BRITISH GEOLOGICAL SURVEY

Sable Island Observatory *Monthly Magnetic Bulletin*

September 2009

09/09/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 BGS. The installation, funded by a joint venture between BGS, Sperry Drilling Services and Sable Offshore Energy, was completed in May 1999 and the observatory became operational from 8th May 1999.

Magnetic observatory data is presented as a series of plots of one-minute, hourly and daily values, followed by a tabulation 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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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:	orba@bgs.ac.uk
Internet:	*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° 55.92′N*	*299°59.46′E*
Geomagnetic:	*53° 56.28′N*	*14°22.26′E*
Height above mean sea level:		*5m (approx)*

The geomagnetic co-ordinates are calculated using the 10th generation International Geomagnetic Reference Field (IGRF) at epoch 2009.5.

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 13th May 2004. The system operates under the control of data acquisition software running on QNX computers, which control the data logging and communications.

There are two sets of sensors used for making magnetic measurements. A triaxial 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 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 whilst 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. Two sets of absolute measurements of the field are made manually once per week. 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. Data Presentation

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 a page and show the 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 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.

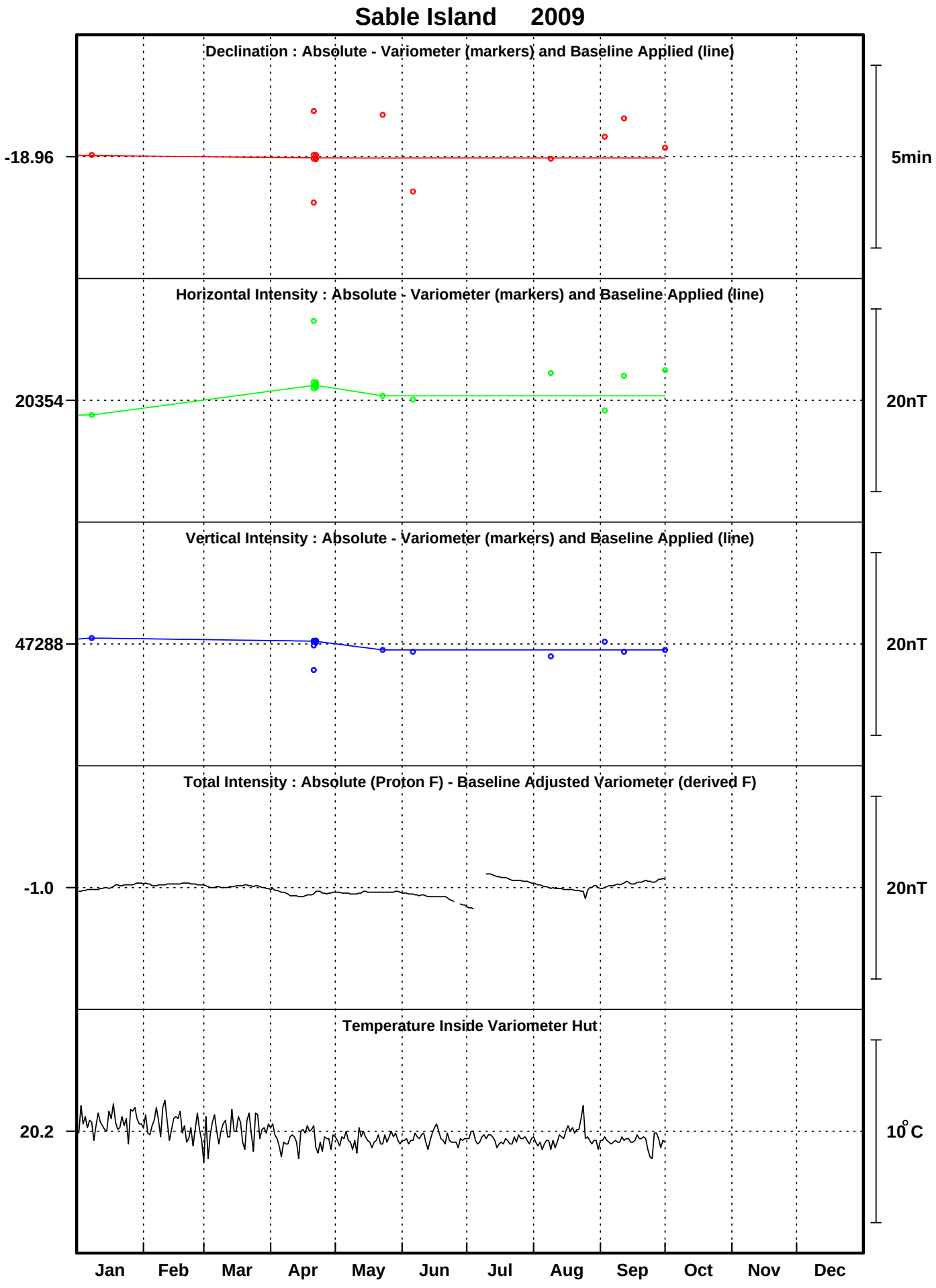
4.5 Daily and Monthly Mean Values

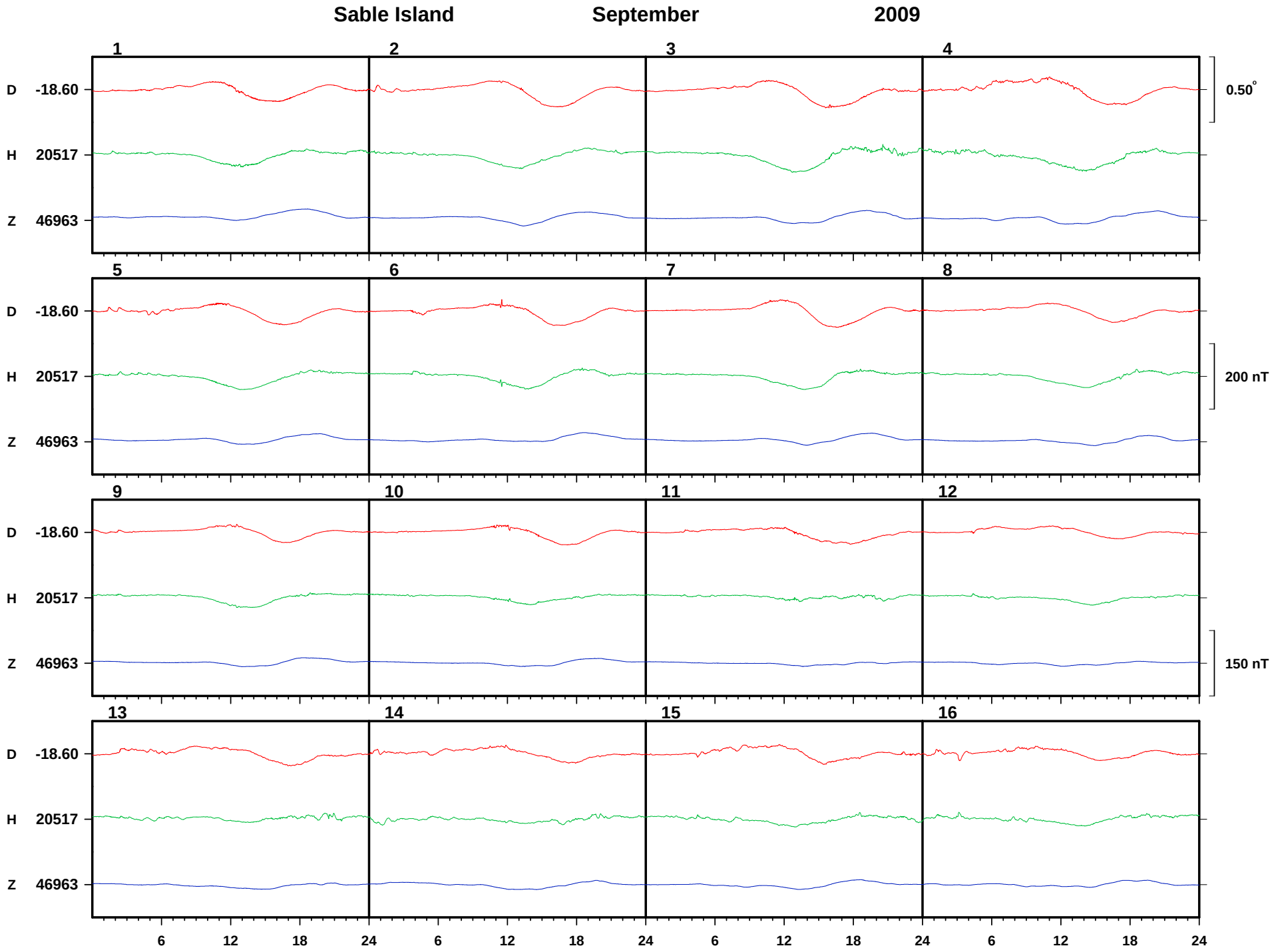
Daily mean values of *D*, *H*, *Z* and *F* are plotted throughout the year. In addition, a table of monthly mean values of all the geomagnetic elements is provided. These values depend on accurate specification of the fluxgate sensor baselines. It is anticipated that provisional values will not be altered by more than a few nT or tenths of arcminutes before being made definitive.

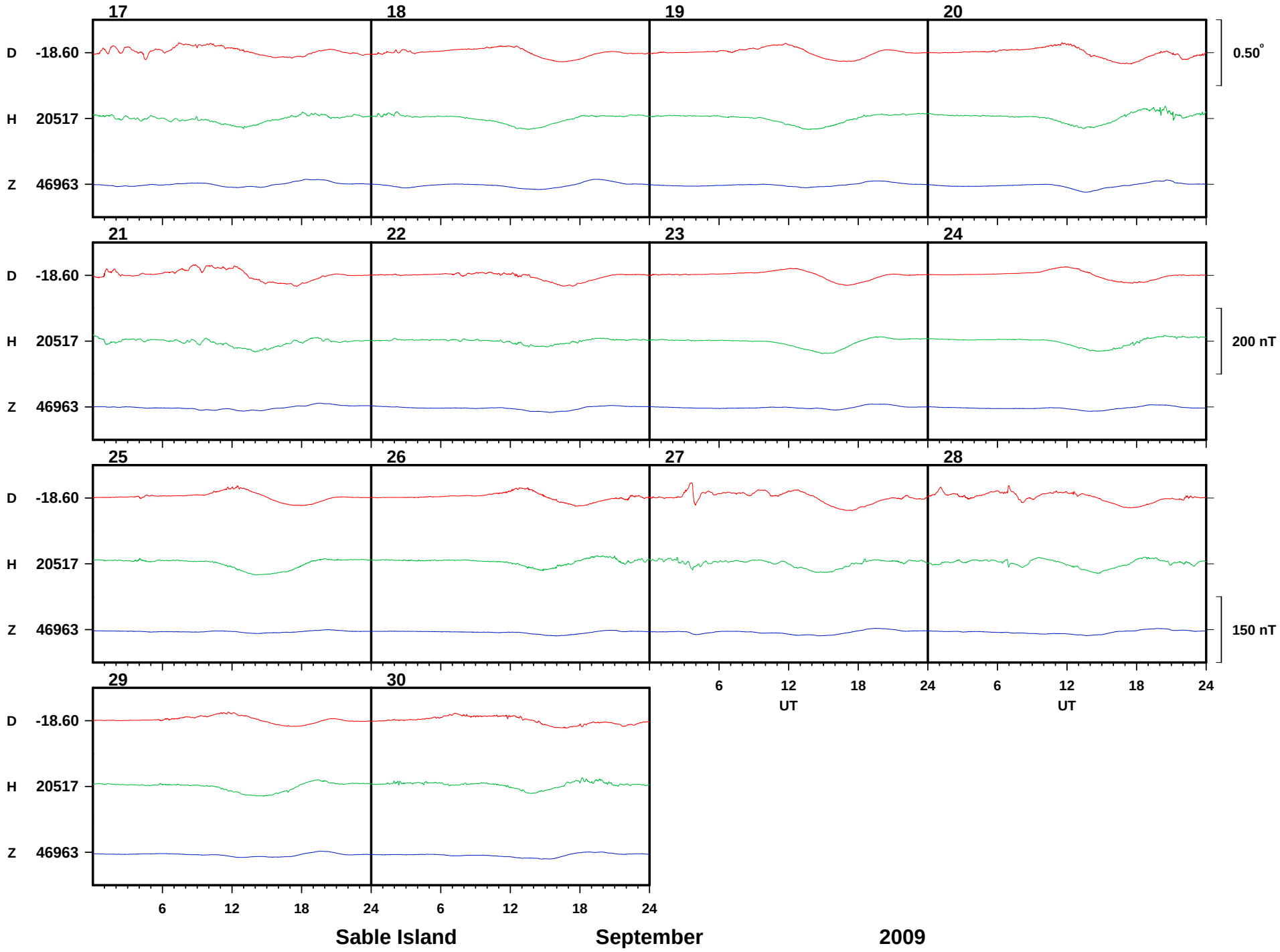
SABLE ISLAND OBSERVATORY

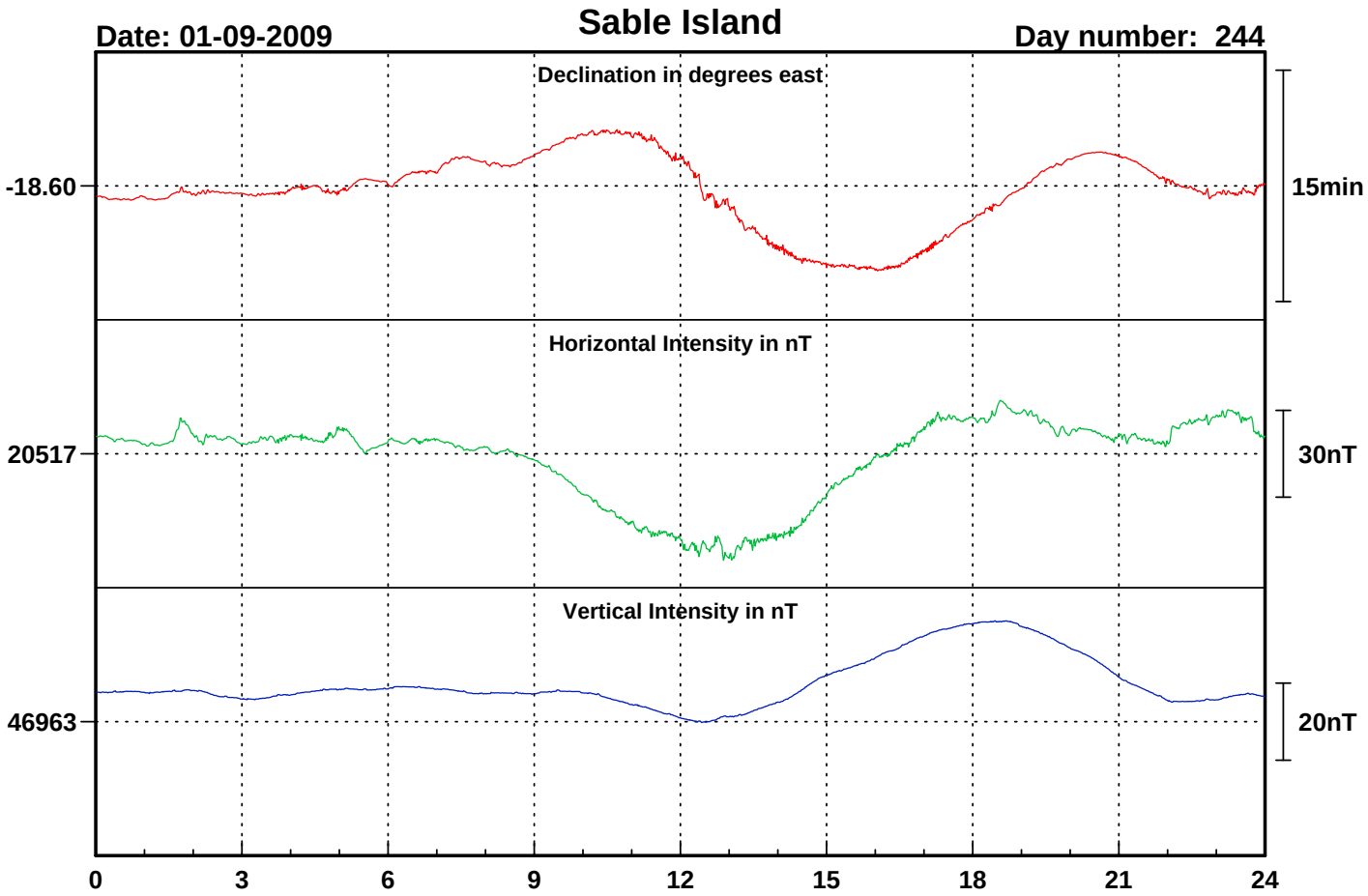
ABSOLUTE OBSERVATIONS

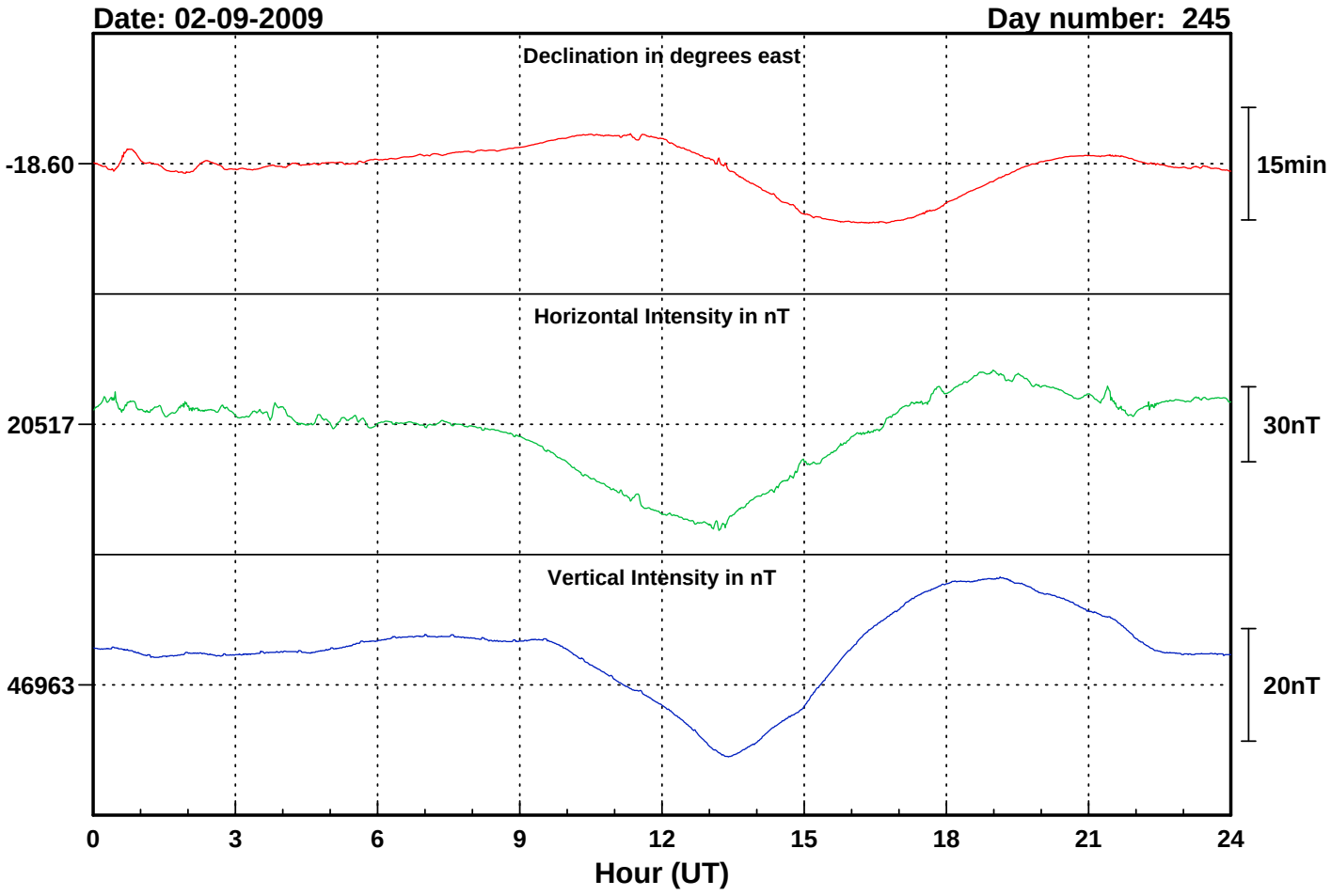
		DECLINATION			INCLINATION							
Date	**Day Number**	**Time (UT)**	**Absolute (º)**	**Baseline (º)**	**Time (UT)**	**Inclination (º)**	**Total Field Intensity (nT)**	**H Absolute (nT)**	**H Baseline (nT)**	**Z Absolute (nT)**	**Z Baseline (nT)**	**Observer**
02-Sep-09	245	16:08	-18.7233	-18.9550	16:48	66.4048	51262.2	20518.9	20352.8	46976.5	47288.6	PR
11-Sep-09	254	16:33	-18.6660	-18.9467	17:10	66.3962	51247.0	20519.8	20356.6	46959.4	47287.5	WIL
30-Sep-09	273	16:28	-18.6509	-18.9600	17:11	66.3833	51251.6	20532.2	20357.2	46959.1	47287.7	PR


