

**BRITISH GEOLOGICAL SURVEY**

**Sable Island  
Observatory  
Monthly  
Magnetic  
Bulletin**

**September 2019**

**19/09/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:

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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°04'12"N 015°45'36"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 2019.5.

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 2019

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

-17.18

5min

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

20874

20nT

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

46005

8nT

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

0.0

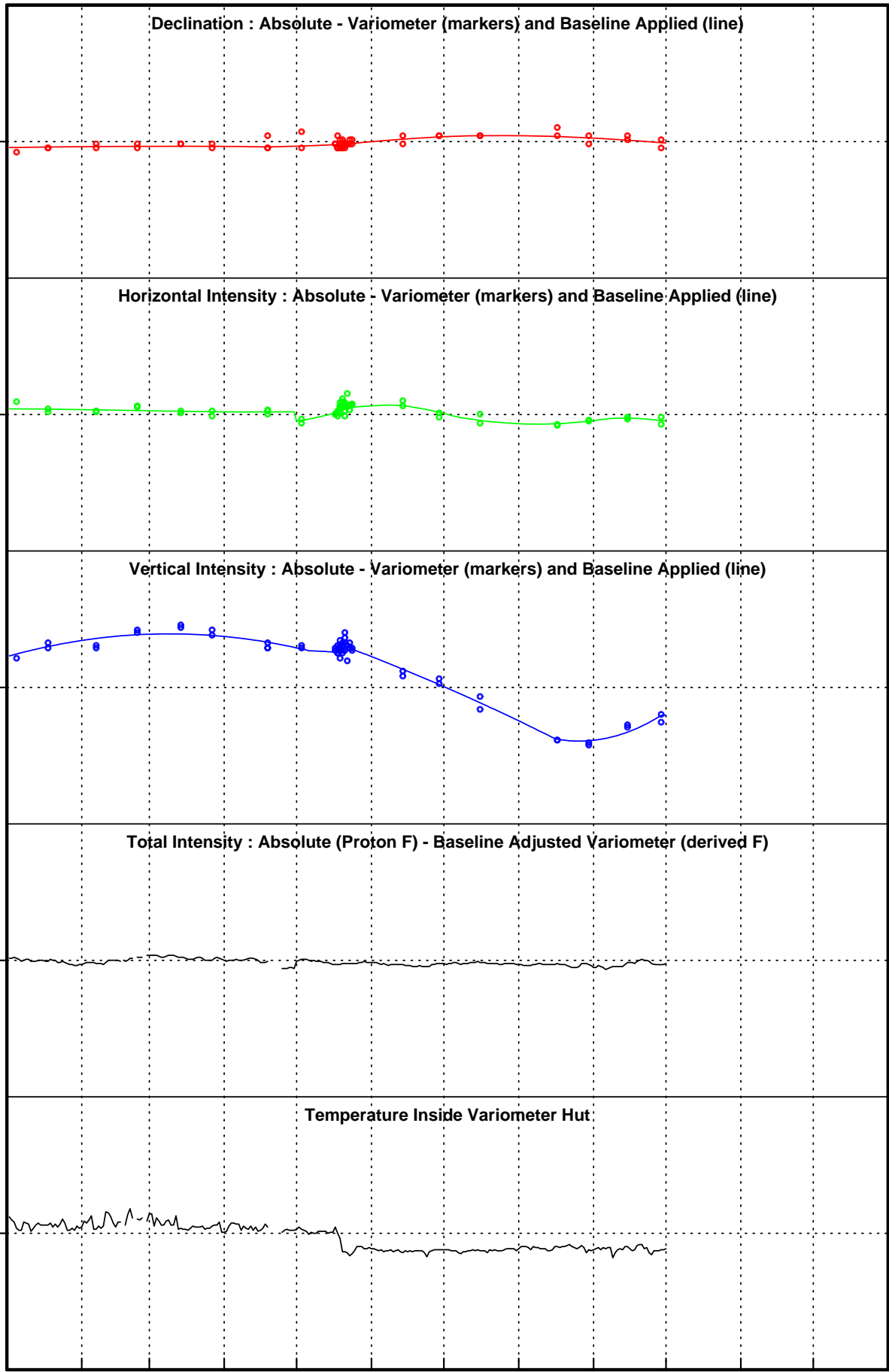
20nT

Temperature Inside Variometer Hut

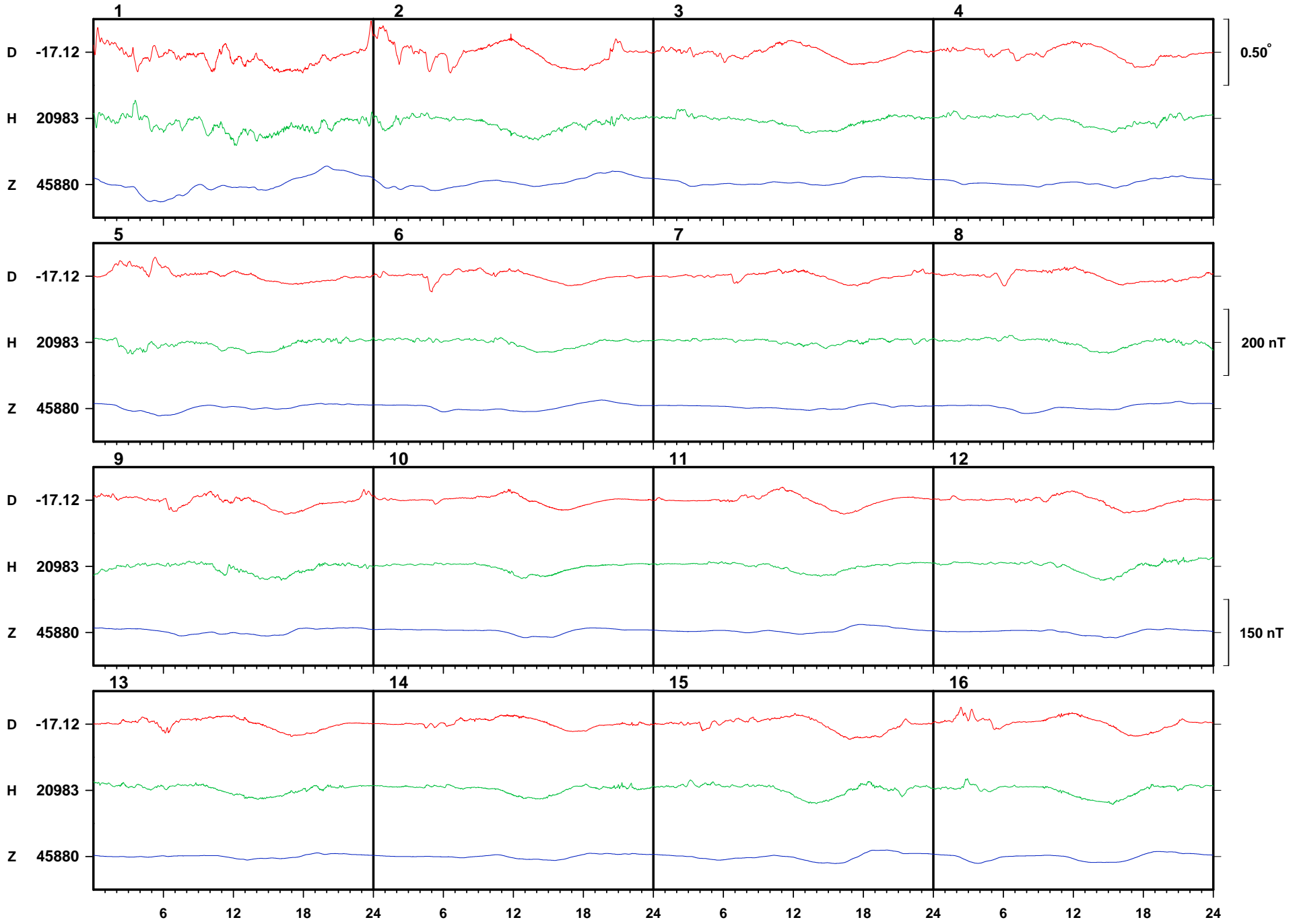
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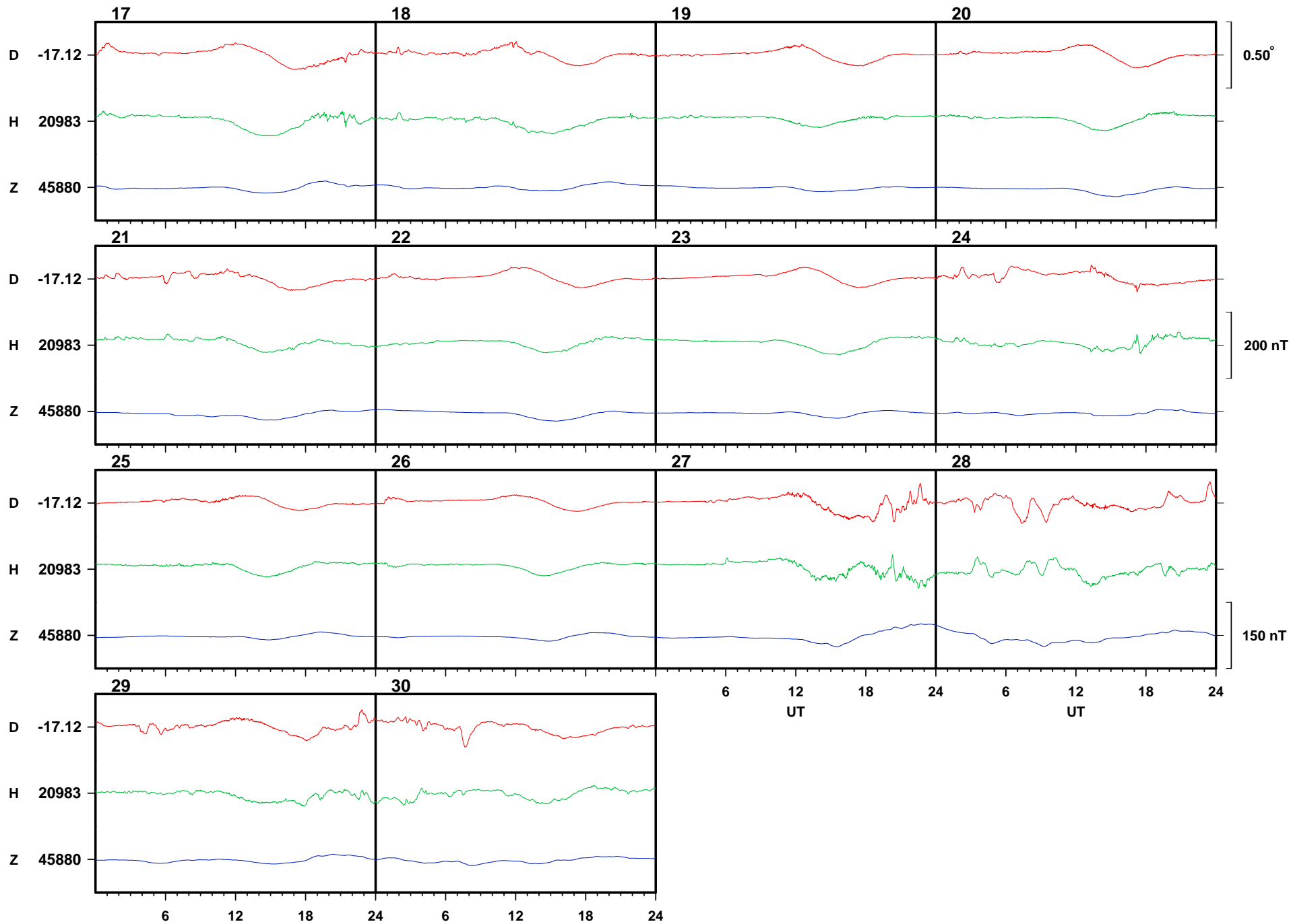
20°C

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



Sable Island September 2019

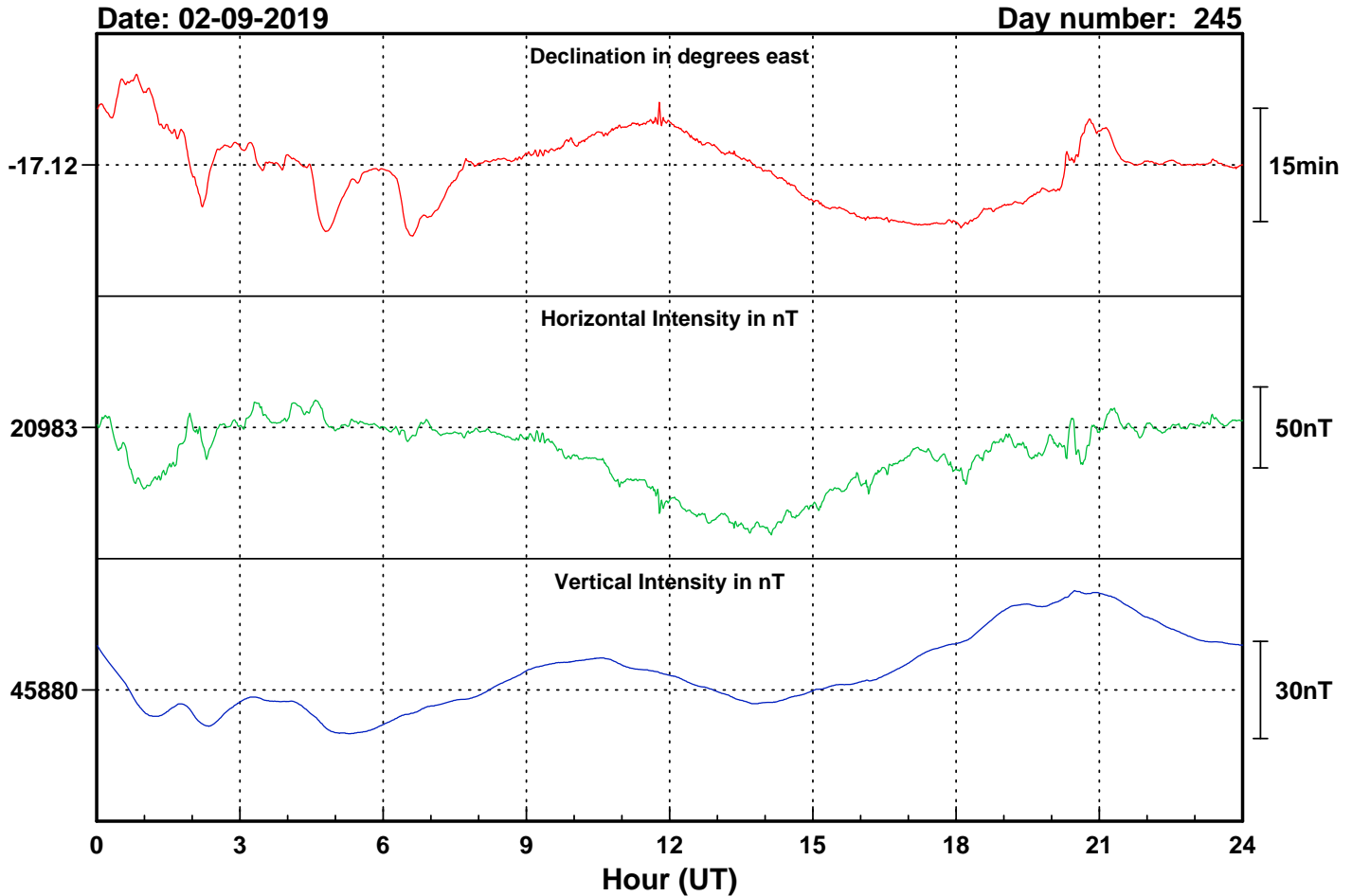
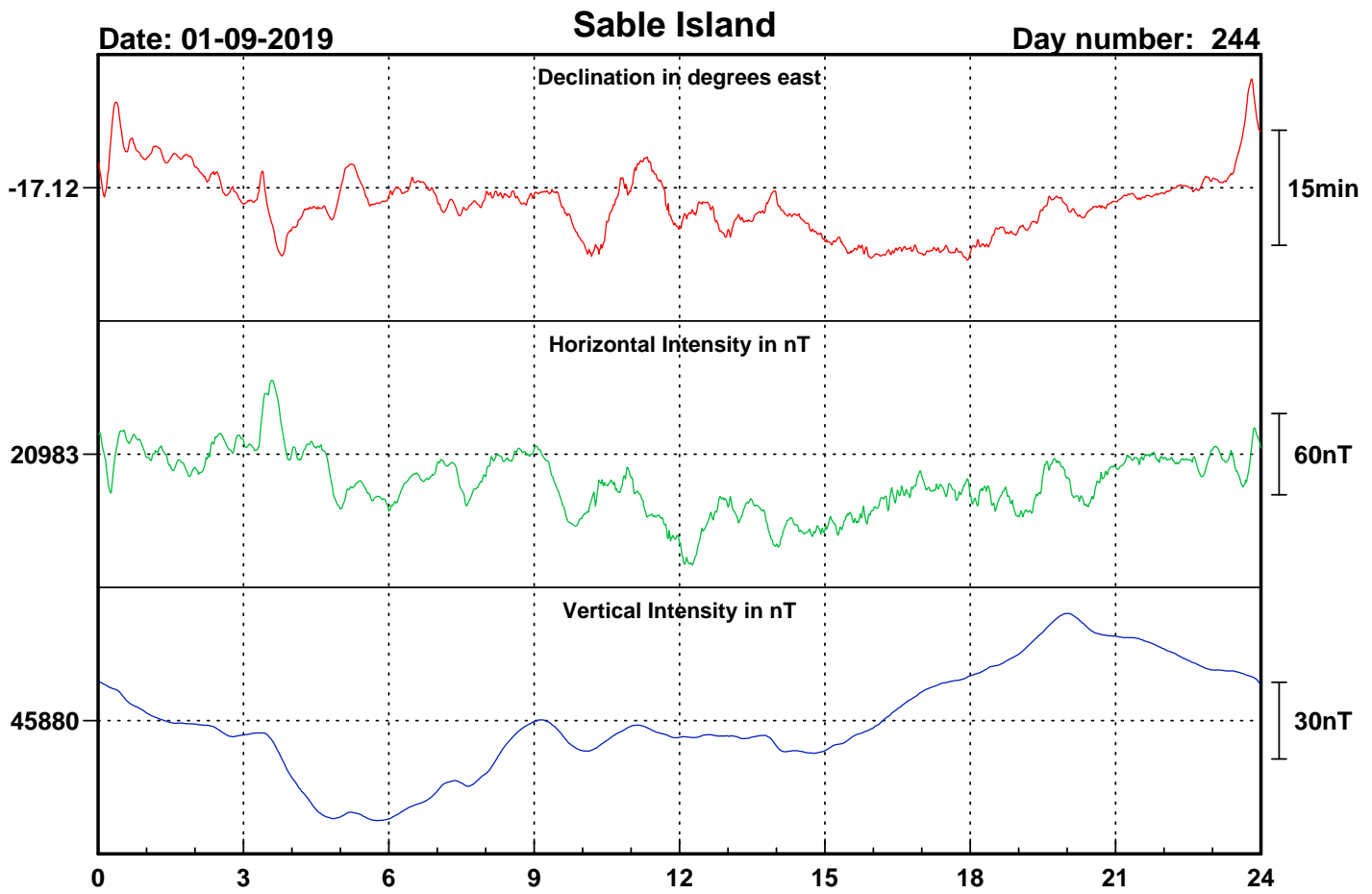




