PUBLS. INST. GEOPHYS. POL. ACAD. SC., C-102 (409), 2009

Results of Geomagnetic Observations Belsk, Hel, Hornsund, 2008

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1. INTRODUCTION

This publication contains basic information on geomagnetic observations carried out in 2008 in three Polish geophysical observatories: Belsk (BEL), Hel (HLP), and Hornsund (HRN). All these observatories belong to the Institute of Geophysics, Polish Academy of Sciences. Observatories Belsk and Hel are located on the territory of Poland, while Hornsund is in Spitsbergen archipelago, governed by Norway.

In 2008, like in the previous years, the Belsk, Hel and Hornsund observatories have kept a close collaboration with the world network of geomagnetic observatories lNTERMAGNET. The Belsk Observatory joined INTERMAGNET in 1992, Hel in 1999, and Hornsund in 2002.

2. DESCRIPTION OF OBSERVATORIES

The location of observatories is shown in Fig. 1 and Table 1. The geomagnetic coordinates in Table 1 were calculated in relation to the geomagnetic pole located at 83.2°N, 118.3°W on the basis of model IGRF-10 from epoch 2005.

The methodology of geomagnetic observations in all the three observatories was very similar, based on the "Guide for Magnetic Measurements and Observatory Practice" (Jankowski and Sucksdorff 1996). The instruments were similar too. Absolute measurements were made with the use of DI-flux magnetometers and proton magnetometers. The magnetic field variations were measured with the use of PSM magnetometers equipped in Bobrov's quartz variometers. The spare sets are equipped in PSM magnetometers or LEMI flux-gate magnetometers.

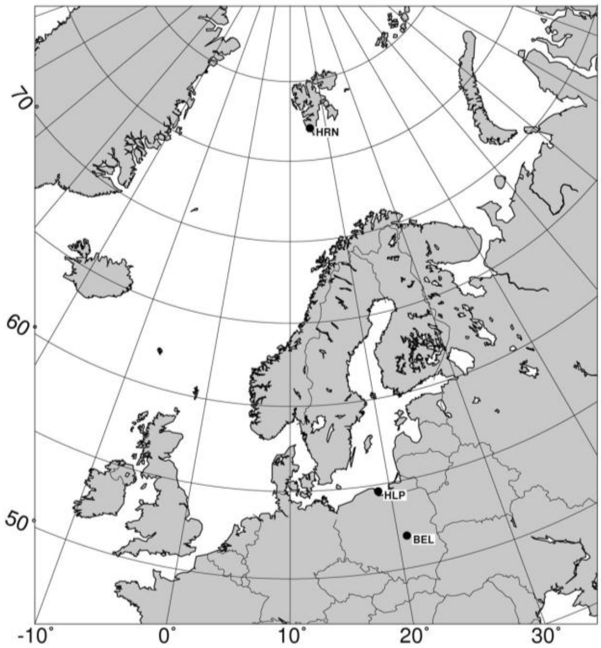

Fig. 1. Location of the Belsk, Hel and Hornsund observatories.

Table 1

Coordinates of the Polish observatories

Observatory	Geographic coordinates		Geomagnetic coordinates		Elevation
	Latitude	Longitude	Latitude	Longitude	[m]
Belsk (BEL)	51°50.2′ N	20°47.5′ E	50.2°N	105.2° E	180
Hel (HLP)	54°36.5′ N	18°49.0′ E	53.2°N	104.6° E	1
Hornsund (HRN)	77°0.0′ N	15°33.0′ E	73.9°N	126.0° E	15

Continuous recording has been made by means of microprocessor-based digital loggers DR-02 or DR-03. Owing to the recording system we use and the fact that we strictly obey the procedures relating to the so-called magnetic service, the gaps in one-minute data from Belsk and Hel are practically absent. Short gaps have only occurred in records of the Hornsund station, because the conditions prevailing there are much harder than in Poland.

It is worth mentioning that in 2008 the Belsk and Hornsund Observatories have been continuing the permanent observation of the Schumann resonance. Two horizontal magnetic components and the vertical component of the electric field have been recorded at a frequency of 100 Hz. This recording was initiated in both observatories in 2004 (Neska and Satori 2006).

2.1 Central Geophysical Observatory at Belsk, Central Poland

The Observatory at Belsk began continuous observations of the Earth magnetic field in 1965 (Jankowski and Marianiuk 2007). It continued the activity of the first Polish magnetic Observatory at Świder near Warsaw, working incessantly through the years 1920-1975. The magnetic observations were transferred from Świder to Belsk because of a strong increase of artificial noise from the Warsaw agglomeration, in particular due to the electric railroad passing nearby the Świder Observatory.

The Belsk Observatory is located at a distance of about 50 km south of Warsaw and about 2 km northwest of the village Belsk Duży. The premises of the Observatory, about 10 ha in area, is at the edge of the forest reserve Modrzewina, far away of people's settlements and automobile traffic. The location of the observatory in relation to the nearby towns and villages is shown in Fig. 2. The Observatory is surrounded by typically agricultural regions (with fertile soil, mostly apple orchards), so the direct neighborhood is deprived of sources of major artificial geomagnetic field disturbances. It is only the electric railroad (DC powered) situated some 14 km away of the Observatory to the north that produces some small artificial magnetic disturbances, whose average level usually does not exceed 1 nT.

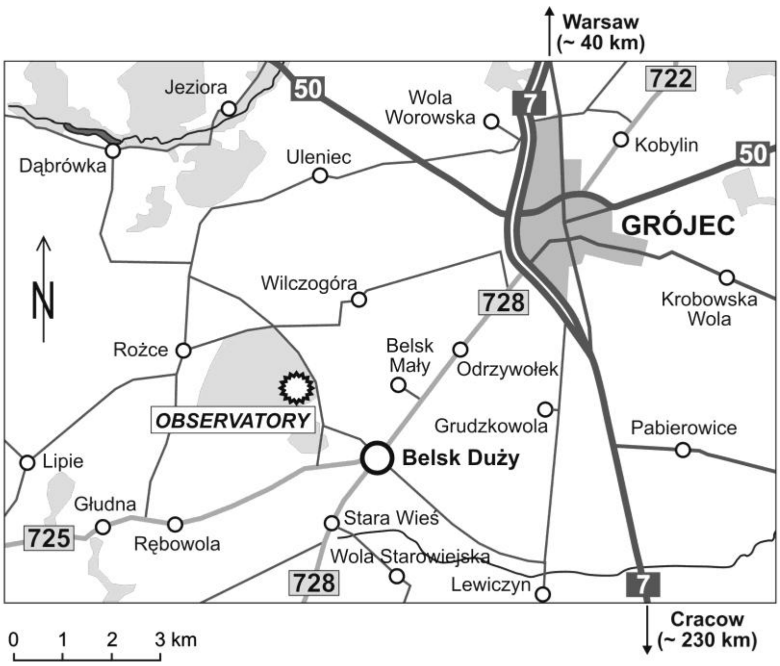

Fig. 2. Location of the Belsk Geophysical Observatory.

More information about the region in which the Observatory is located can be found, in English, Polish and German, on the internet pages of Grójec district (http://www.grojec.pl) to which the village Belsk Duży belongs. Relevant information can also be found at page of the Belsk Observatory (http://www.igf.edu.pl/pl/obserwatoria/cog_belsk).

2.2 Geophysical Observatory at Hel, Northern Poland

The Observatory at Hel began continuous observations of the earth magnetic field in 1932 (Jankowski and Marianiuk 2007). The observations were stopped in 1939, after the outbreak of World War II. During the war, the Observatory as well as its equipment and data were completely destroyed. After reconstruction, continuous observations at Hel were resumed in 1957.

The Hel Observatory is located in a small resort town at the end of Hel Peninsula by the Bay of Gdańsk (see Fig. 3). It is the area of Seaside Landscape Park (Nadmorski Park Krajobrazowy), weakly industrialized and urbanized. The region, surrounded by water from three sides, lacks any major artificial noise and is a good place for continuous magnetic observations.

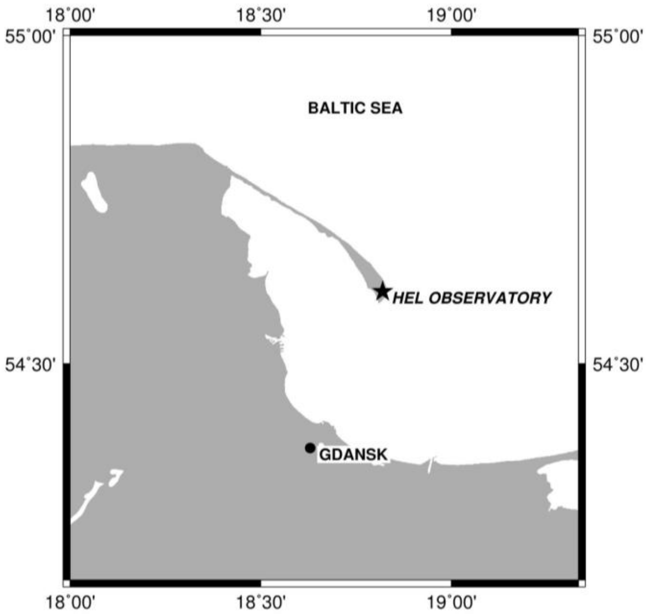

Fig. 3. Location of the Geophysical Observatory at Hel.

The observatory premises, about 4.5 ha in area, is surrounded by mixed forest (mainly pine and birch trees). Pavilions with measurement and recording instruments are located at small clearings.

More information about the town of Hel where the Observatory is located can be found at the address: http://www.hel-miasto.pl/.

2.3 Hornsund, Spitsbergen

The Polish Polar Station Hornsund (PSP Hornsund) is situated on the White Bear Bay (Isbjørnhamna) in Hornsund Fiord, Spitsbergen Island, Svalbard archipelago. (See Fig. 4). More information on the Svalbard Archipelago can be found at the address: http://svalbard.com.

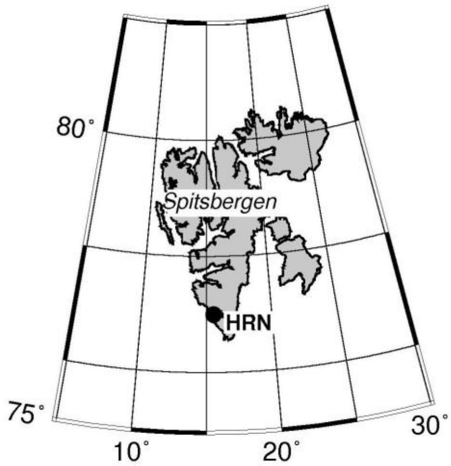

Fig. 4. Location of Polish Polar Station Hornsund.

The Hornsund station is the northernmost Polish scientific facility carrying out year-round activity. The Hornsund region is situated in a zone of strong magnetic field activity, much stronger than on the magnetic pole. Therefore, it is a very interesting place for magnetic observations.

Polish geomagnetic observations in the Arctic were initiated during the II Polar Year; a magnetic station was then established by S. Siedlecki and C. Centkiewicz on the Bear Island. In the years 1932/33, they had carried out continuous recording of magnetic field and performed absolute measurements. In the years 1957/58, in the framework of the International Geophysical Year, measurements of magnetic declination and inclination were made by J. Kowalczuk and K. Karaczun in five sites in the Hornsund Fiord region.

Since the beginning of October 1978, continuous magnetic field recording has been put into operation, and systematic absolute measurements have been implemented (Jankowski and Marianiuk 2007). Since then, PSP Hornsund has begun to fulfill all the requirements for geomagnetic observatory.

Since 1993, PSP Hornsund has been participating in the IMAGE (International Monitor for Auroral Geomagnetic Effects) project. In the framework of this project, Hornsund data are being sent to a server in Finland, once a month on the average. Since 2002, PSP Hornsund is included into the global near-real-time magnetic observatory network INTERMAGNET, sending the results, via Internet, to the GIN (Geomagnetic Information Nodes) centers in Edinburgh and Paris.

3. INSTRUMENTATION

3.1 Introduction

Simplified block diagrams of geomagnetic observations in Belsk, Hel, and Hornsund Observatories are shown in Figs. 5, 6, and 7.

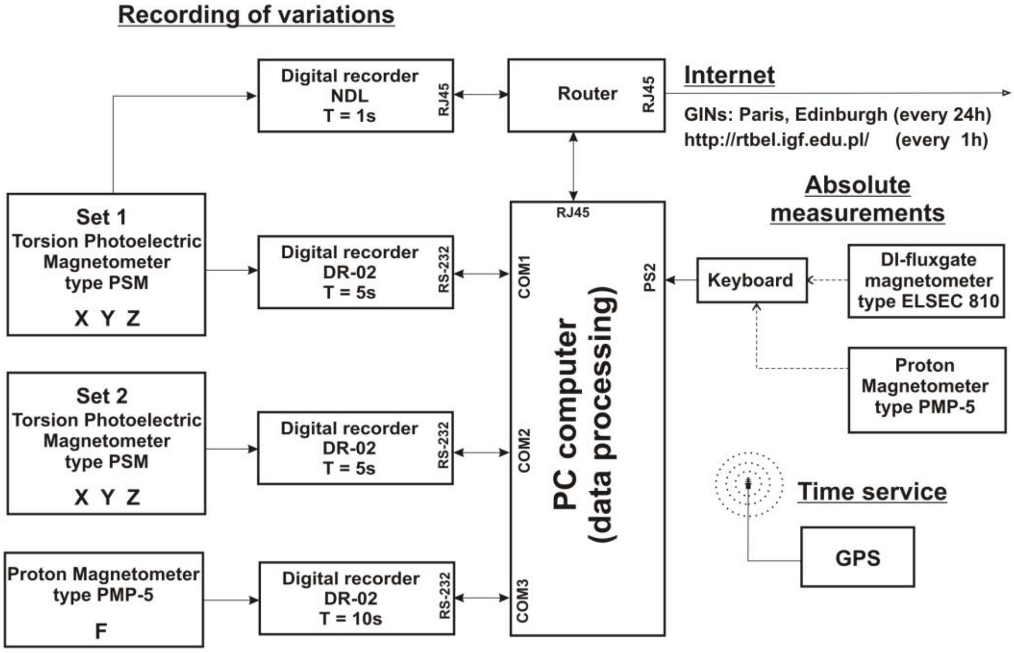

Fig. 5. Block diagram of magnetic observations system at Belsk

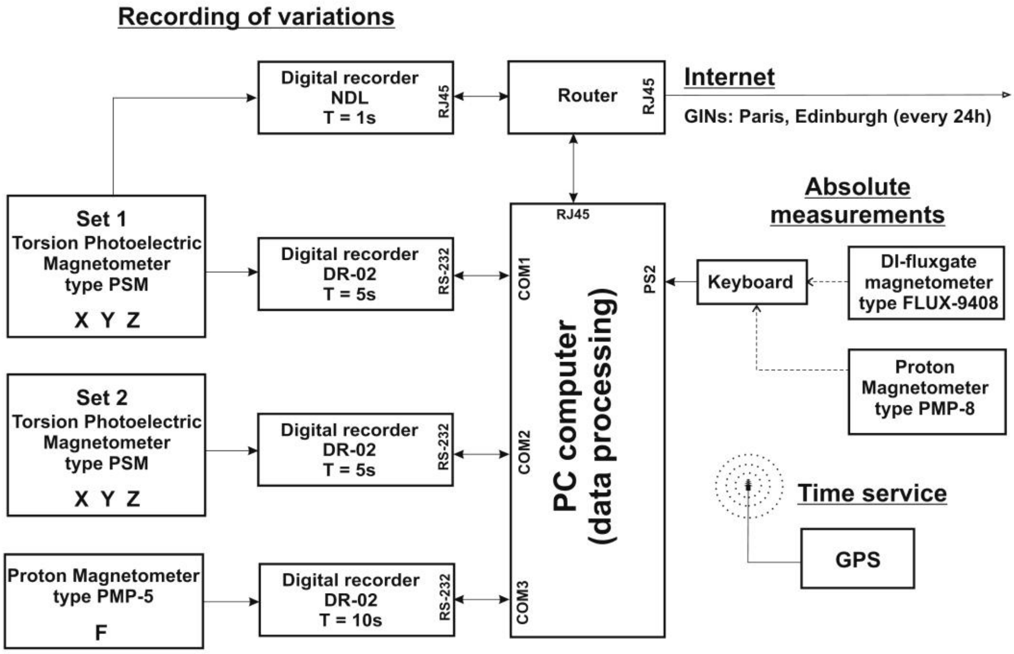

Fig. 6. Block diagram of magnetic observations system at Hel.

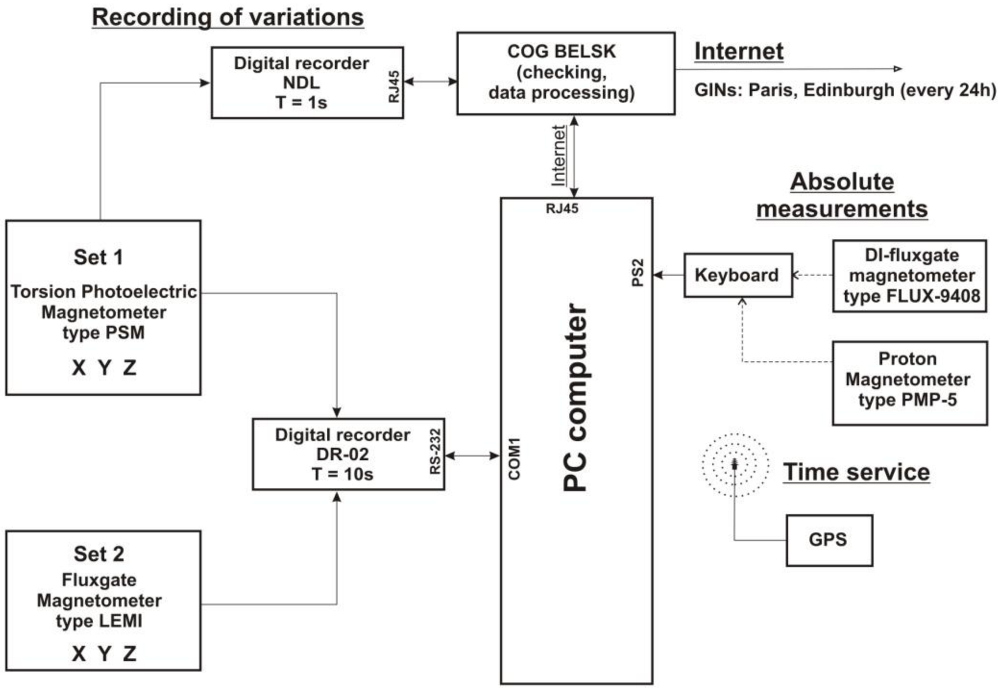

Fig. 7. Block diagram of the magnetic observations system at the Polish Polar Station Hornsund.

3.2 Absolute measurements

In all the three Polish observatories, the absolute measurements used for determination of bases of the recordings are performed by means of DI-flux and proton magnetometers. Di-flux magnetometers measure the absolute values of the angles of declination D and inclination I, while the proton magnetometers measure the absolute values of the total magnetic field vector F. From the measured values of F, D, and I, we can calculate all the remaining magnetic field components, H, X, Y, and Z.

The instruments for absolute measurements are listed in Table 2, and the basic parameters of the instruments in Table 3.

The results of absolute measurements are determined by means of a special computer package DIFLUX, which calculates the base values on the basis of data from the measurement protocol (Tomczyk 2008).

The bases B_A of digital recording of elements X, Y and Z were calculated from the formula:

$$B_A = A - \varepsilon_A \times (a - 32768) ,$$

where A is the result of absolute measurement [nT], ε_A is the scale value of the recording [nT/bit], a is the recorded instantaneous value [bits].

For the digital records with a resolution of 16 bits, the values of $2^{15} = 32768$ bits, corresponding to zero voltages on inputs of these loggers, were adopted as the base levels.

Table 2

Instruments for absolute measurements

	Belsk	Hel	Hornsund
DI-fluxgate (fluxgate, theodolite)	ELSEC 810, THEO-10B sn: 002208	FLUX-9408 THEO-10B sn: 160334	FLUX-9408 THEO-10B sn: 160326
Proton magnetometer	PMP-5 sn: 128 PMP-8 sn: 13/1998	PMP-8 sn: 21/2006	PMP-5 sn: 115
Frequency of measurements	6 per week	2 per week	2 per week

Table 3

Basic parameters of the instruments for absolute measurements

Fluxgate declinometer/inclinometer ELSEC 810 / THEO-10B
- Producer .... ELSEC Oxford, UK
- Mean square error of a horizontal direction .... $\sigma_D \approx \pm 5''$
- Mean square error of a zenith direction .... $\sigma_I \approx \pm 5''$

Fluxgate declinometer/inclinometer FLUX-9408 / THEO-10B
- Producer (FLUX-9408)...............Institute of Geophysics Pol. Acad. Sc.
- Mean square error of a horizontal direction .... $\sigma_D \approx \pm 5''$
- Mean square error of a zenith direction .... $\sigma_I \approx \pm 5''$

Proton magnetometer model PMP-8
- Producer .... Institute of Geophysics Pol. Acad. Sc.
- Resolution .... 0.01 nT
- Absolute accuracy .... 0.2 nT

Proton magnetometer model PMP-5
- Producer .... Institute of Geophysics Pol. Acad. Sc.
- Resolution .... 0.1 nT
- Absolute accuracy .... 0.2 nT

Results of base determinations and the smoothed values adopted for further computations are depicted in Figs. 8, 9, 17, 18 and 26 in the chapters describing individual observatories.

The mean random errors of a single base measurement, m_B, and the number of measurements n taken in 2008 are listed in Table 4.

Thermal coefficients of magnetic sensors are not taken into account in calculations, with a view to the following facts:

- tests made every few years indicated that the coefficients are very small, less than 0.2 nT/^{o}C,

- the magnetic sensors are located in thermostat-controlled wooden boxes where the daily temperature variations are of the order of 0.1-0.2^{o}C.

Table 4

Mean errors of measurements of B_X, B_Y and B_Z in 2008

Observatory	Element	Set I		Set II	
		Number of measurements [n]	Mean error [m_B] [nT]	Number of measurements [n]	Mean error [m_B] [nT]
Belsk	B_X	293	0.4	291	0.5
	B_Y	293	0.5	291	0.5
	B_Z	293	0.2	291	0.2
Hel	B_X	101	0.5	100	0.6
	B_Y	101	0.5	100	0.5
	B_Z	101	0.3	100	0.4
Hornsund	B_X	104	1.1	–	–
	B_Y	104	0.9	–	–
	B_Z	107	0.5	–	–

3.3 Recording of geomagnetic field variations

As we already mentioned, the continuous digital recordings of geomagnetic field variations in all the Polish observatories are performed by means of magnetometers PSM and digital loggers DR-02 (or DR-03). In spare sets, we use magnetometers PSM or LEMI. Both the main and spare sets record the components in the rectangular coordinate system X, Y, Z. At Belsk and Hel, continuous recording of the total magnetic field modulus F is performed as well. The basic parameters of the recording systems are listed in Table 5.

