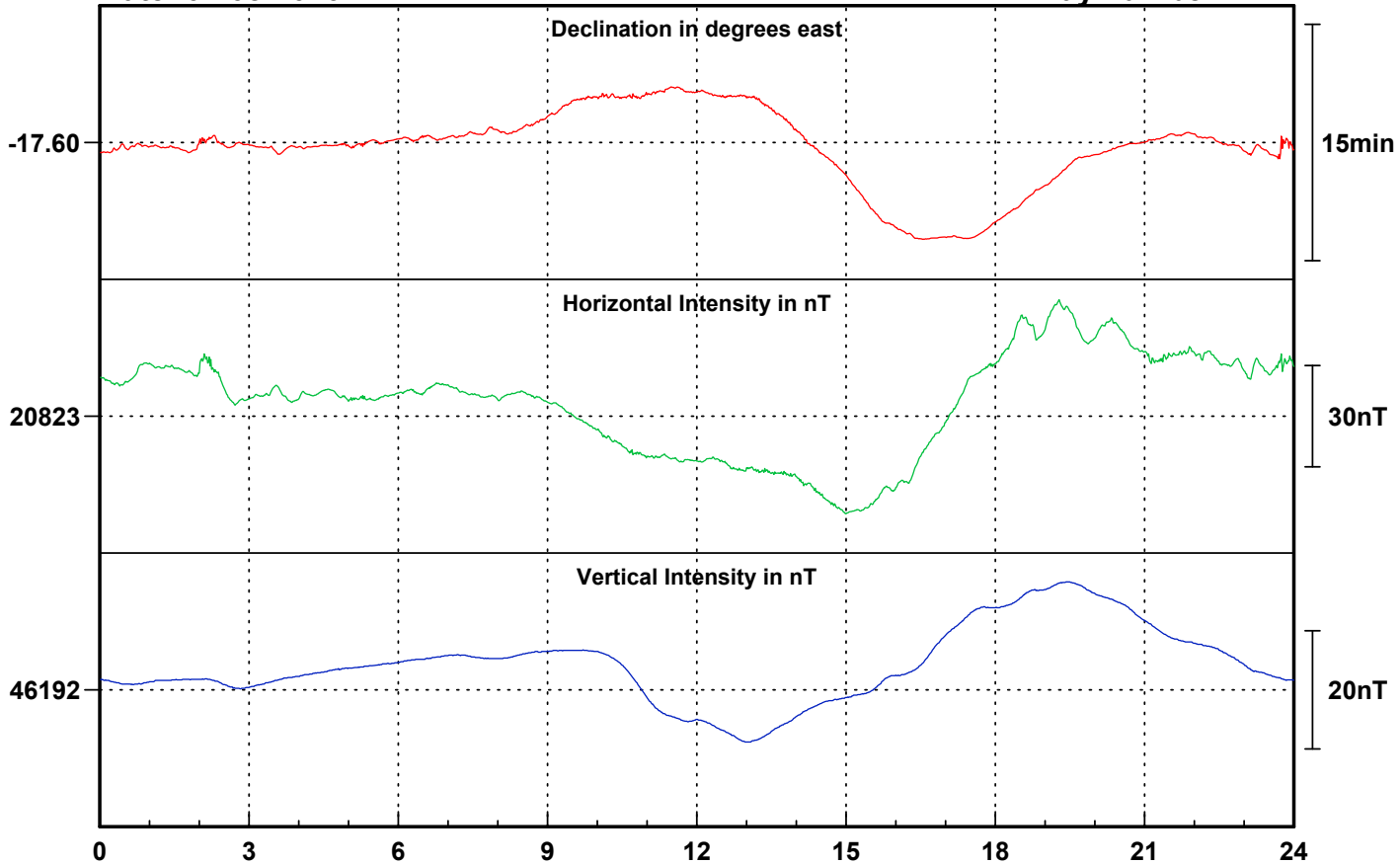




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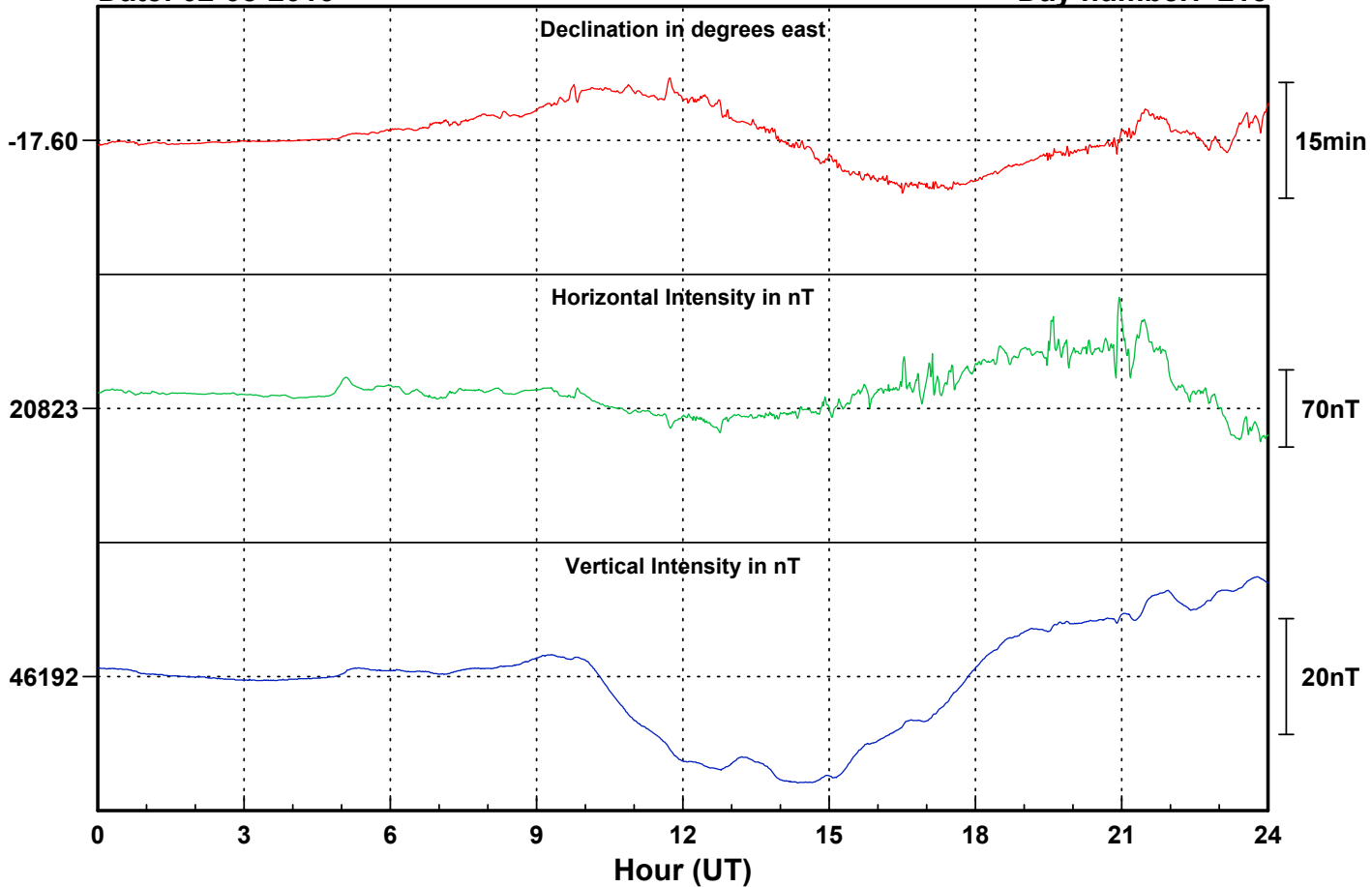
# Sable Island

Day number: 214



Date: 02-08-2016

Day number: 215

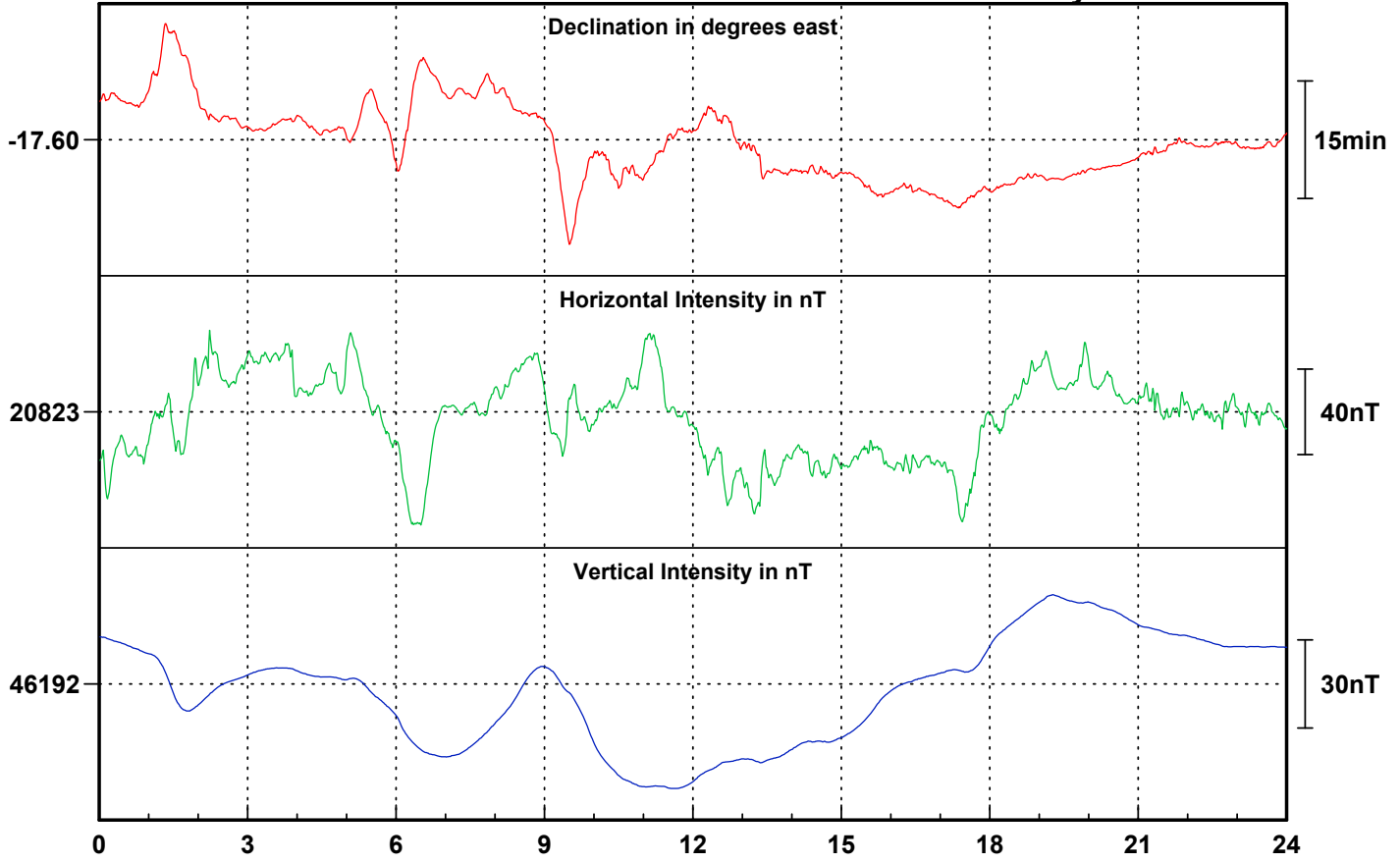




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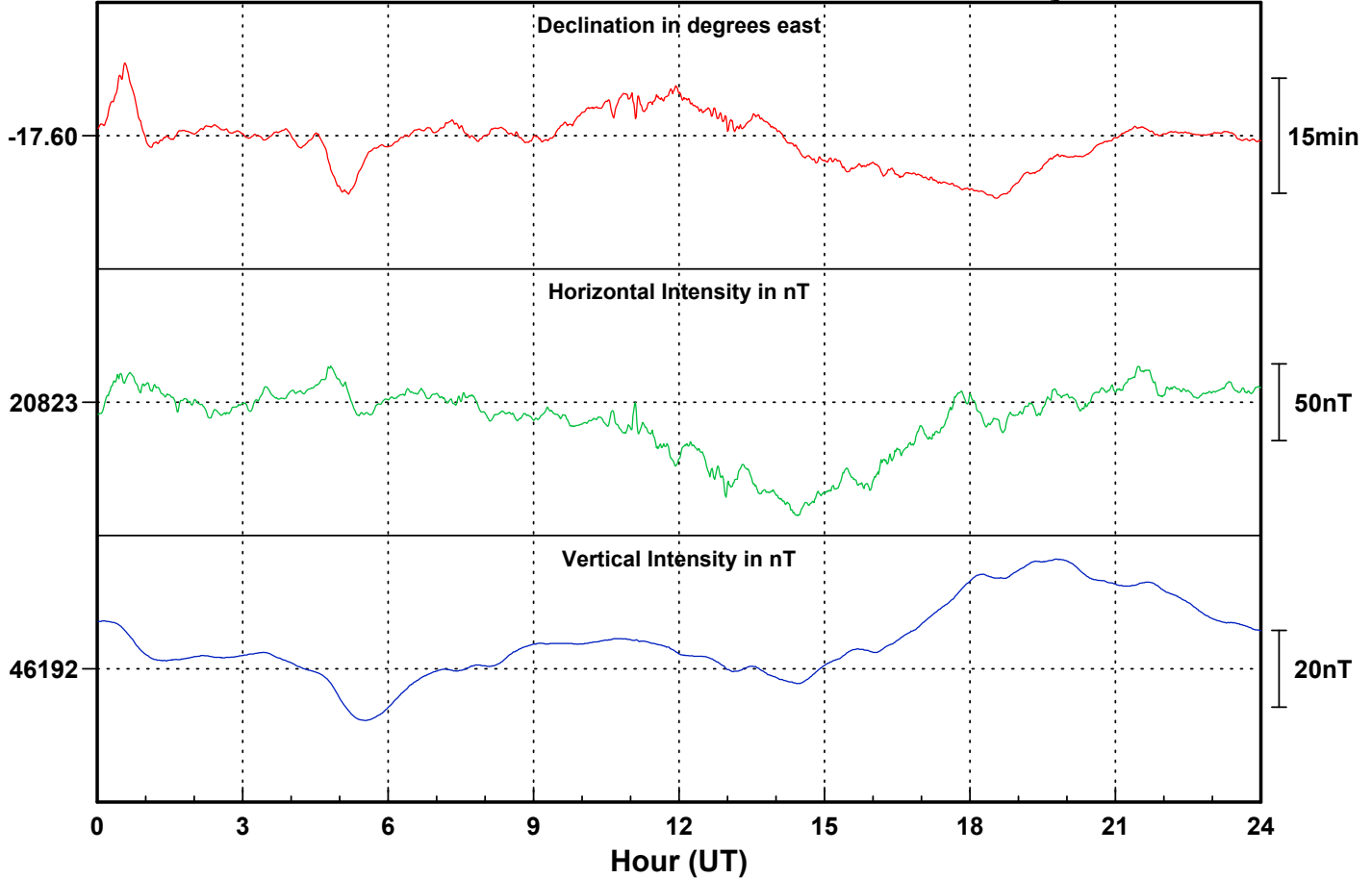
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Day number: 216



