

UPPER ATMOSPHERE PHYSICS DATA,
SYOWA AND ASUKA STATIONS, 1987

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1. Introduction

This data book summarizes upper atmosphere physics data acquired by the "Upper Atmosphere Physics Monitoring Systems" at Syowa Station and Asuka Station in 1987. The items of observations at Syowa Station 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(0 - 15kHz) signal of ELF-VLF emissions.
- 3) Ionosphere : Cosmic noise absorption at 30MHz.
- 4) Aurora : Meridian scanning record at three wavelengths; OI 5577 Å, 6300 Å and H_β 4861 Å, Auroral intensity of N₂⁺ 1NG 4278 Å in three

directions (30° poleward, zenith and 30° equatorward).

The following are observation items for Asuka Station:

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

The Upper Atmosphere Physics Monitoring Systems were installed at Syowa Station in January 1981, and at Asuka Station in January 1987. An outline of the systems is given in Section 2. Section 3 presents specifications of the observation instruments and the data acquisition systems. The recording periods are also listed in Section 3. The format of the compiled digital data is shown in Section 4. Magnetograms and frequency-time spectra of magnetic pulsations in the period of January 1 - December 31, 1987 for Syowa Station and February 19 - December 31, 1987 for Asuka Station are given in Appendices 1 and 2.

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 systems are available to scientists who cooperate the joint study of antarctic upper atmosphere physics. 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

2.1. Syowa Station

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; Kikuchi et al., 1988), and this report forms the 7th 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 UHF band. Wide-band signals of ELF/VLF emissions were transmitted to Syowa Station by an FM telemeter in VHF 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 (1m ϕ)	Yagi(7 elements)
Max. 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. An additional solar battery system with the maximum power of 365 W was installed in January 1987 to reinforce the battery system in the remote station. 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 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. Two sets of the TEAC DR-200 digital data logger system were installed next to the MELCOM 70/25 system as backup machines in January 1987, and recorded almost the same data simultaneously.

Analog data recordings are quite useful for studying wave phenomena in the ELF-VLF frequency range. For example, one roll of standard 3600 ft audio tape can record VLF emissions up to 15 kHz over 6 hours, while the recording time of standard 2400 ft digital tape is only 15 minutes if the recording density is 6250 BPI. The dynamic spectra of ELF-VLF emissions were obtained by FFT (Fast Fourier Transform) spectrum analyzer, then supplied to

the MELCOM 70/25. All the data were recorded with correct universal time 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 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.

2.2. Asuka Station

The wintering observations for upper atmosphere physics has started from February 19, 1987 after constructions of the observation building and other facilities at Asuka Station. This volume, therefore, contains the first data set acquired at Asuka Station through a year.

A block diagram of the upper atmosphere physics monitoring system is shown in Fig. 2. Sensors of an induction and a fluxgate magnetometers were fixed under snow at the locations approximately 150 m southeast of the observation building. A loop antenna (1 m x 1 m square) in order to receive omega signals for a time code generator was also set up about 50 m southeast apart from the observation building. Both an all-sky 35 mm camera and a SIT high-sensitive TV camera for auroral observations were installed inside two acrylic optical domes at the top of the observation building.

Outputs from the induction and the fluxgate magnetometers were put into a digital data logger system (TEAC DR-200/MT800GP), a long-term analog data recorder R-950L and an 8-channel chart

recorder simultaneously. The time code generator(ECHO AQ-9000) which was automatically corrected within ± 10 ms using omega signals supplied analog data recorders with IRIG-B and slow code, and also the digital data logger system with BCD time code, 0.5 pps sampling pulses and 1 pps external clocks continuously.

3. Specifications of Instruments

3.1. Syowa Station

3.1.1. Geomagnetism

(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, 1987 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.

(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 (MELCOM 70/25)

with a sampling frequency of 0.1 Hz.

(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 mm ϕ , 40000 turns). The permalloy core had a dimension of 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 on West Ongul Island. The output signals from the telemetry receiver were supplied to a long-term analog data recorder R-950L, MELCOM 70/25 and TEAC DR-200 digital data recorders. 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 a FFT spectrum analyzer in NIPR. The spectrograms of the H-component magnetic pulsations in the frequency range from 0.05 to 2.5 Hz are presented in Appendix 2.

(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 111nT/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 1987. Inquiries or requests for data copies of the magnetic field measurements should be addressed to World Data Center C2 for Aurora, NIPR.

3.1.2. ELF-VLF waves

The receiving site of natural ELF-VLF electromagnetic waves was located at the 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, 95 kHz were measured by using a 9-channel filter bank and detector units. The ELF-VLF emissions within the intensity range of 10^{-17} to 10^{-13} W/m² Hz were detected by this system. These data were supplied to the MELCOM 70/25 system with a sampling rate of 0.5 Hz,

The wide-band ELF-VLF signals up to 15kHz 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 range of 0.1 - 2 kHz and 0.1 - 10 kHz were obtained every 10 minutes. These dynamic spectral data were also send 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).

3.1.3. Ionosphere

Cosmic noise absorption at 30 MHz was measured with a riometer made by La Jolla Science. The bandwidth and time constant of the receiver were 150 kHz and 0.25 seconds, respectively. The riometer was also installed at the remote station. The riometer data were supplied to the MELCOM 70/25 system with a sampling rate of 0.5 Hz.

Observations of the ionosphere vertical soundings, the cosmic noise absorption (20, 30 and 45 MHz), the CW field strength (8 and 10 MHz) and the aurora radar (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.

3.1.4. Aurora

(1) Meridian scanning photometer

The auroral photoemission at the wavelengths of OI 5577 Å, 6300 Å and H_β 4861 Å, which are typical emission lines in

electron and proton auroras, were observed by a new meridian scanning photometer installed in 1987. The interference filter for H_{β} was tilted with 1 s period to measure a doppler effect of the auroral H_{β} emission. The field of view of the photometer was 3° for 5577 \AA and 6300 \AA , and 5° for H_{β} . The scanning from the poleward horizon to the equatorward horizon required 30 seconds. The meridian scanning photometer had a digital interface to the TEAC DR-200 system for recording on digital magnetic tapes with a sampling frequency of 1 Hz.

(2) Three-direction photometer

A three-direction photometer detected 4278 \AA emission at three zenith angles (zenith, 30° poleward and 30° equatorward). The field of view was 5° . The measureable auroral intensity was within the range from 7 R to 28 kR. The output signals were supplied to both the MELCOM 70/25 and the TEAC DR-200 with a sampling rate of 1 Hz. Some examples of the auroral photometric observations were given by Ono et al. (1986).

(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 seconds. The observations were carried out during clear nights between February 28 and October 8, 1987, as given in Table 5. Inquiries or requests for the all-sky data copies should be addressed to World Data Center C2 for Aurora of NIPR.

3.2. Asuka Station

3.2.1. Magnetogram

Magnetic variations were measured by a three-axis fluxgate magnetometer (SHIMAZU MB162), the same type as used at Syowa Station. 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 simultaneously supplied to a R-950L long-term data recorder, an 8-channel chart recorder and a DR-200 digital data logger with a sampling rate of 0.5 Hz.

Continuous computer plots of magnetogram in the period of February 19 to December 31, 1987 are given in Appendix 1 along with the magnetograms at Syowa Station. 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.

3.2.2. ULF magnetic pulsations

The H-, D- and Z-components of ULF magnetic pulsations were detected by the search coil (induction) magnetometers of the same type as those used at Syowa Station. The search coil magnetometers were set in the sensor area about 150 m southeast of the observation building. The output signals from the induction magnetometer were supplied to the R-950L data recorder, the 8-channel chart recorder and the DR-200 digital data logger. The recording period on R-950L is listed in Table 6. The sampling frequency of the digital data was 0.5 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 D-component magnetic pulsations in the frequency range from 0.05 to 2.5 Hz are presented in Appendix 2.

3.2.3. Baseline of the geomagnetic field

Absolute values of the inclination, the declination and the total force of the geomagnetic field were measured several times near Asuka Station with a GSI magnetic theodolite and a G-866 proton magnetometer. Table 7 gives the baseline values for the magnetogram at Asuka Station in 1987. Inquiries and requests for data copies of the magnetic field measurements should be addressed to World Data Center C2 for Aurora, NIPR.

3.2.4. 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/2.8. A picture was taken every 30 seconds with an exposure time of 20 seconds using a KODAK 4-X(ISO 400) high-sensitive film. The observations were carried out during clear nights between March 4 and September 30, 1987, as given in Table 8. Inquiries or requests for the all-sky data copies should be also addressed to World Data Center C2 for Aurora, NIPR.

4. Compiled Digital Tape Format

4.1. Syowa Station

4.1.1. MELCOM 70/25 data format

The digital magnetic tape outputs from MELCOM 70/25 minicomputer were compiled in a simplified form with HITAC M-260 computer system of the Information Processing Center,

National Institute of Polar Research. The specifications of the compiled digital tapes are as follows.

Track	:9
Record density	:6250 BPI
Record format	:FB
Block length	:20434 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. force
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 95 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 minutes make a block of 20434 bytes. At the beginning of each block, the starting time of this period is recorded with 34 bytes. Fig. 3 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. The more detailed information about the compiled MELCOM 70/25 MT data were reported by Sakurai *et*

a1.(1987).

4.1.2. TEAC DR-200 data format

The digital data recorded by a TEAC DR-200/MT-1000GP system have been available from 13h 24m 25s UT on April 14, 1987 in addition to the MELCOM 70/25 data. During the interval from April 14, 1987 and January 31 (23h 59m 59s UT), simultaneous digital recordings had been continued using both the MELCOM 70/25 and TEAC DR-200 systems. The DR-200 system newly installed at Syowa Station in 1987 was almost the same system as those used in Iceland for the geomagnetic conjugate observations since 1984. The compilatory process of these data has been made based on the compilation process for the Iceland MT data. The specifications of the compiled digital tapes are as follows:

Track	:	9
Record density	:	6250 BPI
Record format	:	FB
Block length	:	28,848 bytes
Logical record length	:	48 bytes
Label	:	Non-label
Filing	:	Multi-file (1 file/day)

In these tapes, 20 kinds of upper atmospheric data are recorded every one second in the following sequence.

Word number	Observation item	Word number	Observation item
1	H-compo. of magnetic field	13	VLF 8 kHz
2	D-compo. of magnetic field	14	VLF 30 kHz
3	Z-compo. of magnetic field	15	VLF 60 kHz
4	H-compo. of ULF waves	16	VLF 95 kHz
5	D-compo. of ULF waves	17	Total mag. force

6	Z-compo. of ULF waves	18	MBR angle
7	CNA (30 MHz)	19	MBR N-S sweep
8	VLF 350 Hz	20	MBR E-W sweep
9	VLF 750 Hz	21	Space
10	VLF 1.2 kHz	22	Space
11	VLF 2 kHz	23	Space
12	VLF 4 kHz	24	Space

Each data is recorded on a tape with 2 bytes in the binary form of signed 2's complement, and a set of these 24 data make a logical record of 48 bytes. The 10 minutes data make a block of 28848 bytes. One-day data (144 blocks) make one file and one-month data (28-31 files) make one volume. At the beginning of each block, the starting time of this period is recorded with 48 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	Station Code	(4 bytes)
6	Space	(36 bytes)

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

H, D, Z-compo. of the geomagnetic field (nT)	= DATA*2500/2048
H-component of ULF waves (nT/s)	= DATA/141
D-component of ULF waves (nT/s)	= DATA/158
Z-component of ULF waves (nT/s)	= DATA/316

As for CNA, VLF and MBR data, individual calibration values are required to transform MT data. Inquiries about these data should be addressed to Upper Atmosphere Research Division of NIPR.

4.2. Asuka Station

The digital data recording with a TEAC DR-200/MT-800GP system started from 16h 30m UT on February 19, 1987 at Asuka Station. The compilation of these data has been made in the same style as the DR-200 data from Syowa and Iceland stations. The specifications of the compiled digital tapes are as follows:

Track	: 9
Record density	: 6250 BPI
Record format	: FB
Block length	: 3612 bytes
Logical record length	: 12 bytes
Label	: Non-label
Filing	: Multi-file (1 file/day)

In these tapes, 6 kinds of geomagnetic data are recorded every 2 seconds in the following sequence.

Word number	Observation item
1	H-compo. of magnetic field
2	D-compo. of magnetic field
3	Z-compo. of magnetic field
4	H-compo. of ULF waves
5	D-compo. of ULF waves
6	Z-compo. of ULF waves

H, D, Z-components of the geomagnetic field (nT) are obtained by DATA*2500/2048. Further information about these data should be addressed to Upper Atmosphere Research Division of NIPR.

For co-researchers of NIPR, it is permitted to use the HITAC M-260H computer system of the Information Processing Center. The center has various kinds of softwares such as tape-to-tape copy,

displays and spectrum analysis programs.

Acknowledgements

It is a pleasure to acknowledge all the members of the 28th Japanese Antarctic Research Expedition for their enthusiastic support to the upper atmosphere physics observations both at Syowa Station and Asuka Station. The publication of this report was possible thanks to the support from all the members of the upper atmosphere physics research group of National Institute of Polar Research.

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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.

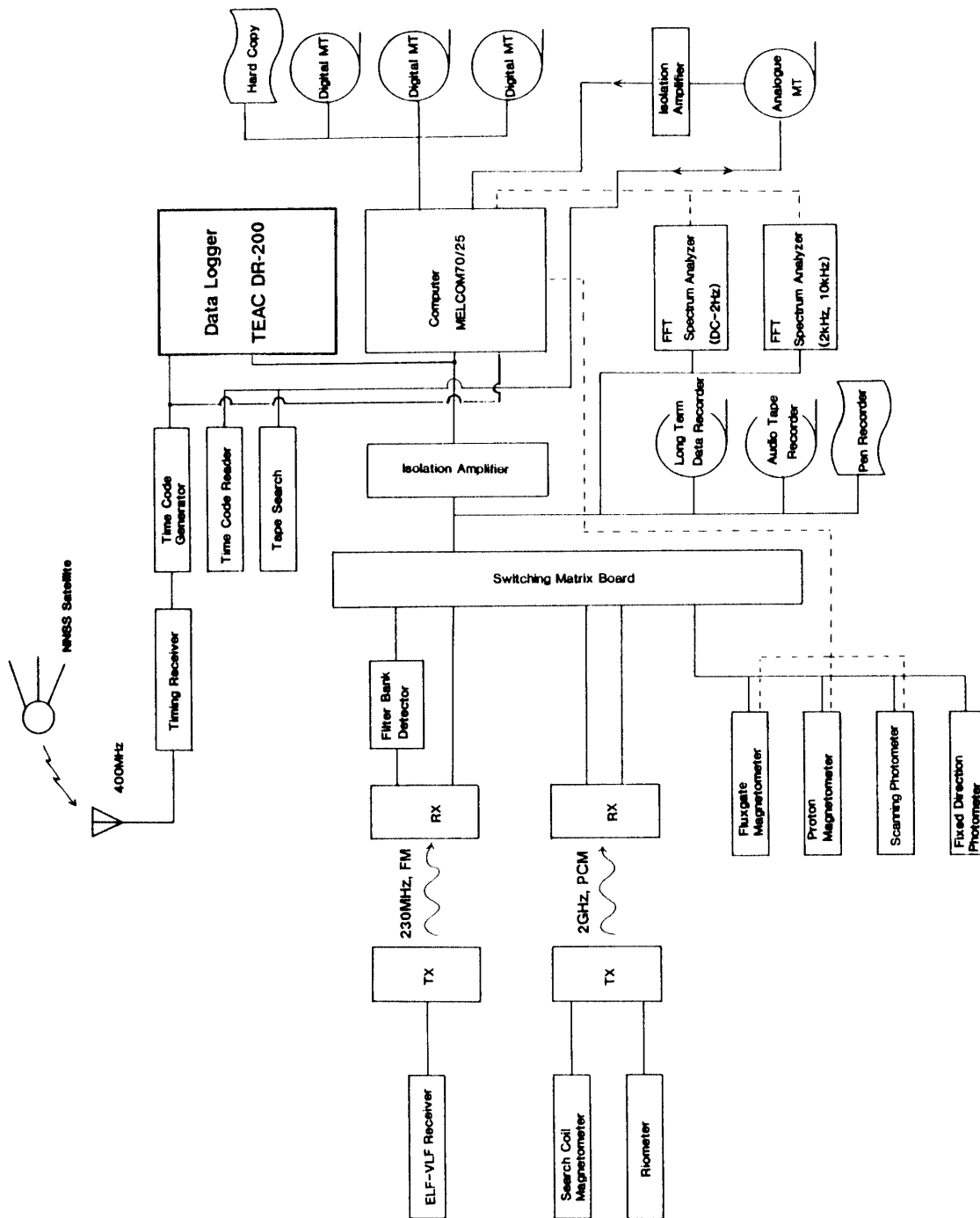


Fig. 1. Block diagram of the "Upper Atmosphere Physics" monitoring system at Syowa Station.

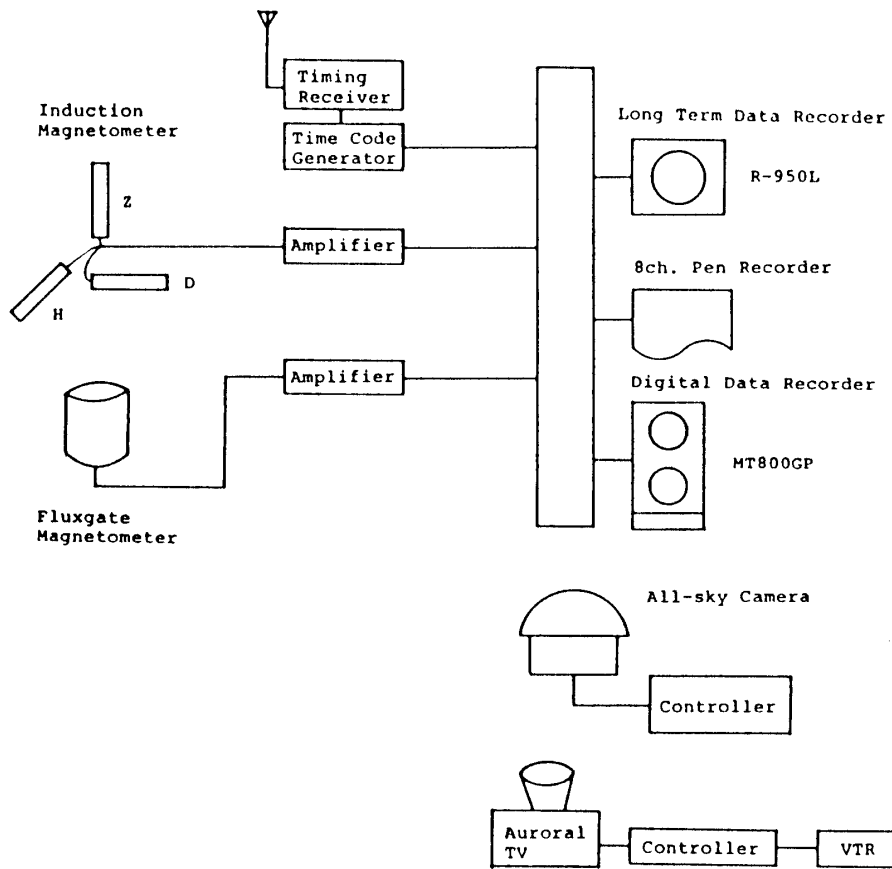


Fig. 2. Block diagram of the "Upper Atmosphere Physics" monitoring system at Asuka Station.

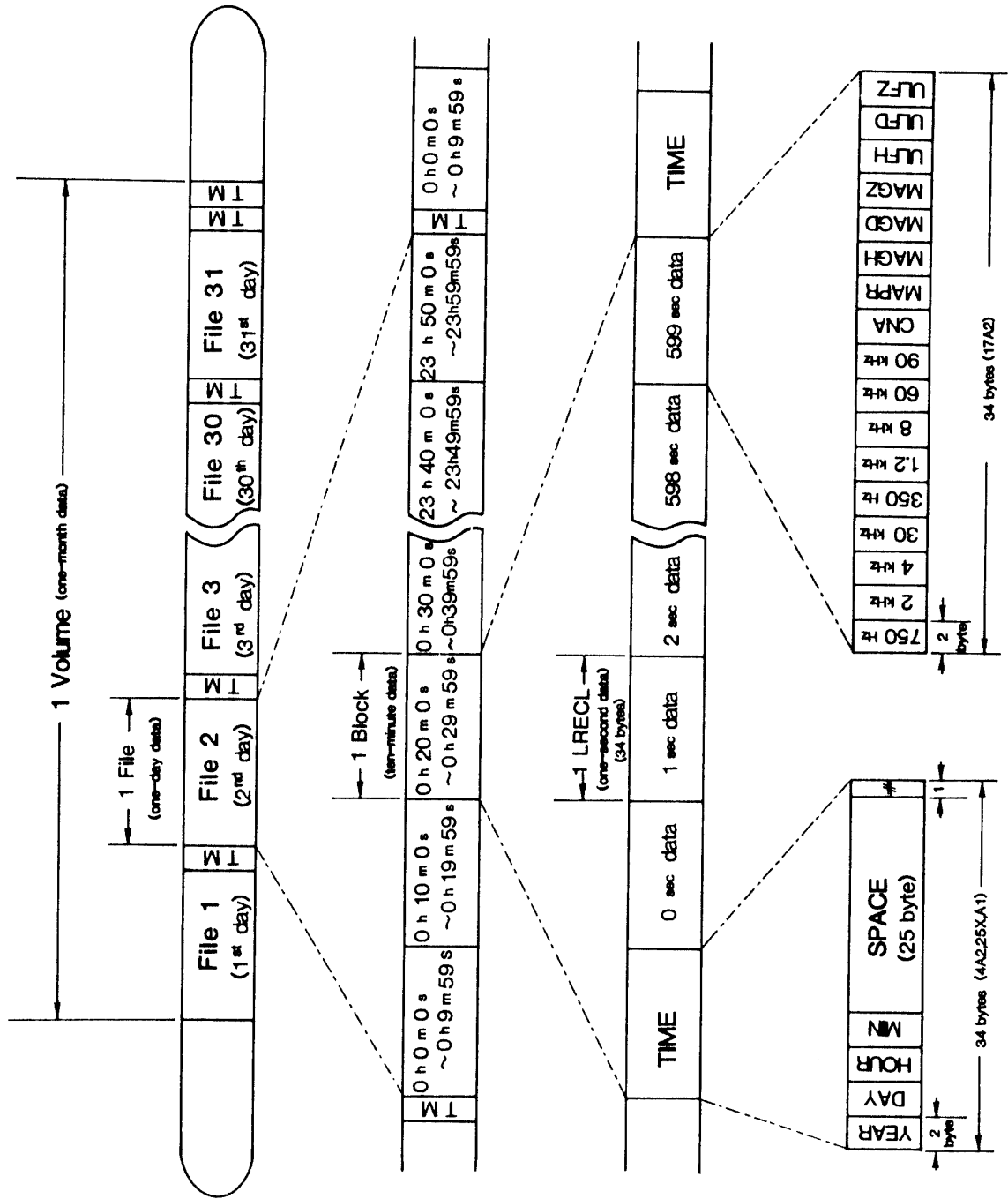


Fig. 3. The structure of the compiled digital tape format (MELCOM 70/25).

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

Start Time		End Time		Tape Number
Date	Time(UT)	Date	Time(UT)	
Feb. 1	0010	Feb. 16	0609	87-03
Feb. 16	0659	Mar. 1	0709	87-04
Mar. 1	0805	Mar. 16	0652	87-05
Mar. 16	0710	Apr. 1	0630	87-06
Apr. 1	0646	Apr. 16	0543	87-07
Apr. 16	0555	May 1	0737	87-08
May 1	0753	May 16	0816	87-09
May 16	0839	June 1	0650	87-10
June 1	0704	June 16	1000	87-11
June 16	1229	July 1	0725	87-12
July 1	0735	July 16	1331	87-13
July 16	1342	Aug. 1	0400	87-14
Aug. 1	0408	Aug. 16	1136	87-15
Aug. 16	1146	Sep. 1	0017	87-16
Sep. 1	0025	Sep. 16	0650	87-17
Sep. 16	0700	Oct. 1	0650	87-18
Oct. 1	0700	Oct. 16	1152	87-19
Oct. 16	1211	Oct. 19	0801	87-20-1
Oct. 19	1241	Nov. 1	0536	87-20-2
Nov. 1	0544	Nov. 16	0829	87-21
Nov. 16	0837	Dec. 1	0545	87-22
Dec. 1	0554	Dec. 16	1045	87-23
Dec. 16	1128	Jan. 1	1304	87-24
Jan. 1	1314	Jan. 16	1037	88-01
Jan. 16	1108	Jan. 31	2342	88-02

Table 2. Baselines of the geomagnetic field at Syowa Station
in 1987.

DATE	TIME (UT)	TOTAL INT. (nT)	HORI- ZONTAL INT. (nT)	VERTICAL INT. (nT)	DECLINATION	DIP ANGLE
FEB. 24 1987	11h 05m	44199	19034	39890	-47° 04.2'	-64° 29.5'
	11 34	44208	19031	39902	-47° 05.4'	-64° 30.1'
	12 28	44194	19038	39883	-47° 00.5'	-64° 29.0'
	12 45	44203	19037	39894	-46° 59.9'	-64° 29.4'
	11 58	44201	19035	39892	-47° 02.5'	-64° 29.5'
MAR. 24	10 04	44220	19042	39910	-47° 02.5'	-64° 29.6'
	10 38	44217	19041	39907	-47° 02.8'	-64° 29.6'
	11 11	44212	19042	39901	-47° 02.6'	-64° 29.3'
	11 30	44214	19040	39904	-47° 03.1'	-64° 29.5'
	10 51	44216	19041	39906	-47° 02.8'	-64° 29.5'
APR. 15	11 05	44208	19027	39903	-47° 00.7'	-64° 30.4'
	11 32	44207	19025	39904	-47° 00.8'	-64° 30.6'
	12 18	44204	19022	39902	-47° 01.8'	-64° 30.7'
	12 37	44204	19023	39901	-47° 02.1'	-64° 30.6'
	11 53	44206	19024	39903	-47° 01.4'	-64° 30.6'
JUNE 15	11 26	44198	19031	39891	-47° 01.3'	-64° 29.7'
	11 48	44197	19030	39890	-47° 01.2'	-64° 29.8'
	12 17	44197	19031	39890	-47° 00.8'	-64° 29.7'
	14 31	44198	19023	39895	-47° 00.6'	-64° 30.4'
	12 31	44198	19029	39892	-47° 01.0'	-64° 29.9'
SEP. 19	14 18	44174	19013	39873	-47° 00.7'	-64° 30.4'
	14 43	44179	19018	39876	-47° 00.1'	-64° 30.1'
	15 16	44182	19019	39880	-47° 01.6'	-64° 30.2'
	15 36	44185	19023	39880	-47° 01.7'	-64° 29.9'
	14 58	44180	19018	39877	-47° 01.0'	-64° 30.2'
NOV. 18	16 05	44159	19011	39857	-47° 00.5'	-64° 30.0'
	16 53	44165	19017	39861	-47° 01.4'	-64° 29.7'
	17 58	44173	19028	39865	-46° 58.9'	-64° 29.1'
	18 21	44176	18996	39883	-46° 58.4'	-64° 31.9'
	17 19	44168	19013	39867	-46° 59.8'	-64° 30.2'
DEC. 28	10 17	44158	19060	39832	-47° 08.6'	-64° 25.7'
	10 42	44153	19059	39828	-47° 08.9'	-64° 25.7'
	11 11	44153	19058	39828	-47° 10.1'	-64° 25.7'
	11 25	44148	19053	39825	-47° 09.3'	-64° 25.9'
	10 54	44153	19058	39828	-47° 09.2'	-64° 25.8'
JAN. 28 1988	14 20	44159	19026	39850	-46° 59.7'	-64° 28.7'
	14 36	44162	19027	39853	-46° 58.6'	-64° 28.7'
	14 57	44159	19029	39848	-47° 00.0'	-64° 28.4'
	15 09	44153	19020	39846	-46° 59.0'	-64° 29.0'
	14 46	44158	19026	39849	-46° 59.3'	-64° 28.7'

Table 3. K-indices at Syowa Station in 1987.

	FEB. (1987)		MAR.		APR.		MAY		JUNE		JULY		AUG.		SEP.		OCT.		NOV.		DEC.		JAN. (1988)	
1	4321	1213	3311	2242	5532	1120	0012	1004	4311	3113	0000	0002	5522	1113	6553	4436	6232	2244	4412	2111	2211	2221	2112	2223
2	2012	1110	1111	1113	2310	1100	2022	1103	5432	1102	1100	0012	4211	1112	4442	2231	5522	1010	4331	2454	2120	1123	3224	4564
3	3221	0000	1312	1035	0000	0000	2011	0000	0002	0011	2000	0014	3312	2432	1111	1001	1243	4584	3322	3465	4321	2423	3422	2124
4	1111	1120	4312	2223	1323	4311	0132	0101	0111	2112	4210	0023	2212	1124	3301	1335	4532	3213	4221	0024	1111	1236	4221	2336
5	1112	1201	3522	4446	4321	1245	0001	1220	3310	2123	4321	0014	5433	2133	4332	1124	3221	2123	3222	1234	4343	2332	4432	3126
6	5322	1104	4322	1035	3400	2113	0000	0015	1144	4345	2200	0004	1321	2233	4412	1233	2121	0133	5431	2122	2210	2226	4244	3575
7	4111	1224	5443	3114	4442	2310	5522	0003	5112	2245	1000	0022	5110	1001	1122	2216	1222	3113	2212	0111	1210	1121	6532	2345
8	3422	2443	4332	2213	1222	1243	3201	1002	3010	0001	2322	1124	3332	2126	5432	1213	5422	1222	2111	1111	1111	0001	5522	3433
9	3322	2115	5421	1110	2211	1232	1111	0001	0000	0003	4332	1025	5431	2113	4321	1033	1111	0044	2221	1236	1110	1133	3432	1012
10	4412	1111	2232	3211	6521	0000	1023	2220	3000	0000	5422	3232	3011	0012	2111	4445	5310	0112	5442	1124	3333	4554	2111	1133
11	3221	1134	2221	2322	0121	1102	1000	0044	0012	1122	3331	1014	3200	1023	6434	3356	3463	4542	2135	6321	2235	4551	1111	
12	5322	4443	5422	1126	1210	0000	1000	0002	2422	2234	2312	2013	5432	2335	4443	3356	2110	2213	4433	1245	4322	2221	2224	4341
13	4321	1021	2322	1104	3312	0334	0000	1115	3322	1102	3000	0004	5434	3134	6532	4427	5432	4456	4533	4434	1120	1111	1122	2233
14	2221	1100	3321	2133	0111	1102	5122	2213	2222	1002	3120	0014	5632	2246	6634	2355	6643	3455	5332	3334	2221	1222	4532	3667
15	0221	1122	4432	1114	4100	0111	0011	1000	2000	0002	3133	3247	5544	3247	6443	2356	4644	4443	5222	2232	1112	2433	6774	4445
16	3322	3332	5222	2134	0110	0002	1211	0000	3110	1053	7543	1335	4533	2124	5343	3236	3432	3333	4421	1211	5633	4535	2132	2112
17	2222	2235	5531	1101	3100	0001	0000	0002	5100	1005	4532	3226	4312	2235	5431	2355	3112	3345	2110	0011	4422	4334	1221	2444
18	4222	1125	4111	1236	1111	0001	0000	0000	4122	1003	5422	2113	4521	1013	5322	1213	3111	2011	2211	1123	4422	1212	2232	2354
19	4122	2101	3321	1134	2333	1122	0000	0002	5544	3115	4211	2134	4521	2124	3111	0000	1111	2224	3332	3323	2121	2232	3332	2332
20	3544	3445	2111	1112	2543	1000	2100	0012	3111	2256	3411	1016	3432	2212	0111	1443	2221	1345	4432	2244	1211	2211	4432	2333
21	4443	2225	2212	2456	1221	0000	2000	0000	4211	1124	2022	0102	4210	0010	4421	1122	5522	2362	4321	1000	1322	3354	4432	1222
22	4532	2126	6223	2255	0111	0113	1100	0004	2011	0032	3321	0044	2222	0131	5531	1557	2221	1012	3421	1133	4432	3354	3222	22--
23	5422	2333	2112	1111	2200	0000	3211	0124	2211	0021	2100	0133	3422	3334	5431	1112	4422	1322	3435	3366	3422	2322	2111	2111
24	3122	1254	0121	1101	4332	3133	5523	2346	0120	0124	2100	0235	3313	2231	5521	1123	4322	2465	5434	4324	3322	2223	1222	2223
25	4111	1122	0011	1314	0110	0022	5856	3231	2000	0135	4223	2243	3124	3465	3330	4560	7543	2125	3432	3323	2222	2224	3212	2334
26	2121	1101	5432	1222	1101	0002	0012	2344	5410	1112	3011	0000	6732	3344	4533	2232	3223	3242	4423	3325	3312	2222	2122	2244
27	2231	2435	5323	3334	1222	2234	4534	2224	2012	2100	4321	0101	5333	4442	1112	1244	5543	4446	5543	4432	2110	1111	4432	2223
28	2342	2235	6433	1220	3000	0002	3122	0036	0411	0003	3223	3455	3412	2268	6342	3245	7634	4554	2332	2332	1111	1133	3422	2012
29			1122	1112	2010	0032	6753	2110	2200	0004	7804	3102	4212	1244	5522	5455	6522	2345	2121	2122	3321	1112	3321	1222
30			2111	1111	0011	0001	1122	2144	2100	0000	5221	2105	5343	2334	7634	3645	4432	2124	2211	2222	2111	1111	1110	0012
31			2211	1211	2322	2345	2322	2345	6632	1022	6632	1022	4542	4545	2322	2322	2322	2244	2322	2244	1112	2223	1222	1112

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

Start Time (UT)	Stop Time (UT)	Tape Number	Start Time (UT)	Stop Time (UT)	Tape Number
Feb. 1 1800	Feb. 1 2400	87-32d	Feb.24 1800	Feb.24 2400	87-55d
2 0000	0600	33a	25 0000	0600	56a
	1200	33b		1200	56b
	1800	33c		1800	56c
	2400	33d		2100	56d
3 0000	0600	34a	26 0000	0600	57a
	1800	34d		1200	57b
4 0000	0600	35a		1800	57c
5 1800	2400	36d	27 0000	0600	58a
6 1200	1800	37c		1200	58b
	2400	37d		1800	58c
7 0600	1200	38b		2400	58d
	1800	38c	28 0000	0600	59a
	2400	38d		1200	59b
8 0600	1200	39b		1800	59c
	1800	39c		2400	59d
	2400	39d	Mar. 1 0000	Mar. 1 0600	60a
9 0000	0600	40a		1200	60b
	2400	40d		1800	60c
10 0000	0600	41a		2400	60d
	1800	41c	2 0000	0600	61a
	2400	41d		1200	61b
11 0000	0600	42a		1800	61c
	2400	42d		2400	61d
12 0000	0600	43a	3 0000	0600	62a
	1800	43d		1200	62b
13 0000	0600	44a		1800	62c
	1800	44c		2100	62d
	2400	44d	4 0000	0600	63a
14 0000	0600	45a		1200	63b
	1200	45b		1800	63c
	1800	45c		2400	63d
	2400	45d	5 0000	0600	64a
15 0600	1200	46b		1200	64b
	2400	46d		1800	64c
16 0000	0600	47a		2100	64d
	2400	47d	6 0000	0600	65a
17 0000	0600	48a		1200	65b
	1200	48b		1800	65c
	1800	48c		2400	65d
	2400	48d	7 0000	0600	66a
18 1200	1800	49c		1200	66b
	2400	49d		1800	66c
19 0600	1200	50b		2400	66d
	2400	50d	8 0000	0600	67a
20 0000	0600	51a		1200	67b
	1200	51b		1800	67c
	1800	51c		2100	67d
	2400	51d	9 0000	0600	68a
21 1200	1800	52c		1200	68b
	2400	52d		1800	68c
22 0000	0600	53a		2400	68d
	1200	53b	10 0000	0600	69a
	1800	53c		1200	69b
	2400	53d		1800	69c
23 0000	0600	54a		2400	69d
	1200	54b	11 0000	0600	70a
	1800	54c		1200	70b
	2400	54d		1800	70c
24 0000	0600	55a		2400	70d
	1200	55b	12 0000	0600	71a
	1800	55c		1200	71b

Start Time (UT)	Stop Time (UT)	Tape Number	Start Time (UT)	Stop Time (UT)	Tape Number
Mar.12 1200	Mar.12 1800	87-71c	Apr.14 1800	Apr.14 2400	87-104d
1800	2400	71d	15 0000	0600	105a
13 0000	0600	72a	1800	2400	105d
0600	1200	72b	16 0000	0600	106a
1200	1800	72c	1800	2400	106d
1800	2400	72d	17 0000	0600	107a
14 0000	0600	73a	1800	2400	107d
0600	1200	73b	18 0000	0600	108a
1200	1800	73c	1800	2400	108d
1800	2400	73d	19 0000	0600	109a
15 0000	0600	74a	1800	2400	109d
0600	1200	74b	20 0000	0600	110a
1200	1800	74c	1800	2400	110d
1800	2400	74d	21 0000	0600	111a
16 0000	0600	75a	1800	2400	111d
0600	1200	75b	22 0000	0600	112a
1200	1800	75c	1800	2400	112d
1800	2400	75d	23 0000	0600	113a
17 0000	0600	76a	1800	2400	113d
0600	1200	76b	24 0000	0600	114a
1800	2400	76d	1800	2400	114d
18 0000	0300	77a	25 0000	0600	115a
1800	2400	77d	1800	2400	115d
19 0000	0600	78a	26 0000	0600	116a
1800	2400	78d	1800	2400	116d
20 0000	0600	79a	27 0000	0600	117a
1800	2400	79d	1800	2400	117d
21 0000	0600	80a	28 0000	0600	118a
1800	2400	80d	1800	2400	118d
22 0000	0600	81a	29 0000	0600	119a
1800	2400	81d	30 0000	0600	120a
23 0000	0600	82a	1800	2400	120d
1800	2400	82d	May 1 0000	May 1 0600	121a
24 0000	0600	83a	1800	2400	121d
1800	2400	83d	2 0000	0600	122a
25 0000	0600	84a	1800	2400	122d
1800	2400	84d	3 0000	0600	123a
26 0000	0600	85a	1800	2400	123d
27 1800	2400	86d	4 0000	0600	124a
28 0000	0600	87a	1800	2400	124d
1800	2400	87d	5 0000	0600	125a
29 0000	0600	88a	1800	2400	125d
1800	2400	88d	6 0000	0600	126a
30 0000	0600	89a	1850	2400	126d
1800	2400	89d	7 0000	0600	127a
31 0000	0600	90a	1800	2400	127d
1800	2400	90d	8 0000	0600	128a
Apr. 1 0000	Apr. 1 0600	91a	1800	2400	128d
1800	2400	91d	9 0000	0600	129a
2 0000	0600	92a	1800	2400	129d
1800	2400	92d	10 0000	0600	130a
3 0000	0600	93a	1800	2400	130d
1800	2400	93d	11 0000	0600	131a
4 0000	0600	94a	1800	2400	131d
1800	2400	94d	12 0000	0600	132a
10 0000	0600	100a	1800	2400	132d
1800	2400	100d	13 0000	0600	133a
11 0000	0600	101a	1800	2400	133d
1800	2400	101d	14 0000	0600	134a
12 0000	0600	102a	1800	2400	134d
1800	2400	102d	15 0000	0600	135a
13 0000	0600	103a	1800	2400	135d
1800	2400	103d	16 0000	0600	136a
14 0000	0600	104a	1800	2400	136d

Start Time (UT)	Stop Time (UT)	Tape Number	Start Time (UT)	Stop Time (UT)	Tape Number
May 17 0000	May 17 0600	87-137a	June 18 0000	June 18 0600	87-169a
1800	2400	137d	1800	2400	169d
18 0000	0600	138a	19 0000	0600	170a
1800	2400	138d	1800	2400	170d
19 0000	0600	139a	20 0000	0600	171a
1800	2400	139d	1800	2400	171d
20 0000	0600	140a	21 0000	0600	172a
1800	2400	140d	1800	2400	172d
21 0000	0600	141a	22 0000	0600	173a
1800	2400	141d	1800	2400	173d
22 0000	0600	142a	23 0000	0600	174a
1800	2400	142d	1800	2400	174d
23 0000	0600	143a	24 0000	0600	175a
1800	2400	143d	1800	2400	175d
24 0000	0600	144a	25 0000	0600	176a
1800	2400	144d	1800	2400	176d
25 0000	0600	145a	26 0000	0600	177a
1800	2400	145d	1800	2400	177d
26 0000	0600	146a	27 0000	0600	178a
1800	2400	146d	1800	2400	178d
27 0000	0600	147a	28 0000	0600	179a
1800	2400	147d	1800	2400	179d
28 0000	0600	148a	29 0000	0600	180a
1800	2400	148d	1800	2400	180d
29 0000	0600	149a	30 0000	0600	181a
1800	2400	149d	1800	2400	181d
30 0000	0600	150a	July 1 0000	July 1 0600	182a
1800	2400	150d	1800	2400	182d
31 0000	0600	151a	2 0000	0600	183a
1800	2400	151d	1800	2400	183d
June 1 0000	June 1 0600	152a	3 0000	0600	184a
1800	2400	152d	1800	2400	184d
2 0000	0600	153a	4 0000	0600	185a
1800	2400	153d	1800	2400	185d
3 0000	0600	154a	5 0000	0600	186a
1800	2400	154d	1800	2400	186d
4 0000	0600	155a	6 0000	0600	187a
1800	2400	155d	1800	2400	187d
5 0000	0600	156a	7 0000	0600	188a
1800	2400	156d	1800	2400	188d
6 0000	0600	157a	8 0000	0600	189a
1800	2400	157d	1800	2400	189d
7 0000	0600	158a	9 0000	0600	190a
1800	2400	158d	1800	2400	190d
8 0000	0600	159a	10 0000	0600	191a
1800	2400	159d	1800	2400	191d
9 0000	0600	160a	11 0000	0600	192a
1800	2400	160d	1800	2100	192d
10 0000	0600	161a	12 0000	0600	193a
1800	2400	161d	1800	2400	193d
11 0000	0600	162a	13 0000	0600	194a
1800	2400	162d	1800	2100	194d
12 0000	0300	163a	14 0000	0600	195a
1800	2400	163d	1800	2400	195d
13 0000	0600	164a	15 0000	0600	196a
1800	2400	164d	1800	2400	196d
14 0000	0600	165a	16 0000	0600	197a
1850	2400	165d	1800	2400	197d
15 0000	0600	166a	17 0000	0600	198a
1800	2400	166d	1800	2400	198d
16 0000	0600	167a	18 0000	0600	199a
1800	2400	167d	1800	2400	199d
17 0000	0600	168a	19 0000	0600	200a
1800	2400	168d	1800	2400	200d

Start Time (UT)	Stop Time (UT)	Tape Number	Start Time (UT)	Stop Time (UT)	Tape Number
July 20 0000	July 20 0600	87-201a	Aug. 21 0000	Aug. 21 0600	87-233a
1800	2400	201d	1800	2400	233d
21 0000	0600	202a	22 0000	0600	234a
1800	2400	202d	1800	2400	234d
22 0000	0600	203a	23 0000	0600	235a
1800	2400	203d	1800	2400	235d
23 0000	0600	204a	24 0000	0600	236a
1800	2400	204d	0600	1200	236b
24 0000	0600	205a	1200	1800	236c
1800	2100	205d	1800	2400	236d
25 0000	0600	206a	25 0600	1200	237b
1800	2400	206d	1200	1800	237c
26 0000	0600	207a	1800	2400	237d
1800	2400	207d	26 0000	0600	238a
27 0000	0600	208a	0600	1200	238b
1800	2400	208d	1200	1800	238c
28 0000	0600	209a	1800	2400	238d
1800	2400	209d	27 0000	0600	239a
29 0000	0600	210a	0600	0900	239b
1800	2400	210d	1200	1800	239c
30 0000	0600	211a	1800	2100	239d
1800	2400	211d	28 0000	0600	240a
31 0000	0600	212a	0600	1200	240b
1800	2400	212d	1200	1800	240c
Aug. 1 0000	Aug. 1 0600	213a	1800	2400	240d
1800	2400	213d	29 0000	0600	241a
2 0000	0600	214a	0600	1200	241b
1800	2400	214d	1200	1800	241c
3 0000	0600	215a	1800	2400	241d
1800	2400	215d	30 0000	0600	242a
4 0000	0600	216a	0600	0900	242b
1800	2400	216d	1200	1800	242c
5 0000	0600	217a	1800	2400	242d
1800	2400	217d	31 0000	0600	243a
6 0000	0600	218a	0600	1200	243b
1800	2400	218d	1200	1800	243c
7 0000	0600	219a	1800	2400	243d
1800	2400	219d	Sep. 1 0000	Sep. 1 0300	244a
8 0000	0600	220a	0600	1200	244b
1800	2400	220d	1200	1800	244c
9 0000	0600	221a	1800	2400	244d
1800	2400	221d	2 0000	0600	245a
10 0000	0600	222a	0600	1200	245b
1800	2400	222d	1200	1800	245c
11 0000	0600	223a	1800	2400	245d
1800	2400	223d	3 0000	0600	246a
12 0000	0600	224a	0600	1200	246b
1800	2400	224d	1200	1800	246c
13 0000	0600	225a	1800	2400	246d
1800	2400	225d	4 0000	0600	247a
14 0000	0600	226a	0600	1200	247b
1800	2400	226d	1200	1800	247c
15 0000	0600	227a	1800	2400	247d
1800	2400	227d	5 0000	0600	248a
16 0000	0600	228a	0600	1200	248b
1800	2400	228d	1200	1800	248c
17 0000	0600	229a	1800	2400	248d
1800	2400	229d	6 0000	0600	249a
18 0000	0600	230a	0600	1200	249b
1800	2400	230d	1220	1800	249c
19 0000	0600	231a	1800	2400	249d
1800	2400	231d	7 0000	0600	250a
20 0000	0600	232a	0600	1200	250b
1800	2400	232d	1200	1800	250c

Start Time (UT)	Stop Time (UT)	Tape Number	Start Time (UT)	Stop Time (UT)	Tape Number
Sep. 7 1800	Sep. 7 2400	87-250d	Sep.23 1800	Sep.23 2400	87-266d
8 0000	0600	251a	24 0000	0600	267a
0600	1200	251b	0600	1200	267b
1200	1800	251c	1200	1800	267c
1800	2400	251d	1800	2400	267d
9 0000	0600	252a	25 0000	0600	268a
0600	1200	252b	0600	1200	268b
1200	1800	252c	1200	1800	268c
1800	2400	252d	1800	2400	268d
10 0000	0600	253a	26 0000	0600	269a
0600	1200	253b	0600	1200	269b
1200	1800	253c	1200	1800	269c
1800	2400	253d	1800	2400	269d
11 0000	0600	254a	27 0000	0600	270a
0600	1200	254b	0600	1200	270b
1200	1800	254c	1200	1800	270c
1800	2400	254d	1800	2100	270d
12 0000	0600	255a	28 0700	1200	271b
0600	1200	255b	1200	1800	271c
1200	1800	255c	1800	2400	271d
1800	2400	255d	29 0000	0600	272a
13 0000	0600	256a	0600	1200	272b
0637	1200	256b	1200	1800	272c
1200	1800	256c	1800	2400	272d
1800	2400	256d	Oct. 1 1800	Oct. 1 2400	274d
14 0000	0600	257a	2 0000	0600	275a
0600	1200	257b	1800	2400	275d
1200	1800	257c	3 0000	0600	276a
1800	2400	257d	1800	2400	276d
15 0000	0600	258a	4 0000	0600	277a
0600	1200	258b	1800	2400	277d
1200	1800	258c	5 0000	0600	278a
1800	2400	258d	1800	2400	278d
16 0000	0600	259a	6 0000	0600	279a
0600	1200	259b	1800	2400	279d
1200	1800	259c	7 0000	0600	280a
1800	2400	259d	1800	2400	280d
17 0000	0600	260a	8 0000	0600	281a
0600	1200	260b	1800	2400	281d
1200	1800	260c	9 0000	0600	282a
1800	2400	260d	1800	2400	282d
18 0000	0600	261a	10 0000	0600	283a
0600	1200	261b	1800	2400	283d
1200	1800	261c	11 0000	0300	284a
1800	2400	261d	1800	2400	284d
19 0000	0600	262a	12 0000	0600	285a
0600	1200	262b	1800	2400	285d
1200	1800	262c	13 0000	0600	286a
1800	2400	262d	1800	2100	286d
20 0000	0600	263a	14 0000	0600	287a
0600	1200	263b	1800	2400	287d
1200	1800	263c	15 0000	0600	288a
1800	2400	263d	1800	2400	288d
21 0000	0600	264a	16 0000	0600	289a
0600	1200	264b	1800	2400	289d
1200	1800	264c	17 0000	0600	290a
1800	2400	264d	1800	2400	290d
22 0000	0600	265a	18 0000	0600	291a
0600	1200	265b	1800	2400	291d
1200	1800	265c	19 0000	0600	292a
1800	2400	265d	1800	2400	292d
23 0000	0600	266a	20 0000	0600	293a
0600	1200	266b	1800	2400	293d
1200	1800	266c	21 0000	0600	294a

Table 5. Observation periods of a 35 mm all-sky camera at Syowa Station in 1987.

Date	Start/Stop Time (UT)									K-Index	
	h	m	s	h	m	s	h	m	s		
Feb. 27				21	13	00	-23	29	37	2231	2435
28				18	02	00	-23	58	37	2342	2235
Mar. 7				18	00	00	-23	27	17	5443	3114
10				18	15	00	-23	29	47	2232	3211
11				18	00	00	-21	02	07	2221	2322
14							19	00	00	3321	2133
15	-00	59	37				19	00	00	4432	1114
16	-00	59	37							5222	2134
19							19	00	00	3321	1134
20	-00	59	37				20	00	00	2111	1112
21	-00	59	37							2212	2456
25							19	00	00	0011	1314
26	-00	59	37							5432	1222
29							19	00	00	1122	1112
30	-02	29	37							2111	1111
Apr. 1							20	00	00	5532	1120
2	-02	49	37				22	37	00	2310	1100
3	-02	59	37							0000	0000
10							19	00	00	6521	0000
11	-02	59	37							0121	1102
14							17	00	00	0111	1102
15	-02	59	37							4100	0111
23							22	00	00	2200	0000
24	-03	21	07							4332	3133
29							20	20	00	2010	0032
30	-01	59	37				23	01	00	0011	0001
May 1	-00	02	07	00	05	00	-04	15	07	0012	1004
2	-03	59	37				20	00	00	0012	1004
7							14	00	00	2022	1103
8	-03	59	37				14	00	00	5522	0003
9	-03	59	37				20	00	00	3201	1002
9	-03	59	37				20	01	00	1111	0001
10	-04	59	37				18	01	00	1023	2220
11	-04	59	37							1000	0044
12							18	00	00	1000	0002
13	-00	59	37				20	10	00	0000	1115
14	-04	59	37				15	00	00	5122	2213
15	-03	59	37							0011	1000
16							18	10	00	1211	0000
17	-03	59	37				19	00	00	0000	0002
18	-03	59	37				19	01	00	0000	0000
19	-02	02	37				19	00	00	0000	0002
20	-03	59	37				19	00	00	2100	0012
21	-03	59	37							2000	0000
22							20	00	00	1100	0004
23	-00	37	07							3211	0124
24				19	17	00	21	08	37	3523	2346
26							17	10	00	0012	2344
27	-03	59	37				17	11	00	4554	2224
28	-03	59	37							3122	0036
June 5							23	00	00	3310	2123
6	-04	58	37							1144	4345
16							20	35	00	3110	1053
17	-04	59	37				18	20	00	5100	1005
18	-04	59	37				18	31	00	4122	1003
19	-04	59	37				21	23	00	5544	3115
20	-05	59	37	19	05	00	22	03	57	3111	2256
23							19	06	00	2211	0021
24	-02	59	37				15	00	00	0120	0124
25	-04	59	37				21	31	00	2000	0135
26	-04	59	37				16	00	00	5410	1112
27	-02	59	37				18	20	00	2012	2100

Date		Start/Stop Time (UT)									K-Index	
		h	m	s	h	m	s	h	m	s		
June	28	-04	59	37				18	05	00	0411	0003
	29	-04	59	37				18	01	00	2200	0004
	30	-04	59	37				18	00	00	2100	0000
July	1	-04	59	37				21	32	00	0000	0002
	2	-04	59	37				20	00	00	1100	0012
	3	-03	18	07				18	00	00	2000	0014
	4	-04	59	37				18	00	00	4210	0023
	5	-04	59	37							4321	0014
	9							20	00	00	4332	1025
	10	-04	59	37				20	00	00	5422	3232
	11	-04	59	37							3331	1014
	12							19	00	00	2312	2013
	13	-04	59	37				19	03	00	3000	0004
	14	-04	59	37							3120	0014
	15							16	24	00	3133	3247
	16	-04	59	37				19	34	00	7543	1335
	17	-04	59	37				19	42	00	4532	3226
	18	-04	59	37				19	43	00	5422	2113
	19	-04	59	37				15	00	00	4211	2134
	20	-04	59	37				22	56	00	3411	1016
	21	-05	53	37				19	45	00	2022	0102
	22	-03	59	37				20	00	00	3321	0044
	23	-03	26	07				20	48	00	2100	0133
	24	-03	59	37							2100	0235
	25							21	00	00	4223	2243
	26	-03	01	07				17	30	00	3011	0000
	27	-03	29	37				17	31	00	4321	0101
	28	-03	29	37				17	31	00	3223	3455
	29	-03	29	37				17	31	00	7864	3102
	30	-03	29	37				18	06	00	5221	2105
	31	-04	29	37				19	07	00	6632	1022
Aug.	1	-04	30	07				20	03	00	5522	1113
	2	-04	29	37				18	00	00	4211	1112
	3	-03	59	37				16	41	00	3312	2432
	4	-03	59	37							2212	1124
	5							21	00	00	5433	2133
	6	-02	59	37							1321	2233
	9							20	30	00	5431	2113
	10	-02	13	37				19	05	00	3011	0012
	11	-02	59	37							3200	1023
	12							22	00	00	5432	2335
	13	-02	59	37				18	20	00	5454	3134
	14	-02	59	37				19	50	00	5632	2246
	15	-02	59	37							5544	3247
	17							20	07	00	4312	2235
	18	-02	59	37				18	01	00	4521	1013
	19	-02	59	37				19	21	00	4521	2124
	20	-03	03	07				17	27	00	3432	2212
	21	-03	29	37				18	36	00	4210	0010
	22	-03	29	37				19	01	00	2222	0131
	23	-03	29	37				17	02	00	3422	3334
	24	-03	29	37				18	38	00	3313	2231
	25	-03	29	57							3124	5465
	26				17	38	00	-20	11	07	6753	3344
	27							20	32	00	5333	4442
	28	-03	29	57				17	00	00	3412	2268
	29	-02	59	37				20	07	00	4212	1244
	30	-02	59	37				17	00	00	5343	2334
	31	-02	59	47				17	17	00	4542	4545
Sep.	1	-02	59	57				17	20	00	6553	4436
	2	-02	59	37							4442	2231
	8				17	00	00	-20	16	07	5432	1213
	9							19	03	00	4321	1033
	10	-02	59	37				19	33	00	2111	4445

Date		Start/Stop Time (UT)									K-Index	
		h	m	s	h	m	s	h	m	s		
Sep.	11	-01	45	37							6434	3356
	12							18	06	00	4443	3356
	13	-02	29	57				16	30	00	6532	4427
	14	-01	49	57	17	02	00	-23	59	37	6634	2355
	15							17	30	00	6443	2356
	16	-01	59	47				17	30	00	5343	3236
	17	-01	16	27				17	31	00	5431	2355
	18	-01	39	57				18	30	00	5322	1213
	19	-01	29	57							3111	0000
	20							17	41	00	0111	1443
	21	-01	01	07				17	01	00	4421	1122
	22	-01	29	37				17	01	00	5531	1557
	23	-01	29	37				17	01	00	5431	1112
	24	-01	29	37							5521	1123
	25							17	45	00	3333	4566
	26	-01	09	37							4553	2232
	28				21	09	00	-23	47	57	6322	3245
	29							18	00	00	5522	5455
	30	-01	00	07				17	00	00	7654	3645
Oct.	1	-00	39	57	18	30	00	-23	59	37	6232	2244
	3				21	46	00	-23	59	57	1243	4584
	7				21	52	00	-23	29	37	1222	3113
	8				20	35	00	-23	29	37	5422	1222

Table 6. Recording periods of ULF magnetic pulsations on a long-term analog data recorder, R-950L at Asuka Station.

Start Time		End Time		Tape Number
Date	Time(UT)	Date	Time(UT)	
Feb. 19	1455	Mar. 7	0604	87-01
Mar. 7	0638	Mar. 16	0628	87-02
Mar. 16	0725	Apr. 1	1846	87-03
Apr. 1	2008	Apr. 15	1205	87-04
Apr. 15	1244	May 1	1246	87-05
May 1	1355	May 15	1325	87-06
May 15	1739	June 1	0324	87-07
June 1	0443	June 16	1406	87-08
June 16	1454	July 1	1135	87-09
July 1	1249	July 18	0630	87-10
July 18	0759	Aug. 3	0651	87-11
Aug. 3	0828	Aug. 16	1830	87-12
Aug. 16	2018	Sep. 1	1950	87-13
Sep. 1	2101	Sep. 17	1035	87-14
Sep. 17	1222	Oct. 1	1020	87-15
Oct. 1	1149	Oct. 17	0620	87-16
Oct. 17	1202	Nov. 1	0901	87-17
Nov. 1	1035	Nov. 16	1418	87-18
Nov. 16	1720	Dec. 4	0928	87-19
Dec. 4	1420	Dec. 23	1422	87-20

Table 7. Baselines of the geomagnetic field at Asuka Station in 1987.

Date	Time (UT)	Total Int.(nT)	H-compo. Int.(nT)	Z-compo. Int.(nT)	Declination	Inclination
Apr. 26	1035	----	----	----	- 36° 21.4'	- 63° 54.7'
July 28	1051	----	----	----	- 36° 14.8'	- 63° 53.4'
Sep. 19	1050	43079	18959	38683	- 36° 22.2'	- 63° 53.4'
Oct. 12	1040	43090	18960	38695	- 36° 17.6'	- 63° 53.8'
Oct. 22	1030	43071	18952	38678	- 36° 19.2'	- 63° 53.7'
Nov. 7	0731	43079	18970	38678	- 36° 25.3'	- 63° 52.5'
Nov. 29	1358	43075	18958	38678	- 36° 17.1'	- 63° 53.3'
Dec. 8	1301	43063	18953	38668	- 36° 15.8'	- 63° 53.3'
	1326	43066	18956	38670	- 36° 16.0'	- 63° 53.2'
Dec. 18	0727	43062	18968	38661	- 36° 23.0'	- 63° 52.0'

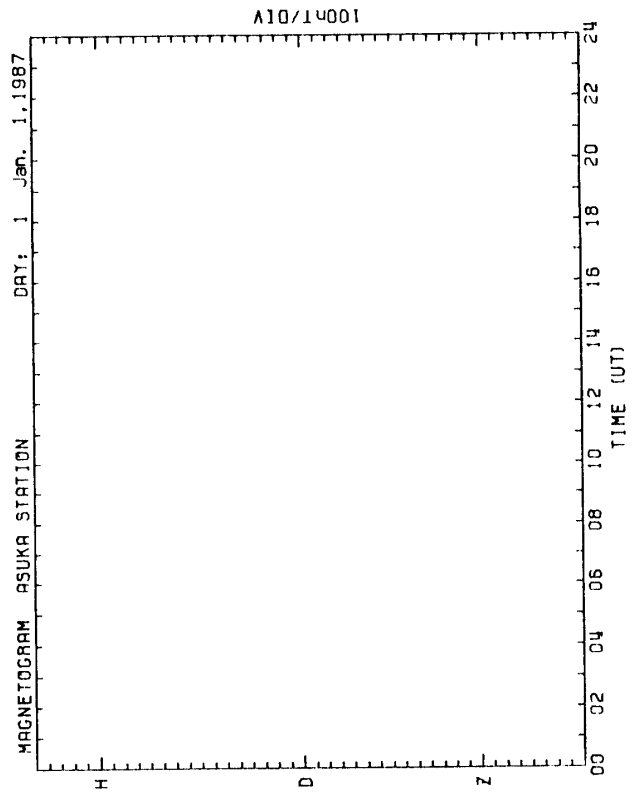
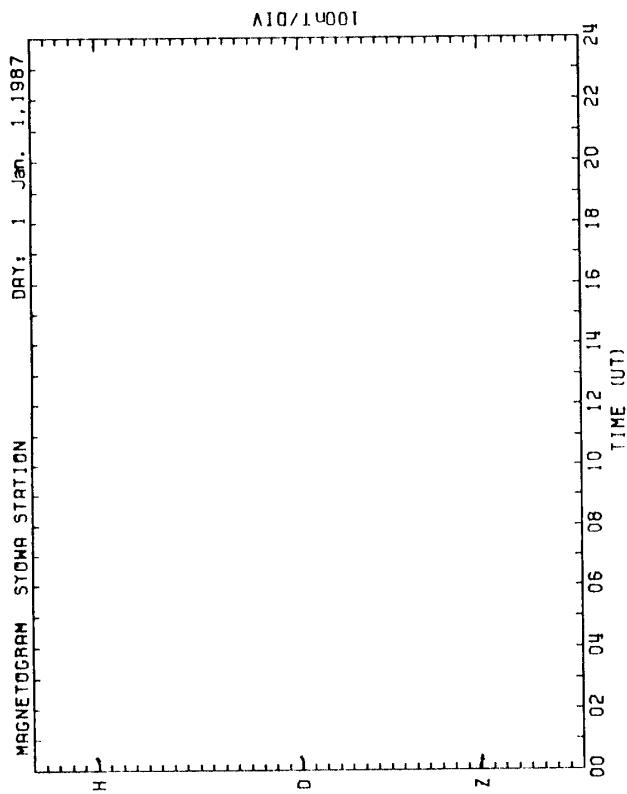
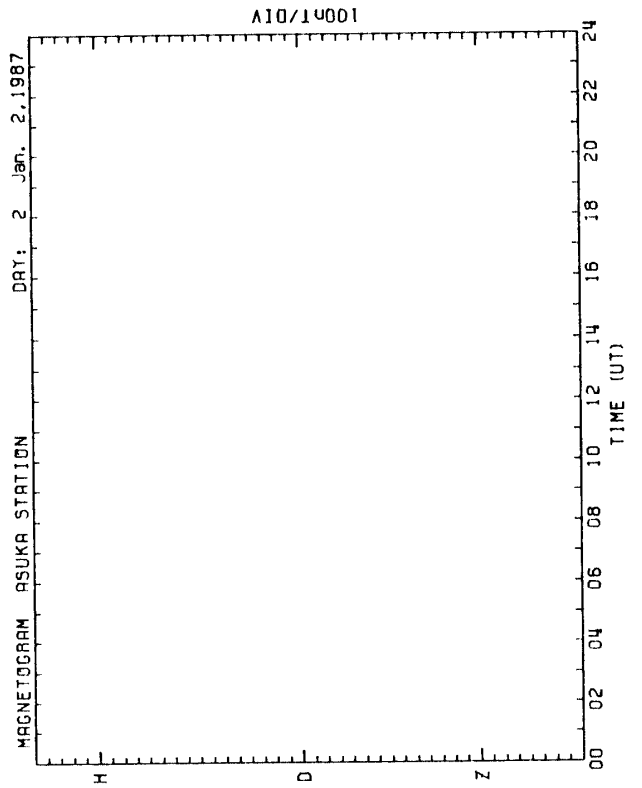
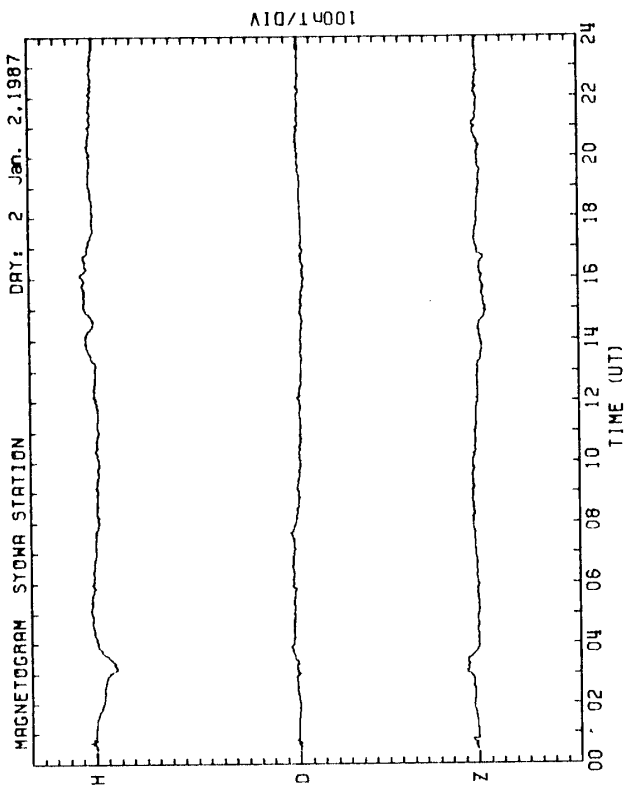
Table 8. Observation periods of a 35 mm all-sky camera at Asuka Station in 1987.

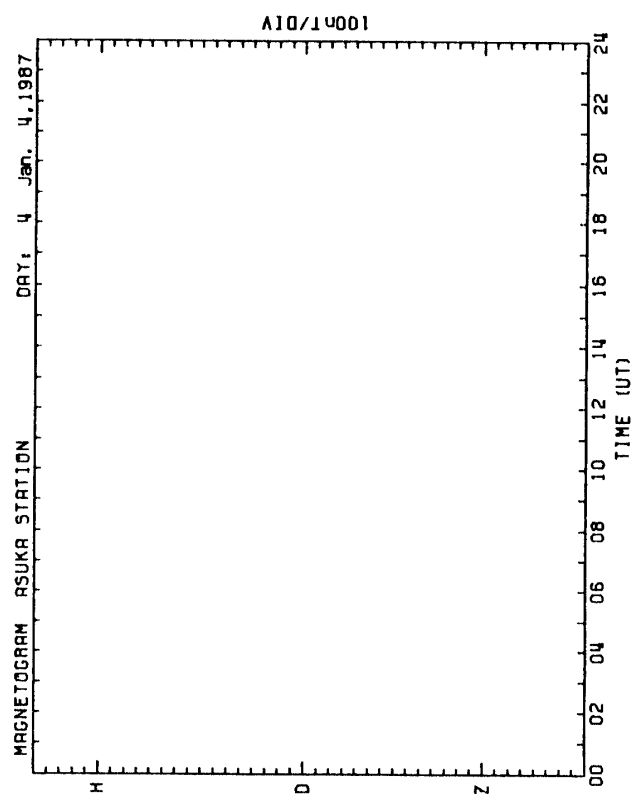
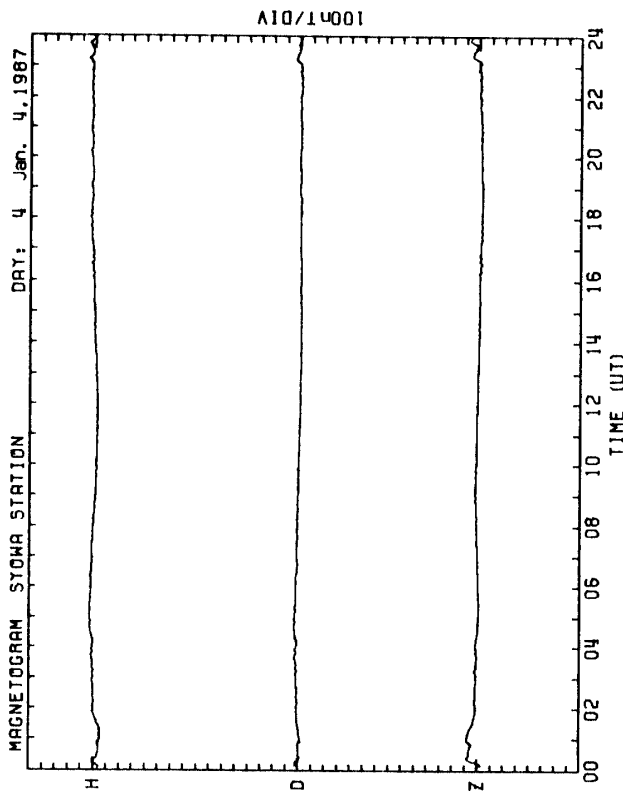
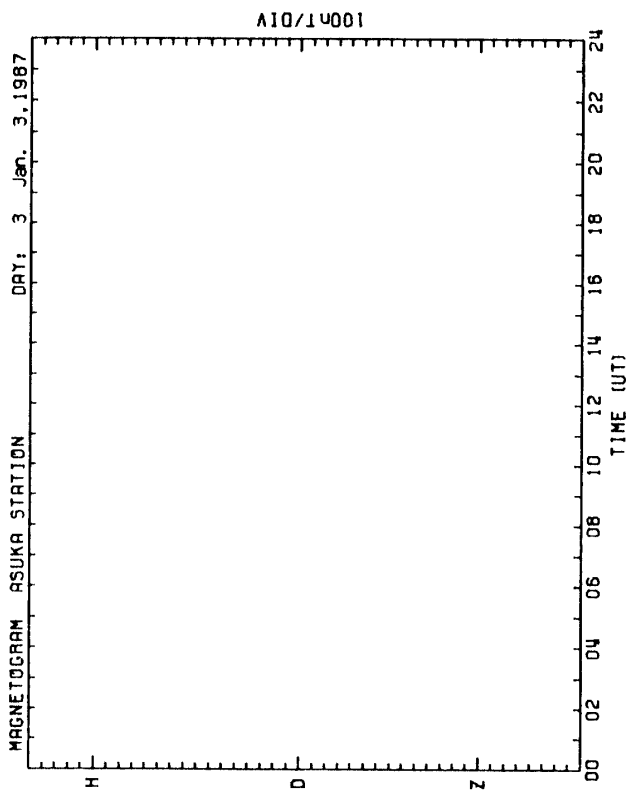
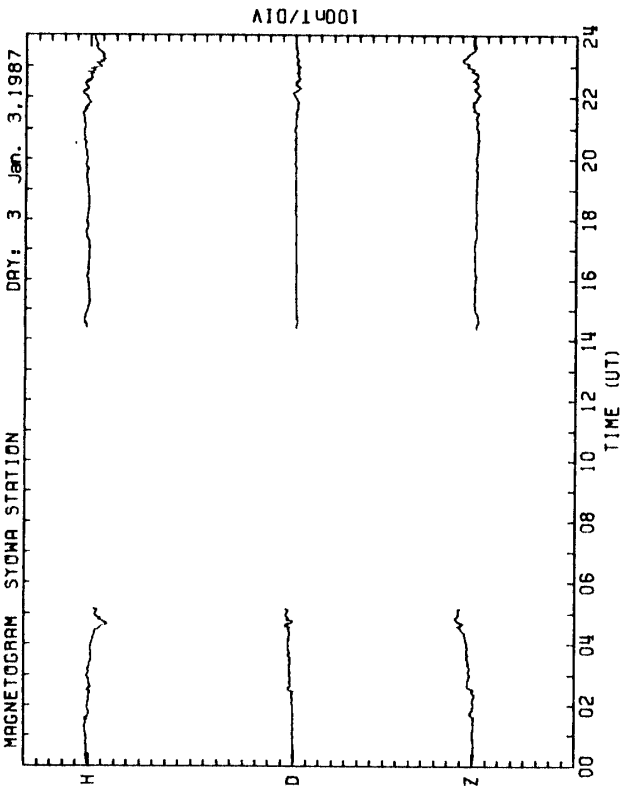
Date	Start/Stop Time (UT)									K-Index	
	h	m	s	h	m	s	h	m	s		
Mar. 4							20	00	00	4312	2223
5	-00	25	50							3522	4446
9							21	37	00	5421	1110
10	-00	29	20				19	31	00	2232	3211
11	-00	53	20				20	02	00	2221	2322
12	-01	00	20				20	00	00	5422	1126
13	-00	54	20							2322	1104
15							20	32	00	4432	1114
16	-01	22	50							5222	2134
18							19	57	00	4111	1236
19	-00	46	20							3321	1134
20							19	56	00	2111	1112
21	-01	23	20							2212	2456
22							21	19	00	6223	2255
23	-01	50	20							2112	1111
28							20	33	00	6433	1220
29	-01	55	20				22	44	00	1122	1112
30	-01	19	50				21	12	00	2111	1111
31	-02	05	20				21	32	00	3211	1211
Apr. 1	-02	24	20							5532	1120
3							22	13	00	0000	0000
4	-02	04	50				20	36	00	1323	4311
5	-02	02	20				20	57	00	4321	1245
6	-01	12	50							3400	2113
8							20	33	00	1222	1243
9	-01	57	20				20	59	00	2211	1232
10	-02	22	20				21	02	00	6121	0000
11	-02	25	20							0121	1102
25							20	41	00	0110	0022
26	-02	21	20				21	05	00	1101	0002
27	-02	57	50							1222	2234
May 1				21	05	00	-23	16	20	0012	1004
4							21	36	00	0132	0101
5	-03	30	20							0001	1220
8							21	47	00	3201	1002
9	-03	39	50				21	02	00	1111	0001
10	-02	58	20							1023	2220
18							21	46	00	0000	0000
19	-03	39	50							0000	0002
24							21	39	00	3523	2346
25	-03	17	50	05	54	00	-07	30	50	5853	3231
26				20	07	00	-23	32	50	0012	2344
27							21	48	00	4554	2224
28	-04	41	50				21	02	00	3122	0036
29	-03	54	50							6753	2110
June 7							21	40	00	5112	2245
8	-04	32	20							3010	0001
10							21	19	00	3000	0000
11	-04	12	20				21	17	00	0012	1122
12	-02	33	20							2422	2234
15							21	43	00	2000	0002
16	-01	36	20				20	42	00	3110	1053
17	-03	35	20				21	19	00	5100	1005
18	-04	14	20				21	45	00	4122	1003
19	-04	39	50				22	09	00	5544	3115
20	-00	47	50							3111	2256
21							21	15	00	4211	1124
22	-05	09	50							2011	0032
23							21	17	00	2211	0021
24	-03	57	20							0120	0124
25							21	24	00	2000	0135
26	-05	28	20				22	49	00	5410	1112

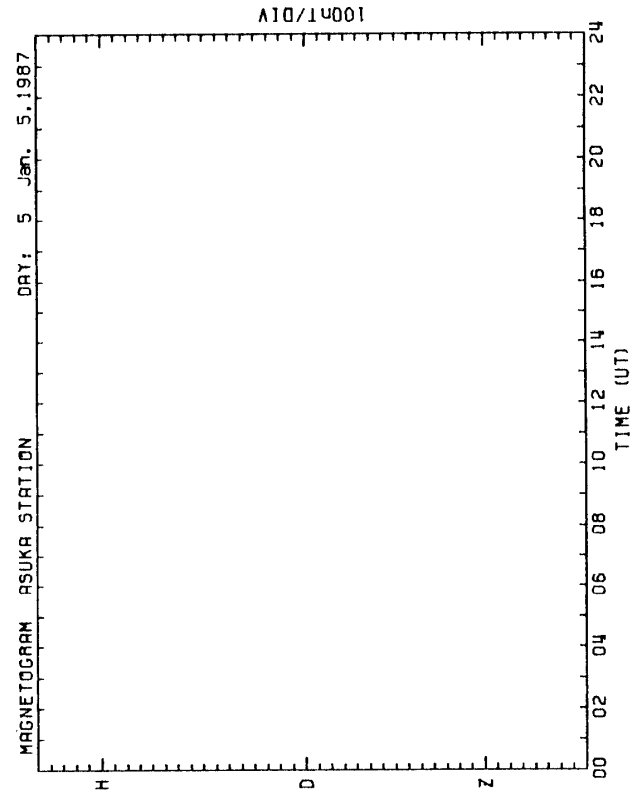
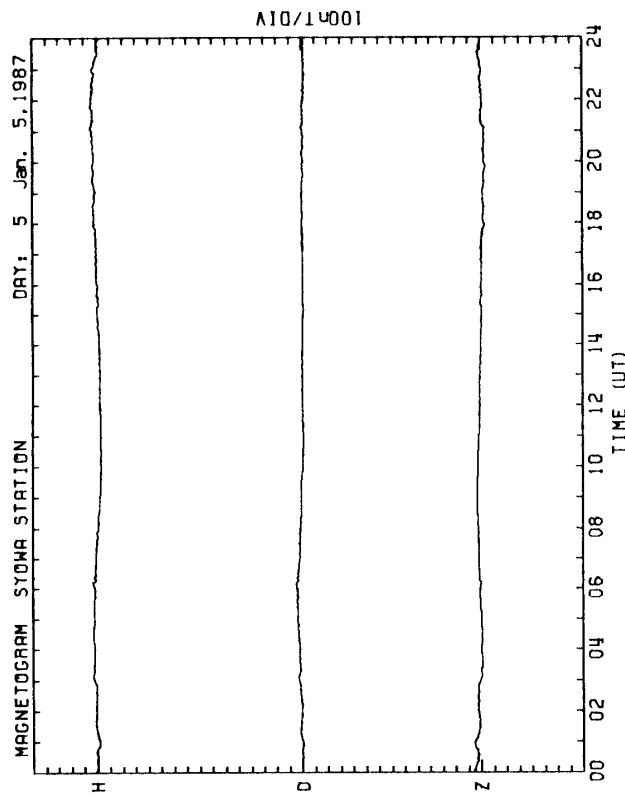
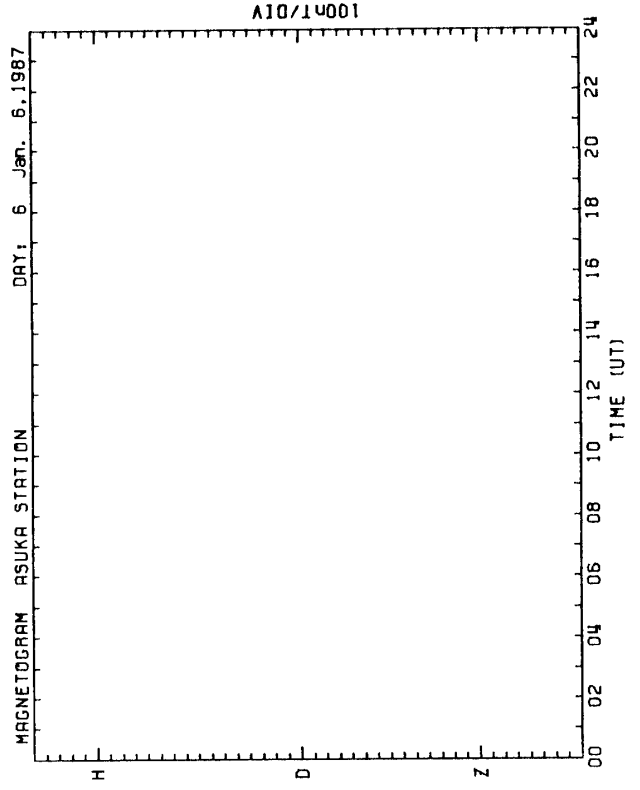
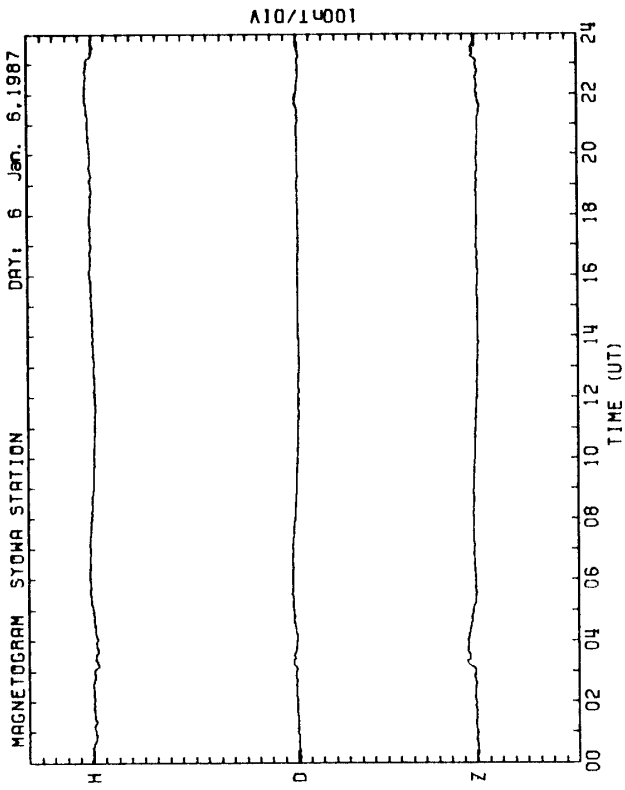
Date		Start/Stop Time (UT)									K-Index	
		h	m	s	h	m	s	h	m	s		
June	27	-05	42	20							2012	2100
	29							21	59	00	2200	0004
	30	-04	53	50				21	41	00	2100	0000
July	1	-04	31	50				21	28	00	0000	0002
	2	-04	22	20				21	52	00	1100	0012
	3	-04	46	50							2000	0014
	4							21	56	00	4210	0023
	5	-05	50	20							4321	0014
	15							21	26	00	3133	3247
	16	-05	18	50				20	01	00	7543	1335
	17	-03	40	20				21	14	00	4532	3226
	18	-05	09	50				21	25	00	5422	2113
	19	-05	17	50				20	38	00	4211	2134
	20	-04	18	20				21	32	00	3411	1016
	21	-05	24	50							2022	0102
	22							21	16	00	3321	0044
	23	-03	39	50				20	45	00	2100	0133
	24	-02	50	50				20	05	00	2100	0235
	25	-02	26	20				20	09	00	4223	2243
	26	-02	32	50							3011	0000
	27							20	58	00	4321	0101
	28	-03	22	20	19	36	00	-23	49	50	3223	3455
	29							21	03	00	7864	3102
	30	-03	26	20							5221	2105
Aug.	1							21	00	00	5522	1113
	2	-03	25	20				21	00	00	4211	1112
	3	-02	54	50							3312	2432
	5							21	01	00	5433	2133
	6	-01	39	20							1321	2233
	12							21	32	00	5432	2335
	13	-00	57	50							5454	3134
	14							19	37	00	5632	2246
	15	-01	33	20	20	26	00	22	01	20	5544	3247
	19							21	27	00	4521	2124
	20	-03	22	20							3432	2212
	21							21	02	00	4210	0010
	22	-02	50	50				19	18	00	2222	0131
	23	-01	06	50							3422	3334
	26							19	43	00	6753	3344
	27	-01	37	20							5333	4442
	28							20	58	00	3412	2268
	29	-02	52	20				18	56	00	4212	1244
	30	-00	40	20				20	09	00	5343	2334
	31	-02	03	50	20	45	00	22	58	20	4542	4545
Sep.	1							19	59	00	6553	4436
	2	-01	51	20				19	48	00	4442	2231
	3	-01	41	20							1111	1001
	11				20	03	00	-23	05	50	6434	3356
	13							19	19	00	6532	4427
	14	-01	12	50				19	24	00	6634	2355
	15	-01	15	50	18	43	00	-21	17	20	6443	2356
	16	-02	22	20				22	28	00	6443	2356
	17	-02	30	50				19	01	00	5343	3236
	18	-01	23	20				19	07	00	5431	2355
	19	-01	23	20				18	47	00	5322	1213
	19	-00	11	20				20	07	00	3111	0000
	20	-01	00	20				19	00	00	0111	1443
	21	-00	55	20							4421	1122
	22							19	03	00	5531	1557
	23	-00	54	50							5431	1112
	24							20	03	00	5521	1123
	25	-00	53	50				19	32	00	3333	4566
	26	-00	26	50	20	02	00	-23	02	50	4553	2232
	29				20	19	00	-21	43	20	5522	5455

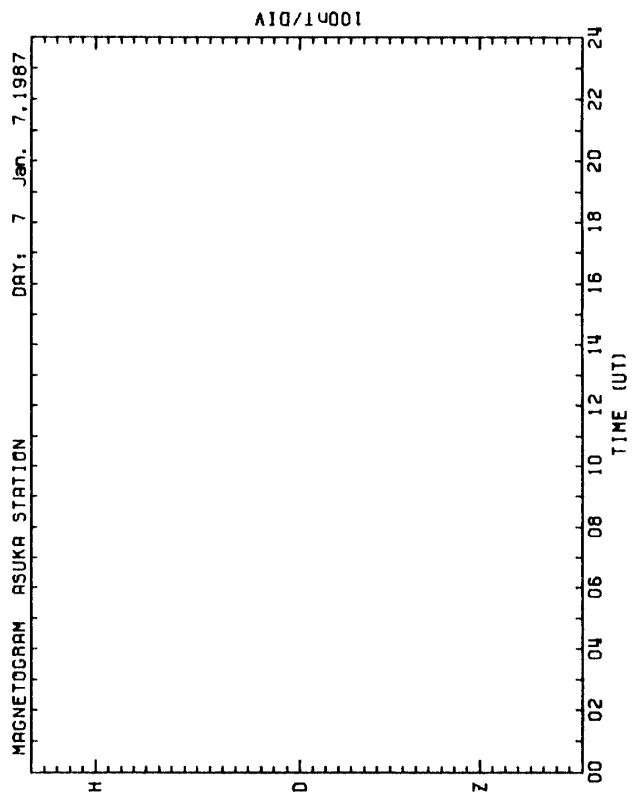
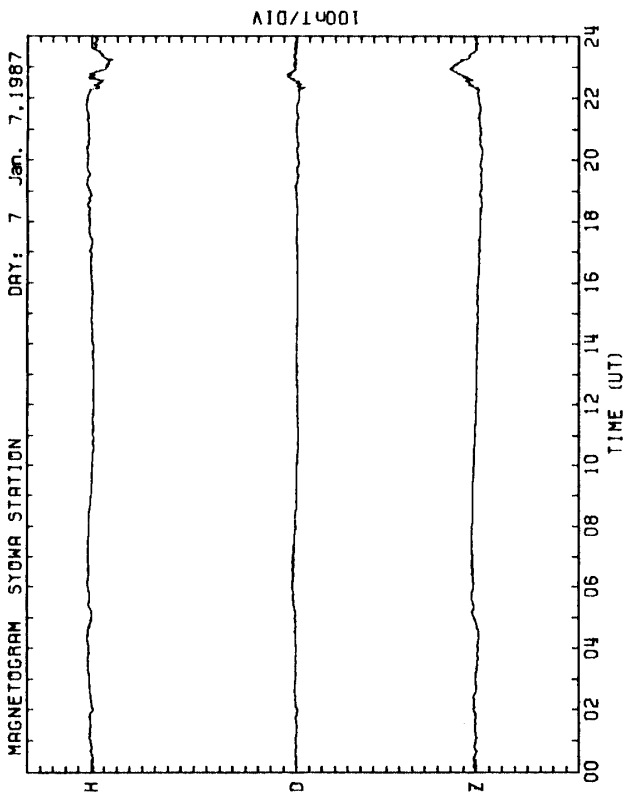
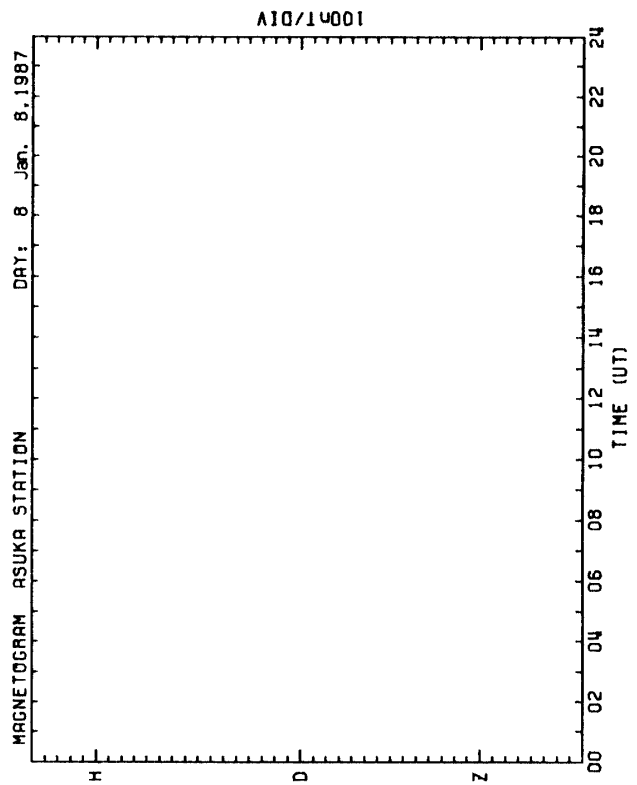
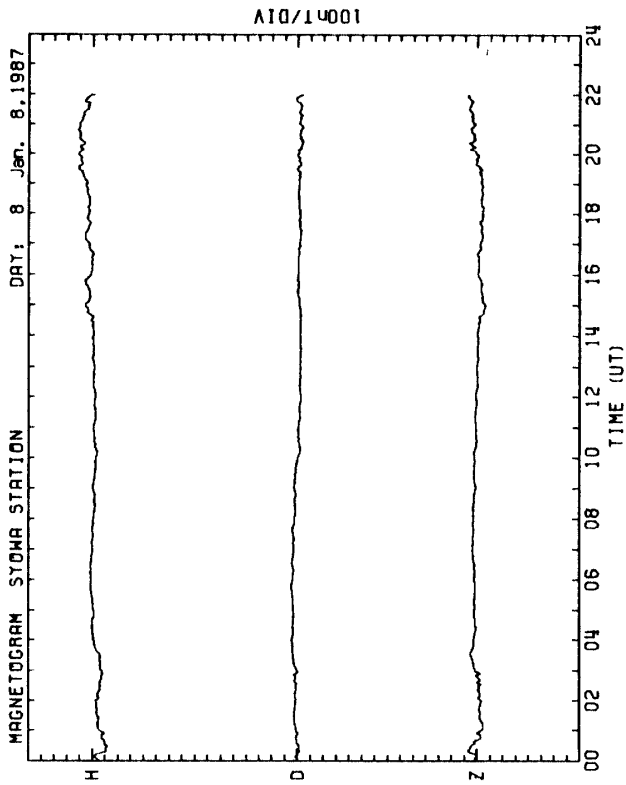
Appendix 1

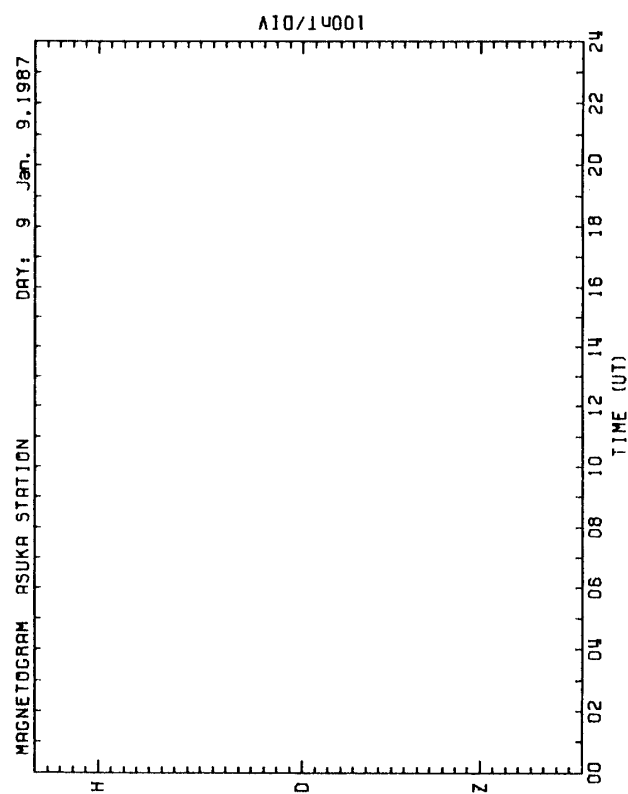
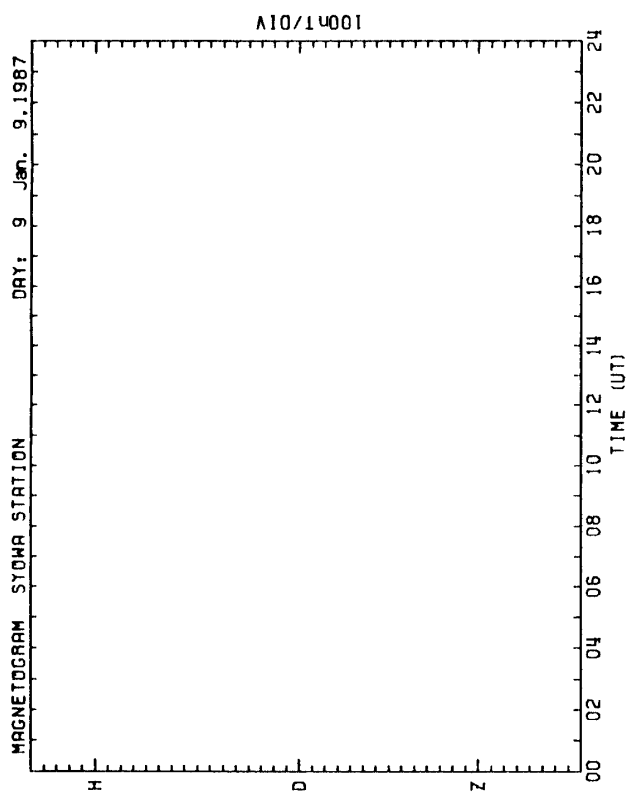
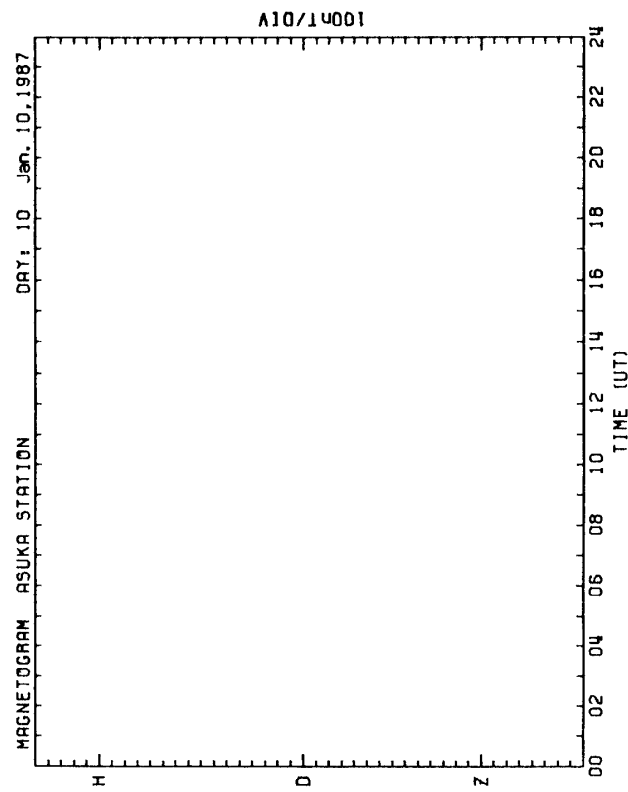
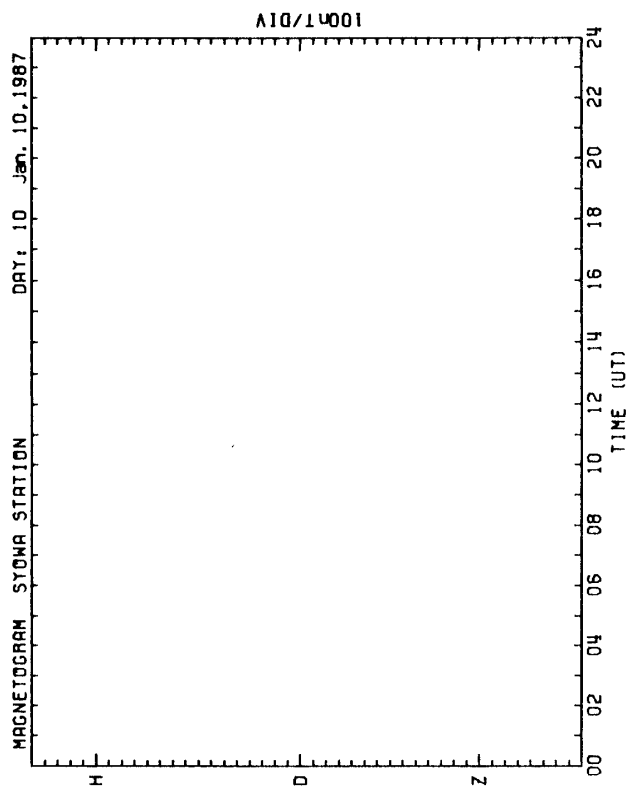
Continuous computer plots of magnetogram in 1987

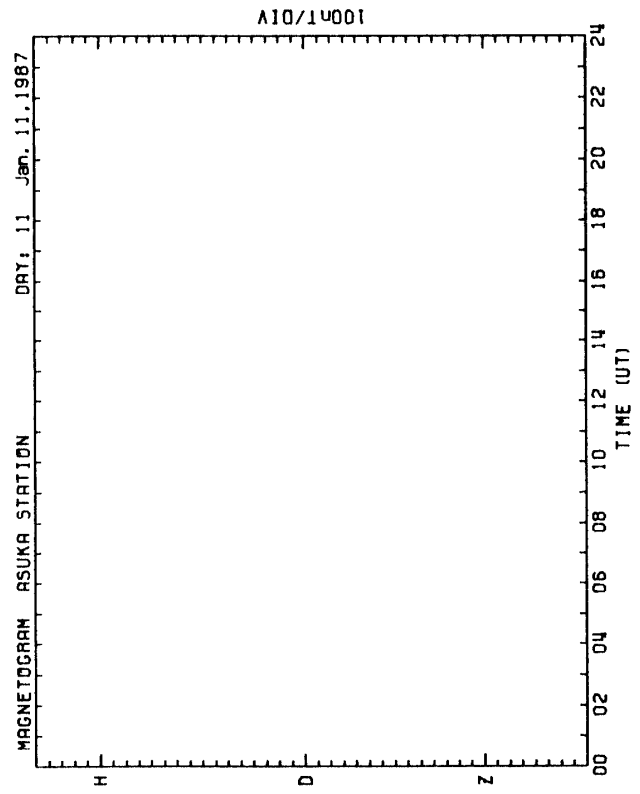
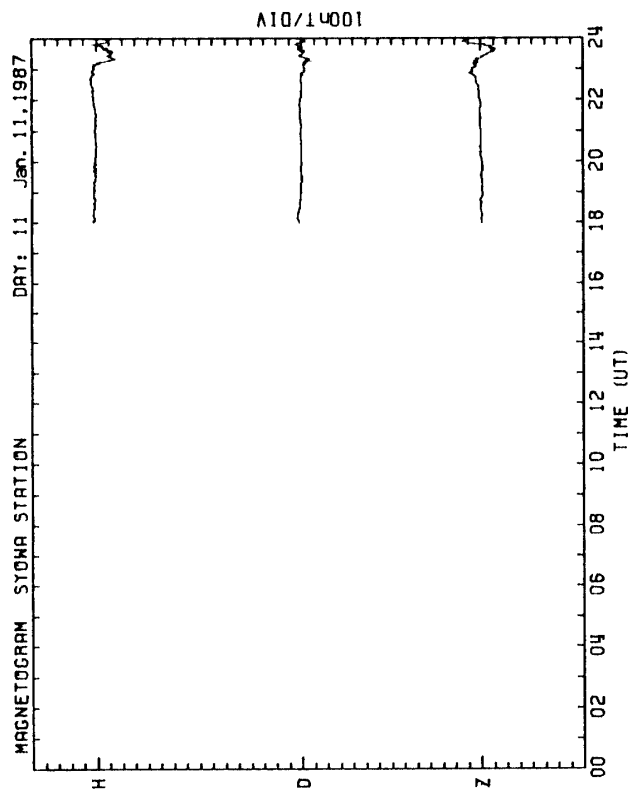
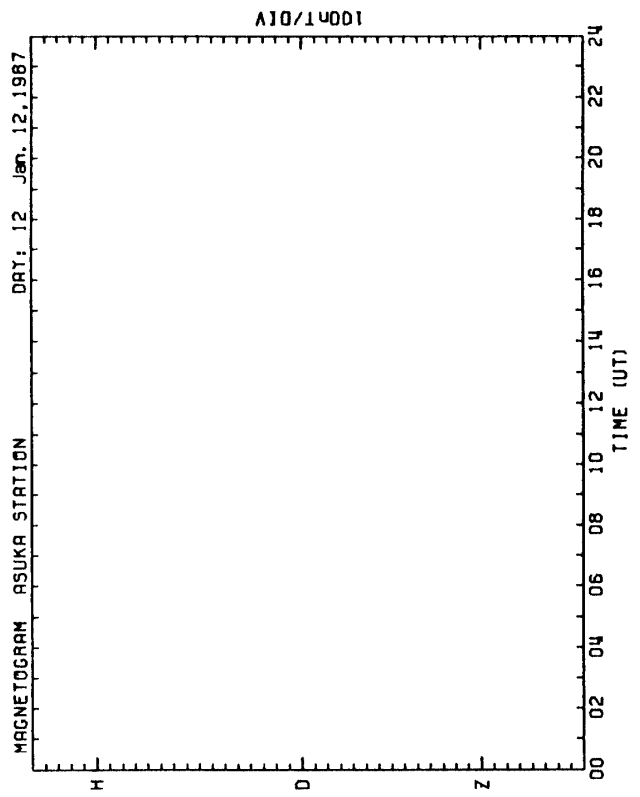
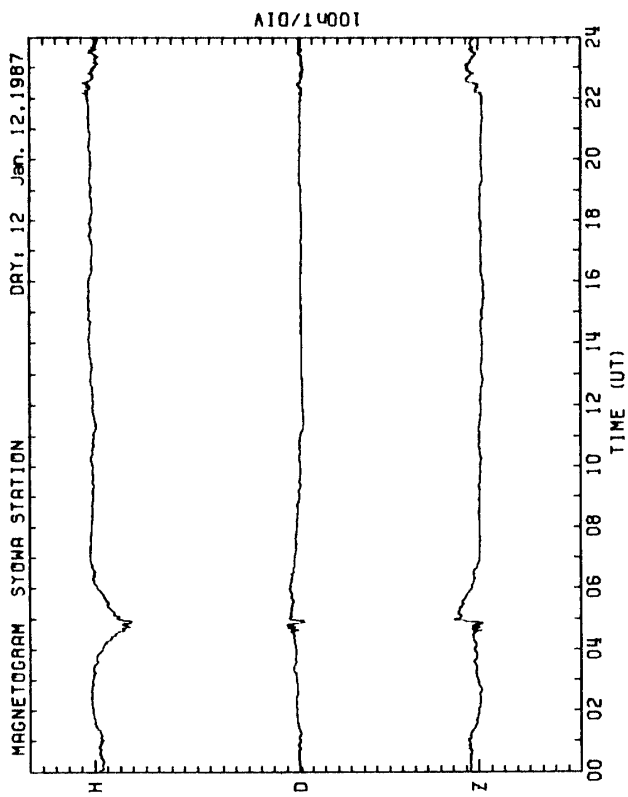


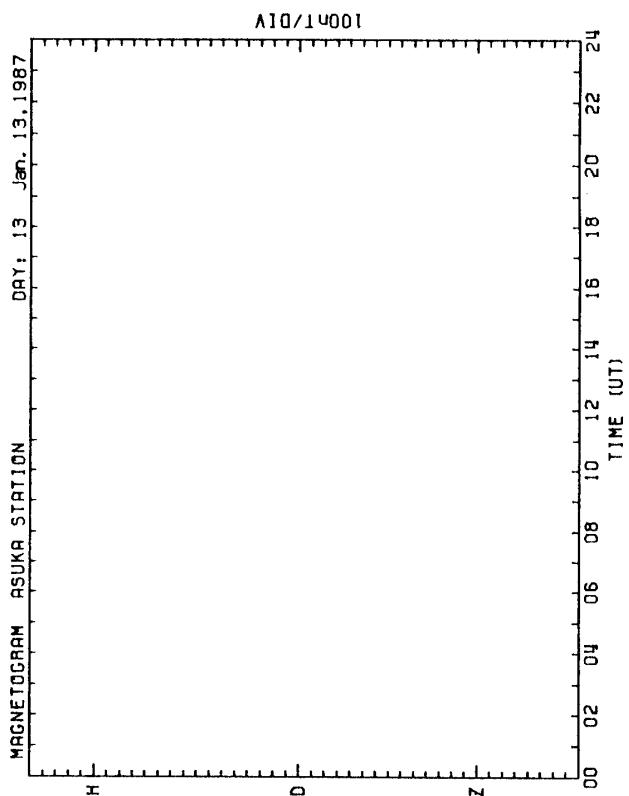
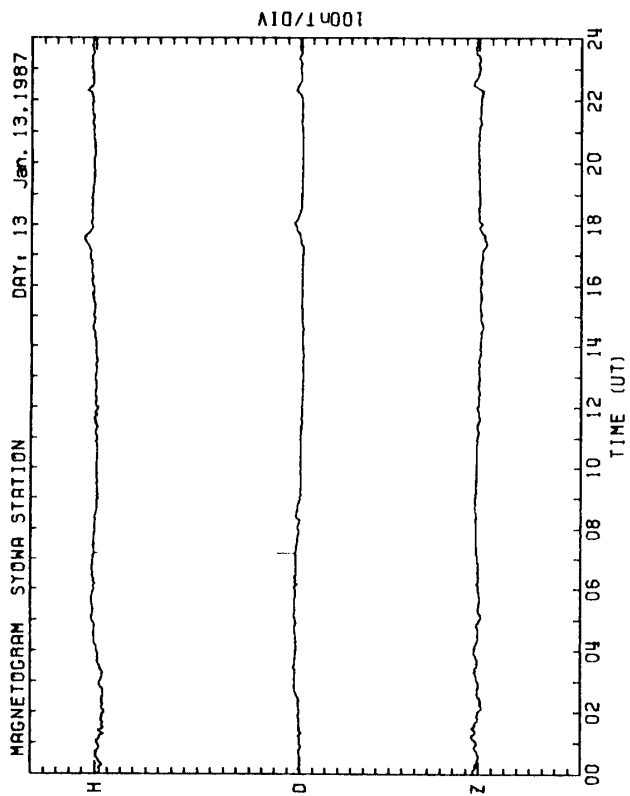
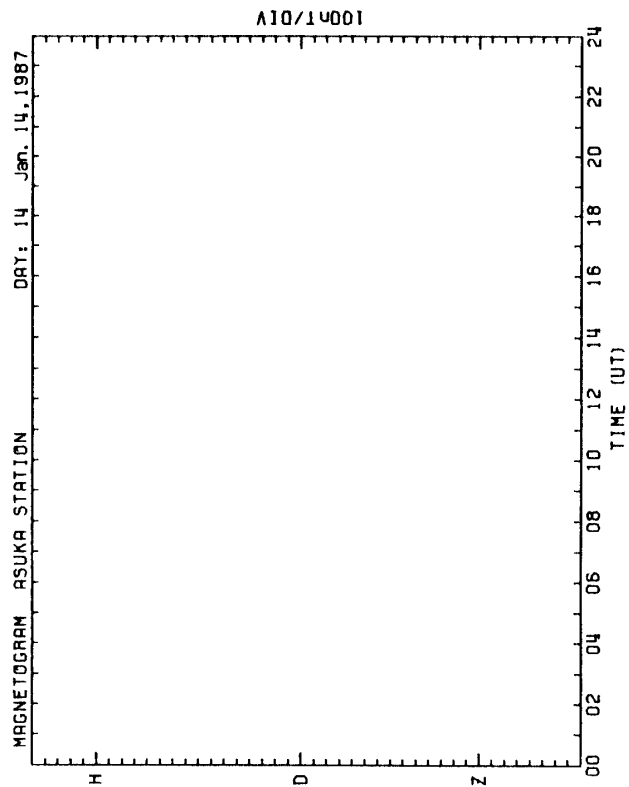
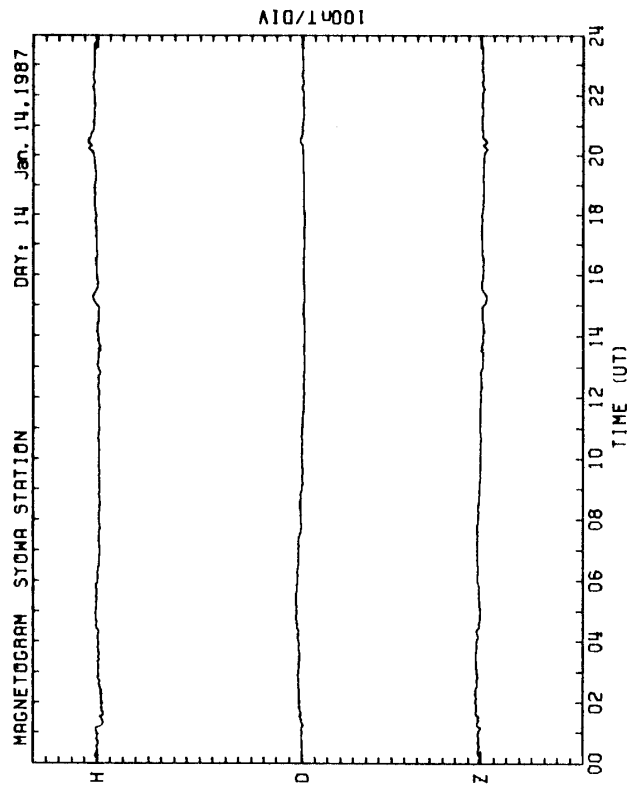


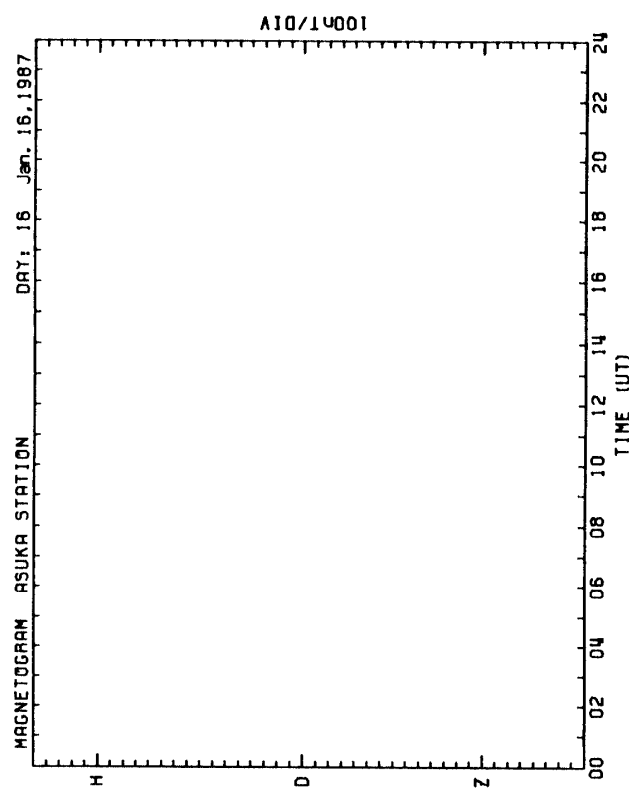
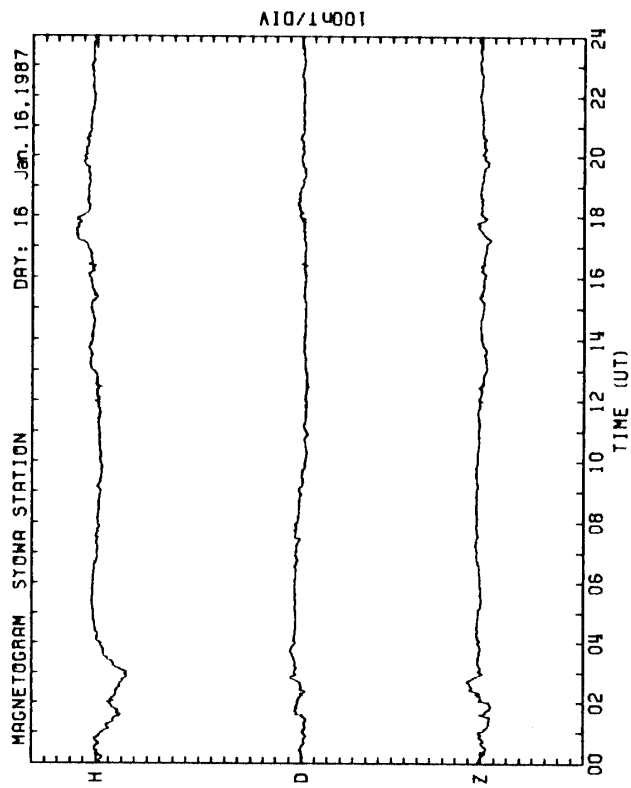
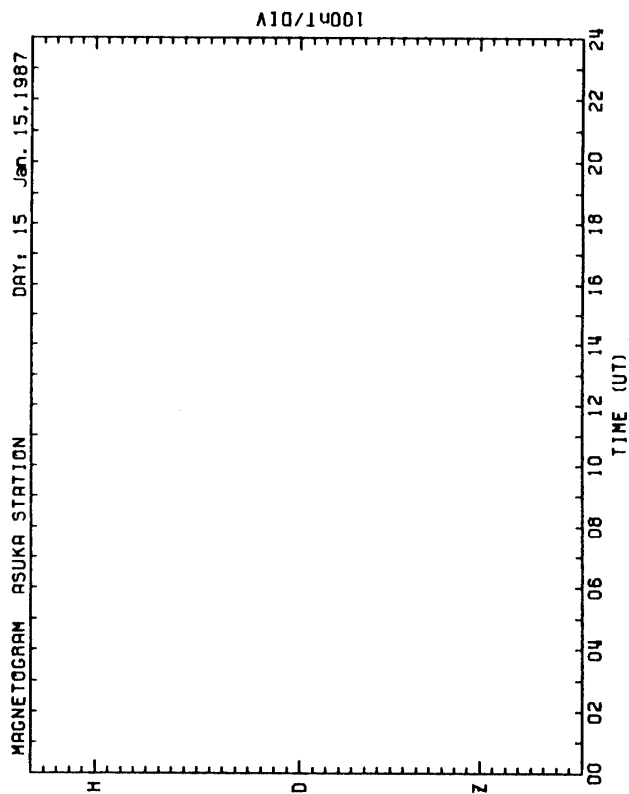
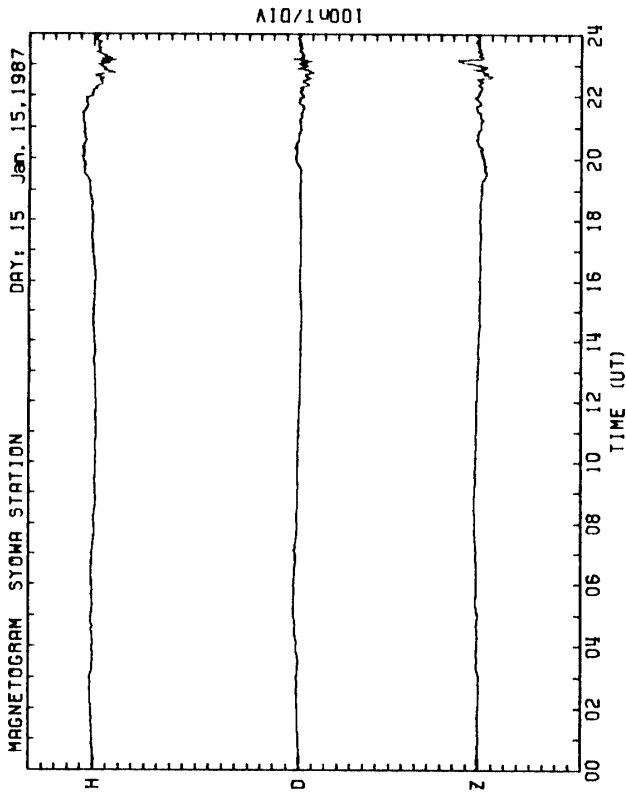


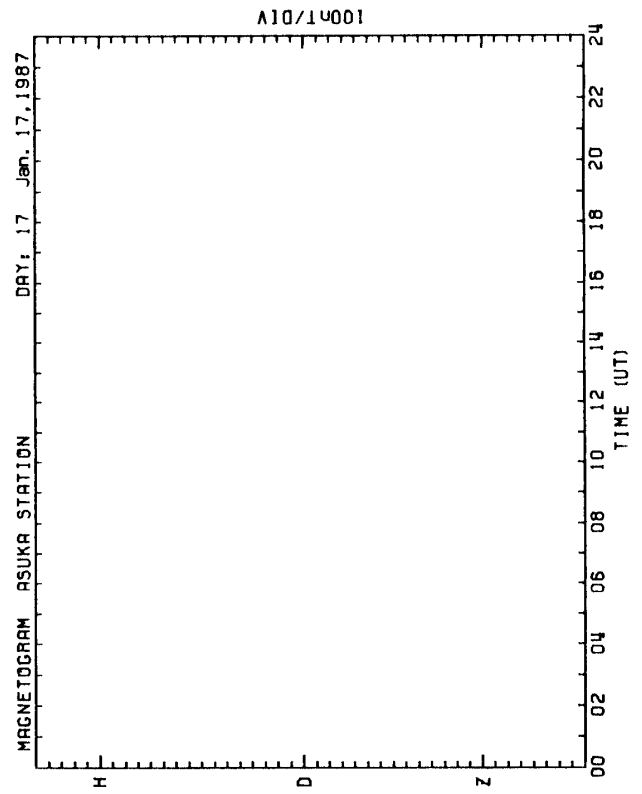
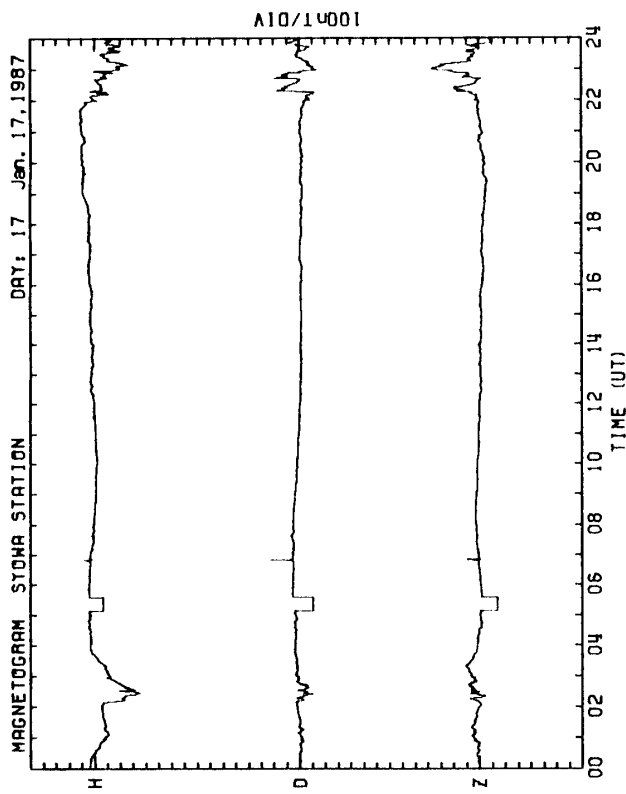
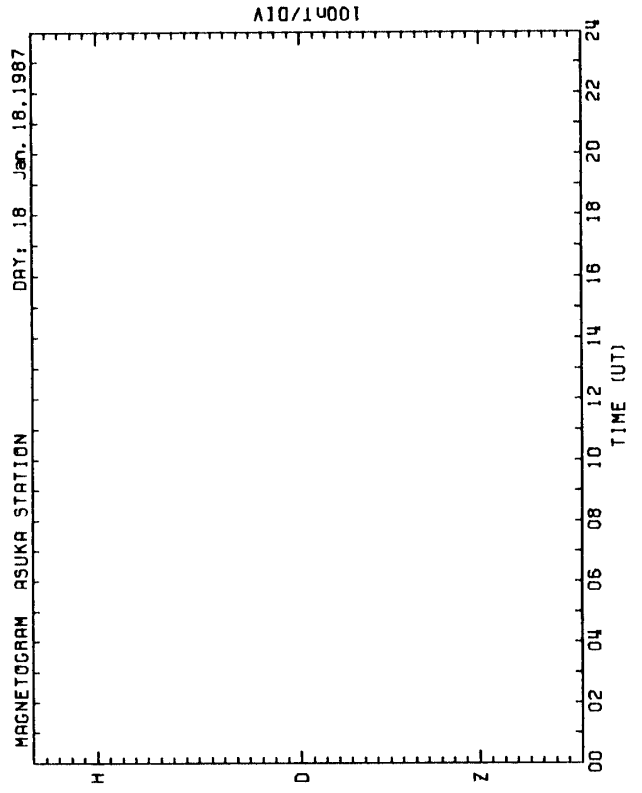
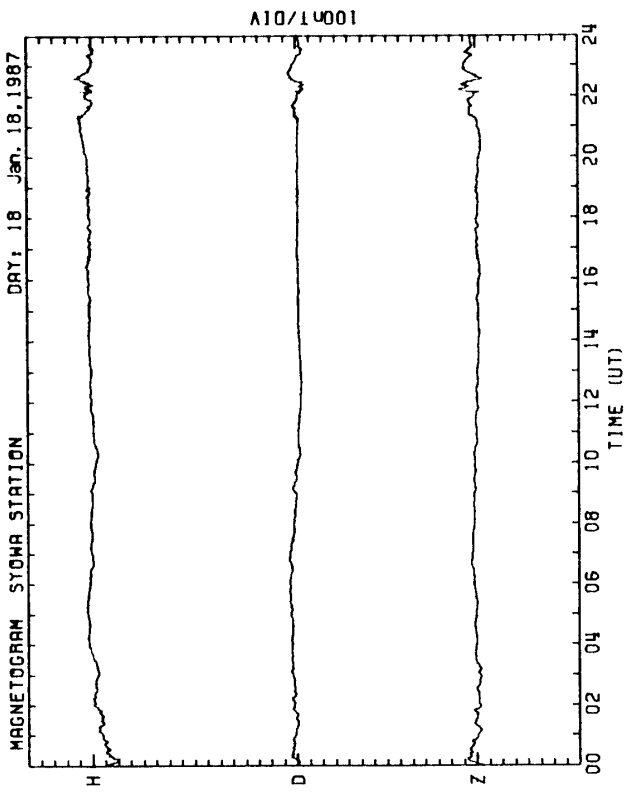


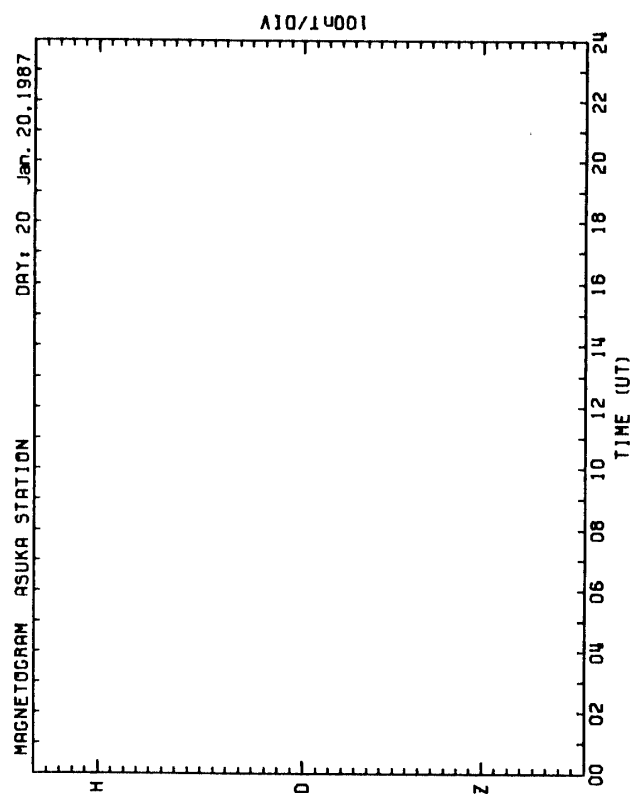
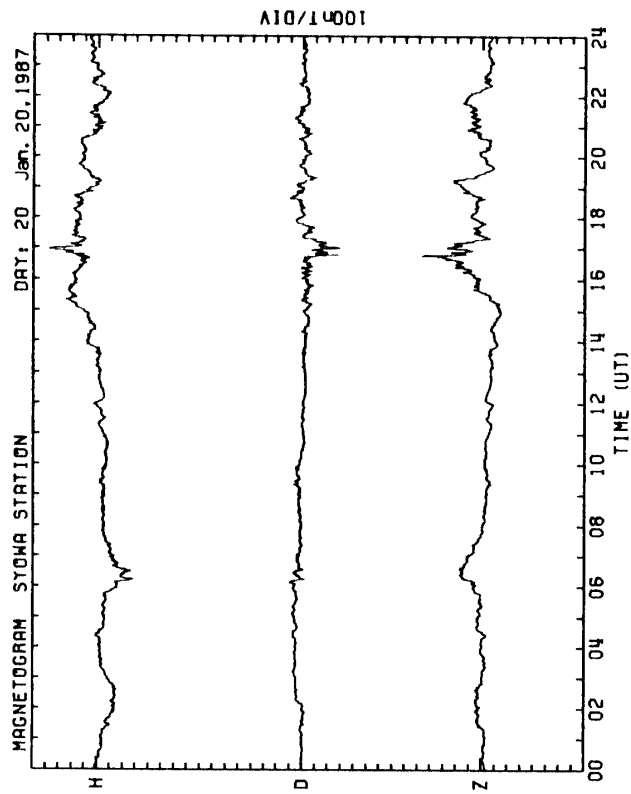
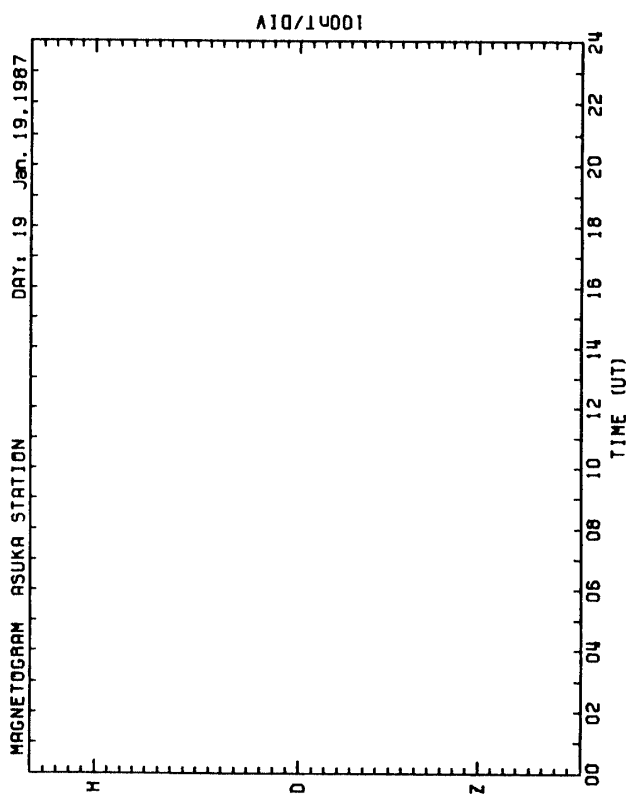
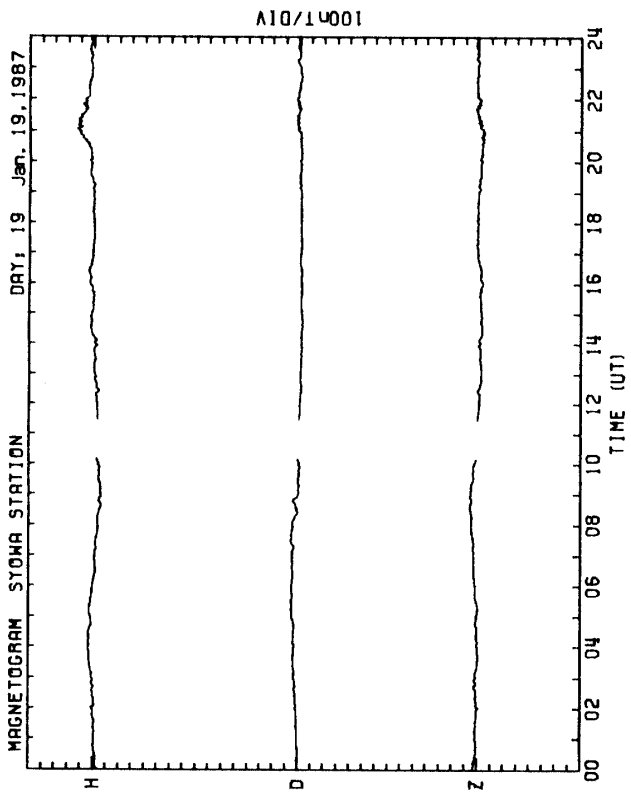


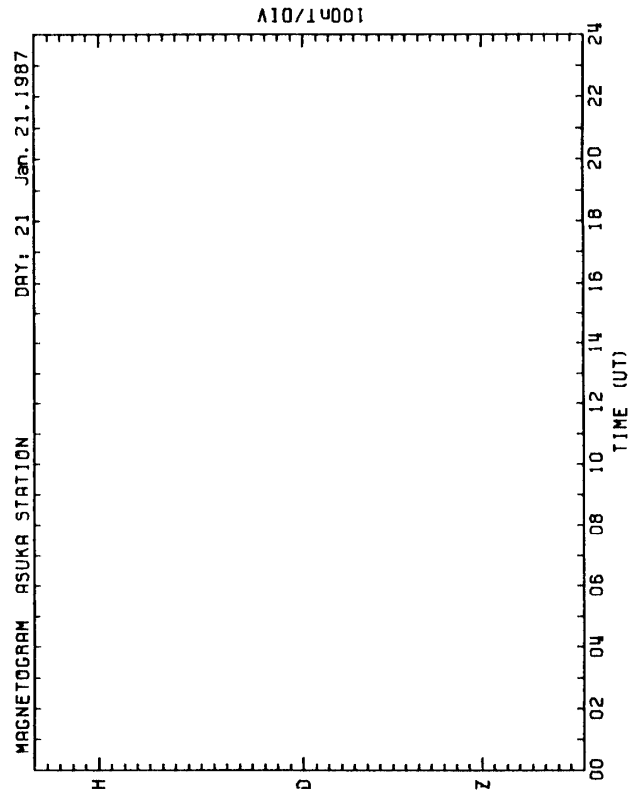
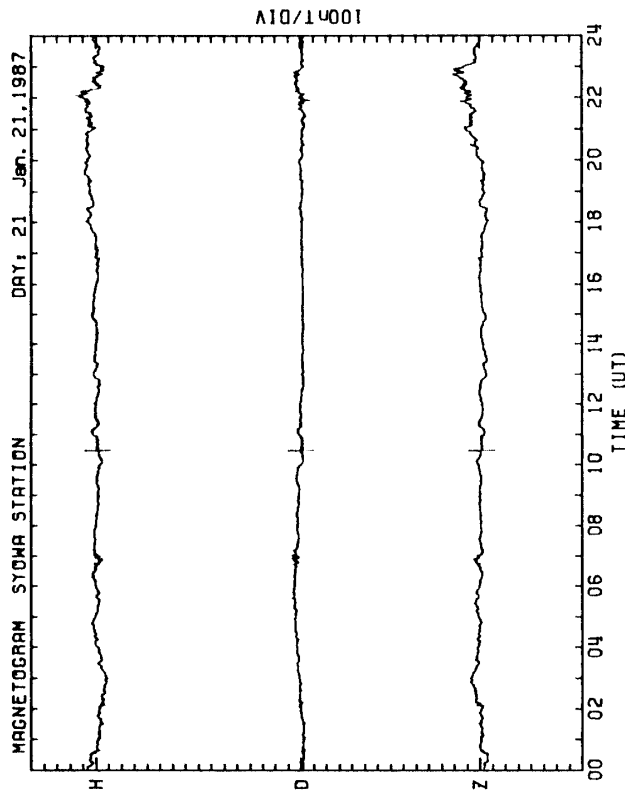
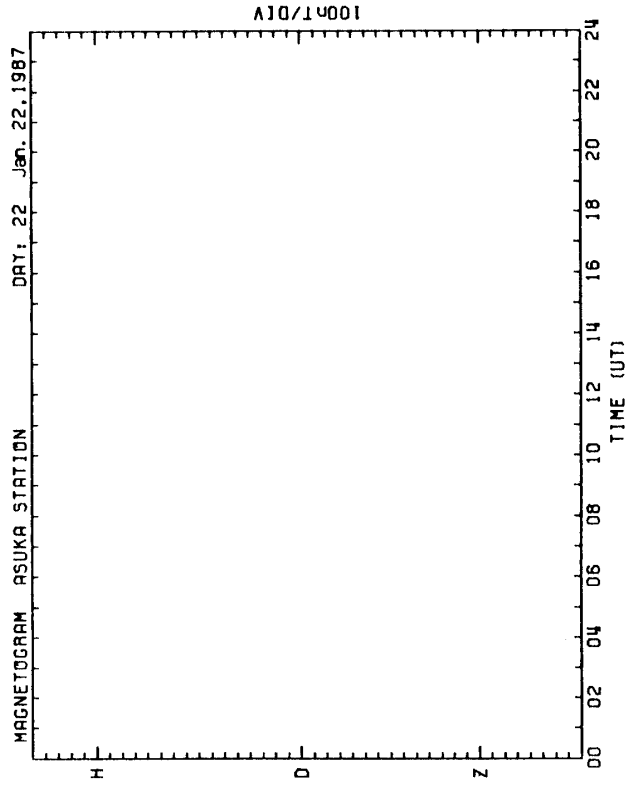
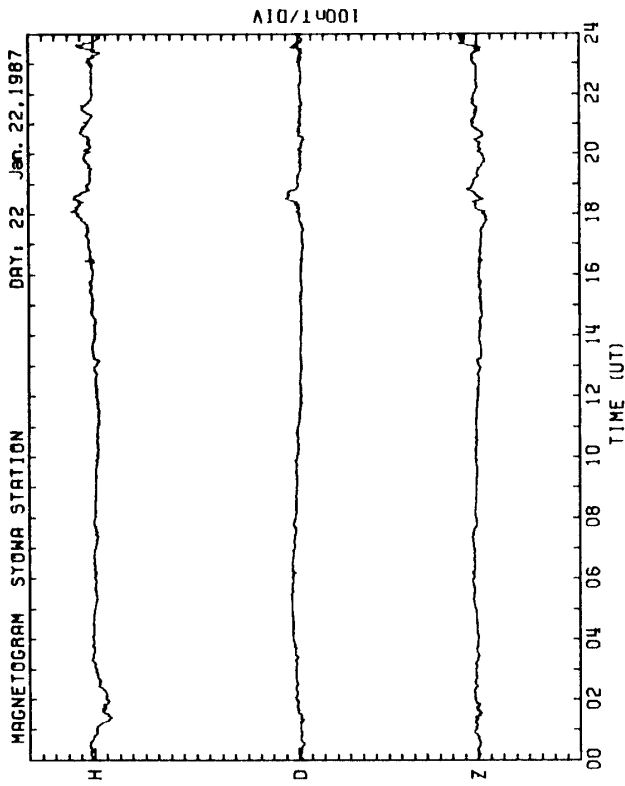