Magnetometers PSM

Magnetometers PSM were designed at the Institute of Geophysics PAS with the use of torsion quartz variometers of V.N. Bobrov system (Marianiuk 1977, Jankowski *et al*. 1984). In these magnetometers, the magnet‘s deflections in response to the magnetic field changes are transformed by means of photoelectric converters into the electric current changes. Owing to a strong negative feedback, the voltage changes on the output of the converter are in linear proportion to the magnetic field changes. The magnetometers PSM are characterized by good stability, of about 3-5 nT/year, and small noise, below 10 pT.

Table 5

Basic instruments for the magnetic field variations recording

		Belsk	Hel	Hornsund
SET 1	Name of magnetometer Kind of sensor	PSM Bobrov	PSM Bobrov	PSM Bobrov
	Type	PSM-8511-01P	PSM 8511-09P	PSM-8911-05P
	Sensor's orientation	XYZ	XYZ	XYZ
	Range	+/– 850 nT	+/– 850 nT	+/– 5000 nT
	Magnetometer's producer	Institute of Geophysics PAS	Institute of Geophysics PAS	Institute of Geophysics PAS
	Digital recorder Producer	DR-02, DR-03 EL-LAB	DR-03 EL-LAB	DR-02 EL-LAB
	Sampling interval	5 s and 1 s	5 s	10 s
SET 2	Name of magnetometer Kind of sensor	PSM Bobrov	PSM Bobrov	LEMI fluxgate
	Type	PSM-8511-01P	PSM 8511-03P	LEMI-003/95
	Sensor's orientation	XYZ	XYZ	XYZ
	Range	+/– 820 nT	+/– 820 nT	+/– 10.000 nT
	Magnetometer's producer	Institute of Geophysics PAS	Institute of Geophysics PAS	Institute of Geophysics PAS
	Digital recorder Producer	DR-02, DR-03 EL-LAB	DR-02 EL-LAB	DR-02 EL-LAB
	Sampling interval	5 s and 1 s	5 s	10 s
Total field	Name of magnetometer	PMP-5	PMP-5	–
	Producer	Institute of Geophysics PAS	Institute of Geophysics PAS	–
	Sampling interval	10 s	10 s	–

Magnetometers LEMI

Magnetometers LEMI were designed at the Lviv Centre of the Institute of Space Research (Ukraine). They employ flux-gate sensors. These magnetometers have been successfully used as auxiliary sets. Their stability is not much less than that of PSM's, and they are also characterized by good orthogonality of sensors and relatively small self noise.

Proton magnetometers PMP-5 and PMP-8

Magnetometers PMP-5 and PMP-8 were designed at the Institute of Geophysics PAS. These are classical proton magnetometers, in which the precession signal is forced in a cycle of proton polarization by means of direct current. The resolution of magnetometers PMP-5 is 0.1nT, that of PMP-8 being 0.01nT. The stability of both magnetometers is better than 0.3 nT/year. More information about PMP-8 magnetometer can be found on the page:

http://www.igf.edu.pl/pl/zaklady_naukowe/konstrukcji_aparatury/aparatura

Digital loggers DR-02 and DR-03

The digital loggers were designed in the early 1990s by the enterprise EL-LAB (Poland) especially for recording the long-term slow-changing variations. These are independent instruments and their cooperation with the computer resolves itself to the read-out of data via the RS-232 interface. Model DR-03 is equipped in clock synchronized by a GPS.

3.4 Calibration of magnetic sensors

The verification of scale values of recording systems in all the three observatories was made by the classical electromagnetic method: electric currents were passed through calibration coils woven over variometers. The currents induce the magnetic field of precisely known intensity. The measurements are made at least few times a year.

Table 6

Scale values adopted for computations in 2008

Observatory	Set	Period	Scale values		
			X [nT/bit]	Y [nT/bit]	Z [nT/bit]
Belsk	Set I	Jan 01-Dec 31	0.0250	0.0249	0.0249
	Set II	Jan 01-Dec 31	0.0249	0.0249	0.0249
Hel	Set I	Jan 01-Feb 27	0.0249	0.0249	0.0249
		Feb 28-Oct 23	0.0254	0.0251	0.0244
		Oct 24-Dec 31	0.0247	0.0247	0.0245
	Set II	Jan 01-Feb 27	0.0250	0.0250	0.0251
		Feb 28-Dec 31	0.0249	0.0250	0.0250
Hornsund	Set I	Jan 01-Dec 31	0.149	0.151	0.149
	Set II	Jan 01-Dec 31	0.307	0.308	0.307

The scale values of magnetometers PSM and LEMI, parameters of calibration coils of PSMs, and mutual orthogonality of sensors in PSMs and LEMIs is checked every few years in large calibration coils installed at the Belsk Observatory.

3.5 Data treatment

In processing the results of digital recordings we used the software packet developed for the needs of an observatory operating in the INTERMAGNET network. This software makes it possible to perform, among other things, the following operations:

- conversion of magnetic data into the INTERMAGNET text format IMFV1.22 and creation in this format of daily files containing one-minute means of X, Y, Z and F (authors: J. Reda and A. Pałka),
- automatic transmission of data, via the Internet, to the Institute of Geophysics PAS in Warsaw and data centers in Paris and Edinburgh (author: M. Neska),
- archivation of data and plotting of magnetograms (author: J. Reda),
- calculation of results of absolute measurements (author: S. Tomczyk),
- automatic calculation of geomagnetic indices K (Nowożyński *et al.* 1991). The indices are calculated with the use of ASm (Adaptive Smoothed) method, developed at the Institute of Geophysics PAS, and recommended by IAGA in 1991. The currently used program calculates the indices from one-minute means in the INTERMAGNET CD-ROM Data Format or in the IMFV1.22 format. The program for calculation of indices may be taken from the INTERMAGNET page: http://www.intermagnet.org/Software_e.html
- test printouts to check various parameters of recording adopted for calculation and a possibility of looking over current and past data curves or tables.

The diagrams illustrating the annual variations of X, Y, and Z, monthly variations of X, Y, Z and F, bases of recording sets as well as plots of K indices for 2008 were prepared with the use of program imagplot.exe provided to us by INTERMAGNET. The diagrams prepared by means of imagplot.exe and other diagrams related to 2008 data are shown in Figs. 8–32.

In the present yearbook, we include for the first time the E indices calculated for Belsk observatory. The E indices, unlike the K indices, are calculated on the basis of energy analysis. They have been described in detail by Reda and Jankowski (2004).

3.6 Data availability

The newest data from Belsk, Hel and Hornsund observatories can be viewed in graphic form through the WEB application

http://rtbel.igf.edu.pl

described by Nowożyński and Reda (2007).

On this page, the Belsk and Hel data appear with one-hour delay, while the delay for Hornsund is few hours. The page makes it possible to view the archival data from any observatory belonging to the INTERMAGNET network (in the form of curves on the screen). It offers also a possiblity of calculating the K indices according to the ASm method (Nowożyński *et al*. 1991) and E indices (Reda and Jankowski 2004).

The current data (of status REPORTED) from all the three observatories can be found in INTERMAGNET at the Internet address:

http://www.intermagnet.org/apps/dl_data_prel_e.php

Data from Belsk, Hel and Hornsund are also available from the WDCs. Addresses of some WDC pages with magnetic data are the following:

WDC for Geomagnetism, Edinburgh http://www.wdc.bgs.ac.uk/catalog/master.html

WDC for Geomagnetism, Kyoto http://swdc234.kugi.kyoto-u.ac.jp/

All the three observatories have in their archives the original data, whose sampling periods are listed in Table 5. For those interested, these data can be made available on request.

4. CONTACT PERSON, POSTAL ADDRESS, CONTACT DETAILS

4.1 Belsk Observatory

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4.2 Hel Observatory

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4.3 Hornsund

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http://hornsund.igf.edu.pl, http://www.igf.edu.pl

5. PERSONNEL TAKING PART IN THE WORK OF BELSK, HEL AND HORNSUND OBSERVATORIES IN 2008

5.1 Belsk

– Jan Reda (head of Geomagnetic Laboratory at Belsk to June 2008)
– Mariusz Neska (head of Geomagnetic Laboratory at Belsk since July 2008)
– Janusz Marianiuk (consulting)
– Halina Suska (data processing, observer)
– Krzysztof Kucharski (observer)
– Paweł Czubak (data processing, since October 2008)
– Józef Skowroński (observer)

5.2 Hel

– Stanisław Wójcik (head of Geophysical Observatory)
– Anna Wójcik (observer)
– Mariusz Neska (data processing)
– Jan Reda (data processing)

5.3 Hornsund

– Mariusz Neska (head of geomagnetic observations)
– Paweł Czubak (observer in 1-st half-year)
– Piotr Łepkowski (observer in 2-nd half-year)
– Jan Reda (data processing)

References

Jankowski, J., and C. Sucksdorff (1996), *Guide for Magnetic Measurements and Observatory Practice*, IAGA, Warsaw, 235 pp.

Jankowski, J., J. Marianiuk, A. Ruta, C. Sucksdorff, and M. Kivinen (1984), Long-term stability of a torque-balance variometer with photoelectric converters in observatory practice, *Geophys. Surv*. **6**, 3/4, 367-380.

Jankowski, J., and J. Marianiuk (2007), Past and present of Polish geomagnetic observatories, *Publs. Inst. Geophys. Pol. Acad. Sc.* **C-99 (398)**, 20-31.

Marianiuk, J. (1977), Photoelectric converter for recording the geomagnetic field elements: construction and principle of operation, *Publs. Inst. Geophys. Pol. Acad. Sc*. **C-4 (114)**, 57-73.

Neska, M., and G. Satori (2006), Schumann resonance observation at Polish Polar Station at Spitsbergen and in Central Geophysical Observatory in Belsk, Poland, *Przegl. Geofiz.* **3-4**, 189-198, (in Polish).

Nowożyński, K., T. Ernst, and J. Jankowski (1991), Adaptive smoothing method for computer derivation of K-indices, *Geophys. J. Int*. **104**, 85-93.

Nowożyński, K., and J. Reda (2007), Comparison of observatory data in quasi-real time, *Publs. Inst. Geophys. Pol. Acad. Sc*. **C-99 (398)**, 123-127.

Reda, J., and M. Neska (2007), Measurement Session during the XII IAGA Workshop at Belsk, *Publs. Inst. Geophys. Pol. Acad. Sc*. **C-99 (398)**, 7-19.

Reda, J., and J. Jankowski (2004), Three hour activity index based on power spectra estimation, *Geophys. J. Int*. **157**, 141-146.

Reda, J. (editor) (2007), XII IAGA Workshop on Geomagnetic Observatory Instruments, Data Acquisition and Processing, Belsk, 19-24 June 2006, Monographic Volume, *Publs. Inst. Geophys. Pol. Acad. Sc.* **C-99 (398)**, 397 pp.

Tomczyk, S. (2008), DIFLUX software package for calculation of absolute measurement results, *Publs. Inst. Geophys. Pol. Acad. Sc*. **C-100 (402)**, 61-67.

Technical data of PMP-8:

http://www.igf.edu.pl/pl/zaklady_naukowe/konstrukcji_aparatury/aparatura

Received March 23, 2009
Accepted April 27, 2009

Tables and plots for Belsk Observatory

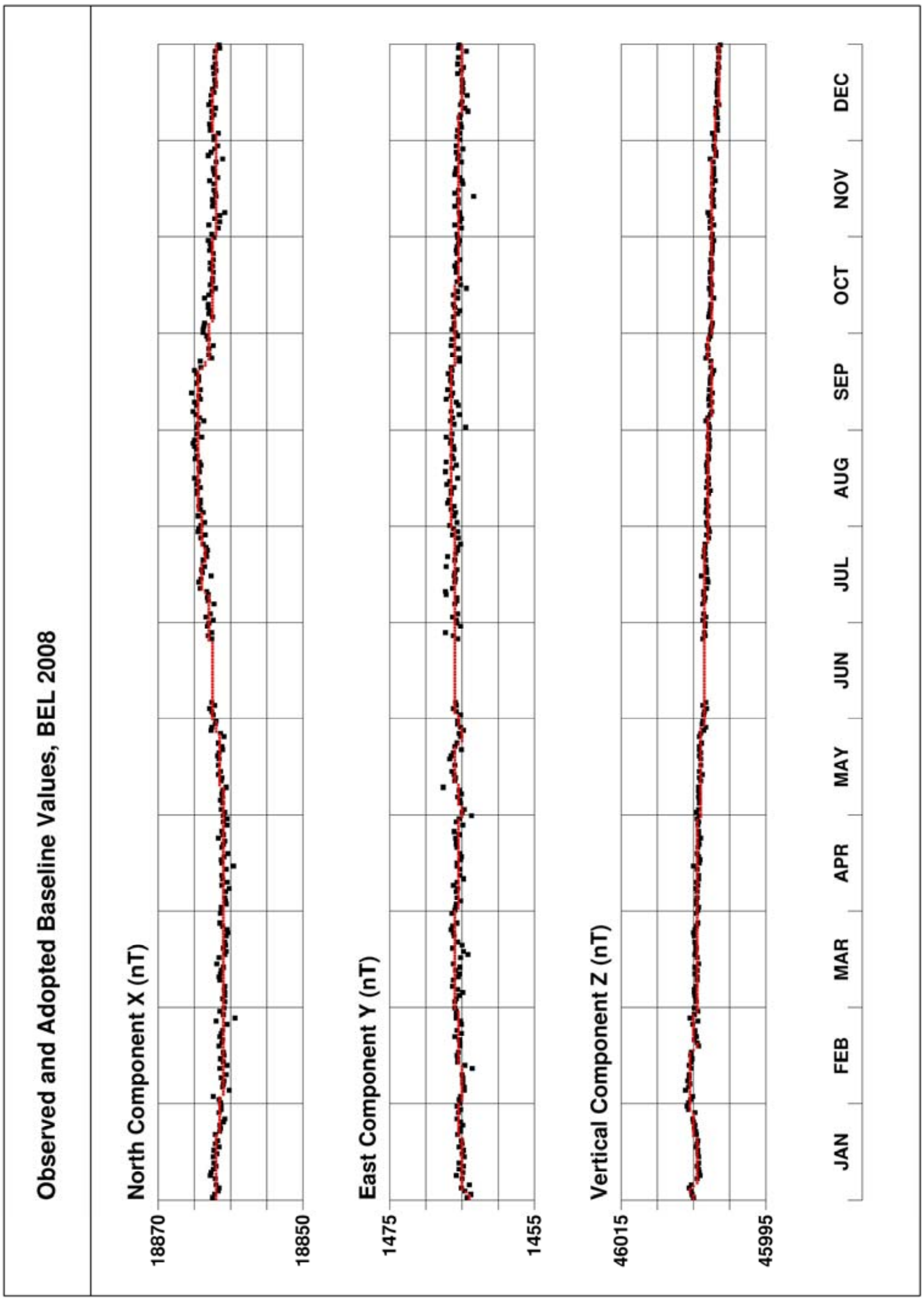

Fig. 8. Base values of set 1, Belsk 2008.

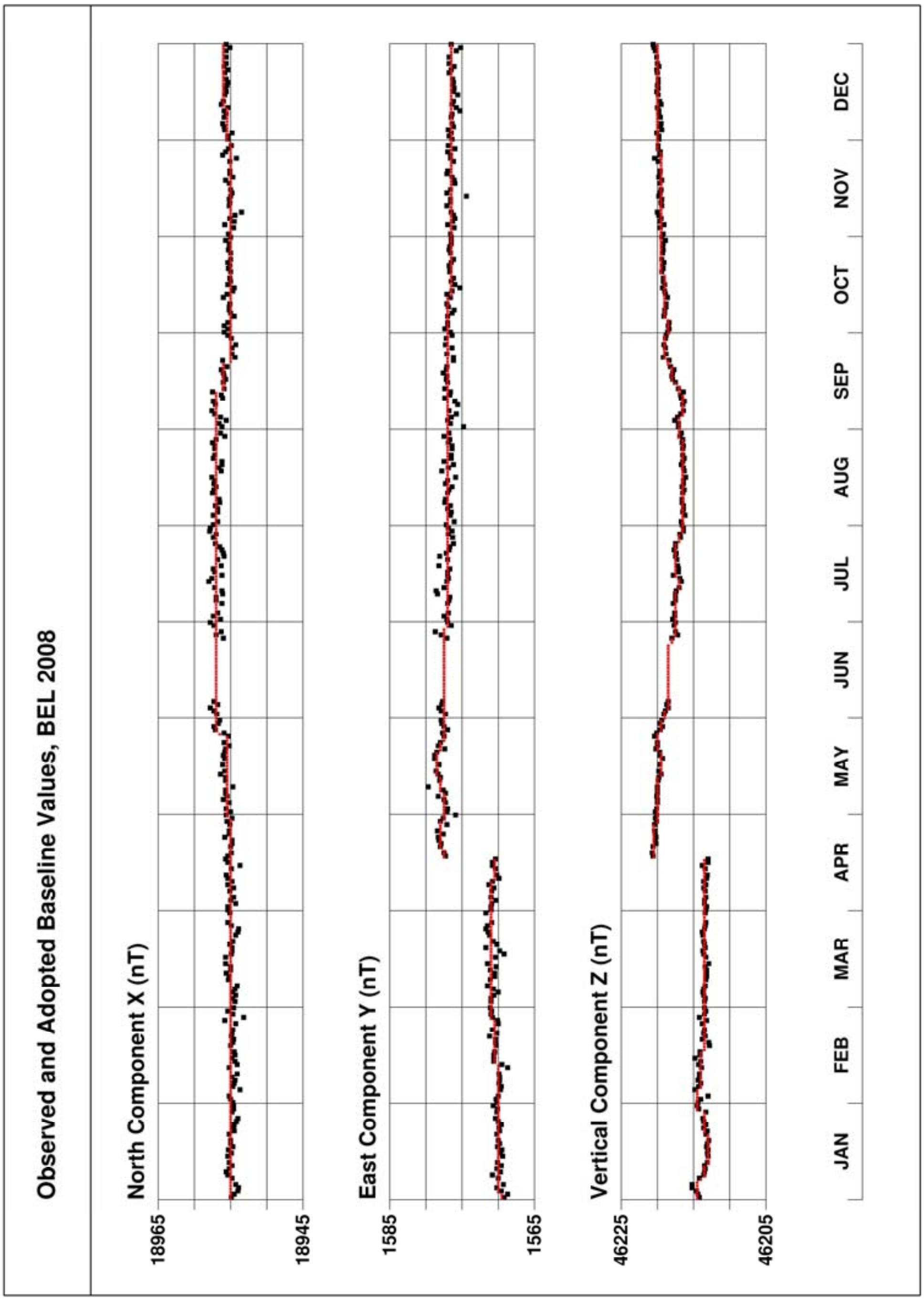

Fig. 9. Base values of set 2, Belsk 2008.

Annual mean values of magnetic elements in Belsk Observatory

No	Year	D [º ‘]	H [nT]	Z [nT]	X [nT]	Y [nT]	I [º ‘]	F [nT]
1	1966	2 04.2	18901.2	45023.3	18888.9	682.8	67 13.6’	48829.8
2	1967	2 05.6	18906.2	45047.7	18893.6	690.7	67 14.0	48854.3
3	1968	2 06.2	18917.8	45071.3	18905.5	694.6	67 13.8	48880.5
4	1969	2 06.3	18935.7	45093.5	18922.9	695.6	6713.3	48907.9
5	1970	2 06.6	18953.0	45123.1	18940.2	697.7	67 13.0	48941.9
6	1971	2 06.6	18975.5	45146.4	18962.6	698.8	67 12.2	48972.1
7	1972	2 08.0	18991.6	45176.3	18978.4	706.7	67 11.9	49005.9
8	1973	2 10.2	19004.6	45210.8	18991.0	719.4	67 12.0	49042.8
9	1974	2 13.3	19016.3	45245.6	19002.0	737.1	67 12.2	49079.3
10	1975	2 16.4	19035.2	45273.5	19020.2	754.9	67 11.7	49112.4
11	1976	2 18.5	19049.7	45306.9	19034.3	767.3	67 11.7	49148.8
12	1977	2 22.0	19062.1	45336.6	19045.8	787.4	67 11.7	49181.0
13	1978	2 27.4	19058.6	45375.7	19041.1	817.1	67 13.0	49215.7
14	1979	2 32.3	19061.4	45401.4	19042.7	844.2	67 13.5	49240.5
15	1980	2 37.2	19063.2	45418.4	19043.3	871.2	67 13.9	49256.8
16	1981	2 42.9	19047.1	45448.9	19025.7	902.0	67 15.7	49278.7
17	1982	2 48.3	19034.8	45478.8	19012.0	931.3	67 17.3	49301.6
18	1983	2 52.4	19032.6	45498.8	19008.7	953.8	67 18.0	49319.2
19	1984	2 56.9	19022.8	45519.8	18997.6	978.4	67 19.2	49334.8
20	1985	3 00.8	19015.2	45542.0	18988.9	999.5	67 20.3	49352.3
21	1986	3 05.1	19003.3	45570.4	18975.8	1022.8	67 21.8	49373.9
22	1987	3 08.5	18999.1	45592.7	18970.6	1041.2	67 22.7	49392.9
23	1988	3 12.4	18983.0	45626.4	18953.3	1062.0	67 24.6	49417.8
24	1989	3 15.9	18966.2	45662.1	18935.4	1080.3	67 26.6	49444.3
25	1990	3 18.8	18961.5	45684.3	18929.8	1095.9	67 27.5	49463.1
26	1991	3 22.2	18950.8	45709.3	18918.0	1114.1	67 28.8	49482.0
27	1992	3 25.3	18954.8	45726.1	18921.0	1131.2	67 29.1	49499.1
28	1993	3 29.8	18956.4	45743.7	18921.1	1156.0	67 29.4	49516.0
29	1994	3 34.8	18953.6	45772.4	18916.6	1183.3	67 30.4	49541.4
30	1995	3 39.8	18959.3	45796.8	18920.6	1211.5	67 30.7	49566.2
31	1996	3 45.0	18965.7	45821.9	18925.1	1240.6	67 30.9	49591.8
32	1997	3 50.9	18962.8	45856.9	18920.0	1272.7	67 32.0	49623.0
33	1998	3 57.3	18955.8	45897.1	18910.6	1307.6	67 33.6	49657.5
34	1999	4 02.5	18957.8	45930.6	18910.6	1336.4	67 34.3	49689.2
35	2000	4 07.8	18955.4	45968.7	18906.2	1365.4	67 35.5	49723.5
36	2001	4 13.0	18962.4	46004.8	18911.1	1394.2	67 36.0	49759.6
37	2002	4 18.4	18969.2	46043.6	18915.6	1424.4	67 36.6	49798.0
38	2003	4 24.2	18970.2	46089.6	18914.2	1456.7	67 37.7	49840.9
39	2004	4 29.4	18980.3	46121.0	18922.0	1486.0	67 37.9	49873.8
40	2005	4 34.7	18984.3	46154.6	18923.7	1515.5	67 38.5	49906.4
41	2006	4 39.8	18996.7	46177.2	18933.8	1544.3	67 38.3	49932.0
42	2007	4 45.8	19007.4	46206.7	18941.8	1578.4	67 38.4	49963.4
43	2008	4 52.5	19014.0	46236.3	18945.2	1615.9	67 38.7	49993.3