Sable Island 2009
Declination : Absolute - Variometer (markers) and Baseline Applied (line)
-18.96
5min
Horizontal Intensity : Absolute - Variometer (markers) and Baseline Applied (line)
20354
20nT
Vertical Intensity : Absolute - Variometer (markers) and Baseline Applied (line)
47288
20nT
Total Intensity : Absolute (Proton F) - Baseline Adjusted Variometer (derived F)
-1.0
20nT
Temperature Inside Variometer Hut
20.2
10°C
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Sable Island
September
2009
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
D -18.60
H 20517
Z 46963
0.50°
200 nT
150 nT
6
12
18
24


17
18
19
20
D -18.60
H 20517
Z 46963
0.50°
21
22
23
24
200 nT
25
26
27
28
150 nT
29
30
6
12
18
24
UT
Sable Island
September
2009


Sable Island
Date: 01-09-2009
Day number: 244
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
30nT
Vertical Intensity in nT
46963
20nT
0
3
6
9
12
15
18
21
24


Date: 02-09-2009
Day number: 245
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
30nT
Vertical Intensity in nT
46963
20nT
0
3
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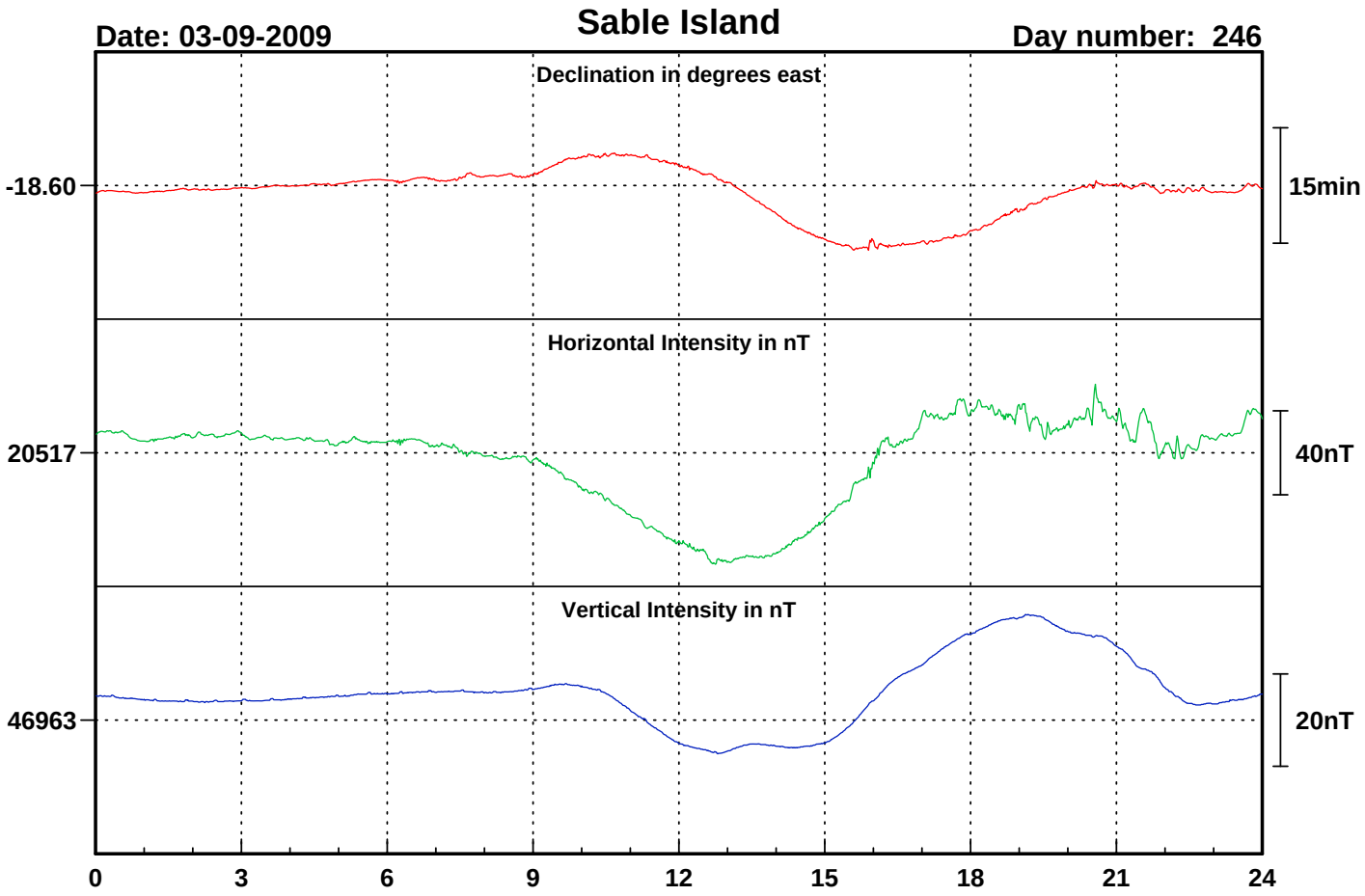
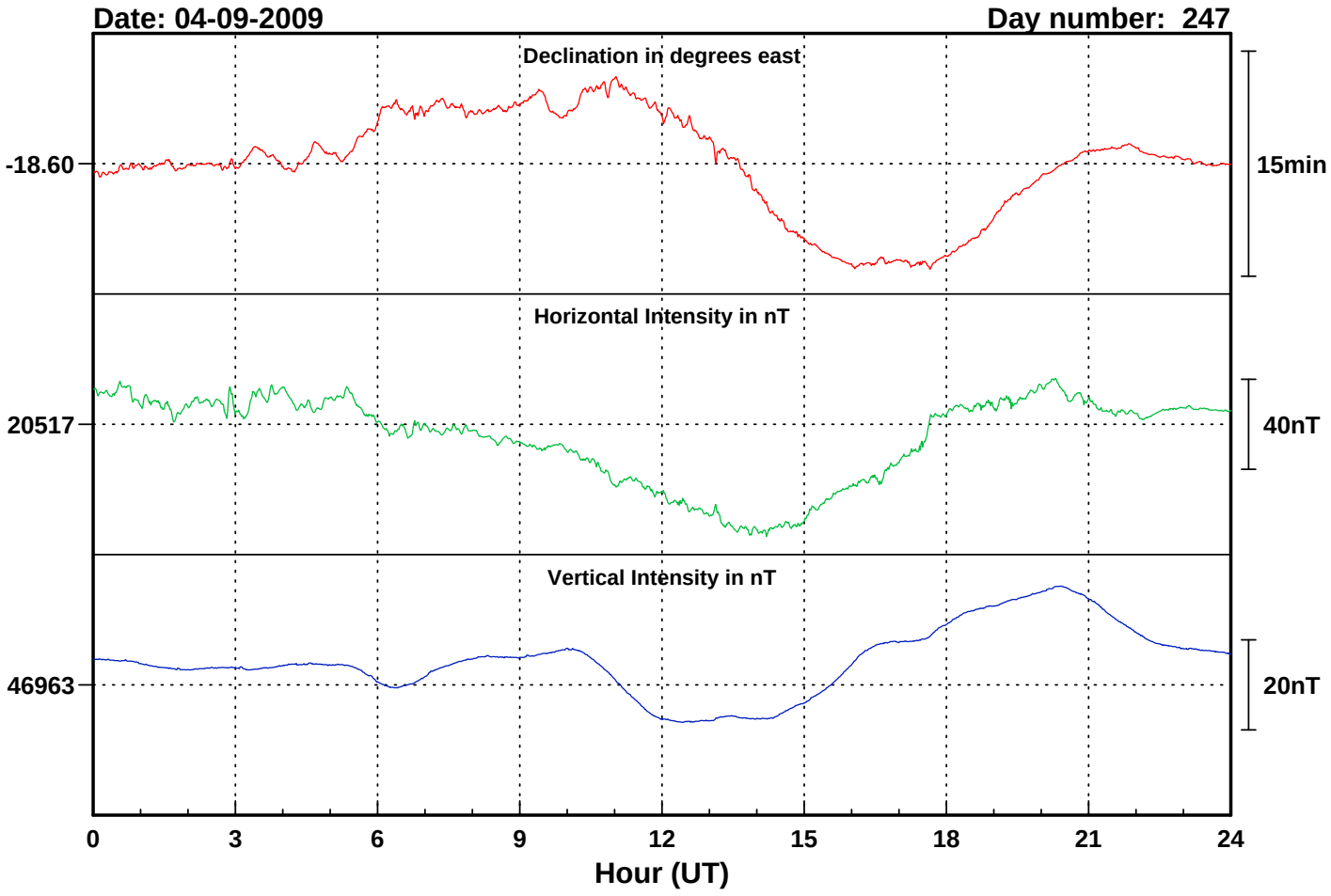
24
Hour (UT)


Sable Island
Date: 03-09-2009
Day number: 246
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
40nT
Vertical Intensity in nT
46963
20nT
0
3
6
9
12
15
18
21
24


Date: 04-09-2009
Day number: 247
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
40nT
Vertical Intensity in nT
46963
20nT
0
3
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12
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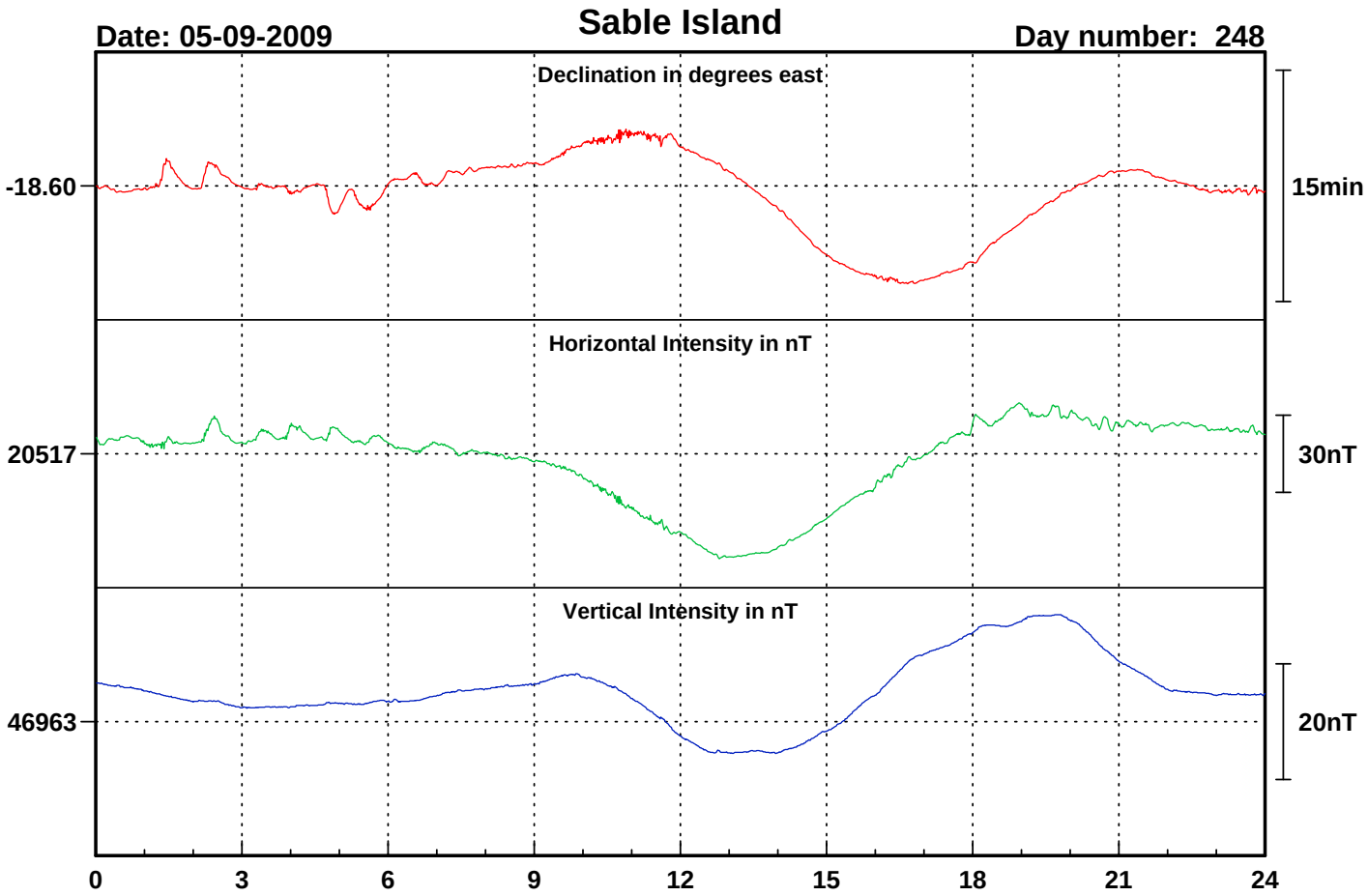
24
Hour (UT)


Sable Island
Date: 05-09-2009
Day number: 248
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
30nT
Vertical Intensity in nT
46963
20nT
0
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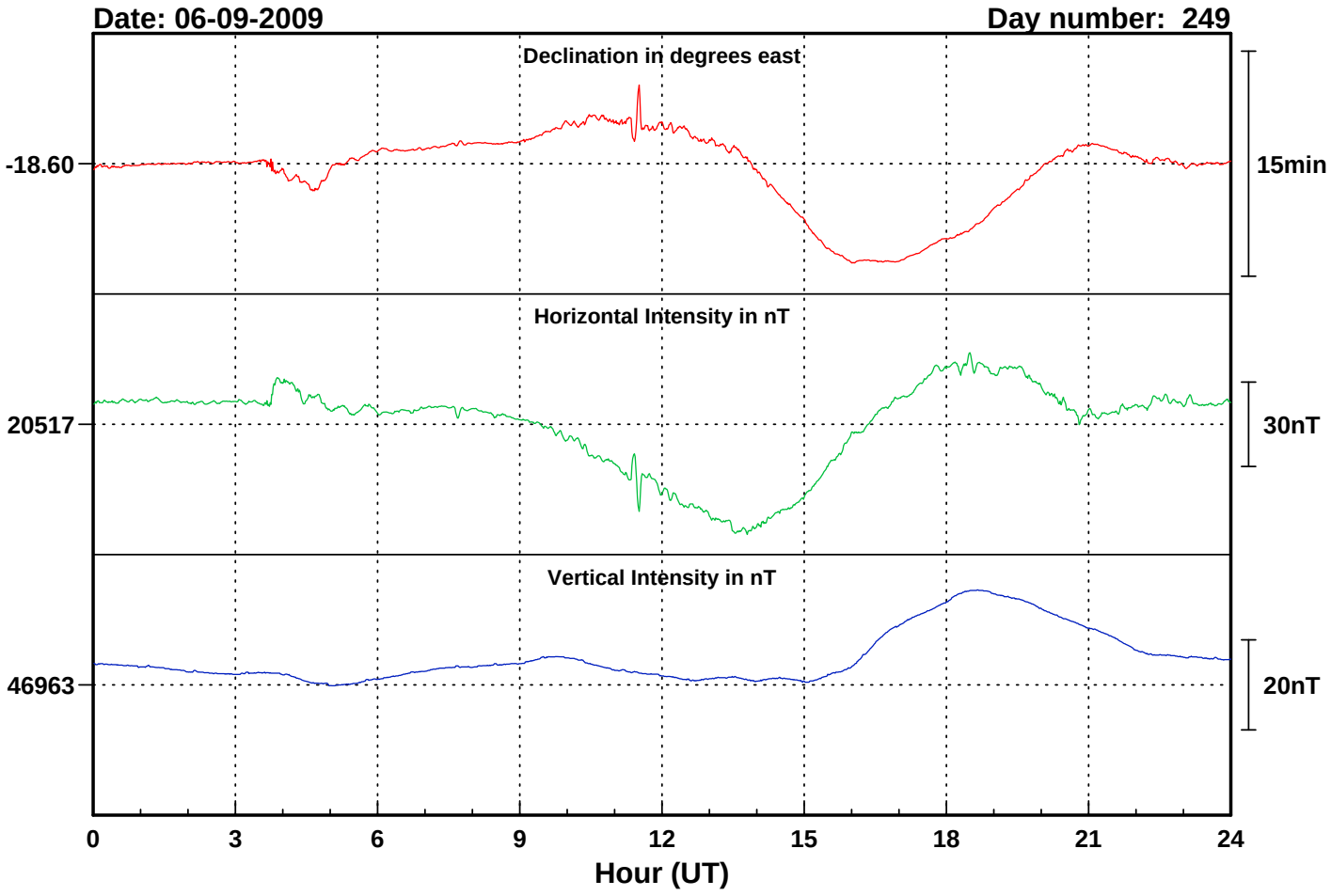
24


