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Yearbook
Magnetic Results
2001, 2002, 2003

Adolf Schmidt
Geomagnetic Observatory
Niemegk

Geomagnetic Observatory
Wingst

Potsdam 2007

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Editor:
Dr. Hans-Joachim-Linthe
GeoForschungsZentrum Potsdam
Adolf Schmidt Geomagnetic
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D-14823 Niemegk

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Yearbook

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Contents

RESULTS OF THE OBSERVATIONS AT THE ADOLF-SCHMIDT-OBSERVATORIUM FÜR GEOMAGNETISMUS AT NIEMEGK IN THE YEAR 2001

H.-J. Linthe

1. Summary/Introduction

This part of the bulletin reports the observations carried out during the year 2001 at the Niemegk Geomagnetic Adolf Schmidt Observatory.

Instrumentation, Observation and Data
During 2001 the recordings and measurements at the Niemegk observatory have been continued without interruption.
Absolute measurements were taken at least once per week using the DI-flux theodolite and an Overhauser effect proton magnetometer. The four classical variometers remained in operation. The three component flux-gate variometers FGE, GEOMAG and MAGSON and the total field variometer GSM recorded continuously throughout the year. In 2001 the sensor locations were not modified. The telluric lines were equipped by a digital data logger. The other recording equipments remained unchanged. The photographic recordings of the classical East system, the storm system and of the telluric lines were stopped on 31 December 2001.
The Niemegk observatory has continued to participate in the INTERMAGNET project. The recordings of the GEOMAG variometer were sent hourly by METEOSAT as Reported Data. The Definitive Data (minute and hourly mean values) have been submitted for the INTERMAGNET CD-ROM and sent to the World Data Centres.
The Kp calculation was continued as in 2000. Twice a month, immediately after receiving the K numbers of the 13 Kp observatories, the Kp and derived indices are calculated and distributed by e-mail. The tables and diagrams are produced monthly and sent to the users. The whole Kp data series are also available online at:
http://www.gfz-potsdam.de/pb2/pb23/GeoMag/niemegk/kp_index/index.html.
A new repeat station measurement campaign was started. The measurements at about half of the stations were finished in time for the magnetic map of Germany for the period 2002.5.

Meetings and Visitors
On 3 May 2001, a meeting took place at Niemegk observatory with scientists involved in the observatories Fürstenfeldbruck, Göttingen, Niemegk, Wingst and Lovö (Sweden). M. Beblo, V. Haak, R. Holme, H.-J. Linthe, E. Pulz, G. Schulz, G. Schwarz, H. Soffel and P. Spitta attended this meeting.
H.-J. Linthe attended the NATO Advanced Research Workshop on Deep Electromagnetic Soundings of the Mantle around the Teisseyre-Tornquist Zone, held 30 May – 2 June 2001 in Belsk (Poland). R. Holme, and H.-J. Linthe participated in the IAGA scientific conference in Hanoi (Vietnam).
The following student groups visited the observatory in the frame of their lectures:

- Institute for Geophysics and Meteorology of the Technical University of Braunschweig on 12 June 2001 (7 participants).
- Institute for Planetary Geodesy of the Technical University of Dresden on 5 July 2001 (31 participants).

The training “Absolute determination of the geomagnetic field vector” was carried out by the following student groups, coming from:

- Geophysical Institute of the Freie Universität Berlin on 24 January, 2001.
- Geoscience Institute of Potsdam University on 12, 13 and 14 December, 2001.

On 24 April 2001 3 scientists from Hurbanovo Observatory (Slovakia) visited the observatory for comparison measurements. On 25 May 2001 18 international geophysics students visited the observatory in the frame of the Geophysical Action Program. P. Kotzè and P. Fourie from Hermanus Magnetic Observatory (South Africa) visited the observatory on 13 September 2001.
The Personnel Council of the GeoForschungsZentrum visited the observatory on 1 October 2001 for a meeting and a guided tour. Five groups of private persons got guided tours at the observatory.

Constructional Changes
The first floor of the workshop building (house No. 26) was renovated. The electrical system, painting and floors were renewed. In the power unit house (house No. 25) a new main electric distribution system was installed.

Data Availability
In addition to this yearbook NGK information is available online. The observatory's homepage is

http://www.gfz-potsdam.de/pb2/pb23/Niemegk/dt/index.html (German version)
http://www.gfz-potsdam.de/pb2/pb23/Niemegk/en/index.html (English version)

The preliminary variations and K indices in graphical form can be found at

http://www.gfz-potsdam.de/pb2/pb23/GeoMag/niemegk/Magnetogram/niemegk_dhz.html
http://www.gfz-potsdam.de/pb2/pb23/GeoMag/niemegk/Magnetogram/niemegk_k.html

A digital archive of minute mean data can be accessed at

http://www.gfz-potsdam.de/pb2/pb23/GeoMag/niemegk/DB/index.html

Rapid access information is published in the Monthly Reports, also available at:

http://www.gfz-potsdam.de/pb2/pb23/GeoMag/niemegk/monrep

Both publications, this report and the monthly report, can be requested from the GFZ; see the address in the impressum.

Acknowledgements
The following persons participated in the production of this yearbook: I. Goldschmidt for absolute measurements and tables, M. Fredow for absolute measurements and plots, J. Schulz for tables and typing of the manuscript and J. Haseloff for diagrams.

Content of the CD
As in the 2000 issue the complete results of the observatory are given in digital form on a CD-ROM. Wingst observatory data are included. The structure and the data formats of the CD-ROM are organised in the same manner as for INTERMAGNET [3]. Because this report will be published together with the 2002 and 2003 issues, the data files of these years are included on the CD-ROM. The CD contains this report as "yearb01.pdf", the 2002 one as "yearb02.pdf", the 2003 one as "yearb03.pdf" and the following directories:

- INTERMAGNET
- Niemegk
- Wingst

The substructure of the directories is as follows:

INTERMAGNET

```
INTERMAGNET
│
├── gmag.cfg                          Configuration file for imag23.exe
├── imag23.exe                        Browsing program
├── instimag.exe                      Installation program
├── readme.txt                        ASCII file containing contents information
├── mag1995 ... mag2003
│   ├── ctry_inf
│   │   ├── ctrylist.idx              Country list file for imag23.exe
│   │   └── intro.pcx                 Welcome graphic file for imag23.exe
│   ├── SSS                           Data subdirectories NGK, WNG
│   │   ├── SSSYYjan.bin              January minute mean values binary file
│   │   ├── SSSYYfeb.bin              February minute mean values binary file
│   │   │   ...
│   │   ├── SSSYYdec.bin              December minute mean values binary file
│   │   ├── SSSYY.blv                 ASCII base line file
│   │   ├── SSSYYk.dka                ASCII K number file
│   │   ├── readme.SSS                ASCII information file
│   │   └── yearmean.SSS              ASCII annual mean values file
│   └── obsy_inf
│       └── YYobsdat.dbf              Configuration file for imag23.exe
├── plotutil
│   ├── hpgl                          HP-GL plotting programs :
│   │   ├── imagblv.exe               Base lines
│   │   ├── imagdayl.exe              Daily mean values
│   │   ├── imaghour.exe              Hourly mean values
│   │   ├── imagknum.exe              K numbers
│   │   └── imagn.exe                 Daily magnetograms
│   └── ps                            PostScript plotting programs:
│       ├── gs601w32.exe              Ghostscript
│       ├── gsv34w32.exe              Ghostview
│       ├── imagplot.exe              Plotting program for Windows
│       ├── readme.txt                Information about PS plotting
│       └── salflibc.dll              Windows system file
└── xtras
    ├── prnstruc.exe                  Display of the binary file format
    └── structur.dat                  Data file for prnstruc.exe
```

with: YY = Year (95-99, 00-03); SSS = NGK, WNG

```
Niemegk
│
└──── dataYY                             YYYY data files in IAGA2002 format
        ├──── ngkYYYYMMdhor.hor          Hourly mean values
        ├──── ngkYYYYdday.day            daily mean values
        ├──── ngkYYYYdmon.mon            monthly mean values
        └──── ngkYYYYdyea.yea            annual mean values
```

with: MM = month (00…12)

```
Wingst
├──── tree_YY.txt                        File structure of directory Wingst
├──── yearb
│       ├────instr.txt                   Instruments used since 1938
│       └────abs_meas.pdf                Reprint of SCHULZ, 2002
└──── dataYY                             YYYY data files
        ├──── wlh+wng.yr                 Updated epoch values WLH and WNG
        ├──── wng.mon                    Updated monthly mean values WNG
        ├──── wng.day                    Updated daily mean values WNG
        ├──── wng.k                      Updated WNG K numbers
        └──── iagaYY                     YYYY data files in IAGA2000 format
                ├──── yr.wng             Epoch values WNG
                ├──── YYYYmt.wng         Monthly mean values
                ├──── YYYYdy.wng         Daily mean values
                ├──── YYYYMMhr.wng       Hourly mean values
                └──── YYYYMMmn.wng       Minute mean values
```

with: MM = month (01…12); YYYY = Year (2001-2003); YY = Last 2 numbers of the year (01-03)

2. Variation Recording

In 2001 the following recording equipment were in operation (Table 1):

- 3 three component flux-gate variometers with digital recording (FGE, GEOMAG, MAGSON)
- 1 scalar Overhauser effect proton magnetometer with digital recording (GSM)
- 1 three component induction coil magnetometer with analogue and digital recording (ICM)
- 4 classical variometer systems with photographic recording (CS, CW, CE, CR)
- 2 telluric recording lines (1000m) with analogue and digital recording (TR)

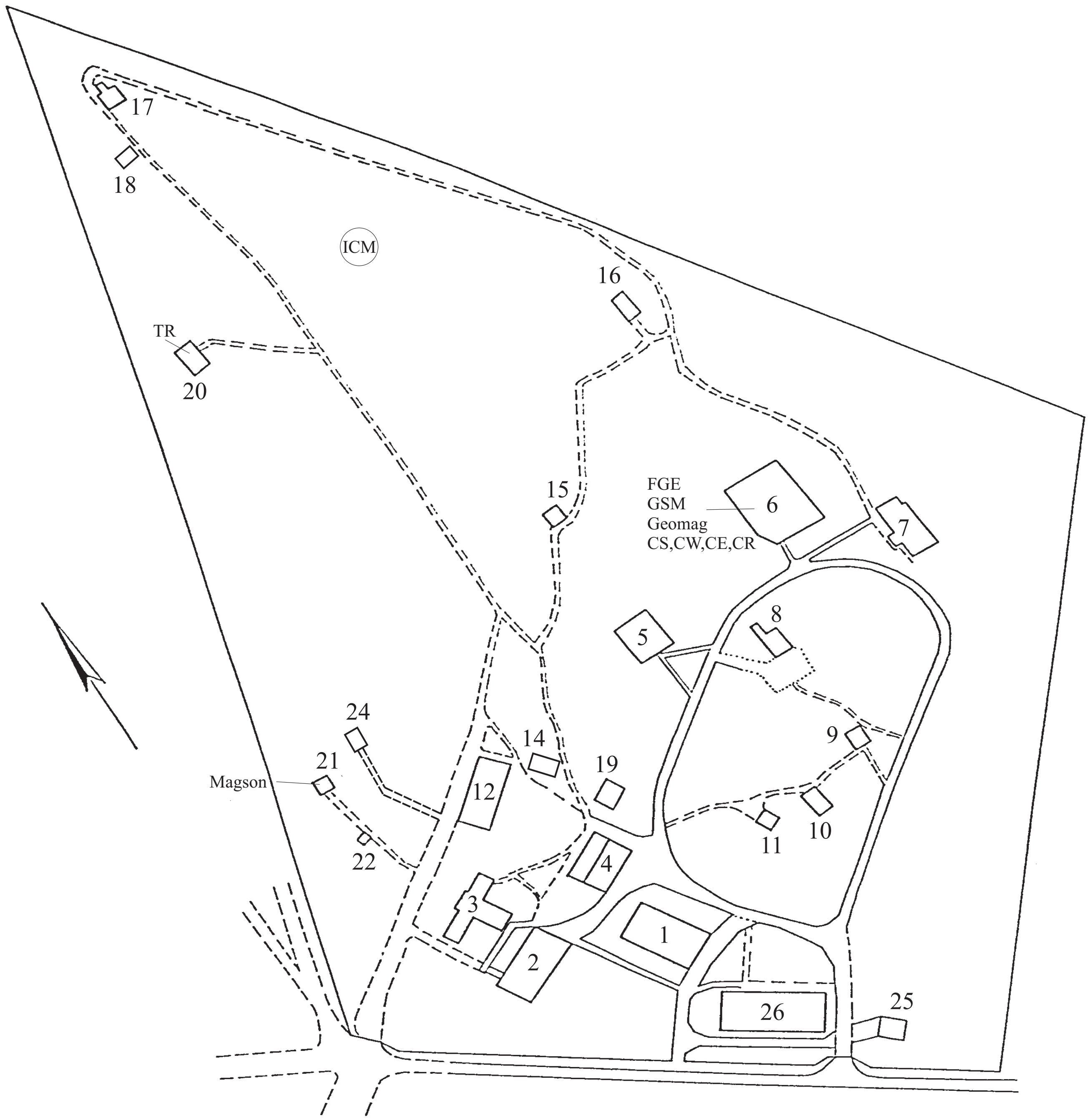
Name	**Elements**	**Recording**	**Sampling rate**	**Resolution**
FGE	H, D, Z	digital	2 Hz	0.1 nT
GEOMAG	X, Y, Z, F	digital	5 s / 1 min	0.1 nT
MAGSON	X, Y, Z	digital	1 s	0.1 nT
GSM	F	digital	5 s	0.01 nT
ICM	X, Y, Z	analogue; digital	360 mm/h; 1s	0.01 nT
CS	X, Y, Z	analogue	20 mm/h	2 nT/mm
CW	H, D, Z	analogue	20 mm/h	2 nT/mm
CE	H, D, F	analogue	20 mm/h	2 nT/mm
CR	H, D, Z	analogue	20 mm/h	10 nT/mm
TR	N-S, E-W	analogue; digital	20 mm/h; 1s	0.2 mV/km/mm;0.1mV

Table 1: Parameters of the variometer systems

Fig. 1 shows a sketch of the premises of the observatory, including the locations of the recording systems. Fig. 2 shows the ground plan of the variation house (building No. 6) showing the locations of the variometers. Fig. 3 shows the block diagram of the recording systems and the data paths. Table 2 contains the conversion factors of the single geomagnetic elements for the year 2001, according to [1], p.5 fig.5; 2.

In the horizontal plane					**In the plane of the magnetic meridian**				
	ΔX/nT	ΔY/nT	ΔH/nT	ΔD/’		ΔH/nT	ΔZ/nT	ΔF/nT	ΔI/’
ΔX/nT	- - -	- 38.5069 -0.02597	0.9997 - 1.0003	-0.14190 -210.542 -	ΔH/nT	- - -	- 0.4163 -2.4019	0.3844 - 2.6018	-13.1286 -15.4041 -
ΔY/nT	- 0.02597 -38.5069	- - -	0.02596 - 38.5199	5.4640 5.4676 -	ΔZ/nT	- 2.4019 -0.4163	- - -	0.9232 - 1.0832	5.4658 36.9998 -
ΔH/nT	- 1.0003 0.9997	38.5199 - 0.02596	- - -	-210.471 0.14194 -	ΔF/nT	- 2.6018 0.3844	1.0832 - 0.9232	- - -	-5.9206 34.1578 -
ΔD/’	- -7.0474 -0.00475	0.1830 - 0.1829	-0.00475 7.0451 -	- - -	ΔI/’	- -0.07617 -0.06492	0.1830 - 0.02703	-0.1689 0.02928 -	- - -
Δ D/nT = 5.4658 · Δ D/’					Δ I/nT = 14.2209 · Δ I/’				

Table 2: Conversion factors for the geomagnetic elements in 2001



1. Main building
2. Electric laboratory
3. Measurement and computer centre
4. Storehouse
5. Magnetic laboratory
6. Variation house
7. Absolute house
8. Heating house
9. Small hut
10. Adjusting hut
11. Thermal adjusting hut
12. Garage

14. Equipments shed
15. Proton magnetometer hut
16. Control hut
17. Coil hut No. 1
18. Control hut
19. Storage hut
20. Telluric hut
21. Coil hut No. 2
22. Small control hut

24. Coil hut No. 3
25. Power unit house
26. Workshop building

Fig. 1: Sketch of the premises of the observatory

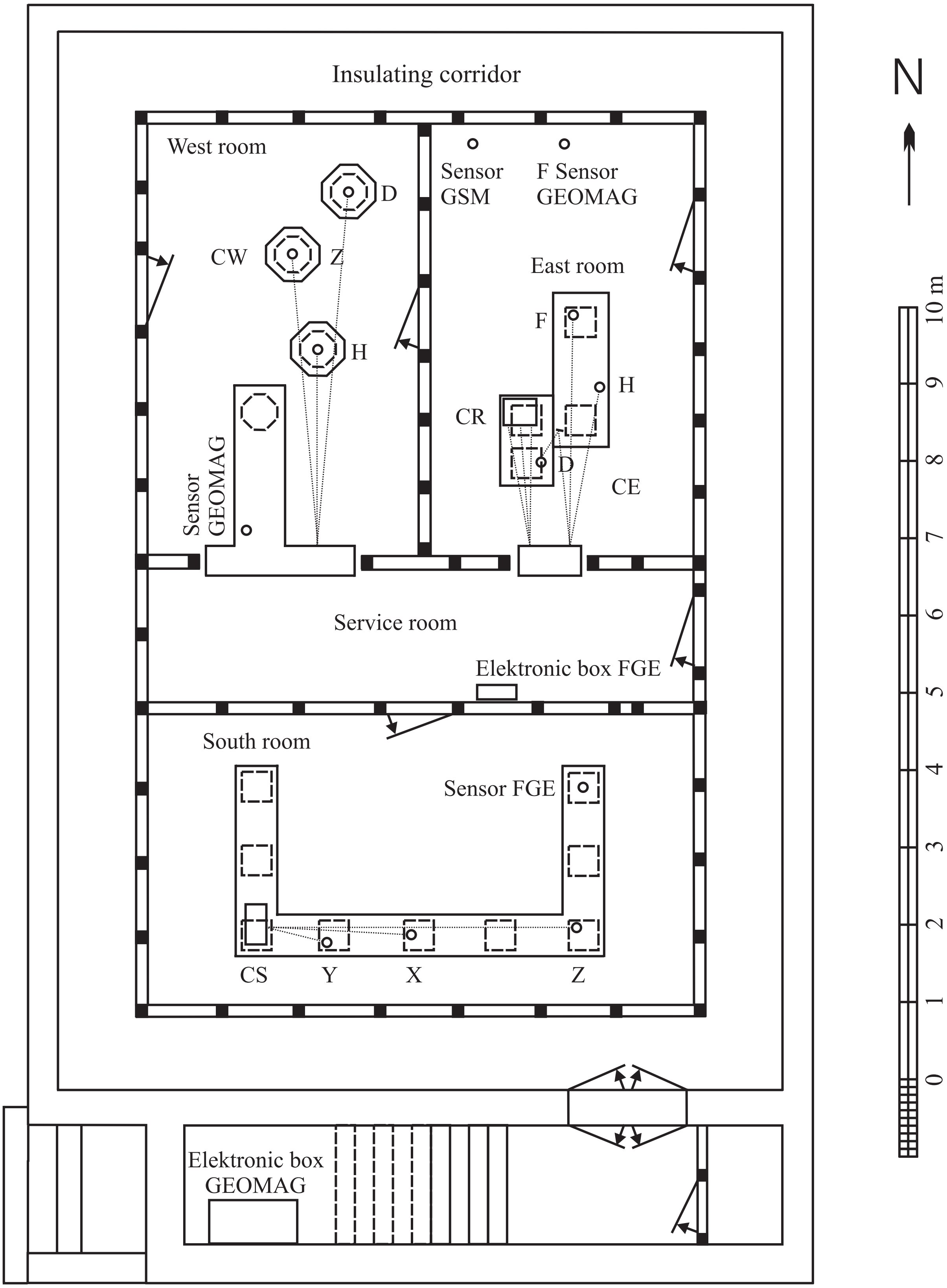


Fig. 2: Ground plan of the variation house with the locations of the variometers

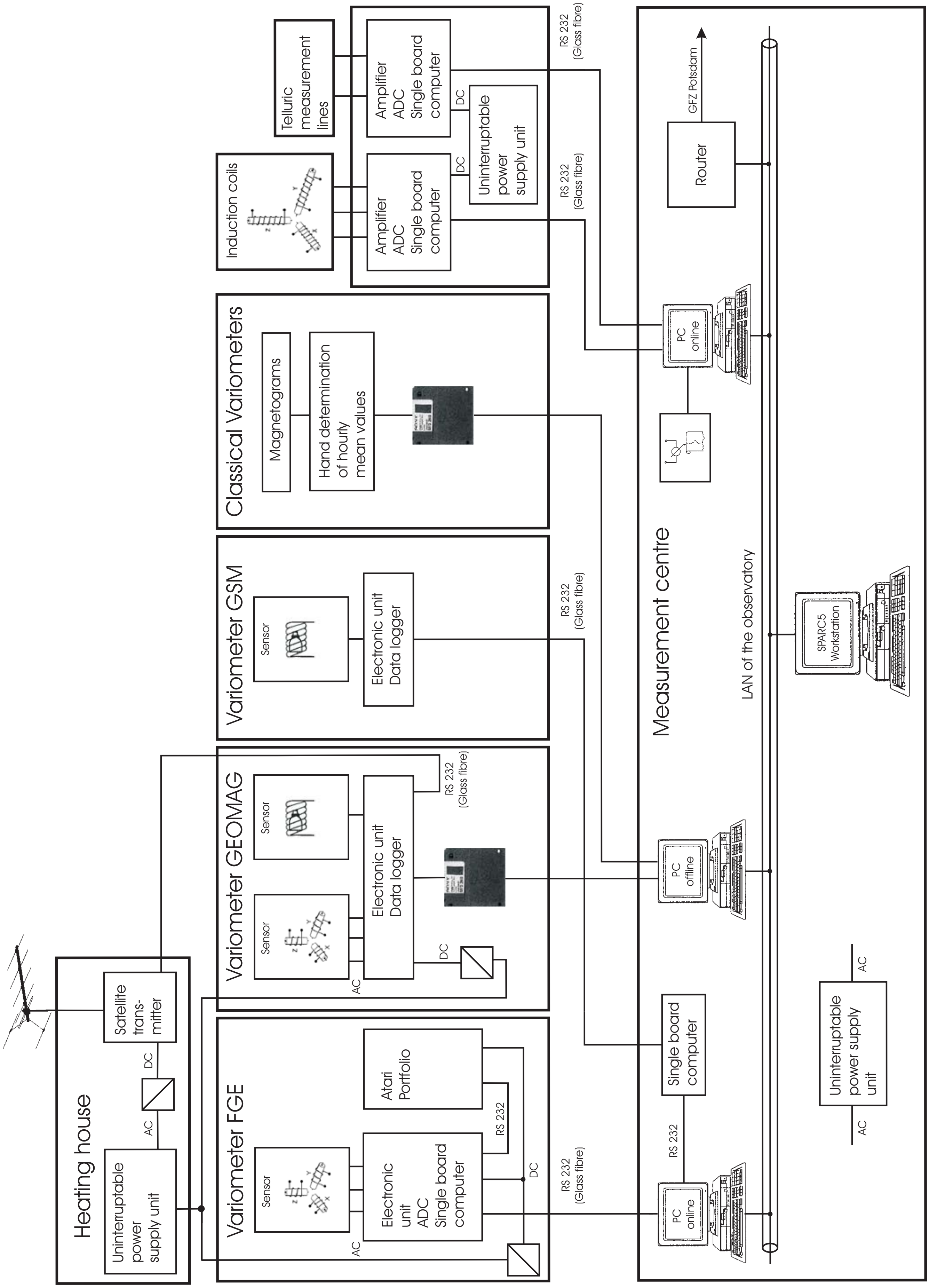


Fig. 3: Block diagram of the recording systems and data paths

2.1 Three component flux-gate variometers

2.1.1 FGE

The FGE variometer is the main vector magnetometer of the observatory. It is a three component linear core flux-gate magnetometer with Cardan's suspension, manufactured by the Danish Meteorological Institute at Copenhagen [2]. The three magnetic elements H, D and Z and the room temperature are recorded.
The scale factor of the instrument is 250 nT/V, the measurement range is $\pm$2500 nT for the magnetic elements. The temperature channel has a scale factor of 1000 K/V with a measurement range of $\pm$2.5 V.
The analogue to digital conversion is carried out by a 20 bit ADC (type CS5506, Crystal) with a sampling rate of 2 Hz by means of a single board computer Z80miniEMUF. The resolution, given by the manufacturer as 0.2 nT is completely satisfied by the 20 bit ADC. The time signal for the data logger is given by a DCF77 radio clock.
The variometer was in operation at the same position and in the same manner as in 2000. The 2 Hz momentary values, obtained by means of the single board computer and the ADC, are transmitted serially (RS232) by glass fibre cable to a PC at the measurement and computer centre (building No. 3). In the same way, minute mean values are transferred to the pocket PC Atari Portfolio. Fig. 5 shows the base lines of this variometer.

2.1.2 GEOMAG

This instrument includes a three component ring core flux-gate magnetometer and an Overhauser effect proton magnetometer. The French manufacturer GEOMAG calls it as an "automatic geomagnetic observatory". It consists of the 2 sensors, the electronic unit (analogue electronic, data logger and power supply unit) and a telemetry.
The instrument was operating throughout 2001 under the same conditions as in 2000. Minute mean values with a resolution of 0.1 nT are recorded according to the INTERMAGNET standard [3]. The data files are written on a 3.5'' floppy. The mean values are transmitted by a special telemetry (located at the heating house, building No. 8) via METEOSAT to the INTERMAGNET GINs at Paris and Edinburgh.

2.1.3 MAGSON

This three component ring core flux-gate magnetometer (manufacturer: MAGSON GmbH, Berlin) was further operating at the coil hut (building No. 21 sensor) and control hut (building No. 22, electronic unit) as a preliminary place. It recorded continuously during the complete year, except for a few interruptions. The components X, Y and Z were recorded. The data logger triggers the measurement values with a sampling rate of 1 Hz and generates 1 minute mean values of a resolution of 0.1 nT which are recorded in the RAM. The storage capacity is sufficient for 15 days. The recorded data can be read by a laptop via the serial interface. Up to now the recorded time series have only been used for occasional comparison. In 2001 the base lines were not determined.

2.2 Overhauser Effect Proton Magnetometer GSM

The geomagnetic total intensity was recorded using the GSM Overhauser effect proton magnetometer (manufactured by GEM Systems, Canada), unchanged in 2001. Every 5 seconds a measurement value of resolution 0.01 nT is generated and transmitted by glass fibre cable to the same PC which records the 2 Hz momentary values of the FGE variometer. Table 3 contains the differences between the momentary values of the GSM 19 and the observatory F momentary values, calculated for the times of the absolute measurements.

2.3 Induction Coil Magnetometer ICM

Three induction coils with highly permeable cores record the temporal gradients of the geomagnetic variations for the North, East and vertical components. For thermal stability, the sensors are buried east of the telluric hut (building No. 20). The electronic amplifiers are located in building No. 20, while a paper recorder and a PC are in the measurement and computer centre (building No. 3).
The analogue recording was carried out continuously during the whole year by means of the Laumann paper recorder in the measurement and computer centre (building No. 3). The signal is transmitted via glass fibre cable. No changes have to be reported for the whole system in 2001.
The digital recording of the temporal gradients of the geomagnetic variations was carried out as in 2000. The signal of the amplifier output, to which the Laumann paper recorder is connected, is digitised by means of a 20 bit ADC (Type CS5506, Crystal). The ADC is controlled by a single board computer (Z80miniEMUF). The measurement values are triggered with a sampling rate of 1 Hz. They are transferred serially (RS232) by glass fibre cable to a PC at the measurement and computer centre (building No. 3). The time signal for the data logger is given by a DCF77 radio clock.
The measurement values are stored in binary format (2 bytes per value of the 3 components), where 1 digit corresponds to 0.1 mV. The induction coils transfer function is dependent on the signal period. In cases of modifications of the equipment the transfer function is re-determined by calibration. For this purpose calibration signals are applied to the calibration coils of the sensors. The calibration procedure yields the transfer functions of the complete apparatus. From the transfer functions, correction functions can be calculated for the 3 components, which must be taken into account if the recording material is used.
Fig. 4 shows the correction functions. The ordinate axis scale is 0.1 mV. The sinusoidal calibration signal confirmed that in the period range of 5 to 100 seconds no phase shift (0 phase characteristic) is present.
The digital recording was in operation all the year with very few interruptions.

2.4 Classical magnetic variometers with photographic recording

The observatory operates 4 classical variometers with photographic recording in the variation house (building No. 6). The single systems are named according to their location rooms: CS: South system, CW: West system, CE: East system. The storm variometer CR and the East system are located in the East room. Table 1 lists the parameters of the instruments. The variometers are temperature compensated. The rooms are continuously heated by a thermostat-controlled electrical heating system supported in cold seasons by warm water central heating. The daily temperature changes are less than 0.1°C. The location of all classical variometers is unchanged since 1982. Hourly mean values of the elements X, Y and Z are obtained from the classical recordings. They are only used for comparison purposes nowadays.
The photographic recordings of the East (CE) and storm system (CR) were stopped on 31 December 2001.

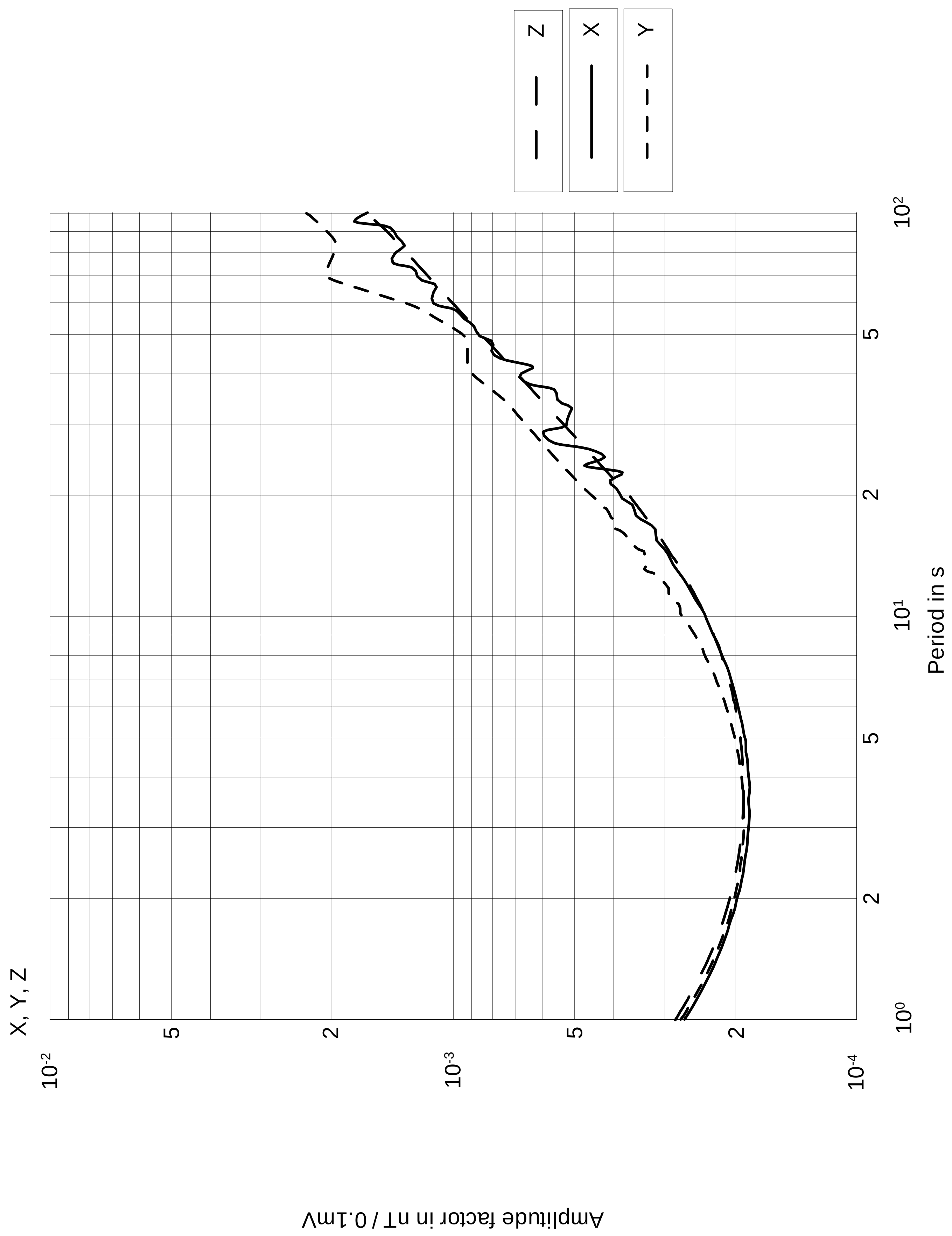


Fig. 4: Transfer functions (amplitudes) of the induction coil variometers

3. Absolute Measurements

Throughout the year, the absolute measurements were carried out as follows: One absolute measurement is taken using the THEO 010B DI-flux theodolite on pillar No. 8 once per week. The corresponding total field measurement is taken using a GSM19 Overhauser effect proton magnetometer located 40 cm above pillar No.14. Therefore, the THEO 010B needs not to be taken away from the pillar for the F measurements. The F measurement values, obtained at pillar No. 14, are corrected by means of the corresponding offset to the level of pillar No. 8. One total field measurement per month is carried out on pillar No. 8 40 cm over the pillar (approximately the altitude of the DI-flux sensor) to check this offset.
Total field measurements are taken once per month on pillars No. 2 and 5 to record the long term drift of the pillar differences. DI-flux measurements are carried out normally once per month by means of a second instrument on pillars No. 2 and 5. The measurements on pillars No. 2 and 5 have comparing and accompanying character. The base lines are determined from the measurements taken on the pillars No. 8 (D, I, F) and No. 14 (F). The measurement values obtained on pillar No. 8 represent the observatory standard.
I. Goldschmidt was in general responsible for the measurements on pillar No. 8, while M. Fredow was responsible for these done on the other pillars. I. Goldschmidt calculated the base values of the variometers from the absolute measurements. The adopted base lines are obtained from the measurements on pillar No. 8. Additional base lines were calculated from the measurements on the pillars No. 2 and 5 to obtain pillar differences between the single pillars. The results are presented in table 3 (annual averages).

Pillar	Δ H/nT	ΔD/’	ΔZ/nT	ΔI/’	ΔF/nT
2					+1.4
5	+0.2	+0.2	- 0.5	-0.03	-0.4
14					-1.2

Table 3: Pillar differences of H, D, Z, I and F obtained on pillars No. 2 and 5 to those on pillar No. 8

$\Delta H = H_{Pn} - H_{P8}$, n = 2,5; equivalent for D, Z, I and F.
The following results of the absolute measurements were reduced with the recordings of the FGE variometer by means of a PC program, which calculates the base values of the elements H, D and Z. This program calculates in addition ΔF, the difference of the total intensity, calculated from the momentary H and Z values for the times of the absolute measurements, and the synchronous recording value of the GSM variometer.

Date	$\Delta F = F_{GSM} - F_{P8}$
2001-01-19	+0.9
2001-02-14	+0.8
2001-03-16	+0.8
2001-04-14	+0.9
2001-06-25	+0.9
2001-07-19	+0.9
2001-08-30	+0.8
2001-09-19	+0.9
2001-10-19	+0.8
2001-11-16	+0.8
2001-12-17	+0.8

Table 4: Differences of the total intensity between the GSM recordings in the variation house and the observatory level (absolute house, pillar No. 8, 40 cm over the pillar)

Table 7 contains the results of the absolute DI-flux measurements combined with the absolute GSM 19 measurements. The adopted base lines of the FGE variometer are shown in Fig. 5. The deviations of the absolute measurement values from the adopted base lines can also be found in table 7. The total intensity measurements carried out once per month on pillar No. 8 were compared with synchronous recording values of the GSM variometer. Table 4 shows the results.
Ending with 2001, the results of the absolute measurements were also reduced with the variations of the classical West system (CW, complete reduction) and of the classical East system (CE, short reduction) using a PC program. Adopted base lines were obtained from the results, which were used for comparisons with the reduction results of the digital FGE variometer recordings and for cross-check. They are not published any more.

3.1 Declination

The declination measurements are carried out, as described, by means of the THEO 010B DI-flux theodolite in the absolute house on pillars No. 8, No. 5 and No. 2. The azimuth marks are the Niemegk church tower and water tower and a collimator at pillar No. 6 (low distance azimuth mark for times of no visibility to the far azimuth marks). Bearings of all azimuth marks can be taken from pillar No. 8, while bearings to the church tower and the water tower can be taken from pillar No. 2, and only the water tower is visible from pillar No. 5. Table 5 contains the azimuth values used [4].

Pillar	Church tower	Water tower	Collimator
8	65°00'11"	91°10'44"	1°49'04"
2	65°06'44"	91°19'54"	
5		91°01'48"	

Table 5: Azimuth values of the azimuth marks

The annual mean differences of the azimuth mark bearings can be found in table 6.

Azimuth mark difference	Pillar 8	Pillar 2
Water tower - church tower	26°10.65' ±0.15'	26°13.25' ±0.1'
Water tower - collimator	89°21.72' ±0.12'	
Church tower - collimator	63°11.05' ±0.15'	

Table 6: Annual mean differences of the azimuth mark bearings

Table 7 contains the measurement results for the FGE variometer and the deviations from the adopted base lines. Fig. 5 shows the FGE adopted base lines.

3.2 Inclination

The inclination is measured directly following to every declination measurement by means of the same instrument, using the magnetic meridian determined from the declination measurement. The inclination measurement results are used together with the total intensity values for the determination of the base values of the horizontal and vertical intensity.

3.3 Horizontal Intensity

The horizontal intensity base values are calculated by means of a PC program from the inclination and total intensity absolute measurements. Table 7 contains the measurement results for the FGE variometer and the deviations from the adopted base lines. Fig. 5 shows the FGE adopted base lines.

3.4 Vertical Intensity

The vertical intensity base values were calculated by means of a PC program from the inclination and total intensity absolute measurements. Table 7 contains the measurement results for the FGE variometer and the deviations from the adopted base lines. Fig. 5 shows the FGE adopted base lines.

3.5 Total Intensity

The total intensity measurements were done as described by means of the GSM19 Overhauser effect proton magnetometer, following the DI-flux measurements. The GSM19 uses the gyromagnetic ratio:

$$\gamma_p = 0.267515255 \cdot 10^9 \, s^{-1} \, T^{-1} \qquad [5]$$

for the conversion of the frequency values into the magnetic total intensity values. The total intensity measurement results are used together with the inclination values for the determination of the base values of the horizontal and vertical intensity.

4. Base values

The base values of the FGE variometer (the observatory main variometer) were determined by means of suitable adoptions from the absolute measurement results (table 7). For every day an adopted base value exists of every recorded element (H, D, Z). The deviations ΔH, ΔD and ΔZ of the absolute measurements from the adopted base values are shown in table 7. A program from the INTERMAGNET CD-ROM was used to plot the adopted base lines. Fig. 5 shows the adopted base values as lines of small squares and the results of the absolute measurements as larger squares. The H, D and Z base values were transformed into X, Y and Z values.
Ending with 2001, the base values of the photographic recording variometers were determined as described in the previous yearbooks for comparison and mutual check with the base values of the digital recording FGE variometer. They are no longer published.

Month	Day	UT	Horizontal intensity		Declination		Vertikal intensity		F
			H/nT	ΔH/nT	D	ΔD/′	Z/nT	ΔZ/nT	ΔF/nT
Jan.	03	12:20	18734.3	-0.6	0°37.96’	-0.09	44929.6	0.6	
Jan.	10	12:25	18735.1	0.3	0°37.95’	-0.10	44929.1	0.1	-0.7
Jan.	17	12:17	18734.5	-0.2	0°37.97’	-0.08	44929.1	0.1	-0.9
Jan.	25	12:14	18733.7	-0.9	0°38.06’	0.01	44928.3	-0.7	-1.1
Jan.	30	13:01	18734.1	-0.4	0°37.88’	-0.17	44928.6	-0.4	-1.1
Feb.	05	12:26	18733.8	-0.7	0°38.19’	0.13	44929.3	0.3	-0.8
Feb.	14	12:23	18734.8	0.3	0°38.23’	0.16	44929.1	0.1	-1.1
Feb.	22	09:16	18734.4	-0.1	0°38.02’	-0.07	44929.0	0.1	-0.7
Feb.	28	09:33	18734.8	0.3	0°38.10’	0.00	44928.8	-0.2	-0.8
Mar.	07	09:24	18734.2	-0.2	0°38.14’	0.02	44928.9	-0.1	-1.3
Mar.	14	09:15	18733.9	-0.4	0°38.16’	0.02	44928.9	-0.1	-1.0
Mar.	22	06:56	18734.2	-0.0	0°37.87’	-0.30	44927.8	-1.2	-0.8
Mar.	27	11:25	18734.2	0.1	0°38.45’	0.27	44929.0	-0.0	-0.7
Apr.	05	11:10	18733.4	-0.6	0°38.54’	0.37	44927.1	-1.9	-0.8
Apr.	11	08:01	18734.0	0.0	0°38.00’	-0.12	44929.0	0.0	-0.8
Apr.	19	06:03	18734.6	0.6	0°38.03’	-0.02	44929.2	0.2	-1.1
Apr.	25	11:28	18733.8	-0.2	0°37.87’	-0.13	44928.4	-0.6	-0.7
May	02	11:35	18734.0	0.0	0°37.99’	0.04	44928.9	-0.0	-0.8
May	08	07:45	18733.8	0.1	0°37.99’	0.04	44929.2	0.3	-0.7
May	16	06:10	18733.4	-0.1	0°37.92’	-0.03	44928.5	-0.3	-0.4
May	22	06:13	18733.1	-0.2	0°37.75’	-0.16	44928.5	-0.2	-1.0
May	30	06:31	18733.0	-0.1	0°37.70	-0.16	44928.0	-0.5	-0.4
June	06	06:18	18733.2	0.2	0°37.70’	-0.15	44928.0	-0.4	-1.0
June	14	06:20	18733.1	0.1	0°37.80’	-0.05	44928.2	-0.1	-1.1
June	20	11:14	18733.2	0.2	0°37.97’	0.12	44927.8	-0.3	-0.4
June	28	05:55	18733.4	0.1	0°37.89’	0.04	44928.1	0.0	-1.1

Table 7: Absolute measurement results by means of the THEO 010B DI-flux theodolite and the GSM 19 Overhauser effect proton magnetometer, reduced with the FGE variometer recordings

Month	Day	UT	Horizontal intensity		Declination		Vertikal intensity		F
			H/nT	ΔH/nT	D	ΔD/′	Z/nT	ΔZ/nT	ΔF/nT
July	04	11:23	18733.5	-0.0	0°37.81’	-0.05	44927.8	-0.2	-0.7
July	10	06:05	18733.7	0.2	0°37.92’	0.04	44928.2	0.1	-0.9
July	13	11:24	18733.7	0.2	0°38.19’	0.30	44928.8	0.7	-0.3
July	23	11:35	18733.6	0.1	0°38.02’	0.10	44928.4	0.1	-0.7
July	30	11:23	18733.7	0.3	0°37.87’	-0.07	44928.2	-0.1	-1.1
Aug.	03	11:06	18733.7	0.1	0°38.28’	0.33	44928.6	0.3	-0.9
Aug.	15	08:00	18733.9	-0.1	0°38.03’	0.08	44928.9	0.6	-0.7
Aug.	21	11:46	18734.3	0.2	0°37.97’	0.02	44928.7	0.4	-1.0
Aug.	29	07:51	18734.2	-0.2	0°37.91’	-0.04	44928.3	-0.0	-0.7
Sep.	07	07:51	18734.3	-0.1	0°37.85’	-0.10	44927.7	-0.6	-0.7
Sep.	11	11:48	18734.1	-0.3	0°38.01’	0.06	44928.3	0.1	
Sep.	18	06:12	18734.6	0.2	0°37.77’	-0.18	44928.3	0.2	-1.0
Sep.	27	07:59	18734.5	0.3	0°38.03’	0.08	44928.2	0.2	-0.8
Oct.	02	11:31	18734.4	0.2	0°38.21’	0.26	44927.7	-0.3	
Oct.	11	08:15	18733.8	-0.4	0°37.88’	-0.07	44928.0	0.0	2.4
Oct.	16	11:26	18733.9	-0.3	0°38.07’	0.12	44928.3	0.3	-0.7
Oct.	16	11:26	18733.9	-0.3	0°38.07’	0.12	44928.4	0.4	-0.8
Oct.	24	06:19	18734.1	-0.1	0°37.89’	-0.06	44928.4	0.2	-0.7
Nov.	01	13:43	18734.0	-0.2	0°38.05’	0.10	44928.4	-0.1	-0.4
Nov.	07	12:42	18734.9	0.6	0°38.09’	0.14	44928.3	-0.3	-0.8
Nov.	13	07:08	18734.7	0.4	0°37.68’	-0.27	44928.6	-0.1	-0.8
Nov.	21	07:20	18734.7	0.3	0°37.62’	-0.33	44928.9	0.1	-0.7
Nov.	27	12:17	18734.2	-0.2	0°37.99’	0.04	44928.4	-0.5	-0.6
Dec.	05	09:25	18734.4	-0.1	0°37.94’	-0.01	44929.3	0.2	-0.8
Dec.	11	12:13	18734.4	-0.1	0°37.71’	-0.24	44929.6	0.4	-0.7
Dec.	17	12:25	18734.3	-0.2	0°37.99’	0.04	44928.8	-0.4	-0.6
Dec.	21	09:16	18735.1	0.6	0°37.70’	-0.25	44929.2	-0.1	-0.8

Table 7: Absolute measurement results by means of the THEO 010B DI-flux theodolite and the GSM 19 Overhauser effect proton magnetometer, reduced with the FGE variometer recordings (continued)

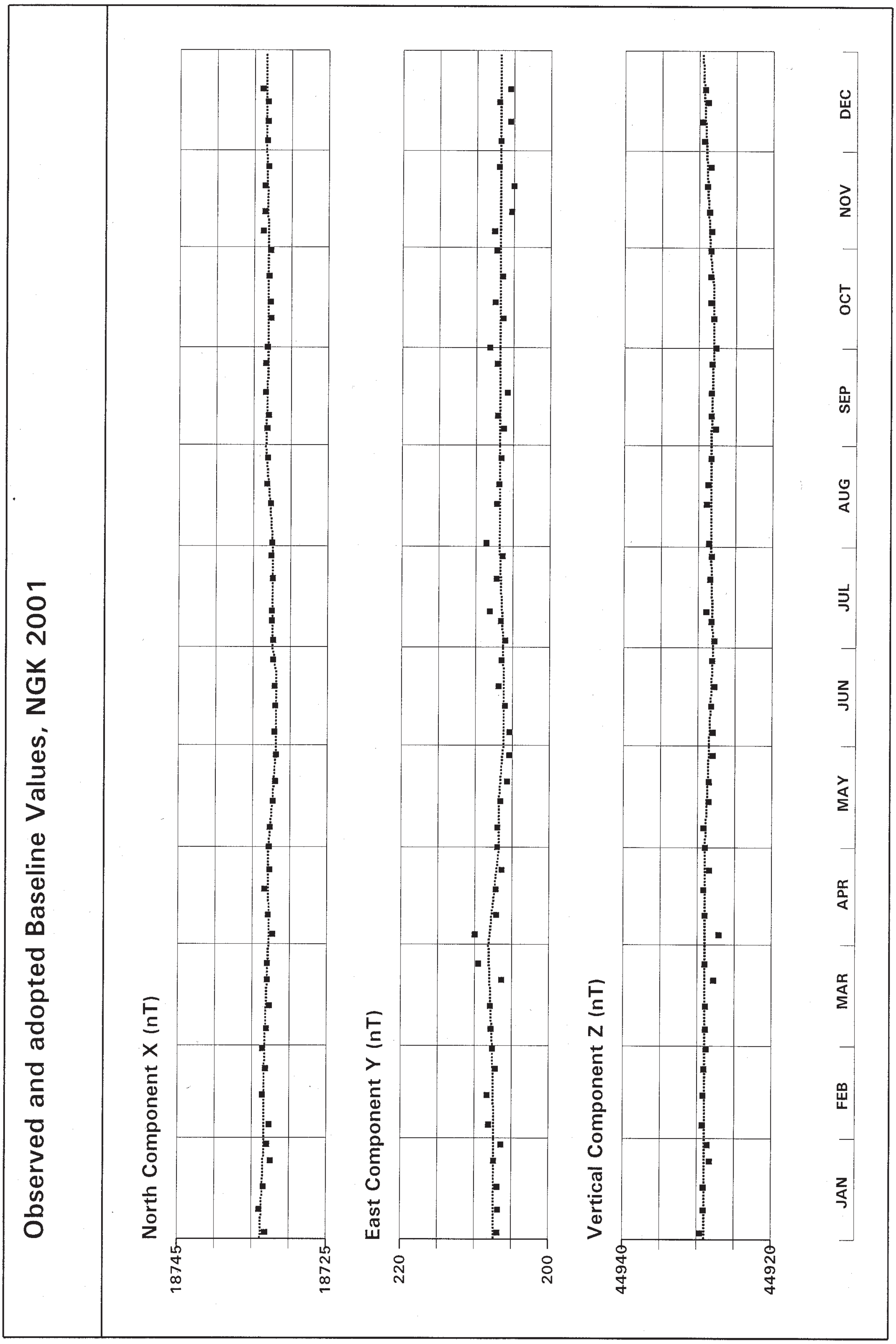


Fig. 5: FGE variometer base lines

5. Telluric Recordings

5.1 Measurement Lines

Four telluric lines in the geographic main directions exist at the observatory: one 1000 m line and one 100 m line in North-South (N-S) and East-West (E-W) direction, respectively. The electrodes of the two 100 m lines are located completely within the properties of the observatory, while the Northern electrode of the 1000 m N-S line and the Western electrode of the 1000 m E-W line are outside. Because of the A9 motorway widening in 1995 the Western electrode of the 1000 m E-W line had to be moved 50 m eastward. This is taken into account by the scale value. The electrodes are connected to the recording equipment located in the telluric hut (building No. 20) by cables. Further information can be found in [6].

5.2 Electrodes

Polarisation free electrodes are in use at all measurement lines [6].

5.3 Recording equipment

Only the 1000 m lines N-S_{1000} and E-W_{950} were continuously recording throughout the year. The electrodes are connected by resistor circuits [7] to 2 light spot galvanometers, which record the potential variations of both measurement lines on the same photographic paper (same recording materials as the classical variometers) with a velocity of 20 mm/h. The electrical equipment and the recording unit are located in the telluric hut (building No. 20).
Initiated by the CEMES (Central Europe Mantle GeoElectrical Structure) project at the Polish Geophysical Institute at Warsaw, a digital recording equipment was installed. Both the 1000 m NS and the 950 m EW lines are connected to lightning protection and anti-aliasing filtering networks (see Fig. 6). The resulting signals are digitised by means of a 20 bit ADC (Type CS5506, Crystal). The ADC is controlled by a single board computer (Z80miniEMUF). The measurement values are triggered with a sampling rate of 1 Hz. They are transferred serially (RS232) by glass fibre cable to a PC at the measurement and computer centre (building No. 3). The time signal for the data logger is given by a DCF77 radio clock.
The transfer function of the data logger is determined from time to time. Due to traditional reasons the electrodes are connected as shown in Fig. 6. Because of inverting filter amplifiers the recordings of the EW line are in the correct polarity, while NS is recorded in the oposite polarity.
The photographic recording of the telluric variations was stopped on 31 December 2001.

5.4 Zero Adjustment of the Measurement Circuit

The adjustment was checked frequently. 10 Ω of the compensation resistor correspond to a basic voltage of 1 mV.

5.5 Scale Values

The scale values are determined once per month. A voltage of 1 mV is applied to the measurement lines by modifying of the compensation resistor [7] by 10 Ω. The auxiliary current is adjusted using a standard cell.

Scale values 2001	Niemegk (mV/km/mm)	
Date	**N-S_{1000}**	**E-W_{950}**
1 January - 31 December	0.45	0.21

Table 8: Scale values of the telluric measurement lines

The telluric current direction is in the case of an increasing recording signal:

- N-S line: from South to North
- E-W line: from West to East

The sensitivity of the digital recordings is 0.1 mV.

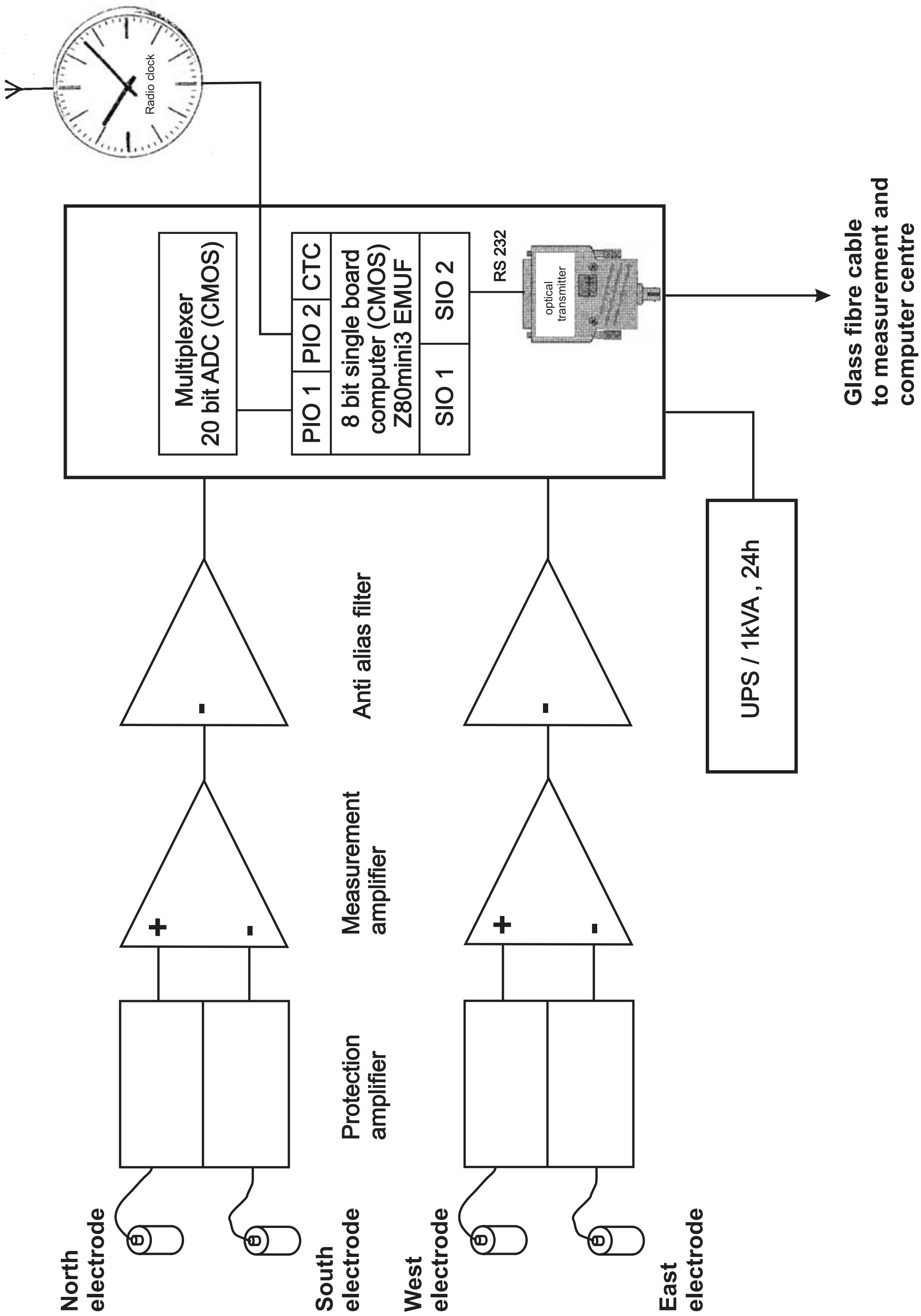


Fig.6: Block diagram of the telluric digital recording equipment

6. Remarks to the Tables and Plots

The tables and plots were obtained from the digital recordings of the FGE variometer and the absolute measurements by means of the THEO 010B DI-flux theodolite and the GSM19 Overhauser effect proton magnetometer. From the 2 Hz momentary values at first minute mean values are calculated. The minute mean value is centred on second 30. That means, the momentary values corresponding to the seconds 0, 0.5, 1.0, 1.5, …, 59.5 are averaged to a minute mean value. These “variometer minute mean values” are in files (1 file per day) with temporary character. The absolute minute mean values are calculated from these by means of the formulas given in [2] and are written into corresponding files (1 file per day). These absolute minute mean value files become final, when the final base values are determined. The hourly mean values are calculated from the “variometer minute mean values” by means of the formulas given in [2] and are written into corresponding files (1 file per year). The hourly mean value files become final, when the final base values are determined.
The absolute minute mean values and the hourly mean values are sent to the World Data Centres and to INTERMAGNET after the necessary format conversions. The hourly mean values are the base of the following tables and plots after conversion from H, D, Z values into X, Y, Z ones.
The acquisition and the preparation of the recording material and the production of the tables and plots was done by programs, written by H.-J. Linthe and S. Wendt.
As in the previous years the hourly mean values obtained from the photographic recording classical variometers were compared with those from the FGE digital recordings. The deviations did never exceeded ± 1nT.
Table 9 contains the activity in terms of the inter-diurnal variability u of the North component [10]:

2001	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
u	1.13	0.94	2.23	2.52	0.93	0.95	0.91	1.13	1.23	2.47	2.97	1.31	1.56

Table 9: Inter-diurnal variability u of the North component in 2001

The reduction factor for Niemegk with the geomagnetic coordinates $\Phi = 51°53'$, $\Lambda = 97°38'$ and $\Psi = -16°41'$ (referring to the International Geomagnetic Reference Field Model 'IGRF 10th' for 2005) has the value 0.01691 [11].

Note the following remarks on the tables and plots:

- X points toward North, Y points toward East and Z points downward. Corresponding to that Eastern declinations and Northern inclinations are positive. Since 1986 the declination in Niemegk is eastward, therefore positive.
- All times correspond to Universal Time (UTC). The hourly mean values correspond to the hours $0^h - 1^h$, $1^h - 2^h$, …, $23^h - 24^h$.
- The minimum value of a table line is marked with “n”, while the maximum is marked with “x”. The quietest days are marked with “*” in the tables and with “Q” in the plots. The most disturbed days are marked with “+” in the tables and with “D” in the plots. The quietest and most disturbed days are determined in the frame of the Kp service of the IAGA at Niemegk.

The order of tables and plots is as follows:

1. Table with the geographic and geomagnetic coordinates of the observatory, the monthly and annual mean values of all magnetic elements and the deviations of the monthly means from the annual mean values.

2. Hourly mean value plots of X, Y and Z for every month.

3. Table with the daily mean values of the declination, horizontal intensity, inclination and total intensity.

4. Daily mean value plots of the North component, East component and vertical intensity.

5. Tables containing the following activity numbers:
   - The Schmidt character figures (C) in scales of 0, 1, 2
   - The Fanselau character figures (F) in scales of 0, 0.5, 1.0, 1.5, 2.0
   - The mean planetary daily activity Ap, calculated in the frame of the ISGI (International Service of Geomagnetic Indices, Kp Index Service) at Niemegk [9]
   - The mean local daily activity A_K, calculated from the K and given in terms of 2nT
   - The three-hourly activity numbers K determined at Niemegk [8], where the lower limit of K=9 corresponds to 500 nT.
   - The daily sum ∑K of the 8 K numbers

The a_K are determined from the K corresponding to table 10, with $A_K = \sum a_K / 8$.

K	0	1	2	3	4	5	6	7	8	9
a_K	0	3	7	15	27	48	80	140	240	400

Table 10: Derivation of the a_K from the single K

6. Tables giving a summary about the frequency of the single K corresponding to the day time and month.

7. This bulletin contains the plot “Deviation of the continuously calculated daily mean values from the normal value” of 2000 and the table “Monthly values of the normal value 2000”. The monthly values of the normal value are displayed by a line in the plots. The numerical values are written next to the right margin of the plots and are contained in table 11.

Month	X/nT	Y/nT	Z/nT
January	18774.7	437.9	45079.9
February	18775.0	440.7	45083.1
March	18775.3	443.6	45086.2
April	18775.7	446.5	45089.4
May	18776.0	449.4	45092.6
June	18776.3	452.3	45095.8
July	18776.7	455.2	45099.0
August	18777.0	458.2	45102.3
September	18777.3	461.1	45105.5
October	18777.7	464.0	45108.7
November	18778.0	466.9	45111.9
December	18778.3	469.8	45115.0

Table 11: Monthly values of the normal value 2000

8. The final table contains the annual mean values of the complete observatory series Potsdam-Seddin-Niemegk adjusted to the level of Niemegk in a table and as a plot.

7. References

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Kyoto, February 2005

8. Tables and Plots of the Results of the Observations in 2001 at Niemegk

Astronomic co-ordinates: φ = 52°4.3' , λ = 12°40.5' E. of Grw.
= 0h50m42s E. of Grw.

Geomagnetic co-ordinates: Φ = 51°53' , Λ = 97°38' Ψ = -16°41' [11]

referring to the International Geomagnetic Reference Field Model 'IGRF 10th' for 2005 [11]

Altitude above sea level: 78 m

Monthly and Annual Mean Values

Niemegk 2001

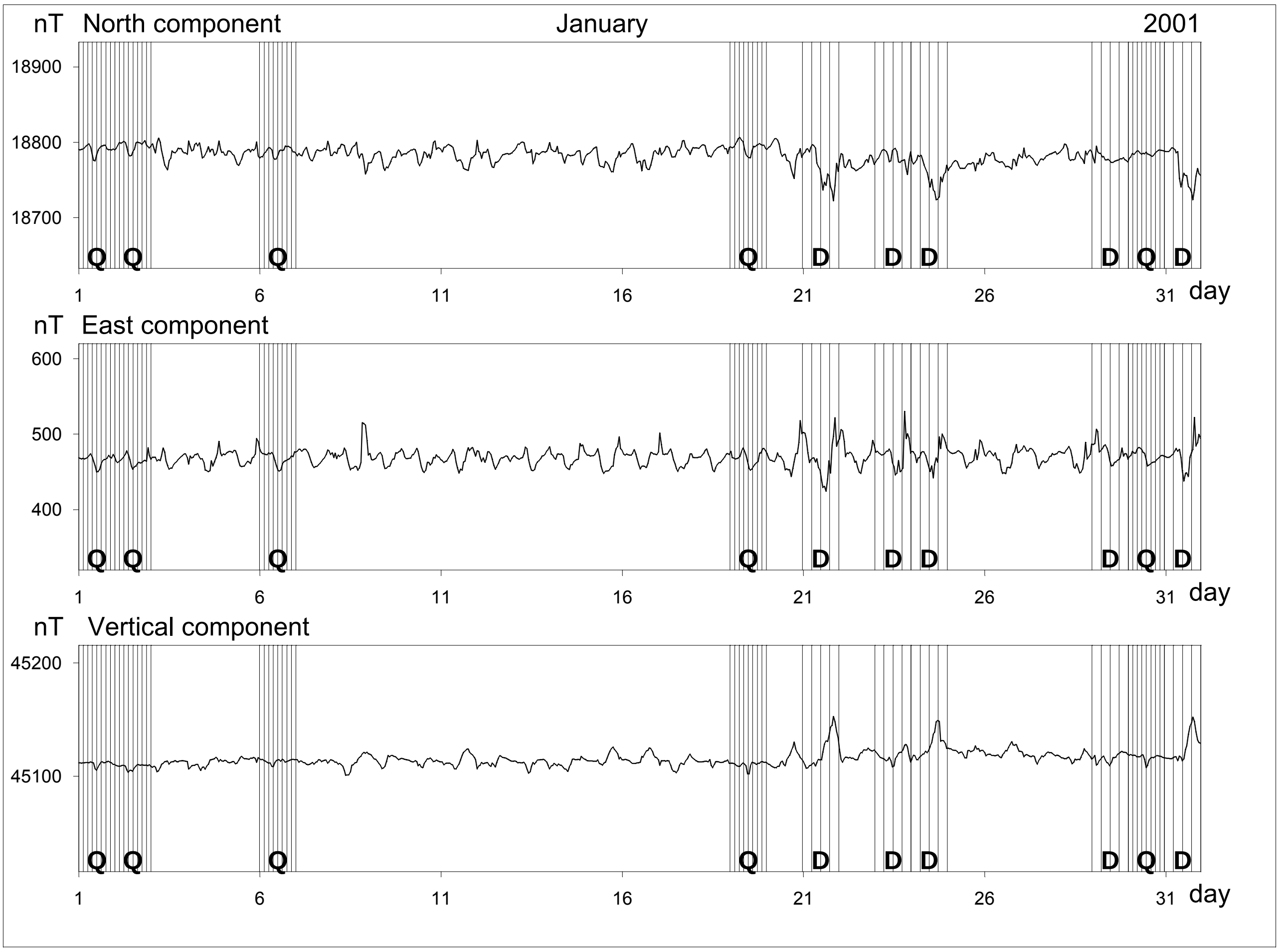
	D	I	H	F	X	Y	Z
Jan.	1° 25.99'	67° 23.43'	18788.7 nT	48871.7 nT	18782.8 nT	469.9 nT	45115.7 nT
Feb.	1 26.48	67 23.13	18792.8	48872.3	18786.9	472.7	45114.6
Mar.	1 27.69	67 23.90	18783.6	48874.6	18777.5	479.1	45121.0
Apr.	1 28.81	67 24.46	18779.6	48883.3	18773.3	485.1	45132.1
May	1 28.07	67 22.78	18801.9	48884.1	18795.7	481.6	45123.7
June	1 28.52	67 22.74	18803.4	48886.4	18797.2	484.1	45125.5
July	1 28.98	67 22.81	18802.7	48887.2	18796.4	486.6	45126.7
Aug.	1 29.58	67 23.27	18797.8	48889.9	18791.4	489.8	45131.7
Sep.	1 30.47	67 23.66	18793.0	48891.0	18786.5	494.5	45134.8
Oct.	1 32.02	67 25.56	18771.7	48900.3	18765.0	502.4	45153.8
Nov.	1 32.46	67 25.47	18774.8	48905.5	18768.0	504.9	45158.1
Dec	1 32.01	67 24.25	18792.0	48908.6	18785.3	502.9	45154.3
Year	1° 29.26'	67° 23.79'	18790.2 nT	48887.9 nT	18783.8 nT	487.8 nT	45132.7 nT

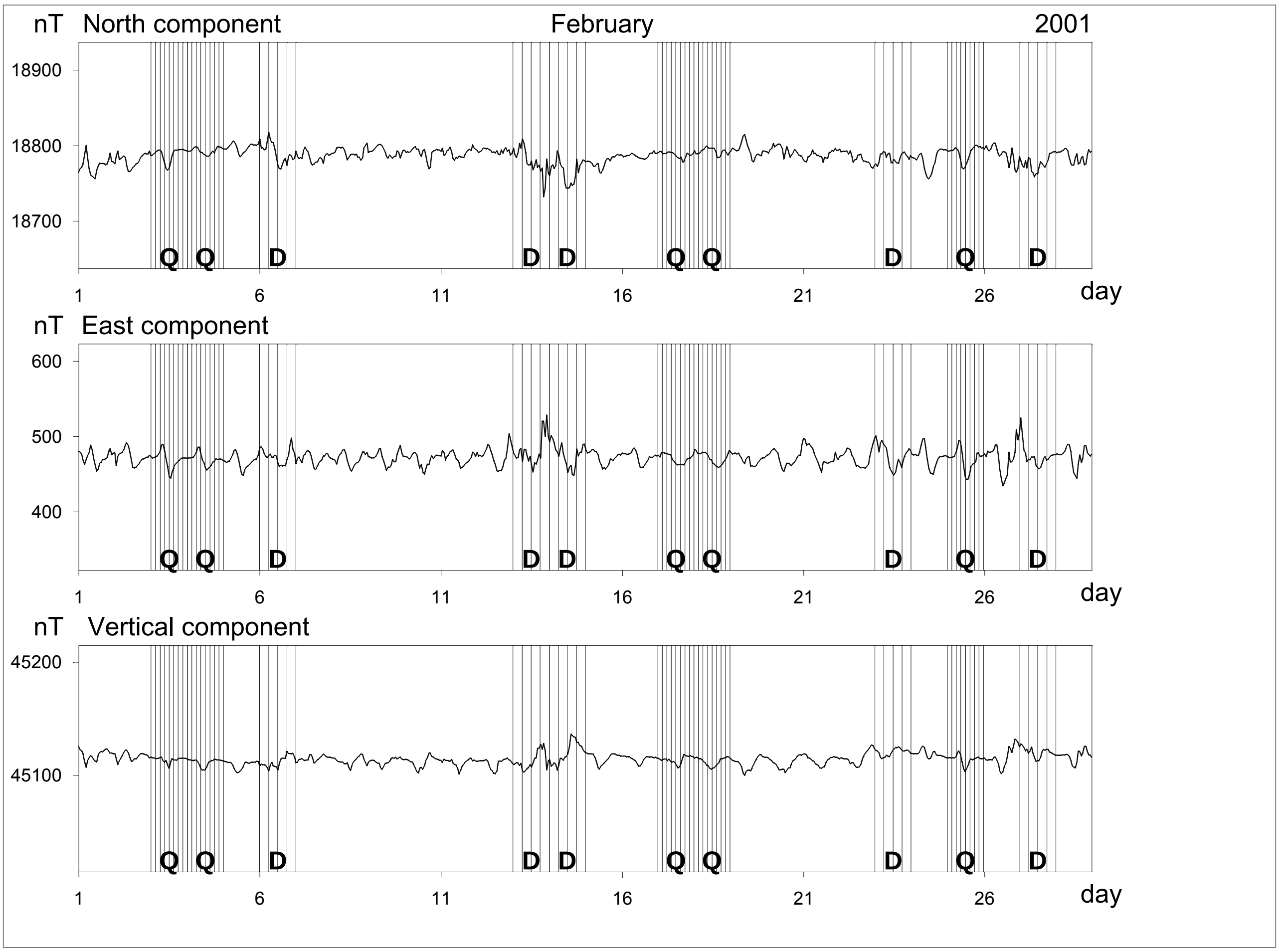
Deviation of the Monthly Means from the Annual Means

Niemegk 2001

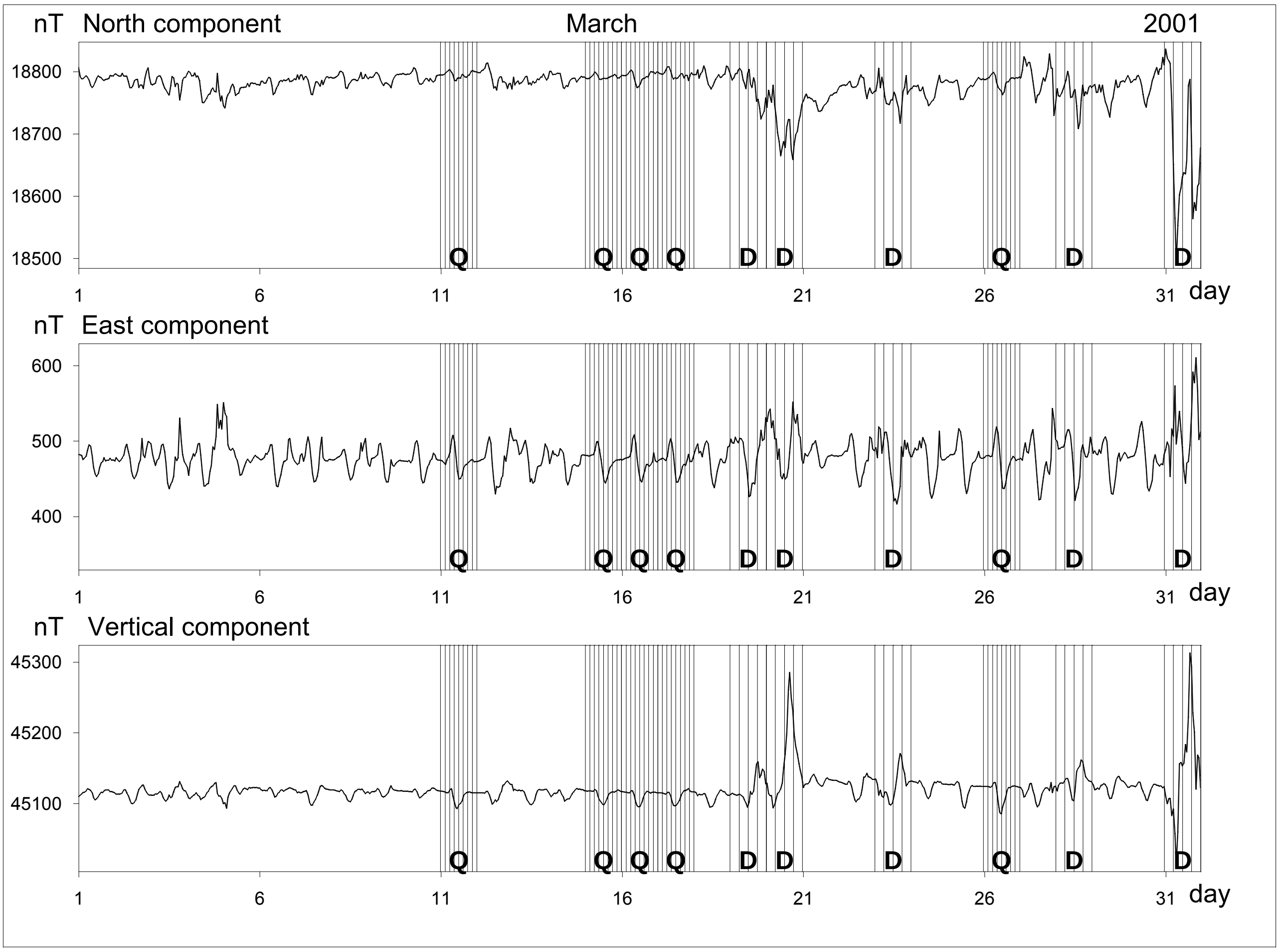
	D	I	H	F	X	Y	Z
Jan.	-3.27 '	-0.36 '	-1.5 nT	-16.2 nT	-1.0 nT	-17.9 nT	-17.0 nT
Feb.	-2.78	-0.66	2.6	-15.6	3.1	-15.1	-18.1
Mar.	-1.57	0.11	-6.6	-13.3	-6.3	-8.7	-11.7
Apr.	-0.45	0.67	-10.6	-4.6	-10.5	-2.7	-0.6
May	-1.19	-1.01	11.7	-3.8	11.9	-6.2	-9.0
June	-0.74	-1.05	13.2	-1.5	13.4	-3.7	-7.2
July	-0.28	-0.98	12.5	-0.7	12.6	-1.2	-6.0
Aug	0.32	-0.52	7.6	2.0	7.6	2.0	-1.0
Sep.	1.21	-0.13	2.8	3.1	2.7	6.7	2.1
Oct.	2.76	1.77	-18.5	12.4	-18.8	14.6	21.1
Nov.	3.20	1.68	-15.4	17.6	-15.8	17.1	25.4
Dec.	2.75	0.46	1.8	20.7	1.5	15.1	21.6

