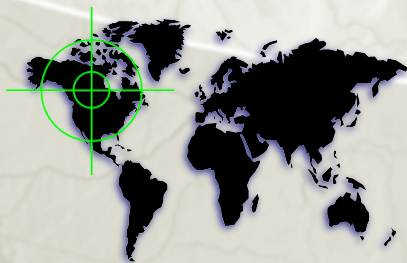


BRITISH GEOLOGICAL SURVEY

**Fort
McMurray
Observatory
Monthly
Magnetic
Bulletin
April 2015
15/04/FM**



**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

RESEARCH COUNCIL

FORT McMURRAY OBSERVATORY MAGNETIC DATA

1. Introduction

Fort McMurray Observatory is the sixth overseas geomagnetic observatory established by the British Geological Survey (BGS). The installation was a joint venture between BGS and Halliburton Group Canada in support of directional drilling programmes and was carried out in December 2014, with usable data being recorded from January 2015.

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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British Geological Survey
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Edinburgh EH9 3LA
Scotland, UK

Tel: +44 (0) 131 667 1000

Fax: +44 (0) 131 668 2683

E-mail: enquiries@bgs.ac.uk

Internet: www.geomag.bgs.ac.uk

2. Position

Fort McMurray Observatory is situated near a Halliburton installation to the south of the town of Fort McMurray in Alberta, Canada. The observatory co-ordinates are:-

Geographic: 56° 35'53"N 248° 41'06" E

Geomagnetic: 63° 31'41"N 309° 32'49" E

Height above mean sea level: 386m

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 2015.5. 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 December 2014. 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 25-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 Fort McMurray observatory, operated by Halliburton Group Canada and the British Geological Survey.'

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

FORT McMURRAY OBSERVATORY

ABSOLUTE OBSERVATIONS

Date	Day Number	Declination			Inclination		Total Field		Horizontal Intensity		Vertical Intensity		Observer
		Time (UT)	Absolute (°)	Baseline (°)	Time (UT)	Absolute (°)	Site difference (nT)	Absolute corrected (nT)	Absolute (nT)	Baseline (nT)	Absolute (nT)	Baseline (nT)	
06-Apr-15	96	20:27	14.8167	14.6017	20:50	77.7250	0.5	57793.8	12287.2	12324.0	56472.6	56488.3	TM
06-Apr-15	96	21:04	14.8196	14.6417	21:14	77.7225	0.5	57792.8	12289.4	12323.8	56471.0	56488.3	TM
06-Apr-15	96	21:28	14.8075	14.6617	21:37	77.7242	0.5	57791.4	12287.5	12324.2	56470.0	56488.2	TM
06-Apr-15	96	22:24	14.7304	14.6183	22:40	77.7079	0.5	57796.7	12304.7	12323.2	56471.7	56488.3	TM
30-Apr-15	120	21:10	14.7158	14.5600	21:19	77.6846	0.5	57786.8	12325.5	12323.9	56457.0	56487.9	SP
30-Apr-15	120	21:37	14.7408	14.5783	21:50	77.6792	0.5	57786.1	12330.7	12324.8	56455.2	56487.7	SP
30-Apr-15	120	22:03	14.7296	14.5650	22:10	77.6763	0.5	57790.1	12334.5	12322.6	56458.5	56488.1	SP
30-Apr-15	120	23:31	14.8042	14.6283	23:37	77.6758	0.5	57789.0	12334.6	12322.7	56457.3	56488.1	SP

Fort McMurray 2015

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

14.62

50min

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

12324

20nT

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

56488

6nT

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

-0.5

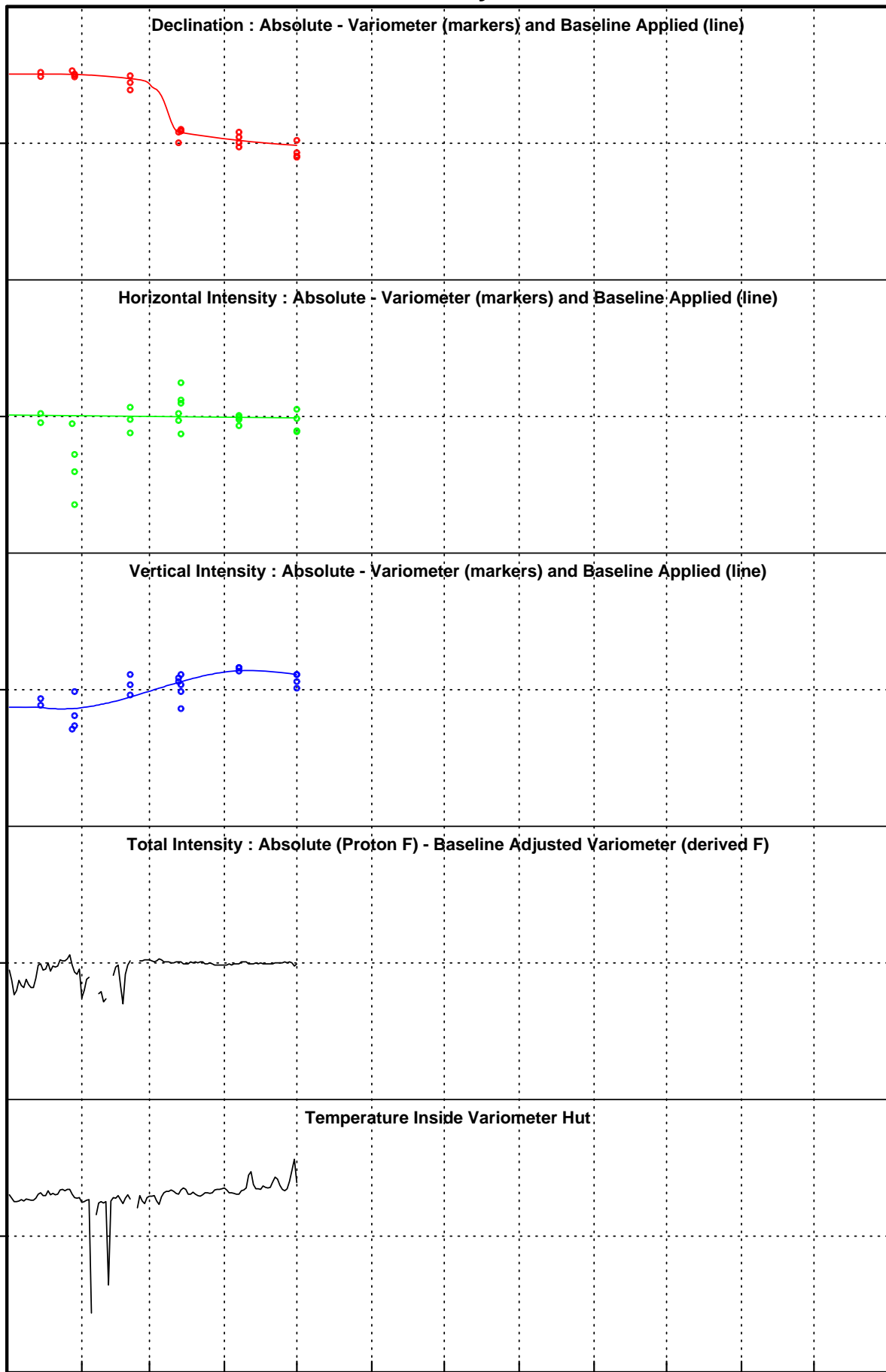
20nT

Temperature Inside Variometer Hut

19.4

30°C

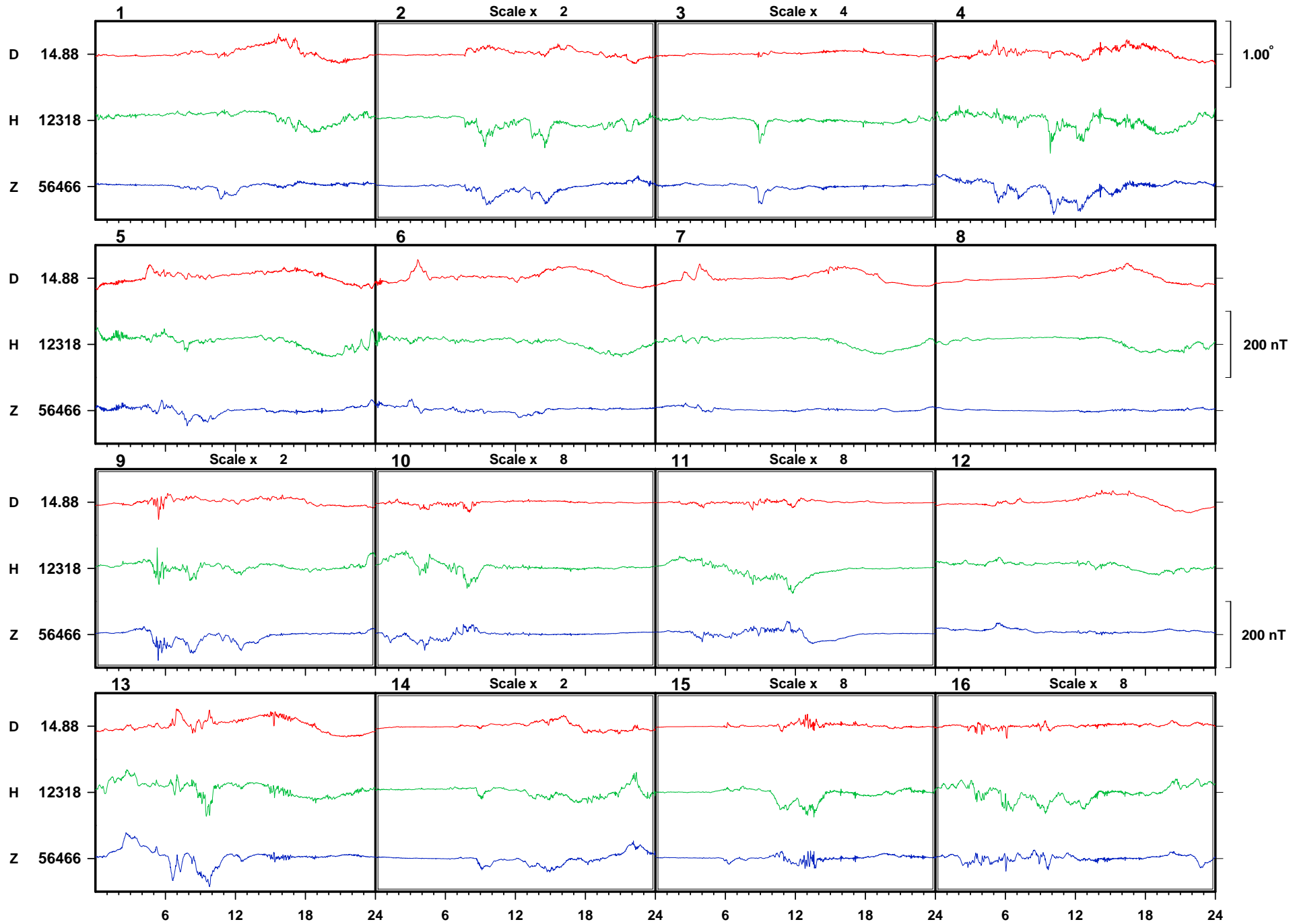
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