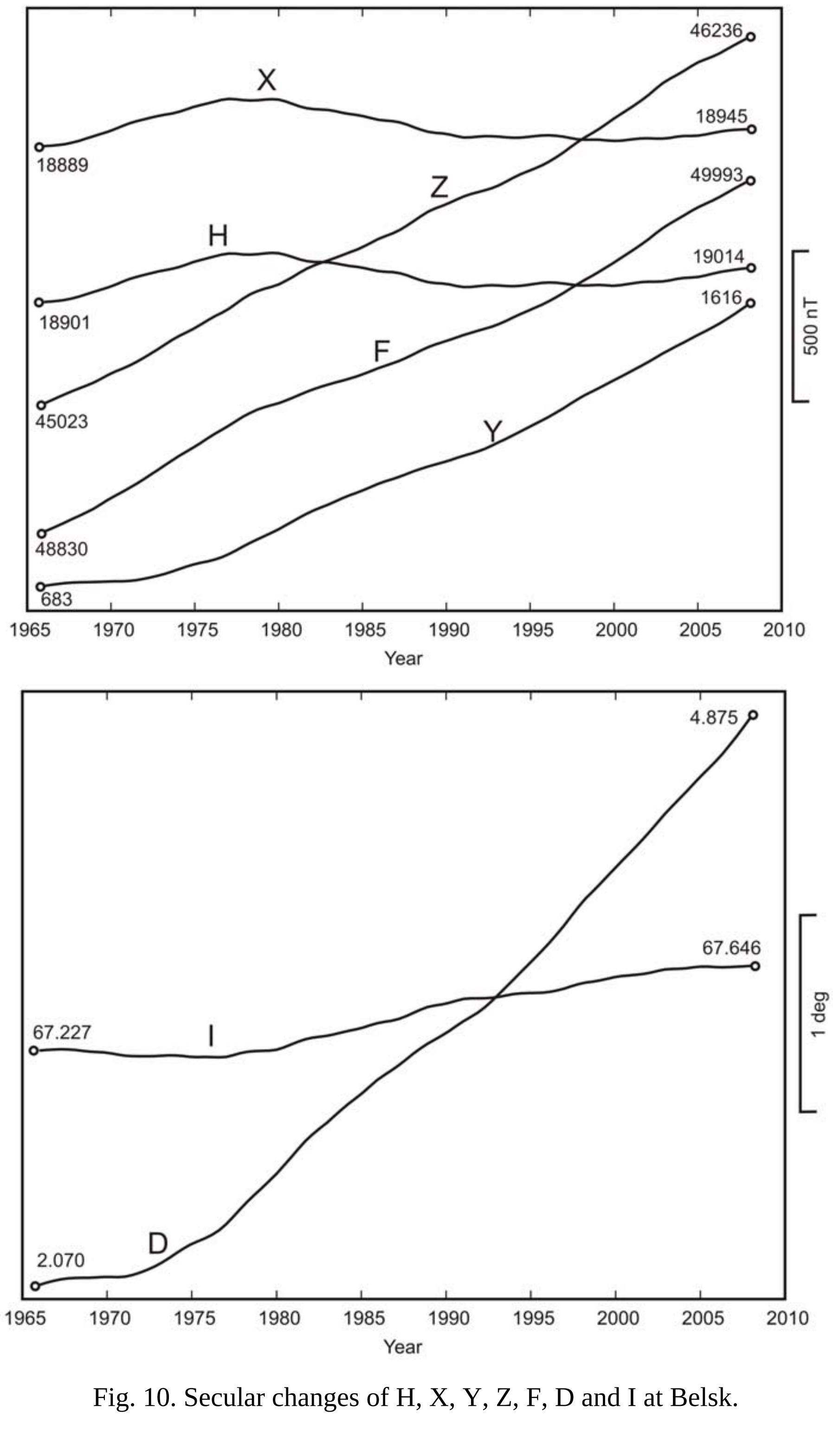

Fig. 10. Secular changes of H, X, Y, Z, F, D and I at Belsk.

MONTHLY AND YEARLY MEAN VALUES OF MAGNETIC ELEMENTS

BELSK **2008**

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
NORTH COMPONENT: 18500 + ... in nT													
All days	443	440	438	442	450	450	450	448	446	443	446	447	445
Quiet days	450	447	445	444	454	452	451	450	447	448	448	450	449
Disturbed days	437	435	429	436	447	451	446	445	441	437	441	442	441
EAST COMPONENT: 1500 + ... in nT													
All days	98	103	106	108	110	114	117	120	123	127	130	133	116
Quiet days	96	101	104	107	110	114	116	119	123	126	129	131	115
Disturbed days	100	108	111	110	111	113	118	122	124	129	131	135	118
VERTICAL COMPONENT: 46000 + ... in nT													
All days	223	228	231	231	231	234	237	238	241	246	247	250	236
Quiet days	221	227	229	230	229	233	236	238	241	245	246	249	235
Disturbed days	223	228	231	233	232	233	238	239	241	247	247	250	237

Three-hour-range K indices

Belsk, January - March, 2008

The limit of K=9 is 450

Day	January K	January SK	February K	February SK	March K	March SK
1	2201 1011	8	3232 2455	26	5333 4443	29
2	0111 1120	7	4422 3343	25	2232 2333	20
3	0101 1012	6	3223 2453	24	1223 1221	14
4	0000 1112	5	3212 1234	18	2011 1101	7
5	2234 4354	27	1211 1210	9	2222 3331	18
6	3332 3454	27	0111 1232	11	1111 0112	8
7	3333 3223	22	3200 1223	13	2110 1122	10
8	2223 2443	22	4111 1232	15	0012 4331	14
9	3222 1122	15	1011 2123	11	3533 3434	28
10	2111 2212	12	0223 4545	25	3323 3444	26
11	2111 1120	9	3323 4433	25	2232 4432	22
12	0012 3422	14	3222 3333	21	3332 3243	23
13	3111 2342	17	2232 4432	22	2223 4223	20
14	3224 3453	26	2122 3143	18	3322 2434	23
15	2222 3222	17	2223 3332	20	4223 2222	19
16	2233 3333	22	3222 2230	16	2211 2323	16
17	3212 4234	21	0122 2113	12	2211 1321	13
18	3322 2332	20	1112 5434	21	3312 2211	15
19	1223 3522	20	3232 3332	21	0121 3333	16
20	1221 2132	14	1321 1201	11	2112 3333	18
21	1112 2233	15	1112 3331	15	2112 0232	13
22	1111 1110	7	1111 2111	9	2010 2123	11
23	0012 2133	12	1111 1232	12	3332 2222	19
24	1111 2232	13	1011 1222	10	1111 1111	8
25	3322 1142	18	2111 1110	8	1011 2223	12
26	3222 1213	16	0111 1122	9	1233 4454	26
27	1101 1232	11	1111 2352	16	4533 3555	33
28	1101 1123	10	3323 2555	28	4343 4443	29
29	1222 1100	9	5233 3655	32	2212 2334	19
30	1111 1000	5			3222 2223	18
31	0011 2333	13			2101 2121	10

Three-hour-range K indices

Belsk, April - June, 2008

The limit of K=9 is 450

Day	April K	April SK	May K	May SK	June K	June SK
1	1212 1110	9	1211 1334	16	2212 2421	16
2	0101 0011	4	5321 3111	17	2211 3221	14
3	2101 1201	8	3233 4233	23	0102 2322	12
4	0011 2444	16	1223 2333	19	2111 2101	9
5	2223 2534	23	2231 3442	21	1102 1210	8
6	3343 3234	25	3222 2122	16	1223 2232	17
7	3322 1443	22	2111 2222	13	2233 3233	21
8	2213 4233	20	2112 2221	13	3212 4312	18
9	3233 3233	22	1111 2112	10	2111 1021	9
10	3222 3233	20	1211 1122	11	1101 2210	8
11	3112 2211	13	2112 2121	12	1122 1011	9
12	3223 3243	22	0111 1221	9	1221 1212	12
13	2112 3421	16	2211 1220	11	1100 1120	6
14	1100 0110	4	0112 2121	10	1111 2445	19
15	0111 3223	13	0111 1121	8	4423 3324	25
16	2223 4353	24	1212 2221	13	2223 3344	23
17	3211 2321	15	1001 1101	5	2223 3322	19
18	2222 2222	16	0112 3111	10	3322 2211	16
19	2211 1223	14	2223 3331	19	1113 3222	15
20	2111 1221	11	2222 2333	19	2333 2222	19
21	1111 1211	9	3332 3322	21	1111 2212	11
22	0111 1323	12	3221 3432	20	2112 2111	11
23	3443 3434	28	2102 3233	16	2111 1110	8
24	3334 3223	23	4222 2322	19	1001 1233	11
25	2222 3232	18	2211 2212	13	3221 2333	19
26	3122 2433	20	1212 0111	9	3333 4322	23
27	2222 2322	17	1011 2222	11	3213 3321	18
28	1123 4444	23	3232 4423	23	1212 2222	14
29	3221 1121	13	2222 3432	20	2213 2223	17
30	0111 1452	15	3222 3442	22	1212 2221	13
31			1223 3332	19		

Three-hour-range K indices

Belsk, July - September, 2008

The limit of K=9 is 450

Day	July K	July SK	August K	August SK	September K	September SK
1	2112 2111	11	1110 1222	10	1111 1111	8
2	2111 1010	7	0111 1111	7	1111 1111	8
3	1101 2211	9	1111 1222	11	1223 1334	19
4	0111 2321	11	1111 2111	9	5633 3433	30
5	2112 3333	18	1011 1110	6	2212 2123	15
6	2111 1111	9	1112 2222	13	3222 3233	20
7	1121 1102	9	1101 1222	10	3221 3241	18
8	0011 1111	6	1001 1212	8	1232 2343	20
9	0111 1111	7	3333 3445	28	1221 1113	12
10	0112 2222	12	3332 2332	21	1111 1231	11
11	2122 3223	17	2222 3212	16	0010 1112	6
12	3433 4232	24	1221 2322	15	1111 1010	6
13	2233 3432	22	2111 1211	10	0000 0001	1
14	2223 3423	21	2211 2210	11	0011 1144	12
15	3222 2222	17	2111 0110	7	3233 4433	25
16	2111 1222	12	1111 1223	12	1223 1432	18
17	2211 1220	11	3212 2212	15	3101 0011	7
18	1111 2111	9	2323 5343	25	2223 2211	15
19	1001 1101	5	3222 3331	19	0111 2231	11
20	1111 1121	9	2212 2110	11	1110 1100	5
21	1221 2222	14	1011 1121	8	1000 1112	6
22	1123 4333	20	1111 1111	8	3200 0101	7
23	3323 4333	24	1100 1111	6	2011 1111	8
24	3222 2222	17	0001 1012	5	1112 1100	7
25	1202 1101	8	1010 1001	4	1001 0133	9
26	2212 2221	14	1111 1111	8	2101 1100	6
27	0112 2124	13	2111 2011	9	0011 1232	10
28	2221 1211	12	1101 1222	10	0012 2110	7
29	0111 1212	9	1110 1211	8	0111 1111	7
30	1212 1222	13	0111 0100	4	0111 2223	12
31	1111 2211	10	0022 2232	13		

Three-hour-range K indices

Belsk, October - December, 2008

The limit of K=9 is 450

Day	October K	October SK	November K	November SK	December K	December SK
1	2222 2233	18	1111 0121	8	0000 0000	0
2	3323 4343	25	0011 1012	6	0000 1000	1
3	3232 3333	22	0101 0111	5	0111 1222	10
4	2323 2213	18	1010 0001	3	2322 3312	18
5	2211 1112	11	0000 0000	0	2212 2525	21
6	1211 0101	7	0000 1010	2	3422 2432	22
7	0001 1120	5	0222 3235	19	2222 3322	18
8	1100 0001	3	3223 3232	20	1110 1231	10
9	0010 1000	2	4222 2233	20	0000 0100	1
10	0111 1103	8	1111 1210	8	0001 1222	8
11	2143 5753	30	0111 0100	4	2211 1221	12
12	4323 2324	23	1011 1111	7	1011 1112	8
13	3222 1232	17	1001 1000	3	2111 0011	7
14	1111 1221	10	0001 0111	4	1000 0000	1
15	3222 1122	15	2110 0123	10	0111 0112	7
16	1111 0111	7	3322 2133	19	1111 2133	13
17	0000 1100	2	2120 0011	7	3211 1221	13
18	0000 0011	2	1000 0110	3	0000 1121	5
19	1112 2333	16	0001 0110	3	1101 2212	10
20	1010 1122	8	0100 0022	5	1001 1110	5
21	2211 1112	11	1001 0010	3	0111 0100	4
22	0011 1233	11	0001 0011	3	0000 1432	10
23	2111 1111	9	2110 0010	5	2222 2344	21
24	0110 0000	2	0000 0013	4	2122 1332	16
25	0001 1111	5	3333 3232	22	1001 2131	9
26	0211 1201	8	3322 2233	20	1100 1122	8
27	1011 0000	3	2222 2233	18	2001 1011	6
28	0122 1222	12	1211 1123	12	2011 1111	8
29	2342 2444	25	1111 0122	9	1001 0101	4
30	3223 2543	24	1011 0210	6	0000 0011	2
31	2222 1233	17			3323 2232	20

Three-hour-range E indices

based on power spectrum estimation(*)

Belsk, January - March, 2008

Day	January K	January SE	February K	February SE	March K	March SE
1	2201 1001	7	3232 1465	26	6433 5543	33
2	0011 0120	5	4422 4354	28	2233 2334	22
3	0000 0011	2	3224 3554	28	1222 1221	13
4	0000 0012	3	3212 1223	16	2011 1000	5
5	2344 4455	31	1100 0210	5	2212 4341	19
6	4433 4554	32	0001 1242	10	1101 0112	7
7	4332 3123	21	3200 0312	11	1110 0012	6
8	2223 2544	24	4111 1122	13	0002 5341	15
9	4222 1122	16	1001 2123	10	4634 4435	33
10	2101 2212	11	0224 5655	29	4323 3455	29
11	3111 0020	8	3424 4443	28	3142 5532	25
12	0011 2433	14	3323 4443	26	3342 4153	25
13	3111 3452	20	2242 5431	23	2223 4233	21
14	4225 3564	31	2112 4153	19	2322 3544	25
15	2222 3233	19	2223 4442	23	4123 3223	20
16	2333 3433	24	2322 3140	17	2211 2213	14
17	3212 4234	21	0112 2013	10	2100 0321	9
18	3322 2443	23	1013 4444	21	2311 2210	12
19	1123 3532	20	3242 3341	22	0021 3444	18
20	1321 2033	15	1322 1301	13	2112 4333	19
21	1112 2233	15	1112 3331	15	2111 0233	13
22	1100 1110	5	1011 2000	5	2000 1014	8
23	0012 1142	11	0111 1342	13	4333 2222	21
24	1101 2241	12	1011 0123	9	0011 1110	5
25	3322 1152	19	2111 1100	7	0011 1113	8
26	4222 2203	17	0101 0122	7	2243 4465	30
27	1101 1143	12	2211 2353	19	5533 3556	35
28	0101 1024	9	4324 2666	33	5353 4444	32
29	1212 1000	7	5234 4755	35	2322 2334	21
30	1100 0000	2			3122 2223	17
31	0001 1344	13			1101 2121	9

* - see literature: Reda and Jankowski, 2004

Three-hour-range E indices
based on power spectrum estimation(*)
Belsk, April – June, 2008

Day	April K	April SE	May K	May SE	June K	June SE
1	1211 0100	6	1111 1235	15	2212 2432	18
2	0100 0010	2	5221 3101	15	1201 2221	11
3	1001 1100	4	3223 4243	23	0201 1222	10
4	0001 2455	17	1123 1333	17	2110 1100	6
5	1113 2635	22	2231 3443	22	0001 1200	4
6	3443 3244	27	4122 1122	15	0122 2132	13
7	4321 1544	24	2001 1122	9	2143 3343	23
8	1113 4234	19	2111 1121	10	4212 3312	18
9	3233 3233	22	1011 1011	6	2001 0021	6
10	3212 3232	18	1111 1112	9	1001 1110	5
11	3102 2301	12	1111 2120	9	1122 1000	7
12	3323 3243	23	0000 1121	5	0211 1112	9
13	1112 3531	17	2200 1220	9	0100 1110	4
14	1100 0000	2	0101 2110	6	1001 2346	17
15	0011 2224	12	0111 1011	6	4433 3324	26
16	3123 4353	24	1112 2211	11	2223 3344	23
17	4211 1210	12	1001 0000	2	3223 3432	22
18	2122 1112	12	0001 2110	5	4422 2100	15
19	2111 0224	13	3123 3331	19	1002 3222	12
20	2011 1321	11	2222 3334	21	2443 2222	21
21	1101 0110	5	4422 3322	22	1111 2112	10
22	0001 0333	10	3111 2442	18	1111 2000	6
23	3444 4544	32	2102 3243	17	2100 0000	3
24	4443 4223	26	4112 2312	16	0000 1123	7
25	2222 2232	17	2211 2212	13	4221 2433	21
26	3122 2434	21	1111 0101	6	4334 3331	24
27	2222 2311	15	0011 1223	10	4213 2411	18
28	1113 3543	21	3332 4423	24	0102 2232	12
29	3210 1121	11	2222 3432	20	2213 2234	19
30	0001 0452	12	4112 3542	22	1111 2230	11
31			0123 4342	19		

* - see literature: Reda and Jankowski, 2004

Three-hour-range E indices

based on power spectrum estimation(*)

Belsk, August - September, 2008

Day	July K	July SE	August K	August SE	September K	September SE
1	2111 2101	9	0000 1112	5	1000 1110	4
2	2001 1010	5	0000 1011	3	0011 1101	5
3	0001 2210	6	0011 1223	10	1123 1334	18
4	0010 2211	7	1001 1111	6	6633 3533	32
5	1112 4333	18	0011 1100	4	2312 3123	17
6	2120 1010	7	1112 1222	12	4212 3243	21
7	1111 0002	6	1101 1122	9	4211 3251	19
8	0002 1111	6	0000 1202	5	1222 2453	21
9	0001 1111	5	3333 3556	31	1211 0004	9
10	0002 2112	8	4431 1432	22	1000 1130	6
11	1112 4213	15	3112 3212	15	0000 0013	4
12	3444 4332	27	1221 2312	14	1000 0000	1
13	2223 3443	23	3101 1111	9	0000 0001	1
14	2223 3423	21	3311 2110	12	0011 0144	11
15	3221 1223	16	3101 0010	6	3234 4443	27
16	1111 1222	11	0111 1124	11	1323 1432	19
17	3111 1110	9	3112 3212	15	3100 0001	5
18	0111 1110	6	2324 5453	28	2213 2211	14
19	0001 1001	3	3222 2431	19	0100 2230	8
20	1001 0021	5	2112 1100	8	1100 0100	3
21	2111 2222	13	0001 1021	5	0000 0112	4
22	0123 4434	21	1110 0100	4	3200 0100	6
23	3422 5442	26	1000 1001	3	2011 1001	6
24	4222 2221	17	0000 1002	3	0012 1000	4
25	0102 1001	5	0000 0000	0	0001 0133	8
26	2102 1221	11	0000 1110	3	2100 1000	4
27	0012 1125	12	2111 1000	6	0000 1132	7
28	2221 1100	9	0000 1112	5	0011 2100	5
29	0001 1112	6	1010 1110	5	0011 1001	4
30	1201 1121	9	0011 0000	2	0010 1223	9
31	0111 1211	8	0001 1221	7		

* - see literature: Reda and Jankowski, 2004

Three-hour-range E indices

based on power spectrum estimation(*)

Belsk, October - December, 2008

Day	October K	October SE	November K	November SE	December K	December SE
1	2122 2234	18	1010 0110	4	0000 0000	0
2	3323 4343	25	0011 1012	6	0000 0000	0
3	3233 4344	26	0000 0000	0	0001 1222	8
4	2423 2203	18	1000 0000	1	1422 3312	18
5	1211 1002	8	0000 0000	0	2113 2625	22
6	0110 0000	2	0000 0020	2	4532 2532	26
7	0000 0120	3	0222 2236	19	2222 3322	18
8	1100 0000	2	4323 3242	23	0100 1230	7
9	0000 0000	0	4222 1234	20	0000 0000	0
10	0001 1103	6	2101 1200	7	0000 1221	6
11	2144 6754	33	0100 0000	1	2112 1221	12
12	5333 3424	27	1010 0012	5	1001 1111	6
13	4222 1232	18	0000 0000	0	2101 0000	4
14	1011 1221	9	0000 0100	1	1000 0000	1
15	3322 1122	16	1100 0113	7	0110 0012	5
16	1001 0010	3	3321 2013	15	0011 1244	13
17	0000 1100	2	2110 0011	6	2210 1210	9
18	0000 0010	1	0000 0000	0	0000 1121	5
19	1112 2234	16	0000 0010	1	0001 2212	8
20	1000 1122	7	0000 0012	3	0001 1100	3
21	2111 1012	9	0000 0000	0	0110 0000	2
22	0000 1343	11	0000 0000	0	0000 0432	9
23	1010 0000	2	1110 0010	4	2222 2455	24
24	0000 0000	0	0000 0001	1	2222 1332	17
25	0000 0011	2	4332 2342	23	0001 3131	9
26	0221 1202	10	3321 1234	19	1000 1011	4
27	0000 0000	0	3212 2242	18	2000 0011	4
28	0022 1221	10	1211 0124	12	2001 0000	3
29	3242 2544	26	0011 0112	6	0001 0000	1
30	3223 2543	24	1000 0200	3	0000 0011	2
31	1221 1133	14			3334 2342	24

* - see literature: Reda and Jankowski, 2004

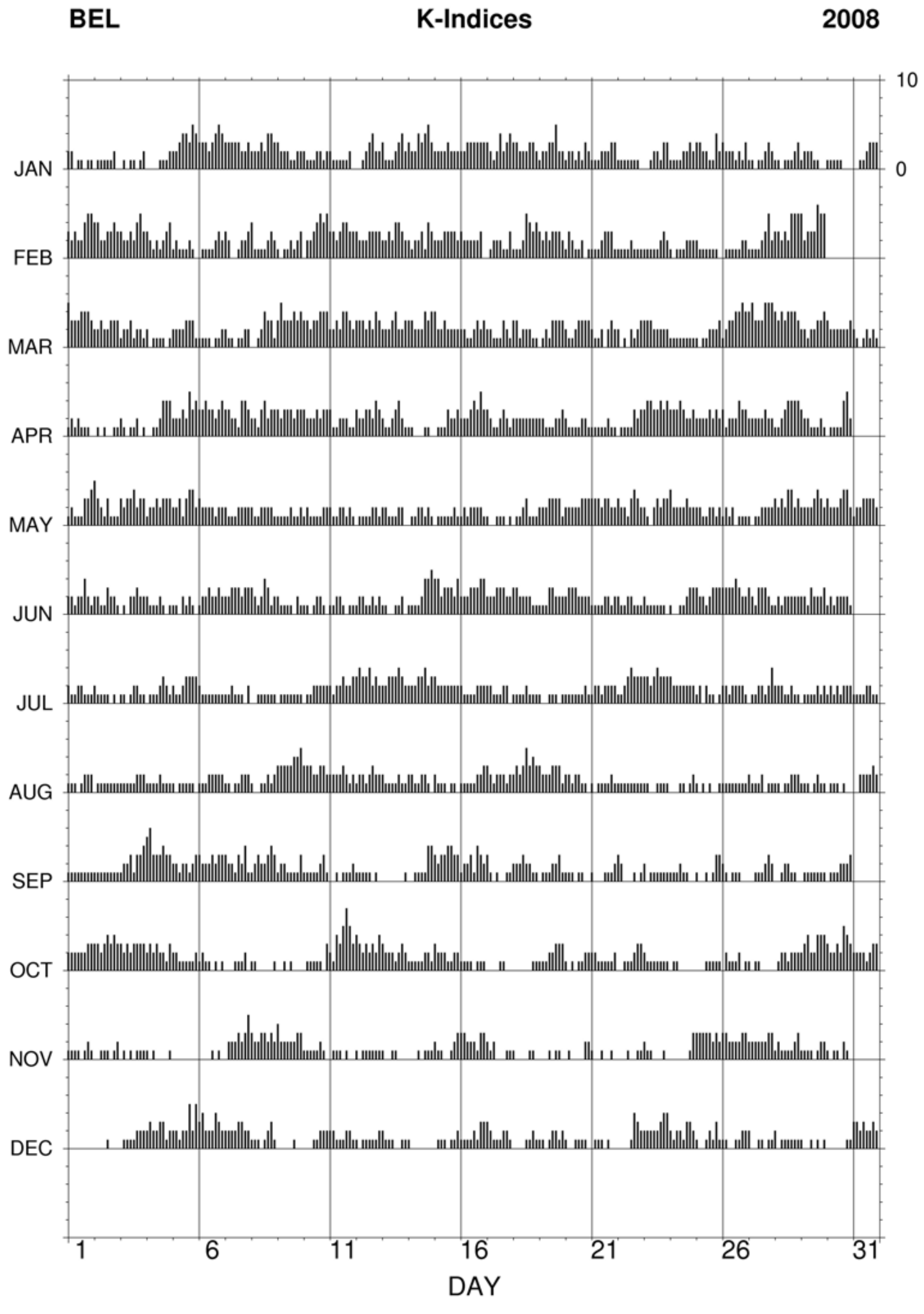

Fig. 11. K-indices in graphical form, Belsk 2008.

