BRITISH GEOLOGICAL SURVEY

Lerwick Observatory

Monthly Magnetic Bulletin

November 2016

16/11/LE

SHETLAND ISLANDS

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

LERWICK OBSERVATORY MAGNETIC DATA

1. Introduction

Lerwick observatory is one of three geomagnetic observatories in the UK operated and maintained by the British Geological Survey (BGS).

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, reports of rapid variations and geomagnetic activity indices. The operation of the observatory and presentation of data are described in the rest of this section.

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Fax: +44 (0) 131 668 2683
E-mail: enquiries@bgs.ac.uk
Internet: www.geomag.bgs.ac.uk

2. Position

The observatory is situated on a ridge of high ground about 2.5 km to the SW of the port of Lerwick in Shetland. The observatory co-ordinates are:

Geographic: 60°08'16.8"N 358°49'01.2"E
Geomagnetic: 61°47'56"N 088°45'40"E
Height above mean sea level: 85 m

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
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 2002, and became fully operational in January 2003. 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. The one-minute values provide input for various data products, available on-line at
www.geomag.bgs.ac.uk/data_service/home

3.2 Back-up Systems

There are two other fully independent identical systems, GDAS 2 and GDAS 3, operating at the observatory. The data from these are also processed in near real-time and used for quality control purposes. They are also used to fill any gaps or replace any corrupt values in the primary system, GDAS 1.

3.3 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. 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.

Full lists of the UK observatory hourly mean values from 1983 to the present day are available at www.geomag.bgs.ac.uk/data_service/data/obs_data/hourly_means

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.

4.6 Rapid Variations

Charged particles stream from the Sun in the solar wind. The solar wind interacts with the geomagnetic field to create a cavity, the magnetosphere, in which the field is confined. When a region of enhanced velocity and/or density in the solar wind arrives at the dayside boundary of the magnetosphere (at about 10 earth radii) the boundary is pushed towards the Earth. Currents set up on the boundary of the magnetosphere can cause an abrupt change in the geomagnetic field measured on the ground and this is recorded on observatory magnetograms as a sudden impulse (*si*). If, following an *si*, there is a change in the rhythm of activity, the *si* is termed a storm sudden commencement (*ssc*). A classical magnetic storm exhibiting initial, main and recovery phases (shown by, for instance, the *Dst* ring current index) can often occur after a *ssc*, in which case the start of the storm is taken as the time of the *ssc*.

Solar flares, seen at optical wavelengths as a sudden brightening of a small region of the Sun's surface, are also responsible for increased X-ray emissions. These X-rays cause increased ionisation in the ionosphere, which leads to absorption of short-wave radio signals. A solar flare effect (*sfe*), or "crochet", may be observed on a magnetogram during geomagnetically quiet times. It is a relatively short-term change (tens of minutes) to the normal diurnal variation and can vary in size (tens of nT) depending on local time (LT), geomagnetic latitude and solar zenith angle.

4.7 Local geomagnetic activity indices

The Observatory K index. This summarises geomagnetic activity at an observatory by assigning a code, an integer in the range 0 to 9, to each 3-hour Universal Time (UT) interval. The index for each 3-hour UT interval is determined from the maximum range in *H* or *D* (scaled in nT), with allowance made for the regular (undisturbed) diurnal variation. The conversion from range to an index value is made using a quasi-logarithmic scale, with the scale values dependent on the geomagnetic latitude of the observatory. The lower bounds (in nT) for the classification of each period at Lerwick are:

0	1	2	3	4	5	6	7	8	9
0	10	20	40	80	140	240	400	660	1000

The *K* index retains the LT and seasonal dependence of activity associated with the position of the observatory. The 3-hourly *K* indices for the month are tabulated and also plotted as a histogram. All UK observatory *K* indices are available at www.geomag.bgs.ac.uk/data_service/data/magnetic_indices/k_indices

4.8 Global geomagnetic activity indices

The aa index. A number of 3-hour geomagnetic indices are computed by combining *K* indices from networks of observatories to characterise global activity levels and to eliminate LT and seasonal effects. The simplest of these is the *aa* index, computed using the *K* indices from two approximately antipodal observatories: Hartland in the UK and Canberra in Australia. The *aa* index is calculated from linearisations of the Hartland and Canberra *K* indices, and has units of nT. The 3-hourly *aa* indices are tabulated along with the daily mean value of *aa* (denoted *Aa*), the mean values of *aa* for the intervals 00-12UT (Aa_{am}) and 12-24UT (Aa_{pm}) and the monthly mean value. The 3-hourly *aa* indices for the month are also plotted as a histogram.

Although the *aa* index is based on data from only two observatories, provided averages over 12 hours or longer are used, the index is strongly correlated with the *ap* and *am* indices, which are derived using data from more extensive observatory networks.

The *aa* indices listed in this bulletin are available at www.geomag.bgs.ac.uk/data_service/data/magnetic_indices/aaindex as well as the full data set from 1868.

Definitive *aa* are published by the International Service for Geomagnetic Indices, LATMOS, 4 Avenue de Neptune, F-94107 Saint Maur Cedex, France.

5. Conditions of Use

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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

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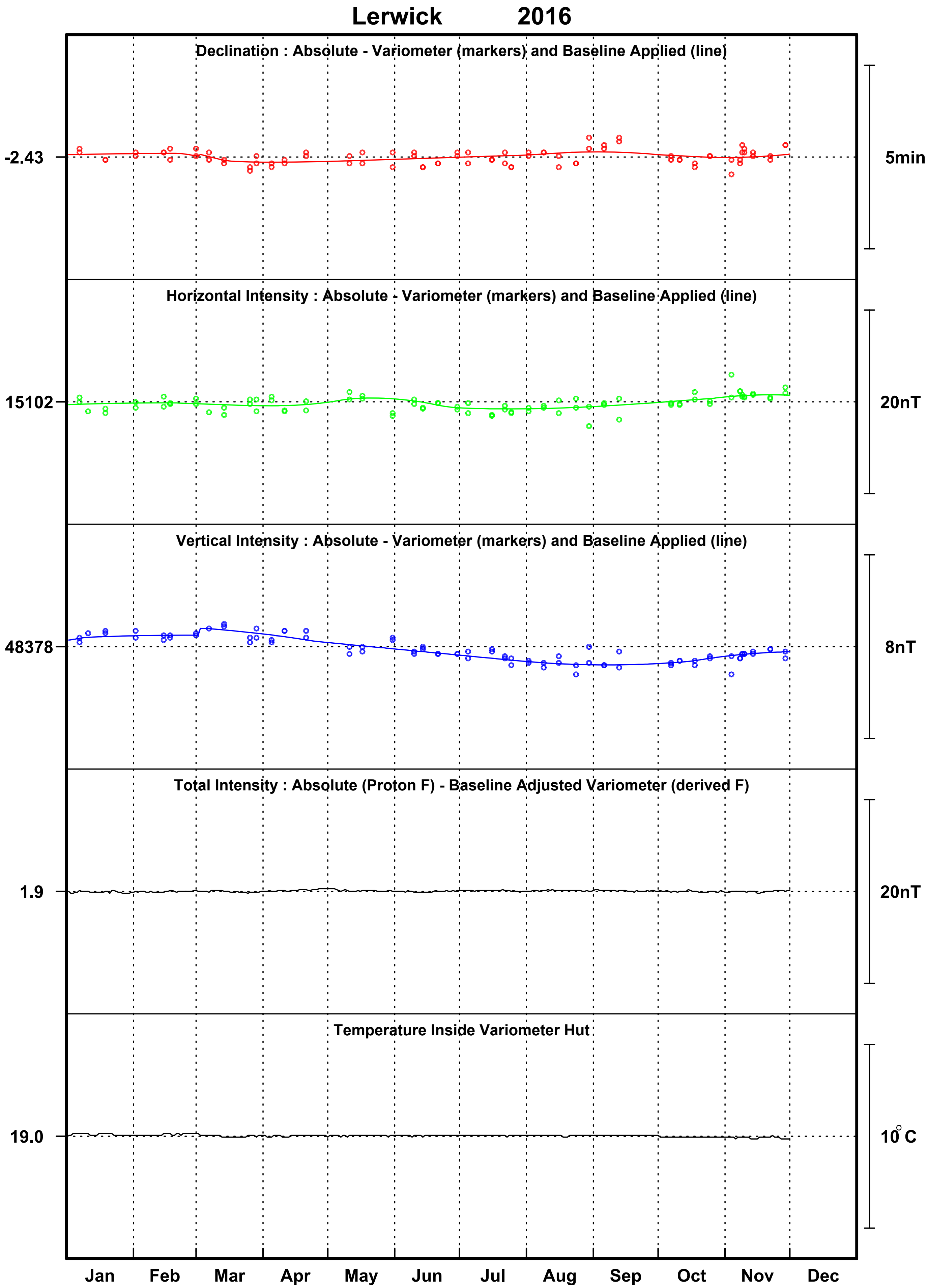
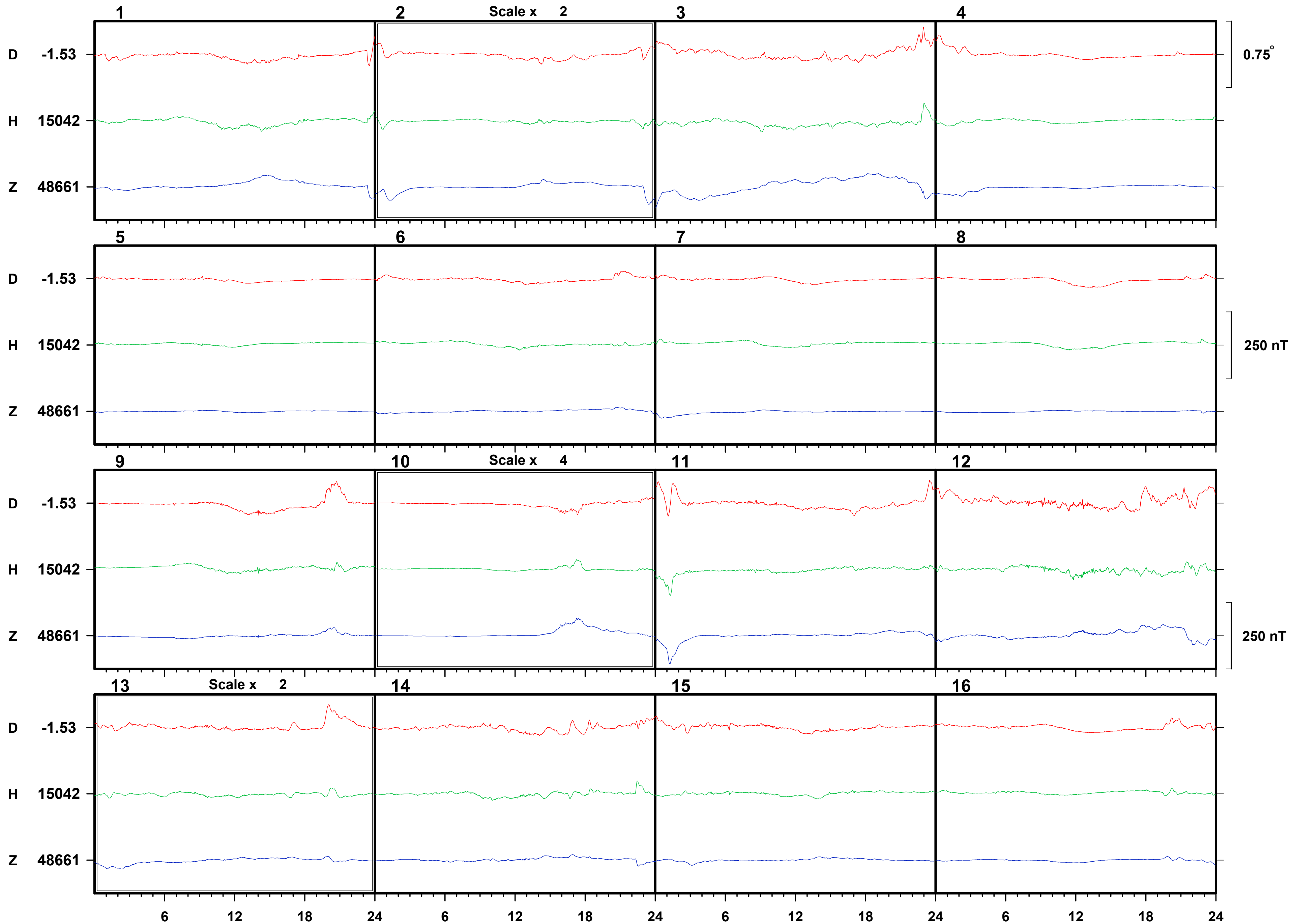
LERWICK OBSERVATORY

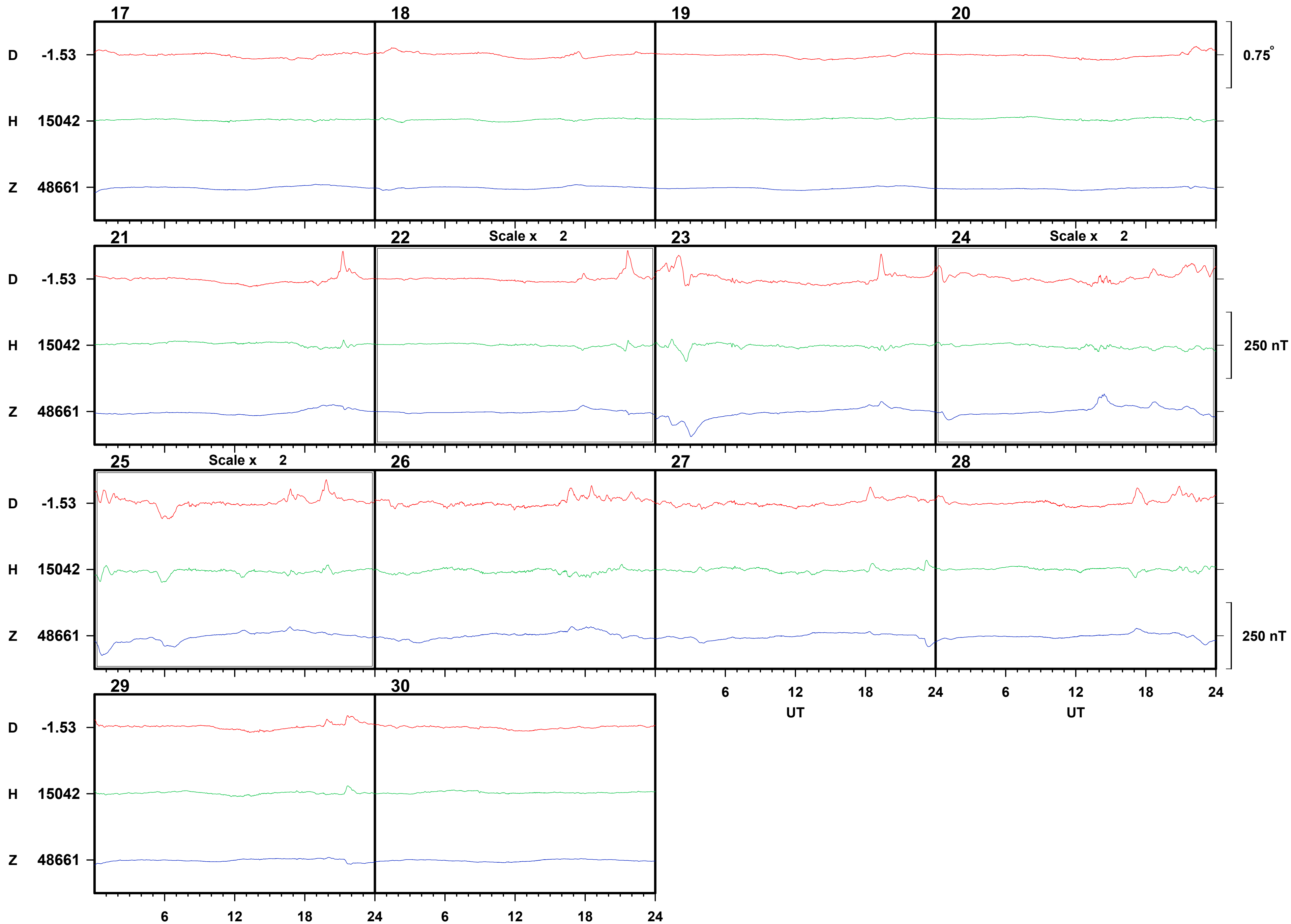
ABSOLUTE OBSERVATIONS

		Declination			Inclination		Total Field		Horizontal Intensity		Vertical Intensity		
Date	**Day Number**	**Time (UT)**	**Absolute (º)**	**Baseline (º)**	**Time (UT)**	**Absolute (º)**	**Site difference (nT)**	**Absolute corrected (nT)**	**Absolute (nT)**	**Baseline (nT)**	**Absolute (nT)**	**Baseline (nT)**	**Observer**
03-Nov-16	308	12:48	-1.6063	-2.4300	13:05	72.8515	-1.9	50941.9	15020.2	15102.9	48677.2	48377.9	OB
03-Nov-16	308	13:18	-1.6074	-2.4367	13:38	72.8444	-1.9	50942.1	15026.3	15105.4	48675.5	48377.1	OB
07-Nov-16	312	09:19	-1.5115	-2.4300	09:32	72.8265	-1.9	50936.4	15039.8	15103.6	48665.4	48377.8	WH
07-Nov-16	312	09:42	-1.5172	-2.4317	09:56	72.8285	-1.9	50935.1	15037.7	15103.6	48664.7	48377.8	WH
08-Nov-16	313	14:33	-1.6146	-2.4267	14:46	72.8293	-1.9	50931.5	15036.0	15103.2	48661.4	48378.0	CT
08-Nov-16	313	15:02	-1.5904	-2.4233	15:17	72.8244	-1.9	50933.0	15040.5	15103.0	48661.6	48378.0	CT
09-Nov-16	314	08:43	-1.5343	-2.4267	08:55	72.8039	-1.9	50929.4	15056.9	15102.9	48652.7	48378.0	CT
09-Nov-16	314	09:12	-1.5264	-2.4250	09:26	72.8147	-1.9	50930.0	15048.0	15103.0	48656.2	48378.0	CT
13-Nov-16	318	14:50	-1.5542	-2.4267	15:02	72.8333	-1.9	50946.1	15036.9	15103.3	48676.5	48378.0	OB
13-Nov-16	318	15:12	-1.5596	-2.4283	15:26	72.8317	-1.9	50946.0	15038.2	15103.2	48675.9	48378.1	OB
21-Nov-16	326	09:13	-1.5479	-2.4300	09:23	72.8102	-1.9	50930.3	15051.8	15102.8	48655.3	48378.2	NL
21-Nov-16	326	09:31	-1.5501	-2.4283	09:41	72.8124	-1.9	50929.2	15049.6	15102.9	48654.9	48378.2	NL
28-Nov-16	333	14:13	-1.5688	-2.4233	14:26	72.8195	-1.9	50935.5	15045.5	15103.4	48662.7	48378.1	PK
28-Nov-16	333	14:36	-1.5554	-2.4233	14:46	72.8156	-1.9	50937.0	15049.3	15104.0	48663.1	48377.8	PK


Lerwick 2016
Declination : Absolute - Variometer (markers) and Baseline Applied (line)
-2.43
5min
Horizontal Intensity : Absolute - Variometer (markers) and Baseline Applied (line)
15102
20nT
Vertical Intensity : Absolute - Variometer (markers) and Baseline Applied (line)
48378
8nT
Total Intensity : Absolute (Proton F) - Baseline Adjusted Variometer (derived F)
1.9
20nT
Temperature Inside Variometer Hut
19.0
10°C
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