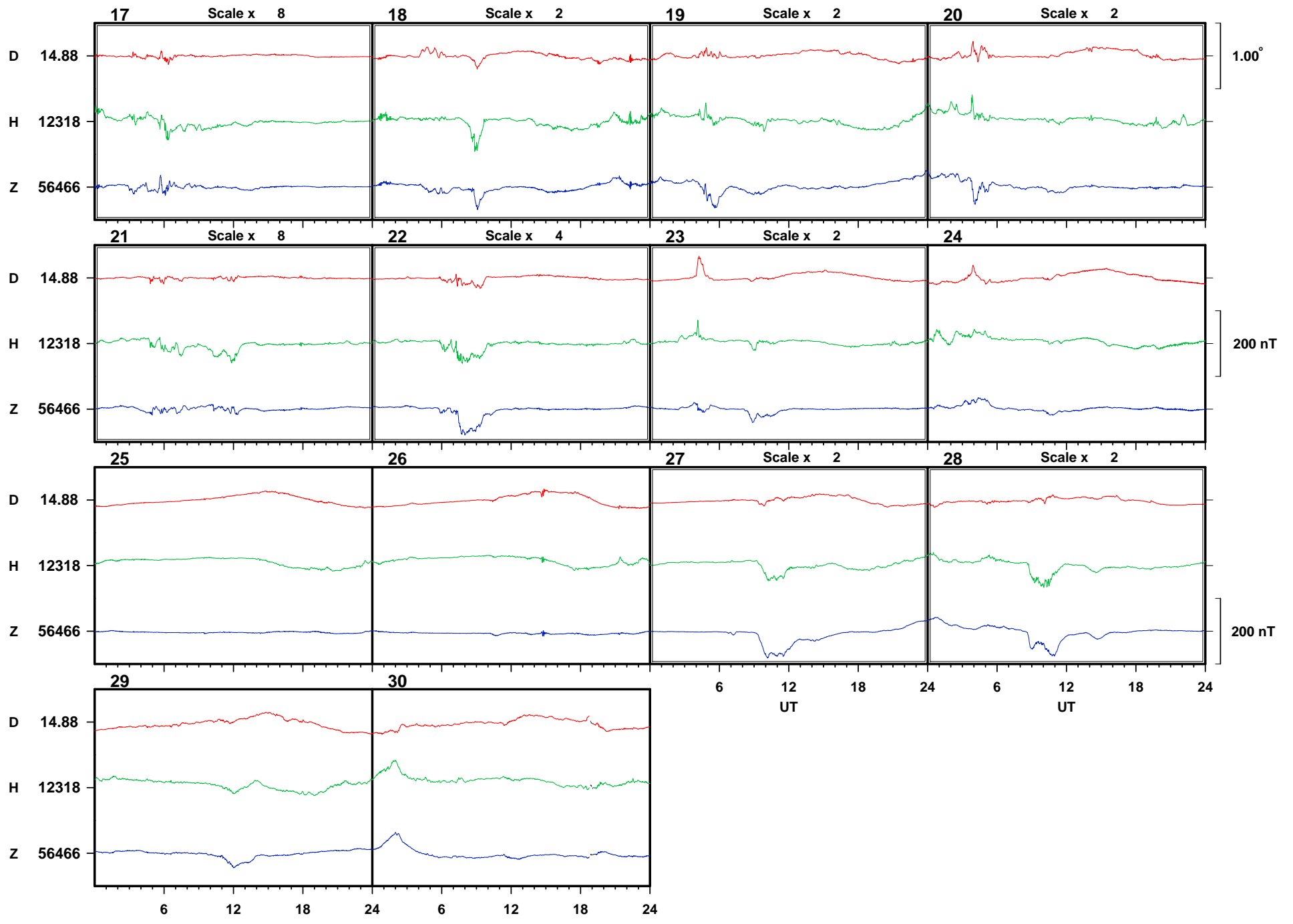


Fort McMurray

April

2015





Fort McMurray

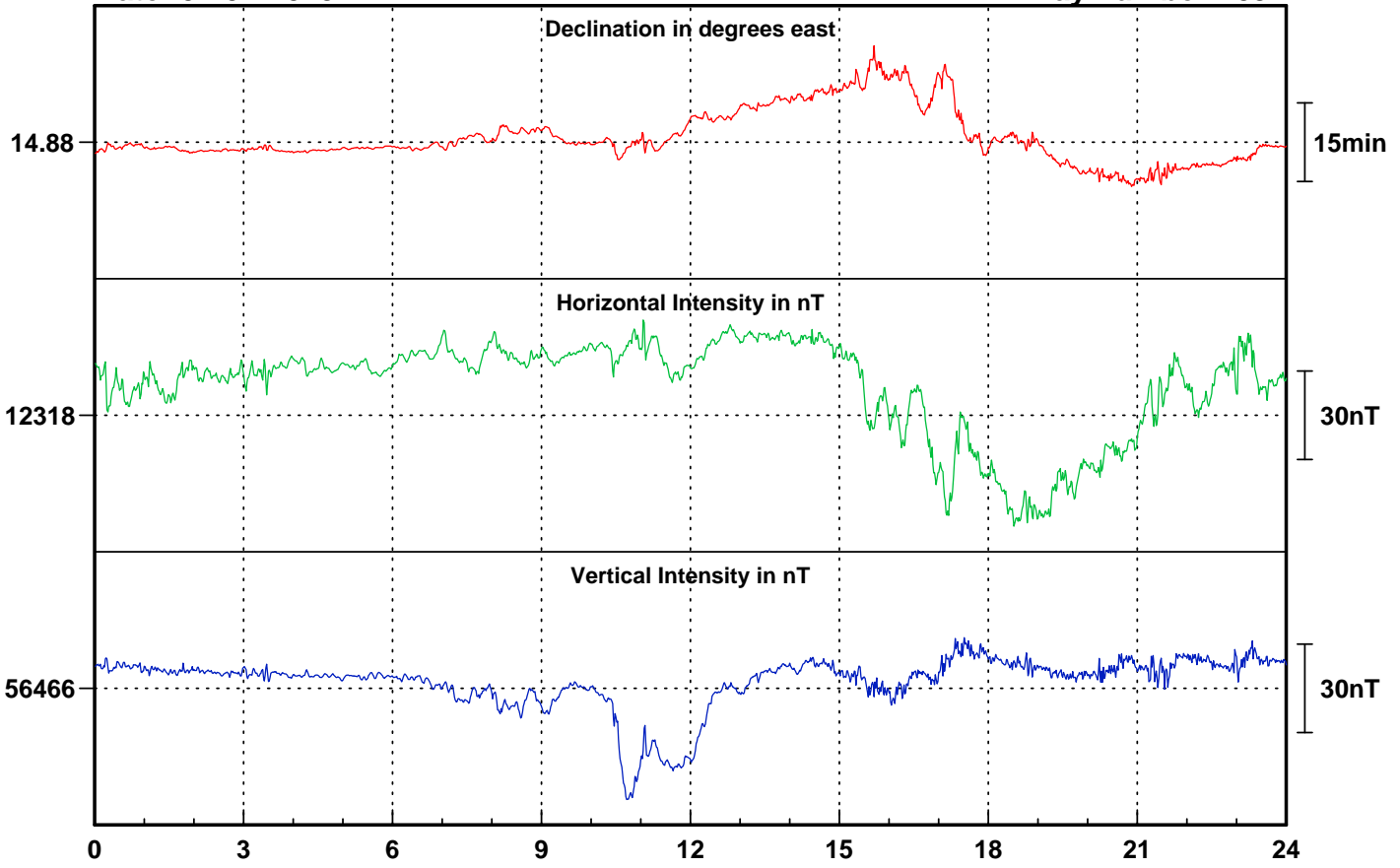
April

2015

Date: 01-04-2015

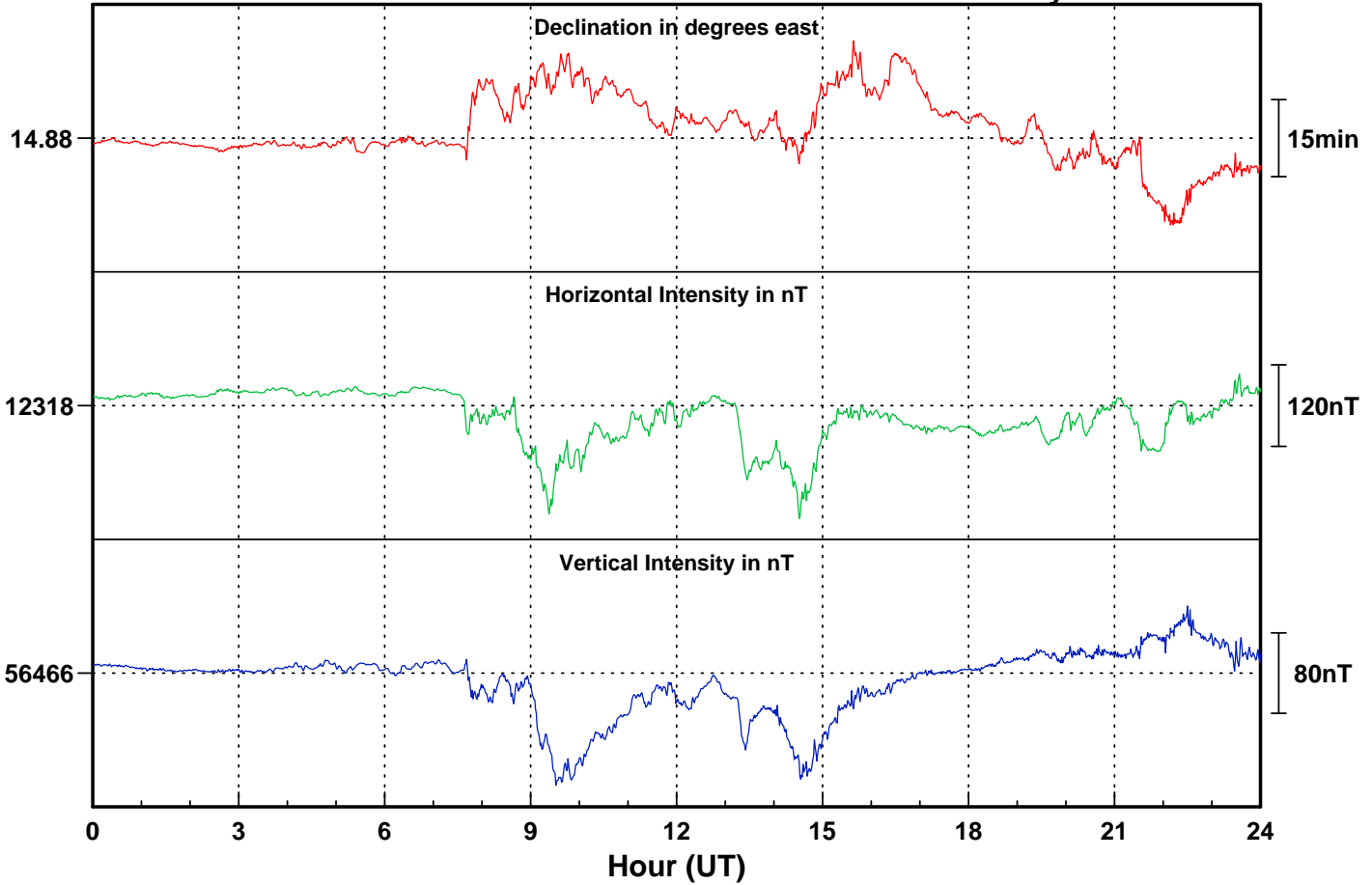
Fort McMurray

Day number: 091



Date: 02-04-2015

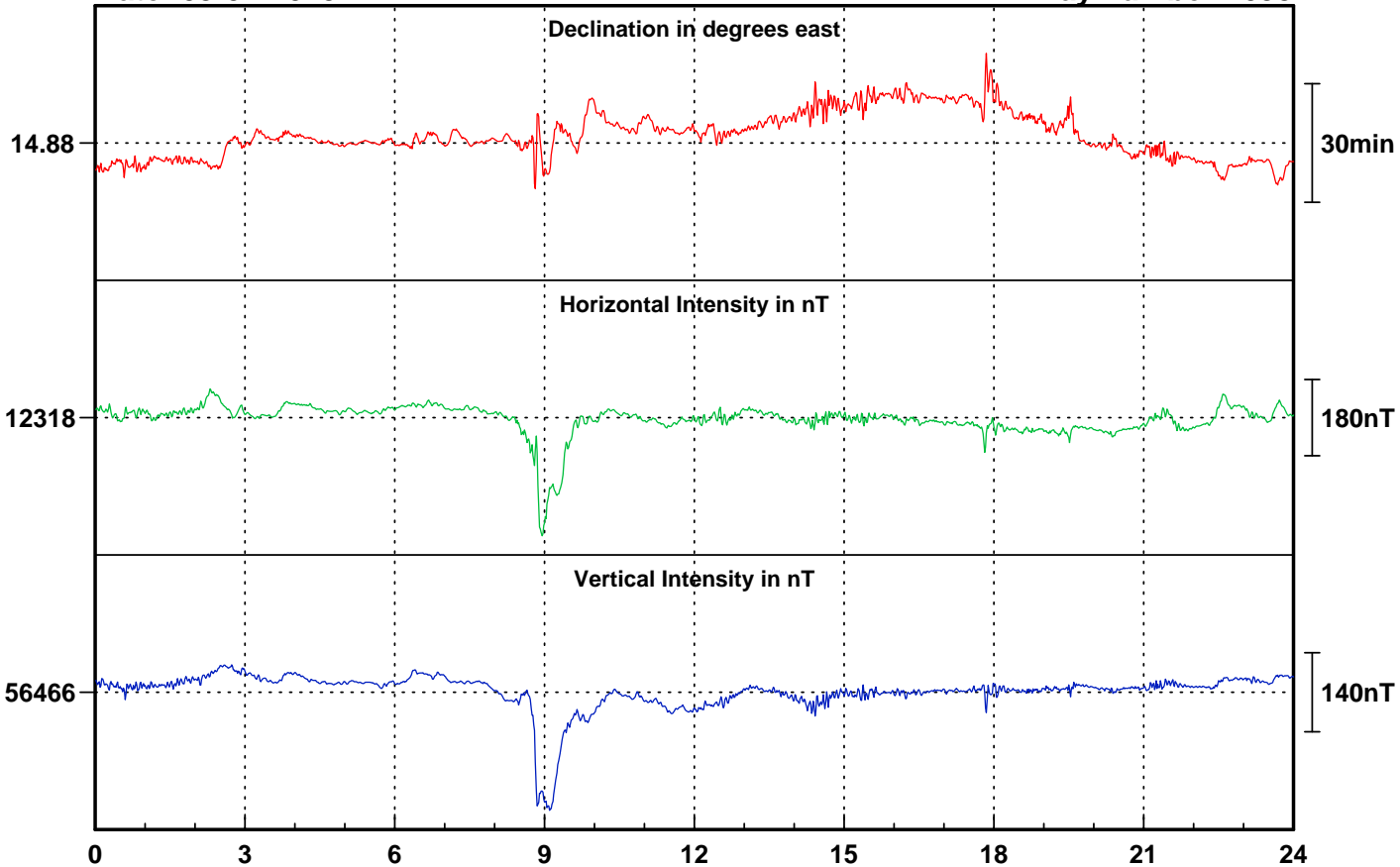
Day number: 092



Date: 03-04-2015

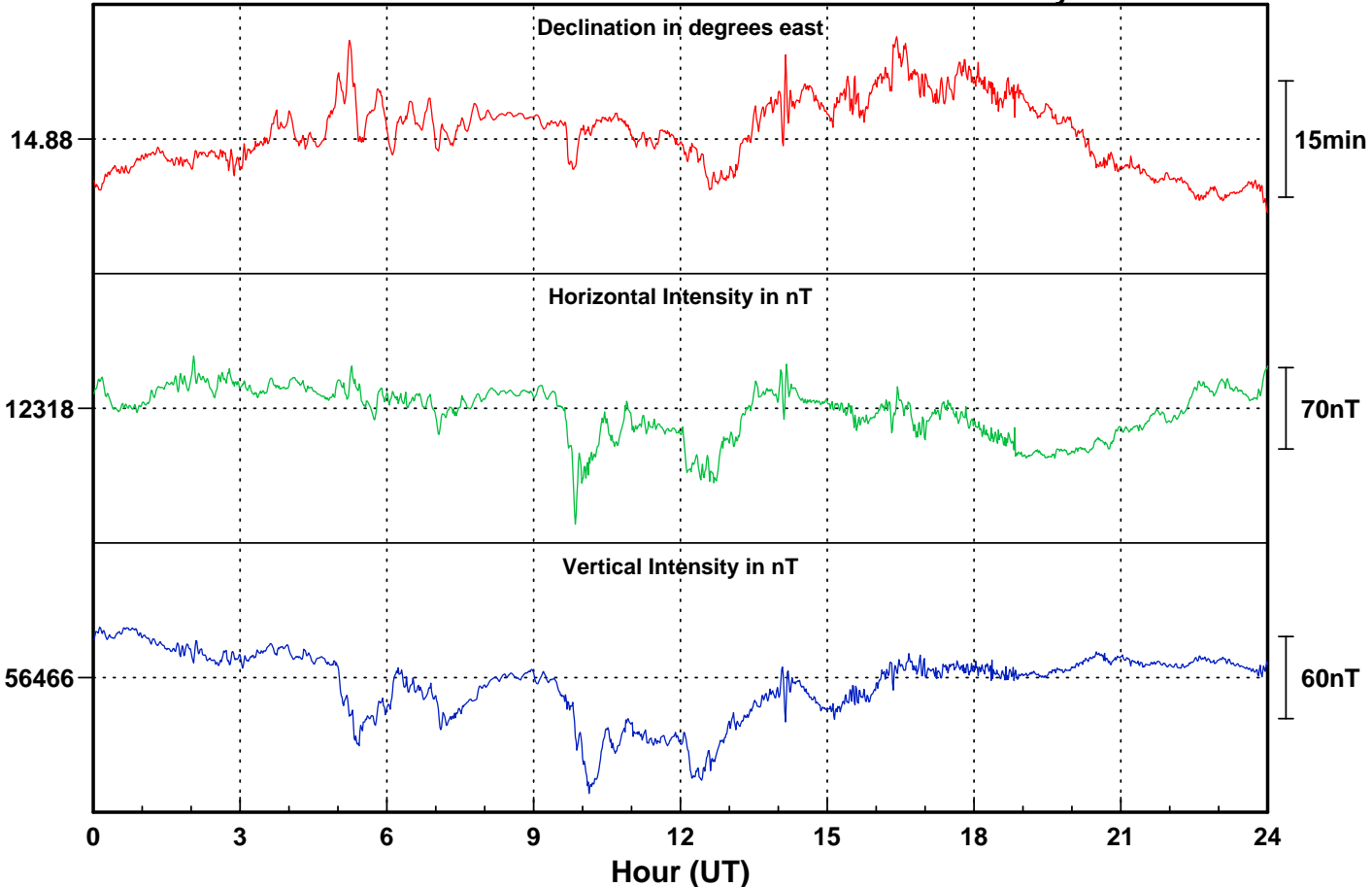
Fort McMurray

Day number: 093



Date: 04-04-2015

