UPPER ATMOSPHERE PHYSICS DATA, SYOWA STATION, 1986

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1. Introduction

This data book summarizes upper atmosphere physics data by the "Upper Atmosphere Physics Monitoring System" at Syowa Station in 1986. The items of observations are as follows.

1) Geomagnetism: H-, D- and Z-components of magnetic variations, Total force of the geomagnetic field, H-, D- and Z-components of magnetic pulsations.

2) ELF-VLF wave: Intensities at 0.35, 0.75, 1.2, 2, 4, 8, 30, 60 and 95 kHz, Wide-band signal of ELF-VLF emissions.

3) Ionosphere : Cosmic noise absorption at 30 MHz.

4) Aurora : Meridian scanning record of OI 5577 Å and H_β 4861 Å, Auroral intensity of 1NG N_2^+ 4278 Å at three directions (30° poleward, zenith and 30° equatorward).

The Upper Atmosphere Physics Monitoring System was installed at Syowa Station in January 1981. An outline of the system is given in Section 2. Section 3 presents specifications of the observation instruments and the data acquisition system. The recording periods are also listed in Section 3. The format of the compiled digital data is given in Section 4. Magnetograms and frequency-time spectra of magnetic pulsations in the period of January 1 - December 31, 1986 are given in the appendices.

Digital tapes of the magnetograms and the summary plots of the monitoring data are available to users on request. The request should be addressed to:

World Data Center C2 for Aurora
National Institute of Polar Research
9-10, Kaga 1-chome, Itabashi-ku,
Tokyo 173, Japan

Digital and analog data described here and the summary plots of the monitoring system are available to scientists who cooperate with us in the study of antarctic upper atmosphere. The request should be addressed to:

Upper Atmosphere Research Division
National Institute of Polar Research
9-10, Kaga 1-chome, Itabashi-ku,

Tokyo 173, Japan.

2. Upper Atmosphere Physics Monitoring System

A realtime digital data acquisition system of upper atmosphere physics was constructed at Syowa Station in January 1981 (Sato et al., 1984), and these data have been collected and published as JARE Data Reports (Upper Atmosphere Physics) (Sato et al., 1984; Fujii et al., 1985; Sakurai et al., 1985; Ono et al., 1986; Yamagishi et al, 1987), and this report forms the 6th volume of this series.

A block diagram of this system is shown in Fig. 1. The sensors for measuring weak natural electromagnetic waves such as ELF-VLF emissions, ULF magnetic pulsations and the cosmic radio noise absorption (CNA) were installed at a remote station on West Ongul Island located about 5 km apart from Syowa Station in order to avoid man-made electromagnetic interferences. The data of magnetic pulsations and CNA were transmitted to Syowa Station by a PCM telemeter in VHF band. Wide-band signals of ELF/VLF emissions were transmitted to Syowa Station by an FM telemeter in UHF band. The specifications of these telemeters are as follows:

	UHF telemeter	VHF telemeter
Modulation	: PCM	FM
Carrier frequency	: 1859 MHz	240 MHz
Transmitter power	: 0.4 W	0.4 W

Antenna	: Parabola (1mφ)	Yagi (7 elements)
Max. frequency deviation	: 200 kHz	125 kHz
VCO stability	: better than 1%	better than 1%
VCO linearity	: better than 1%	better than 1%
Carrier spurious	: less than -30 dB	less than -30 dB

The electric power of the remote station has been supplied by a solar rechargeable battery system with the maximum output power of 530 W since February 1985. During the months of polar night, the rechargeable batteries with the capacity of 2000 AH were charged up once a month by a 16 kVA diesel-engined dynamo.

At Syowa Station, the sensors of fluxgate and proton magnetometers were set up about 150 m apart from the data processing building. The sensors of meridian scanning photometer and three-direction photometers were placed on the roof of the data processing building. The data acquisition facilities were installed inside the data processing building. All the outputs from the observation instruments were supplied to a switching matrix terminal board before they are fed to pen recorders, analog data recorders, and the MELCOM 70/25 computer system.

Analog data recordings are quite useful for studying wave phenomena in a high frequency range. For example, one roll of standard 3600 ft audio tape can record VLF emissions up to 15 kHz over 6 h, while the recording time of standard 2400 ft digital tape is only 15 min if the recording density is

6250 BPI. The dynamic spectra of ELF-VLF emissions were obtained by FFT (Fast Fourier Transform) spectrum analyzer. The output digital signals from the FFT spectrum analyzer were supplied to a computer. All the data were recorded with universal time marks supplied from a precise timekeeping system. This system consisted of NNSS satellite timing receiver, a quartz frequency standard with a stability of 2×10^{-11}/day, and a time code generator. The time code generator supplied IRIG A, B, E and slow code for analog data recorders and 36-bit BCD time code to the computer. The absolute accuracy of this system is about 1 ms. The timer in the computer is synchronized to the timekeeping system with a 10 kHz clock signal.

3. Specifications of Instruments

3.1. Geomagnetism

3.1.1. Magnetogram

Magnetic variations were measured by a three-axis fluxgate magnetometer. The full-scale range was ± 2500 nT, and the frequency response was DC-2 Hz. The noise level was less than 0.5 nT. The H-, D- and Z-components of the magnetometer were supplied to a computer with sampling rate of 1 Hz. The H-component of the magnetometer was also recorded by a long term analog data recorder, R-950L.

Continuous computer plots of magnetogram in the period of January 1 to December 31, 1986 are given in Appendix 1. In

these plots, positive signs of the H-, D- and Z-components indicate northward, eastward and upward, respectively. One division of the vertical axis corresponds to 100 nT.

3.1.2. Total force of the geomagnetic field

The total force of the geomagnetic field (F) was continuously measured by a proton magnetometer. The observation range was 0 - 65000 nT, and the frequency response was up to 0.2 Hz. The noise level was less than 0.2 nT. The digital output signals were recorded on digital magnetic tapes with a sampling frequency of 0.1 Hz.

3.1.3. ULF magnetic pulsations

The H-, D- and Z-components of ULF magnetic pulsations were detected by three sets of search coil magnetometers. The search coil sensors had permalloy cores wound by copper wire (0.4 mmϕ, 40000 turns). The permalloy core were 1 cm in diameter and 100 cm in length. The detectable intensity range of the magnetometer was 0.001 - 5 nT/s, and the frequency range 0.001 - 3 Hz. The search coil magnetometers were set at the remote station. The output signals from the telemetry receiver were supplied to a long term analog data recorder, R-950L, and a computer. The recording period on R-950L is listed in Table 1. The sampling frequency of the digital data was 1 Hz for each component.

Frequency-time spectrograms of magnetic pulsations were obtained from the reproduced analog signals with an FFT

spectrum analyzer. The spectrograms of the H-component magnetic pulsations in the frequency range from 0.05 to 2.5 Hz are presented in Appendix 2.

3.1.4. Base line of the magnetic field and K-index

The ordinary magnetogram was available also on chart papers with a recording speed of 5 cm/h. The sensitivities of the H-, D- and Z-components on the chart papers are 118 nT/cm, 100 nT/cm and 111 nT/cm, respectively. According to the maximum deviations of the H-component from its quiet-day baseline, K-indices were calculated for each 3-hour interval by using the following scale.

K-index	deviation	K-index	Deviation
0 :	0- 25 nT	5 :	350- 600 nT
1 :	25- 50	6 :	600-1000
2 :	50-100	7 :	1000-1660
3 :	100-200	8 :	1660-2500
4 :	200-350	9 :	2500 and more

Tables 2 and 3 give the baseline values and K-indices at Syowa Station in 1986. Inquiries or requests for data copies of the magnetic field measurements should be addressed to World Data Center C2 for Aurora, NIPR.