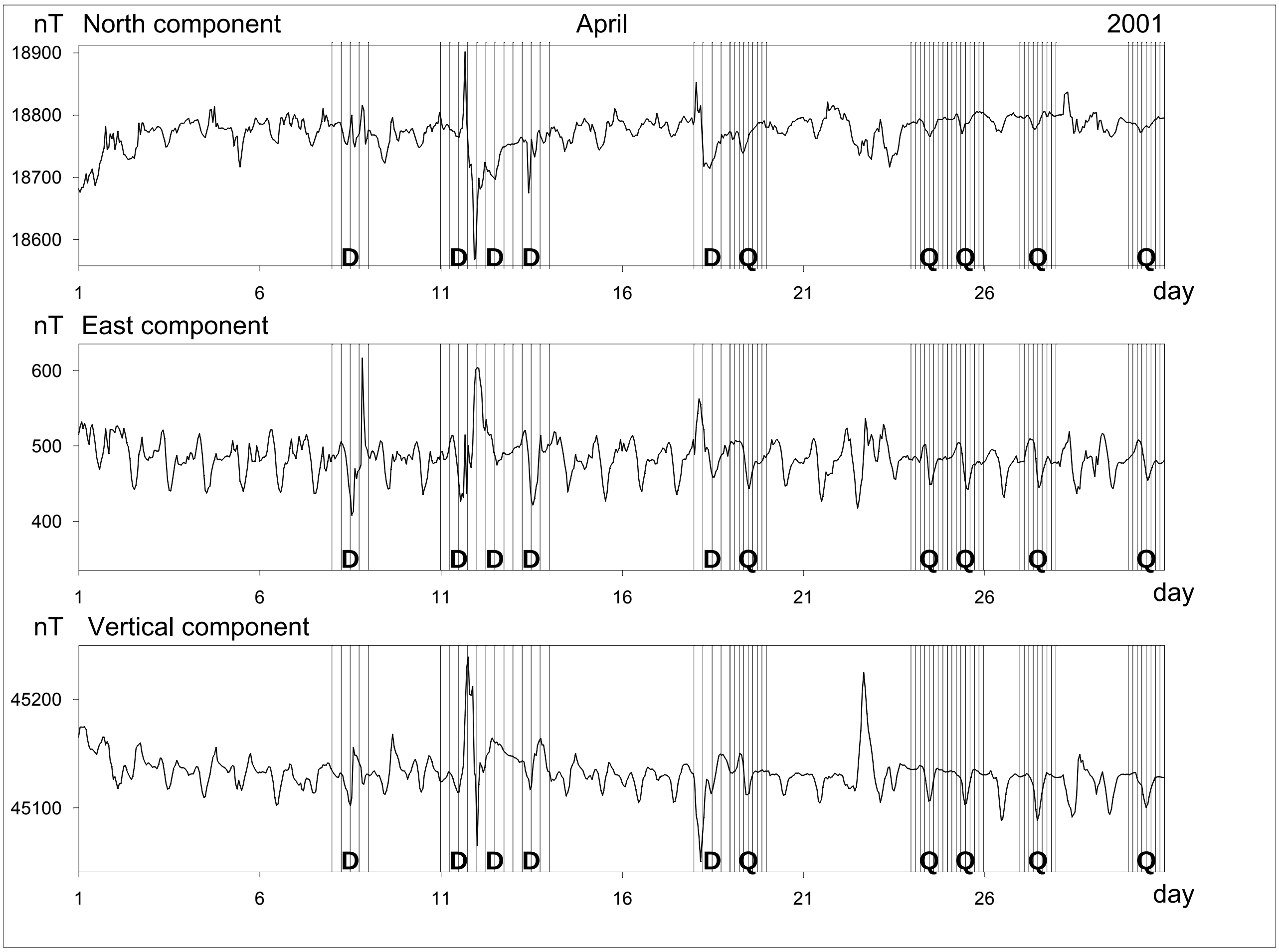
Hourly Mean Values Plot 2001



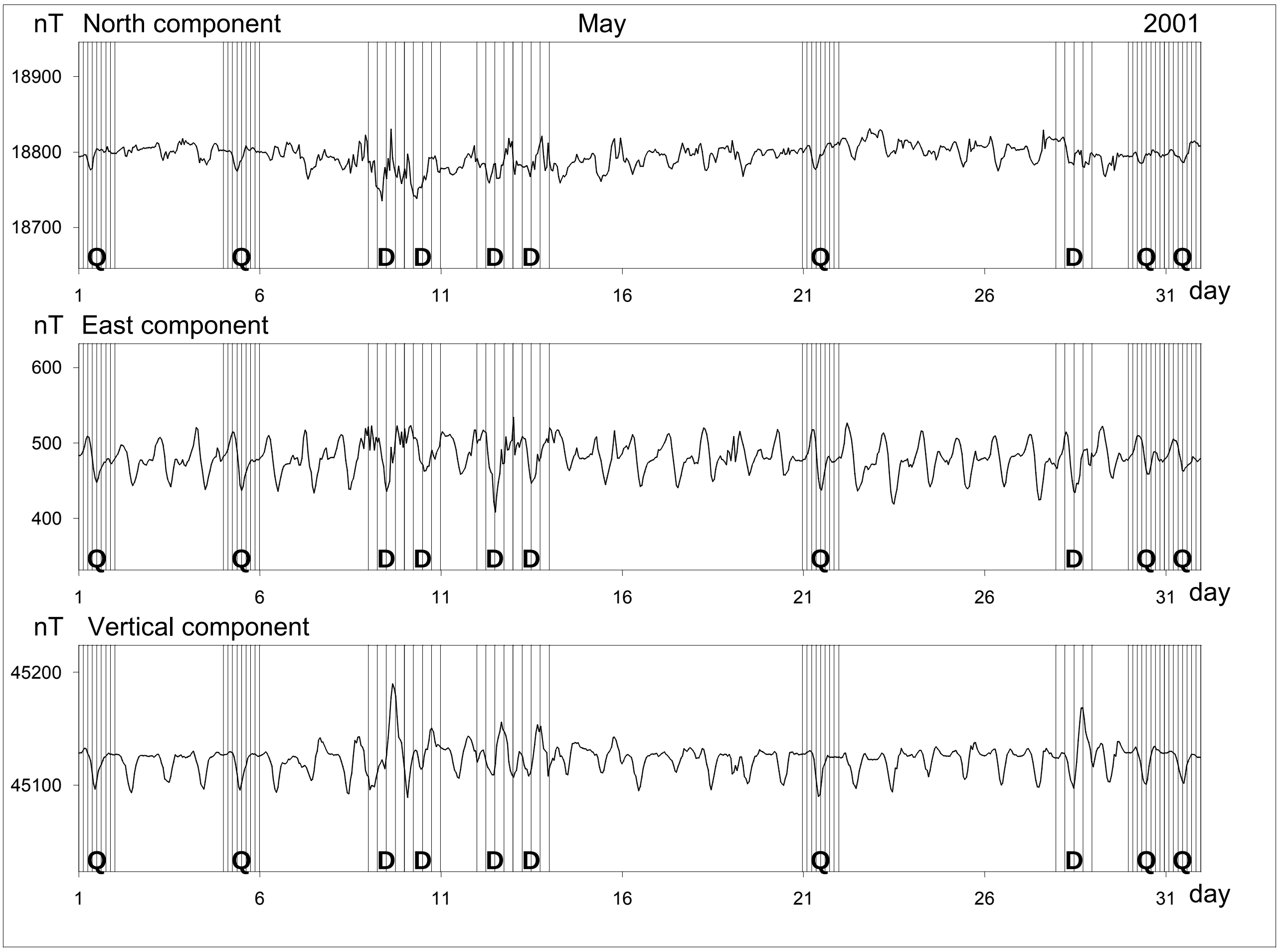


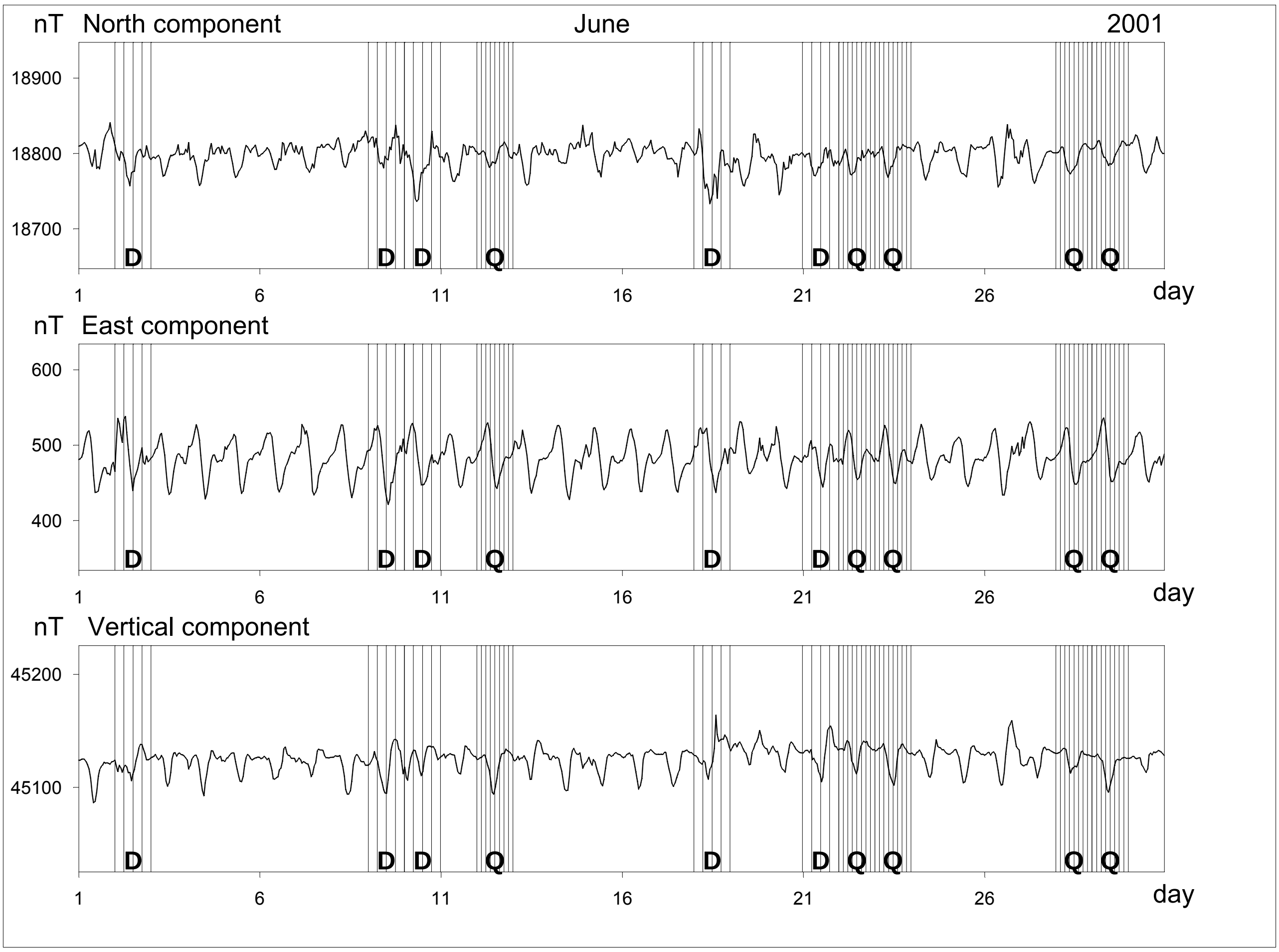
Q = Quiet day D = Disturbed day



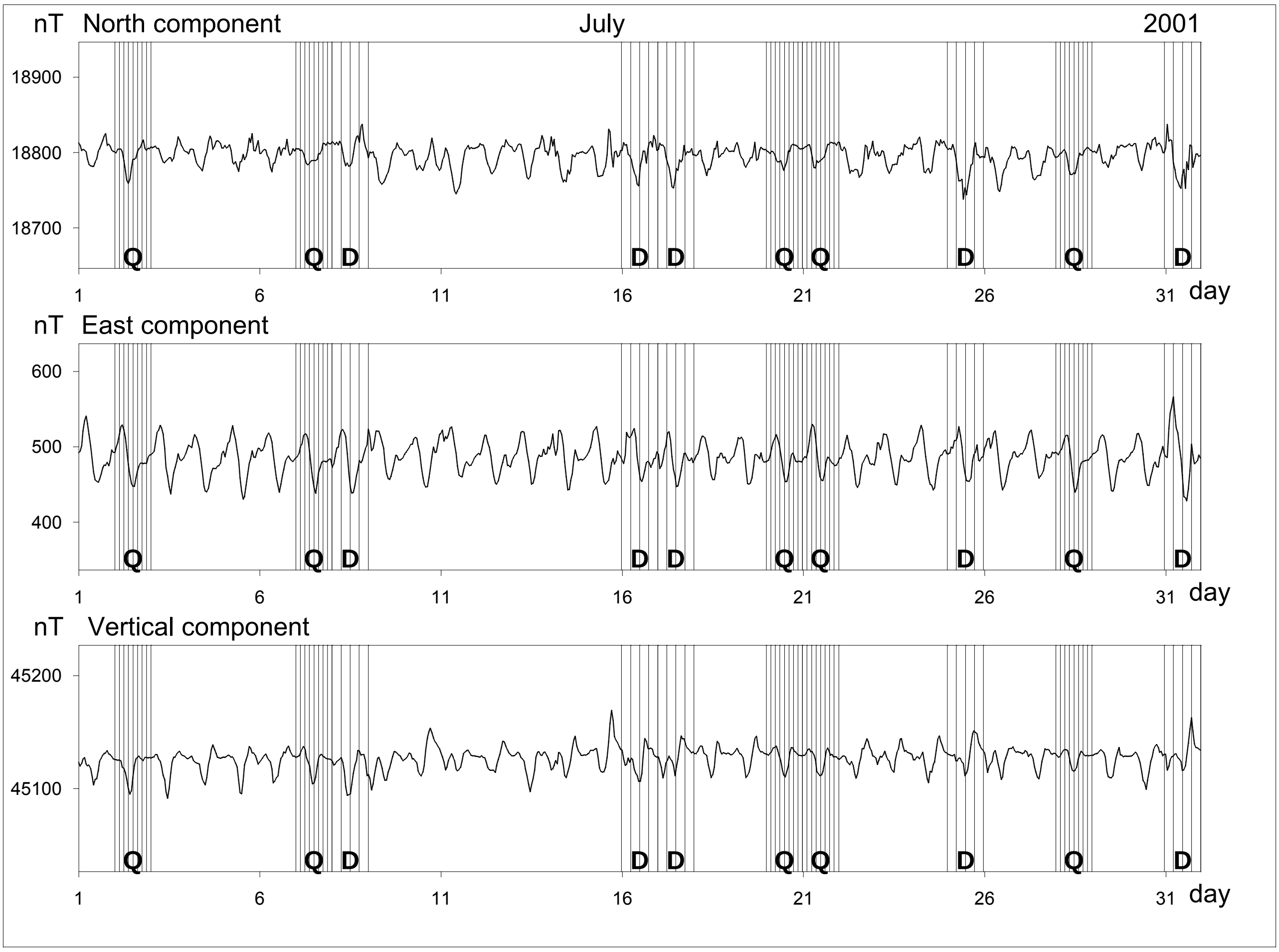


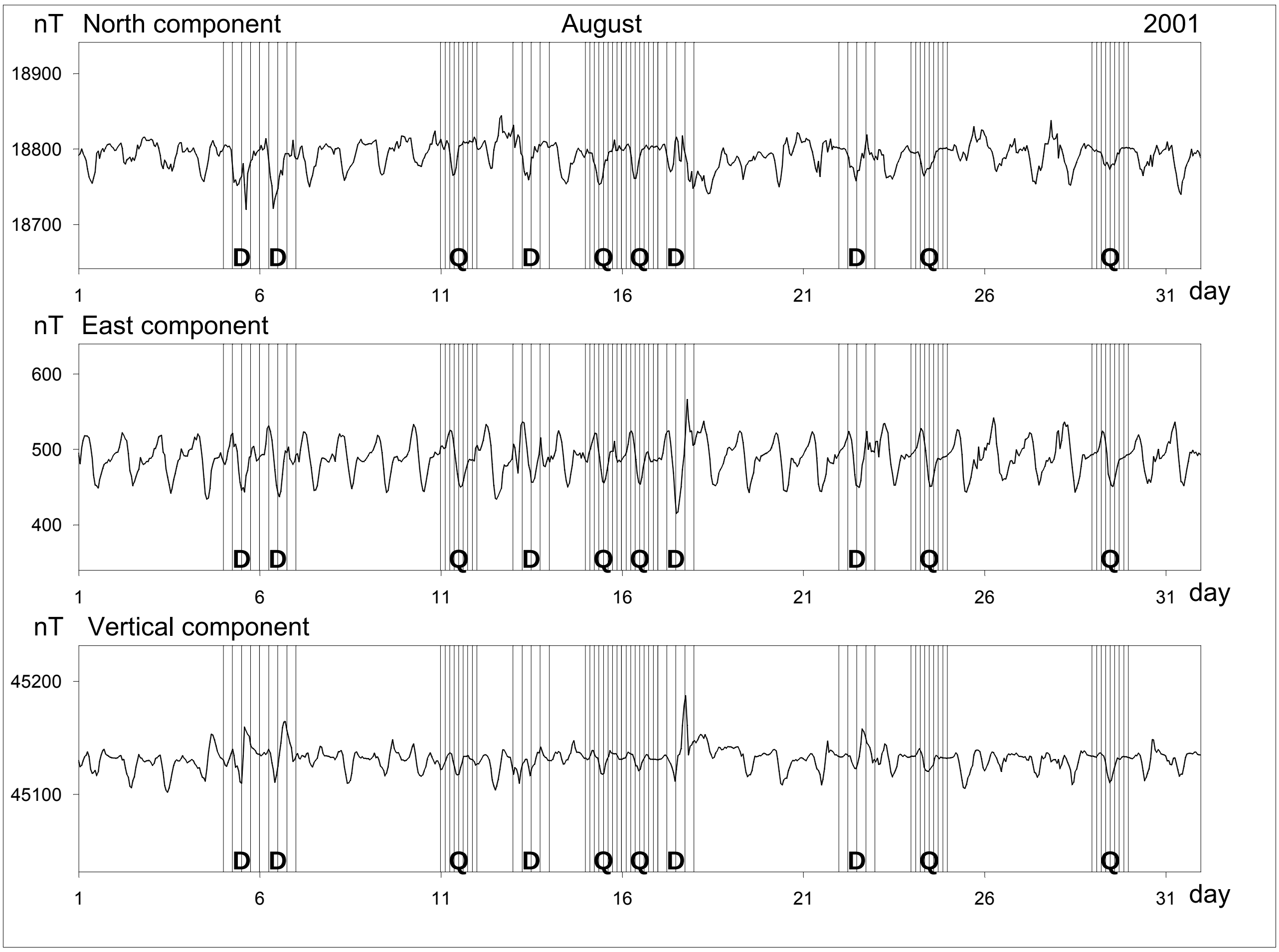
Q = Quiet day D = Disturbed day



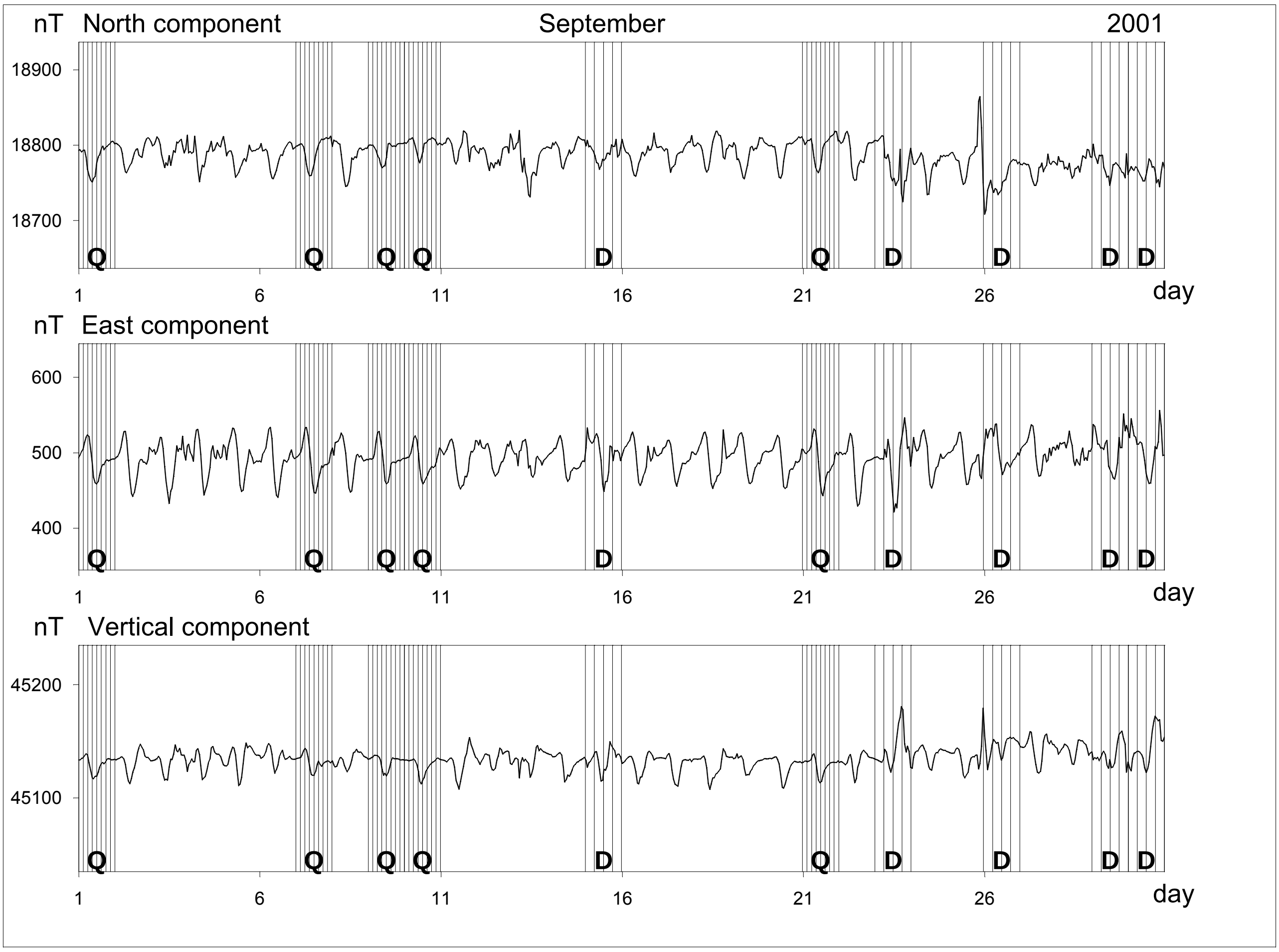


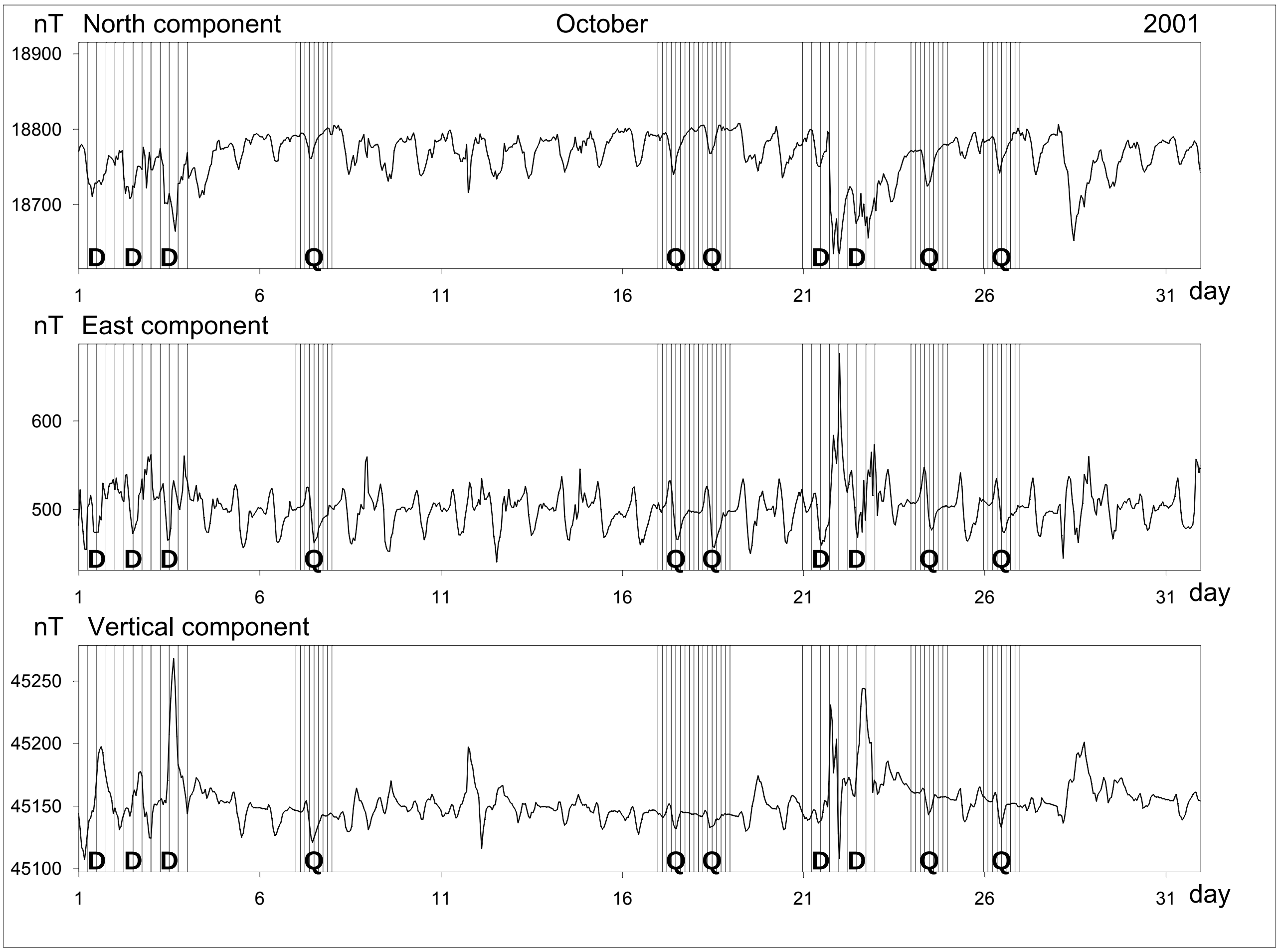
Q = Quiet day D = Disturbed day



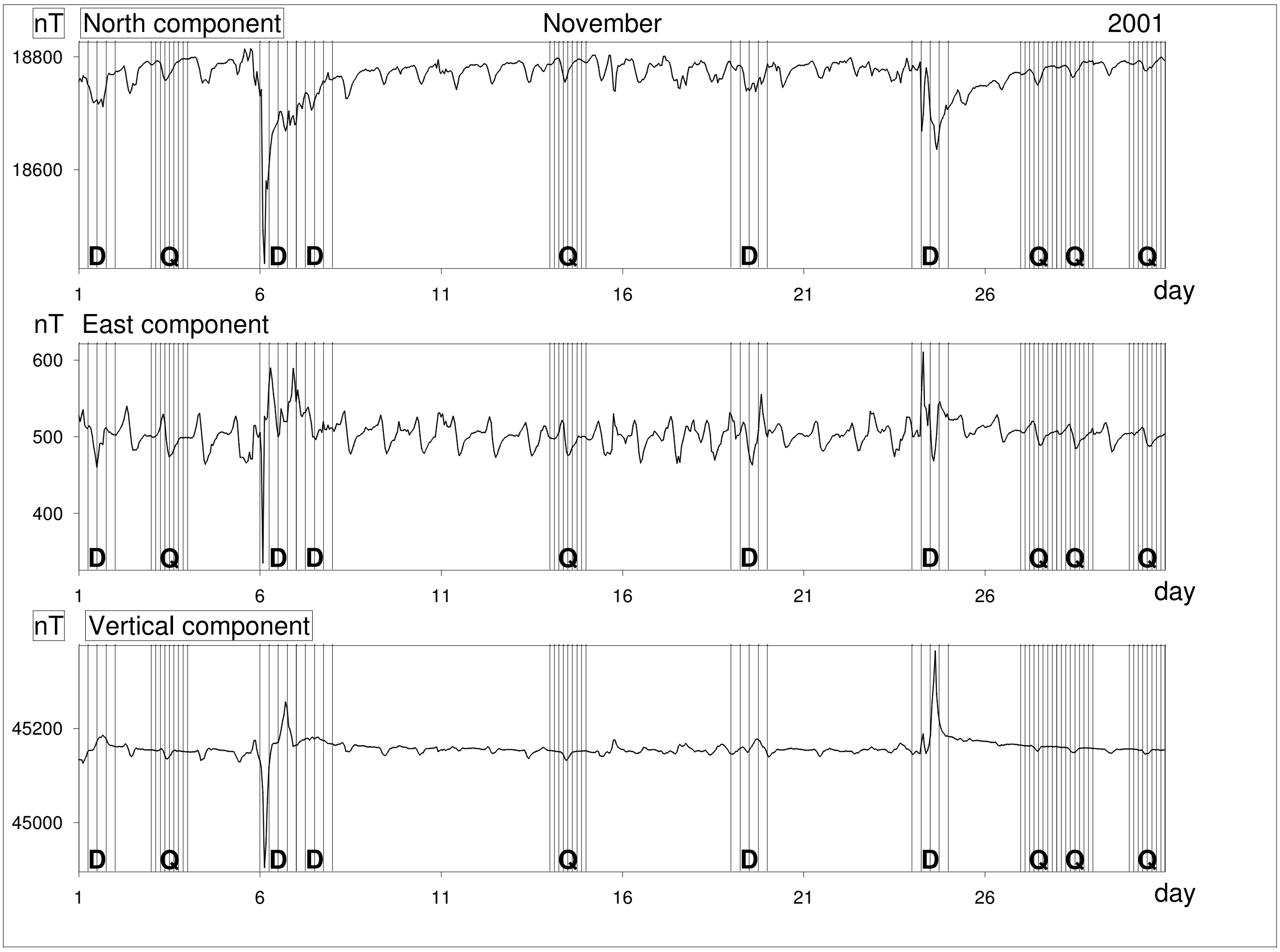


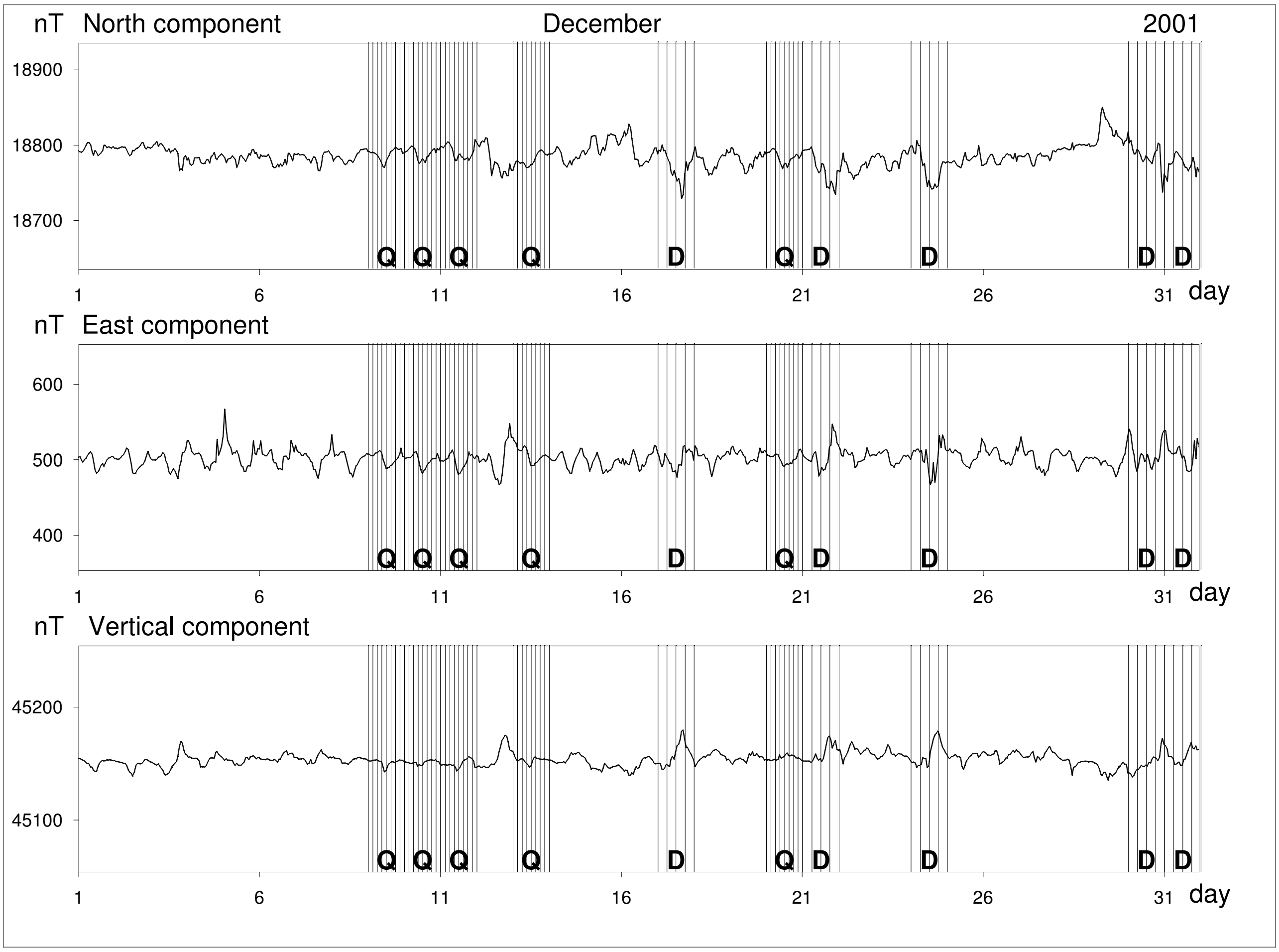
Q = Quiet day D = Disturbed day





Q = Quiet day D = Disturbed day





Q = Quiet day D = Disturbed day

Daily Mean Values of the Declination

Niemegk — Daily Intervals Calculated in Terms of UTC — 2001

D= 1° 20.0' + Tabular Value

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	5.3	6.6	7.0	13.5	7.6	6.9 n	9.3	9.0	9.8	11.6	12.5	11.2
2	5.2 n	6.6	7.4	10.4	6.9	9.5	8.9	9.3	9.4	15.0	12.4	11.3
3	5.4	5.9	7.1	8.2	7.3	7.9	9.2	9.0	9.9	14.5	11.2	10.9
4	5.4	6.0	8.1	7.8	7.7	8.4	7.8 n	9.0	10.4	12.7	11.0	12.5
5	6.2	5.4 n	8.7	8.2	7.6	8.4	8.7	9.0	10.5	10.5	10.5 n	13.3 x
6	5.7	6.8	7.0	8.6	7.0	8.4	8.7	9.3	9.8	10.6	17.4 x	12.4
7	6.1	6.2	7.1	8.4	7.3	8.2	8.4	9.1	9.5	10.6	15.5	11.8
8	6.6	6.1	7.2	8.4	8.7	8.0	8.5	9.6	10.4	11.7	12.8	11.8
9	5.9	6.3	6.4 n	8.4	9.9	8.3	10.0	9.1	9.9	10.8	12.5	12.0
10	5.4	5.9	6.7	7.7	10.0	8.6	9.3	9.7	9.4	11.4	12.3	11.4
11	5.7	6.4	6.7	9.7	10.4 x	8.2	10.1 x	9.5	9.7	11.5	12.6	11.3
12	5.6	6.9	6.8	14.4 x	8.1	8.9	8.4	8.6 n	11.1	11.4	11.6	11.6
13	5.7	8.1 x	7.6	9.0	9.2	8.2	9.5	10.0	10.4	11.8	11.6	13.0
14	6.0	7.3	6.5	8.9	10.1	8.2	9.2	9.6	9.8	11.9	11.1	11.7
15	5.7	6.4	6.8	7.9	8.2	8.2	9.1	9.8	11.3	11.0	11.4	10.4 n
16	5.9	6.6	6.8	8.5	7.8	8.3	9.3	9.6	10.7	10.2	11.1	11.6
17	5.8	6.2	6.6	8.3	8.0	7.7	8.3	10.1	9.9	11.1	11.9	11.7
18	5.6	6.3	7.4	11.2	8.3	9.3	9.1	10.6 x	10.3	10.1 n	11.6	12.0
19	5.8	6.1	8.6	8.7	8.8	10.2 x	8.7	9.7	10.4	11.2	12.7	12.7
20	5.8	6.2	11.7	8.5	8.2	8.2	8.8	8.9	9.8	11.5	12.1	11.9
21	5.8	6.8	8.1	6.7 n	7.5	8.3	9.0	9.0	9.7	13.3	11.5	12.6
22	6.8	6.5	7.8	9.4	7.1	8.9	8.2	10.4	9.0 n	17.7 x	12.5	12.6
23	6.7	6.9	7.4	9.4	6.2 n	8.8	9.2	10.6 x	9.8	13.8	12.3	12.2
24	6.6	6.6	7.0	7.9	7.7	8.8	9.0	9.8	10.9	12.8	15.8	12.4
25	6.6	6.0	7.2	7.5	7.2	8.1	9.4	9.0	10.2	11.2	14.4	12.5
26	5.6	6.5	7.2	7.2	7.8	8.7	9.1	10.1	12.3	11.7	13.5	12.8
27	6.4	6.8	7.6	8.2	6.8	9.8	9.6	9.8	12.2	11.3	12.5	11.9
28	6.1	6.8	8.6	7.7	7.2	8.4	8.4	10.6 x	12.1	12.9	12.0	11.9
29	7.2 x		7.3	7.8	8.8	9.1	8.4	9.4	12.9 x	12.2	11.8	10.7
30	6.2		7.5	8.3	8.6	8.8	8.7	9.5	12.6	11.6	11.6	12.8
31	6.7		14.6 x		8.1		10.1 x	10.5		12.9		13.3 x
Mean	6.0	6.5	7.7	8.8	8.1	8.5	9.0	9.6	10.5	12.0	12.5	12.0

Daily Mean Values of the Horizontal Intensity

Niemegk — Daily Intervals Calculated in Terms of UTC — 2001

H= 18700 nT + Tabular Value

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	97	81	96	26 n	103	114	109	96	92	54	53	102
2	101 x	87	95	62	110	99	102	106	97	52	79	103
3	94	94	87	81	111	100	108	100	101	37	91	98
4	97	99	83	93	108	100	108	97	97	54	88	88
5	92	104 x	79	76	104	102	107	85	92	84	96 x	91
6	94	97	90	90	108	107	106	87	94	89	-36 n	87
7	93	91	92	86	96	106	106	95	100	95	41	91
8	93	97	96	83	98	115 x	114 x	98	92	85	67	91
9	85	98	96	68	80	113	96	105	101	74	81	95
10	93	97	98	80	78 n	91	99	106	108 x	79	84	96
11	88	97	102	64	90	98	93	108	106	79	81	98
12	89	99	97	26 n	91	105	106	115 x	95	72	86	88
13	96	85	93	60	94	101	105	104	87	78	88	87
14	91	73 n	96	78	88	111	98	93	102	81	94	92
15	84	85	98	85	95	107	101	94	97	88	90	110
16	87	93	99	89	97	113	103	101	95	91	87	100
17	96	94	103 x	90	101	106	98	95	99	89	82	78 n
18	97	99	100	67	105	87 n	102	75 n	102	101 x	83	86
19	101 x	100	84	77	101	96	106	91	97	83	71	89
20	92	100	22	89	107	94	105	101	101	80	84	91
21	73	94	62	100	107	97	109	106	106	57	89	78 n
22	79	90	84	72	120 x	99	98	96	98	-2 n	92	78 n
23	87	90	71	68	118	105	101	91	82	43	81	89
24	65 n	87	78	92	110	105	108	95	82	69	27	78 n
25	77	97	85	101	110	103	91 n	111	94	87	41	87
26	83	95	92	98	108	108	94	102	61 n	86	66	89
27	87	83	96	101	111	99	96	100	77	86	80	92
28	91	92	73	103 x	105	103	100	96	83	35	90	104
29	85		77	91	96	110	106	98	80	61	93	124 x
30	92		93	93	102	110	112	96	73	76	96 x	94
31	70		-26 n		108		96	90		80		81
Mean	89	93	84	80	102	103	103	98	93	72	75	92

Daily Mean Values of the Inclination

Niemegk Daily Intervals Calculated in Terms of UTC 2001

I= 67° 20.0' + Tabular Value

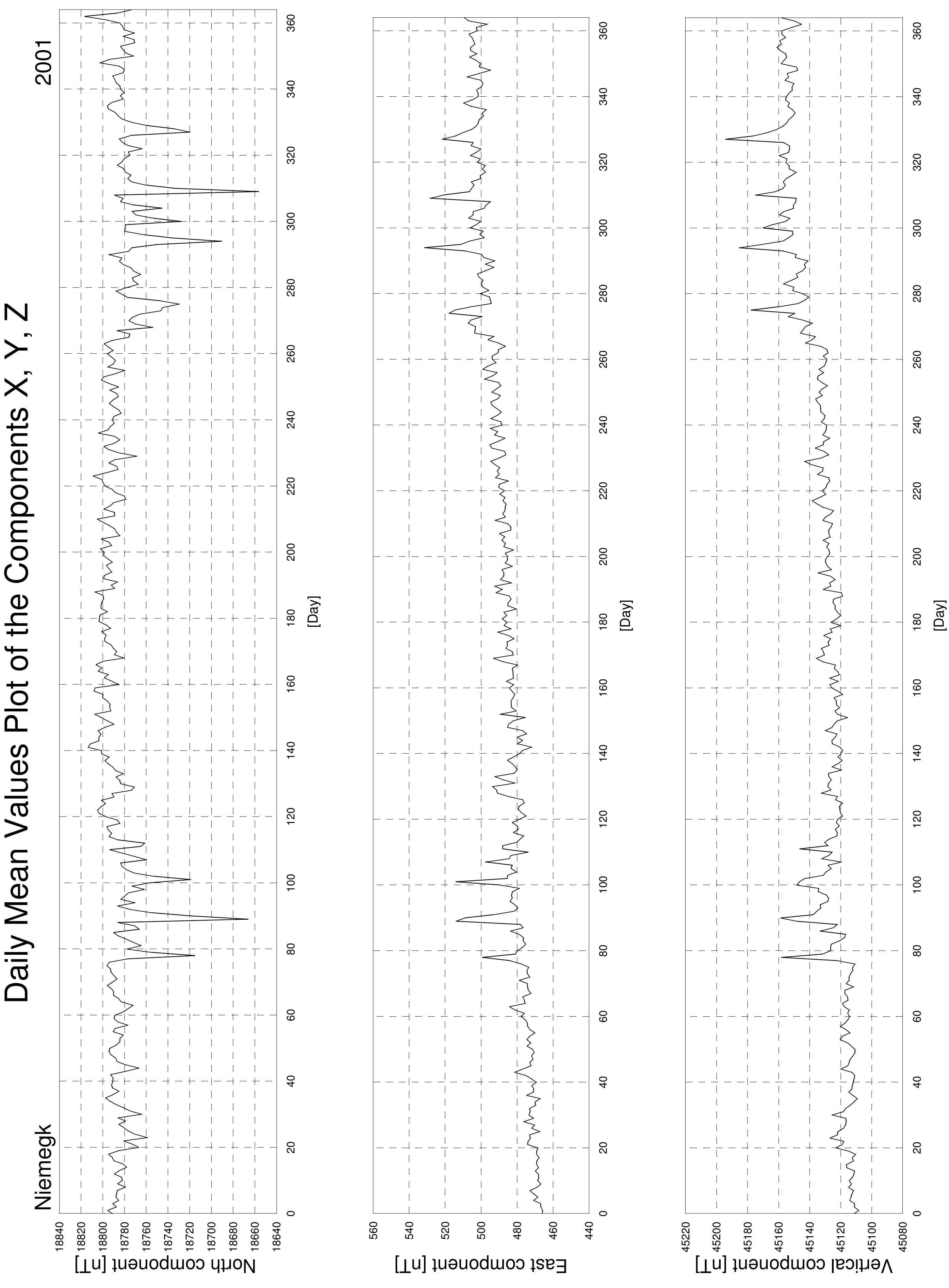
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	2.8	4.0	3.0	8.7 x	2.7	1.8 n	2.3	3.4	3.6	6.7	7.0	3.6
2	2.4 n	3.6	3.0	5.8	2.2	2.9	2.7	2.6	3.4	6.7	5.2	3.4
3	3.0	3.0	3.5	4.4	2.1	2.9	2.3	3.0	3.1	8.5	4.2	3.8
4	2.8	2.6	3.8	3.6	2.3	2.9	2.4	3.3	3.3	6.9	4.4	4.5
5	3.2	2.3 n	4.1	4.7	2.6	2.7	2.4	4.2	3.7	4.6	3.9 n	4.3
6	3.0	2.8	3.5	3.7	2.3	2.5	2.6	4.2	3.7	4.1	12.4 x	4.6
7	3.0	3.2	3.2	3.9	3.2	2.5	2.5	3.5	3.1	3.7	8.1	4.4
8	3.1	2.8	2.9	4.2	3.0	1.8 n	1.9 n	3.2	3.7	4.5	6.1	4.3
9	3.6	2.7	3.0	5.3	4.4 x	2.0	3.1	2.8	3.1	5.3	5.1	4.0
10	3.1	2.8	2.9	4.5	4.4 x	3.5	3.2	2.7	2.5 n	5.0	4.8	3.9
11	3.4	2.8	2.5	5.9	3.7	3.1	3.4	2.6	2.8	5.1	5.0	3.8
12	3.4	2.6	2.9	8.3	3.6	2.5	2.6	2.0 n	3.5	5.5	4.6	4.6
13	2.9	3.6	3.1	6.1	3.3	2.9	2.6	2.8	4.1	5.0	4.5	4.5
14	3.2	4.6 x	2.9	4.6	3.8	2.1	3.1	3.7	3.0	4.8	4.0	4.3
15	3.7	3.7	2.7	4.1	3.4	2.4	3.1	3.5	3.4	4.2	4.4	2.9
16	3.5	3.1	2.7	3.7	3.0	2.1	2.8	3.1	3.4	4.0	4.6	3.6
17	2.8	3.0	2.4 n	3.7	2.9	2.5	3.2	3.6	3.2	4.1	4.9	5.2
18	2.8	2.7	2.5	5.0	2.6	4.0 x	2.9	5.0 x	2.9	3.3 n	4.8	4.7
19	2.5	2.5	3.9	4.7	2.7	3.5	2.7	3.7	3.3	4.7	5.8	4.5
20	3.2	2.6	8.9	3.8	2.4	3.5	2.7	3.0	3.0	4.9	4.8	4.4
21	4.7	3.0	5.6	3.0	2.3	3.3	2.4	2.7	2.7	6.6	4.4	5.3 x
22	4.2	3.3	4.0	5.4	1.5 n	3.2	3.1	3.5	3.3	11.2 x	4.2	5.3 x
23	3.6	3.5	4.9	5.1	1.7	2.7	3.0	3.7	4.6	7.9	5.1	4.6
24	5.3 x	3.6	4.4	3.6	2.3	2.7	2.5	3.4	4.5	5.8	9.5	5.3 x
25	4.4	2.9	3.8	3.0	2.3	2.8	3.7 x	2.3	3.7	4.6	8.2	4.6
26	4.0	3.1	3.3	3.0	2.4	2.6	3.4	3.0	6.1 x	4.5	6.3	4.6
27	3.6	3.9	3.0	2.8	2.2	3.0	3.3	3.1	5.0	4.6	5.2	4.4
28	3.3	3.2	4.9	2.7 n	2.8	2.8	3.0	3.3	4.5	8.4	4.5	3.4
29	3.7		4.5	3.4	3.2	2.2	2.6	3.2	4.6	6.6	4.2	2.0 n
30	3.2		3.4	3.4	2.8	2.4	2.2	3.4	5.3	5.3	4.0	4.0
31	4.9		11.8 x		2.4		3.4	3.7		5.0		5.1
Mean	3.4	3.1	3.9	4.5	2.8	2.7	2.8	3.3	3.7	5.6	5.5	4.3

Daily Mean Values of the Total Intensity

Niemegk Daily Intervals Calculated in Terms of UTC 2001

F= 48850 nT + Tabular Value

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	21	21	24	38	33	31 n	36	38	36 n	44	49	59
2	20	22	23	32	33	32	31	38	41	39 n	56	58
3	20	22	21	37	35	34	35	34 n	43	59 x	55	58
4	21	22	18	39	34	31 n	37	39	41	50	54	57
5	22	22	20	34	32	34	36	38	41	50	56	57
6	22	22	25	34	32	35	37	42	43	48	5 n	58
7	21	22	23	32	32	37	37	41	41	47	58	59
8	20	22	25	32	31	34	34	38	40	47	57	58
9	20	23	26	31	34	37	28 n	43	41	49	57	57
10	21	21	27	35	27 n	32	40	41	41	50	57	58
11	21	21	24	42	34	36	33	41	44	56	57	57
12	19 n	22	26	27	34	34	39	43	42	49	58	59
13	21	18 n	22	36	34	37	35	39	38	47	55	56
14	19 n	20	24	32	32	35	36	41	41	49	54	59
15	21	20	24	33	36	35	44 x	39	42	48	57	59
16	22	23	23	32	28	39	37	41	38	48	56	57
17	21	22	24	34	36	35	37	46 x	39	48	56	57
18	22	22	22	17 n	33	36	40	42	39	50	56	59
19	22	22	26	33	30	43 x	41	39	40	51	56	58
20	22	22	36 x	33	35	37	40	38	38	49	55	59
21	23	22	27	35	33	39	40	43	41	48	56	58
22	21	22	30	44 x	37	42	37	44	41	52	58	60
23	23	27 x	25	25	37	39	39	37	44	55	57	61
24	23	24	27	37	39	40	40	38	40	53	71 x	58
25	23	23	25	37	39	38	37	41	43	56	60	58
26	25 x	25	25	32	37	43 x	34	42	39	53	61	61
27	24	24	26	33	36	35	36	39	44	54	61	62
28	24	25	32	34	41 x	38	37	37	45 x	52	61	61
29	21		26	27	34	34	38	38	39	56	60	63 x
30	24		29	30	35	40	40	40	43	54	60	55 n
31	24		8 n		35		39	36		53		58
Mean	22	22	25	33	34	36	37	40	41	50	56	59



Daily Mean Values Plot of the Components X, Y, Z
Niemegk
2001
North component [nT]
East component [nT]
Vertical component [nT]
[Day]

Niemegk **Activity Indices**

January 2001

Day	C	F	Ap	AK	ΣK	K	
1	0	0.0	2	2	4	0011	0011
2	0	0.5	4	4	7	2000	1013
3	0	0.5	8	6	14	2322	2111
4	0	0.5	11	13	22	3223	3333
5	0	0.5	5	6	11	2100	1124
6	0	0.5	4	4	10	2111	1112
7	0	0.5	5	5	11	2111	1113
8	0	0.5	10	15	20	2212	1354
9	0	0.5	5	6	13	2112	2122
10	0	0.5	5	8	15	1111	2333
11	0	0.5	7	9	16	2012	2333
12	0	0.5	7	5	10	3221	1001
13	0	0.5	6	6	13	2112	3112
14	0	0.5	8	10	18	3222	1143
15	0	0.5	6	9	16	1022	2234
16	0	0.5	6	6	12	1111	3221
17	0	0.5	6	8	15	3211	1322
18	0	0.5	4	4	9	0012	1023
19	0	0.5	4	5	12	2210	2122
20	0	0.5	9	12	20	2122	2344
21	1	0.5	19	21	27	3323	3454
22	0	0.5	12	14	22	4323	2323
23	1	0.5	18	25	26	2214	3365
24	1	0.5	20	22	25	2313	3463
25	0	0.5	6	9	16	2211	1243
26	0	0.5	11	10	19	2223	2233
27	0	0.5	4	5	11	3211	1111
28	0	0.5	8	10	17	1121	3243
29	1	0.5	16	16	21	4522	1133
30	0	0.0	3	3	7	2111	1100
31	0	0.5	18	15	21	0133	3443
Mean:	0.1	0.5	8.3	9.5	15.5		
Max:	1	0.5	20	25	27		
Min:	0	0.0	2	2	4		

February 2001

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	8	10	19	2332	2133
2	0	0.5	6	5	11	3211	0112
3	0	0.0	1	2	4	1011	1000
4	0	0.0	1	1	3	0001	1010
5	0	0.0	3	3	6	0001	1013
6	0	0.5	14	12	20	3232	1243
7	0	0.5	6	7	14	3221	1131
8	0	0.5	6	7	14	1222	0223
9	0	0.5	5	6	12	1011	2232
10	0	0.5	6	6	12	1212	2310
11	0	0.5	6	5	12	2122	2012
12	0	0.5	6	8	15	2111	2233
13	1	1.0	25	28	31	3443	3455
14	1	0.5	19	17	25	3323	3443
15	0	0.5	5	5	12	2122	1211
16	0	0.5	3	3	8	0001	2122
17	0	0.5	2	3	8	1011	0221
18	0	0.5	3	4	9	2101	1112
19	0	0.5	4	5	11	2012	2121
20	0	0.5	7	8	15	1113	3222
21	0	0.5	6	6	14	2212	2212
22	0	0.5	5	6	14	1122	1223
23	0	0.5	10	10	19	3322	2322
24	0	0.0	4	3	7	1111	2100
25	0	0.0	2	2	6	0011	1021
26	0	0.5	10	14	19	3111	1444
27	0	0.5	12	11	18	4333	2120
28	0	0.5	9	9	15	0013	3332
Mean:	0.1	0.5	8.3	9.5	15.5		
Max:	1	0.5	20	25	27		
Min:	0	0.0	2	2	4		

March 2001

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	6	6	14	3221	1212
2	0	0.5	8	11	19	2122	2343
3	1	0.5	15	17	24	3223	3353
4	1	0.5	19	20	26	3333	2354
5	0	0.5	20	12	20	4432	2212
6	0	0.5	7	10	18	2222	2143
7	0	0.5	9	10	18	2322	2421
8	0	0.5	6	9	16	1112	2234
9	0	0.5	6	6	14	3122	2211
10	0	0.5	5	6	13	1122	1231
11	0	0.5	4	4	10	1221	1111
12	0	0.5	11	11	17	0112	3334
13	0	0.5	9	8	17	2313	2222
14	0	0.5	7	6	14	3222	1121
15	0	0.0	2	2	4	0010	1011
16	0	0.0	2	2	6	0001	1112
17	0	0.5	4	5	11	0111	1232
18	0	0.5	8	8	17	3222	1223
19	1	1.0	37	30	29	2223	4565
20	1	1.0	74	40	36	4543	5645
21	0	0.5	8	7	12	4221	1101
22	0	0.5	12	14	19	1111	4443
23	1	1.0	28	32	32	5533	3553
24	0	0.5	11	11	19	2322	2341
25	0	0.5	6	5	12	1122	2121
26	0	0.5	4	4	9	0111	2121
27	1	0.5	27	27	28	4323	2356
28	1	1.0	44	34	32	3255	6533
29	1	0.5	22	17	25	3343	3423
30	0	0.5	12	14	22	2232	2344
31	2	1.5	192	134	54	7875	6777
Mean:	0.3	0.6	20.2	16.8	19.6		
Max:	2	1.5	192	134	54		
Min:	0	0.0	2	2	4		

April 2001

Day	C	F	Ap	AK	ΣK	K	
1	1	1.0	38	31	32	5442	4355
2	1	0.5	22	20	26	5333	2442
3	0	0.5	6	7	15	2121	2322
4	1	0.5	23	22	25	2222	5552
5	1	0.5	19	17	24	1244	3433
6	0	0.5	13	13	21	2132	3334
7	1	0.5	20	20	26	4332	2453
8	1	1.0	63	48	34	2234	6476
9	0	0.5	20	14	22	2333	2432
10	0	0.5	11	12	20	3213	3323
11	1	1.5	85	51	31	3212	3767
12	1	1.0	50	29	28	6544	4311
13	1	1.0	50	34	30	1136	5554
14	1	0.5	18	16	24	4333	3332
15	1	0.5	13	16	23	3322	5233
16	0	0.5	8	9	18	3222	2223
17	0	0.5	6	7	15	2211	2223
18	1	1.0	50	40	30	6752	2233
19	0	0.5	6	8	15	3212	2113
20	0	0.5	6	7	14	3311	2112
21	0	0.5	8	10	16	2111	1433
22	1	1.0	37	28	30	3333	4644
23	0	0.5	16	14	22	4433	2321
24	0	0.5	6	6	14	2222	2112
25	0	0.5	6	5	12	1012	2222
26	0	0.5	6	8	16	2222	2123
27	0	0.5	4	5	12	1122	1221
28	1	1.0	40	33	32	2643	5543
29	0	0.5	13	13	21	4332	3321
30	0	0.0	1	2	4	1011	0010
Mean:	0.5	0.6	22.1	18.2	21.7		
Max:	1	1.5	85	51	34		
Min:	0	0.0	1	2	4		

Niemegk **Activity Indices**

May 2001

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	3	4	9	1111	1121
2	0	0.5	5	5	12	1222	1211
3	0	0.5	6	6	14	2112	2222
4	0	0.5	7	8	17	1232	2223
5	0	0.5	3	3	8	1111	0211
6	0	0.5	5	7	15	1122	3222
7	0	0.5	12	12	21	3332	3331
8	1	0.5	16	18	23	1123	3454
9	1	1.0	39	33	34	5434	4554
10	1	0.5	23	19	25	5422	3333
11	0	0.5	6	6	13	3111	1123
12	1	0.5	30	25	29	3233	4455
13	1	0.5	27	26	30	5333	3454
14	0	0.5	11	10	17	4321	1231
15	0	0.5	11	12	20	1222	2344
16	0	0.5	7	8	17	3222	2213
17	0	0.5	6	7	15	2212	1322
18	0	0.5	8	10	18	3312	3213
19	0	0.5	10	11	18	4422	2121
20	0	0.5	5	6	13	1222	2112
21	0	0.5	4	5	11	1102	2221
22	0	0.5	7	10	19	2213	2333
23	0	0.5	9	12	20	2321	3333
24	0	0.5	5	6	13	2211	2221
25	0	0.5	7	8	16	2112	3331
26	0	0.5	5	5	12	2222	1111
27	0	0.5	8	10	15	1111	2522
28	1	0.5	18	19	25	3223	3534
29	0	0.5	9	12	19	3212	4421
30	0	0.5	3	4	10	1101	2221
31	0	0.5	2	3	8	1101	1211
Mean:	0.2	0.5	10.2	10.6	17.3		
Max:	1	1.0	39	33	34		
Min:	0	0.5	2	3	8		

June 2001

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	9	13	19	0113	4334
2	1	0.5	22	21	27	5434	3233
3	0	0.5	6	8	16	2221	2232
4	0	0.5	7	10	18	3123	2322
5	0	0.5	5	6	13	2211	2212
6	0	0.5	6	8	15	1112	3322
7	0	0.5	9	10	18	2313	3222
8	0	0.5	7	10	19	1223	2333
9	1	0.5	25	24	28	2324	4355
10	1	0.5	20	20	26	5333	2343
11	0	0.5	8	10	18	2212	3332
12	0	0.5	4	4	11	2111	1122
13	0	0.5	8	10	19	2322	2332
14	0	0.5	7	10	17	3111	2324
15	0	0.5	7	8	16	3313	1221
16	0	0.5	5	6	14	2121	2231
17	0	0.5	7	10	17	1122	4322
18	1	1.0	36	31	33	3444	5544
19	0	0.5	12	14	22	3312	2434
20	0	0.5	11	12	20	2333	3312
21	0	0.5	13	15	23	2332	3442
22	0	0.5	5	6	13	3101	2222
23	0	0.5	5	6	14	2221	2221
24	0	0.5	7	8	17	2122	3322
25	0	0.5	6	6	13	2211	2221
26	0	0.5	13	14	21	1213	4343
27	0	0.5	6	6	10	4211	1100
28	0	0.0	2	3	7	0111	1111
29	0	0.5	3	3	8	0011	1122
30	0	0.5	6	8	16	1212	2233
Mean:	0.1	0.5	9.6	10.7	17.6		
Max:	1	1.0	36	31	33		
Min:	0	0.0	2	3	7		

July 2001

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	7	9	17	3211	2233
2	0	0.5	4	6	14	1212	2132
3	0	0.5	6	8	16	1212	3232
4	0	0.5	6	8	17	2212	2323
5	0	0.5	12	12	21	2223	3333
6	0	0.5	8	9	17	1212	3332
7	0	0.5	5	5	12	2201	2221
8	1	0.5	14	16	22	2222	2345
9	0	0.5	10	12	18	5221	2222
10	0	0.5	9	10	17	0212	2343
11	0	0.5	7	7	14	3301	2221
12	0	0.5	6	10	19	2222	3233
13	0	0.5	6	8	15	2212	1133
14	0	0.5	12	14	22	4423	3321
15	0	0.5	10	11	18	1121	3433
16	1	0.5	13	16	23	3313	3424
17	1	0.5	16	16	24	4323	4422
18	0	0.5	8	9	18	2222	3322
19	0	0.5	7	10	17	1113	2432
20	0	0.5	4	5	12	1212	2211
21	0	0.5	4	4	11	1112	2112
22	0	0.5	8	12	20	2231	3333
23	0	0.5	9	11	20	3222	3332
24	0	0.5	12	12	20	3122	4332
25	1	0.5	20	16	24	2334	3432
26	0	0.5	10	10	18	3322	2123
27	0	0.5	6	7	15	1122	2322
28	0	0.0	3	3	7	1101	2101
29	0	0.5	5	7	15	1222	2321
30	0	0.5	7	10	17	1113	3233
31	1	1.0	26	28	31	4443	5533
Mean:	0.2	0.5	9.0	10.4	17.8		
Max:	1	1.0	26	28	31		
Min:	0	0.0	3	3	7		

August 2001

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	9	11	19	4213	3222
2	0	0.5	6	8	16	2222	3311
3	0	0.5	12	14	23	3243	3332
4	0	0.5	6	9	18	2222	2332
5	1	0.5	21	23	27	2233	5543
6	1	0.5	17	16	24	2333	3334
7	0	0.5	7	8	16	3212	2222
8	0	0.5	6	6	14	3221	2121
9	0	0.5	7	8	16	1221	2323
10	0	0.5	6	7	15	2222	1132
11	0	0.5	4	4	9	2100	1113
12	0	0.5	12	13	20	2114	2433
13	1	0.5	22	22	28	4533	3343
14	0	0.5	10	12	21	2323	3323
15	0	0.5	5	8	17	2221	2233
16	0	0.5	3	4	9	1211	1111
17	1	1.0	42	34	28	1114	4566
18	1	0.5	15	16	23	3231	4433
19	0	0.5	8	8	16	1233	2221
20	0	0.5	6	8	15	0113	3232
21	0	0.5	13	13	21	1224	3333
22	1	0.5	19	16	23	1233	3344
23	0	0.5	8	8	17	3222	3122
24	0	0.5	3	4	9	1212	2100
25	0	0.5	10	12	19	0213	3343
26	0	0.5	10	12	21	3233	2233
27	0	0.5	13	12	20	1213	3343
28	0	0.5	11	10	18	4322	2221
29	0	0.5	5	6	13	1123	2211
30	0	0.5	10	10	17	0222	3431
31	0	0.5	12	12	20	3223	2422
Mean:	0.2	0.5	10.9	11.4	18.5		
Max:	1	1.0	42	34	28		
Min:	0	0.5	3	4	9		

Niemegk **A c t i v i t y   I n d i c e s**

September 2001

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	4	5	11	2112	2210
2	0	0.5	4	7	12	0001	2333
3	1	0.5	17	18	24	2223	3435
4	0	0.5	15	14	23	4323	2333
5	0	0.5	8	8	15	3121	2330
6	0	0.5	5	5	12	2121	1122
7	0	0.0	3	3	6	0000	1113
8	0	0.5	6	8	15	4212	2220
9	0	0.5	4	4	10	1212	2110
10	0	0.5	3	4	9	1101	1113
11	0	0.5	9	10	17	2102	3333
12	0	0.5	12	12	21	3232	2234
13	1	0.5	18	16	23	2444	3321
14	0	0.5	9	10	19	3222	3223
15	1	0.5	20	21	28	4333	4443
16	0	0.5	8	10	17	3111	2333
17	0	0.5	6	6	13	1131	2113
18	0	0.5	11	10	17	2111	2442
19	0	0.5	9	10	19	3322	2232
20	0	0.5	4	6	12	1112	2113
21	0	0.5	4	6	12	2111	2113
22	0	0.5	8	7	14	2123	3210
23	1	1.0	41	30	29	0244	4654
24	0	0.5	8	10	18	4223	2221
25	1	1.0	33	30	20	1121	2067
26	1	0.5	26	17	23	5343	2222
27	0	0.5	11	11	18	1113	2343
28	0	0.5	14	12	21	3232	2333
29	1	0.5	28	25	29	3324	3455
30	1	1.0	29	31	29	4222	3466
Mean:	0.3	0.5	12.6	12.2	17.9		
Max:	1	1.0	41	31	29		
Min:	0	0.0	3	3	6		

October 2001

Day	C	F	Ap	AK	ΣK	K	
1	1	1.0	48	33	33	5644	3434
2	1	1.0	52	29	30	4333	3356
3	1	1.0	69	36	35	5344	5545
4	0	0.5	17	14	23	4233	2333
5	0	0.5	8	8	14	1113	1331
6	0	0.5	7	6	13	2123	2021
7	0	0.0	3	3	7	1011	2002
8	0	0.5	16	14	21	2222	3325
9	0	0.5	18	12	20	3324	3311
10	0	0.5	7	7	15	2122	2231
11	1	0.5	21	20	24	3221	3553
12	1	0.5	34	25	30	5433	3444
13	0	0.5	11	10	18	3223	2231
14	0	0.5	13	15	21	1223	2353
15	0	0.5	10	10	18	3323	2212
16	0	0.5	7	8	16	3122	2222
17	0	0.5	4	5	11	3121	1111
18	0	0.5	3	3	8	1001	1221
19	0	0.5	9	11	17	0112	3343
20	0	0.5	11	12	20	1333	2332
21	1	1.0	57	34	27	3211	2666
22	1	1.5	96	63	41	6335	5667
23	0	0.5	17	14	21	5332	2222
24	0	0.0	2	2	4	1111	0000
25	0	0.5	7	8	15	0132	1233
26	0	0.5	4	4	11	1112	1122
27	0	0.5	6	6	13	2312	2111
28	1	1.0	44	28	31	3543	4345
29	0	0.5	14	12	21	4222	2333
30	0	0.5	7	8	16	3222	2212
31	1	0.5	12	17	20	1021	3355
Mean:	0.3	0.6	20.5	15.4	19.8		
Max:	1	1.5	96	63	41		
Min:	0	0.0	2	2	4		

November 2001

Day	C	F	Ap	AK	ΣK	K	
1	1	0.5	24	18	24	5432	3331
2	0	0.5	5	6	12	1122	3111
3	0	0.0	2	2	4	1001	1010
4	0	0.5	5	4	9	0022	2210
5	1	0.5	21	20	22	1013	3455
6	2	1.5	142	110	47	9754	4666
7	1	0.5	19	15	22	5322	2233
8	0	0.5	6	4	9	2211	1002
9	0	0.5	5	6	13	1112	1232
10	0	0.5	7	8	15	2212	1124
11	0	0.5	5	5	11	3222	1010
12	0	0.0	2	3	7	2012	2000
13	0	0.5	4	4	11	1111	1222
14	0	0.5	3	4	10	1122	1111
15	0	0.5	9	8	11	0001	1441
16	0	0.5	7	8	16	3222	2212
17	1	0.5	13	18	25	2323	4344
18	0	0.5	10	10	18	2212	2234
19	1	0.5	20	21	26	4222	3454
20	0	0.5	8	6	10	3232	0000
21	0	0.5	4	4	9	1111	1211
22	0	0.5	9	10	19	2222	2243
23	0	0.5	13	11	20	3222	2333
24	1	1.5	104	77	42	3686	6634
25	0	0.5	8	6	14	1223	2211
26	0	0.5	4	3	8	2122	0001
27	0	0.0	2	2	4	1001	0101
28	0	0.0	2	2	6	1010	1102
29	0	0.0	3	2	5	1111	1000
30	0	0.0	2	2	6	1101	1011
	1	0.5	24	18	24	5432	3331
Mean:	0.3	0.5	15.6	13.3	15.2		
Max:	2	1.5	142	110	47		
Min:	0	0.0	2	2	4		

December 2001

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	7	6	14	1112	3222
2	0	0.5	4	6	13	1022	2222
3	0	0.5	8	12	19	1212	3244
4	0	0.5	10	14	22	3223	3243
5	0	0.5	11	12	20	4312	2242
6	0	0.5	11	12	21	3223	2333
7	0	0.5	6	6	14	2211	2312
8	0	0.5	6	7	13	4112	2111
9	0	0.5	3	4	8	1102	0013
10	0	0.5	4	4	9	1011	2112
11	0	0.5	4	5	11	1111	1123
12	0	0.5	11	12	21	2223	2343
13	0	0.5	3	3	8	2111	1101
14	0	0.5	4	5	11	0101	2223
15	0	0.5	9	7	15	2222	3112
16	0	0.5	10	10	19	3332	2222
17	0	0.5	16	14	22	3322	3432
18	0	0.5	9	9	17	4222	2212
19	0	0.5	8	8	17	3222	1232
20	0	0.5	4	5	11	2012	2112
21	0	0.5	14	14	21	1123	2444
22	0	0.5	8	9	16	3322	2031
23	0	0.5	7	6	13	1113	2212
24	1	0.5	23	23	28	2334	4543
25	0	0.5	9	10	18	2223	2214
26	0	0.5	6	8	16	3112	1233
27	0	0.5	7	8	16	3112	2232
28	0	0.5	4	5	11	1022	2112
29	0	0.5	11	12	20	1423	3223
30	1	0.5	21	18	24	3422	2245
31	1	0.5	15	18	24	3322	2354
Mean:	0.1	0.5	8.8	9.4	16.5		
Max:	1	0.5	23	23	28		
Min:	0	0.5	3	3	8		

K Index Frequencies in the Eight Three Hourly Intervals

2001

UT	00-03	03-06	06-09	09-12	12-15	15-18	18-21	21-24	Σ	00-03	03-06	06-09	09-12	12-15	15-18	18-21	21-24	Σ
				January									July					
K=0	3	5	2	3	1	4	2	1	21	1	-	3	-	-	-	1	-	5
1	4	11	17	11	13	11	7	5	79	11	7	12	7	1	5	2	6	51
2	16	10	11	10	9	5	7	5	73	9	17	13	16	15	8	11	12	101
3	6	4	1	6	8	8	6	14	53	6	5	2	7	12	12	15	11	70
4	2	-	-	1	-	3	5	5	16	3	2	1	1	2	5	2	1	17
5	-	1	-	-	-	-	2	1	4	1	-	-	-	1	1	-	1	4
6	-	-	-	-	-	-	2	-	2	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				February									August					
K=0	1	-	3	-	-	-	1	-	5	3	-	1	1	-	-	1	1	7
1	11	7	12	7	1	5	2	6	51	9	5	9	5	3	6	4	7	48
2	9	17	13	16	15	8	11	12	101	9	22	13	8	12	8	9	8	89
3	6	5	2	7	12	12	15	11	70	7	3	7	14	13	11	11	12	78
4	3	2	1	1	2	5	2	1	17	3	-	1	3	2	4	5	2	20
5	1	-	-	-	1	1	-	1	4	-	1	-	-	1	2	-	-	4
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	2
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				March									September					
K=0	5	9	4	-	3	5	2	5	33	3	2	4	1	-	1	-	5	16
1	8	8	13	13	10	8	8	5	73	6	13	8	9	3	7	8	2	56
2	7	6	7	10	11	9	9	9	68	8	9	11	10	18	8	6	4	74
3	7	4	3	5	4	3	5	7	38	7	5	4	7	7	8	9	13	60
4	1	1	1	-	-	3	3	1	10	5	1	3	3	2	5	3	2	24
5	-	-	-	-	-	-	1	1	2	1	-	-	-	-	-	2	2	5
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	1	4
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				April									October					
K=0	-	2	-	-	1	1	-	1	5	2	3	1	-	1	3	2	1	13
1	5	5	8	5	2	4	5	4	38	8	9	7	7	5	3	5	8	52
2	10	10	7	14	13	6	9	8	77	4	8	13	10	14	8	6	7	70
3	7	8	10	7	6	8	7	11	64	9	8	7	10	8	11	8	6	67
4	4	2	4	3	3	6	3	3	28	3	1	3	3	1	2	4	2	19
5	2	1	1	-	4	3	4	1	16	4	1	-	1	2	2	4	4	18
6	2	1	-	1	1	1	1	1	8	1	1	-	-	-	2	2	2	8
7	-	1	-	-	-	1	1	1	4	-	-	-	-	-	-	-	1	1
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				May									November					
K=0	-	-	3	-	1	-	-	-	4	2	7	4	1	3	8	7	6	38
1	12	11	11	9	7	5	7	13	75	12	8	10	8	12	5	9	9	73
2	7	12	12	16	11	12	12	5	87	7	10	12	16	8	9	2	5	69
3	7	5	5	5	9	7	7	7	52	5	2	2	3	4	3	6	3	28
4	2	3	-	1	3	4	1	5	19	1	1	-	1	2	3	3	5	16
5	3	-	-	-	-	3	4	1	11	2	-	1	-	-	-	2	1	6
6	-	-	-	-	-	-	-	-	-	-	1	-	1	1	2	1	1	7
7	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1
8	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1
9	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
				June									December					
K=0	3	1	1	-	-	-	1	1	7	1	4	2	-	1	2	1	-	11
1	5	10	15	11	5	4	3	5	58	10	10	12	5	4	7	10	3	61
2	13	9	9	8	13	10	12	14	88	7	9	15	18	19	15	6	14	103
3	6	8	4	8	7	13	9	5	60	10	6	2	7	6	4	6	9	50
4	1	2	1	3	4	2	4	4	21	3	2	-	1	1	2	7	4	20
5	2	-	-	-	1	1	1	1	6	-	-	-	-	-	1	1	1	3
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

K Index Frequencies

Niemegk — Annual Sums — 2001

K	UT	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24	Σ
0		28	35	26	7	11	25	18	21	171
1		95	106	129	97	74	72	74	77	724
2		104	132	138	149	156	106	96	96	977
3		85	64	51	87	88	95	94	106	670
4		32	16	16	20	22	42	46	38	232
5		16	6	3	3	10	16	25	16	95
6		3	3	-	2	4	7	10	7	36
7		1	2	1	-	-	2	2	4	12
8		-	1	1	-	-	-	-	-	2
9		1	-	-	-	-	-	-	-	1

K Index Monthly Means

Niemegk — 2001

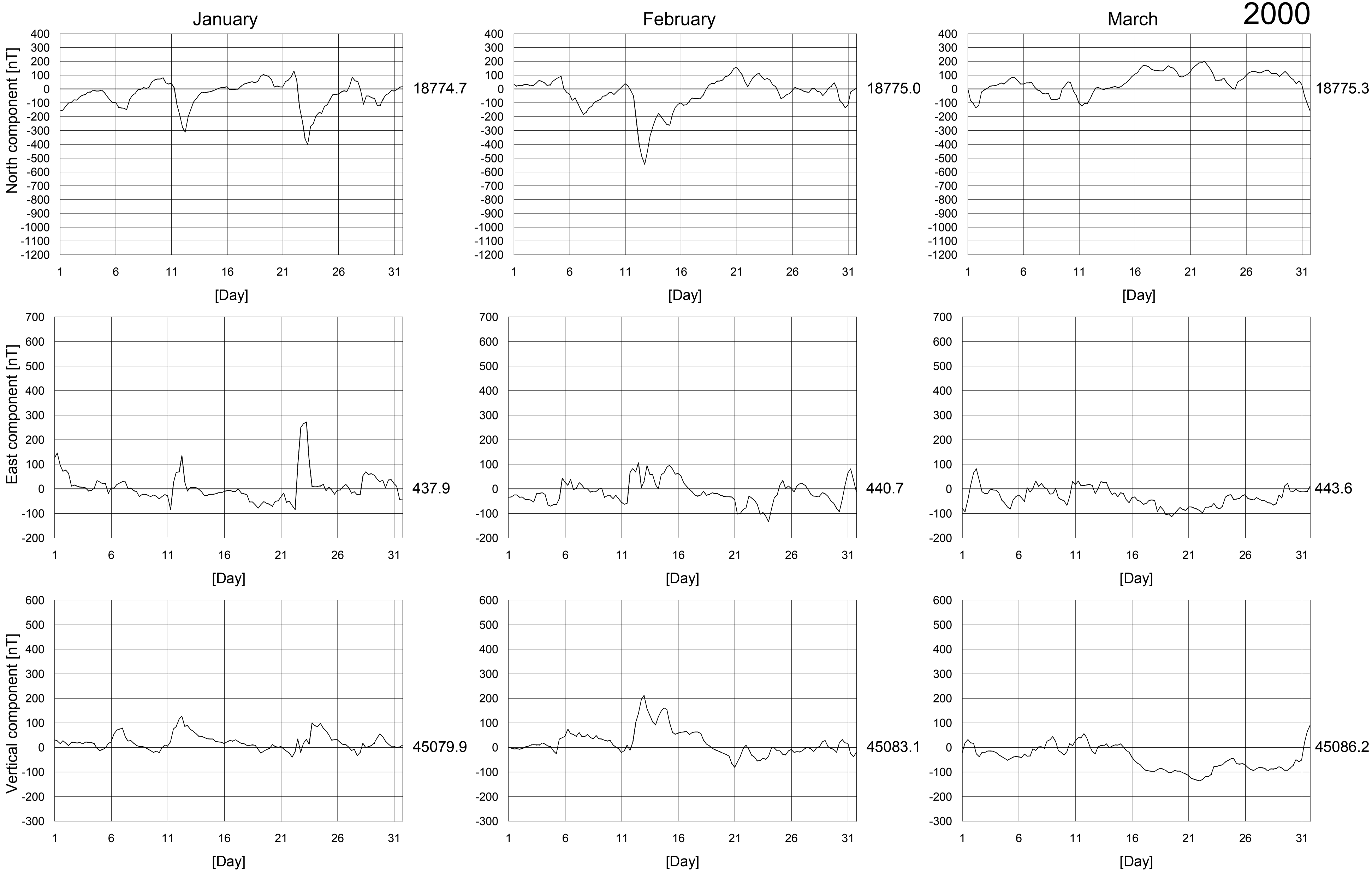
Month	UT	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24	Mean
January		2.0	1.5	1.4	1.7	1.8	1.8	2.6	2.6	1.9
February		1.7	1.3	1.4	1.7	1.6	1.7	2.1	1.9	1.7
March		2.3	2.2	2.2	2.2	2.3	2.7	3.0	2.7	2.4
April		2.8	2.5	2.4	2.4	2.8	3.1	3.0	2.8	2.7
May		2.3	2.0	1.6	1.9	2.2	2.6	2.5	2.2	2.2
June		2.1	2.0	1.6	2.1	2.4	2.5	2.5	2.3	2.2
July		2.1	2.1	1.5	2.1	2.6	2.6	2.5	2.3	2.2
August		1.9	2.0	1.9	2.4	2.5	2.6	2.6	2.4	2.3
September		2.3	1.7	1.8	2.1	2.3	2.4	2.7	2.7	2.2
October		2.6	2.1	2.1	2.4	2.3	2.6	2.9	2.8	2.5
November		2.1	1.7	1.8	2.0	1.8	1.9	2.0	2.0	1.9
December		2.1	1.7	1.5	2.1	2.1	2.0	2.4	2.5	2.1
Mean		2.2	1.9	1.8	2.1	2.2	2.4	2.5	2.4	2.2

K Index Frequencies

Niemegk — Monthly Sums — 2001

K	Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Σ
0		21	33	11	5	4	7	5	7	16	13	38	11	171
1		79	73	60	38	75	58	51	48	56	52	73	61	724
2		73	68	78	77	87	88	101	89	74	70	69	103	977
3		53	38	50	64	52	60	70	78	60	67	28	50	670
4		16	10	22	28	19	21	17	20	24	19	16	20	232
5		4	2	16	16	11	6	4	4	5	18	6	3	95
6		2	-	5	8	-	-	-	2	4	8	7	-	36
7		-	-	5	4	-	-	-	-	1	1	1	-	12
8		-	-	1	-	-	-	-	-	-	-	1	-	2
9		-	-	-	-	-	-	-	-	-	-	1	-	1

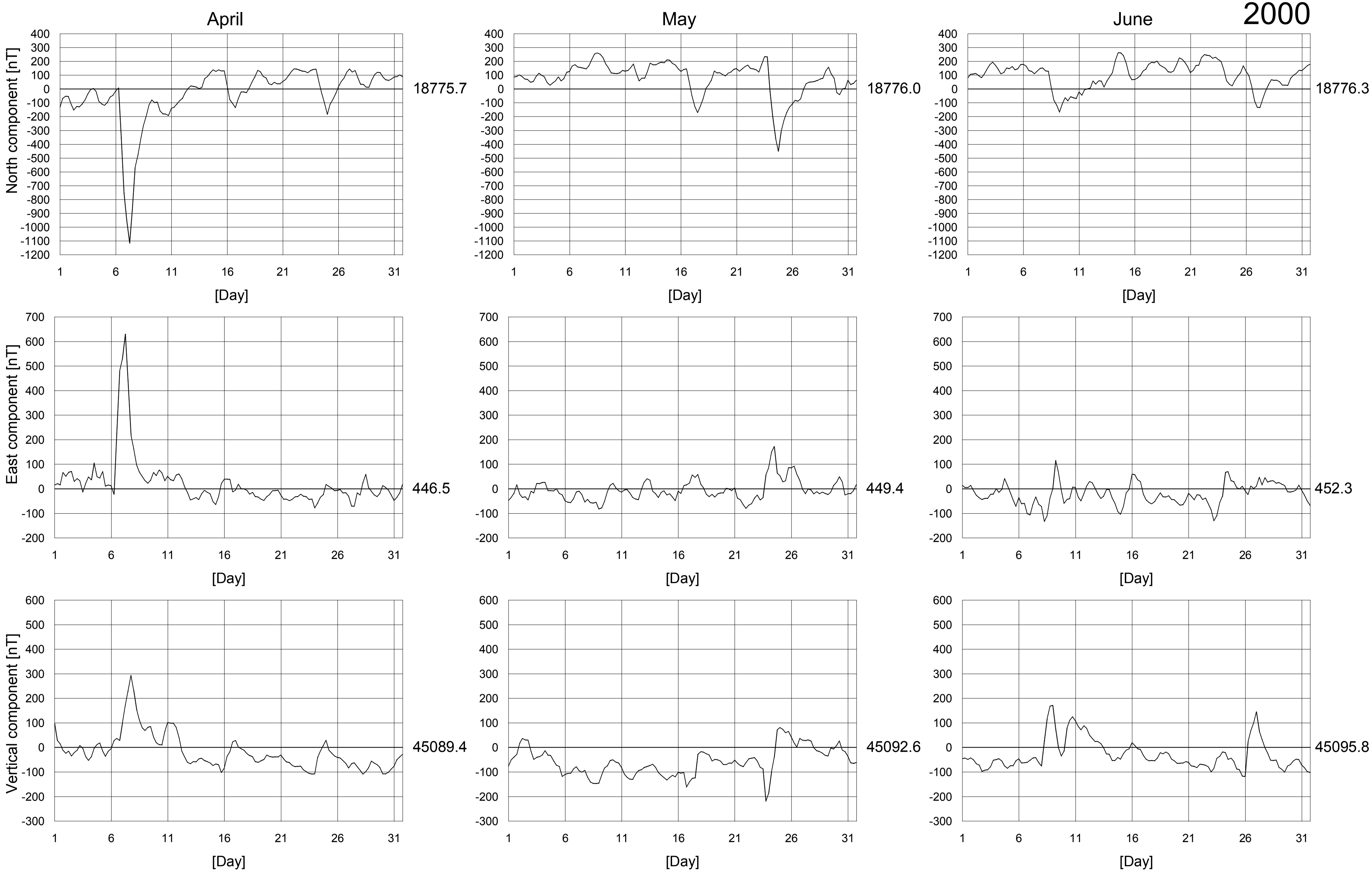
Deviations of the Magnetic Components from Normal Value



The values at the right margin apply to the middle of the month

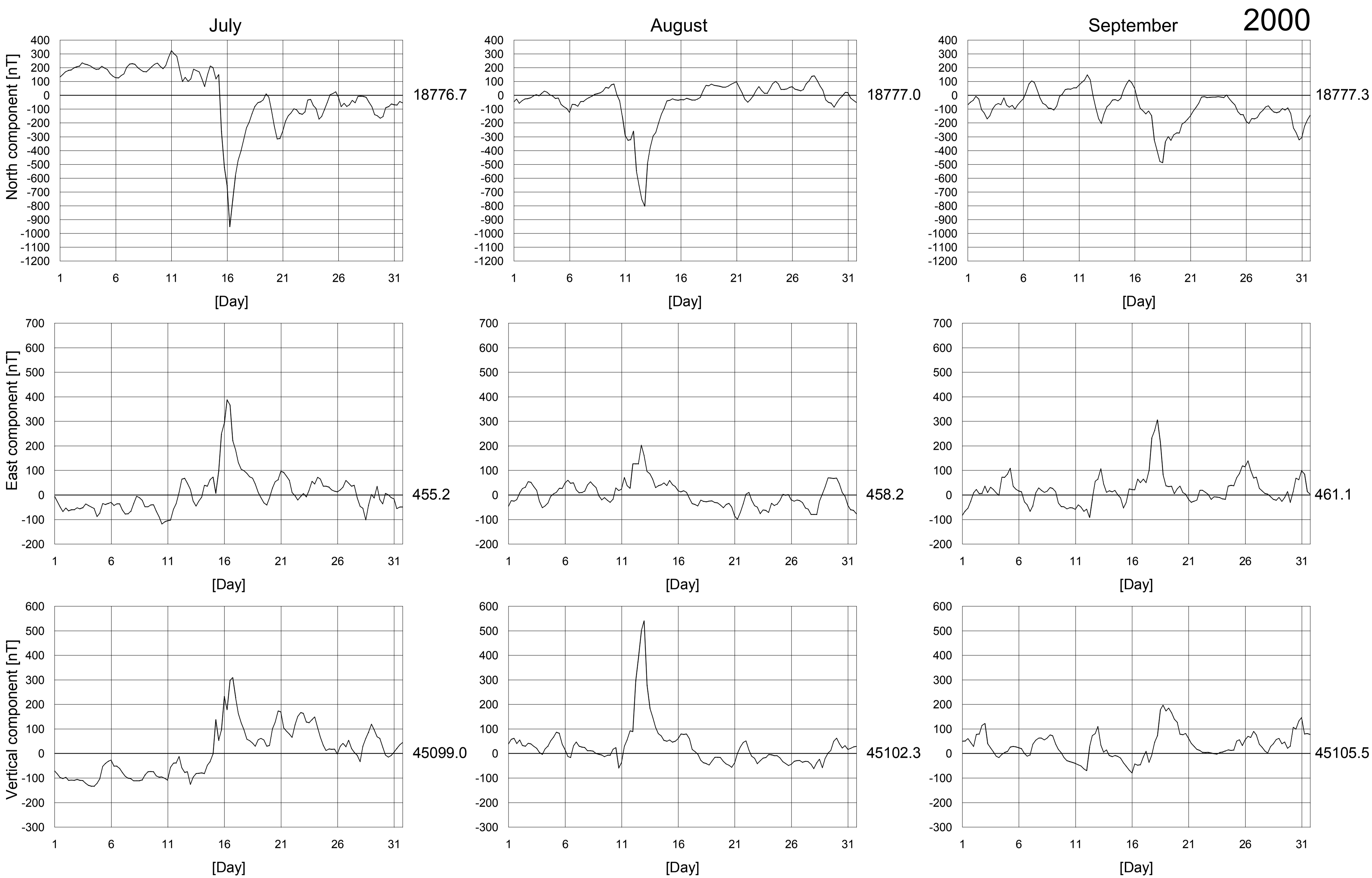
Deviations of the Magnetic Components from Normal Value

2000



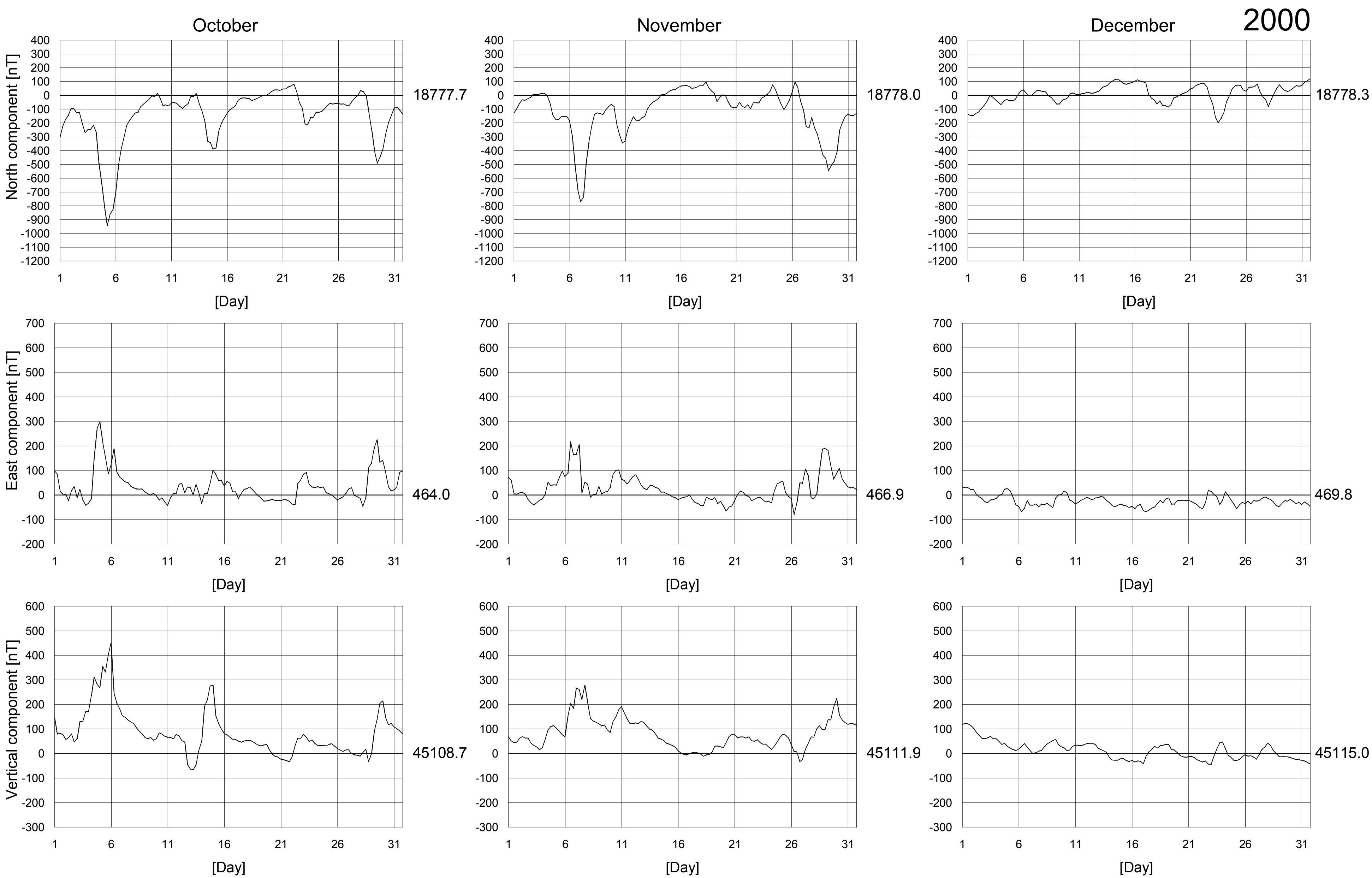
The values at the right margin apply to the middle of the month