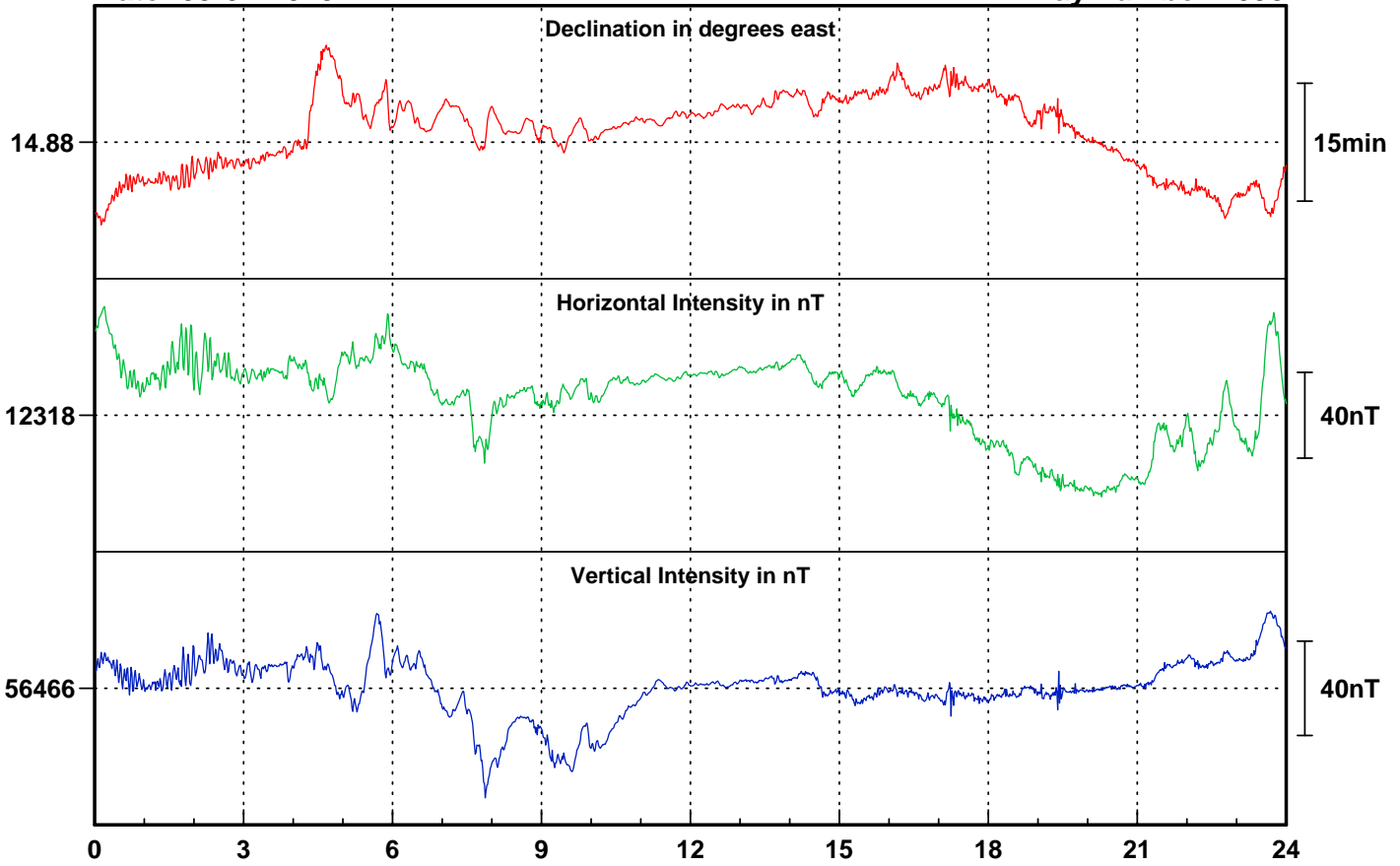
Day number: 094



Date: 05-04-2015

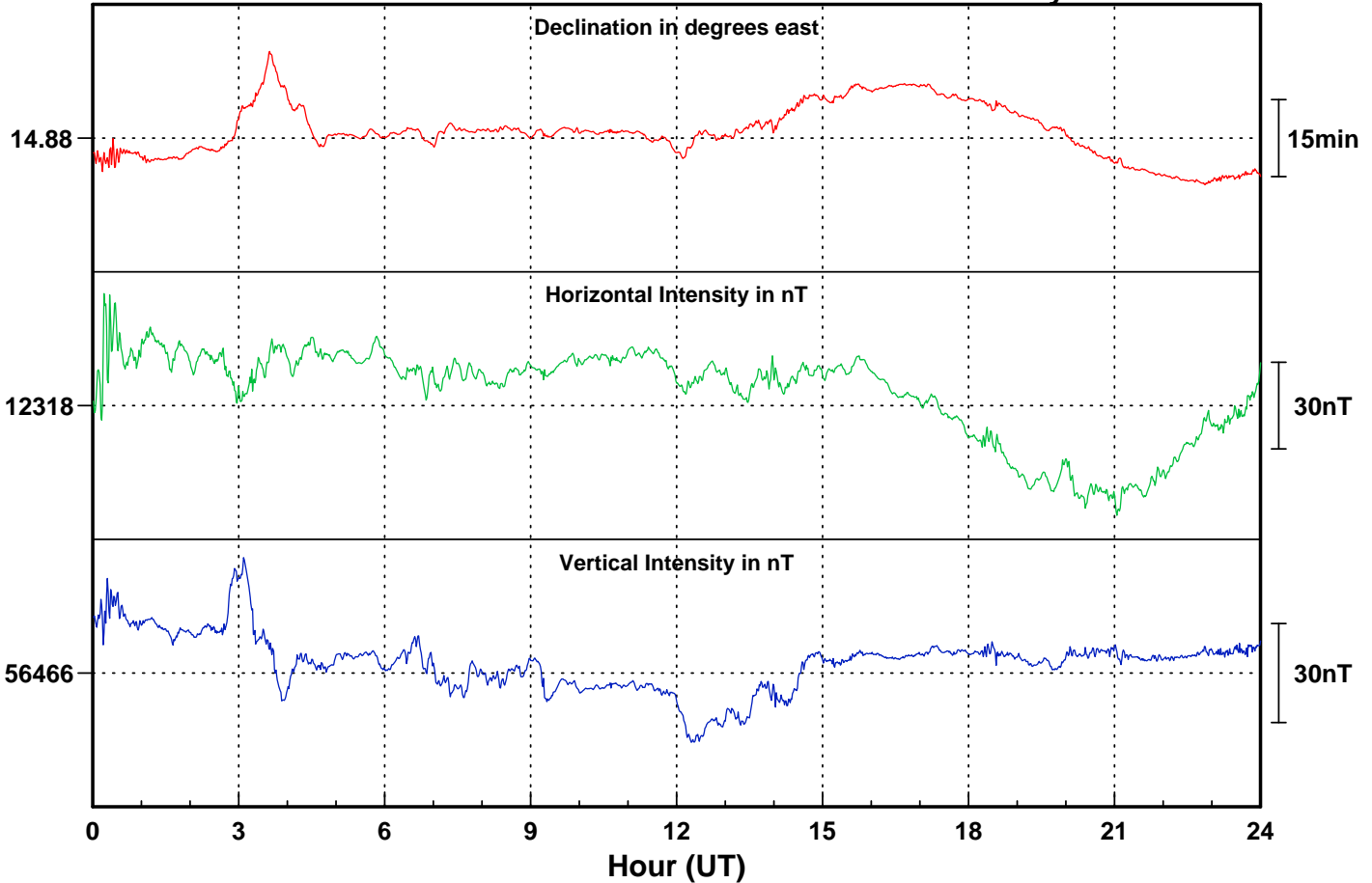
Fort McMurray

Day number: 095



Date: 06-04-2015

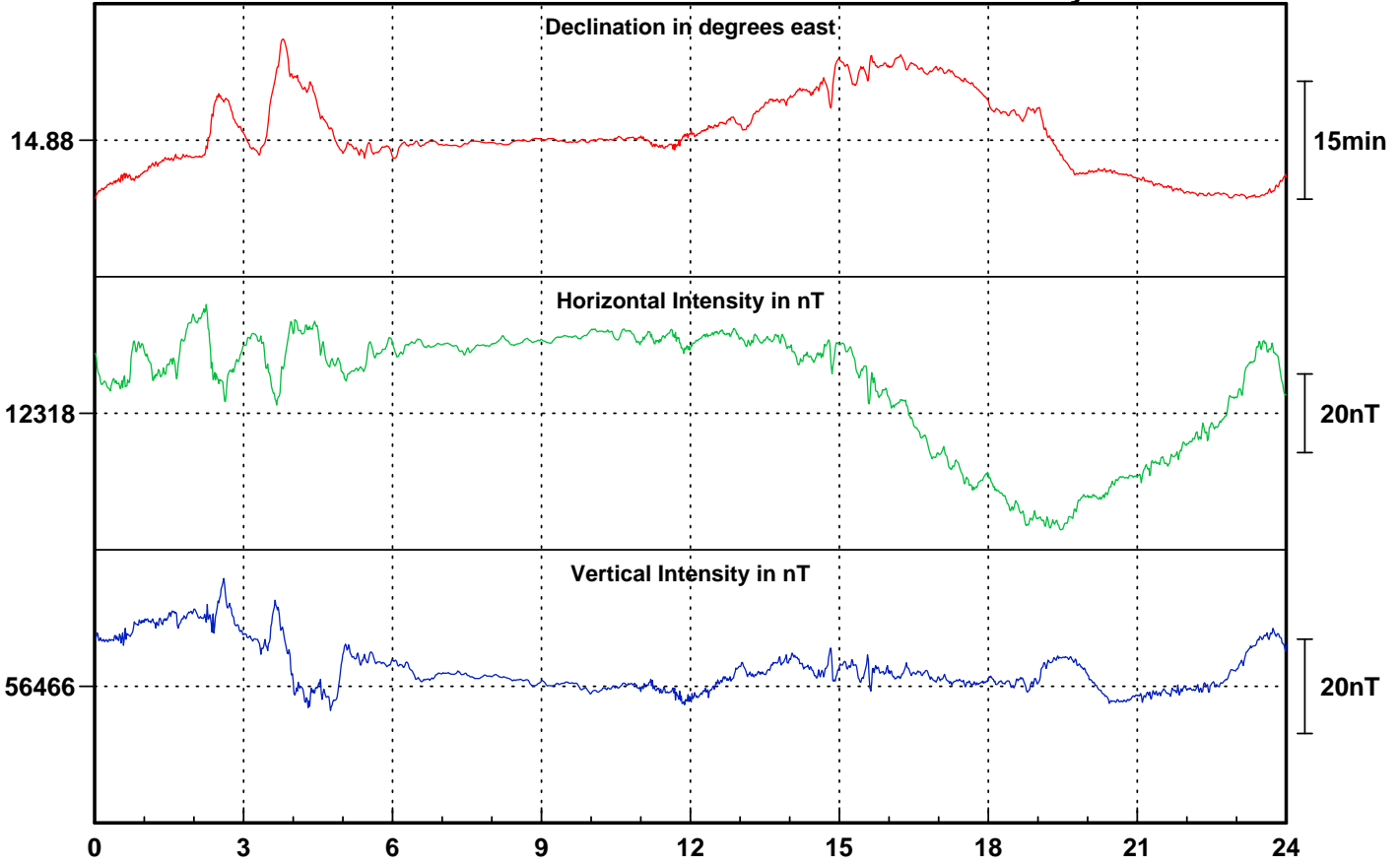
Day number: 096



Date: 07-04-2015

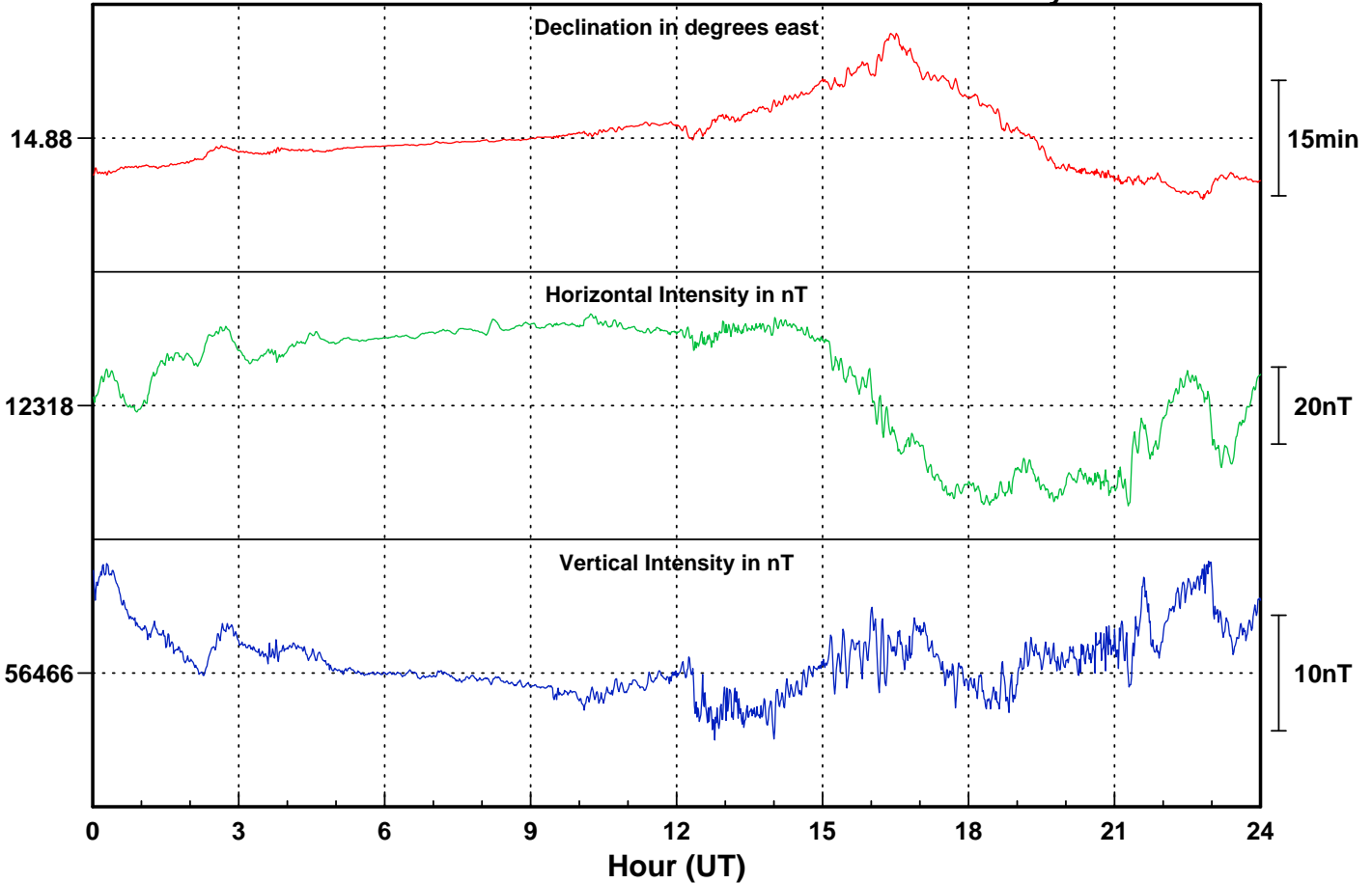
Fort McMurray

Day number: 097



Date: 08-04-2015

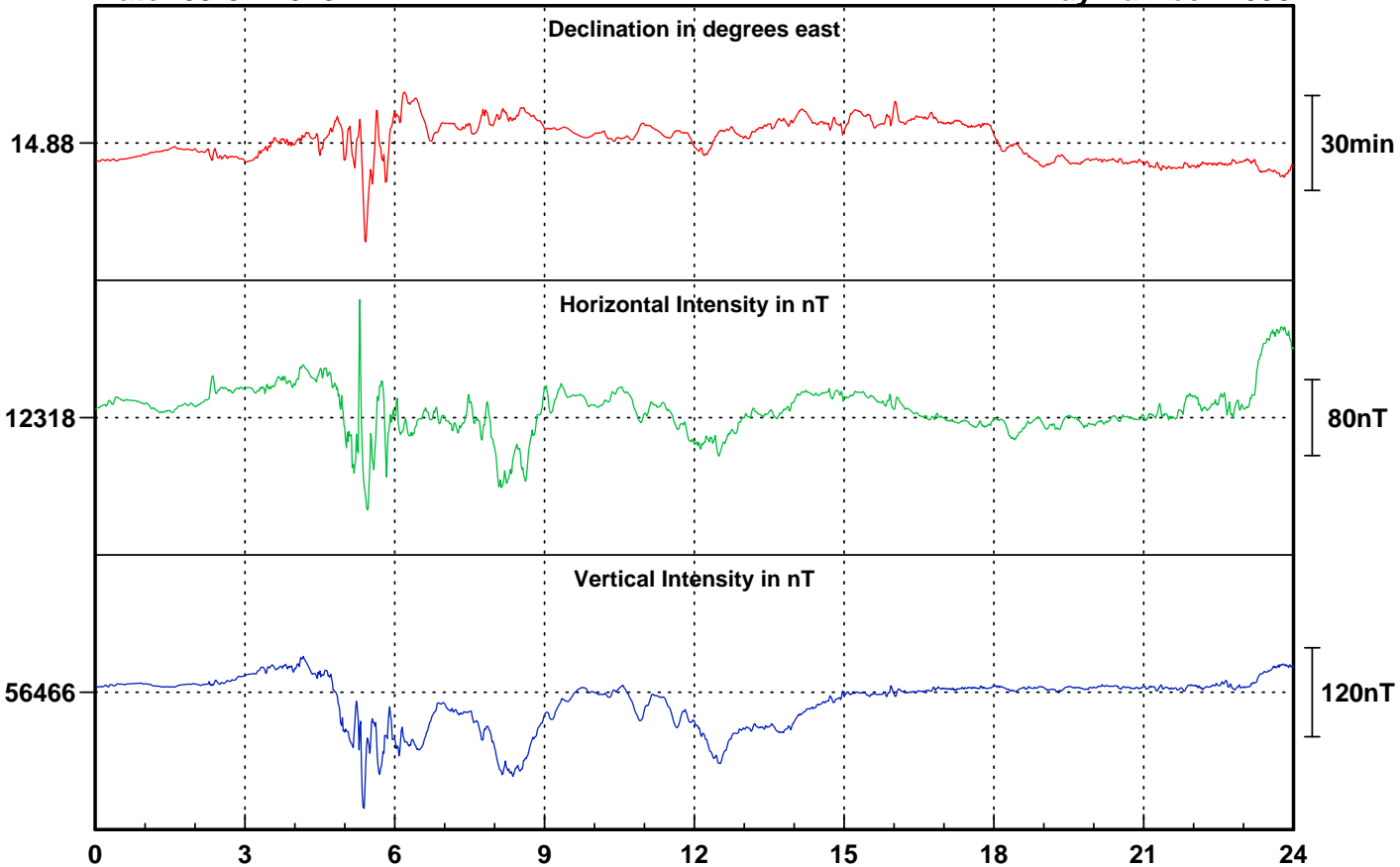
Day number: 098



Date: 09-04-2015

