


**NURMIJÄRVI GEOPHYSICAL
OBSERVATORY**

MAGNETIC RESULTS 2004

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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 2004. Magnetic isolines describing the distribution of geomagnetic field components in Finland 2005.0 are shown by a series of maps.</p>		
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1 Description of the observatory

The Nurmijärvi Geophysical Observatory of the Finnish Meteorological Institute (FMI) started recording the Earth's magnetic field in April 1952. The first yearbook was for 1953. The observatory is a part of Space Research Division (AVA).

The observatory lies in a pine forest on a moraine ridge by a lake shore, about 40 kilometers NNW of Helsinki. There are no artificial disturbance sources nearby.

Coordinates:

	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 once per week with absolute measurements. An other magnetic recording instruments 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. Hydrological and meteorological observations are part of the daily routine. The Helsinki University operates the seismic station.

The observatory has a magnetic calibration and test laboratory consisting of the magnetometer calibration system and the magnetic cleanliness measuring system. The calibrations are performed with three component coils and a computer controlled measuring system. Angles between sensors are measured with accuracy better than one minute of arc and the transformation factors with 0.03% accuracy. The facility includes a temperature test system for the magnetometer sensors with good temperature control and a non-tilting pillar. The magnetic cleanliness measuring system is used for testing satellite instruments and materials. Objects are measured on a rotating table inside the big calibration coils, which can reduce the Earth's field down to zero. Common software is used both for magnetic calibrations and cleanliness measurements. The demagnetizing system operates at $3Hz$ and can generate alternating fields from $5mT$ down to $30nT$.

2 Recording instruments

In the variation room the Danish suspended flux gate magnetometer (FGE) is the primary instrument. The Ukrainian LEMI-004 flux gate magnetometer is the second variometer. The sensors are directed in geographic north and east directions measuring the X, Y and Z components. The temperature in the variometer room is kept constant at $18^{\circ}C$. Analog voltages from the magnetometers are AD-converted in the variation room and the digital data are transferred through optical wires to the computers in the main observatory building. The Linux based software stores the data in three files as one-second, ten-seconds and one-minute averages. Timing is based on GPS time sheared through the local network. The standard one-minute values are 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 is the starting minute at the centre of the period (00, 01, 02 etc.).

3 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. 2.

4 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 $750nT$.

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 2002 was published in 2004 containing minute data, annual means and base line values from Nurmijärvi together with data from 88 other magnetic observatories.

5 IMAGE stations

The IMAGE magnetometer network consisted at the end of 2004 of 29 stations from Tartu in Estonia to Ny Ålesund on Svalbard. The principal investigator of this international project was Ari Viljanen at AVA. 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 in co-operation with the Sodankylä Geophysical Observatory of the Oulu University.

A new IMAGE station was established at Mekrijärvi (MEK) in eastern Finland. Mekrijärvi is a research station of Joensuu 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 Nurmijärvi. TAR in Estonia and KEV and MEK in Finland had direct network connections and OUI and MAS were still operated through ordinary modems. The data of the nine stations was processed and inspected at the observatory and was sent to the AVA for IMAGE filing. Data transmission from the other IMAGE stations was also operated at the observatory.

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

Year	X	Y	Z
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

6 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.

7 Personnel

Ph.D. Kari Pajunpää, head of the observatory

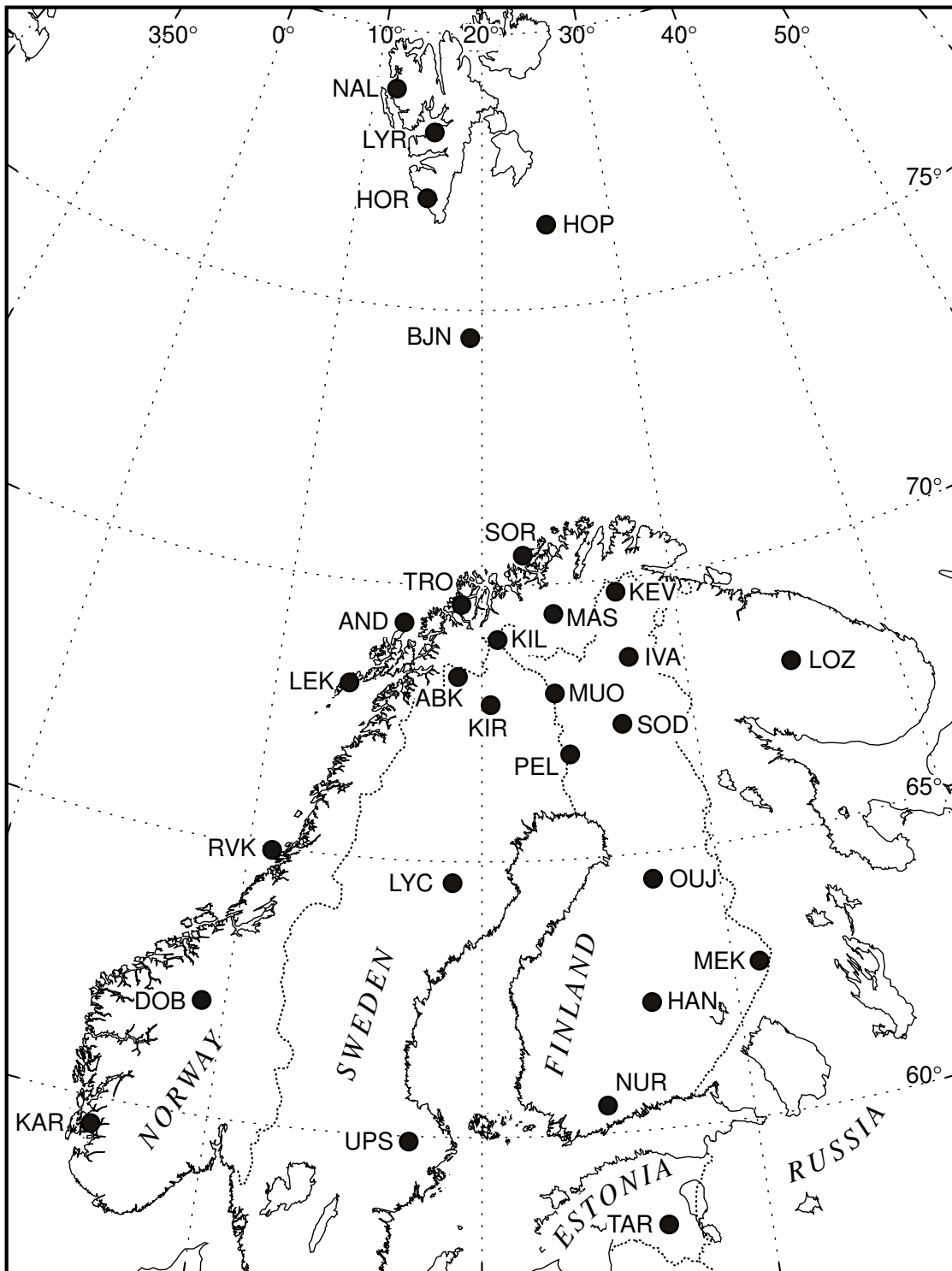
M.Sc. Anja Koistinen, assistant

Mr. Pentti Posio, technician

Ms. Tuulikki Kangas, secretary, retired for pension in Dec. 2005

8 IMAGE Magnetometer Network

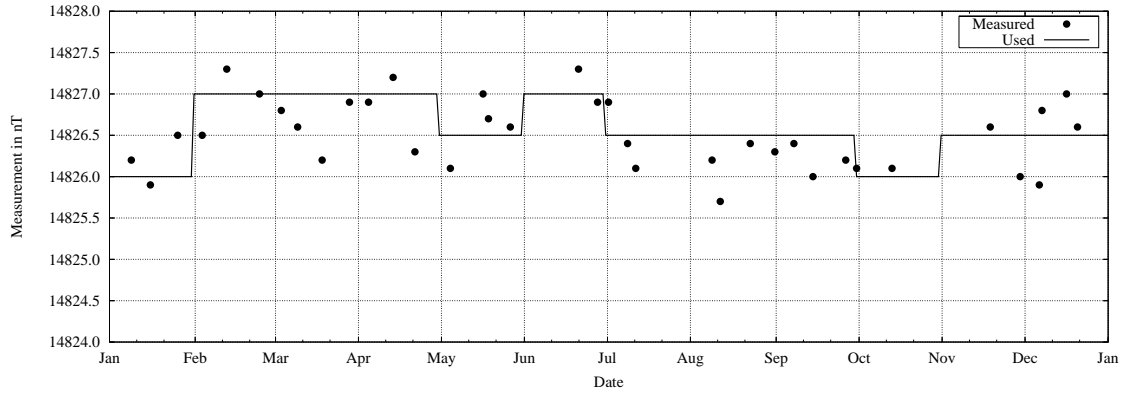
IMAGE Magnetometer Network



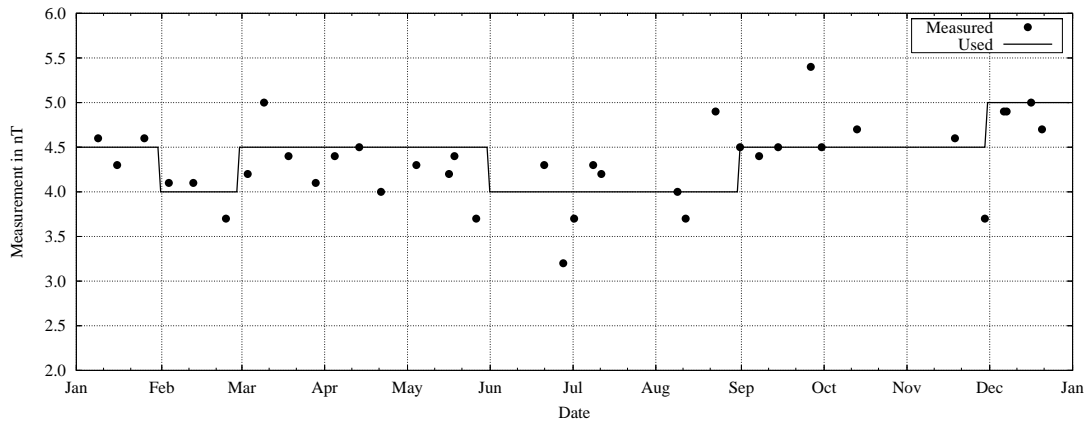
December 2004

Figure 1: Map of IMAGE magnetometer network

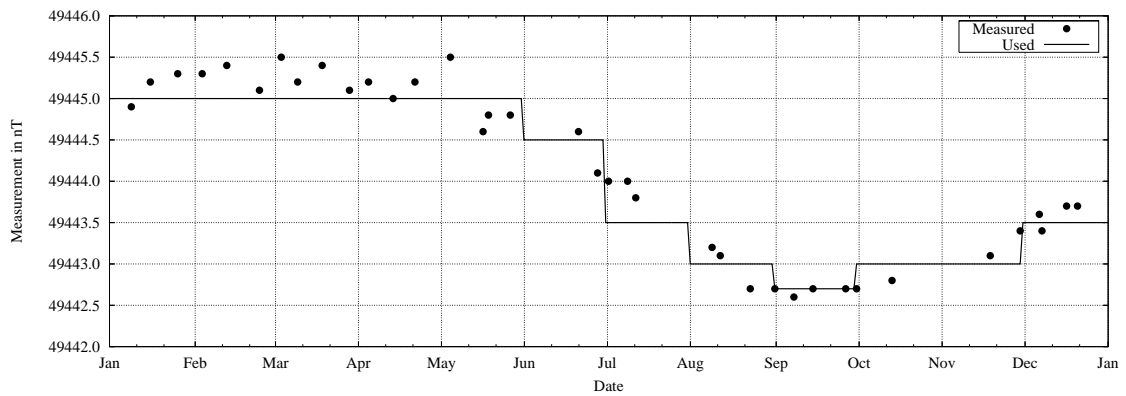
9 Baseline Measurements for FGE



(a) Baseline measurements for X component



(b) Baseline measurements for Y component



(c) Baseline measurements for Z component

Figure 2: Baseline measurements

10 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)

Nurnijärvi Finland

January 2004 North component X in nT (X = 14900 nT + tabular values)

Table with 25 columns (Day, Char, 1-24, Mean) and 31 rows of data for January 2004 North component X in nT.