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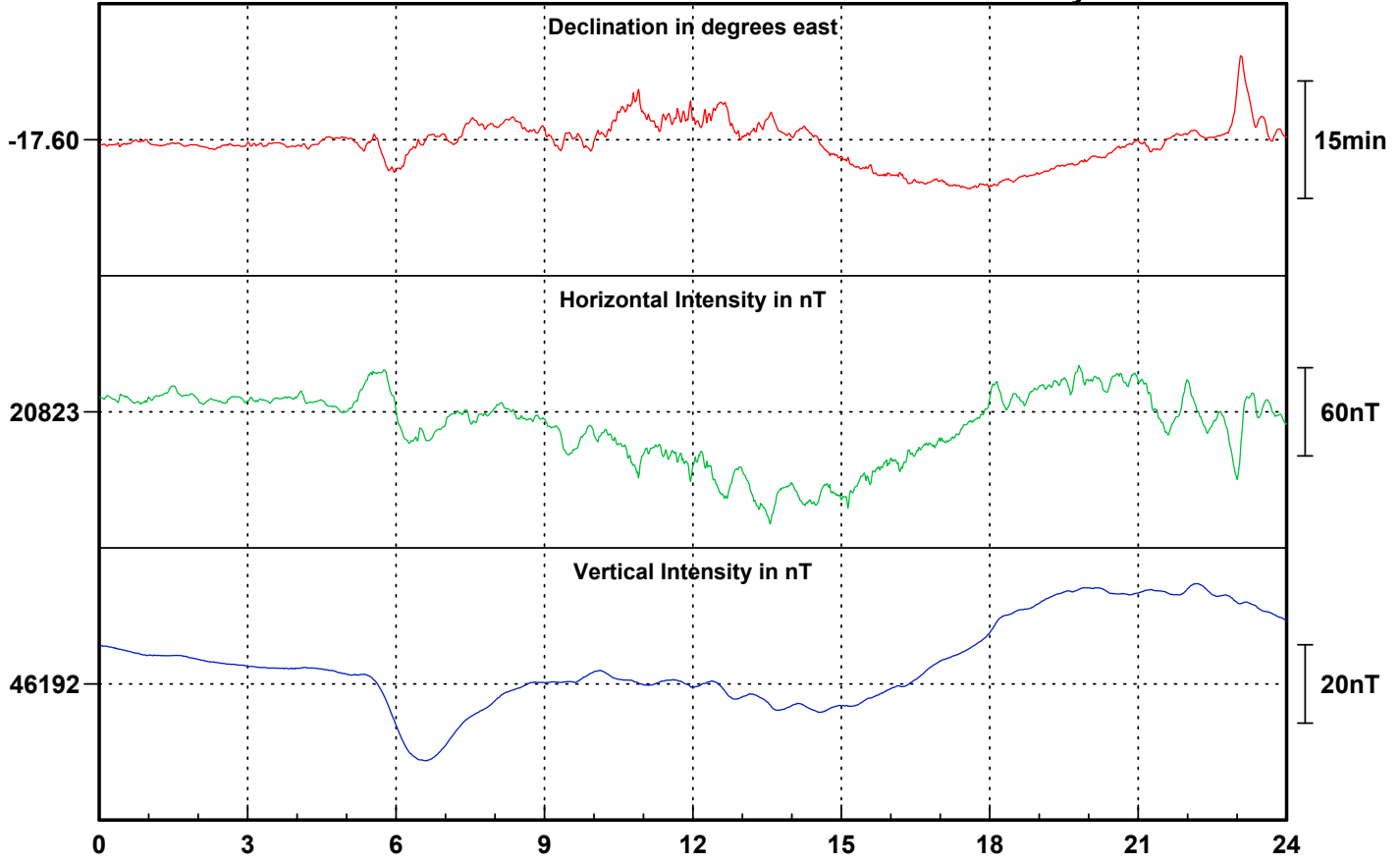
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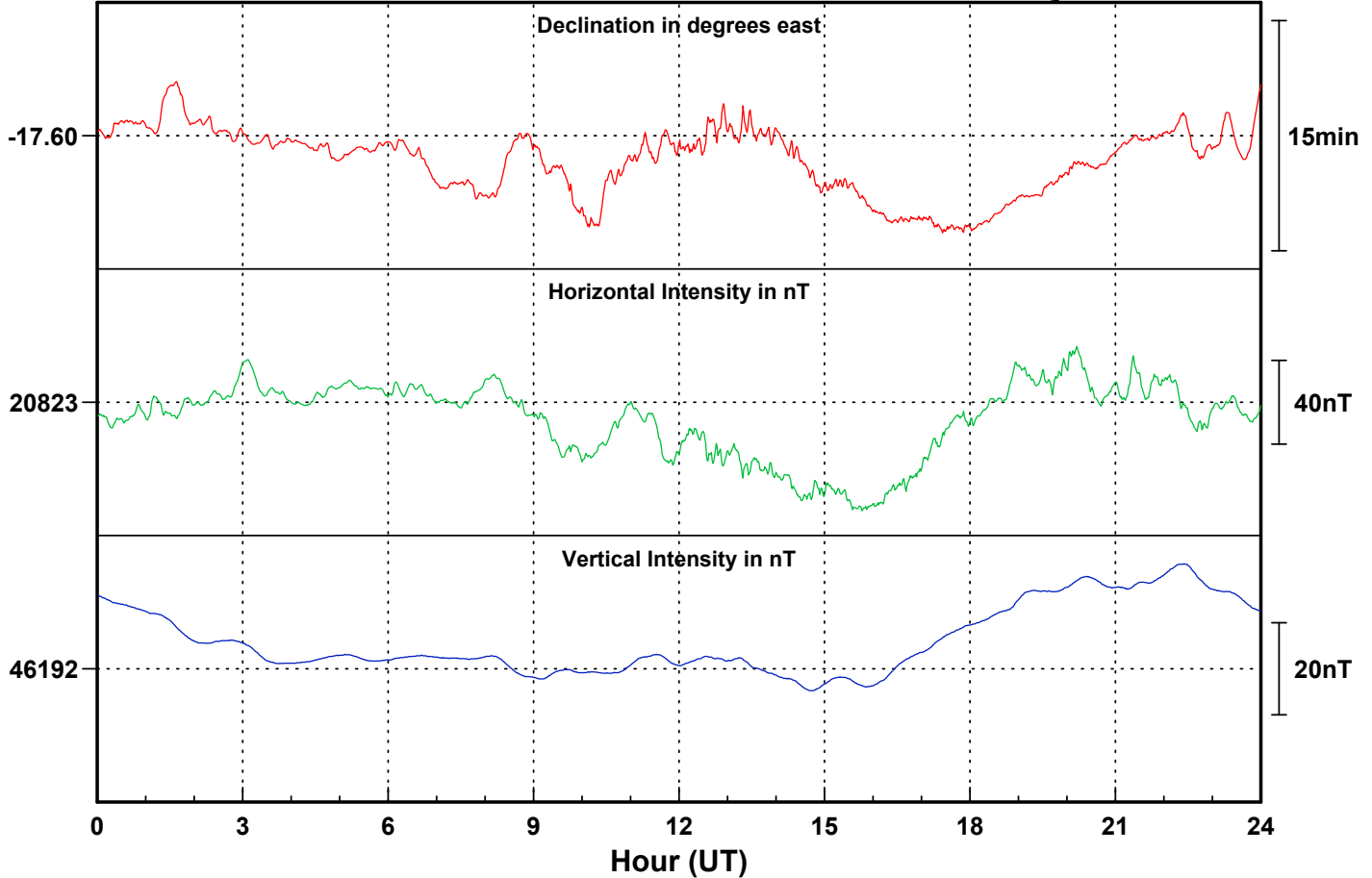
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Day number: 218



Date: 06-08-2016

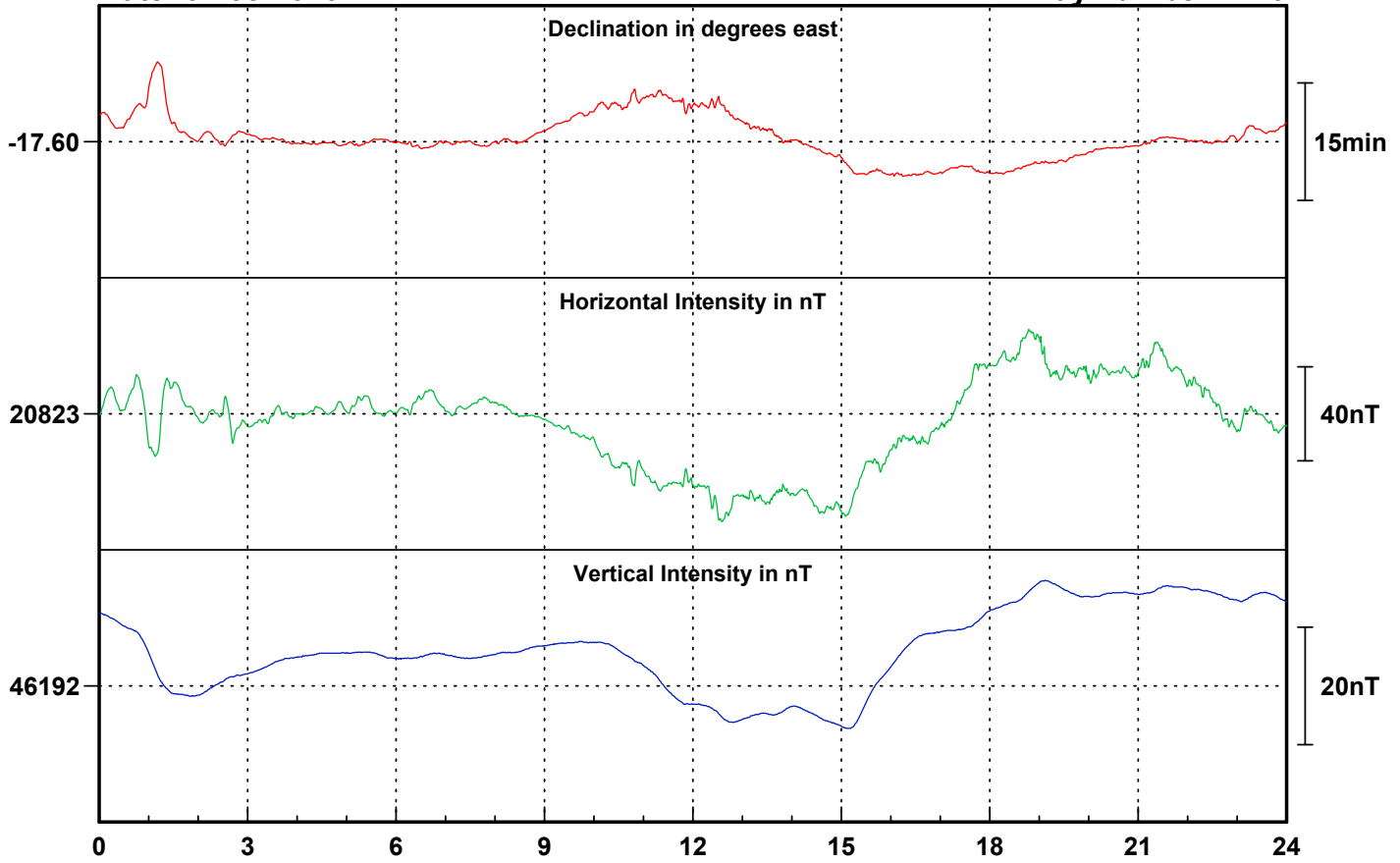
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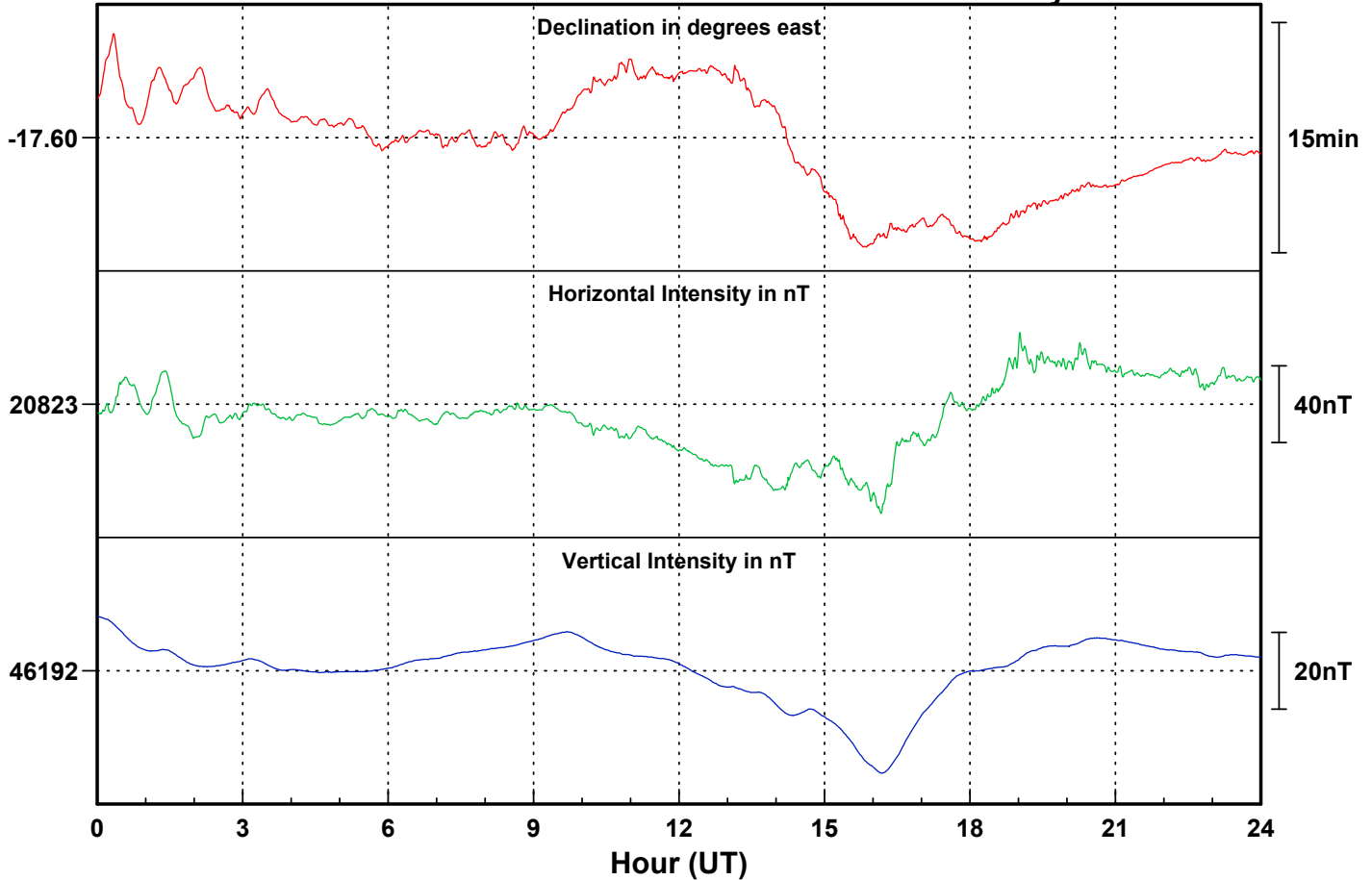
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Day number: 220



