


**NURMIJÄRVI GEOPHYSICAL  
OBSERVATORY**

**MAGNETIC RESULTS 2005**

**Editors K. Pajunpää and H. Nevanlinna**

**ILMATIETEEN LAITOS  
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<p>Abstract</p> <p>The magnetic yearbook of the magnetic recordings at the Nurmijärvi observatory contains tables, figures of hourly, monthly, and yearly means of the magnetic field components X, Y and Z as well as magnetic activity indices (K, Ak) in 2005. Magnetic isolines describing the distribution of geomagnetic field components in Finland 2006.0 are shown by a series of maps.</p>		
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## 1 Introduction

This report presents magnetic measurements carried out at the Nurmijärvi (NUR) Geophysical Observatory between January 1 and December 31, 2005. The observatory is operated by the Finnish Meteorological Institute (FMI) and is part of the Space Research Division of the institute. Information about the IMAGE magnetometer network is included in this report, as it is partly operated by the observatory. The Nurmijärvi Geophysical Observatory started recording the Earth's magnetic field in April 1952. The first yearbook was for 1953.

## 2 Description of the observatory

The observatory is located some 40 km NNW from Helsinki in the northern part of the Nurmijärvi municipality having about 36,000 inhabitants. The observatory lies on a moraine ridge by the lake Sääksjärvi. The 7 ha forest area of the observatory is limited to the lake in the North and North-East, to a nature reserve forest in the South and to a private forest in the West. There are no artificial disturbance sources nearby.

The coordinates of the observatory are:

	Lat.	Lon.
Geographical	60°30.5'N	24°39.3'E
Geomagnetic	57°43.8'	113°28.8'
Corr.geomagnetic	56°49.2'	102°31.2'

The magnetic coordinates are referred to the IGRF-95 model:

L-value	3.3
Height	105m

The Nurmijärvi observatory is running two digital magnetometers, which are controlled usually once per week with absolute measurements. An other magnetic recording system at the observatory is the three-component pulsation magnetometer of the Sodankylä Geophysical Observatory. The Air quality department of FMI makes continuous airborne radioactivity recording. An automatic weather station observes the following: temperature, humidity, snow depth, current weather and clouds. The Vaisala company installed at the observatory an automatic station as part of the Helsinki Testbed project. An automatic rain gauge is part to the system. Precipitation and snow depth are measured also manually at the observatory. Helsinki University operates the seismic station. Water level in the lake Sääksjärvi is recorded for the needs of the Nurmijärvi municipality.

## 3 Recording instruments

In the variation room the Danish suspended flux gate magnetometer (FGE-89) was the primary instrument. The Ukrainian LEMI-004 flux gate magnetometer was the second variometer. The sensors were directed in geographic North and East directions measuring the X, Y and Z components. The temperature in the variometer room was kept at  $18 \pm 1^\circ\text{C}$ . During cold seasons in the winter the temperature dropped down to about  $16^\circ\text{C}$  for a few days. The FGE magnetometer data was corrected for the temperature variations with coefficients  $-0.22$ ,  $-0.10$

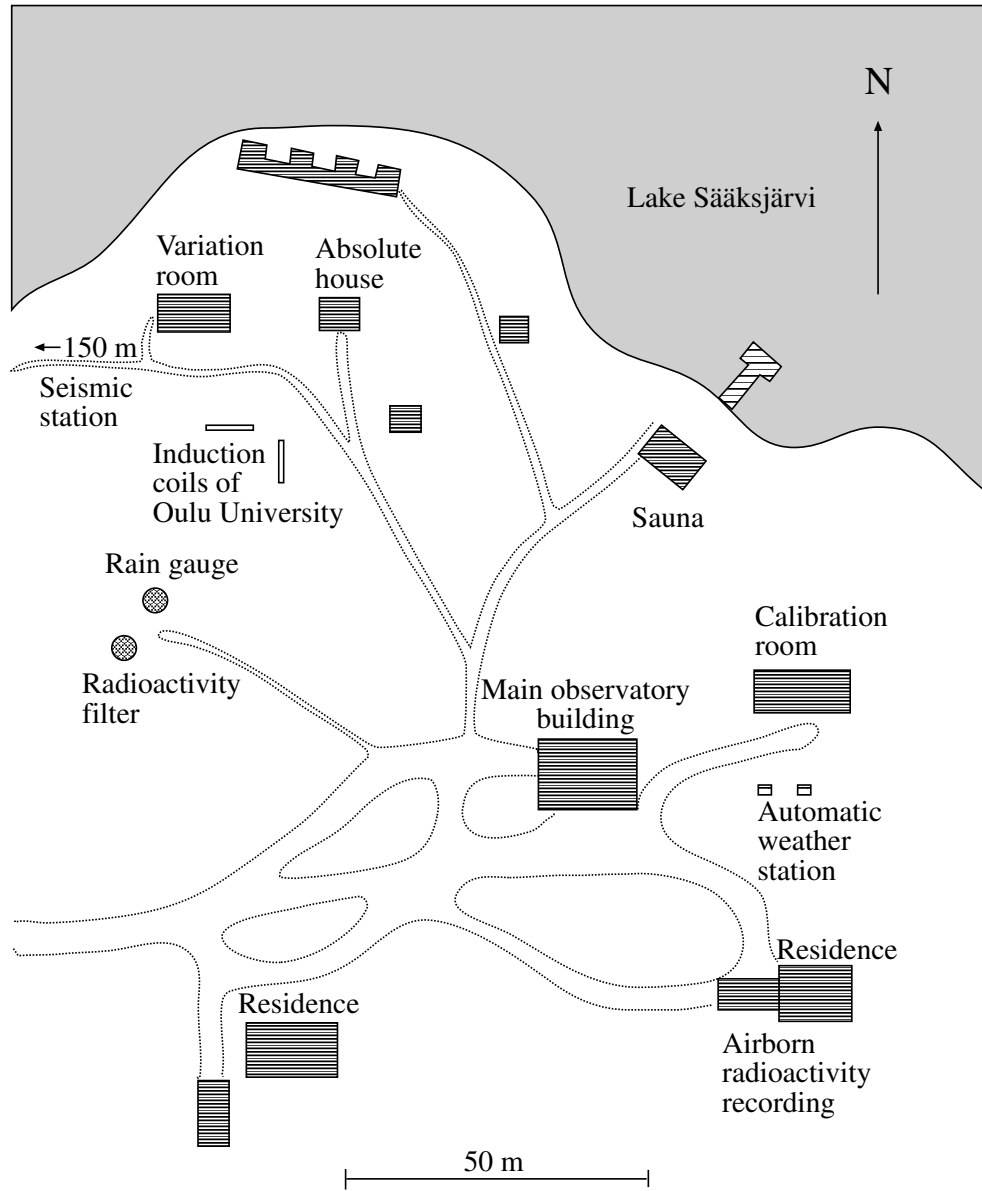


Figure 1: Formal map of the observatory.



Figure 2: The suspended FGE magnetometer sensor on the left and the electronics unit above.

and  $-0.05nT/^\circ C$ . Analog voltages from the magnetometers were AD-converted in the variation room and the digital data were transferred through optical wires to the computers in the main observatory building. The Linux based software stored the data in three files as one-second, ten-seconds and one-minute averages. Timing was based on GPS time sheared through the local network. The standard one-minute values were averages over one minute periods starting and ending at a half minute (e.g. 59:30 - 00:30, 00:30 - 01:30, 01:30 - 02:30). The given time was the starting minute at the centre of the period (00, 01, 02 etc.).



Figure 3: The LEMI-004 magnetometer electronics on the left and the sensor above.

## 4 Absolute measurements

The total field ( $F$ ) was measured by a Polish PMP-7 proton precession magnetometer and declination and inclination with a DI-flux-magnetometer, which consists of a flux-gate element mounted on the telescope of a non-magnetic Zeiss-Jena theodolite (010B). The absolute measurements were done on average once a week. The base line values as determined for the FGE are shown in Fig. 7.



Figure 4: The magnetometer hut at the Pello (PEL) IMAGE station. The computer is in the house and data transfer is through optical wires.

## 5 Data processing and dissemination

In the processing the final base line values and sensitivities were used and hourly mean values were calculated. The measured base line values were followed closer than half a nanoTesla. All the digital data were visually inspected on the computer screen.

Tables showing the three-hour K-indices were computed from 10 s data using the 'FMI' algorithm. The upper limit for K=9 is  $750nT$ .

Electricity blackouts occurred in the Autumn causing gaps in the magnetic data. The longest blackout after a heavy snowfall lasted for over 30 hours on 30.11.-1.12. Another reason for short data gaps was in the software.

Daily magnetograms and K-indices were published in the monthly bulletin together with the Sodankylä Geophysical Observatory of the University of Oulu. The bulletin contains daily magnetograms of Nurmijärvi, Hankasalmi, Oulujärvi and Sodankylä, daily ionosond and riometer recordings and cosmic ray data.

Daily files of minute data were sent by e-mail for the INTERMAGNET system. INTERMAGNET CD-ROM 2003 was published in 2005 containing minute data, annual means and base line values from Nurmijärvi together with data from 91 other magnetic observatories.

## 6 IMAGE stations

The IMAGE magnetometer network consisted at the end of 2005 of 29 stations from Tartu in Estonia to Ny Ålesund on Svalbard. The principal investigator of this international project was Ari Viljanen at FMI. The observatory operated nine IMAGE stations in Finland (including Nurmijärvi) one in Estonia and one in northern Norway. At seven of the stations the service and absolute measurements were done





Figure 5: The magnetometer hut at the Tõravere (TAR) observatory in Estonia. A new concrete basement for secular variation measurements in the front.

in co-operation with the Sodankylä Geophysical Observatory of the Oulu University.

The data sampling interval at the IMAGE stations was 10 seconds and the 10-s values were averages over the seconds 00-10, 10-20, 20-30 etc. The time stamp given for the 10-second period was the first second of that period.

Data from most of the stations was transmitted through ISDN modems to Nurmi-järvi. TAR in Estonia and KEV and MEK in Finland had direct network connections and OUJ was still operated through an ordinary modem. The Hankasalmi (HAN) station was moved  $7\text{km}$  southwest to a new site. The data of the nine stations was processed and inspected at the observatory and was sent to the AVA/FMI for IMAGE filing. Data transmission from the other IMAGE stations was also operated at the observatory.

The annual mean values were calculated for Oulujärvi ( $64^{\circ}31'N$ ,  $27^{\circ}14'E$ ) since 1993 (all days):

Year	X[nT]	Y[nT]	Z[nT]
1993.5	12971	1912	50591
1994.5	12953	1935	50616
1995.5	12951	1963	50642
1996.5	12937	1994	50664
1997.5	12926	2023	50701
1998.5	12912	2051	50742
1999.5	12902	2077	50780
2000.5	12892	2108	50828
2001.5	12889	2136	50867
2002.5	12886	2168	50914
2003.5	12870	2200	50961
2004.5	12878	2228	50998
2005.5	12867	2256	51035

## 7 SAMNET stations

The observatory provided 1-second data from the stations KIL, OIJ, HAN and NUR for the SAMNET magnetometer network operated by the Lancaster University in United Kingdom.

## 8 Personnel

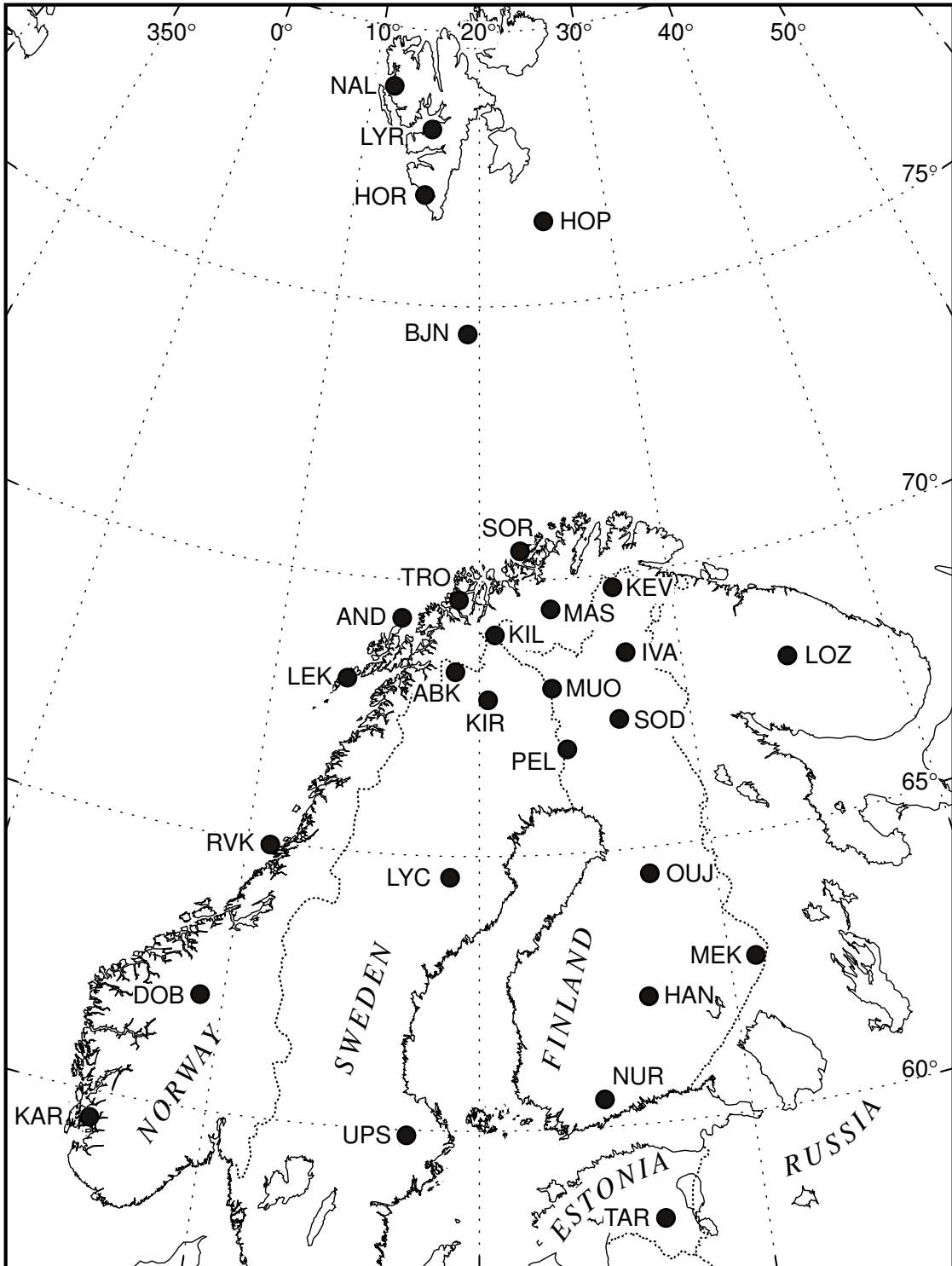
Ph.D. Kari Pajunpää, head of the observatory