January 2004 East component Y in nT (Y = 1400 nT + tabular values)

Table with 25 columns (Day, Char, 1-24, Mean) and 31 rows of data for January 2004 East component Y in nT.

January 2004 Vertical component Z in nT (Z = 49400 nT + tabular values)

Table with 25 columns (Day, Char, 1-24, Mean) and 31 rows of data for January 2004 Vertical component Z in nT.

Nurmijärvi Finland

May 2004 North component X in nT (X = 14900 nT + tabular values)

Table with columns: Day, Char, 1-24, Mean. Contains daily data for the North component X in nT.

May 2004 East component Y in nT (Y = 1400 nT + tabular values)

Table with columns: Day, Char, 1-24, Mean. Contains daily data for the East component Y in nT.

May 2004 Vertical component Z in nT (Z = 49400 nT + tabular values)

Table with columns: Day, Char, 1-24, Mean. Contains daily data for the Vertical component Z in nT.

Nurmijärvi Finland

July 2004 North component X in nT (X = 14900 nT + tabular values)

Table with 26 columns (Day, Char, 1-24, Mean) and 33 rows of data for July 2004 North component X in nT.

July 2004 East component Y in nT (Y = 1400 nT + tabular values)

Table with 26 columns (Day, Char, 1-24, Mean) and 33 rows of data for July 2004 East component Y in nT.

July 2004 Vertical component Z in nT (Z = 49400 nT + tabular values)

Table with 26 columns (Day, Char, 1-24, Mean) and 33 rows of data for July 2004 Vertical component Z in nT.

Nurmijärvi Finland

October 2004 North component X in nT (X = 14900 nT + tabular values)

Table with 25 columns (Day, Char, 1-24, Mean) and 31 rows of data for the North component X in nT.

October 2004 East component Y in nT (Y = 1400 nT + tabular values)

Table with 25 columns (Day, Char, 1-24, Mean) and 31 rows of data for the East component Y in nT.

October 2004 Vertical component Z in nT (Z = 49400 nT + tabular values)

Table with 25 columns (Day, Char, 1-24, Mean) and 31 rows of data for the Vertical component Z in nT.

11.3 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	-19	1	8	-7	8	3	7	7	-1	5	8	0	2	19	14	7	28	5	-7	-6	-20	-18	-25	-20	14873
February	-9	-3	-5	-3	4	-1	-4	-5	-4	-6	-6	-11	-5	-1	1	11	49	47	-1	-7	-14	-7	-11	-7	14886
March	-40	2	-1	7	6	0	4	-6	-26	-15	-9	5	10	17	19	20	30	21	25	-3	13	-10	-24	-43	14878
April	12	6	10	13	13	10	8	4	-5	-22	-16	-6	24	19	32	24	27	59	14	-24	-49	-39	-64	-48	14882
May	3	1	-2	-1	-2	-9	-17	-23	-28	-33	-27	-25	-6	6	15	22	22	19	27	23	19	11	2	4	14895
June	4	3	4	2	2	-9	-31	-33	-30	-26	-21	-13	8	-8	12	21	22	21	22	24	12	6	4	3	14900
July	-192	-83	-74	-56	-60	-87	-108	-91	-71	-40	12	136	208	222	131	184	117	62	24	-4	-14	-40	-84	-92	14875
August	-8	-3	-1	3	10	7	-1	-19	-22	-17	-17	-8	7	32	44	57	52	29	7	-5	-14	-39	-62	-35	14879
September	9	-1	0	7	7	-4	-9	-9	-18	-26	-18	-6	1	8	9	5	7	13	9	14	-3	-2	0	5	14884
October	6	3	3	14	13	5	-1	-6	-14	-13	-16	-9	-4	-1	0	-1	-2	-4	3	10	6	4	0	3	14879
November	-191	8	-21	-53	-187	-130	-41	13	20	87	149	142	128	148	148	124	102	94	72	-35	-235	-78	-70	-193	14786
December	2	1	-6	7	14	10	16	14	5	-4	-6	-3	2	-3	0	-9	-9	-11	-9	-8	-2	3	-2	-1	14878
Winter	-54	2	-6	-14	-40	-29	-5	7	5	20	36	32	41	41	33	42	34	14	-14	-68	-25	-27	-55	-55	14856
Equinox	-3	2	3	10	10	3	1	-5	-16	-19	-15	-4	8	11	15	12	16	22	13	-1	-8	-12	-22	-21	14881
Summer	-48	-20	-18	-13	-13	-25	-41	-43	-38	-29	-13	22	54	63	50	71	53	33	20	9	1	-16	-35	-30	14887
Year	-35	-6	-7	-6	-14	-17	-15	-13	-16	-9	3	17	31	38	35	39	37	30	16	-2	-25	-17	-28	-35	14875

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	18	10	5	-12	-15	-26	-17	-22	-20	-17	-26	-20	-8	-20	-8	-7	-7	45	25	23	29	29	22	18	1661
February	4	1	4	10	6	-6	-17	-14	-13	-13	-15	-19	-18	-22	-7	-2	10	14	14	9	4	24	26	20	1655
March	4	9	4	-3	1	-3	4	-2	-2	-15	-22	-29	-33	-32	-20	3	8	7	11	16	23	23	22	22	1664
April	7	8	0	3	6	12	13	16	12	-7	-19	-31	-35	-36	-34	-34	-21	-7	6	25	7	28	51	30	1658
May	20	20	12	14	17	20	22	14	3	-11	-21	-30	-29	-25	-20	-14	-12	-5	-5	-3	8	10	7	9	1656
June	12	15	16	19	27	31	27	13	4	0	-11	-24	-31	-26	-26	-19	-9	-5	-8	-4	3	-2	2	-1	1658
July	32	39	0	-4	7	4	4	5	12	21	14	14	7	-31	-31	-40	-18	-16	-15	-16	-12	1	8	16	1679
August	16	14	5	10	6	8	6	2	-5	-14	-30	-34	-32	-30	-26	-17	-10	12	16	10	13	31	33	17	1668
September	4	8	4	9	10	9	5	1	-4	-18	-37	-34	-30	-19	-11	-9	5	14	20	12	5	23	5	18	1668
October	16	2	-6	2	0	-1	-6	-3	-4	-10	-17	-29	-30	-26	-10	10	16	3	12	24	15	28	9	4	1672
November	22	14	3	-5	-36	-29	-27	15	7	17	14	-16	-22	-18	-3	-14	-26	3	0	13	20	20	16	35	1705
December	14	12	1	-4	-7	-12	-12	-10	-5	-10	-11	-9	-18	-14	-8	1	22	6	13	18	15	13	7	-2	1679
Winter	14	9	3	-3	-13	-18	-18	-8	-8	-6	-9	-16	-16	-18	-6	-6	0	17	13	16	17	22	18	18	1675
Equinox	8	7	1	3	5	4	4	3	1	-13	-21	-31	-32	-28	-19	-7	2	4	12	19	13	26	22	18	1666
Summer	20	22	8	10	14	16	15	8	4	-1	-12	-19	-21	-28	-26	-23	-12	-4	-3	-3	3	10	12	10	1665
Year	14	13	4	3	2	1	0	1	-1	-7	-14	-22	-23	-25	-17	-12	-4	6	8	11	11	19	17	15	1669

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	-54	-63	-72	-67	-49	-31	-20	-15	-8	0	10	38	67	65	71	57	73	77	52	35	-40	-43	-39	-46	49675
February	-19	-15	-26	-34	-24	-21	-19	-16	-15	-7	3	5	9	16	28	51	66	48	46	10	-15	-22	-25	-26	49677
March	-84	-45	-35	-29	-18	-15	2	6	12	12	9	10	12	24	43	68	84	60	46	17	-10	-35	-64	-70	49664
April	-9	-11	-8	-10	-7	-6	-3	-2	-2	-4	0	2	19	23	35	46	68	72	40	-9	-44	-40	-78	-71	49667
May	-12	-10	-21	-20	-15	-9	-3	-4	-4	-3	2	8	13	15	19	20	23	25	12	11	3	-8	-21	-20	49663
June	-16	-26	-24	-16	-8	-4	-5	-5	-3	-3	-4	2	15	21	17	24	29	24	15	4	2	-4	-12	-26	49668
July	-249	-170	-124	-59	-24	-31	-10	17	58	93	106	122	87	16	87	94	87	94	71	23	-1	-45	-91	-152	49647
August	-38	-32	-28	-27	-19	-12	-6	-3	0	1	4	13	20	39	64	76	74	52	14	-14	-29	-44	-69	-35	49684
September	-17	-19	-23	-15	-9	-4	-2	0	0	0	2	14	28	43	50	41	40	25	16	-7	-27	-23	-49	-65	49681
October	-39	-41	-40	-22	-13	-10	-3	1	3	3	7	14	29	40	52	44	35	24	19	-5	-12	-23	-29	-33	49683
November	-79	-92	-137	-103	-139	-38	-4	36	67	82	81	65	96	106	115	99	97	47	14	-28	-76	-59	-49	-99	49691
December	-27	-23	-20	-13	-12	-12	-10	-9	-6	-3	2	4	7	15	22	46	39	22	18	9	3	-5	-19	-29	49705
Winter	-45	-48	-64	-54	-56	-26	-13	-1	10	18	24	28	45	51	59	63	69	49	33	7	-32	-32	-33	-50	49687
Equinox	-37	-29	-27	-19	-12	-9	-1	1	3	3	4	10	22	33	45	50	57	45	30	-1	-24	-30	-55	-60	49674
Summer	-79	-59	-49	-30	-16	-14	-7	1	13	22	27	36	34	23	47	54	54	49	28	6	-6	-25	-48	-58	49665
Year	-54	-46	-47	-35	-28	-16	-7	0	9	14	18	25	33	35	50	55	60	48	30	4	-21	-29	-45	-56	49675

12 Monthly and Annual Means

All days

	Z	H	D	F	X	Y	I
January	49671	14975	6° 20.4'	51879	14884	1654	73° 13.4'
February	49669	14983	6° 19.7'	51880	14892	1652	73° 12.8'
March	49666	14982	6° 20.7'	51877	14890	1656	73° 12.8'
April	49666	14984	6° 20.5'	51877	14893	1655	73° 12.7'
May	49665	14990	6° 20.6'	51878	14899	1656	73° 12.3'
June	49668	14994	6° 21.0'	51882	14902	1658	73° 12.1'
July	49667	14985	6° 22.9'	51878	14892	1666	73° 12.7'
August	49683	14981	6° 23.0'	51892	14888	1665	73° 13.2'
September	49683	14981	6° 23.4'	51892	14887	1667	73° 13.2'
October	49686	14982	6° 23.7'	51895	14889	1669	73° 13.2'
November	49700	14957	6° 27.3'	51901	14862	1681	73° 15.1'
December	49702	14976	6° 26.1'	51909	14882	1678	73° 13.9'
Winter	49686	14973	6° 23.4'	51893	14880	1666	73° 13.8'
Equinox	49675	14982	6° 22.1'	51885	14890	1662	73° 13.0'
Summer	49671	14987	6° 21.9'	51882	14895	1661	73° 12.6'
Year	49677	14981	6° 22.4'	51887	14888	1663	73° 13.1'

