Hermanus Magnetic Observatory

A facility of the National Research Foundation

Magnetic Results 2003

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 2003.

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° 36' S	82° 54' E	26
Hartebeesthoek	25° 52' 58" S	27° 42' 25" E	36° 17' S	95° 21' E	1555
Tsumeb	19° 12' 08" S	17° 35' 03" E	31° 02' S	86° 54' E	1273

Geomagnetic coordinates given are relative to a geomagnetic north pole position of 82.6° N, 115.4° W, computed from the IGRF model (degree 13) at the epoch 2003.5.

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' 26"
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	20.2 nT	1 – 31	70.8 nT	1 – 59	17.8 nT
32 – 59	19.5 nT	32–59	71.7 nT	60–90	17.7 nT
60 – 90	18.4 nT	60–90	72.6 nT	91–181	17.6 nT
91 – 120	18.6 nT	91–120	73.5 nT	182–365	17.7 nT
121 – 151	18.9 nT	121–151	74.4 nT		
152 – 181	19.2 nT	152–181	75.3 nT		
182 – 212	21.8 nT	182–212	76.2 nT		
213 – 243	21.2 nT	213–365	77.0 nT		
244 – 273	20.4 nT				
274 – 300	21.1 nT				
301 – 334	22.5 nT				
335–365	22.4 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
Band pass	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 d 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. 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

8. CONTACT INFORMATION

Hermanus Magnetic Observatory
P.O. Box 32
Hermanus 7200
South Africa

Tel. : +27 (28) 3121196
Fax. : +27 (28) 3122039
Email : info@hmo.ac.za
Internet : http://www.hmo.ac.za

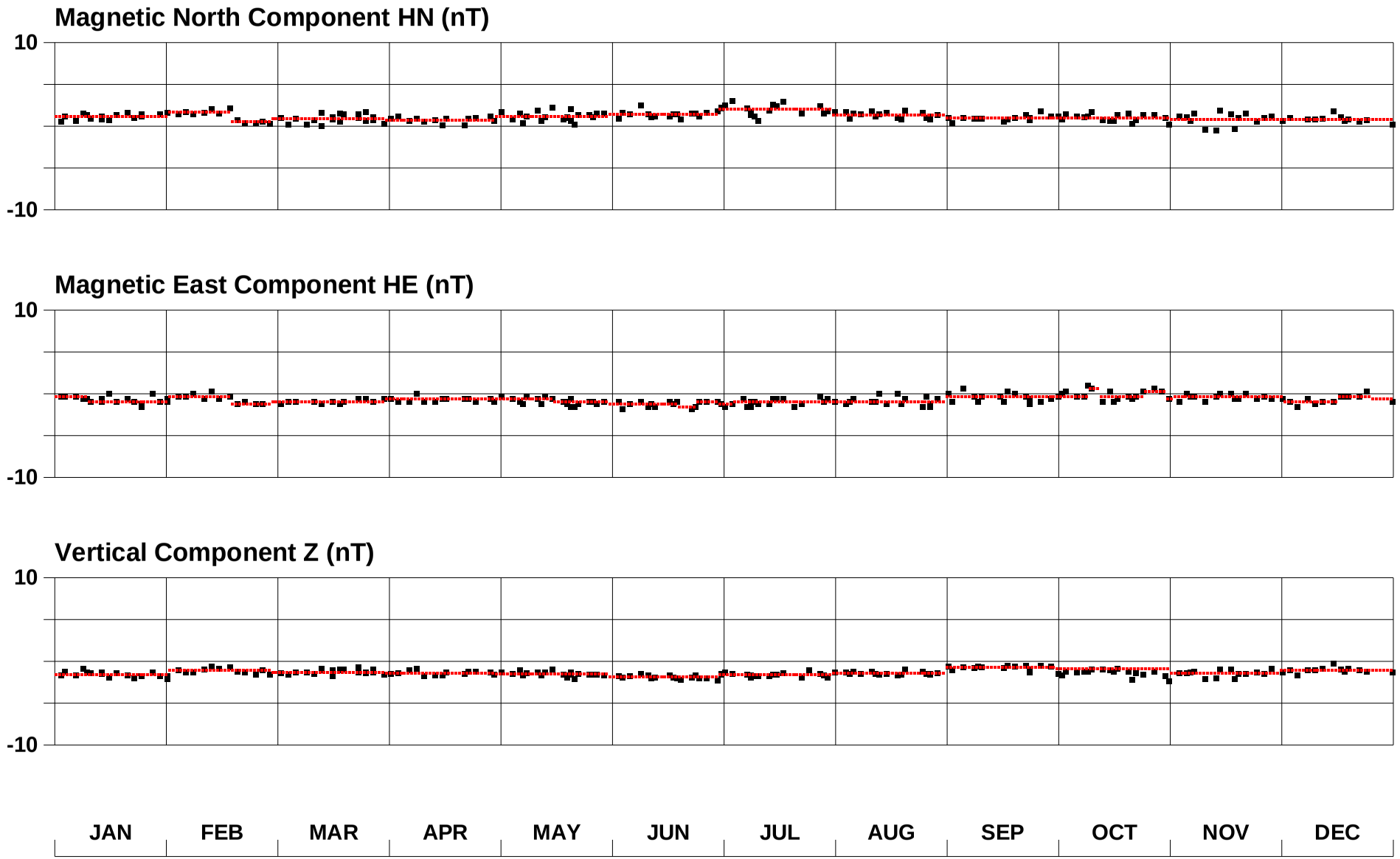
Magnetic Results 2003

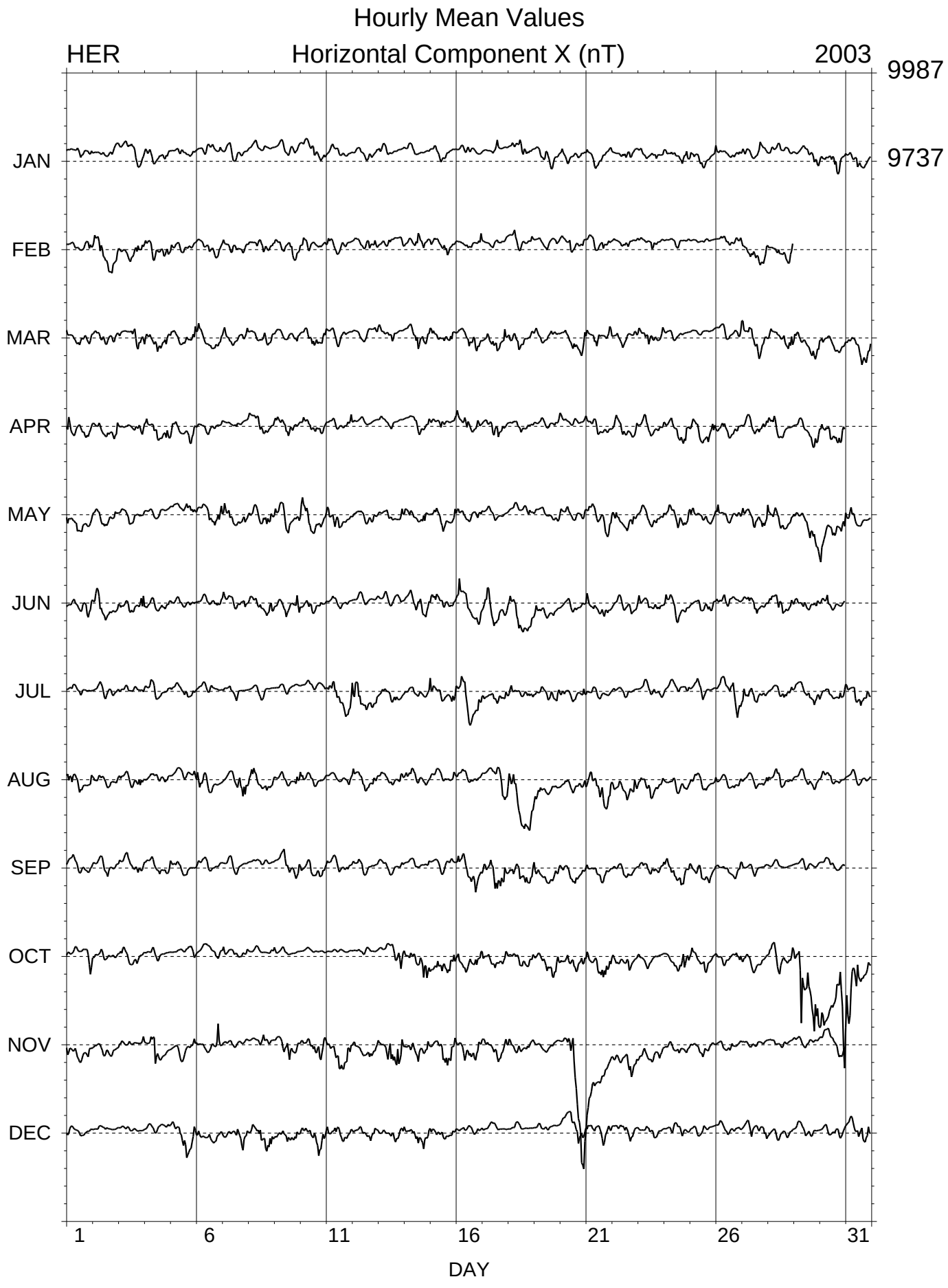
Hermanus

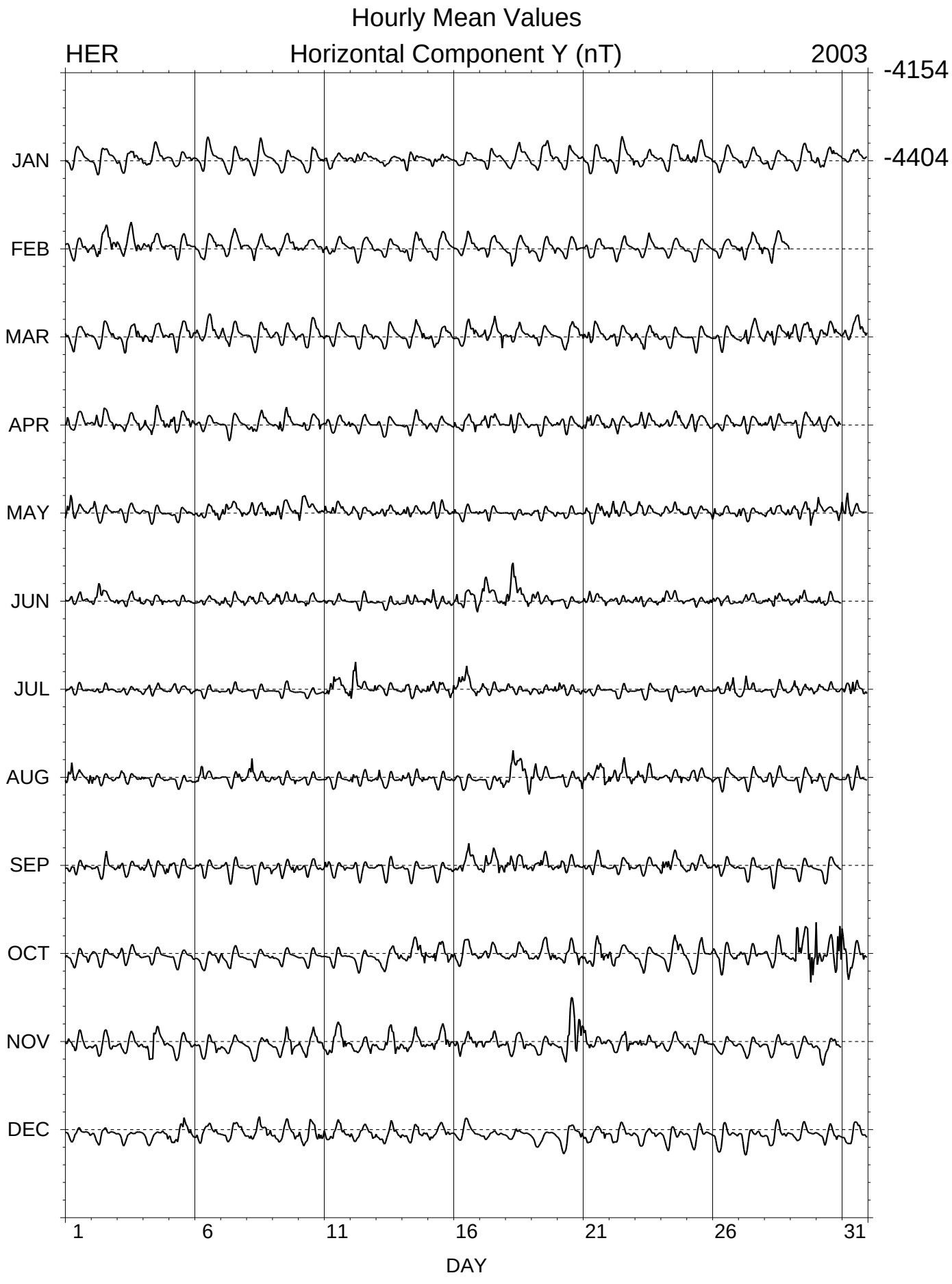
Observed and Adopted Baseline Values, HER 2003

