Hermanus Magnetic Observatory

A facility of the National Research Foundation

Magnetic Results 2002

Hermanus, Hartebeesthoek and Tsumeb observatories

1. INTRODUCTION

The Hermanus Magnetic Observatory (HMO) operates three permanent geomagnetic observatories in Southern Africa, namely Hermanus, Hartebeesthoek and Tsumeb (Namibia).

This yearbook presents the results of the magnetic measurements carried out at these observatories during 2002.

2. DESCRIPTION OF THE OBSERVATORIES

The locations of the magnetic observatories are as follows:

Observatory	Geographic Coordinates		Geomagnetic Coordinates		Elevation
	Latitude	Longitude	Latitude	Longitude	m
Hermanus	34° 25' 30" S	19° 13' 30" E	42° 35' S	82° 52' E	26
Hartebeesthoek	25° 52' 58" S	27° 42' 25" E	36° 17' S	95° 19' E	1428
Tsumeb	19° 12' 08" S	17° 35' 03" E	31° 04' S	86° 49' E	1273

Geomagnetic coordinates given are relative to a geomagnetic north pole position of 81.2° N, 110.5° W, computed from the IGRF model (degree 10) at the epoch 2002.5.

3. ABSOLUTE MEASUREMENTS

At each observatory absolute measurements are made in a single absolute hut. Since 1st January 2000, absolute values of all geomagnetic elements are referred to a single standard pillar at each of the observatories. For continuity with previous data the differences between the new and old standards are quoted in the tables of annual mean values in the sense (old standard – new standard) for all elements of the geomagnetic field. Thus, annual mean values prior to 2000.5 can be referred to the new standard by adding the site difference to the old standard values.

3.1 DI-Flux

Absolute observations were carried out on a regular basis at each observatory by means of a DI-flux magnetometer for measuring the angles *D* and *I*, and a Proton Precession Magnetometer (PPM) for measuring the total magnetic field intensity, *F*. The absolute values *H* and *Z* were then derived from

$$H = F \cos I$$
$$Z = F \sin I$$

Where *H*, *Z* and *F* are field values at the time of the *I* measurement. Baseline values H_o, D_o and Z_o were then calculated for the vector magnetometer systems described in section 4 below.
The DI-flux consists of a ZEISS non-magnetic theodolite type THEO 010B (at Hermanus) and a THEO 015B (at Hartebeesthoek and Tsumeb) and a single-axis fluxgate sensor mounted on top of the telescope and electronics from Bartington. The DI-flux is considered to be an absolute instrument, which means that the angles

measured by the instrument do not deviate from the true values *D* and *I*. This is achieved by using an observation procedure which eliminates the unknown parameters such as sensor offset, collimation angles and theodolite errors.

The following azimuth values were used at each observatory.

Observatory	Mark	Azimuth value
Hermanus	HMO Beacon	342° 20' 31"
Hartebeesthoek	Red-white pole	177° 45' 09"
Tsumeb	Max Planck	015° 55' 06"

3.2 Proton Magnetometer

The proton precession magnetometer which is an integral part of the proton vector magnetometer is used for the continuous recording of total intensity data, F. See 4.2.3 below.

3.2.1 F pillar corrections

At Hermanus *D* and *I* are measured on pillar no. 1 in the Absolute House and at Hartebeesthoek and Tsumeb *D* and *I* are measured in the so-called "Standard Huts", while *F* is measured by the integral Geometrics magnetometer of the PVM system some distance away. The site differences have been measured which enable the *F* measurements to be reduced to the absolute pillar:

$$F_{\text{absolute pillar}} = F_{\text{ppm}} + \Delta F_{\text{pillar}}$$

The following are the adopted values for the year:

Site differences of ΔF_{pillar}					
Hermanus		Hartebeesthoek		Tsumeb	
Period (Day numbers)	Correction	Period (Day numbers)	Correction	Period (Day numbers)	Correction
1 – 31	18.3 nT	1 – 365	70.9 nT	1 – 365	17.8 nT
32 – 59	18.4 nT				
60 – 90	18.5 nT				
91 – 120	18.6 nT				
121 – 151	18.7 nT				
152 – 181	18.9 nT				
182 – 212	19.0 nT				
213 – 243	19.3 nT				
244 – 273	19.6 nT				
274 – 304	19.8 nT				
305 – 334	20.0 nT				
335 – 365	20.2 nT				

4. VECTOR MAGNETOMETERS

4.1 FGE Magnetometer

A type FGE fluxgate manufactured by the Danish Meteorological Institute, Denmark is in operation at all three magnetic observatories.

The sensor unit consists of three orthogonally mounted sensors on a marble cube. In order to improve long-term stability these sensors have compensation coils wound on quartz tubes in order to obtain a sensor drift of only a few nT per year. The marble cube is suspended by two strips of crossed phosphor-bronze working as a Cardan's suspension to compensate for pillar tilting which might cause baseline drift.

The sensors may be set up to record either *X*,*Y* and *Z* or *H*,*D* and *Z* components. The latter orientation has been chosen to keep the continuity of earlier recordings.

The box containing the electronics is almost magnetic free and is placed about 3 meters from the sensor. At this distance it has no effect on the recordings. Temperature outputs for the sensor and the electronics are also available.

The recording rate is 1 sec. and according to INTERMAGNET specifications a numerical filter is applied in order to obtain the final minute data series.

Technical specifications are:

Analogue output	± 10 volt
Dynamic range	3000 nT p-p
Resolution	0.2 nT
Scale value	150 nT/volt
Misalignment of sensor axis	< 7 min of arc
Long term drift	< 3nT/year
Temperature coefficient, sensor	< 0.2 nT/°C
Temperature coefficient, electronics	< 0.1 nT/°C
Bandpass	DC to 1 Hz

4.2 PVM Magnetometer

A Proton Vector Magnetometer (PVM) is also in use. It consists of a Proton Precession Magnetometer (PPM) mounted in the centre of a set of coils which are used to apply bias fields to the magnetometer.

4.2.1 Overall Instrument Description

The PVM consists of a proton precession magnetometer, a dual four-coil combination, electronics unit and a personal computer.

The electronics unit houses the PPM, current control, DC power supply and interfacing hardware. The PC computer serves as the instrument controller and data logger.
The PPM sensor is mounted inside the coil combination. The coils are positioned such that additional field vectors can be applied in the horizontal and vertical planes perpendicular to the total field vector (*F*). A stable current is passed through each coil set individually to apply the additional vectors first in a forward and then in a

reverse direction. At each of these steps the resulting vector length is determined by taking a PPM reading. This is used to calculate the *H, D* and *Z* components of the ambient magnetic field.

A stable current through the coils is obtained using a series connected current load. Current switching is controlled through a digital I/O port on the computer.

The PPM readings are fed into the computer for processing through an RS232 serial port.

The instrument runs continuously and obtains a reading every 5 seconds. From these readings one-minute values for *F, H, D* and *Z* can be derived. These are calculated by the computer and is available on the screen and line printer. A graphic display of the last 24 hours recorded data is also available. Unprocessed data are stored on disk every 5 minutes.

4.2.2 Sensor

The sensor consists of two four-coil combinations (*D* and *I*) mounted orthogonally with the PPM sensor in the middle. Each coil set consists of four equiradial circular coils on aluminium formers mounted coaxially. Each is a Barker 52/23 type with coil distances calculated for optimum homogeneity over the volume of the PPM sensor.

4.2.3 Proton Precession Magnetometer (PPM)

The PPM is a Geometrics type G-856AX. It is installed in the electronics unit and is powered from the DC power supply 16V outlet. The PPM is triggered from the computer digital I/O and the output is obtained serially. The signal levels are converted to RS232 by a converter card in the electronics unit and fed to the computer's serial port.

4.3 dIdD Magnetometer

The dIdD has a completely integrated design for measuring the Earth’s magnetic field by a sequence of measuring the total magnetic field and then four biased values of the magnetic field with an integral Overhauser magnetometer based on GEM Systems GSM-19 Model.

Equal and opposite currents are sequentially introduced into the "Inclination" (*I*) coil, which is perpendicular to *F*. These deflection fields lie in the local geomagnetic meridian plane. The resultant deflected values of *F* (*I*+ and *I*-) as measured by the Overhauser magnetometer are logged. The undeflected value of *F* is also logged.

Then, equal and opposite currents are sequentially introduced into the "Declination" (*D*) coil, which is also perpendicular to *F.* The *D* deflection fields lie in the horizontal plane. The resultant deflected values of *F* (*D*+ and *D*-) as measured by the Overhauser magnetometer are also logged. A simple algorithm is used to determine the instantaneous angular difference between the coil axes and the direction of the earth vector to compute *H* and *Z* components.

GEM Systems' advanced Overhauser design employs continuous radio frequency polarization and special sensors to maximise the signal-to-noise ratio.

The measuring range is 20,000-120,000 nT, the sensitivity 0.02 nT, resolution 0.01 nT and the absolute accuracy 0.2 nT. A cycling time of 1 sec. was used which corresponds to a reading every 5 secs. From these readings one-minute values were derived.

The data is logged by the DIMARK data acquisition system supplied by the Eötvös Loràn Geophysical Institute, Hungary.

5. PRESENTATION OF RESULTS

5.1 Base-line values

The observed and adopted base-line values are shown in a graphical form. The quality of the Hartebeesthoek and Tsumeb base-line values are not good due to environmental conditions, not properly trained observers, etc. In order to improve the base-line values an analysis of the night levels of Hermanus data versus Hartebeesthoek (or Tsumeb) were done. Whenever large deviations were detected in the data, the base-line values were adjusted and new one-minute data computed. This is particularly visible in the graphs where the adopted base-line values are not representative of the observed values.

5.1 Hourly mean values

Hourly mean values, centred on the UT half hour, are computed from the one-minute values. A value is not computed if there are more than 6 one-minute values missing. The data presentation is *XYZF* rather than *HDZF* as it is more convenient for the user who is interested in certain events to compare component values.

5.2 Monthly mean values

Monthly mean values are calculated from the daily mean values of *H*, *D* and *Z*. Monthly means are not computed if there is any missing daily value. The mean values of *X*,*Y*,*F* and *I* are calculated from the corresponding mean values of *H*, *D* and *Z*. Annual mean values are also calculated from the daily mean values. Monthly and annual mean values are also calculated for the five international quiet and disturbed days in each month.

5.3 Mean annual values

Mean annual values since the start of each observatory are presented in a separate table. The values are centred on the middle of each year. Graphical presentations of mean annual values are also included, but only for *D*, *H*, *Z* and *F*. Site differences were taken into account when the data were plotted.

6. INDICES

6.4.1 K-indices

K-indices are only computed at the Hermanus Magnetic Observatory. The index values are determined from the *H* and *D* data. The LRNS-method is used and the K9 limit is 300nT. K-indices are sent twice a month to "*Service International des Indices Geomagnetiques*", Paris.

6.4.2 *am* Indices

The Hermanus K-indices are also used in deriving the *am* index, a further planetary activity index.

6.4.3 Dst indices

The Hermanus Magnetic Observatory also supplies one-minute data for the generation of the Dst ring-current index, which is the most commonly used measure of geomagnetic storm intensity.

7. RAPID VARIATIONS

The supply of rapid variations as recorded at the Hermanus Magnetic Observatory is performed according to guidelines given in the "*Provisional Atlas of Rapid Variations (IAGA, 1961)* ". Occurrences of Solar Flare Effects (SFEs) and Storm Sudden Commencements (SSCs) are identified for publication in "*Solar-Geophysical Data*". Only SSC data for Hermanus are included in this publication.

8. DATA AVAILABILITY

Tables of hourly mean values of the magnetic elements are no longer published in this series of publications. Final digital one-minute values and hourly values are available through the World Data Center for Geomagnetism, Copenhagen:

http://dmiweb.dmi.dk/fsweb/projects/wdcc1/master.html

The data are also published on the annual INTERMAGNET CD-ROM. More information is available from:

http://www.intermagnet.org

9. CONTACT INFORMATION

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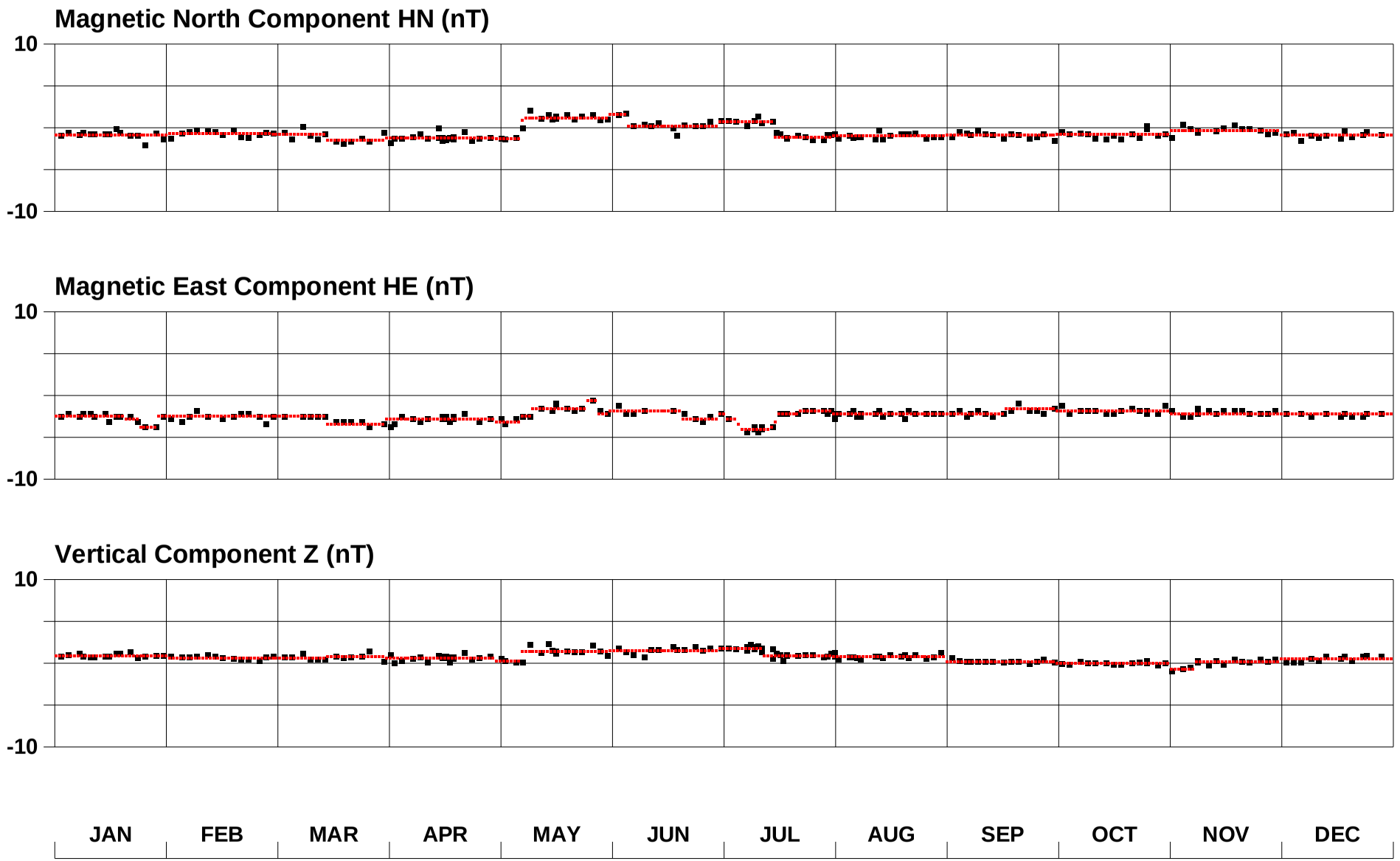
Magnetic Results 2002