5 Quiet days

	Z	H	D	F	X	Y	I
January	49669	14980	6° 19.0'	51879	14889	1648	73° 13.0'
February	49669	14987	6° 19.1'	51880	14896	1649	73° 12.6'
March	49664	14990	6° 19.0'	51877	14899	1649	73° 12.3'
April	49665	14990	6° 19.7'	51878	14899	1652	73° 12.3'
May	49666	14993	6° 20.4'	51880	14902	1656	73° 12.1'
June	49668	14996	6° 21.0'	51883	14904	1659	73° 12.0'
July	49669	14995	6° 21.5'	51883	14903	1660	73° 12.1'
August	49685	14983	6° 22.8'	51895	14890	1665	73° 13.1'
September	49685	14982	6° 22.9'	51894	14889	1665	73° 13.2'
October	49686	14986	6° 23.3'	51897	14893	1667	73° 13.0'
November	49696	14978	6° 24.8'	51904	14884	1673	73° 13.7'
December	49702	14980	6° 25.3'	51910	14886	1676	73° 13.7'
Winter	49684	14981	6° 22.1'	51894	14889	1662	73° 13.2'
Equinox	49675	14987	6° 21.2'	51887	14895	1658	73° 12.7'
Summer	49672	14992	6° 21.4'	51885	14900	1660	73° 12.3'
Year	49677	14987	6° 21.6'	51888	14895	1660	73° 12.7'

5 Disturbed days

	Z	H	D	F	X	Y	I
January	49675	14965	6° 22.4'	51880	14873	1661	73° 14.0'
February	49677	14978	6° 20.7'	51886	14886	1655	73° 13.3'
March	49664	14971	6° 22.8'	51872	14878	1664	73° 13.5'
April	49667	14974	6° 21.4'	51875	14882	1658	73° 13.4'
May	49663	14987	6° 20.7'	51875	14895	1656	73° 12.4'
June	49668	14992	6° 21.0'	51881	14900	1658	73° 12.3'
July	49647	14970	6° 26.3'	51855	14875	1679	73° 13.3'
August	49684	14972	6° 23.8'	51891	14879	1668	73° 13.8'
September	49681	14978	6° 23.7'	51890	14884	1668	73° 13.4'
October	49683	14973	6° 24.8'	51890	14879	1672	73° 13.7'
November	49691	14884	6° 34.6'	51872	14786	1705	73° 19.5'
December	49705	14972	6° 26.3'	51911	14878	1679	73° 14.2'
Winter	49687	14950	6° 26.0'	51887	14856	1675	73° 15.3'
Equinox	49674	14974	6° 23.2'	51882	14881	1666	73° 13.5'
Summer	49665	14980	6° 23.0'	51875	14887	1665	73° 12.9'
Year	49675	14968	6° 24.0'	51881	14875	1669	73° 13.9'

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

13.1 H-Component

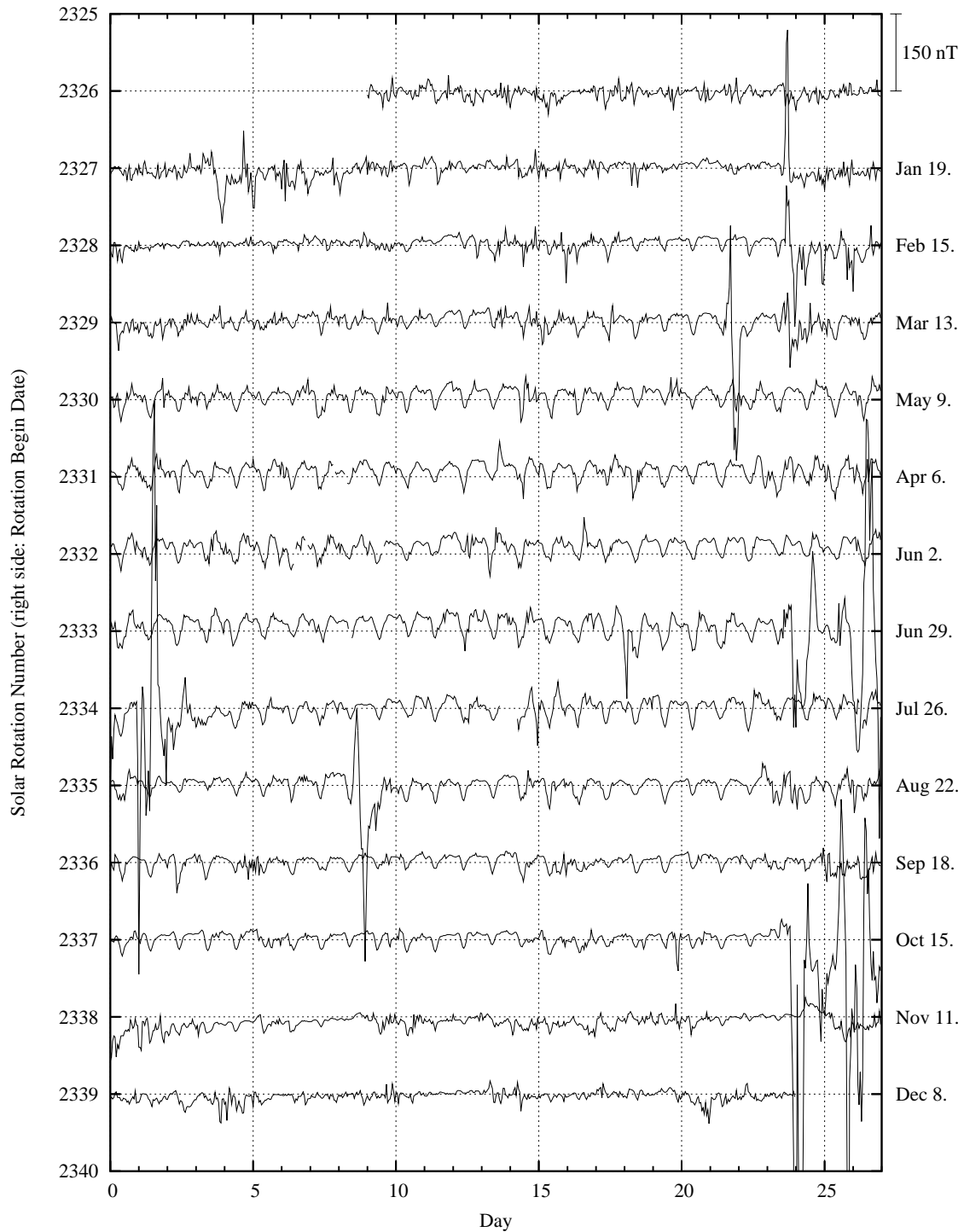


Figure 3: Hourly means of H sequenced in Bartels' solar rotation cycles.

13.2 D-Component

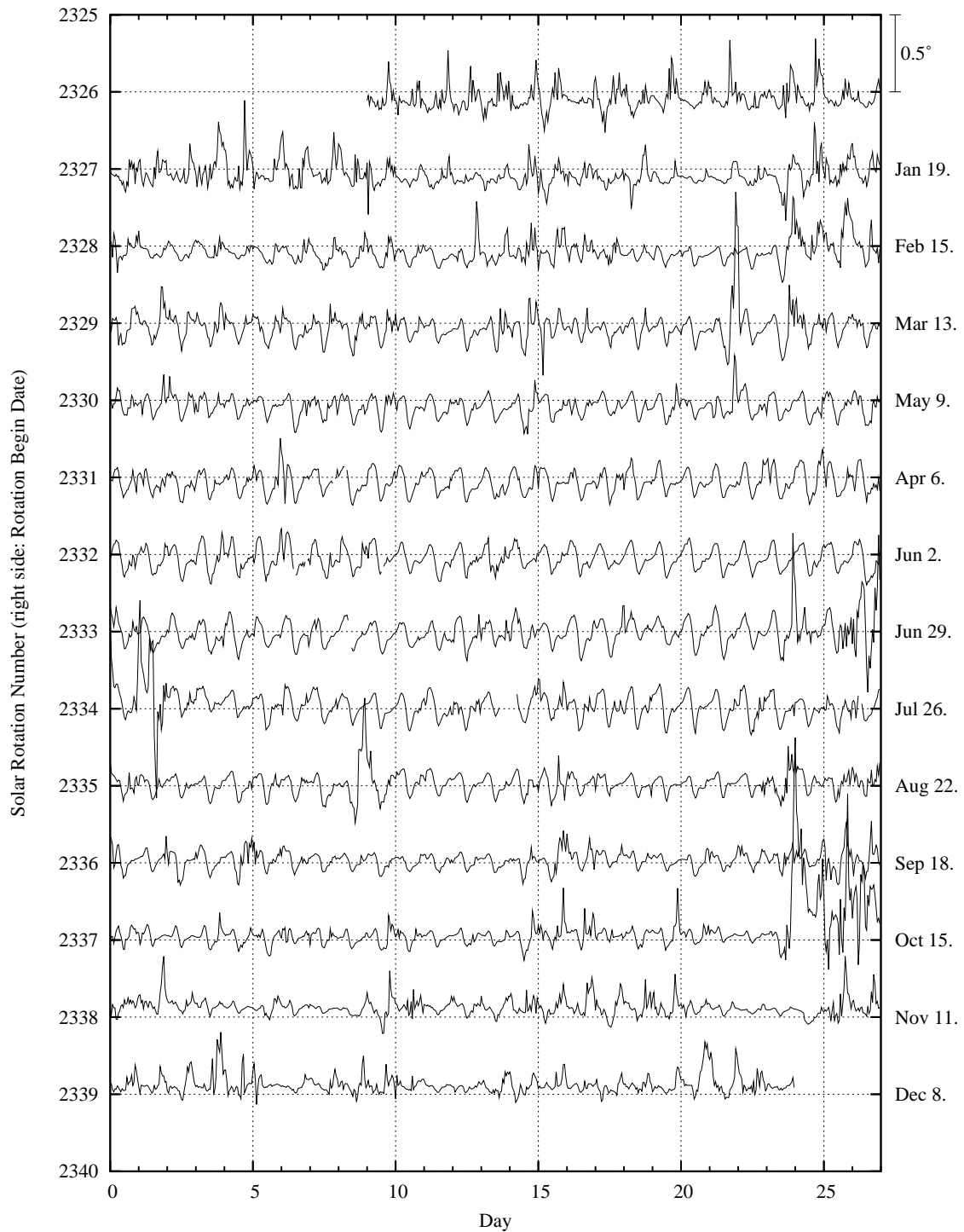


Figure 4: Hourly means of D sequenced in Bartels' solar rotation cycles.