Sable Island

September

2019

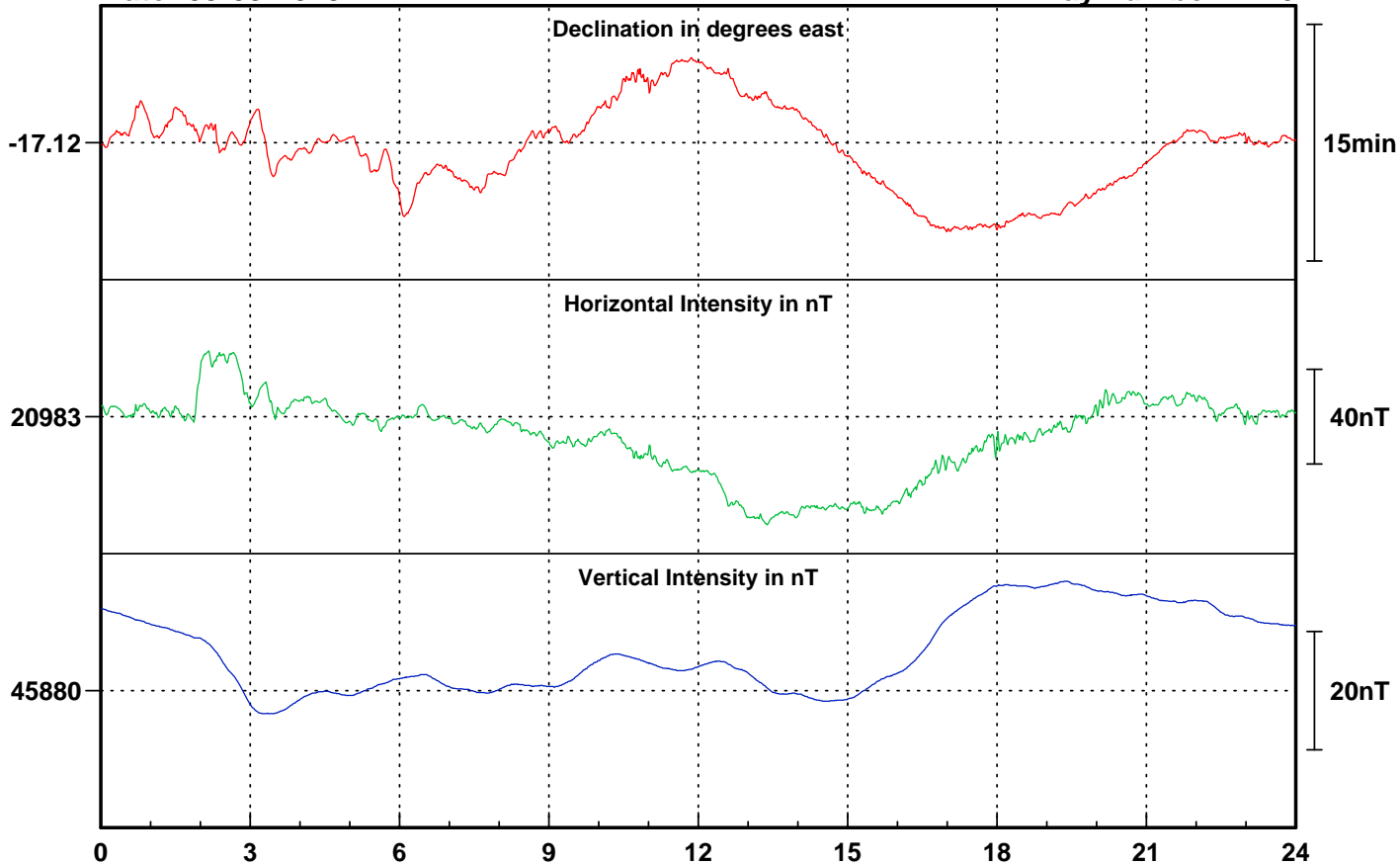




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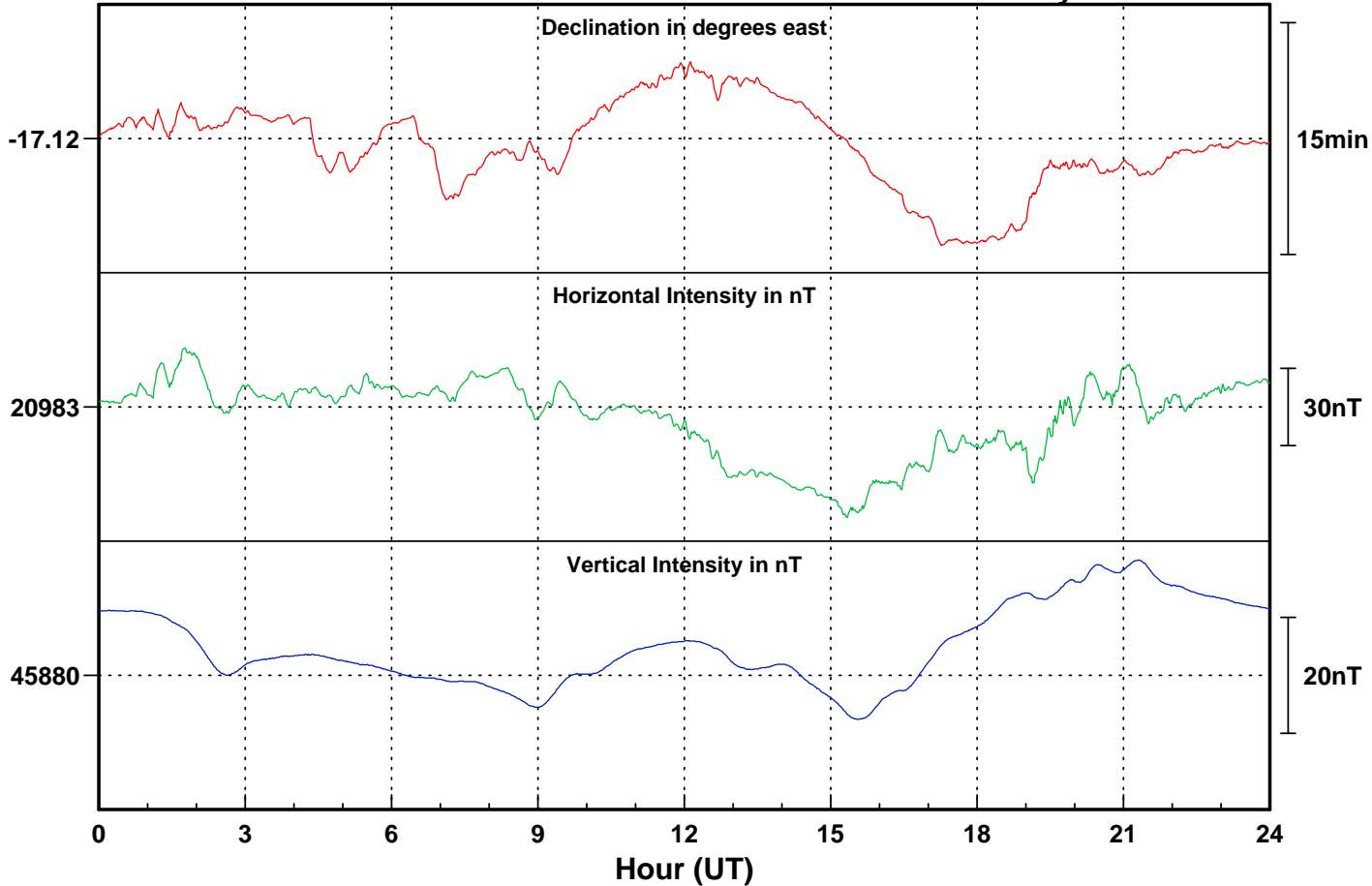
# Sable Island

Day number: 246



Date: 04-09-2019

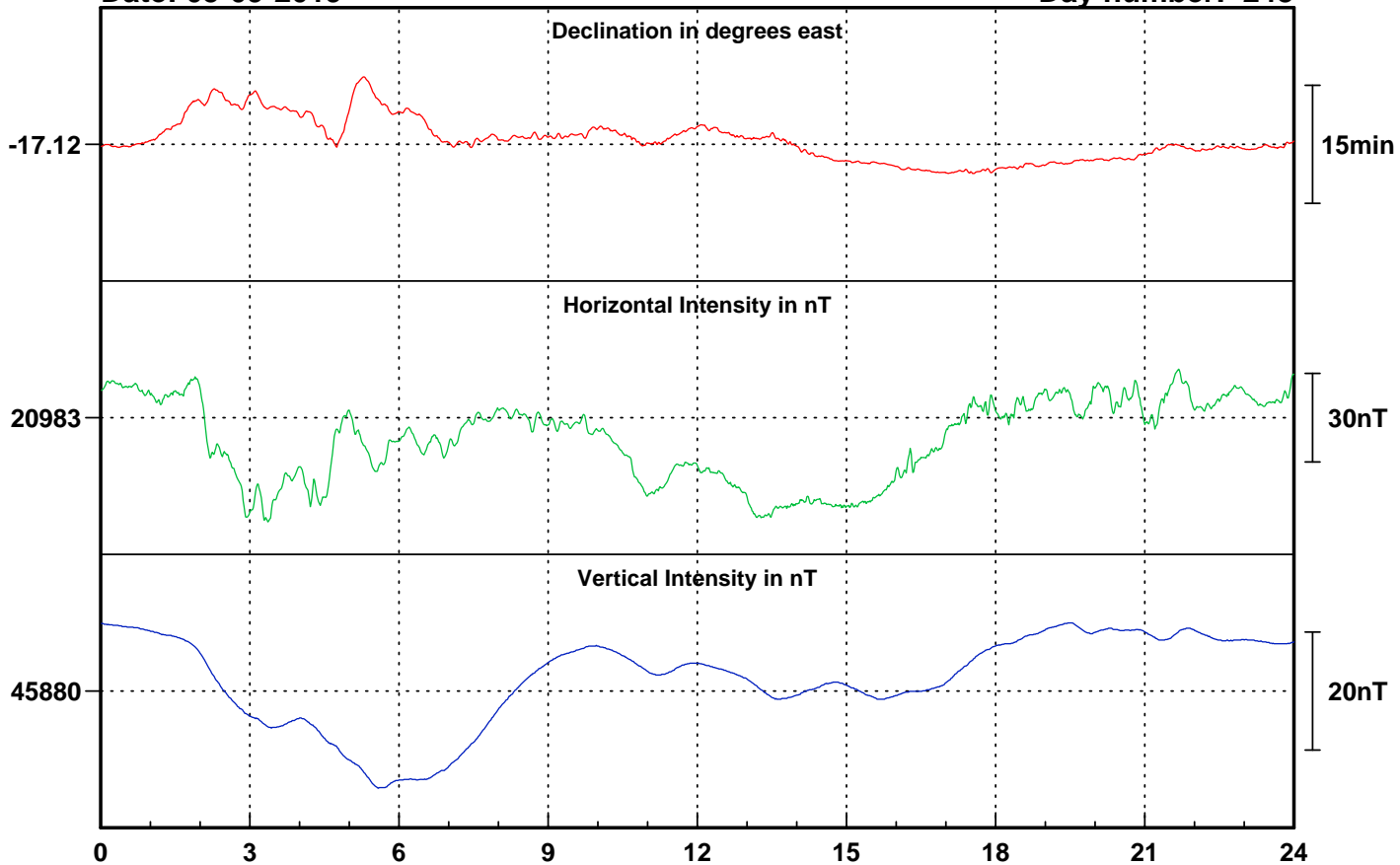
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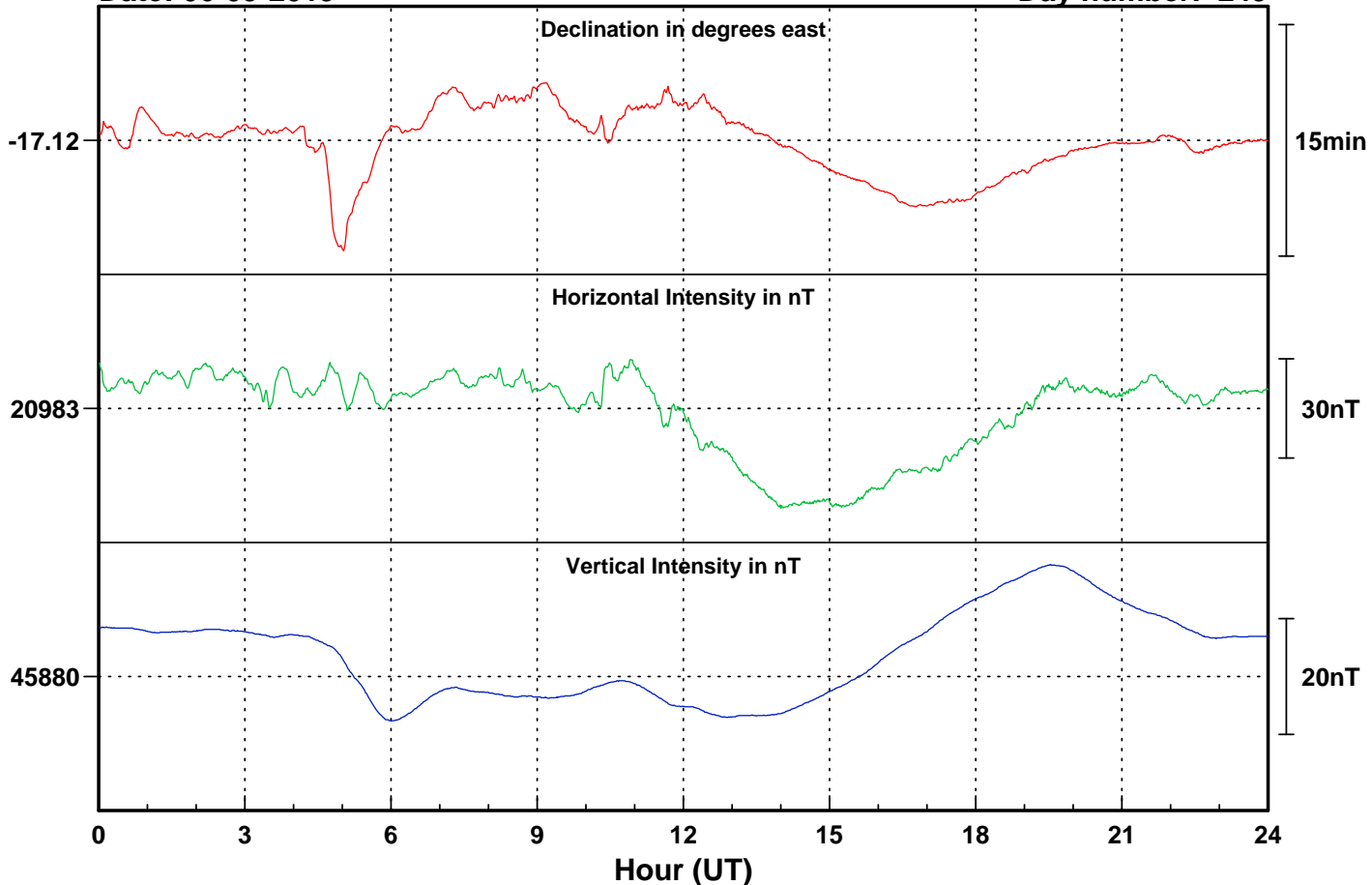
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Day number: 248