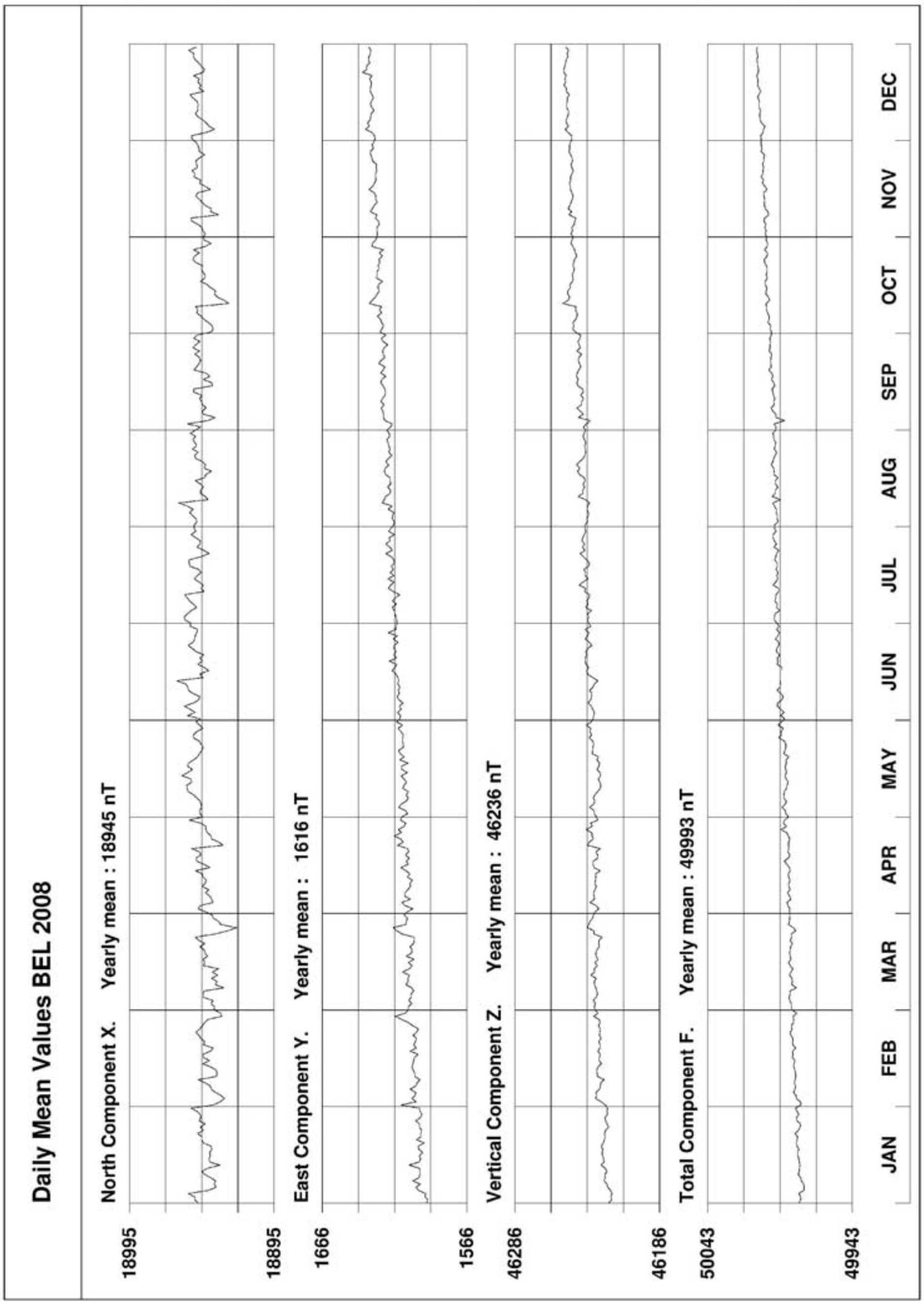

Fig. 12. Daily mean data plot for Belsk 2008.

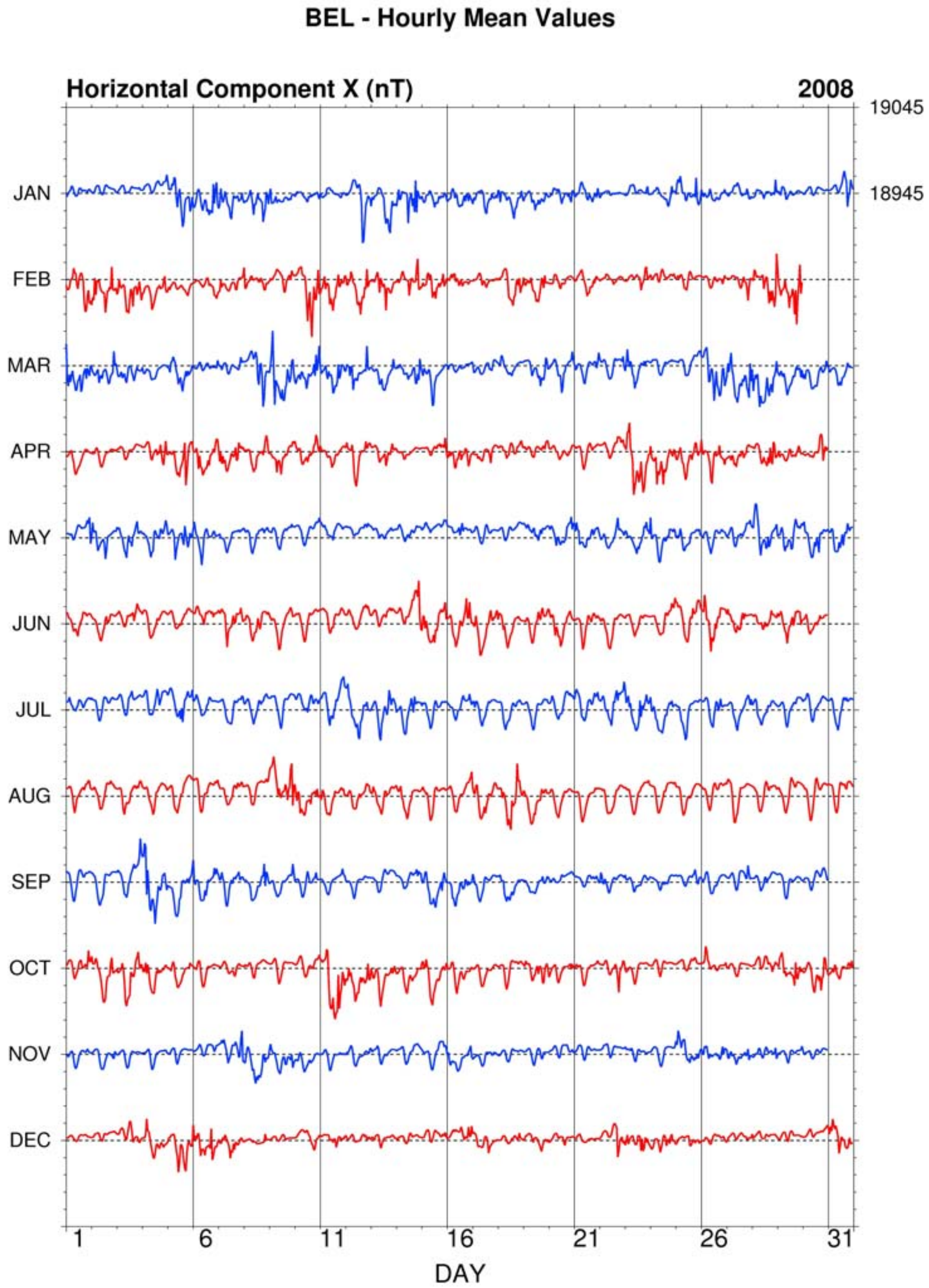

Fig. 13. Hourly mean data plot of X component for Belsk 2008.

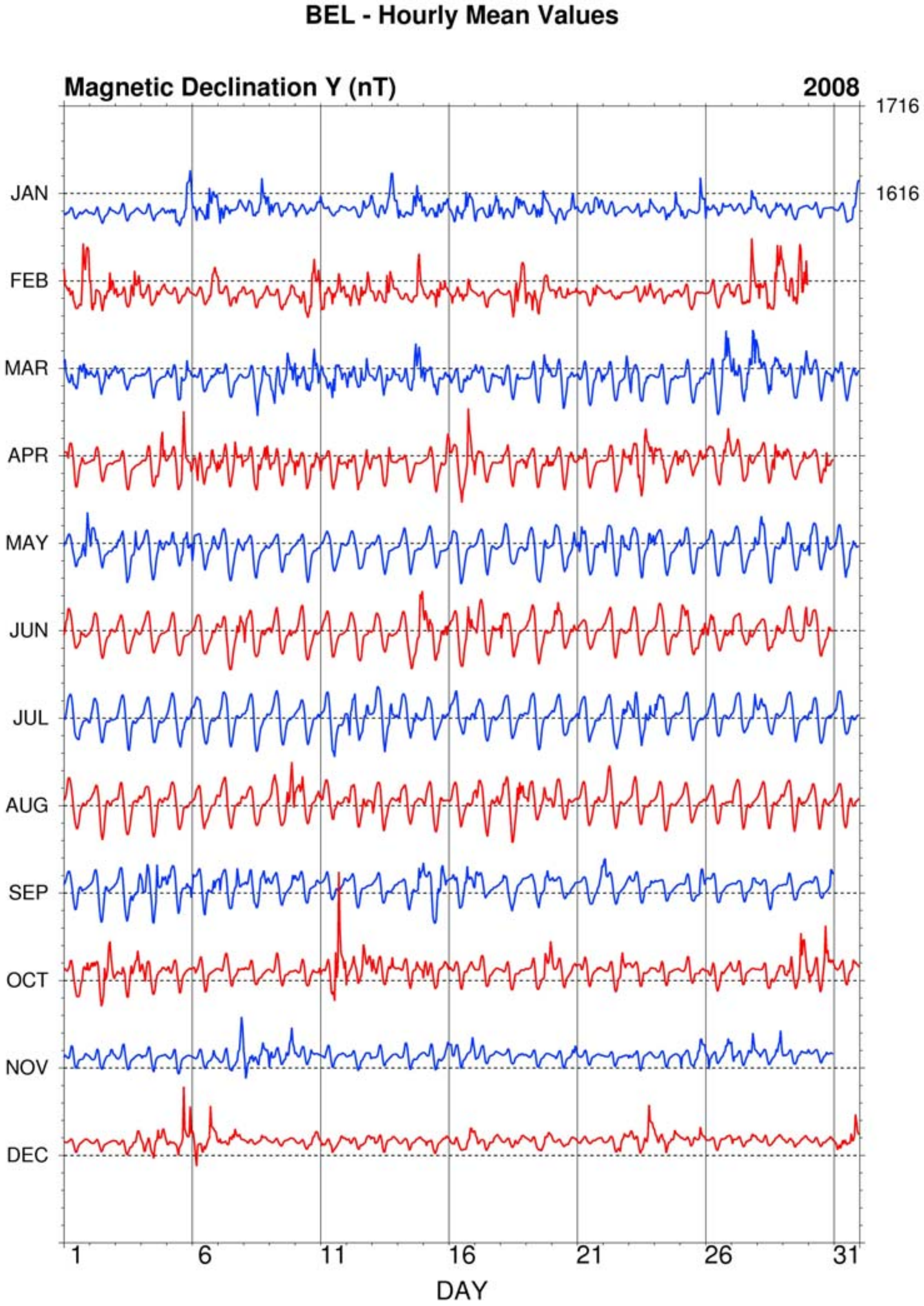

Fig. 14. Hourly mean data plot of Y component for Belsk 2008.

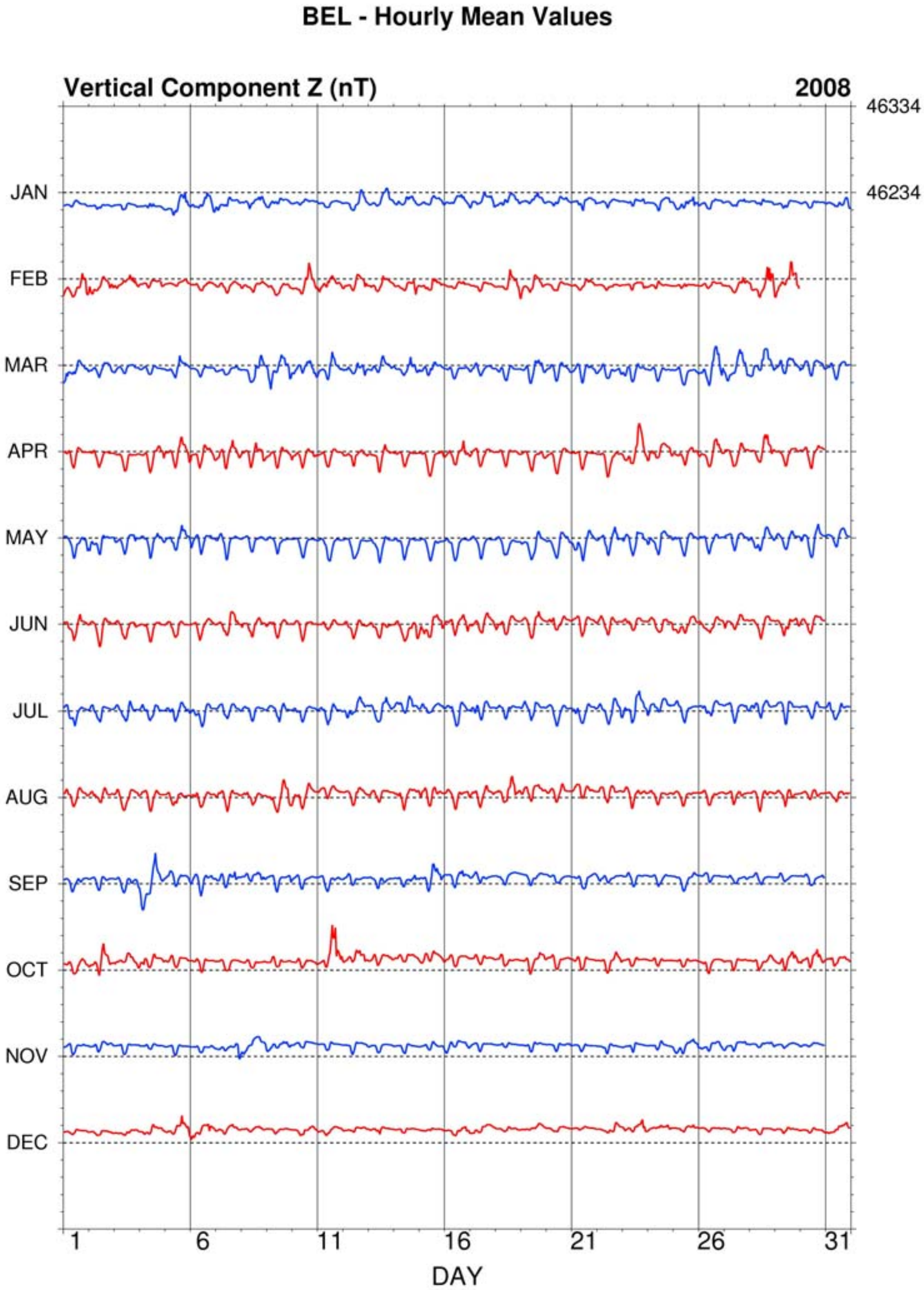

Fig. 15. Hourly mean data plot of Z component for Belsk 2008.

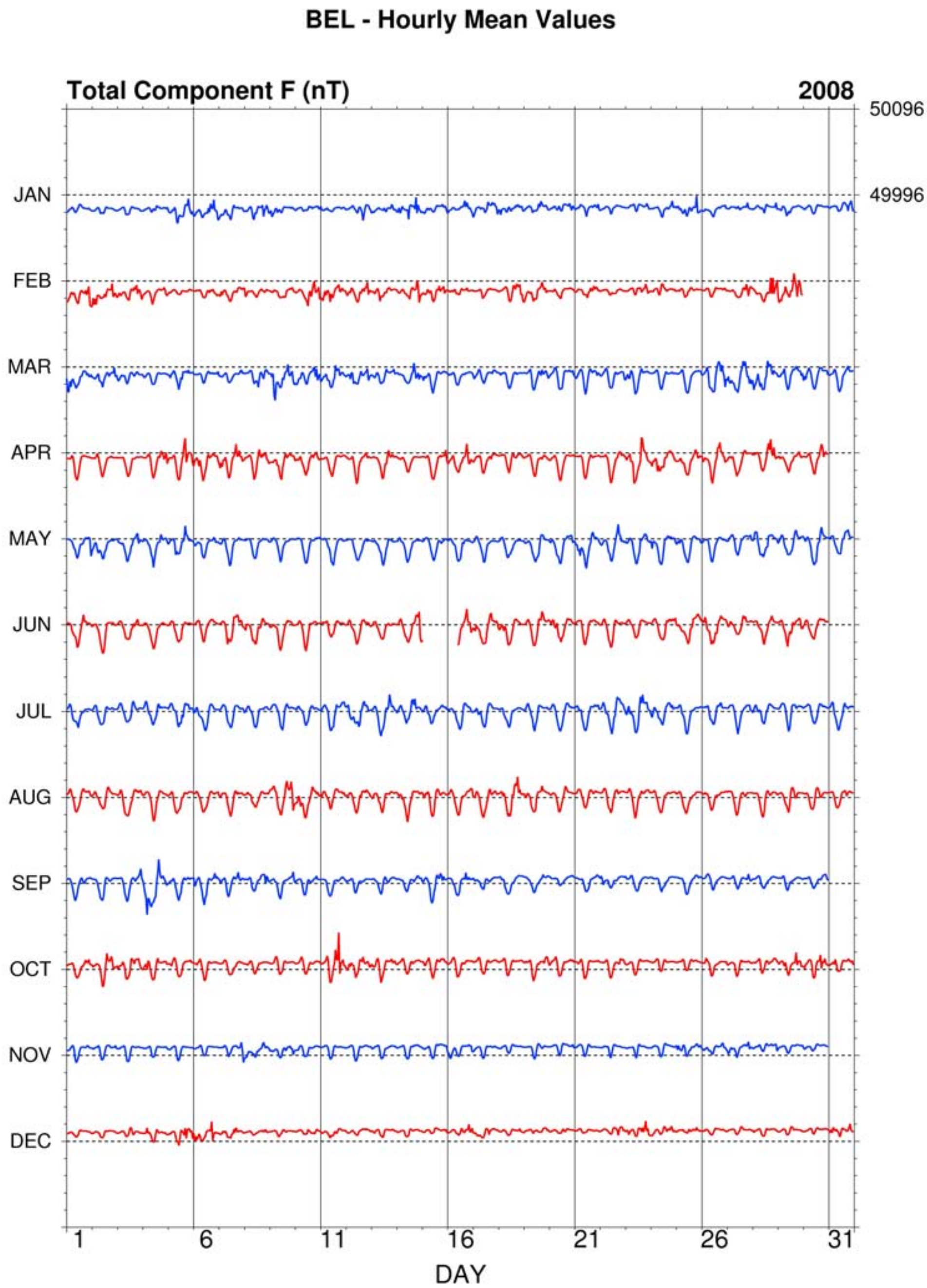

Fig. 16. Hourly mean data plot of F component for Belsk 2008.