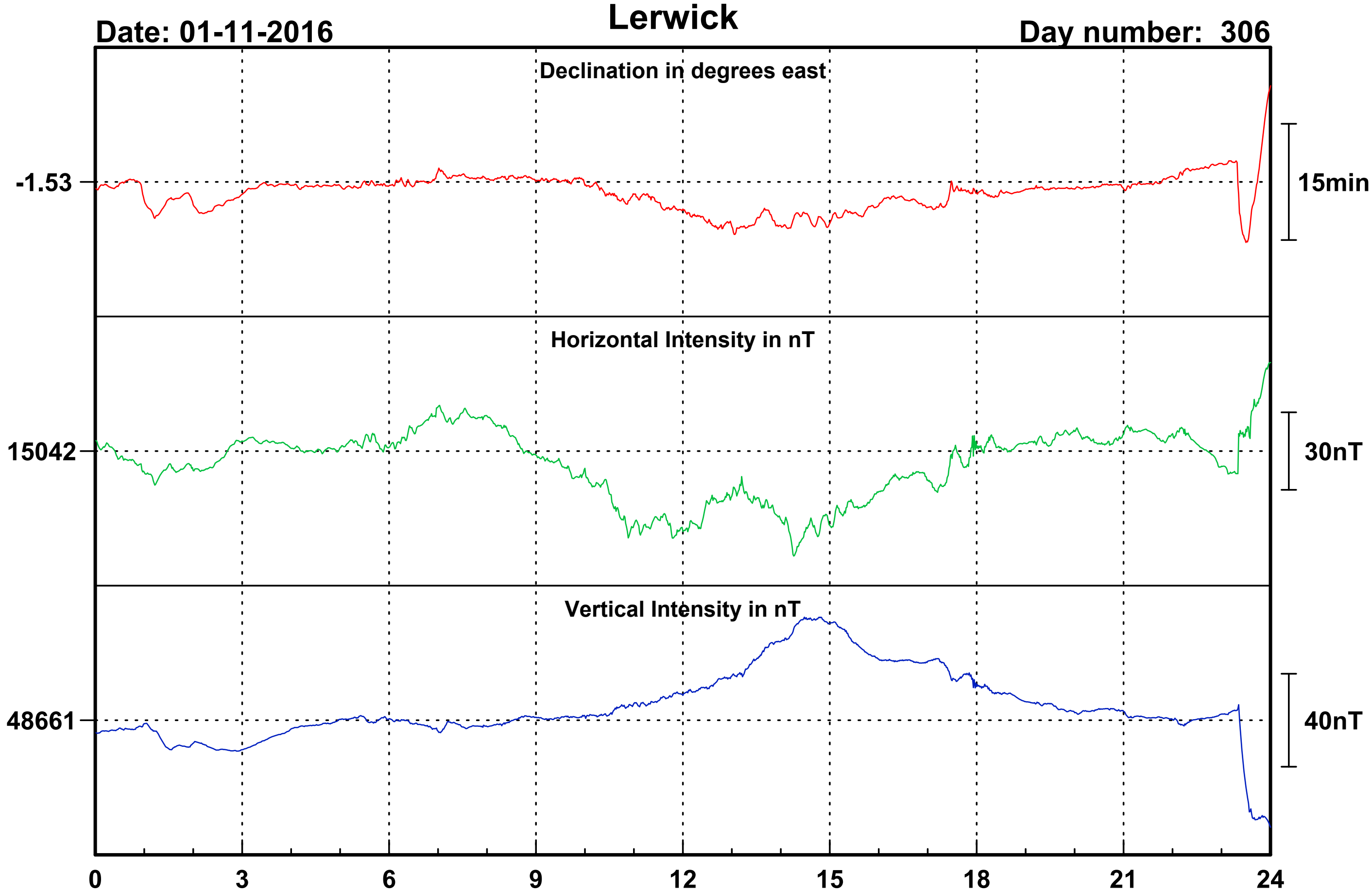
Lerwick November 2016





Lerwick November 2016

Lerwick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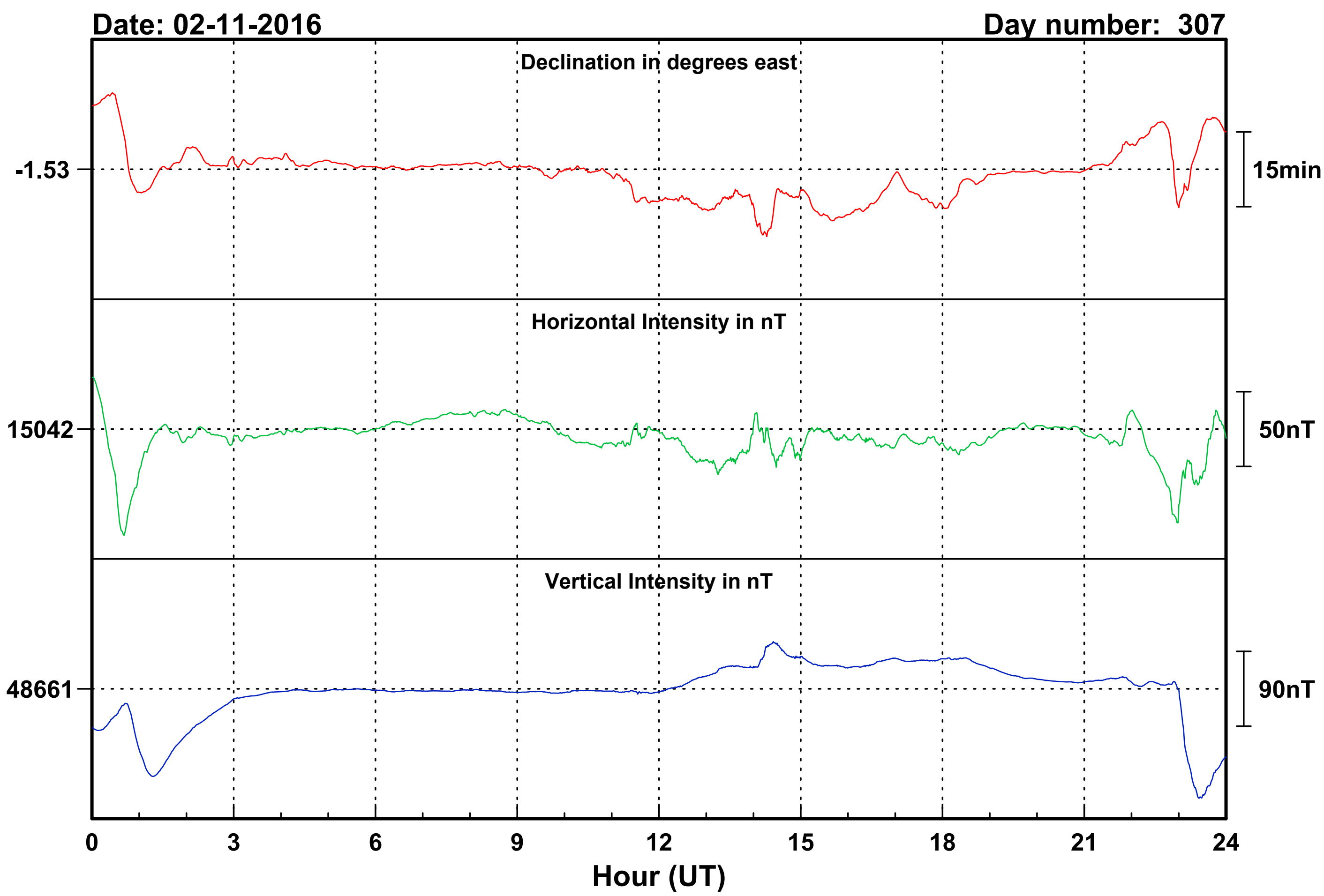
Day number: 306
Declination in degrees east
-1.53
15min
Horizontal Intensity in nT
15042
30nT
Vertical Intensity in nT
48661
40nT
0
3
6
9
12
15
18
21
24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15min
Horizontal Intensity in nT
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50nT
Vertical Intensity in nT
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90nT
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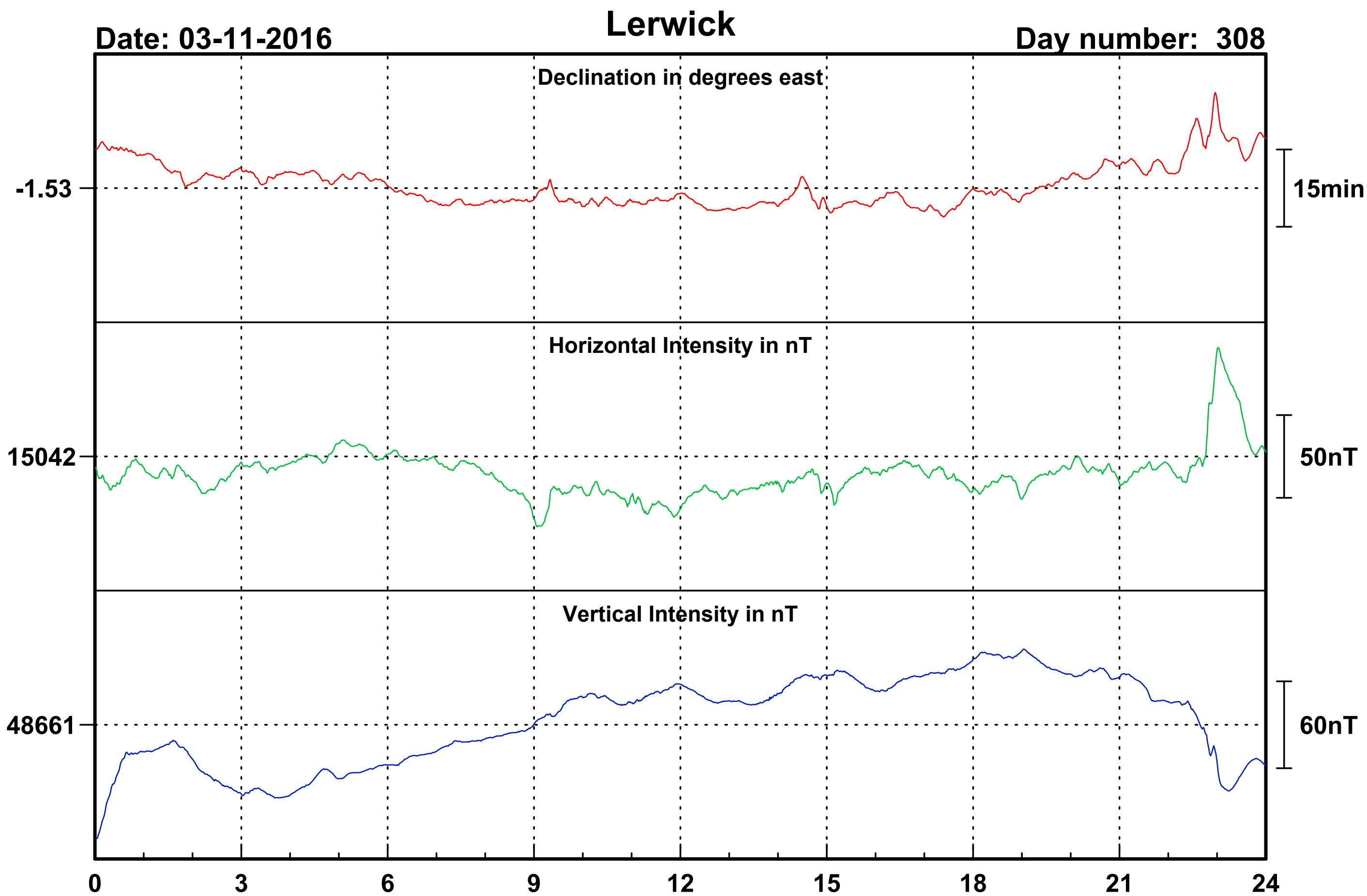
3
6
9
12
15
18
21
24
Hour (UT)


Lerwick
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Day number: 308
Declination in degrees east
-1.53
15min
Horizontal Intensity in nT
15042
50nT
Vertical Intensity in nT
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60nT
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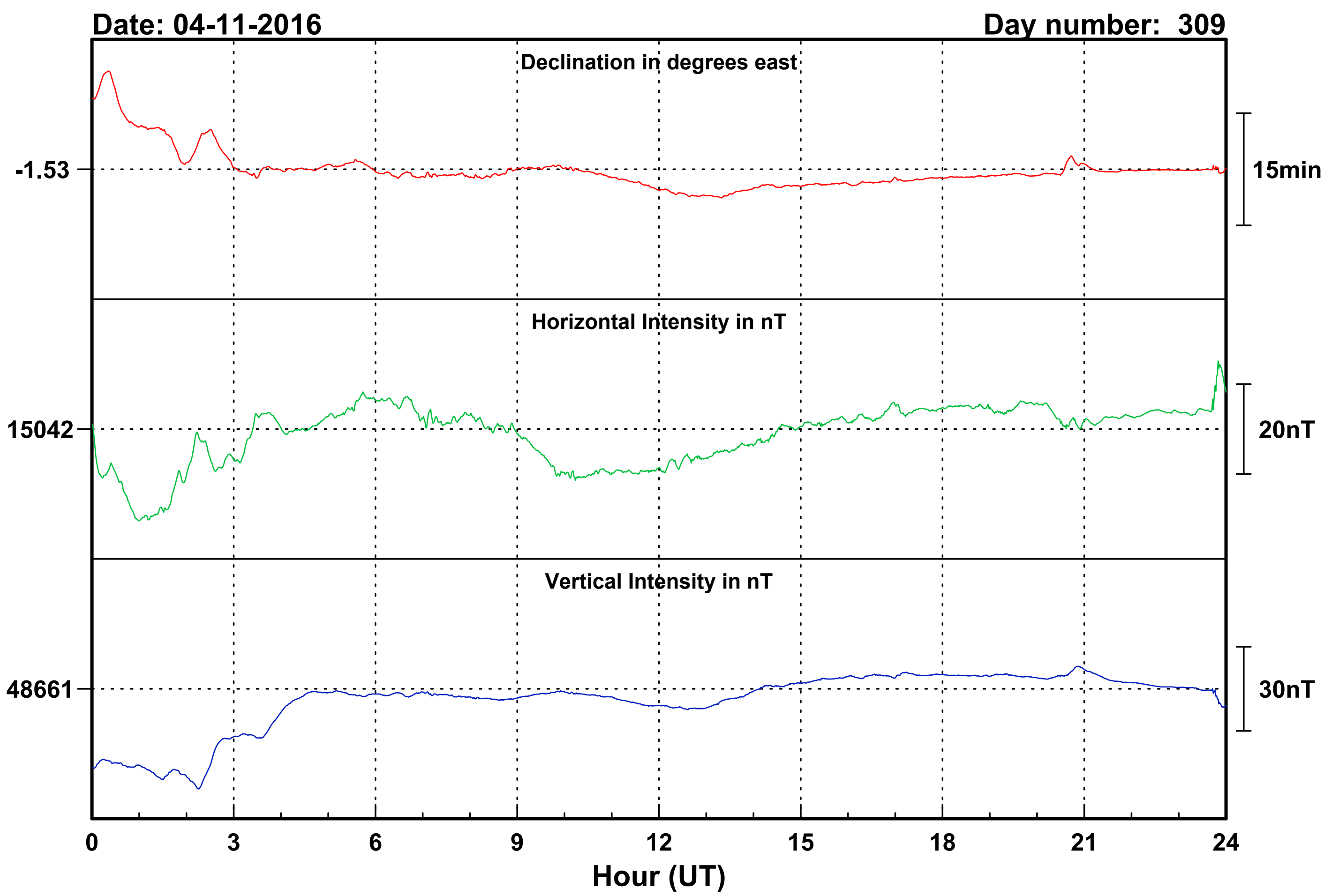
12
15
18
21
24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Day number: 309
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15min
Horizontal Intensity in nT
15042
20nT
Vertical Intensity in nT
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3
6
9
12
15
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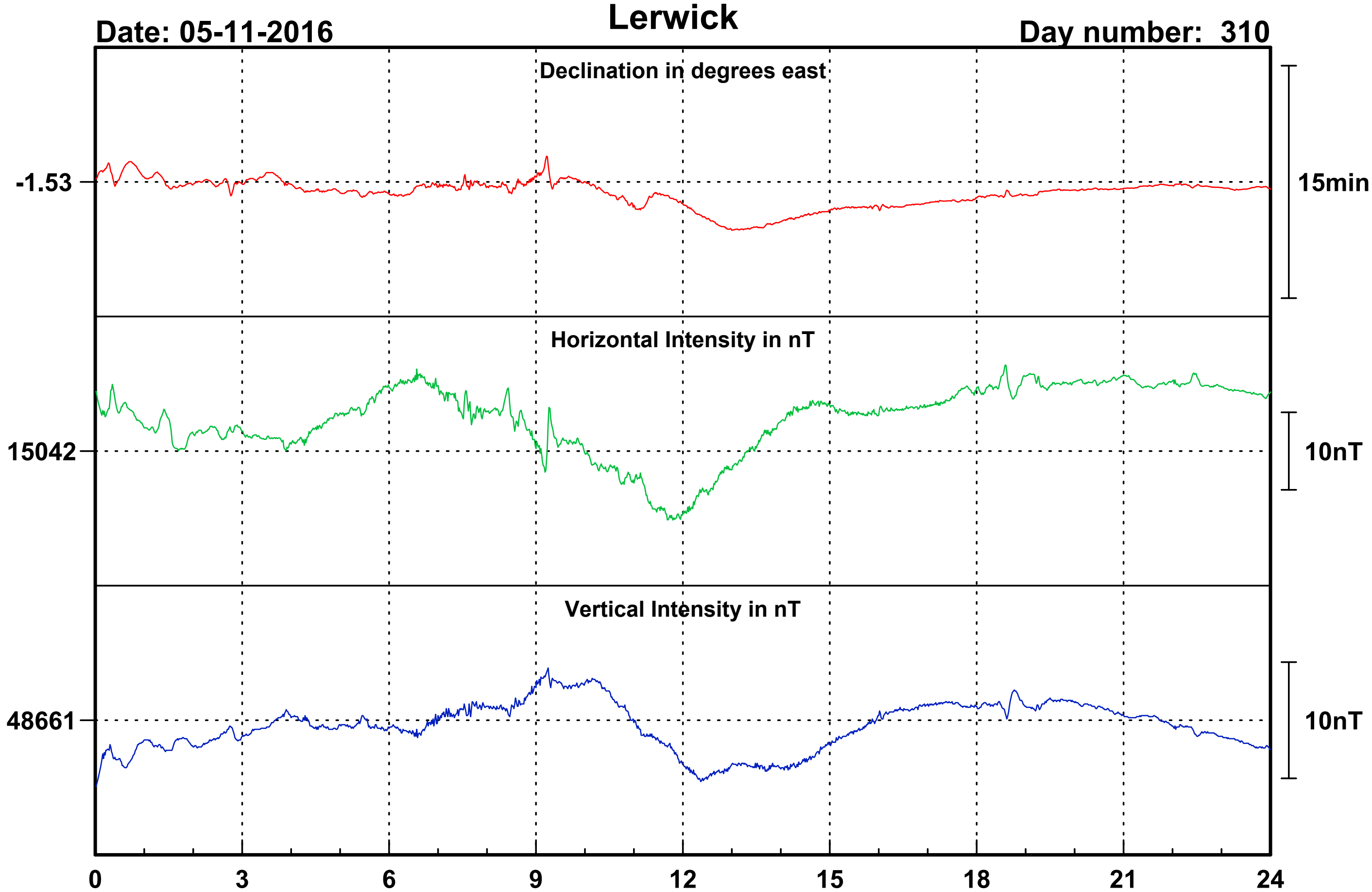
21
24
Hour (UT)