LAT: 124.425 LONG: 19.225

INSTITUTION: HMO INSTRUMENT: LC




Hourly Mean Values
HER
Horizontal Component X (nT)
2003
9987
9737
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY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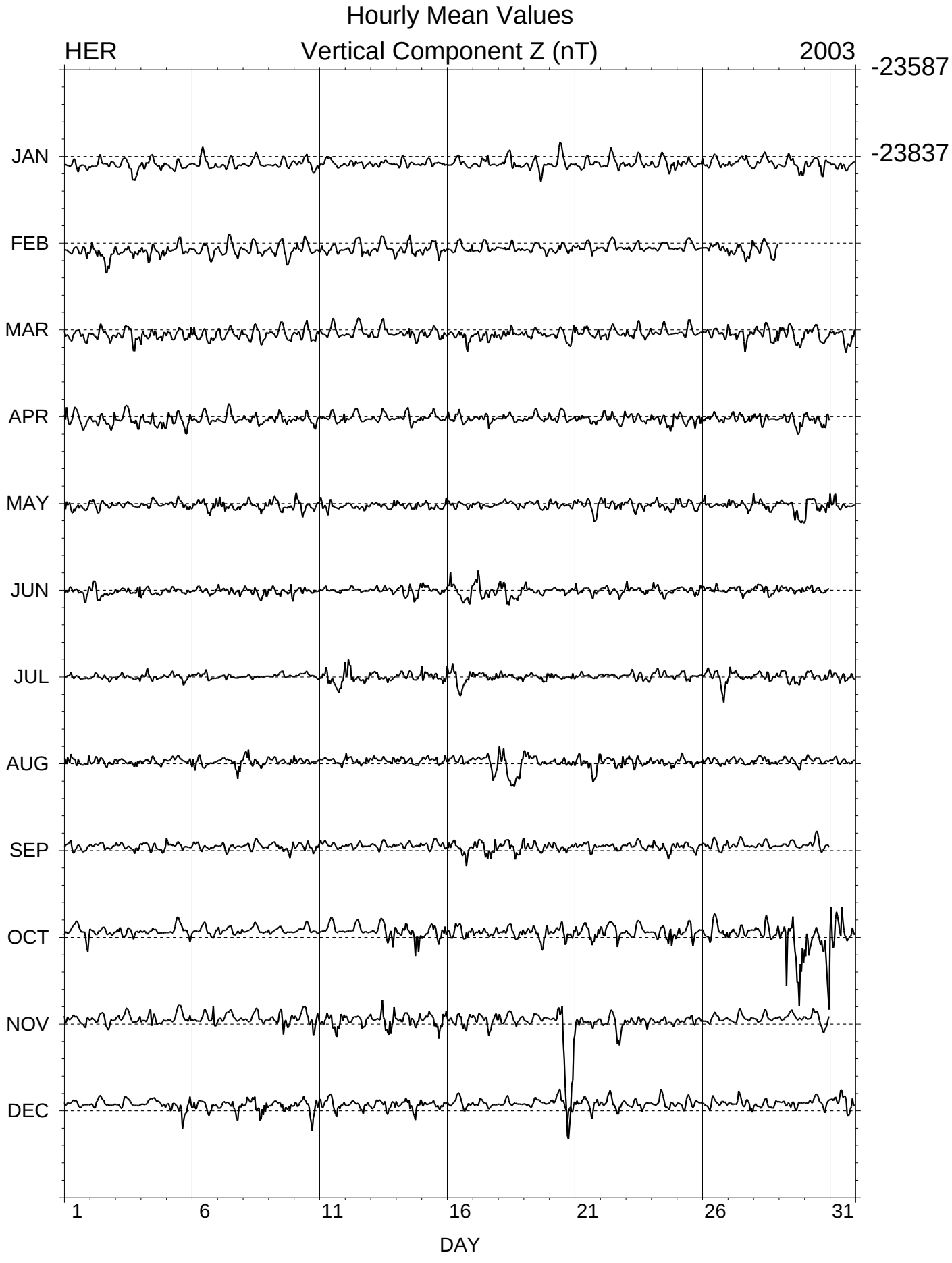
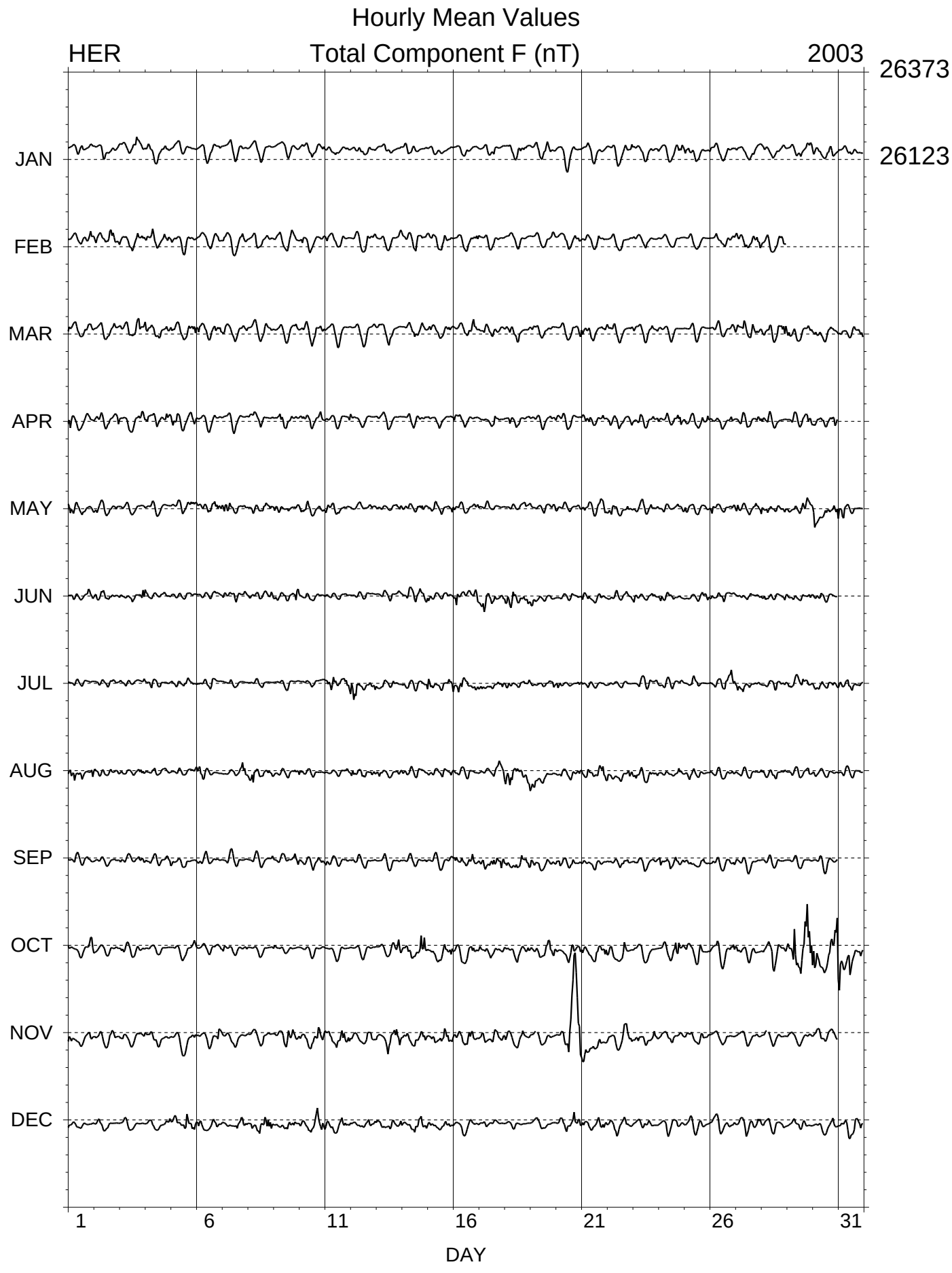
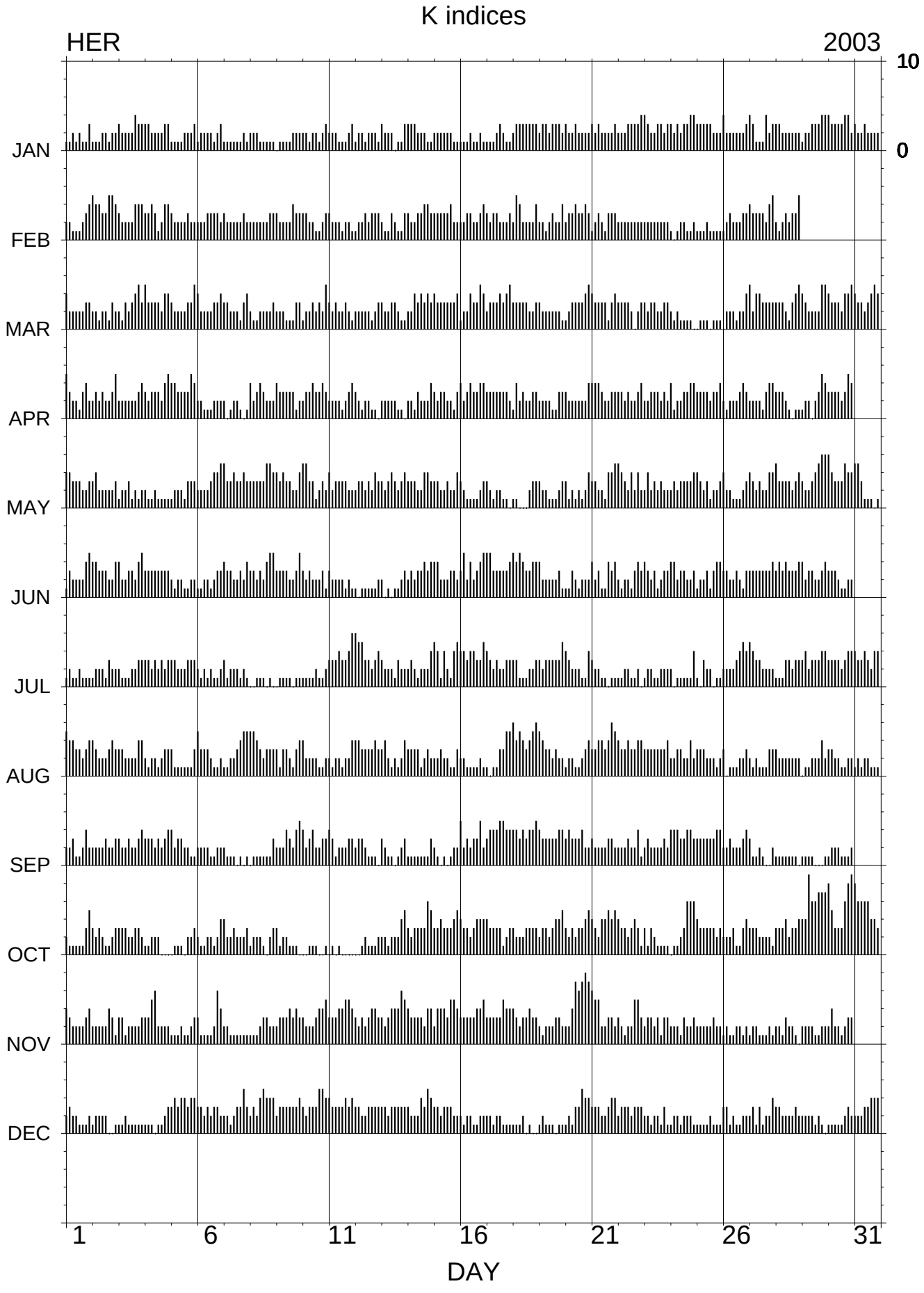
HER
Horizontal Component Y (nT)
2003
-4154
-4404
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY


Hourly Mean Values
HER
Vertical Component Z (nT)
2003
-23587
-23837
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY


Hourly Mean Values
HER
Total Component F (nT)
2003
26373
26123
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY


K indices
HER
2003
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 — 2003

DATE	JAN	FEB	MAR	APR	MAY	JUN
01	1121 2113	2211 1234	4222 2233	5322 1342	4433 3223	1322 2245
02	1112 2122	5443 3554	2212 2132	2323 2235	3422 2223	4433 3224
03	3222 2433	3222 2444	2132 3453	2222 2234	1223 1212	4223 3245
04	3322 2233	3343 1244	5333 3244	3233 3245	2112 1111	3333 3333
05	1111 2223	3222 2322	3222 2335	4433 3354	1222 1333	2122 1122
06	1222 2123	2223 3332	4222 2334	2211 1222	2222 3445	1122 1233
07	1111 1121	3222 2232	3322 2134	2012 2101	5334 3343	4332 2324
08	2221 1111	2222 2233	2112 2223	4234 3222	3333 3554	3323 2455
09	0111 1222	3222 2433	2221 1133	4333 3312	4343 3224	3333 2235
10	2212 2123	3322 1123	1223 2325	2334 3343	5533 1232	3232 2231
11	2221 1123	3222 1221	3232 2321	2222 1234	4233 3322	3222 2121
12	1221 2221	1223 2333	2222 2123	3212 2110	2332 3243	1011 1112
13	3222 0113	2113 2113	3223 3211	2222 2110	3234 3234	2010 1123
14	3332 2211	3223 3443	2243 4343	2213 2224	3332 2443	2323 3434
15	2222 2211	3333 3422	4333 3334	3233 2213	3322 3224	4422 2332
16	1112 1121	2233 2234	1224 3354	4234 3344	3211 1123	3524 2345
17	1112 3211	3233 2223	2333 4345	3333 3332	3212 2110	5533 3334
18	2333 3333	2542 2224	3333 3223	1423 2233	1100 0233	5454 3344
19	2332 3332	2212 3224	3222 2221	2222 1133	3221 1123	4222 2231
20	3223 2222	2334 3343	1233 3345	3222 2224	3121 2124	1132 1222
21	3232 2223	1232 1333	4333 3134	4443 2233	3322 1445	4231 1434
22	2223 3334	2222 2222	3333 2023	3323 2234	5432 4242	2122 1343
23	4322 3323	2222 2222	3233 2233	2233 3232	2423 2322	4323 1233
24	3232 3344	1012 2112	2121 1110	4122 3344	2323 3334	4423 3223
25	3333 3222	1112 1111	0111 0111	3333 2334	4323 1223	1223 1344
26	4222 2223	1232 2233	0222 1224	2122 2343	4221 1123	3322 3213
27	4311 1423	4333 3245	5244 3333	2222 1344	4323 2244	3333 3334
28	3322 2222	2123 2335	3332 1345	3332 1011	5333 3234	3434 3334
29	1223 3344		4322 2255	1220 2354	3223 4566	4233 2234
30	4333 3442		4333 2445	3333 2354	6433 3544	3332 1122
31	3223 2222		4332 3454		5531 1101	