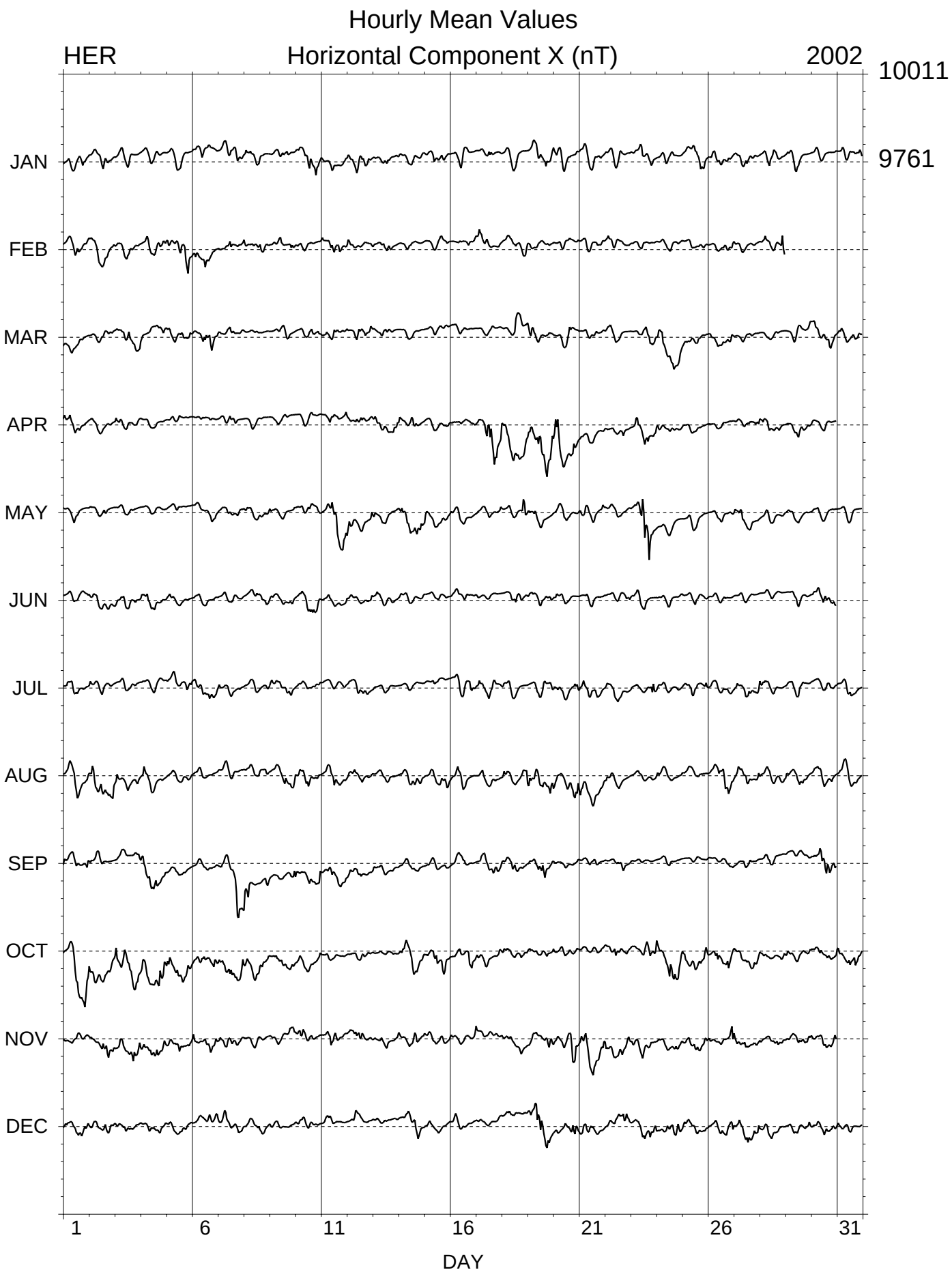
Hermanus

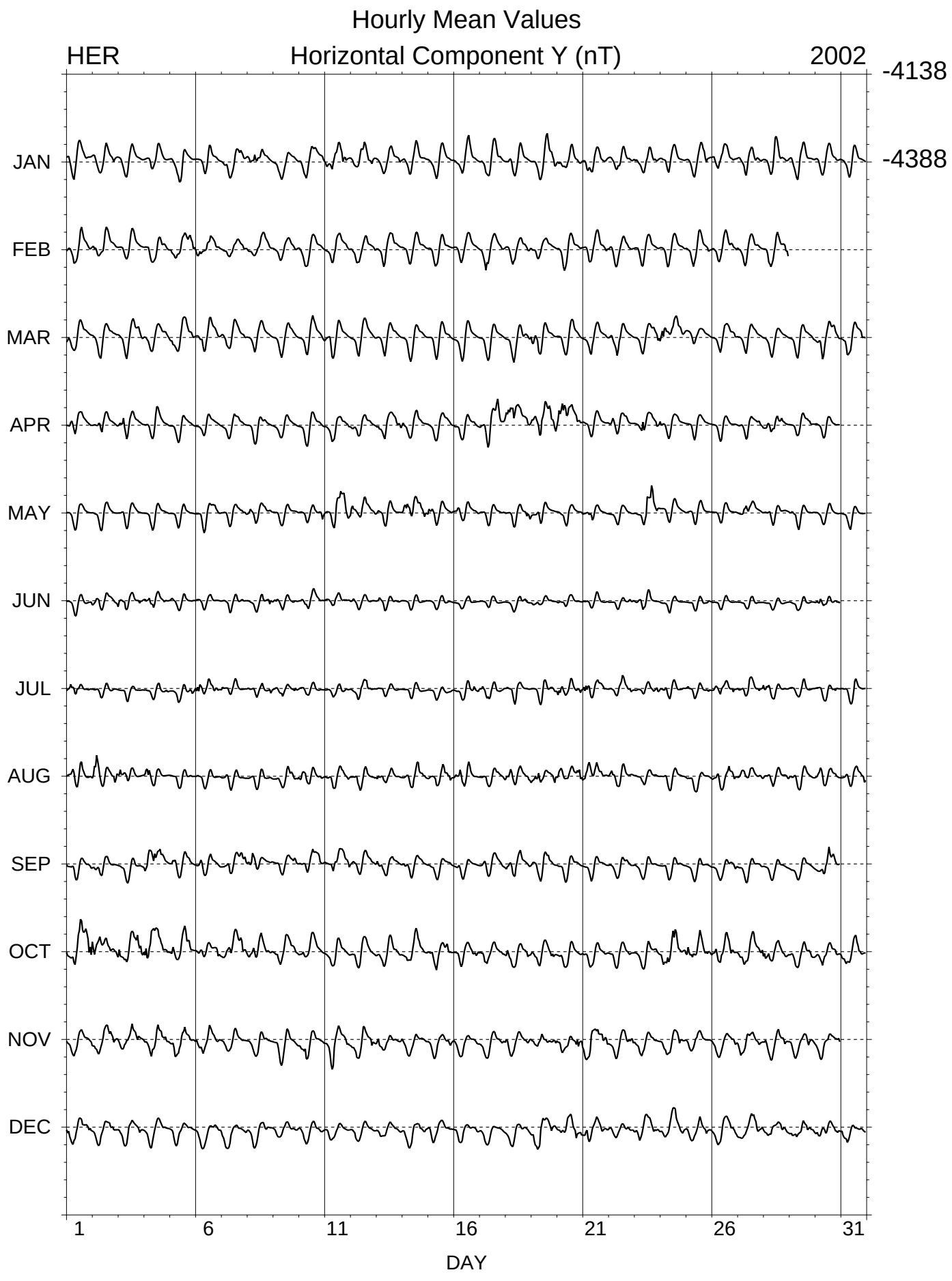
Observed and Adopted Baseline Values, HER 2002

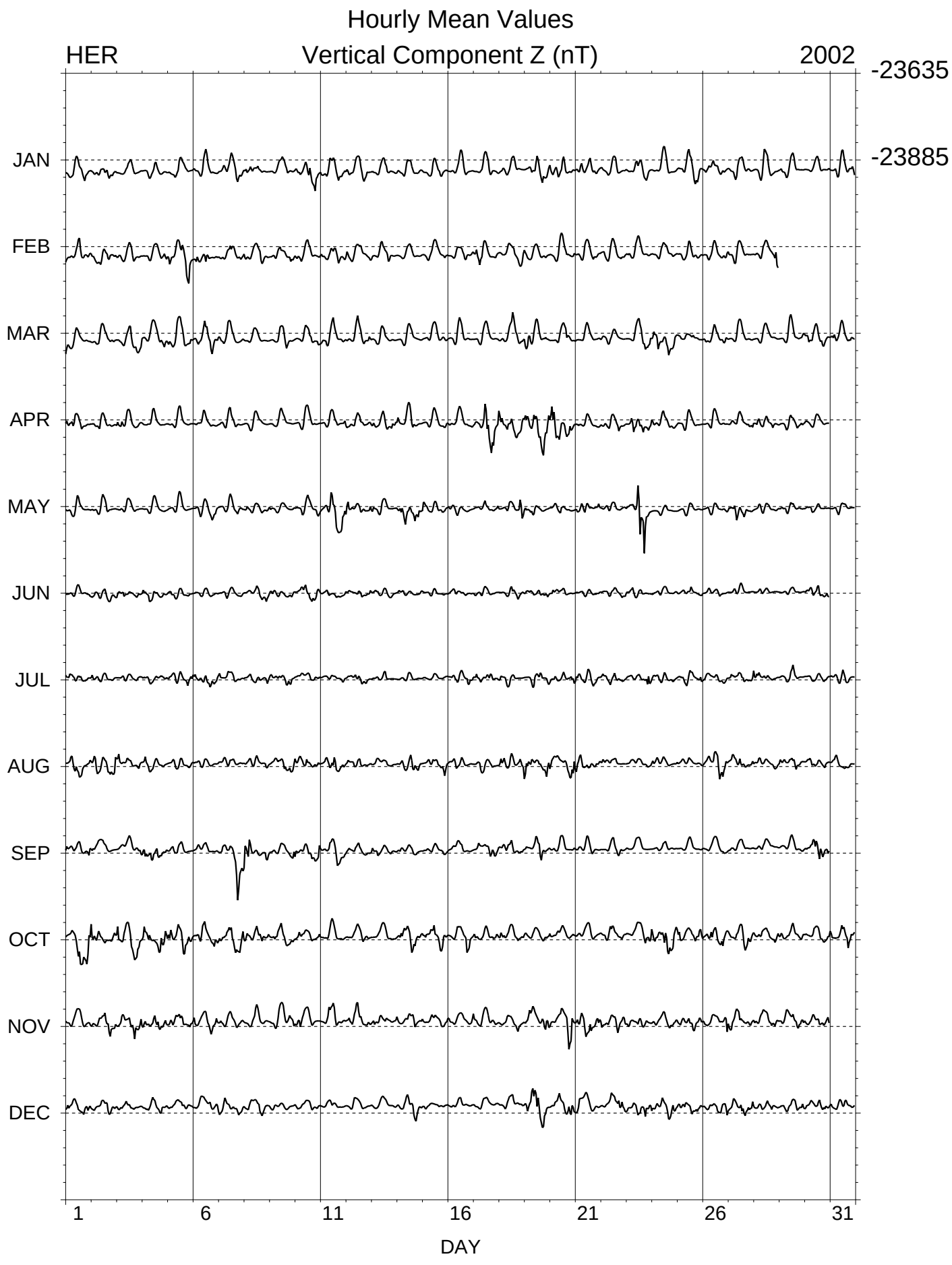
LAT: 124.425 LONG: 19.225

INSTITUTION: HMO INSTRUMENT: LC




Hourly Mean Values
HER
Horizontal Component X (nT)
2002
10011
9761
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY


Hourly Mean Values
HER
Horizontal Component Y (nT)
2002
-4138
-4388
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY


Hourly Mean Values
HER
Vertical Component Z (nT)
2002
-23635
-23885
JAN
FEB
MAR
APR
MAY
JUN
JUL
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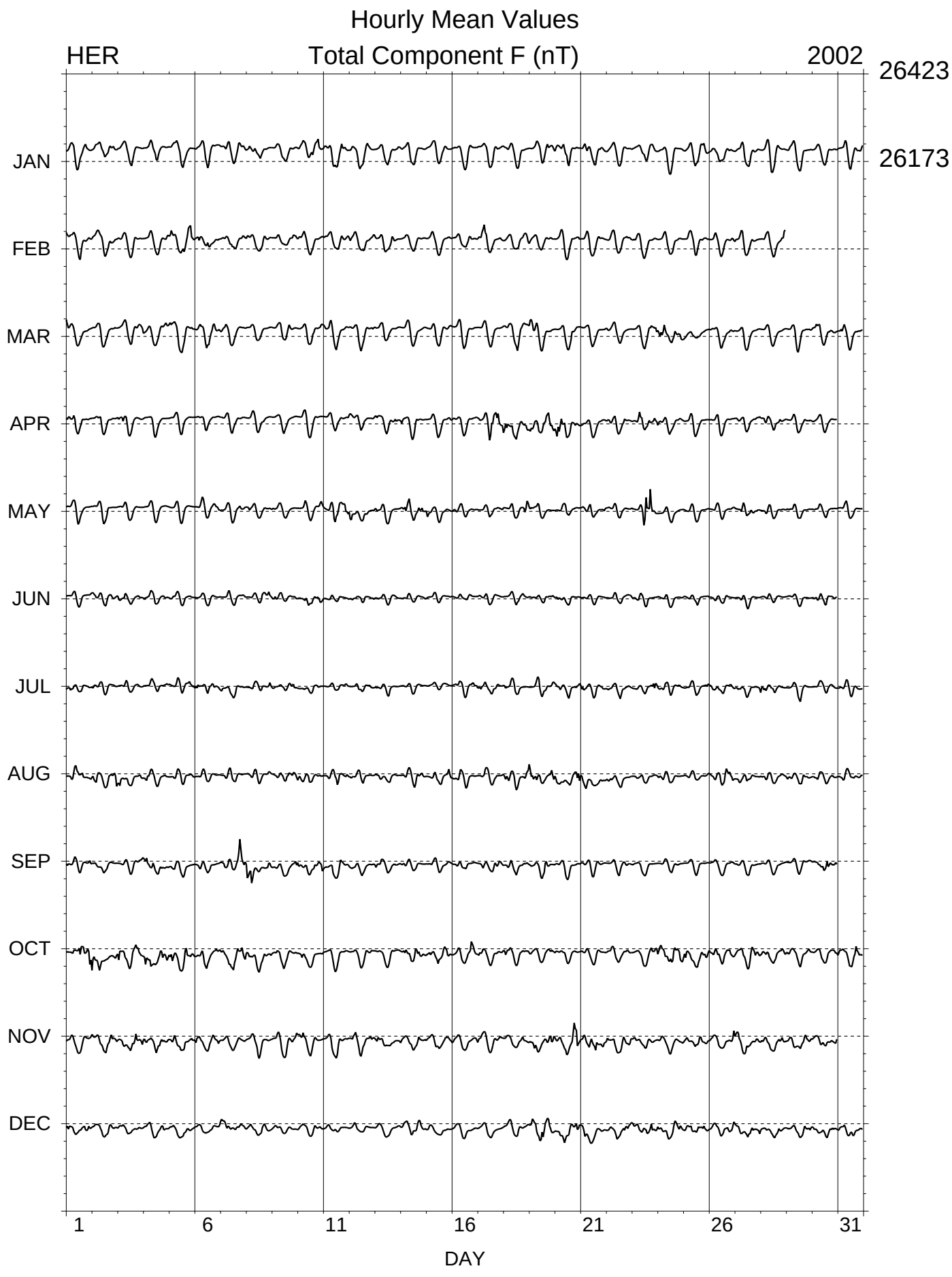
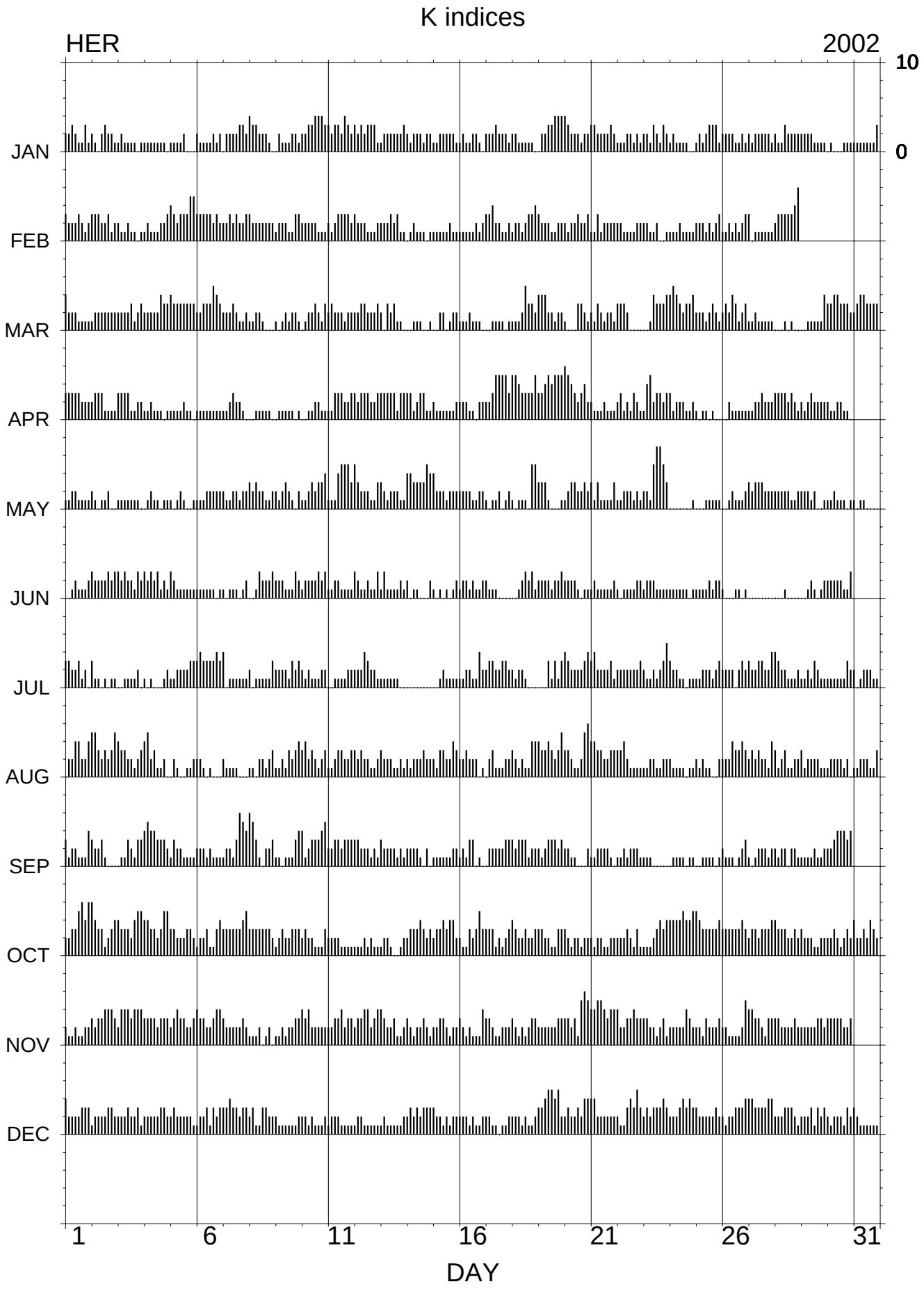
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY


Hourly Mean Values
HER
Total Component F (nT)
2002
26423
26173
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY


K indices
HER
2002
10
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY

K INDICES

HER K9 = 300 NT 2002

DATE	JAN	FEB	MAR	APR	MAY	JUN
01	2232 1131	3222 3212	4222 1111	3333 3222	1122 1111	0012 1112
02	2102 3221	3332 2312	1222 2222	2333 1111	2101 1200	3222 2323
03	1211 1101	2112 1101	2222 3123	3333 1122	1111 1110	3232 2132
04	1111 1110	1211 1223	2222 2433	1121 1101	0121 1011	3232 3121
05	1111 2000	4323 3355	4333 3333	1111 2110	1012 1001	3211 1111
06	2111 1212	3333 3232	2233 3543	1111 1111	1112 2222	1111 1101
07	0222 2332	2232 3223	2223 2112	1123 2210	2112 2122	1011 1012
08	4332 2210	3222 2222	1122 1000	0011 1110	3232 2112	0013 2223
09	0211 1221	1222 1133	1012 1221	0111 1101	2123 2102	2221 1132
10	2233 4443	2222 2111	0122 3213	0011 2211	1123 2334	1222 2323
11	3233 2432	2123 3332	2322 2122	1133 3223	1114 5553	1122 1111
12	3232 3331	3222 1112	2233 2223	3233 3223	5322 2113	3211 2113
13	1222 2223	2223 2311	2032 3110	3333 3133	3212 2211	1311 1121
14	2122 2122	0121 1101	0011 1001	3312 3311	4433 3354	2011 0002
15	1122 2221	1111 1211	0022 0122	2111 1112	4222 1222	1010 1012
16	1211 2210	1111 1212	1112 1110	2221 1022	2222 1122	1221 2112
17	2223 2221	3342 2112	0011 1101	2235 5553	1011 2012	2111 0000
18	2211 1110	1221 2334	1112 5332	5543 3335	1011 1055	0012 3231
19	0223 3444	3222 1122	4442 2122	3345 4555	3331 0001	2222 1223
20	4322 2122	2122 3223	1000 3321	6543 2342	1233 2232	2222 1011
21	3322 2232	1131 2222	2132 1221	2111 2111	3131 1113	1211 1112
22	1112 2121	2211 1122	3332 0000	2312 1321	1122 2121	1011 1122
23	2213 2132	2211 2001	0014 3334	1452 3323	2215 7753	1222 1111
24	1211 1100	1112 1111	4543 2334	3122 2112	0000 0001	1111 1101
25	1212 3331	2221 2123	2221 2321	1011 0100	0001 1111	1111 2122
26	2222 1121	1121 2123	2324 3123	0021 1111	0012 1112	1000 1101
27	2122 2221	3011 1111	1121 1111	1122 3222	3233 3222	0000 0000
28	2113 2222	2333 3346	0001 0100	3333 2321	2222 2112	0001 0000
29	2222 1111		0011 1114	2123 2222	2221 2001	0012 1012
30	0100 0111		3344 3332	2112 2110	1121 1101	2222 2113
31	1111 1113		2344 3333		1011 0000	

	JUL	AUG	SEP	OCT	NOV	DEC
01	3322 3120	0224 4224	3122 1114	2233 5646	2112 1122	4222 2333
02	3110 1011	5532 3235	3223 1000	6433 1234	3233 4443	1222 2332
03	0011 1120	4332 2123	0113 2133	4333 2455	2444 3444	2223 2231
04	1010 0012	4523 1120	4544 3332	4433 2355	3333 2333	2222 2332
05	1122 2233	0210 0112	1322 1111	3322 2332	2343 3223	2322 2221
06	3433 3343	2210 1000	2221 2111	1223 1134	4332 2344	1223 1323
07	4011 1111	2111 1000	1221 3654	3333 3345	3222 2232	3343 3233
08	2011 1113	1102 2123	6531 0223	3333 3332	1112 0120	2311 3322
09	2222 1323	1121 3234	1101 1134	1232 2333	1121 2233	2111 1112
10	2121 1122	3423 2123	4123 3345	2322 1113	4342 2222	2212 1112
11	0011 1122	1123 3223	2233 2333	2222 1111	2233 4233	1222 1111
12	2224 3221	3232 2112	3322 2121	1112 1211	2334 4234	1221 1111
13	1111 1100	3222 1121	3222 2121	1221 0012	4322 3112	1211 1112
14	0000 0000	2122 2322	2222 1020	2333 4323	3212 2321	2323 2333
15	0012 1111	2133 2243	1111 1122	2334 3442	2233 2122	3221 2122
16	1122 1142	2232 2201	1213 3010	2113 2353	3212 1114	2221 2112
17	2332 2332	0231 1122	0222 2233	3331 2123	3321 1222	2211 0112
18	2122 1000	3212 1144	3233 3122	4322 3223	3212 1233	2221 2112
19	0003 1313	4334 3235	2123 3323	3322 1133	2222 2233	3345 5452
20	4322 2234	3321 1256	2211 0002	3212 2122	3323 1565	2322 3244
21	3422 2231	4433 2233	1122 2210	2122 1122	4455 4344	4422 2222
22	2222 2223	3342 1111	1121 2221	2223 2131	4223 3433	2113 4353
23	2112 1235	1122 1122	1110 0000	1112 3434	3322 1231	2323 3343
24	3221 1011	2111 1011	0111 1011	4444 5445	2222 2432	2223 4343
25	1122 2123	2121 1002	0011 1101	5433 3334	2213 2223	3222 2232
26	2222 0232	2224 3343	2111 0123	3333 3343	2211 1125	2122 3334
27	3223 3224	2323 2214	1012 2212	2332 3334	4433 2133	4433 3344
28	4322 1112	3123 1122	2122 0221	4333 2232	3322 2232	2223 3321
29	1121 3211	3122 2211	1111 2112	3222 1122	2222 2332	2223 1323
30	1111 1132	1222 2120	2234 4434	2232 1232	3333 3223	2122 2132
31	2012 2211	1122 2113		4223 2432		3211 1111

Principal Magnetic Storms – Hermanus 2002

Commencement					SC amplitudes			Maximum 3 hr. K-index		Ranges			U.T. End	
Mth.	Day	Hr.	Min.	Type	D(′)	H(nT)	Z(nT)	Day (3 hr. periods)	K	D(′)	H(nT)	Z(nT)	Day	Hr.
Jan.	31	21	26	ssc	+1	+18	+15	31(3)	3	28	86	83	01	15
Feb.	04	21	--	..	..	..	..	05(7,8)	5	26	119	151	06	21
	17	02	56	ssc	..	+30	+24	17(3)	4	31	80	88	17	16
	28	04	50	ssc	+2*	+22	+16	28(8)	6	27	84	102	01	03
Mar.	06	05	--	..	..	..	..	06(6)	5	32	74	118	06	24
	18	13	24	ssc	+6	+54	+46	18(5)	5	38	76	138	19	12
	20	13	28	ssc	+3	+15	+13	20(5,6)	3	15	52	62	20	21
	23	11	38	ssc	+3	+26	+22	24(2)	5	26	136	129	25	09
	29	22	39	ssc	+2	+26	+23	29(8), 30(3,4)	4	38	101	79	30	22
Apr.	17	11	08	ssc	+ 8	+51	+47	20(1)	6	40	177	176	20	21
	23	04	49	ssc	+3*	+19	+17	23(3)	5	17	104	61	23	18
May	11	10	16	ssc	..	+28	+38	11(5,6,7), 12(1)	5	32	176	146	12	04
	14	00	--	..	..	..	..	14(7)	5	27	90	77	15	03
	18	20	11	ssc	+2	+30	+26	18(7,8)	5	13	63	72	19	08
	20	03	43	ssc	+2	+7	+6	20(3,4,7)	3	18	63	37	20	19
	23	10	52	ssc	+3	+21	+19	23(5,6)	7	33	235	249	23	24
Jun.					NO DISTURBANCES RECORDED									
Jul.	19	10	10	ssc	-2	+14	+20	20(1)	4	23	68	47	20	16
Aug.	01	05	11	ssc	+2	+10	+8	02(1,2,8)	5	39	120	92	03	12
	04	01	--	..	..	..	..	04(2)	5	30	67	60	04	12
	18	18	47	ssc	+3	+55	+22	19(8)	5	21	85	83	20	09
	20	17	--	..	..	..	..	20(8)	6	22	106	92	21	15
Sep.	03	18	--	..	..	..	..	04(2)	5	19	124	55	04	21
	07	12	--	..	..	..	..	07(6), 08(1)	6	29	161	245	08	11
	10	05	--	..	..	..	..	10(8)	5	21	65	69	10	24
Oct.	01	06	--	..	..	..	..	02(6,8)	6	47	234	186	02	12
	03	15	--	..	..	..	..	03(7,8), 04(7,8)	5	25	113	118	05	06
	06	18	--	..	..	..	..	07(8)	5	27	93	96	08	21
	16	16	--	..	..	..	..	16(7)	5	19	59	87	17	09
	23	10	--	..	..	..	..	24(5,8), 25(1)	5	32	139	110	29	12
Nov.	09	17	52	ssc	+1	+8	+5	10(1,3)	4	25	74	71	10	17
	20	11	--	..	..	..	..	20(7)	6	34	159	137	22	03
	26	21	51	ssc*	+2	+35	+23	26(8)	5	22	86	83	27	15
Dec.	19	00	--	..	..	..	..	19(4,5,7)	5	31	166	138	19	21
	22	10	--	..	..	..	..	22(7)	5	12	44	65	22	24

ssc = sudden commencement; ssc* = small initial impulse followed by main pulse;
.. = gradual commencement.

Degree of activity: Moderate (when K ≤ 5); Moderately severe (when K = 6 or 7);
Severe (when K = 8 or 9)

HERMANUS
MEAN MONTHLY VALUES 2002

Date	° D	'	° I	'	H nT	X nT	Y nT	Z nT	F nT	*	ELE
JAN	-24	08.1	-65	51.7	10715	9779	-4381	-23912	26203	A	HDZF
FEB	-24	09.2	-65	51.8	10712	9774	-4383	-23906	26197	A	HDZF
MAR	-24	10.5	-65	51.5	10710	9771	-4386	-23896	26186	A	HDZF
APR	-24	11.4	-65	52.9	10697	9758	-4383	-23894	26179	A	HDZF
MAY	-24	12.6	-65	52.8	10697	9757	-4387	-23892	26177	A	HDZF
JUN	-24	12.4	-65	50.8	10711	9769	-4392	-23884	26176	A	HDZF
JUL	-24	12.9	-65	50.9	10708	9766	-4392	-23880	26171	A	HDZF
AUG	-24	13.2	-65	51.9	10698	9757	-4389	-23876	26164	A	HDZF
SEP	-24	14.2	-65	51.8	10698	9755	-4391	-23873	26161	A	HDZF
OCT	-24	15.0	-65	53.9	10681	9738	-4387	-23875	26155	A	HDZF
NOV	-24	16.0	-65	51.4	10699	9754	-4397	-23869	26157	A	HDZF
DEC	-24	14.8	-65	49.8	10710	9766	-4398	-23864	26157	A	HDZF
YEAR	-24	12.5	-65	51.8	10703	9762	-4389	-23885	26174	A	HDZF
JAN	-24	07.4	-65	51.0	10721	9785	-4382	-23912	26206	Q	HDZF
FEB	-24	08.4	-65	51.4	10715	9778	-4382	-23904	26196	Q	HDZF
MAR	-24	11.2	-65	50.4	10718	9777	-4391	-23893	26187	Q	HDZF
APR	-24	11.6	-65	51.0	10712	9771	-4390	-23890	26182	Q	HDZF
MAY	-24	13.3	-65	52.8	10697	9755	-4389	-23891	26176	Q	HDZF
JUN	-24	12.3	-65	49.8	10718	9776	-4394	-23882	26177	Q	HDZF
JUL	-24	12.9	-65	49.8	10717	9774	-4396	-23880	26174	Q	HDZF
AUG	-24	13.2	-65	50.3	10711	9768	-4394	-23874	26167	Q	HDZF
SEP	-24	13.7	-65	49.1	10717	9773	-4398	-23867	26162	Q	HDZF
OCT	-24	14.3	-65	51.2	10700	9757	-4393	-23869	26158	Q	HDZF
NOV	-24	15.1	-65	49.6	10712	9767	-4400	-23865	26158	Q	HDZF
DEC	-24	13.3	-65	47.4	10727	9783	-4401	-23859	26160	Q	HDZF
YEAR	-24	12.2	-65	50.3	10714	9772	-4392	-23882	26175	Q	HDZF
JAN	-24	08.8	-65	53.0	10707	9770	-4380	-23917	26204	D	HDZF
FEB	-24	10.1	-65	53.5	10701	9763	-4381	-23912	26197	D	HDZF
MAR	-24	11.0	-65	53.1	10698	9759	-4383	-23898	26183	D	HDZF
APR	-24	12.3	-65	58.9	10653	9716	-4368	-23905	26171	D	HDZF
MAY	-24	11.8	-65	54.8	10684	9746	-4379	-23899	26179	D	HDZF
JUN	-24	12.5	-65	51.7	10704	9763	-4389	-23887	26176	D	HDZF
JUL	-24	13.0	-65	51.9	10700	9759	-4389	-23881	26169	D	HDZF
AUG	-24	14.2	-65	54.6	10678	9737	-4383	-23882	26160	D	HDZF
SEP	-24	14.6	-65	55.9	10668	9728	-4380	-23885	26159	D	HDZF
OCT	-24	15.3	-65	58.7	10646	9706	-4373	-23886	26151	D	HDZF
NOV	-24	17.2	-65	54.0	10680	9735	-4393	-23875	26155	D	HDZF
DEC	-24	14.1	-65	51.4	10699	9756	-4392	-23868	26156	D	HDZF
YEAR	-24	12.9	-65	54.3	10685	9745	-4382	-23891	26172	D	HDZF