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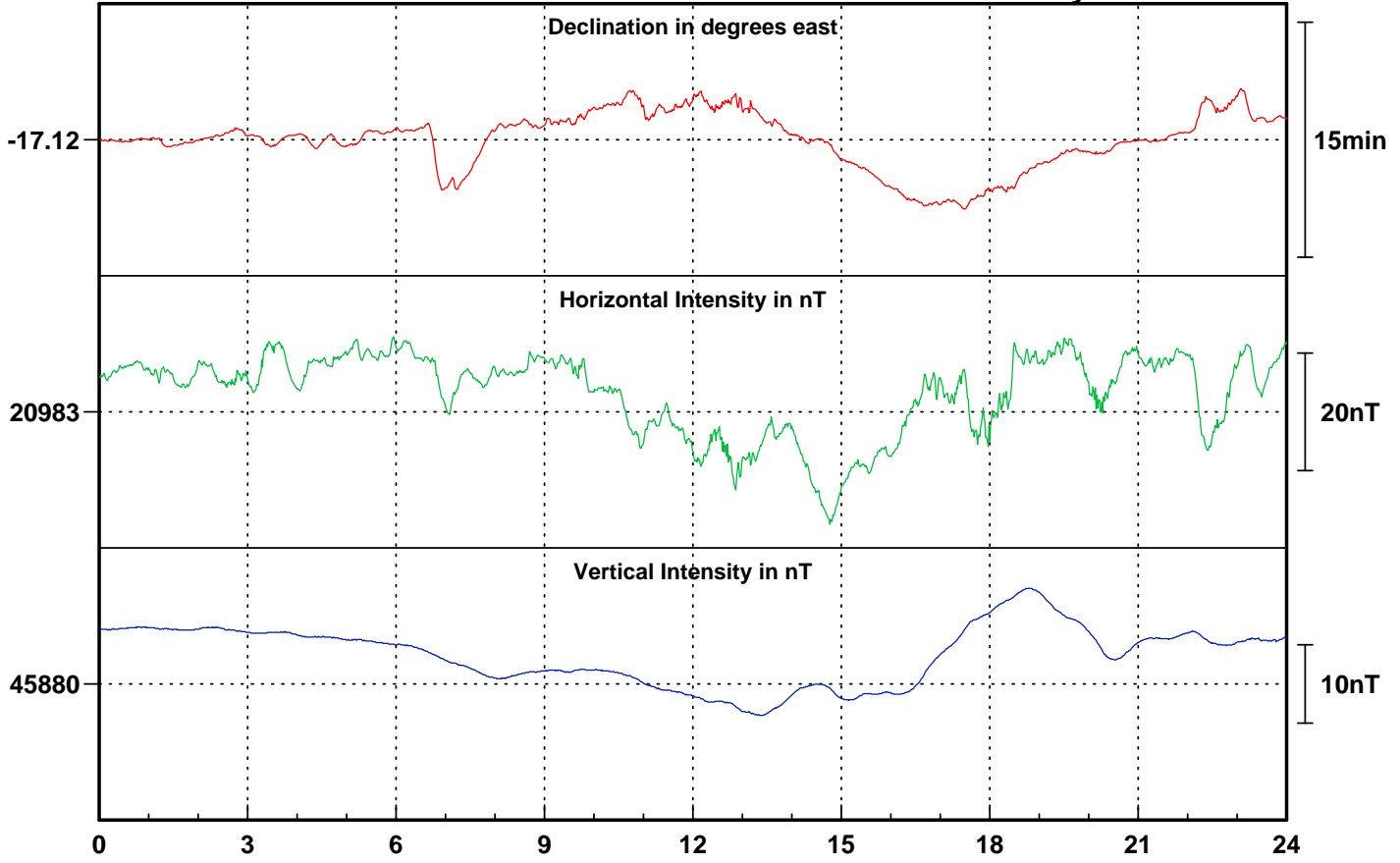
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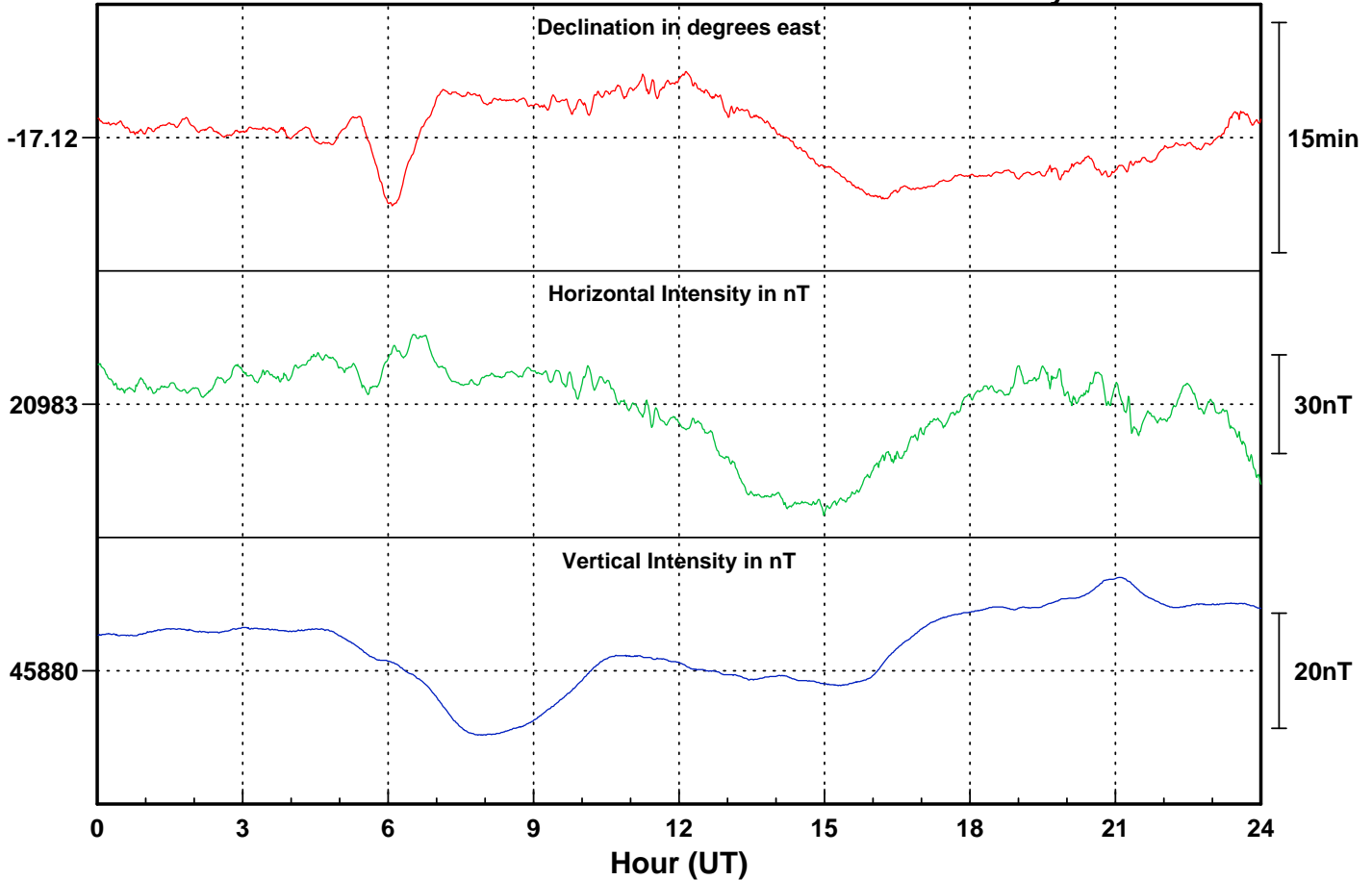
# Sable Island

Day number: 250



Date: 08-09-2019

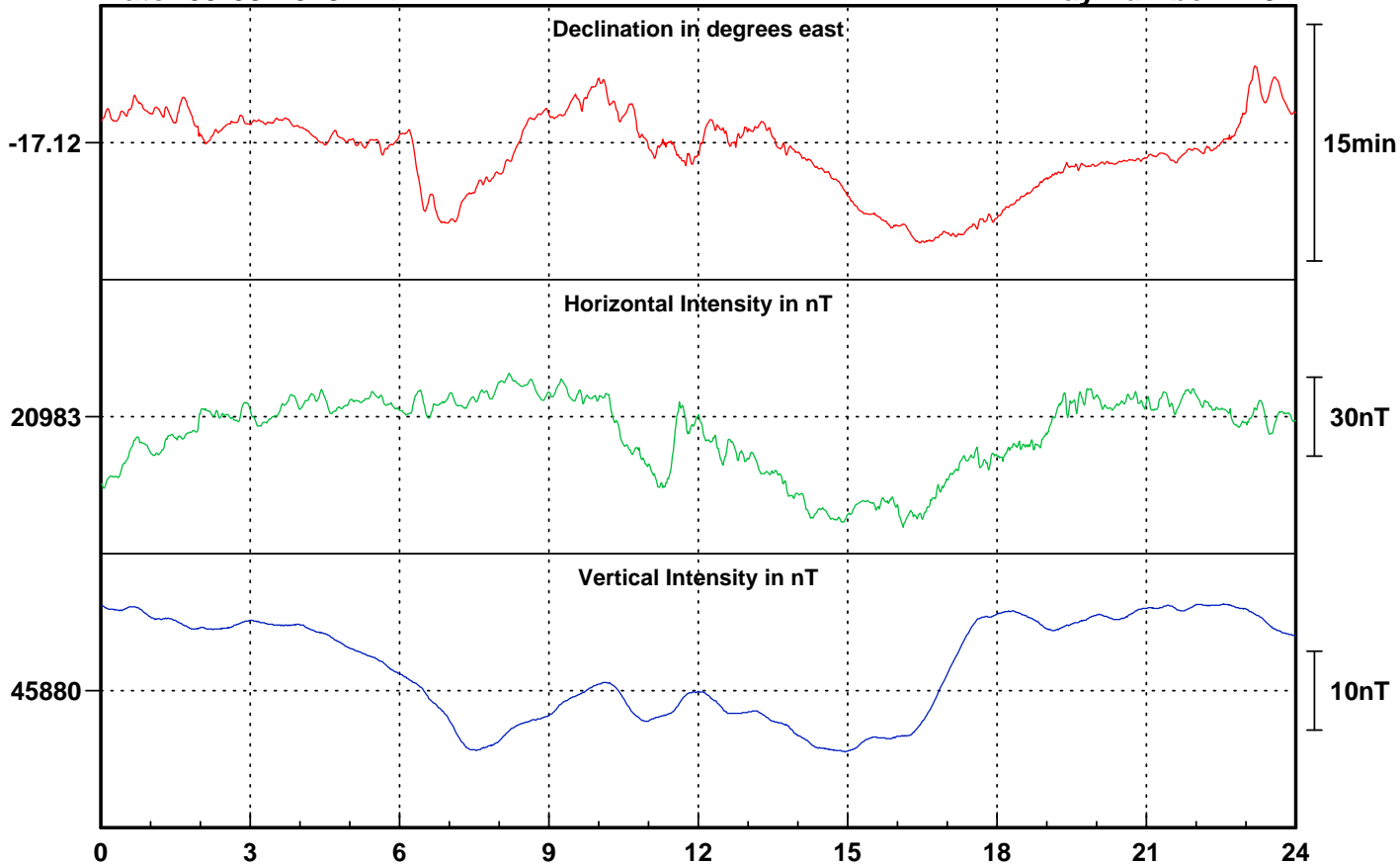
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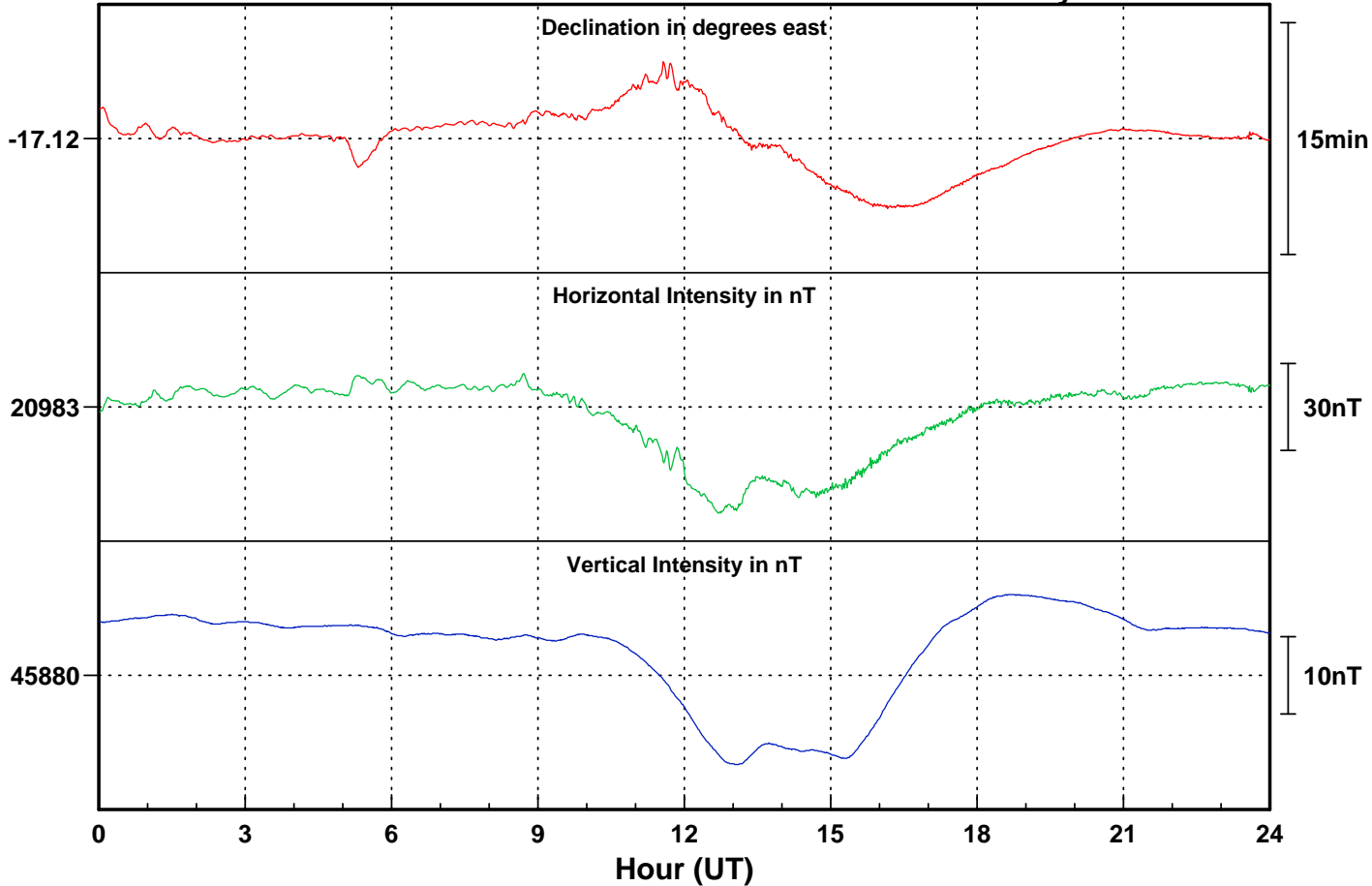
# Sable Island

Day number: 252



Date: 10-09-2019

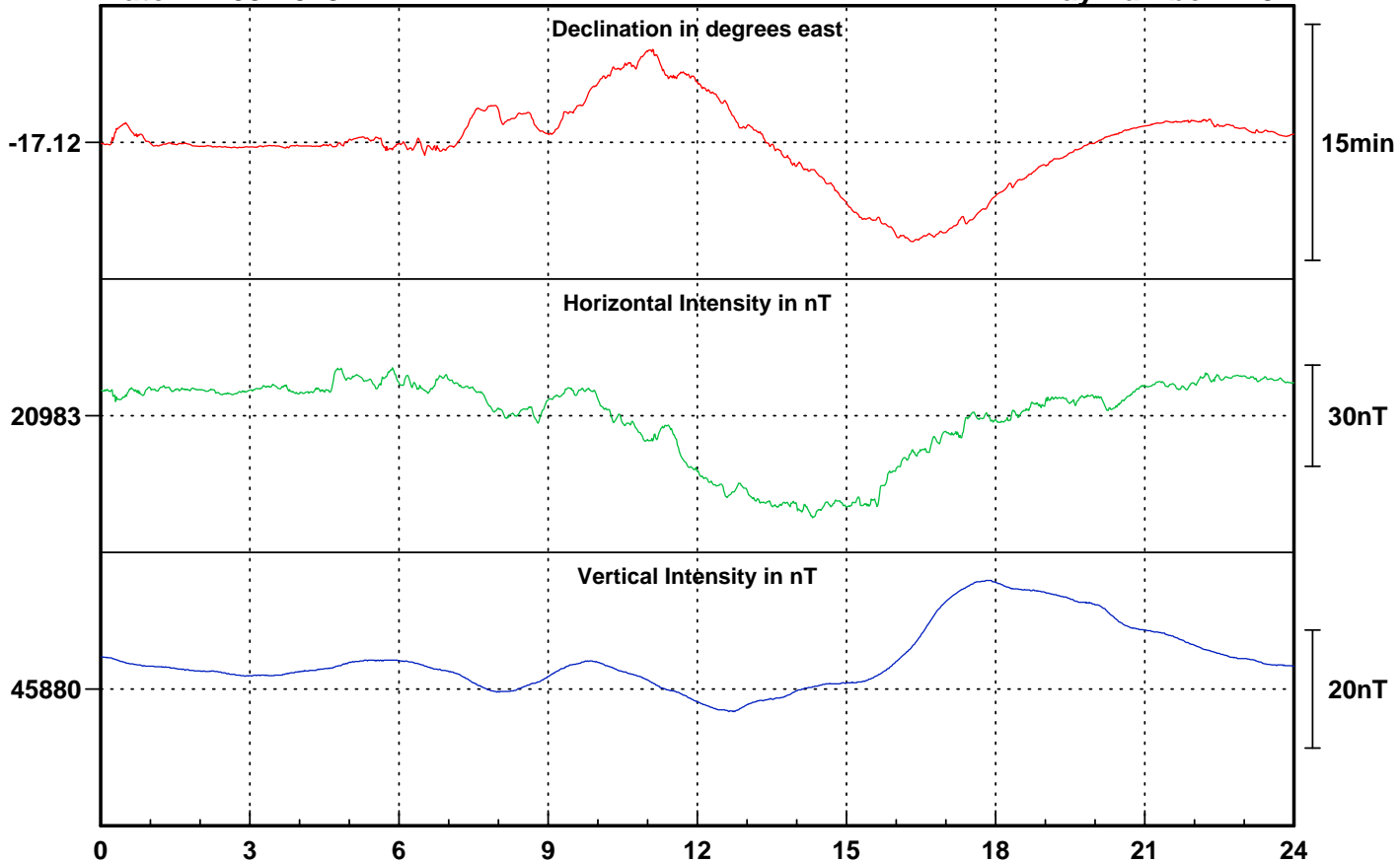
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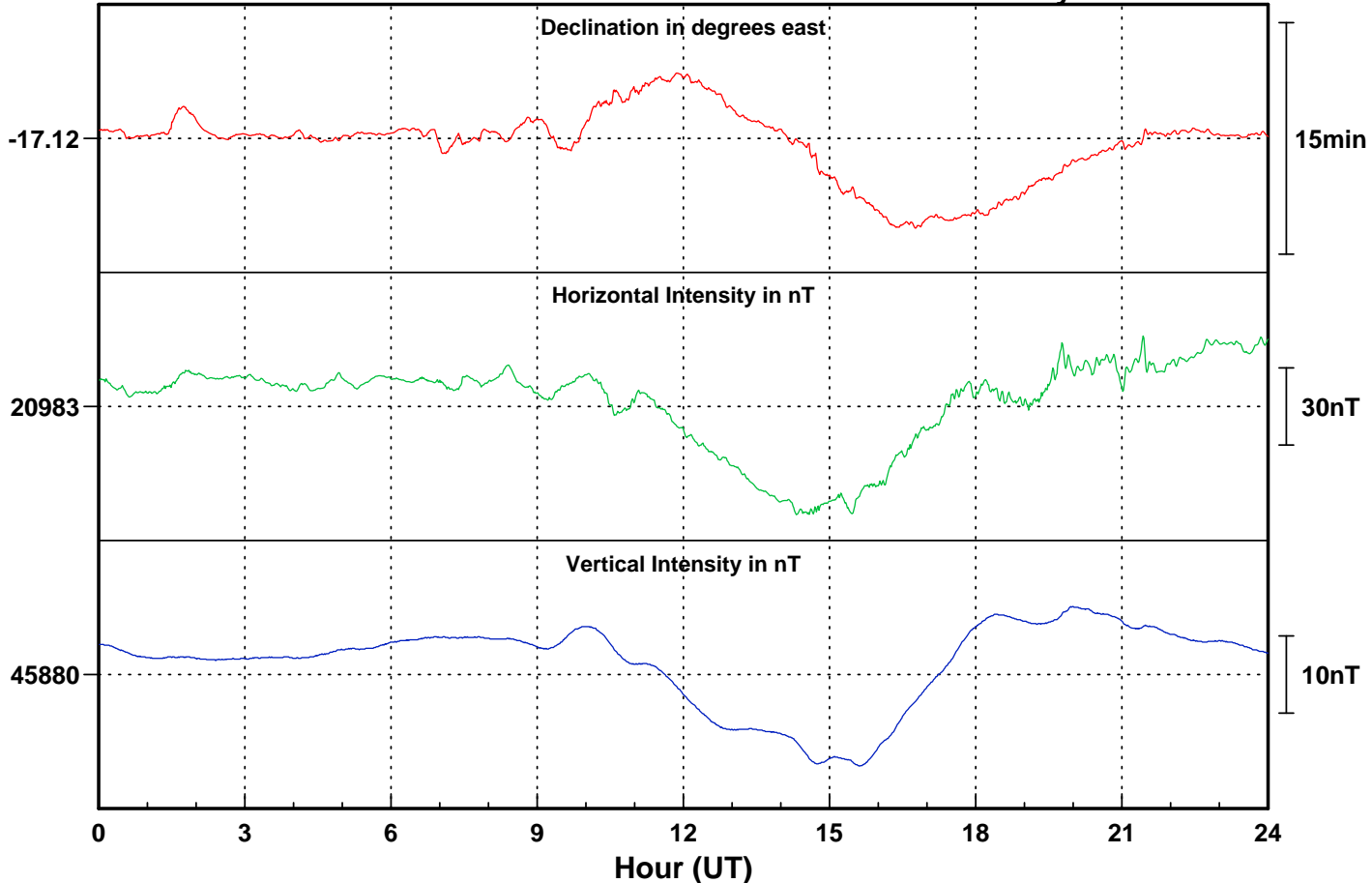
# Sable Island