Date: 08-08-2016

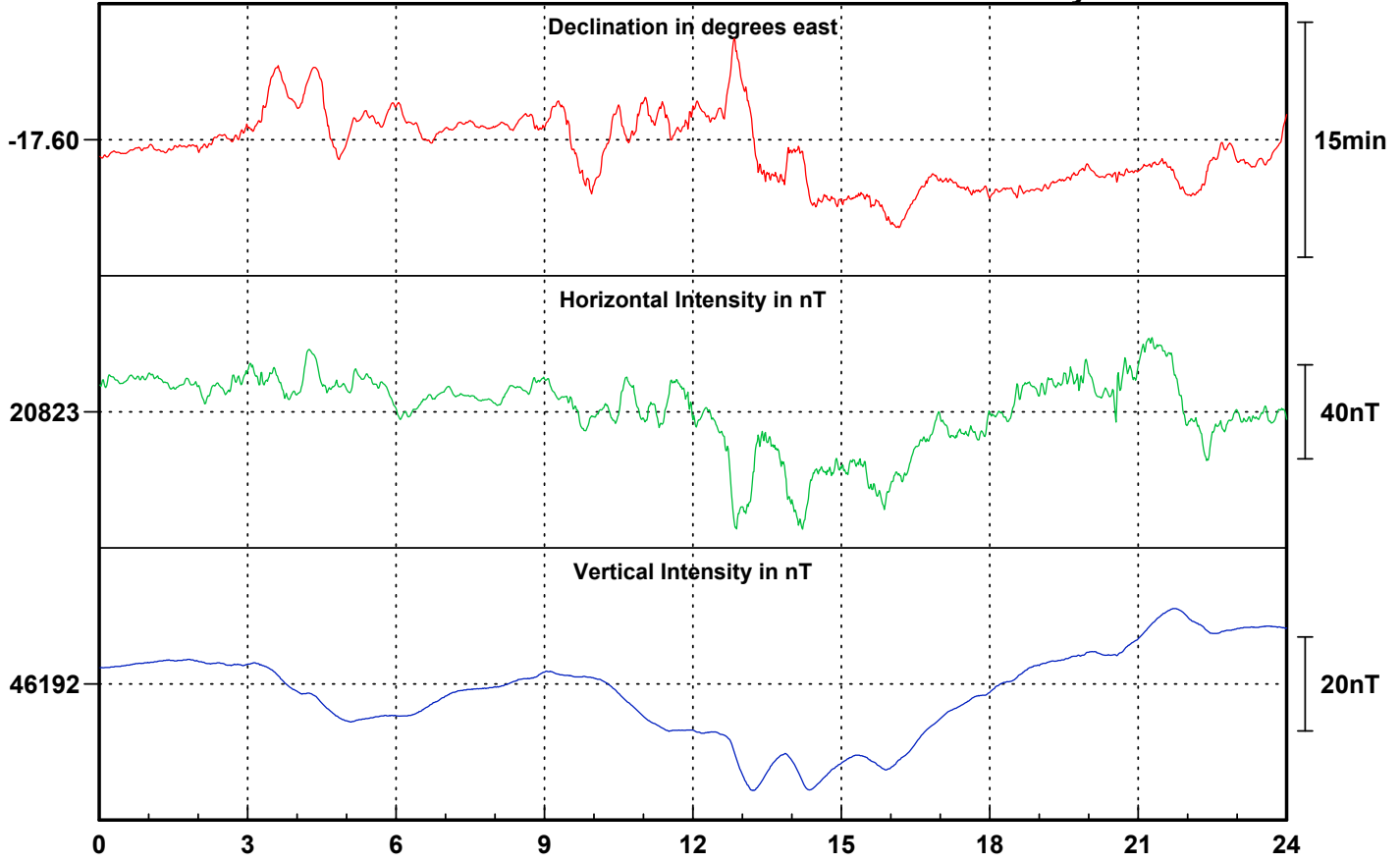
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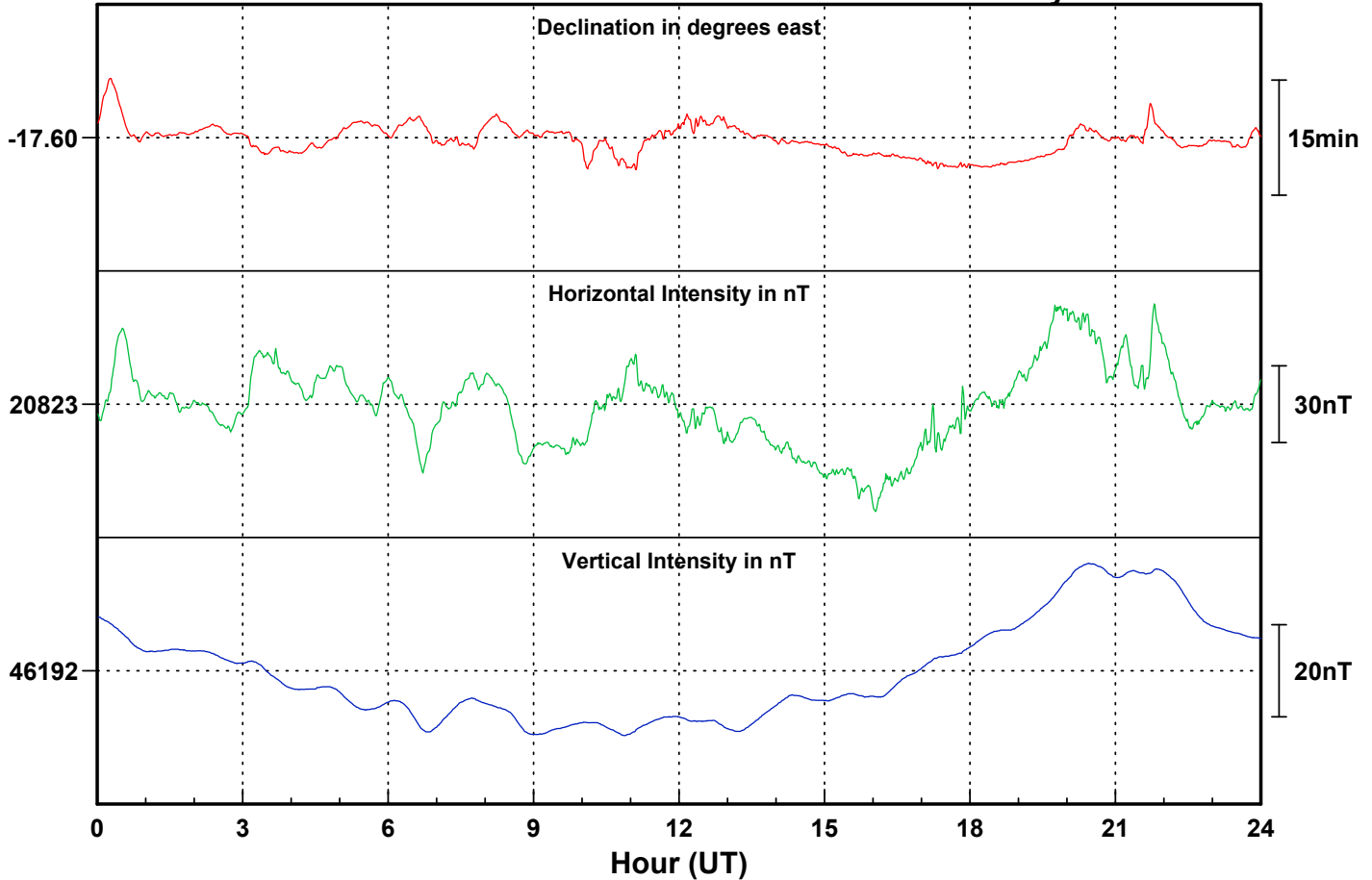
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Day number: 222



Date: 10-08-2016

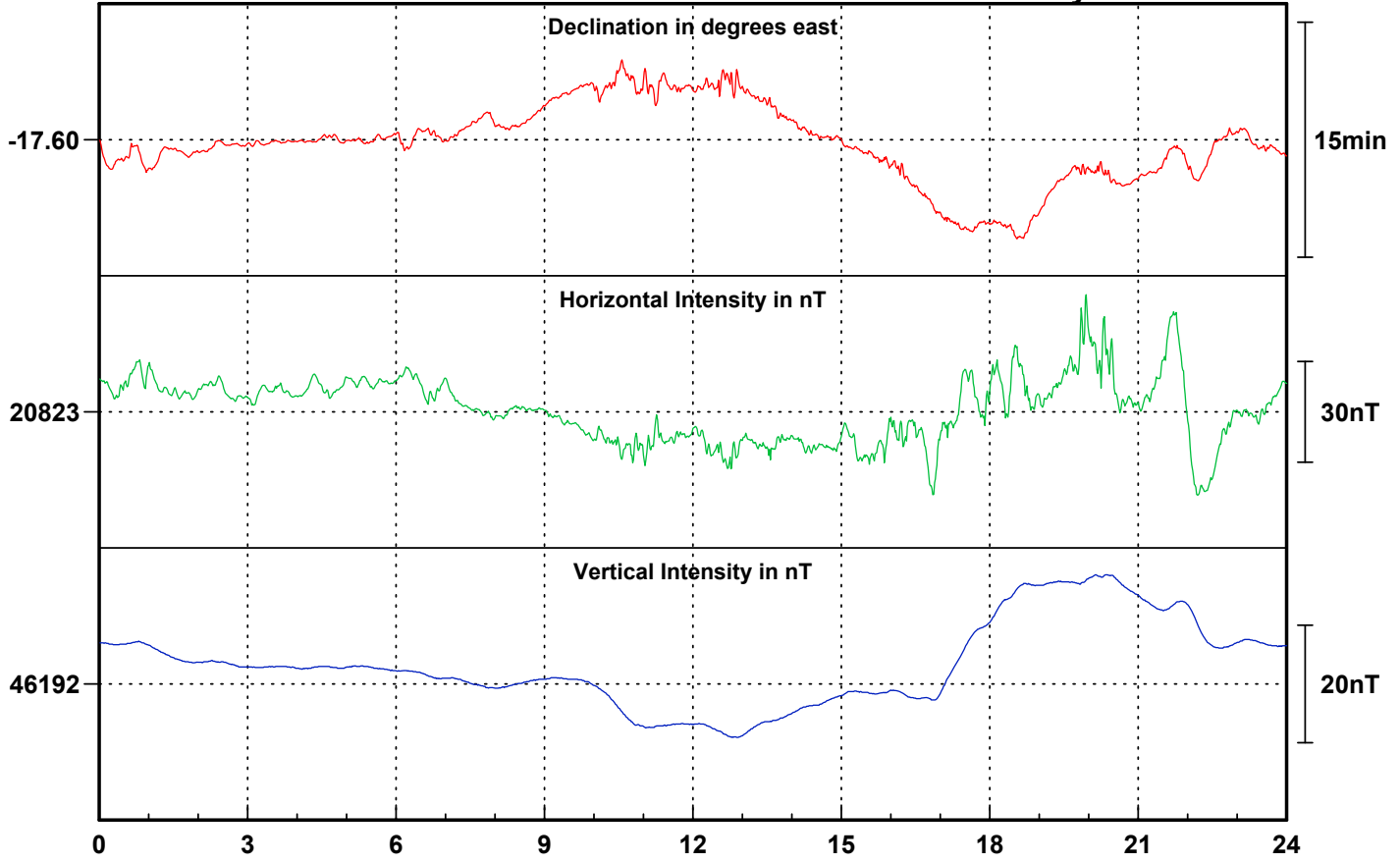
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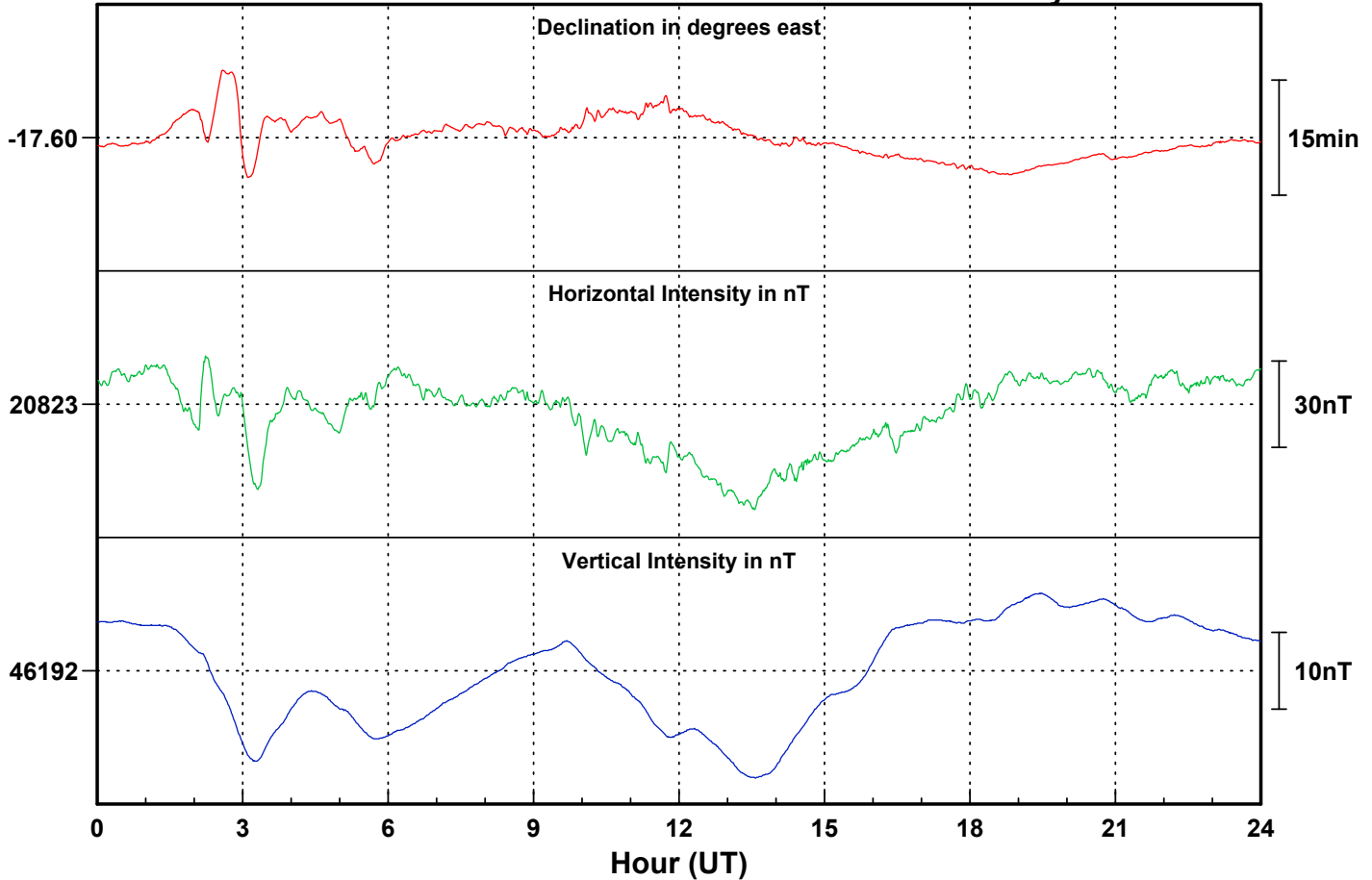
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Day number: 224



Date: 12-08-2016

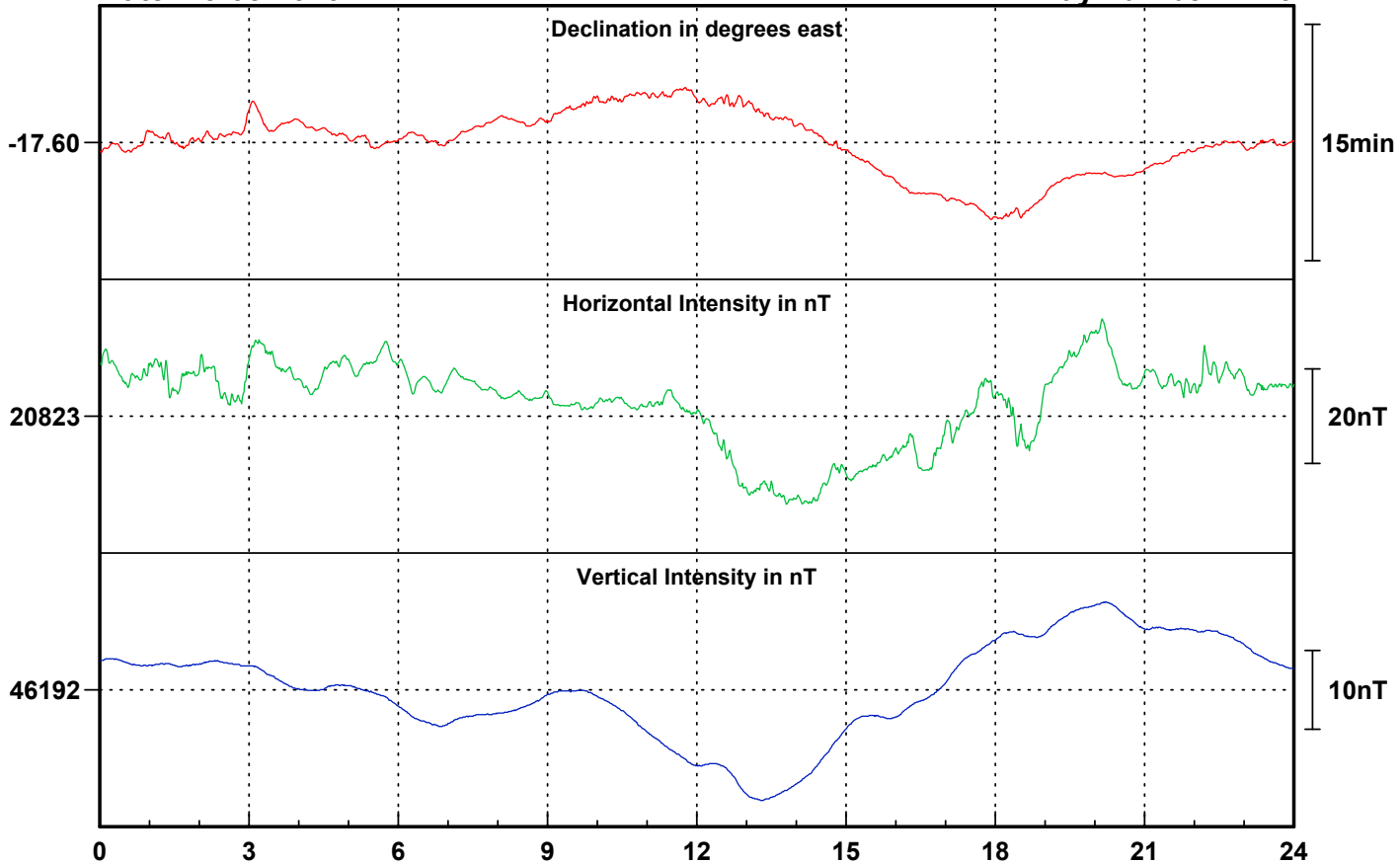
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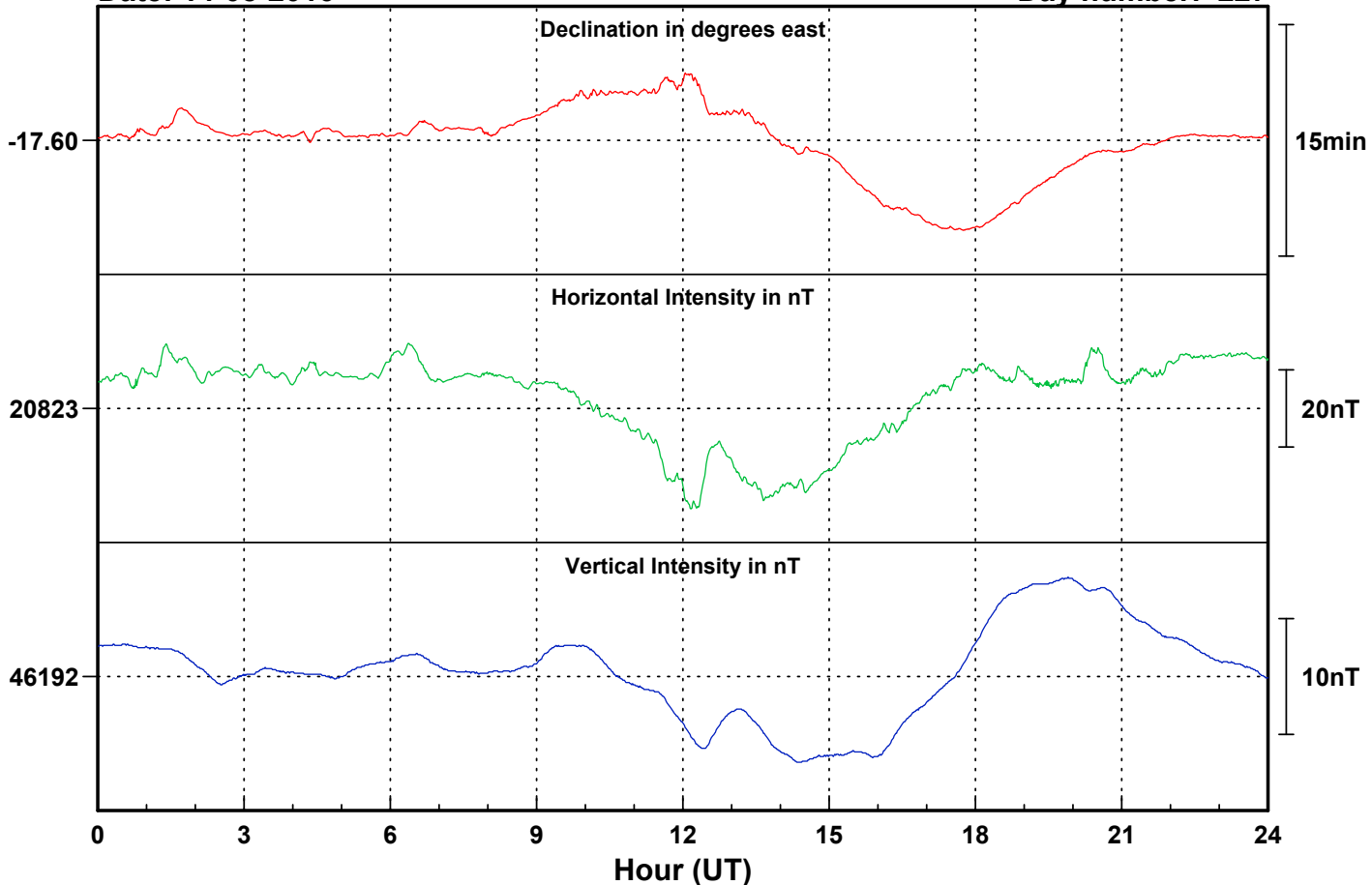
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Day number: 226