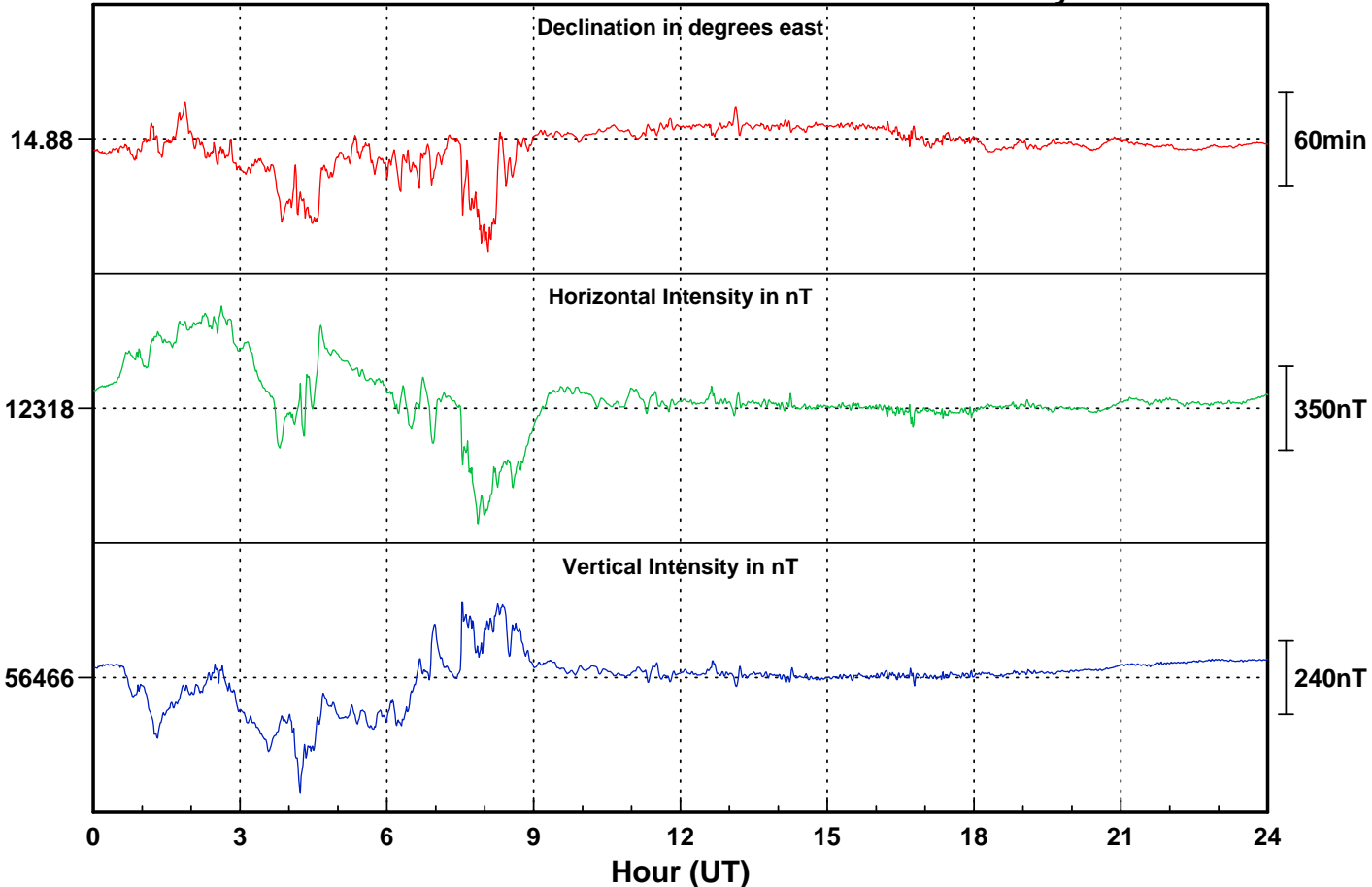
Fort McMurray

Day number: 099



Date: 10-04-2015

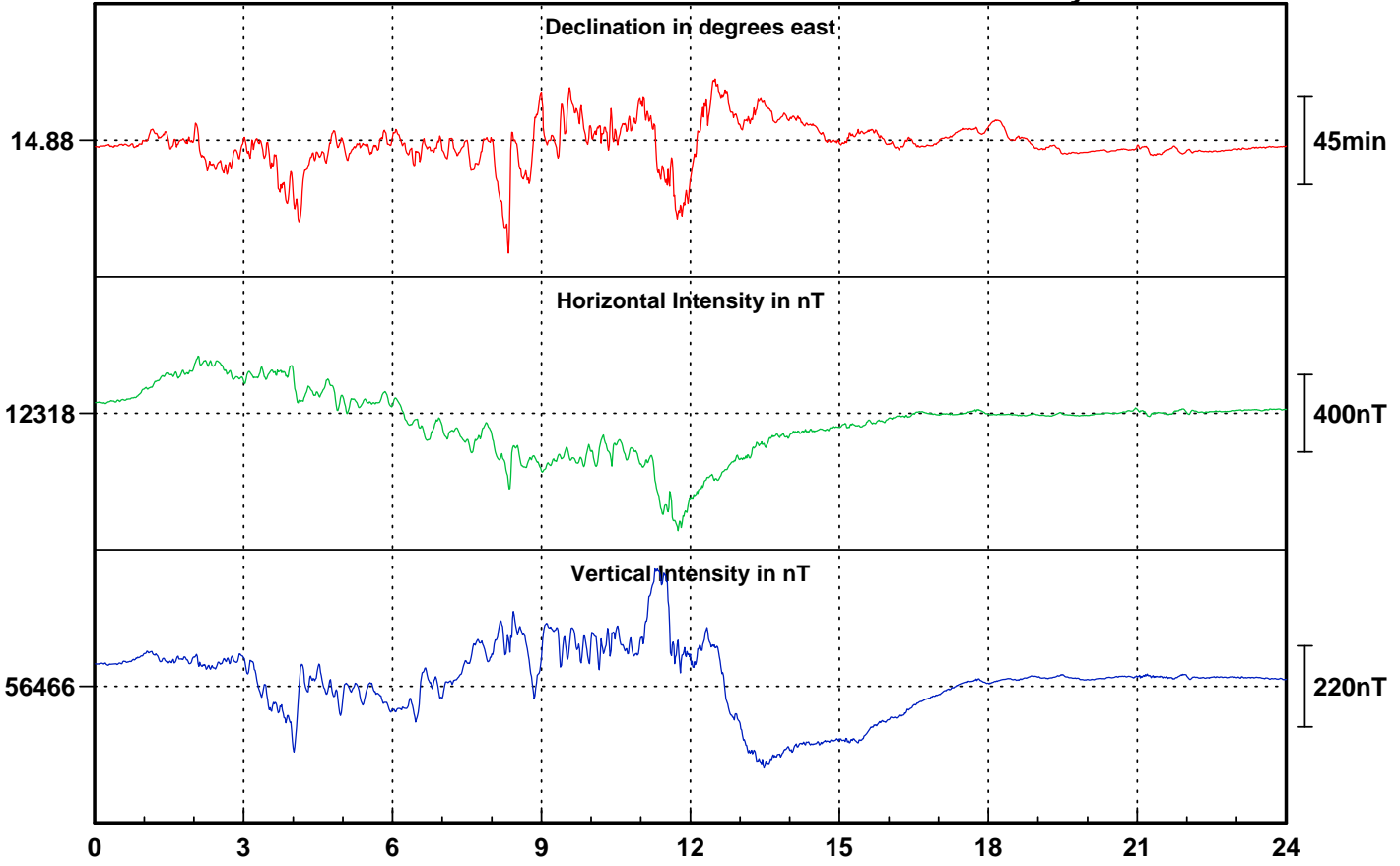
Day number: 100



Date: 11-04-2015

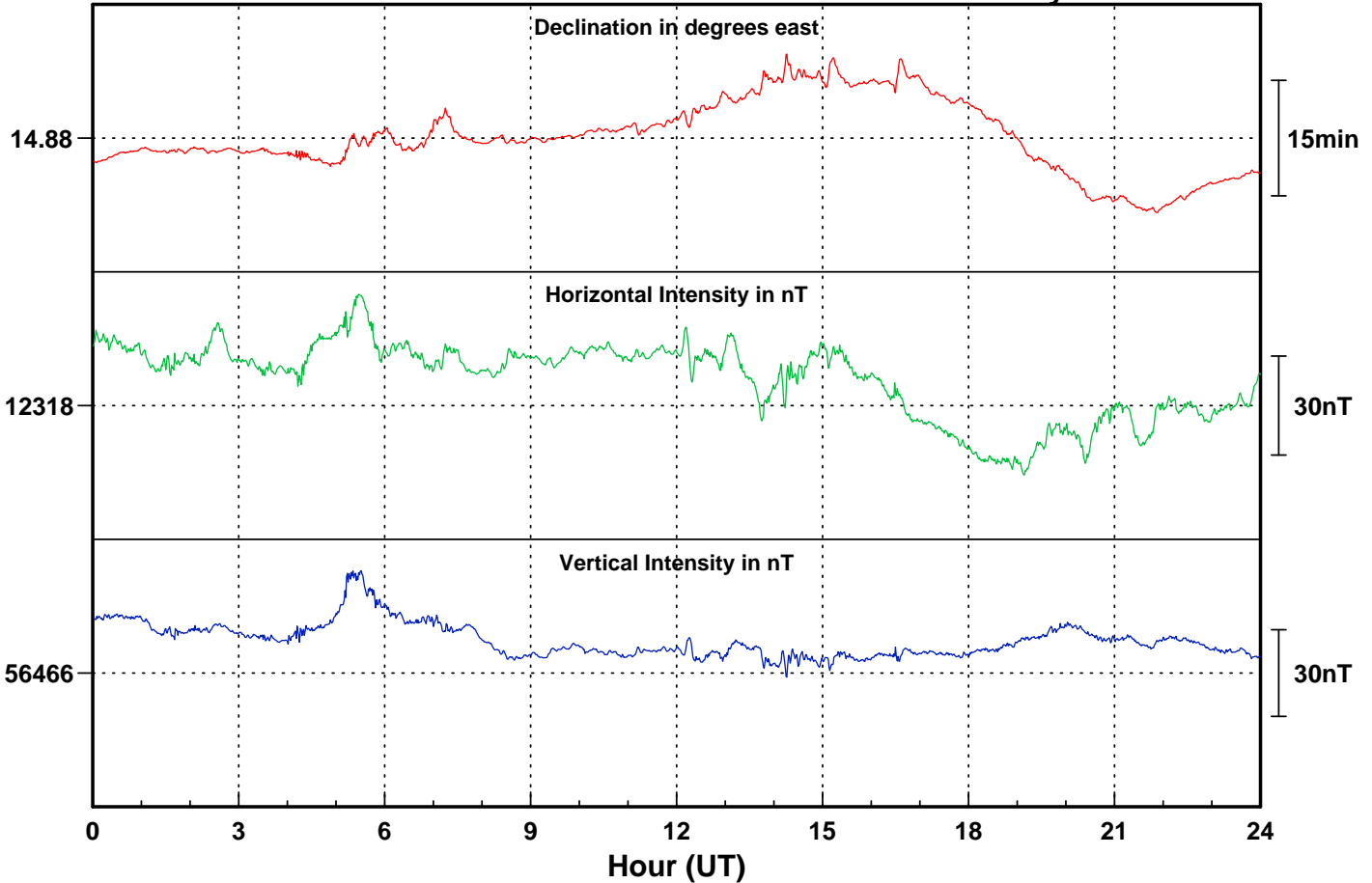
Fort McMurray

Day number: 101



Date: 12-04-2015

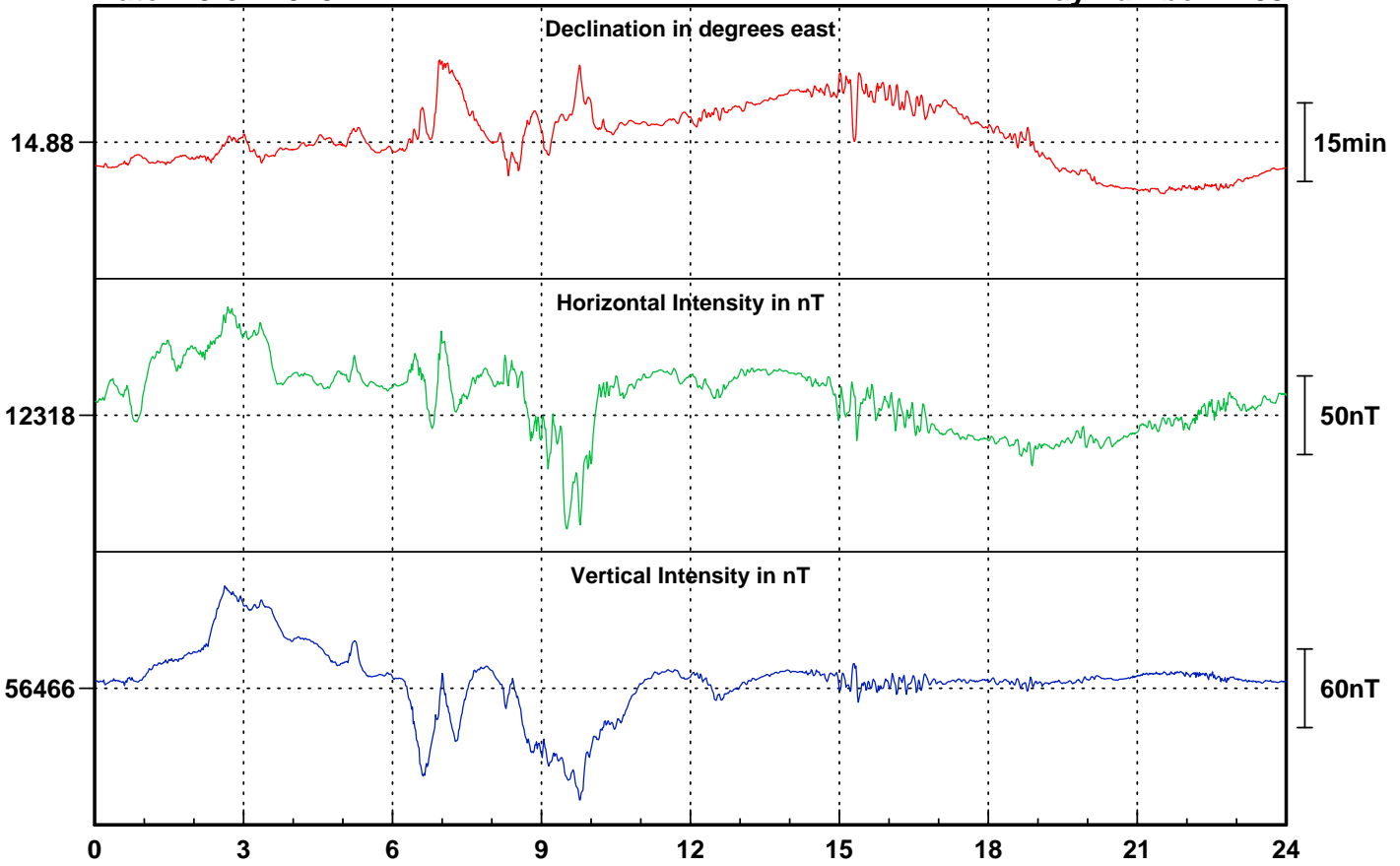
Day number: 102



Date: 13-04-2015

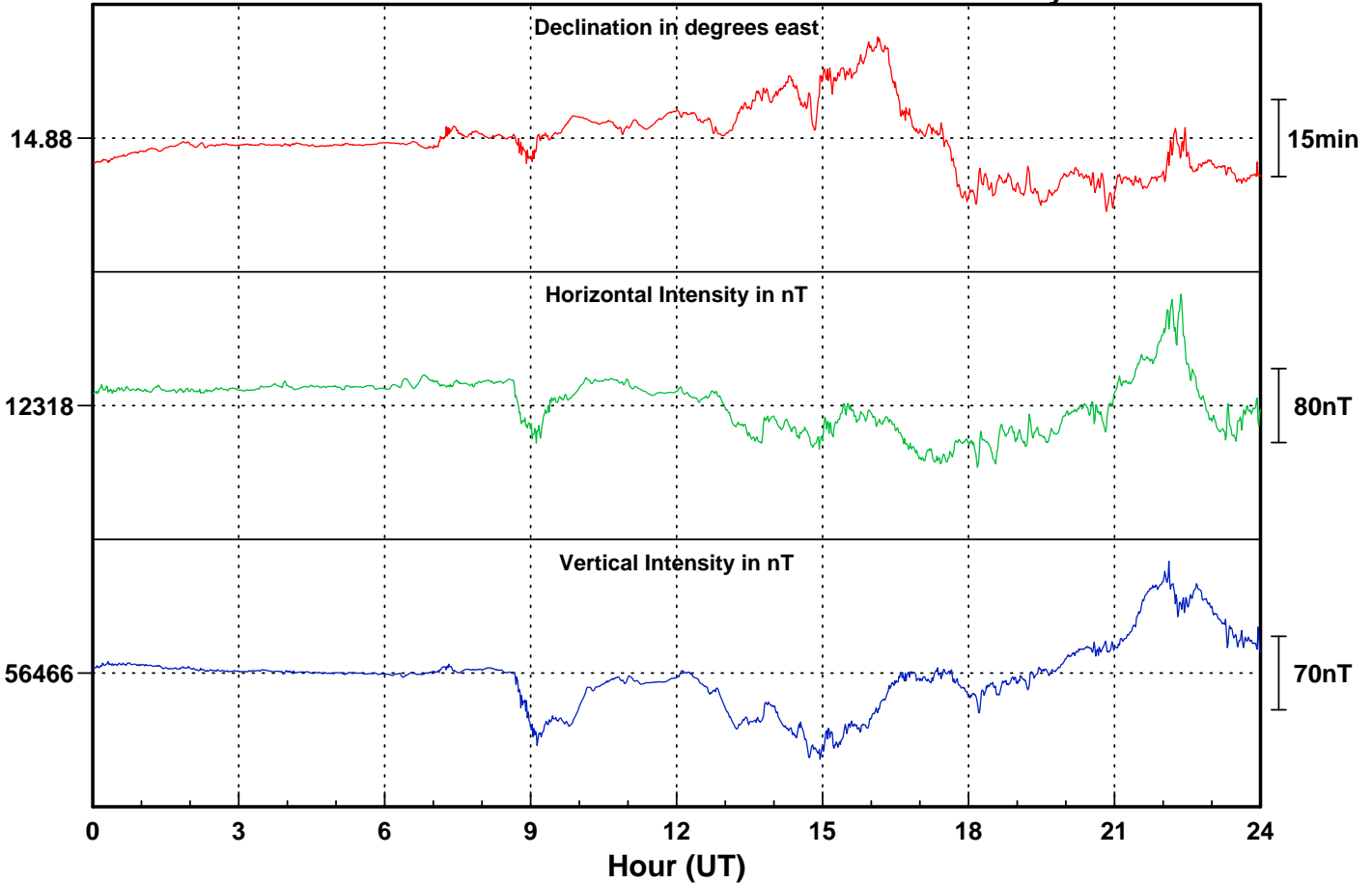
Fort McMurray

Day number: 103



Date: 14-04-2015