M.Sc. Anja Koistinen, assistant

Mr. Pentti Posio, technician

## 9 IMAGE Magnetometer Network

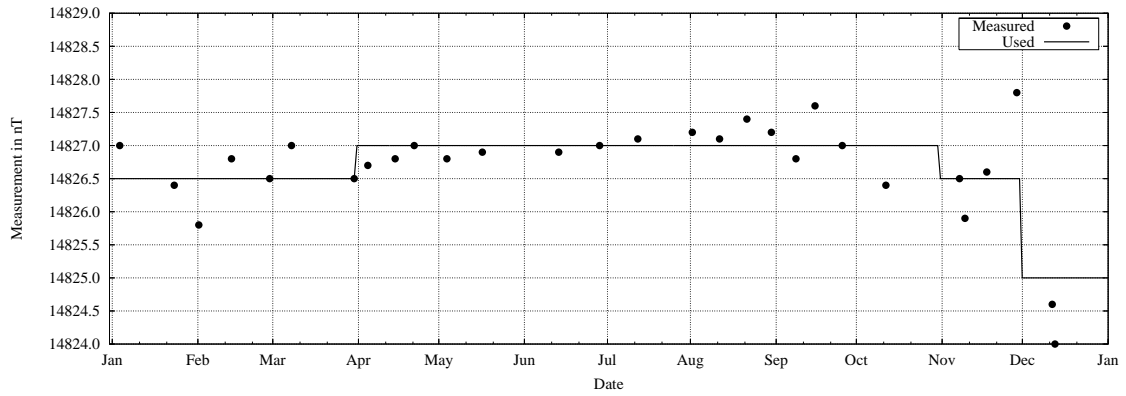
## IMAGE Magnetometer Network



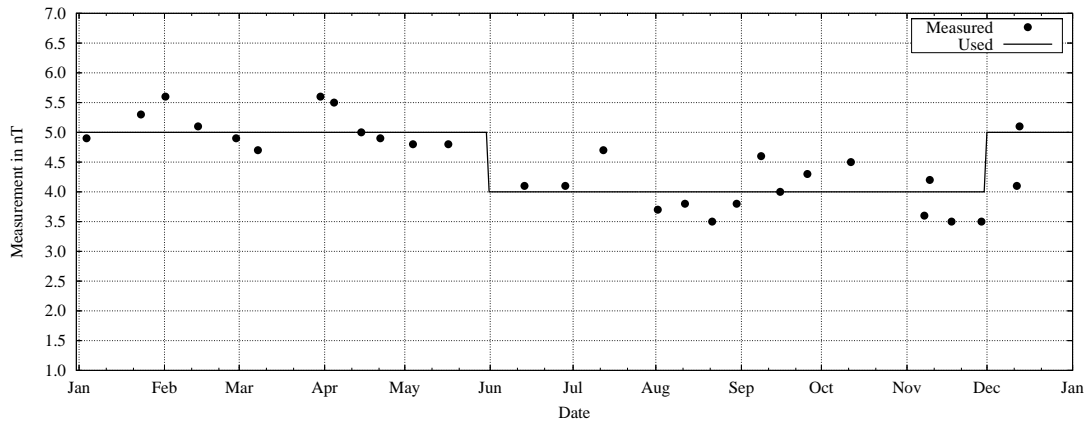
December 2004

Figure 6: Map of IMAGE magnetometer network

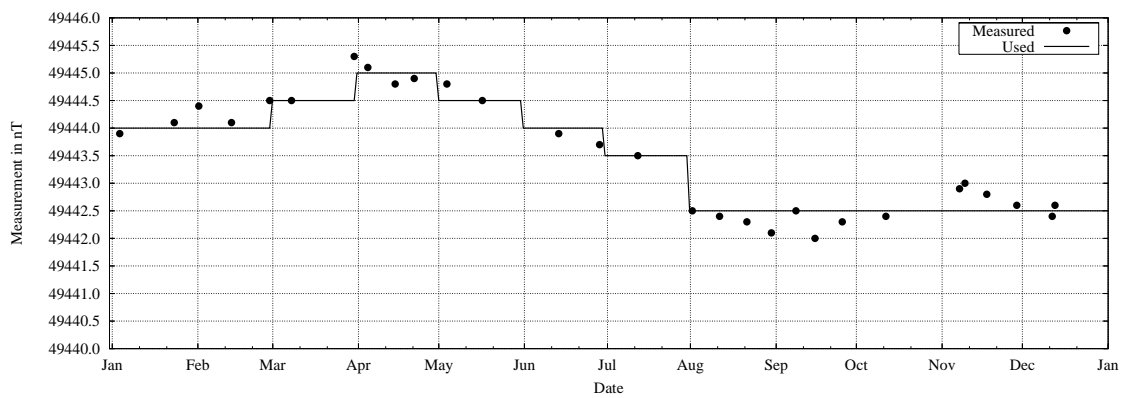
## 10 Baseline Measurements for FGE



(a) Baseline measurements for X component



(b) Baseline measurements for Y component



(c) Baseline measurements for Z component

Figure 7: Baseline measurements

## 11 Tables of Hourly Means of X, Y, and Z

Explanations of the tables:

- **X** is the North component of the magnetic vector
- **Y** is the East component of the magnetic vector
- **Z** is the vertical component of the magnetic vector
- The unit is nanotesla (nT) =  $10^{-9}$  T
- The time is universal time (UTC). The local time is UTC + 2 h (during the daylight saving time UTC + 3 h)



Nurmijärvi Finland

February 2005 North component X in nT (X = 14900 nT + tabular values)

Table with 26 columns (Day, Char, 1-24, Mean) and 26 rows (1-28). Rows 1-27 contain numerical data for various days and characters (Q, D). Row 28 is a summary row with 'All Quiet' and 'Dist.' categories.

February 2005 East component Y in nT (Y = 1600 nT + tabular values)

Table with 26 columns (Day, Char, 1-24, Mean) and 26 rows (1-28). Rows 1-27 contain numerical data for various days and characters (Q, D). Row 28 is a summary row with 'All Quiet' and 'Dist.' categories.

February 2005 Vertical component Z in nT (Z = 49600 nT + tabular values)

Table with 26 columns (Day, Char, 1-24, Mean) and 26 rows (1-28). Rows 1-27 contain numerical data for various days and characters (Q, D). Row 28 is a summary row with 'All Quiet' and 'Dist.' categories.





Nurmijärvi Finland

April 2005 North component X in nT (X = 14900 nT + tabular values)

Table with 25 columns (Day, Char, 2-24, Mean) and 30 rows of data for the North component X in nT.

April 2005 East component Y in nT (Y = 1600 nT + tabular values)

Table with 25 columns (Day, Char, 1-30, Mean) and 30 rows of data for the East component Y in nT.

April 2005 Vertical component Z in nT (Z = 49600 nT + tabular values)

Table with 25 columns (Day, Char, 1-24, Mean) and 30 rows of data for the Vertical component Z in nT.



















# 12 Hourly Means minus Monthly Means

## 12.1 All Days

North Component X in nT

Month/Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Mean
January	-10	-11	-3	-3	0	4	7	2	-3	-2	-4	0	4	6	8	3	16	15	2	2	-1	-9	-13	-10	14876
February	0	1	1	2	5	8	7	2	-3	-8	-12	-11	-6	-1	1	4	3	1	0	2	1	1	1	1	14886
March	1	0	0	3	7	6	1	-6	-14	-18	-16	-10	-4	4	4	5	6	7	5	4	3	3	5	2	14888
April	-1	1	2	1	5	2	-5	-13	-22	-26	-22	-14	-4	5	8	11	14	14	11	11	5	7	7	2	14889
May	-4	-5	-5	-3	-5	-17	-31	-36	-34	-29	-21	-5	8	35	38	30	29	23	19	10	6	2	1	-4	14885
June	2	1	2	1	-1	-5	-13	-20	-26	-26	-22	-12	0	6	15	17	20	21	25	15	8	4	-7	-2	14889
July	-5	-2	2	-4	-7	-6	-13	-19	-23	-26	-23	-15	0	14	27	27	22	21	18	12	4	-3	2	-4	14892
August	0	-3	-2	1	-1	-4	-9	-18	-25	-27	-20	-5	4	10	13	29	22	14	14	4	4	-4	2	2	14888
September	0	-5	-6	-2	-3	-4	-12	-17	-23	-24	-17	-4	6	21	18	19	10	11	8	7	4	3	4	6	14876
October	4	4	5	9	10	11	5	-5	-14	-19	-18	-12	-5	-1	0	0	2	4	3	4	3	2	5	5	14885
November	0	-1	2	4	6	8	6	0	-5	-7	-6	-4	-2	-1	-1	-2	-3	-3	-1	1	2	2	2	1	14884
December	-3	-3	1	2	5	6	3	2	0	-1	-1	2	2	2	2	0	-4	-4	-1	0	-2	-2	-2	-3	14885
Winter	-3	-4	0	1	4	6	6	2	-3	-4	-5	-3	-1	2	3	1	3	2	0	1	0	-2	-3	-3	14883
Equinox	1	0	0	3	5	4	-3	-10	-18	-22	-18	-10	-2	7	7	9	8	9	7	6	4	4	5	4	14884
Summer	-2	-2	-1	-1	-3	-8	-17	-23	-27	-27	-21	-10	3	16	23	26	23	20	19	10	5	-1	0	-2	14888
Year	-1	-2	0	1	2	1	-5	-11	-16	-18	-15	-8	0	9	11	12	12	11	8	6	3	0	1	0	14885

East Component Y in nT

Month/Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Mean
January	7	2	-4	-13	-15	-10	-7	1	-2	-2	-7	-12	-11	-7	-4	0	2	5	4	12	11	19	17	14	1685
February	3	4	5	2	-2	0	1	5	5	0	-8	-15	-18	-17	-13	-9	-7	1	8	16	10	10	8	9	1680
March	7	7	6	4	4	5	9	5	-4	-15	-24	-25	-22	-15	-5	2	5	6	9	9	10	6	7	1682	
April	5	4	8	10	11	16	17	15	8	-3	-17	-29	-30	-25	-17	-9	0	1	4	6	6	6	10	8	1684
May	8	9	10	14	17	20	20	14	3	-8	-19	-27	-27	-27	-19	-11	-6	-4	-2	7	6	8	7	6	1687
June	10	12	14	16	20	20	22	19	7	-5	-19	-29	-31	-27	-19	-12	-9	-7	-1	2	4	3	4	7	1689
July	14	16	15	16	16	17	21	17	10	-1	-15	-25	-32	-28	-22	-18	-11	-6	-5	0	0	5	7	8	1691
August	7	9	10	15	17	21	20	15	6	-5	-12	-28	-34	-29	-19	-14	-5	-3	3	2	4	4	7	9	1693
September	6	1	5	6	8	9	9	6	0	-8	-17	-22	-22	-17	-8	-2	1	5	2	7	8	12	8	3	1698
October	5	2	1	1	2	5	7	8	5	-4	-13	-18	-20	-16	-10	-6	-3	2	6	12	11	8	6	7	1698
November	4	0	0	0	-1	-2	-1	0	-2	-6	-11	-13	-13	-10	-8	-5	1	8	9	8	13	15	10	3	1701
December	-2	-2	-3	-2	-3	-3	-2	-2	-3	-5	-9	-10	-9	-6	-5	-2	1	2	9	14	11	10	13	5	1705
Winter	3	1	0	-4	-5	-3	-2	1	-1	-3	-9	-12	-13	-10	-7	-4	-1	4	8	13	11	14	12	8	1693
Equinox	6	4	5	5	6	9	11	9	4	-5	-15	-23	-24	-20	-13	-5	0	3	5	9	8	9	7	6	1691
Summer	10	11	12	16	18	20	21	16	7	-5	-16	-27	-31	-28	-20	-14	-8	-5	-1	3	3	5	7	7	1690
Year	6	5	6	6	6	8	10	9	4	-4	-13	-21	-23	-20	-13	-8	-3	1	4	8	8	9	9	7	1691

Vertical Component Z in nT

Month/Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Mean
January	-32	-35	-28	-23	-16	-5	-1	3	3	7	8	12	18	21	21	25	30	24	18	9	4	-11	-21	-32	49702
February	-14	-18	-12	-10	-6	-4	-3	-2	-2	-3	-2	2	6	10	13	15	13	18	14	10	4	-2	-13	-11	49702
March	-17	-16	-13	-9	-5	-2	0	0	-1	-2	-2	2	6	12	15	17	18	15	11	8	-1	-5	-14	-17	49698
April	-16	-14	-12	-9	-5	-1	1	1	0	-2	-4	-1	8	13	16	18	18	15	11	6	-3	-8	-13	-19	49700
May	-21	-27	-25	-21	-15	-13	-5	-3	1	2	2	8	19	26	27	26	23	22	17	5	-4	-11	-14	-16	49710
June	-15	-17	-13	-13	-9	-5	-2	0	0	-1	-1	3	10	13	16	18	19	17	12	1	-2	-9	-10	-12	49709
July	-22	-22	-18	-16	-14	-9	-6	-4	-4	-4	-4	1	12	24	34	31	28	23	17	6	-2	-10	-18	-22	49711
August	-16	-14	-10	-7	-6	-5	-4	-4	-5	-5	-4	1	8	18	22	28	21	16	11	3	-3	-17	-17	-13	49717
September	-22	-26	-24	-22	-16	-11	-7	-2	2	6	8	15	20	30	31	32	29	23	7	-6	-15	-13	-16	-23	49728
October	-12	-10	-7	-6	-5	-3	-1	0	-1	-2	0	2	6	9	12	14	14	12	10	3	-3	-7	-12	-11	49724
November	-11	-9	-7	-5	-4	-3	-2	-2	-2	-1	1	4	6	8	9	11	14	13	9	4	3	-6	-11	-15	49726
December	-9	-7	-7	-6	-4	-3	-2	-1	-1	-1	0	2	4	5	4	7	9	9	7	4	2	-1	-5	-9	49727
Winter	-17	-17	-14	-11	-8	-4	-2	0	0	1	2	5	8	11	12	15	17	16	12	7	3	-5	-12	-17	49714
Equinox	-17	-16	-14	-11	-8	-4	-2	0	0	1	4	9	16	18	20	20	16	10	3	-6	-8	-14	-17	49713	
Summer	-18	-20	-17	-11	-8	-4	-3	-2	-2	2	3	12	20	25	26	23	19	14	4	-3	-12	-15	-16	49712	
Year	-17	-18	-15	-12	-9	-5	-3	-1	-1	0	4	10	16	18	20	20	17	12	4	-2	-8	-14	-17	49713	

## 12.2 Quiet Days

North Component X in nT

Month/Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Mean
January	-3	-4	-3	-1	1	2	2	0	-4	-7	-7	-5	0	3	4	1	2	2	1	6	3	2	3	3	14886
February	-1	-1	0	0	2	2	2	1	-4	-10	-12	-11	-6	0	3	4	3	3	1	4	5	6	4	4	14893
March	2	3	1	4	5	4	-1	-10	-18	-20	-18	-11	-4	1	5	6	6	7	6	5	6	7	6	8	14891
April	3	4	6	8	8	4	-2	-10	-18	-23	-24	-20	-10	-1	2	4	6	8	10	10	10	9	9	8	14895
May	4	7	9	9	7	1	-8	-20	-30	-34	-26	-18	-9	1	3	8	15	15	15	14	10	8	10	9	14893
June	3	3	5	5	2	-3	-9	-17	-24	-28	-25	-15	-9	-1	1	8	10	13	18	18	16	12	10	8	14895
July	0	1	2	4	1	-4	-11	-19	-25	-27	-24	-17	-7	1	7	13	14	17	17	17	14	12	8	6	14897
August	3	1	1	2	0	-4	-10	-17	-25	-26	-23	-13	-2	6	11	11	11	10	12	15	11	8	10	9	14887
September	5	4	3	3	3	-1	-6	-12	-20	-22	-19	-8	-3	2	6	6	5	7	7	7	8	9	9	7	14883
October	1	2	3	5	8	8	5	-5	-15	-22	-23	-15	-7	0	3	3	4	6	7	7	7	8	7	6	14889
November	-2	-2	0	2	3	5	2	-4	-8	-8	-6	-2	2	3	2	1	2	2	1	1	1	3	1	1	14889
December	-2	-2	-2	0	1	1	0	-3	-4	-6	-3	1	3	4	4	4	3	3	1	1	-1	0	-1	-3	14890
Winter	-2	-2	-1	0	2	3	1	-1	-5	-8	-7	-4	0	2	3	3	3	2	1	3	2	3	2	1	14889
Equinox	3	3	3	5	6	4	-1	-9	-18	-22	-21	-13	-6	0	4	5	6	7	7	7	8	8	8	7	14890
Summer	2	3	4	5	3	-3	-10	-18	-26	-29	-24	-16	-7	2	6	10	12	14	15	16	13	10	9	8	14893
Year	1	1	2	3	3	1	-3	-10	-16	-19	-18	-11	-4	2	4	6	7	8	8	9	7	7	6	6	14891