Date: 14-08-2016

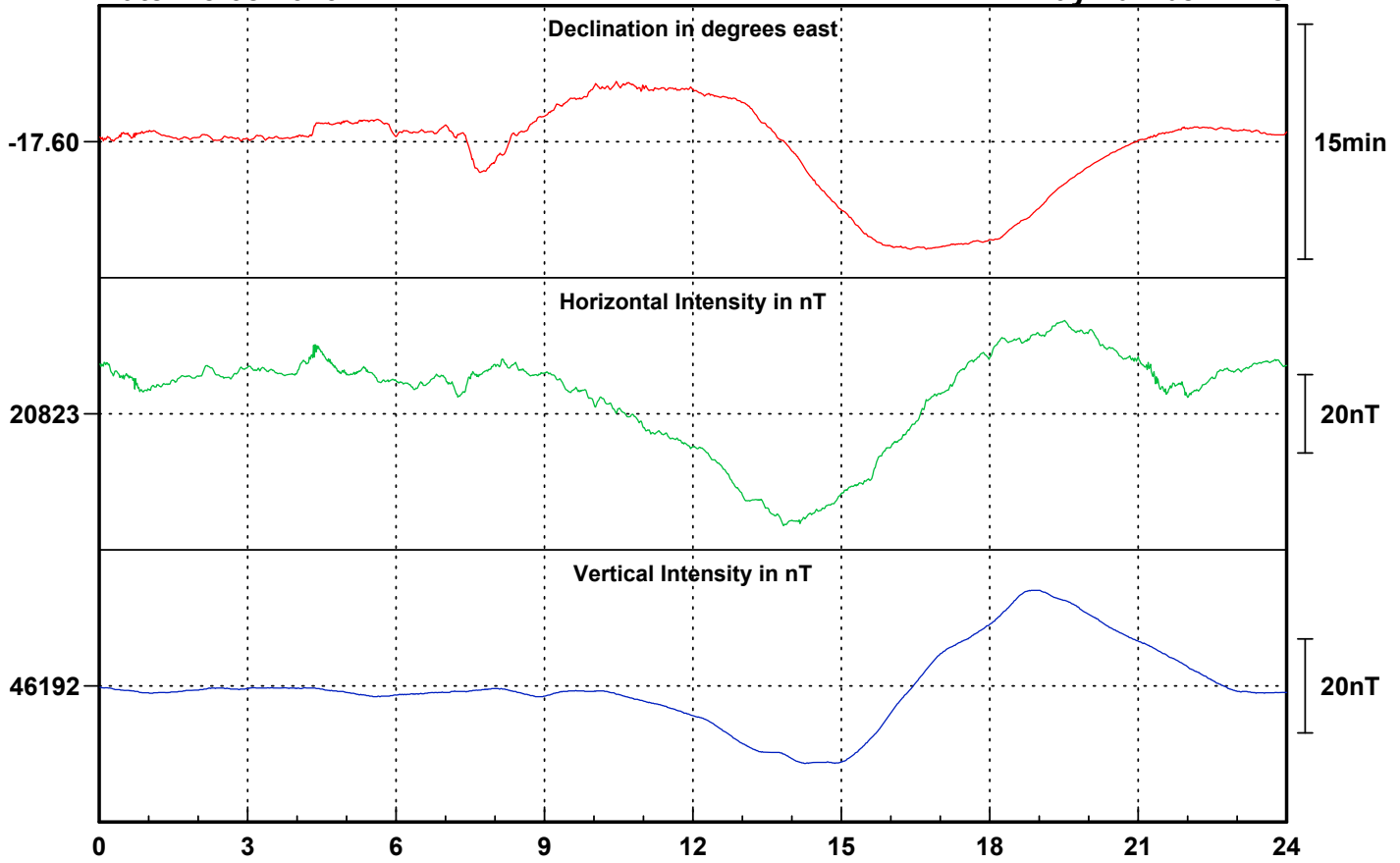
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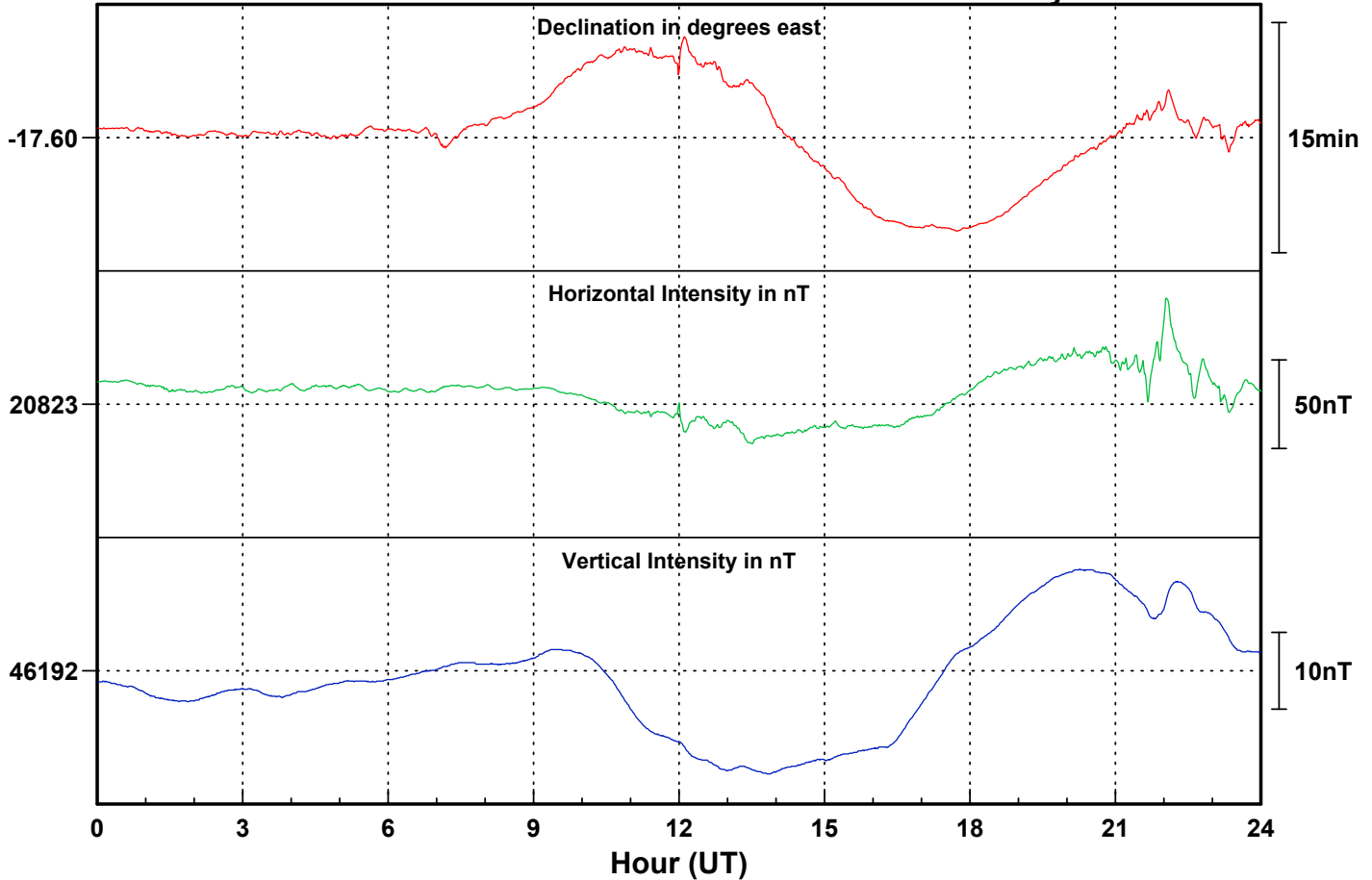
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Day number: 228



Date: 16-08-2016

Day number: 229

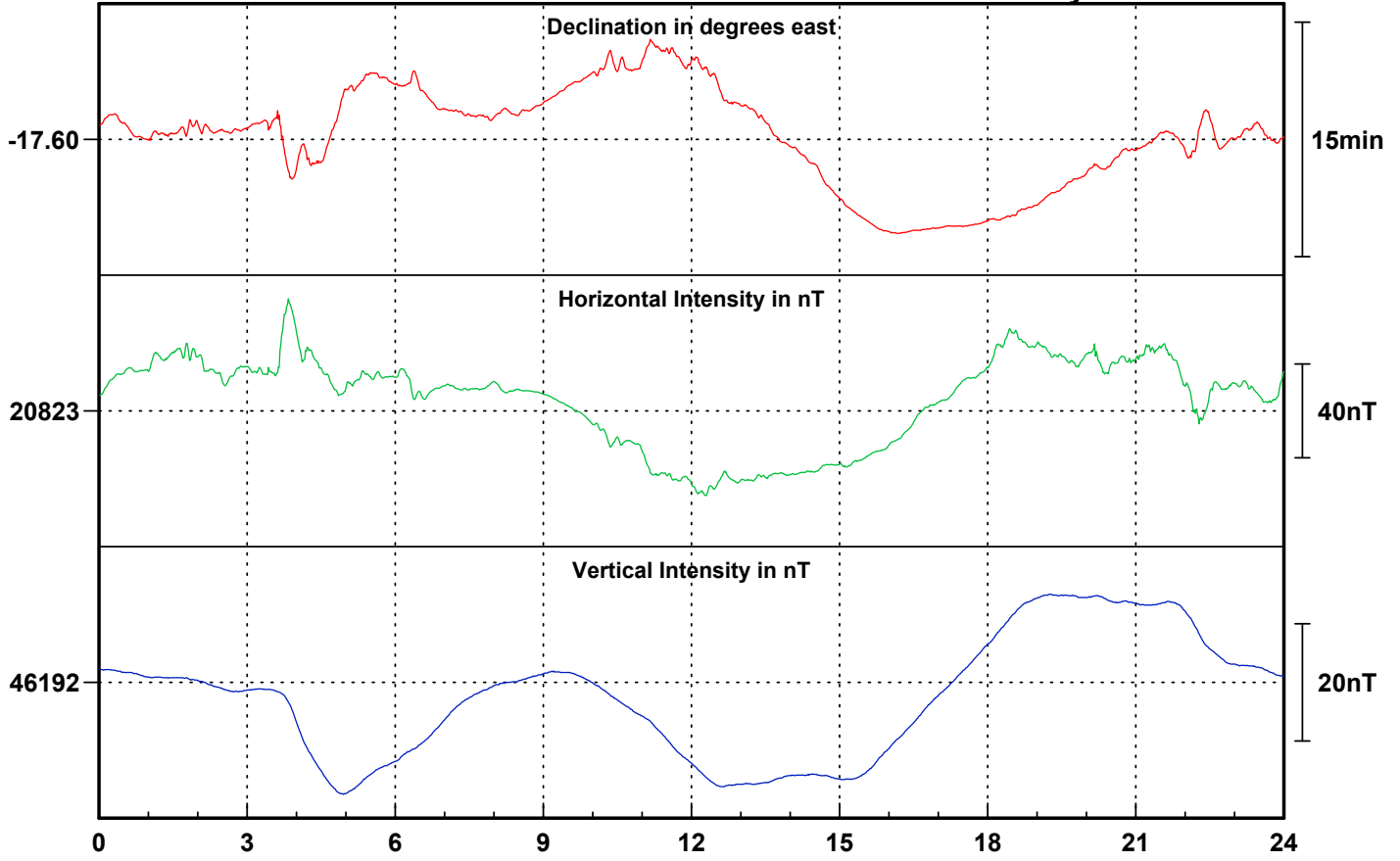




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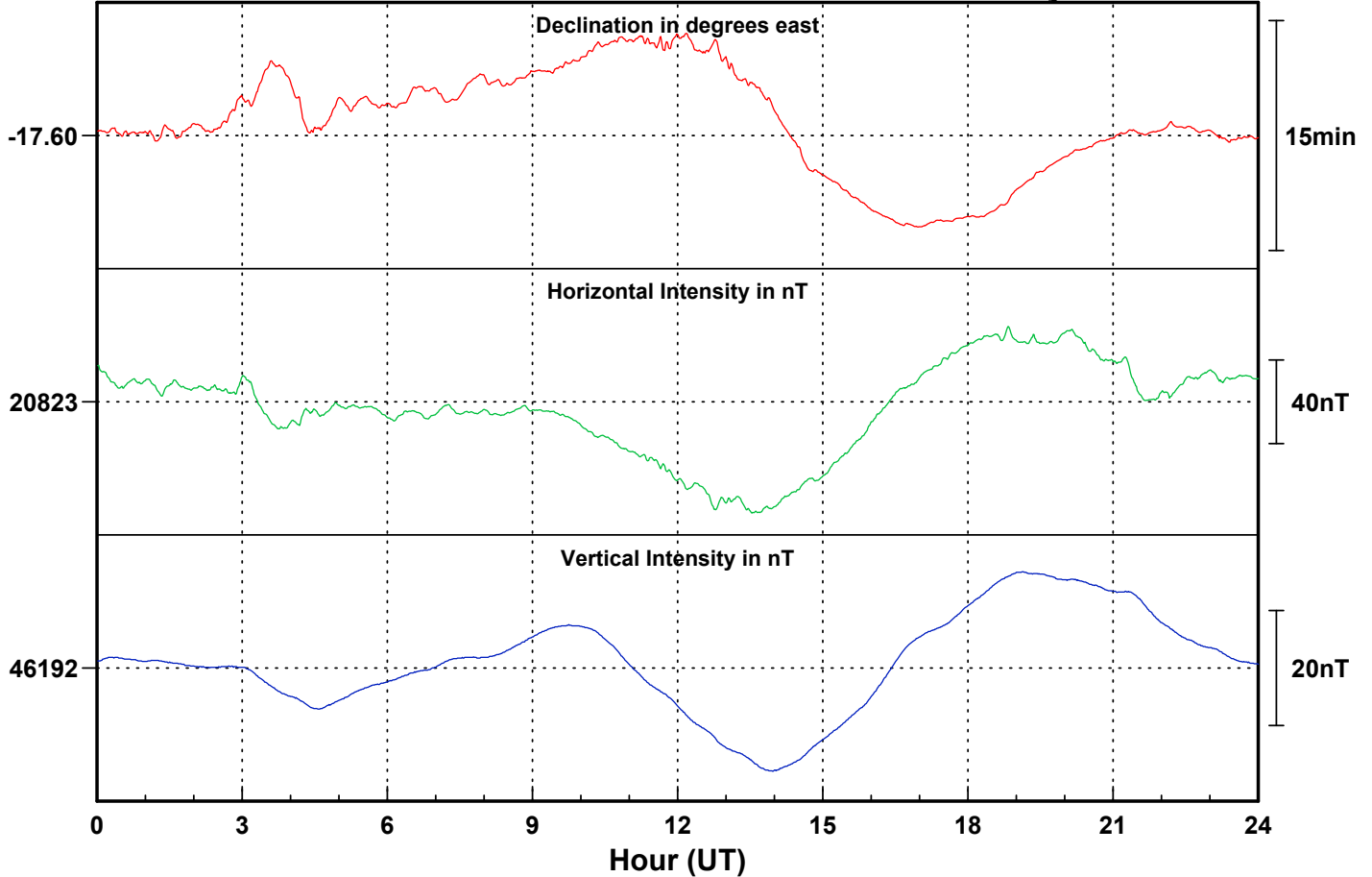
# Sable Island