3.2. ELF-VLF waves

The receiving site of natural ELF-VLF electromagnetic waves was located at a remote station in order to avoid man-made electromagnetic interferences. The ELF-VLF receiving system at the remote station comprised a triangle-shaped three turn loop antenna (10 m in height, 20 m in the length of the bottom side), a pre-amplifier and a main amplifier. The gains of the pre- and main-amplifiers were 60 and 40 dB, respectively. The ELF-VLF wave intensities at the frequency bands of 0.35, 0.75, 1.2, 2, 4, 8, 30, 60 and 95 kHz were measured by using a 9-channel filter bunk and detector units. The ELF-VLF emissions within the intensity range of 10^{-17} to 10^{-13} W/m^2 Hz were detected by this system. These data were supplied to a computer with a sampling rate of 0.5 Hz.

The wide-band ELF-VLF signals up to 10 kHz were recorded on audio tape recorders. The recording periods of each audio tapes are listed in Table 4. The wide-band signals were also supplied to an FFT spectrum analyzer, and the spectra in the frequency ranges of 0.1 - 2 kHz and 0.1 - 10 kHz were obtained every 10 min. These dynamic spectral data were also supplied to the computer. Some examples of the computer plots of ELF-VLF wave intensities and frequency-time spectrograms were shown by Sato et al.(1984).

3.3. Ionosphere

Cosmic noise absorption at 30 MHz was measured by a riometer made by La Jolla Science. The bandwidth and time constant of the receiver were 150 kHz and 0.25 s, respectively.

The riometer was installed at a remote station. The riometer data were supplied to a computer with a sampling rate of 0.5 Hz.

Observations of the ionosphere vertical soundings, the cosmic noise absorption (30 MHz), the CW field strength (8 MHz) and the aurora radar (50 and 112 MHz) were also carried out continuously by other observation systems at Syowa Station, and the observational results have been published as JARE Data Reports (Ionosphere). Inquiries and requests for data copies are to be addressed to:

World Data Center C2
Communications Research Laboratory
Ministry of Posts and Telecommunications
2-1, Nukui-Kitamachi 4-chome, Koganei-shi,
Tokyo 184, Japan.

3.4. Aurora

3.4.1. Meridian scanning photometer

The auroral photoemissions at the wavelengths of OI 5577 Å and H_β 4861 Å, which are typical emission lines in electron and proton auroras, were observed by meridian scanning photometers. The interference filter for H_β was tilted with 1 s period to measure the Doppler effect of the auroral H_β emission. The field of view of the photometers was 3° for 5577 Å and 5° for H_β. The scanning from the poleward horizon to the equatorward horizon required 30 s. The sensitivity range was 4 R - 15 kR for 5577 Å and 0.1 - 100 R/Å for H_β. The meridian scanning

photometer had a digital interface to a computer for recording on digital magnetic tapes with a sampling frequency of 1 Hz.

3.4.2. Three-direction photometer

A three-direction photometer detected 4278 Å emission at three zenith angles (zenith, 30° poleward and 30° equatorward). The field of view was 5°. The measurable auroral intensity was within the range from 7 R to 28 kR. The output signals were supplied to a computer with a sampling rate of 1 Hz. Some examples of the auroral photometric observations were given by Ono et al. (1986).

3.4.3. All-sky camera

Black and white all-sky aurora images were observed by using a 35 mm cine-pulse camera with a fish eye lens of f/1.4 and an exposure time of 7 s. The observations were carried out during clear nights between February 17 and October 5, 1986, as given in Table 5. Inquiries or requests for the all-sky data copies should be addressed to:

World Data Center C2 for Aurora
National Institute of Polar Research
9-10, Kaga 1-chome, Itabashi-ku,
Tokyo 173, Japan.

4. Compiled Digital Tape Format

The digital magnetic tape outputs from MELCOM 70/25 minicomputer were compiled in a simplified form with HITAC

M-180 computer system of the Information Processing Center, National Institute of Polar Research (NIPR). The details of the compilation were reported by Sakurai et al.(1987). The specifications of the compiled digital tapes are as follows.

Track	: 9
Record density	: 6250 BPI
Record format	: FB
Block length	: 20,434 bytes
Logical record length	: 34 bytes
Label	: Non-label

On these tapes, 17 kinds of upper atmospheric data are recorded for every one second in the following sequence.

Word number	Observation item	Word number	Observation item
1	: VLF 750 Hz	10	: CNA
2	: VLF 2 kHz	11	: Total mag. field intensity
3	: VLF 4 kHz	12	: H-component of mag. field
4	: VLF 30 kHz	13	: D-component of mag. field
5	: VLF 350 Hz	14	: Z-component of mag. field
6	: VLF 1.2 kHz	15	: H-component of ULF waves
7	: VLF 8 kHz	16	: D-component of ULF waves
8	: VLF 60 kHz	17	: Z-component of ULF waves
9	: VLF 90 kHz		

Each data is recorded on the tape with 2 bytes in the binary form of signed 2's complement, and a set of these 17 kinds of data make a logical record of 34 bytes. The data for 10 min make a block of 20434 bytes. At the top of each block, the starting time of this period is recorded with 34 bytes in the following format:

Sequence		Item	
1	:	Year	(2 bytes)
2	:	Total day	(2 bytes)
3	:	Hour	(2 bytes)
4	:	Minute	(2 bytes)
5	:	Space	(26 bytes)

Fig. 2 illustrates the structure of the compiled digital tape, in which one-day data (144 blocks) make one file and one-month data (28-31 files) make one volume.

An example of FORTRAN statements to read the compiled tape is as follows:

```
      INTEGER*2  TIME(4), DATA (17,6ØØ)
      READ (1Ø,1ØØ) TIME, DATA
1ØØ FORMAT (4A2, 26X, 1Ø(6Ø(17A2)))
```

The recorded data on the compiled tape can be transformed to physical quantities by the following relations:

H, D and Z components of the geomagnetic field (nT) is DATA*0.1 before 13 UT on June 4, 1986, and DATA*0.25 after 13 UT on June 4, 1986.

H-component of magnetic pulsations (nT/s) $=DATA*4.4*10^{-4}$

D-component of magnetic pulsations (nT/s) $=DATA*4.0*10^{-4}$

Z-component of magnetic pulsations (nT/s) $=DATA*3.3*10^{-4}$

throughout the year, and

ELF wave intensity at 350 Hz (w/m^2 Hz) $=(DATA+1160)^2*1.5*10^{-20}$

750 Hz $=(DATA+1020)^2*6.2*10^{-20}$

1.2 kHz $=(DATA+1020)^2*3.3*10^{-21}$

2 kHz $=(DATA+807)^2*1.1*10^{-21}$

VLF wave intensity at 4 kHz $=(DATA+1150)^2*9.5*10^{-22}$

8 kHz $=(DATA+1060)^2*3.6*10^{-21}$

throughout the year.

For co-researchers of NIPR, it is permitted to use the HITAC M-260H computer system of the Information Processing Center, which was replaced with M-180 system on December 1986. NIPR has various kinds of softwares such as tape-to-tape copy, various kinds of display and spectrum analysis programs.