Deviations of the Magnetic Components from Normal Value



The values at the right margin apply to the middle of the month

Deviations of the Magnetic Components from Normal Value



The values at the right margin apply to the middle of the month

Annual Mean Values of the Observatories
Potsdam (1890-1907), Seddin (1908-1931) and Niemegk (from 1932), referenced to Niemegk

Year	D	H	I	F	X	Y	Z
1890	-10° 57.3'	18731 nT	66° 29.0'	46942 nT	18390 nT	-3559 nT	43044 nT
1891	-10 50.8	18749	66 25.3	46873	18414	-3528	42959
1892	-10 44.8	18759	66 25.8	46914	18430	-3498	43000
1893	-10 39.9	18790	66 25.0	46966	18466	-3477	43044
1894	-10 34.0	18809	66 23.3	46959	18490	-3449	43028
1895	-10 28.5	18834	66 21.1	46954	18520	-3424	43011
1896	-10 22.9	18861	66 19.8	46976	18552	-3399	43024
1897	-10 18.3	18888	66 17.7	46982	18583	-3379	43018
1898	-10 13.6	18908	66 16.6	46999	18608	-3357	43028
1899	-10 09.3	18932	66 14.6	46993	18635	-3338	43011
1900	-10 04.9	18958	66 13.0	47008	18665	-3319	43016
1901	-10 00.7	18975	66 11.5	47006	18686	-3299	43006
1902	-9 56.6	18987	66 09.6	46977	18702	-3279	42969
1903	-9 52.4	18990	66 08.8	46959	18709	-3256	42948
1904	-9 48.0	18994	66 08.4	46957	18717	-3233	42943
1905	-9 43.1	18993	66 08.0	46942	18720	-3206	42928
1906	-9 38.2	18993	66 07.2	46916	18725	-3179	42900
1907	-9 32.6	18980	66 07.7	46900	18717	-3147	42888
1908	-9 26.6	18966	66 08.0	46875	18709	-3112	42867
1909	-9 19.3	18952	66 08.4	46855	18702	-3070	42850
1910	-9 11.6	18942	66 08.4	46828	18699	-3027	42826
1911	-9 03.1	18929	66 08.8	46808	18694	-2978	42809
1912	-8 54.6	18916	66 09.2	46788	18688	-2930	42794
1913	-8 45.2	18898	66 10.1	46772	18678	-2876	42784
1914	-8 35.4	18874	66 11.6	46758	18662	-2819	42780
1915	-8 25.9	18841	66 13.8	46743	18637	-2763	42778
1916	-8 16.3	18812	66 15.8	46737	18617	-2706	42783
1917	-8 07.1	18787	66 17.8	46734	18599	-2653	42791
1918	-7 58.1	18763	66 19.4	46724	18582	-2601	42792
1919	-7 48.6	18739	66 21.1	46715	18565	-2546	42792
1920	-7 38.5	18721	66 22.3	46708	18554	-2489	42792
1921	-7 27.8	18704	66 23.4	46700	18546	-2430	42791
1922	-7 16.7	18690	66 24.6	46701	18539	-2368	42798
1923	-7 05.9	18679	66 25.3	46697	18536	-2308	42799
1924	-6 54.1	18665	66 26.7	46706	18530	-2243	42815
1925	-6 42.0	18646	66 28.5	46714	18518	-2175	42831
1926	-6 29.6	18615	66 31.4	46729	18496	-2105	42861
1927	-6 18.2	18602	66 32.9	46742	18490	-2042	42880
1928	-6 06.9	18580	66 34.6	46740	18475	-1980	42888
1929	-5 56.4	18556	66 37.3	46766	18456	-1920	42927
1930	-5 45.9	18532	66 40.1	46791	18438	-1861	42965
1931	-5 36.2	18526	66 41.5	46820	18437	-1809	42999
1932	-5 25.7	18511	66 43.5	46848	18428	-1751	43035
1933	-5 16.1	18499	66 45.7	46884	18421	-1698	43080
1934	-5 05.2	18491	66 46.9	46905	18418	-1639	43106

Annual Mean Values Potsdam – Seddin – Niemegk (continuation)

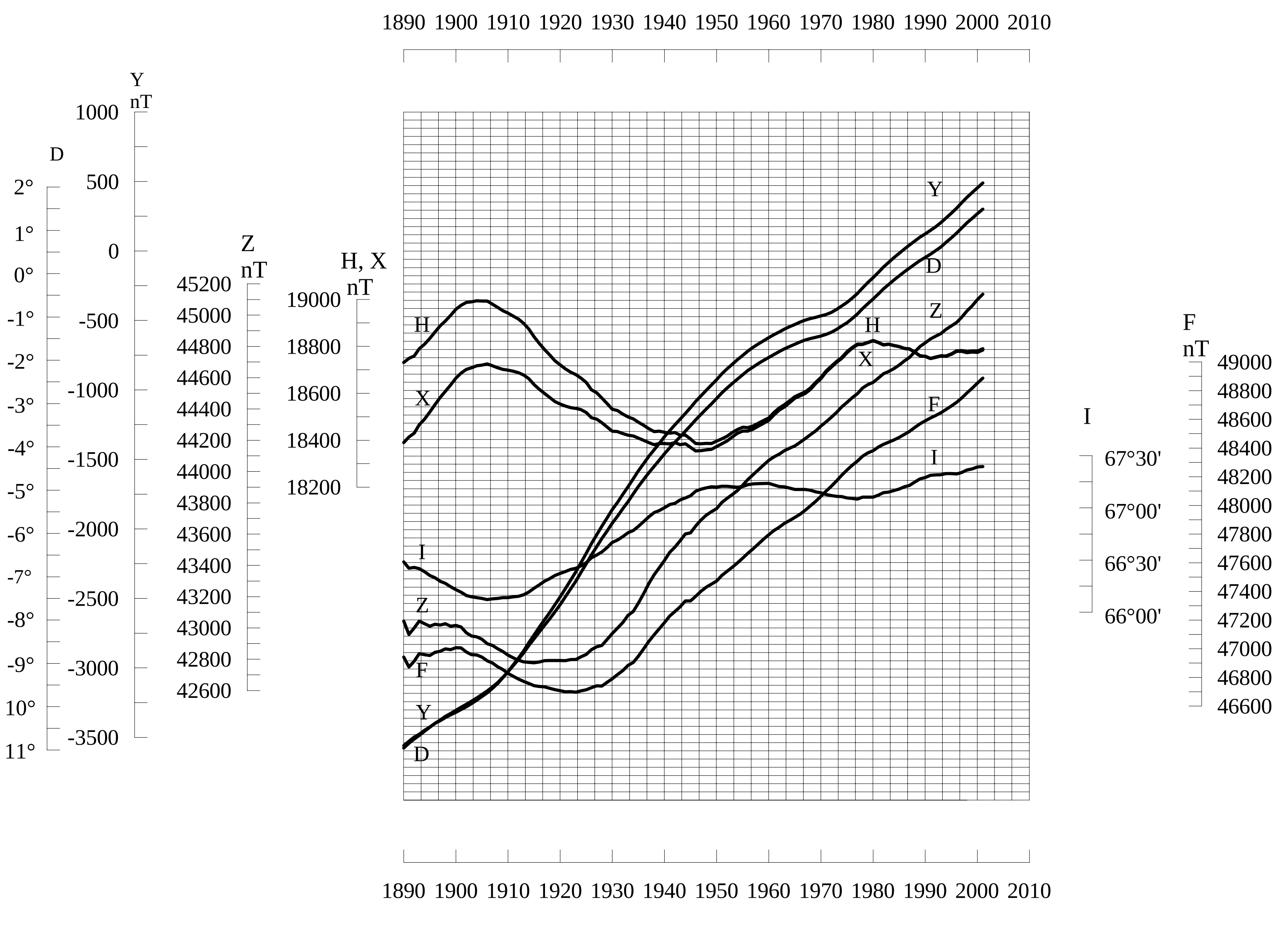
Year	D	H	I	F	X	Y	Z
1935	-4° 54.9’	18477 nT	66°49.4’	46948 nT	18409 nT	-1583 nT	43159 nT
1936	-4 45.3	18464	66 52.1	46999	18400	-1531	43220
1937	-4 35.8	18449	66 54.8	47051	18390	-1478	43284
1938	-4 27.1	18437	66 57.3	47098	18381	-1431	43339
1939	-4 18.3	18438	66 58.5	47141	18386	-1384	43386
1940	-4 09.6	18434	67 00.1	47182	18386	-1337	43431
1941	-4 01.4	18430	67 01.9	47228	18384	-1293	43484
1942	-3 53.8	18433	67 02.6	47259	18390	-1252	43516
1943	-3 46.0	18421	67 04.6	47293	18381	-1210	43558
1944	-3 38.4	18422	67 05.7	47333	18385	-1169	43601
1945	-3 30.7	18405	67 07.0	47333	18370	-1127	43608
1946	-3 22.5	18386	67 09.6	47366	18354	-1082	43652
1947	-3 15.1	18385	67 10.7	47401	18356	-1043	43690
1948	-3 07.6	18387	67 11.5	47430	18359	-1003	43721
1949	-3 00.4	18386	67 12.1	47451	18361	-965	43744
1950	-2 53.1	18396	67 12.0	47472	18373	-926	43763
1951	-2 45.3	18406	67 12.4	47511	18385	-885	43801
1952	-2 38.4	18417	67 12.5	47541	18397	-848	43829
1953	-2 32.2	18433	67 12.1	47568	18414	-816	43852
1954	-2 25.9	18446	67 11.9	47599	18430	-782	43879
1955	-2 20.0	18455	67 12.3	47633	18439	-751	43913
1956	-2 14.1	18454	67 13.4	47666	18439	-720	43949
1957	-2 09.1	18461	67 13.8	47697	18448	-693	43980
1958	-2 04.6	18472	67 13.9	47730	18460	-669	44011
1959	-2 00.2	18484	67 14.0	47764	18472	-646	44042
1960	-1 55.9	18495	67 14.1	47796	18485	-623	44072
1961	-1 52.0	18518	67 13.2	47824	18508	-603	44094
1962	-1 48.2	18537	67 12.3	47847	18528	-583	44110
1963	-1 44.1	18551	67 12.1	47874	18542	-562	44134
1964	-1 40.8	18568	67 11.4	47895	18560	-544	44150
1965	-1 37.8	18586	67 10.6	47916	18579	-529	44164
1966	-1 34.7	18596	67 10.6	47939	18589	-512	44186
1967	-1 31.8	18606	67 10.6	47966	18599	-497	44211
1968	-1 29.8	18623	67 10.2	47997	18617	-486	44236
1969	-1 28.2	18647	67 09.3	48028	18641	-478	44260
1970	-1 26.3	18668	67 08.7	48064	18662	-468	44291
1971	-1 24.1	18695	67 07.7	48099	18690	-457	44317
1972	-1 21.2	18716	67 07.1	48134	18711	-442	44347
1973	-1 17.2	18736	67 06.6	48171	18732	-421	44378
1974	-1 12.5	18753	67 06.5	48211	18749	-396	44414
1975	-1 07.9	18777	67 05.7	48246	18773	-371	44442
1976	-1 02.1	18795	67 05.4	48280	18792	-340	44472
1977	-0 56.0	18810	67 05.1	48309	18807	-306	44497
1978	-0 48.5	18810	67 06.1	48343	18808	-266	44534
1979	-0 41.6	18817	67 06.2	48366	18816	-228	44556
1980	-0 35.0	18825	67 06.2	48382	18824	-192	44570

Annual Mean Values Potsdam – Seddin – Niemegk (continuation)

Year	D	H	I	F	X	Y	Z
1981	-0° 28.1’	18817 nT	67° 07.4’	48406 nT	18816 nT	-154 nT	44598 nT
1982	-0 21.2	18807	67 08.8	48426	18806	-116	44625
1983	-0 15.0	18809	67 09.1	48440	18809	-82	44639
1984	-0 08.8	18804	67 10.0	48456	18804	-48	44659
1985	-0 03.1	18799	67 10.8	48474	18799	-17	44680
1986	0 02.6	18791	67 12.1	48495	18791	14	44707
1987	0 07.7	18789	67 12.9	48516	18789	42	44730
1988	0 13.0	18775	67 14.8	48543	18775	71	44765
1989	0 18.2	18760	67 16.7	48569	18760	99	44800
1990	0 22.4	18758	67 17.5	48589	18757	122	44822
1991	0 27.2	18748	67 18.8	48610	18748	148	44848
1992	0 31.6	18754	67 18.9	48627	18753	172	44865
1993	0 37.1	18760	67 19.0	48645	18759	203	44882
1994	0 43.4	18759	67 19.7	48669	18757	237	44909
1995	0 49.6	18768	67 19.8	48693	18766	271	44931
1996	0 56.1	18781	67 19.5	48719	18779	307	44953
1997	1 03.2	18782	67 20.4	48749	18779	346	44986
1998	1 10.5	18777	67 21.8	48784	18773	385	45026
1999	1 16.6	18780	67 22.4	48816	18775	419	45059
2000	1 23.1	18780	67 23.5	48853	18775	454	45099
2001	1 29.2	18790	67 23.8	48888	18784	488	45133

Niemegk Observatory

Secular Variation of the Geomagnetic Elements

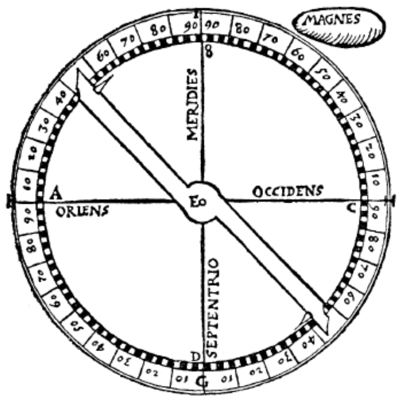


GeoForschungsZentrum Potsdam

Geomagnetic Results Wingst

2001

Yearbook No. 47



Potsdam 2007

The Wingst Observatory staff in front of the Office Building. In the background: the Large Laboratory which contains a Fanselau coil system

Wingst Observatory: Fanselau coil system constructed in 1943

Cover: Compass after Pierre de Maricourt, 1269 (SCHÜCK,1911)

Geomagnetic Results Wingst 2001 – Yearbook No 47

Günter Schulz

Contents

1 Introduction

This report (yearbook No 47) contains the results of Erdmagnetisches Observatorium Wingst (WNG) for 2001[1]).

The enclosed CDrom contains recorded minute values as well as derived (hourly, daily, monthly) mean values and indices. It also provides recalculated epoch values from 1939.5 on and those of Marineobservatorium Wilhelmshaven (WLH) before then. Revised sets of monthly and daily mean values (since 1943) and K values (since 1944) are also included.

In the year under review, Wingst Observatory additionally published on a monthly basis:

a) Reports on geomagnetic indices and special geomagnetic events
b) Reports on preliminary daily and monthly means

Geomagnetic data have been provided on a regular basis to the following institutions:

a) International Space Environment Service (ISES): Geomagnetic indices and geomagnetic events (daily)

b) International Service of Geomagnetic Indices (ISGI): Geomagnetic indices and special geomagnetic events (monthly and annually)

c) World Data Centers for Geomagnetism: geomagnetic indices and one-minute values (annually)

d) INTERMAGNET (Global near-real-time magnetic observatory network): One-minute values (reported data via METEOSAT and Email, hourly; adjusted data via Email, on weekdays); Geomagnetic indices and one-minute values (CDrom, annually)

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[1] Reports up to 1999 were published by Bundesamt für Seeschiffahrt und Hydrographie. The last one (SCHULZ, 2004) contains a complete digital set of all data that have been published since the establishment of Wingst Observatory in 1938

Indices and information about special events were made available through a telephone service on weekdays.

Phone: +49 4778 812152

The preliminary variations and indices can be found on the Internet on a real time basis (10 min updates) in graphical form:

http://www.gfz-potsdam.de/pb2/pb23/Wingst/Magnetogram/wingst_dhz_e.html

Definitive (compressed) data from 1939 onwards (minute values since 1981) can be found at:

ftp://ftp.bsh.de/outgoing/wng

The following list shows some additional selected links providing Wingst data:

Intermagnet (variations):
http://www.intermagnet.bgs.ac.uk/cgi-bin/imagform

RWC Brussels (indices):
http://sidc.oma.be/products/wng

WDC Kyoto (pulsations):
http://swdcwww.kugi.kyoto-u.ac.jp/caplot/index.html

WDC Copenhagen (variations):
http://dmiweb.dmi.dk/fsweb/projects/wdcc1

Address:

Erdmagnetisches Observatorium
Am Olymp 13
D-21789 Wingst

Phone: +49 4778 81210
Fax: +49 4778 812150

Collaborators: W.D. Grube and A. Glodek.

2 General Remarks

Wingst Geomagnetic Observatory was established in 1938 as a successor to Wilhelmshaven. Since then, the station has been operated without interruption. The observatory's development is described by VOPPEL, 1988, and SCHULZ, 2001 (see also yearbook No 46, 2000, appendix 3). The development of the modern recording devices is given by SCHULZ, 1998. For the instrumentation since 1938, see also instr.txt on the Cdrom.

The observatory is located in the Lower Elbe area on top of a terminal moraine of the Saale glacial period (elevation 50 m). Its co-ordinates are:

	Latitude	Longitude
Geographic	53° 44.6'N	09° 04.4'E
Geomagnetic	54.12°	95.00°

Geomagnetic co-ordinates refer to International Geomagnetic Reference Field Model 'IGRF 10th' (TAKEDA, et. al., 2005)

The following abbreviations are used throughout this report:

X North component
Y East component
Z Vertical component (downward positive)
H Horizontal intensity
D Declination (eastward positive)
I Inclination (downward positive)
F Total intensity
U North-west component
V North-east component

Times are related to UTC (Co-ordinated Universal Time).

2.1 Recording systems

The results of this edition were derived from the following recording systems:

a) Digital system for variations:

Suspended fluxgate magnetometer (FM) of type FGE(DMI) (*U*, V, Z): One-minute and hourly means as well as indices of activity
Proton precession magnetometer (PPM) of type V75(VARIAN) (*F*): One minute spot values for quality check only

b) Photographic system for variations of type SCHULZE/LA COUR (*D*, *H* and *Z*; 20 mm h^{-1}): Geomagnetic events (ssc, sfe, bay) and substitute hourly means

c) Photographic system for pulsations of type KIM762(KARMANN) (amplitude and phase characteristics see yearbook No 30, 1984): Geomagnetic events (pc, pi)

2.2 Levels, standards and constants

The results of this edition refer to the International Magnetic Standard (IMS). The results of the yearbooks up to and including 1980 referred to the Observatory Standard (OBS), which was represented by the classic type base line instruments bound to their original locations and surroundings.

H, *Z*, and *F* are referred to the proton vector magnetometer (PVM) of type ASKANIA/V4931(VARIAN) on pier NW (section 3.2), *D* to the fluxgate theodolite (DI-flux) of type 010B(ZEISS)/MAG01H(BARTINGTON) on pier NE (section 3.1) of the absolute house. Both instruments are assumed to represent IMS.

The following equations apply to *D* (see yearbook No 37, 1991), *H* and *Z* (see yearbook No 38, 1992):

$D_{OBS} = D_{IMS}$
$H_{OBS} = H_{IMS} + 6.7$ nT
$Z_{OBS} = Z_{IMS} + 11.1$ nT.

The differences for the derived elements depend on the components, i.e. for 2001:

$F_{OBS} = F_{IMS} + 12.8$ nT
$I_{OBS} = I_{IMS} - 0.15'$
$X_{OBS} = X_{IMS} + 6.7$ nT
$Y_{OBS} = Y_{IMS}$

The following physical standards are available at Wingst. They guarantee the quality of data:

SCHWILLE (frequency, DCF77, 10^{-8})
PATEK PHILIPPE and HOPF (UTC, DCF77)
CROPICO VS10 (Voltage, $5 \cdot 10^{-6}$)
GUILDLINE 100 Ohm (resistance, $5 \cdot 10^{-6}$)
Helmholtz coil of high precision (magnetic field strength, 10^{-4})

For the determination of the magnetic induction, the IAGA-recommended gyromagnetic constant (RASMUSSEN, 1991) was used:

$2\pi\tau^{-1} = 23.487203$ nT s

The azimuth marks were last checked by the German Geodetic Survey in 1995. Their values, related to the NE pier (R: 3504926.873, H: 5956702.028), and their deviations in the year under review are:

Azimuth mark	Azimuth	Deviation against
N	11°38.36’	N
NE	13° 23.19’	(-0.17 ±0.04)’
W	308° 42.94’	(0.01 ±0.04’)

2.3 Special measurements

In the year under review, no comparative measurements were carried out.

3 Absolute measurements

The absolute measurements were reduced according to the variations of the digital system (section 4).

3.1 Declination and Inclination

Absolute measurements of *D* were made with the *DI*-flux on an approximately monthly basis. Also the determination of *I* was included in the measurement routine. Each measurement is based on a set of four positions. *I* was corrected by the pier difference of -0.2’ in the sense of NW minus NE. The differences $E=I-\mathrm{arctg}(Z/H)$ are shown in Table 1.

Additionally, relative measurements of *D* were carried out with the PVM according to the addition field method (Serson) on a weekly basis. The mean difference in the sense of PVM minus DI-flux of all pairs of measurements carried out on the same day was used as an instrument constant. Its value e is as follows:

e = -23.92’ (11 measurements).

3.2 Horizontal intensity, vertical component and total intensity

Absolute measurements of *H* and *Z* were carried out with the PVM according to the compensation field method (Nelson) after each relative determination of *D.*

The magnetic induction vector is over-determined due to the measurement of three elements within the meridian plane. The difference $c=F-(H^2+Z^2)^{1/2}$ represents the measurements' inherent accuracy. The annual mean of the error *C* amounted to:

+0.2 nT ± 0.4 nT value (52 measurements).

C is shown in Table 1.

As a rule, the PPM of type V75 was used. This instrument shows a long-term drift of some 0.1 nT depending on the components (SCHULZ AND CARSTENS, 1979).). Therefore, comparative measurements using the PPM of type V4931, which represents IMS (see section 2.2), were carried out on a monthly basis. All base line values as well as the recorded minute spot values of *F* (section 4) are referred to this instrument.

4 Digital recording system

Minute mean values of the orthogonal components *U*, *V*, and *Z* as well as spot values of *F* were acquired by the primary digital system (V75 and FGE (No 125), section 2.1). The PPM is not only part of the recording system but also serves as an indicator of the PVM (section 3).

Owing to over-determination, outliers, jumps and short-term base line instabilities between the dates of absolute measurements of all three components could be detected (section 4.1) and, under certain conditions, automatically eliminated. The following equation applies to Wingst:

$dF = 0.26\, dU + 0.26\, dV + 0.93\, dZ.$

Additionally, a forth fluxgate was operated, which had been aligned in such a way that its W orientation satisfies the following equation:

$dW = 0.578(dU + dV + dZ).$

In this way, jumps and outliers of the secondary system could be monitored independently.

A second suspended FM of type FGE (No 126), an FM of type EDA FM100B and a PPM of type PPM105(EDA) were operated as stand-by devices in case of failure of the primary system.

4.1 Base line values

Table 1 shows the base line values of the FGE125 referred to IMS. Fig 1 shows the results in graphical form. Absolute measurements of *D* and *I* (DI-flux) are marked by circles, those of *H* and *Z* (PVM) as well as relative measurements of *D* by dots. *I* (derived from *H* and *Z*) is also displayed (dots).

To obtain base line values, the dependence of the measured elements *D*, *H, I* and *F* on the recorded components *U*, *V*, and *Z* within the range of variations was developed up to terms of second order (see yearbook No 46, 2000, appendix 3). Minute mean values of the magnetometer and the baseline instruments were processed, which had been synchronized within ±5 s.

For 2001, the base line values of the primary components refer to the following equivalent voltages *E* of the fluxgate compensation fields:

Component	*E* in mV (nominal)
U	12861
V	12613
Z	45463

4.2 Scale values, temperature coefficients and cross talk

Scale values and cross talk were traced back to the respective parameters of the old FM100C(EDA) system by employing stochastic methods, making use of strong variations during a substorm on April 7, 1995 (SCHULZ, 1998). The following values apply to the primary components (FGE125):

	Scale Values in nT/mV 1.000+	Cross Talk against FM100C in 10^{-3}	
U	$+10^{-3}(1.4 \pm 0.6)$	*V*: +0.2±1.0	*Z*: +0.9±0.6
V	$-10^{-3}(1.5 \pm 0.8)$	*U*: -0.7±0.6	*Z*: -0.5±0.4
Z	$+10^{-3}(0.8 \pm 0.6)$	*U*: -0.6±0.4	*V*: -1.2±0.8

Considering the respective values of the FM100C (see yearbook No 41, 1995), the absolute misalignments and errors of the scale values of the FGE125 fluxgates probably do not exceed the order of magnitude of 10^{-3}.

Temperature coefficients were neglected because the FGE double system had been installed in the old variometer room (SCHULZ 2001) with almost perfect temperature control (contact thermometers, ±0.03°C).

5 Data processing

The base line values (Tables 1) were smoothed by Bathspline approximation in steps of 0.01' for *D* or 0.1 nT for *H* and *Z*, respectively (SCHOTT, 1992).

Hourly mean values were formed using 60 minute mean values of *U*, *V*, and *Z* (taken at minutes 00 to 59 UTC and centred at second 30) as well as 60 F spot values (taken at second 05).

The international quiet (*Q*) and disturbed (*D*) days were taken from the Niemegk listings of ISGI. *A* denotes normal days. In the case of averaging, *A* means that all days of the month or the year, respectively, have been included.

The data were processed by a computer double system of type HP9000 330/360. Each workstation is connected to a data acquisition unit of type HP3852 and to the Internet. All necessary calculations including those for the yearbook were carried out by the workstation of type HP9000 360.

6 Indices

The indices presented in this edition (File wng01.k and Table 4) indicate the local disturbances of the geomagnetic field resulting from particle radiation. Their meaning in detail:

K: geomagnetic three-hourly index, quasi-logarithmic measure of the maximum disturbance in steps of 0 to 9; lower limit for *K* = 9: 500 nT

sum: Sum of the eight three-hourly indices of a day

Ak: Mean value of the equivalent amplitudes derived from the eight three-hourly indices, measured in units of 2 nT.

Ck: daily character figure derived from *Ak* and scaled from 0.0 to 2.5.

C: estimated daily character figure; scale: 0, 1, 2

The indices were derived using the IAGA-recommended FMI-routine (Häkkinen, 1992).

7 Files on the CDrom

\wingst	*Wingst root directory, containing the following subdirectories and files*
tree_01.txt:	File structure
yearb01\:	
yearb01\instr.txt:	Instruments used since 1938
data01\:	*Directory containing the following data*
data01\wlh+wng.yr:	Updated epoch values WLH and WNG (*D* and *I* in 0.1'; F, H, X, Y and Z in nT)
data01\wng.mon:	Updated monthly mean values WNG (since 1943; *D* and *I* in 0.1'; *F*, *H*, *X*, *Y*, and *Z* in nT)
data01\wng.day:	Updated daily mean values WNG (since 1943; *D* and *I* in 0.1'; *F*, *H*, *X*, *Y*, and *Z* in nT)
data01\wng.k:	Updated activity figures *K*, *Ak*, *Ck*, and *C* as well as monthly and annual mean values of *Ak*, *Ck,* and and *C* (since 1944)
data01\iaga01\:	*Directory containing the following data in the IAGA2000 format (TAKEDA et al., 2005). See also* http://www.ngdc.noaa.gov/IAGA/vdat/iagaformat.html
data01\iaga01\YR.WNG:	Epoch values WNG 1939 – 1979: D and I in 0.1'; *X, Y, Z, H* and *F* in nT; from 1980 onward: 0.01' or 0.1 nT, respectively)
data01\iaga01\2001MT.WNG:	Monthly means (*D* and *I* in 0.01'; *X, Y, Z, H* and *F* in 0.1 nT)
data01\iaga01\2001DY.WNG:	Daily means (*D* and *I* in 0.01'; *X, Y, Z, H* and *F* in 0.1 nT)
data01\iaga01\2001mmHR.WNG:	Hourly means (*F, X, Y* and *Z* in 0.1 nT) of the month mm
data01\iaga01\2001mmMN.WNG:	Minute means (*F, X, Y* and *Z* in 0.1 nT) of the month mm

8 References

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Kyoto, February 2005

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Appendix 1 and 2: Figures and Tables

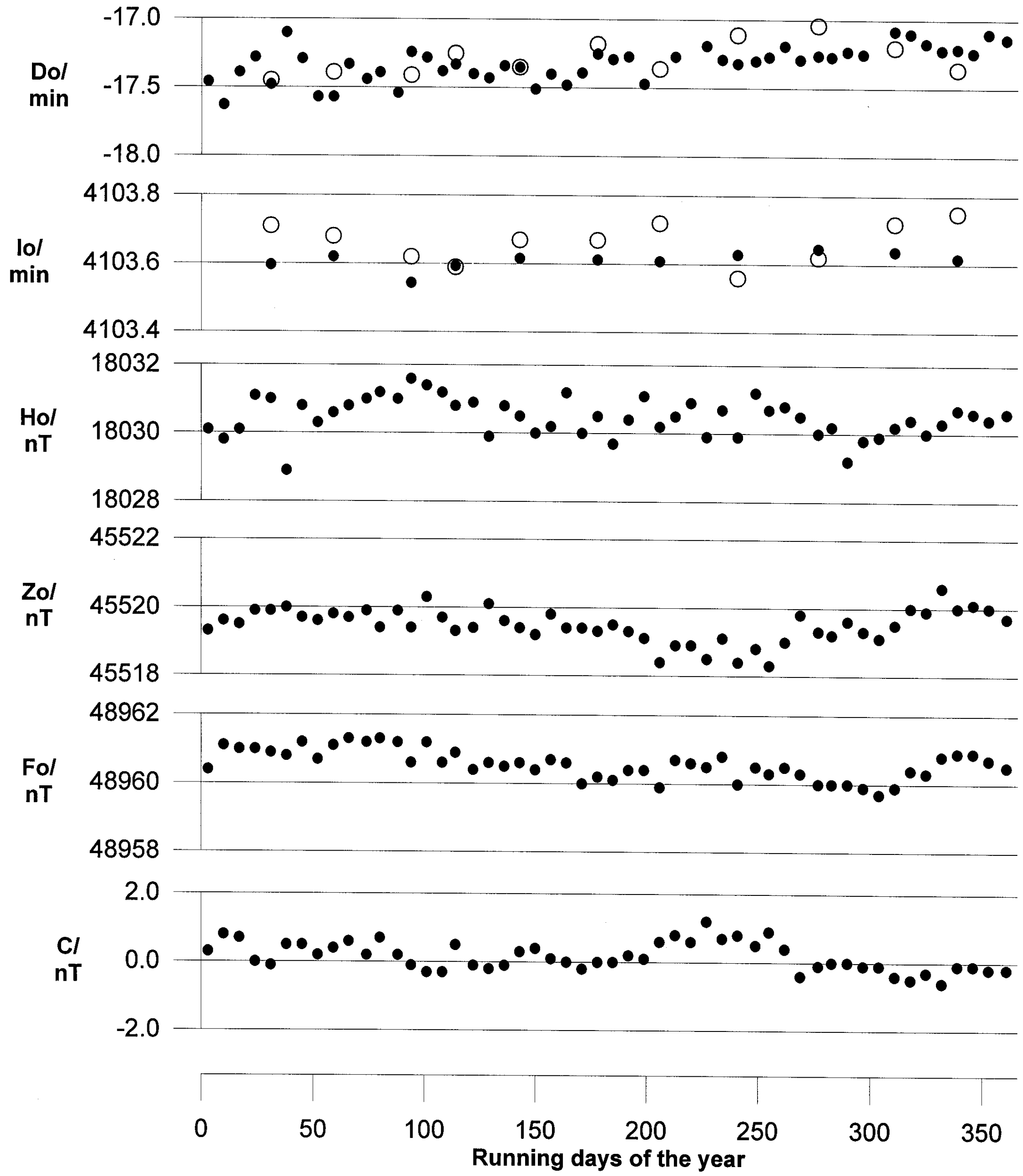


Fig. 1

Wingst 2001 Base line values of the fluxgate system FGE125, IMS

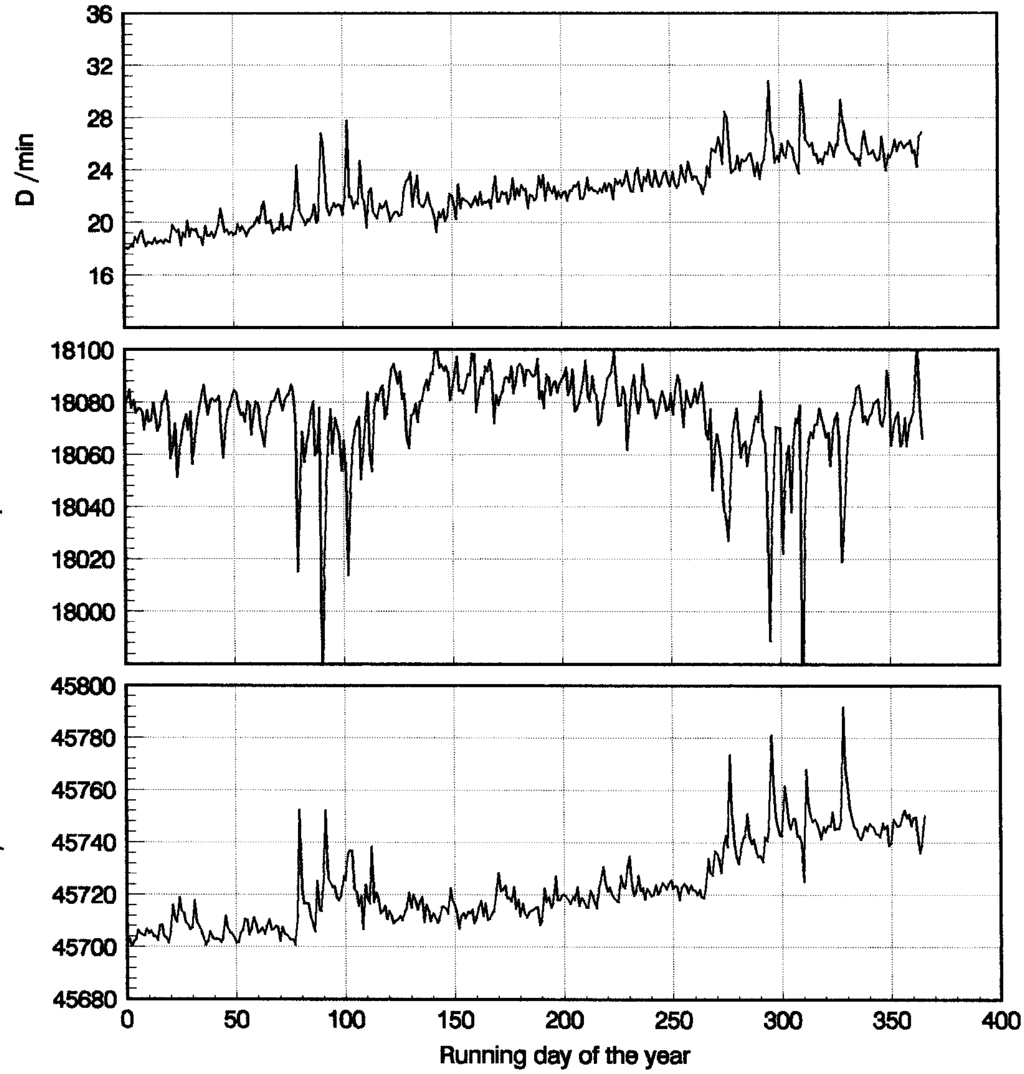


Fig. 2

Wingst 2001 Daily mean values D, H and Z

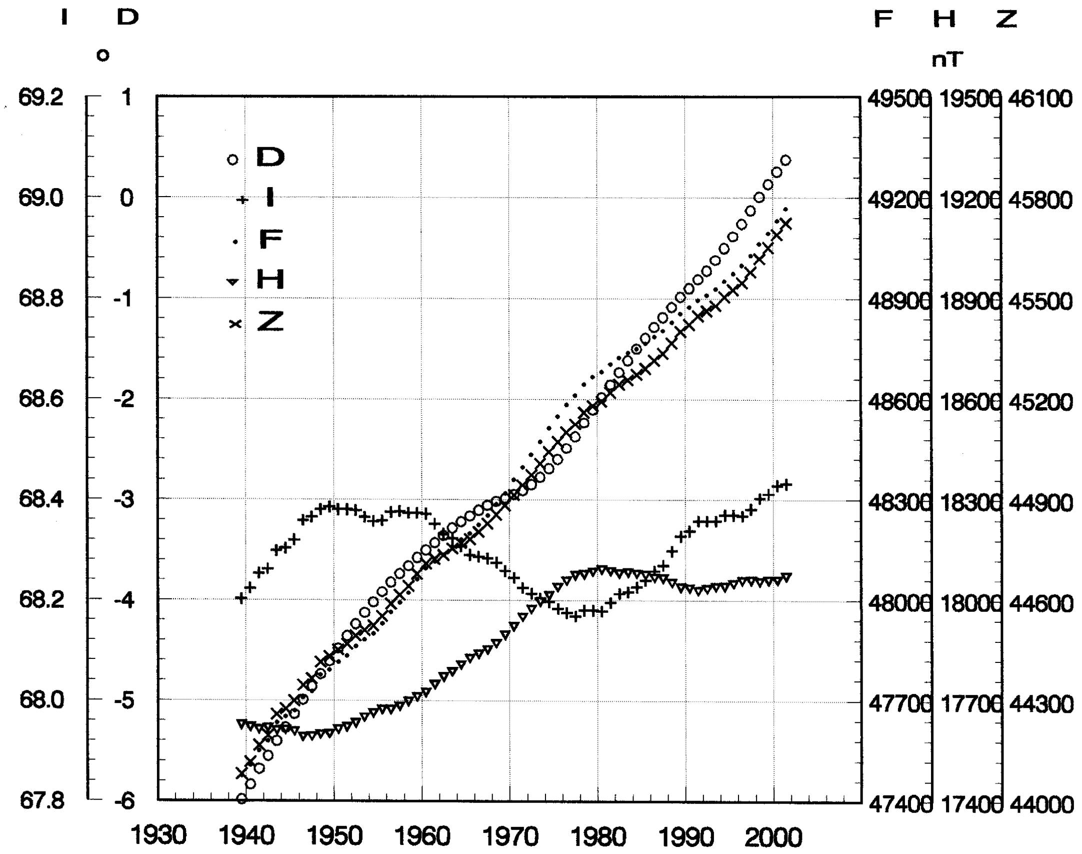


Fig. 3

Wingst Epoch values I, D, F, H and Z

```
wingst\
        tree_01.txt

        yearb01\

                instr.txt

        data01\
                wlh+wng.yr
                wng.mon
                wng.day
                wng.k

                iaga01\
                        YR.WNG
                        2001MT.WNG
                        2001DY.WNG
                        200101MN.WNG
                        .
                        200112MN.WNG
                        200101HR.WNG
                        .
                        200112HR.WNG
```

Fig. 4

Structure of the file set on CDrom

Wingst 2001

Base-line measurements, system FGE125, IMS

Month	day	Do(abs)	Do(rel)	Io	Fo nT	Ho nT	Zo nT	C	E
Jan.	3		-0°17.46'		48960.4	18030.1	45519.3	+0.3	
	10		-0 17.63		48961.1	18029.8	45519.6	+0.8	
	17		-0 17.39		48961.0	18030.1	45519.5	+0.7	
	24		-0 17.28		48961.0	18031.1	45519.9	+0.0	
	31	-0°17.45'	-0 17.48	+68°23.71'	48960.9	18031.0	45519.9	-0.1	+0.26'
Feb.	7		-0 17.10		48960.8	18028.9	45520.0	+0.5	
	14		-0 17.29		48961.2	18030.8	45519.7	+0.5	
	21		-0 17.57		48960.7	18030.3	45519.6	+0.2	
	28	-0 17.39	-0 17.57	+68 23.68	48961.1	18030.6	45519.8	+0.4	+0.20
March	7		-0 17.33		48961.3	18030.8	45519.7	+0.6	
	15		-0 17.44		48961.2	18031.0	45519.9	+0.2	
	21		-0 17.39		48961.3	18031.2	45519.4	+0.7	
	29		-0 17.54		48961.2	18031.0	45519.9	+0.2	
April	4	-0 17.41	-0 17.24	+68 23.62	48960.6	18031.6	45519.4	-0.1	+0.22
	11		-0 17.28		48961.2	18031.4	45520.3	-0.3	
	18		-0 17.38		48960.6	18031.2	45519.7	-0.3	
	24	-0 17.25	-0 17.33	+68 23.59	48960.9	18030.8	45519.3	+0.5	+0.14
May	2		-0 17.40		48960.4	18030.9	45519.4	-0.1	
	9		-0 17.43		48960.6	18029.9	45520.1	-0.2	
	16		-0 17.34		48960.5	18030.8	45519.6	-0.1	
	23	-0 17.35	-0 17.35	+68 23.67	48960.6	18030.5	45519.4	+0.3	+0.20
	30		-0 17.51		48960.4	18030.0	45519.2	+0.4	
June	6		-0 17.40		48960.7	18030.2	45519.8	+0.1	
	13		-0 17.48		48960.6	18031.2	45519.4	+0.0	
	20		-0 17.39		48960.0	18030.0	45519.4	-0.2	
	27	-0 17.18	-0 17.25	+68 23.67	48960.2	18030.5	45519.3	+0.0	+0.20
July	4		-0 17.29		48960.1	18029.7	45519.5	+0.0	
	11		-0 17.27		48960.4	18030.4	45519.3	+0.2	
	18		-0 17.47		48960.4	18031.1	45519.1	+0.1	
	25	-0 17.36	-0 17.05	+68 23.72	48959.9	18030.2	45518.4	+0.6	+0.25
Aug.	1		-0 17.27		48960.7	18030.5	45518.9	+0.8	
	8		-0 17.05		48960.6	18030.9	45518.9	+0.6	
	15		-0 17.19		48960.5	18029.9	45518.5	+1.2	
	22		-0 17.29		48960.8	18030.7	45519.1	+0.7	
	29	-0 17.11	-0 17.32	+68 23.56	48960.0	18029.9	45518.4	+0.8	+0.08
Sep.	6		-0 17.30		48960.5	18031.2	45518.8	+0.5	
	12		-0 17.27		48960.3	18030.7	45518.3	+0.9	
	19		-0 17.19		48960.5	18030.8	45519.0	+0.4	
	26		-0 17.29		48960.3	18030.5	45519.8	-0.4	
Oct.	4	-0 17.04	-0 17.26	+68 23.62	48960.0	18030.0	45519.3	-0.1	+0.12
	10		-0 17.27		48960.0	18030.2	45519.2	+0.0	
	17		-0 17.23		48960.0	18029.2	45519.6	+0.0	
	24		-0 17.25		48959.9	18029.8	45519.3	-0.1	
	31		-0 17.06		48959.7	18029.9	45519.1	-0.1	
Nov.	7	-0 17.20	-0 17.08	+68 23.72	48959.9	18030.2	45519.5	-0.4	+0.23
	14		-0 17.10		48960.4	18030.4	45520.0	-0.5	
	21		-0 17.17		48960.3	18030.0	45519.9	-0.3	
	28		-0 17.22		48960.8	18030.3	45520.6	-0.6	
Dec.	5	-0 17.36	-0 17.21	+68 23.75	48960.9	18030.7	45520.0	-0.1	+0.28
	12		-0 17.24		48960.9	18030.6	45520.1	-0.1	
	19		-0 17.10		48960.7	18030.4	45520.0	-0.2	
	27		-0 17.14		48960.5	18030.6	45519.7	-0.2	

Table 1 Wingst 2001 base line values of the fluxgate system FGE125

Wingst (WNG)
Geographic Coordinates: 53.743° N 9.073° E

2001

Monthly mean values, IMS

D: disturbed, Q: quiet, A: all days

Month		D	F nT	H nT	I	X nT	Y nT	Z nT
Jan	A	-18.8'	49151	18073	68°25.5'	18073	99	45707
Feb	A	-19.4	49151	18077	68 25.2	18077	102	45706
Mar	A	-20.5	49153	18068	68 25.9	18068	108	45711
Apr	A	-21.9	49162	18064	68 26.5	18064	115	45723
May	A	21.4	49162	18086	68 24.9	18086	113	45714
Jun	A	21.9	49164	18088	68 24.8	18088	115	45716
Jul	A	22.4	49165	18087	68 24.9	18087	118	45717
Aug	A	22.9	49168	18083	68 25.3	18082	121	45722
Sep	A	23.8	49169	18077	68 25.8	18076	125	45725
Oct	A	25.4	49180	18056	68 27.6	18056	133	45746
Nov	A	26.0	49185	18060	68 27.5	18059	136	45750
Dec	A	25.5	49188	18077	68 26.3	18076	134	45746
Mean	A	22.5	49167	18075	68 25.9	18074	118	45724
Jan	Q	18.5	49150	18081	68 24.9	18081	97	45703
Feb	Q	19.1	49151	18081	68 25.0	18081	101	45705
Mar	Q	19.7	49152	18083	68 24.8	18083	104	45704
Apr	Q	21.3	49162	18076	68 25.6	18076	112	45718
May	Q	21.2	49161	18088	68 24.7	18088	112	45713
Jun	Q	22.2	49165	18089	68 24.8	18089	117	45717
Jul	Q	22.1	49165	18089	68 24.8	18089	116	45716
Aug	Q	23.0	49168	18084	68 25.2	18083	121	45722
Sep	Q	22.9	49167	18084	68 25.2	18084	121	45721
Oct	Q	24.7	49179	18072	68 26.4	18071	130	45739
Nov	Q	25.2	49187	18074	68 26.5	18073	133	45746
Dec	Q	25.5	49187	18078	68 26.2	18077	134	45744
Mean	Q	22.1	49166	18082	68 25.3	18081	117	45721
Jan	D	19.4	49152	18062	68 26.5	18062	102	45714
Feb	D	20.1	49150	18071	68 25.8	18070	106	45708
Mar	D	22.8	49155	18033	68 28.6	18033	120	45727
Apr	D	23.6	49159	18046	68 27.9	18045	124	45727
May	D	22.2	49161	18075	68 25.7	18075	117	45718
Jun	D	22.2	49163	18082	68 25.1	18082	116	45716
Jul	D	22.5	49165	18086	68 25.0	18085	119	45718
Aug	D	23.1	49171	18079	68 25.6	18079	121	45726
Sep	D	25.1	49170	18063	68 26.8	18063	132	45732
Oct	D	27.6	49180	18027	68 29.8	18026	145	45757
Nov	D	28.2	49177	18018	68 30.4	18017	148	45757
Dec	D	26.1	49186	18067	68 27.0	18066	137	45748
Mean	D	23.6	49166	18059	68 27.0	18059	124	45729

Table 2 Monthly and annual mean values 2001

Wingst (WNG)

Geographic Coordinates: 53.743°N 9.073°E

Annual mean values (IMS)

Epoch	D	F nT	H nT	I	X nT	Y nT	Z nT
1939.5	-5°59.1'	47476	17630	68°12.1'	17534	-1838	44081
1940.5	-5 50.2	47506	17624	68 13.4	17533	-1792	44116
1941.5	-5 40.8	47550	17617	68 15.2	17530	-1744	44166
1942.5	-5 33.1	47579	17622	68 15.7	17540	-1705	44196
1943.5	-5 24.2	47634	17614	68 18.0	17535	-1659	44259
1944.5	-5 16.2	47652	17616	68 18.3	17541	-1618	44276
1945.5	-5 8.2	47671	17611	68 19.2	17540	-1577	44299
1946.5	-4 59.6	47708	17595	68 21.5	17528	-1532	44346
1947.5	-4 51.7	47726	17596	68 22.0	17532	-1491	44365
1948.5	-4 44.4	47775	17602	68 22.9	17541	-1454	44415
1949.5	-4 36.6	47791	17604	68 23.2	17547	-1415	44431
1950.5	-4 29.1	47814	17617	68 22.9	17562	-1378	44451
1951.5	-4 21.5	47832	17624	68 22.8	17573	-1339	44468
1952.5	-4 14.5	47861	17636	68 22.7	17587	-1304	44494
1953.5	-4 7.6	47882	17653	68 22.0	17607	-1270	44510
1954.5	-4 1.3	47899	17666	68 21.5	17623	-1239	44523
1955.5	-3 55.1	47930	17676	68 21.6	17634	-1208	44552
1956.5	-3 49.3	47964	17676	68 22.6	17636	-1178	44589
1957.5	-3 44.2	47993	17686	68 22.6	17648	-1152	44616
1958.5	-3 39.5	48023	17700	68 22.4	17663	-1129	44643
1959.5	-3 34.6	48062	17714	68 22.4	17679	-1105	44679
1960.5	-3 30.1	48095	17727	68 22.4	17693	-1082	44710
1961.5	-3 25.7	48117	17751	68 21.1	17719	-1061	44723
1962.5	-3 21.3	48136	17773	68 20.0	17742	-1040	44735
1963.5	-3 16.9	48160	17789	68 19.4	17760	-1018	44755
1964.5	-3 13.1	48183	17810	68 18.4	17782	-1000	44771
1965.5	-3 9.6	48201	17829	68 17.5	17802	-983	44783
1966.5	-3 6.3	48226	17842	68 17.3	17815	-966	44805
1967.5	-3 3.4	48254	17855	68 17.1	17829	-952	44830
1968.5	-3 1.0	48286	17874	68 16.5	17849	-941	44857
1969.5	-2 59.2	48320	17899	68 15.5	17874	-932	44883
1970.5	-2 56.9	48359	17924	68 14.7	17900	-922	44915
1971.5	-2 54.5	48397	17953	68 13.6	17930	-911	44944
1972.5	-2 51.0	48434	17977	68 12.9	17954	-894	44975
1973.5	-2 46.6	48473	17999	68 12.2	17978	-872	45008
1974.5	-2 41.4	48513	18018	68 11.9	17998	-846	45043
1975.5	-2 36.0	48549	18043	68 11.0	18024	-818	45073
1976.5	-2 29.3	48583	18062	68 10.5	18045	-784	45101
1977.5	-2 22.4	48612	18078	68 10.1	18062	-748	45126
1978.5	-2 14.1	48646	18081	68 10.9	18066	-705	45161
1979.5	-2 6.3	48668	18089	68 10.9	18076	-664	45181
1980.5	-1 59.0	48682	18096	68 10.7	18085	-626	45194
1981.5	-1 51.4	48704	18091	68 11.7	18082	-586	45220
1982.5	-1 43.9	48724	18084	68 12.8	18076	-546	45244
1983.5	-1 36.9	48738	18087	68 13.0	18080	-510	45257
1984.5	-1 29.9	48752	18083	68 13.7	18077	-473	45274
1985.5	-1 23.5	48768	18080	68 14.4	18075	-439	45292
1986.5	-1 17.0	48787	18071	68 15.5	18067	-404	45316
1987.5	-1 11.1	48804	18069	68 16.2	18065	-374	45336
1988.5	-1 5.0	48829	18056	68 17.9	18053	-341	45368
1989.5	-59.0	48856	18042	68 19.7	18039	-309	45402
1990.5	-53.9	48875	18041	68 20.3	18038	-283	45423
1991.5	-48.5	48895	18032	68 21.5	18031	-255	45448
1992.5	-43.4	48911	18038	68 21.5	18037	-228	45463
1993.5	-37.1	48928	18044	68 21.6	18043	-195	45479
1994.5	-30.0	48952	18045	68 22.2	18044	-158	45505
1995.5	-23.0	48975	18053	68 22.2	18053	-121	45526
1996.5	-15.6	48998	18062	68 22.1	18062	-82	45547
1997.5	-7.6	49028	18063	68 22.9	18063	-40	45579
1998.5	0.5	49062	18059	68 24.2	18059	3	45618
1999.5	8.0	49094	18063	68 24.7	18063	42	45651
2000.5	15.4	49132	18064	68 25.7	18064	81	45690
2001.5	22.5	49167	18075	68 25.9	18074	118	45724

Table 3 Wingst Epoch values from 1939 to 2001

Wingst (WNG)
Geographic Coordinates: 53.743° N 9.073° E

2001

Absolute and relative Frequencies of the Three-hourly Index K

K	UTC 0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24
0	27	26	20	7	12	23	14	16
1	79	83	103	76	67	63	65	69
2	106	140	150	150	142	105	102	101
3	89	82	63	93	94	89	100	104
4	43	22	21	30	30	54	40	45
5	15	6	5	5	15	19	29	17
6	4	3	1	4	4	8	10	6
7	0	2	0	0	1	2	5	6
8	1	1	2	0	0	2	0	0
9	1	0	0	0	0	0	0	1

Absolute Number of Days during the Year for a given K

K	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
0	23	30	8	6	3	4	2	5	9	13	31	11	145
1	75	72	46	28	59	44	29	36	49	40	71	56	605
2	75	71	88	74	90	88	105	86	84	61	72	102	996
3	49	39	48	69	59	64	81	79	59	77	33	57	714
4	18	9	31	28	23	33	27	31	24	28	14	19	285
5	6	3	14	23	12	6	4	9	9	15	7	3	111
6	2	0	7	5	2	1	0	2	5	9	7	0	40
7	0	0	4	4	0	0	0	0	1	5	2	0	16
8	0	0	2	2	0	0	0	0	0	0	2	0	6
9	0	0	0	1	0	0	0	0	0	0	1	0	2

Absolute Number of Three-hour-intervals for a given K

Table 4 Statistics of indices 2001

GeoForschungsZentrum Potsdam

Yearbook
Geomagnetic Results Niemegk

Adolf Schmidt Geomagnetic Observatory

Niemegk

2002

Hans-Joachim Linthe

Potsdam 2007

Contents

RESULTS OF THE OBSERVATIONS AT THE ADOLF-SCHMIDT-OBSERVATORIUM FÜR GEOMAGNETISMUS AT NIEMEGK IN THE YEAR 2002

H.-J. Linthe

1. Summary/Introduction

This part of the bulletin reports the observations carried out during the year 2002 at the Niemegk Geomagnetic Adolf Schmidt Observatory.

Instrumentation, Observation and Data
During 2002 the recordings and measurements at the Niemegk observatory have been continued without interruption.
Absolute measurements were taken at least once per week using the DI-flux theodolite and an Overhauser effect proton magnetometer. The two classical variometers remained in operation. The three component flux-gate variometers FGE, GEOMAG and MAGSON and the total field variometer GSM recorded continuously throughout the year. In 2002 the sensor locations were not modified. All recording equipment remained unchanged and operated continuously as in 2001.
The Niemegk observatory has continued to participate in the INTERMAGNET project. The recordings of the GEOMAG variometer were sent hourly by METEOSAT as Reported Data. The Definitive Data (minute and hourly mean values) have been submitted for the INTERMAGNET CD-ROM and sent to the World Data Centres.
The Kp calculation was continued as in 2001. Twice a month, immediately after receiving the K numbers of the 13 Kp observatories, the Kp and derived indices are calculated and distributed by e-mail. The tables and diagrams are produced monthly and sent to the users. The whole Kp data series are also available online at:
http://www.gfz-potsdam.de/pb2/pb23/GeoMag/niemegk/kp_index/index.html.
The repeat station measurement campaign started in 2001 was continued and finished. As a result the magnetic map of Germany for the period 2002.5 was determined.

Personnel
R. Holme quitted his position as scientific director of the observatory on 31 January 2002.
C. Müller, who finished on 28 February 2002 his vocational training at the observatory mechanical workshop, won the German 2002 competition in precision mechanics.
R. Winkler retired on 31 December 2002 from his long-term job as the master of the observatory mechanical workshop.

Meetings and Visitors
H.-J. Linthe and E. Pulz participated in an observatory meeting on 29 January 2002 at Fürstenfeldbruck observatory. They also attended the X^{th} IAGA Workshop on Geomagnetic Observatory Instruments, Data Acquisition and Processing, held 15-24 April 2002 at Hermanus Magnetic Observatory, South Africa, where a new absolute measurement equipment was presented by U. Auster and E. Pulz [12], [13].
C. Turbitt from British Geological Survey visited the observatory in August 2002 in the frame of a cooperation to equip the new Bolivian observatory of Villa Remedios with modern instruments.
H.-J. Linthe and J. Haseloff installed the instruments and data loggers at the new observatory of Villa Remedios, Bolivia in December 2002 and trained the observatory staff according to the cooperation contract between the GeoForschungsZentrum Potsdam and the Universidad Mayor de San Andres La Paz.
A student group of 8 participants from Friedrich Schiller University Jena visited the observatory in the frame of their lectures on 26 February 2002.
On 20 September a micro-symposium was held. Five applicants for the vacant position of the observatory scientific director presented talks and were interviewed by the finding committee.
On 9 October the staff of Projektbereich 2.3 of the GFZ visited the observatory in the frame of a works outing.
The training “Absolute determination of the geomagnetic field vector” was carried out by a student group, coming from Geoscience Institute of Potsdam University on 28 November, 2002.
Two groups of private persons got guided tours at the observatory.

Constructional Changes
The complete sewerage at the observatory and the complete fence around the properties were renewed in 2002.

Data Availability
In addition to this yearbook NGK information is available online. The observatory's homepage is
http://www.gfz-potsdam.de/pb2/pb23/Niemegk/dt/index.html (German version)
http://www.gfz-potsdam.de/pb2/pb23/Niemegk/en/index.html (English version)

The preliminary variations and K indices in graphical form can be found at
http://www.gfz-potsdam.de/pb2/pb23/GeoMag/niemegk/Magnetogram/niemegk_dhz.html
http://www.gfz-potsdam.de/pb2/pb23/GeoMag/niemegk/Magnetogram/niemegk_k.html

A digital archive of minute mean data can be accessed at
http://www.gfz-potsdam.de/pb2/pb23/GeoMag/niemegk/DB/index.html

Rapid access information is published in the Monthly Reports, also available at:
http://www.gfz-potsdam.de/pb2/pb23/GeoMag/niemegk/monrep

Both publications, this report and the monthly report, can be requested from the GFZ; see the address in the impressum.

Acknowledgements
The following persons participated in the production of this yearbook: I. Goldschmidt for absolute measurements and tables, M. Fredow for absolute measurements and plots, J. Schulz for tables and typing of the manuscript and J. Haseloff for diagrams.

Content of the CD
As in the 2001 issue the complete results of the observatory are given in digital form on a CD-ROM. Wingst observatory data are included. The structure and the data formats of the CD-ROM are organised in the same manner as for INTERMAGNET [3]. Because this report will be published together with the 2001 and 2003 issues, the data files of these years are included on the CD-ROM. The CD contains this report as “yearb02.pdf”, the 2001 one as “yearb01.pdf”, the 2003 one as “yearb03.pdf” and the following directories:

- INTERMAGNET
- Niemegk
- Wingst

The substructure of the directories is as follows:

INTERMAGNET

```
INTERMAGNET
    gmag.cfg                                  Configuration file for imag23.exe
    imag23.exe                                Browsing program
    instimag.exe                              Installation program
    readme.txt                                ASCII file containing contents information
    mag1995 ... mag2003
        ctry_inf
            ctrylist.idx                      Country list file for imag23.exe
            intro.pcx                         Welcome graphic file for imag23.exe
        SSS                                   Data subdirectories NGK, WNG
            SSSYYjan.bin                      January minute mean values binary file
            SSSYYfeb.bin                      February minute mean values binary file
            ...
            SSSYYdec.bin                      December minute mean values binary file
            SSSYY.blv                         ASCII base line file
            SSSYYk.dka                        ASCII K number file
            readme.SSS                        ASCII information file
            yearmean.SSS                      ASCII annual mean values file
        obsy_inf
            YYobsdat.dbf                      Configuration file for imag23.exe
    plotutil
        hpgl                                  HP-GL plotting programs :
            imagblv.exe                       Base lines
            imagdayl.exe                      Daily mean values
            imaghour.exe                      Hourly mean values
            imagknum.exe                      K numbers
            imagn.exe                         Daily magnetograms
        ps                                    PostScript plotting programs:
            gs601w32.exe                      Ghostscript
            gsv34w32.exe                      Ghostview
            imagplot.exe                      Plotting program for Windows
            readme.txt                        Information about PS plotting
            salflibc.dll                      Windows system file
    xtras
        prnstruc.exe                          Display of the binary file format
        structur.dat                          Data file for prnstruc.exe
```

with: YY = Year (95-99, 00-03); SSS = NGK, WNG

Niemegk

└── dataYY	YYYY data files in IAGA2002 format
├── ngkYYYYMMdhor.hor	Hourly mean values
├── ngkYYYYdday.day	daily mean values
├── ngkYYYYdmon.mon	monthly mean values
└── ngkYYYYdyea.yea	annual mean values

with: MM = month (00…12)

Wingst

├── tree_YY.txt	File structure of directory Wingst
├── yearb	
│ ├── instr.txt	Instruments used since 1938
│ └── abs_meas.pdf	Reprint of SCHULZ, 2002
└── dataYY	YYYY data files
├── wlh+wng.yr	Updated epoch values WLH and WNG
├── wng.mon	Updated monthly mean values WNG
├── wng.day	Updated daily mean values WNG
├── wng.k	Updated WNG K numbers
└── iagaYY	YYYY data files in IAGA2000 format
├── yr.wng	Epoch values WNG
├── YYYYmt.wng	Monthly mean values
├── YYYYdy.wng	Daily mean values
├── YYYYMMhr.wng	Hourly mean values
└── YYYYMMmn.wng	Minute mean values

with: MM = month (01…12); YYYY = Year (2001-2003); YY = Last 2 numbers of the year (01-03)

2. Variation Recording

In 2002 the following recording equipment were in operation (Table 1):

- 3 three component flux-gate variometers with digital recording (FGE, GEOMAG, MAGSON)
- 1 scalar Overhauser effect proton magnetometer with digital recording (GSM)
- 1 three component induction coil magnetometer with analogue and digital recording (ICM)
- 2 classical variometer systems with photographic recording (CS, CW)
- 2 telluric recording lines (1000m) with digital recording (TR)

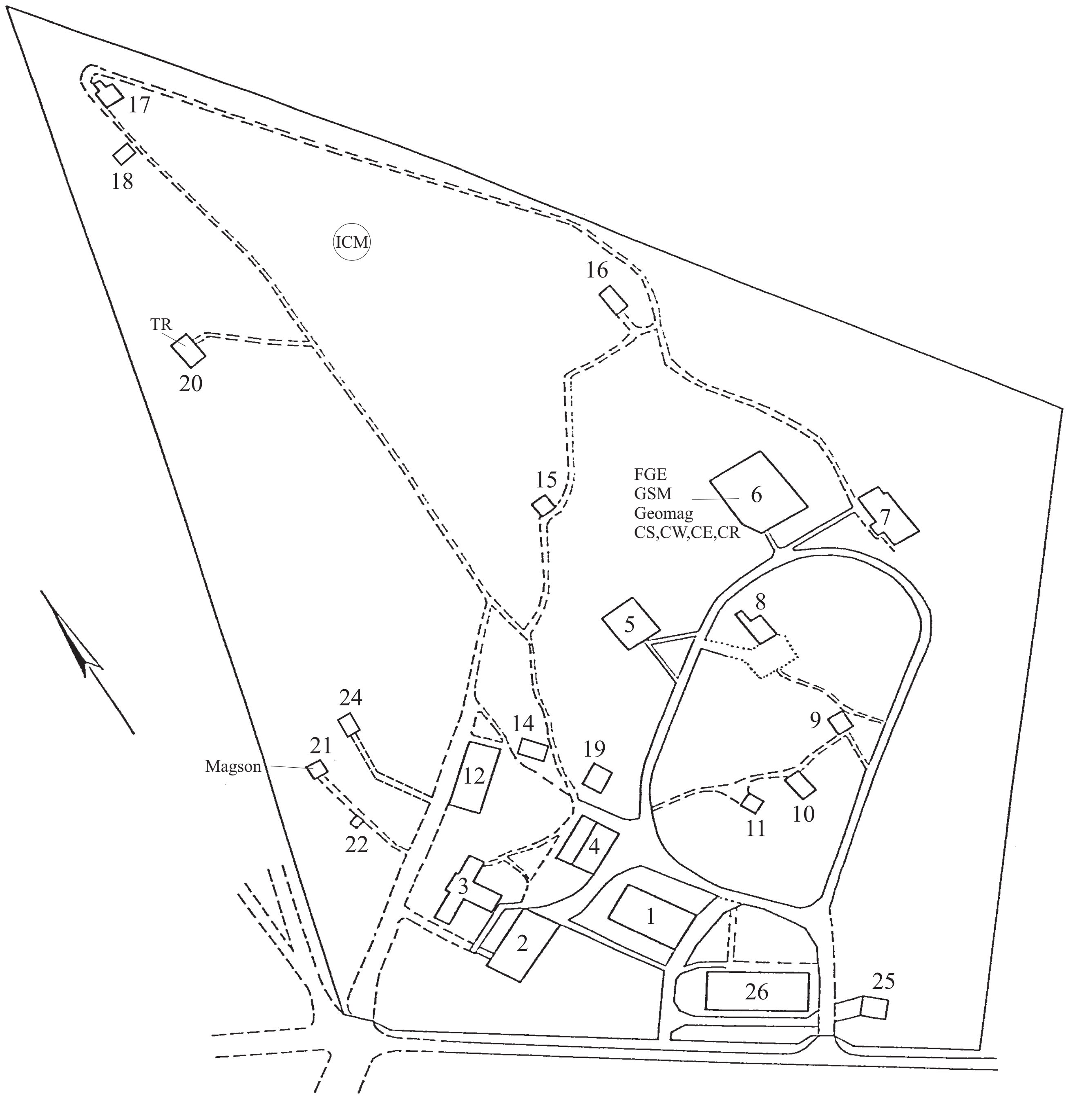
Name	Elements	Recording	Sampling rate	Resolution
FGE	H, D, Z	digital	2 Hz	0.1 nT
GEOMAG	X, Y, Z, F	digital	5 s / 1 min	0.1 nT
MAGSON	X, Y, Z	digital	1 s	0.1 nT
GSM	F	digital	5 s	0.01 nT
ICM	X, Y, Z	analogue/digital	1 s	0.01 nT
CS	X, Y, Z	analogue	20 mm/h	2 nT/mm
CW	H, D, Z	analogue	20 mm/h	2 nT/mm
TR	N-S, E-W	digital	1 s	0.1 mV

Table 1: Parameters of the variometer systems

Fig. 1 shows a sketch of the premises of the observatory, including the locations of the recording systems. Fig. 2 shows the ground plan of the variation house (building No. 6) showing the locations of the variometers. Fig. 3 shows the block diagram of the recording systems and the data paths. Table 2 contains the conversion factors of the single geomagnetic elements for the year 2002, according to [1] p.5 fig. 5; 2.

In the horizontal plane					In the plane of the magnetic meridian				
	ΔX/nT	ΔY/nT	ΔH/nT	ΔD/’		ΔH/nT	ΔZ/nT	ΔF/nT	ΔI/’
ΔX/nT	- - -	- 35.8499 -0.02789	0.9996 - 1.0004	-0.15247 -196.111 -	ΔH/nT	- - -	- 0.4162 -2.4029	0.3842 - 2.6027	-13.1396 -15.4153 -
ΔY/nT	- 0.02789 -35.8499	- - -	0.02788 - 35.8638	5.4661 5.4703 -	ΔZ/nT	- 2.4029 -0.4162	- - -	0.9232 - 1.0831	5.4683 37.0410 -
ΔH/nT	- 1.0004 0.9996	35.8638 - 0.02788	- - -	-196.034 0.15253 -	ΔF/nT	- 2.6027 0.3842	1.0831 - 0.9232	- - -	-5.9229 34.1977 -
ΔD/’	- -6.5586 -0.00510	0.1829 - 0.1828	-0.00510 6.5561 -	- - -	ΔI/’	- -0.07611 -0.06487	0.1829 - 0.02700	-0.1688 0.02924 -	- - -
$\Delta D/nT = 5.4682 \cdot \Delta D'$					$\Delta I/nT = 14.2320 \cdot \Delta I'$				

Table 2: Conversion factors for the geomagnetic elements in 2002



1. Main building
2. Electric laboratory
3. Measurement and computer centre
4. Storehouse
5. Magnetic laboratory
6. Variation house
7. Absolute house
8. Heating house
9. Small hut
10. Adjusting hut
11. Thermal adjusting hut
12. Garage
14. Equipments shed
15. Proton magnetometer hut
16. Control hut
17. Coil hut No. 1
18. Control hut
19. Storage hut
20. Telluric hut
21. Coil hut No. 2
22. Small control hut
24. Coil hut No. 3
25. Power unit house
26. Workshop building

Fig. 1: Sketch of the premises of the observatory

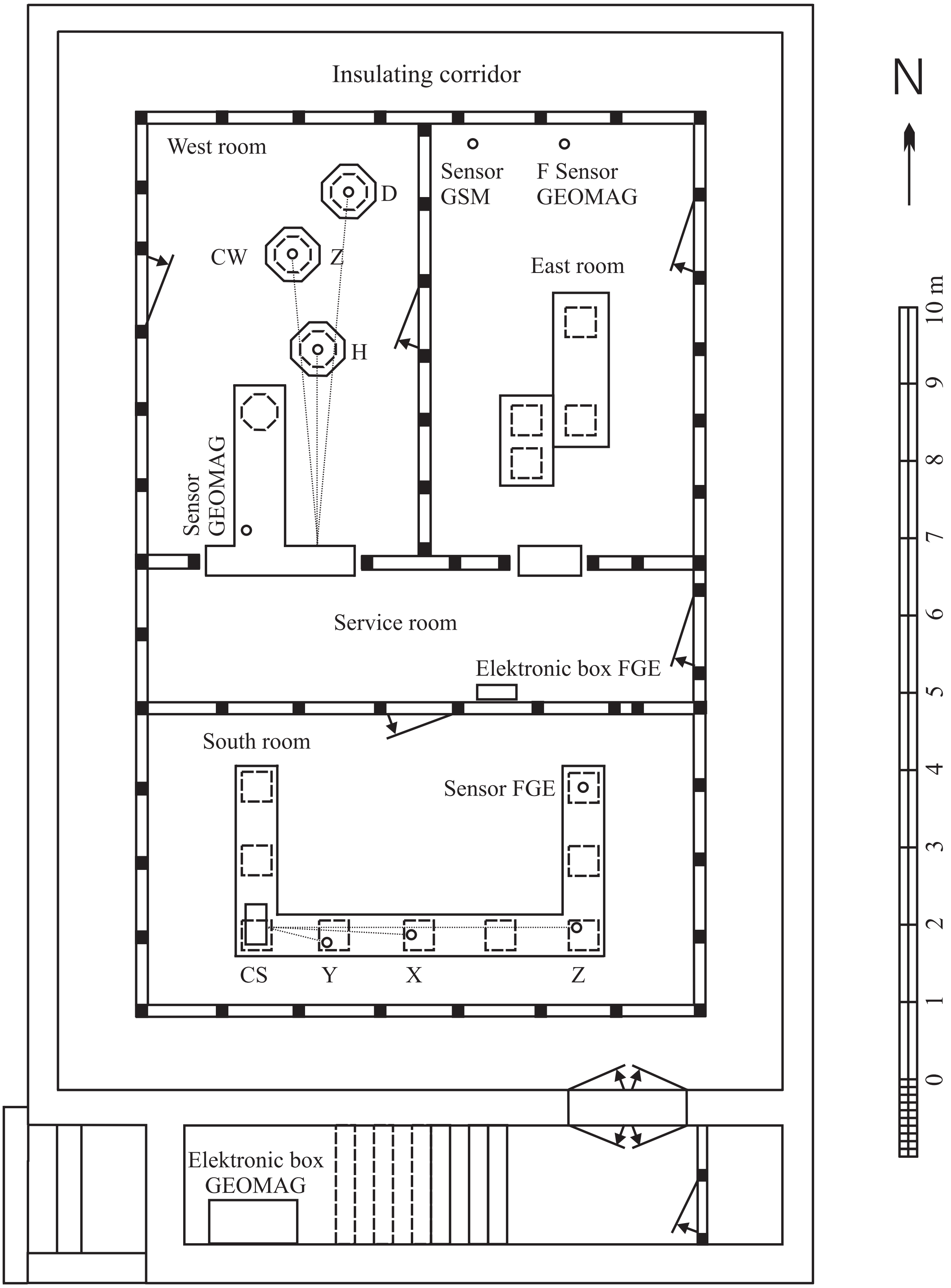


Fig. 2: Ground plan of the variation house with the locations of the variometers

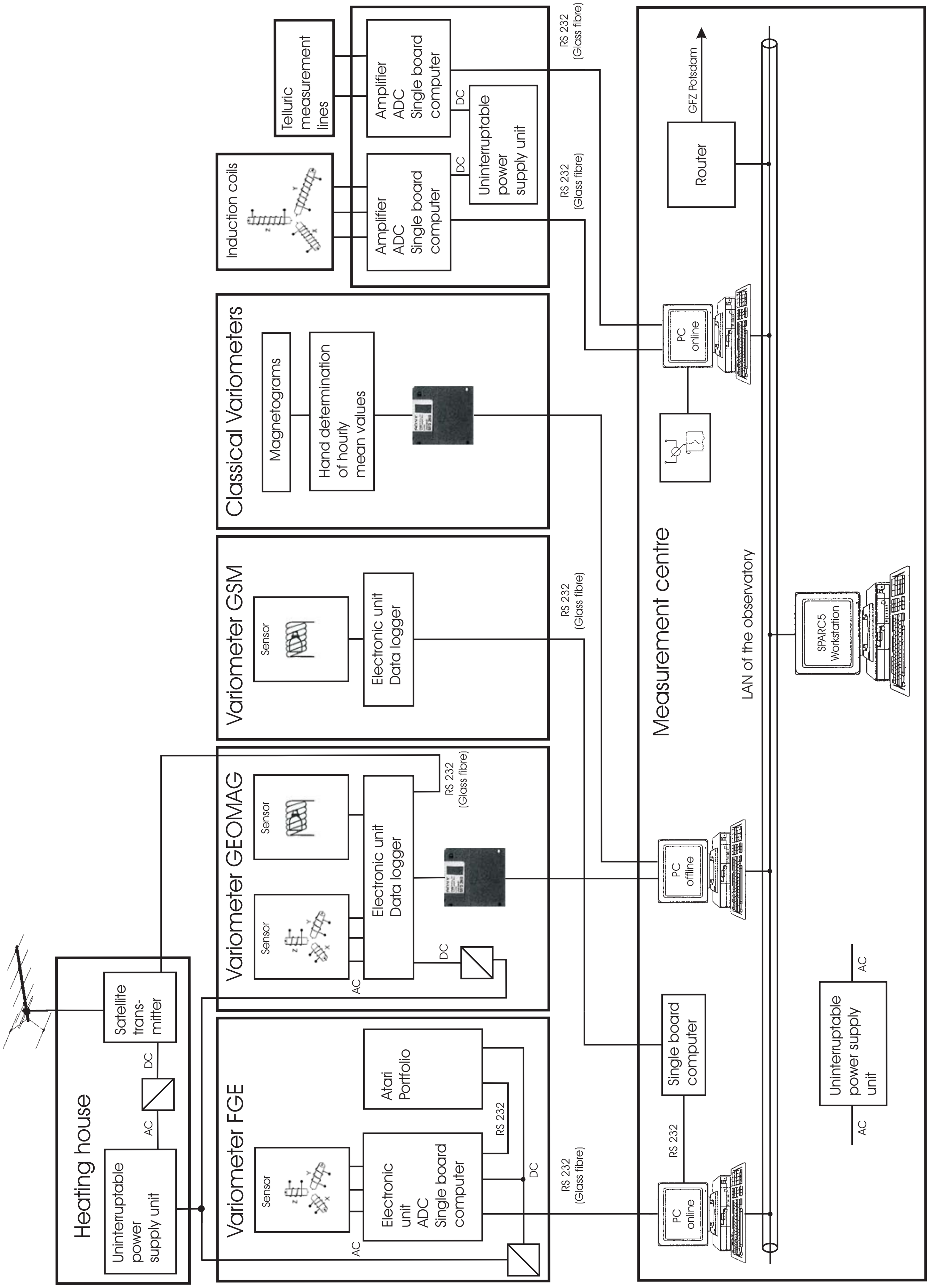


Fig. 3: Block diagram of the recording systems and data paths

2.1 Three component flux-gate variometers

2.1.1 FGE

The FGE variometer is the main vector magnetometer of the observatory. It is a three component linear core flux-gate magnetometer with Cardan's suspension, manufactured by the Danish Meteorological Institute at Copenhagen [2]. The three magnetic elements H, D and Z and the room temperature are recorded.
The scale factor of the instrument is 250 nT/V, the measurement range is $\pm$2500 nT for the magnetic elements. The temperature channel has a scale factor of 1000 K/V with a measurement range of $\pm$2.5 V.
The analogue to digital conversion is carried out by a 20 bit ADC (type CS5506, Crystal) with a sampling rate of 2 Hz by means of a single board computer Z80miniEMUF. The resolution, given by the manufacturer as 0.2 nT is completely satisfied by the 20 bit ADC. The time signal for the data logger is given by a DCF77 radio clock.
The variometer was in operation at the same position and in the same manner as in 2001. The 2 Hz momentary values, obtained by means of the single board computer and the ADC, are transmitted serially (RS232) by glass fibre cable to a PC at the measurement and computer centre (building No. 3). In the same way, minute mean values are transferred to the pocket PC Atari Portfolio. Fig. 5 shows the base lines of this variometer.

2.1.2 GEOMAG

This instrument includes a three component ring core flux-gate magnetometer and an Overhauser effect proton magnetometer. The French manufacturer GEOMAG calls it as an "automatic geomagnetic observatory". It consists of the 2 sensors, the electronic unit (analogue electronic, data logger and power supply unit) and a telemetry.
The instrument was operating throughout 2002 under the same conditions as in 2001. Minute mean values with a resolution of 0.1 nT are recorded according to the INTERMAGNET standard [3]. The data files are written on a 3.5'' floppy. The mean values are transmitted by a special telemetry (located at the heating house, building No. 8) via METEOSAT to the INTERMAGNET GINs at Paris and Edinburgh.

2.1.3 MAGSON

This three component ring core flux-gate magnetometer (manufacturer: MAGSON GmbH, Berlin) was further operating at the coil hut (building No. 21 sensor) and control hut (building No. 22, electronic unit) as a preliminary place. It recorded continuously during the complete year, except for a few interruptions. The components X, Y and Z were recorded. The data logger triggers the measurement values with a sampling rate of 1 Hz and generates 1 minute mean values of a resolution of 0.1 nT which are recorded in the RAM. The storage capacity is sufficient for 15 days. The recorded data can be read by a laptop via the serial interface. Up to now the recorded time series have only been used for occasional comparison. In 2002 the base lines were not determined.

2.2 Overhauser Effect Proton Magnetometer GSM

The geomagnetic total intensity was recorded using the GSM Overhauser effect proton magnetometer (manufactured by GEM Systems, Canada), unchanged from 2001. Every 5 seconds a measurement value of resolution 0.01 nT is generated and transmitted by glass fibre cable to the same PC which records the 2 Hz momentary values of the FGE variometer. Table 3 contains the differences between the momentary values of the GSM 19 and the observatory F momentary values, calculated for the times of the absolute measurements.

2.3 Induction Coil Magnetometer ICM

Three induction coils with highly permeable cores record the temporal gradients of the geomagnetic variations for the North, East and vertical components. For thermal stability, the sensors are buried east of the telluric hut (building No. 20). The electronic amplifiers are located in building No. 20, while a paper recorder and a PC are in the measurement and computer centre (building No. 3).
The analogue recording was carried out continuously during the whole year by means of the Laumann paper recorder in the measurement and computer centre (building No. 3). The signal is transmitted via glass fibre cable. No changes have to be reported for the whole system in 2002.
The digital recording of the temporal gradients of the geomagnetic variations was carried out as in 2001. The signal of the amplifier output, to which the Laumann paper recorder is connected, is digitised by means of a 20 bit ADC (Type CS5506, Crystal). The ADC is controlled by a single board computer (Z80miniEMUF). The measurement values are triggered with a sampling rate of 1 Hz. They are transferred serially (RS232) by glass fibre cable to a PC at the measurement and computer centre (building No. 3). The time signal for the data logger is given by a DCF77 radio clock.
The measurement values are stored in binary format (2 bytes per value of the 3 components), where 1 digit corresponds to 0.1 mV. The induction coils transfer function is dependent on the signal period. In cases of modifications of the equipment the transfer function is re-determined by calibration. For this purpose calibration signals are applied to the calibration coils of the sensors. The calibration procedure yields the transfer functions of the complete apparatus. From the transfer functions, correction functions can be calculated for the 3 components, which must be taken into account if the recording material is used.
Fig. 4 shows the correction functions. The ordinate axis scale is 0.1 mV. The sinusoidal calibration signal confirmed that in the period range of 5 to 100 seconds no phase shift (0 phase characteristic) is present.
The digital recording was in operation all the year with very few interruptions.

2.4 Classical magnetic variometers with photographic recording

The observatory operates 2 classical variometers with photographic recording in the variation house (building No. 6). The single systems are named according to their location rooms: CS: South system, CW: West system. Table 1 lists the parameters of the instruments. The variometers are temperature compensated. The rooms are continuously heated by a thermostat-controlled electrical heating system supported in cold seasons by warm water central heating. The daily temperature changes are less than 0.1°C. The location of all classical variometers is unchanged since 1982.

