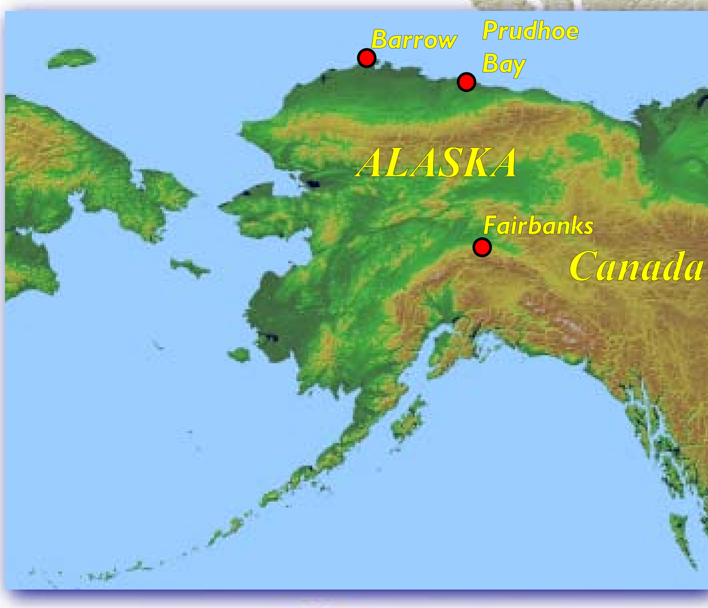
BRITISH GEOLOGICAL SURVEY

Jim Carrigan Observatory Prudhoe Bay

Monthly Magnetic Bulletin

December 2020

20/12/JC



British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

JIM CARRIGAN OBSERVATORY MAGNETIC DATA

1. Introduction

Jim Carrigan observatory is the fourth overseas geomagnetic observatory established by the British Geological Survey (BGS). The installation was a joint venture between BGS and Sperry Drilling Services (SDS), Halliburton in support of directional drilling programmes. SDS operated a prototype station since 1997, which was upgraded by the BGS to a standard high-quality observatory in October 2003.

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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Scotland, UK

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E-mail: enquiries@bgs.ac.uk
Internet: www.geomag.bgs.ac.uk

2. Position

Jim Carrigan Observatory is situated at T-Pad, a man-made gravel bed close to the drilling sites at Prudhoe Bay, Alaska, USA. The observatory co-ordinates are:-

Geographic: 70° 21'21.6"N 211° 12'03.6" E
Geomagnetic: 70° 26'53"N 257° 13'01" E
Height above mean sea level: 20m (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 13th generation International Geomagnetic Reference Field (IGRF) at epoch 2020.5. 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

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 and became fully operational from October 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 0.05Hz.

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 13-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 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.

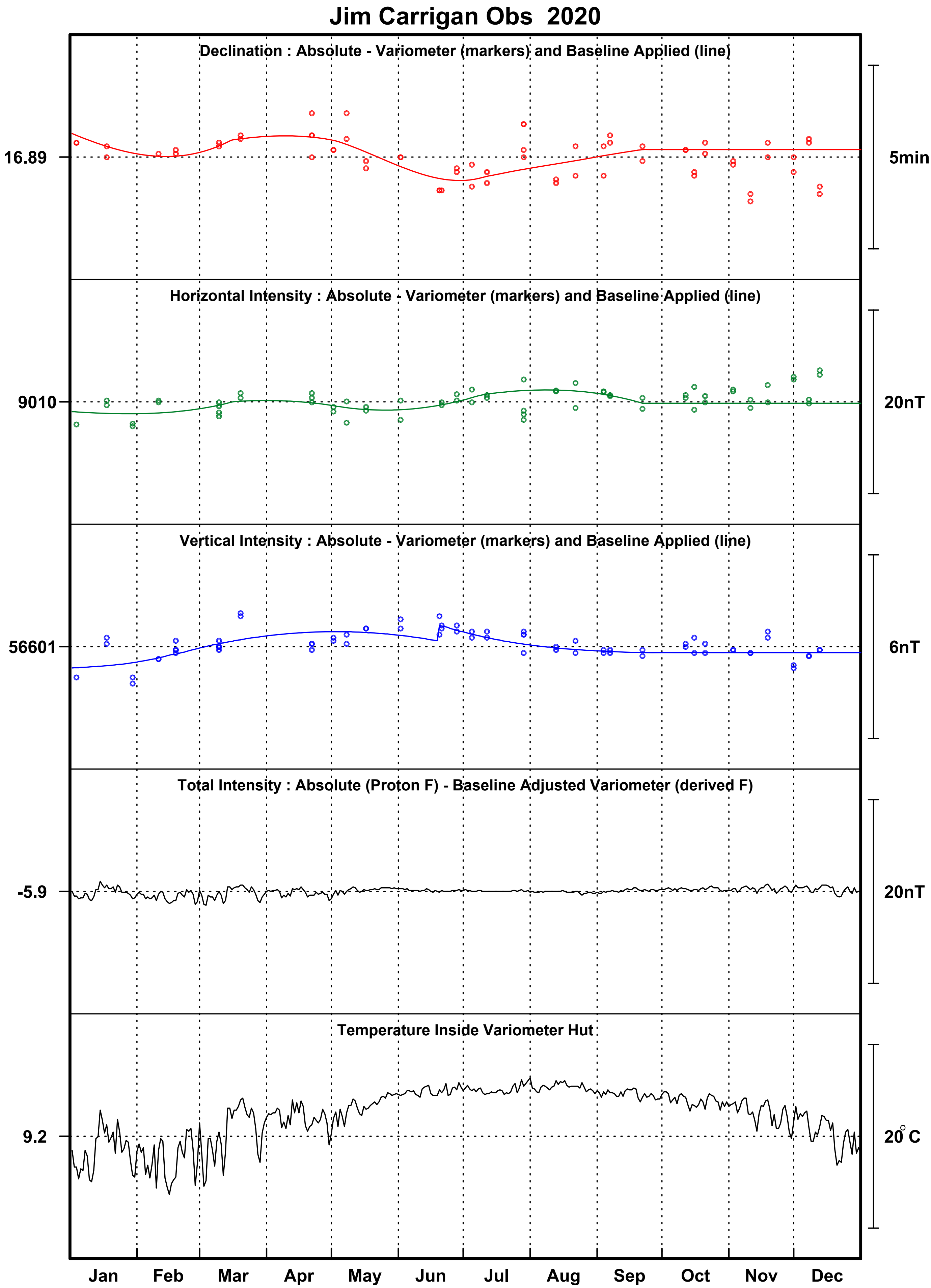
Reproduction of any part of this bulletin should be accompanied by the statement: 'Reproduced with the permission of the British Geological Survey ©NERC. All rights Reserved'. Publications making use of the data should include an acknowledgment statement of the form: 'The results presented in this paper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

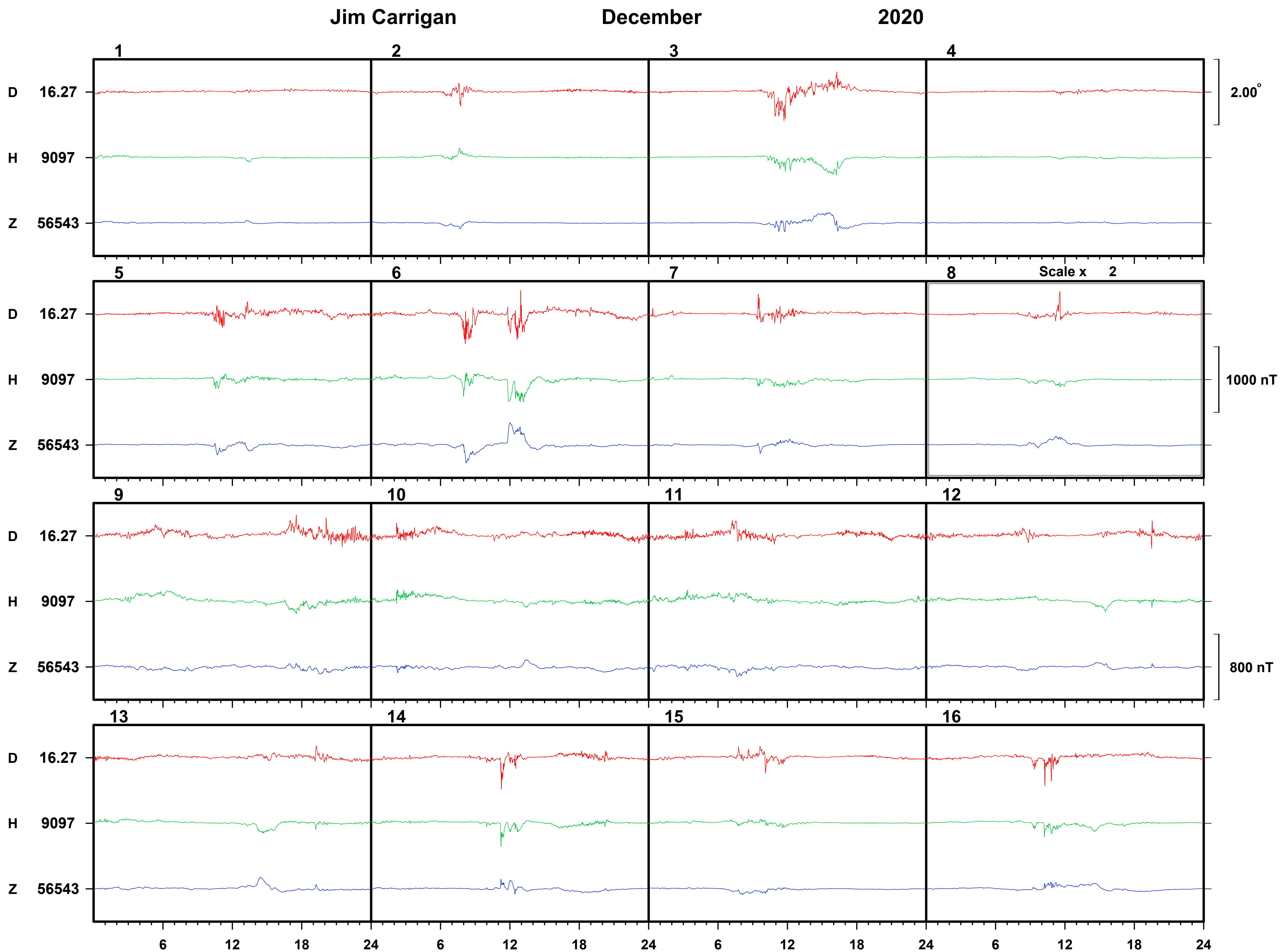
Commercial users can contact the geomagnetism team for information on the range of applications and services offered. Full contact details are available at www.geomag.bgs.ac.uk/contactus/staff

JIM CARRIGAN OBSERVATORY

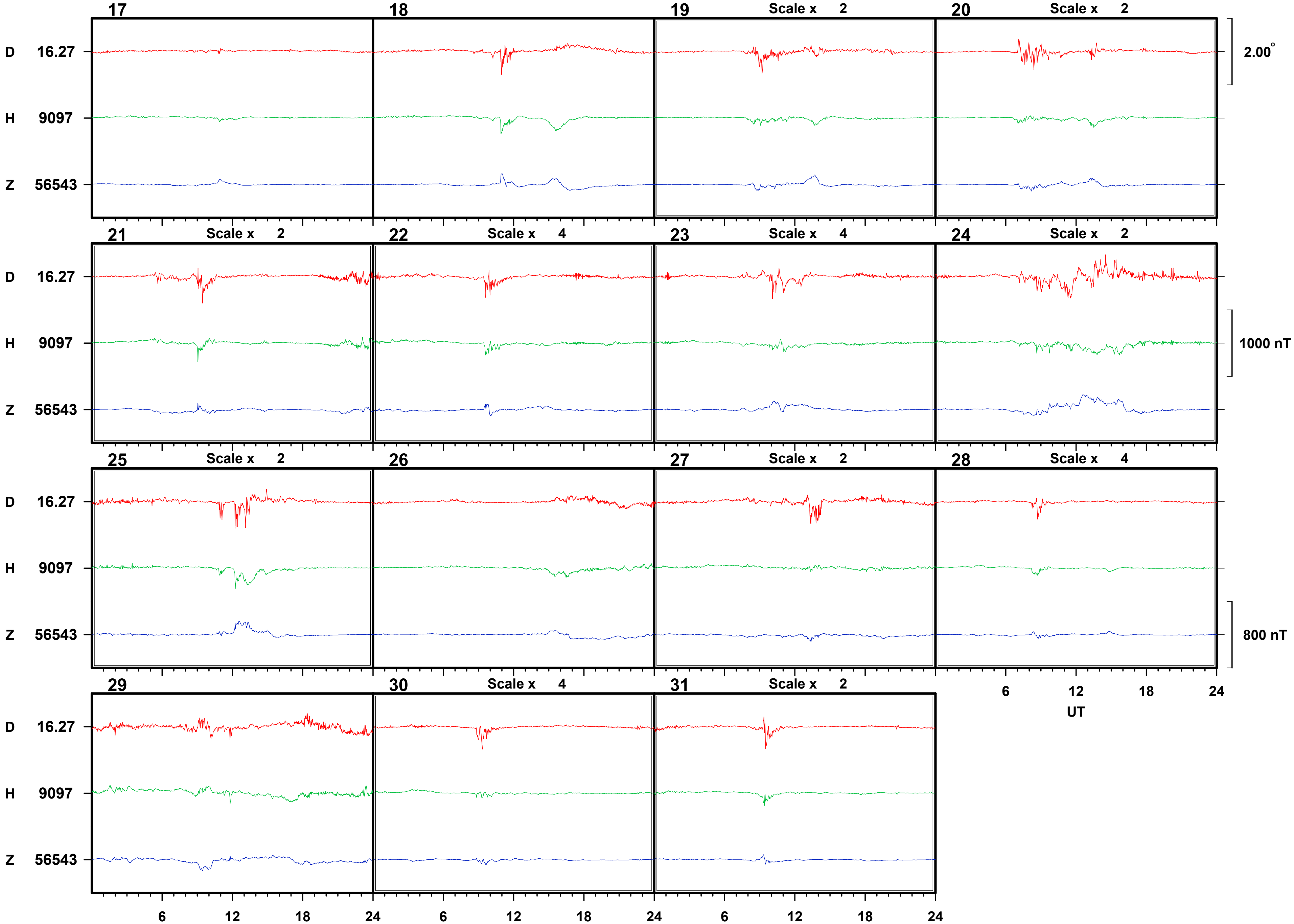
ABSOLUTE OBSERVATIONS

		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**
07-Dec-20	342	22:13	16.2951	16.8933	22:29	80.8542	5.9	57278.0	9104.2	9010.1	56549.9	56601.1	CZ
07-Dec-20	342	22:44	16.3016	16.8950	22:57	80.8531	5.9	57277.9	9105.2	9009.7	56549.6	56601.1	CZ
12-Dec-20	347	20:59	16.2854	16.8733	21:17	80.8573	5.9	57266.8	9099.4	9013.3	56539.3	56601.3	CZ
12-Dec-20	347	21:32	16.2193	16.8700	21:49	80.8615	5.9	57266.2	9095.2	9012.8	56539.4	56601.3	CZ


Jim Carrigan Obs 2020
Declination : Absolute - Variometer (markers) and Baseline Applied (line)
16.89
5min
Horizontal Intensity : Absolute - Variometer (markers) and Baseline Applied (line)
9010
20nT
Vertical Intensity : Absolute - Variometer (markers) and Baseline Applied (line)
56601
6nT
Total Intensity : Absolute (Proton F) - Baseline Adjusted Variometer (derived F)
-5.9
20nT
Temperature Inside Variometer Hut
9.2
20°C
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