Day number: 254



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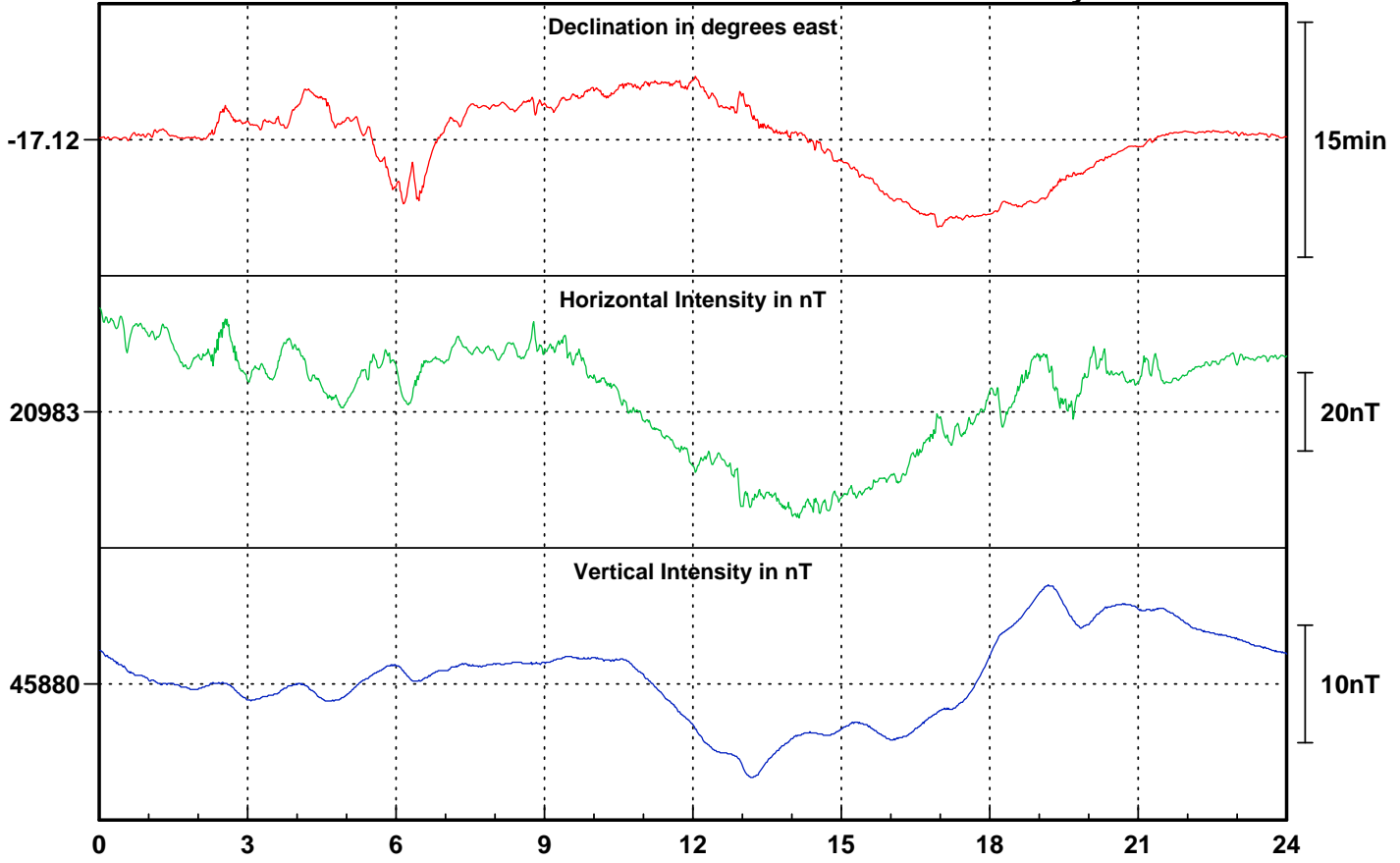
Day number: 255