East Component Y in nT

Month/Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Mean
January	2	1	0	0	2	3	5	5	3	0	-4	-8	-10	-7	-7	-6	-4	-4	-1	9	9	7	3	1	1678
February	2	1	1	2	3	5	7	9	9	3	-5	-11	-14	-12	-8	-3	-3	-3	1	5	3	4	2	1	1677
March	2	3	4	5	8	13	17	19	12	0	-11	-19	-22	-19	-13	-7	-5	-4	-1	1	6	4	4	4	1679
April	2	2	6	11	14	17	19	17	11	1	-14	-25	-28	-22	-12	-4	-1	1	1	1	3	1	0	0	1682
May	4	9	17	23	27	27	22	13	2	-11	-23	-31	-30	-24	-15	-7	-1	1	1	-2	-2	-2	0	2	1685
June	6	11	15	18	20	23	25	21	11	-1	-16	-27	-28	-24	-16	-10	-6	-5	-3	-3	-3	-3	-2	-2	1688
July	7	10	17	21	24	25	28	26	15	1	-14	-25	-31	-28	-23	-17	-11	-9	-7	-6	-7	-3	2	4	1689
August	6	10	13	19	20	20	20	16	7	-5	-18	-26	-26	-22	-17	-11	-8	-7	-6	-3	-1	6	7	8	1694
September	3	3	9	11	14	16	15	10	4	-4	-15	-22	-20	-15	-9	-4	-1	-2	-1	3	3	0	1	1	1696
October	3	3	4	4	5	8	12	14	12	2	-10	-18	-18	-13	-6	-4	-3	-2	-1	0	1	2	2	2	1697
November	3	1	1	2	1	3	4	4	0	-4	-8	-10	-9	-6	-3	-1	-1	0	3	1	3	5	6	1	1699
December	1	1	2	1	1	2	3	1	-2	-6	-10	-11	-7	-2	0	0	0	0	3	3	3	7	6	4	1701
Winter	2	1	1	1	2	3	5	5	2	-2	-7	-10	-10	-7	-4	-3	-2	-2	2	5	5	6	4	2	1689
Equinox	2	3	6	8	10	13	16	15	10	0	-12	-21	-22	-17	-10	-5	-2	-2	-1	1	3	2	2	2	1688
Summer	6	10	15	20	23	24	24	19	9	-4	-18	-27	-29	-25	-18	-11	-7	-5	-4	-4	-3	-1	2	3	1689
Year	3	5	7	10	12	13	15	13	7	-2	-12	-20	-20	-16	-11	-6	-4	-3	-1	1	2	2	3	2	1689

Vertical Component Z in nT

Month/Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Mean
January	-5	-2	-1	0	1	0	0	-1	-2	-1	-1	0	2	2	2	2	2	2	3	2	-1	-1	-1	-2	49706
February	0	-1	0	0	1	1	1	-1	-3	-5	-5	-2	0	2	3	3	2	3	4	2	0	-2	-2	-2	49701
March	-1	0	0	0	1	2	2	-1	-5	-8	-8	-5	-1	2	3	3	3	4	5	5	3	-1	-2	-2	49701
April	-1	1	3	4	3	2	2	-1	-4	-7	-11	-10	-5	-1	3	6	5	4	3	2	1	0	0	1	49702
May	0	3	4	3	0	-1	-2	-2	-6	-9	-9	-6	-3	1	4	5	6	6	3	2	1	1	0	-2	49711
June	2	3	4	1	-1	0	0	-1	-3	-9	-10	-7	-5	0	4	5	6	5	4	3	1	-1	-1	0	49713
July	0	3	2	2	3	1	-2	-5	-7	-9	-11	-8	-4	-1	3	4	5	6	6	5	4	3	1	-1	49709
August	0	-1	1	2	1	0	0	0	-3	-5	-5	-4	-1	2	3	3	3	2	3	3	4	2	0	-8	49717
September	-3	-5	-7	-2	0	0	0	-1	-2	-3	-5	-4	0	2	5	5	6	5	5	4	2	1	0	-1	49727
October	-3	-2	-1	-1	0	0	1	1	-1	-3	-3	-2	2	4	4	2	1	1	1	1	1	0	-1	-2	49724
November	-3	-1	0	0	0	0	0	-1	-2	-1	0	1	2	2	1	2	2	2	3	3	2	-1	-4	-4	49726
December	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	2	3	2	1	0	0	0	1	1	1	0	-1	-1	49726
Winter	-2	-1	-1	0	0	0	0	-1	-2	-2	-1	-1	2	2	2	2	1	2	3	2	1	-1	-2	-2	49715
Equinox	-2	-2	-1	0	1	1	1	-1	-3	-5	-7	-5	-1	2	4	4	4	4	4	3	2	0	-1	-1	49714
Summer	0	2	3	2	1	0	-1	-2	-5	-8	-9	-6	-3	1	3	4	5	5	4	3	2	1	0	-3	49712
Year	-1	0	0	1	0	0	0	-1	-3	-5	-6	-4	-1	1	3	3	3	3	3	3	2	0	-1	-2	49714

## 12.3 Disturbed Days

North Component X in nT

Month/Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Mean
January	-16	-40	-1	-10	-11	1	10	-3	-17	0	6	28	29	24	30	26	103	81	5	4	-28	-64	-105	-53	14862
February	-12	-2	-7	-7	7	12	10	5	5	-4	-11	-6	3	7	0	10	9	7	8	7	-4	-5	-22	-6	14875
March	-7	-11	-5	1	13	6	-4	-6	-9	-7	-6	-4	-1	10	5	12	14	4	8	7	-2	-6	-1	-9	14881
April	-28	-14	-3	-22	-5	-2	-9	-13	-20	-24	-13	5	14	20	26	33	32	20	13	11	-5	1	1	-18	14878
May	-10	-21	-26	-22	-23	-52	-113	-113	-76	-45	-18	17	51	161	161	97	74	42	13	-13	-22	-29	-12	-22	14878
June	-1	-1	7	-4	-1	-9	-15	-23	-28	-18	-13	1	21	19	49	39	43	47	47	4	-18	-33	-76	-47	14880
July	-14	-3	2	-28	-39	-12	-12	-18	-24	-37	-29	-20	11	60	125	103	58	30	11	-15	-37	-66	-23	-24	14895
August	-3	-14	-12	-3	-5	-14	-19	-30	-32	-29	-10	36	40	48	28	122	75	20	11	-41	-37	-76	-39	-18	14889
September	-17	-18	-17	-24	-25	-17	-43	-38	-42	-28	-9	20	43	88	55	61	20	25	2	-2	-17	-16	-9	8	14866
October	2	5	8	24	18	19	8	-5	-11	-17	-15	-8	-5	-2	-2	-4	3	1	-7	-6	-6	-13	6	7	14878
November	3	-5	6	1	7	9	12	6	-2	-9	-7	-8	-10	-1	-4	-9	-9	-1	-1	4	0	7	3	0	14880
December	-4	-8	3	15	12	12	6	6	3	-2	-1	8	7	7	8	-2	-20	-16	-1	-1	0	-11	-5	-13	14878
Winter	-7	-14	0	-1	4	9	10	4	-3	-4	-3	6	8	10	9	7	25	19	3	3	-8	-20	-36	-19	14873
Equinox	-12	-10	-4	-5	0	1	-12	-16	-21	-19	-11	3	13	29	21	26	17	13	5	3	-8	-8	-1	-3	14876
Summer	-7	-10	-7	-14	-17	-22	-40	-46	-40	-32	-17	8	31	72	91	90	63	35	21	-16	-29	-51	-37	-28	14885
Year	-9	-11	-4	-4	-4	-4	-15	-20	-22	-19	-11	6	17	38	42	43	35	22	10	-4	-15	-27	-24	-17	14878

East Component Y in nT

Month/Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Mean
January	-10	-10	-12	-35	-42	-17	-11	13	-2	8	-5	-9	-5	-3	0	-2	-5	33	6	8	-3	44	38	21	1694
February	14	21	26	2	-11	-8	-10	-7	-2	-6	-13	-21	-28	-25	-17	-25	-11	-5	16	46	15	22	2	15	1688
March	5	10	17	2	1	-6	-4	-10	-14	-13	-19	-28	-24	-27	-25	-6	23	17	25	35	19	23	-5	4	1686
April	10	8	14	14	-1	5	3	1	-4	-12	-22	-39	-33	-31	-25	-15	11	13	20	18	-1	7	38	22	1691
May	29	14	-2	2	13	19	34	30	12	-4	-16	-27	-36	-60	-40	-24	-17	-19	-11	31	16	27	21	9	1689
June	22	24	13	6	11	4	5	13	-7	-13	-23	-36	-38	-37	-32	-25	-23	-20	13	28	29	36	34	24	1691
July	18	21	10	6	-10	-5	17	13	16	2	-13	-21	-36	-29	-19	-30	-18	3	3	8	11	22	18	13	1691
August	11	20	15	12	17	22	19	12	-4	-8	22	-31	-48	-46	-36	-35	-13	-13	11	11	17	9	14	26	1695
September	11	0	7	7	3	9	-2	-8	-2	-10	-13	-24	-28	-20	-13	5	-4	8	0	21	10	19	17	6	1706
October	13	-2	-10	-9	-1	3	3	1	1	-9	-15	-19	-21	-20	-15	-11	-1	5	16	31	26	19	9	10	1699
November	7	0	1	-3	-4	-10	-3	-2	-3	-4	-14	-16	-15	-15	-18	-9	7	25	25	15	18	19	1	3	1702
December	-2	-6	-13	-6	-8	-11	-9	-9	-8	-8	-13	-16	-16	-10	-12	-6	3	4	21	20	21	27	41	1	1713
Winter	2	2	1	-11	-12	-8	0	-1	-3	-2	-11	-16	-17	-14	-11	-9	-2	14	17	23	13	28	20	11	1698
Equinox	10	4	7	3	1	3	0	-4	-5	-11	-17	-28	-27	-25	-19	-7	7	11	15	26	13	17	15	10	1696
Summer	20	20	9	6	8	10	19	17	4	-6	-8	-29	-39	-43	-32	-29	-18	-12	4	19	18	23	22	18	1692
Year	11	9	6	0	-3	1	4	4	-1	-7	-12	-24	-28	-28	-21	-15	-4	4	12	23	15	23	19	13	1695

Vertical Component Z in nT

Month/Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Mean
January	-48	-112	-104	-67	-51	-12	3	21	16	31	37	49	62	59	60	63	87	77	39	-15	-6	-53	-72	-64	49698
February	-46	-68	-47	-35	-18	-6	-2	2	6	5	9	14	20	33	46	58	37	41	31	18	9	-12	-48	-26	49695
March	-41	-58	-40	-35	-19	-11	-2	4	10	10	12	18	22	31	35	56	63	48	23	3	-17	-23	-46	-43	49690
April	-49	-52	-47	-41	-22	-10	0	6	10	16	20	23	45	46	50	53	58	45	24	8	-27	-40	-48	-69	49690
May	-65	-93	-98	-79	-52	-51	-19	-6	15	27	31	48	81	90	81	63	41	52	36	0	-13	-36	-33	-21	49713
June	-45	-47	-26	-24	-25	-18	-10	1	5	9	15	22	42	43	46	54	50	51	36	-21	-21	-58	-41	-48	49697
July	-38	-38	-41	-53	-56	-41	-28	-15	-10	-6	-2	11	42	85	136	108	80	59	30	-19	-32	-54	-72	-46	49718
August	-37	-43	-25	-19	-18	-15	-15	-10	-9	-6	8	23	31	48	56	100	68	41	25	-10	-31	-83	-55	-26	49726
September	-73	-75	-65	-64	-47	-26	-20	0	15	37	45	62	71	104	87	91	65	51	-7	-45	-72	-41	-39	-58	49726
October	-29	-28	-23	-22	-19	-13	-8	-4	-1	0	6	9	13	20	30	41	48	44	38	5	-18	-23	-33	-18	49727
November	-14	-16	-16	-13	-10	-10	-5	-2	-2	1	5	13	18	20	26	33	35	25	13	-3	-1	-13	-36	-25	49725
December	-28	-17	-24	-20	-15	-10	-5	-2	0	1	4	5	6	8	6	16	29	25	15	6	6	2	-7	-13	49728
Winter	-34	-55	-49	-34	-24	-9	-2	5	5	10	14	21	28	31	36	44	48	43	26	2	3	-21	-43	-34	49711
Equinox	-48	-53	-44	-40	-26	-15	-7	2	9	16	21	28	38	50	51	61	58	46	18	-7	-34	-31	-41	-47	49708
Summer	-46	-55	-47	-44	-38	-31	-18	-8	0	6	13	26	49	66	80	81	60	51	32	-12	-24	-57	-50	-35	49714
Year	-43	-55	-47	-39	-29	-18	-9	0	5	11	16	25	38	50	57	63	56	47	25	-6	-19	-37	-45	-39	49711

## 13 Monthly and Annual Means

All days

	Z	H	D	F	X	Y	I
January	49702	14972	6° 27.7'	51908	14876	1685	73° 14.2'
February	49702	14980	6° 26.4'	51910	14886	1680	73° 13.6'
March	49698	14983	6° 26.8'	51908	14888	1682	73° 13.4'
Aprl	49700	14984	6° 27.1'	51910	14889	1684	73° 13.3'
May	49710	14980	6° 28.0'	51918	14885	1687	73° 13.8'
June	49709	14984	6° 28.4'	51918	14889	1689	73° 13.5'
July	49711	14988	6° 28.6'	51921	14892	1691	73° 13.3'
August	49717	14984	6° 29.2'	51926	14888	1693	73° 13.6'
September	49728	14973	6° 30.8'	51934	14876	1698	73° 14.6'
October	49724	14981	6° 30.5'	51932	14885	1698	73° 14.0'
November	49726	14981	6° 31.2'	51934	14884	1701	73° 14.1'
December	49727	14983	6° 32.0'	51935	14885	1705	73° 14.0'
Winter	49714	14979	6° 29.3'	51922	14883	1693	73° 14.0'
Equinox	49713	14980	6° 28.8'	51921	14884	1691	73° 13.8'
Summer	49712	14984	6° 28.5'	51921	14888	1690	73° 13.6'
Year	49713	14981	6° 28.9'	51921	14885	1691	73° 13.8'

5 Quiet days

	Z	H	D	F	X	Y	I
January	49706	14980	6° 25.9'	51914	14886	1678	73° 13.7'
February	49701	14987	6° 25.5'	51911	14893	1677	73° 13.2'
March	49701	14985	6° 26.0'	51911	14891	1679	73° 13.3'
Aprl	49702	14990	6° 26.6'	51913	14895	1682	73° 13.0'
May	49711	14988	6° 27.3'	51921	14893	1685	73° 13.3'
June	49713	14990	6° 27.9'	51924	14895	1688	73° 13.2'
July	49709	14992	6° 28.2'	51920	14897	1689	73° 13.0'
August	49717	14983	6° 29.5'	51926	14887	1694	73° 13.7'
September	49727	14980	6° 30.0'	51934	14883	1696	73° 14.1'
October	49724	14985	6° 30.0'	51933	14889	1697	73° 13.7'
November	49726	14986	6° 30.7'	51935	14889	1699	73° 13.7'
December	49726	14987	6° 31.1'	51935	14890	1701	73° 13.7'
Winter	49715	14985	6° 28.3'	51924	14889	1689	73° 13.6'
Equinox	49714	14985	6° 28.1'	51923	14890	1688	73° 13.5'
Summer	49712	14988	6° 28.2'	51923	14893	1689	73° 13.3'
Year	49714	14986	6° 28.2'	51923	14891	1689	73° 13.5'

5 Disturbed days

	Z	H	D	F	X	Y	I
January	49698	14958	6° 30.0'	51901	14862	1694	73° 14.9'
February	49695	14970	6° 28.5'	51901	14875	1688	73° 14.1'
March	49690	14976	6° 27.9'	51898	14881	1686	73° 13.7'
Aprl	49690	14974	6° 29.0'	51897	14878	1691	73° 13.8'
May	49713	14974	6° 28.6'	51920	14878	1689	73° 14.2'
June	49697	14976	6° 29.1'	51905	14880	1691	73° 13.8'
July	49718	14990	6° 28.5'	51929	14895	1691	73° 13.3'
August	49726	14985	6° 29.8'	51935	14889	1695	73° 13.8'
September	49726	14964	6° 32.9'	51929	14866	1706	73° 15.1'
October	49727	14974	6° 30.9'	51932	14878	1699	73° 14.5'
November	49725	14977	6° 31.6'	51932	14880	1702	73° 14.3'
December	49728	14976	6° 34.0'	51934	14878	1713	73° 14.4'
Winter	49711	14970	6° 30.9'	51916	14873	1698	73° 14.4'
Equinox	49708	14972	6° 30.2'	51914	14876	1696	73° 14.3'
Summer	49714	14981	6° 29.0'	51922	14885	1692	73° 13.8'
Year	49711	14975	6° 30.0'	51917	14878	1695	73° 14.2'