*A: All days
*Q: Quiet days
*D: Disturbed days
ELE: Elements recorded

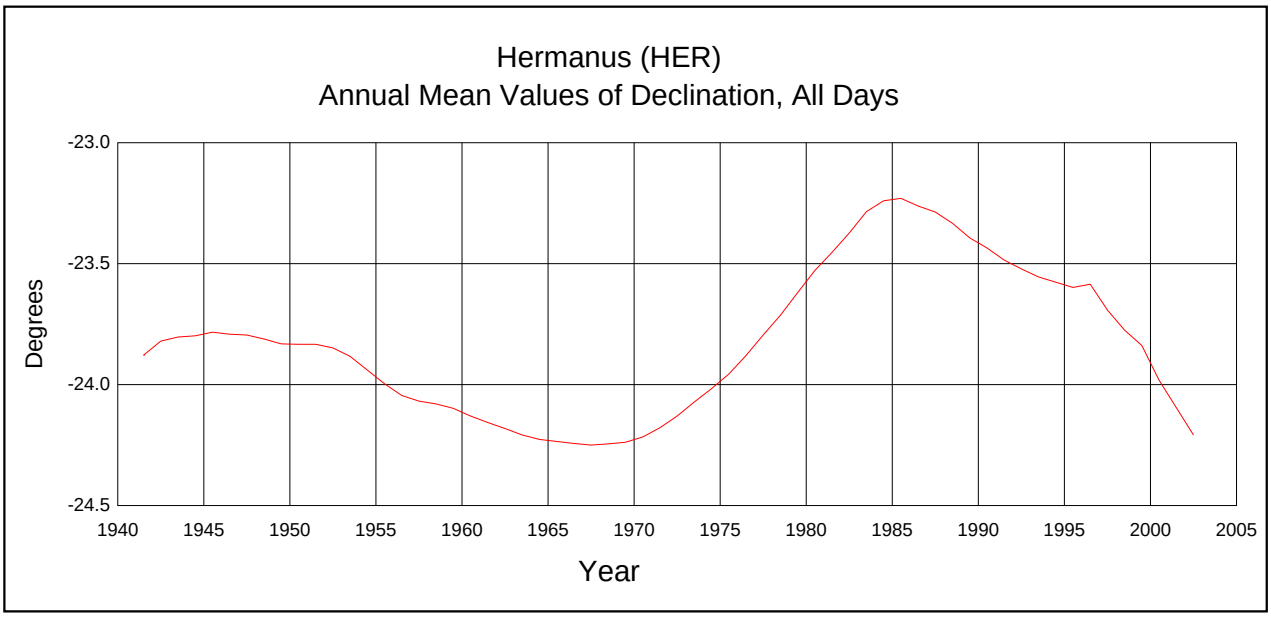
HERMANUS
MEAN ANNUAL VALUES

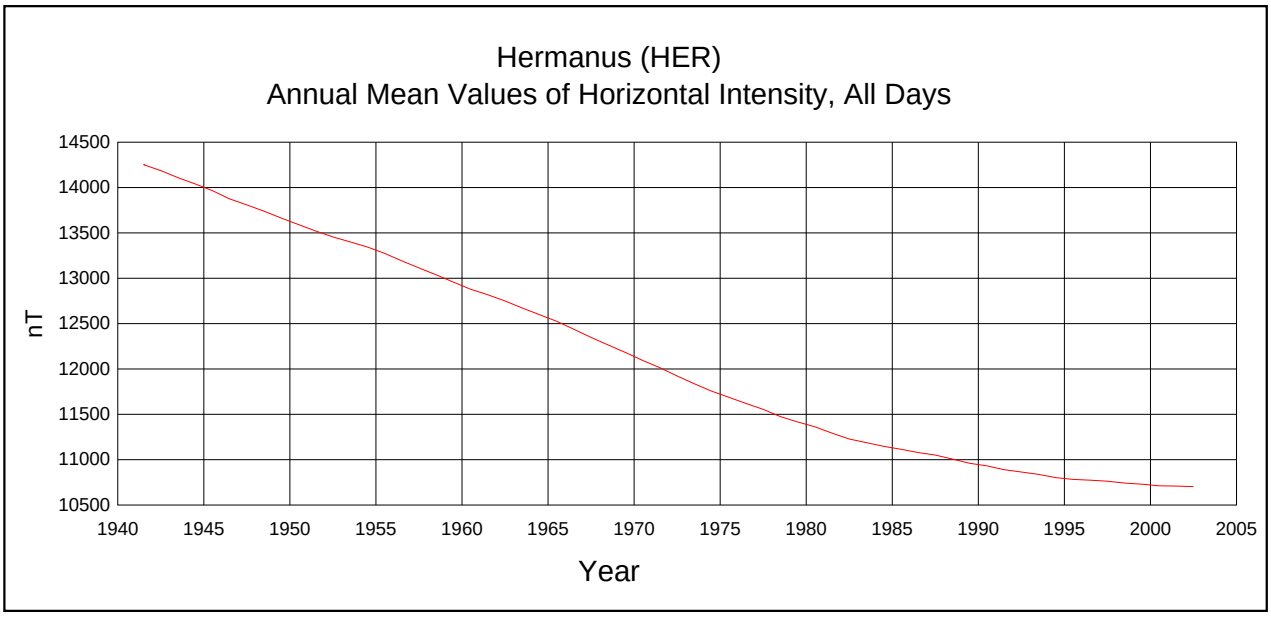
Date	° D '	° I '	H nT	X nT	Y nT	Z nT	F nT	*	ELE
1941.5	-23 51.6	-64 01.4	14252	13034	-5765	-29249	32537	A	DHZ
1942.5	-23 48.1	-64 03.0	14187	12980	-5724	-29153	32422	A	DHZ
1943.5	-23 47.1	-64 06.4	14109	12911	-5690	-29065	32309	A	DHZ
1944.5	-23 46.8	-64 09.1	14040	12848	-5661	-28981	32202	A	DHZ
1945.5	-23 45.9	-64 12.4	13966	12782	-5628	-28900	32097	A	DHZ
1946.5	-23 46.4	-64 17.5	13875	12697	-5594	-28819	31985	A	DHZ
1947.5	-23 46.6	-64 19.9	13809	12637	-5567	-28734	31880	A	DHZ
1948.5	-23 47.6	-64 22.4	13739	12571	-5543	-28642	31767	A	DHZ
1949.5	-23 48.8	-64 25.8	13664	12501	-5517	-28557	31657	A	DHZ
1950.5	-23 48.9	-64 28.5	13592	12435	-5488	-28465	31543	A	DHZ
1951.5	-23 48.9	-64 31.2	13521	12370	-5460	-28373	31430	A	DHZ
1952.5	-23 49.8	-64 33.1	13456	12309	-5436	-28278	31316	A	DHZ
1953.5	-23 51.9	-64 33.9	13401	12255	-5422	-28179	31203	A	DHZ
1954.5	-23 55.3	-64 35.3	13345	12199	-5411	-28090	31098	A	DHZ
1955.5	-23 58.7	-64 38.7	13275	12130	-5395	-28013	30999	A	DHZ
1956.5	-24 01.6	-64 44.0	13192	12049	-5372	-27950	30907	A	DHZ
1957.5	-24 03.0	-64 48.5	13114	11976	-5344	-27880	30810	A	DHZ
1958.5	-24 03.7	-64 52.6	13038	11905	-5316	-27804	30709	A	DHZ
1959.5	-24 04.8	-64 56.9	12958	11830	-5287	-27724	30603	A	DHZ
1960.5	-24 06.7	-65 01.0	12879	11755	-5261	-27640	30493	A	DHZ
1961.5	-24 08.3	-65 02.8	12818	11697	-5242	-27546	30382	A	DHZ
1962.5	-24 09.8	-65 04.8	12750	11633	-5219	-27444	30261	A	DHZ
1963.5	-24 11.4	-65 08.0	12672	11559	-5192	-27340	30134	A	DHZ
1964.5	-24 12.5	-65 10.6	12599	11491	-5166	-27238	30010	A	DHZ
1965.5	-24 13.0	-65 13.5	12526	11423	-5138	-27139	29890	A	DHZ
1966.5	-24 13.5	-65 18.2	12438	11343	-5104	-27046	29769	A	DHZ
1967.5	-24 13.9	-65 23.3	12348	11260	-5068	-26956	29650	A	DHZ
1968.5	-24 13.6	-65 27.6	12264	11184	-5032	-26860	29527	A	DHZ
1969.5	-24 13.2	-65 31.6	12182	11110	-4997	-26764	29406	A	DHZ
1970.5	-24 11.9	-65 36.3	12094	11032	-4957	-26668	29282	A	DHZ
1971.5	-24 09.6	-65 40.3	12014	10962	-4917	-26573	29163	A	DHZ
1972.5	-24 06.7	-65 45.7	11923	10883	-4871	-26482	29042	A	DHZ
1973.5	-24 03.2	-65 50.7	11837	10809	-4825	-26394	28927	A	DHZ
1974.5	-23 59.9	-65 55.0	11756	10740	-4781	-26302	28810	A	DHZ
1975.5	-23 56.3	-65 57.9	11688	10683	-4743	-26210	28698	A	DHZ
1976.5	-23 51.7	-66 00.9	11620	10627	-4700	-26116	28584	A	DHZ
1977.5	-23 46.6	-66 03.5	11555	10574	-4659	-26024	28473	A	DHZ
1978.5	-23 41.7	-66 08.1	11475	10508	-4611	-25937	28362	A	DHZ
1979.5	-23 36.1	-66 10.2	11416	10461	-4571	-25846	28255	A	DHZ
1980.5	-23 30.6	-66 11.4	11363	10420	-4533	-25753	28148	A	DHZ

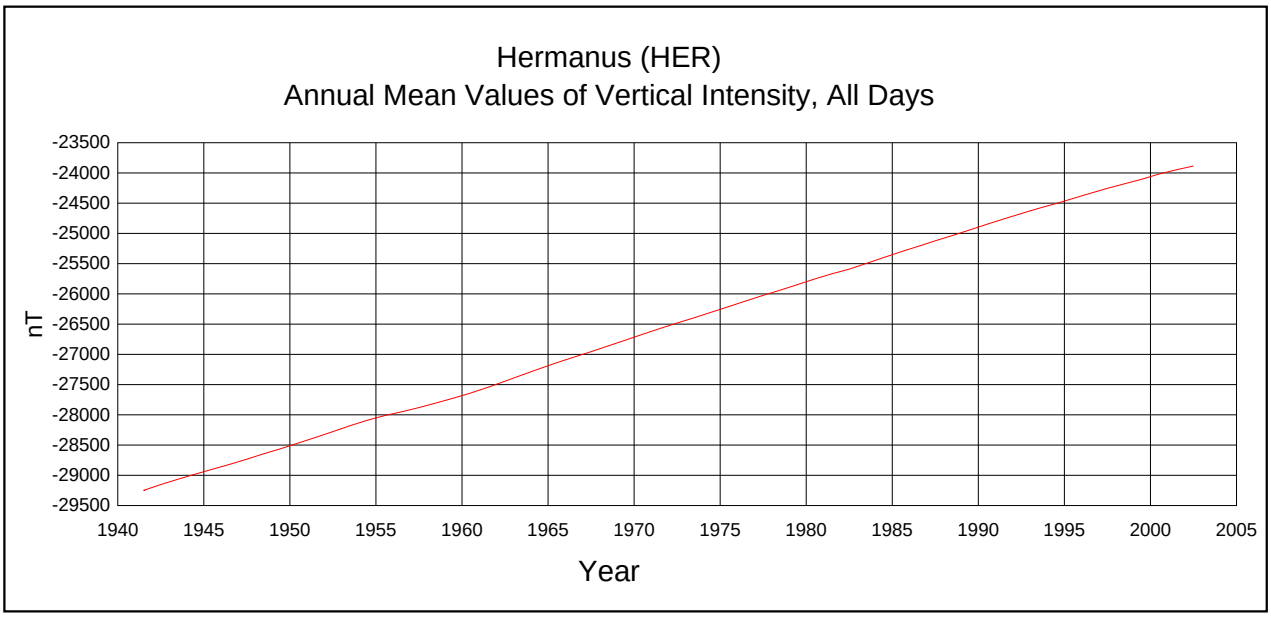
HERMANUS
MEAN ANNUAL VALUES

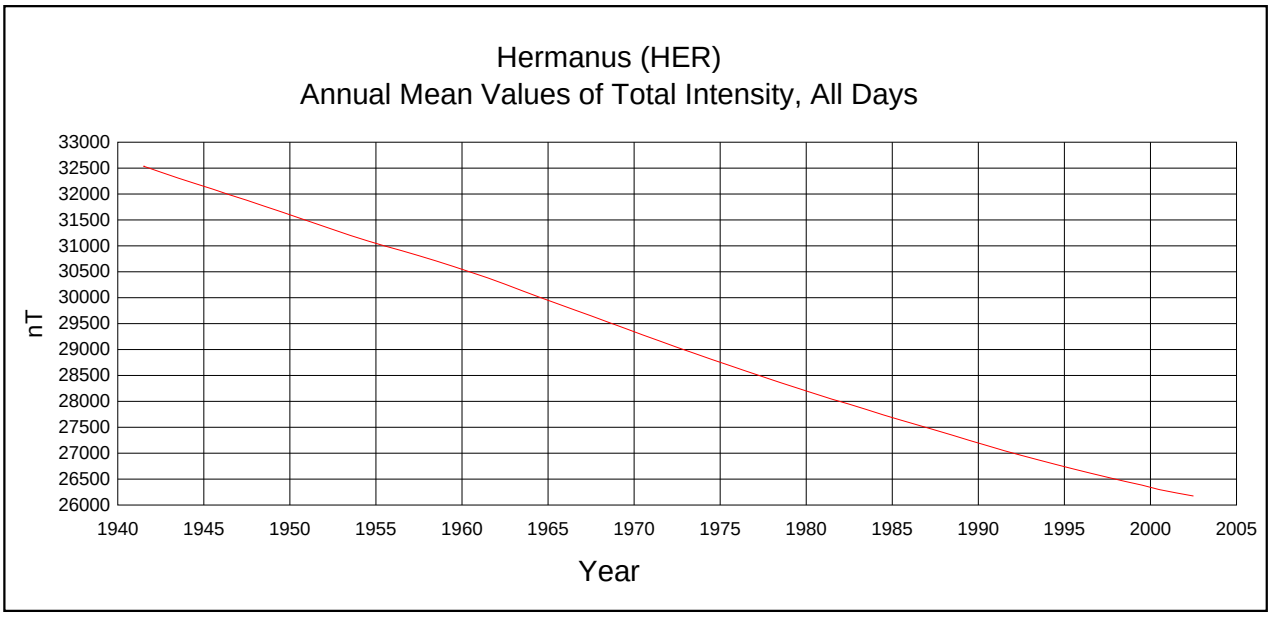
Date	°D	'	°I	'	H nT	X nT	Y nT	Z nT	F nT	*	ELE
1981.5	-23	26.1	-66	15.0	11293	10362	-4492	-25667	28042	A	DHZ
1982.5	-23	21.3	-66	18.6	11228	10309	-4452	-25591	27946	A	DHZ
1983.5	-23	16.0	-66	18.4	11188	10279	-4420	-25496	27843	A	DHZ
1984.5	-23	13.3	-66	18.3	11147	10244	-4395	-25399	27737	A	DHZ
1985.5	-23	12.7	-66	17.2	11115	10216	-4381	-25304	27638	A	DHZ
1986.5	-23	14.6	-66	16.8	11079	10180	-4373	-25215	27542	A	DHZ
1987.5	-23	16.1	-66	15.3	11051	10153	-4366	-25122	27445	A	DHZ
1988.5	-23	18.9	-66	15.9	11007	10109	-4357	-25034	27347	A	DHZ
1989.5	-23	22.5	-66	16.7	10960	10061	-4349	-24943	27245	A	DHZ
1990.5	-23	25.0	-66	15.2	10932	10032	-4345	-24849	27148	A	DHZ
1991.5	-23	28.0	-66	15.5	10890	9990	-4337	-24759	27049	A	DHZ
1992.5	-23	30.2	-66	14.0	10864	9963	-4333	-24671	26958	A	DHZ
1993.5	-23	32.2	-66	12.7	10838	9937	-4329	-24586	26870	A	DHZ
1994.5	-23	33.5	-66	12.8	10802	9902	-4318	-24507	26783	A	DHZ
1995.5	-23	34.8	-66	10.7	10783	9883	-4314	-24423	26698	A	DHZ
1996.5	-23	34.0	-66	07.2	10774	9876	-4308	-24337	26616	A	DHZ
1997.5	-23	40.4	-66	04.3	10763	9858	-4322	-24255	26536	A	DHZ
1998.5	-23	45.4	-66	02.7	10742	9833	-4328	-24179	26458	A	DHZ
1999.0	0	1.1	0	-0.5	3	4	2	-16	4	J	DHZ
1999.5	-23	50.3	-66	00.3	10730	9815	-4337	-24104	26385	A	DHZ
2000.5	-23	58.9	-65	57.8	10712	9788	-4355	-24018	26299	A	DHZ
2001.5	-24	05.7	-65	54.4	10709	9776	-4372	-23948	26234	A	DHZ
2002.5	-24	12.5	-65	51.7	10703	9762	-4389	-23885	26174	A	DHZ

*A: All days
*Q: Quiet days
*D: Disturbed days
*J: Jump in data, jump value = old site value - new site value
ELE: Elements recorded


Hermanus (HER)
Annual Mean Values of Declination, All Days
Degrees
-23.0
-23.5
-24.0
-24.5
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
Year


Hermanus (HER)
Annual Mean Values of Horizontal Intensity, All Days
nT
14500
14000
13500
13000
12500
12000
11500
11000
10500
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
Year


Hermanus (HER)
Annual Mean Values of Vertical Intensity, All Days
nT
-23500
-24000
-24500
-25000
-25500
-26000
-26500
-27000
-27500
-28000
-28500
-29000
-29500
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
Year


Hermanus (HER)
Annual Mean Values of Total Intensity, All Days
nT
33000
32500
32000
31500
31000
30500
30000
29500
29000
28500
28000
27500
27000
26500
26000
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
Year