Date: 13-09-2019

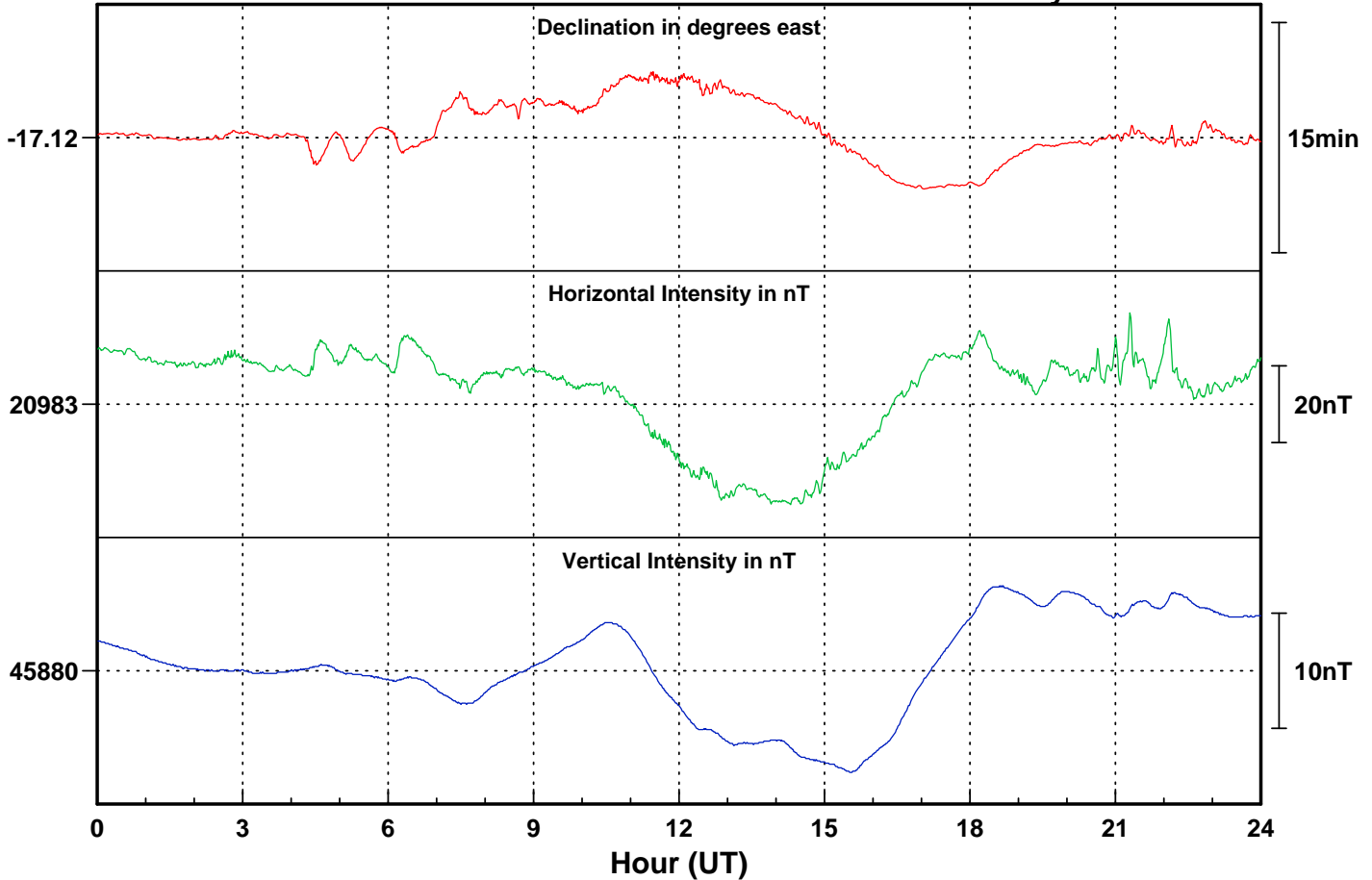
# Sable Island

Day number: 256



Date: 14-09-2019

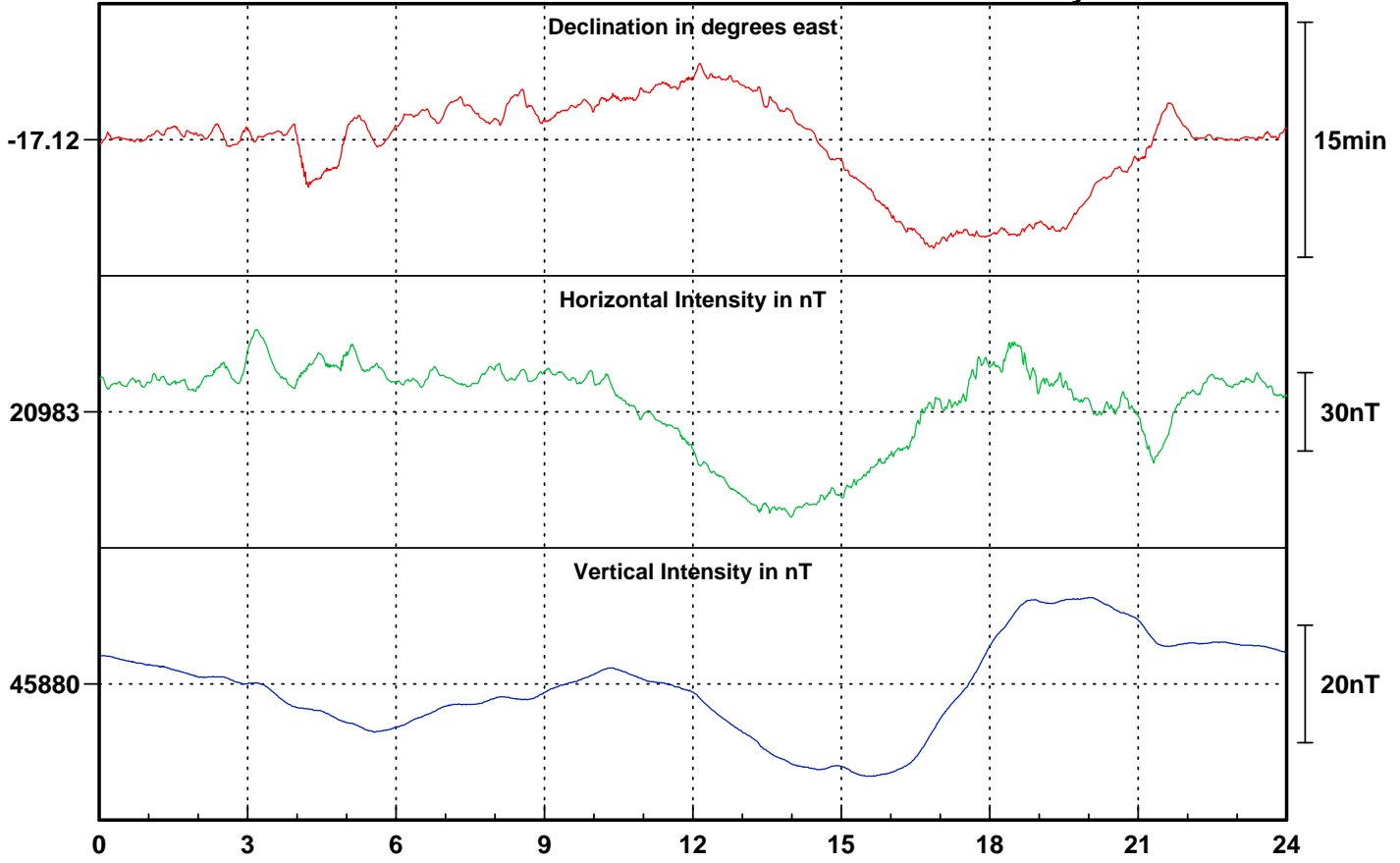
Day number: 257



Date: 15-09-2019

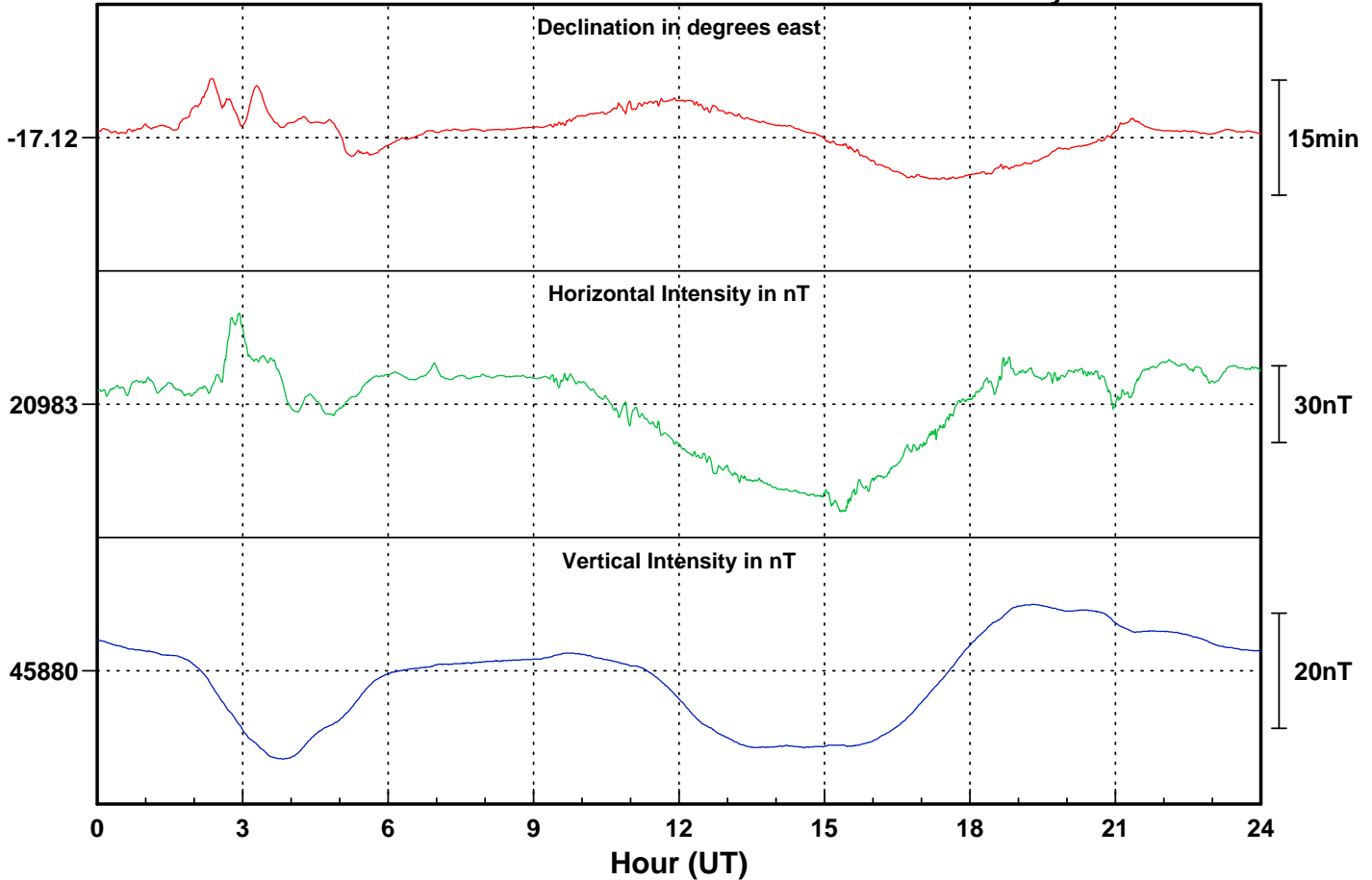
# Sable Island

Day number: 258



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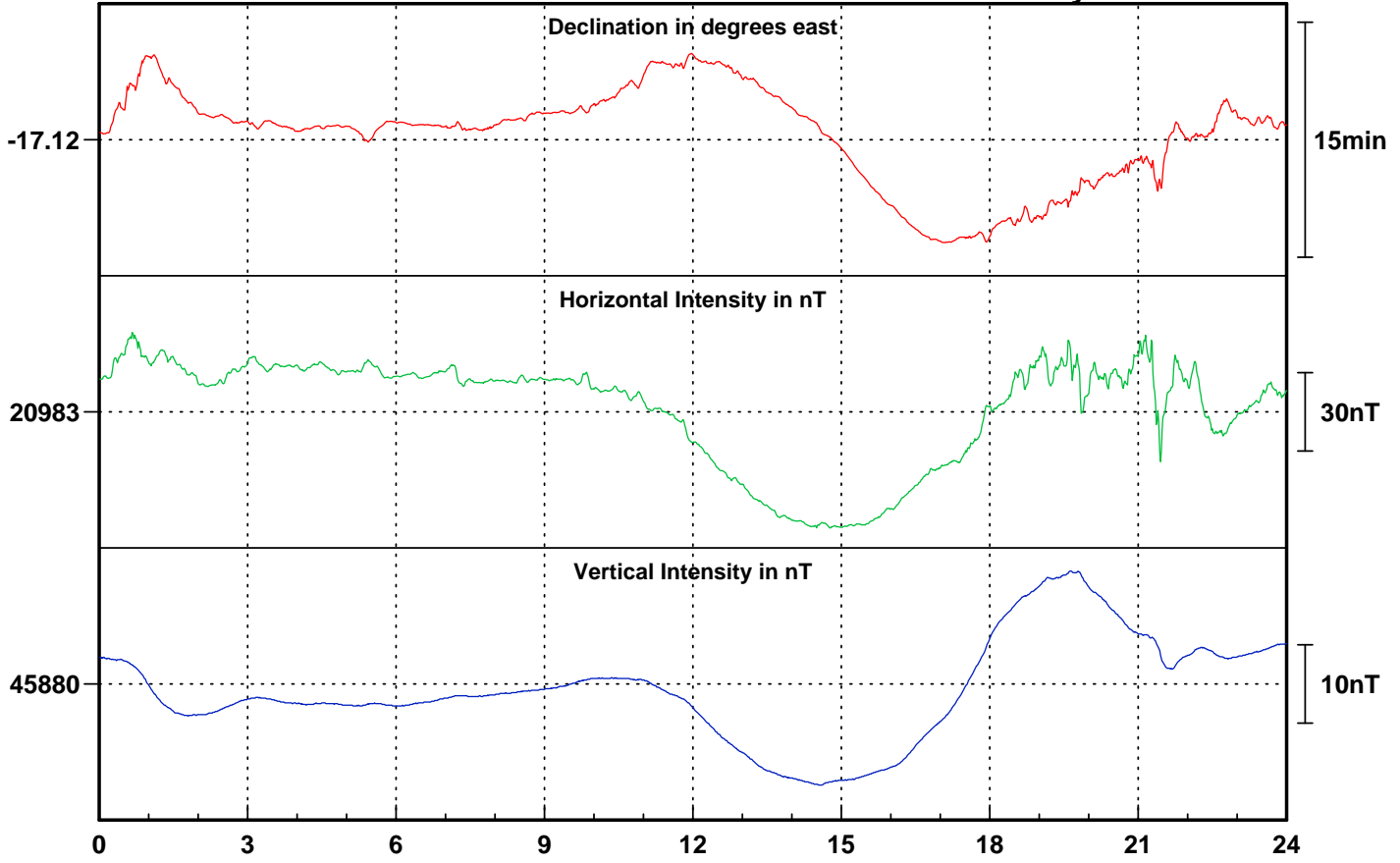
Day number: 259