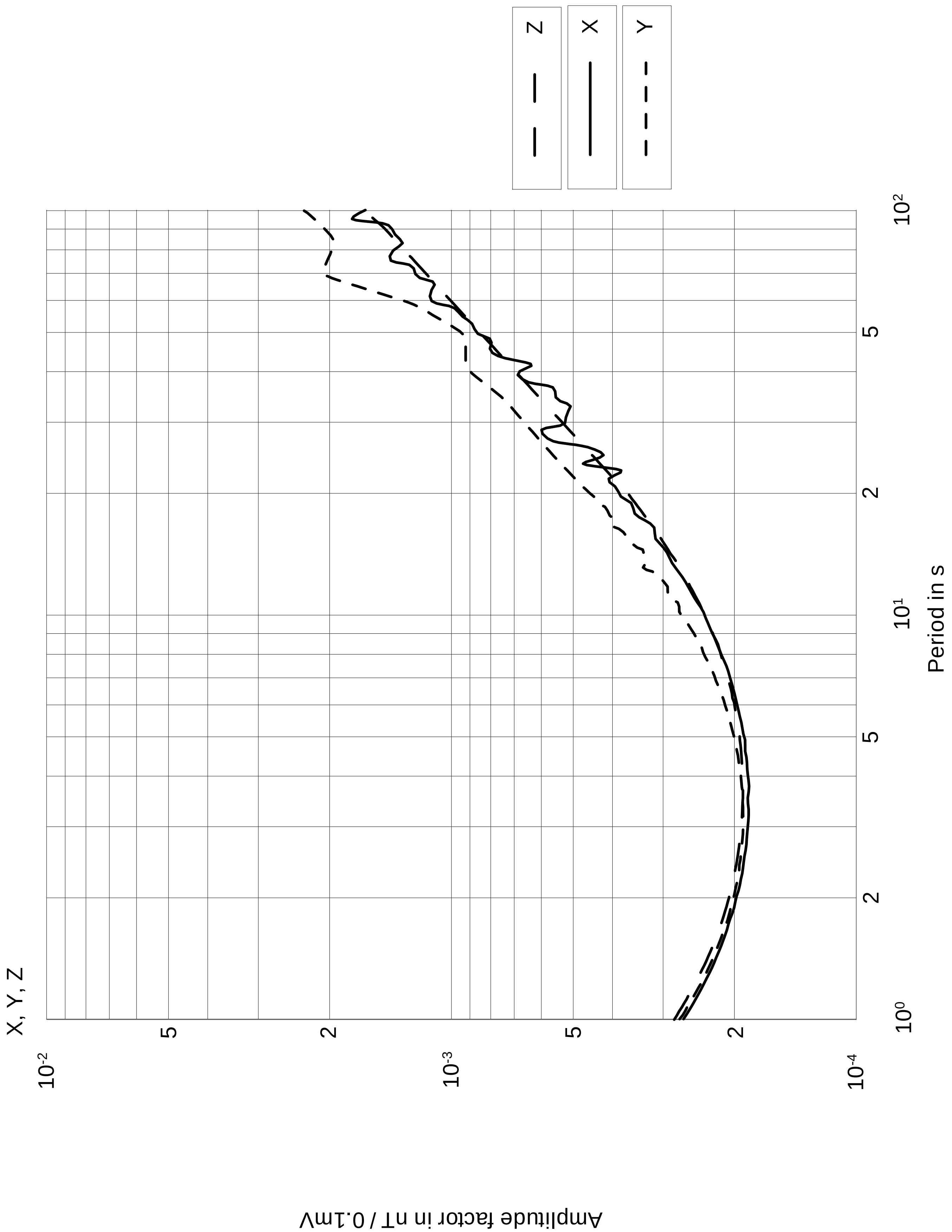


Fig. 4: Transfer functions (amplitudes) of the induction coil variometers

3. Absolute Measurements

Throughout the year, the absolute measurements were carried out as follows: One absolute measurement is taken using the THEO 010B DI-flux theodolite on pillar No. 8 once per week. The corresponding total field measurement is taken using a GSM19 Overhauser effect proton magnetometer located 40 cm above pillar No.14. Therefore, the THEO 010B needs not to be taken away from the pillar for the F measurements. The F measurement values, obtained at pillar No. 14, are corrected by means of the corresponding offset to the level of pillar No. 8. One total field measurement per month is carried out on pillar No. 8 40 cm over the pillar (approximately the altitude of the DI-flux sensor) to check this offset.

Total field measurements are taken once per month on pillars No. 2 and 5 to record the long term drift of the pillar differences. DI-flux measurements are carried out normally once per month by means of a second instrument on pillars No. 2 and 5. The measurements on pillars No. 2 and 5 have comparing and accompanying character. The base lines are determined from the measurements taken on pillars No. 8 (D, I, F) and No. 14 (F). The measurement values obtained on pillar No. 8 represent the observatory standard.

I. Goldschmidt was in general responsible for the measurements on pillar No. 8, while M. Fredow was responsible for these done on the other pillars. I. Goldschmidt calculated the base lines of the variometers from the absolute measurements. The adopted base lines are obtained from the measurements on pillar No. 8. Additional base lines were calculated from the measurements on the pillars No. 2 and 5 to obtain pillar differences between the single pillars. The results are presented in table 3 (annual averages).

Pillar	Δ H/nT	ΔD/’	ΔZ/nT	ΔI/’	ΔF/nT
2					+1.4
5	+0.0	+0.06	- 0.6	-0.03	-0.5
14					-1.2

Table 3: Pillar differences of H, D, Z, I and F obtained on pillars No. 2 and 5 to those on pillar No. 8

$\Delta H = H_{Pn} - H_{P8}$, n = 2,5; equivalent for D, Z, I and F.

The following results of the absolute measurements were reduced with the recordings of the FGE variometer by means of a PC program, which calculates the base values of the elements H, D and Z. This program calculates in addition ΔF, the difference of the total intensity, calculated from the momentary H and Z values for the times of the absolute measurements, and the synchronous recording value of the GSM variometer.

Date	$\Delta F = F_{GSM} - F_{P8}$
2002-01-16	+0.6
2002-02-12	+0.8
2002-03-19	+0.7
2002-04-10	+0.7
2002-05-21	+0.7
2002-06-18	+0.5
2002-07-19	+0.7
2002-08-20	+1.0
2002-09-19	+0.9
2002-10-24	+0.7
2002-11-14	+0.6
2002-12-16	+0.7

Table 4: Differences of the total intensity between the GSM recordings in the variation house and the observatory level (absolute house, pillar No. 8, 40 cm over the pillar)

Table 7 contains the results of the absolute DI-flux measurements combined with the absolute GSM 19 measurements. The adopted base lines of the FGE variometer are shown in Fig. 5. The deviations of the absolute measurement values from the adopted base lines can also be found in table 7. The total intensity measurements carried out once per month were compared with synchronous recording values of the GSM variometer. Table 4 shows the results.

3.1 Declination

The declination measurements are carried out, as described, by means of the THEO 010B DI-flux theodolite in the absolute house on pillars No. 8, No. 5 and No. 2. The azimuth marks are the Niemegk church tower and water tower and a collimator at pillar No. 6 (low distance azimuth mark for times of no visibility to the far azimuth marks). Bearings of all azimuth marks can be taken from pillar No. 8, while bearings to the church tower and the water tower can be taken from pillar No. 2, and only the water tower is visible from pillar No. 5. Table 5 contains the azimuth values used [4].

Pillar	Church tower	Water tower	Collimator
8	65°00’11”	91°10’44”	1°49’04”
2	65°06’44”	91°19’54”	
5		91°01’48”	

Table 5: Azimuth values of the azimuth marks

The annual mean differences of the azimuth mark bearings can be found in table 6.

Azimuth mark difference	Pillar 8	Pillar 2
Water tower-church tower	26°10.68’ ±0.15’	26°13.22’ ±0.1’
Water tower – collimator	89°21.80’ ±0.15’	
Church tower - collimator	63°10.98’ ±0.12’	

Table 6: Annual mean differences of the azimuth mark bearings

Table 7 contains the measurement results for the FGE variometer and the deviations from the adopted base lines. Fig. 5 shows the FGE adopted base lines.

3.2 Inclination

The inclination is measured directly following to every declination measurement by means of the same instrument, using the magnetic meridian determined from the declination measurement. The inclination measurement results are used together with the total intensity values for the determination of the base values of the horizontal and vertical intensity.

3.3 Horizontal Intensity

The horizontal intensity base values are calculated by means of a PC program from the inclination and total intensity absolute measurements. Table 7 contains the measurement results for the FGE variometer and the deviations from the adopted base lines. Fig. 5 shows the FGE adopted base lines.

3.4 Vertical Intensity

The vertical intensity base values were calculated by means of a PC program from the inclination and total intensity absolute measurements. Table 7 contains the measurement results for the FGE variometer and the deviations from the adopted base lines. Fig. 5 shows the FGE adopted base lines.

3.5 Total Intensity

The total intensity measurements were done as described by means of the GSM19 Overhauser effect proton magnetometer, following the DI-flux measurements. The GSM19 uses the gyromagnetic ratio.

$$\gamma_p = 0.267515255 \cdot 10^9 \ s^{-1} \ T^{-1} \qquad [5]$$

for the conversion of the frequency values into the magnetic total intensity values. The total intensity measurement results are used together with the inclination values for the determination of the base values of the horizontal and vertical intensity.

4. Base values

The base values of the FGE variometer (the observatory main variometer) were determined by means of suitable adoptions from the absolute measurement results (table 7). For every day an adopted base value exists of every recorded element (H, D, Z). The deviations ΔH, ΔD and ΔZ of the absolute measurements from the adopted base values are shown in table 7. A program from the INTERMAGNET CD-ROM was used to plot the adopted base lines. Fig. 5 shows the adopted base values as lines of small squares and the results of the absolute measurements as larger squares. The H, D and Z base values were transformed into X, Y and Z values.

Month	Day	UT	Horizontal intensity		Declination		Vertical intensity		F
			H/nT	ΔH/nT	D	ΔD/′	Z/nT	ΔZ/nT	ΔF/nT
Jan.	02	12:19	18734.5	-0.0	0°38.04’	0.09	44929.6	0.1	-0.8
Jan.	07	09:17	18733.8	-0.7	0°37.98’	0.01	44929.1	-0.3	-1.2
Jan.	15	09:27	18735.5	1.0	0°38.06’	0.06	44927.8	-1.5	-1.4
Jan.	22	09:29	18734.6	0.1	0°37.99’	-0.03	44928.8	-0.4	-1.1
Jan.	28	12:09	18733.7	-0.8	0°38.17’	0.13	44928.7	-0.4	-1.1
Feb.	04	09:24	18734.3	-0.2	0°38.01’	-0.05	44928.4	-0.6	-1.4
Feb.	13	12:23	18734.2	-0.3	0°38.05’	-0.04	44929.2	0.2	-0.2
Feb.	20	09:22	18734.0	-0.5	0°38.16’	0.04	44929.9	0.9	-0.6
Feb.	26	12:12	18734.9	0.4	0°38.25’	0.11	44928.1	-0.9	-0.6
Mar.	07	09:21	18734.3	-0.2	0°38.10’	-0.07	44927.2	-1.8	-1.6
Mar.	13	12:41	18733.5	-1.0	0°38.19’	0.00	44929.1	0.1	-0.9
Mar.	20	06:52	18734.6	0.1	0°38.29’	0.08	44928.9	-0.1	-0.6
Mar.	26	07:01	18733.7	-0.8	0°38.09’	-0.14	44929.4	0.4	-0.9
Apr.	04	05:58	18734.4	-0.0	0°38.36’	0.11	44928.9	-0.1	-0.4
Apr.	08	12:53	18734.5	0.1	0°38.37’	0.11	44929.1	0.1	-0.8
Apr.	16	11:35	18733.8	-0.4	0°38.37’	0.10	44928.4	-0.5	-0.8
Apr.	25	11:29	18734.3	0.2	0°38.16’	-0.13	44928.1	-0.7	-0.8
Apr.	30	11:28	18733.7	-0.3	0°38.24’	-0.06	44928.7	0.0	-1.1
May	06	11:18	18733.9	0.2	0°38.37’	0.08	44928.5	-0.1	-0.8
May	15	11:30	18733.6	0.1	0°38.25’	-0.00	44928.8	0.2	-0.9
May	22	11:26	18733.2	-0.3	0°38.19’	-0.02	44927.8	-0.8	-0.5
May	29	10:59	18733.7	0.2	0°38.25’	0.08	44927.9	-0.6	-0.6
June	05	05:56	18732.5	-1.0	0°38.07’	-0.08	44928.3	-0.2	-0.7
June	11	06:12	18733.2	-0.3	0°38.05’	-0.10	44928.2	-0.3	-1.2
June	13	06:20	18734.0	0.5	0°38.11’	-0.04	44927.9	-0.6	-0.4
June	26	08:13	18733.4	-0.1	0°38.19’	0.04	44929.1	0.4	-0.7

Table 7: Absolute measurement results by means of the THEO 010B DI-flux theodolite and the GSM 19 Overhauser effect proton magnetometer, reduced with the FGE variometer recordings

Month	Day	UT	Horizontal intensity		Declination		Vertikal intensity		F
			H/nT	ΔH/nT	D	ΔD/′	Z/nT	ΔZ/nT	ΔF/nT
July	02	11:32	18733.2	-0.3	0°38.21’	0.06	44928.9	0.1	-0.4
July	08	11:29	18733.4	-0.1	0°38.30’	0.13	44928.9	-0.2	-0.4
July	16	11:24	18732.8	-0.7	0°38.21’	0.01	44929.7	0.2	-0.9
July	24	11:14	18733.9	0.4	0°38.25’	0.05	44928.3	-0.9	-0.2
July	30	06:08	18733.7	0.2	0°38.03’	-0.17	44929.1	0.4	-0.3
Aug.	06	06:17	18733.9	0.4	0°38.31’	0.09	44927.8	-0.7	-0.8
Aug.	14	11:19	18733.4	-0.1	0°38.19’	-0.06	44928.8	0.4	-0.8
Aug.	21	11:29	18733.7	0.2	0°38.33’	0.05	44927.9	-0.6	-1.7
Sep.	02	11:29	18733.1	-0.3	0°38.48’	0.17	44928.6	0.1	-0.4
Sep.	11	08:36	18733.0	-0.4	0°38.17’	0.03	44928.4	0.1	-1.0
Sep.	17	05:54	18732.5	-0.7	0°38.02’	0.00	44928.5	0.2	-0.9
Sep.	24	06:03	18732.8	-0.3	0°38.02’	0.02	44928.0	-0.1	-1.3
Oct.	04	06:25	18734.3	1.3	0°37.95’	0.02	44927.4	-0.6	-1.2
Oct.	10	06:21	18733.2	0.1	0°37.79’	-0.01	44927.7	-0.2	-1.1
Oct.	16	08:43	18733.4	0.1	0°37.91’	0.07	44927.5	-0.3	-1.2
Oct.	22	06:23	18733.0	-0.4	0°37.86’	-0.02	44927.8	0.2	-0.5
Nov.	01	09:30	18733.8	0.3	0°37.92’	0.00	44927.5	-0.0	-1.1
Nov.	08	07:21	18733.8	0.1	0°37.91’	-0.01	44928.0	0.1	-1.1
Nov.	14	07:07	18734.1	0.2	0°37.89’	-0.03	44929.0	0.9	-0.7
Nov.	27	12:20	18733.4	-1.0	0°37.93’	0.01	44929.7	0.6	-0.0
Dec.	03	12:47	18734.4	-0.1	0°38.15’	0.05	44929.3	-0.2	-0.6
Dec.	09	12:39	18734.6	0.1	0°38.11’	-0.00	44929.3	-0.2	-0.8
Dec.	12	12:18	18735.3	0.8	0°38.18’	0.06	44929.4	-0.1	-0.3

Table 7: Absolute measurement results by means of the THEO 010B DI-flux theodolite and the GSM 19 Overhauser effect proton magnetometer, reduced with the FGE variometer recordings (continued)

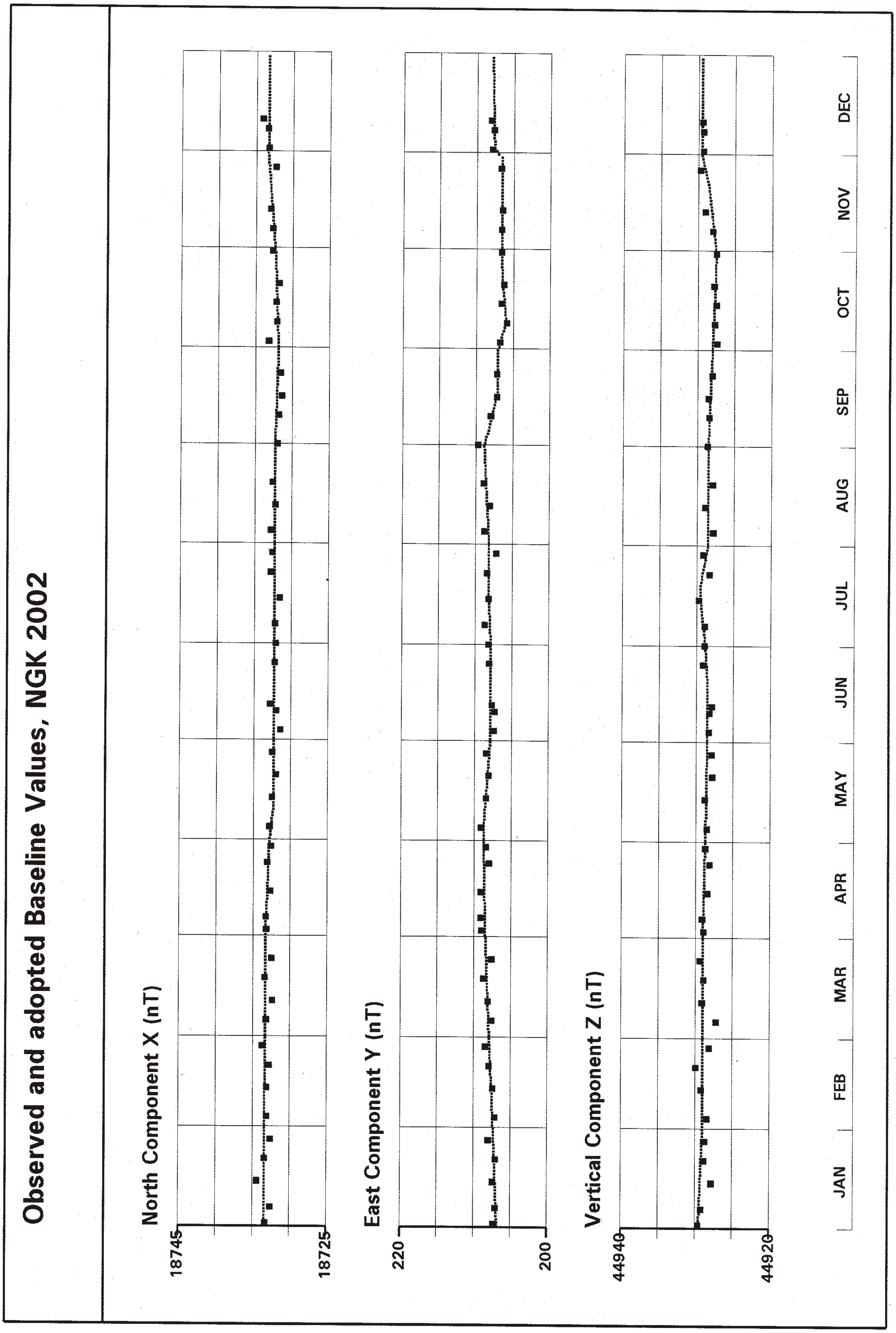


Fig. 5: FGE variometer base lines

5. Telluric Recordings

5.1 Measurement Lines

Four telluric lines in the geographic main directions exist at the observatory: one 1000 m line and one 100 m line in North-South (N-S) and East-West (E-W) direction, respectively. The electrodes of the two 100 m lines are located completely within the properties of the observatory, while the Northern electrode of the 1000 m N-S line and the Western electrode of the 1000 m E-W line are outside. Because of the A9 motorway widening in 1995 the Western electrode of the 1000 m E-W line had to be moved 50 m eastward. This has to be taken into account by the scale value. The electrodes are connected to the recording equipment located in the telluric hut (building No. 20) by cables. Further information can be found in [6].

5.2 Electrodes

Polarisation free electrodes are in use at all measurement lines [6].

5.3 Recording equipment

Only the 1000 m lines $N\text{-}S_{1000}$ and $E\text{-}W_{950}$ were continuously recording throughout the year. Both the 1000 m NS and the 950 m EW lines are connected to lightning protection and anti-aliasing filtering networks (see Fig. 6). The resulting signals are digitised by means of a 20 bit ADC (Type CS5506, Crystal). The ADC is controlled by a single board computer (Z80miniEMUF). The measurement values are triggered with a sampling rate of 1 Hz. They are transferred serially (RS232) by glass fibre cable to a PC at the measurement and computer centre (building No. 3). The NS and EW measurement samples are stored in units of 1 mV in ASCII format daily files. The time signal for the data logger is given by a DCF77 radio clock.
The transfer function of the data logger is determined from time to time. Due to traditional reasons the electrodes are connected as shown in Fig. 6. Because of inverting filter amplifiers the recordings of the EW line are in the correct polarity, while NS is recorded in the oposite polarity.

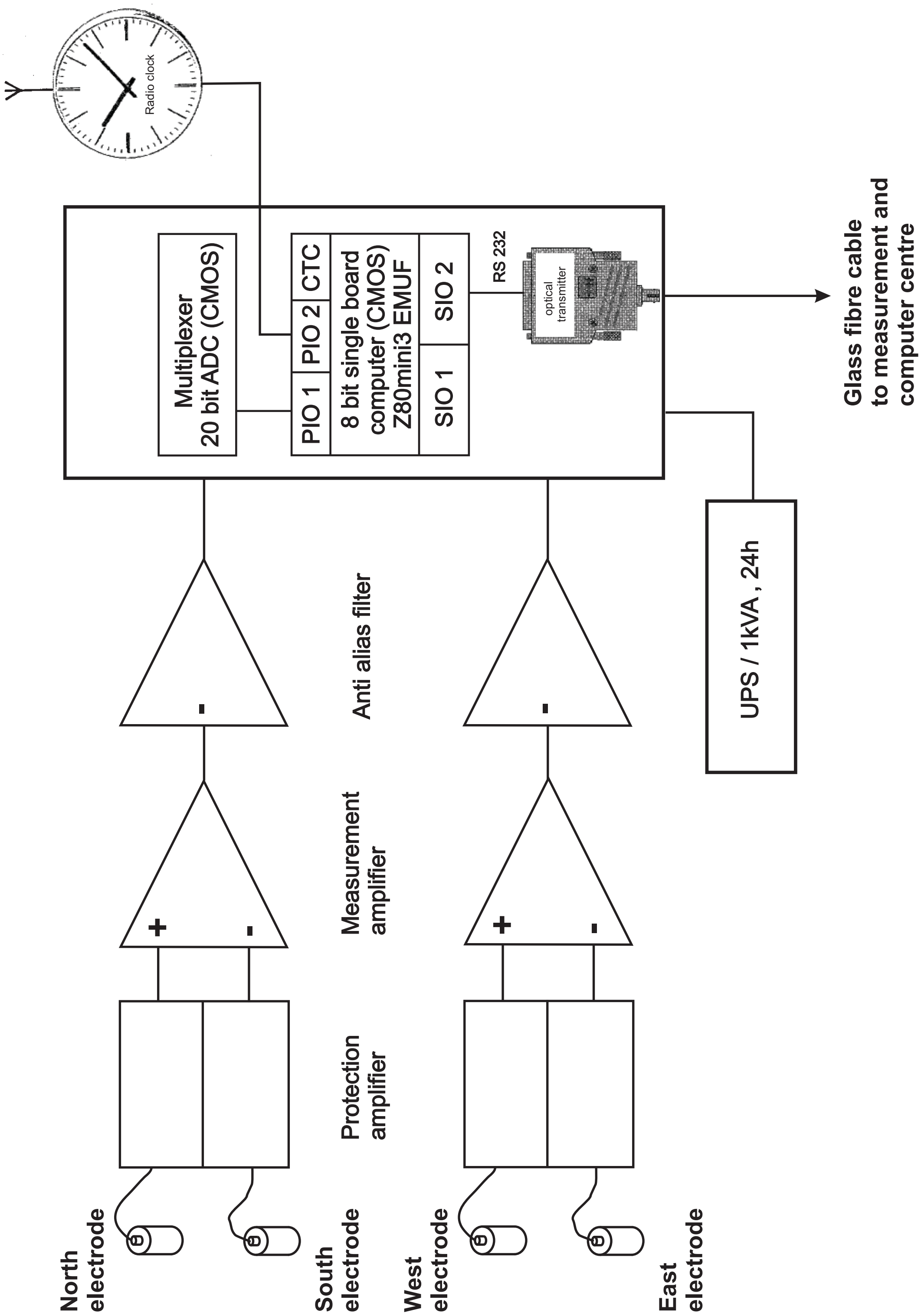


Fig.6: Block diagram of the telluric digital recording equipment

6. Remarks to the Tables and Plots

The tables and plots were obtained from the digital recordings of the FGE variometer and the absolute measurements by means of the THEO 010B DI-flux theodolite and the GSM19 Overhauser effect proton magnetometer. From the 2 Hz momentary values at first minute mean values are calculated. The minute mean value is centred on second 30. That means, the momentary values corresponding to the seconds 0, 0.5, 1.0, 1.5, …, 59.5 are averaged to a minute mean value. These “variometer minute mean values” are in files (1 file per day) with temporary character. The absolute minute mean values are calculated from these by means of the formulas given in [2] and are written into corresponding files (1 file per day). These absolute minute mean value files become final, when the final base values are determined. The hourly mean values are calculated from the “variometer minute mean values” by means of the formulas given in [2] and are written into corresponding files (1 file per year). The hourly mean value files become final, when the final base values are determined.
The absolute minute mean values and the hourly mean values are sent to the world data centres and to INTERMAGNET after the necessary format conversions. The hourly mean values are the base of the following tables and plots after conversion from H, D, Z values into X, Y, Z ones.
The acquisition and the preparation of the recording material and the production of the tables and plots was done by programs, written by H.-J. Linthe.
Table 8 contains the activity in terms of the inter-diurnal variability u of the North component [10]:

2002	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
u	0.78	0.89	1.28	1.26	1.64	0.73	0.97	1.02	1.36	1.35	1.16	1.13	1.13

Table 8: Inter-diurnal variability u of the North component in 2002

The reduction factor for Niemegk with the geomagnetic coordinates Φ = 51°53′, Λ = 97°38′ and Ψ = -16°41′ (referring to the International Geomagnetic Reference Field Model 'IGRF 10th' for 2005) has the value 0.01691 [11].

Note the following remarks on the tables and plots:

- X points toward North, Y points toward East and Z points downward. Corresponding to that Eastern declinations and Northern inclinations are positive. Since 1986 the declination in Niemegk is eastward, therefore positive.
- All times correspond to Universal Time (UTC). The hourly mean values correspond to the hours $0^h - 1^h$, $1^h - 2^h$, …, $23^h - 24^h$.
- The minimum value of a table line is marked with “n”, while the maximum is marked with “x”. The quietest days are marked with “*” in the tables and with “Q” in the plots. The most disturbed days are marked with “+” in the tables and with “D” in the plots. The quietest and most disturbed days are determined in the frame of the Kp service of the IAGA at Niemegk.

The order of tables and plots is as follows:

1. Table with the geographic and geomagnetic coordinates of the observatory, the monthly and annual mean values of all magnetic elements and the deviations of the monthly means from the annual mean values.

2. Hourly mean value plots of X, Y and Z for every month.

3. Table with the daily mean values of the declination, horizontal intensity, inclination and total intensity.

4. Daily mean value plots of the North component, East component and vertical intensity.

5. Tables containing the following activity numbers:
   - The Schmidt character figures (C) in scales of 0, 1, 2
   - The Fanselau character figures (F) in scales of 0, 0.5, 1.0, 1.5, 2.0
   - The mean planetary daily activity Ap, calculated in the frame of the ISGI (International Service of Geomagnetic Indices, Kp Index Service) at Niemegk [9]
   - The mean local daily activity A_K, calculated from the K and given in terms of 2nT
   - The three-hourly activity numbers K determined at Niemegk [8], where the lower limit of K=9 corresponds to 500 nT.
   - The daily sum ∑K of the 8 K numbers

The a_K are determined from the K corresponding to table 9, with $A_K = \sum a_K / 8$.

K	0	1	2	3	4	5	6	7	8	9
a_K	0	3	7	15	27	48	80	140	240	400

Table 9: Derivation of the a_K from the single K

6. Tables giving a summary about the frequency of the single K corresponding to the day time and month.

7. This bulletin contains the plot “Deviation of the continuously calculated daily mean values from the normal value” of 2001 and the table “Monthly values of the normal value 2001”. The monthly values of the normal value are displayed by a line in the plots. The numerical values are written next to the right margin of the plots and are contained in table 10.

Month	**X/nT**	**Y/nT**	**Z/nT**
January	18778.9	472.7	45118.1
February	18779.7	475.5	45120.8
March	18780.4	478.2	45123.6
April	18781.2	481.0	45126.4
May	18782.0	483.9	45129.2
June	18782.8	486.7	45132.1
July	18783.5	489.5	45134.9
August	18784.3	492.4	45137.8
September	18785.1	495.2	45140.6
October	18785.9	498.1	45143.4
November	18786.7	500.9	45146.2
December	18787.5	503.7	45149.1

Table 10: Monthly values of the normal value 2001

8. The final table contains the annual mean values of the complete observatory series Potsdam-Seddin-Niemegk adjusted to the level of Niemegk in a table and as a plot.

7. References

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Proceedings of the Xth IAGA Workshop on Geomagnetic Instruments, Data Acquisition and Processing, April 15-24, 2002; Hermanus, South Africa; pp. 53-62

8. Tables and Plots of the Results of the Observations in 2002 at Niemegk

Astronomic co-ordinates: φ = 52°4.3' , λ = 12°40.5' E. of Grw.
= 0h50m42s E. of Grw.

Geomagnetic co-ordinates: Φ = 51°53' , Λ = 97°38' Ψ = -16°41' [11]
referring to the International Geomagnetic Reference Field Model 'IGRF 10th' for 2005 [11]

Altitude above sea level: 78 m

Monthly and Annual Mean Values

Niemegk 2002

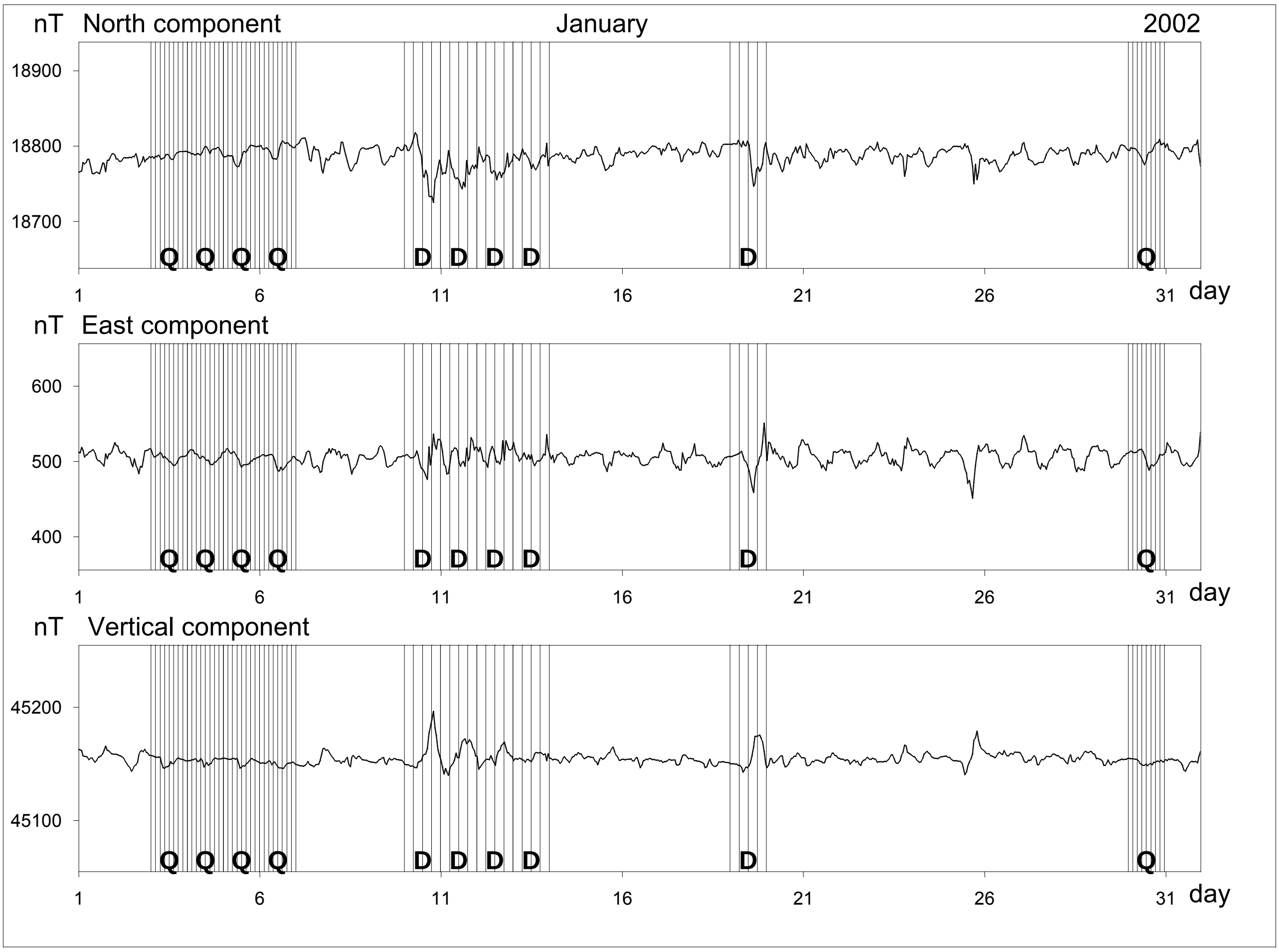
	D	I	H	F	X	Y	Z
Jan.	1° 32.58'	67° 24.10'	18794.6 nT	48910.1 nT	18787.8 nT	506.1 nT	45154.9 nT
Feb.	1 33.20	67 23.99	18796.1	48910.4	18789.2	509.5	45154.5
Mar.	1 33.41	67 23.66	18801.0	48911.8	18794.1	510.8	45154.0
Apr.	1 34.29	67 24.03	18797.8	48915.9	18790.7	515.5	45159.8
May	1 34.99	67 23.76	18803.0	48920.4	18795.8	519.5	45162.5
June	1 34.81	67 23.06	18813.7	48924.3	18806.5	518.8	45162.3
July	1 35.76	67 23.33	18810.7	48925.6	18803.4	523.9	45164.9
Aug.	1 36.79	67 24.13	18801.1	48927.9	18793.6	529.3	45171.4
Sep.	1 37.34	67 24.83	18794.0	48933.5	18786.5	532.1	45180.4
Oct.	1 38.99	67 26.07	18779.9	48939.3	18772.1	540.7	45192.6
Nov.	1 39.17	67 25.43	18790.2	48944.3	18782.4	542.0	45193.7
Dec	1 39.06	67 24.85	18798.9	48947.0	18791.1	541.6	45193.0
Year	1° 35.87'	67° 24.27'	18798.4 nT	48925.9 nT	18791.1 nT	524.1 nT	45170.3 nT

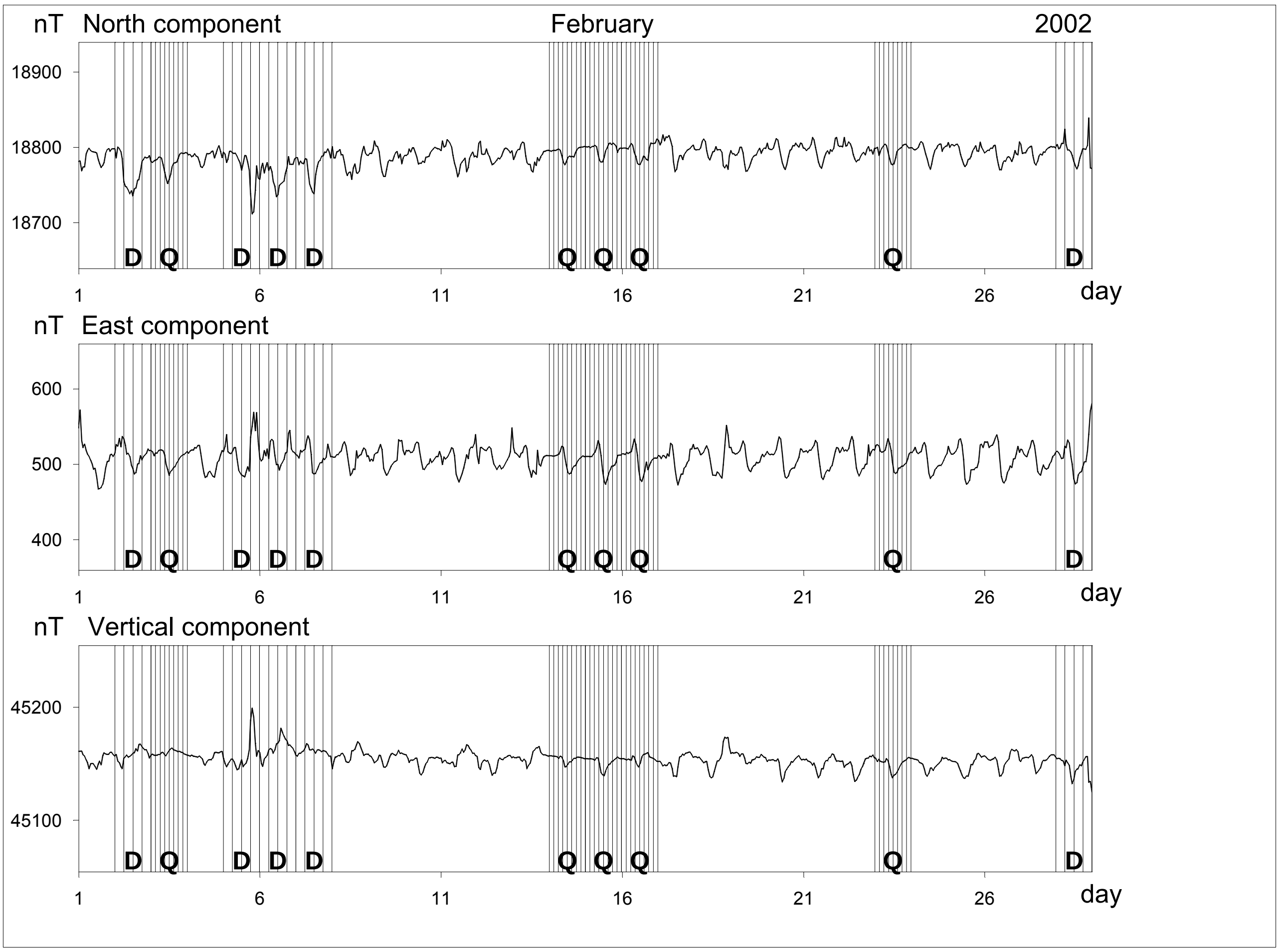
Deviation of the Monthly Means from the Annual Means

Niemegk 2002

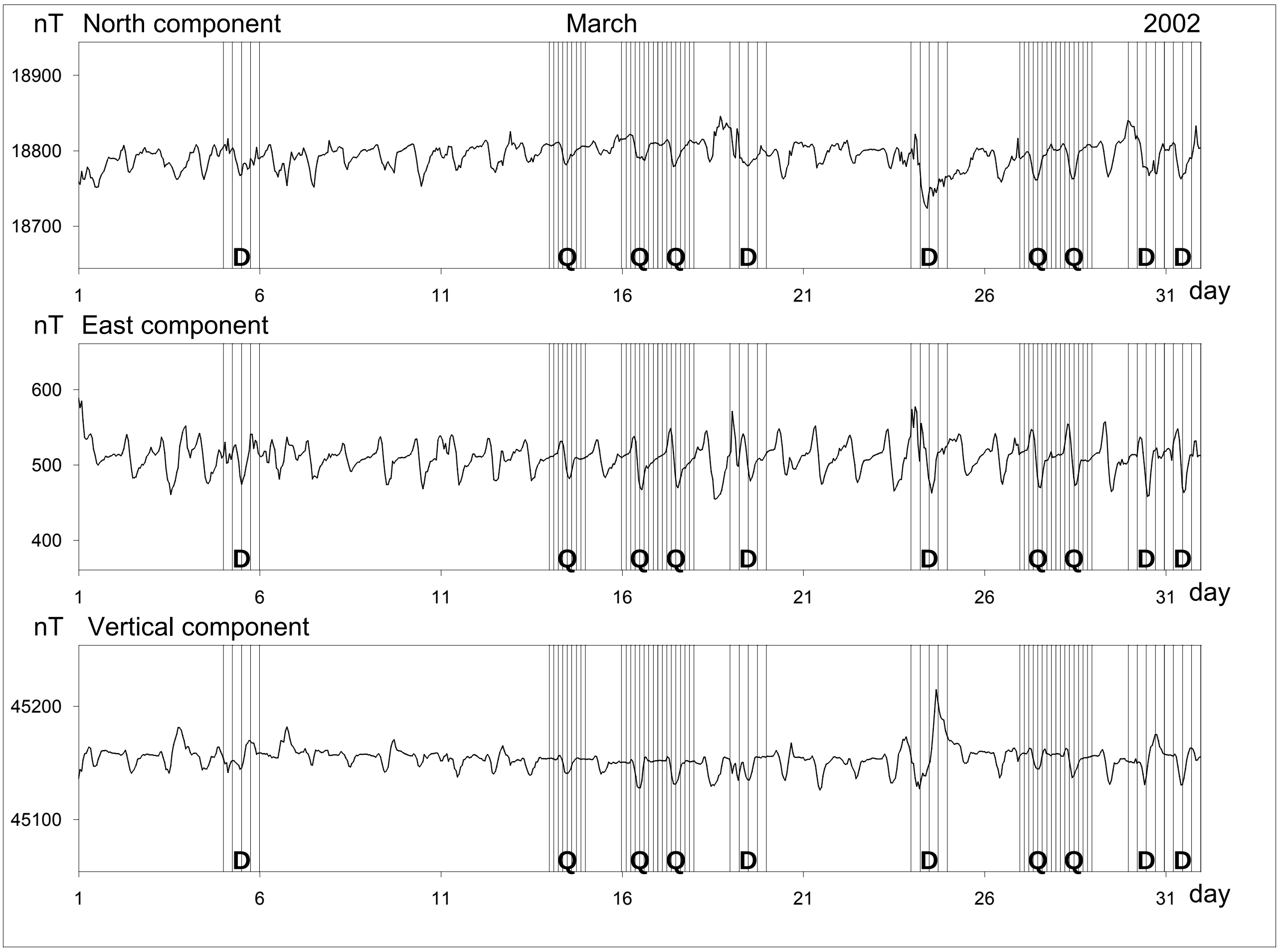
	D	I	H	F	X	Y	Z
Jan.	-3.29 '	-0.17 '	-3.8 nT	-15.8 nT	-3.3 nT	-18.0 nT	-15.4 nT
Feb.	-2.67	-0.28	-2.3	-15.5	-1.9	-14.6	-15.8
Mar.	-2.46	-0.61	2.6	-14.1	3.0	-13.4	-16.3
Apr.	-1.58	-0.24	-0.6	-10.0	-0.4	-8.6	-10.5
May	-0.88	-0.51	4.6	-5.5	4.7	-4.6	-7.8
June	-1.06	-1.21	15.3	-1.6	15.4	-5.4	-8.0
July	-0.11	-0.94	12.3	-0.3	12.3	-0.2	-5.4
Aug	0.92	-0.14	2.7	2.0	2.5	5.1	1.1
Sep.	1.47	0.56	-4.4	7.6	-4.6	7.9	10.1
Oct.	3.12	1.80	-18.5	13.4	-19.0	16.6	22.3
Nov.	3.30	1.16	-8.2	18.4	-8.7	17.9	23.4
Dec.	3.19	0.58	0.5	21.1	-0.0	17.4	22.7

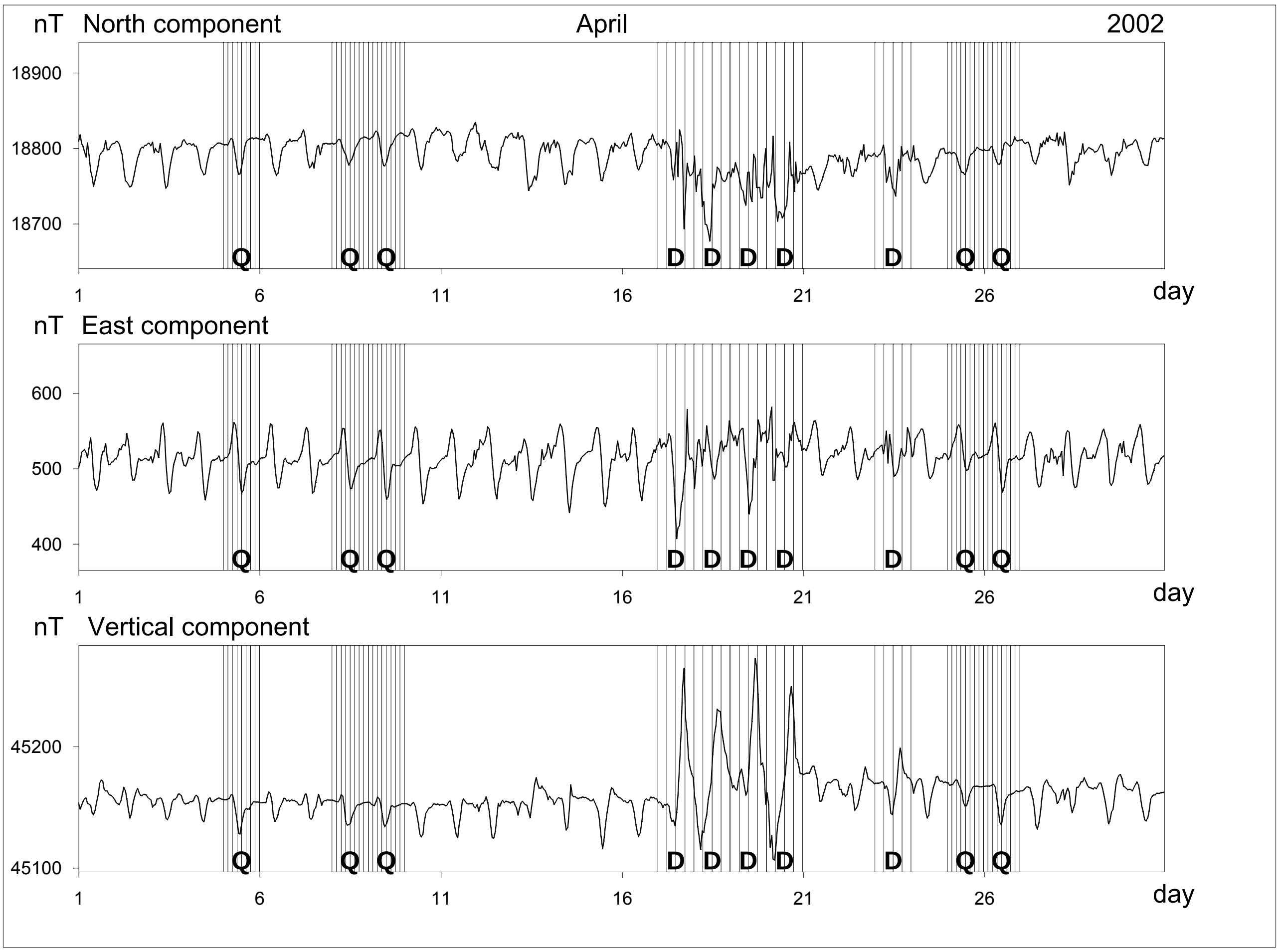
Hourly Mean Values Plot 2002



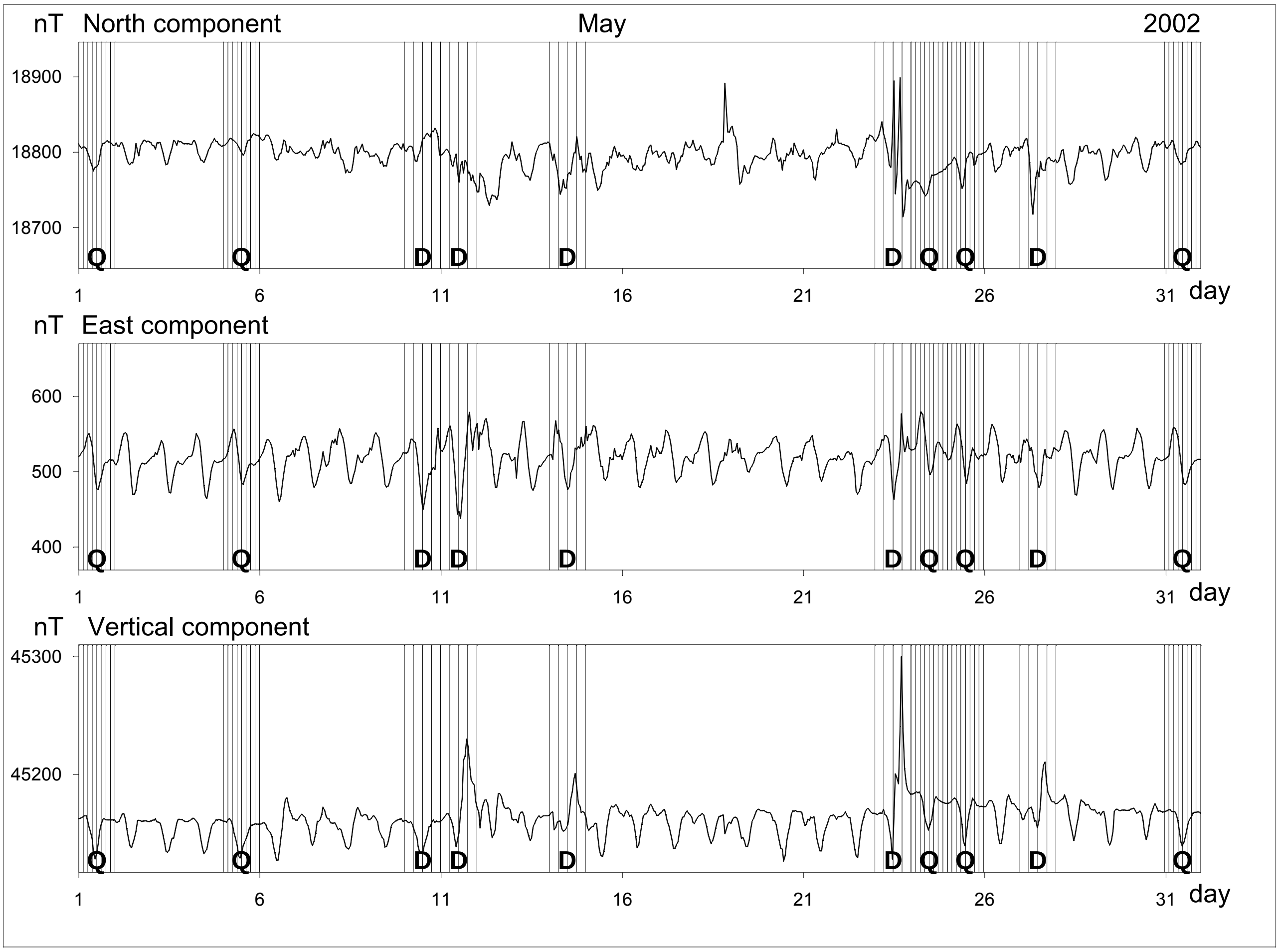


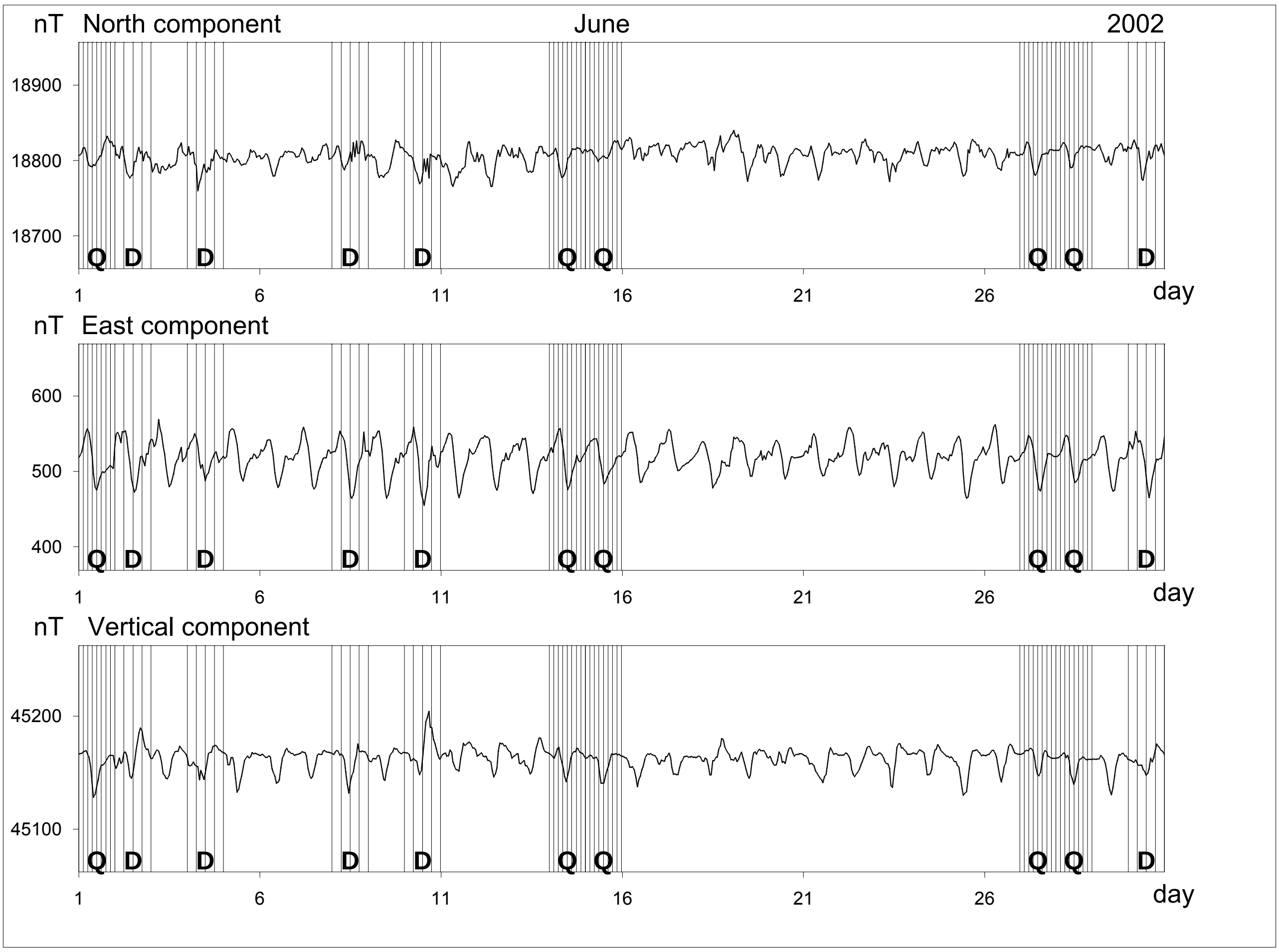
Q = Quiet day D = Disturbed day



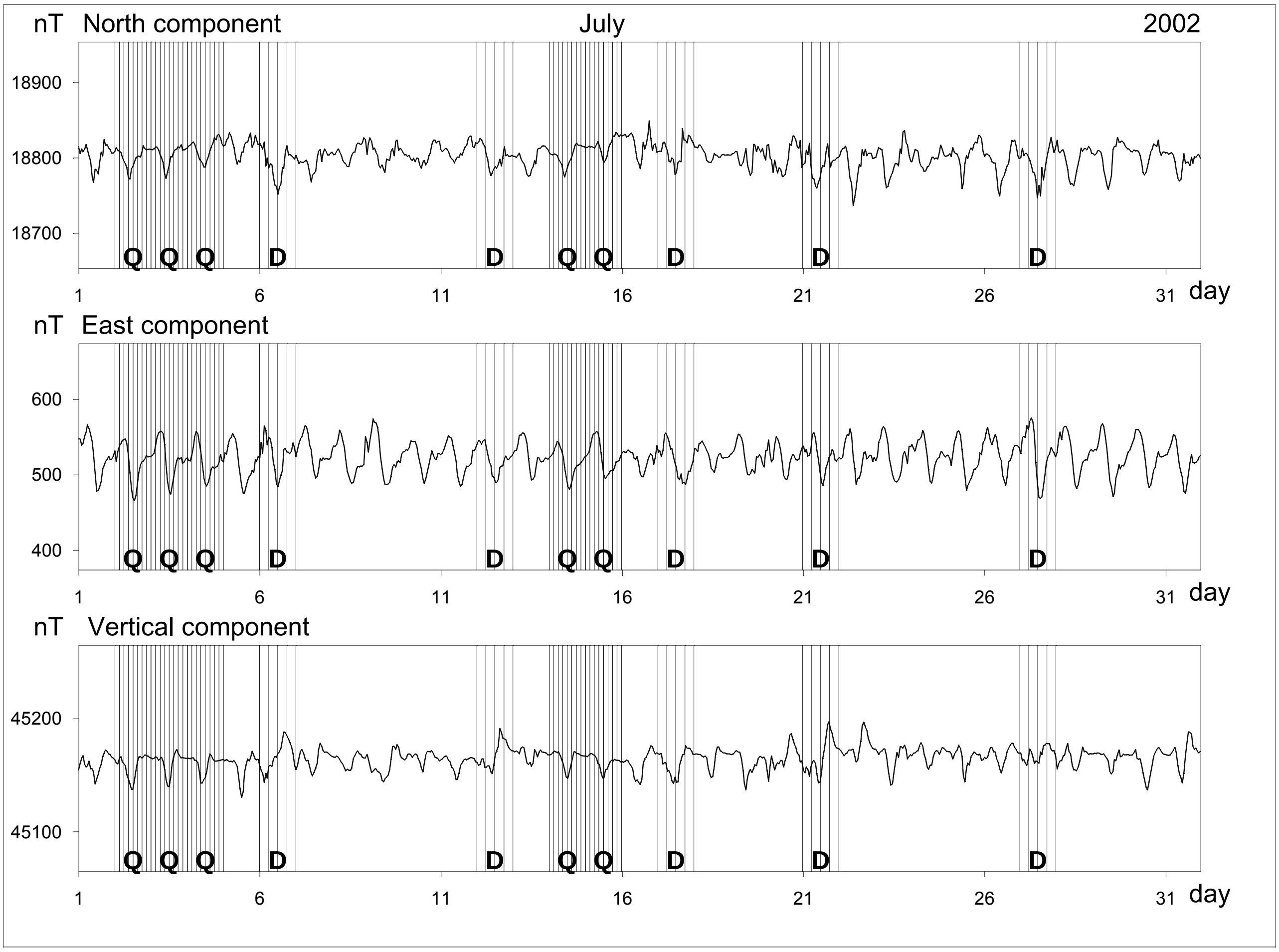


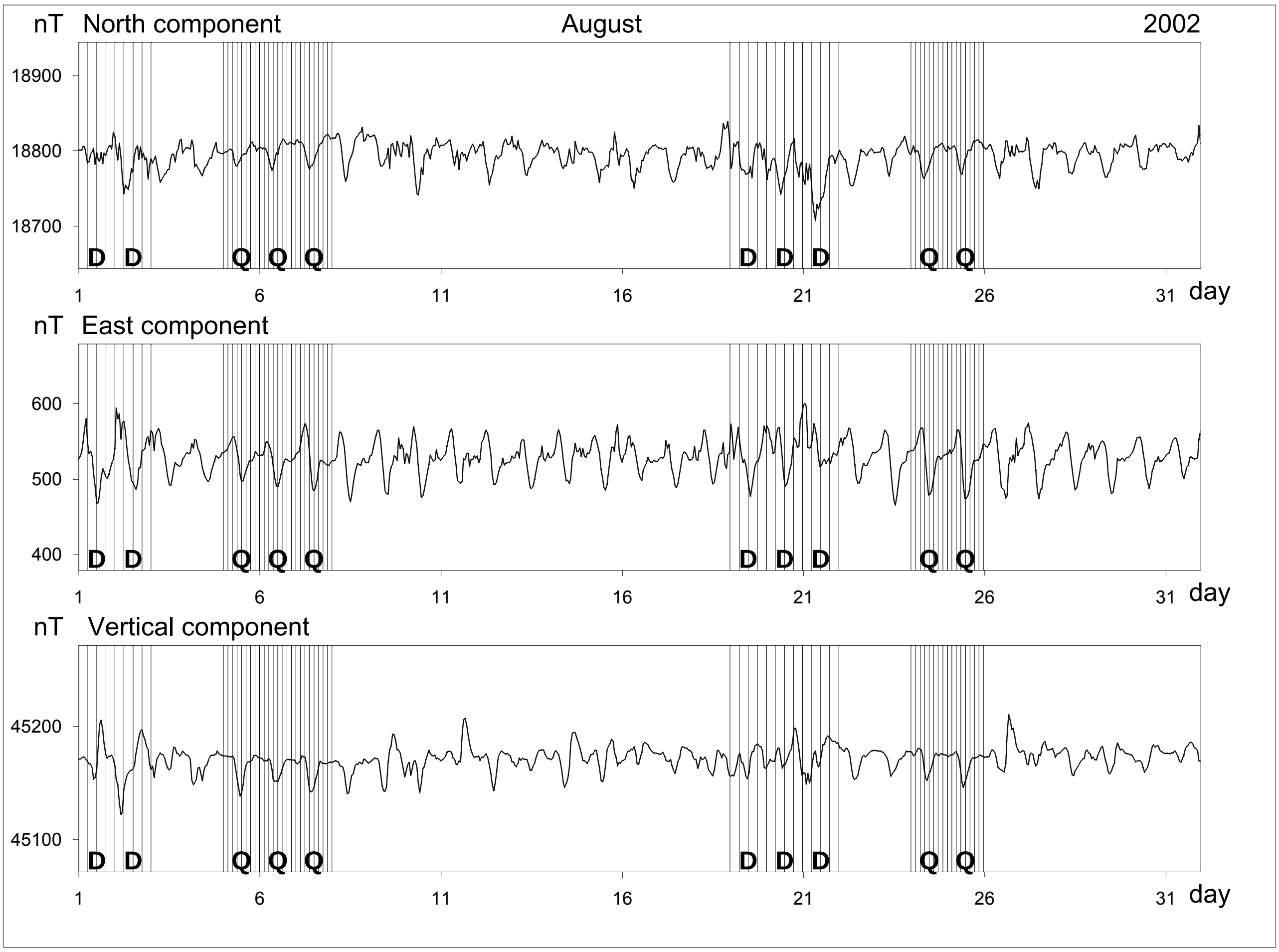
Q = Quiet day D = Disturbed day



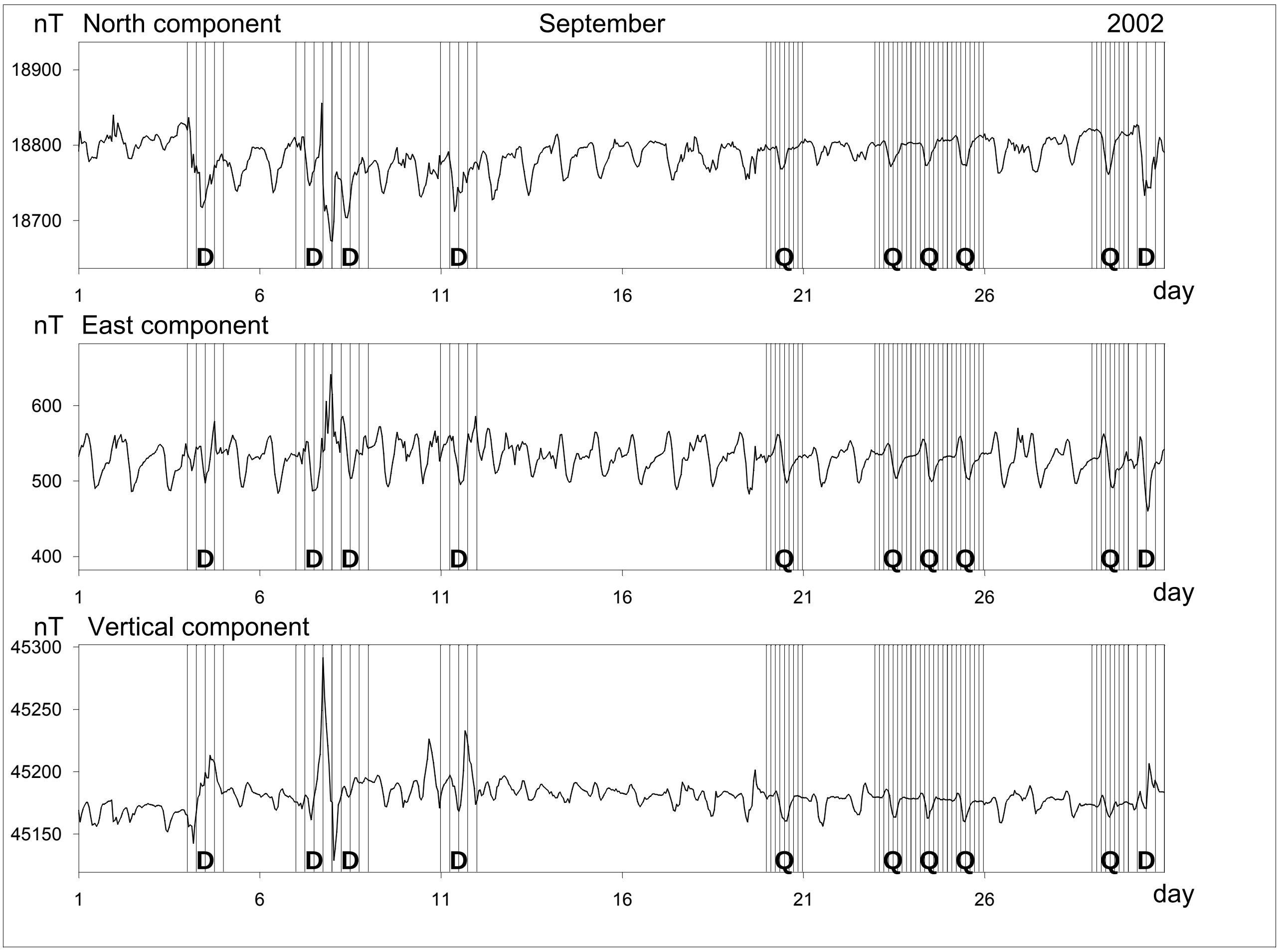


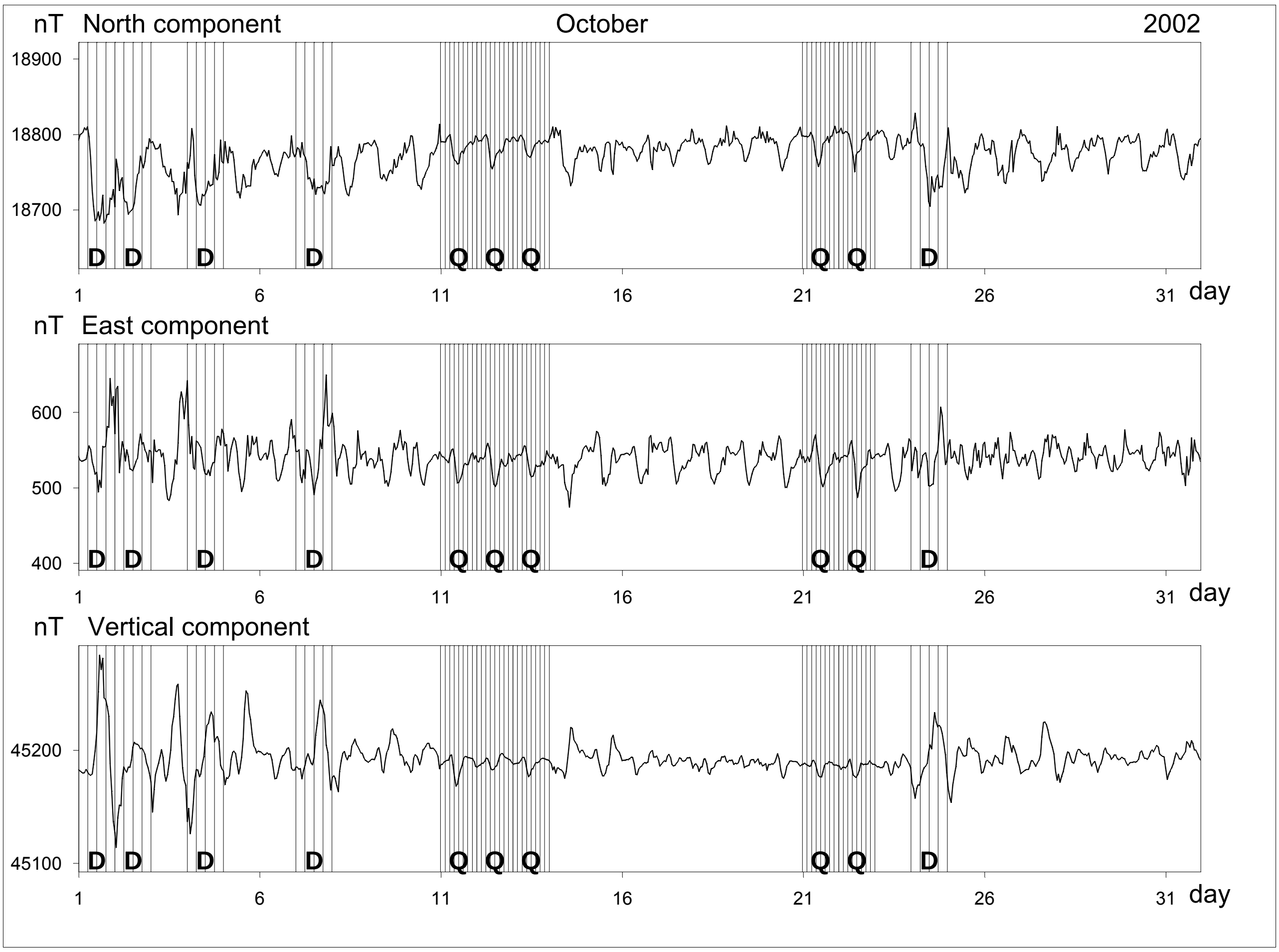
Q = Quiet day D = Disturbed day



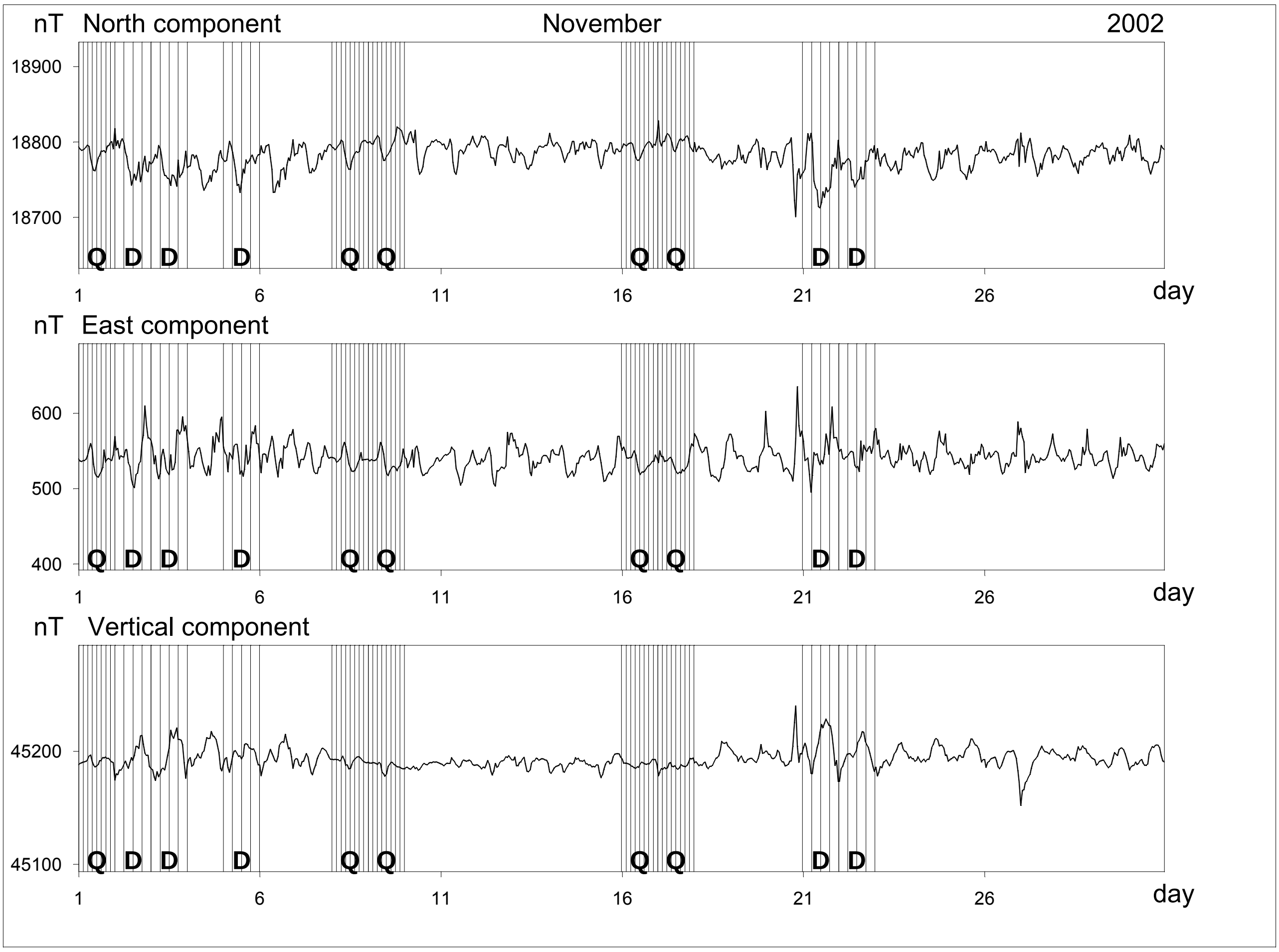


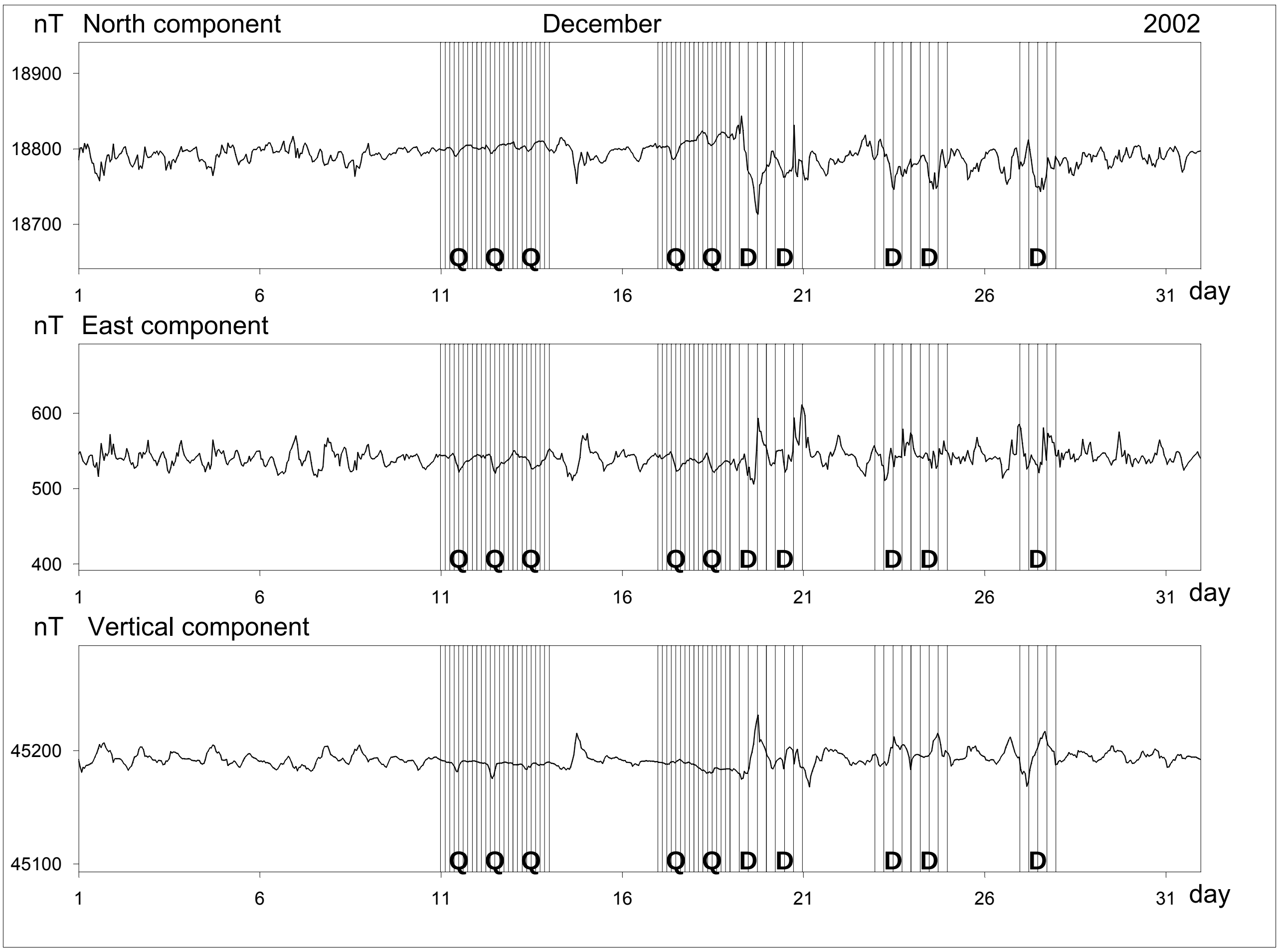
Q = Quiet day D = Disturbed day





Q = Quiet day D = Disturbed day





Q = Quiet day D = Disturbed day

Daily Mean Values of the Declination

Niemegk Daily Intervals Calculated in Terms of UTC 2002

D= 1° 30.0' + Tabular Value

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	3.2	2.5	6.7 x	3.4	4.3	3.8	6.2	5.0 n	6.7	10.8	8.2	9.2
2	2.7	4.1	3.0	4.3	3.8	5.4	4.5	8.6	6.8	11.3 x	9.9	9.2
3	2.4	3.0	3.4	4.1	3.6	5.4	5.4	7.2	5.9	10.2	10.4	8.9
4	2.5	2.4	3.2	3.2	3.6	5.1	4.8	6.3	7.9	10.8	10.3	8.8
5	2.4	4.7 x	3.8	3.7	4.5	5.5	4.4 n	6.9	7.3	9.9	10.3	8.9
6	1.7	4.3	4.1	3.8	3.9	4.4	6.5	5.8	6.7	9.7	10.5 x	8.0
7	1.8	3.6	2.6	3.5	4.6	4.8	6.9	6.5	8.4	10.3	9.0	8.9
8	2.4	3.6	3.1	3.5	5.4	4.6	5.6	5.2	10.4 x	9.4	8.6	9.1
9	2.4	3.2	2.7	2.8	4.6	4.4	5.9	6.9	9.1	8.5	8.0	8.8
10	2.8	3.6	3.0	2.8	3.4	3.9	5.8	5.8	9.0	8.1	7.7 n	8.5
11	3.0	2.9	3.7	3.0	5.6	4.5	5.5	6.8	9.3	7.8	8.1	8.5
12	3.4 x	3.4	3.0	4.0	6.6	5.2	5.3	6.4	9.2	7.6	8.3	8.3
13	2.9	2.9	3.1	3.1	4.2	4.4	6.2	6.0	7.7	8.1	9.3	8.5
14	2.4	2.7	3.1	3.7	5.8	4.9	4.4 n	7.2	6.8	6.4 n	8.2	8.3
15	2.7	2.3 n	2.9	4.0	6.4	4.6	5.8	7.4	7.6	9.1	8.4	9.3
16	2.2	2.7	2.4	3.6	5.1	4.9	5.3	6.6	6.5	8.8	8.1	8.7
17	2.6	2.4	2.7	2.2 n	4.9	5.7	4.7	5.8	7.3	8.8	7.9	8.3
18	2.0	3.3	1.3 n	5.7	5.3	3.6 n	6.3	7.0	7.7	8.4	9.0	7.6 n
19	1.9	3.3	4.0	6.2	5.3	5.7	5.9	7.3	7.1	8.6	9.2	8.8
20	2.8	2.9	3.8	7.3 x	5.0	5.0	5.9	9.2	7.0	8.0	10.4	10.8 x
21	2.8	3.1	3.3	6.2	5.0	5.1	5.9	9.7 x	6.0	7.9	10.5 x	10.8 x
22	2.5	3.7	3.5	5.3	3.0 n	6.2 x	6.1	7.6	7.2	7.8	10.1	9.0
23	3.1	3.3	3.1	5.8	6.2	4.7	6.0	6.1	7.0	8.1	10.1	9.5
24	2.7	2.7	5.2	5.3	7.8 x	5.2	6.6	6.7	6.8	8.9	9.4	9.8
25	1.6 n	2.8	4.2	5.7	6.0	3.9	5.2	6.0	6.9	8.9	8.7	9.7
26	2.8	3.5	4.2	4.4	5.8	5.3	7.3 x	6.8	7.5	9.6	9.3	9.1
27	3.1	3.0	3.6	4.3	4.9	4.4	6.6	6.7	7.1	9.8	9.9	10.3
28	2.7	3.7	3.4	3.9	5.5	4.5	6.7	7.3	6.4	9.6	9.4	10.0
29	2.9		2.9	5.3	5.0	4.4	5.4	5.9	6.2	8.9	8.6	9.6
30	2.6		3.0	4.3	5.0	4.8	6.4	6.5	5.0 n	9.6	9.4	9.2
31	2.9		3.9		4.8		5.0	7.4		9.1		8.6
Mean	2.6	3.2	3.4	4.3	5.0	4.8	5.8	6.8	7.3	9.0	9.2	9.1

Daily Mean Values of the Horizontal Intensity

Niemegk   Daily Intervals Calculated in Terms of UTC   2002

H= 18700 nT + Tabular Value

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	81	95	78	99	109	117	111	105	109	46 n	95	94
2	91	77	100	93	112	110	109	91	111	46 n	83	96
3	95	87	90	99	114	105	112	94	120 x	60	74	98
4	101	96	100	103	113	105	120	99	76	53	73	96
5	97	82	98	109	121 x	110	125	105	80	60	80	102
6	104 x	73 n	93	108	115	110	101	109	90	77	80	110
7	100	85	97	108	111	115	104	111	76	57	91	99
8	95	89	102	110	102	116	115	114 x	54 n	69	97	93
9	99	93	100	115	106	108	114	109	78	73	107	102
10	85	98	99	117 x	119	104	112	100	74	76	101	106
11	73 n	95	102	117 x	91	100 n	118	107	70	91	98	108
12	83	98	104	106	72	108	110	103	79	92	101	110
13	91	96	108	98	100	111	108	104	86	96	92	112
14	93	100	108	99	89	112	110	103	94	84	101	104
15	93	105 x	113	102	91	119	124	98	95	85	98	99
16	100	102	114	109	98	124 x	127 x	96	103	88	101	106
17	101	105 x	110	93	105	122	117	97	93	92	110 x	110
18	103	100	124 x	53 n	115	123	113	106	95	93	90	123 x
19	97	97	104	66	99	119	110	98	93	98	93	91
20	93	104	102	57	106	112	109	87	99	94	82	88
21	94	103	107	80	105	113	99 n	69 n	105	99 x	67 n	87
22	98	103	107	91	113	120	101	94	102	99 x	77	104
23	96	103	101	87	105	109	106	105	103	98	84	88
24	95	103	69 n	88	71 n	118	107	101	105	70	83	84
25	96	102	88	96	94	118	114	107	108	72	85	91
26	88	97	94	107	106	113	103	104	103	77	93	92
27	95	101	97	111	92	114	101	99	101	81	92	82 n
28	97	102	103	100	97	120	106	101	112	88	88	91
29	99		110	101	102	119	111	101	111	93	96	97
30	102		105	109	109	116	113	107	96	85	92	99
31	101		102		110		103	108		84		101
Mean	81	95	78	99	109	117	111	105	109	46 n	95	94