Date: 06-09-2009
Day number: 249
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
30nT
Vertical Intensity in nT
46963
20nT
0
3
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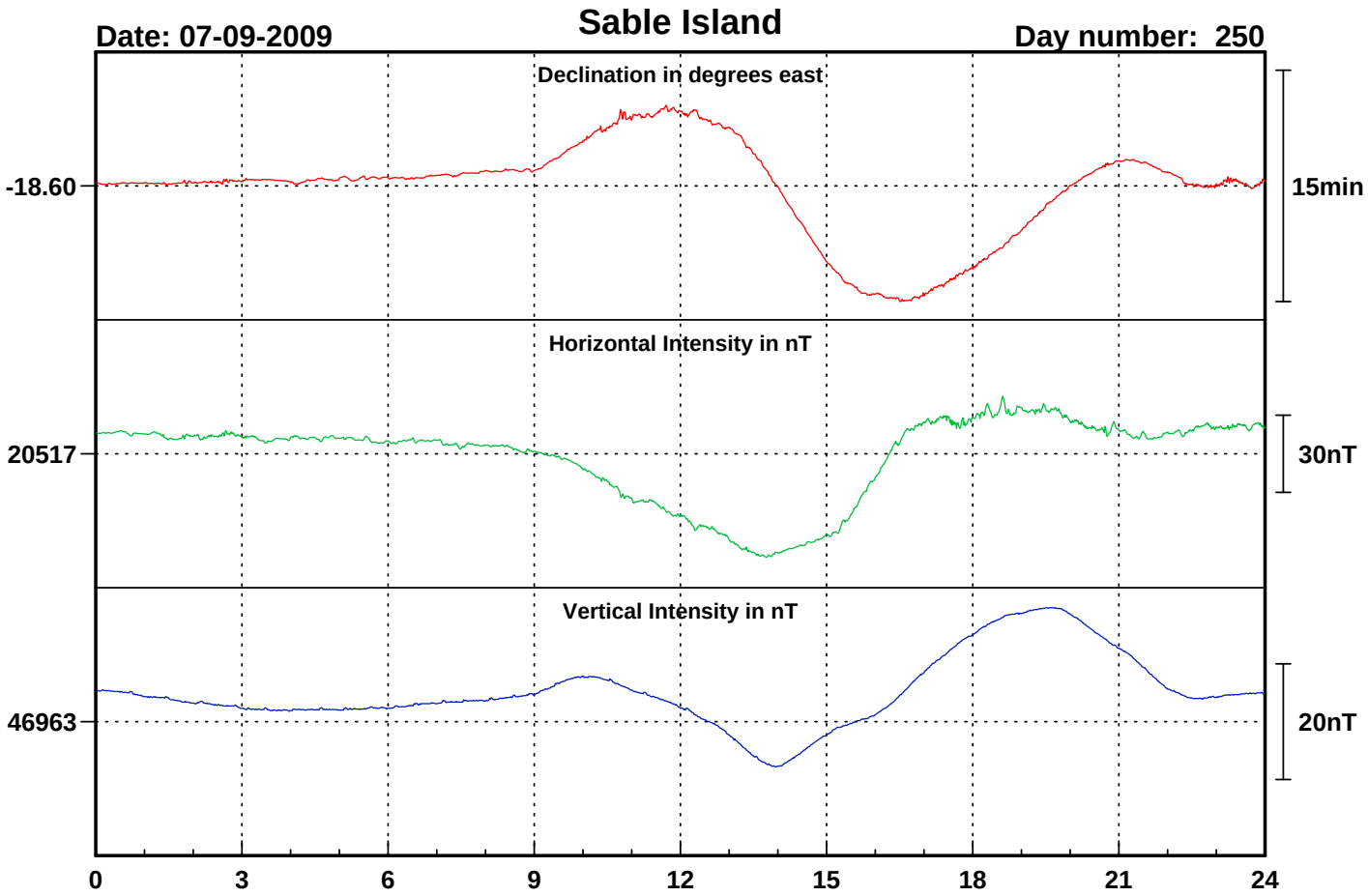
Hour (UT)


Sable Island
Date: 07-09-2009
Day number: 250
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
30nT
Vertical Intensity in nT
46963
20nT
0
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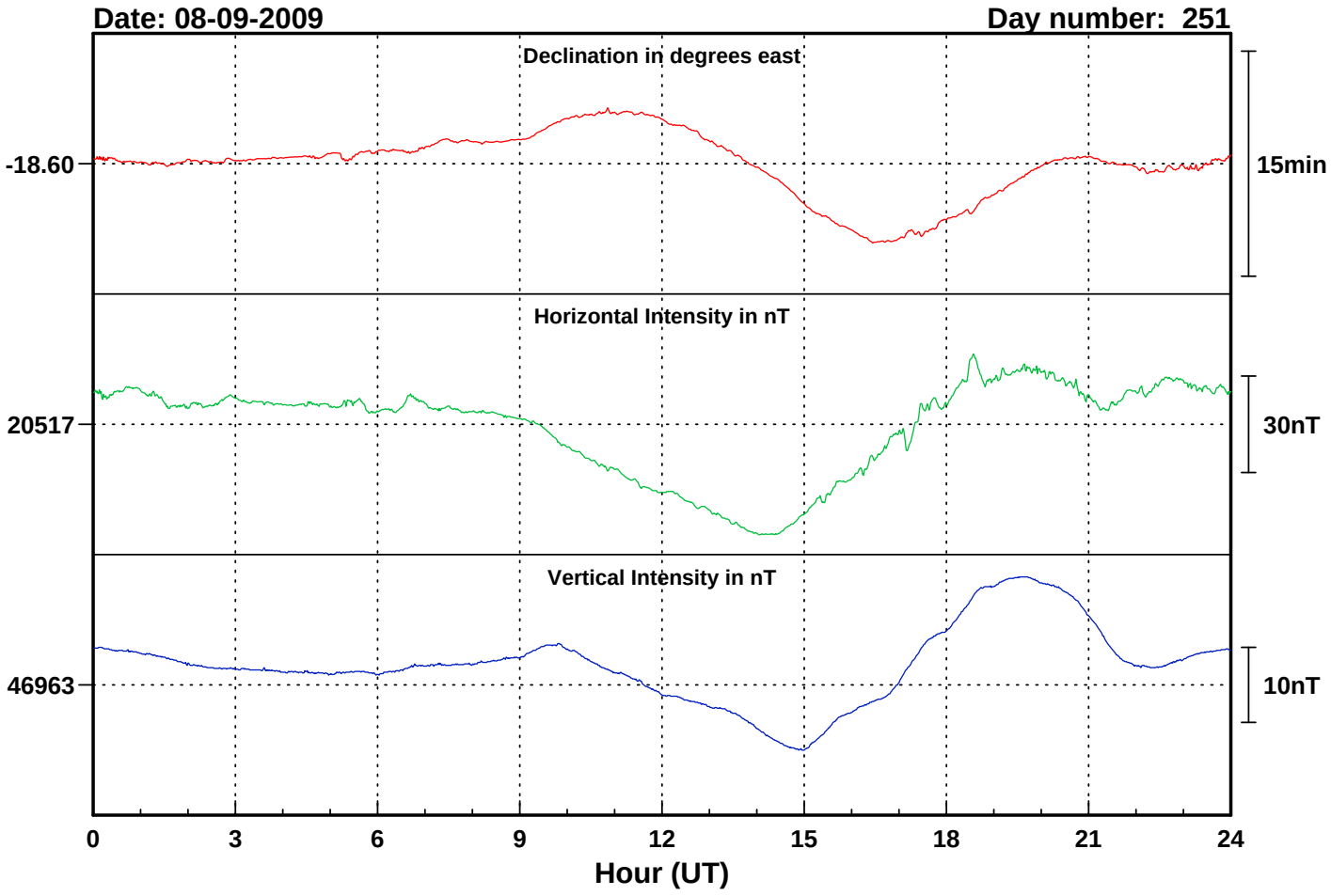
Date: 08-09-2009
Day number: 251
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
30nT
Vertical Intensity in nT
46963
10nT
0
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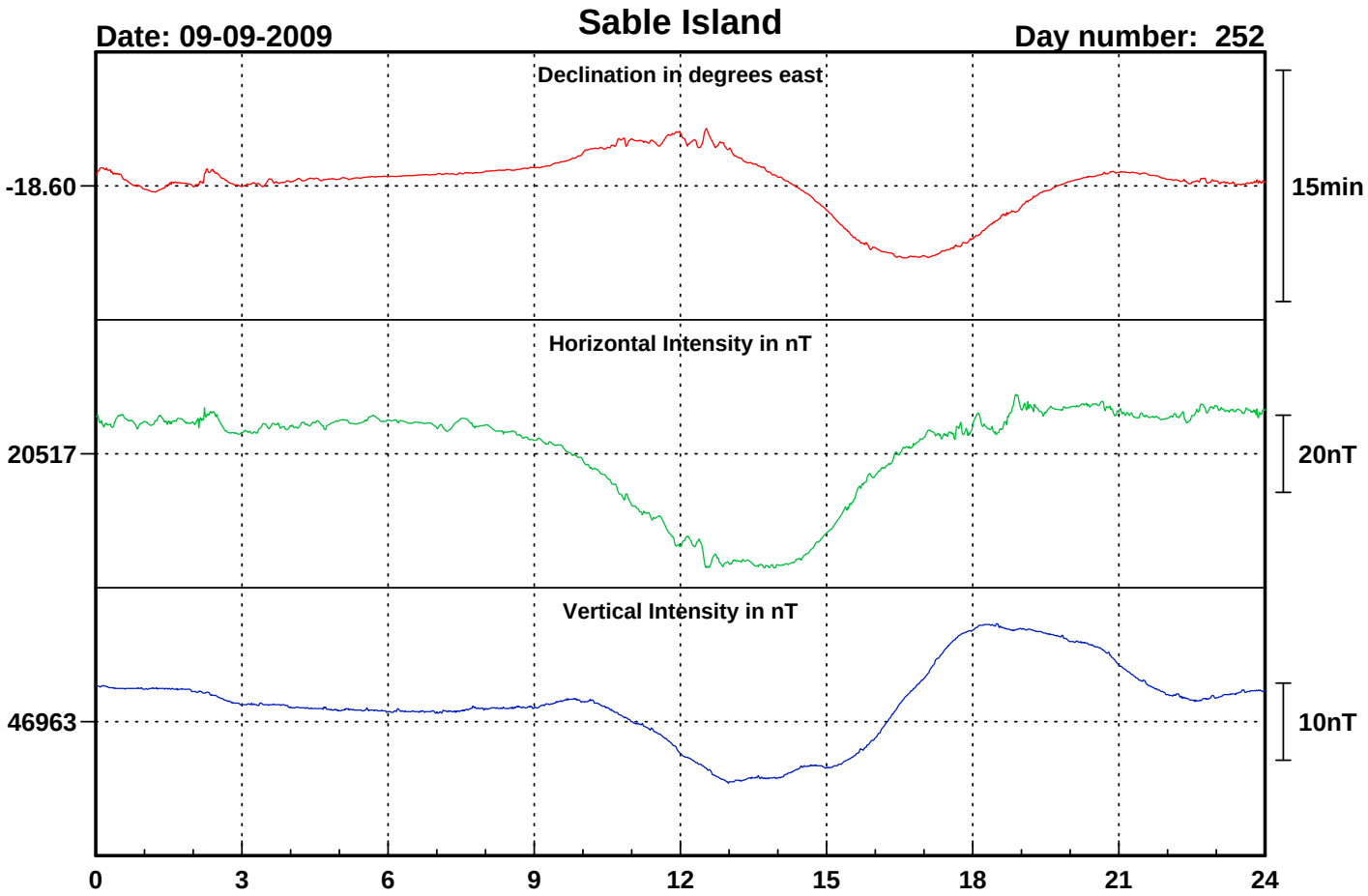
Hour (UT)


Sable Island
Date: 09-09-2009
Day number: 252
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
20nT
Vertical Intensity in nT
46963
10nT
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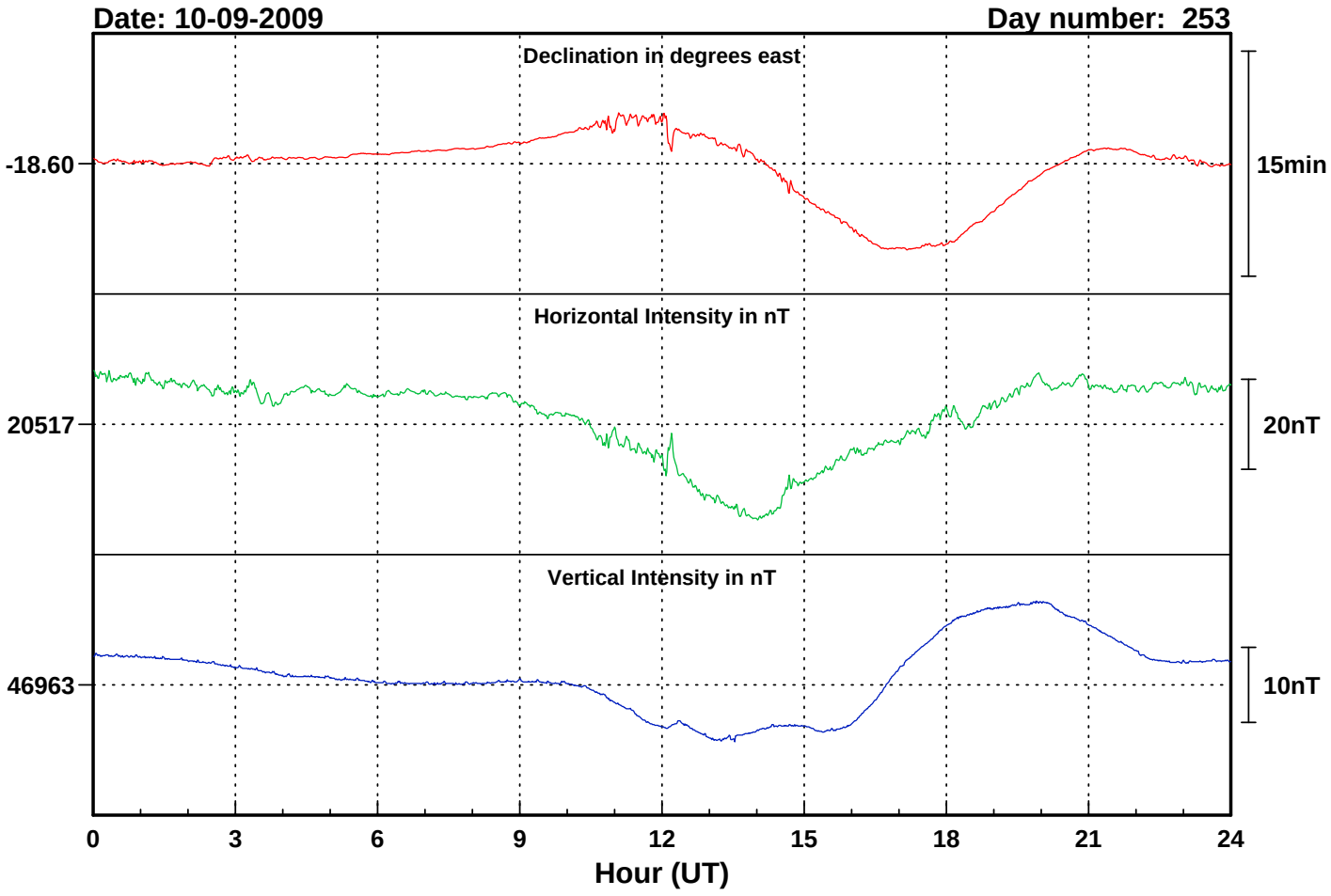
Date: 10-09-2009
Day number: 253
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
20nT
Vertical Intensity in nT
46963
10nT
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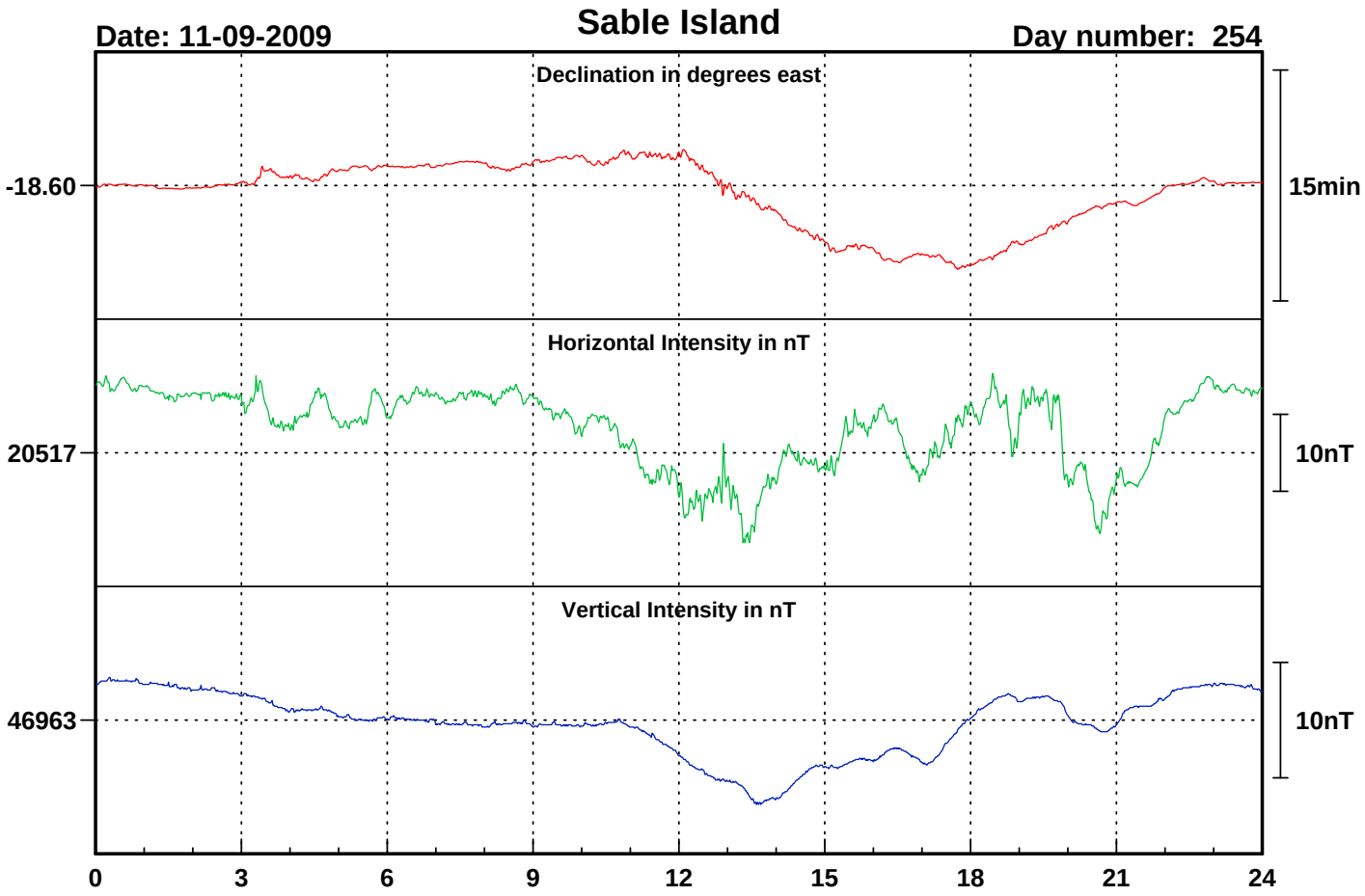
Hour (UT)