# 14 Hourly Means of All Days as Sequenced in Bartels' 27-day Solar Rotation Number

## 14.1 H-Component

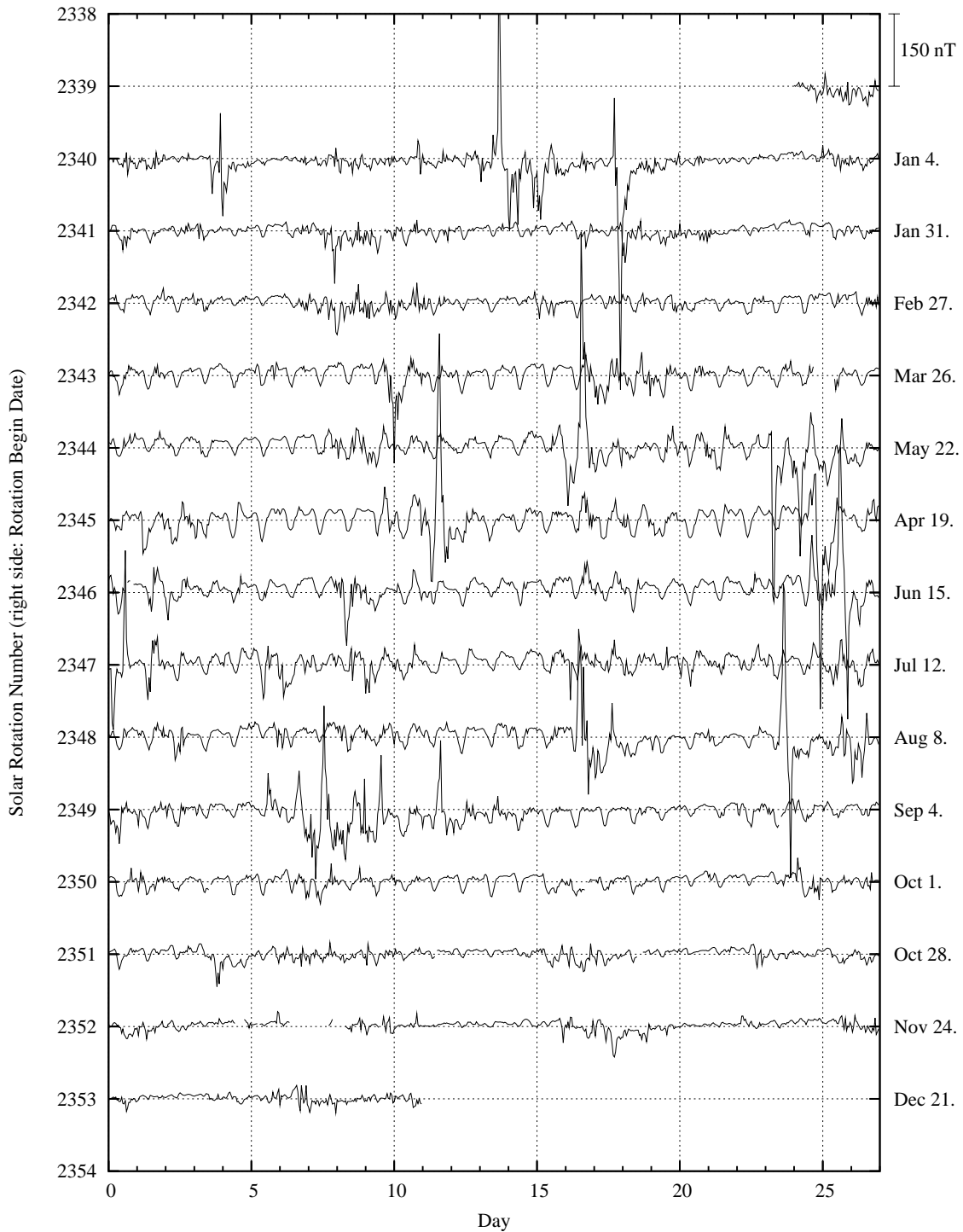


Figure 8: Hourly means of H sequenced in Bartels' solar rotation cycles.

## 14.2 D-Component

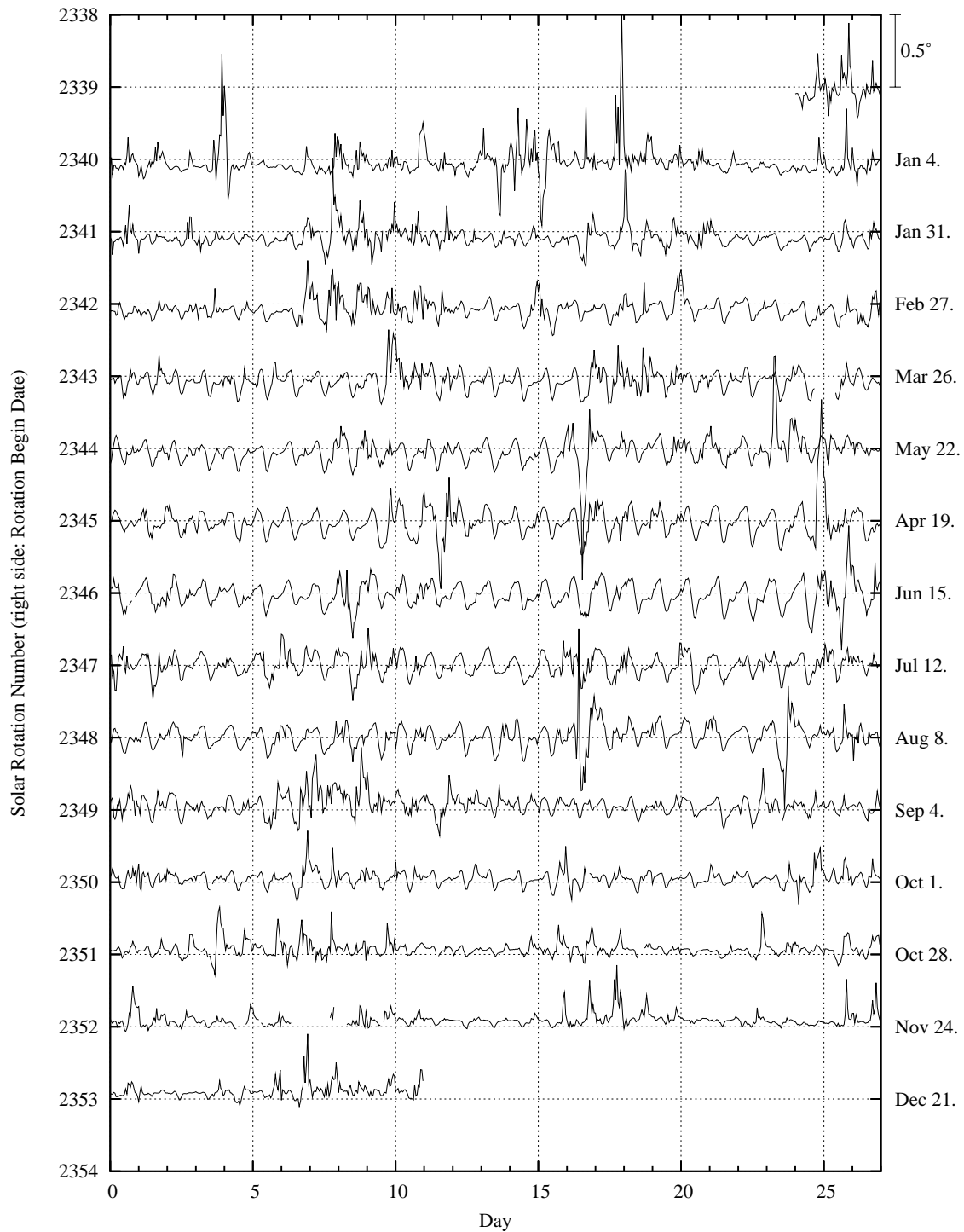


Figure 9: Hourly means of D sequenced in Bartels' solar rotation cycles.

### 14.3 Z-Component

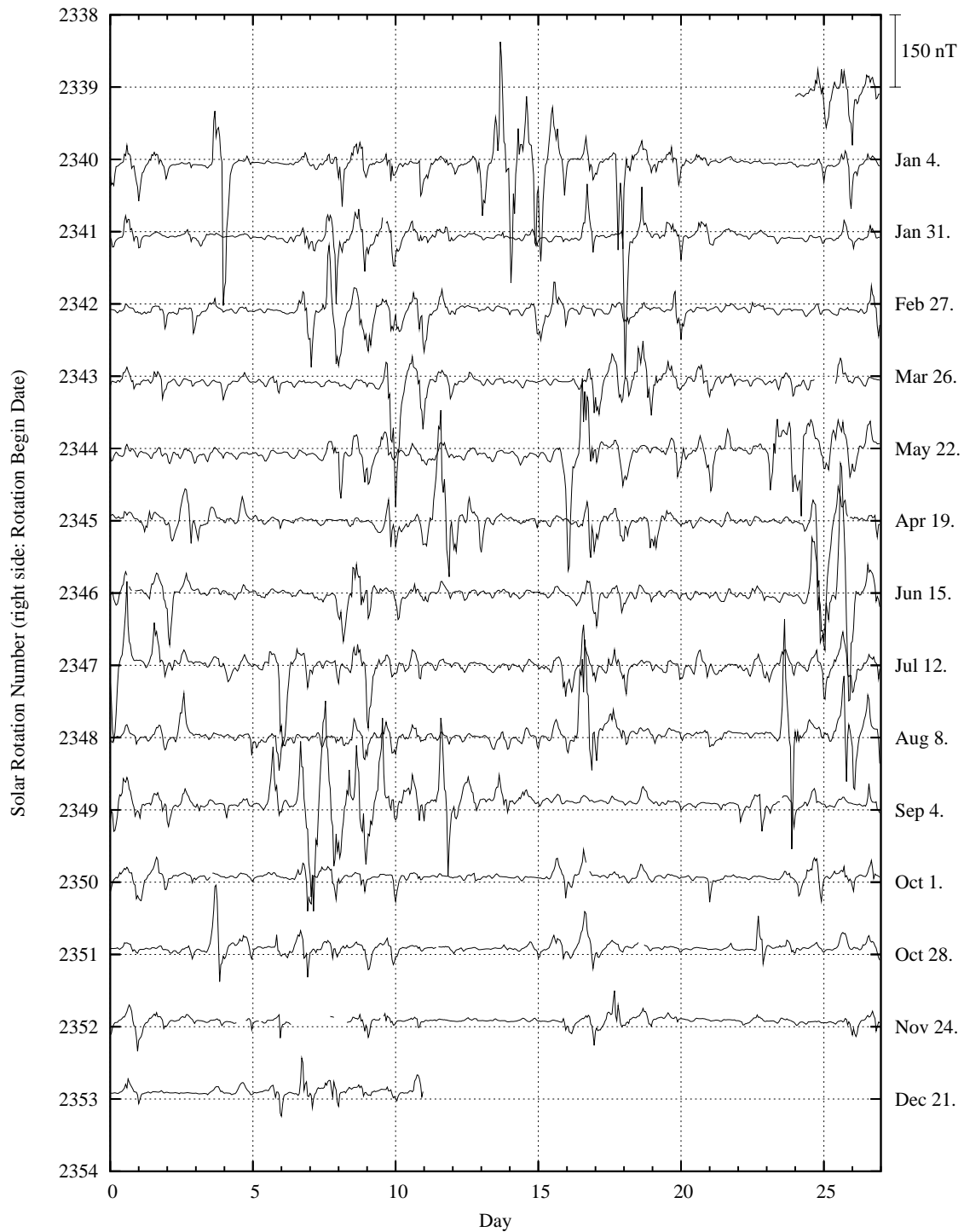


Figure 10: Hourly means of Z sequenced in Bartels' solar rotation cycles.



# 15 K-Indices

## 15.1 Monthly Tables of K-Indices

January			February			March					
Day	K	Ak	Day	K	Ak	Day	K	Ak			
1	2 2 2 2	2 4 4 3	13	1	3 0 1 1	1 2 1 1	5	1	2 2 3 2	2 2 2 2	8
2	4 4 4 3	2 6 4 6	36	2	0 1 1 1	2 4 4 2	10	2	3 2 2 3	2 4 2 2	12
3	3 3 2 3	3 4 4 2	16	3	2 3 2 1	1 2 1 2	7	3	1 1 1 1	1 2 3 1	5
4	4 3 3 3	5 5 4 3	26	4	0 0 0 2	2 2 1 1	3	4	1 0 1 1	1 0 1 0	2
5	3 2 3 3	3 4 3 3	16	5	0 0 1 0	1 0 1 0	1	5	1 2 2 2	2 3 4 5	15
6	1 1 1 0	1 1 4 1	6	6	0 2 2 2	1 1 3 3	7	6	4 3 3 3	3 4 5 5	26
7	0 0 0 1	4 5 4 8	43	7	3 3 2 2	4 3 6 6	31	7	4 3 4 4	4 5 6 4	35
8	6 5 3 3	3 2 3 3	26	8	3 4 3 3	3 5 5 5	29	8	4 5 3 3	2 4 5 5	29
9	0 0 0 3	1 1 1 0	3	9	3 4 3 3	3 4 5 5	23	9	3 3 3 2	3 4 5 4	21
10	0 1 0 1	1 2 3 3	6	10	4 3 3 3	4 4 5 3	24	10	4 3 2 3	3 3 3 2	15
11	2 2 2 1	1 4 2 4	11	11	2 2 2 3	2 2 4 3	12	11	1 1 1 2	1 1 0 2	4
12	3 4 3 3	4 5 5 3	26	12	1 1 1 1	2 1 3 0	5	12	1 0 0 0	0 1 1 2	2
13	2 2 3 2	2 4 4 3	14	13	1 1 1 0	0 2 3 0	4	13	1 0 0 1	1 2 3 4	7
14	2 2 2 2	1 2 5 5	17	14	1 2 1 1	1 1 2 3	6	14	4 3 2 3	3 2 2 2	13
15	3 3 2 3	3 4 3 1	14	15	1 0 1 1	0 0 2 1	2	15	2 0 1 1	1 0 0 3	4
16	3 2 2 2	3 3 3 3	12	16	2 1 1 1	3 4 4 4	14	16	1 0 0 2	3 2 2 3	7
17	4 3 4 5	5 9 6 5	87	17	2 1 0 1	1 2 1 3	5	17	2 3 1 2	2 4 3 2	11
18	6 5 6 5	5 5 5 6	60	18	6 4 3 2	3 5 3 2	27	18	1 1 1 1	1 2 4 4	10
19	5 5 4 5	5 5 3 3	37	19	1 2 2 3	3 4 4 3	15	19	4 3 1 2	2 0 1 1	8
20	2 2 2 3	4 5 4 3	19	20	3 2 2 1	2 4 4 4	15	20	0 1 1 1	1 1 1 1	3
21	4 2 2 2	3 6 9 9	118	21	3 1 1 1	1 1 1 2	5	21	0 0 1 2	2 2 2 2	5
22	5 4 3 3	4 4 4 3	25	22	0 0 0 0	1 2 2 2	3	22	0 0 1 0	1 1 2 1	2
23	3 3 2 3	3 5 3 4	20	23	1 0 1 1	1 0 2 1	3	23	0 0 1 1	2 1 3 2	5
24	3 2 1 2	3 3 3 2	11	24	0 0 1 1	3 1 1 2	4	24	1 0 0 1	3 1 3 2	6
25	1 1 1 1	1 1 3 1	5	25	1 1 2 3	2 3 3 2	9	25	1 3 3 3	4 3 3 4	17
26	1 0 0 1	0 0 2 1	2	26	3 1 2 3	3 3 3 1	11	26	1 2 3 3	4 3 3 2	13
27	0 0 1 0	0 0 1 1	1	27	0 2 2 1	2 1 2 1	5	27	2 2 2 3	3 4 3 2	13
28	1 1 1 1	0 1 4 3	7	28	2 2 2 3	2 3 2 3	10	28	1 1 1 1	1 1 3 3	6
29	3 2 2 3	3 3 5 4	19					29	0 1 1 1	1 1 1 3	4
30	3 3 2 2	3 3 2 2	11					30	2 2 2 2	2 3 1 1	7
31	3 2 2 2	5 4 4 1	18					31	1 3 2 1	1 3 3 3	10
Mean			23.4	Mean			10.5	Mean			10.5