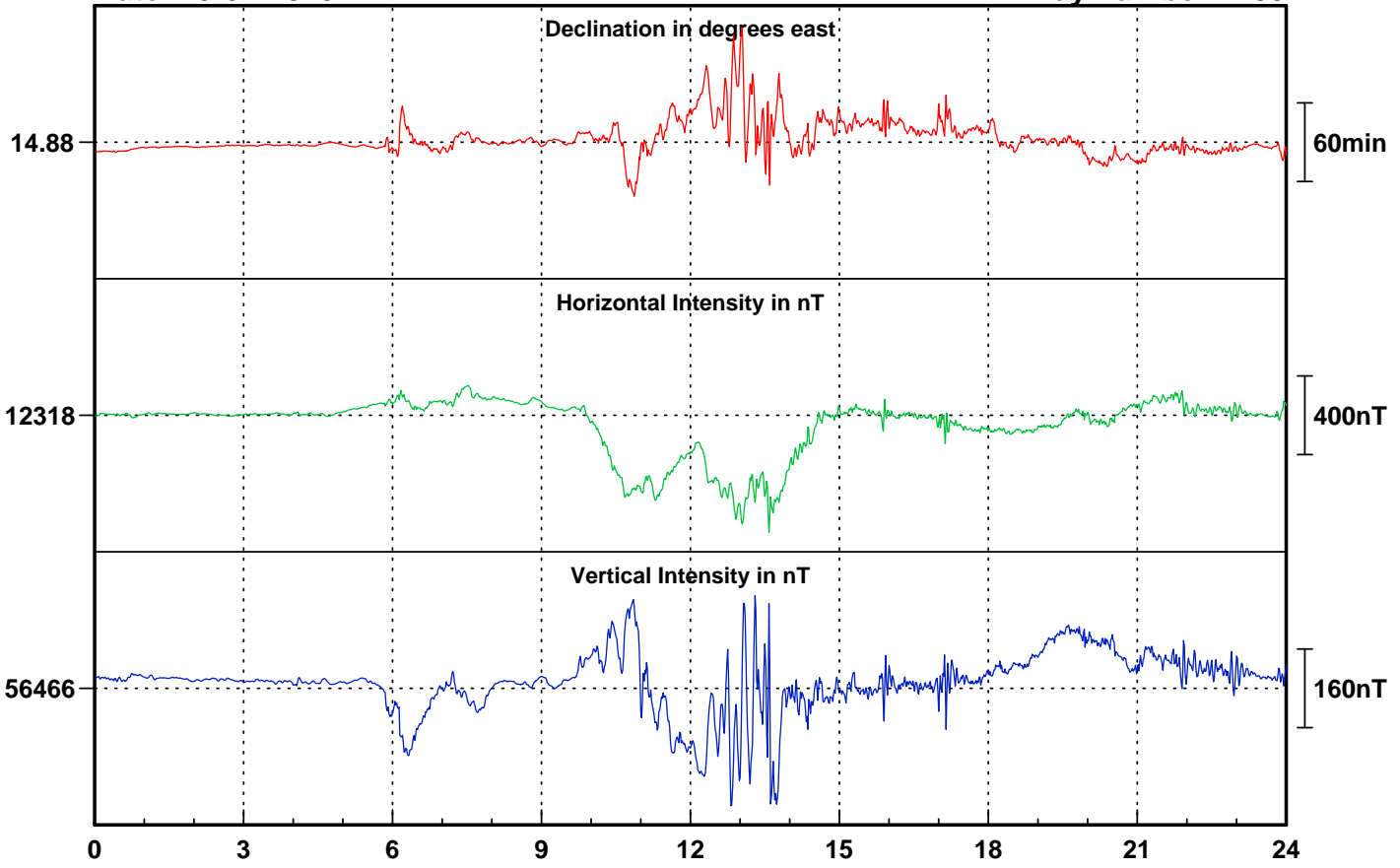
Day number: 104



Date: 15-04-2015

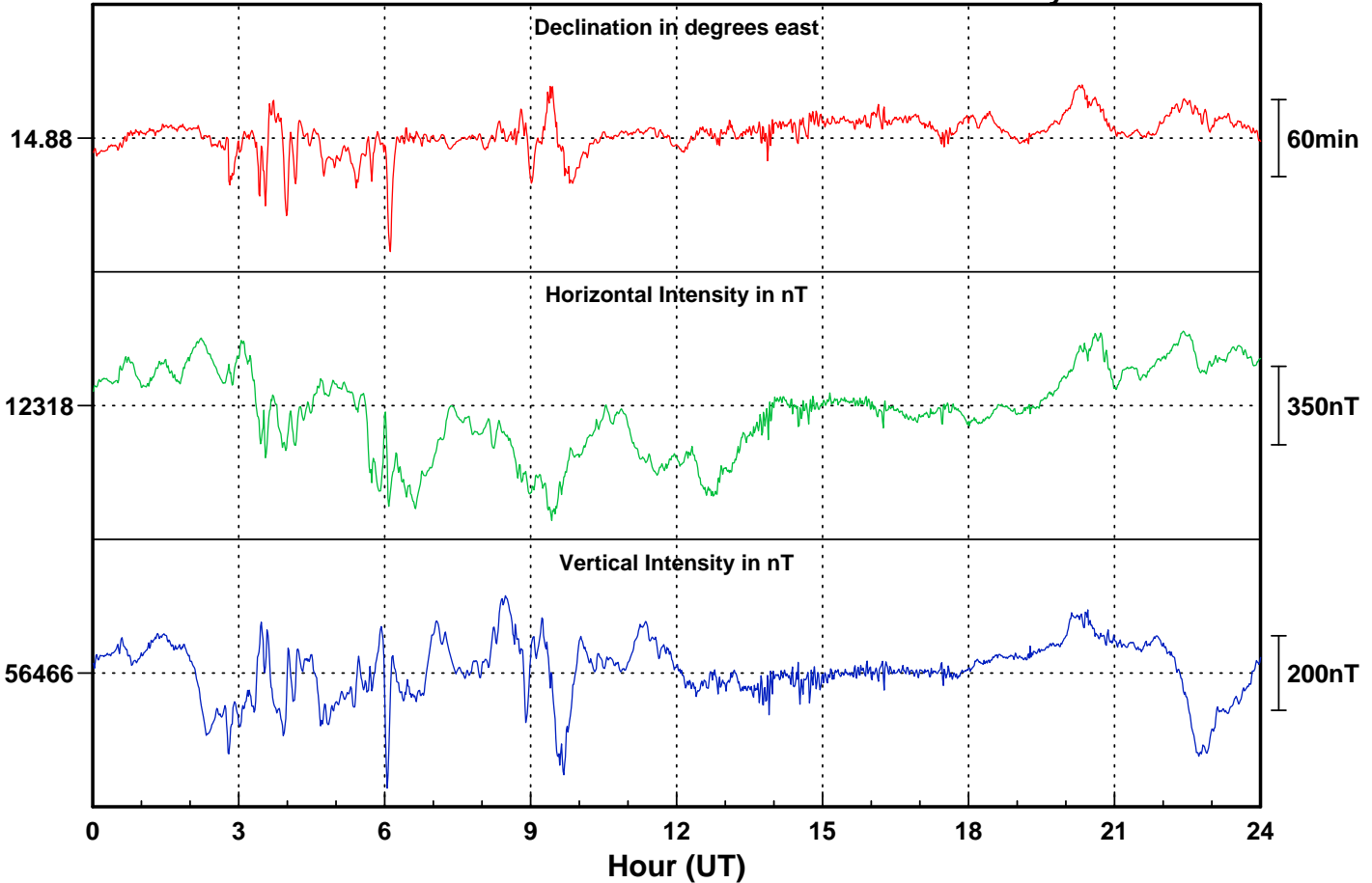
Fort McMurray

Day number: 105



Date: 16-04-2015

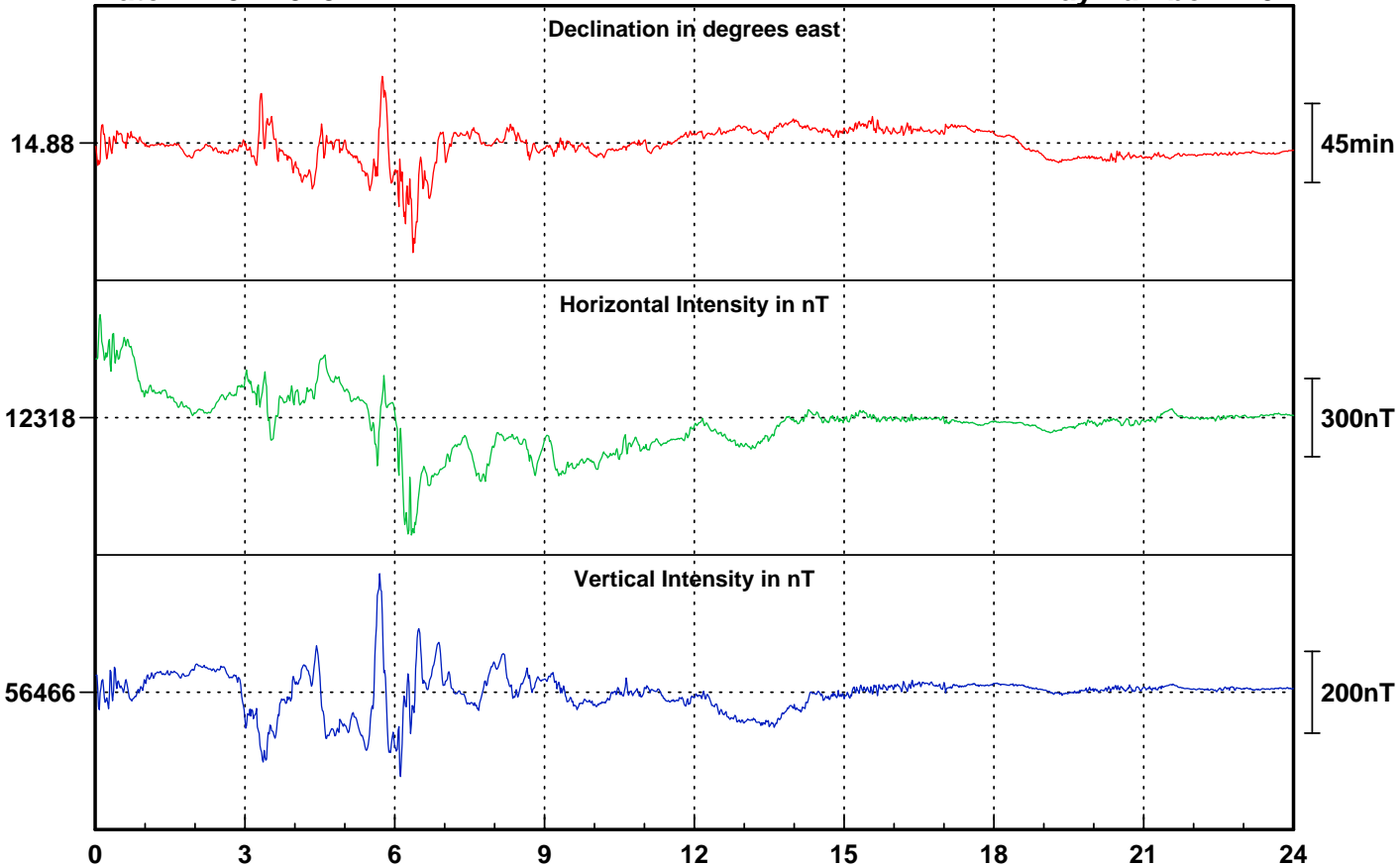
Day number: 106



Date: 17-04-2015

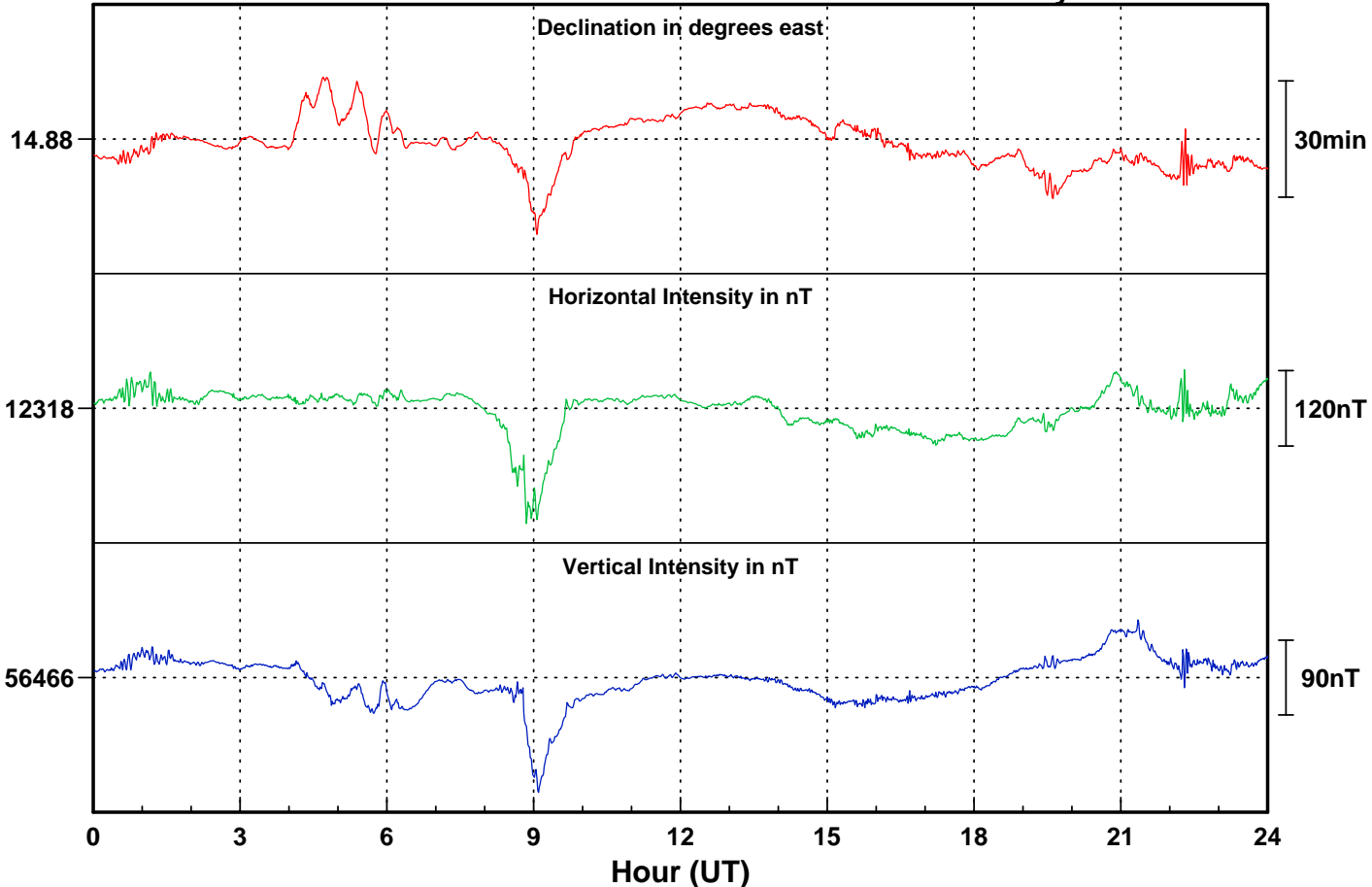
Fort McMurray

Day number: 107



Date: 18-04-2015

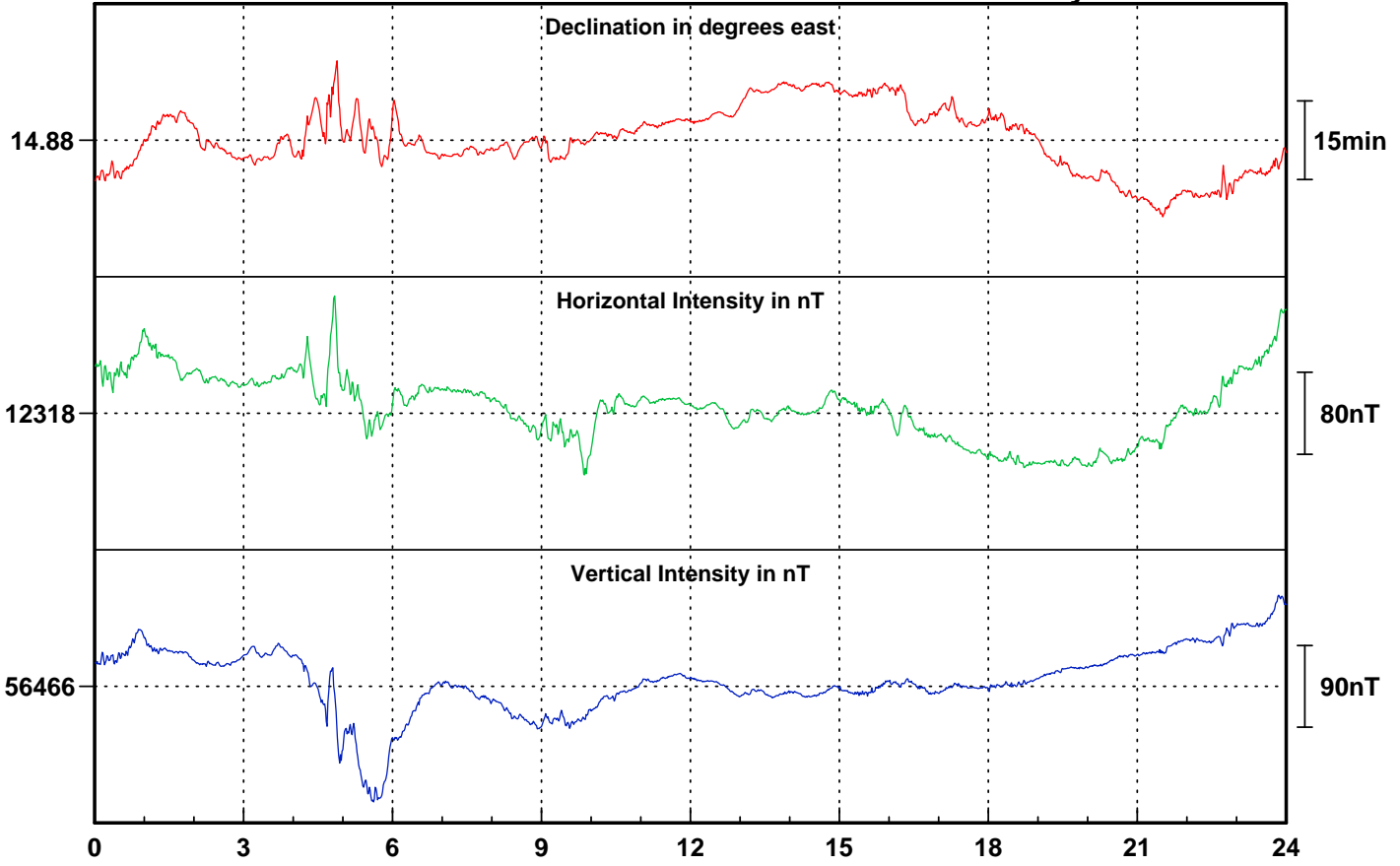
Day number: 108



Date: 19-04-2015