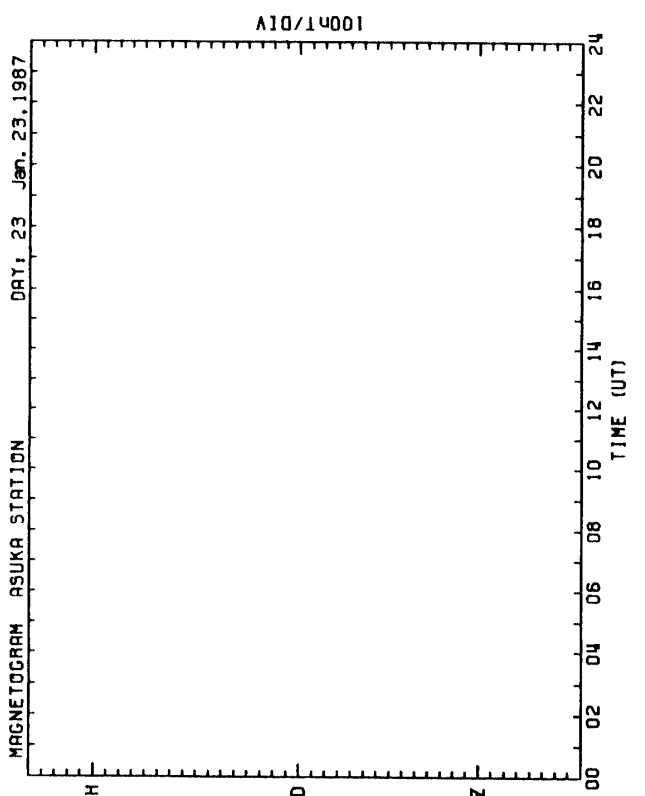
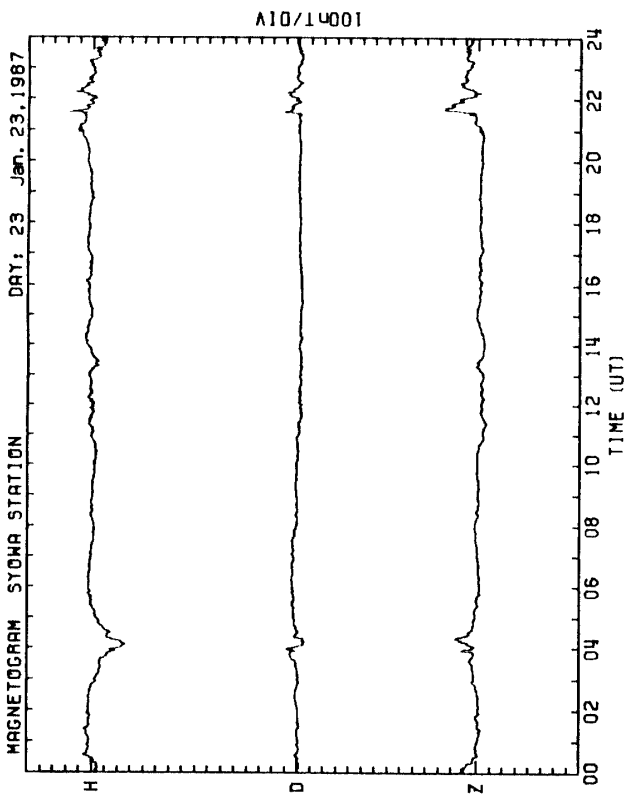
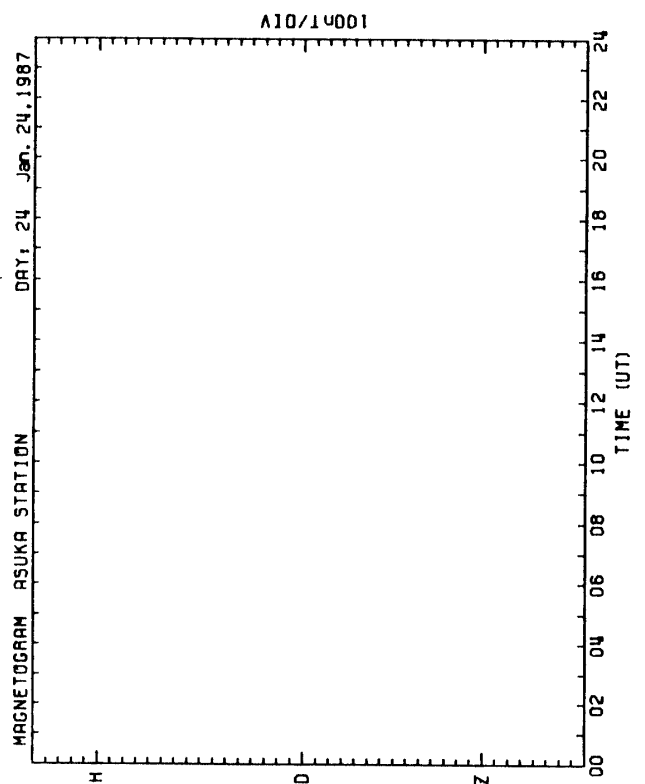
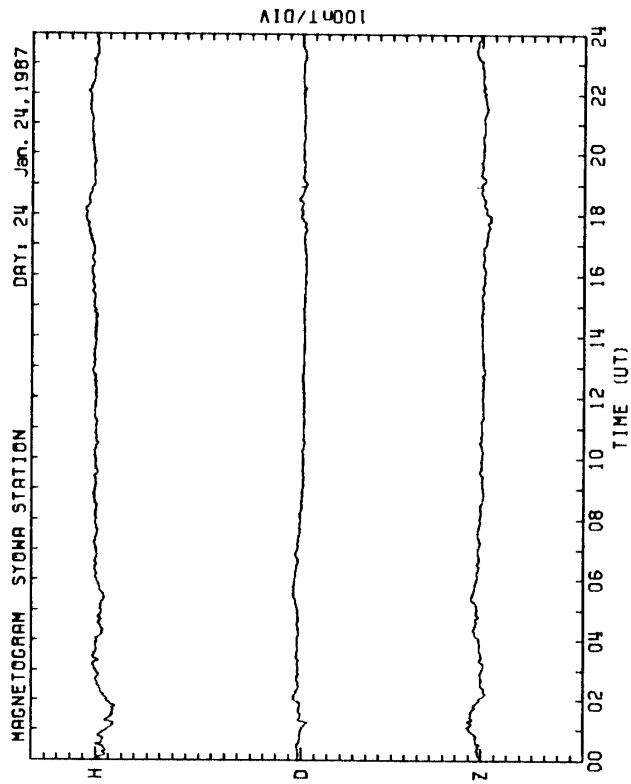


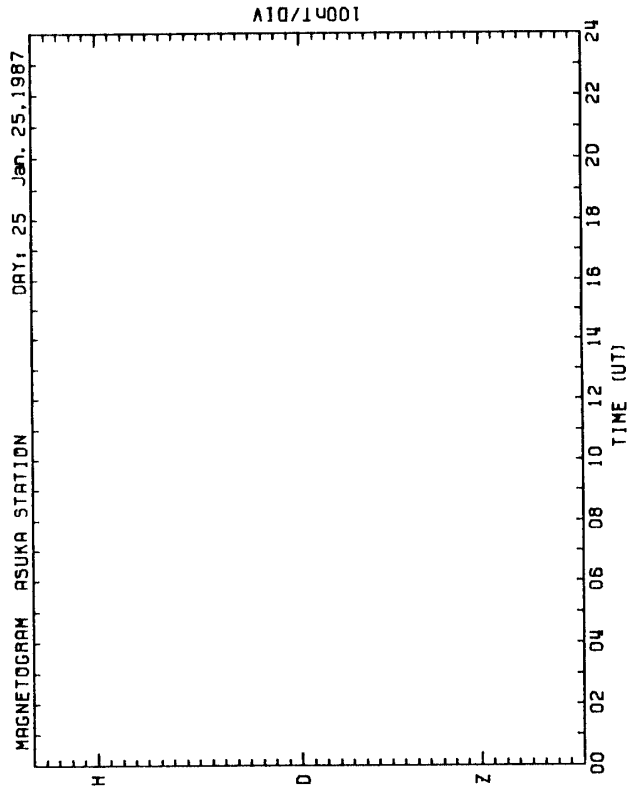
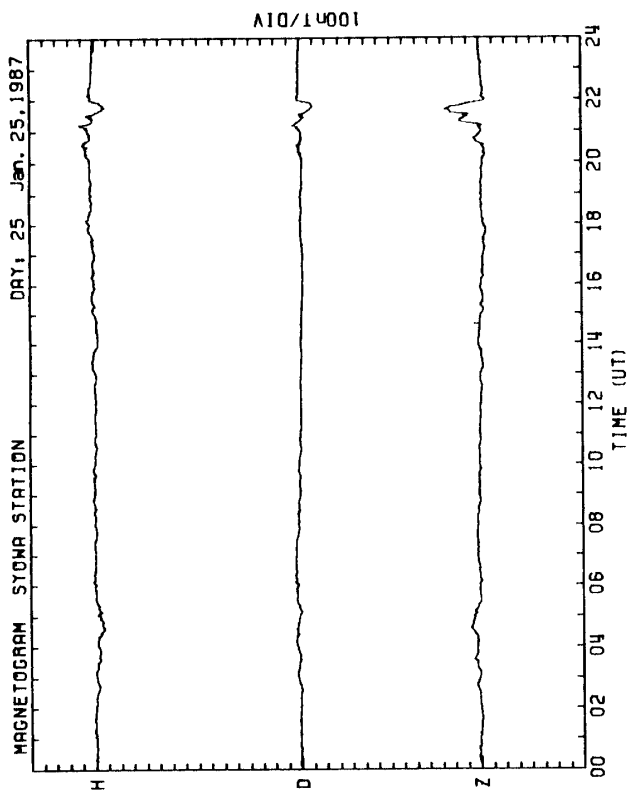
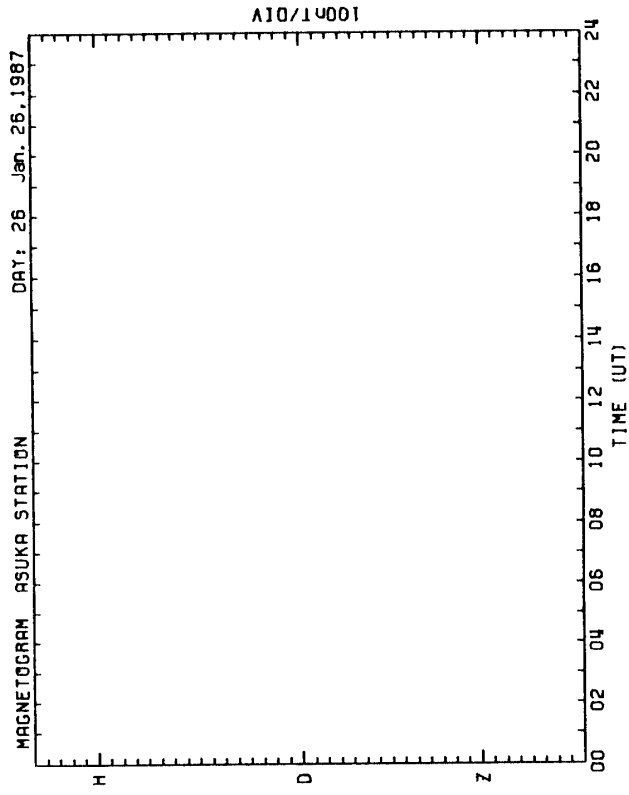
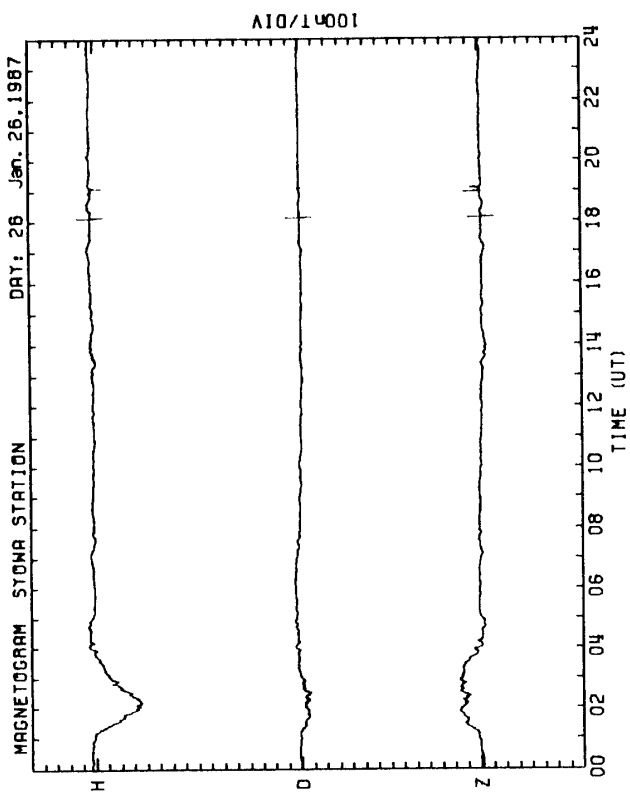


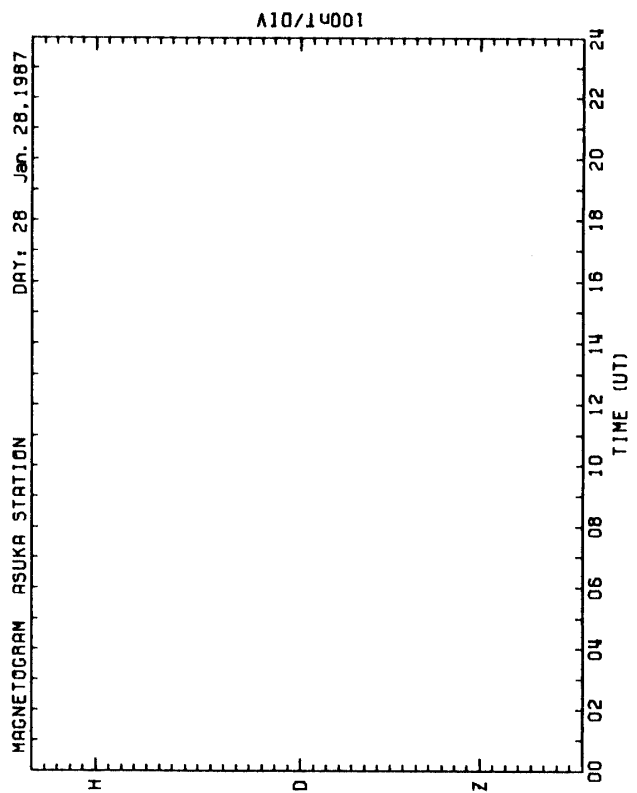
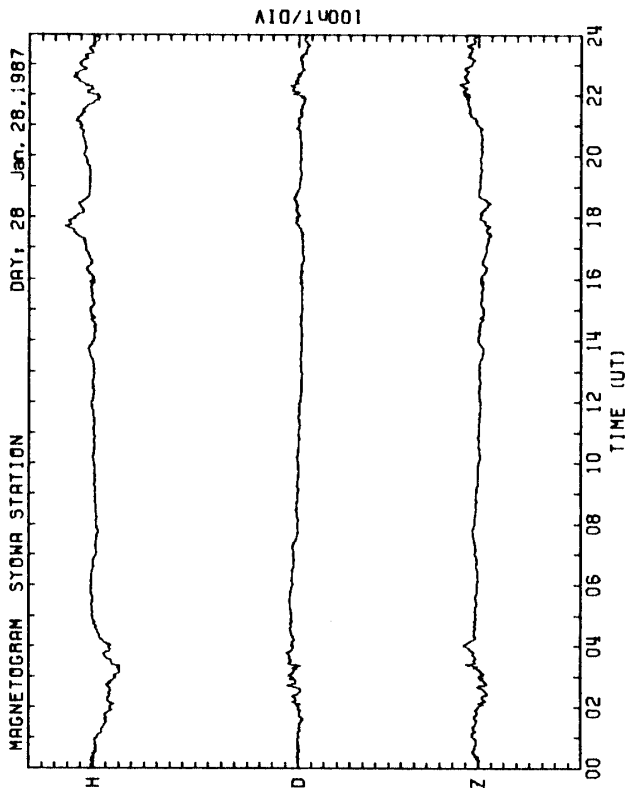
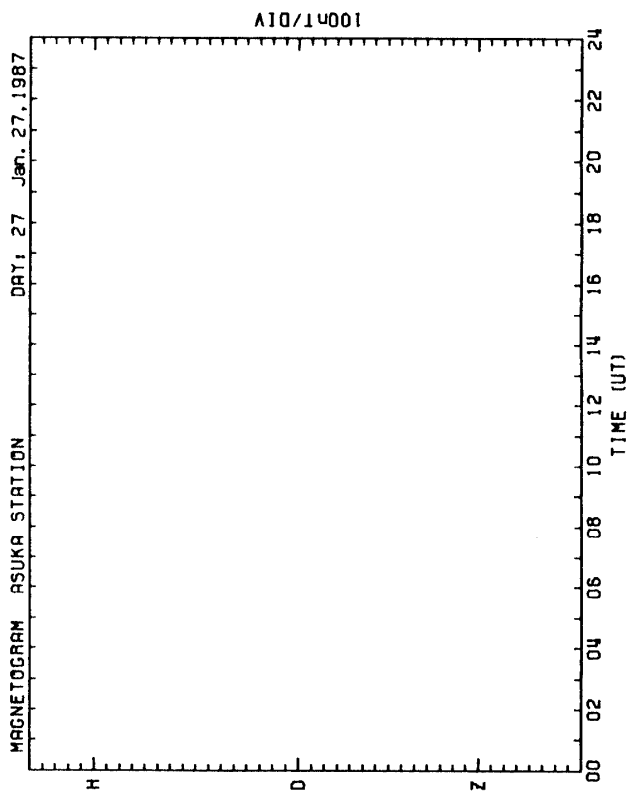
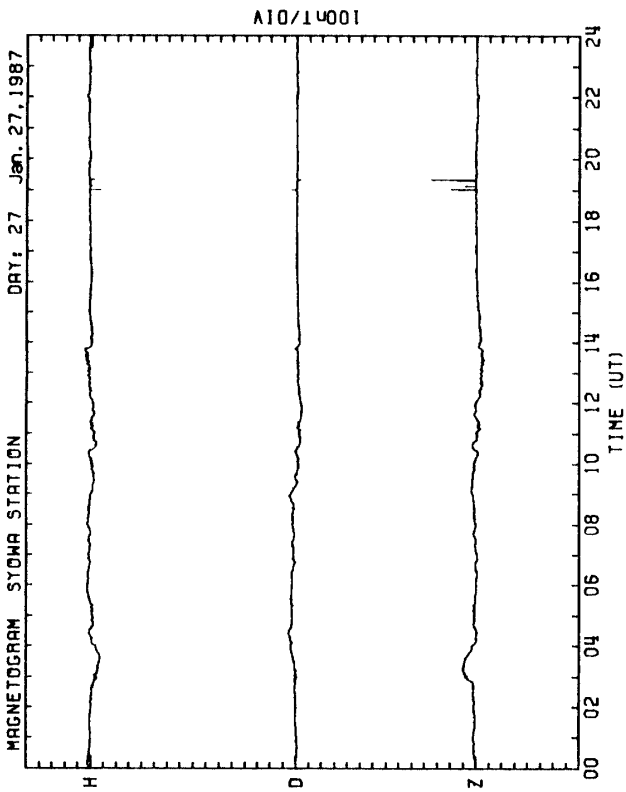


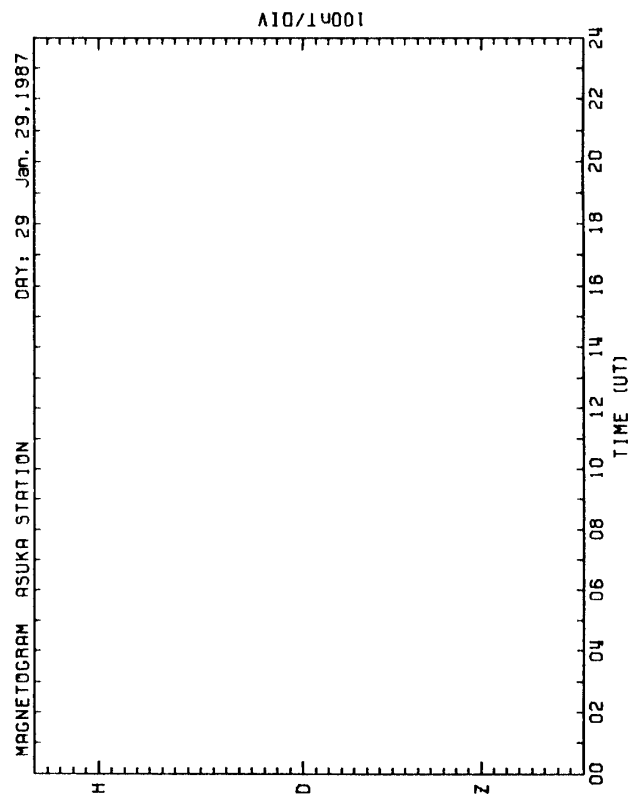
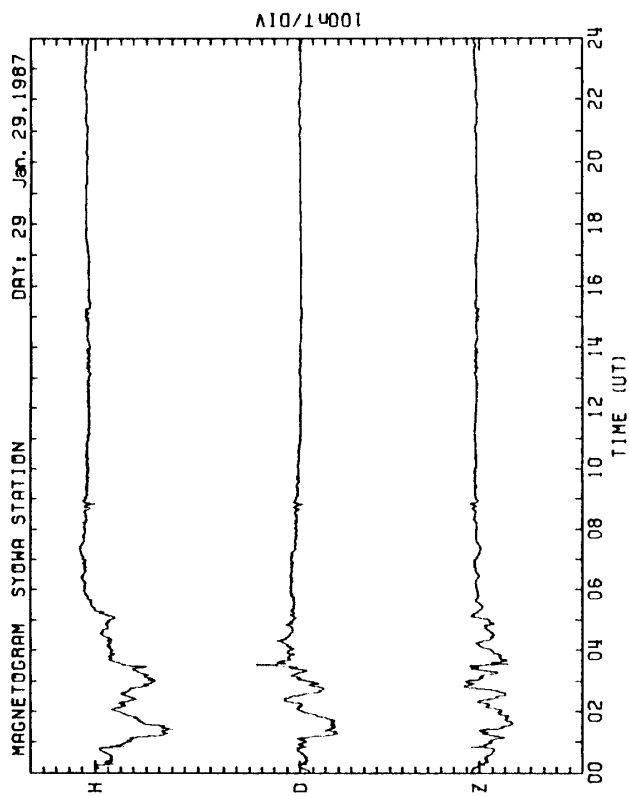
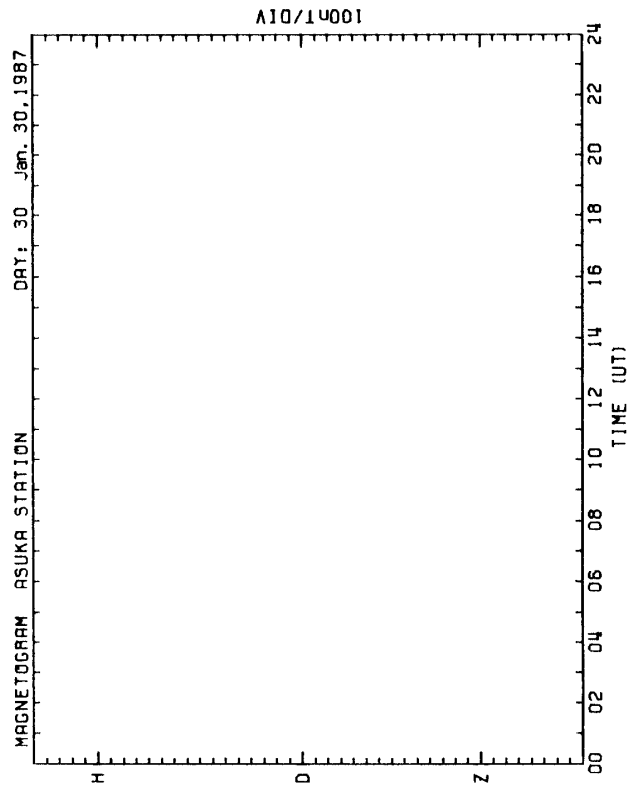
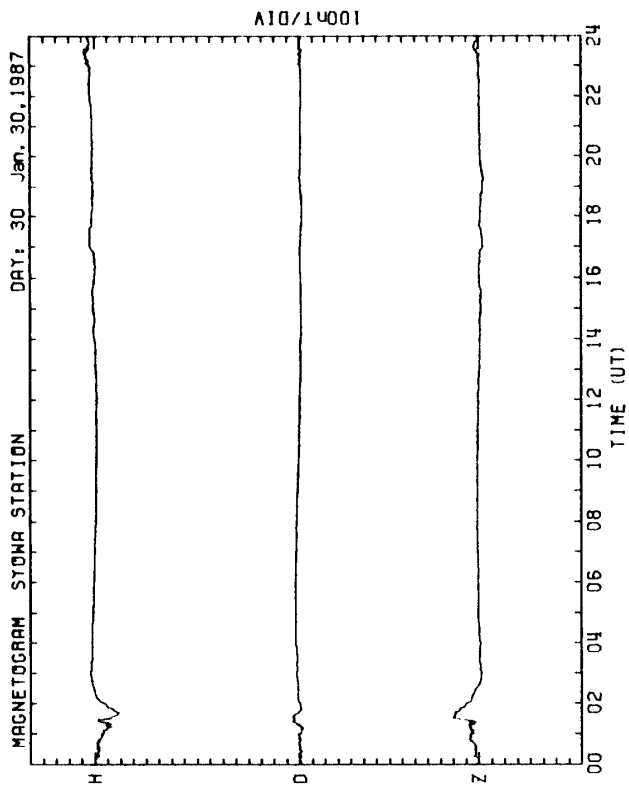


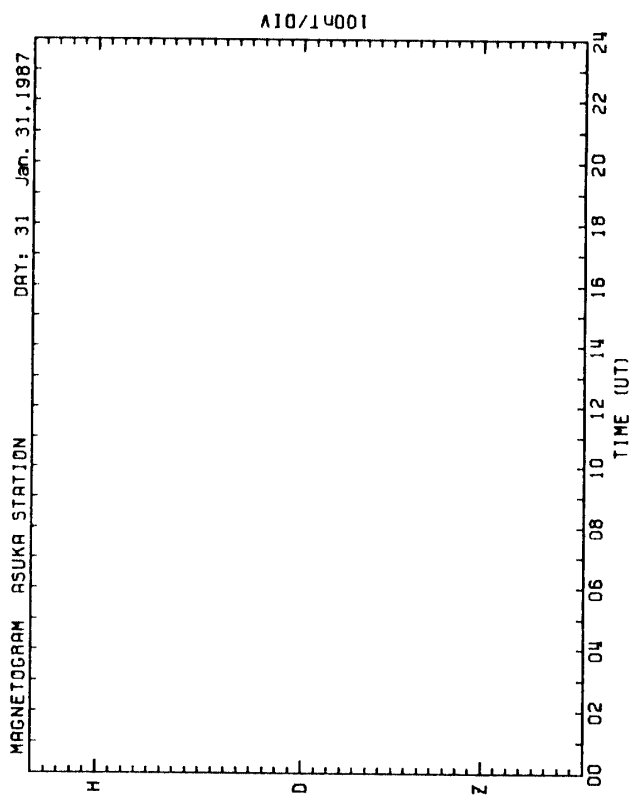
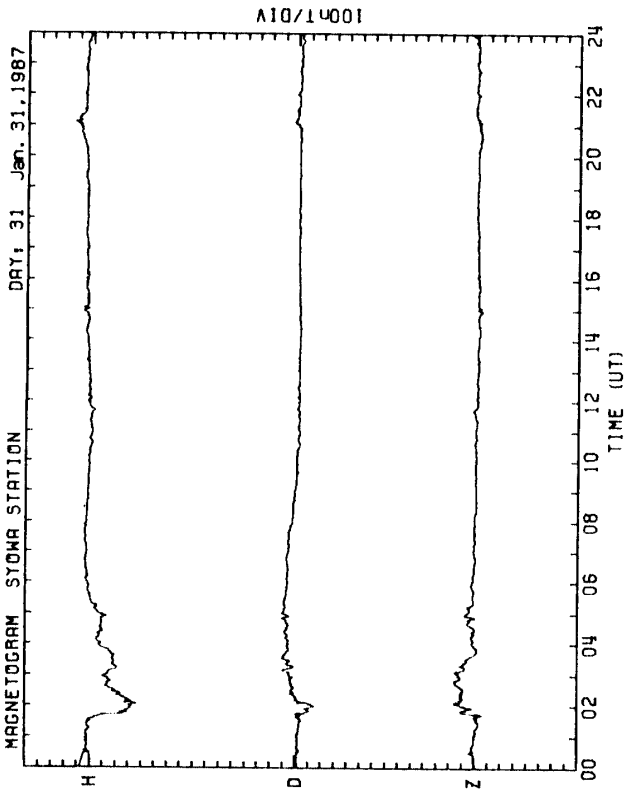
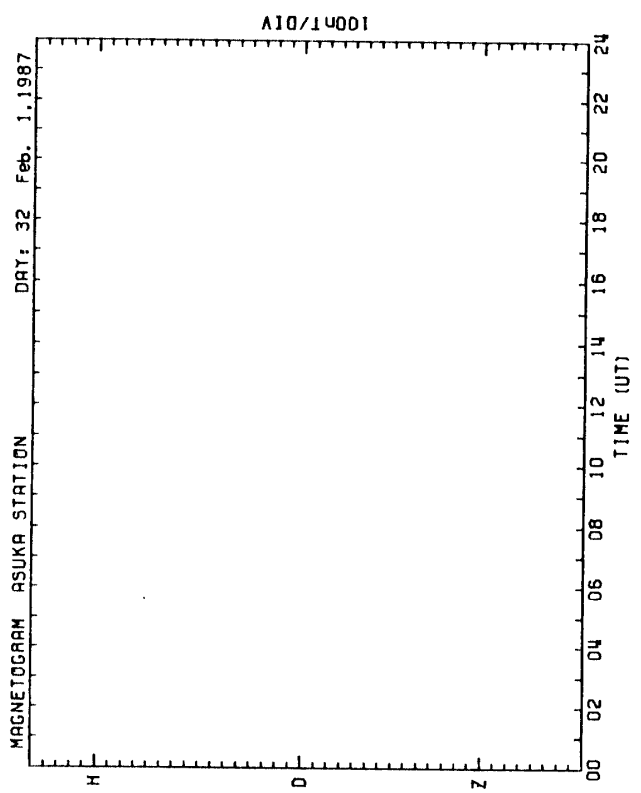
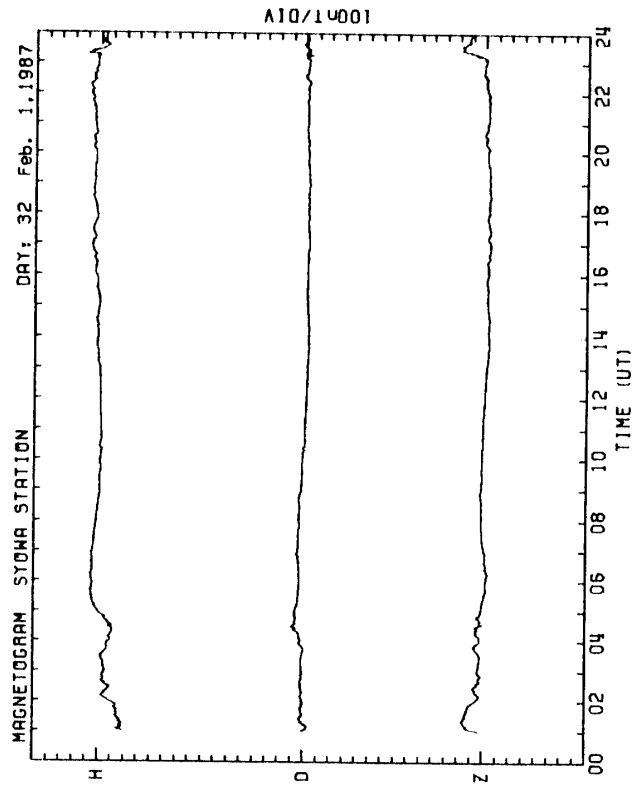


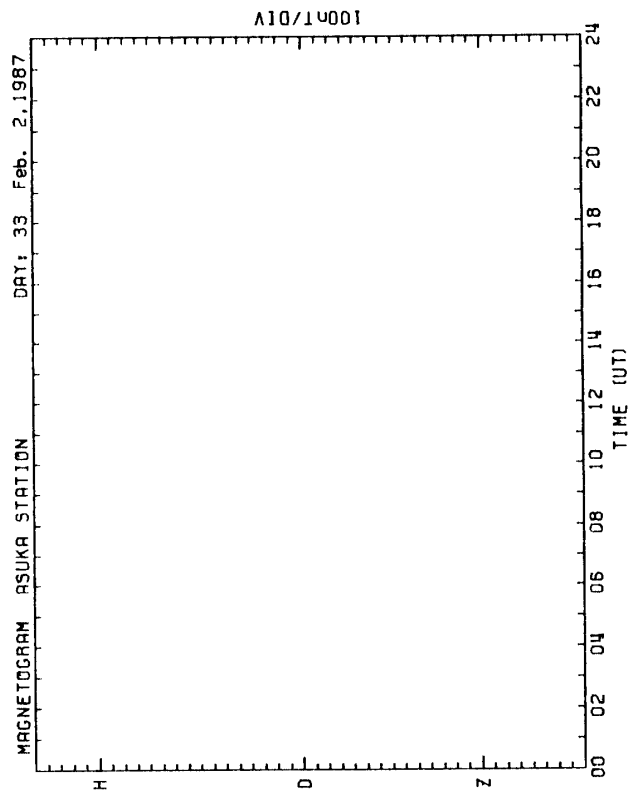
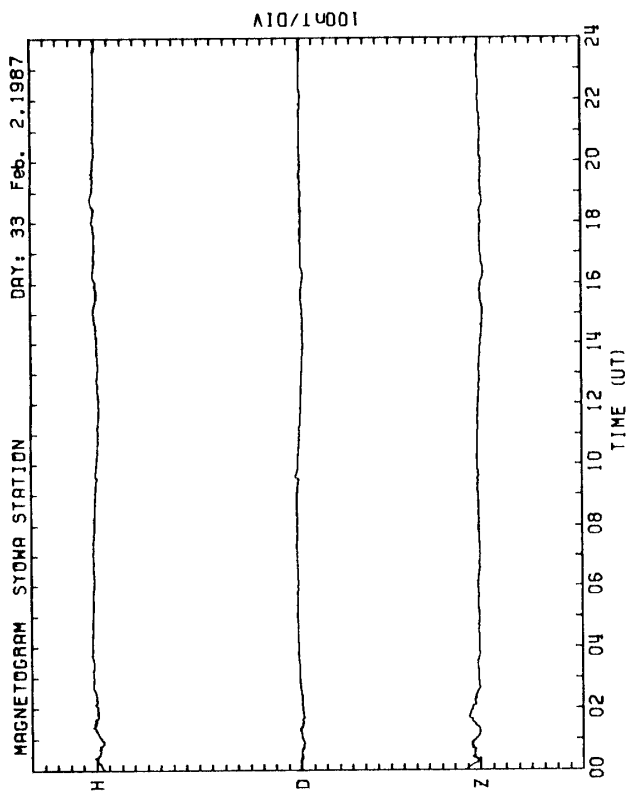
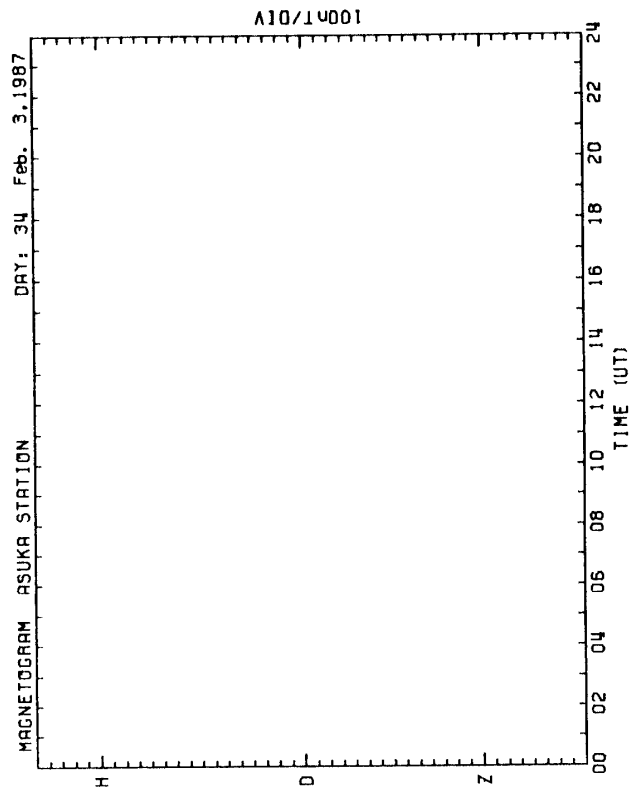
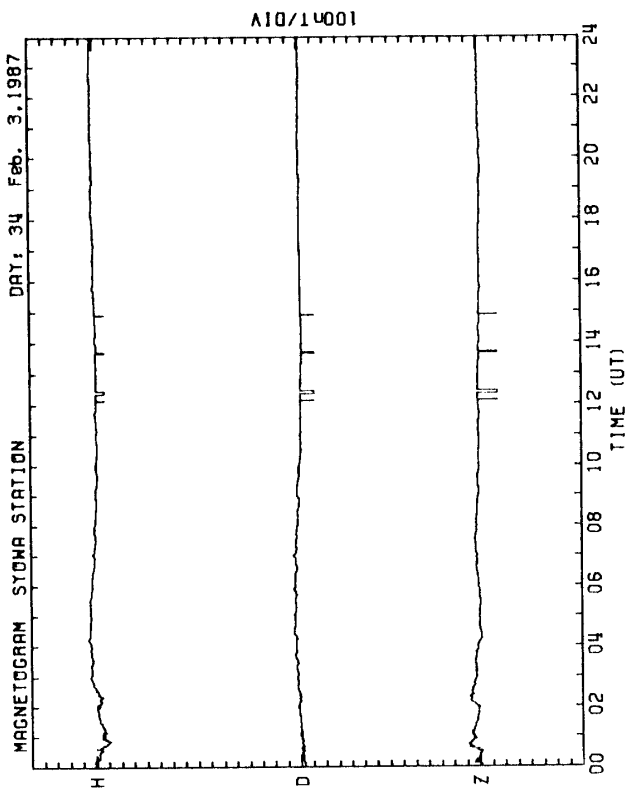


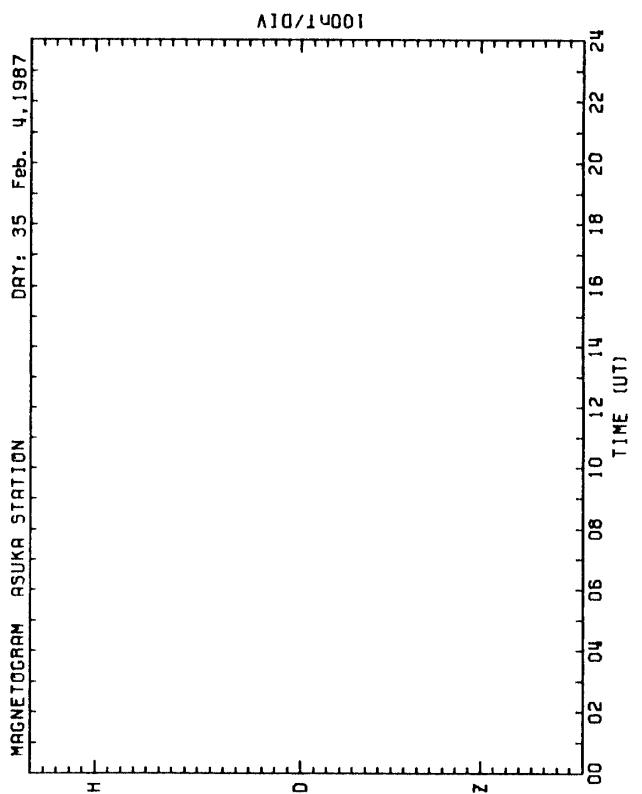
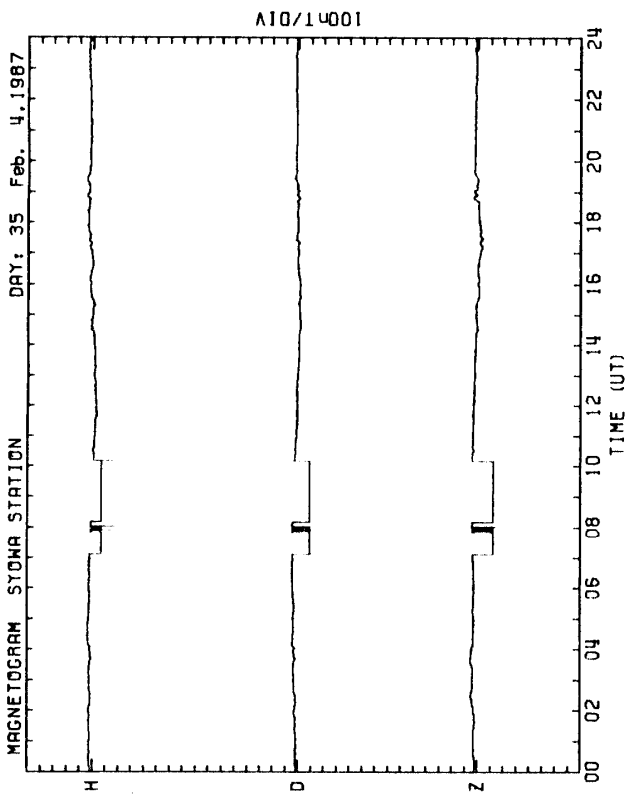
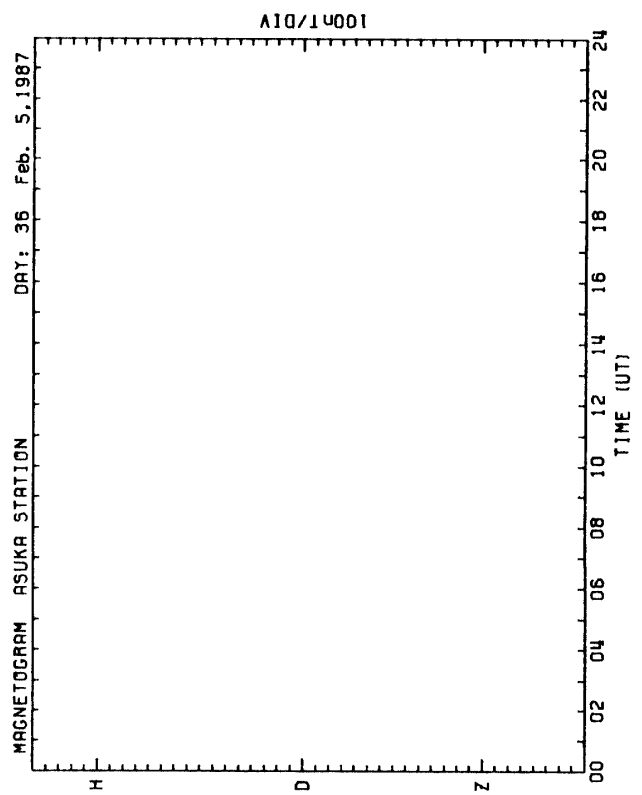
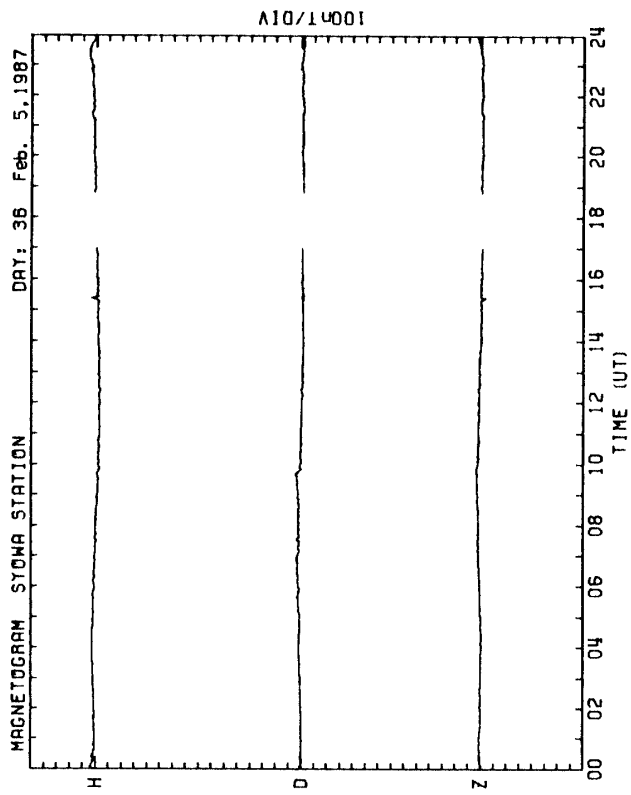


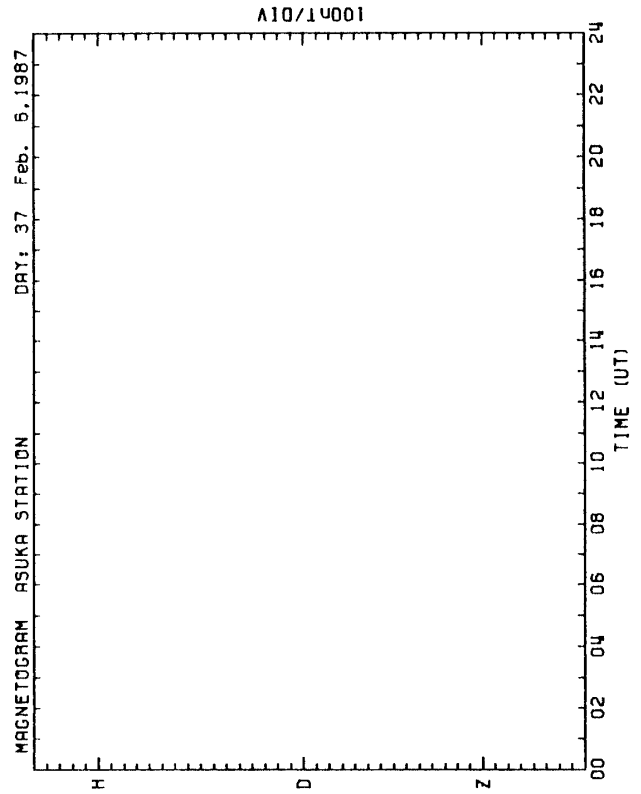
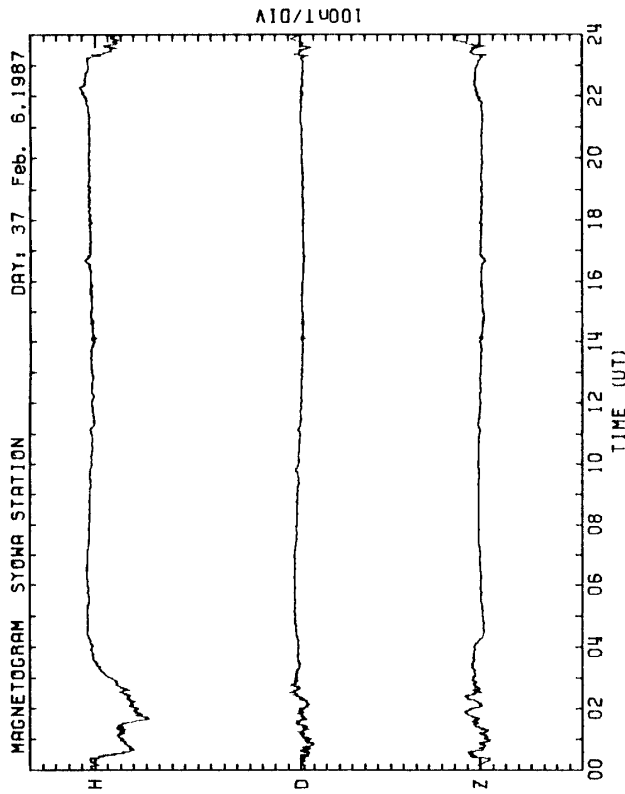
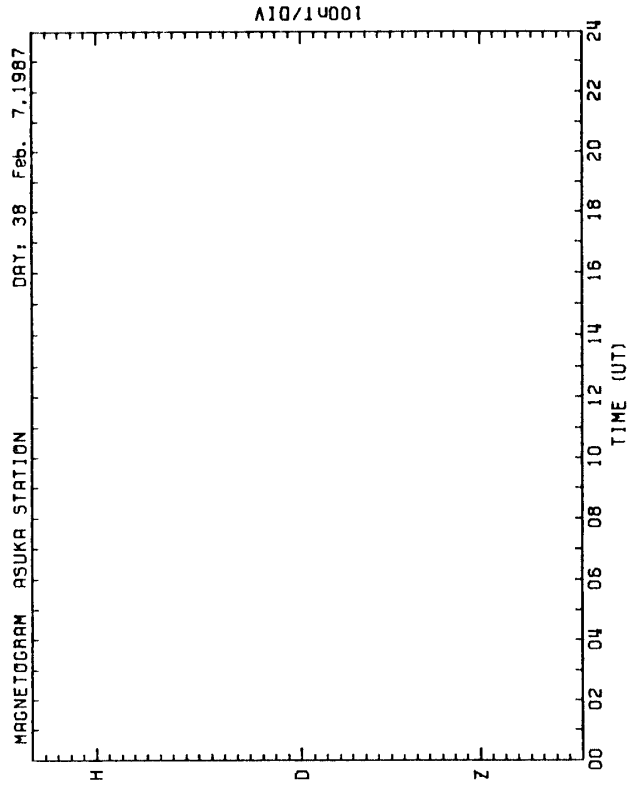
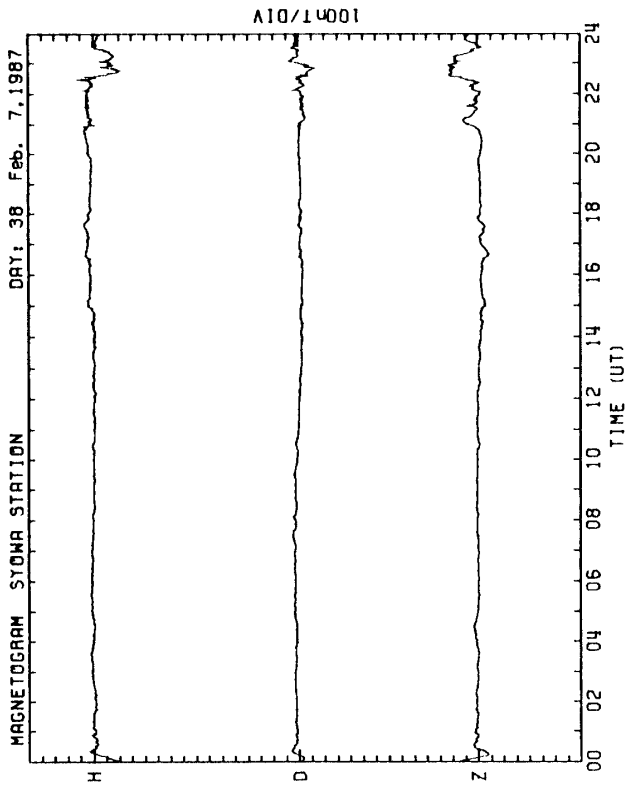


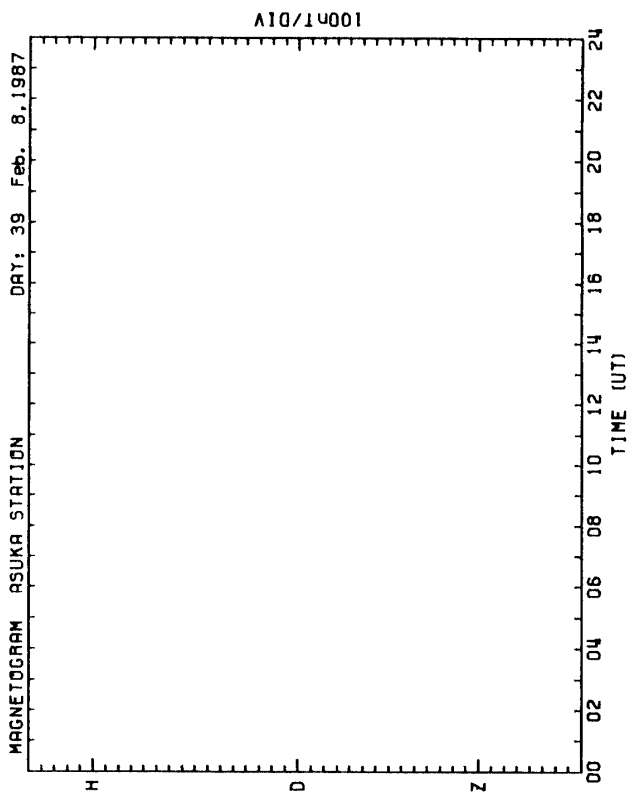
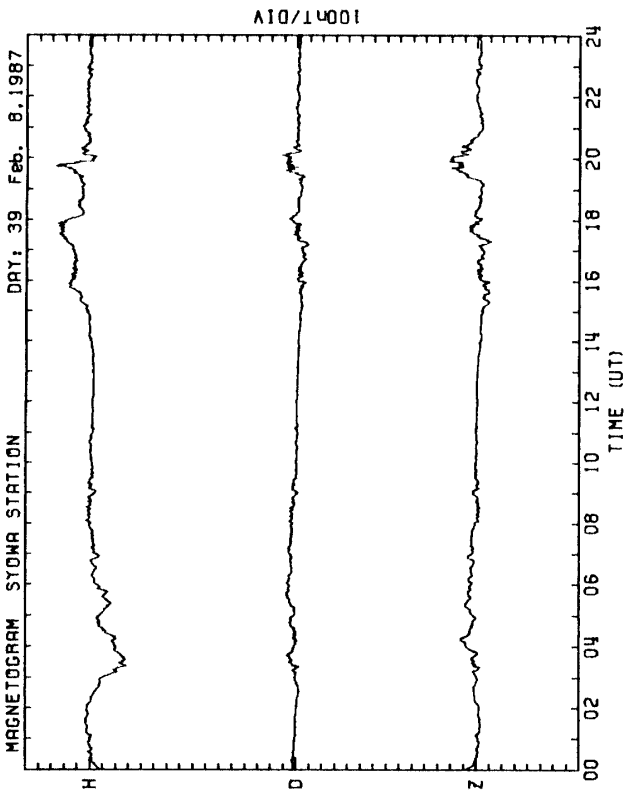
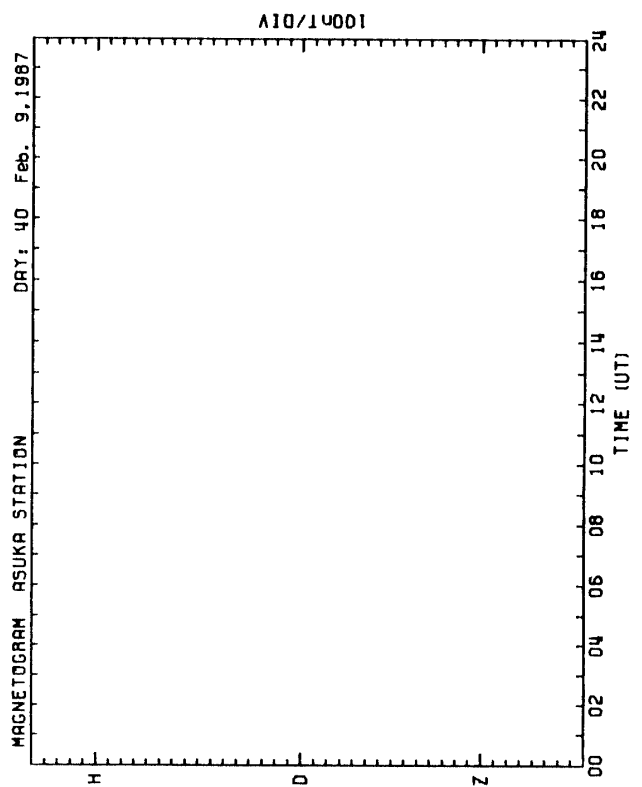
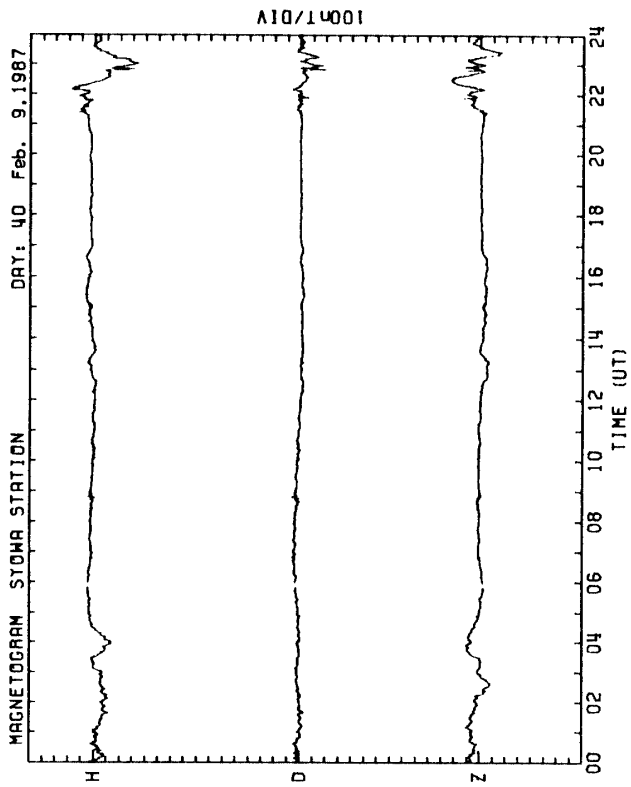


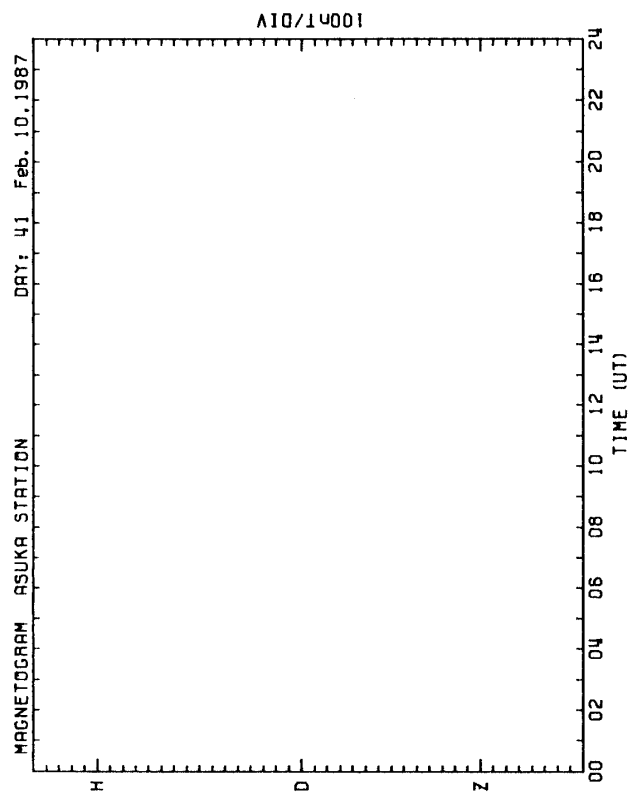
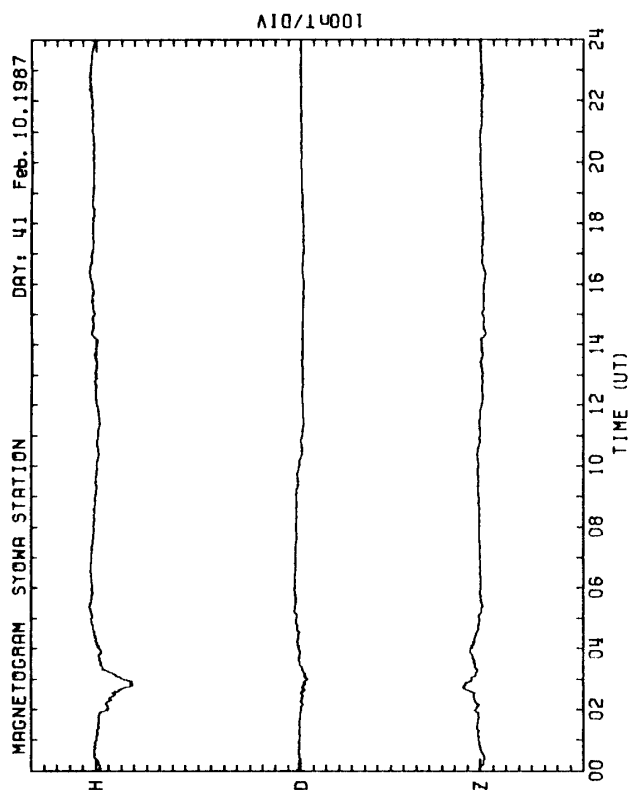
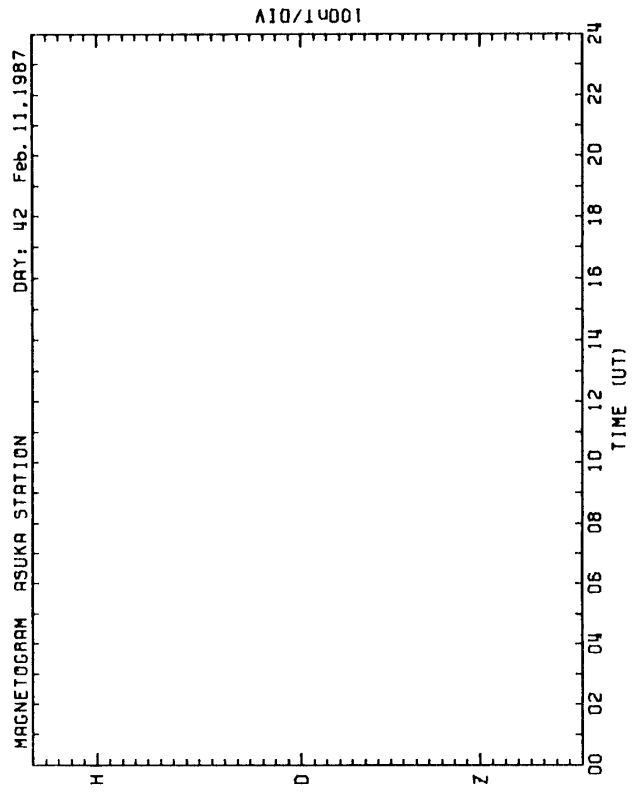
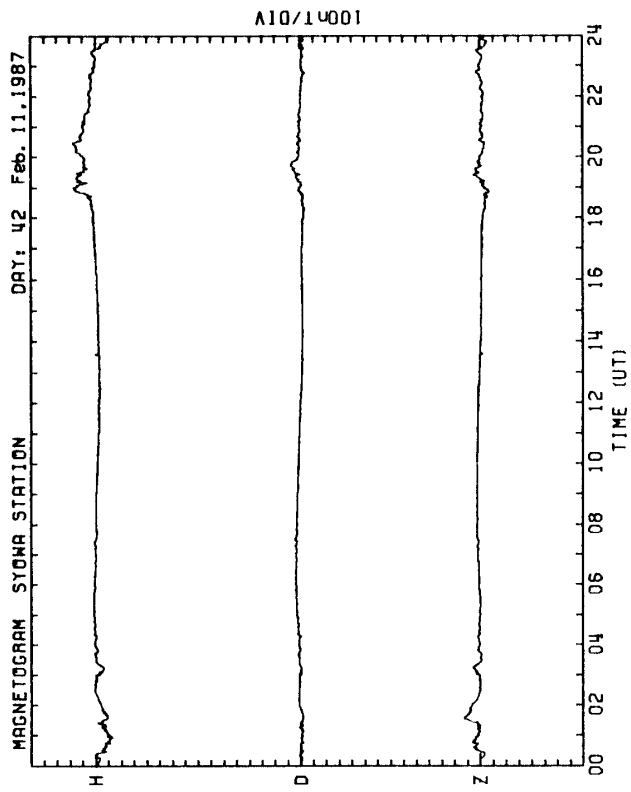


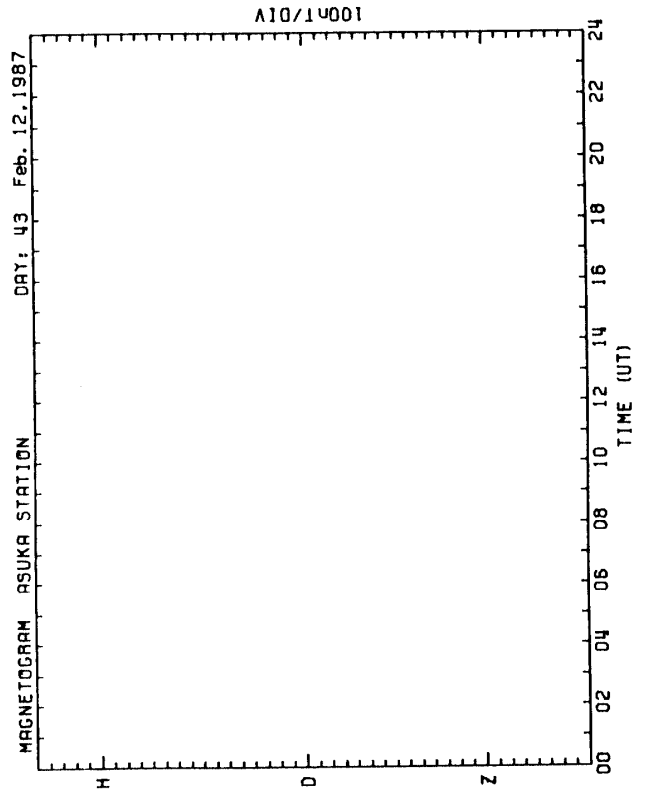
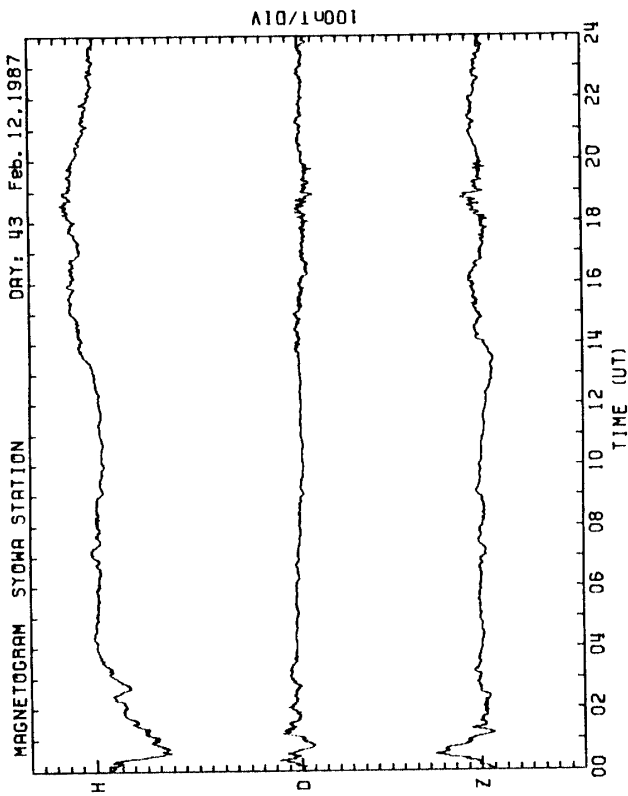
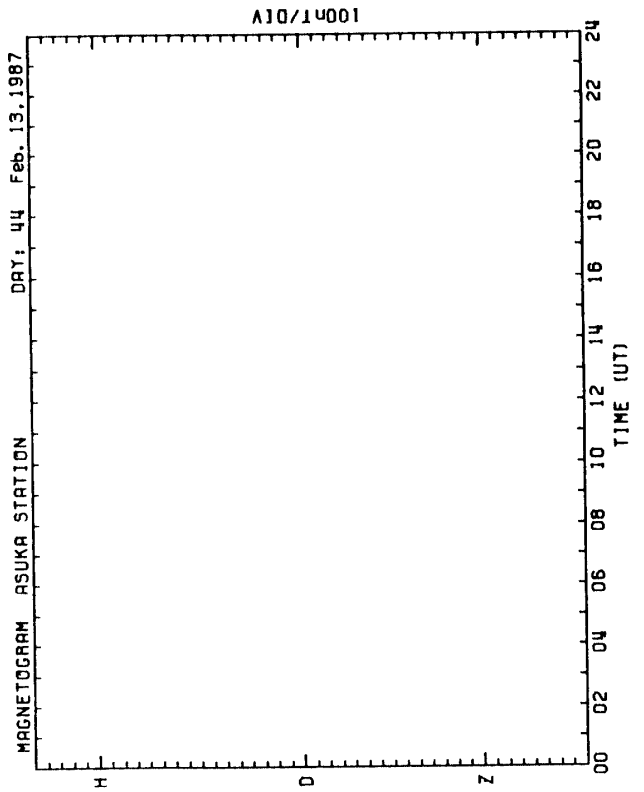
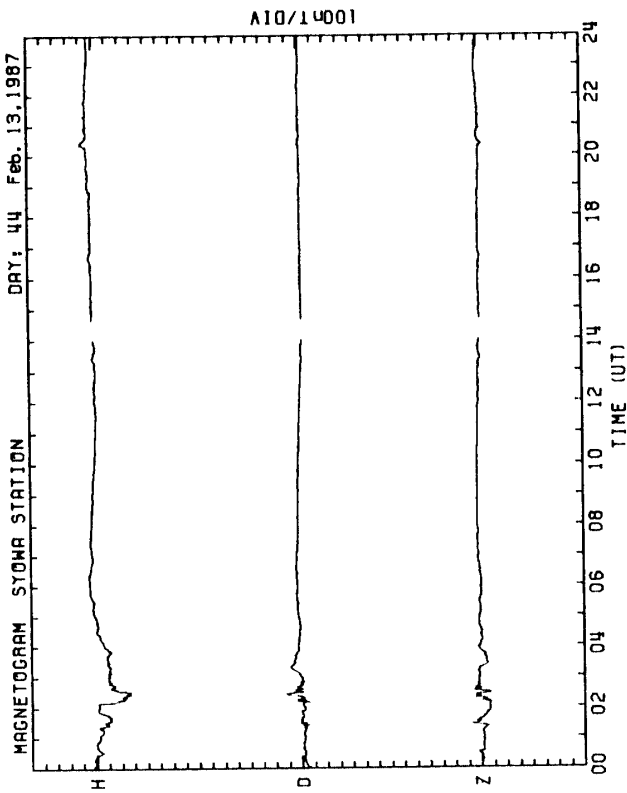


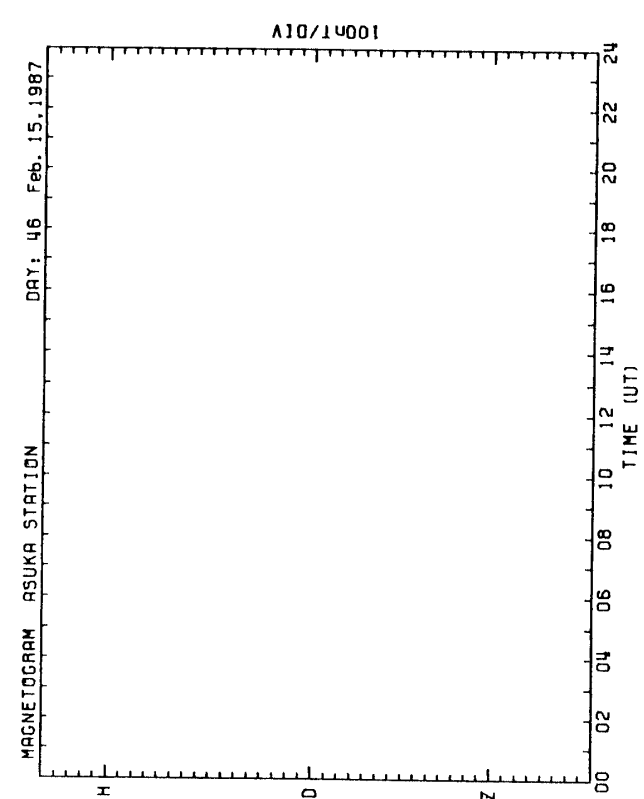
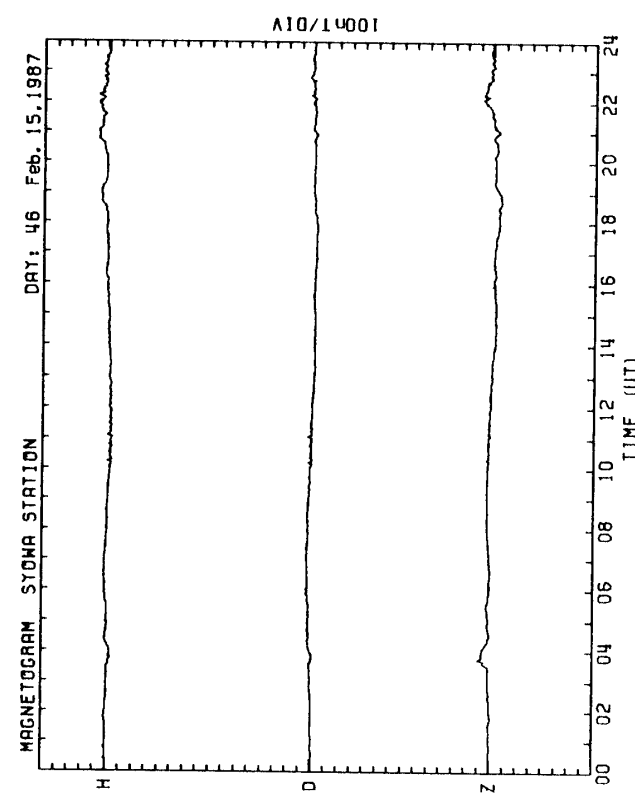
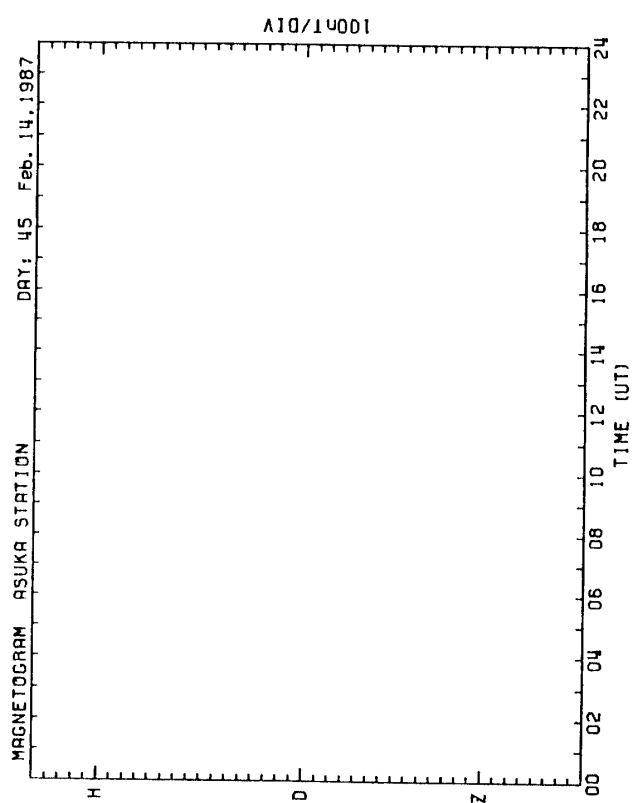
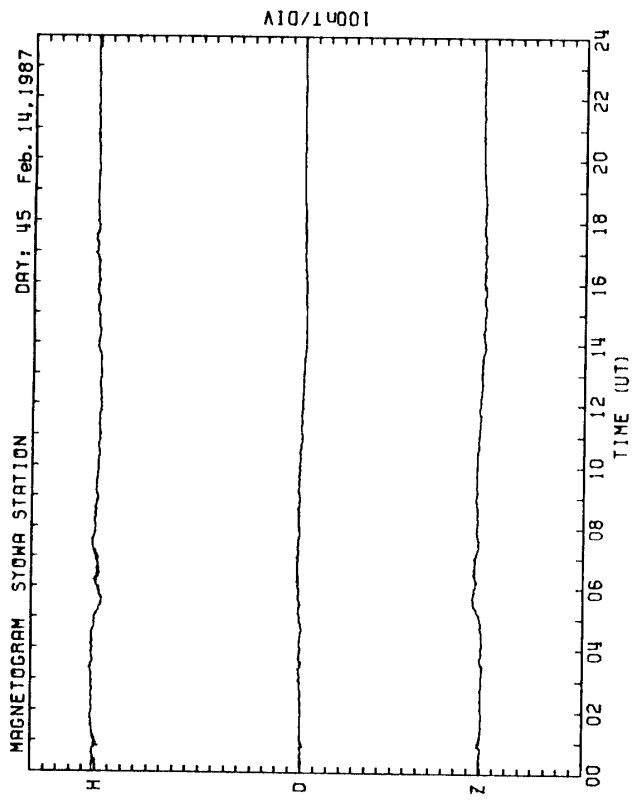


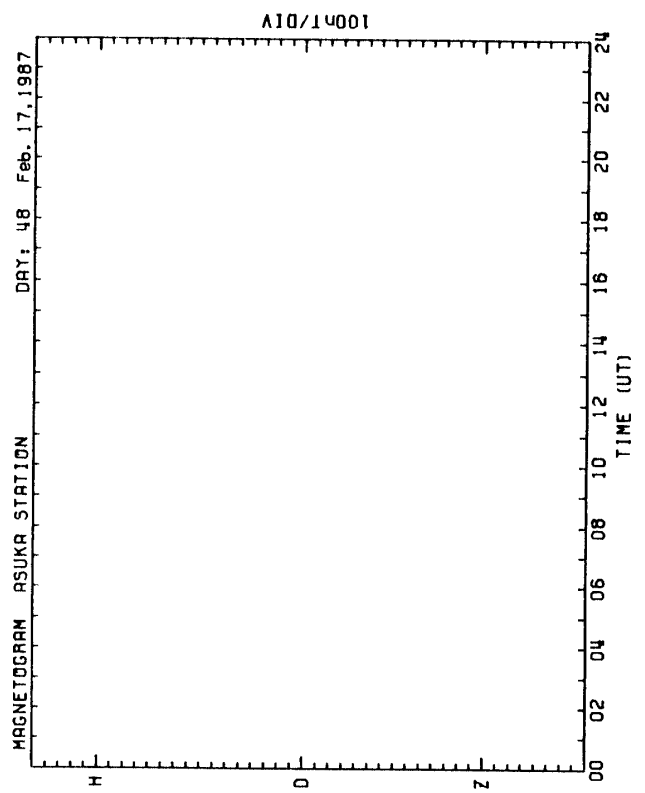
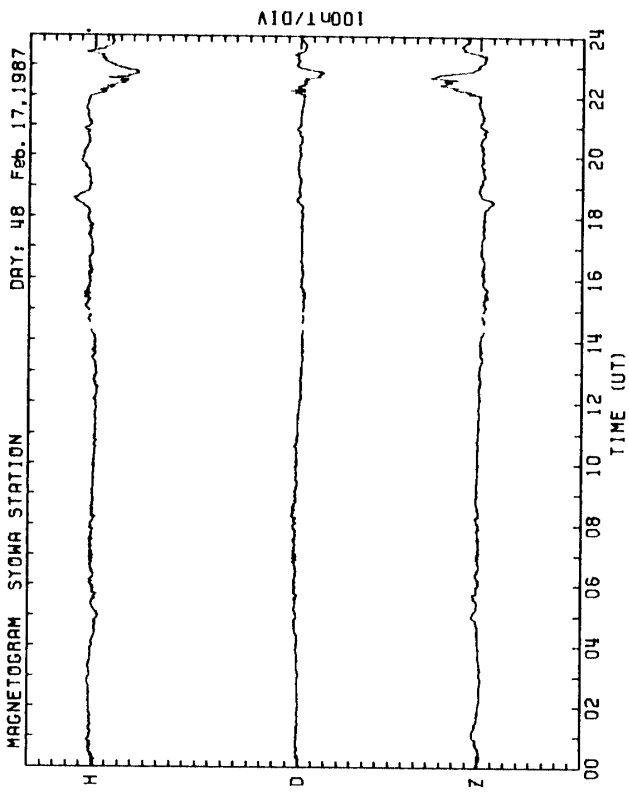
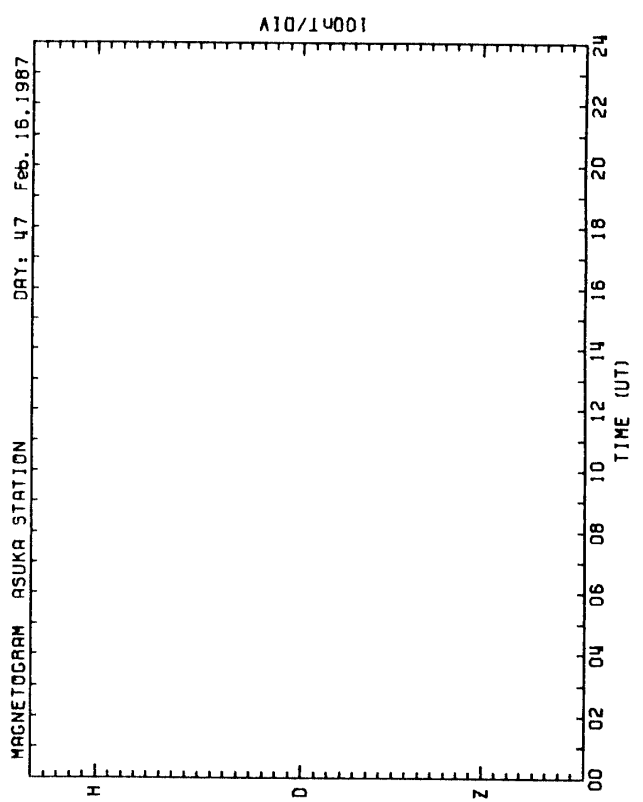
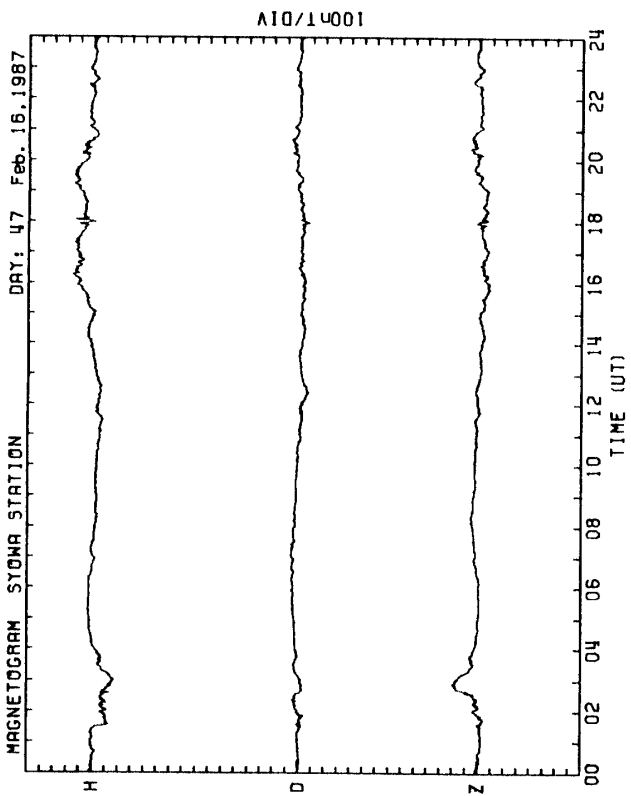


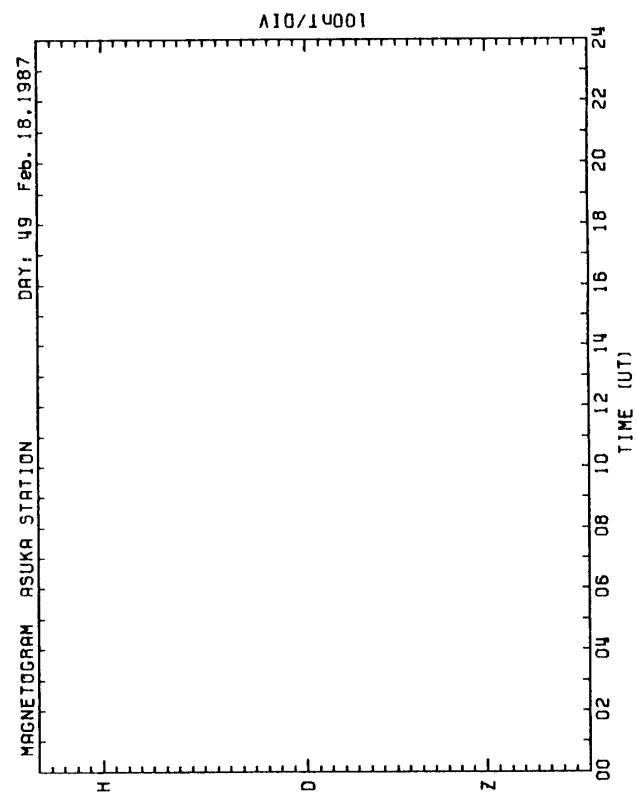
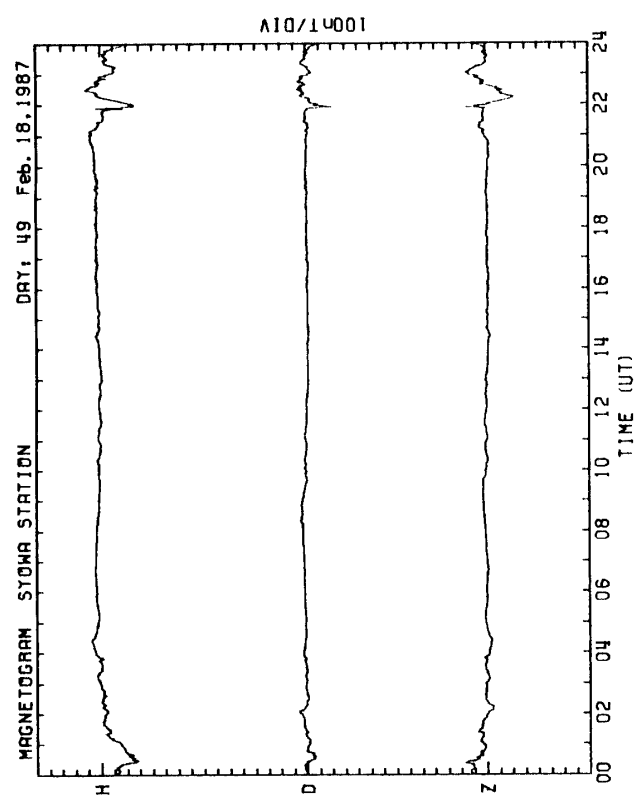
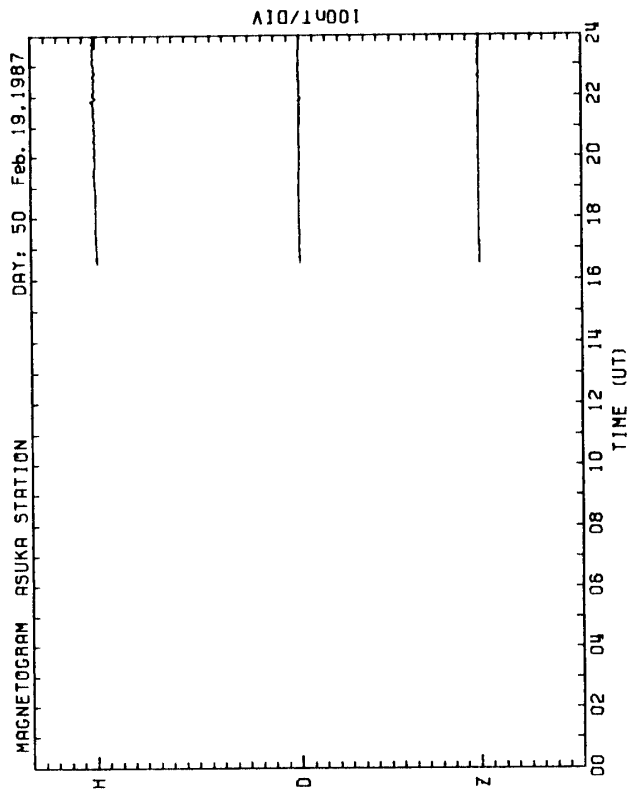
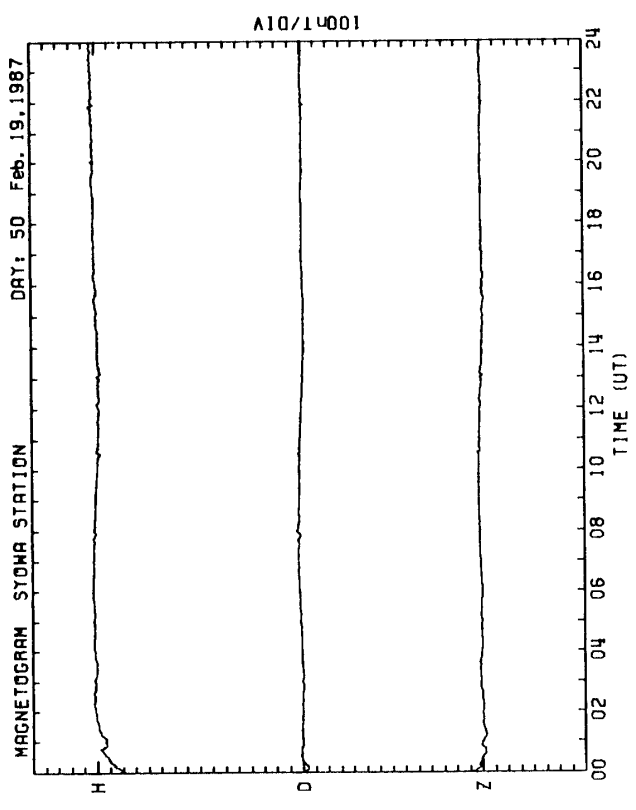


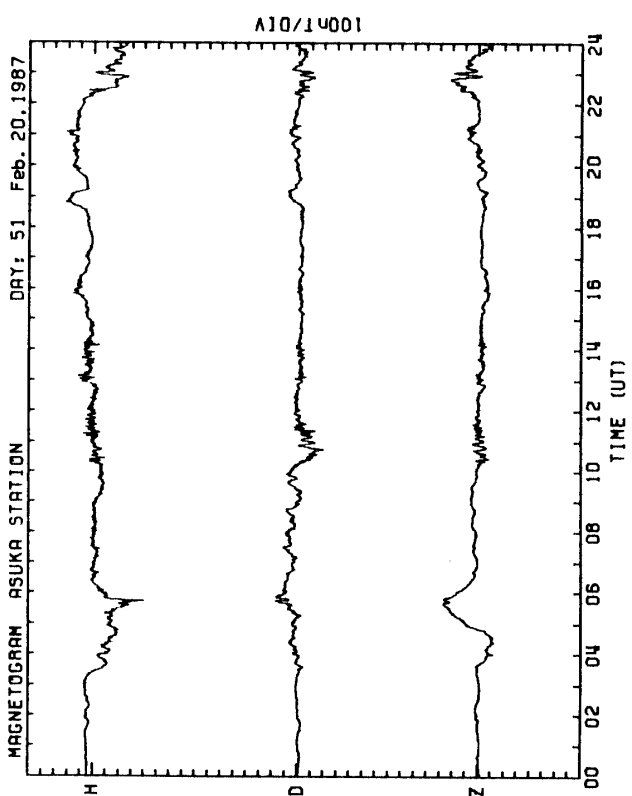
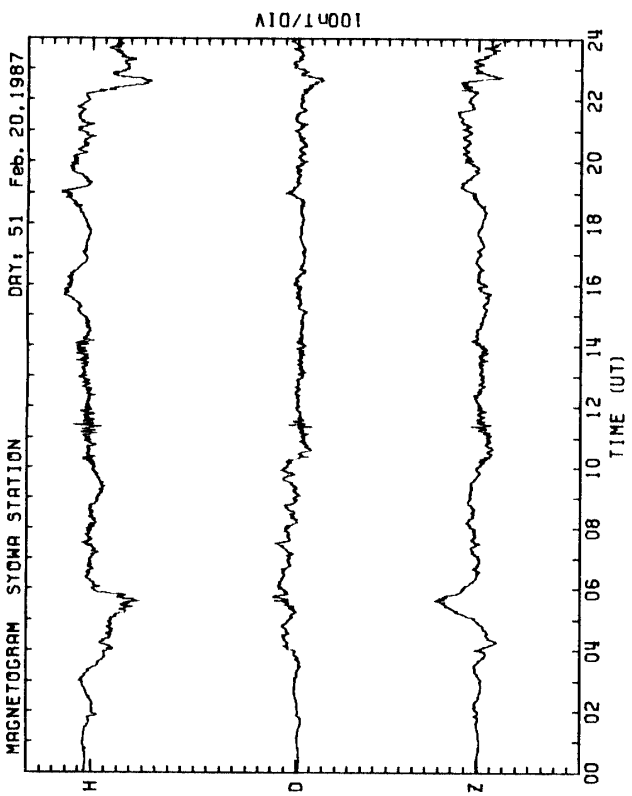
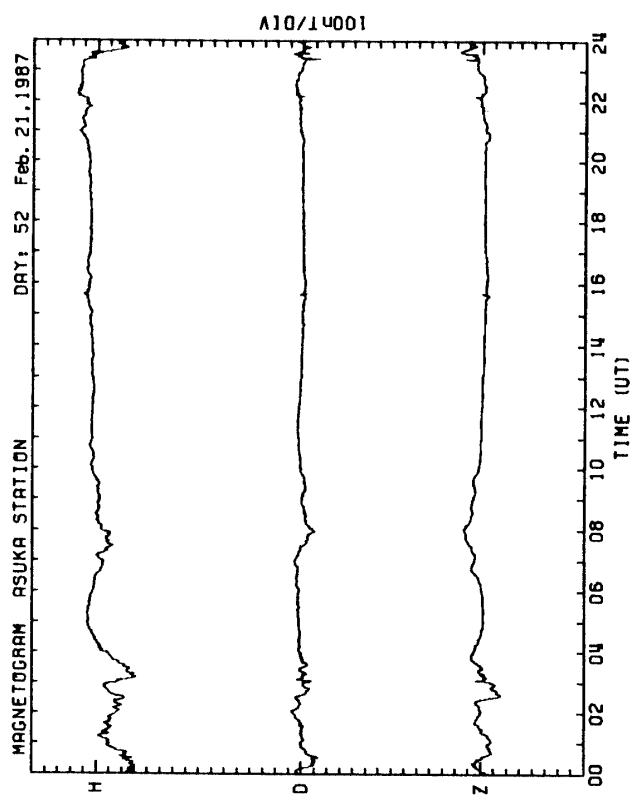
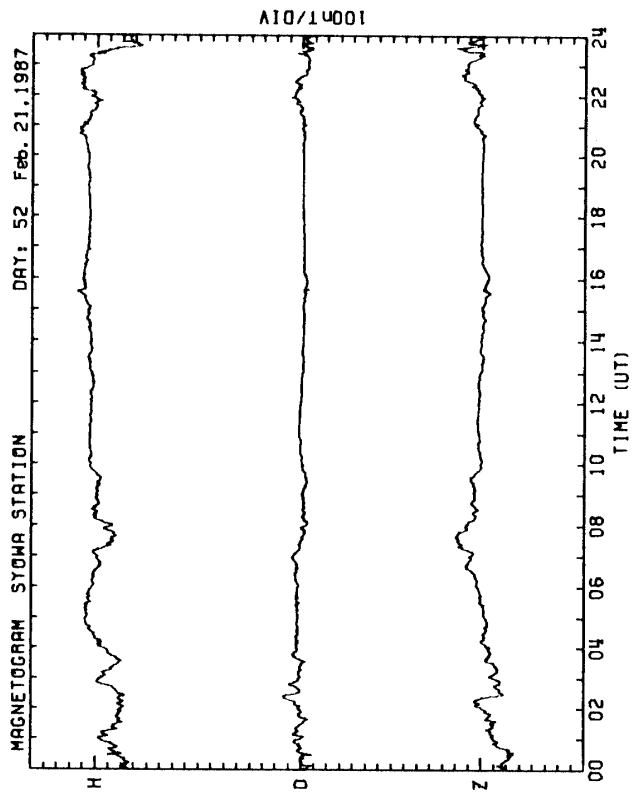


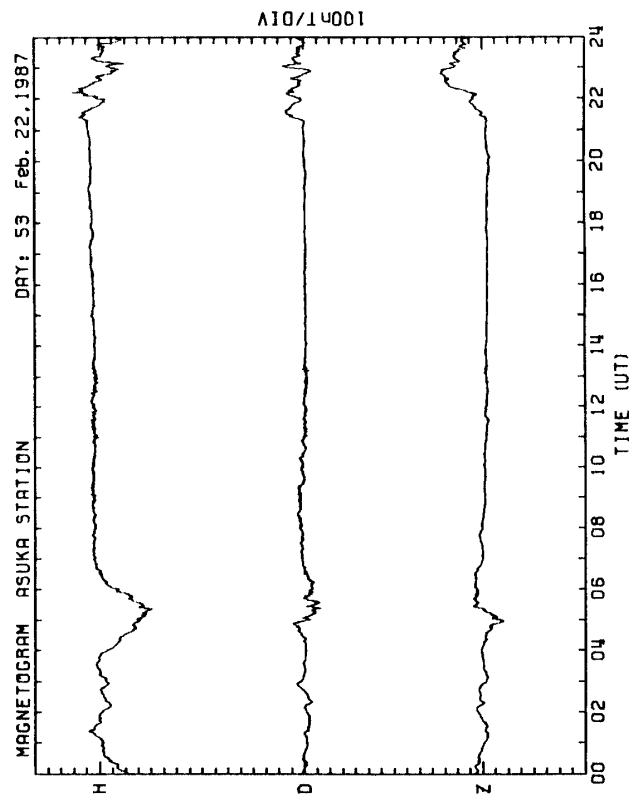
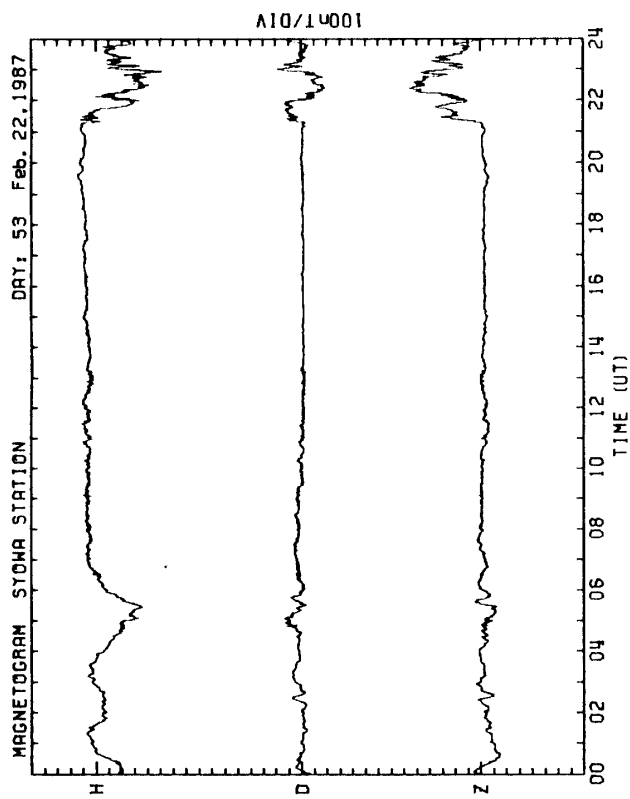
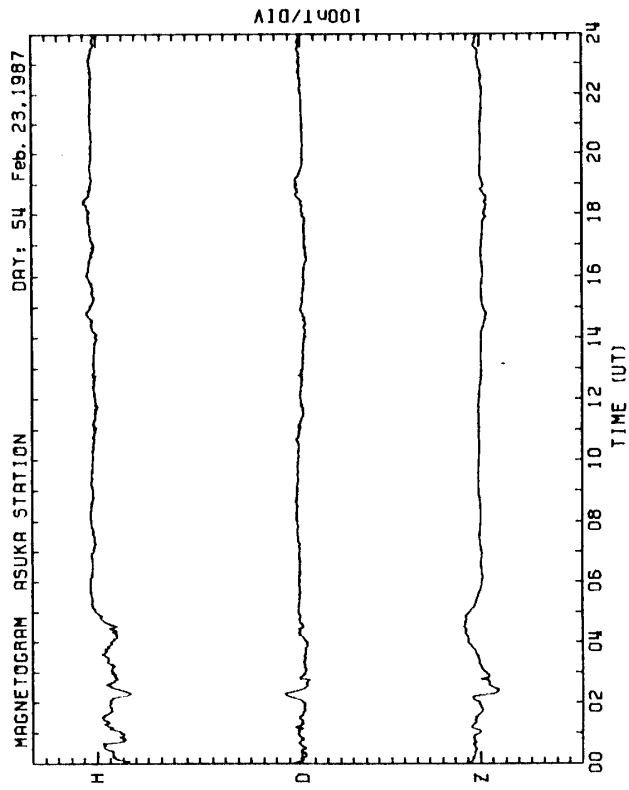
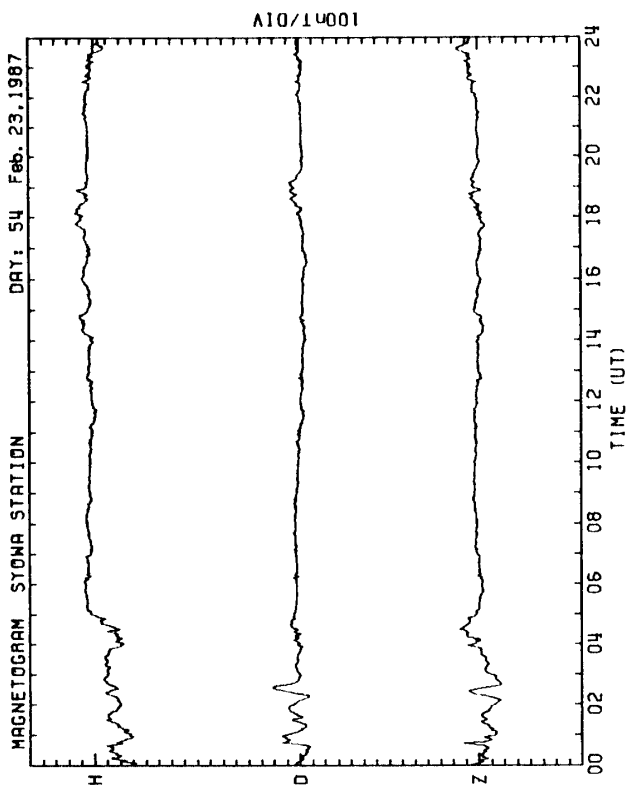


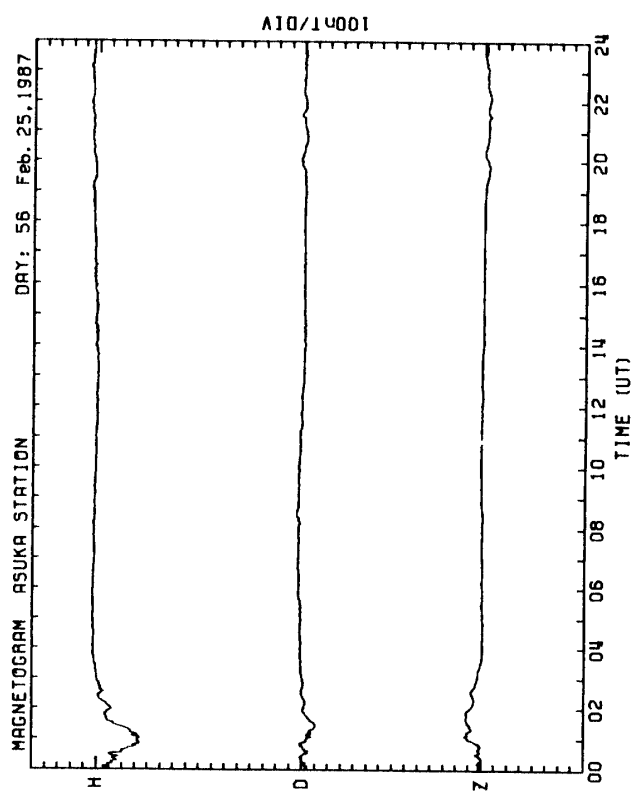
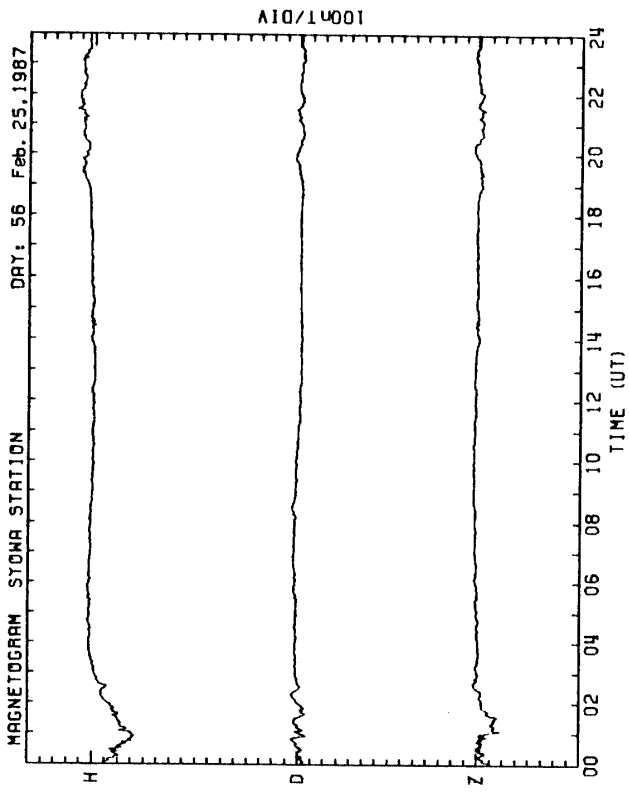
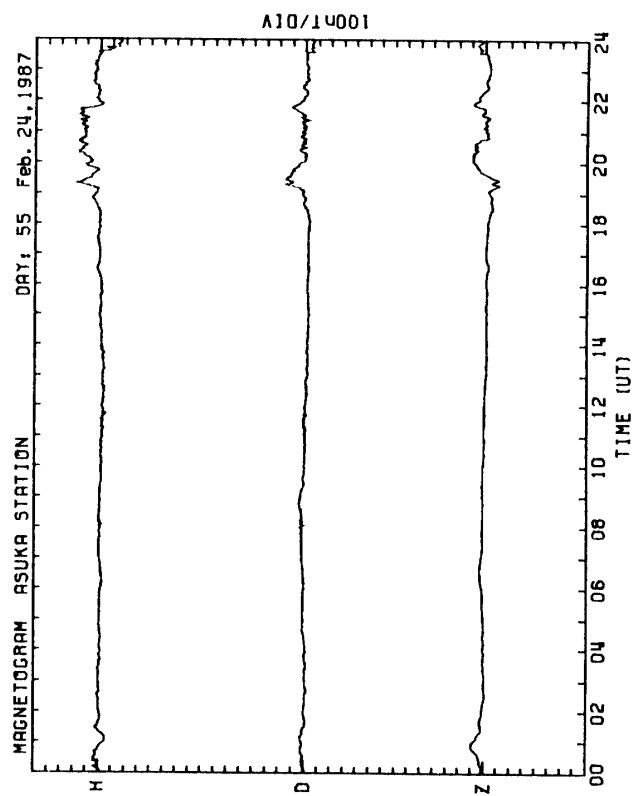
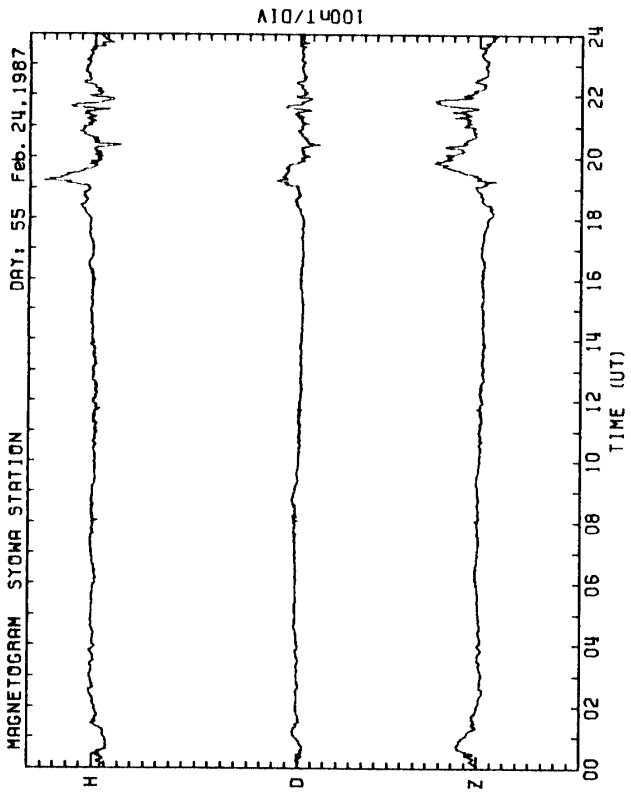


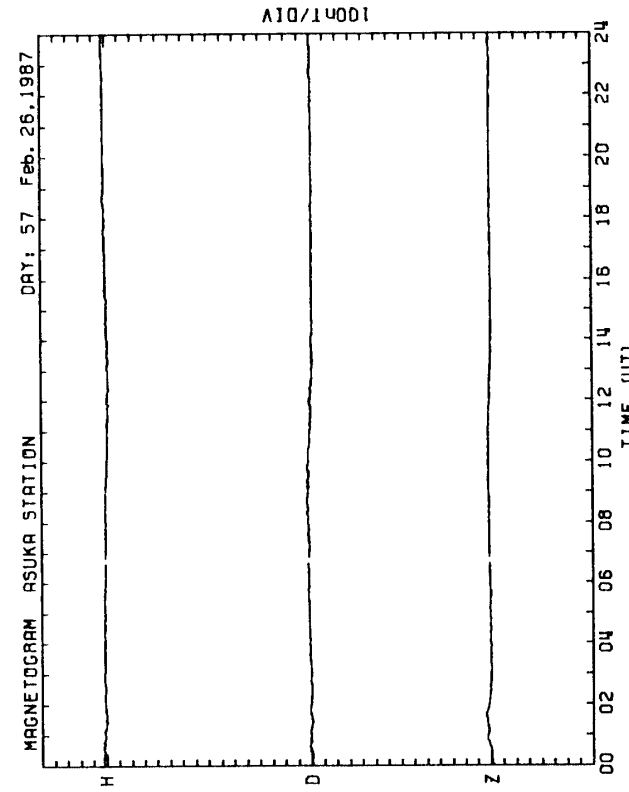
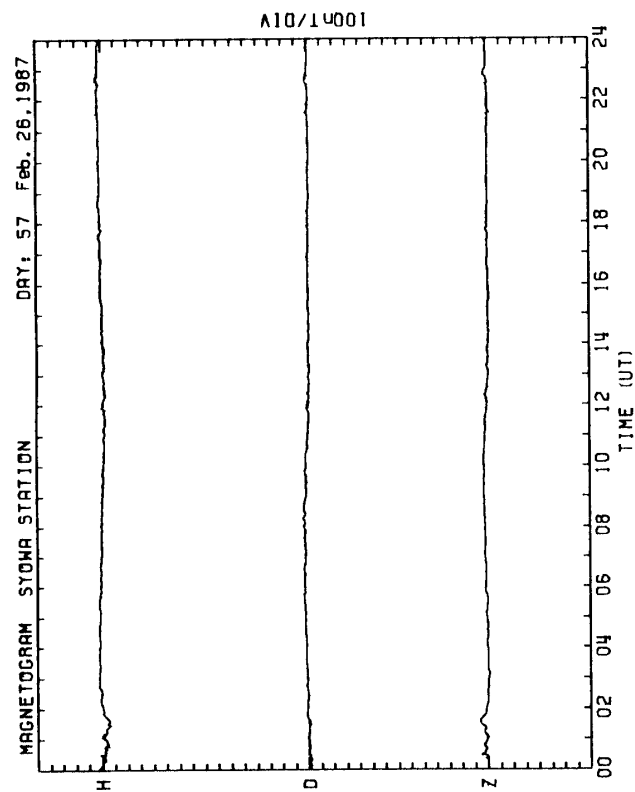
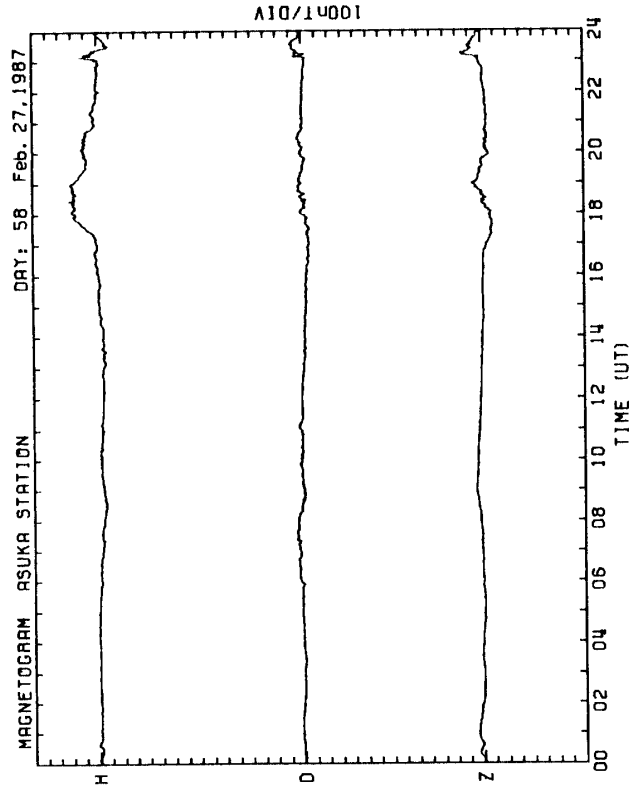
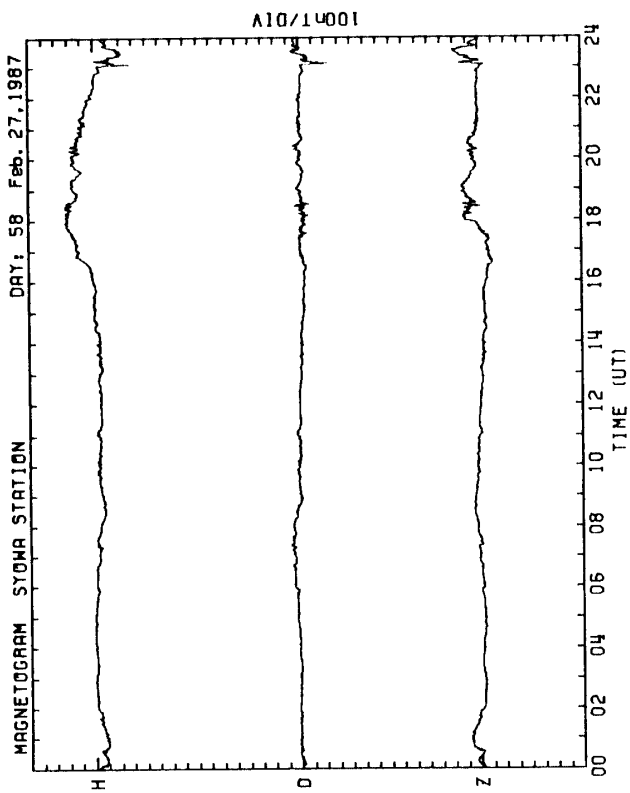


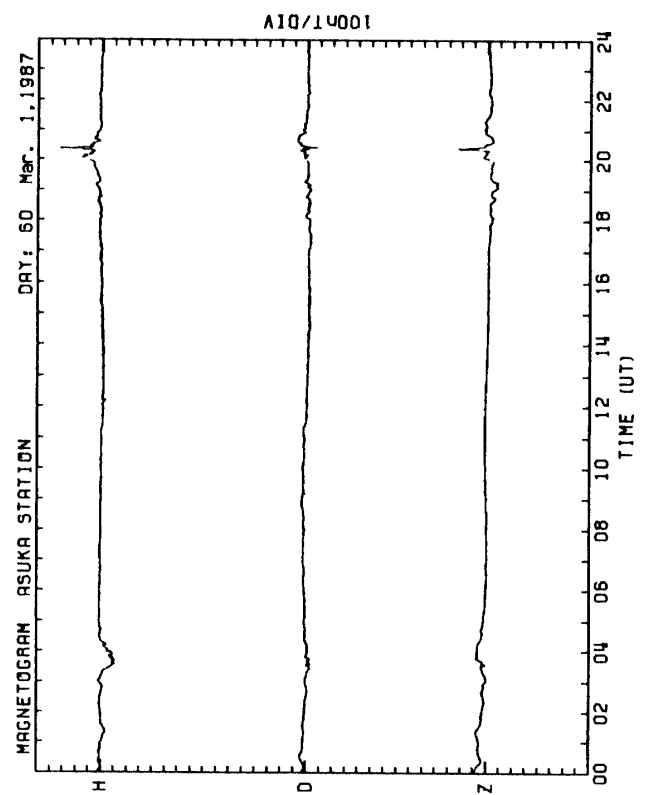
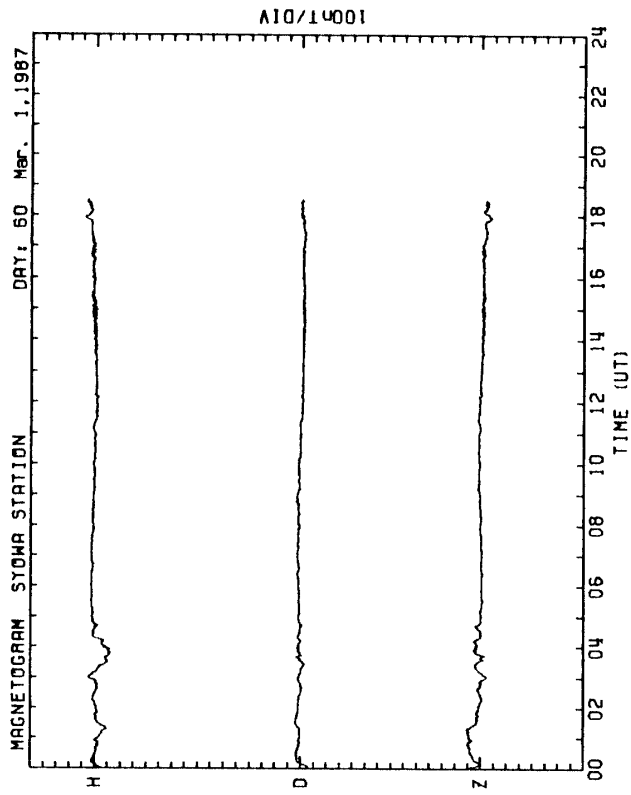
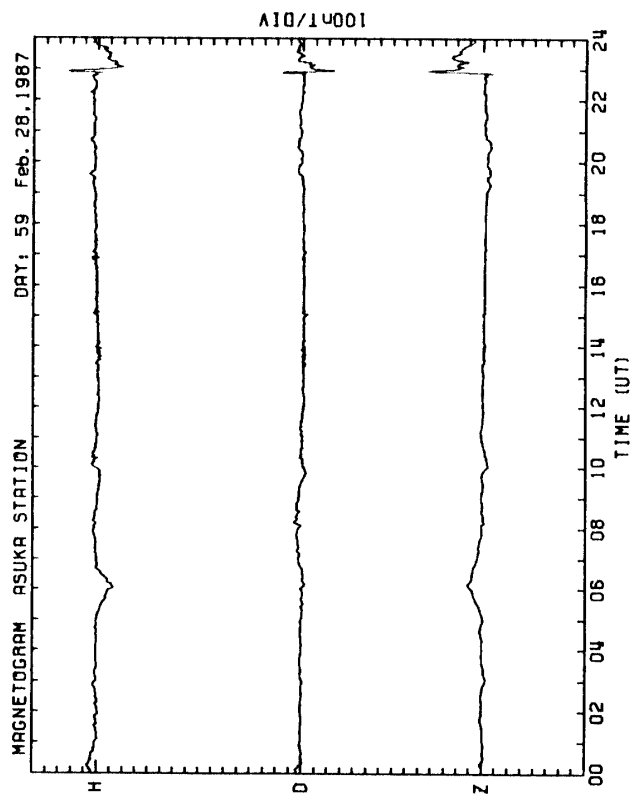
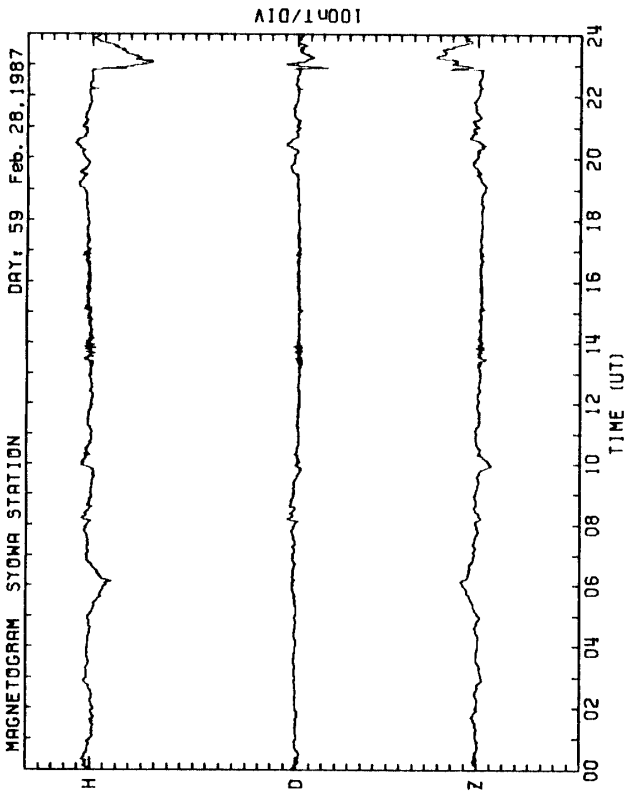


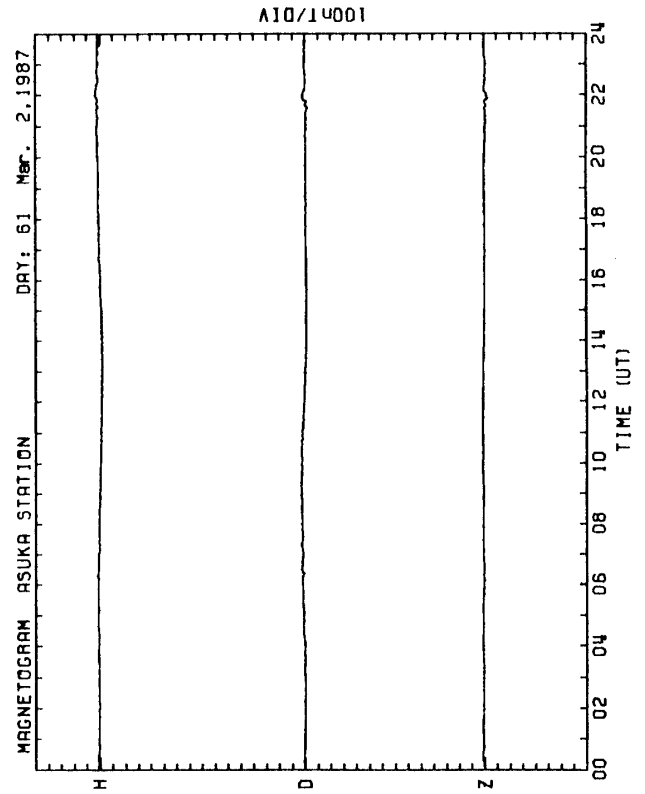
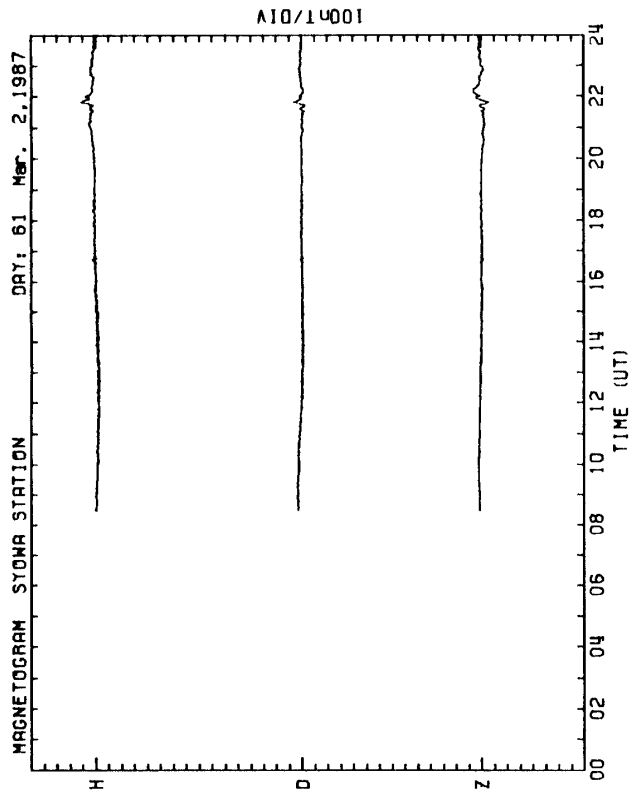
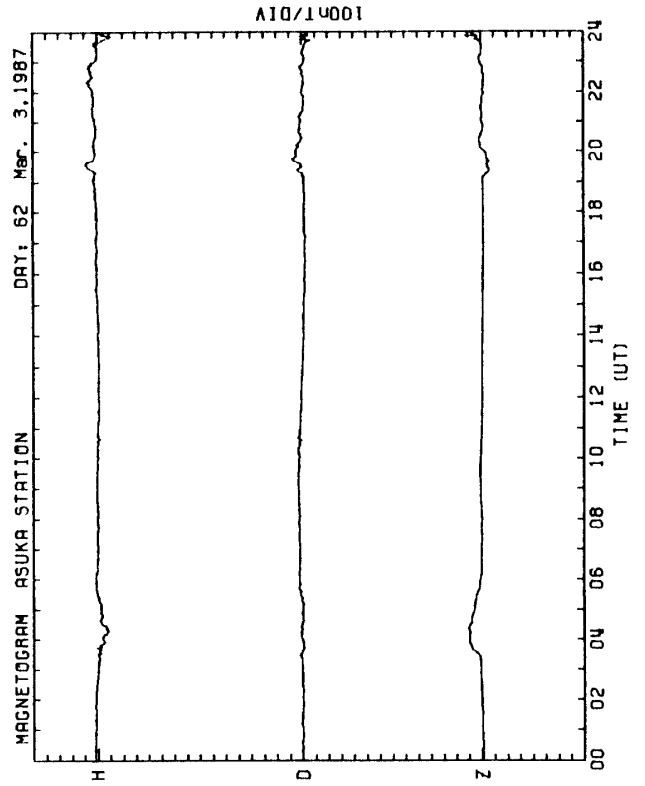
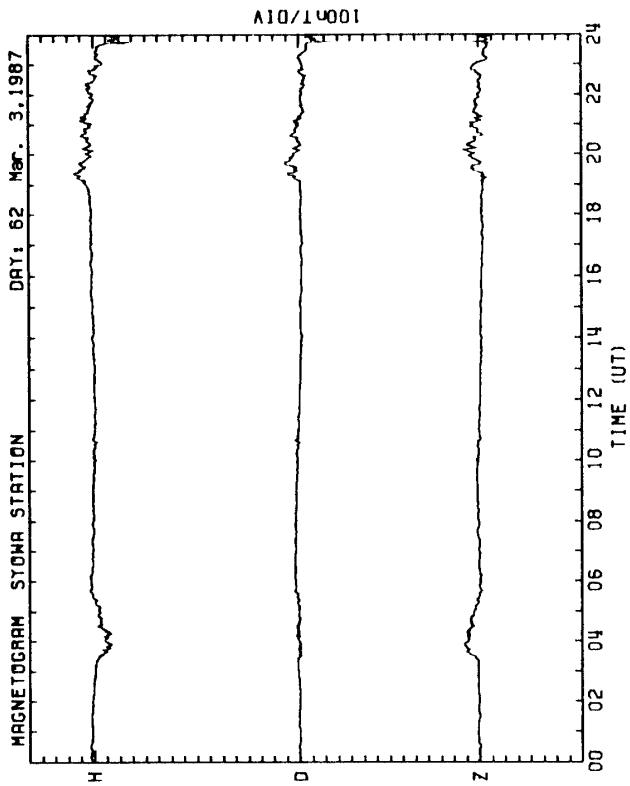


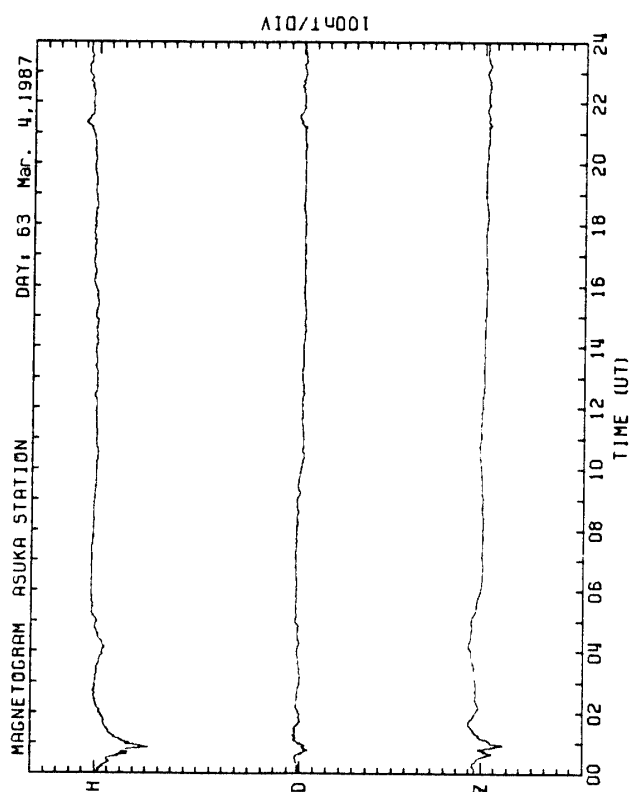
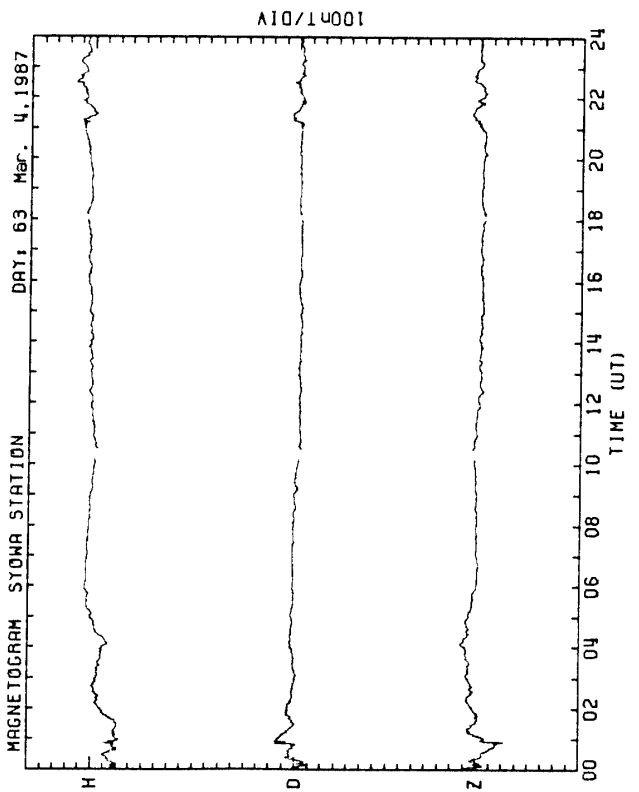
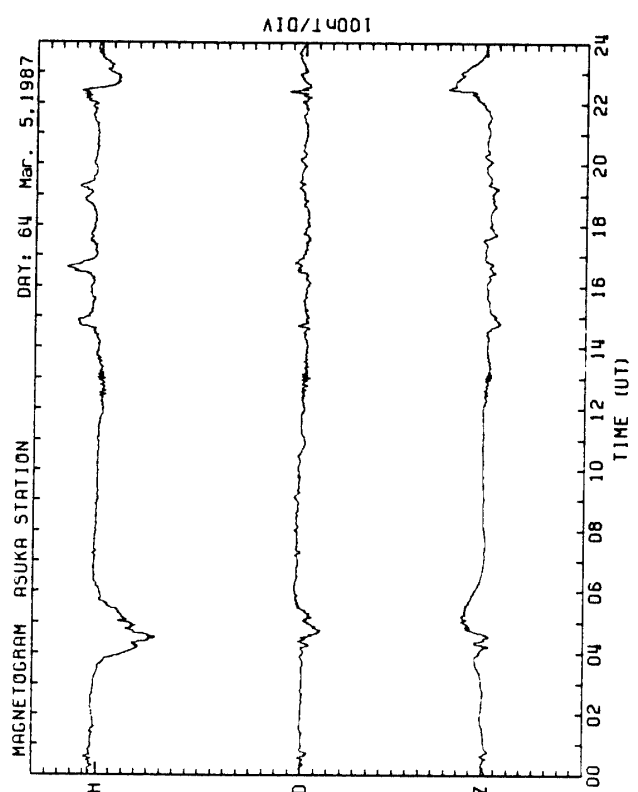
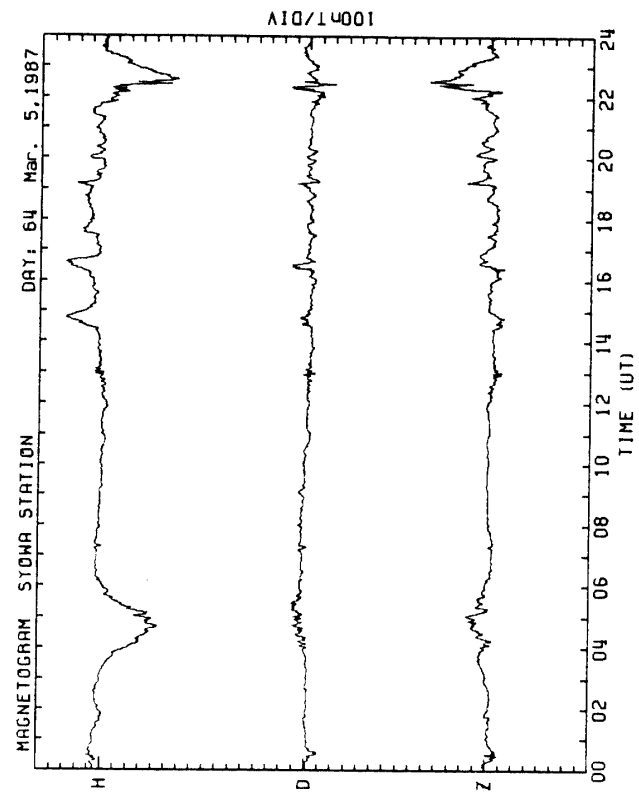


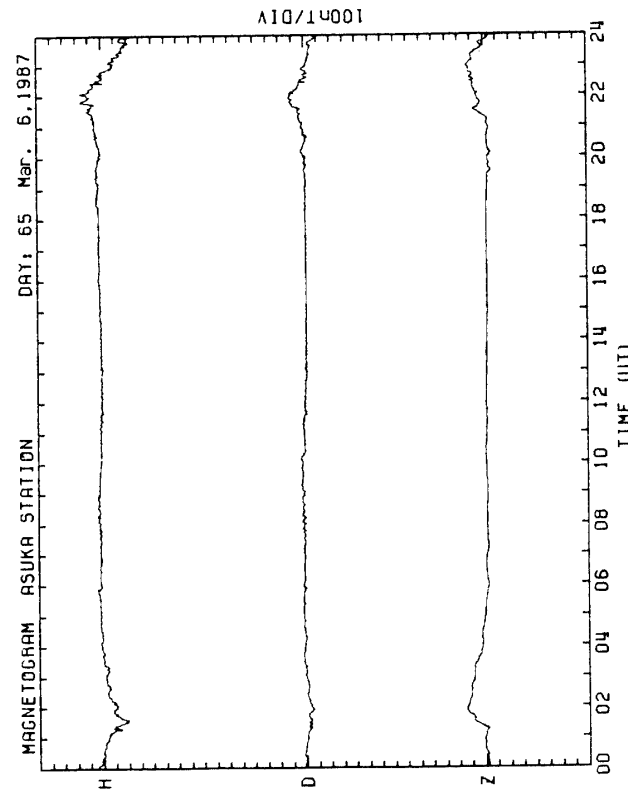
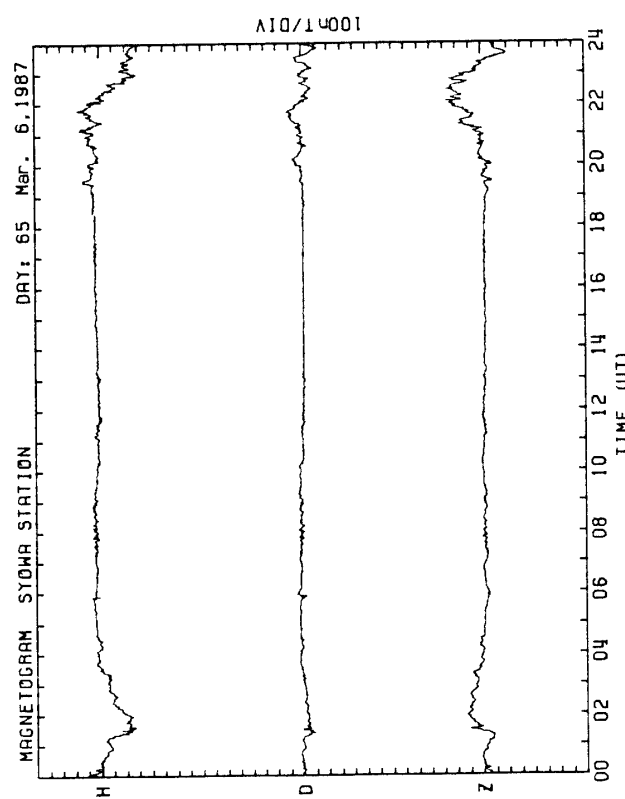
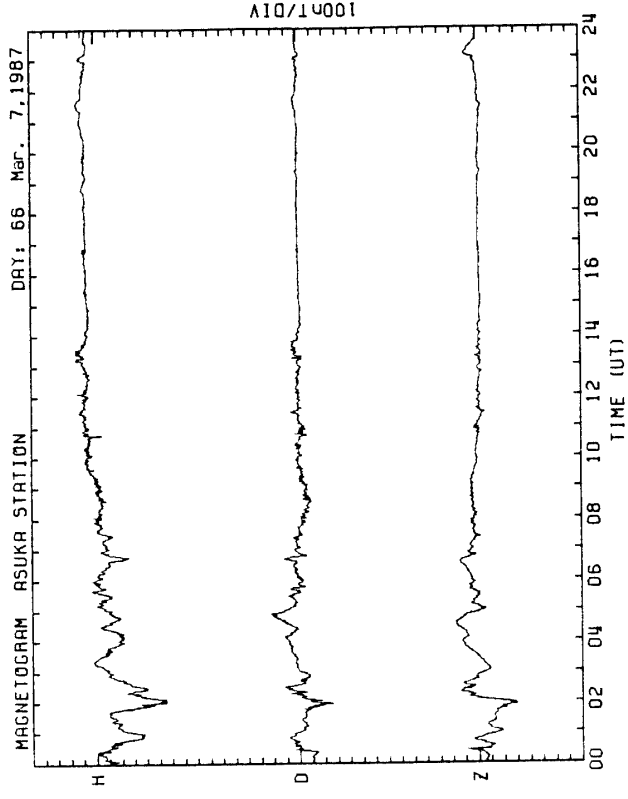
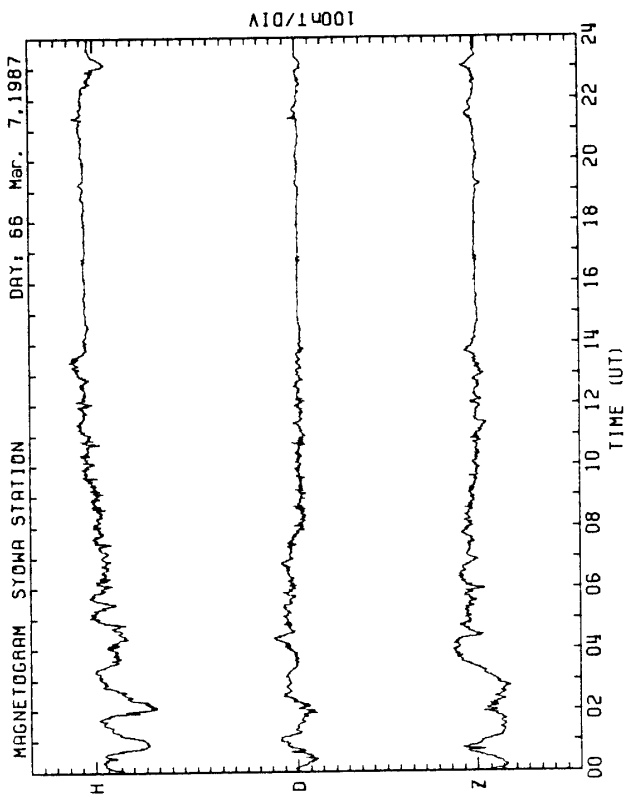