April			May			June					
Day	K	Ak	Day	K	Ak	Day	K	Ak			
1	0 1 2 1	2 1 2 2	5	1	4 3 3 3	4 3 4 2	19	1	3 2 2 3	2 2 1 1	8
2	1 0 1 1	1 1 0 1	2	2	2 2 1 2	3 2 2 2	8	2	1 2 1 2	2 2 2 3	7
3	2 1 1 1	1 2 2 3	6	3	2 2 2 3	4 4 3 2	14	3	2 2 2 3	3 2 2 1	9
4	1 1 2 3	3 4 6 6	29	4	2 2 0 1	2 2 2 1	5	4	2 2 2 2	4 4 5 4	20
5	6 5 3 3	3 3 3 4	29	5	1 1 0 2	2 2 1 0	4	5	3 3 3 3	3 3 4 4	18
6	3 2 1 2	2 3 3 3	11	6	1 0 0 1	3 2 2 2	5	6	3 3 2 1	2 2 1 4	11
7	3 1 2 2	2 2 0 1	6	7	1 1 1 2	4 3 3 5	15	7	3 3 2 3	4 2 2 2	13
8	2 0 1 1	2 1 2 1	4	8	5 4 4 6	9 8 6 5	119	8	2 1 1 1	2 1 1 1	4
9	1 0 0 1	1 0 1 1	2	9	3 3 1 2	2 3 3 4	13	9	2 0 0 2	2 1 2 2	5
10	0 0 0 1	1 1 0 0	1	10	3 2 2 2	2 2 2 3	9	10	1 1 0 1	1 1 1 0	2
11	1 1 0 1	2 3 4 4	11	11	1 1 1 2	3 3 4 4	13	11	1 1 1 2	1 2 2 2	5
12	4 4 3 3	4 4 5 5	29	12	2 3 2 2	3 4 3 3	14	12	2 1 2 5	5 6 7 8	72
13	3 3 3 3	4 5 4 4	24	13	4 3 3 3	3 4 2 2	16	13	6 4 4 3	4 2 3 1	25
14	3 3 2 2	3 3 4 3	15	14	1 1 2 2	2 2 3 0	6	14	2 2 1 2	3 1 5 3	13
15	2 2 2 2	3 3 3 3	11	15	5 5 8 6	4 4 5 4	68	15	3 4 3 2	4 3 2 1	15
16	2 1 1 1	1 2 2 2	5	16	5 6 6 4	5 5 2 2	43	16	0 1 3 4	5 5 3 3	21
17	0 2 1 1	1 1 1 1	3	17	3 3 2 3	3 5 2 3	17	17	4 3 2 3	3 3 3 1	14
18	1 2 1 2	2 2 2 3	7	18	3 2 2 2	3 3 1 1	9	18	1 2 2 2	3 2 2 1	7
19	2 1 2 2	3	8	19	1 2 3 3	3 2 2 2	10	19	1 1 2 1	3 3 1 1	7
20		4 3 4 1	18	20	3 4 4 4	4 4 2 3	22	20	1 1 1 2	2 2 1 0	4
21	1 1 0 0	1 1 1 1	2	21	3 3 3 3	3 3 5 2	18	21	0 0 0 1	0 1 1 1	2
22	2 1 1 1	3 2 3 2	8	22	3 2 1 3	3 1 1 1	8	22	2 1 1 3	3 2 2 3	9
23	1 1 1 1	2 3 3 1	7	23	2 1 2 1	3 2 1 1	6	23	4 5 5 4	5 4 5 3	36
24	2 2 2 2	3 1 2 2	8	24	1 0 0 1	2 0 1 2	3	24	3 3 2 3	3 1 1 2	10
25	2 2 2 2	2 2 1 2	7	25	2 1 1 2	2 2 0 0	4	25	2 3 2 2	2 4 2 3	12
26	1 0 1 1	1 0 2 1	3	26	0 1 1 1	1 0 0 0	2	26	3 2 3 3	2 2 1 2	10
27	0 0 0 1	2 0 0 0	1	27	0 1 1 2	2 0 0 0	3	27	1 0 1 1	2 2 2 1	4
28	0 0 0 1	2 2 2 1	3	28	1 1 2 2	3 4 4 3	13	28	1 1 1 1	2 2 1 1	4
29	0 1 1 2	3 3 3 4	11	29	3 2 3 3	2 3 3 5	17	29	2 1 1 2	3 3 1 1	7
30	4 3 3 4	4 4 3 4	23	30	4 3 5 6	7 9 7 5	112	30	2 1 2 2	2 3 2 2	8
31				31	3 3 3 3	5 2 2 2	16				
Mean			10.0	Mean			20.4	Mean			12.7

July

Day	K			Ak
1	2	2	2	16
2	3	2	3	13
3	2	2	2	7
4	1	1	1	4
5	1	1	1	6
6	1	1	1	5
7	1	2	1	8
8	2	1	1	5
9	2	2	2	34
10	4	4	3	94
11	3	3	4	21
12	4	5	3	44
13	2	2	4	28
14	2	3	2	7
15	1	1	0	5
16	3	2	2	8
17	2	2	3	19
18	4	4	3	18
19	3	1	1	8
20	3	2	2	20
21	4	5	3	21
22	3	2	2	15
23	2	1	1	5
24	0	0	1	4
25	1	1	1	4
26	1	1	1	5
27	2	2	1	15
28	3	5	2	21
29	3	3	2	17
30	4	3	3	11
31	1	1	2	11
Mean				16.1

August

Day	K			Ak
1	3	2	3	15
2	2	2	2	10
3	2	2	2	13
4	2	2	3	9
5	1	1	1	9
6	3	3	3	20
7	4	3	3	17
8	2	1	1	6
9	2	1	2	10
10	2	1	3	13
11	1	0	1	4
12	1	1	0	6
13	2	2	2	17
14	3	3	1	8
15	0	1	1	7
16	3	3	2	15
17	3	2	2	15
18	3	2	3	15
19	2	1	1	7
20	1	1	1	4
21	1	1	1	13
22	2	3	2	11
23	2	1	2	11
24	3	2	5	127
25	5	3	2	26
26	2	2	2	7
27	3	1	2	6
28	1	1	1	6
29	3	2	2	5
30	0	0	1	4
31	1	2	2	112
Mean				17.7

September

Day	K			Ak
1	4	3	2	12
2	2	2	3	29
3	5	5	4	28
4	3	3	4	25
5	3	2	2	11
6	3	2	2	10
7	3	3	1	6
8	2	1	1	6
9	1	2	1	19
10	2	2	3	28
11	6	6	7	100
12	4	3	6	48
13	4	3	4	32
14	2	2	3	14
15	3	2	3	50
16	3	2	3	17
17	1	2	1	13
18	1	2	1	8
19	2	1	1	6
20	1	1	1	4
21	1	0	0	2
22	1	1	1	4
23	2	2	2	6
24	2	0	0	2
25	0	0	1	5
26	3	2	2	15
27	3	3	2	11
28	2	2	2	10
29	2	2	1	8
30	1	1	1	10
Mean				18.0

October

Day	K			Ak
1	3	2	2	12
2	4	3	2	14
3	2	2	2	5
4	2	1	1	5
5	1	0	0	3
6	1	0	0	3
7	1	1	2	11
8	3	3	4	20
9	3	2	2	11
10	2	2	2	7
11	3	1	1	8
12	0	1	0	2
13	1	1	1	4
14	1	1	1	2
15	0	0	1	1
16	0	1	1	8
17	3	3	2	12
18	0	1	1	4
19	2	2	1	6
20	2	0	1	3
21	0	0	0	2
22	4	2	1	7
23	1	0	0	2
24	1	0	0	4
25	4	4	2	21
26	2	1	2	16
27	3	1	1	11
28	1	0	1	6
29	0	0	1	4
30	1	1	0	6
31	0	1	1	22
Mean				7.8

November

Day	K			Ak
1	3	1	1	11
2	2	1	1	10
3	3	4	3	22
4	3	3	3	16
5	2	3	3	11
6	4	2	3	18
7	3	1	2	6
8	1	0	1	3
9	2	0	1	2
10	0	0	2	3
11	1	2	1	7
12	2	2	1	13
13	2	3	1	12
14	3	3	1	10
15	1	1	1	4
16	0	0	0	3
17	1	0	1	1
18	0	0	0	2
19	0	0	0	10
20	1	2	2	7
21	2	2	1	4
22	2	0	1	7
23	1	2	2	7
24	2	1	2	10
25	3	2	2	10
26	2	0	1	5
27	0	1	0	3
28	1	0	1	4
29	1	0	1	12
30	2	1	2	
Mean				7.8

December

Day	K			Ak
1			3	
2		2	2	11
3	3	2	2	14
4	1	0	1	5
5	2	0	0	2
6	0	0	0	2
7	0	0	0	0
8	0	0	0	2
9	1	0	0	5
10	2	3	2	11
11	3	2	2	25
12	3	2	2	11
13	1	1	1	6
14	0	1	2	2
15	1	1	0	2
16	1	2	1	7
17	0	0	0	3
18	1	0	1	2
19	1	1	1	11
20	3	3	2	15
21	1	1	2	10
22	3	1	1	4
23	0	0	0	0
24	0	0	0	5
25	2	1	1	4
26	0	0	0	8
27	3	1	0	22
28	3	3	2	17
29	4	2	3	14
30	2	2	1	9
31	3	1	1	13
Mean				7.8

## 15.2 K-Indices Sequenced in Bartel's Solar Rotation Number

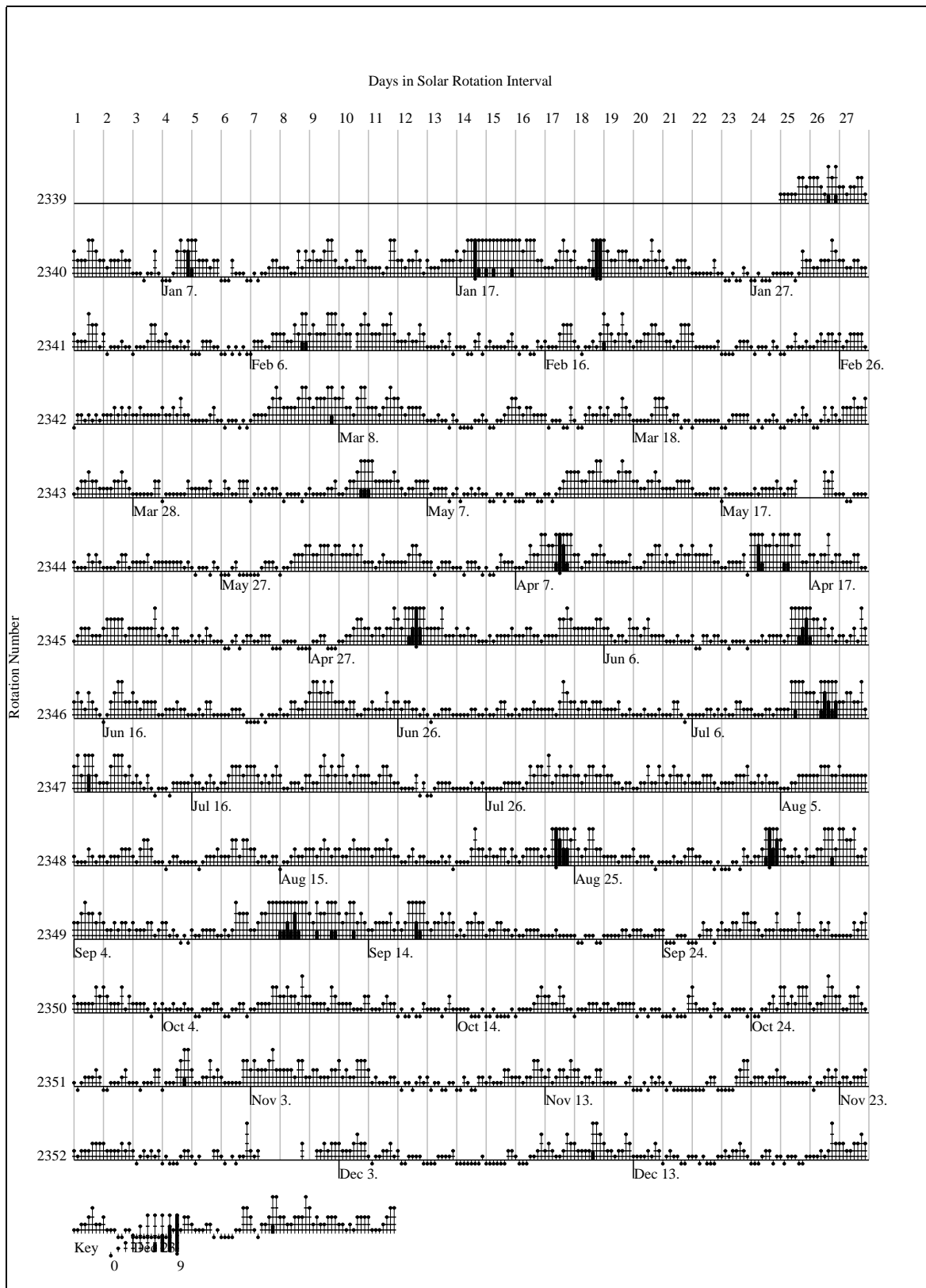


Figure 11: K-indices sequenced in Bartel's solar rotation number

### 15.3 Ak-Indices

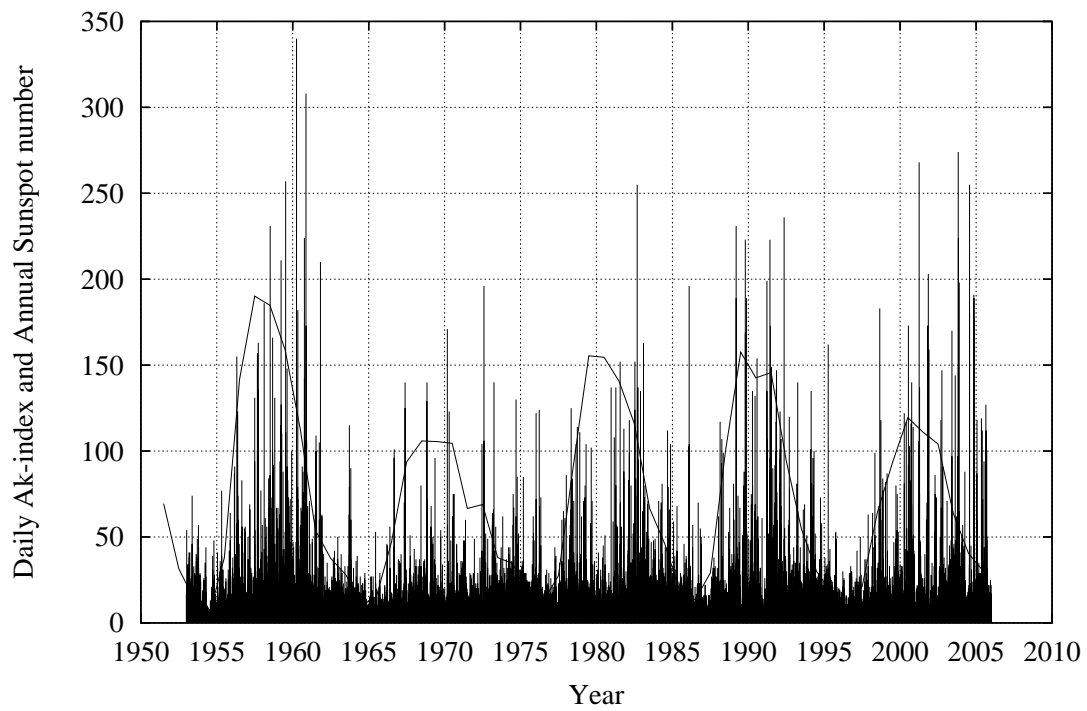


Figure 12: Daily Ak-indices (vertical lines) and sunspots (solid line)