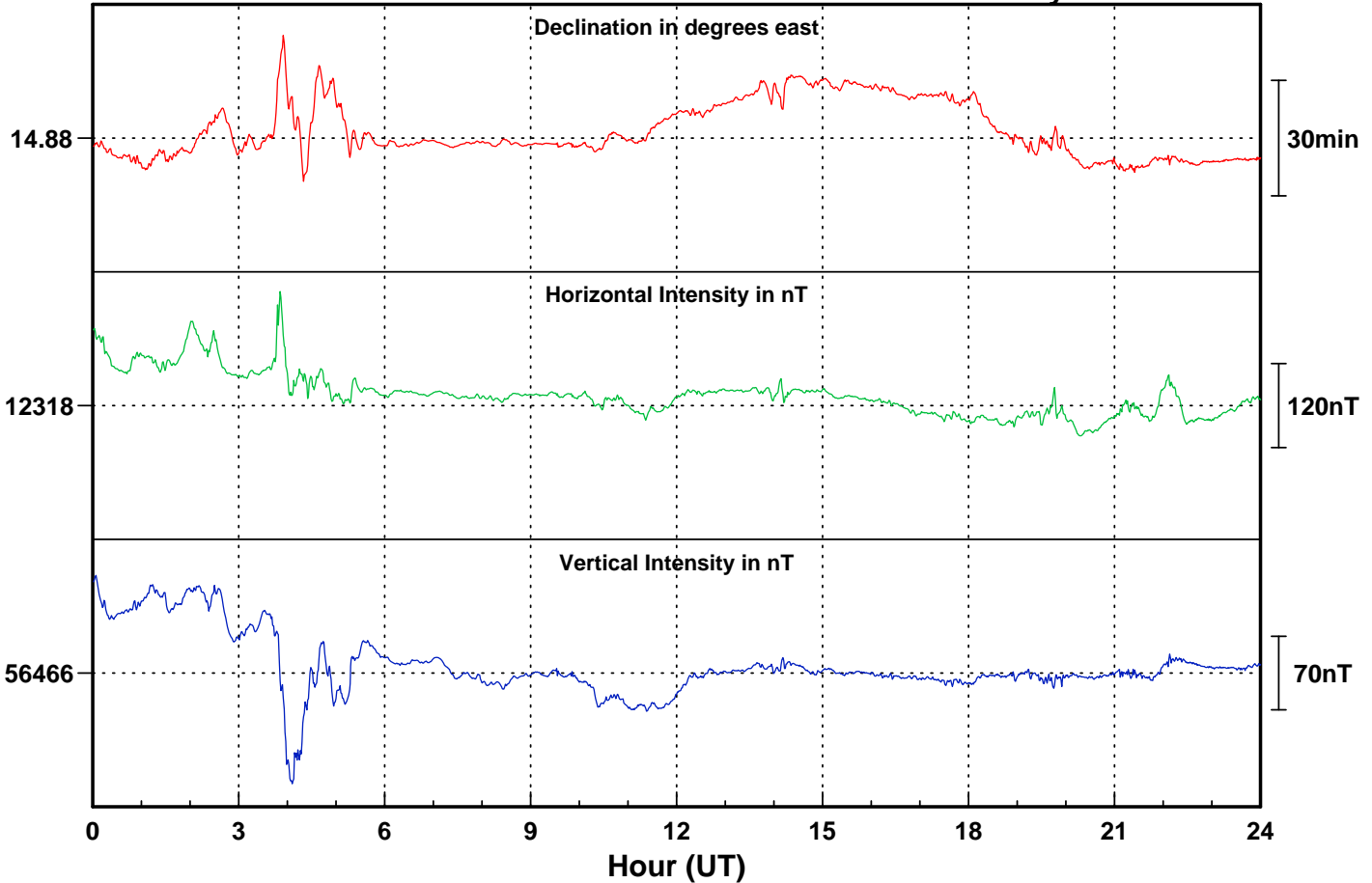
Fort McMurray

Day number: 109



Date: 20-04-2015

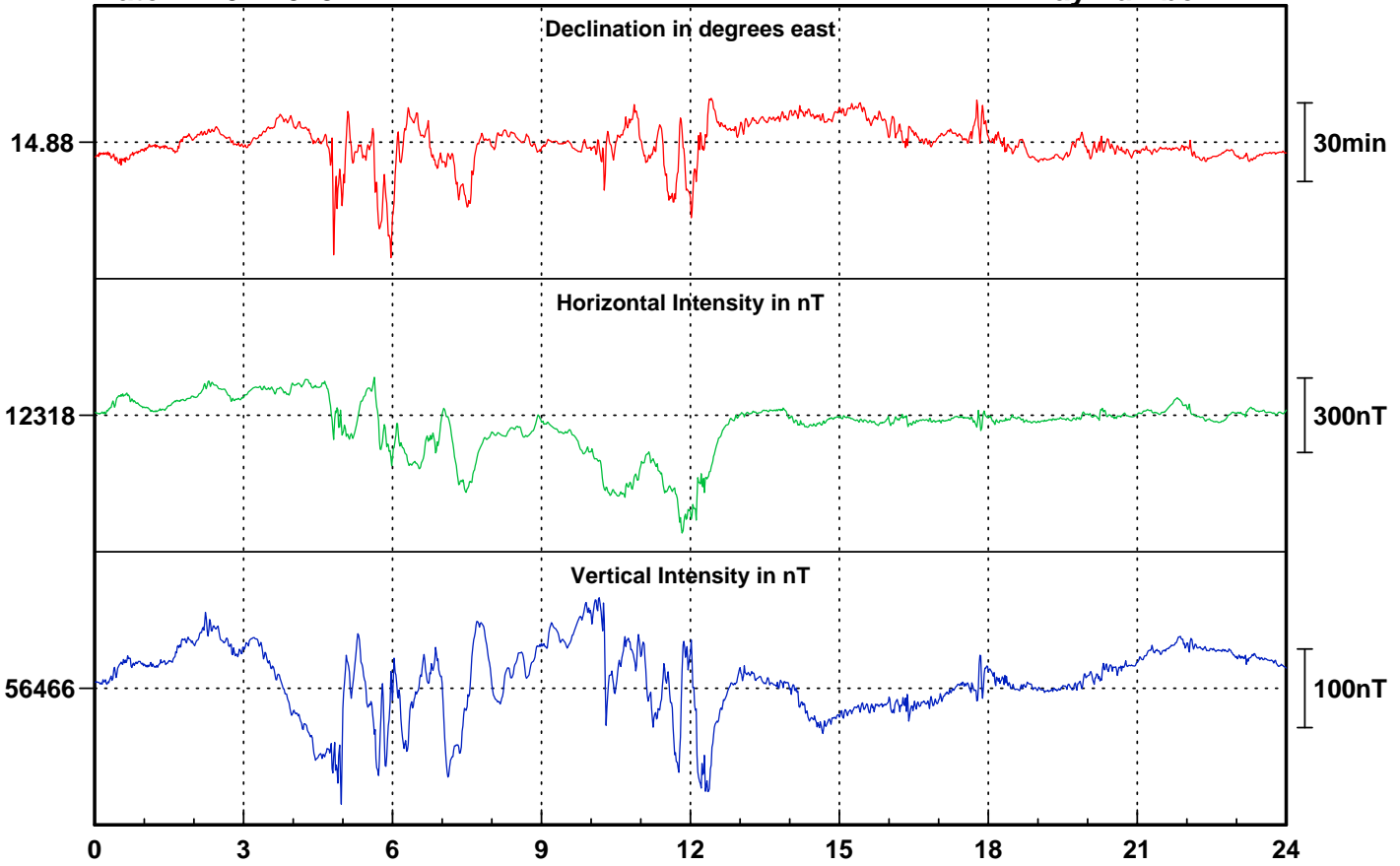
Day number: 110



Date: 21-04-2015

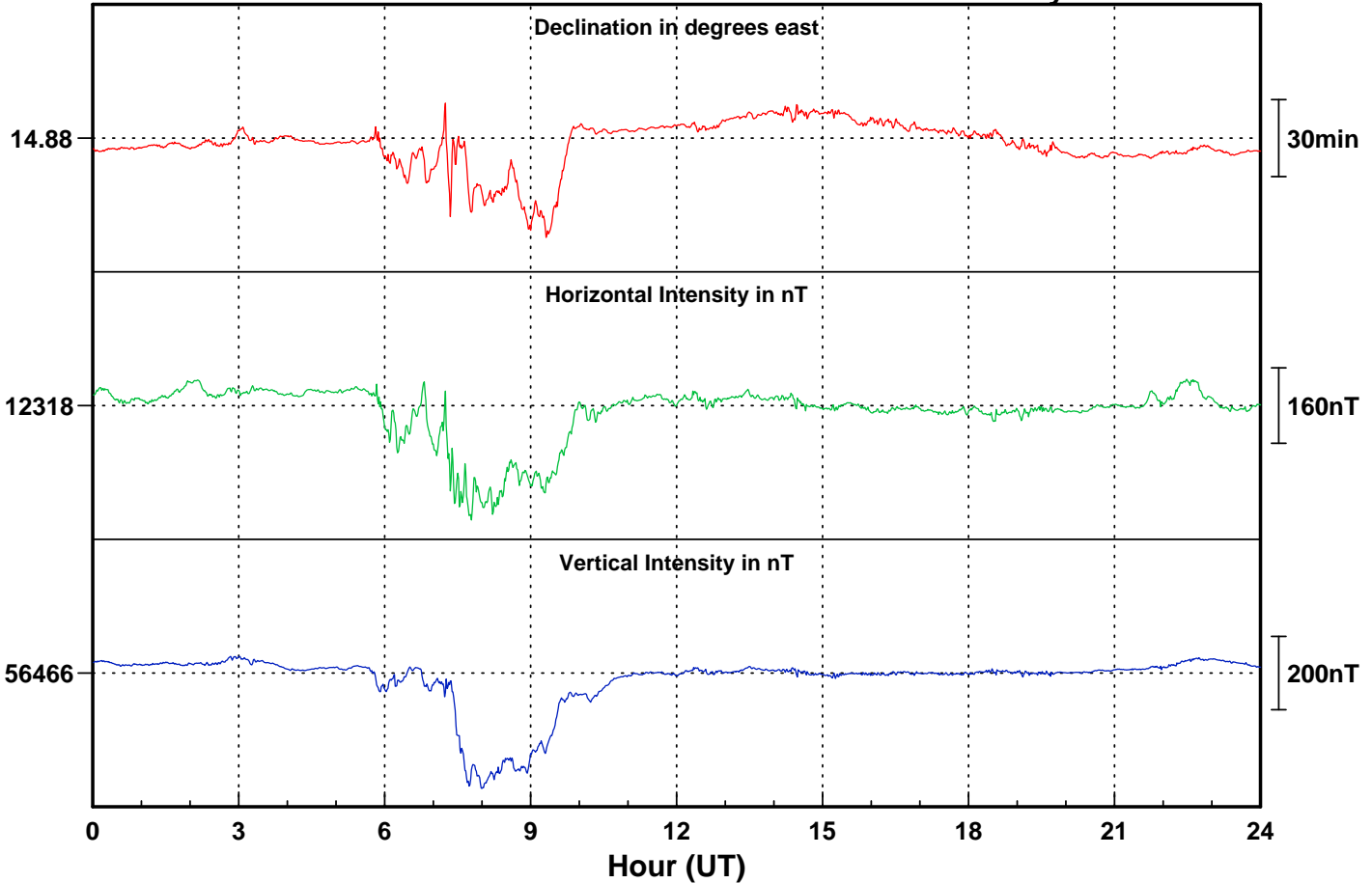
Fort McMurray

Day number: 111



Date: 22-04-2015

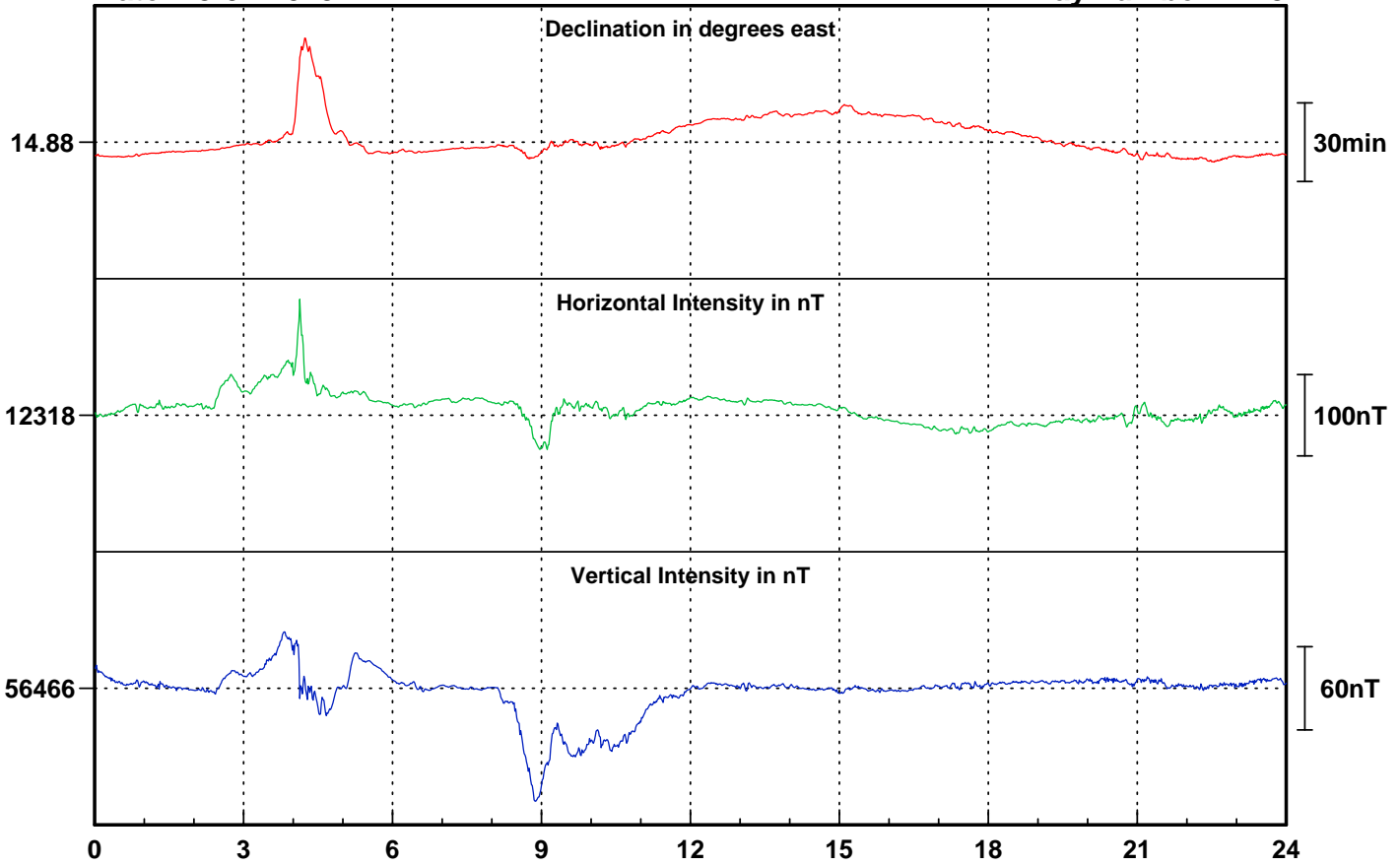
Day number: 112



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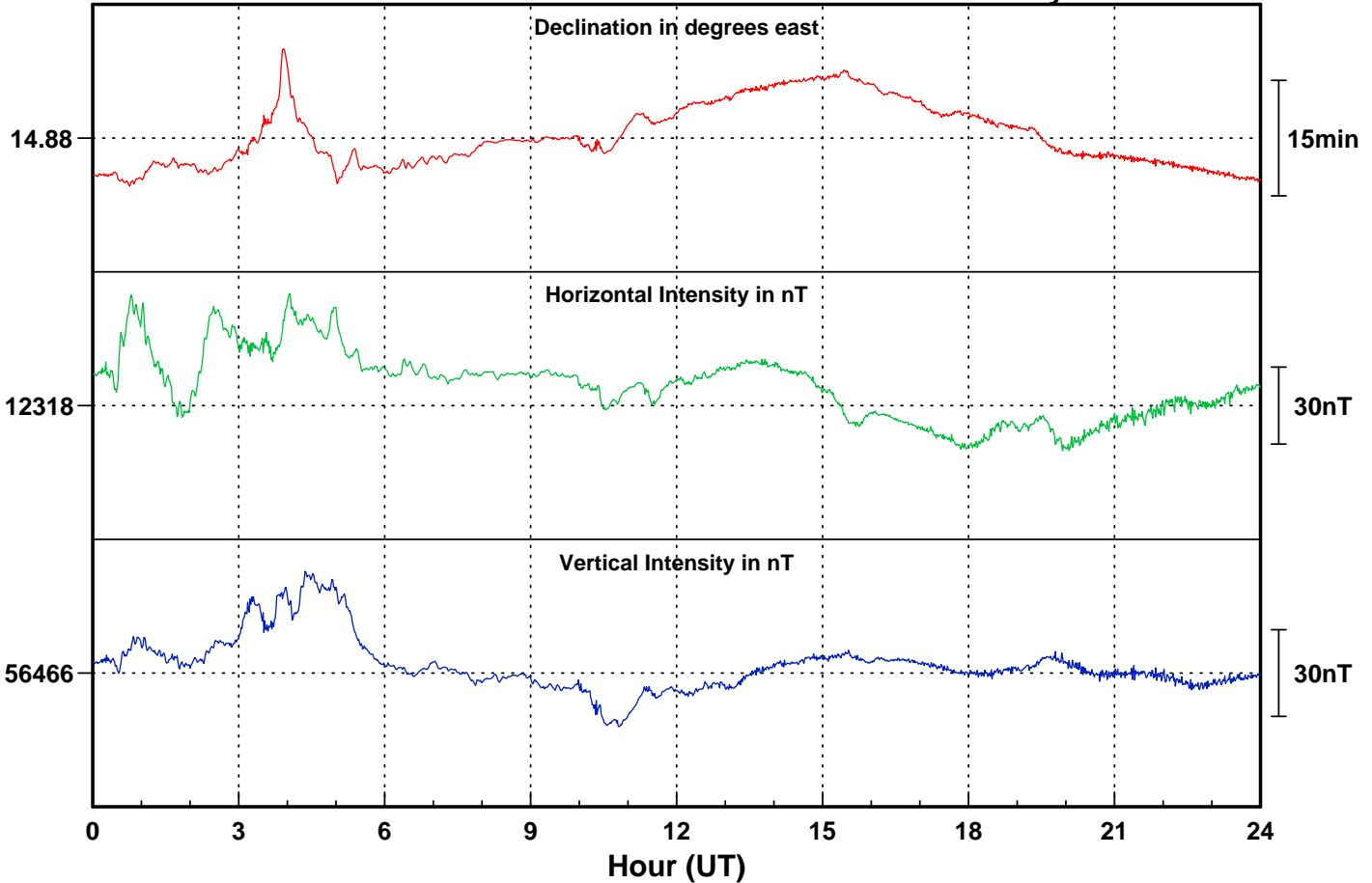
Fort McMurray