Date: 17-09-2019

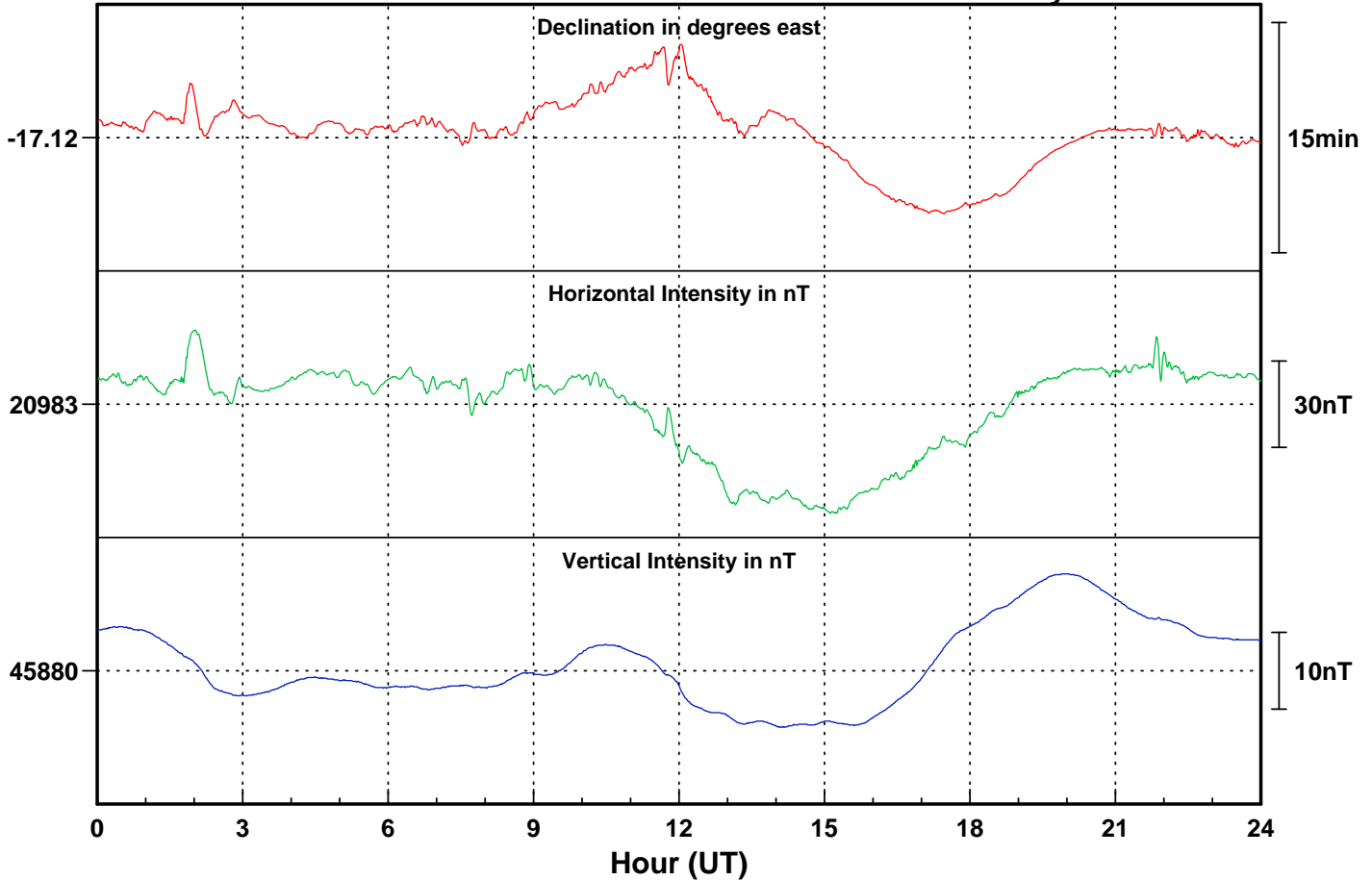
# Sable Island

Day number: 260



Date: 18-09-2019

Day number: 261

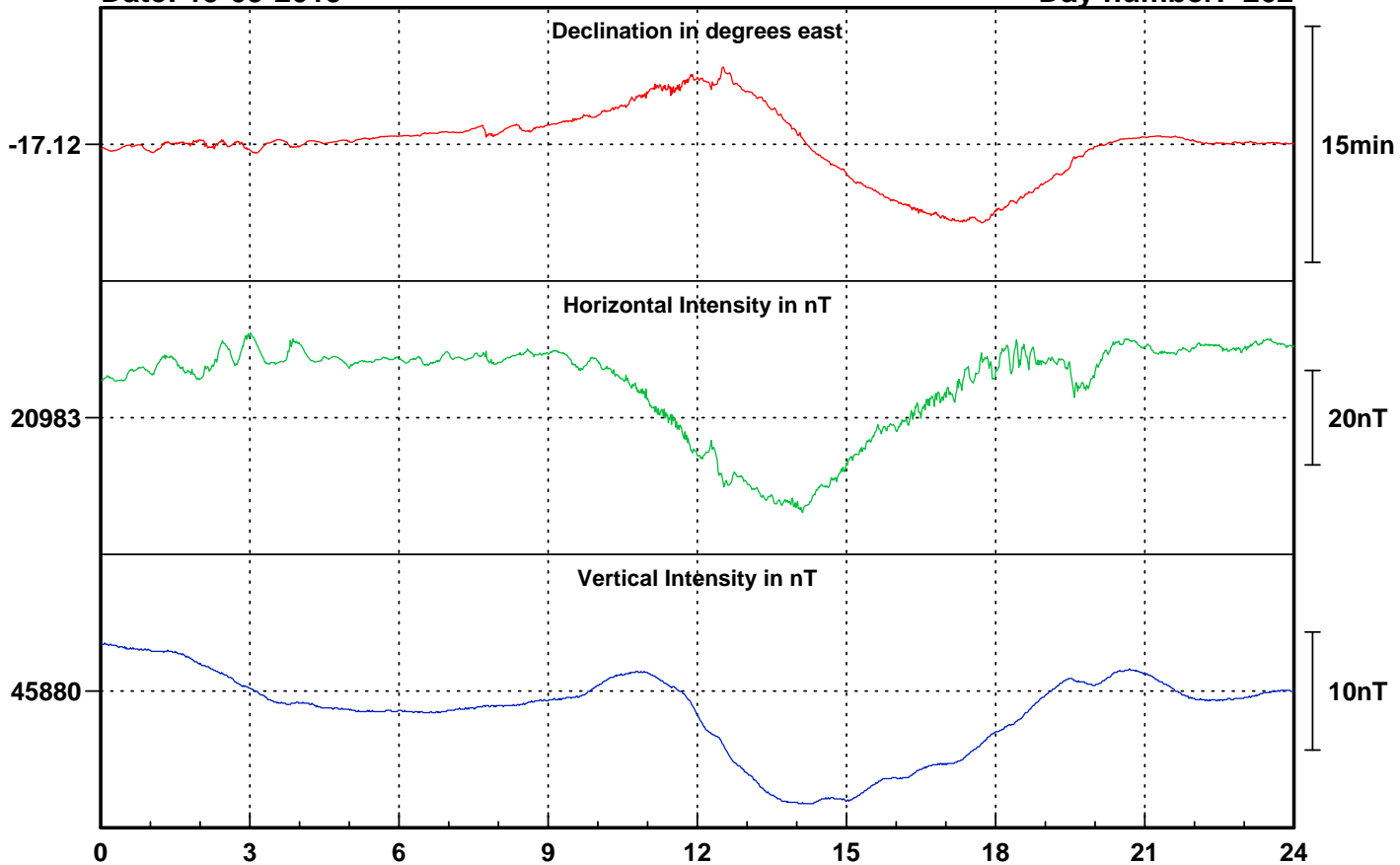




Date: 19-09-2019

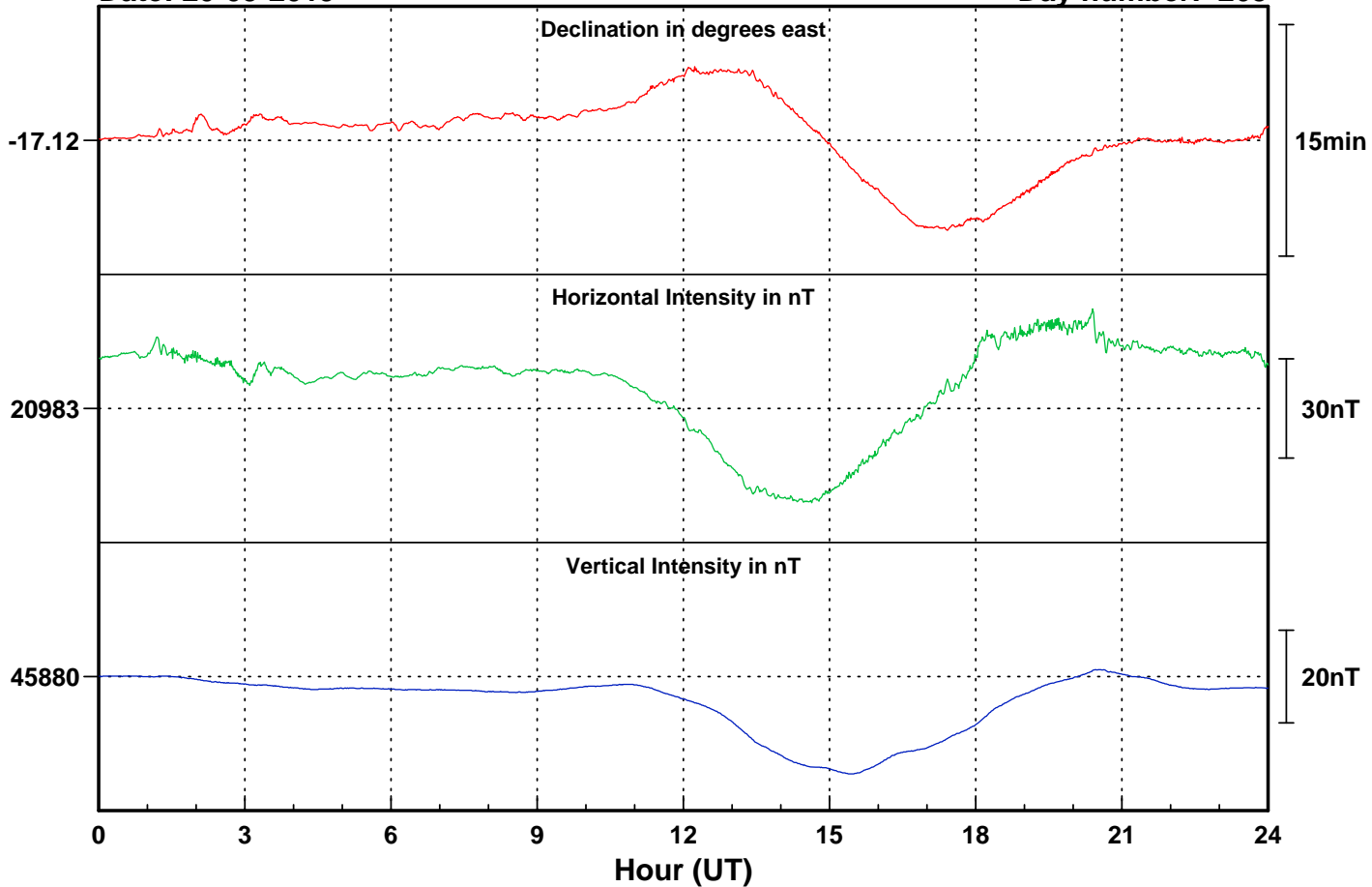
# Sable Island

Day number: 262



Date: 20-09-2019

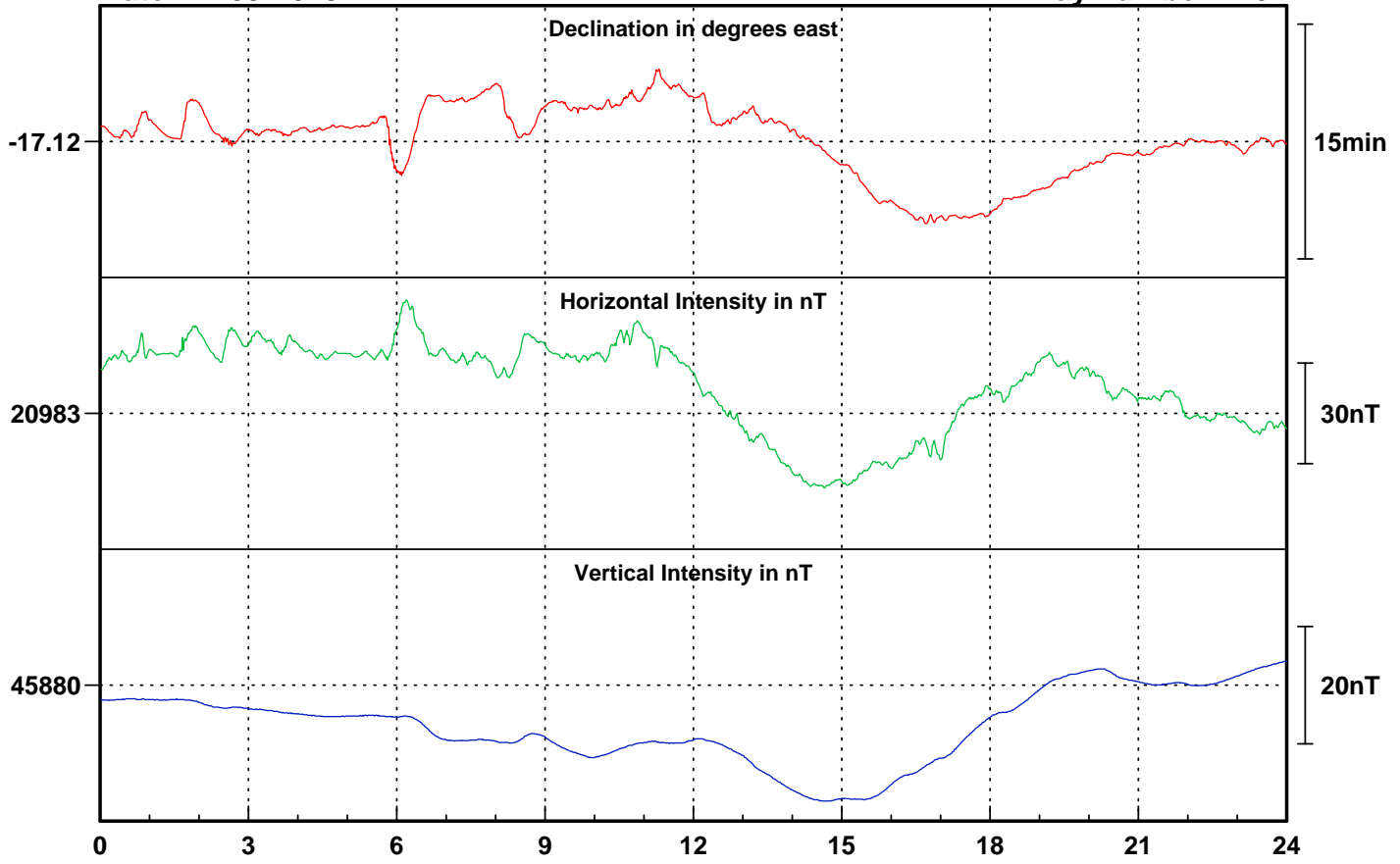
Day number: 263



Date: 21-09-2019

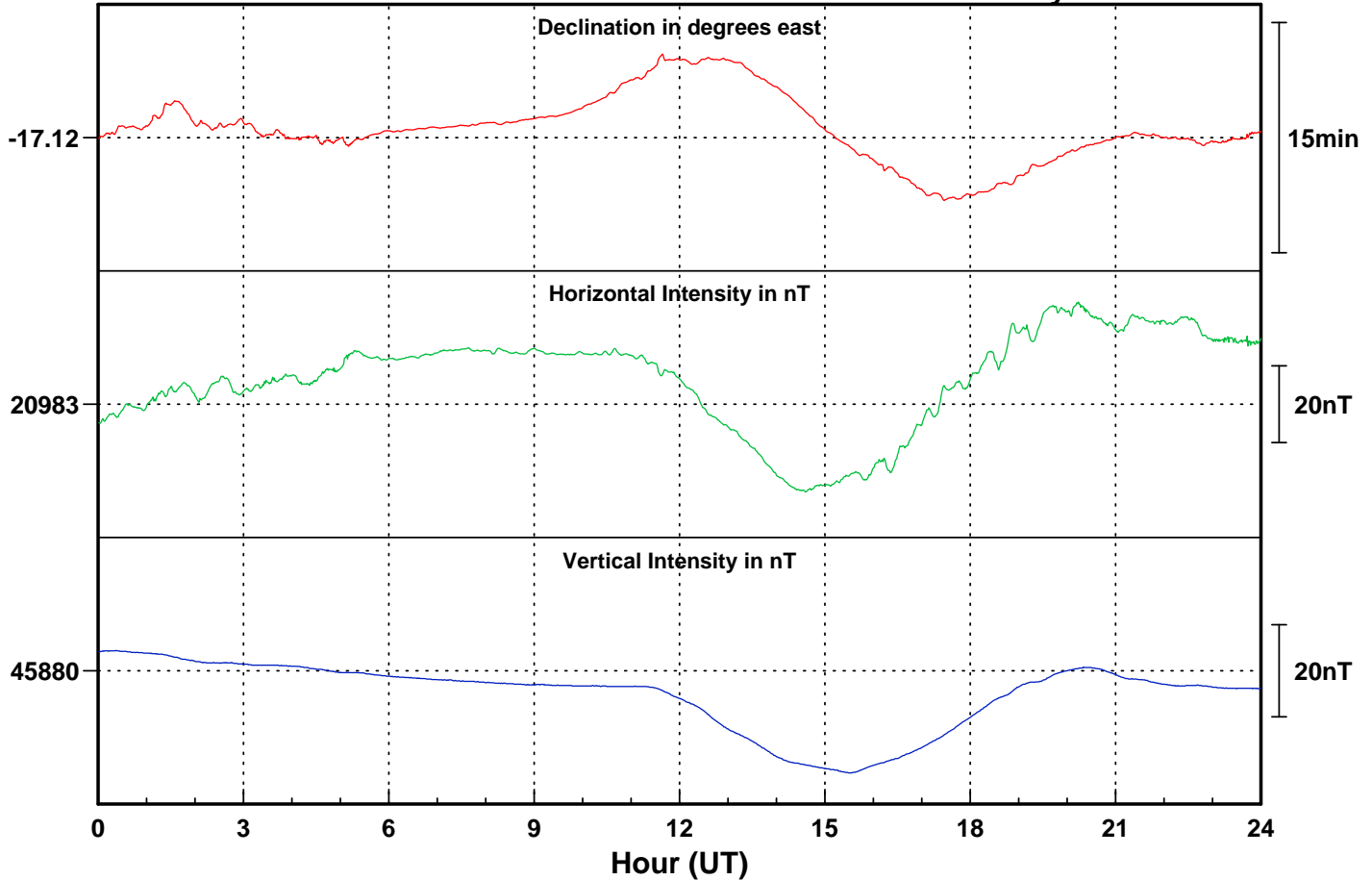
# Sable Island

Day number: 264



Date: 22-09-2019

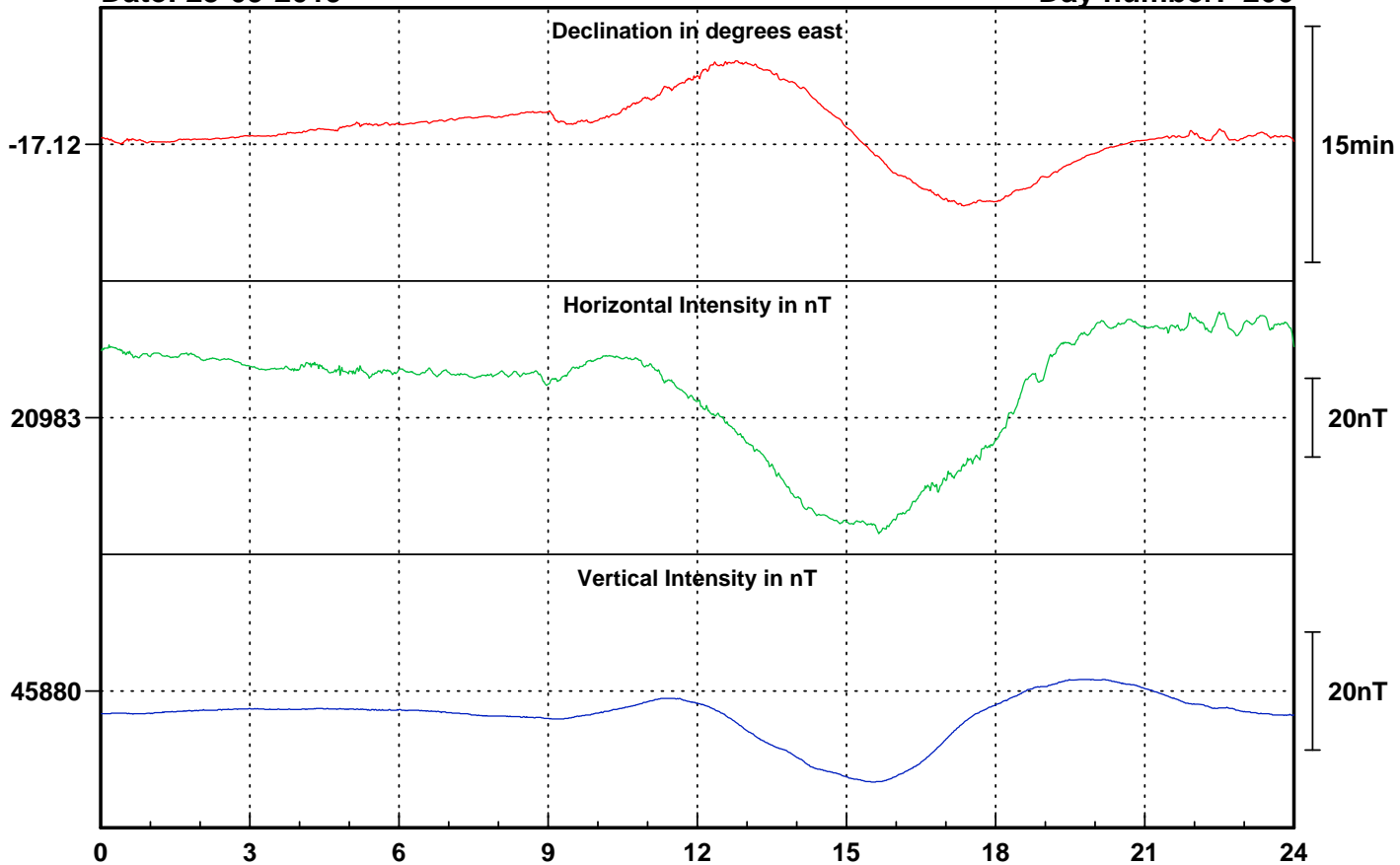
Day number: 265



Date: 23-09-2019

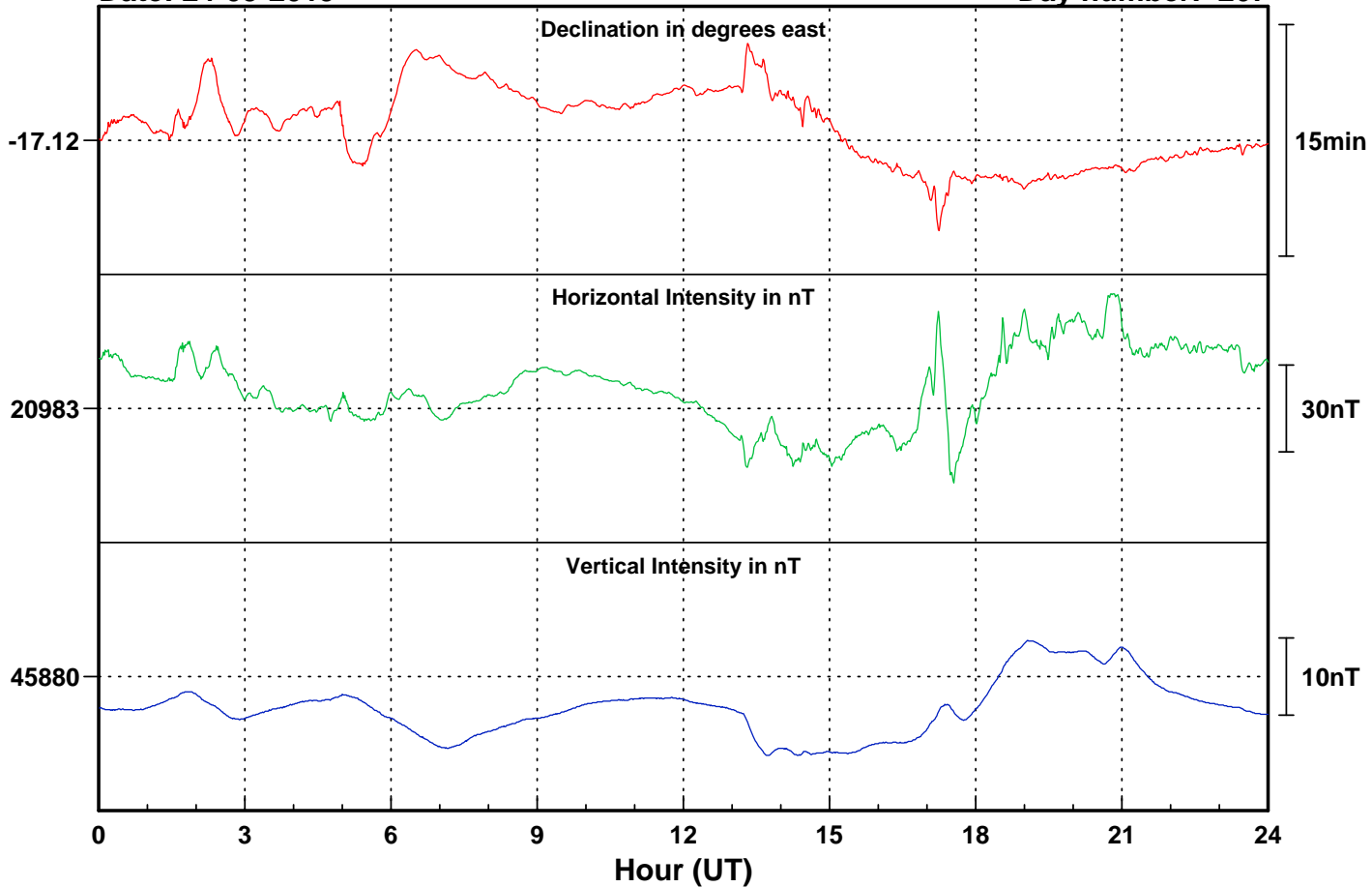
# Sable Island

Day number: 266



Date: 24-09-2019

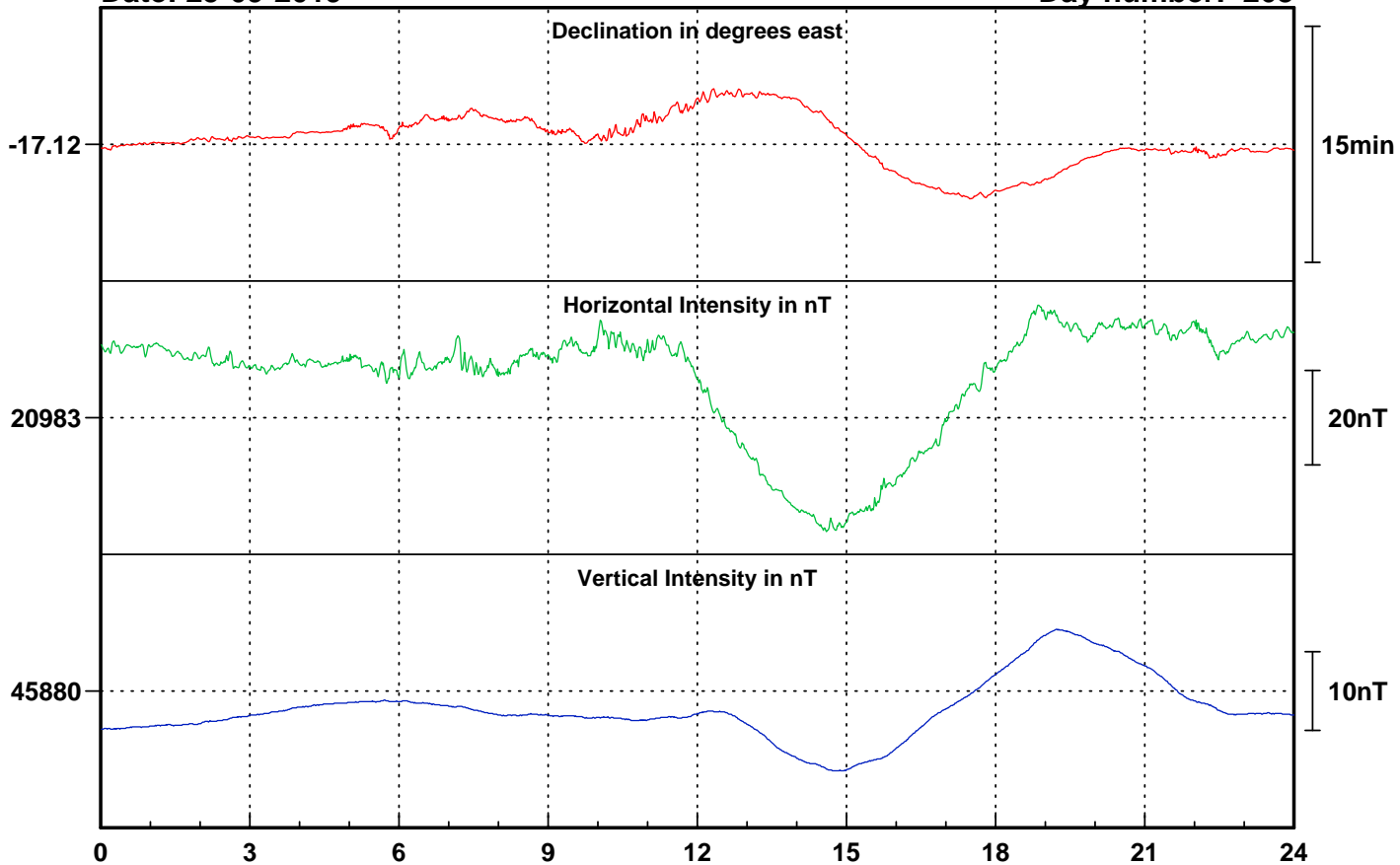
Day number: 267



Date: 25-09-2019

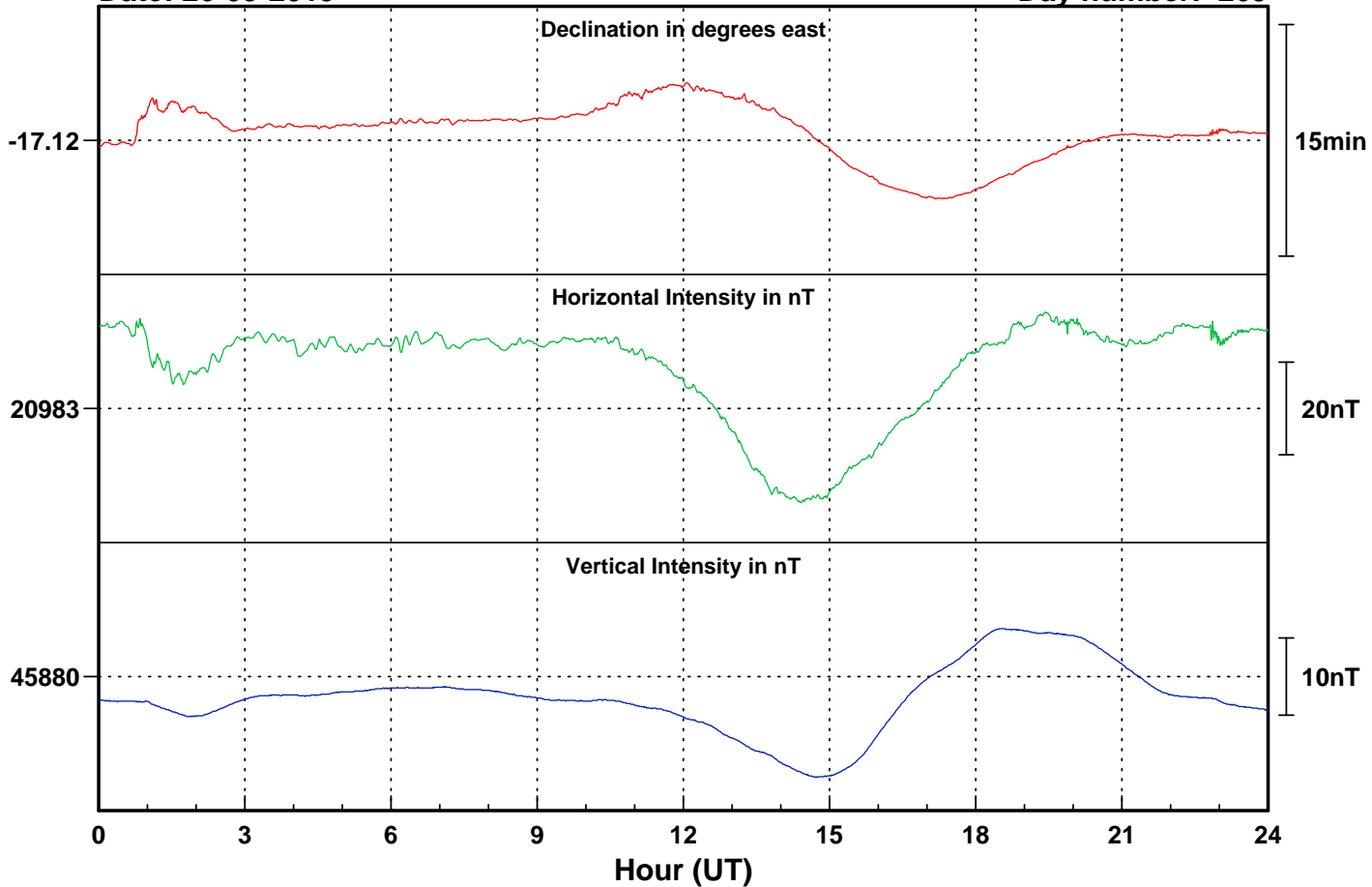
# Sable Island

Day number: 268



Date: 26-09-2019

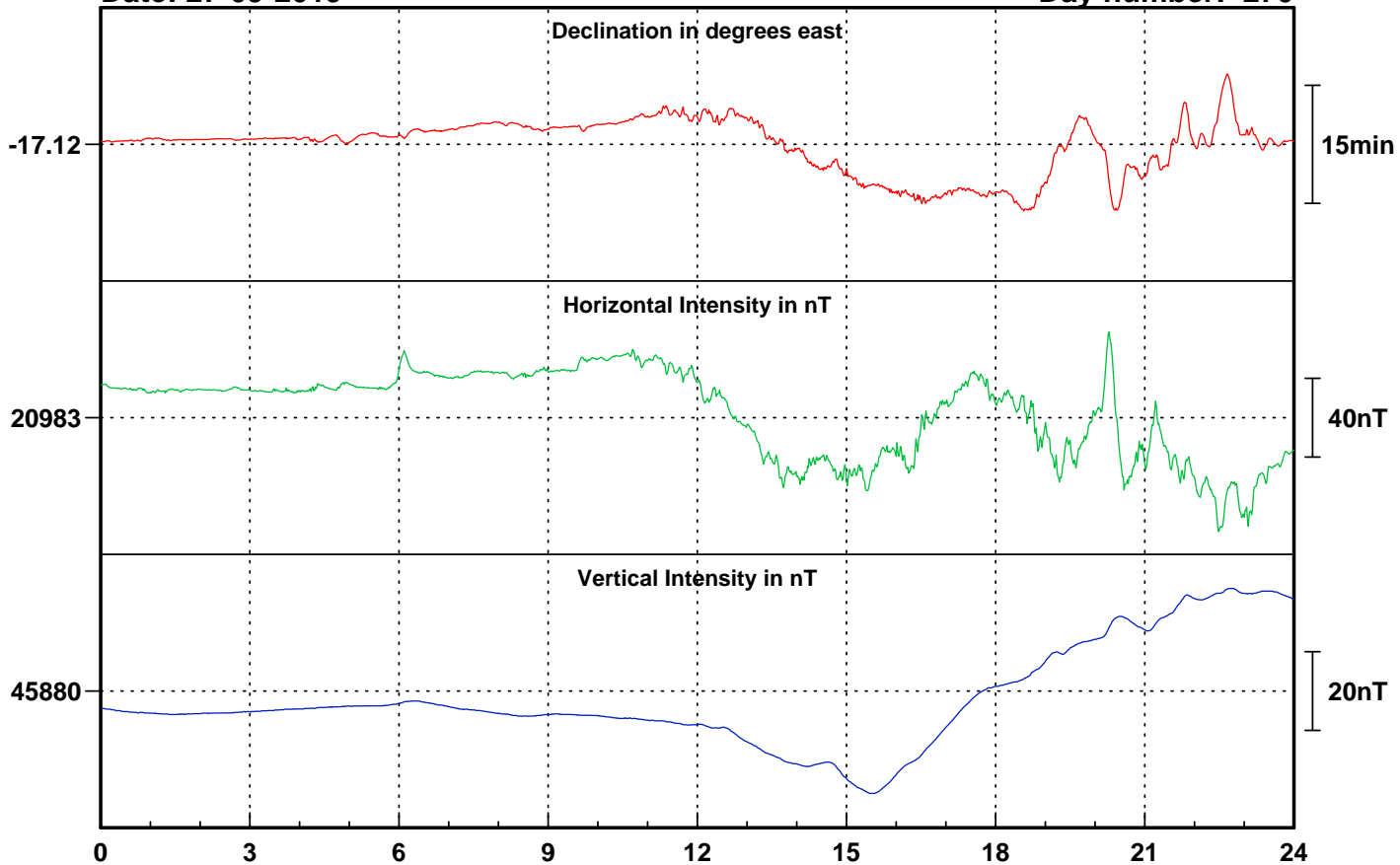
Day number: 269



Date: 27-09-2019