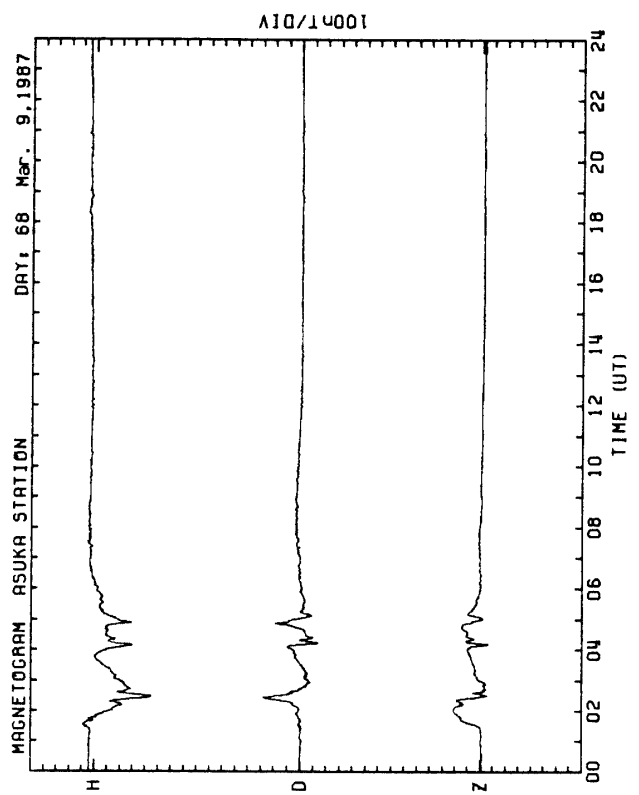
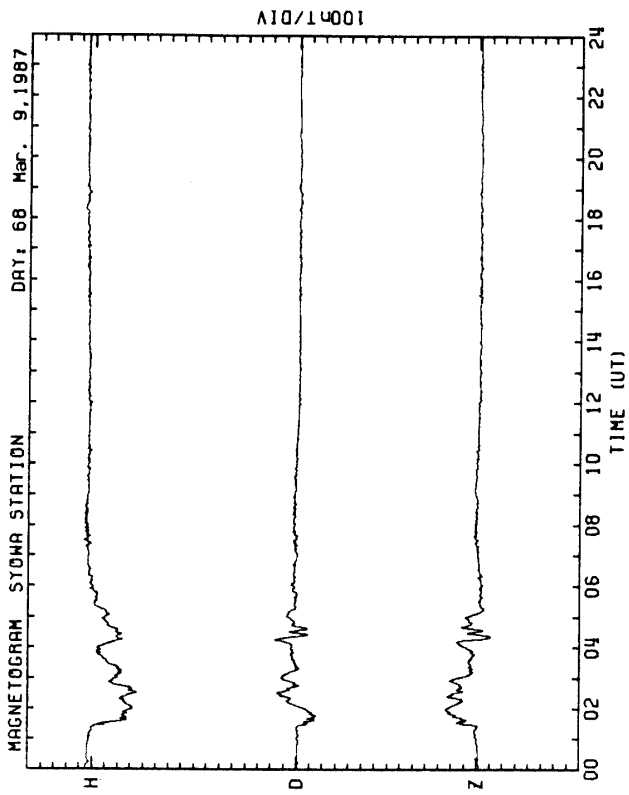
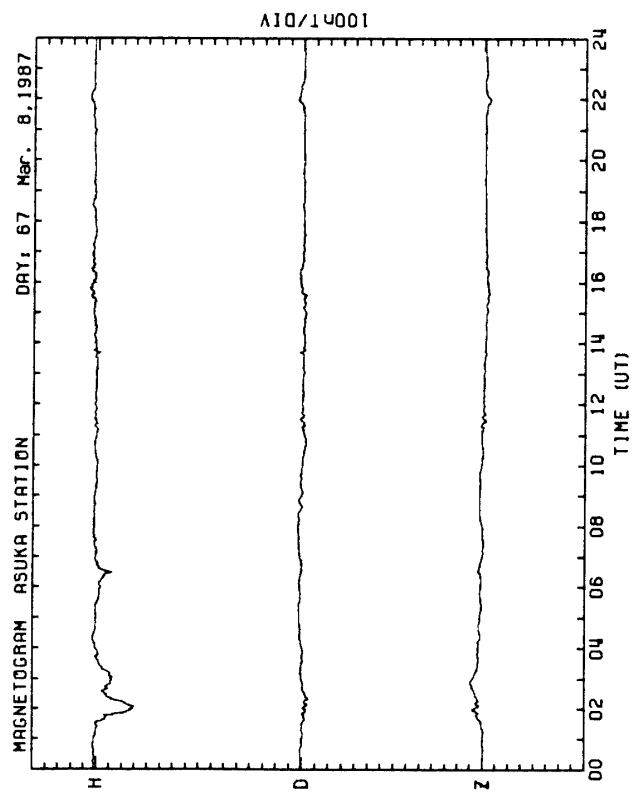
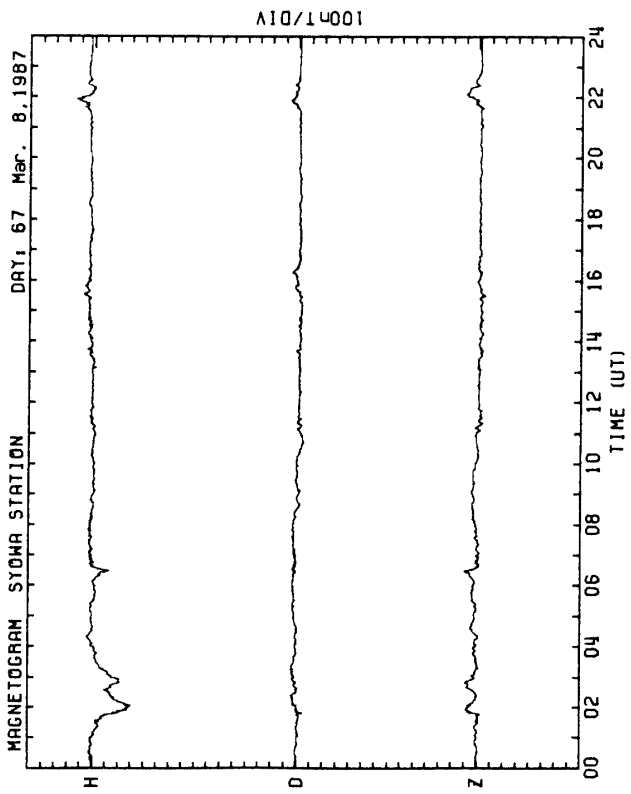


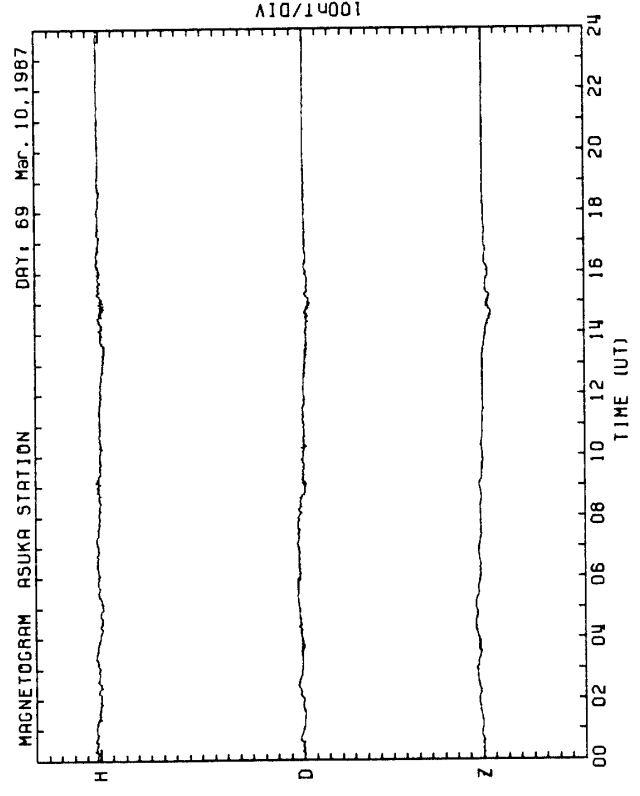
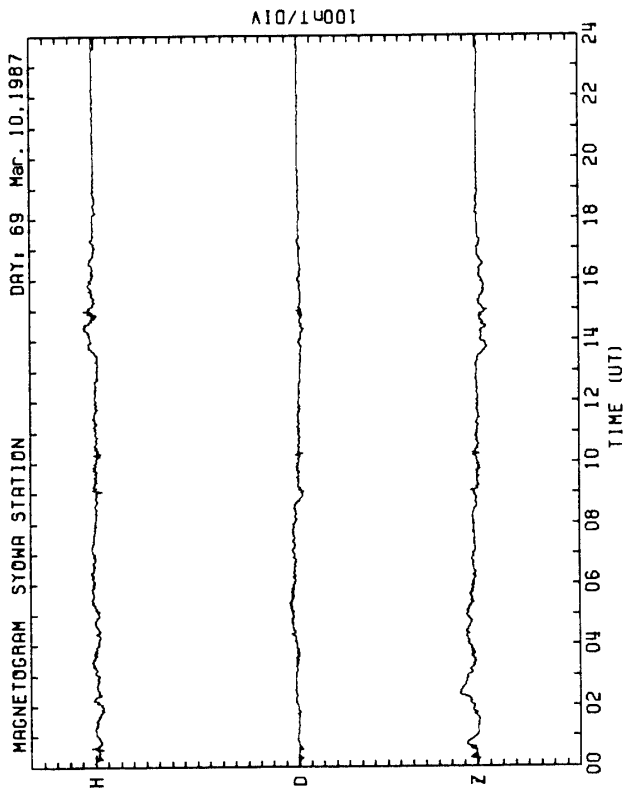
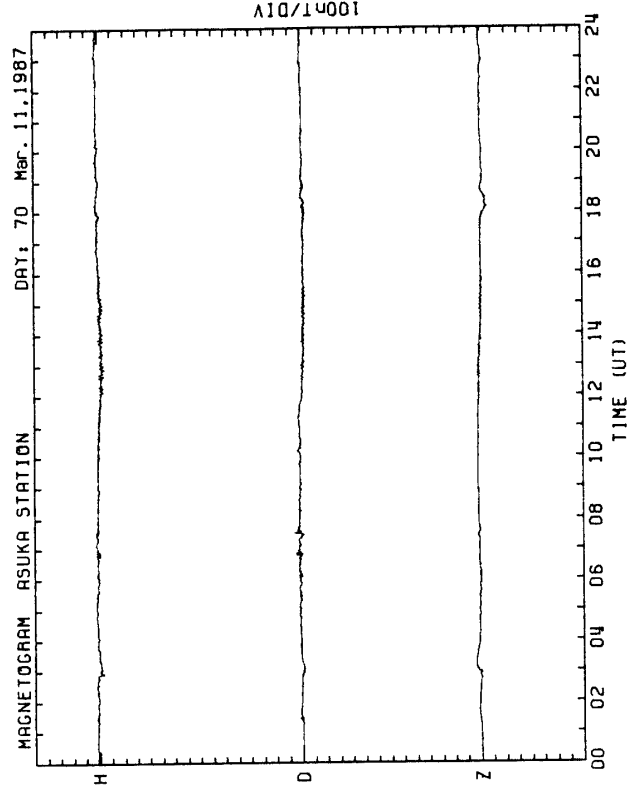
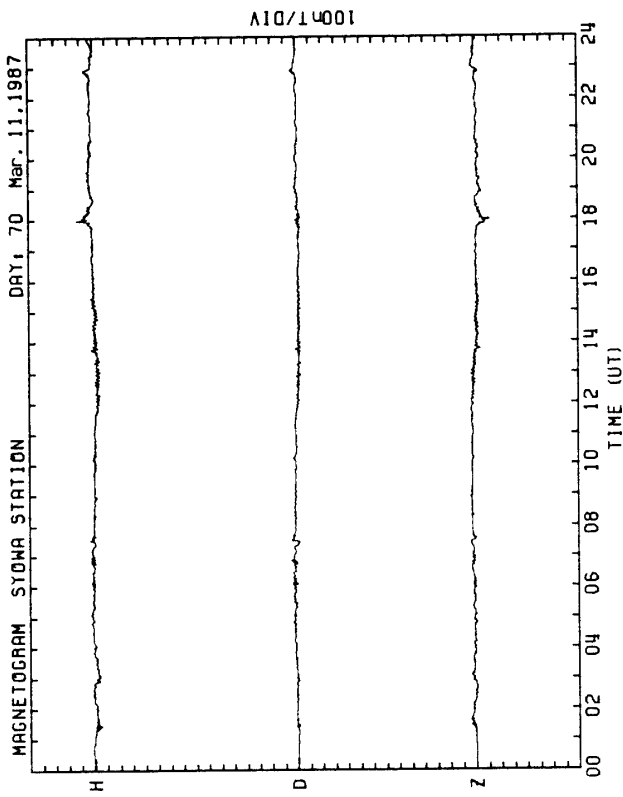


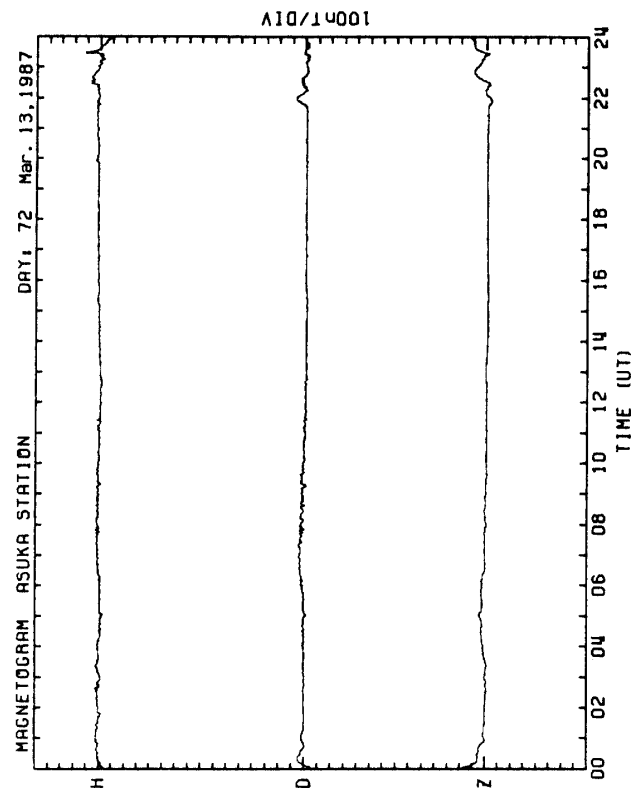
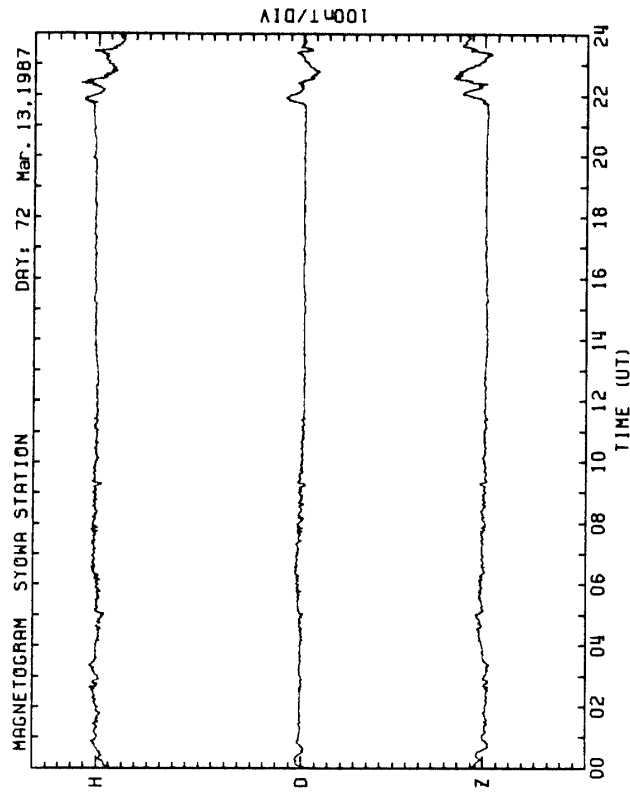
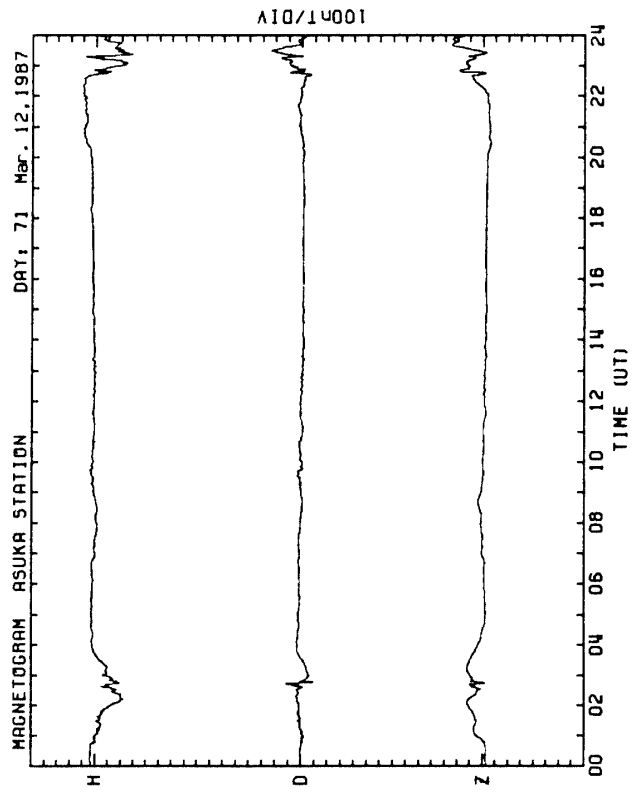
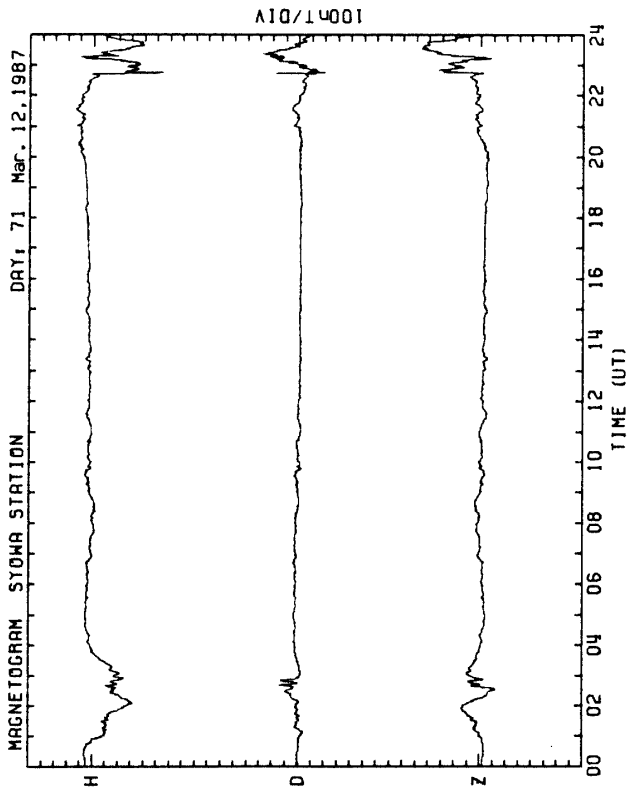


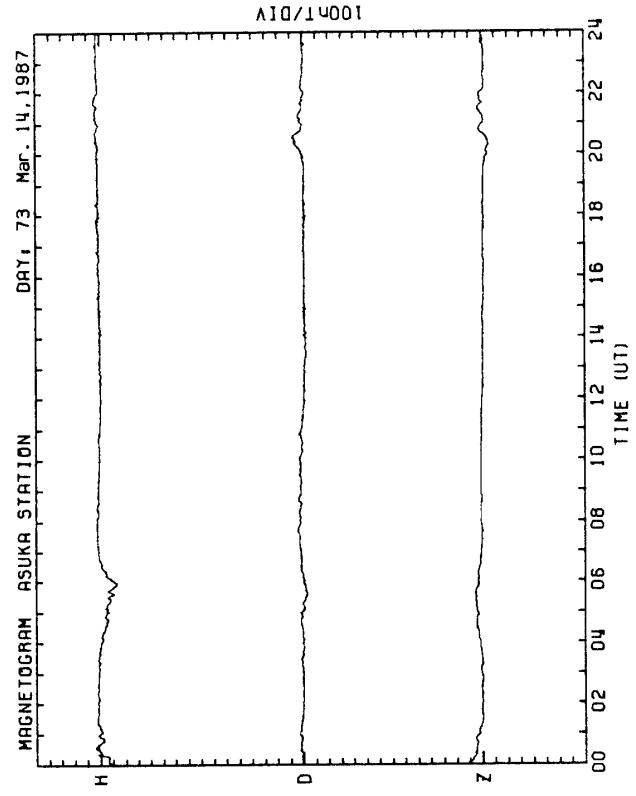
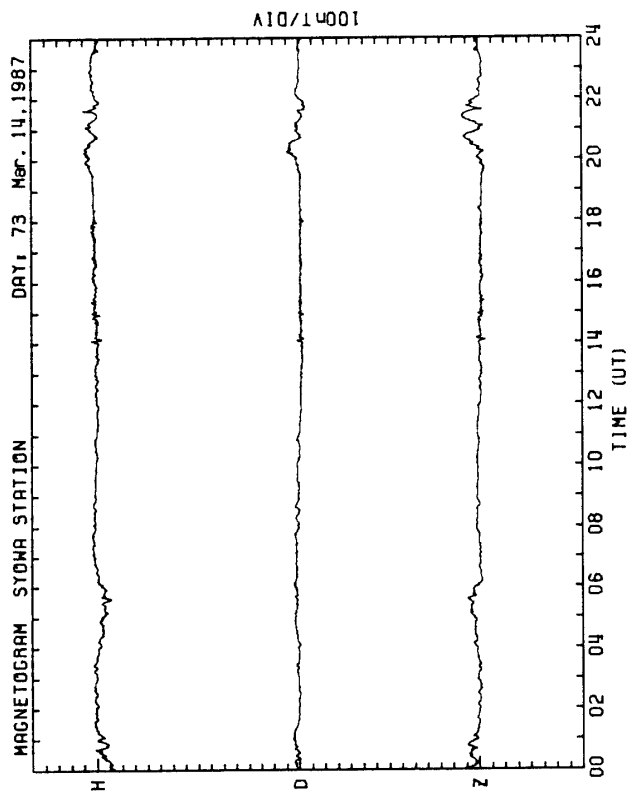
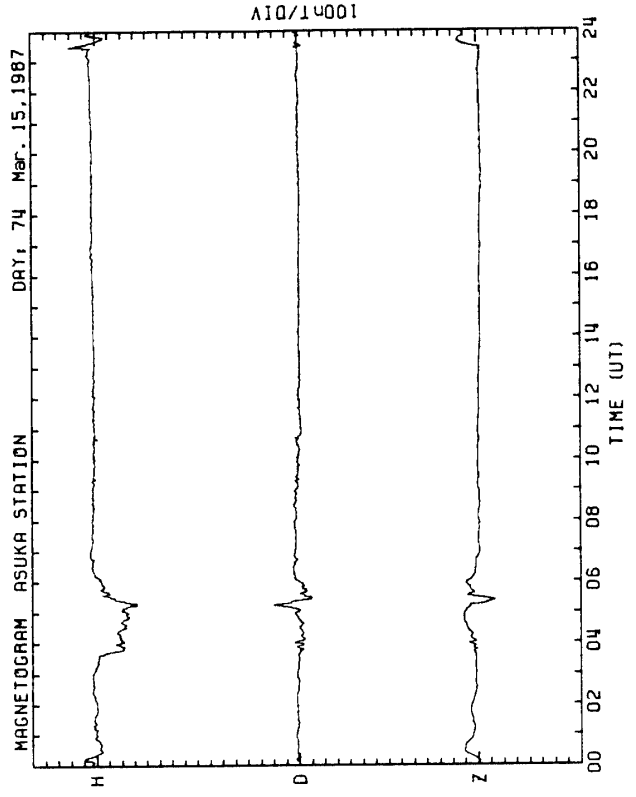
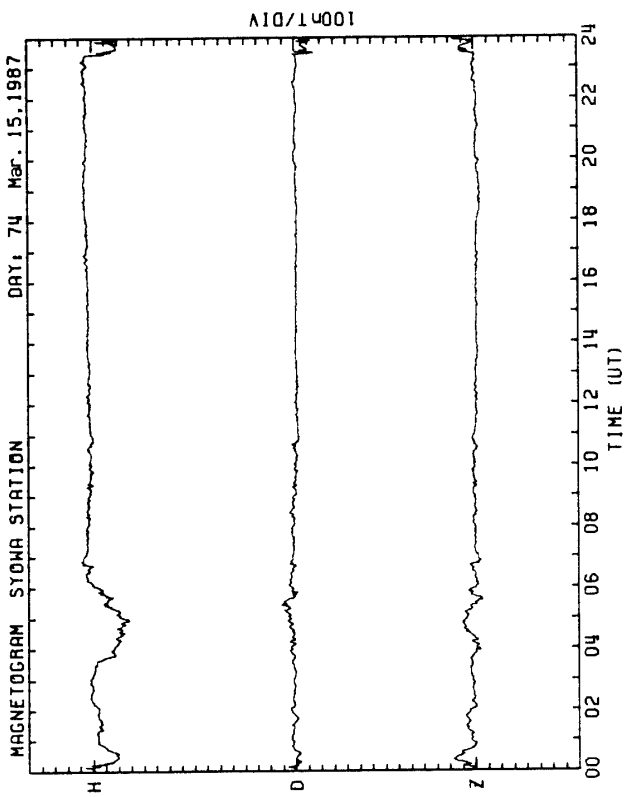


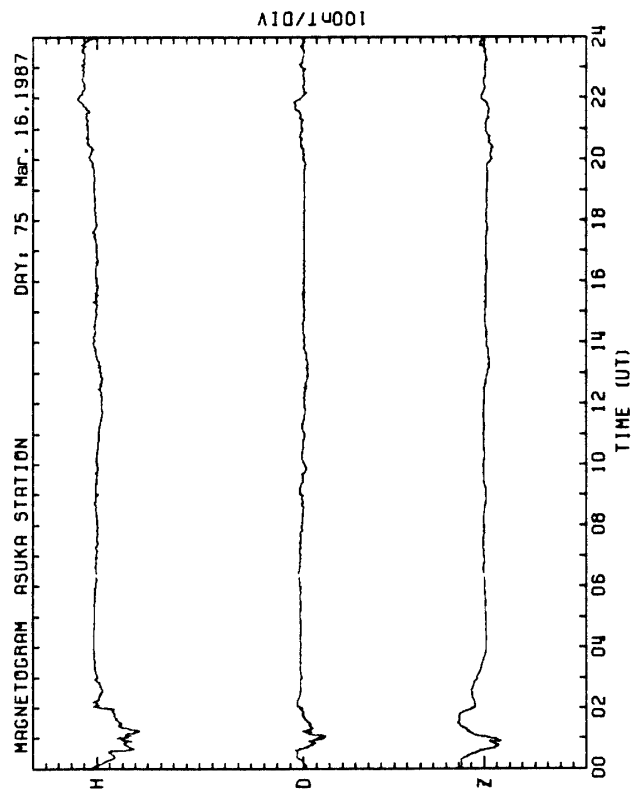
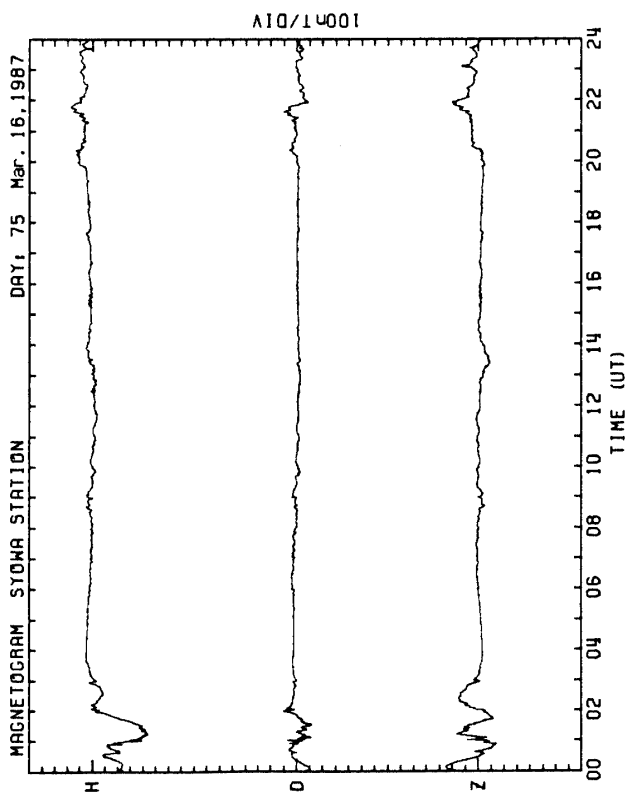
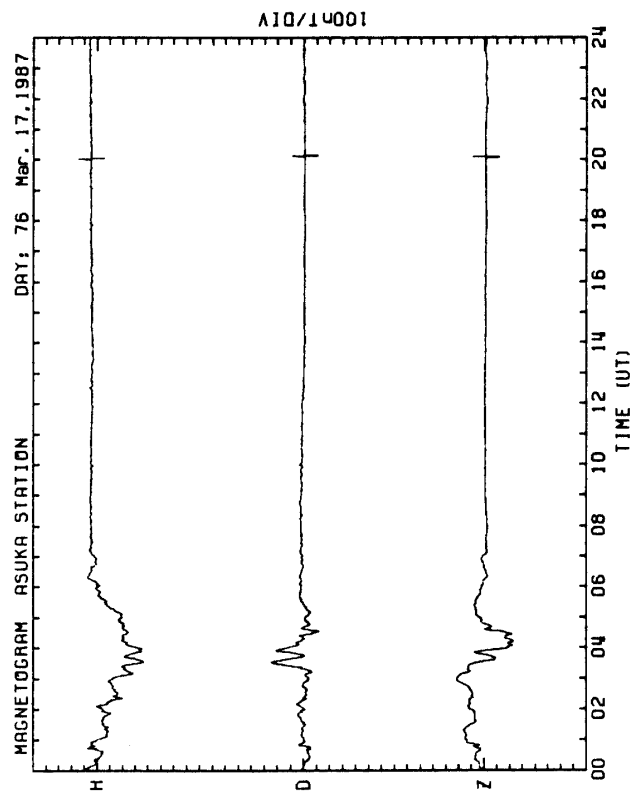
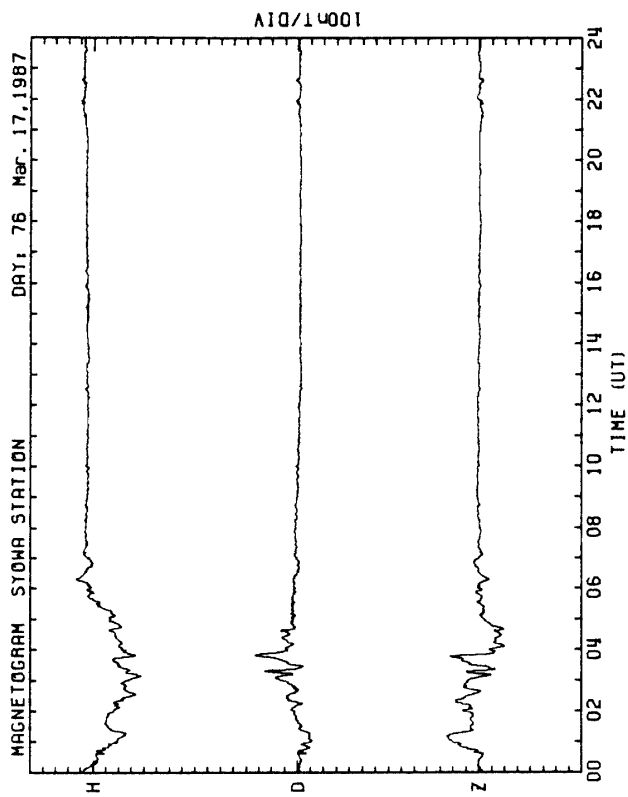


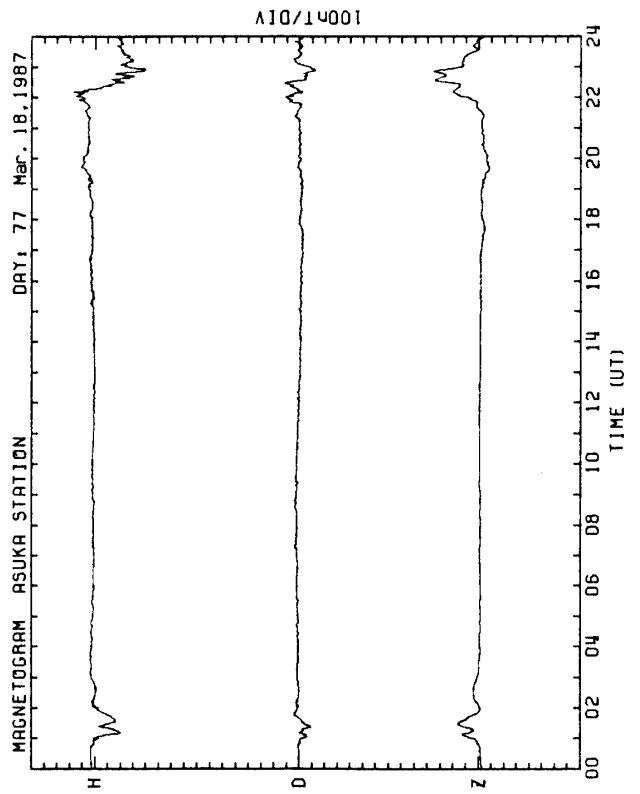
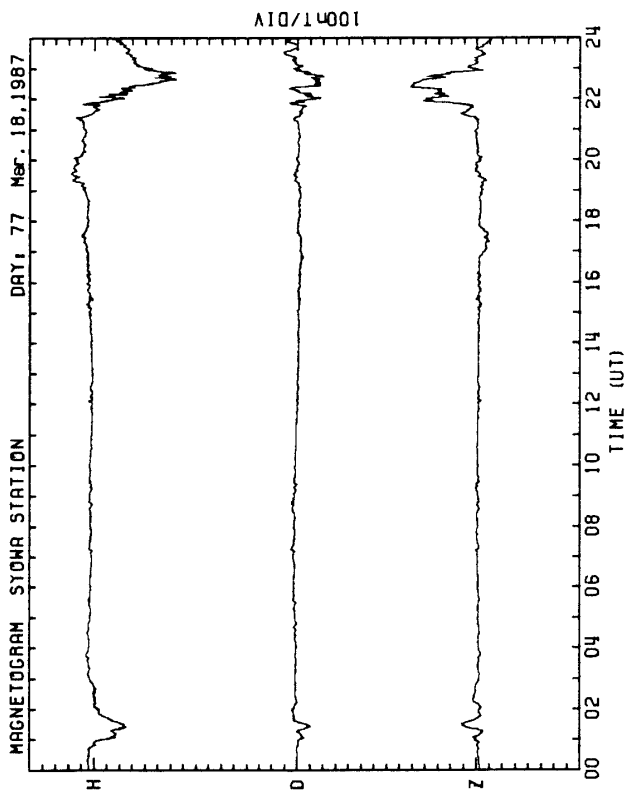
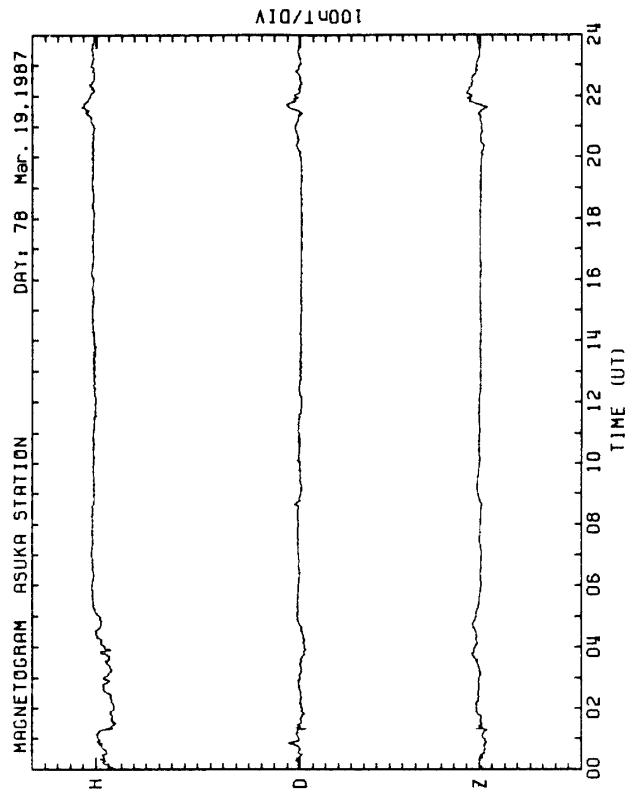
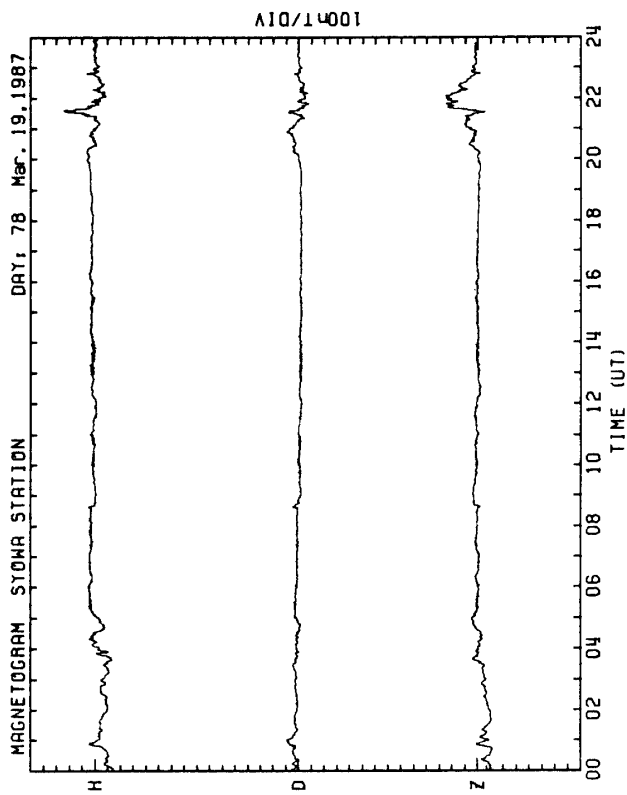


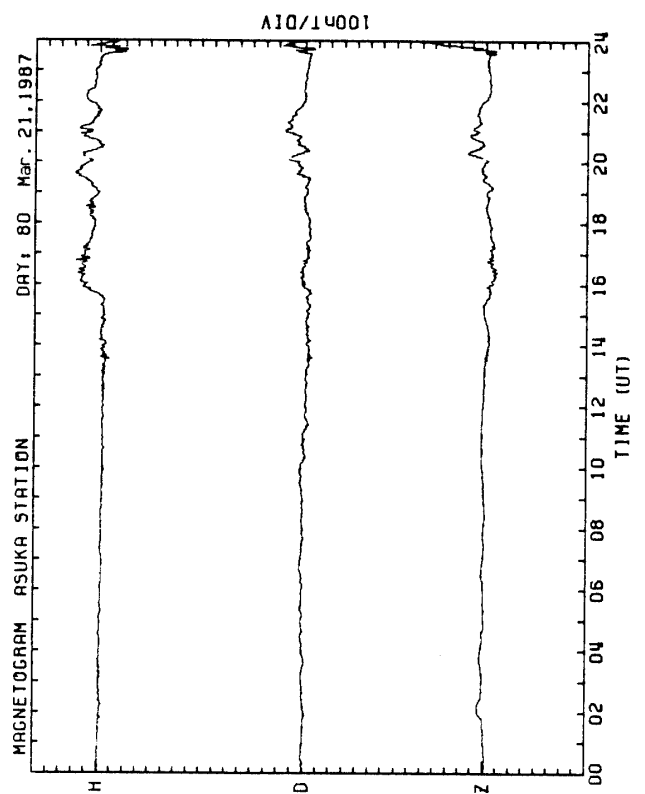
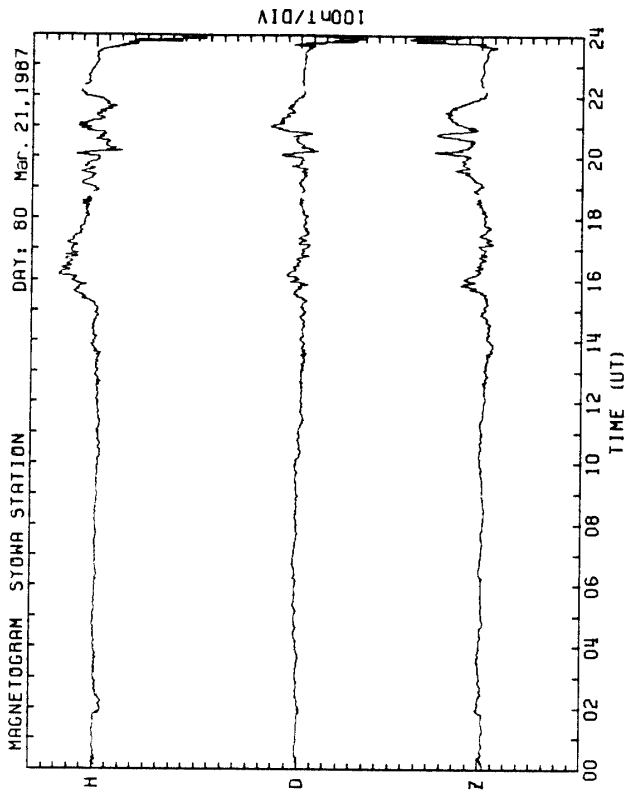
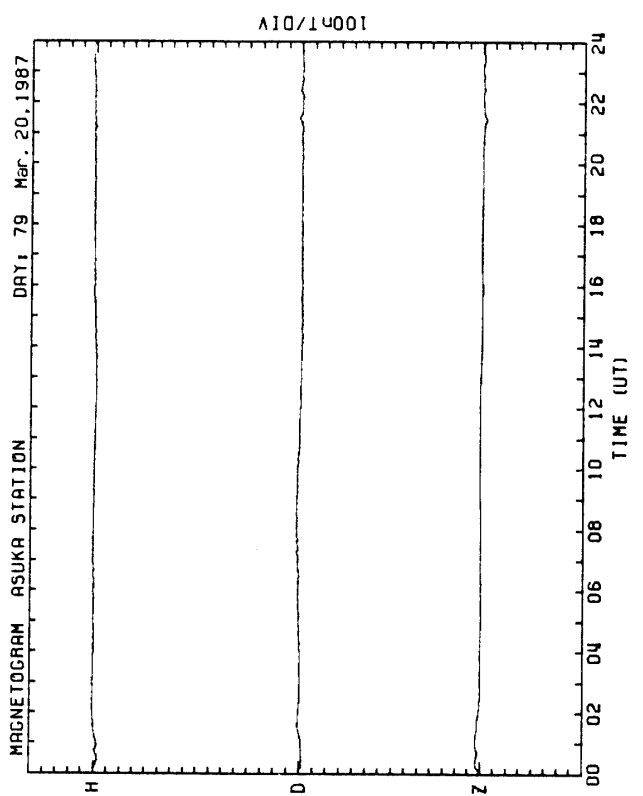
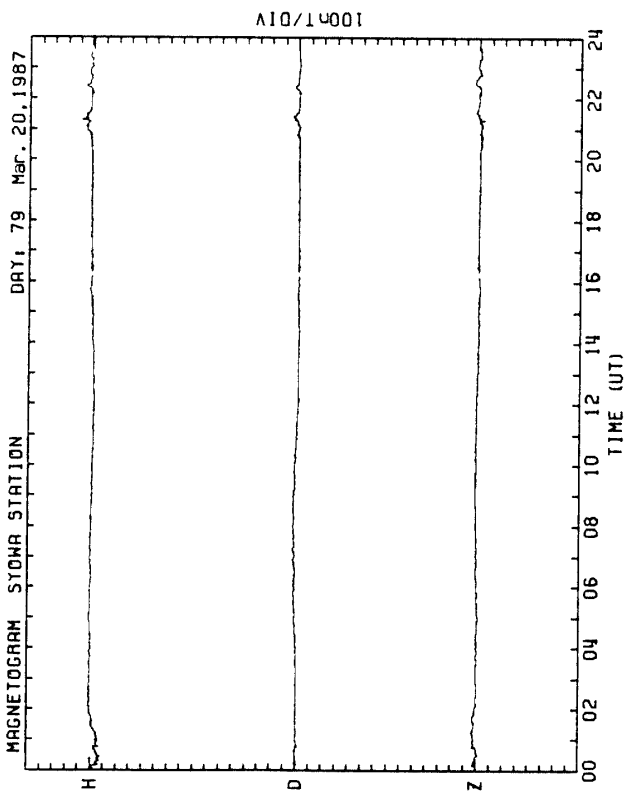


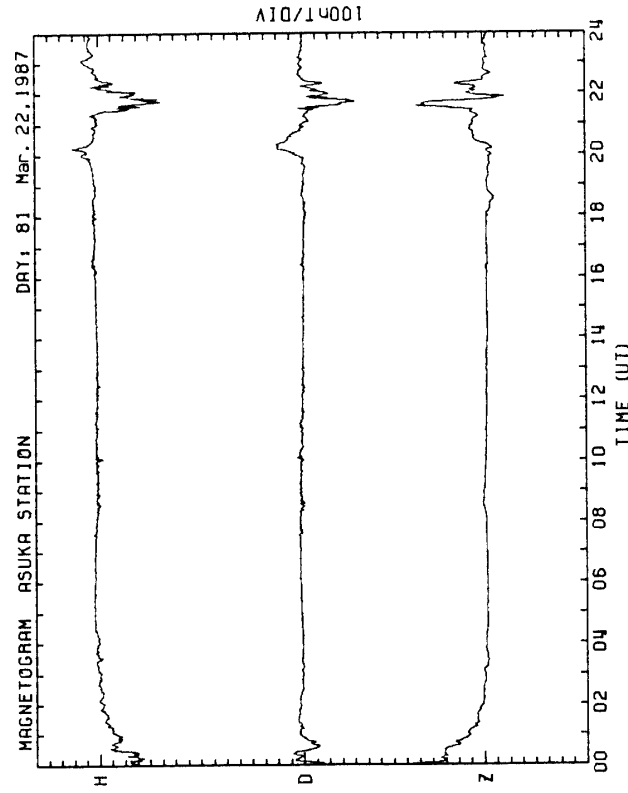
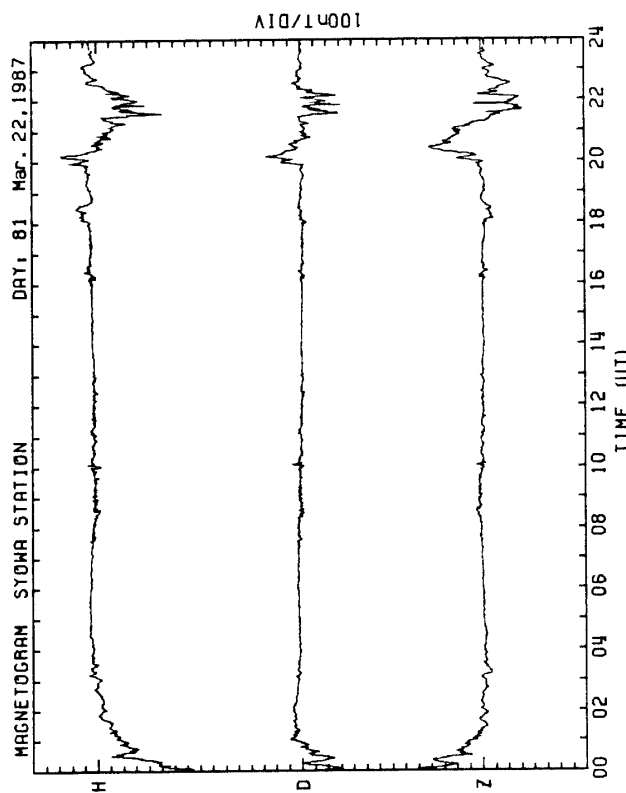
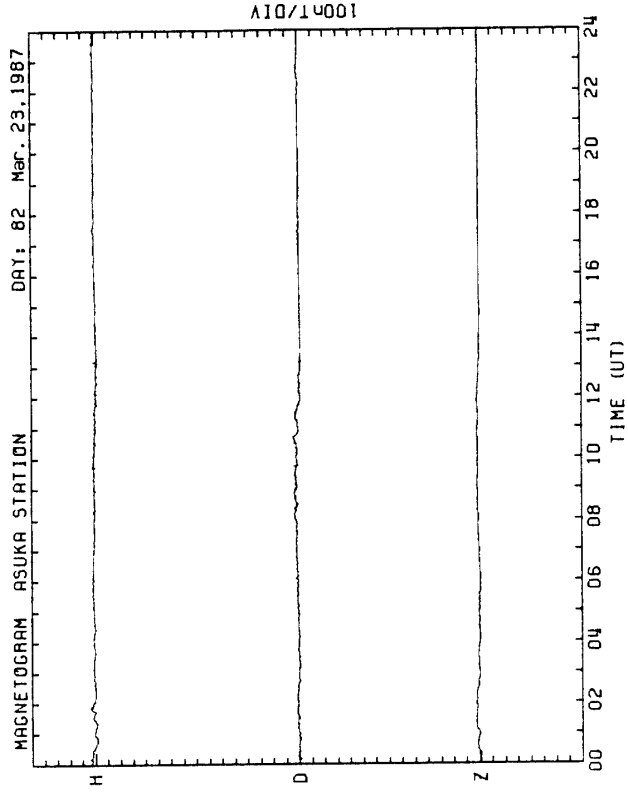
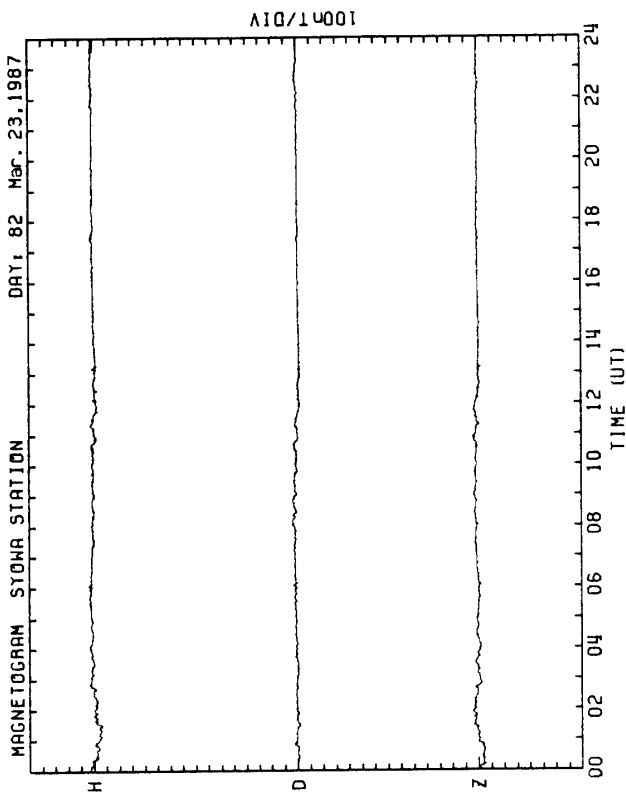


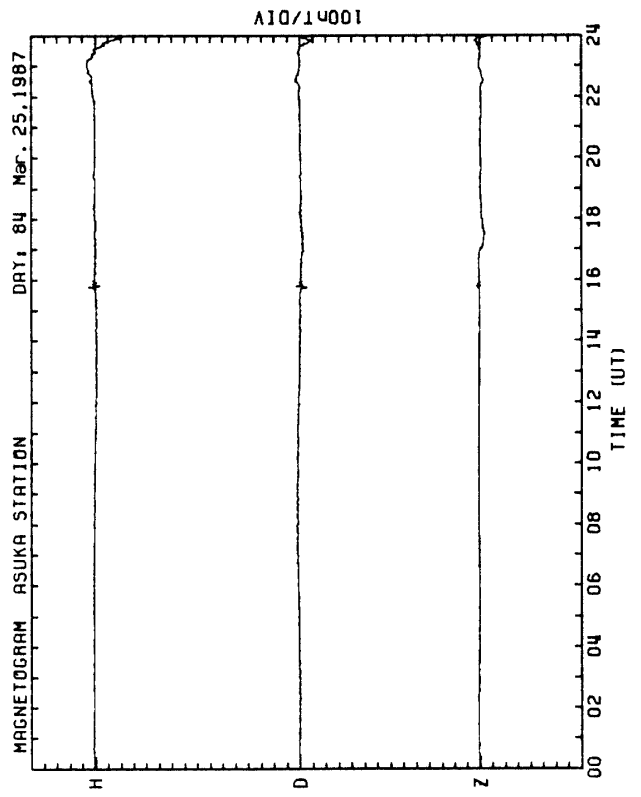
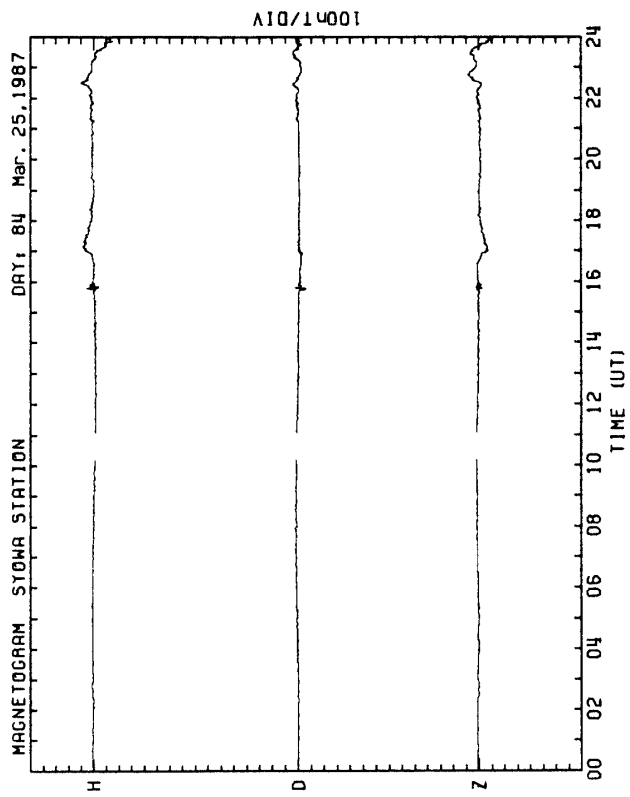
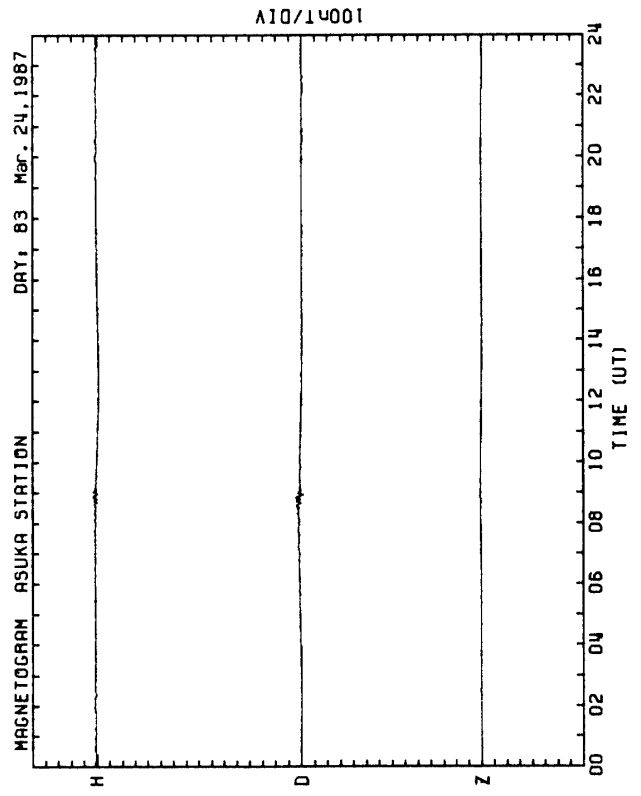
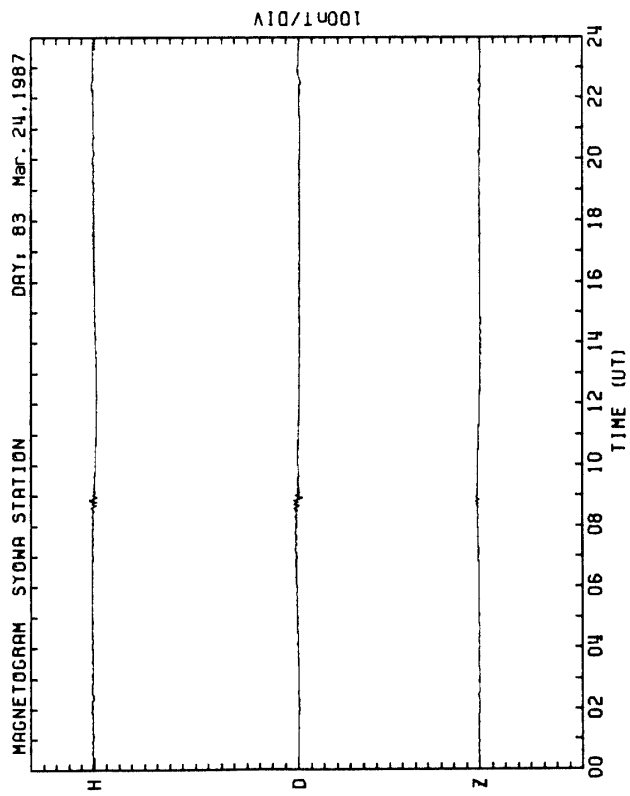


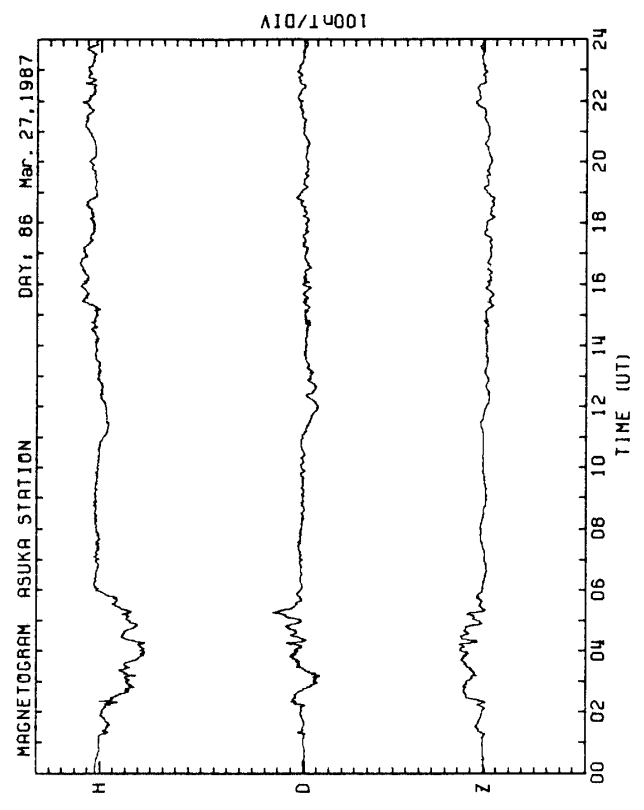
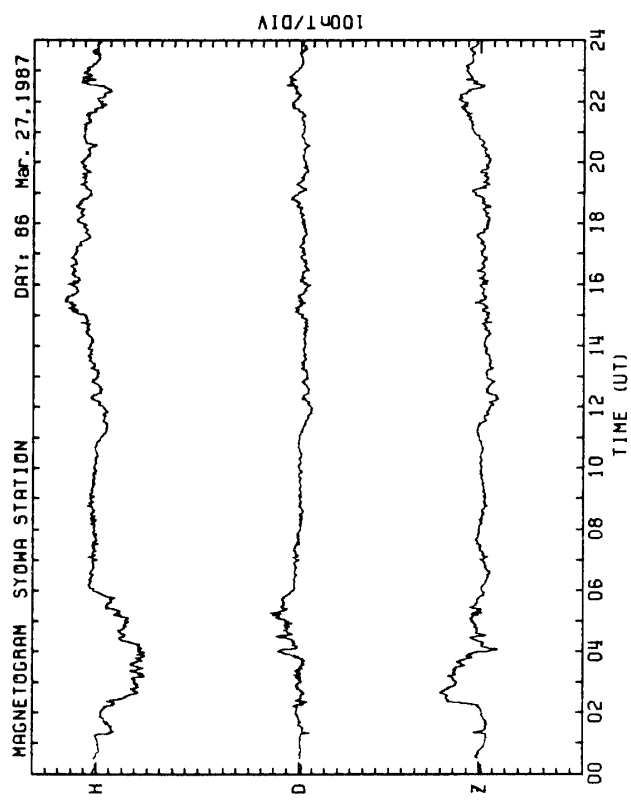
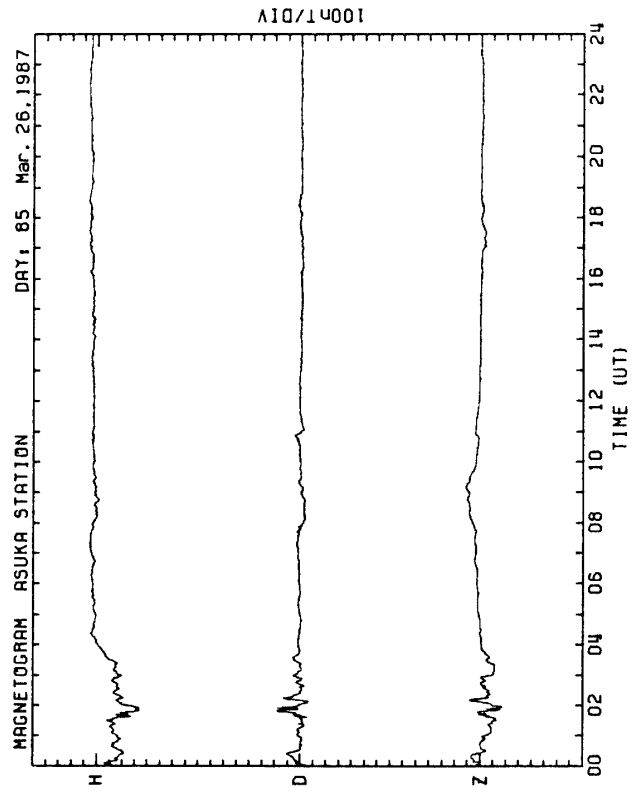
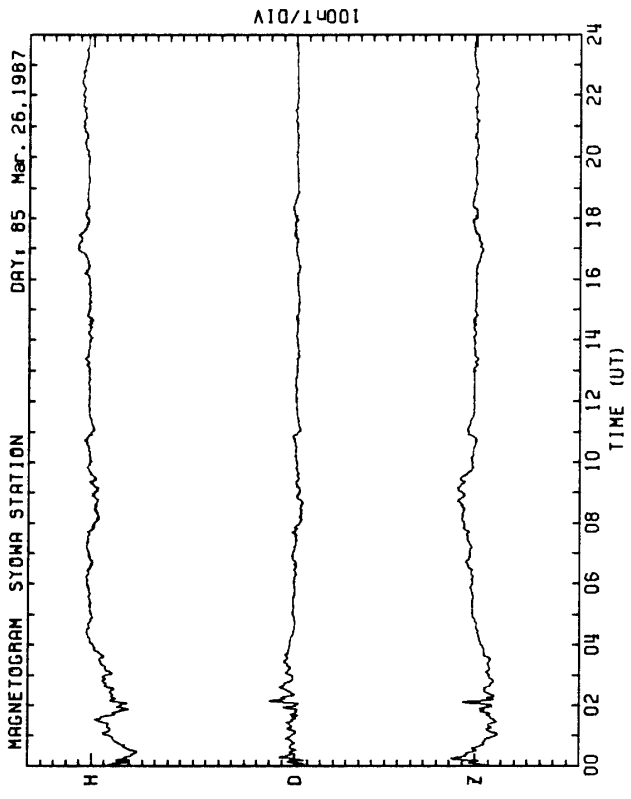


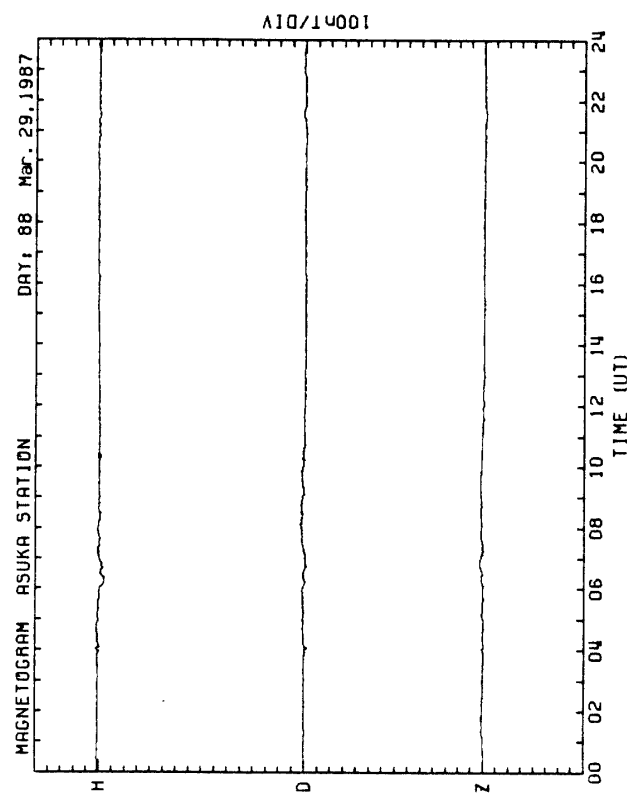
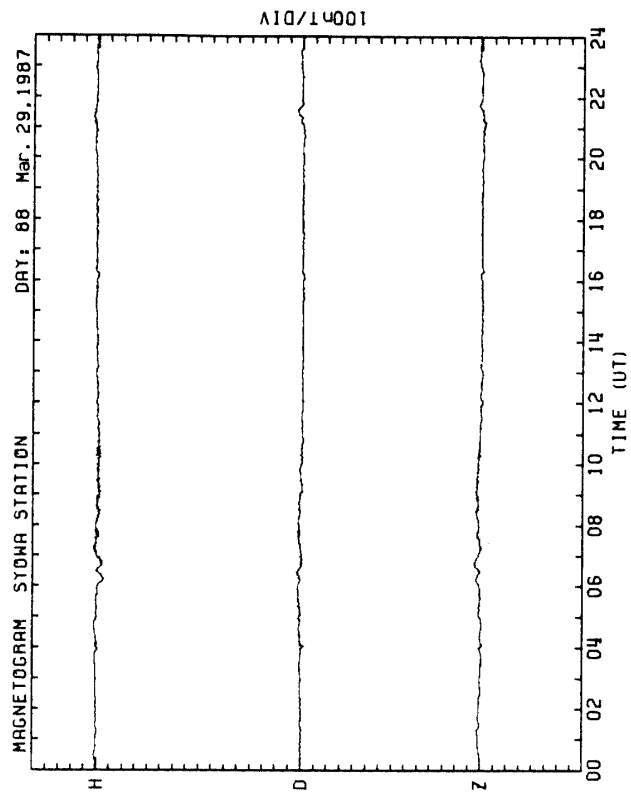
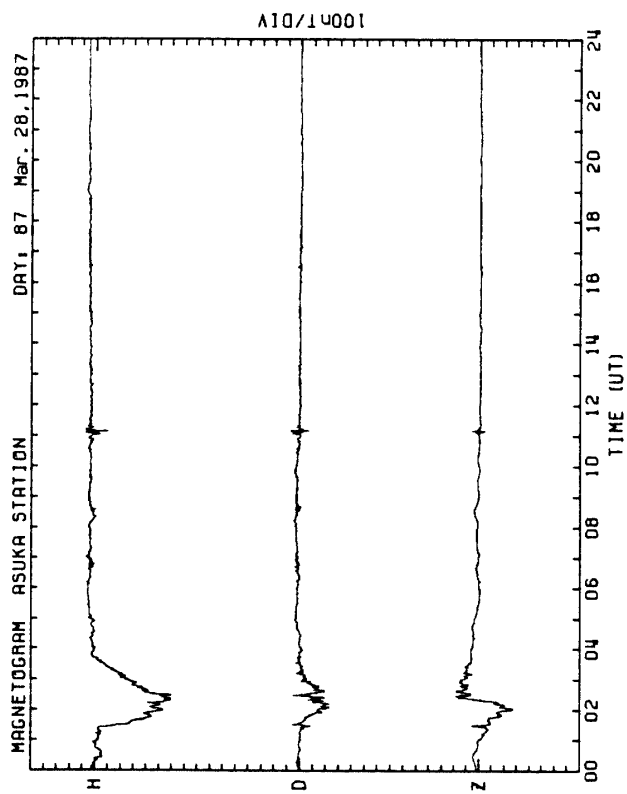
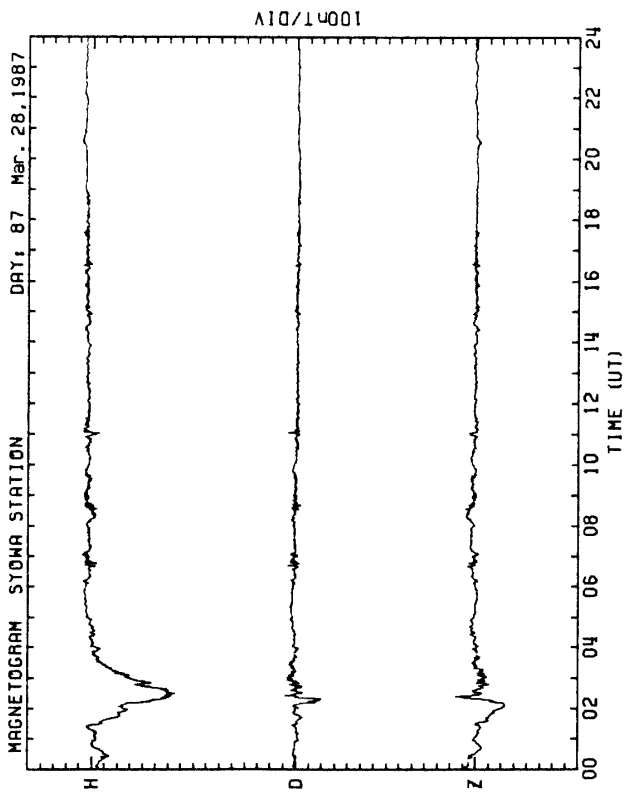


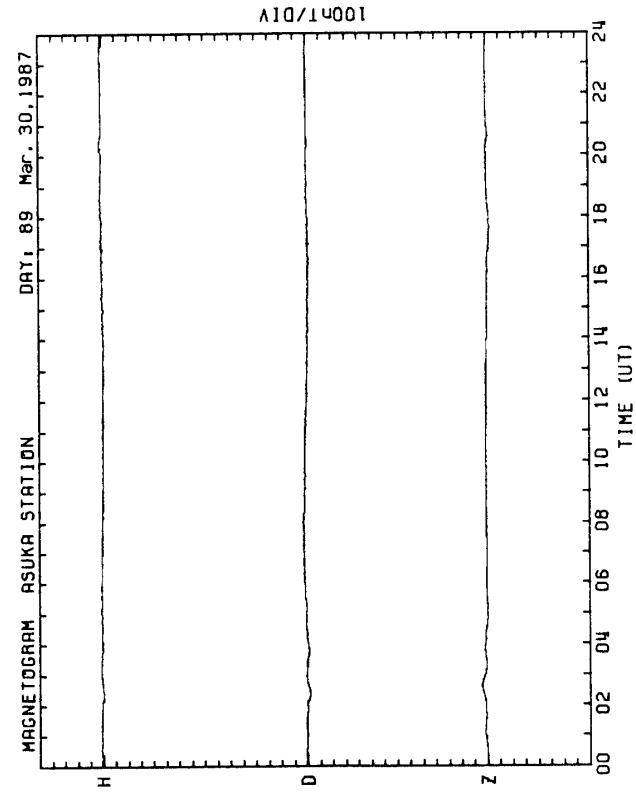
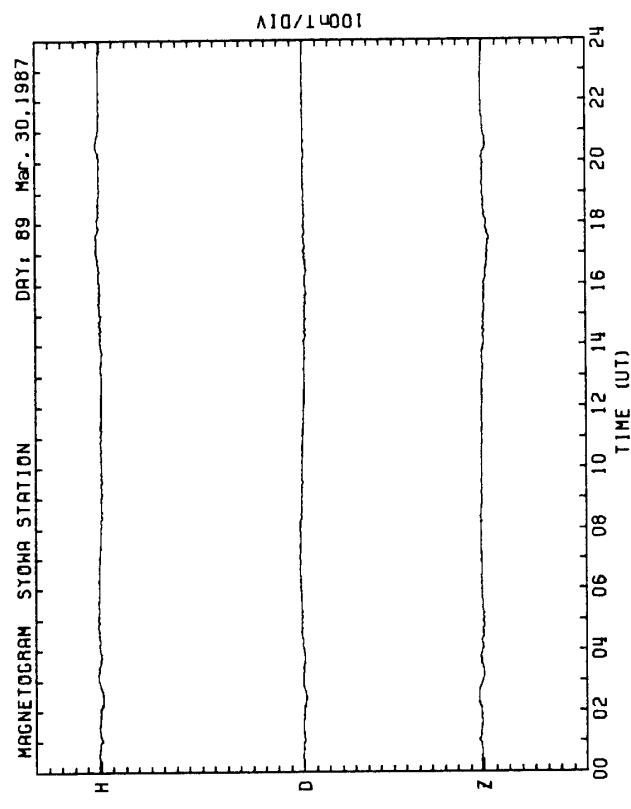
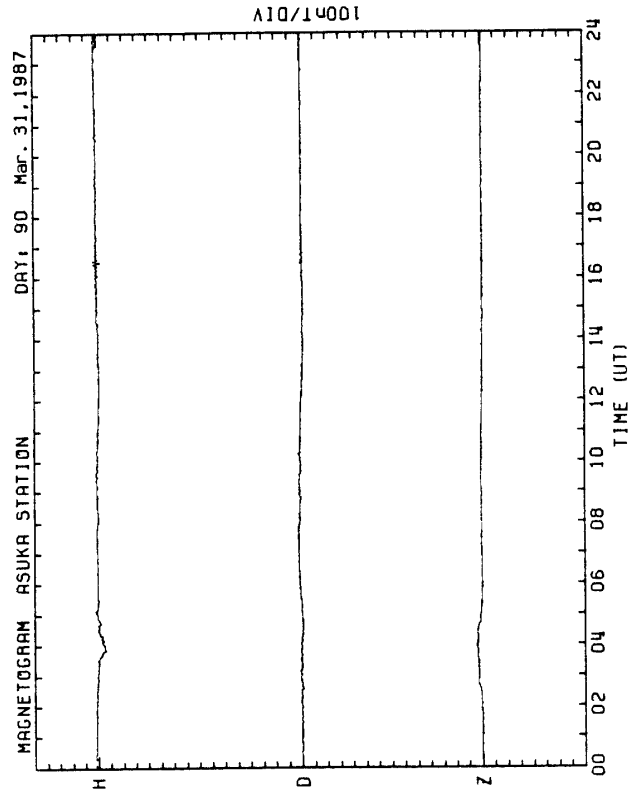
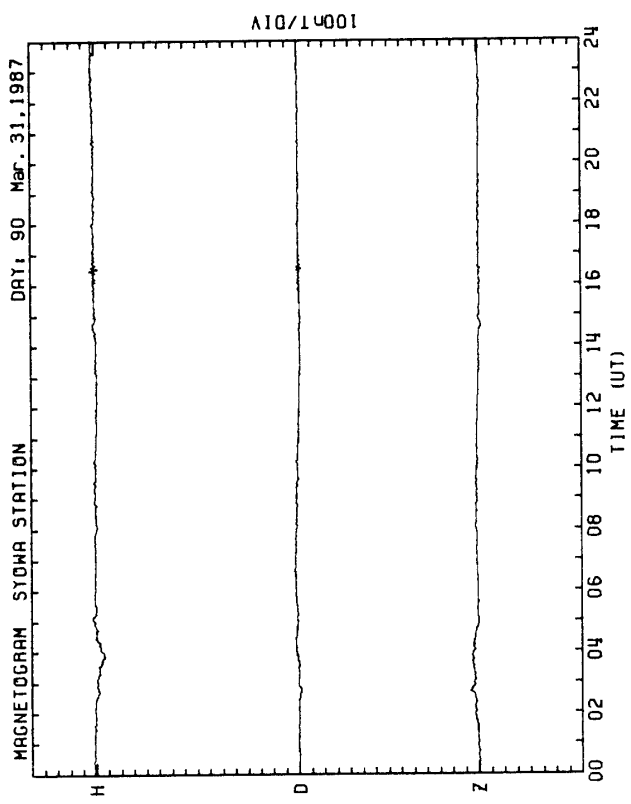


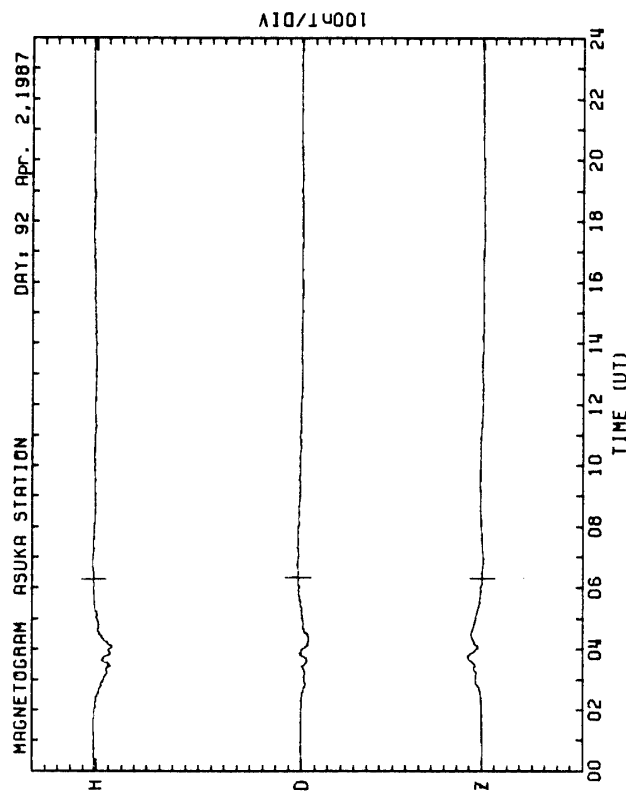
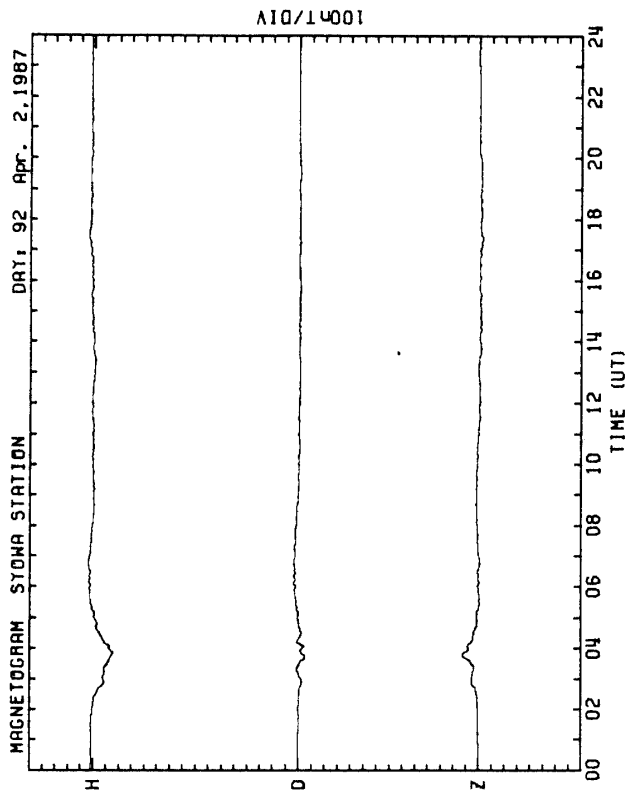
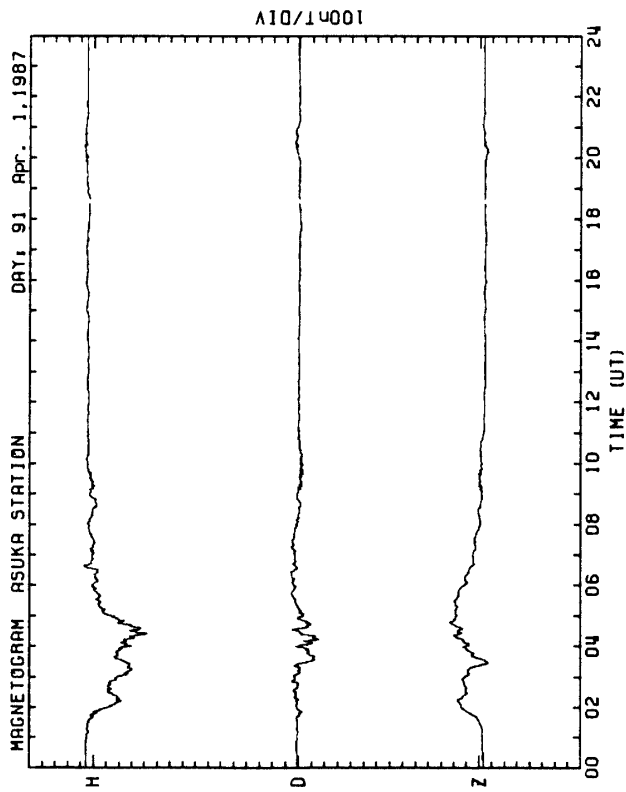
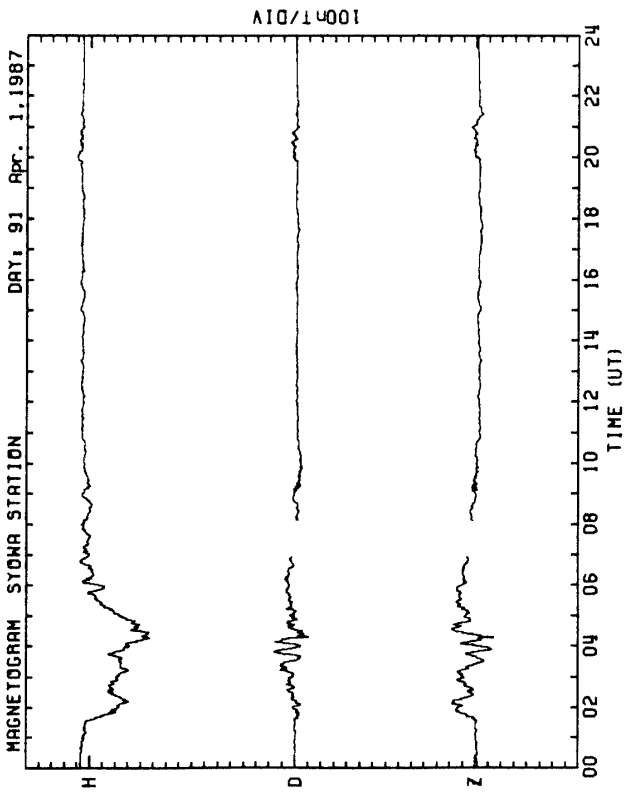


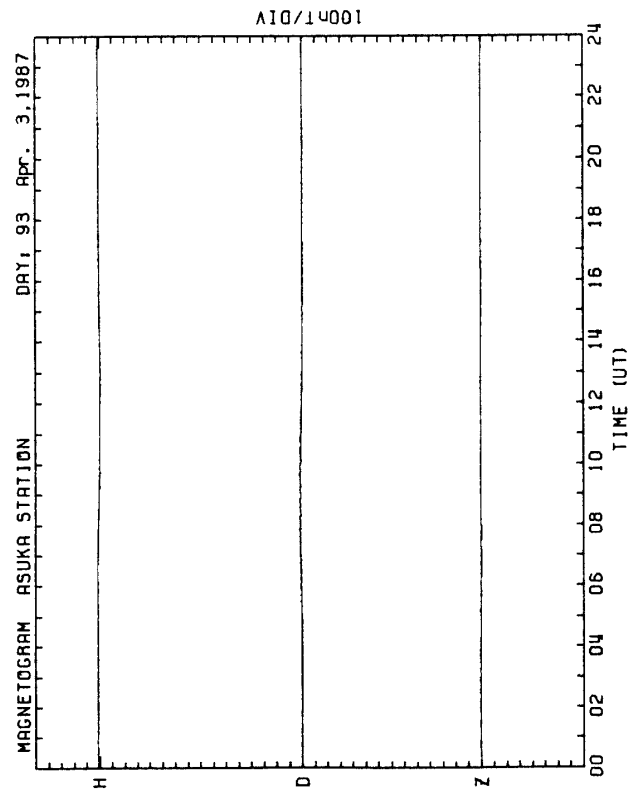
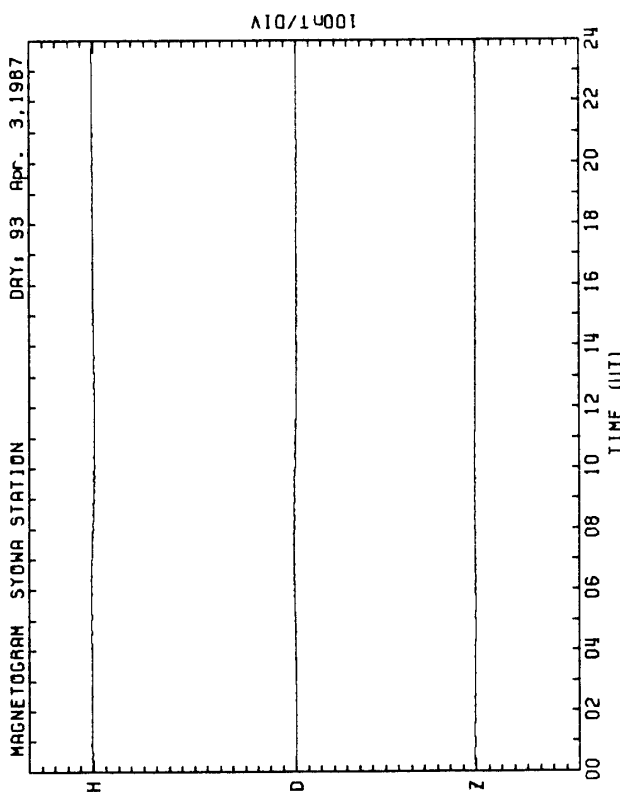
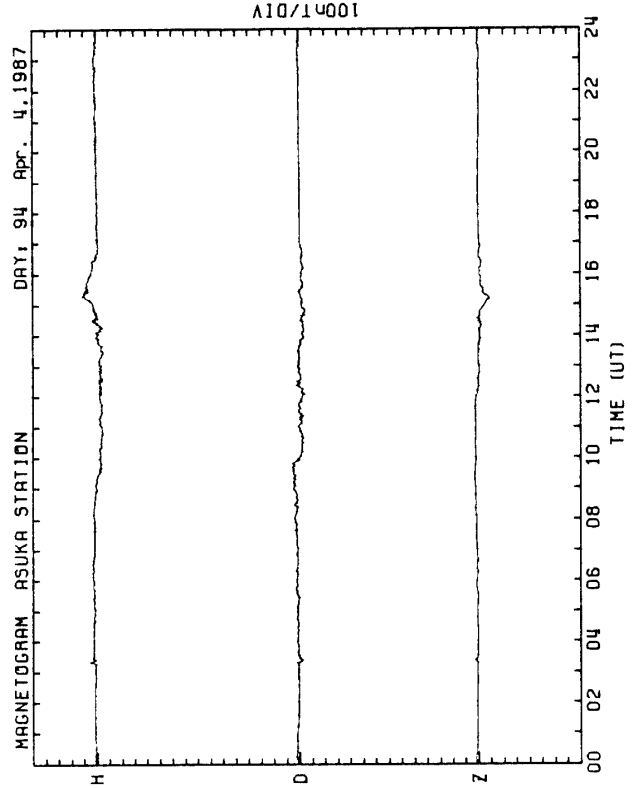
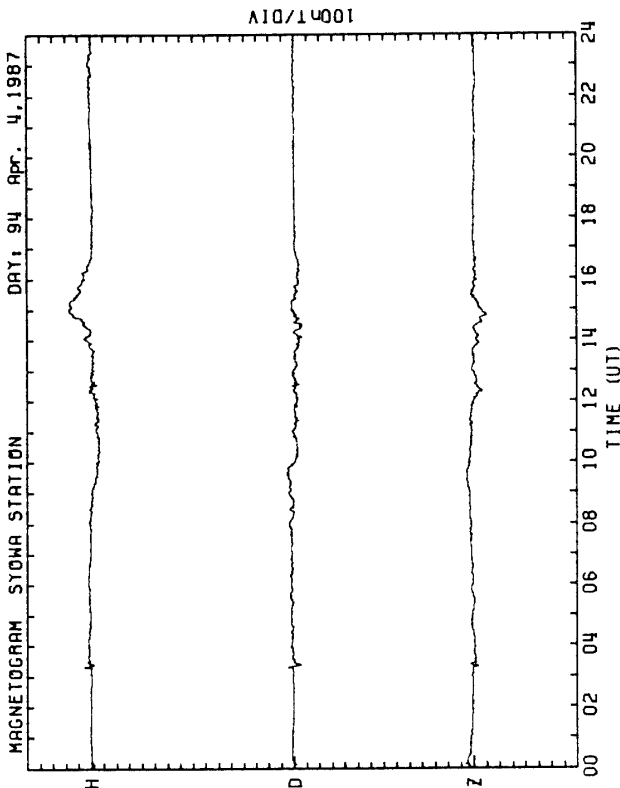


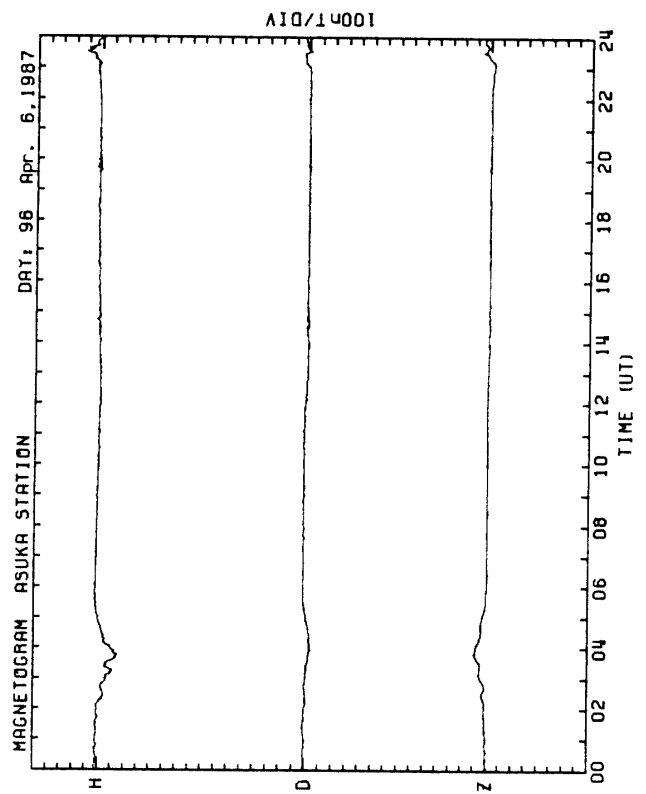
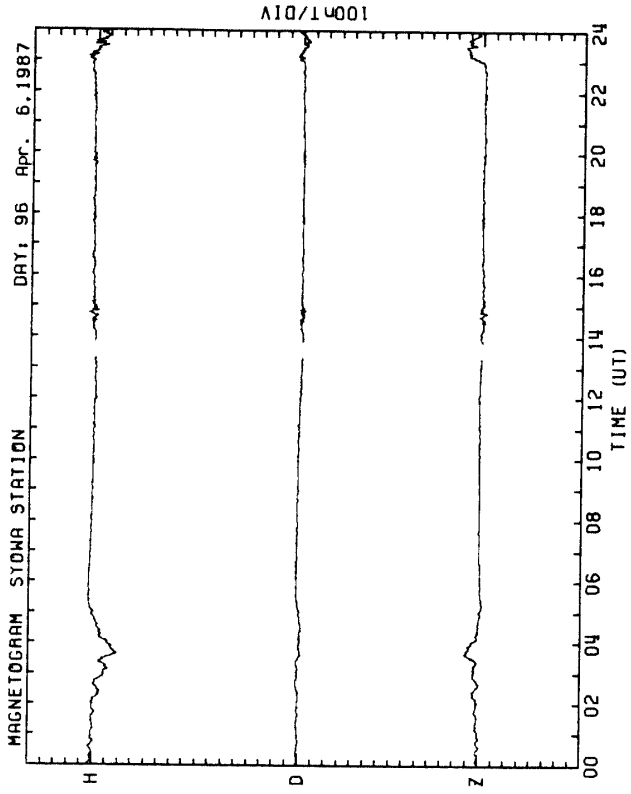
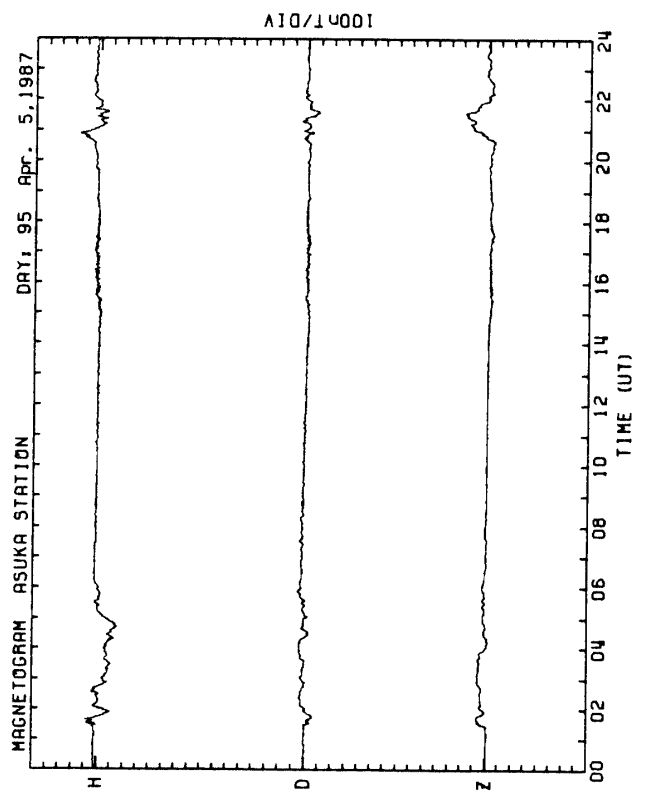
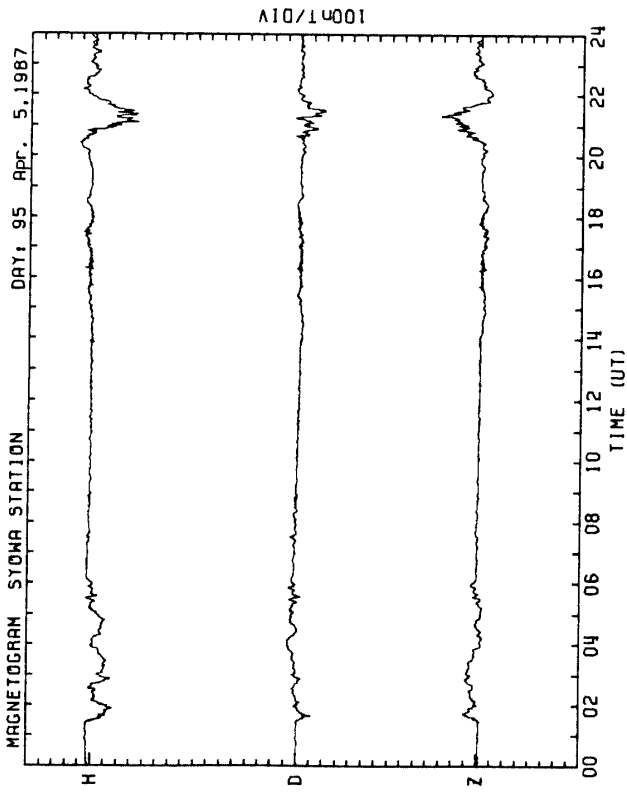


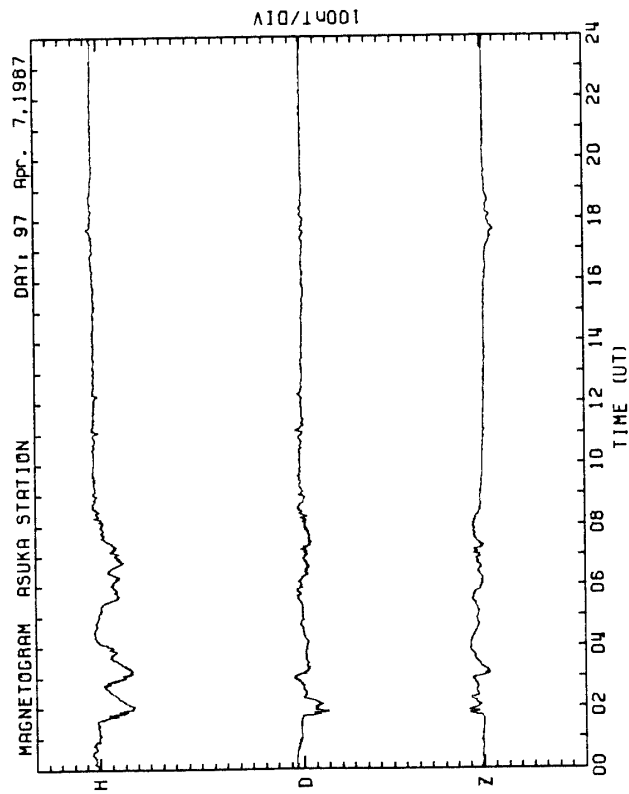
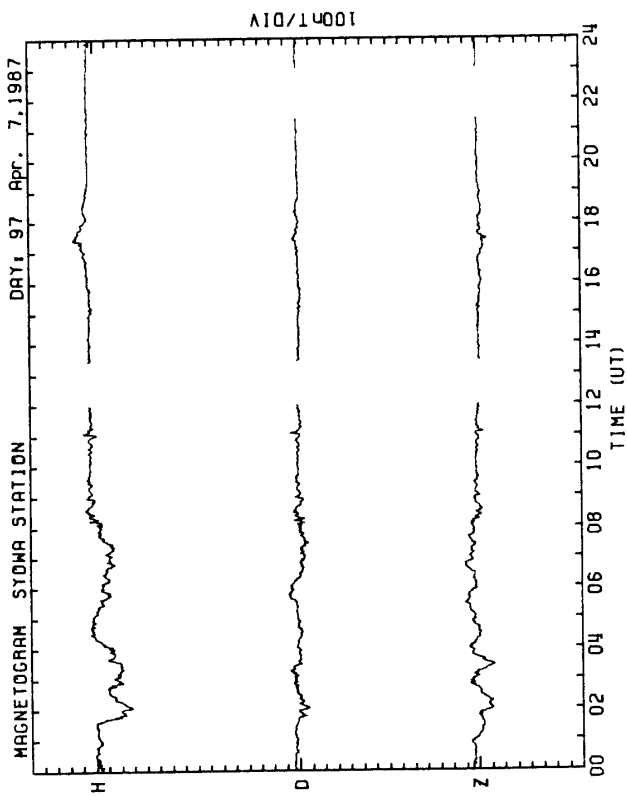
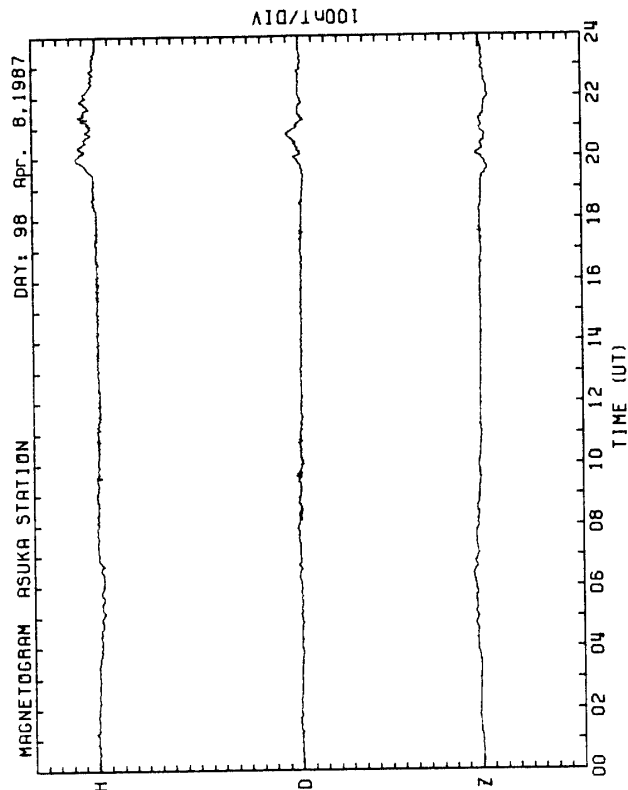
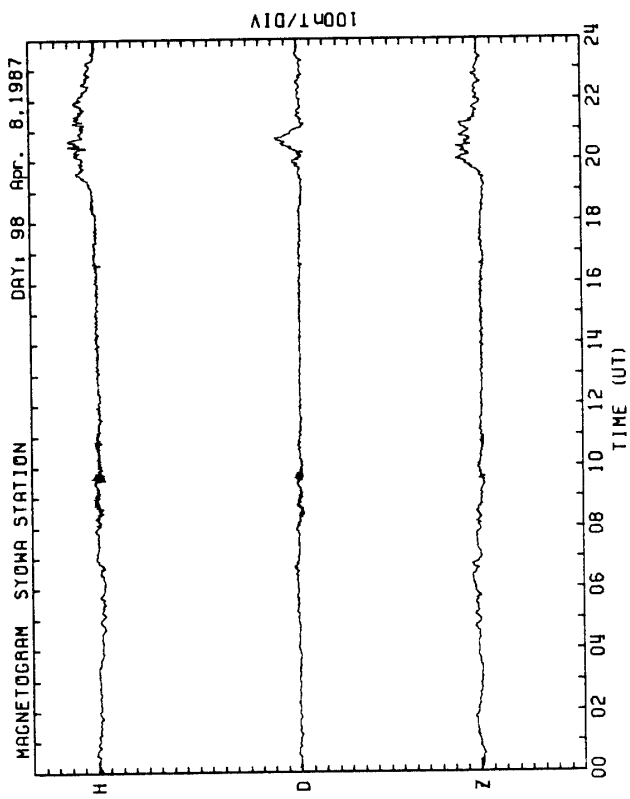


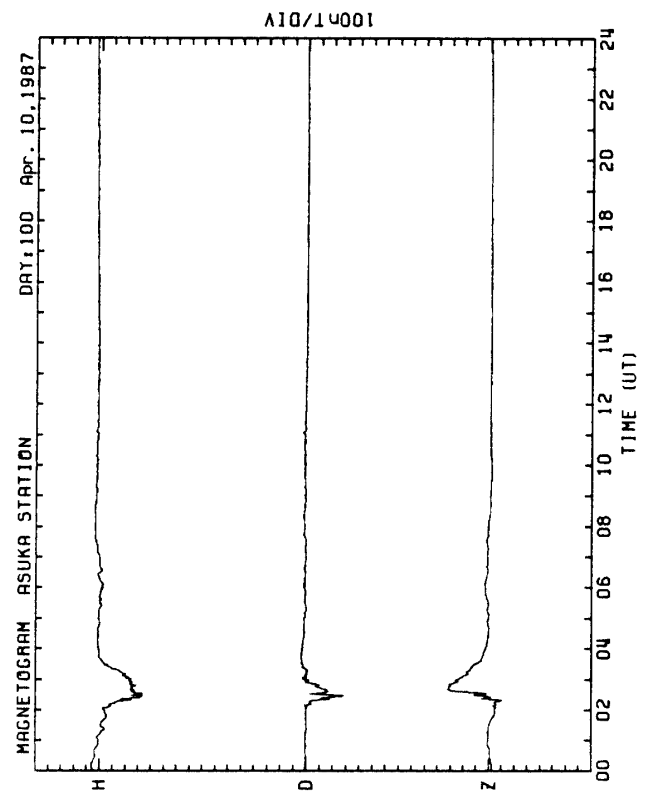
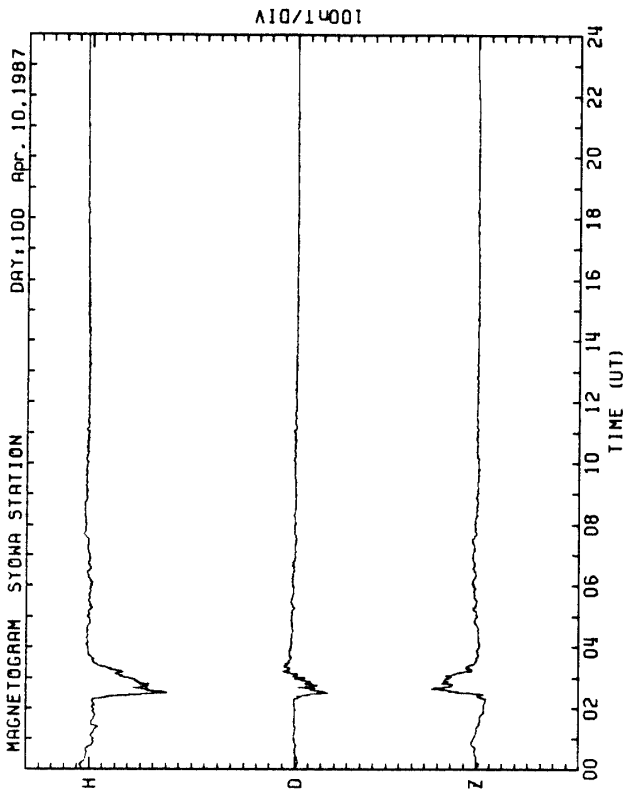
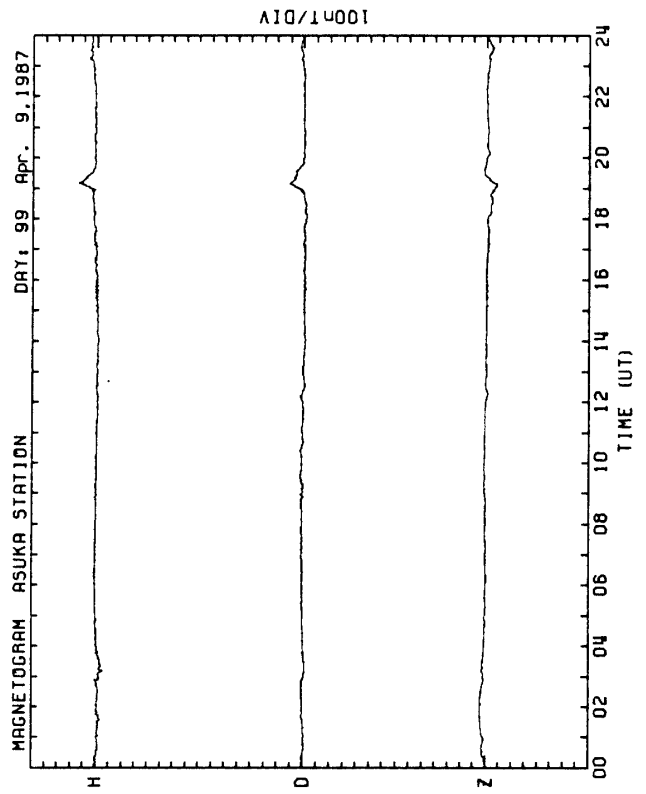
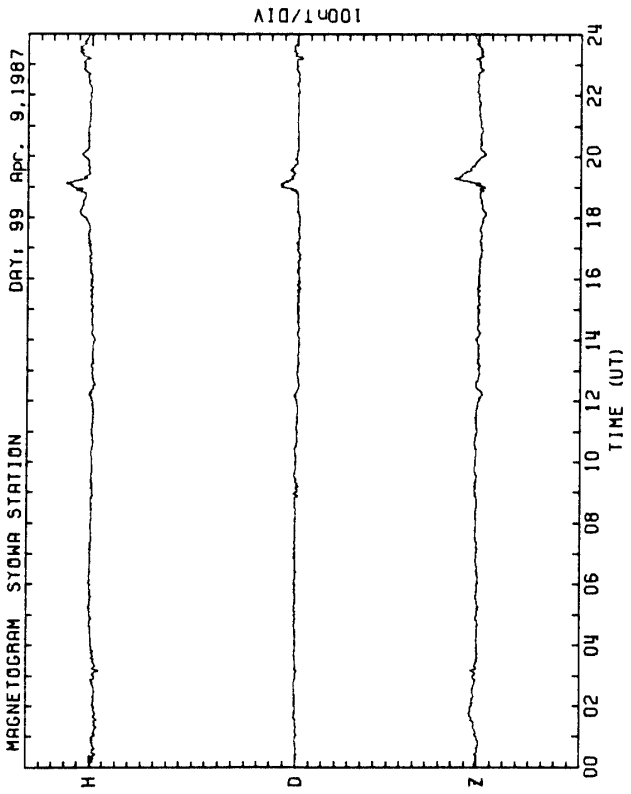


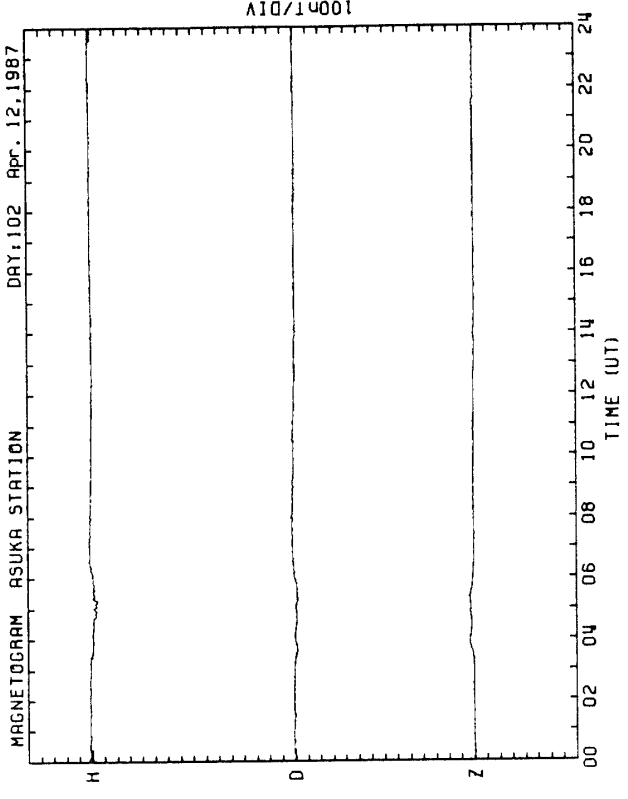
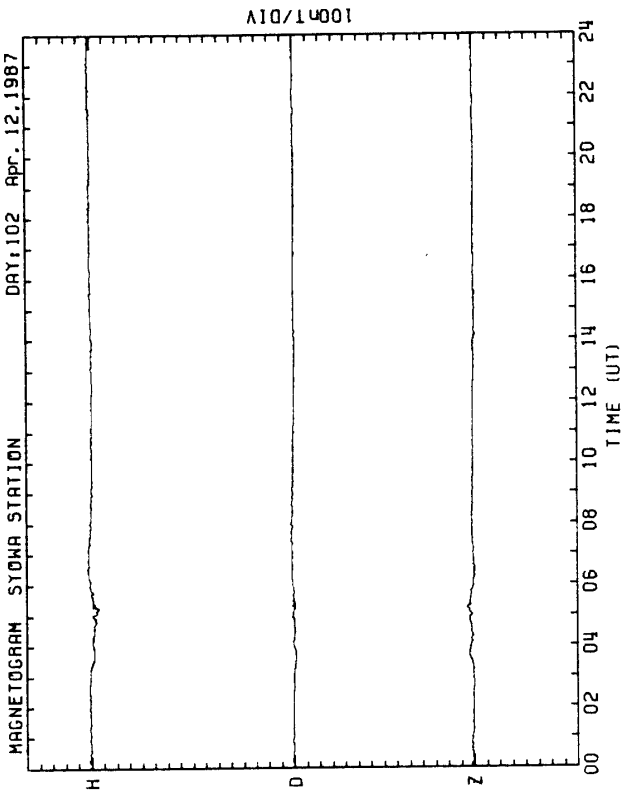
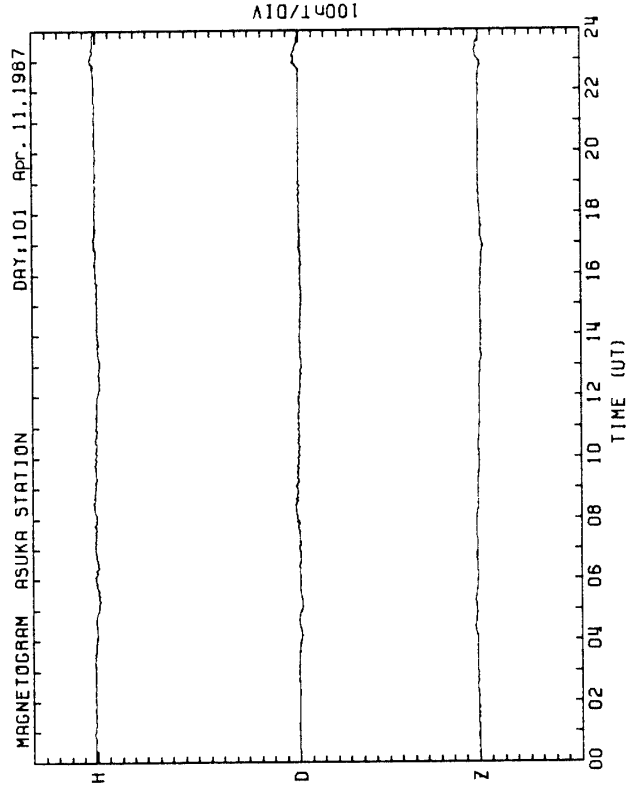
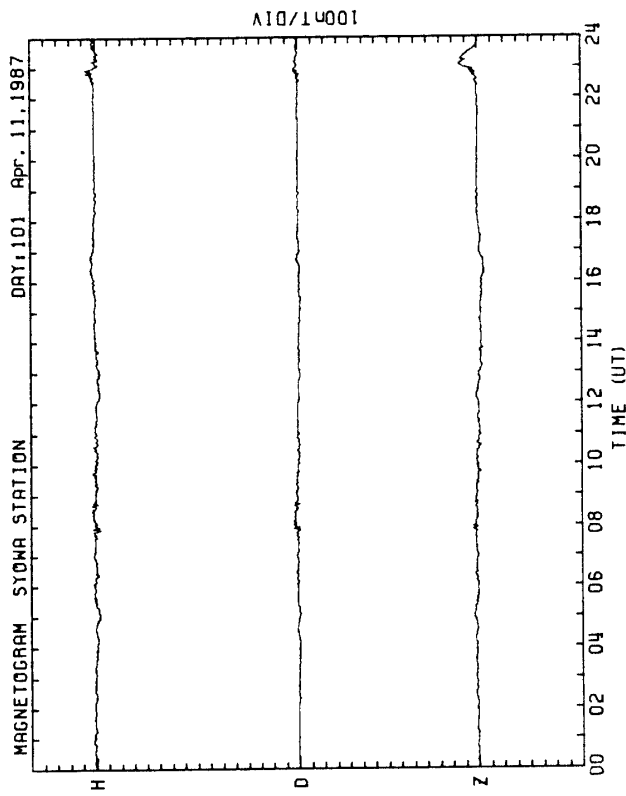


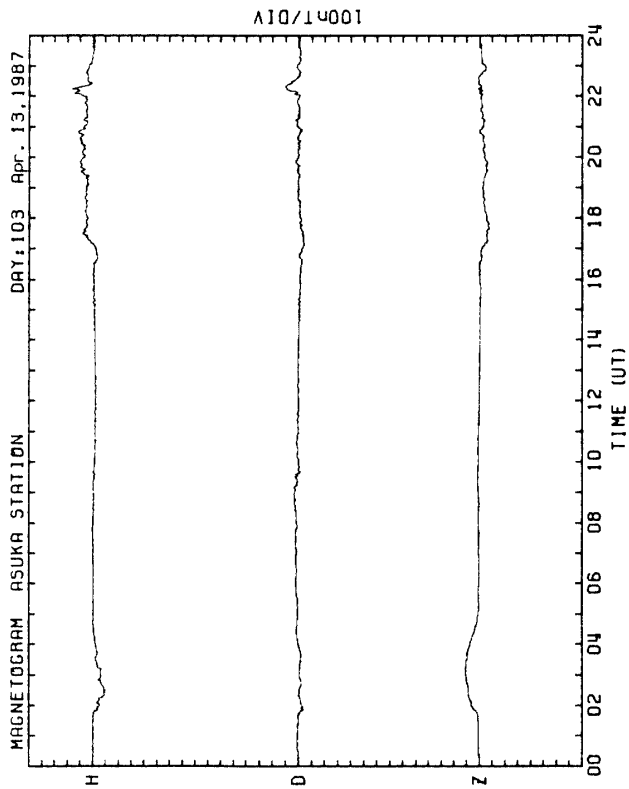
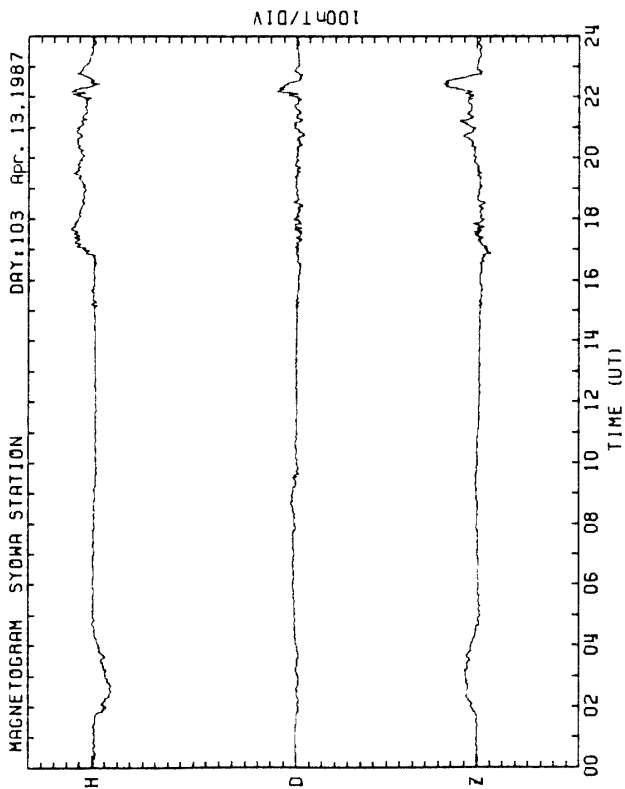
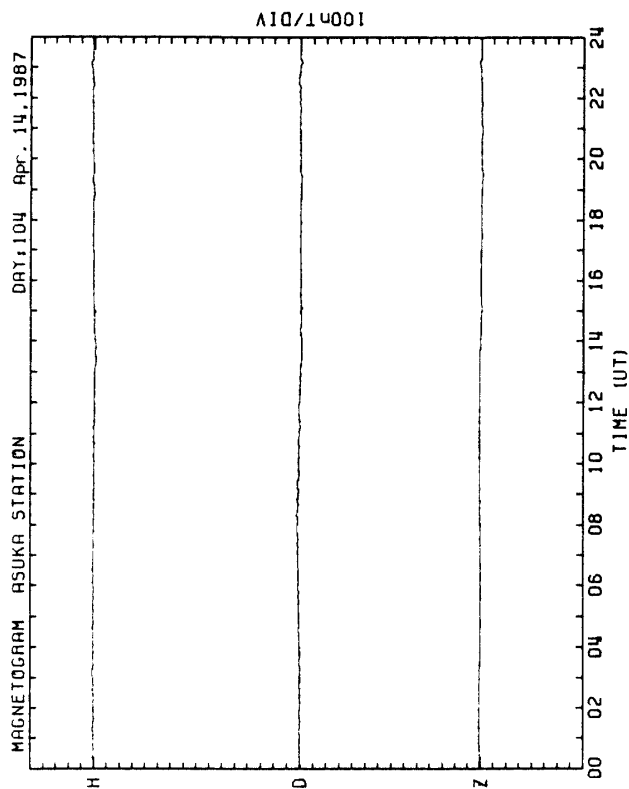
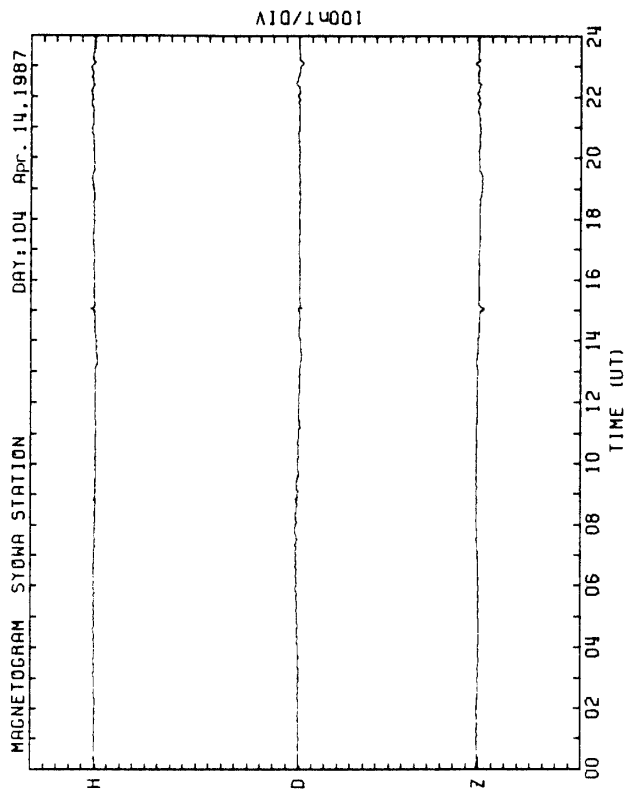


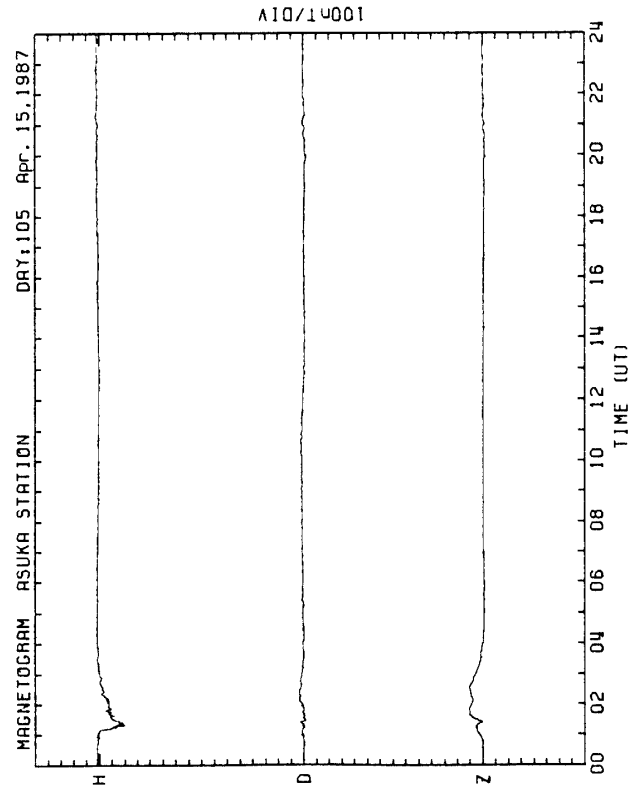
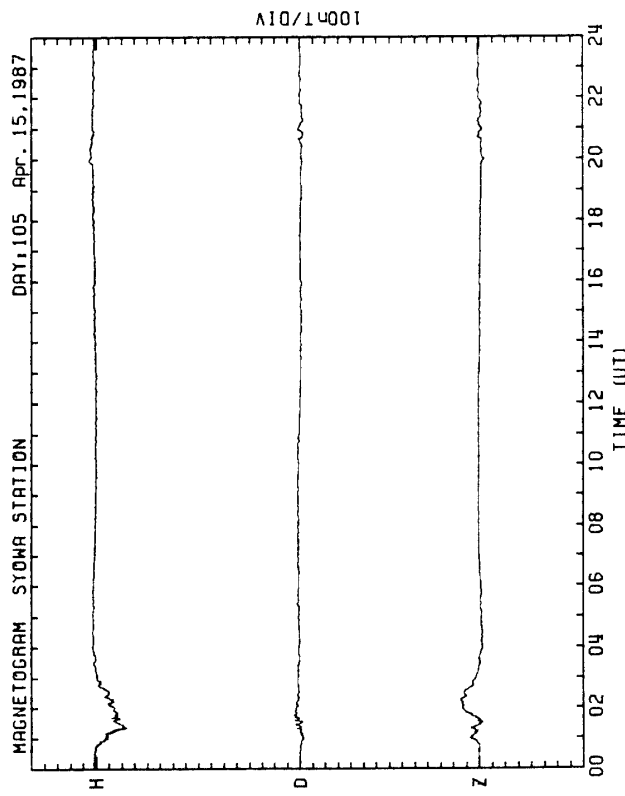
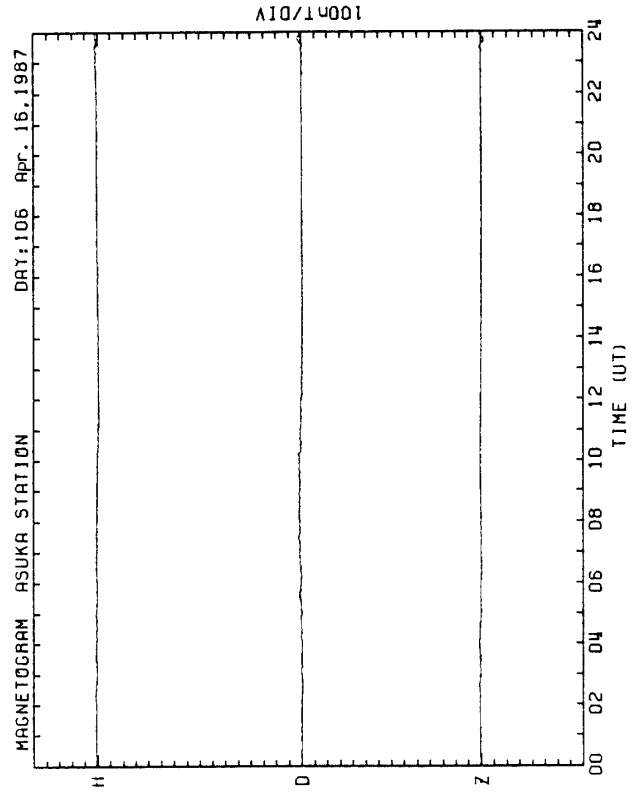
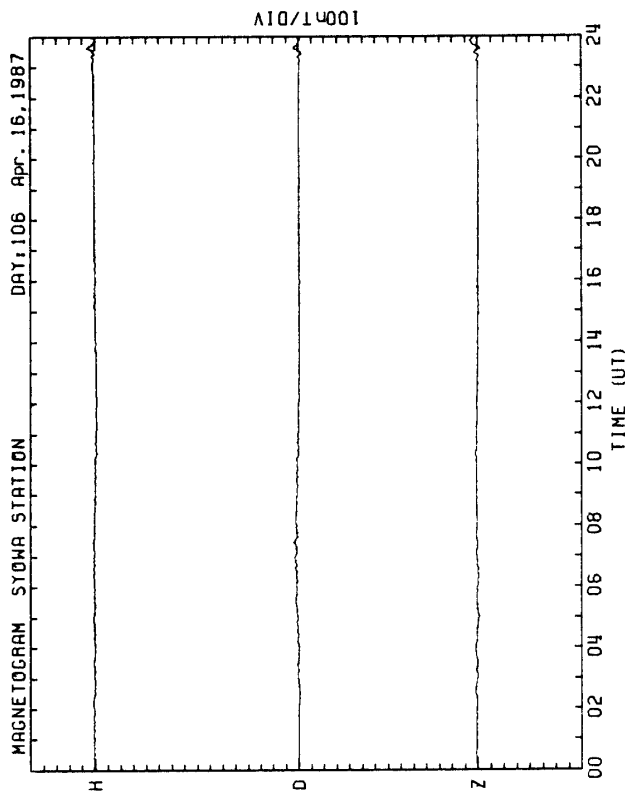


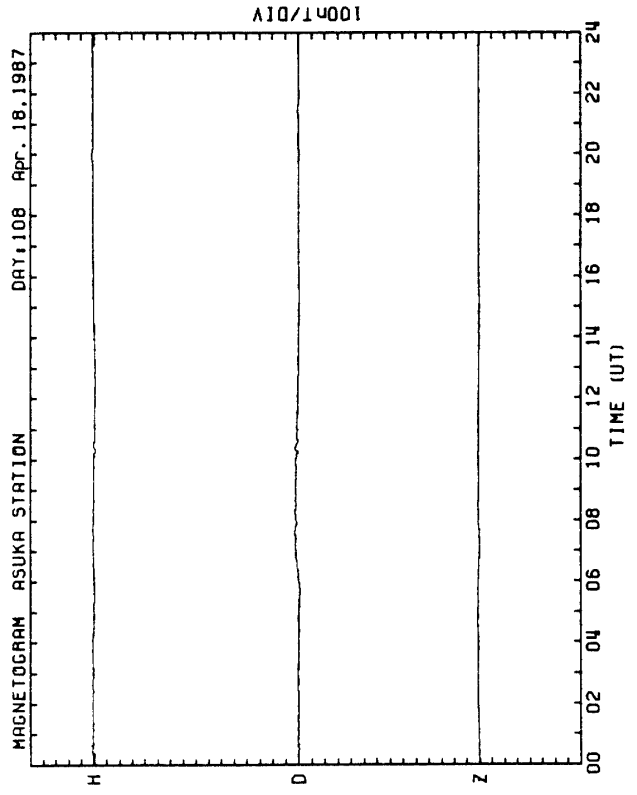
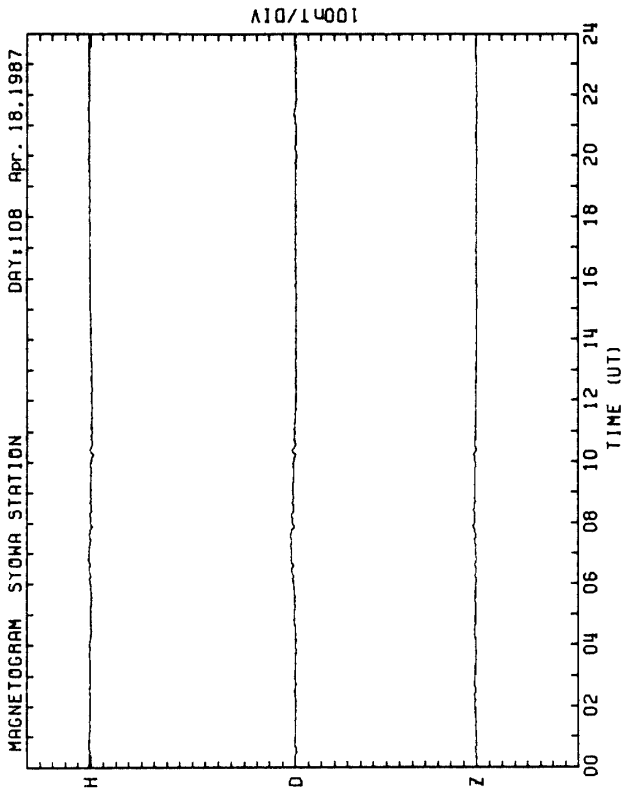
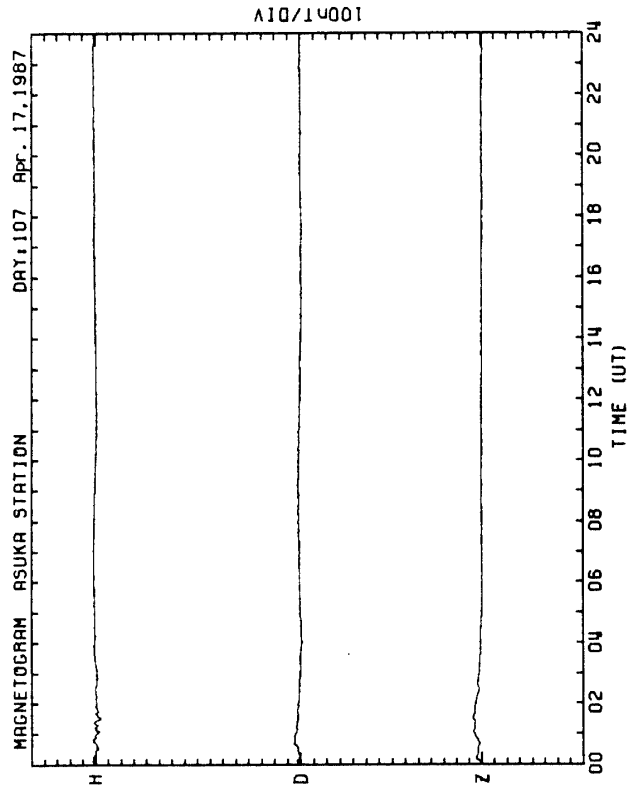
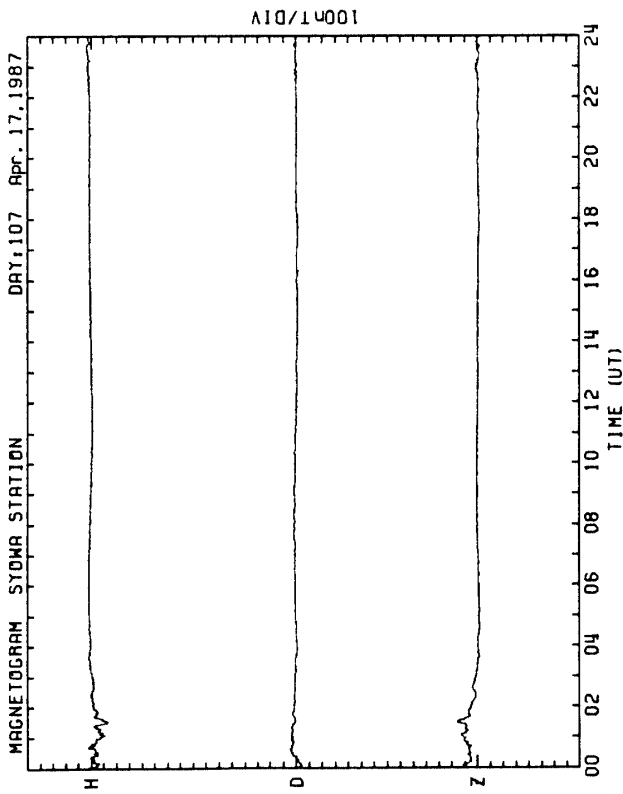