13.3 Z-Component

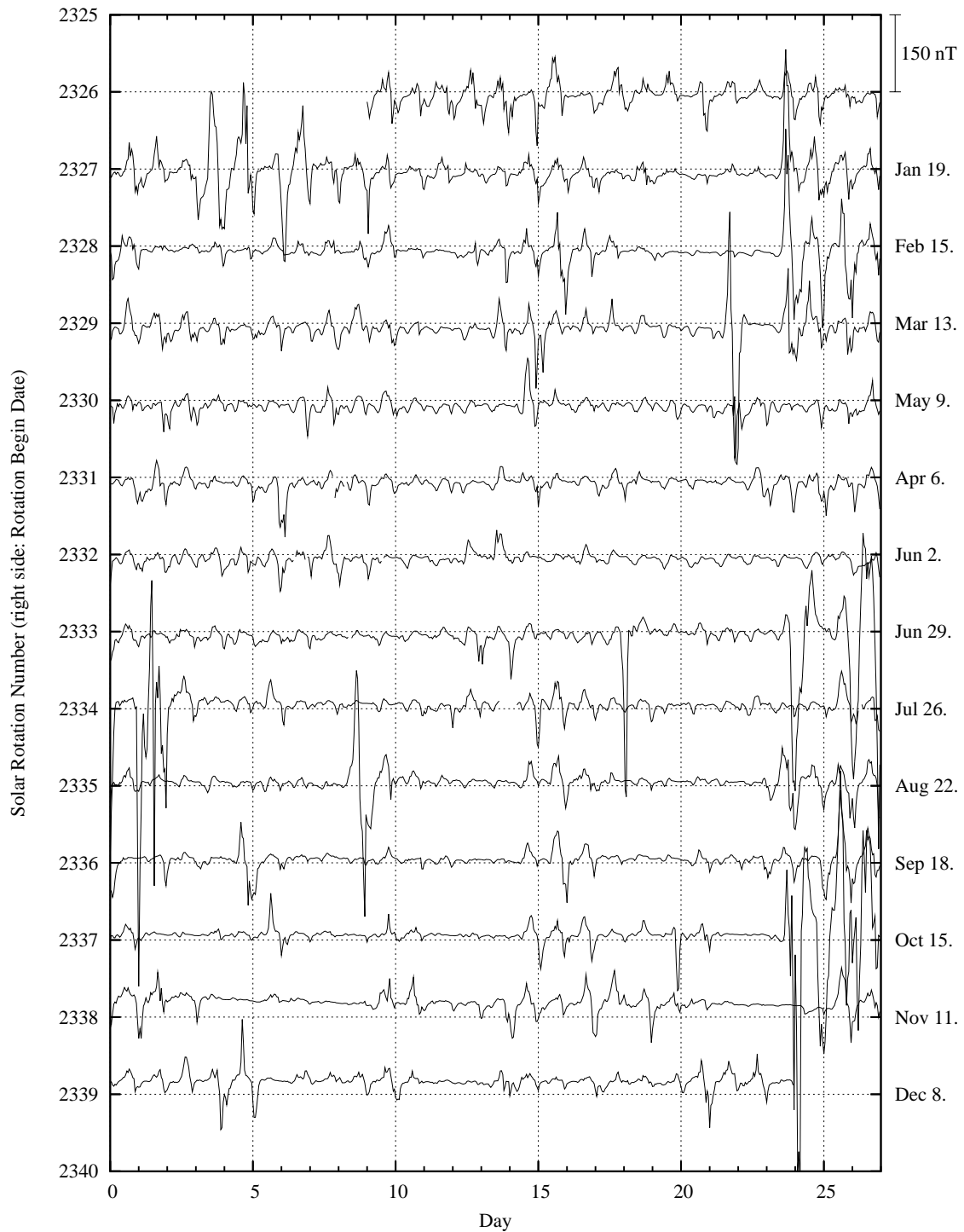


Figure 5: Hourly means of Z sequenced in Bartels' solar rotation cycles.

14 K-Indices

14.1 Monthly Tables of K-Indices

January			February			March					
Day	K	Ak	Day	K	Ak	Day	K	Ak			
1	3 2 3 2	4 4 5 4	22	1	1 2 2 1	2 2 3 3	8	1	3 2 3 2	3 5 5 5	25
2	3 2 2 2	3 3 4 4	15	2	1 1 3 3	3 5 2 4	17	2	3 3 3 2	3 3 4 4	17
3	2 3 3 3	3 3 5 3	18	3	4 3 3 3	3 4 3 3	18	3	2 2 2 3	3 3 3 1	11
4	3 3 2 3	4 5 4 2	20	4	4 2 3 2	2 3 3 4	15	4	1 1 2 2	1 2 2 1	5
5	3 3 2 3	4 6 5 4	29	5	3 2 2 3	2 2 2 3	10	5	2 2 2 1	1 1 1 2	5
6	3 2 3 3	2 2 3 5	16	6	2 3 4 4	3 4 4 2	19	6	2 1 1 1	1 0 0 0	2
7	3 3 4 4	4 5 4 3	25	7	1 1 2 1	1 1 3 1	5	7	0 0 1 2	1 0 2 2	3
8	1 1 1 2	2 1 2 4	8	8	0 0 1 1	0 1 1 3	3	8	1 1 1 2	1 1 0 0	3
9	3 3 4 2	3 5 4 2	20	9	1 0 1 1	2 2 3 3	7	9	1 1 2 3	3 7 6 6	43
10	4 3 3 3	4 4 4 2	20	10	2 1 1 2	2 3 0 2	6	10	6 5 5 3	4 3 5 6	45
11	1 1 2 3	5 5 4 3	21	11	2 1 1 2	4 8 7 4	57	11	4 3 3 3	4 6 6 5	38
12	0 1 0 1	2 2 4 4	9	12	2 3 4 3	3 5 6 4	29	12	6 3 3 2	3 4 3 3	24
13	3 2 2 2	4 5 4 4	21	13	4 3 2 3	4 4 4 5	24	13	3 2 3 3	3 2 3 2	12
14	3 1 1 2	3 2 3 3	10	14	4 3 3 3	3 4 4 3	20	14	3 2 2 3	3 2 5 3	16
15	2 2 1 1	4 4 5 4	19	15	4 3 3 3	2 4 3 3	17	15	3 3 2 2	3 3 3 3	13
16	4 2 3 3	3 5 5 3	24	16	4 1 1 2	1 0 3 1	8	16	3 1 1 2	2 3 3 3	10
17	2 2 3 3	3 3 5 4	19	17	1 0 0 0	0 1 2 2	3	17	3 2 1 1	1 1 3 2	7
18	2 3 2 2	2 1 5 5	18	18	2 1 0 0	1 3 3 3	7	18	2 2 2 2	2 2 3 4	11
19	2 2 2 2	3 4 3 3	13	19	2 2 2 1	0 2 3 3	8	19	4 1 1 1	2 1 2 2	8
20	3 3 2 3	4 5 3 3	20	20	1 1 0 0	0 2 2 1	3	20	2 2 1 2	2 5 2 3	13
21	2 2 3 2	3 3 5 3	16	21	2 1 0 1	2 2 3 2	6	21	3 2 2 2	3 2 3 1	10
22	5 4 4 5	6 5 6 5	51	22	2 1 1 2	3 2 4 3	11	22	2 2 1 1	2 3 3 3	9
23	4 3 3 4	4 7 6 5	47	23	2 2 1 2	2 2 2 3	8	23	3 2 2 2	1 2 3 2	9
24	5 2 2 2	2 3 4 4	18	24	3 2 1 2	2 3 3 3	11	24	1 1 0 1	0 0 0 1	2
25	5 6 3 3	4 5 5 4	39	25	2 1 1 1	2 0 3 3	7	25	0 0 1 0	1 3 2 1	4
26	3 2 2 2	3 3 5 3	16	26	1 1 0 0	1 0 1 1	2	26	1 1 1 2	4 4 4 4	16
27	4 2 3 2	4 4 2 3	17	27	0 3 2 2	1 2 5 4	14	27	2 2 2 4	4 5 3 5	23
28	5 3 3 3	2 3 5 3	22	28	1 2 3 3	3 3 4 4	16	28	3 5 3 3	3 3 3 2	18
29	2 1 2 2	2 1 2 2	6	29	2 3 3 4	4 3 4 4	20	29	2 2 2 2	3 4 2 2	11
30	2 2 2 4	3 3 4 4	17	30				30	1 2 2 3	4 2 2 2	10
31	1 1 1 3	1 1 1 2	5	31				31	1 1 2 2	3 3 3 1	9
Mean			20.0	Mean			13.1	Mean			13.9

April			May			June					
Day	K	Ak	Day	K	Ak	Day	K	Ak			
1	0 0 1 1	2 1 2 1	3	1	3 2 2 2	3 3 3 2	11	1	3 3 3 3	4 3 2 3	16
2	1 0 1 1	1 1 0 0	2	2	3 1 1 3	2 2 2 1	8	2	2 2 2 3	2 3 3 3	11
3	1 2 2 3	5 7 9 6	88	3	1 1 2 1	2 2 2 3	7	3	2 2 2 2	2 2 2 3	8
4	7 2 1 2	3 3 2 2	25	4	2 2 2 2	2 1 2 2	7	4	3 2 1 2	3 2 2 2	9
5	1 1 1 1	3 5 6 5	25	5	2 3 2 2	3 4 3 3	14	5	2 2 1 3	3 3 3 3	12
6	4 3 3 4	5 2 4 3	23	6	2 2 2 3	2 2 3 3	10	6	3 3 2 3	3 2 3 2	12
7	3 2 2 2	3 1 4 3	11	7	2 3 2 3	3 3 4 3	15	7	3 2 1 2	3 2 2 4	11
8	2 2 2 3	3 2 2 2	9	8	2 2 2 2	3 2 2 2	8	8	4 3 2 2	2 3 2 1	11
9	3 3 3 3	2 2 3 2	12	9	2 2 1 2	2 2 1 1	6	9	3 1 2 3	3 3 3 2	12
10	2 2 2 1	1 1 3 4	9	10	1 1 1 2	2 2 2 2	6	10	3 2 2 1	3 1 3 2	9
11	3 2 2 2	2 3 3 3	11	11	3 2 1 2	2 2 3 5	14	11	3 1 1 2	2 2 1 0	6
12	3 2 2 3	2 2 4 1	11	12	4 5 2 1	2 2 2 1	14	12	0 1 1 2	2 1 0 0	3
13	2 1 1 1	1 1 3 2	6	13	1 2 3 2	3 3 4 3	13	13	0 1 1 2	2 2 1 2	5
14	1 1 0 0	1 1 0 2	2	14	1 1 1 1	2 1 2 2	5	14	1 1 2 3	4 3 2 2	11
15	1 0 1 3	2 2 2 3	7	15	3 2 1 2	2 1 1 3	8	15	2 2 3 3	5 4 3 2	18
16	2 2 2 3	2 3 3 3	11	16	2 0 1 2	2 1 1 2	5	16	2 2 3 2	3 2 1 2	9
17	2 2 1 2	2 1 2 2	6	17	1 1 0 2	1 1 1 2	4	17	1 2 2 3	2 3 2 1	8
18	1 2 2 2	3 2 3 3	10	18	1 1 1 2	2 1 1 1	4	18	1 2 2 3	4 3 2 2	11
19	2 1 2 2	2 2 1 1	6	19	1 2 1 2	4 4 2 2	11	19	2 1 2 2	3 2 1 0	6
20	2 0 2 2	1 0 1 2	4	20	1 2 3 4	3 3 3 3	14	20	1 1 1 1	2 2 2 1	5
21	1 2 2 2	2 1 3 1	7	21	4 2 2 3	3 3 1 0	11	21	1 1 1 2	2 2 1 1	5
22	0 0 2 1	2 2 2 1	4	22	2 2 3 2	2 2 1 1	7	22	0 1 1 1	1 1 1 1	3
23	2 2 3 3	4 3 3 3	15	23	3 2 2 3	4 3 2 2	13	23	1 1 0 1	2 2 1 1	4
24	1 1 2 4	2 2 1 2	8	24	3 2 3 3	4 2 2 1	12	24	1 1 2 1	3 1 1 0	5
25	2 2 3 3	2 3 2 2	10	25	1 1 2 2	2 1 1 0	4	25	0 1 0 0	3 2 2 0	4
26	2 1 1 1	2 3 2 1	6	26	0 1 1 2	2 2 0 1	4	26	1 1 1 2	4 3 2 2	9
27	0 1 1 1	2 3 2 1	5	27	2 1 1 1	1 1 2 1	4	27	1 1 0 1	1 1 1 2	3
28	1 0 2 1	2 4 4 3	11	28	1 1 0 1	3 2 2 3	7	28	3 3 2 3	3 2 3 4	15
29	1 1 1 1	1 1 2 2	4	29	3 3 2 4	3 3 2 4	16	29	4 4 3 4	3 3 3 3	20
30	2 2 2 1	2 3 4 4	13	30	2 2 2 3	4 3 3 4	15	30	3 2 2 3	2 2 2 2	9
31				31	4 2 2 3	2 2 3 2	12	31			
Mean			12.1	Mean			9.3	Mean			9.0