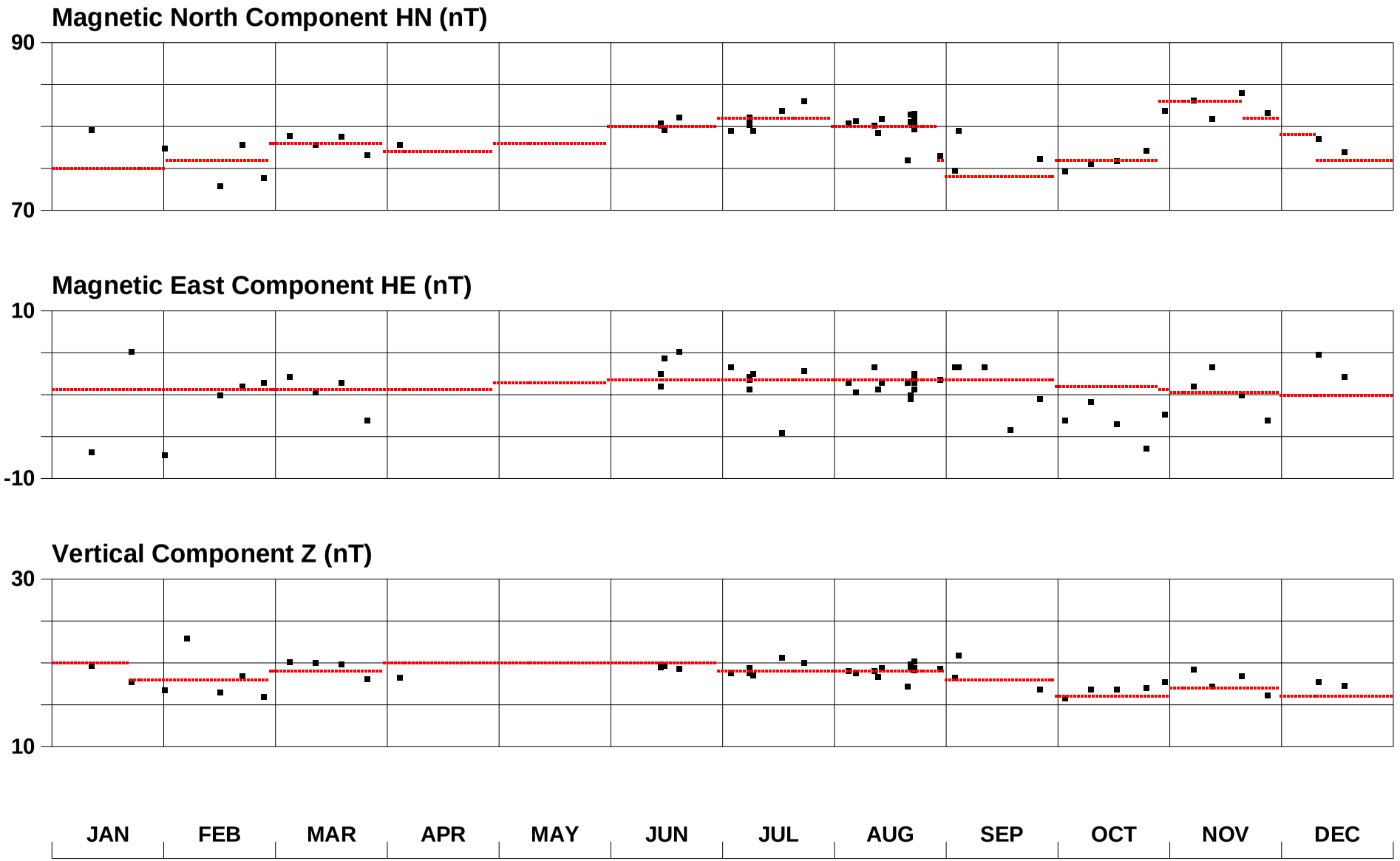
Magnetic Results 2002

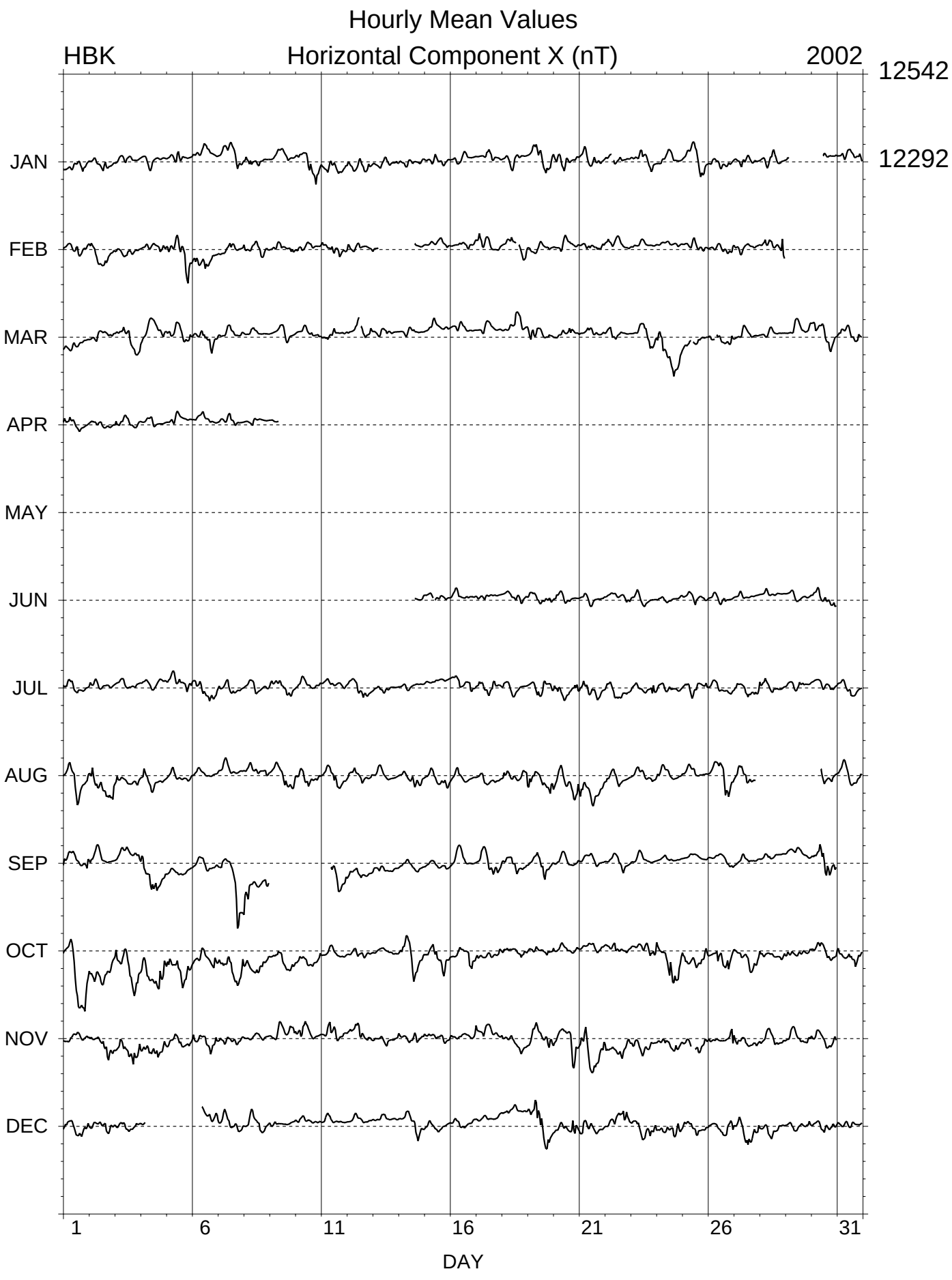
Hartebeesthoek

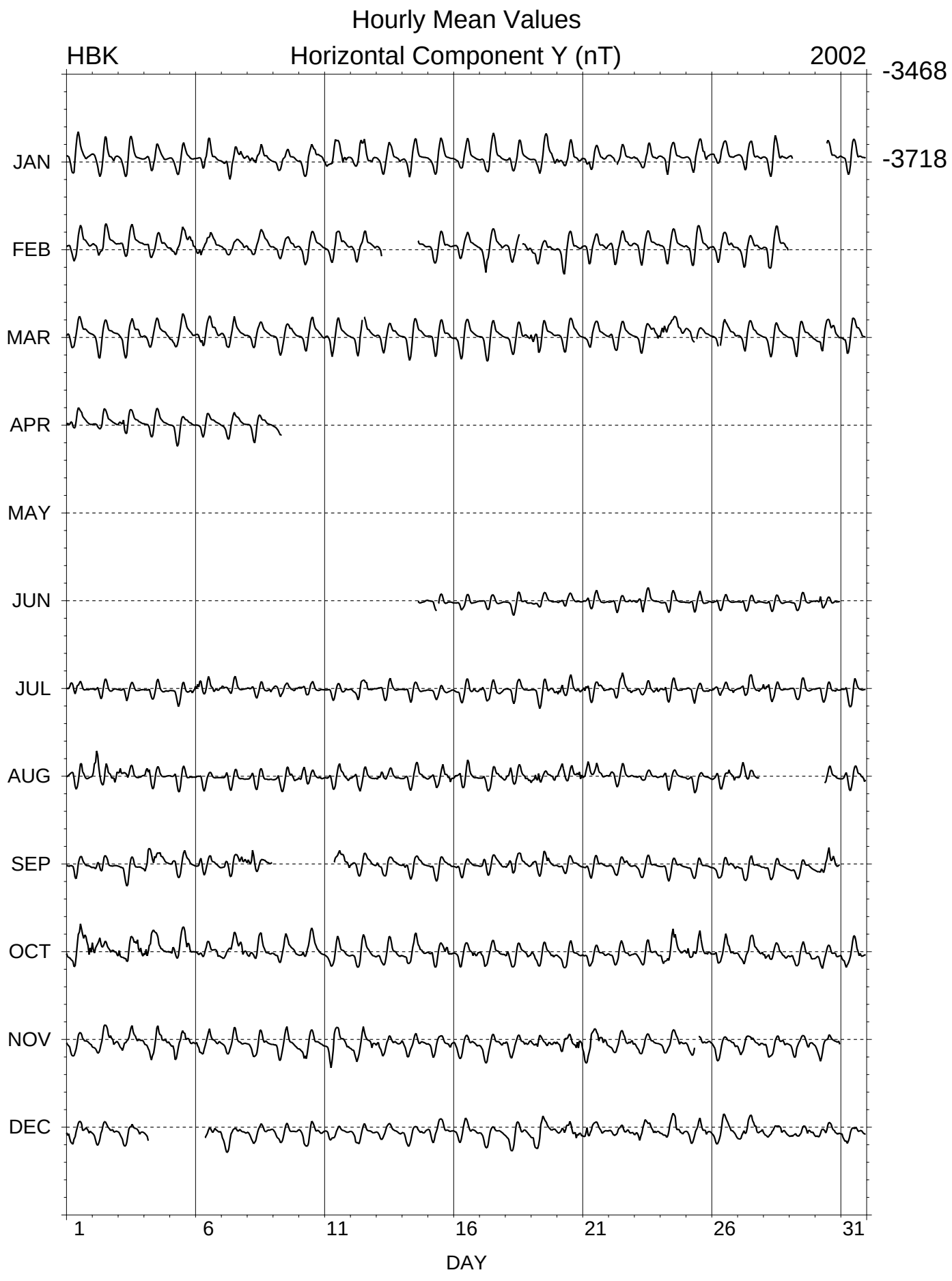
Observed and Adopted Baseline Values, HBK 2002

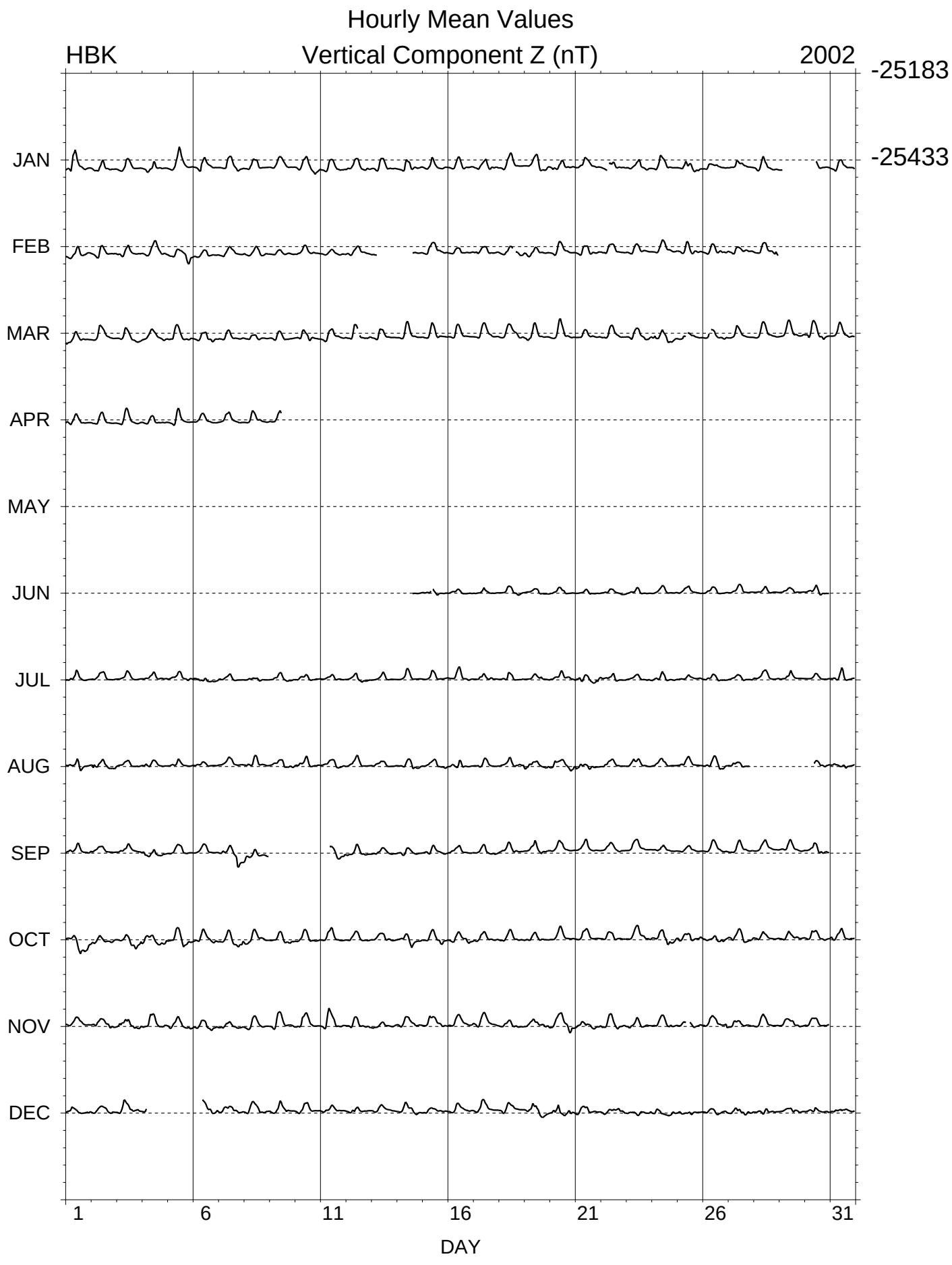
LAT: 115.883 LONG: 27.707

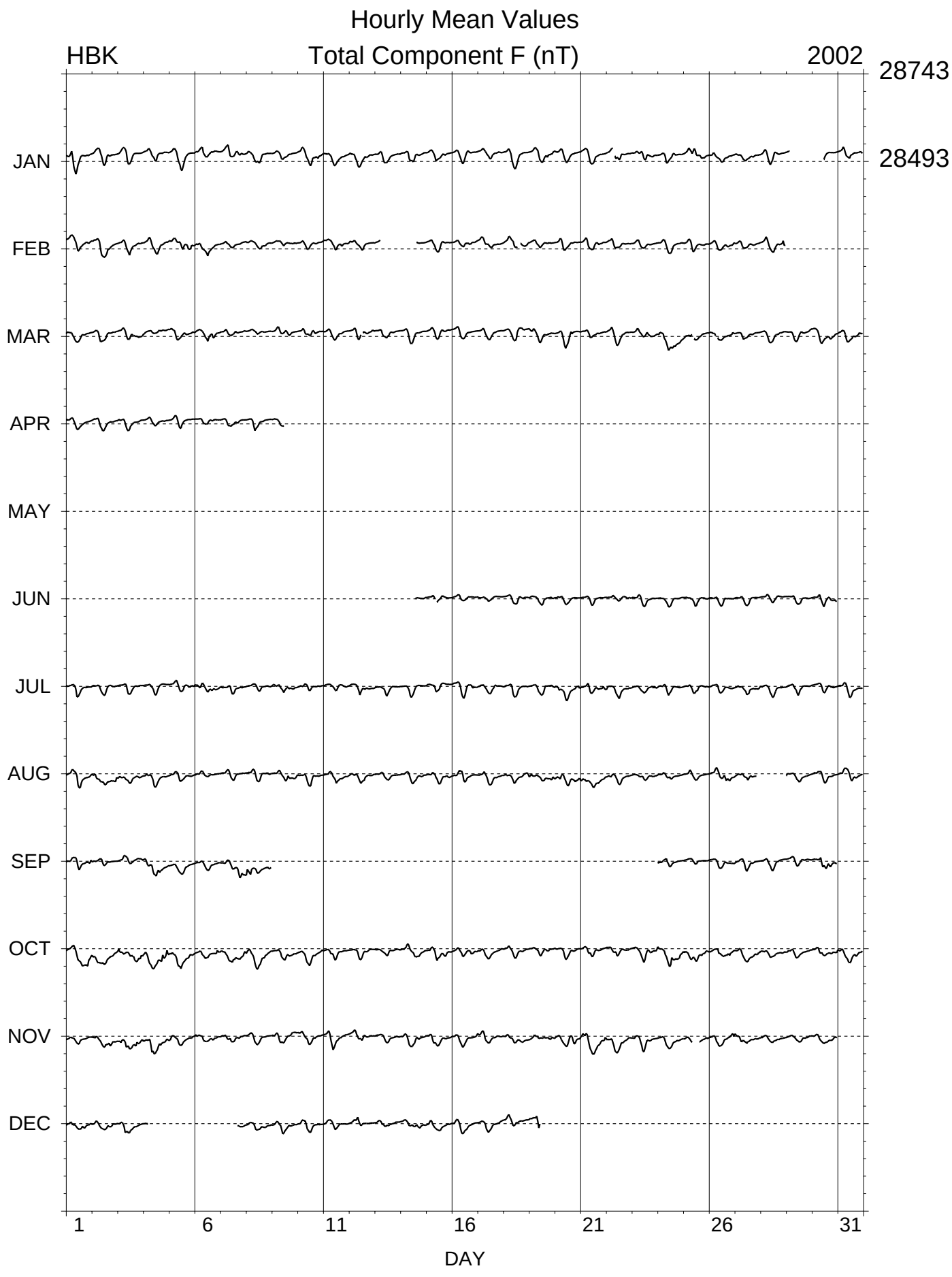
INSTITUTION: HMO INSTRUMENT: LC




Hourly Mean Values
HBK
Horizontal Component X (nT)
2002
12542
12292
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY


Hourly Mean Values
HBK
Horizontal Component Y (nT)
2002
-3468
-3718
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY


Hourly Mean Values
HBK
Vertical Component Z (nT)
2002
-25183
-25433
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY


Hourly Mean Values
HBK
Total Component F (nT)
2002
28743
28493
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY

HARTEBEESTHOEK
MEAN MONTHLY VALUES 2002

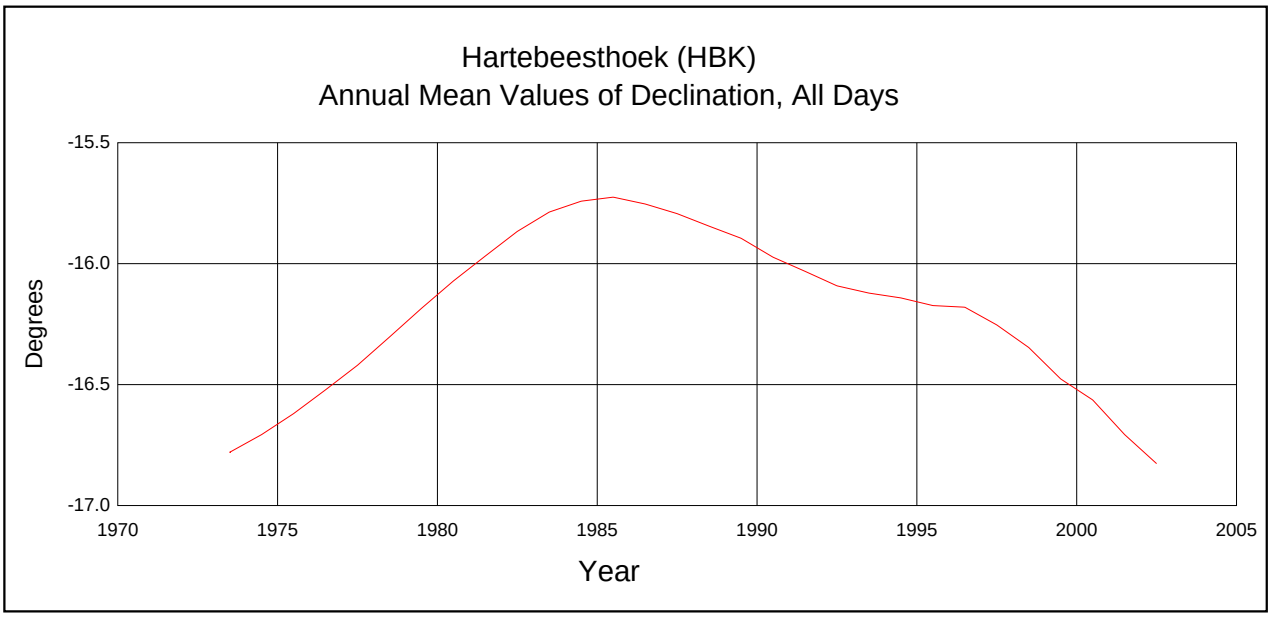
Date	D ° ,	I ° ,	H nT	X nT	Y nT	Z nT	F nT	*	ELE
JAN	-16 45.7	-63 13.4	12844	12298	-3704	-25452	28512	A	HDZF
FEB	-16 46.5	-63 13.2	12844	12297	-3707	-25449	28507	A	HDZF
MAR	-16 47.0	-63 12.2	12849	12301	-3710	-25440	28501	A	HDZF
APR	-16 47.5	-63 11.9	12850	12302	-3712	-25435	28499	A	HDZF
MAY	*** ****	*** ****	*****	*****	*****	******	*****	A	HDZF
JUN	-16 49.9	-63 11.4	12852	12301	-3721	-25430	28494	A	HDZF
JUL	-16 50.4	-63 11.9	12846	12296	-3722	-25429	28489	A	HDZF
AUG	-16 50.5	-63 12.9	12837	12286	-3719	-25428	28485	A	HDZF
SEP	-16 50.9	-63 12.2	12842	12291	-3722	-25426	28487	A	HDZF
OCT	-16 51.5	-63 14.5	12822	12271	-3719	-25430	28479	A	HDZF
NOV	-16 53.3	-63 12.3	12841	12288	-3730	-25427	28485	A	HDZF
DEC	-16 52.9	-63 11.2	12852	12298	-3732	-25427	28490	A	HDZF
YEAR	-16 49.8	-63 12.6	12843	12292	-3718	-25434	28493	A	HDZF
JAN	-16 45.5	-63 12.6	12851	12306	-3705	-25452	28515	Q	HDZF
FEB	-16 45.3	-63 12.7	12848	12302	-3704	-25447	28507	Q	HDZF
MAR	-16 47.6	-63 11.0	12858	12310	-3715	-25436	28501	Q	HDZF
APR	-16 49.0	-63 11.0	12857	12307	-3720	-25434	28501	Q	HDZF
MAY	*** ****	*** ****	*****	*****	*****	******	*****	Q	HDZF
JUN	-16 49.9	-63 10.8	12857	12306	-3723	-25429	28495	Q	HDZF
JUL	-16 50.3	-63 10.8	12855	12304	-3724	-25427	28491	Q	HDZF
AUG	-16 50.6	-63 11.3	12851	12300	-3724	-25427	28490	Q	HDZF
SEP	-16 50.8	-63 10.0	12860	12308	-3727	-25421	28494	Q	HDZF
OCT	-16 51.4	-63 12.0	12845	12293	-3725	-25427	28487	Q	HDZF
NOV	-16 52.8	-63 10.4	12857	12303	-3734	-25424	28489	Q	HDZF
DEC	-16 52.3	-63 08.8	12872	12318	-3736	-25423	28495	Q	HDZF
YEAR	-16 49.8	-63 11.0	12856	12305	-3722	-25431	28496	Q	HDZF
JAN	-16 46.5	-63 14.6	12833	12287	-3704	-25453	28508	D	HDZF
FEB	-16 46.6	-63 15.0	12829	12283	-3703	-25453	28504	D	HDZF
MAR	-16 46.4	-63 13.5	12837	12291	-3704	-25439	28494	D	HDZF
APR	*** ****	*** ****	*****	*****	*****	******	*****	D	HDZF
MAY	*** ****	*** ****	*****	*****	*****	******	*****	D	HDZF
JUN	-16 50.1	-63 11.7	12848	12298	-3721	-25429	28492	D	HDZF
JUL	-16 50.3	-63 12.8	12839	12288	-3719	-25432	28488	D	HDZF
AUG	-16 50.4	-63 15.3	12816	12266	-3713	-25431	28478	D	HDZF
SEP	-16 51.4	-63 16.7	12805	12255	-3713	-25435	28477	D	HDZF
OCT	-16 51.3	-63 19.0	12784	12235	-3707	-25437	28468	D	HDZF
NOV	-16 53.6	-63 14.8	12819	12266	-3725	-25429	28477	D	HDZF
DEC	-16 52.4	-63 12.8	12839	12286	-3727	-25432	*****	D	HDZF
YEAR	-16 49.9	-63 14.8	12823	12274	-3713	-25438	28487	D	HDZF