Day number: 230



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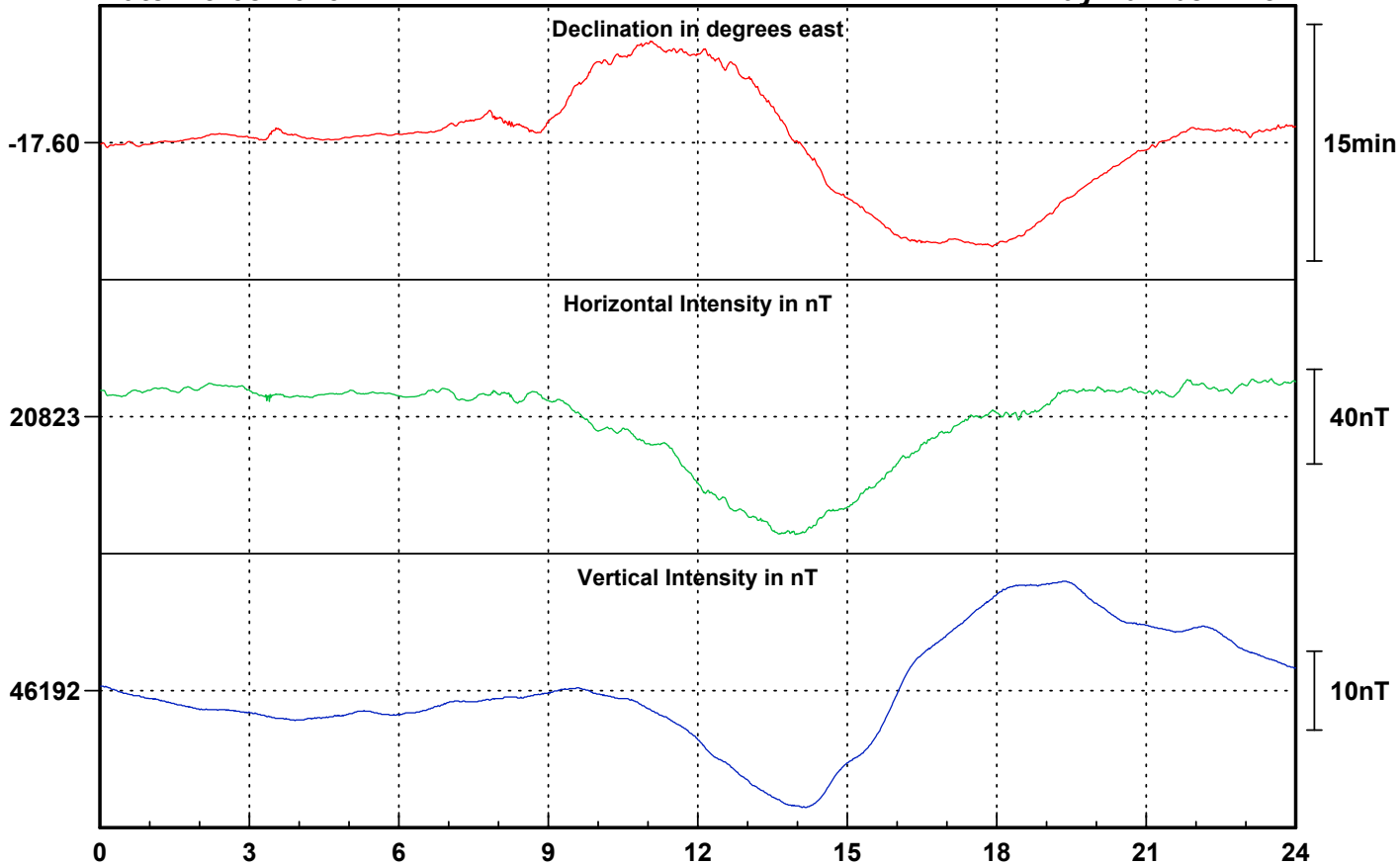
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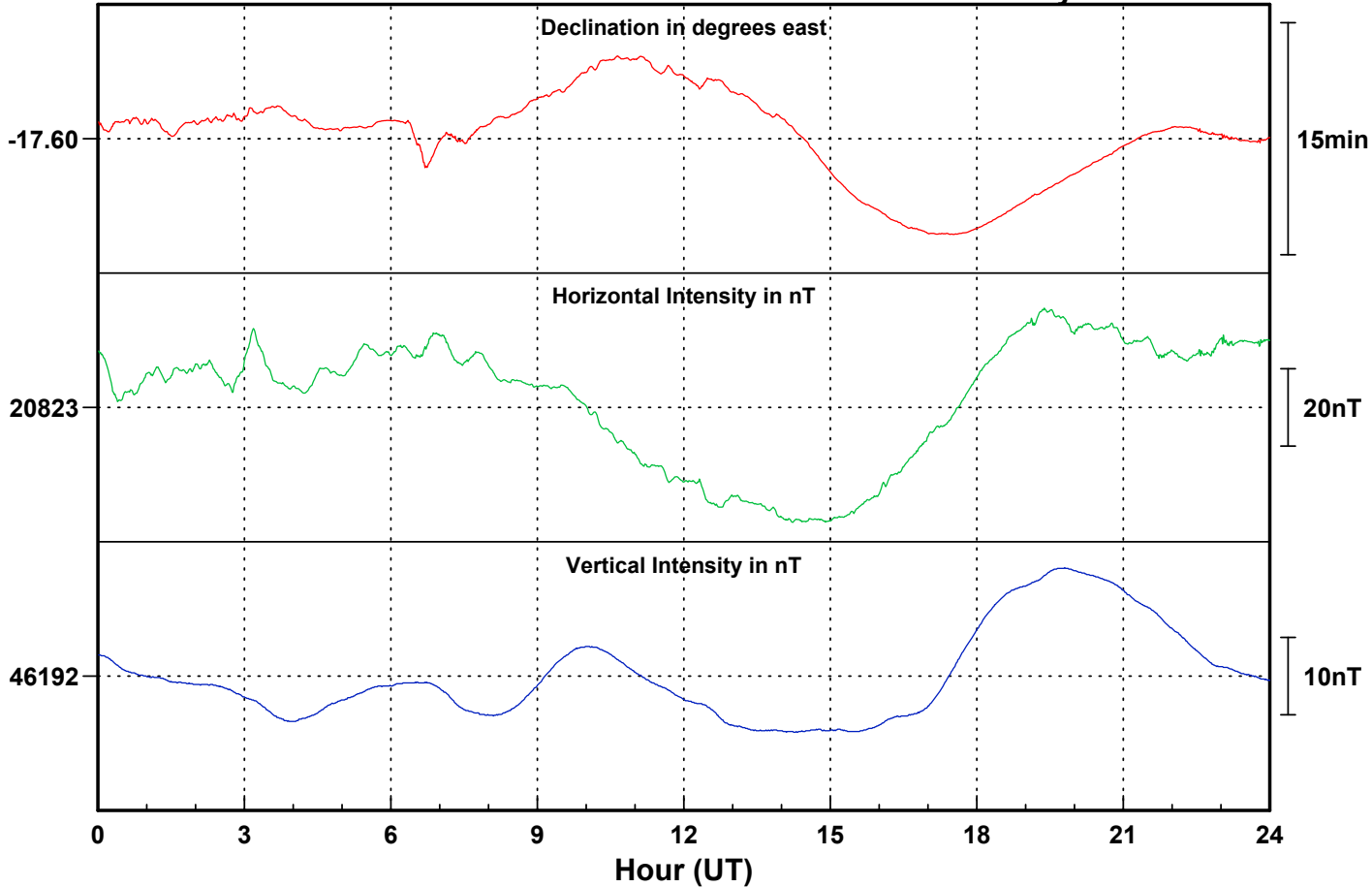
# Sable Island

Day number: 232



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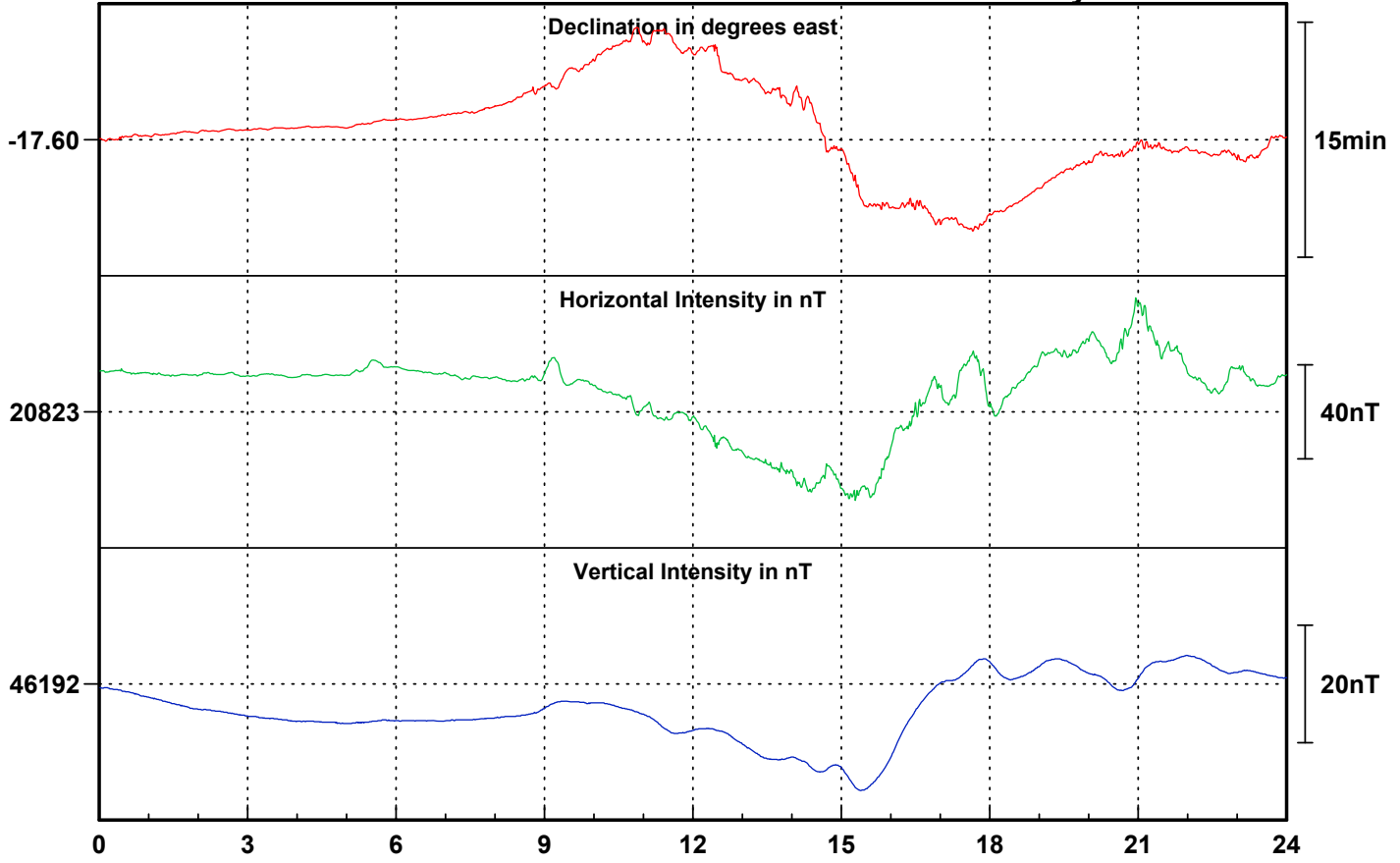
Day number: 233