Day number: 113



Date: 24-04-2015

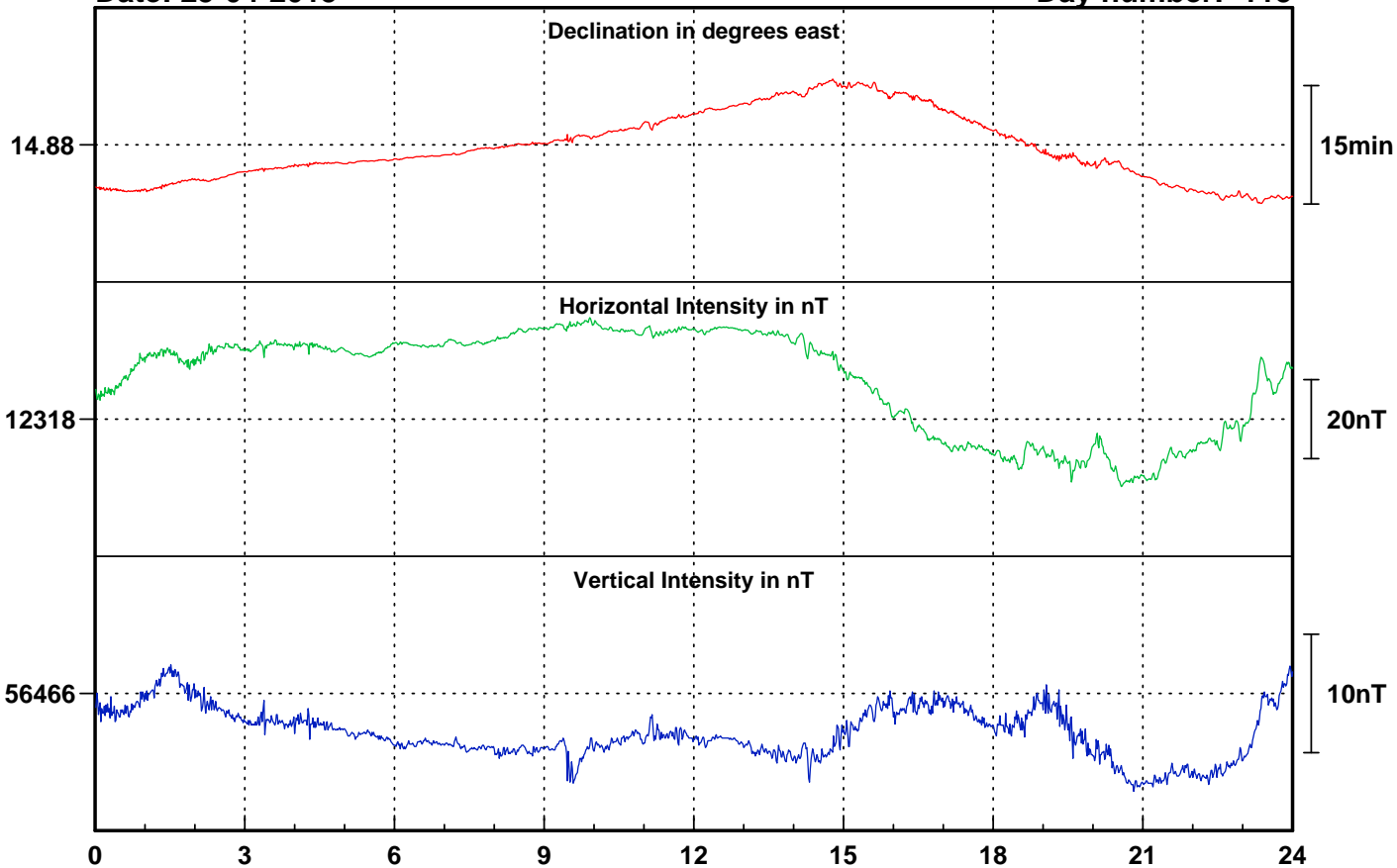
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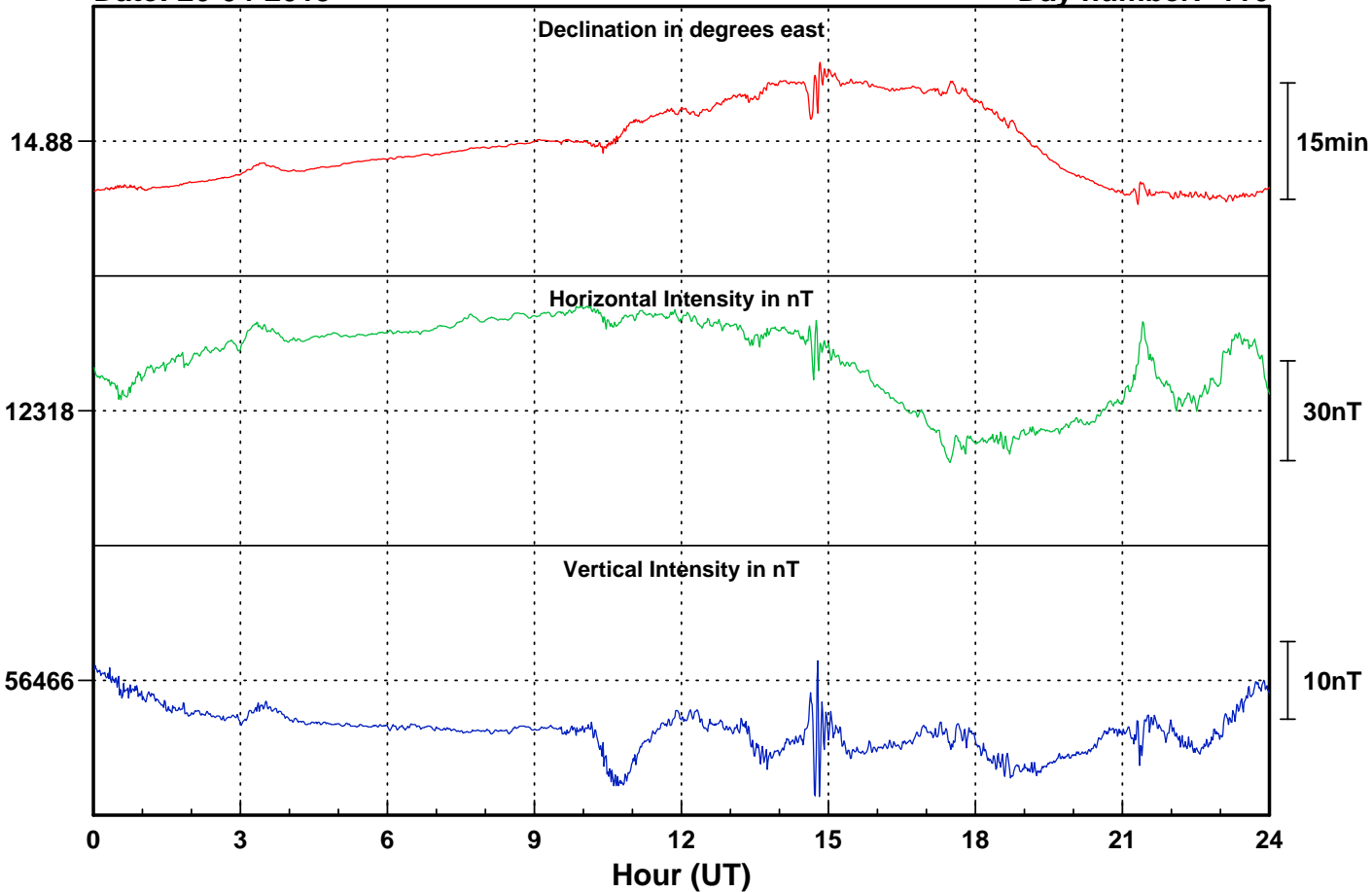
Fort McMurray