Tables and plots for Hel Observatory

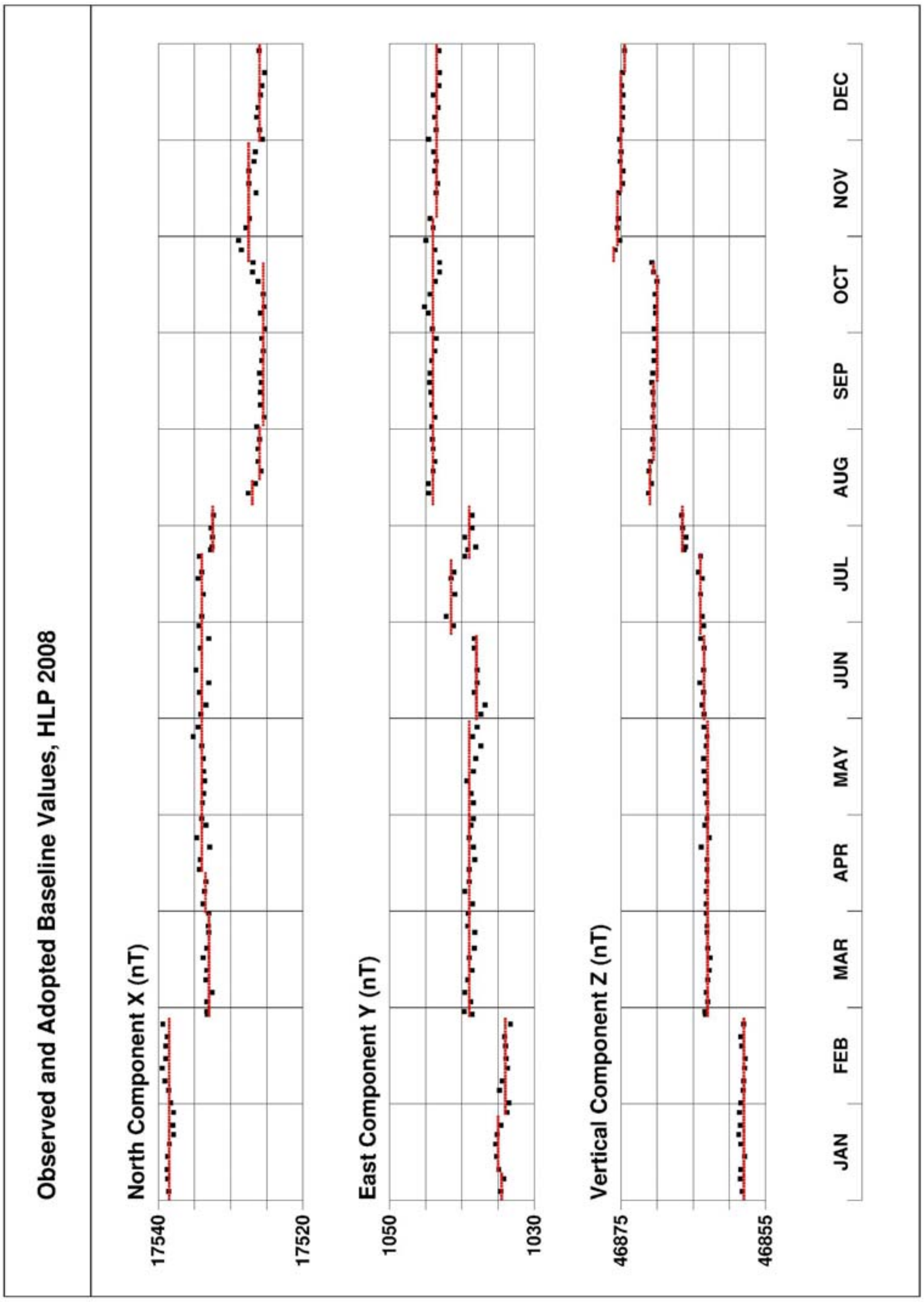

Fig. 17. Base values of set 1, Hel 2008.

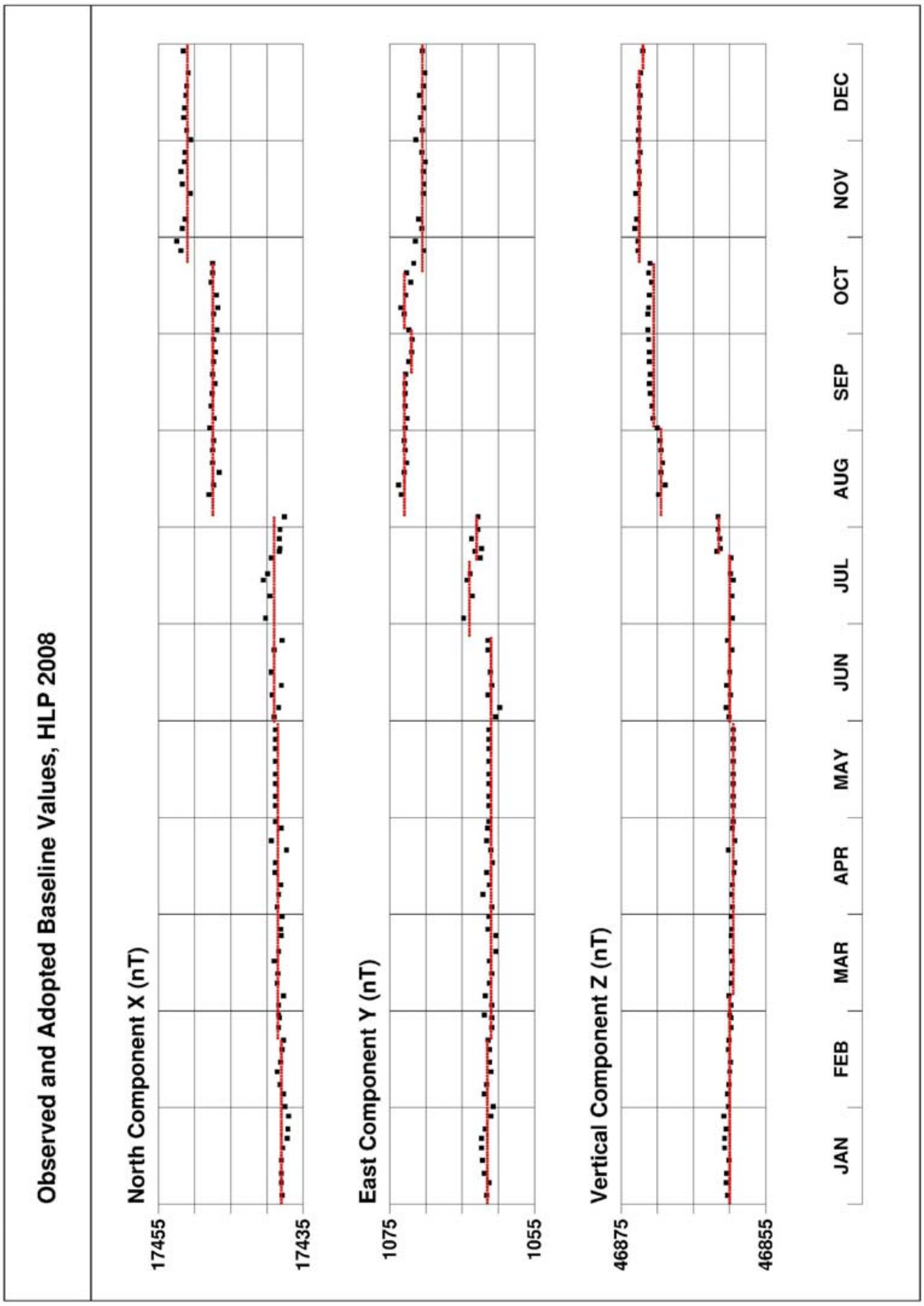

Fig. 18. Base values of set 2, Hel 2008.

Annual mean values of magnetic elements in Hel Observatory

No	Year	D [° ']	H [nT]	Z [nT]	X [nT]	Y [nT]	I [° ']	F [nT]
1	1953	-0 14.5	17388	45327	17388	-73	69 00.8	48548
2	1954	-0 10.0	17394	45374	17394	-51	69 01.5	48594
3	1955	-0 04.2	17379	45430	17379	-21	69 03.9	48640
4	1956	0 03.9	17371	45450	17371	20	69 05.0	48656
5	1957	0 05.7	17372	45475	17372	29	69 05.5	48680
6	1958	0 10.2	17380	45535	17380	52	69 06.5	48739
7	1959	0 14.7	17390	45565	17390	74	69 06.6	48771
8	1960	0 17.6	17402	45602	17402	89	69 06.8	48810
9	1961	0 19.8	17422	45625	17422	100	69 06.0	48838
10	1962	0 22.7	17438	45647	17438	115	69 05.5	48864
11	1963	0 26.5	17449	45663	17448	134	69 05.2	48883
12	1964	0 28.6	17464	45676	17463	145	69 04.6	48901
13	1965	0 30.0	17476	45692	17475	152	69 04.2	48920
14	1966	0 31.6	17485	45710	17484	161	69 04.0	48940
15	1967	0 33.3	17492	45743	17491	169	69 04.4	48973
16	1968	0 34.4	17502	45769	17501	175	69 04.4	49001
17	1969	0 34.3	17524	45792	17523	175	69 03.5	49030
18	1970	0 34.8	17542	45824	17541	178	69 03.2	49067
19	1971	0 35.7	17565	45849	17564	182	69 02.3	49098
20	1972	0 36.1	17579	45880	17578	184	69 02.1	49132
21	1973	0 38.5	17595	45912	17594	197	69 01.9	49168
22	1974	0 41.9	17606	45951	17605	215	69 02.2	49208
23	1975	0 45.0	17625	45984	17623	231	69 01.7	49246
24	1976	0 49.6	17639	46015	17637	254	69 01.6	49280
25	1977	0 55.0	17651	46045	17649	282	69 01.5	49312
26	1978	1 00.2	17646	46085	17643	309	69 02.9	49349
27	1979	1 05.1	17651	46112	17648	334	69 03.2	49375
28	1980	1 11.5	17653	46127	17649	367	69 03.5	49390
29	1981	1 17.5	17637	46156	17632	398	69 05.2	49411
30	1982	1 23.4	17620	46184	17615	427	69 07.1	49431
31	1983	1 28.6	17614	46200	17608	454	69 07.8	49444
32	1984	1 33.5	17602	46219	17596	479	69 09.1	49457
33	1985	1 37.9	17591	46239	17584	501	69 10.3	49472
34	1986	1 42.7	17579	46263	17571	525	69 11.6	49490
35	1987	1 46.3	17572	46285	17564	543	69 12.6	49508
36	1988	1 51.0	17555	46318	17546	567	69 14.6	49533

No	Year	D [º ‘]	H [nT]	Z [nT]	X [nT]	Y [nT]	I [º ‘]	F [nT]
37	1989	1 55.5	17535	46352	17525	589	69 16.7	49558
38	1990	1 58.4	17527	46374	17516	604	69 17.8	49575
39	1991	2 00.6	17513	46398	17502	614	69 19.3	49593
40	1992	2 03.9	17515	46416	17504	631	69 19.6	49611
41	1993	2 10.0	17516	46428	17503	662	69 19.8	49622
42	1994	2 15.9	17512	46456	17498	692	69 20.7	49647
43	1995	2 21.3	17518	46481	17503	720	69 21.0	49672
44	1996	2 26.6	17523	46506	17507	747	69 21.2	49698
45	1997	2 32.9	17519	46539	17502	779	69 22.3	49727
46	1998	2 39.8	17512	46581	17493	814	69 23.8	49764
47	1999	2 45.4	17511	46615	17491	842	69 24.7	49796
48	2000	2 51.9	17507	46657	17485	875	69 25.9	49833
49	2001	2 57.7	17515	46692	17492	905	69 26.2	49869
50	2002	3 03.7	17520	46730	17495	936	69 26.9	49906
51	2003	3 10.8	17519	46777	17492	972	69 28.1	49950
52	2004	3 16.6	17529	46809	17500	1002	69 28.2	49983
53	2005	3 22.3	17531	46843	17501	1031	69 28.9	50016
J	2006.0	0 -1.5	-2	9	-2	-8	0 0.6	7
54	2006	3 29.9	17550	46859	17517	1071	69 28.1	50038
55	2007	3 36.7	17559	46887	17524	1106	69 28.2	50067
56	2008	3 43.8	17564	46917	17527	1143	69 28.5	50097

Note: Since 2006 the observatory has stopped introducing the so-called historical corrections. The corrections were related, among other things, with the variable location of the instruments for absolute measurements. In the 2006.0 line we include the jump value J relating to the neglect of historical corrections. The jump values are defined as follows:

jump value J = old site value - new site value

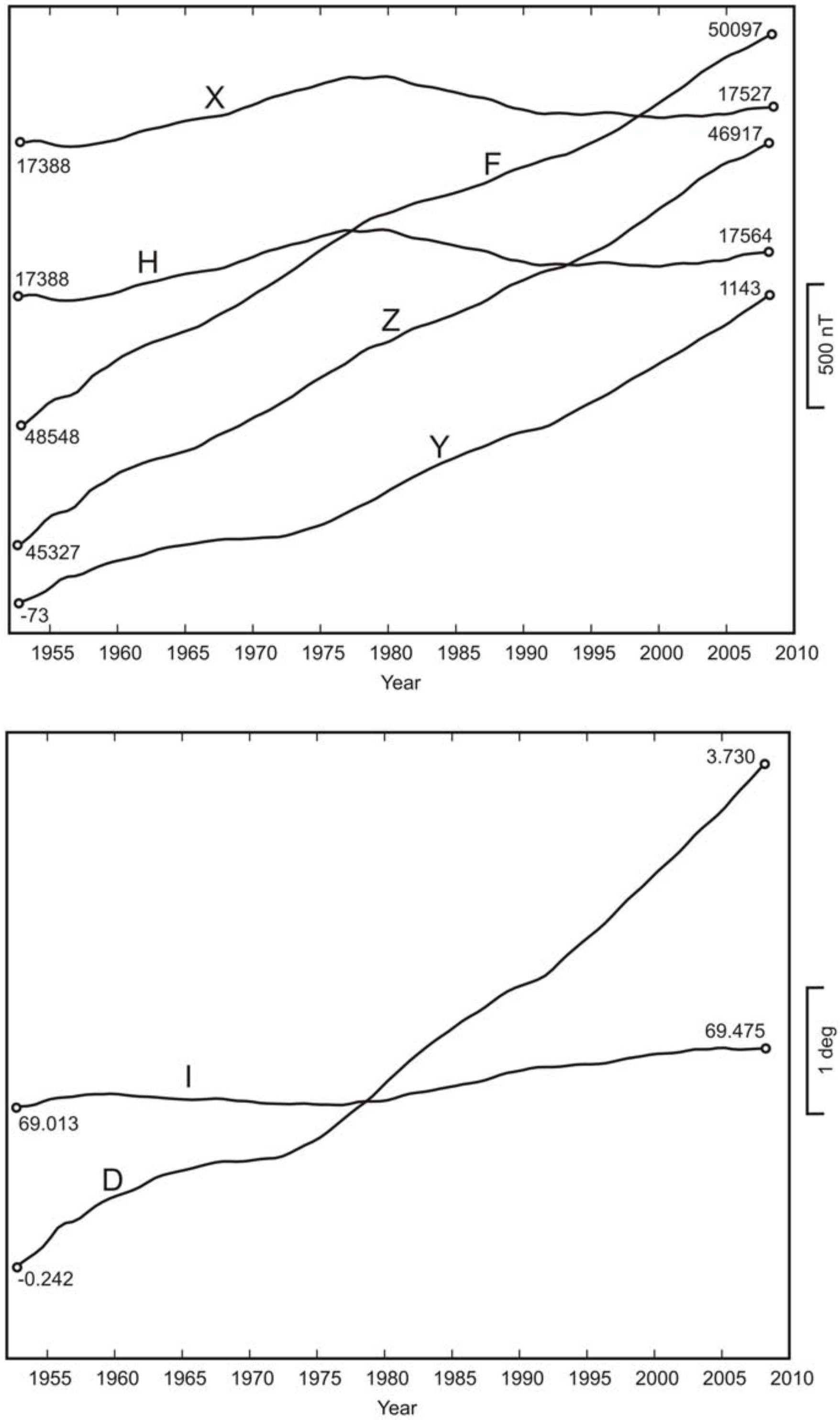

Fig. 19. Secular changes of H, X, Y, Z, F, D and I at Hel.

MONTHLY AND YEARLY MEAN VALUES OF MAGNETIC ELEMENTS

HEL **2008**

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
NORTH COMPONENT: 17000 + ... in nT													
All days	524	522	521	525	532	531	532	529	527	525	529	529	527
Quiet days	530	528	527	526	535	533	530	532	530	520	529	531	529
Disturbed days	519	517	512	519	530	532	530	527	524	524	528	530	524
EAST COMPONENT: 1000 + ... in nT													
All days	127	131	133	135	136	140	144	146	150	154	157	161	143
Quiet days	124	128	130	134	136	139	142	146	150	157	158	160	142
Disturbed days	129	136	137	138	137	139	142	146	150	153	157	161	144
VERTICAL COMPONENT: 46500 + ... in nT													
All days	404	409	412	412	412	415	417	419	422	427	428	431	417
Quiet days	402	408	410	411	410	415	419	418	422	428	428	431	417
Disturbed days	404	408	411	414	413	413	419	420	423	427	429	432	418

Three-hour-range K indices

Hel, January - March, 2008

The limit of K=9 is 550

Day	January K	January SK	February K	February SK	March K	March SK
1	2101 1001	6	3222 1355	23	5323 4433	27
2	0000 1120	4	4322 3243	23	2222 2323	18
3	0000 0011	2	3223 2443	23	2123 1111	12
4	0000 1112	5	3212 1233	17	2011 1001	6
5	2233 3354	25	1101 1210	7	2212 3231	16
6	3332 3443	25	0011 1232	10	1111 0111	7
7	3223 3123	19	3200 0213	11	1110 0011	5
8	1222 2443	20	3111 1133	14	0013 4331	15
9	3221 1122	14	2000 2123	10	3533 3434	28
10	2111 1212	11	0223 4544	24	3223 3444	25
11	2011 0020	6	3323 3333	23	2232 4432	22
12	0001 2322	10	2222 3333	20	3332 3243	23
13	3111 2342	17	1131 4331	17	2223 3222	18
14	3224 3453	26	2122 3143	18	3322 2434	23
15	2222 3222	17	2223 3332	20	4223 3222	20
16	2233 2333	21	2222 2130	14	2111 2222	13
17	2212 3124	17	0112 2112	10	2111 1321	12
18	3332 2332	21	1012 4434	19	3311 2111	13
19	1123 2422	17	3232 3332	21	0121 3333	16
20	1221 2032	13	1311 1201	10	2112 3333	18
21	1112 1223	13	1112 2331	14	2111 0233	13
22	1110 0110	5	1011 1011	6	2001 2123	11
23	0012 1133	11	0112 1232	12	3322 2222	18
24	0111 2232	12	1011 1222	10	1111 1110	7
25	3322 1042	17	2011 0100	5	0012 2113	10
26	3121 1213	14	0111 1122	9	1133 4454	25
27	1101 1132	10	1111 2352	16	4433 3555	32
28	0111 0023	8	3323 2545	27	4343 4443	29
29	1211 1000	6	4233 3644	29	2211 2234	17
30	1100 0000	2			3212 2213	16
31	0001 2333	12			1101 2021	8

Three-hour-range K indices

Hel, April - June, 2008

The limit of K=9 is 550

Day	April K	April SK	May K	May SK	June K	June SK
1	1211 1110	8	1112 1234	15	2222 2321	16
2	0000 0001	1	5212 3101	15	2212 3221	15
3	2001 0100	4	3233 4232	22	1102 2322	13
4	0011 2443	15	1223 2333	19	2121 2101	10
5	2123 3534	23	2131 3432	19	1002 1210	7
6	3443 3233	25	3222 2121	15	1223 2222	16
7	3322 1433	21	2001 2222	11	2133 3233	20
8	2213 4233	20	2112 2111	11	3212 4312	18
9	2233 3233	21	1111 2111	9	1001 1011	5
10	3222 3233	20	1111 1122	10	1001 2110	6
11	3112 2201	12	2111 2121	11	1122 1001	8
12	3223 3133	20	1010 1211	7	1221 1111	10
13	1112 3421	15	1101 1220	8	1100 1120	6
14	1100 0000	2	0102 2110	7	1001 2445	17
15	0001 3223	11	0111 1111	7	3433 3324	25
16	2223 4343	23	1202 2221	12	2223 3334	22
17	3212 2221	15	1001 0100	3	2223 3322	19
18	2222 2212	15	0002 3111	8	3322 3211	17
19	2111 1223	13	2113 3321	16	1112 3222	14
20	2111 1221	11	2122 3333	19	2333 2222	19
21	1101 1211	8	3323 3222	20	1111 2211	10
22	0002 1323	11	2222 3432	20	2111 2111	10
23	3343 3433	26	2102 2233	15	2101 1000	5
24	3333 3223	22	3122 2312	16	1000 1123	8
25	2222 3221	16	2211 2211	12	3221 2333	19
26	3122 2433	20	1111 0111	7	3333 4322	23
27	2112 2321	14	0011 1112	7	3223 3321	19
28	1122 3443	20	3222 4323	21	1112 2222	13
29	2211 1121	11	2212 3332	18	2212 2223	16
30	0111 1351	13	3112 3442	20	1102 2220	10
31			0223 3332	18		

Three-hour-range K indices

Hel, July - September, 2008

The limit of K=9 is 550

Day	July K	July SK	August K	August SK	September K	September SK
1	2112 3101	11	1010 2222	10	1000 2111	6
2	2001 1010	5	0001 1111	5	1112 1111	9
3	1001 2211	8	1011 2122	10	1223 2333	19
4	0001 2211	7	1011 1111	7	5533 3433	29
5	1223 3322	18	0001 1100	3	2212 2122	14
6	1111 1110	7	11-122222	-1	3222 3233	20
7	1111 0101	6	1111 1222	11	3122 3241	18
8	0001 1111	5	0000 1212	6	1232 2343	20
9	0111 1111	7	3323 3445	27	1211 1113	11
10	0002 2212	9	3332 2322	20	1111 1121	9
11	1122 3223	16	2212 3211	14	0000 1112	5
12	3433 4232	24	1232 2312	16	1000 0000	1
13	2233 3432	22	2112 1111	10	0000 0001	1
14	2223 3422	20	2211 2210	11	0011 1143	11
15	3222 2222	17	2111 1100	7	3233 3433	24
16	1111 2212	11	0111 1123	10	1222 1432	17
17	2211 1210	10	3112 3212	15	3101 1001	7
18	0101 1101	5	2224 4443	25	2212 1111	11
19	0001 1101	4	3222 3331	19	0111 1131	9
20	1001 1121	7	2112 2100	9	1100 1100	4
21	2111 2222	13	1001 2011	6	0000 0112	4
22	0123 4333	19	1110 1001	5	3100 0101	6
23	3322 4333	23	1001 2111	7	2011 1011	7
24	3222 2222	17	0001 1001	3	1002 1100	5
25	1112 1101	8	1000 1001	3	1001 0133	9
26	2112 2221	13	0001 1110	4	1101 1100	5
27	0012 2124	12	2111 1000	6	0000 1222	7
28	2222 1211	13	0001 1111	5	0012 2100	6
29	0101 1212	8	1111 0211	8	0111 1001	5
30	1212 1112	11	0111 1000	4	0011 2223	11
31	0111 2211	9	0012 3121	10		