Date: 21-08-2016

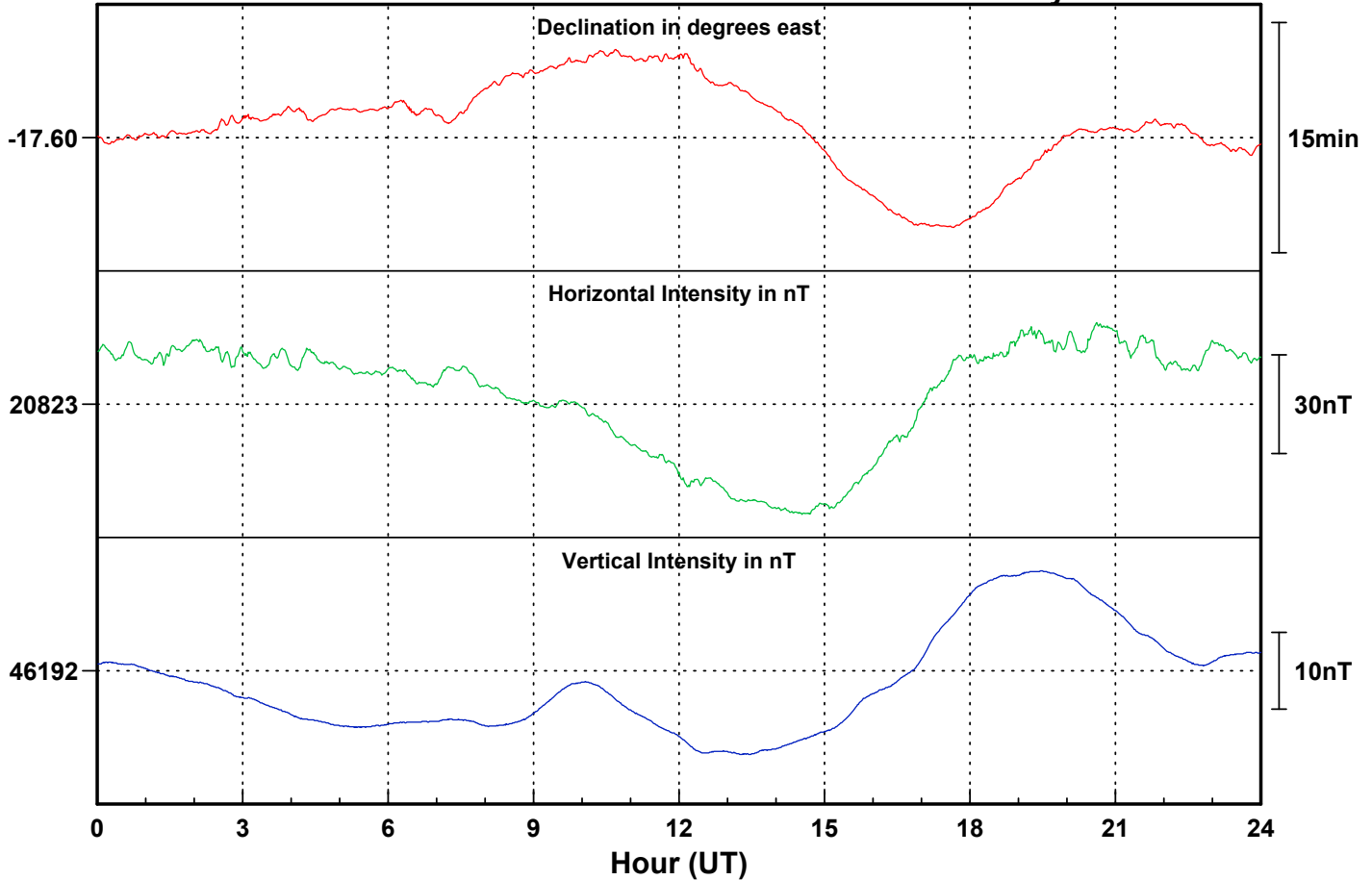
# Sable Island

Day number: 234



Date: 22-08-2016

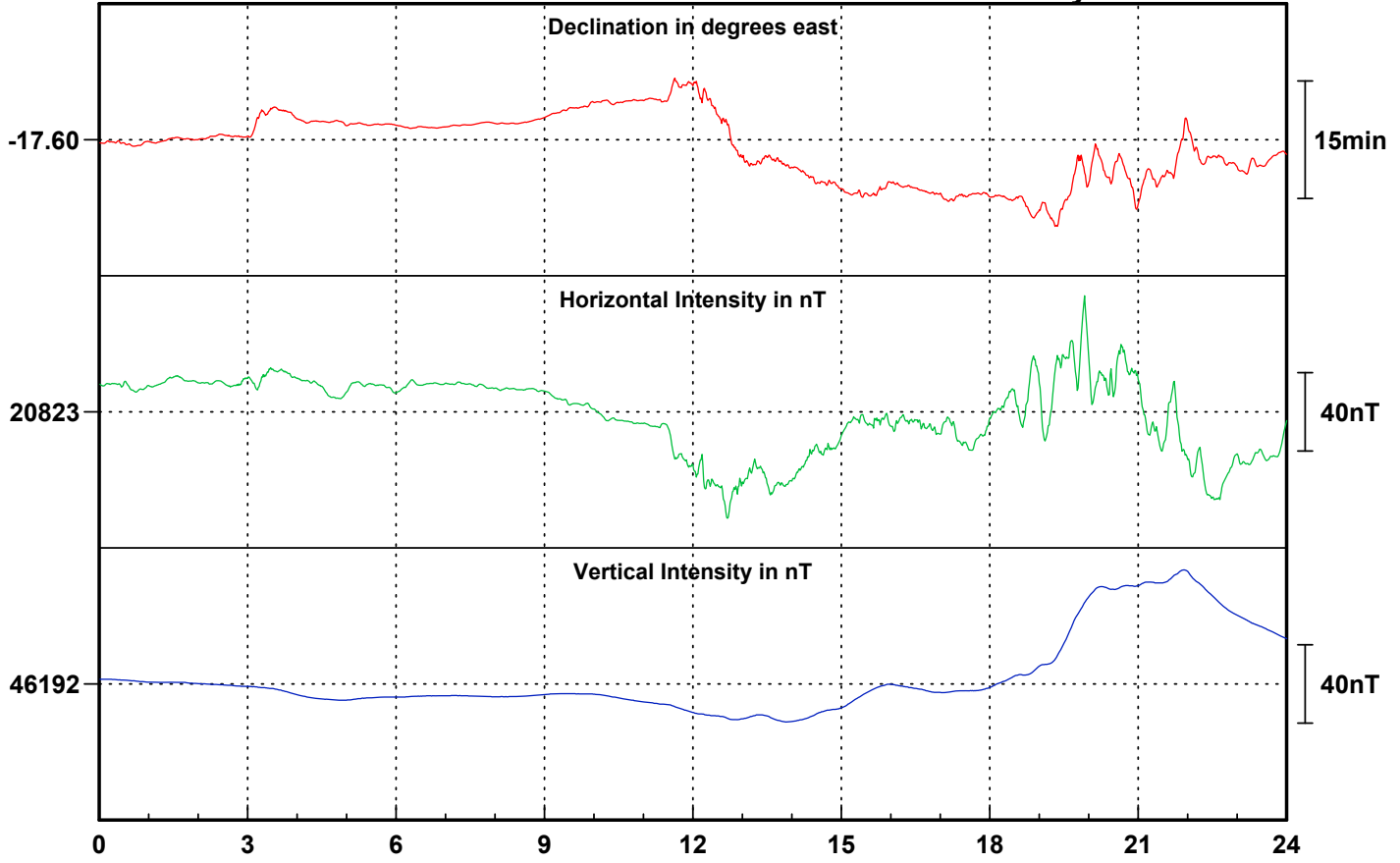
Day number: 235



Date: 23-08-2016

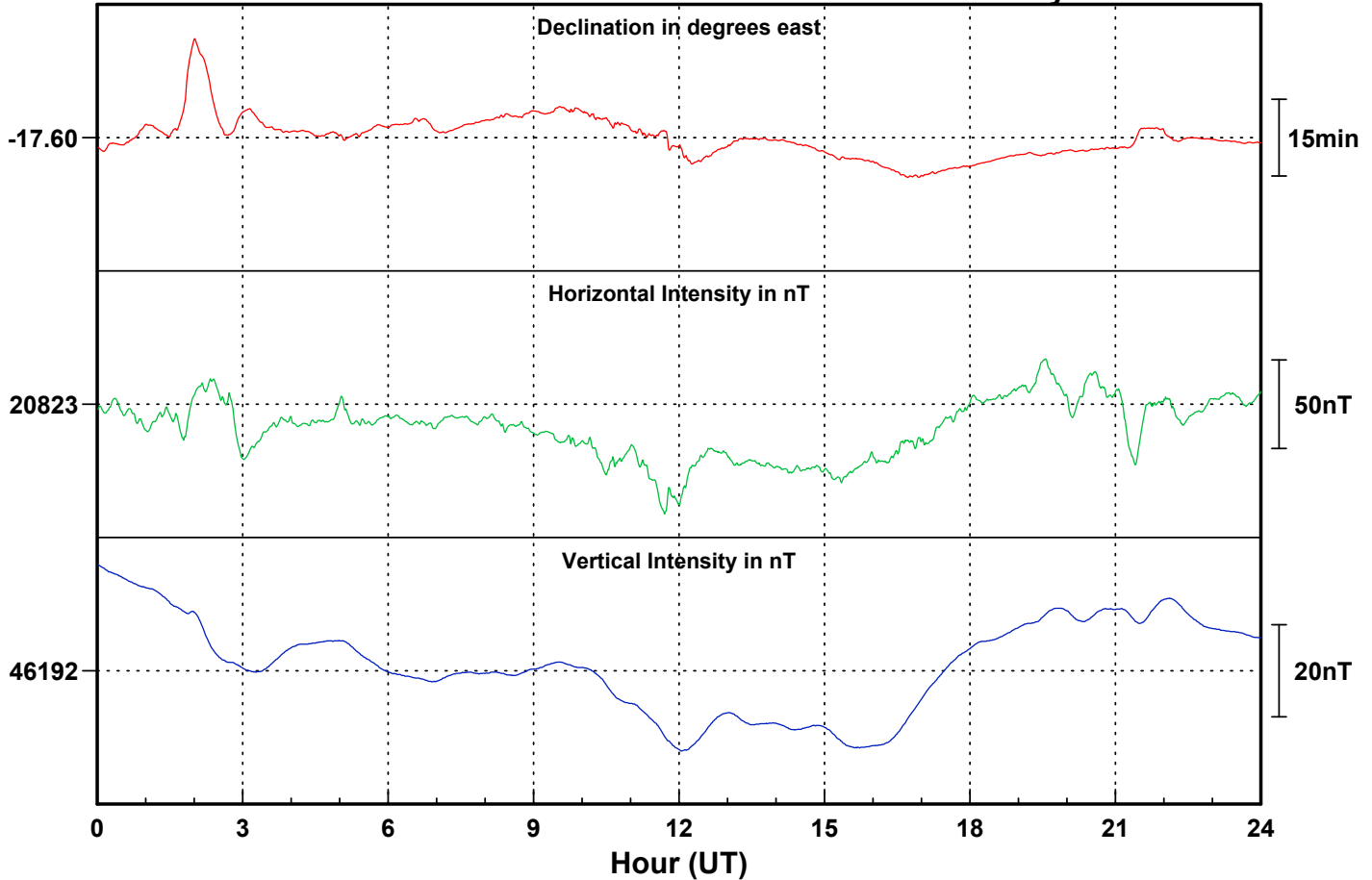
# Sable Island

Day number: 236



Date: 24-08-2016

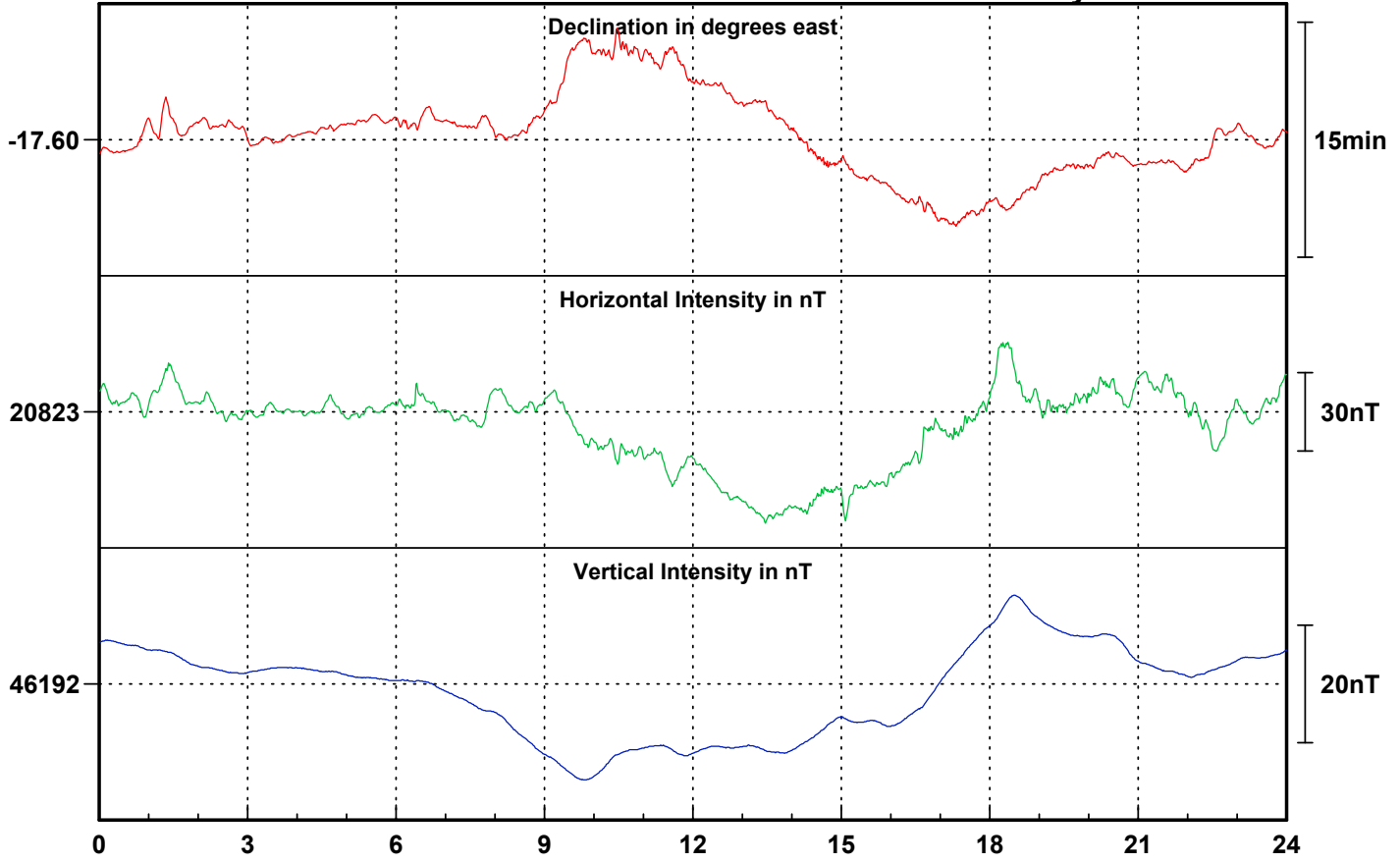
Day number: 237



Date: 25-08-2016

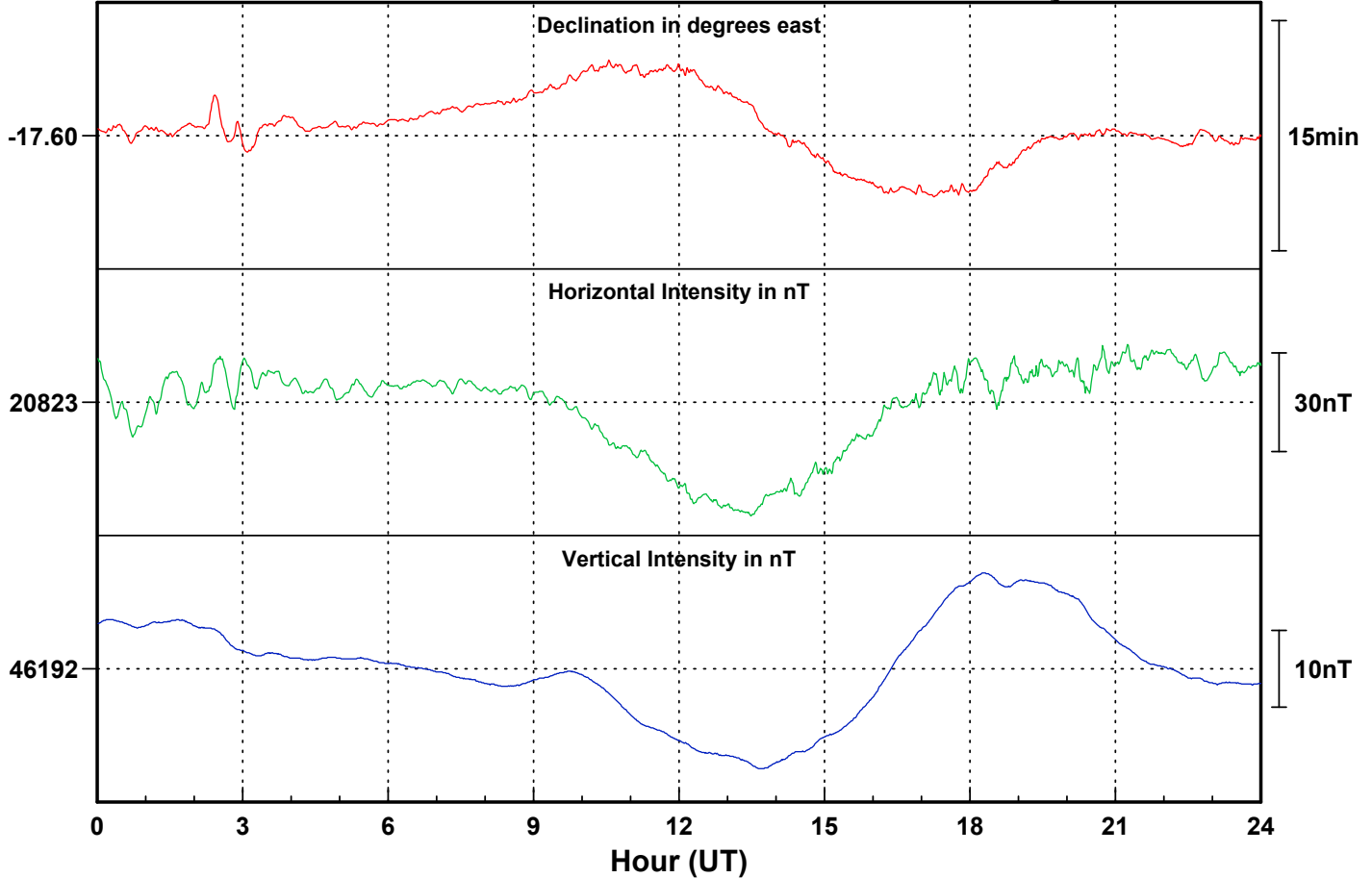
# Sable Island

Day number: 238



Date: 26-08-2016

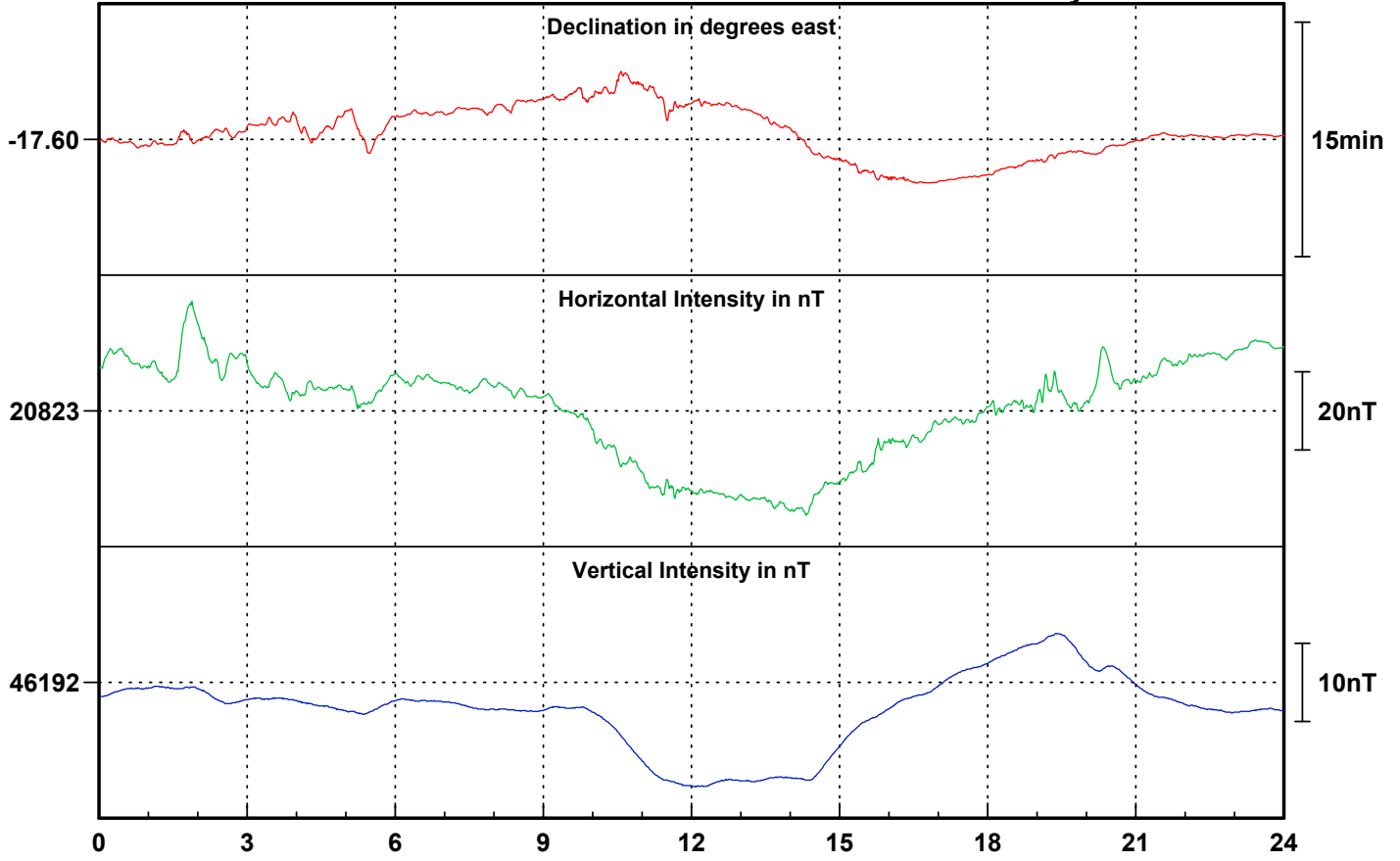
Day number: 239



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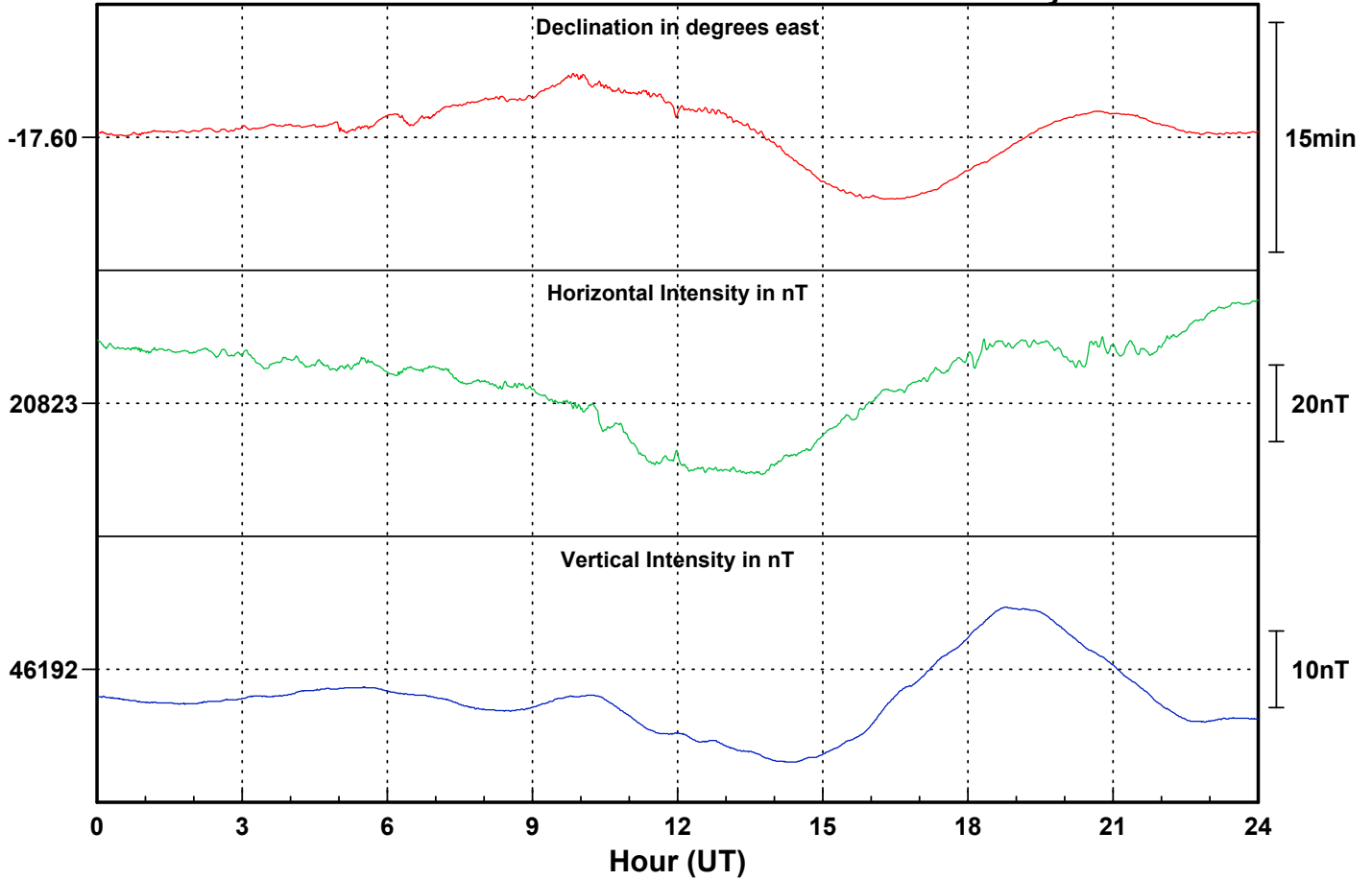
# Sable Island