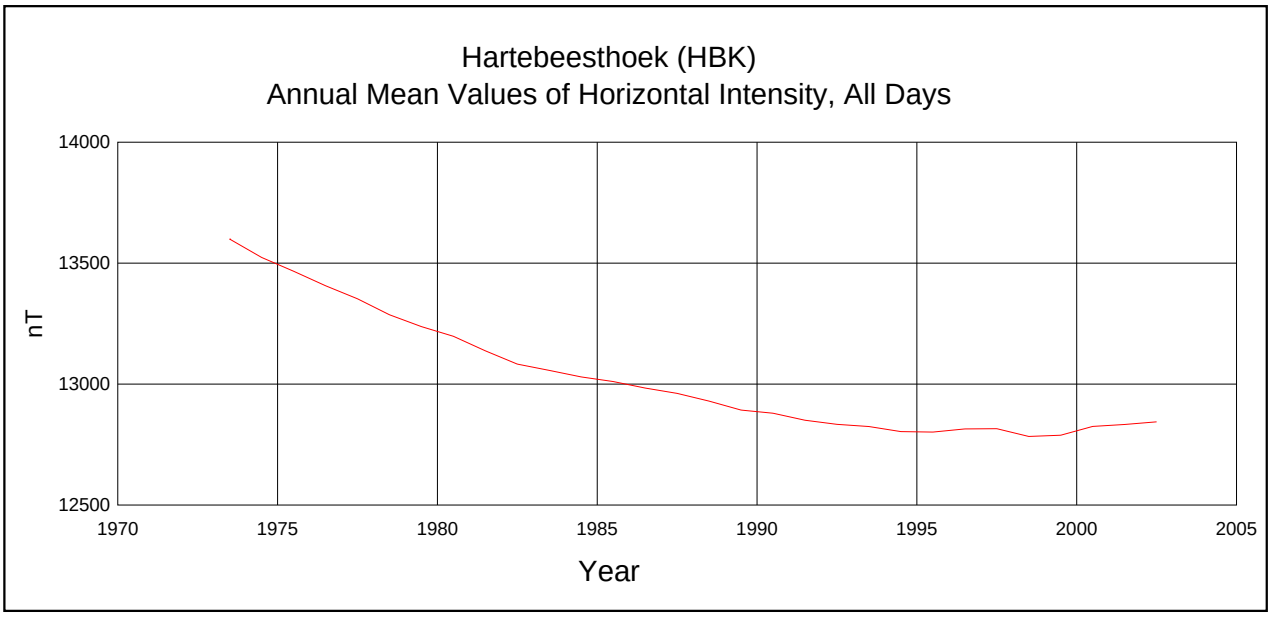
*A: All days
*Q: Quiet days
*D: Disturbed days
ELE: Elements recorded

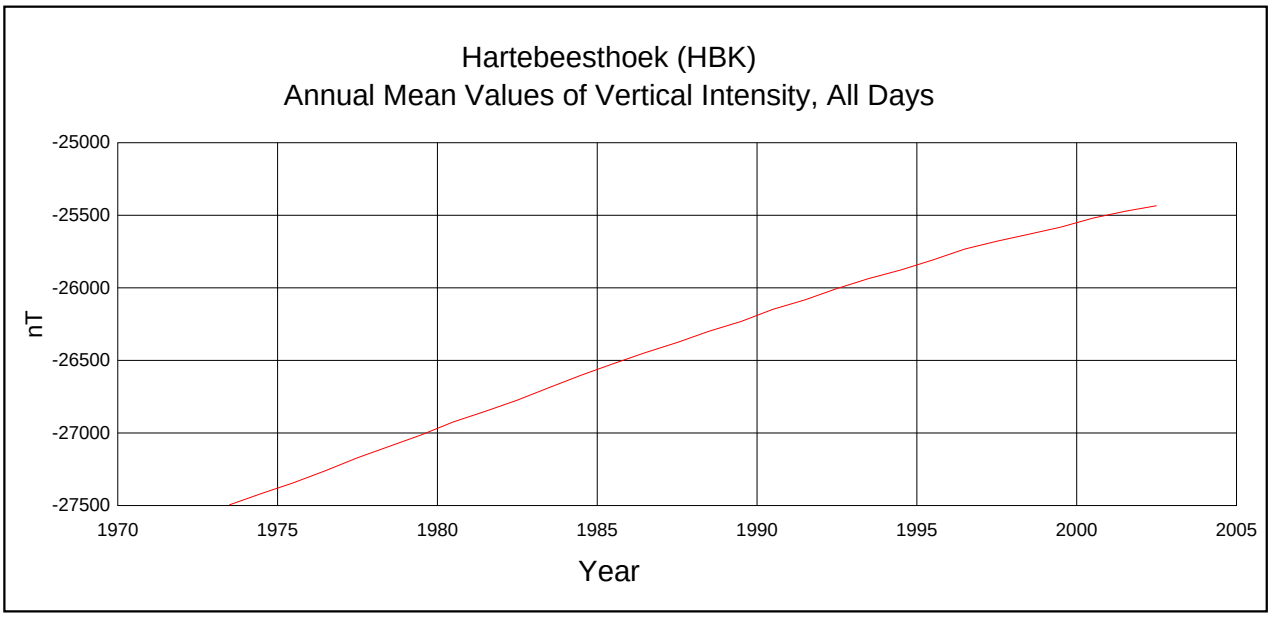
HARTEBEESTHOEK
MEAN ANNUAL VALUES

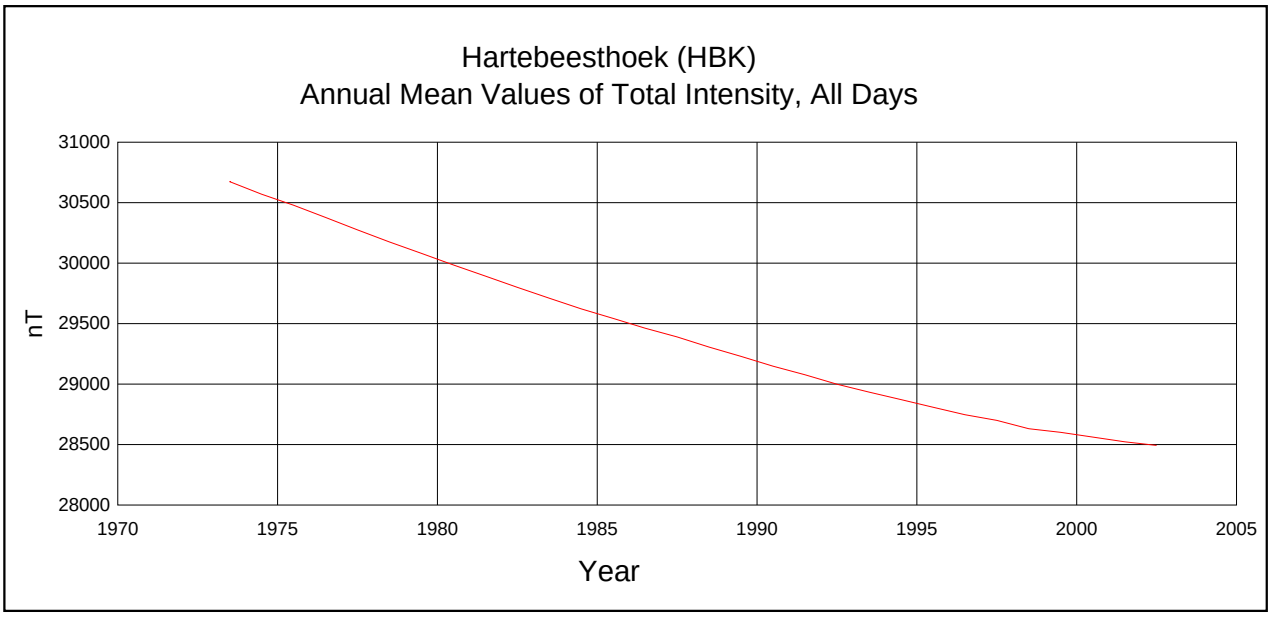
Date	° D ,	° I ,	H nT	X nT	Y nT	Z nT	F nT	*	ELE
1973.5	-16 46.6	-63 41.0	13599	13020	-3925	-27495	30674	A	DHZ
1974.5	-16 42.2	-63 44.8	13523	12952	-3887	-27417	30570	A	DHZ
1975.5	-16 37.0	-63 46.8	13466	12903	-3851	-27343	30479	A	DHZ
1976.5	-16 31.1	-63 48.8	13406	12852	-3812	-27260	30378	A	DHZ
1977.5	-16 25.0	-63 49.8	13352	12808	-3774	-27171	30275	A	DHZ
1978.5	-16 18.0	-63 52.6	13286	12752	-3729	-27092	30175	A	DHZ
1979.5	-16 10.9	-63 53.7	13237	12713	-3689	-27013	30081	A	DHZ
1980.5	-16 04.1	-63 53.2	13197	12682	-3653	-26924	29985	A	DHZ
1981.5	-15 57.9	-63 55.7	13137	12631	-3614	-26851	29893	A	DHZ
1982.5	-15 51.8	-63 57.5	13082	12585	-3577	-26774	29800	A	DHZ
1983.5	-15 47.0	-63 55.8	13056	12564	-3552	-26687	29710	A	DHZ
1984.5	-15 44.3	-63 54.3	13029	12541	-3535	-26602	29622	A	DHZ
1985.5	-15 43.3	-63 52.2	13010	12524	-3526	-26523	29543	A	DHZ
1986.5	-15 45.0	-63 51.2	12983	12496	-3525	-26447	29462	A	DHZ
1987.5	-15 47.4	-63 49.8	12961	12473	-3528	-26377	29390	A	DHZ
1988.5	-15 50.5	-63 49.2	12929	12438	-3530	-26299	29306	A	DHZ
1989.5	-15 53.5	-63 49.6	12892	12400	-3531	-26232	29229	A	DHZ
1990.5	-15 58.2	-63 46.7	12879	12382	-3544	-26148	29148	A	DHZ
1991.5	-16 01.7	-63 46.4	12850	12351	-3549	-26083	29077	A	DHZ
1992.5	-16 05.3	-63 44.1	12833	12331	-3557	-26005	28999	A	DHZ
1993.5	-16 07.1	-63 41.4	12824	12320	-3561	-25936	28934	A	DHZ
1994.5	-16 08.3	-63 40.5	12803	12299	-3559	-25877	28872	A	DHZ
1995.5	-16 10.2	-63 37.1	12801	12295	-3565	-25808	28809	A	DHZ
1996.5	-16 10.6	-63 31.7	12814	12308	-3570	-25733	28747	A	DHZ
1997.5	-16 15.0	-63 28.7	12815	12304	-3586	-25679	28700	A	DHZ
1998.5	-16 20.6	-63 29.6	12783	12267	-3598	-25631	28631	A	DHZ
1999.5	-16 28.4	-63 26.4	12788	12263	-3627	-25582	28601	A	DHZ
2000.0	0 0.0	0 -4.8	-35	-34	11	-18	0	J	DHZ
2000.5	-16 33.8	-63 19.1	12825	12293	-3657	-25520	28562	A	DHZ
2001.5	-16 42.4	-63 15.7	12833	12292	-3689	-25473	28523	A	DHZ
2002.5	-16 49.6	-63 12.4	12844	12294	-3719	-25434	28493	A	DHZ

*A: All days
*Q: Quiet days
*D: Disturbed days
*J: Jump in data, jump value = old site value - new site value
ELE: Elements recorded


Hartebeesthoek (HBK)
Annual Mean Values of Declination, All Days
Degrees
-15.5
-16.0
-16.5
-17.0
1970
1975
1980
1985
1990
1995
2000
2005
Year


Hartebeesthoek (HBK)
Annual Mean Values of Horizontal Intensity, All Days
nT
14000
13500
13000
12500
1970
1975
1980
1985
1990
1995
2000
2005
Year


Hartebeesthoek (HBK)
Annual Mean Values of Vertical Intensity, All Days
-25000
-25500
-26000
-26500
-27000
-27500
nT
1970
1975
1980
1985
1990
1995
2000
2005
Year


Hartebeesthoek (HBK)
Annual Mean Values of Total Intensity, All Days
31000
30500
30000
29500
29000
28500
28000
nT
1970
1975
1980
1985
1990
1995
2000
2005
Year