Three-hour-range K indices

Hel, October - December, 2008

The limit of K=9 is 550

Day	October K	October SK	November K	November SK	December K	December SK
1	2222 2323	18	1010 0021	5	0000 0000	0
2	2223 4333	22	0011 1012	6	0000 0000	0
3	2232 3333	21	0000 0000	0	1111 1122	10
4	2323 2212	17	1000 0000	1	2322 3311	17
5	2211 1002	9	0000 0000	0	2112 2525	20
6	1111 0101	6	0000 0010	1	3322 2432	21
7	0000 1120	4	0112 2224	14	2122 2312	15
8	1100 0001	3	3223 3232	20	1100 1221	8
9	0010 0000	1	4222 1233	19	0000 0100	1
10	0002 1103	7	1111 0210	7	0001 1222	8
11	2133 5653	28	0101 0000	2	2211 1211	11
12	4322 2323	21	1010 0112	6	1001 1111	6
13	3122 1232	16	0000 0000	0	1101 0010	4
14	1011 1121	8	0000 0111	3	1000 0000	1
15	3222 1122	15	1100 0123	8	0110 0112	6
16	1011 0011	5	3222 1023	15	0011 2133	11
17	0000 1000	1	1120 0011	6	3210 1210	10
18	0000 0010	1	0000 0010	1	0000 1121	5
19	1112 2332	15	0000 0010	1	1001 1211	7
20	1000 1112	6	0100 0021	4	1000 1100	3
21	2111 1012	9	0001 0000	1	0111 0000	3
22	0001 1232	9	0000 0010	1	0000 0332	8
23	11-1-1-1110	-1	2110 0010	5	2222 1344	20
24	011-11000	-1	0000 0003	3	2122 2232	16
25	0001 0111	4	4332 3232	22	1001 2131	9
26	0221 1201	9	3322 2233	20	1000 0022	5
27	1001 0000	2	2112 1233	15	1000 1011	4
28	0122 1221	11	1111 0123	10	1011 0111	6
29	2332 3443	24	0111 0112	7	0001 0000	1
30	3223 2532	22	1000 0210	4	0000 0011	2
31	2221 1232	15			3323 2232	20

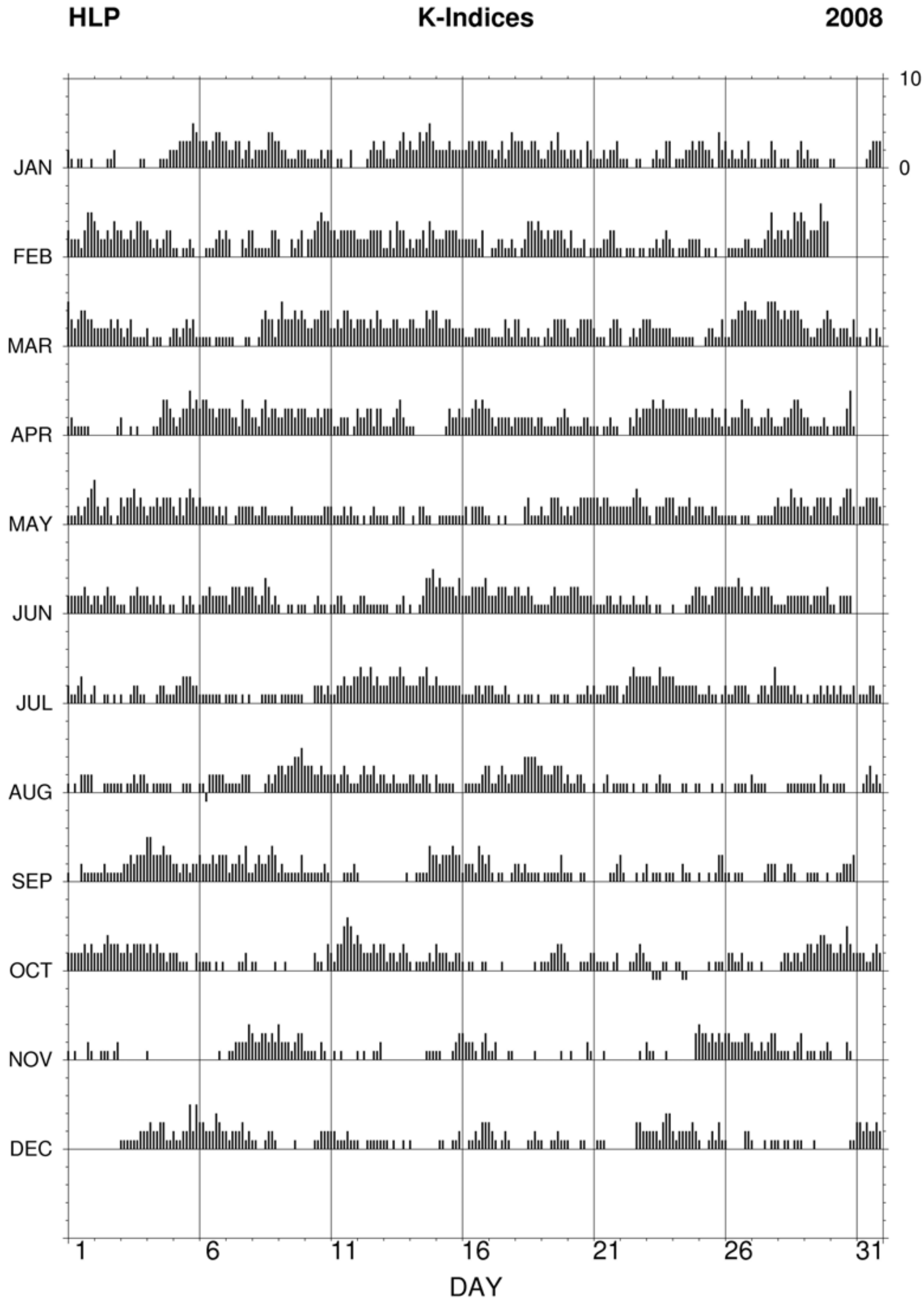

Fig. 20. K-indices in graphical form, Hel 2008.

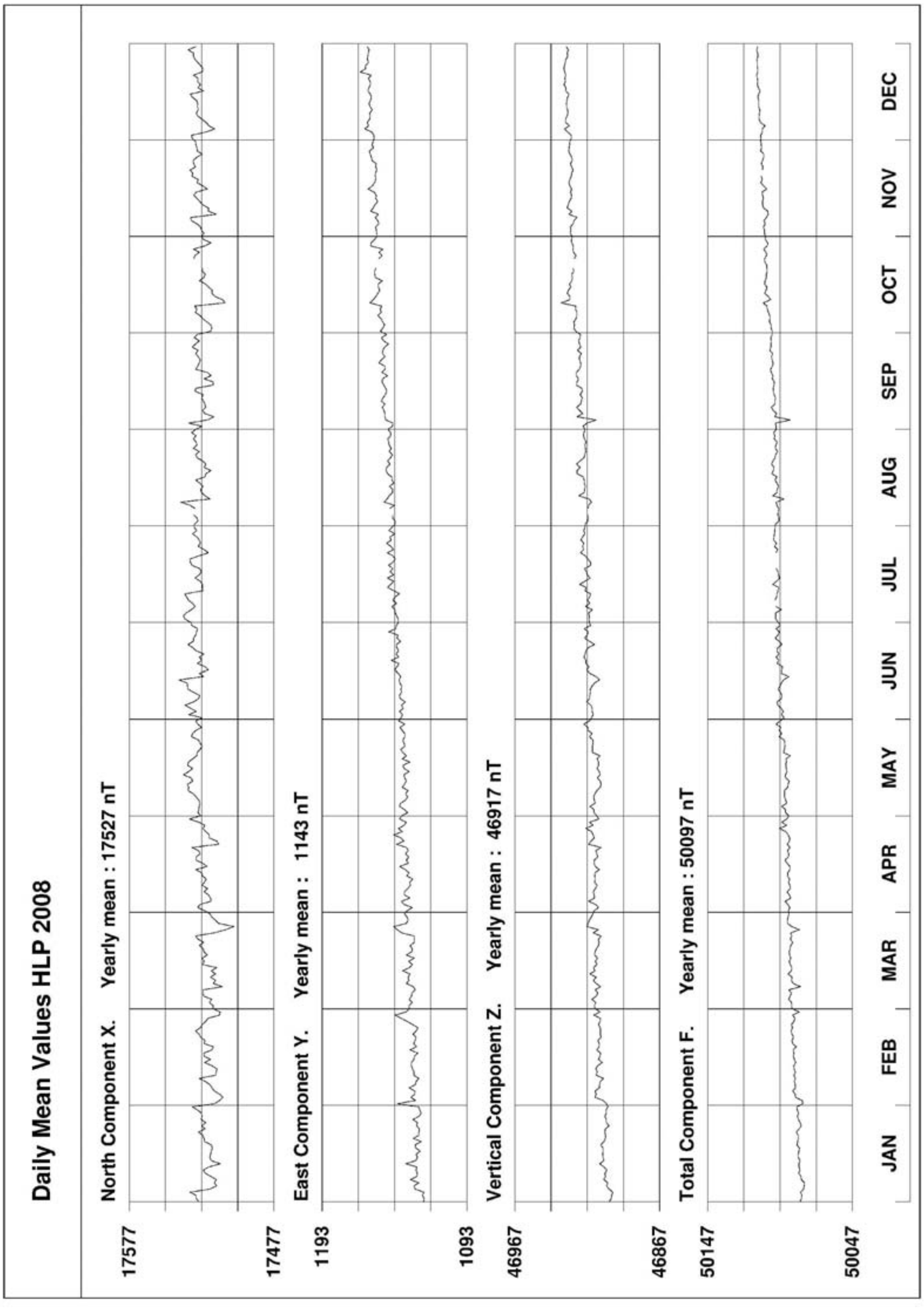

Fig. 21. Daily mean data plot for Hel 2008.

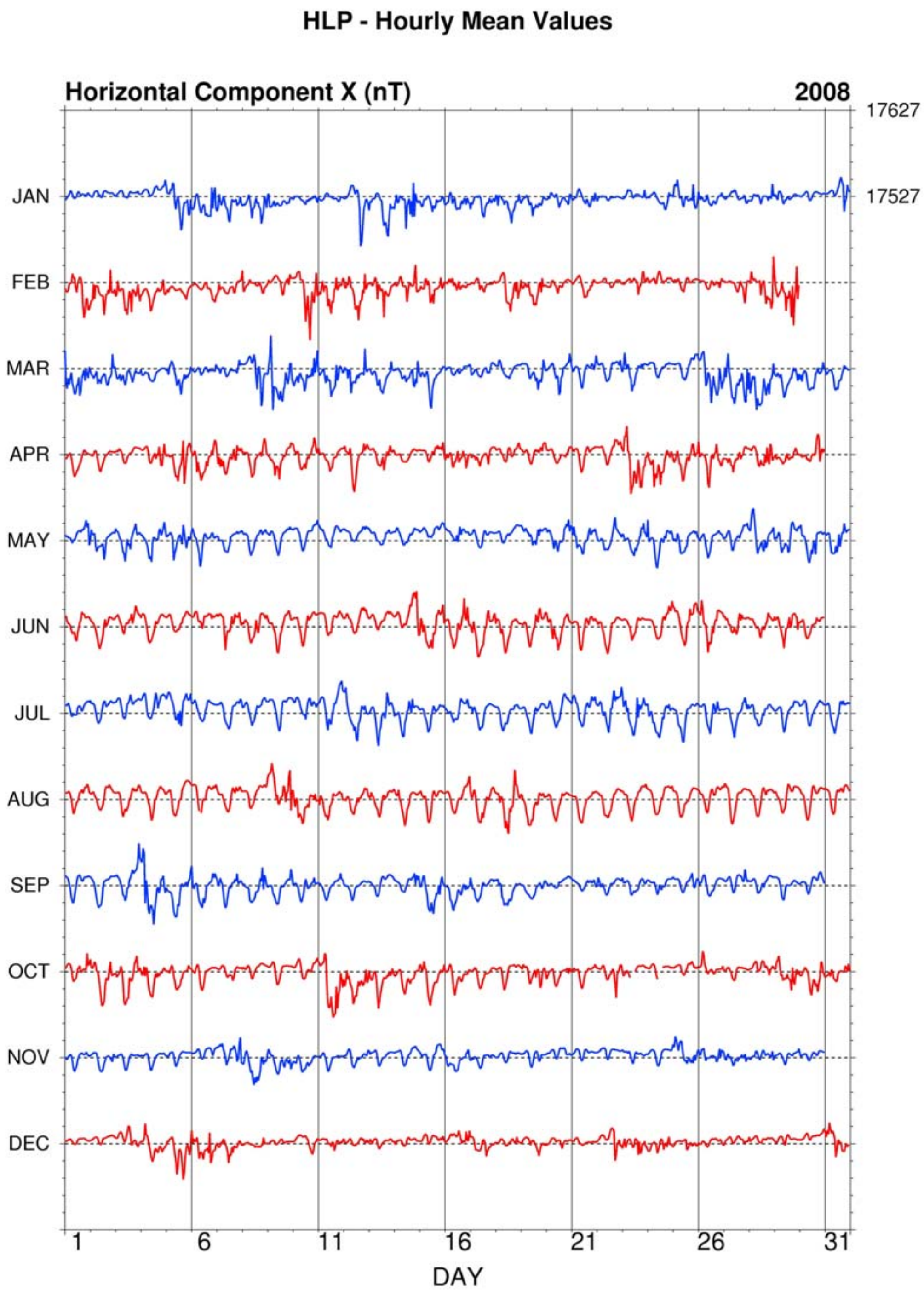

Fig. 22. Hourly mean data plot of X component for Hel 2008.

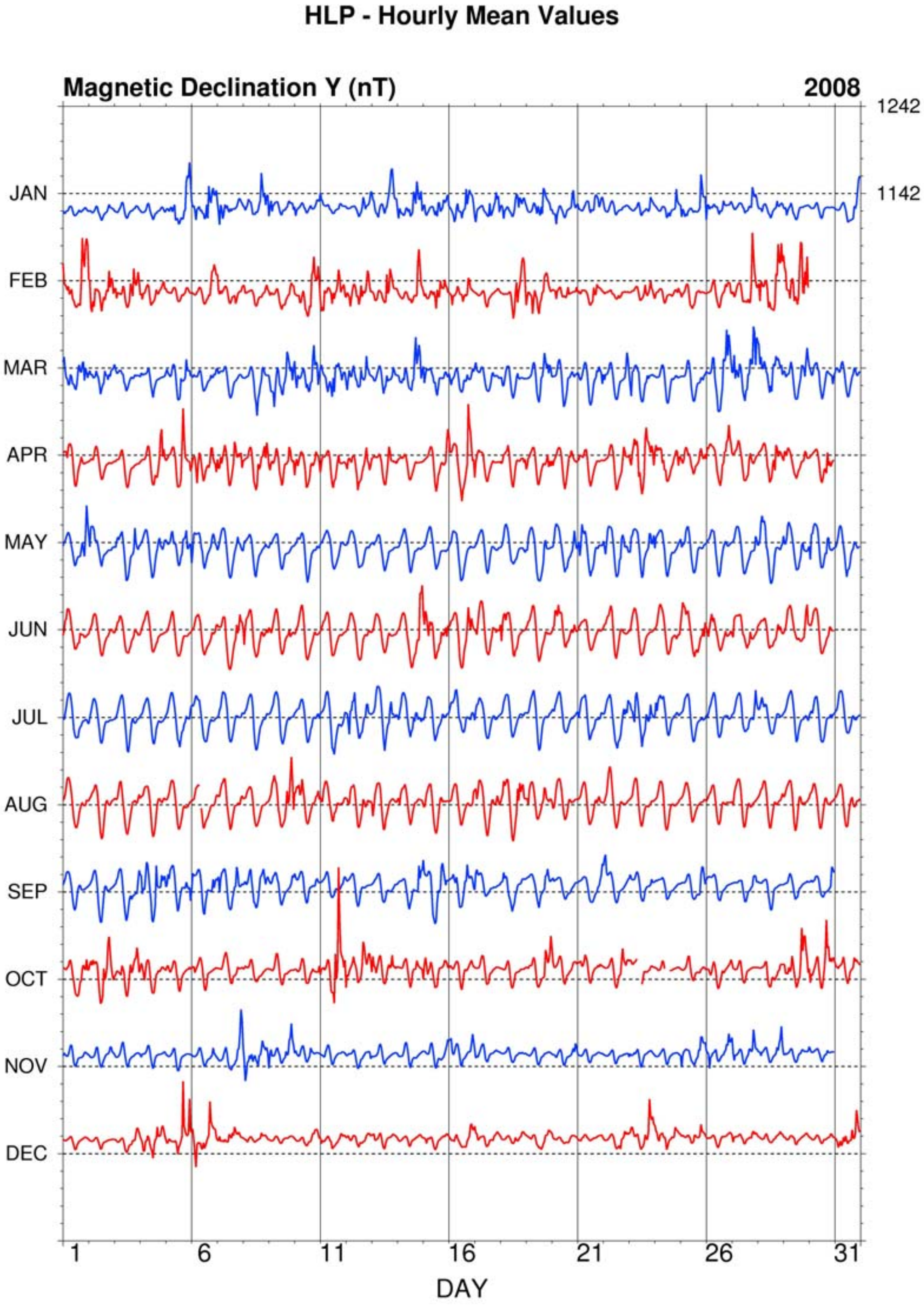

Fig. 23. Hourly mean data plot of Y component for Hel 2008.

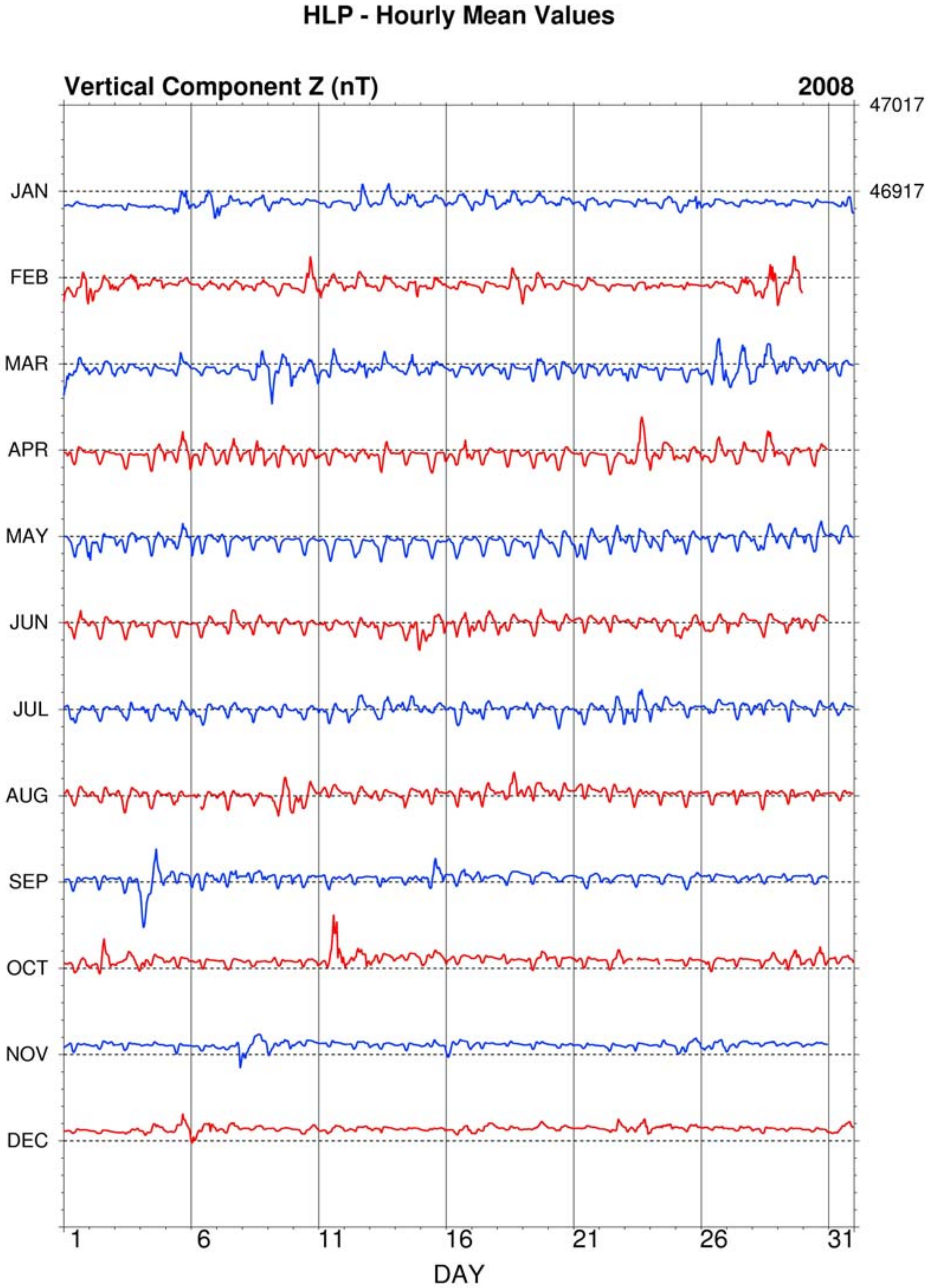

Fig. 24. Hourly mean data plot of Z component for Hel 2008.