Lerwick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15min
Horizontal Intensity in nT
15042
10nT
Vertical Intensity in nT
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10nT
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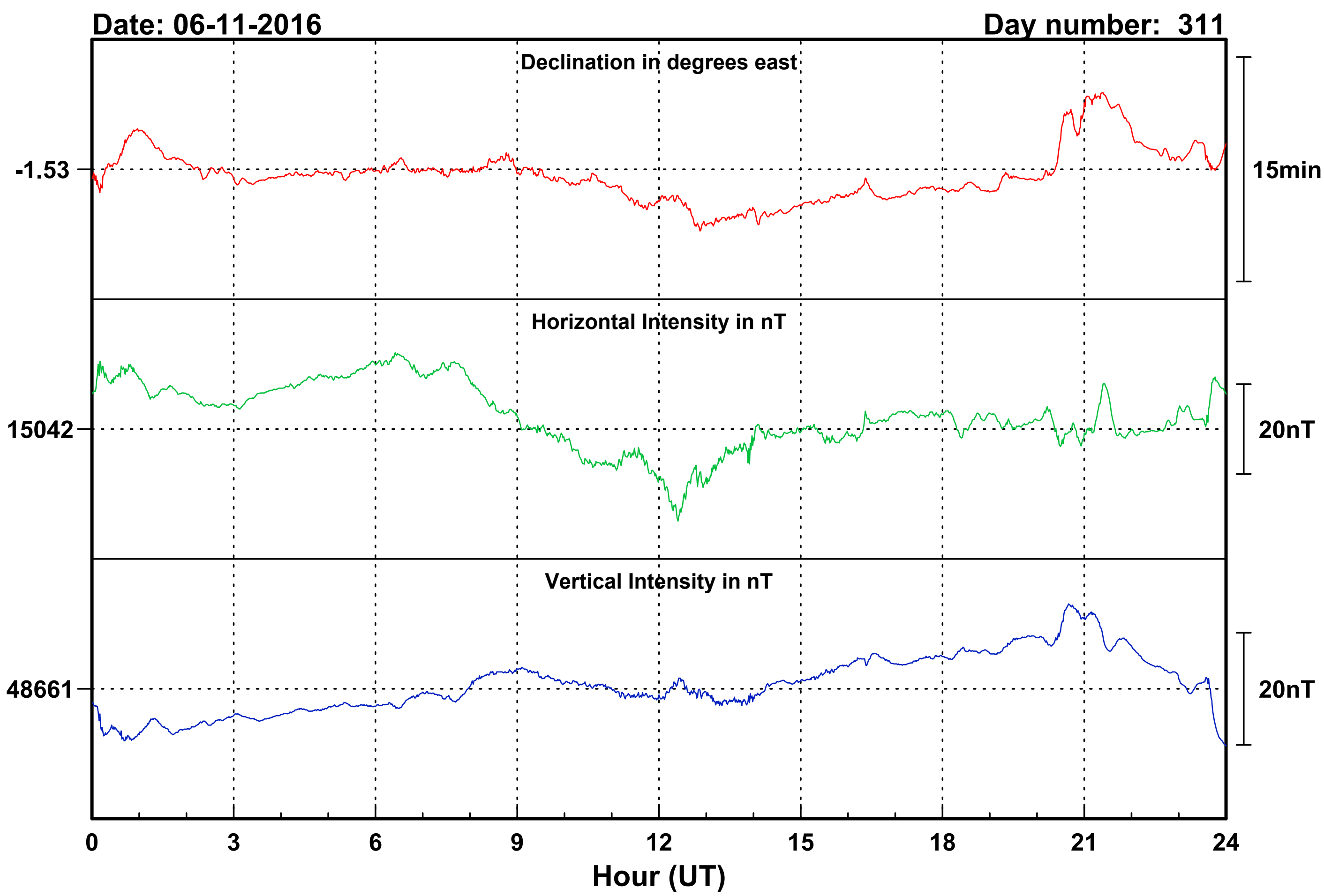
3
6
9
12
15
18
21
24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Day number: 311
Declination in degrees east
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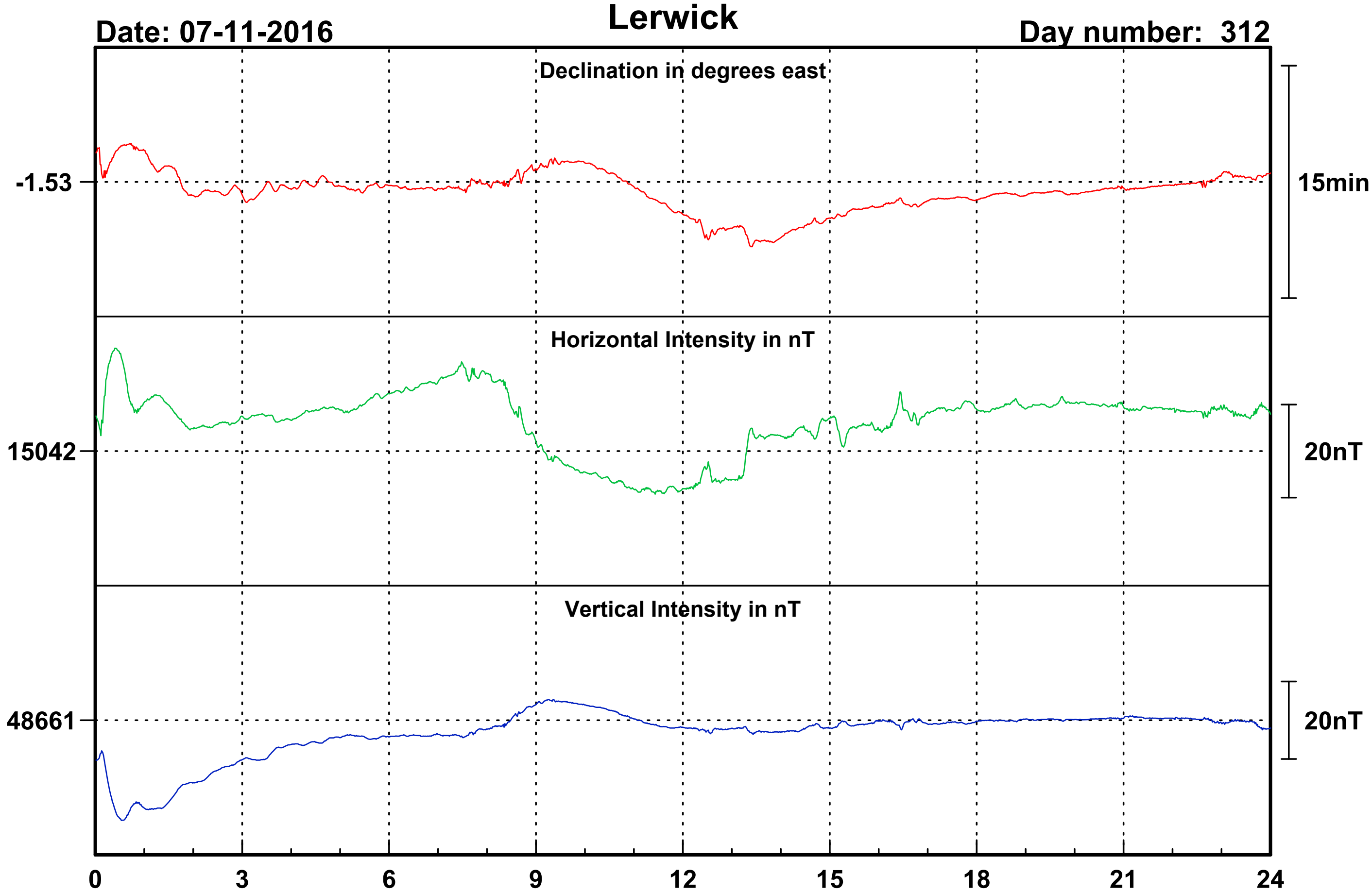
15min
Horizontal Intensity in nT
15042
20nT
Vertical Intensity in nT
48661
20nT
0
3
6
9
12
15
18
21
24
Hour (UT)

Lerwick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20nT
Vertical Intensity in nT
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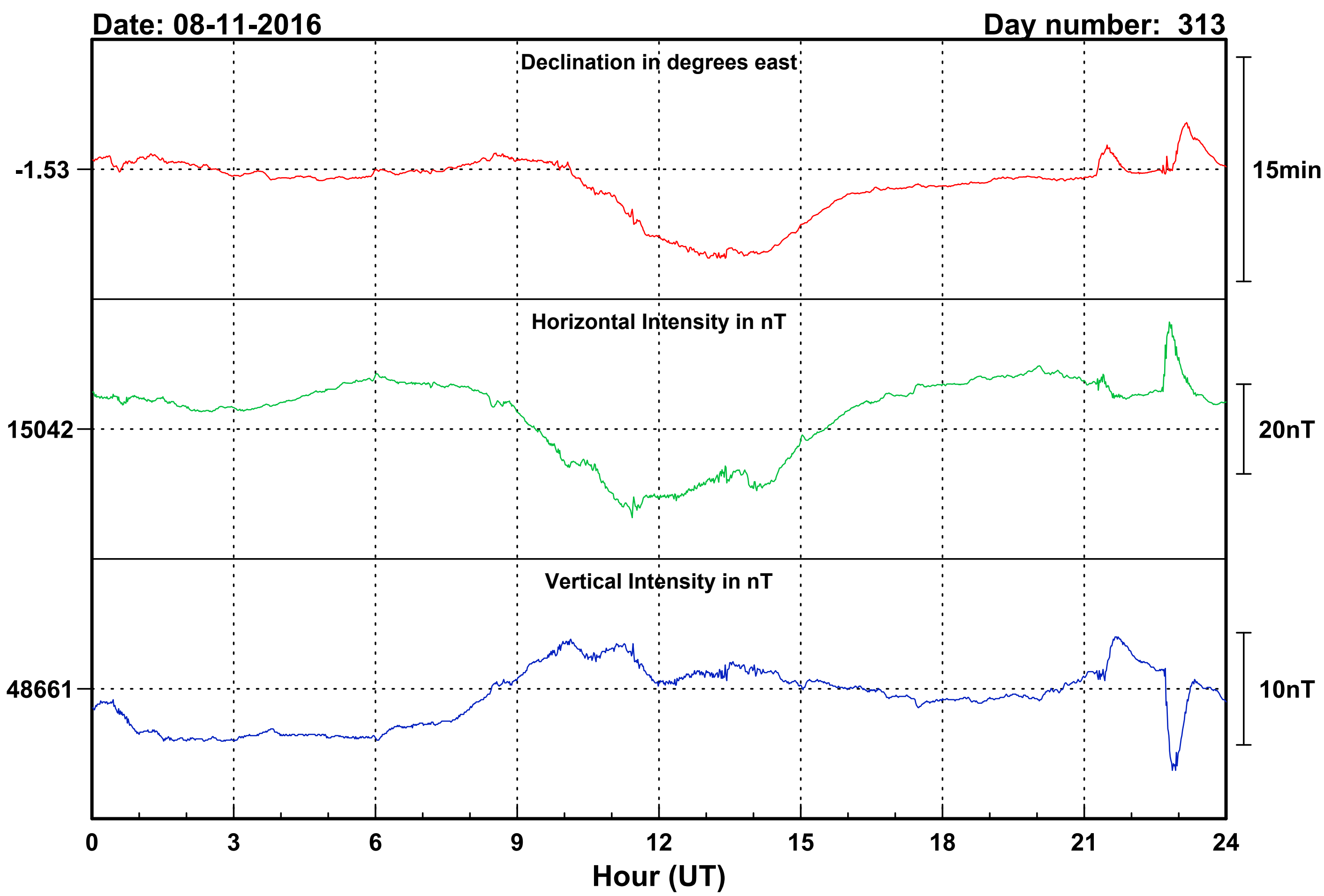
20nT
0 3 6 9 12 15 18 21 24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15min
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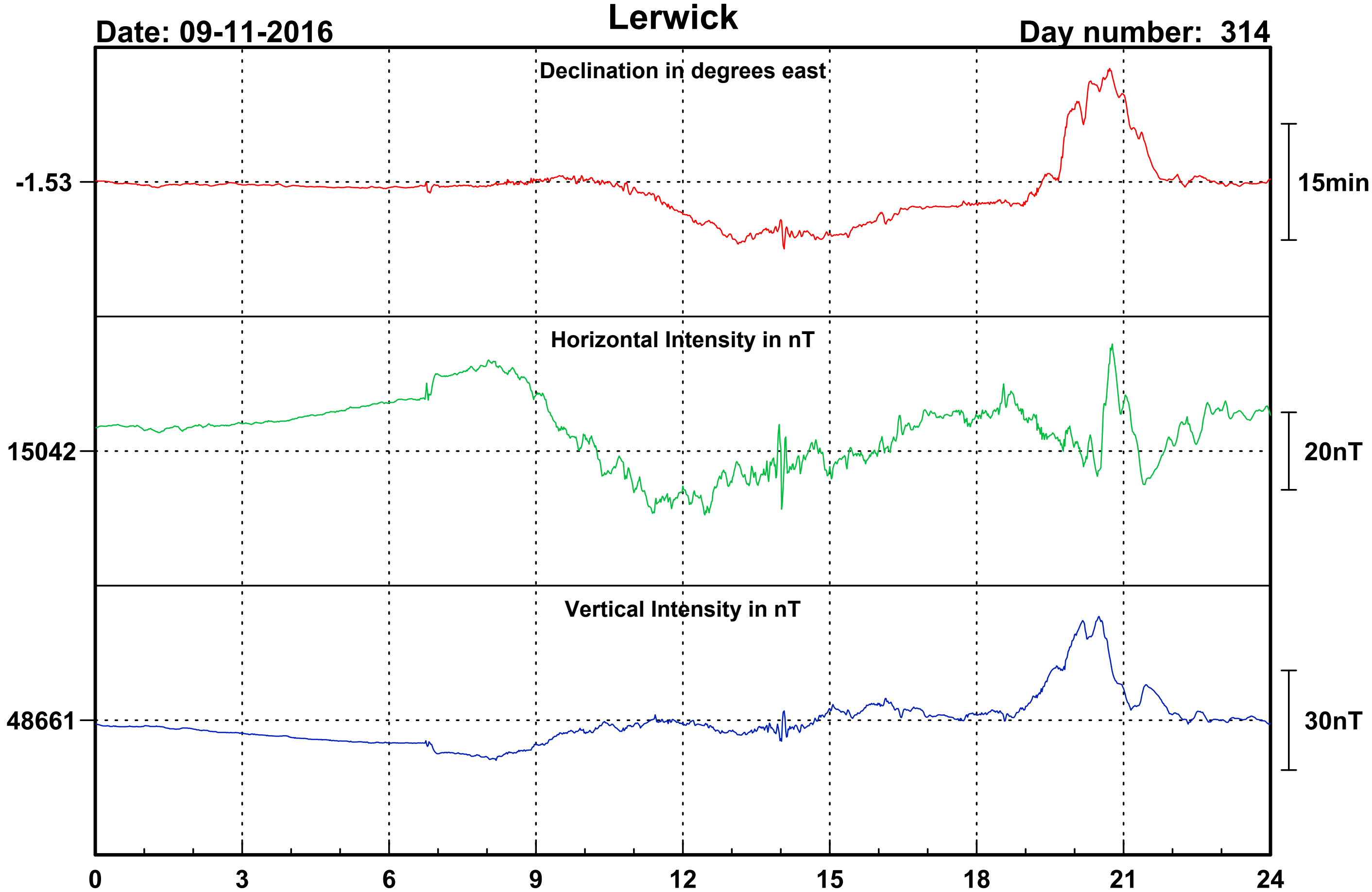
15042
20nT
Vertical Intensity in nT
48661
10nT
0 3 6 9 12 15 18 21 24
Hour (UT)

Lerwick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Day number: 314
Declination in degrees east
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15min
Horizontal Intensity in nT
15042
20nT
Vertical Intensity in nT
48661
30nT
0
3
6
9
12
15
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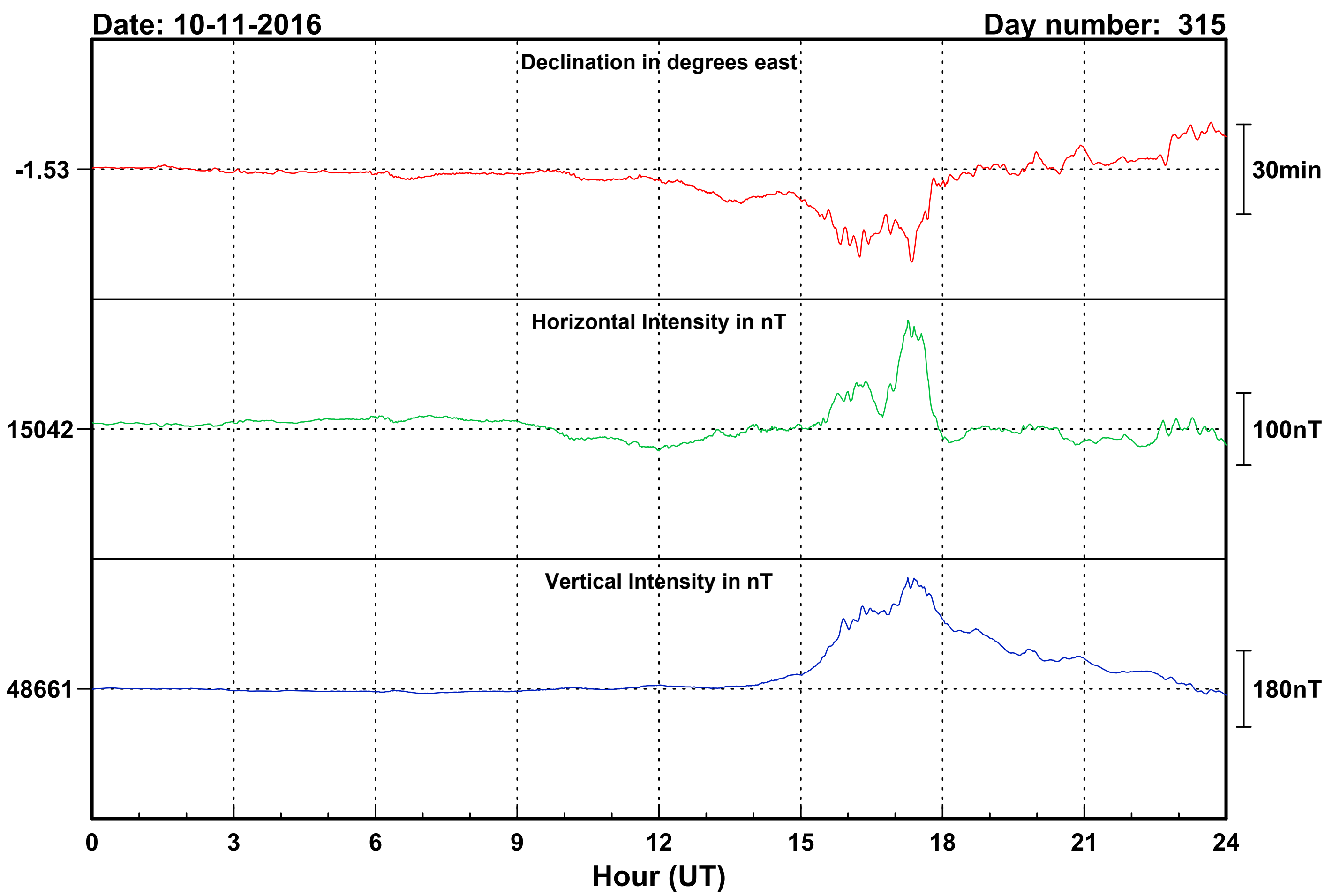
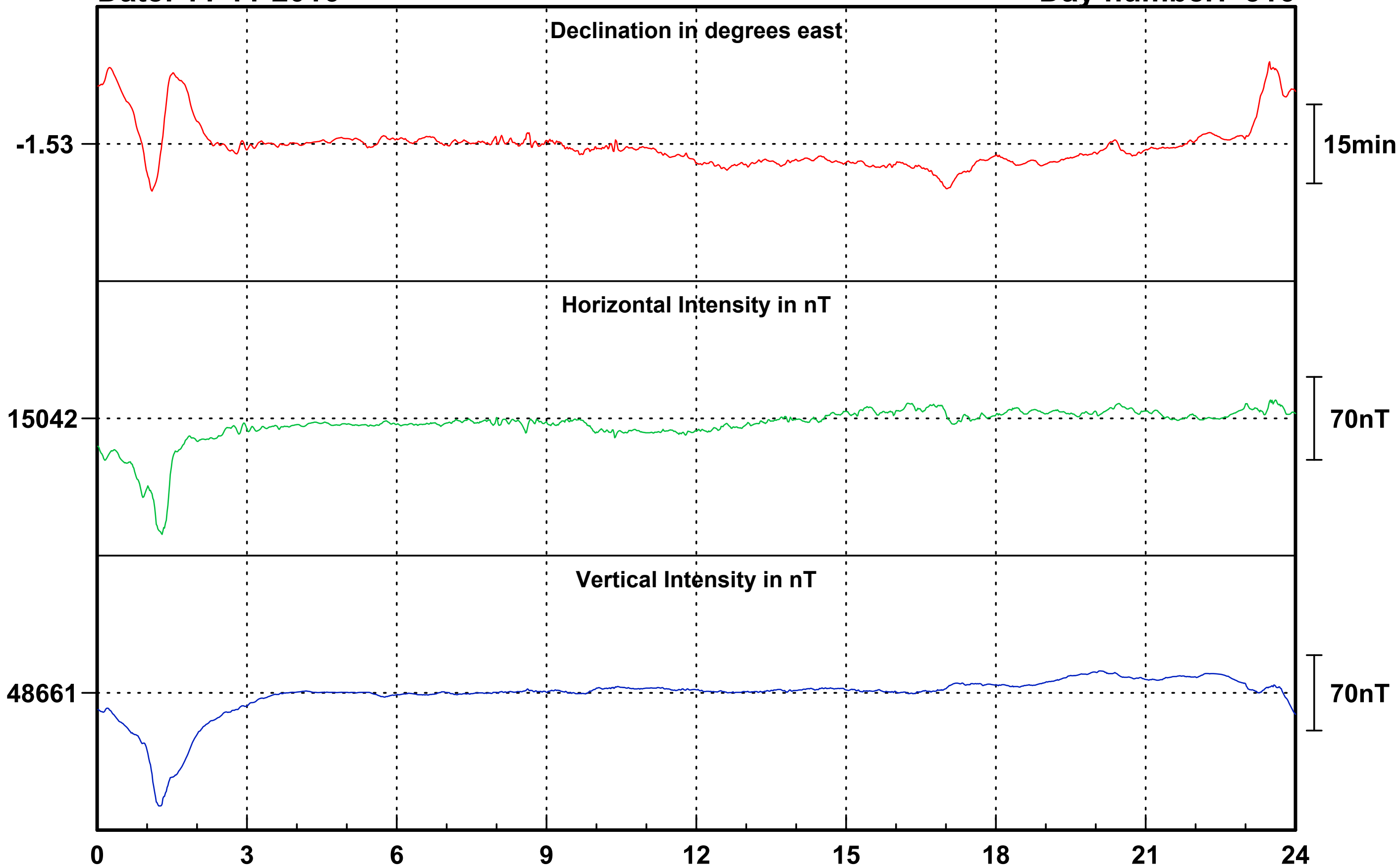
21
24