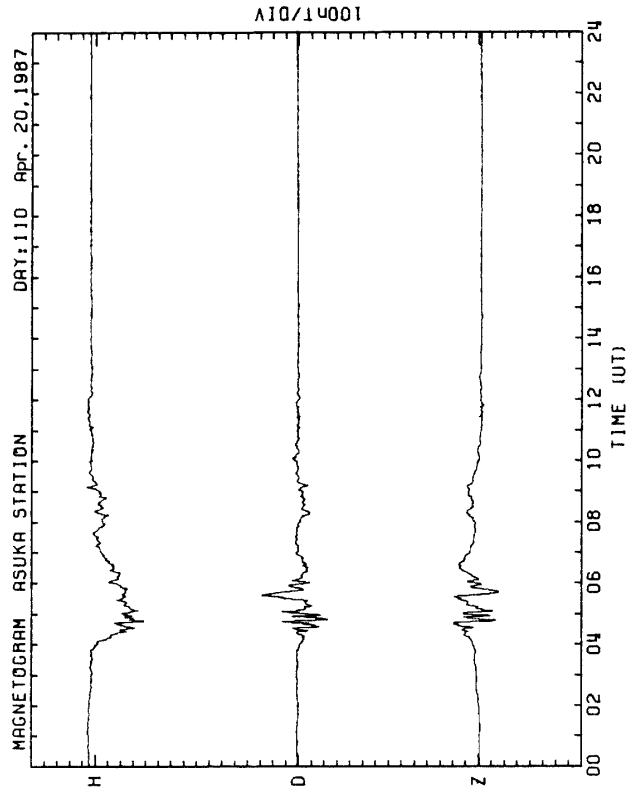
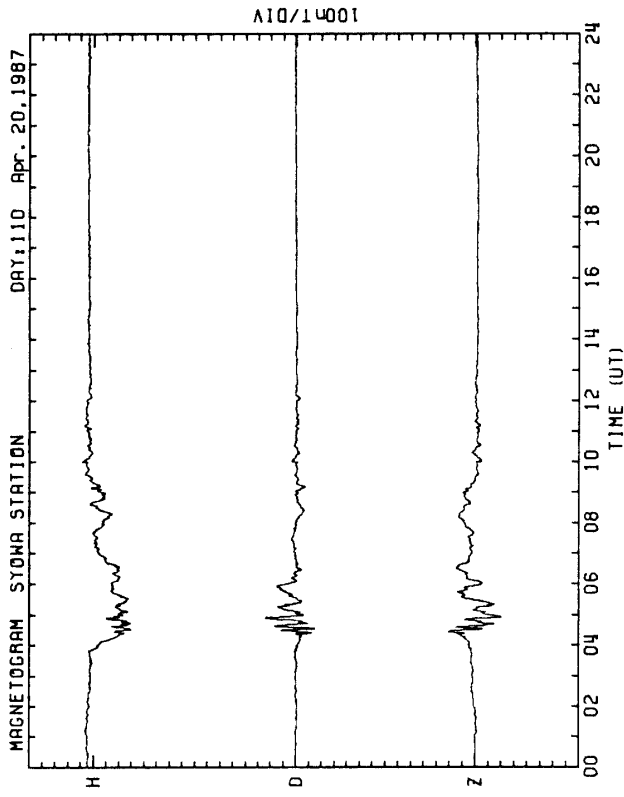
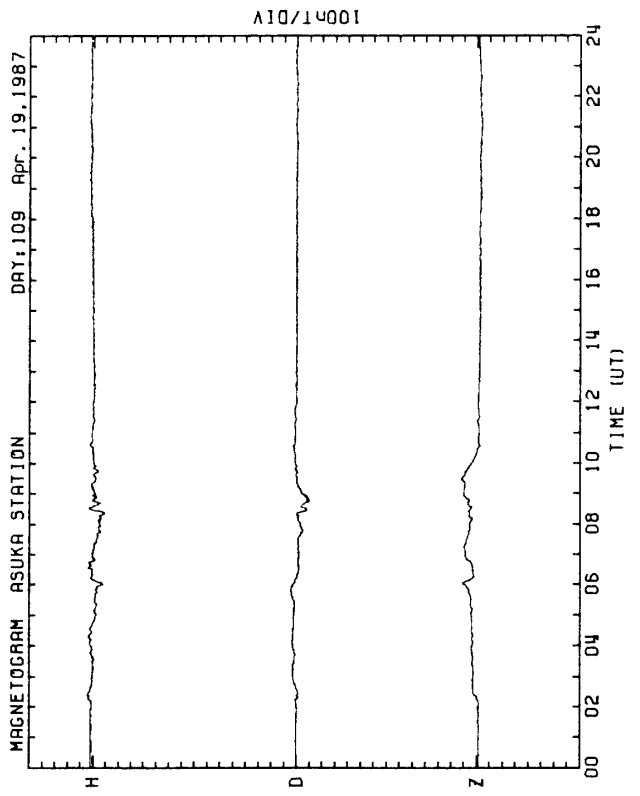
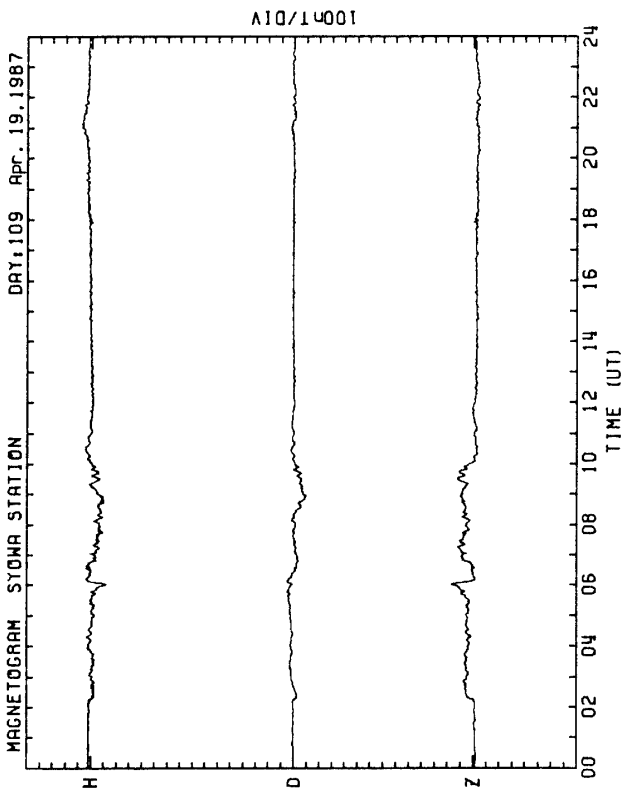


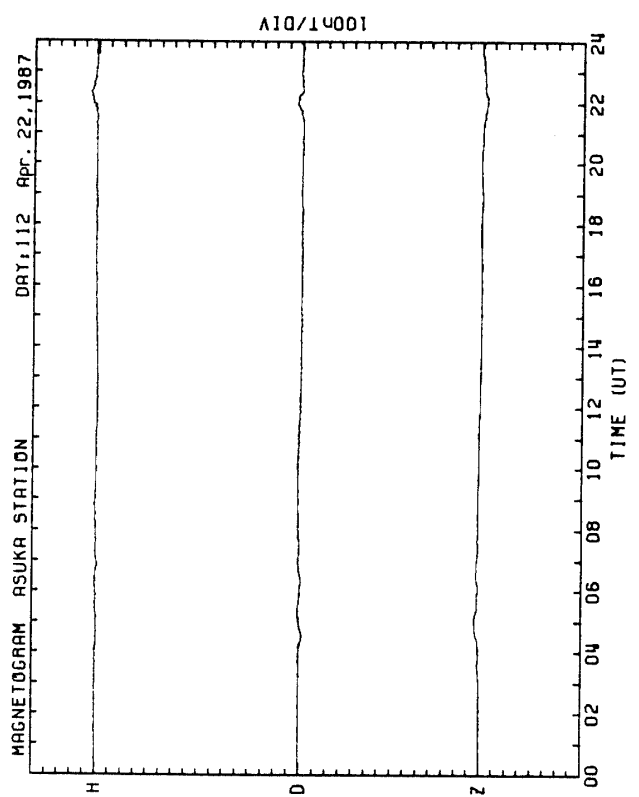
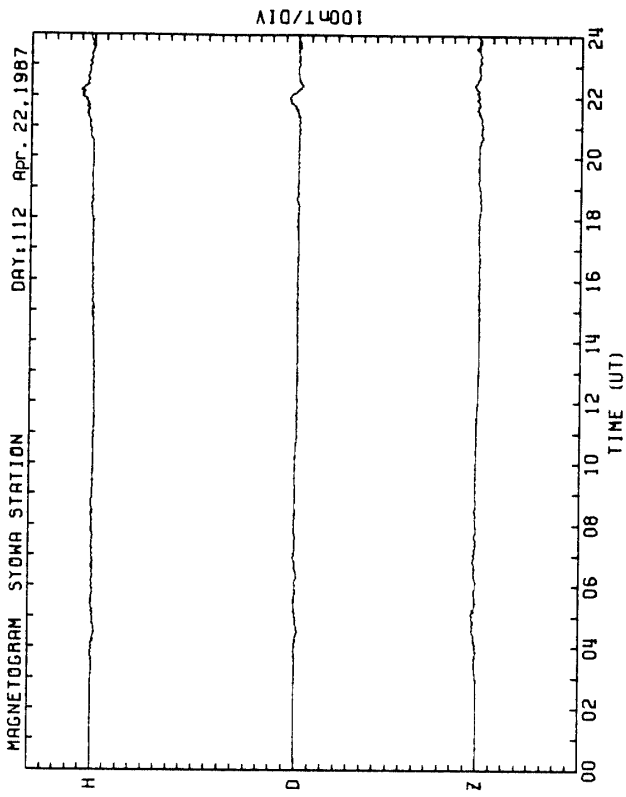
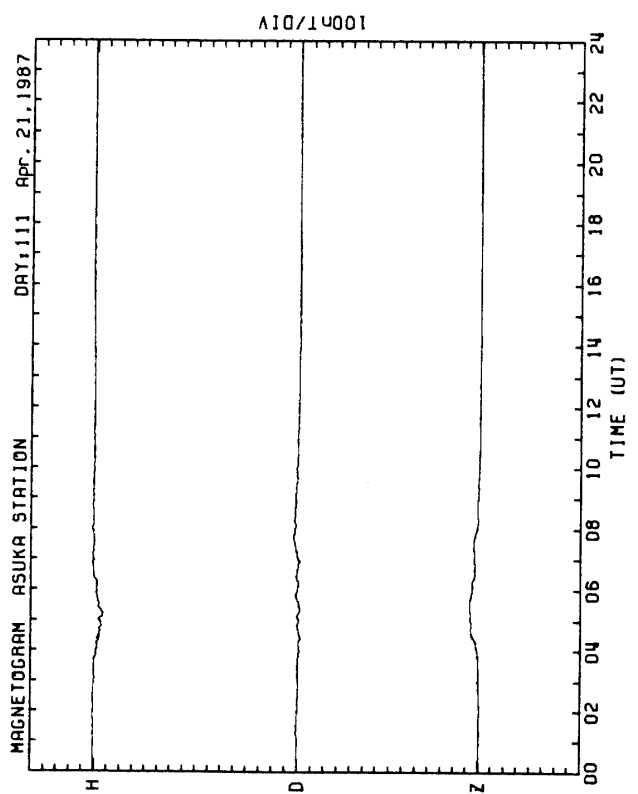
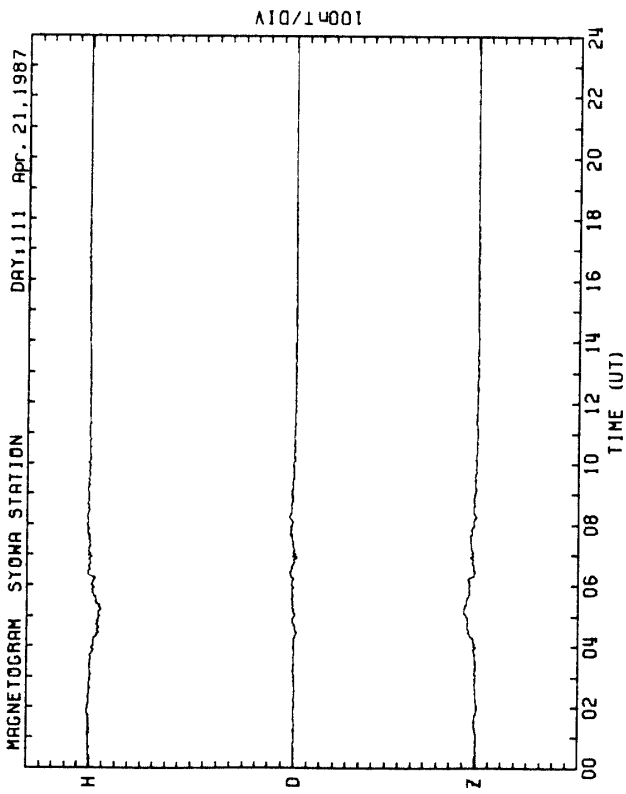


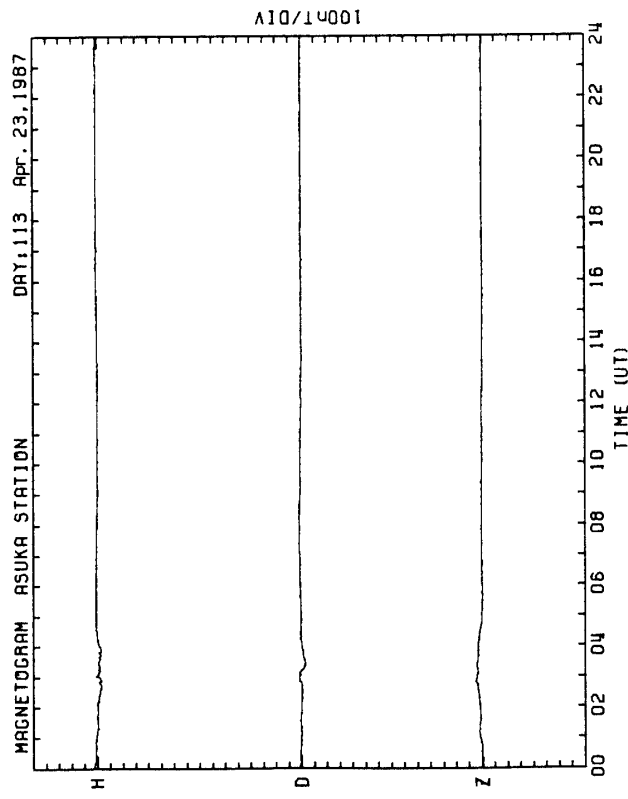
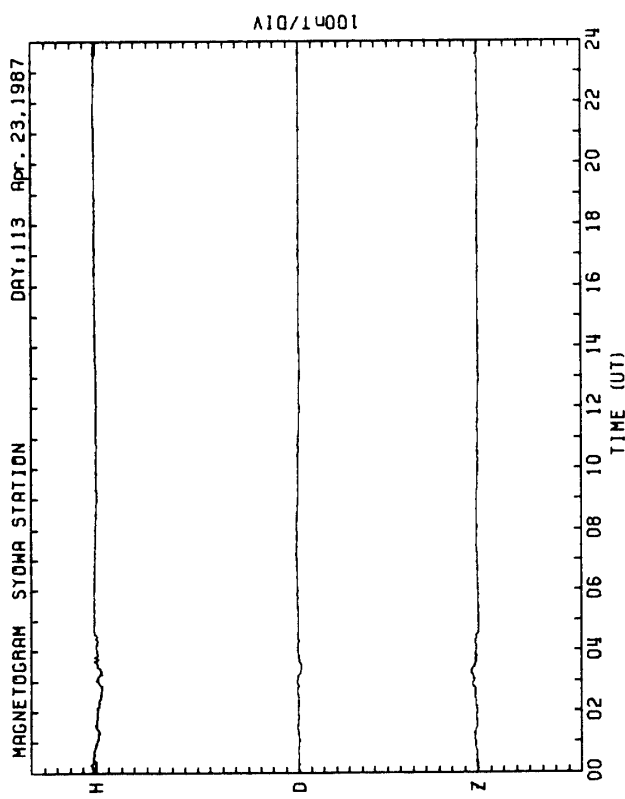
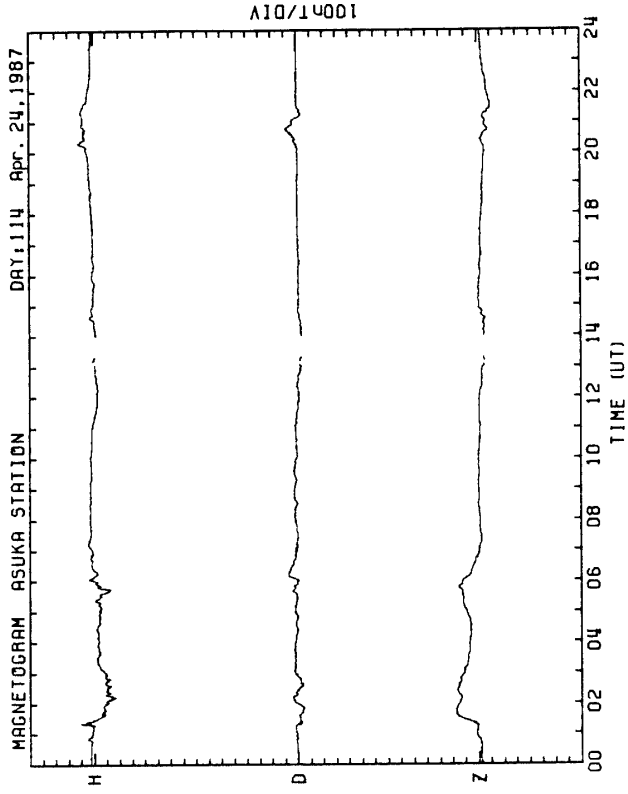
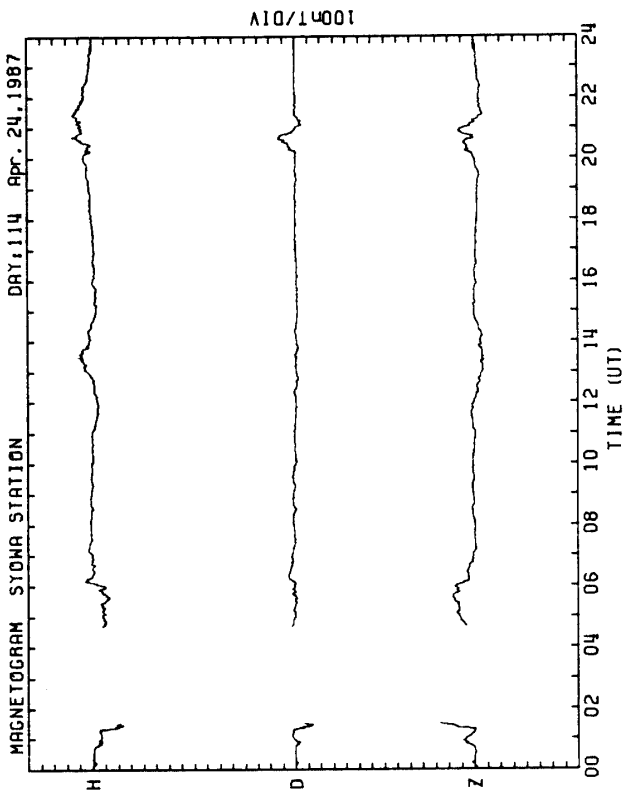


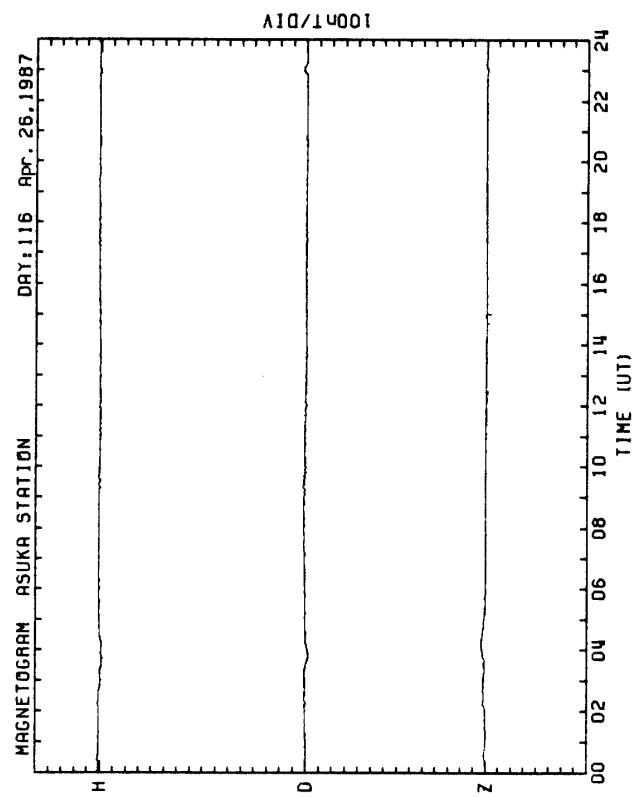
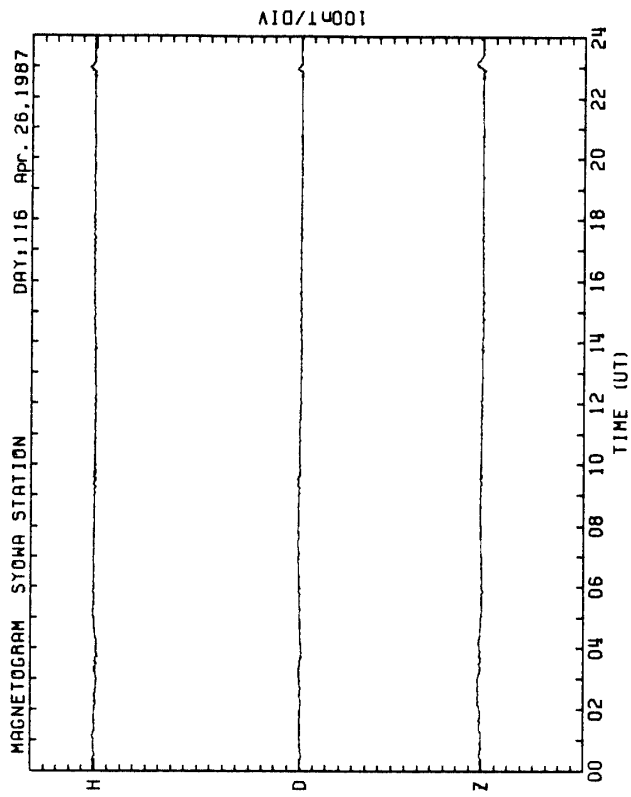
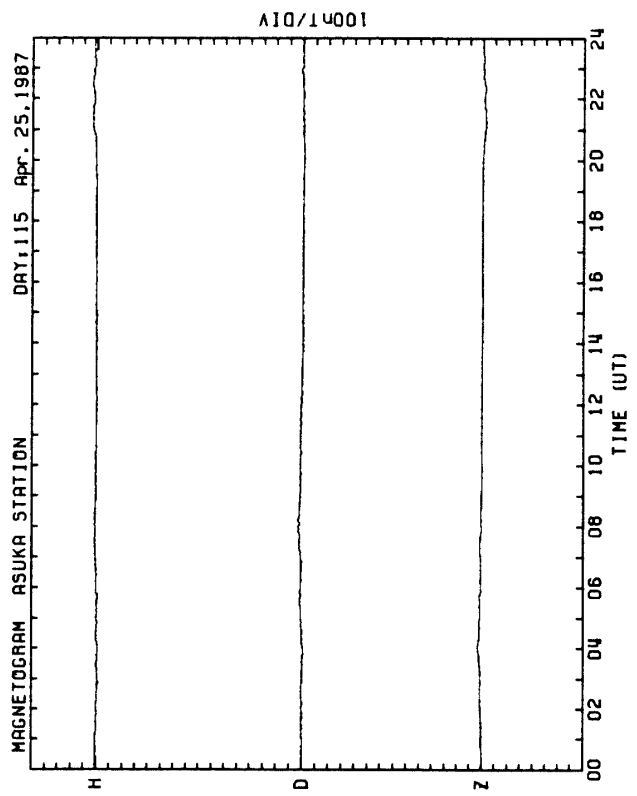
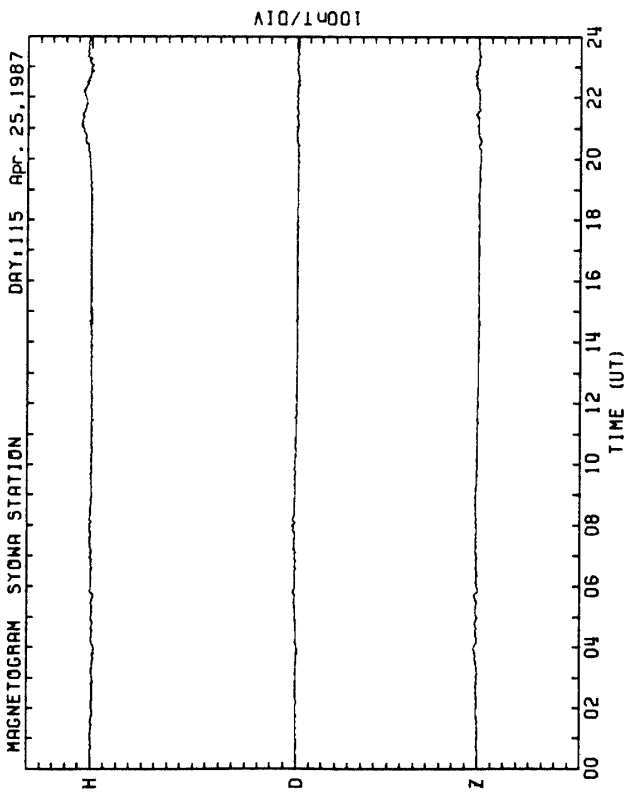


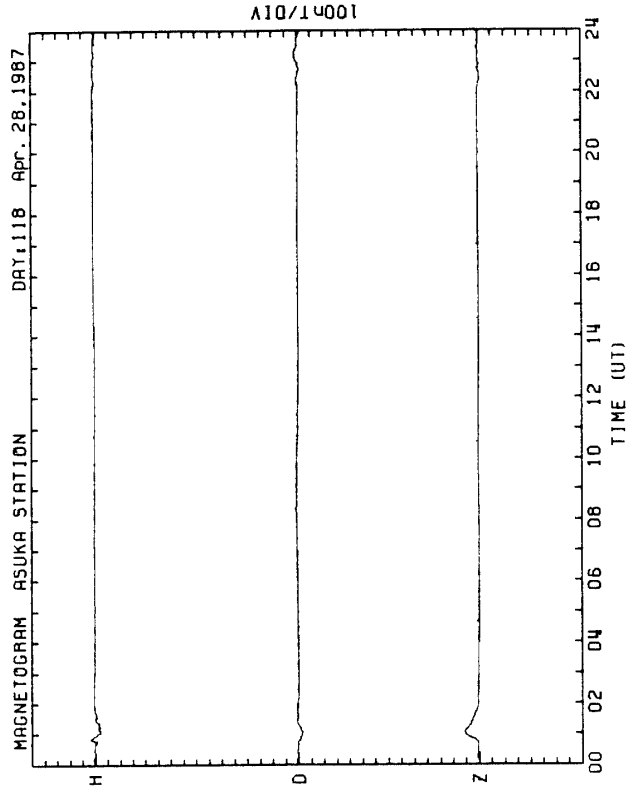
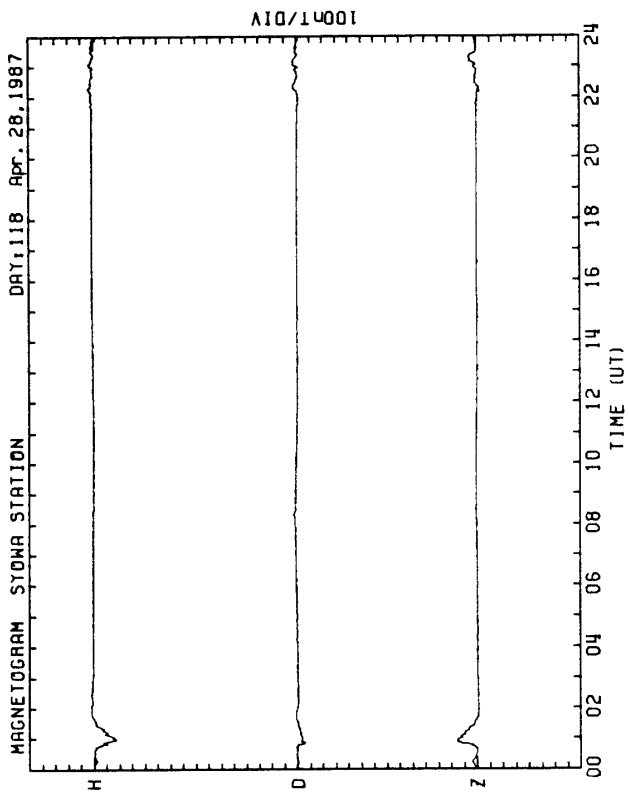
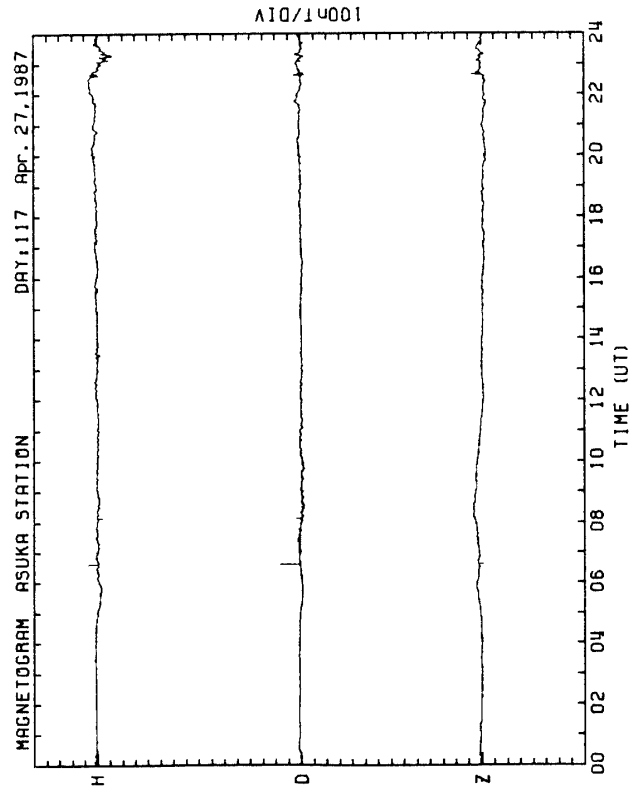
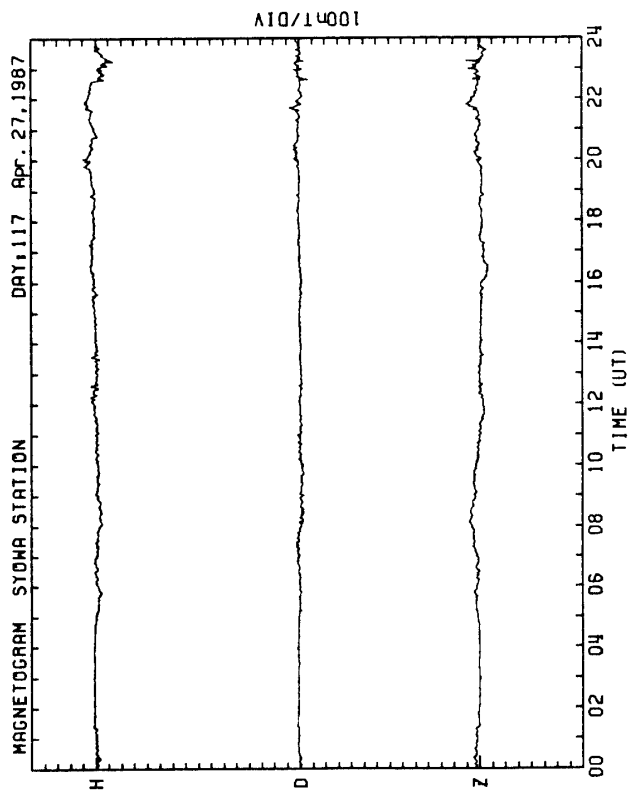


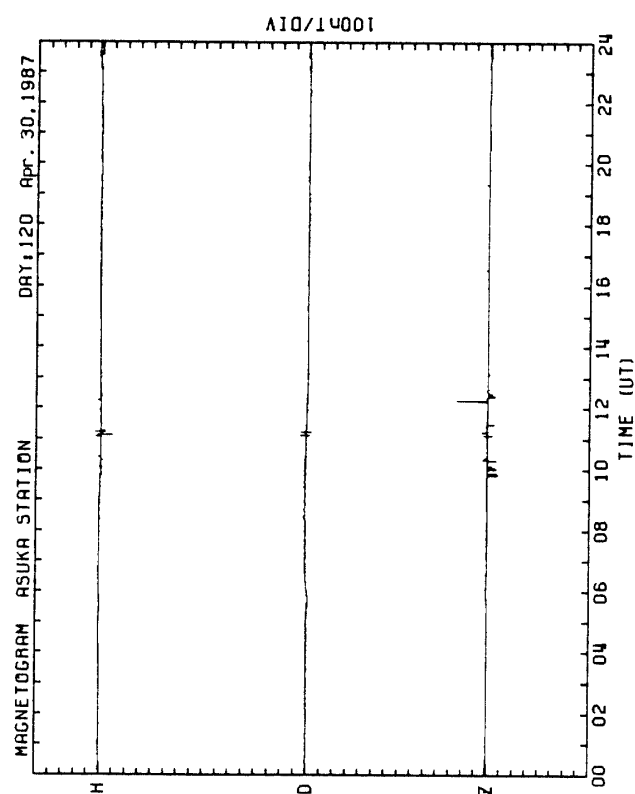
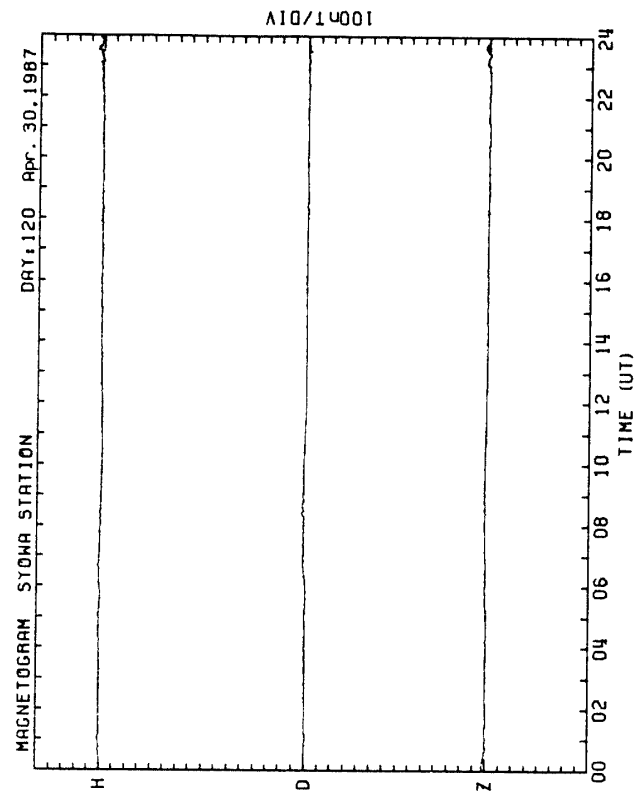
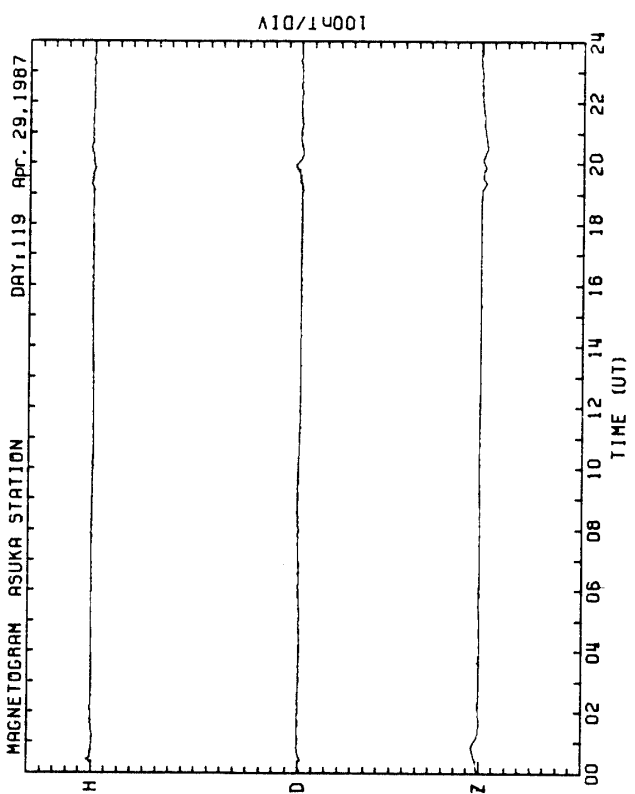
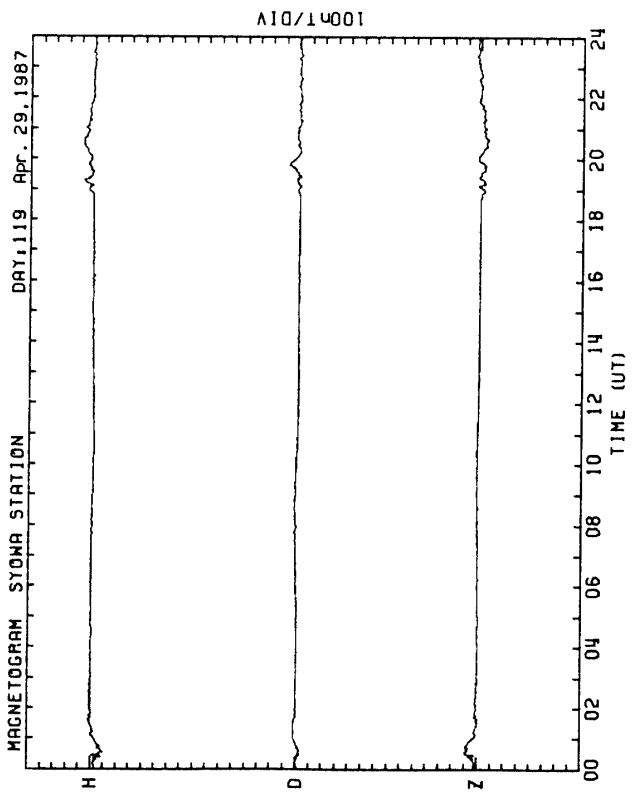


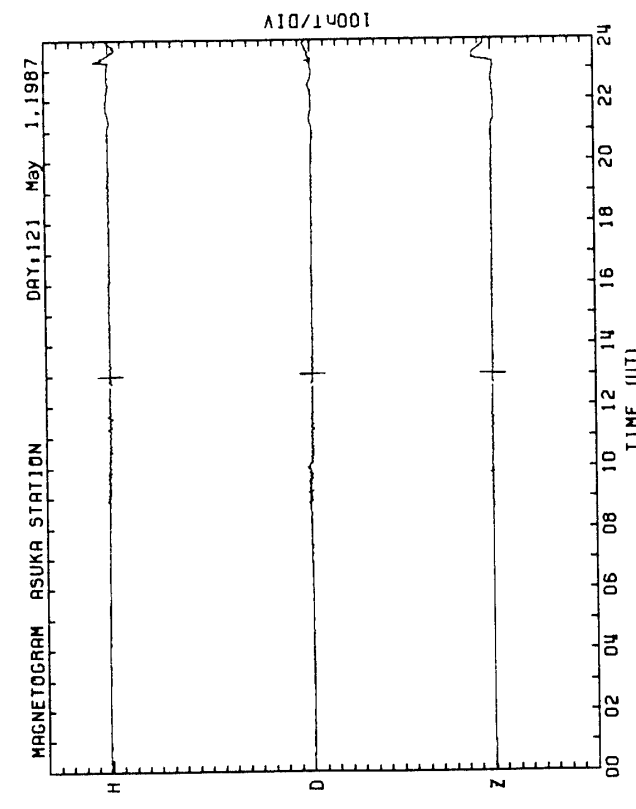
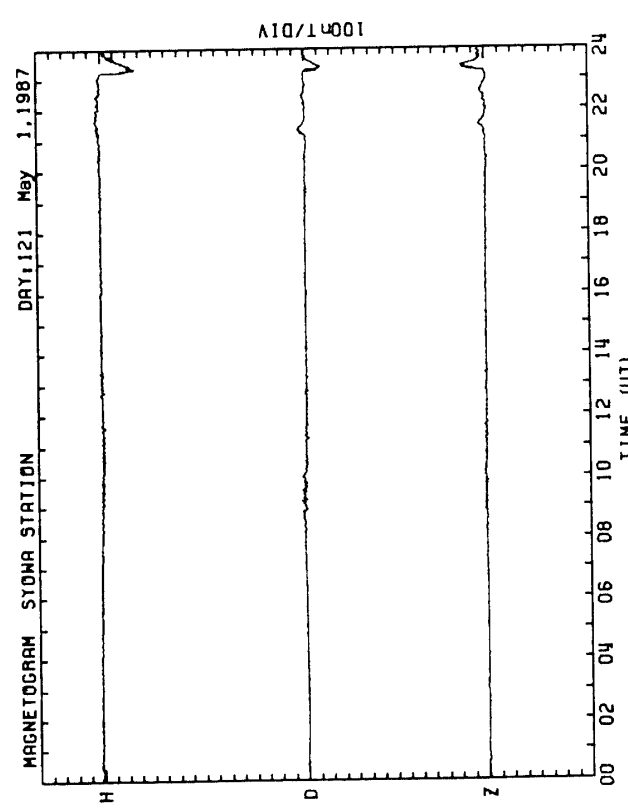
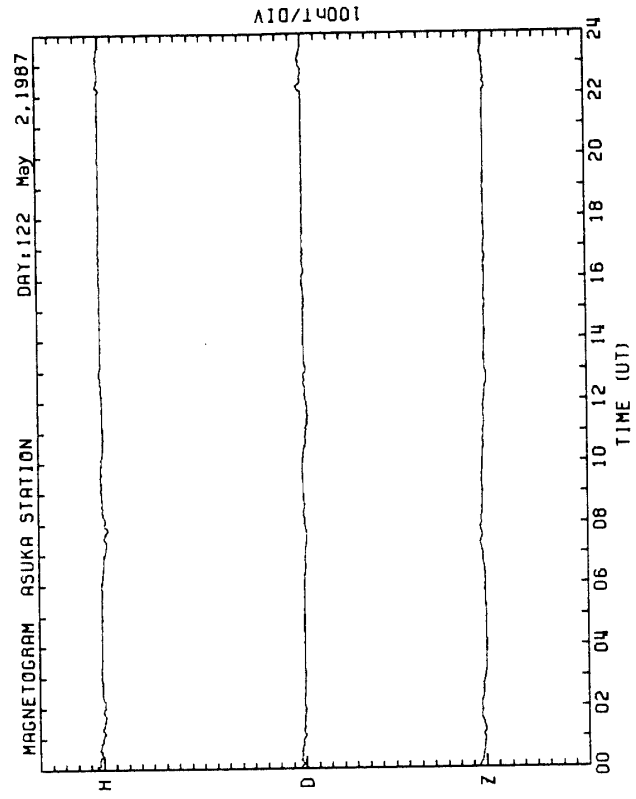
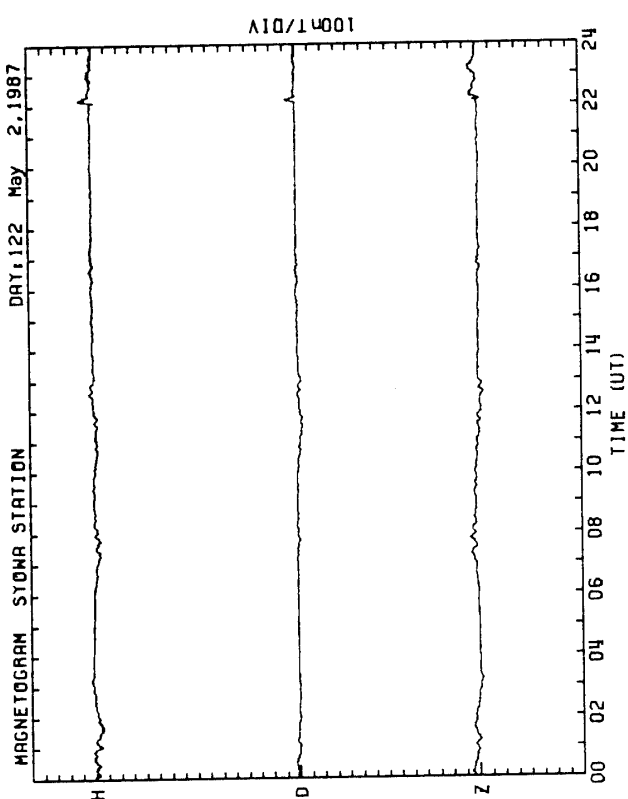


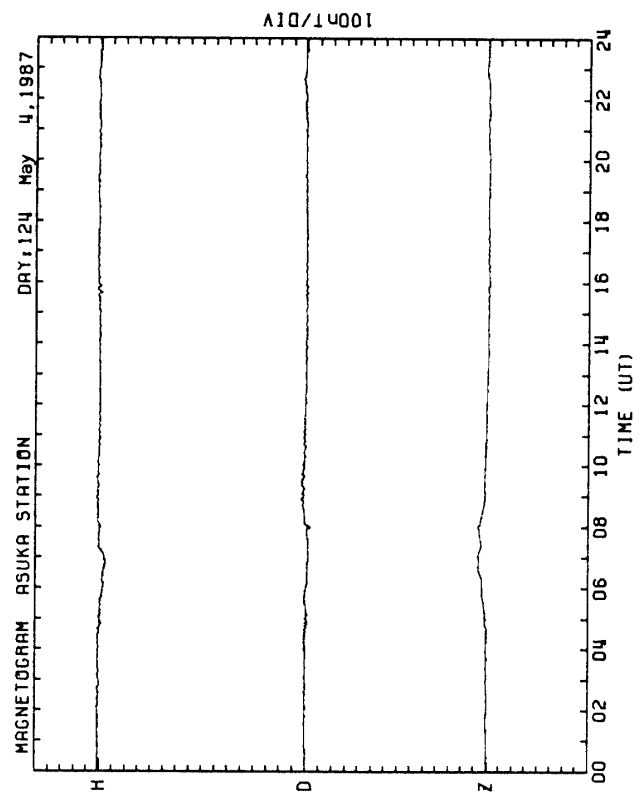
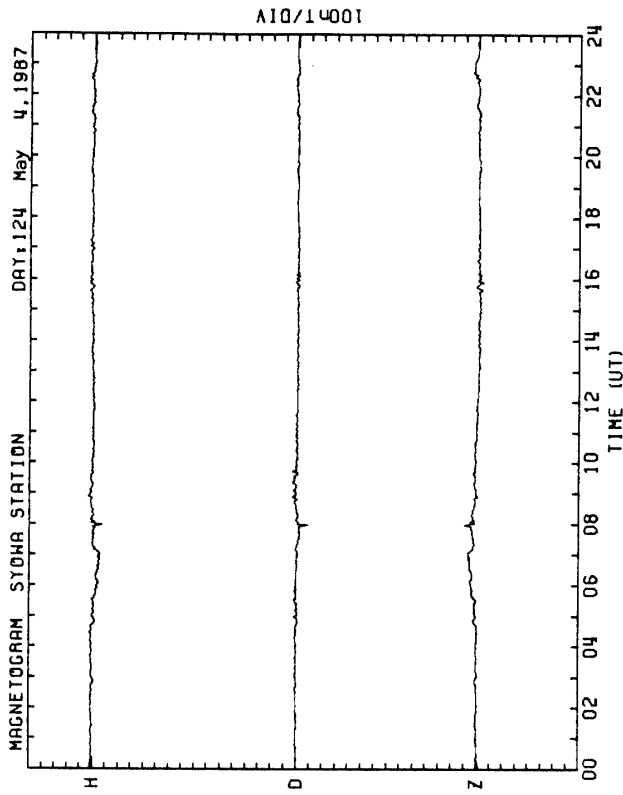
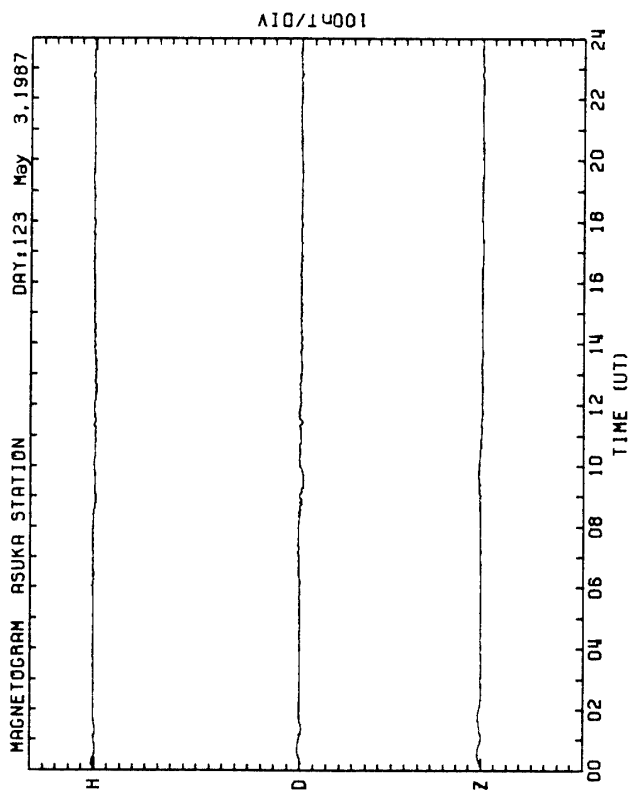
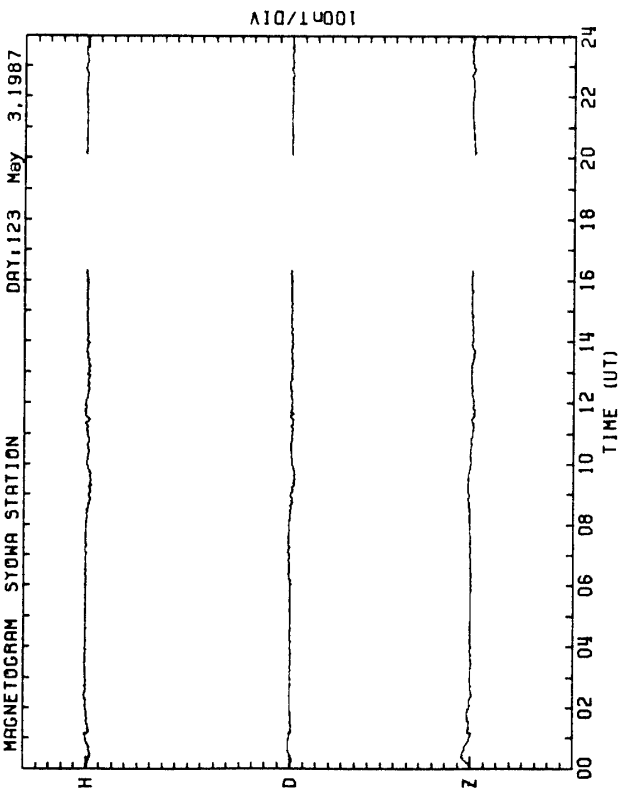


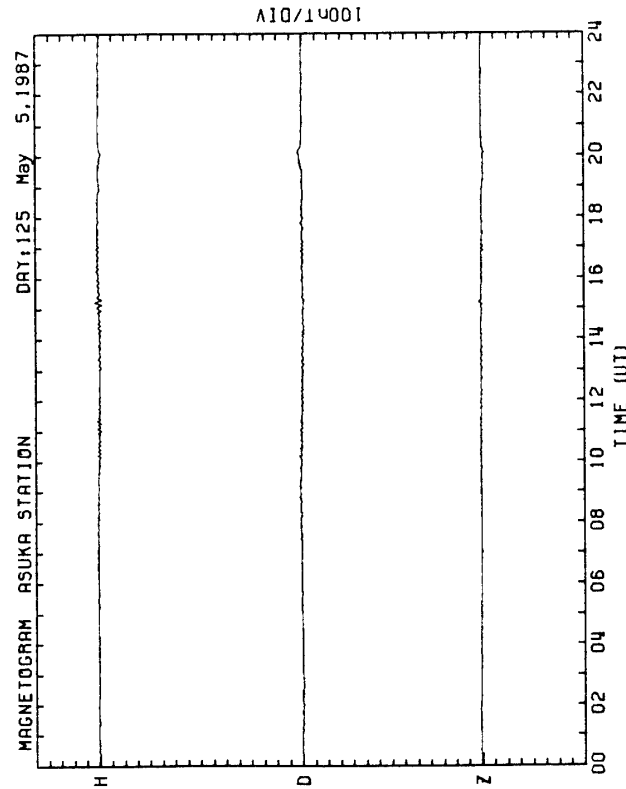
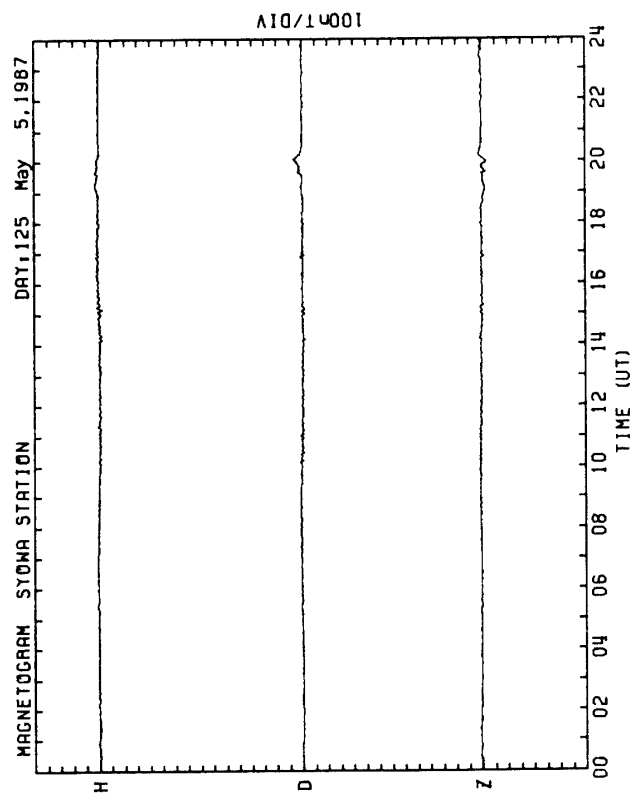
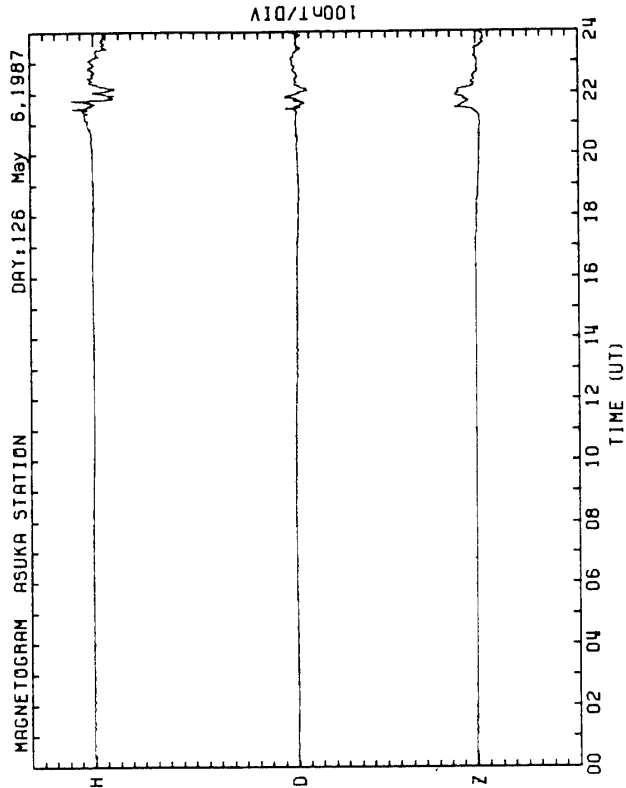
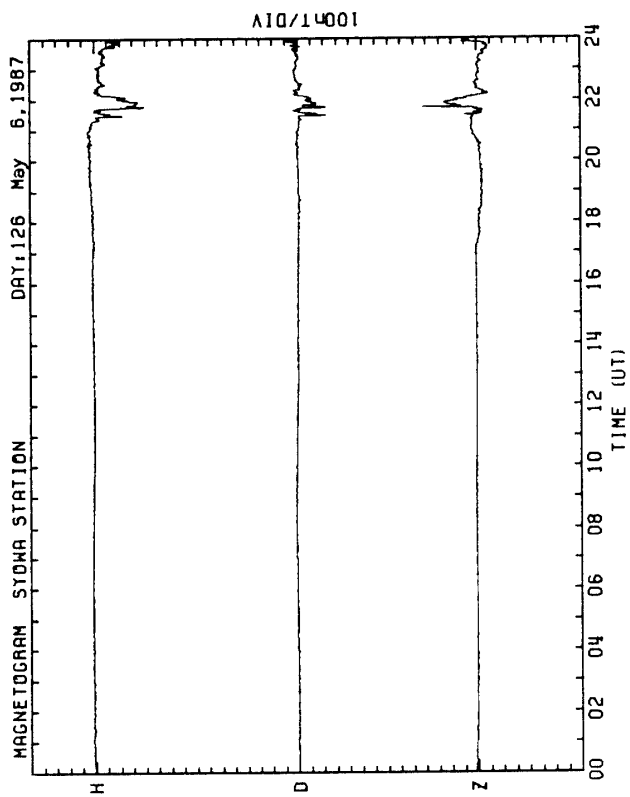


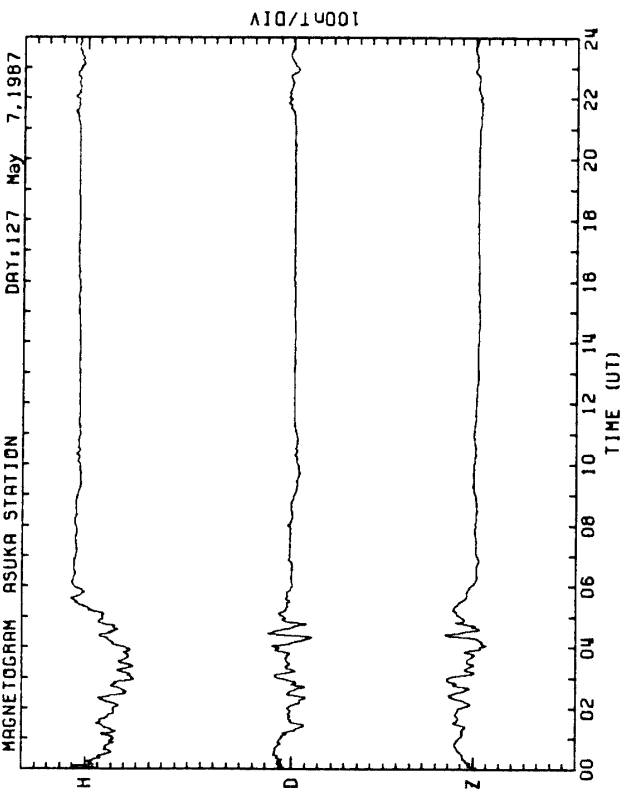
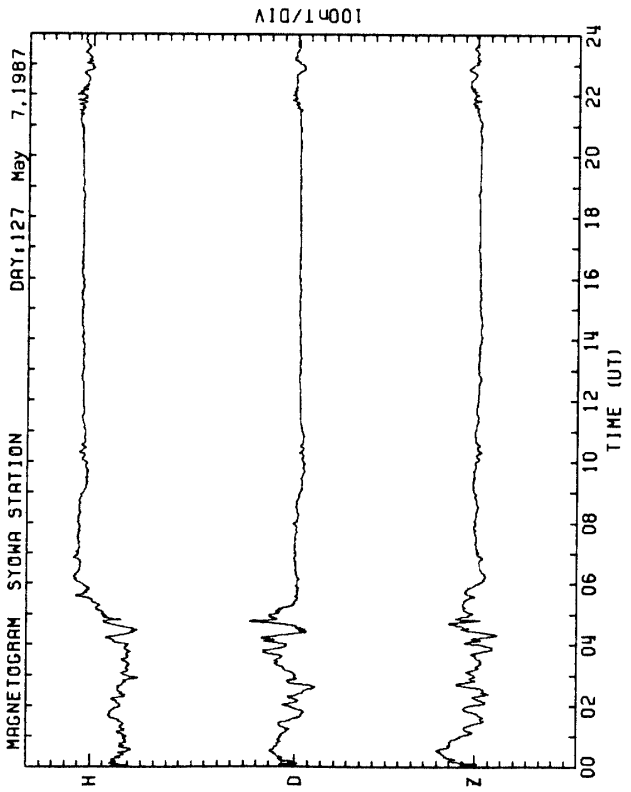
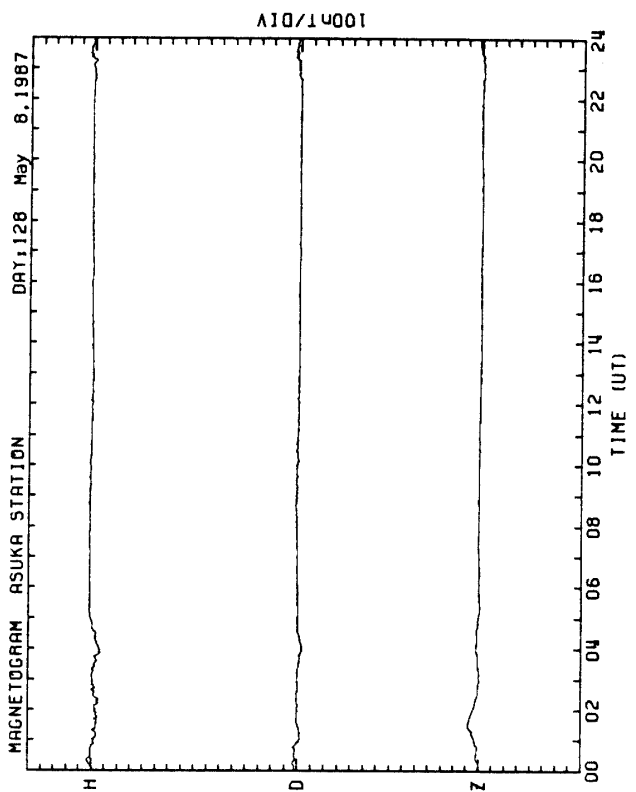
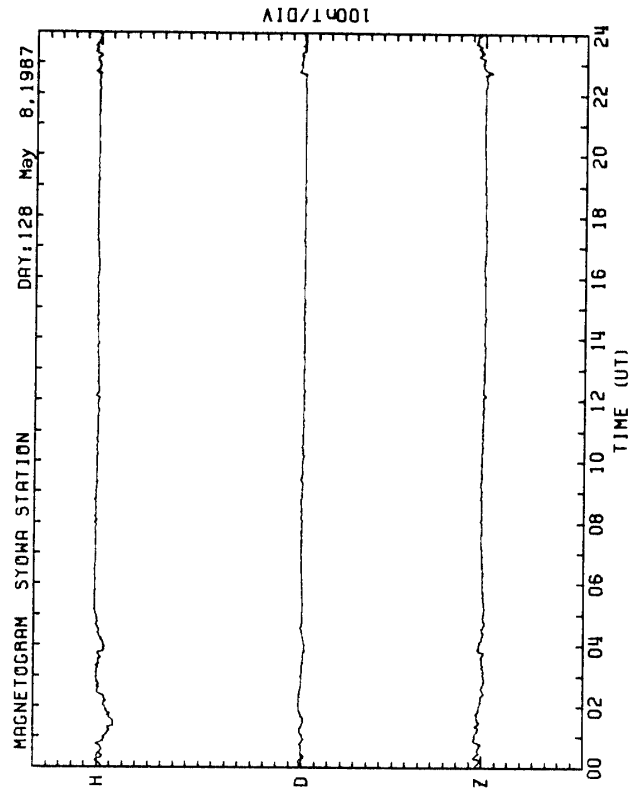


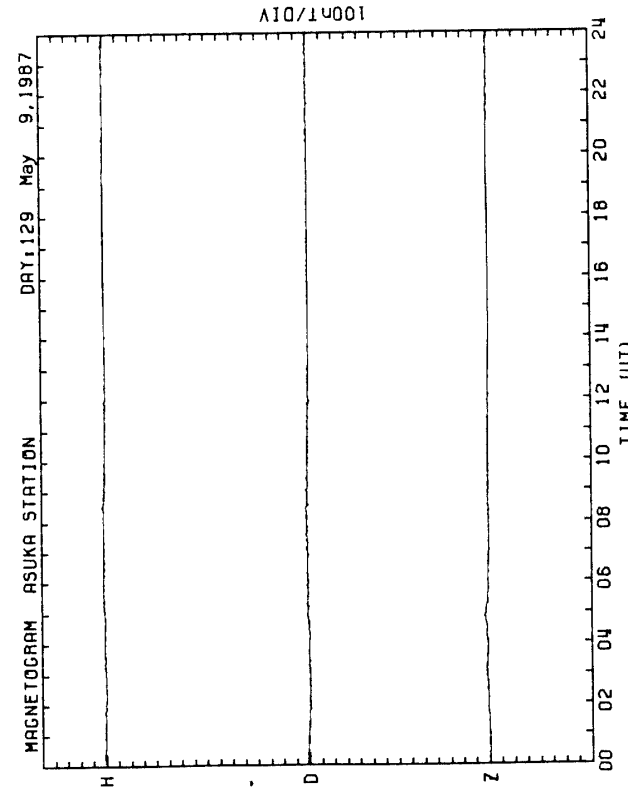
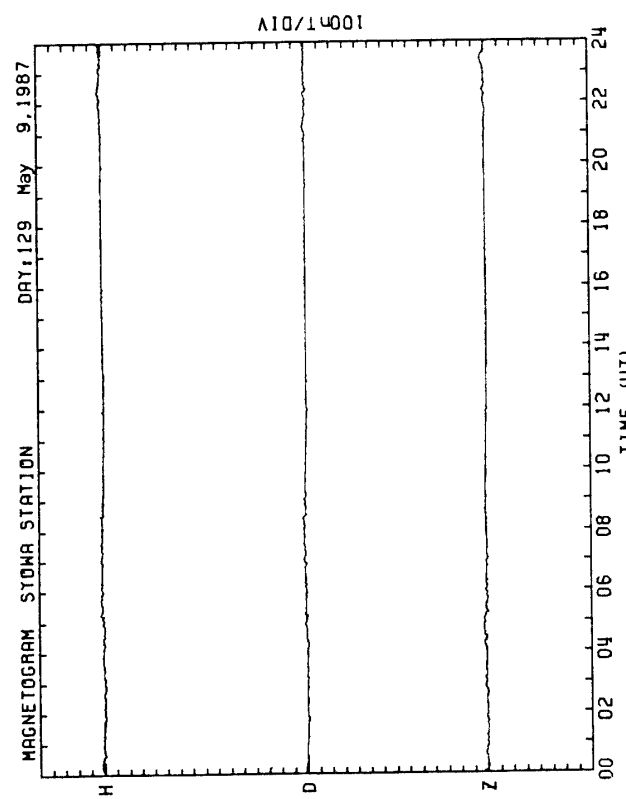
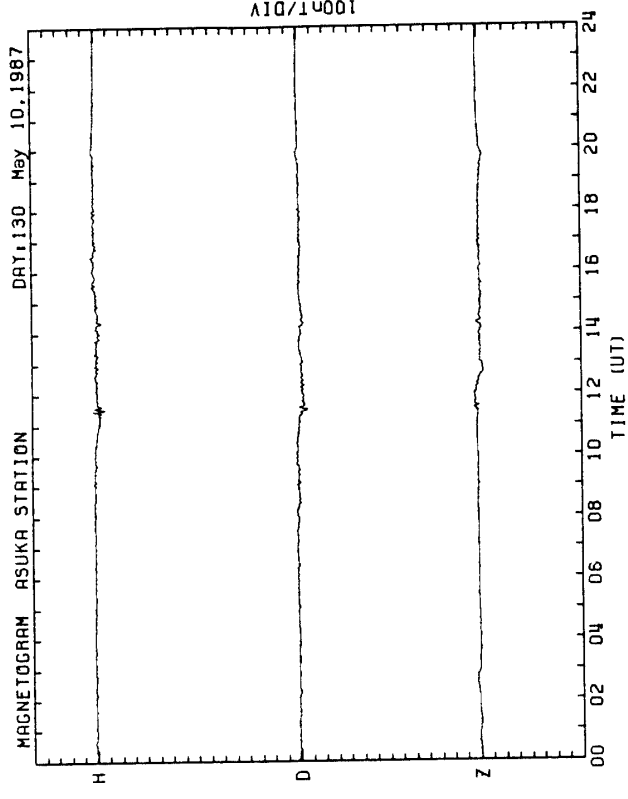
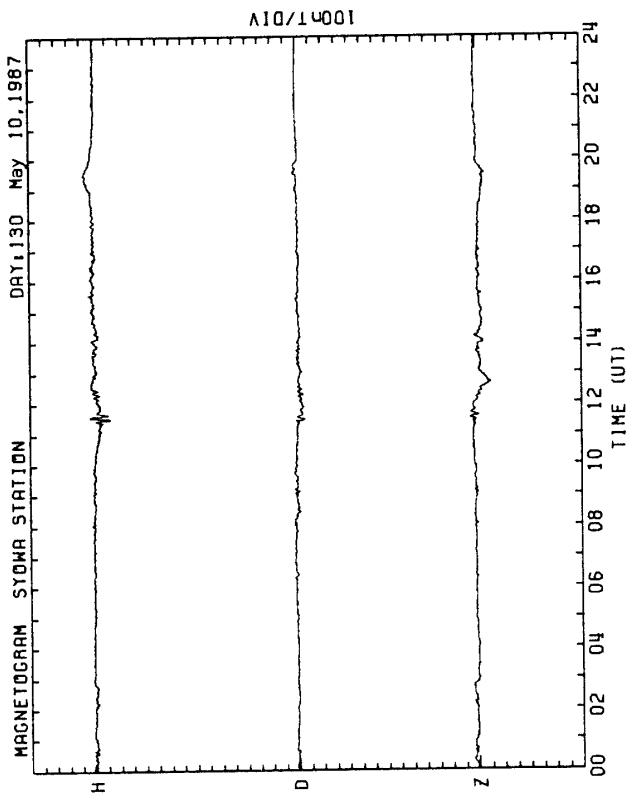


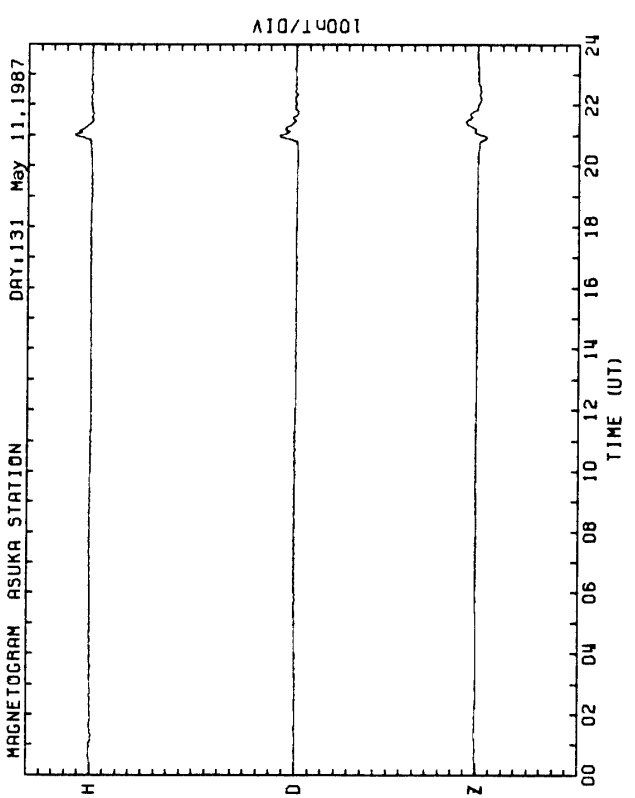
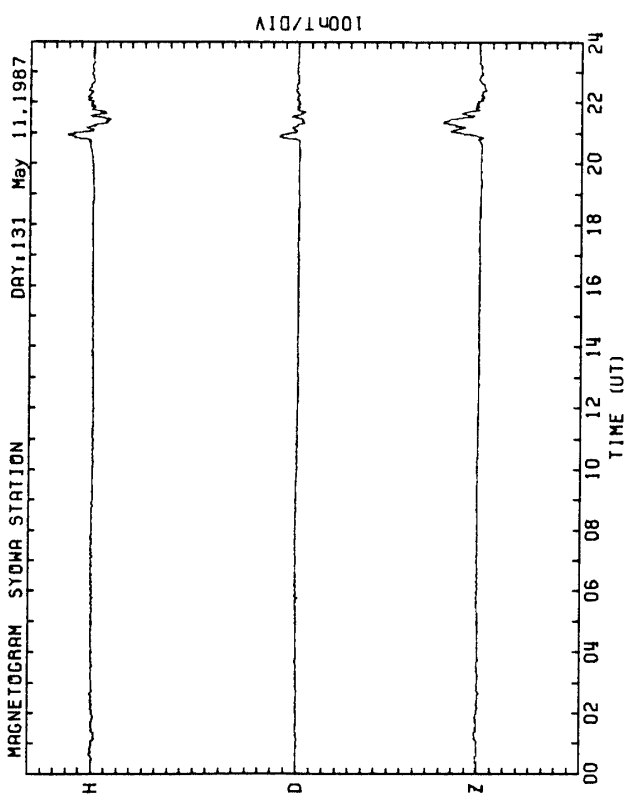
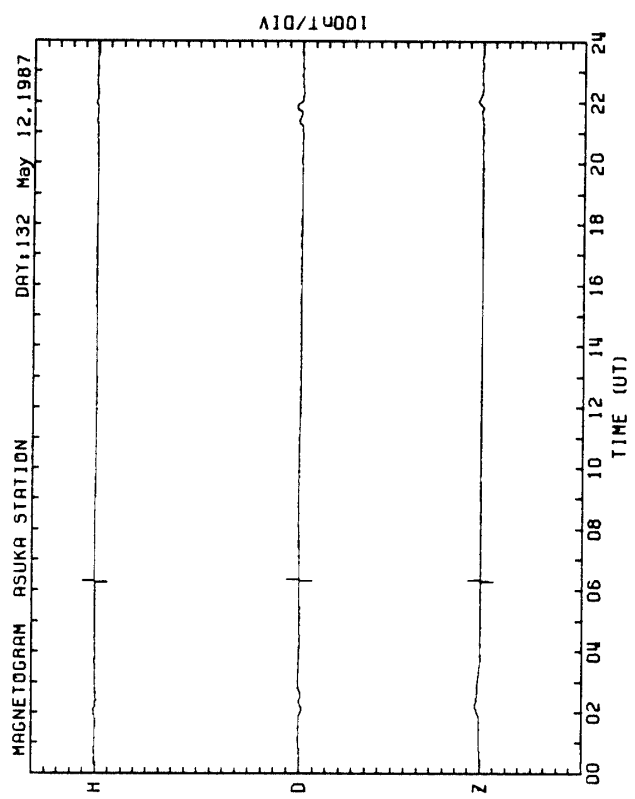
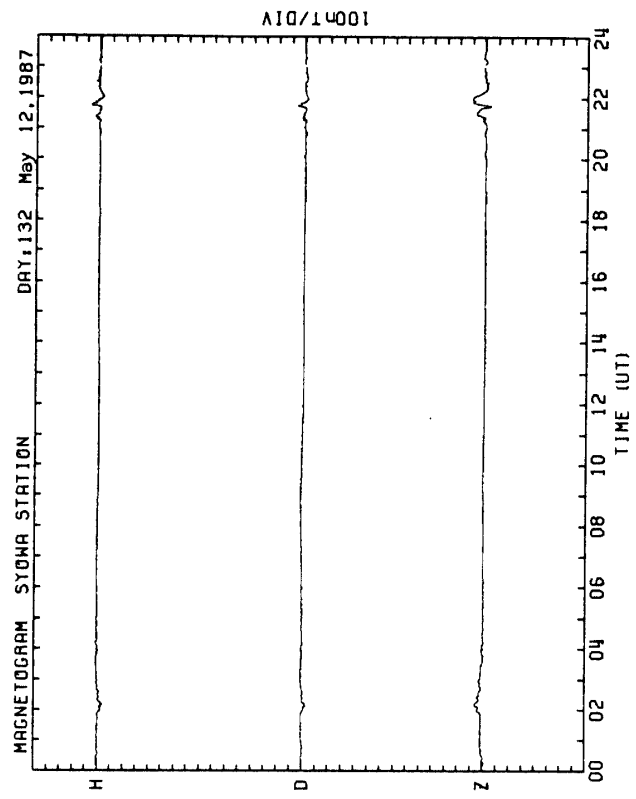


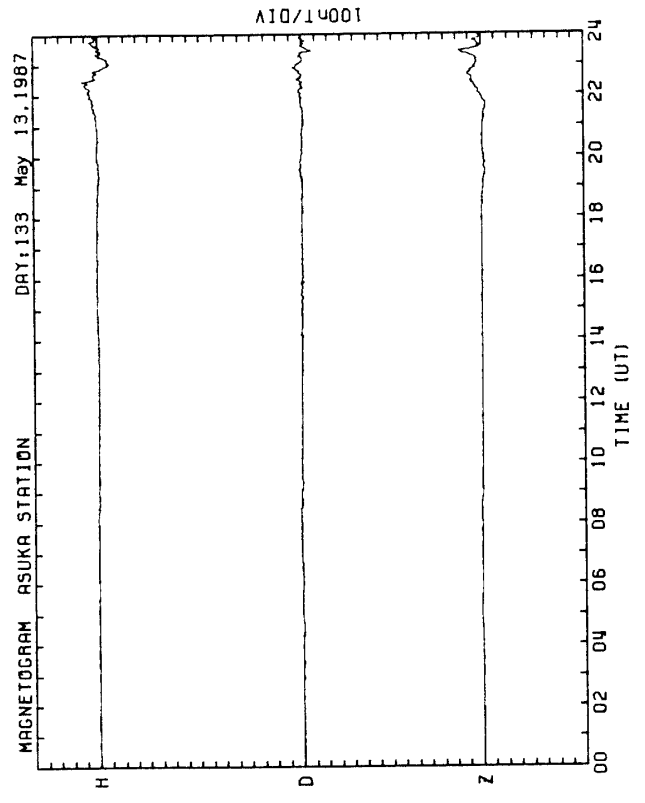
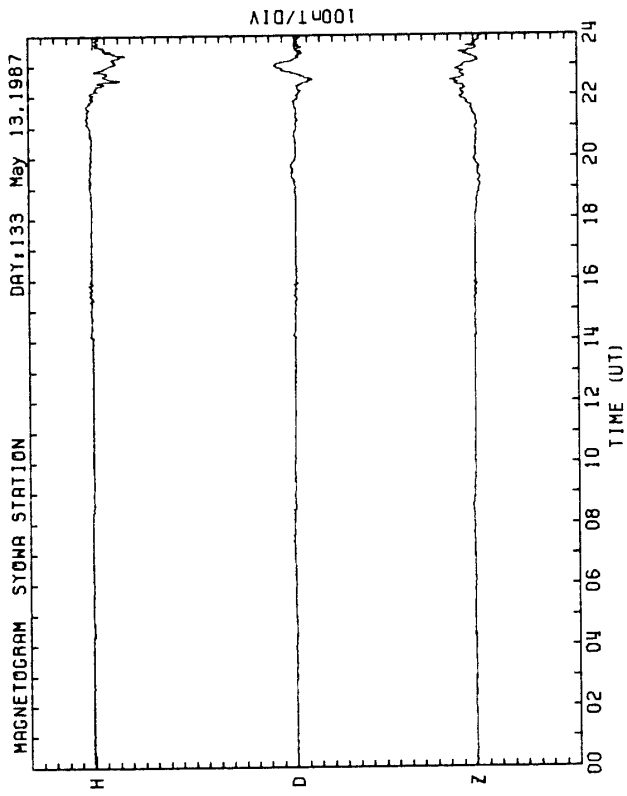
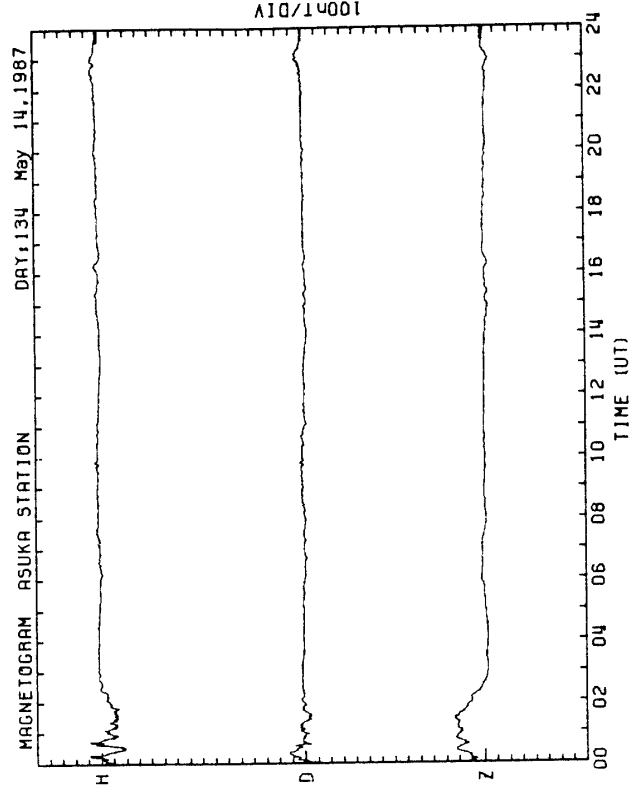
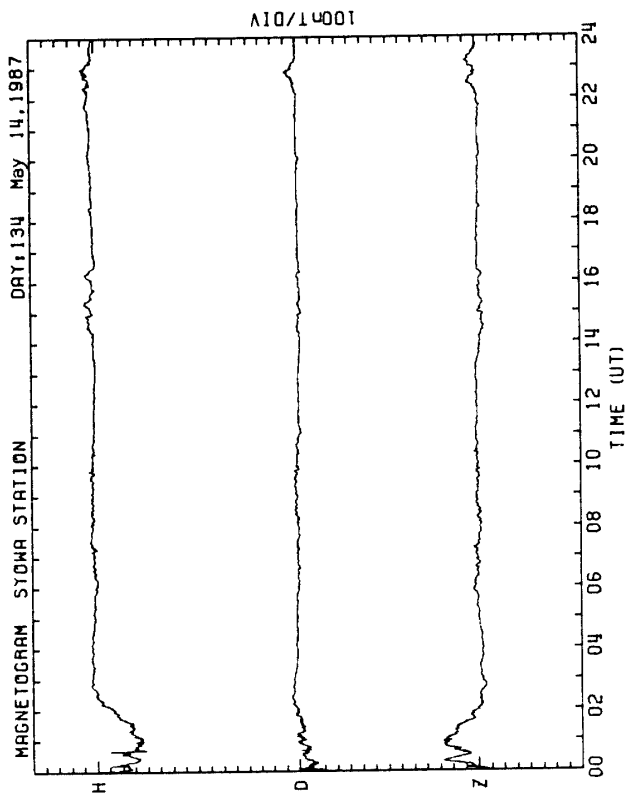


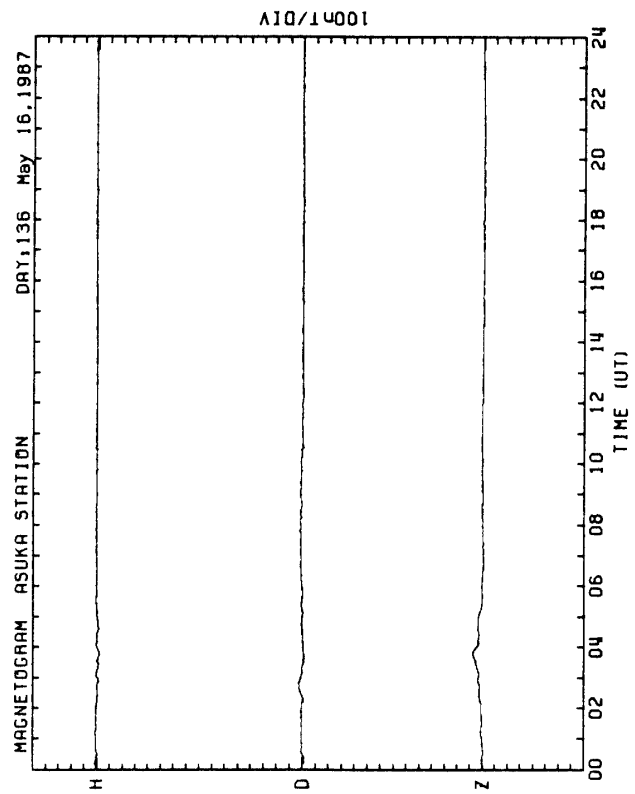
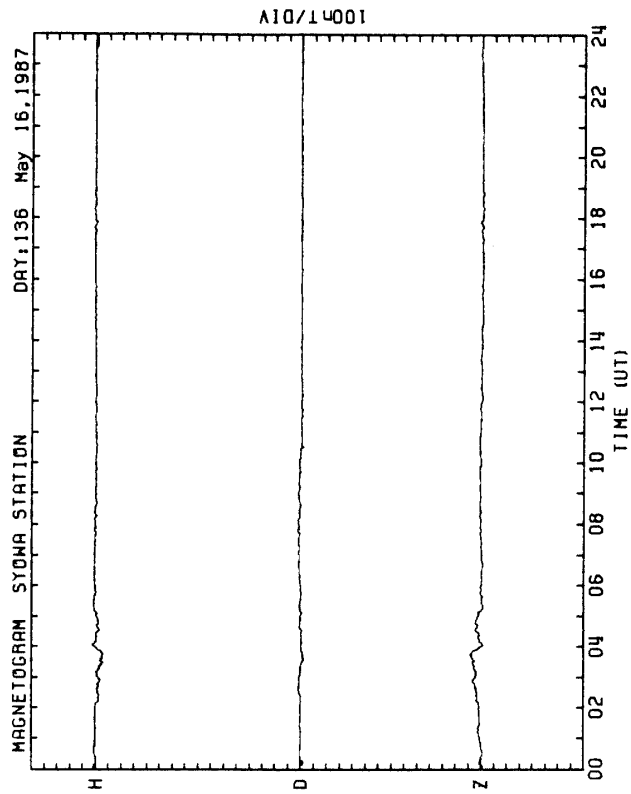
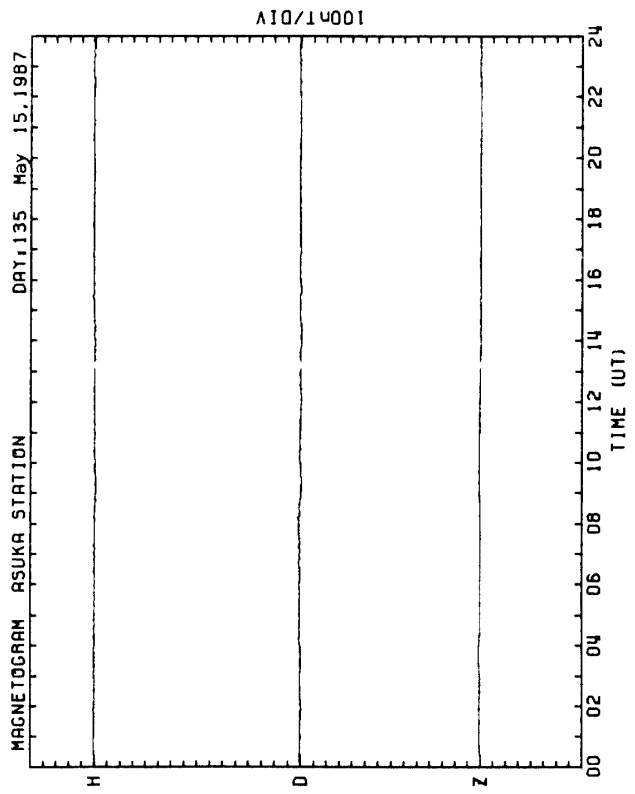
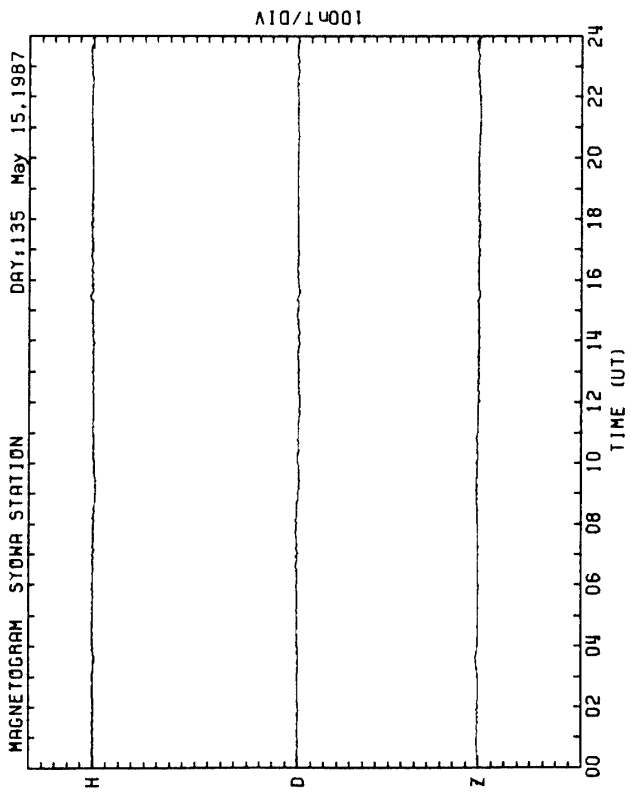


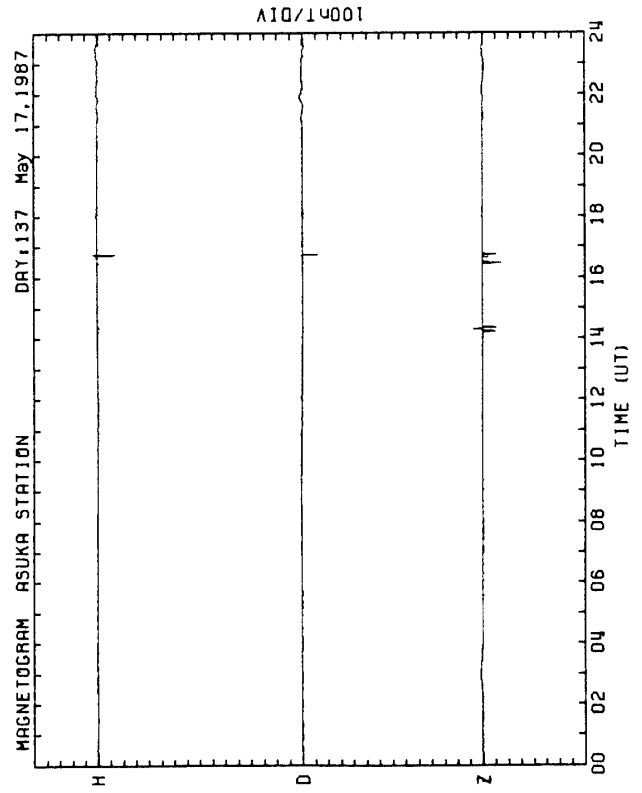
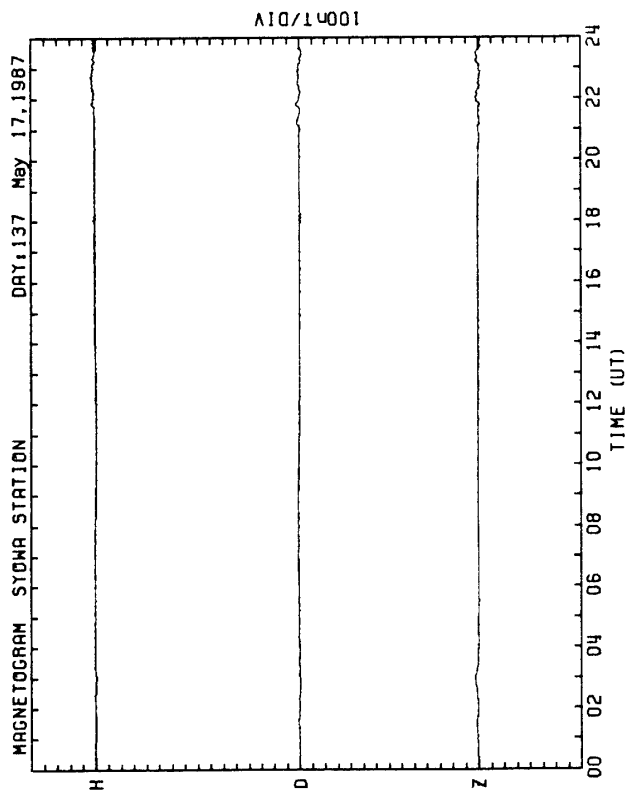
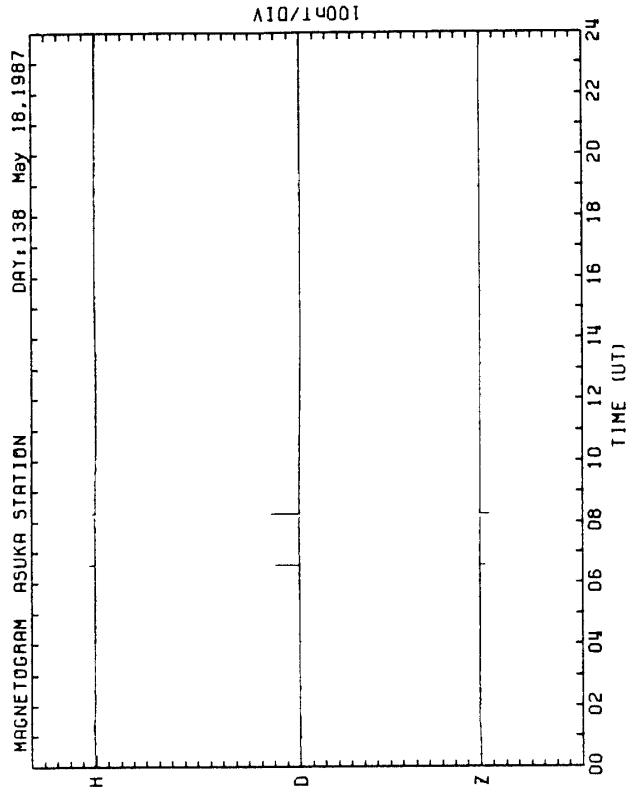
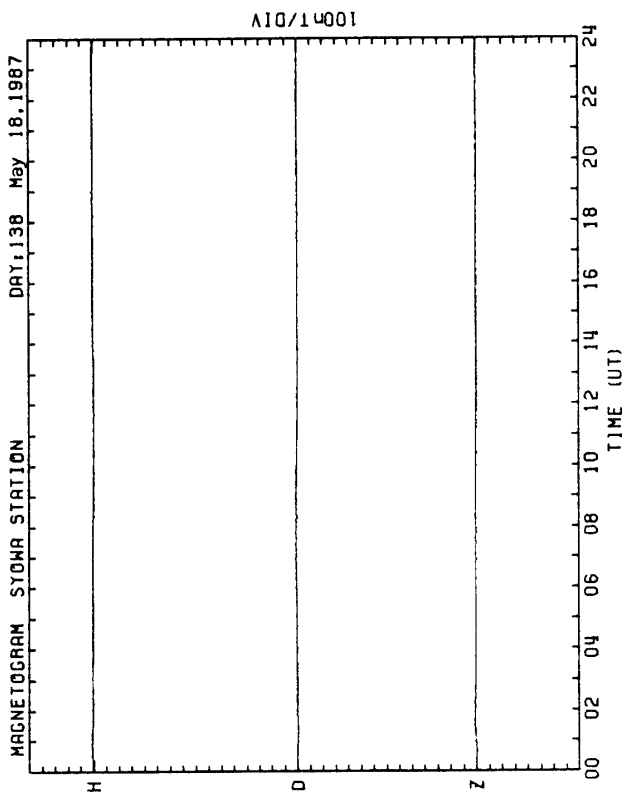


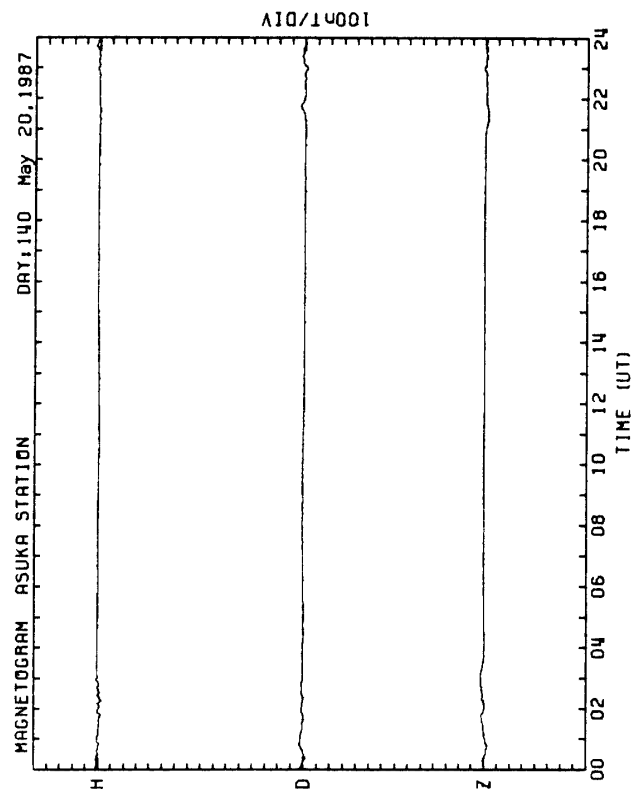
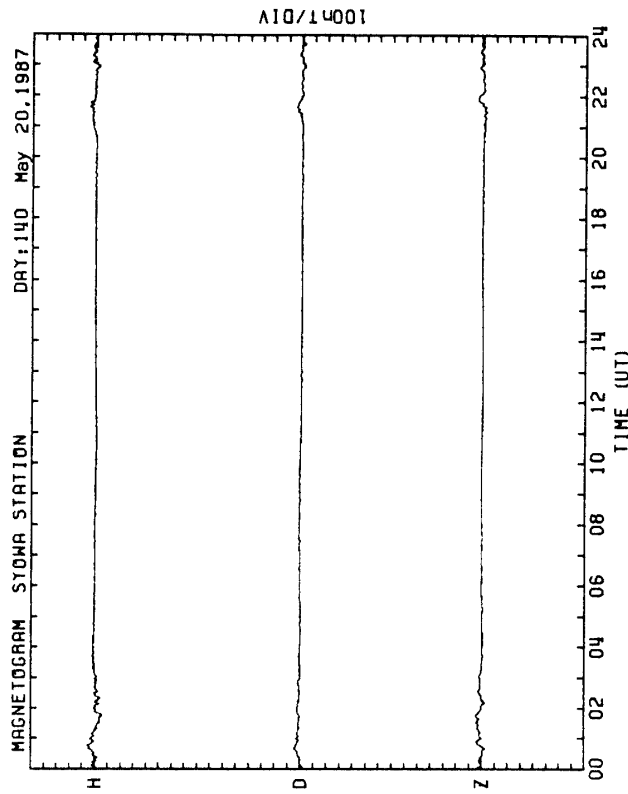
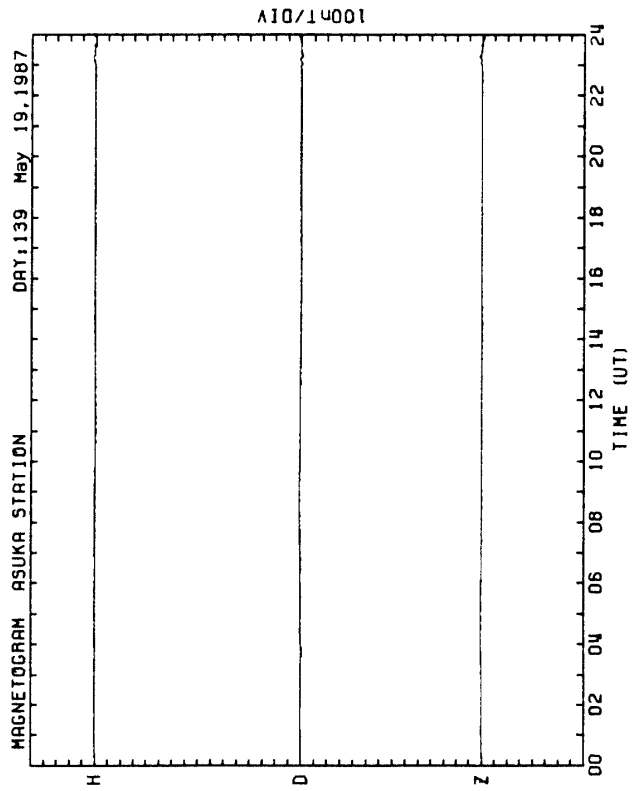
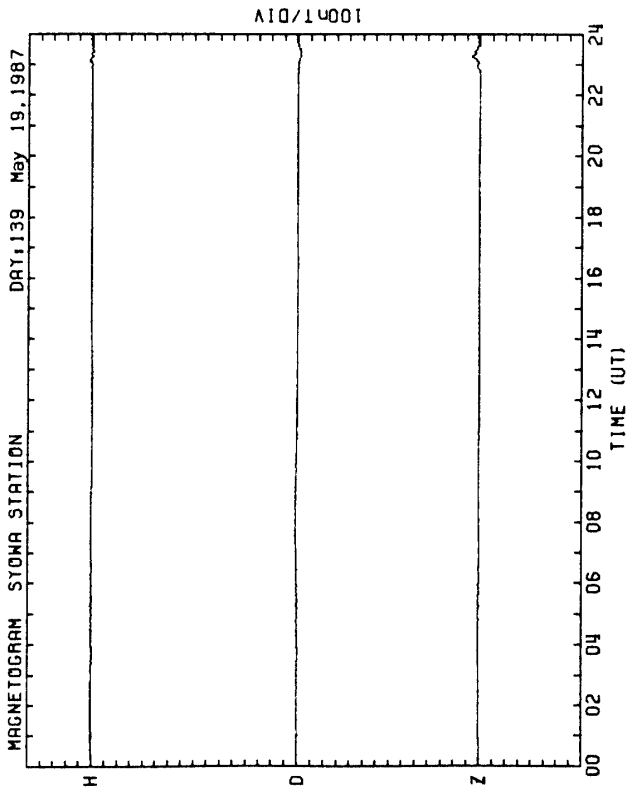


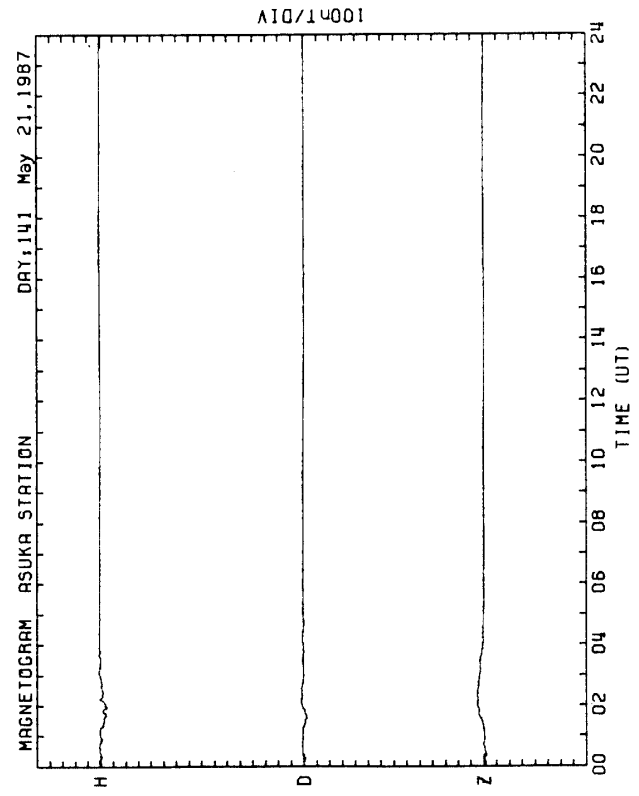
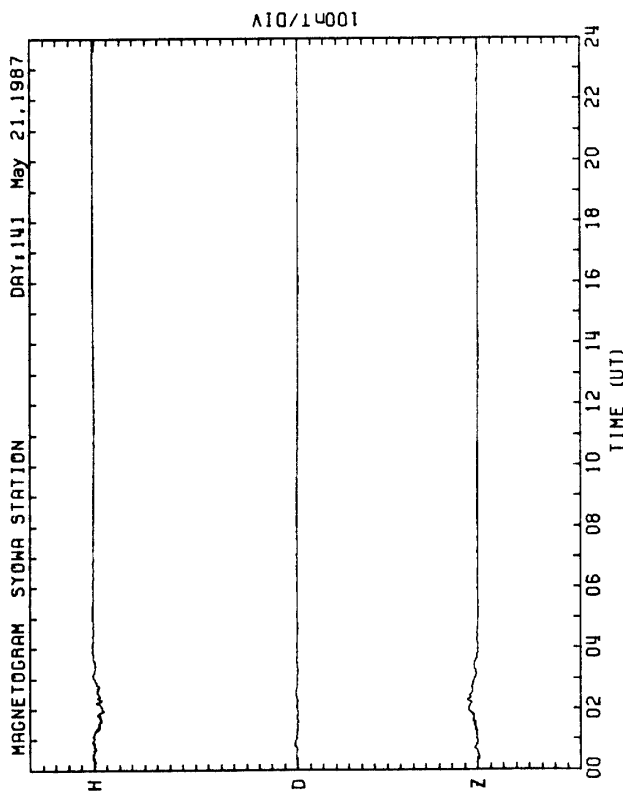
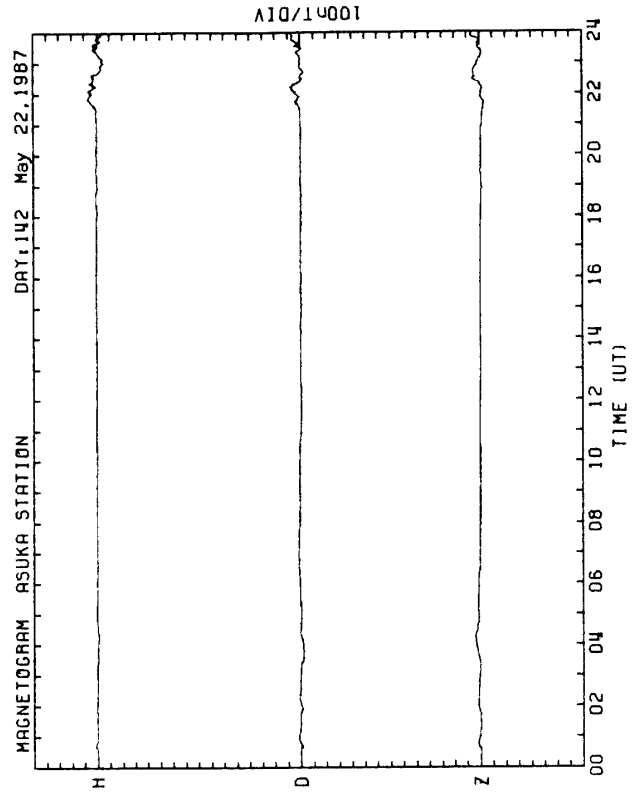
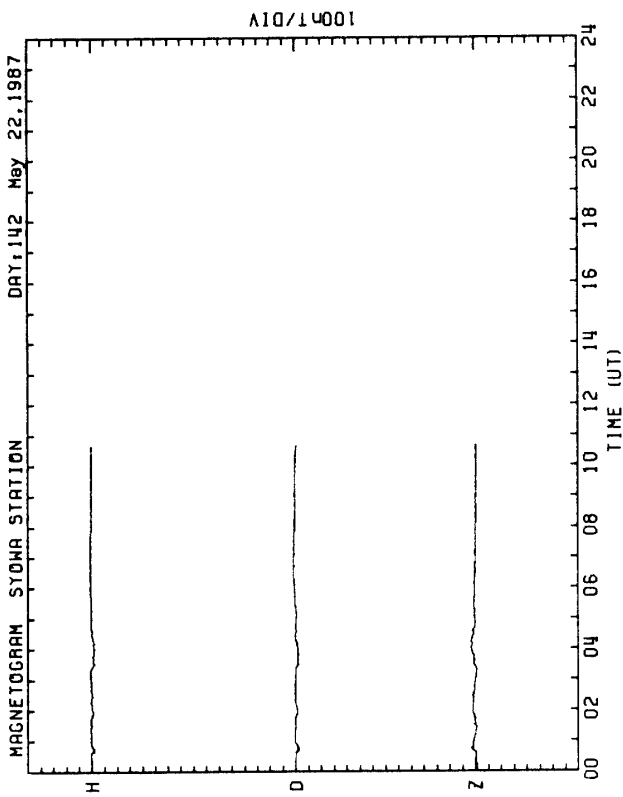


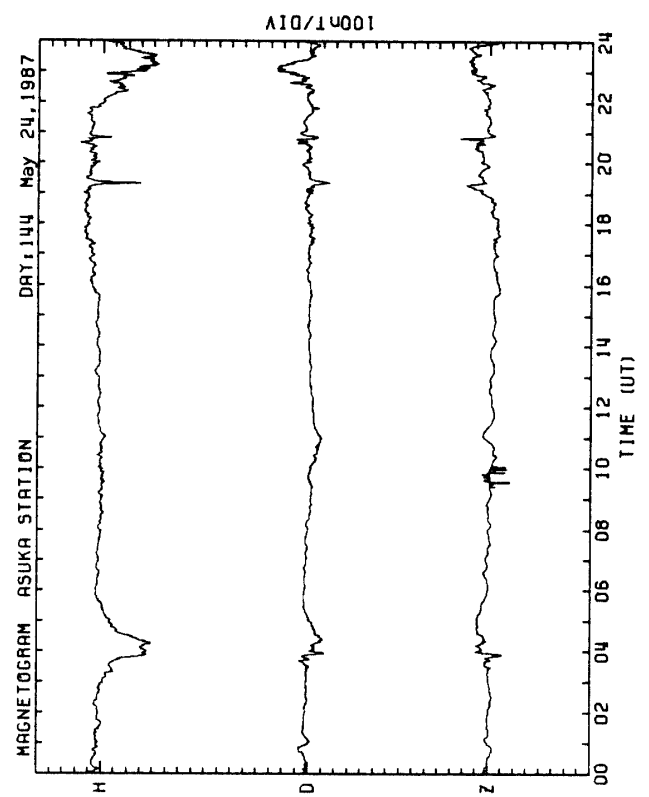
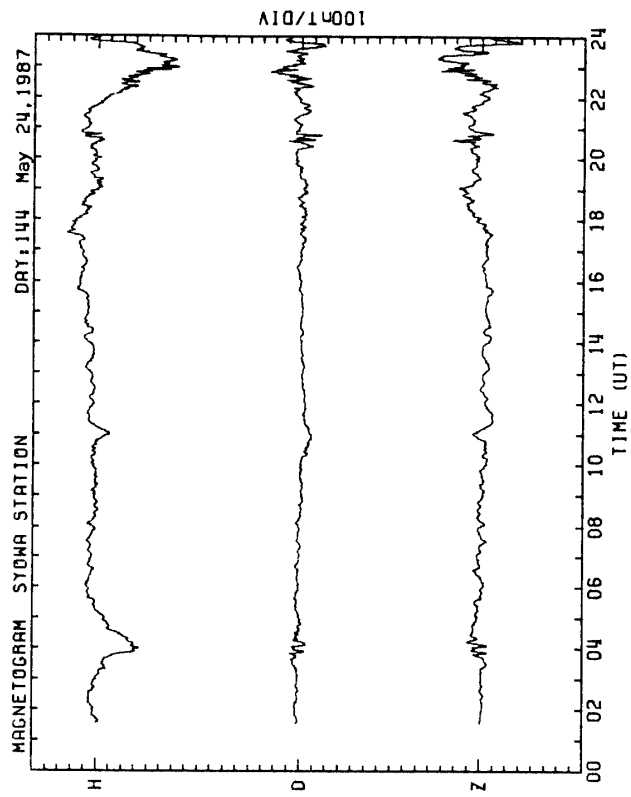
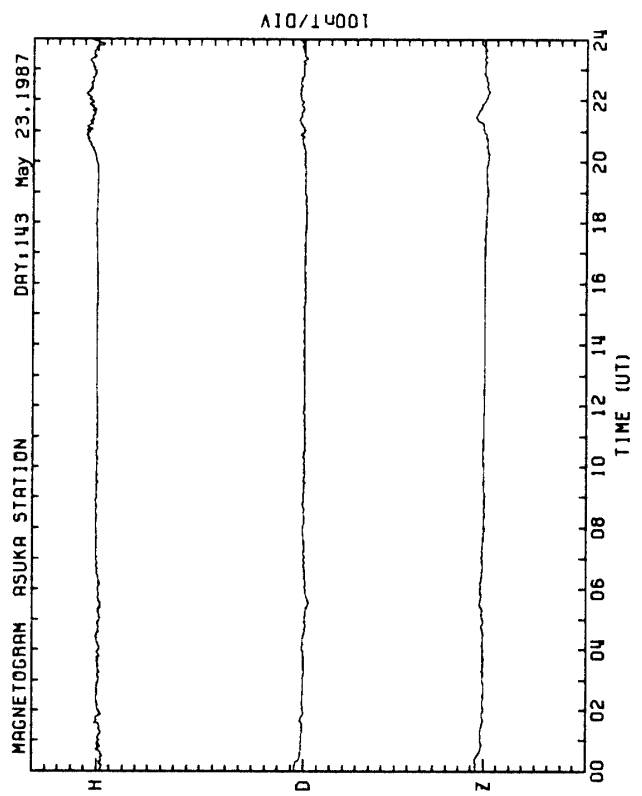
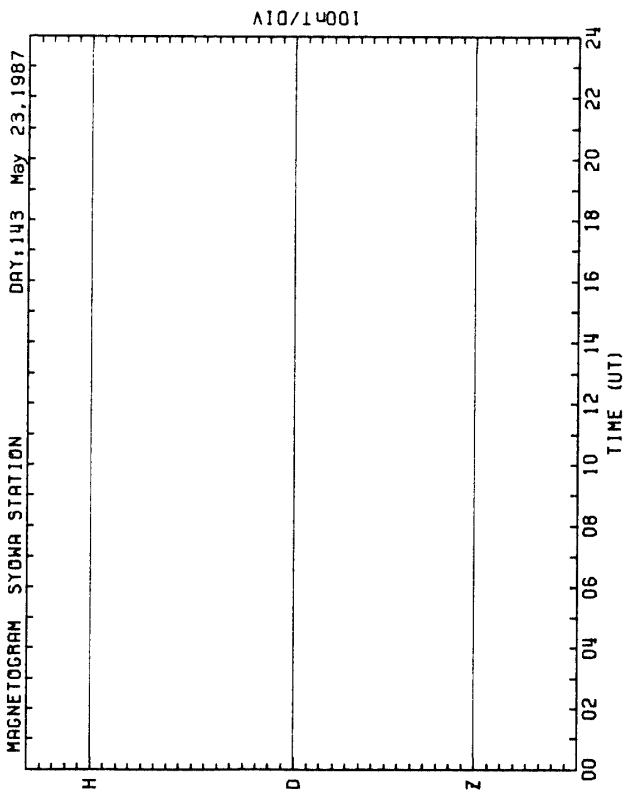


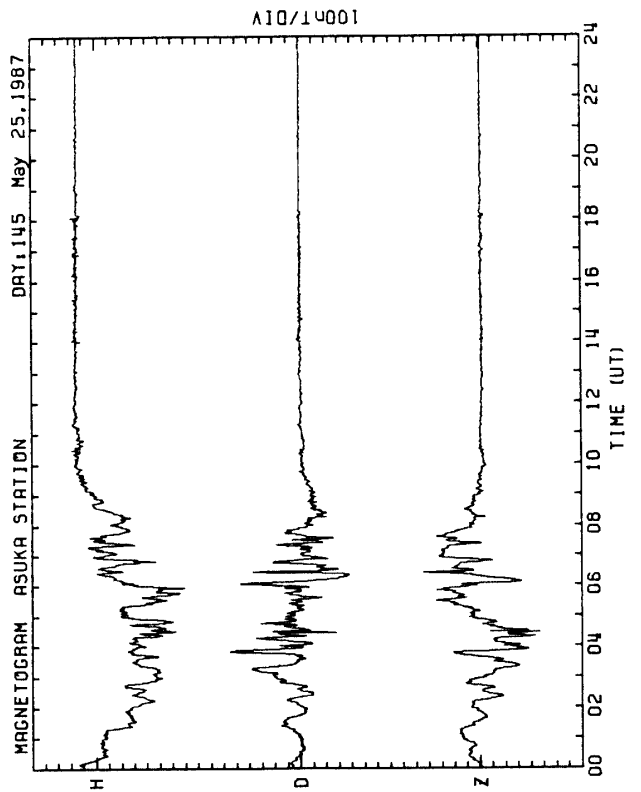
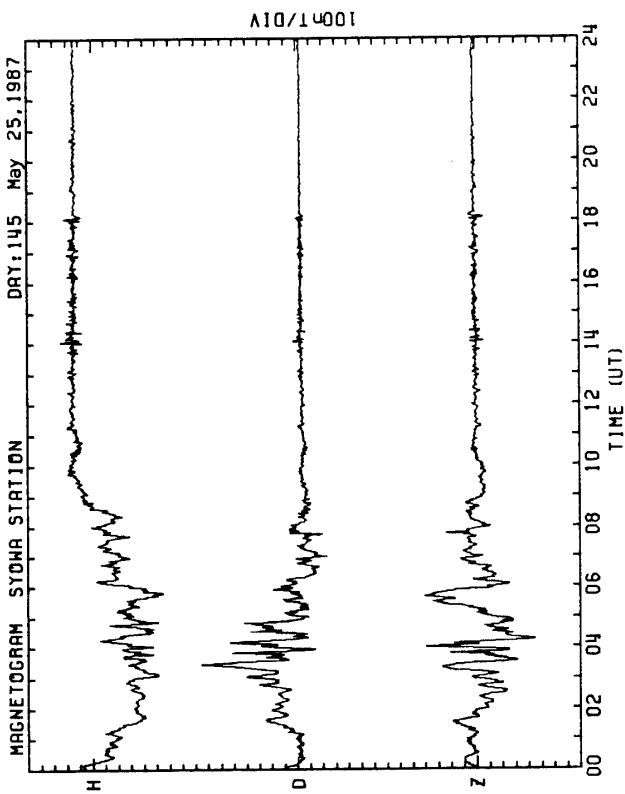
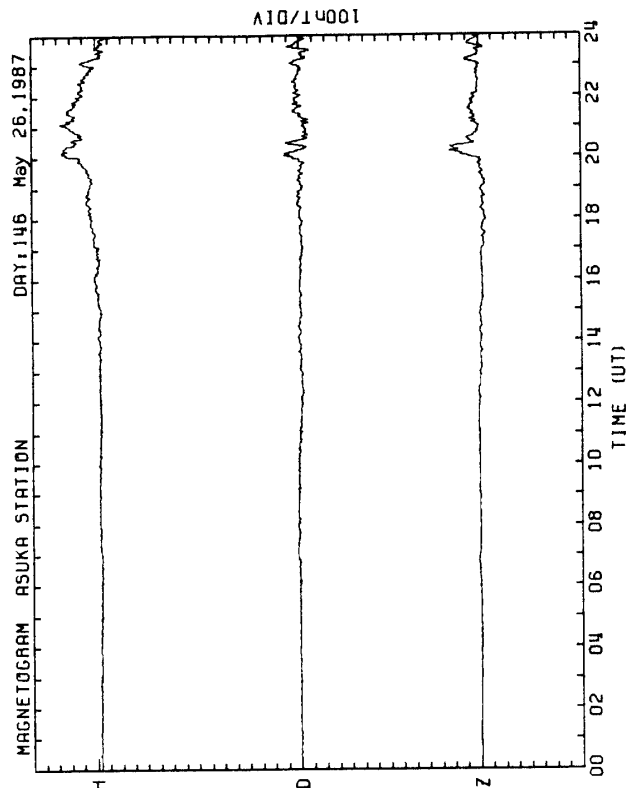
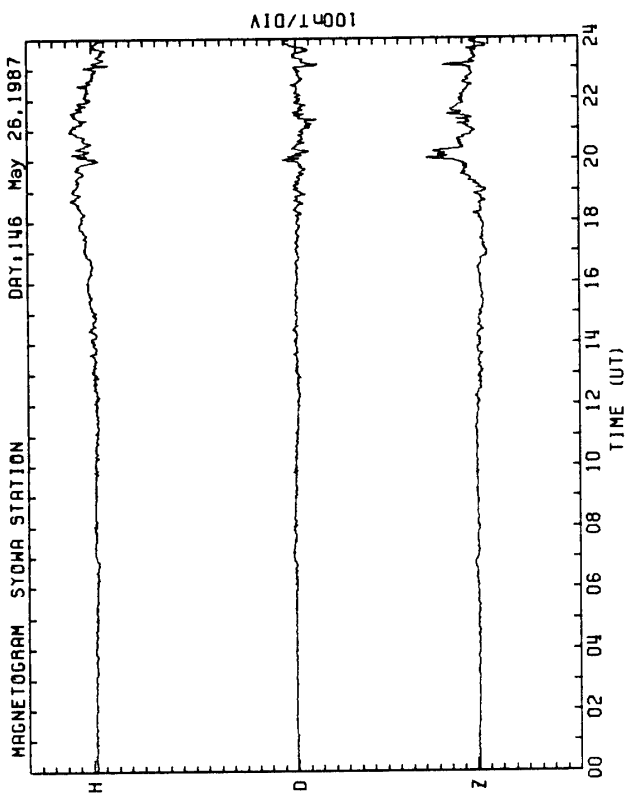


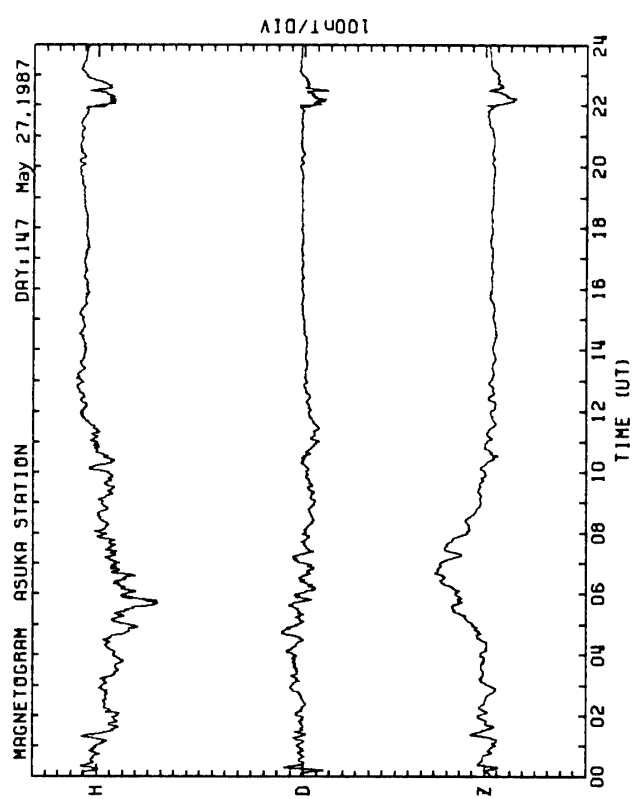
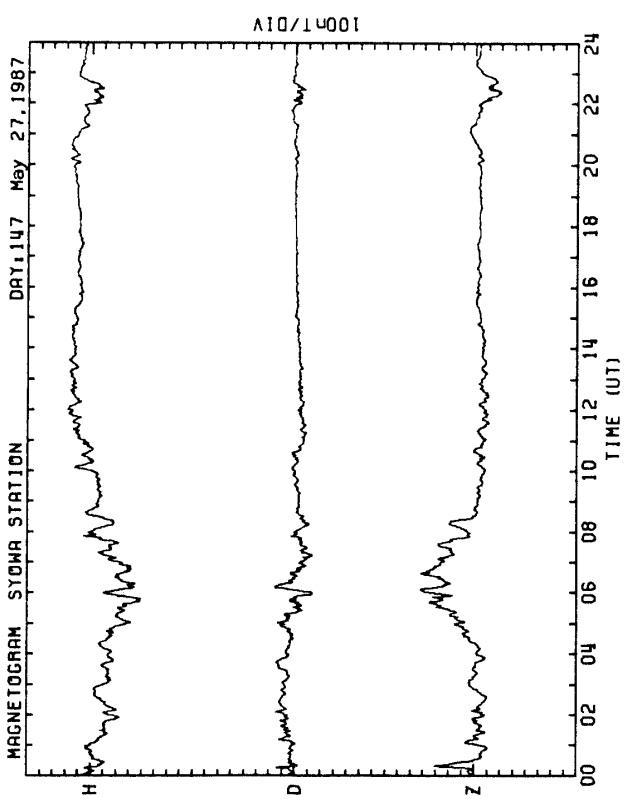
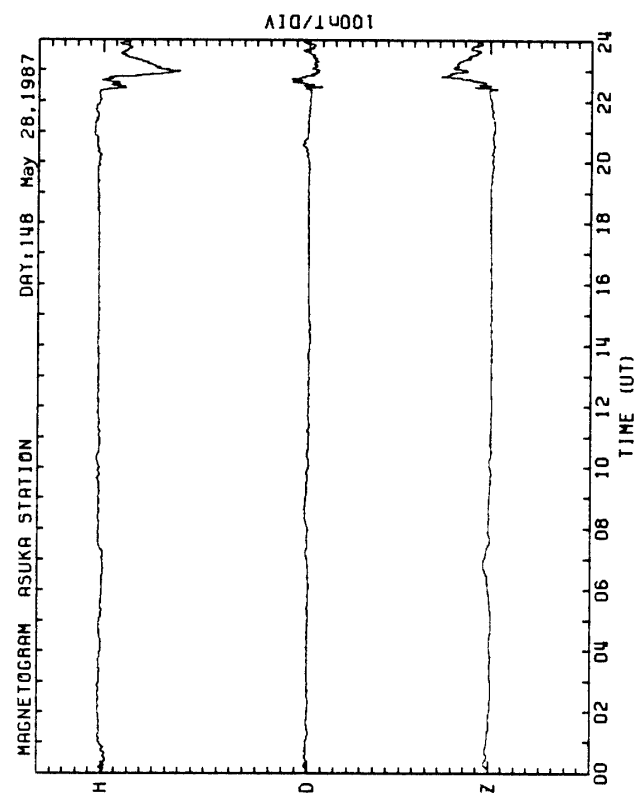
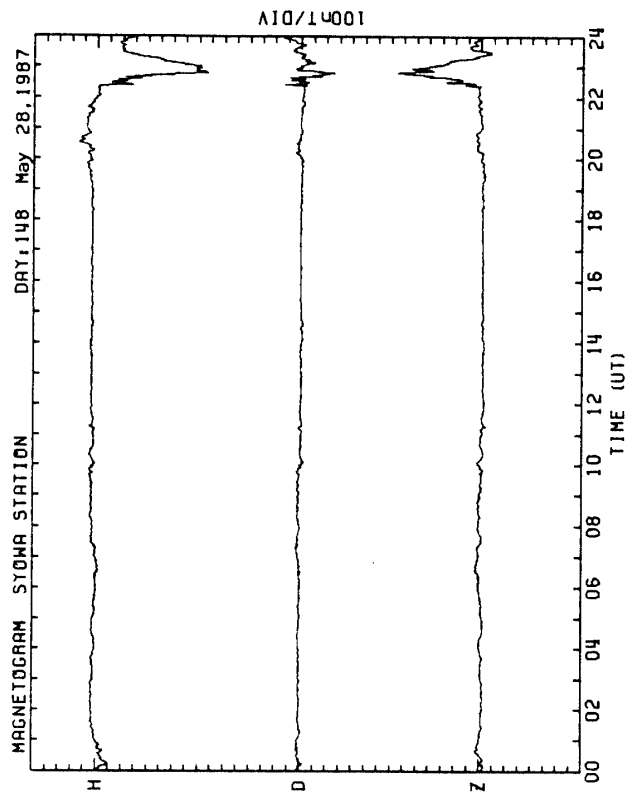


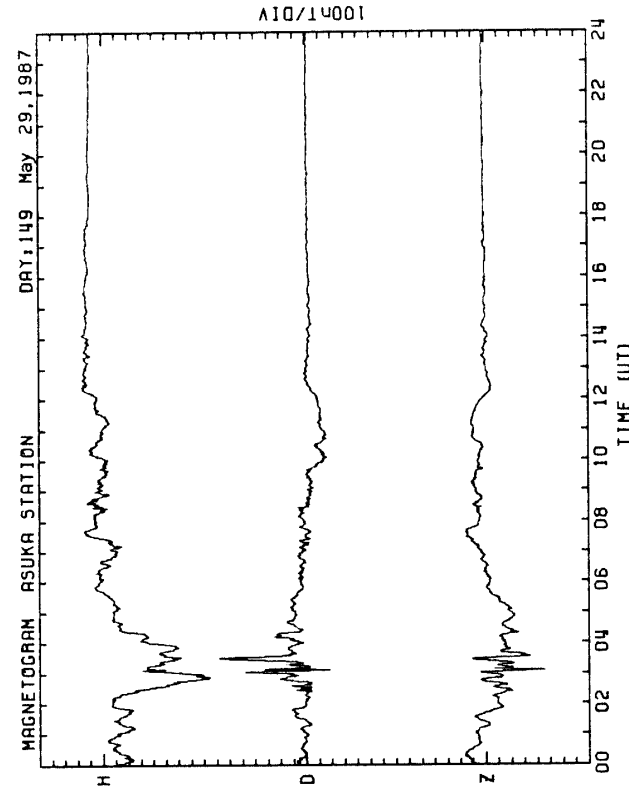
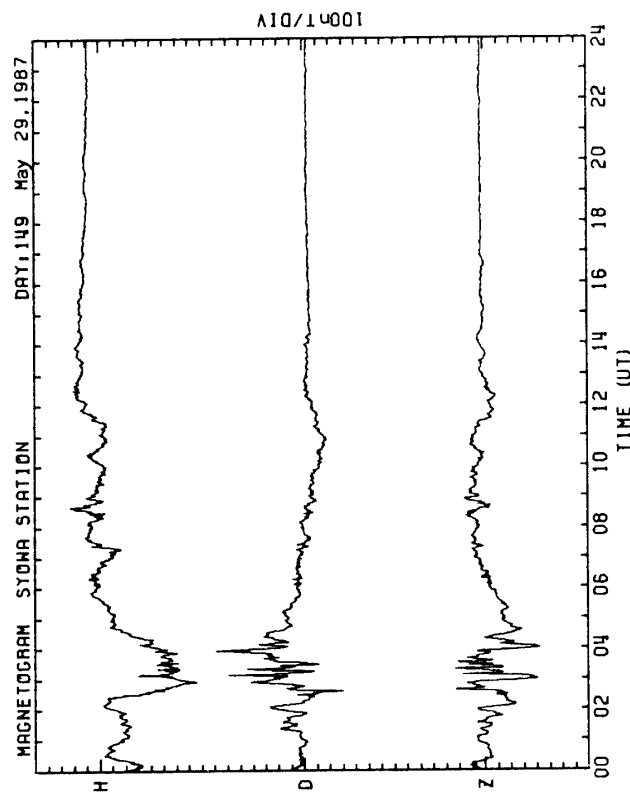
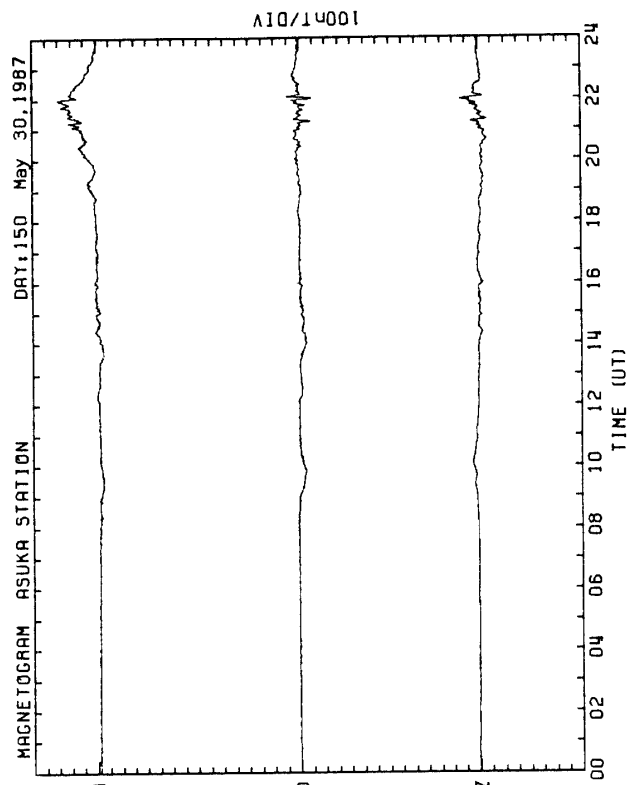
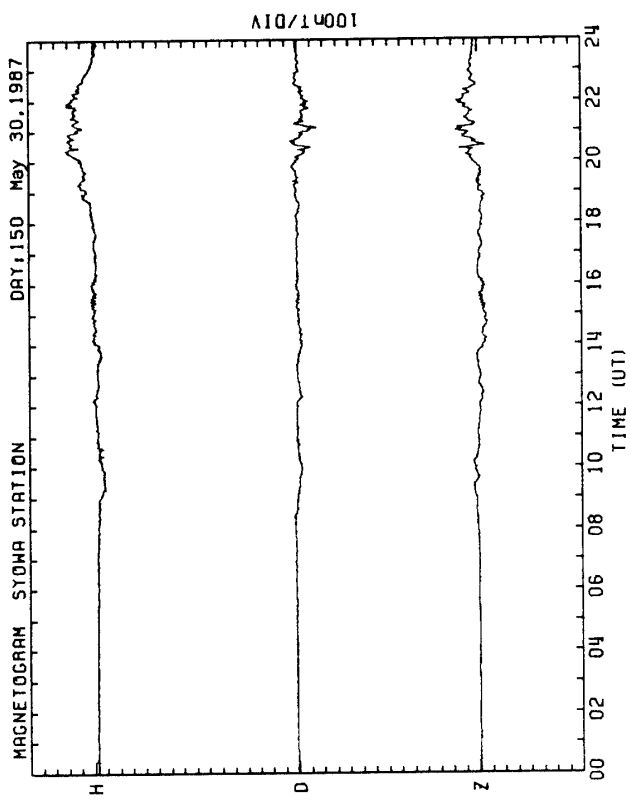


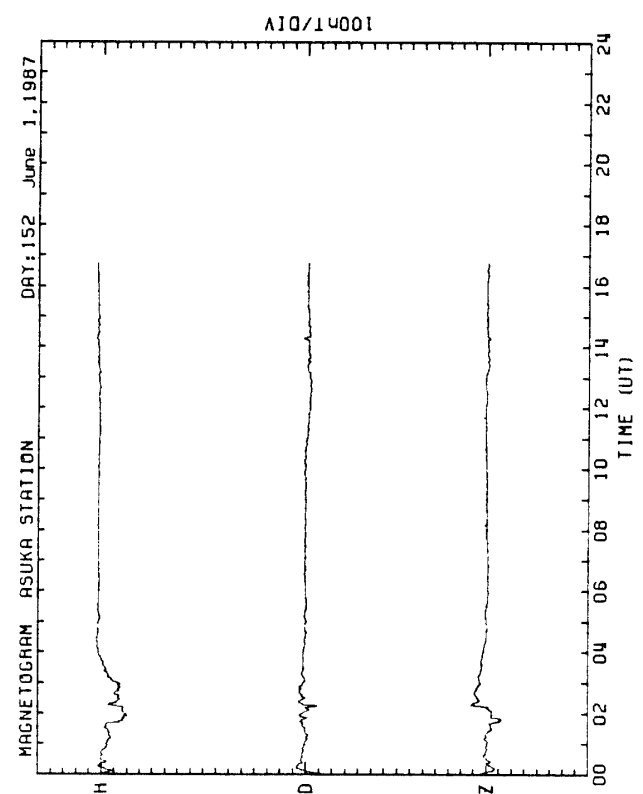
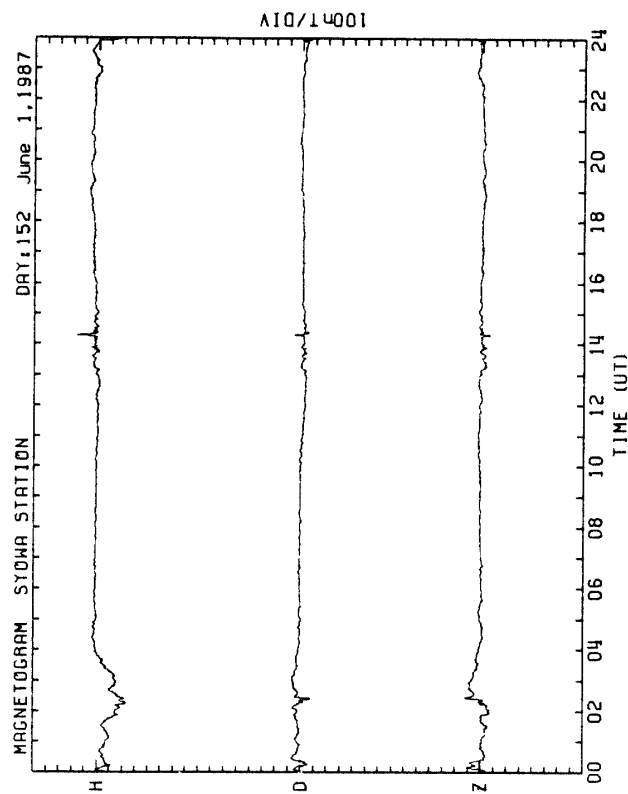
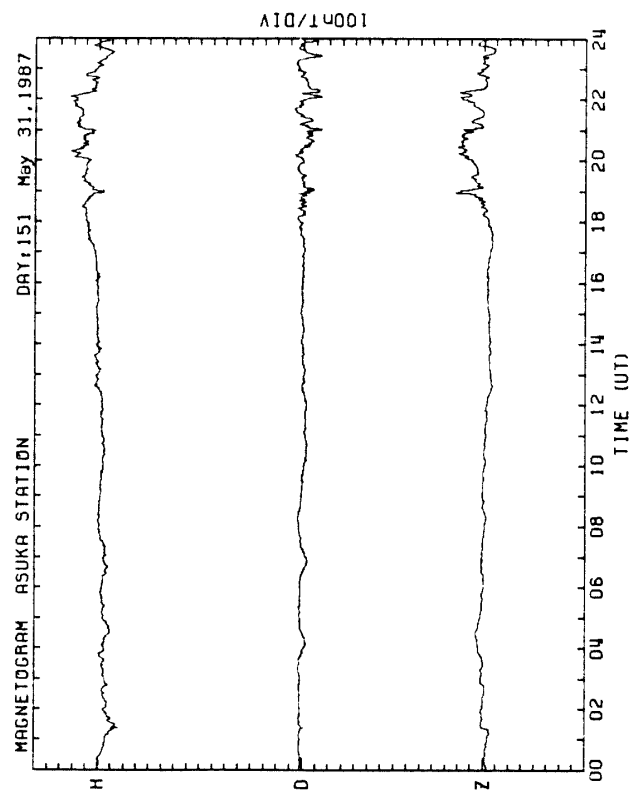
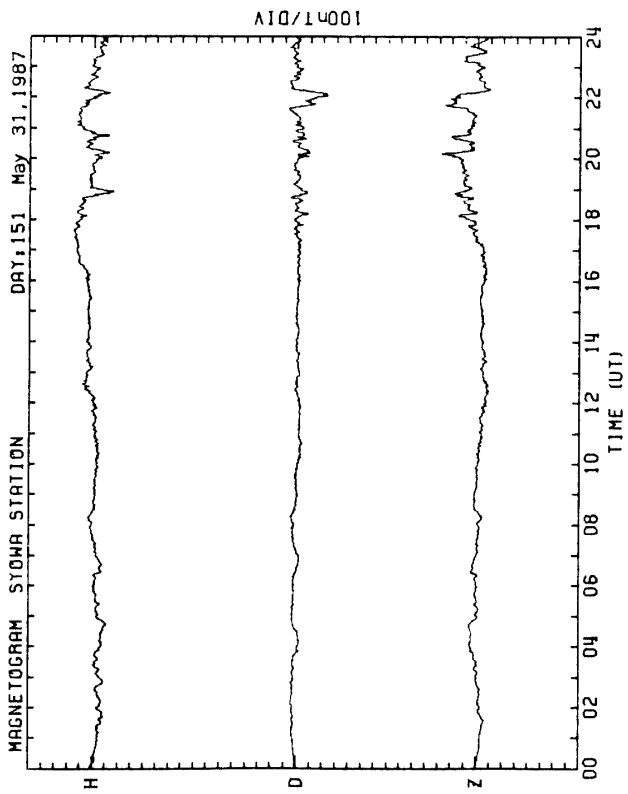