Daily Mean Values of the Inclination

Niemegk Daily Intervals Calculated in Terms of UTC 2002

I= 67° 10.0' + Tabular Value

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	15.0	14.1	15.2	13.9	13.2	12.7	13.2	14.0	13.6	18.6 x	15.1	15.2
2	14.4	15.4	13.8	14.3	13.1	13.4	13.3	14.6	13.4	17.9	15.9	15.0
3	14.0	14.8	14.5	13.8	12.8	13.7	13.2	14.6	12.8 n	17.5	16.5	14.9
4	13.7	14.1	13.8	13.5	12.9	13.6	12.6	14.2	16.1	17.7	16.7	15.1
5	13.9	15.0	13.9	13.1	12.3 n	13.2	12.3	13.7	15.8	17.6	16.2	14.6
6	13.4 n	15.8 x	14.4	13.2	12.8	13.3	14.0	13.5	15.1	16.3	16.2	14.0
7	13.7	14.9	14.1	13.2	13.2	13.0	13.8	13.2	16.4	17.7	15.4	14.8
8	14.0	14.6	13.6	13.0	13.6	12.9	13.0	13.1 n	17.4 x	16.8	14.9	15.3
9	13.8	14.2	13.8	12.7	13.4	13.4	13.0	13.6	16.0	16.7	14.2	14.6
10	14.9	13.8	13.9	12.4 n	12.5	13.9	13.3	14.1	16.5	16.4	14.6	14.3
11	15.6 x	14.1	13.5	12.5	14.9	14.1 x	12.8	13.9	16.8	15.2	14.8	14.2
12	14.9	13.8	13.4	13.2	15.9	13.5	13.5	13.9	16.0	15.2	14.6	14.0
13	14.4	14.1	13.1	13.9	13.9	13.3	13.6	13.9	15.5	14.9	15.2	13.9
14	14.2	13.7	13.1	13.8	14.8	13.2	13.4	14.1	14.9	15.9	14.6	14.5
15	14.3	13.4 n	12.8	13.5	14.4	12.6	12.4	14.3	14.9	15.8	14.8	14.8
16	13.7	13.6	12.6	13.1	14.1	12.3 n	12.2 n	14.6	14.3	15.5	14.6	14.3
17	13.7	13.4 n	12.9	14.7	13.5	12.4	12.8	14.4	14.9	15.3	14.0 n	14.0
18	13.5	13.7	11.9 n	17.3 x	12.9	12.5	13.2	13.7	14.7	15.1	15.5	13.0 n
19	14.0	14.0	13.3	16.9	13.9	12.7	13.3	14.3	14.9	14.8	15.3	15.4
20	14.2	13.4 n	13.6	17.0	13.4	13.2	13.5	15.1	14.4	15.0	16.1	15.5
21	14.1	13.4 n	13.1	15.5	13.5	13.0	14.1	16.3 x	14.0	14.7	17.2 x	15.6
22	13.9	13.4 n	13.2	14.6	13.1	12.6	14.2 x	14.6	14.3	14.6 n	16.4	14.5
23	14.1	13.4 n	13.7	15.0	14.2	13.4	13.7	13.9	14.2	14.8	15.9	15.7
24	14.1	13.4 n	16.0 x	14.8	16.1 x	12.9	13.7	14.1	14.0	16.8	16.0	16.0 x
25	14.1	13.5	14.7	14.3	14.5	12.7	13.2	13.7	13.8	16.5	15.9	15.4
26	14.7	14.0	14.2	13.4	13.8	13.2	14.0	14.1	14.1	16.3	15.2	15.4
27	14.1	13.6	14.0	13.2	14.9	13.1	14.0	14.4	14.3	16.1	15.2	16.0 x
28	14.0	13.4 n	13.5	14.0	14.4	12.6	13.6	14.1	13.5	15.5	15.7	15.5
29	13.8		13.0	13.9	13.9	12.6	13.4	14.2	13.5	15.2	15.1	15.0
30	13.5		13.4	13.3	13.4	12.9	13.1	13.8	14.8	15.8	15.4	14.9
31	13.6		13.6		13.3		13.9	13.8		15.9		14.7
Mean	14.1	14.0	13.7	14.0	13.8	13.1	13.3	14.1	14.8	16.1	15.4	14.8

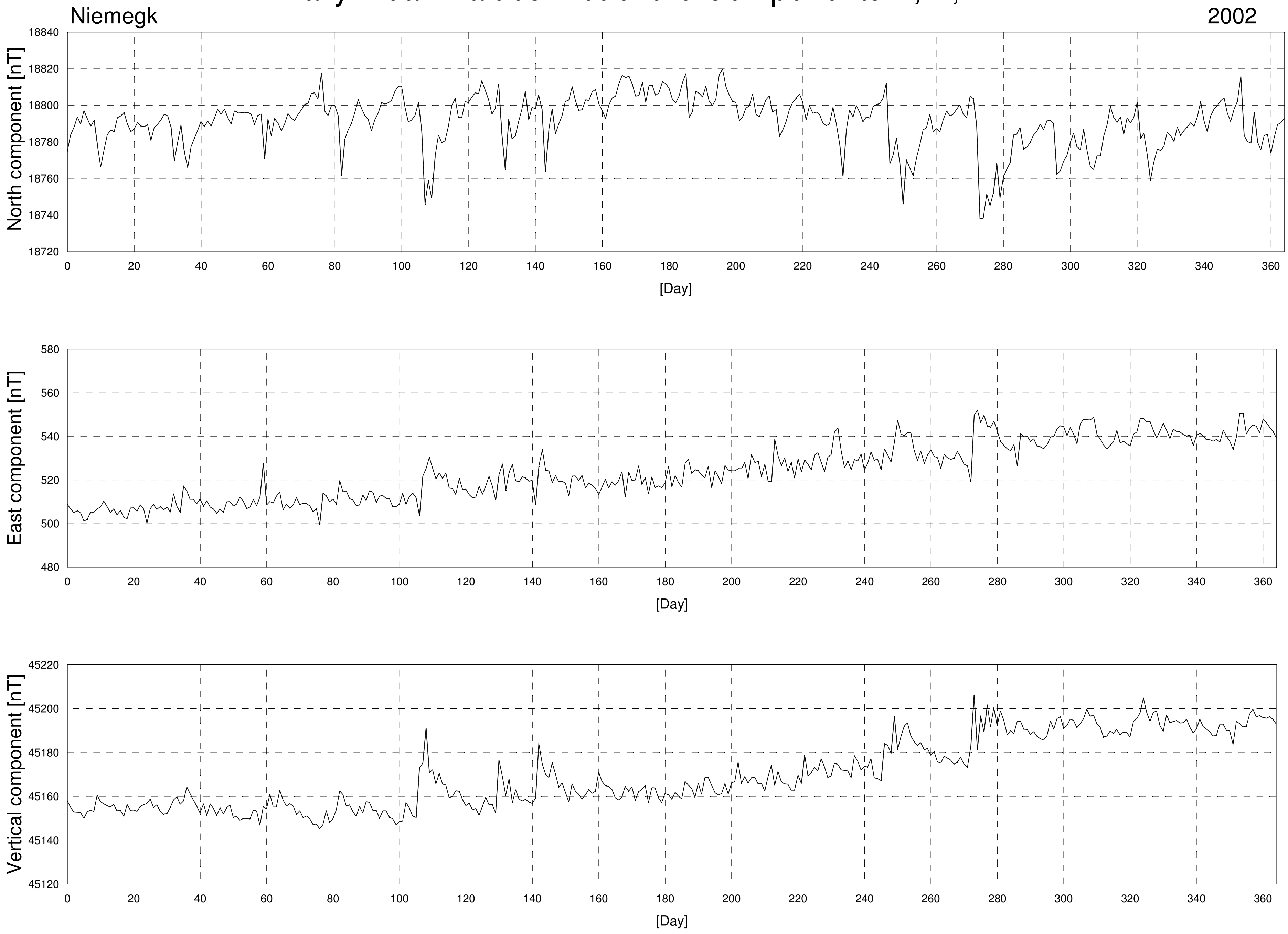
Daily Mean Values of the Total Intensity

Niemegk Daily Intervals Calculated in Terms of UTC 2002

F= 48900 nT + Tabular Value

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	8	10	4 n	15	17	22	22	32	28	39	44	47
2	9	7	12	12	19	26	19 n	18 n	29	16 n	41	46
3	9	12	14	11	16	21	24	25	31	36	40 n	48
4	11	12	13	12	17	20 n	25	23	30	26	43	48
5	9	8	12	11	17	20 n	26	24	31	40	43	47
6	9	11	17 x	14	19	22	24	26	31	38	44	47
7	11	12	14	14	21	26	23	24	42 x	38	44	45
8	10	11	14	12	14	25	26	25	19 n	35	45	47
9	10	10	14	13	16	22	22	30	34	43	45	47
10	12	10	13	12	17	29	27	22	37	40	43	48
11	5 n	12	10	13	29	24	25	37 x	36	40	44	47
12	7	8	13	9 n	15	25	29	27	34	42	44	46
13	10	12	11	14	17	26	28	29	35	42	42	47
14	10	12	12	12	20	25	26	30	36	43	43	49
15	11	11	13	9 n	11 n	24	28	27	38	43	43	47
16	11	13 x	10	11	19	25	28	32	38	41	45	47
17	12	12	9	26	18	25	25	28	35	42	46	49
18	10	12	13	13	21	30 x	27	28	32	41	45	48
19	13 x	12	7	33 x	16	27	22	25	33	43	47 x	45
20	8	10	12	11	17	26	26	26	31	40	45	43
21	9	10	9	21	16	20 n	23	19	33	41	46	42 n
22	10	8	11	19	21	27	32 x	26	35	41	44	48
23	11	9	12	22	41 x	24	25	30	34	42	43	47
24	12	9	8	18	20	29	28	28	34	37	46	48
25	13 x	8	14	20	24	22	28	28	34	35	47 x	47
26	11	10	11	19	27	26	26	36	33	41	44	48
27	10	11	13	21	28	26	26	31	34	43	41	43
28	12	6 n	12	20	25	24	25	29	35	41	47 x	46
29	10		13	20	22	22	27	30	34	44 x	47 x	50 x
30	10		15	19	26	25	24	32	36	44 x	45	49
31	10		11		23		27	36		43		48
Mean	10	10	12	16	20	25	26	28	33	39	44	47

Daily Mean Values Plot of the Components X, Y, Z



Niemegk **A c t i v i t y   I n d i c e s**

January 2002

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	8	8	16	2321	2132
2	0	0.5	8	9	16	2012	3332
3	0	0.0	2	2	6	2111	1000
4	0	0.5	3	3	8	1101	1112
5	0	0.0	2	2	5	1201	1000
6	0	0.0	2	2	5	1000	1111
7	0	0.5	7	8	15	0113	2332
8	0	0.5	11	10	17	3332	3111
9	0	0.0	2	2	6	0001	1211
10	1	0.5	19	18	23	2122	3544
11	1	0.5	27	24	29	4433	3543
12	1	0.5	17	18	26	4333	3442
13	0	0.5	13	12	21	3223	3224
14	0	0.5	8	8	16	2221	2223
15	0	0.5	7	6	15	2122	2222
16	0	0.5	4	3	8	1121	1110
17	0	0.5	8	11	20	3322	2323
18	0	0.5	5	5	10	3211	1200
19	1	0.5	14	15	21	0123	4434
20	0	0.5	10	10	19	4222	2223
21	0	0.5	11	12	21	4322	2332
22	0	0.5	6	6	13	1212	2122
23	0	0.5	8	12	21	3223	2243
24	0	0.5	4	3	8	1201	1111
25	0	0.5	10	12	19	2112	3442
26	0	0.5	8	7	15	3212	1222
27	0	0.5	8	9	18	3223	2222
28	0	0.5	7	7	15	2112	3222
29	0	0.5	4	5	12	2212	1202
30	0	0.5	3	3	8	1001	1122
31	0	0.5	6	6	11	2110	1114
Mean:	0.1	0.4	8.1	8.3	14.9		
Max:	1	0.5	27	24	29		
Min:	0	0.0	2	2	5		

February 2002

Day	C	F	Ap	AK	ΣK	K	
1	1	0.5	14	16	23	5323	3223
2	0	0.5	19	14	22	3333	3313
3	0	0.0	4	3	7	2101	1200
4	0	0.5	6	7	14	1211	1233
5	1	0.5	23	23	27	4222	3455
6	1	0.5	22	20	27	4343	3343
7	0	0.5	15	12	20	3233	3114
8	0	0.5	11	12	21	3223	3332
9	0	0.5	11	12	19	2222	2144
10	0	0.5	9	8	17	3322	2212
11	0	0.5	14	13	22	3223	3333
12	0	0.5	9	8	15	3221	1114
13	0	0.5	12	13	21	3233	3421
14	0	0.0	3	2	4	0011	1100
15	0	0.5	3	3	8	0011	1221
16	0	0.5	5	5	12	1112	1222
17	0	0.5	12	12	20	3333	2213
18	0	0.5	11	12	19	1222	2244
19	0	0.5	6	6	13	3121	1122
20	0	0.5	8	8	16	2112	3223
21	0	0.5	8	8	16	1222	2223
22	0	0.5	8	10	17	2312	2142
23	0	0.5	4	5	11	3121	2101
24	0	0.5	5	6	13	2112	2122
25	0	0.5	6	7	14	2012	2133
26	0	0.5	8	8	17	2122	2233
27	0	0.5	6	6	14	3112	2212
28	1	1.0	25	28	29	2433	3356
Mean:	0.1	0.5	10.2	10.2	17.1		
Max:	1	1.0	25	28	29		
Min:	0	0.0	3	2	4		

March 2002

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	6	6	14	3221	1212
2	0	0.5	10	10	16	4412	2120
3	0	0.5	6	6	15	1222	2222
4	0	0.5	11	13	22	2233	3333
5	0	0.5	10	11	20	3222	2333
6	1	0.5	21	24	29	5433	3443
7	1	0.5	17	18	26	2343	3443
8	0	0.5	9	9	17	2223	3113
9	0	0.5	4	3	8	1122	1010
10	0	0.5	5	6	12	1012	2321
11	0	0.5	9	8	13	0112	3114
12	0	0.5	10	10	19	3422	2222
13	0	0.5	11	12	21	2233	2333
14	0	0.5	5	6	12	2122	3110
15	0	0.0	3	2	5	0011	1110
16	0	0.5	5	6	12	0021	1233
17	0	0.5	3	4	9	1012	2210
18	0	0.0	2	2	4	0001	1011
19	0	0.5	14	14	20	2112	5333
20	1	0.5	19	17	21	5532	1122
21	0	0.5	9	8	13	1000	3432
22	0	0.5	7	6	14	2122	1222
23	0	0.5	6	5	11	2322	1100
24	0	0.5	13	13	18	0013	3344
25	1	1.0	45	27	30	5553	3333
26	0	0.5	7	7	15	2211	2322
27	0	0.5	11	12	21	2233	2234
28	0	0.5	4	4	10	1120	1221
29	0	0.0	2	1	3	0101	0010
30	0	0.5	5	5	9	0001	1124
31	1	0.5	20	17	25	2333	4343
Mean:	0.2	0.5	10.4	9.8	16.0		
Max:	1	1.0	45	27	30		
Min:	0	0.0	2	1	3		

April 2002

Day	C	F	Ap	AK	ΣK	K	
1	1	0.5	18	16	24	4333	3332
2	0	0.5	14	10	18	2333	2221
3	0	0.5	14	11	20	3333	2222
4	0	0.5	5	6	14	2222	2112
5	0	0.0	3	2	6	1101	1011
6	0	0.5	4	4	10	1112	1211
7	0	0.5	7	7	14	1122	3311
8	0	0.0	2	2	5	0011	1011
9	0	0.0	3	3	7	0111	2101
10	0	0.5	5	5	11	0121	2212
11	0	0.5	15	12	20	2133	3323
12	0	0.5	16	14	23	4223	3333
13	1	0.5	17	17	25	3323	3434
14	0	0.5	13	12	19	3312	4321
15	0	0.5	6	6	14	2111	2223
16	0	0.5	7	6	14	2221	2122
17	1	1.0	62	45	33	3225	5763
18	1	1.0	63	34	33	6544	3335
19	1	1.0	62	41	36	3345	5565
20	1	1.0	70	42	36	5643	4653
21	0	0.5	5	5	11	2111	1113
22	0	0.5	11	11	20	3322	3322
23	1	0.5	27	23	27	1453	4424
24	0	0.5	7	7	15	3212	2212
25	0	0.5	3	3	8	2101	1120
26	0	0.5	3	4	9	1110	1122
27	0	0.5	10	12	19	1212	3343
28	1	0.5	20	17	25	4433	3332
29	0	0.5	9	12	20	2123	3333
30	0	0.5	7	7	15	3212	2221
Mean:	0.3	0.5	16.9	13.2	18.4		
Max:	1	1.0	70	45	36		
Min:	0	0.0	2	2	5		

Niemegk **A c t i v i t y I n d i c e s**

May 2002

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	4	4	10	1211	2111
2	0	0.5	5	6	13	2111	3311
3	0	0.5	5	6	13	1221	2221
4	0	0.5	4	4	11	1211	2121
5	0	0.0	3	3	7	1001	1112
6	0	0.5	8	6	14	1112	2322
7	0	0.5	8	10	18	2212	2333
8	0	0.5	8	8	17	3222	2222
9	0	0.5	6	8	15	3123	2112
10	1	0.5	15	16	24	2234	3334
11	1	1.0	49	37	30	1125	6654
12	0	0.5	15	12	21	4232	2323
13	0	0.5	8	10	17	4311	3212
14	1	0.5	29	22	28	3433	3354
15	0	0.5	12	12	21	4322	2332
16	0	0.5	7	8	17	2212	2233
17	0	0.5	5	8	16	2122	3222
18	0	0.5	14	14	19	2112	2254
19	0	0.5	11	8	13	3431	1001
20	0	0.5	10	11	19	1224	2332
21	0	0.5	10	10	18	3132	2124
22	0	0.5	8	10	18	2123	3322
23	1	1.5	78	56	35	3316	7744
24	0	0.0	2	2	6	1111	1001
25	0	0.5	4	5	11	1111	1321
26	0	0.5	7	8	17	2122	2323
27	1	0.5	22	18	26	4343	4323
28	0	0.5	9	9	18	2222	3322
29	0	0.5	7	8	15	3211	3212
30	0	0.5	6	6	13	1221	2212
31	0	0.5	3	4	11	1211	1122
Mean:	0.2	0.5	12.3	11.3	17.1		
Max:	1	1.5	78	56	35		
Min:	0	0.0	2	2	6		

June 2002

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	4	5	11	0112	1222
2	1	0.5	16	17	25	4323	3334
3	0	0.5	10	10	18	3321	2232
4	0	0.5	13	14	23	3343	3322
5	0	0.5	6	8	17	3321	2222
6	0	0.5	4	4	11	2111	1212
7	0	0.5	5	7	15	2112	2223
8	0	0.5	14	15	21	1113	4434
9	0	0.5	8	9	18	3222	2232
10	0	0.5	14	14	22	2232	4432
11	0	0.5	8	9	18	2222	2332
12	0	0.5	6	8	17	3212	2223
13	0	0.5	7	8	17	1222	2332
14	0	0.5	4	6	13	2112	1222
15	0	0.5	4	4	10	1111	1113
16	0	0.5	7	10	18	2222	4222
17	0	0.5	4	6	14	3212	2211
18	0	0.5	10	10	17	1112	4332
19	0	0.5	11	14	22	4323	2323
20	0	0.5	5	6	13	2222	1211
21	0	0.5	7	10	19	2312	3332
22	0	0.5	6	8	15	1112	2233
23	0	0.5	9	11	20	2333	3222
24	0	0.5	5	6	14	2211	2321
25	0	0.5	8	10	18	2212	4223
26	0	0.5	5	6	12	3101	2311
27	0	0.0	2	2	5	1100	0120
28	0	0.0	2	3	7	0101	1211
29	0	0.5	5	8	15	1212	2133
30	0	0.5	12	12	21	3332	3223
Mean:	0.0	0.5	7.4	8.7	16.2		
Max:	1	0.5	16	17	25		
Min:	0	0.0	2	2	5		

July 2002

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	14	14	22	3323	4331
2	0	0.5	5	6	13	3122	1121
3	0	0.5	4	4	9	0111	2121
4	0	0.5	5	6	12	2111	1123
5	0	0.5	12	12	21	2222	3343
6	1	0.5	22	20	27	3434	3433
7	0	0.5	8	10	18	4212	3321
8	0	0.5	8	8	16	2112	2224
9	0	0.5	12	14	23	3233	3333
10	0	0.5	7	8	17	2222	2232
11	0	0.5	5	7	15	2112	2223
12	1	0.5	19	16	24	2324	4432
13	0	0.5	6	6	14	2211	2321
14	0	0.5	2	4	10	1112	1211
15	0	0.5	4	5	12	1121	1222
16	0	0.5	12	12	21	2222	3343
17	1	0.5	20	22	28	3433	3543
18	0	0.5	5	6	11	3231	1100
19	0	0.5	10	12	19	1114	3423
20	1	0.5	18	18	25	4432	2334
21	1	0.5	20	18	25	4432	4431
22	0	0.5	16	13	22	2233	3333
23	1	0.5	17	19	25	3222	3445
24	0	0.5	7	8	17	3222	2231
25	0	0.5	12	15	23	2224	3334
26	0	0.5	12	13	22	3323	2333
27	1	0.5	17	17	25	4323	4333
28	0	0.5	11	14	22	4332	2323
29	0	0.5	10	11	19	1322	4322
30	0	0.5	6	8	15	1211	2332
31	0	0.5	7	8	15	1113	3321
Mean:	0.2	0.5	10.7	11.4	18.9		
Max:	1	0.5	22	22	28		
Min:	0	0.5	2	4	9		

August 2002

Day	C	F	Ap	AK	ΣK	K	
1	1	0.5	25	24	28	1434	5434
2	1	1.0	42	33	33	5533	5435
3	1	0.5	14	17	24	5333	2332
4	0	0.5	13	12	20	3423	2231
5	0	0.5	4	4	11	1111	1222
6	0	0.5	4	4	11	2211	2111
7	0	0.5	4	5	12	2111	2221
8	0	0.5	6	8	16	1212	2233
9	0	0.5	14	15	22	2122	4443
10	1	0.5	15	16	24	4423	3323
11	0	0.5	13	13	21	1223	4333
12	0	0.5	12	14	23	3333	3323
13	0	0.5	8	10	18	3322	2132
14	0	0.5	12	14	22	2222	4433
15	1	0.5	22	20	25	2223	3355
16	0	0.5	11	12	21	3333	3222
17	0	0.5	8	8	16	1331	2222
18	1	0.5	21	20	24	4212	3255
19	1	1.0	30	28	31	5344	3345
20	1	0.5	30	24	26	3322	2356
21	1	0.5	32	17	25	4432	3333
22	0	0.5	8	10	19	3332	2222
23	0	0.5	7	8	15	1222	1133
24	0	0.5	4	6	13	2211	2122
25	0	0.5	5	6	13	2122	1113
26	1	0.5	16	18	25	2224	4434
27	0	0.5	13	14	22	2323	3324
28	0	0.5	7	8	17	2222	1233
29	0	0.5	8	9	17	3112	3322
30	0	0.5	8	9	16	1232	3230
31	0	0.5	7	8	15	1112	2224
Mean:	0.3	0.5	13.6	13.4	20.2		
Max:	1	1.0	42	33	33		
Min:	0	0.5	4	4	11		

Niemegk **A c t i v i t y I n d i c e s**

September 2002

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	11	15	21	4222	2225
2	0	0.5	8	8	15	3223	2111
3	0	0.5	7	8	14	0113	2133
4	1	1.0	42	30	32	4534	3553
5	0	0.5	7	7	15	1322	2221
6	0	0.5	7	8	16	2222	3122
7	1	1.0	57	35	29	2322	2666
8	1	1.0	36	30	26	7432	1324
9	0	0.5	9	9	15	2011	2234
10	1	0.5	24	21	26	4222	3445
11	1	0.5	26	16	24	2233	3434
12	0	0.5	14	12	21	3223	2342
13	0	0.5	11	10	18	4222	2231
14	0	0.5	8	8	16	2322	2221
15	0	0.5	6	6	14	2112	1232
16	0	0.5	6	6	12	1112	3121
17	0	0.5	11	9	17	0222	2333
18	0	0.5	14	12	21	3223	3323
19	0	0.5	15	13	21	2123	3433
20	0	0.5	4	4	10	2111	1112
21	0	0.5	6	7	14	1112	3321
22	0	0.5	6	7	15	2121	2322
23	0	0.0	2	2	5	1110	0110
24	0	0.5	2	3	8	0012	2111
25	0	0.0	2	2	6	0001	2111
26	0	0.5	5	8	14	2111	1224
27	0	0.5	6	6	13	3102	2212
28	0	0.5	5	4	11	2111	1221
29	0	0.5	4	4	9	1111	1112
30	1	0.5	28	24	29	2344	4345
Mean:	0.2	0.5	13.0	11.1	16.9		
Max:	1	1.0	57	35	32		
Min:	0	0.0	2	2	5		

October 2002

Day	C	F	Ap	AK	ΣK	K	
1	1	1.0	67	44	33	2234	5746
2	1	1.0	53	32	32	6543	3434
3	1	1.0	45	36	32	5233	3466
4	1	1.0	64	41	35	6543	3365
5	1	0.5	28	24	28	5323	3543
6	1	0.5	15	18	22	1233	1255
7	1	1.0	48	33	33	3443	4465
8	1	1.0	33	28	31	5433	4543
9	1	0.5	20	20	25	1233	3544
10	0	0.5	16	13	21	3333	2214
11	0	0.5	6	8	16	2122	2223
12	0	0.5	6	7	15	2112	2223
13	0	0.5	5	6	12	2111	1123
14	1	0.5	23	18	26	3343	4333
15	1	0.5	18	20	27	3334	3443
16	1	0.5	18	21	25	3223	3363
17	0	0.5	13	12	21	3332	3223
18	0	0.5	14	14	23	3322	3334
19	0	0.5	14	14	22	3322	2244
20	0	0.5	10	10	19	3322	2223
21	0	0.5	8	8	17	2222	2232
22	0	0.5	10	10	19	3223	2232
23	0	0.5	11	15	22	2122	3444
24	1	1.0	63	45	38	5534	5655
25	1	1.0	39	29	32	5443	4345
26	1	0.5	27	25	30	4334	4453
27	1	0.5	25	26	30	3333	4545
28	1	0.5	19	18	26	4333	3343
29	0	0.5	14	15	23	3223	3244
30	0	0.5	16	12	20	2242	2233
31	1	0.5	20	24	29	4324	4543
Mean:	0.6	0.6	24.8	20.8	25.3		
Max:	1	1.0	67	45	38		
Min:	0	0.5	5	6	12		

November 2002

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	7	8	16	2122	1323
2	1	1.0	28	33	32	5333	3465
3	1	1.0	35	36	34	4433	4655
4	1	0.5	23	23	28	4333	2445
5	1	0.5	24	21	28	3433	4434
6	1	0.5	21	23	28	4323	3454
7	0	0.5	13	12	21	4322	2332
8	0	0.5	5	5	10	1112	1130
9	0	0.5	6	6	12	1011	1233
10	0	0.5	17	14	22	4442	2222
11	0	0.5	12	12	20	2233	3133
12	1	0.5	17	18	24	2324	3253
13	0	0.5	13	12	21	4323	3222
14	0	0.5	8	8	17	3212	2322
15	0	0.5	12	11	20	3322	2233
16	0	0.5	7	8	14	3111	1124
17	0	0.5	7	8	15	4211	1222
18	0	0.5	10	9	17	3211	2233
19	0	0.5	14	15	23	3332	2244
20	1	1.0	25	32	26	3222	1574
21	1	1.0	50	40	37	4554	5455
22	1	0.5	26	26	30	4333	5534
23	1	0.5	17	18	25	4323	3442
24	1	0.5	15	20	26	3323	2544
25	0	0.5	15	14	22	3232	3423
26	0	0.5	13	13	19	3211	2235
27	1	0.5	24	19	25	5432	3233
28	0	0.5	12	13	21	2222	3442
29	0	0.5	14	14	22	2222	3443
30	0	0.5	16	15	24	3333	3333
Mean:	0.4	0.6	16.9	16.9	22.6		
Max:	1	1.0	50	40	37		
Min:	0	0.5	5	5	10		

December 2002

Day	C	F	Ap	AK	ΣK	K	
1	1	0.5	18	17	25	3323	3434
2	0	0.5	13	14	22	3222	2443
3	0	0.5	11	10	19	2223	3232
4	0	0.5	12	14	22	2222	3443
5	0	0.5	9	8	17	3222	2231
6	0	0.5	9	9	17	2212	1333
7	1	0.5	18	17	25	4323	3343
8	0	0.5	12	12	21	2322	3333
9	0	0.5	6	6	12	3112	1112
10	0	0.5	5	4	11	2111	1122
11	0	0.5	4	4	9	0112	2111
12	0	0.5	5	4	10	1111	2112
13	0	0.5	4	4	10	2111	1112
14	1	0.5	13	16	23	2223	2444
15	0	0.5	8	7	14	3112	2131
16	0	0.5	5	5	12	2212	2102
17	0	0.0	3	2	6	2110	0011
18	0	0.5	3	3	8	1111	2101
19	1	1.0	25	32	32	3444	4562
20	1	0.5	21	27	30	4323	4455
21	1	0.5	21	17	23	5422	2323
22	0	0.5	10	12	19	3112	3243
23	1	0.5	24	25	30	4333	4454
24	1	0.5	20	26	28	4123	5553
25	0	0.5	12	14	22	3322	3342
26	1	0.5	15	18	23	2113	3445
27	1	1.0	37	28	32	4444	4543
28	1	0.5	19	16	25	3333	3433
29	0	0.5	13	14	22	2223	2443
30	0	0.5	11	12	20	3122	2343
31	0	0.5	7	8	15	3213	2112
Mean:	0.4	0.5	12.7	13.1	19.5		
Max:	1	1.0	37	32	32		
Min:	0	0.0	3	2	6		

K Index Frequencies in the Eight Three Hourly Intervals 2002

UT	00-03	03-06	06-09	09-12	12-15	15-18	18-21	21-24	Σ	00-03	03-06	06-09	09-12	12-15	15-18	18-21	21-24	Σ
				January									**July**					
K=0	3	4	6	2	-	2	4	4	25	1	-	-	-	-	-	1	1	3
1	7	10	10	10	12	9	7	4	69	6	9	10	6	5	4	1	9	50
2	10	11	12	12	10	11	10	14	90	10	12	13	14	10	6	12	5	82
3	7	5	3	7	8	4	5	5	44	9	6	8	7	11	15	13	12	81
4	4	1	-	-	1	3	5	4	18	5	4	-	4	5	5	4	3	30
5	-	-	-	-	-	2	-	-	2	-	-	-	-	-	1	-	1	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				February									**August**					
K=0	3	4	6	2	-	2	4	4	25	-	-	-	-	-	-	-	1	1
1	7	10	10	10	12	9	7	4	69	8	6	8	5	4	5	2	3	41
2	10	11	12	12	10	11	10	14	90	10	11	13	14	11	11	11	8	89
3	7	5	3	7	8	4	5	5	44	7	9	9	9	10	10	13	10	77
4	4	1	-	-	1	3	5	4	18	3	4	1	3	4	5	2	4	26
5	-	-	-	-	-	2	-	-	2	3	1	-	-	2	-	3	4	13
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9										-	-	-	-	-	-	-	-	-
				March									**September**					
K=0	7	8	4	2	1	3	1	7	33	4	3	2	1	1	-	-	1	12
1	6	7	8	6	9	8	8	3	55	5	12	11	7	6	9	7	9	66
2	12	7	10	13	9	7	9	6	73	12	9	13	14	14	9	11	7	89
3	2	3	7	10	10	10	8	11	61	4	4	3	6	8	7	7	5	44
4	1	4	1	-	1	3	5	4	19	4	1	1	2	1	3	3	4	19
5	3	2	1	-	1	-	-	-	7	-	1	-	-	-	1	1	3	6
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	3
7	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				April									**October**					
K=0	3	1	2	1	-	2	1	1	11	-	-	-	-	-	-	-	-	-
1	6	11	10	8	6	6	8	8	63	2	4	2	1	2	1	1	-	13
2	8	7	9	8	9	7	11	9	68	7	9	11	9	8	11	5	2	62
3	8	7	5	10	10	10	6	8	64	12	12	12	16	12	6	6	14	90
4	3	2	3	1	3	2	1	2	17	3	3	6	5	7	6	12	7	49
5	1	1	1	2	2	1	1	2	11	5	3	-	-	2	5	3	6	24
6	1	1	-	-	-	1	2	-	5	2	-	-	-	-	1	4	2	9
7	-	-	-	-	-	1	-	-	1	-	-	-	-	-	1	-	-	1
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				May									**November**					
K=0	-	1	1	-	-	2	2	-	6	-	1	-	-	-	-	-	1	2
1	11	11	13	12	5	6	7	7	72	2	3	7	5	6	3	-	-	26
2	9	13	11	11	15	8	13	13	93	5	9	11	12	9	10	7	7	70
3	7	4	5	4	8	13	5	5	51	11	12	10	11	11	4	11	10	80
4	4	2	1	2	1	-	1	6	17	10	4	1	2	2	9	6	7	41
5	-	-	-	1	-	-	3	-	4	2	1	1	-	2	3	4	5	18
6	-	-	-	1	1	1	-	-	3	-	-	-	-	-	1	1	-	2
7	-	-	-	-	1	1	-	-	2	-	-	-	-	-	-	1	-	1
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				June									**December**					
K=0	2	-	3	1	1	-	-	1	8	1	-	-	1	1	1	2	-	6
1	7	11	14	7	6	3	6	5	59	2	12	13	4	4	9	6	5	55
2	11	11	9	17	13	16	13	14	104	11	9	14	13	12	3	2	9	73
3	8	8	3	5	5	9	11	8	57	11	7	2	11	9	6	7	12	65
4	2	-	1	-	5	2	-	2	12	5	3	2	2	4	9	10	3	38
5	-	-	-	-	-	-	-	-	-	1	-	-	-	1	3	3	2	10
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

K Index Frequencies

Niemegk — Annual Sums — 2002

K	UT	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24	Σ
0		23	21	19	8	4	10	14	19	118
1		66	104	115	78	72	72	59	56	622
2		113	118	138	149	131	111	112	101	973
3		97	83	72	105	112	99	97	110	775
4		46	29	18	21	34	49	53	50	300
5		16	9	3	3	10	16	20	24	101
6		3	1	-	1	1	5	9	5	25
7		1	-	-	-	1	3	1	-	6
8		-	-	-	-	-	-	-	-	-
9		-	-	-	-	-	-	-	-	-

K Index Monthly Means

Niemegk — 2002

Month	UT	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24	Mean
January		2.1	1.6	1.4	1.8	1.9	2.1	2.0	2.0	1.9
February		2.4	1.8	1.9	2.1	2.1	2.0	2.3	2.6	2.1
March		1.8	1.8	1.9	2.0	2.1	2.1	2.3	2.1	2.0
April		2.3	2.2	2.0	2.3	2.5	2.5	2.3	2.3	2.3
May		2.1	1.8	1.7	2.1	2.5	2.4	2.2	2.3	2.1
June		2.0	1.9	1.5	1.9	2.2	2.3	2.2	2.2	2.0
July		2.4	2.2	1.9	2.3	2.5	2.8	2.6	2.3	2.4
August		2.5	2.5	2.1	2.3	2.6	2.5	2.8	2.9	2.5
September		2.1	1.7	1.7	2.0	2.1	2.4	2.4	2.5	2.1
October		3.3	2.7	2.7	2.8	3.0	3.3	3.7	3.7	3.2
November		3.2	2.6	2.3	2.3	2.5	3.1	3.5	3.2	2.8
December		2.6	2.0	1.8	2.3	2.5	2.7	3.0	2.6	2.4
Mean		2.4	2.1	1.9	2.2	2.4	2.5	2.6	2.6	2.3

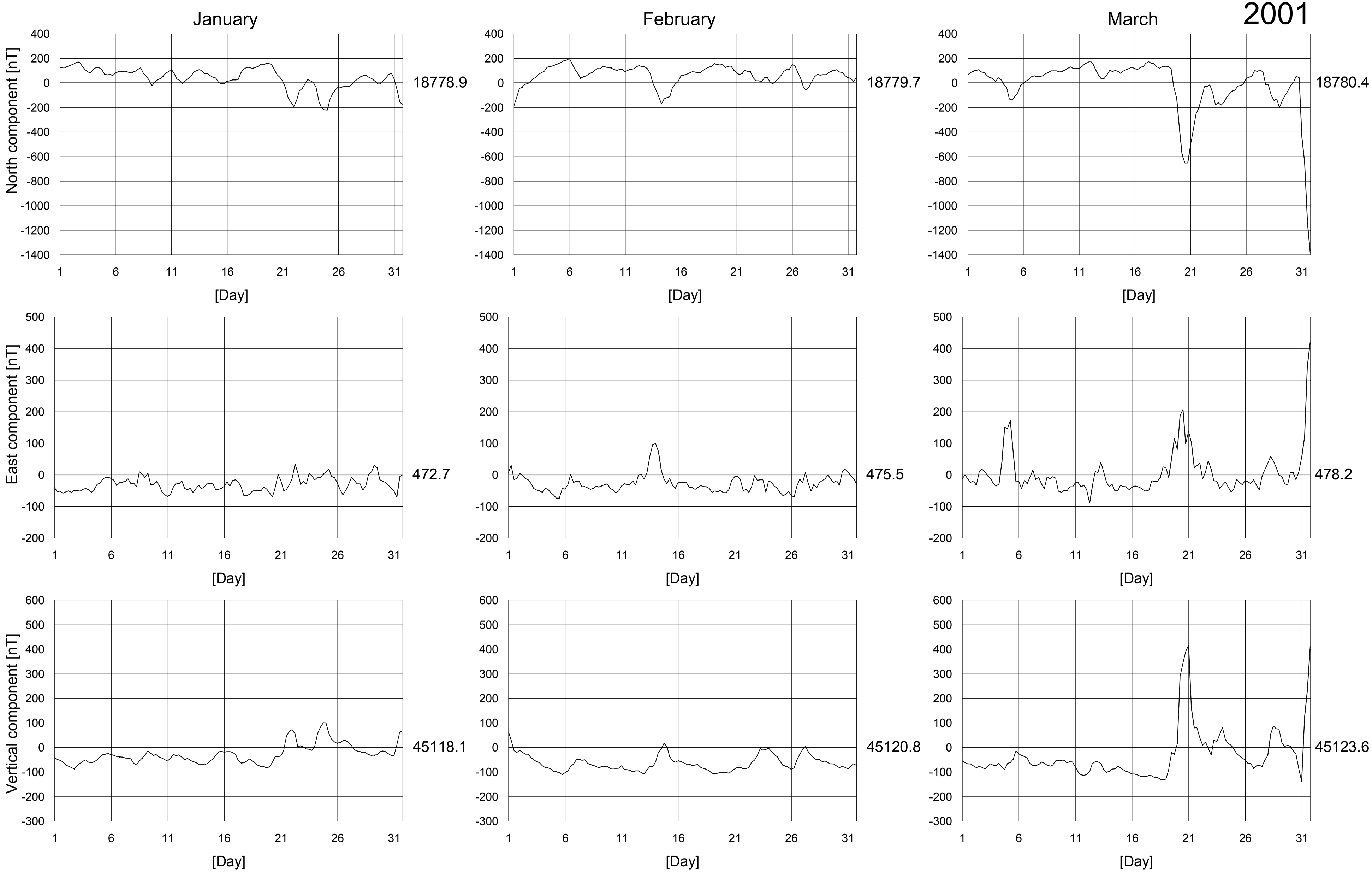
K Index Frequencies

Niemegk — Monthly Sums — 2002

K	Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	∑
0		25	11	33	11	6	8	3	1	12	-	2	6	118
1		69	53	55	63	72	59	50	41	66	13	26	55	622
2		90	80	73	68	93	104	82	89	89	62	70	73	973
3		44	61	61	64	51	57	81	77	44	90	80	65	775
4		18	14	19	17	17	12	30	26	19	49	41	38	300
5		2	4	7	11	4	-	2	13	6	24	18	10	101
6		-	1	-	5	3	-	-	1	3	9	2	1	25
7		-	-	-	1	2	-	-	-	1	1	1	-	6
8		-	-	-	-	-	-	-	-	-	-	-	-	-
9		-	-	-	-	-	-	-	-	-	-	-	-	-

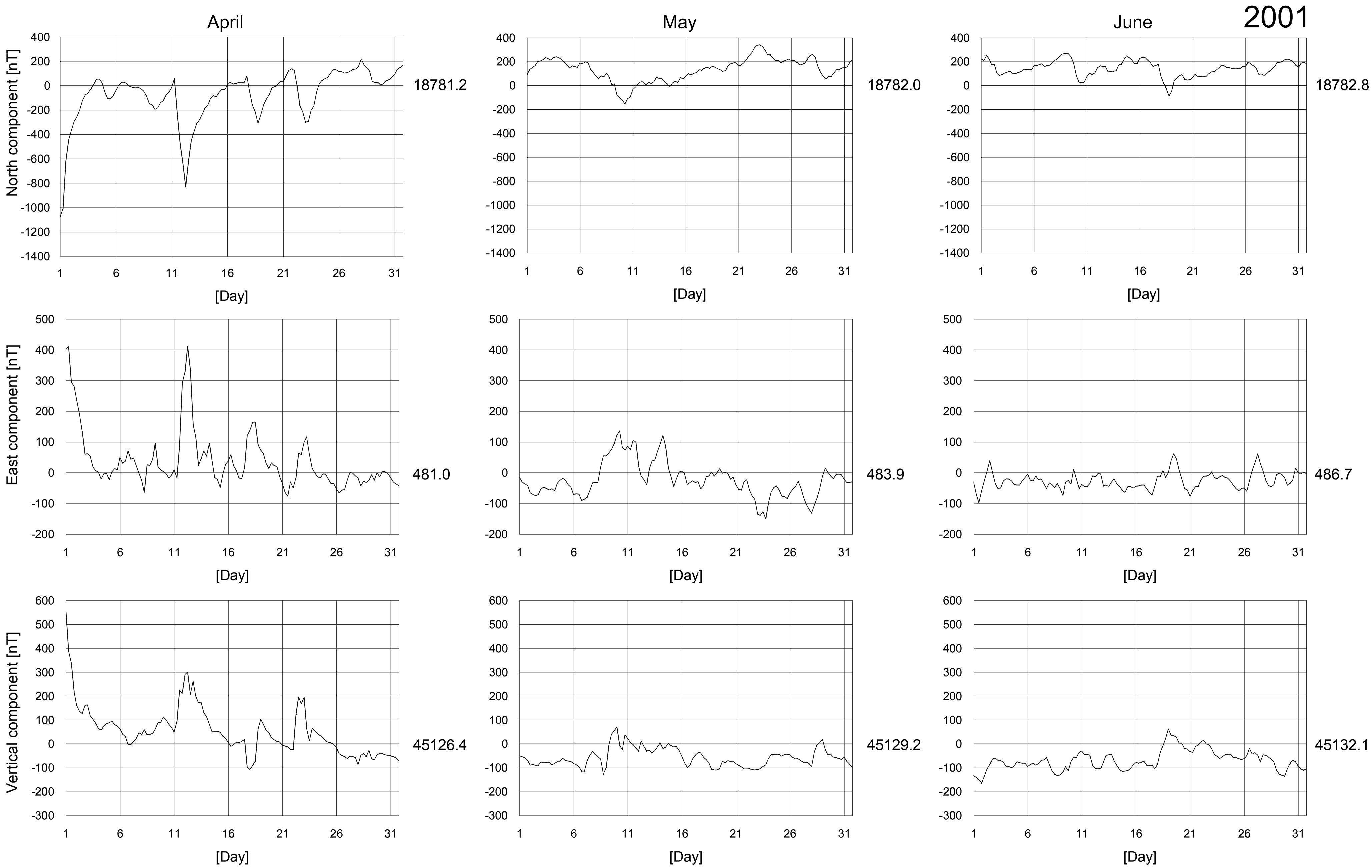
Deviations of the Magnetic Components from Normal Value

2001



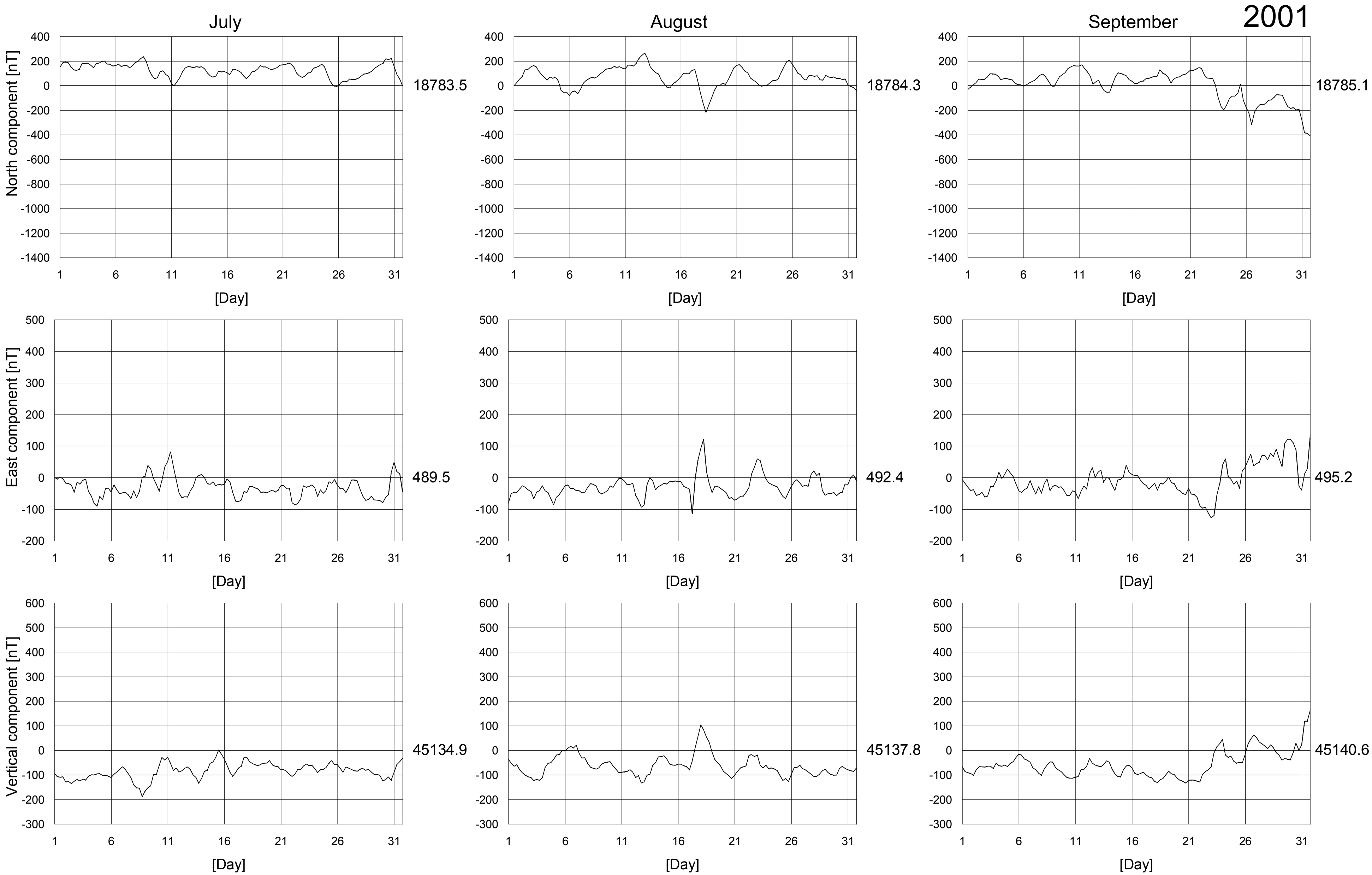
The values at the right margin apply to the middle of the month

Deviations of the Magnetic Components from Normal Value



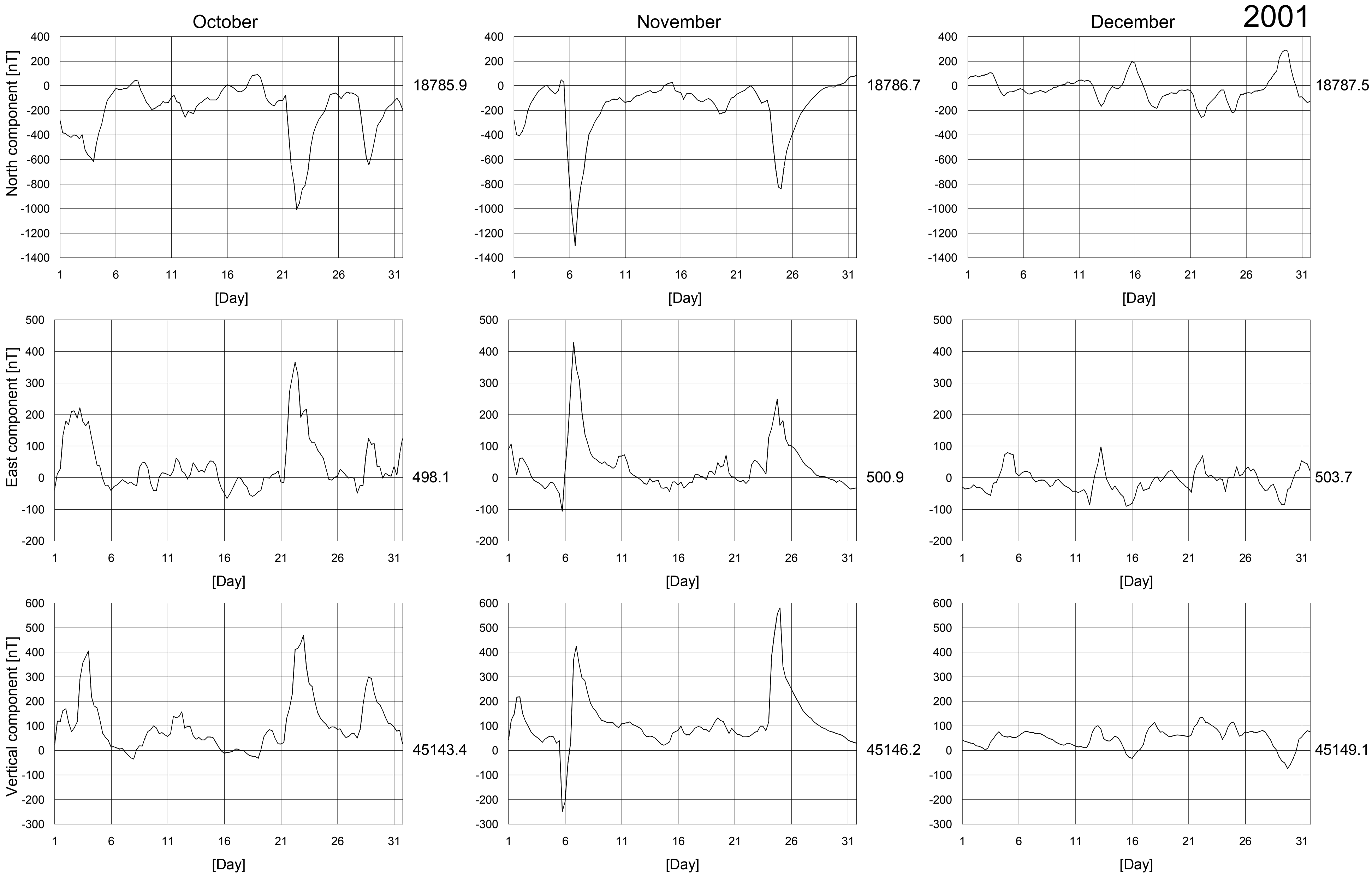
The values at the right margin apply to the middle of the month

Deviations of the Magnetic Components from Normal Value



The values at the right margin apply to the middle of the month

Deviations of the Magnetic Components from Normal Value



The values at the right margin apply to the middle of the month

Annual Mean Values of the Observatories
Potsdam (1890-1907), Seddin (1908-1931) and Niemegk (from 1932), referenced to Niemegk

Year	D	H	I	F	X	Y	Z
1890	-10° 57.3’	18731 nT	66°29.0’	46942 nT	18390 nT	-3559 nT	43044 nT
1891	-10 50.8	18749	66 25.3	46873	18414	-3528	42959
1892	-10 44.8	18759	66 25.8	46914	18430	-3498	43000
1893	-10 39.9	18790	66 25.0	46966	18466	-3477	43044
1894	-10 34.0	18809	66 23.3	46959	18490	-3449	43028
1895	-10 28.5	18834	66 21.1	46954	18520	-3424	43011
1896	-10 22.9	18861	66 19.8	46976	18552	-3399	43024
1897	-10 18.3	18888	66 17.7	46982	18583	-3379	43018
1898	-10 13.6	18908	66 16.6	46999	18608	-3357	43028
1899	-10 09.3	18932	66 14.6	46993	18635	-3338	43011
1900	-10 04.9	18958	66 13.0	47008	18665	-3319	43016
1901	-10 00.7	18975	66 11.5	47006	18686	-3299	43006
1902	-9 56.6	18987	66 09.6	46977	18702	-3279	42969
1903	-9 52.4	18990	66 08.8	46959	18709	-3256	42948
1904	-9 48.0	18994	66 08.4	46957	18717	-3233	42943
1905	-9 43.1	18993	66 08.0	46942	18720	-3206	42928
1906	-9 38.2	18993	66 07.2	46916	18725	-3179	42900
1907	-9 32.6	18980	66 07.7	46900	18717	-3147	42888
1908	-9 26.6	18966	66 08.0	46875	18709	-3112	42867
1909	-9 19.3	18952	66 08.4	46855	18702	-3070	42850
1910	-9 11.6	18942	66 08.4	46828	18699	-3027	42826
1911	-9 03.1	18929	66 08.8	46808	18694	-2978	42809
1912	-8 54.6	18916	66 09.2	46788	18688	-2930	42794
1913	-8 45.2	18898	66 10.1	46772	18678	-2876	42784
1914	-8 35.4	18874	66 11.6	46758	18662	-2819	42780
1915	-8 25.9	18841	66 13.8	46743	18637	-2763	42778
1916	-8 16.3	18812	66 15.8	46737	18617	-2706	42783
1917	-8 07.1	18787	66 17.8	46734	18599	-2653	42791
1918	-7 58.1	18763	66 19.4	46724	18582	-2601	42792
1919	-7 48.6	18739	66 21.1	46715	18565	-2546	42792
1920	-7 38.5	18721	66 22.3	46708	18554	-2489	42792
1921	-7 27.8	18704	66 23.4	46700	18546	-2430	42791
1922	-7 16.7	18690	66 24.6	46701	18539	-2368	42798
1923	-7 05.9	18679	66 25.3	46697	18536	-2308	42799
1924	-6 54.1	18665	66 26.7	46706	18530	-2243	42815
1925	-6 42.0	18646	66 28.5	46714	18518	-2175	42831
1926	-6 29.6	18615	66 31.4	46729	18496	-2105	42861
1927	-6 18.2	18602	66 32.9	46742	18490	-2042	42880
1928	-6 06.9	18580	66 34.6	46740	18475	-1980	42888
1929	-5 56.4	18556	66 37.3	46766	18456	-1920	42927
1930	-5 45.9	18532	66 40.1	46791	18438	-1861	42965
1931	-5 36.2	18526	66 41.5	46820	18437	-1809	42999
1932	-5 25.7	18511	66 43.5	46848	18428	-1751	43035
1933	-5 16.1	18499	66 45.7	46884	18421	-1698	43080
1934	-5 05.2	18491	66 46.9	46905	18418	-1639	43106

Annual Mean Values Potsdam – Seddin – Niemegk (continuation)

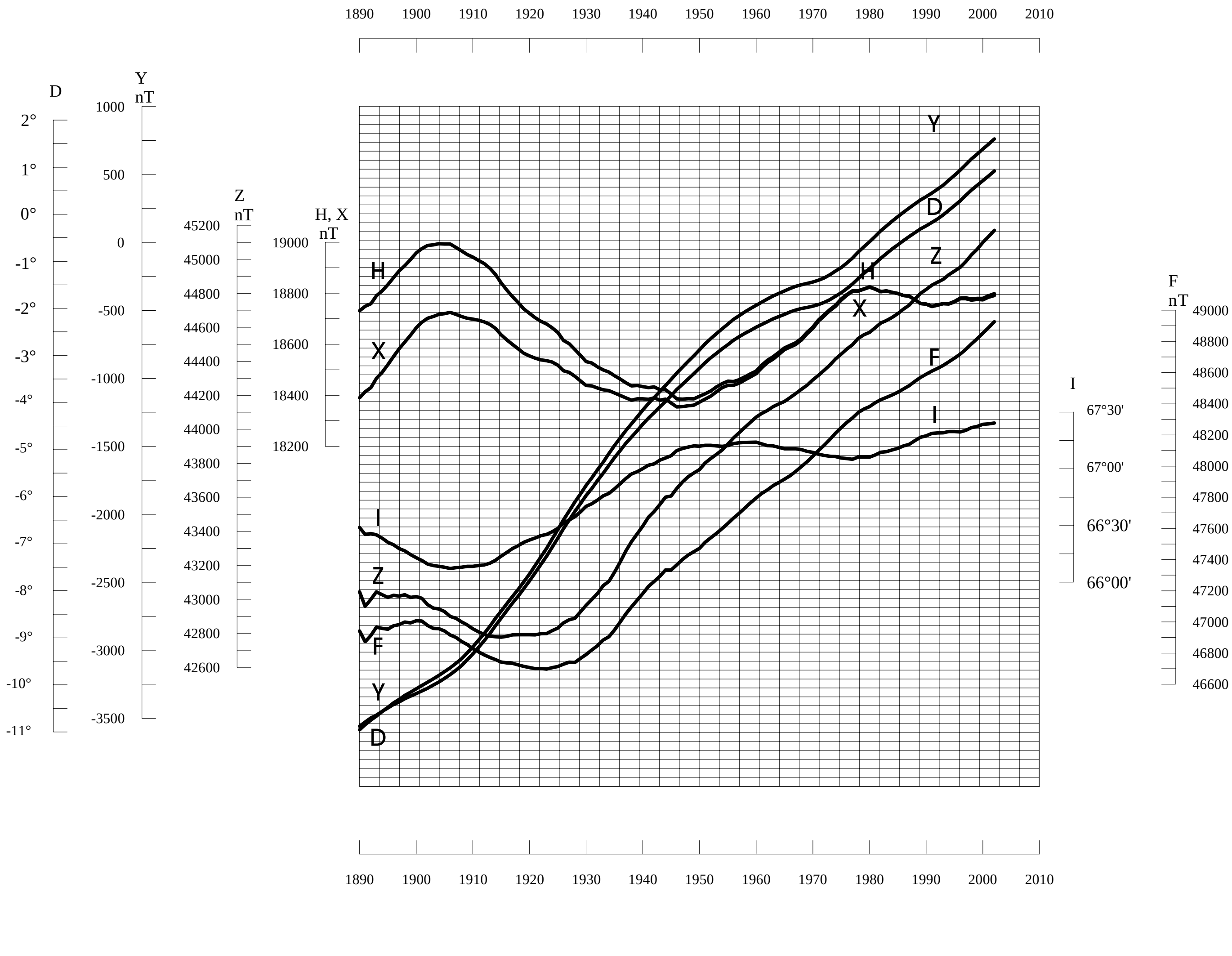
Year	D	H	I	F	X	Y	Z
1935	-4° 54.9’	18477 nT	66°49.4’	46948 nT	18409 nT	-1583 nT	43159 nT
1936	-4 45.3	18464	66 52.1	46999	18400	-1531	43220
1937	-4 35.8	18449	66 54.8	47051	18390	-1478	43284
1938	-4 27.1	18437	66 57.3	47098	18381	-1431	43339
1939	-4 18.3	18438	66 58.5	47141	18386	-1384	43386
1940	-4 09.6	18434	67 00.1	47182	18386	-1337	43431
1941	-4 01.4	18430	67 01.9	47228	18384	-1293	43484
1942	-3 53.8	18433	67 02.6	47259	18390	-1252	43516
1943	-3 46.0	18421	67 04.6	47293	18381	-1210	43558
1944	-3 38.4	18422	67 05.7	47333	18385	-1169	43601
1945	-3 30.7	18405	67 07.0	47333	18370	-1127	43608
1946	-3 22.5	18386	67 09.6	47366	18354	-1082	43652
1947	-3 15.1	18385	67 10.7	47401	18356	-1043	43690
1948	-3 07.6	18387	67 11.5	47430	18359	-1003	43721
1949	-3 00.4	18386	67 12.1	47451	18361	-965	43744
1950	-2 53.1	18396	67 12.0	47472	18373	-926	43763
1951	-2 45.3	18406	67 12.4	47511	18385	-885	43801
1952	-2 38.4	18417	67 12.5	47541	18397	-848	43829
1953	-2 32.2	18433	67 12.1	47568	18414	-816	43852
1954	-2 25.9	18446	67 11.9	47599	18430	-782	43879
1955	-2 20.0	18455	67 12.3	47633	18439	-751	43913
1956	-2 14.1	18454	67 13.4	47666	18439	-720	43949
1957	-2 09.1	18461	67 13.8	47697	18448	-693	43980
1958	-2 04.6	18472	67 13.9	47730	18460	-669	44011
1959	-2 00.2	18484	67 14.0	47764	18472	-646	44042
1960	-1 55.9	18495	67 14.1	47796	18485	-623	44072
1961	-1 52.0	18518	67 13.2	47824	18508	-603	44094
1962	-1 48.2	18537	67 12.3	47847	18528	-583	44110
1963	-1 44.1	18551	67 12.1	47874	18542	-562	44134
1964	-1 40.8	18568	67 11.4	47895	18560	-544	44150
1965	-1 37.8	18586	67 10.6	47916	18579	-529	44164
1966	-1 34.7	18596	67 10.6	47939	18589	-512	44186
1967	-1 31.8	18606	67 10.6	47966	18599	-497	44211
1968	-1 29.8	18623	67 10.2	47997	18617	-486	44236
1969	-1 28.2	18647	67 09.3	48028	18641	-478	44260
1970	-1 26.3	18668	67 08.7	48064	18662	-468	44291
1971	-1 24.1	18695	67 07.7	48099	18690	-457	44317
1972	-1 21.2	18716	67 07.1	48134	18711	-442	44347
1973	-1 17.2	18736	67 06.6	48171	18732	-421	44378
1974	-1 12.5	18753	67 06.5	48211	18749	-396	44414
1975	-1 07.9	18777	67 05.7	48246	18773	-371	44442
1976	-1 02.1	18795	67 05.4	48280	18792	-340	44472
1977	-0 56.0	18810	67 05.1	48309	18807	-306	44497
1978	-0 48.5	18810	67 06.1	48343	18808	-266	44534
1979	-0 41.6	18817	67 06.2	48366	18816	-228	44556
1980	-0 35.0	18825	67 06.2	48382	18824	-192	44570

Annual Mean Values Potsdam – Seddin – Niemegk (continuation)

Year	D	H	I	F	X	Y	Z
1981	-0° 28.1’	18817 nT	67° 07.4’	48406 nT	18816 nT	-154 nT	44598 nT
1982	-0 21.2	18807	67 08.8	48426	18806	-116	44625
1983	-0 15.0	18809	67 09.1	48440	18809	-82	44639
1984	-0 08.8	18804	67 10.0	48456	18804	-48	44659
1985	-0 03.1	18799	67 10.8	48474	18799	-17	44680
1986	0 02.6	18791	67 12.1	48495	18791	14	44707
1987	0 07.7	18789	67 12.9	48516	18789	42	44730
1988	0 13.0	18775	67 14.8	48543	18775	71	44765
1989	0 18.2	18760	67 16.7	48569	18760	99	44800
1990	0 22.4	18758	67 17.5	48589	18757	122	44822
1991	0 27.2	18748	67 18.8	48610	18748	148	44848
1992	0 31.6	18754	67 18.9	48627	18753	172	44865
1993	0 37.1	18760	67 19.0	48645	18759	203	44882
1994	0 43.4	18759	67 19.7	48669	18757	237	44909
1995	0 49.6	18768	67 19.8	48693	18766	271	44931
1996	0 56.1	18781	67 19.5	48719	18779	307	44953
1997	1 03.2	18782	67 20.4	48749	18779	346	44986
1998	1 10.5	18777	67 21.8	48784	18773	385	45026
1999	1 16.6	18780	67 22.4	48816	18775	419	45059
2000	1 23.1	18780	67 23.5	48853	18775	454	45099
2001	1 29.2	18790	67 23.8	48888	18784	488	45133
2002	1 35.8	18798	67 24.3	48926	18791	524	45170

Niemegk Observatory

Secular Variation of the Geomagnetic Elements

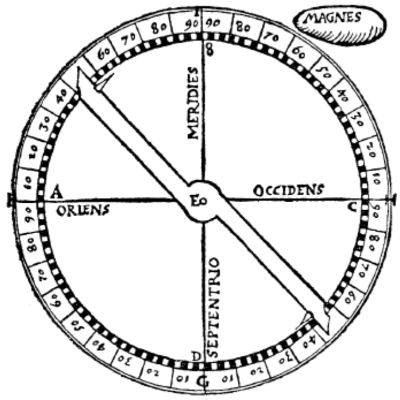


GeoForschungsZentrum Potsdam

Geomagnetic Results Wingst

2002

Yearbook No. 48



Potsdam 2007

Map showing the location of Wingst Observatory

The Wingst is one of a number of hills of glacial origin formed by a terminal moraine in the North German Lowland

In the north-east: the Oste, a tributary of the river Elbe

In the south: Lake Balksee, which formed at the same time as the large high-moor bogs in the area when land was deposited by the North Sea's tidal currents several millennia ago

Cover: Compass after Pierre de Maricourt, 1269 (SCHÜCK,1911)

Geomagnetic Results Wingst 2002 – Yearbook No 48

Günter Schulz

Contents

1 Introduction

This report (yearbook No 48) contains the results of Erdmagnetisches Observatorium Wingst (WNG) for 2002[1]).

The enclosed CDrom contains recorded minute values as well as derived (hourly, daily, monthly) mean values and indices. It also provides recalculated epoch values from 1939.5 on and those of Marineobservatorium Wilhelmshaven (WLH) before then. Revised sets of monthly and daily mean values (since 1943) and K values (since 1944) are also included.

In the year under review, Wingst Observatory additionally published on a monthly basis:

a) Reports on geomagnetic indices and special geomagnetic events
b) Reports on preliminary daily and monthly means

Geomagnetic data have been provided on a regular basis to the following institutions:

a) International Space Environment Service (ISES): Geomagnetic indices and geomagnetic events (daily)

b) International Service of Geomagnetic Indices (ISGI): Geomagnetic indices and special geomagnetic events (monthly and annually)

c) World Data Centers for Geomagnetism: geomagnetic indices and one-minute values (annually)

d) INTERMAGNET (Global near-real-time magnetic observatory network): One-minute values (reported data via METEOSAT and Email, hourly; adjusted data via Email, on weekdays); Geomagnetic indices and one-minute values (CDrom, annually)

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[1] Reports up to 1999 were published by Bundesamt für Seeschiffahrt und Hydrographie. The last one (SCHULZ, 2004) contains a complete digital set of all data that have been published since the establishment of Wingst Observatory in 1938.

Indices and information about special events were made available through a telephone service on weekdays.

Phone: +49 4778 812152

The preliminary variations and indices can be found on the Internet on a real time basis (10 min updates) in graphical form:

http://www.gfz-potsdam.de/pb2/pb23/Wingst/Magnetogram/wingst_e.html

Definitive (compressed) data from 1939 onwards (minute values since 1981) can be found at:

ftp://ftp.bsh.de/outgoing/wng

The following list shows some additional selected links providing Wingst data:

Intermagnet (variations):
http://www.intermagnet.bgs.ac.uk/cgi-bin/imagform

RWC Brussels (indices):
http://sidc.oma.be/products/wng

WDC Kyoto (pulsations):
http://swdcwww.kugi.kyoto-u.ac.jp/caplot/index.html

WDC Copenhagen (variations):
http://dmiweb.dmi.dk/fsweb/projects/wdcc1

Address:

Erdmagnetisches Observatorium
Am Olymp 13
D-21789 Wingst

Phone: +49 4778 81210
Fax: +49 4778 812150

Collaborators: W.D. Grube and A. Glodek.

2 General Remarks

Wingst Geomagnetic Observatory was established in 1938 as a successor to Wilhelmshaven. Since then, the station has been operated without interruption. The observatory's development is described by VOPPEL, 1988, and SCHULZ, 2001 (see also yearbook No 46, 2000, appendix 3). The development of the modern recording devices is given by SCHULZ, 1998. For the instrumentation since 1938, see also instr.txt on the Cdrom.

The observatory is located in the Lower Elbe area on top of a terminal moraine of the Saale glacial period (elevation 50 m). Its co-ordinates are:

	Latitude	Longitude
Geographic	53° 44.6'N	09° 04.4'E
Geomagnetic	54.2°	95.3°

Geomagnetic co-ordinates refer to International Geomagnetic Reference Field 'IGRF 10th' (TAKEDA et al., 2005)

The following abbreviations are used throughout this report:

X North component
Y East component
Z Vertical component (downward positive)
H Horizontal intensity
D Declination (eastward positive)
I Inclination (downward positive)
F Total intensity
U North-west component
V North-east component

Times are related to UTC (Co-ordinated Universal Time).

2.1 Recording systems

The results of this edition were derived from the following recording and software systems:

a) Digital system for variations:

Suspended fluxgate magnetometer (FM) of type FGE(DMI) (*U*, *V*, *Z*): One-minute and hourly means as well as indices of activity
Proton precession magnetometer (PPM) of type V75(VARIAN) (*F*): One minute spot values for quality check only

b) Visualisation software varplot.exe (BEBLO AND FELLER, 2002) for variations (*D, H, Z, F* and $c=F-(H^2+Z^2)^{1/2}$): Geomagnetic events (ssc, sfe, bay)

2.2 Levels, standards and constants

The results of this edition refer to the International Magnetic Standard (IMS). The results of the yearbooks up to and including 1980 referred to the Observatory Standard (OBS), which was represented by the classic type base line instruments bound to their original locations and surroundings.

H, *Z*, and *F* are referred to the proton vector magnetometer (PVM) of type ASKANIA/V4931(VARIAN) on pier NW (section 3.2), *D* to the fluxgate theodolite (DI-flux) of type 010B(ZEISS)/MAG01H(BARTINGTON) on pier NE (section 3.1) of the absolute house. Both instruments are assumed to represent IMS.

The following equations apply to *D* (see yearbook No 37, 1991), *H* and *Z* (see yearbook No 38, 1992):

$D_{OBS} = D_{IMS}$
$H_{OBS} = H_{IMS} + 6.7$ nT
$Z_{OBS} = Z_{IMS} + 11.1$ nT.

The differences for the derived elements depend on the components, i.e. for 2002:

$F_{OBS} = F_{IMS} + 12.8$ nT
$I_{OBS} = I_{IMS} - 0.15'$
$X_{OBS} = X_{IMS} + 6.7$ nT
$Y_{OBS} = Y_{IMS}$

The following physical standards are available at Wingst. They guarantee the quality of data:

SCHWILLE (frequency, DCF77, 10^{-8})
PATEK PHILIPPE and HOPF (UTC, DCF77)
CROPICO VS10 (Voltage, $5 \cdot 10^{-6}$)
GUILDLINE 100 Ohm (resistance, $5 \cdot 10^{-6}$)
Helmholtz coil of high precision (magnetic field strength, 10^{-4})

For the determination of the magnetic induction, the IAGA-recommended gyromagnetic constant (RASMUSSEN, 1991) was used:

$2\pi\tau^{-1} = 23.487203$ nT s

The azimuth marks were last checked by the German Geodetic Survey in 1995. Their values, related to the NE pier (R: 3504926.873, H: 5956702.028), and their deviations in the year under review are:

Azimuth mark	Azimuth	Deviation against
N	11°38.36’	N
NE	13° 23.19’	(-0.16 ±0.02)’
W	308° 42.94’	(-0.08 ±0.04’)

2.3 Special measurements

In the year under review, one comparative measurement was carried out at Wingst using Niemegk (NGK) instruments. The station difference is as follows:

At	WNG minus	D	I	F
WNG	NGK	+0.12’	-0.04’	+2.7 nT

A PPM of type G856 (GEOMETRICS) was installed near to the pulsation hut. The device was connected to the data acquisition system via telemetry. Together with the V75 at the absolute house and the FGE125 *F* recording at the variation house, it forms a triple which makes it possible to detect external sources of disturbances by monitoring their mutual *F* differences.

3 Absolute measurements

The absolute measurements were reduced according to the variations of the digital system (section 4).

3.1 Declination and Inclination

Absolute measurements of *D* were made with the *DI*-flux on an approximately monthly basis. Also the determination of *I* was included in the measurement routine. Each measurement is based on a set of four positions. *I* was corrected by the pier difference of -0.2’ in the sense of NW minus NE. The differences $E=I$-arctg(Z/H) are shown in Table 1.

Additionally, relative measurements of *D* were carried out with the PVM according to the addition field method (Serson) on a weekly basis. The mean difference in the sense of PVM minus DI-flux of all pairs of measurements carried out on the same day was used as an instrument constant. Its value e is as follows:

e = -23.99’ (12 measurements).

3.2 Horizontal intensity, vertical component and total intensity

Absolute measurements of *H* and *Z* were carried out with the PVM according to the compensation field method (Nelson) after each relative determination of *D.*

The magnetic induction vector is over-determined due to the measurement of three elements within the meridian plane. The difference $c=F-(H^2+Z^2)^{1/2}$ represents the measurements' inherent accuracy. The annual mean of the error *C* amounted to:

+0.1 nT ± 0.5 nT value (54 measurements).

C is shown in Table 1.

As a rule, the PPM of type V75 was used. This instrument shows a long-term drift of some 0.1 nT depending on the components (SCHULZ AND CARSTENS, 1979).). Therefore, comparative measurements using the PPM of type V4931, which represents IMS (see section 2.2), were carried out on a monthly basis. All base line values as well as the recorded minute spot values of *F* (section 4) are referred to this instrument.

4 Digital recording system

Minute mean values of the orthogonal components *U*, *V*, and *Z* as well as spot values of *F* were acquired by the primary digital system (V75 and FGE (No 125), section 2.1). The PPM is not only part of the recording system but also serves as an indicator of the PVM (section 3).

Owing to over-determination, outliers, jumps and short-term base line instabilities between the dates of absolute measurements of all three components could be detected (section 4.1) and, under certain conditions, automatically eliminated. The following equation applies to Wingst:

$dF = 0.26\, dU + 0.26\, dV + 0.93\, dZ.$

Additionally, a forth fluxgate was operated, which had been aligned in such a way that its W orientation satisfies the following equation:

$dW = 0.578(dU + dV + dZ).$

In this way, jumps and outliers of the secondary system could be monitored independently.

A second suspended FM of type FGE (No 126), an FM of type EDA FM100B and a PPM of type PPM105(EDA) were operated as stand-by devices in case of failure of the primary system.

4.1 Base line values

Table 1 shows the base line values of the FGE125 referred to IMS. Fig 1 shows the results in graphical form. Absolute measurements of *D* and *I* (DI-flux) are marked by circles, those of *H* and *Z* (PVM) as well as relative measurements of *D* by dots. *I* (derived from *H* and *Z*) is also displayed (dots).

To obtain base line values, the dependence of the measured elements *D*, *H, I* and *F* on the recorded components *U*, *V*, and *Z* within the range of variations was developed up to terms of second order (see yearbook No 46, 2000, appendix 3). Minute mean values of the magnetometer and the baseline instruments were processed, which had been synchronized within ±5 s.

For 2002, the base line values of the primary components refer to the following equivalent voltages *E* of the fluxgate compensation fields:

Component	*E* in mV (nominal)
U	12861
V	12613
Z	45463

4.2 Scale values, temperature coefficients and cross talk

Scale values and cross talk were traced back to the respective parameters of the old FM100C(EDA) system by employing stochastic methods, making use of strong variations during a substorm on April 7, 1995 (SCHULZ, 1998). The following values apply to the primary components (FGE125):

	Scale Values in nT/mV 1.000+	Cross Talk against FM100C in 10^{-3}	
U	$+10^{-3}(1.4 \pm 0.6)$	*V*: +0.2±1.0	*Z*: +0.9±0.6
V	$-10^{-3}(1.5 \pm 0.8)$	*U*: -0.7±0.6	*Z*: -0.5±0.4
Z	$+10^{-3}(0.8 \pm 0.6)$	*U*: -0.6±0.4	*V*: -1.2±0.8

Considering the respective values of the FM100C (see yearbook No 41, 1995), the absolute misalignments and errors of the scale values of the FGE125 fluxgates probably do not exceed the order of magnitude of 10^{-3}.

Temperature coefficients were neglected because the FGE double system had been installed in the old variometer room (SCHULZ 2001) with almost perfect temperature control (contact thermometers, ±0.03°C).

5 Data processing

The base line values (Tables 1) were smoothed by Bathspline approximation in steps of 0.01‘ for *D* or 0.1 nT for *H* and *Z*, respectively (SCHOTT, 1992).

Hourly mean values were formed using 60 minute mean values of *U*, *V*, and *Z* (taken at minutes 00 to 59 UTC and centred at second 30) as well as 60 F spot values (taken at second 05).

The international quiet (*Q*) and disturbed (*D*) days were taken from the Niemegk listings of ISGI. *A* denotes normal days. In the case of averaging, *A* means that all days of the month or the year, respectively, have been included.

The data were processed by a computer double system of type HP9000 330/360. Each workstation is connected to a data acquisition unit of type HP3852 and to the Internet. All necessary calculations including those for the yearbook were carried out by the workstation of type HP9000 360.

6 Indices

The indices presented in this edition (File wng02.k and Table 4) indicate the local disturbances of the geomagnetic field resulting from particle radiation. Their meaning in detail:

K: geomagnetic three-hourly index, quasi-logarithmic measure of the maximum disturbance in steps of 0 to 9; lower limit for *K* = 9: 500 nT

sum: Sum of the eight three-hourly indices of a day

Ak: Mean value of the equivalent amplitudes derived from the eight three-hourly indices, measured in units of 2 nT.

Ck: daily character figure derived from *Ak* and scaled from 0.0 to 2.5.

C: estimated daily character figure; scale: 0, 1, 2

The indices were derived using the IAGA-recommended FMI-routine (Häkkinen, 1992).