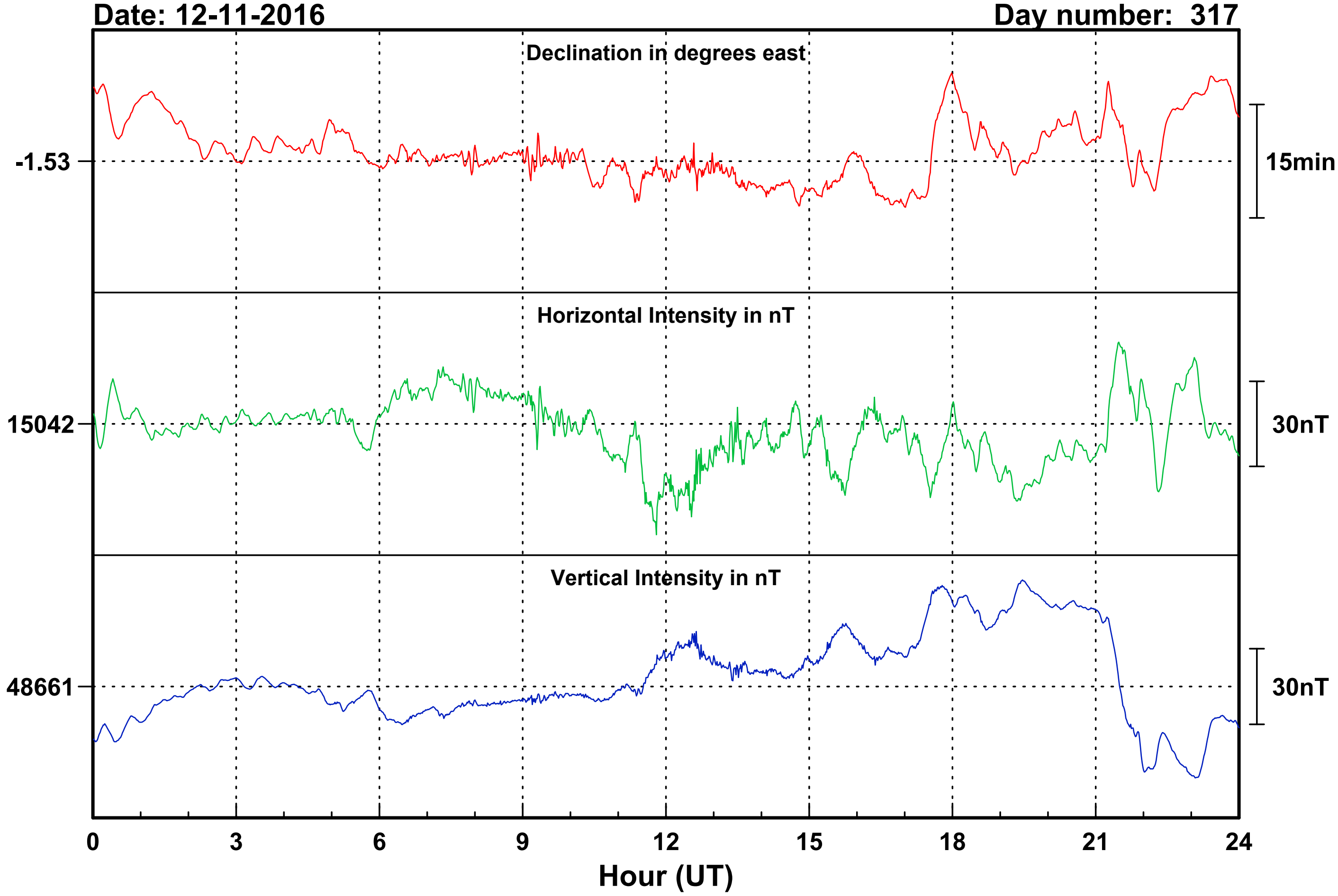

Date: 10-11-2016
Day number: 315
Declination in degrees east
-1.53
30min
Horizontal Intensity in nT
15042
100nT
Vertical Intensity in nT
48661
180nT
0
3
6
9
12
15
18
21
24
Hour (UT)