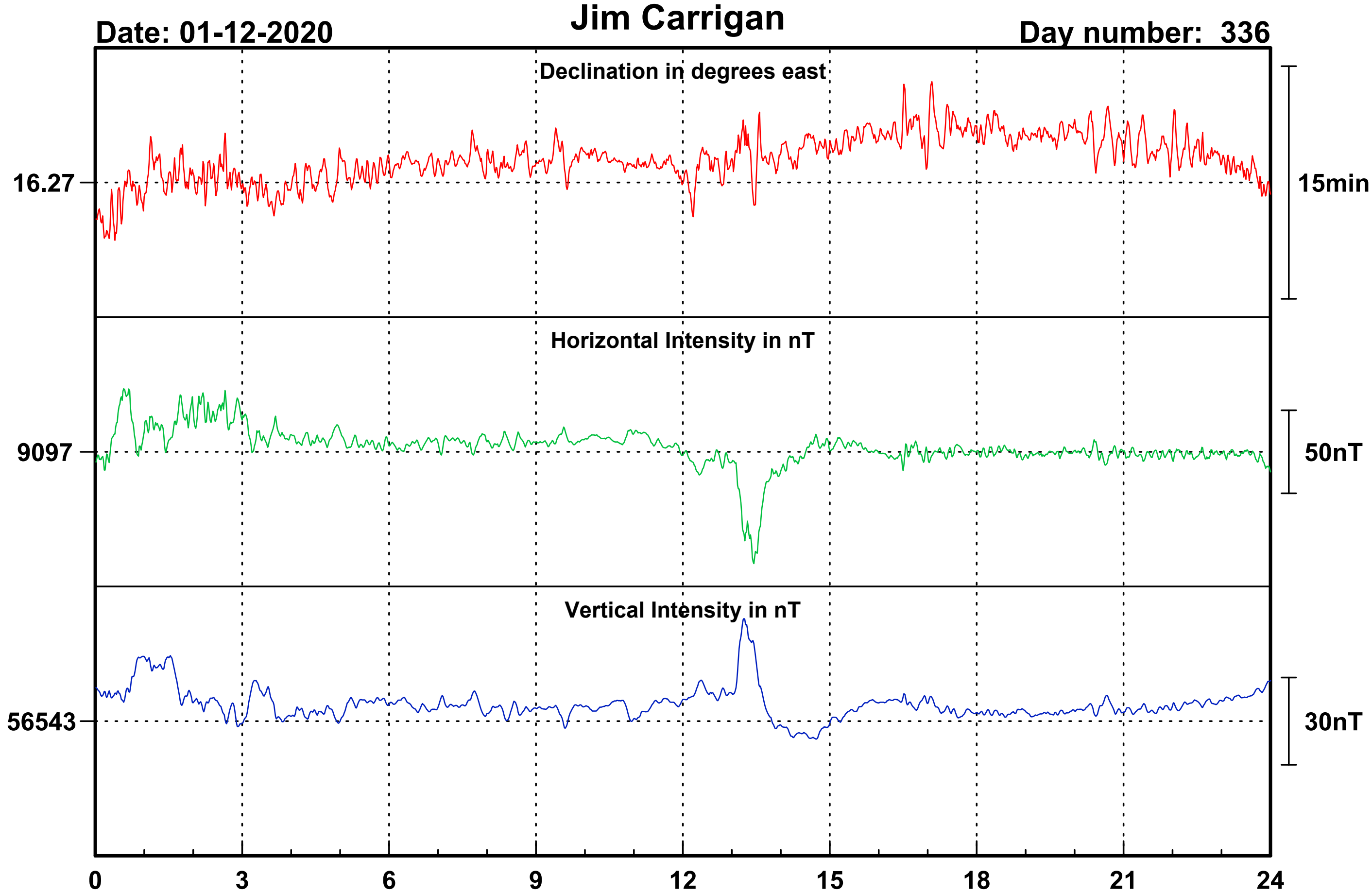


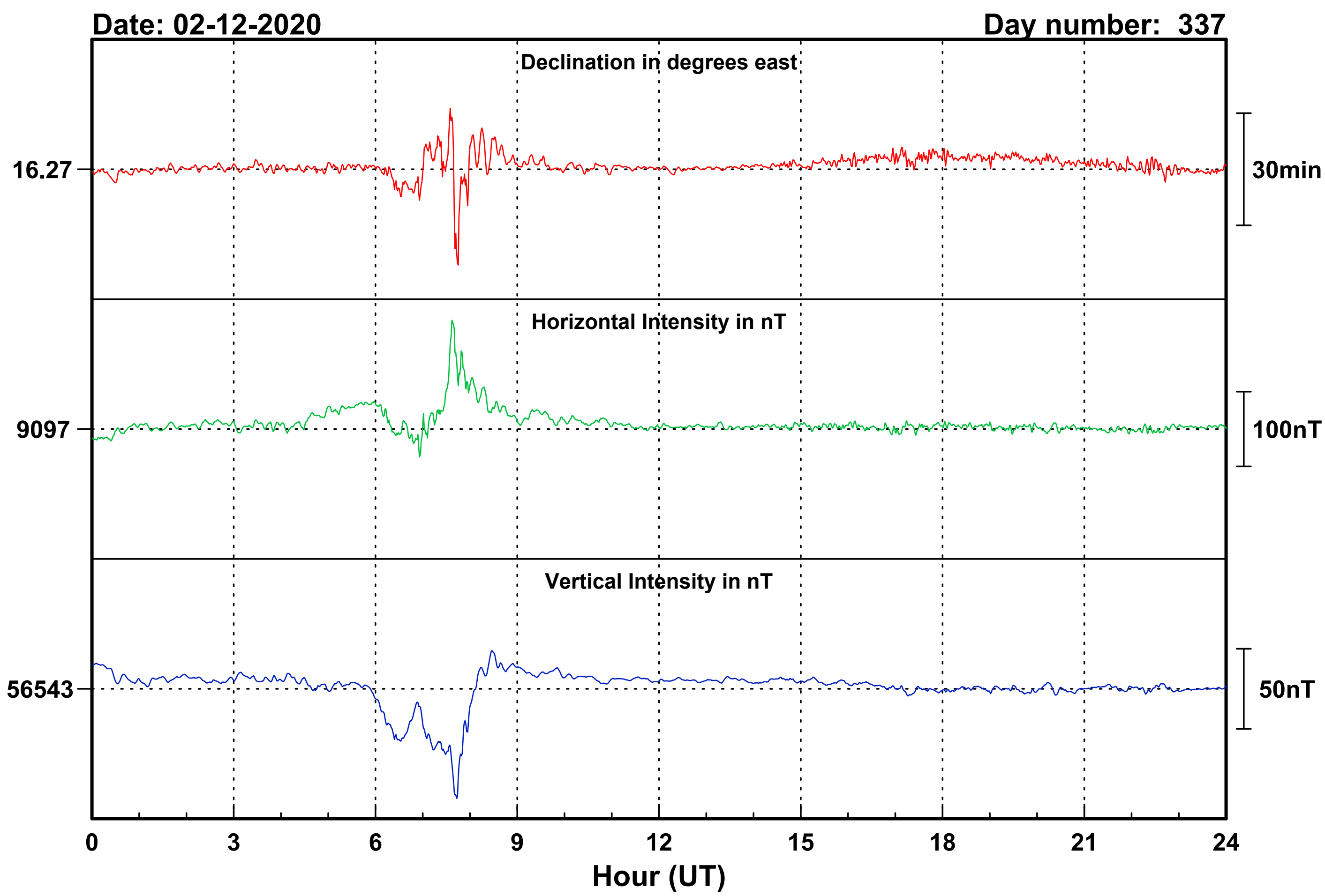
Jim Carrigan
December
2020
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
D 16.27
H 9097
Z 56543
2.00°
1000 nT
800 nT
Scale x 2
6
12
18
24

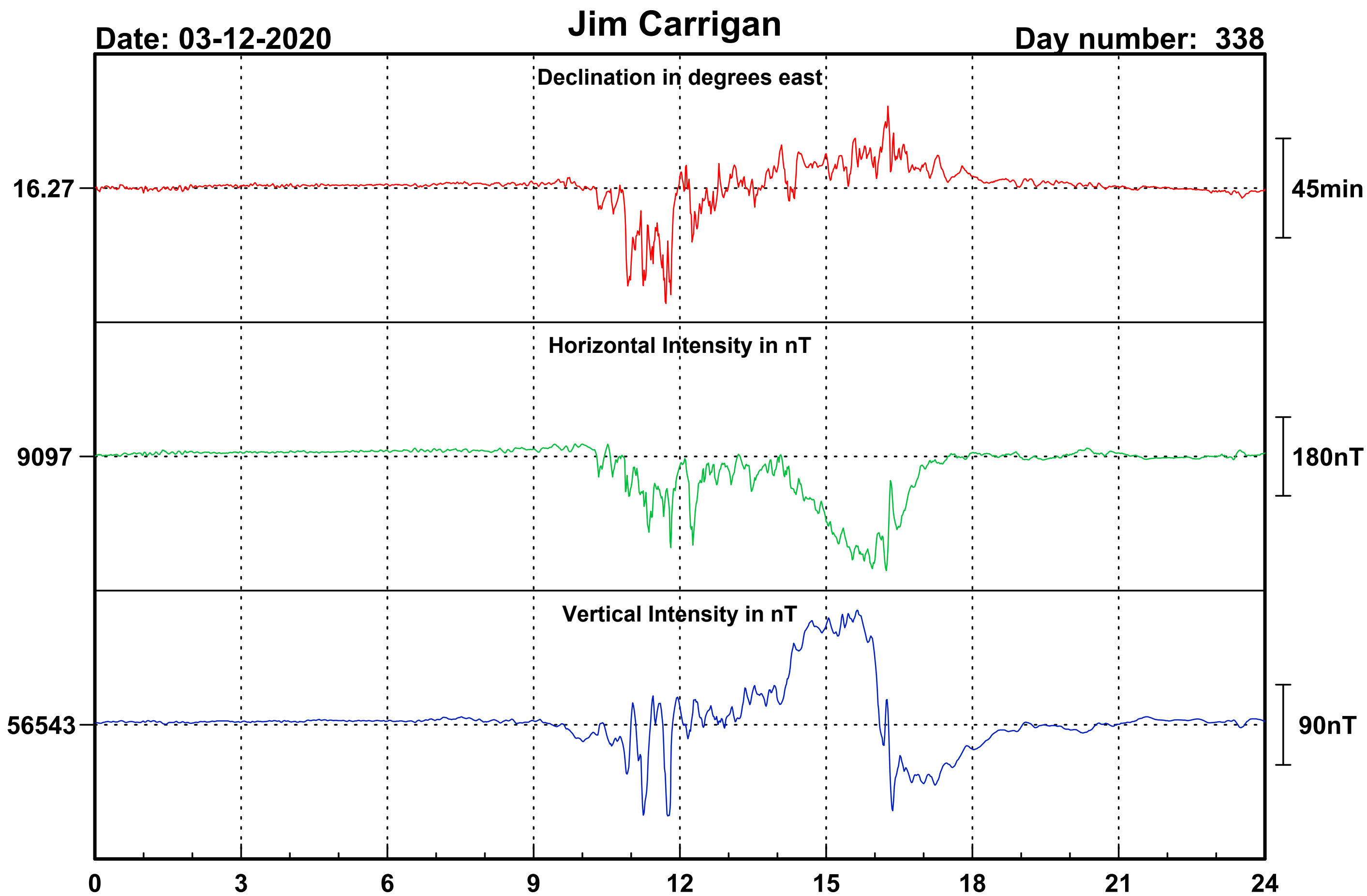


Jim Carrigan December 2020

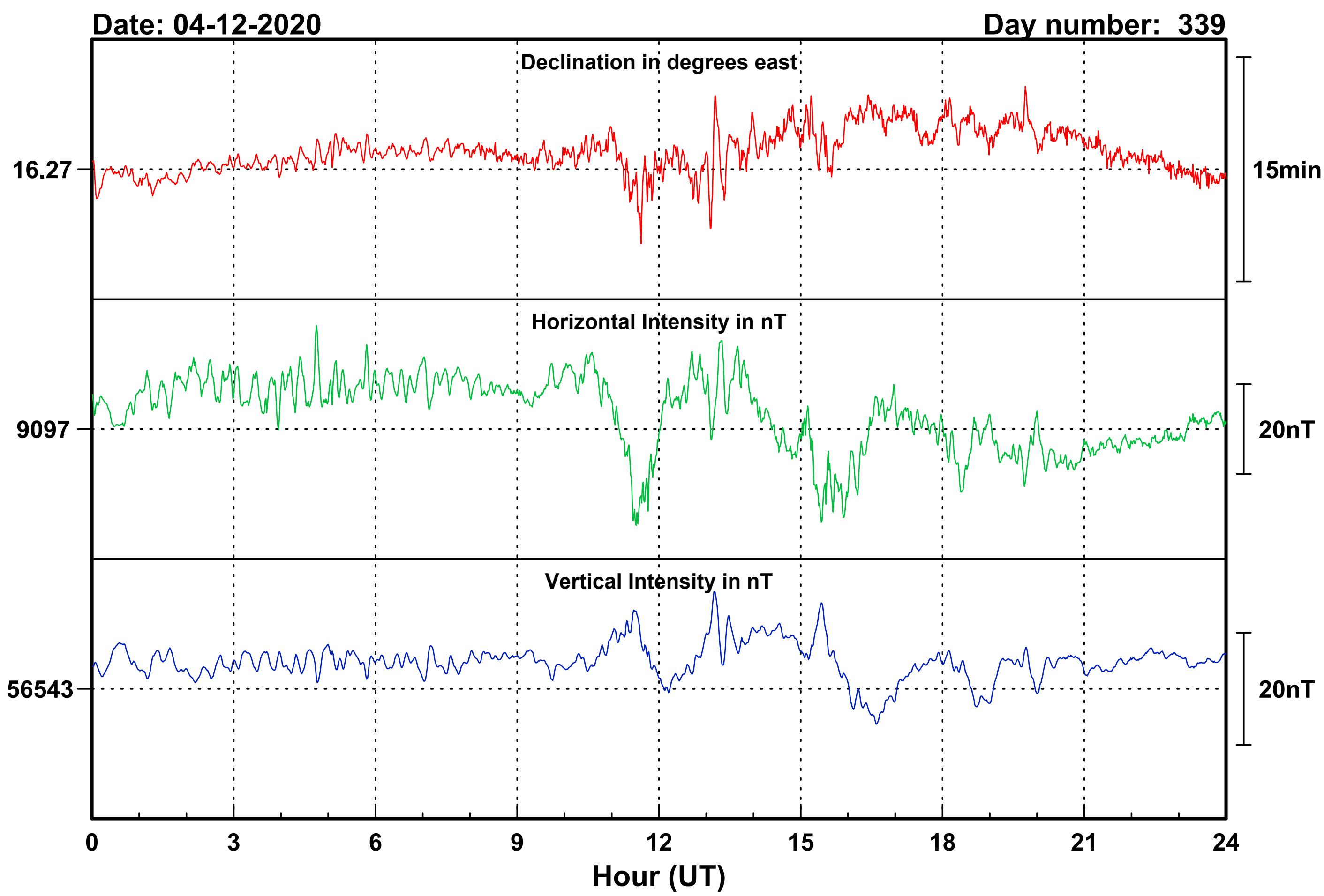
Jim Carrigan







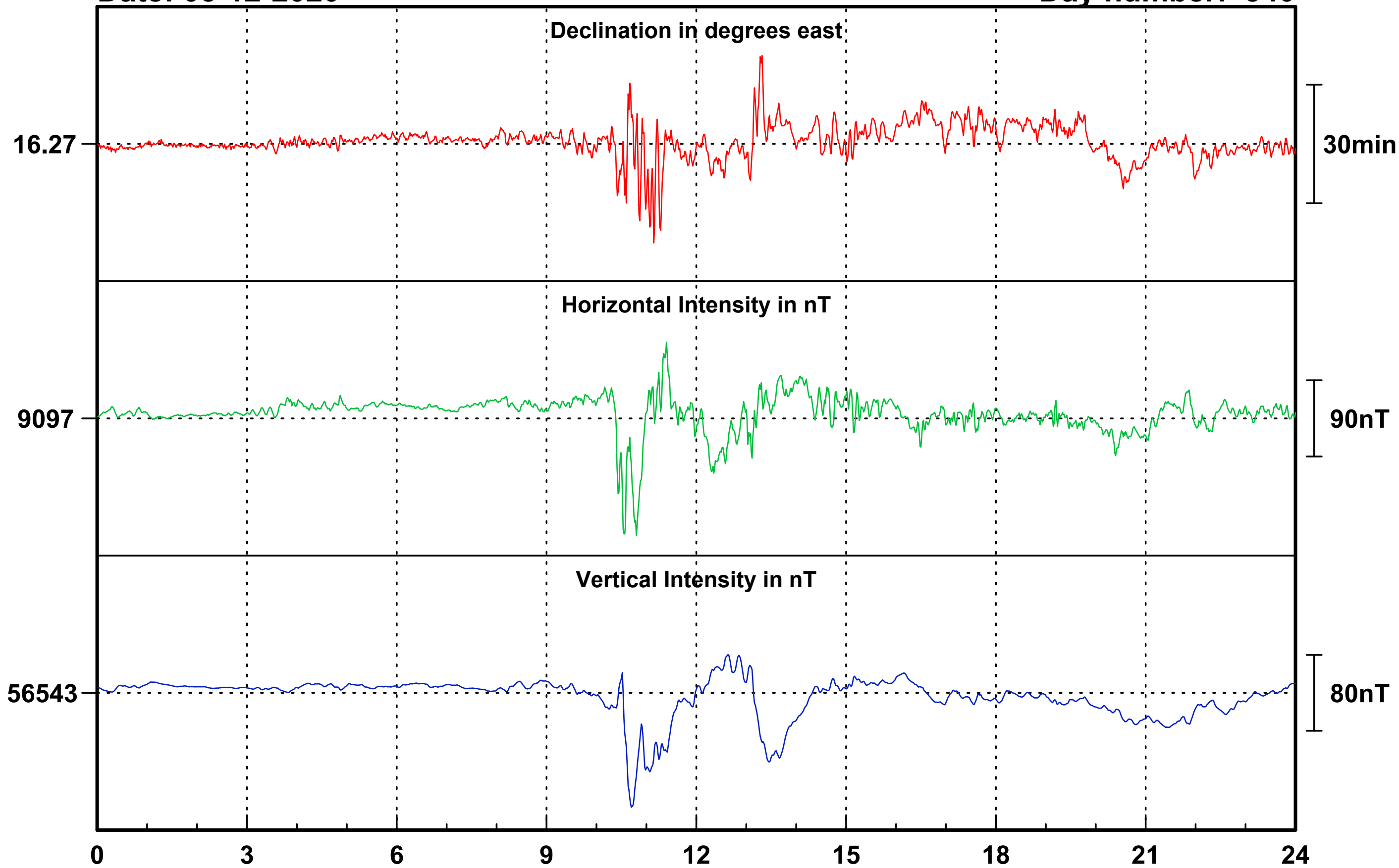
Jim Carrigan
Date: 03-12-2020
Day number: 338
Declination in degrees east
16.27
45min
Horizontal Intensity in nT
9097
180nT
Vertical Intensity in nT
56543
90nT
0
3
6
9
12
15
18
21
24



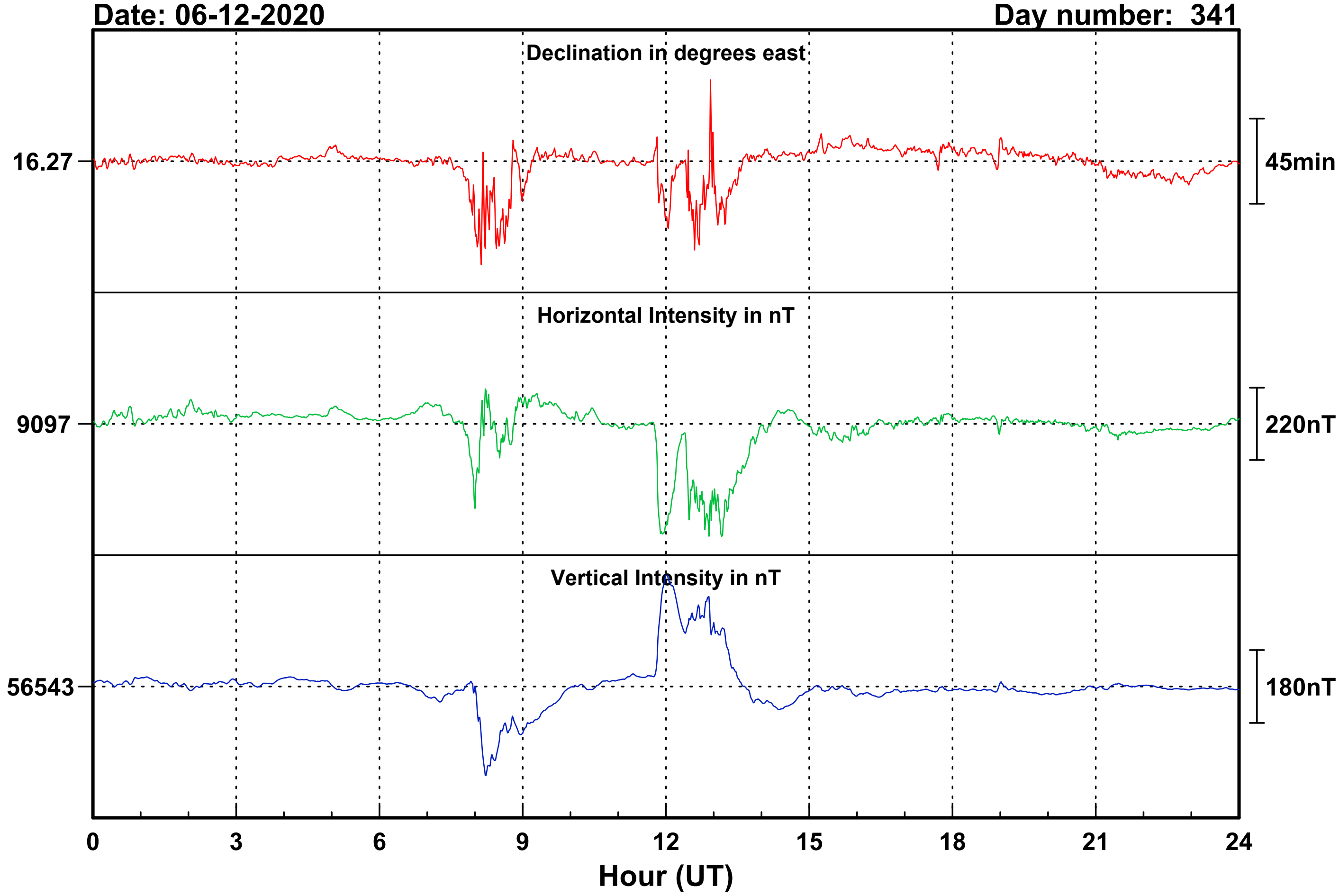
Date: 04-12-2020
Day number: 339
Declination in degrees east
16.27
15min
Horizontal Intensity in nT
9097
20nT
Vertical Intensity in nT
56543
20nT
0
3
6
9
12
15
18
21
24
Hour (UT)