7 Files on the CDrom

\wingst	*Wingst root directory, containing the following subdirectories and files*
tree_02.txt:	File structure
yearb02\\:	
yearb02\instr.txt:	Instruments used since 1938
yearb02\abs_meas.pdf:	Reprint of SCHULZ, 2002
data02\\:	*Directory containing the following data*
data02\wlh+wng.yr:	Updated epoch values WLH and WNG (*D* and *I* in 0.1'; *F*, *H*, *X*, *Y*, and *Z* in nT)
data02\wng.mon:	Updated monthly mean values WNG (since 1943; *D* and *I* in 0.1'; *F*, *H*, *X*, *Y*, and *Z* in nT)
data02\wng.day:	Updated daily mean values WNG (since 1943; *D* and *I* in 0.1'; *F*, *H*, *X*, *Y*, and *Z* in nT)
data02\wng.k:	Updated activity figures *K*, *Ak*, *Ck*, and *C* as well as monthly and annual mean values of *Ak*, *Ck,* and *C* (since 1944)
data02\iaga02\\:	*Directory containing the following data in the IAGA2000 format (TAKEDA et al.,2005).See also:* http://www.ngdc.noaa.gov/IAGA/vdat/iagaformat.html
data02\iaga02\YR.WNG:	Epoch values WNG 1939 – 1979: D and I in 0.1'; *X, Y, Z, H* and *F* in nT; from 1980 onward: 0.01' or 0.1 nT, respectively
data02\iaga02\2002MT.WNG:	Monthly means (*D* and *I* in 0.01'; *X, Y, Z, H* and *F* in 0.1 nT)
data02\iaga02\2002DY.WNG:	Daily means (*D* and *I* in 0.01'; *X, Y, Z, H* and *F* in 0.1 nT)
data02\iaga02\2002mmHR.WNG:	Hourly means (*F, X, Y* and *Z* in 0.1 nT) of the month mm
data02\iaga02\2002mmMN.WNG:	Minute means (*F, X, Y* and *Z* in 0.1 nT) of the month mm

8 References

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Appendix 1 and 2: Figures and Tables

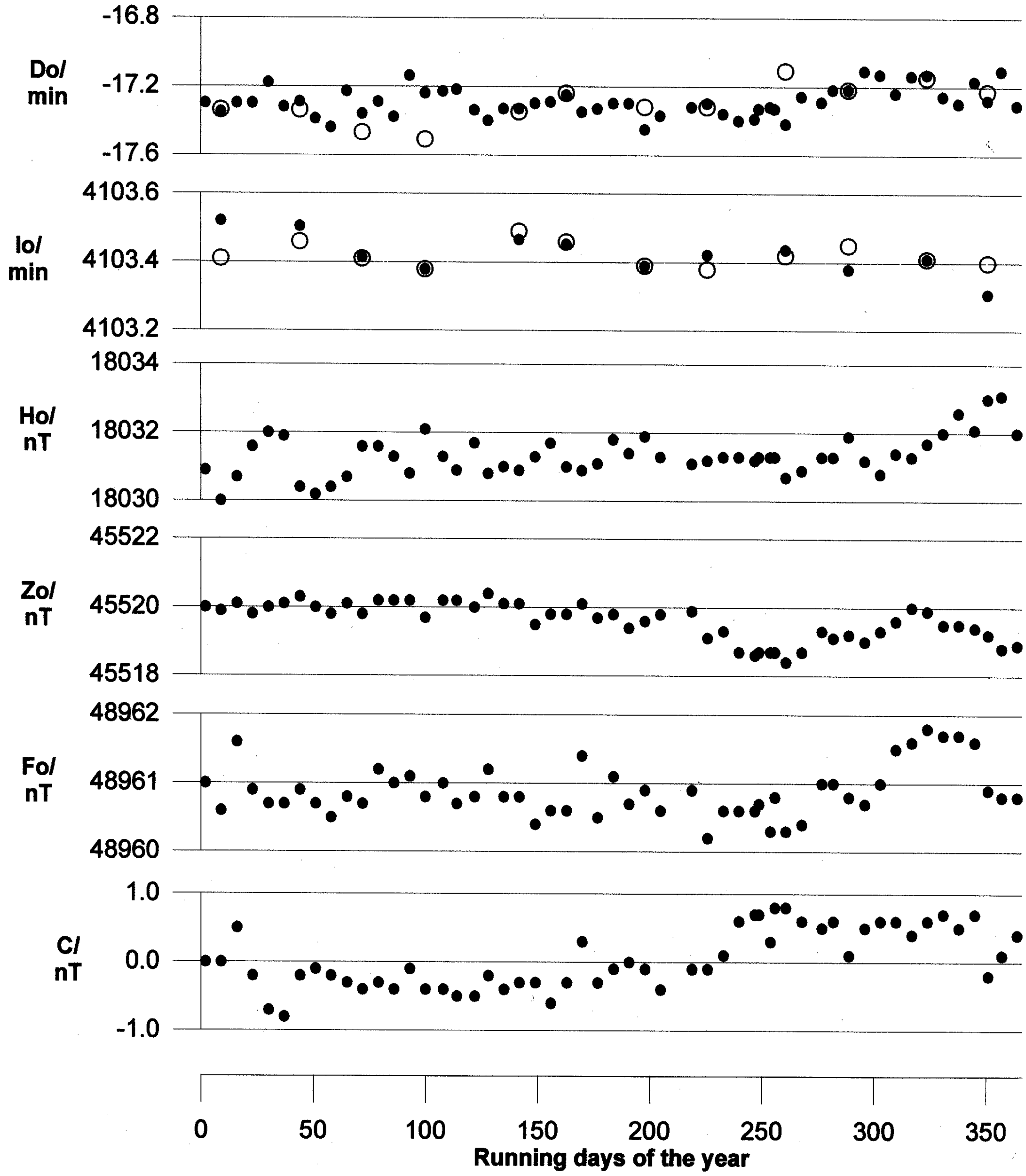


Fig. 1

Wingst 2002 Base line values of the fluxgate system FGE125, IMS

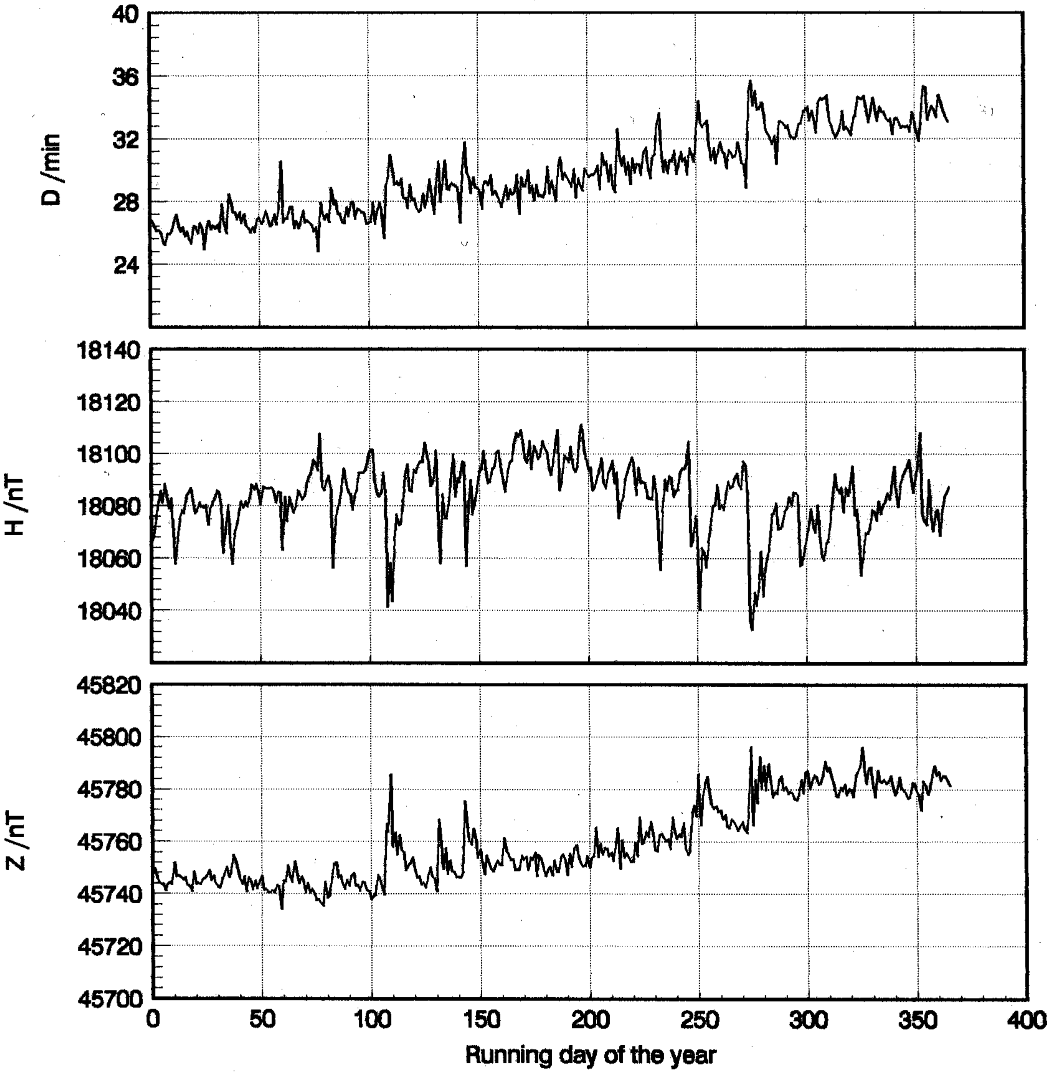


Fig. 2

Wingst 2002 Daily mean values D, H and Z

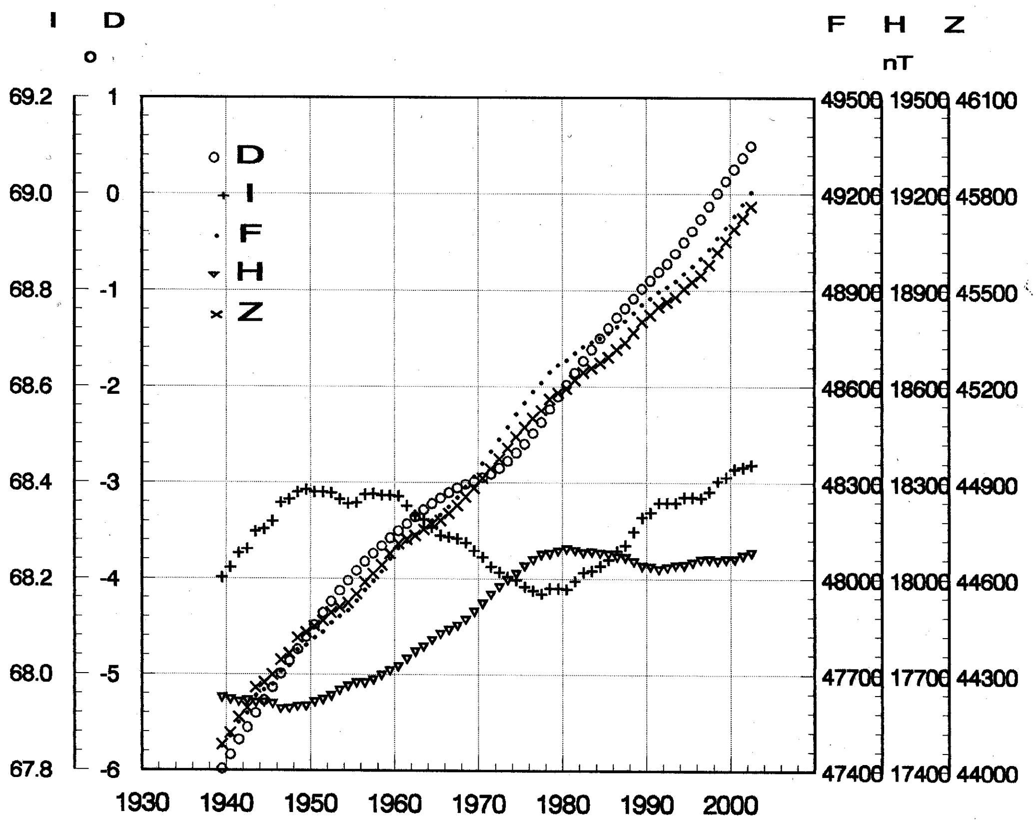


Fig. 3

Wingst Epoch values I, D, F, H and Z

```
wingst\
        tree_02.txt

        yearb02\

                instr.txt
                abs_meas.pdf

        data02\
                wlh+wng.yr
                wng.mon
                wng.day
                wng.k

                iaga02\
                        YR.WNG
                        2002MT.WNG
                        2002DY.WNG
                        200201MN.WNG
                        .
                        200212MN.WNG
                        200201HR.WNG
                        .
                        200212HR.WNG
```

Fig. 4

Structure of the file set on CDrom

Wingst 2002

Base-line measurements, system FGE125, IMS

Month	day	Do(abs)	Do(rel)	Io	Fo nT	Ho nT	Zo nT	C	E
Jan.	2		-0°17.30'		48961.0	18030.9	45520.0	+0.0	
	9	-0°17.34'	-0 17.35	+68°23.41'	48960.6	18030.0	45519.9	+0.0	-0.11'
	16		-0 17.30		48961.6	18030.7	45520.1	+0.5	
	23		-0 17.30		48960.9	18031.6	45519.8	-0.2	
	30		-0 17.18		48960.7	18032.0	45520.0	-0.7	
Feb.	6		-0 17.32		48960.7	18031.9	45520.1	-0.8	
	13	-0 17.34	-0 17.29	+68 23.46	48960.9	18030.4	45520.3	-0.2	-0.04
	20		-0 17.39		48960.7	18030.2	45520.0	-0.1	
	27		-0 17.44		48960.5	18030.4	45519.8	-0.2	
March	6		-0 17.23		48960.8	18030.7	45520.1	-0.3	
	13	-0 17.47	-0 17.36	+68 23.41	48960.7	18031.6	45519.8	-0.4	+0.00
	20		-0 17.29		48961.2	18031.6	45520.2	-0.3	
	27		-0 17.38		48961.0	18031.3	45520.2	-0.4	
April	3		-0 17.14		48961.1	18030.8	45520.2	-0.1	
	10	-0 17.51	-0 17.24	+68 23.38	48960.8	18032.1	45519.7	-0.4	+0.00
	18		-0 17.23		48961.0	18031.3	45520.2	-0.4	
	24		-0 17.22		48960.7	18030.9	45520.2	-0.5	
May	2		-0 17.34		48960.8	18031.7	45520.0	-0.5	
	8		-0 17.40		48961.2	18030.8	45520.4	-0.2	
	15		-0 17.33		48960.8	18031.0	45520.1	-0.4	
	22	-0 17.35	-0 17.33	+68 23.49	48960.8	18030.9	45520.1	-0.3	+0.03
	29		-0 17.30		48960.4	18031.3	45519.5	-0.3	
June	5		-0 17.29		48960.6	18031.7	45519.8	-0.6	
	12	-0 17.24	-0 17.25	+68 23.46	48960.6	18031.0	45519.8	-0.3	+0.01
	19		-0 17.35		48961.4	18030.9	45520.1	+0.3	
	26		-0 17.33		48960.5	18031.1	45519.7	-0.3	
July	3		-0 17.30		48961.1	18031.8	45519.8	-0.1	
	10		-0 17.30		48960.7	18031.4	45519.4	+0.0	
	17	-0 17.32	-0 17.45	+68 23.39	48960.9	18031.9	45519.6	-0.1	+0.00
	24		-0 17.37		48960.6	18031.3	45519.8	-0.4	
Aug.	7		-0 17.32		48960.9	18031.1	45519.9	-0.1	
	14	-0 17.32	-0 17.30	+68 23.38	48960.2	18031.2	45519.1	-0.1	-0.04
	21		-0 17.36		48960.6	18031.3	45519.3	+0.1	
	28		-0 17.40		48960.6	18031.3	45518.7	+0.6	
Sep.	4		-0 17.39		48960.6	18031.2	45518.6	+0.7	
	6		-0 17.33		48960.7	18031.3	45518.7	+0.7	
	11		-0 17.32		48960.3	18031.3	45518.7	+0.3	
	13		-0 17.33		48960.8	18031.3	45518.7	+0.8	
	18	-0 17.11	-0 17.42	+68 23.42	48960.3	18030.7	45518.4	+0.8	-0.01
	25		-0 17.26		48960.4	18030.9	45518.7	+0.6	
Oct.	4		-0 17.29		48961.0	18031.3	45519.3	+0.5	
	9		-0 17.22		48961.0	18031.3	45519.1	+0.6	
	16	-0 17.22	-0 17.22	+68 23.45	48960.8	18031.9	45519.2	+0.1	+0.08
	23		-0 17.11		48960.7	18031.2	45519.0	+0.5	
	30		-0 17.13		48961.0	18030.8	45519.3	+0.6	
Nov.	6		-0 17.24		48961.5	18031.4	45519.6	+0.6	
	13		-0 17.14		48961.6	18031.3	45520.0	+0.4	
	20	-0 17.15	-0 17.13	+68 23.41	48961.8	18031.7	45519.9	+0.6	+0.00
	27		-0 17.26		48961.7	18032.0	45519.5	+0.7	
Dec.	4		-0 17.30		48961.7	18032.6	45519.5	+0.5	
	11		-0 17.17		48961.6	18032.1	45519.4	+0.7	
	17	-0 17.23	-0 17.28	+68 23.40	48960.9	18033.0	45519.2	-0.2	+0.10
	23		-0 17.11		48960.8	18033.1	45518.8	+0.1	
	30		-0 17.31		48960.8	18032.0	45518.9	+0.4	

Table 1 Wingst 2002 base line values of the fluxgate system FGE125

Wingst (WNG)
Geographic Coordinates: 53.743° N 9.073° E

2002

Monthly mean values, IMS

D: disturbed, Q: quiet, A: all days

Month		D	F nT	H nT	I	X nT	Y nT	Z nT
Jan	A	26.1'	49188	18079	68°26.1'	18078	137	45745
Feb	A	26.9	49188	18080	68 26.1	18079	141	45745
Mar	A	27.1	49189	18085	68 25.7	18084	142	45744
Apr	A	28.0	49194	18083	68 26.0	18082	147	45750
May	A	28.8	49198	18088	68 25.7	18087	152	45752
Jun	A	28.7	49202	18099	68 25.0	18098	151	45752
Jul	A	29.6	49202	18096	68 25.3	18095	156	45754
Aug	A	30.6	49205	18087	68 26.0	18086	161	45760
Sep	A	31.3	49211	18080	68 26.7	18079	165	45770
Oct	A	33.1	49218	18067	68 27.9	18066	174	45782
Nov	A	33.5	49223	18076	68 27.3	18075	176	45784
Dec	A	33.4	49224	18085	68 26.7	18084	176	45782
Mean	A	29.8	49204	18084	68 26.2	18083	157	45761
Jan	Q	25.9	49188	18084	68 25.8	18084	136	45743
Feb	Q	26.4	49189	18083	68 25.9	18083	139	45745
Mar	Q	26.7	49189	18090	68 25.3	18090	140	45742
Apr	Q	27.8	49193	18092	68 25.4	18091	147	45746
May	Q	29.4	49199	18085	68 25.9	18085	155	45753
Jun	Q	28.3	49201	18101	68 24.8	18100	149	45751
Jul	Q	28.8	49201	18099	68 24.9	18098	152	45751
Aug	Q	30.3	49203	18091	68 25.6	18090	160	45756
Sep	Q	31.9	49211	18063	68 28.0	18062	168	45776
Oct	Q	32.0	49219	18081	68 26.8	18080	168	45777
Nov	Q	32.5	49223	18087	68 26.5	18086	171	45780
Dec	Q	32.6	49224	18098	68 25.7	18097	171	45776
Mean	Q	29.4	49204	18088	68 25.9	18087	155	45759
Jan	D	26.3	49188	18070	68 26.7	18070	139	45748
Feb	D	27.8	49186	18068	68 26.9	18067	146	45747
Mar	D	27.7	49187	18080	68 26.1	18079	146	45744
Apr	D	28.9	49202	18060	68 28.0	18059	152	45767
May	D	28.8	49206	18086	68 26.1	18086	152	45761
Jun	D	28.6	49201	18095	68 25.3	18094	151	45753
Jul	D	29.6	49202	18091	68 25.6	18090	156	45755
Aug	D	31.7	49200	18076	68 26.7	18075	167	45760
Sep	D	30.8	49211	18090	68 25.9	18089	162	45766
Oct	D	34.6	49209	18043	68 29.4	18042	181	45782
Nov	D	34.5	49222	18063	68 28.3	18062	181	45788
Dec	D	34.2	49222	18073	68 27.5	18072	180	45785
Mean	D	30.4	49204	18075	68 26.9	18074	160	45764

Table 2   Monthly and annual mean values 2002

Wingst (WNG) annual mean values (IMS)

Geographic Coordinates: 53.743°N 9.073°E

Epoch	D	F nT	H nT	I	X nT	Y nT	Z nT
1939.5	-5°59.1'	47476	17630	68°12.1'	17534	-1838	44081
1940.5	-5 50.2	47506	17624	68 13.4	17533	-1792	44116
1941.5	-5 40.8	47550	17617	68 15.2	17530	-1744	44166
1942.5	-5 33.1	47579	17622	68 15.7	17540	-1705	44196
1943.5	-5 24.2	47634	17614	68 18.0	17535	-1659	44259
1944.5	-5 16.2	47652	17616	68 18.3	17541	-1618	44276
1945.5	-5 8.2	47671	17611	68 19.2	17540	-1577	44299
1946.5	-4 59.6	47708	17595	68 21.5	17528	-1532	44346
1947.5	-4 51.7	47726	17596	68 22.0	17532	-1491	44365
1948.5	-4 44.4	47775	17602	68 22.9	17541	-1454	44415
1949.5	-4 36.6	47791	17604	68 23.2	17547	-1415	44431
1950.5	-4 29.1	47814	17617	68 22.9	17562	-1378	44451
1951.5	-4 21.5	47832	17624	68 22.8	17573	-1339	44468
1952.5	-4 14.5	47861	17636	68 22.7	17587	-1304	44494
1953.5	-4 7.6	47882	17653	68 22.0	17607	-1270	44510
1954.5	-4 1.3	47899	17666	68 21.5	17623	-1239	44523
1955.5	-3 55.1	47930	17676	68 21.6	17634	-1208	44552
1956.5	-3 49.3	47964	17676	68 22.6	17636	-1178	44589
1957.5	-3 44.2	47993	17686	68 22.6	17648	-1152	44616
1958.5	-3 39.5	48023	17700	68 22.4	17663	-1129	44643
1959.5	-3 34.6	48062	17714	68 22.4	17679	-1105	44679
1960.5	-3 30.1	48095	17727	68 22.4	17693	-1082	44710
1961.5	-3 25.7	48117	17751	68 21.1	17719	-1061	44723
1962.5	-3 21.3	48136	17773	68 20.0	17742	-1040	44735
1963.5	-3 16.9	48160	17789	68 19.4	17760	-1018	44755
1964.5	-3 13.1	48183	17810	68 18.4	17782	-1000	44771
1965.5	-3 9.6	48201	17829	68 17.5	17802	-983	44783
1966.5	-3 6.3	48226	17842	68 17.3	17815	-966	44805
1967.5	-3 3.4	48254	17855	68 17.1	17829	-952	44830
1968.5	-3 1.0	48286	17874	68 16.5	17849	-941	44857
1969.5	-2 59.2	48320	17899	68 15.5	17874	-932	44883
1970.5	-2 56.9	48359	17924	68 14.7	17900	-922	44915
1971.5	-2 54.5	48397	17953	68 13.6	17930	-911	44944
1972.5	-2 51.0	48434	17977	68 12.9	17954	-894	44975
1973.5	-2 46.6	48473	17999	68 12.2	17978	-872	45008
1974.5	-2 41.4	48513	18018	68 11.9	17998	-846	45043
1975.5	-2 36.0	48549	18043	68 11.0	18024	-818	45073
1976.5	-2 29.3	48583	18062	68 10.5	18045	-784	45101
1977.5	-2 22.4	48612	18078	68 10.1	18062	-748	45126
1978.5	-2 14.1	48646	18081	68 10.9	18066	-705	45161
1979.5	-2 6.3	48668	18089	68 10.9	18076	-664	45181
1980.5	-1 59.0	48682	18096	68 10.7	18085	-626	45194
1981.5	-1 51.4	48704	18091	68 11.7	18082	-586	45220
1982.5	-1 43.9	48724	18084	68 12.8	18076	-546	45244
1983.5	-1 36.9	48738	18087	68 13.0	18080	-510	45257
1984.5	-1 29.9	48752	18083	68 13.7	18077	-473	45274
1985.5	-1 23.5	48768	18080	68 14.4	18075	-439	45292
1986.5	-1 17.0	48787	18071	68 15.5	18067	-404	45316
1987.5	-1 11.1	48804	18069	68 16.2	18065	-374	45336
1988.5	-1 5.0	48829	18056	68 17.9	18053	-341	45368
1989.5	-59.0	48856	18042	68 19.7	18039	-309	45402
1990.5	-53.9	48875	18041	68 20.3	18038	-283	45423
1991.5	-48.5	48895	18032	68 21.5	18031	-255	45448
1992.5	-43.4	48911	18038	68 21.5	18037	-228	45463
1993.5	-37.1	48928	18044	68 21.6	18043	-195	45479
1994.5	-30.0	48952	18045	68 22.2	18044	-158	45505
1995.5	-23.0	48975	18053	68 22.2	18053	-121	45526
1996.5	-15.6	48998	18062	68 22.1	18062	-82	45547
1997.5	-7.6	49028	18063	68 22.9	18063	-40	45579
1998.5	0.5	49062	18059	68 24.2	18059	3	45618
1999.5	8.0	49094	18063	68 24.7	18063	42	45651
2000.5	15.4	49132	18064	68 25.7	18064	81	45690
2001.5	22.5	49167	18075	68 25.9	18074	118	45724
2002.5	29.8	49204	18084	68 26.2	18083	157	45761

Table 3 Wingst Epoch values from 1939 to 2002

Wingst (WNG)
Geographic Coordinates: 53.743°N 9.073°E

2002

Absolute and relative Frequencies of the Three-hourly Index K

K	UTC 0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24
0	18	17	8	3	5	5	8	14
1	52	71	98	62	52	69	51	54
2	110	128	135	145	136	104	107	91
3	108	99	83	120	106	97	101	115
4	54	28	35	25	51	56	62	53
5	16	19	6	9	12	25	20	28
6	6	3	0	0	2	4	13	8
7	0	0	0	1	1	4	3	2
8	1	0	0	0	0	1	0	0
9	0	0	0	0	0	0	0	0

Absolute Number of Days during the Year for a given K

K	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
0	22	9	19	6	1	4	1	0	11	0	0	5	78
1	62	45	66	51	55	44	32	29	51	8	20	46	509
2	96	82	72	70	98	97	81	89	89	54	54	74	956
3	45	64	59	65	56	80	86	75	55	90	86	68	829
4	19	18	24	27	26	13	39	36	18	51	53	40	364
5	4	5	8	12	7	2	9	18	11	29	18	12	135
6	0	1	0	7	2	0	0	1	3	13	6	3	36
7	0	0	0	2	3	0	0	0	1	2	3	0	11
8	0	0	0	0	0	0	0	0	1	1	0	0	2
9	0	0	0	0	0	0	0	0	0	0	0	0	0

Absolute Number of Three-hour-intervals for a given K

Table 4 Statistics of indices 2002

GeoForschungsZentrum Potsdam

Yearbook
Geomagnetic Results Niemegk

Adolf Schmidt Geomagnetic Observatory

Niemegk

2003

Hans-Joachim Linthe

Potsdam 2007

Contents

RESULTS OF THE OBSERVATIONS AT THE ADOLF-SCHMIDT-OBSERVATORIUM FÜR GEOMAGNETISMUS AT NIEMEGK IN THE YEAR 2003

H.-J. Linthe

1. Summary/Introduction

This part of the bulletin reports the observations carried out during the year 2003 at the Niemegk Geomagnetic Adolf Schmidt Observatory.

Instrumentation, Observation and Data

During 2003 the recordings and measurements at the Niemegk observatory have been continued without interruption.
Absolute measurements were taken at least once per week using the DI-flux theodolite and an Overhauser effect proton magnetometer. Due to the renovation of the absolute house (starting in September) the measurements were carried out from June to September in parallel in the absolute house and in the small hut (building No. 9). After starting the renovation the absolute measurements took place at the small hut only. The two classical variometers remained in operation. The three component flux-gate variometers FGE, GEOMAG and MAGSON and the total field variometer GSM recorded continuously throughout the year. In 2003 the sensor locations were not modified. All recording equipments remained unchanged and were operated continuously as in 2002.
The Niemegk observatory has continued to participate in the INTERMAGNET project. The recordings of the GEOMAG variometer were sent hourly by METEOSAT as Reported Data. A daily e-mail transmission of Reported Data of the variometers FGE and GSM was started additionally. The Definitive Data (minute and hourly mean values) have been submitted for the INTERMAGNET CD-ROM and sent to the World Data Centres.
The daily automatic transmission of Niemegk K numbers by e-mail was started.
The Kp calculation was continued as in 2002. Twice a month, immediately after receiving the K numbers of the 13 Kp observatories, the Kp and derived indices are calculated and distributed by e-mail. The tables and diagrams are produced monthly and sent to the users. The whole Kp data series are also available online at:

http://www.gfz-potsdam.de/pb2/pb23/GeoMag/niemegk/kp_index/index.html.

A new repeat station measurement campaign was started. The measurements at about half of the stations were finished in time for the magnetic map of Germany for the period 2004.5.
The first data logger for remote operation was installed 13-17 October at Wingst observatory by H.-J. Linthe and J. Haseloff.

Personnel

M. Lenners retired on 31 December 2003.

Meetings and Visitors

M. Mandea and M. Korte initiated the workshop on European Magnetic Repeat Station, which took place 20-21 February 2003 at the observatory. The 48 participants from 20 European countries agreed in a continuous cooperation of all countries to improve the data quality.
H.-J. Linthe and E. Pulz participated in the INTERMAGNET Operations Committee meeting, which was held 22-24 April 2003 in Dourbes, Belgium. H.-J. Linthe became a new member of the committee. E. Pulz presented the a new absolute measurement instrument for simplified absolute measurements without a theodolite [11], [12].
M. Korte and H.-J. Linthe attended the IUGG scientific assembly, which was held 30 June - 11 July 2003 in Sapporo, Japan. H.-J. Linthe became chair of the IAGA working Group V-OBS.
E. Pulz participated in the observatory meeting in November 2003 at Black Forrest Observatory in Schiltach.
The training “Absolute determination of the geomagnetic field vector” was carried out by a student group, coming from the Geophysical Institute of Berlin University of Technology on 17 February, 2003.
P. Sutcliffe from Hermanus Magnetic Observatory (South Africa) visited the observatory on 6 March 2003.
The GFZ trainees visited the observatory on 17 April 2003.

On 5 May 2003 the measurement team of the Amt für das GeoInfowesen der Bundeswehr calibrated their declinometers at the observatory. A teacher with 9 pupils from the Theodor Heuss Gymnasium Schopfheim (Baden-Württemberg) visited the observatory on 27 May 2003 in the frame of a special course.
Three groups of private persons got guided tours at the observatory.

Constructional Changes
The small hut (building No. 9) was completely renovated. In September 2003 the complete renovation of the absolute house (building No. 7) was started and not finished before the end of the year.

Data Availability
In addition to this yearbook NGK information is available online. The observatory's homepage is
http://www.gfz-potsdam.de/pb2/pb23/Niemegk/dt/index.html (German version)
http://www.gfz-potsdam.de/pb2/pb23/Niemegk/en/index.html (English version)

The preliminary variations and K indices in graphical form can be found at
http://www.gfz-potsdam.de/pb2/pb23/GeoMag/niemegk/Magnetogram/niemegk_dhz.html
http://www.gfz-potsdam.de/pb2/pb23/GeoMag/niemegk/Magnetogram/niemegk_k.html

A digital archive of minute mean data can be accessed at
http://www.gfz-potsdam.de/pb2/pb23/GeoMag/niemegk/DB/index.html

Rapid access information is published in the Monthly Reports, also available at:
http://www.gfz-potsdam.de/pb2/pb23/GeoMag/niemegk/monrep

Both publications, this report and the monthly report, can be requested from the GFZ; see the address in the impressum.

Acknowledgements
The following persons participated in the production of this yearbook: I. Goldschmidt for absolute measurements and tables, M. Fredow for absolute measurements and plots, J. Schulz for tables and typing of the manuscript and J. Haseloff for diagrams.

Content of the CD
As in the 2002 issue the complete results of the observatory are given in digital form on a CD-ROM. Wingst observatory data are included. The structure and the data formats of the CD-ROM are organised in the same manner as for INTERMAGNET [3]. Because this report will be published together with the 2001 and 2002 issues, the data files of these years are included on the CD-ROM. The CD contains this report as "yearb03.pdf", the 2001 one as "yearb01.pdf", the 2002 one as "yearb02.pdf" and the following directories:

- INTERMAGNET
- Niemegk
- Wingst

The substructure of the directories is as follows:

INTERMAGNET

```
INTERMAGNET
│
├──── gmag.cfg                         Configuration file for imag23.exe
├──── imag23.exe                       Browsing program
├──── instimag.exe                     Installation program
├──── readme.txt                       ASCII file containing contents information
├──── mag1995 ... mag2003
│       ├──── ctry_inf
│       │       ├──── ctrylist.idx     Country list file for imag23.exe
│       │       └──── intro.pcx        Welcome graphic file for imag23.exe
│       ├──── SSS                      Data subdirectories NGK, WNG
│       │       ├──── SSSYYjan.bin     January minute mean values binary file
│       │       ├──── SSSYYfeb.bin     February minute mean values binary file
│       │       │     ...
│       │       ├──── SSSYYdec.bin     December minute mean values binary file
│       │       ├──── SSSYY.blv        ASCII base line file
│       │       ├──── SSSYYk.dka       ASCII K number file
│       │       ├──── readme.SSS       ASCII information file
│       │       └──── yearmean.SSS     ASCII annual mean values file
│       ├──── obsy_inf
│       │       └──── YYobsdat.dbf     Configuration file for imag23.exe
├──── plotutil
│       ├──── hpgl                     HP-GL plotting programs :
│       │       ├──── imagblv.exe      Base lines
│       │       ├──── imagdayl.exe     Daily mean values
│       │       ├──── imaghour.exe     Hourly mean values
│       │       ├──── imagknum.exe     K numbers
│       │       └──── imagn.exe        Daily magnetograms
│       └──── ps                       PostScript plotting programs:
│               ├──── gs601w32.exe     Ghostscript
│               ├──── gsv34w32.exe     Ghostview
│               ├──── imagplot.exe     Plotting program for Windows
│               ├──── readme.txt       Information about PS plotting
│               └──── salflibc.dll     Windows system file
├──── xtras
        ├──── prnstruc.exe             Display of the binary file format
        └──── structur.dat             Data file for prnstruc.exe
```

with: YY = Year (95-99, 00-03); SSS = NGK, WNG

```
Niemegk
└── dataYY                          YYYY data files in IAGA2002 format
    ├── ngkYYYYMMdhor.hor           Hourly mean values
    ├── ngkYYYYdday.day             daily mean values
    ├── ngkYYYYdmon.mon             monthly mean values
    └── ngkYYYYdyea.yea             annual mean values
```

with: MM = month (00…12)

```
Wingst
├── tree_YY.txt                     File structure of directory Wingst
├── yearb
│   ├── instr.txt                   Instruments used since 1938
│   └── abs_meas.pdf                Reprint of SCHULZ, 2003
└── dataYY                          YYYY data files
    ├── wlh+wng.yr                  Updated epoch values WLH and WNG
    ├── wng.mon                     Updated monthly mean values WNG
    ├── wng.day                     Updated daily mean values WNG
    ├── wng.k                       Updated WNG K numbers
    └── iagaYY                      YYYY data files in IAGA2000 format
        ├── yr.wng                  Epoch values WNG
        ├── YYYYmt.wng              Monthly mean values
        ├── YYYYdy.wng              Daily mean values
        ├── YYYYMMhr.wng            Hourly mean values
        └── YYYYMMmn.wng            Minute mean values
```

with: MM = month (01…12); YYYY = Year (2001-2003); YY = Last 2 numbers of the year (01-03)

2. Variation Recording

In 2003 the following recording equipment were in operation (Table 1):

- 3 three component flux-gate variometers with digital recording (FGE, GEOMAG, MAGSON)
- 1 scalar Overhauser effect proton magnetometer with digital recording (GSM)
- 1 three component induction coil magnetometer with analogue and digital recording (ICM)
- 2 classical variometer systems with photographic recording (CS, CW)
- 2 telluric recording lines (1000m) with digital recording (TR)

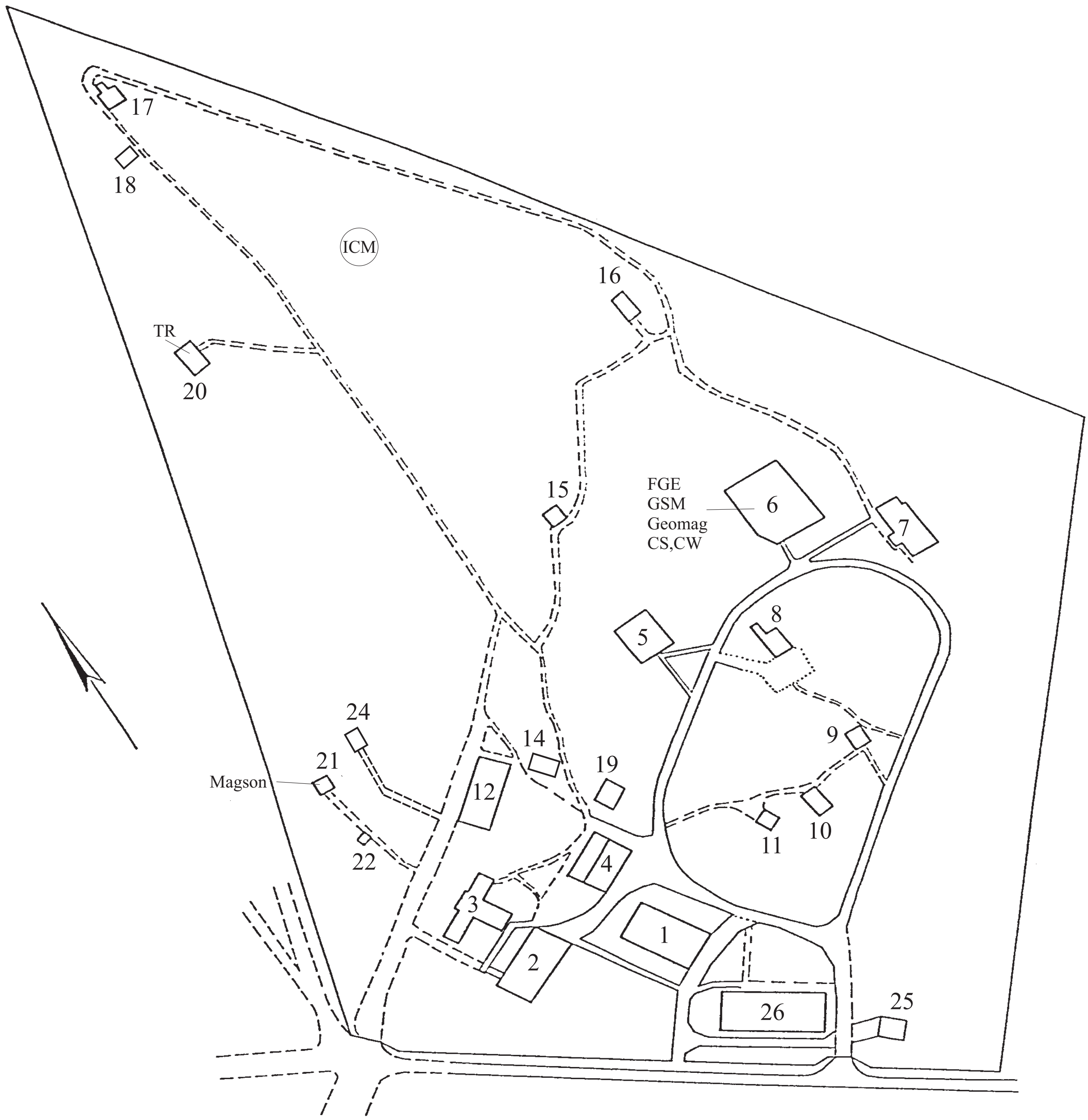
Name	**Elements**	**Recording**	**Sampling rate**	**Resolution**
FGE	H, D, Z	digital	2 Hz	0.1 nT
GEOMAG	X, Y, Z, F	digital	5 s / 1 min	0.1 nT
MAGSON	X, Y, Z	digital	1 s	0.1 nT
GSM	F	digital	5 s	0.01 nT
ICM	X, Y, Z	analogue/digital	1 s	0.01 nT
CS	X, Y, Z	analogue	20 mm/h	2 nT/mm
CW	H, D, Z	analogue	20 mm/h	2 nT/mm
TR	N-S, E-W	digital	1 s	0.1 mV

Table 1: Parameters of the variometer systems

Fig. 1 shows a sketch of the premises of the observatory, including the locations of the recording systems. Fig. 2 shows the ground plan of the variation house (building No. 6) showing the locations of the variometers. Fig. 3 shows the block diagram of the recording systems and the data paths. Table 2 contains the conversion factors of the single geomagnetic elements for the year 2003, according to [1] p.5 fig. 5;2.

In the horizontal plane					**In the plane of the magnetic meridian**				
	ΔX/nT	ΔY/nT	ΔH/nT	ΔD/’		ΔH/nT	ΔZ/nT	ΔF/nT	ΔI/’
ΔX/nT	- - -	- 33.2858 -0.03004	0.9995 - 1.0005	-0.16421 -182.096 -	ΔH/nT	- - -	- 0.4157 -2.4053	0.3839 - 2.6049	-13.1528 -15.4262 -
ΔY/nT	- 0.03004 -33.2858	- - -	0.03003 - 33.3008	5.4657 5.4707 -	ΔZ/nT	- 2.4053 -0.4157	- - -	0.9234 - 1.0830	5.4682 37.1049 -
ΔH/nT	- 1.0005 0.9995	33.3008 - 0.03003	- - -	-182.013 0.16428 -	ΔF/nT	- 2.6049 0.3839	1.0830 - 0.9234	- - -	-5.9219 34.2619 -
ΔD/’	- -6.0899 -0.00549	0.1830 - 0.1828	-0.00549 6.0872 -	- - -	ΔI/’	- -0.07603 -0.06482	0.1829 - 0.02695	-0.1689 0.02919 -	- - -
Δ D/nT = 5.4682 · Δ D/’					Δ I/nT = 14.2442 · Δ I/’				

Table 2: Conversion factors for the geomagnetic elements in 2003



1. Main building
2. Electric laboratory
3. Measurement and computer centre
4. Storehouse
5. Magnetic laboratory
6. Variation house
7. Absolute house
8. Heating house
9. Small hut
10. Adjusting hut
11. Thermal adjusting hut
12. Garage

14. Equipments shed
15. Proton magnetometer hut
16. Control hut
17. Coil hut No. 1
18. Control hut
19. Storage hut
20. Telluric hut
21. Coil hut No. 2
22. Small control hut

24. Coil hut No. 3
25. Power unit house
26. Workshop building

Fig. 1: Sketch of the premises of the observatory

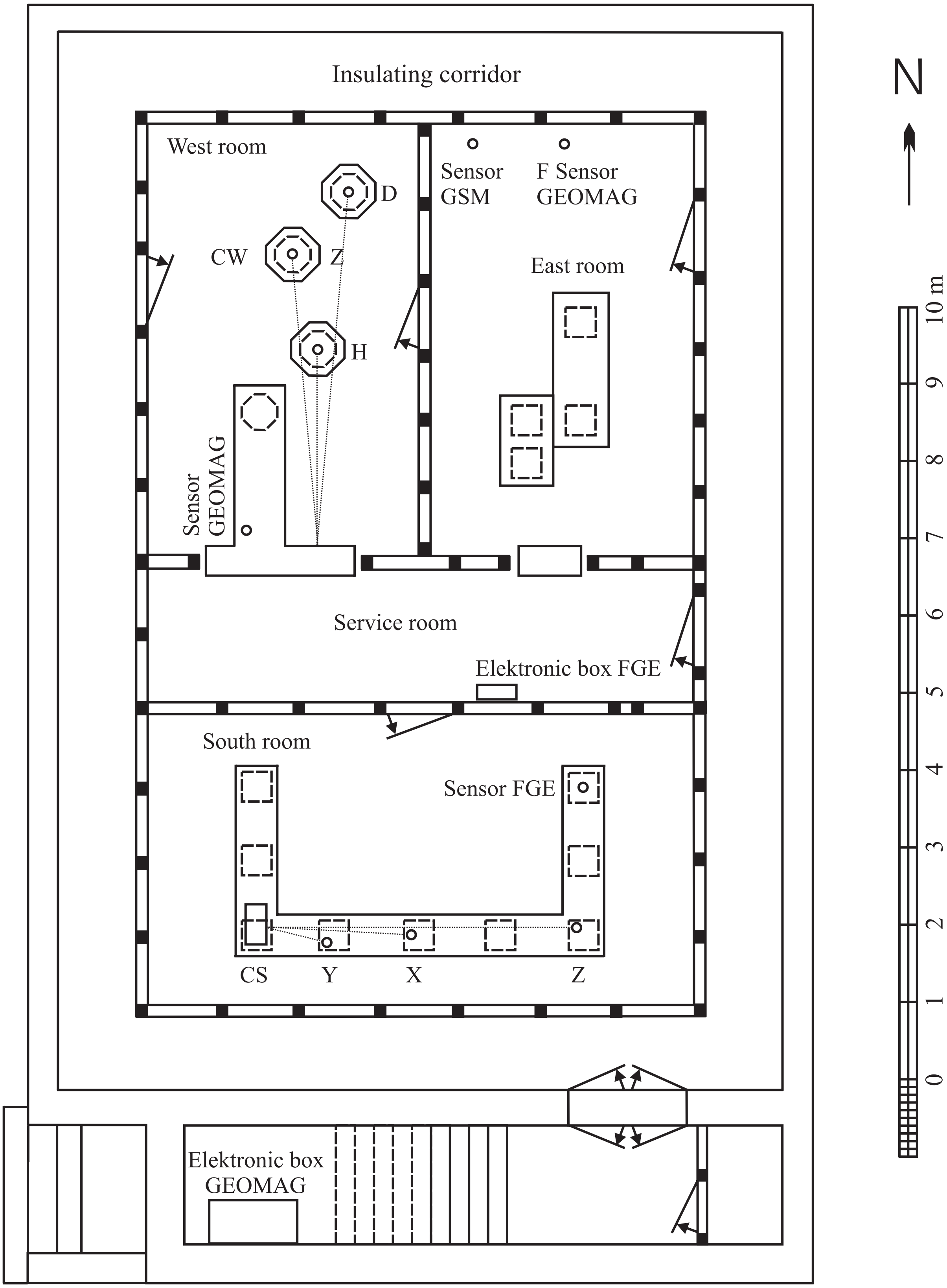


Fig. 2: Ground plan of the variation house with the locations of the variometers

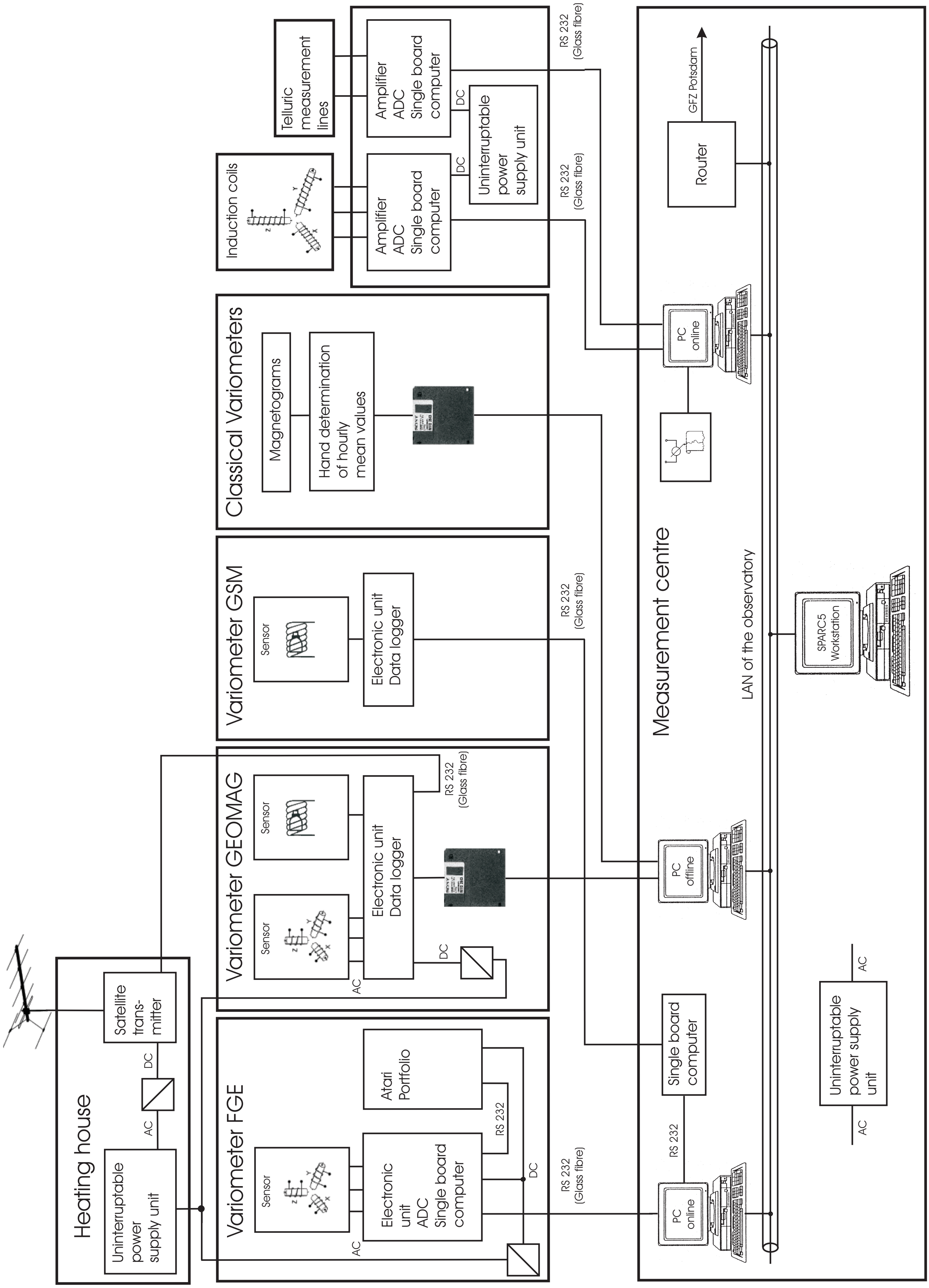


Fig. 3: Block diagram of the recording systems and data paths

2.1 Three component flux-gate variometers

2.1.1 FGE

The FGE variometer is the main vector magnetometer of the observatory. It is a three component linear core flux-gate magnetometer with Cardan's suspension, manufactured by the Danish Meteorological Institute at Copenhagen [2]. The three magnetic elements H, D and Z and the room temperature are measured.
The scale factor of the instrument is 250 nT/V, the measurement range is $\pm$2500 nT for the magnetic elements. The temperature channel has a scale factor of 1000 K/V with a measurement range of $\pm$2.5 V.
The analogue to digital conversion is carried out by a 20 bit ADC (type CS5506, Crystal) with a sampling rate of 2 Hz by means of a single board computer Z80miniEMUF. The resolution, given by the manufacturer of 0.2 nT is completely satisfied by the 20 bit ADC. The time signal for the data logger is given by a DCF77 radio clock.
The variometer was in operation at the same position and in the same manner as in 2002. The 2 Hz momentary values, obtained by means of the single board computer and the ADC, are transmitted serially (RS232) by glass fibre cable to a PC at the measurement and computer centre (building No. 3). In the same way, minute mean values are transferred to the pocket PC Atari Portfolio. Fig. 5 shows the base lines of this variometer.

2.1.2 GEOMAG

This instrument includes a three component ring core flux-gate magnetometer and an Overhauser effect proton magnetometer. The French manufacturer GEOMAG calls it as an "automatic geomagnetic observatory". It consists of the 2 sensors, the electronic unit (analogue electronic, data logger and power supply unit) and a telemetry.
The instrument was operating throughout 2003 under the same conditions as in 2002. According to the INTERMAGNET standard [3], minute mean values with a resolution of 0.1 nT are recorded. The data files are written on a 3.5" floppy. The mean values are transmitted by a special telemetry (located at the heating house, building No. 8) via METEOSAT to the INTERMAGNET GINs at Paris and Edinburgh.

2.1.3 MAGSON

This three component ring core flux-gate magnetometer (manufacturer: MAGSON GmbH, Berlin) was further operating at the coil hut (building No. 21 sensor) and control hut (building No. 22, electronic unit) as a preliminary place. It recorded continuously during the complete year, except for a few interruptions. The components X, Y and Z were recorded. The data logger triggers the measurement values with a sampling rate of 1 Hz and generates 1 minute mean values of a resolution of 0.1 nT which are recorded in the RAM. The storage capacity is sufficient for 15 days. The recorded data can be read by a laptop via the serial interface. Up to now the recorded time series have only been used for occasional comparison. In 2003 the base lines were not determined.

2.2 Overhauser Effect Proton Magnetometer GSM

The geomagnetic total intensity was recorded using the GSM Overhauser effect proton magnetometer (manufactured by GEM Systems, Canada), unchanged from 2002. Every 5 seconds a measurement value of resolution 0.01 nT is generated and transmitted by glass fibre cable to the same PC as records the 2 Hz momentary values of the FGE variometer. Table 3 contains the differences between the momentary values of the GSM 19 and the observatory F momentary values, calculated for the times of the absolute measurements.

2.3 Induction Coil Magnetometer ICM

Three induction coils with highly permeable cores record the temporal gradients of the geomagnetic variations for the North, East and vertical components. For thermal stability, the sensors are buried east of the telluric hut (building No. 20). The electronic amplifiers are located in building No. 20, while a paper recorder and a PC are in the measurement and computer centre (building No. 3).
The analogue recording was carried out continuously during the whole year by means of the Laumann paper recorder in the measurement and computer centre (building No. 3). The signal is transmitted via glass fibre cable. No changes have to be reported for the whole system in 2003.
The digital recording of the temporal gradients of the geomagnetic variations was carried out as in 2002. The signal of the amplifier output, to which the Laumann paper recorder is connected, is digitised by means of a 20 bit ADC (Type CS5506, Crystal). The ADC is controlled by a single board computer (Z80miniEMUF). The measurement values are triggered with a sampling rate of 1 Hz. They are transferred serially (RS232) by glass fibre cable to a PC at the measurement and computer centre (building No. 3). The time signal for the data logger is given by a DCF77 radio clock.
The measurement values are stored in binary format (2 bytes per value of the 3 components), where 1 digit corresponds to 0.1 mV. The induction coils transfer function is dependent on the signal period. In cases of modifications of the equipment the transfer function is re-determined by calibration. For this purpose calibration signals are applied to the calibration coils of the sensors. The calibration procedure yields the transfer functions of the complete apparatus. From the transfer functions, correction functions can be calculated for the 3 components, which must be taken into account if the recording material is used.
Fig. 4 shows the correction functions. The ordinate axis scale is 0.1 mV. The sinusoidal calibration signal confirmed that in the period range of 5 to 100 seconds no phase shift (0 phase characteristic) is present.
The digital recording was in operation all the year with very few interruptions.

2.4 Classical magnetic variometers with photographic recording

The observatory operates 2 classical variometers with photographic recording in the variation house (building No. 6). The single systems are named according to their location rooms: CS: South system, CW: West system. Table 1 lists the parameters of the instruments. The variometers are temperature compensated. The rooms are continuously heated by a thermostat-controlled electrical heating system supported in cold seasons by warm water central heating. The daily temperature changes are less than 0.1°C. The location of all classical variometers is unchanged since 1982.

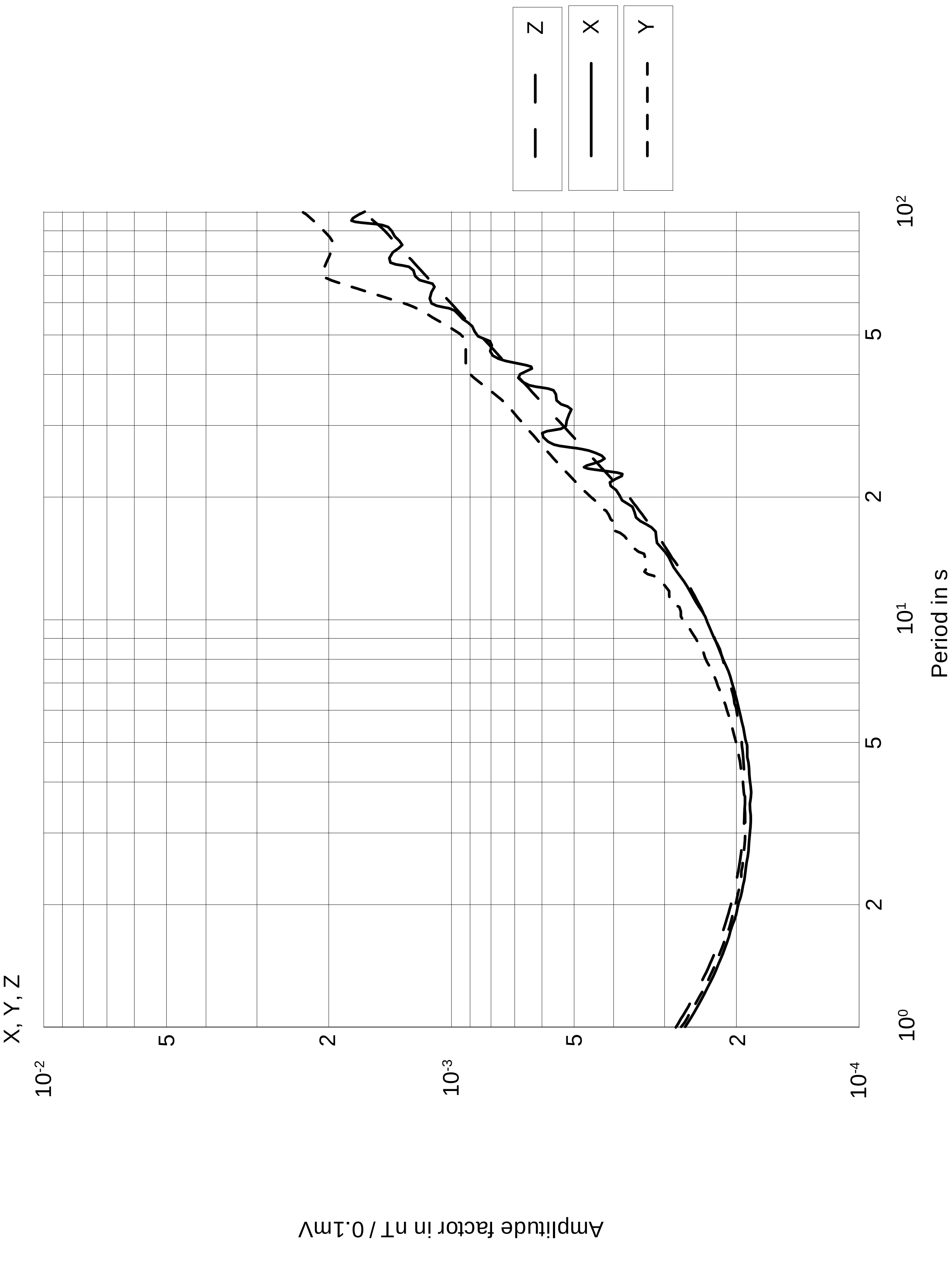


Fig. 4: Transfer functions (amplitudes) of the induction coil variometers

3. Absolute Measurements

Before starting the renovation of the absolute house (house No. 7) in September 2003, the absolute measurements were carried out as follows: One absolute measurement is made using the THEO 010B DI-flux theodolite on pillar No. 8 once per week. The corresponding total field measurement is made using a GSM19 Overhauser effect proton magnetometer located 40 cm above pillar No.14. Therefore, the THEO 010B needs not to be taken from the pillar for the F measurements. The F measurement values, obtained at pillar No. 14, are corrected by means of the corresponding offset to the level of pillar No. 8. One total field measurement per month is carried out on pillar No. 8 40 cm over the pillar (approximately the altitude of the DI-flux sensor) to check this offset.
Total field measurements are taken once per month on pillars No. 2 and 5 to record the long term drift of the pillar differences. DI-flux measurements are carried out normally once per month by means of a second instrument on pillars No. 2 and 5. The measurements on pillars No. 2 and 5 have comparing and accompanying character. The base lines are determined from the measurements taken on the pillars No. 8 (D, I, F) and No. 14 (F). The measurement values obtained on pillar No. 8 represent the observatory standard.
After finishing the renovation of the small hut (house No. 9) absolute measurements by means of the DI-flux and the Overhauser proton magnetometer GSM19 were carried out begining with 14 August 2003 on pillar N of this hut (H9N). The measurements were reduced with the FGE and GSM variometer recordings. The results were compared with the reduced measuremets taken at pillar No. 8 in the absolute house during the interval 18 August – 2 September 2003. Table 3 includes the offsets, which were obtained from these comparisons. The absolute measurements after 2 September were carried out at pillar N in the small hut only (H9N). They were transmitted to the normal absolute level (refering to pillar No 8 in the absolute house) by means of the offsets in table 3.
I. Goldschmidt was in general responsible for the measurements on pillar No. 8 and H9N, while M. Fredow was responsible for these done on the other pillars. I. Goldschmidt calculated the base values of the variometers from the absolute measurements. The adopted base lines are obtained from the measurements on pillar No. 8 for the time interval 1 January – 2 September 2003. All further adopted base line values are from the measurements taken at H9N, transformed to the normal absolute level by means of table 3. Additional base lines were calculated from the measurements on the pillars No. 2 and 5 to obtain pillar differences between the single pillars. The results are presented in table 3.

Pillar	Δ H/nT	ΔD/’	ΔZ/nT	ΔI/’	ΔF/nT
2	-0.5	+0.34	+1.9	+0.09	+1.5
5	-0.15	+0.04	-0.6	-0.02	-0.2
14					-1.2
H9N	+1.3	+1.88	-11.9	-0.42	-11.0

Table 3: Pillar differences of H, D, Z, I and F obtained on pillars No. 2, 5, 14 and H9N to those on pillar No. 8

$\Delta H = H_{Pn} - H_{P8}$, n = 2,5; equivalent for D, Z, I and F.
The further described results of the absolute measurements were reduced with the recordings of the FGE variometer by means of a PC program, which calculates the base values of the elements H, D and Z. This program calculates in addition ΔF, the difference of the total intensity, calculated from the momentary H and Z values for the times of the absolute measurements, and the synchronous recording value of the GSM variometer.

Date	$\Delta F = F_{GSM} - F_{P8}$
2003-01-17	+0.7
2003-02-18	+0.5
2003-03-21	+0.7
2003-04-24	+0.8
2003-05-21	+0.7
2003-06-18	+0.8
2003-07-17	+0.8
2003-08-13	+1.0
Date	$\Delta F = F_{GSM} - F_{H9N}$
2003-09-15	+11.8
2003-10-17	+11.7
2003-11-19	+11.7
2003-12-10	+11.7

Table 4: Differences of the total intensity between the GSM recordings in the variation house and the observatory level (absolute house, pillar No. 8, 40 cm over the pillar) and H9N, 25 cm over the pillar

Table 7 contains the results of the absolute DI-flux measurements combined with the absolute GSM 19 measurements. The adopted base lines of the FGE variometer are shown in Fig. 5. The deviations of the absolute measurement values from the adopted base lines can also be found in table 7. The total intensity measurements carried out once per month on pillar No. 8 or on H9N were compared with synchronous recording values of the GSM variometer. Table 4 shows the results.

3.1 Declination

The declination measurements were carried out, as described, by means of the THEO 010B DI-flux theodolite in the absolute house on pillars No. 8, No. 5, No. 2 and on H9N. The azimuth marks are the Niemegk church tower and water tower and a collimator at pillar No. 6 (low distance azimuth mark for the case of bad view to the far azimuth marks). Bearings can be taken of all azimuth marks from pillar No. 8, while bearings can be taken to the church tower and the water tower from pillar No. 2, and only the water tower is visible from pillar No. 5. Azimuth mark bearings to the water tower from pillar N in the small hut (H9N) can be taken. The azimuth value can be found in table 5. A low distance azimuth mark was fixed at the heating house (building No. 8; H8). The azimuth value was determined by means of difference bearings. It can be found also in table 5. Table 5 contains the azimuth values used [4].

Pillar	Church tower	Water tower	Collimator	H8
8	65°00’11”	91°10’44”	1°49’04”	
2	65°06’44”	91°19’54”		
5		91°01’48”		
H9 N		89°24’47”		0°33’02″

Table 5: Azimuth values of the azimuth marks

The annual mean differences of the azimuth mark bearings can be found in table 6.

Azimuth mark difference	Pillar 8	Pillar 2	H9 N
Water tower - church tower	26°10.62’ ±0.15’	26°13.22’ ±0.1’	
Water tower - collimator	89°21.73’ ±0.23’		
Church tower - collimator	63°11.10’ ±0.17’		
Water tower - H8			88°51’45”

Table 6: Annual mean differences of the azimuth mark bearings

Table 7 contains the measurement results for the FGE variometer and the deviations from the adopted base lines. Fig. 5 shows the FGE adopted base lines.

3.2 Inclination

Directly following to every declination measurement the inclination is measured by means of the same instrument using the magnetic meridian determined from the declination measurement. The inclination measurement results are used together with the total intensity values for the determination of the base values of the horizontal and vertical intensity.

3.3 Horizontal Intensity

The horizontal intensity base values are calculated by means of a PC program from the inclination and total intensity absolute measurements. Table 7 contains the measurement results for the FGE variometer and the deviations from the adopted base lines. Fig. 5 shows the FGE adopted base lines.

3.4 Vertical Intensity

The vertical intensity base values were calculated by means of a PC program from the inclination and total intensity absolute measurements. Table 7 contains the measurement results for the FGE variometer and the deviations from the adopted base lines. Fig. 5 shows the FGE adopted base lines.

3.5 Total Intensity

The total intensity measurements were done as described by means of the GSM19 Overhauser effect proton magnetometer following the DI-flux measurements. The GSM19 uses the gyromagnetic ratio:

$$\gamma_p = 0.267515255 \cdot 10^9 \, s^{-1} \, T^{-1} \qquad [5]$$

for the conversion of the frequency values into the magnetic total intensity values. The total intensity measurement results are used together with the inclination values for the determination of the base values of the horizontal and vertical intensity.

4. Base values

The base values of the FGE variometer (the observatory main variometer) were determined by means of suitable adoptions from the absolute measurement results (table 7). For every day an adopted base value exists of every recorded element (H, D, Z). The deviations ΔH, ΔD and ΔZ of the absolute measurements from the adopted base values are shown in table 7. A program from the INTERMAGNET CD-ROM was used to plot the adopted base lines. Fig. 5 shows the adopted base values as lines of small squares and the results of the absolute measurements as larger squares. The H, D and Z base values were transformed into X, Y and Z values.
The base values of the complete year refer to the pillar No. 8 level in the absolute house. The 3 September – 31 December 2003 base values which were obtained from the H9N measurements, were transformed by means of the offsets in table 3.

Month	Day	UT	Horizontal intensity		Declination		Vertical intensity		F
			H/nT	ΔH/nT	D	ΔD/′	Z/nT	ΔZ/nT	ΔF/nT
Jan.	2	12:34	18734.3	-0.2	0° 38.21’	0.06	44929.5	-0.0	-1.1
Jan.	8	12:25	18735.6	0.9	0° 38.39’	0.22	44929.7	0.1	-1.0
Jan.	15	09:23	18735.4	0.7	0° 38.21’	0.01	44929.1	-0.6	-0.8
Jan.	24	07:20	18735.1	0.2	0° 38.36’	0.14	44930.0	0.1	-0.2
Jan.	29	12:25	18735.5	0.5	0° 38.33’	0.09	44929.9	-0.0	-0.5
Feb.	6	07:10	18735.0	0.0	0° 38.11’	-0.14	44929.9	-0.1	-0.1
Feb.	11	12:15	18735.3	0.3	0° 38.15’	-0.10	44929.7	-0.3	-1.2
Feb.	19	09:25	18735.4	0.4	0° 38.24’	-0.01	44930.0	0.0	-0.4
Feb.	24	09:30	18735.0	-0.0	0° 38.01’	-0.24	44929.7	-0.3	-0.5
Mar.	6	12:35	18734.6	-0.4	0° 38.27’	0.02	44930.7	0.8	-0.4
Mar.	11	12:17	18734.4	-0.5	0° 38.25’	0.00	44929.9	-0.1	-0.8
Mar.	19	07:19	18734.8	0.0	0° 38.14’	-0.11	44930.2	0.2	-1.0
Mar.	25	09:27	18734.7	-0.1	0° 38.30’	0.05	44929.3	-0.7	-0.6
Apr.	4	07:59	18735.3	0.6	0° 38.21’	-0.04	44929.9	-0.0	-0.2
Apr.	9	08:00	18735.0	0.4	0° 38.15’	-0.09	44929.6	-0.2	-1.5
Apr.	15	11:05	18734.4	-0.2	0° 38.30’	0.07	44929.1	-0.4	-1.1
Apr.	23	11:25	18734.9	0.4	0° 38.04’	-0.17	44929.0	-0.2	-0.2
Apr.	29	08:04	18734.4	-0.1	0° 38.14’	-0.06	44928.6	-0.5	-1.1
May	8	06:17	18734.6	0.1	0° 38.23’	0.03	44929.2	0.2	-0.9
May	15	11:15	18734.5	0.0	0° 38.21’	0.01	44929.1	0.1	-0.5
May	21	08:08	18734.3	-0.2	0° 38.45’	0.25	44928.5	-0.3	-0.3
May	28	11:48	18735.6	1.1	0° 38.11’	-0.09	44928.1	-0.5	-0.7
June	4	06:00	18734.2	-0.2	0° 38.17’	-0.03	44928.3	-0.3	-0.9
June	11	08:10	18734.6	0.3	0° 38.19’	-0.01	44928.7	-0.2	-0.6
June	19	08:06	18734.0	-0.2	0° 38.35’	0.15	44929.4	0.2	-0.9
June	25	06:25	18733.3	-0.8	0° 38.27’	0.07	44929.7	0.3	-0.9
July	1	08:17	18733.8	-0.2	0° 38.19’	-0.01	44929.9	0.2	-0.6
July	9	11:15	18734.5	0.4	0° 38.10’	-0.10	44929.5	-0.2	-1.2
July	16	11:25	18735.3	1.1	0° 38.28’	0.08	44928.9	-0.8	-0.9
July	22	08:02	18734.4	0.1	0° 38.24’	0.04	44929.9	0.2	-0.4
July	30	08:06	18735.2	0.7	0° 38.12’	-0.08	44929.5	-0.2	-0.3
Aug.	4	08:05	18734.7	0.2	0° 38.12’	-0.08	44929.6	-0.2	-1.2
Aug.	11	06:16	18734.0	-0.4	0° 38.20’	0.00	44929.9	-0.1	-1.6
Aug.	14	06:17	18733.1	-1.2	0° 38.21’	0.01	44929.9	-0.1	-1.4

Table 7: Absolute measurement results by means of the THEO 010B DI-flux theodolite and the GSM 19 Overhauser effect proton magnetometer, reduced with the FGE variometer recordings

Month	Day	UT	Horizontal intensity		Declination		Vertical intensity		F
			H/nT	ΔH/nT	D	ΔD/′	Z/nT	ΔZ/nT	ΔF/nT
Aug.	19	12:03	18734.2	0.0	0° 38.29’	0.09	44929.9	-0.1	-0.4
Aug.	27	07:59	18734.5	0.4	0° 38.09’	-0.11	44928.7	-1.3	-1.2
Sep.	1	08:07	18733.8	-0.2	0° 38.15’	-0.05	44929.6	-0.4	-1.0
Sep.	2	06:07	18734.4	0.4	0° 38.16’	-0.04	44929.5	-0.5	-0.4
Sep.	4	08:30	18733.4	-0.6	0° 38.22’	0.02	44929.6	-0.4	-12.2
Sep.	5	08:28	18733.9	-0.1	0° 38.12’	-0.09	44929.8	-0.2	-12.2
Sep.	9	08:52	18733.3	-0.7	0° 38.06’	-0.15	44929.6	-0.4	-12.4
Sep.	11	07:01	18734.0	0.0	0° 38.30’	0.08	44930.0	-0.0	-11.1
Sep.	15	11:49	18734.0	-0.0	0° 38.13’	-0.09	44929.8	-0.2	-12.0
Sep.	22	11:31	18733.6	-0.4	0° 38.30’	0.07	44929.7	-0.3	-11.6
Sep.	29	08:28	18734.0	-0.0	0° 38.14’	-0.11	44930.1	0.1	-11.4
Sep.	29	12:22	18733.9	-0.1	0° 38.18’	-0.07	44930.0	0.0	-11.7
Oct.	6	08:32	18733.4	-0.7	0° 38.25’	-0.08	44930.2	0.1	-11.9
Oct.	10	11:20	18734.1	-0.2	0° 38.32’	-0.08	44929.9	-0.3	-11.6
Oct.	17	08:19	18734.9	0.5	0° 38.32’	-0.07	44930.7	0.3	-12.2
Oct.	20	12:55	18734.3	-0.2	0° 38.24’	-0.14	44930.4	-0.1	
Oct.	24	06:36	18734.6	0.1	0° 38.32’	-0.05	44930.5	-0.0	-12.4
Oct.	28	09:17	18733.5	-1.0	0° 38.21’	-0.15	44931.3	0.8	-11.2
Nov.	4	07:31	18734.9	0.4	0° 38.19’	-0.14	44929.8	-0.7	-11.7
Nov.	4	13:09	18734.1	-0.4	0° 38.32’	-0.01	44929.9	-0.6	-12.1
Nov.	13	07:37	18734.1	-0.4	0° 38.27’	-0.02	44930.5	-0.0	-11.4
Nov.	19	07:33	18734.6	0.1	0° 37.95’	-0.31	44930.1	-0.4	-11.0
Nov.	19	09:13	18733.6	-0.9	0° 38.12’	-0.14	44930.0	-0.6	-11.8
Nov.	19	12:20	18734.3	-0.2	0° 38.18’	-0.08	44929.6	-0.9	-11.9
Nov.	25	07:26	18733.8	-0.7	0° 38.12’	-0.11	44930.0	-0.5	-11.9
Dec.	2	09:17	18733.1	-1.4	0° 38.13’	-0.07	44930.4	-0.1	-11.1
Dec.	9	09:34	18736.0	1.4	0° 37.97’	-0.22	44929.6	-0.7	-11.2
Dec.	10	09:26	18734.2	-0.4	0° 37.97’	-0.22	44929.8	-0.5	-11.9
Dec.	15	12:34	18735.7	1.0	0° 38.13’	-0.05	44929.2	-1.1	-11.3
Dec.	19	07:28	18734.9	0.1	0° 38.15’	-0.02	44929.7	-0.5	-11.1
Dec.	22	09:20	18734.8	-0.1	0° 38.03’	-0.14	44929.2	-1.0	-11.7
Dec.	29	07:32	18733.5	-1.4	0° 38.12’	-0.03	44929.7	-0.4	-11.5
Dec.	30	09:34	18734.7	-0.3	0° 37.80’	-0.35	44929.0	-1.0	-11.8

Table 7: Absolute measurement results by means of the THEO 010B DI-flux theodolite and the GSM 19 Overhauser effect proton magnetometer, reduced with the FGE variometer recordings (continued)

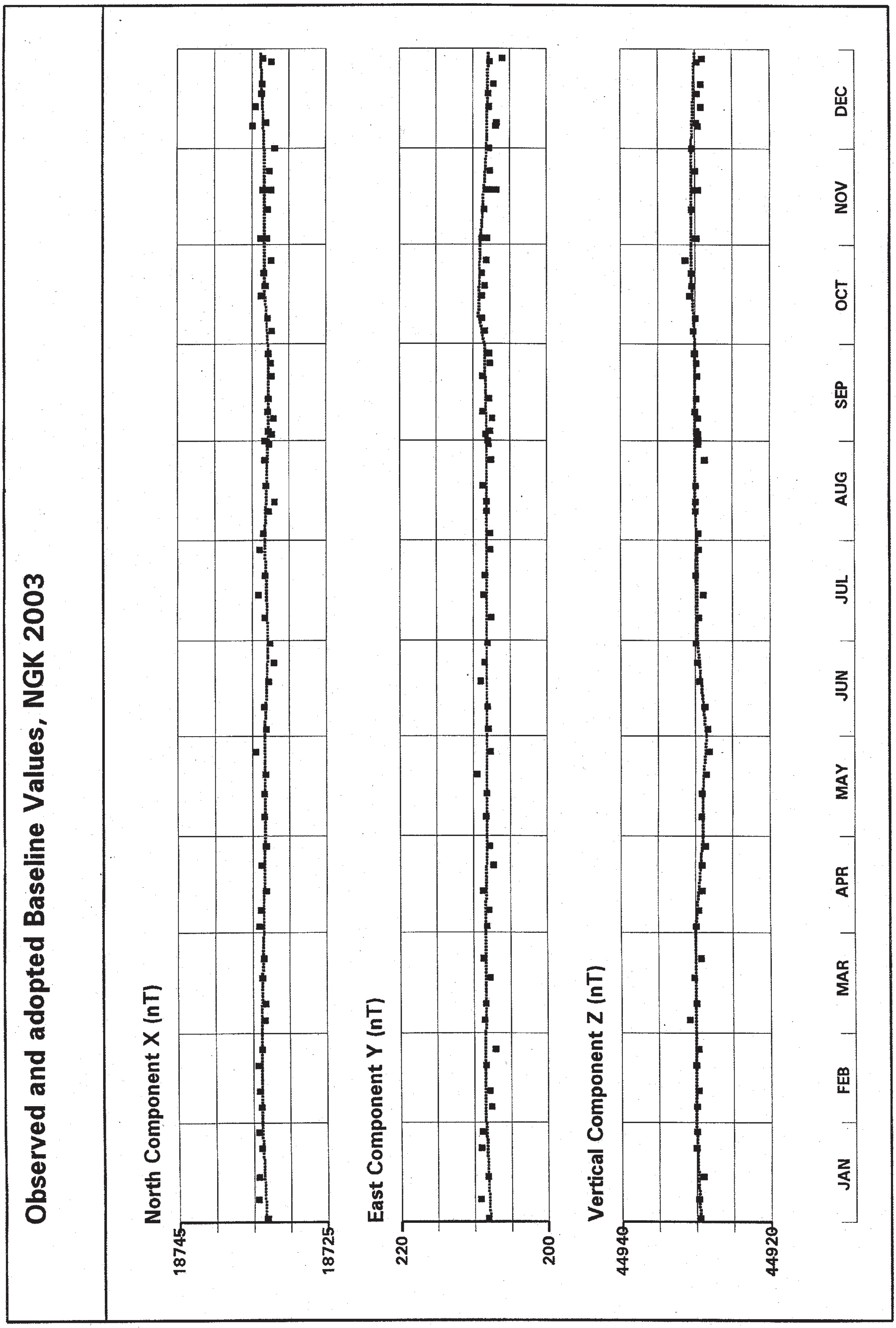


Fig. 5: FGE variometer base lines

5. Telluric Recordings

5.1 Measurement Lines

Four telluric lines in the geographic main directions exist at the observatory: one 1000 m line and one 100 m line in North-South (N-S) and East-West (E-W) direction, respectively. The electrodes of the both 100 m lines are located completely within the premises of the observatory, while the Northern electrode of the 1000 m N-S line and the Western electrode of the 1000 m E-W line are outside. Because of the BAB (Bundesautobahn) A9 motorway widening in 1995 the Western electrode of the 1000 m E-W line had to be moved 50 m eastward. This has to be taken into account with the scale values. The electrodes are connected to the recording equipments located in the telluric hut (building No. 20) by cables. Further information can be found in [6].

5.2 Electrodes

Polarisation free electrodes are in use at all measurement lines [6].

5.3 Recording equipment

Only the 1000 m lines N-S_{1000} and E-W_{950} were continuously recording throughout the year. Both the 1000 m NS and the 950 m EW lines are connected to lightning protection and anti-aliasing filtering networks (see Fig. 6). The resulting signals are digitised by means of a 20 bit ADC (Type CS5506, Crystal). The ADC is controlled by a single board computer (Z80miniEMUF). The measurement values are triggered with a sampling rate of 1 Hz. They are transferred serially (RS232) by glass fibre cable to a PC at the measurement and computer centre (building No. 3). The NS and EW measurement samples are stored in units of 1 mV in ASCII format daily files. The time signal for the data logger is a DCF77 radio clock.
The transfer function of the data logger is determined from time to time. Due to traditional reasons the electrodes are connected as shown at Fig. 6. Because of inverting filter amplifiers the recordings of the EW line are in the correct polarity, while NS is recorded in the oposite polarity.

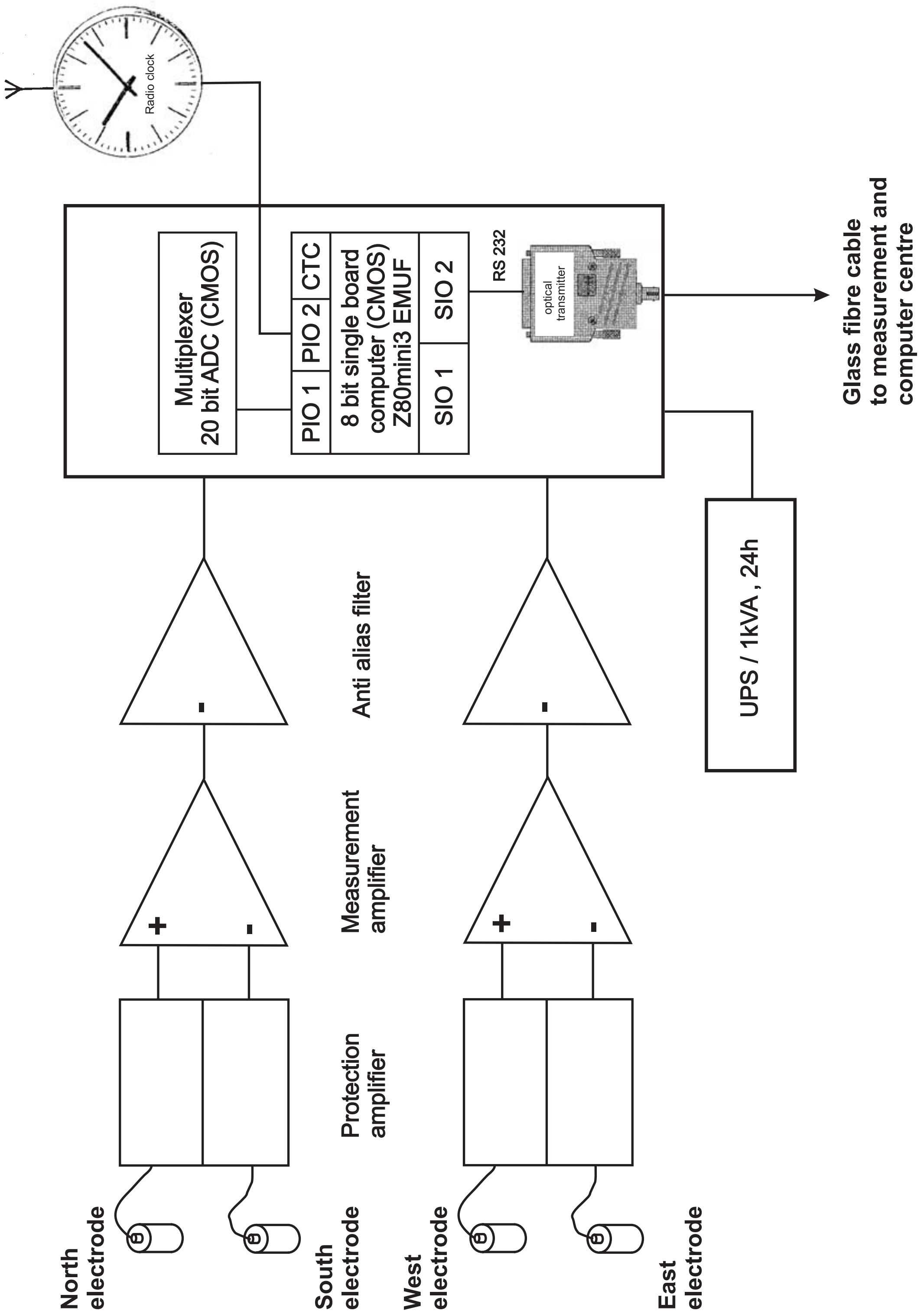


Fig.6: Block diagram of the telluric digital recording equipment

6. Remarks to the Tables and Plots

The tables and plots were obtained from the digital recordings of the FGE variometer and the absolute measurements by means of the THEO 010B DI-flux theodolite and the GSM19 Overhauser effect proton magnetometer. From the 2 Hz momentary values at first minute mean values are calculated. The minute mean value is centred on second 30. That means, the momentary values corresponding to the seconds 0, 0.5, 1.0, 1.5, …, 59.5 are averaged to a minute mean value. These "variometer minute mean values" are in files (1 file per day) with temporary character. The absolute minute mean values are calculated from these by means of the formulas given in [2] and are written into corresponding files (1 file per day). These absolute minute mean value files become final, when the final base values are determined. The hourly mean values are calculated from the "variometer minute mean values" by means of the formulas given in [2] and are written into corresponding files (1 file per year). The hourly mean value files become final, when the final base values are determined.
The absolute minute mean values and the hourly mean values are sent to the world data centres and to INTERMAGNET after the necessary format conversions. The hourly mean values are the basis of the following tables and plots after conversion from H, D, Z values into X, Y, Z ones.
The acquisition and the preparation of the recording material and the production of the tables and plots was done by programs, written by H.-J. Linthe.

Table 8 contains the activity in terms of the inter-diurnal variability u of the North component [9]:

2003	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
u	1.23	1.09	1.05	1.05	1.37	1.28	1.26	1.61	0.91	2.09	2.19	0.98	1.34

Table 8: Inter-diurnal variability u of the North component in 2003

The reduction factor for Niemegk with the geomagnetic coordinates Φ = 51°53´, Λ = 97°38´ and Ψ= -16°41´ (referring to the International Geomagnetic Reference Field Model 'IGRF 10th' for 2005) has the value 0.01691 [10].