Acknowledgments

It is a pleasure to acknowledge all the members of the 27th Japanese Antarctic Research Expedition for their enthusiastic support to the upper atmosphere physics observations at Syowa Station, Antarctica. The tables of the magnetic field

measurements and the observation logs of all-sky photographs were provided by Dr. T. Ono, WDC-C2 for Aurora. The publication of this report was possible thanks to the support from all the members of the upper atmosphere physics research group, NIPR.

References

Fujii, R., Sato, N. and Fukunishi, H. (1985): Upper atmosphere physics data, Syowa Station, 1982. JARE Data Rep., 105 (Upper Atmos. Phys. 2), 266 p.

Ono, T., Tsunomura, S., Ejiri, M., Fujii, R. and Sato, N.(1986): Upper atmosphere physics data, Syowa Station, 1984. JARE Data Rep., 118 (Upper Atmos. Phys. 4), 271 p.

Sakurai, H., Shibasaki, K., Fujii, R. and Sato, N. (1985): Upper atmosphere physics data, Syowa Station, 1983. JARE Data Rep., 108 (Upper Atmos. Phys. 3), 212 p.

Sakurai, H., Tonegawa Y., Fujii, R. and Sato, N.(1987): Syowa Kiti densanki shuroku dêta no henshû shori (Computer compilatory process of the data acquired by the computer system at Syowa Station). Nankyoku Shiryô (Antarct. Rec.), 31, 77-92.

Sato, N., Fujii, R., Fukunishi, H. and Nakajima, D.(1984): Upper atmosphere physics data, Syowa Station, 1981. JARE Data Rep., 93 (Upper Atmos. Phys. 1), 206 p.

Yamagishi, H., Ayukawa, I., Matsumura, S., Sakurai, H. and Sato, N.(1986): Upper atmosphere physics data, Syowa Station, 1985. JARE Data Rep., 128 (Upper Atmos, Phys. 5), 272p.

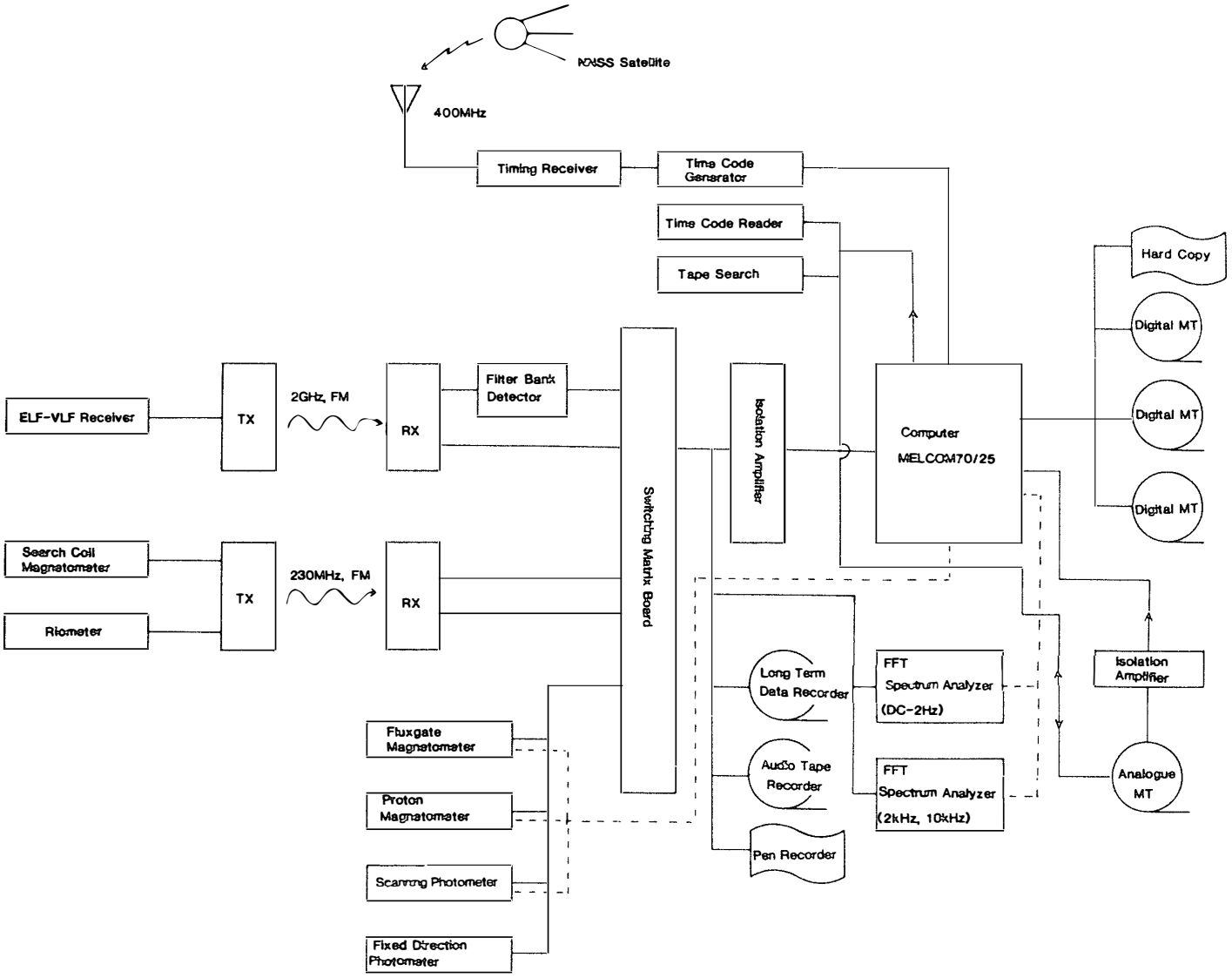

Fig. 1. Block diagram of the "Upper Atmosphere Physics Monitoring System".

Table 1. Recording periods of ULF magnetic pulsations on the long term analog data recorder, R-950L.

Start time		End time		Tape
Date	Time (UT)	Date	Time (UT)	number
Jan. 30	1635	Feb. 15	0524	86-03
Feb. 15	0535	Mar. 1	0102	04
Mar. 1	0110	Mar. 16	1656	05
Mar. 16	1707	Apr. 1	0516	06
Apr. 1	0531	Apr. 16	0510	07
Apr. 16	0529	May 1	1325	08
May 1	1336	May 16	1345	09
May 16	1357	June 1	1302	10
June 1	1318	June17	0413	11
June17	0423	July 1	0740	12
July 1	0748	July16	1445	13
July16	1454	Aug. 1	0454	14
Aug. 1	0504	Aug. 16	1902	15
Aug. 16	1912	Sep. 1	0312	16
Sep. 1	0322	Sep. 16	1722	17
Sep. 16	1732	Oct. 1	1210	18
Oct. 1	1222	Oct. 18	1322	19
Oct. 18	1332	Oct. 23	0500	20
Oct. 23	0523	Nov. 2	0904	21
Nov. 2	0910	Nov. 15	2234	22
Nov. 15	2241	Dec. 1	0552	23
Dec. 1	0606	Dec. 16	0720	24
Dec. 16	0730	Jan. 1	0051	25
Jan. 1	0101	Jan. 16	1605	87-01
Jan. 16	1616	Feb. 1	0001	02

Table 2. Base lines of the geomagnetic field at Syowa Station in 1986.