Day number: 240



Date: 28-08-2016

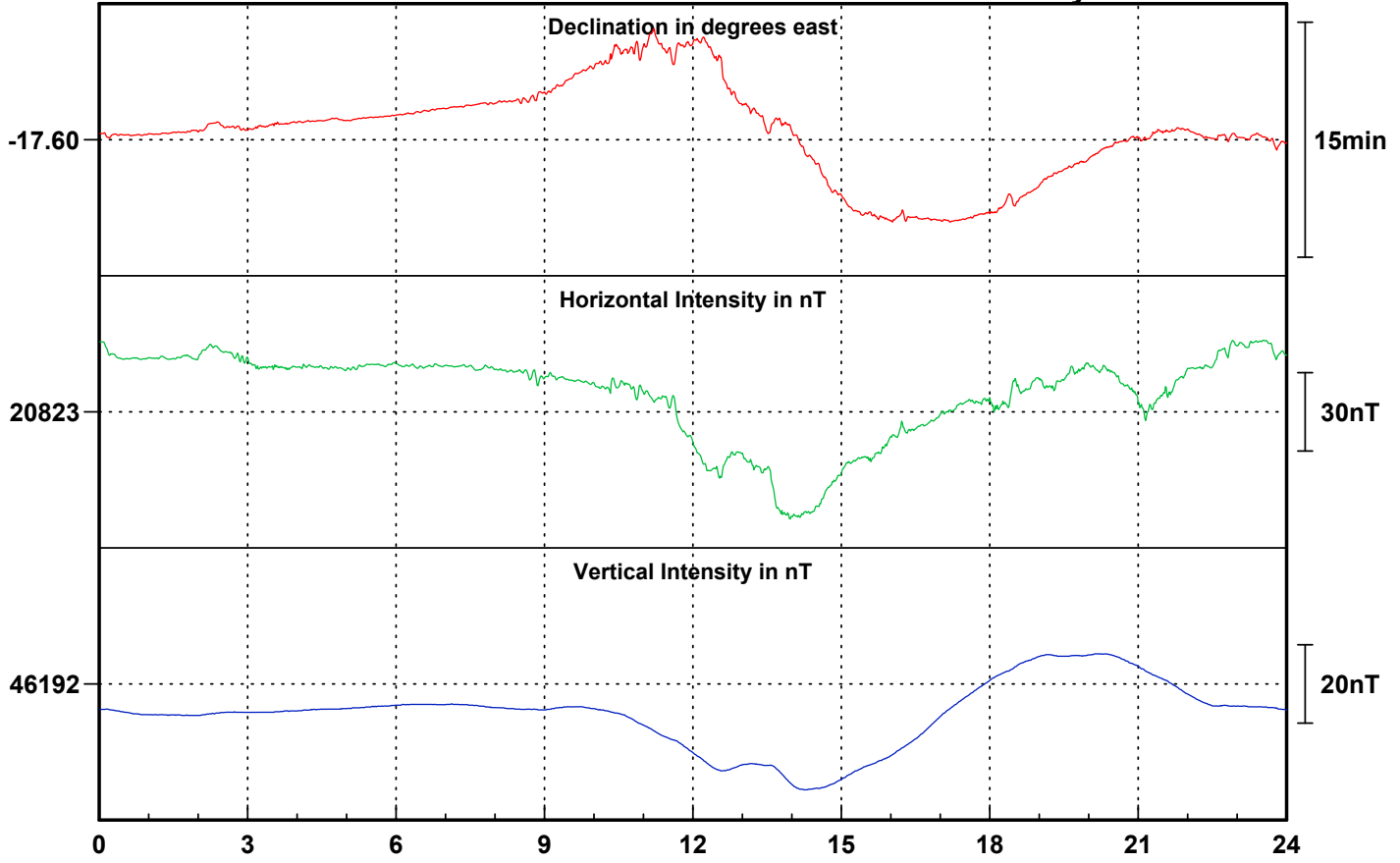
Day number: 241



Date: 29-08-2016

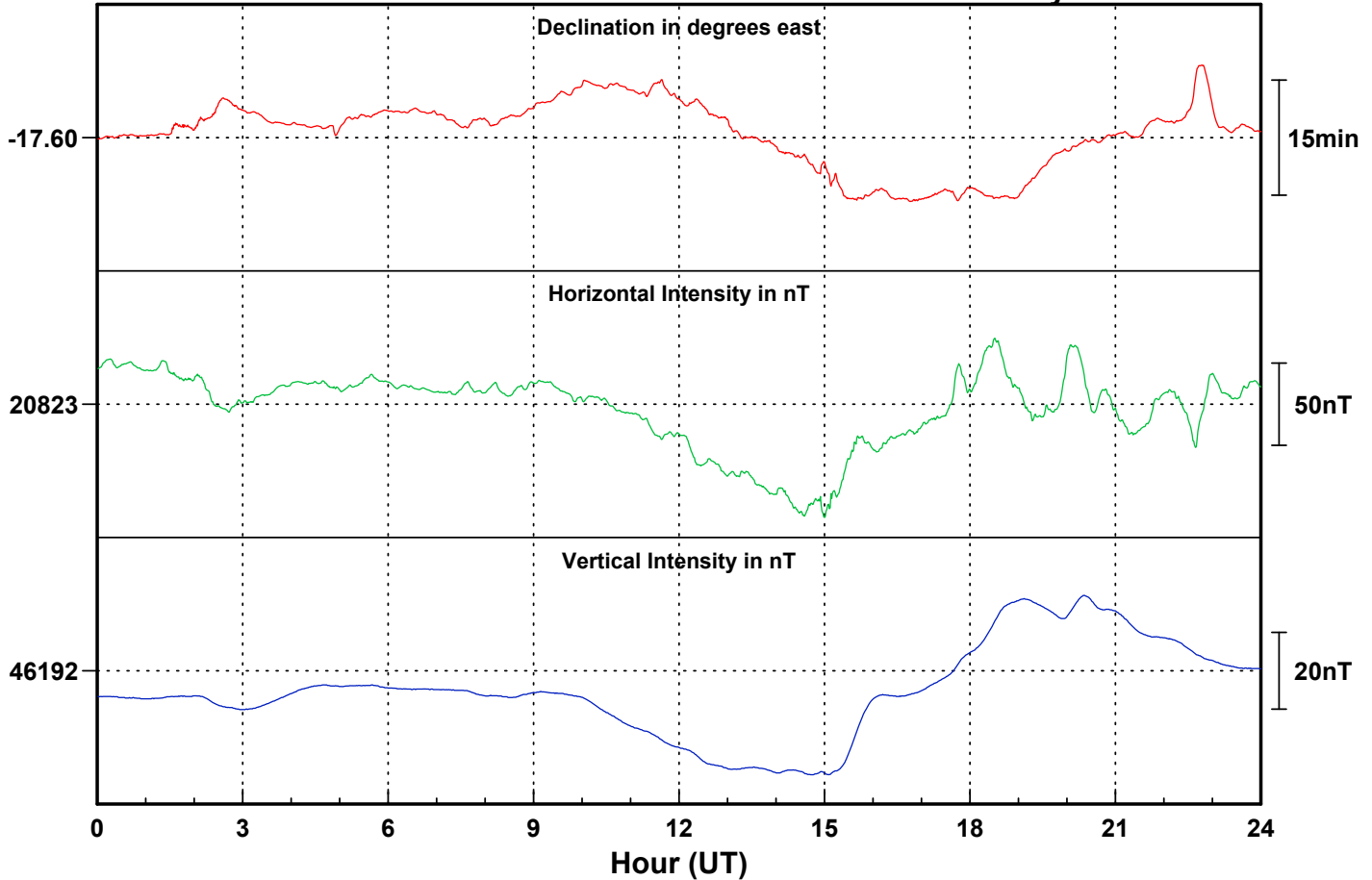
# Sable Island

Day number: 242



Date: 30-08-2016

Day number: 243

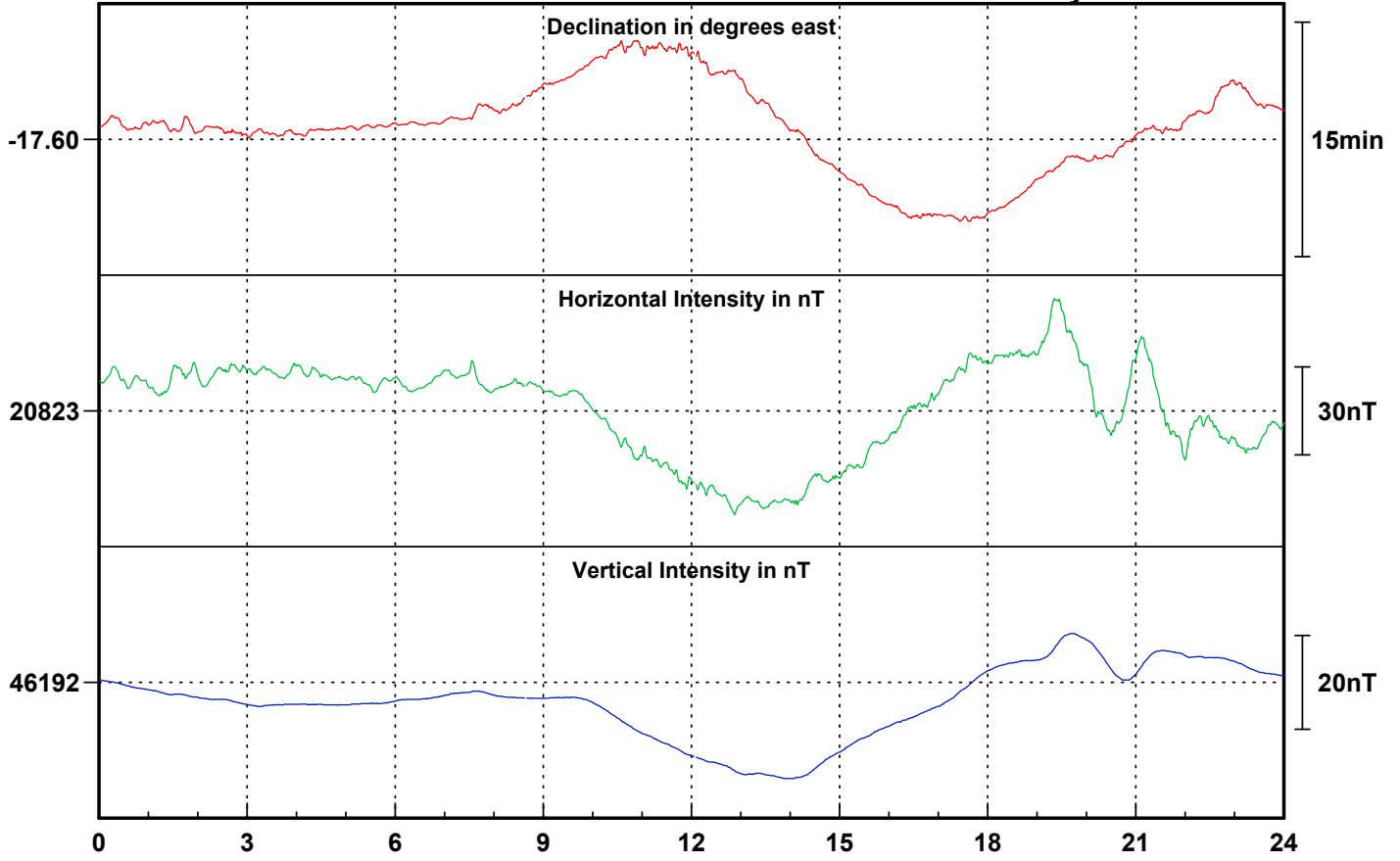




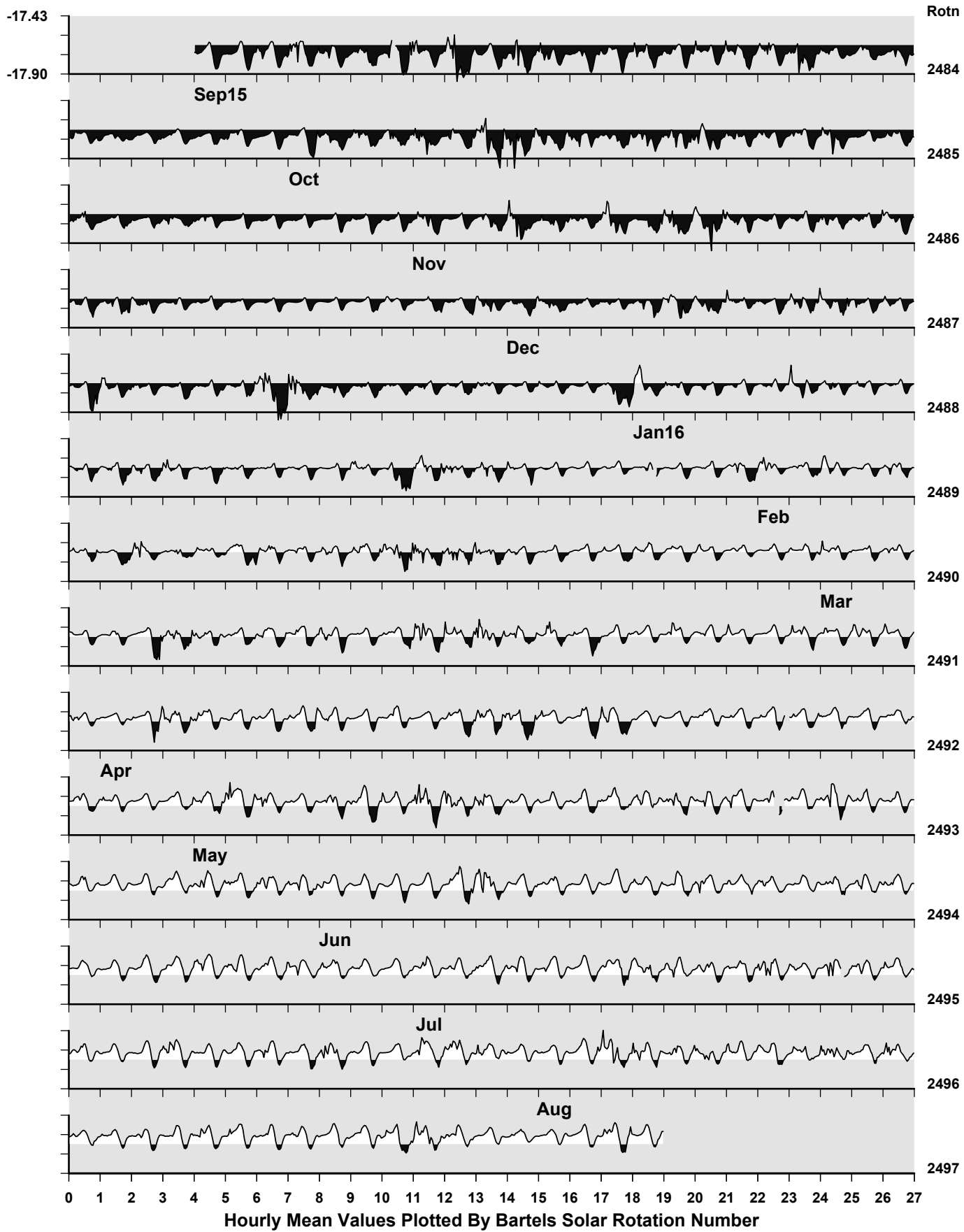
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# Sable Island

Day number: 244

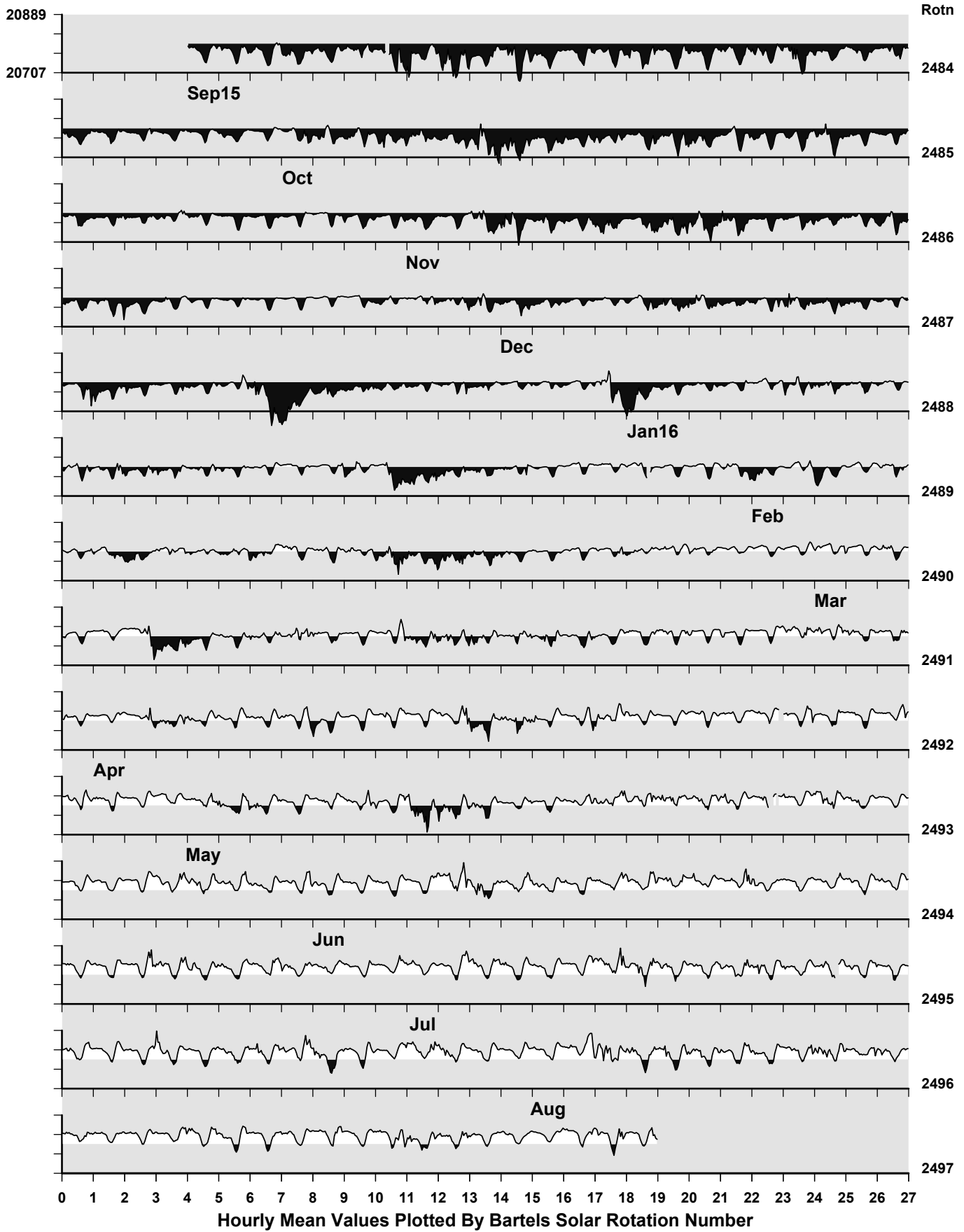


# Sable Island Observatory: Declination (degrees)

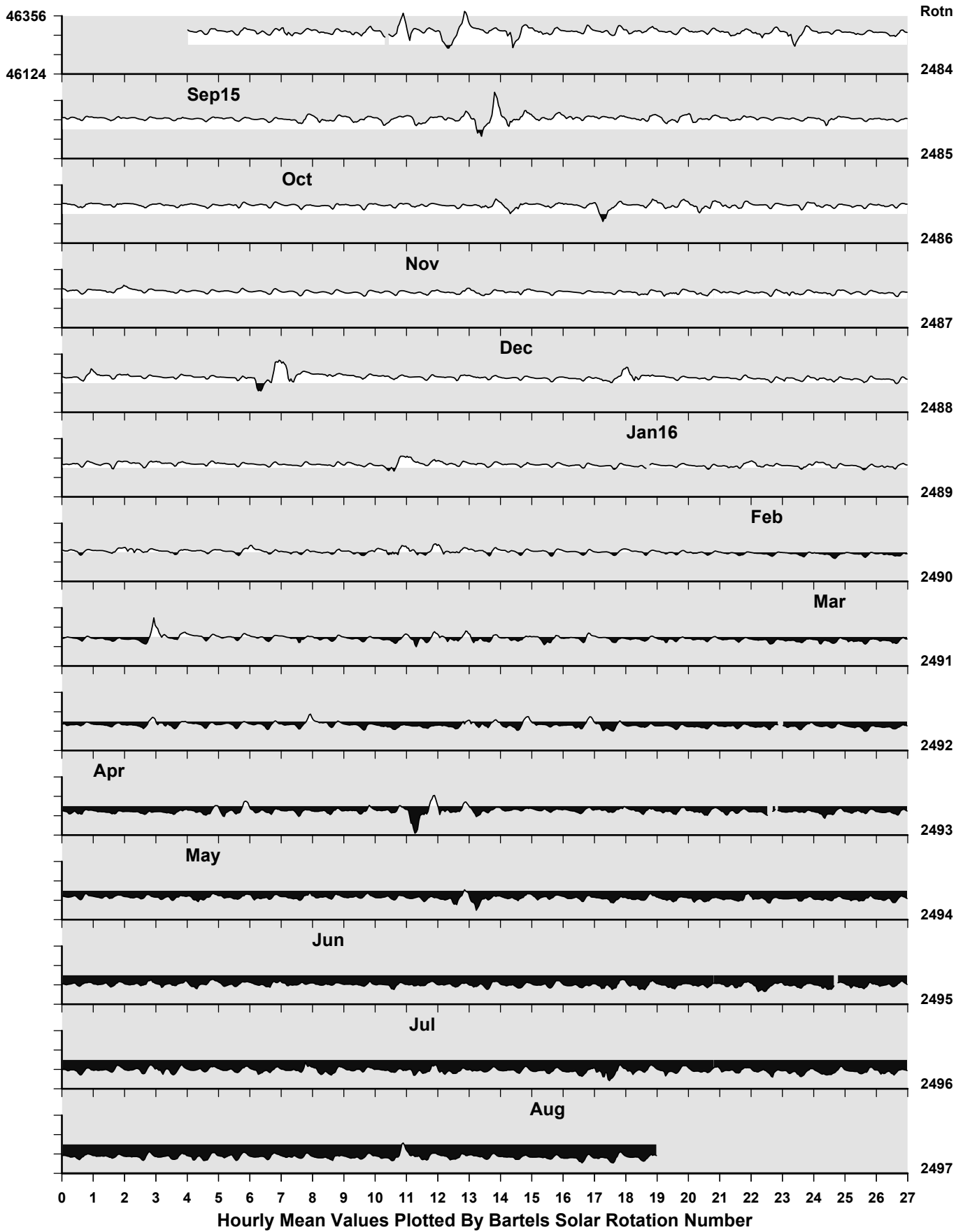


Hourly Mean Values Plotted By Bartels Solar Rotation Number

# Sable Island Observatory: Horizontal Intensity (nT)

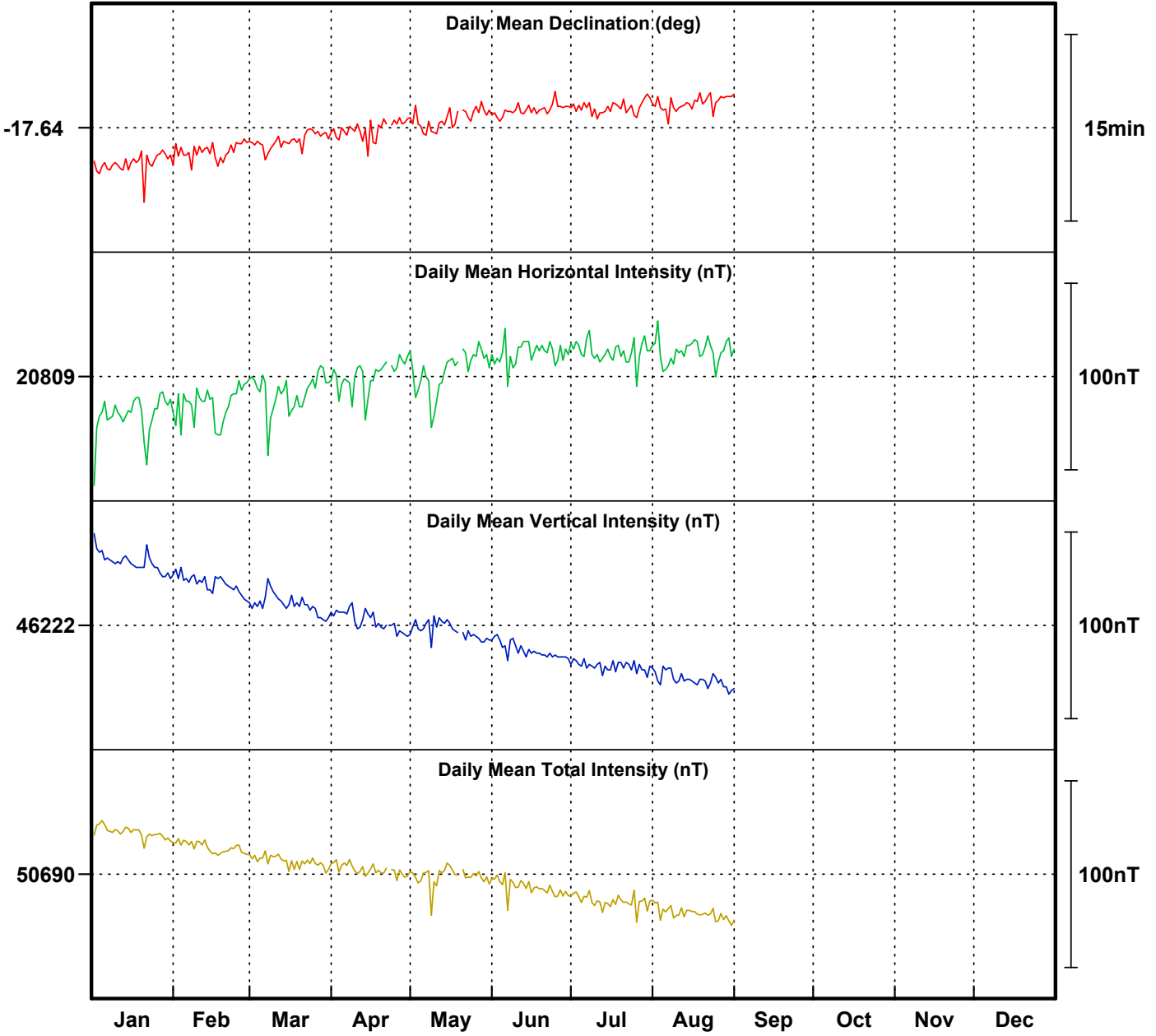


# Sable Island Observatory: Vertical Intensity (nT)



Hourly Mean Values Plotted By Bartels Solar Rotation Number