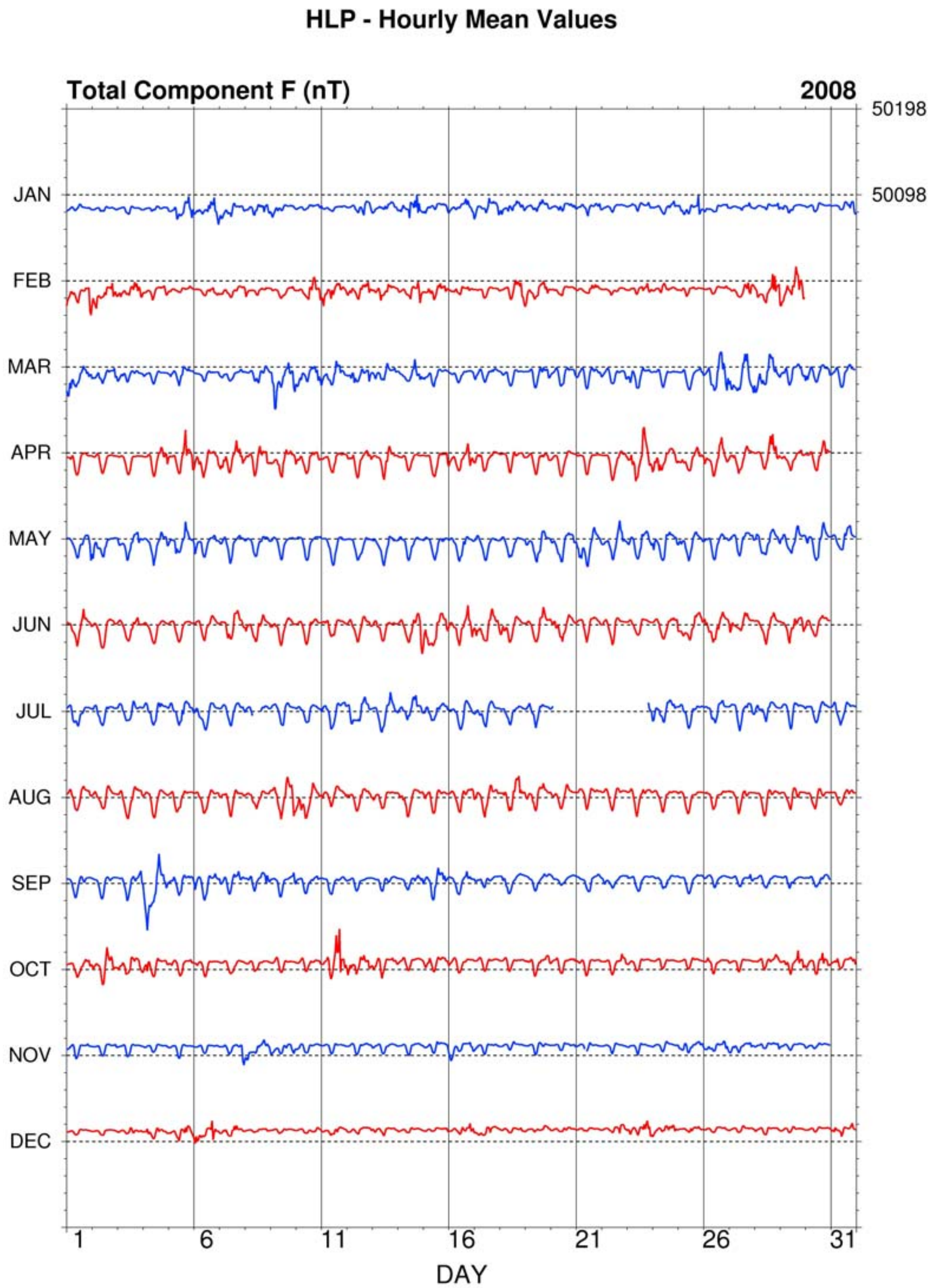

Fig. 25. Hourly mean data plot of F component for Hel 2008.

Tables and plots for Hornsund Observatory

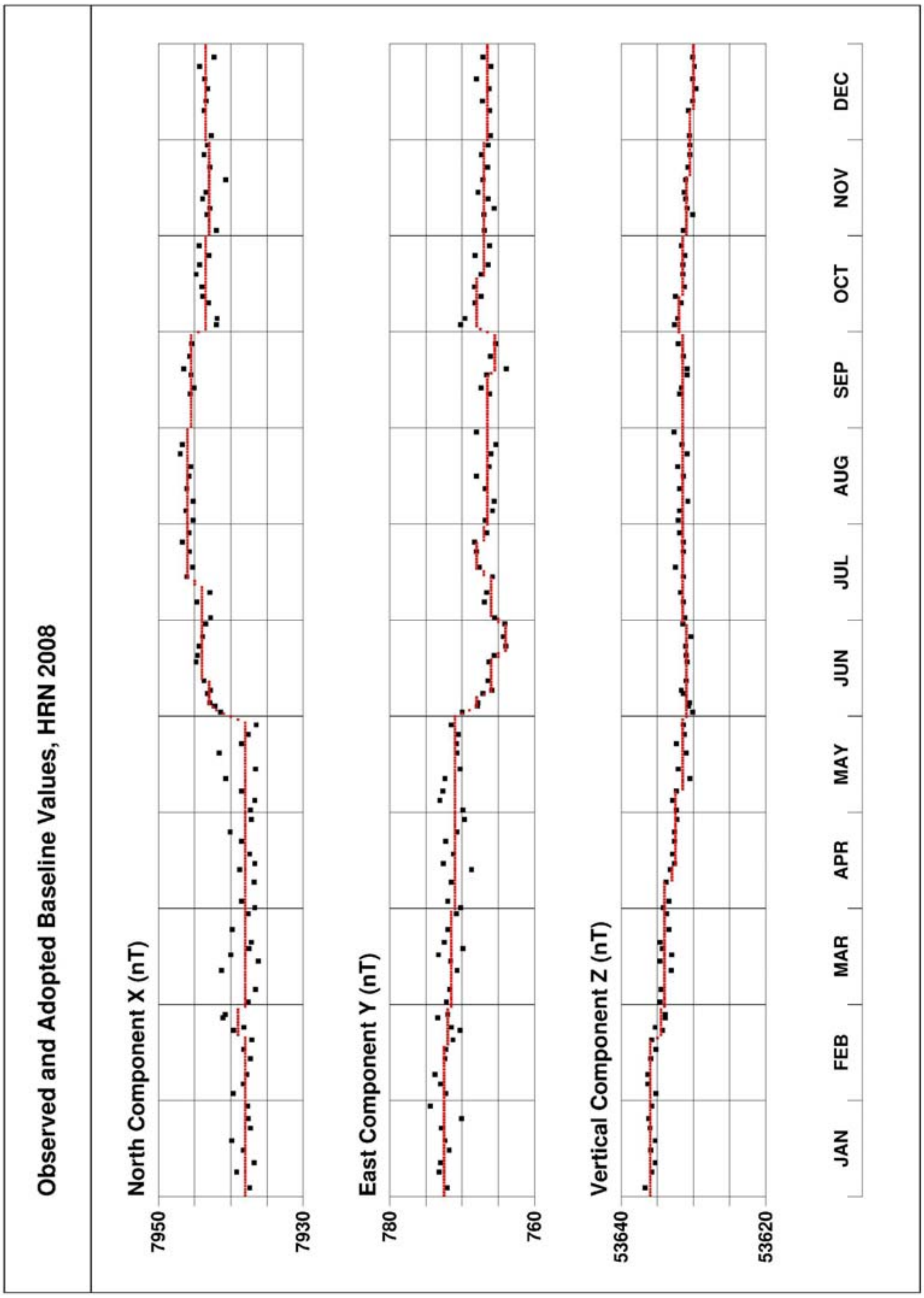

Fig. 26. Base values, Hornsund 2008.

Annual mean values of magnetic elements in Hornsund Observatory

Year	D [° ´]	H [nT]	Z [nT]	X [nT]	Y [nT]	I [° ´]	F [nT]
1979	-0 32.2	8384	53447	8384	-79	81 05.1	54101
1980	-0 14.2	8370	53447	8370	-35	81 06.0	54098
1981	-0 09.3	8351	53449	8351	-23	81 07.2	54097
1982	-0 09.4	8319	53481	8319	-23	81 09.5	54124
1983	-0 02.0	8295	53457	8295	-5	81 10.8	54097
1984	0 07.7	8266	53439	8266	19	81 12.4	54075
1985	0 14.3	8238	53405	8238	34	81 13.9	54037
1986	0 20.4	8213	53392	8213	49	81 15.3	54020
1987	0 25.6	8193	53360	8193	61	81 16.3	53985
1988	0 34.7	8168	53368	8168	82	81 17.9	53989
1989	0 40.8	8148	53369	8147	97	81 19.2	53987
1990	0 47.2	8122	53360	8121	112	81 20.7	53975
1991	0 53.0	8107	53355	8106	125	81 21.6	53967
1992	1 01.4	8088	53352	8087	144	81 22.8	53962
1993	1 12.9	8065	53356	8063	171	81 24.3	53962
1994	1 25.9	8044	53374	8041	201	81 25.8	53977
1995	1 38.4	8038	53374	8035	230	81 26.1	53976
1996	1 51.4	8023	53385	8019	260	81 27.2	53985
1997	2 07.2	8004	53406	7999	296	81 28.6	54003
1998	2 24.0	8001	53440	7994	335	81 29.1	54036
1999	2 39.1	7998	53471	7989	370	81 29.6	54066
2000	2 55.5	7996	53504	7986	408	81 30.0	54098
2001	3 12.4	7992	53542	7979	447	81 30.6	54135
2002	3 29.7	7989	53585	7974	487	81 31.2	54177
2003	3 49.8	7965	53646	7947	532	81 33.3	54234
2004	4 04.2	7961	53675	7941	565	81 33.8	54262
2005	4 20.5	7953	53707	7930	602	81 34.6	54293
2006	4 36.2	7958	53727	7932	639	81 34.5	54314
2007	4 51.3	7950	53757	7922	673	81 35.2	54342
2008	5 07.9	7941	53785	7909	710	81 36.1	54368

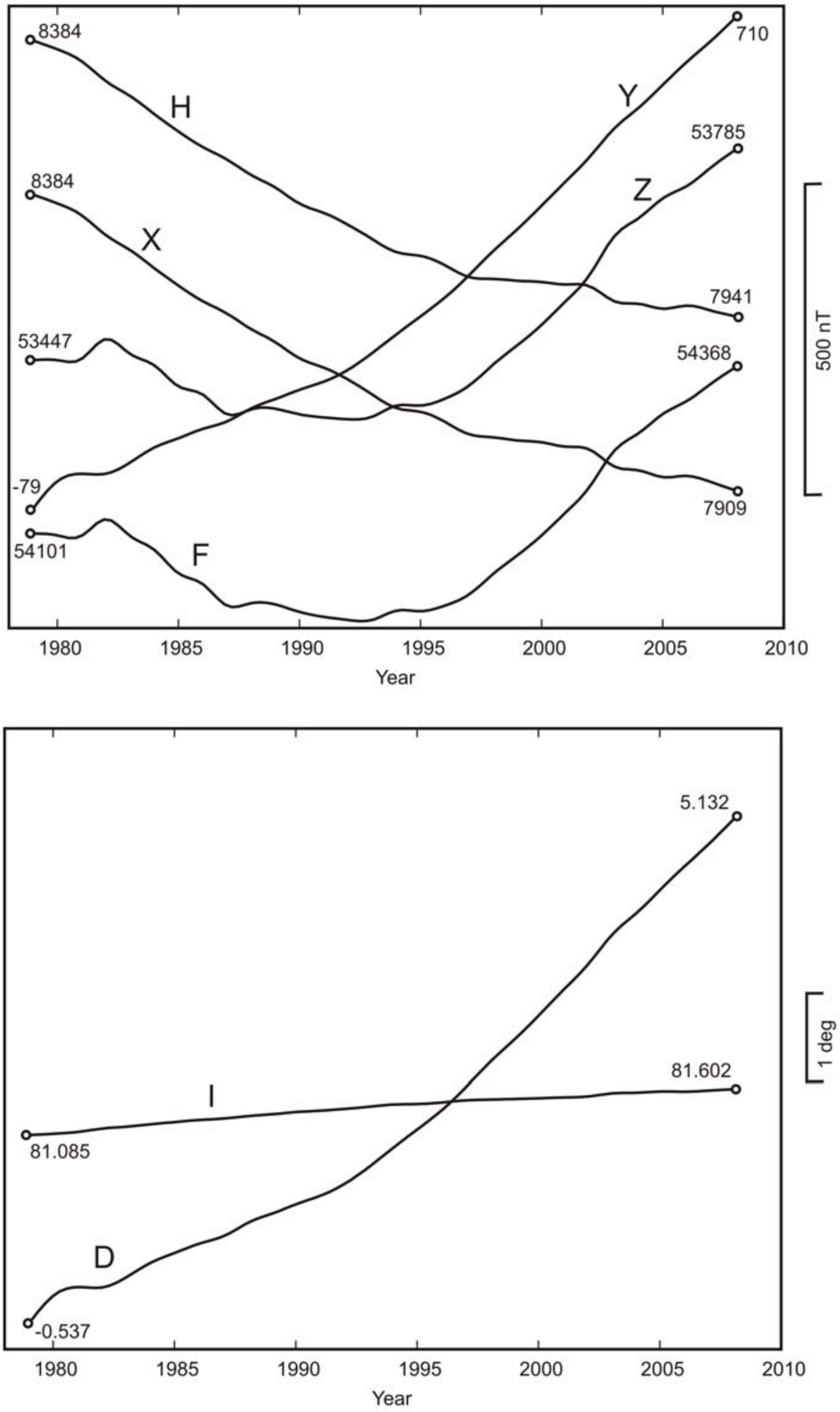

Fig. 27. Secular changes of H, X, Y, Z, F, D and I at Hornsund.

MONTHLY AND YEARLY MEAN VALUES OF MAGNETIC ELEMENTS

Hornsund **2008**

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
NORTH COMPONENT: 7500 + ... in nT													
All days	398	396	398	410	424	425	424	417	409	402	403	398	409
Quiet days	414	418	416	417	425	428	421	419	411	411	409	408	416
Disturbed days	372	369	352	388	424	418	417	413	389	370	386	368	389
EAST COMPONENT: 500 + ... in nT													
All days	196	197	202	201	200	204	210	213	219	223	228	230	210
Quiet days	192	194	198	200	200	205	209	213	217	222	225	228	209
Disturbed days	202	196	218	213	197	202	214	215	222	227	236	237	215
VERTICAL COMPONENT: 53500 + ... in nT													
All days	279	282	290	286	277	283	275	281	292	293	294	293	285
Quiet days	269	271	281	285	274	276	284	278	282	287	286	289	280
Disturbed days	282	303	307	292	280	288	269	287	305	302	309	301	294

Three-hour-range K indices

Hornsund, January - March, 2008

The limit of K=9 is 2500

Day	January K	January SK	February K	February SK	March K	March SK
1	1221 2101	10	4333 1245	25	6554 3454	36
2	1210 0022	8	2442 3375	30	3343 3235	26
3	0101 0034	9	5443 2435	30	4333 2133	22
4	0001 0033	7	3343 2256	28	3132 2000	11
5	1233 3255	24	3312 2122	16	1333 4322	21
6	2442 3465	30	1222 1353	19	1232 1112	13
7	4443 3223	25	3211 1214	15	3121 1011	10
8	2343 2555	29	4222 3024	19	0012 4211	11
9	4333 1132	20	1111 2122	11	4533 3655	34
10	2222 1115	16	1223 4355	25	3453 3345	30
11	5222 1030	15	2443 3643	29	4343 4634	31
12	0023 1212	11	2453 3264	29	2453 3265	30
13	2322 2344	22	1343 3552	26	1454 4324	27
14	3464 3464	34	2343 3165	27	2443 3644	30
15	2443 3224	24	2444 4553	31	3354 3221	23
16	2464 3655	35	1443 2252	23	2422 3312	19
17	3333 3244	25	0143 2103	14	3311 2332	18
18	3553 3333	28	1233 3355	25	2322 3111	15
19	2353 3542	27	3243 3354	27	0332 3565	27
20	1443 2154	24	1333 2200	14	2223 3121	16
21	2233 2444	24	1233 3432	21	2222 1052	16
22	3222 2120	14	0122 2100	8	1212 2113	13
23	0122 3045	17	0232 2253	19	3433 2112	19
24	1322 2323	18	1123 1222	14	1312 1110	10
25	2442 1063	22	1223 1100	10	0112 2112	10
26	3243 2213	20	0222 1113	12	2234 3435	26
27	1311 1253	17	1321 3452	21	4644 3355	34
28	1222 1034	15	4433 3556	33	4444 5445	34
29	1223 2001	11	6344 3736	36	3333 4345	28
30	1111 1000	5			3333 3233	23
31	0000 0124	7			2212 2252	18

Three-hour-range K indices

Hornsund, April - June, 2008

The limit of K=9 is 2500

Day	April K	April SK	May K	May SK	June K	June SK
1	2322 1210	13	2232 2225	20	3332 2522	22
2	0110 0020	4	4332 3101	17	2313 2233	19
3	1001 2100	5	3224 4242	23	2222 2144	19
4	0221 3445	21	2333 3544	27	2222 2111	13
5	2233 3733	26	3342 3632	26	2112 1121	11
6	3443 3252	26	5333 3143	25	1322 3223	18
7	2443 2653	29	2222 2143	18	3244 4354	29
8	2233 4334	24	2343 1231	19	2323 3343	23
9	2344 3153	25	2222 3001	12	3212 2032	15
10	2343 3255	27	1331 2021	13	1111 2120	9
11	2322 3321	18	2231 1032	14	1121 1101	8
12	2344 3153	25	1121 1231	12	1331 1103	13
13	2233 3541	23	1311 1111	10	1220 1010	7
14	1212 0100	7	1122 2132	14	1112 2336	19
15	0102 2124	12	1210 2111	9	3543 4333	28
16	1234 3253	23	2313 2121	15	3343 2455	29
17	2223 3220	16	1001 1110	5	3444 3433	28
18	1343 3212	19	0111 2001	6	4433 3121	21
19	2232 2212	16	3222 3231	18	2222 2242	18
20	2211 2431	16	2322 3235	22	2343 3222	21
21	2222 1210	12	3333 3222	21	2212 3122	15
22	1112 1141	12	2433 3552	27	2222 2100	11
23	3454 4632	31	2112 4253	20	2221 2100	10
24	5455 4344	34	4343 3422	25	2211 1123	13
25	2433 3252	24	1322 3122	16	3331 3233	21
26	4433 3425	28	1222 1232	15	4444 4321	26
27	2222 2321	16	2112 2214	15	3333 3411	21
28	2223 5455	28	3443 3332	25	2222 2351	19
29	2342 2253	23	3233 3442	24	3322 2223	19
30	1212 2541	18	3323 4552	27	1222 3222	16
31			1345 3342	25		

Three-hour-range K indices

Hornsund, July - September, 2008

The limit of K=9 is 2500

Day	July K	July SK	August K	August SK	September K	September SK
1	2233 2121	16	1221 2123	14	1120 2122	11
2	2212 2022	13	1011 2002	7	0111 2100	6
3	1111 2111	9	1111 1212	10	0333 2215	19
4	0101 2310	8	1111 1112	9	7753 3335	36
5	2233 3224	21	0121 2100	7	2323 2133	19
6	3222 2121	15	1122 2132	14	4322 3212	19
7	1221 0003	9	2211 1113	12	3333 3252	24
8	1001 1112	7	1211 1111	9	2343 2553	27
9	1111 2111	9	2433 2436	27	2433 2003	17
10	1113 2222	14	2343 3334	25	2221 1143	16
11	3222 3212	17	2333 3221	19	1210 0123	10
12	3545 3333	29	2343 3212	20	3110 1000	6
13	2333 3543	26	2322 2132	17	0010 0000	1
14	2344 3533	27	2311 2201	12	0112 1134	13
15	2333 3122	19	3212 1110	11	2344 4353	28
16	2332 1234	20	0123 2122	13	1333 2653	26
17	3322 1220	15	3212 2212	15	3311 0011	10
18	2322 2211	15	2335 4354	29	1232 3243	20
19	1101 1003	7	3333 3431	23	0121 2122	11
20	1111 2022	10	2323 2210	15	0221 1100	7
21	2223 3221	17	1122 2221	13	0001 1001	3
22	1233 4244	23	2111 1111	9	3311 1000	9
23	4443 5432	29	2220 2003	11	2212 2101	11
24	4332 3244	25	1002 1002	6	1212 2100	9
25	2322 2013	15	1011 1001	5	0001 1023	7
26	2222 2231	16	0001 2011	5	1311 2000	8
27	1112 2133	14	1311 2010	9	0020 1022	7
28	2333 2211	17	1102 1112	9	1122 2000	8
29	1221 1113	12	1221 1110	9	0222 2003	11
30	2322 1121	14	0222 0000	6	0120 2203	10
31	1112 2111	10	0011 3123	11		

Three-hour-range K indices

Hornsund, October - December, 2008

The limit of K=9 is 2500

Day	October K	October SK	November K	November SK	December K	December SK
1	2223 3212	17	1222 0011	9	0100 0000	1
2	3333 3253	25	0121 2111	9	0000 0000	0
3	2344 3345	28	0212 0001	6	0101 2114	10
4	3443 2212	21	1100 0003	5	1533 2223	21
5	2422 2012	15	0000 0000	0	2322 2324	20
6	0222 1000	7	0000 0011	2	5433 3763	34
7	0111 1132	10	0222 2125	16	2343 3423	24
8	1100 0000	2	2434 3143	24	2221 1233	16
9	0020 1000	3	4323 3244	25	1101 0000	3
10	0111 1002	6	2222 1220	13	0110 1133	10
11	1243 4653	28	0201 0010	4	2212 1220	12
12	3332 3654	29	1111 1011	7	1111 2122	11
13	2233 2152	20	1000 0000	1	3111 1023	12
14	2222 2231	16	0110 0000	2	1101 2002	7
15	2222 2414	19	0210 0001	4	0220 0012	7
16	3221 1121	13	3332 1025	19	1112 2154	17
17	0011 1120	6	2241 1033	16	3311 2323	18
18	0000 0010	1	1100 0000	2	0100 0043	8
19	1112 2232	14	0010 0120	4	0111 2211	9
20	1120 1112	9	1200 0032	8	0011 1100	4
21	2221 1102	11	1110 0000	3	0112 0110	6
22	0111 1232	11	0000 0000	0	0000 1321	7
23	2222 1000	9	0121 0011	6	3233 2266	27
24	0310 1000	5	0000 0000	0	3432 2143	22
25	0100 0001	2	3333 2255	26	1112 2143	15
26	0331 1101	10	4533 2155	28	2211 1014	12
27	3111 0000	6	4333 2254	26	2012 2010	8
28	0123 1112	11	2222 2045	19	1020 1113	9
29	3442 2663	30	1231 1113	13	0100 0003	4
30	2433 3634	28	3112 0100	8	0100 0011	3
31	2233 1143	19			1333 2254	23

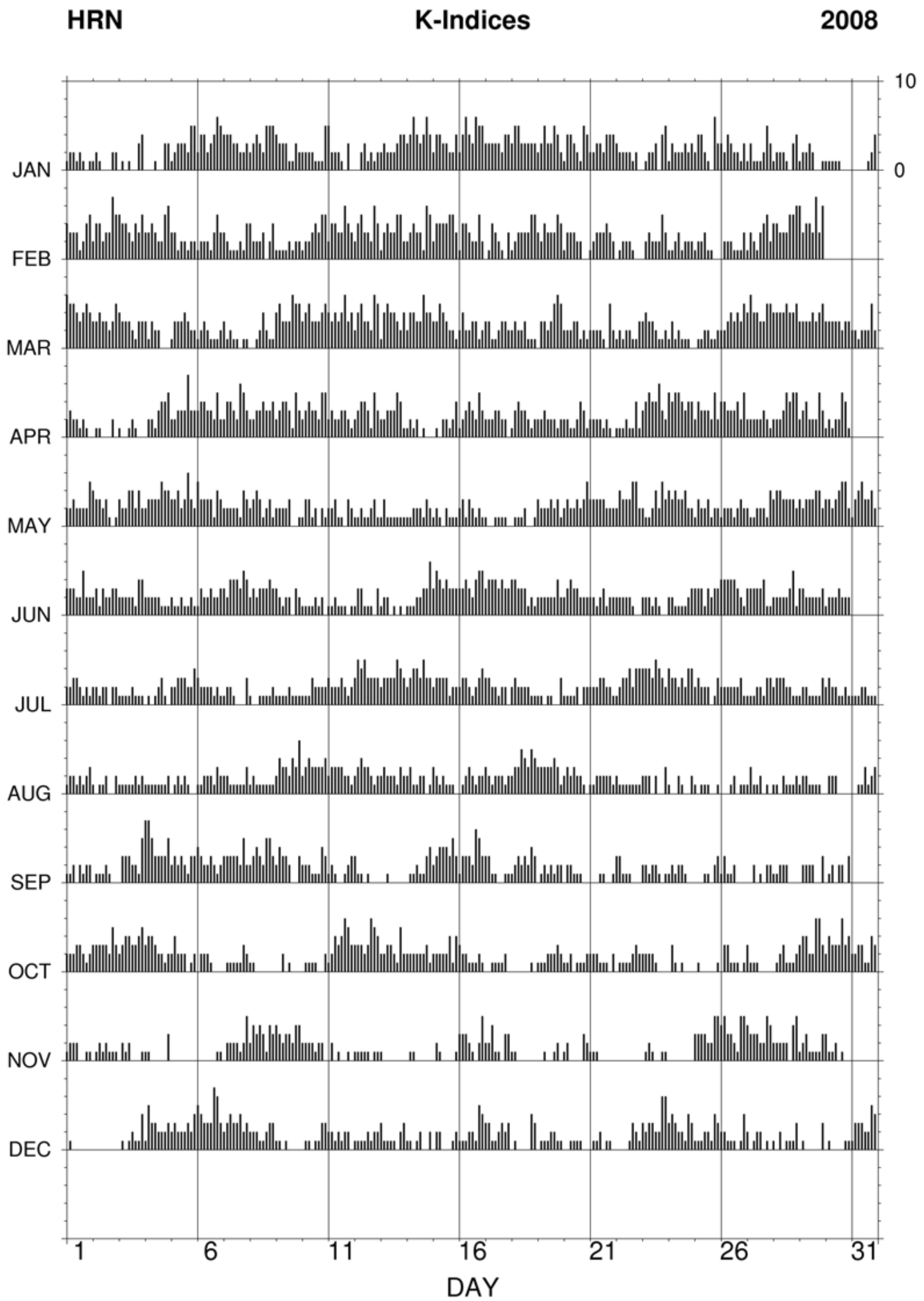

Fig. 28. K-indices in graphical form, Hornsund 2008.