	JUL	AUG	SEP	OCT	NOV	DEC
01	1211 2111	5443 3234	2231 1242	2111 1135	4322 2234	2322 1112
02	1222 1322	4322 2343	2222 3223	3232 1123	2222 2431	1222 2001
03	2111 2233	3322 2244	3223 2234	3332 2332	3312 2223	1121 1111
04	3323 2323	2122 1233	3332 3234	1122 2000	3356 2222	1110 1123
05	3322 2333	3111 1113	4233 2211	0111 0223	1112 1123	3434 4344
06	2121 2112	5333 2112	2222 1122	2112 2124	3111 1264	3323 2332
07	3122 2121	1122 3455	2111 0101	4223 2223	2211 1111	2212 3353
08	0011 1010	5543 2333	0111 1113	1222 1023	1112 3322	2324 5444
09	0111 1011	3133 2134	2224 3245	3122 1110	2333 4343	2333 3334
10	1111 2112	4222 2112	4234 2233	0011 1001	3222 3445	3233 3554
11	3334 3346	2122 1224	4312 2233	0101 0000	3334 4554	4333 3434
12	6553 3234	4433 3343	2332 1110	0012 1112	3232 3443	3322 3333
13	3222 1322	3421 2124	3211 0123	2212 2245	3234 4465	3323 3333
14	2321 2224	3333 1232	1111 1113	3233 3365	4333 3244	3222 4354
15	5414 2145	2232 2113	2101 0122	3343 3345	2444 3554	3323 3322
16	4434 4335	2211 1121	5232 3352	4332 3444	3333 3445	2122 1122
17	4323 2233	1011 3355	3444 5544	4333 3123	3333 3544	2212 2111
18	3311 1223	6454 3456	4434 3445	3222 3333	4323 3433	1112 0100
19	3233 3335	5433 2322	4333 3344	2332 3445	2122 2332	1211 1011
20	4322 2114	1221 1234	3433 3422	3232 3345	2247 6787	1213 3544
21	3221 1011	3344 3465	3222 2332	4324 4545	6552 2332	3332 2344
22	1122 1120	4334 3344	2223 2241	4332 3431	3212 2553	2333 2333
23	1221 1222	3333 3334	2322 2232	3132 1111	2332 3133	2212 2131
24	2011 1114	2233 2242	4443 3443	0112 3666	2221 3223	1221 2221
25	1032 2011	3332 2212	3333 3344	4333 3323	2222 2322	1111 2111
26	2222 3454	3011 1223	2232 2234	2223 1134	1211 2212	3312 1122
27	5433 2222	2121 1133	3112 1002	3332 2221	1221 1121	2313 1224
28	1113 3233	3222 2222	1111 1110	3334 2334	2213 2210	3322 2232
29	3423 3344	0112 2242	1111 0001	4496 6777	2222 1122	2222 1210
30	3333 2344	3322 1122	1222 1112	8533 3689	2422 1233	1111 1232
31	4334 3244	1212 2111		8666 6443		2223 3444

HERMANUS
MEAN MONTHLY VALUES 2003

Date	° D ,	° I ,	H nT	X nT	Y nT	Z nT	F nT	*	ELE
JAN	-24 15.3	-65 49.9	10707	9762	-4398	-23859	26151	A	HDZF
FEB	-24 17.0	-65 51.0	10696	9750	-4399	-23855	26143	A	HDZF
MAR	-24 18.4	-65 51.9	10686	9739	-4398	-23850	26134	A	HDZF
APR	-24 18.9	-65 51.8	10684	9737	-4399	-23844	26128	A	HDZF
MAY	-24 19.9	-65 52.4	10679	9731	-4400	-23843	26125	A	HDZF
JUN	-24 20.1	-65 52.0	10681	9732	-4401	-23839	26123	A	HDZF
JUL	-24 21.1	-65 51.3	10686	9735	-4406	-23837	26122	A	HDZF
AUG	-24 21.7	-65 51.3	10683	9732	-4407	-23831	26116	A	HDZF
SEP	-24 21.7	-65 50.1	10690	9738	-4410	-23825	26113	A	HDZF
OCT	-24 23.6	-65 51.4	10679	9725	-4410	-23823	26108	A	HDZF
NOV	-24 24.5	-65 51.8	10677	9722	-4412	-23827	26110	A	HDZF
DEC	-24 23.7	-65 48.8	10698	9743	-4418	-23818	26110	A	HDZF
YEAR	-24 20.5	-65 51.1	10687	9737	-4405	-23838	26124	A	HDZF
JAN	-24 14.6	-65 48.7	10716	9771	-4400	-23858	26154	Q	HDZF
FEB	-24 16.9	-65 49.6	10706	9759	-4402	-23851	26143	Q	HDZF
MAR	-24 18.8	-65 50.1	10699	9750	-4405	-23845	26136	Q	HDZF
APR	-24 18.8	-65 50.4	10695	9746	-4403	-23841	26129	Q	HDZF
MAY	-24 19.6	-65 50.8	10691	9742	-4404	-23841	26128	Q	HDZF
JUN	-24 20.7	-65 50.8	10690	9739	-4407	-23838	26125	Q	HDZF
JUL	-24 21.5	-65 50.0	10695	9743	-4411	-23834	26124	Q	HDZF
AUG	-24 21.5	-65 49.6	10696	9744	-4412	-23829	26119	Q	HDZF
SEP	-24 22.1	-65 48.7	10701	9748	-4415	-23822	26115	Q	HDZF
OCT	-24 22.4	-65 48.4	10700	9747	-4416	-23816	26110	Q	HDZF
NOV	-24 23.9	-65 49.0	10696	9741	-4418	-23819	26110	Q	HDZF
DEC	-24 23.3	-65 47.7	10706	9750	-4421	-23816	26111	Q	HDZF
YEAR	-24 20.3	-65 49.5	10699	9748	-4409	-23834	26125	Q	HDZF
JAN	-24 15.6	-65 51.0	10697	9752	-4395	-23857	26146	D	HDZF
FEB	-24 17.4	-65 53.6	10678	9733	-4392	-23864	26144	D	HDZF
MAR	-24 18.5	-65 54.5	10666	9721	-4391	-23854	26130	D	HDZF
APR	-24 19.8	-65 53.2	10675	9727	-4398	-23847	26127	D	HDZF
MAY	-24 21.2	-65 54.8	10661	9712	-4396	-23847	26122	D	HDZF
JUN	-24 18.7	-65 53.9	10666	9720	-4391	-23842	26119	D	HDZF
JUL	-24 20.5	-65 53.4	10670	9721	-4398	-23841	26120	D	HDZF
AUG	-24 22.2	-65 54.8	10657	9707	-4397	-23838	26112	D	HDZF
SEP	-24 20.8	-65 52.6	10671	9722	-4399	-23829	26110	D	HDZF
OCT	-24 29.5	-65 59.2	10622	9666	-4403	-23841	26101	D	HDZF
NOV	-24 24.3	-65 55.4	10655	9703	-4402	-23845	26118	D	HDZF
DEC	-24 24.2	-65 50.7	10685	9730	-4414	-23823	26110	D	HDZF
YEAR	-24 21.0	-65 53.9	10667	9718	-4398	-23844	26121	D	HDZF

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

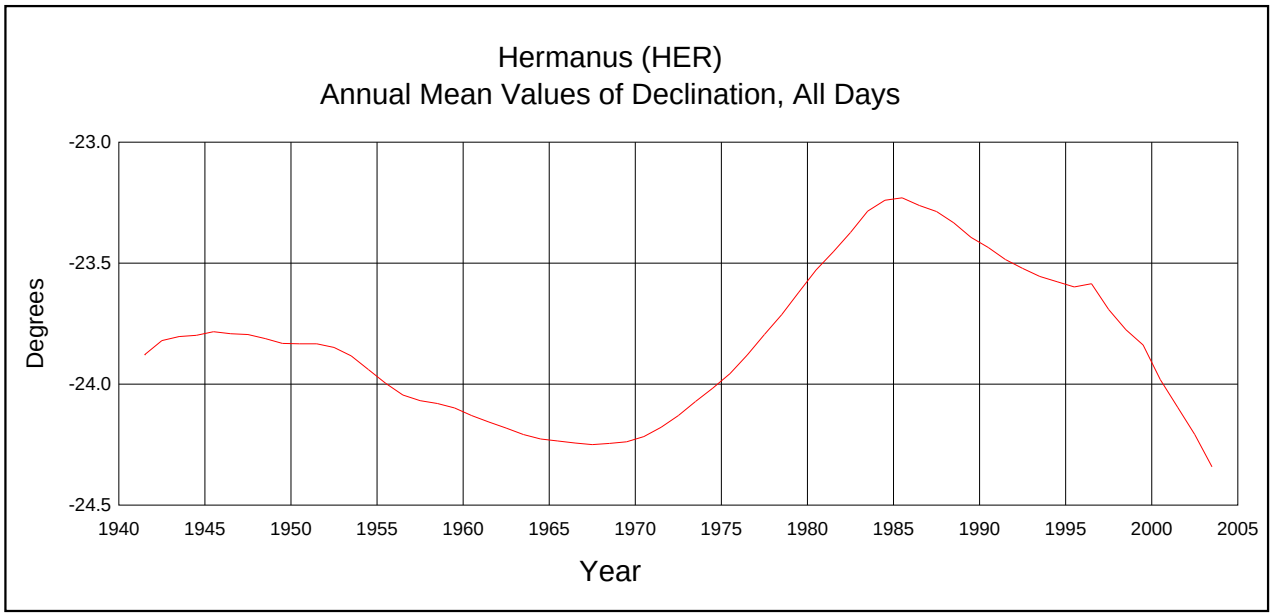
HERMANUS
MEAN ANNUAL VALUES

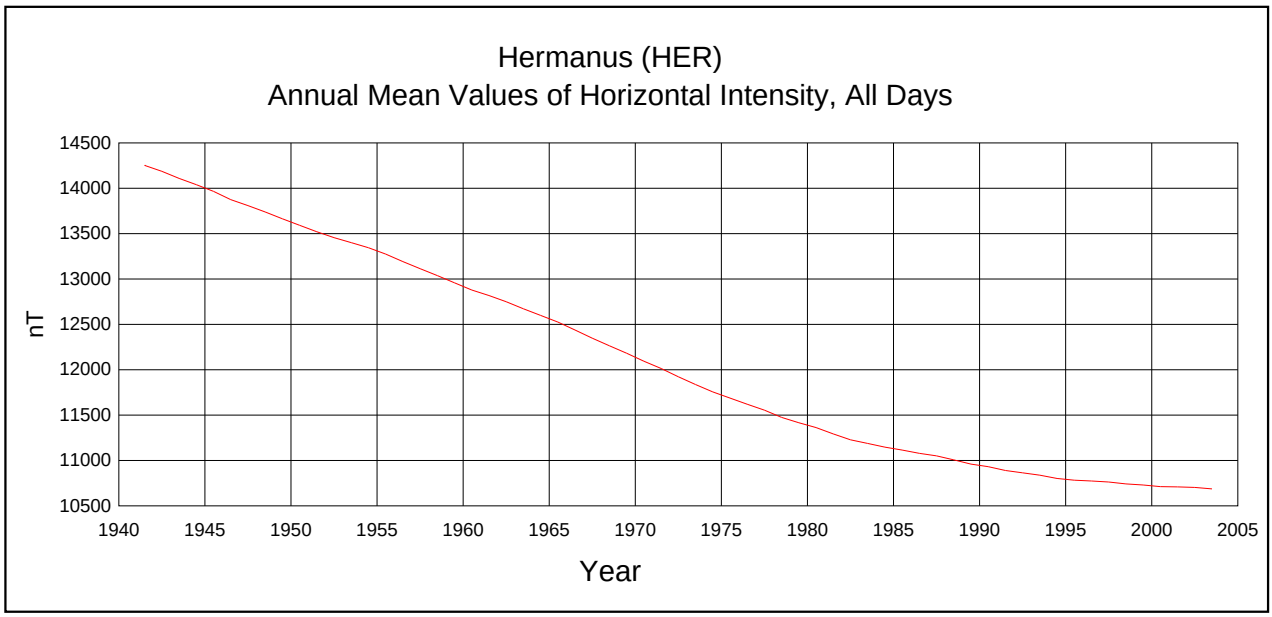
Date	° D '	° I '	H nT	X nT	Y nT	Z nT	F nT	*	ELE
1941.5	-23 51.6	-64 01.4	14252	13034	-5765	-29249	32537	A	DHZ
1942.5	-23 48.1	-64 03.0	14187	12980	-5724	-29153	32422	A	DHZ
1943.5	-23 47.1	-64 06.4	14109	12911	-5690	-29065	32309	A	DHZ
1944.5	-23 46.8	-64 09.1	14040	12848	-5661	-28981	32202	A	DHZ
1945.5	-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