Note the following remarks on the tables and plots:

- X points toward North, Y points toward East and Z points downward. Corresponding to that Eastern declinations and Northern inclinations are positive. Since 1986 the declination in Niemegk is eastward, therefore positive.
- All times correspond to Universal Time (UTC). The hourly mean values correspond to the hours $0^h - 1^h$, $1^h - 2^h$, …, $23^h - 24^h$.
- The minimum value of a table line is marked with "n", while the maximum is marked with "x". The quietest days are marked with "*" in the tables and with "Q" in the plots. The most disturbed days are marked with "+" in the tables and with "D" in the plots. The quietest and most disturbed days are determined in the frame of the Kp service of the IAGA at Niemegk.

The order of tables and plots is as follows:

1. Table with the geographic and geomagnetic coordinates of the observatory, the monthly and annual mean values of all magnetic elements and the deviations of the monthly means from the annual mean values.

2. Hourly mean value plots of X, Y and Z for every month.

3. Table with the daily mean values of the declination, horizontal intensity, inclination and total intensity.

4. Daily mean value plots of the North component, East component and vertical intensity.

5. Tables containing the following activity numbers:
   - The Schmidt character figures (C) in scales of 0, 1, 2
   - The Fanselau character figures (F) in scales of 0, 0.5, 1.0, 1.5, 2.0
   - The mean planetary daily activity Ap, calculated in the frame of the ISGI (International Service of Geomagnetic Indices, Kp Index Service) at Niemegk [8]
   - The mean local daily activity A_K, calculated from the K and given in terms of 2nT
   - The three-hourly activity numbers K determined at Niemegk [7], where the lower limit of K=9 corresponds to 500 nT.
   - The daily sum $\sum$K of the 8 K numbers

The a_K are determined from the K corresponding to table 9, with $A_K = \sum a_K / 8$.

K	0	1	2	3	4	5	6	7	8	9
a_K	0	3	7	15	27	48	80	140	240	400

Table 9: Derivation of the a_K from the single K

6. Tables giving a summary about the frequency of the single K corresponding to the day time and month.

7. This bulletin contains the plot "Deviation of the continuously calculated daily mean values from the normal value" of 2002 and the table "Monthly values of the normal value 2002". The monthly values of the normal value are displayed by a line in the plots. The numerical values are written next to the right margin of the plots and are contained in table 10.

Month	**X/nT**	**Y/nT**	**Z/nT**
January	18788.0	506.8	45152.3
February	18788.2	510.0	45155.7
March	18788.4	513.2	45159.2
April	18788.6	516.5	45162.7
May	18788.8	519.7	45166.3
June	18789.0	523.0	45169.8
July	18789.2	526.3	45173.4
August	18789.4	529.6	45177.0
September	18789.6	532.9	45180.5
October	18789.8	536.2	45184.1
November	18790.0	539.5	45187.6
December	18790.2	542.8	45191.2

Table 10: Monthly values of the normal value 2002

8. The final table contains the annual mean values of the complete observatory series Potsdam-Seddin-Niemegk adjusted to the level of Niemegk in a table and as a plot.

7. References

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Proceedings of the Xth IAGA Workshop on Geomagnetic Instruments, Data Acquisition and Processing, April 15-24, 2002; Hermanus, South Africa; pp. 53-62

8. Tables and Plots of the Results of the Observations in 2003 at Niemegk

Astronomic co-ordinates: φ = 52°4.3' , λ = 12°40.5' E. of Grw.
= 0h50m42s E. of Grw.

Geomagnetic co-ordinates: Φ = 51°53' , Λ = 97°38' Ψ = -16°41' [10]
referring to the International Geomagnetic Reference Field Model 'IGRF 10th' for 2005 [10]

Altitude above sea level: 78 m

Monthly and Annual Mean Values

Niemegk 2003

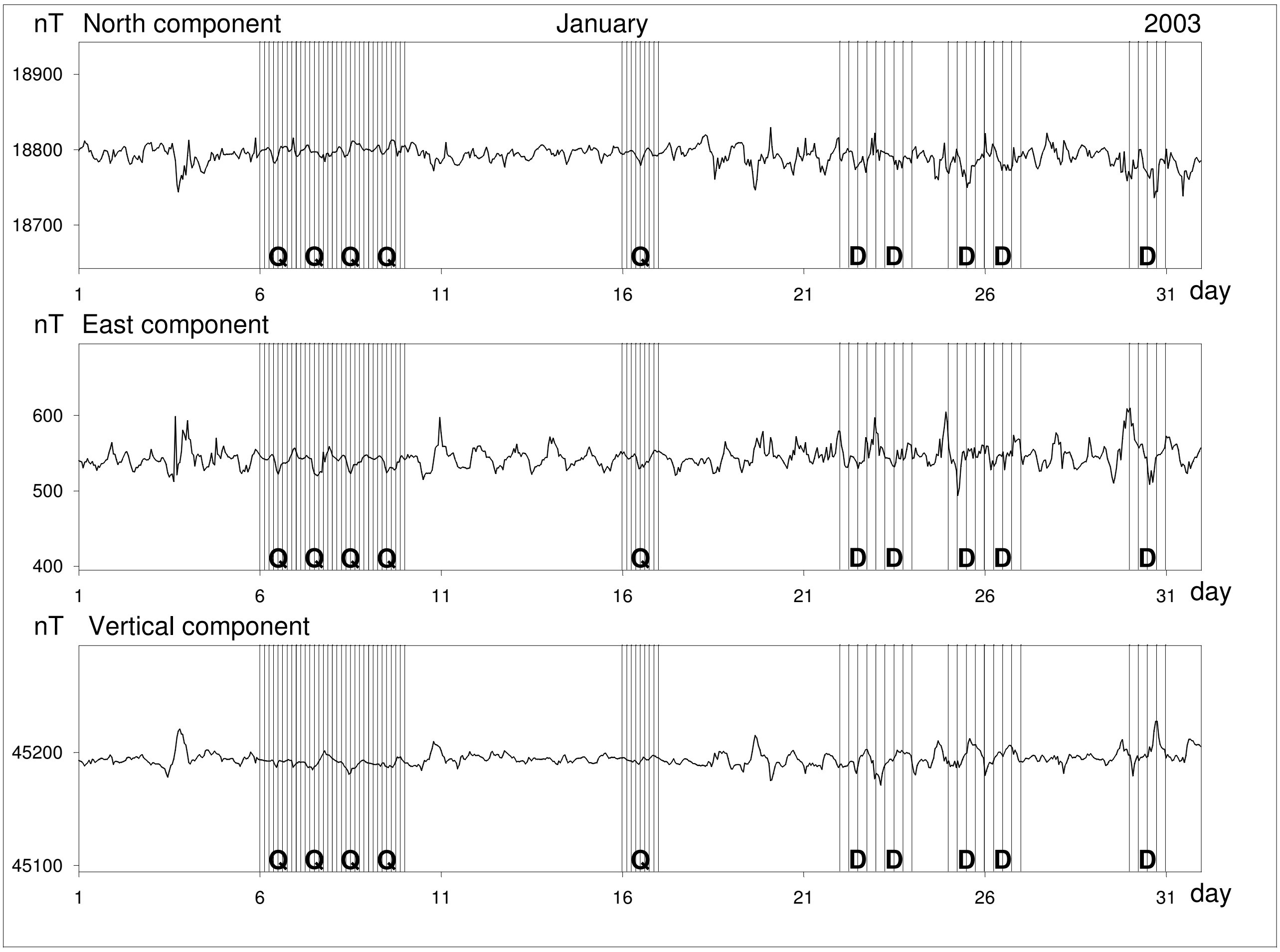
	D	I	H	F	X	Y	Z
Jan.	1° 39.65′	67° 24.79′	18800.5 nT	48948.9 nT	18792.6 nT	544.9 nT	45194.4 nT
Feb.	1 40.63	67 25.02	18798.7	48952.3	18790.6	550.2	45198.9
Mar.	1 41.35	67 25.16	18797.6	48954.2	18789.4	554.1	45201.4
Apr.	1 41.50	67 25.02	18800.7	48957.5	18792.5	555.0	45203.7
May	1 42.24	67 24.99	18802.6	48961.4	18794.3	559.1	45207.1
June	1 42.63	67 25.13	18803.8	48969.2	18795.4	561.3	45215.0
July	1 43.38	67 25.17	18803.9	48970.9	18795.4	565.4	45216.8
Aug.	1 44.14	67 25.61	18799.2	48973.8	18790.6	569.4	45221.9
Sep.	1 44.39	67 25.52	18800.7	48974.7	18792.0	570.8	45222.3
Oct.	1 46.15	67 26.60	18786.4	48974.3	18777.4	580.0	45227.8
Nov.	1 46.80	67 27.12	18785.2	48989.1	18776.1	583.5	45244.3
Dec	1 46.15	67 26.00	18800.1	48989.4	18791.1	580.4	45238.5
Year	1° 43.25′	67° 25.51′	18798.3 nT	48968.0 nT	18789.8 nT	564.5 nT	45216.0 nT

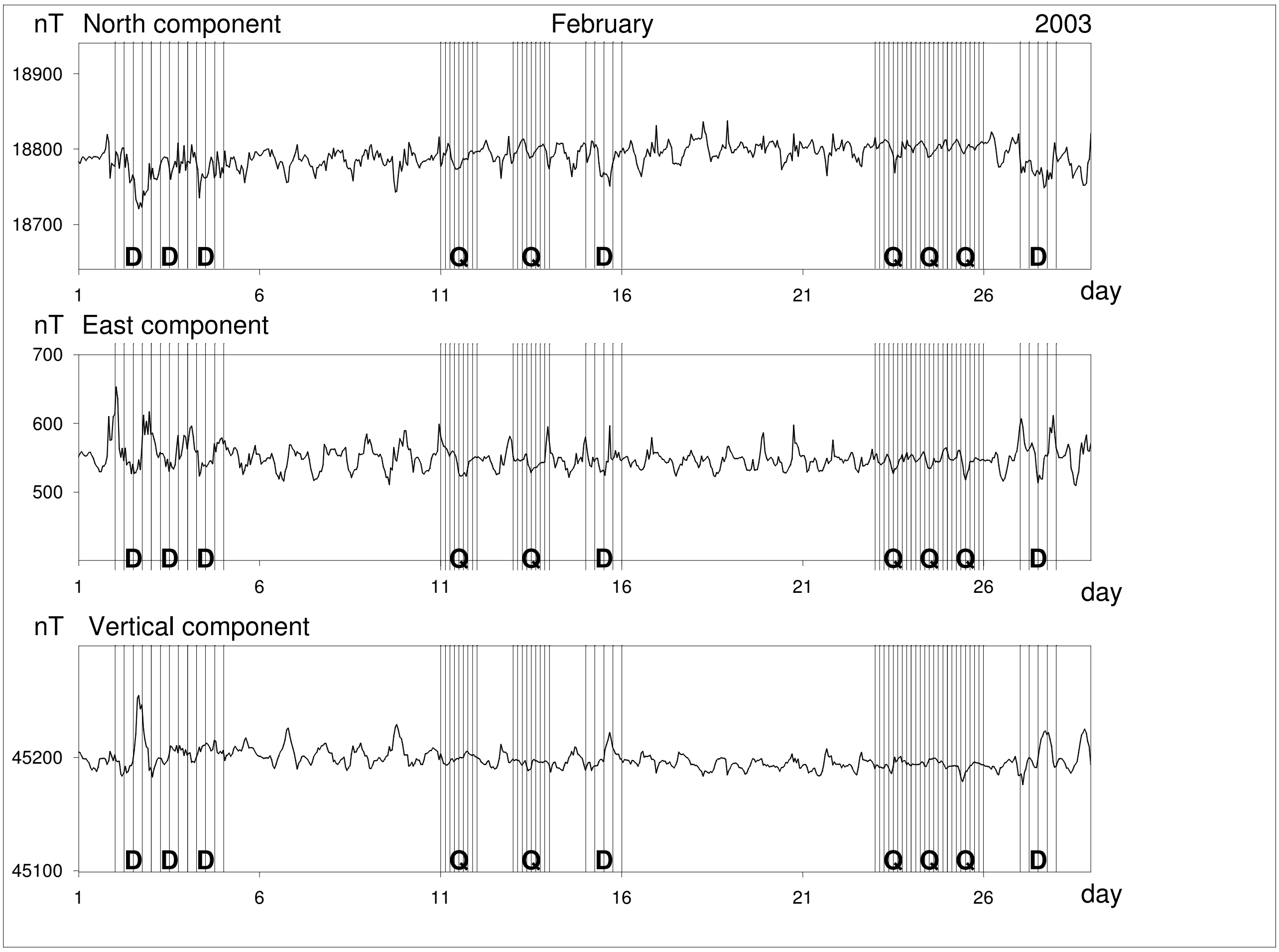
Deviation of the Monthly Means from the Annual Means

Niemegk 2003

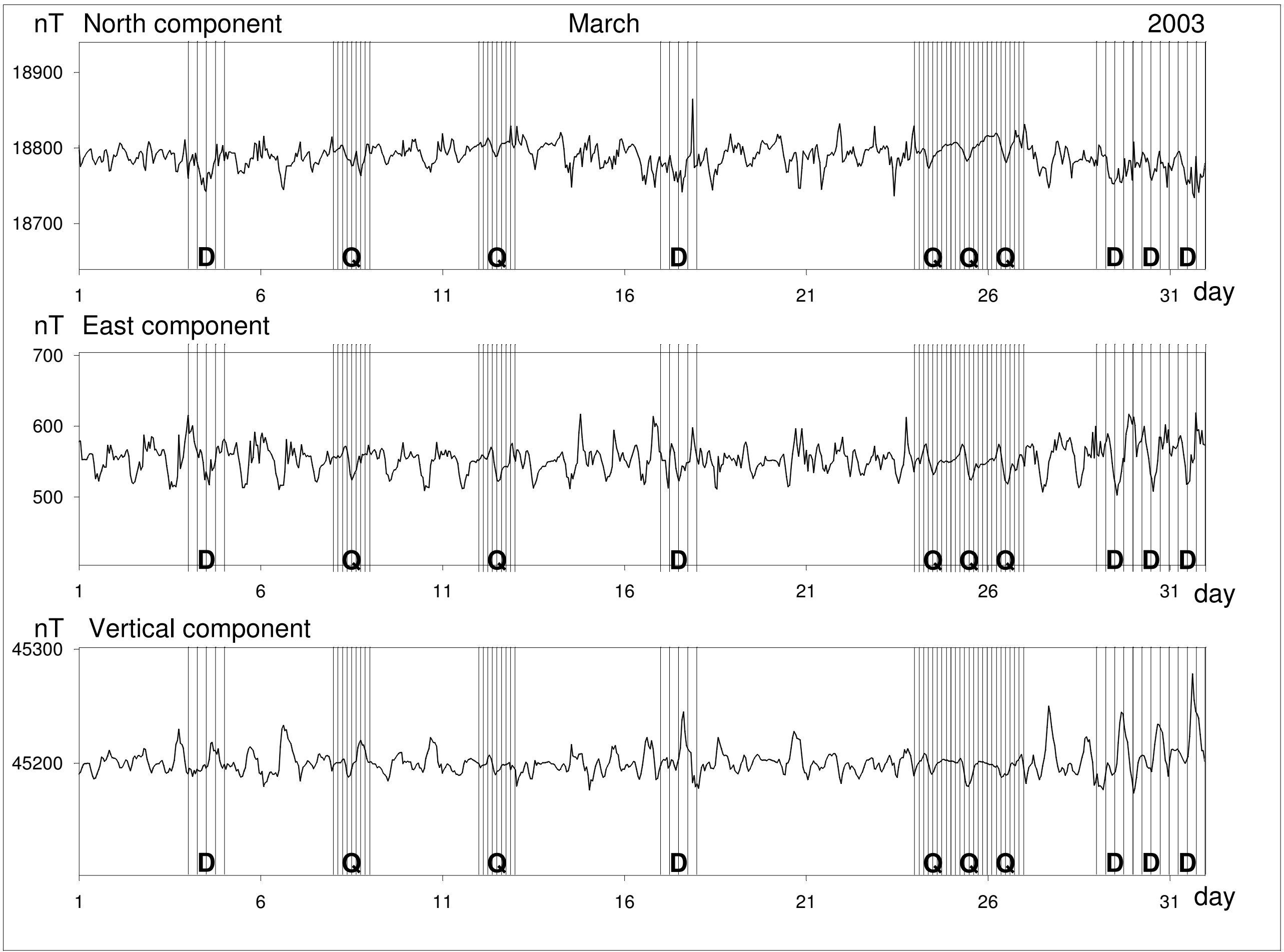
	D	I	H	F	X	Y	Z
Jan.	-3.60 ′	-0.72 ′	2.2 nT	-19.1 nT	2.8 nT	-19.6 nT	-21.6 nT
Feb.	-2.62	-0.49	0.4	-15.7	0.8	-14.3	-17.1
Mar.	-1.90	-0.35	-0.7	-13.8	-0.4	-10.4	-14.6
Apr.	-1.75	-0.49	2.4	-10.5	2.7	-9.5	-12.3
May	-1.01	-0.52	4.3	-6.6	4.5	-5.4	-8.9
June	-0.62	-0.38	5.5	1.2	5.6	-3.2	-1.0
July	0.13	-0.34	5.6	2.9	5.6	0.9	0.8
Aug	0.89	0.10	0.9	5.8	0.8	4.9	5.9
Sep.	1.14	0.01	2.4	6.7	2.2	6.3	6.3
Oct.	2.90	1.09	-11.9	6.3	-12.4	15.5	11.8
Nov.	3.55	1.61	-13.1	21.1	-13.7	19.0	28.3
Dec.	2.90	0.49	1.8	21.4	1.3	15.9	22.5

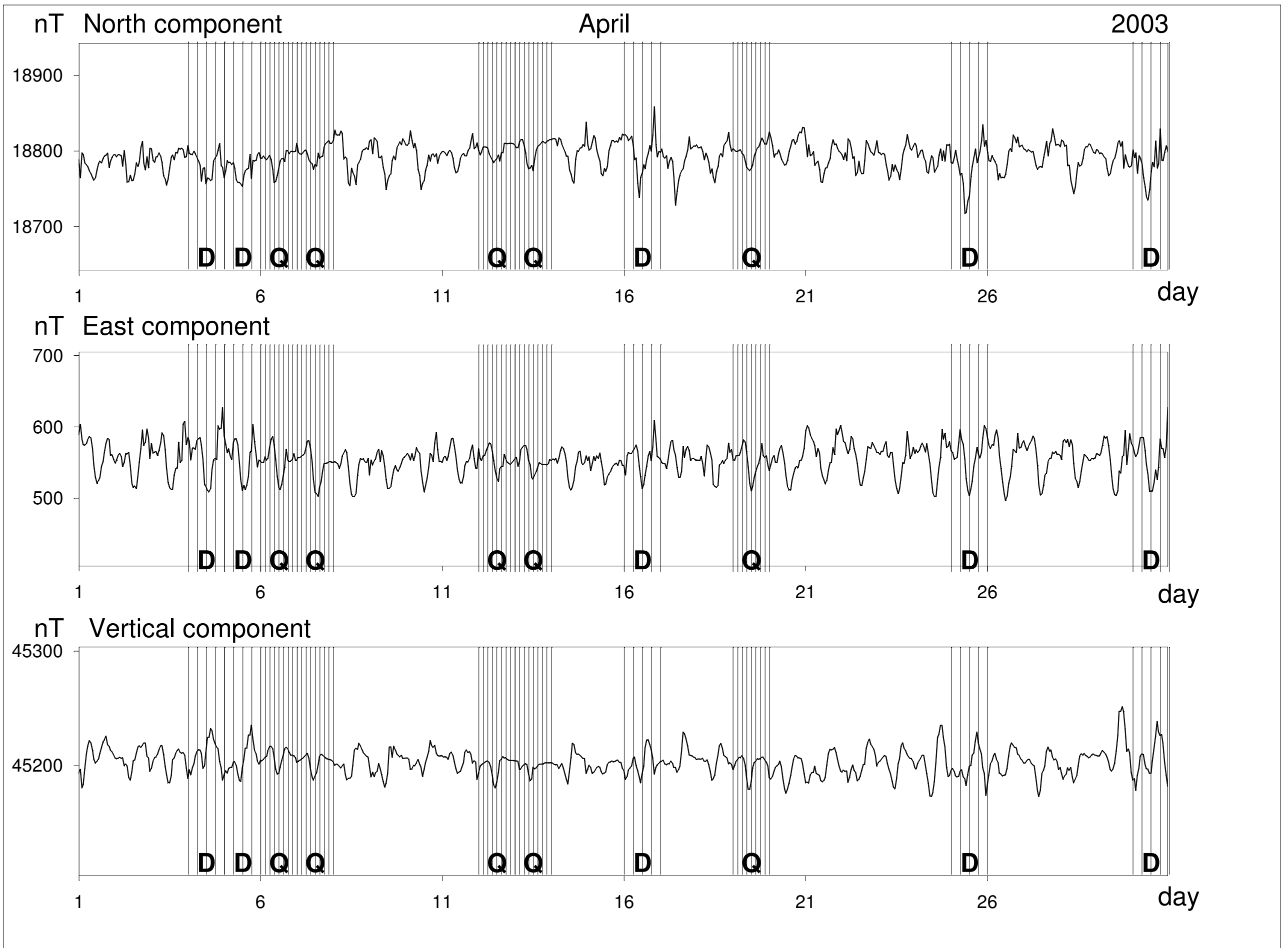
Hourly Mean Values Plot 2003



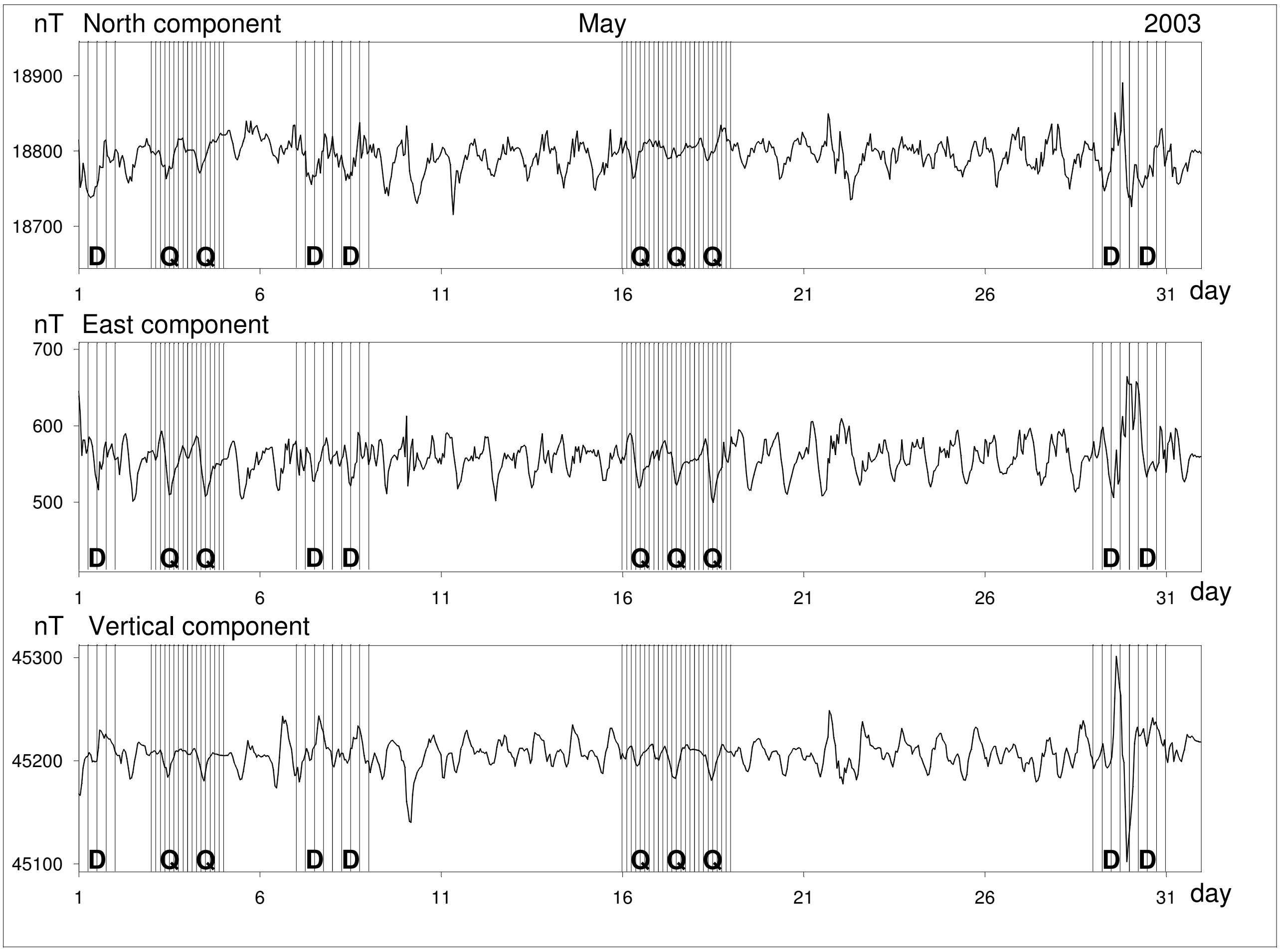


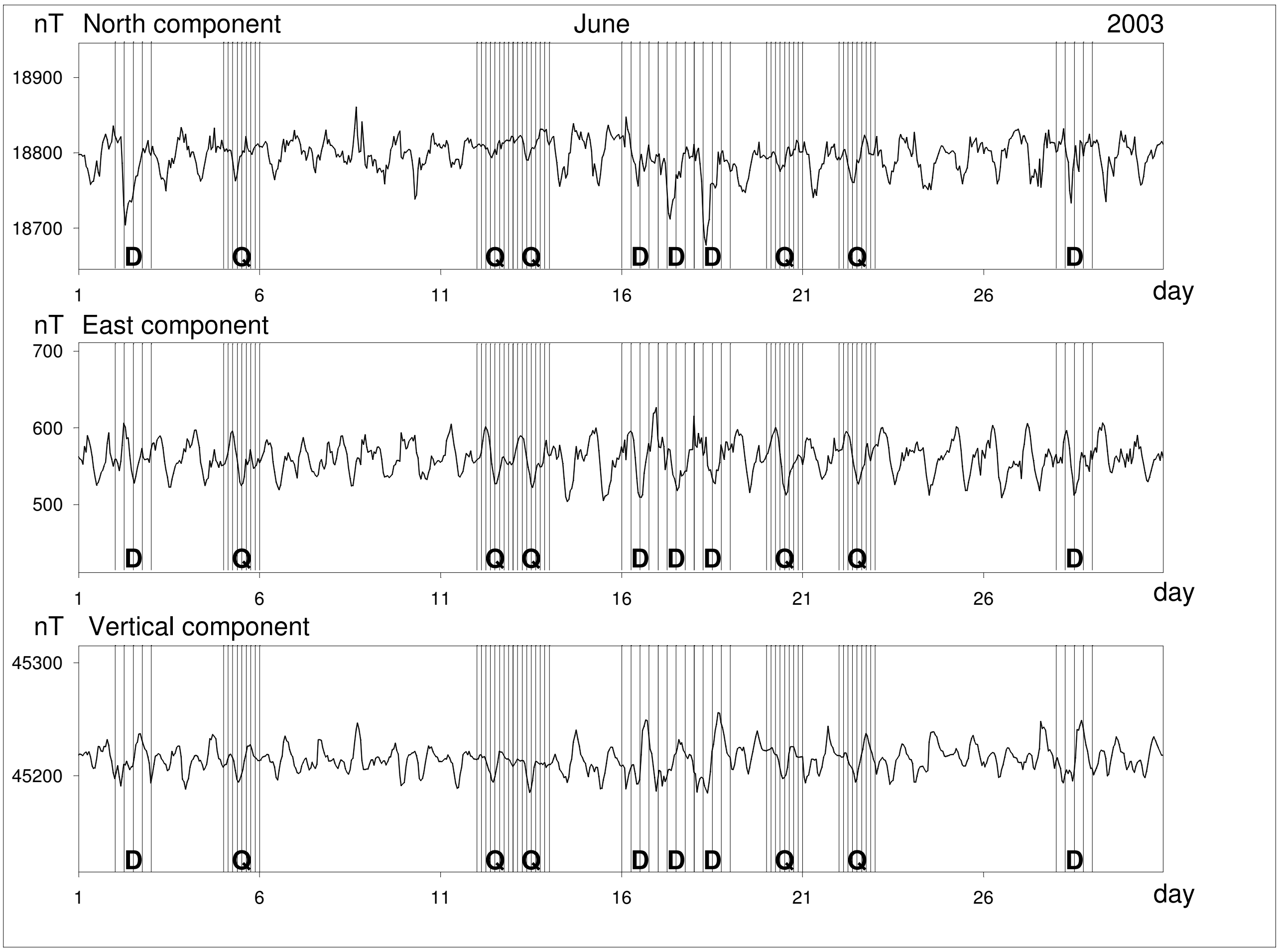
Q = Quiet day D = Disturbed day



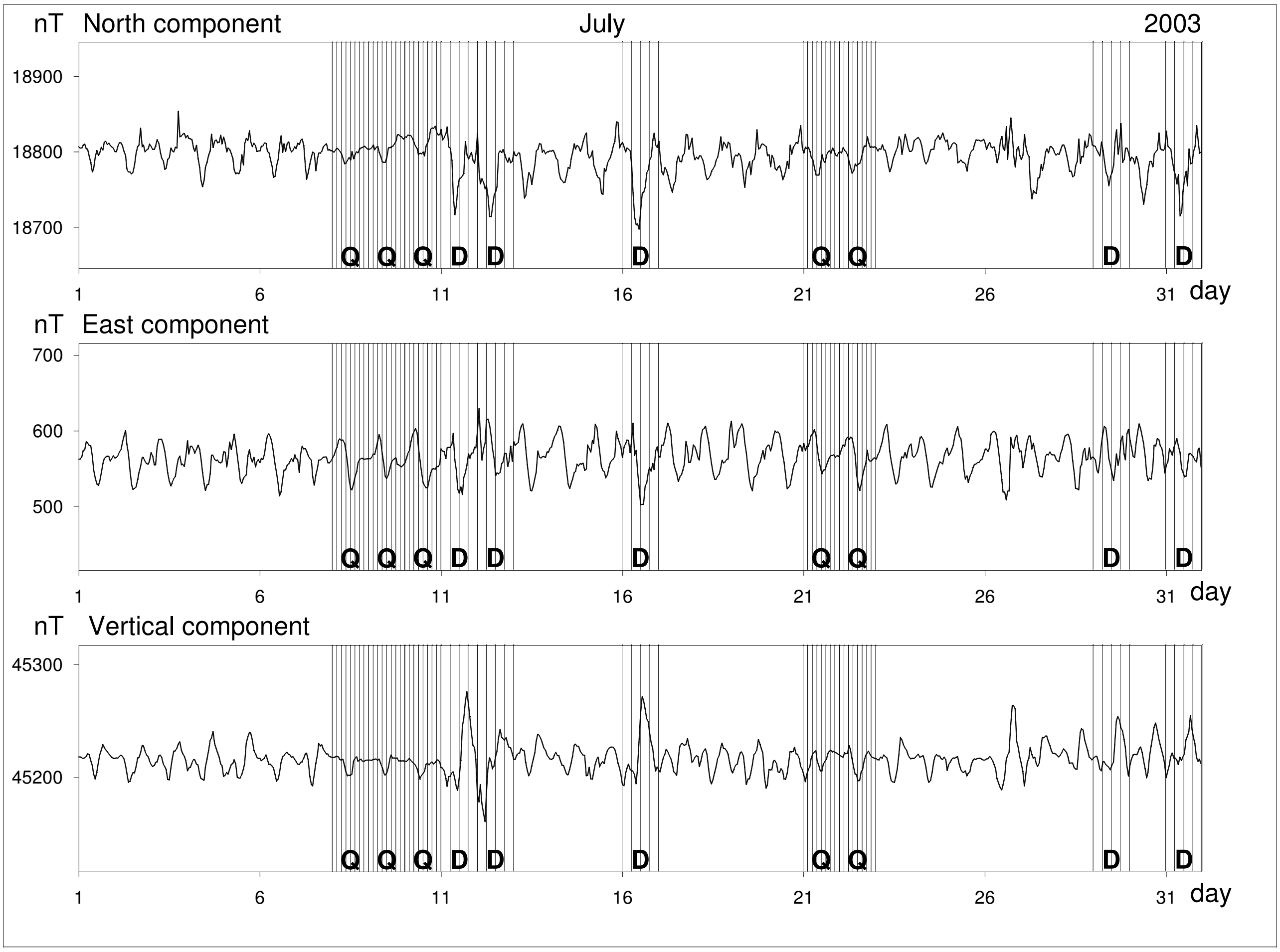


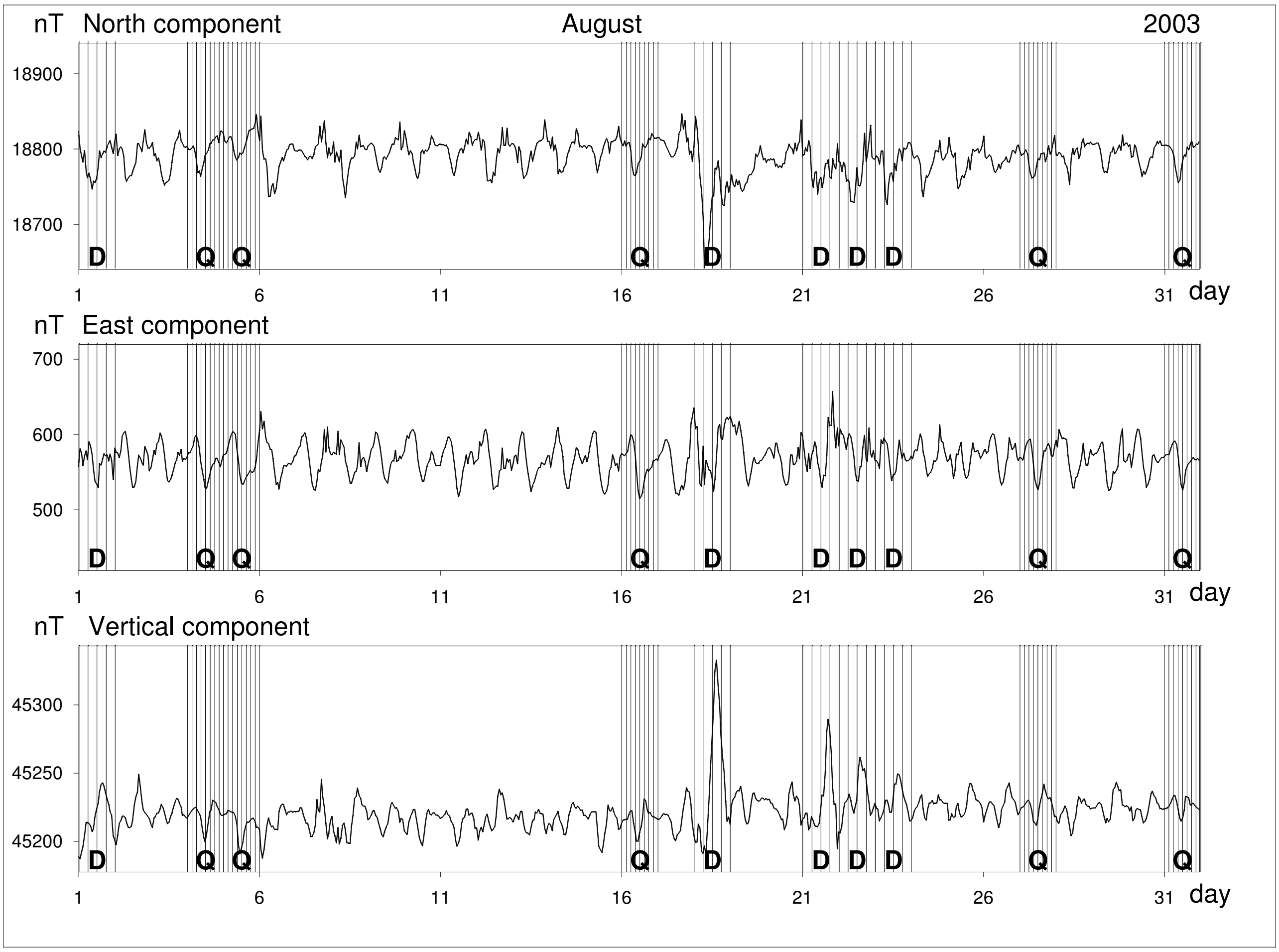
Q = Quiet day D = Disturbed day



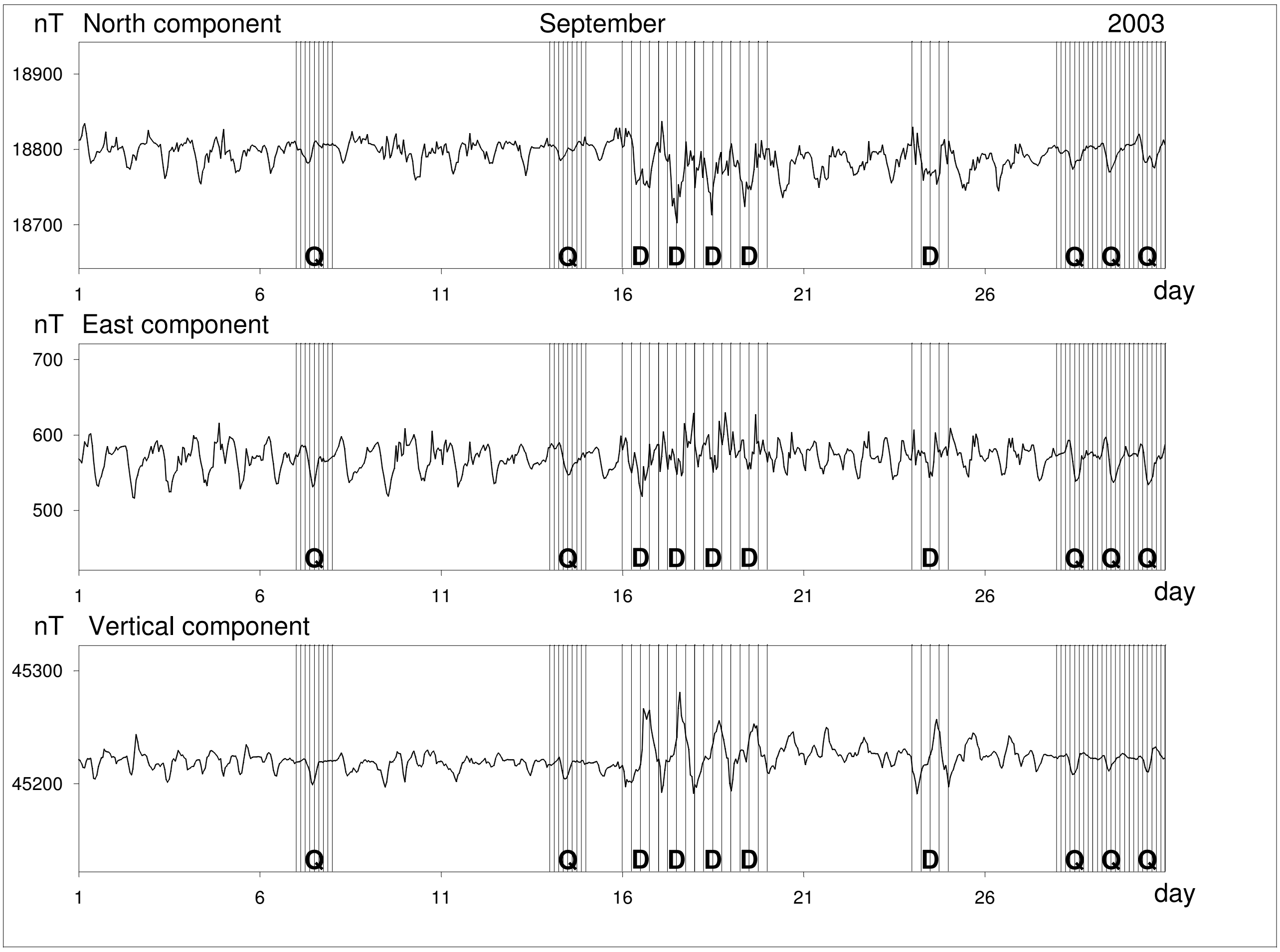


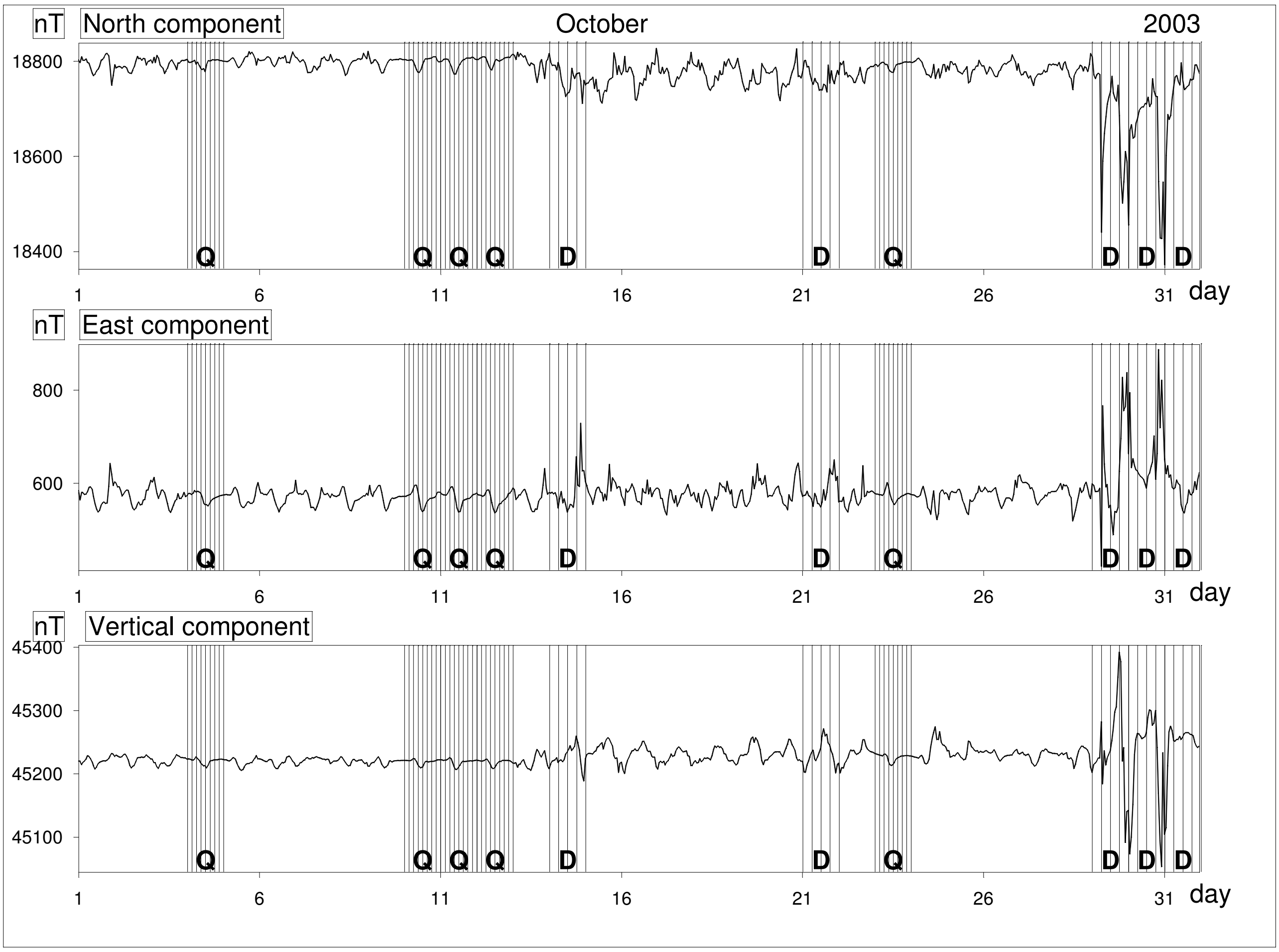
Q = Quiet day D = Disturbed day



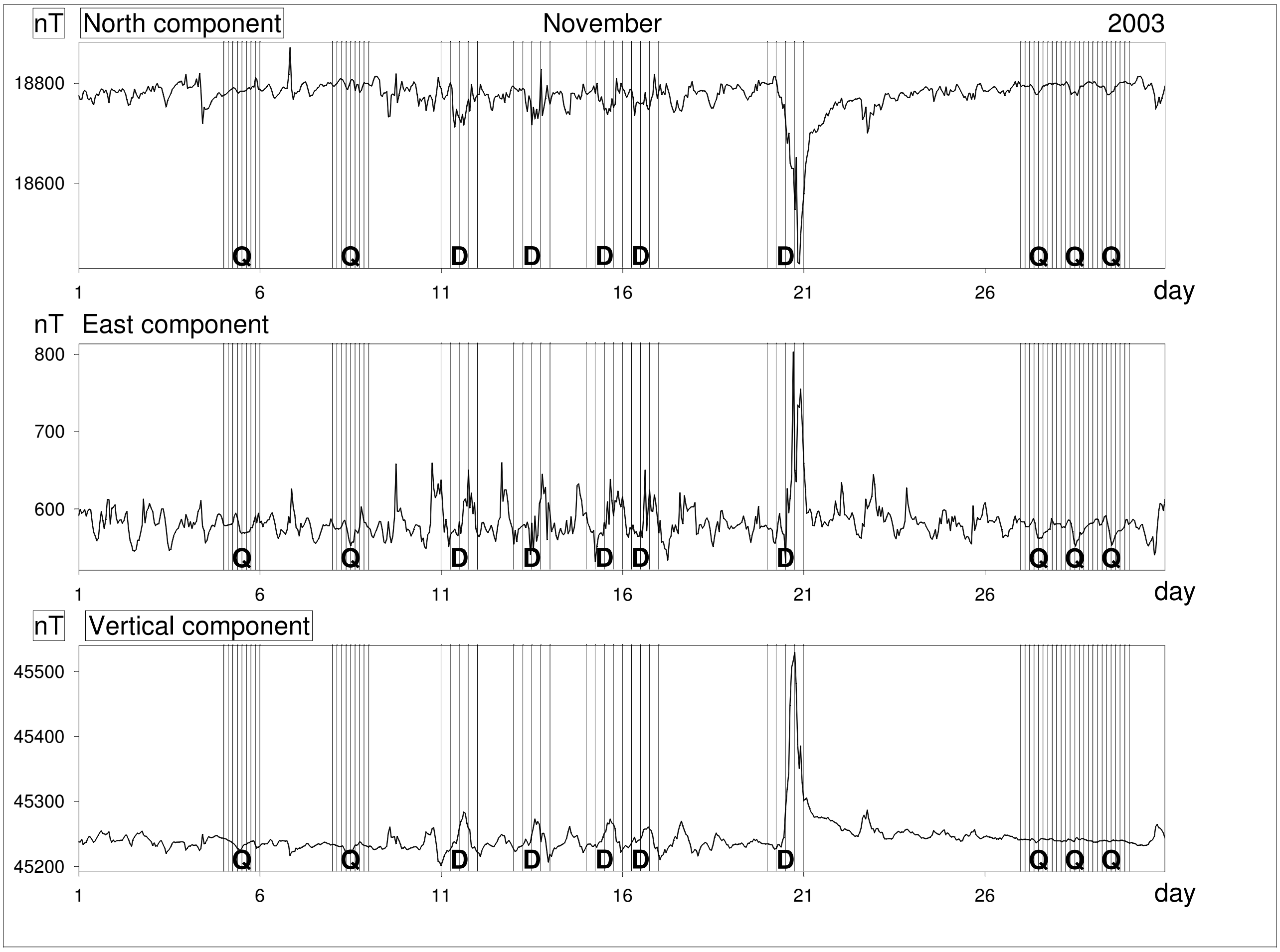


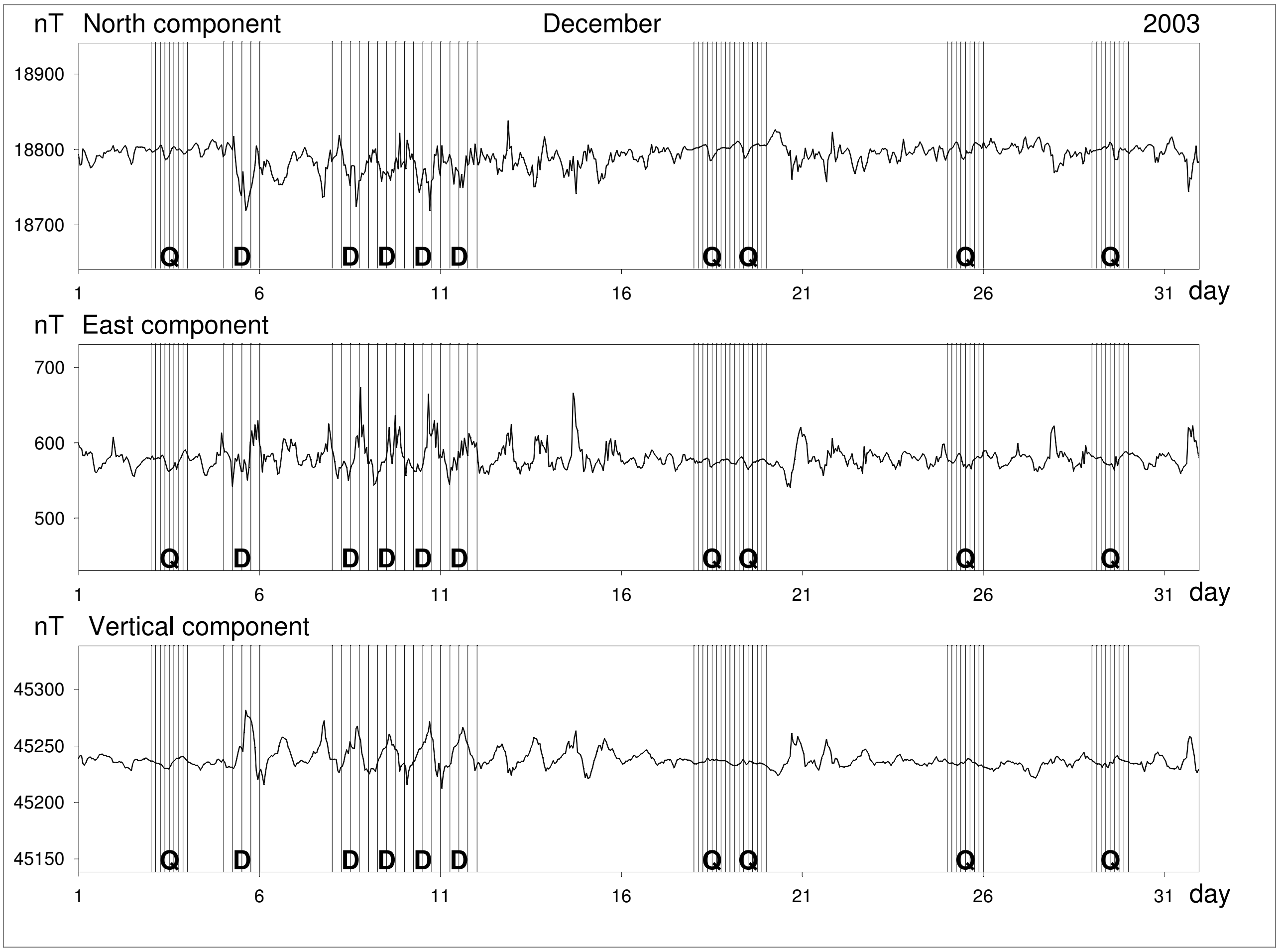
Q = Quiet day D = Disturbed day





Q = Quiet day D = Disturbed day





Q = Quiet day D = Disturbed day

Daily Mean Values of the Declination

Niemegk — Daily Intervals Calculated in Terms of UTC — 2003

D= 1° 30.0' + Tabular Value

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	8.7	11.6	11.1	13.5	14.1	12.3	12.6	13.3	14.0	15.3	17.8	16.2
2	8.6	14.1 x	11.0	11.6	10.9	12.9	12.2	14.2	13.1 n	14.9	16.0	15.2
3	9.4	12.2	11.1	12.3	11.8	12.6	12.4	14.1	13.4	14.9	15.9	15.4
4	10.1	12.3	12.9	13.0	10.6	12.9	12.5	13.4	14.9	14.4	16.6	15.4
5	9.1	11.3	11.7	12.0	9.9 n	12.1	12.8	13.6	14.1	14.4	16.0	16.8
6	9.0	9.5	11.6	11.0	11.9	11.8	12.4	14.5	13.9	14.3	16.6	17.2
7	8.8	9.8	10.5	10.1	11.8	12.1	12.5	14.6	13.5	14.6	15.1 n	16.7
8	8.7	10.9	11.4	9.4 n	12.0	13.0	12.8	13.6	13.4	14.1	15.2	16.9
9	8.5 n	10.9	11.0	9.6	12.4	12.2	12.8	14.1	13.4	14.7	16.0	16.6
10	8.9	11.0	10.2	11.3	12.4	12.5	12.3	14.7	15.1	14.4	17.1	17.5 x
11	9.6	10.4	9.9	11.2	12.2	13.3	12.6	13.4	13.8	14.3	18.1	16.9
12	9.3	10.4	10.6	11.3	11.4	12.6	15.3 x	13.4	13.8	13.8 n	17.2	16.3
13	9.3	10.0	9.7 n	10.8	11.8	12.5	13.8	12.9	14.1	14.6	16.6	16.6
14	9.8	9.9	11.1	10.4	12.7	11.0 n	13.5	13.8	14.3	16.8	17.0	17.3
15	8.9	10.4	11.3	9.9	11.9	11.7	14.5	12.9	13.6	17.7	17.3	16.3
16	9.4	10.2	12.4	11.8	11.7	14.2	11.9 n	12.6 n	13.2	16.1	17.7	15.6
17	8.8	9.8	10.9	11.8	11.4	11.7	14.2	12.9	15.9	14.6	16.1	15.5
18	8.7	9.4 n	10.6	10.7	10.5	13.7	14.0	16.3 x	17.0 x	15.3	16.0	15.2
19	10.1	10.3	10.6	11.1	12.6	13.4	14.3	15.9	16.3	16.6	15.8	15.1
20	10.6	10.3	11.7	10.0	11.4	12.5	14.0	13.9	15.1	16.8	24.1 x	14.7 n
21	10.6	9.6	11.6	13.9 x	12.8	13.0	14.5	16.1	14.8	17.1	19.1	16.8
22	10.6	9.8	10.9	12.8	13.1	13.3	13.4	16.1	14.5	14.4	19.2	16.0
23	10.7	9.8	11.0	11.5	12.0	13.8	14.1	14.3	14.4	15.2	17.6	16.0
24	11.0	10.3	10.8	12.1	12.3	11.8	12.7	15.1	15.1	13.9	16.1	16.0
25	9.5	9.8	10.4	12.3	12.2	13.0	13.3	13.8	15.8	14.6	16.0	15.4
26	10.7	9.6	10.2	12.0	12.7	11.8	13.7	15.0	14.8	15.6	16.4	15.9
27	9.6	13.2	11.5	11.6	13.1	12.6	13.7	14.2	14.2	16.7	15.3	16.2
28	9.8	11.1	12.6	11.8	12.0	11.9	13.4	14.4	14.3	15.9	15.1 n	16.2
29	10.9		13.1	11.8	14.2	14.3 x	14.4	13.5	14.0	23.5	15.5	15.6
30	11.1 x		14.2 x	12.0	16.6 x	12.4	14.8	14.1	13.6	32.6 x	15.5	15.7
31	10.4		13.8		12.8		13.4	13.5		18.6		17.0
Mean	9.7	10.6	11.3	11.5	12.2	12.6	13.4	14.1	14.4	16.2	16.8	16.1

Daily Mean Values of the Horizontal Intensity

Niemegk | Daily Intervals Calculated in Terms of UTC | 2003

H= 18700 nT + Tabular Value

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	104	98	96	92	81 n	102	111	94	113	103	86	100
2	103	72 n	100	92	100	87	108	101	108	102	89	107
3	98	86	98	97	103	103	115	98	108	105	99	107
4	95	84	84	93	110	106	110	108	104	106	86	112
5	103	90	94	85 n	127 x	107	109	120 x	103	112	97	83
6	107	93	90	97	117	110	109	91	107	113 x	100	81 n
7	104	92	98	105	99	113	107	110	109	105	101	91
8	110 x	95	98	103	101	112	108	97	115	108	108 x	85
9	110 x	90	102	103	96	102	115	108	112	108	96	90
10	103	98	99	99	85	103	124 x	106	98	108	88	84
11	99	96	106	105	94	111	97	108	106	107	69	88
12	100	102	113	108	100	117	79 n	105	109	111	84	99
13	104	107	110	110	105	123 x	95	106	107	107	78	91
14	104	101	102	109	102	111	100	107	110	77	81	90
15	106	94	100	110	96	114	101	111	116 x	67	82	93
16	103	102	92	107	109	107	81	108	93	83	81	101
17	107	104	85	94	109	83	96	117	83	87	82	106
18	105	114 x	92	102	118	74 n	101	54 n	79 n	86	89	109
19	97	110	103	107	110	88	102	77	84	80	99	112
20	97	107	99	114 x	106	105	102	102	86	78	2 n	110
21	101	107	100	100	113	96	102	86	90	75	23	100
22	100	107	102	103	94	102	105	82	94	85	62	99
23	98	110	99	98	105	105	111	91	97	102	80	104
24	96	110	103	101	107	93	118	91	93	95	93	108
25	88	112	110	89	99	104	111	94	87	94	93	110
26	98	111	115 x	100	106	111	116	97	92	97	99	113 x
27	105	82	95	108	105	106	94	98	102	85	103	113 x
28	104	88	94	98	101	108	106	103	103	94	103	99
29	97		82	100	102	105	105	105	104	-7	103	108
30	83 n		87	92	88	104	94	101	107	-34 n	100	108
31	86		78 n		95		93	103		40		101
Mean	100	99	98	101	103	104	104	99	101	86	85	100

Daily Mean Values of the Inclination

Niemegk — Daily Intervals Calculated in Terms of UTC — 2003

I= 67° 10.0' + Tabular Value

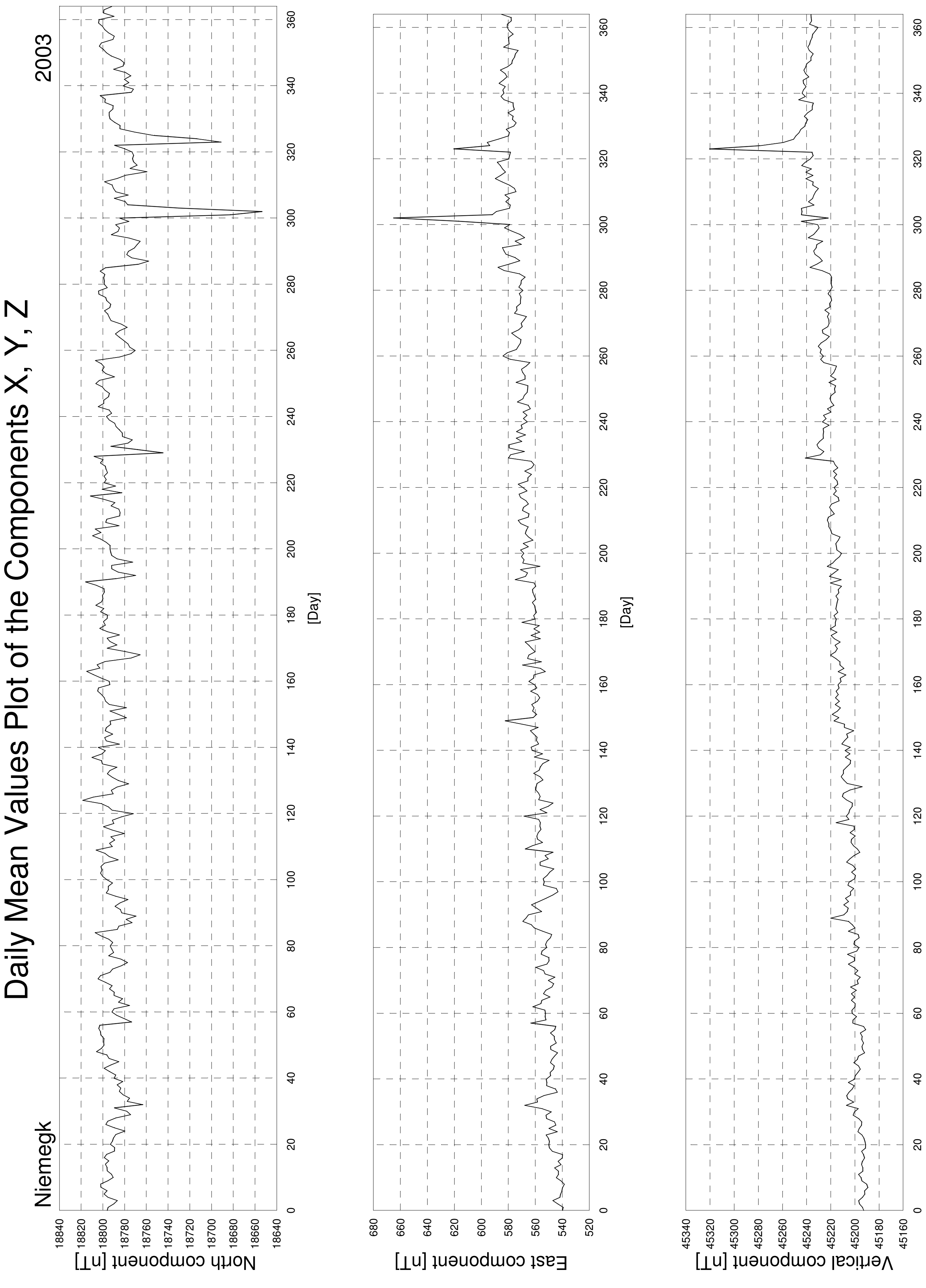
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	14.5	15.0	15.2	15.8	16.4 x	15.4	14.7	15.8	14.7	15.4	17.0	16.0
2	14.6	17.0 x	15.0	15.6	15.1	16.2	14.9	15.4	15.1	15.5	16.9	15.5
3	15.0	15.9	15.2	15.3	14.9	15.1	14.4	15.7	14.9	15.2	16.0	15.5
4	15.2	16.2	16.0	15.7	14.4	15.0	14.8	15.0	15.3	15.1	16.9	15.1
5	14.6	15.8	15.4	16.1 x	13.3 n	14.9	14.8	14.0 n	15.4	14.7 n	16.1	17.3 x
6	14.3	15.6	15.7	15.4	14.0	14.8	14.8	15.9	15.1	14.7 n	15.9	17.3 x
7	14.5	15.6	15.1	14.7	15.3	14.5	14.9	14.8	14.8	15.3	15.8	16.8
8	14.0 n	15.3	15.2	14.9	15.2	14.6	14.8	15.6	14.4 n	15.0	15.3 n	17.1
9	14.1	15.8	14.8	14.8	15.4	15.2	14.4	15.0	14.6	15.0	16.2	16.7
10	14.6	15.1	15.1	15.2	15.8	15.2	13.7 n	15.0	15.7	15.0	16.7	17.2
11	14.9	15.2	14.5	14.8	15.5	14.6	15.7	14.9	15.0	15.0	18.1	16.9
12	14.9	14.8	14.1	14.4	15.2	14.2	16.7	15.2	14.9	14.8	16.9	16.1
13	14.5	14.4	14.2	14.3	15.0	13.7 n	15.9	15.0	15.0	15.1	17.5	16.7
14	14.5	14.8	14.9	14.5	15.1	14.6	15.4	15.0	14.8	17.2	17.2	16.8
15	14.5	15.4	14.9	14.3	15.5	14.3	15.3	14.6	14.4 n	18.1	17.3	16.5
16	14.6	14.8	15.5	14.6	14.6	14.9	16.8 x	14.9	16.1	16.9	17.3	16.0
17	14.3	14.6	16.1	15.5	14.5	16.4	15.7	14.4	16.8	16.6	17.1	15.6
18	14.5	13.8 n	15.5	14.9	13.9	17.1 x	15.4	19.1 x	17.0 x	16.7	16.6	15.4
19	15.0	14.2	14.8	14.6	14.6	16.3	15.2	17.2	16.8	17.1	16.0	15.1
20	14.9	14.4	15.2	13.9 n	14.7	15.1	15.1	15.6	16.7	17.4	24.6 x	15.3
21	14.6	14.3	14.9	14.9	14.4	15.6	15.2	16.7	16.4	17.5	22.1	16.0
22	14.8	14.4	14.8	14.8	15.5	15.3	15.0	17.0	16.1	16.8	19.0	16.1
23	14.9	14.2	15.0	15.2	14.9	15.0	14.7	16.4	15.8	15.6	17.6	15.7
24	15.0	14.2	14.8	15.0	14.8	15.9	14.2	16.3	16.0	16.3	16.7	15.4
25	15.7	14.0	14.2	15.7	15.2	15.2	14.6	16.1	16.6	16.3	16.7	15.3
26	15.0	14.1	13.9 n	15.1	14.8	14.6	14.5	15.9	16.2	16.0	16.3	15.0 n
27	14.5	16.2	15.4	14.5	14.7	15.1	15.9	15.8	15.5	16.7	15.9	15.0 n
28	14.6	15.8	15.4	15.1	15.1	14.9	15.2	15.4	15.4	16.2	15.9	16.1
29	15.1		16.2	15.4	15.1	15.1	15.2	15.4	15.3	23.1	15.8	15.4
30	16.1 x		15.9	15.7	16.2	15.1	16.0	15.6	15.1	24.3 x	16.1	15.4
31	15.9		16.9 x		15.7		16.0	15.5		20.1		15.9
Mean	14.8	15.0	15.2	15.0	15.0	15.1	15.2	15.6	15.5	16.6	17.1	16.0

Daily Mean Values of the Total Intensity

Niemegk — Daily Intervals Calculated in Terms of UTC — 2003

F= 48900 nT + Tabular Value

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	49	51	51	59	53	72	74	68	78 x	75	89	90
2	50	50	56	57	59	62	70	72	78 x	78	91	89
3	50	50	56	58	59	66	75	73	73	75	85	89
4	49	54	48 n	60	60	72	72	75	74	76	84	90
5	50	57 x	52	53	66	69	71	74	74	77	85	91
6	49	56	53	60	67 x	73	70	64 n	75	77	85	85 n
7	48	53	54	59	63	72	71	74	73	77	85	91
8	48	53	56	59	63	73	69	67	76	76	85	88
9	49	55	54	56	56	67	72	73	73	74	85	88
10	50	54	57	59	43 n	68	74	70	73	75	82	87
11	49	52	54	60	58	69	72	71	71	75	80 n	89
12	51 x	53	57	57	63	72	56 n	72	77	76	80 n	89
13	49	53	54	58	66	70	72	70	73	76	83	88
14	50	52	55	60	64	71	70	73	73	70	80 n	89
15	51 x	52	52	57	61	68	67	71	74	76	88	89
16	49	53	52	58	64	68	68	72	75	76	85	91
17	49	53	54	58	61	59 n	70	77	74	74	81	90
18	49	52	51	59	65	59 n	69	74	70 n	76	82	91
19	48	52	56	57	65	68	67	72	75	77	86	91
20	45 n	51	59	56	60	71	65	78	74	77	128 x	93 x
21	46	50	53	52	67 x	66	69	76	78 x	74	98	90
22	46	51	52	56	55	70	70	76	78 x	78	95	88
23	47	52	54	56	66	67	73	78	75	79	93	90
24	47	54	55	57	65	67	74	75	71	88 x	97	90
25	47	50	55	49 n	59	74	70	76	73	83	94	90
26	50	52	57	58	63	72	78 x	77	76	83	95	89
27	51 x	49 n	57	58	57	75 x	70	78	75	76	93	87
28	50	51	52	54	63	72	76	75	75	80	93	89
29	50		49	69 x	63	71	76	81 x	76	54	92	90
30	49		54	56	65	70	73	77	78 x	23 n	93	91
31	49		64 x		64		72	79		72		88
Mean	49	52	54	58	61	69	71	74	75	74	89	89


Daily Mean Values Plot of the Components X, Y, Z
Niemegk
2003
North component [nT]
East component [nT]
Vertical component [nT]
[Day]
[Day]
[Day]

Niemegk **A c t i v i t y   I n d i c e s**

January 2003

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	7	8	16	1221	2233
2	0	0.5	6	8	15	3111	2232
3	1	0.5	18	24	25	3122	2645
4	1	0.5	16	19	25	5422	2343
5	0	0.5	7	10	18	3112	2234
6	0	0.5	4	5	10	1110	1123
7	0	0.5	6	6	13	2112	1132
8	0	0.5	4	4	10	2111	1121
9	0	0.5	3	4	8	0001	1132
10	0	0.5	12	11	19	2212	2334
11	0	0.5	10	11	18	3311	1234
12	0	0.5	8	8	17	2222	2232
13	0	0.5	7	8	15	3212	1114
14	0	0.5	9	10	18	3323	2212
15	0	0.5	7	7	15	3212	2212
16	0	0.5	5	4	11	1112	2121
17	0	0.5	7	8	16	1222	3222
18	0	0.5	12	14	22	2222	4343
19	1	0.5	18	18	26	3233	3444
20	1	0.5	19	18	25	4422	3343
21	1	0.5	18	18	26	4333	3334
22	1	0.5	19	20	25	4222	2445
23	1	0.5	20	18	24	5412	3333
24	1	0.5	18	18	25	3223	3444
25	1	0.5	28	25	30	4453	4433
26	1	0.5	20	22	28	5333	4343
27	0	0.5	10	11	18	3320	1324
28	0	0.5	13	14	22	4422	2233
29	1	0.5	16	21	25	2123	3554
30	1	0.5	25	24	28	5333	3542
31	0	0.5	17	15	23	4324	3322
Mean:	0.4	0.5	12.5	13.3	19.9		
Max:	1	0.5	28	25	30		
Min:	0	0.5	3	4	8		

February 2003

Day	C	F	Ap	AK	ΣK	K	
1	1	0.5	14	17	20	3211	1255
2	1	1.0	52	44	38	5544	4565
3	1	1.0	22	29	31	5323	4554
4	1	0.5	31	26	30	4454	2344
5	1	0.5	14	18	25	4223	4433
6	0	0.5	14	13	21	2123	3343
7	0	0.5	13	13	21	3312	3243
8	1	0.5	16	16	24	3333	3234
9	1	0.5	19	21	27	4323	3543
10	1	0.5	16	16	23	4432	2134
11	0	0.5	10	9	17	4222	1222
12	1	0.5	13	17	22	1223	1454
13	0	0.5	7	10	14	3112	1015
14	1	0.5	20	18	26	4323	3344
15	1	0.5	23	23	28	4423	4533
16	1	0.5	17	22	28	3333	3445
17	0	0.5	12	11	20	3223	2323
18	1	0.5	21	21	27	2543	3334
19	0	0.5	13	15	21	2212	3335
20	1	0.5	17	18	25	2333	3353
21	1	0.5	14	16	24	2333	2443
22	0	0.5	11	11	20	2223	3323
23	0	0.5	11	12	20	3212	3333
24	0	0.5	6	7	15	2112	2223
25	0	0.5	5	4	11	2121	2111
26	0	0.5	15	12	20	1232	3234
27	1	0.5	30	27	31	4433	4445
28	1	0.5	18	18	24	3133	2435
Mean:	0.6	0.5	16.9	17.3	23.3		
Max:	1	1.0	52	44	38		
Min:	0	0.5	5	4	11		

March 2003

Day	C	F	Ap	AK	ΣK	K	
1	1	0.5	15	16	24	4223	3343
2	0	0.5	11	14	21	2222	2353
3	1	0.5	24	25	26	3122	3465
4	1	0.5	34	26	31	4434	4444
5	1	0.5	19	20	26	3223	3544
6	1	0.5	27	25	30	4333	4544
7	0	0.5	15	13	21	4323	2133
8	0	0.5	8	10	17	1112	2433
9	0	0.5	11	11	19	2322	2134
10	1	0.5	16	21	27	2333	3445
11	0	0.5	12	12	19	4222	2421
12	0	0.5	8	9	17	2222	2124
13	0	0.5	14	12	20	4333	3112
14	1	0.5	23	22	26	2233	5254
15	1	0.5	26	26	30	5333	3544
16	1	1.0	31	29	30	3323	4465
17	1	1.0	42	36	34	3443	5456
18	1	0.5	28	24	29	4444	5233
19	0	0.5	12	11	20	3322	2233
20	1	0.5	25	21	26	1233	4445
21	1	0.5	30	24	29	4434	3245
22	1	0.5	16	18	25	4433	2234
23	1	0.5	22	24	29	3334	3454
24	0	0.5	6	6	14	3222	2111
25	0	0.5	3	3	8	1110	1121
26	0	0.5	8	8	15	1211	2233
27	1	0.5	25	16	25	4333	3333
28	1	0.5	27	20	26	3332	2445
29	1	1.0	37	30	31	4333	3465
30	1	1.0	39	29	30	6233	3445
31	1	1.0	43	34	31	3223	5655
Mean:	0.6	0.6	21.2	19.2	24.4		
Max:	1	1.0	43	36	34		
Min:	0	0.5	3	3	8		

April 2003

Day	C	F	Ap	AK	ΣK	K	
1	1	0.5	18	19	25	4322	2453
2	1	0.5	24	23	28	2343	3445
3	1	0.5	17	16	24	3232	3344
4	1	0.5	28	26	30	4333	3455
5	1	0.5	28	22	28	4333	3453
6	0	0.5	9	8	17	2222	1323
7	0	0.5	5	6	14	2112	3212
8	1	0.5	22	16	24	3234	4422
9	1	0.5	22	17	25	4343	3323
10	1	0.5	23	17	25	2333	3344
11	0	0.5	14	12	20	2222	1344
12	0	0.5	9	9	17	3221	3321
13	0	0.5	9	10	18	3322	3212
14	1	0.5	17	18	24	2213	4444
15	0	0.5	17	13	22	3333	3223
16	1	1.0	33	28	32	4344	4454
17	1	0.5	28	20	26	3434	3441
18	1	0.5	21	20	27	2434	4334
19	0	0.5	9	11	19	2312	2243
20	0	0.5	14	13	21	3321	3324
21	1	0.5	22	17	25	3342	3343
22	1	0.5	23	22	29	4334	3444
23	1	0.5	19	16	24	2333	3343
24	1	0.5	27	25	29	3233	4455
25	1	0.5	33	25	30	3434	3445
26	1	0.5	15	19	25	3232	3453
27	0	0.5	13	14	22	3222	2443
28	0	0.5	14	10	19	3323	2222
29	1	0.5	27	22	25	2322	3463
30	1	1.0	45	33	32	4333	3556
Mean:	0.7	0.5	20.2	17.6	24.2		
Max:	1	1.0	45	33	32		
Min:	0	0.5	5	6	14		

May 2003

Day	C	F	Ap	AK	ΣK	K	
1	1	1.0	43	31	32	6443	4443
2	0	0.5	15	14	22	3423	3313
3	0	0.5	9	11	20	2323	3223
4	0	0.5	5	6	13	2112	2212
5	0	0.5	14	12	19	1212	2443
6	1	1.0	28	29	31	3333	5455
7	1	1.0	38	28	32	5443	4444
8	1	1.0	39	35	34	4434	4564
9	1	1.0	31	31	33	4454	5434
10	1	1.0	42	27	28	6542	2342
11	1	0.5	31	24	29	4254	4433
12	1	0.5	20	19	26	3333	3353
13	1	0.5	24	22	29	4334	3444
14	1	1.0	29	29	32	4433	4554
15	1	0.5	22	22	28	3433	4533
16	0	0.5	9	10	19	3222	2233
17	0	0.5	7	8	16	3222	2221
18	0	0.5	8	10	16	1111	2343
19	0	0.5	10	11	20	3322	2323
20	0	0.5	10	12	21	3223	3323
21	1	0.5	29	23	27	3322	3545
22	1	0.5	26	22	27	5432	4342
23	1	0.5	16	18	26	3334	3433
24	1	0.5	21	18	26	3333	3344
25	1	0.5	16	16	24	3333	2334
26	1	0.5	16	16	24	4232	3334
27	1	0.5	30	25	30	4334	4354
28	1	0.5	34	26	31	4444	4443
29	1	1.5	109	66	40	4433	6677
30	1	1.0	59	43	37	5543	4655
31	1	0.5	20	18	22	5521	3321
Mean:	0.7	0.7	26.1	22.0	26.3		
Max:	1	1.5	109	66	40		
Min:	0	0.5	5	6	13		

June 2003

Day	C	F	Ap	AK	ΣK	K	
1	1	0.5	22	21	27	2333	4345
2	1	0.5	38	22	29	3444	3434
3	1	0.5	29	22	29	4334	4344
4	1	0.5	22	24	29	3334	4453
5	0	0.5	10	13	22	3223	3333
6	1	0.5	13	16	24	2333	3433
7	1	0.5	25	27	31	4434	5434
8	1	1.0	37	34	33	3334	4655
9	1	0.5	28	22	28	3334	3435
10	1	0.5	24	19	26	3353	3333
11	0	0.5	12	14	23	3333	3332
12	0	0.5	7	8	17	1222	3322
13	0	0.5	9	9	16	2111	2234
14	1	0.5	28	26	30	2434	4544
15	1	0.5	18	16	25	3433	3333
16	1	0.5	40	27	30	3424	4355
17	1	1.0	49	33	34	4544	5543
18	1	1.0	60	36	35	5455	3544
19	0	0.5	14	14	23	3323	3342
20	0	0.5	11	14	22	1333	3333
21	1	0.5	22	20	27	4333	3434
22	0	0.5	12	14	23	3232	3343
23	1	0.5	18	18	26	4333	3334
24	1	0.5	23	20	27	4434	3333
25	1	0.5	16	18	26	2333	3444
26	1	0.5	16	16	24	3323	4333
27	1	1.0	31	31	33	4344	5544
28	1	1.0	42	36	34	3436	5544
29	1	0.5	24	27	31	3435	4444
30	0	0.5	17	14	23	4333	2323
Mean:	0.7	0.6	23.9	21.0	26.9		
Max:	1	1.0	60	36	35		
Min:	0	0.5	7	8	16		

July 2003

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	8	10	19	2223	3322
2	0	0.5	12	11	20	2223	3332
3	1	0.5	19	19	26	3322	4444
4	1	0.5	22	21	28	4334	4433
5	1	0.5	18	18	26	4332	4343
6	0	0.5	9	12	20	2213	4332
7	0	0.5	11	14	22	3333	4321
8	0	0.5	3	5	10	1101	3220
9	0	0.5	4	5	12	1211	2122
10	0	0.5	7	8	17	1222	3223
11	1	1.0	52	36	35	3454	5545
12	1	1.0	43	29	32	5543	4344
13	1	0.5	13	16	24	3333	3423
14	0	0.5	14	14	22	2222	3434
15	1	1.0	28	27	29	5424	2255
16	1	1.0	48	28	32	4444	4345
17	1	0.5	18	17	25	4323	3343
18	1	0.5	15	18	24	3421	3335
19	1	0.5	30	26	30	4234	4445
20	1	0.5	17	16	25	3333	3334
21	0	0.5	7	10	17	4222	3121
22	0	0.5	6	8	16	2122	2331
23	0	0.5	9	12	21	2222	3433
24	0	0.5	7	8	16	2211	2323
25	0	0.5	8	10	18	1233	3222
26	1	1.0	33	27	29	2224	5554
27	1	0.5	22	18	25	5333	3332
28	1	0.5	21	17	23	2213	5433
29	1	1.0	38	30	32	3433	4555
30	1	0.5	27	22	29	3433	4444
31	1	1.0	35	33	34	4345	5445
Mean:	0.6	0.6	19.5	17.6	23.8		
Max:	1	1.0	52	36	35		
Min:	0	0.5	3	5	10		

August 2003

Day	C	F	Ap	AK	ΣK	K	
1	1	1.0	39	32	33	5444	5335
2	1	0.5	21	21	28	4333	3444
3	0	0.5	14	14	23	3333	2333
4	0	0.5	10	9	17	1222	1333
5	0	0.5	7	9	16	3111	2224
6	1	0.5	32	22	28	5443	3333
7	1	1.0	32	28	27	1222	4565
8	1	1.0	33	29	32	4544	3453
9	0	0.5	14	14	23	2333	3234
10	0	0.5	9	12	21	4223	3232
11	0	0.5	10	11	20	2222	3333
12	1	0.5	26	24	30	4344	4443
13	0	0.5	15	14	23	3323	3234
14	1	0.5	14	16	24	3333	3342
15	0	0.5	11	14	22	3222	3433
16	0	0.5	8	11	20	3222	3332
17	1	0.5	20	20	22	1111	5445
18	1	1.5	108	49	40	5555	5645
19	1	0.5	19	20	26	5333	3432
20	1	0.5	17	17	23	1332	2435
21	1	1.0	58	38	36	4444	5555
22	1	1.0	46	38	36	4444	5555
23	1	1.0	36	28	31	4543	4533
24	1	0.5	20	21	27	3343	3353
25	0	0.5	20	14	22	3432	3322
26	0	0.5	11	14	21	4212	2334
27	0	0.5	8	10	19	2222	2333
28	1	0.5	18	16	24	4224	2343
29	1	0.5	16	16	21	1113	3453
30	0	0.5	14	13	21	4422	2322
31	0	0.5	6	6	13	1212	2221
Mean:	0.5	0.6	23.0	19. 4	24.8		
Max:	1	1.5	108	49	40		
Min:	0	0.5	6	6	13		

Niemegk **A c t i v i t y   I n d i c e s**

September 2003

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	13	12	20	2332	2242
2	0	0.5	12	12	20	3222	4223
3	1	0.5	15	17	25	3323	3344
4	1	0.5	22	20	27	3333	4344
5	1	0.5	16	16	24	4333	3422
6	0	0.5	8	12	21	3223	2333
7	0	0.5	4	5	11	3110	1221
8	0	0.5	5	7	14	1111	3223
9	1	0.5	22	18	25	2224	4344
10	1	0.5	21	18	25	4224	3343
11	1	0.5	14	16	24	4323	2343
12	0	0.5	9	8	17	2322	2222
13	0	0.5	8	8	16	3222	1123
14	0	0.5	4	6	12	1111	2123
15	0	0.5	4	7	11	2000	1134
16	1	0.5	34	21	28	4433	4343
17	1	1.0	70	47	39	5445	5655
18	1	1.0	50	45	38	5535	4655
19	1	1.0	39	28	31	4334	4553
20	1	0.5	27	25	30	4443	4533
21	1	0.5	18	18	25	4223	4343
22	1	0.5	17	18	24	3323	3451
23	0	0.5	15	15	23	2322	3443
24	1	1.0	41	31	33	5443	4454
25	1	0.5	28	27	31	4334	4454
26	1	0.5	15	16	24	3233	3343
27	0	0.5	6	6	11	3111	1013
28	0	0.5	4	5	11	2011	2221
29	0	0.5	4	4	10	1211	1112
30	0	0.5	4	6	12	0121	1223
Mean:	0.5	0.6	18.3	16.5	22.1		
Max:	1	1.0	70	47	39		
Min:	0	0.5	4	4	10		