Lerwick

Date: 11-11-2016 **Day number: 316**

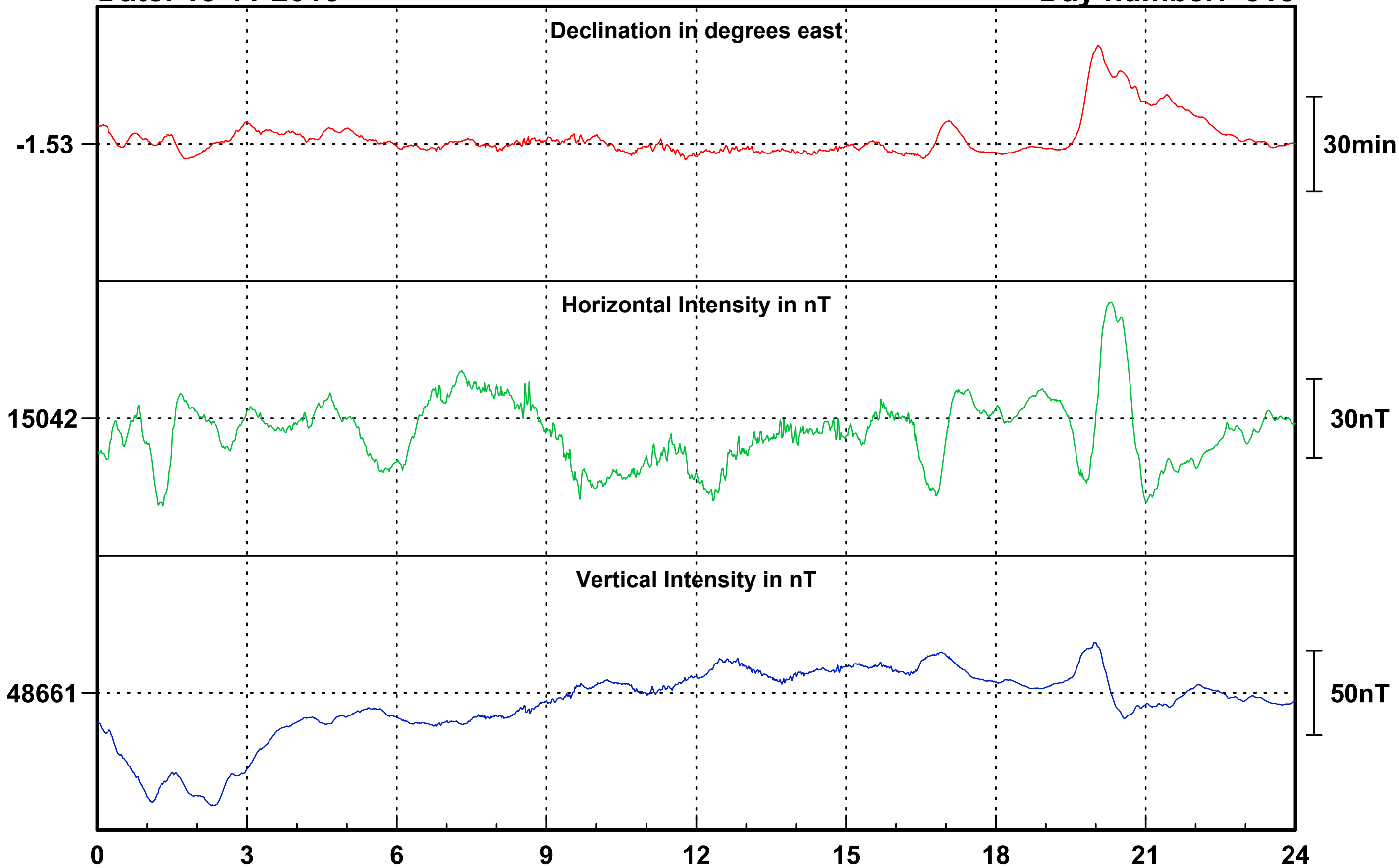


Date: 12-11-2016 **Day number: 317**

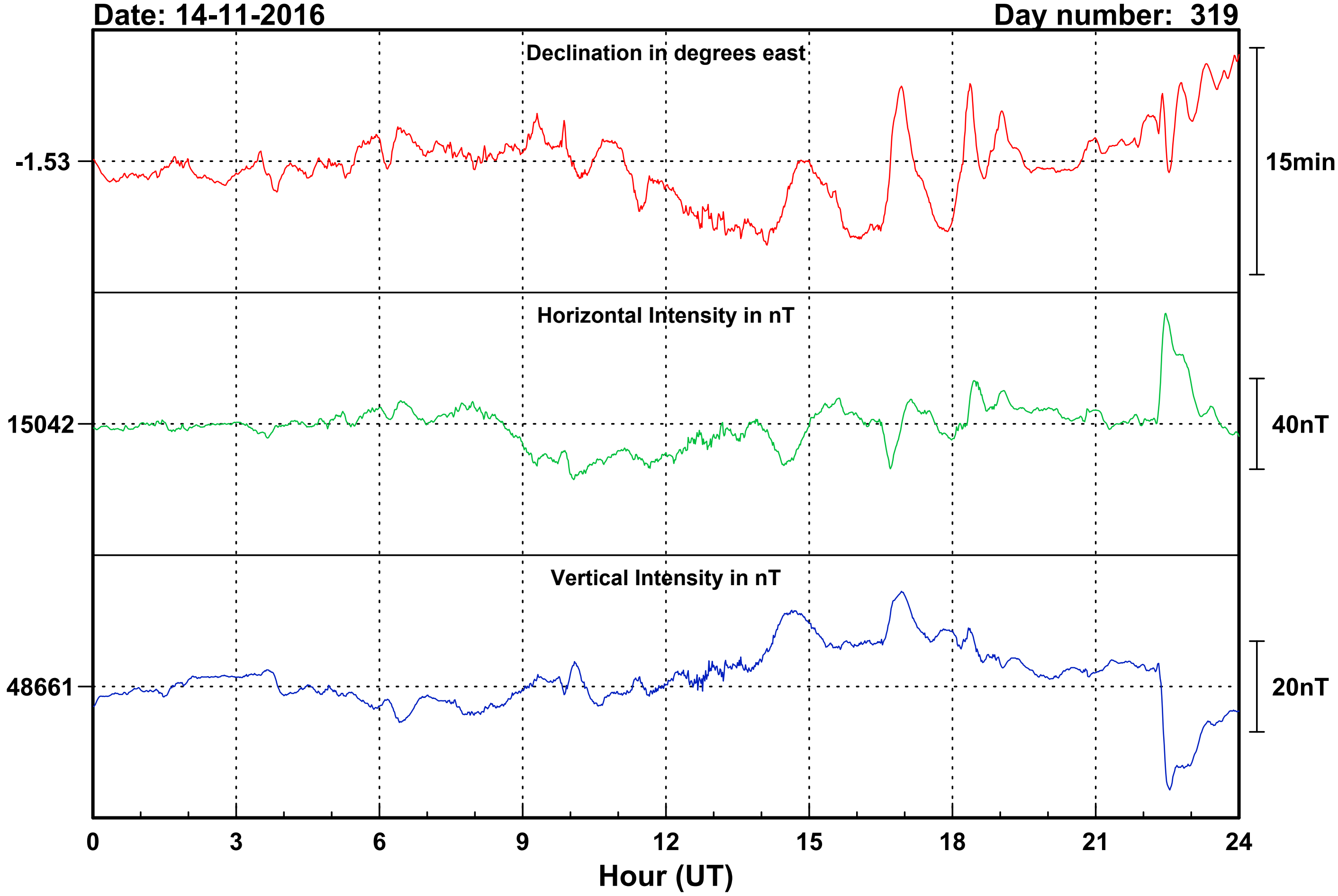


Lerwick

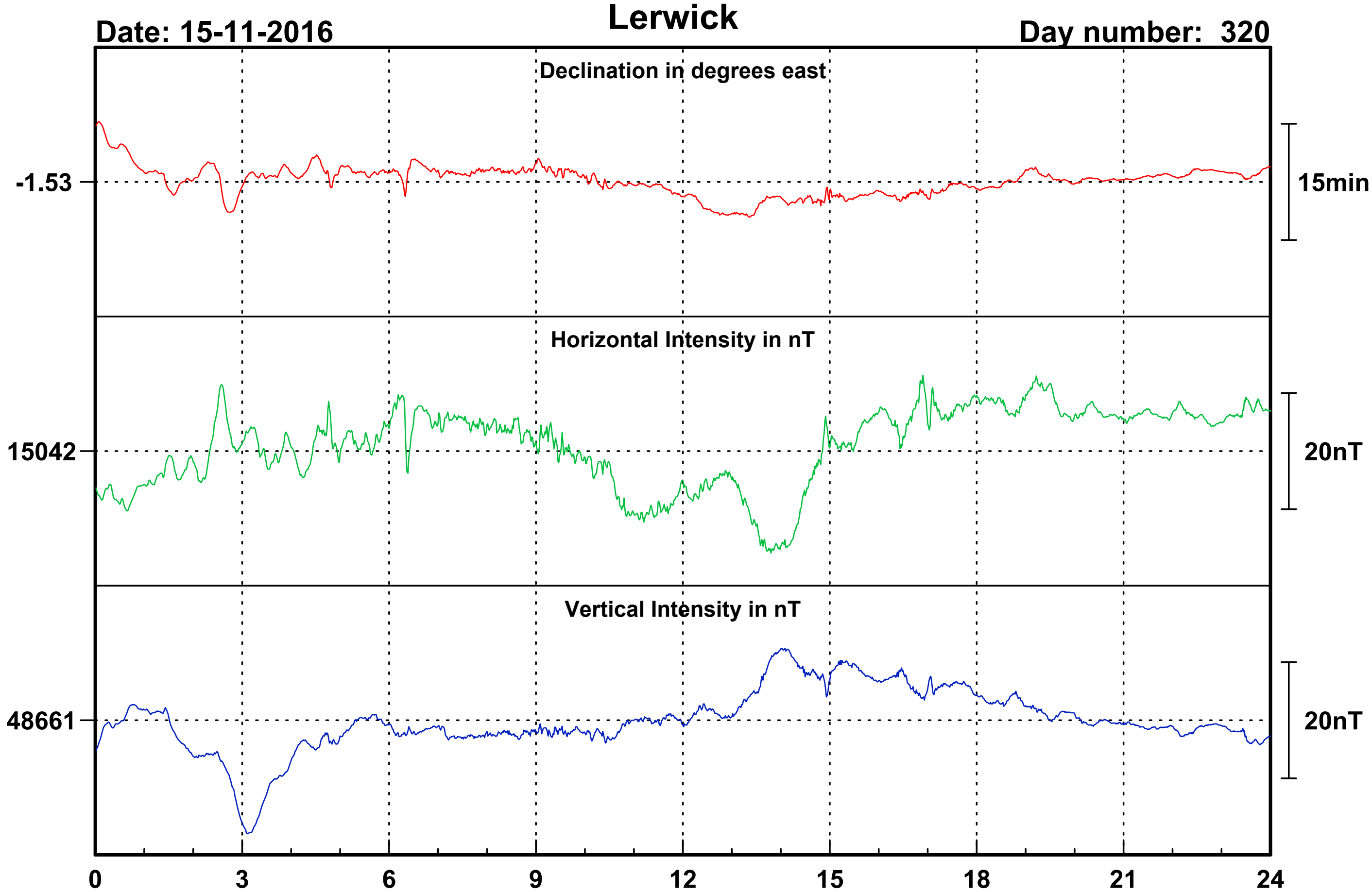
Date: 13-11-2016 Day number: 318



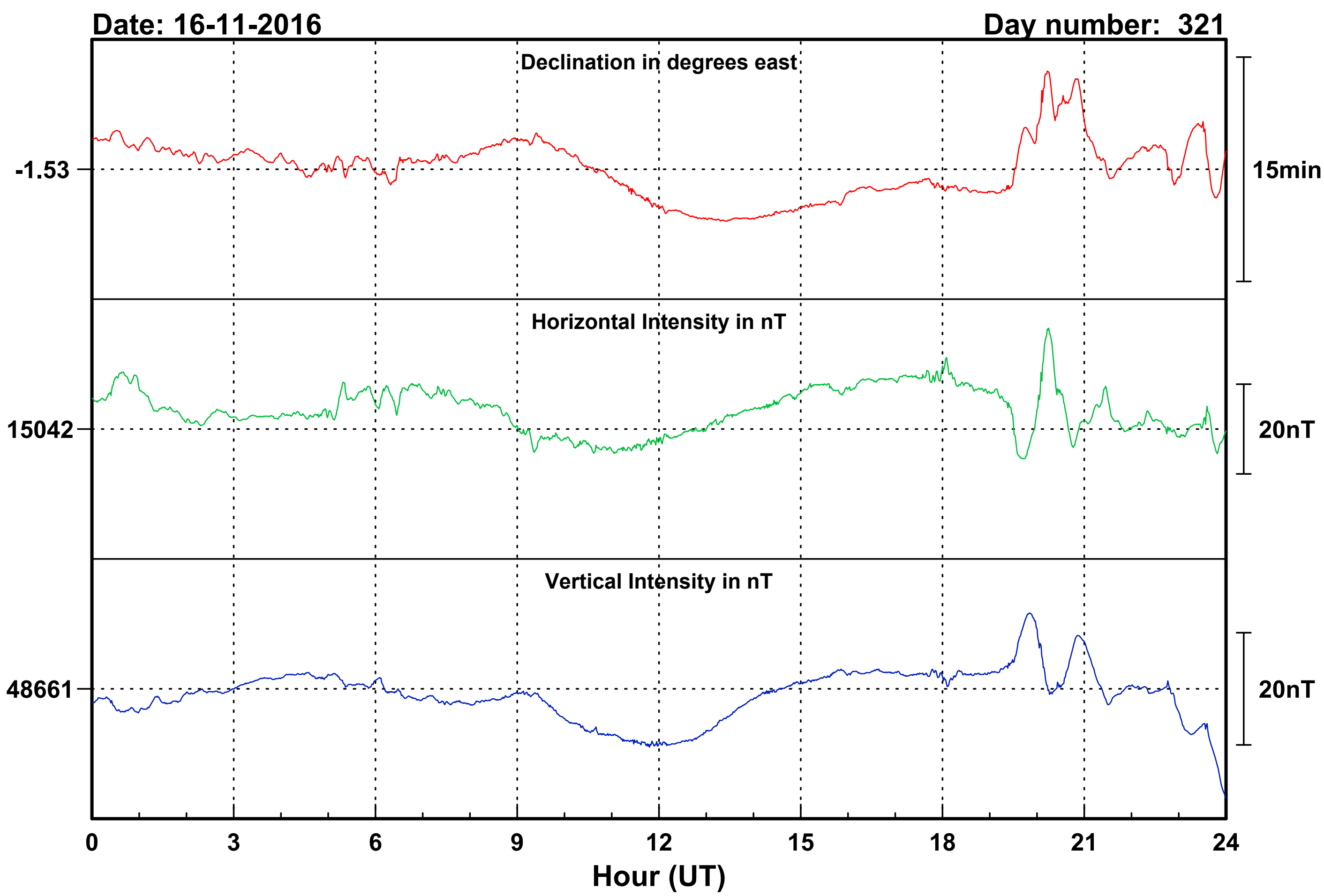
Date: 14-11-2016 Day number: 319



Lerwick

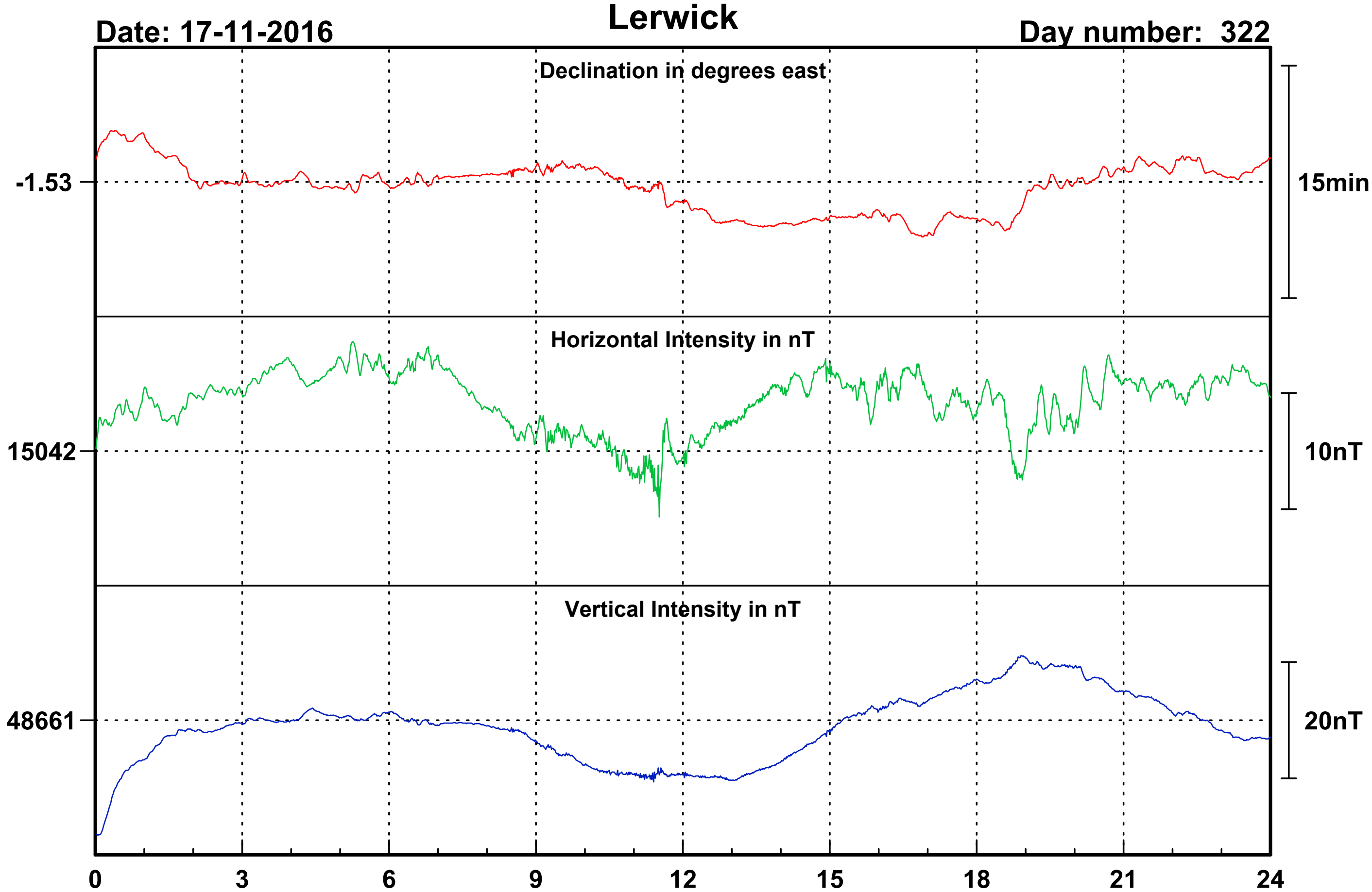


Date: 15-11-2016
Day number: 320
Declination in degrees east
-1.53
15min
Horizontal Intensity in nT
15042
20nT
Vertical Intensity in nT
48661
20nT
0
3
6
9
12
15
18
21
24

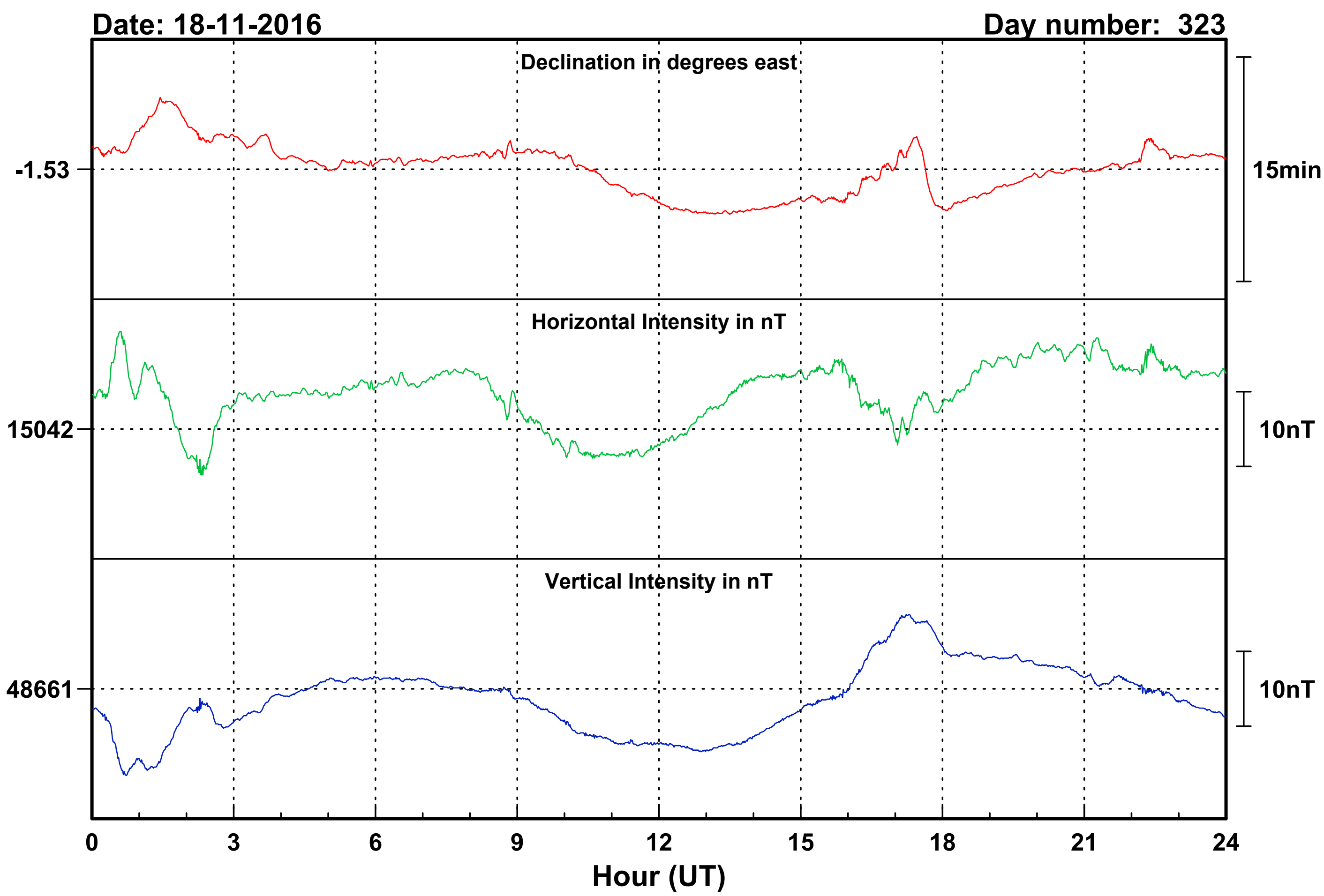


Date: 16-11-2016
Day number: 321
Declination in degrees east
-1.53
15min
Horizontal Intensity in nT
15042
20nT
Vertical Intensity in nT
48661
20nT
0
3
6
9
12
15
18
21
24
Hour (UT)

Lerwick

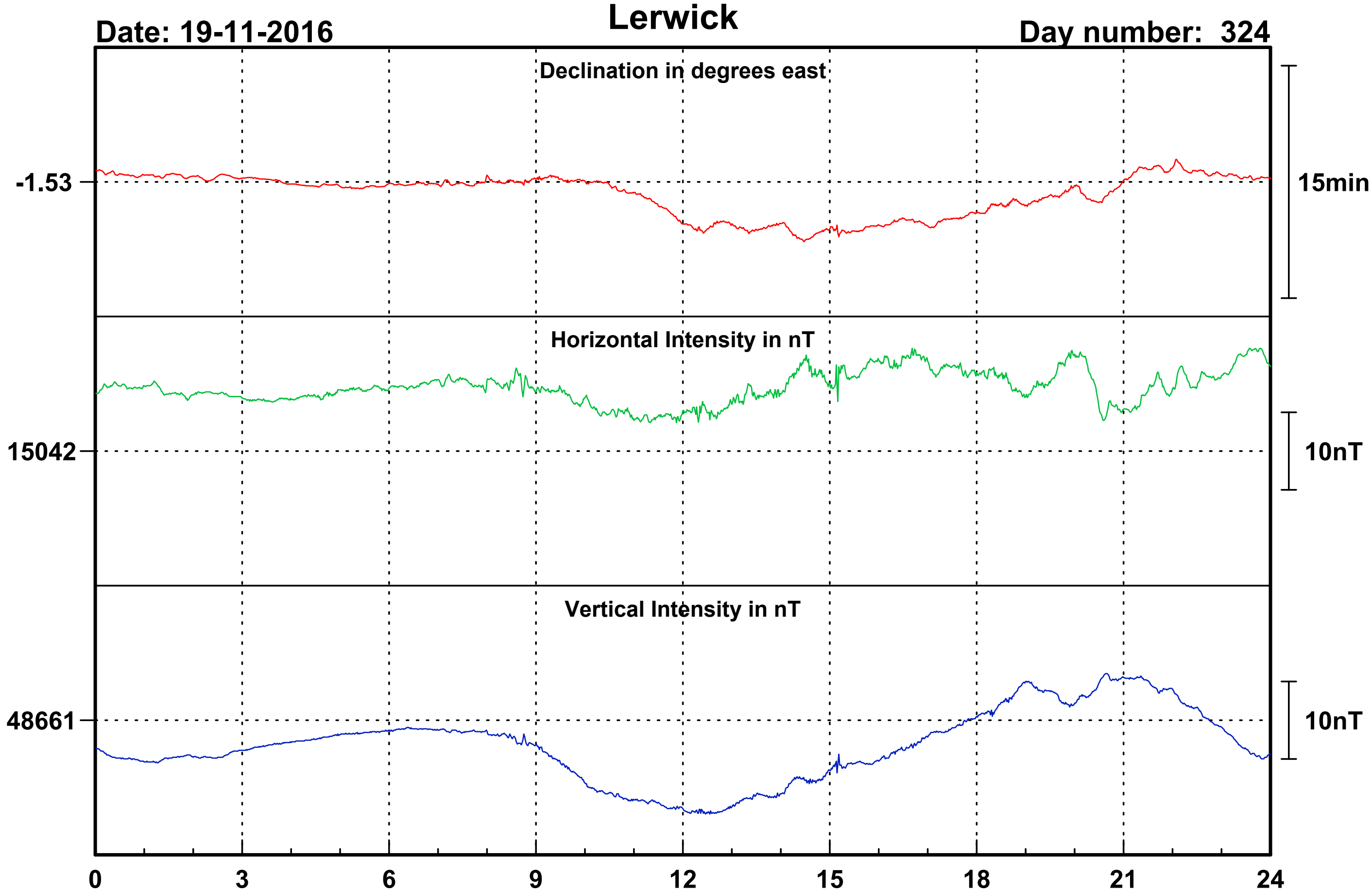


Date: 17-11-2016
Day number: 322