14.2 K-Indices Sequenced in Bartel's Solar Rotation Number

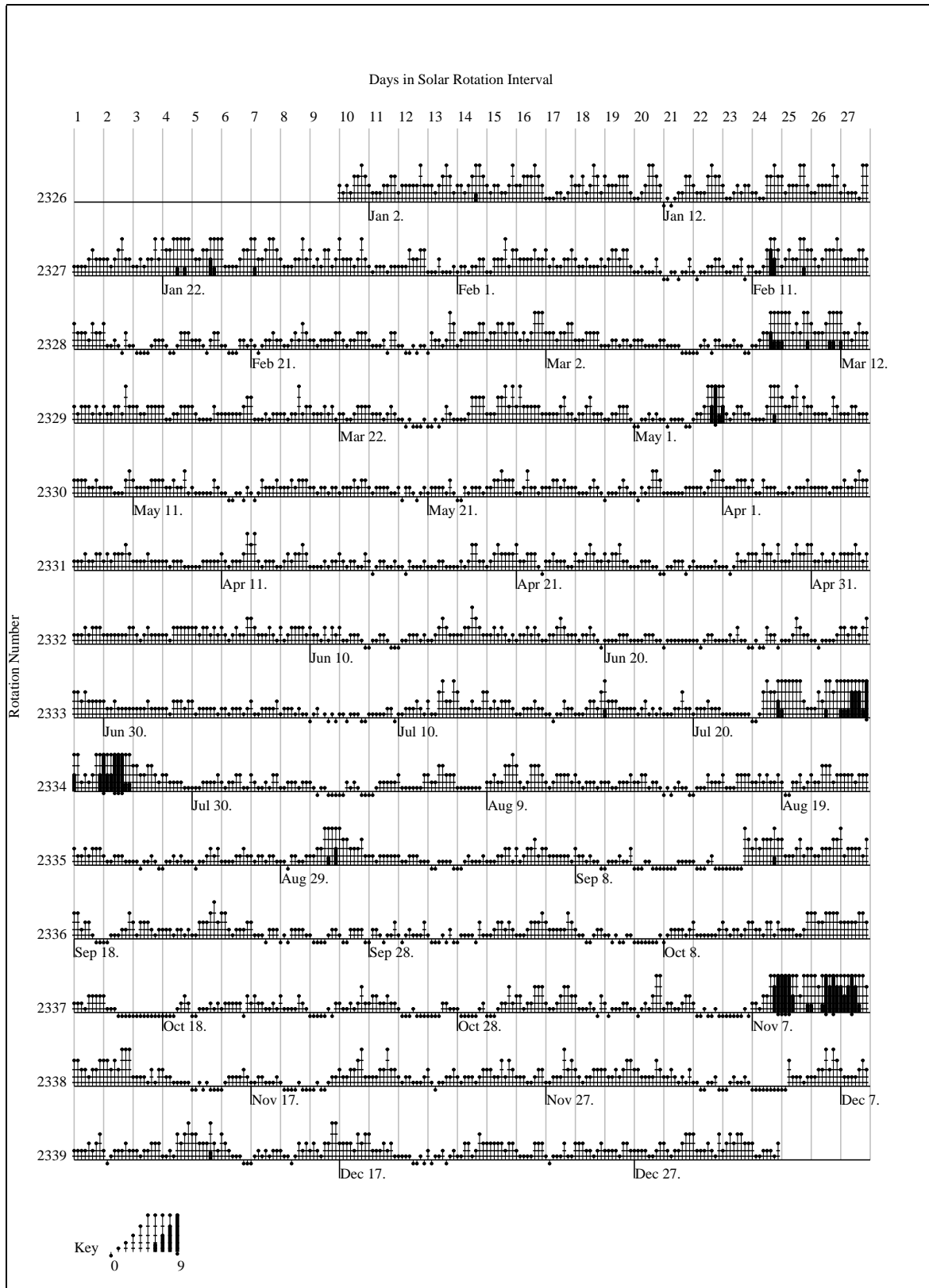


Figure 6: K-indices sequenced in Bartel's solar rotation number

14.3 Ak-Indices

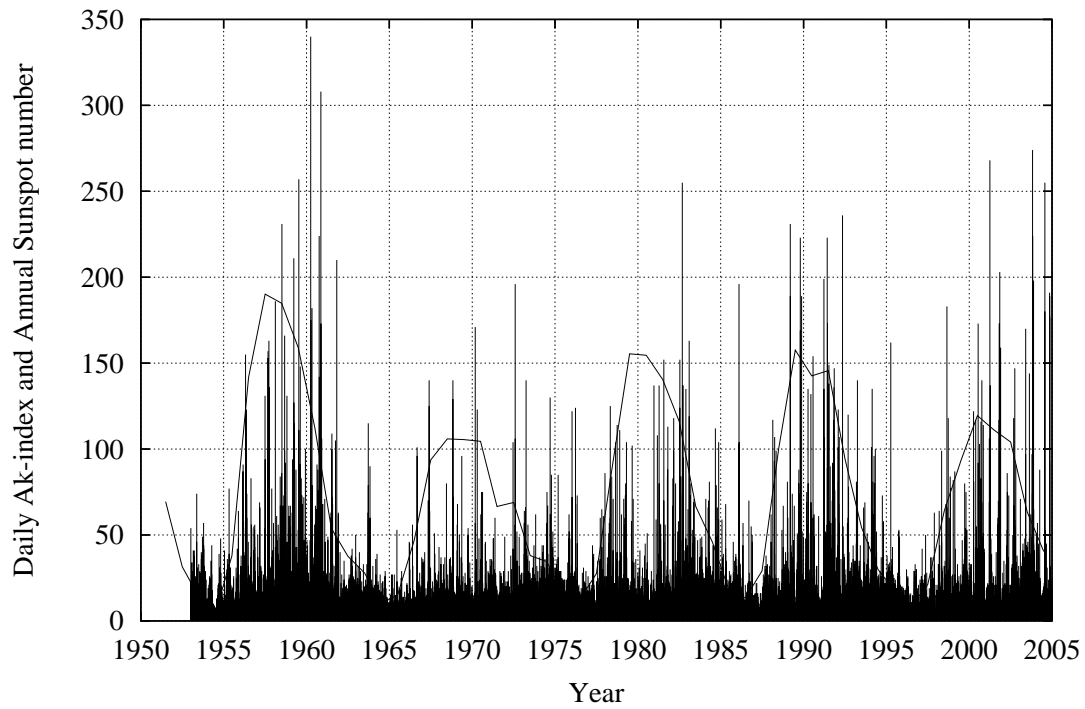


Figure 7: Daily Ak-indices (vertical lines) and sunspots (solid line)