Jim Carrigan

Date: 05-12-2020 Day number: 340

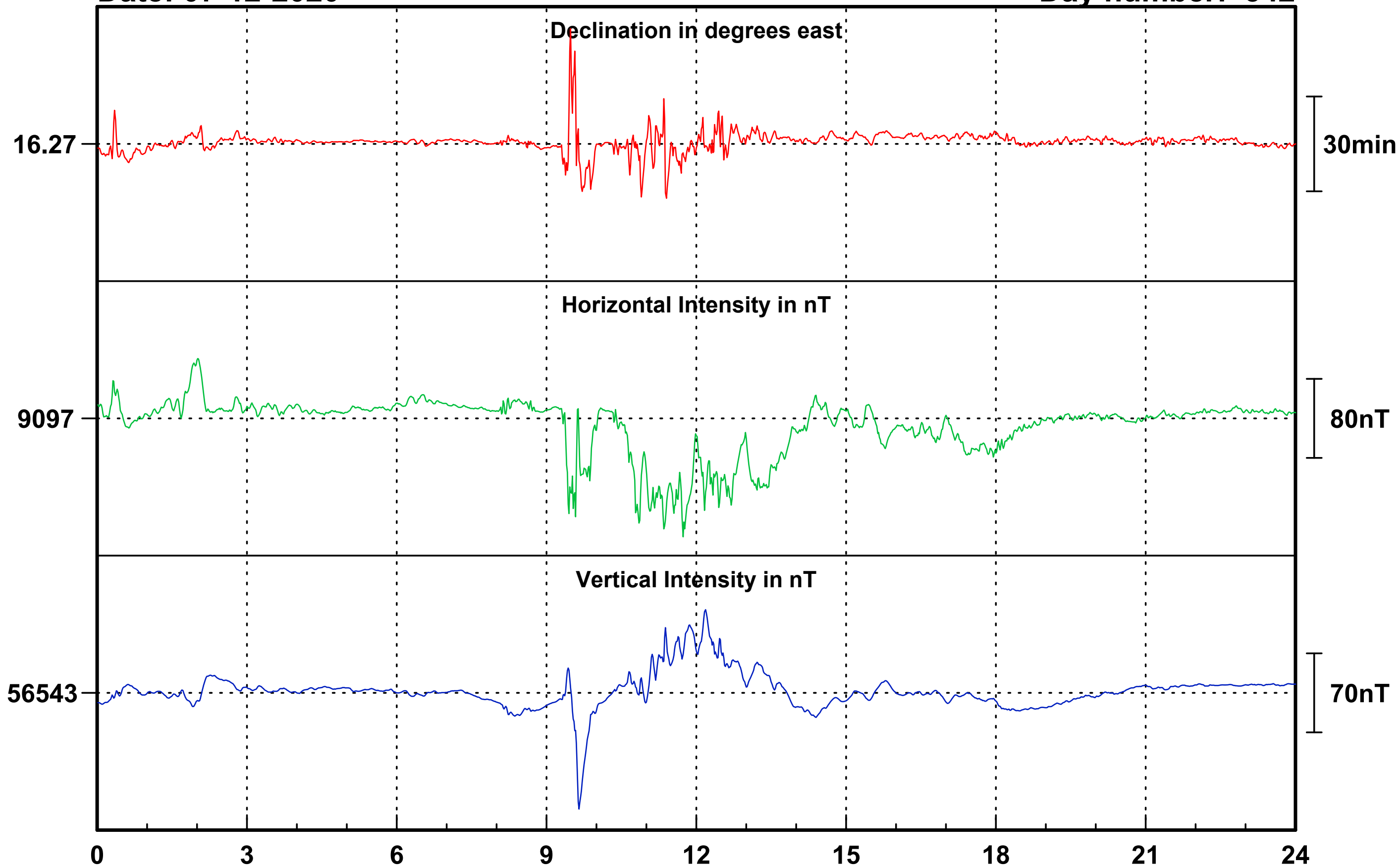


Date: 06-12-2020 Day number: 341

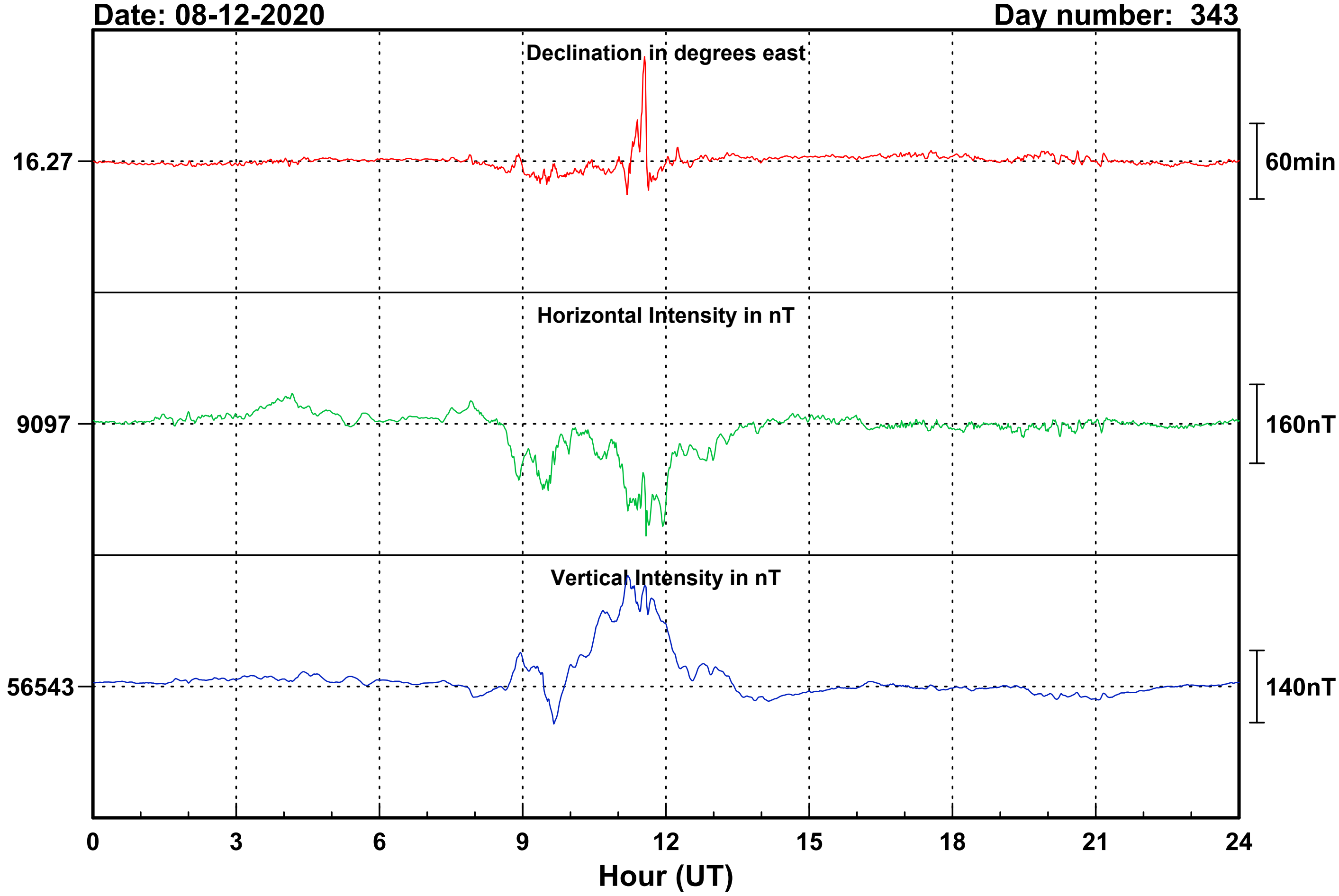


Jim Carrigan

Date: 07-12-2020 Day number: 342

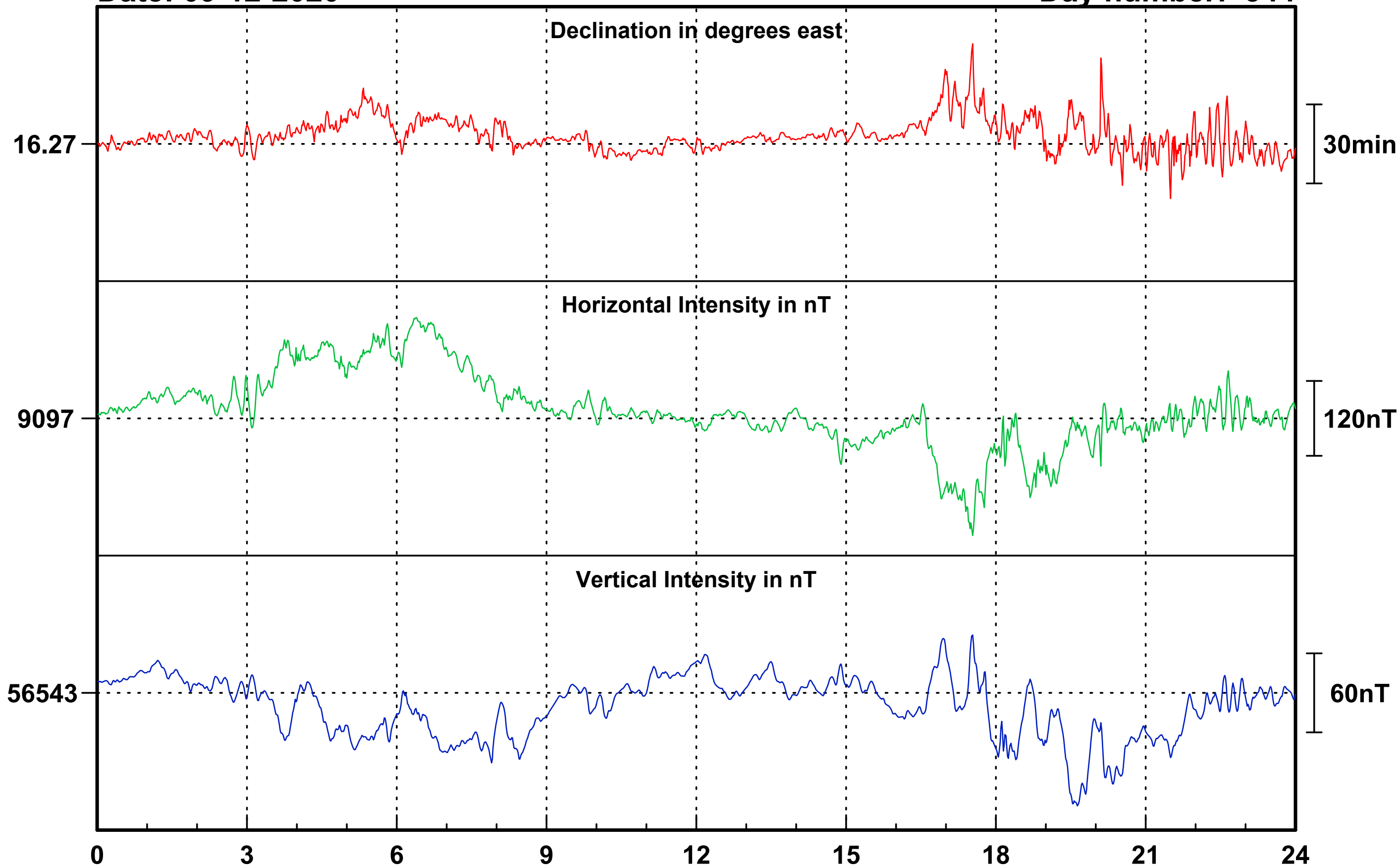


Date: 08-12-2020 Day number: 343

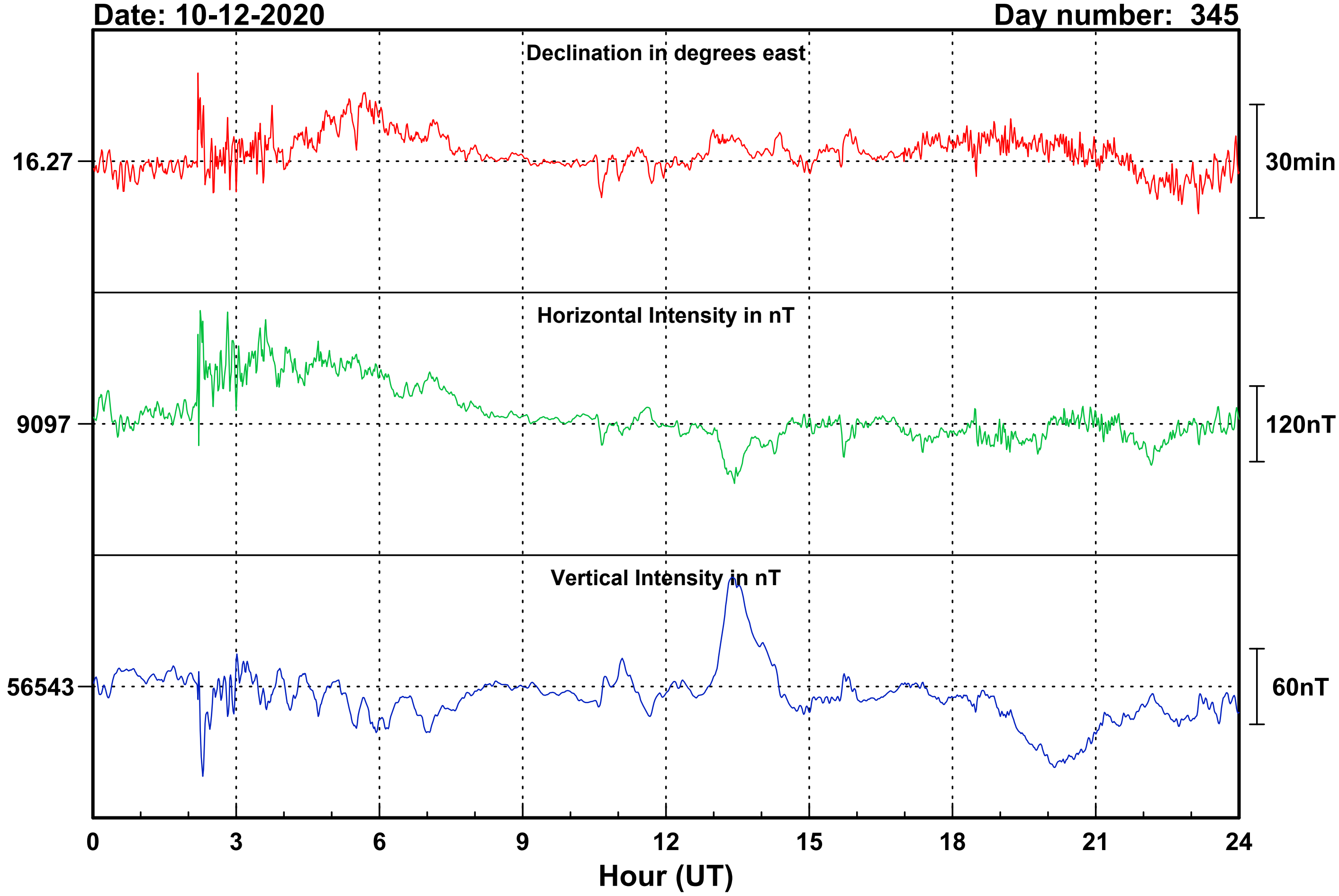


Jim Carrigan

Date: 09-12-2020 **Day number: 344**

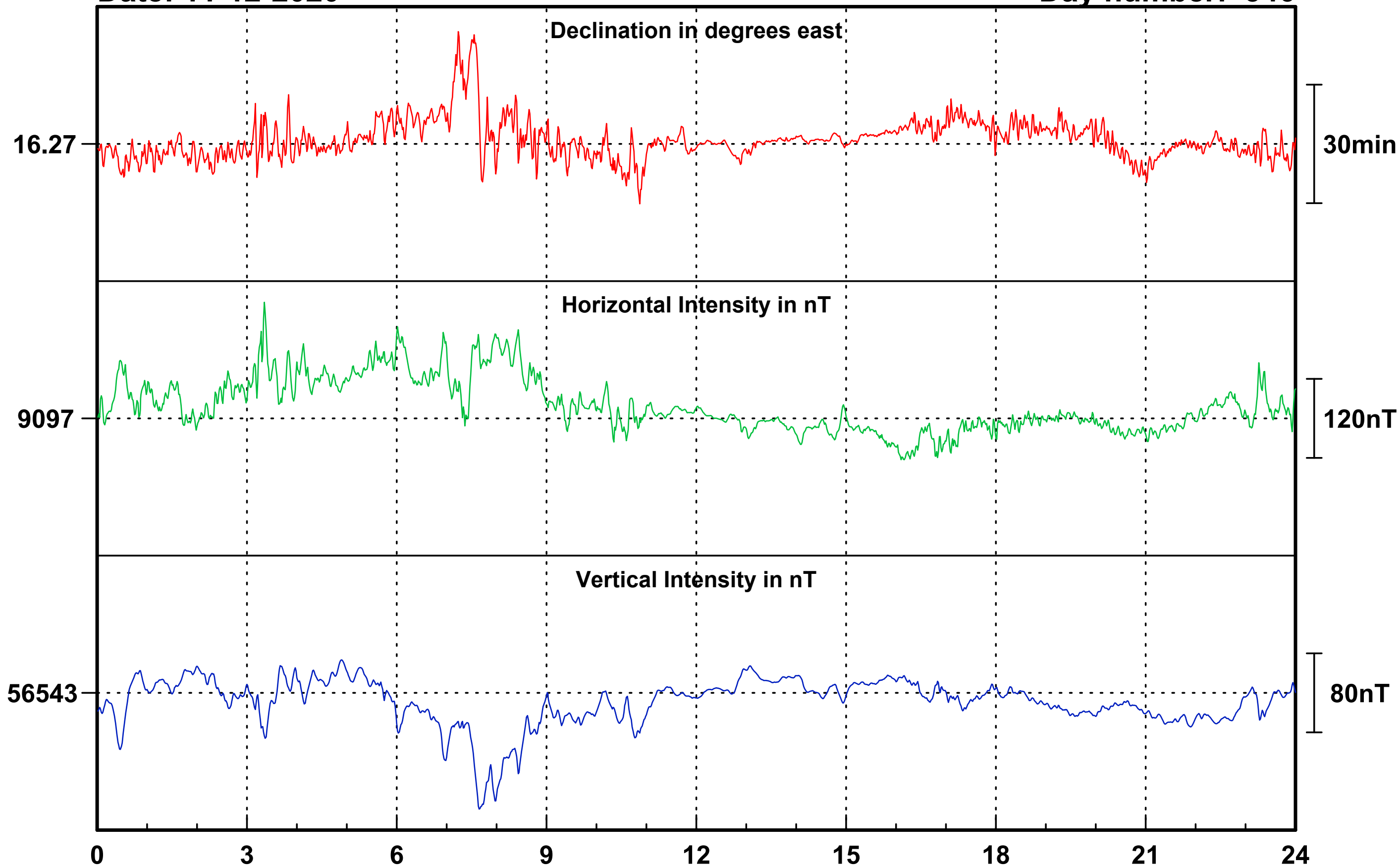


Date: 10-12-2020 **Day number: 345**

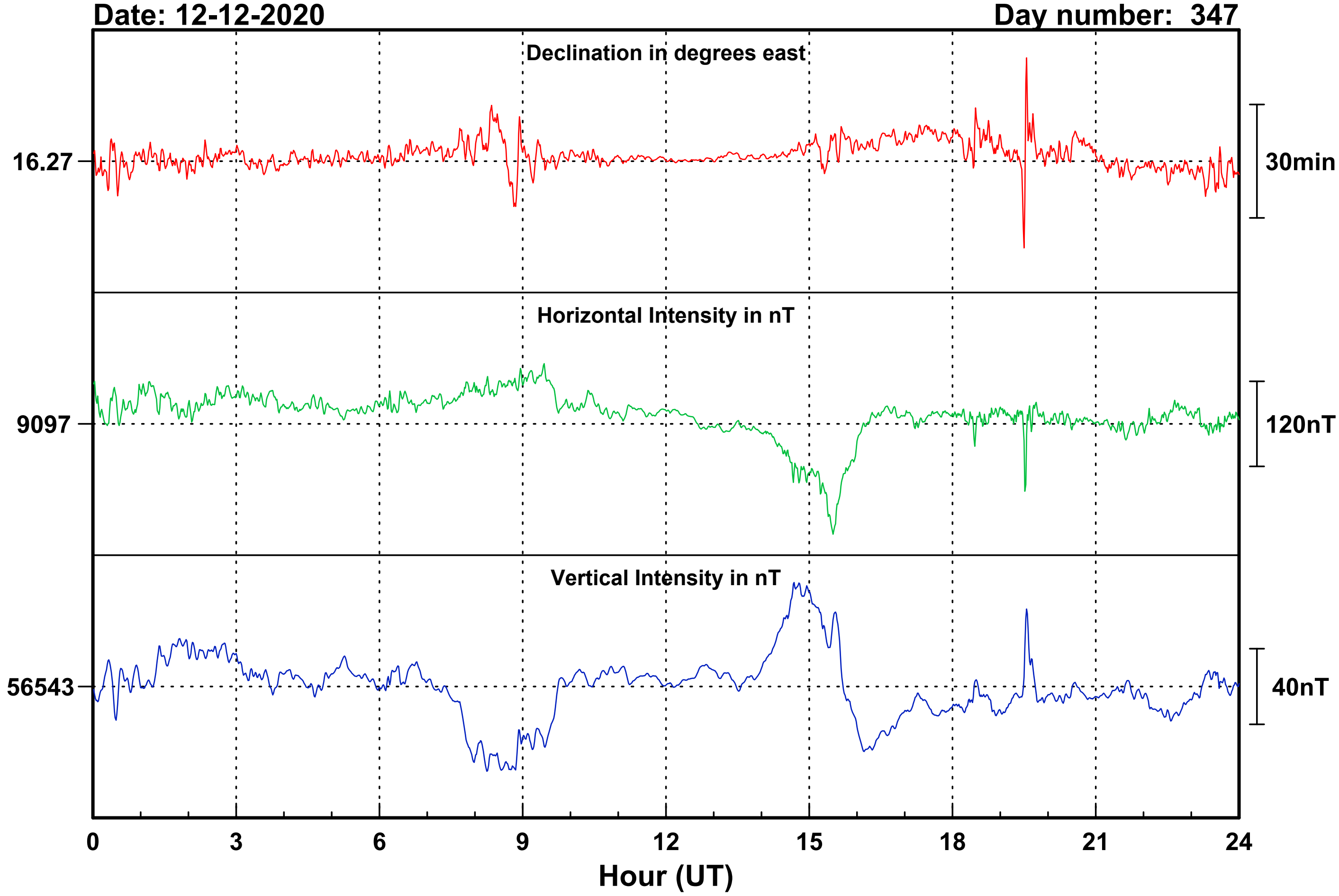


Jim Carrigan

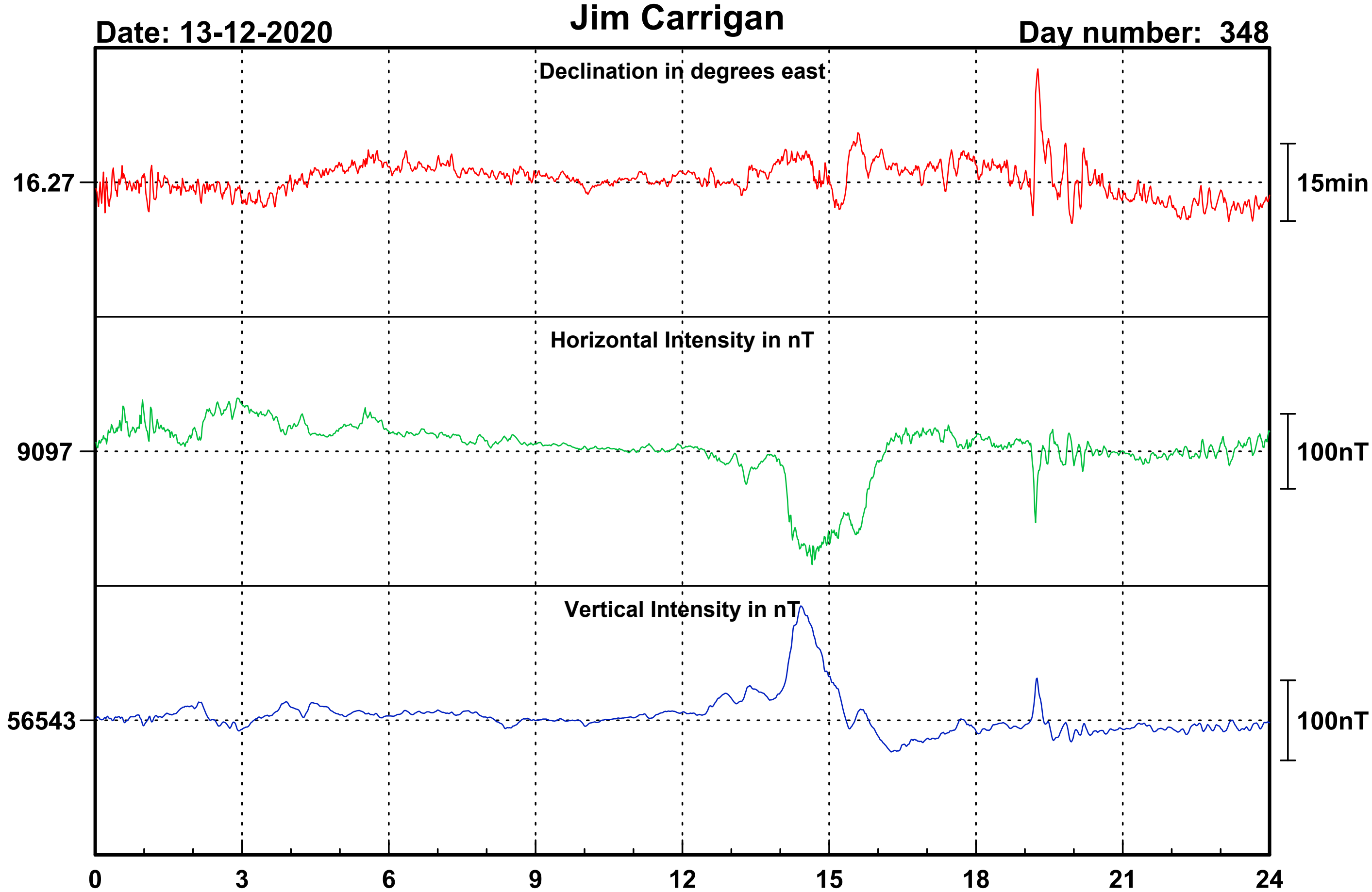
Date: 11-12-2020 Day number: 346

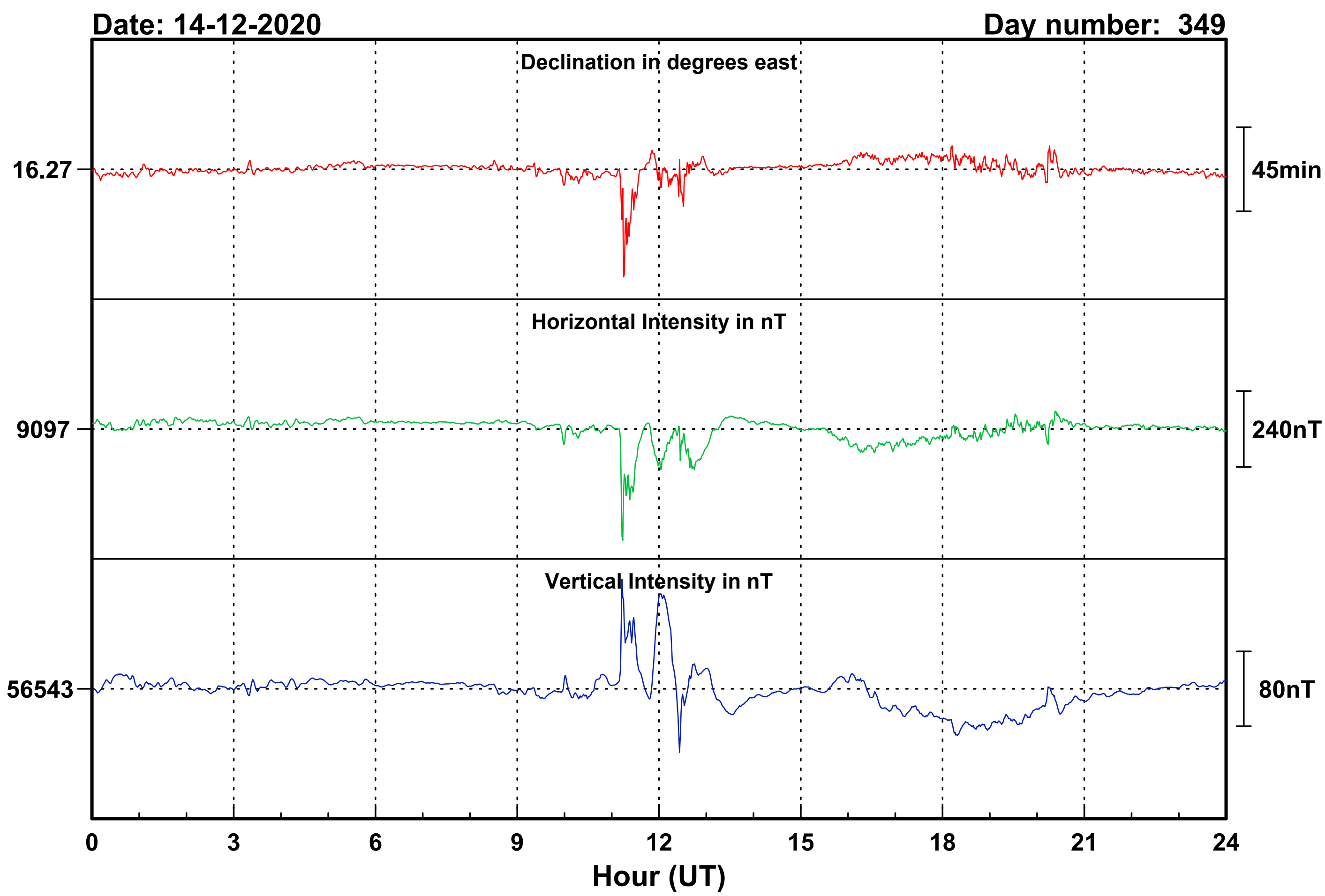