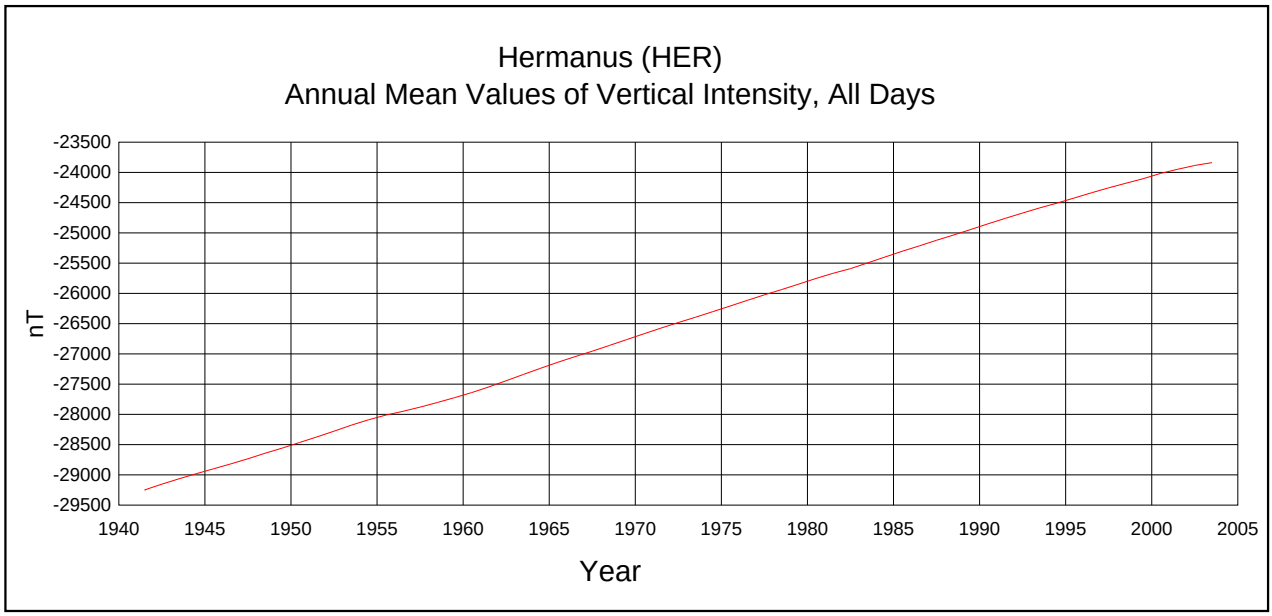
HERMANUS
MEAN ANNUAL VALUES

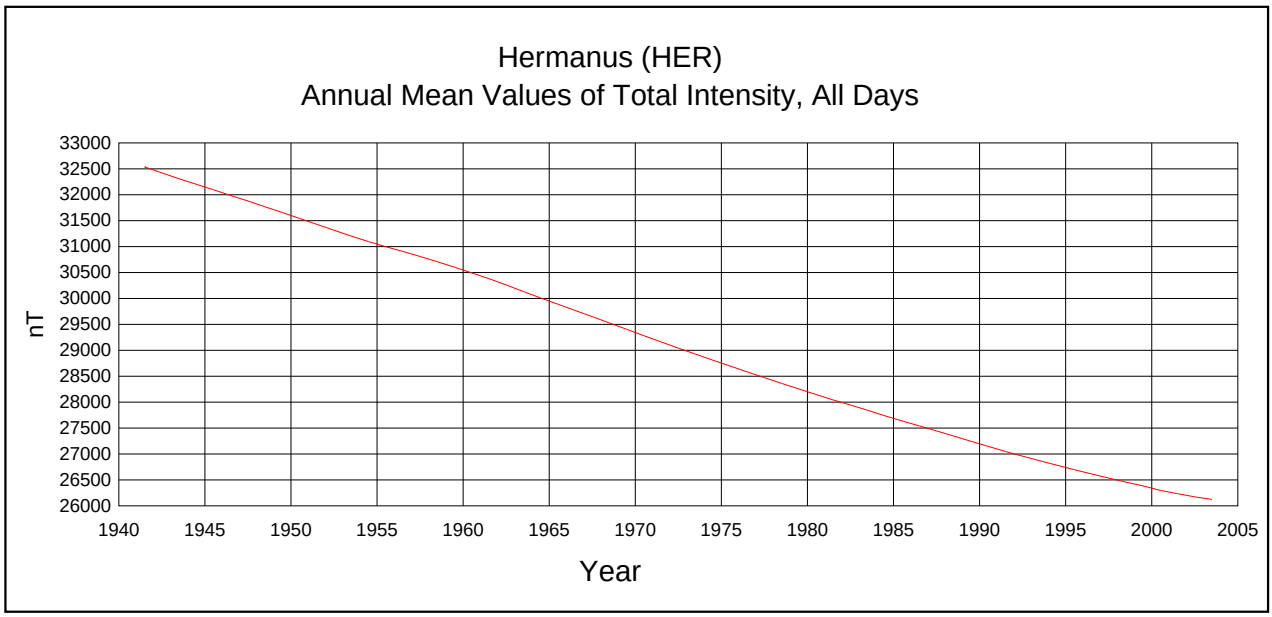
Date	° D ,	° I ,	H nT	X nT	Y nT	Z nT	F nT	*	ELE
1981.5	-23 26.1	-66 15.0	11293	10362	-4492	-25667	28042	A	DHZ
1982.5	-23 21.3	-66 18.6	11228	10309	-4452	-25591	27946	A	DHZ
1983.5	-23 16.0	-66 18.4	11188	10279	-4420	-25496	27843	A	DHZ
1984.5	-23 13.3	-66 18.3	11147	10244	-4395	-25399	27737	A	DHZ
1985.5	-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
2003.5	-24 20.5	-65 51.1	10687	9738	-4406	-23838	26124	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

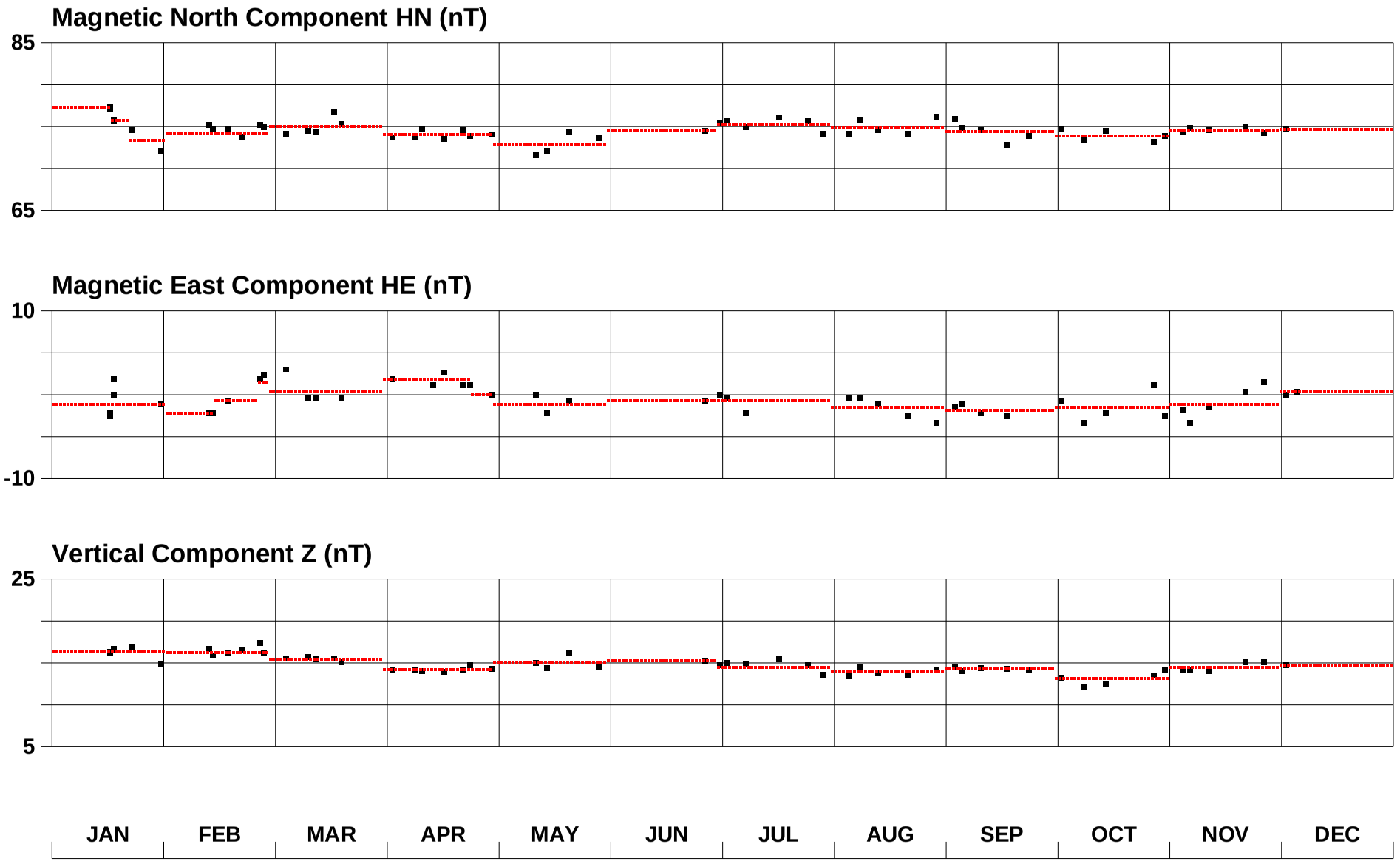
Magnetic Results 2003

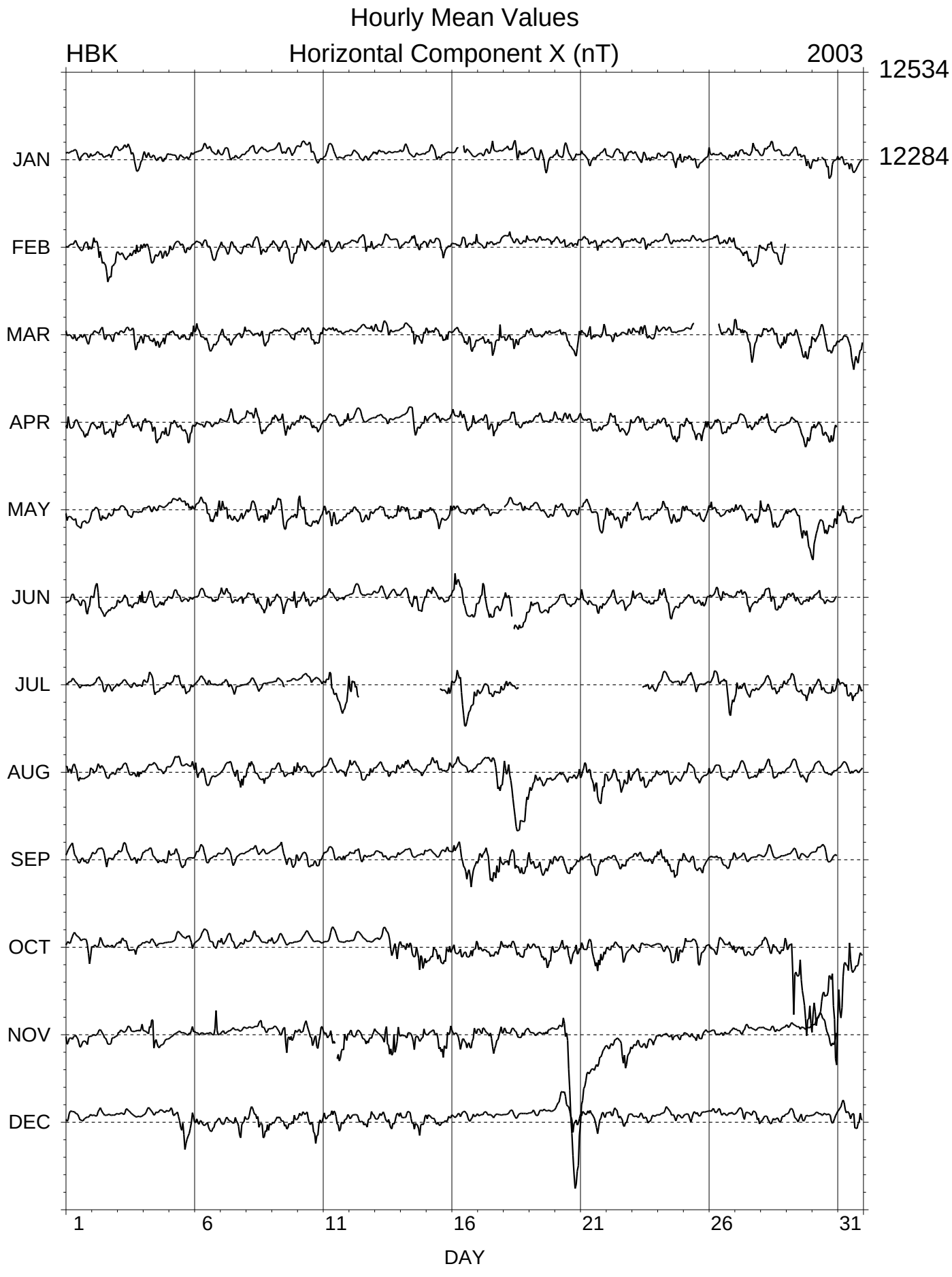
Hartebeesthoek

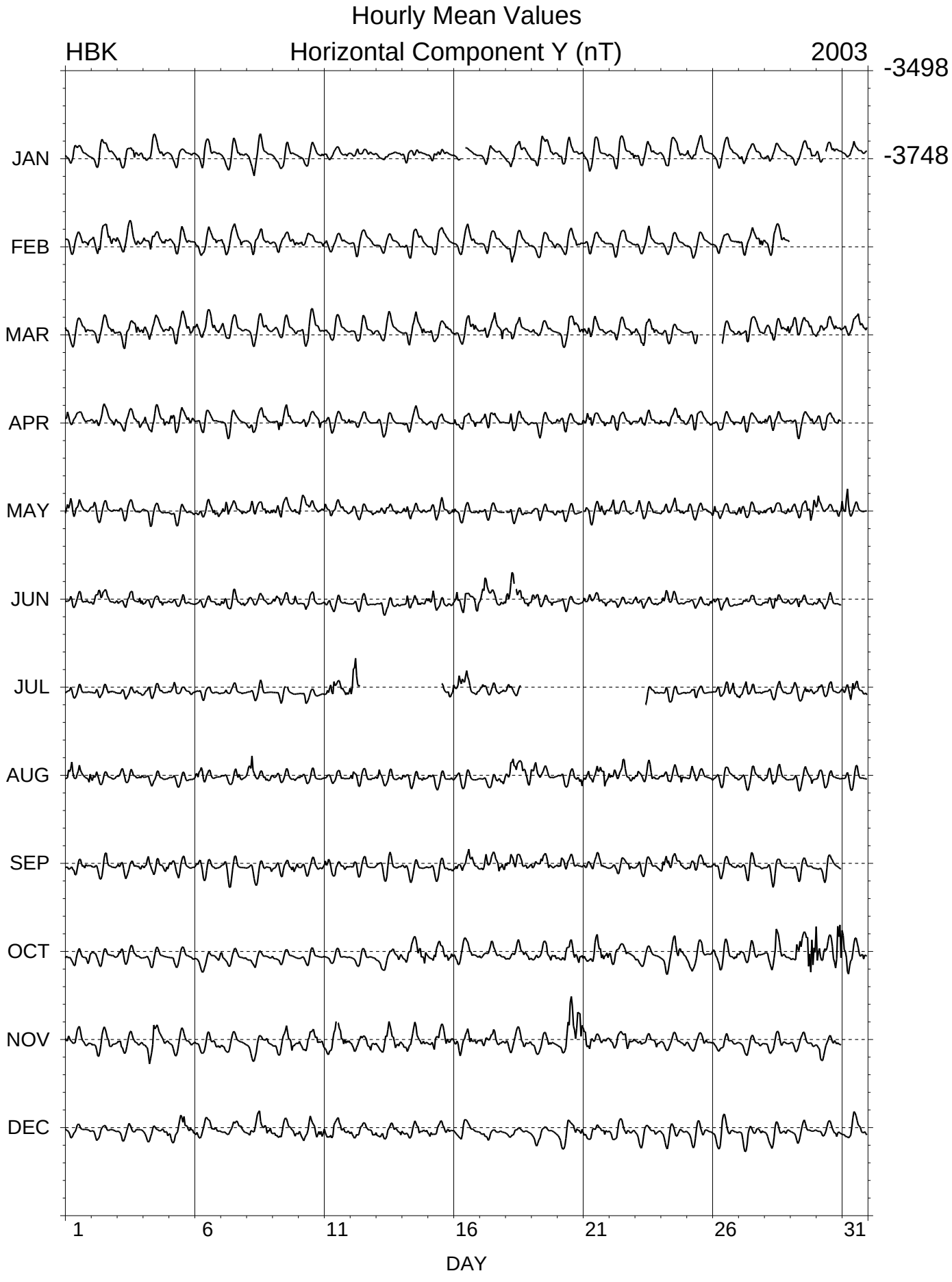
Observed and Adopted Baseline Values, HBK 2003