DATE	TIME (UT)	TOTAL INT. (nT)	HORI-ZONTAL INT.(nT)	VERTICAL INT. (nT)	DECLINATION	DIPANGLE
	11h 52m	44302.9	19011.2	40016.5	-46° 49.1′	-64° 35.3′
FEB. 2	12 01	44311.7	19016.2	40023.9	-46° 48.6′	-64° 35.2′
1986	12 19	44310.3	19012.1	40024.3	-46° 49.6′	-64° 35.5′
	12 27	44304.3	19006.0	40020.5	-46° 49.7′	-64° 35.8′
	12 10	44306.4	19011.4	40021.3	-46° 49.3′	-64° 35.5′
	13 39	44333.9	19026.9	40043.4	-46° 49.8′	-64° 35.1′
	13 54	44326.0	19013.0	40041.2	-46° 51.0′	-64° 36.0′
MAR. 4	14 28	44321.9	19011.2	40037.5	-46° 50.7′	-64° 36.0′
	14 41	44325.5	19012.8	40040.8	-46° 49.9′	-64° 36.0′
	14 11	44326.8	19016.0	40040.7	-46° 50.4′	-64° 35.8′
	11 24	44316.1	19011.1	40031.2	-46° 51.1′	-64° 35.8′
	11 42	44318.4	19015.5	40031.6	-46° 51.4′	-64° 35.5′
MAR. 5	12 08	44318.2	19012.0	40033.1	-46° 50.3′	-64° 35.8′
	12 22	44318.1	19007.3	40035.2	-46° 50.4′	-64° 36.2′
	11 54	44317.7	19011.5	40032.8	-46° 50.8′	-64° 35.8′
	11 06	44302.1	19013.2	40014.7	-46° 53.1′	-64° 35.1′
	11 15	44302.8	19014.7	40014.8	-46° 54.3′	-64° 35.0′
APR. 5	11 38	44308.2	19020.5	40018.9	-46° 51.8′	-64° 34.7′
	11 44	44306.0	19012.5	40019.3	-46° 51.9′	-64° 35.3′
	11 26	44304.8	19015.2	40016.7	-46° 52.8′	-64° 35.0′
	11 38	44294.1	19022.6	40001.4	-46° 52.3′	-64° 34.0′
	11 46	44295.9	19024.5	40002.4	-46° 52.3′	-64° 33.9′
MAY 13	12 02	44295.9	19023.3	40003.0	-46° 52.6′	-64° 34.0′
	12 09	44298.1	19025.5	40004.4	-46° 52.5′	-64° 33.9′
	12 54	44296.0	19024.0	40002.8	-46° 52.4′	-64° 34.0′
	09 13	44281.7	19025.4	39986.3	-46° 52.4′	-64° 33.3′
	09 21	44277.7	19019.0	39984.9	-46° 52.4′	-64° 33.7′
JUNE16	09 35	44281.5	19028.8	39984.5	-46° 52.8′	-64° 33.0′
	09 43	44279.5	19025.6	39983.8	-46° 52.0′	-64° 33.2′
	09 28	44280.1	19024.7	39984.9	-46° 52.4′	-64° 33.3′
	11 58	44279.1	19019.6	39986.2	-46° 51.5′	-64° 33.7′
	12 06	44292.2	19027.6	39996.9	-46° 53.1′	-64° 33.5′
JULY18	12 20	44297.4	19029.8	40001.6	-46° 53.7′	-64° 33.5′
	12 29	44294.5	19028.6	39999.0	-46° 52.4′	-64° 33.5′
	12 13	44290.8	19026.4	39995.9	-46° 52.7′	-64° 33.6′

DATE	TIME (UT)	TOTAL INT. (nT)	HORI-ZONTAL INT.(nT)	VERTICAL INT. (nT)	DECLINATION	DIPANGLE
	10h 18m	44260.7	19024.5	39963.5	-46° 56.6′	-64° 32.6′
SEP.11	10 26	44261.1	19025.8	39963.3	-46° 57.0′	-64° 32.5′
1986	10 42	44260.9	19023.4	39964.2	-46° 56.8′	-64° 32.7′
	10 49	44260.7	19023.3	39964.0	-46° 56.8′	-64° 32.7′
	10 34	44260.9	19024.3	39963.8	-46° 56.8′	-64° 32.6′
	13 03	44266.2	19021.1	39971.2	-46° 55.1′	-64° 33.1′
	13 35	44267.9	19022.9	39972.2	-46° 55.0′	-64° 33.0′
OCT.12	14 04	44266.3	19021.1	39971.3	-46° 55.4′	-64° 33.1′
	14 31	44270.1	19026.2	39973.1	-46° 55.2′	-64° 32.8′
	13 48	44267.6	19022.8	39972.0	-46° 55.2′	-64° 33.0′
	11 42	44255.8	19020.1	39960.1	-46° 54.3′	-64° 32.8′
	11 49	44256.8	19018.2	39962.1	-46° 54.0′	-64° 33.0′
OCT.23	12 01	44255.9	19016.6	39961.9	-46° 54.0′	-64° 33.1′
	12 07	44255.0	19015.1	39961.6	-46° 54.4′	-64° 33.2′
	11 55	44255.9	19017.5	39961.4	-46° 54.2′	-64° 33.0′
	11 21	44243.1	19012.3	39949.8	-46° 56.2′	-64° 33.0′
	11 33	44247.4	19015.3	39953.1	-46° 57.2′	-64° 32.9′
NOV.19	11 52	44248.2	19019.1	39952.2	-46° 56.0′	-64° 32.6′
	12 00	44246.9	19016.2	39952.1	-46° 55.6′	-64° 32.8′
	11 42	44246.4	19015.7	39951.8	-46° 56.3′	-64° 32.8′
	12 13	44232.6	19015.9	39936.4	-46° 54.6′	-64° 32.3′
	12 47	44233.4	19016.3	39937.1	-46° 54.9′	-64° 32.3′
DEC.18	13 11	44239.3	19025.8	39939.2	-46° 54.3′	-64° 31.7′
	13 24	44238.3	19027.7	39937.1	-46° 54.0′	-64° 31.5′
	12 54	44235.9	19021.4	39937.5	-46° 54.5′	-64° 32.0
	12 20	44229.5	19022.7	39929.8	-46° 54.4′	-64° 31.6′
JAN.14	12 34	44229.7	19022.8	39929.9	-46° 54.4′	-64° 31.6′
1987	12 56	44233.1	19021.9	39934.1	-46° 53.3′	-64° 31.8′
	13 08	44242.7	19028.4	39941.7	-46° 53.4′	-64° 31.6′
	12 45	44233.8	19024.0	39933.9	-46° 53.9′	-64° 31.7′

Table 3. K-indices at Syowa Staion in the period of February 1986 - January 1987.