Sable Island
Date: 11-09-2009
Day number: 254
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
10nT
Vertical Intensity in nT
46963
10nT
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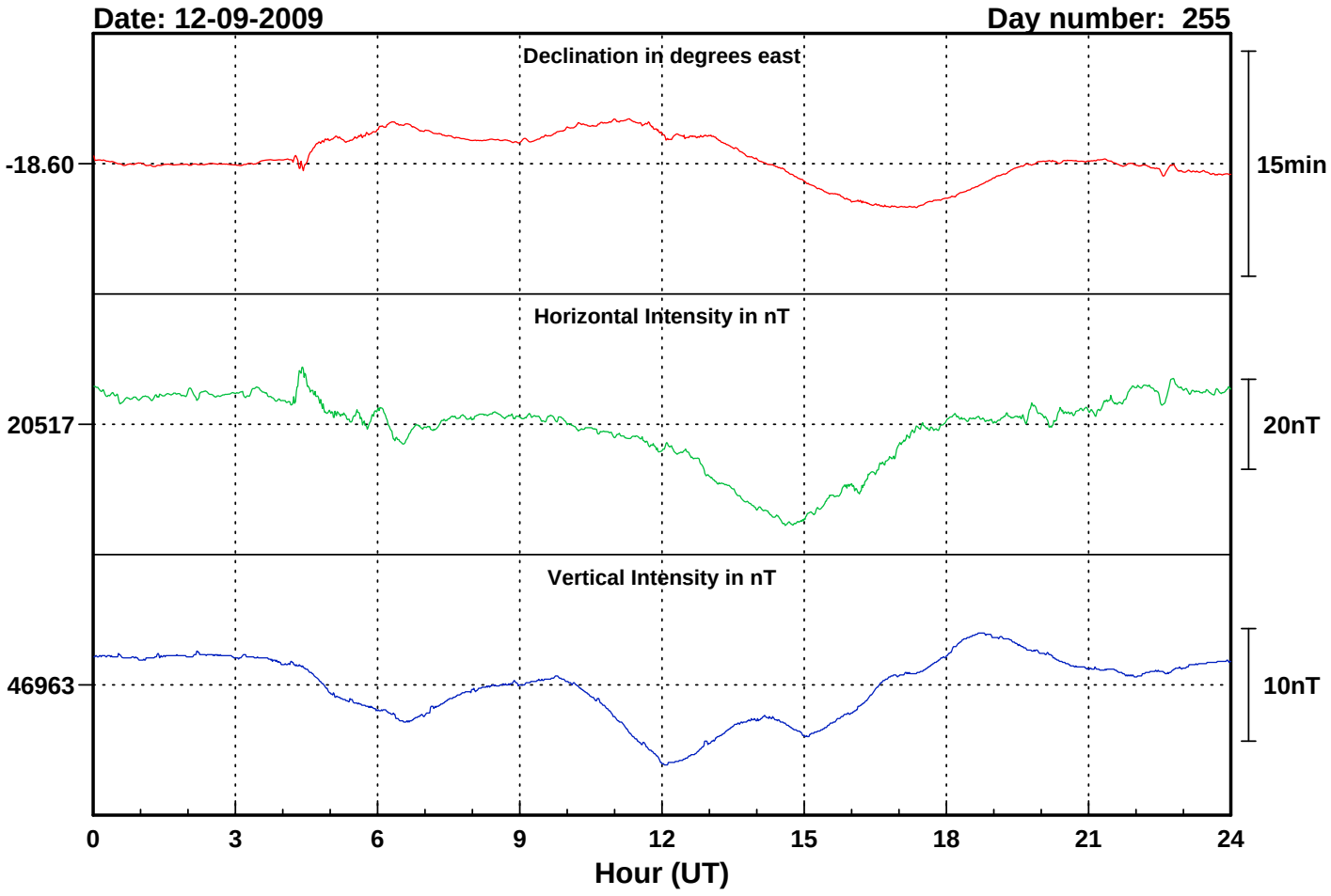
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Day number: 255
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
20nT
Vertical Intensity in nT
46963
10nT
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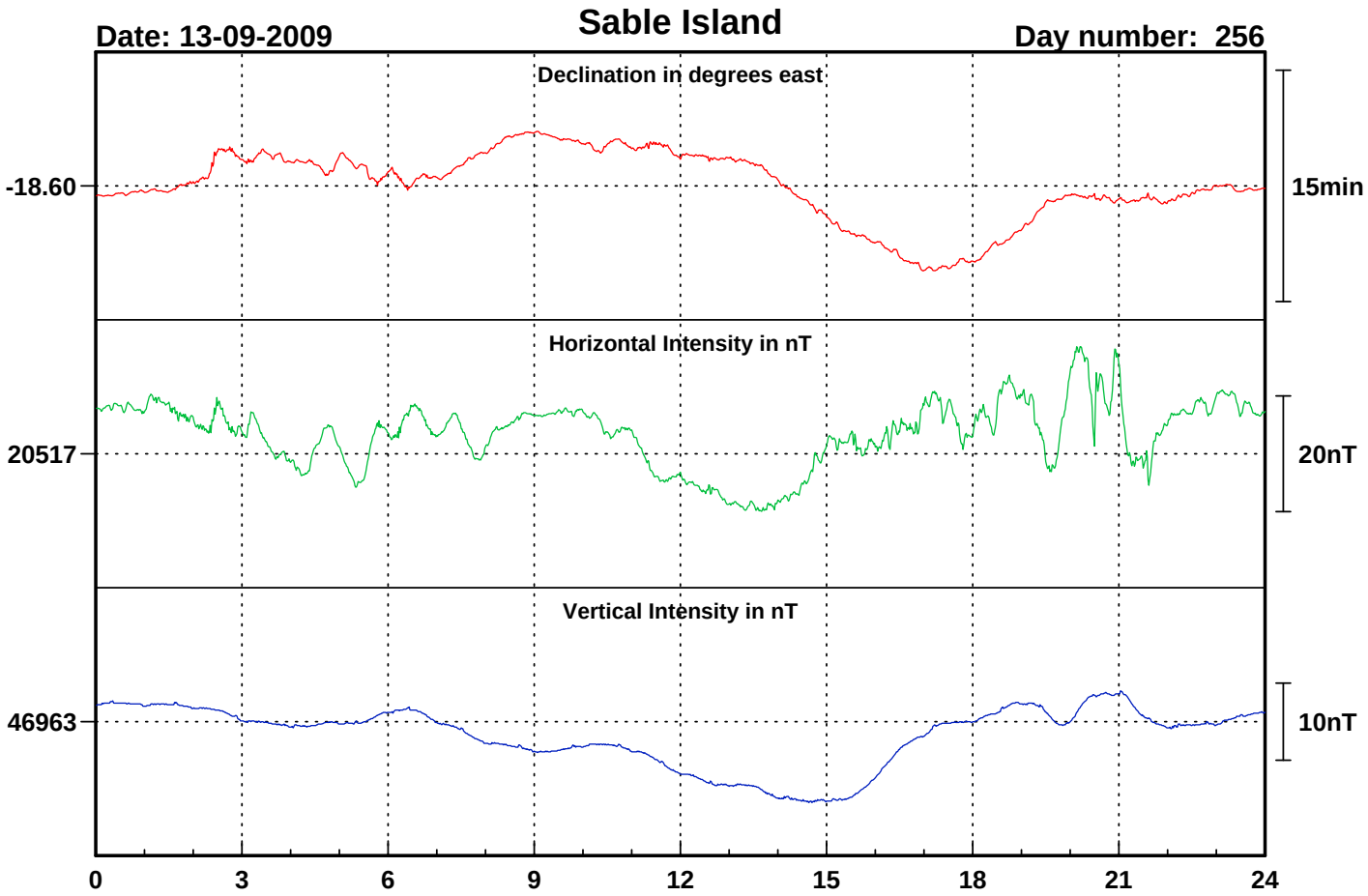
Hour (UT)


Sable Island
Date: 13-09-2009
Day number: 256
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
20nT
Vertical Intensity in nT
46963
10nT
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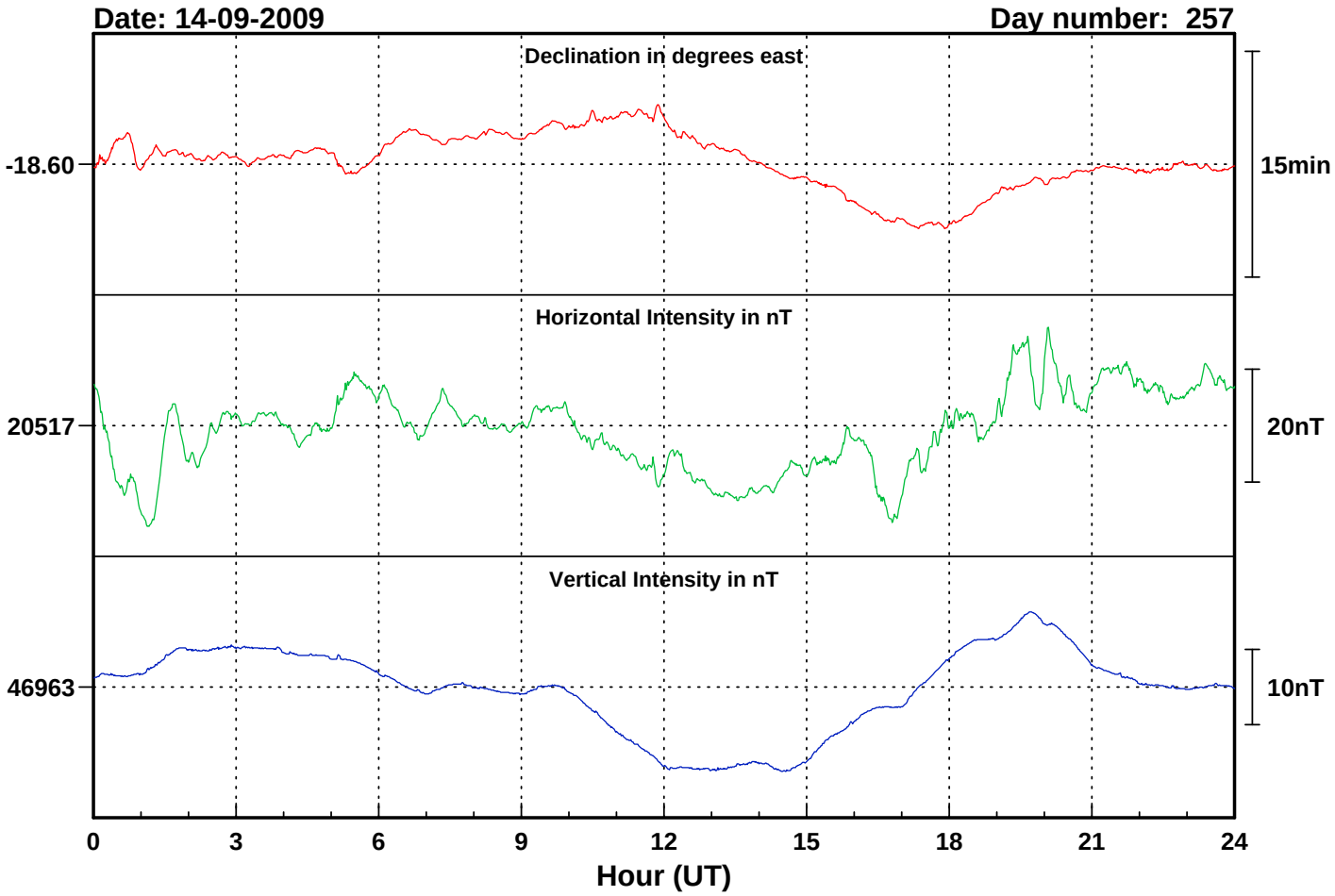
Date: 14-09-2009
Day number: 257
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
20nT
Vertical Intensity in nT
46963
10nT
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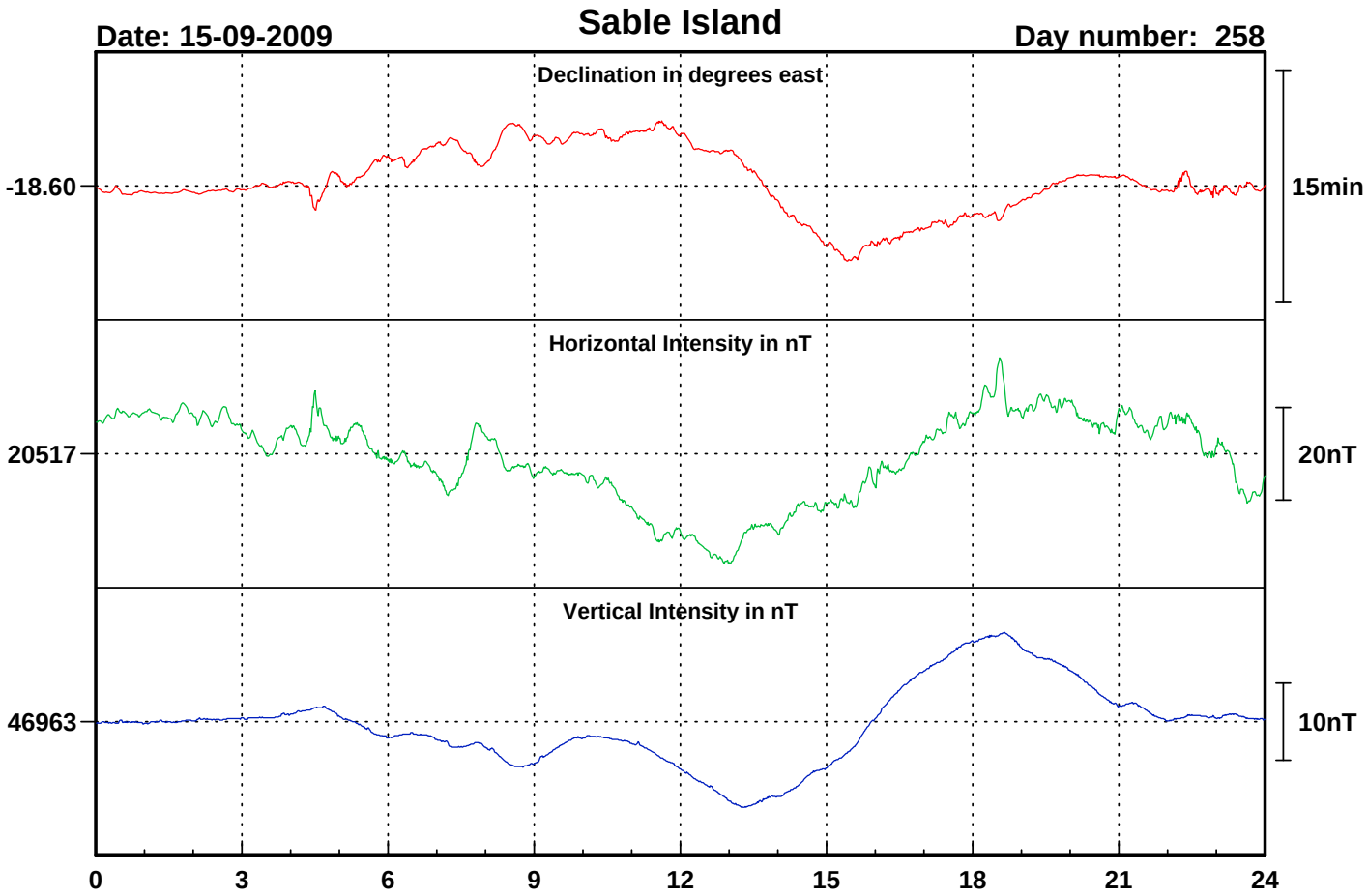
Hour (UT)