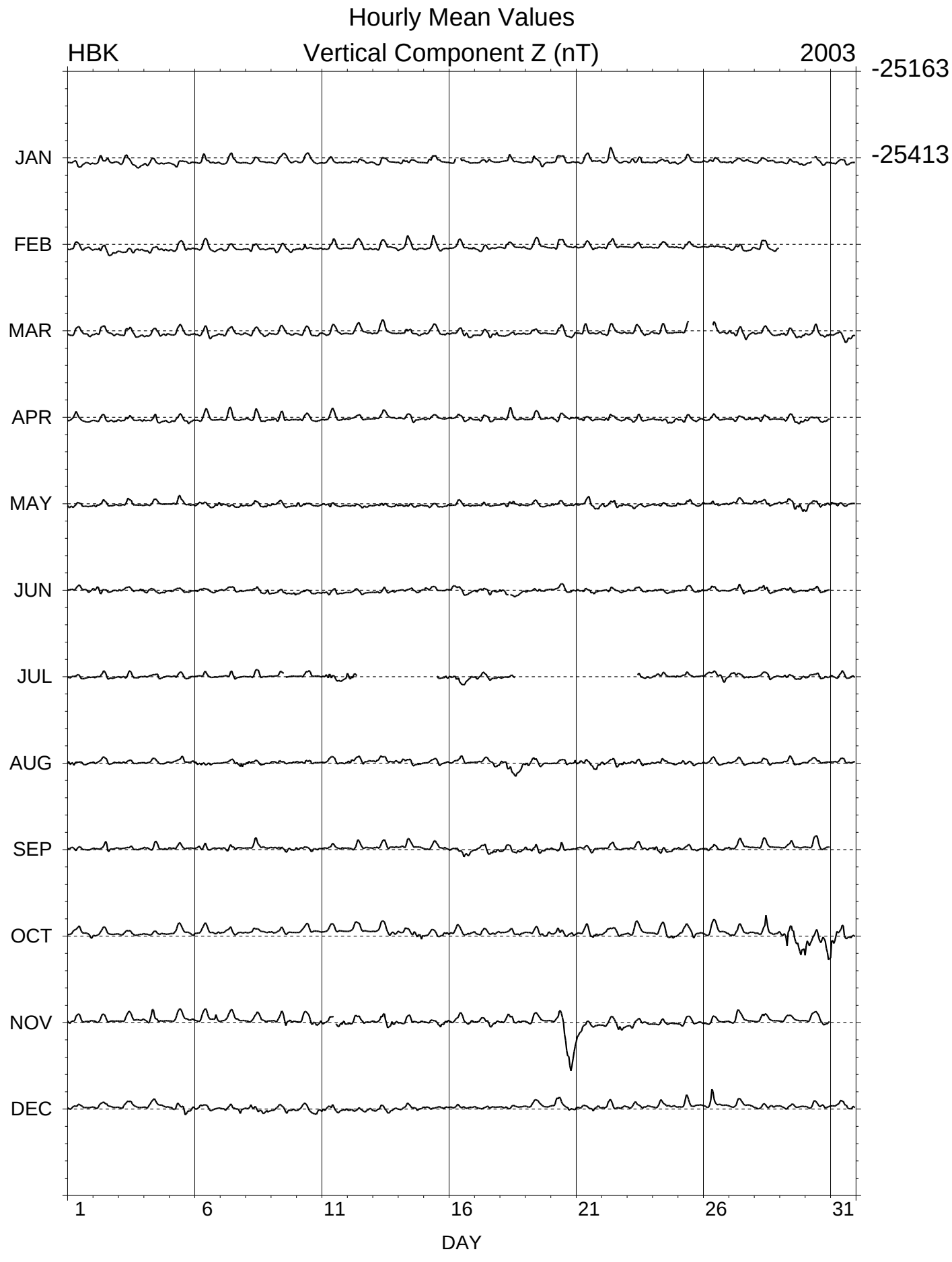
LAT: 115.883 LONG: 27.707

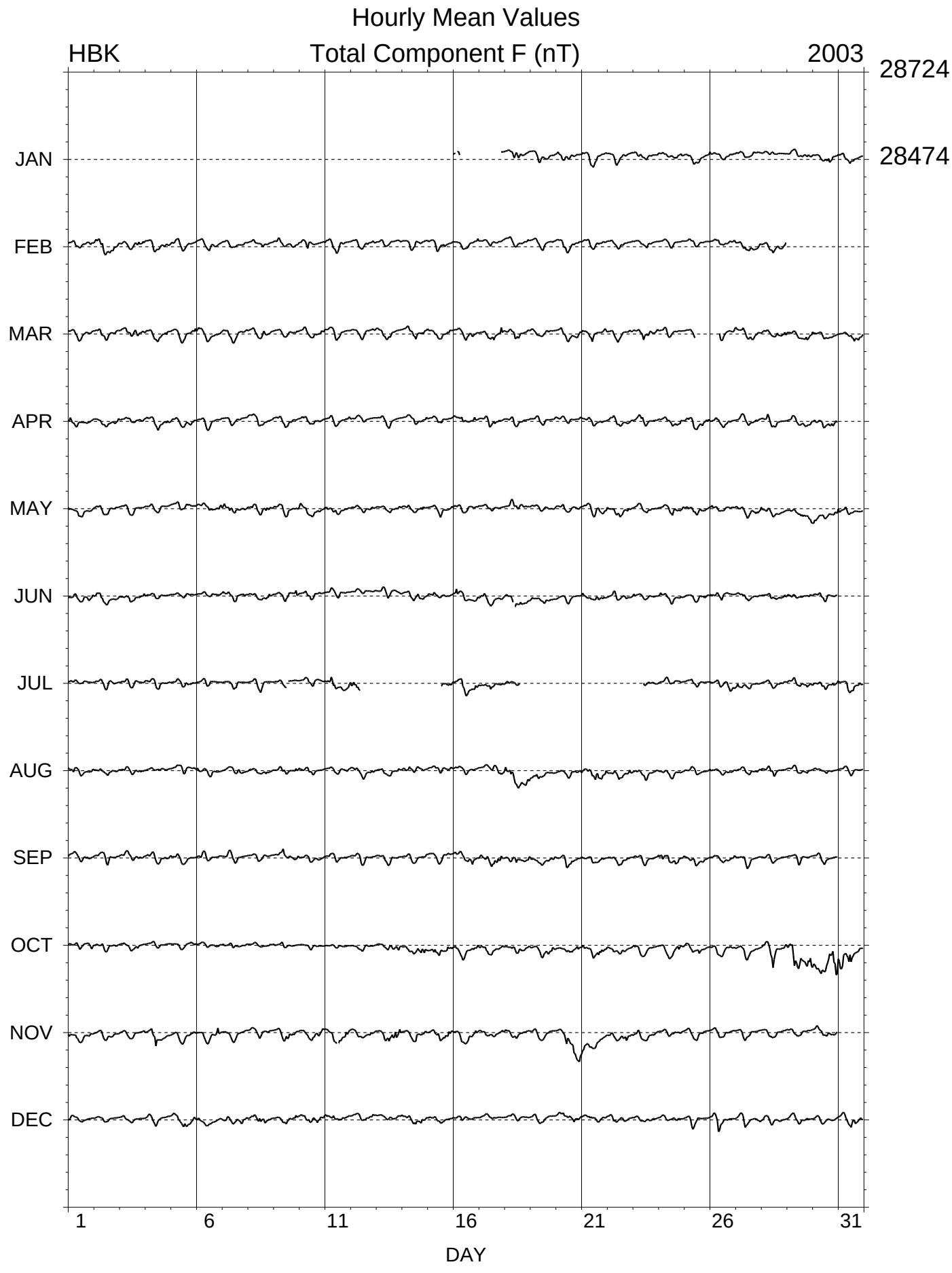
INSTITUTION: HMO INSTRUMENT: LC




Hourly Mean Values
HBK
Horizontal Component X (nT)
2003
12534
12284
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)
2003
-3498
-3748
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)
2003
-25163
-25413
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)
2003
28724
28474
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY

HARTEBEESTHOEK
MEAN MONTHLY VALUES 2003

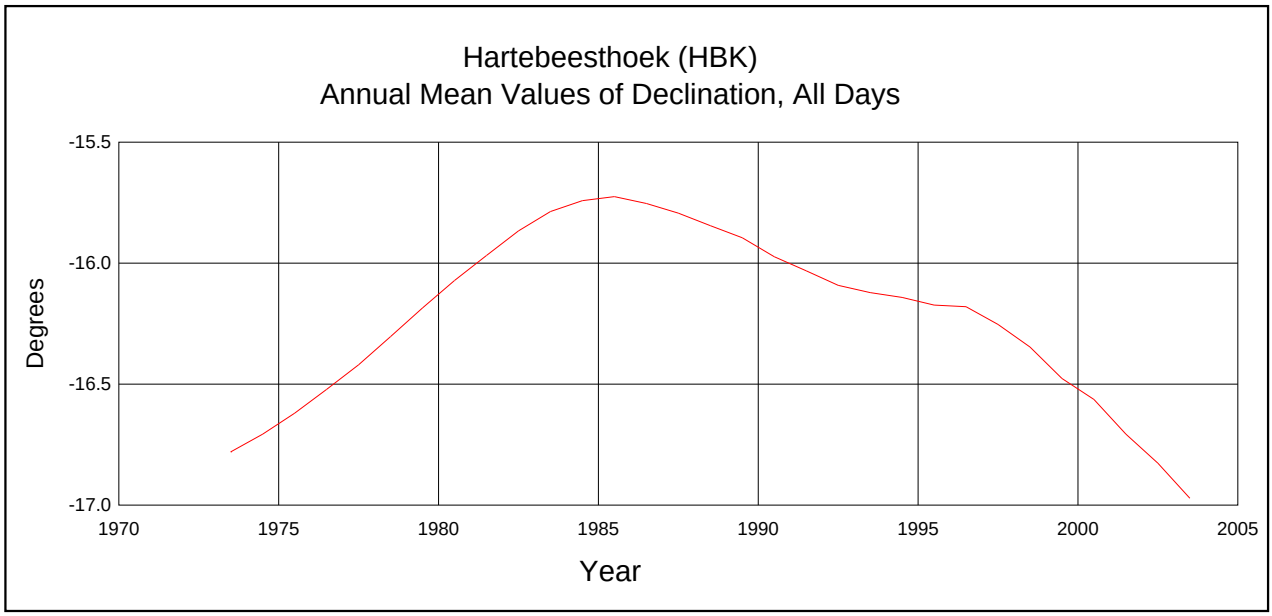
Date	° D '	° I '	H nT	X nT	Y nT	Z nT	F nT	*	ELE
JAN	-16 53.1	-63 10.7	12855	12300	-3734	-25423	28485	A	HDZF
FEB	-16 54.1	-63 11.6	12845	12290	-3734	-25422	28483	A	HDZF
MAR	-16 54.2	-63 12.4	12837	12282	-3732	-25419	28476	A	HDZF
APR	-16 56.7	-63 12.0	12839	12282	-3742	-25417	28476	A	HDZF
MAY	-16 58.5	-63 12.6	12833	12274	-3747	-25415	28472	A	HDZF
JUN	-17 00.3	-63 11.9	12838	12277	-3755	-25414	28473	A	HDZF
JUL	-17 01.3	-63 11.1	12845	12282	-3760	-25412	28474	A	HDZF
AUG	-16 59.3	-63 11.1	12844	12284	-3753	-25411	28472	A	HDZF
SEP	-16 59.7	-63 10.1	12852	12291	-3757	-25408	28474	A	HDZF
OCT	-17 01.4	-63 11.1	12840	12277	-3759	-25402	28463	A	HDZF
NOV	-17 00.5	-63 11.6	12838	12277	-3755	-25409	28468	A	HDZF
DEC	-16 59.7	-63 09.0	12862	12301	-3760	-25407	28477	A	HDZF
YEAR	-16 58.2	-63 11.3	12844	12285	-3749	-25413	28474	A	HDZF
JAN	-16 53.2	-63 09.6	12864	12309	-3737	-25422	*****	Q	HDZF
FEB	-16 54.3	-63 10.3	12856	12301	-3738	-25419	28485	Q	HDZF
MAR	-16 54.6	-63 10.8	12850	12294	-3738	-25416	28479	Q	HDZF
APR	-16 56.8	-63 10.6	12851	12293	-3746	-25414	28478	Q	HDZF
MAY	-16 58.6	-63 10.9	12848	12288	-3751	-25414	28478	Q	HDZF
JUN	-17 01.0	-63 10.8	12849	12286	-3760	-25414	28478	Q	HDZF
JUL	-17 01.7	-63 09.4	12859	12296	-3766	-25409	28478	Q	HDZF
AUG	-16 59.4	-63 09.3	12860	12299	-3758	-25408	28477	Q	HDZF
SEP	-17 00.2	-63 08.6	12864	12302	-3762	-25403	28475	Q	HDZF
OCT	-17 00.8	-63 08.0	12866	12303	-3765	-25397	28470	Q	HDZF
NOV	-16 60.0	-63 08.6	12863	12301	-3761	-25402	28473	Q	HDZF
DEC	-16 59.8	-63 07.8	12871	12309	-3762	-25403	28478	Q	HDZF
YEAR	-16 58.4	-63 09.5	12859	12299	-3754	-25410	28477	Q	HDZF
JAN	-16 53.0	-63 11.7	12844	12290	-3730	-25422	28482	D	HDZF
FEB	-16 54.5	-63 14.4	12822	12268	-3729	-25427	28478	D	HDZF
MAR	-16 54.1	-63 14.8	12817	12263	-3726	-25423	28471	D	HDZF
APR	-16 57.3	-63 13.4	12828	12270	-3741	-25419	28473	D	HDZF
MAY	-16 58.8	-63 14.8	12813	12255	-3742	-25417	28465	D	HDZF
JUN	-16 59.0	-63 13.7	12822	12263	-3745	-25415	28467	D	HDZF
JUL	-17 01.1	-63 13.3	12827	12265	-3754	-25416	28469	D	HDZF
AUG	-16 59.4	-63 14.5	12816	12256	-3745	-25416	28464	D	HDZF
SEP	-16 58.8	-63 12.4	12834	12274	-3748	-25414	28471	D	HDZF
OCT	-17 04.1	-63 19.1	12772	12210	-3749	-25414	28443	D	HDZF
NOV	-17 00.5	-63 15.5	12807	12247	-3746	-25418	28462	D	HDZF
DEC	-16 59.5	-63 10.8	12849	12288	-3755	-25413	28477	D	HDZF
YEAR	-16 58.3	-63 14.0	12821	12262	-3742	-25418	28468	D	HDZF