	FEB. (1986)		MAR.		APR.		MAY		JUNE		JULY		AUG.		SEP.		OCT.		NOV.		DEC.		JAN. (1987)	
1	1111	2232	4232	2354	1222	1133	1122	1013	7422	1325	4422	0013	5221	0121	5433	1034	1112	2224	5532	1111	4322	2231	4422	4343
2	2321	1231	4422	3224	3211	0013	3322	5447	4322	2135	3334	2346	0111	1102	5552	2123	5521	4444	1221	2213	3222	2215	3421	2322
3	2111	1124	3221	2235	5532	1222	6662	1034	6332	2243	5432	1113	4434	3255	4411	1115	4331	1123	2322	1337	4221	2223	2322	2123
4	3120	1110	3222	1133	1211	1112	4323	3216	4523	3122	5322	1224	6633	4313	4411	1125	5221	1134	7664	5655	3221	2233	2111	1122
5	0101	2124	3311	1345	1431	0135	4321	2356	3002	1114	5111	1125	5522	2125	5222	1135	5432	3353	6752	2224	6211	0012	1220	1222
6	3220	2324	6512	4556	2121	0024	6765	4766	4311	1220	4311	1110	4320	0122	5312	2213	5552	1123	5422	2234	3412	0122	1211	1112
7	3534	5767	5642	3466	3302	0103	6332	1234	1123	3223	0110	0103	1011	1114	2321	1112	2221	1124	4221	1114	3222	2222	1221	1124
8	4777	7678	5322	2444	2012	1004	4112	2134	3332	2114	2010	1154	4221	1223	4211	0004	2011	2224	3311	1112	2210	1223	3212	2234
9	8754	4554	2321	1101	4530	1234	4211	1002	4320	0124	4221	2113	3211	1325	4331	1000	3221	1133	2121	2211	3211	1224	3322	2212
10	4222	1122	0111	1100	7564	2221	5201	0022	5443	2125	5312	0112	5211	1011	3111	1000	1111	1123	2211	1124	5421	2344	1221	2111
11	4421	2465	0111	1022	3410	1114	1232	1022	5221	1000	2111	1012	4422	1122	1320	1136	2011	1111	4662	2223	4321	1122	1211	1223
12	5542	2244	0122	2113	5432	2334	4511	1102	3310	1124	1000	1114	0442	2111	5875	3466	4001	1119	5422	1113	2111	1234	3421	1113
13	5512	2136	5533	3425	3211	1134	1000	0013	2210	1123	2310	2101	2223	2212	6634	2236	2111	3364	4221	2232	3321	1235	2221	1322
14	5521	3332	6311	1124	3311	1113	3110	0012	3321	1152	1111	2100	3122	1224	5521	1224	3663	3445	3222	1122	4543	2243	2110	1222
15	3311	0121	4221	1144	1111	1114	1211	0054	1111	1100	0110	0002	5211	1215	5313	3453	4343	2345	4322	2434	3321	1121	1220	1134
16	0111	1122	3222	1012	5312	1122	2221	1236	0011	0023	3000	1103	4120	1012	4410	0015	4211	1123	5422	2353	5522	2332	4422	3332
17	2112	1226	4211	0221	1001	1233	5411	2113	1101	1121	3522	1003	3301	1101	4442	2126	4211	1124	3322	2223	1111	2233	5321	1235
18	4222	2225	5322	2212	5411	0005	2122	1003	4420	2010	3301	1104	2111	0000	5543	2355	1102	2454	3221	1012	2111	1234	4222	1223
19	3221	2222	5422	1123	5412	2233	4311	1232	2001	0034	2120	1102	1012	2124	6642	3425	5533	3335	1111	1233	2311	1134	1222	2233
20	5522	3445	1111	0010	1100	1013	3301	1111	4022	0024	2100	1004	3210	2264	5432	2236	4322	2245	4311	1111	3211	2224	3343	3543
21	4444	2337	2322	4237	5211	1002	0013	2220	4321	1021	4011	0014	3134	4436	5422	2132	5422	2235	1111	1221	4111	2245	3322	2234
22	5553	3435	6632	3334	3513	2125	0000	0011	5410	0113	4421	1112	5553	3255	2111	1022	5522	1112	1111	1111	4422	4445	3222	2344
23	6543	4444	4322	3244	2231	1134	3222	2114	5211	0010	3121	2102	5563	4335	6763	3556	2011	1123	1221	1234	4433	4336	3422	3234
24	4533	3244	4333	4444	4232	2222	3111	2102	0221	0121	1111	0024	6543	2446	6553	2246	1101	1101	5523	3656	5422	2334	3221	2332
25	6523	3245	5543	2367	4411	1112	4332	2211	2010	0010	4322	2237	6633	2244	3323	5426	1111	1103	5553	4475	3432	1114	2211	2234
26	4433	3435	5333	2336	5412	1001	4132	2221	1010	0003	5654	3226	6442	3113	6533	3323	2011	1112	5432	3423	5433	2245	5321	2221
27	5634	2335	6534	2223	2101	0004	4211	1114	4422	2356	4334	2105	5433	3224	5453	3465	2432	4445	4432	2111	4222	2224	2322	2111
28	5523	3455	4433	2244	5532	2100	3100	1001	6642	2035	4333	2225	3111	3244	5432	2146	5512	1125	1221	1132	2211	0001	4421	2434
29			4321	1333	3432	2112	1101	0004	4222	2325	5422	3345	5444	4345	6522	1246	6522	2235	4421	3443	3211	1112	6531	1111
30			1112	1033	2111	1111	2001	0134	5401	1223	4433	3225	5544	3277	3221	1000	5422	2465	1222	4445	2111	1244	4210	1212
31			1111	1222			5553	2236			4423	2225	7623	3234			3311	1104			2221	2212	5422	2223

Table 4. Recording periods of ELF-VLF wide band signals recorded on audio tapes.

Start time	(UT)	Stop time	(UT)	Tape Number
Feb. 01	1110	Feb. 01	1720	86-032b
02	0500		1110	033a
	1100		1720	033b
03	1110		1720	034b
07	1110		1720	038b
08	0500		1110	039a
	1110		1720	039b
09	0500		1110	040a
	1110		1720	040b
11	0500		1110	042a
	1110		1720	042b
13	1110		1720	044b
14	0500		1110	045a
	1110		1720	045b
15	1110		1720	046b
16	0500		1110	047a
	1110		1720	047b
18	1110		1720	049b
19	0500		1110	050a
	1110		1720	050b
20	0500		1110	051a
	1110		1720	051b
21	0500		1110	052a
	1110		1720	052b
22	0500		1110	053a
23	1110		1720	054b
25	0500		1110	056a
	1110		1720	056b
26	0500		1110	057a
27	0500		1110	058a
	1110		1720	058b
28	0500		1110	059a
	1110		1720	059b
Mar. 01	1110	Mar. 01	1720	060b
02	1200		1800	061c
	1800		2400	061d
03	1200		1800	062c
	1800		2400	062d
04	0600		1200	063b
	1200		1800	063c
	1800		2400	063d
05	1200		1800	064c
	1800		2400	064d
06	0000		0600	065a
	0600		1200	065b
	1200		1800	065c
	1800		2400	065d
07	1200		1800	066c
	1800		2400	066d
08	1200		1800	067c
	1800		2400	067d
09	0000		0600	068a
	0600		1200	068b
	1200		1800	068c
	1800		2400	068d
10	0000		0600	069a
	1200		1800	069c
	1800		2400	069d
11	0000		0600	070a
Mar. 11	1800	Mar. 11	2400	86-070d
12	0000		0600	071a
13	0600		1200	072b
	1800		2400	072d
14	0000		0600	073a
	0600		1200	073b
	1200		1800	073c
	1800		2400	073d
15	0000		0600	074a
	0600		1200	074b
	1200		1800	074c
	1800		2400	074d
16	1200		1800	075c
17	0600		1200	076b
	1200		1800	076c
	1800		2400	076d
18	0000		0600	077a
	0600		1200	077b
	1200		1800	077c
	1800		2400	077d
19	0000		0600	078a
	0600		1200	078b
	1200		1800	078c
	1800		2400	078d
22	0500		1110	081a
	1110		1720	081b
23	0500		1110	082a
24	0500		1110	083a
	1110		1720	083b
25	0500		1110	084a
	1110		1720	084b
26	0500		1110	085a
	1110		1720	085b
27	0500		1110	086a
28	1110		1720	086b
29	0500		1110	087a
	1110		1720	087b
Apr. 02	0500	Apr. 02	1110	092a
03	1110		1720	093b
05	1110		1720	095b
07	0500		1110	097a
09	0500		1110	099a
	1110		1720	099b
13	0500		1110	103a
	1110		1720	103b
14	1110		1720	104b
16	1110		1720	106b
18	0500		1110	108a
	1110		1720	108b
19	0500		1110	109a
	1110		1720	109b
21	0500		1110	111a
	1110		1720	111b
22	0500		1110	112a
	1110		1720	112b
24	0500		1110	114a
26	1110		1720	116b
27	1110		1720	117b
28	1110		1720	118b