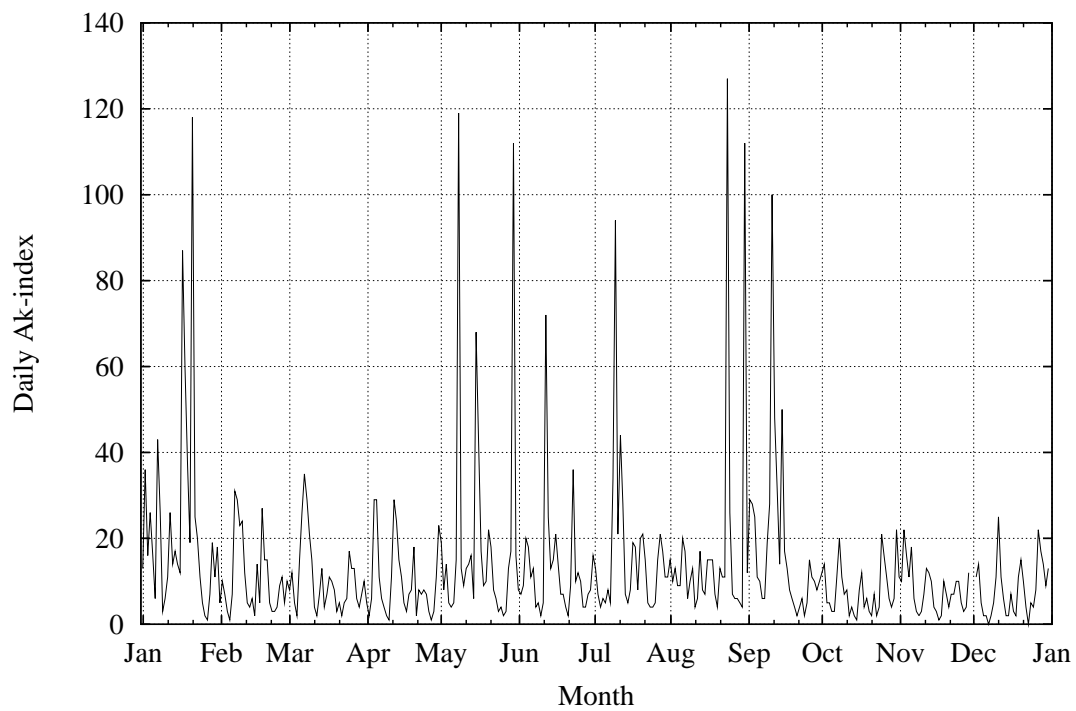


Figure 13: Daily Ak-indices

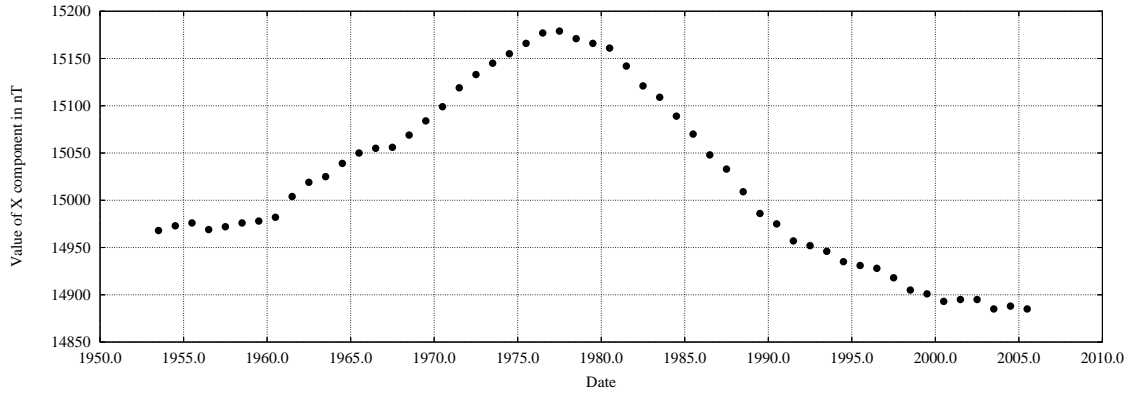
## 15.4 Table of Annual Ak-indices

m/M denotes sunspot minimum/maximum

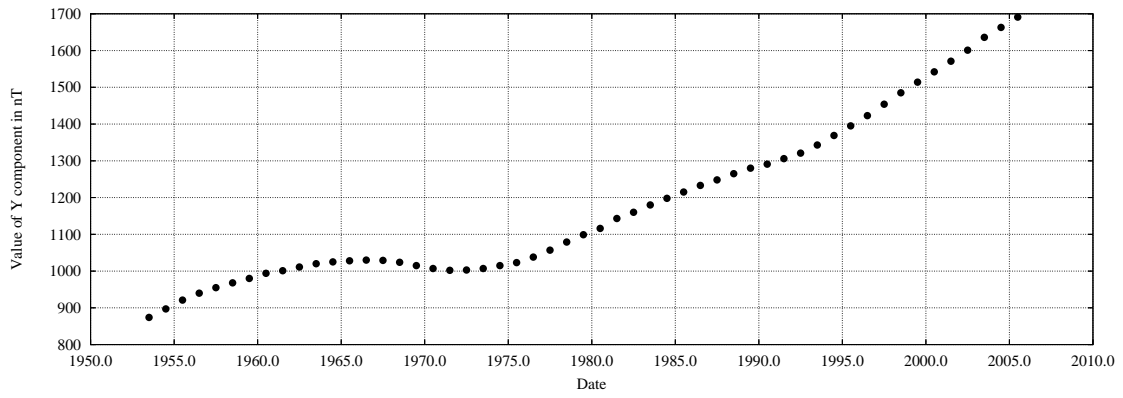
Year	Ak
1953	11
1954m	8
1955	9
1956	14
1957M	16
1958	18
1959	21
1960	22
1961	12
1962	10
1963	10
1964m	8
1965	6
1966	8
1967	10
1968M	11
1969	10
1970	10
1971	9
1972	10
1973	13
1974	15
1975	11
1976m	10
1977	9
1978	13
1979M	12

Year	Ak
1980	9
1981	13
1982	19
1983	15
1984	14
1985	10
1986m	10
1987	8
1988	11
1989M	16
1990	13
1991	21
1992	15
1993	13
1994	16
1995	11
1996m	9
1997	8
1998	12
1999	12
2000M	15
2001	14
2002	13
2003	22
2004	14
2005	14

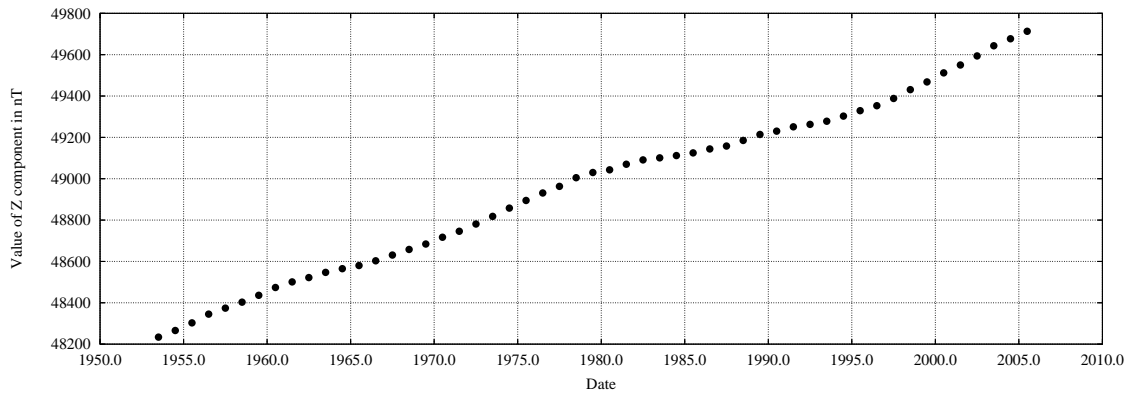
## 16 Annual Means



(a) Annual means for X component

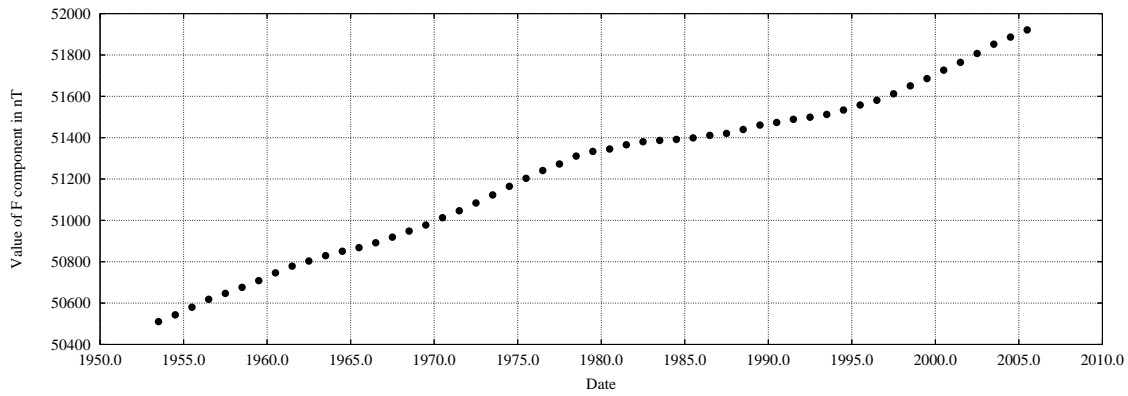


(b) Annual means for Y component

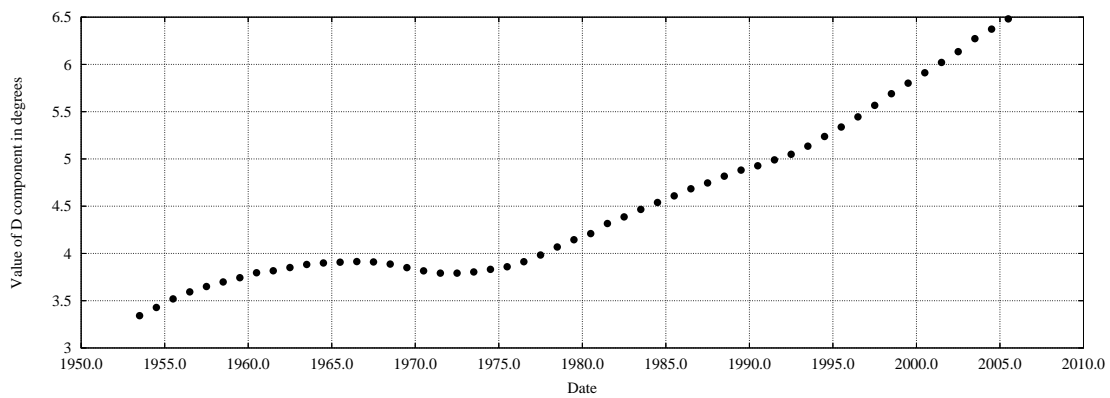


(c) Annual means for Z component

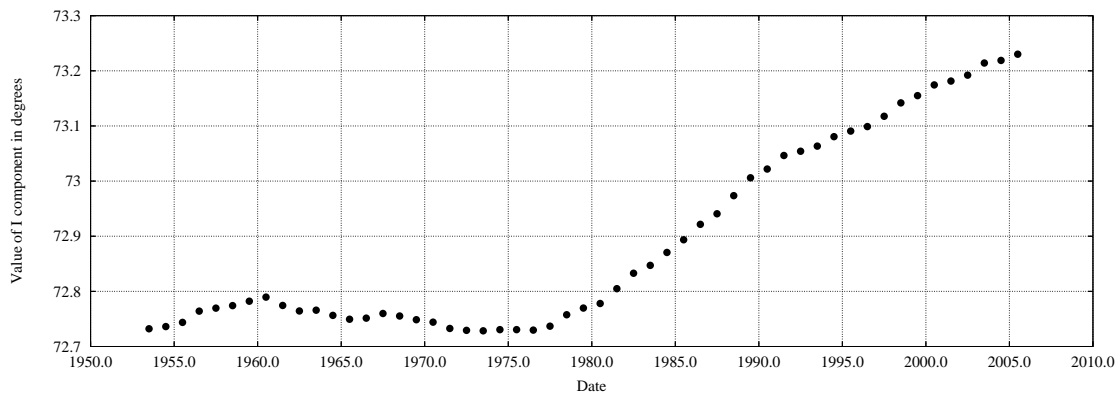
Figure 14: Figures of annual means of X, Y, and Z