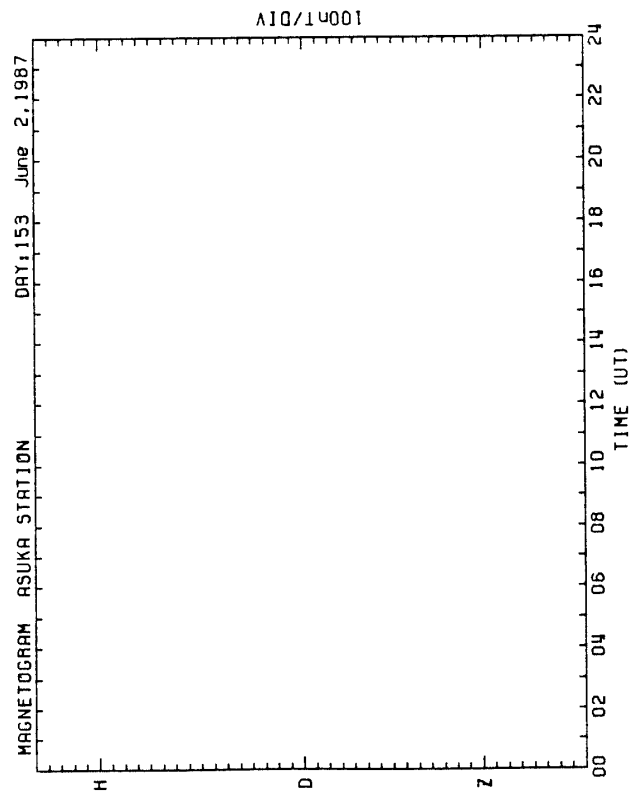
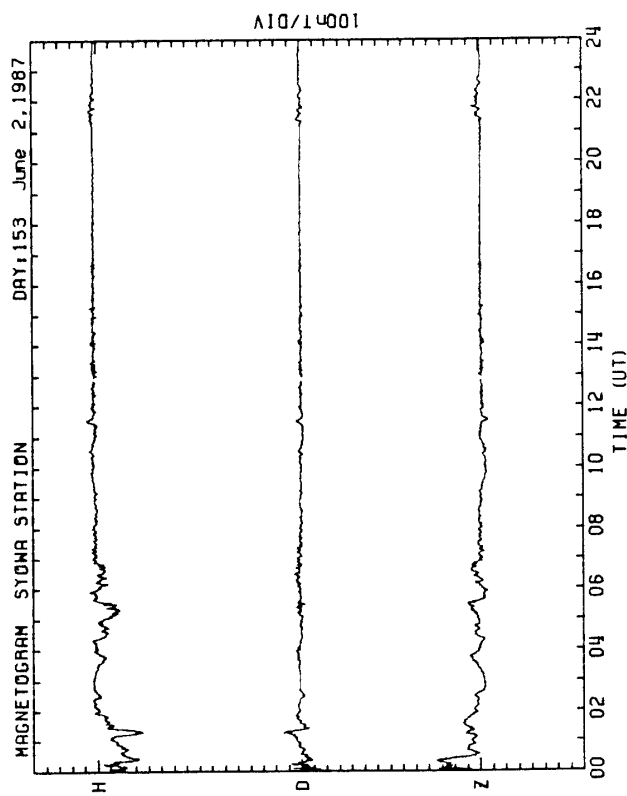
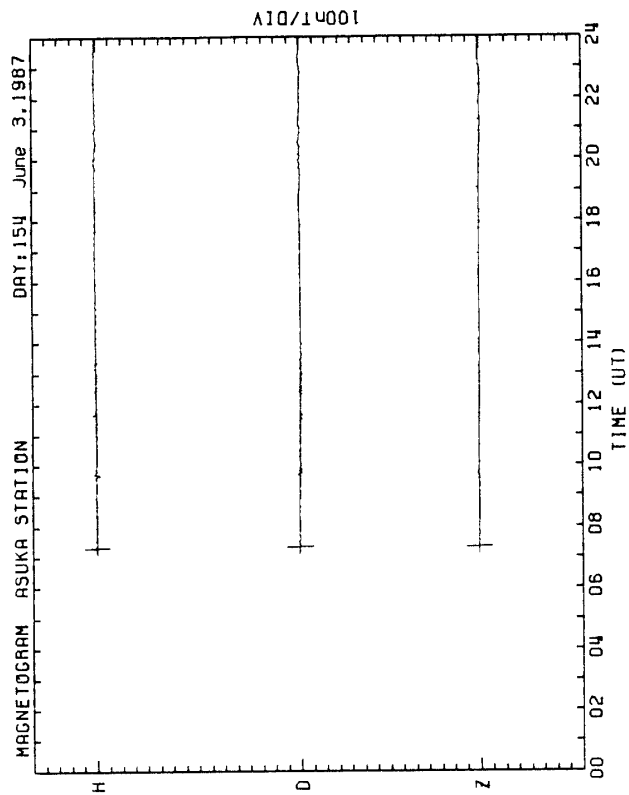
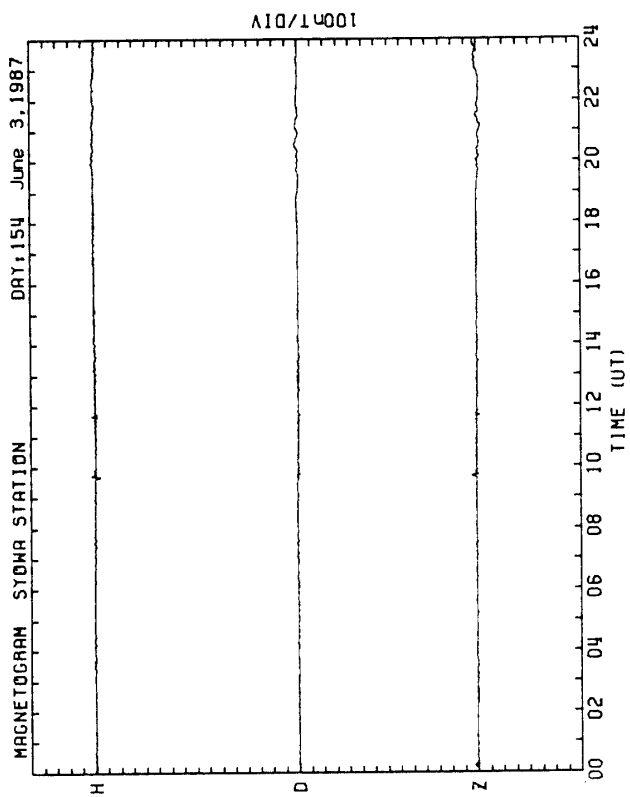


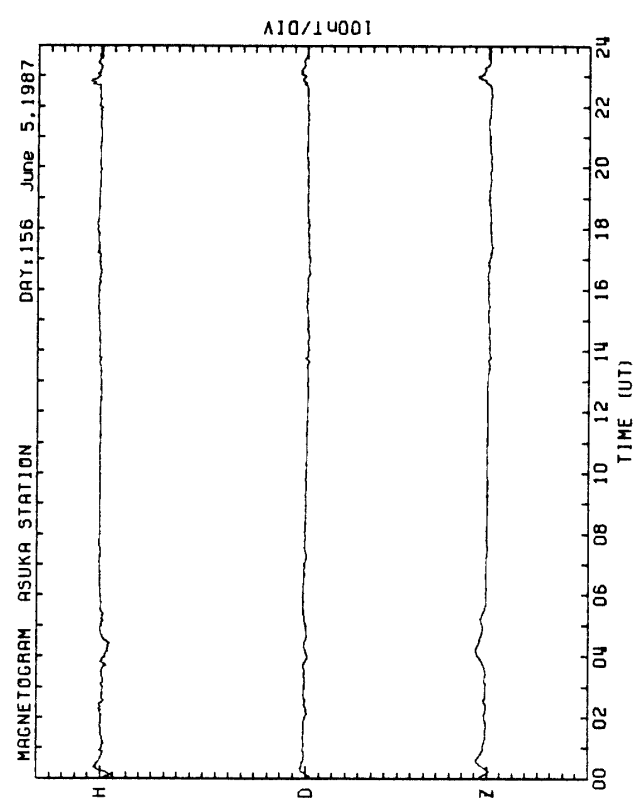
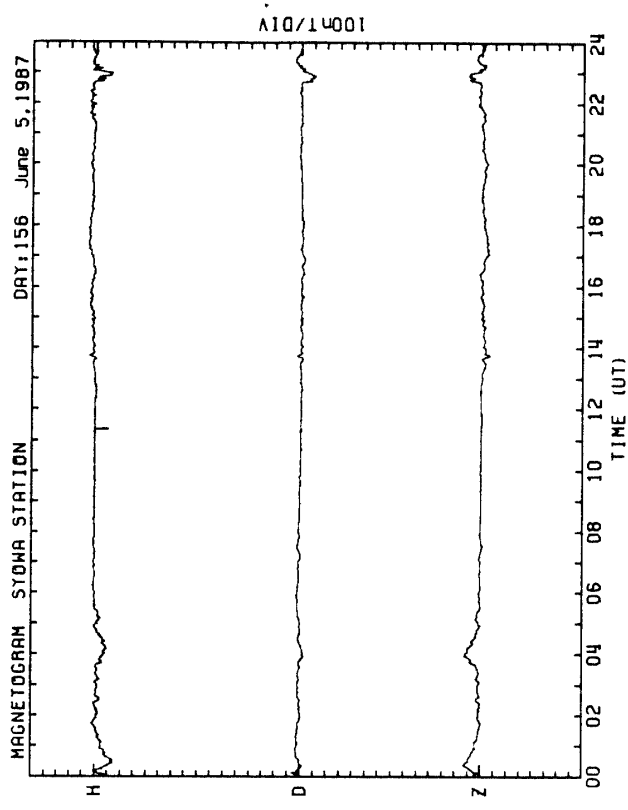
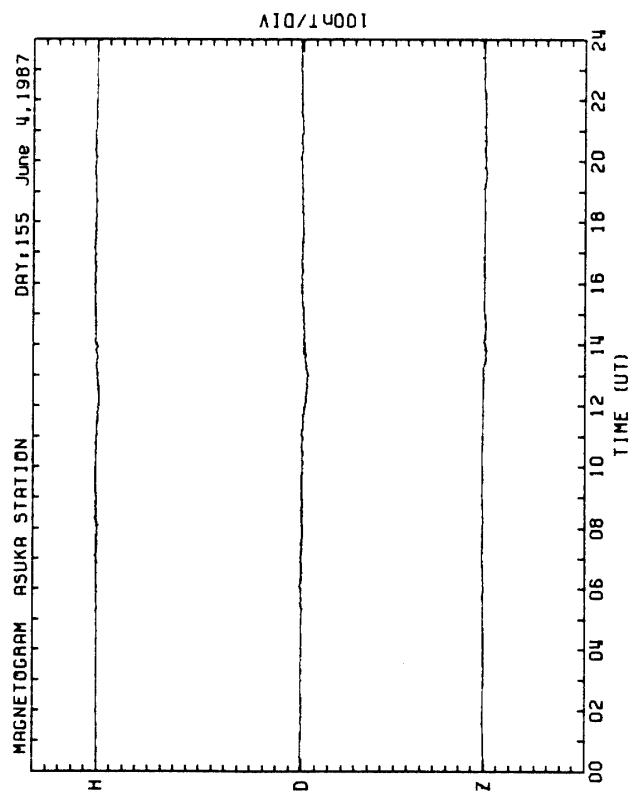
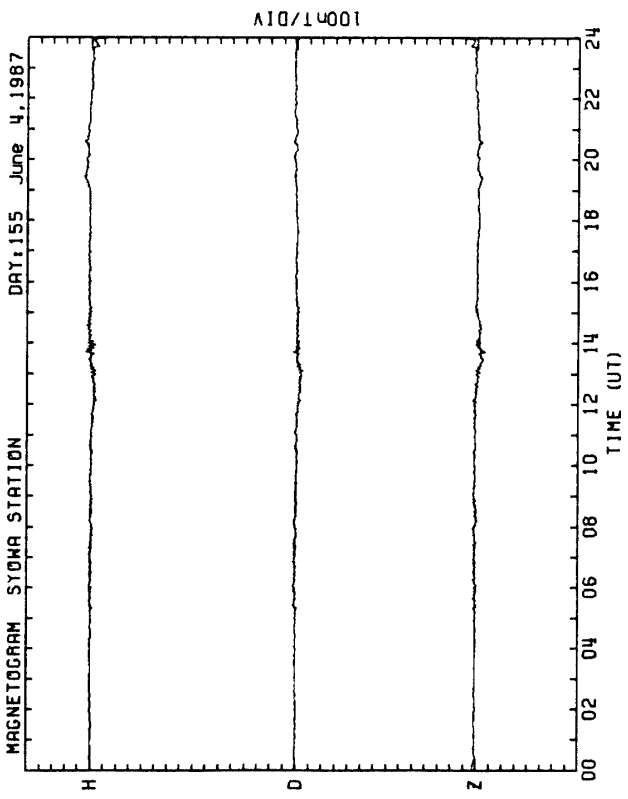


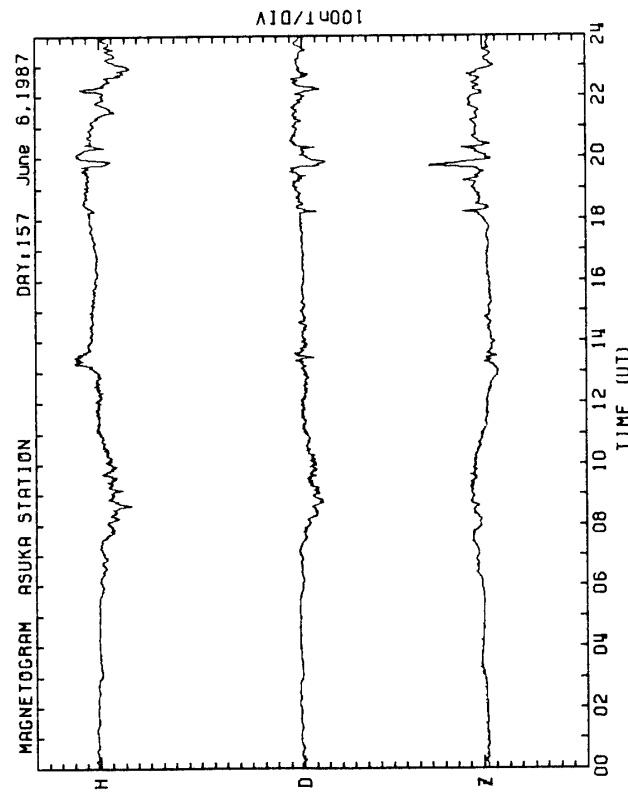
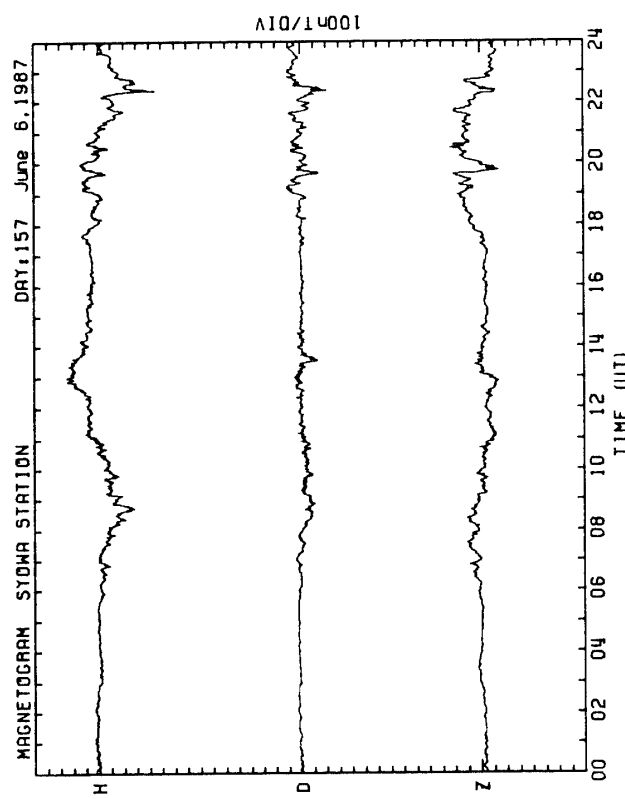
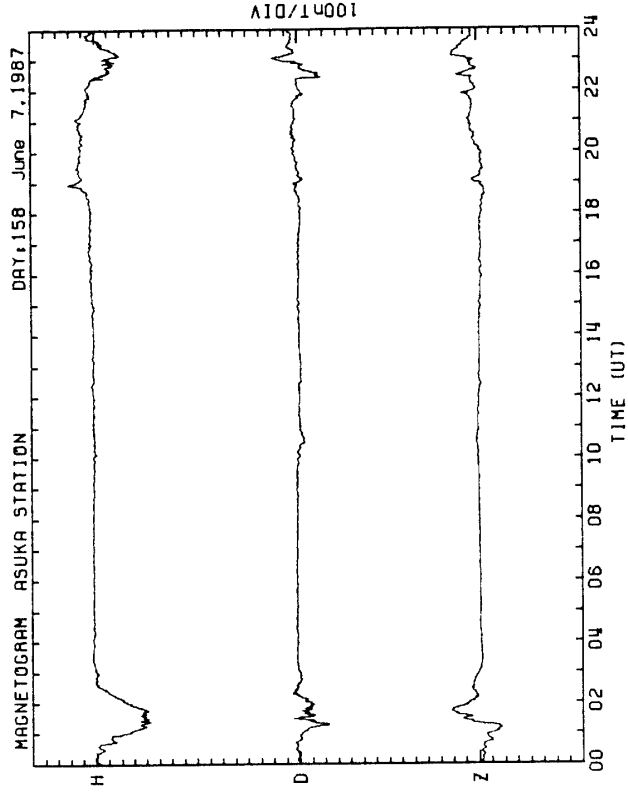
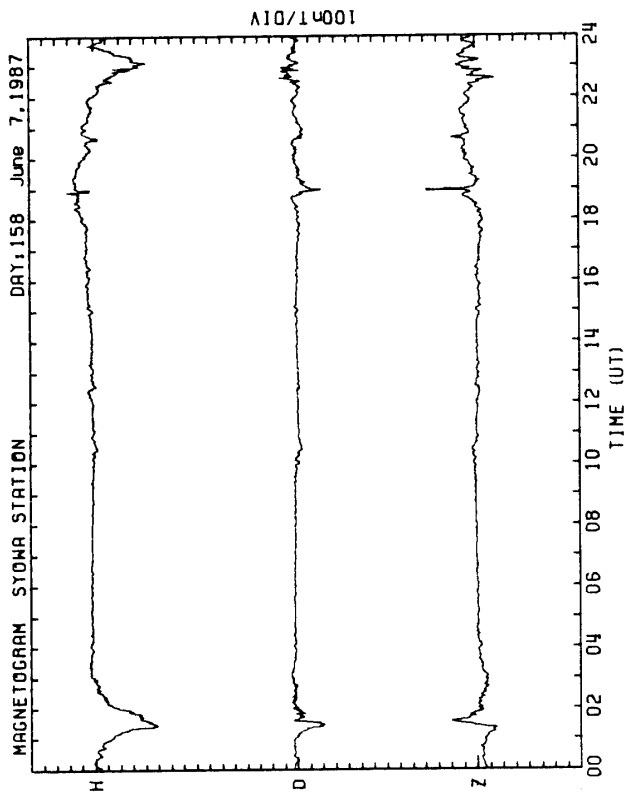


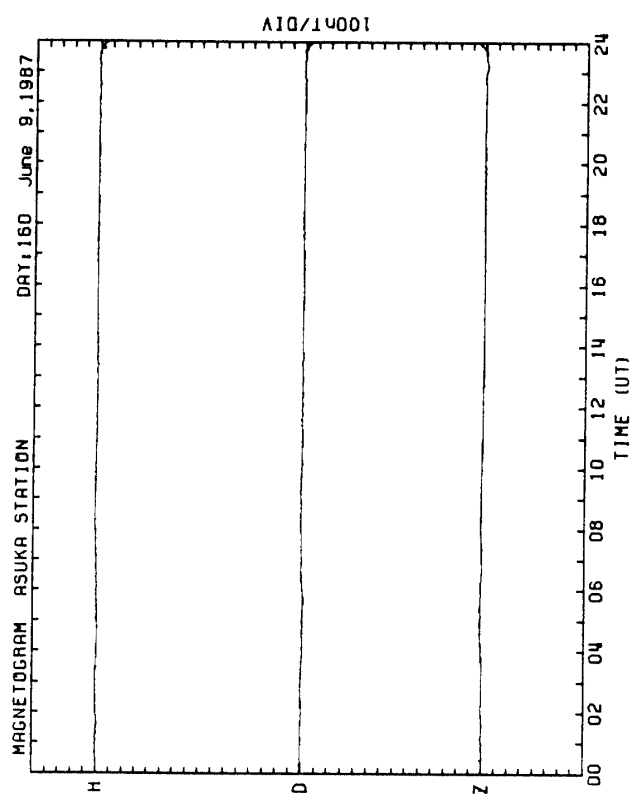
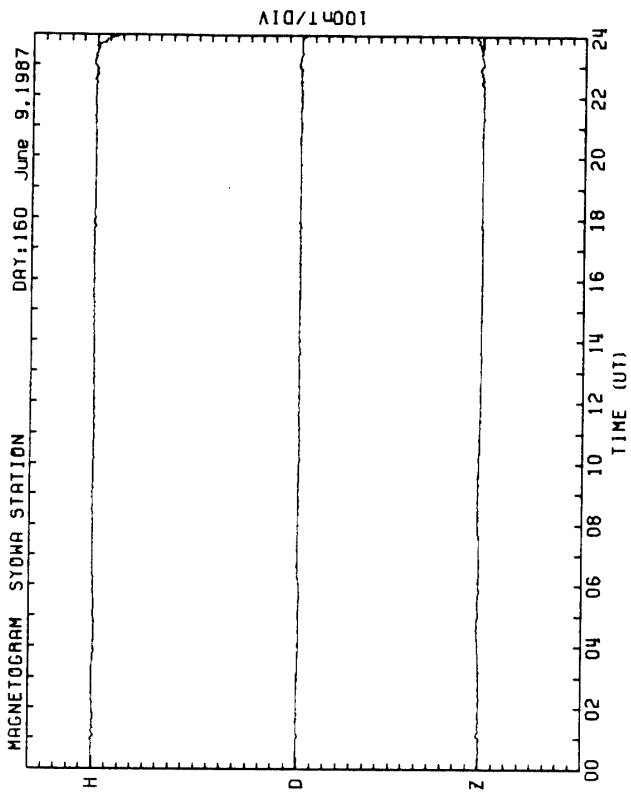
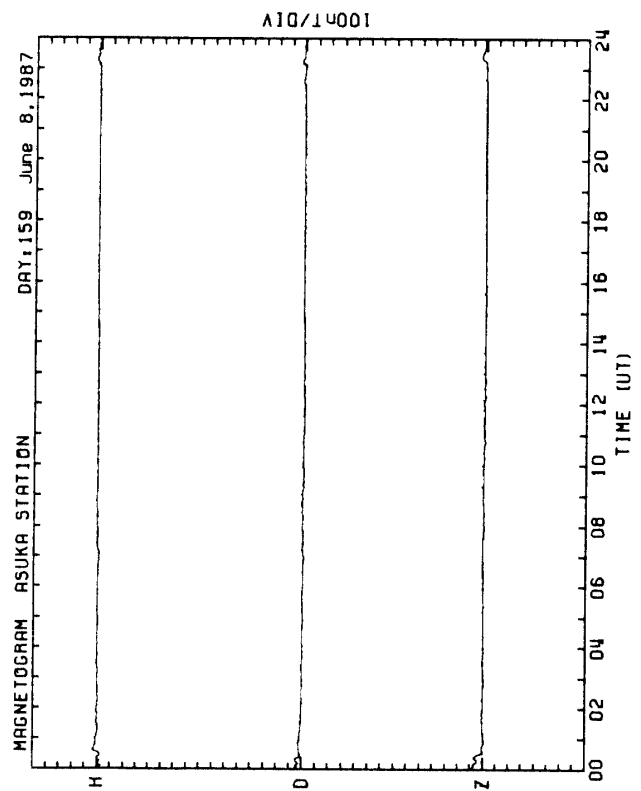
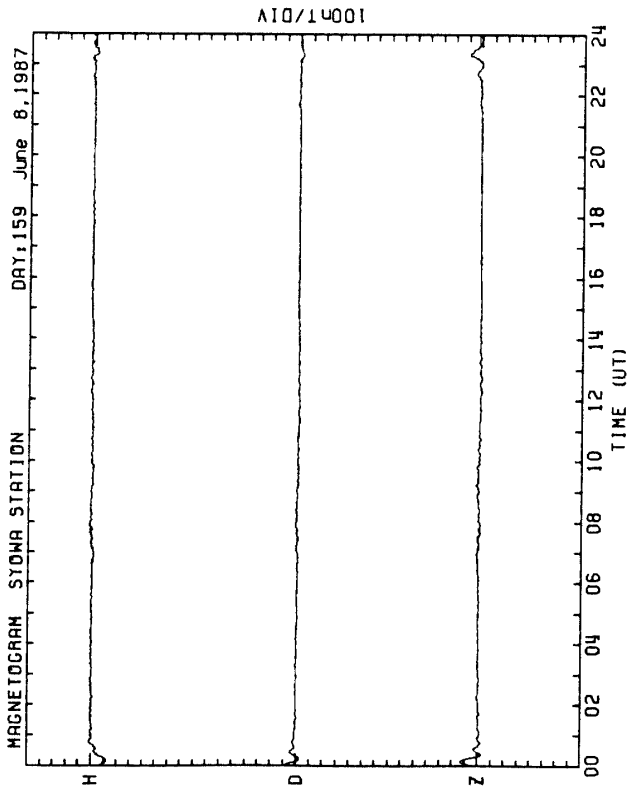


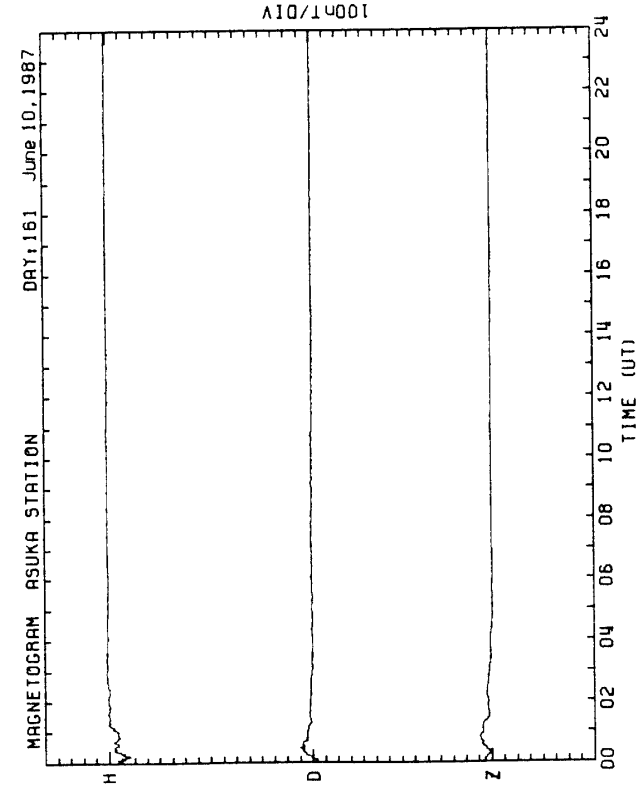
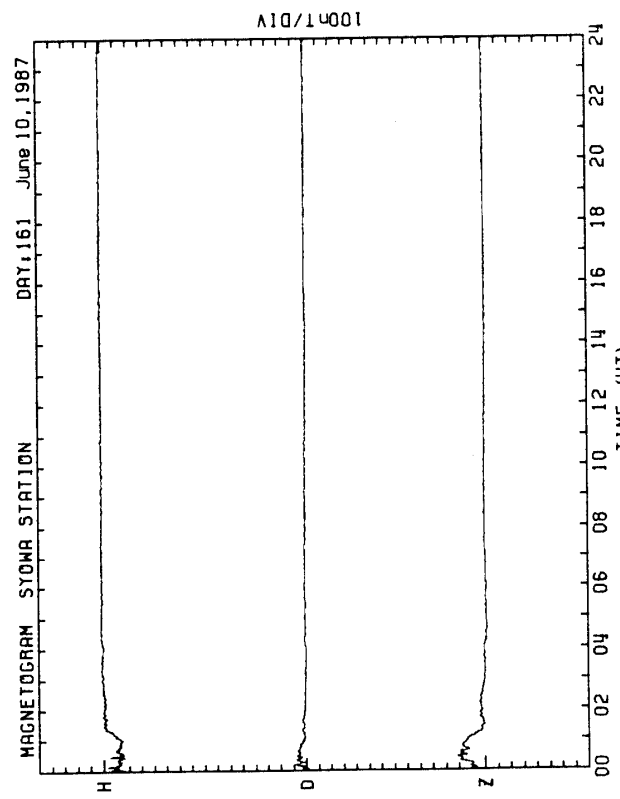
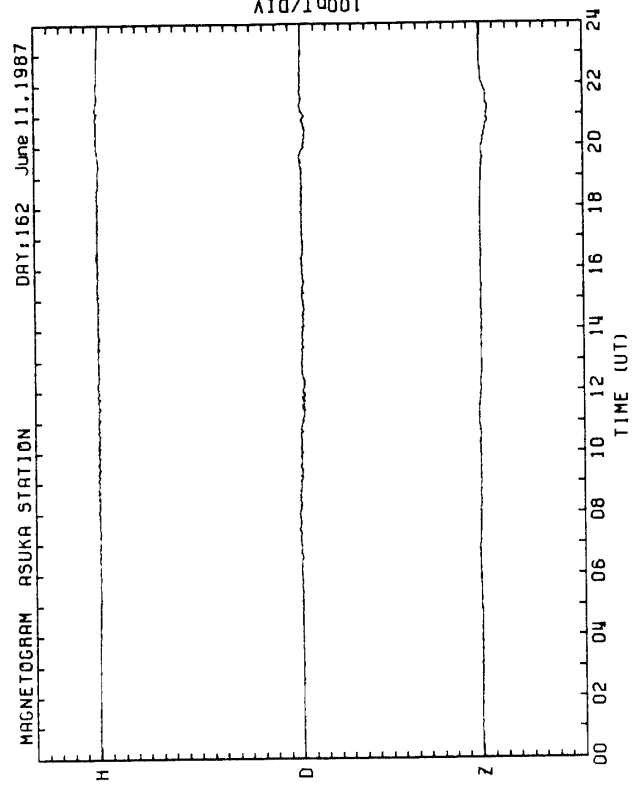
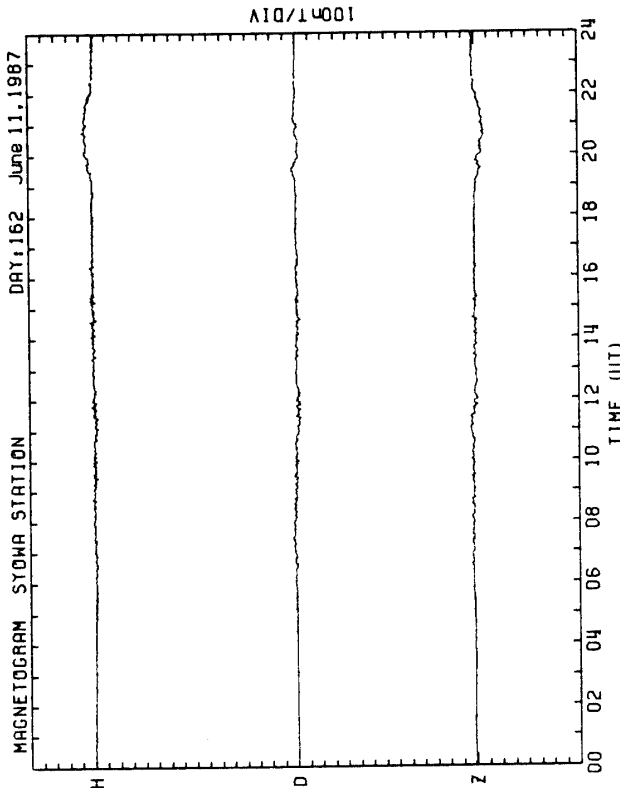


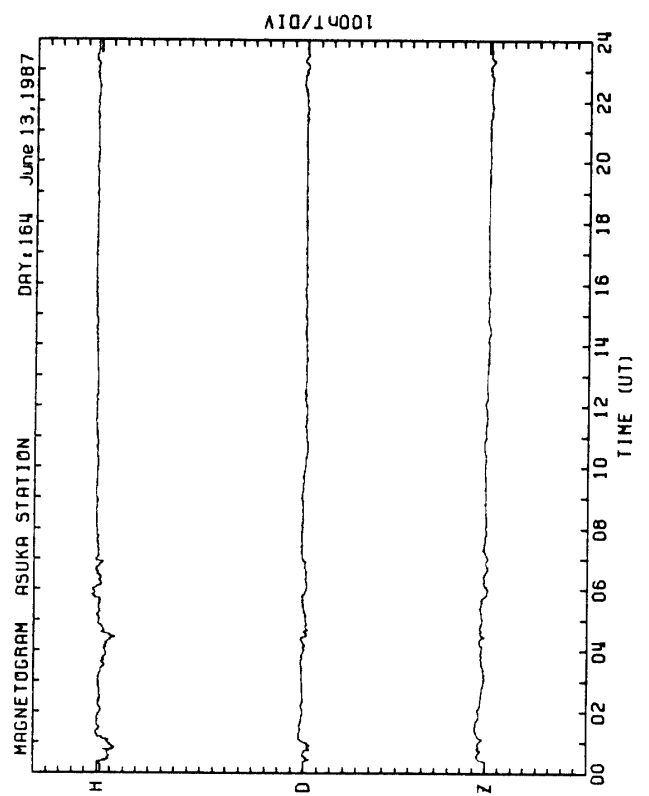
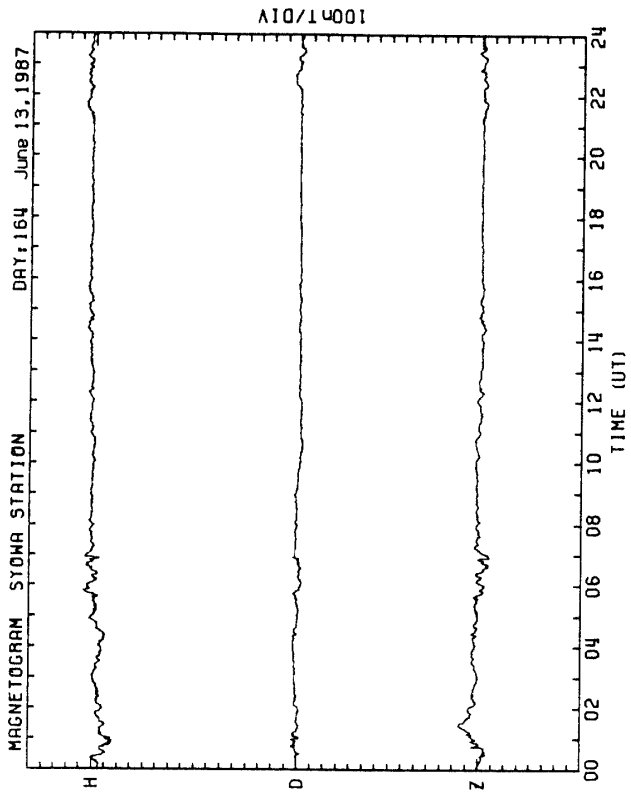
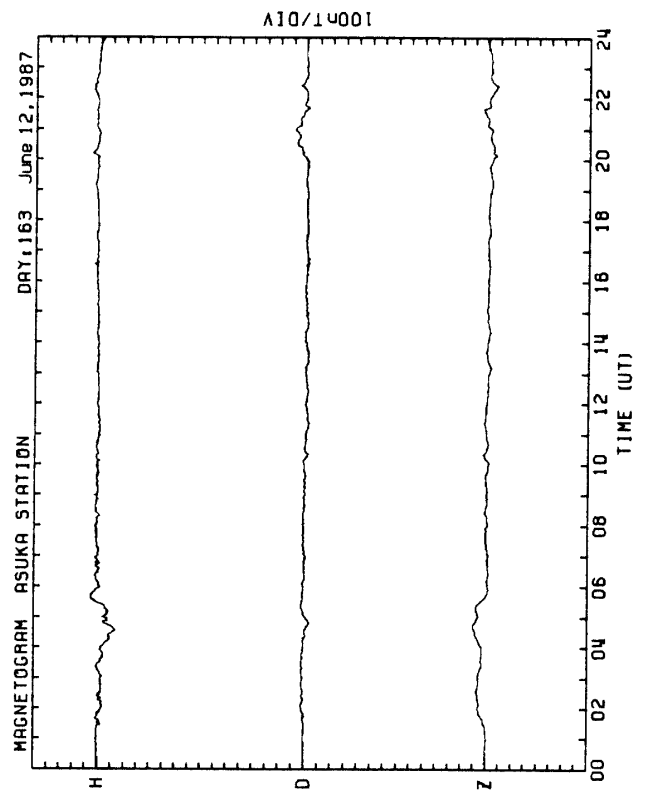
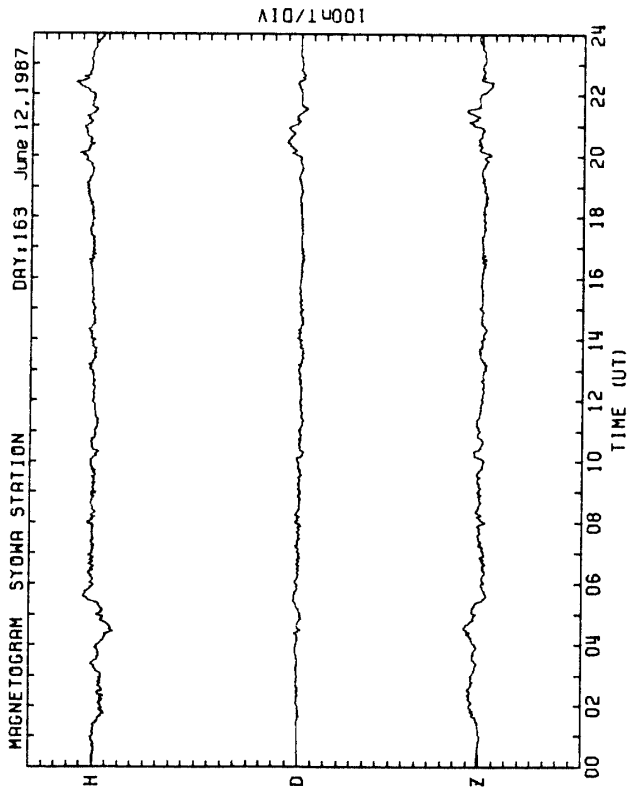


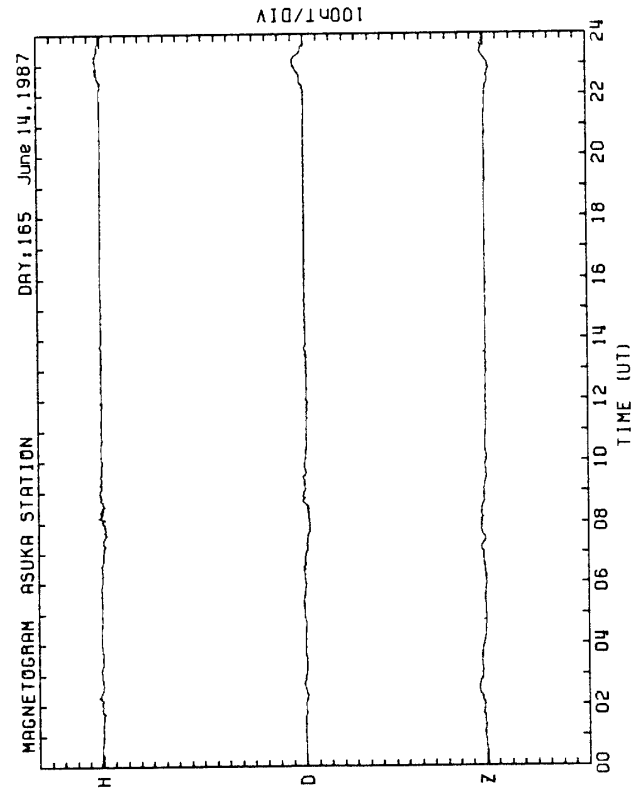
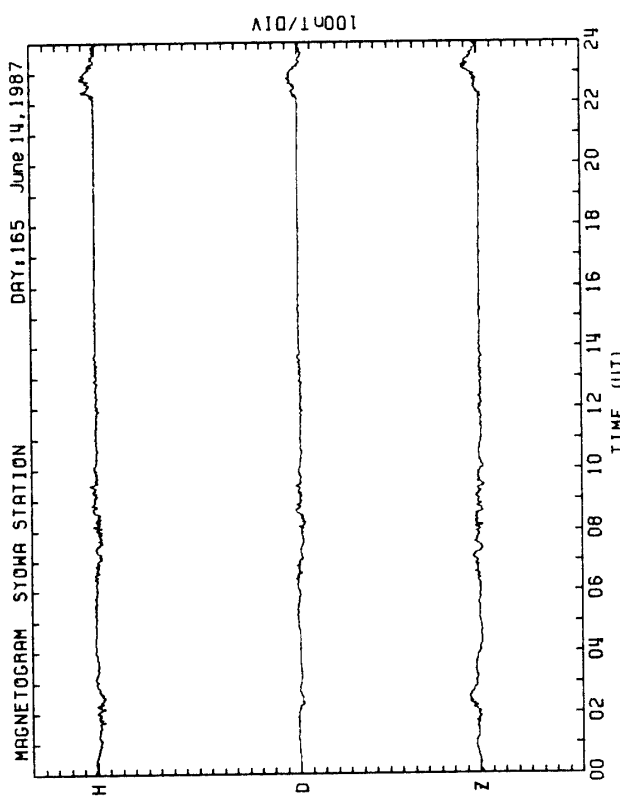
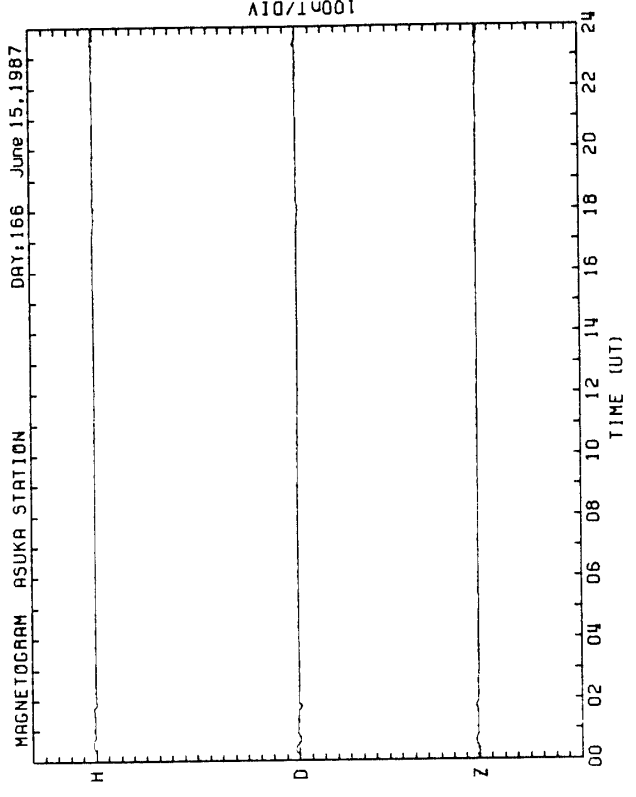
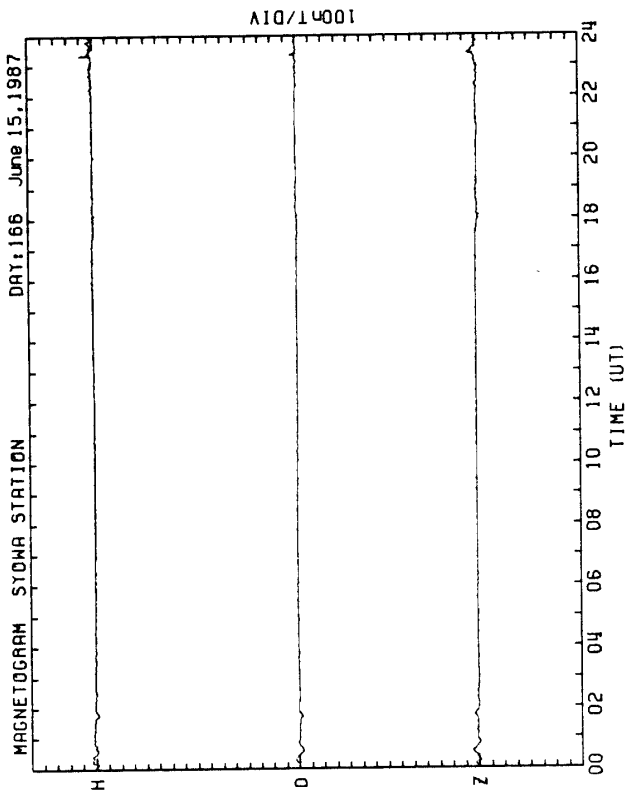


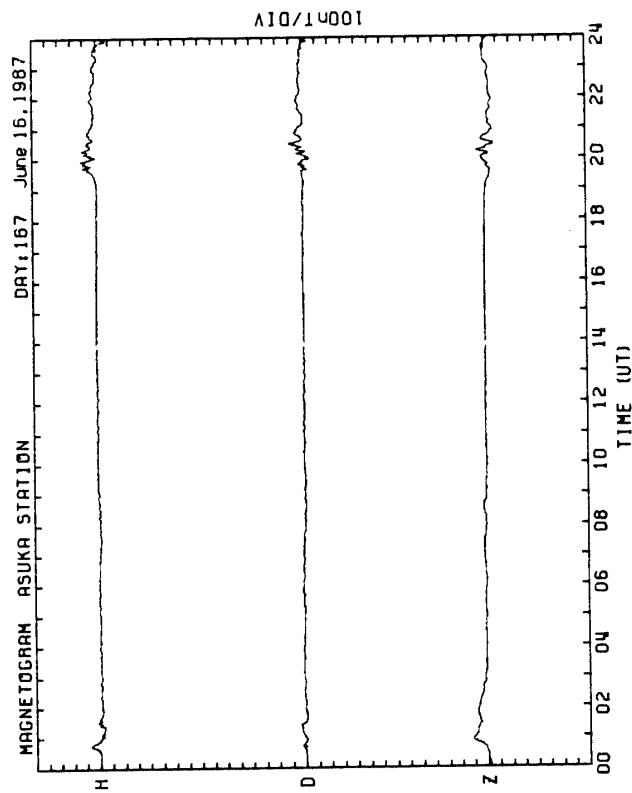
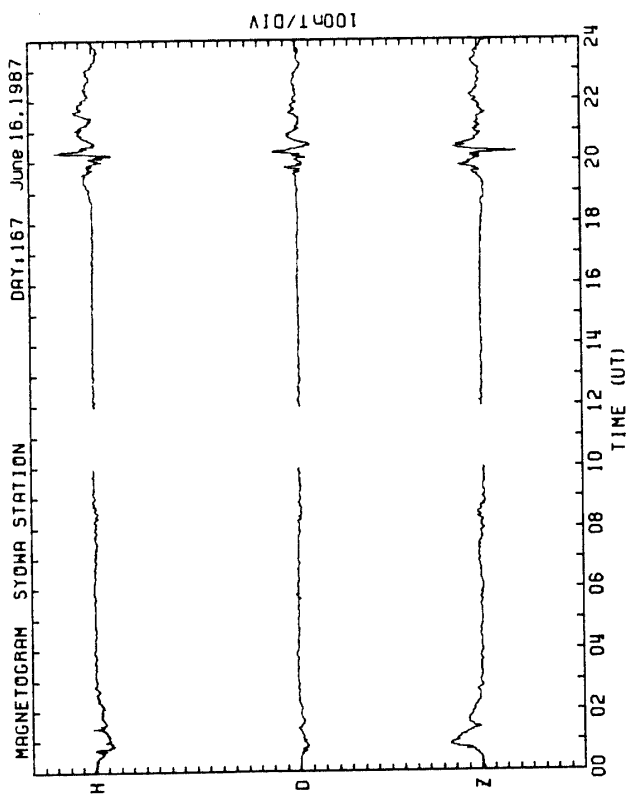
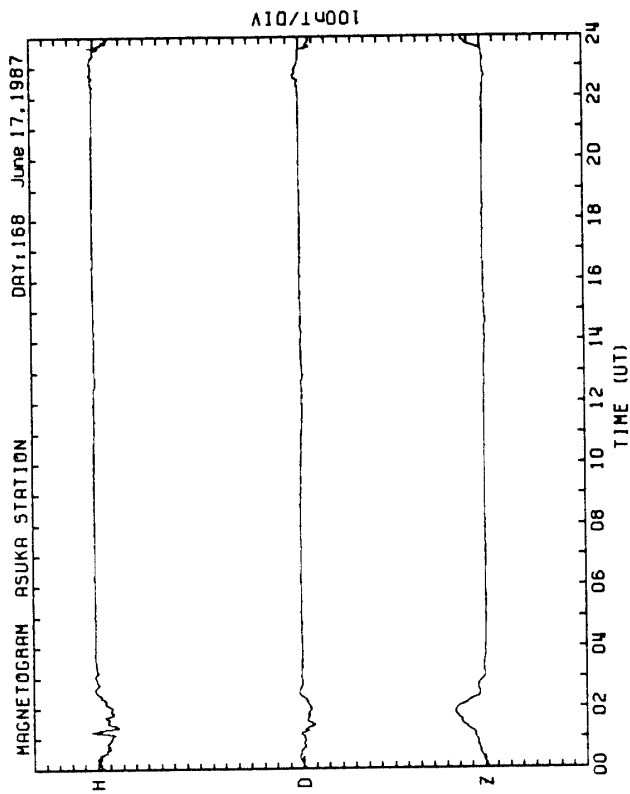
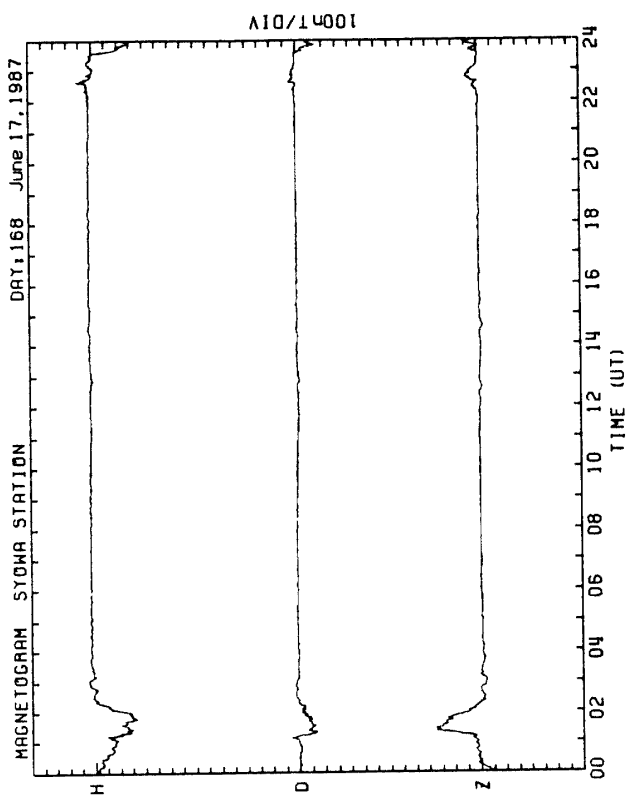


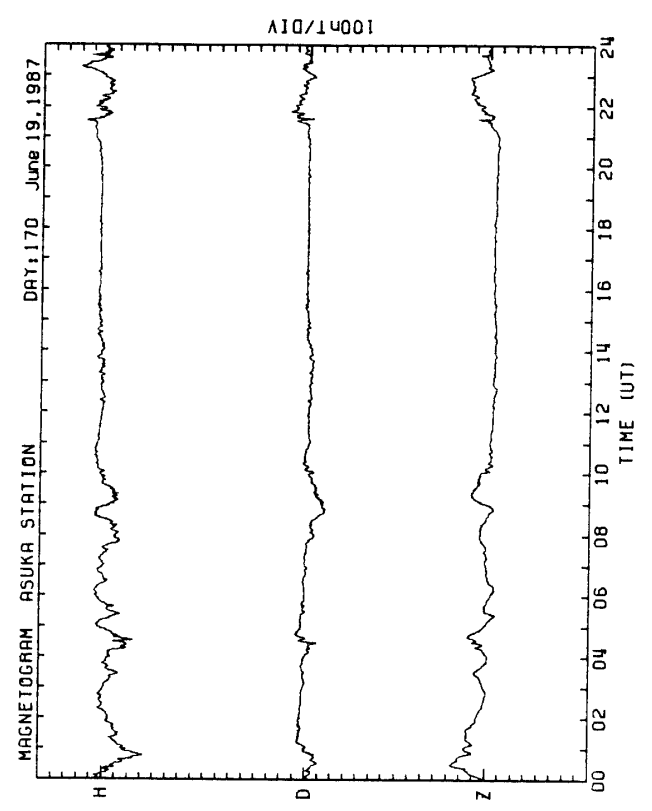
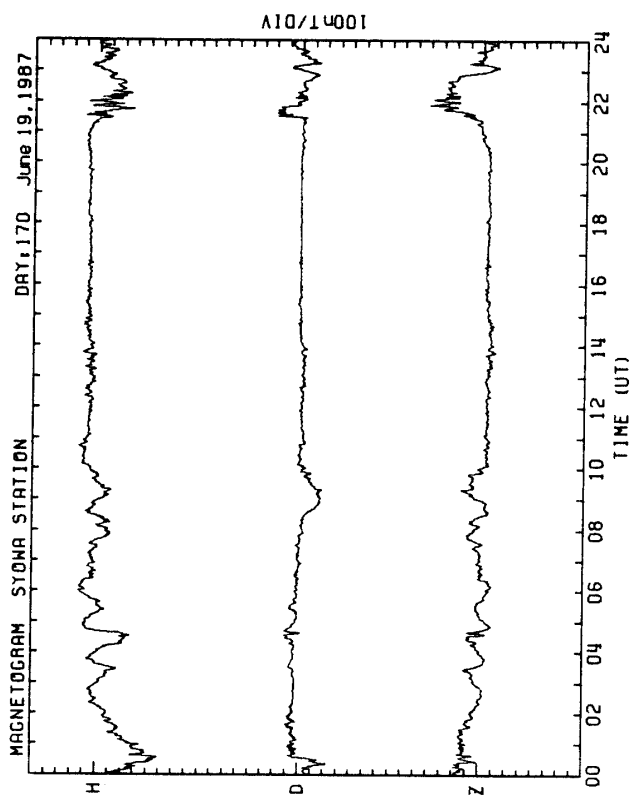
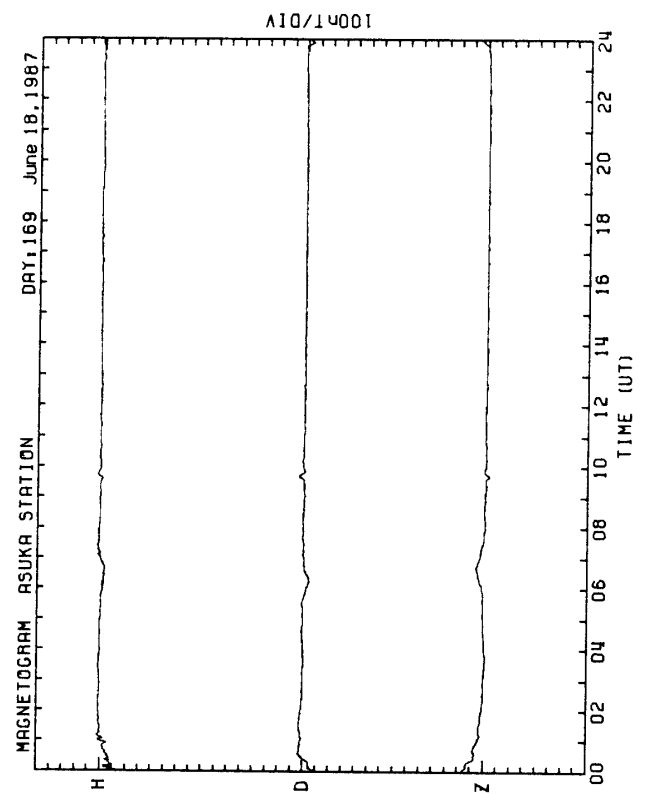
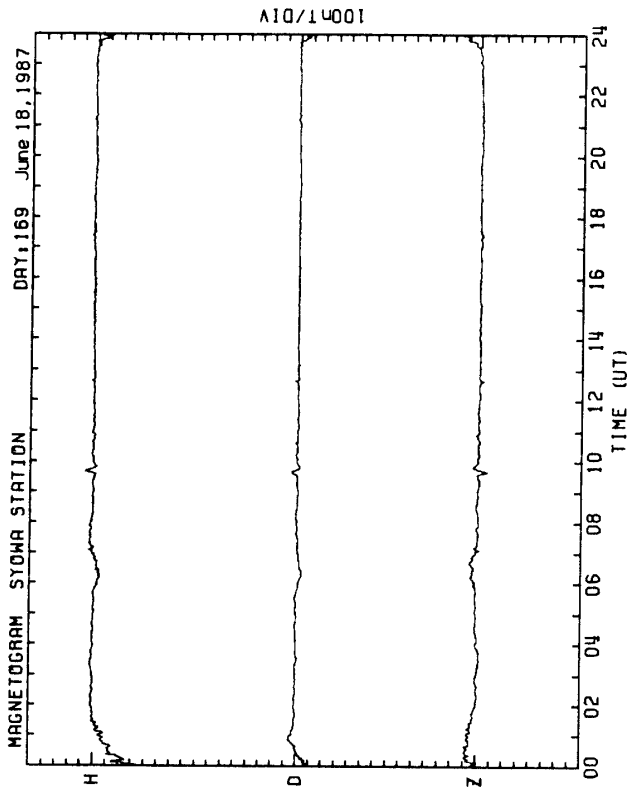


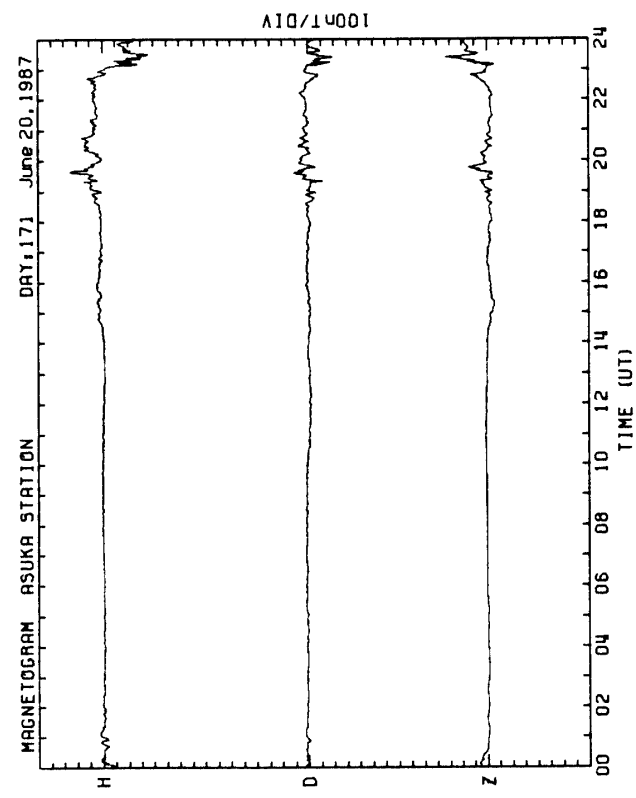
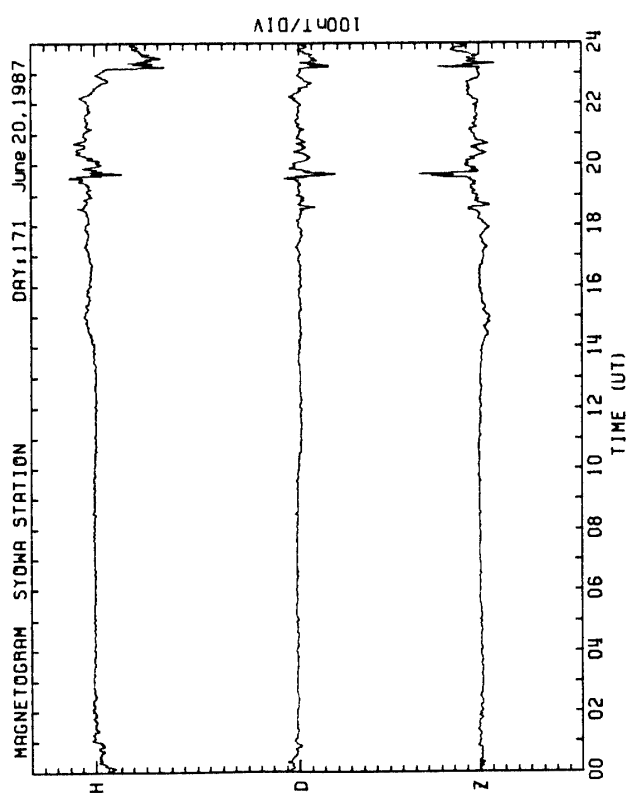
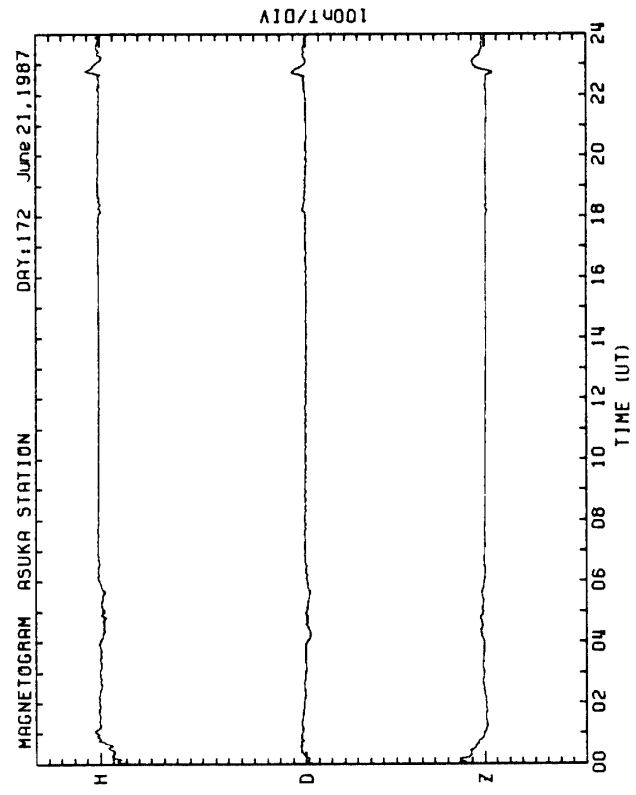
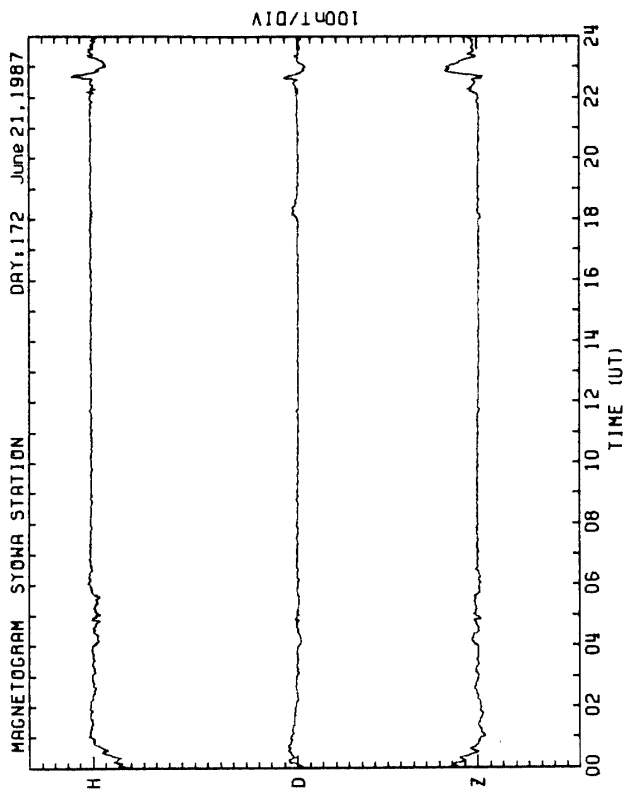


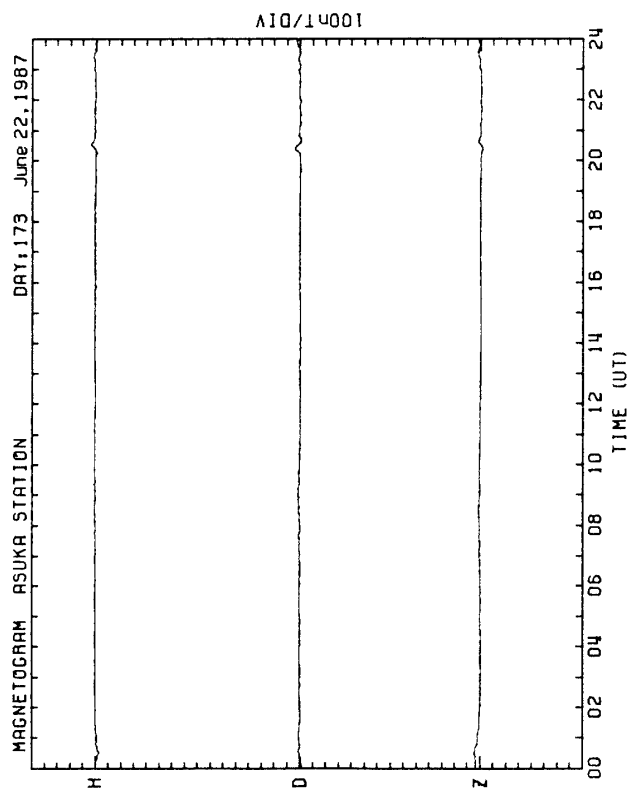
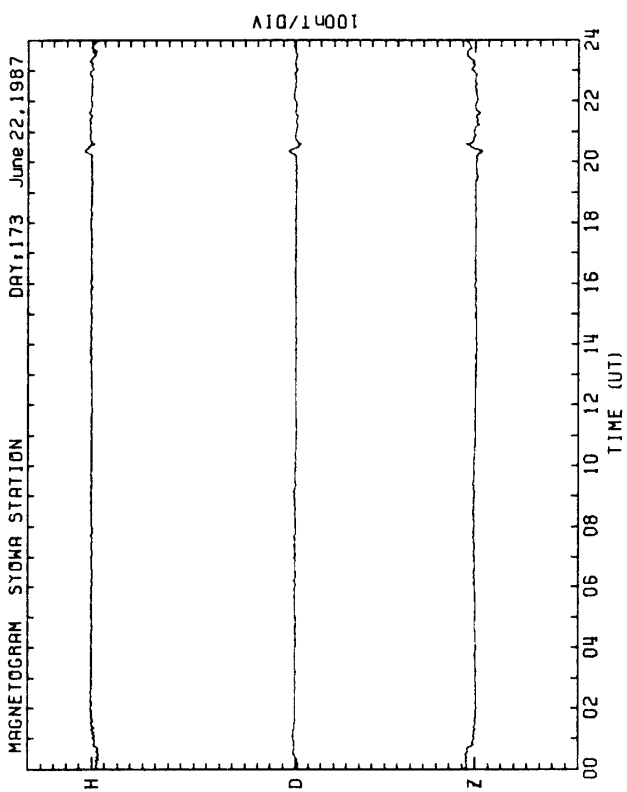
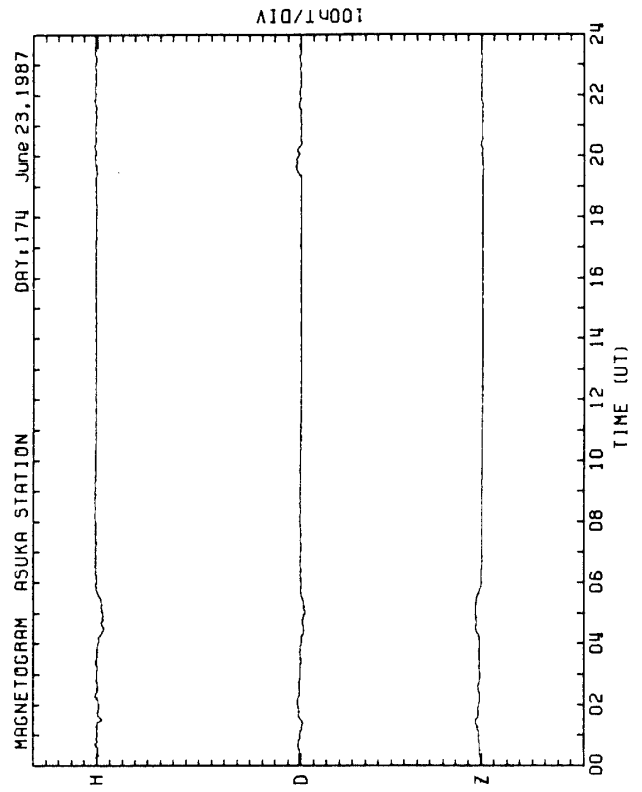
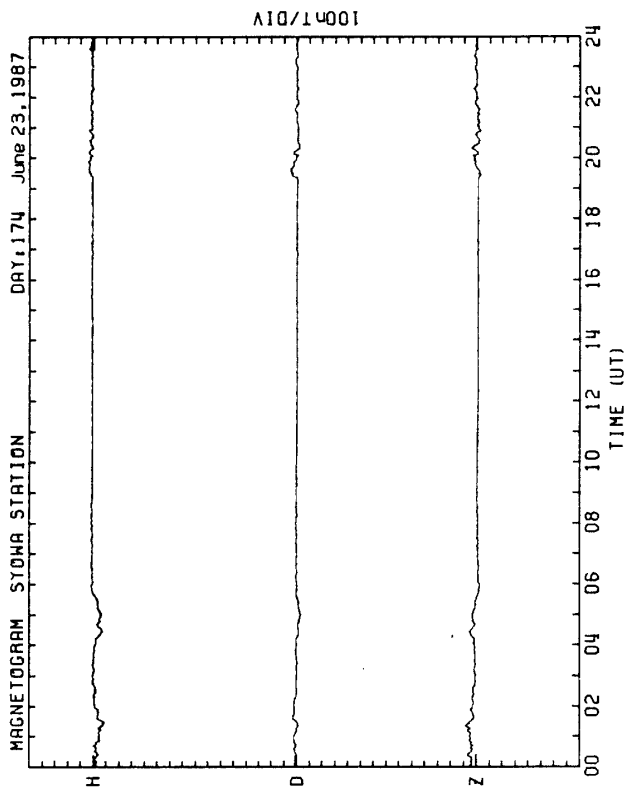


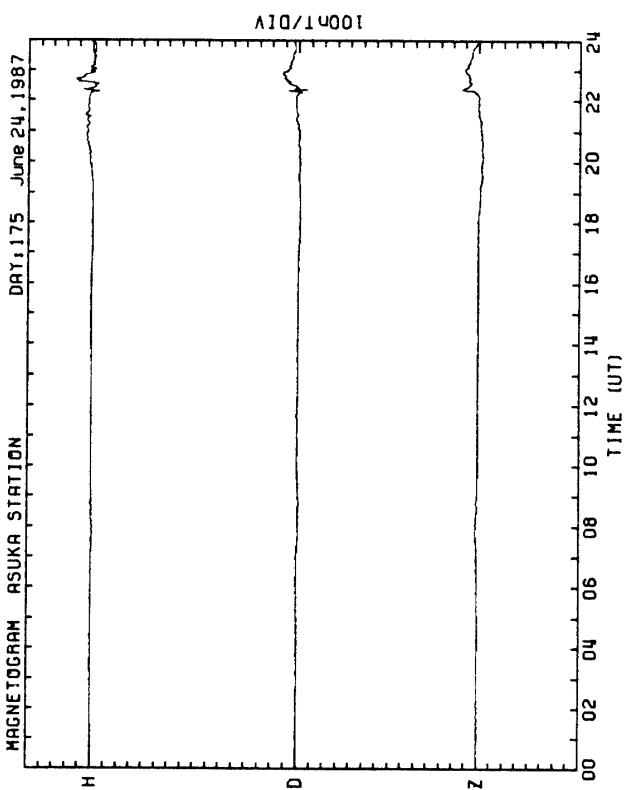
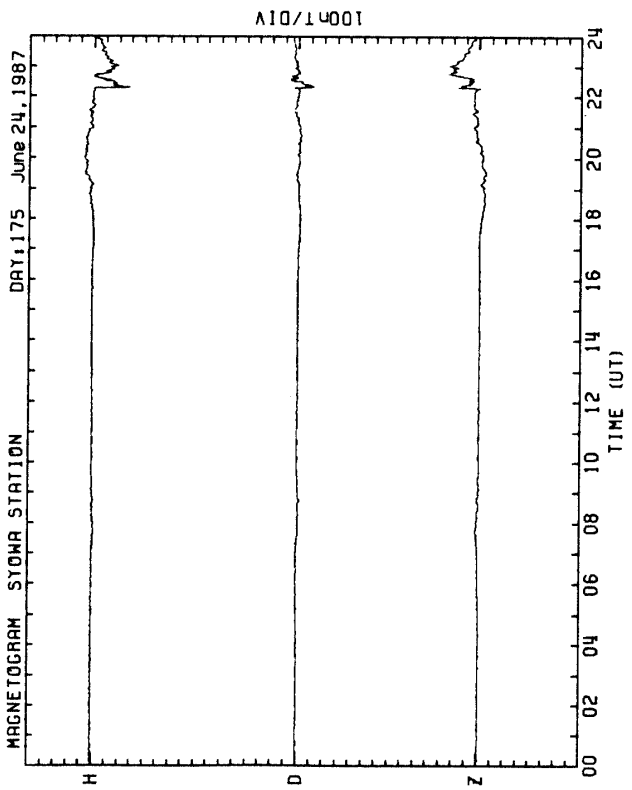
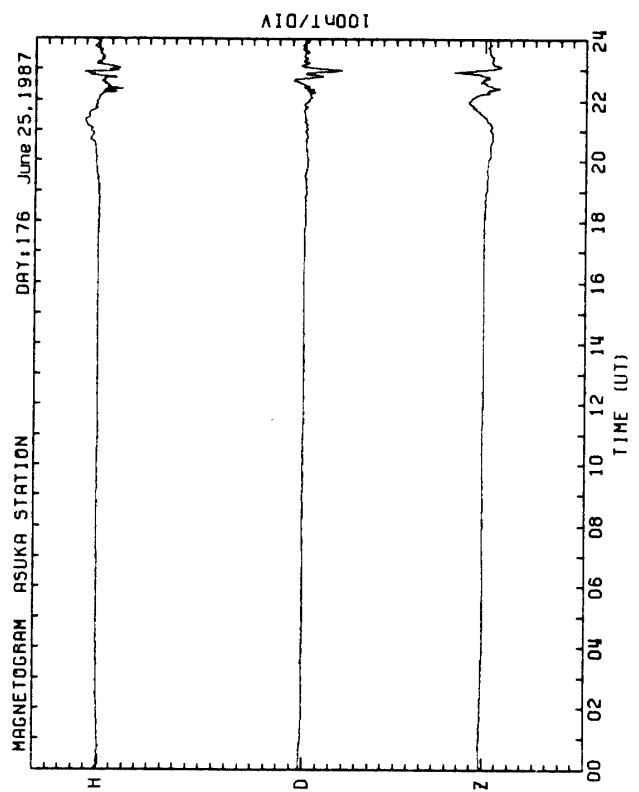
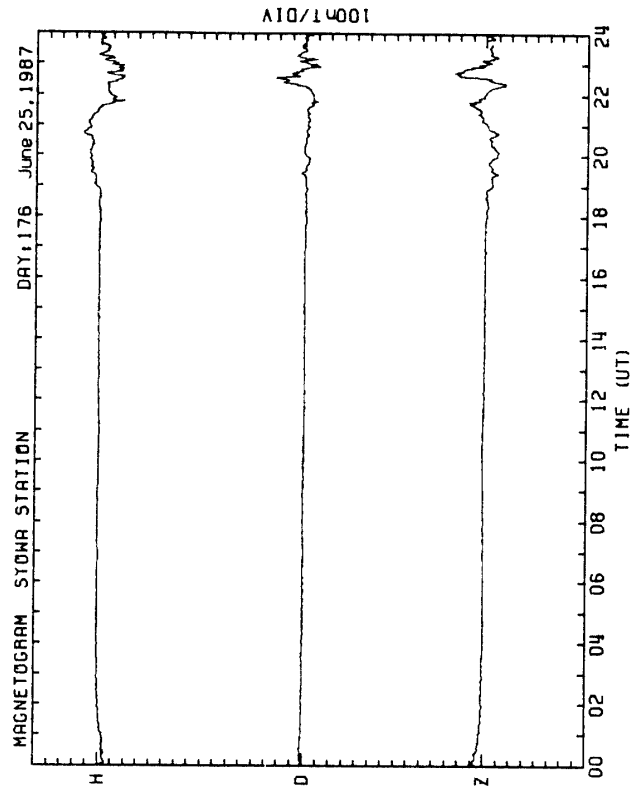


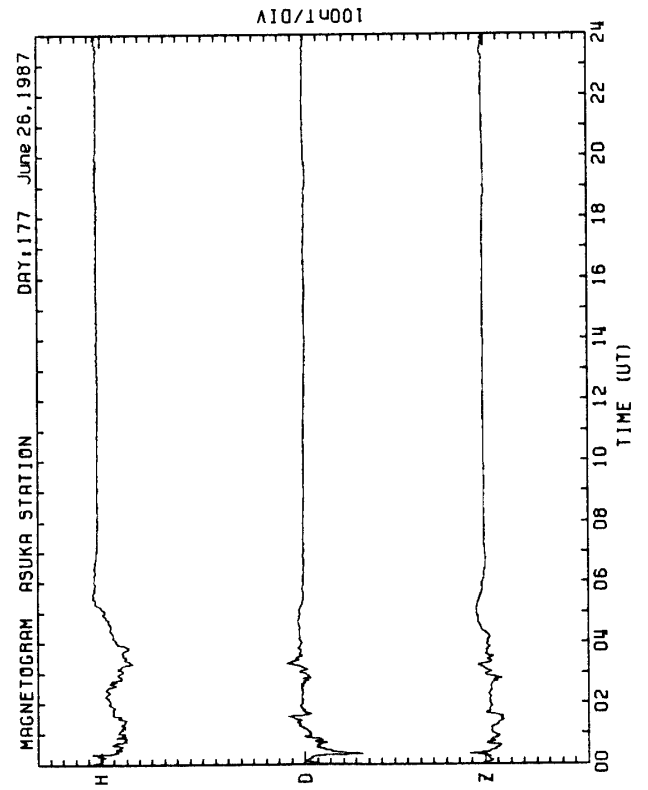
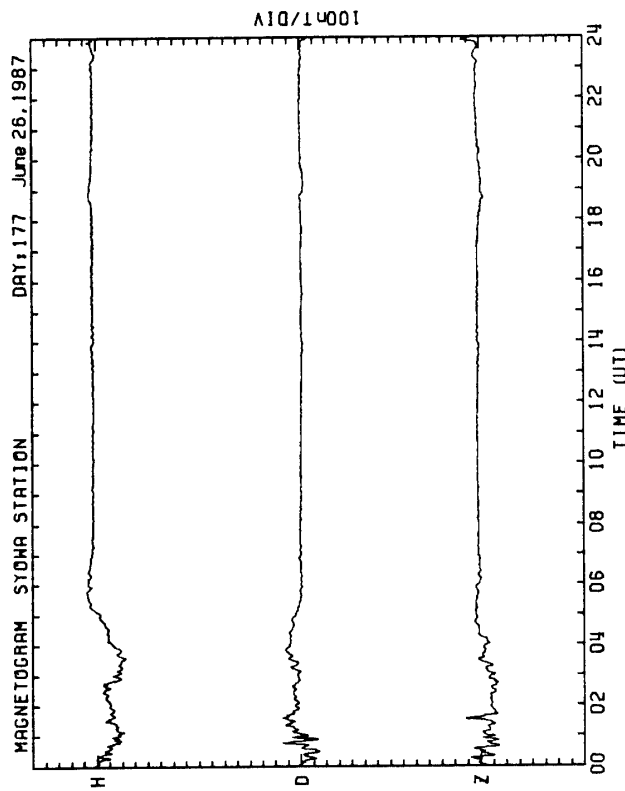
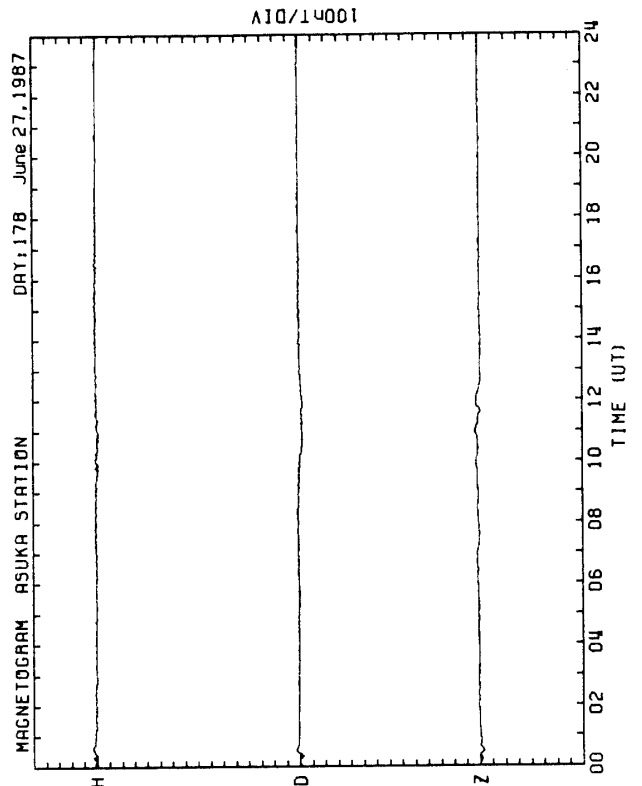
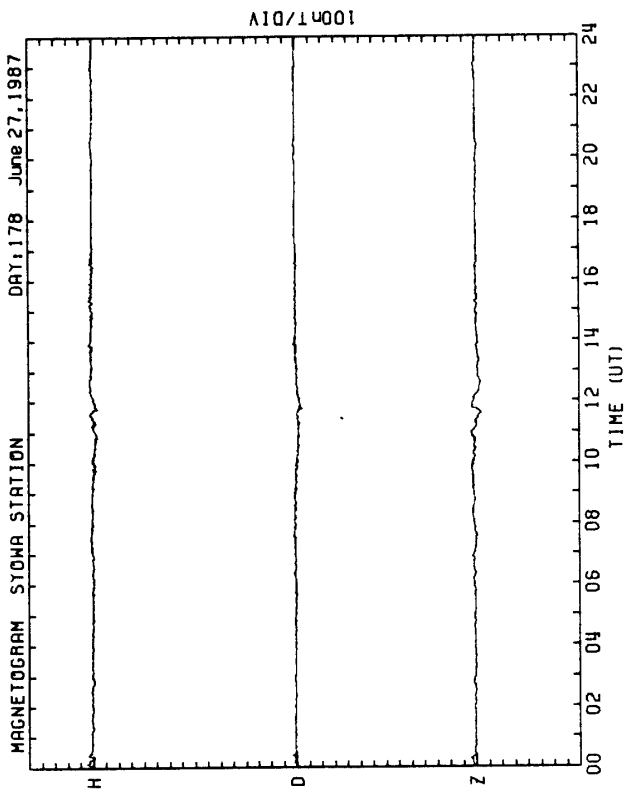


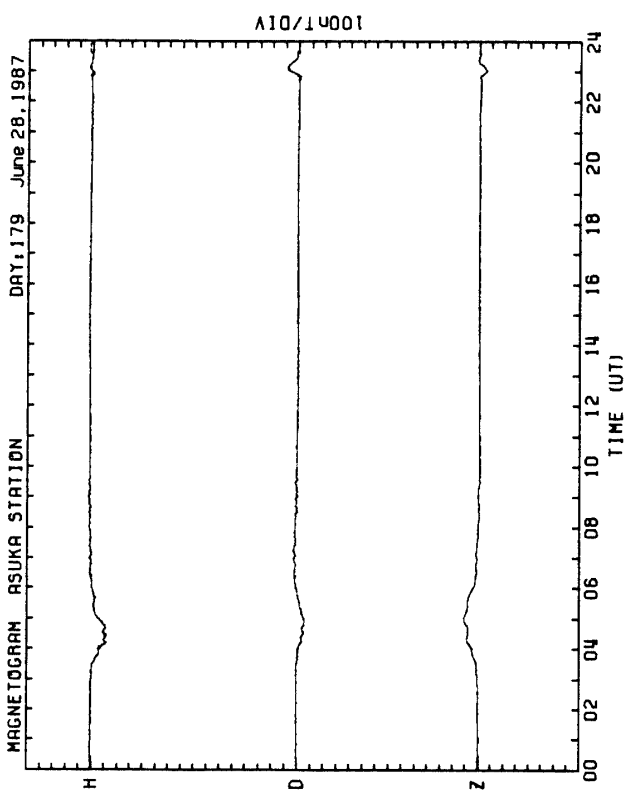
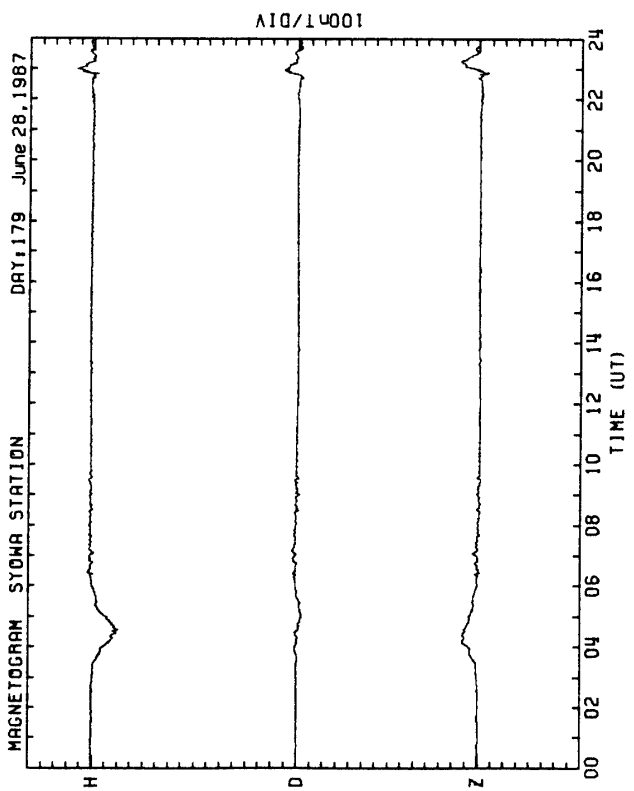
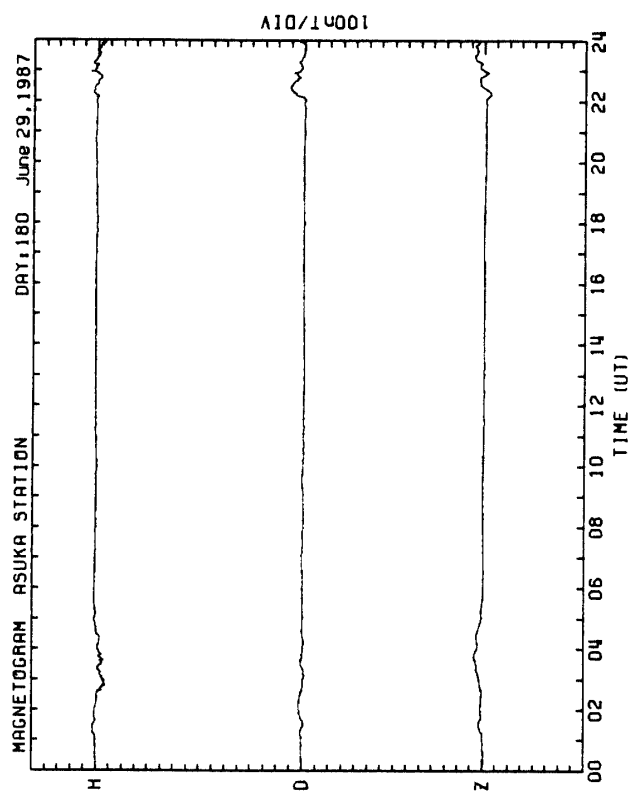
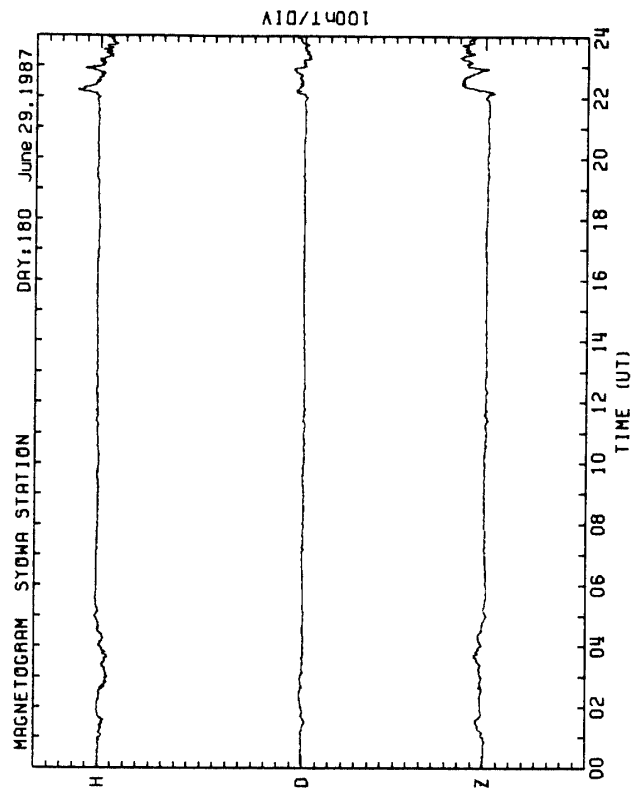


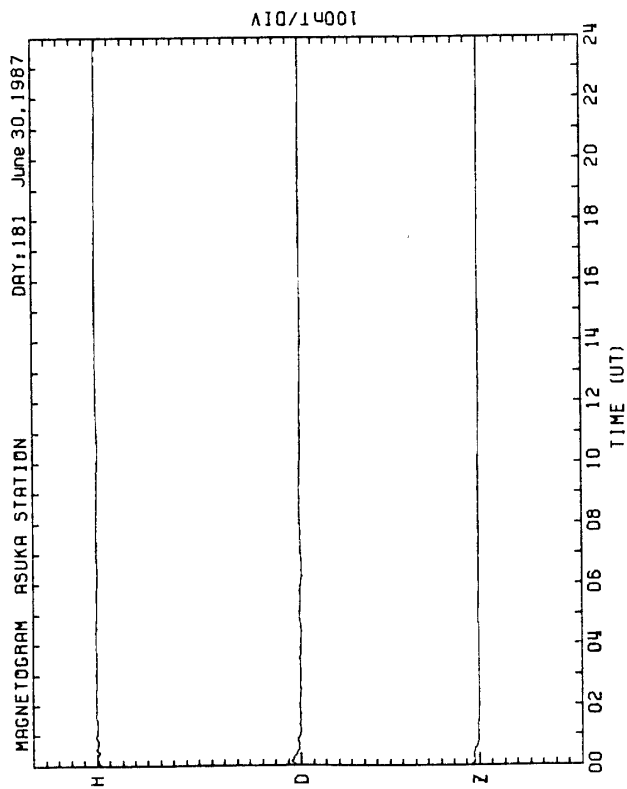
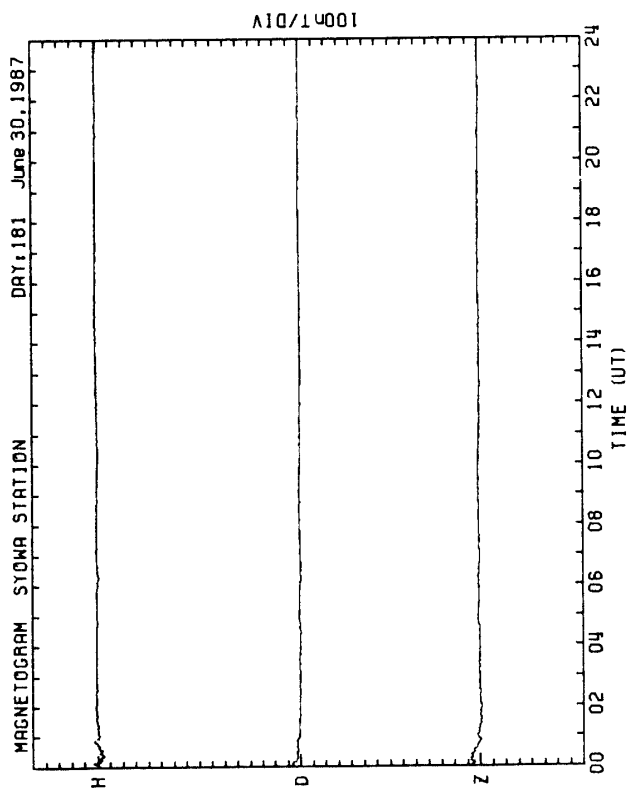
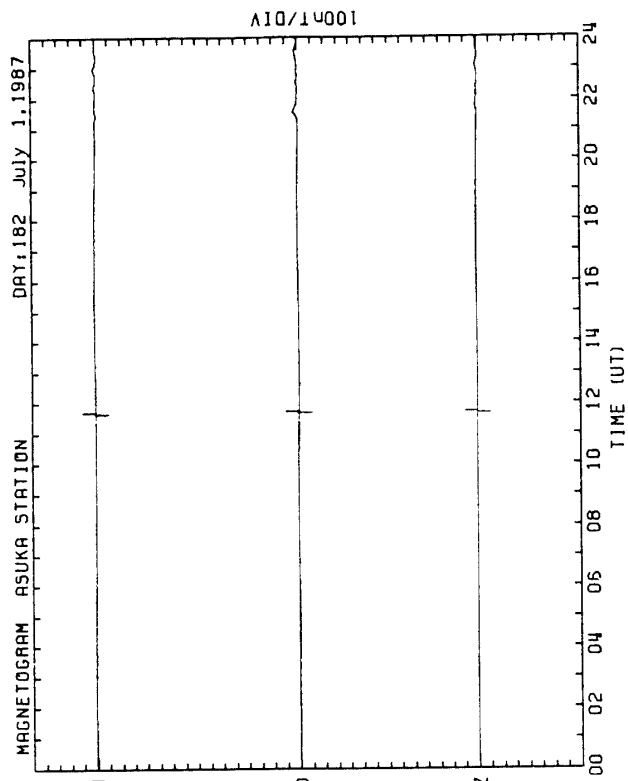
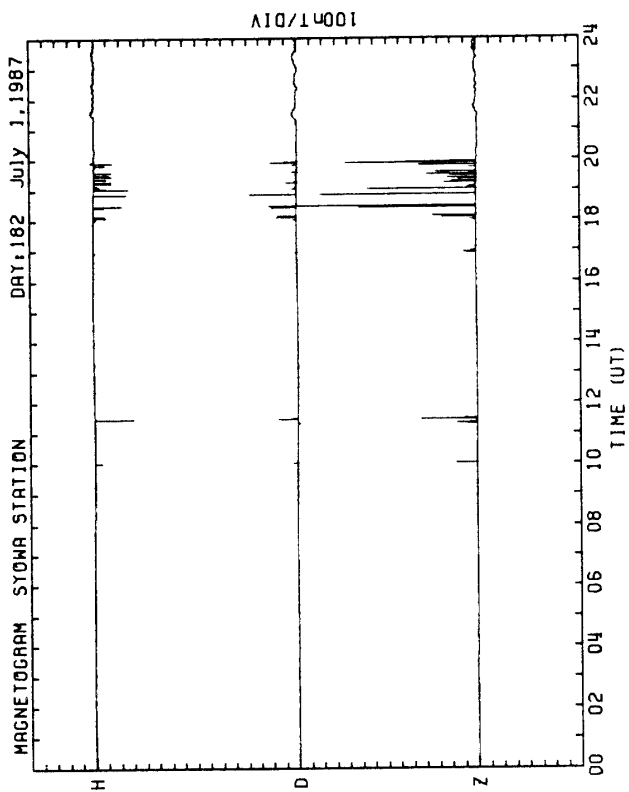


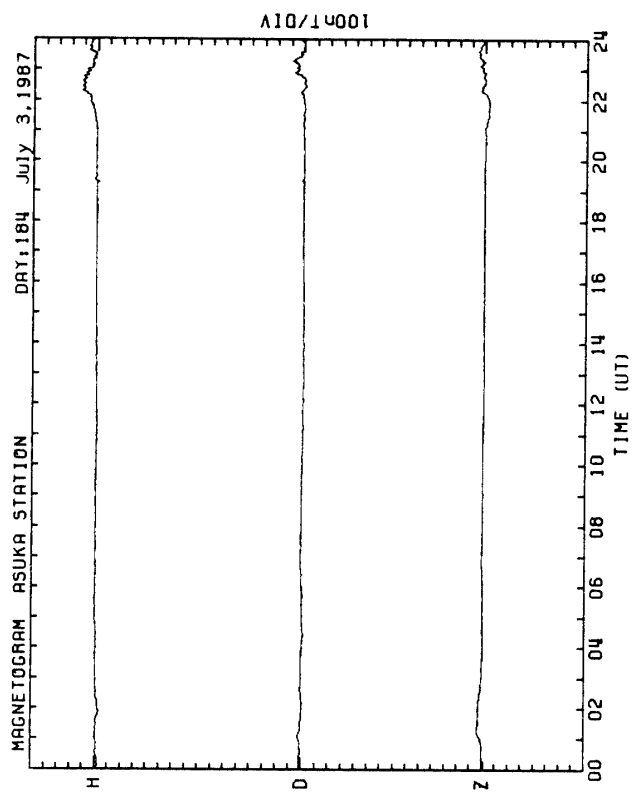
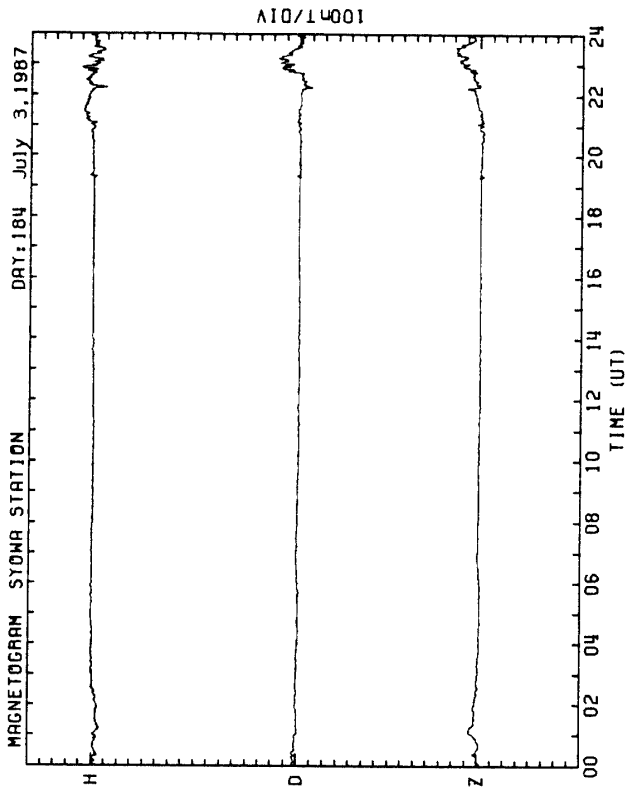
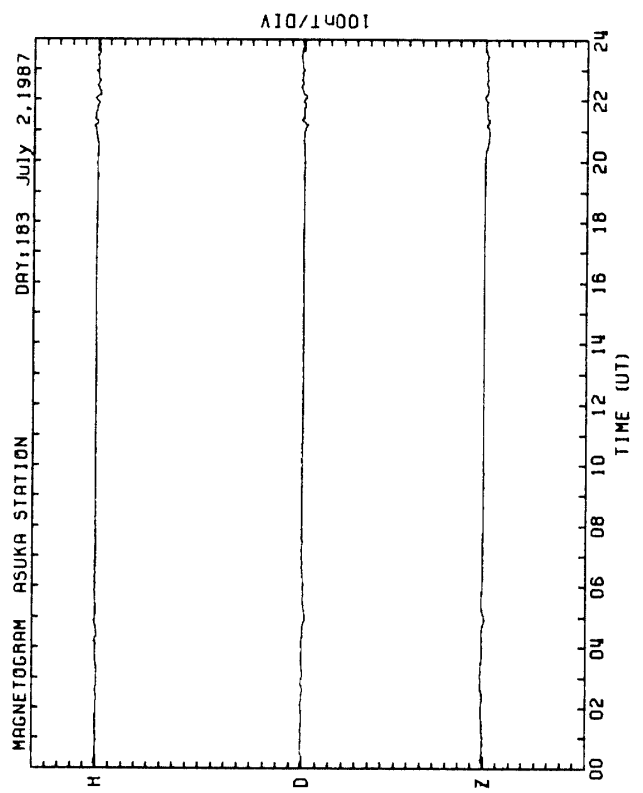
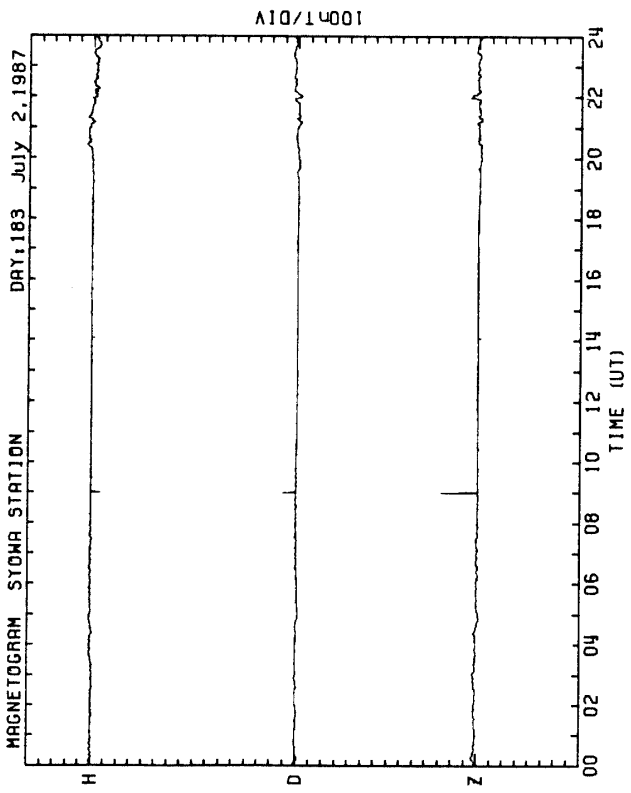


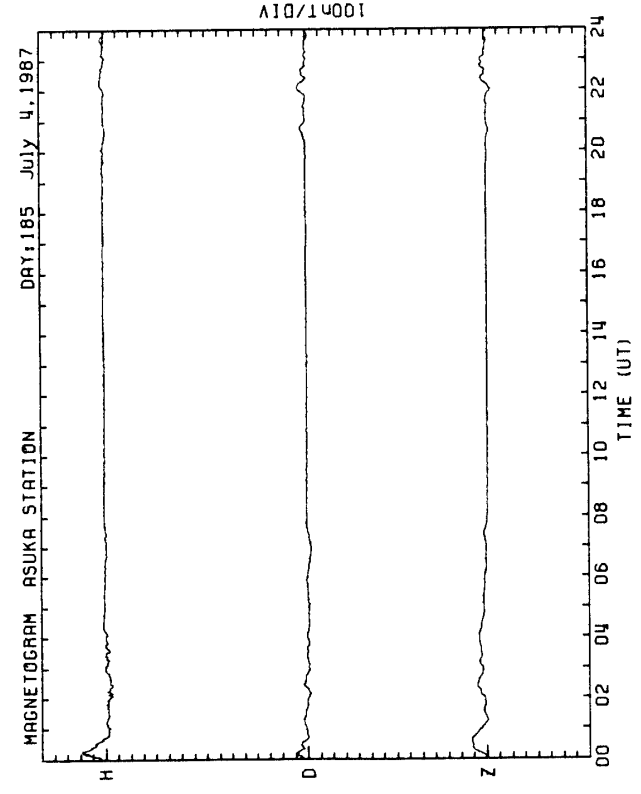
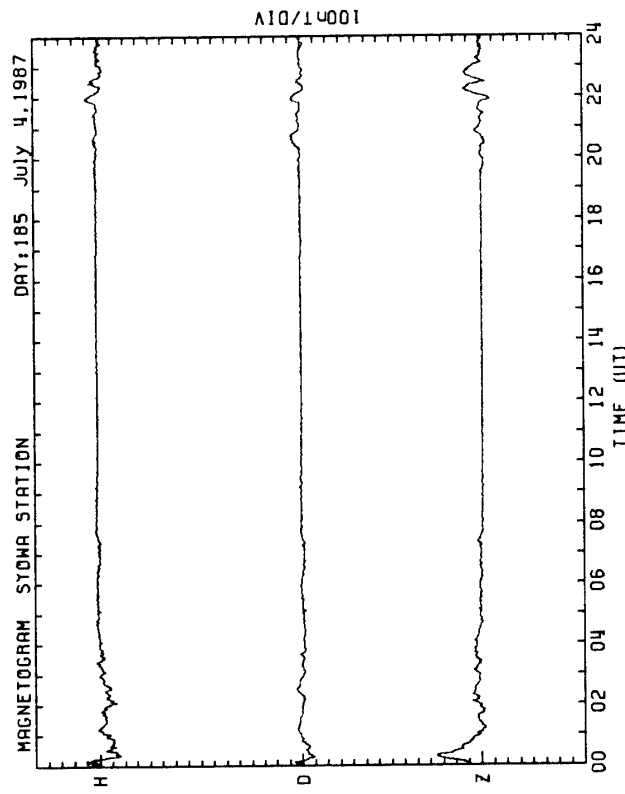
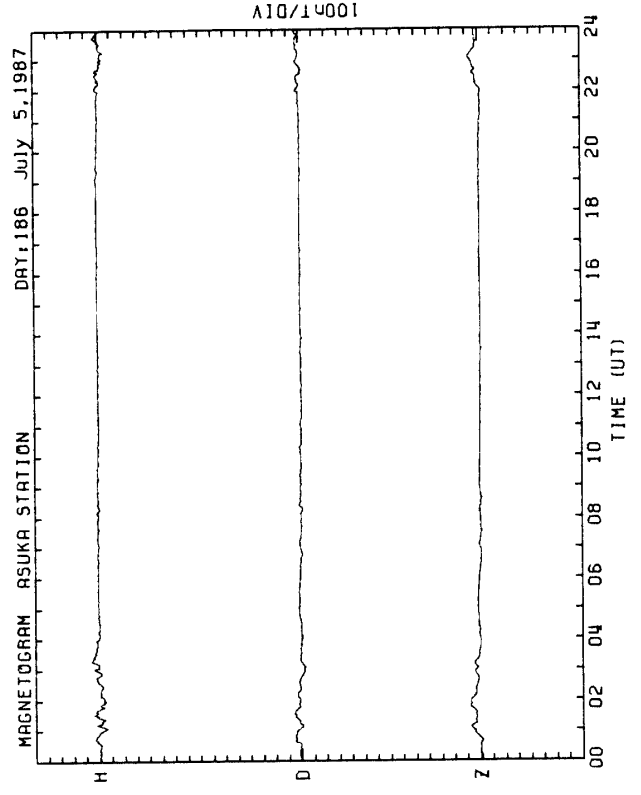
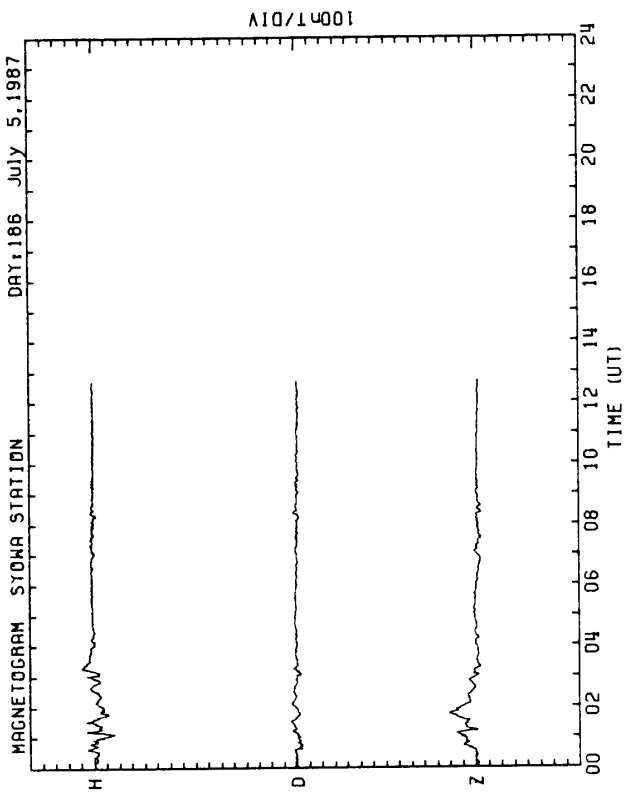


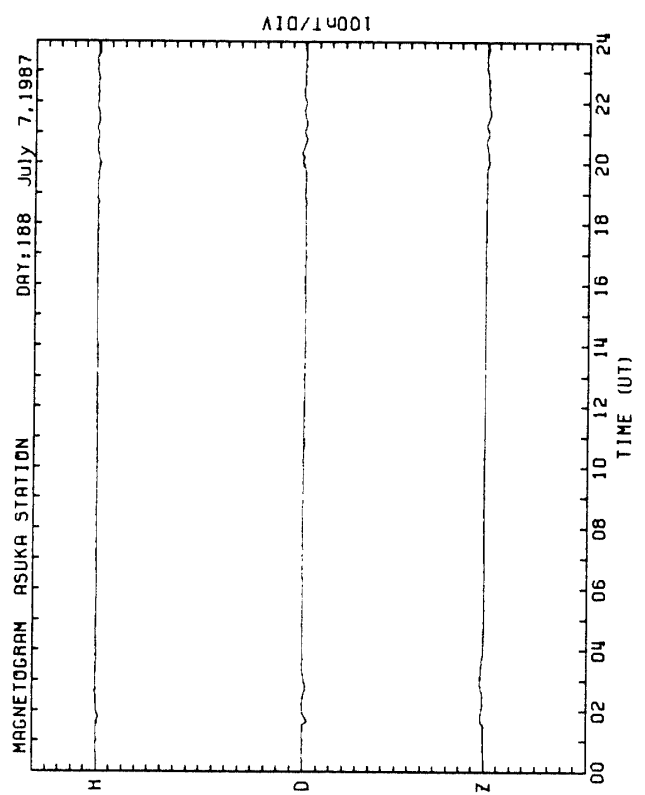
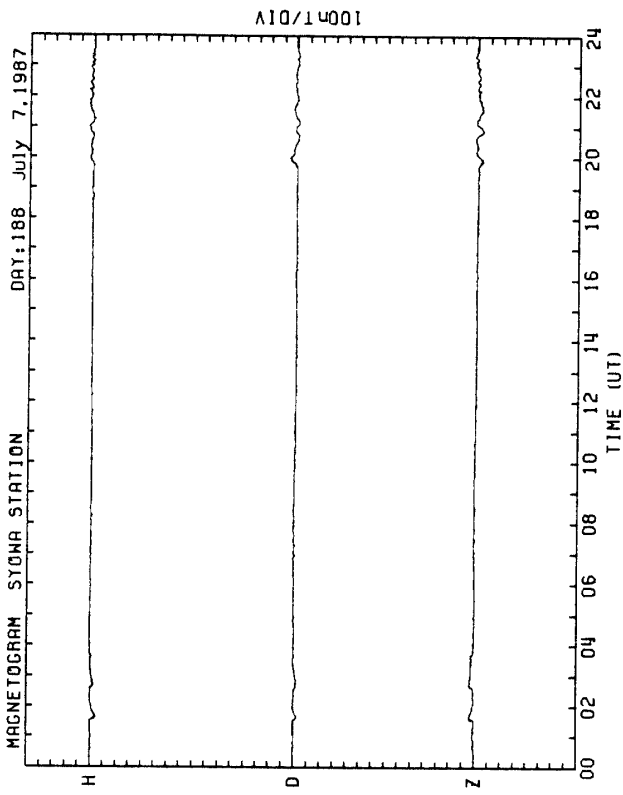
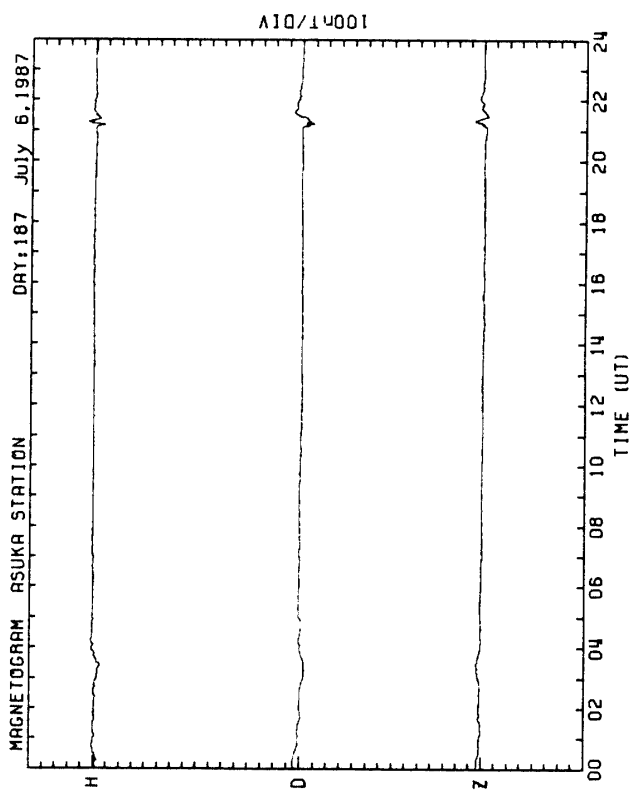
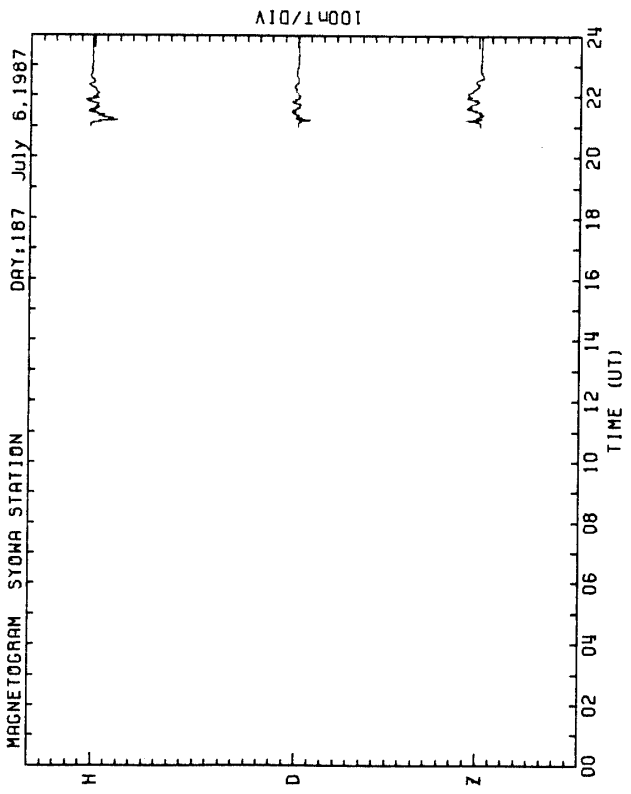


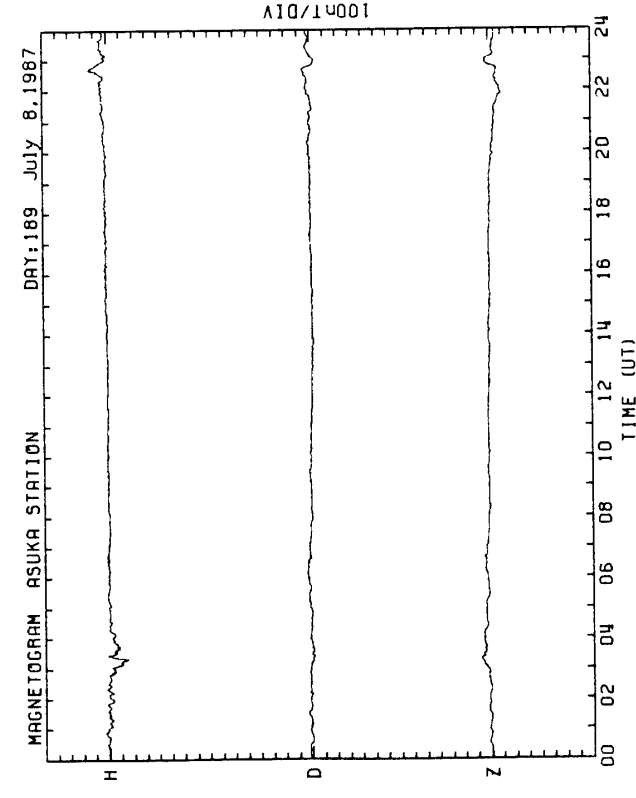
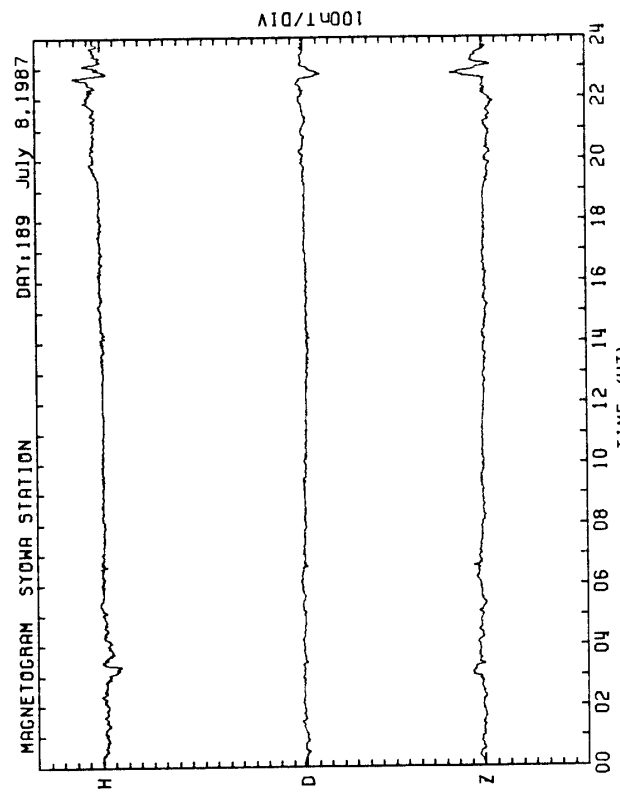
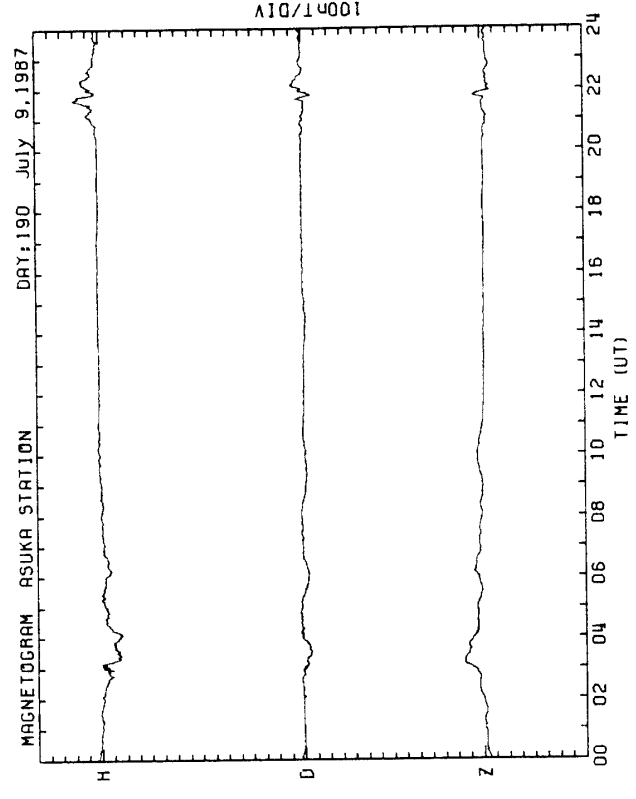
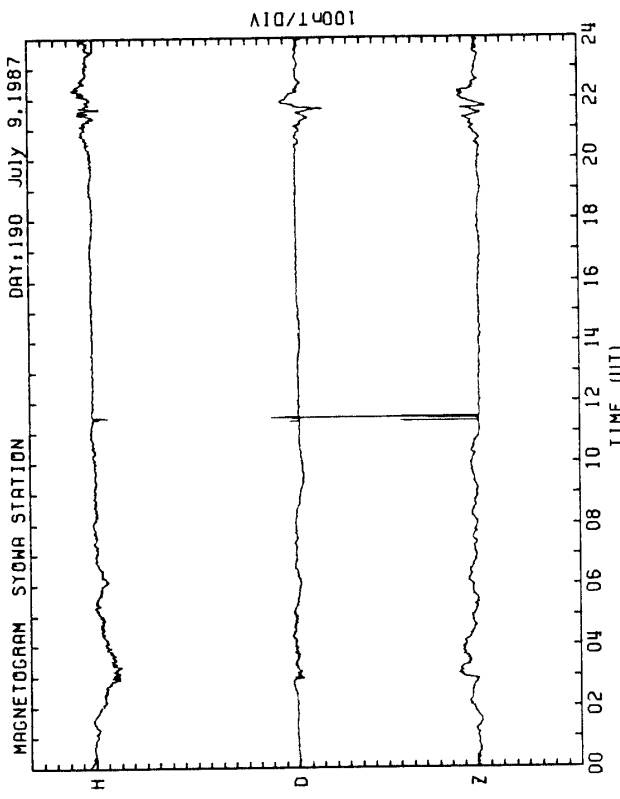


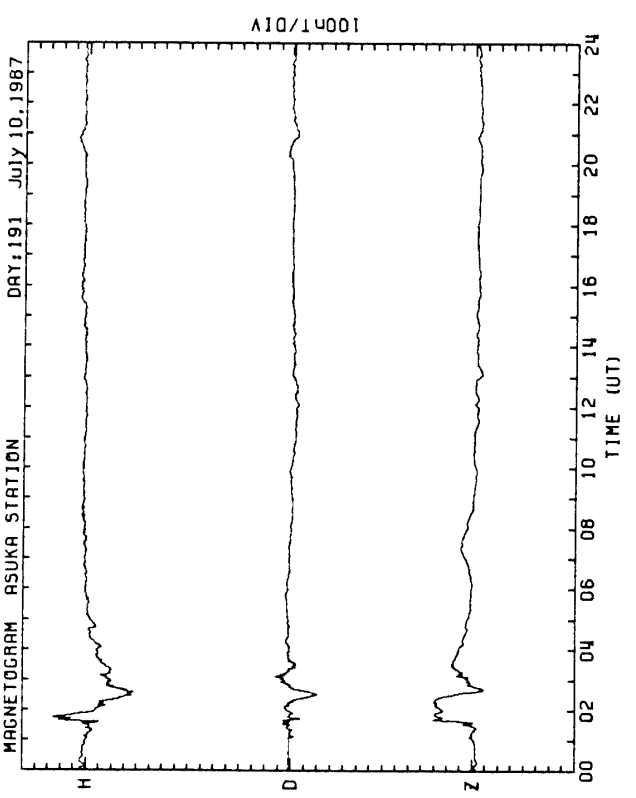
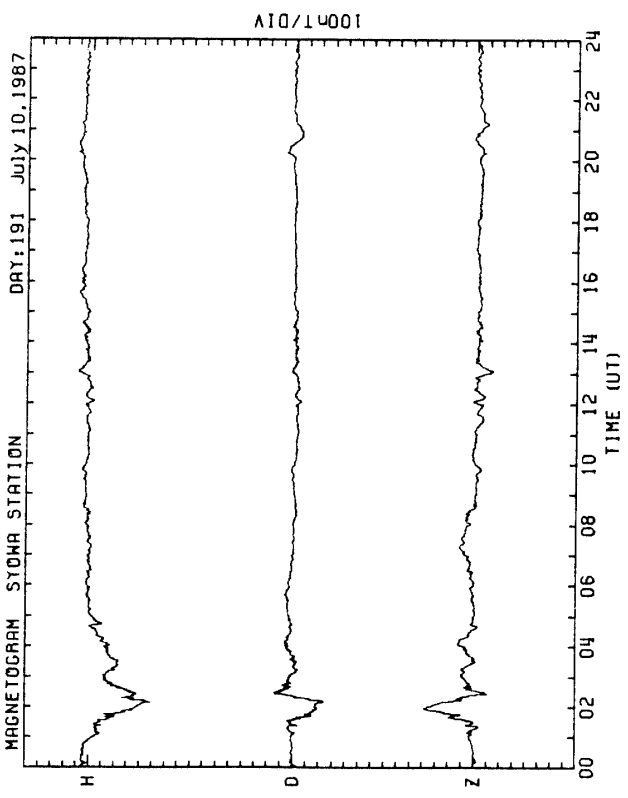
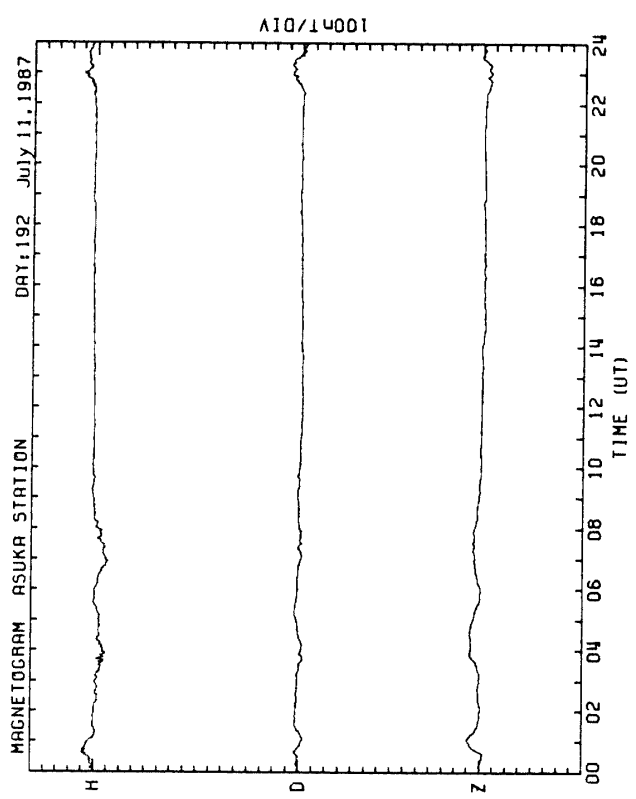
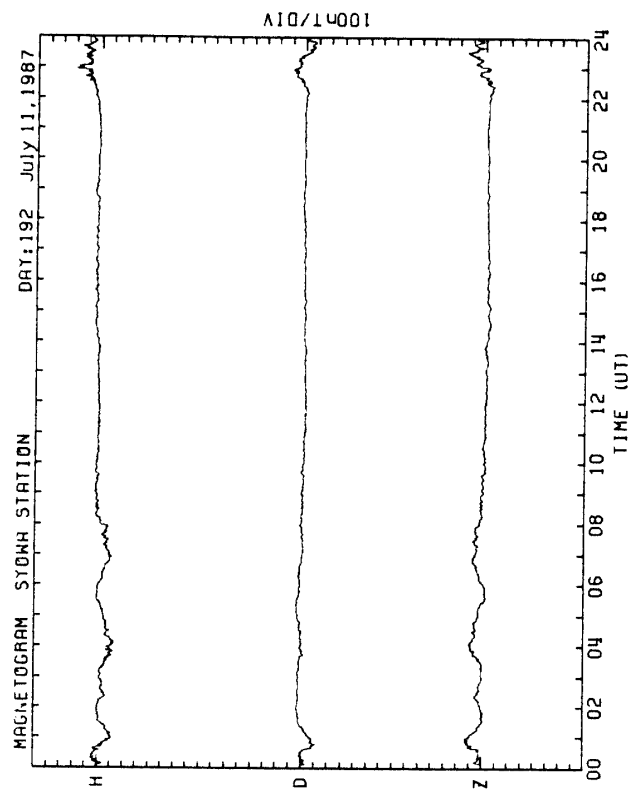


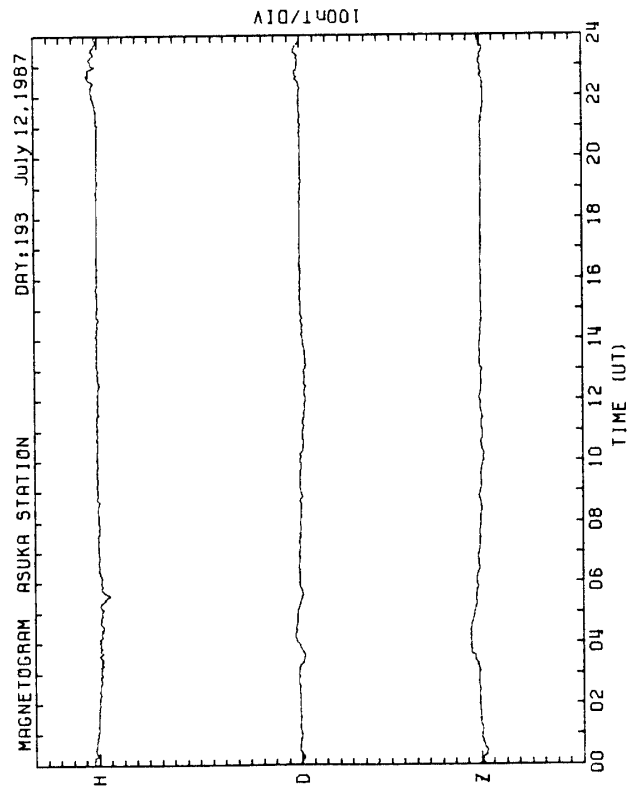
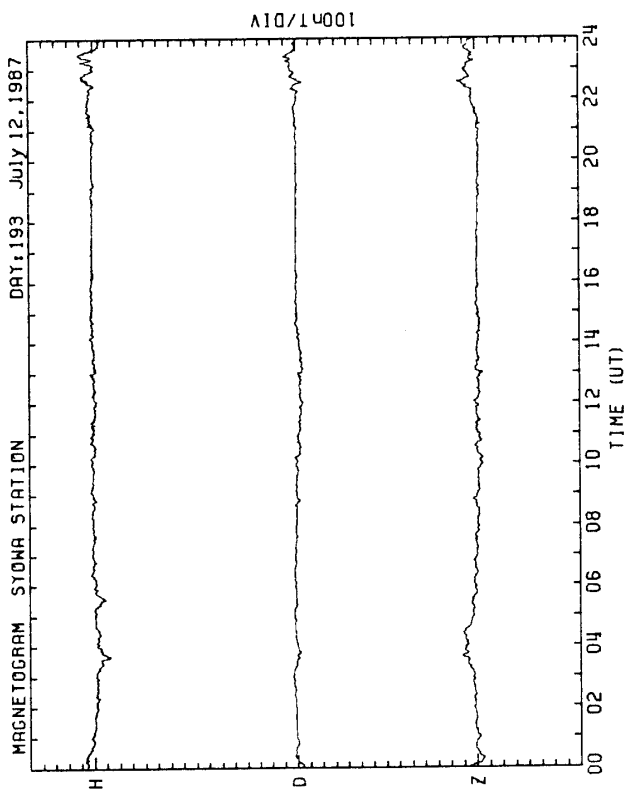
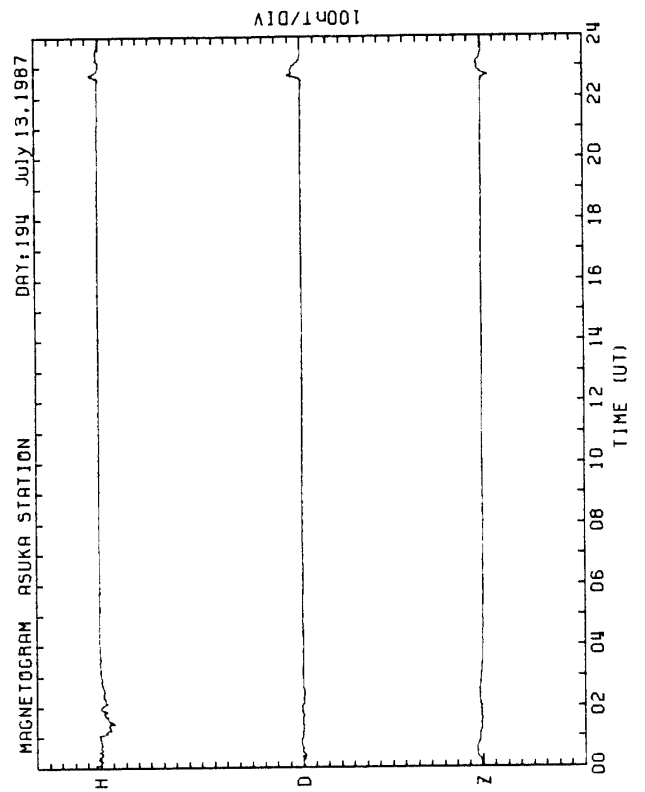
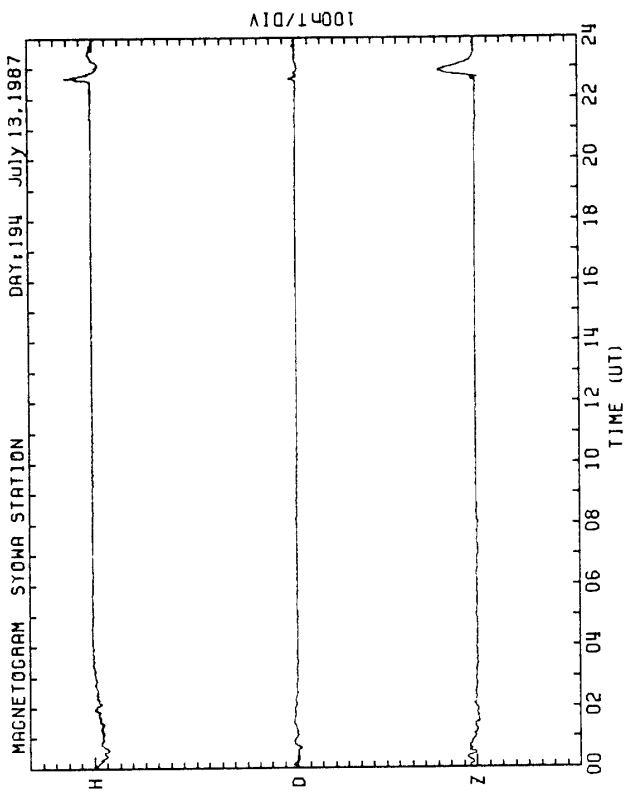