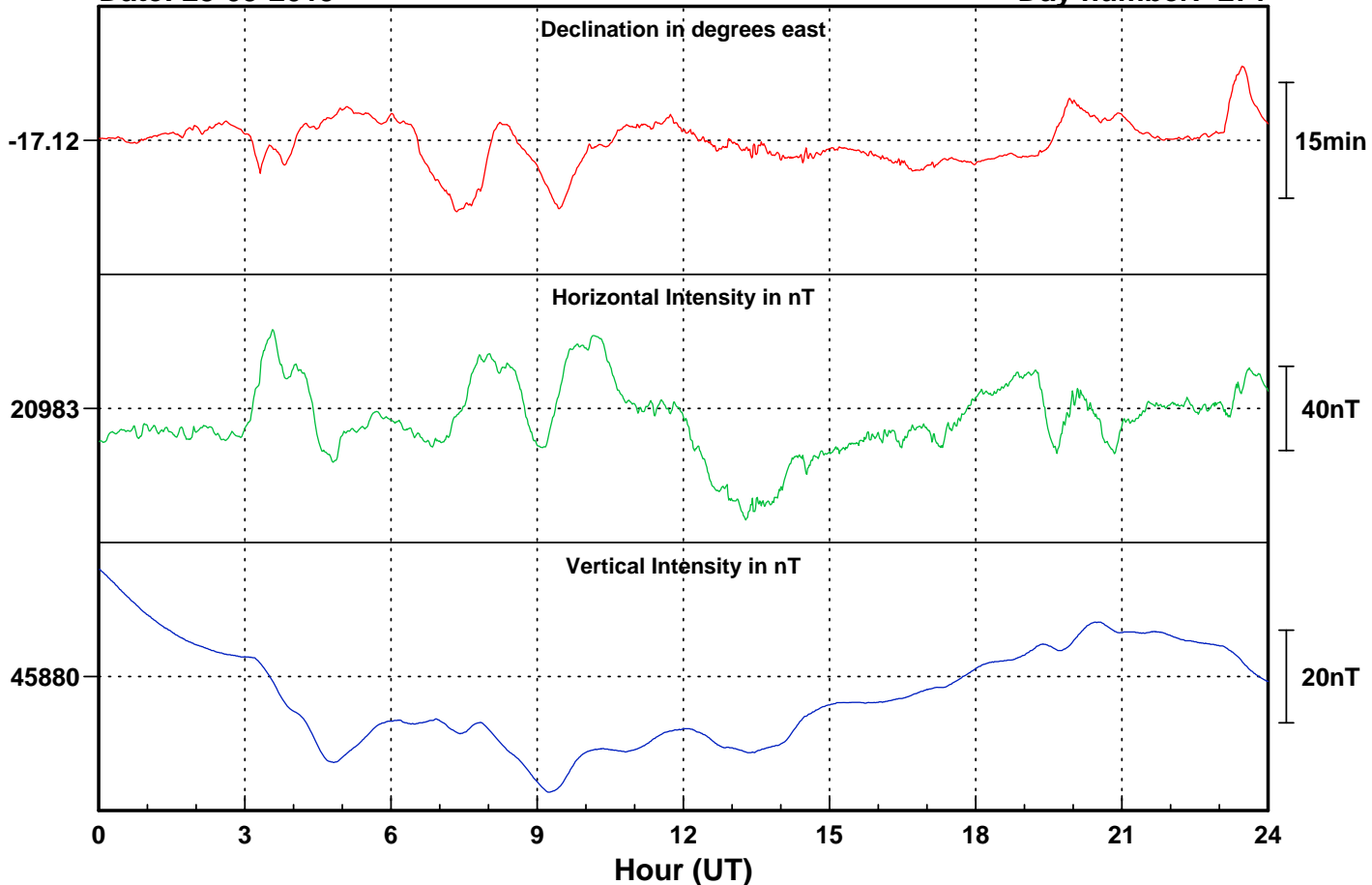
# Sable Island

Day number: 270



Date: 28-09-2019

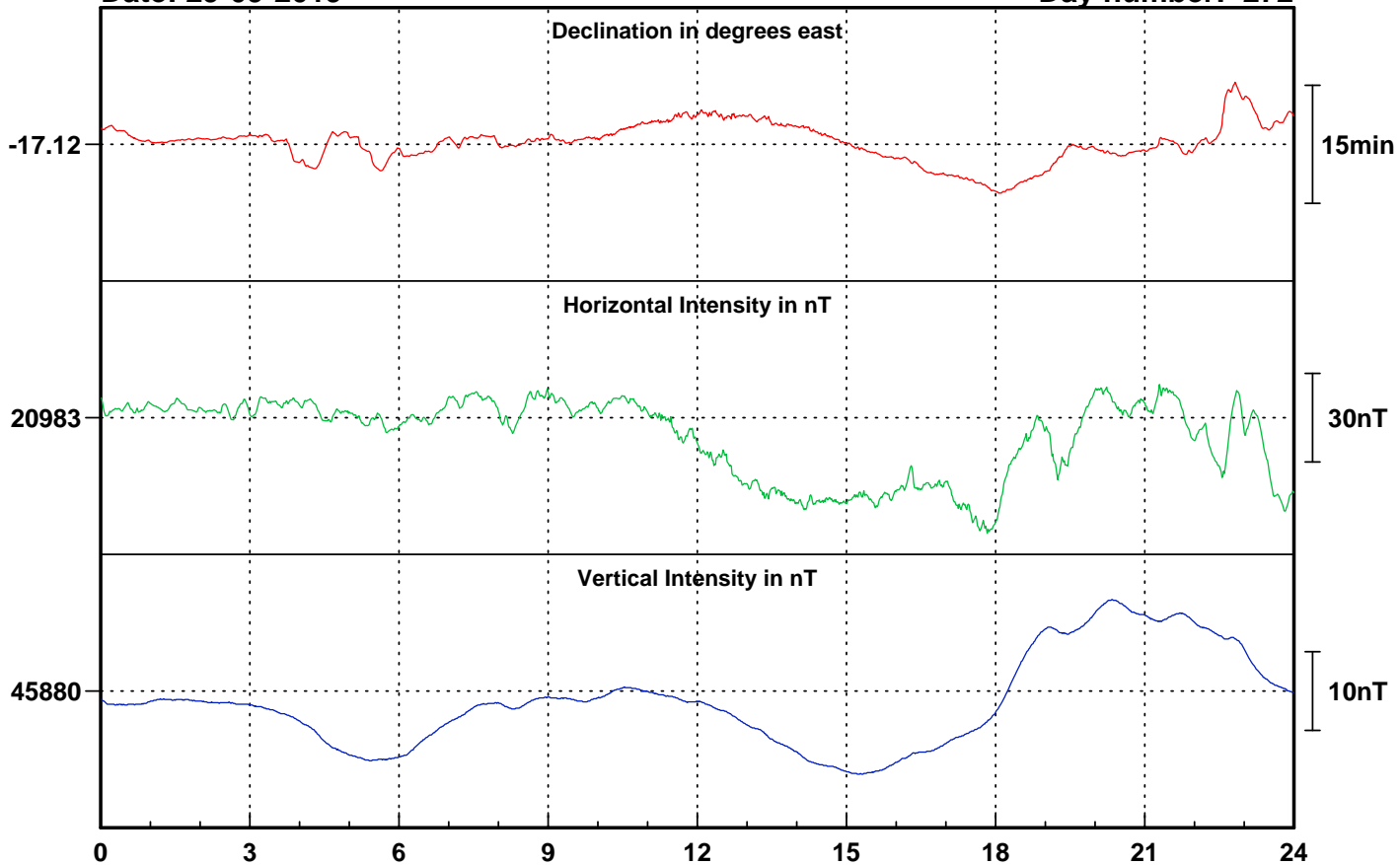
Day number: 271



Date: 29-09-2019

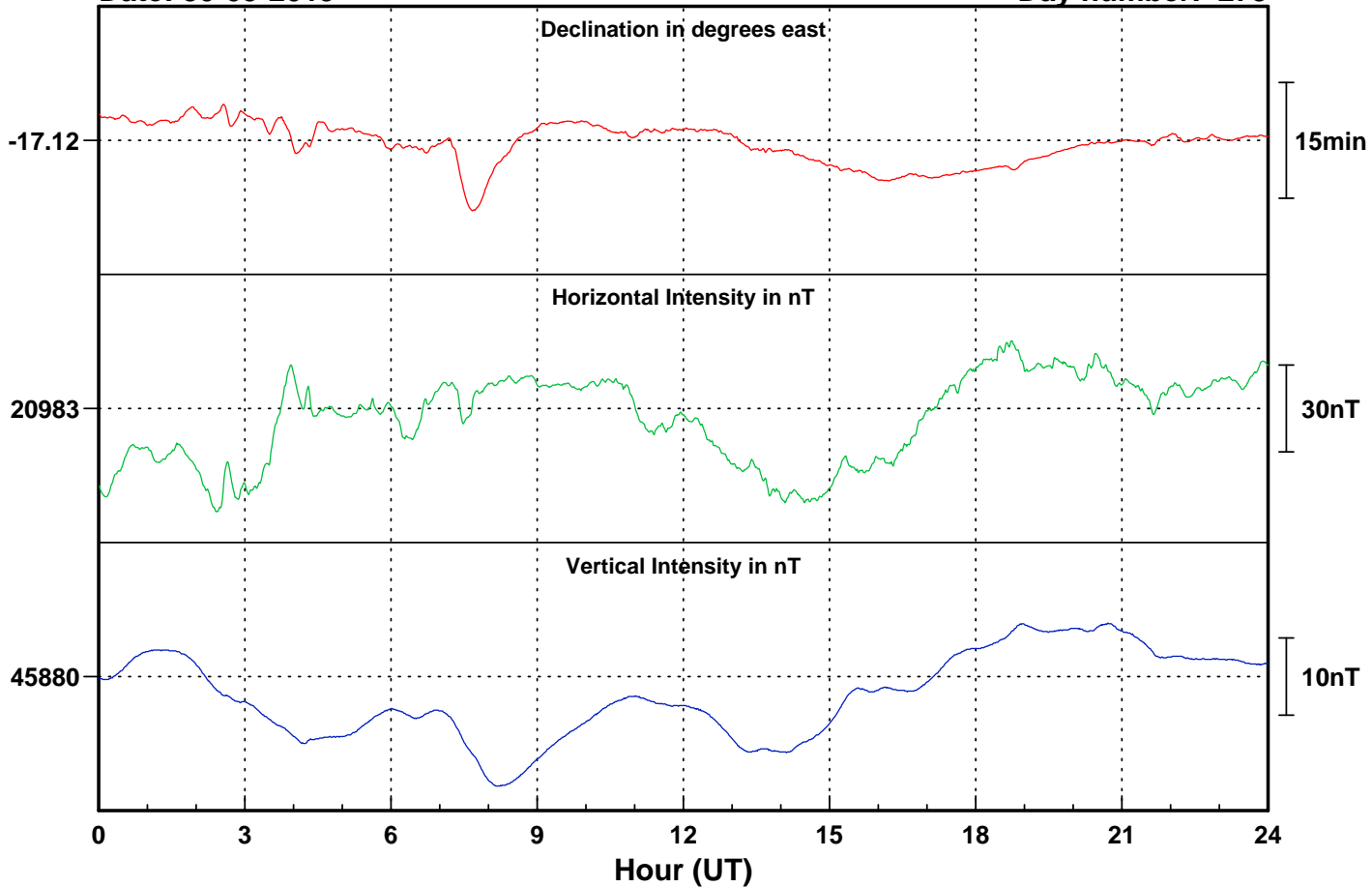
# Sable Island

Day number: 272

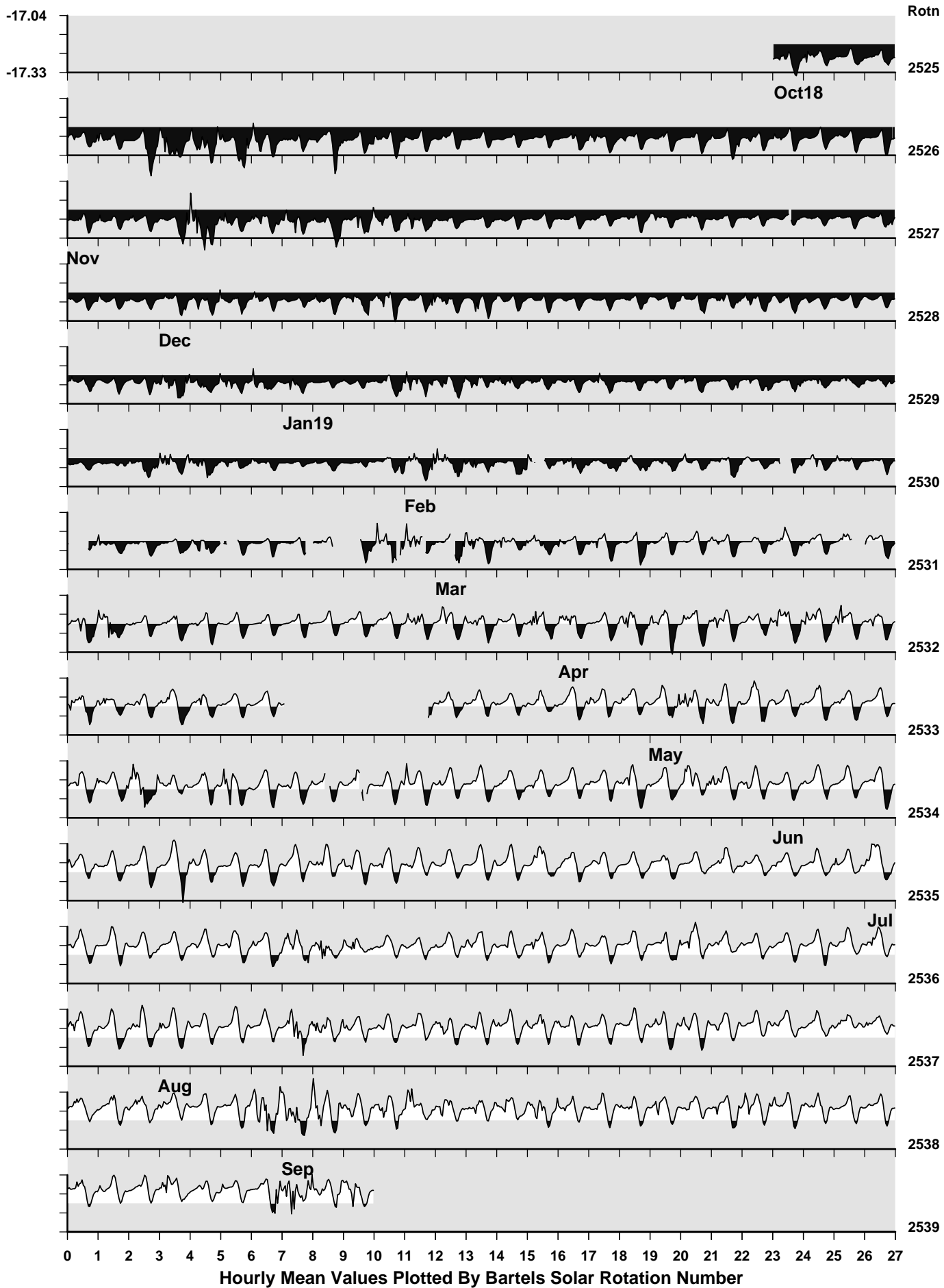


Date: 30-09-2019

Day number: 273

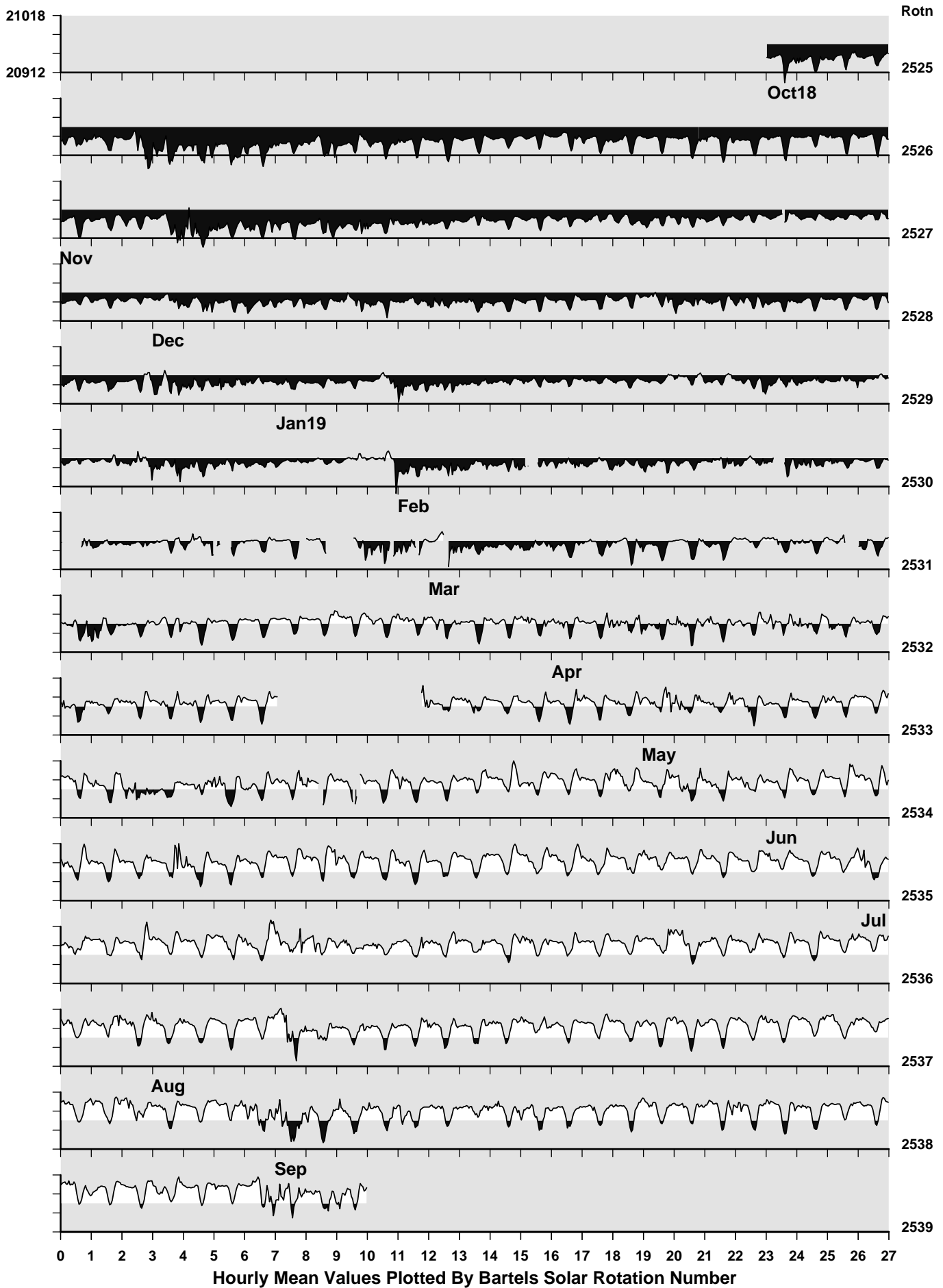


# Sable Island Observatory: Declination (degrees)



Hourly Mean Values Plotted By Bartels Solar Rotation Number

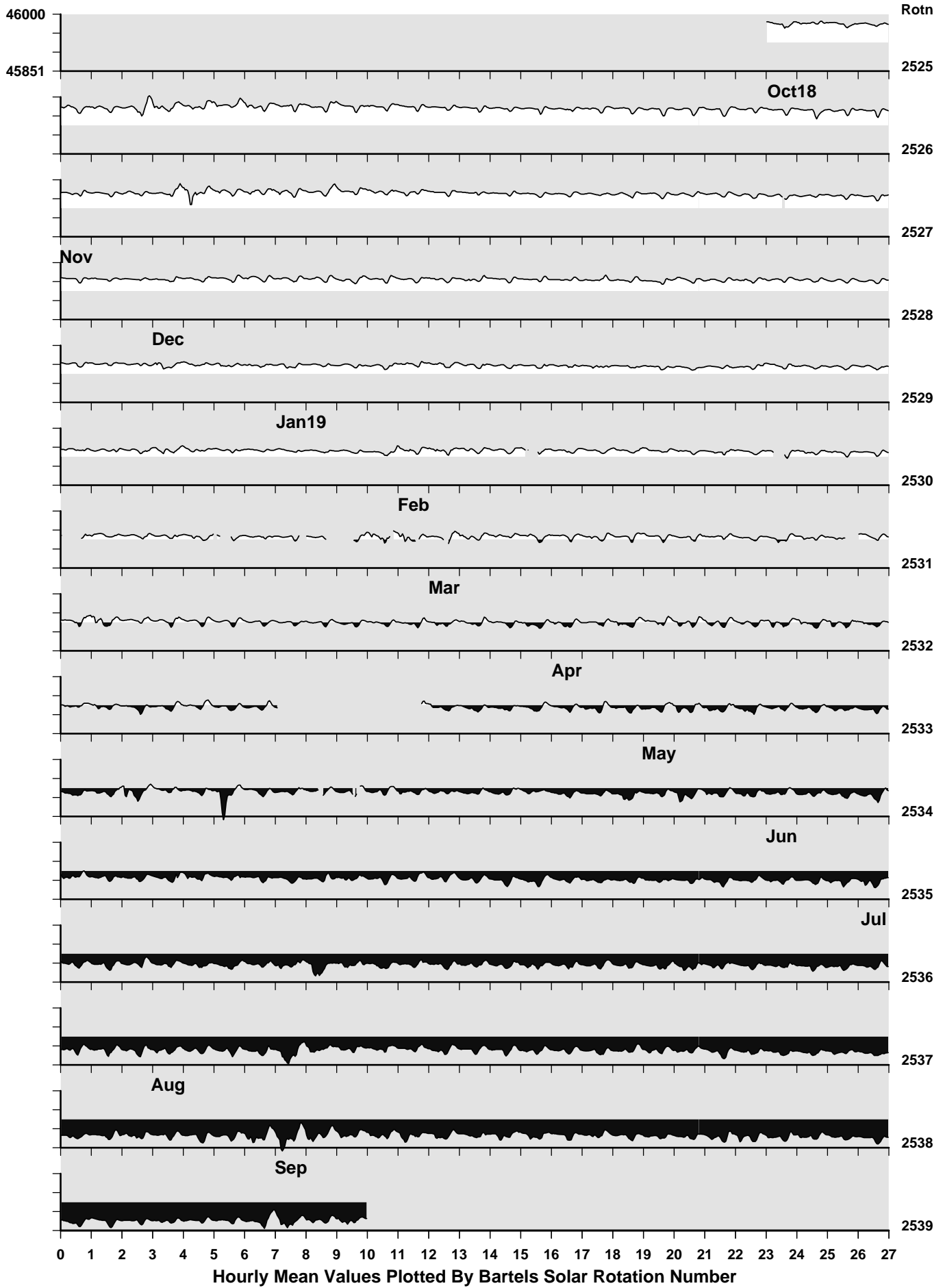
# Sable Island Observatory: Horizontal Intensity (nT)



Hourly Mean Values Plotted By Bartels Solar Rotation Number

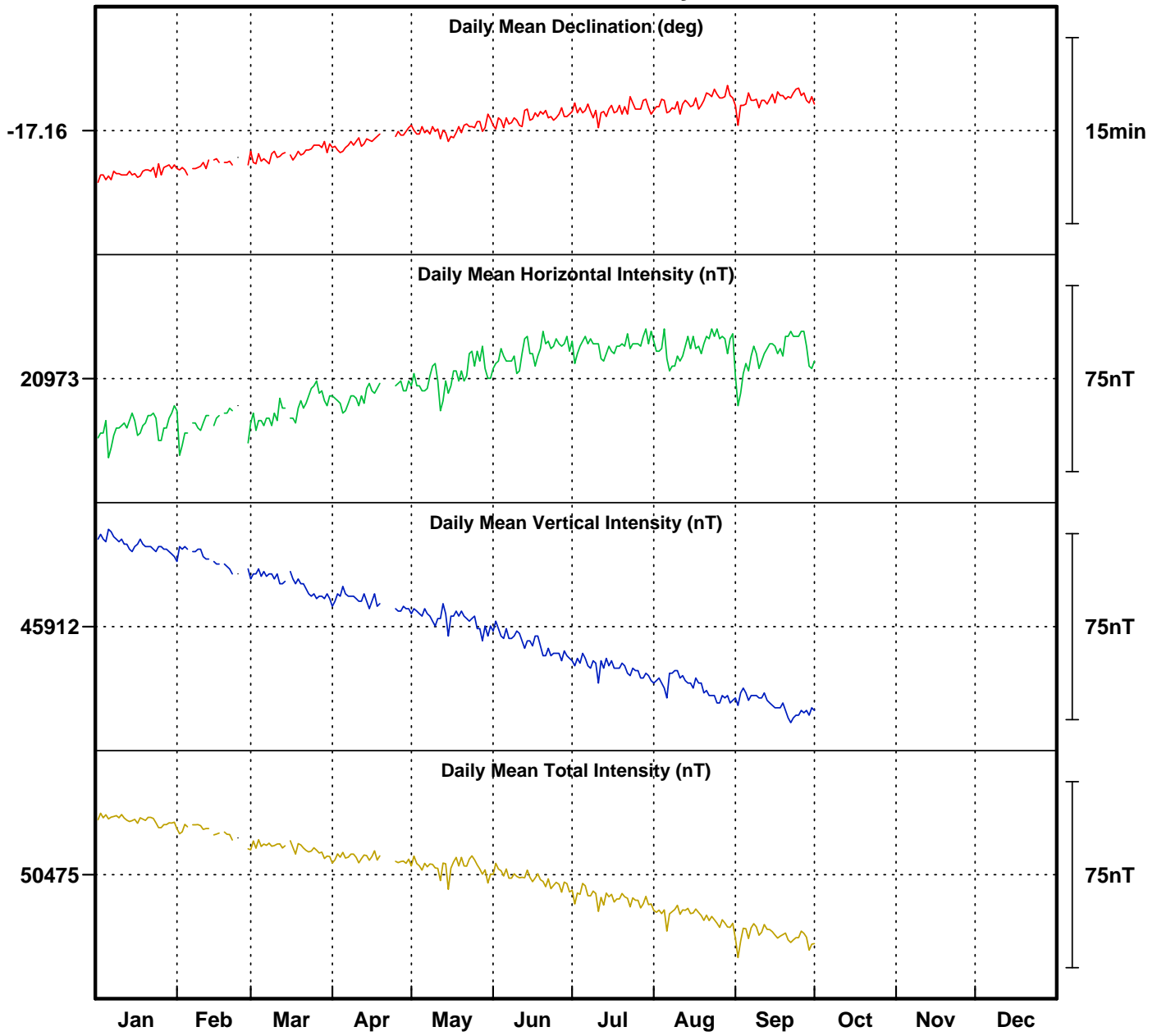


# Sable Island Observatory: Vertical Intensity (nT)



Hourly Mean Values Plotted By Bartels Solar Rotation Number