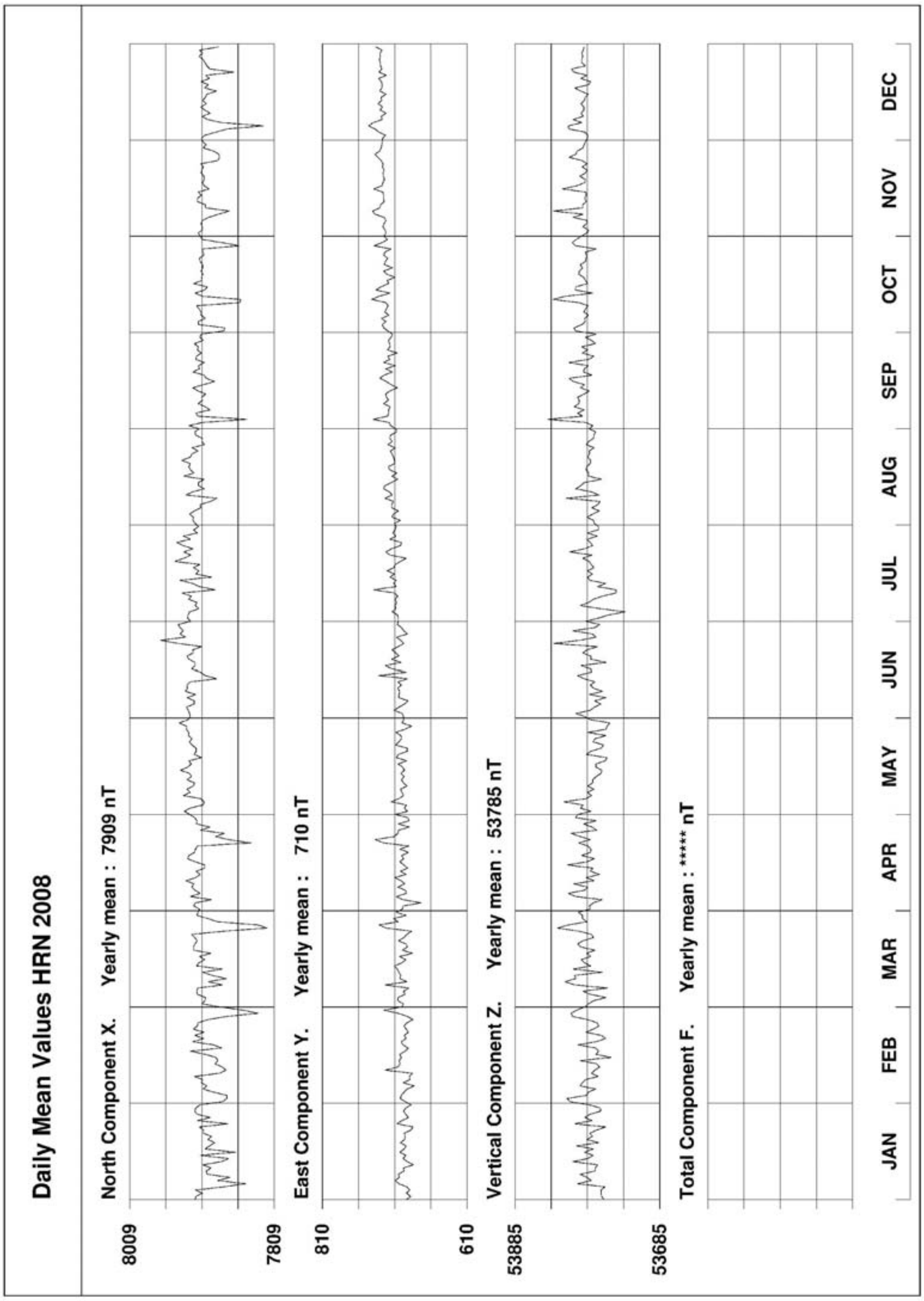

Fig. 29. Daily mean data plot for Hornsund 2008.

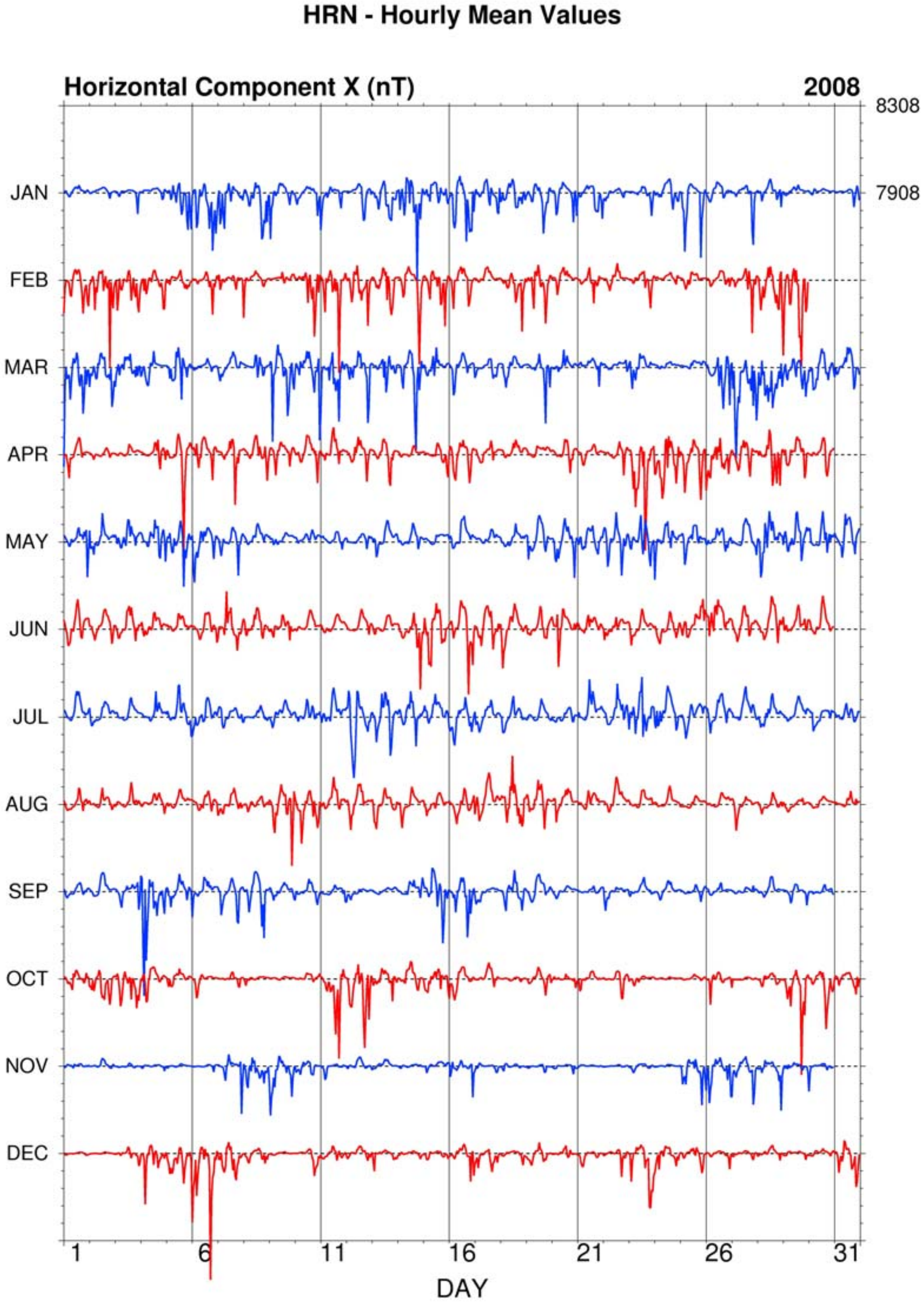

Fig. 30. Hourly mean data plot of X component for Hornsund.

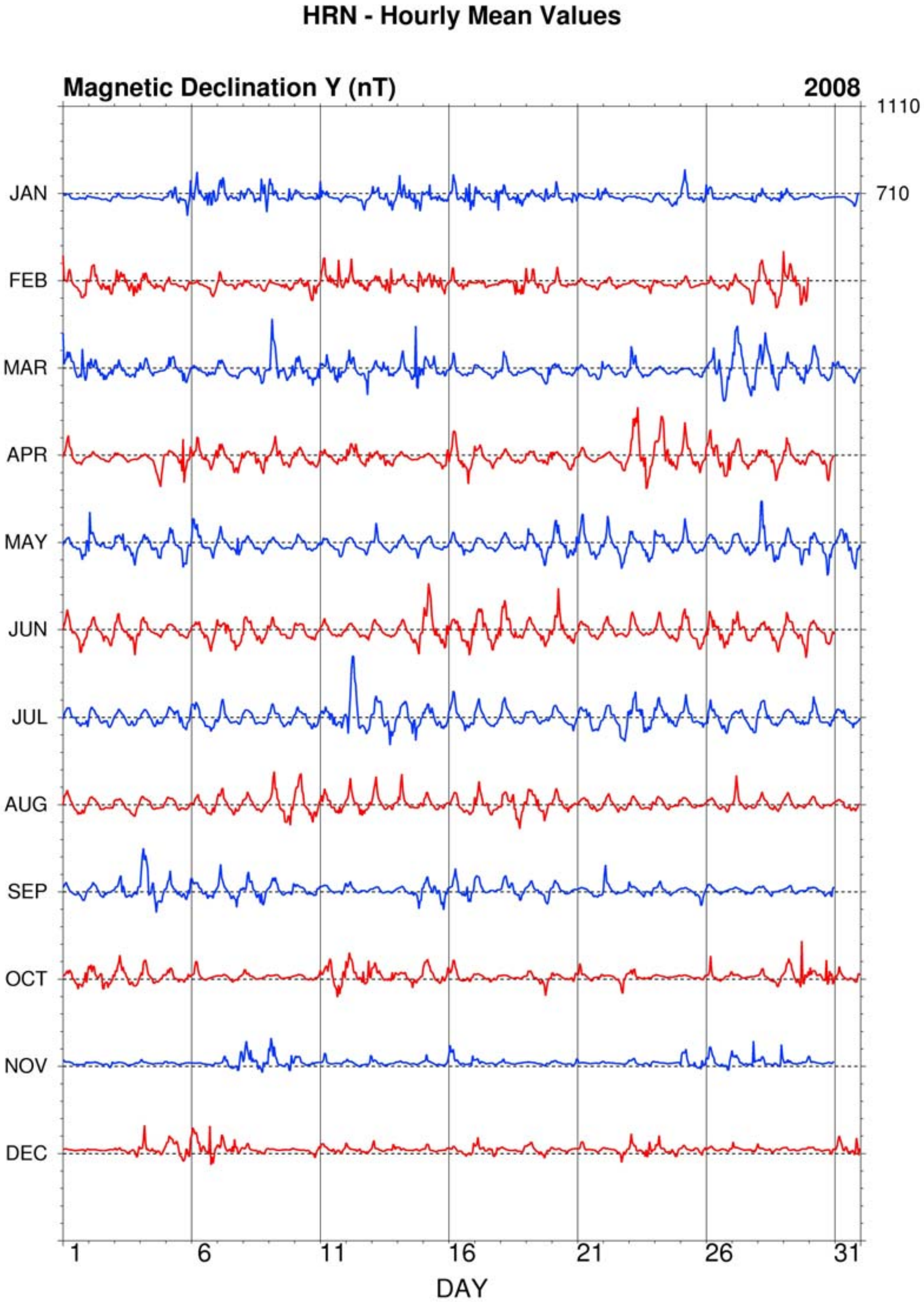

Fig. 31. Hourly mean data plot of Y component for Hornsund.

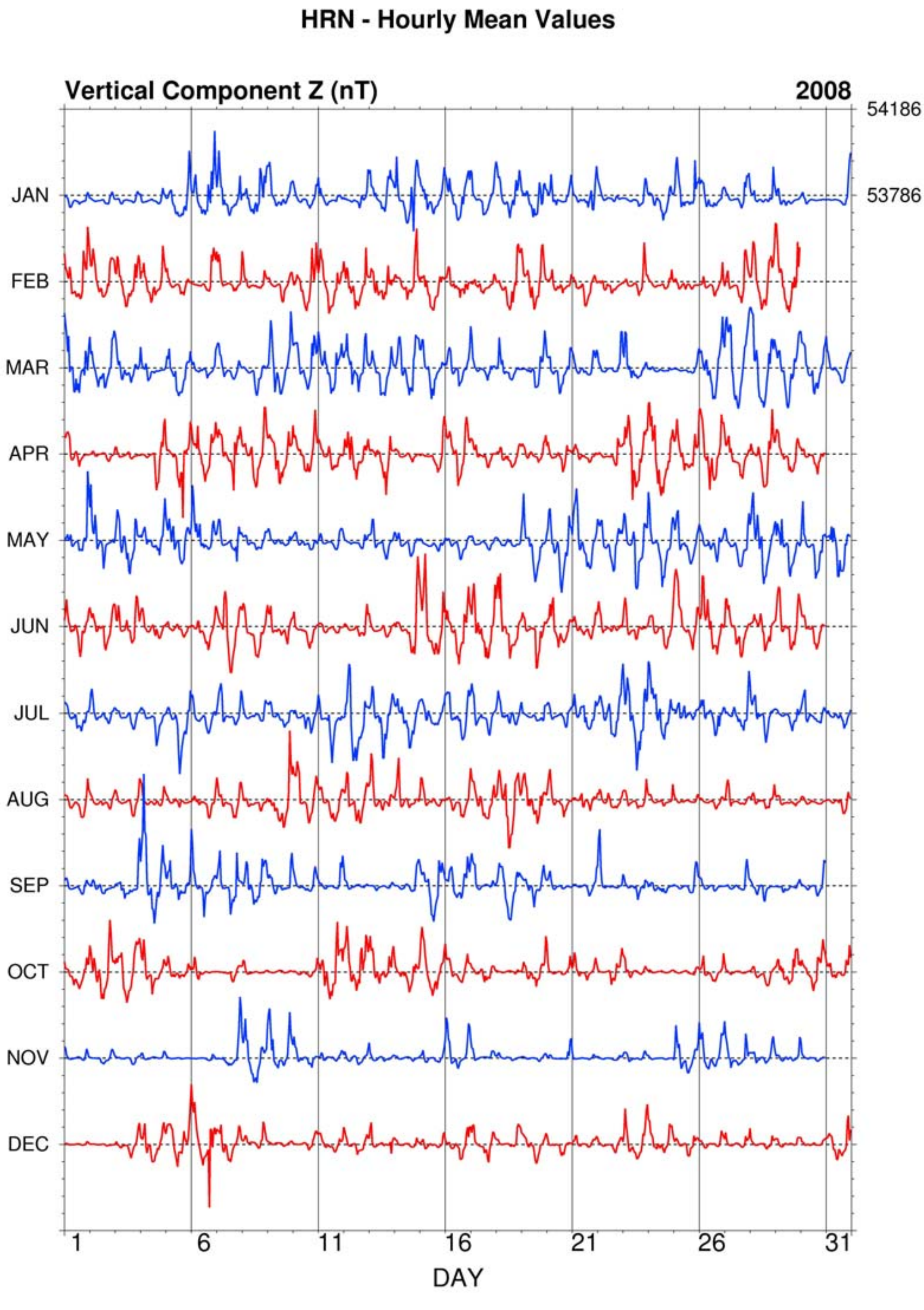

Fig. 32. Hourly mean data plot of Z component for Hornsund.

List of Yearbooks from Polish Geomagnetic Observatories

Below is the list of yearbooks with the results from the Polish geomagnetic observatories. Since the year 2006, one joint yearbook has been published in place of individual yearbooks from each observatory. The present edition is an activity report, and refers the reader to the internet where one-minute data are available. Most of the issues listed below are still available from the Institute of Geophysics.

I. Results of Geomagnetic Observations Belsk, Hel, Hornsund (since 2006)

Published in

***Publications of the Institute of Geophysics, Pol. Acad. Sc.*:**

2006 – no C-100 (402)

2007 – no C-101 (408)

II. Results of Geomagnetic Observations, Belsk Geophysical Observatory (1966-2005)

Published in

***Materiały i Prace Zakładu Geofizyki PAN*:**

1966 – no 20;	1967 – no 27;	1968 – no 42;	1969 – no 46;
1970 – no 50;	1971 – no 57;	1972 – no 70;	1973 – no 76;
1974 – no 88			

***Publications of the Institute of Geophysics, Pol. Acad. Sc.*:**

1975 – no C-2 (107);	1976 – no C-4 (114);	1977 – no C-5 (125);
1978 – no C-8 (133);	1979 – no C-9 (139);	1980 – no C-10- (144);
1981 – no C-13 (159);	1982 – no C-17 (166);	1983 – no C-20 (180);
1984 – no C-23 (187);	1985 – no C-26 (196);	1986 – no C-29 (205);
1987 – no C-34 (218);	1988 – no C-37 (227);	1989 – no C-38 (228);

1990 – no C-40 (240); 1991 – no C-45 (250); 1992 – no C-49 (259);
1993 – no C-51 (267); 1994 – no C-55 (277); 1995 – no C-58 (287);
1996 – no C-61 (296); 1997 – no C-68 (305); 1998 – no C-70 (312);
1999 – no C-74 (318); 2000 – no C-79 (328); 2001 – no C-82 (343);
2002 – no C-85 (356); 2003 – no C-89 (368); 2004 – no C-92 (379);
2005 – no C-96 (392)

III. Results of Geomagnetic Observations, Hel Geophysical Observatory (1958-2005)

Published in

***Publications of the Institute of Geophysics, Pol. Acad. Sc.*:**

1958-1965 – no C-41 (241); 1966-1970 – no C-6 (127);
1971-1975 – no C-7 (128); 1976-1979 – no C-11 (154);
1980-1981 – no C-16 (165) 1982 – no C-18 (170);
1983 – no C-19 (179); 1984 – no C-24 (128); 1985 – no C-25 (195);
1986 – no C-30 (206); 1987 – no C-33 (217); 1988 – no C-36 (226);
1989 – no C-39 (239); 1990 – no C-42 (242); 1991 – no C-46 (251);
1992 – no C-50 (260); 1993 – no C-52 (268); 1994 – no C-56 (278);
1995 – no C-59 (288); 1996 – no C-62 (297); 1997 – no C-67 (304);
1998 – no C-71 (313); 1999 – no C-76 (320); 2000 – no C-81 (330);
2001 – no C-84 (345); 2002 – no C-87 (358); 2001 – no C-84 (345);
2003 – no C-91 (370); 2004 – no C-94 (381); 2005 – no C-98 (394)

IV. Results of Geomagnetic Observations, Polish Polar Station Hornsund, Spitsbergen (1978-2005)

Published in

***Publications of the Institute of Geophysics, Pol. Acad. Sc.*:**

1978-1979 – no C-14 (163); 1980-1981 – no C-27 (199);
1982-1983 – no C-31 (210); 1984-1985 – no C-43 (243);

1986-1987 – no C-47 (254);		1988-1989 – no C-48 (256);
1990-1991 – no C-53 (272);		1992-1993 – no C-57 (286);
1994-1995 – no C-64 (301);		1996 – no C-66 (303);
1997 – no C-69 (311);	1998 – no C-72 (315);	1999 – no C-75 (319);
2000 – no C-80 (329);	2001 – no C-83 (344);	2002 – no C-86 (357);
2003 – no C-90 (369);	2004 – no C-93 (380);	2005 – no C-97 (393)

V. Results of Geomagnetic Observations, Polish Antarctic Station Arctowski (1978-1995)

Published in

***Publications of the Institute of Geophysics, Pol. Acad. Sc.*:**

1978-1979 – no C-21 (181);	1980-1981 – no C-22 (182);
1982-1983 – no C-28 (202);	1984-1985 – no C-32 (212);
1986-1987 – no C-35 (225);	1988-1989 – no C-44 (244);
1990-1991 – no C-54 (276);	1992-1993 – no C-60 (292);
1994-1995 – no C-63 (300)	

VI. Yearbooks from Świder Observatory (1937-1967)

Annuaires Magnetiques (*Roczniki magnetyczne*) for the years 1937-1967 were published in *Travaux de l'Observatoire Geophysique de St. Kalinowski a Swider* (*Prace Obserwatorium Geofizycznego im. St. Kalinowskiego w Świdrze*).