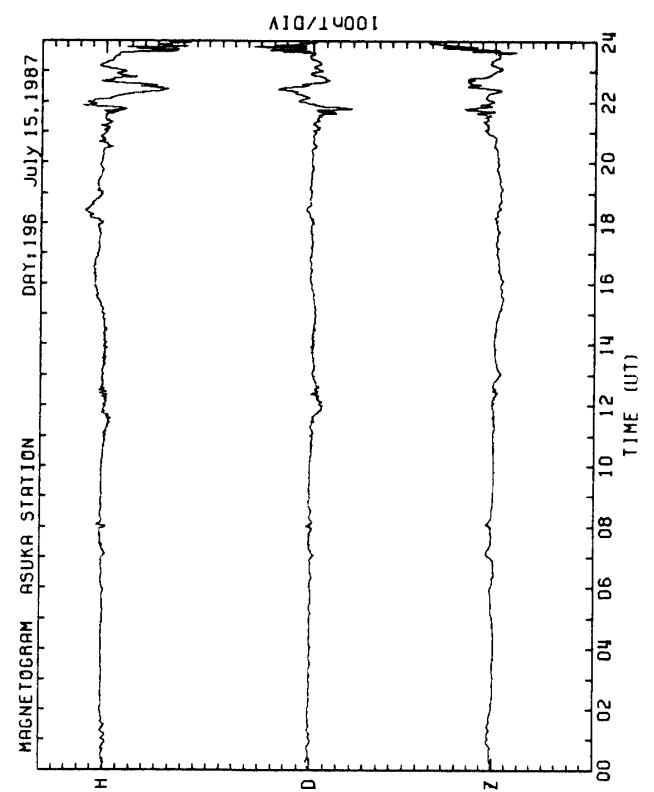
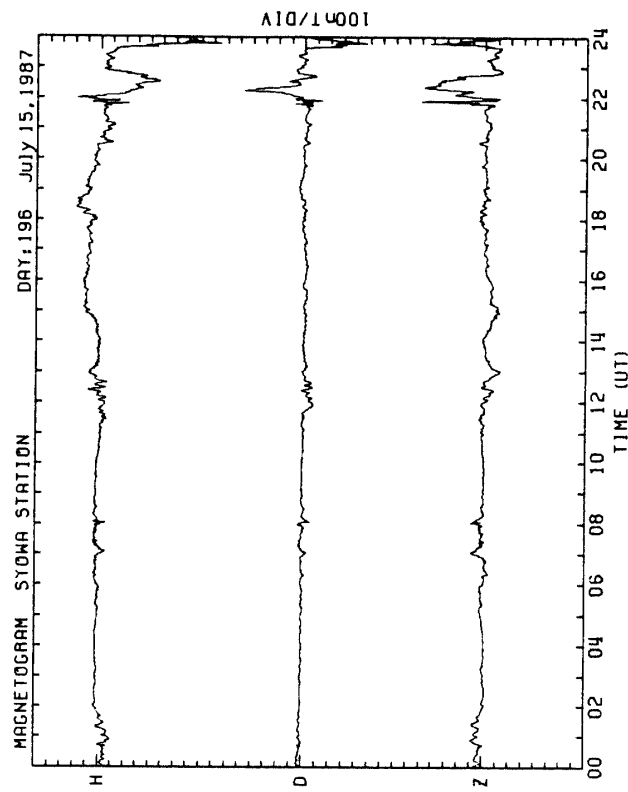
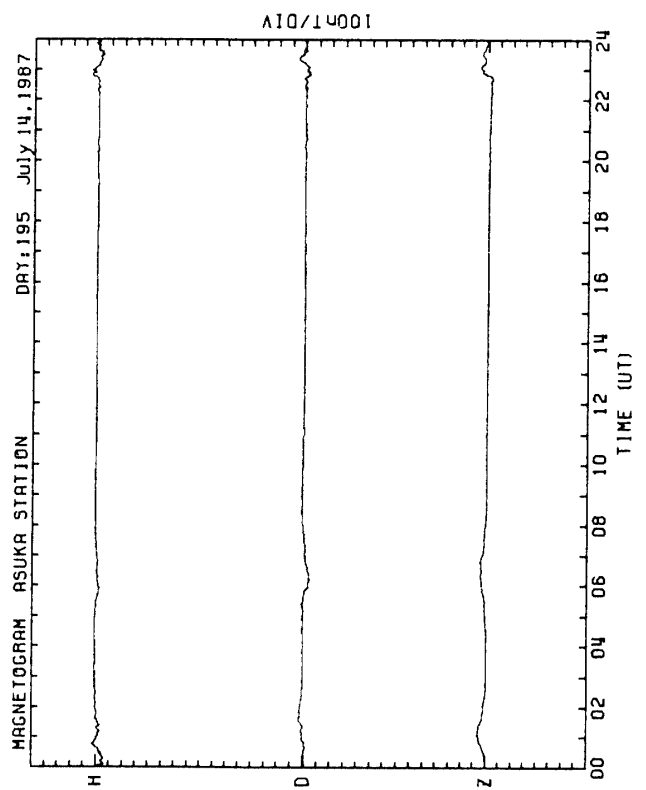
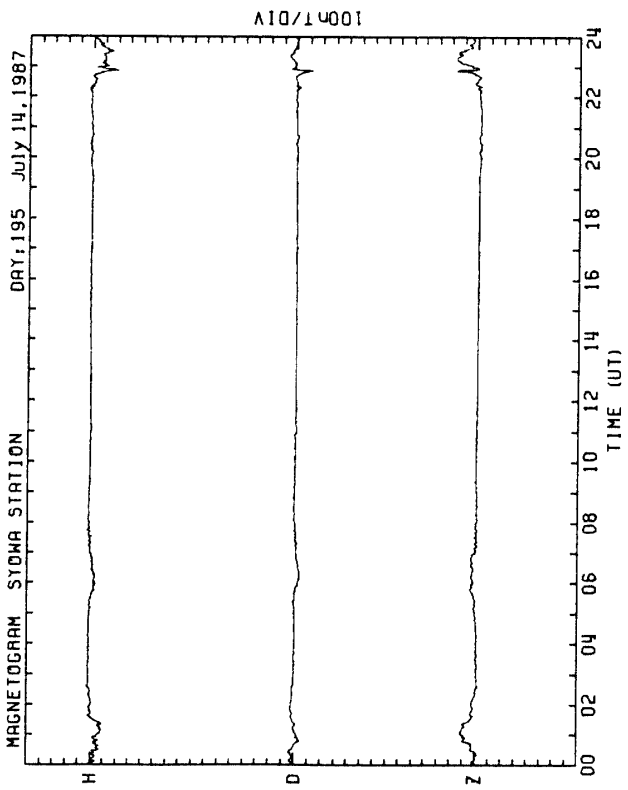


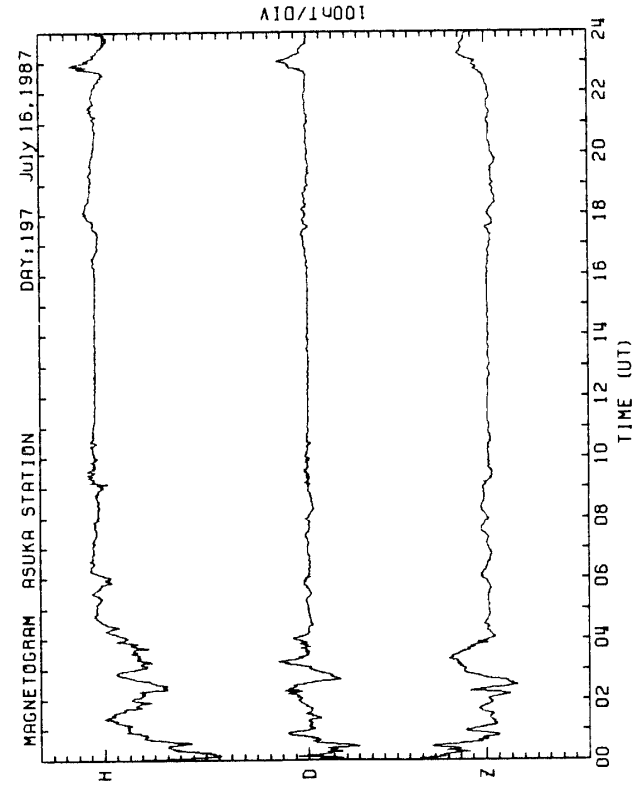
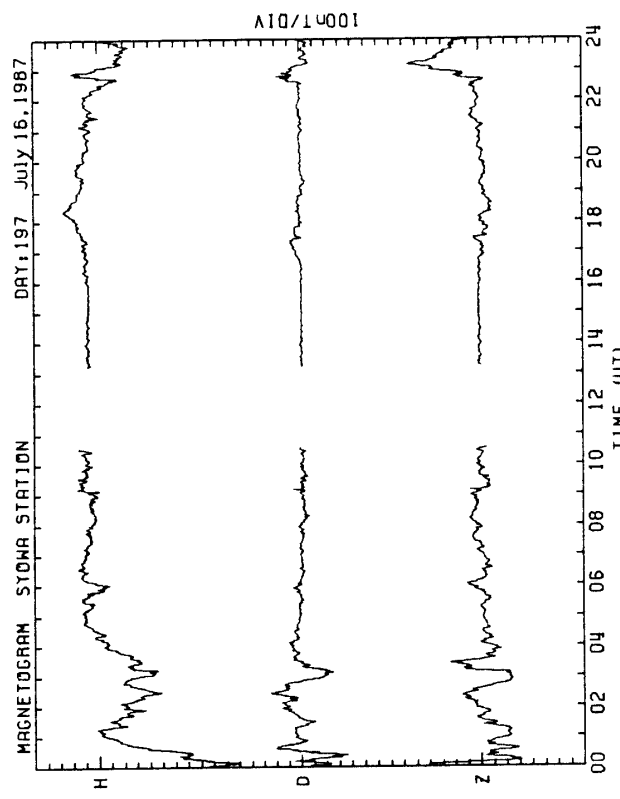
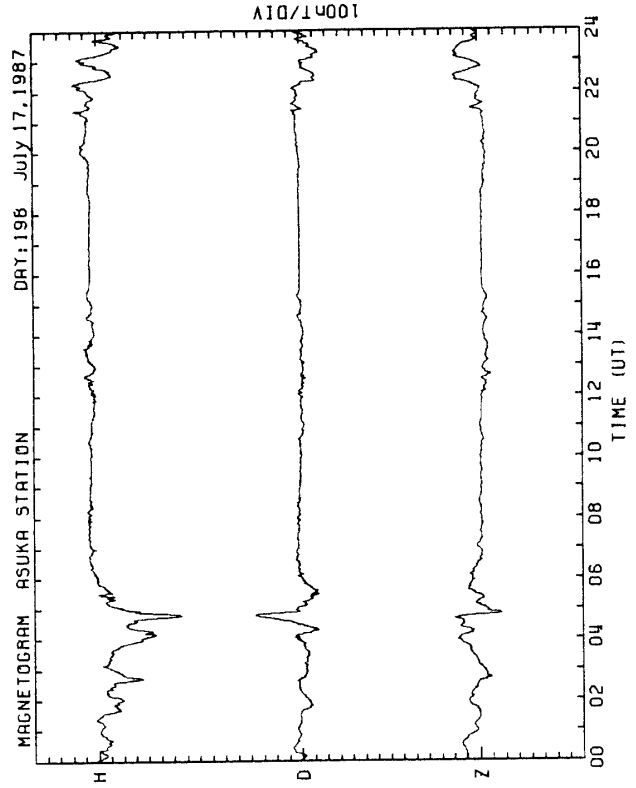
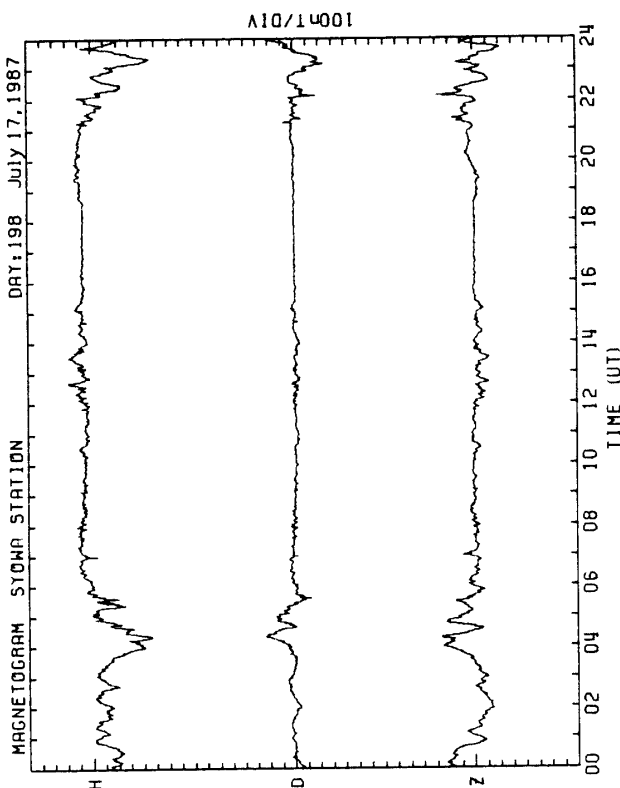


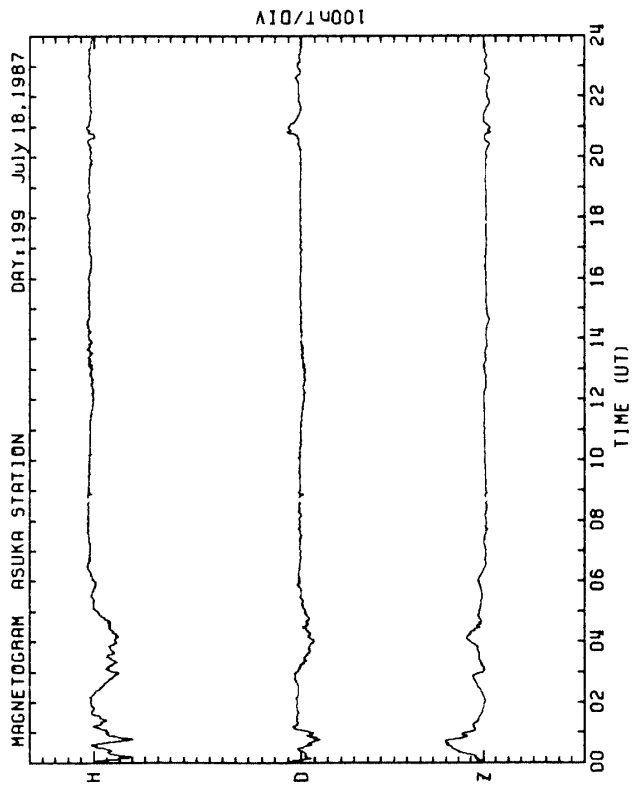
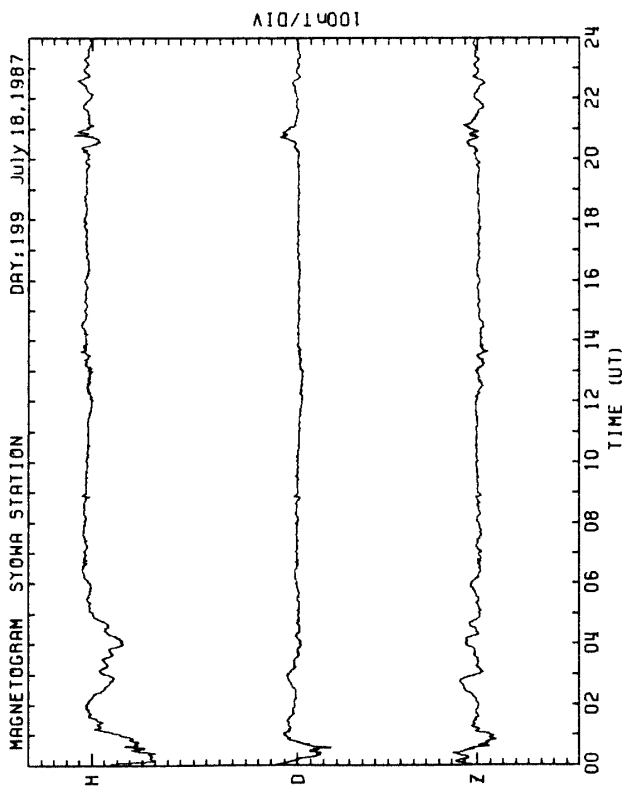
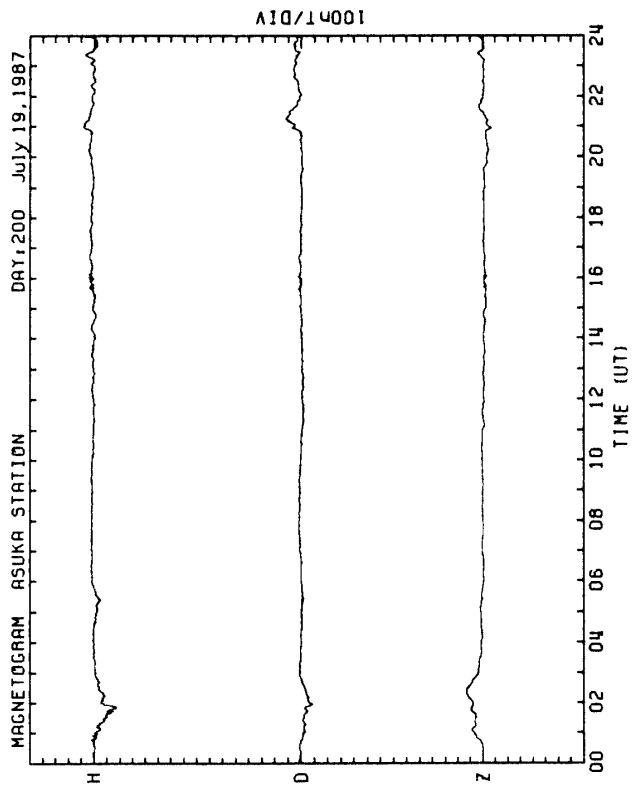
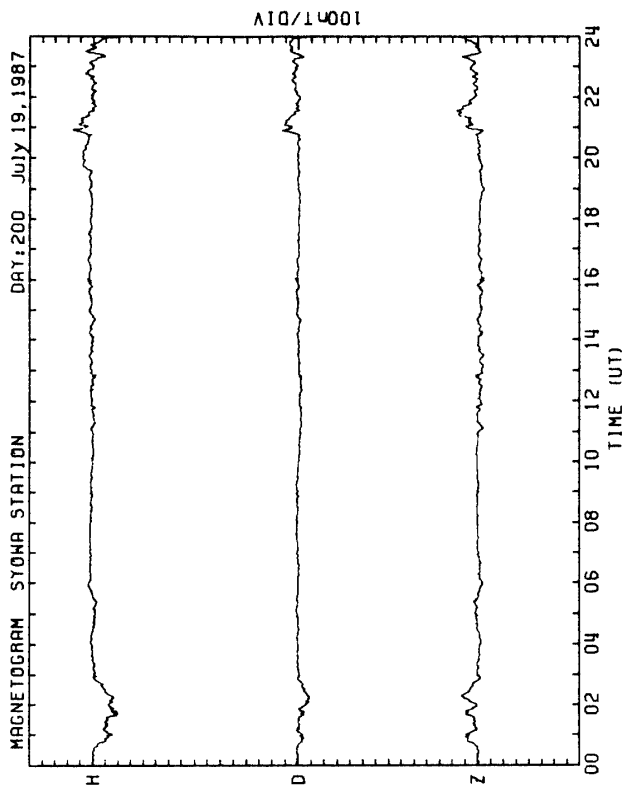


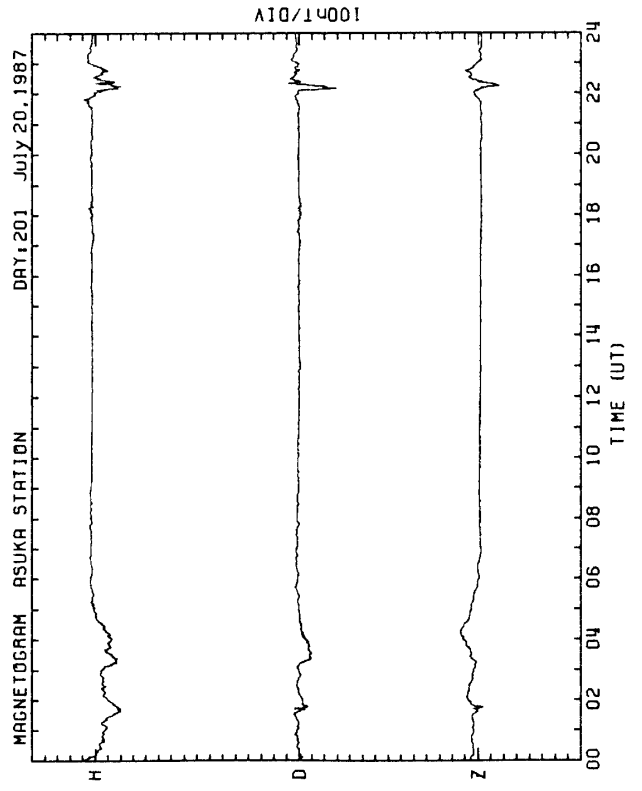
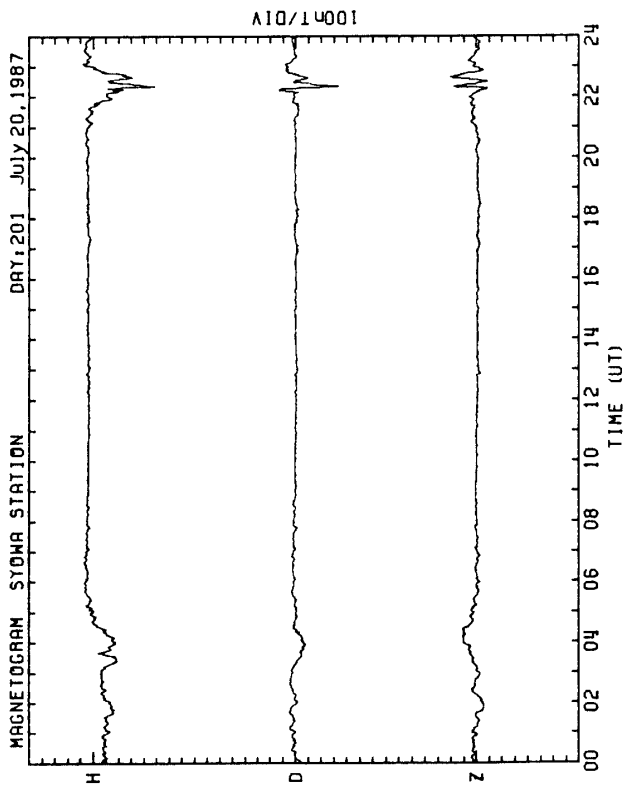
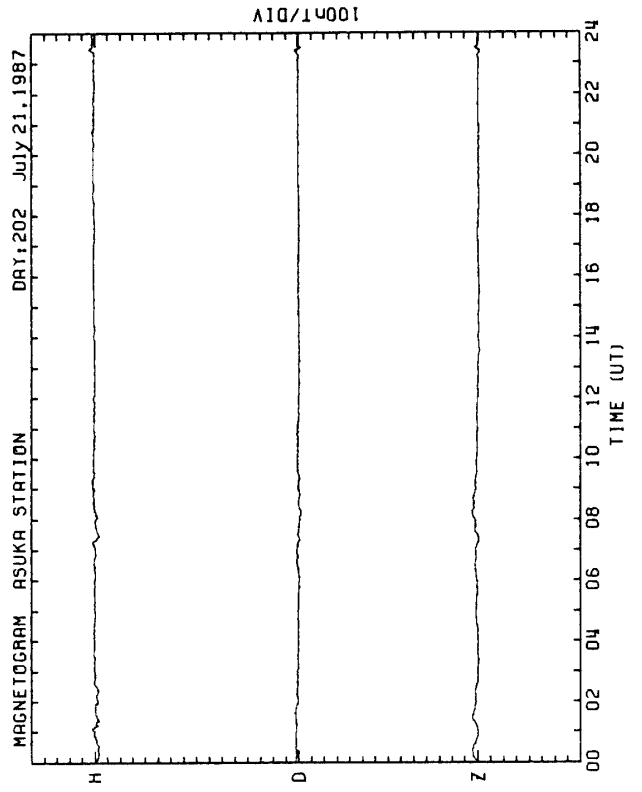
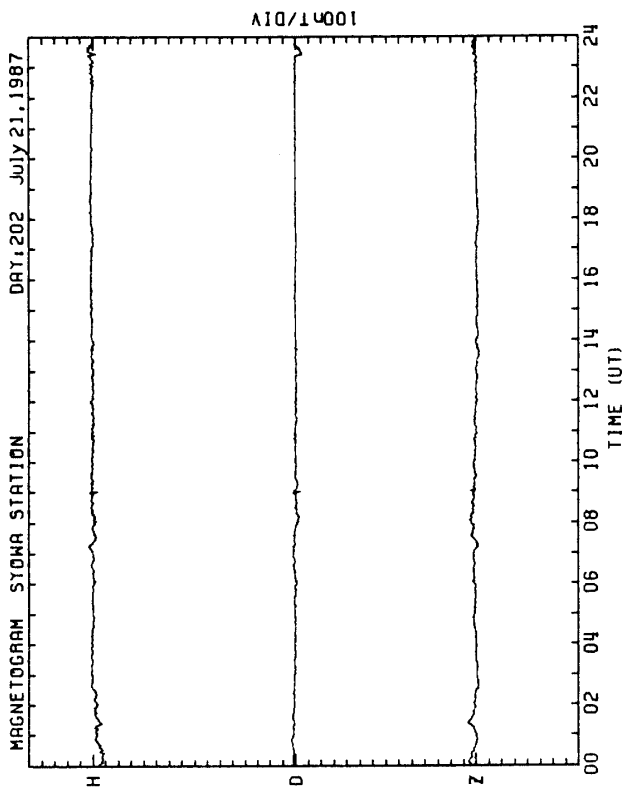


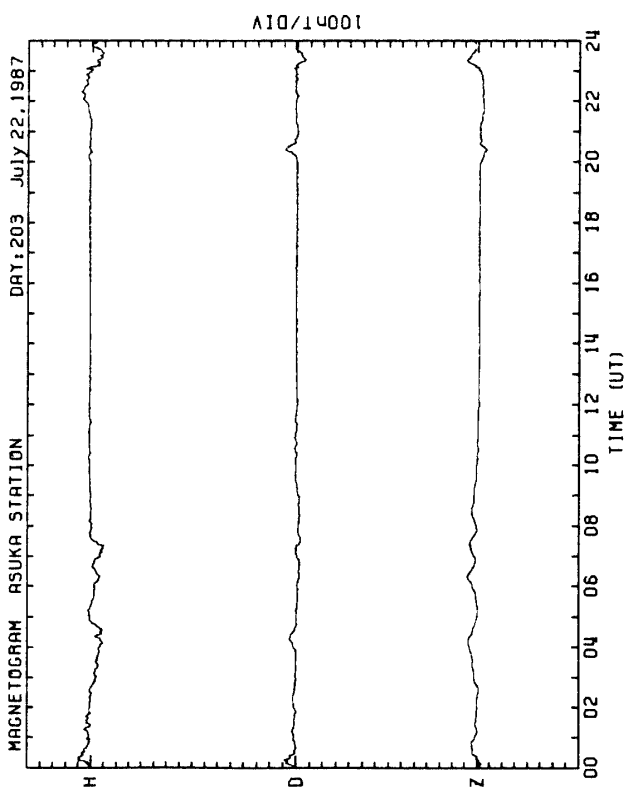
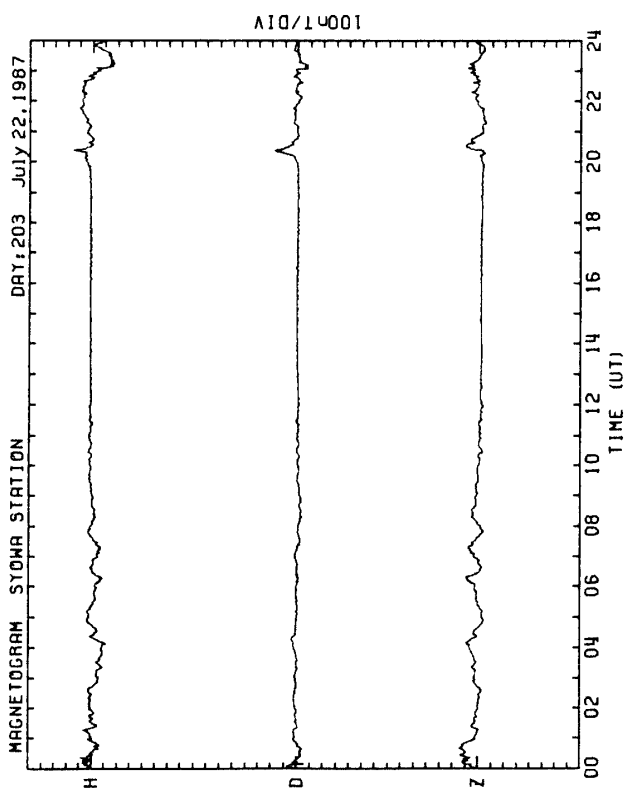
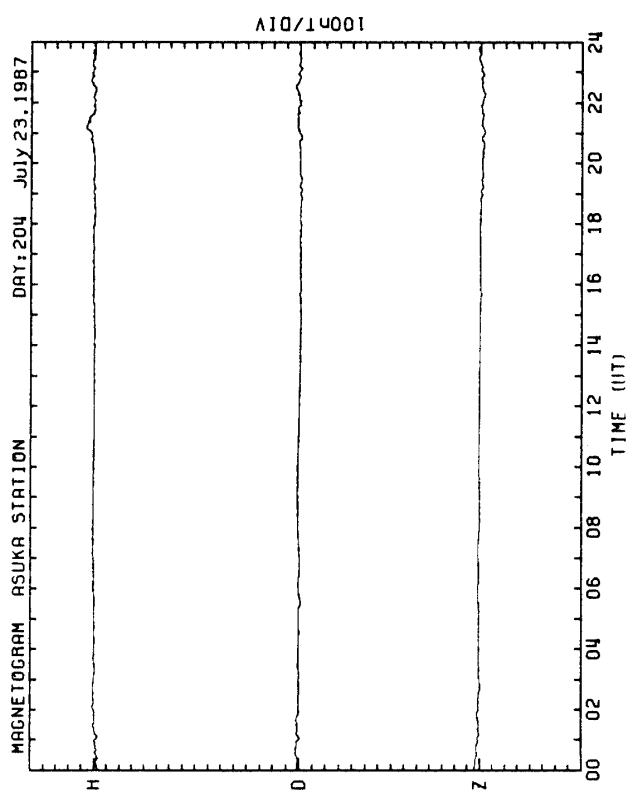
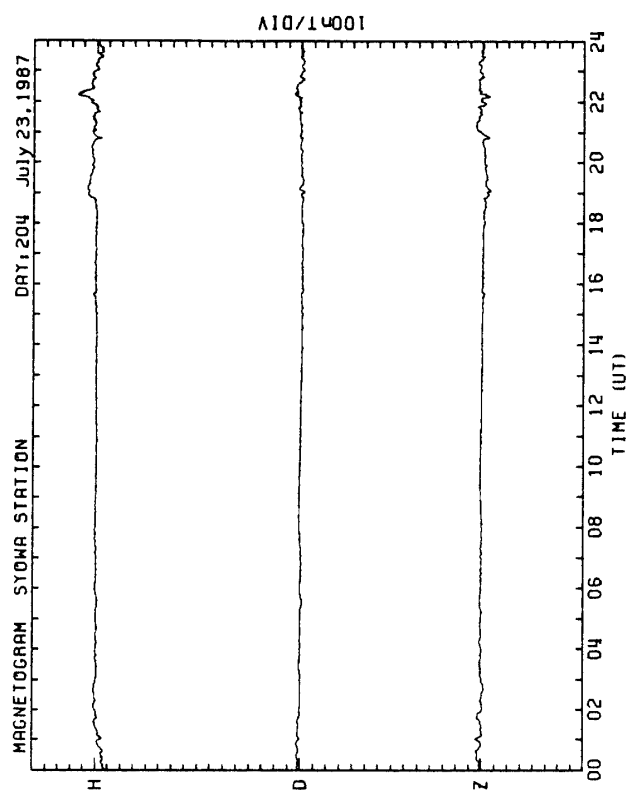


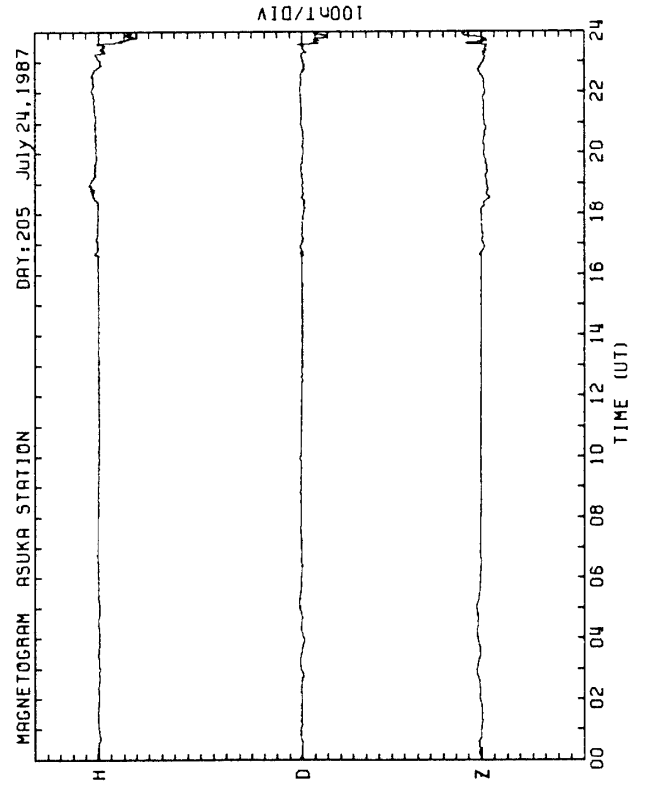
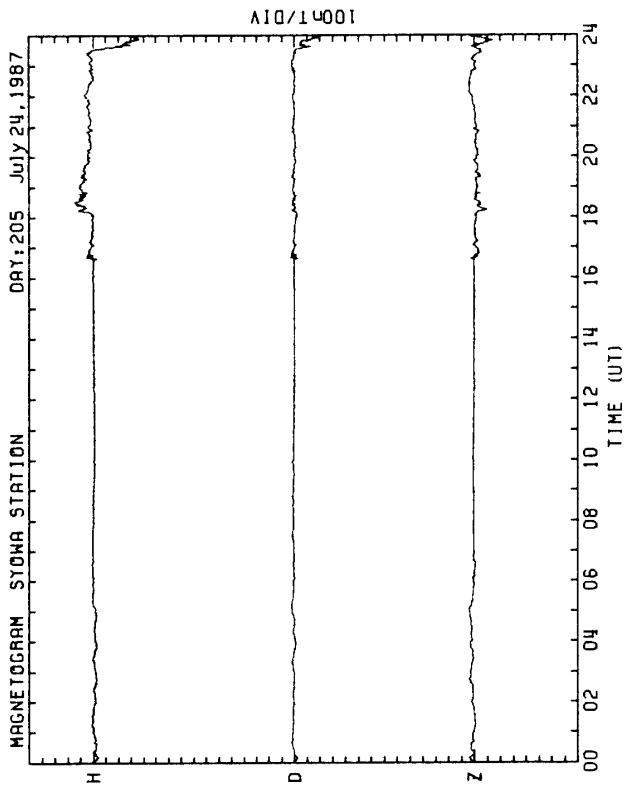
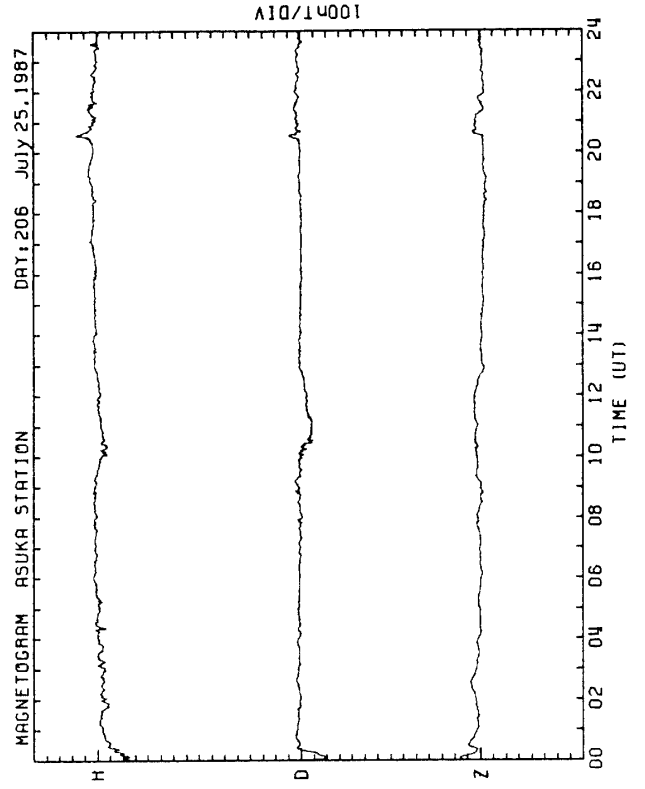
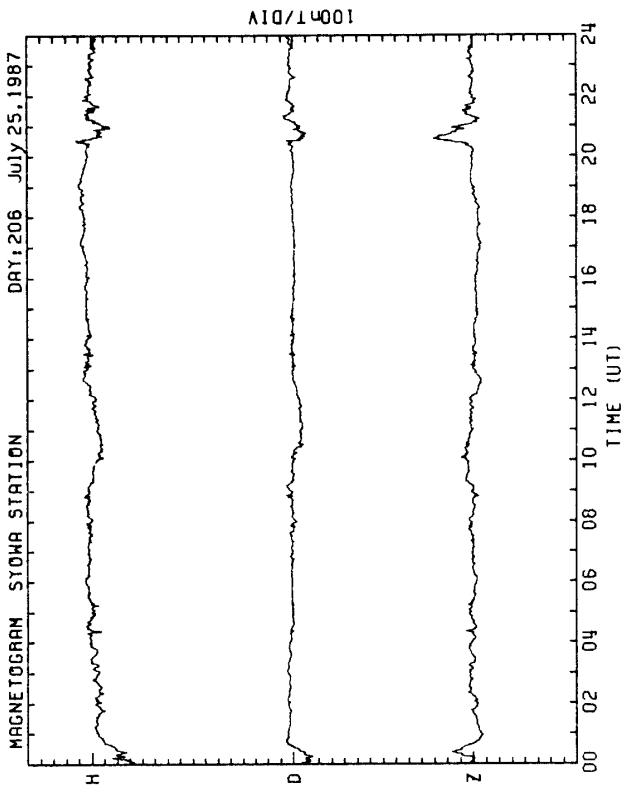


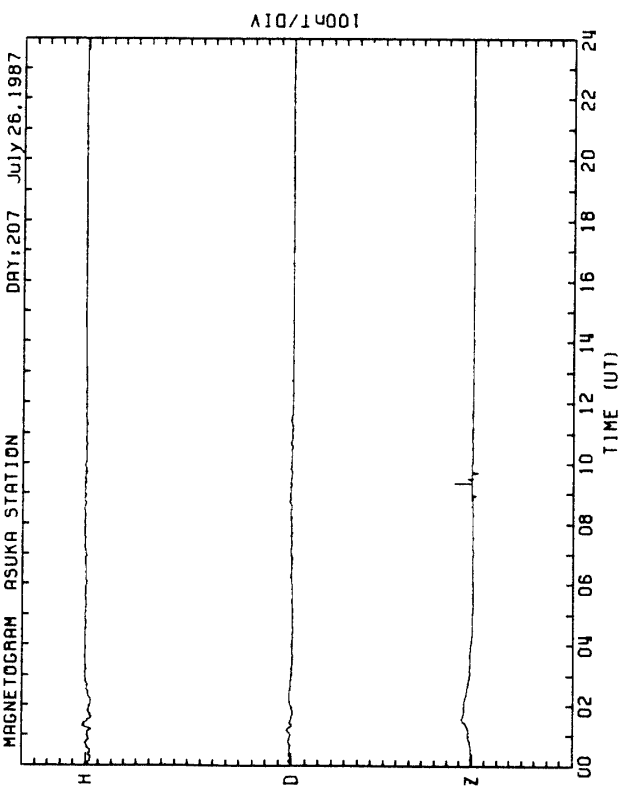
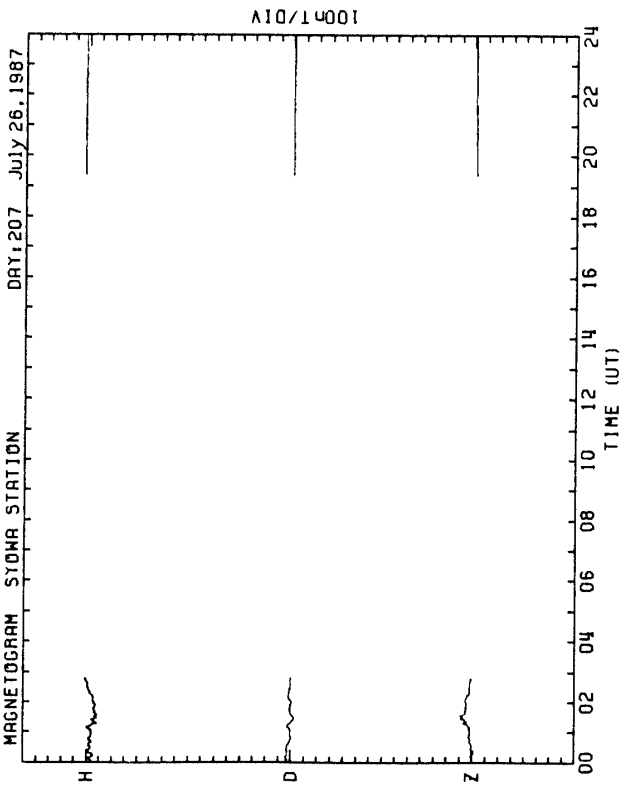
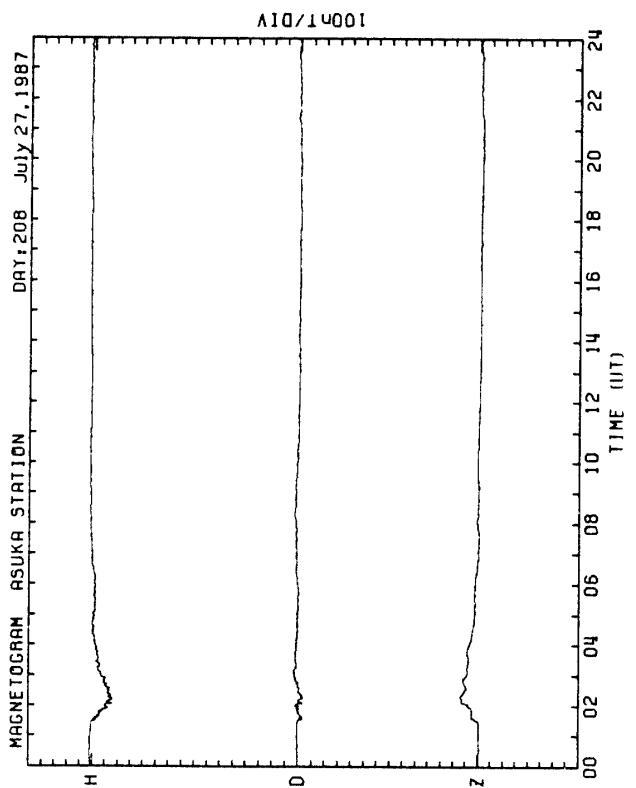
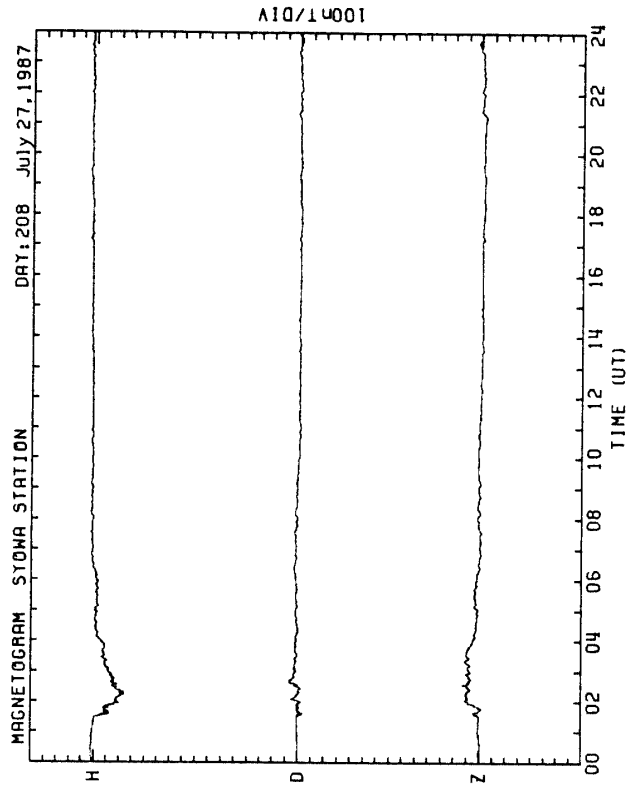


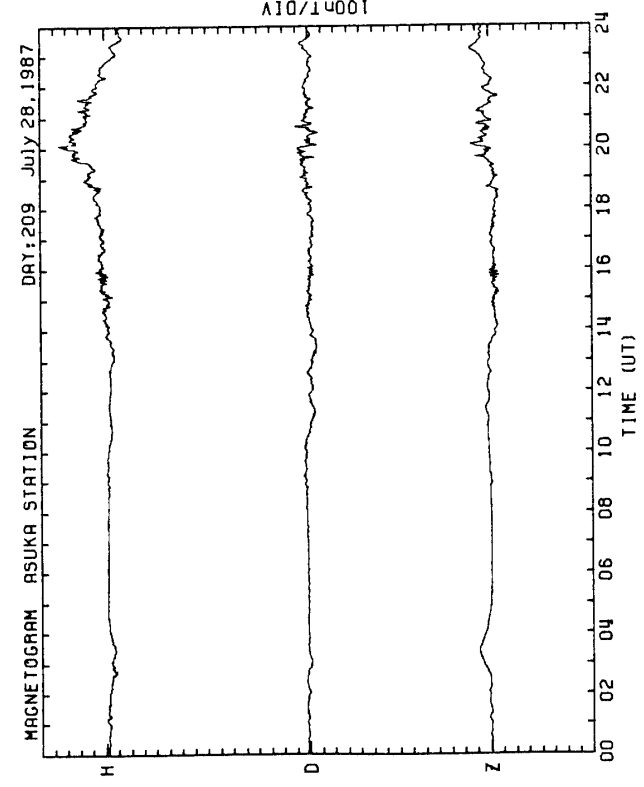
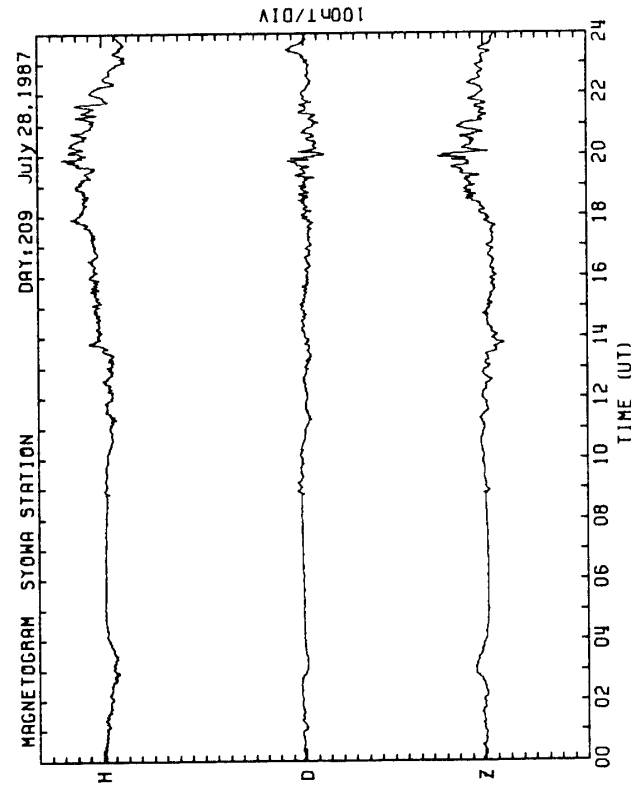
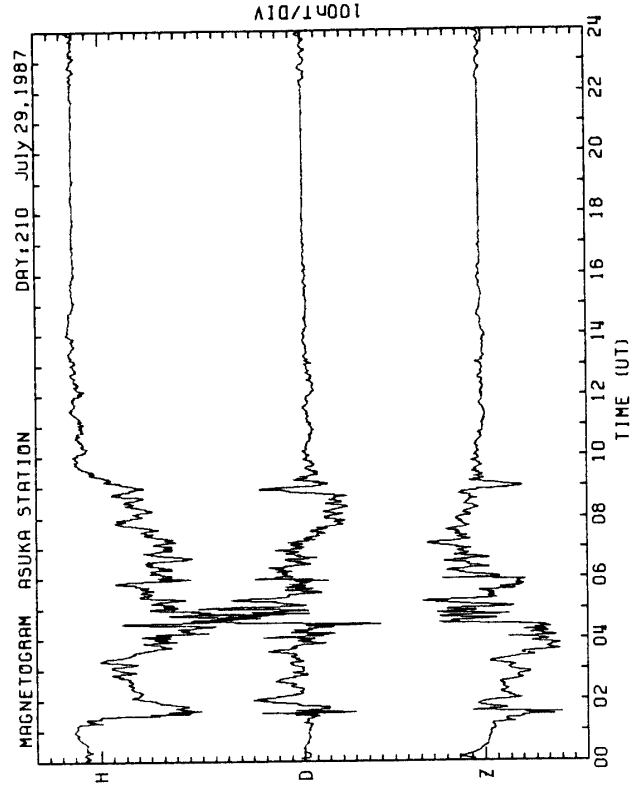
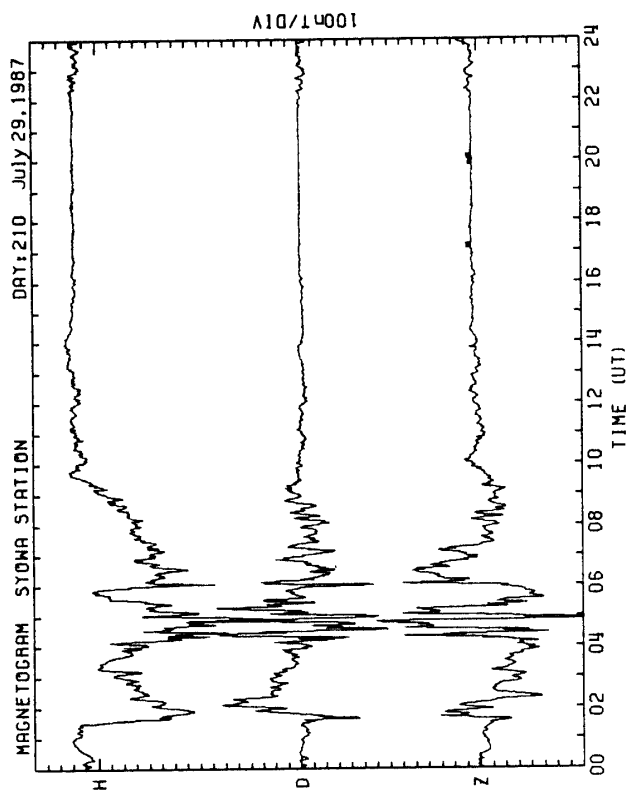


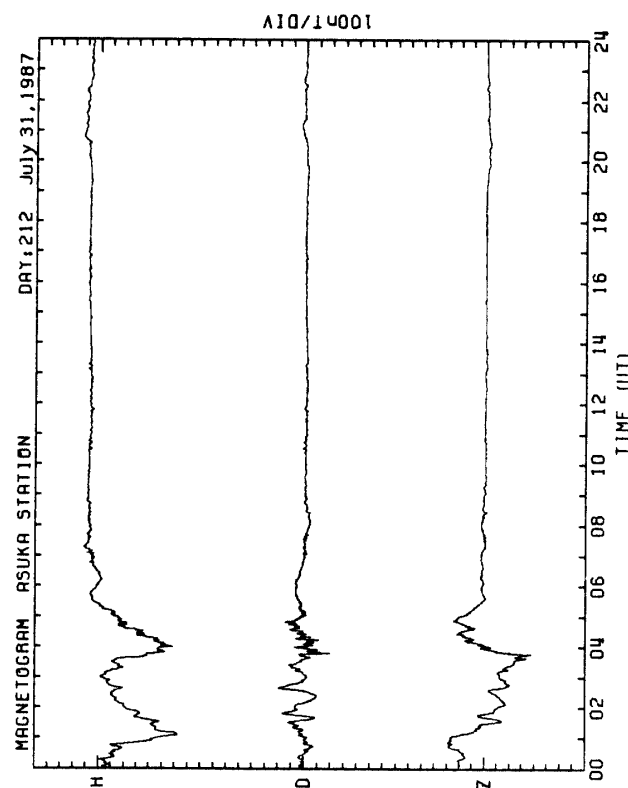
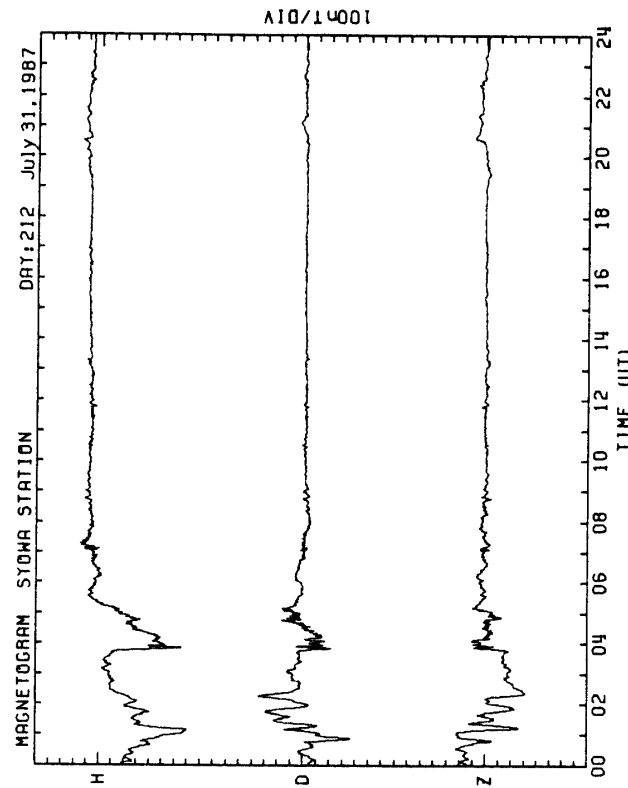
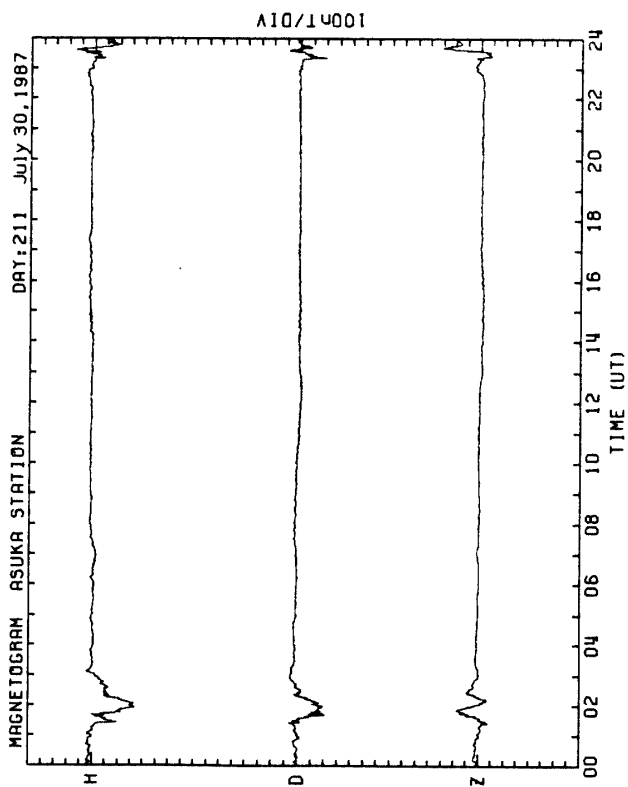
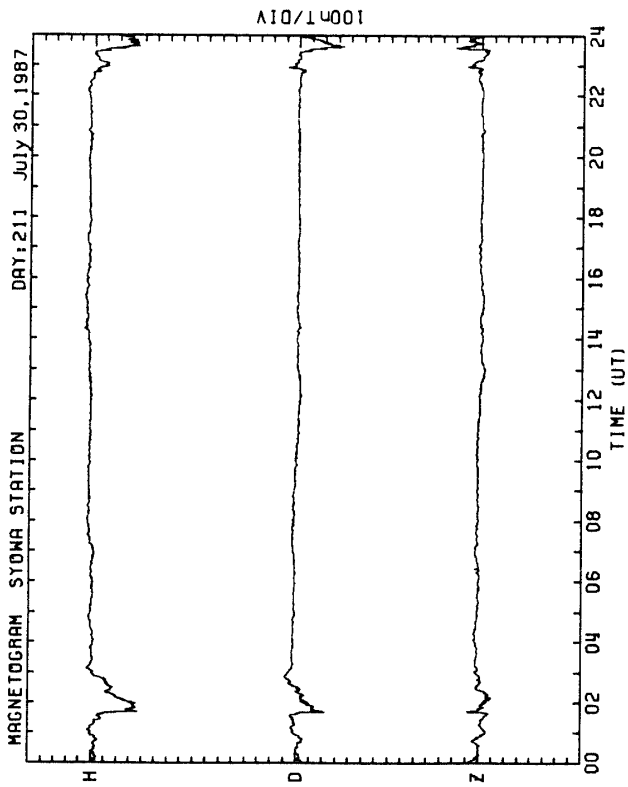


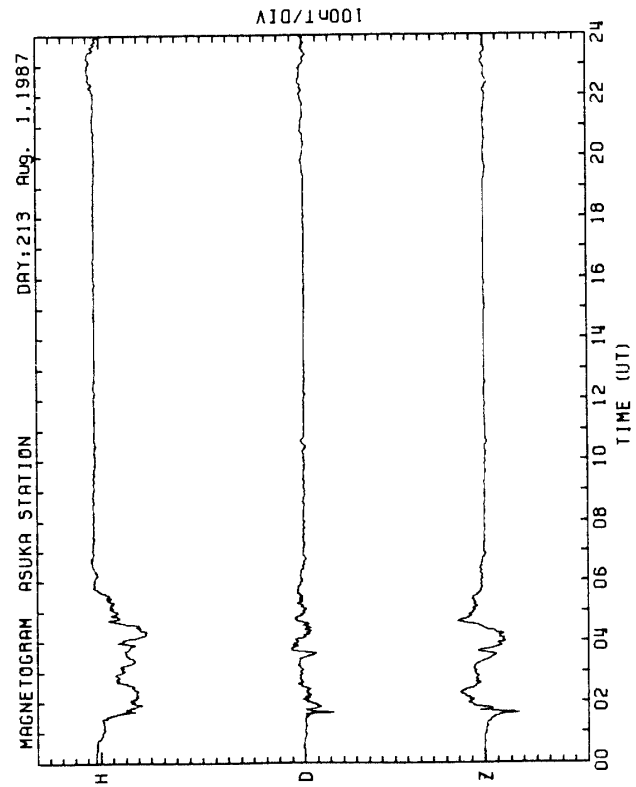
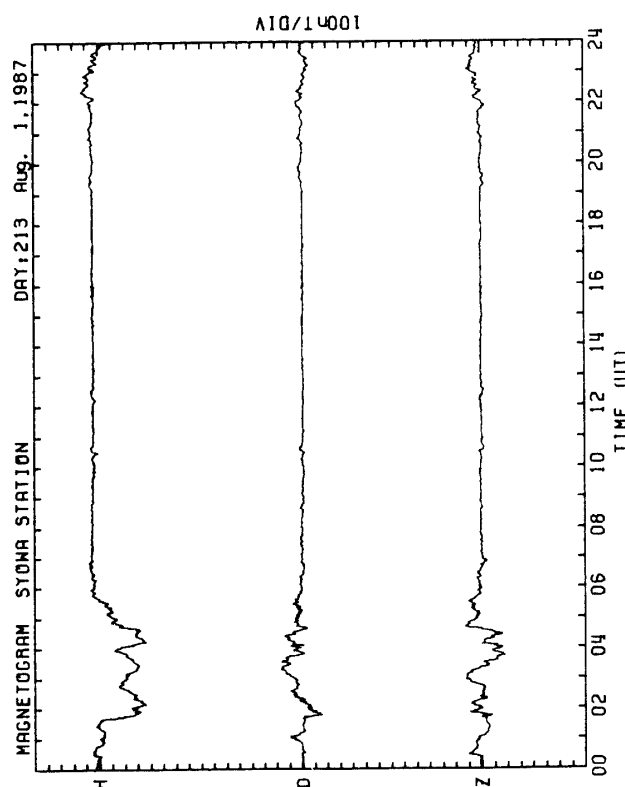
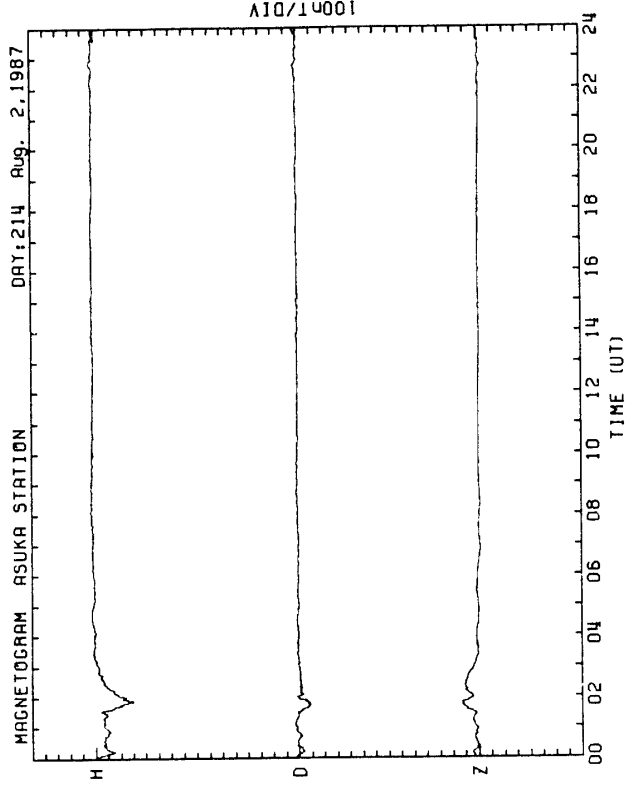
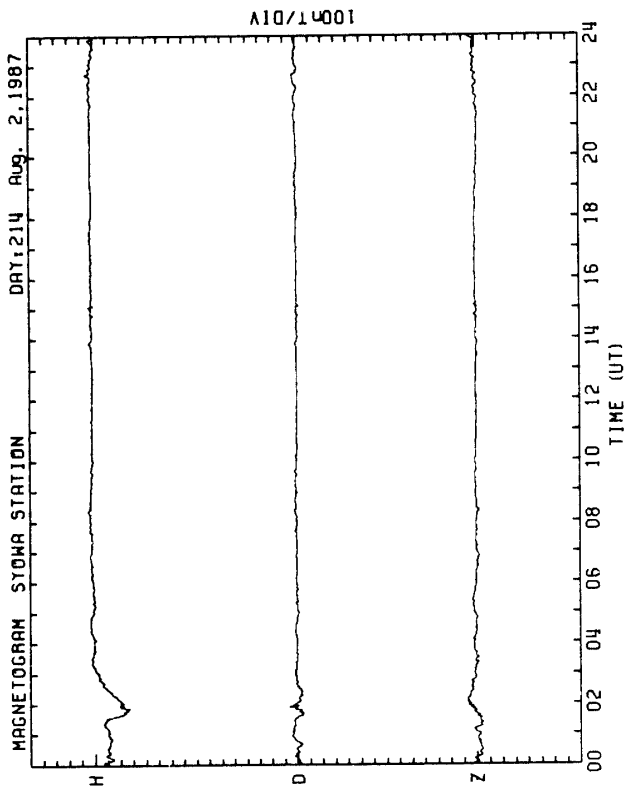


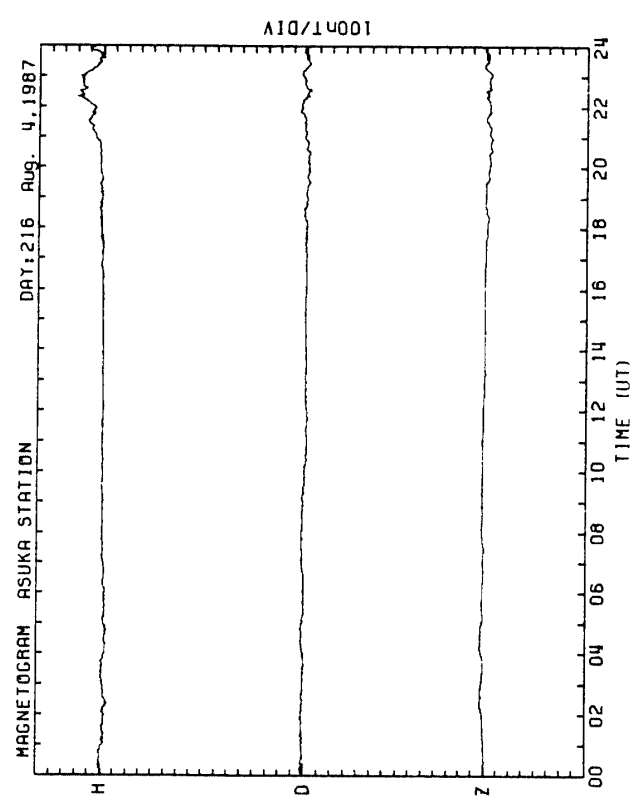
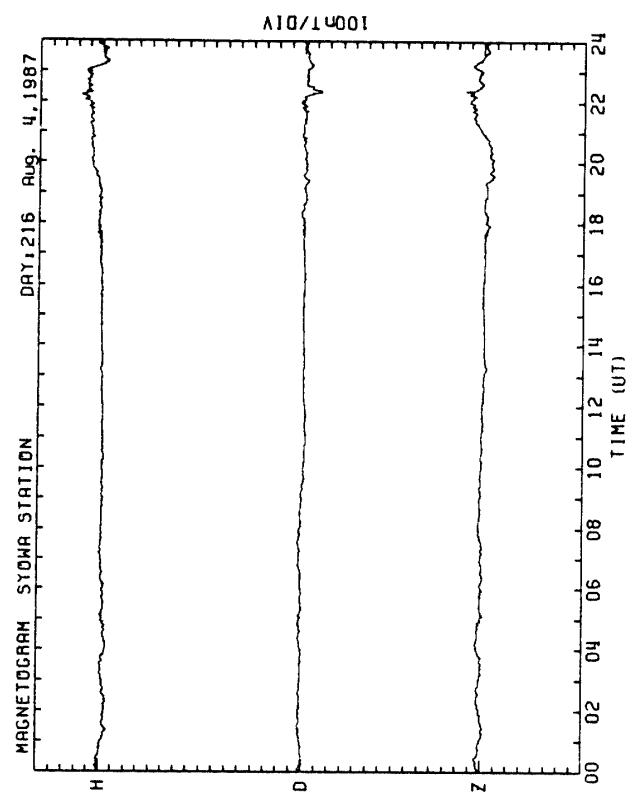
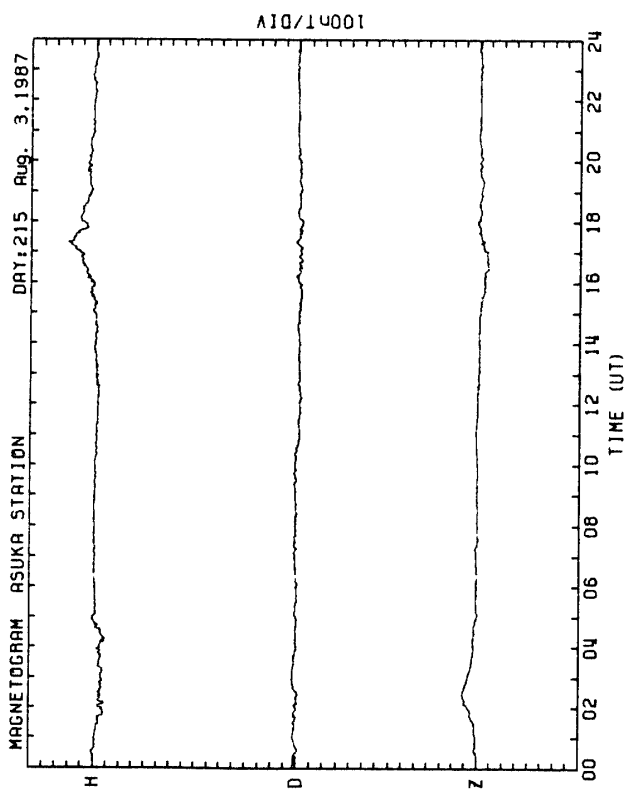
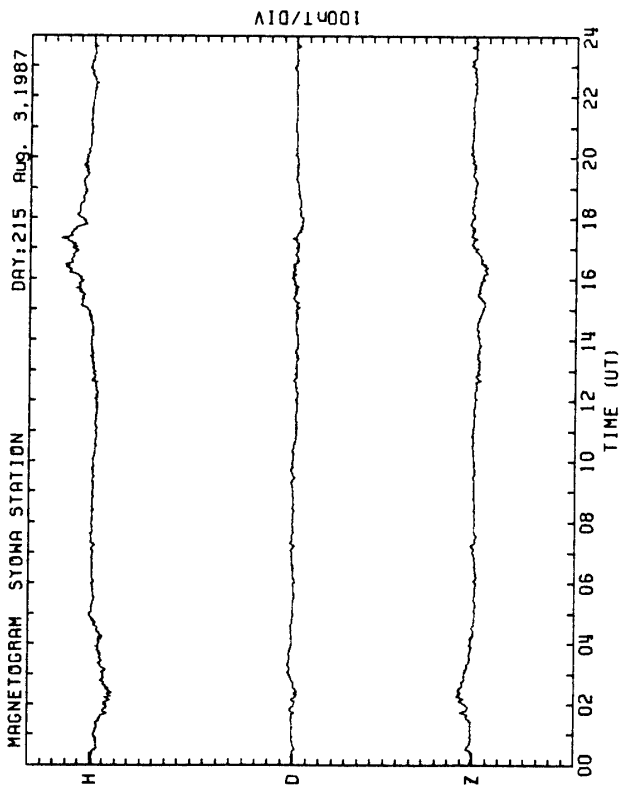


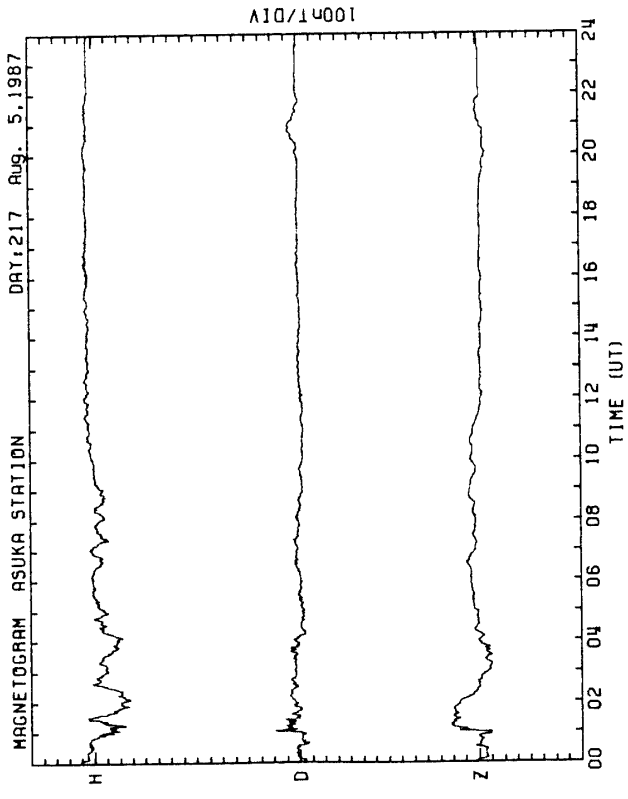
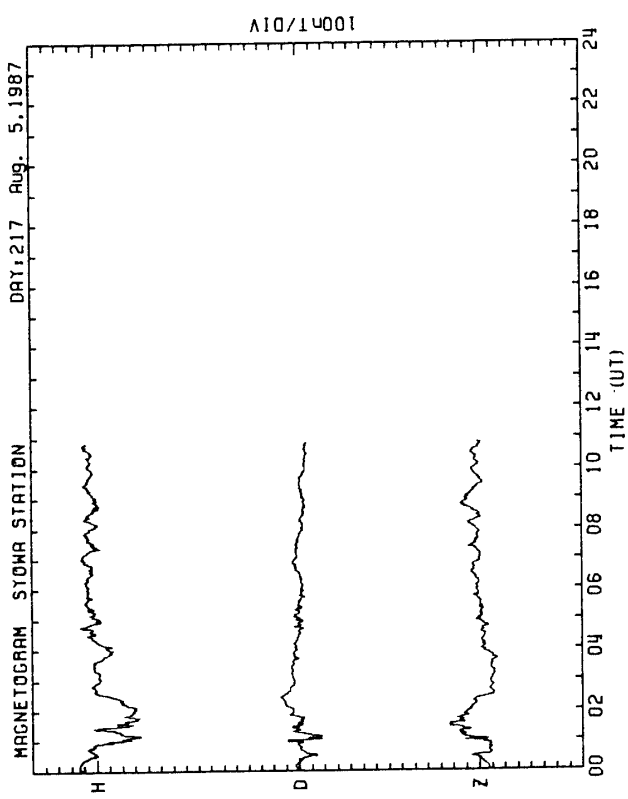
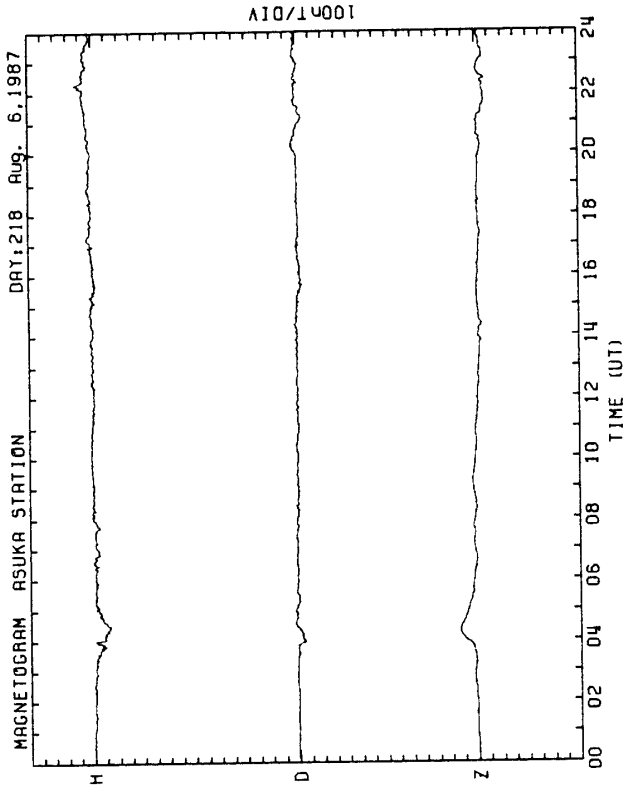
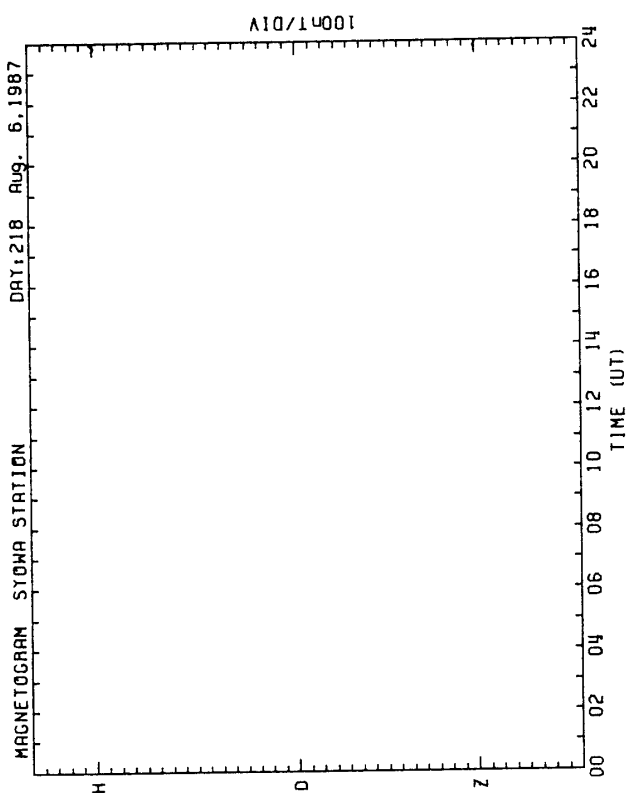


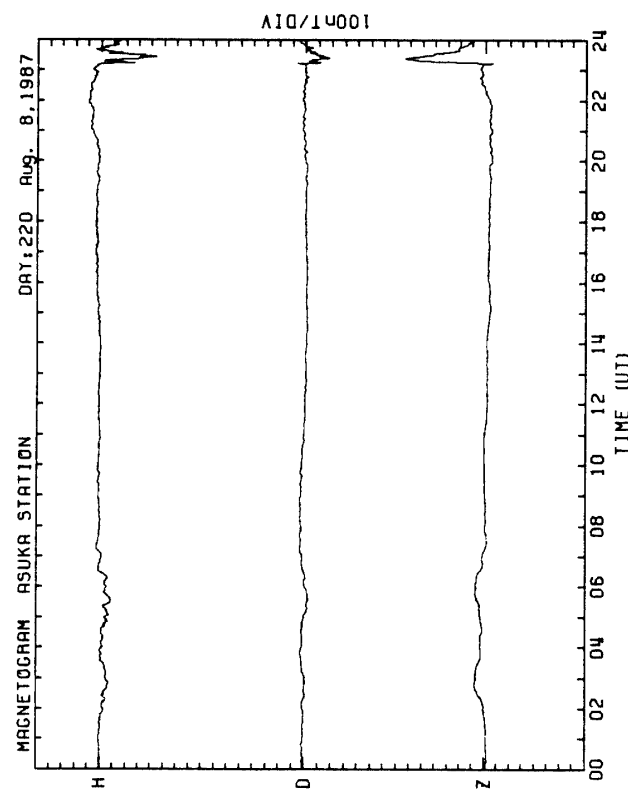
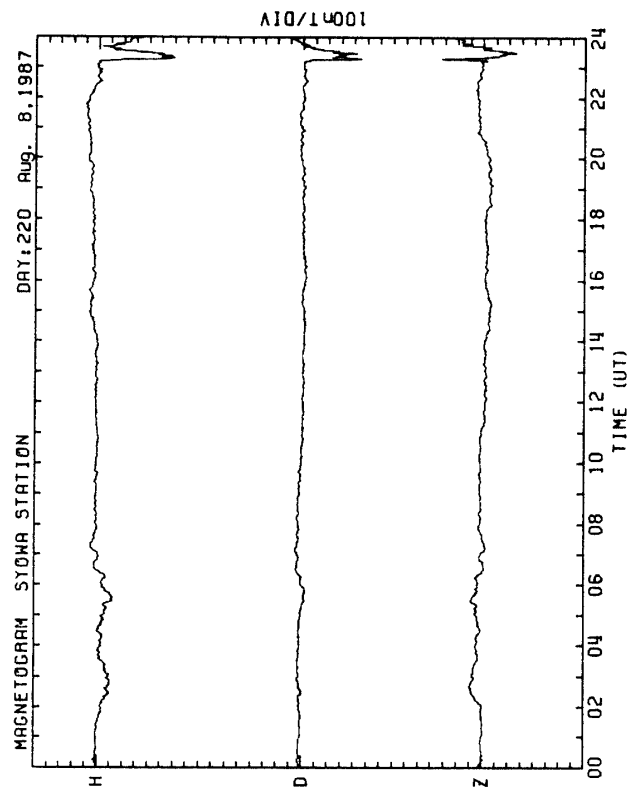
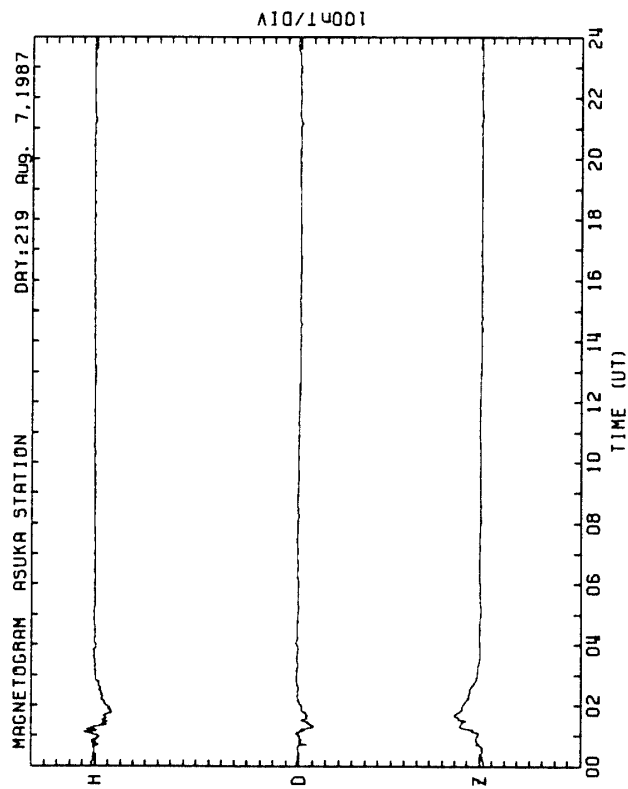
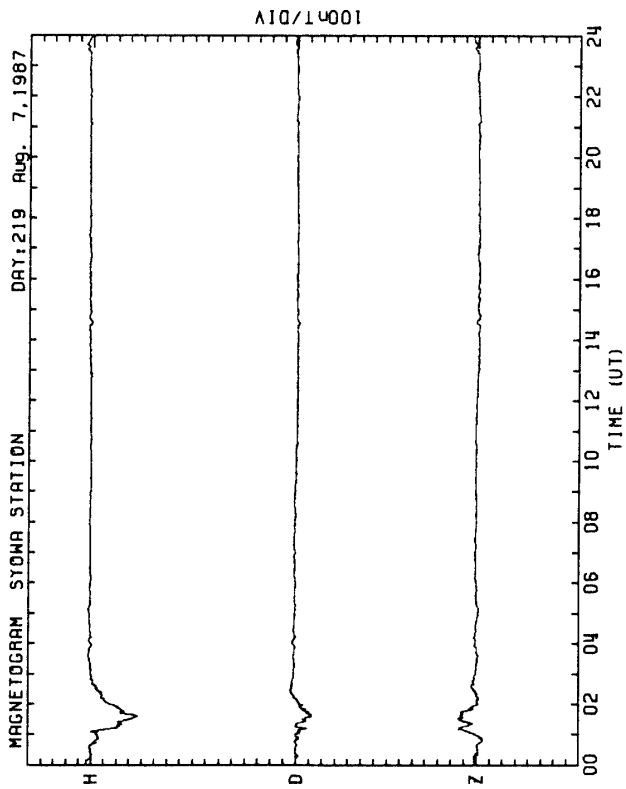


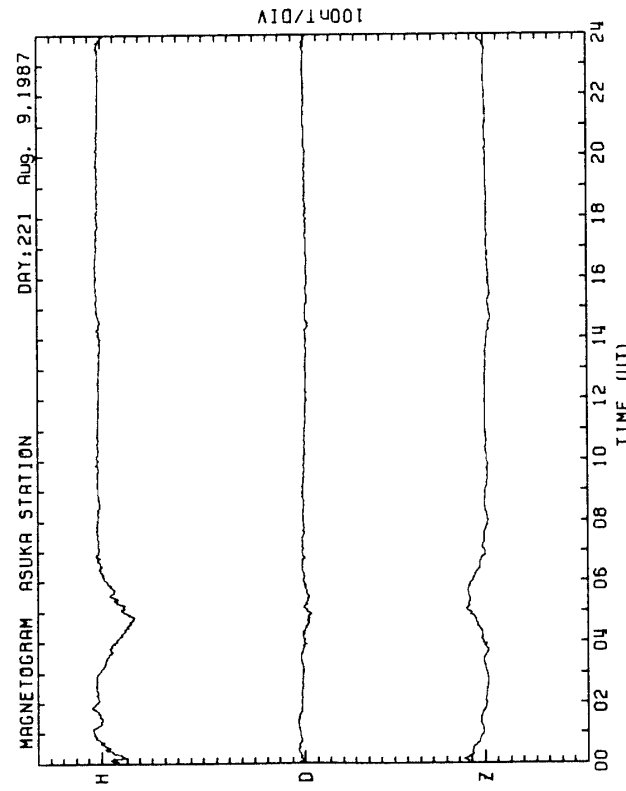
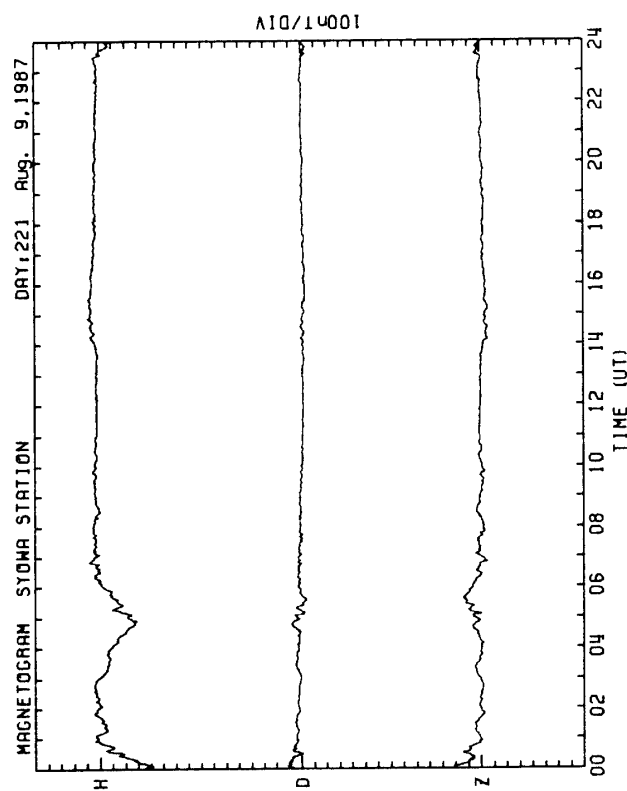
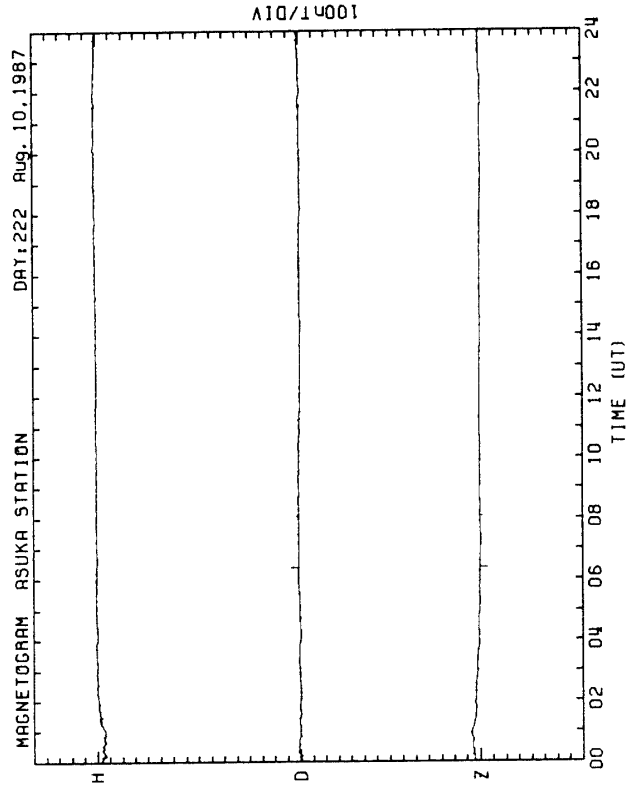
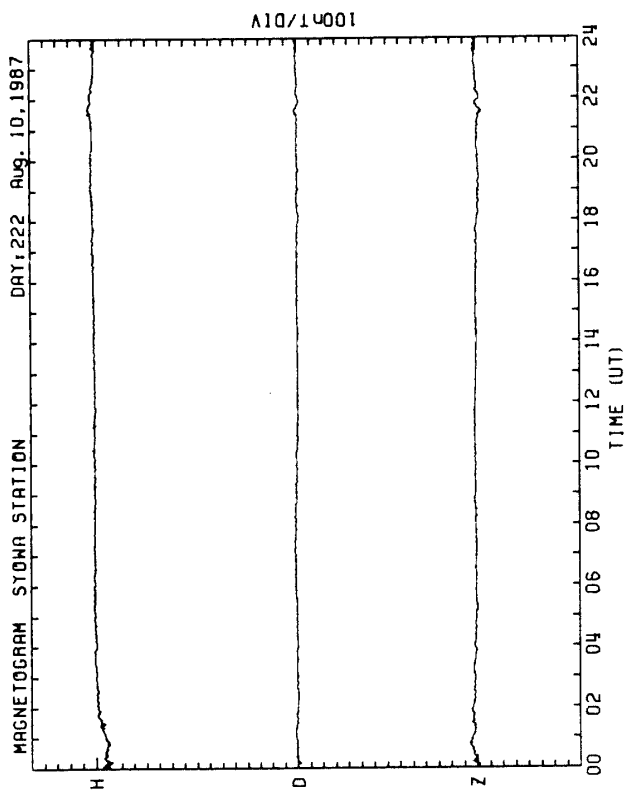


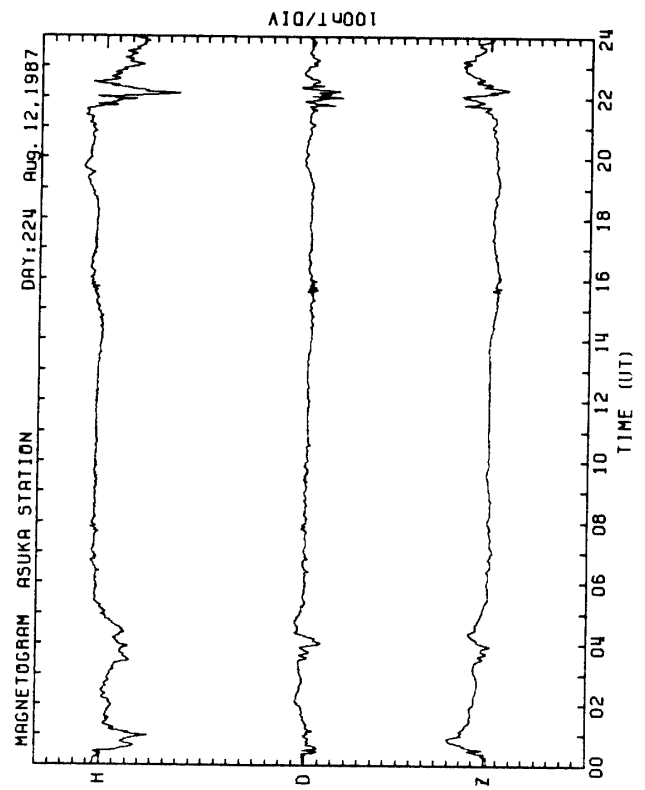
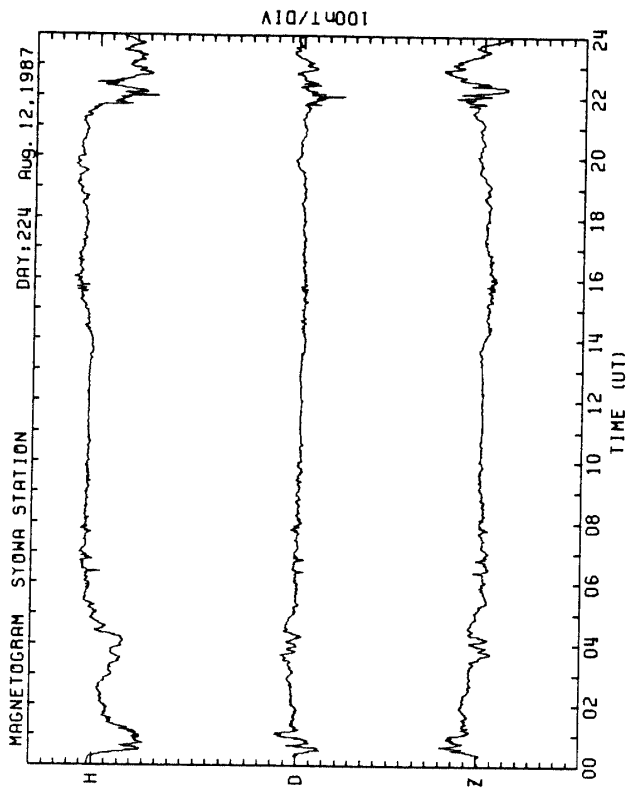
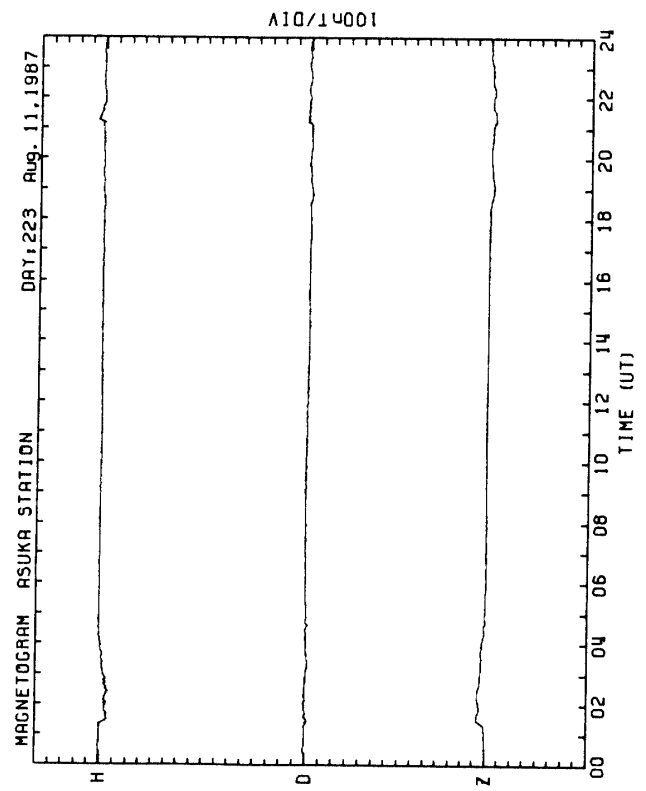
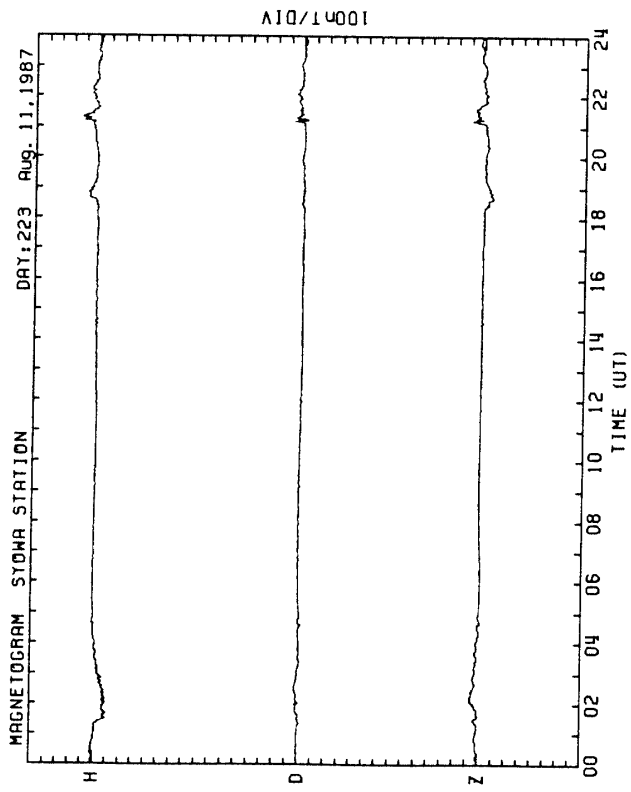


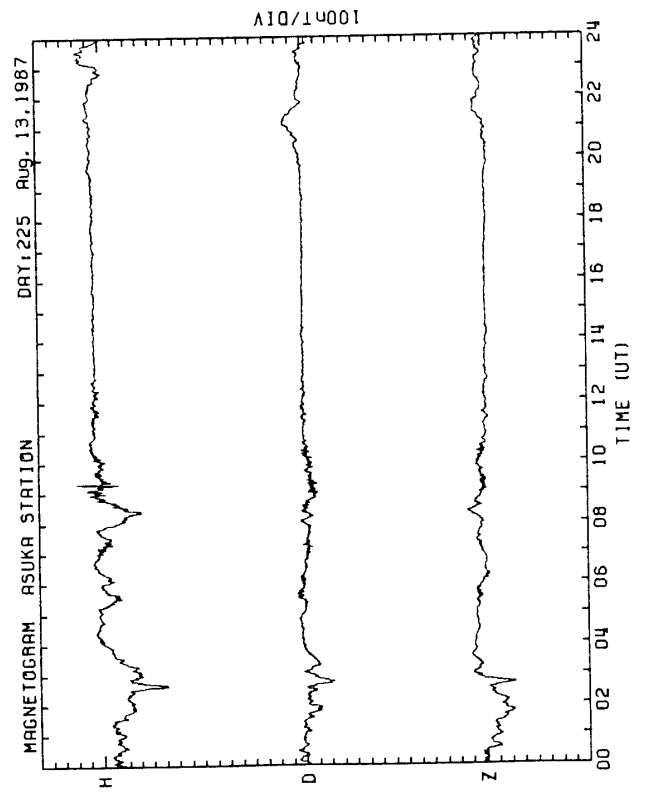
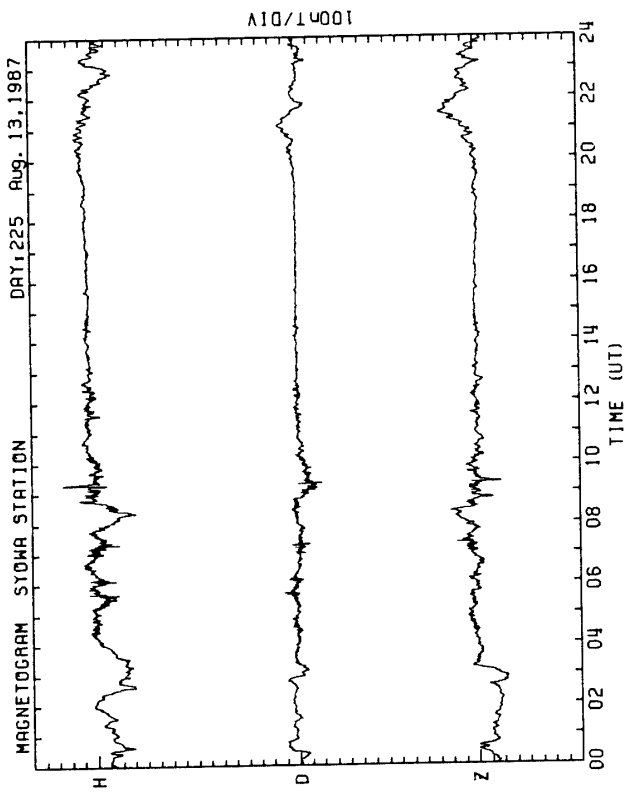
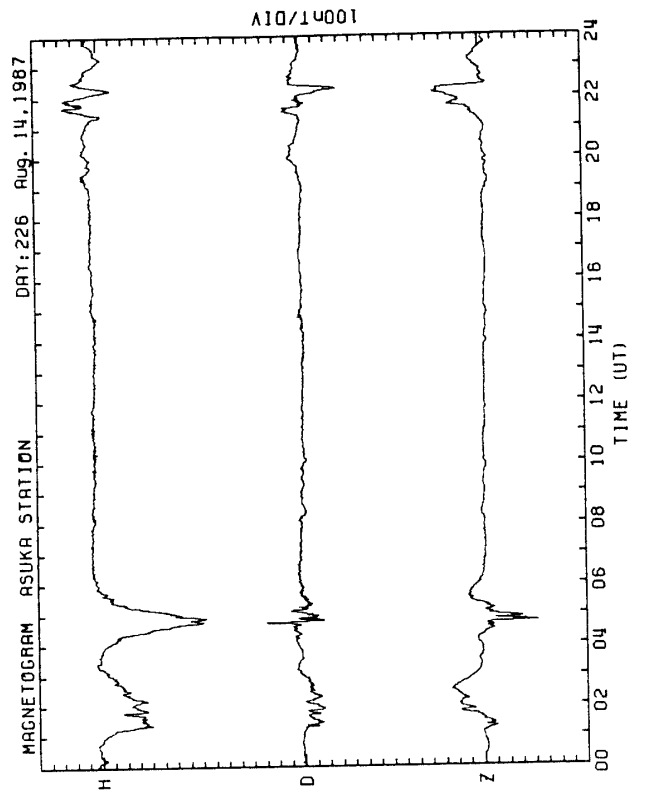
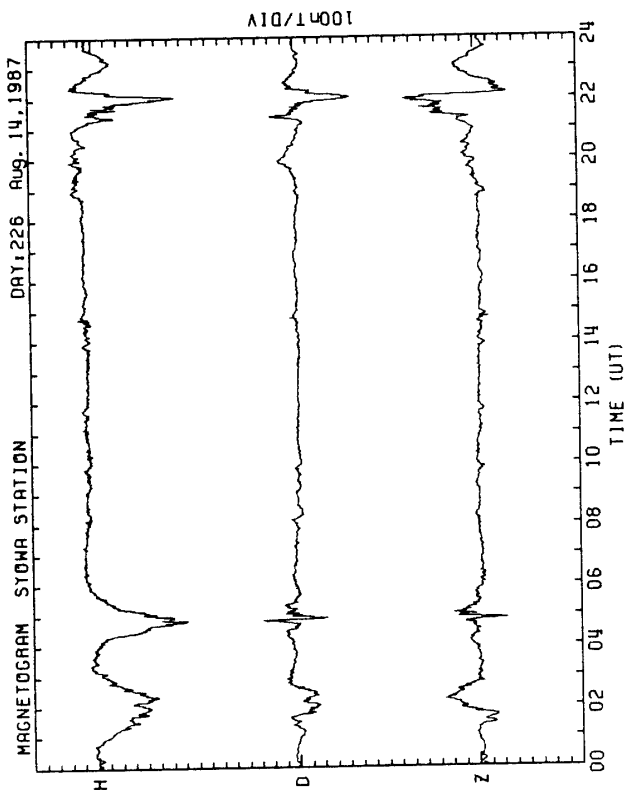


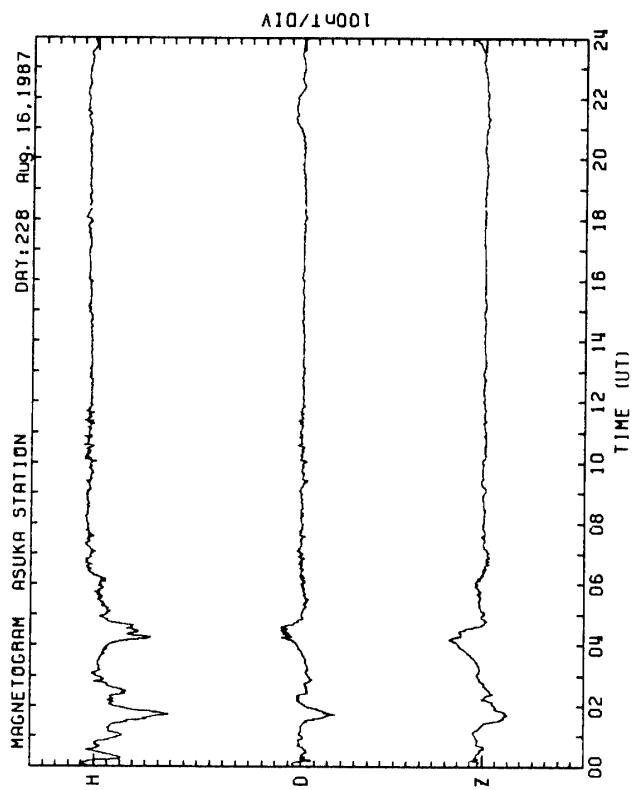
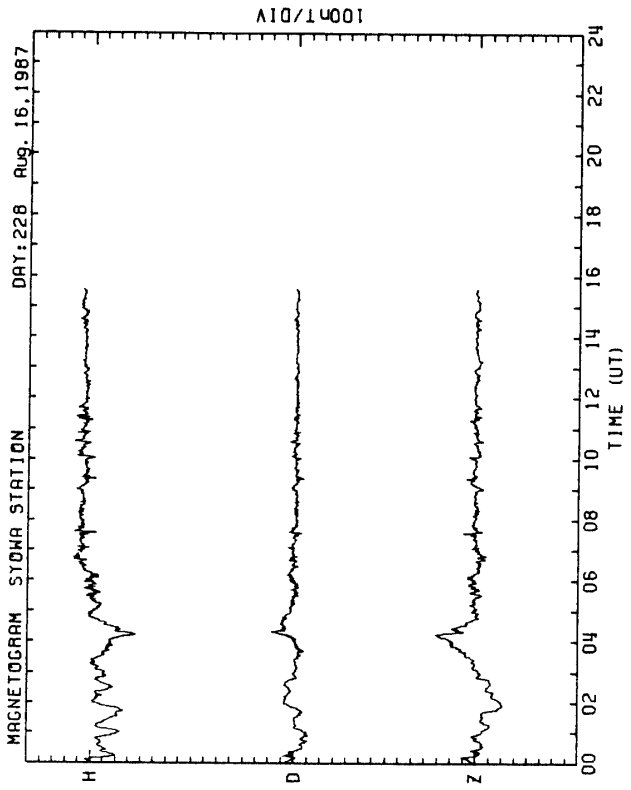
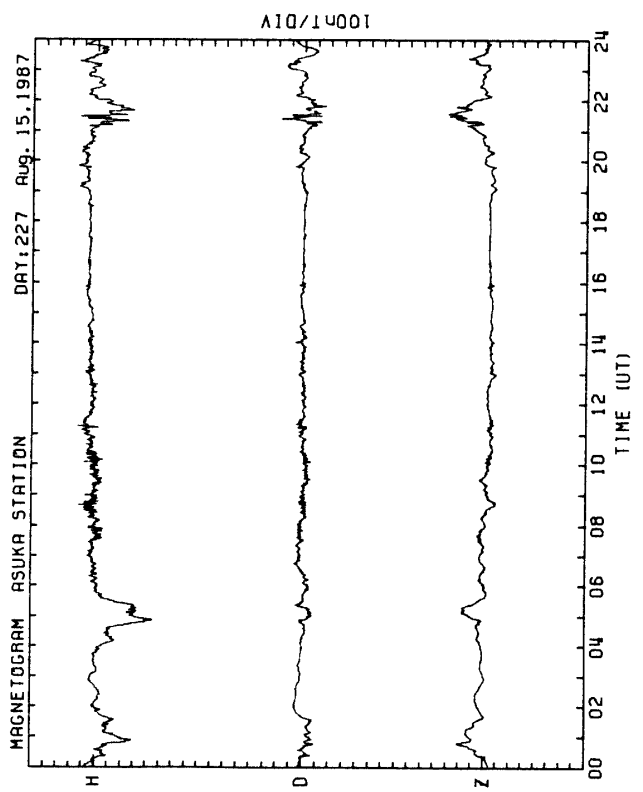
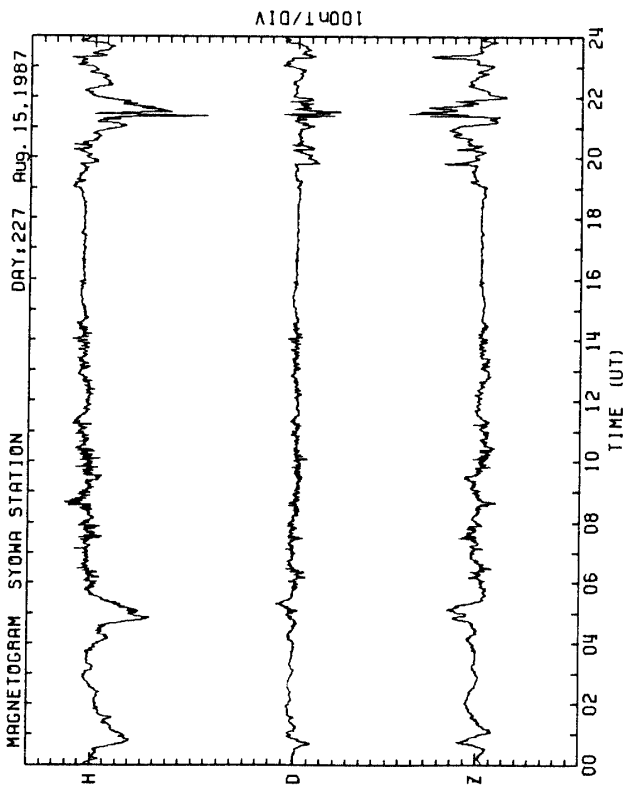


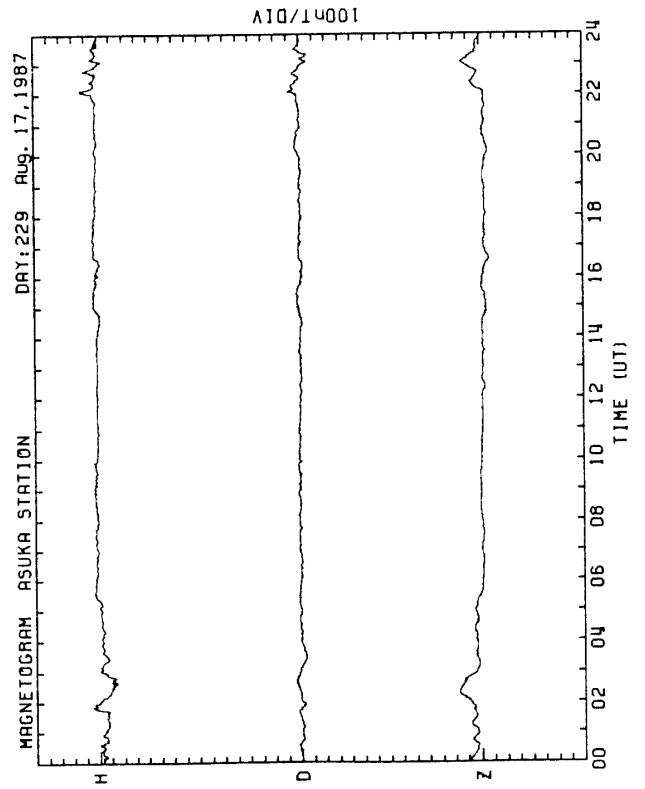
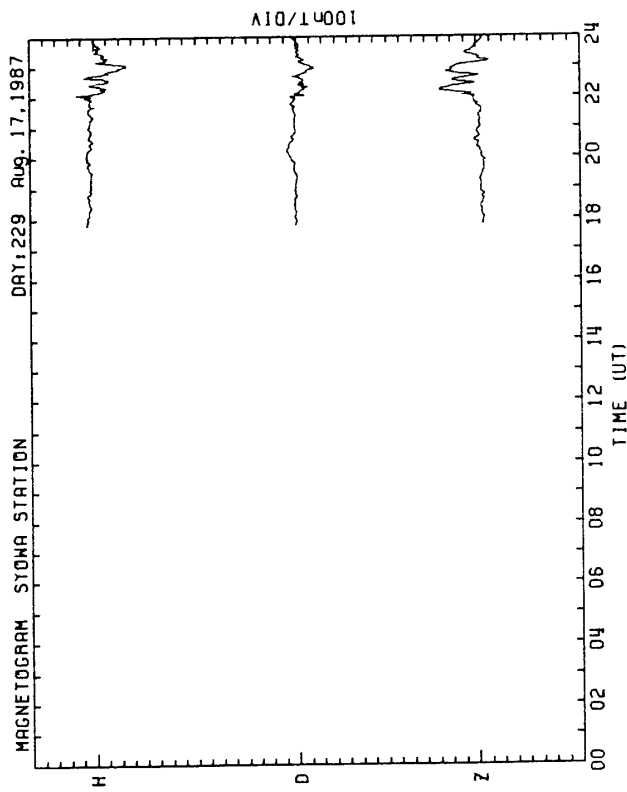
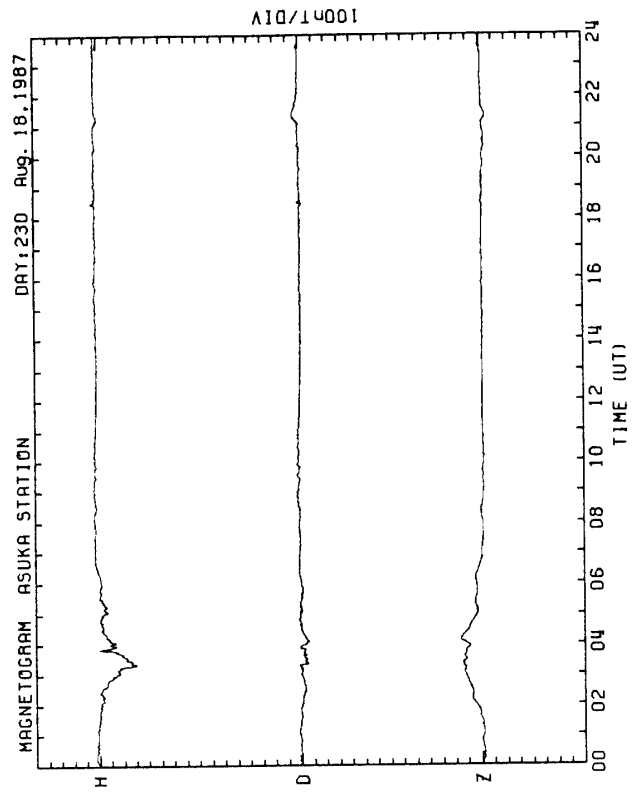
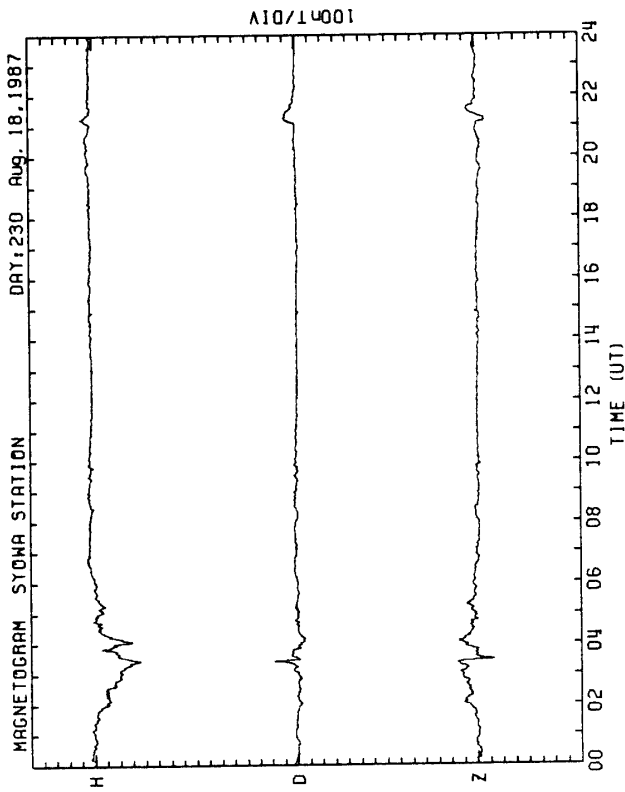


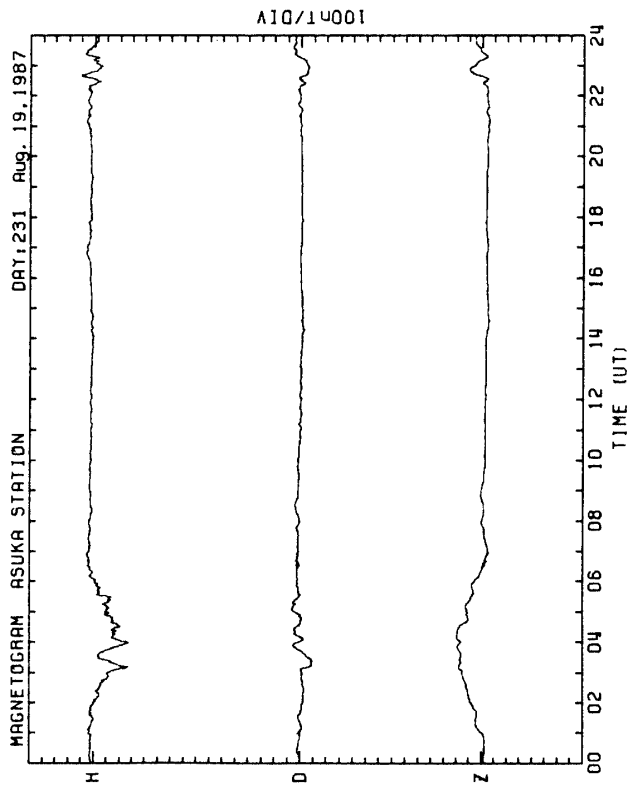
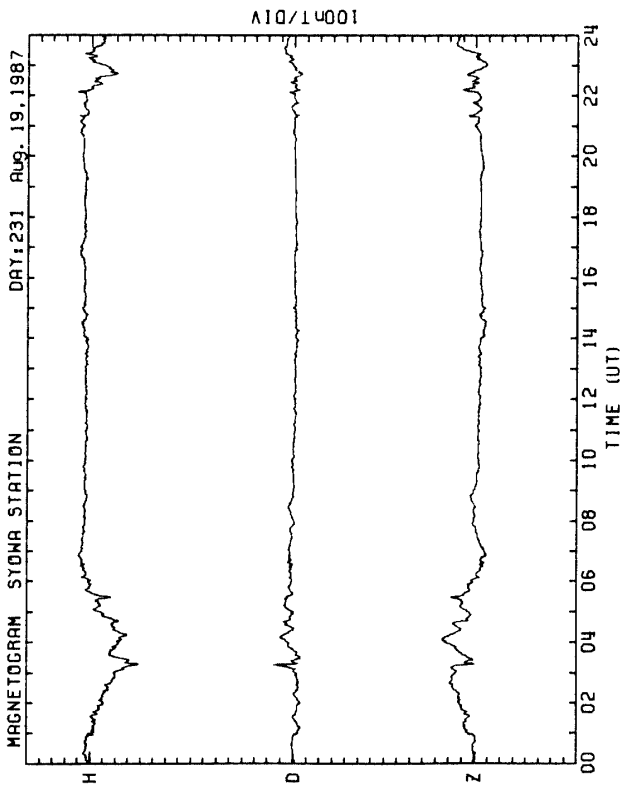
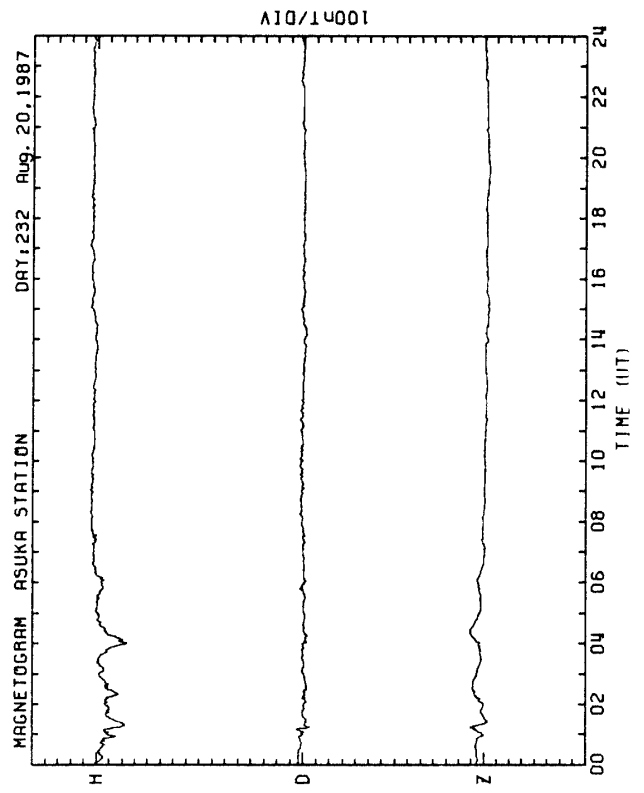
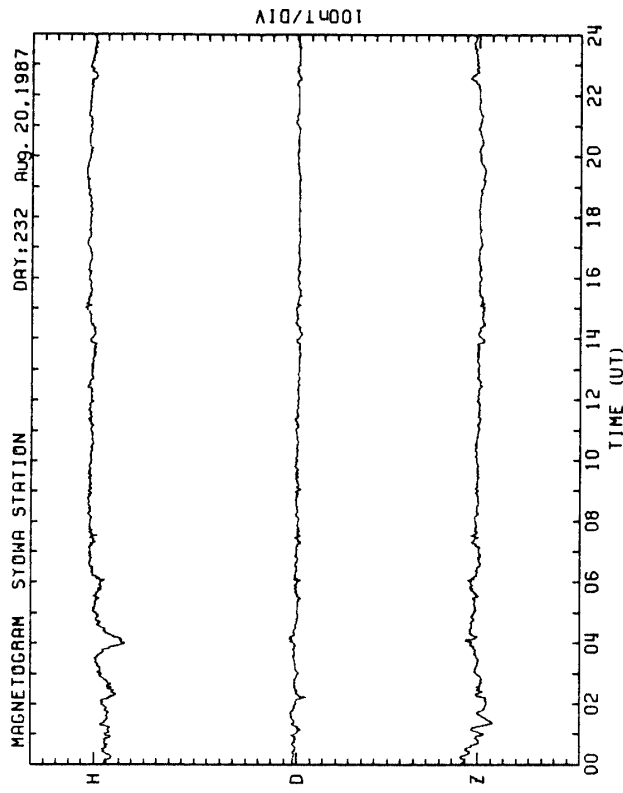


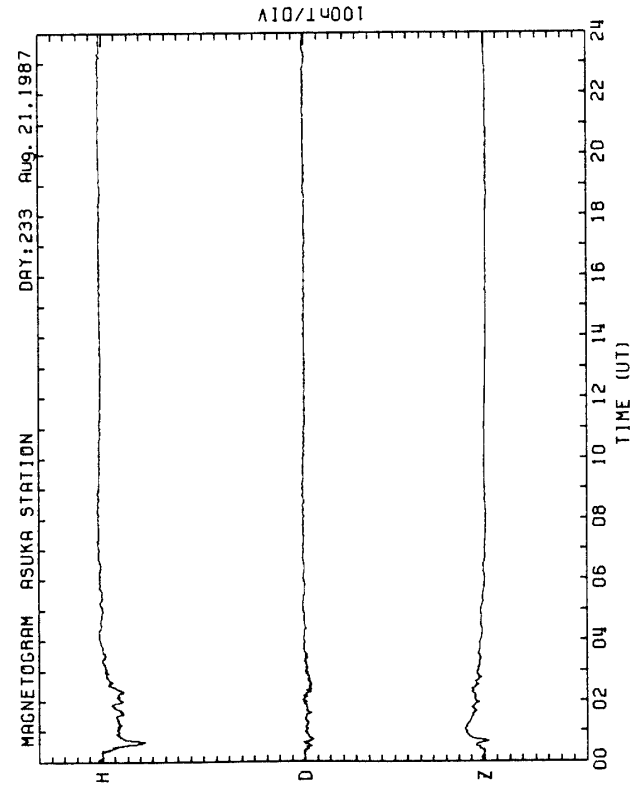
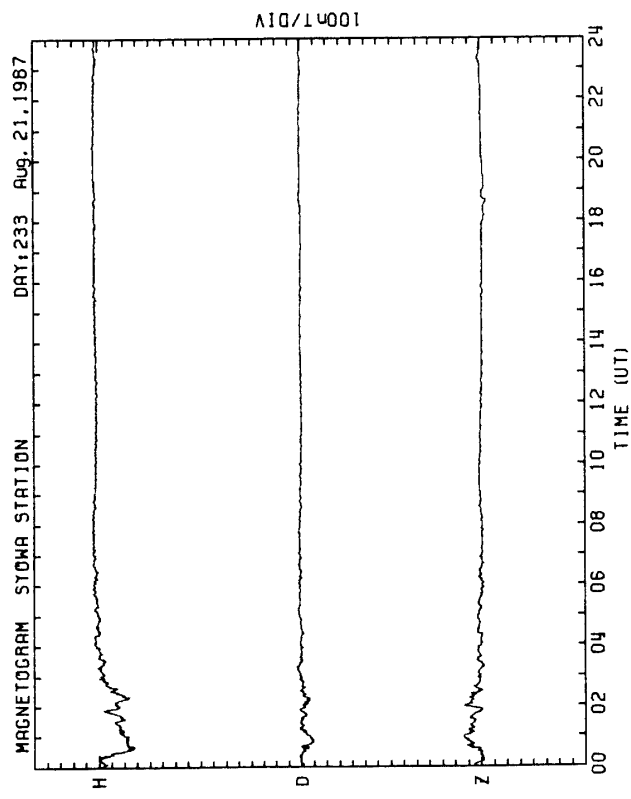
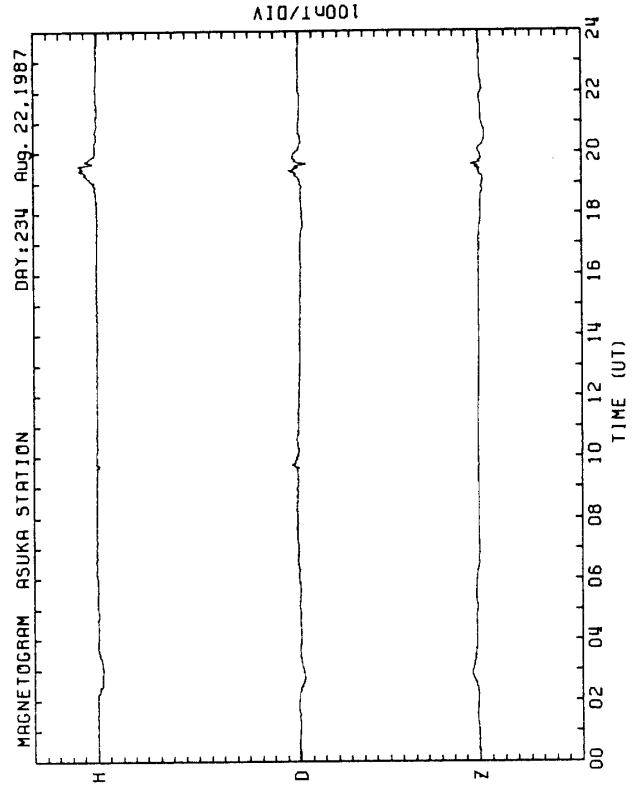
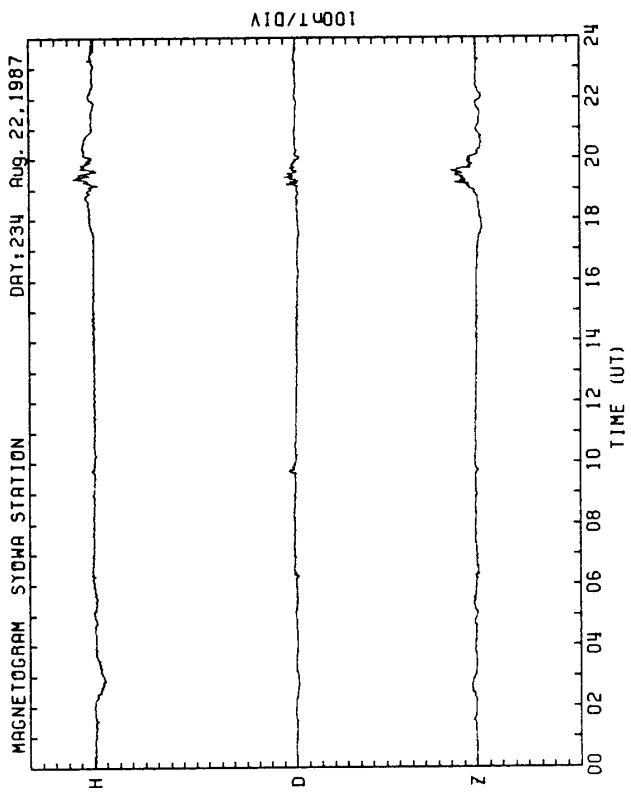


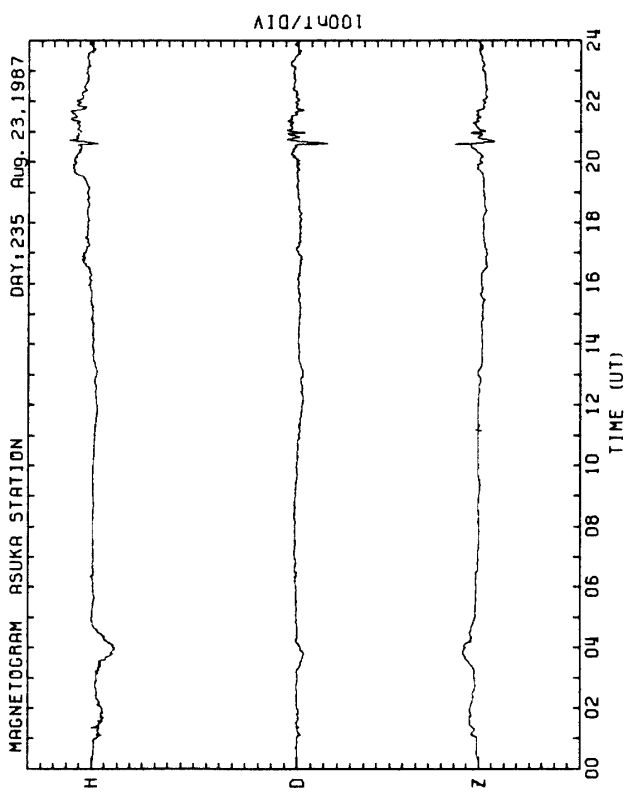
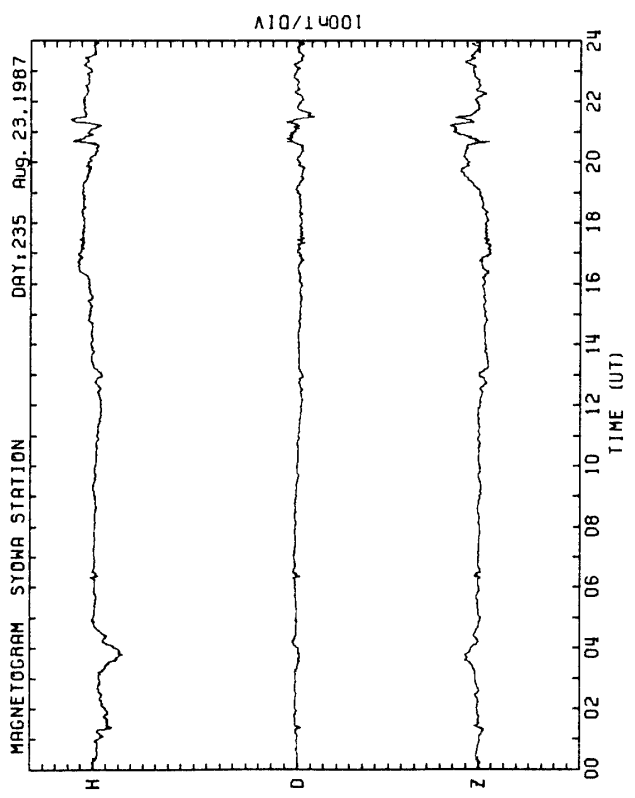
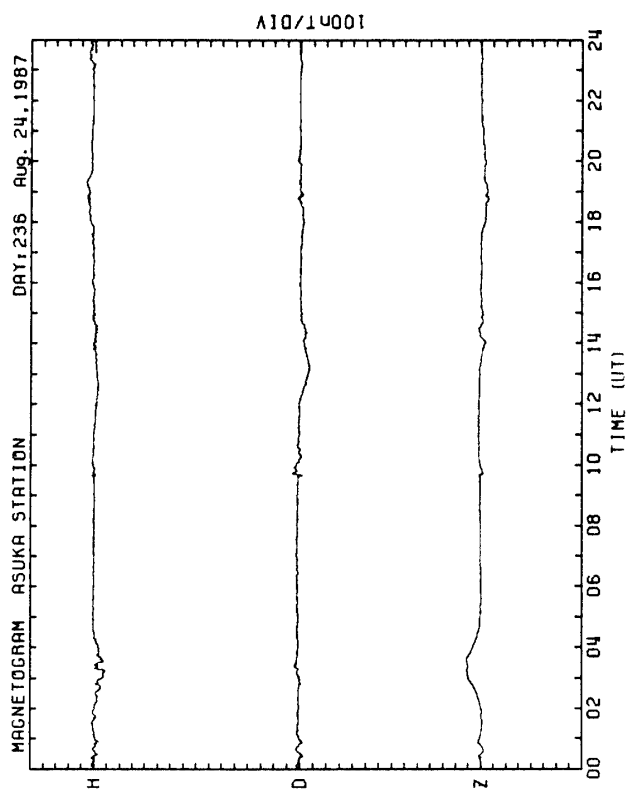
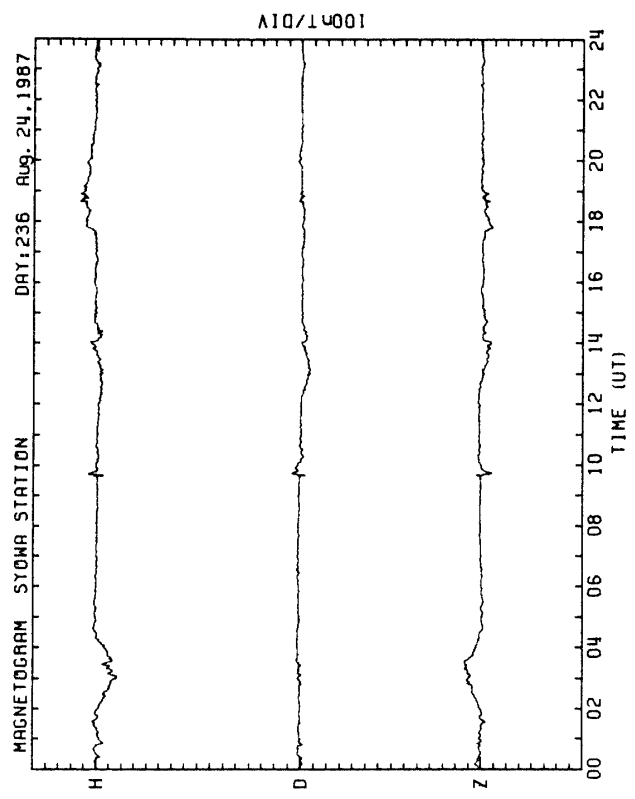


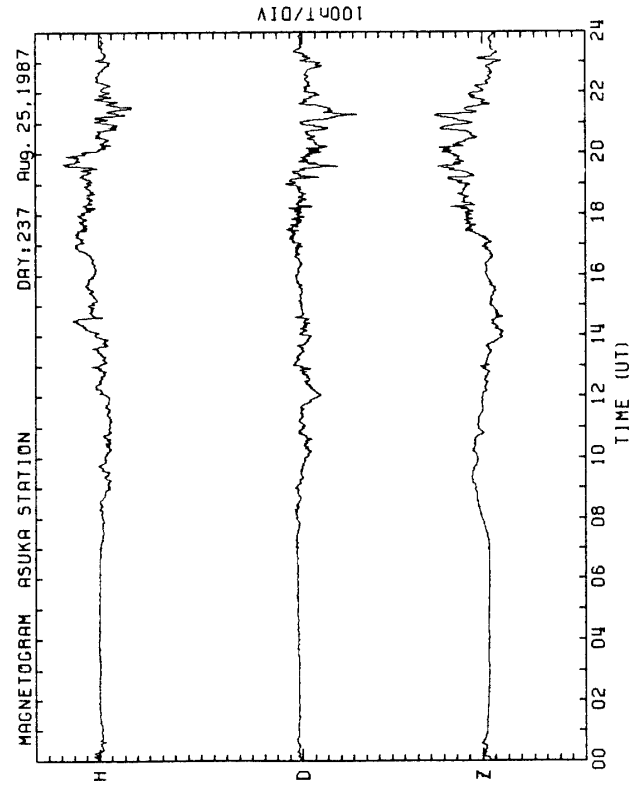
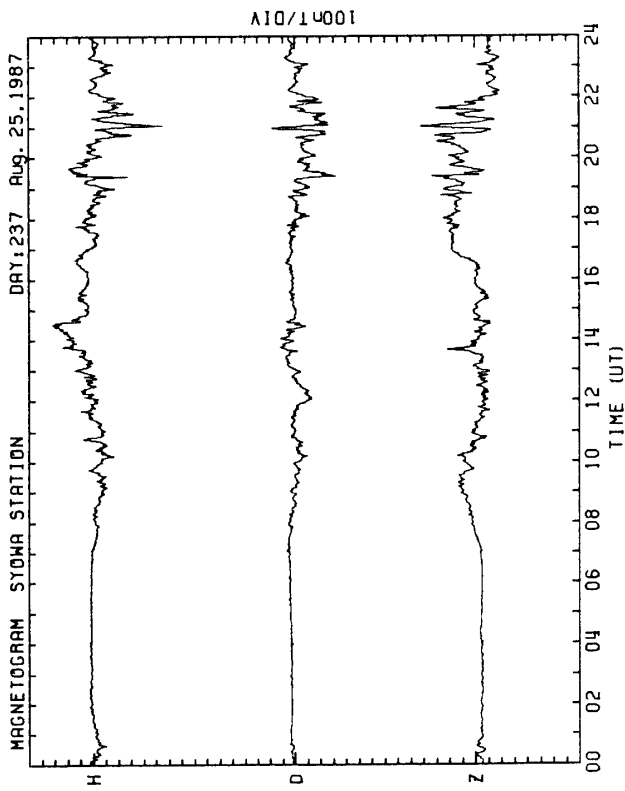
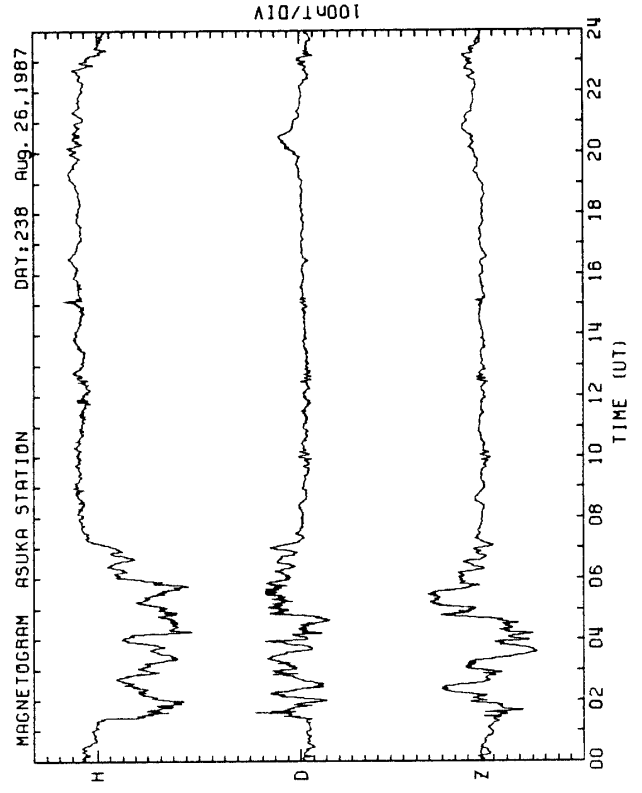
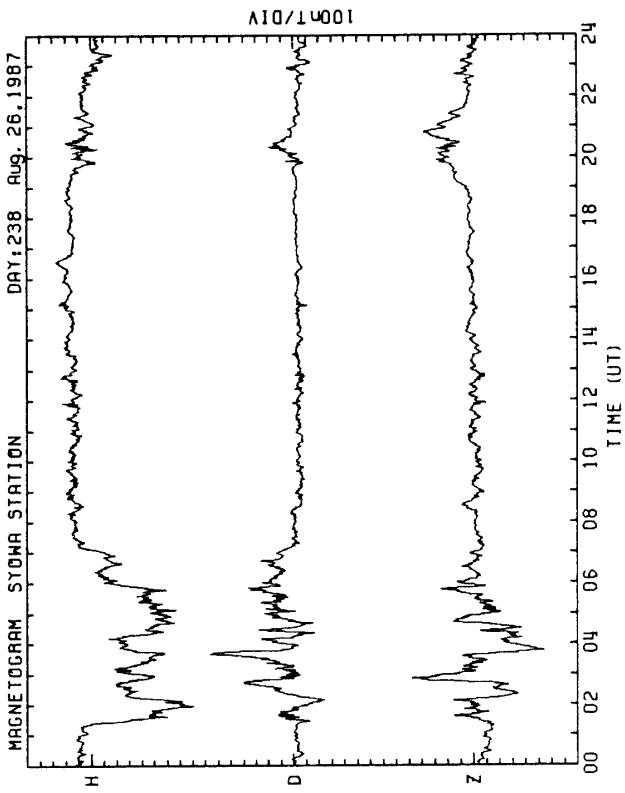