Declination in degrees east
-1.53
15min
Horizontal Intensity in nT
15042
10nT
Vertical Intensity in nT
48661
20nT
0
3
6
9
12
15
18
21
24



Date: 18-11-2016
Day number: 323
Declination in degrees east
-1.53
15min
Horizontal Intensity in nT
15042
10nT
Vertical Intensity in nT
48661
10nT
0
3
6
9
12
15
18
21
24
Hour (UT)

Lerwick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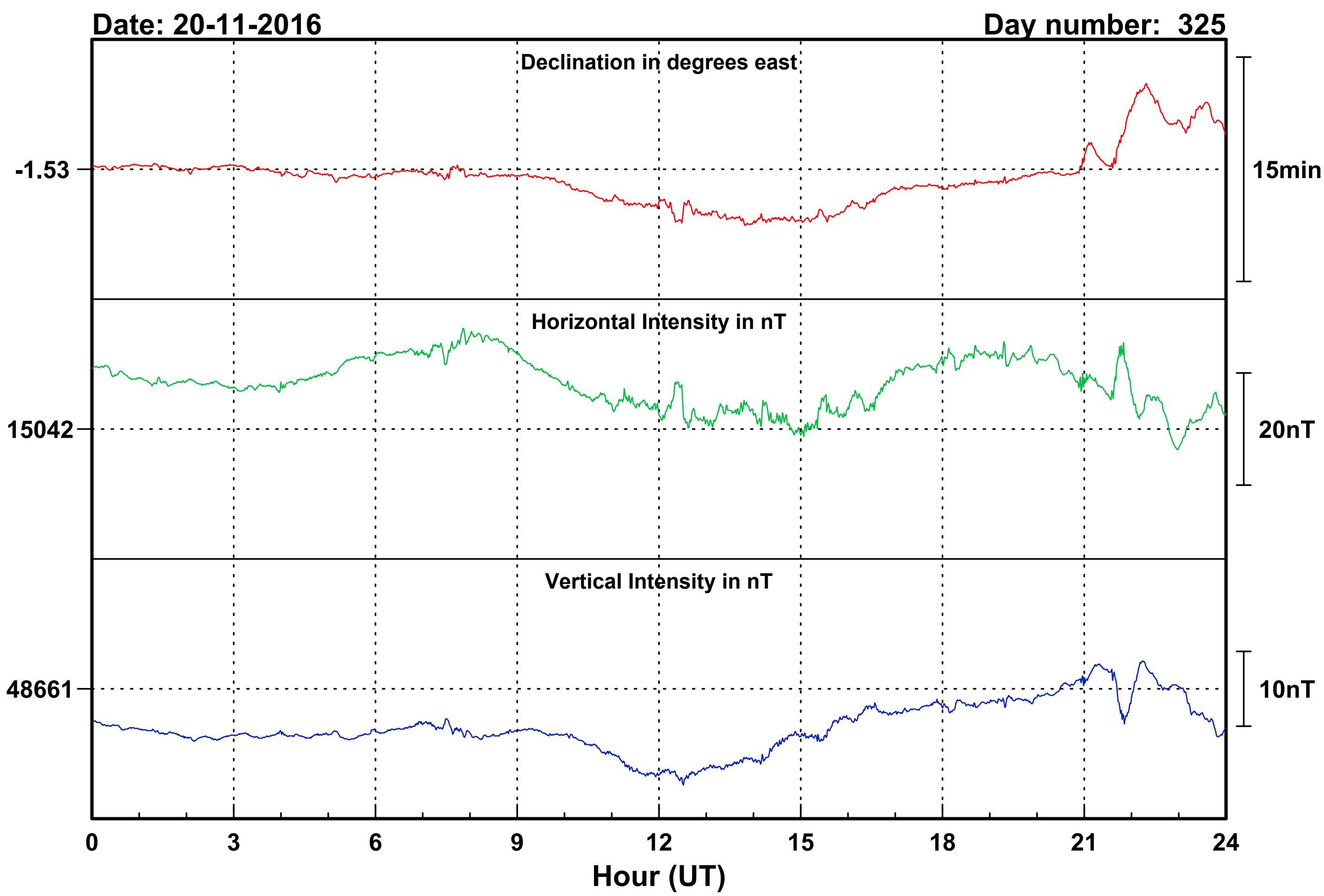
Day number: 324
Declination in degrees east
-1.53
15min
Horizontal Intensity in nT
15042
10nT
Vertical Intensity in nT
48661
10nT
0
3
6
9
12
15
18
21
24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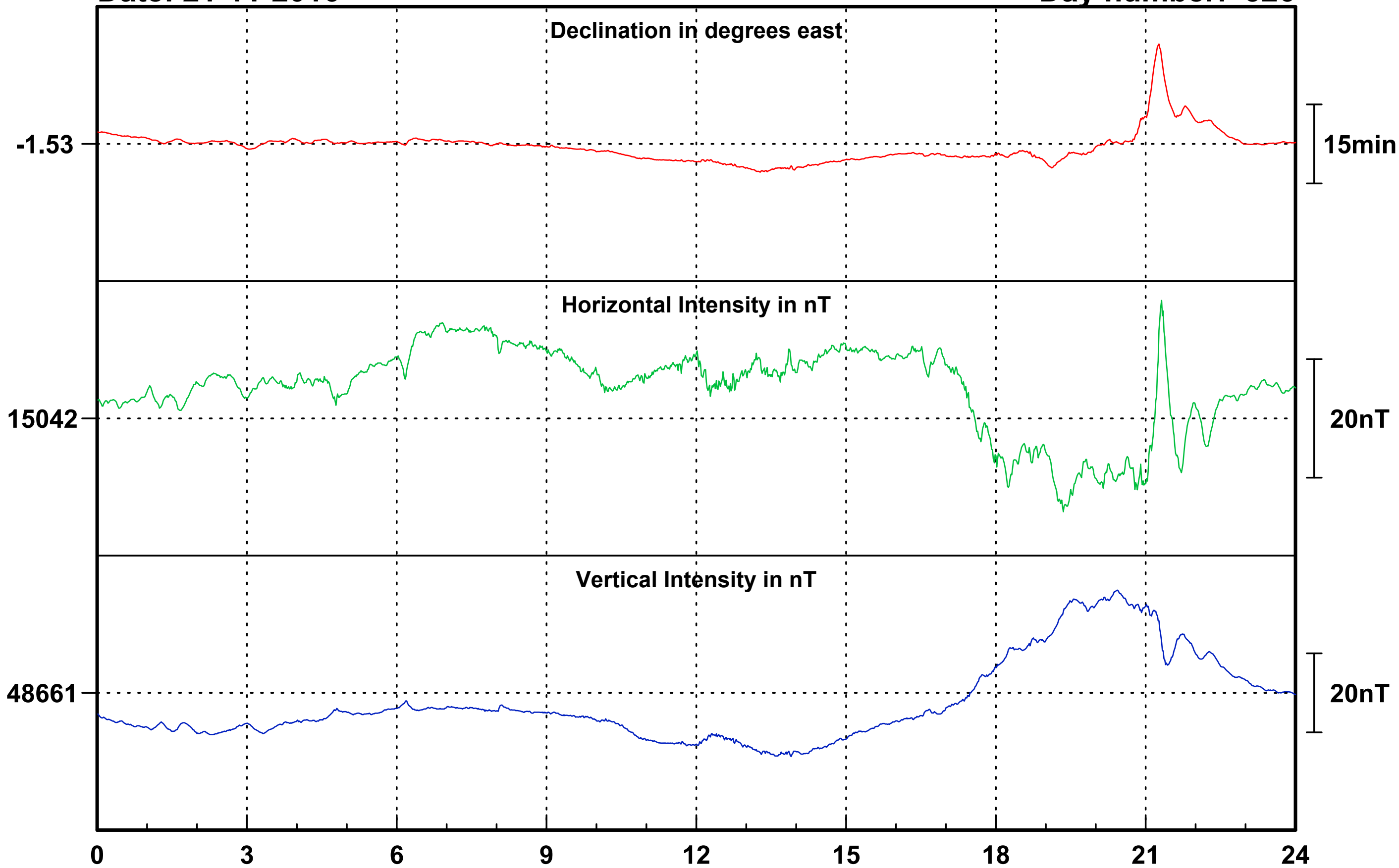
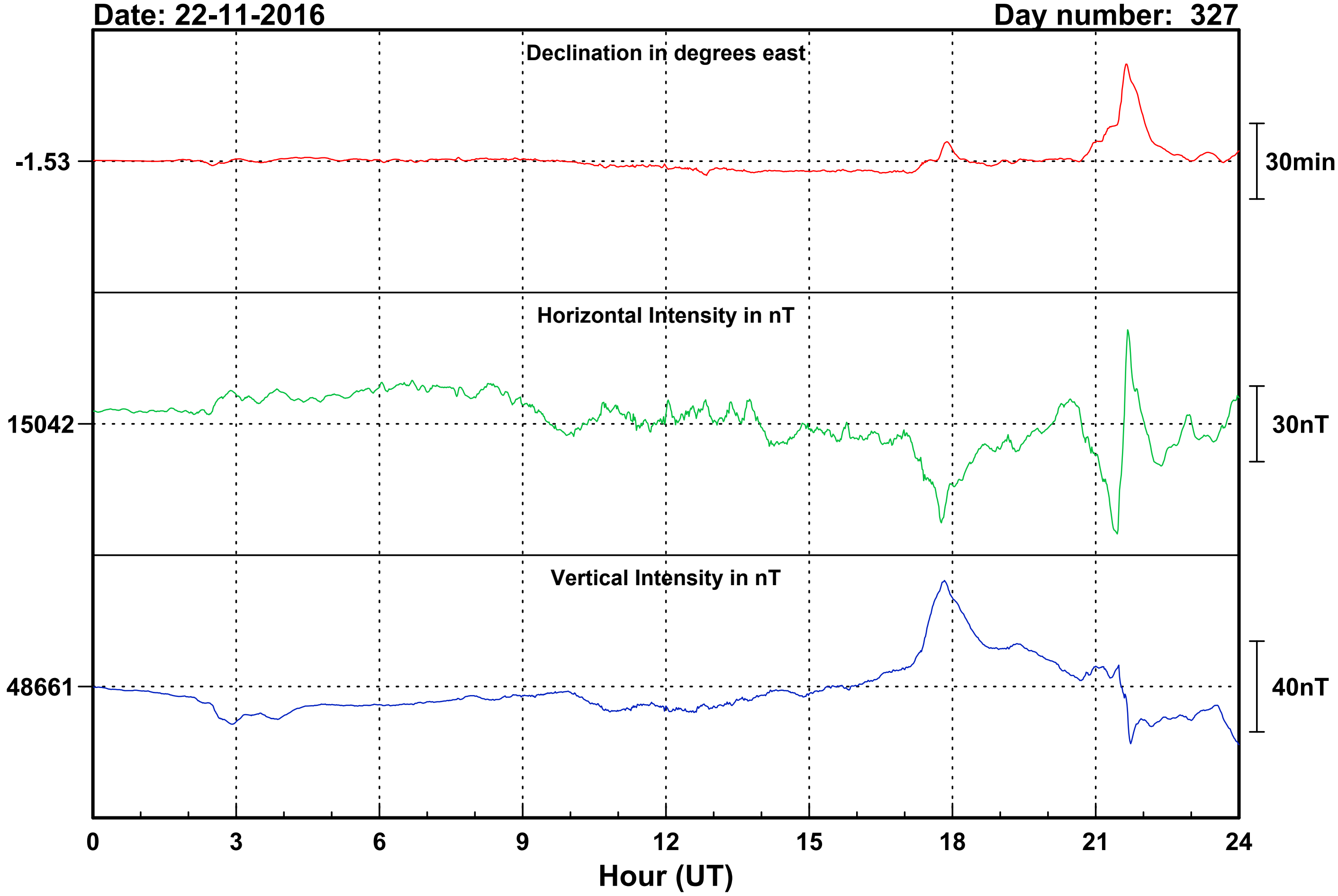
Day number: 325
Declination in degrees east
-1.53
15min
Horizontal Intensity in nT
15042
20nT
Vertical Intensity in nT
48661
10nT
0
3
6
9
12
15
18
21
24
Hour (UT)