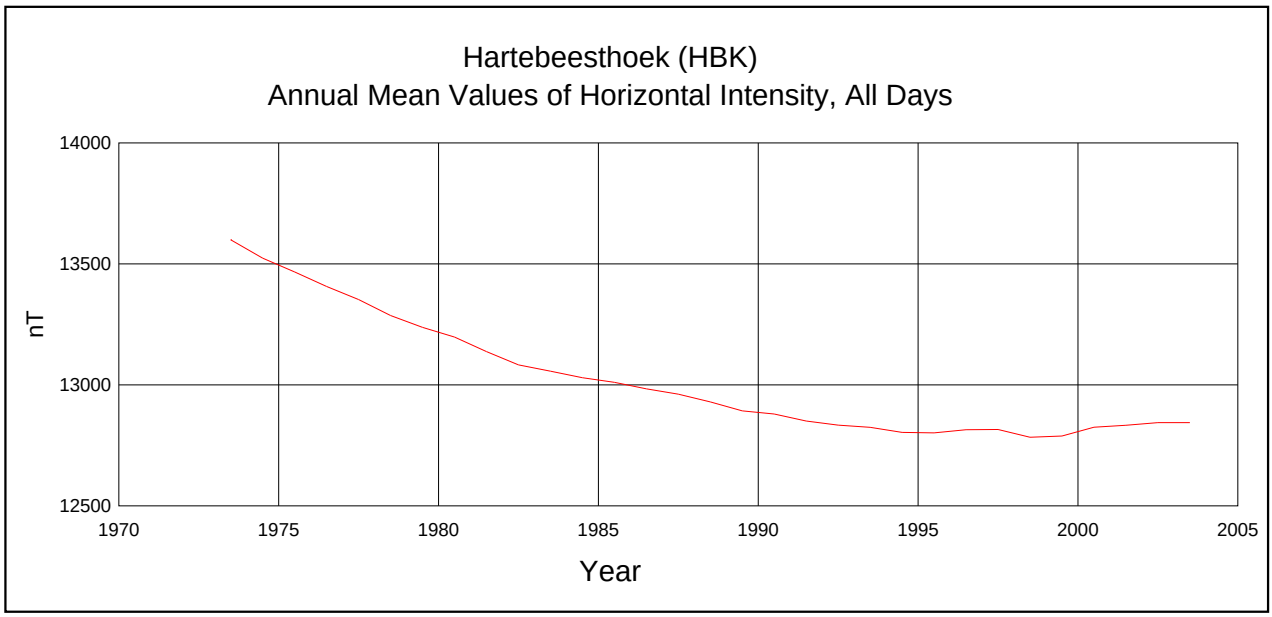
*A: All days
*Q: Quiet days
*D: Disturbed days
ELE: Elements recorded

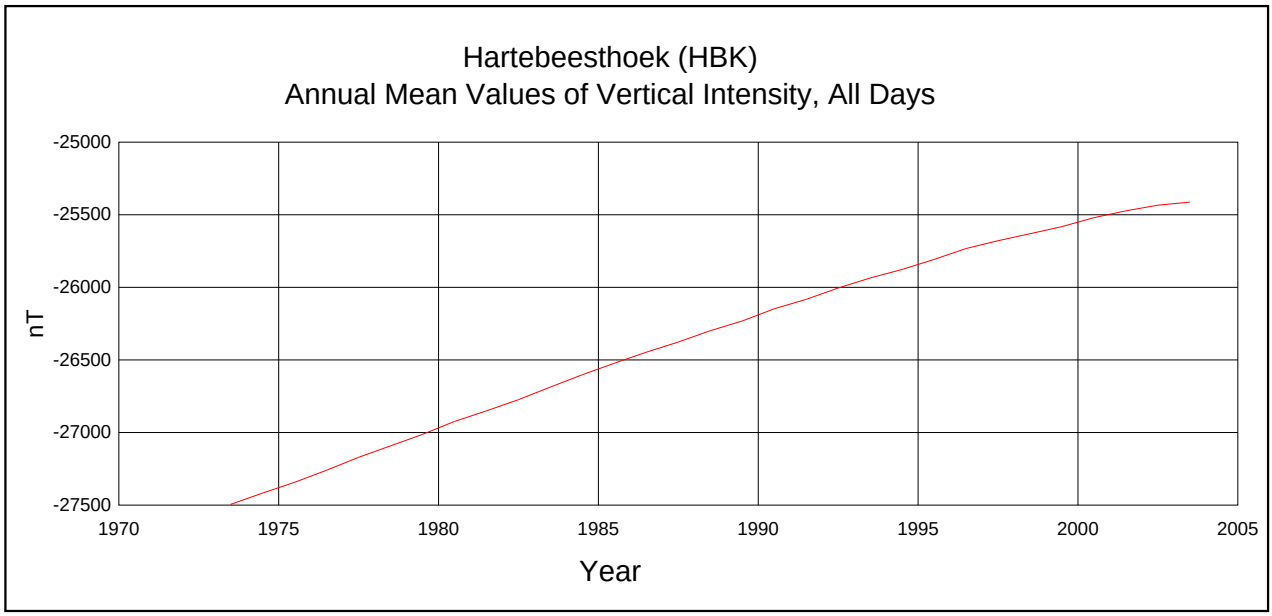
HARTEBEESTHOEK
MEAN ANNUAL VALUES

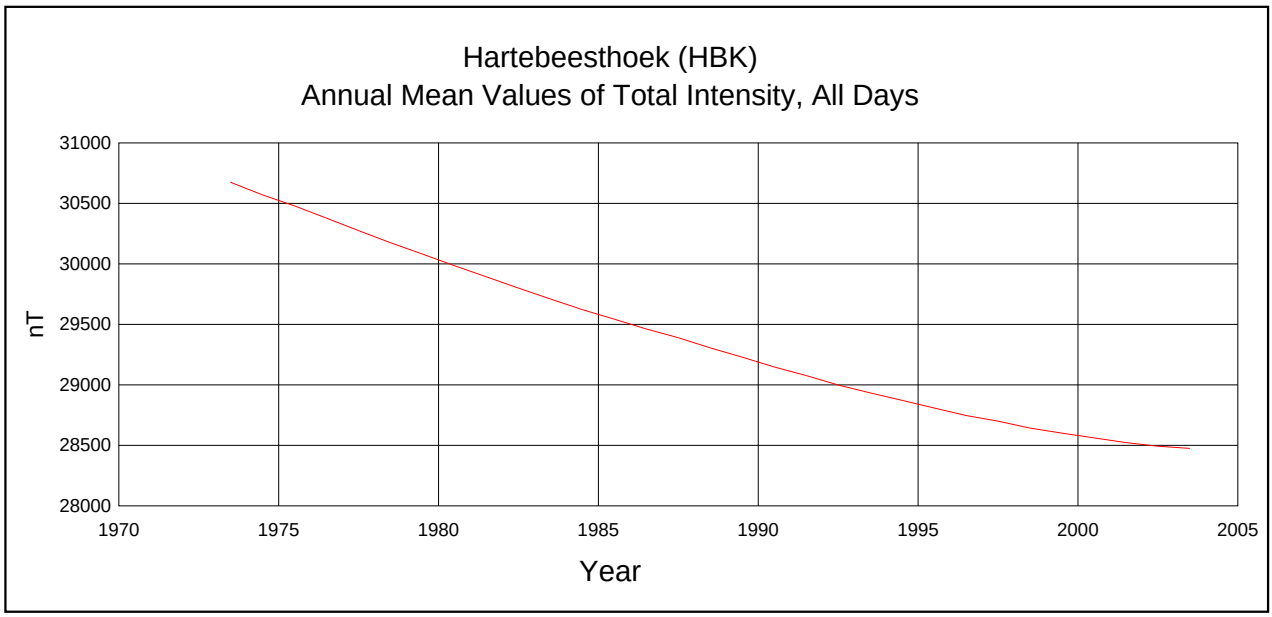
Date	° D	'	° I	'	H nT	X nT	Y nT	Z nT	F nT	*	ELE
1973.5	-16	46.6	-63	41.0	13599	13020	-3925	-27495	30674	A	DHZ
1974.5	-16	42.2	-63	44.8	13523	12952	-3887	-27417	30570	A	DHZ
1975.5	-16	37.0	-63	46.8	13466	12903	-3851	-27343	30479	A	DHZ
1976.5	-16	31.1	-63	48.8	13406	12852	-3812	-27260	30378	A	DHZ
1977.5	-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	28643	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
2003.5	-16	58.3	-63	11.3	12844	12285	-3749	-25413	28475	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