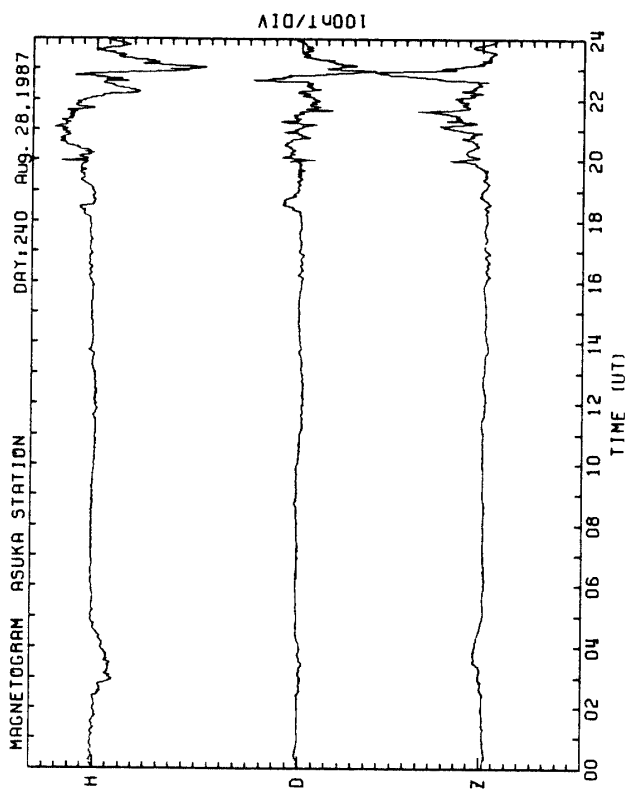
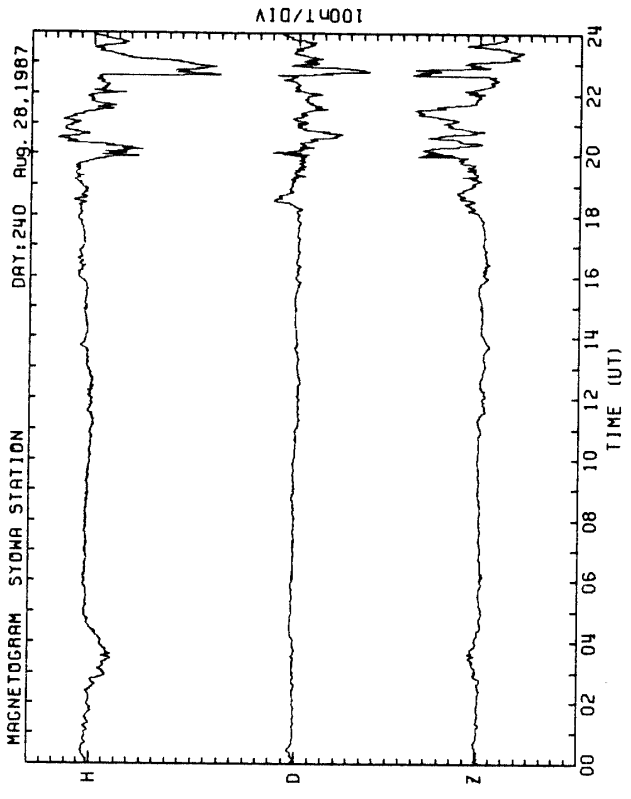
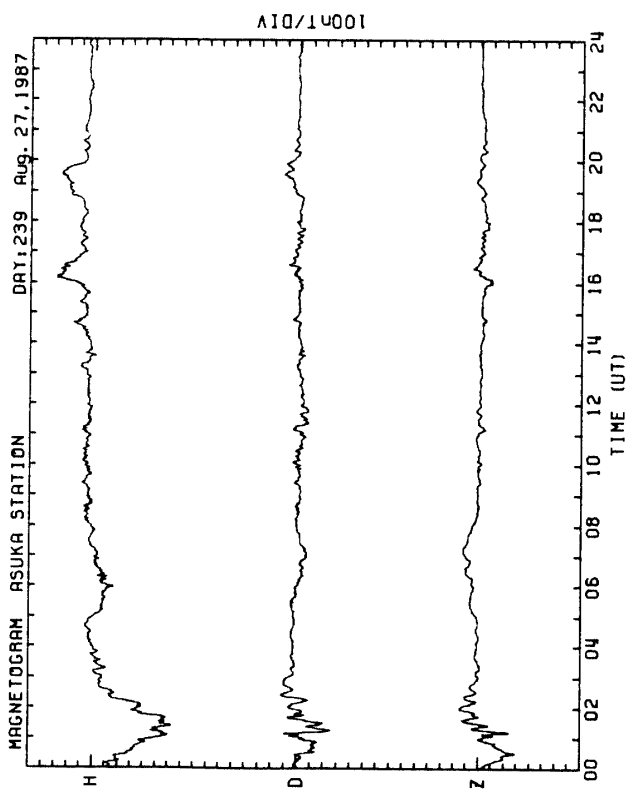
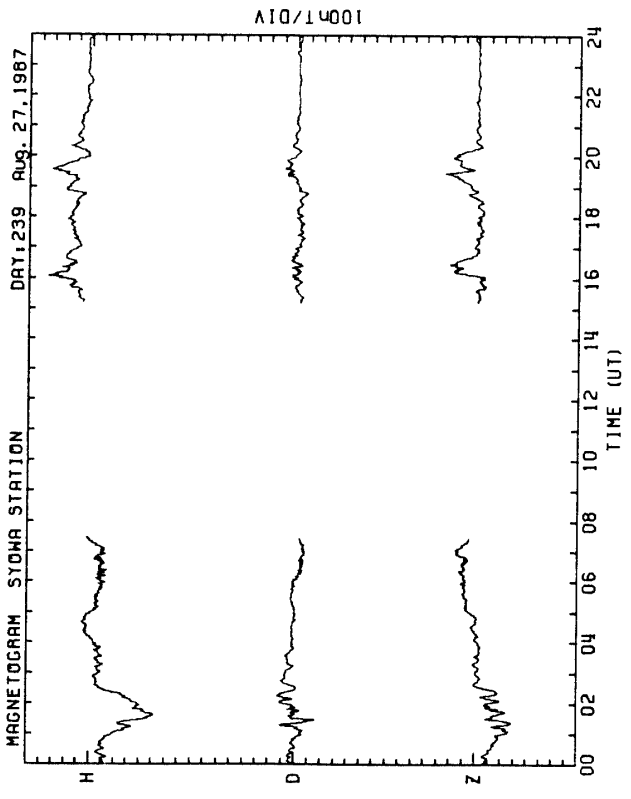


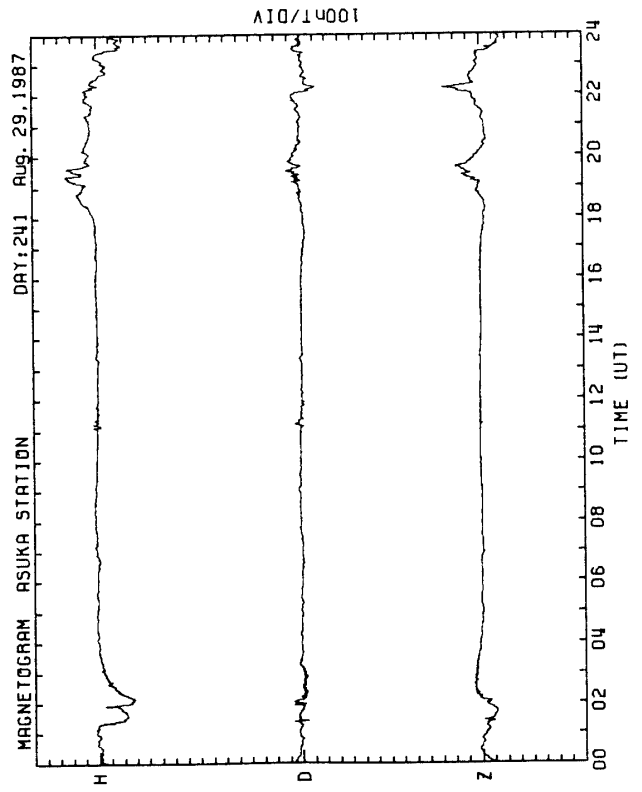
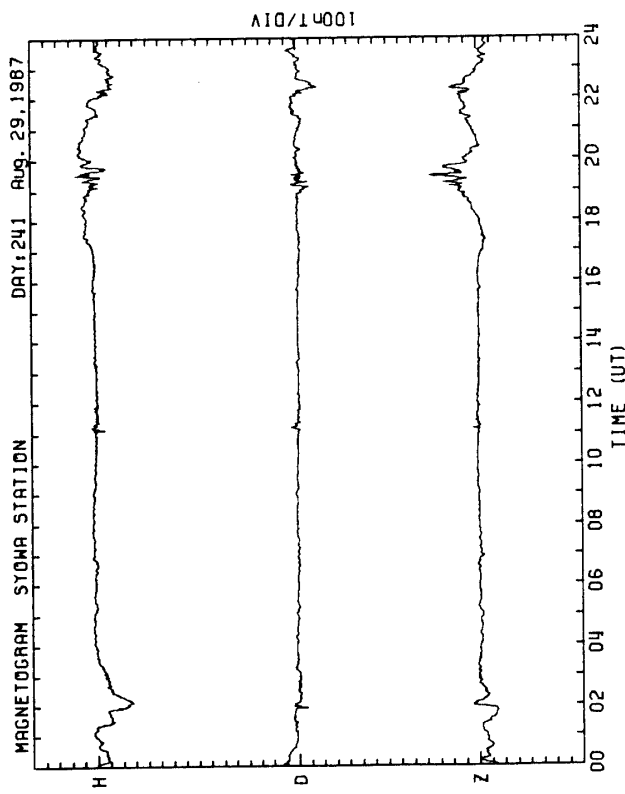
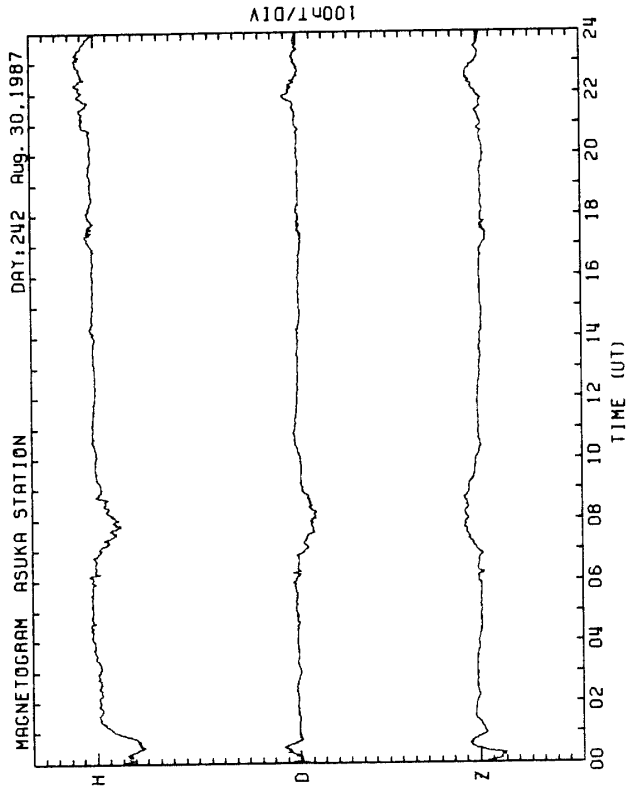
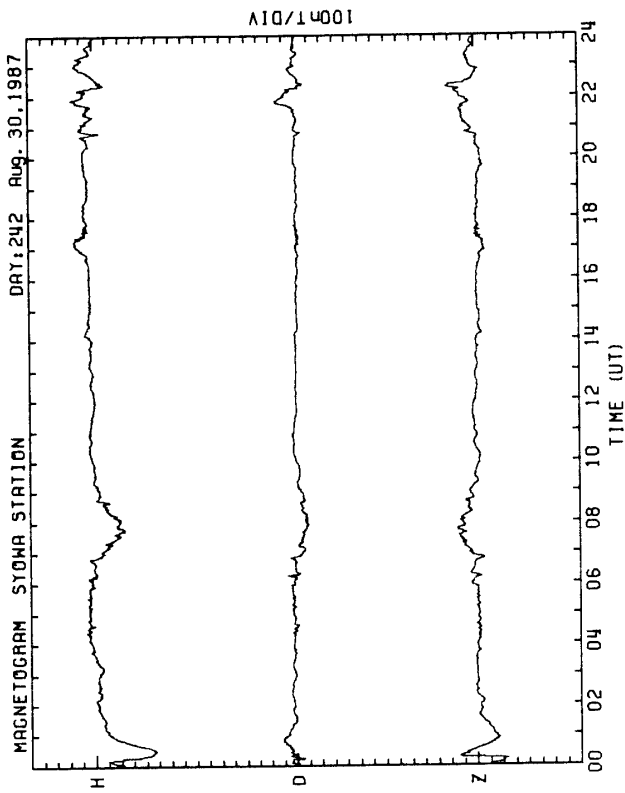


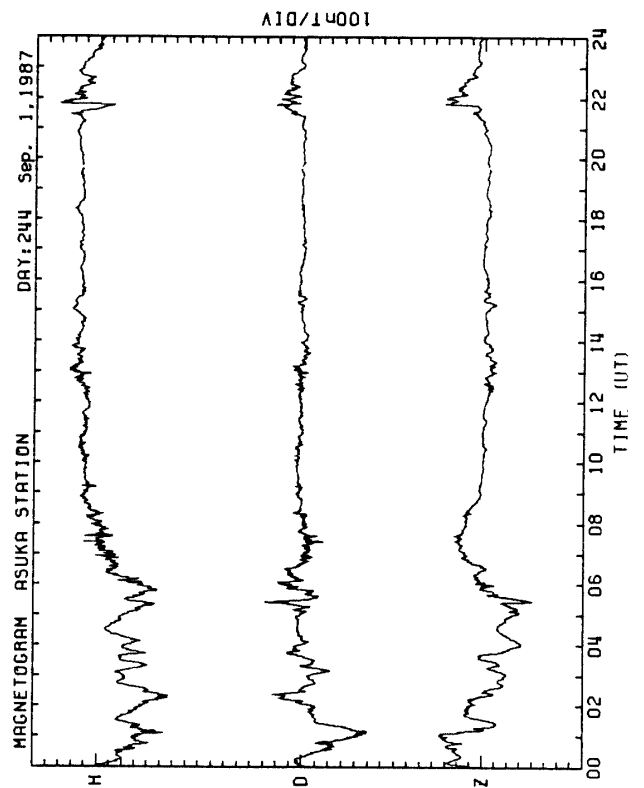
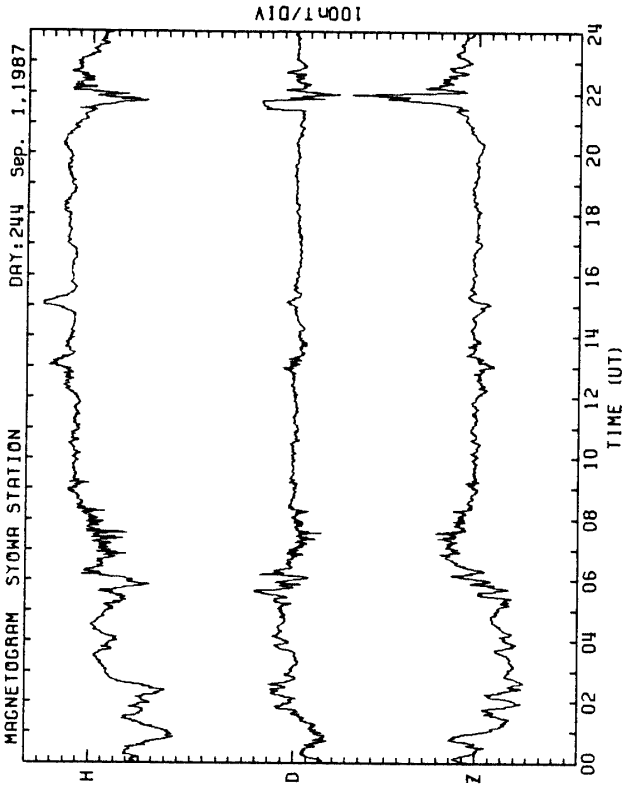
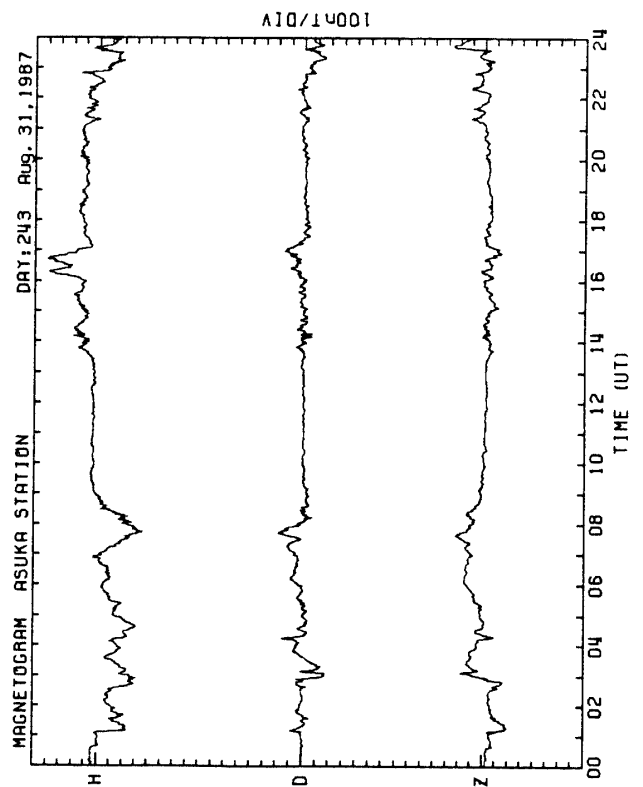
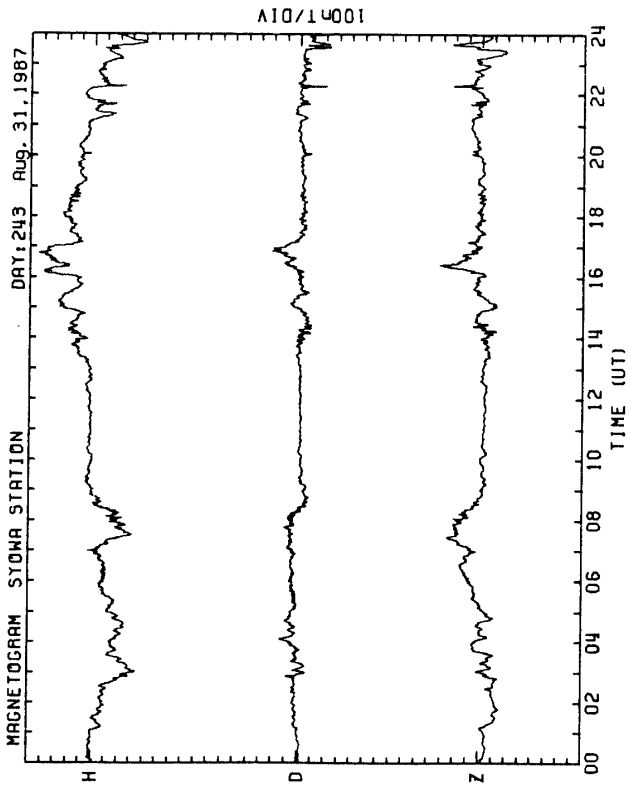


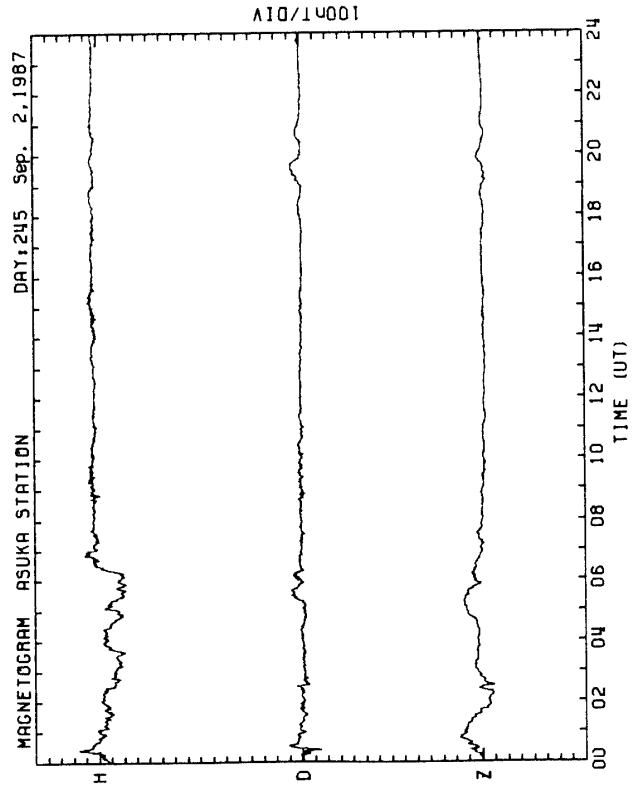
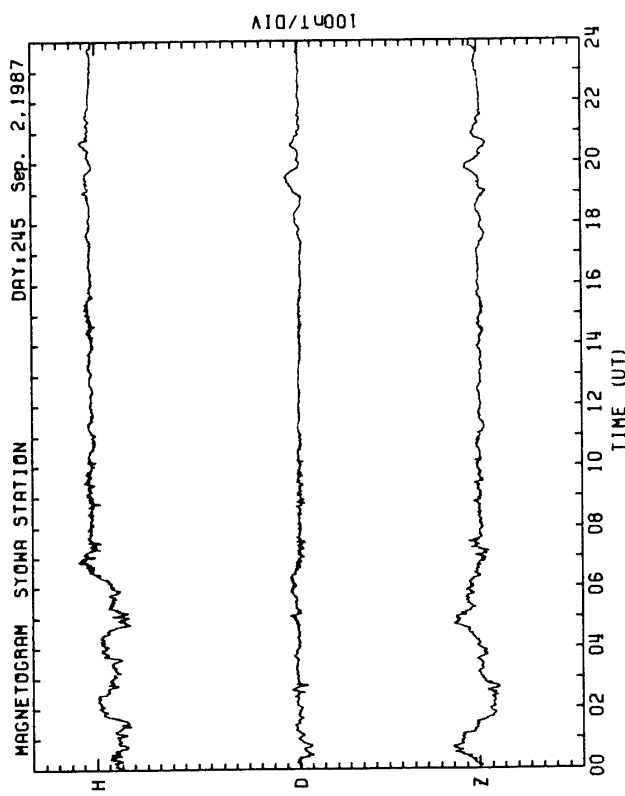
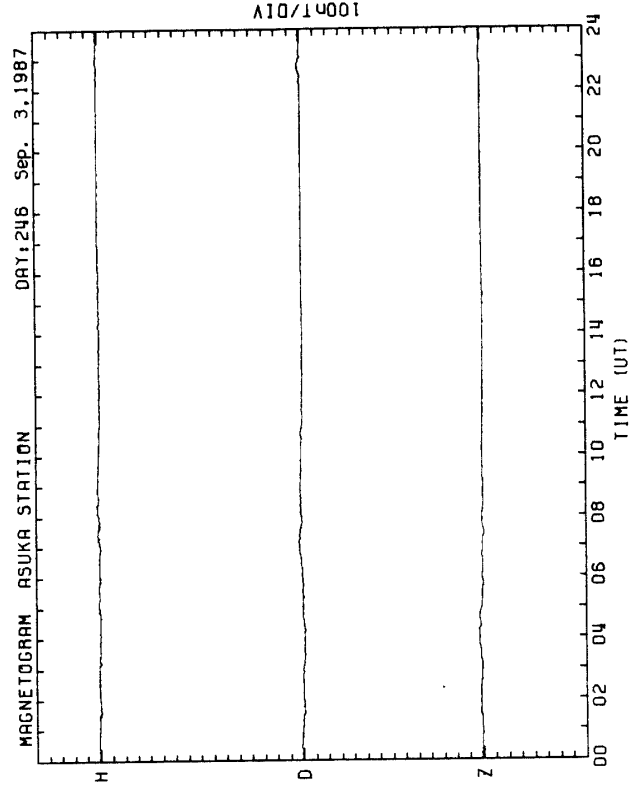
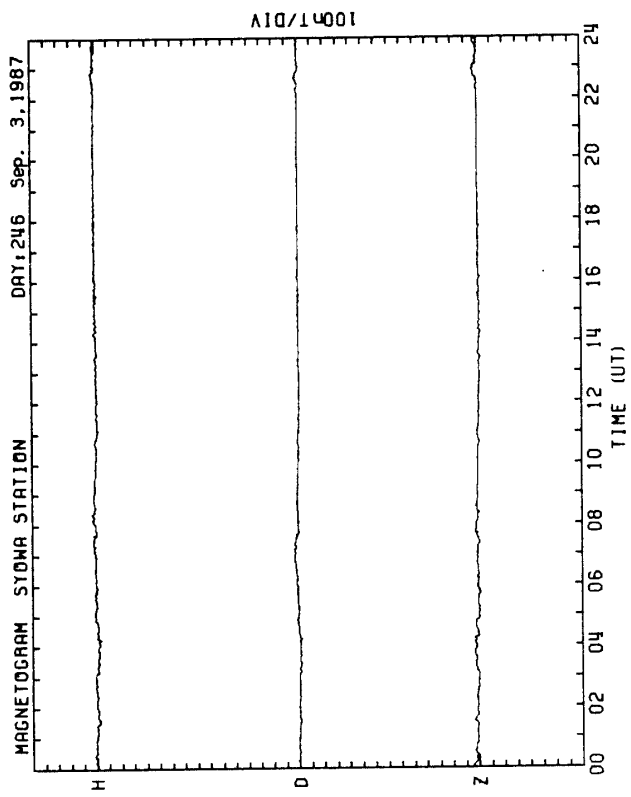


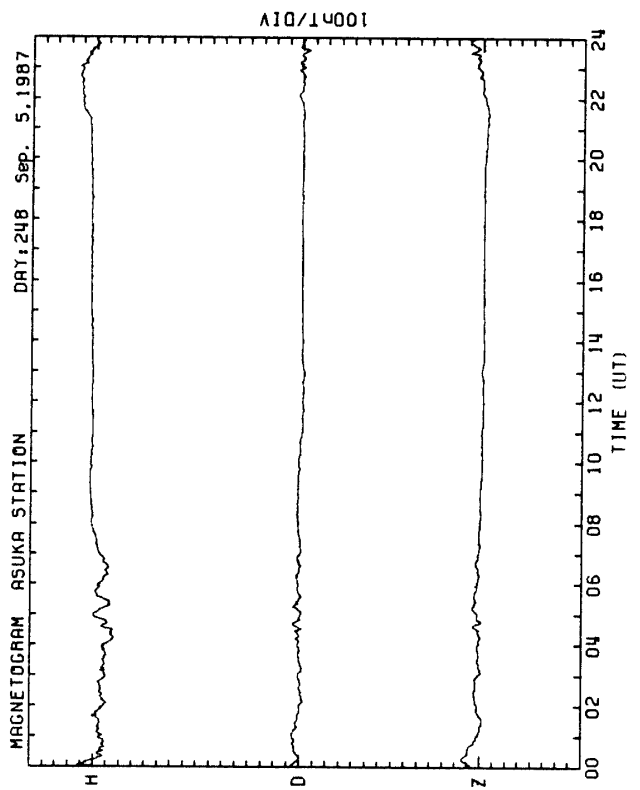
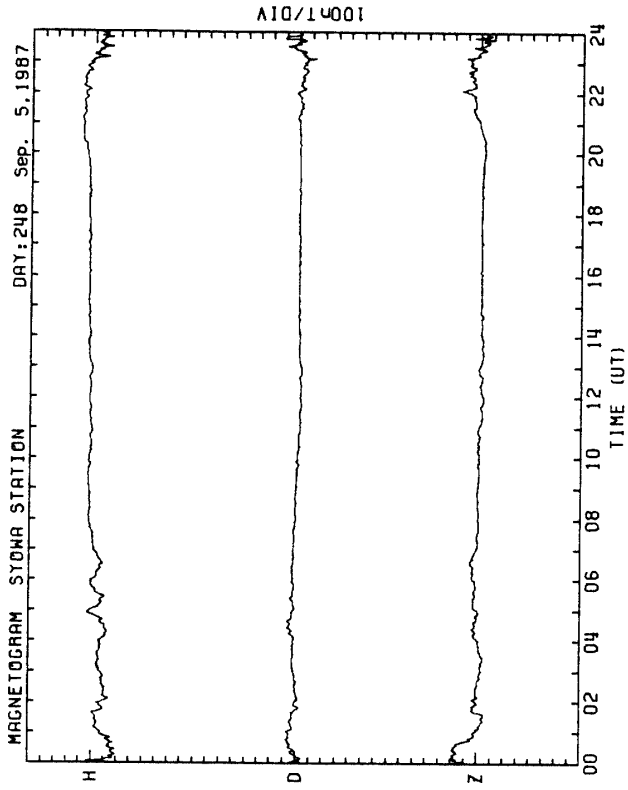
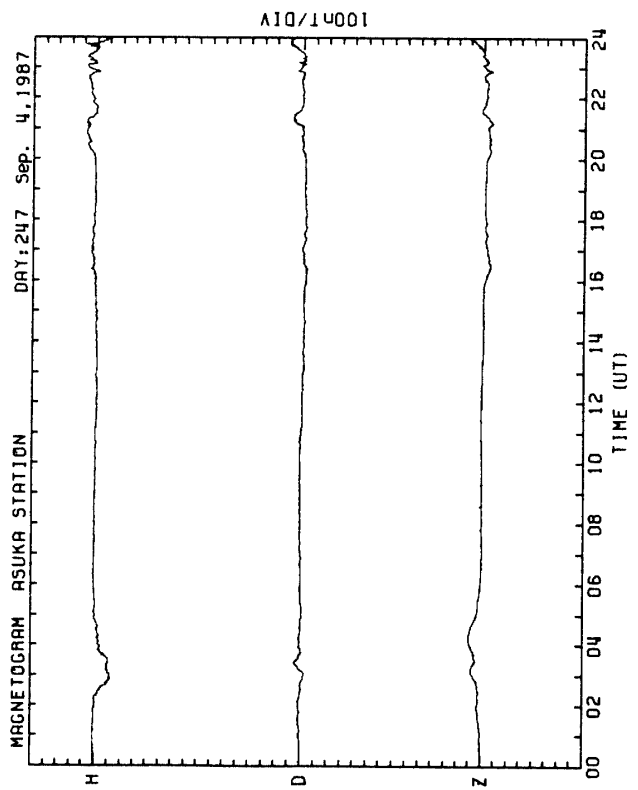
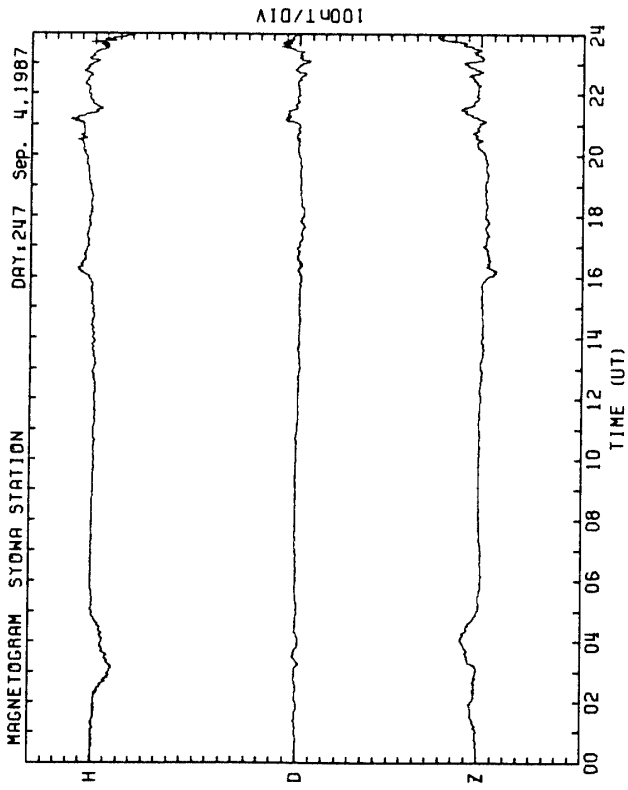


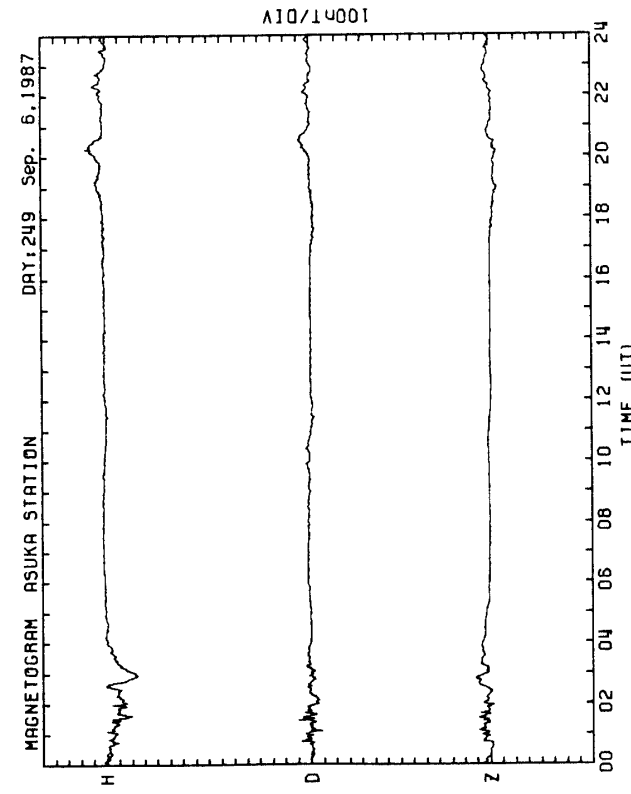
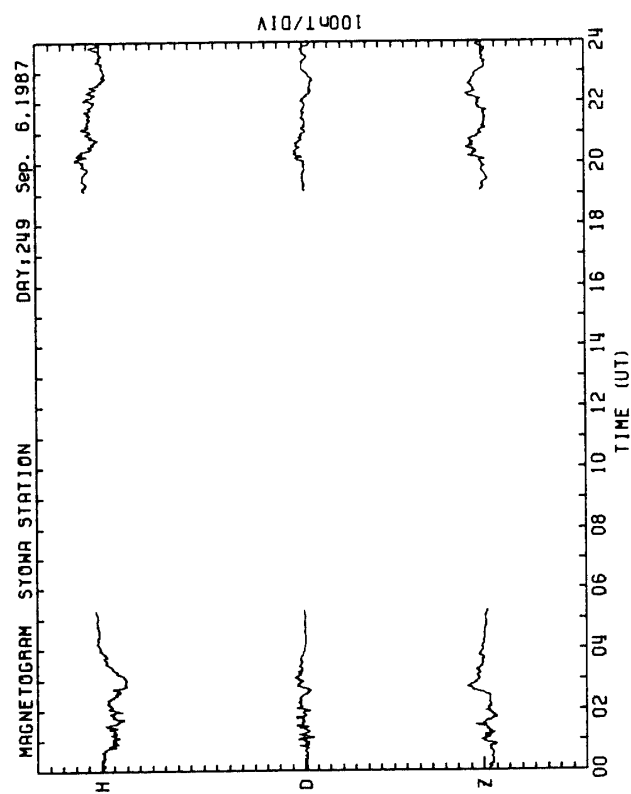
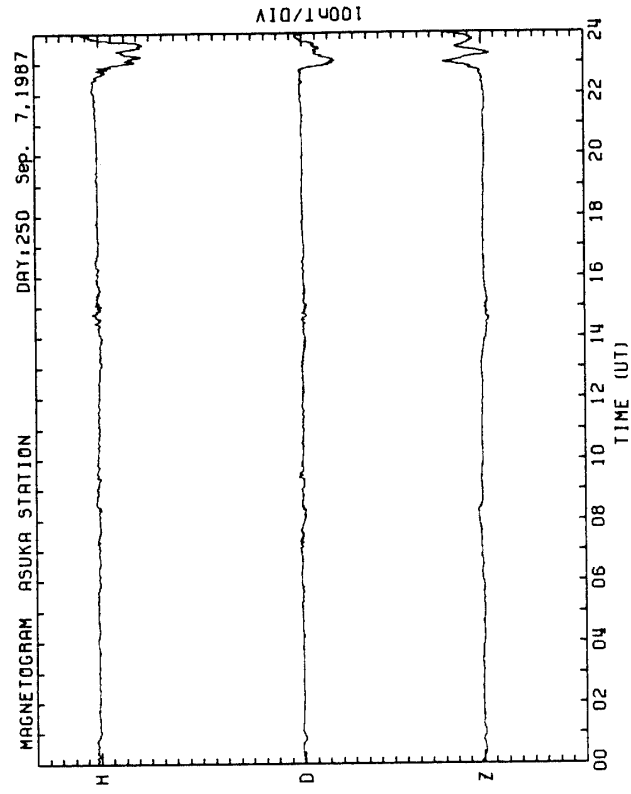
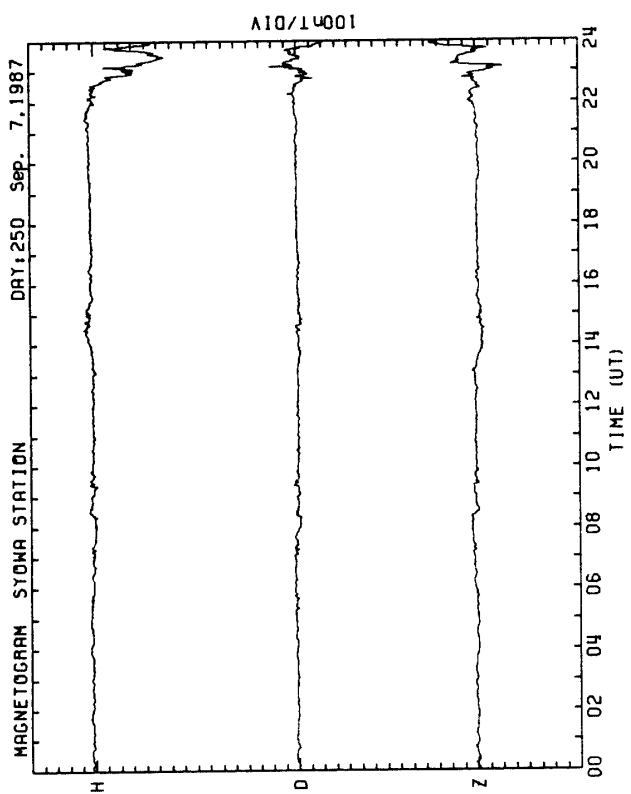


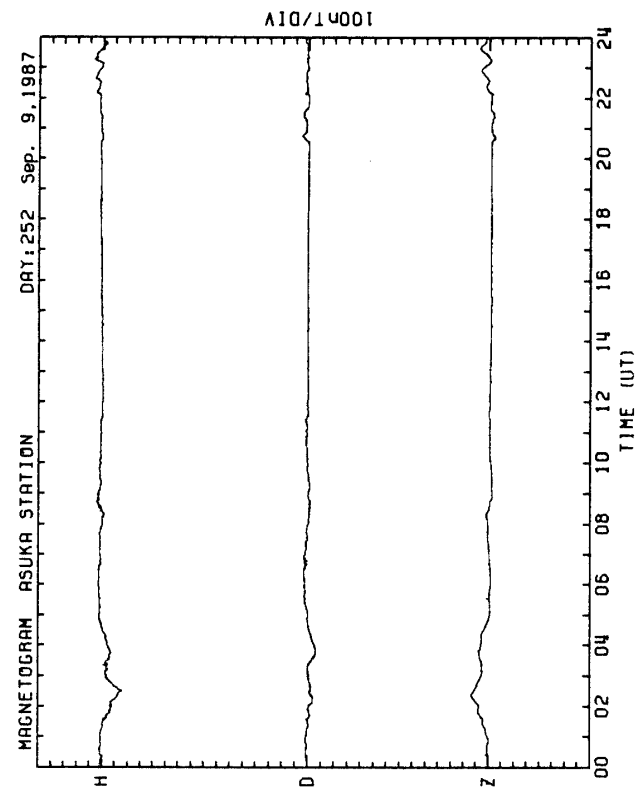
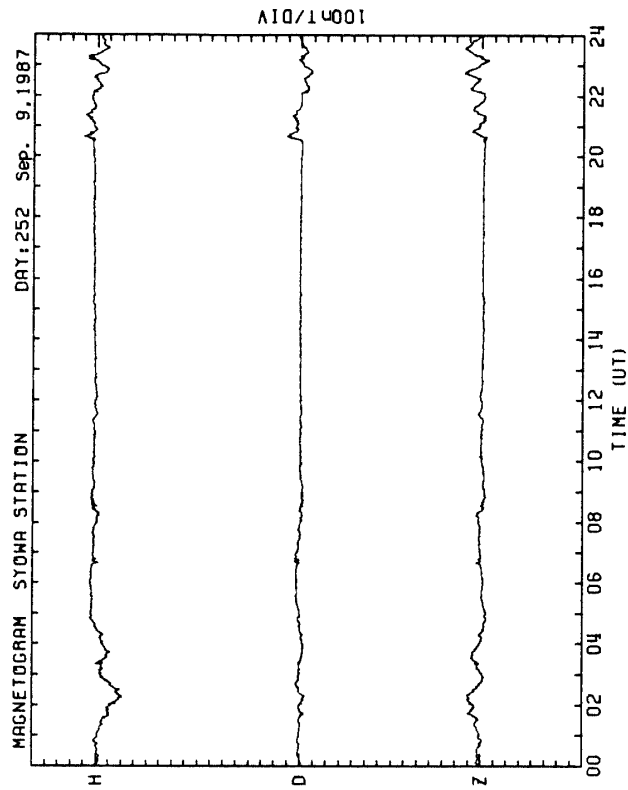
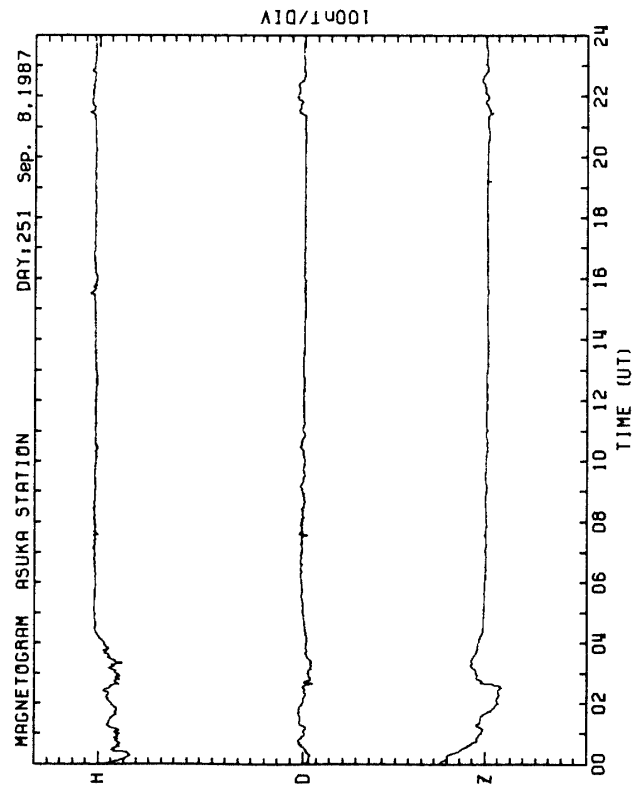
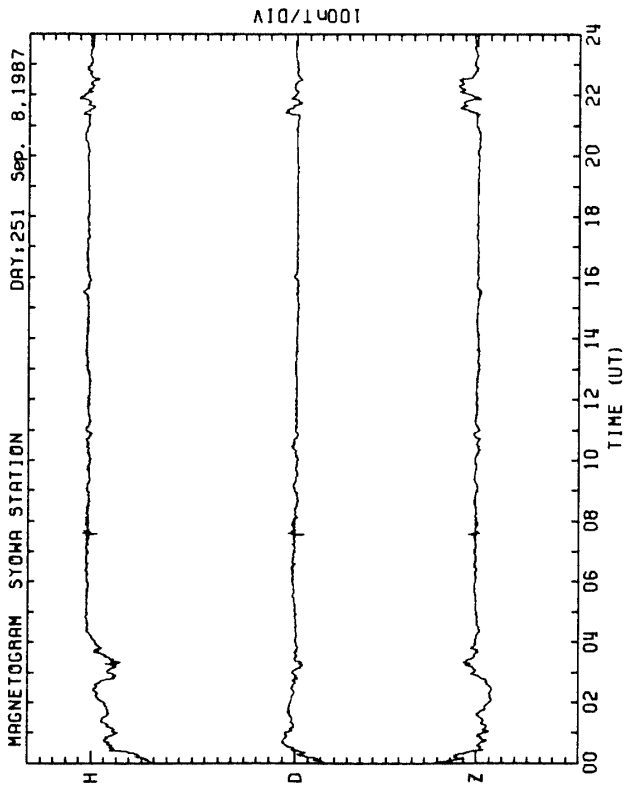


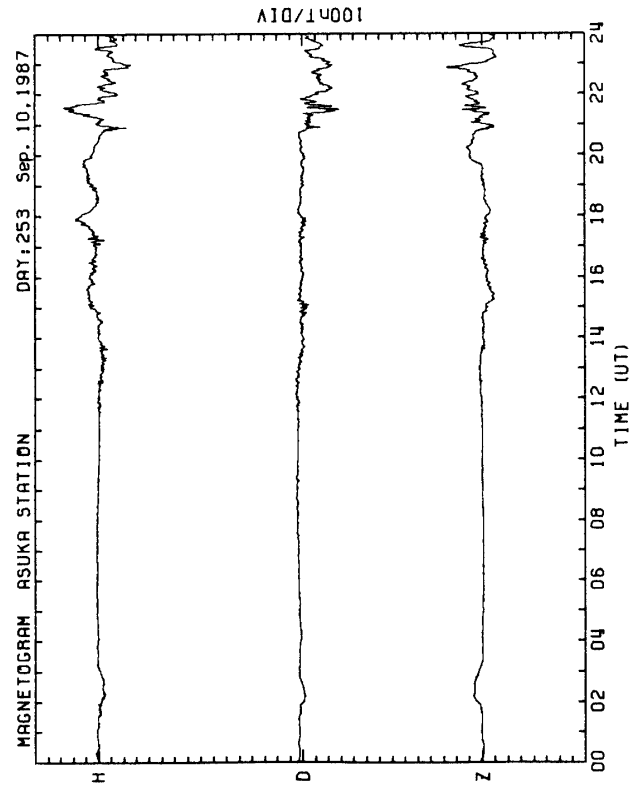
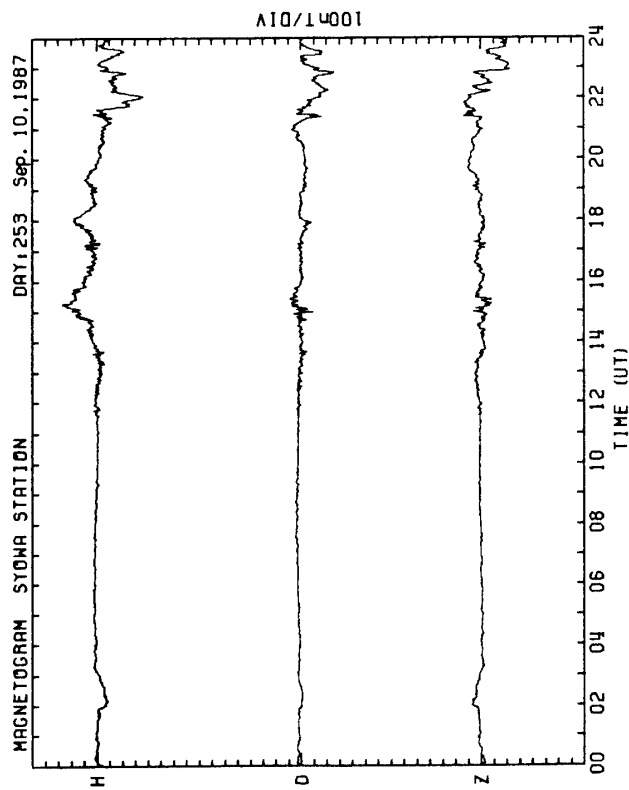
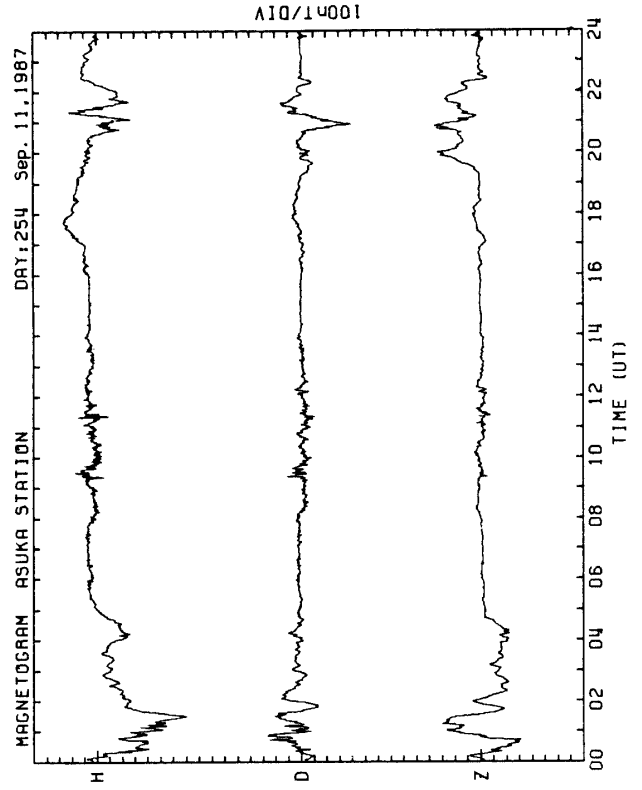
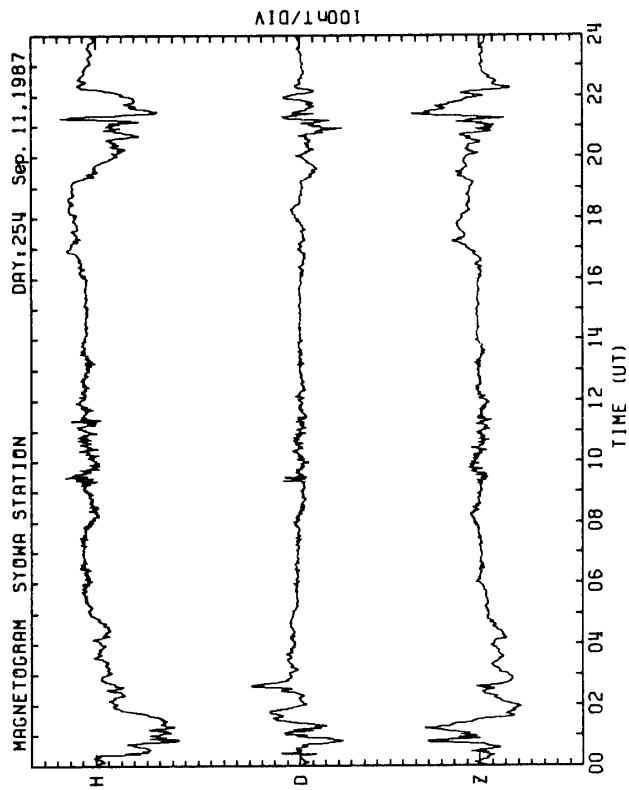


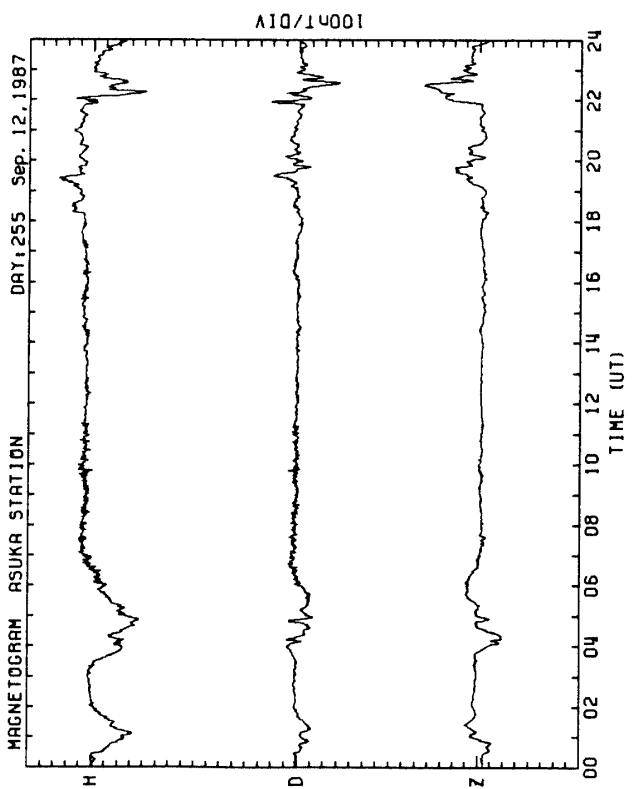
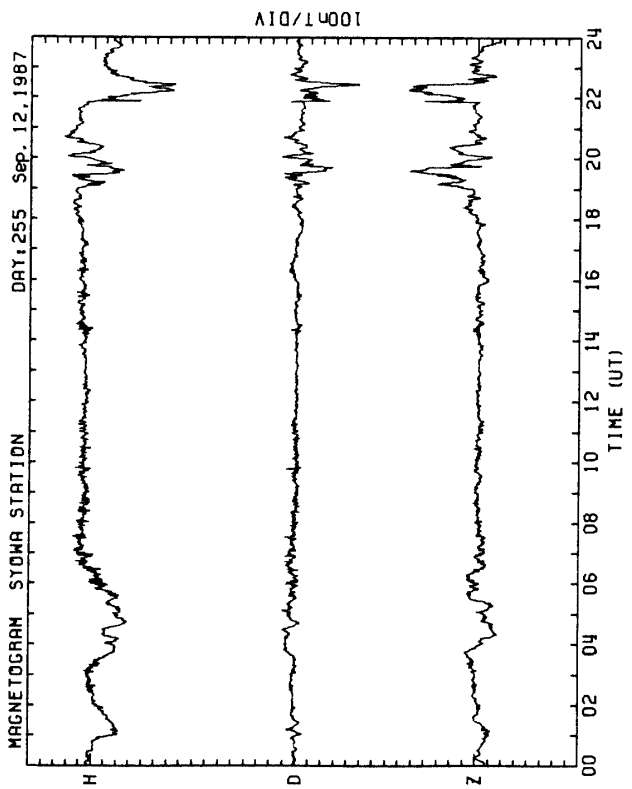
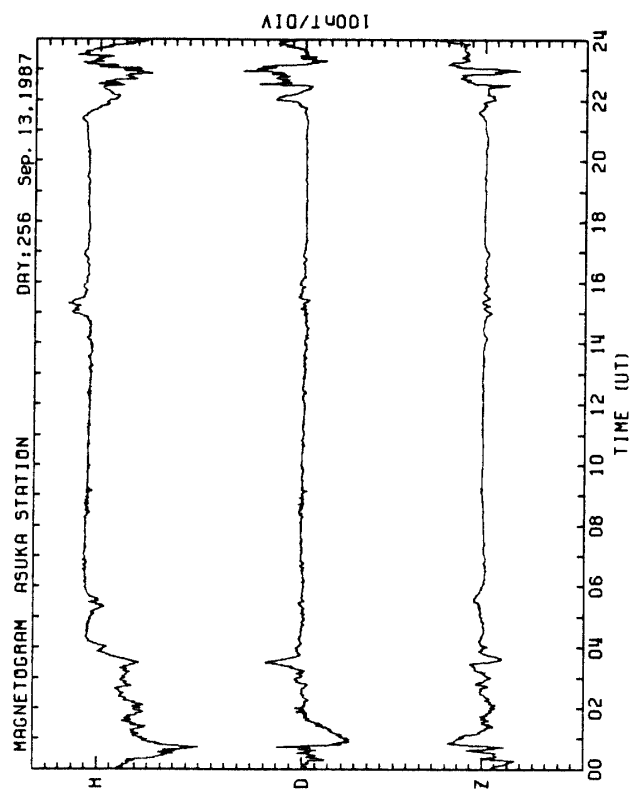
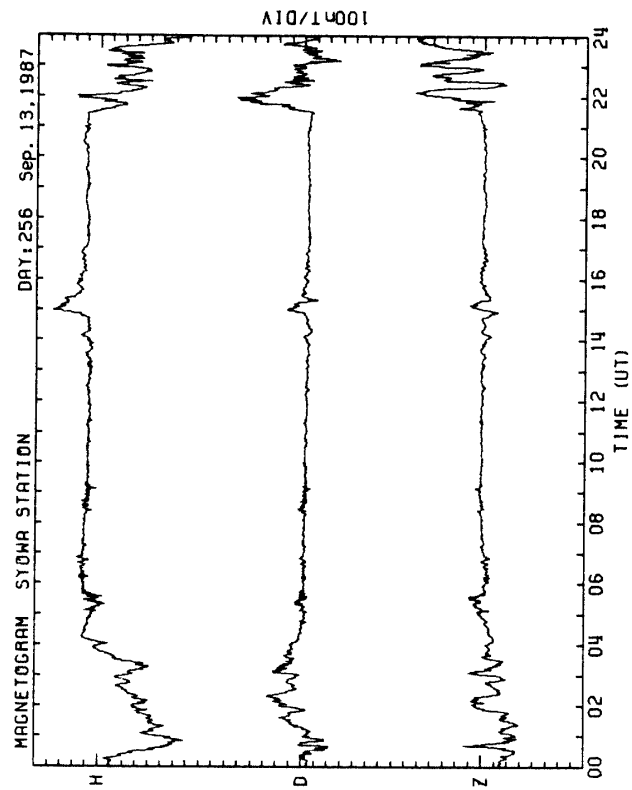


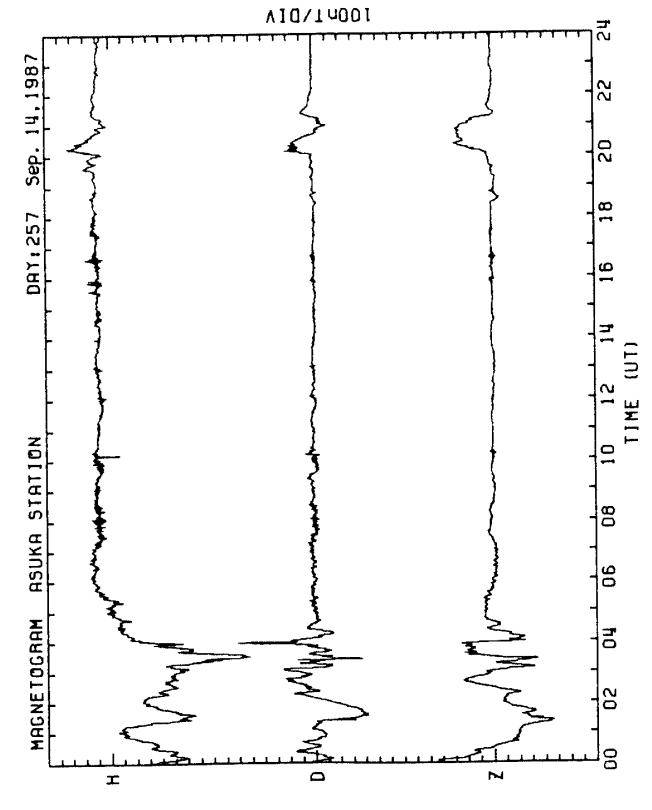
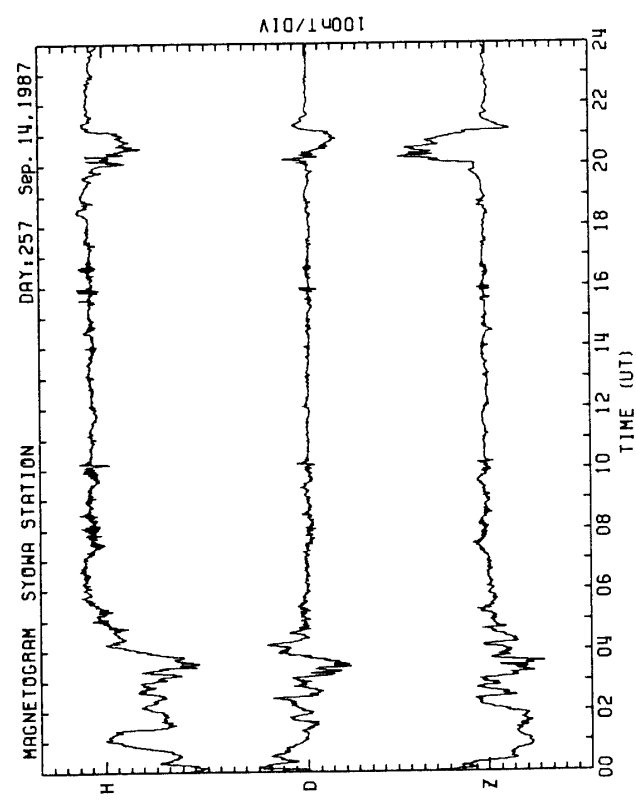
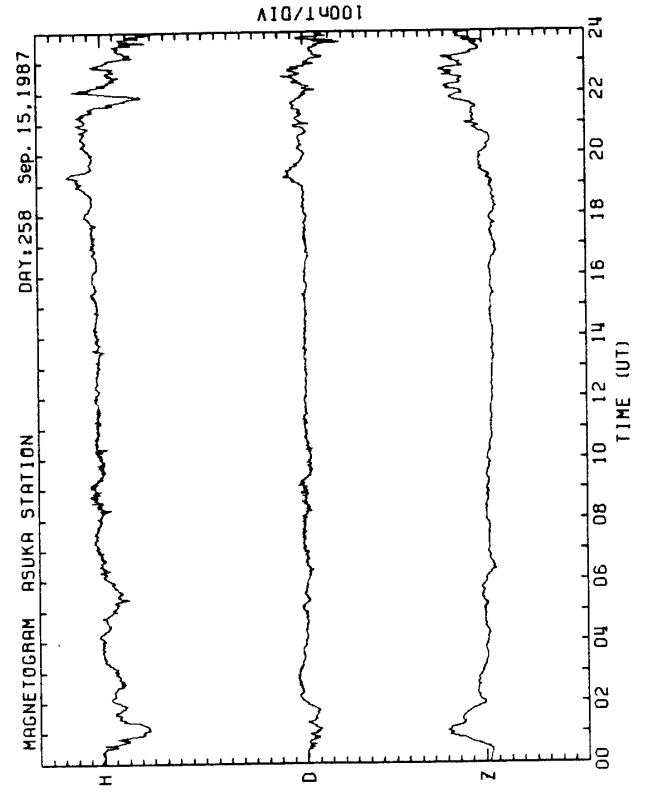
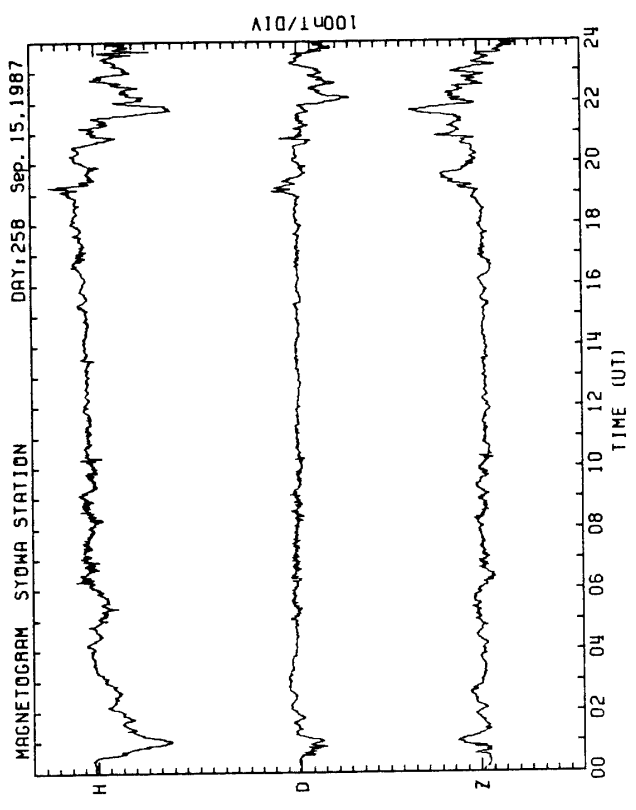


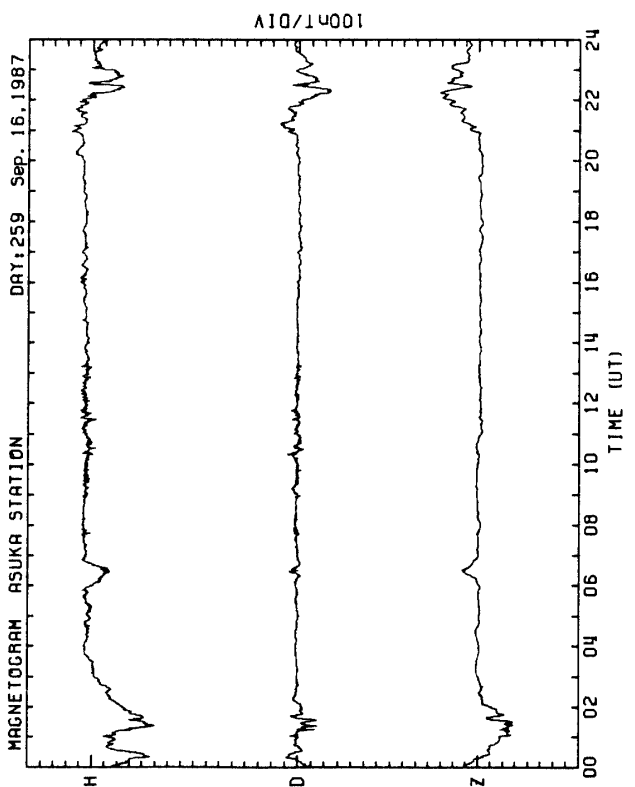
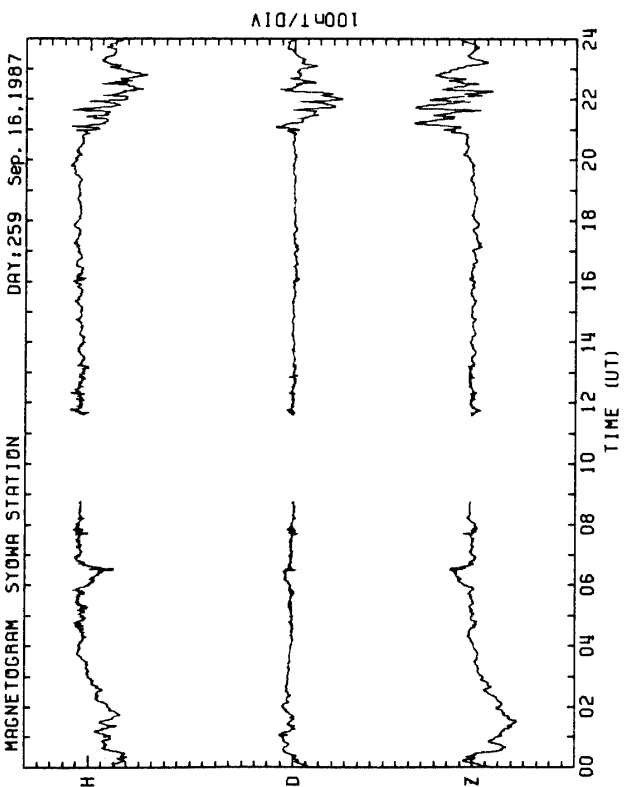
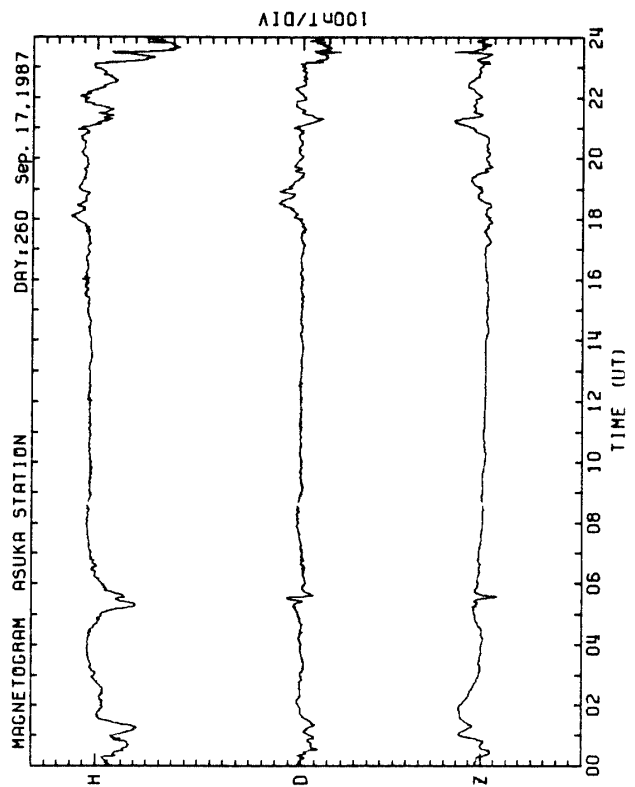
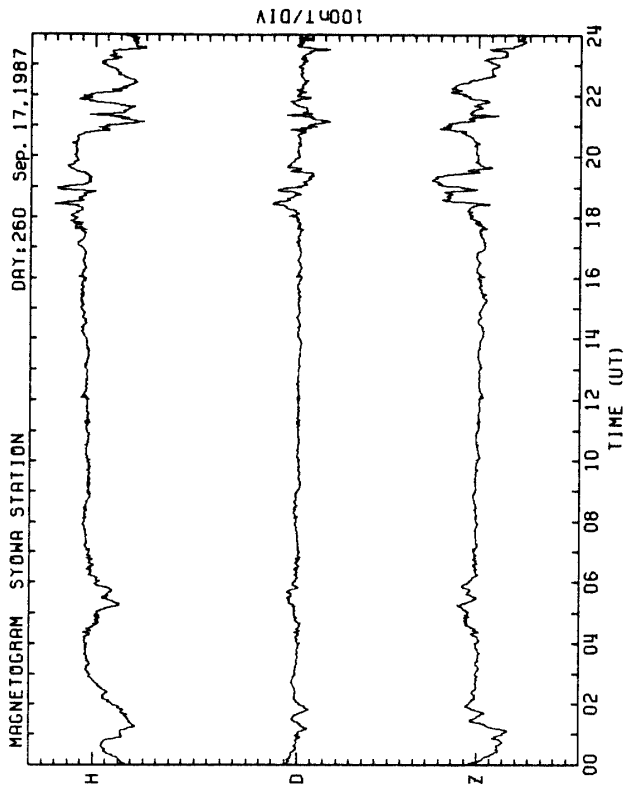


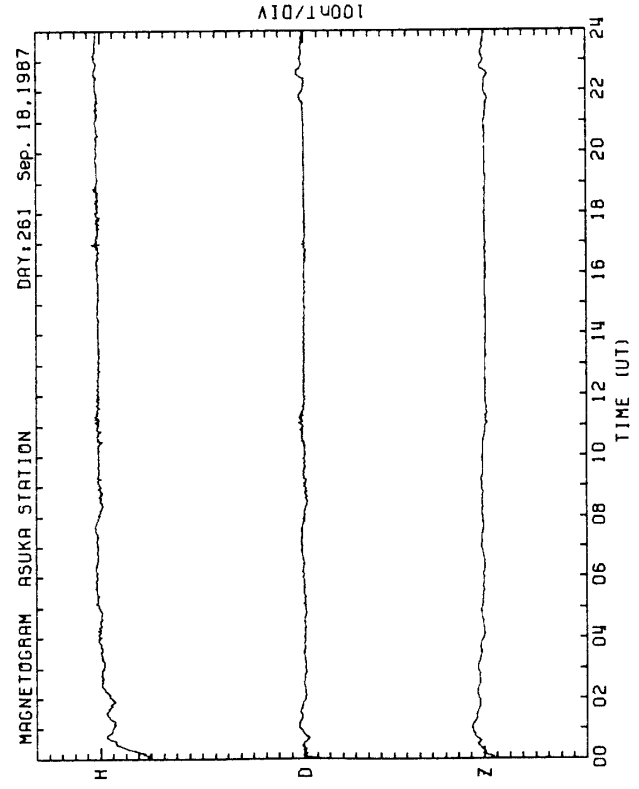
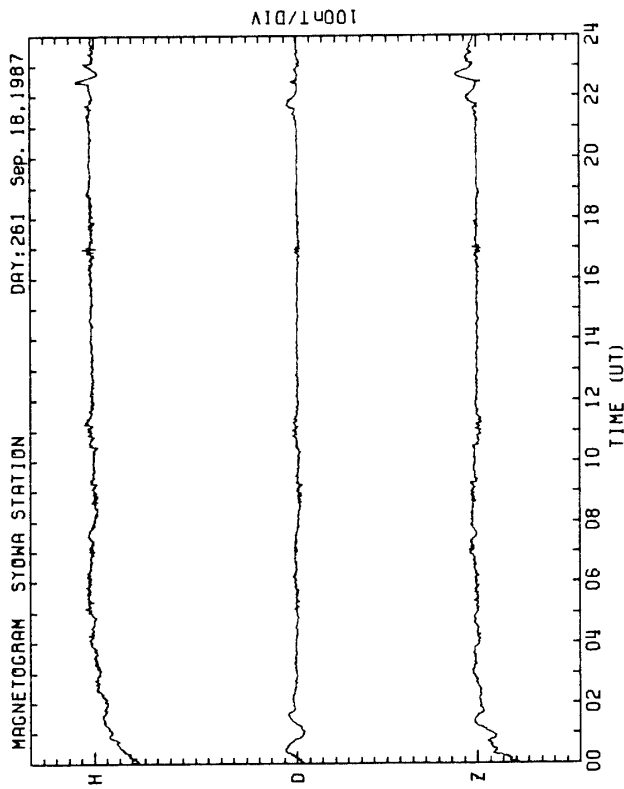
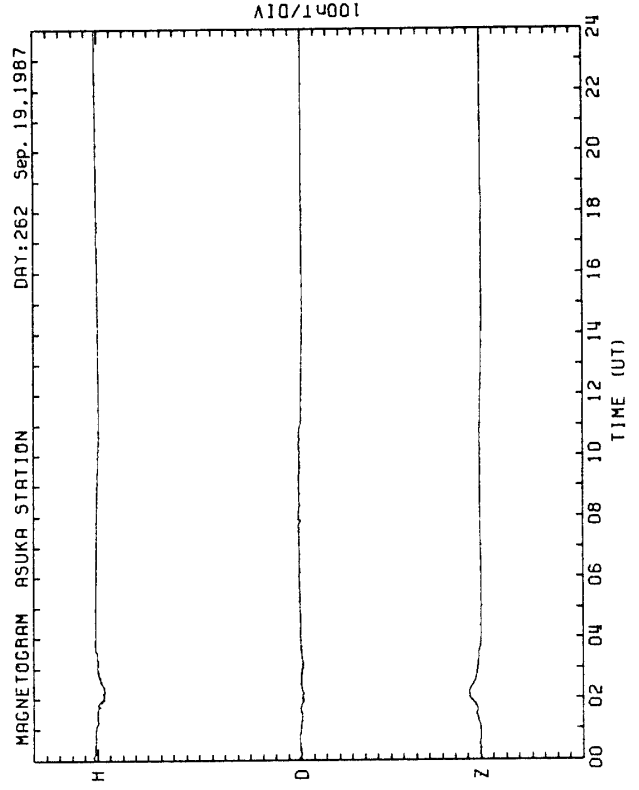
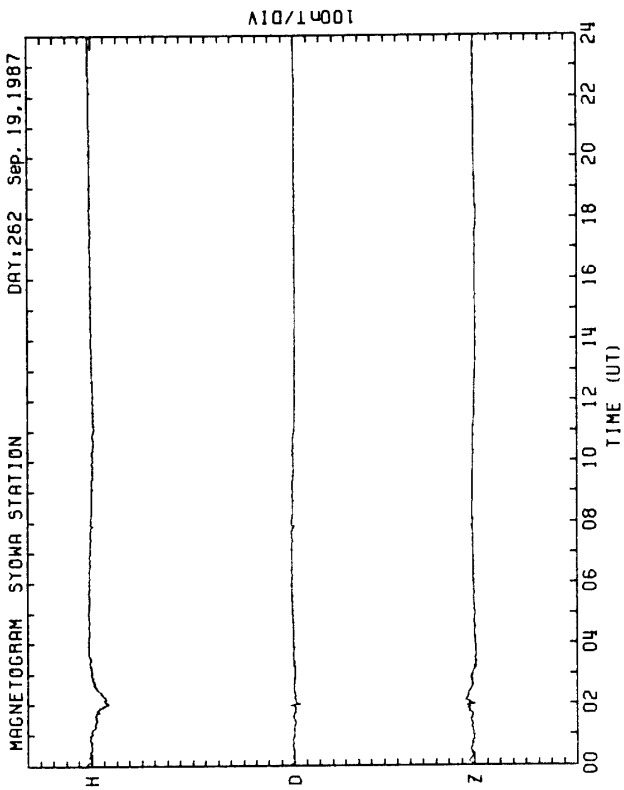


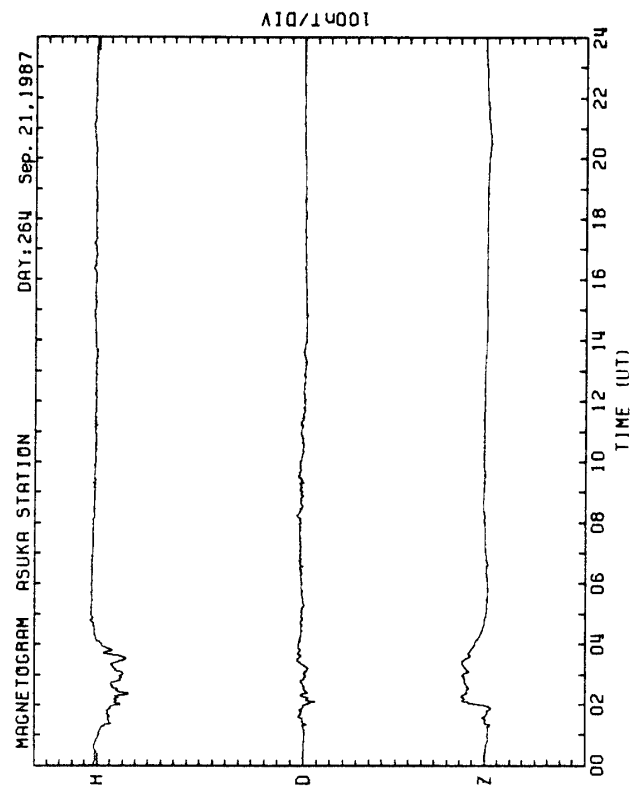
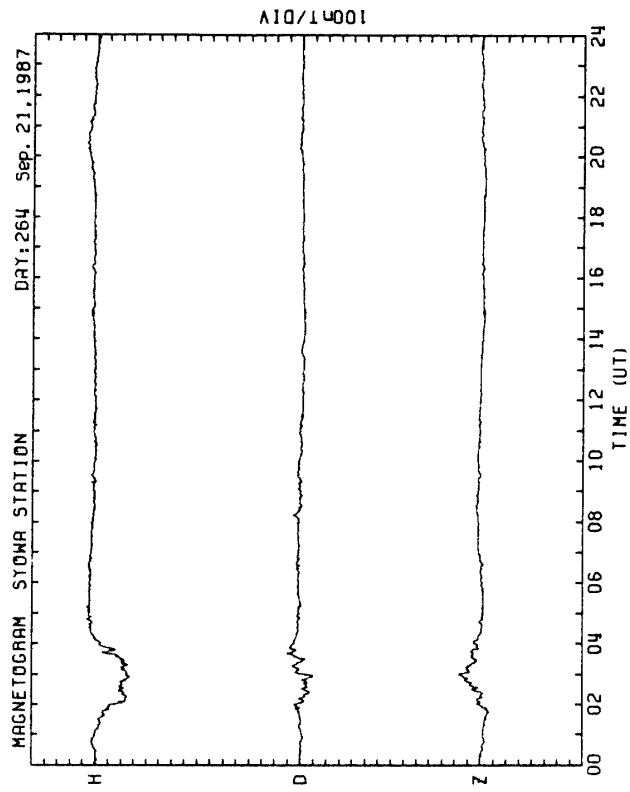
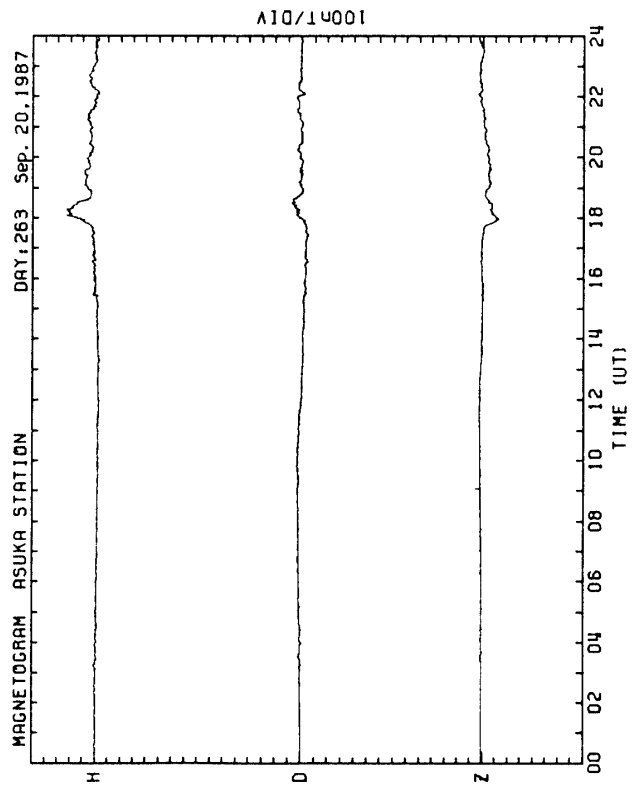
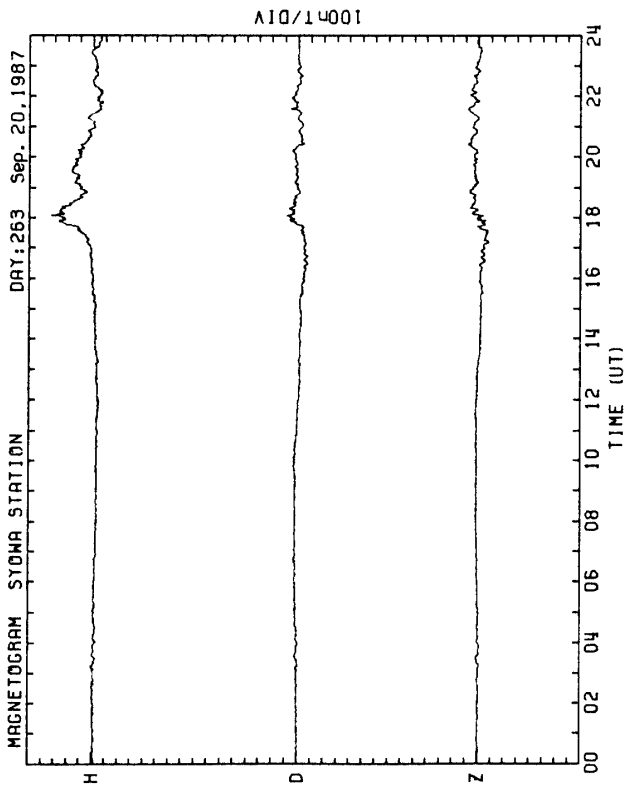


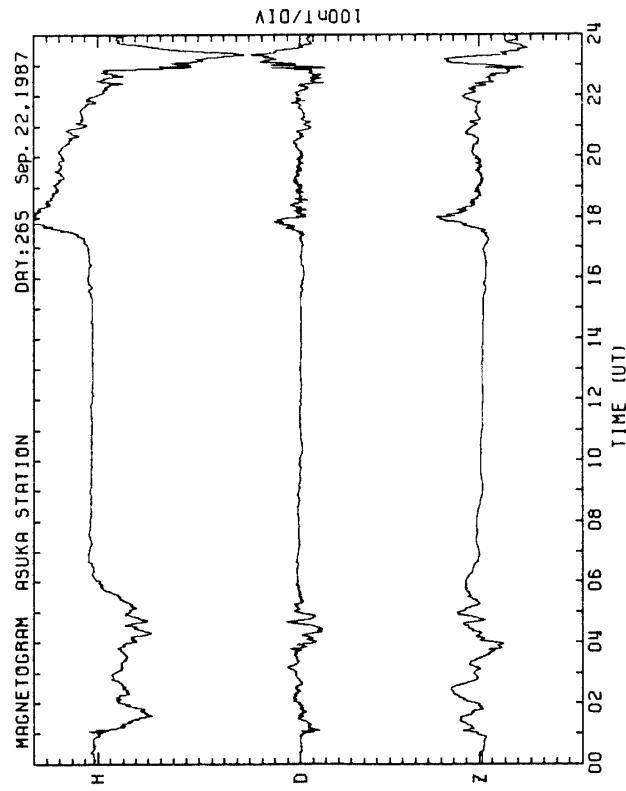
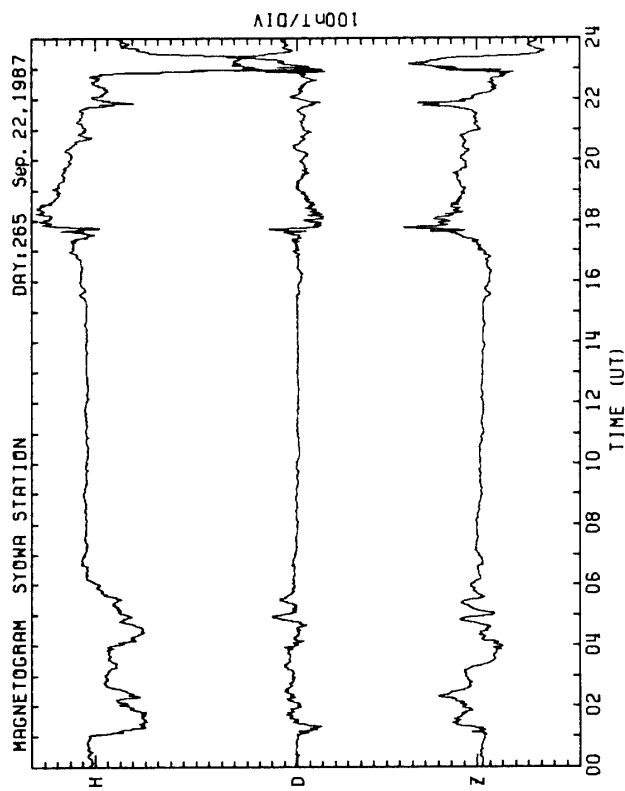
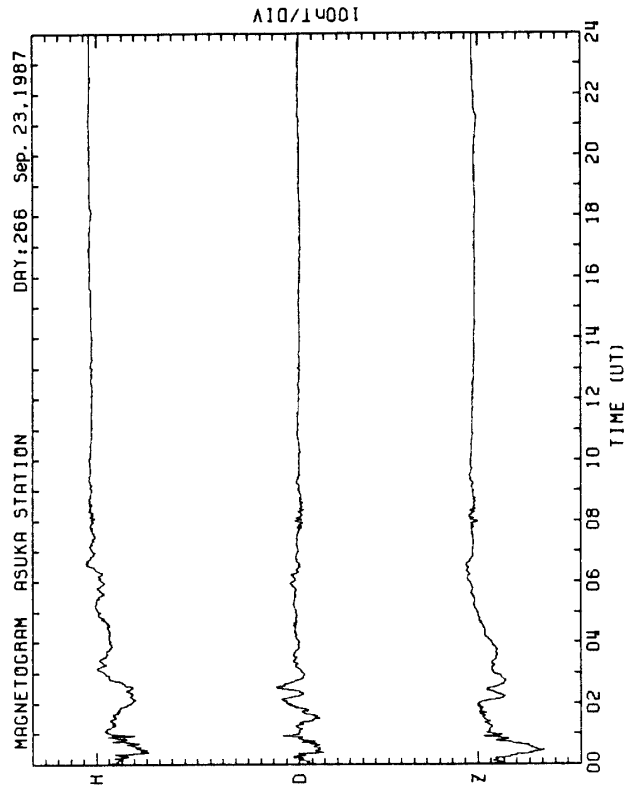
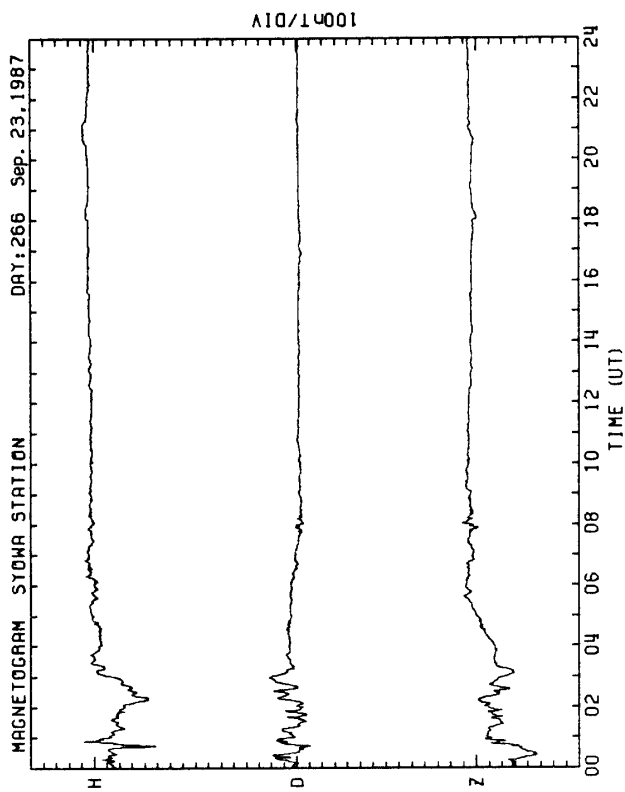


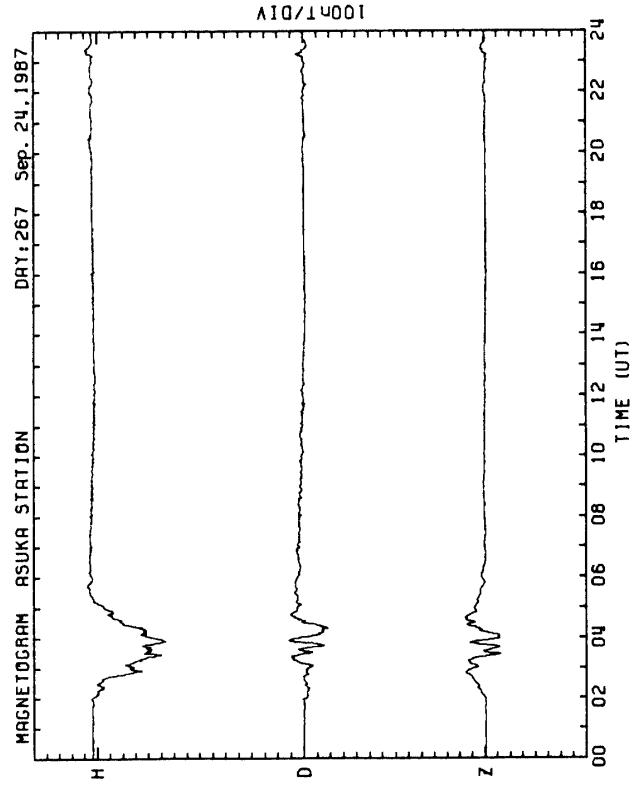
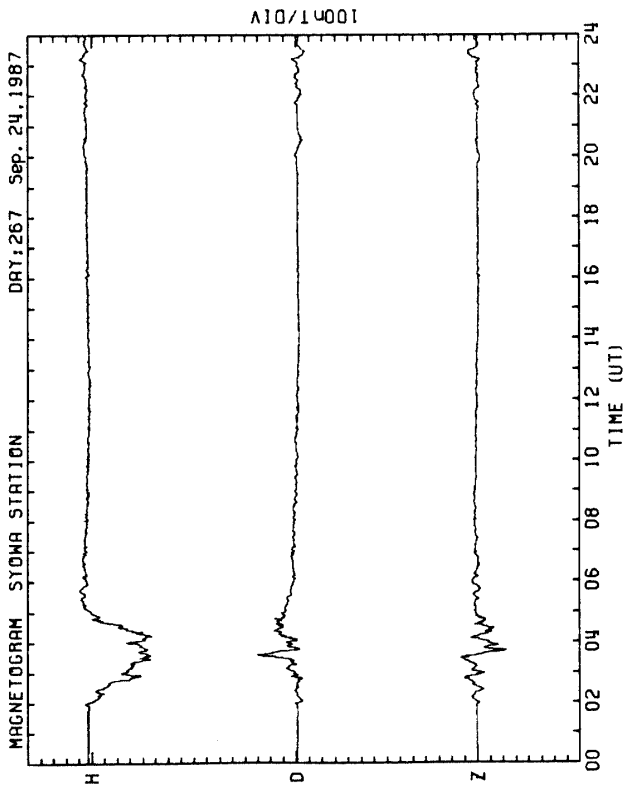
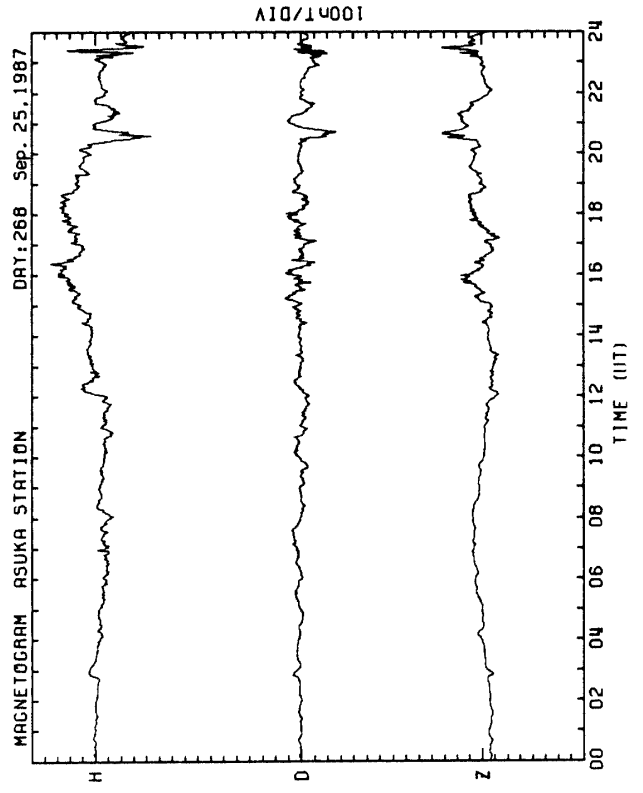
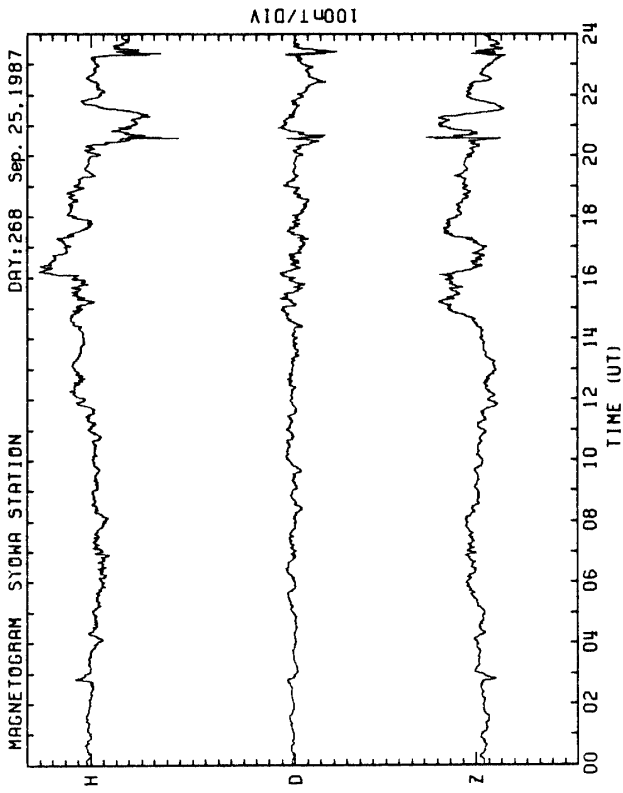


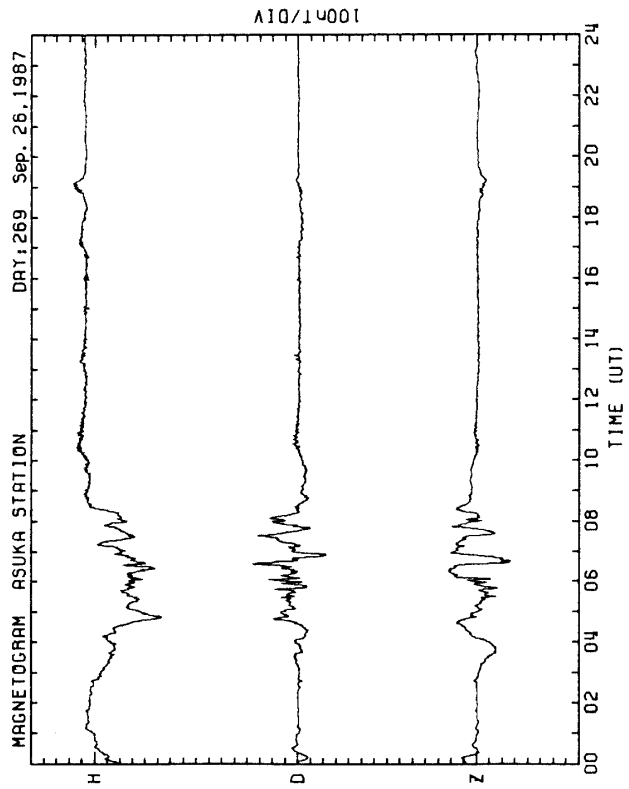
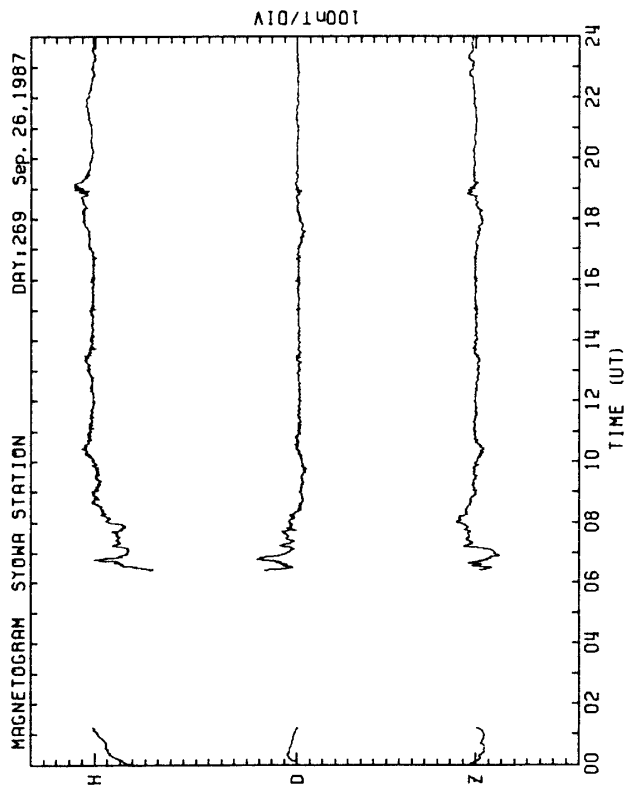
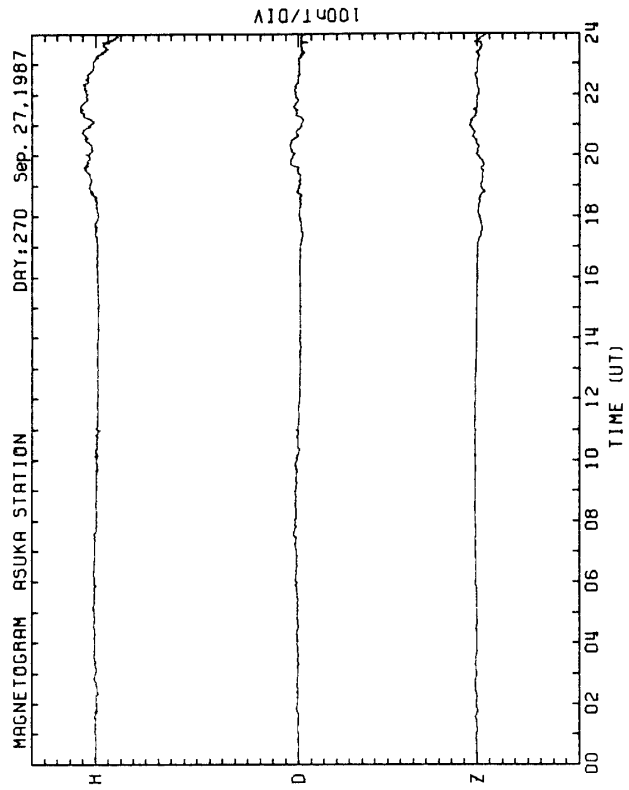
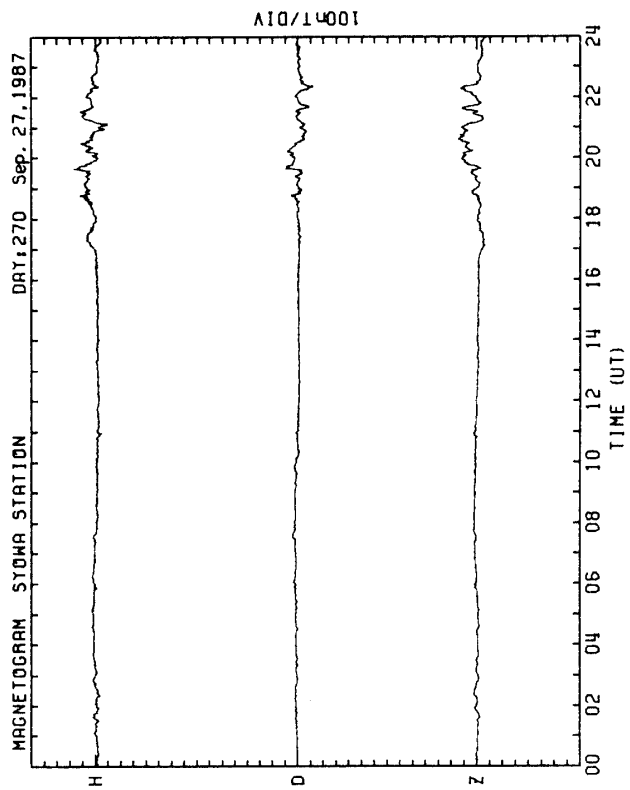


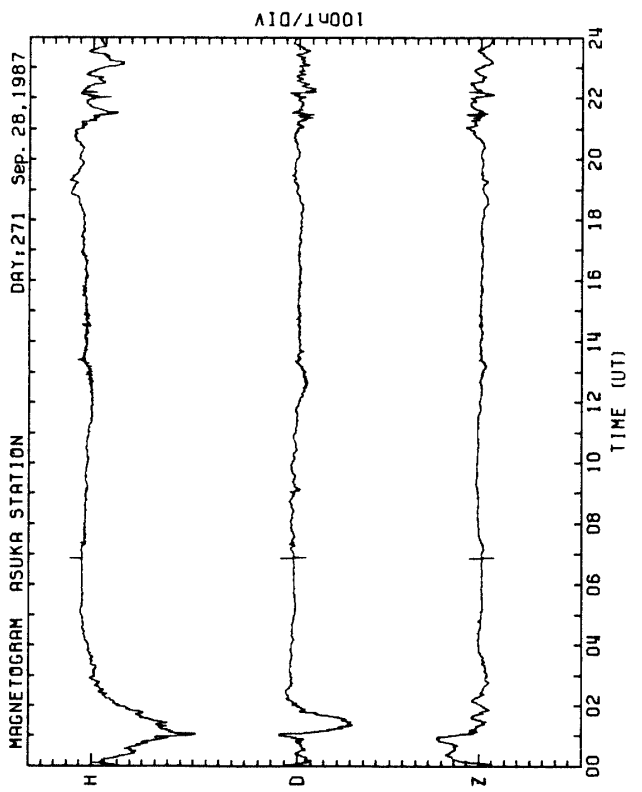
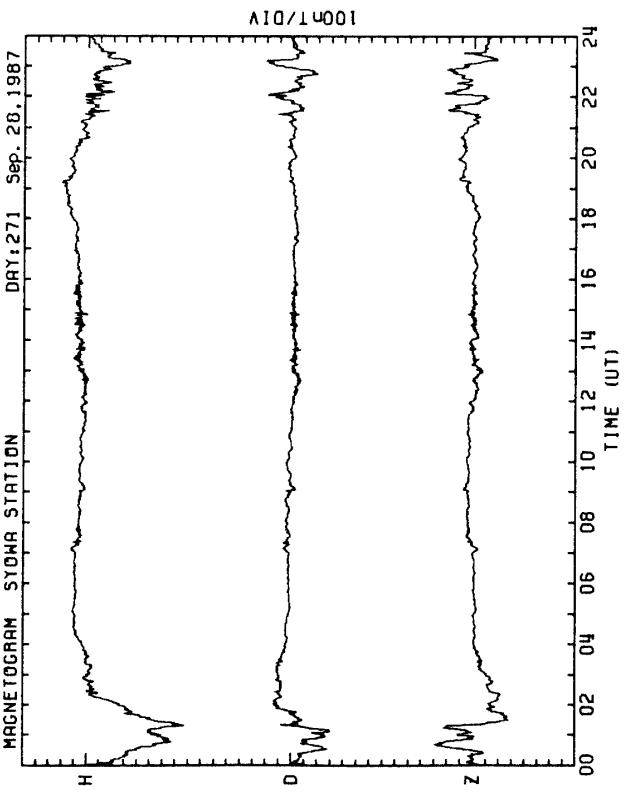
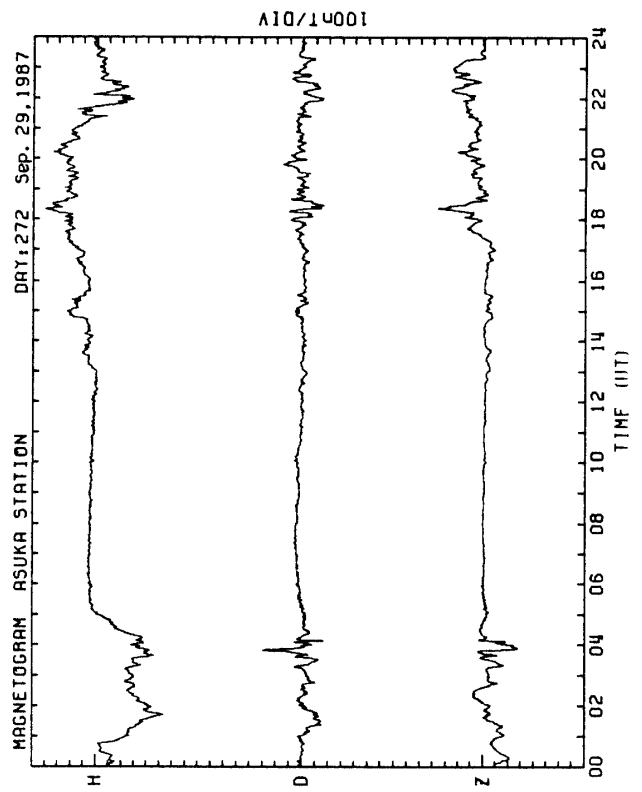
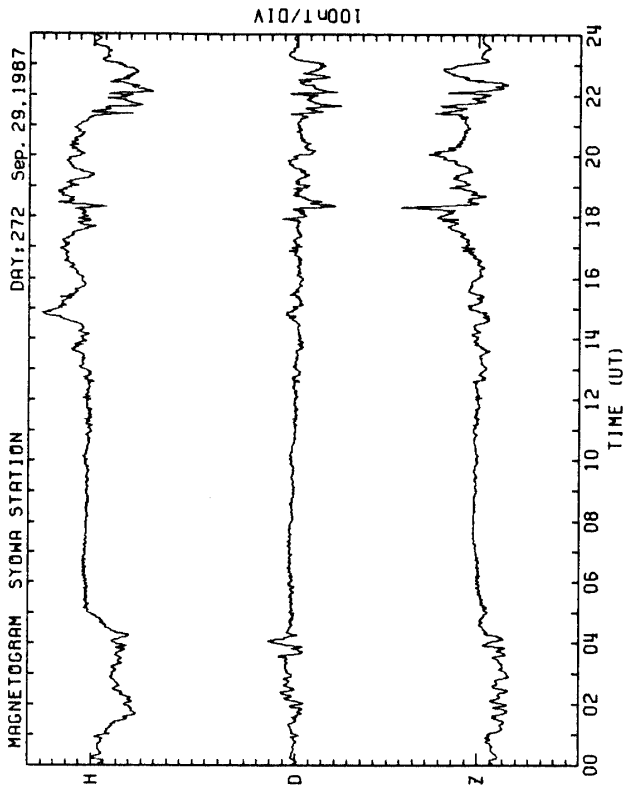


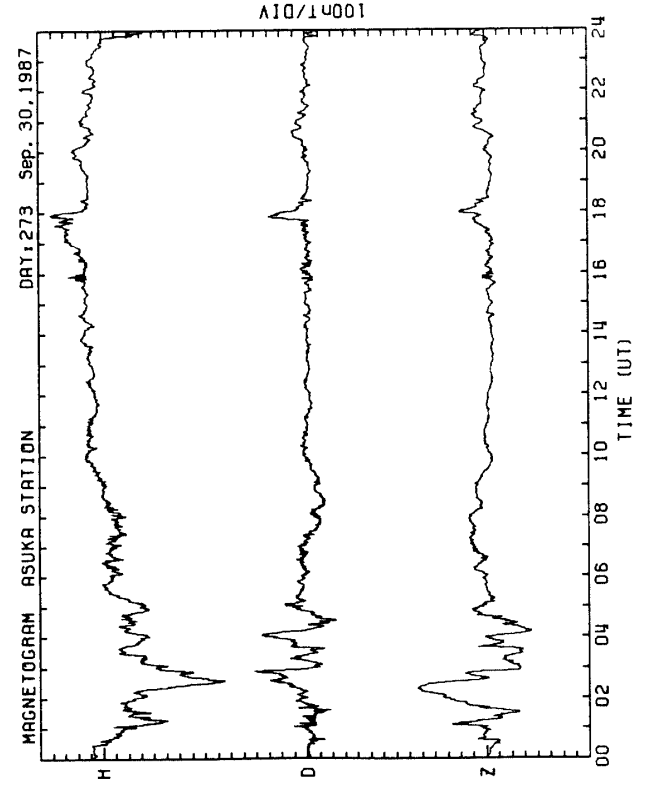
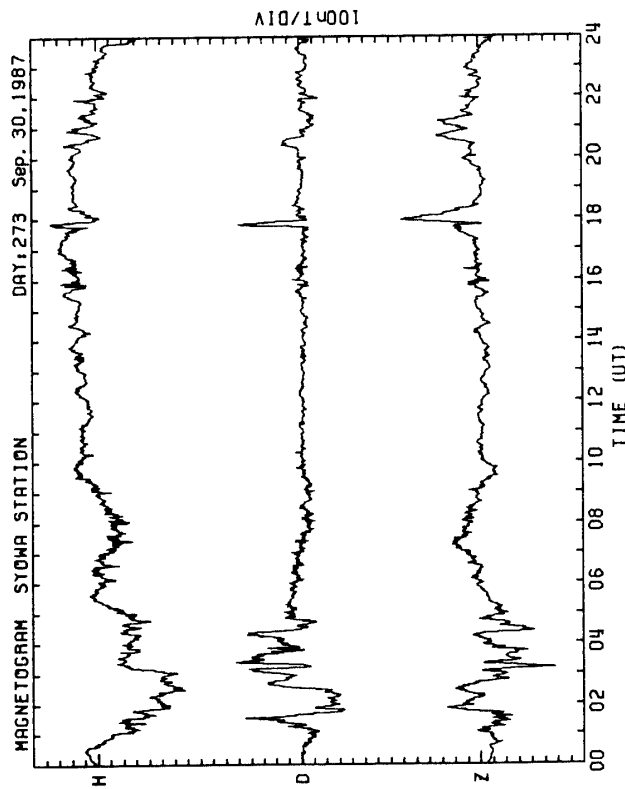
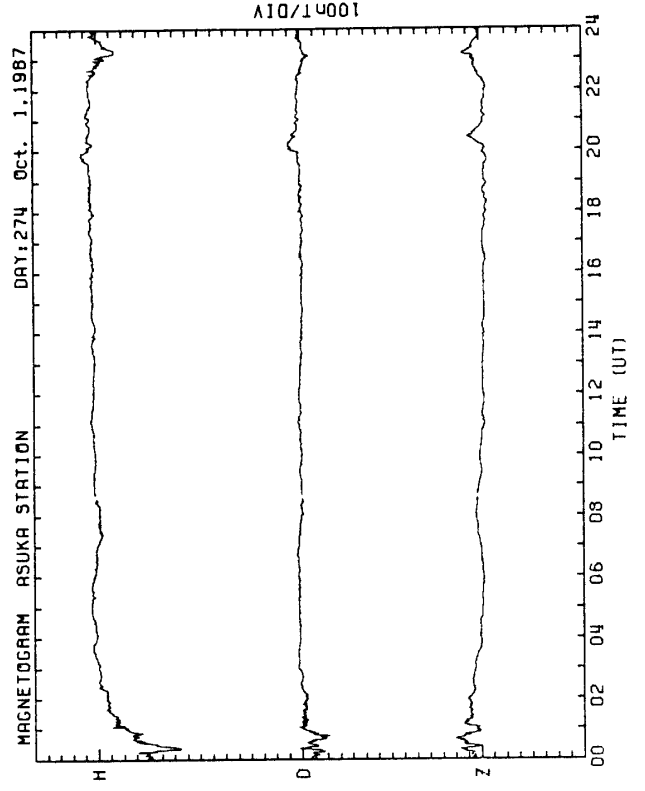
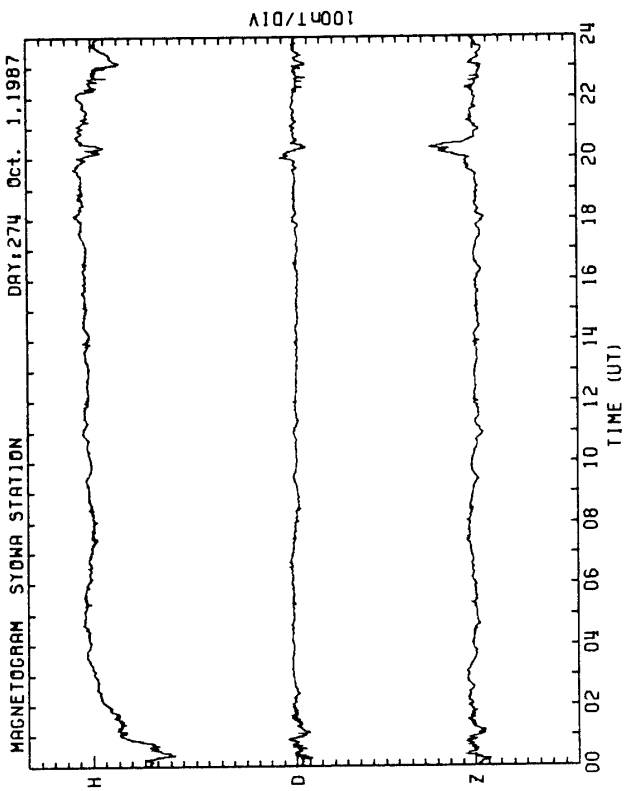


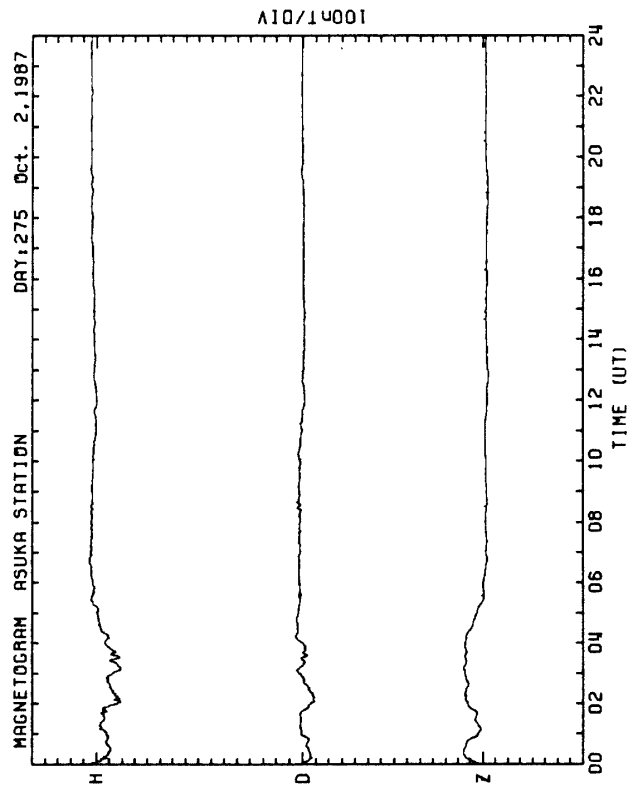
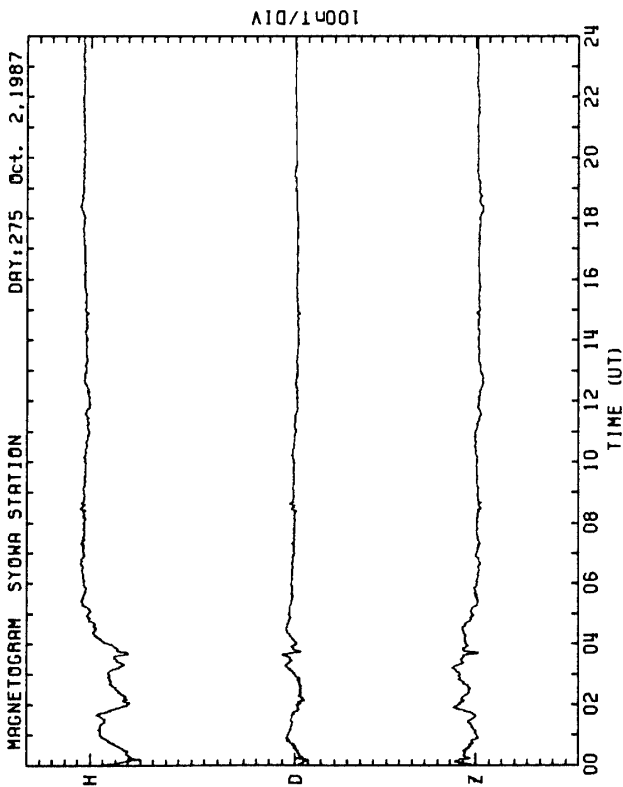
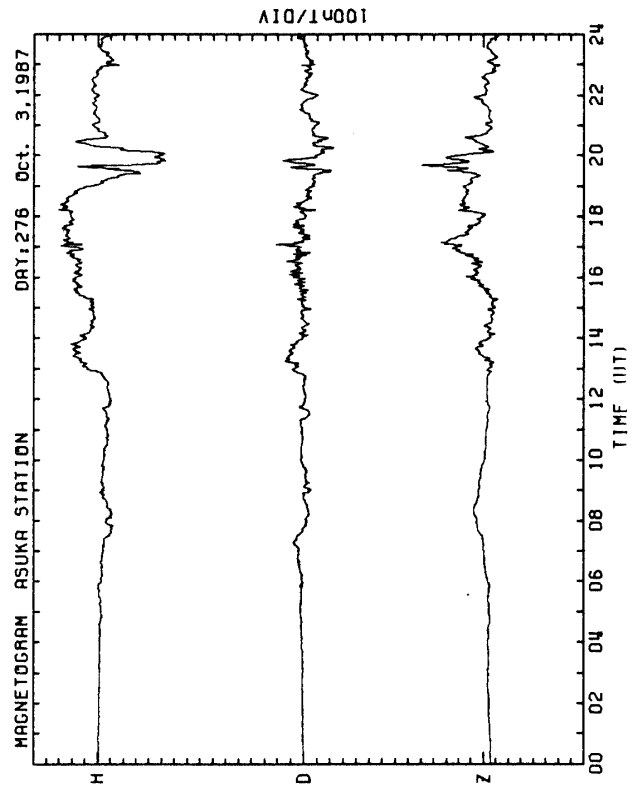
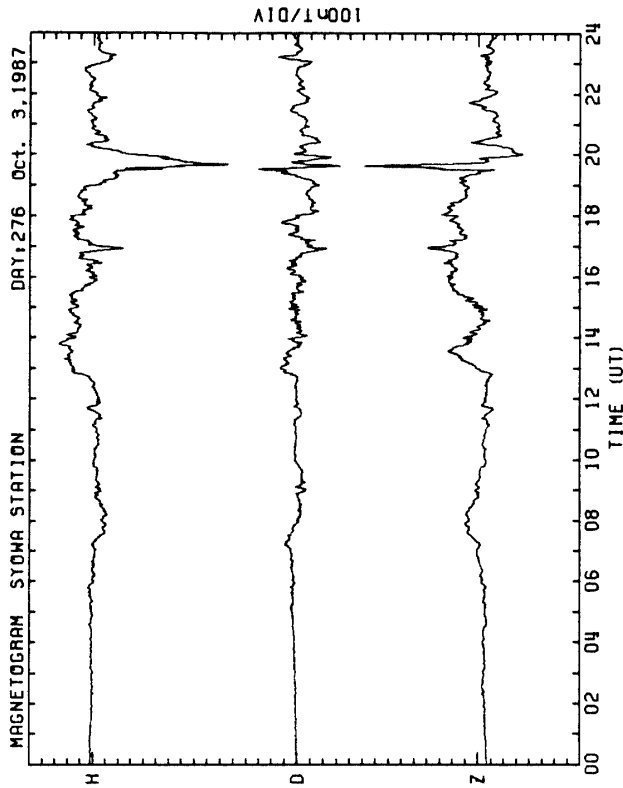


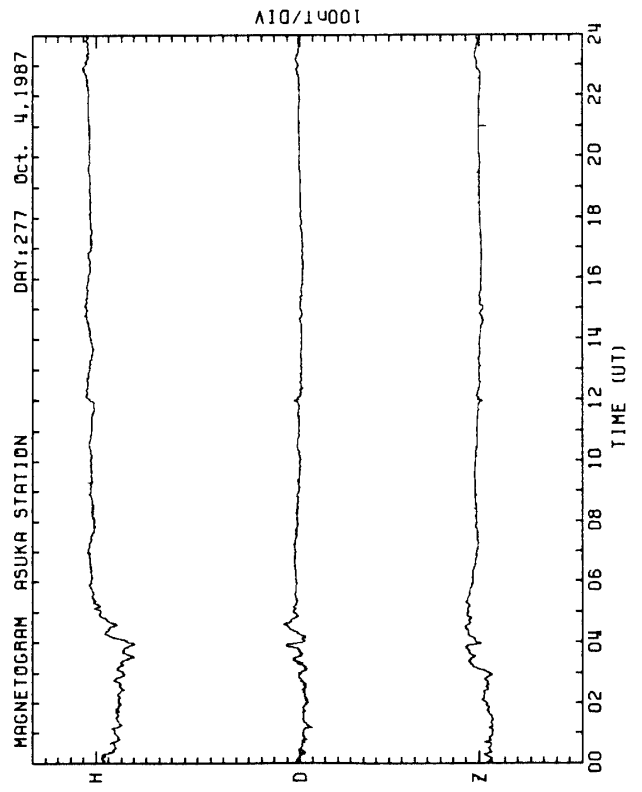
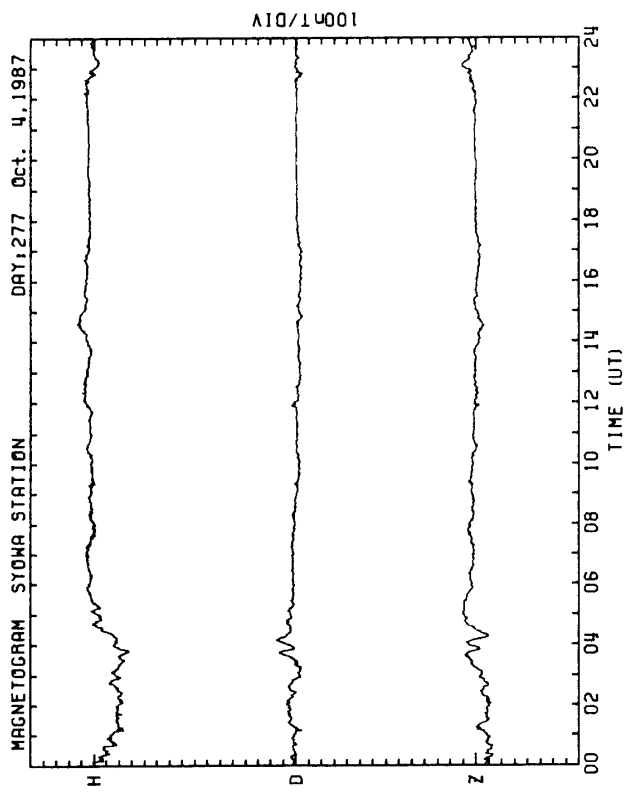
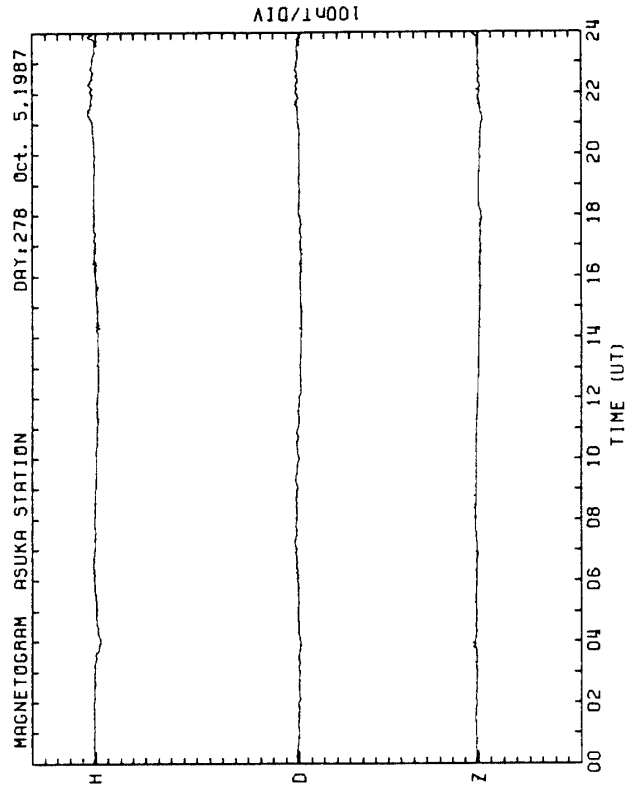
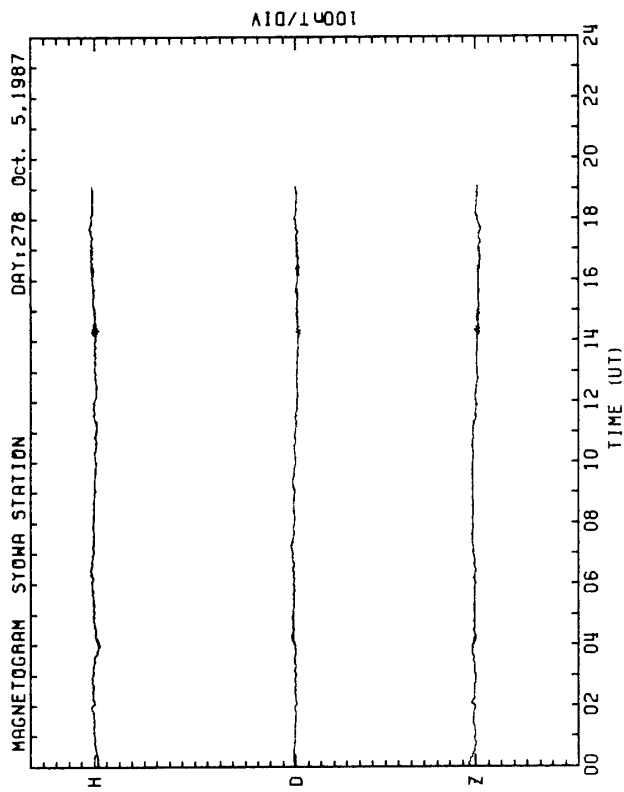


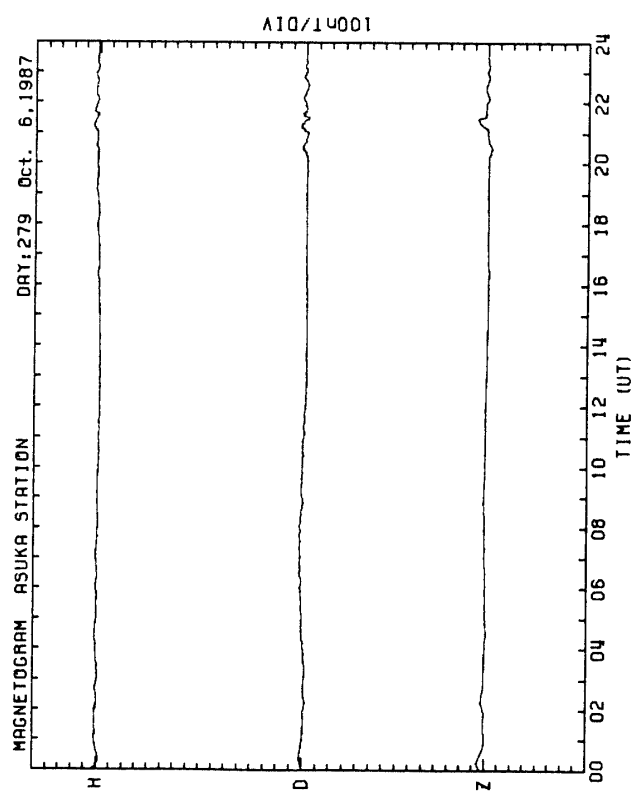
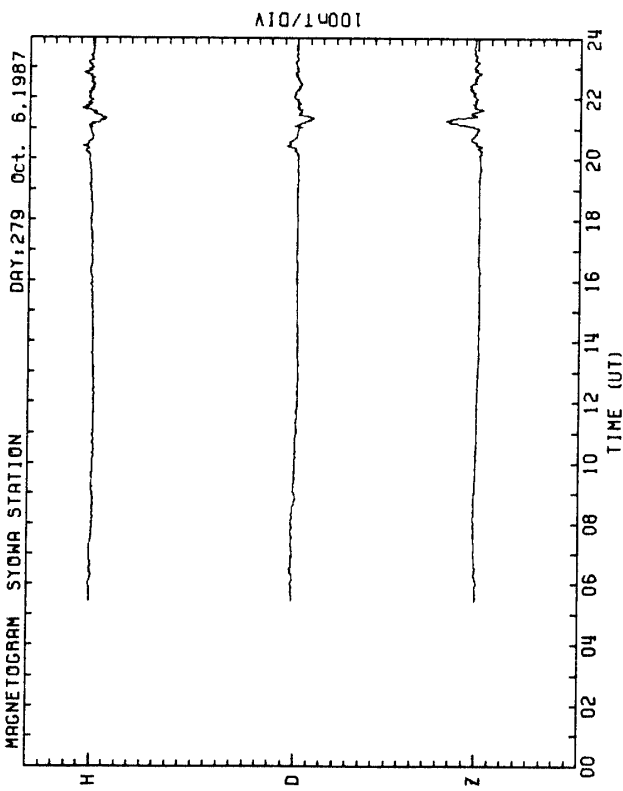
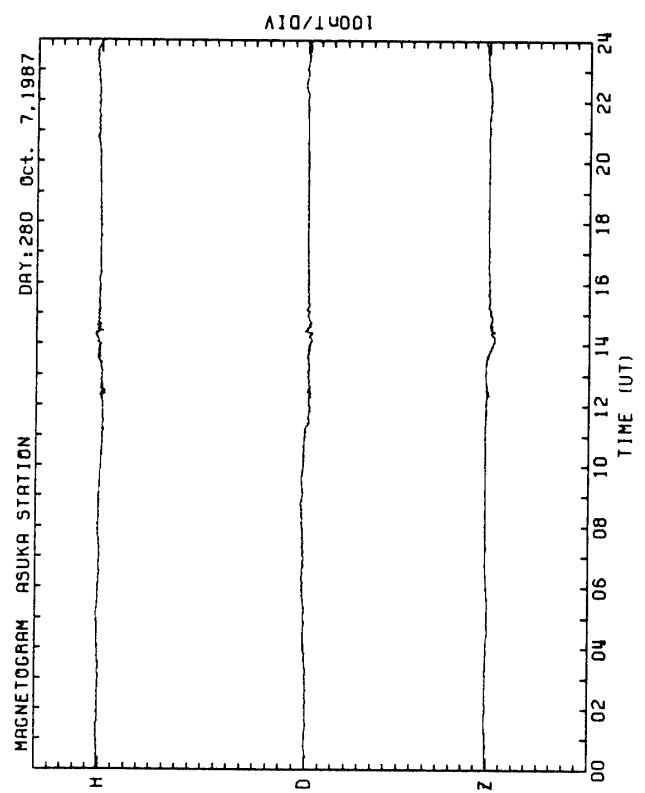
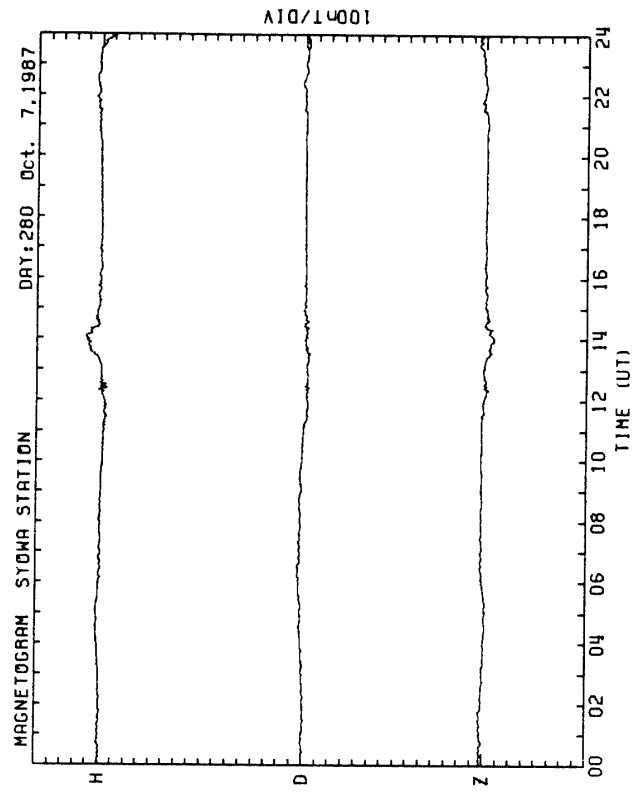