Start time	(UT)	Stop time	(UT)	Tape Number
Apr. 29	1110	Apr. 29	1720	86-119b
30	0500		1110	120a
	1110		1720	120b
May 04	0500	May 04	1110	124a
	1110		1720	124b
06	1110		1720	126b
07	1110		1720	127b
08	0500		1110	128a
09	0500		1110	129a
	1110		1720	129b
12	0000		0600	132a
	0600		1200	132b
	1200		1800	132c
	1800		2400	132d
13	0000		0600	133a
	1800		2400	133d
15	1200		1800	135c
	1800		2400	135d
16	0000		0600	136a
	1200		1800	136c
	1800		2400	136d
17	0000		0600	137a
	1800		2400	137d
18	0000		0600	138a
	1200		1800	138c
	1800		2400	138d
19	1200		1800	139c
21	1200		1800	141c
	1800		2400	141d
22	0000		0600	142a
	0600		1200	142b
	1200		1800	142c
	1800		2400	142d
23	1800		2400	143d
26	1800		2440	146d
27	0000		0600	147a
	0600		1200	147b
	1800		2400	147d
29	1800		2400	149d
30	0000		0600	150a
	1200		1800	150c
	1800		2400	150d
31	0000		0600	151a
	1800		2400	151d
June01	1800	June01	2400	152d
02	1200		1800	153c
	1800		2400	153d
03	0000		0600	154a
	1800		2400	154d
04	0000		0600	155a
	0600		1200	155b
	1200		1800	155c
	1800		2400	155d
05	0000		0600	156a
	1800		2400	156d
07	1800		2400	158d
08	1800		2400	159d
09	1800		2400	160d

Start time	(UT)	Stop time	(UT)	Tape Number
June11	0600	June11	1200	86-162b
	1800		2400	162d
12	0000		0600	163a
	1800		2400	163d
13	1800		2400	164d
14	0000		0600	165a
	1800		2400	165d
17	1200		1800	168c
	1800		2400	168d
18	0000		0600	169a
	1800		2400	169d
19	0000		0600	170a
	1800		2400	170d
20	1800		2400	171d
21	0000		0600	172a
22	0000		0600	173a
24	1800		2400	175d
25	0000		0600	176a
26	1800		2400	177d
27	0000		0600	178a
	1200		1800	178c
	1800		2400	178d
28	1800		2400	179d
29	0000		0600	180a
	0600		1200	180b
	1200		1800	180c
	1800		2400	180d
30	0000		0600	181a
	1200		1800	181b
	1800		2400	181d
July01	0000	July01	0600	182a
	1200		1800	182c
	1800		2400	182d
02	1800		2400	183d
03	1200		1800	184c
	1800		2400	184d
04	0000		0600	185a
	1200		1800	185c
	1800		2400	185d
05	1200		1800	186c
	1800		2400	186d
06	1200		1800	187c
	1800		2400	187d
07	1800		2400	188d
08	1800		2400	189d
09	1800		2400	190d
10	1200		1800	191c
11	0600		1200	192b
	1200		1800	192c
	1800		2400	192d
12	0000		0600	193a
	0600		1200	193b
	1800		2400	193d
14	1800		2400	195d
15	0000		0600	196a
16	0800		2400	197d
17	1200		1800	198c
	1800		2400	198d
18	0000		0600	199a

Start time	(UT)	Stop time	(UT)	Tape Number
July 18	1800	July 18	2400	86-199d
19	1800		2400	200d
20	1800		2400	201d
21	0600		1200	202b
	1800		2400	202d
22	0000		0600	203a
	0600		1200	203b
	1800		2400	203d
23	0600		1200	204b
24	0600		1200	205b
25	0600		1200	206b
	1800		2400	206d
25	0000		0600	207a
	1800		2400	207d
26	1800		2400	208d
28	1800		2400	209d
29	1800		2400	210d
31	1800		2400	212d
Aug. 03	0000	Aug. 03	0600	215a
	1800		2400	215d
04	1800		2400	216d
05	0000		0600	217a
	1800		2400	217d
06	0000		0600	218a
	1200		1800	218c
	1800		2400	218d
07	1800		2400	219d
08	0600		1200	220b
	1200		1800	220c
	1800		2400	220d
09	1800		2400	221d
10	1200		1800	223c
	1800		2400	223d
13	1800		2400	225d
14	0000		0600	226a
	0600		1200	226b
	1800		2400	226d
19	1800		2400	231d
20	0000		0600	232a
	0600		1200	232b
	1200		1800	232c
21	1800		2400	233d
22	1800		2400	234d
23	1200		1800	235c
24	1800		2400	236d
25	1800		2400	237d
26	0000		0600	238a
	0600		1200	238b
27	1800		2400	239d
28	0600		1200	240b
29	0000		0600	241a
	0600		1200	241b
	1200		1800	241c
	1800		2400	241d
30	0000		0600	242a
	0600		1200	242b
	1200		1800	242c
	1800		2400	242d
31	0000		0600	243a

Start time	(UT)	Stop time	(UT)	Tape Number
Aug. 31	0600	Aug. 31	1200	86-243b
	1200		1800	243c
	1800		2400	243d
Sep. 01	0000	Sep. 01	0600	244a
	0600		1200	244b
	1200		1800	244c
02	0000		0600	245a
	0600		1200	245b
03	0600		1200	246b
	1200		1800	246c
04	0600		1200	247b
	1200		1800	247c
	1800		2400	247d
05	0000		0600	248a
	0600		1200	248b
	1200		1800	248c
	1800		2400	248d
06	0000		0600	249a
	0600		1200	249b
	1200		1800	249c
	1800		2400	249d
07	0600		1200	250b
	1200		1800	250c
	1800		2400	250d
08	0000		0600	251a
	0600		1200	251b
	1200		1800	251c
09	1800		2400	252d
10	0000		0600	253a
	0600		1200	253b
	1200		1800	253c
11	1200		1800	254c
	1800		2400	254d
12	1800		2400	255d
13	1800		2400	256d
14	1800		2400	257d
15	0000		0600	258a
	0600		1200	258b
	1200		1800	258c
16	1200		1800	259c
	1800		2400	259d
17	0000		0600	260a
	0600		1200	260b
	1200		1800	260c
	1800		2400	260d
18	0600		1200	261b
	1200		1800	261c
	1800		2400	261d
19	1200		1800	262c
20	1200		1800	263c
	1800		2400	263d
21	0600		1200	264b
	1800		2400	264d
22	1200		1800	265c
23	0600		1200	266b
	1200		1800	266c
	1800		2400	266d
24	1200		1800	267c
25	1200		1800	268c