# Sable Island Observatory 2016



### Monthly Mean Values for Sable Island Observatory 2016

Month	<i>D</i>	<i>H</i>	<i>I</i>	<i>X</i>	<i>Y</i>	<i>Z</i>	<i>F</i>
January	-17° 41.0′	20789 nT	65° 48.0′	19806 nT	-6315 nT	46255 nT	50712 nT
February	-17° 40.0′	20795 nT	65° 47.3′	19814 nT	-6311 nT	46244 nT	50704 nT
March	-17° 39.1′	20801 nT	65° 46.6′	19821 nT	-6308 nT	46233 nT	50697 nT
April	-17° 38.2′	20810 nT	65° 45.8′	19832 nT	-6305 nT	46224 nT	50692 nT
May	-17° 37.4′	20812 nT	65° 45.5′	19836 nT	-6301 nT	46219 nT	50689 nT
June	-17° 36.7′	20822 nT	65° 44.6′	19846 nT	-6300 nT	46208 nT	50682 nT
July	-17° 36.5′	20822 nT	65° 44.3′	19847 nT	-6299 nT	46200 nT	50676 nT
August	-17° 36.1′	20823 nT	65° 44.1′	19848 nT	-6297 nT	46192 nT	50669 nT

#### Note

i. The values shown here are provisional.