Date: 12-12-2020 Day number: 347



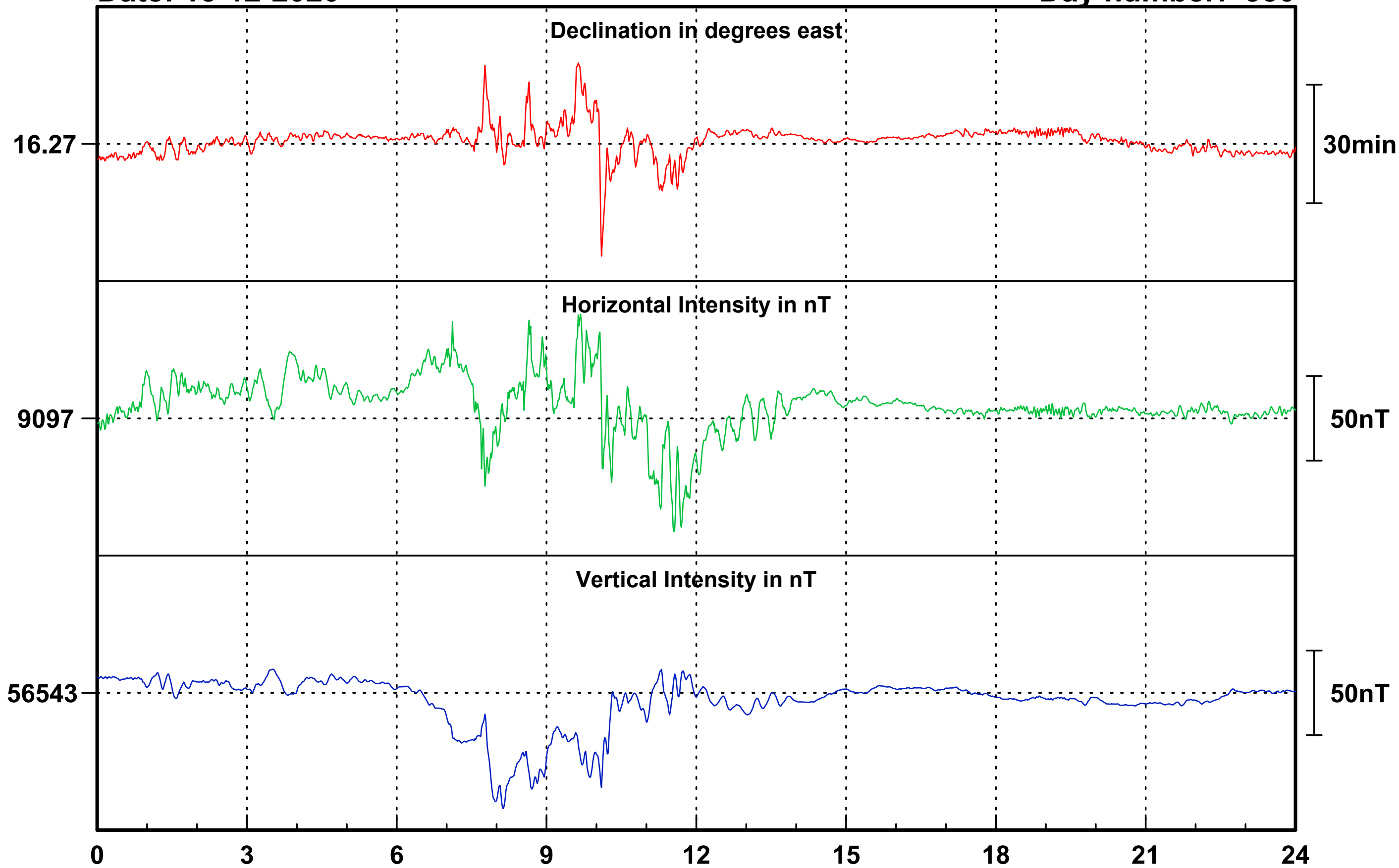
Jim Carrigan



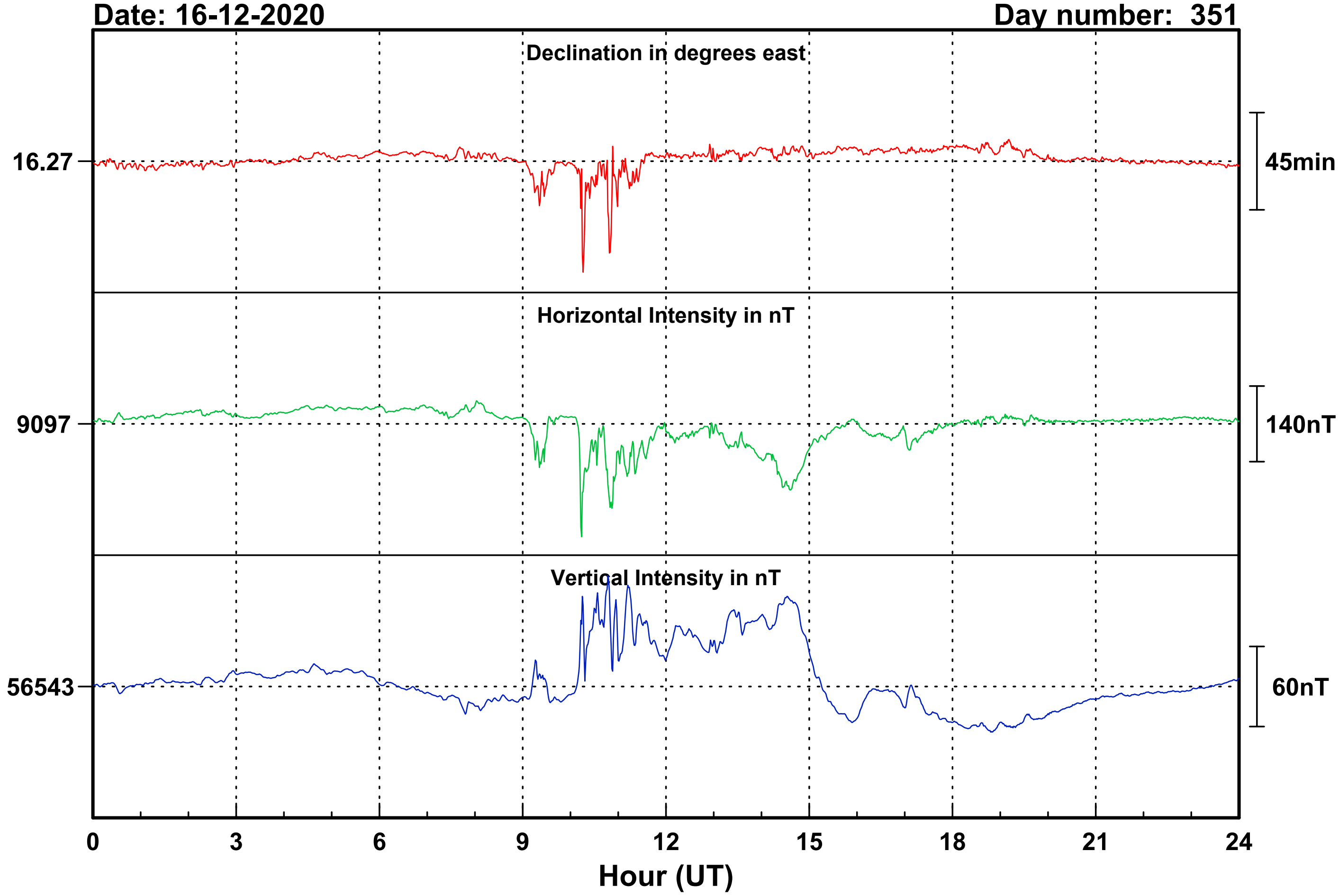


Jim Carrigan

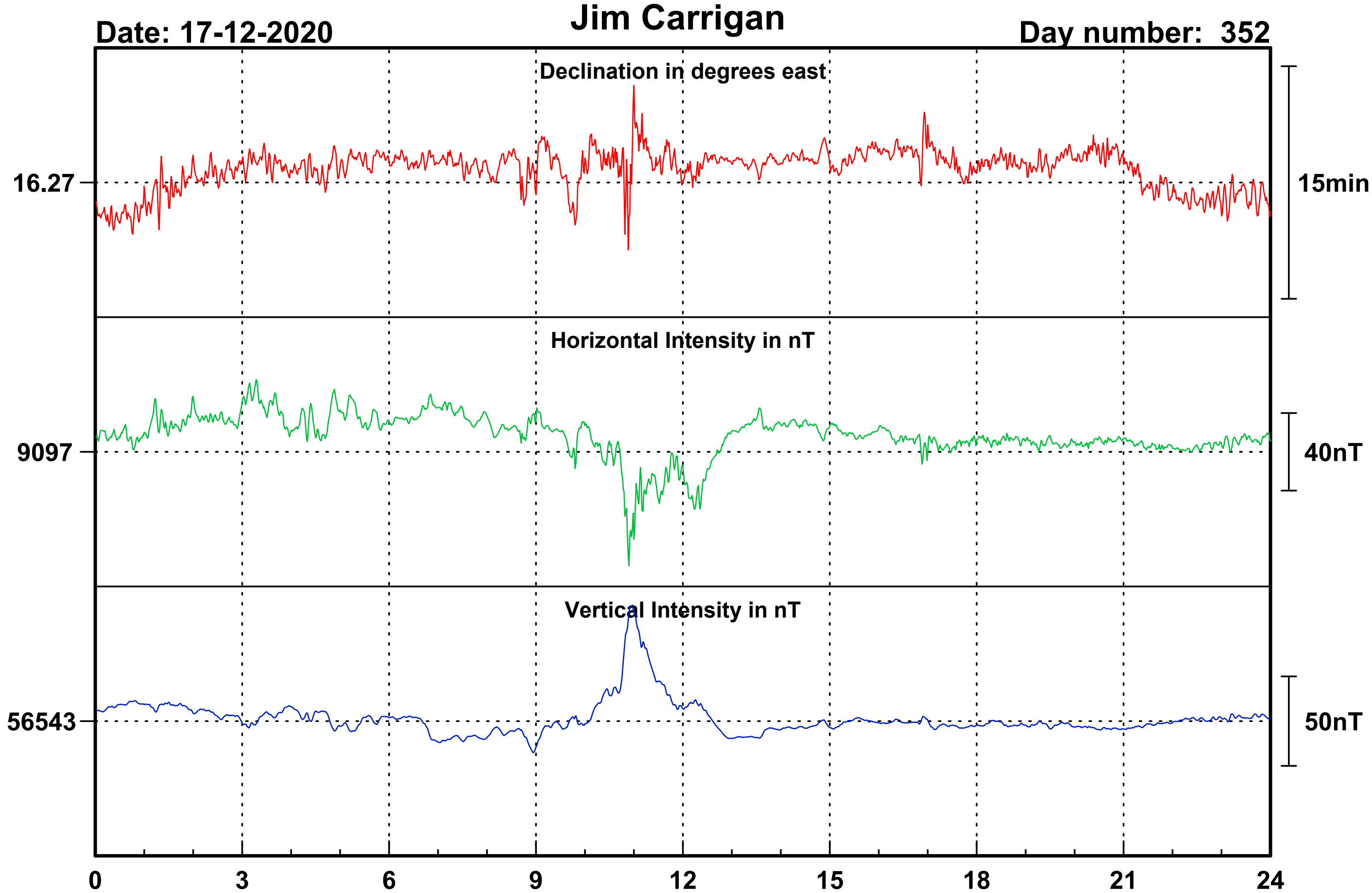
Date: 15-12-2020 Day number: 350

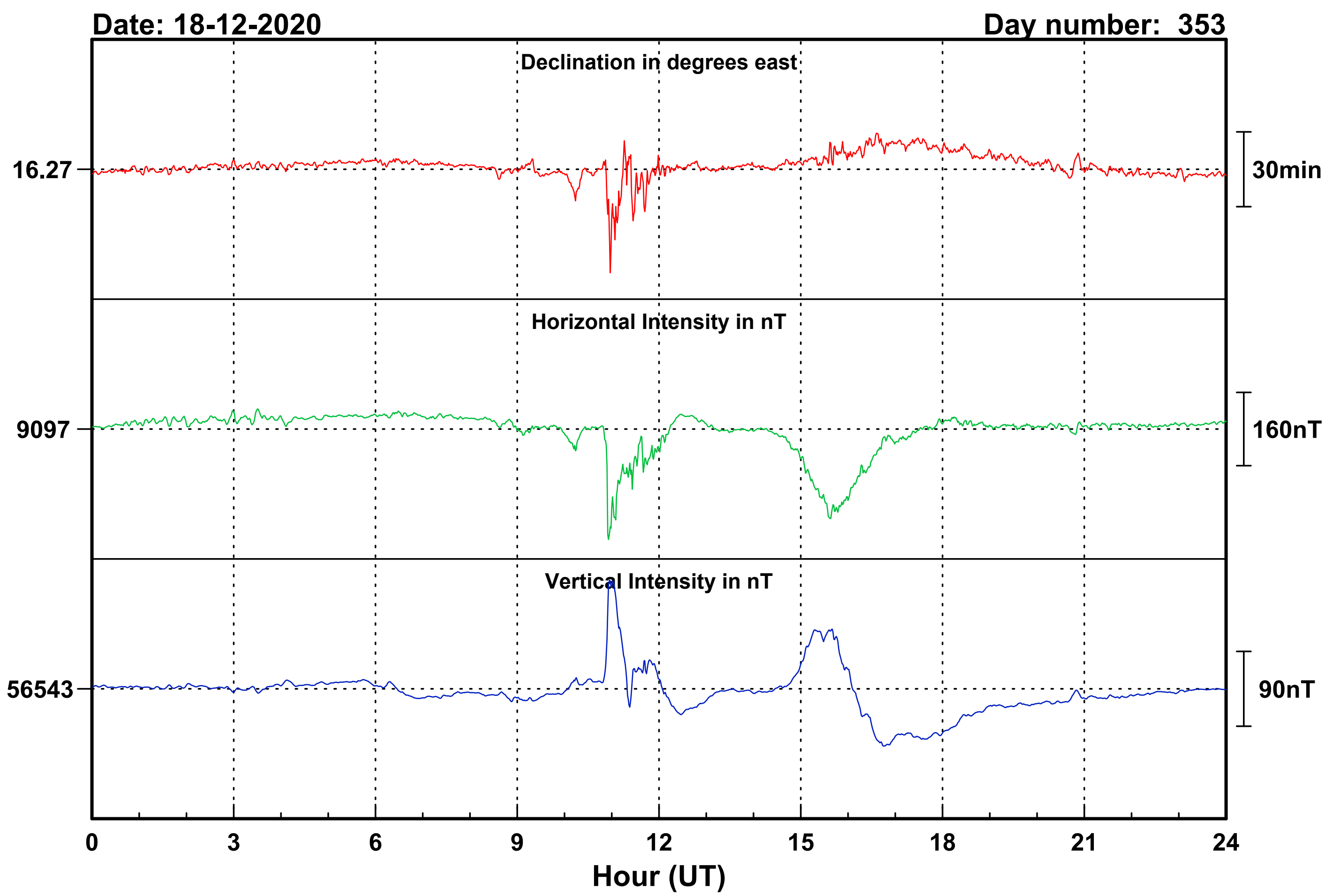


Date: 16-12-2020 Day number: 351



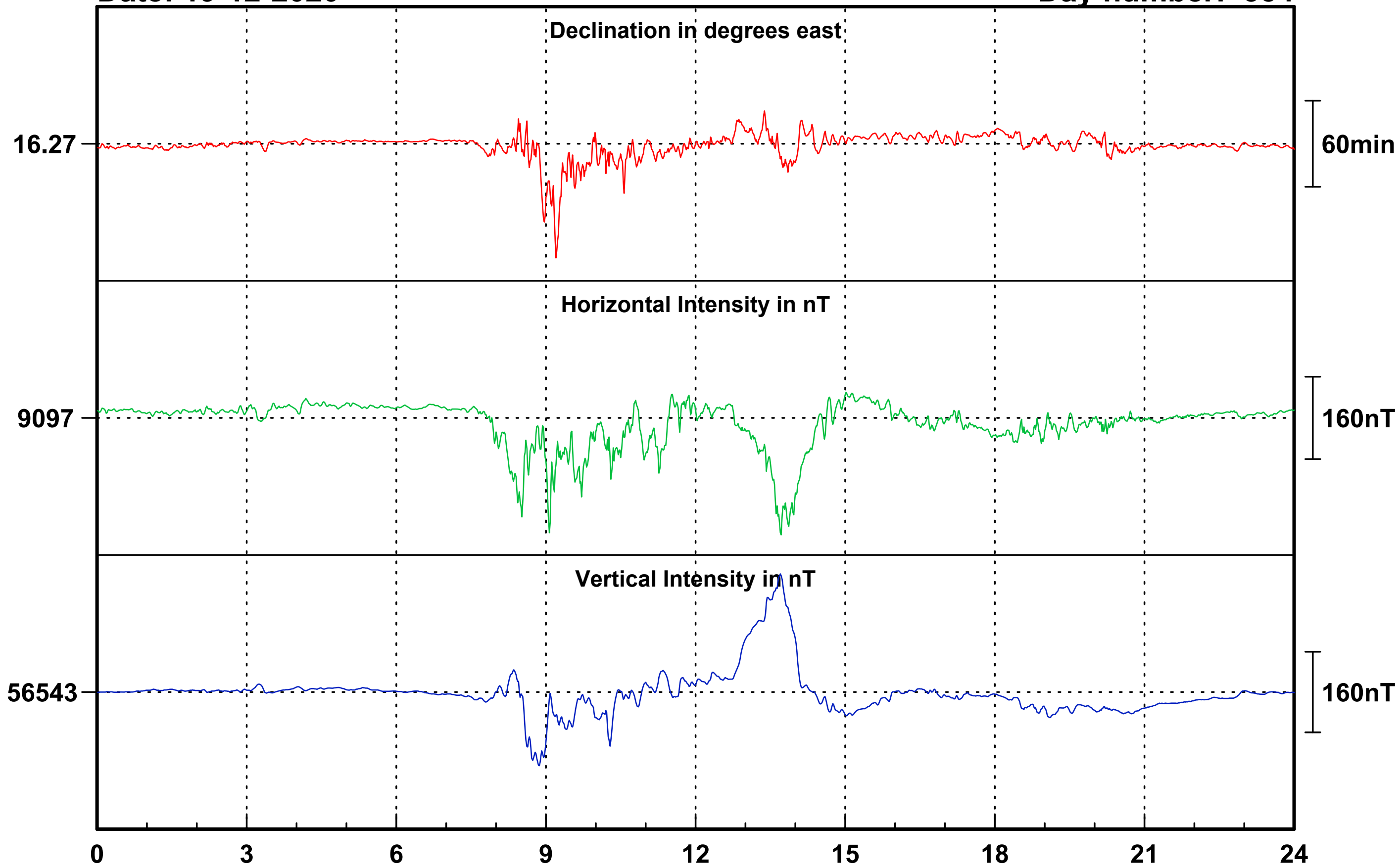
Jim Carrigan



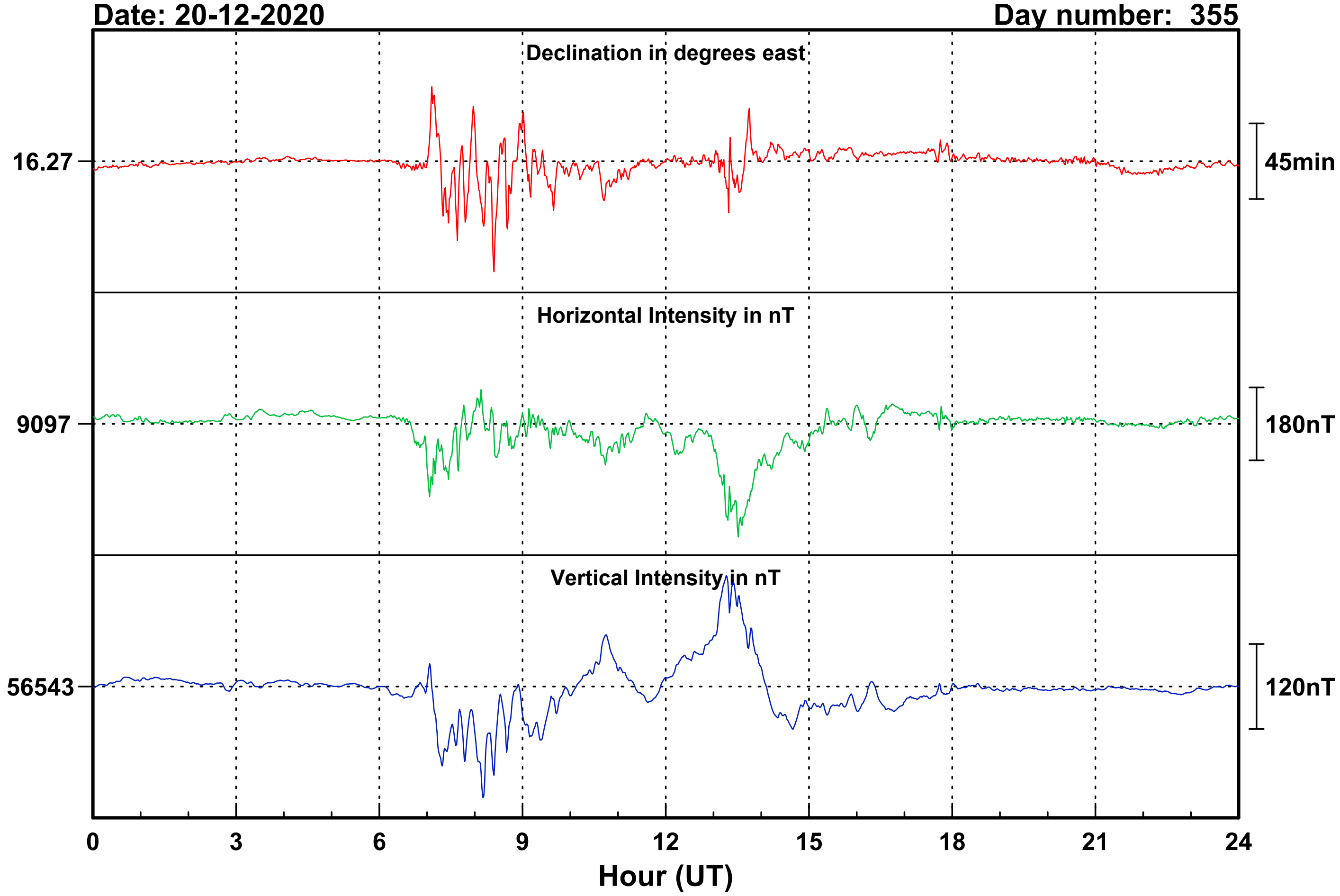


Jim Carrigan

Date: 19-12-2020 Day number: 354

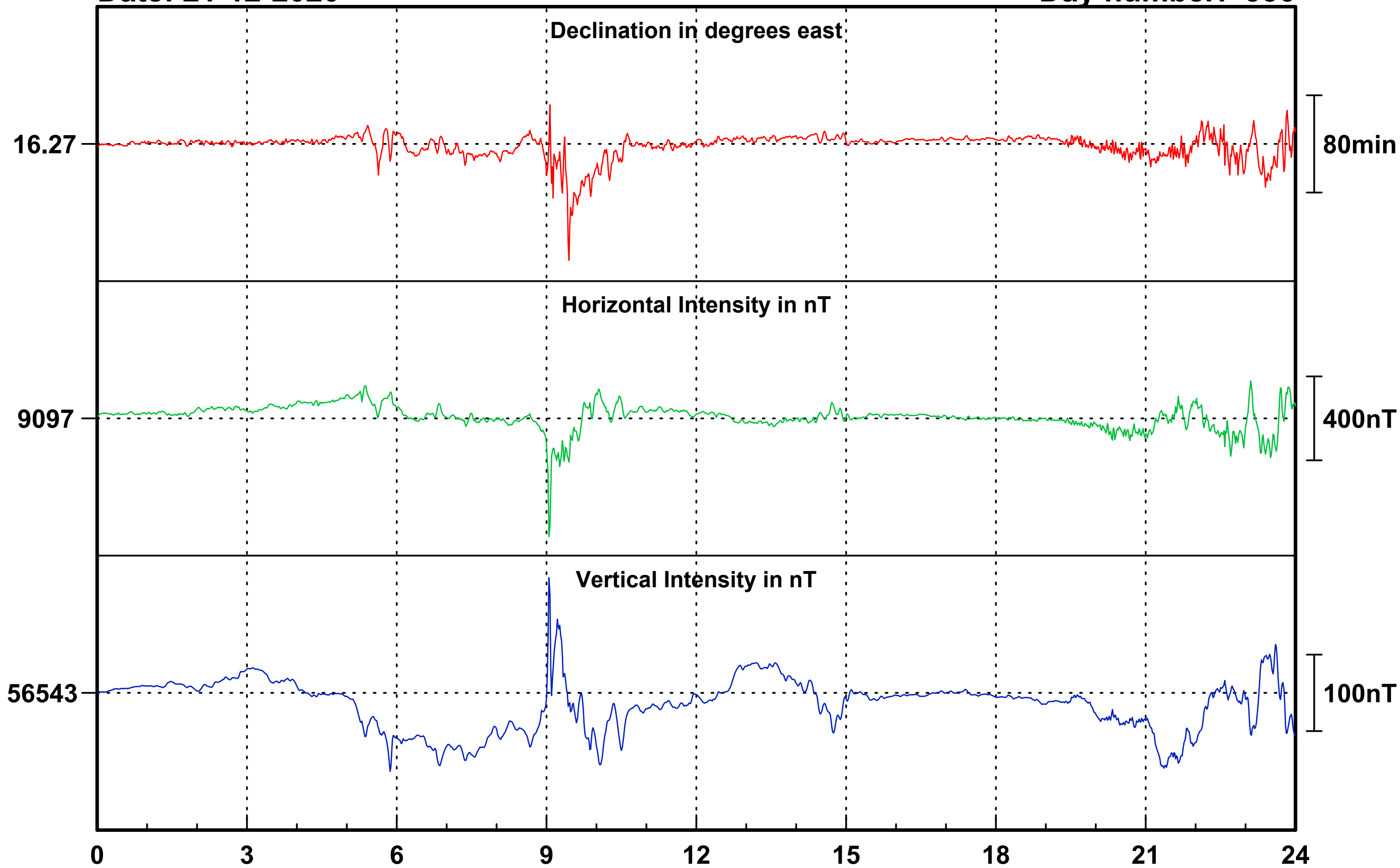


Date: 20-12-2020 Day number: 355

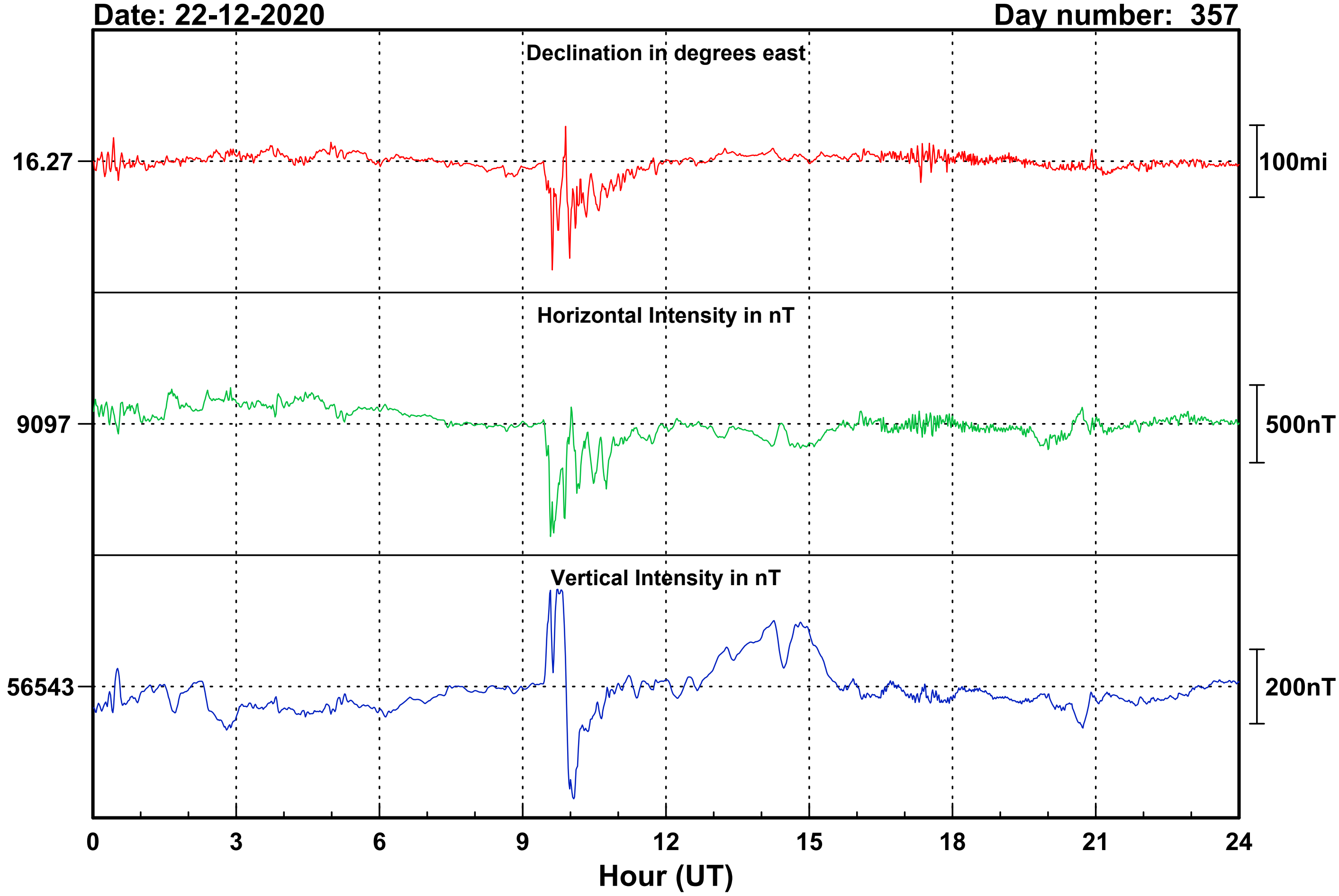


Jim Carrigan

Date: 21-12-2020 Day number: 356

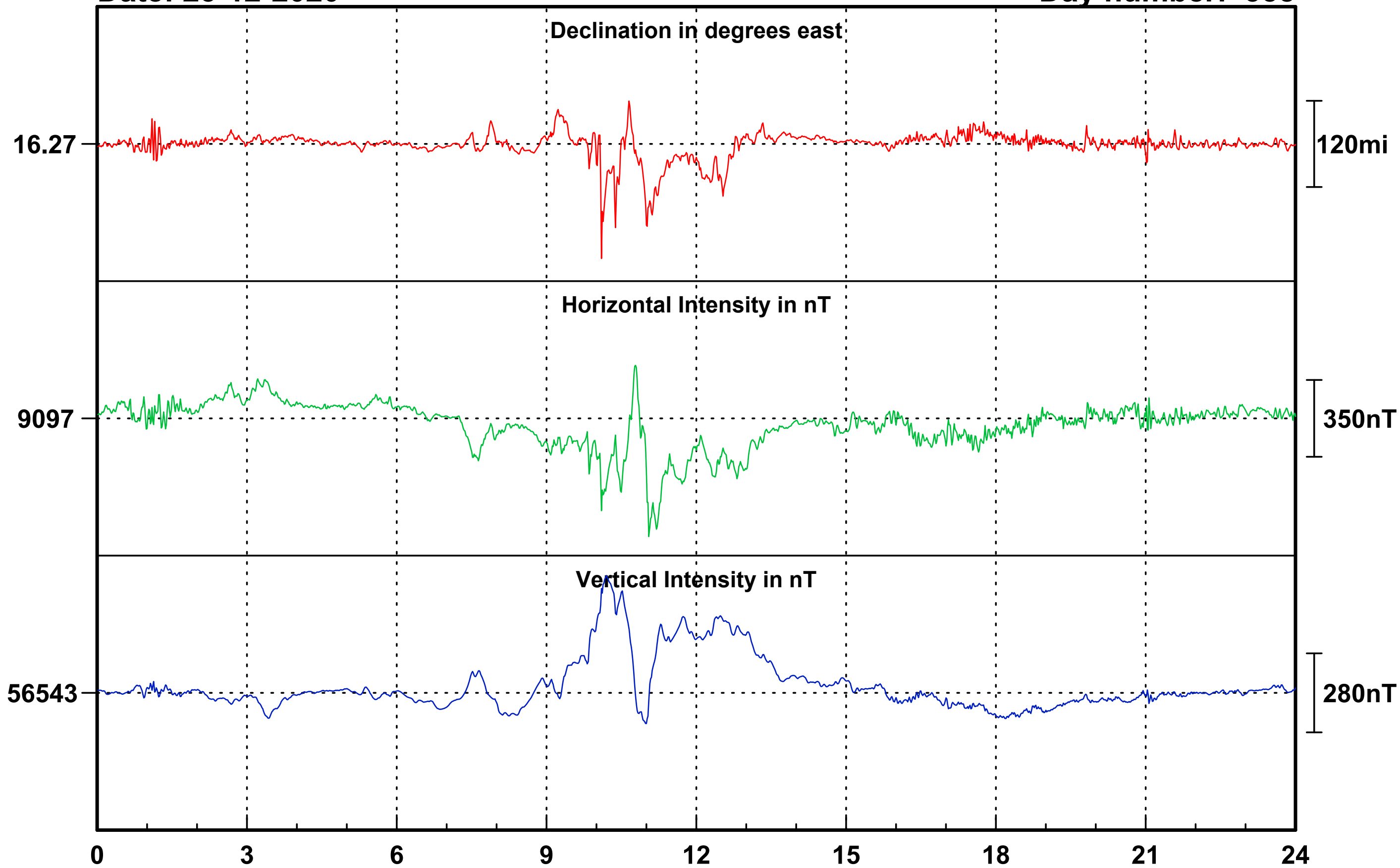