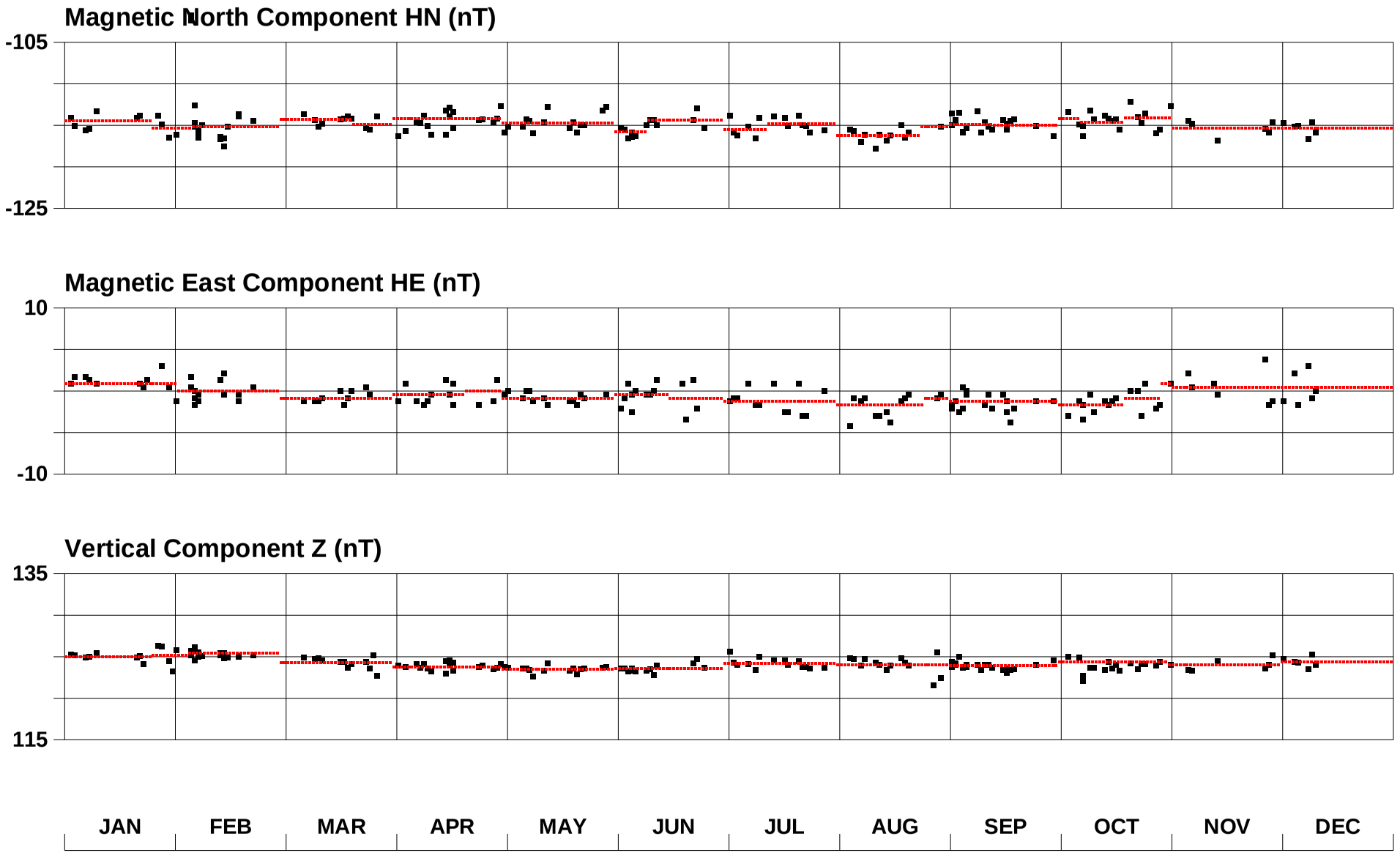
Magnetic Results 2003

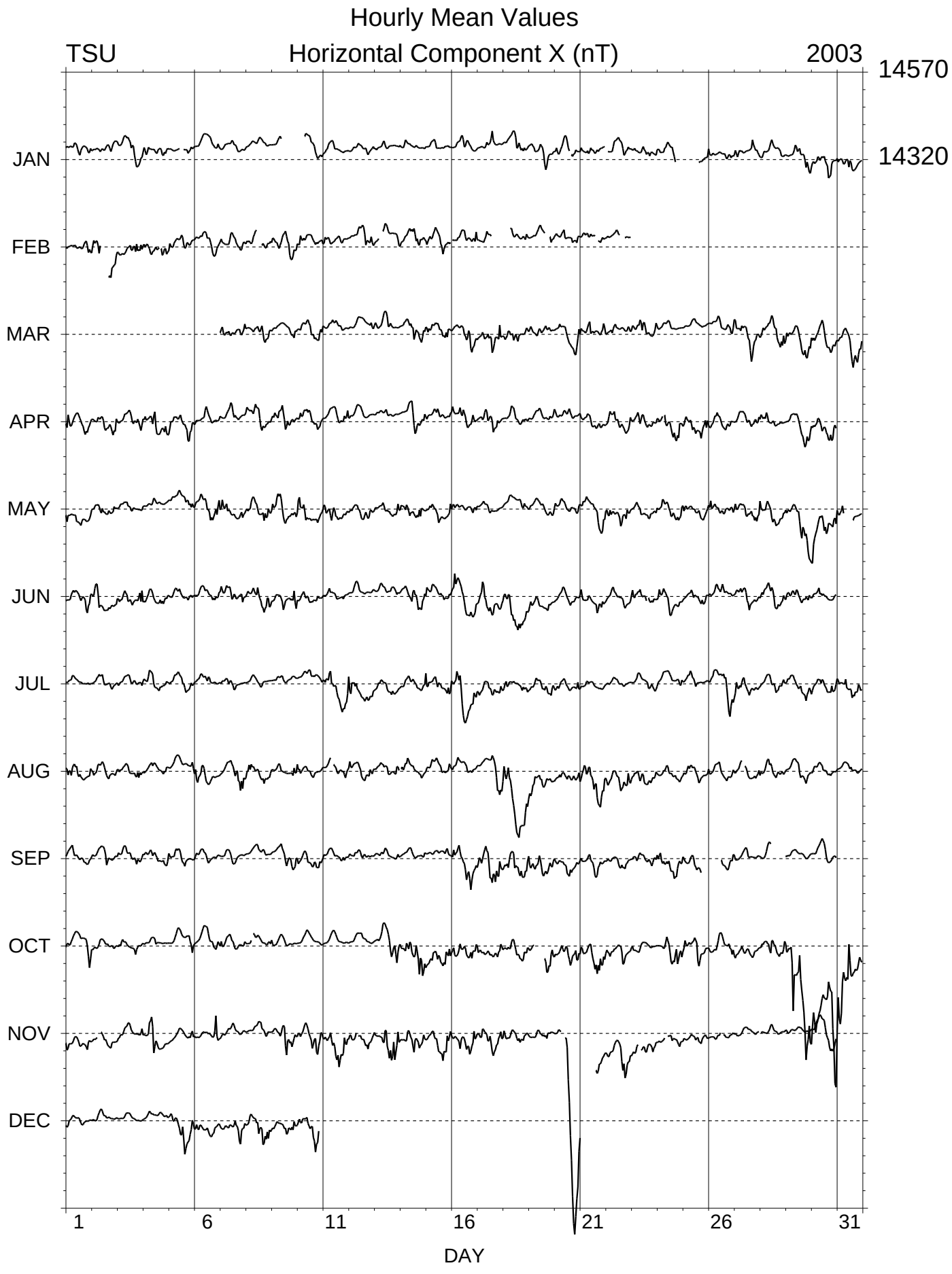
Tsumeb

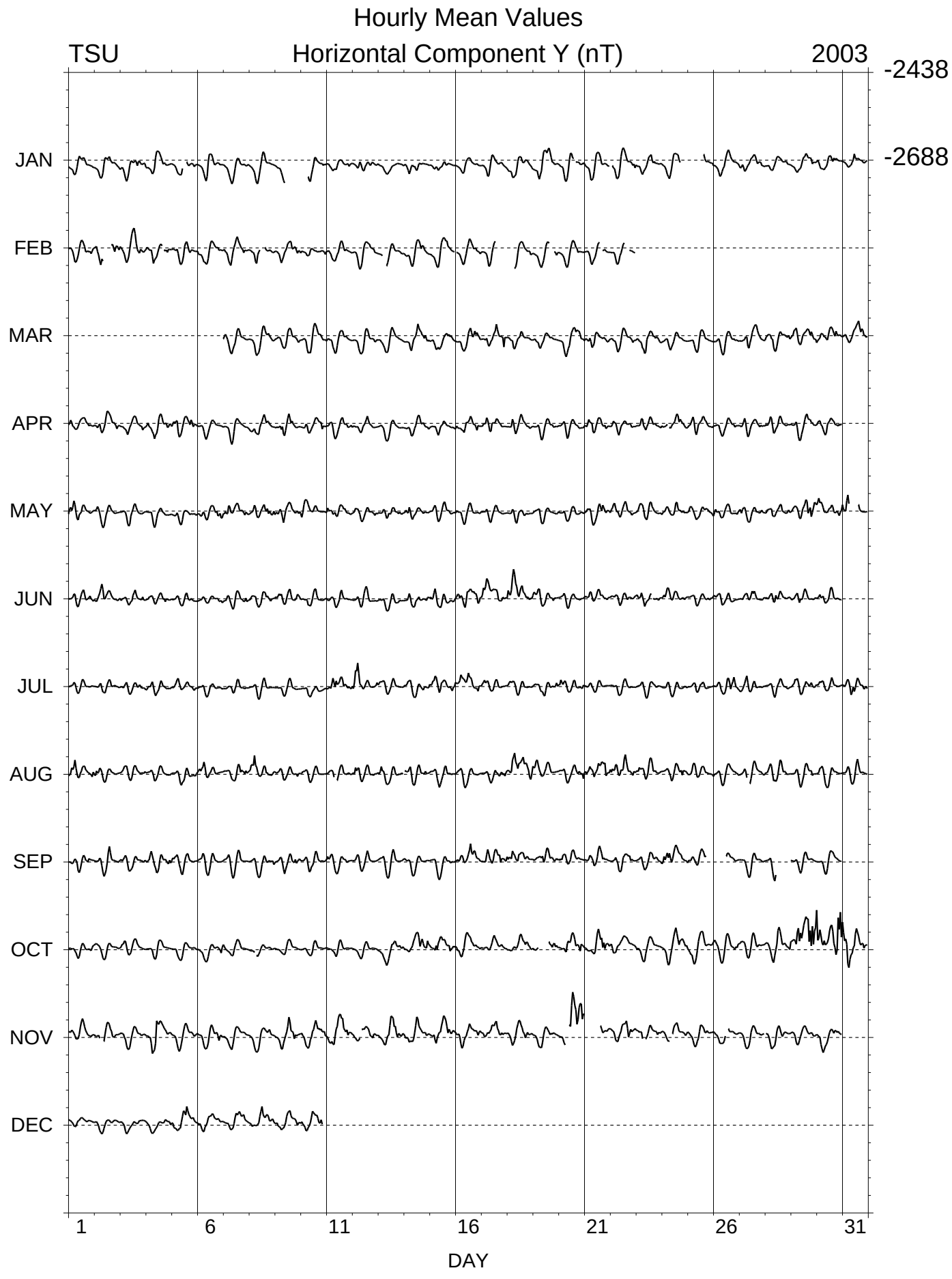
Observed and Adopted Baseline Values, TSU 2003

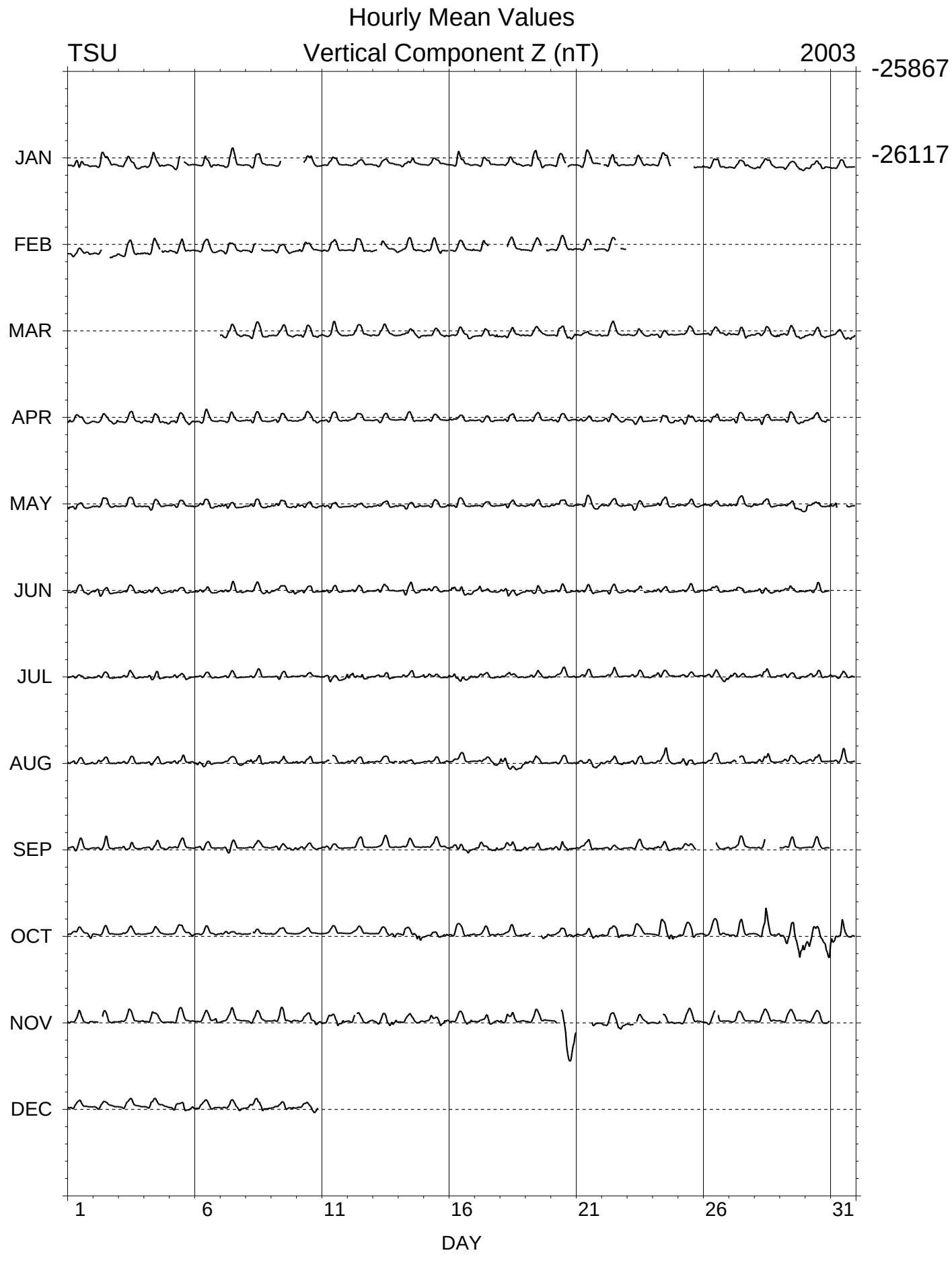
LAT: 109.202 LONG: 17.584

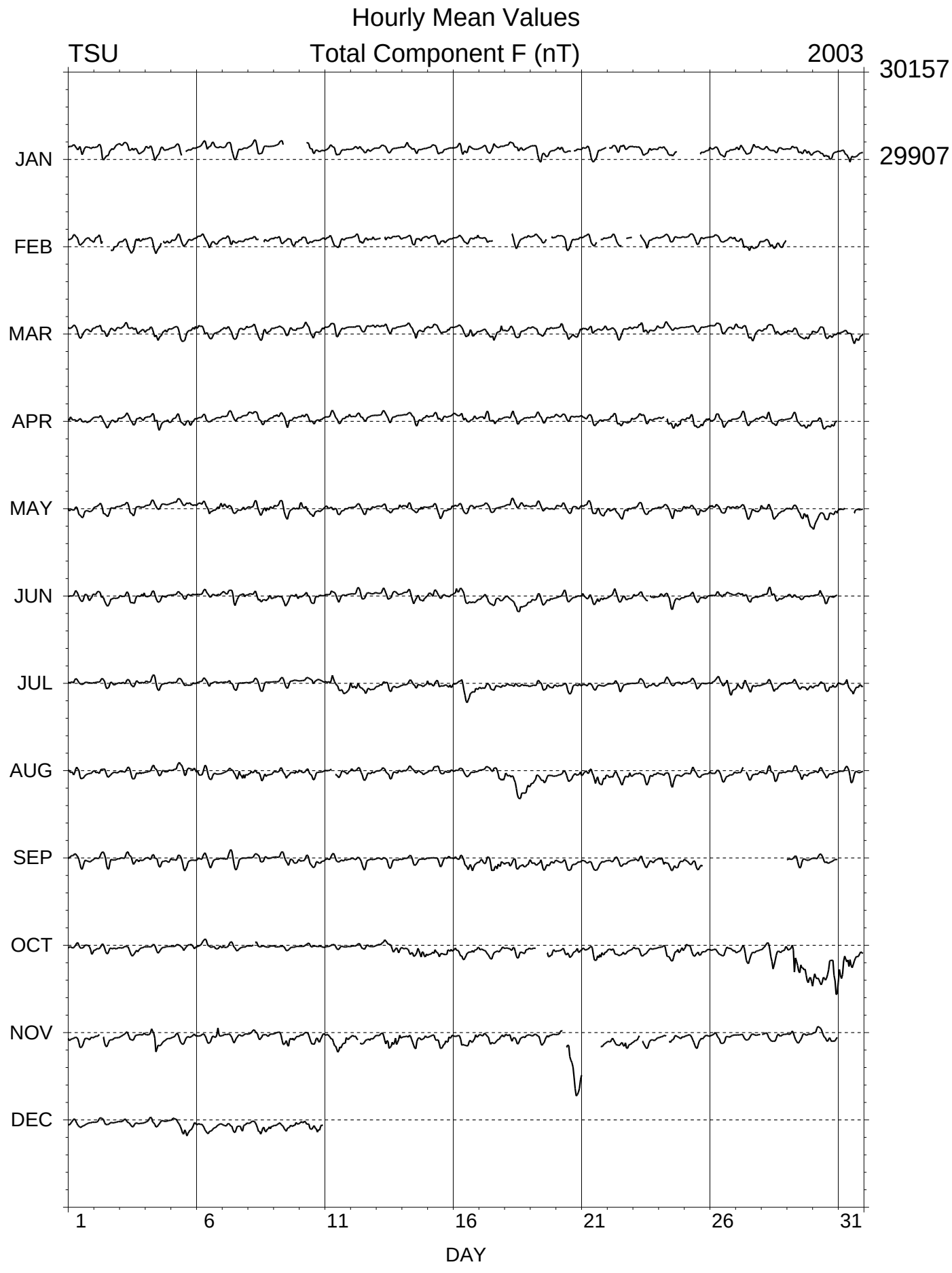
INSTITUTION: HMO INSTRUMENT: LC




Hourly Mean Values
TSU
Horizontal Component X (nT)
2003
14570
14320
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)
2003
-2438
-2688
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)
2003
-25867
-26117
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)
2003
30157
29907
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1
6
11
16
21
26
31
DAY