Start time	(UT)	Stop time	(UT)	Tape Number
Sep. 26	1200	Sep. 26	1800	86-269c
27	0000		0600	270a
	0600		1200	270b
	1200		1800	270c
	1800		2400	270d
28	0000		0600	271a
	0600		1200	271b
	1200		1800	271c
29	0600		1200	272b
	1200		1800	272c
30	1200		1800	273c
Oct. 01	1200	Oct. 01	1800	274c
	18000		2400	274d
02	0000		0600	275a
	0600		1200	275b
	1200		1800	275c
	1800		2400	275d
03	0000		0600	276a
	0600		1200	276b
	1200		1800	276c
	1800		2400	276d
04	0600		1200	277b
	1200		1800	277c
05	0600		1200	278b
	1800		2400	278c
06	0000		0600	279a
	0935		1200	279b
08	0600		1200	281b
	1800		2400	281d
09	0000		0600	282a
	0600		1200	282b
	1800		2400	282d
10	1200		1800	283c
	1800		2400	283d
13	0000		0600	286a
14	0600		1200	287b
	1200		1800	287c
15	0000		0600	288a
16	0600		1200	289b
	1200		1800	289c
17	1200		1800	290c
18	0600		1200	291b
19	0600		1200	292c
20	0600		1200	293b
	1200		1800	293c
21	0000		0600	294a
	0600		1200	294b
	1200		1800	294c
22	0600		1200	295b
	1200		1800	295c
23	1800		2400	296d
24	1800		2400	297d
25	0000		0600	298a
	0600		1200	298b
26	1800		2400	299d
28	1200		1800	301c
29	0600		1200	302b
30	0600		1200	303b
	1200		1800	303c

Start time	(UT)	Stop time	(UT)	Tape Number
Nov. 03	1800	Nov. 03	2400	86-307d
06	0000		0600	310a
	0600		1200	310b
	1200		1800	310c
16	0600		1200	320b
	1200		1800	320c
17	0600		1200	321b
	1200		1800	321c
18	1200		1800	322c
	1800		2400	322d
20	0600		1200	324b
	1200		1800	324c
	1800		2400	324d
22	0000		0600	326a
24	0600		1200	328b
	1200		1800	328c
25	0600		1200	329b
26	0600		1200	330b
29	0600		1200	333b
	1200		1800	333c
Dec. 04	1200	Dec. 04	1800	338c
06	1200		1800	340c
	1800		2400	340d
07	0600		1200	341b
08	1200		1800	342c
10	0600		1200	344b
	1200		1800	344c
11	0600		1200	345b
	1200		1800	345c
13	0600		1200	347b
	1200		1800	347c
15	1200		1800	349c
16	1200		1800	350c
21	0600		1200	355b
	1200		1800	355c
22	1200		1800	356c
23	0600		1200	357b
24	0600		1200	358b
26	0600		1200	360b
27	0000		0600	361a
	0600		1200	361b
28	0000		0600	362a
	0600		1200	362b
Jan. 01	0000	Jan. 01	0600	87-001b
02	0600		1200	002b
	1200		1800	002c
03	1200		1800	003c
06	1200		1800	006c
	1800		2400	006d
07	0000		0600	007a
11	1800		2400	011d
13	1200		1800	013c
16	0600		1200	016b
	1200		1800	016c
18	1200		1800	018c
20	1800		2400	020d
21	0600		1200	021b
22	1200		1800	022c

Start time	(UT)	Stop time	(UT)	Tape Number
Jan. 23	1800	Jan. 23	2400	87-023d
24	1800		2400	024d
27	0600		1200	027b
28	0600		1200	028b
	1200		1800	028c
29	0600		1200	029b
	1200		1800	029c
31	0600		1200	031b
	1200		1800	031c
	1800		2400	031d

Table 5. Hours of operation of the 35 mm all-sky camera at Syowa Staion in 1986.

Date	Hours (Universal Time)									K-Index	
	h	m	s	h	m	s	h	m	s		
Feb. 20				20	00	00	-22	59	37	5522	3445
24				20	50	15	-22	59	37	4533	3244
25				20	01	00	-23	00	07	6523	3245
26				20	01	00	-22	59	07	4433	3435
27				20	01	00	-22	26	37	5634	2335
28							20	20	10	5523	3455
Mar. 1	-00	28	07							4232	2354
6				18	45	00	-22	54	07	6512	4556
7							18	30	30	5642	3466
8	-00	29	37				18	01	00	5322	2444
9	-00	59	37				18	30	00	2321	1101
10	-01	29	37				19	30	00	0111	1100
11	-00	01	07				18	16	00	0111	1022
12	-00	44	37				18	16	00	0122	2113
13	-00	44	37				18	16	00	5533	3425
14	-00	44	37				18	15	00	6311	1124
15	-00	44	37				18	20	00	4221	1144
16	-00	43	07							3222	1012
19							18	15	00	5422	1123
20	-00	43	07				18	16	00	1111	0010
21	-00	43	07							2322	4237
22							19	01	00	6632	3334
23	-00	58	07							4322	3244
25							19	30	30	5543	2367
26	-02	28	07							5333	2336
28				19	45	00	-23	57	37	4433	2244
29				17	01	00	-23	28	07	4321	1333
Apr. 1							20	50	00	1222	1133
2	-00	59	37	17	00	00	-21	29	52	3211	0013
4				18	00	00	-20	59	37	1211	1112
5							18	00	00	1431	0135
6	-01	59	37	18	00	00	-20	59	37	2121	0024
8							17	01	00	2012	1004

Date	Hours (Universal Time)			K-Index	
	h m s	h m s	h m s		
Apr. 9	-01 31 37	18 15 00	-23 59 57	4530	1234
15			20 31 00	1111	1114
16	-00 59 37			5312	1122
18			18 45 00	5411	0005
19	-00 59 37		20 30 00	5412	2233
20	-01 59 37		18 00 00	1100	1013
21	-01 59 37		19 36 00	5211	1002
22	-01 59 37			3513	2125
24		18 00 00	-23 32 37	4232	2222
May 1		19 36 00	-20 43 37	1122	1013
2			15 00 00	3322	5447
3	-00 59 37	15 01 00	-20 26 47	6662	1034
7		15 00 00	-21 28 37	6332	1234
8		17 30 00	-21 29 37	4112	2134
9			17 30 00	4211	1002
10	-00 49 07			5201	0022
15			15 00 00	1211	0054
16	-03 59 37			2221	1236
17			17 31 00	5411	2113
18	-03 59 37		19 00 00	2122	1003
19	-03 59 37		17 00 00	4311	1232
20	-02 59 37		17 01 00	3301	1111
21	-02 59 37			0013	2220
24			14 04 00	3111	2102
25	-03 59 37		14 00 00	4332	2211
26	-03 59 37		16 30 00	4132	2221
27	-03 59 37		15 00 00	4211	1114
28	-03 59 37			3100	1001
29			15 00 00	1101	0004
30	-03 59 37		14 30 00	2001	0134
31	-04 29 37		14 00 00	5553	2236
June 1	-03 59 37			7422	1325
2			19 05 00	4322	2135
3	-01 02 37			6332	2243
7			14 01 00	1123	3223