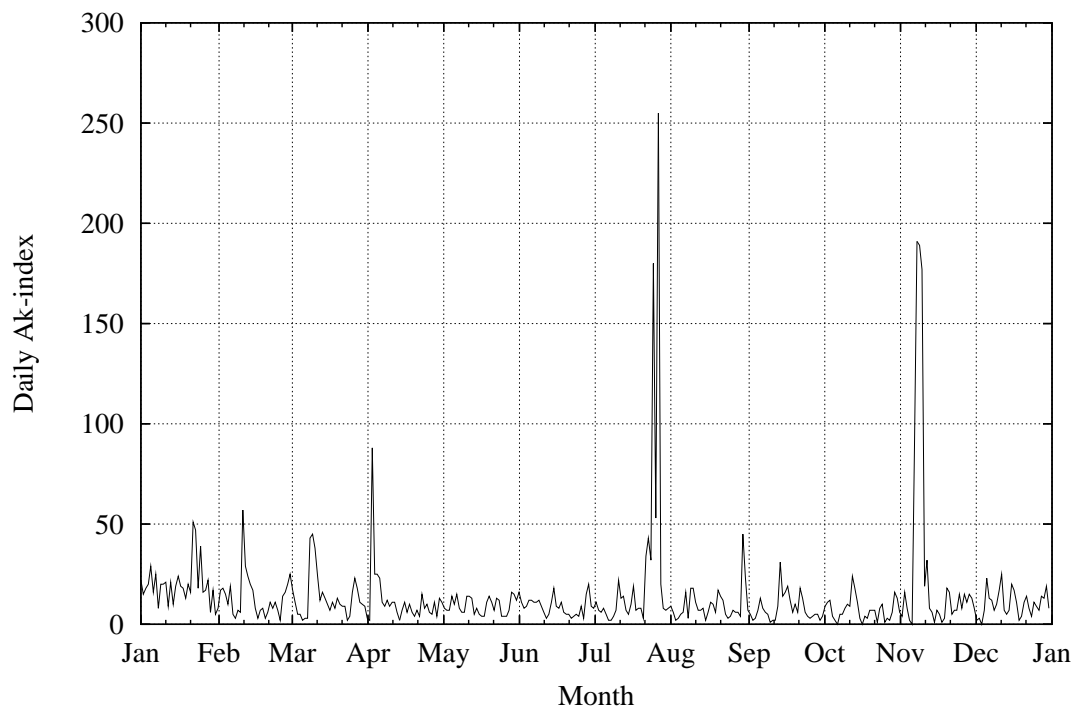


Figure 8: Daily Ak-indices

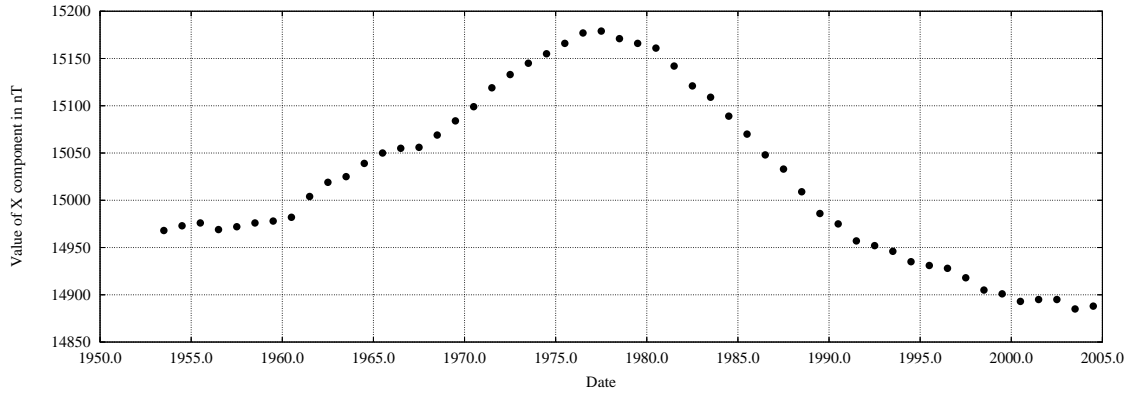
14.4 Table of Annual Ak-indices

m/M denotes sunspot minimum/maximum

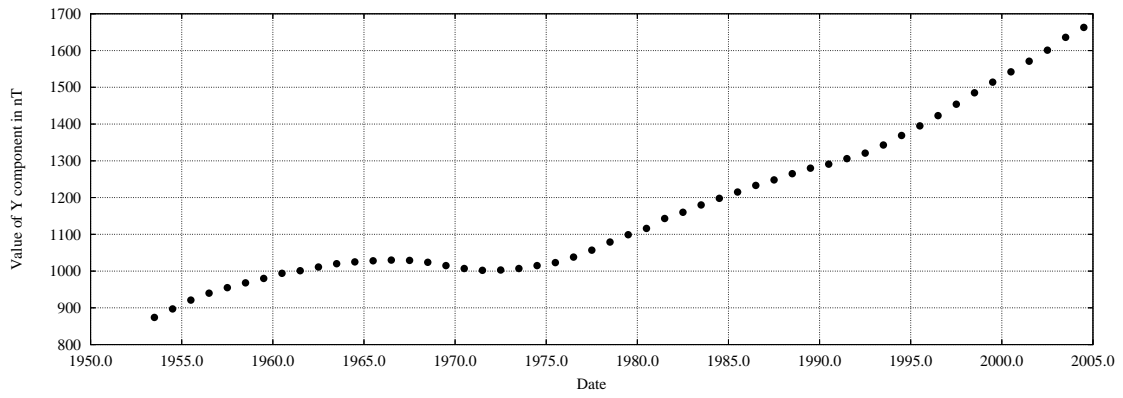
Year	Ak
1953	11
1954m	8
1955	9
1956	14
1957M	16
1958	18
1959	21
1960	22
1961	12
1962	10
1963	10
1964m	8
1965	6
1966	8
1967	10
1968M	11
1969	10
1970	10
1971	9
1972	10
1973	13
1974	15
1975	11
1976m	10
1977	9
1978	13

Year	Ak
1979M	12
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

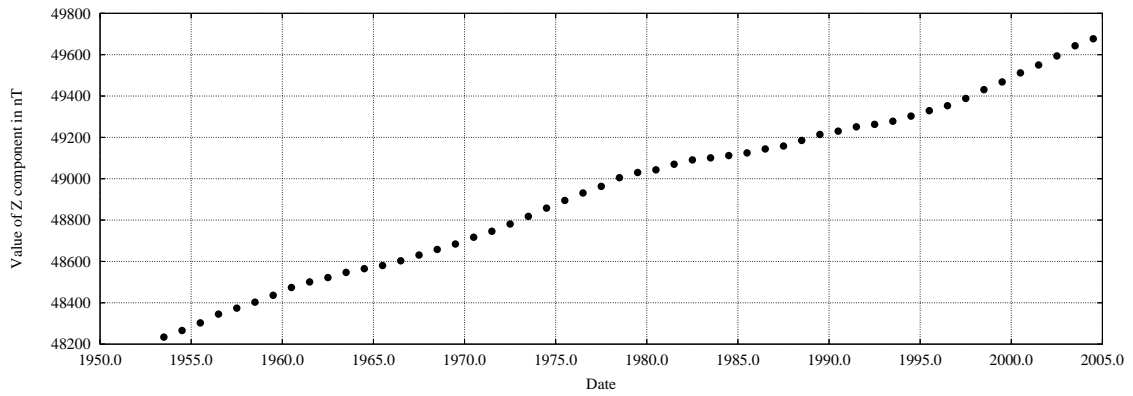
15 Annual Means



(a) Annual means for X component

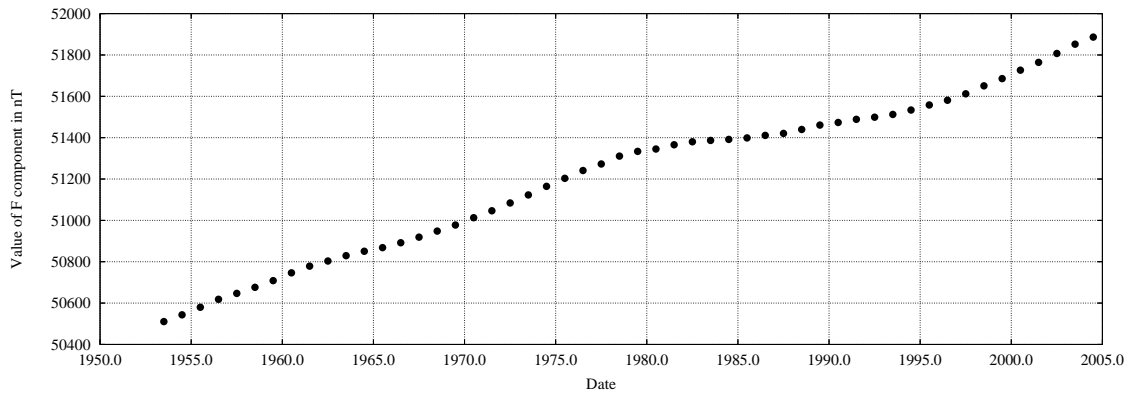


(b) Annual means for Y component

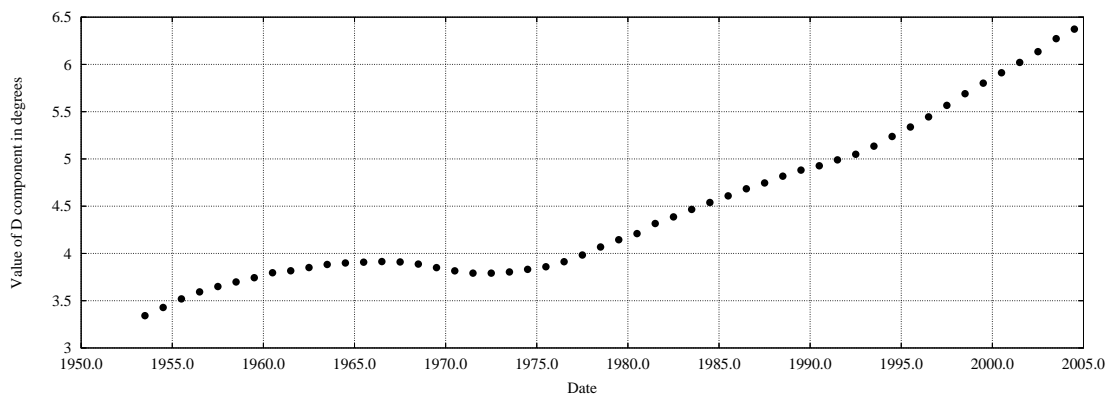


(c) Annual means for Z component

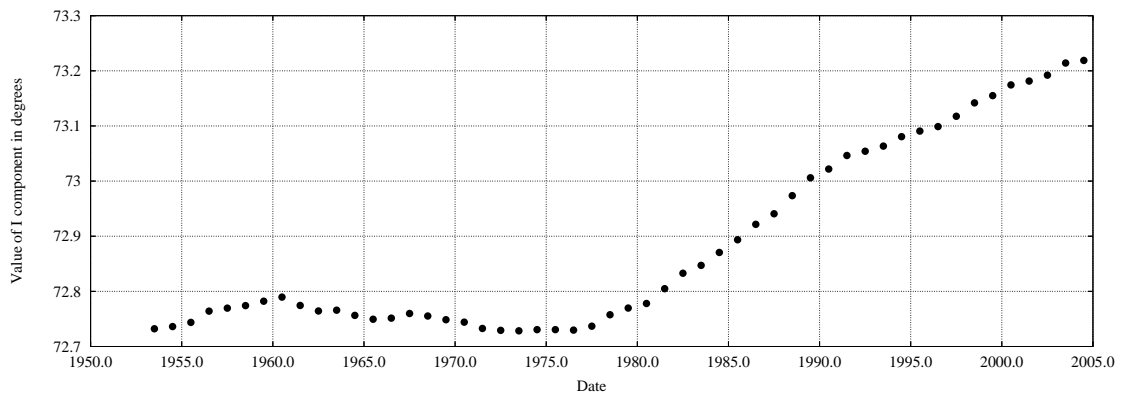
Figure 9: Figures of annual means of X, Y, and Z