# Sable Island Observatory 2019



### Monthly Mean Values for Sable Island Observatory 2019

Month	<i>D</i>	<i>H</i>	<i>I</i>	<i>X</i>	<i>Y</i>	<i>Z</i>	<i>F</i>
January	-17° 13.2′	20954 nT	65° 29.0′	20015 nT	-6203 nT	45944 nT	50497 nT
February	999 999.9	99999	999 999.9	99999	99999	99999	99999
March	-17° 11.5′	20961 nT	65° 28.1′	20025 nT	-6196 nT	45929 nT	50486 nT
April	999 999.9	99999	999 999.9	99999	99999	99999	99999
May	-17° 09.6′	20974 nT	65° 26.9′	20040 nT	-6188 nT	45915 nT	50478 nT
June	-17° 08.7′	20984 nT	65° 26.0′	20051 nT	-6186 nT	45905 nT	50473 nT
July	-17° 08.0′	20986 nT	65° 25.6′	20055 nT	-6183 nT	45895 nT	50466 nT
August	-17° 07.4′	20986 nT	65° 25.4′	20055 nT	-6179 nT	45887 nT	50458 nT
September	-17° 07.2′	20983 nT	65° 25.4′	20053 nT	-6177 nT	45880 nT	50451 nT

#### Note

- i. The values shown here are provisional.
- ii. 999 999.9 and 99999 indicate values that have been flagged due to >10% of data missing during that month.