October 2003

Day	C	F	Ap	AK	ΣK	K	
1	1	0.5	10	16	19	3211	1155
2	0	0.5	8	11	20	3322	2233
3	1	0.5	17	18	25	3432	2443
4	0	0.5	5	6	12	2222	3100
5	0	0.5	5	7	11	0110	0234
6	0	0.5	9	9	17	3112	2233
7	1	0.5	15	17	25	4233	3433
8	0	0.5	6	8	16	2222	2123
9	0	0.5	7	7	13	4212	2110
10	0	0.0	2	3	7	0011	1112
11	0	0.0	2	3	7	2001	1012
12	0	0.5	4	5	10	1101	1123
13	1	0.5	16	22	26	4222	3355
14	1	1.5	66	52	36	4344	3477
15	1	1.0	44	36	35	3445	4555
16	1	1.0	29	28	31	5333	4544
17	1	0.5	32	22	28	4443	4234
18	1	0.5	25	22	29	3433	4444
19	1	1.0	37	34	33	4333	4565
20	1	1.0	36	28	31	4244	3455
21	1	1.0	49	40	36	4344	5655
22	1	1.0	34	30	31	4443	4642
23	0	0.5	6	5	10	2132	1100
24	1	1.0	38	32	26	0122	4656
25	1	0.5	16	19	26	4233	4424
26	0	0.5	10	13	20	3223	1144
27	0	0.5	11	10	19	3332	2222
28	1	1.0	25	28	31	3435	3544
29	2	2.0	204	163	53	5397	7688
30	2	2.0	191	156	49	8544	4699
31	2	1.5	116	120	49	9667	7545
Mean:	0.7	0.8	34.7	31.3	25.2		
Max:	2	2.0	204	163	53		
Min:	0	0.0	2	3	7		

November 2003

Day	C	F	Ap	AK	ΣK	K	
1	1	0.5	26	24	29	5333	3444
2	1	0.5	18	19	26	3333	3353
3	0	0.5	13	14	23	3333	2333
4	1	0.5	38	25	27	3356	2233
5	0	0.5	6	8	14	2011	1234
6	1	0.5	17	22	22	3111	2365
7	0	0.5	8	8	16	3222	1222
8	0	0.5	8	9	17	2112	3332
9	1	1.0	29	30	30	3233	5563
10	1	0.5	27	26	30	3333	4455
11	1	1.5	61	49	40	5455	5655
12	1	1.0	30	30	31	4333	3654
13	1	1.0	52	48	38	4344	5666
14	1	1.0	38	29	32	5434	4354
15	1	1.0	40	40	36	3454	5654
16	1	1.0	41	38	35	4343	5655
17	1	1.0	39	39	36	4444	5654
18	1	1.0	26	28	31	5334	4543
19	0	0.5	12	12	20	2222	3441
20	2	2.0	150	159	46	1345	7998
21	1	1.0	42	30	30	6553	2333
22	1	1.0	30	29	30	4323	3564
23	1	0.5	22	22	27	4432	3254
24	0	0.5	13	14	22	3222	4333
25	1	0.5	14	16	24	3332	3433
26	0	0.5	8	11	20	3222	2333
27	0	0.5	6	7	15	2222	1132
28	0	0.5	5	5	12	2212	2201
29	0	0.5	6	6	14	2222	2112
30	0	0.5	12	15	22	2312	2444
Mean:	0.7	0.8	27.9	27.1	26.5		
Max:	2	2.0	150	159	46		
Min:	0	0.5	5	5	12		

December 2003

Day	C	F	Ap	AK	ΣK	K	
1	0	0.5	10	10	18	3322	1214
2	0	0.5	7	7	14	3222	2012
3	0	0.5	4	4	10	1111	1212
4	0	0.5	6	8	14	2111	1134
5	1	1.0	39	32	33	3443	5545
6	1	0.5	23	23	28	4323	3544
7	0	0.5	14	14	22	3221	3344
8	1	1.0	35	34	33	3433	4565
9	1	1.0	29	28	31	3433	4455
10	1	1.0	41	38	35	5334	4655
11	1	1.0	40	35	35	5444	4545
12	1	1.0	25	28	31	4333	4455
13	1	0.5	26	22	28	4323	4444
14	1	1.0	27	29	30	4323	3654
15	1	0.5	25	24	29	4433	5433
16	0	0.5	10	11	20	2232	2333
17	0	0.5	7	7	15	2212	2321
18	0	0.0	3	3	7	1112	1100
19	0	0.0	1	2	6	1011	1011
20	1	0.5	16	16	21	1113	3543
21	1	0.5	24	22	29	4433	3444
22	1	0.5	18	16	24	3323	3433
23	0	0.5	7	10	18	2212	3332
24	0	0.5	6	8	16	2211	2323
25	0	0.5	5	5	11	2111	2202
26	0	0.5	8	7	14	3211	1213
27	1	0.5	11	16	22	3313	2235
28	0	0.5	13	15	23	4322	3342
29	0	0.5	5	6	13	2012	2321
30	0	0.5	6	6	14	2111	2232
31	1	0.5	19	22	26	3222	3554
Mean:	0.5	0.6	16.5	16.4	21.6		
Max:	1	1.0	41	38	35		
Min:	0	0.0	1	2	6		

K Index Frequencies in the Eight Three Hourly Intervals 2003

UT	00-03	03-06	06-09	09-12	12-15	15-18	18-21	21-24	Σ	00-03	03-06	06-09	09-12	12-15	15-18	18-21	21-24	Σ
				January										**July**				
K=0	1	1	1	2	-	-	-	-	5	-	-	1	-	-	-	-	1	2
1	4	8	11	5	7	6	3	2	46	4	2	4	4	-	2	-	3	19
2	6	10	14	15	12	9	6	9	81	9	13	12	7	4	4	9	6	64
3	10	7	4	8	9	9	12	9	68	8	9	10	13	13	13	10	8	84
4	6	5	-	1	3	4	9	9	37	7	6	3	6	10	9	9	6	56
5	4	-	1	-	-	2	1	2	10	3	1	1	1	4	3	3	7	23
6	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				February										**August**				
K=0	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-
1	2	5	6	2	4	2	2	1	24	6	3	5	2	1	-	-	1	18
2	8	9	11	8	7	6	4	1	54	3	10	10	11	8	5	4	6	57
3	8	8	8	16	12	9	9	11	81	8	9	7	11	14	13	15	12	89
4	8	4	2	2	5	6	8	8	43	10	6	8	6	3	8	6	5	52
5	2	2	1	-	-	4	4	7	20	4	3	1	1	5	4	5	7	30
6	-	-	-	-	-	-	1	-	1	-	-	-	-	-	1	1	-	2
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				March										**September**				
K=0	-	-	-	1	-	-	-	-	1	1	2	1	2	-	1	-	-	7
1	4	3	3	1	1	6	2	3	23	3	5	6	6	6	4	2	3	35
2	5	11	12	9	11	6	3	1	58	6	8	12	5	6	7	9	4	57
3	9	12	14	16	11	3	8	8	81	9	10	8	11	7	9	3	15	72
4	11	5	2	4	4	12	10	9	57	8	4	3	4	10	5	10	6	50
5	1	-	-	-	4	3	5	9	22	3	1	-	2	1	2	6	2	17
6	1	-	-	-	-	1	3	1	6	-	-	-	-	-	2	-	-	2
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				April										**October**				
K=0	-	-	-	-	-	-	-	-	-	3	2	2	1	1	1	2	3	15
1	-	1	3	2	2	-	2	2	12	1	5	5	4	6	8	3	-	32
2	10	9	9	11	4	5	7	4	59	4	9	6	10	6	5	4	4	48
3	13	17	14	11	19	10	1	11	96	9	7	9	8	6	1	5	6	51
4	7	3	4	6	5	14	12	8	59	10	6	7	4	9	6	7	7	56
5	-	-	-	-	-	1	7	4	12	2	1	-	2	1	5	6	7	24
6	-	-	-	-	-	-	1	1	2	-	1	1	-	-	5	1	1	9
7	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	1	1	6
8	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	1	3
9	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	1	1	4
				May										**November**				
K=0	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	-	2
1	2	2	3	2	-	-	2	2	13	1	2	5	2	3	2	1	2	18
2	2	6	8	9	8	4	5	3	45	7	8	7	11	8	5	1	4	51
3	12	10	13	13	10	12	7	13	90	11	13	10	9	8	8	9	9	77
4	9	10	5	7	10	9	10	9	69	6	5	4	5	4	5	4	9	42
5	4	3	2	-	2	4	5	3	23	4	1	4	2	6	3	9	4	33
6	2	-	-	-	1	2	1	-	6	1	-	-	1	-	6	4	1	13
7	-	-	-	-	-	-	1	1	2	-	-	-	-	1	-	-	-	1
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	2
				June										**December**				
K=0	-	-	-	-	-	-	-	-	-	-	2	-	-	-	2	2	1	7
1	2	1	1	1	-	-	-	-	5	4	6	13	8	6	2	5	3	47
2	5	3	5	2	2	1	2	3	23	8	8	9	9	8	6	3	6	57
3	14	16	19	13	16	15	14	11	118	10	9	7	12	9	7	7	6	67
4	8	9	3	11	8	8	11	12	70	7	6	2	2	6	6	8	8	45
5	1	1	2	2	4	5	3	4	22	2	-	-	-	2	6	5	7	22
6	-	-	-	1	-	1	-	-	2	-	-	-	-	-	2	1	-	3
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

K Index Frequencies

Niemegk — Annual Sums — 2003

K	UT	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24	Σ
0		5	8	5	6	1	5	5	5	40
1		33	43	65	39	36	32	22	22	292
2		73	104	115	107	84	63	57	51	654
3		121	127	123	141	134	109	100	119	974
4		97	69	43	58	77	92	104	96	636
5		30	13	12	10	29	42	59	63	258
6		4	1	1	2	1	21	13	4	47
7		-	-	-	2	3	-	2	2	9
8		1	-	-	-	-	-	1	2	4
9		1	-	1	-	-	1	2	1	6

K Index Monthly Means

Niemegk — 2003

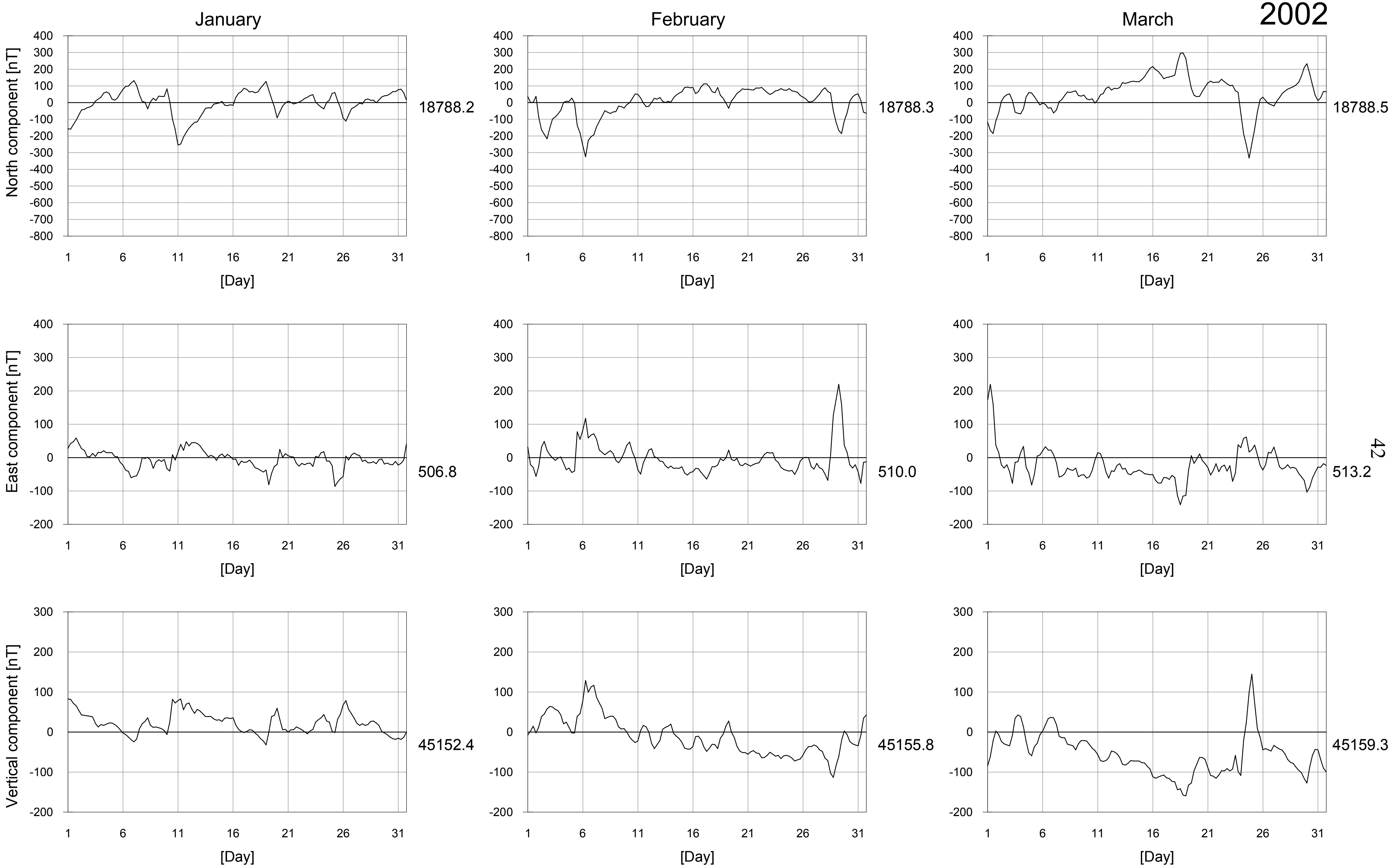
Month	UT	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24	Mean
January		2.9	2.2	1.8	2.0	2.3	2.7	3.0	3.0	2.5
February		3.0	2.6	2.3	2.6	2.6	3.0	3.4	3.7	2.9
March		3.1	2.6	2.5	2.7	3.0	3.1	3.7	3.7	3.0
April		2.9	2.7	2.6	2.7	2.9	3.4	3.6	3.4	3.0
May		3.5	3.2	2.8	2.8	3.3	3.6	3.6	3.4	3.3
June		3.0	3.2	3.0	3.5	3.5	3.7	3.5	3.6	3.4
July		2.9	2.7	2.4	2.8	3.5	3.2	3.2	3.2	3.0
August		3.1	2.9	2.7	2.8	3.1	3.5	3.5	3.4	3.1
September		3.0	2.4	2.2	2.5	2.8	2.9	3.3	3.0	2.8
October		3.3	2.5	2.8	2.8	2.9	3.2	3.7	3.8	3.1
November		3.3	2.7	2.8	2.9	3.2	3.9	4.1	3.6	3.3
December		2.8	2.4	1.9	2.3	2.7	3.3	3.1	3.2	2.7
Mean		3.1	2.7	2.5	2.7	3.0	3.3	3.5	3.4	3.0

K Index Frequencies

Niemegk — Monthly Sums — 2003

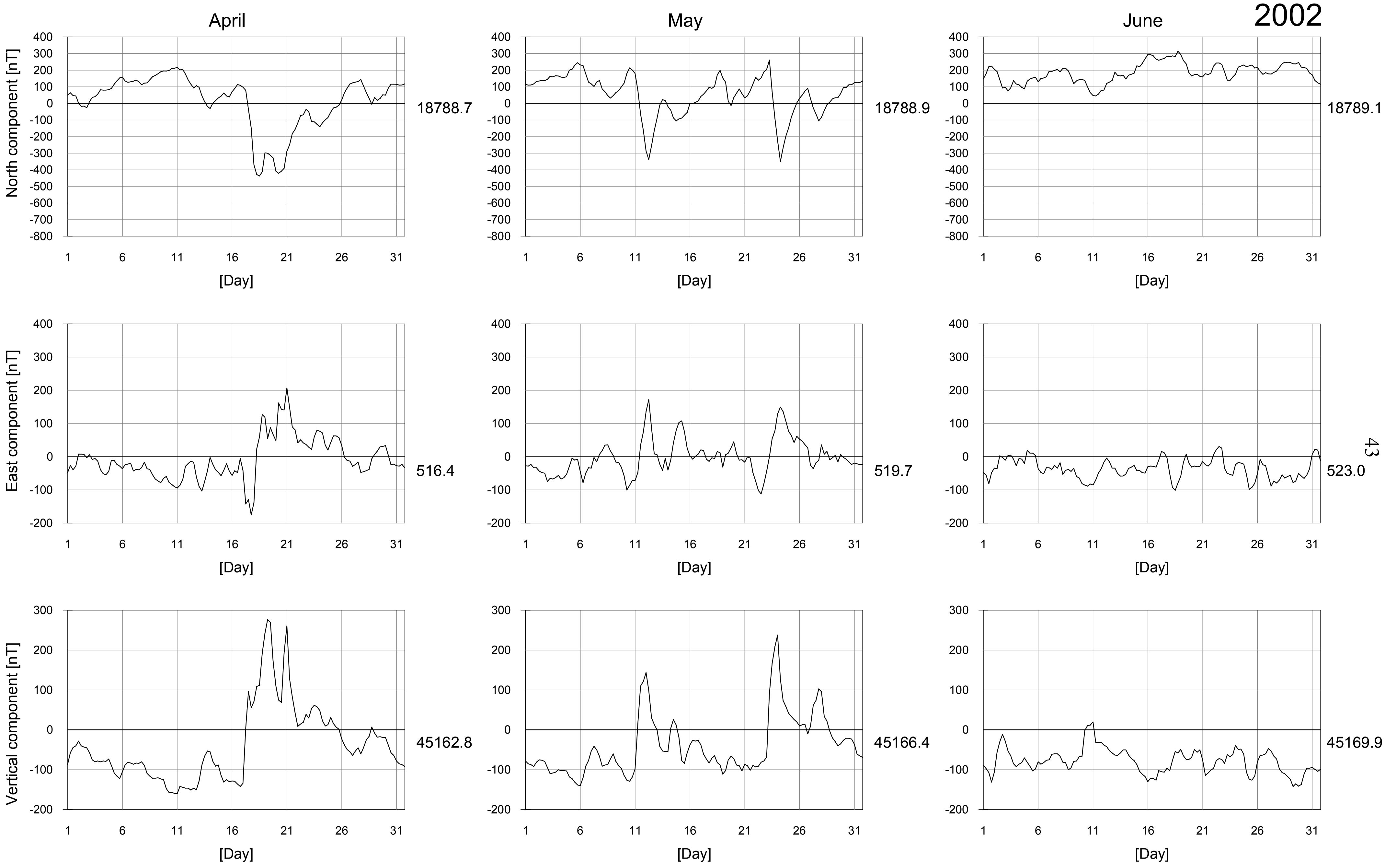
K	Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Σ
0		5	1	1	-	-	-	2	-	7	15	2	7	40
1		46	24	23	12	13	5	19	18	35	32	18	47	292
2		81	54	58	59	45	23	64	57	57	48	51	57	654
3		68	81	81	96	90	118	84	89	72	51	77	67	974
4		37	43	57	59	69	70	56	52	50	56	42	45	636
5		10	20	22	12	23	22	23	30	17	24	33	22	258
6		1	1	6	2	6	2	-	2	2	9	13	3	47
7		-	-	-	-	2	-	-	-	-	6	1	-	9
8		-	-	-	-	-	-	-	-	-	3	1	-	4
9		-	-	-	-	-	-	-	-	-	4	2	-	6

Deviations of the Magnetic Components from Normal Value



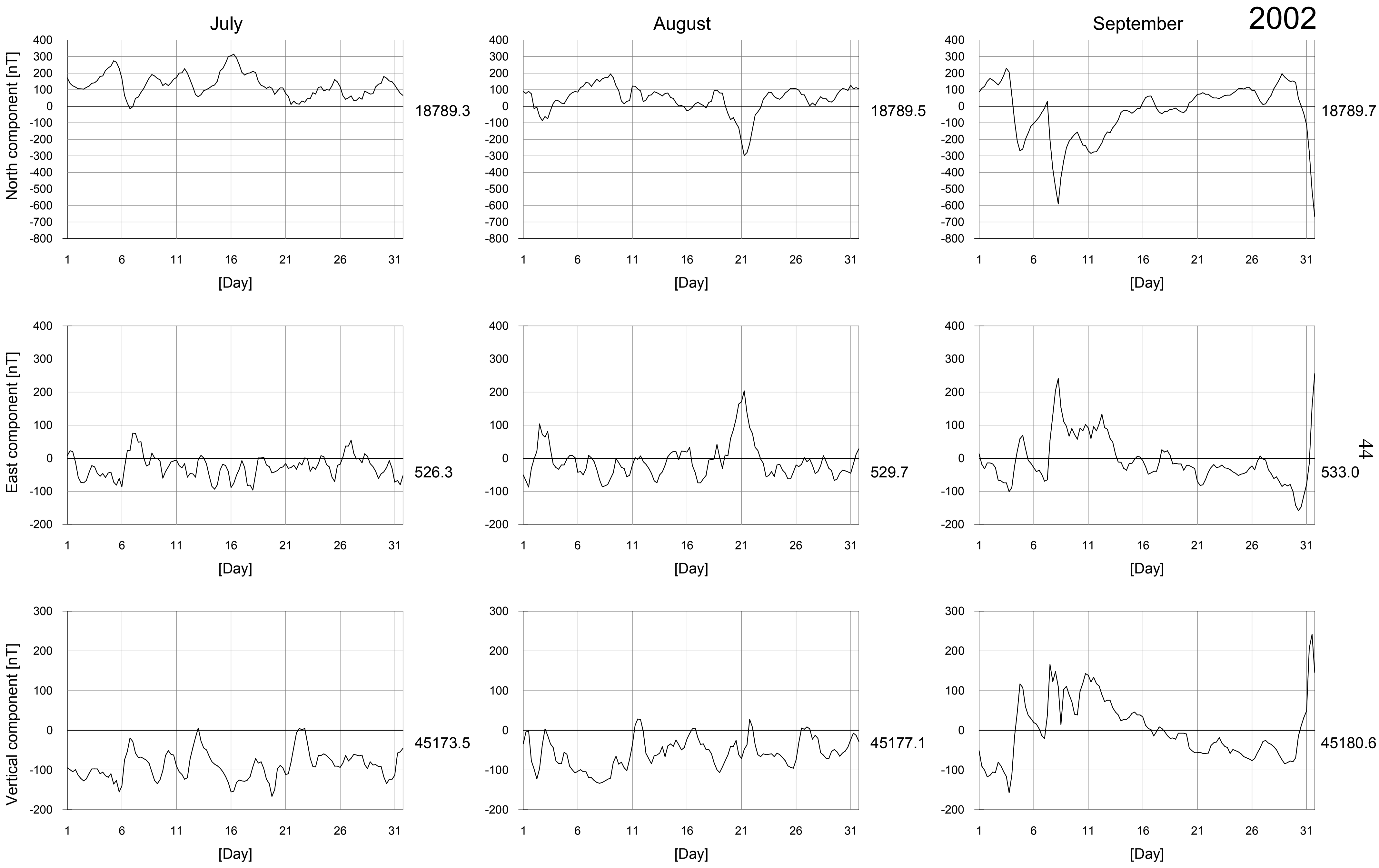
The values at the right margin apply to the middle of the month

Deviations of the Magnetic Components from Normal Value



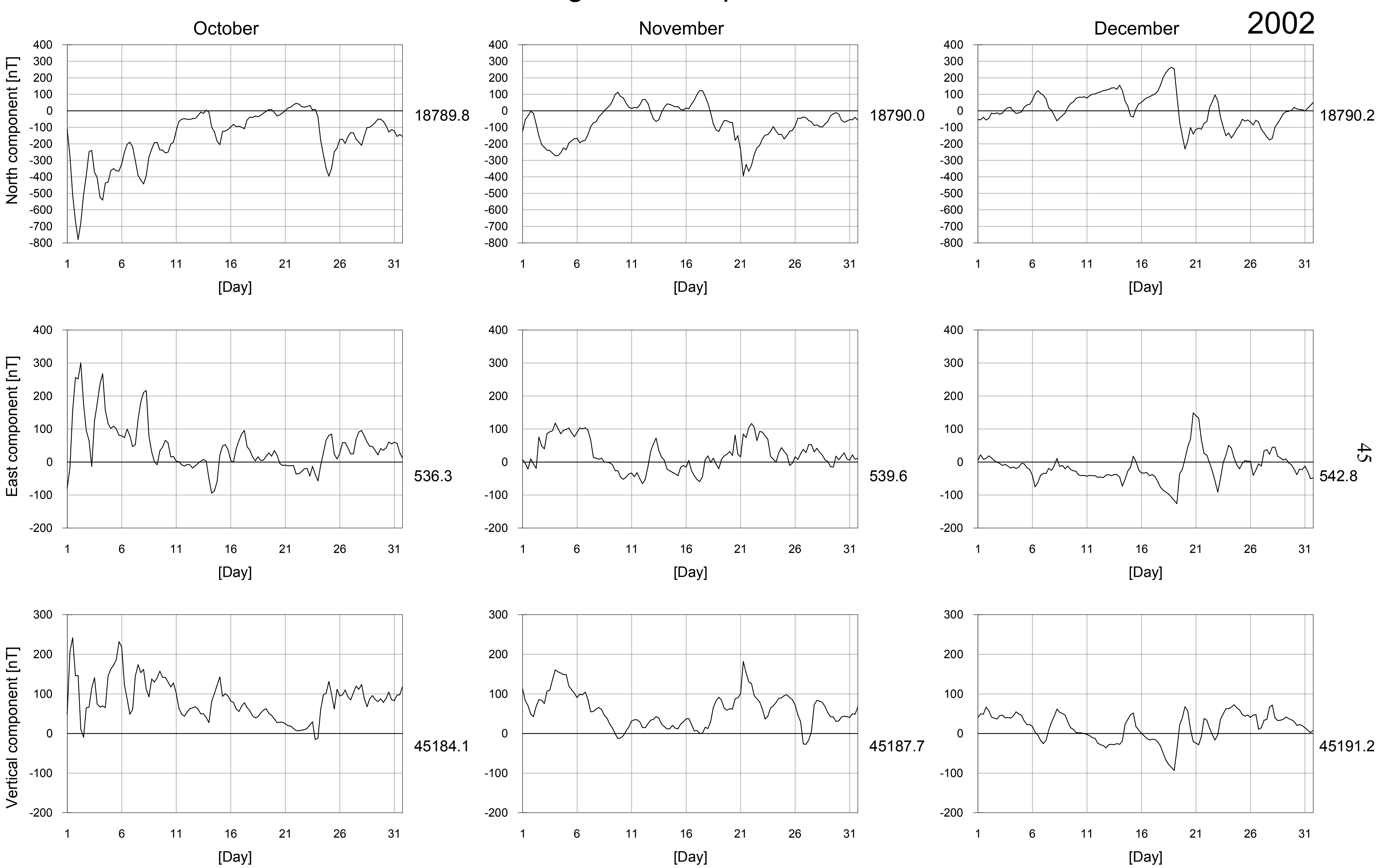
The values at the right margin apply to the middle of the month

Deviations of the Magnetic Components from Normal Value



The values at the right margin apply to the middle of the month

Deviations of the Magnetic Components from Normal Value



The values at the right margin apply to the middle of the month

Annual Mean Values of the Observatories
Potsdam (1890-1907), Seddin (1908-1931) and Niemegk (from 1932), referenced to Niemegk

Year	D	H	I	F	X	Y	Z
1890	-10° 57.3’	18731 nT	66° 29.0’	46942 nT	18390 nT	-3559 nT	43044 nT
1891	-10 50.8	18749	66 25.3	46873	18414	-3528	42959
1892	-10 44.8	18759	66 25.8	46914	18430	-3498	43000
1893	-10 39.9	18790	66 25.0	46966	18466	-3477	43044
1894	-10 34.0	18809	66 23.3	46959	18490	-3449	43028
1895	-10 28.5	18834	66 21.1	46954	18520	-3424	43011
1896	-10 22.9	18861	66 19.8	46976	18552	-3399	43024
1897	-10 18.3	18888	66 17.7	46982	18583	-3379	43018
1898	-10 13.6	18908	66 16.6	46999	18608	-3357	43028
1899	-10 09.3	18932	66 14.6	46993	18635	-3338	43011
1900	-10 04.9	18958	66 13.0	47008	18665	-3319	43016
1901	-10 00.7	18975	66 11.5	47006	18686	-3299	43006
1902	-9 56.6	18987	66 09.6	46977	18702	-3279	42969
1903	-9 52.4	18990	66 08.8	46959	18709	-3256	42948
1904	-9 48.0	18994	66 08.4	46957	18717	-3233	42943
1905	-9 43.1	18993	66 08.0	46942	18720	-3206	42928
1906	-9 38.2	18993	66 07.2	46916	18725	-3179	42900
1907	-9 32.6	18980	66 07.7	46900	18717	-3147	42888
1908	-9 26.6	18966	66 08.0	46875	18709	-3112	42867
1909	-9 19.3	18952	66 08.4	46855	18702	-3070	42850
1910	-9 11.6	18942	66 08.4	46828	18699	-3027	42826
1911	-9 03.1	18929	66 08.8	46808	18694	-2978	42809
1912	-8 54.6	18916	66 09.2	46788	18688	-2930	42794
1913	-8 45.2	18898	66 10.1	46772	18678	-2876	42784
1914	-8 35.4	18874	66 11.6	46758	18662	-2819	42780
1915	-8 25.9	18841	66 13.8	46743	18637	-2763	42778
1916	-8 16.3	18812	66 15.8	46737	18617	-2706	42783
1917	-8 07.1	18787	66 17.8	46734	18599	-2653	42791
1918	-7 58.1	18763	66 19.4	46724	18582	-2601	42792
1919	-7 48.6	18739	66 21.1	46715	18565	-2546	42792
1920	-7 38.5	18721	66 22.3	46708	18554	-2489	42792
1921	-7 27.8	18704	66 23.4	46700	18546	-2430	42791
1922	-7 16.7	18690	66 24.6	46701	18539	-2368	42798
1923	-7 05.9	18679	66 25.3	46697	18536	-2308	42799
1924	-6 54.1	18665	66 26.7	46706	18530	-2243	42815
1925	-6 42.0	18646	66 28.5	46714	18518	-2175	42831
1926	-6 29.6	18615	66 31.4	46729	18496	-2105	42861
1927	-6 18.2	18602	66 32.9	46742	18490	-2042	42880
1928	-6 06.9	18580	66 34.6	46740	18475	-1980	42888
1929	-5 56.4	18556	66 37.3	46766	18456	-1920	42927
1930	-5 45.9	18532	66 40.1	46791	18438	-1861	42965
1931	-5 36.2	18526	66 41.5	46820	18437	-1809	42999
1932	-5 25.7	18511	66 43.5	46848	18428	-1751	43035
1933	-5 16.1	18499	66 45.7	46884	18421	-1698	43080
1934	-5 05.2	18491	66 46.9	46905	18418	-1639	43106

Annual Mean Values Potsdam – Seddin – Niemegk (continued)

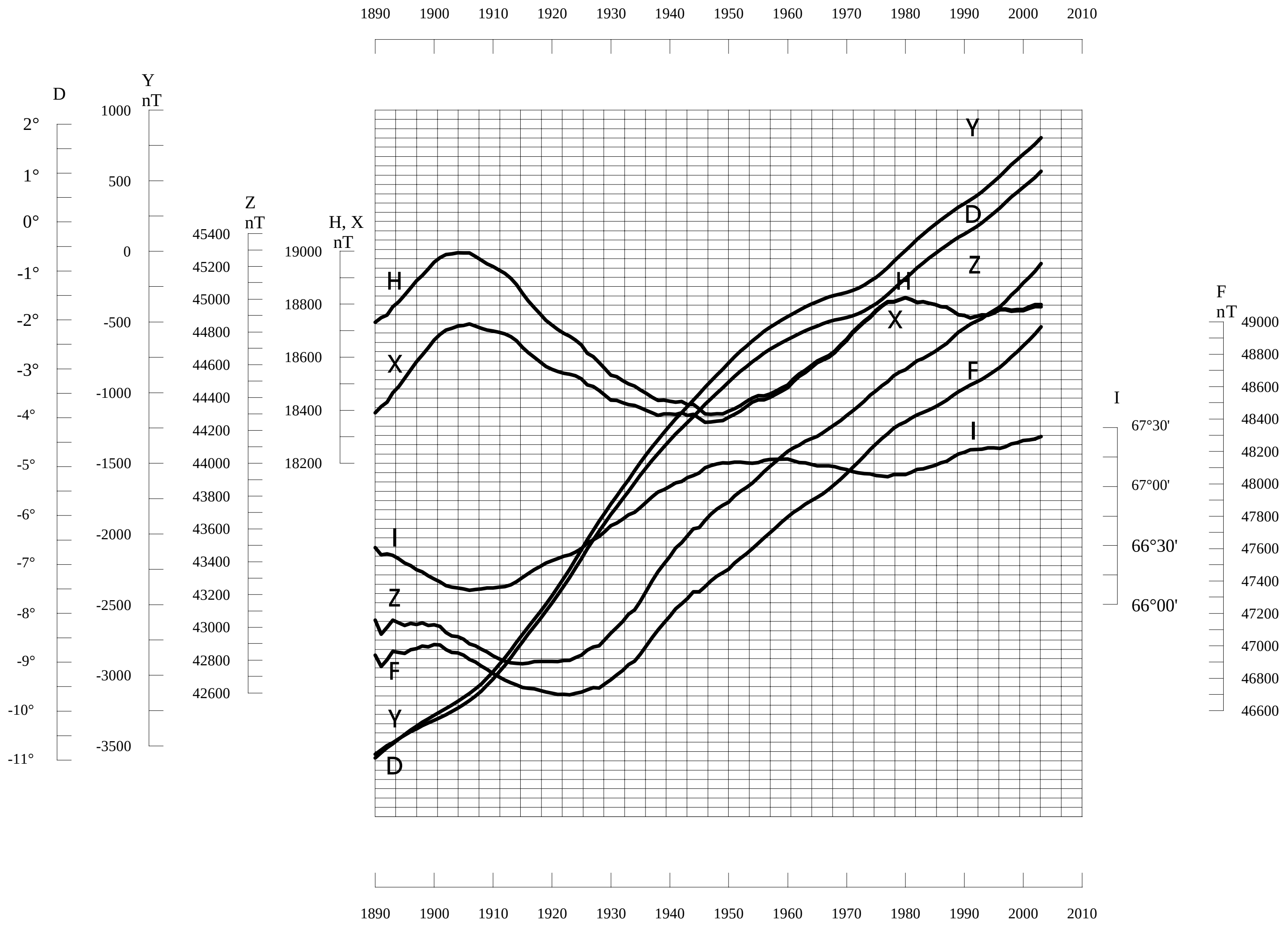
Year	D	H	I	F	X	Y	Z
1935	-4° 54.9’	18477 nT	66° 49.4’	46948 nT	18409 nT	-1583 nT	43159 nT
1936	-4 45.3	18464	66 52.1	46999	18400	-1531	43220
1937	-4 35.8	18449	66 54.8	47051	18390	-1478	43284
1938	-4 27.1	18437	66 57.3	47098	18381	-1431	43339
1939	-4 18.3	18438	66 58.5	47141	18386	-1384	43386
1940	-4 09.6	18434	67 00.1	47182	18386	-1337	43431
1941	-4 01.4	18430	67 01.9	47228	18384	-1293	43484
1942	-3 53.8	18433	67 02.6	47259	18390	-1252	43516
1943	-3 46.0	18421	67 04.6	47293	18381	-1210	43558
1944	-3 38.4	18422	67 05.7	47333	18385	-1169	43601
1945	-3 30.7	18405	67 07.0	47333	18370	-1127	43608
1946	-3 22.5	18386	67 09.6	47366	18354	-1082	43652
1947	-3 15.1	18385	67 10.7	47401	18356	-1043	43690
1948	-3 07.6	18387	67 11.5	47430	18359	-1003	43721
1949	-3 00.4	18386	67 12.1	47451	18361	-965	43744
1950	-2 53.1	18396	67 12.0	47472	18373	-926	43763
1951	-2 45.3	18406	67 12.4	47511	18385	-885	43801
1952	-2 38.4	18417	67 12.5	47541	18397	-848	43829
1953	-2 32.2	18433	67 12.1	47568	18414	-816	43852
1954	-2 25.9	18446	67 11.9	47599	18430	-782	43879
1955	-2 20.0	18455	67 12.3	47633	18439	-751	43913
1956	-2 14.1	18454	67 13.4	47666	18439	-720	43949
1957	-2 09.1	18461	67 13.8	47697	18448	-693	43980
1958	-2 04.6	18472	67 13.9	47730	18460	-669	44011
1959	-2 00.2	18484	67 14.0	47764	18472	-646	44042
1960	-1 55.9	18495	67 14.1	47796	18485	-623	44072
1961	-1 52.0	18518	67 13.2	47824	18508	-603	44094
1962	-1 48.2	18537	67 12.3	47847	18528	-583	44110
1963	-1 44.1	18551	67 12.1	47874	18542	-562	44134
1964	-1 40.8	18568	67 11.4	47895	18560	-544	44150
1965	-1 37.8	18586	67 10.6	47916	18579	-529	44164
1966	-1 34.7	18596	67 10.6	47939	18589	-512	44186
1967	-1 31.8	18606	67 10.6	47966	18599	-497	44211
1968	-1 29.8	18623	67 10.2	47997	18617	-486	44236
1969	-1 28.2	18647	67 09.3	48028	18641	-478	44260
1970	-1 26.3	18668	67 08.7	48064	18662	-468	44291
1971	-1 24.1	18695	67 07.7	48099	18690	-457	44317
1972	-1 21.2	18716	67 07.1	48134	18711	-442	44347
1973	-1 17.2	18736	67 06.6	48171	18732	-421	44378
1974	-1 12.5	18753	67 06.5	48211	18749	-396	44414
1975	-1 07.9	18777	67 05.7	48246	18773	-371	44442
1976	-1 02.1	18795	67 05.4	48280	18792	-340	44472
1977	-0 56.0	18810	67 05.1	48309	18807	-306	44497
1978	-0 48.5	18810	67 06.1	48343	18808	-266	44534
1979	-0 41.6	18817	67 06.2	48366	18816	-228	44556
1980	-0 35.0	18825	67 06.2	48382	18824	-192	44570

Annual Mean Values Potsdam – Seddin – Niemegk (continued)

Year	D	H	I	F	X	Y	Z
1981	-0° 28.1’	18817 nT	67° 07.4’	48406 nT	18816 nT	-154 nT	44598 nT
1982	-0 21.2	18807	67 08.8	48426	18806	-116	44625
1983	-0 15.0	18809	67 09.1	48440	18809	-82	44639
1984	-0 08.8	18804	67 10.0	48456	18804	-48	44659
1985	-0 03.1	18799	67 10.8	48474	18799	-17	44680
1986	0 02.6	18791	67 12.1	48495	18791	14	44707
1987	0 07.7	18789	67 12.9	48516	18789	42	44730
1988	0 13.0	18775	67 14.8	48543	18775	71	44765
1989	0 18.2	18760	67 16.7	48569	18760	99	44800
1990	0 22.4	18758	67 17.5	48589	18757	122	44822
1991	0 27.2	18748	67 18.8	48610	18748	148	44848
1992	0 31.6	18754	67 18.9	48627	18753	172	44865
1993	0 37.1	18760	67 19.0	48645	18759	203	44882
1994	0 43.4	18759	67 19.7	48669	18757	237	44909
1995	0 49.6	18768	67 19.8	48693	18766	271	44931
1996	0 56.1	18781	67 19.5	48719	18779	307	44953
1997	1 03.2	18782	67 20.4	48749	18779	346	44986
1998	1 10.5	18777	67 21.8	48784	18773	385	45026
1999	1 16.6	18780	67 22.4	48816	18775	419	45059
2000	1 23.1	18780	67 23.5	48853	18775	454	45099
2001	1 29.2	18790	67 23.8	48888	18784	488	45133
2002	1 35.8	18798	67 24.3	48926	18791	524	45170
2003	1 43.2	18798	67 25.5	48968	18790	565	45216

Niemegk Observatory

Secular Variation of the Geomagnetic Elements

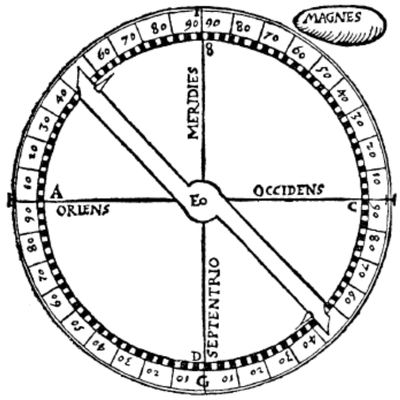


GeoForschungsZentrum Potsdam

Geomagnetic Results Wingst

2003

Yearbook No. 49



Potsdam 2007

Wingst Observatory: the Variation House and the NE azimuth mark in the background

Wingst Observatory: Absolute House

PVMs of type Askania/Varian (in the background on the right-hand side) and Zeiss/Magson (on the left-hand side); DI-flux of type Zeiss/Bartington in the foreground

Cover: Compass after Pierre de Maricourt, 1269 (SCHÜCK,1911)

Geomagnetic Results Wingst 2003 – Yearbook No 49

Günter Schulz

Contents

1 Introduction

This report (yearbook No 49) contains the results of Erdmagnetisches Observatorium Wingst (WNG) for 2003 [1]).

The enclosed CDrom contains recorded minute values as well as derived (hourly, daily, monthly) mean values and indices. It also provides recalculated epoch values from 1939.5 on and those of Marineobservatorium Wilhelmshaven (WLH) before then. Revised sets of monthly and daily mean values (since 1943) and K values (since 1944) are also included.

In the year under review, Wingst Observatory additionally published on a monthly basis:

a) Reports on geomagnetic indices and special geomagnetic events
b) Reports on preliminary daily and monthly means

Geomagnetic data have been provided on a regular basis to the following institutions:

a) International Space Environment Service (ISES): Geomagnetic indices and geomagnetic events (daily)

b) International Service of Geomagnetic Indices (ISGI): Geomagnetic indices and special geomagnetic events (monthly and annually)

c) World Data Centers for Geomagnetism: geomagnetic indices and one-minute values (annually)

d) INTERMAGNET (Global near-real-time magnetic observatory network): One-minute values (reported data via METEOSAT and Email, hourly; adjusted data via Email, on weekdays); Geomagnetic indices and one-minute values (CDrom, annually)

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[1] Reports up to 1999 were published by Bundesamt für Seeschiffahrt und Hydrographie. The last one (SCHULZ, 2004) contains a complete digital set of all data that have been published since the establishment of Wingst Observatory in 1938.

Indices and information about special events were made available through a telephone service on weekdays.

Phone: +49 4778 812152

The preliminary variations and indices can be found on the Internet on a real time basis (10 min updates) in graphical form:

http://www.gfz-potsdam.de/pb2/pb23/Wingst/Magnetogram/wingst_e.html

Definitive (compressed) data from 1939 onwards (minute values since 1981) can be found at:

ftp://ftp.bsh.de/outgoing/wng

Address:

Erdmagnetisches Observatorium
Am Olymp 13
D-21789 Wingst

Phone:+49 4778 81210
Fax: +49 4778 812150

Collaborators: W.D. Grube and A. Glodek.

2 General Remarks

Wingst Geomagnetic Observatory was established in 1938 as a successor to Wilhelmshaven. Since then, the station has been operated without interruption. The observatory's development is described by VOPPEL, 1988, and SCHULZ, 2001 (see also yearbook No 46, appendix 3). The development of the modern recording devices is given by SCHULZ, 1998. For the instrumentation since 1938, see also instr.txt on the Cdrom.

The observatory is located in the Lower Elbe area on top of a terminal moraine of the Saale glacial period (elevation 50 m). Its co-ordinates are:

	Latitude	Longitude
Geographic	53° 44.6'N	09° 04.4'E
Geomagnetic	54.2°	95.3°

Geomagnetic co-ordinates refer to International Geomagnetic Reference Field 'IGRF 10th' (TAKEDA et al., 2005)

The following abbreviations are used throughout this report:

X North component
Y East component
Z Vertical component (downward positive)
H Horizontal intensity
D Declination (eastward positive)
I Inclination (downward positive)
F Total intensity
U North-west component
V North-east component

Times are related to UTC (Co-ordinated Universal Time).

2.1 Recording systems

The results of this edition were derived from the following recording and software systems:

a) Digital system for variations:

Suspended fluxgate magnetometer (FM) of type FGE(DMI) (*U, V, Z*): One-minute and hourly means as well as indices of activity
Proton precession magnetometer (PPM) of type PPM105(EDA) (*F*): One minute spot values for quality check only

b) Visualisation software varplot.exe (BEBLO AND FELLER, 2002) for variations (*D, H, Z, F* and $c=F-(H^2+Z^2)^{1/2}$): Geomagnetic events (ssc, sfe, bay)

2.2 Levels, standards and constants

The results of this edition refer to the International Magnetic Standard (IMS). The results of the yearbooks up to and including 1980 referred to the Observatory Standard (OBS), which was represented by the classic type base line instruments bound to their original locations and surroundings.

H, *Z*, and *F* are referred to the proton vector magnetometer (PVM) of type ASKANIA/V4931(VARIAN) on pier NW (section 3.2), *D* to the fluxgate theodolite (DI-flux) of type 010B(ZEISS)/MAG01H(BARTINGTON) on pier NE (section 3.1) of the absolute house. Both instruments are assumed to represent IMS.

The following equations apply to *D* (see yearbook No 37, 1991), *H* and *Z* (see yearbook No 38, 1992):

$D_{OBS} = D_{IMS}$
$H_{OBS} = H_{IMS} + 6.7$ nT
$Z_{OBS} = Z_{IMS} + 11.1$ nT.

The differences for the derived elements depend on the components, i.e. for 2003:

$F_{OBS} = F_{IMS} + 12.8$ nT
$I_{OBS} = I_{IMS} - 0.15'$
$X_{OBS} = X_{IMS} + 6.7$ nT
$Y_{OBS} = Y_{IMS}$

The following physical standards are available at Wingst. They guarantee the quality of data:

SCHWILLE (frequency, DCF77, 10^{-8})
PATEK PHILIPPE and HOPF (UTC, DCF77)
CROPICO VS10 (Voltage, $5 \cdot 10^{-6}$)
GUILDLINE 100 Ohm (resistance, $5 \cdot 10^{-6}$)
Helmholtz coil of high precision (magnetic field strength, 10^{-4})

For the determination of the magnetic induction, the IAGA-recommended gyromagnetic constant (RASMUSSEN, 1991) was used:

$2\pi\tau^{-1} = 23.487203$ nT s

The azimuth marks were last checked by the German Geodetic Survey in 1995. Their values, related to the NE pier (R: 3504926.873, H: 5956702.028), and their deviations in the year under review are:

Azimuth mark	Azimuth	Deviation against
N	11°38.36’	N
NE	13° 23.19’	(-0.23 ±0.09)’
W	308° 42.94’	(-0.04 ±0.03’)

While the differences between the N and W azimuth mark proved to be small and stable, the NE azimuth mark showed an increasing eastward drift during the last few months of the year under review. Therefore, the bearings of the NE azimuth mark were no longer taken into account. This means that *D* may have been reported with an error of some +0.05’ towards east in the preceding years.

2.3 Special measurements

In the year under review, no comparative measurements were carried out.

3 Absolute measurements

The absolute measurements were reduced according to the variations of the digital system (section 4).

3.1 Declination and Inclination

Absolute measurements of *D* were made with the *DI*-flux on an approximately monthly basis. Also the determination of *I* was included in the measurement routine. Each measurement is based on a set of four positions. *I* was corrected by the pier difference of -0.2’ in the sense of NW minus NE. The differences $E=I\text{-arctg}(Z/H)$ are shown in Table 1.

Additionally, relative measurements of *D* were carried out with the PVM according to the addition field method (Serson) on a weekly basis. The mean difference in the sense of PVM minus DI-flux of all pairs of measurements carried out on the same day was used as an instrument constant. Its value e is as follows:

e = -23.93’ (13 measurements).

3.2 Horizontal intensity, vertical component and total intensity

Absolute measurements of *H* were carried out with the PVM according to the addition field method (Serson) and *Z* according to the compensation field method (Nelson) after each relative determination of *D.*

The magnetic induction vector is over-determined due to the measurement of three elements within the meridian plane. The difference $c=F-(H^2+Z^2)^{1/2}$ represents the measurements' inherent accuracy. The annual mean of the error *C* amounted to:

+0.6 nT ± 0.2 nT value (54 measurements).

C is shown in Table 1.

At the beginning of the year under review, the PPM of type V75 (VARIAN) was replaced by the PPM of type PPM105 (EDA). See also appendix 3.

4 Digital recording system

Minute mean values of the orthogonal components *U*, *V*, and *Z* as well as spot values of *F* were acquired by the primary digital system (PPM105 and FGE (No 125), section 2.1). The PPM is not only part of the recording system but also serves as an indicator of the PVM (section 3).

Owing to over-determination, outliers, jumps and short-term base line instabilities between the dates of absolute measurements of all three components could be detected (section 4.1) and, under certain conditions, automatically eliminated. The following equation applies to Wingst:

$dF = 0.26\, dU + 0.26\, dV + 0.93\, dZ.$

Additionally, a forth fluxgate was operated, which had been aligned in such a way that its W orientation satisfies the following equation:

$dW = 0.578(dU + dV + dZ).$

In this way, jumps and outliers of the secondary system could be monitored independently.

A second suspended FM of type FGE (No 126), an FM of type EDA FM100B and a PPM of type GSM19(GEM) were operated as stand-by devices in case of failure of the primary system.

4.1 Base line values

Table 1 shows the base line values of the FGE125 referred to IMS. Fig 1 shows the results in graphical form. Absolute measurements of *D* and *I* (DI-flux) are marked by circles, those of *H* and *Z* (PVM) as well as relative measurements of *D* by dots. *I* (derived from *H* and *Z*) is also displayed (dots).

To obtain base line values, the dependence of the measured elements *D*, *H, I* and *F* on the recorded components *U*, *V*, and *Z* within the range of variations was developed up to terms of second order (see yearbook No 46, 2000, appendix 3). Minute mean values of the magnetometer and the baseline instruments were processed, which had been synchronized within ±5 s.

For 2003, the base line values of the primary components refer to the following equivalent voltages *E* of the fluxgate compensation fields:

Component	*E* in mV (nominal)
U	12861
V	12613
Z	45463

4.2 Scale values, temperature coefficients and cross talk

Scale values and cross talk were traced back to the respective parameters of the old FM100C(EDA) system by employing stochastic methods, making use of strong variations during a substorm on April 7, 1995 (SCHULZ, 1998). The following values apply to the primary components (FGE125):

	Scale Values in nT/mV 1.000+	Cross Talk against FM100C in 10^{-3}	
U	$+10^{-3}(1.4 \pm 0.6)$	*V*: +0.2±1.0	*Z*: +0.9±0.6
V	$-10^{-3}(1.5 \pm 0.8)$	*U*: -0.7±0.6	*Z*: -0.5±0.4
Z	$+10^{-3}(0.8 \pm 0.6)$	*U*: -0.6±0.4	*V*: -1.2±0.8

Considering the respective values of the FM100C (see yearbook No 41, 1995), the absolute misalignments and errors of the scale values of the FGE125 fluxgates probably do not exceed the order of magnitude of 10^{-3}.

Temperature coefficients were neglected because the FGE double system had been installed in the old variometer room (SCHULZ 2001) with almost perfect temperature control (contact thermometers, ±0.03°C).

5 Data processing

The base line values (Tables 1) were smoothed by Bathspline approximation in steps of 0.01‘ for *D* or 0.1 nT for *H* and *Z*, respectively (SCHOTT, 1992).

Hourly mean values were formed using 60 minute mean values of *U*, *V*, and *Z* (taken at minutes 00 to 59 UTC and centred at second 30) as well as 60 F spot values (taken at second 05).

The international quiet (*Q*) and disturbed (*D*) days were taken from the Niemegk listings of ISGI. *A* denotes normal days. In the case of averaging, *A* means that all days of the month or the year, respectively, have been included.

The data were processed by a computer double system of type HP9000 330/360. Each workstation is connected to a data acquisition unit of type HP3852 and to the Internet. All necessary calculations including those for the yearbook were carried out by the workstation of type HP9000 360.

6 Indices

The indices presented in this edition (File wng03.k and Table 4) indicate the local disturbances of the geomagnetic field resulting from particle radiation. Their meaning in detail:

K: geomagnetic three-hourly index, quasi-logarithmic measure of the maximum disturbance in steps of 0 to 9; lower limit for *K* = 9: 500 nT

sum: Sum of the eight three-hourly indices of a day

Ak: Mean value of the equivalent amplitudes derived from the eight three-hourly indices, measured in units of 2 nT.

Ck: daily character figure derived from *Ak* and scaled from 0.0 to 2.5.

C: estimated daily character figure; scale: 0, 1, 2

The indices were derived using the IAGA-recommended FMI-routine (Häkkinen, 1992).

7 Files on the CDrom

\wingst	*Wingst root directory, containing the following subdirectories and files*
tree_03.txt:	File structure
yearb03\\:	
yearb03\instr.txt:	Instruments used since 1938
data03\\:	*Directory containing the following data*
data03\wlh+wng.yr:	Updated epoch values WLH and WNG (*D* and *I* in 0.1'; F, H, X, Y and Z in nT)
data03\wng.mon:	Updated monthly mean values WNG (since 1943; *D* and *I* in 0.1'; *F*, *H*, *X*, *Y*, and *Z* in nT)
data03\wng.day:	Updated daily mean values WNG (since 1943; *D* and *I* in 0.1'; *F*, *H*, *X*, *Y*, and *Z* in nT)
data03\wng.k:	Updated activity figures *K*, *Ak*, *Ck*, and *C* as well as monthly and annual mean values of *Ak*, *Ck,* and and *C* (since 1944)
data03\iaga03\\:	*Directory containing the following data in the IAGA2000 format (TAKEDA et al., 2005). See also* http://www.ngdc.noaa.gov/IAGA/vdat/iagaformat.html
data03\iaga03\YR.WNG:	Epoch values WNG 1939 – 1979: D and I in 0.1'; *X, Y, Z, H* and *F* in nT; from 1980 onward: 0.01' or 0.1 nT, respectively
data03\iaga03\2003MT.WNG:	Monthly means (*D* and *I* in 0.01'; *X, Y, Z, H* and *F* in 0.1 nT)
data03\iaga03\2003DY.WNG:	Daily means (*D* and *I* in 0.01'; *X, Y, Z, H* and *F* in 0.1 nT)
data03\iaga03\2003mmHR.WNG:	Hourly means (*F, X, Y* and *Z* in 0.1 nT) of the month mm
data03\iaga03\2003mmMN.WNG:	Minute means (*F, X, Y* and *Z* in 0.1 nT) of the month mm

8 References

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Appendix 1 and 2: Figures and Tables

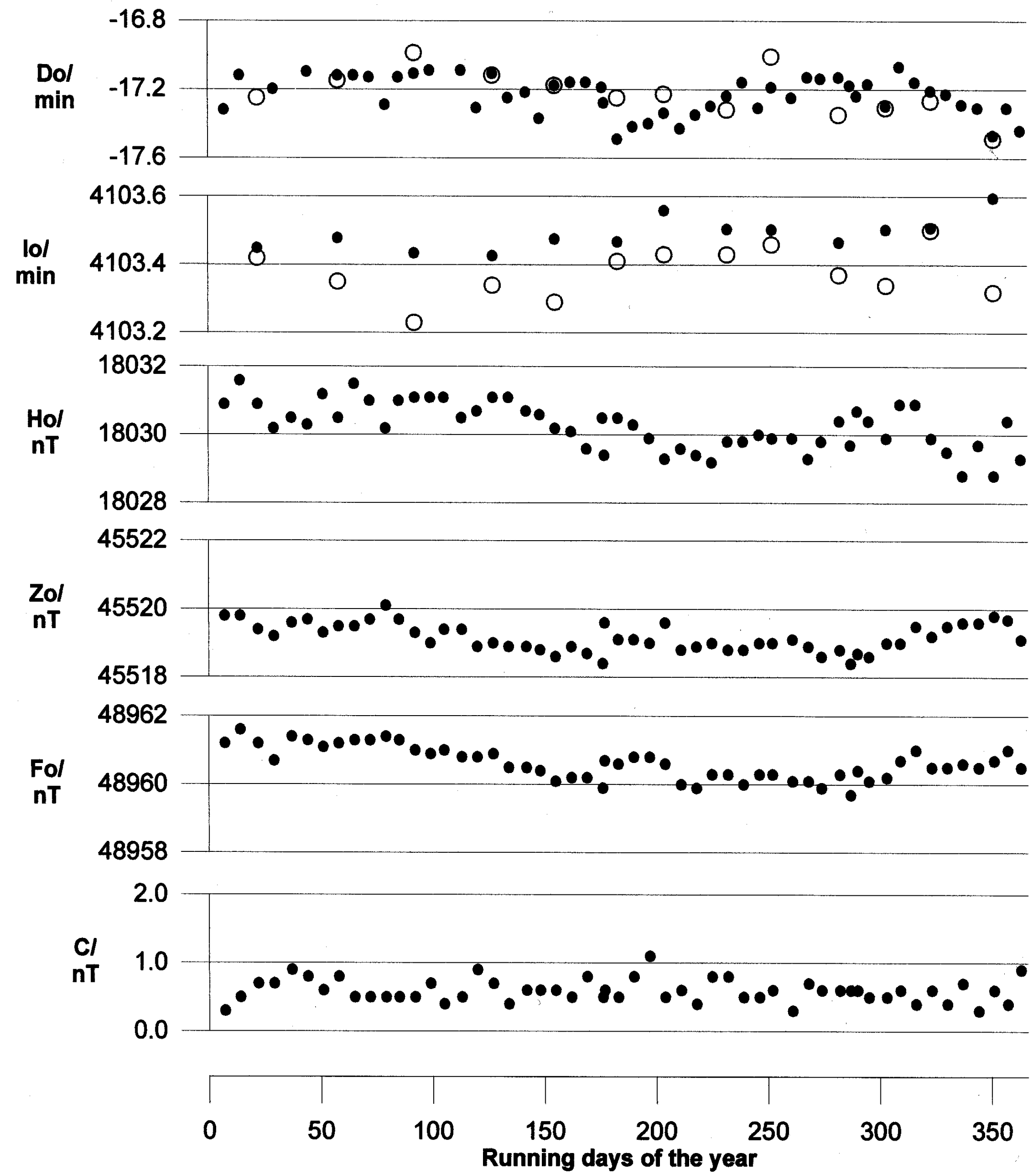

Fig. 1

Wingst 2003 Base line values of the fluxgate system FGE125, IMS

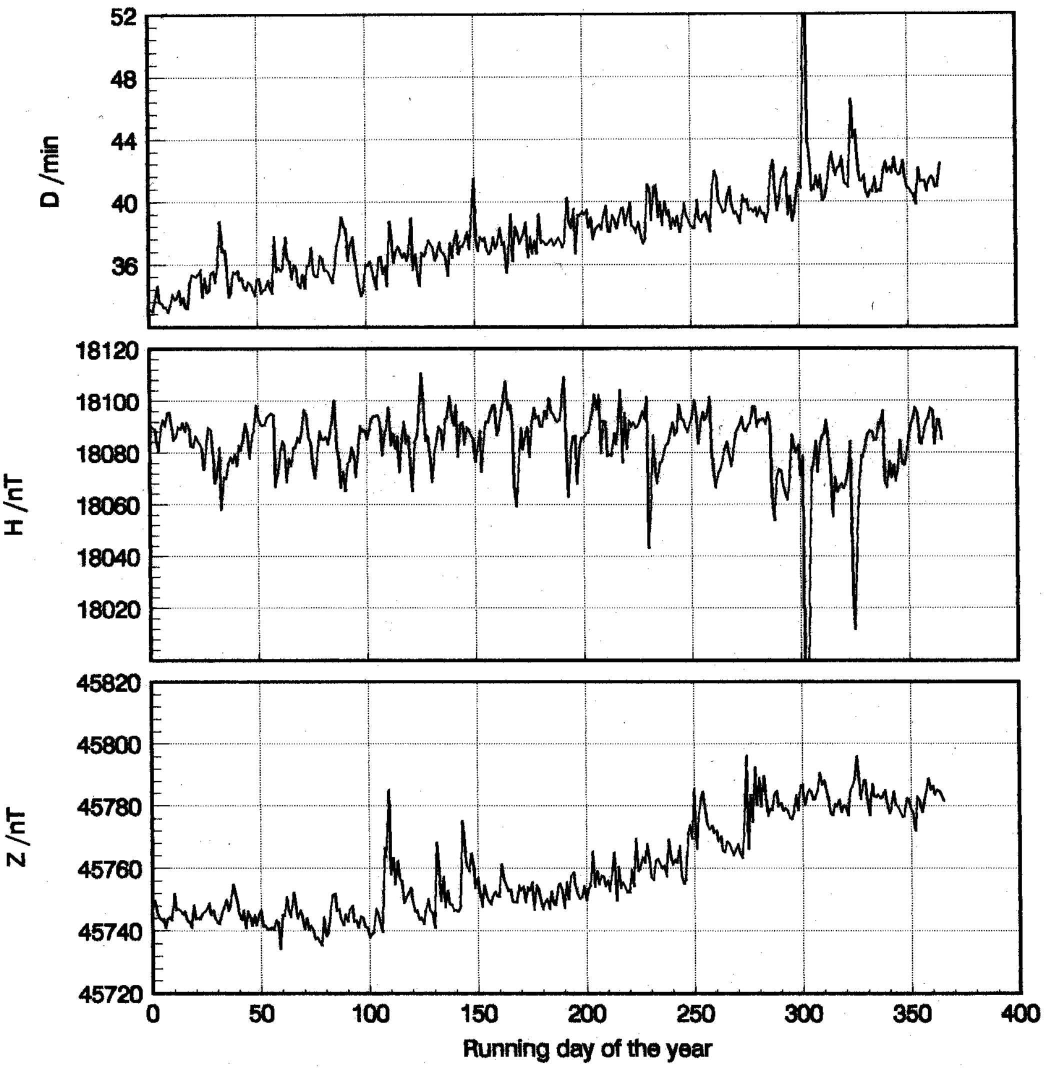

Fig. 2

Wingst 2003 Daily mean values D, H and Z

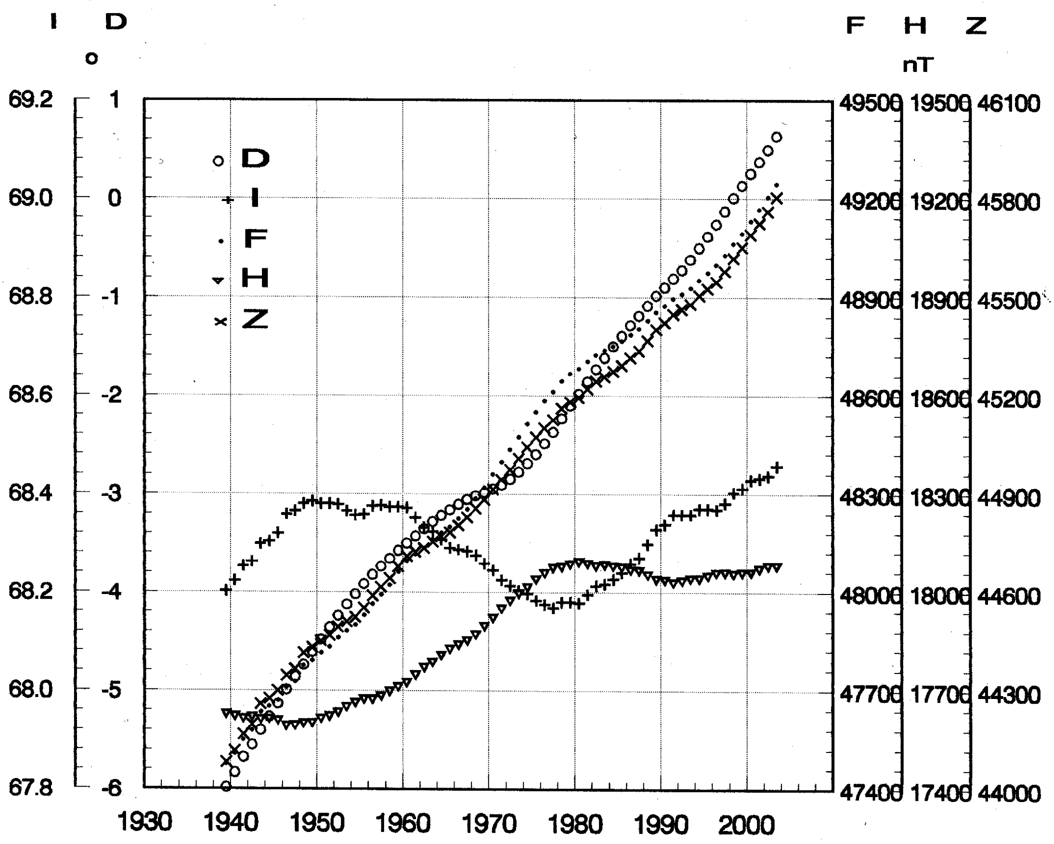

Fig. 3

Wingst Epoch values I, D, F, H and Z

```
wingst\
        tree_03.txt

        yearb03\

                instr.txt
        data03\
                wlh+wng.yr
                wng.mon
                wng.day
                wng.k

                iaga03\
                        YR.WNG
                        2003MT.WNG
                        2003DY.WNG
                        200301MN.WNG
                        .
                        200312MN.WNG
                        200301HR.WNG
                        .
                        200312HR.WNG
```

Fig. 4

Structure of the file set on CDrom

Wingst 2003

Base-line measurements, system FGE125, IMS

Month	day	Do(abs)	Do(rel)	Io	Fo nT	Ho nT	Zo nT	C	E
Jan.	7		-0°17.32'		48961.2	18030.9	45519.8	+0.3	
	14		-0 17.12		48961.6	18031.6	45519.8	+0.5	
	22	-0°17.25'	-0 17.05	+68°23.42'	48961.2	18030.9	45519.4	+0.7	-0.03'
	29		-0 17.20		48960.7	18030.2	45519.2	+0.7	
Feb.	6		-0 16.96		48961.4	18030.5	45519.6	+0.9	
	13		-0 17.10		48961.3	18030.3	45519.7	+0.8	
	20		-0 17.04		48961.1	18031.2	45519.3	+0.6	
	27	-0 17.15	-0 17.12	+68 23.35	48961.2	18030.5	45519.5	+0.8	-0.12
March	6		-0 17.12		48961.3	18031.5	45519.5	+0.5	
	13		-0 17.13		48961.3	18031.0	45519.7	+0.5	
	20		-0 17.29		48961.4	18030.2	45520.1	+0.5	
	26		-0 17.13		48961.3	18031.0	45519.7	+0.5	
April	2	-0 16.99	-0 17.11	+68 23.23	48961.0	18031.1	45519.3	+0.5	-0.20
	9		-0 17.09		48960.9	18031.1	45519.0	+0.7	
	15		-0 17.06		48961.0	18031.1	45519.4	+0.4	
	23		-0 17.09		48960.8	18030.5	45519.4	+0.5	
	30		-0 17.31		48960.8	18030.7	45518.9	+0.9	
May	7	-0 17.12	-0 17.11	+68 23.34	48960.9	18031.1	45519.0	+0.7	-0.08
	14		-0 17.25		48960.5	18031.1	45518.9	+0.4	
	22		-0 17.22		48960.5	18030.7	45518.9	+0.6	
	28		-0 17.37		48960.4	18030.6	45518.8	+0.6	
June	4	-0 17.18	-0 17.18	+68 23.29	48960.1	18030.2	45518.6	+0.6	-0.18
	11		-0 17.16		48960.2	18030.1	45518.9	+0.5	
	18		-0 17.16		48960.2	18029.6	45518.7	+0.8	
	25		-0 17.19		48959.9	18030.5	45518.4	+0.5	
	26		-0 17.28		48960.7	18029.4	45519.6	+0.6	
July	2	-0 17.25	-0 17.49	+68 23.41	48960.6	18030.5	45519.1	+0.5	-0.05
	9		-0 17.42		48960.8	18030.3	45519.1	+0.8	
	16		-0 17.40		48960.8	18029.9	45519.0	+1.1	
	23	-0 17.23	-0 17.34	+68 23.43	48960.6	18029.3	45519.6	+0.5	-0.12
	30		-0 17.43		48960.0	18029.6	45518.8	+0.6	
Aug.	6		-0 17.35		48959.9	18029.4	45518.9	+0.4	
	13		-0 17.30		48960.3	18029.2	45519.0	+0.8	
	20	-0 17.32	-0 17.24	+68 23.43	48960.3	18029.8	45518.8	+0.8	-0.07
	27		-0 17.16		48960.0	18029.8	45518.8	+0.5	
Sep.	3		-0 17.31		48960.3	18030.0	45519.0	+0.5	
	9	-0 17.01	-0 17.19	+68 23.46	48960.3	18029.9	45519.0	+0.6	-0.04
	18		-0 17.25		48960.1	18029.9	45519.1	+0.3	
	25		-0 17.13		48960.1	18029.3	45518.9	+0.7	
Oct.	1		-0 17.14		48959.9	18029.8	45518.6	+0.6	
	9	-0 17.35	-0 17.13	+68 23.37	48960.3	18030.4	45518.8	+0.6	-0.09
	14		-0 17.18		48959.7	18029.7	45518.4	+0.6	
	17		-0 17.24		48960.4	18030.7	45518.7	+0.6	
	22		-0 17.17		48960.1	18030.4	45518.6	+0.5	
	30	-0 17.31	-0 17.30	+68 23.34	48960.2	18029.9	45519.0	+0.5	-0.16
Nov.	5		-0 17.07		48960.7	18030.9	45519.0	+0.6	
	12		-0 17.16		48961.0	18030.9	45519.5	+0.4	
	19	-0 17.27	-0 17.21	+68 23.50	48960.5	18029.9	45519.2	+0.6	-0.01
	26		-0 17.23		48960.5	18029.5	45519.5	+0.4	
Dec.	3		-0 17.29		48960.6	18028.8	45519.6	+0.7	
	10		-0 17.31		48960.5	18029.7	45519.6	+0.3	
	17	-0 17.49	-0 17.47	+68 23.32	48960.7	18028.8	45519.8	+0.6	-0.27
	23		-0 17.31		48961.0	18030.4	45519.7	+0.4	
	29		-0 17.44		48960.5	18029.3	45519.1	+0.9	

Table 1 Wingst 2003 base line values of the fluxgate system FGE125

Wingst (WNG)
Geographic Coordinates: 53.743³ N 9.073³ E

2003

Monthly mean values, IMS

D: disturbed, Q: quiet, A: all days

Month		D	F nT	H nT	I	X nT	Y nT	Z nT
Jan	A	34.2'	49226	18086	68°26.7'	18085	180	45783
Feb	A	35.2	49229	18083	68 27.0	18082	185	45788
Mar	A	36.0	49231	18082	68 27.1	18081	189	45790
Apr	A	36.2	49234	18085	68 26.9	18084	191	45792
May	A	37.1	49237	18087	68 26.9	18086	195	45794
Jun	A	37.4	49246	18089	68 27.0	18088	197	45803
Jul	A	38.3	49247	18090	68 27.0	18089	201	45805
Aug	A	39.0	49250	18085	68 27.4	18083	205	45810
Sep	A	39.4	49252	18087	68 27.3	18086	207	45811
Oct	A	41.2	49252	18072	68 28.4	18071	216	45816
Nov	A	41.8	49268	18073	68 28.8	18071	220	45833
Dec	A	41.4	49267	18085	68 27.9	18084	218	45827
Mean	A	38.1	49245	18084	68 27.4	18083	200	45804
Jan	Q	33.4	49227	18092	68 26.2	18091	176	45781
Feb	Q	34.7	49229	18091	68 26.3	18090	183	45784
Mar	Q	35.4	49233	18092	68 26.4	18091	186	45789
Apr	Q	35.6	49236	18090	68 26.6	18089	187	45792
May	Q	36.1	49237	18094	68 26.4	18093	190	45792
Jun	Q	37.4	49247	18096	68 26.5	18095	197	45802
Jul	Q	38.0	49248	18096	68 26.5	18095	200	45802
Aug	Q	38.4	49253	18092	68 26.9	18091	202	45810
Sep	Q	39.0	49253	18092	68 26.9	18091	205	45810
Oct	Q	39.4	49254	18091	68 27.0	18090	208	45811
Nov	Q	40.6	49267	18088	68 27.7	18087	213	45827
Dec	Q	40.7	49267	18094	68 27.2	18093	214	45825
Mean	Q	37.4	49246	18092	68 26.7	18091	197	45802
Jan	D	35.1	49225	18078	68 27.2	18077	184	45785
Feb	D	37.0	49228	18069	68 28.0	18068	195	45792
Mar	D	37.7	49231	18069	68 28.1	18068	198	45795
Apr	D	37.0	49231	18078	68 27.4	18077	194	45792
May	D	38.5	49236	18080	68 27.4	18078	203	45797
Jun	D	37.6	49239	18077	68 27.7	18076	198	45801
Jul	D	38.3	49245	18077	68 27.8	18076	201	45806
Aug	D	40.0	49251	18068	68 28.7	18067	210	45817
Sep	D	40.6	49251	18075	68 28.2	18073	213	45814
Oct	D	47.0	49233	18014	68 32.3	18012	246	45819
Nov	D	43.3	49273	18056	68 30.1	18055	227	45845
Dec	D	42.1	49266	18072	68 28.8	18070	221	45832
Mean	D	39.5	49242	18068	68 28.5	18066	208	45808

Table 2 Monthly and annual mean values 2003

Wingst (WNG) annual mean values (IMS)

Geographic Coordinates: 53.743°N 9.073°E

Epoch	D	F	H	I	X	Y	Z
		nT	nT		nT	nT	nT
1939.5	-5³59.1'	47476	17630	68³12.1'	17534	-1838	44081
1940.5	-5 50.2	47506	17624	68 13.4	17533	-1792	44116
1941.5	-5 40.8	47550	17617	68 15.2	17530	-1744	44166
1942.5	-5 33.1	47579	17622	68 15.7	17540	-1705	44196
1943.5	-5 24.2	47634	17614	68 18.0	17535	-1659	44259
1944.5	-5 16.2	47652	17616	68 18.3	17541	-1618	44276
1945.5	-5 8.2	47671	17611	68 19.2	17540	-1577	44299
1946.5	-4 59.6	47708	17595	68 21.5	17528	-1532	44346
1947.5	-4 51.7	47726	17596	68 22.0	17532	-1491	44365
1948.5	-4 44.4	47775	17602	68 22.9	17541	-1454	44415
1949.5	-4 36.6	47791	17604	68 23.2	17547	-1415	44431
1950.5	-4 29.1	47814	17617	68 22.9	17562	-1378	44451
1951.5	-4 21.5	47832	17624	68 22.8	17573	-1339	44468
1952.5	-4 14.5	47861	17636	68 22.7	17587	-1304	44494
1953.5	-4 7.6	47882	17653	68 22.0	17607	-1270	44510
1954.5	-4 1.3	47899	17666	68 21.5	17623	-1239	44523
1955.5	-3 55.1	47930	17676	68 21.6	17634	-1208	44552
1956.5	-3 49.3	47964	17676	68 22.6	17636	-1178	44589
1957.5	-3 44.2	47993	17686	68 22.6	17648	-1152	44616
1958.5	-3 39.5	48023	17700	68 22.4	17663	-1129	44643
1959.5	-3 34.6	48062	17714	68 22.4	17679	-1105	44679
1960.5	-3 30.1	48095	17727	68 22.4	17693	-1082	44710
1961.5	-3 25.7	48117	17751	68 21.1	17719	-1061	44723
1962.5	-3 21.3	48136	17773	68 20.0	17742	-1040	44735
1963.5	-3 16.9	48160	17789	68 19.4	17760	-1018	44755
1964.5	-3 13.1	48183	17810	68 18.4	17782	-1000	44771
1965.5	-3 9.6	48201	17829	68 17.5	17802	-983	44783
1966.5	-3 6.3	48226	17842	68 17.3	17815	-966	44805
1967.5	-3 3.4	48254	17855	68 17.1	17829	-952	44830
1968.5	-3 1.0	48286	17874	68 16.5	17849	-941	44857
1969.5	-2 59.2	48320	17899	68 15.5	17874	-932	44883
1970.5	-2 56.9	48359	17924	68 14.7	17900	-922	44915
1971.5	-2 54.5	48397	17953	68 13.6	17930	-911	44944
1972.5	-2 51.0	48434	17977	68 12.9	17954	-894	44975
1973.5	-2 46.6	48473	17999	68 12.2	17978	-872	45008
1974.5	-2 41.4	48513	18018	68 11.9	17998	-846	45043
1975.5	-2 36.0	48549	18043	68 11.0	18024	-818	45073
1976.5	-2 29.3	48583	18062	68 10.5	18045	-784	45101
1977.5	-2 22.4	48612	18078	68 10.1	18062	-748	45126
1978.5	-2 14.1	48646	18081	68 10.9	18066	-705	45161
1979.5	-2 6.3	48668	18089	68 10.9	18076	-664	45181
1980.5	-1 59.0	48682	18096	68 10.7	18085	-626	45194
1981.5	-1 51.4	48704	18091	68 11.7	18082	-586	45220
1982.5	-1 43.9	48724	18084	68 12.8	18076	-546	45244
1983.5	-1 36.9	48738	18087	68 13.0	18080	-510	45257
1984.5	-1 29.9	48752	18083	68 13.7	18077	-473	45274
1985.5	-1 23.5	48768	18080	68 14.4	18075	-439	45292
1986.5	-1 17.0	48787	18071	68 15.5	18067	-404	45316
1987.5	-1 11.1	48804	18069	68 16.2	18065	-374	45336
1988.5	-1 5.0	48829	18056	68 17.9	18053	-341	45368
1989.5	-59.0	48856	18042	68 19.7	18039	-309	45402
1990.5	-53.9	48875	18041	68 20.3	18038	-283	45423
1991.5	-48.5	48895	18032	68 21.5	18031	-255	45448
1992.5	-43.4	48911	18038	68 21.5	18037	-228	45463
1993.5	-37.1	48928	18044	68 21.6	18043	-195	45479
1994.5	-30.0	48952	18045	68 22.2	18044	-158	45505
1995.5	-23.0	48975	18053	68 22.2	18053	-121	45526
1996.5	-15.6	48998	18062	68 22.1	18062	-82	45547
1997.5	-7.6	49028	18063	68 22.9	18063	-40	45579
1998.5	0.5	49062	18059	68 24.2	18059	3	45618
1999.5	8.0	49094	18063	68 24.7	18063	42	45651
2000.5	15.4	49132	18064	68 25.7	18064	81	45690
2001.5	22.5	49167	18075	68 25.9	18074	118	45724
2002.5	29.8	49204	18084	68 26.2	18083	157	45761
2003.5	38.1	49245	18084	68 27.4	18083	200	45804

Table 3 Wingst Epoch values from 1939 to 2003

Wingst (WNG)
Geographic Coordinates: 53.743°N 9.073°E

2003

Absolute and relative Frequencies of the Three-hourly Index K

K	UTC 0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24
0	24	24	7	7	2	12	10	14
1	59	63	103	76	61	59	51	38
2	100	117	135	123	128	105	95	104
3	100	107	81	116	102	93	106	95
4	53	34	28	33	49	58	48	78
5	19	16	9	7	14	25	42	27
6	7	5	2	4	9	10	8	7
7	3	0	1	0	1	3	4	0
8	0	0	0	0	0	0	1	0
9	1	0	0	0	0	1	1	3

Absolute Number of Days during the Year for a given K

K	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
0	13	8	19	7	1	1	0	7	7	7	10	20	100
1	41	38	62	38	19	30	27	34	25	55	56	85	510
2	81	63	78	81	100	71	76	77	77	68	56	79	907
3	62	57	70	71	71	74	79	74	67	67	60	48	800
4	33	40	16	33	37	41	34	33	40	28	34	12	381
5	14	23	3	6	16	16	20	17	14	9	17	4	159
6	4	3	0	0	3	7	5	5	8	11	6	0	52
7	0	0	0	1	1	0	4	1	1	3	1	0	12
8	0	0	0	1	0	0	0	0	0	0	0	0	1
9	0	0	0	2	0	0	3	0	1	0	0	0	6

Absolute Number of Three-hour-intervals for a given K

Table 4 Statistics of indices 2003

Appendix 3: Changes of instrumentation and their implications for the measuring routine

1. Base-line instruments

At the beginning of the year under review, the PPM of type V75 was replaced by that of type PPM105, which resulted in two changes affecting the measuring routine.

H: Nelson's method had to be replaced by Serson's method due to a limitation of the measurement range at low fields;

F, H and Z: comparative measurements with the PPM of type V3931 (period measuring, IMS) were no longer carried out.

At the end of the year under review, measurements with the old PVM of type ASKANIA/V4931(VARIAN) were discontinued. At the same time, test measurements with the new PVM of type ZEISS/MAGSON (SCHULZ, 2002), which is located on the central pier, were resumed. The electronics of the PVM had been replaced by a new one with an improved signal/noise ratio.

From 2004, the primary *I* standard will be replaced by the DI-flux located on pier NE in order to eliminate the base-line system's overestimation. This means that *H* and *Z* will no longer be considered to be separate standards; instead, they will be derived from *F* and *I* in future.

Recent differences *E* of the inclination in the sense of PVM(NW,IMS) minus DI-flux(NE) are given in Table 1 (table 1). Owing to the fact that *C* (also shown in Table 1) systematically deviates from zero, the transfer of the standard can only be achieved by a compromise. An acceptable solution avoiding unrealistic jumps of the FGE125's *H* and *Z* base-line is given in the case of zero *E*.

Contrary to *I*, the *F standard* continues to be related to pier NW. The following differences in the sense of V4931 minus PPM are based on special measurements or long-term recordings:

V4931 minus	V75	-0.9 nT
	PPM105	-0.4
	GSM19	-0.7

To preserve the magnetic standards of *F* and *I*, the following relations are applied:

in 2003
F(IMS) = F(PPM105,NW) -0.4 nT
H(IMS) = H(PVM,NW)
Z(IMS) = Z(PVM,NW)

from 2004
F(IMS) = F(GSM19,NW) –0.7 nT
I(IMS) = I(DI-flux, NE)

2. Variometers

On October 14, the FGE125 electronics was replaced by a low-noise version, which additionally contains an integrated data logger of type Niemegk.

The scale values of the new assembly were determined galvanically by means of the Helmholtz coil triple designed by BEBLO et al. (1999). The scale values of *Z* had to be corrected by a factor of 0.9987 (PULZ, 2003) because the fluxgate had shifted in the direction of the coil axis. Before determining the scale values, the coil constants had been checked magnetically using the Helmholtz coil of high precision (see section 2.2). The constants show small significant deviations from the calculated values:

		U	*V*	*Z*
constants	calculated	14.7729	14.7729	22.6088 nT/mA
	measured	14.7683 $\pm 4\ 10^{-4}$	14.7442 $\pm 7\ 10^{-4}$	22.5963 nT/mA $\pm 4\ 10^{-4}$
scale values		1.0003 $\pm 10^{-3}$	0.9988 $\pm 10^{-3}$	0.9986 nT/mV $\pm 10^{-3}$

References

BEBLO, M., FELLER,.M. and W. BAUER, 1999: A single 3-axial coil system for calibration of the DMI fluxgate magnetometer FGE with suspended sensors. Münchner Geophys. Mitteil., MGM 8

PULZ, E, 2003: personal communication