TSUMEB
MEAN MONTHLY VALUES 2003

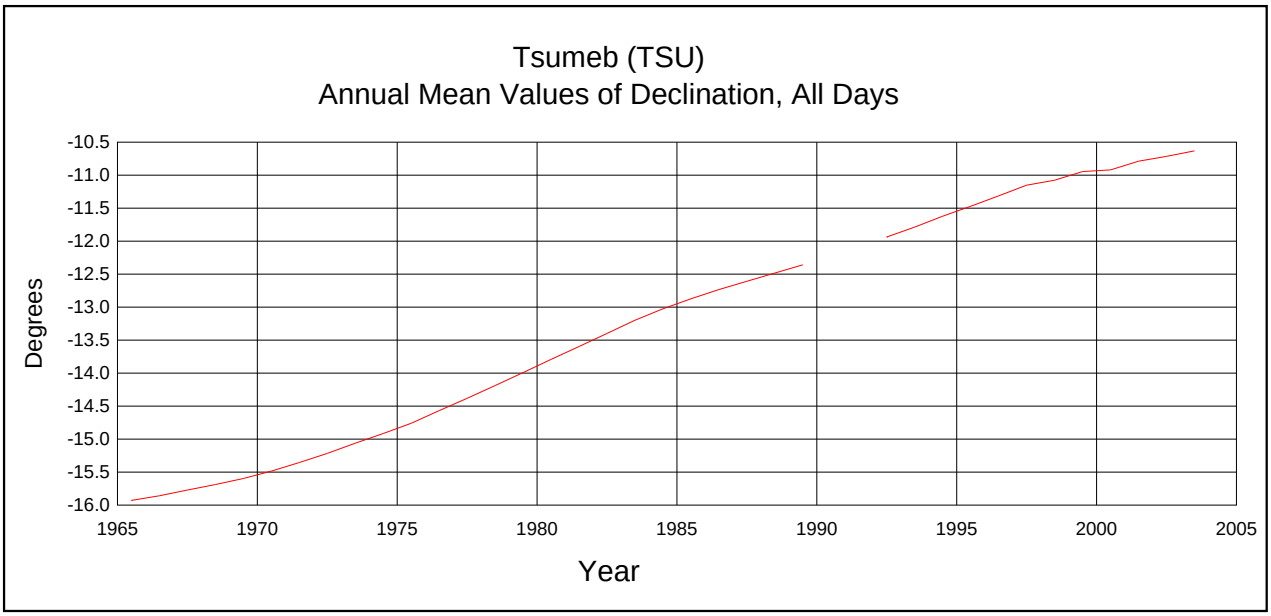
Date	° D ,	° I ,	H nT	X nT	Y nT	Z nT	F nT	*	ELE
JAN	-10 39.8	-60 48.4	14602	14350	-2702	-26134	29936	A	HDZF
FEB	-10 39.6	-60 49.4	14590	14338	-2699	-26130	29927	A	HDZF
MAR	-10 39.7	-60 50.0	14581	14330	-2698	-26125	29919	A	HDZF
APR	-10 39.2	-60 50.2	14578	14326	-2695	-26123	29915	A	HDZF
MAY	-10 38.8	-60 51.2	14567	14316	-2691	-26121	29908	A	HDZF
JUN	-10 37.5	-60 51.0	14567	14318	-2686	-26118	29906	A	HDZF
JUL	-10 37.9	-60 50.6	14569	14319	-2688	-26115	29904	A	HDZF
AUG	-10 36.9	-60 50.9	14565	14316	-2683	-26112	29899	A	HDZF
SEP	-10 36.9	-60 50.0	14571	14322	-2684	-26108	29899	A	HDZF
OCT	-10 36.4	-60 51.8	14554	14305	-2679	-26108	29890	A	HDZF
NOV	-10 36.4	-60 52.2	14550	14301	-2678	-26109	29890	A	HDZF
DEC	-10 36.2	-60 50.9	14562	14313	-2680	-26107	29894	A	HDZF
YEAR	-10 37.9	-60 50.6	14571	14321	-2688	-26118	29907	A	HDZF
JAN	-10 40.0	-60 46.7	14618	14365	-2706	-26132	29941	Q	HDZF
FEB	-10 39.8	-60 48.2	14600	14348	-2702	-26128	29932	Q	HDZF
MAR	-10 40.2	-60 48.4	14597	14344	-2703	-26124	29925	Q	HDZF
APR	-10 39.8	-60 48.8	14591	14339	-2700	-26122	29921	Q	HDZF
MAY	-10 39.1	-60 49.6	14582	14331	-2695	-26120	29915	Q	HDZF
JUN	-10 38.0	-60 49.9	14578	14328	-2690	-26118	29910	Q	HDZF
JUL	-10 38.4	-60 49.4	14580	14330	-2692	-26114	29908	Q	HDZF
AUG	-10 37.1	-60 49.1	14581	14332	-2687	-26110	29905	Q	HDZF
SEP	-10 37.1	-60 48.8	14583	14333	-2687	-26107	29903	Q	HDZF
OCT	-10 36.7	-60 48.6	14583	14334	-2685	-26105	29902	Q	HDZF
NOV	-10 36.6	-60 49.5	14575	14326	-2684	-26105	29898	Q	HDZF
DEC	-10 37.0	-60 49.0	14579	14329	-2686	-26104	29899	Q	HDZF
YEAR	-10 38.3	-60 48.9	14587	14336	-2693	-26116	29914	Q	HDZF
JAN	-10 39.5	-60 49.9	14588	14336	-2698	-26136	29933	D	HDZF
FEB	-10 39.5	-60 51.2	14574	14322	-2695	-26133	29919	D	HDZF
MAR	-10 38.5	-60 52.9	14554	14304	-2688	-26128	29909	D	HDZF
APR	-10 39.3	-60 51.6	14565	14314	-2693	-26124	29910	D	HDZF
MAY	-10 38.5	-60 53.6	14544	14294	-2686	-26123	29899	D	HDZF
JUN	-10 36.0	-60 52.7	14551	14303	-2676	-26120	29900	D	HDZF
JUL	-10 37.2	-60 52.6	14551	14301	-2682	-26118	29897	D	HDZF
AUG	-10 36.2	-60 54.2	14534	14286	-2674	-26116	29888	D	HDZF
SEP	-10 35.5	-60 52.4	14549	14301	-2674	-26111	29892	D	HDZF
OCT	-10 36.0	-61 00.4	14473	14226	-2662	-26118	29860	D	HDZF
NOV	-10 35.9	-60 57.0	14507	14259	-2668	-26117	29876	D	HDZF
DEC	-10 35.8	-60 52.3	14550	14301	-2676	-26109	29890	D	HDZF
YEAR	-10 37.2	-60 53.6	14543	14294	-2680	-26121	29897	D	HDZF

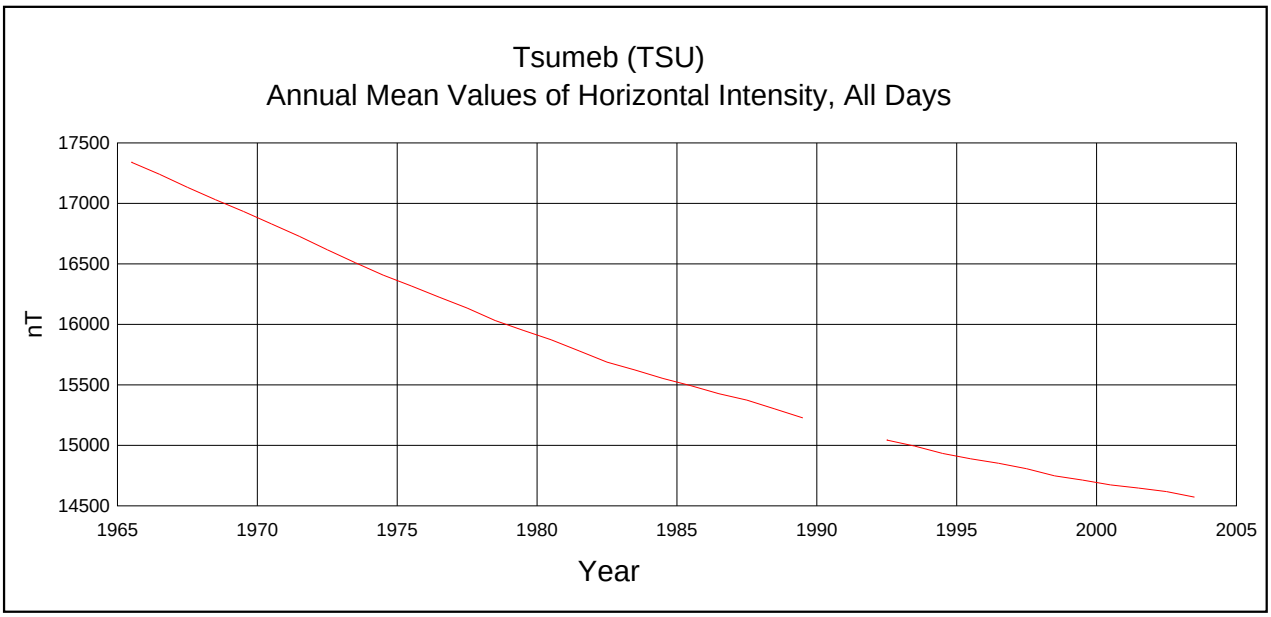
*A: All days
*Q: Quiet days
*D: Disturbed days
ELE: Elements recorded

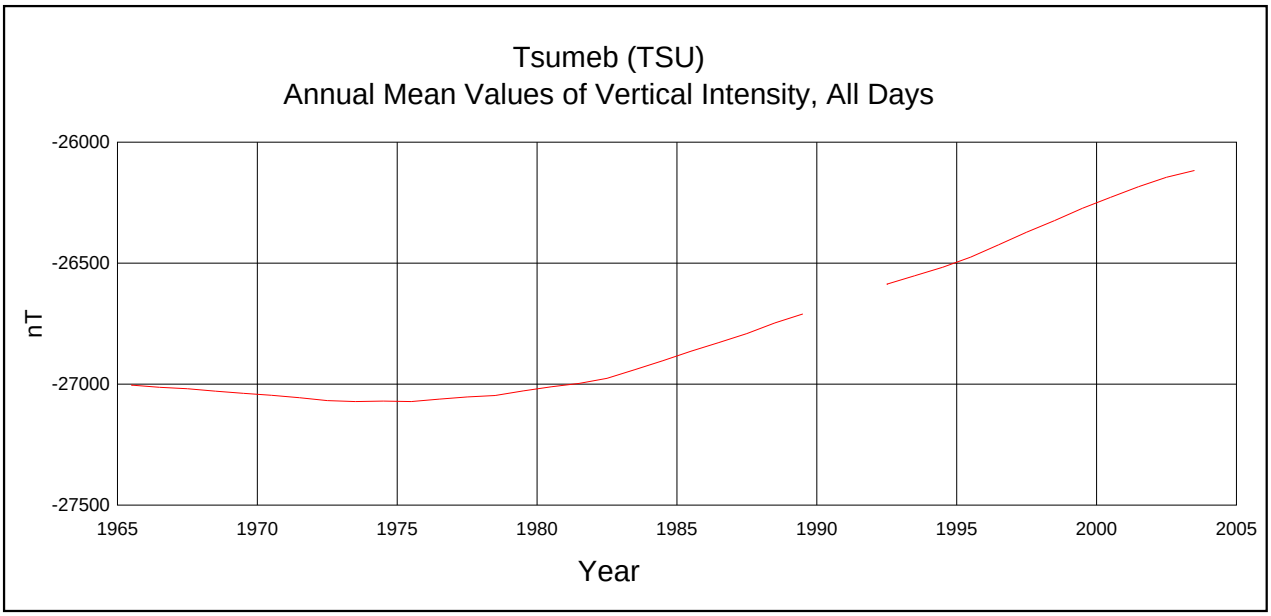
TSUMEB
MEAN ANNUAL VALUES

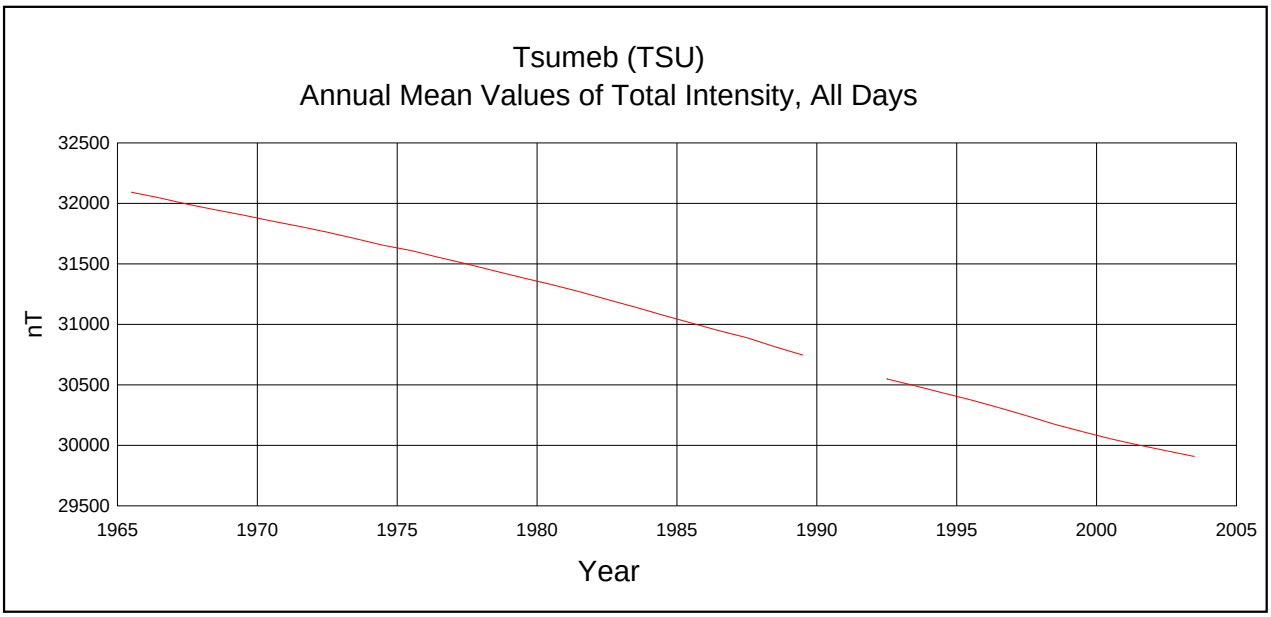
Date	°D ,	°I ,	H nT	X nT	Y nT	Z nT	F nT	*	ELE
1965.5	-15 58.0	-57 17.7	17340	16671	-4770	-27004	32092	A	DHZ
1966.5	-15 53.8	-57 27.1	17241	16582	-4722	-27013	32046	A	DHZ
1967.5	-15 48.6	-57 37.3	17133	16484	-4668	-27019	31993	A	DHZ
1968.5	-15 43.6	-57 47.1	17031	16393	-4616	-27029	31947	A	DHZ
1969.5	-15 38.1	-57 56.4	16934	16308	-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
2003.5	-10 37.9	-60 50.5	14572	14322	-2689	-26117	29908	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