Date: 22-12-2020 Day number: 357

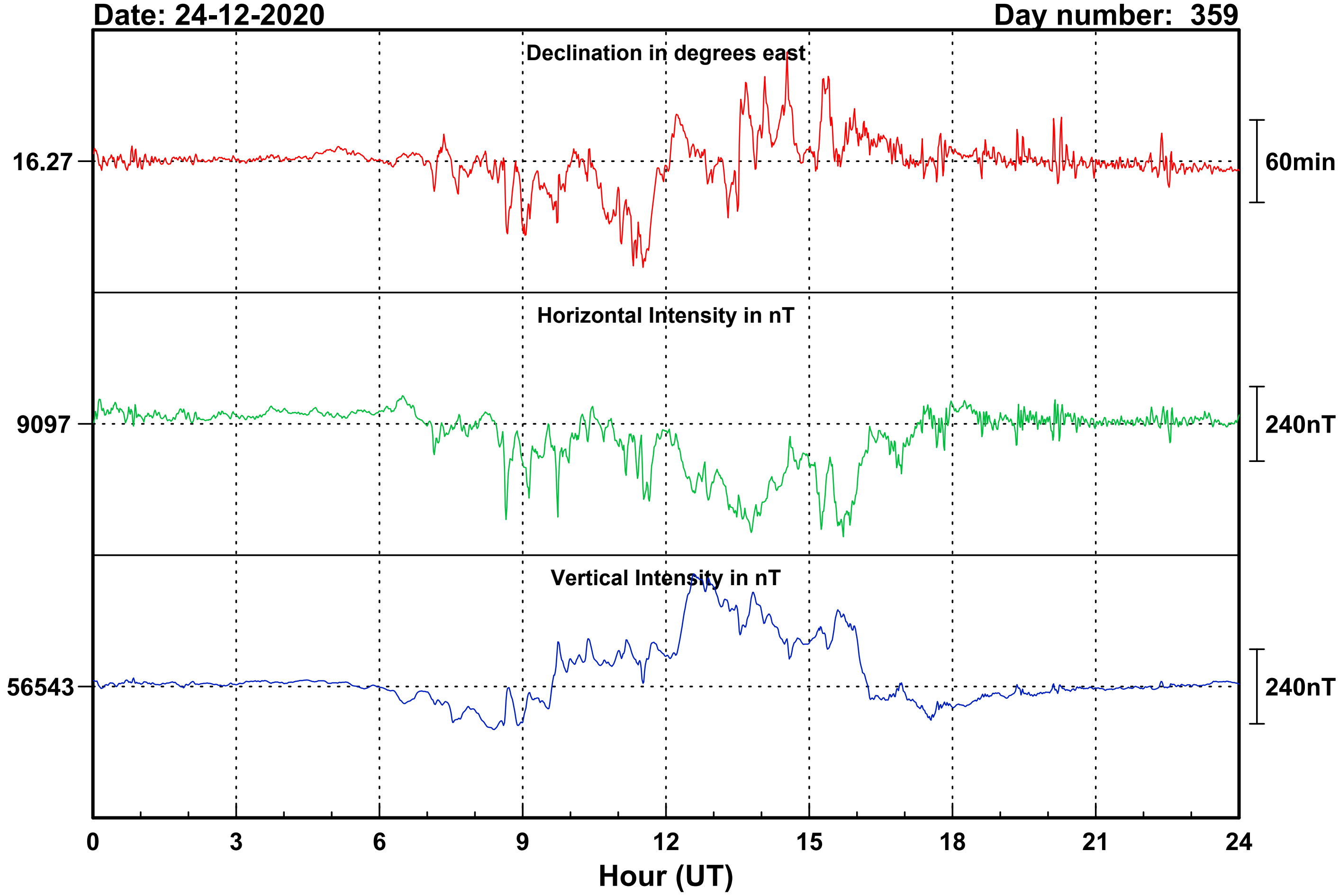


Jim Carrigan

Date: 23-12-2020 Day number: 358

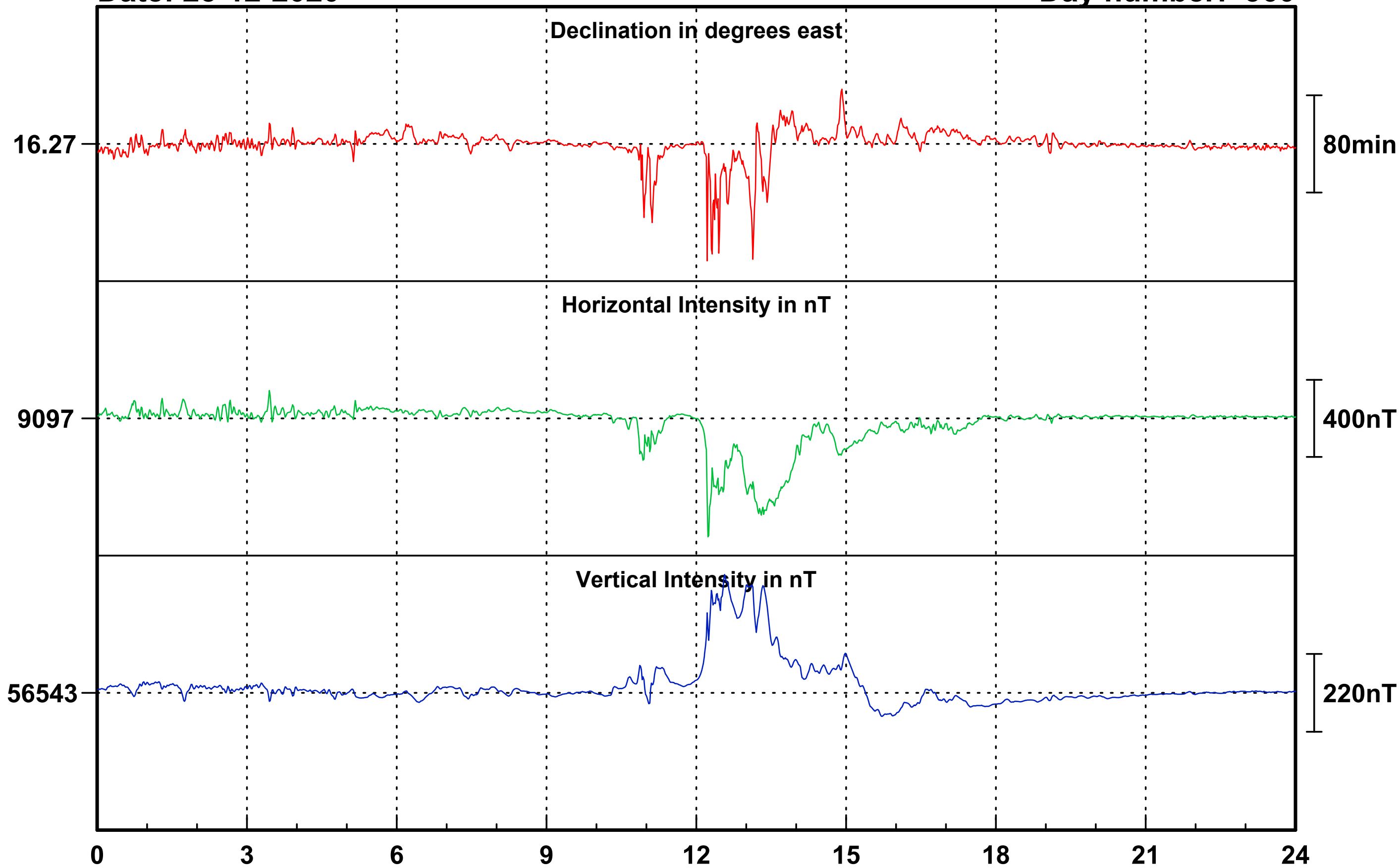


Date: 24-12-2020 Day number: 359

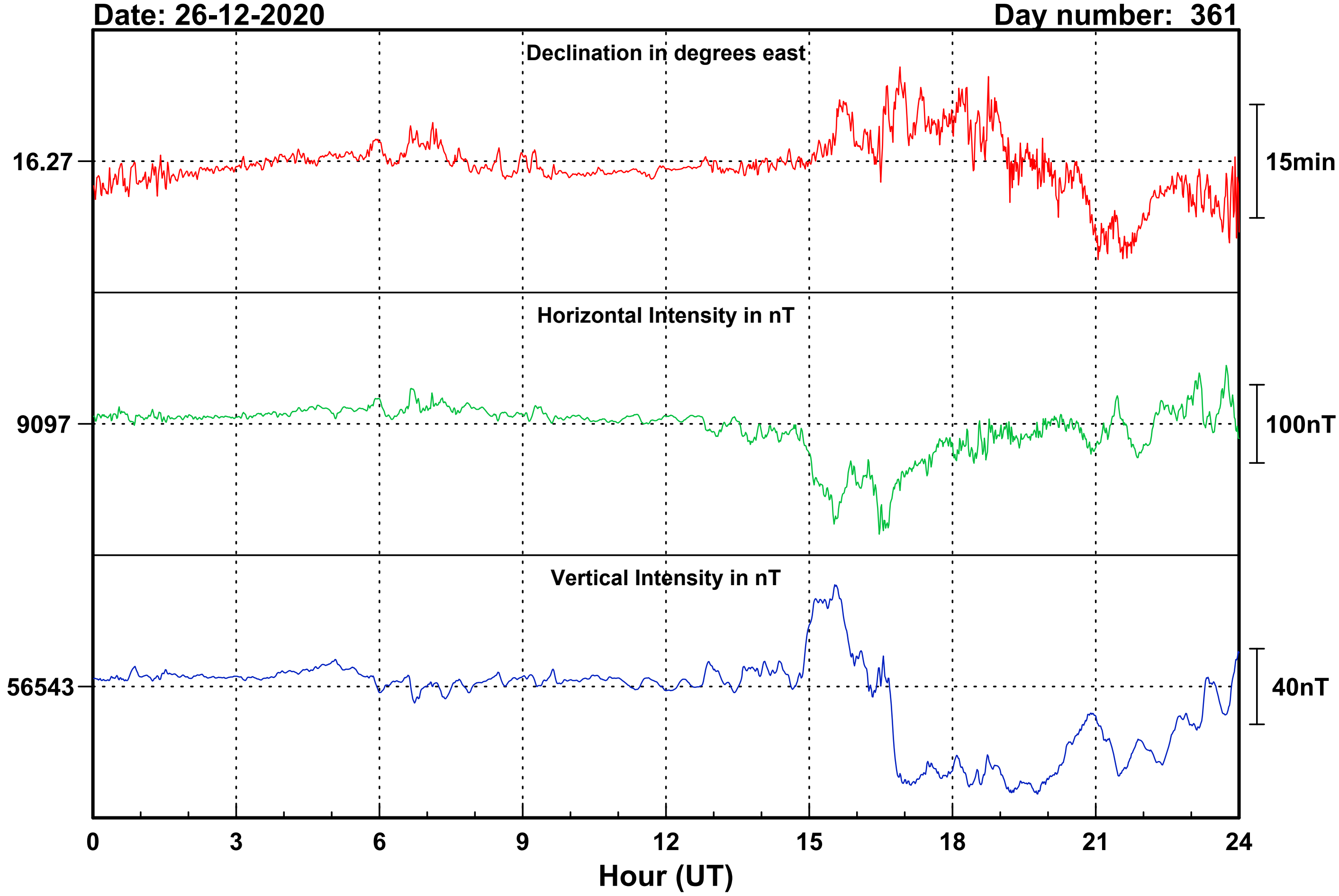


Jim Carrigan

Date: 25-12-2020 Day number: 360

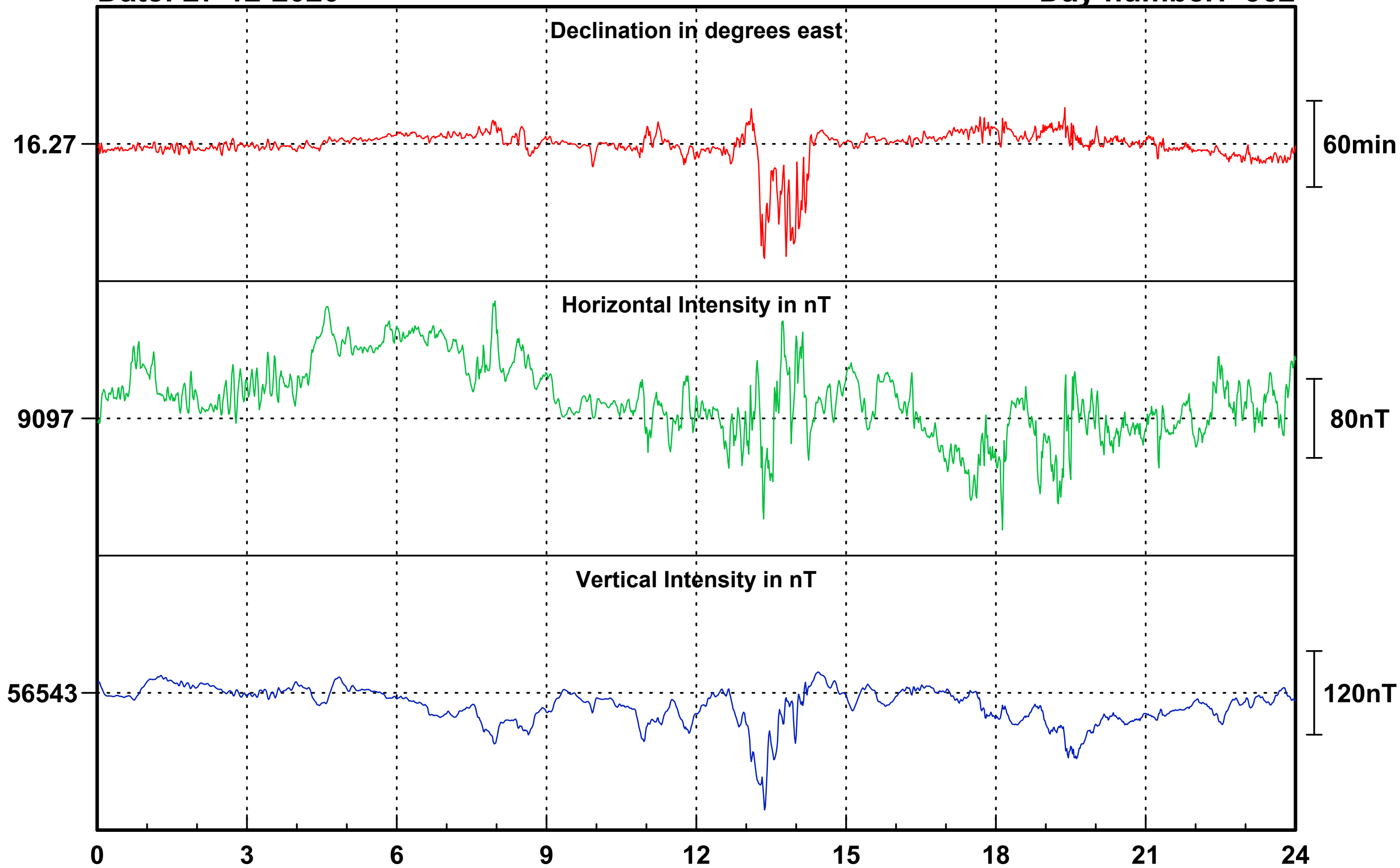


Date: 26-12-2020 Day number: 361

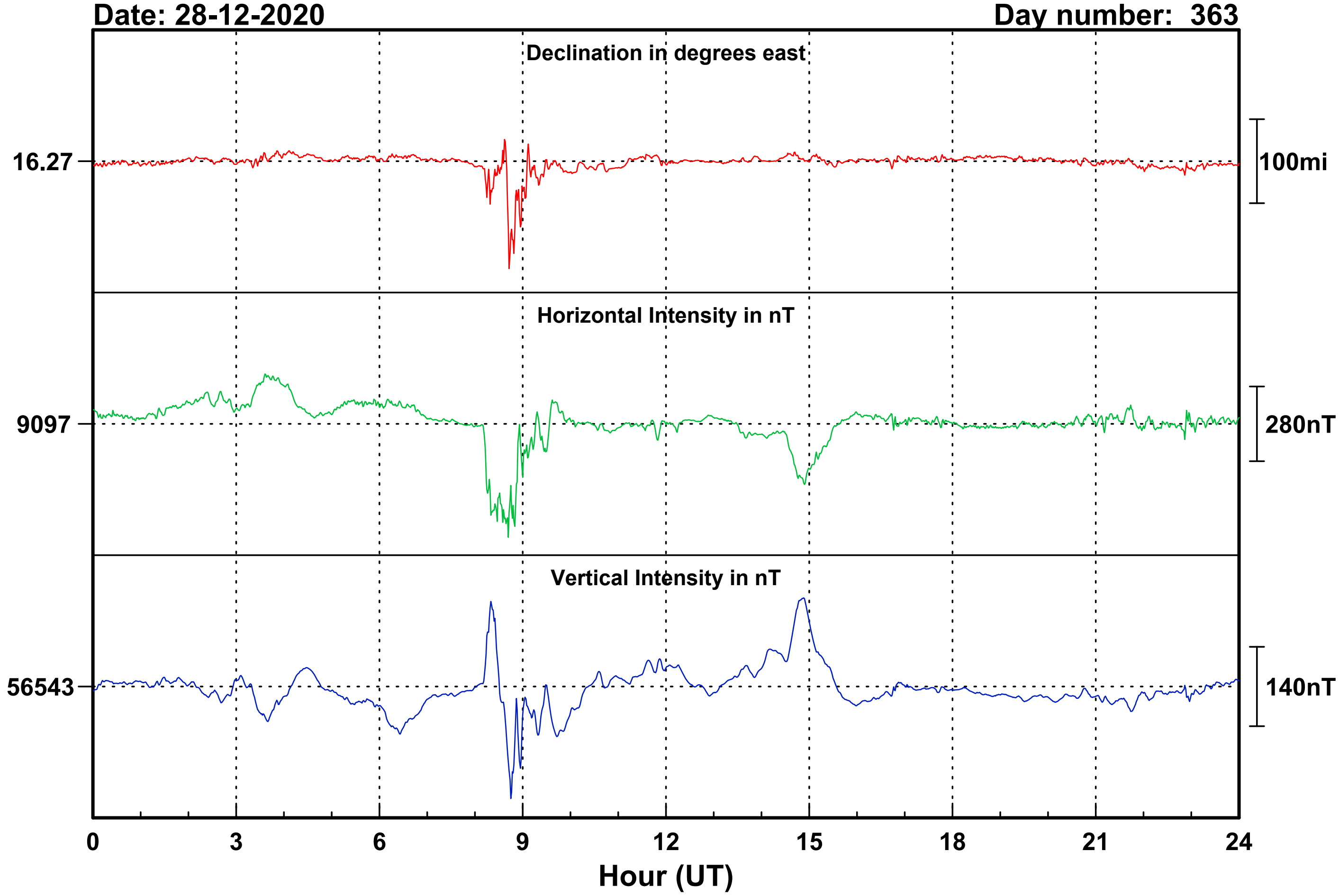


Jim Carrigan

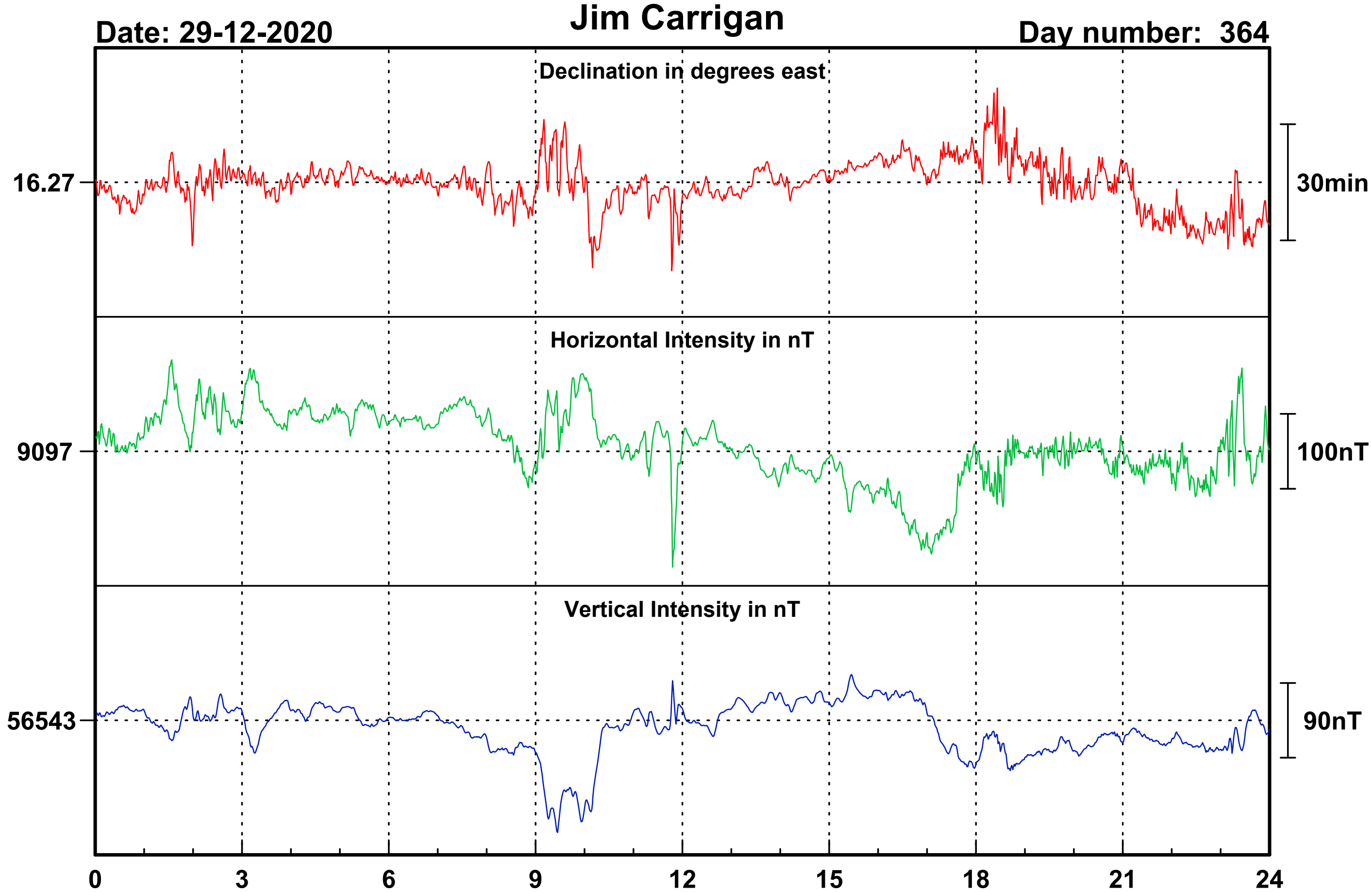
Date: 27-12-2020 Day number: 362

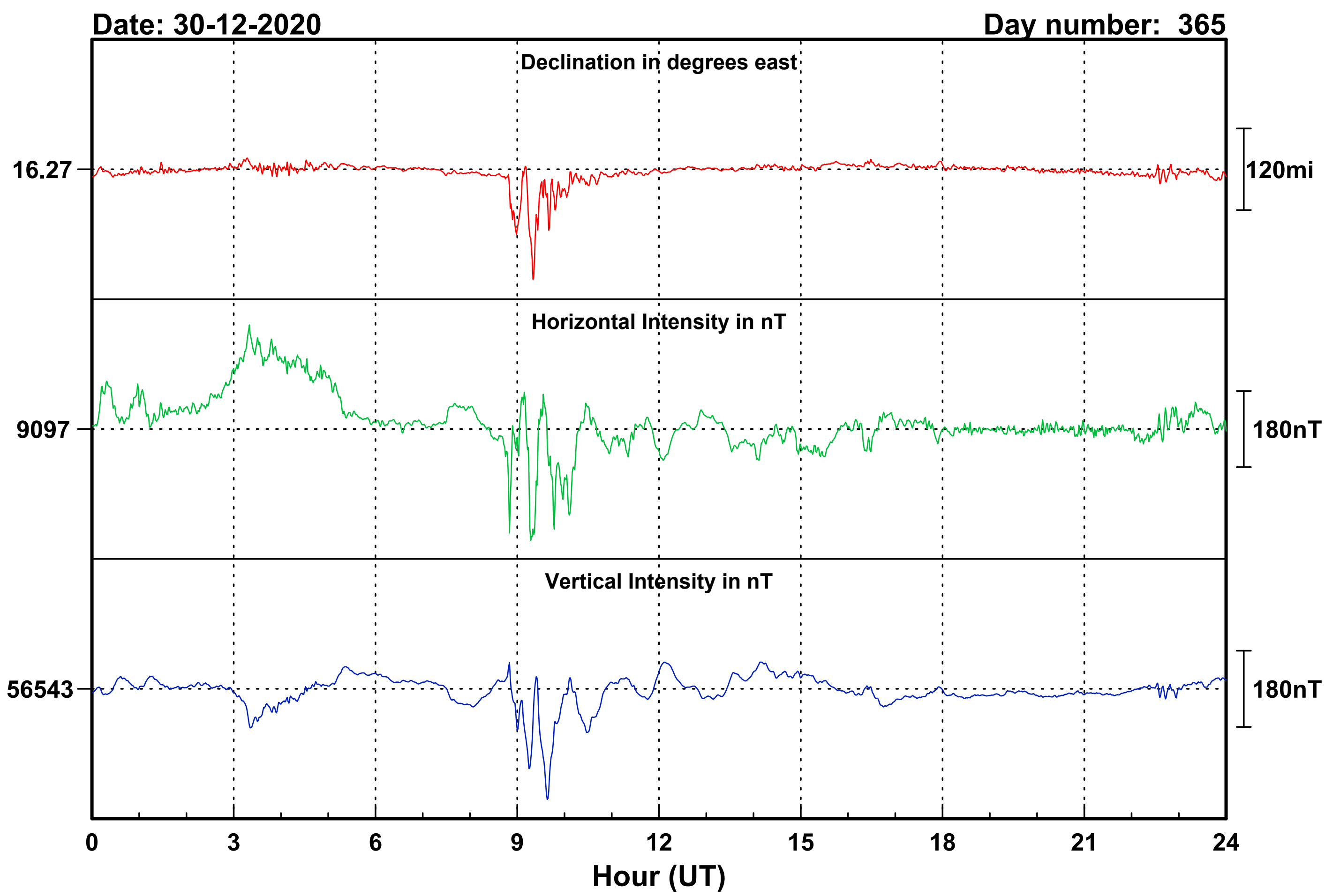


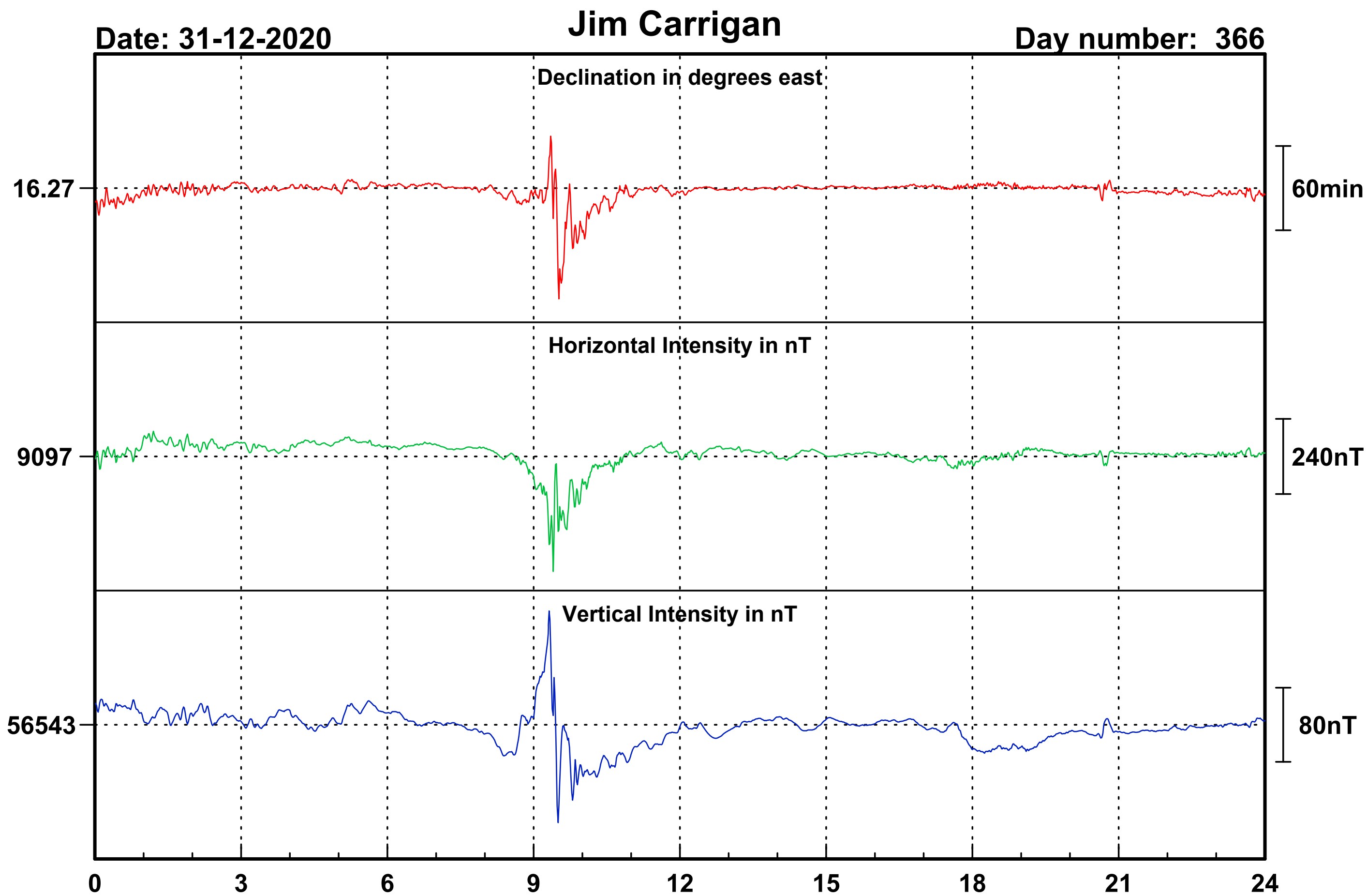
Date: 28-12-2020 Day number: 363

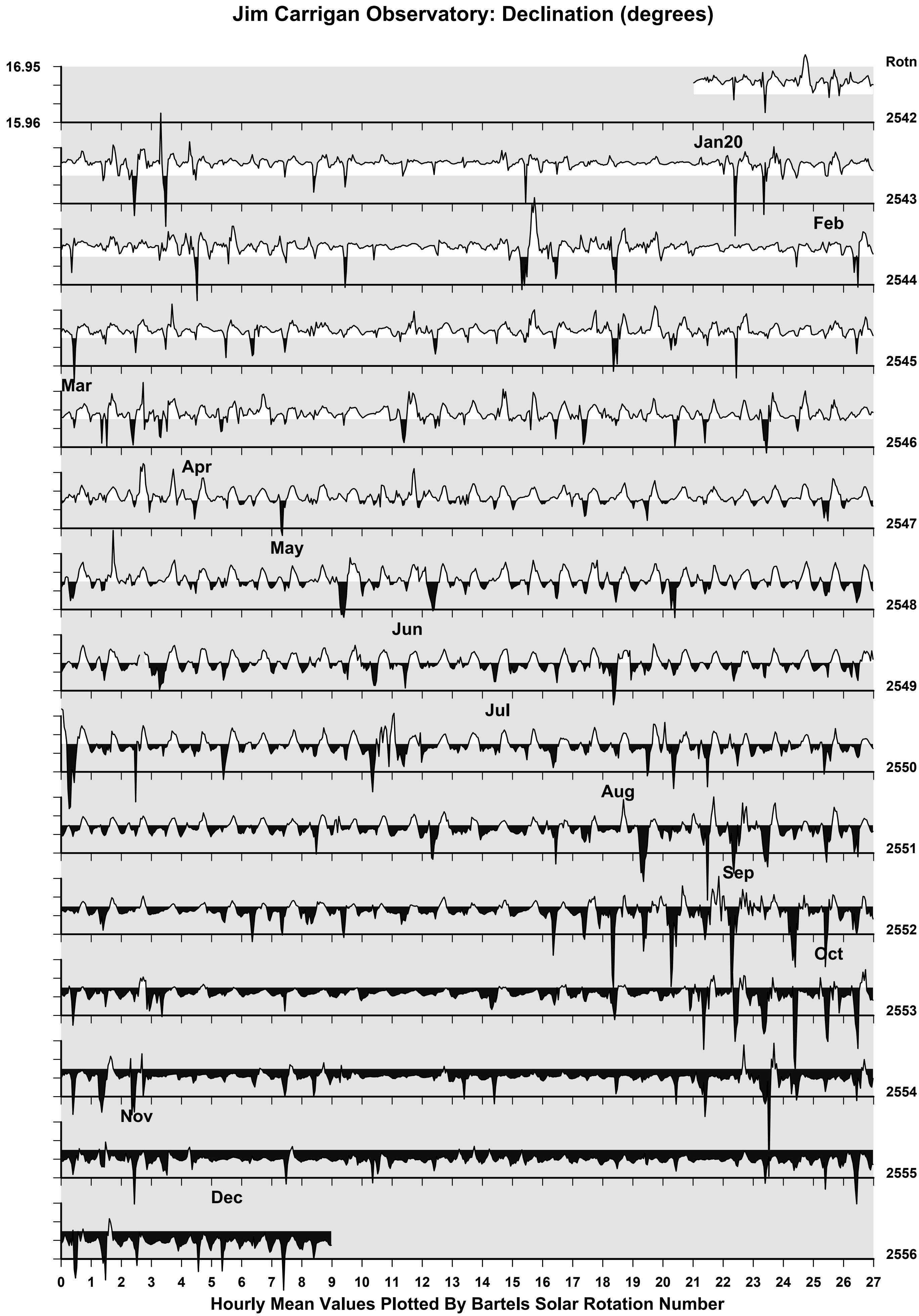