Sable Island
Date: 15-09-2009
Day number: 258
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
20nT
Vertical Intensity in nT
46963
10nT
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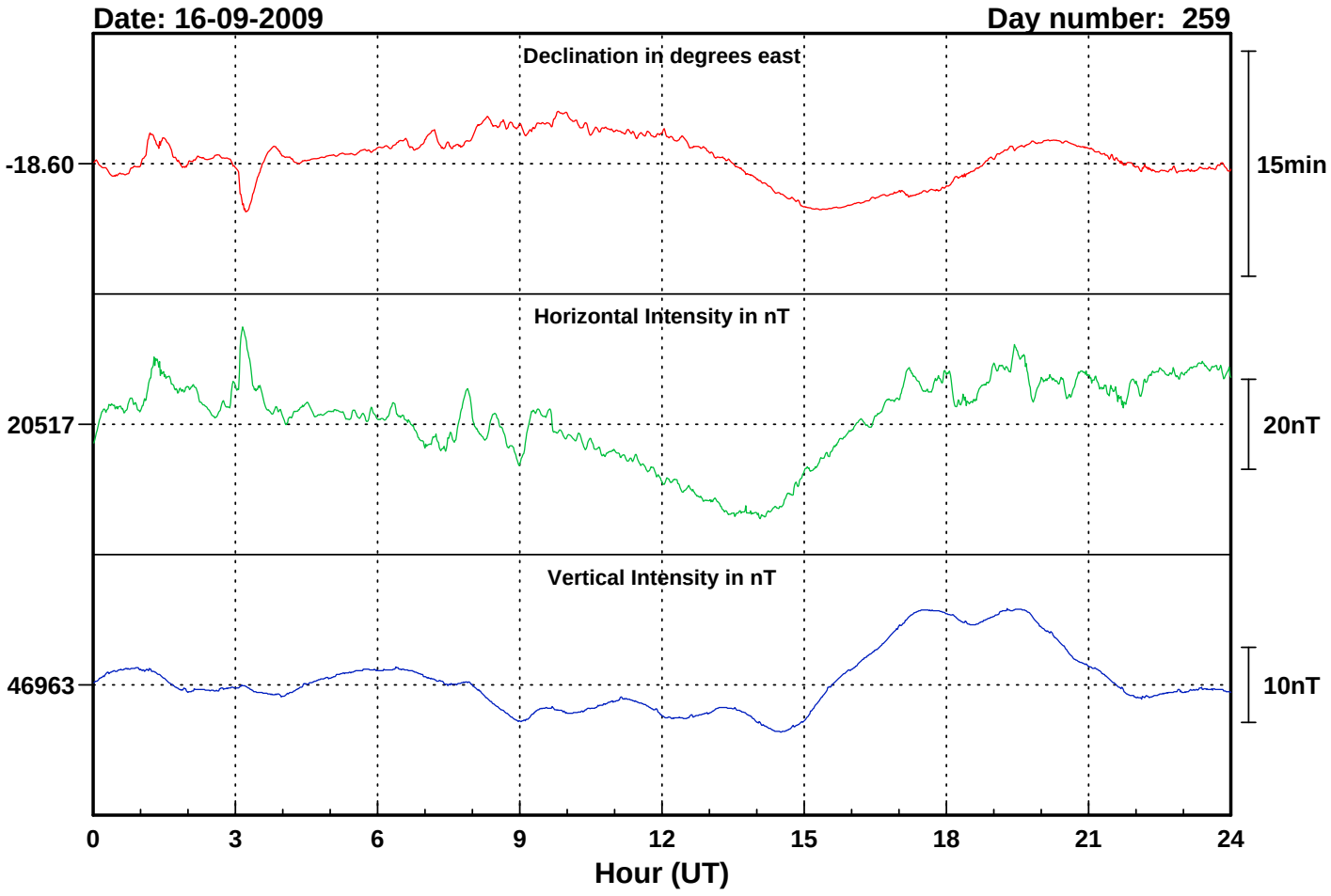
Date: 16-09-2009
Day number: 259
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
20nT
Vertical Intensity in nT
46963
10nT
0
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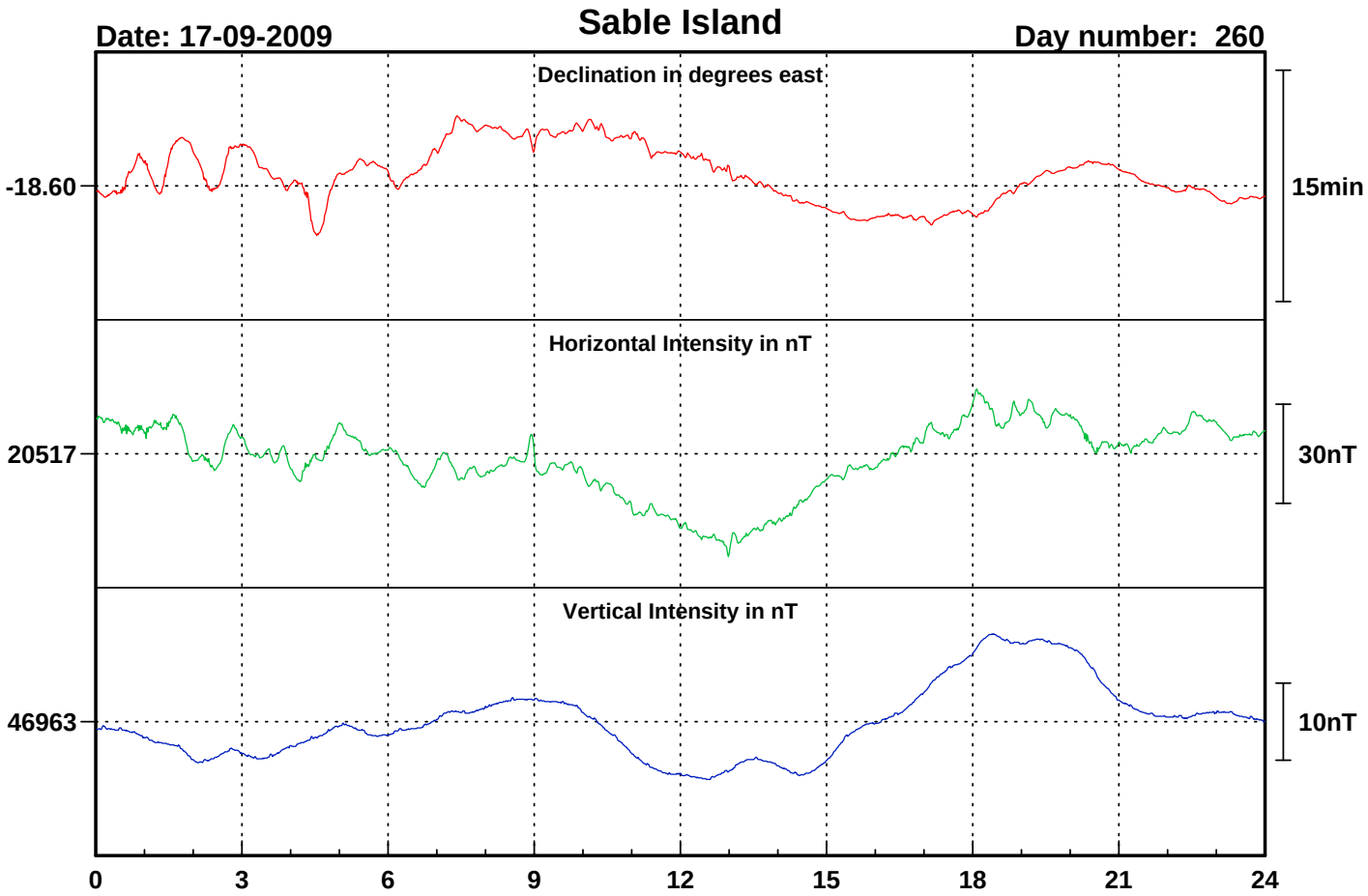
Hour (UT)


Sable Island
Date: 17-09-2009
Day number: 260
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
30nT
Vertical Intensity in nT
46963
10nT
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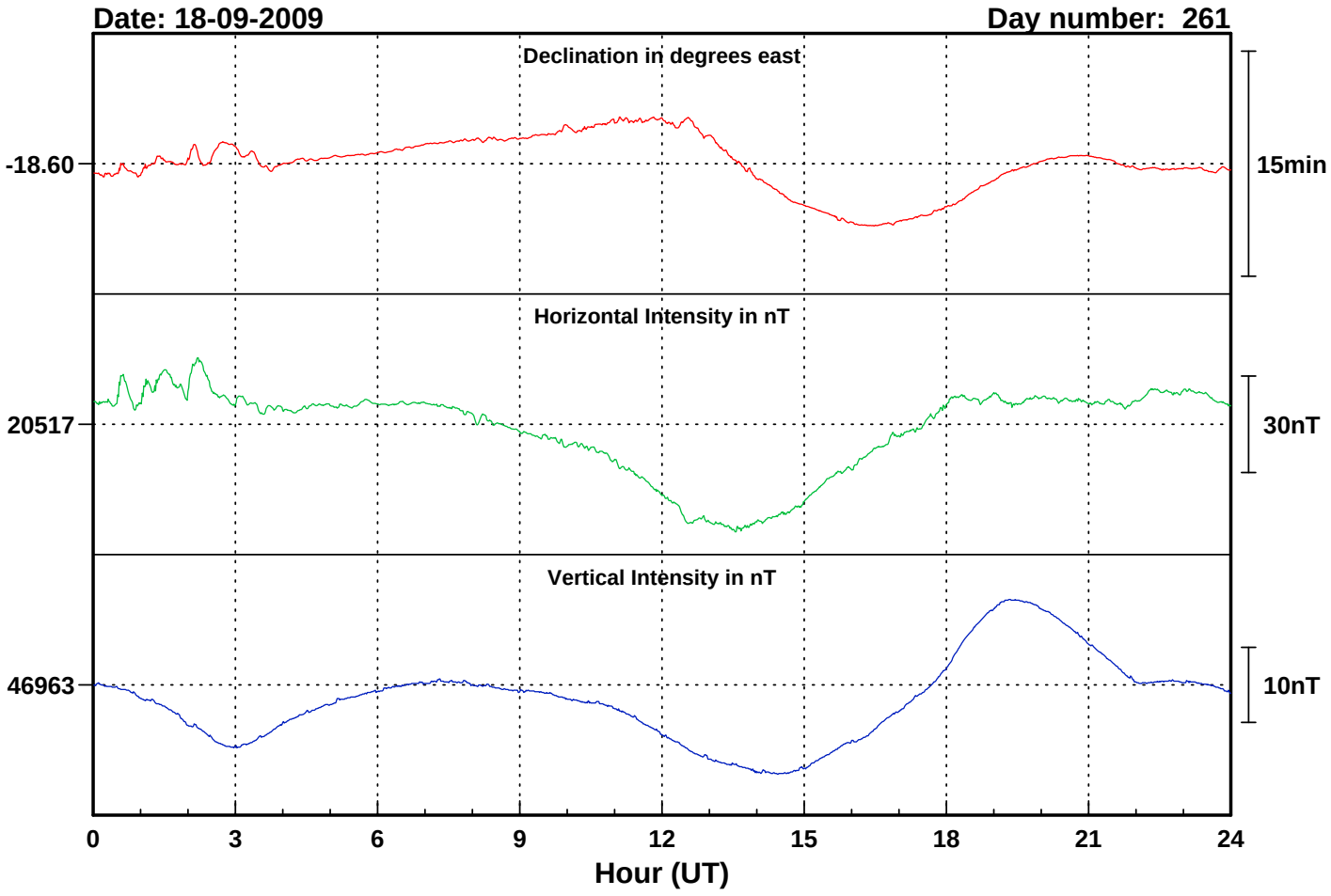
Date: 18-09-2009
Day number: 261
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
30nT
Vertical Intensity in nT
46963
10nT
0
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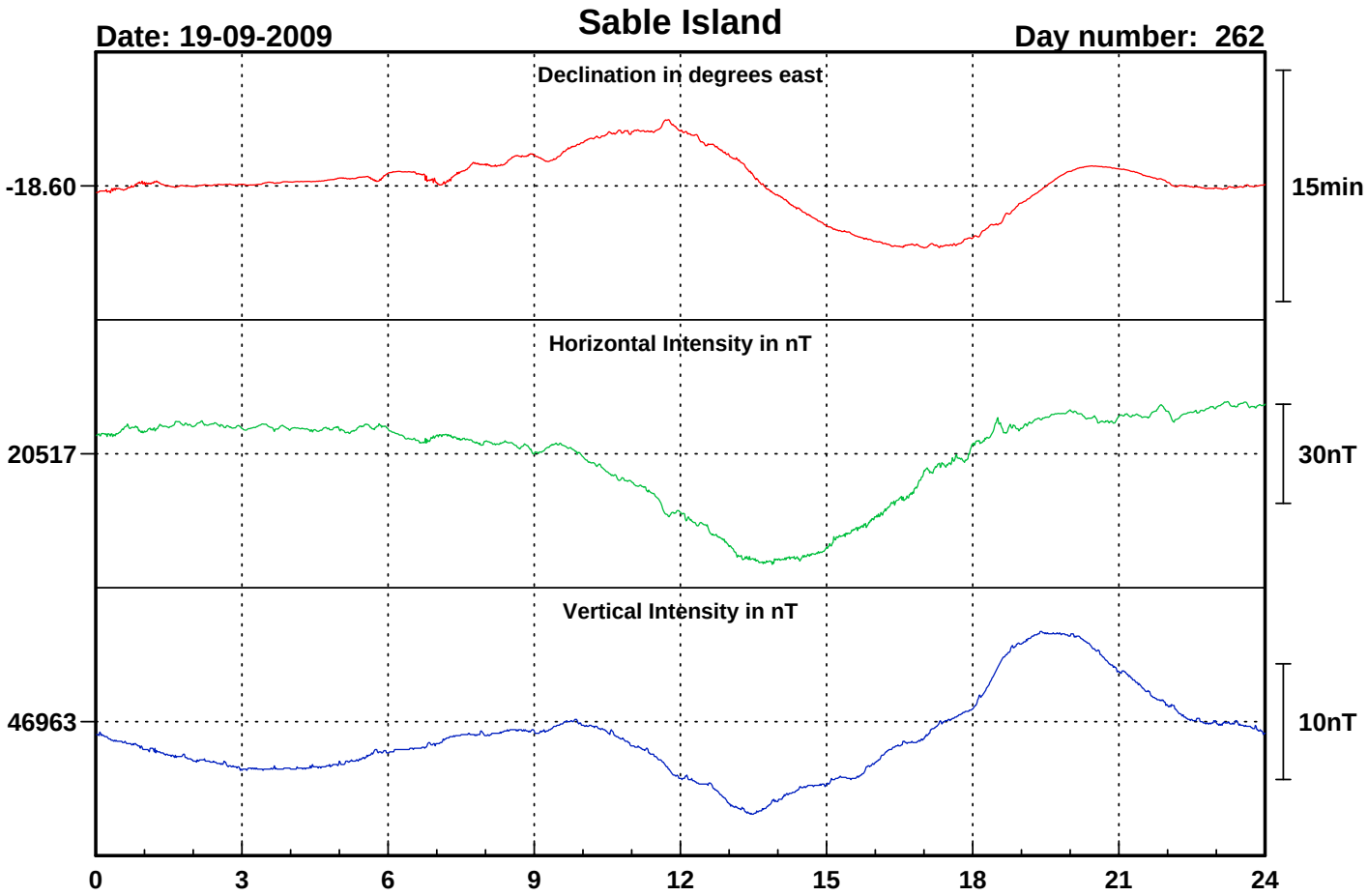
Hour (UT)


Sable Island
Date: 19-09-2009
Day number: 262
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
30nT
Vertical Intensity in nT
46963
10nT
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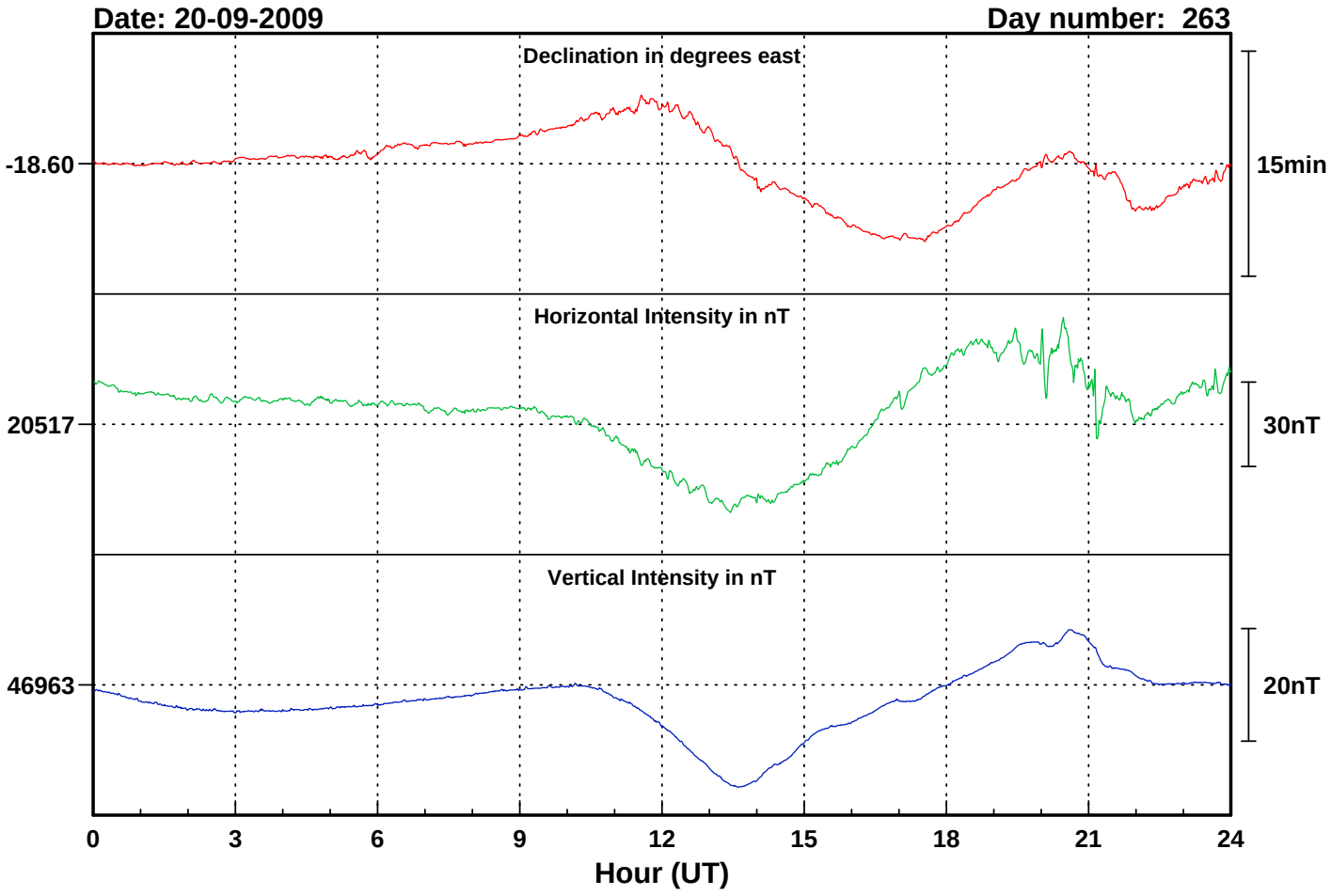
Date: 20-09-2009
Day number: 263
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
30nT
Vertical Intensity in nT
46963
20nT
0
3
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9
12
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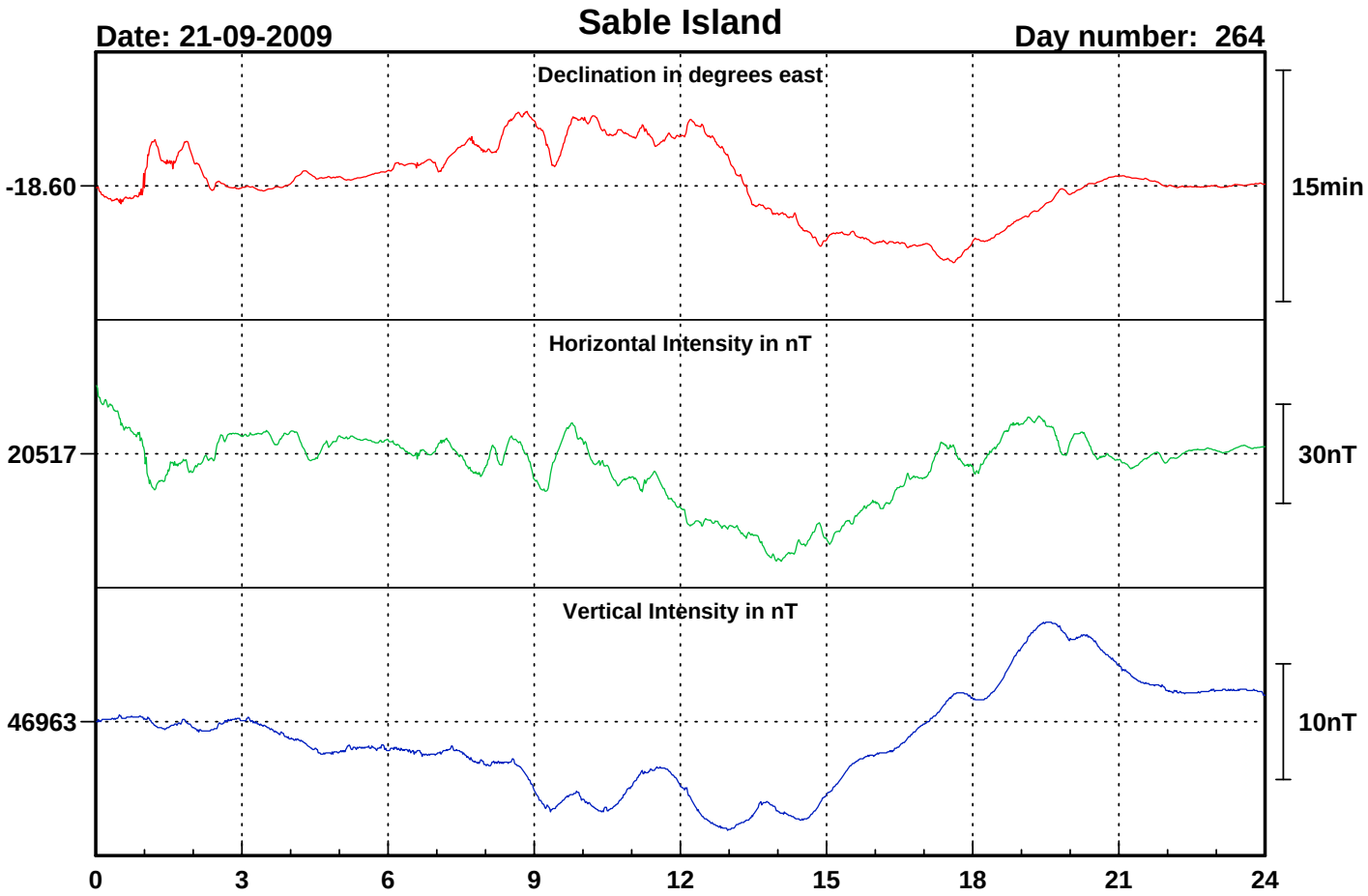
24
Hour (UT)