Lerwick

Date: 21-11-2016 Day number: 326

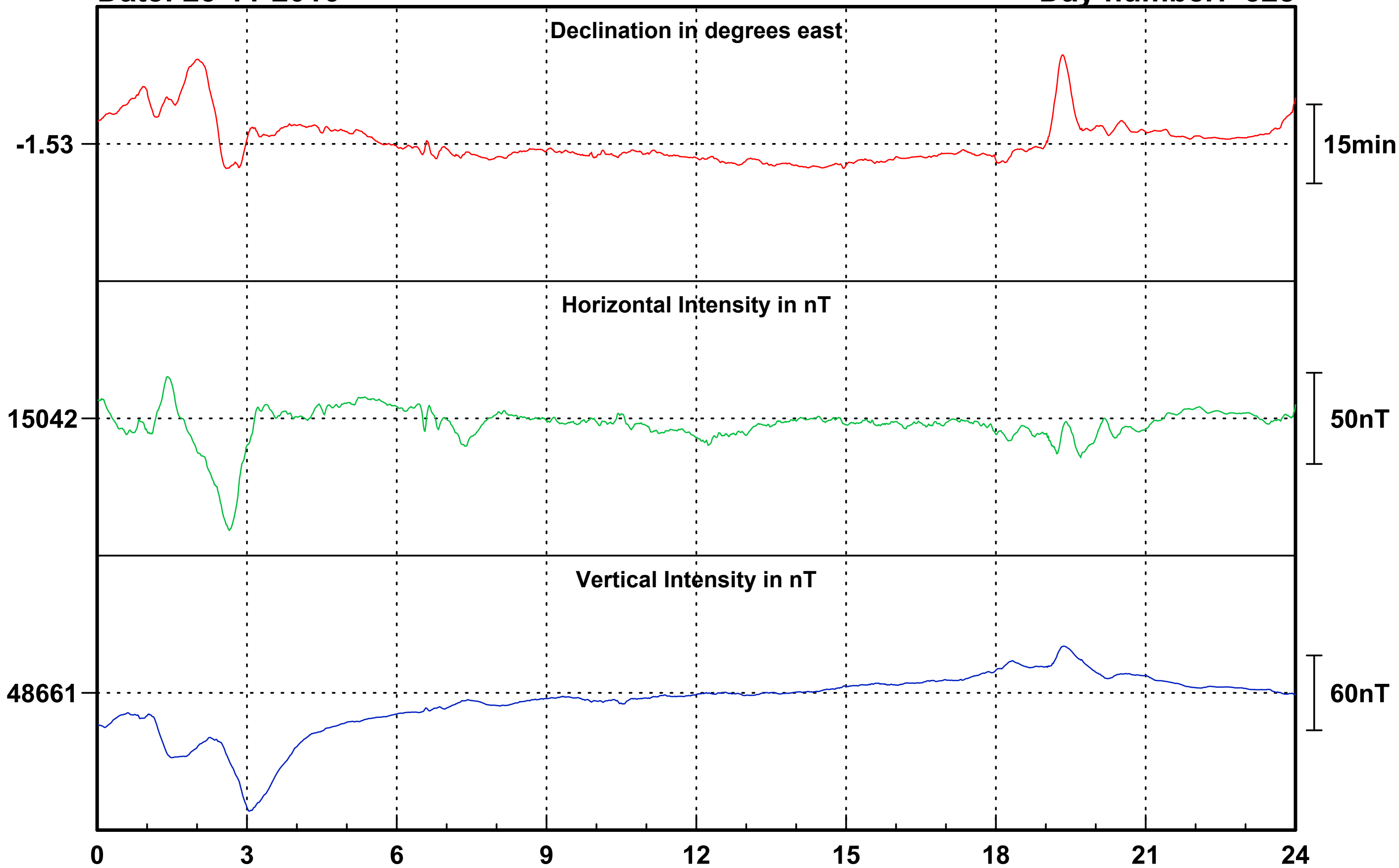


Date: 22-11-2016 Day number: 327

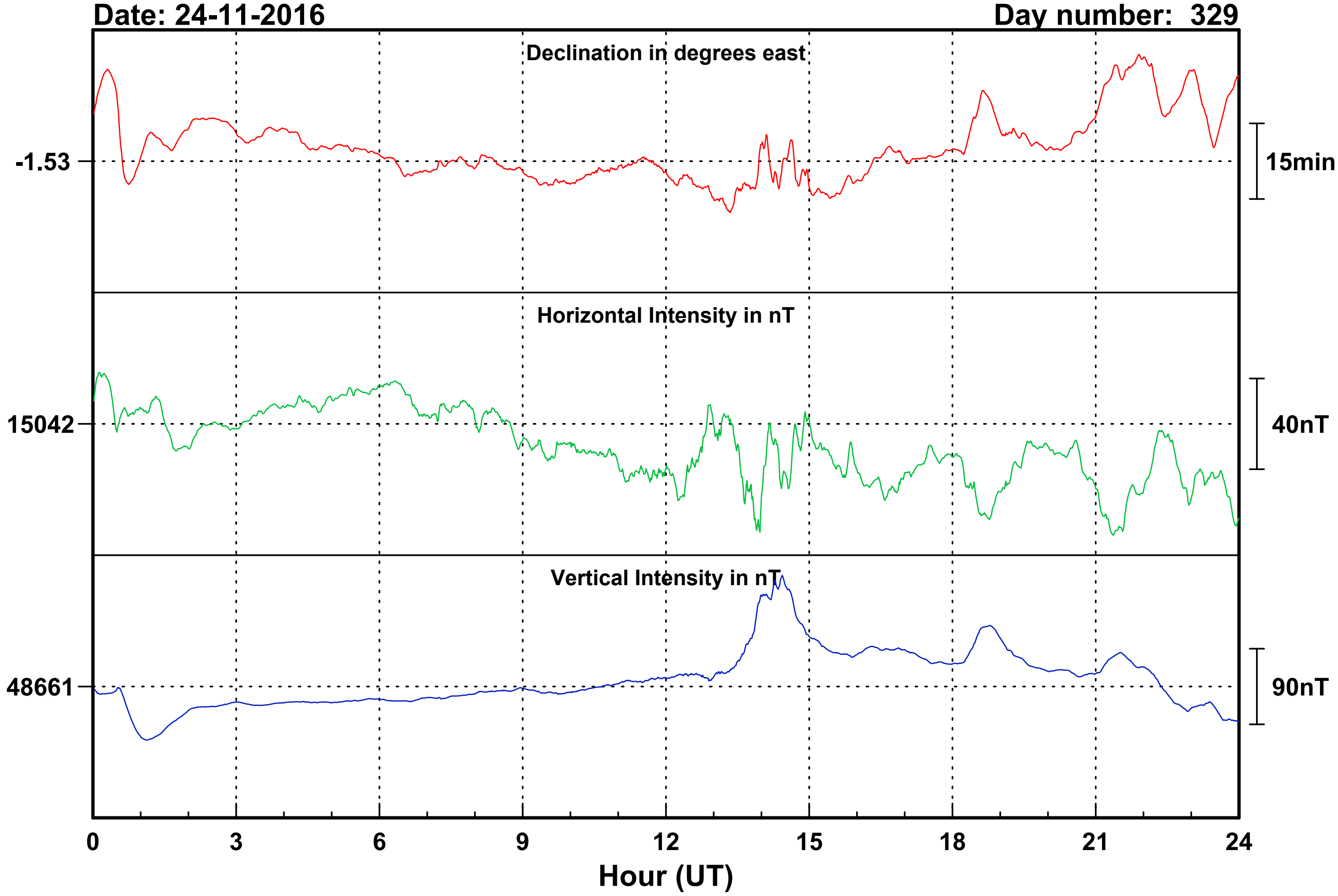


Lerwick

Date: 23-11-2016 **Day number: 328**

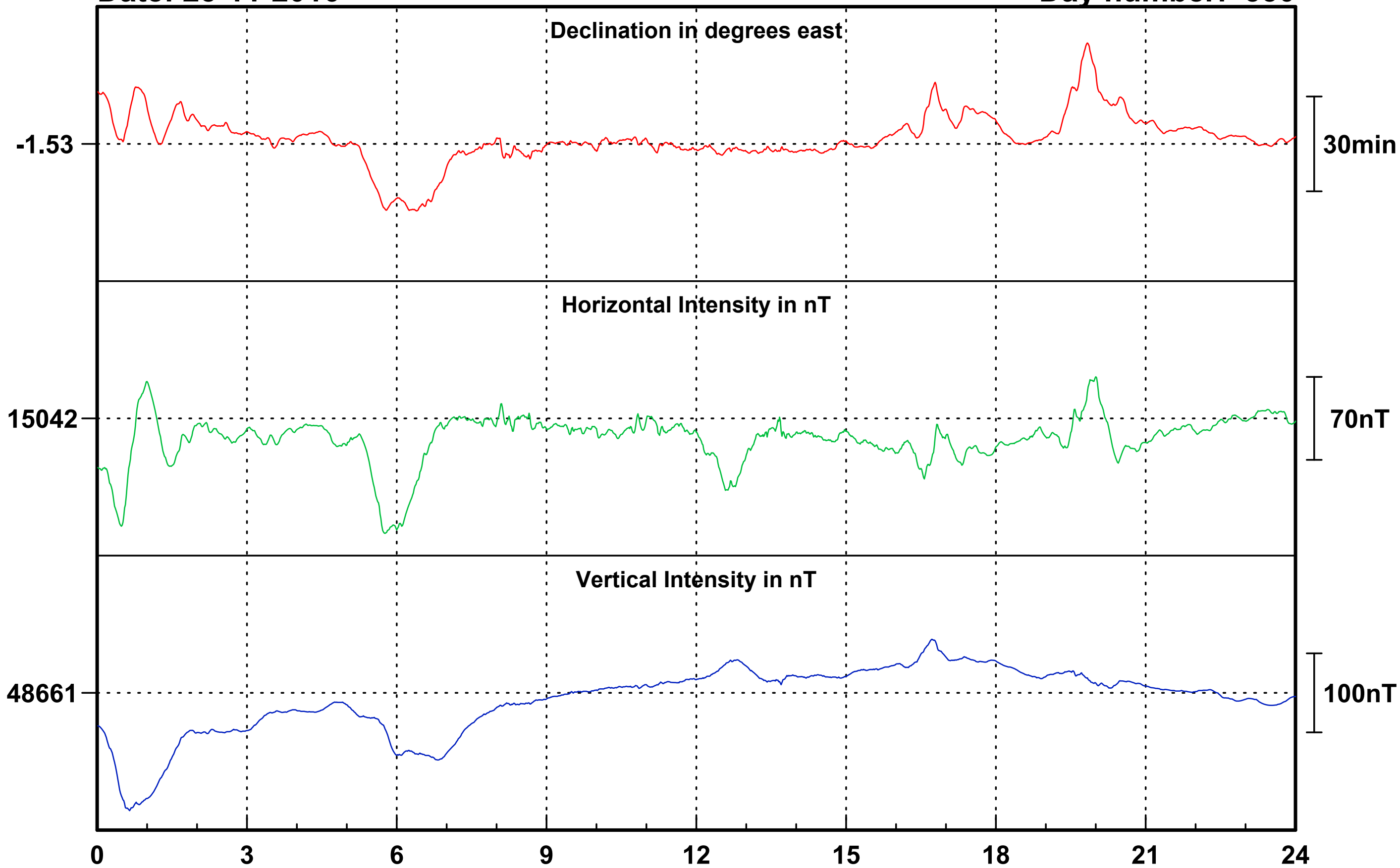


Date: 24-11-2016 **Day number: 329**

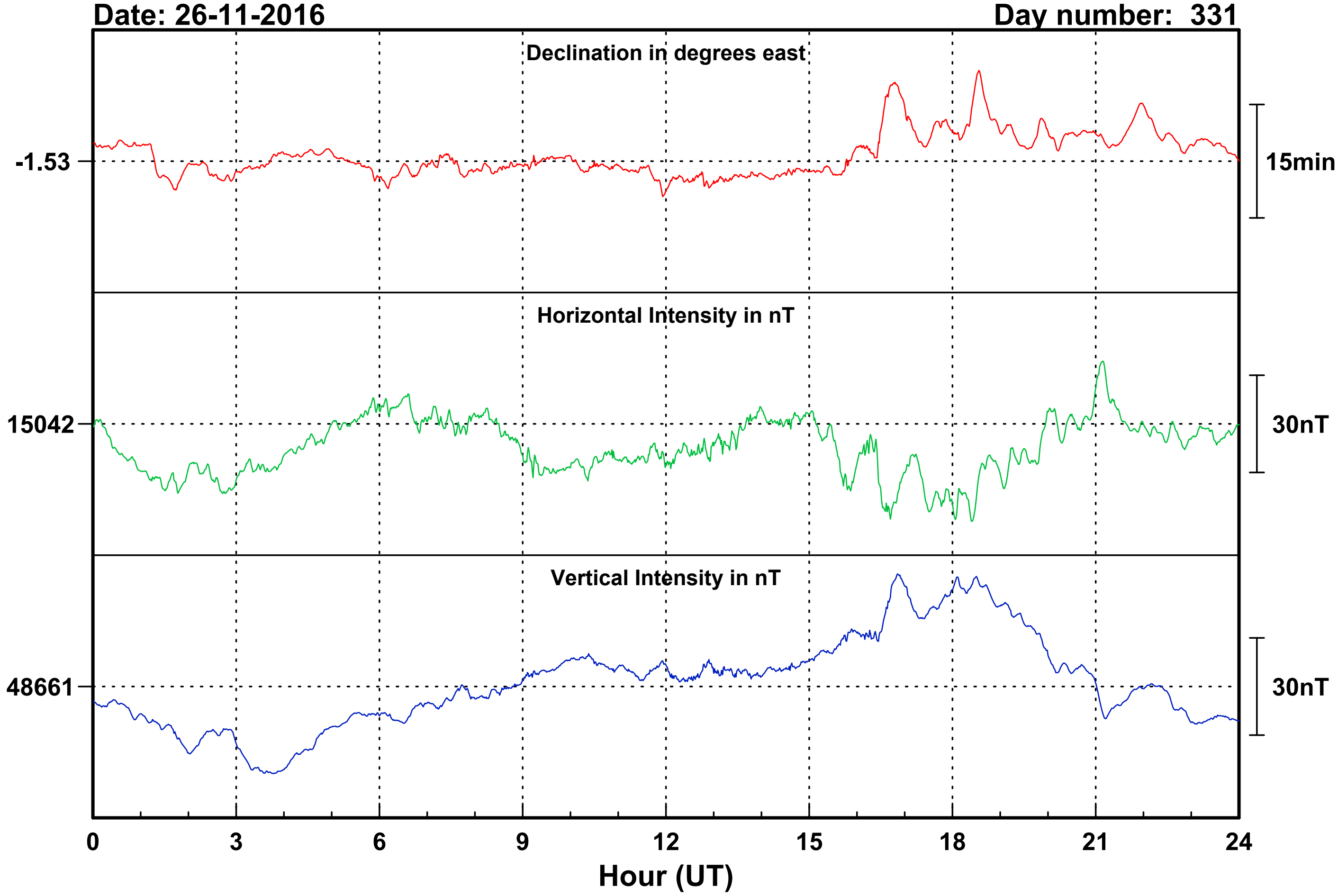


Lerwick

Date: 25-11-2016 **Day number: 330**

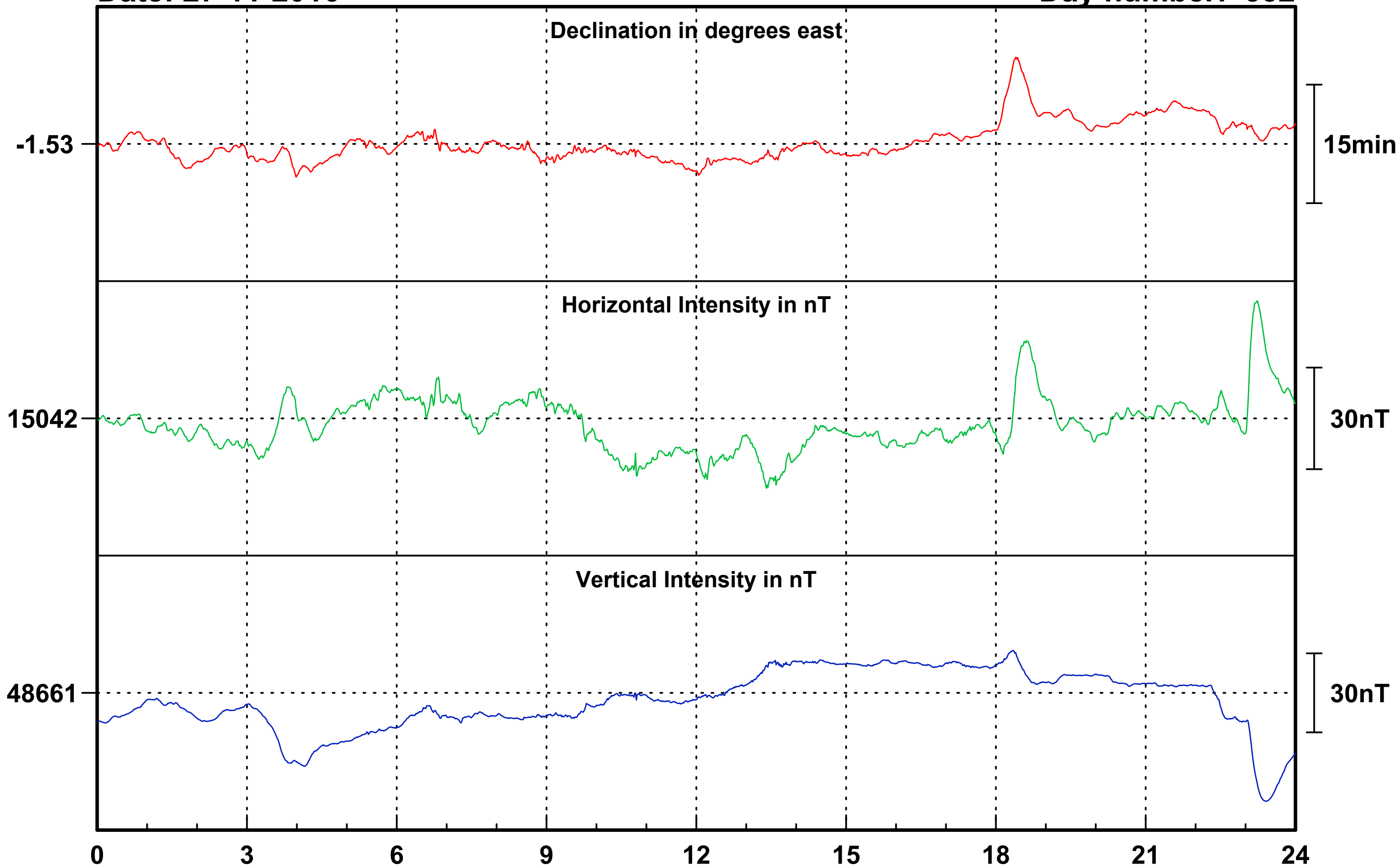


Date: 26-11-2016 **Day number: 331**

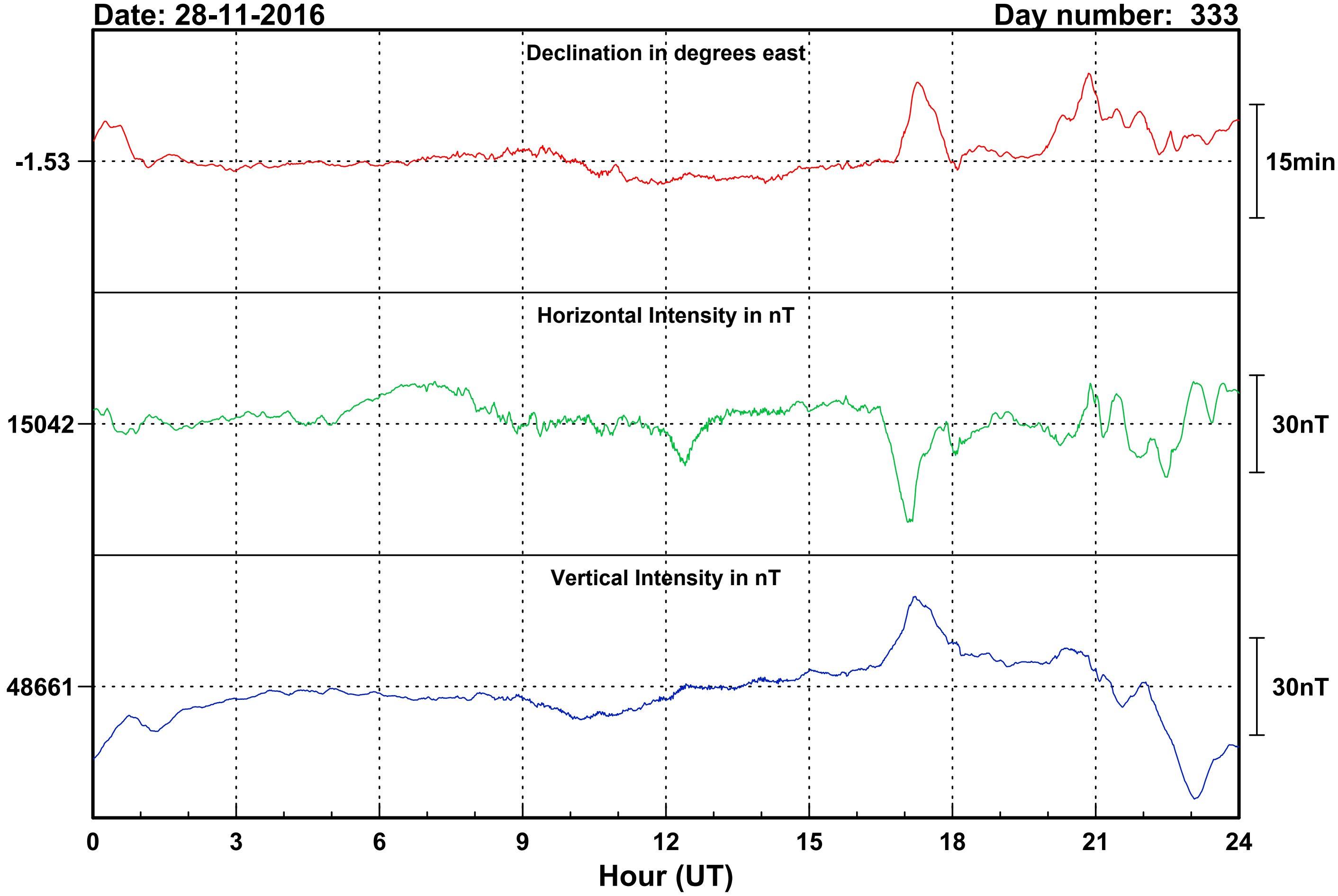


Lerwick

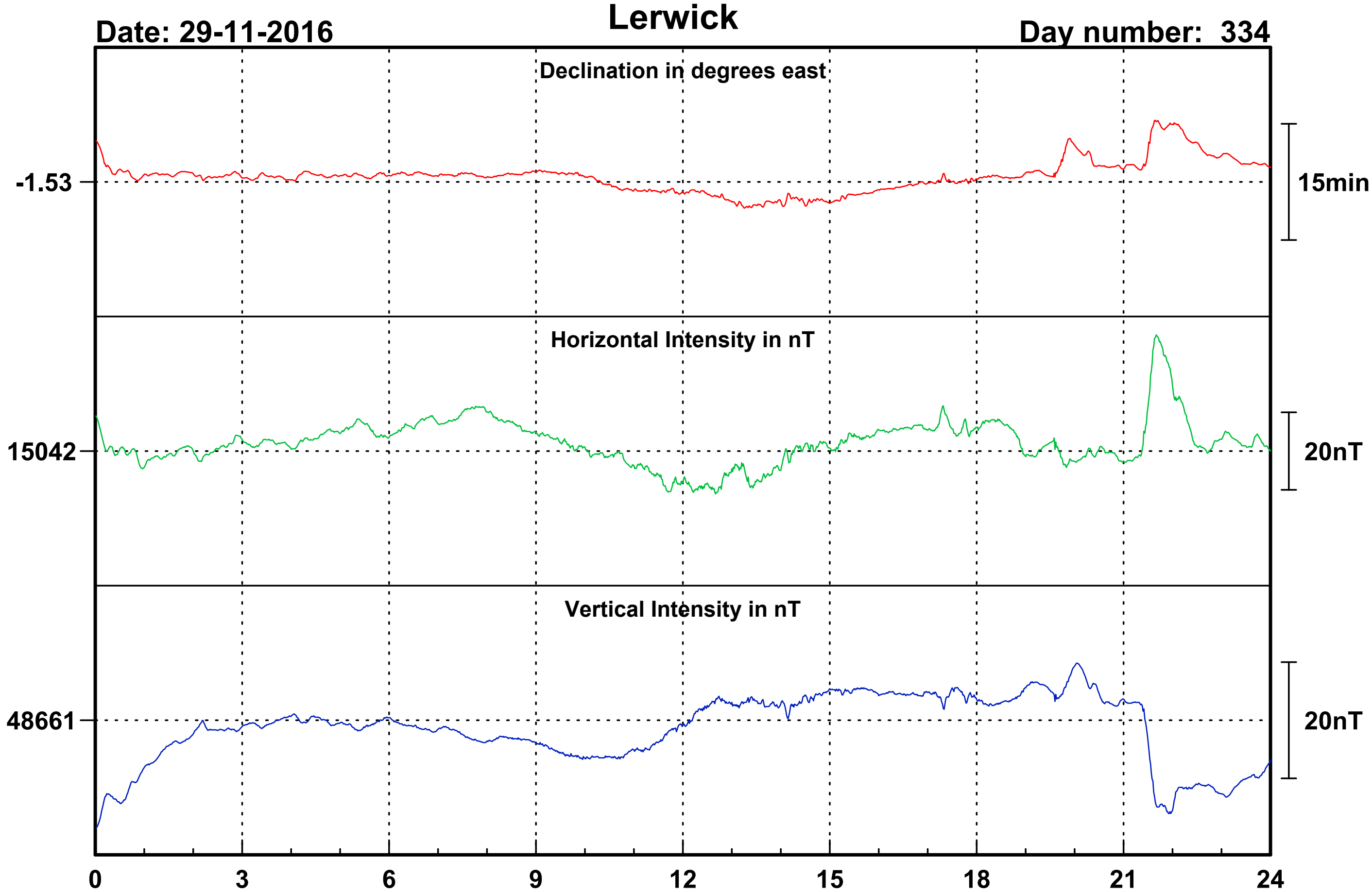
Date: 27-11-2016 **Day number: 332**



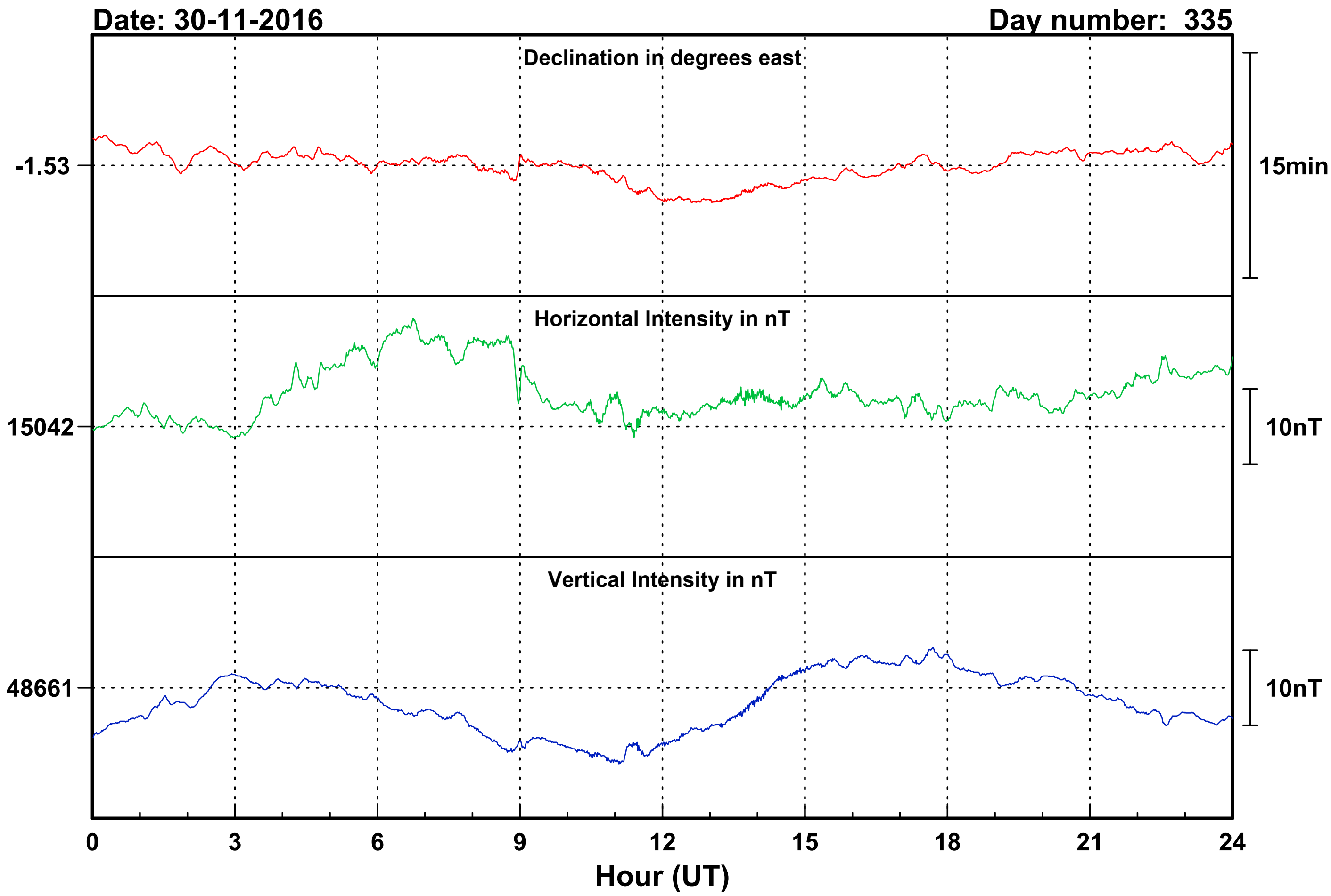
Date: 28-11-2016 **Day number: 333**



Lerwick

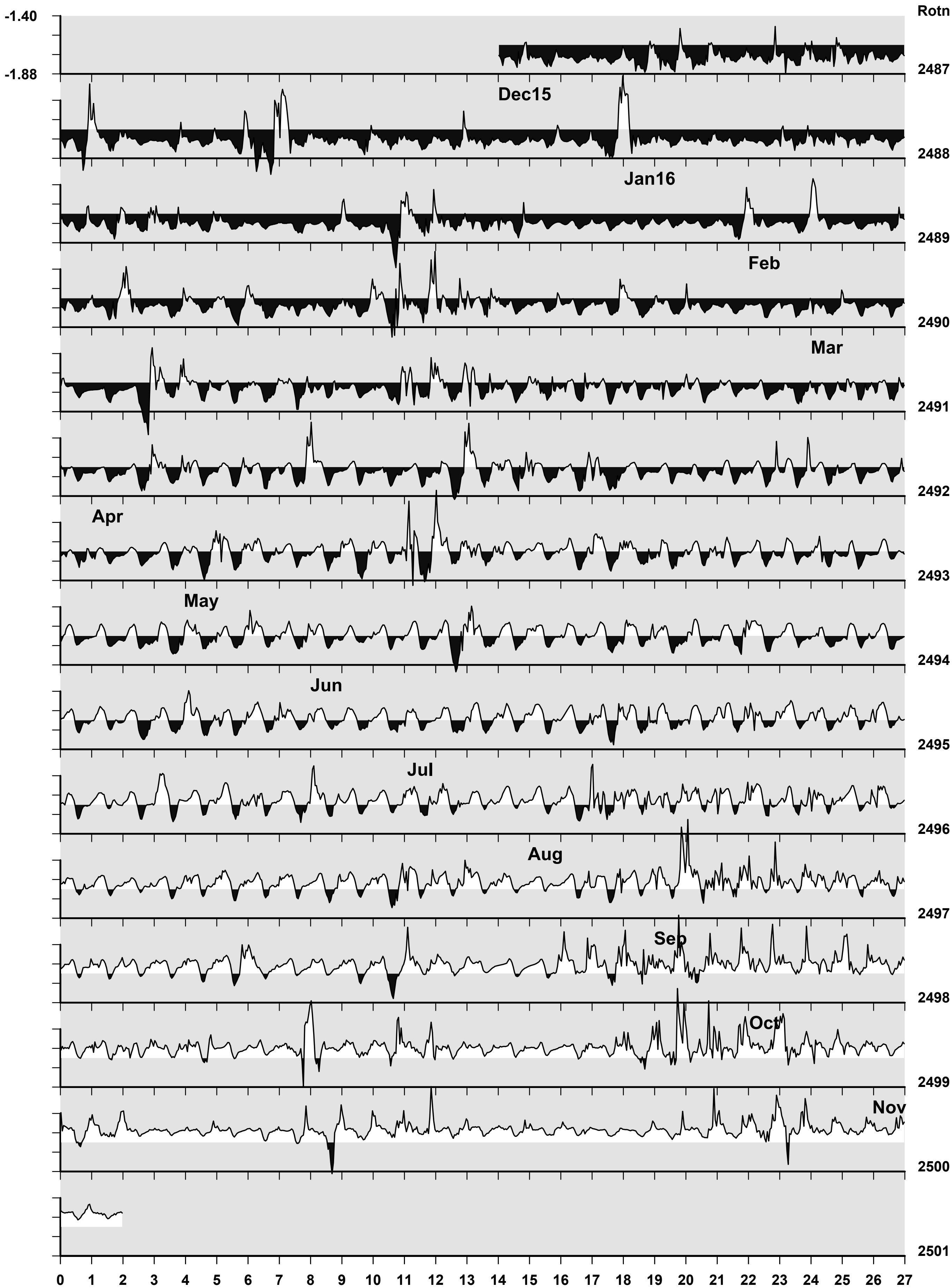


Date: 29-11-2016
Day number: 334
Declination in degrees east
-1.53
15min
Horizontal Intensity in nT
15042
20nT
Vertical Intensity in nT
48661
20nT
0
3
6
9
12
15
18
21
24