Jim Carrigan



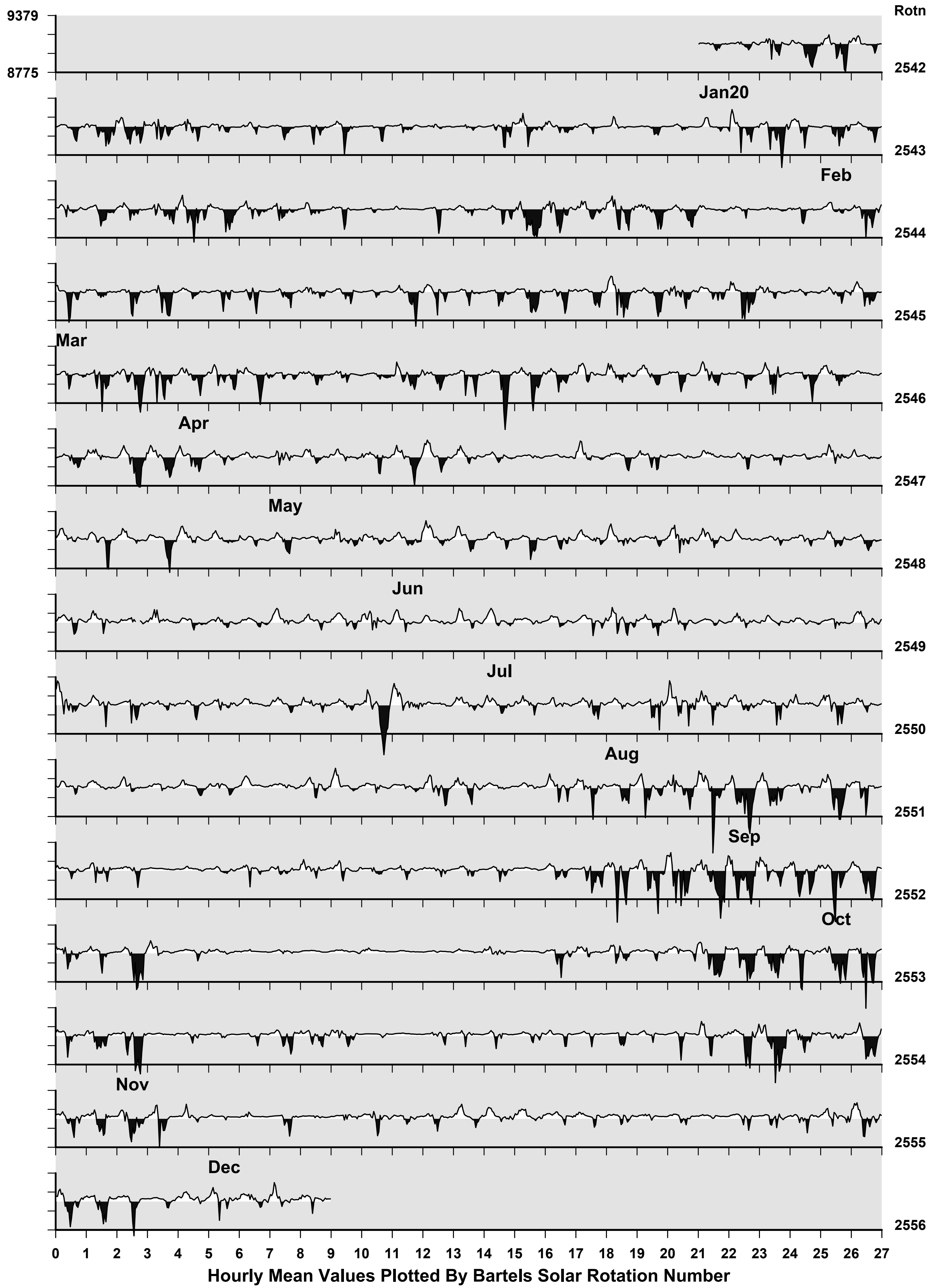



Date: 31-12-2020
Jim Carrigan
Day number: 366
Declination in degrees east
16.27
60min
Horizontal Intensity in nT
9097
240nT
Vertical Intensity in nT
56543
80nT
0
3
6
9
12
15
18
21
24

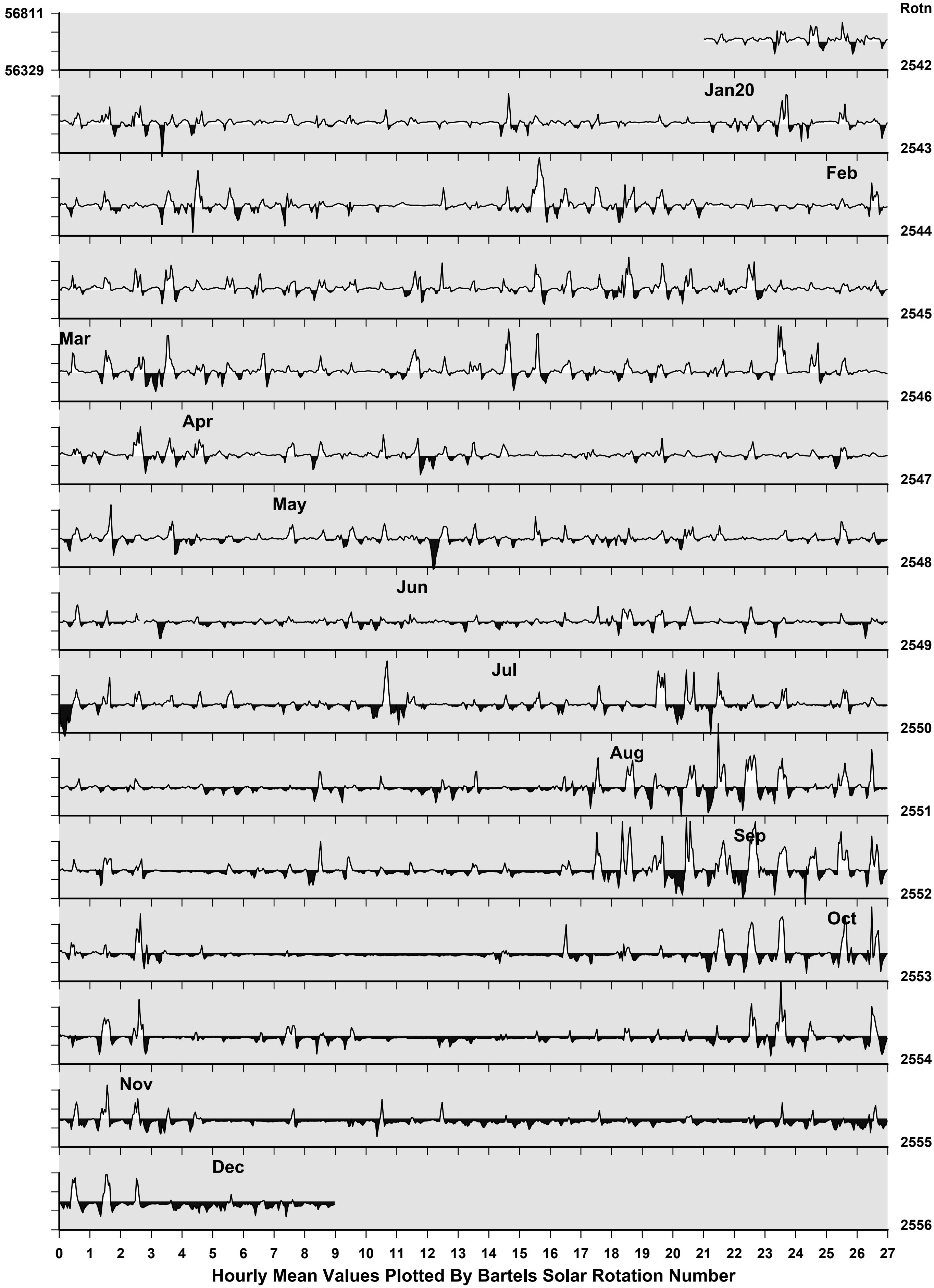


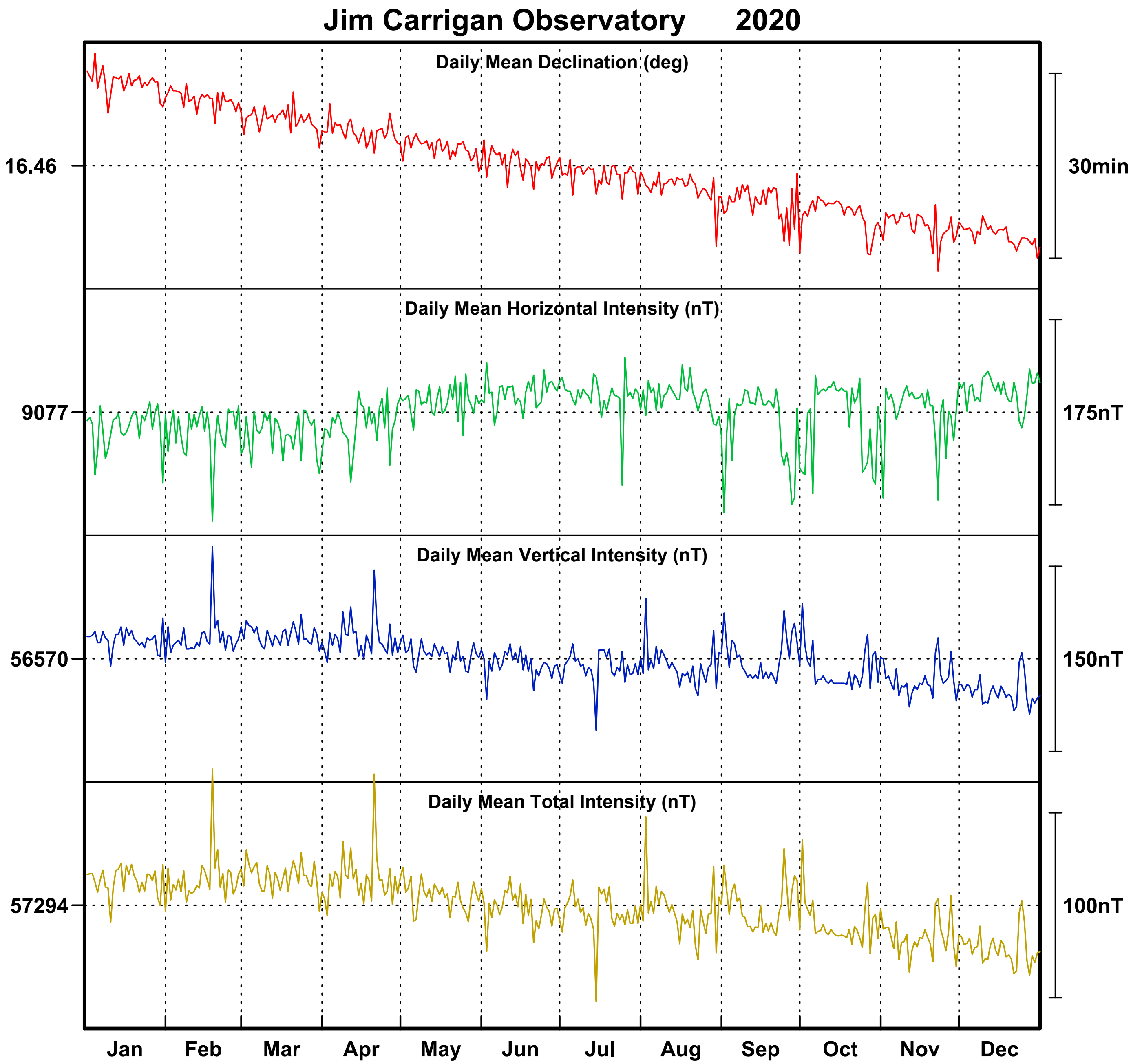
Jim Carrigan Observatory: Declination (degrees)
16.95
15.96
Rotn
2542
2543
2544
2545
2546
2547
2548
2549
2550
2551
2552
2553
2554
2555
2556
Jan20
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Hourly Mean Values Plotted By Bartels Solar Rotation Number

Jim Carrigan Observatory: Horizontal Intensity (nT)