Sable Island
Date: 21-09-2009
Day number: 264
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
30nT
Vertical Intensity in nT
46963
10nT
0
3
6
9
12
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18
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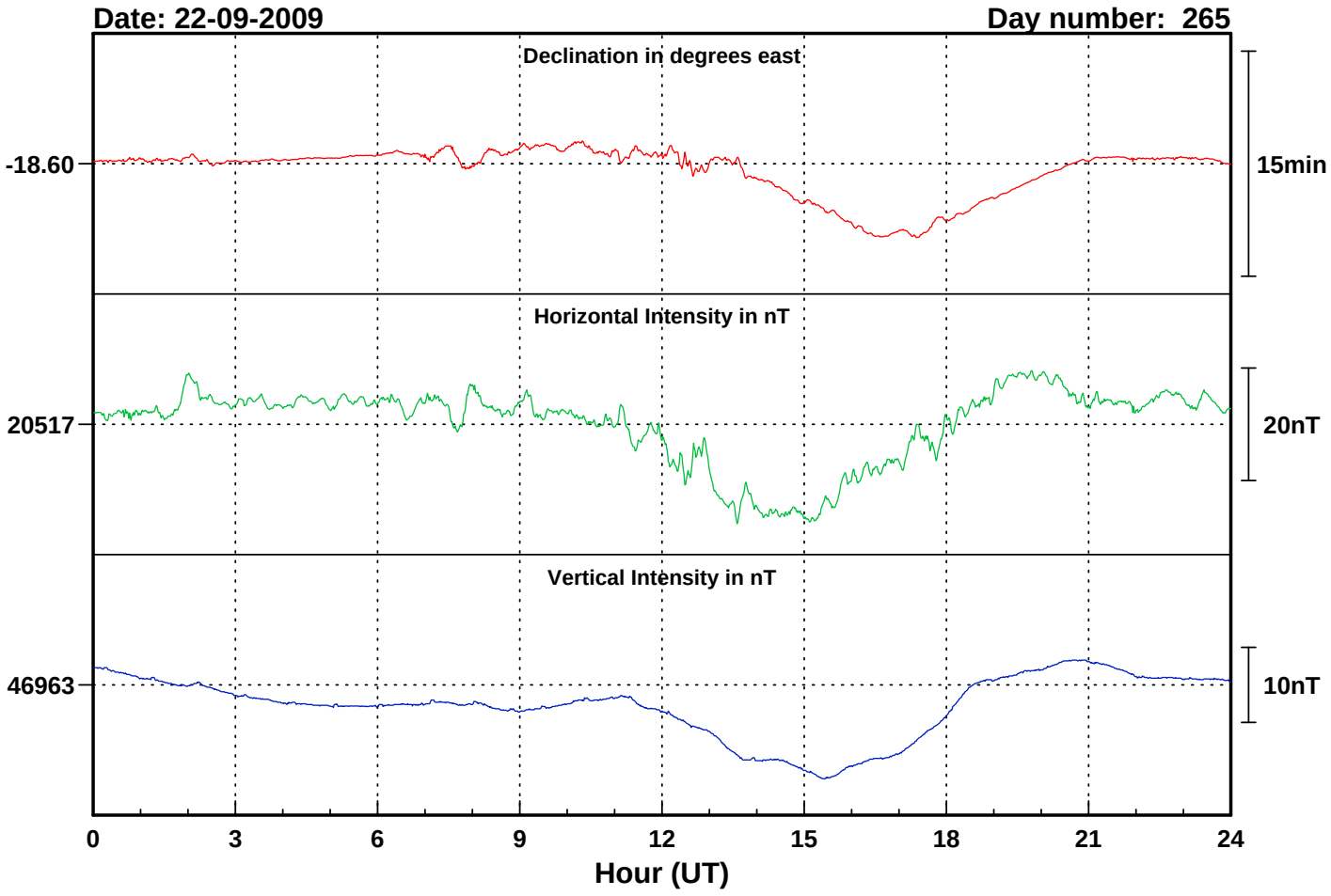
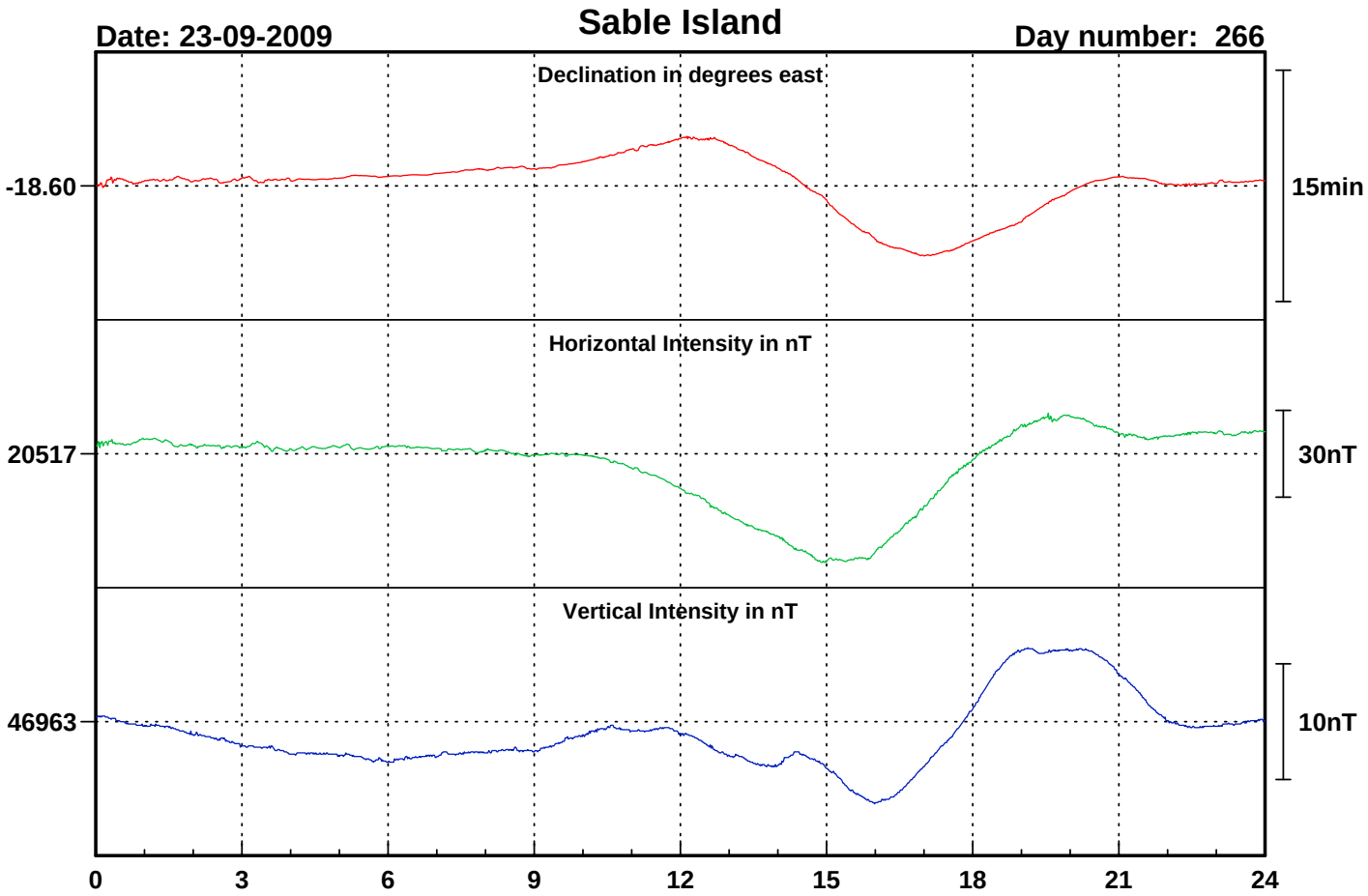
24


Date: 22-09-2009
Day number: 265
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
20nT
Vertical Intensity in nT
46963
10nT
0
3
6
9
12
15
18
21
24
Hour (UT)