(a) Annual means for F component



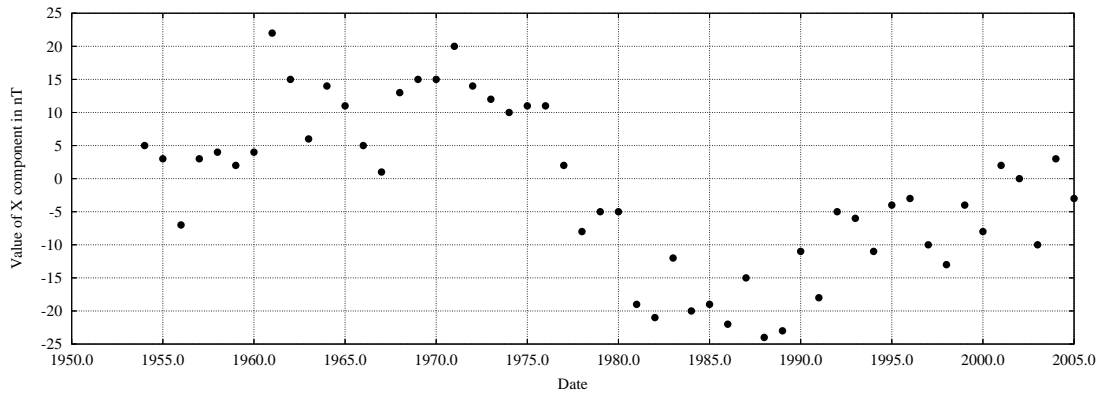
(b) Annual means for D component



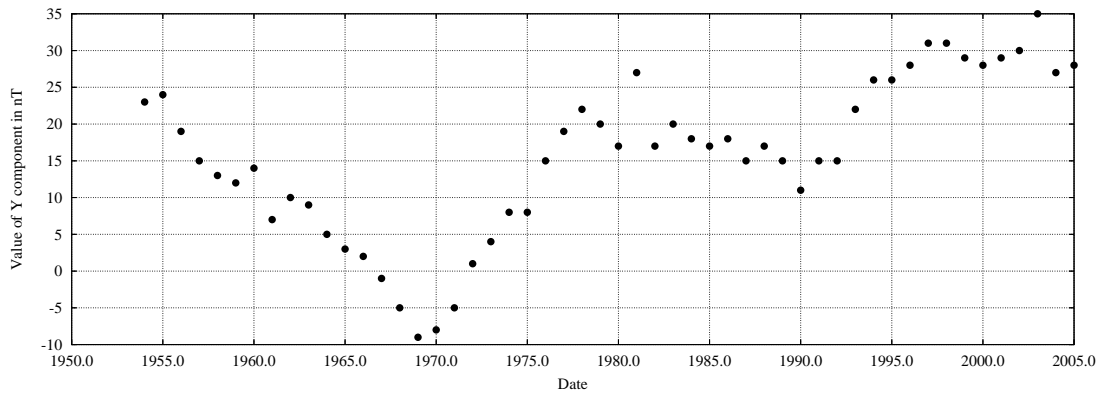
(c) Annual means for I component

Figure 15: Figures of annual means of F, D, and I

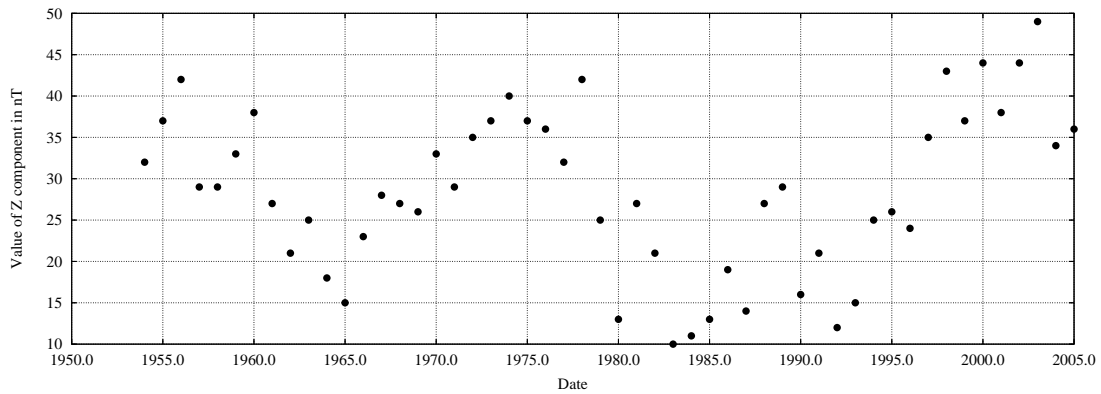
## 17 Secular Variation



(a) Annual change of X component



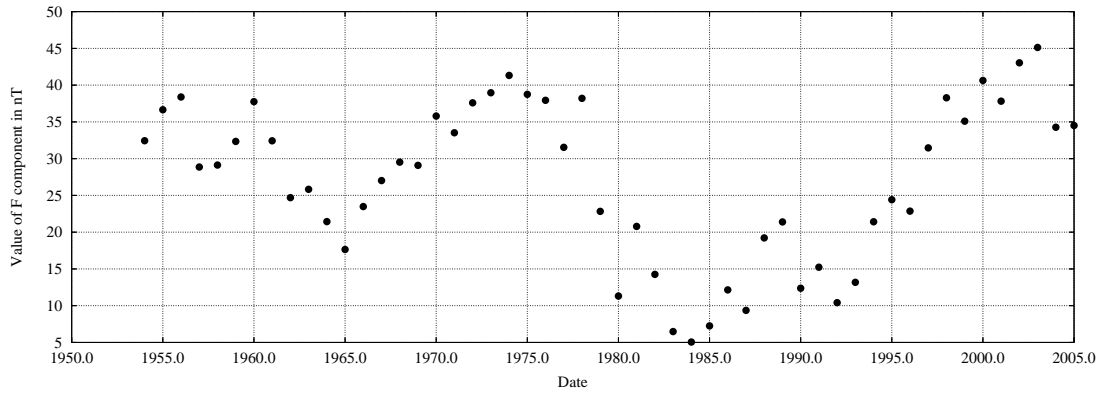
(b) Annual change of Y component



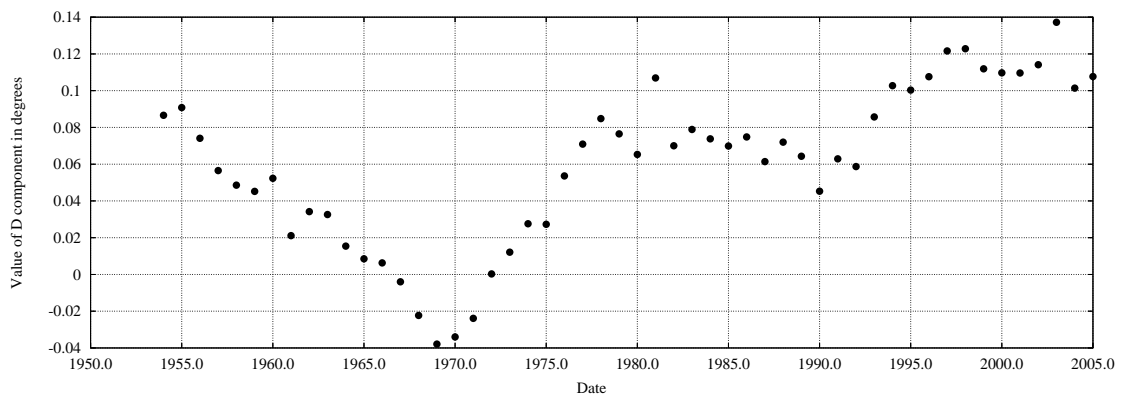
(c) Annual change of Z component

Figure 16: Annual change of components X, Y, and X

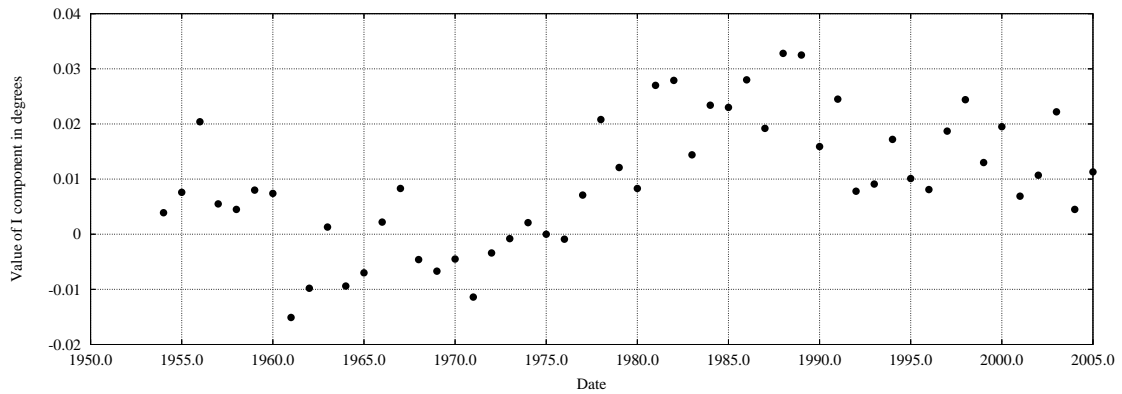




(a) Annual change of F component



(b) Annual change of D component



(c) Annual change of I component

Figure 17: Annual change of components F, D, and I

# 18 Tables of Annual Means

## 18.1 All Days

Year	X	Y	Z	D	H	F	I
1953	14968	874	48234	3° 20.5'	14993	50511	72° 43.9'
1954	14973	897	48266	3° 25.7'	15000	50543	72° 44.2'
1955	14976	921	48303	3° 31.1'	15004	50580	72° 44.6'
1956	14969	940	48345	3° 35.6'	14998	50618	72° 45.8'
1957	14972	955	48374	3° 39.0'	15002	50647	72° 46.2'
1958	14976	968	48403	3° 41.9'	15007	50676	72° 46.4'
1959	14978	980	48436	3° 44.6'	15010	50708	72° 46.9'
1960	14982	994	48474	3° 47.7'	15015	50746	72° 47.4'
1961	15004	1001	48501	3° 49.0'	15037	50779	72° 46.5'
1962	15019	1011	48522	3° 51.1'	15053	50803	72° 45.9'
1963	15025	1020	48547	3° 53.0'	15060	50829	72° 45.9'
1964	15039	1025	48565	3° 53.9'	15074	50851	72° 45.4'
1965	15050	1028	48580	3° 54.5'	15085	50868	72° 45.0'
1966	15055	1030	48603	3° 54.8'	15090	50892	72° 45.1'
1967	15056	1029	48631	3° 54.6'	15091	50919	72° 45.6'
1968	15069	1024	48658	3° 53.3'	15104	50948	72° 45.3'
1969	15084	1015	48684	3° 51.0'	15118	50977	72° 44.9'
1970	15099	1007	48717	3° 48.9'	15133	51013	72° 44.6'
1971	15119	1002	48746	3° 47.5'	15152	51047	72° 44.0'
1972	15133	1003	48781	3° 47.5'	15166	51084	72° 43.8'
1973	15145	1007	48818	3° 48.2'	15178	51123	72° 43.7'
1974	15155	1015	48858	3° 49.9'	15189	51165	72° 43.8'
1975	15166	1023	48895	3° 51.5'	15200	51203	72° 43.8'
1976	15177	1038	48931	3° 54.8'	15212	51241	72° 43.8'
1977	15179	1057	48963	3° 59.0'	15216	51273	72° 44.2'
1978	15171	1079	49005	4° 04.1'	15209	51311	72° 45.5'
1979	15166	1099	49030	4° 08.7'	15206	51334	72° 46.2'
1980	15161	1116	49043	4° 12.6'	15202	51345	72° 46.7'
1981	15142	1143	49070	4° 19.0'	15185	51366	72° 48.3'
1982	15121	1160	49091	4° 23.2'	15165	51380	72° 50.0'
1983	15109	1180	49101	4° 27.9'	15155	51387	72° 50.8'
1984	15089	1198	49112	4° 32.4'	15136	51392	72° 52.2'
1985	15070	1215	49125	4° 36.6'	15119	51399	72° 53.6'
1986	15048	1233	49144	4° 41.1'	15098	51411	72° 55.3'
1987	15033	1248	49158	4° 44.7'	15085	51420	72° 56.4'
1988	15009	1265	49185	4° 49.1'	15062	51440	72° 58.4'
1989	14986	1280	49214	4° 52.9'	15041	51461	73° 00.4'
1990	14975	1291	49230	4° 55.6'	15031	51473	73° 01.3'
1991	14957	1306	49251	4° 59.4'	15014	51489	73° 02.8'
1992	14952	1321	49263	5° 02.9'	15010	51499	73° 03.3'
1993	14946	1343	49278	5° 08.1'	15006	51512	73° 03.8'
1994	14935	1369	49303	5° 14.2'	14998	51534	73° 04.8'
1995	14931	1395	49329	5° 20.3'	14996	51558	73° 05.4'
1996	14928	1423	49353	5° 26.7'	14996	51581	73° 05.9'
1997	14918	1454	49388	5° 34.0'	14989	51612	73° 07.1'
1998	14905	1485	49431	5° 41.4'	14979	51651	73° 08.5'
1999	14901	1514	49468	5° 48.1'	14978	51686	73° 09.3'
2000	14893	1542	49512	5° 54.7'	14973	51726	73° 10.5'
2001	14895	1571	49550	6° 01.2'	14978	51764	73° 10.9'
2002	14895	1601	49594	6° 08.1'	14981	51807	73° 11.5'
2003	14885	1636	49643	6° 16.3'	14975	51852	73° 12.9'
2004	14888	1663	49677	6° 22.4'	14981	51887	73° 13.1'
2005	14885	1691	49713	6° 28.9'	14981	51921	73° 13.8'

## 18.2 Quiet Days

Year	X	Y	Z	D	H	F	I
1953	14975	872	48235	3° 20.0'	15000	50514	72° 43.5'
1954	14977	895	48266	3° 25.2'	15004	50544	72° 43.9'
1955	14980	919	48302	3° 30.6'	15008	50580	72° 44.4'
1956	14978	936	48343	3° 34.6'	15007	50619	72° 45.2'
1957	14978	951	48372	3° 38.0'	15008	50647	72° 45.8'
1958	14984	965	48400	3° 41.1'	15015	50676	72° 45.9'
1959	14986	976	48433	3° 43.6'	15018	50708	72° 46.4'
1960	14993	989	48474	3° 46.4'	15026	50749	72° 46.7'
1961	15010	998	48501	3° 48.2'	15043	50780	72° 46.1'
1962	15022	1009	48523	3° 50.6'	15056	50805	72° 45.7'
1963	15032	1018	48547	3° 52.5'	15066	50831	72° 45.5'
1964	15042	1024	48566	3° 53.7'	15077	50852	72° 45.2'
1965	15051	1027	48581	3° 54.2'	15086	50869	72° 44.9'
1966	15059	1028	48602	3° 54.3'	15094	50892	72° 44.8'
1967	15062	1028	48630	3° 54.3'	15097	50920	72° 45.2'
1968	15073	1022	48657	3° 52.7'	15108	50948	72° 45.1'
1969	15089	1013	48684	3° 50.4'	15123	50979	72° 44.6'
1970	15104	1005	48715	3° 48.4'	15137	51013	72° 44.3'
1971	15124	1001	48746	3° 47.2'	15157	51048	72° 43.6'
1972	15139	1001	48780	3° 47.0'	15172	51085	72° 43.4'
1973	15151	1004	48819	3° 47.5'	15184	51126	72° 43.4'
1974	15162	1012	48859	3° 49.1'	15196	51167	72° 43.4'
1975	15171	1020	48896	3° 50.8'	15205	51206	72° 43.5'
1976	15182	1035	48930	3° 54.0'	15217	51242	72° 43.5'
1977	15184	1054	48963	3° 58.2'	15221	51274	72° 43.9'
1978	15178	1075	49003	4° 03.1'	15216	51311	72° 45.0'
1979	15171	1096	49028	4° 07.9'	15211	51333	72° 45.8'
1980	15163	1115	49042	4° 12.3'	15204	51345	72° 46.5'
1981	15148	1140	49067	4° 18.2'	15191	51365	72° 47.9'
1982	15128	1157	49090	4° 22.4'	15172	51381	72° 49.5'
1983	15115	1176	49101	4° 26.9'	15161	51388	72° 50.5'
1984	15095	1195	49113	4° 31.6'	15142	51394	72° 51.9'
1985	15076	1212	49125	4° 35.8'	15125	51401	72° 53.2'
1986	15055	1230	49144	4° 40.2'	15105	51413	72° 54.9'
1987	15037	1246	49158	4° 44.2'	15089	51422	72° 56.2'
1988	15014	1262	49182	4° 48.3'	15067	51438	72° 58.1'
1989	14995	1276	49213	4° 51.8'	15049	51463	72° 59.8'
1990	14982	1288	49227	4° 54.8'	15037	51472	73° 00.8'
1991	14965	1302	49248	4° 58.3'	15022	51488	73° 02.2'
1992	14959	1318	49261	5° 02.1'	15017	51499	73° 02.8'
1993	14952	1341	49277	5° 07.5'	15012	51513	73° 03.4'
1994	14944	1365	49304	5° 13.1'	15006	51537	73° 04.3'
1995	14937	1392	49328	5° 19.4'	15002	51559	73° 05.1'
1996	14934	1421	49353	5° 26.1'	15001	51583	73° 05.6'
1997	14923	1452	49388	5° 33.4'	14993	51614	73° 06.7'
1998	14910	1484	49431	5° 41.0'	14984	51652	73° 08.2'
1999	14905	1512	49467	5° 47.5'	14981	51686	73° 09.0'
2000	14900	1540	49510	5° 54.1'	14979	51726	73° 10.0'
2001	14901	1569	49548	6° 00.6'	14983	51764	73° 10.5'
2002	14901	1599	49593	6° 07.5'	14987	51808	73° 11.1'
2003	14896	1632	49644	6° 15.1'	14985	51856	73° 12.2'
2004	14894	1660	49677	6° 21.6'	14986	51888	73° 12.8'
2005	14891	1689	49714	6° 28.3'	14986	51924	73° 13.5'

## 18.3 Disturbed Days

Year	X	Y	Z	D	H	F	I
1953	14959	879	48230	3° 21.8'	14985	50504	72° 44.4'
1954	14968	899	48264	3° 26.2'	14995	50540	72° 44.4'
1955	14967	924	48301	3° 32.0'	14995	50575	72° 45.2'
1956	14952	945	48344	3° 37.0'	14982	50612	72° 46.9'
1957	14959	961	48376	3° 40.5'	14990	50645	72° 47.0'
1958	14958	974	48407	3° 43.5'	14990	50675	72° 47.7'
1959	14963	986	48439	3° 46.2'	14995	50707	72° 47.9'
1960	14960	1004	48468	3° 50.4'	14994	50734	72° 48.6'
1961	14992	1005	48498	3° 50.1'	15026	50772	72° 47.2'
1962	15013	1013	48522	3° 51.6'	15047	50802	72° 46.3'
1963	15014	1025	48543	3° 54.3'	15049	50822	72° 46.6'
1964	15035	1027	48564	3° 54.5'	15070	50848	72° 45.6'
1965	15044	1030	48580	3° 55.0'	15079	50866	72° 45.3'
1966	15046	1033	48602	3° 55.7'	15081	50888	72° 45.6'
1967	15042	1034	48630	3° 55.9'	15077	50914	72° 46.5'
1968	15061	1028	48659	3° 54.3'	15096	50947	72° 45.8'
1969	15074	1019	48684	3° 52.0'	15108	50974	72° 45.5'
1970	15089	1011	48721	3° 50.0'	15123	51014	72° 45.4'
1971	15111	1006	48746	3° 48.5'	15144	51044	72° 44.5'
1972	15122	1007	48780	3° 48.6'	15155	51080	72° 44.4'
1973	15133	1013	48816	3° 49.8'	15167	51118	72° 44.4'
1974	15147	1019	48857	3° 50.9'	15181	51161	72° 44.3'
1975	15157	1027	48892	3° 52.6'	15192	51198	72° 44.3'
1976	15166	1042	48931	3° 55.8'	15202	51238	72° 44.5'
1977	15169	1061	48962	4° 00.1'	15206	51269	72° 44.8'
1978	15158	1086	49006	4° 05.9'	15197	51308	72° 46.3'
1979	15158	1103	49031	4° 09.7'	15198	51332	72° 46.7'
1980	15153	1120	49046	4° 13.6'	15194	51346	72° 47.2'
1981	15133	1146	49073	4° 19.8'	15176	51366	72° 48.9'
1982	15106	1166	49089	4° 24.8'	15151	51374	72° 50.9'
1983	15099	1184	49099	4° 29.0'	15145	51382	72° 51.4'
1984	15078	1203	49108	4° 33.7'	15126	51385	72° 52.8'
1985	15061	1219	49124	4° 37.6'	15110	51395	72° 54.1'
1986	15037	1237	49141	4° 42.2'	15088	51405	72° 55.9'
1987	15027	1250	49161	4° 45.3'	15079	51422	72° 56.9'
1988	15001	1268	49186	4° 49.9'	15054	51438	72° 58.9'
1989	14968	1287	49212	4° 54.9'	15023	51454	73° 01.4'
1990	14964	1296	49232	4° 57.0'	15020	51472	73° 02.0'
1991	14942	1313	49257	5° 01.3'	15000	51490	73° 03.8'
1992	14943	1324	49264	5° 03.8'	15002	51497	73° 03.8'
1993	14937	1348	49277	5° 09.4'	14998	51509	73° 04.3'
1994	14924	1373	49300	5° 15.4'	14987	51528	73° 05.5'
1995	14924	1398	49328	5° 21.1'	14989	51555	73° 05.9'
1996	14923	1425	49350	5° 27.3'	14991	51577	73° 06.2'
1997	14909	1457	49388	5° 34.9'	14980	51610	73° 07.6'
1998	14893	1489	49431	5° 42.6'	14967	51647	73° 09.3'
1999	14891	1517	49468	5° 49.0'	14968	51683	73° 09.9'
2000	14878	1547	49514	5° 56.2'	14958	51724	73° 11.4'
2001	14880	1576	49554	6° 02.8'	14963	51764	73° 11.9'
2002	14886	1604	49594	6° 09.0'	14972	51805	73° 12.1'
2003	14866	1643	49641	6° 18.4'	14957	51845	73° 14.0'
2004	14875	1669	49675	6° 24.1'	14968	51881	73° 13.9'
2005	14879	1696	49711	6° 30.2'	14975	51918	73° 14.1'