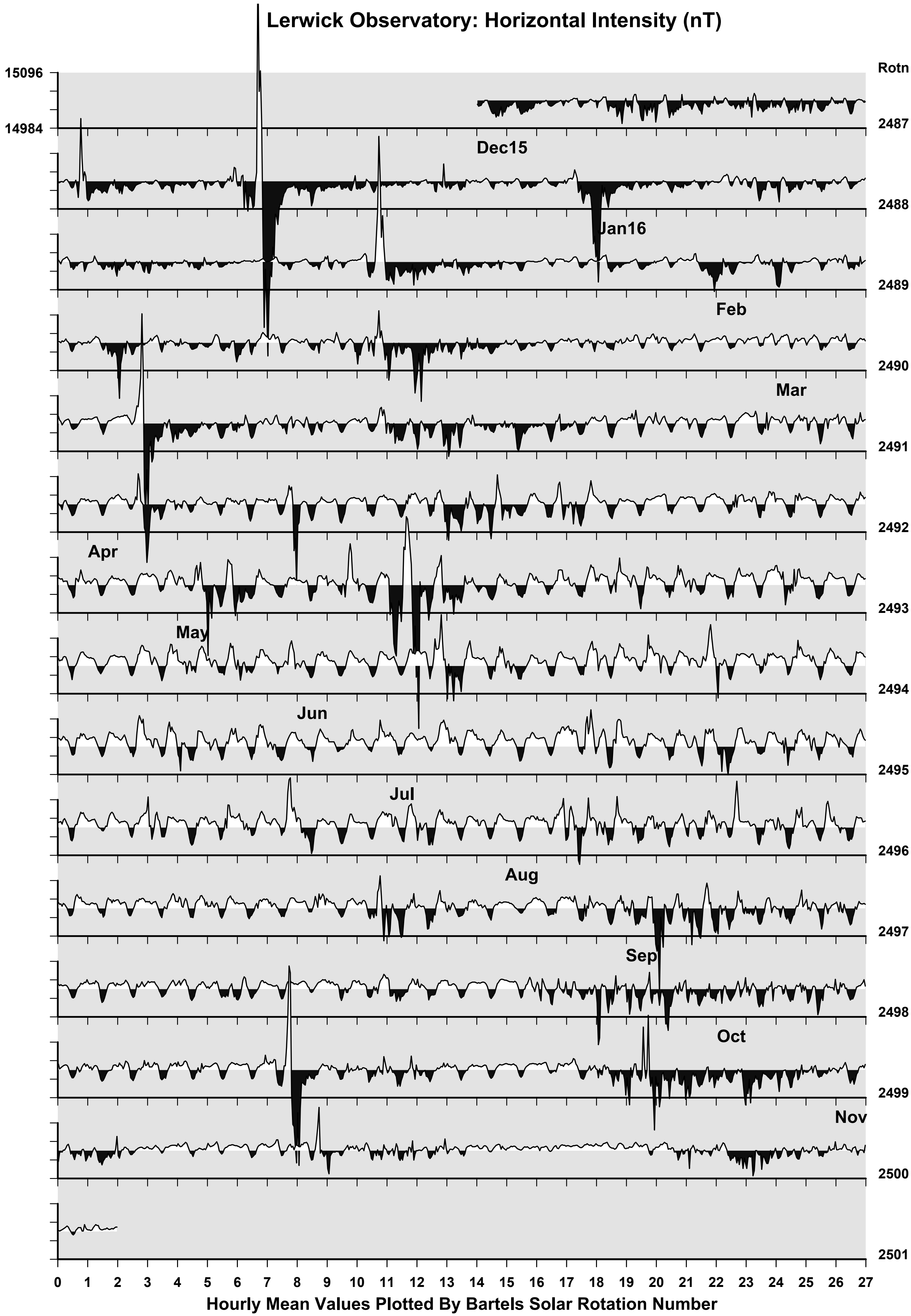


Date: 30-11-2016
Day number: 335
Declination in degrees east
-1.53
15min
Horizontal Intensity in nT
15042
10nT
Vertical Intensity in nT
48661
10nT
0
3
6
9
12
15
18
21
24
Hour (UT)

Lerwick Observatory: Declination (degrees)

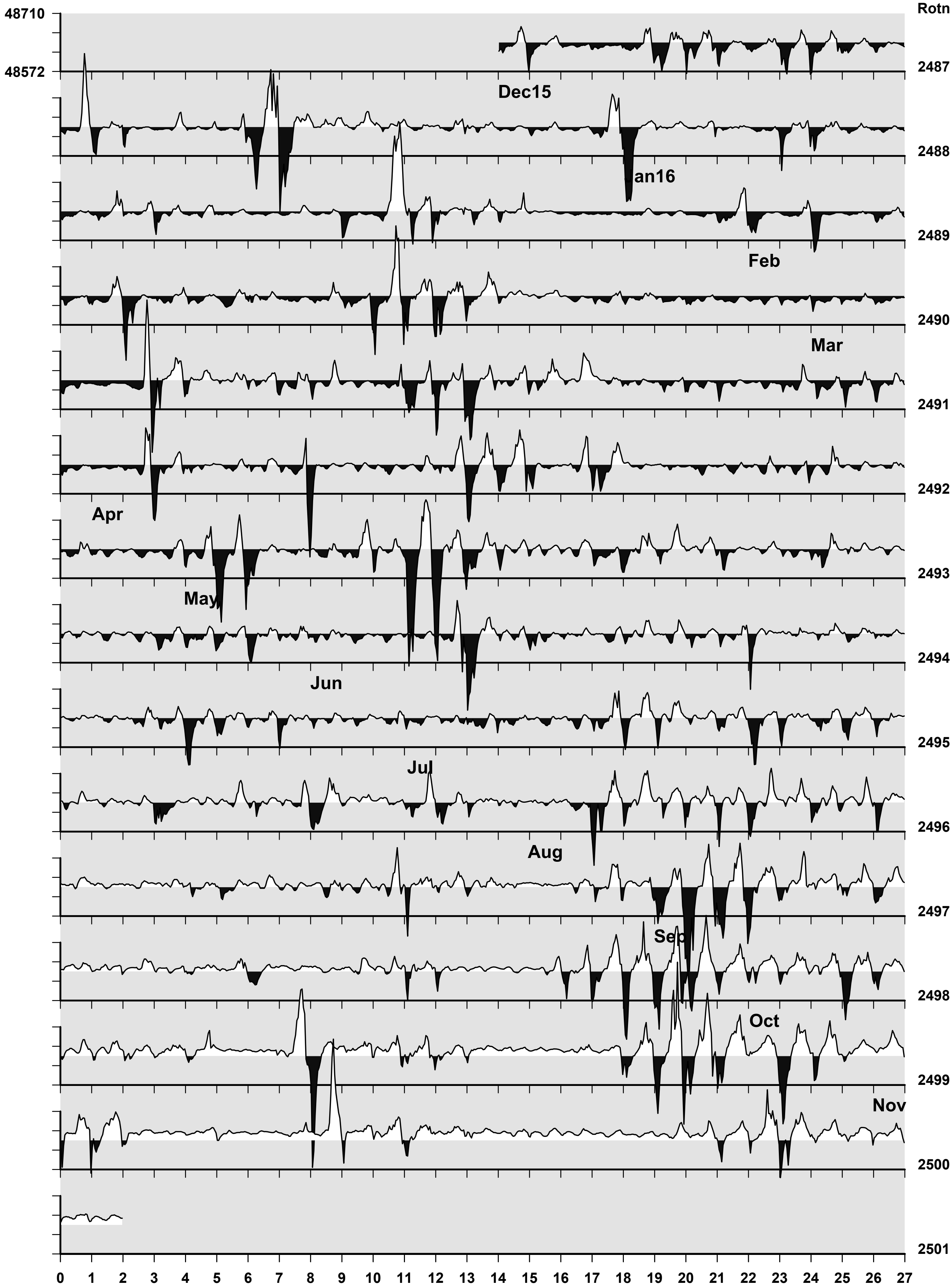


Hourly Mean Values Plotted By Bartels Solar Rotation Number

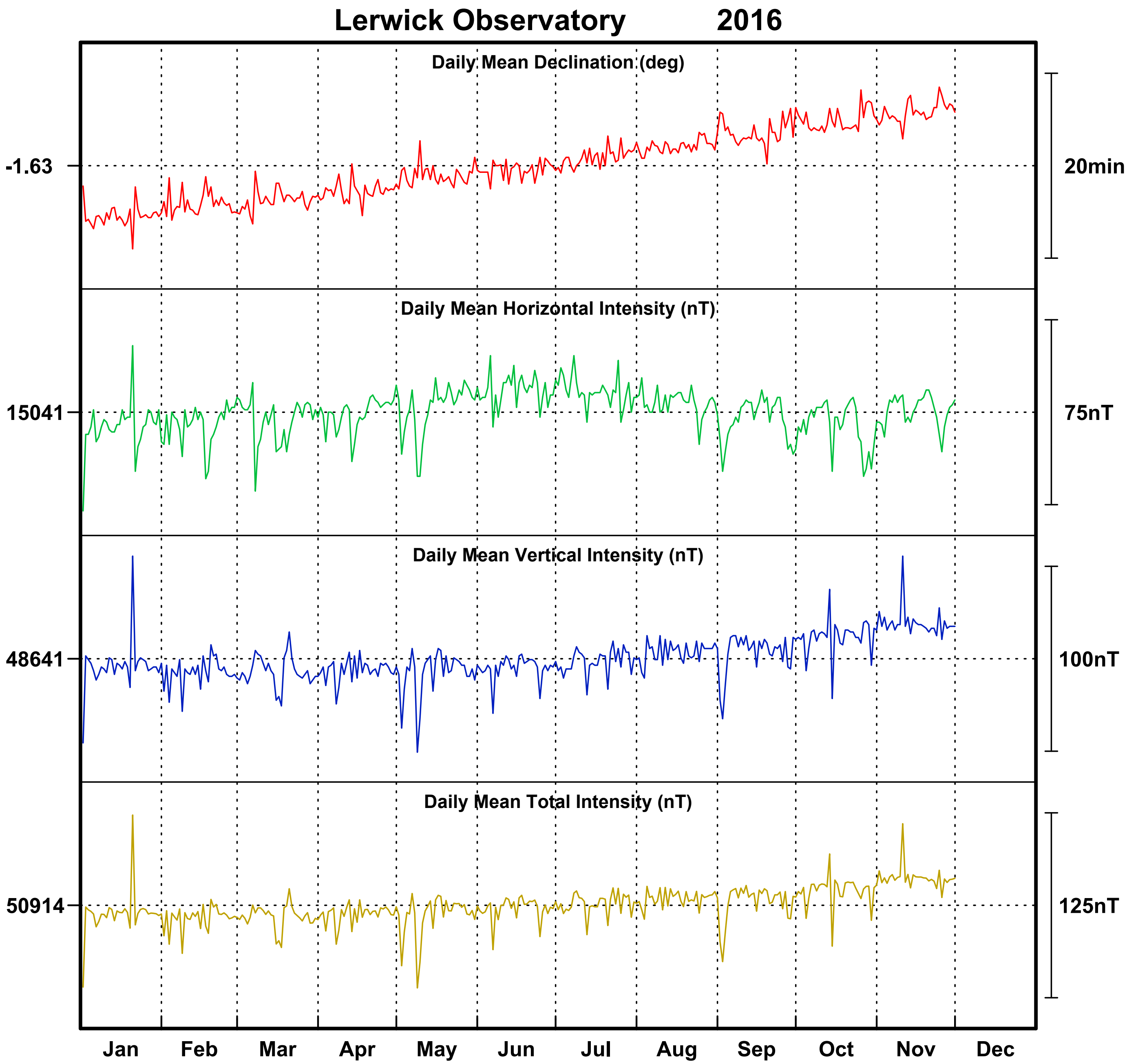


Lerwick Observatory: Horizontal Intensity (nT)
15096
14984
Rotn
2487
Dec15
2488
Jan16
2489
Feb
2490
Mar
2491
2492
Apr
2493
May
2494
Jun
2495
Jul
2496
Aug
2497
Sep
2498
Oct
2499
Nov
2500
2501
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Hourly Mean Values Plotted By Bartels Solar Rotation Number

Lerwick Observatory: Vertical Intensity (nT)



Hourly Mean Values Plotted By Bartels Solar Rotation Number


Lerwick Observatory 2016
Daily Mean Declination (deg)
-1.63
20min
Daily Mean Horizontal Intensity (nT)
15041
75nT
Daily Mean Vertical Intensity (nT)
48641
100nT
Daily Mean Total Intensity (nT)
50914
125nT
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Monthly Mean Values for Lerwick Observatory 2016

Month	*D*	*H*	*I*	*X*	*Y*	*Z*	*F*
January	-1° 43.3´	15035 nT	72° 49.4´	15028 nT	-452 nT	48638 nT	50908 nT
February	-1° 42.0´	15036 nT	72° 49.2´	15030 nT	-446 nT	48634 nT	50905 nT
March	-1° 41.6´	15037 nT	72° 49.1´	15031 nT	-444 nT	48635 nT	50906 nT
April	-1° 40.6´	15041 nT	72° 48.9´	15034 nT	-440 nT	48635 nT	50908 nT
May	-1° 38.9´	15043 nT	72° 48.8´	15037 nT	-433 nT	48634 nT	50907 nT
June	-1° 38.3´	15050 nT	72° 48.4´	15044 nT	-430 nT	48637 nT	50912 nT
July	-1° 37.0´	15049 nT	72° 48.5´	15043 nT	-424 nT	48640 nT	50915 nT
August	-1° 35.8´	15045 nT	72° 48.9´	15039 nT	-419 nT	48645 nT	50919 nT
September	-1° 34.3´	15038 nT	72° 49.3´	15032 nT	-412 nT	48645 nT	50916 nT
October	-1° 33.0´	15036 nT	72° 49.6´	15030 nT	-407 nT	48653 nT	50924 nT
November	-1° 32.1´	15042 nT	72° 49.4´	15036 nT	-403 nT	48661 nT	50933 nT

Note

i. The values shown here are provisional.

LERWICK RAPID VARIATIONS

SIs and SSCs

Date	Time (UT)	Type	Quality	H (nT)	D (min)	Z (nT)
09-11-16	06 43	SSC*	B	4.2/-4.3	-1.27	-1.7
21-11-16	07 59	SSC*	C	-3.0	0.24	1.4

Notes:
An asterisk (*) indicates that the principal impulse was preceded by a smaller reversed impulse.
The quality of the event is classified as follows:

A = very distinct
B = fair, ordinary, but unmistakable
C = doubtful

The amplitudes given are for the first chief movement of the event.

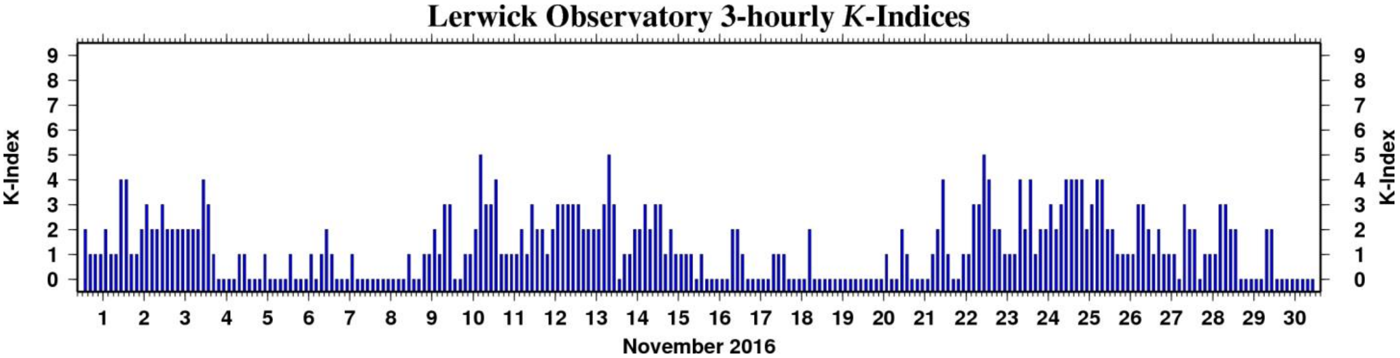
SFEs

Date	Universal Time			H (nT)	D (min)	Z (nT)
	Start	Maximum	End			
None						

Note:
The amplitudes given are for the first chief movement of the event.

INDICES OF GEOMAGNETIC ACTIVITY

Day	*K* - INDICES FOR THREE-HOUR INTERVAL							
	00-03	03-06	06-09	09-12	12-15	15-18	18-21	21-24
1	2	1	1	1	2	1	1	4
2	4	1	1	2	3	2	2	3
3	2	2	2	2	2	2	2	4
4	3	1	0	0	0	0	1	1
5	0	0	0	1	0	0	0	0
6	1	0	0	0	1	0	1	2
7	1	0	0	0	1	0	0	0
8	0	0	0	0	0	0	0	1
9	0	0	1	1	2	1	3	3
10	0	0	1	1	2	5	3	3
11	4	1	1	1	1	2	1	3
12	2	2	1	2	3	3	3	3
13	3	2	2	2	2	3	5	3
14	0	1	1	2	2	3	2	3
15	3	1	2	1	1	1	1	0
16	1	0	0	0	0	0	2	2
17	1	0	0	0	0	0	1	1
18	1	0	0	0	0	2	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	1	0	0	2
21	1	0	0	0	0	1	2	4
22	1	0	0	1	1	3	3	5
23	4	2	2	1	1	1	4	2
24	4	1	2	2	3	2	3	4
25	4	4	4	2	3	4	4	2
26	2	1	1	1	1	3	3	2
27	1	2	1	1	1	0	3	2
28	2	0	1	1	1	3	3	2
29	2	0	0	0	0	0	2	2
30	0	0	0	0	0	0	0	0



The *aa* Index

Date	Day	3-hourly *aa*-indices								Aa_{am}	Aa_{pm}	*Aa*
01-11-16	306	12	8	16	38	32	24	16	45	18.4	29.4	23.9
02-11-16	307	37	12	8	24	59	32	12	58	20.2	40.4	30.3
03-11-16	308	20	16	46	38	24	24	16	37	29.8	25.4	27.6
04-11-16	309	20	8	8	5	5	2	8	5	10.2	5.1	7.6
05-11-16	310	8	8	2	8	5	2	2	5	6.5	3.8	5.1
06-11-16	311	9	5	12	9	16	8	12	16	8.9	13.0	10.9
07-11-16	312	12	8	16	5	8	8	2	2	10.2	5.1	7.7
08-11-16	313	2	2	2	8	12	2	2	9	3.8	6.5	5.2
09-11-16	314	2	2	24	12	16	12	33	24	10.3	21.3	15.8
10-11-16	315	20	20	12	24	32	81	24	32	19.1	42.2	30.7
11-11-16	316	37	8	8	16	16	16	16	45	17.2	23.4	20.3
12-11-16	317	24	46	16	81	46	45	24	45	41.6	40.1	40.9
13-11-16	318	24	32	24	32	32	24	67	37	28.1	40.0	34.0
14-11-16	319	8	8	16	24	32	32	12	24	14.0	25.1	19.5
15-11-16	320	20	12	12	12	24	8	5	8	13.9	11.2	12.6
16-11-16	321	5	8	8	5	2	5	12	12	6.5	7.8	7.2
17-11-16	322	5	5	5	5	5	8	8	8	5.1	7.1	6.1
18-11-16	323	9	5	2	5	5	16	2	5	5.5	7.2	6.3
19-11-16	324	2	2	2	2	8	9	8	2	2.5	6.9	4.7
20-11-16	325	2	2	8	9	12	8	8	12	5.5	9.9	7.7
21-11-16	326	8	12	12	5	16	8	24	37	9.2	21.3	15.3
22-11-16	327	12	12	12	24	24	45	32	67	15.0	42.1	28.6
23-11-16	328	37	16	16	12	12	12	33	12	20.3	17.2	18.8
24-11-16	329	37	16	24	24	59	32	45	45	25.4	45.5	35.4
25-11-16	330	45	80	45	24	59	45	67	16	48.8	46.7	47.8
26-11-16	331	16	16	12	24	16	24	37	20	17.1	24.3	20.7
27-11-16	332	16	16	16	16	24	8	20	24	16.1	19.0	17.5
28-11-16	333	12	8	12	12	16	24	20	24	10.9	21.0	16.0
29-11-16	334	12	5	2	5	12	8	12	20	6.2	12.9	9.5
30-11-16	335	8	8	8	2	5	5	2	2	6.5	3.8	5.2
											Monthly Mean Value	18.0

Notes

i. The units of the *aa* index are nT.
ii. The 3-hour *aa* values are rounded to the nearest integer. Where *aa* = *.5, *aa* is rounded down.
iii. Daily values (Aa_{am}, Aa_{pm} and *Aa*) are computed from *aa* values of original resolution.
iv. The monthly mean value is computed from the daily mean values, *Aa*.
v. Definitive *aa* indices are derived and published by the International Service for Geomagnetic Indices.