Jim Carrigan Observatory: Vertical Intensity (nT)




Jim Carrigan Observatory 2020
Daily Mean Declination (deg)
16.46
30min
Daily Mean Horizontal Intensity (nT)
9077
175nT
Daily Mean Vertical Intensity (nT)
56570
150nT
Daily Mean Total Intensity (nT)
57294
100nT
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Monthly Mean Values for Jim Carrigan Observatory 2020

Month	*D*	*H*	*I*	*X*	*Y*	*Z*	*F*
January	16° 40.9´	9063 nT	80° 54.0´	8681 nT	2601 nT	56585 nT	57306 nT
February	16° 38.2´	9059 nT	80° 54.3´	8680 nT	2594 nT	56588 nT	57308 nT
March	16° 34.9´	9057 nT	80° 54.4´	8680 nT	2585 nT	56589 nT	57309 nT
April	16° 32.9´	9067 nT	80° 53.8´	8691 nT	2582 nT	56586 nT	57308 nT
May	16° 30.3´	9087 nT	80° 52.5´	8713 nT	2582 nT	56574 nT	57299 nT
June	16° 28.0´	9095 nT	80° 51.9´	8722 nT	2578 nT	56565 nT	57292 nT
July	16° 25.9´	9092 nT	80° 52.1´	8721 nT	2572 nT	56563 nT	57289 nT
August	16° 23.9´	9091 nT	80° 52.2´	8721 nT	2566 nT	56564 nT	57290 nT
September	16° 21.3´	9065 nT	80° 53.8´	8698 nT	2553 nT	56570 nT	57292 nT
October	16° 19.7´	9072 nT	80° 53.3´	8706 nT	2551 nT	56561 nT	57284 nT
November	16° 17.7´	9077 nT	80° 52.9´	8713 nT	2547 nT	56552 nT	57276 nT
December	16° 16.1´	9097 nT	80° 51.6´	8733 nT	2549 nT	56543 nT	57270 nT

<u>Note</u>

i. The values shown here are provisional.