## 19 Earth's Magnetic Field Maps of Finland 2006.0

The isolines of total field (F) and horizontal field (H) are given in nanoteslas (nT), declination (D, positive eastwards) and inclination (I, positive downwards) in degrees of arc (see also [www.geo.fmi.fi/MAGN/magncharts.html](http://www.geo.fmi.fi/MAGN/magncharts.html))

## TOTAL INTENSITY (F) 2006.0

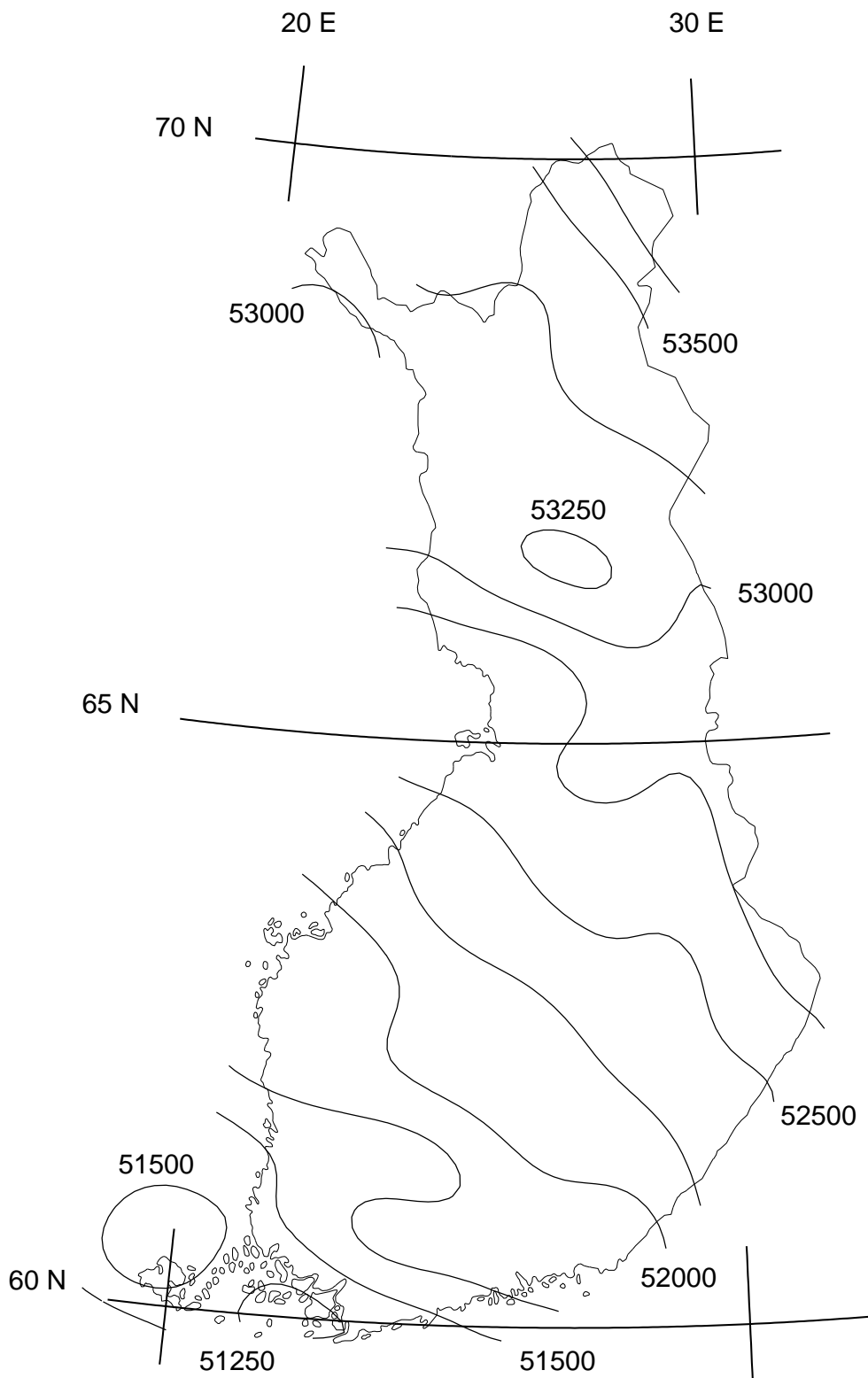


Figure 18: Total intensity F 2006.0 in nT

## HORIZONTAL INTENSITY (H) 2006.0

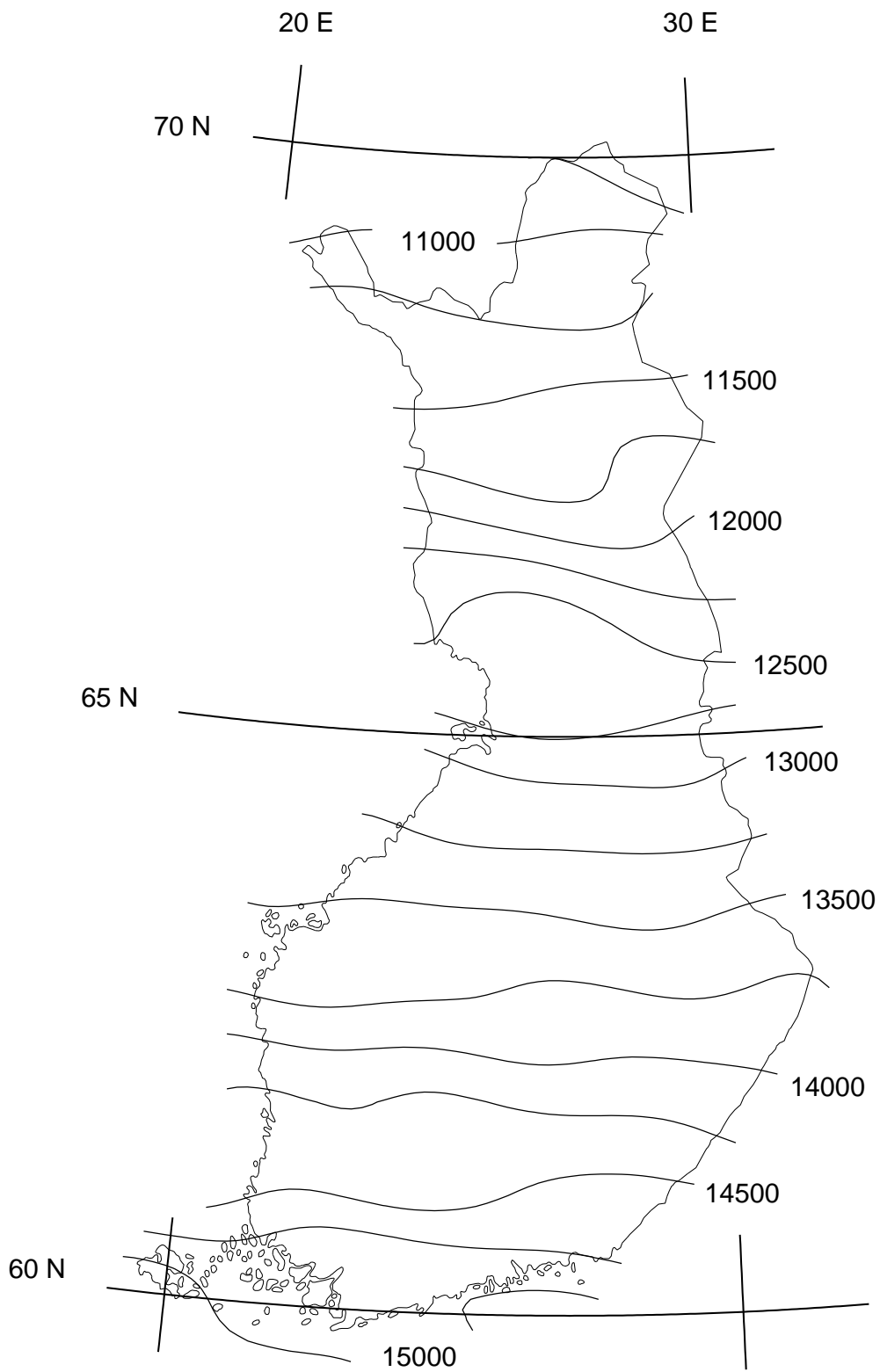


Figure 19: Horizontal intensity H 2006.0 in nT

## DECLINATION (D) 2006.0

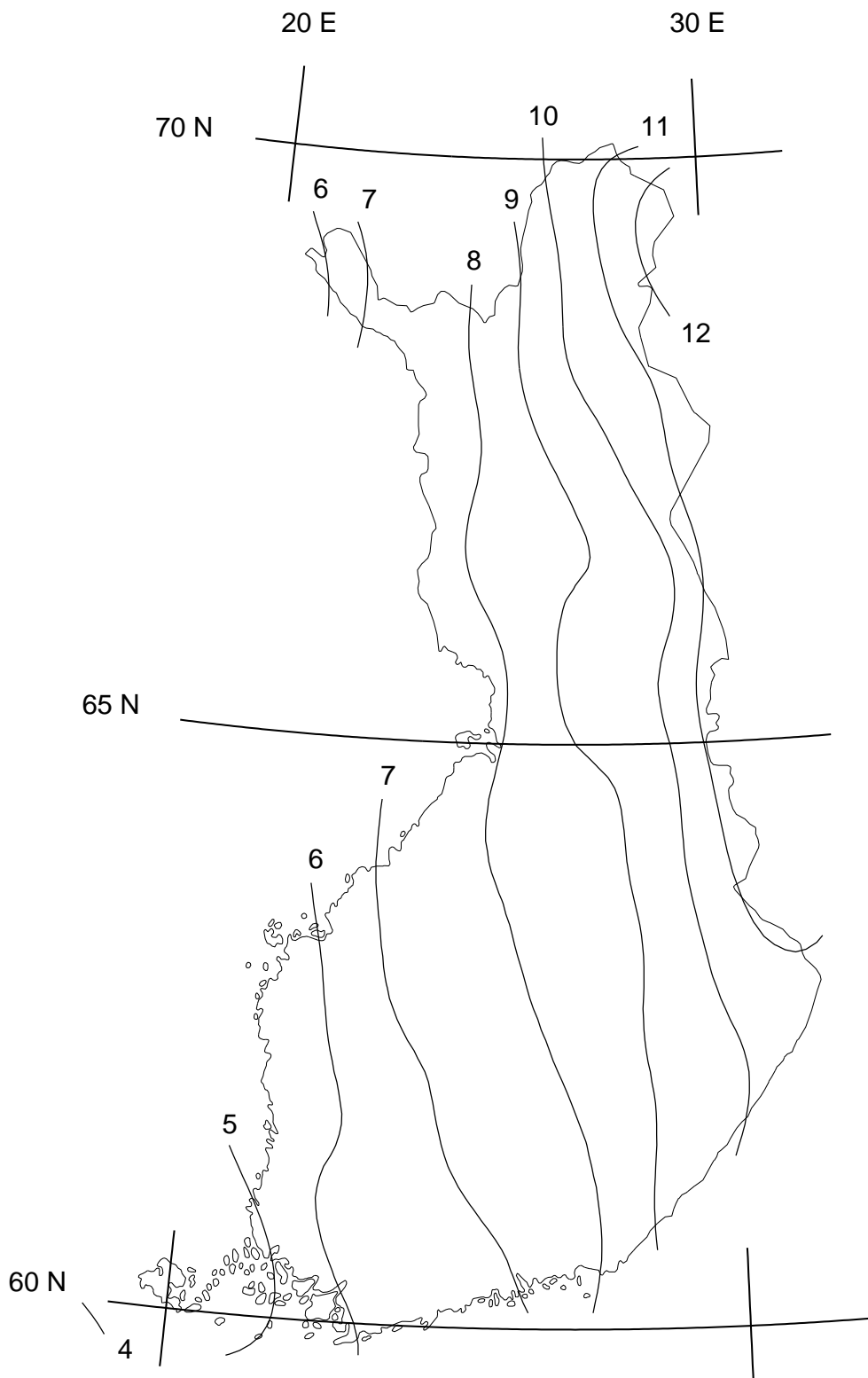


Figure 20: Declination D 2006.0 in degrees



## INCLINATION (I) 2006.0

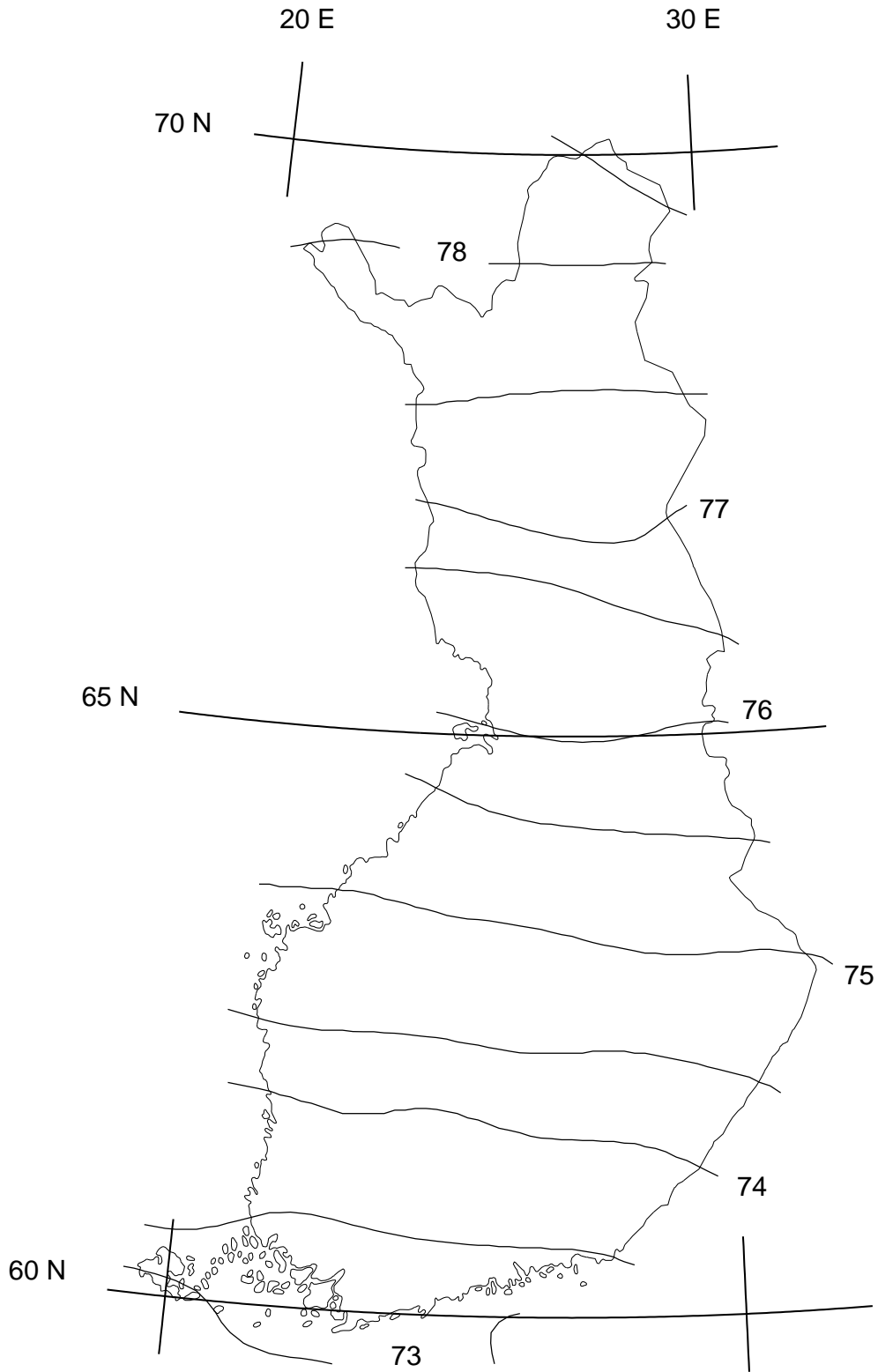


Figure 21: Inclination I 2006.0 in degrees

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