Date	Hours (Universal Time)									K-Index	
	h	m	s	h	m	s	h	m	s		
June 8	-01	59	52							3332	2114
9							15	01	00	4320	0124
10	-03	25	07				14	01	00	5443	2125
11	-03	59	37				14	00	00	5221	1000
12	-03	59	37				14	00	00	3310	1124
13	-03	59	37				16	00	00	2210	1123
14	-02	35	37				15	12	00	3321	1152
15	-03	59	37				15	00	00	1111	1100
16	-03	59	07				15	00	00	0011	0023
17	-03	59	37				14	00	00	1101	1121
18	-03	59	07							4420	2010
19							14	00	00	2001	0034
20	-03	59	37				20	15	00	4022	0024
21	-03	59	37							4321	1021
24							15	00	00	0221	0121
25	-03	59	37							2010	0010
30							19	45	00	5401	1223
July 1	-04	05	07							4422	0013
2							15	05	00	3334	2346
3	-04	59	37							5432	1113
6							15	01	00	4311	1110
7	-04	59	37				16	01	00	0110	0103
8	-01	59	37				19	20	00	2010	1154
9	-01	19	07							4221	2113
12							19	42	00	1000	1114
13	-03	29	37				15	00	00	2310	2101
14	-02	59	57				15	00	00	1111	2100
15	-03	59	37				17	30	00	0110	0002
16	-04	29	37				15	02	00	3000	1103
17	-03	59	37				15	00	00	3522	1003
18	-04	59	37				18	01	00	3301	1104
19	-04	09	07				19	32	00	2120	1102
20	-04	59	37				13	30	00	2100	1004
21	-05	30	07				15	01	00	4011	0014
22	-04	59	37				15	01	00	4421	1112

Date	Hours (Universal Time)			K-Index	
	h m s	h m s	h m s		
July 23	-04 41 07		15 15 00	3121	2102
24	-04 59 37		15 01 00	1111	0024
25	-04 59 37		15 01 00	4322	2237
26	-04 59 37		15 01 00	5654	3226
27	-02 24 37			4334	2105
29		15 02 00	-21 29 37	5422	3345
30			19 45 00	4433	3225
31	-04 59 57		17 30 00	4423	2225
Aug. 1	-02 14 07			5221	0121
3			14 30 00	4434	3255
4	-04 59 37			6633	4313
8			15 01 00	4221	1223
9	-04 59 37		18 31 00	3211	1325
10	-04 29 57			5211	1011
11			16 01 00	4422	1122
12	-02 20 07		18 00 00	0442	2111
13	-03 59 37			2223	2212
16			17 32 00	4120	1012
17	-03 59 37		17 31 00	3301	1101
18	-03 59 37		17 31 00	2111	0000
19	-03 59 07			1012	2124
23			20 01 00	5563	4335
24	-03 28 37		19 11 00	6543	2446
25	-03 09 57			6633	2244
28			19 01 00	3111	3244
29	-02 59 57		20 02 00	5444	4345
30	-00 49 37			5544	3277
31			17 31 00	7623	3234
Sep. 1	-01 59 57		17 31 00	5433	1034
2	-01 59 07		17 31 00	5552	2123
3	-01 59 37		17 01 00	4411	1115
4	-01 59 37		17 02 00	4411	1125
5	-01 59 57		17 01 00	5222	1135
6	-01 45 47		17 01 00	5312	2213
7	-01 59 57			2321	1112

Date	Hours (Universal Time)									K-Index	
	h	m	s	h	m	s	h	m	s		
Sep. 10							17	00	00	3111	1000
11	-01	42	07				17	01	00	1320	1136
12	-00	30	07							5875	3466
14							17	00	00	5521	1224
15	-00	00	07							5313	3453
20							18	52	00	5432	2236
21	-01	30	07				17	01	00	5422	2132
22	-01	00	07							2111	1022
25							20	01	20	3323	5426
26	-01	30	07	18	01	00	-20	10	07	6533	3323
28							18	01	00	5432	2146
29	-00	00	07				18	01	00	6522	1246
30	-00	59	57				18	01	00	3221	1000
Oct. 1	-00	59	57	18	01	00	-23	29	57	1112	2224
2							18	01	00	5521	4444
3	-01	00	07	18	01	00	-23	59	57	4331	1123
4				18	01	00	-23	29	57	5221	1134

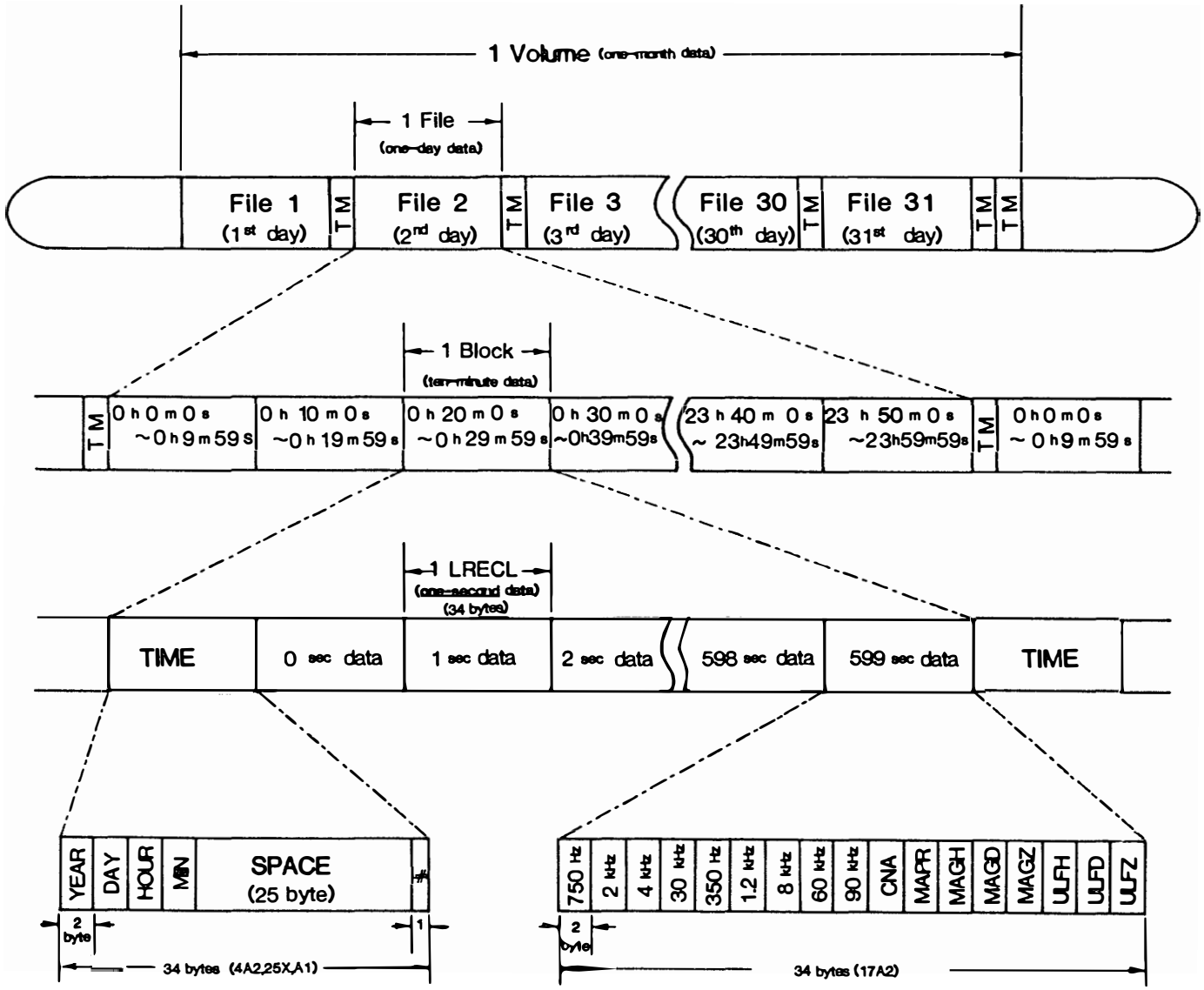

Fig. 2. Structure of the data format of a compiled digital tape.