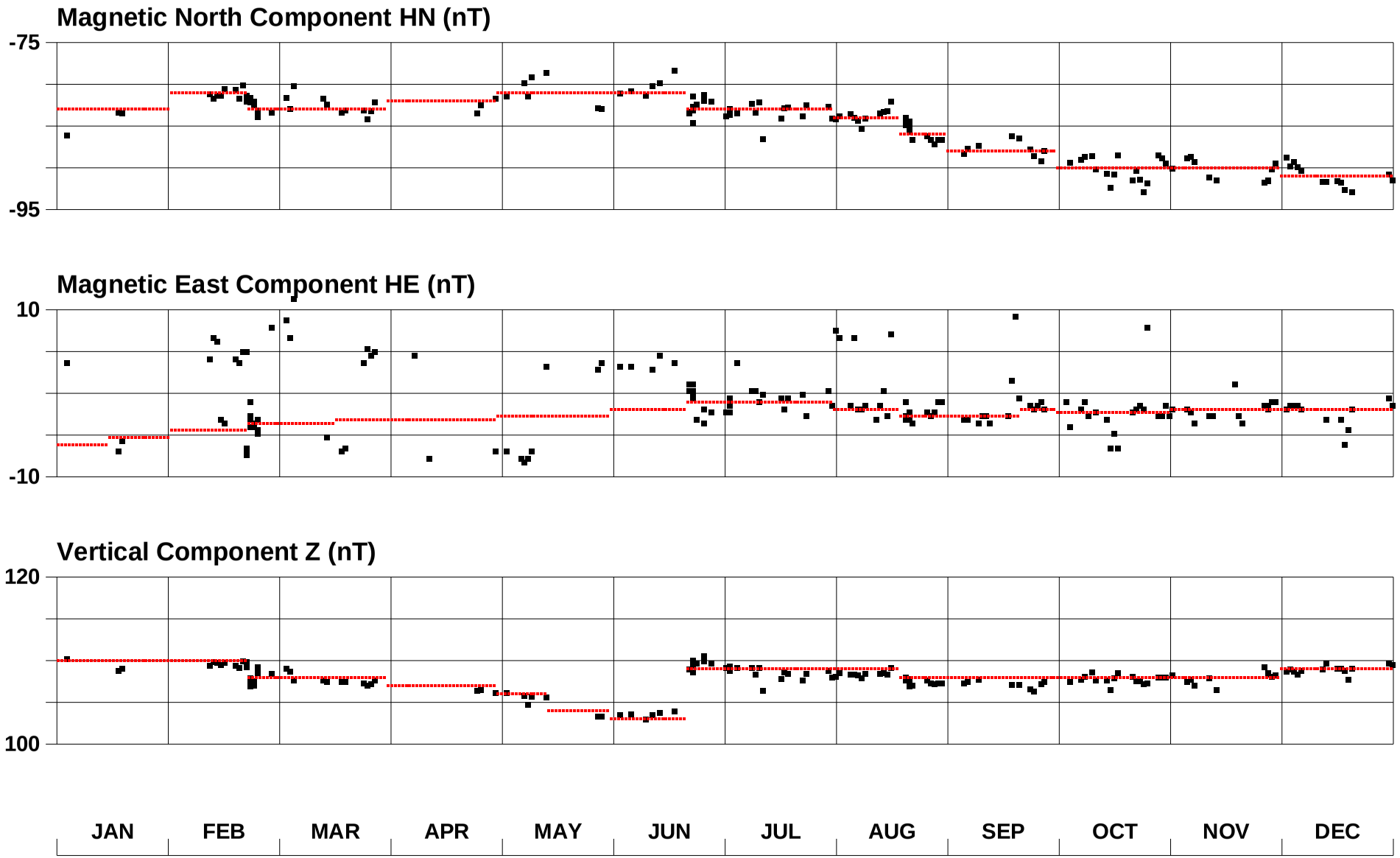
Magnetic Results 2002

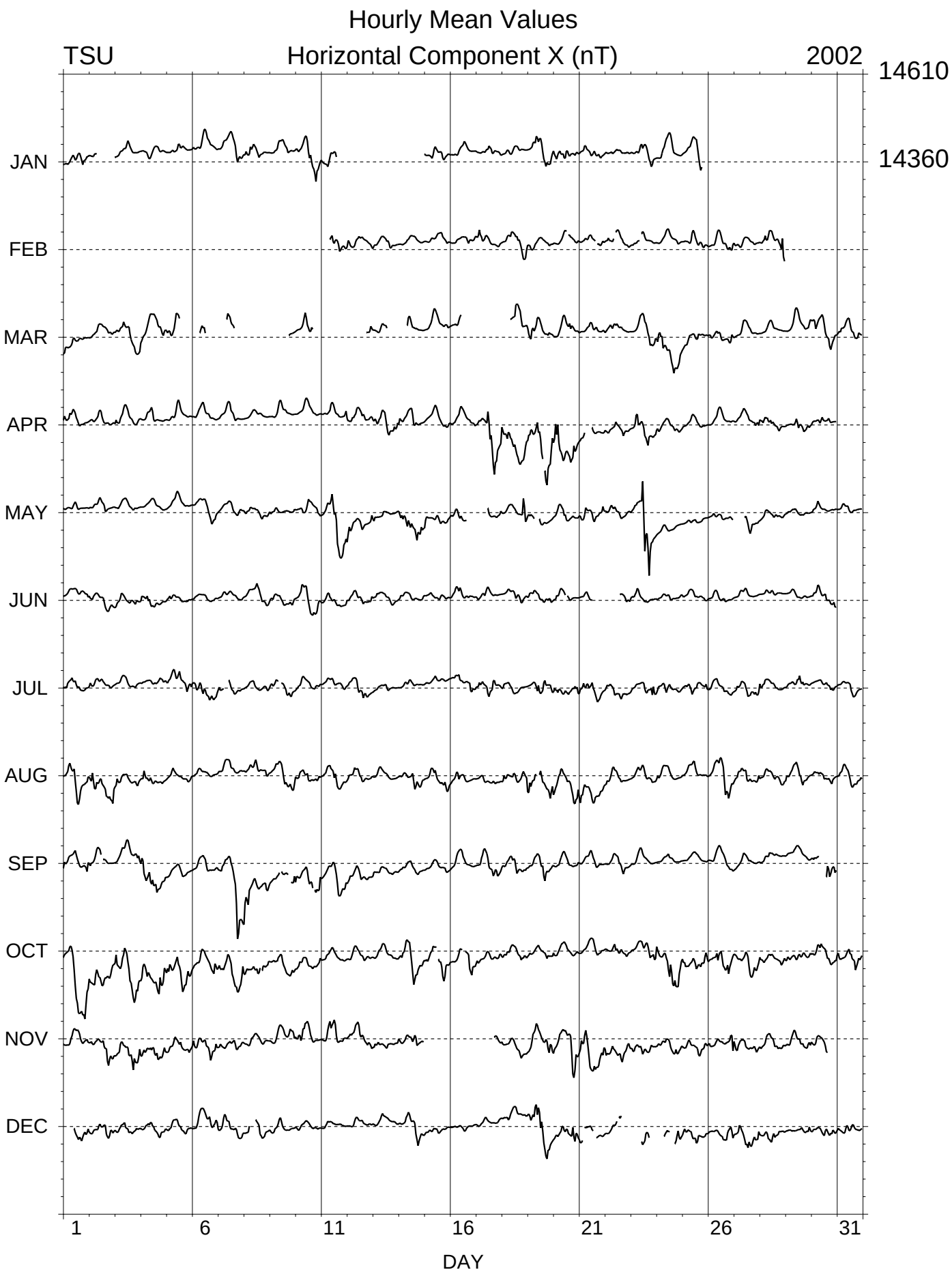
Tsumeb

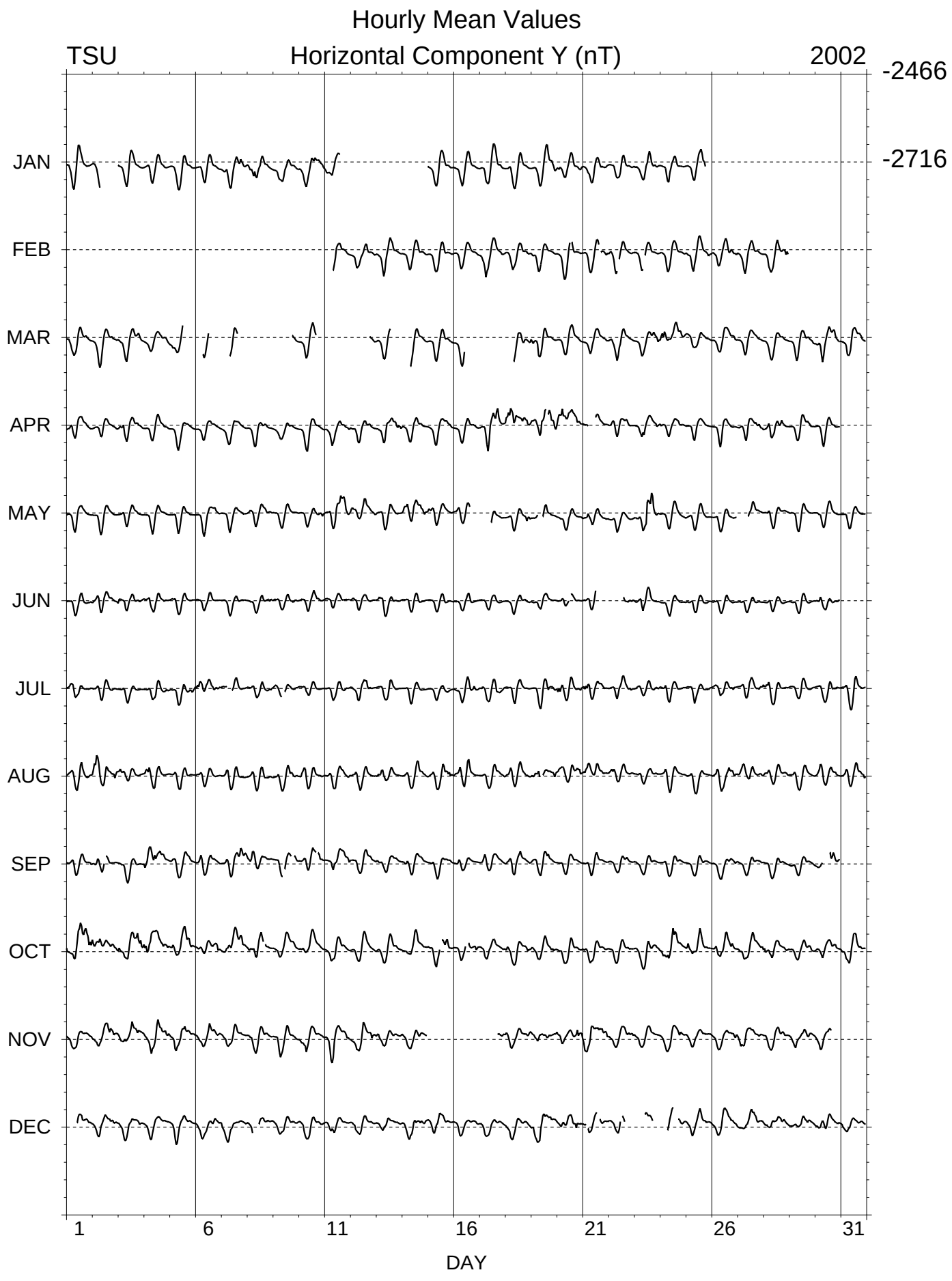
Observed and Adopted Baseline Values, TSU 2002

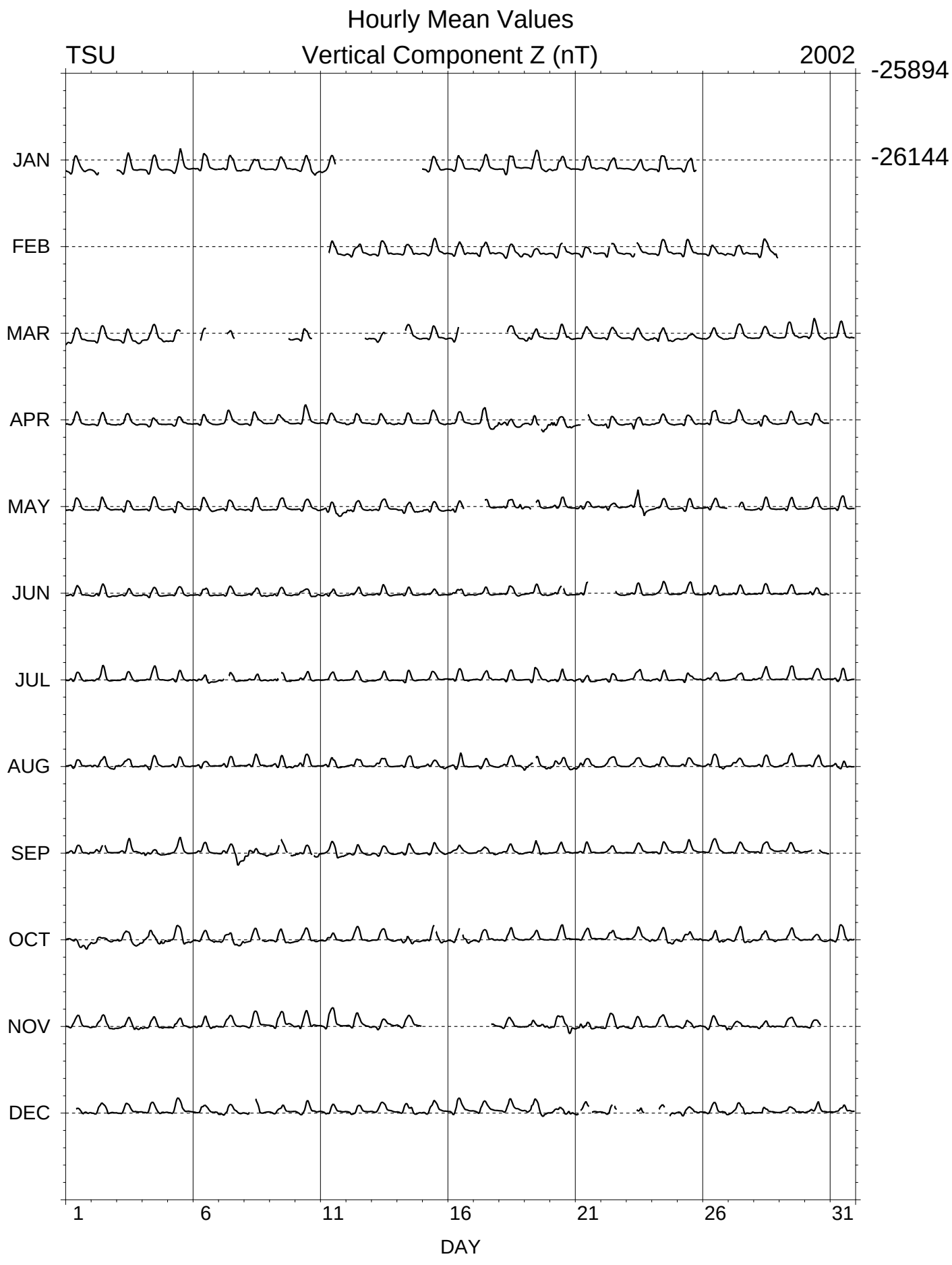
LAT: 109.202 LONG: 17.584

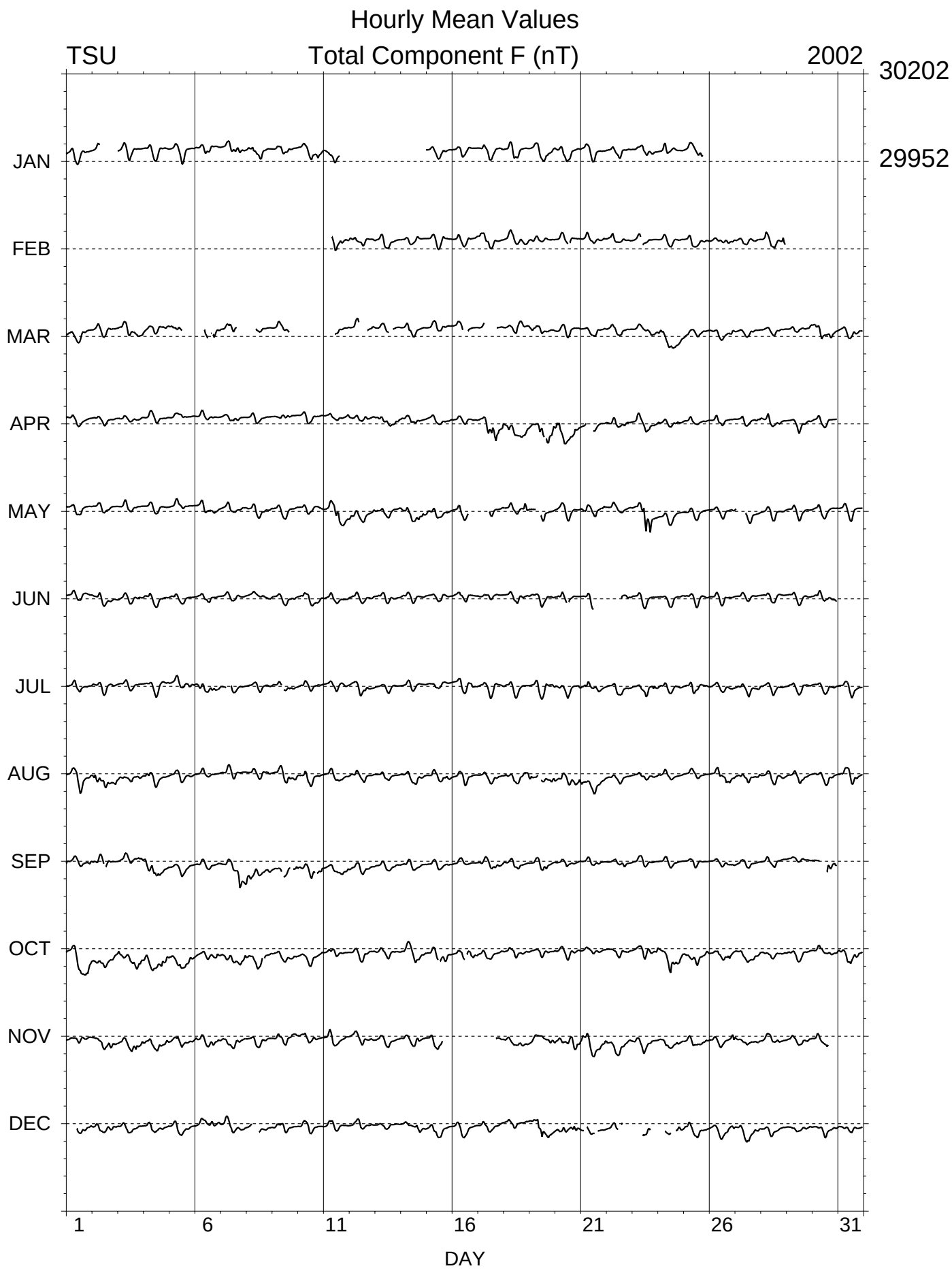
INSTITUTION: HMO INSTRUMENT: LC




Hourly Mean Values
TSU
Horizontal Component X (nT)
2002
14610
14360
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY


Hourly Mean Values
TSU
Horizontal Component Y (nT)
2002
-2466
-2716
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY


Hourly Mean Values
TSU
Vertical Component Z (nT)
2002
-25894
-26144
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY


Hourly Mean Values
TSU
Total Component F (nT)
2002
30202
29952
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY

TSUMEB
MEAN MONTHLY VALUES 2002

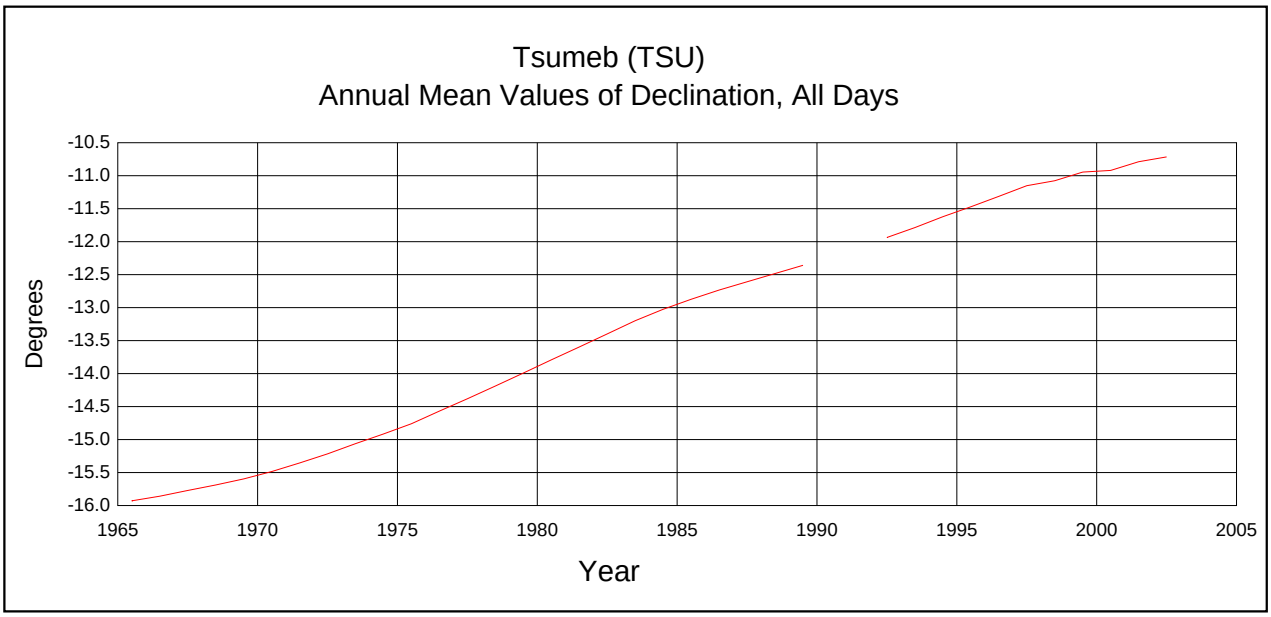
Date	D ° ,	I ° ,	H nT	X nT	Y nT	Z nT	F nT	*	ELE
JAN	-10 45.1	-60 45.5	14648	14390	-2732	-26163	29984	A	HDZF
FEB	-10 44.7	-60 45.8	14642	14385	-2730	-26159	29978	A	HDZF
MAR	-10 43.9	-60 46.5	14632	14376	-2725	-26152	29968	A	HDZF
APR	-10 43.4	-60 47.2	14623	14367	-2721	-26150	29960	A	HDZF
MAY	-10 44.0	-60 48.0	14613	14357	-2722	-26146	29955	A	HDZF
JUN	-10 42.9	-60 46.7	14625	14370	-2719	-26144	29956	A	HDZF
JUL	-10 42.9	-60 46.8	14621	14366	-2719	-26140	29951	A	HDZF
AUG	-10 42.0	-60 47.9	14609	14355	-2712	-26138	29944	A	HDZF
SEP	-10 42.0	-60 48.3	14605	14351	-2712	-26138	29943	A	HDZF
OCT	-10 41.1	-60 50.5	14584	14331	-2704	-26140	29933	A	HDZF
NOV	-10 41.4	-60 49.0	14598	14345	-2708	-26138	29938	A	HDZF
DEC	-10 40.9	-60 47.8	14609	14355	-2708	-26136	29941	A	HDZF
YEAR	-10 42.7	-60 47.7	14615	14360	-2716	-26144	29952	A	HDZF
JAN	-10 44.9	-60 44.8	14655	14397	-2733	-26164	29986	Q	HDZF
FEB	-10 44.5	-60 45.5	14644	14388	-2729	-26158	29979	Q	HDZF
MAR	-10 44.2	-60 45.6	14638	14382	-2727	-26149	29969	Q	HDZF
APR	-10 44.1	-60 45.4	14640	14384	-2727	-26149	29968	Q	HDZF
MAY	-10 44.5	-60 47.9	14614	14357	-2724	-26146	29954	Q	HDZF
JUN	-10 43.1	-60 45.9	14632	14377	-2721	-26144	29960	Q	HDZF
JUL	-10 43.2	-60 45.7	14631	14376	-2722	-26139	29955	Q	HDZF
AUG	-10 42.5	-60 46.4	14624	14369	-2717	-26138	29951	Q	HDZF
SEP	-10 42.0	-60 45.8	14629	14374	-2716	-26136	29952	Q	HDZF
OCT	-10 41.5	-60 47.9	14609	14355	-2710	-26138	29943	Q	HDZF
NOV	-10 41.7	-60 46.9	14617	14363	-2713	-26134	29944	Q	HDZF
DEC	-10 40.5	-60 45.7	14629	14376	-2710	-26134	29949	Q	HDZF
YEAR	-10 43.0	-60 46.2	14629	14374	-2720	-26143	29959	Q	HDZF
JAN	-10 45.0	-60 45.9	14643	14386	-2731	-26163	29981	D	HDZF
FEB	-10 45.2	-60 45.6	14643	14385	-2732	-26157	29976	D	HDZF
MAR	-10 43.3	-60 47.5	14621	14366	-2720	-26151	29961	D	HDZF
APR	-10 42.1	-60 53.0	14568	14314	-2705	-26155	29938	D	HDZF
MAY	-10 43.2	-60 50.1	14594	14339	-2714	-26149	29949	D	HDZF
JUN	-10 42.8	-60 47.3	14619	14364	-2718	-26145	29955	D	HDZF
JUL	-10 42.5	-60 47.9	14611	14357	-2715	-26142	29948	D	HDZF
AUG	-10 41.6	-60 50.4	14585	14331	-2706	-26139	29934	D	HDZF
SEP	-10 41.5	-60 53.3	14559	14306	-2701	-26144	29925	D	HDZF
OCT	-10 40.2	-60 55.0	14543	14292	-2693	-26146	29918	D	HDZF
NOV	-10 41.4	-60 51.1	14579	14326	-2704	-26141	29931	D	HDZF
DEC	-10 40.7	-60 49.3	14594	14341	-2704	-26137	29934	D	HDZF
YEAR	-10 42.1	-60 50.3	14590	14336	-2709	-26146	29942	D	HDZF

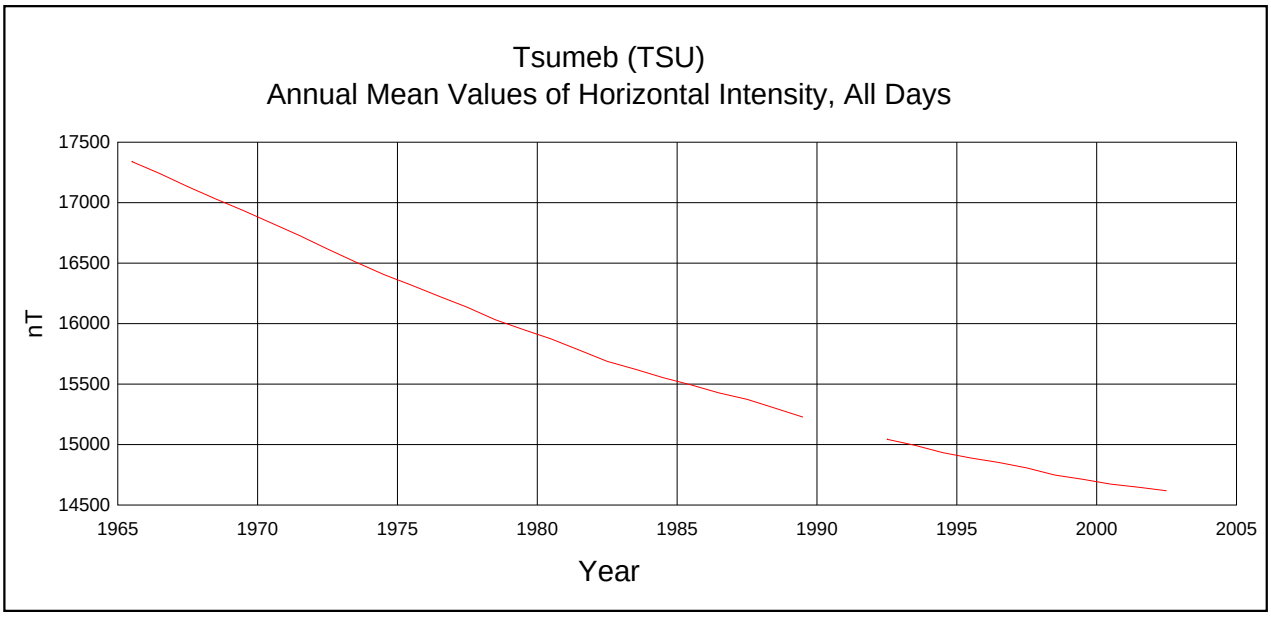
*A: All days
*Q: Quiet days
*D: Disturbed days
ELE: Elements recorded

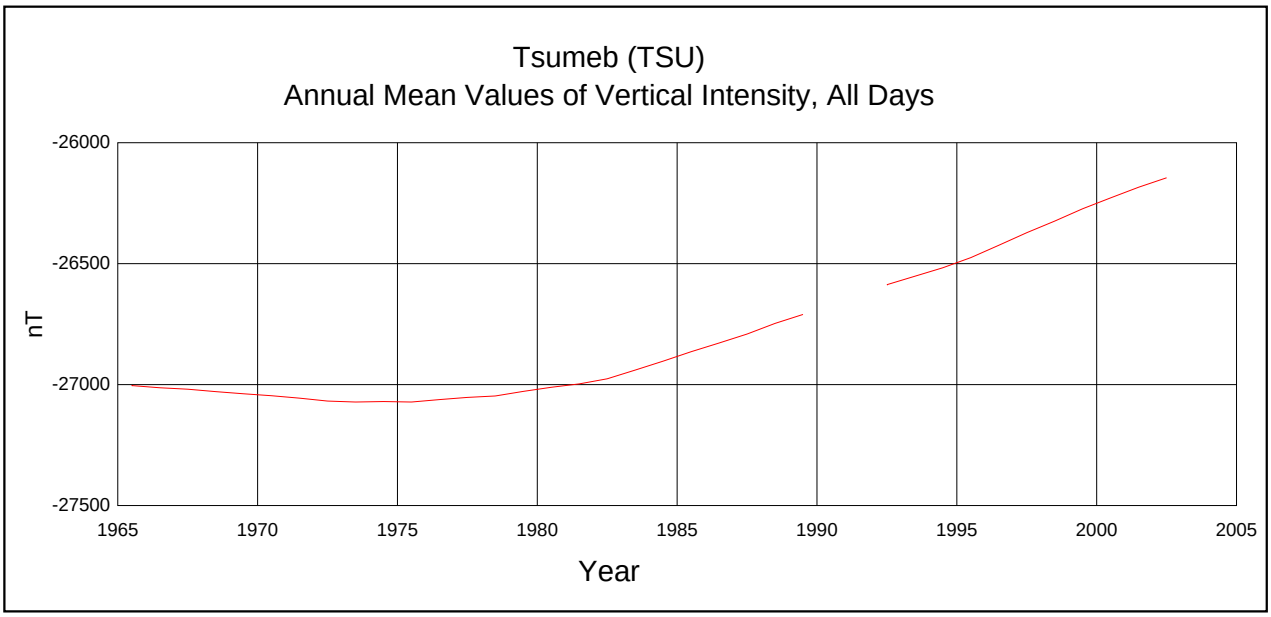
TSUMEB
MEAN ANNUAL VALUES

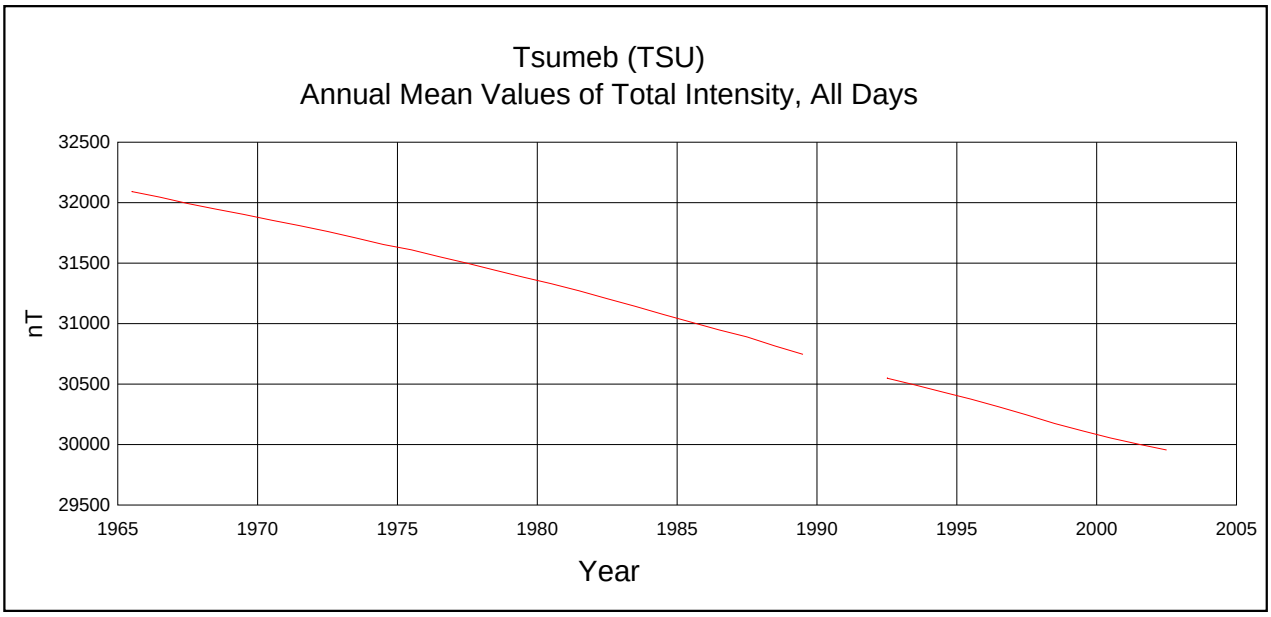
Date	° D ,	° I ,	H nT	X nT	Y nT	Z nT	F nT	*	ELE
1965.5	-15 58.0	-57 17.7	17340	16671	-4770	-27004	32092	A	DHZ
1966.5	-15 53.8	-57 27.1	17241	16582	-4772	-27013	32046	A	DHZ
1967.5	-15 48.6	-57 37.3	17133	16484	-4668	-27019	31993	A	DHZ
1968.5	-15 43.6	-57 47.1	17031	16393	-4616	-27029	31947	A	DHZ
1969.5	-15 38.1	-57 56.4	16934	16309	-4564	-27038	31903	A	DHZ
1970.5	-15 31.4	-58 06.4	16831	16217	-4504	-27046	31855	A	DHZ
1971.5	-15 23.6	-58 16.4	16728	16127	-4440	-27056	31810	A	DHZ
1972.5	-15 15.3	-58 27.3	16617	16031	-4372	-27068	31762	A	DHZ
1973.5	-15 06.0	-58 37.4	16510	15940	-4301	-27072	31709	A	DHZ
1974.5	-14 57.2	-58 46.8	16407	15851	-4234	-27070	31654	A	DHZ
1975.5	-14 47.9	-58 55.2	16318	15777	-4168	-27072	31610	A	DHZ
1976.5	-14 36.4	-59 03.3	16225	15700	-4091	-27062	31553	A	DHZ
1977.5	-14 25.2	-59 11.2	16135	15627	-4018	-27053	31499	A	DHZ
1978.5	-14 13.6	-59 20.6	16032	15540	-3940	-27047	31441	A	DHZ
1979.5	-14 01.8	-59 27.1	15951	15475	-3867	-27028	31384	A	DHZ
1980.5	-13 49.8	-59 33.5	15873	15413	-3795	-27011	31330	A	DHZ
1981.5	-13 38.1	-59 41.5	15781	15336	-3720	-26997	31271	A	DHZ
1982.5	-13 26.2	-59 49.1	15688	15259	-3646	-26976	31206	A	DHZ
1983.5	-13 14.2	-59 53.4	15623	15209	-3578	-26940	31143	A	DHZ
1984.5	-13 03.8	-59 58.0	15553	15151	-3516	-26903	31076	A	DHZ
1985.5	-12 54.7	-60 01.6	15493	15102	-3463	-26864	31012	A	DHZ
1986.5	-12 46.3	-60 06.0	15427	15046	-3411	-26828	30948	A	DHZ
1987.5	-12 38.8	-60 09.0	15374	15002	-3366	-26791	30890	A	DHZ
1988.5	-12 31.3	-60 13.6	15301	14938	-3318	-26747	30815	A	DHZ
1989.5	-12 23.8	-60 18.8	15227	14873	-3269	-26710	30746	A	DHZ
1990.5	*** **.*	*** **.*	*****	*****	*****	*****	*****		
1991.5	*** **.*	*** **.*	*****	*****	*****	*****	*****		
1992.5	-11 58.5	-60 29.8	15044	14717	-3122	-26587	30549	A	DHZ
1993.5	-11 49.5	-60 32.9	14994	14676	-3073	-26552	30493	A	DHZ
1994.5	-11 39.6	-60 36.8	14933	14626	-3019	-26517	30434	A	DHZ
1995.5	-11 30.6	-60 38.8	14889	14591	-2971	-26475	30376	A	DHZ
1996.5	-11 21.1	-60 39.7	14852	14562	-2924	-26424	30312	A	DHZ
1997.5	-11 11.4	-60 41.2	14807	14526	-2874	-26372	30245	A	DHZ
1998.5	-11 06.9	-60 44.4	14748	14472	-2844	-26324	30174	A	DHZ
1999.5	-10 59.0	-60 45.0	14713	14444	-2804	-26273	30113	A	DHZ
2000.0	0 -2.3	0 -0.2	1	-1	-10	1	-1	J	DHZ
2000.5	-10 55.2	-60 46.5	14673	14408	-2780	-26228	30054	A	DHZ
2001.5	-10 47.3	-60 46.7	14647	14388	-2742	-26184	30003	A	DHZ
2002.5	-10 42.9	-60 47.4	14618	14363	-2718	-26145	29955	A	DHZ

*A: All days
*Q: Quiet days
*D: Disturbed days
*J: Jump in data, jump value = old site value - new site value
ELE: Elements recorded


Tsumeb (TSU)
Annual Mean Values of Declination, All Days
Degrees
-10.5
-11.0
-11.5
-12.0
-12.5
-13.0
-13.5
-14.0
-14.5
-15.0
-15.5
-16.0
1965
1970
1975
1980
1985
1990
1995
2000
2005
Year


Tsumeb (TSU)
Annual Mean Values of Horizontal Intensity, All Days
nT
17500
17000
16500
16000
15500
15000
14500
1965
1970
1975
1980
1985
1990
1995
2000
2005
Year


Tsumeb (TSU)
Annual Mean Values of Vertical Intensity, All Days
-26000
-26500
-27000
-27500
nT
1965
1970
1975
1980
1985
1990
1995
2000
2005
Year


Tsumeb (TSU)
Annual Mean Values of Total Intensity, All Days
32500
32000
31500
31000
30500
30000
29500
nT
1965
1970
1975
1980
1985
1990
1995
2000
2005
Year