(a) Annual means for F component



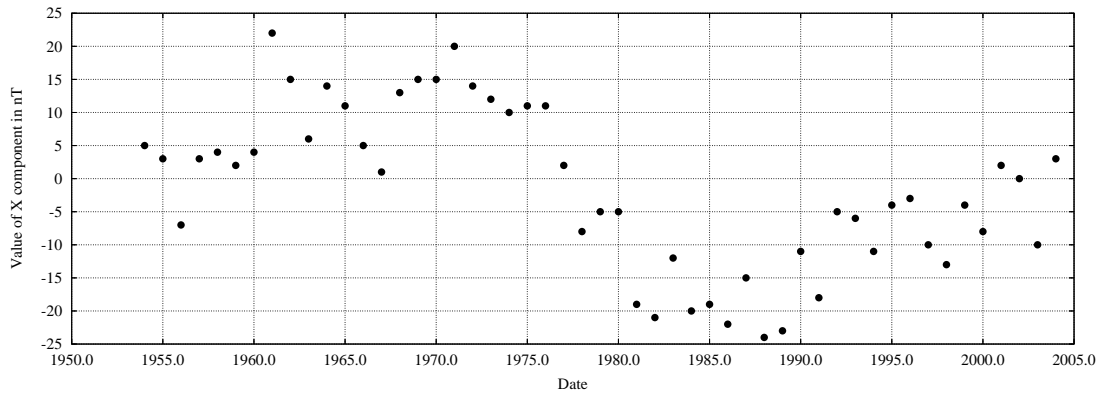
(b) Annual means for D component



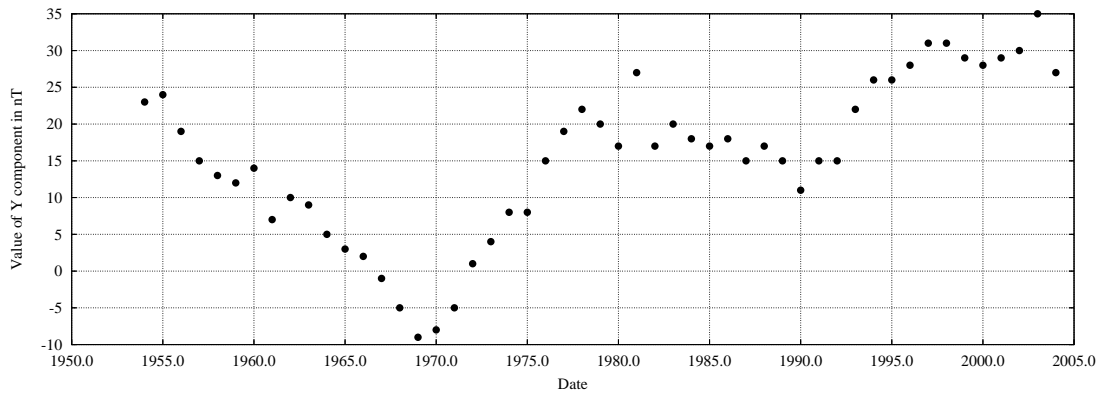
(c) Annual means for I component

Figure 10: Figures of annual means of F, D, and I

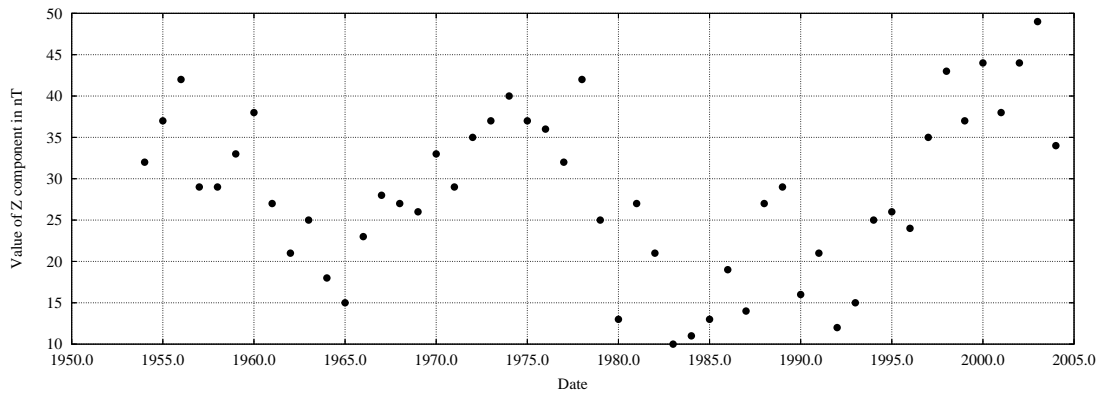
16 Secular Variation



(a) Annual change of X component

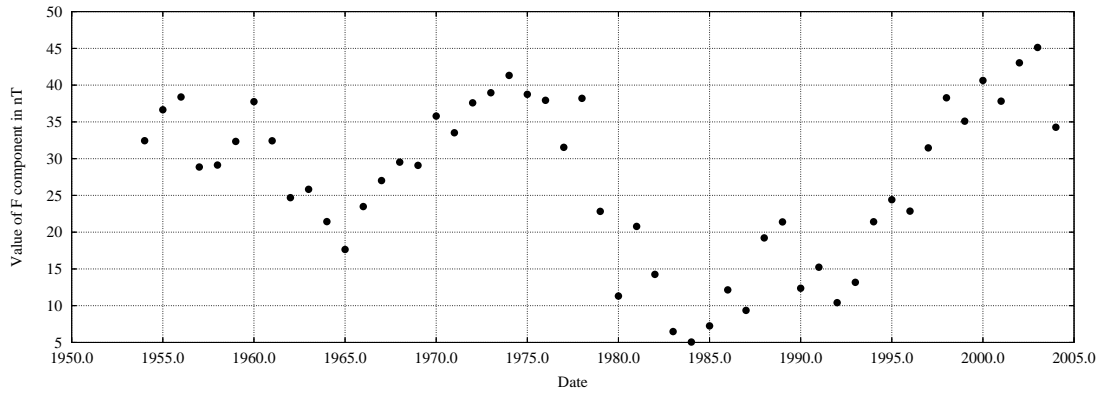


(b) Annual change of Y component

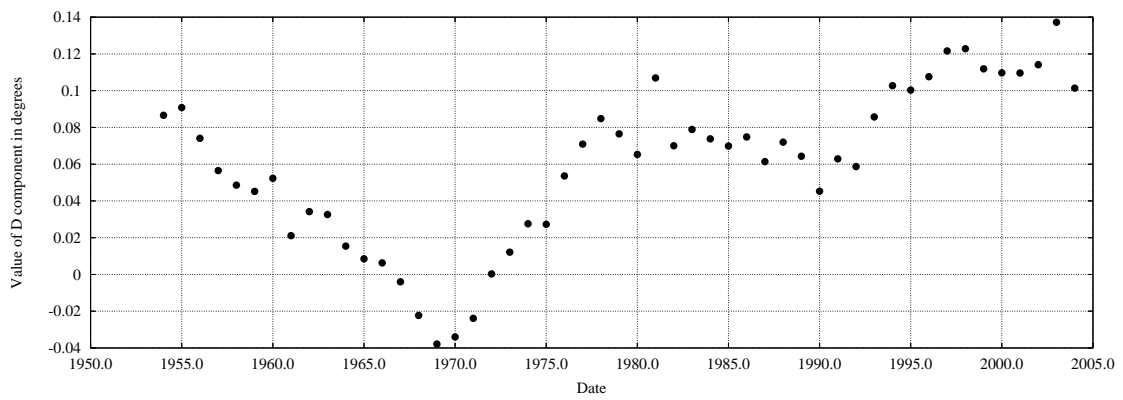


(c) Annual change of Z component

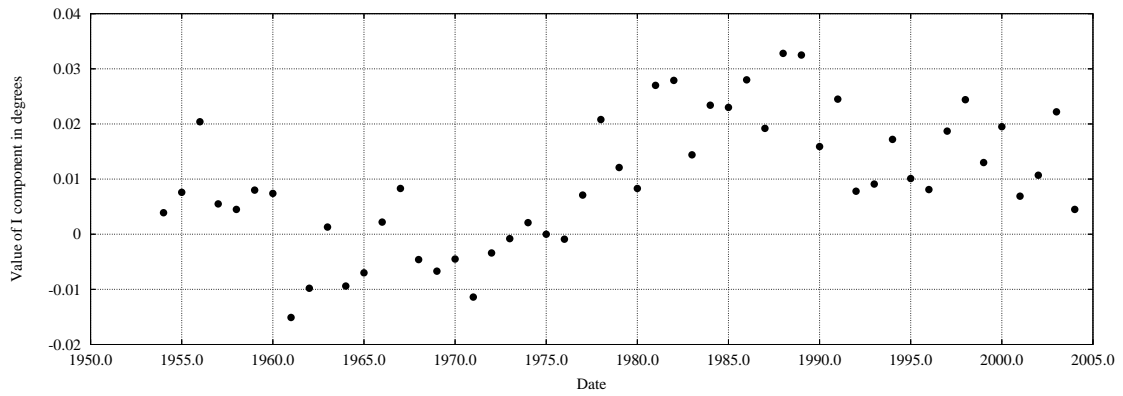
Figure 11: Annual change of components X, Y, and X



(a) Annual change of F component



(b) Annual change of D component



(c) Annual change of I component

Figure 12: Annual change of components F, D, and I

17 Tables of Annual Means

17.1 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'

17.2 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'
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'

17.3 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'

18 Earth's Magnetic Field Maps of Finland 2005.0

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)