Day number: 115



Date: 26-04-2015

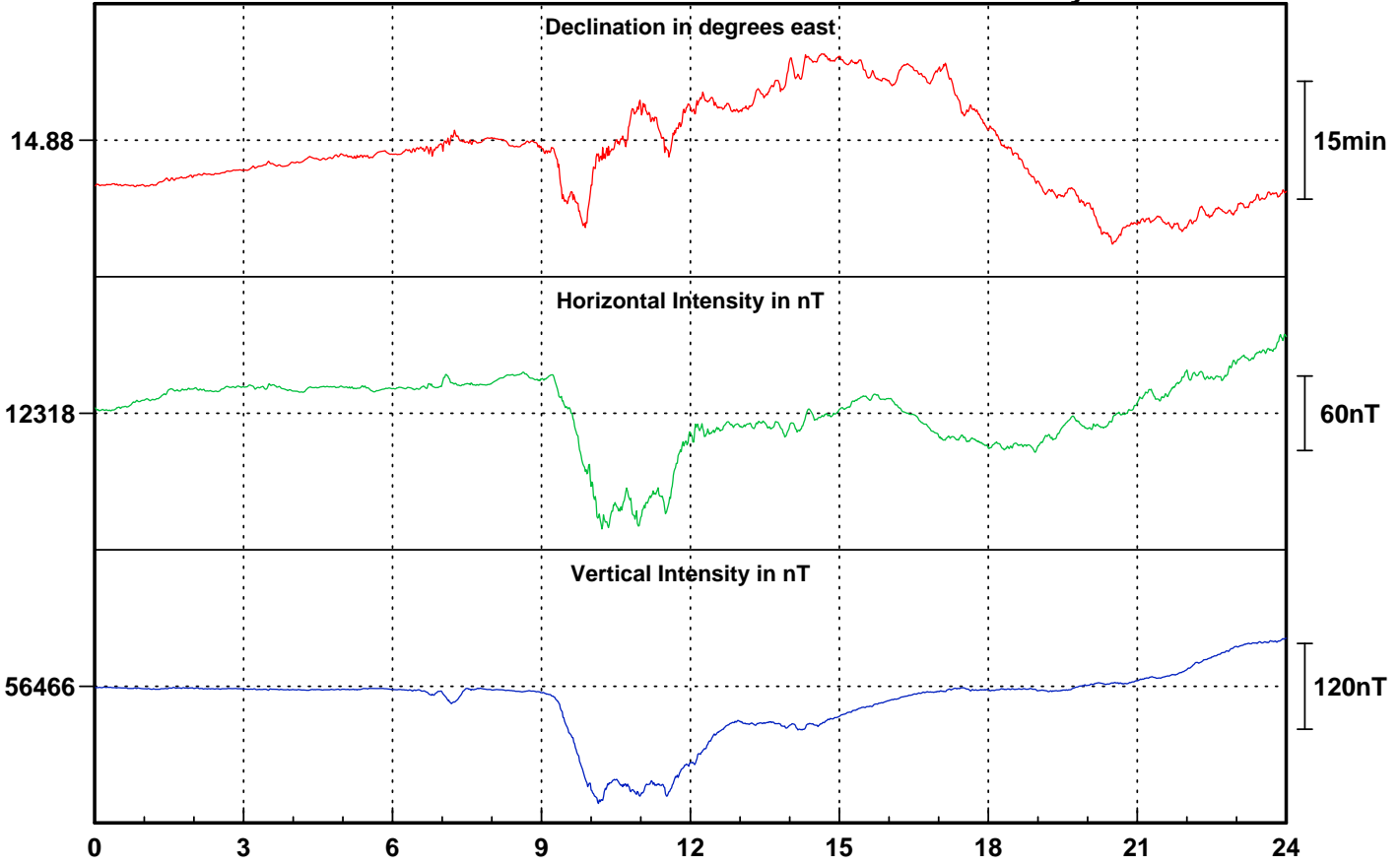
Day number: 116



Date: 27-04-2015

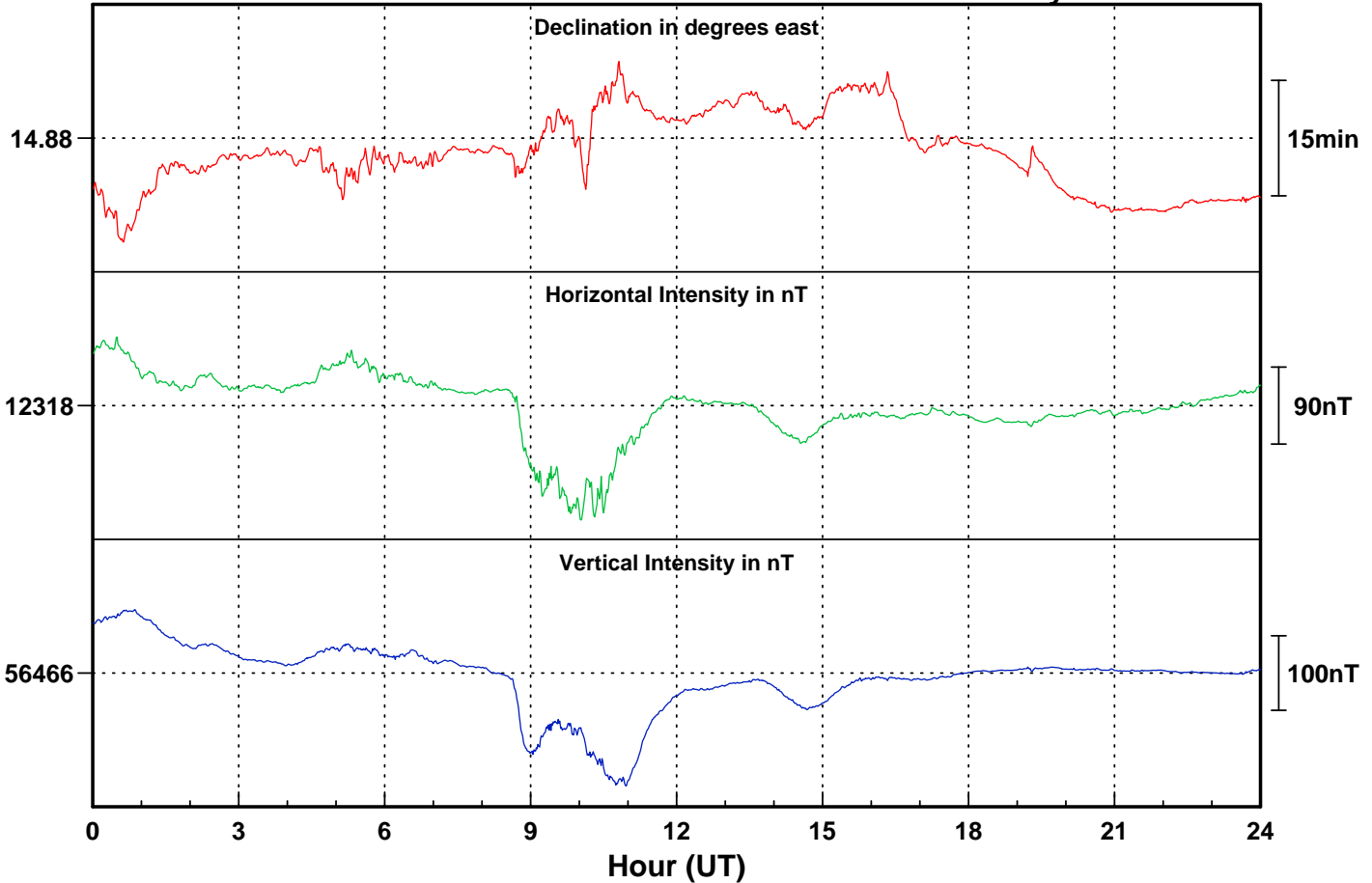
Fort McMurray

Day number: 117



Date: 28-04-2015

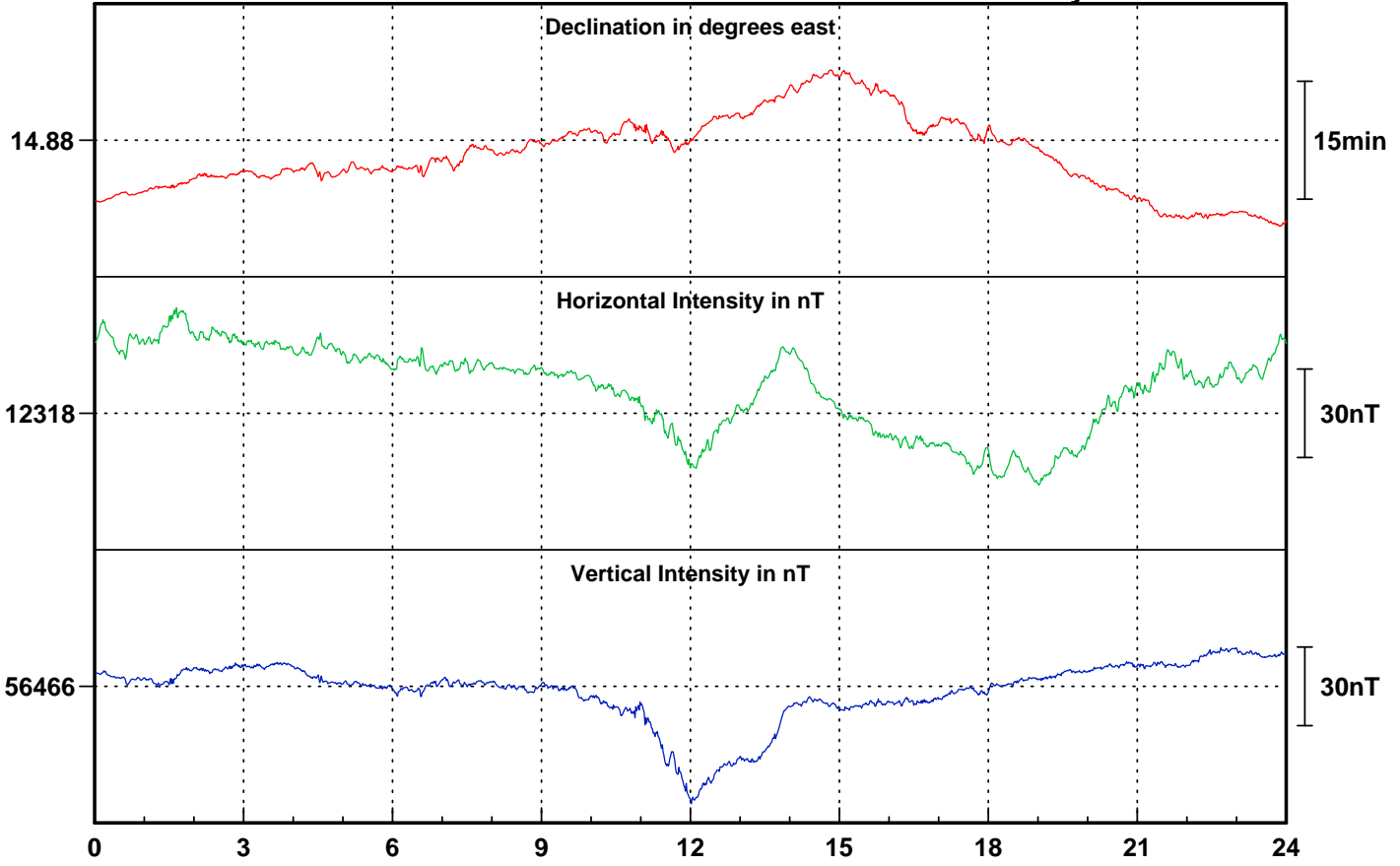
Day number: 118



Date: 29-04-2015

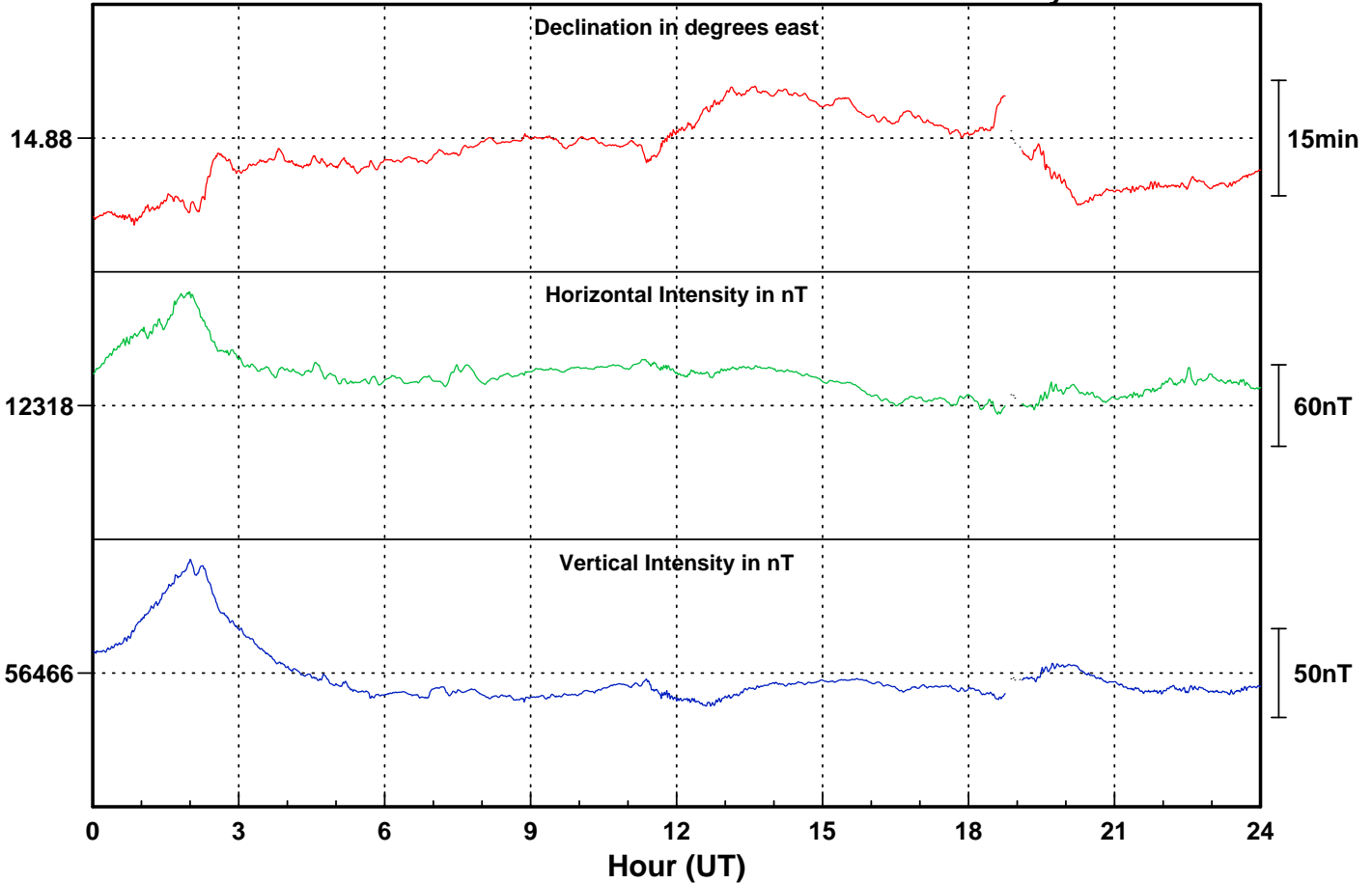
Fort McMurray

Day number: 119

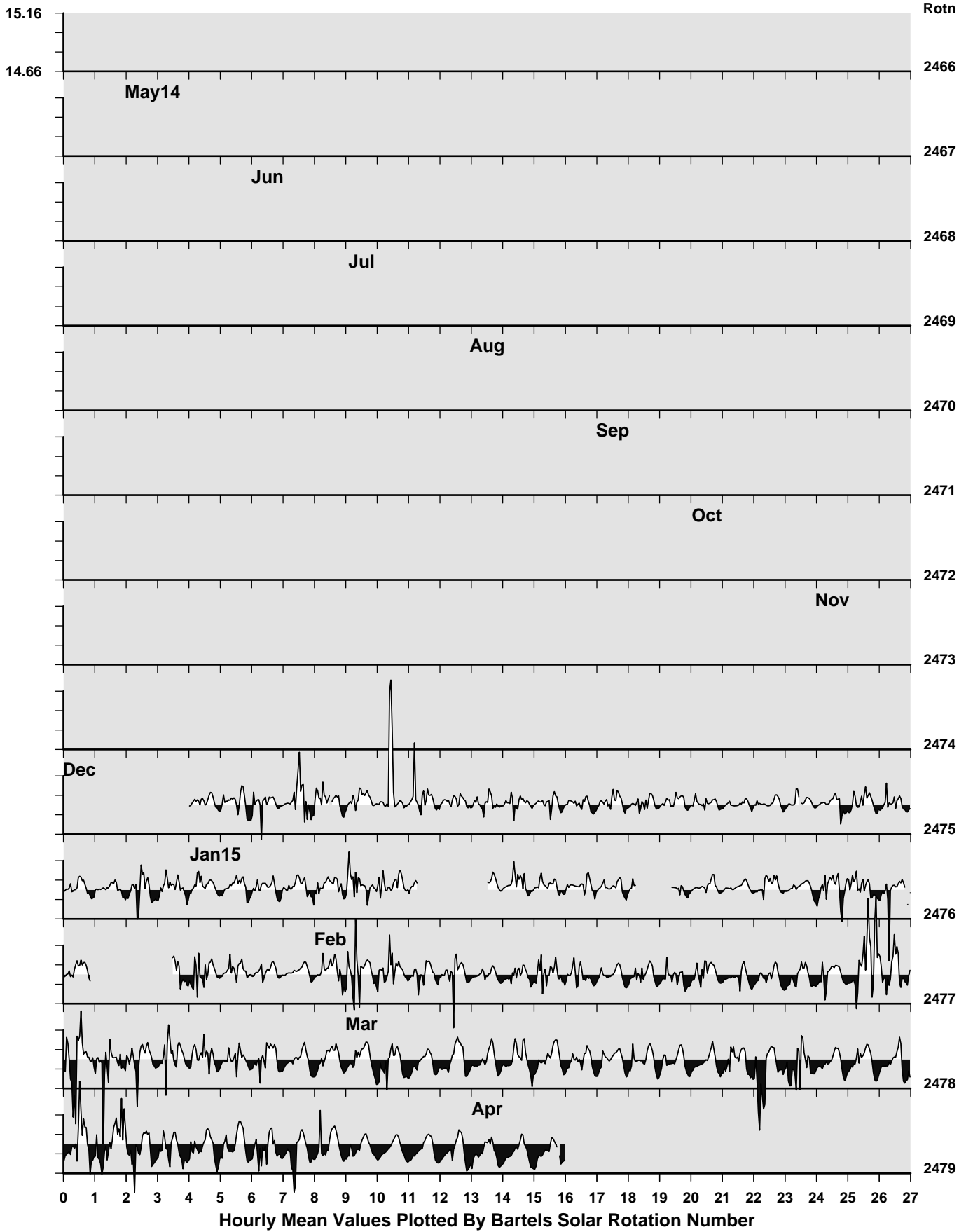


Date: 30-04-2015

Day number: 120

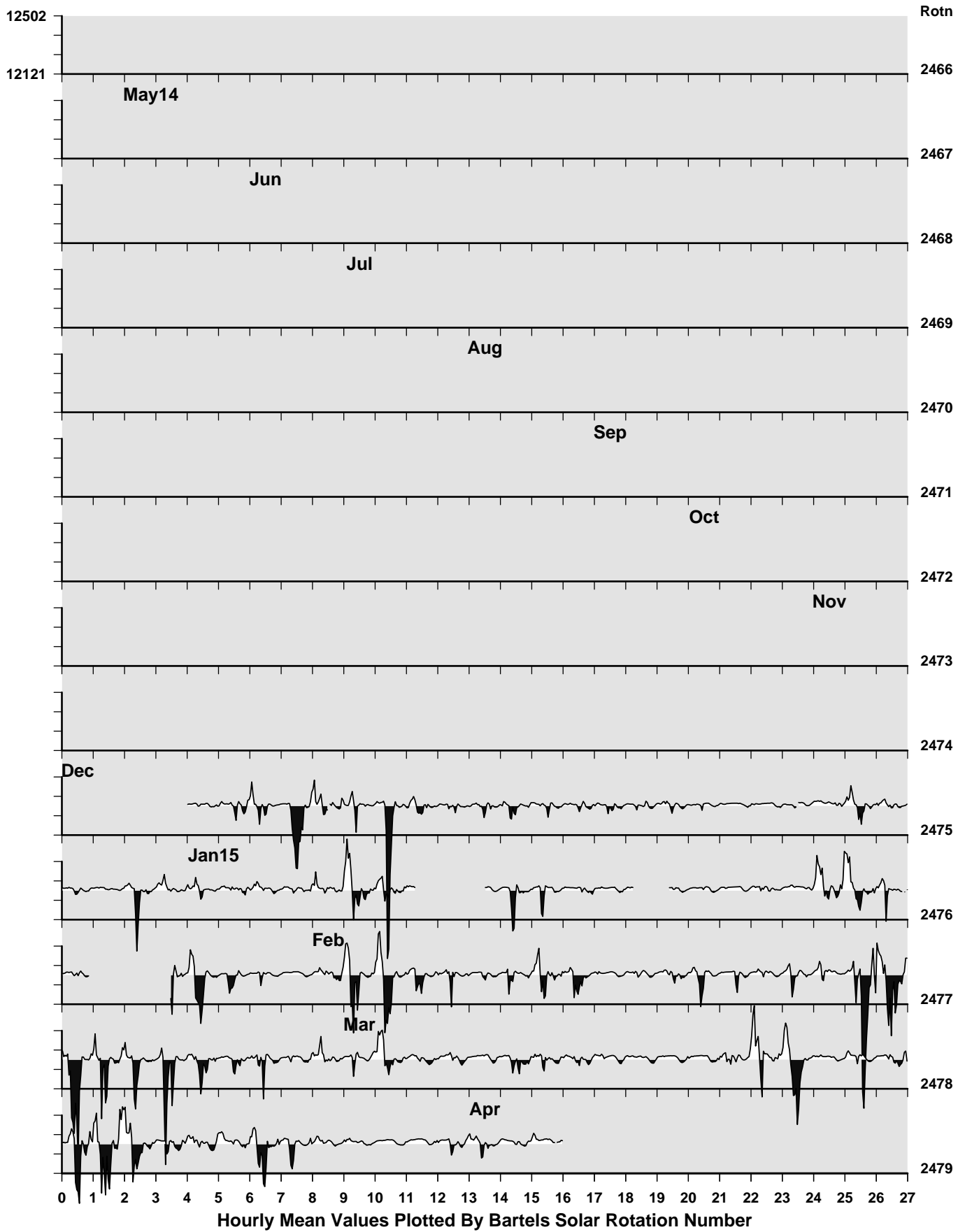


Fort McMurray Observatory: Declination (degrees)

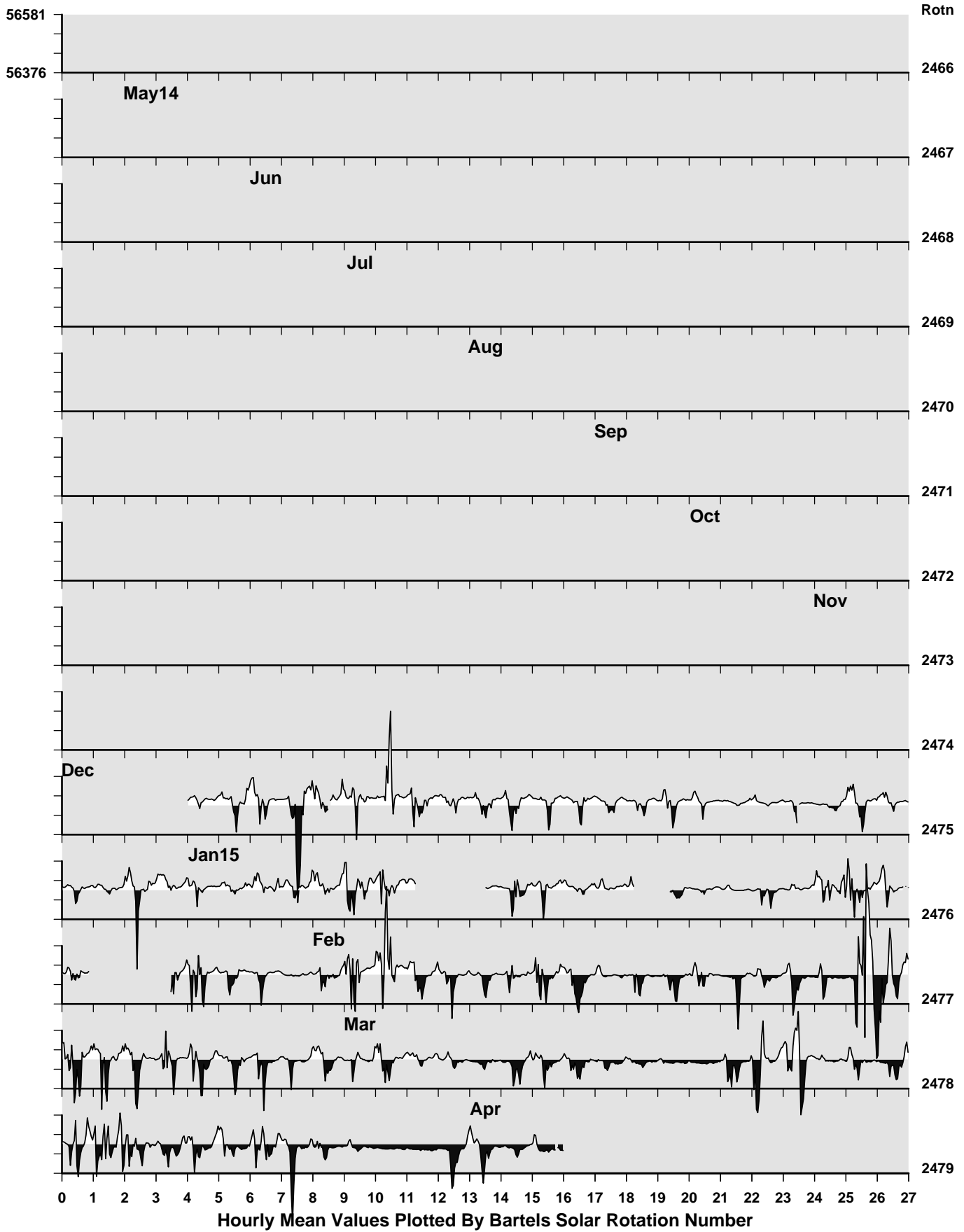


Hourly Mean Values Plotted By Bartels Solar Rotation Number

Fort McMurray Observatory: Horizontal Intensity (nT)

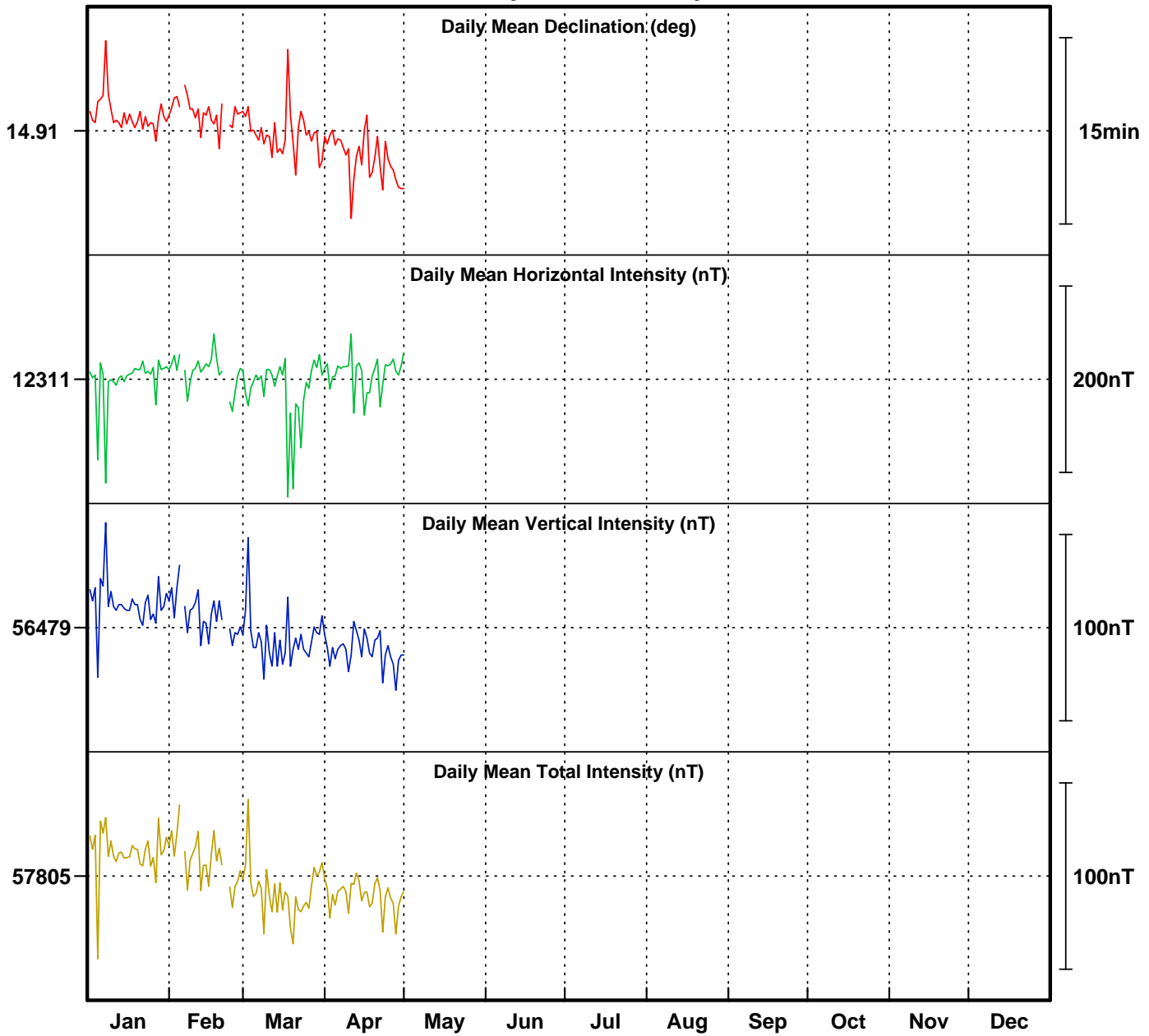


Fort McMurray Observatory: Vertical Intensity (nT)



Hourly Mean Values Plotted By Bartels Solar Rotation Number

Fort McMurray Observatory 2015



Monthly Mean Values for Fort McMurray Observatory 2015

Month	<i>D</i>	<i>H</i>	<i>I</i>	<i>X</i>	<i>Y</i>	<i>Z</i>	<i>F</i>
January	14° 55.8′	12310 nT	77° 42.4′	11895 nT	3172 nT	56492 nT	57818 nT
February	***° ***′	***** nT	***° ***′	***** nT	***** nT	***** nT	***** nT
March	14° 54.3′	12300 nT	77° 42.8′	11886 nT	3164 nT	56473 nT	57796 nT
April	14° 52.6′	12318 nT	77° 41.6′	11905 nT	3162 nT	56466 nT	57794 nT

Note

i. The values shown here are provisional.