Sable Island
Date: 23-09-2009
Day number: 266
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
30nT
Vertical Intensity in nT
46963
10nT
0
3
6
9
12
15
18
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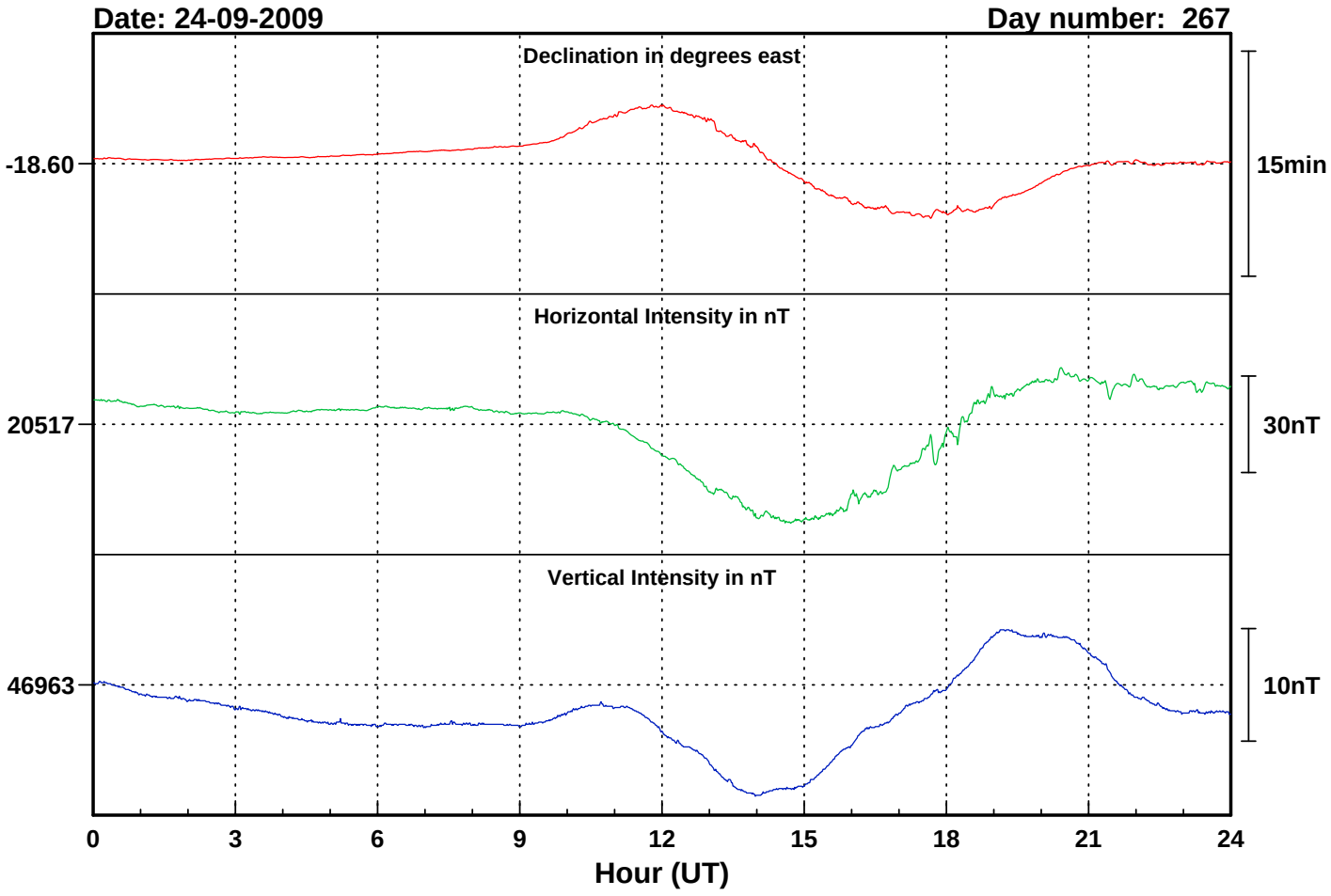
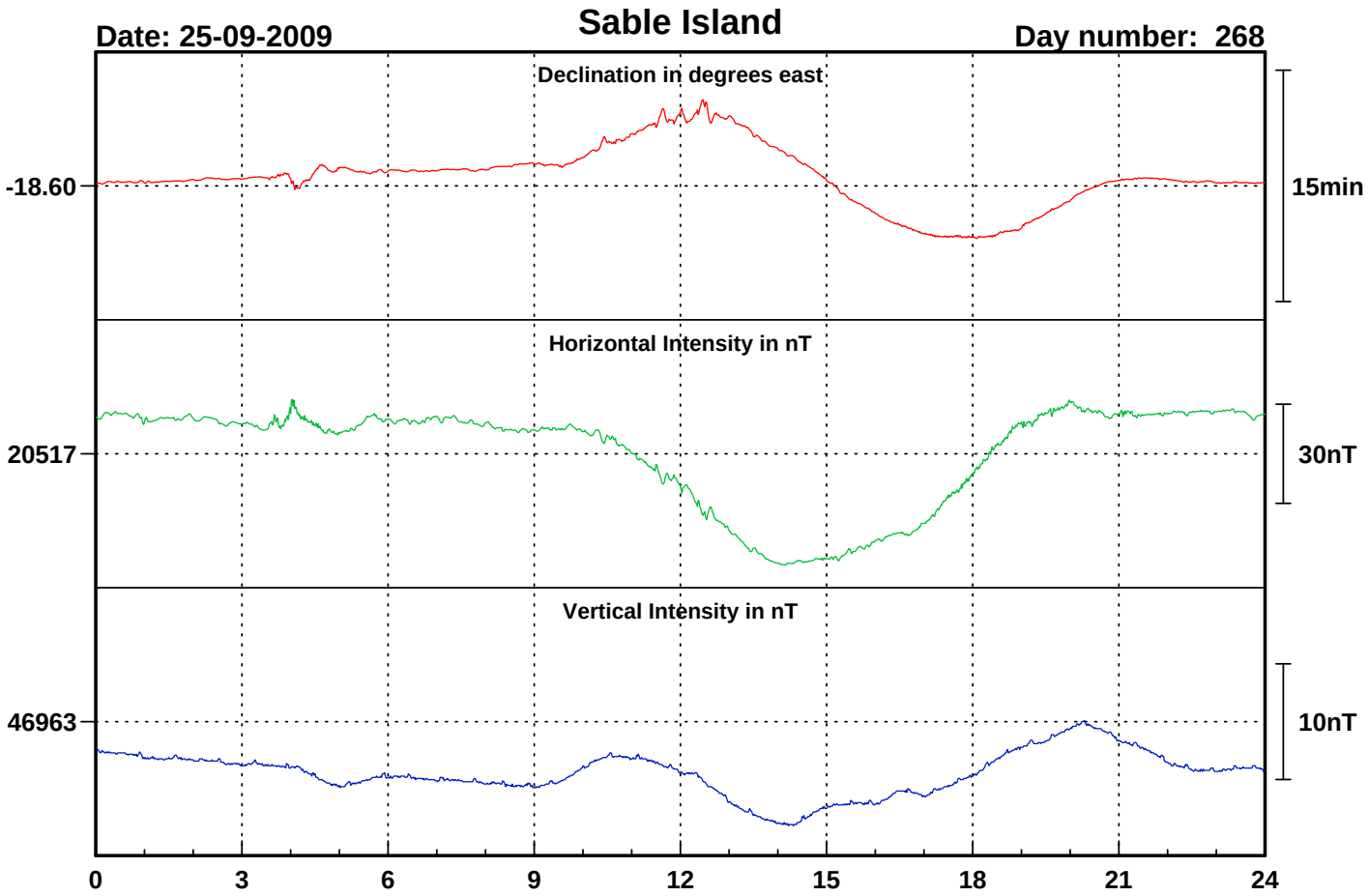
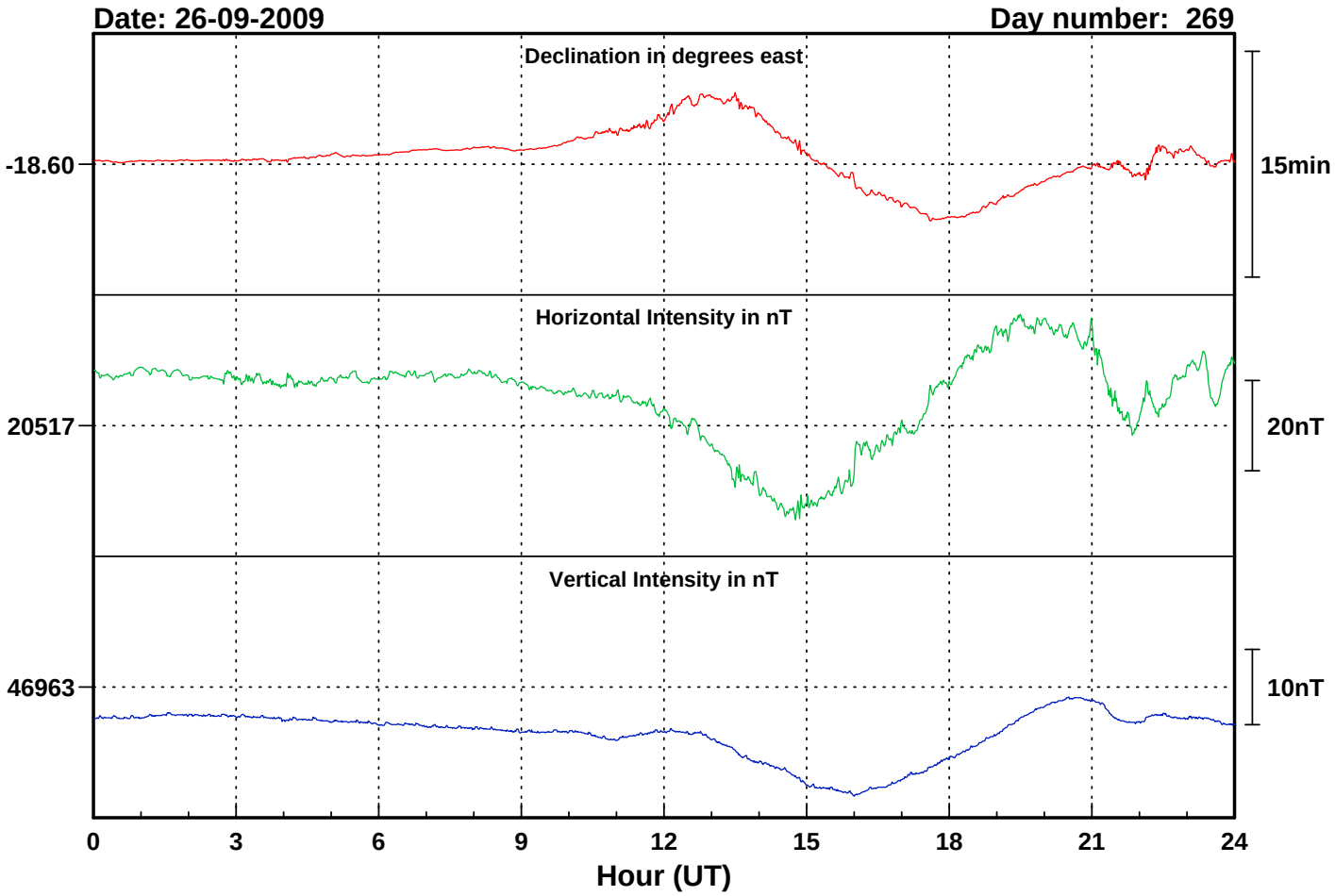
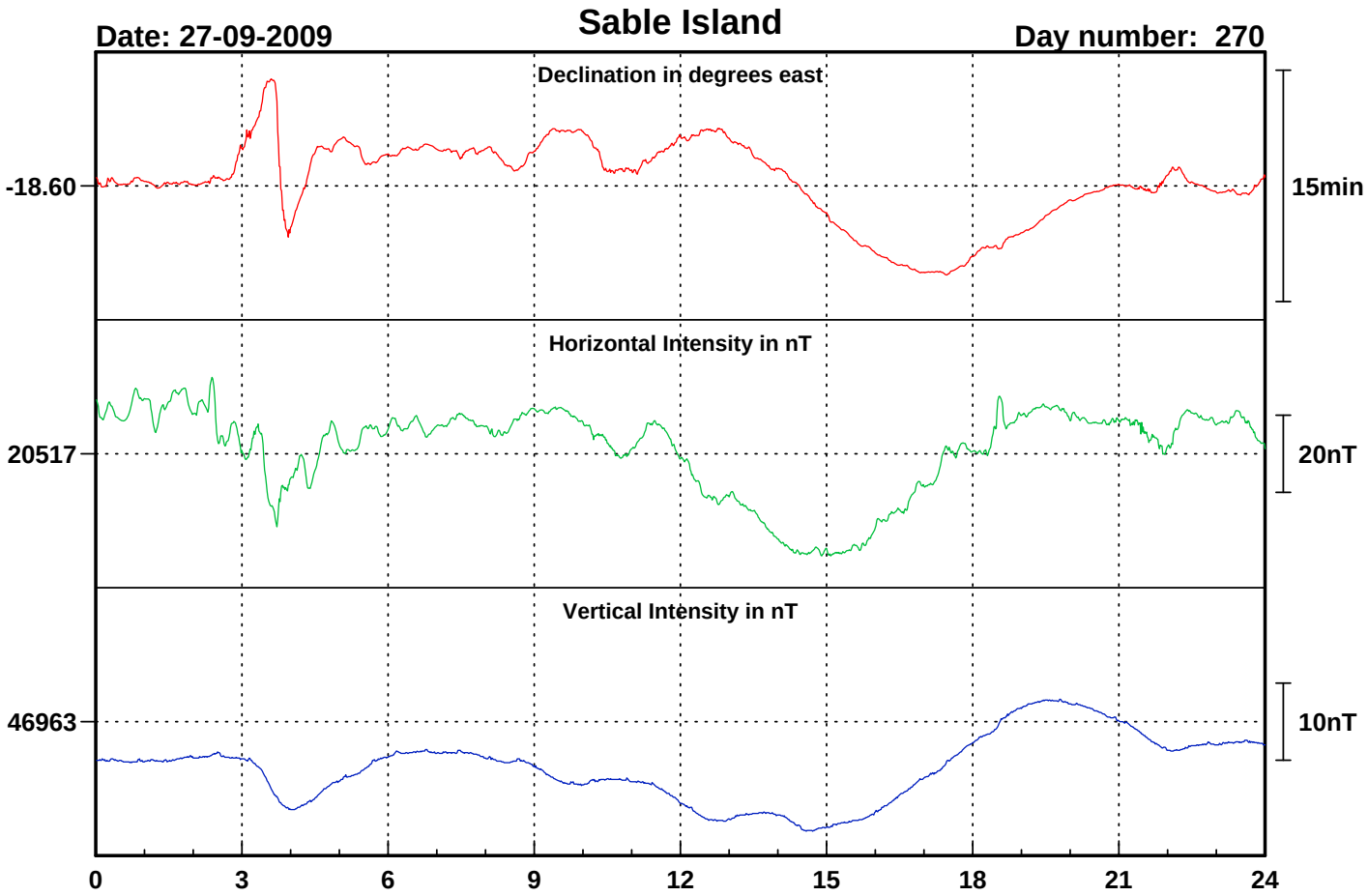
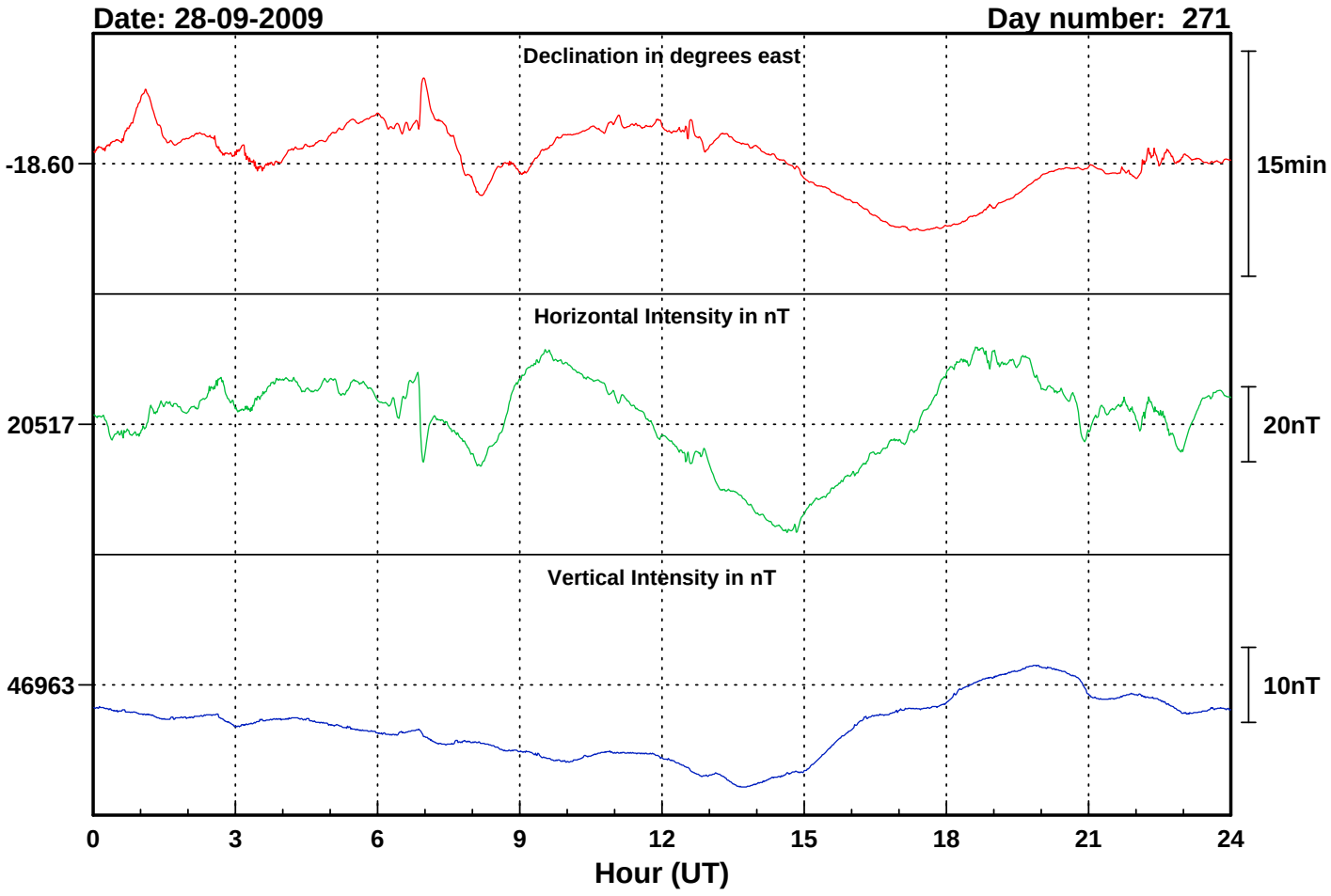
24

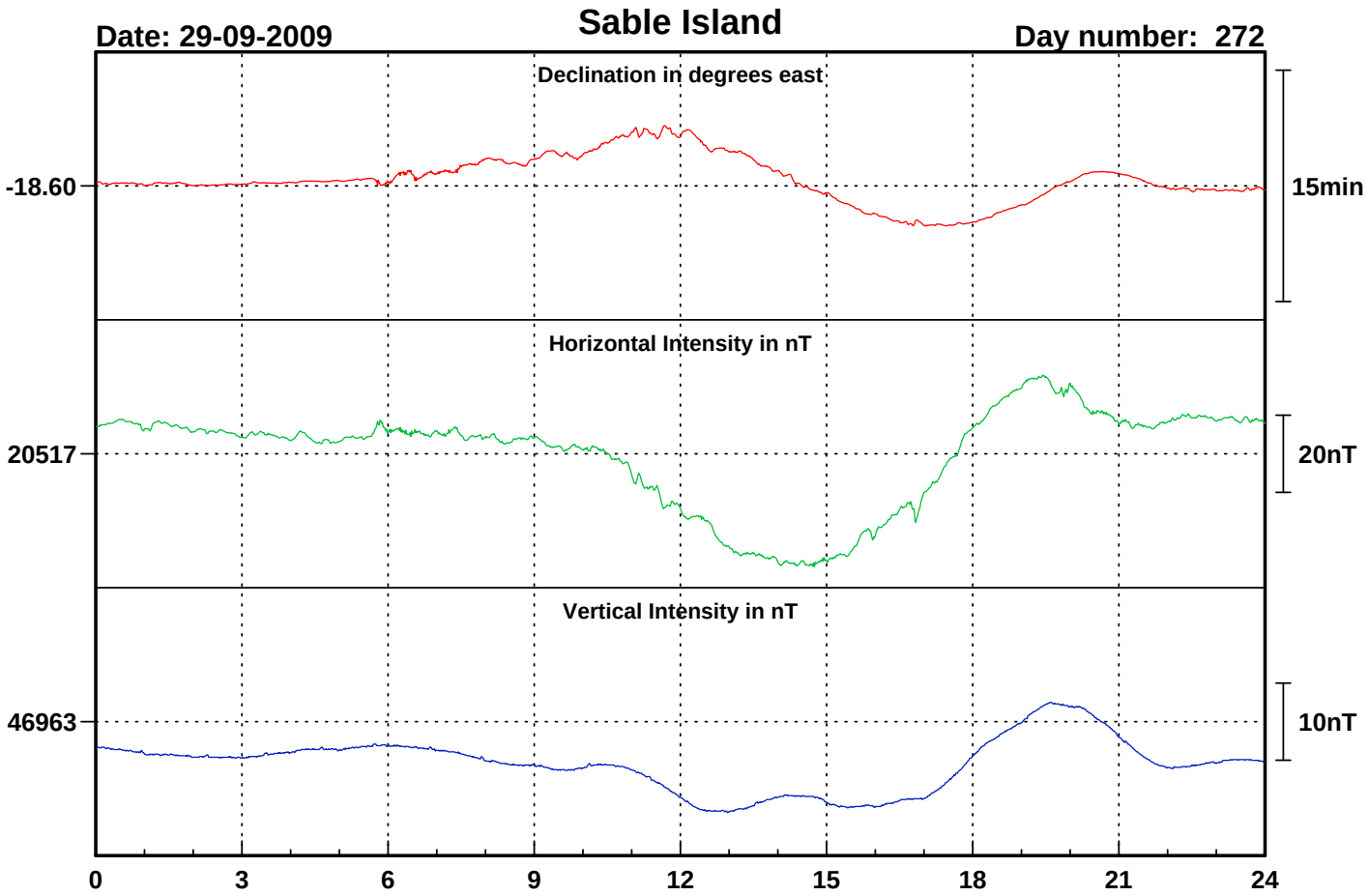

Date: 24-09-2009
Day number: 267
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
30nT
Vertical Intensity in nT
46963
10nT
0
3
6
9
12
15
18
21
24
Hour (UT)

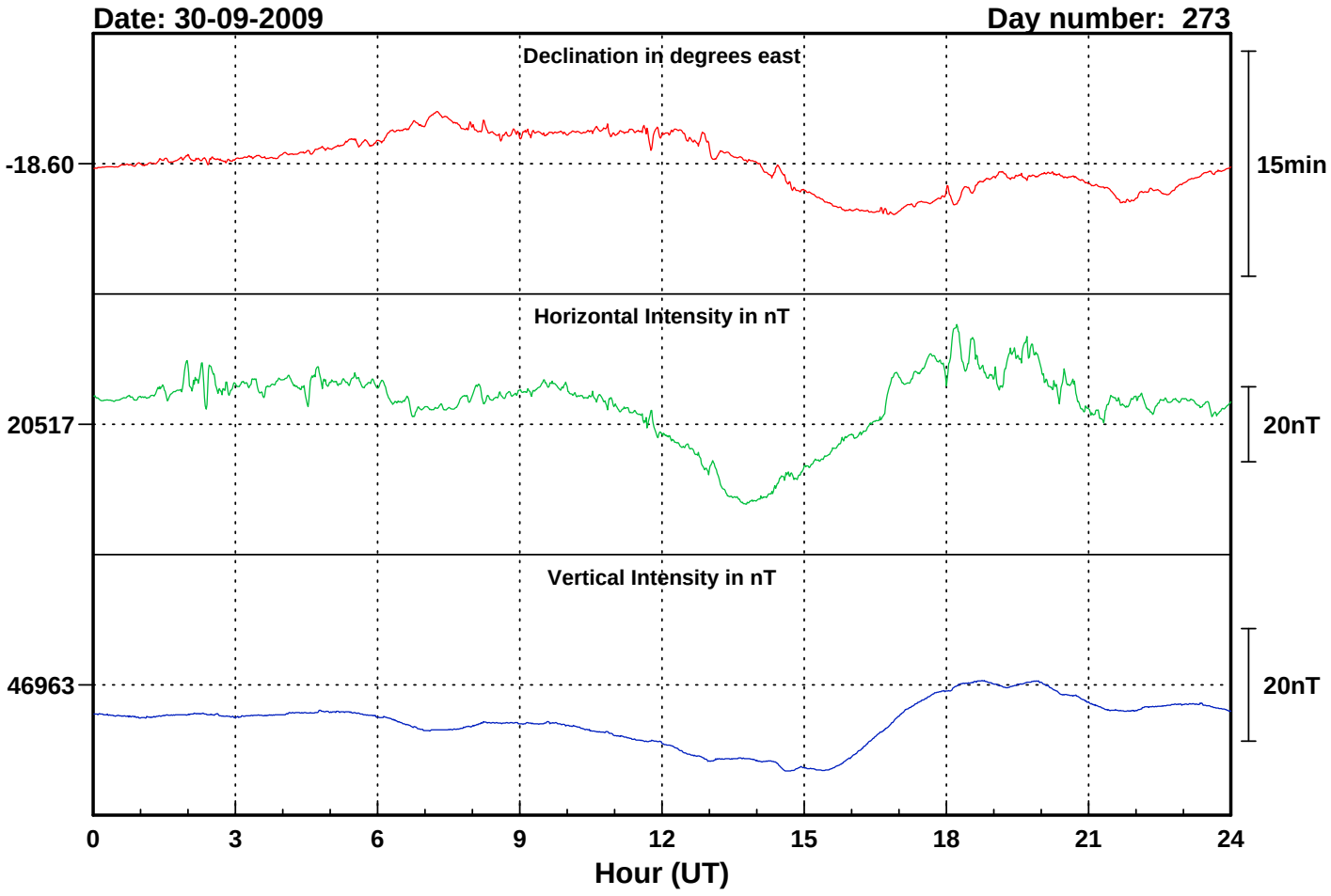

Sable Island
Date: 25-09-2009
Day number: 268
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
30nT
Vertical Intensity in nT
46963
10nT
0
3
6
9
12
15
18
21
24