TOTAL INTENSITY (F) 2005.0

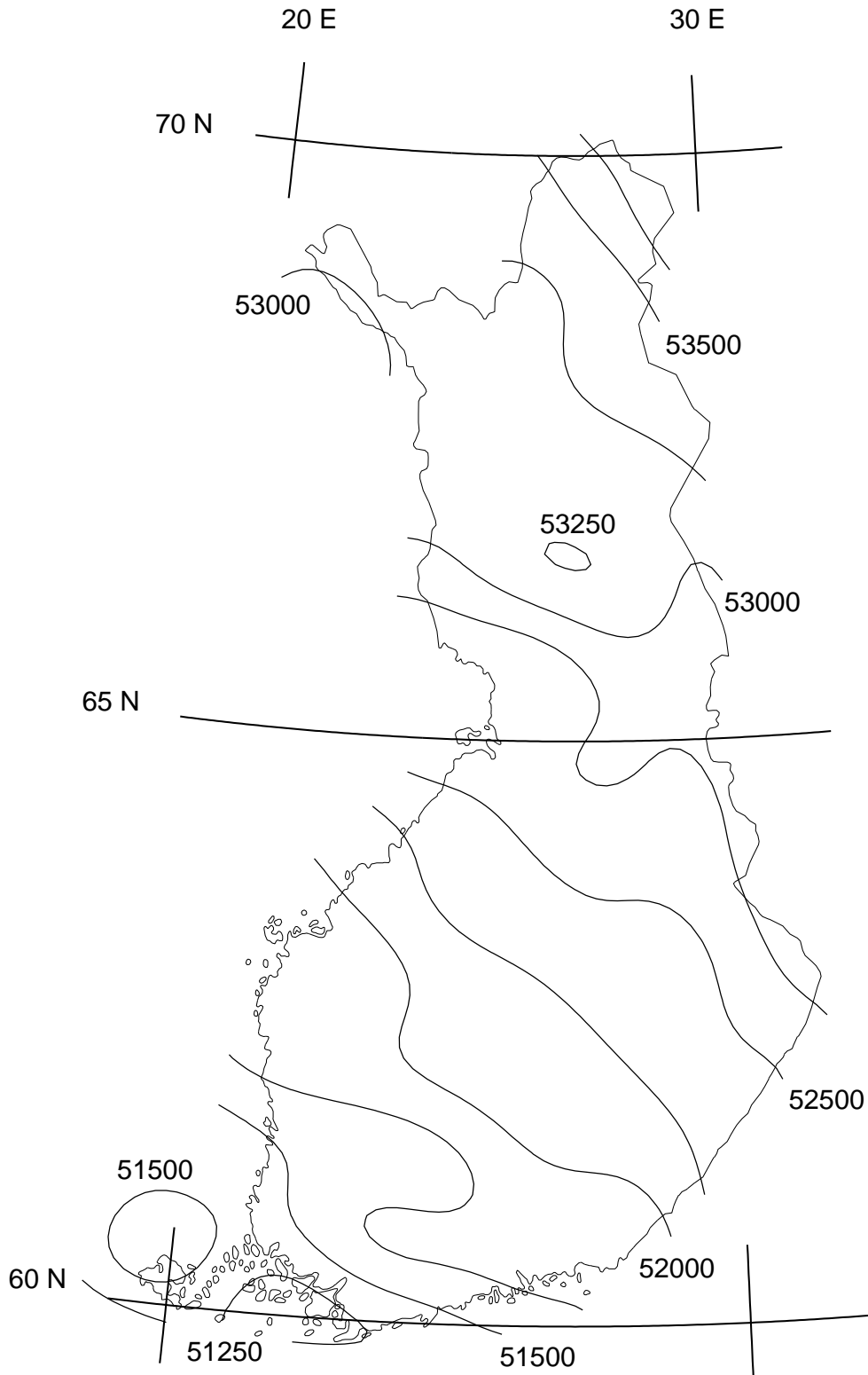


Figure 13: Total intensity F 2005.0 in nT

HORIZONTAL INTENSITY (H) 2005.0

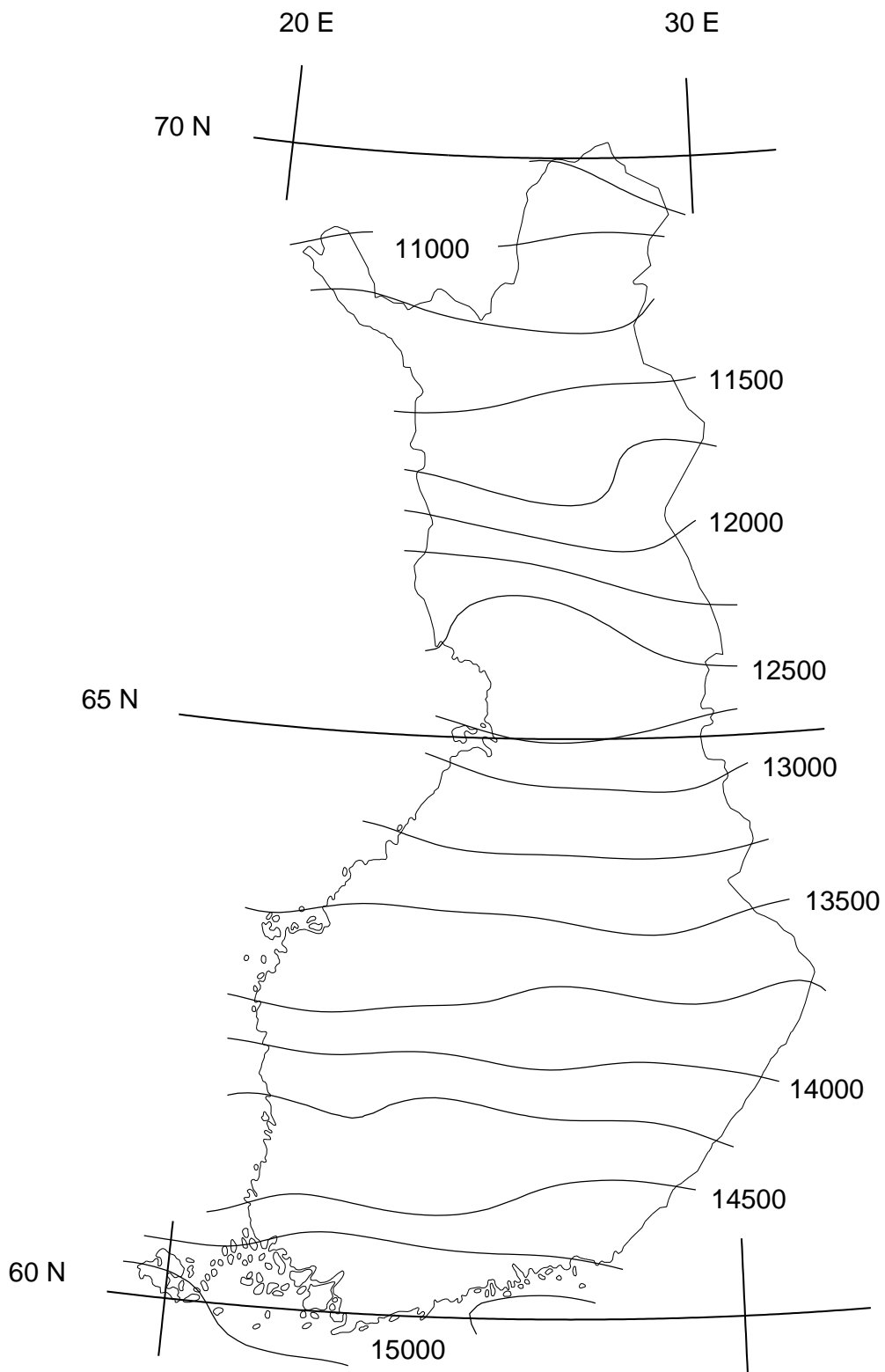


Figure 14: Horizontal intensity H 2005.0 in nT

DECLINATION (D) 2005.0

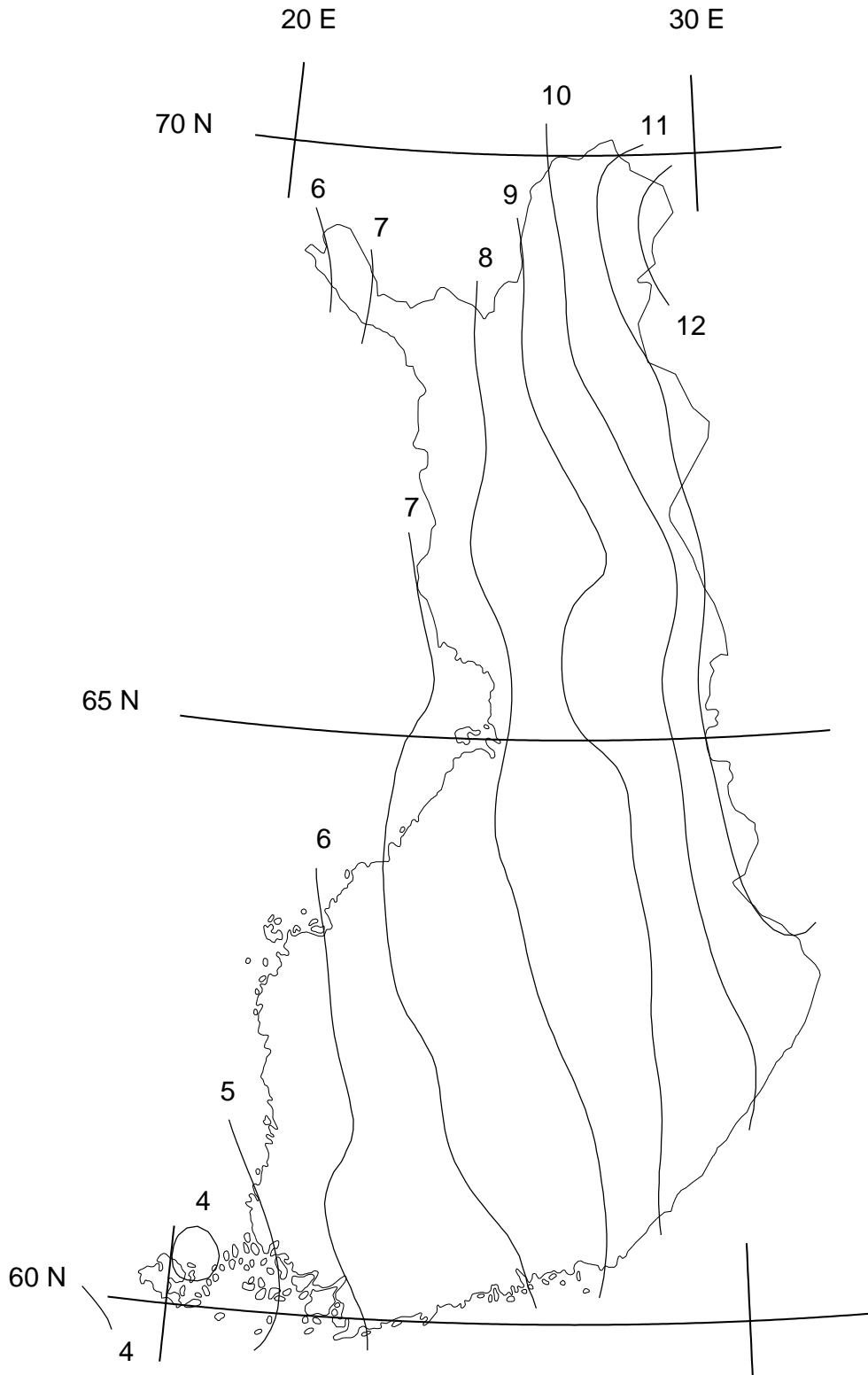


Figure 15: Declination D 2005.0 in degrees

INCLINATION (I) 2005.0

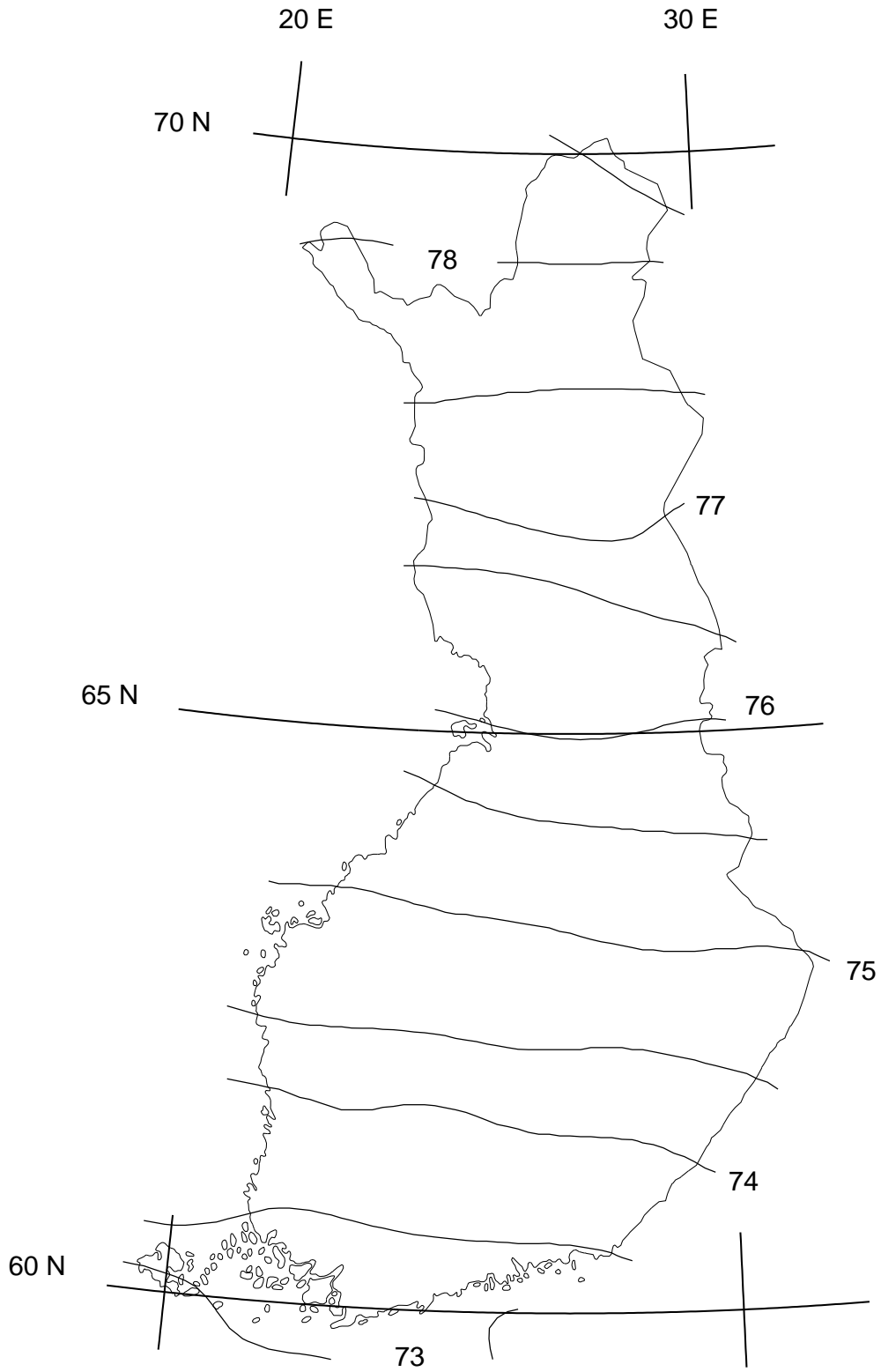


Figure 16: Inclination I 2005.0 in degrees

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- Magnetic Results 2003, Helsinki 2006, 47 p.
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