Date: 26-09-2009
Day number: 269
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
20nT
Vertical Intensity in nT
46963
10nT
0
3
6
9
12
15
18
21
24
Hour (UT)

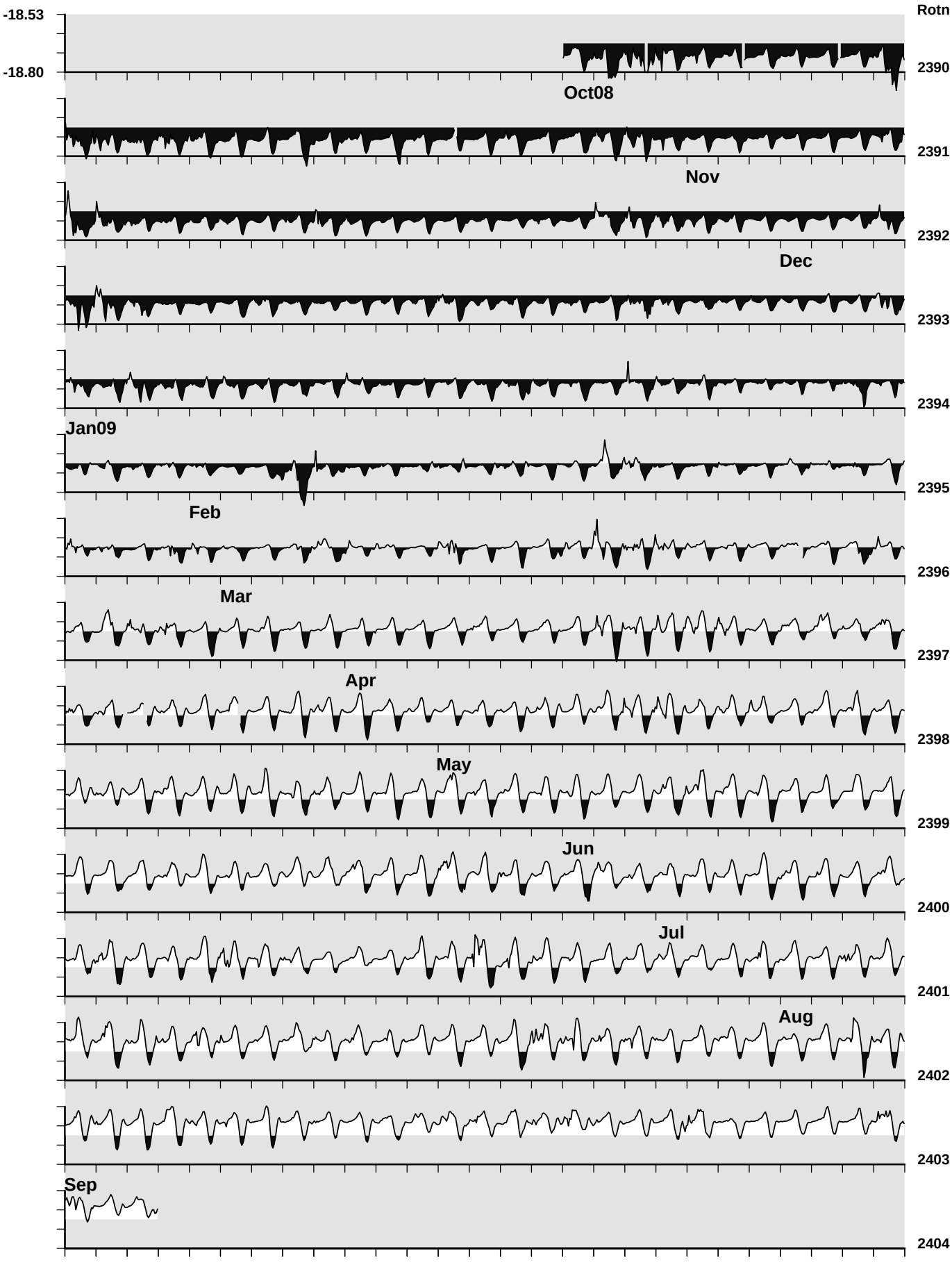

Sable Island
Date: 27-09-2009
Day number: 270
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
20nT
Vertical Intensity in nT
46963
10nT
0
3
6
9
12
15
18
21
24


Date: 28-09-2009
Day number: 271
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
20nT
Vertical Intensity in nT
46963
10nT
0
3
6
9
12
15
18
21
24
Hour (UT)


Sable Island
Date: 29-09-2009
Day number: 272
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
20nT
Vertical Intensity in nT
46963
10nT
0
3
6
9
12
15
18
21
24

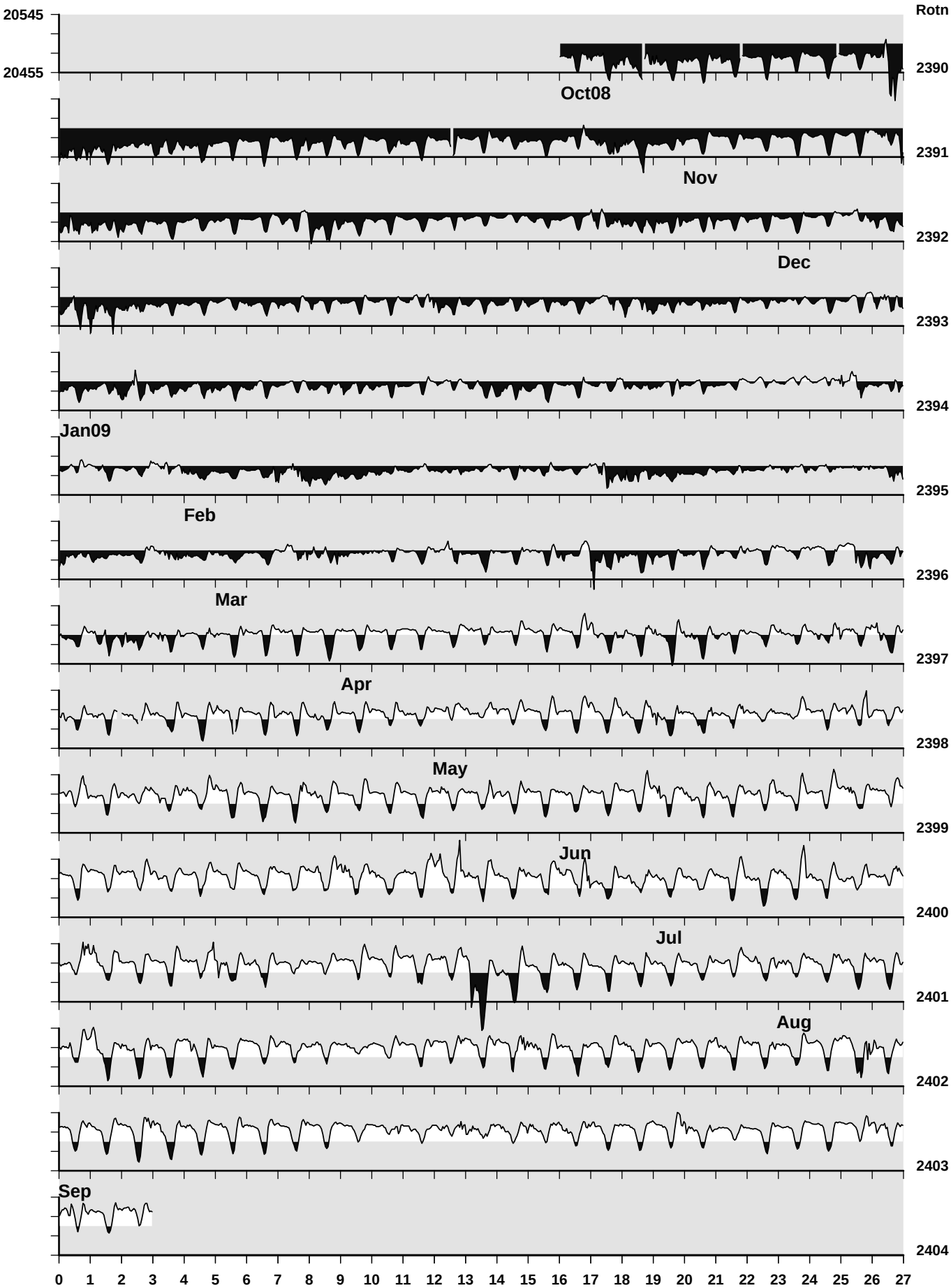

Date: 30-09-2009
Day number: 273
Declination in degrees east
-18.60
15min
Horizontal Intensity in nT
20517
20nT
Vertical Intensity in nT
46963
20nT
0
3
6
9
12
15
18
21
24
Hour (UT)

Sable Island Observatory: Declination (degrees)



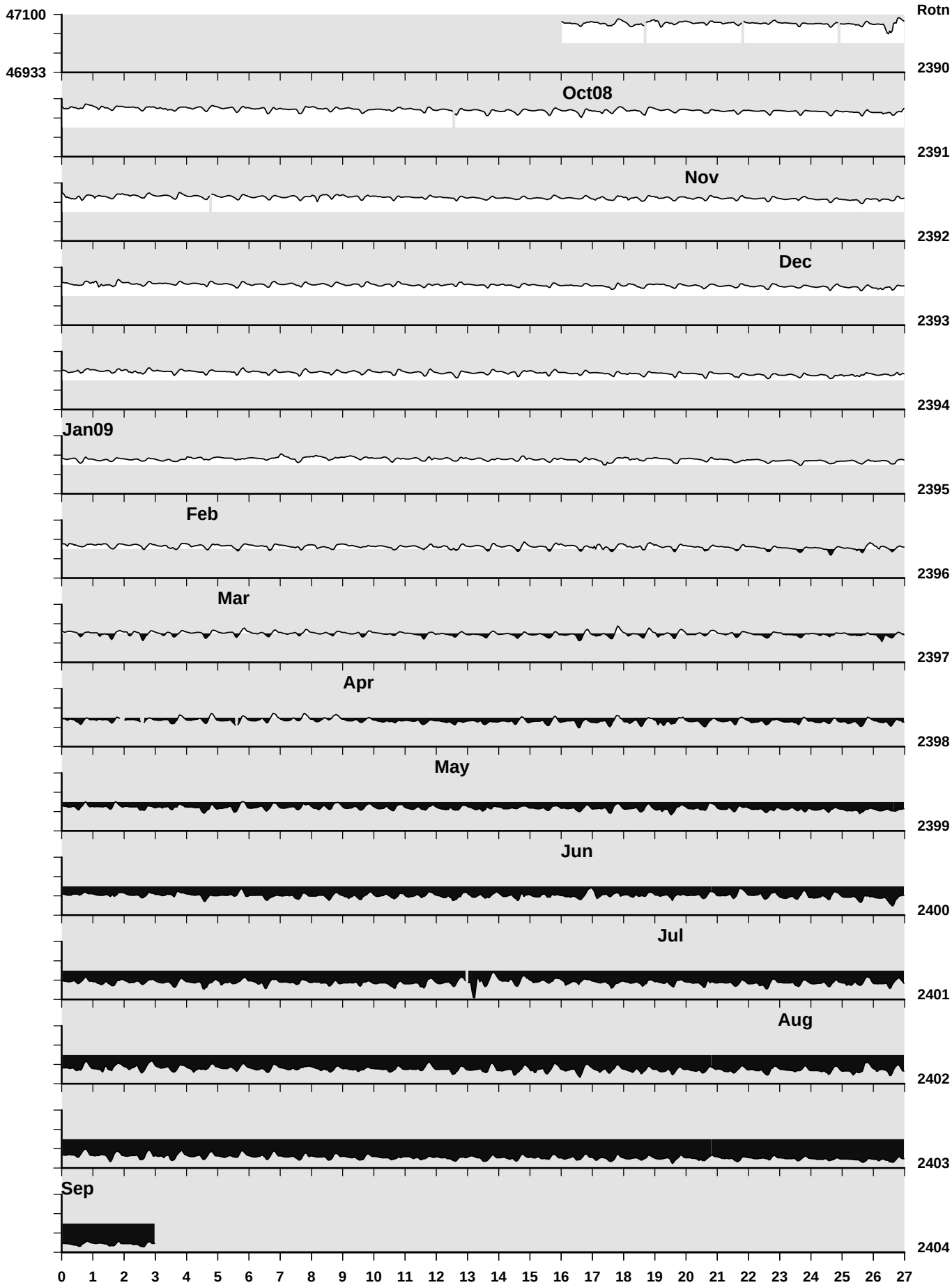
Hourly Mean Values Plotted By Bartels Solar Rotation Number

Sable Island Observatory: Horizontal Intensity (nT)

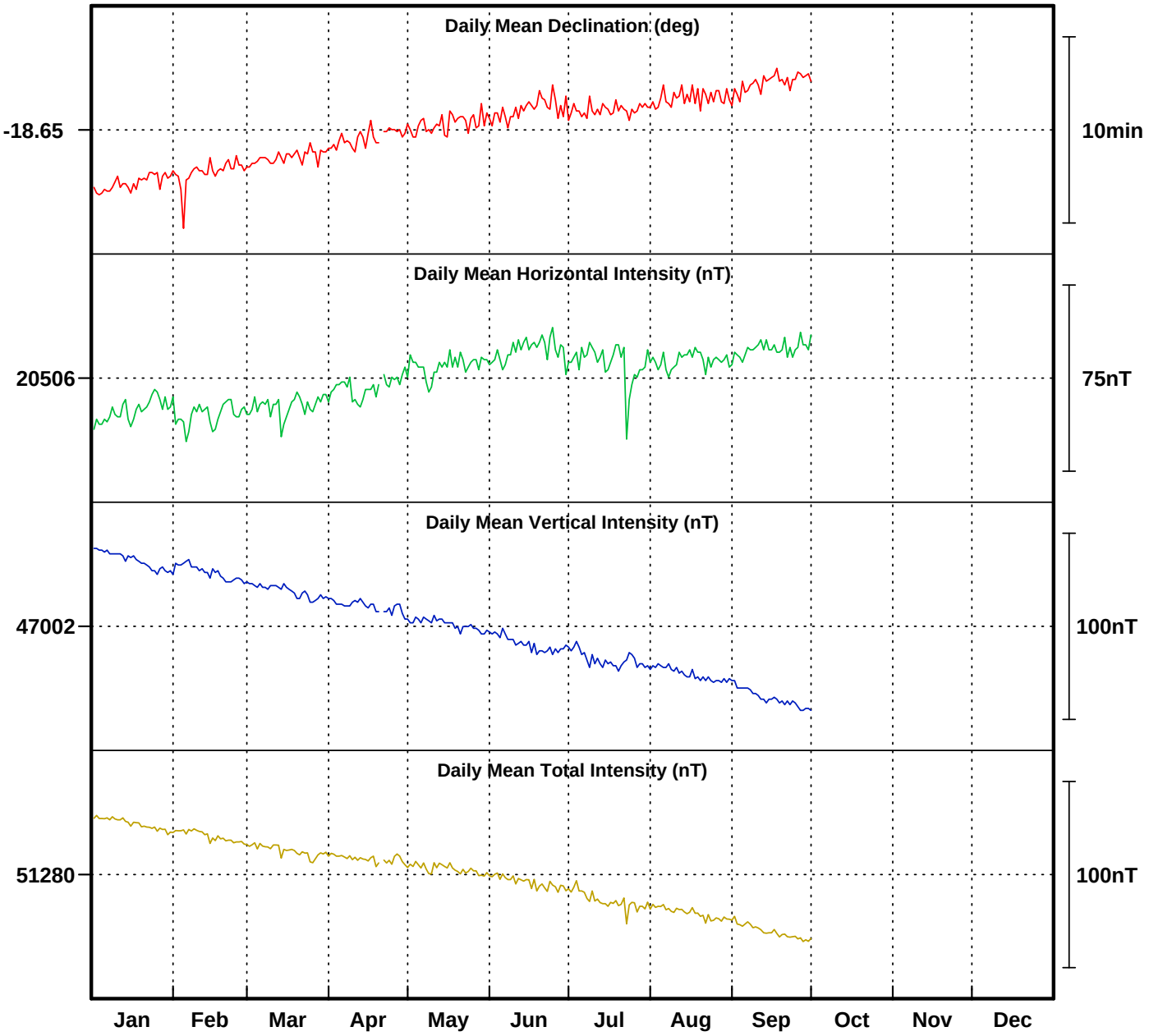


Hourly Mean Values Plotted By Bartels Solar Rotation Number

Sable Island Observatory: Vertical Intensity (nT)



Sable Island Observatory 2009



Monthly Mean Values for Sable Island Observatory 2009

Month	*D*	*H*	*I*	*X*	*Y*	*Z*	*F*
January	-18° 41.6′	20493 nT	66° 27.5′	19412 nT	-6568 nT	47037 nT	51308 nT
February	-18° 41.0′	20491 nT	66° 27.5′	19411 nT	-6564 nT	47031 nT	51301 nT
March	-18° 40.2′	20494 nT	66° 27.0′	19416 nT	-6560 nT	47021 nT	51293 nT
April	-18° 39.1′	20502 nT	66° 26.3′	19425 nT	-6557 nT	47013 nT	51289 nT
May	-18° 38.4′	20511 nT	66° 25.5′	19435 nT	-6555 nT	47003 nT	51283 nT
June	-18° 37.6′	20517 nT	66° 24.8′	19442 nT	-6553 nT	46992 nT	51276 nT
July	-18° 37.6′	20512 nT	66° 24.9′	19437 nT	-6552 nT	46984 nT	51266 nT
August	-18° 37.0′	20513 nT	66° 24.7′	19439 nT	-6548 nT	46976 nT	51260 nT
September	-18° 36.1′	20517 nT	66° 24.0′	19446 nT	-6545 nT	46963 nT	51249 nT

Note

i. The values shown here are provisional.