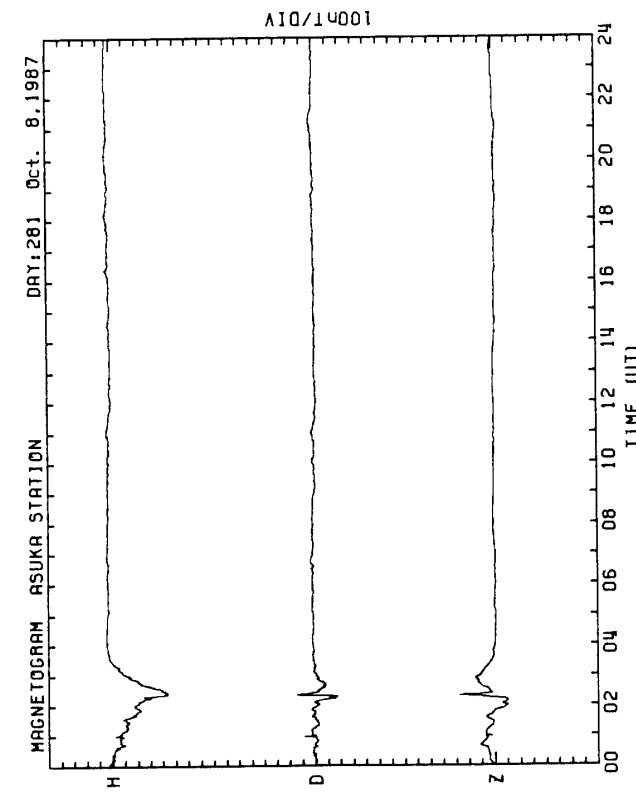
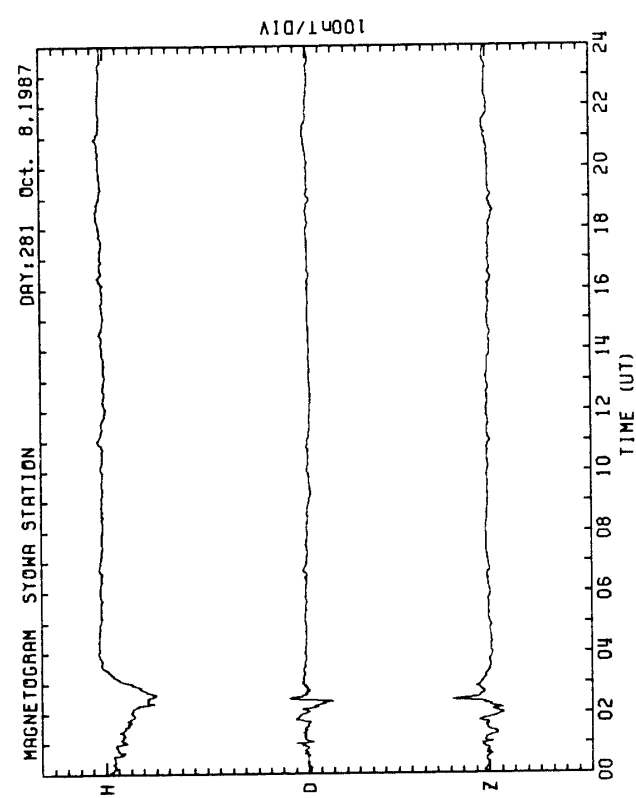
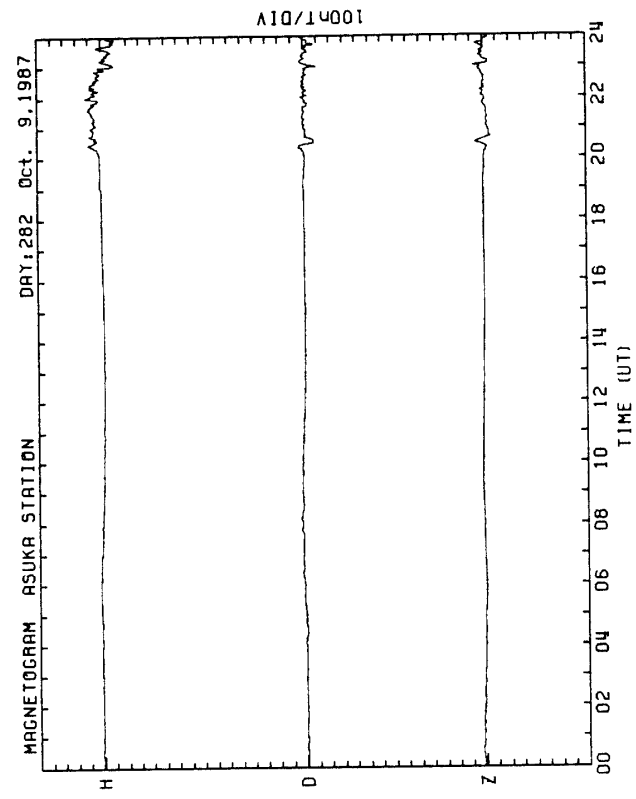
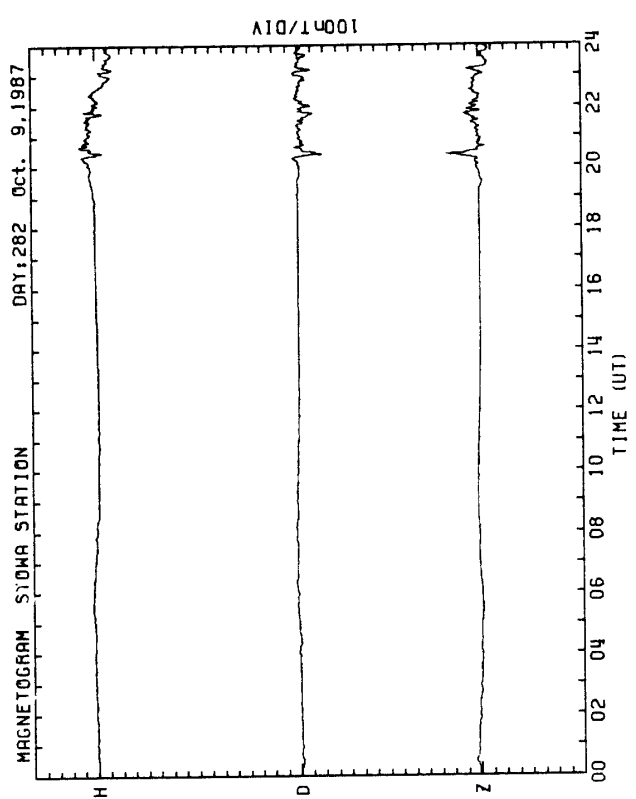


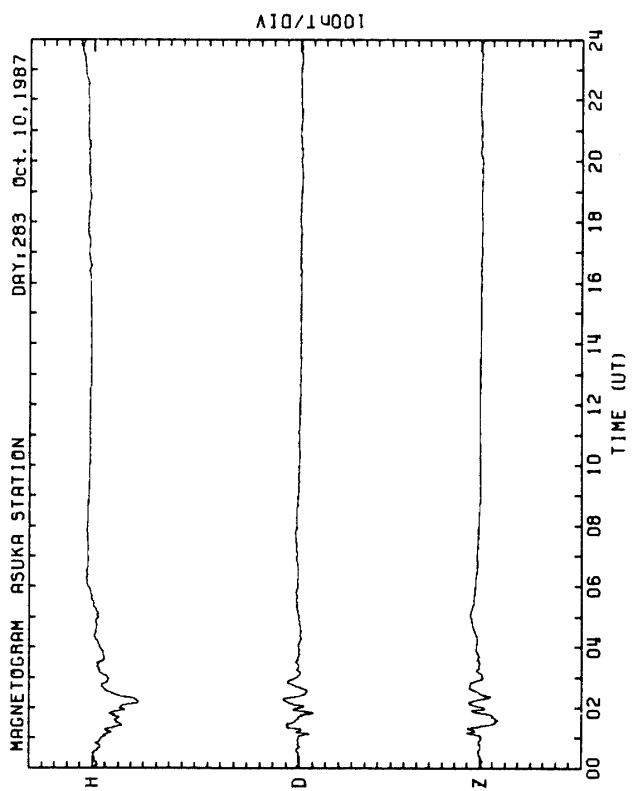
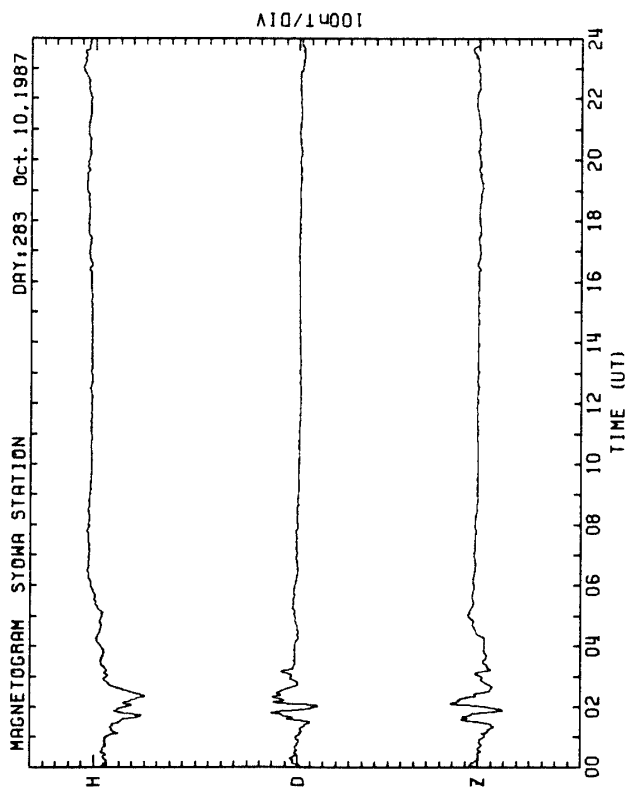
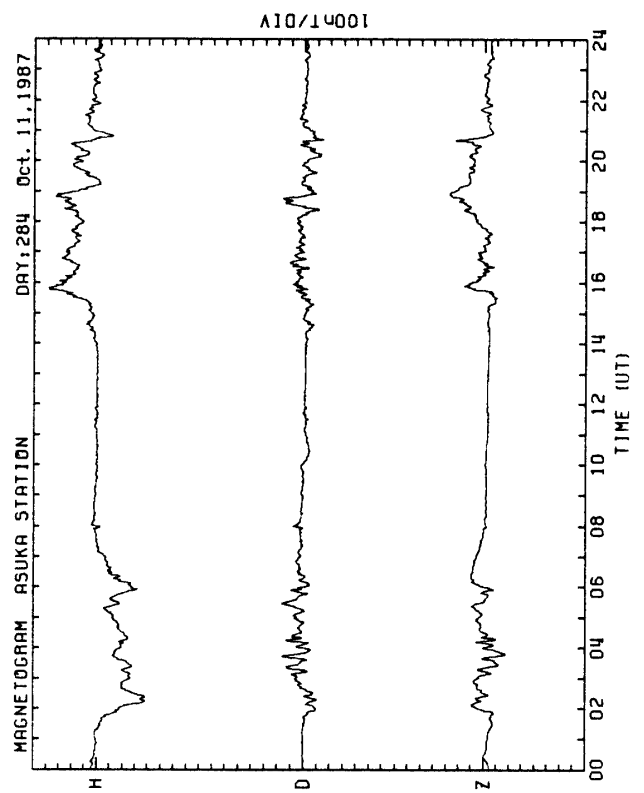
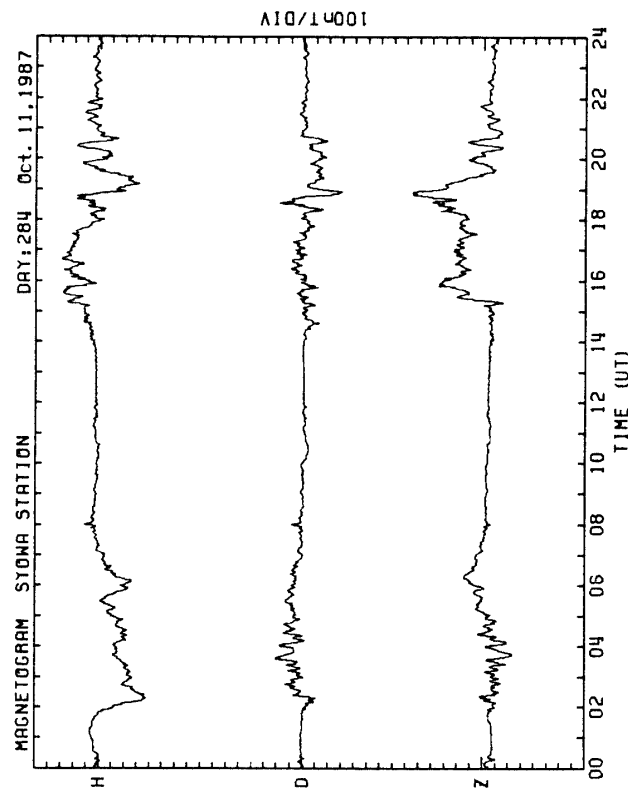


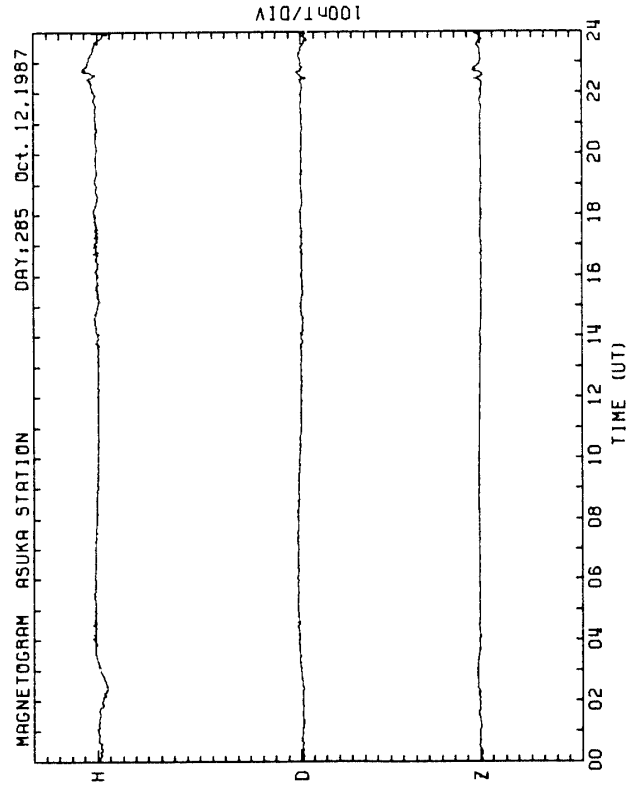
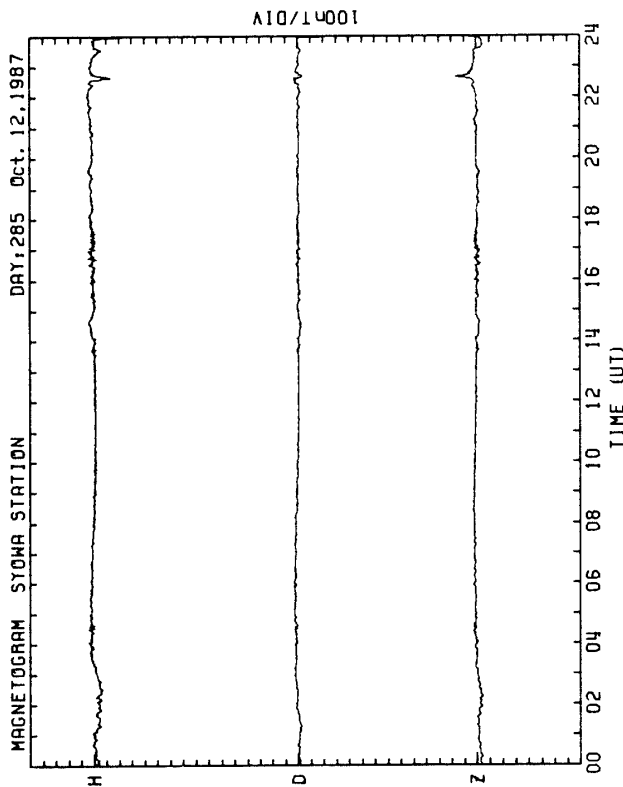
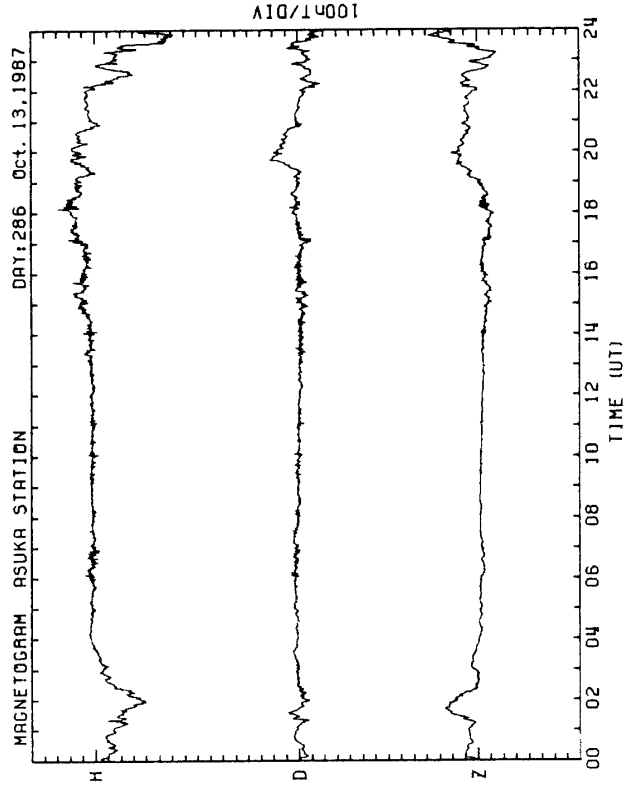
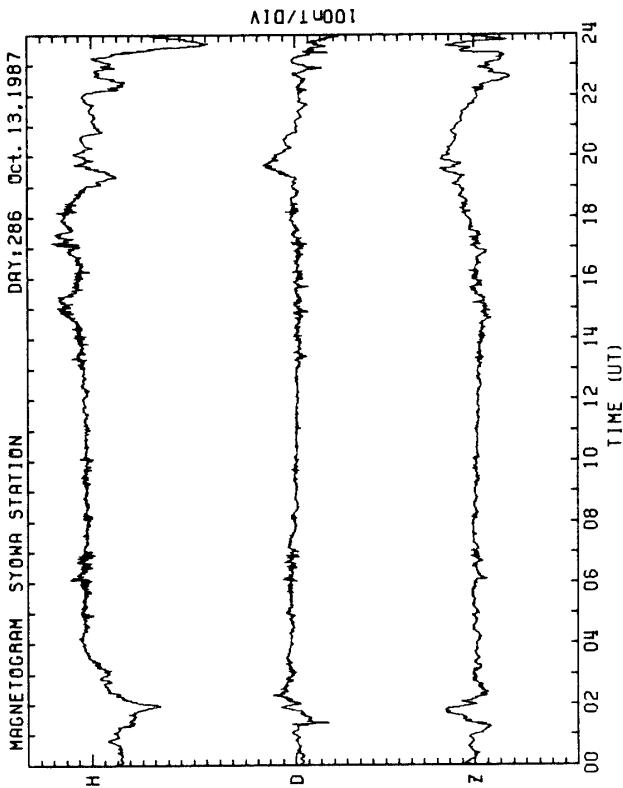


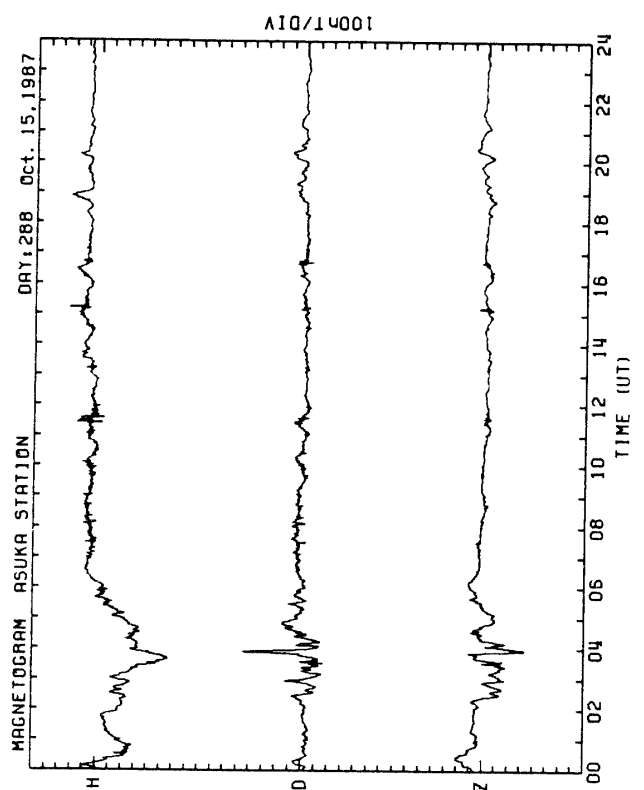
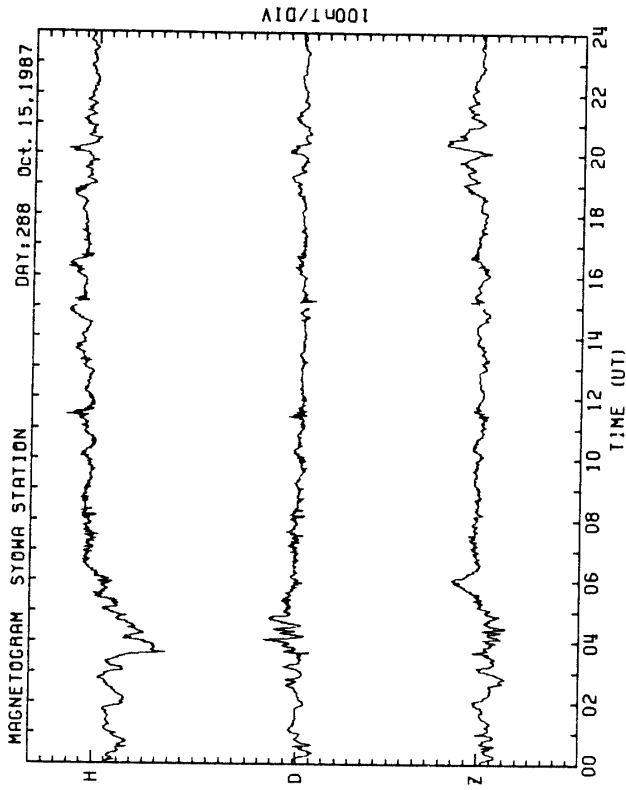
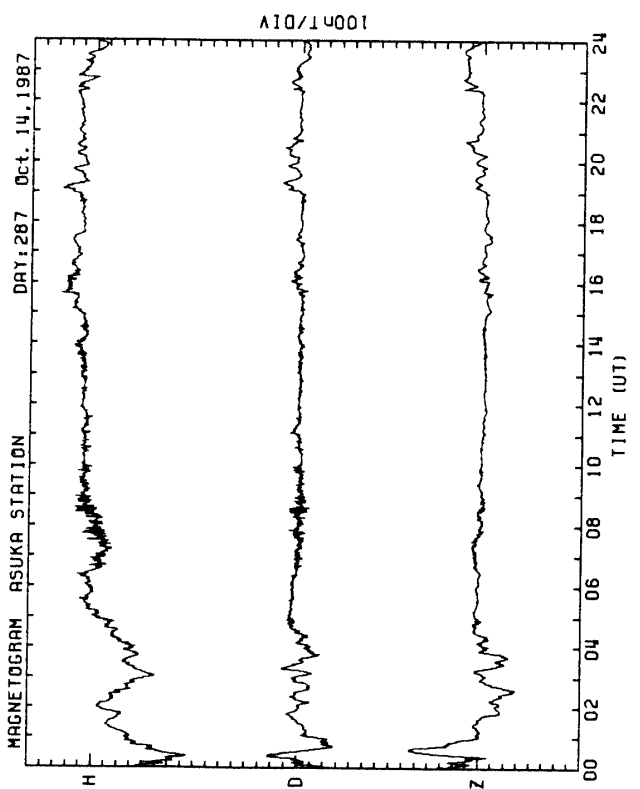
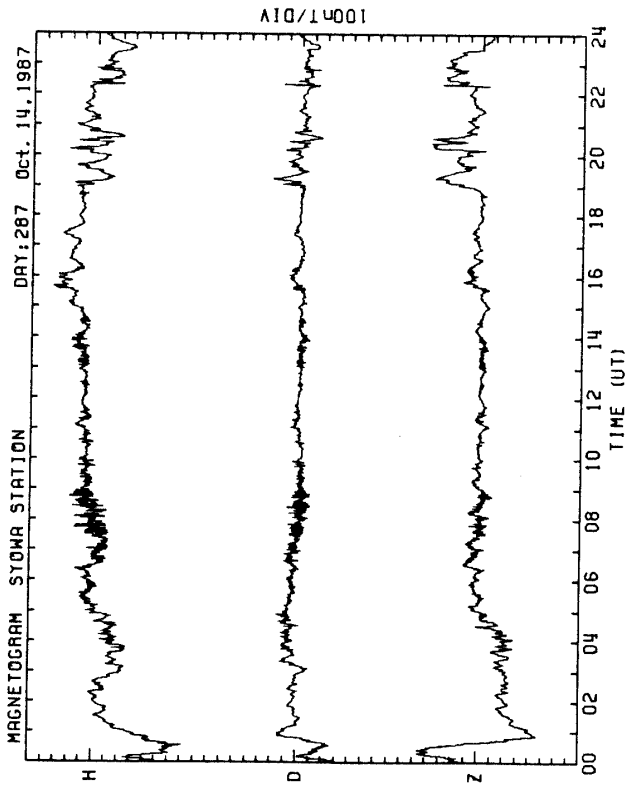


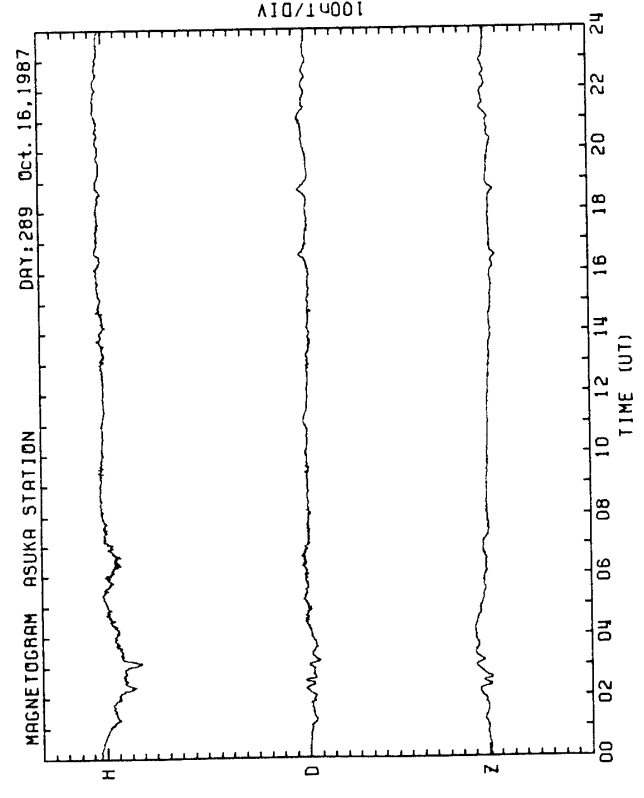
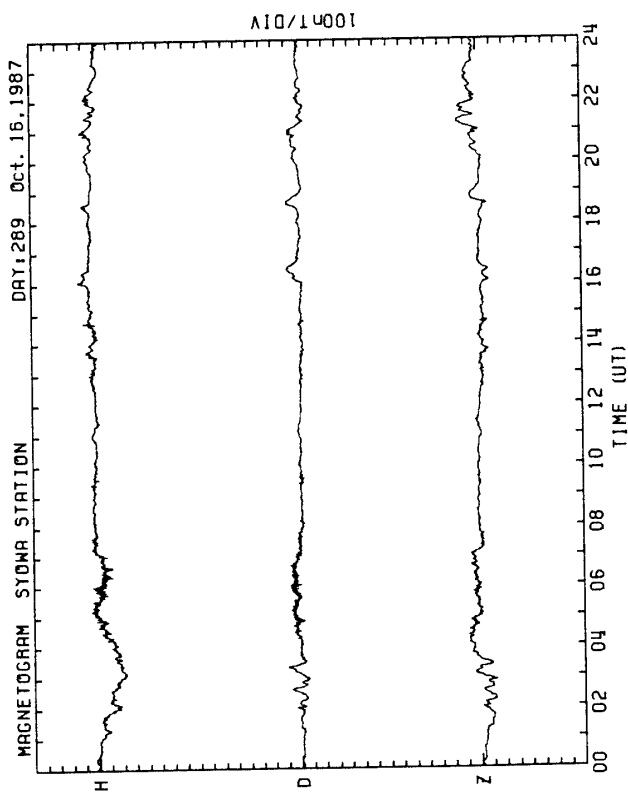
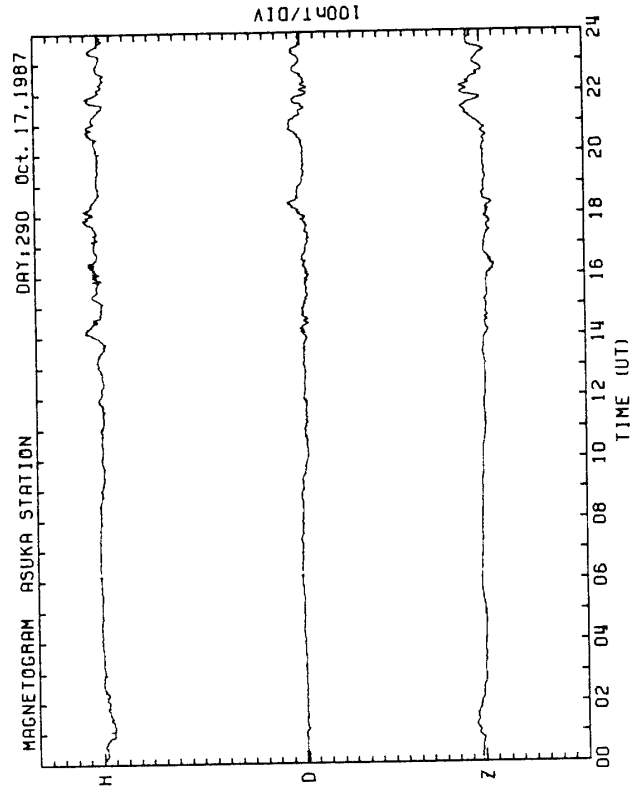
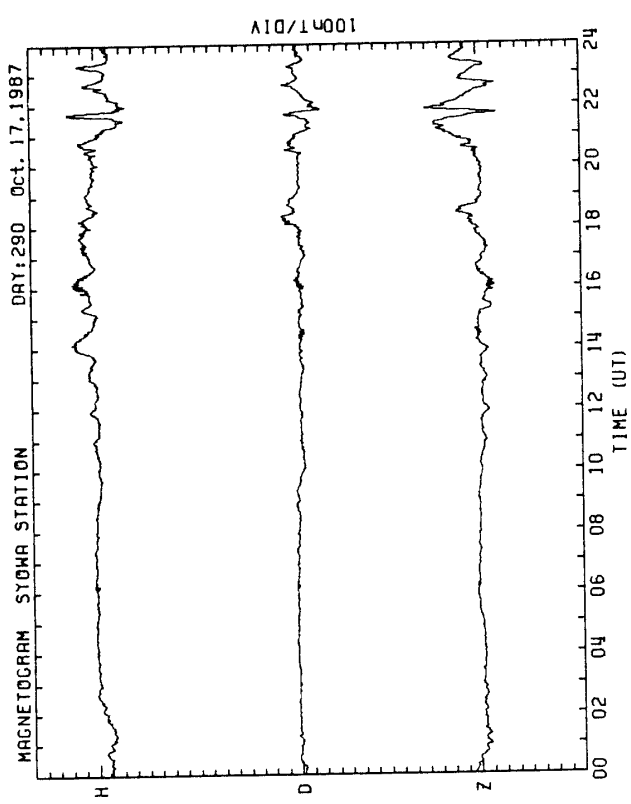


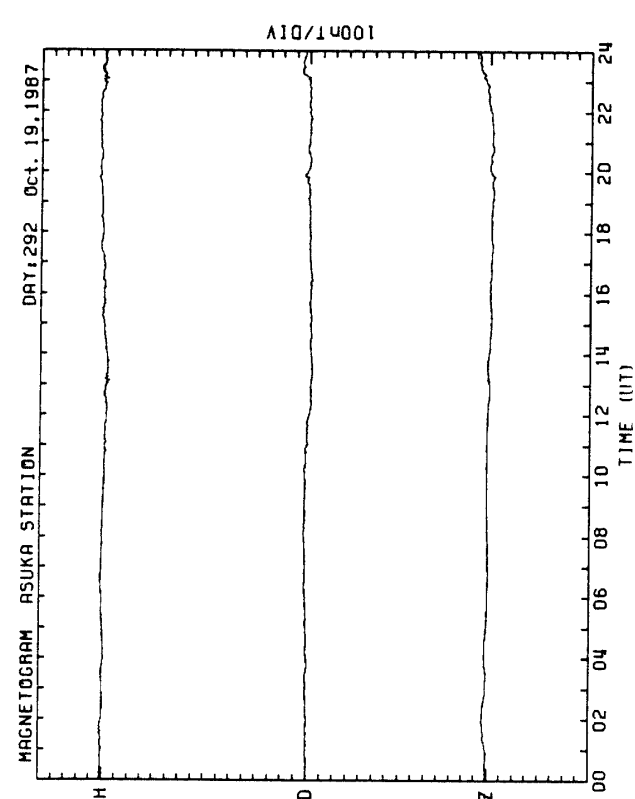
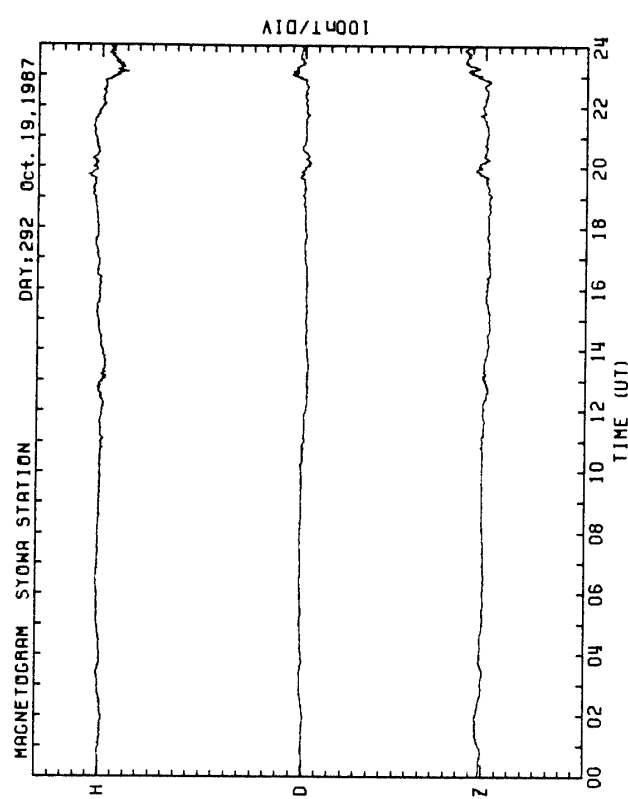
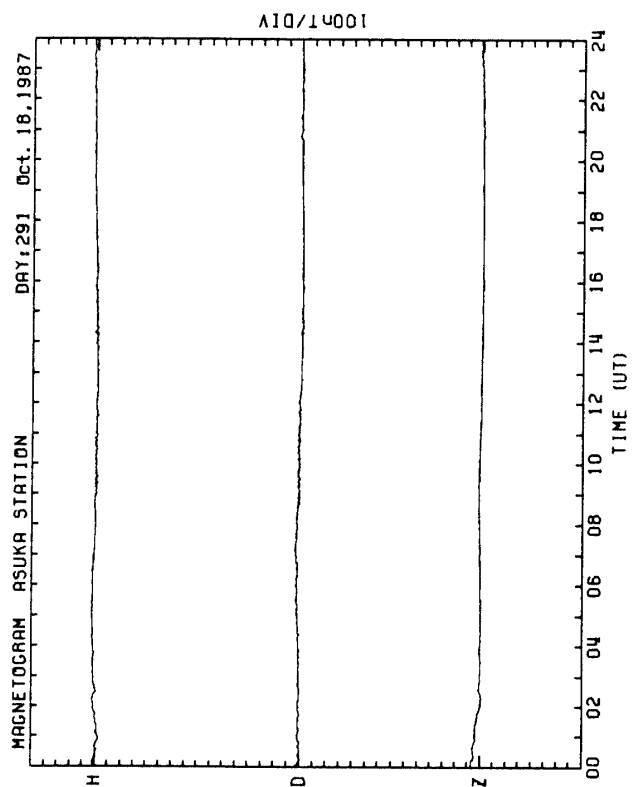
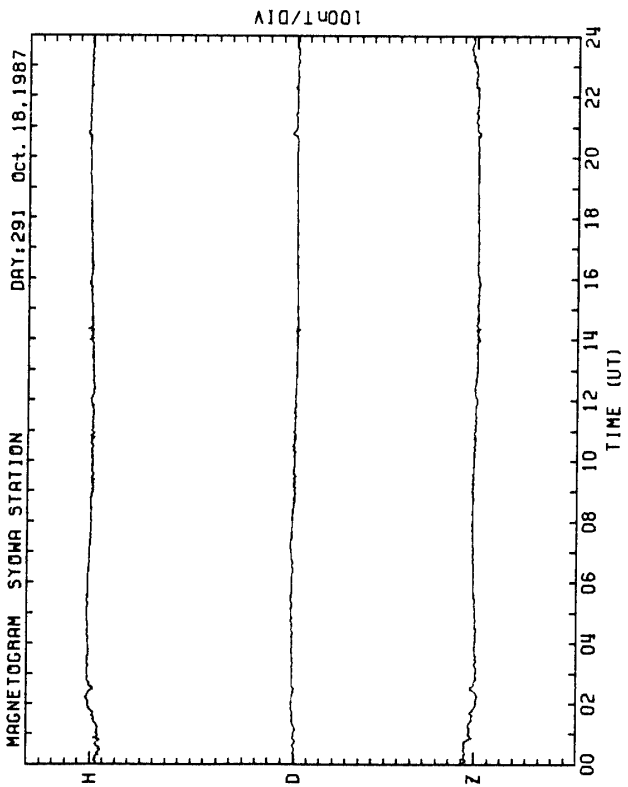


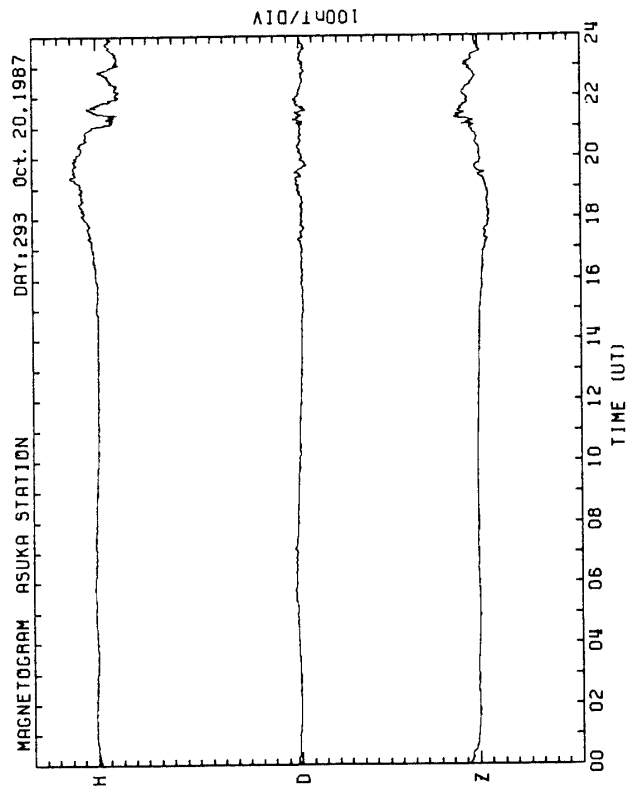
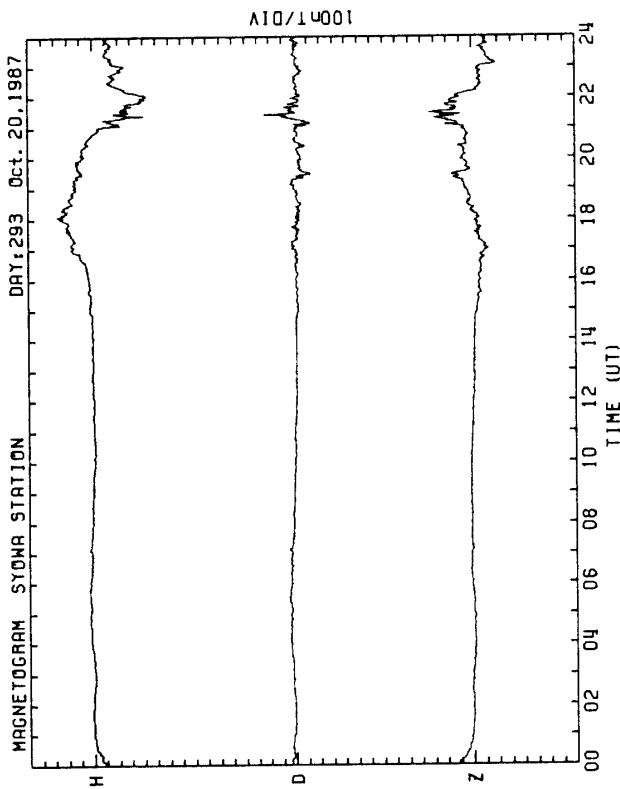
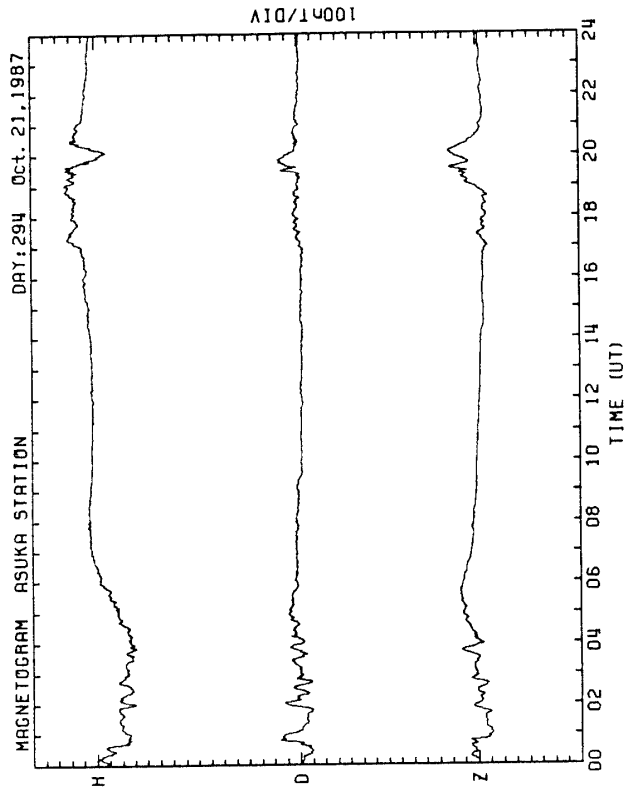
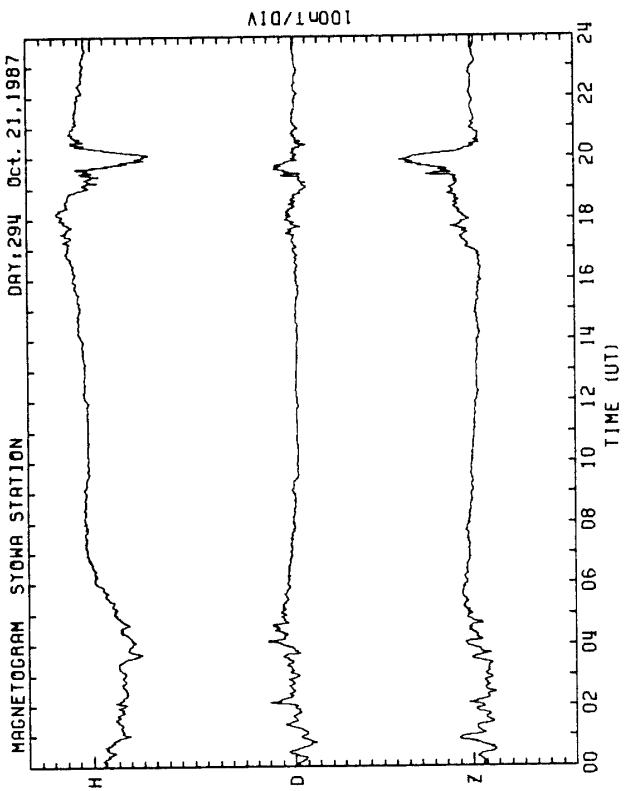


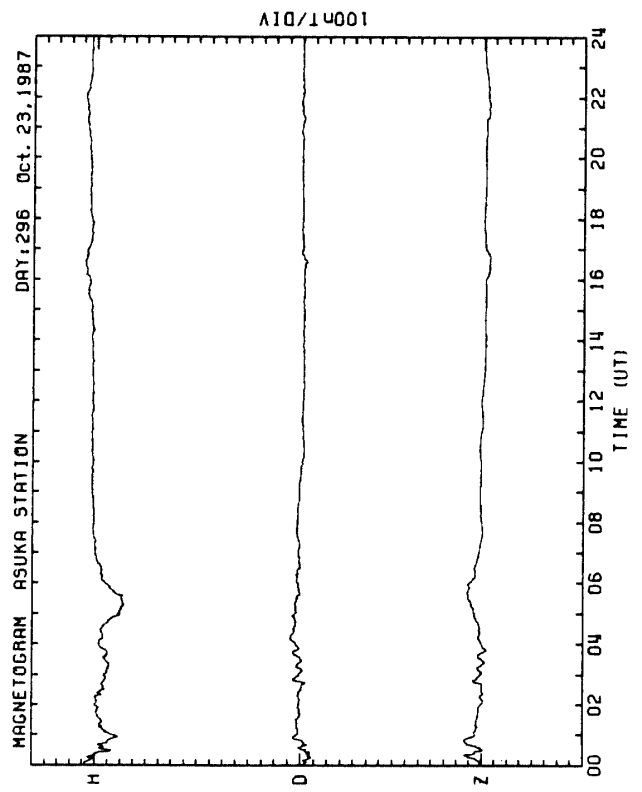
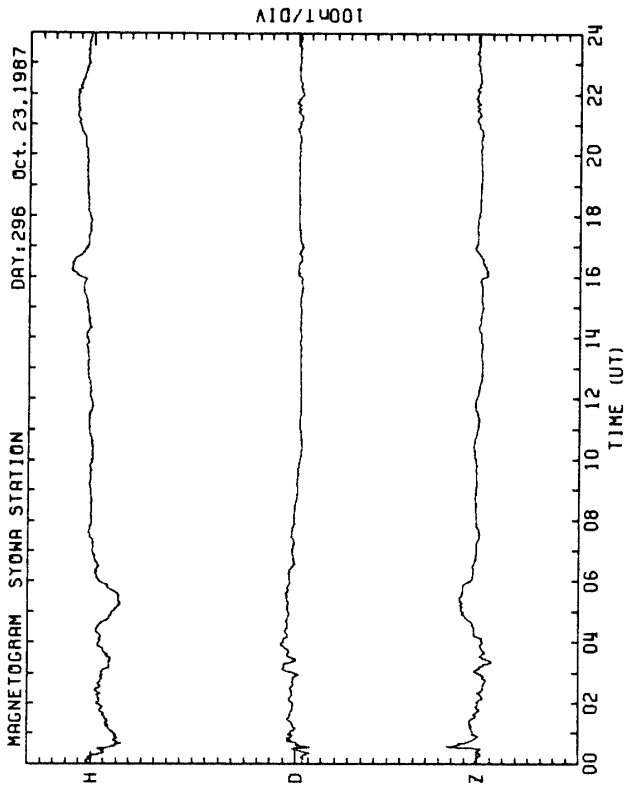
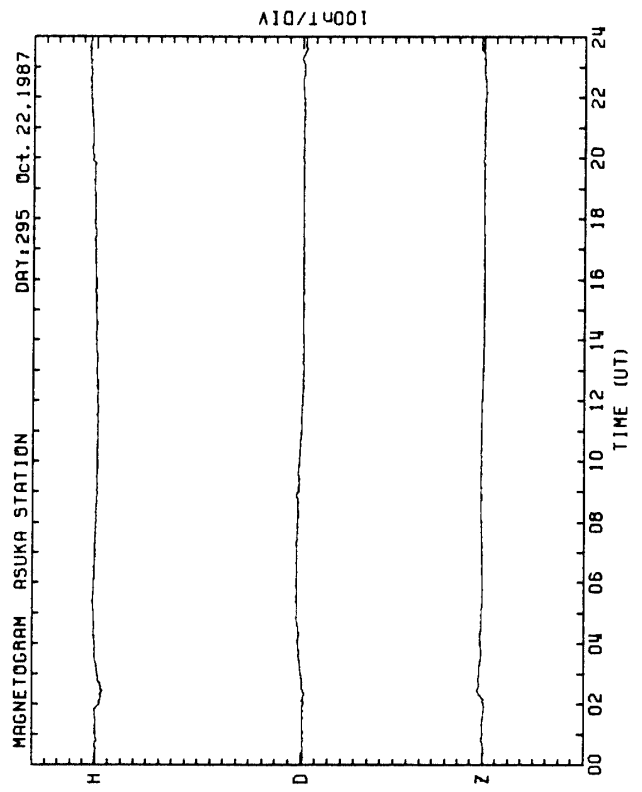
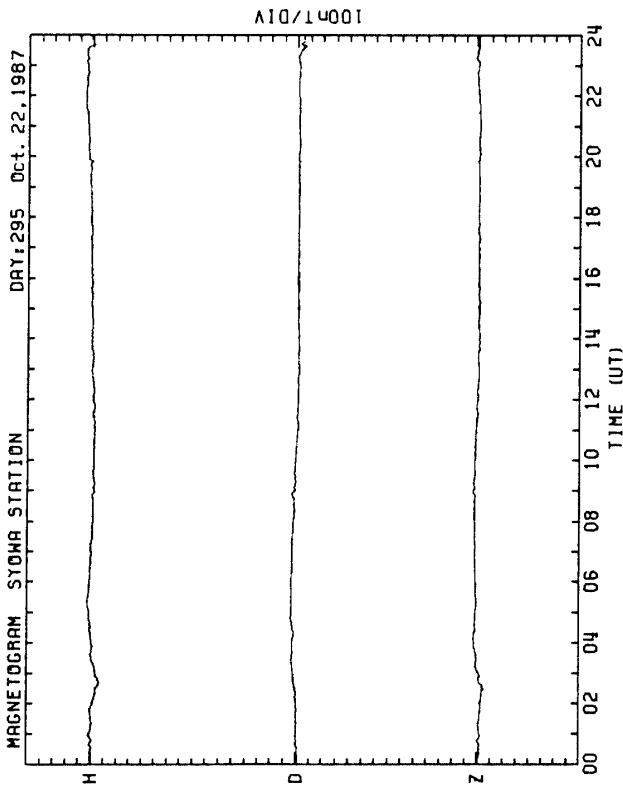


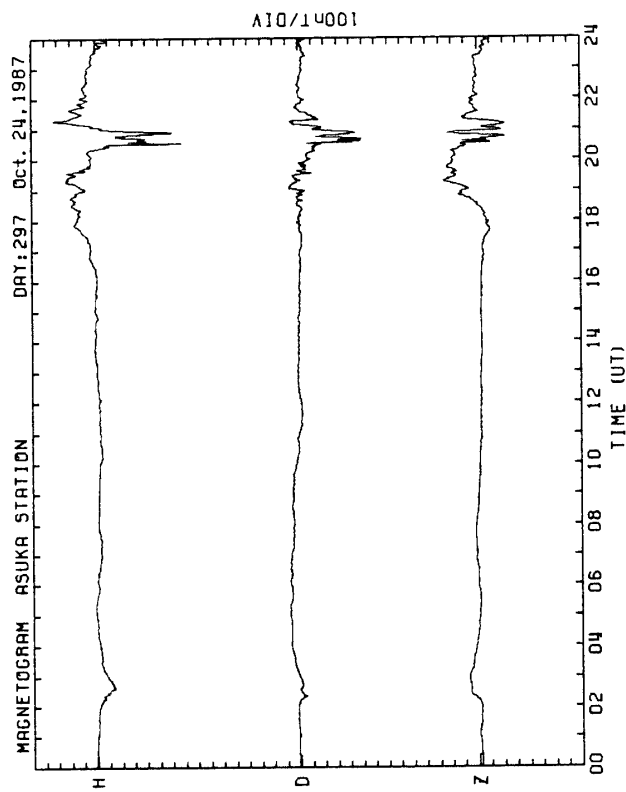
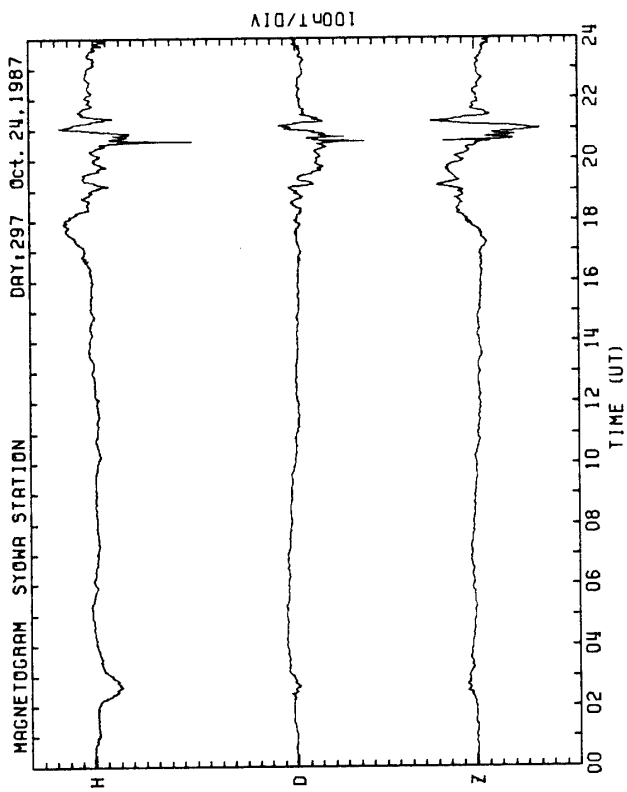
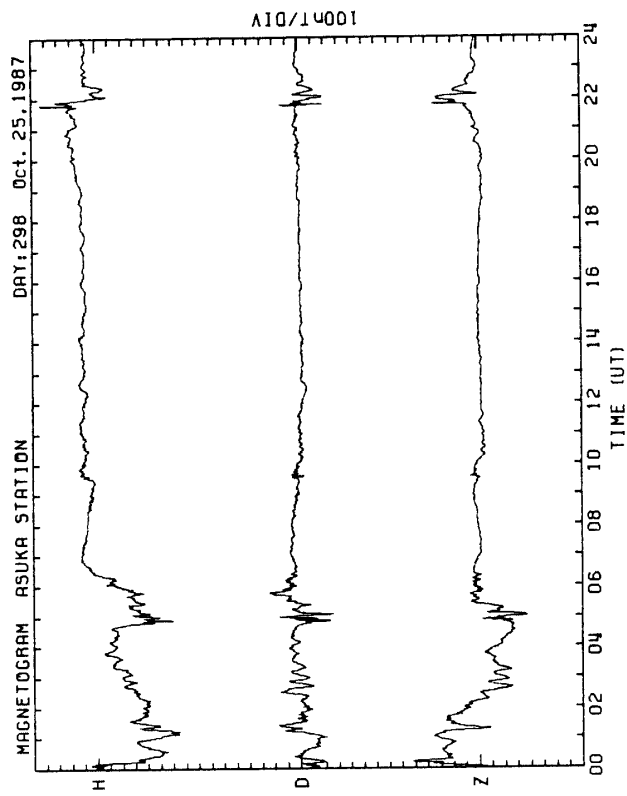
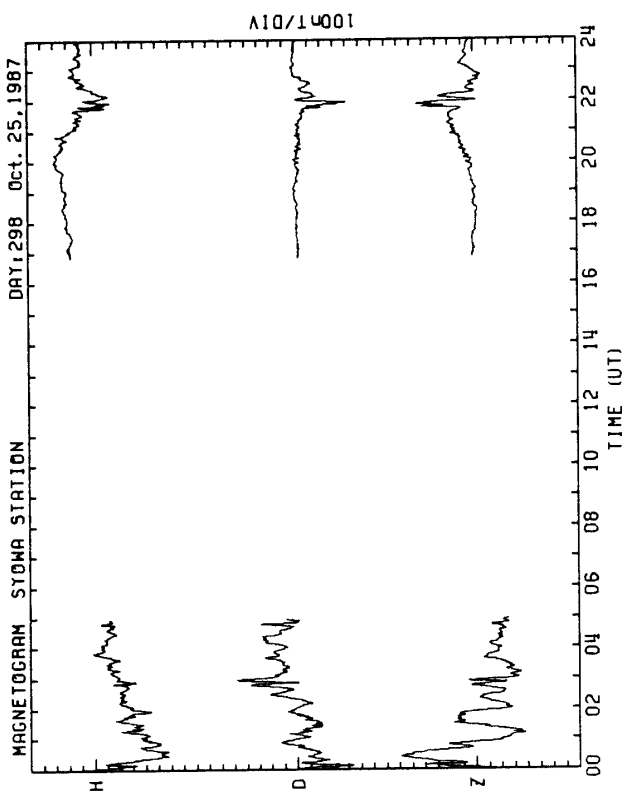


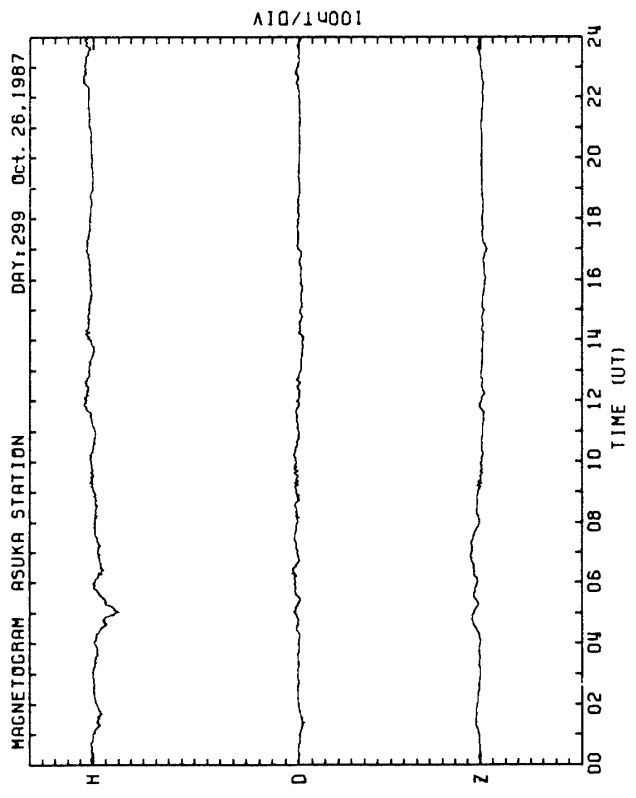
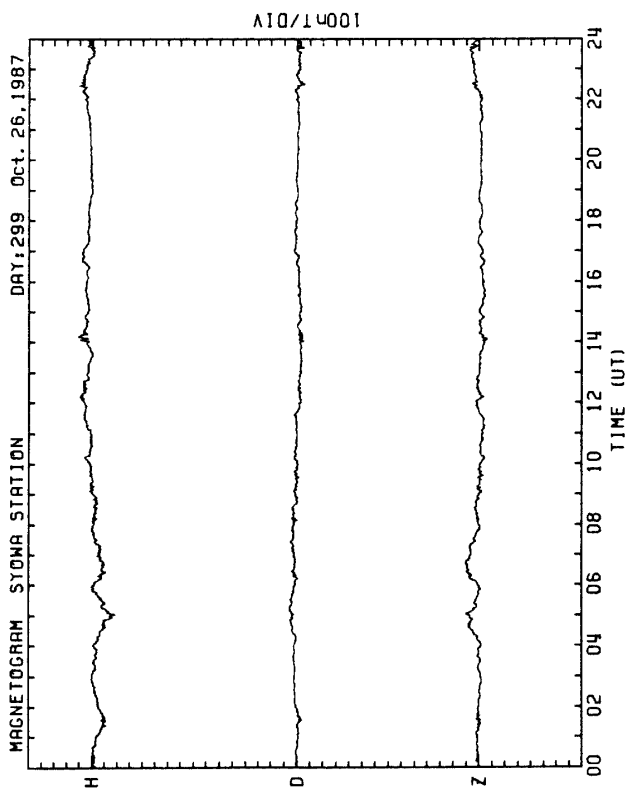
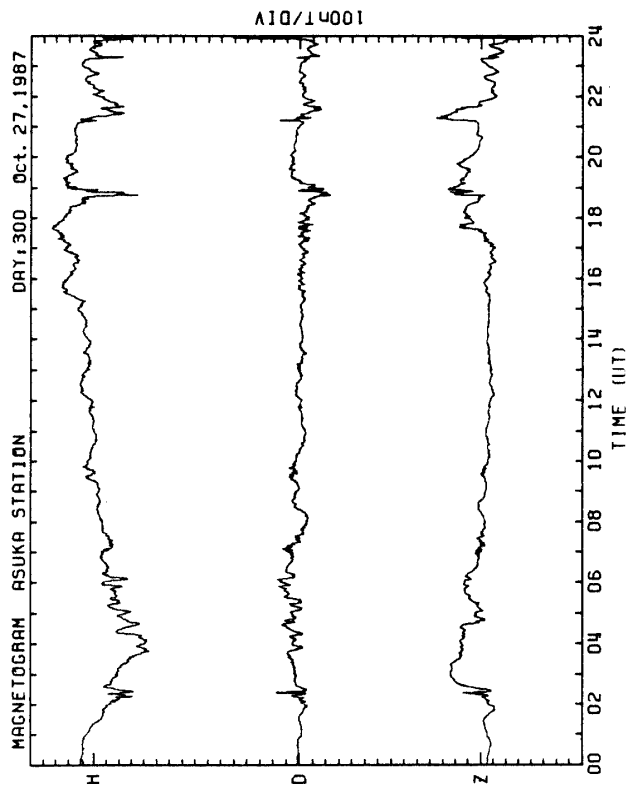
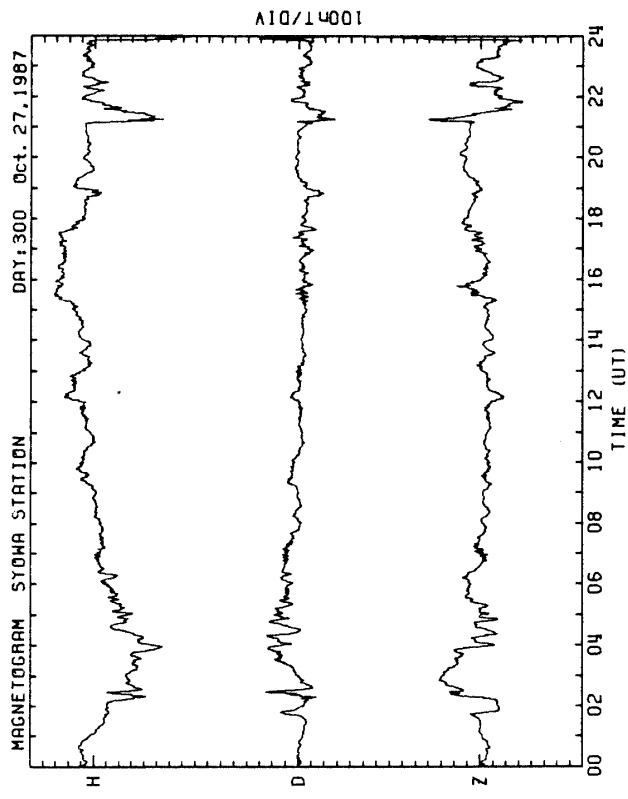


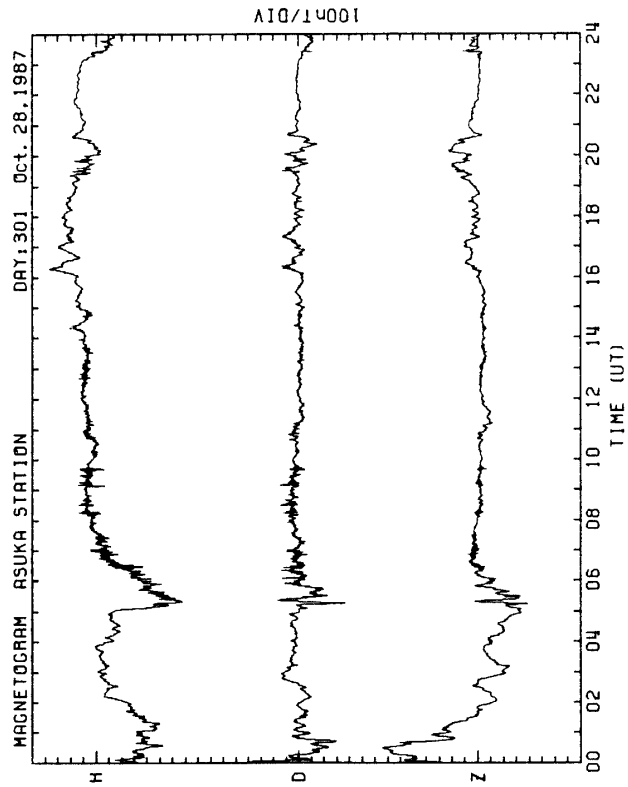
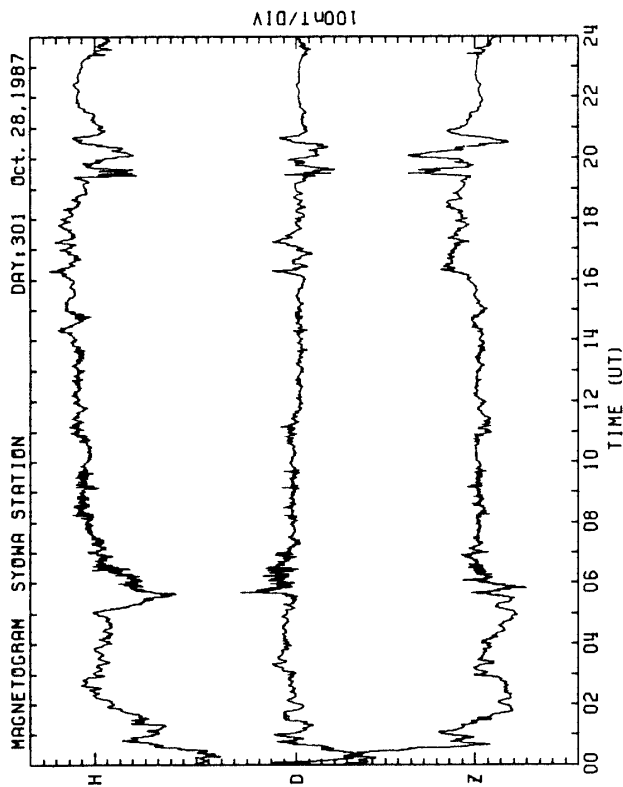
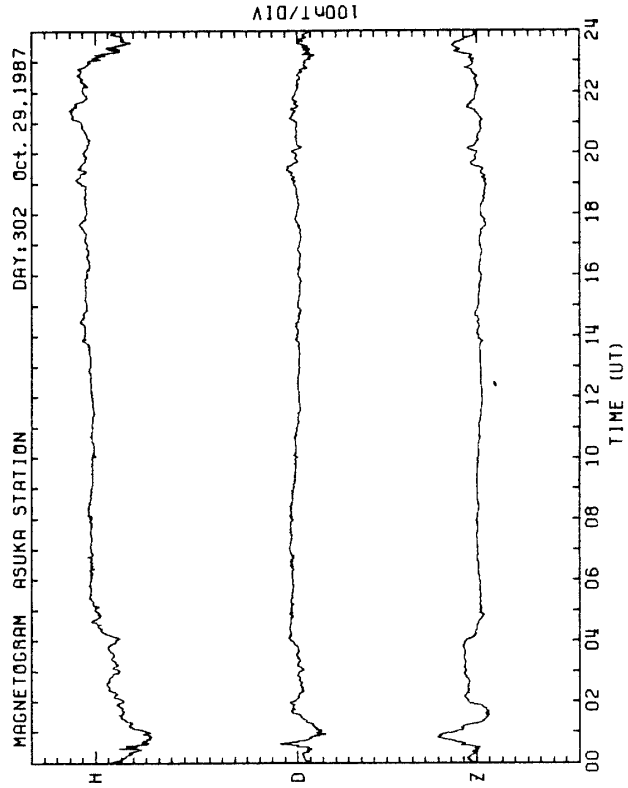
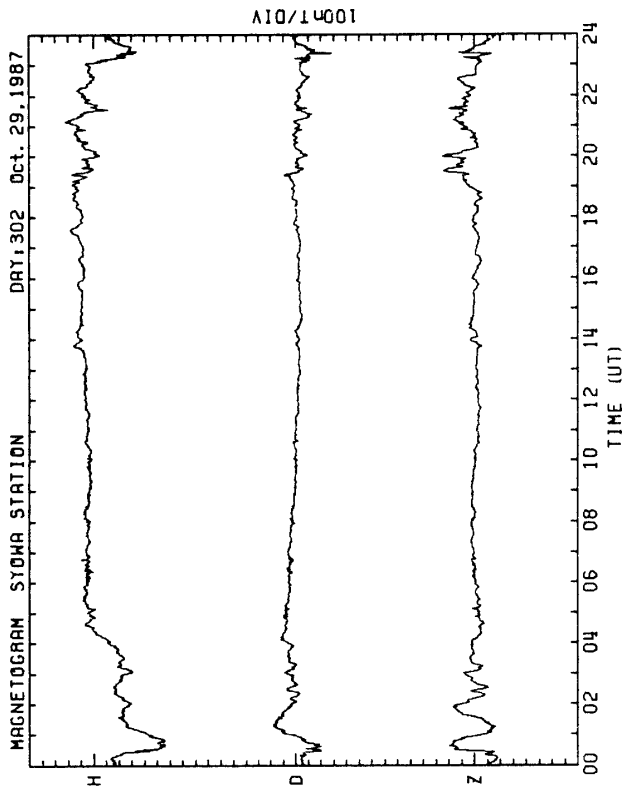


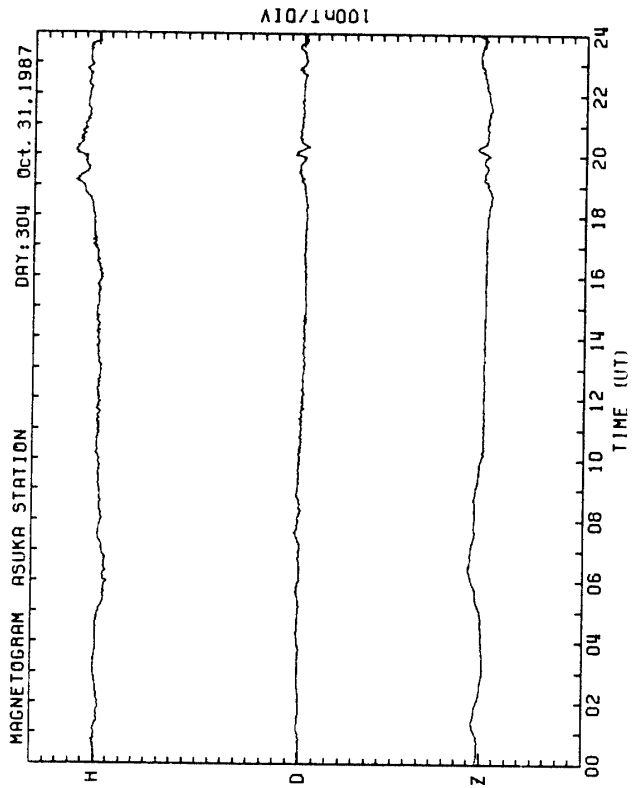
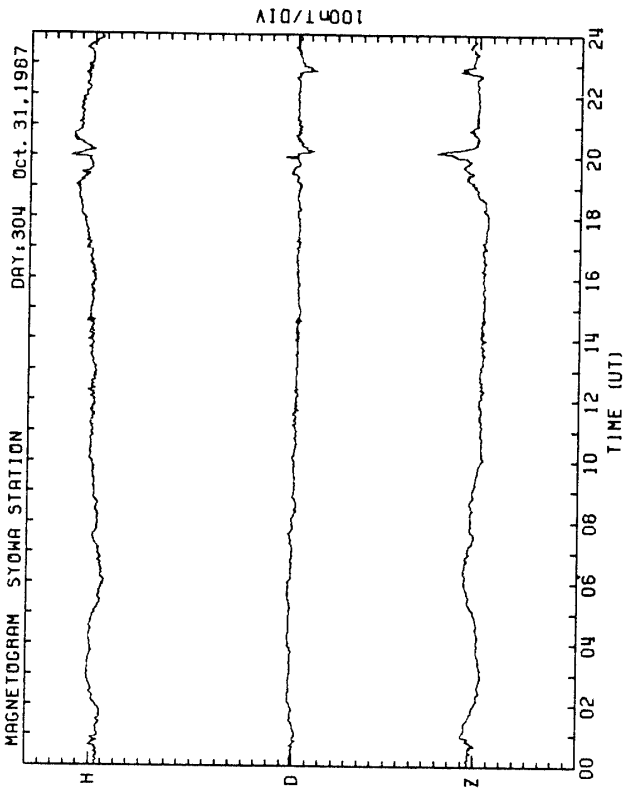
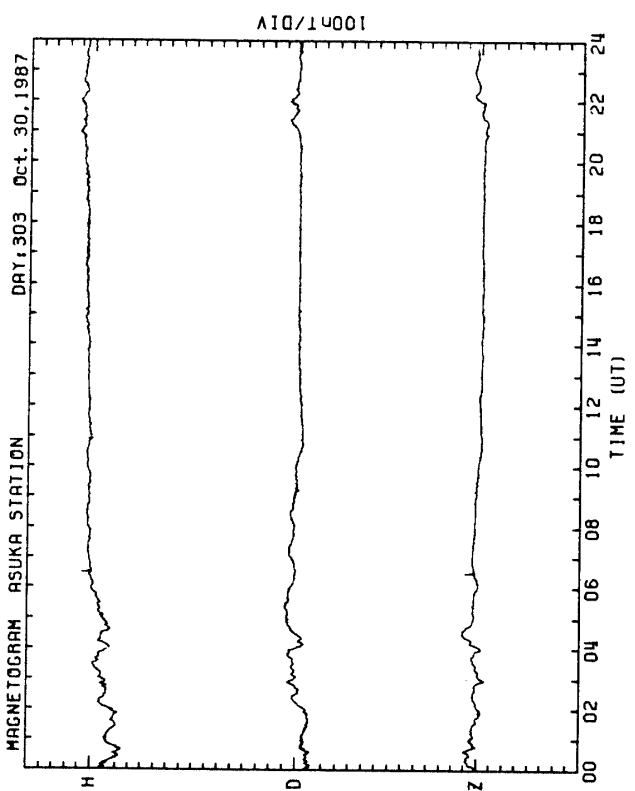
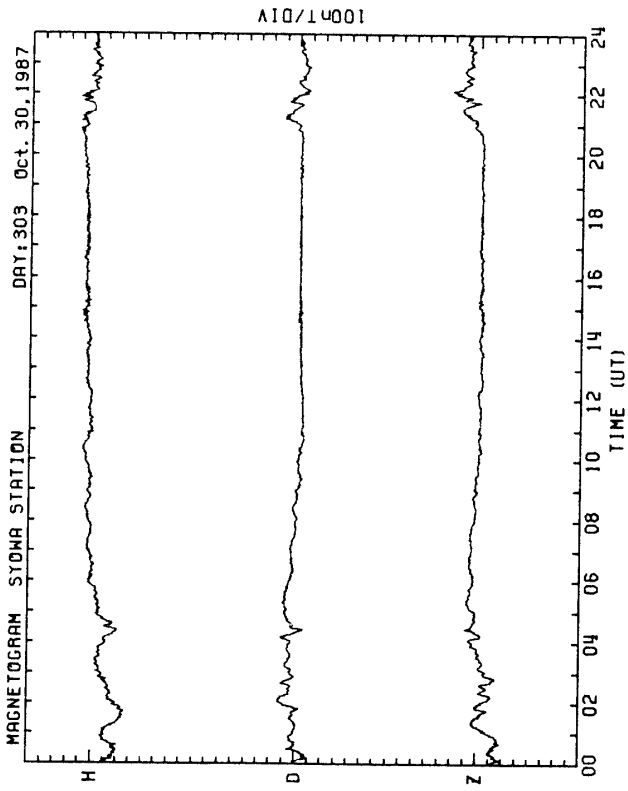


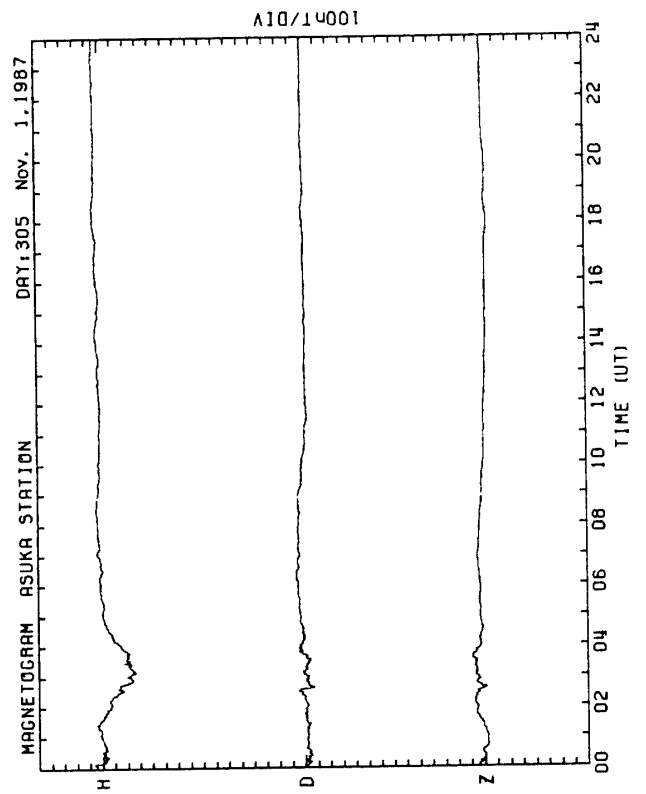
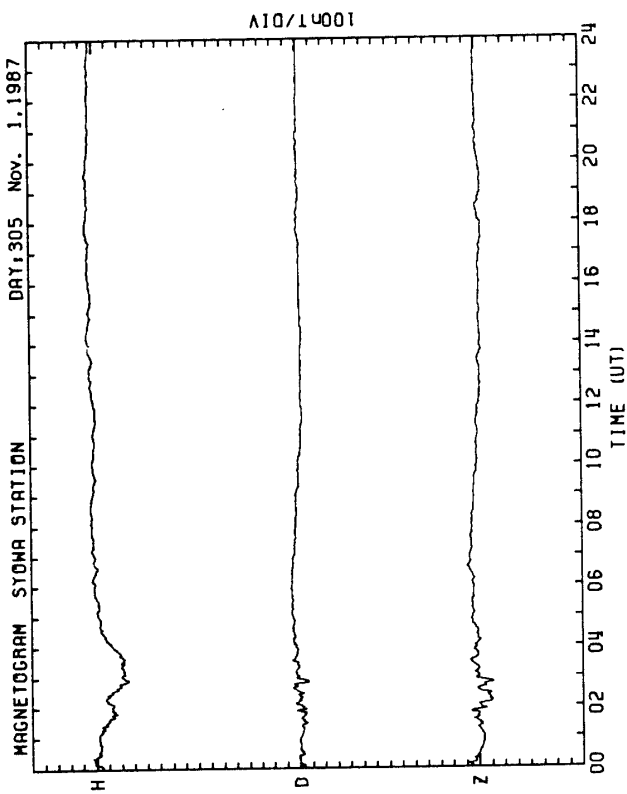
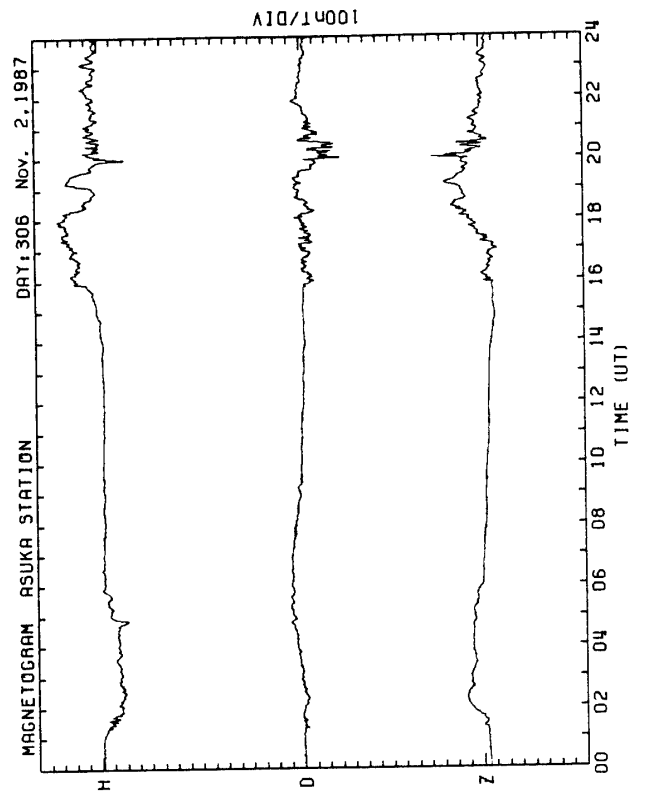
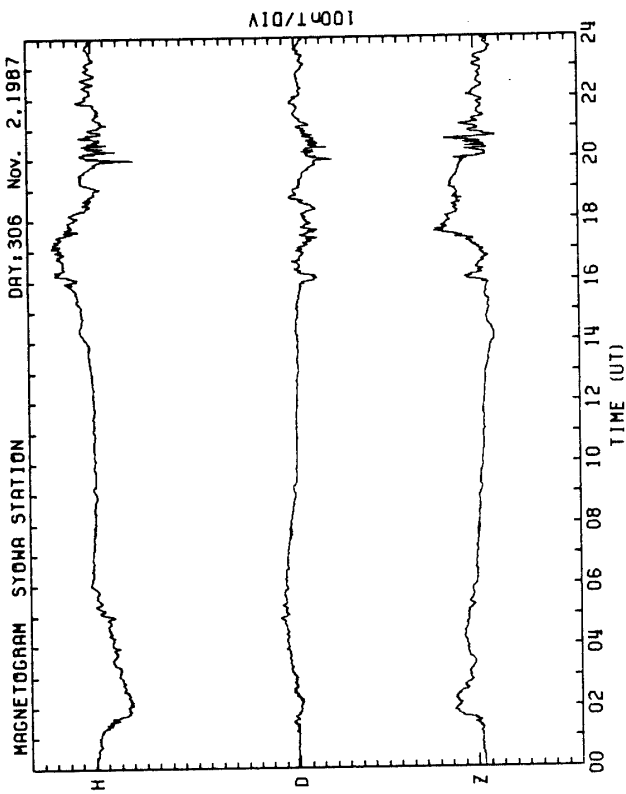


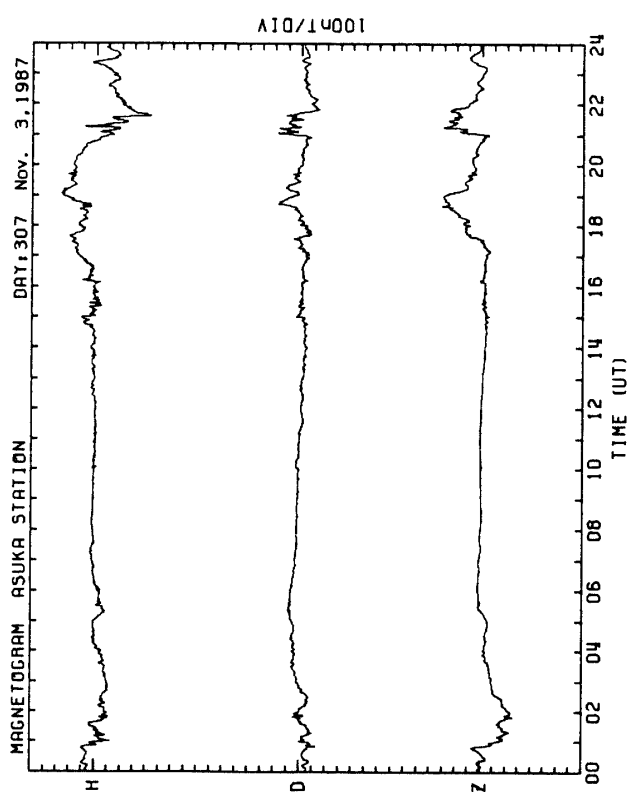
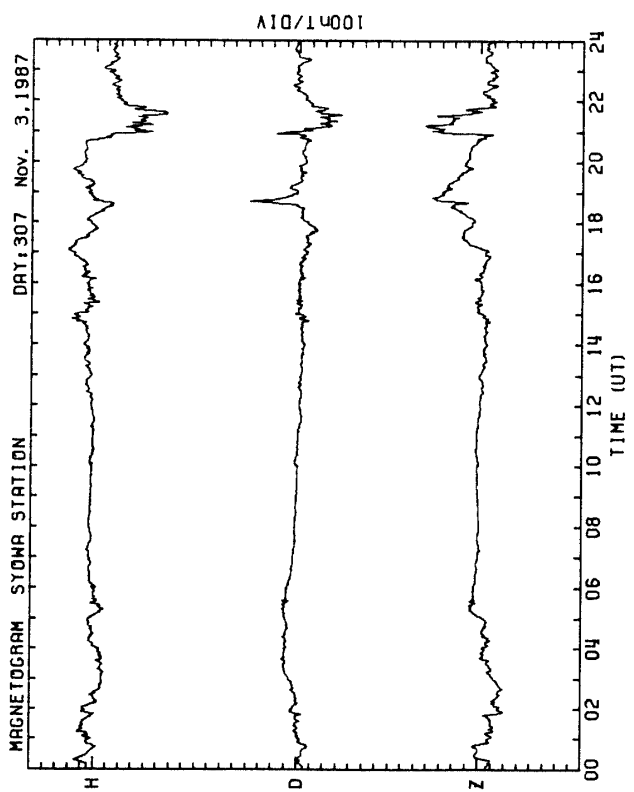
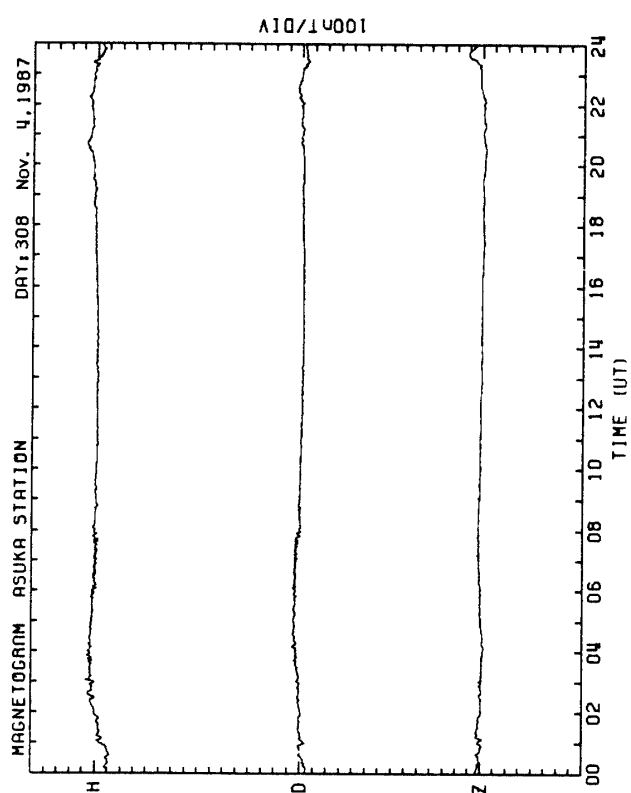
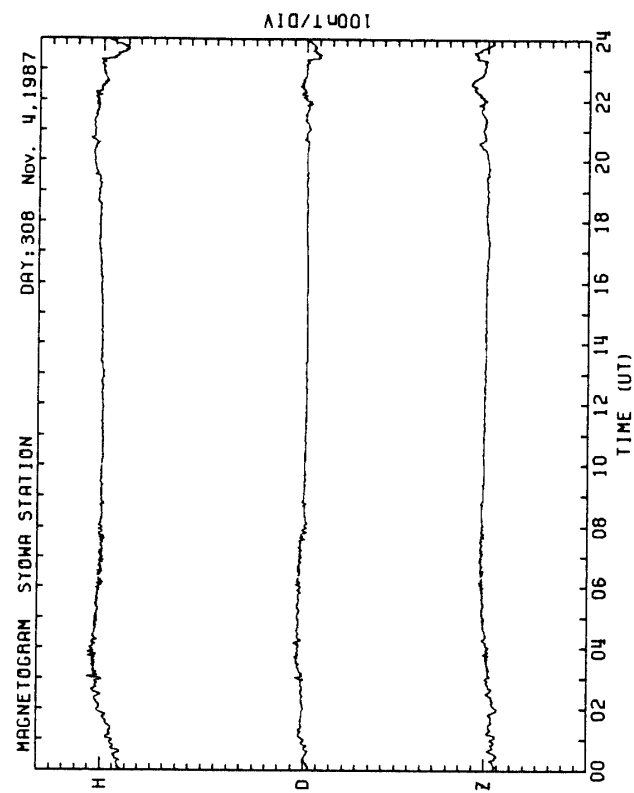


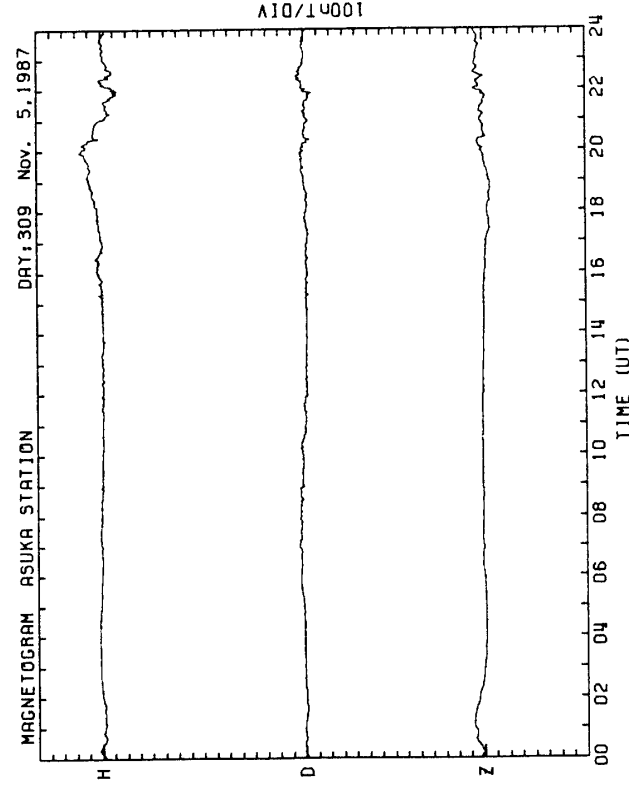
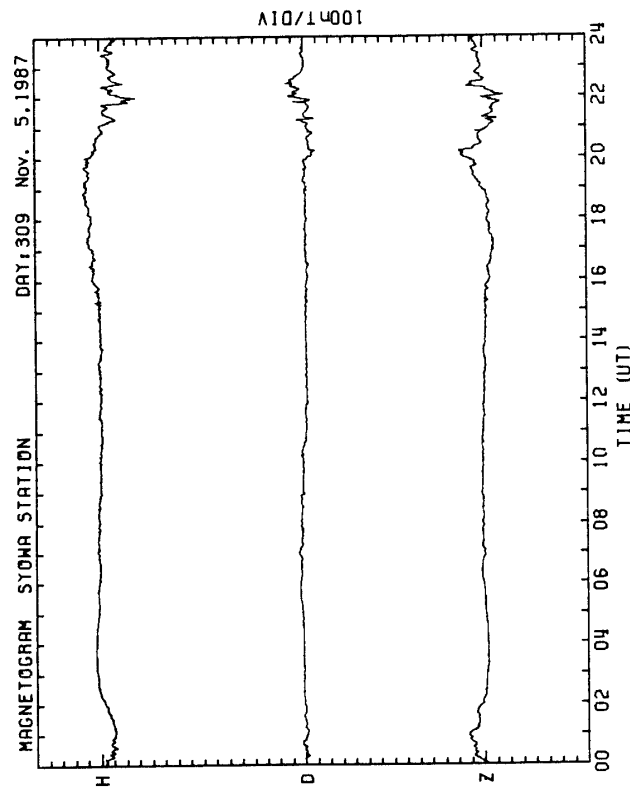
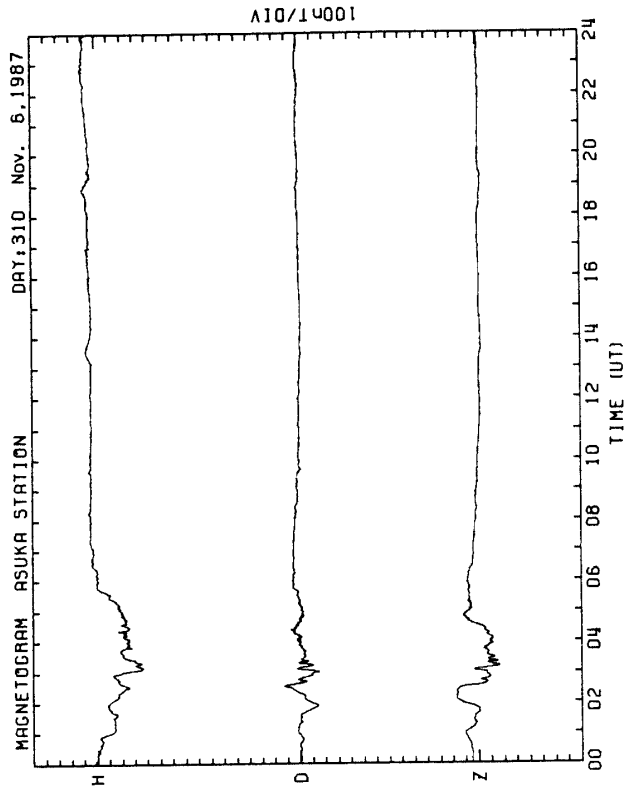
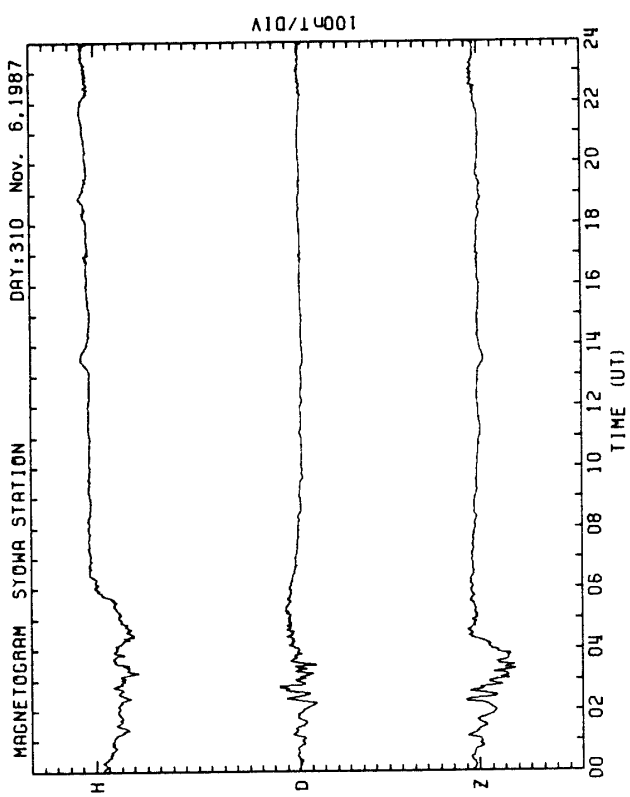


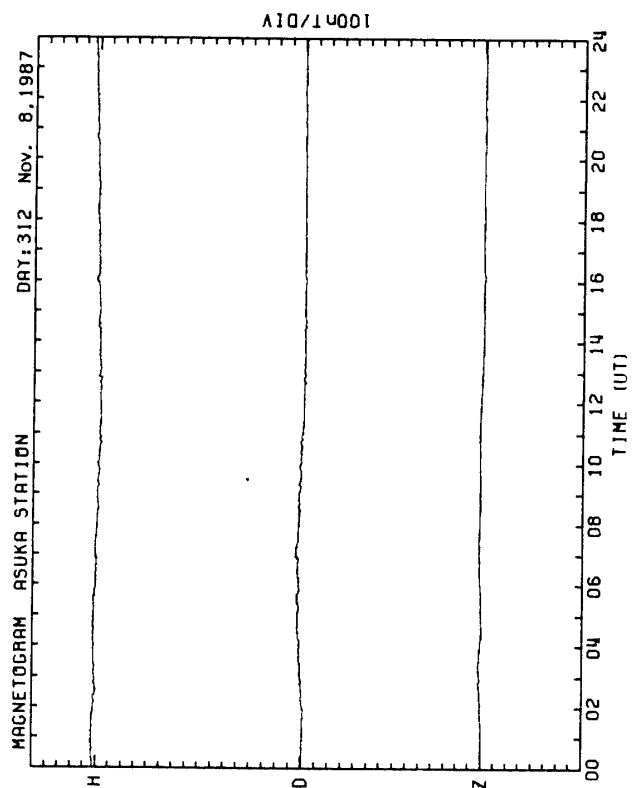
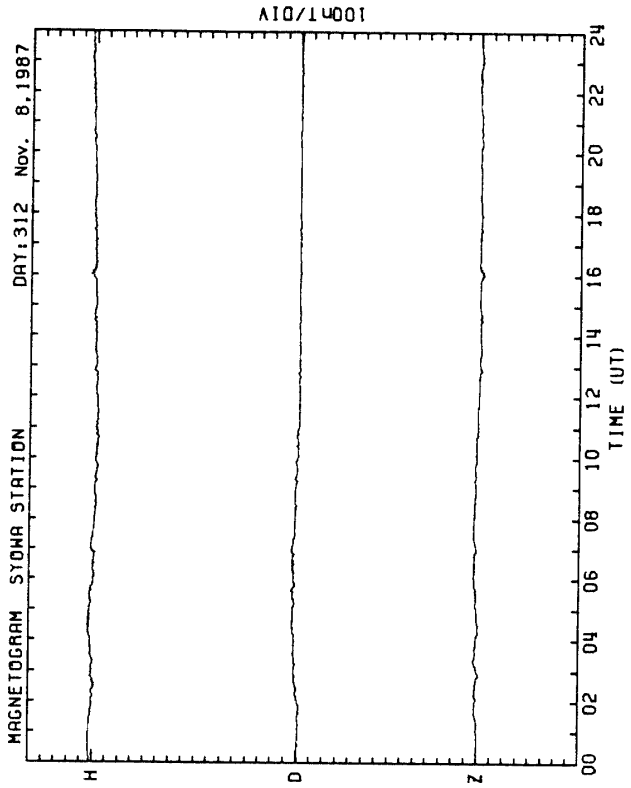
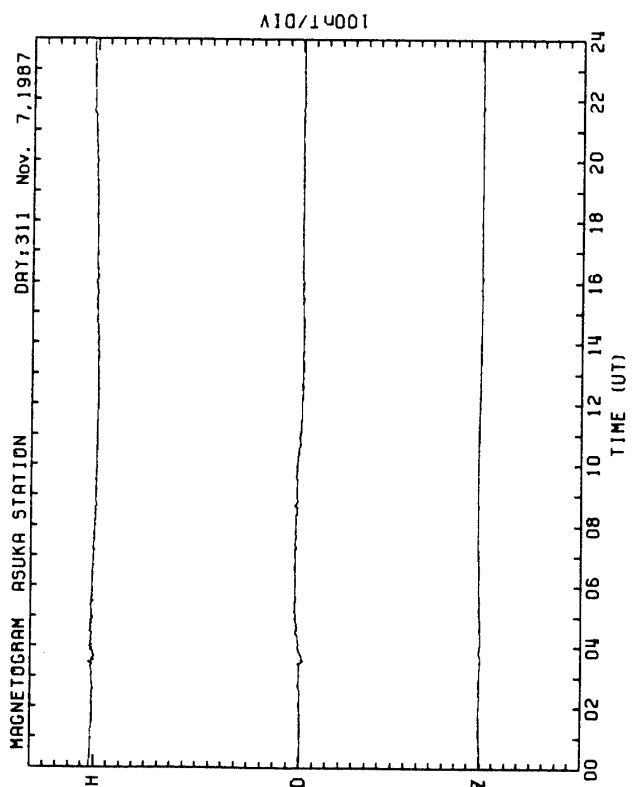
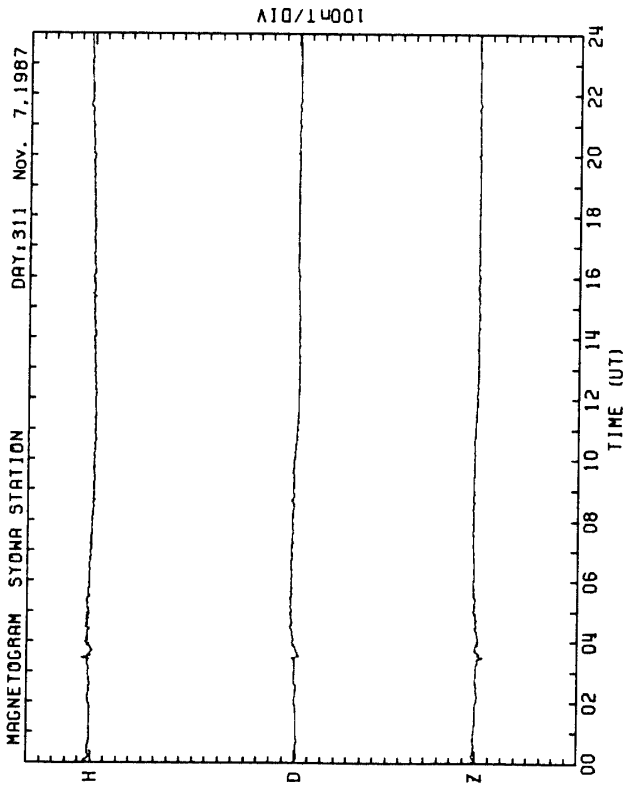


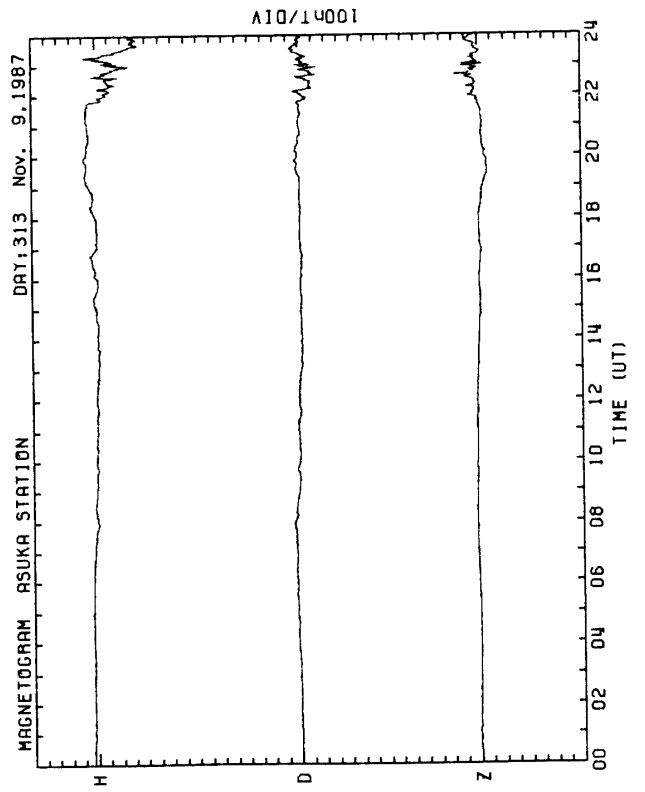
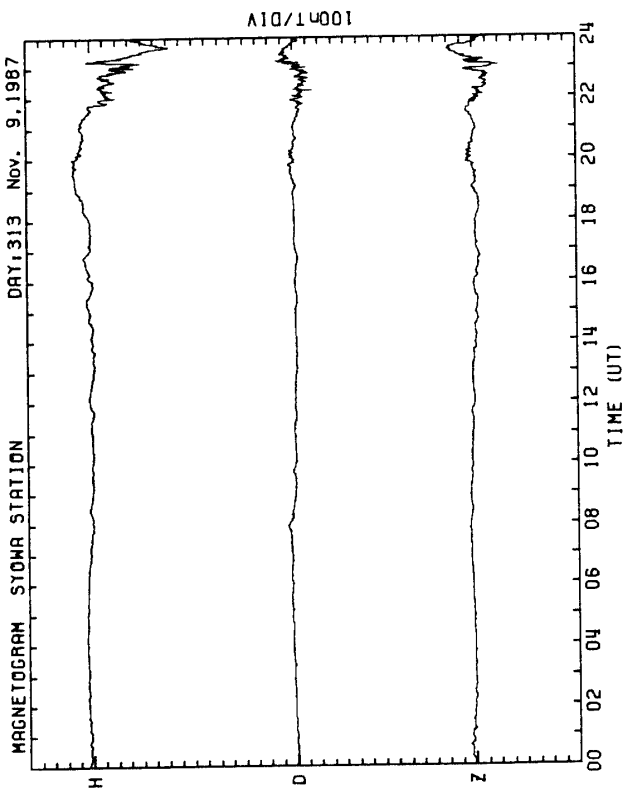
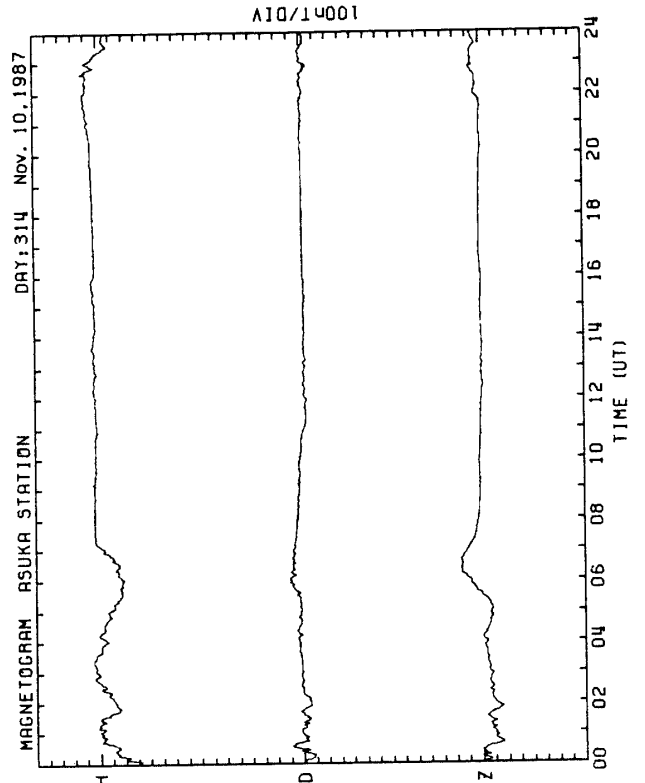
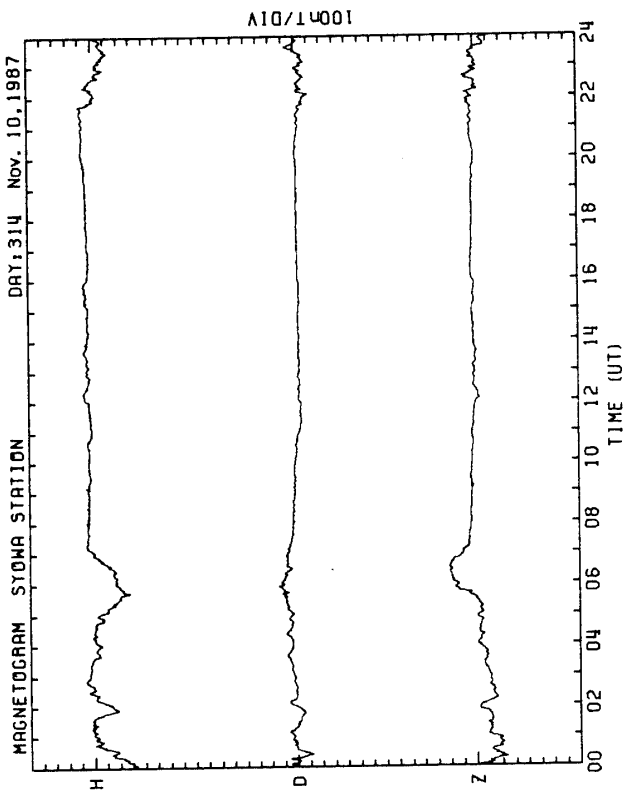


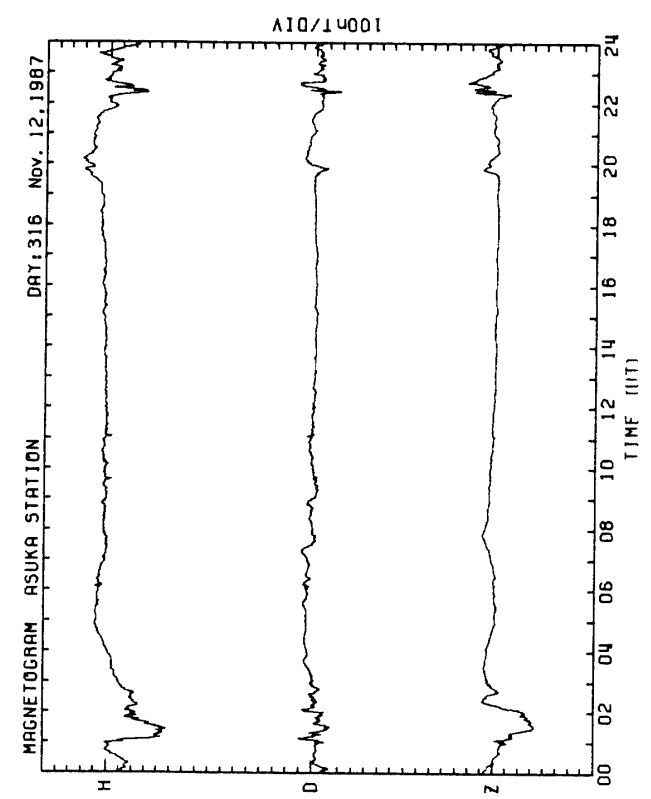
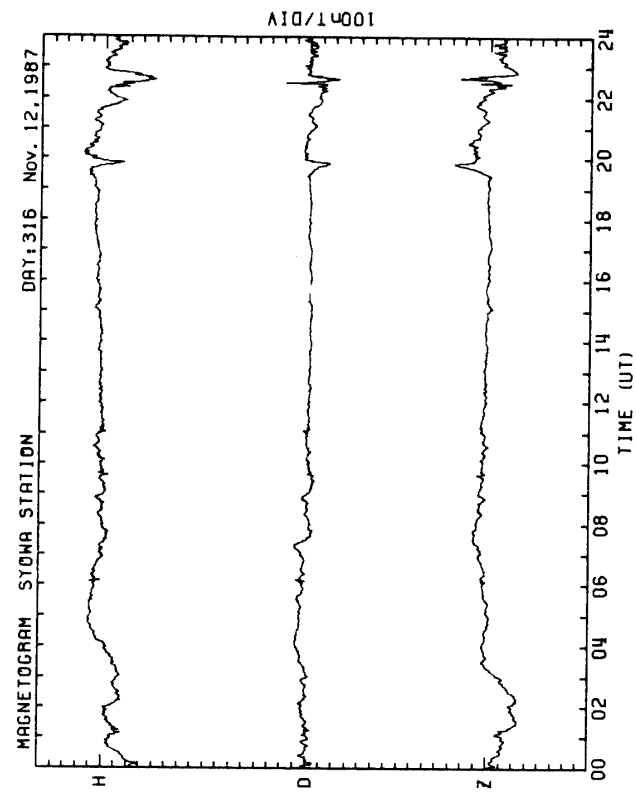
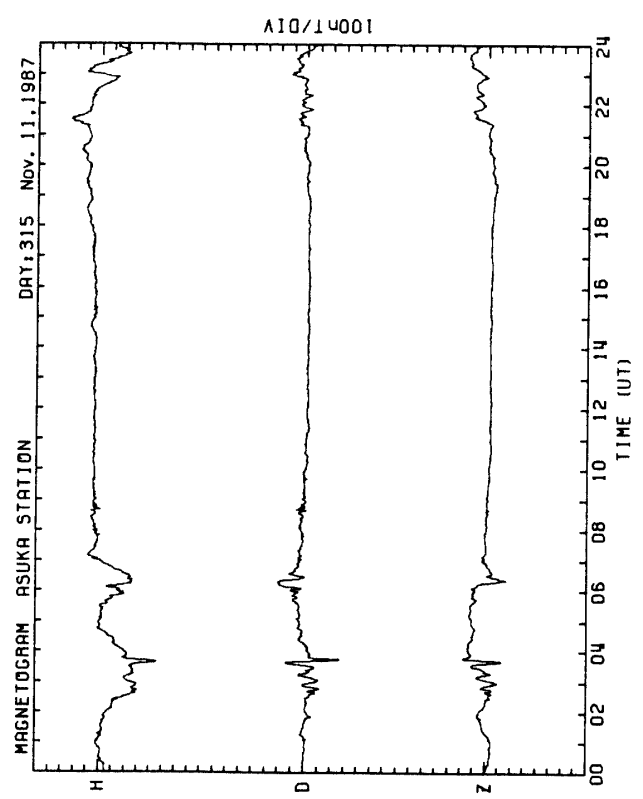
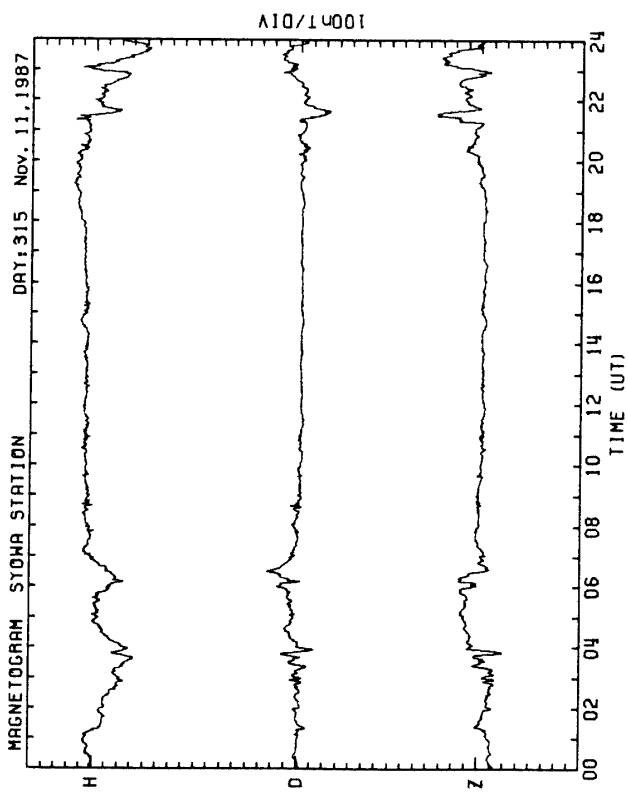


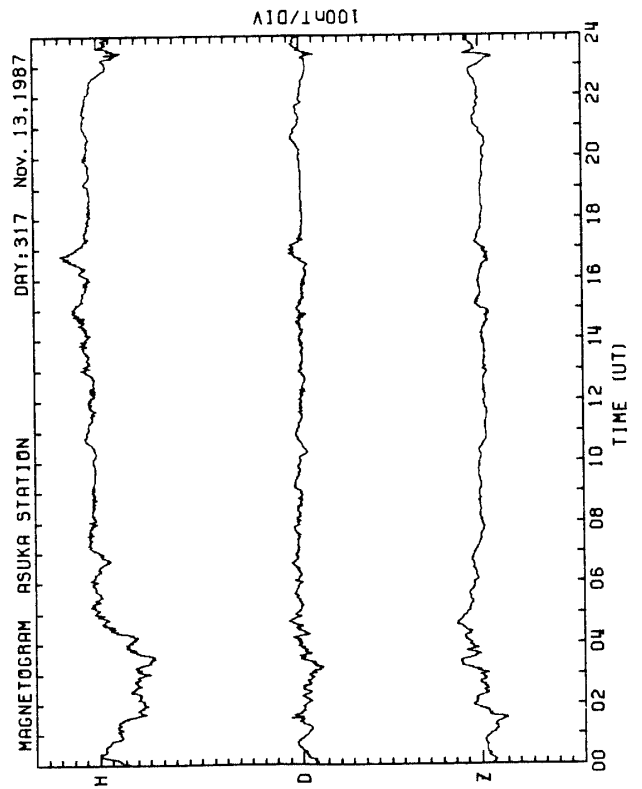
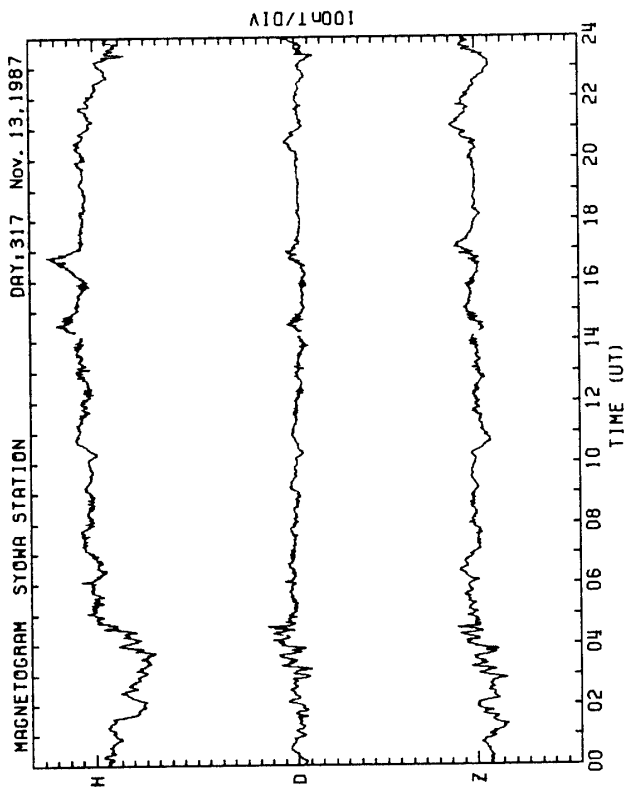
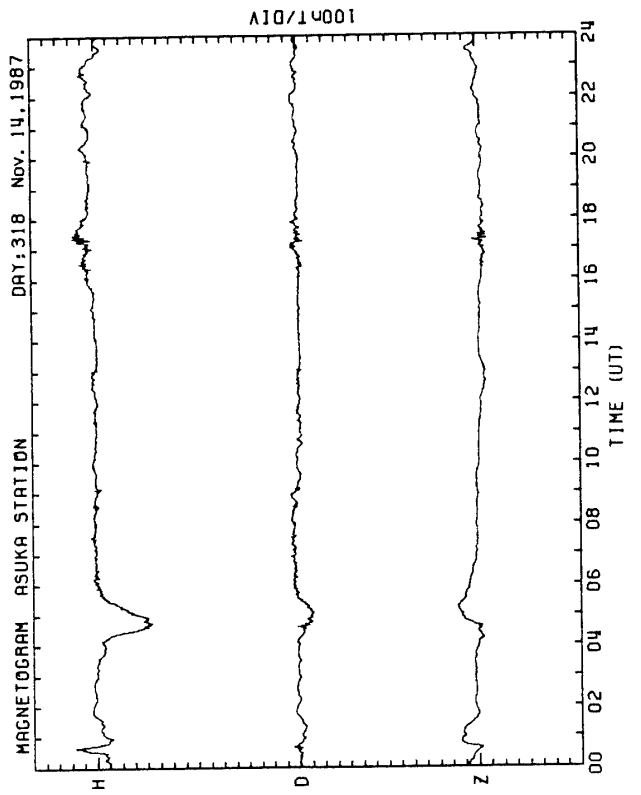
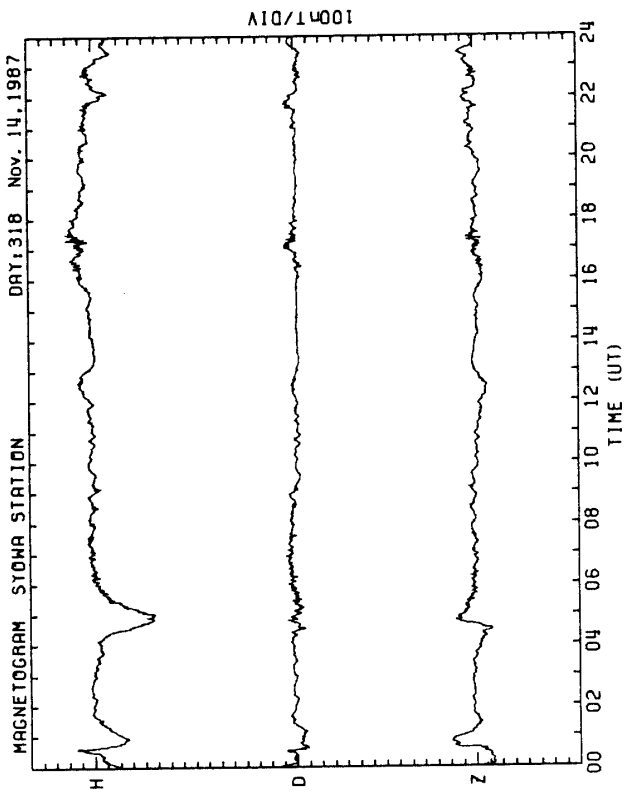


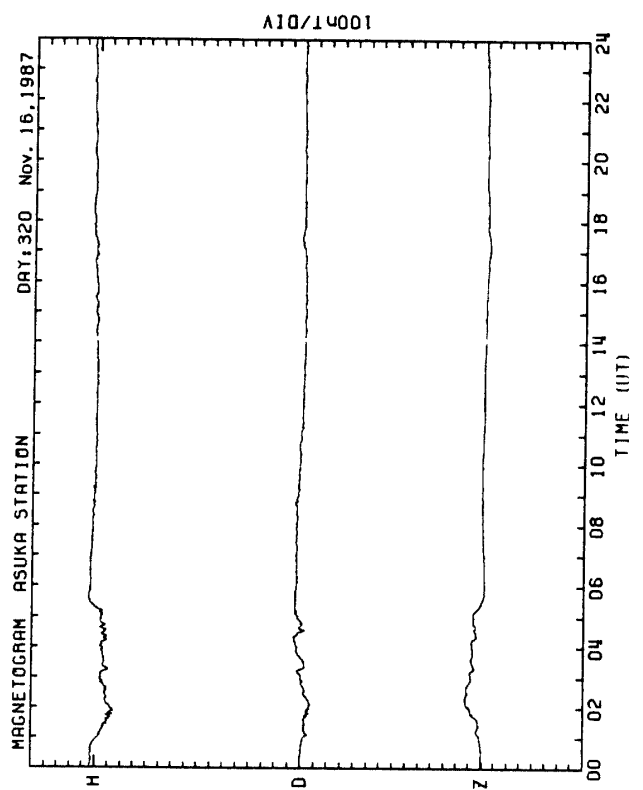
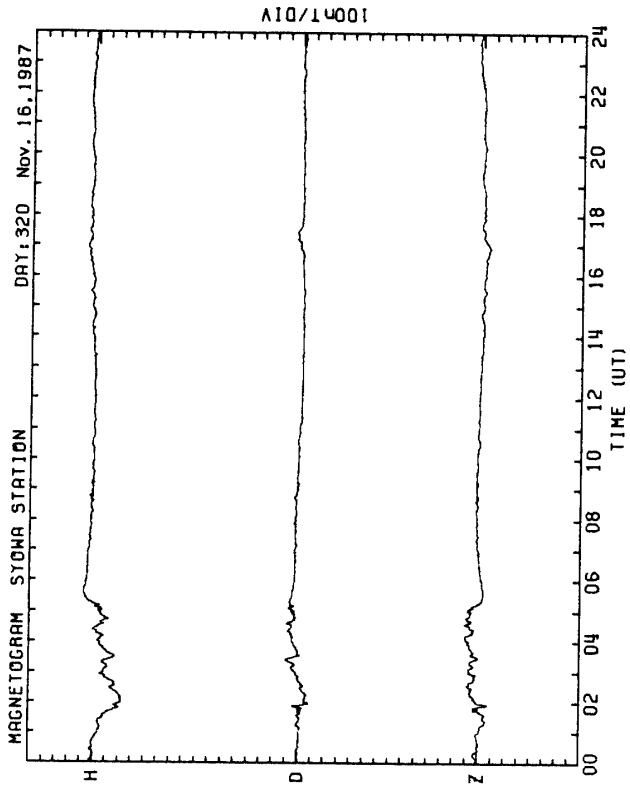
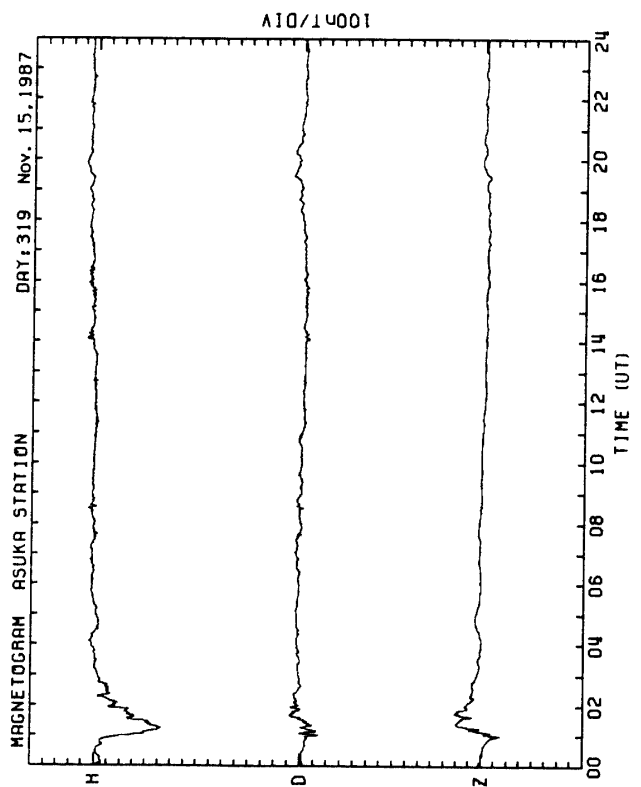
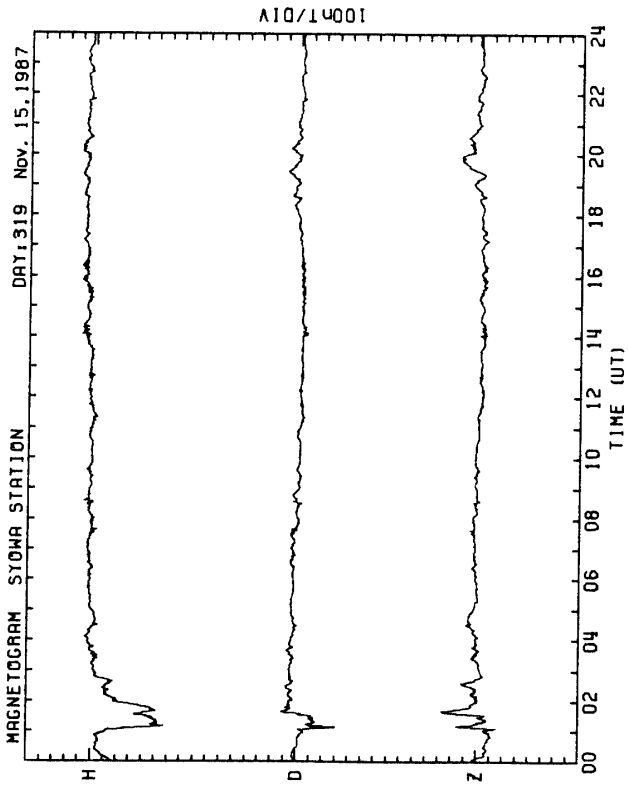


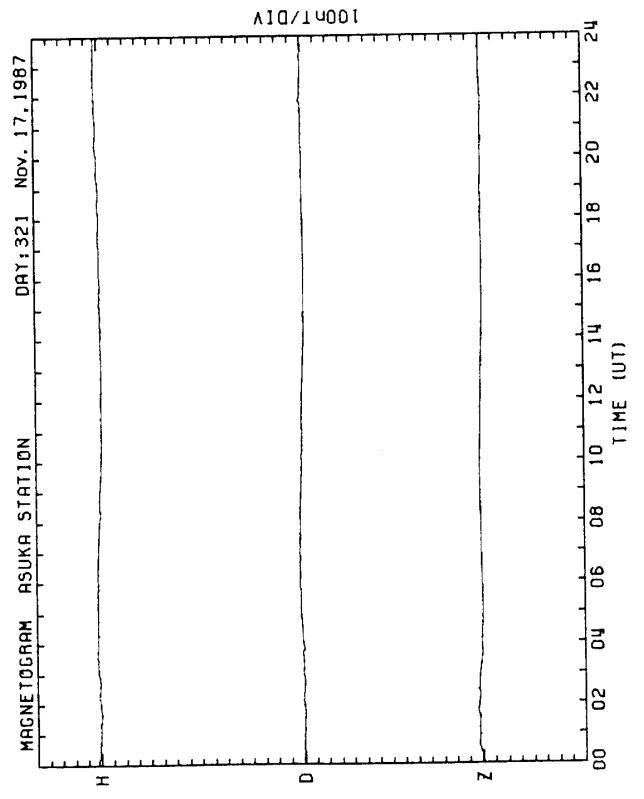
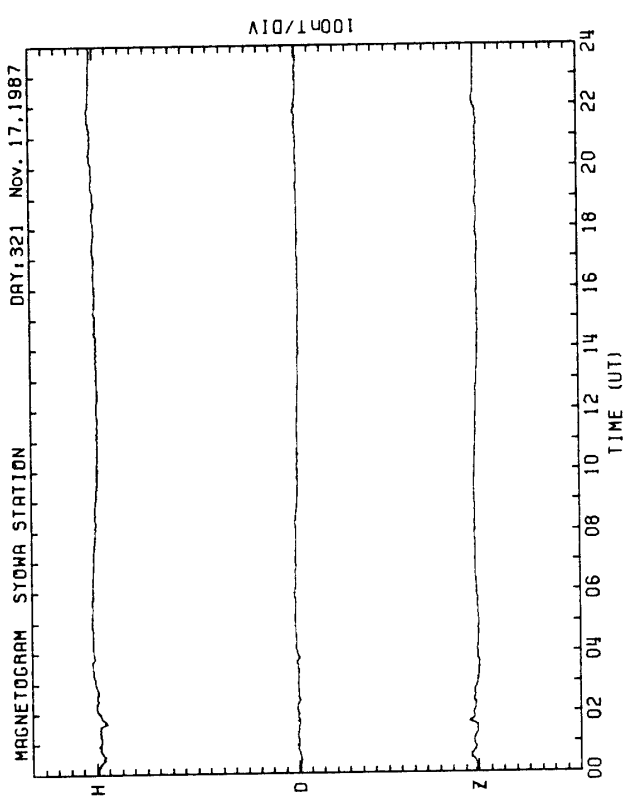
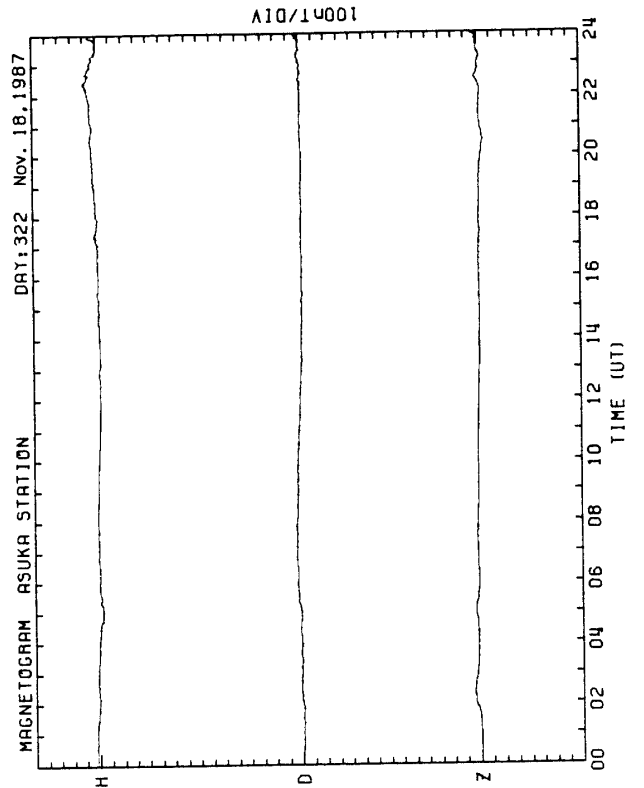
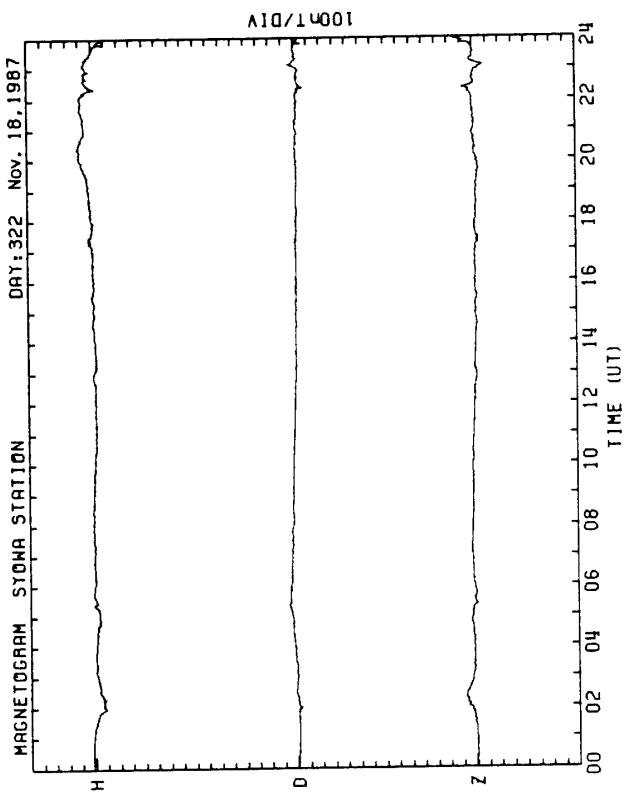


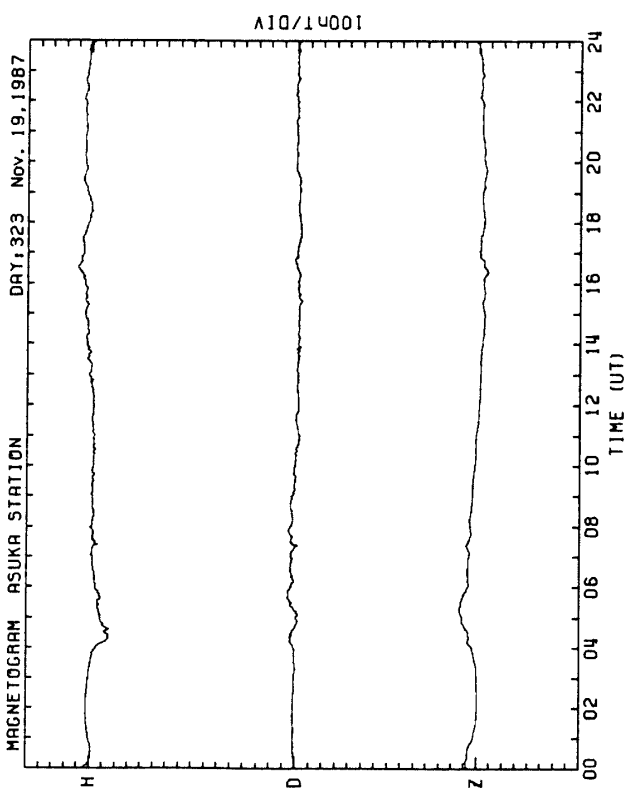
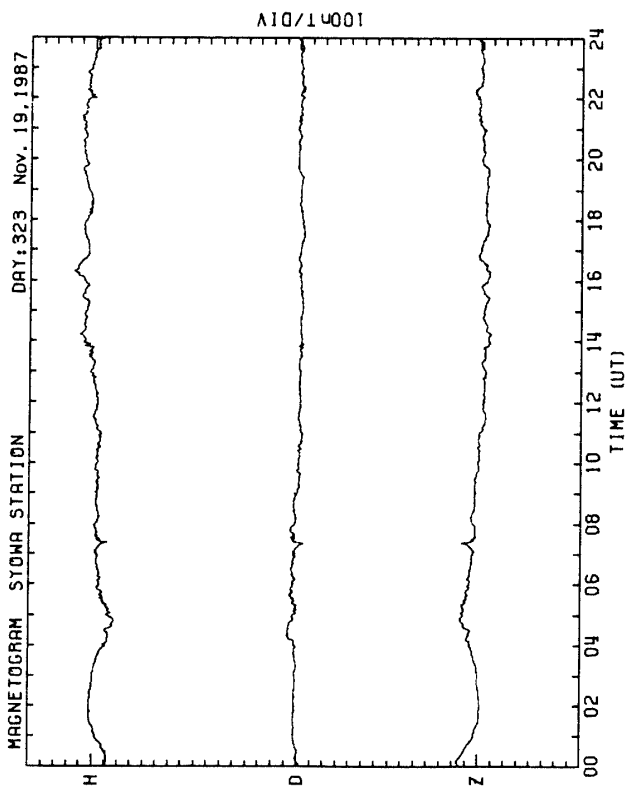
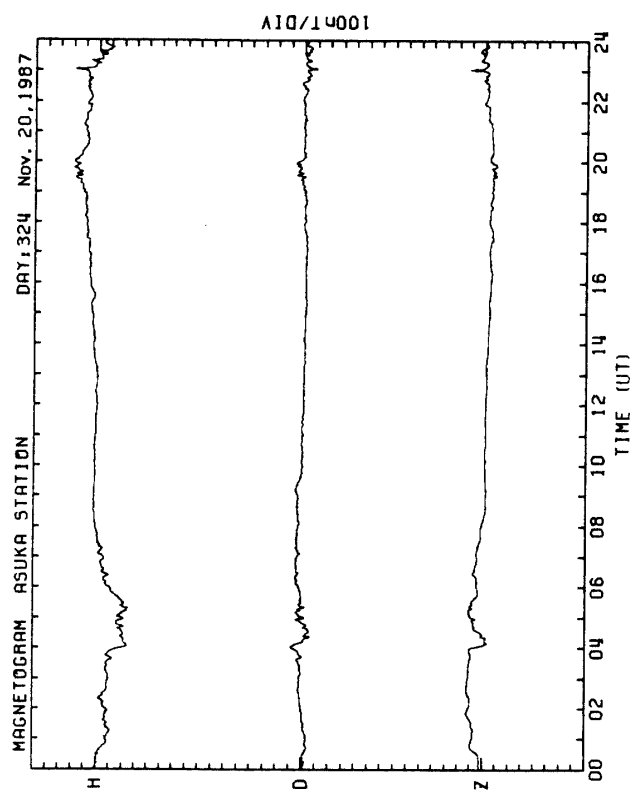
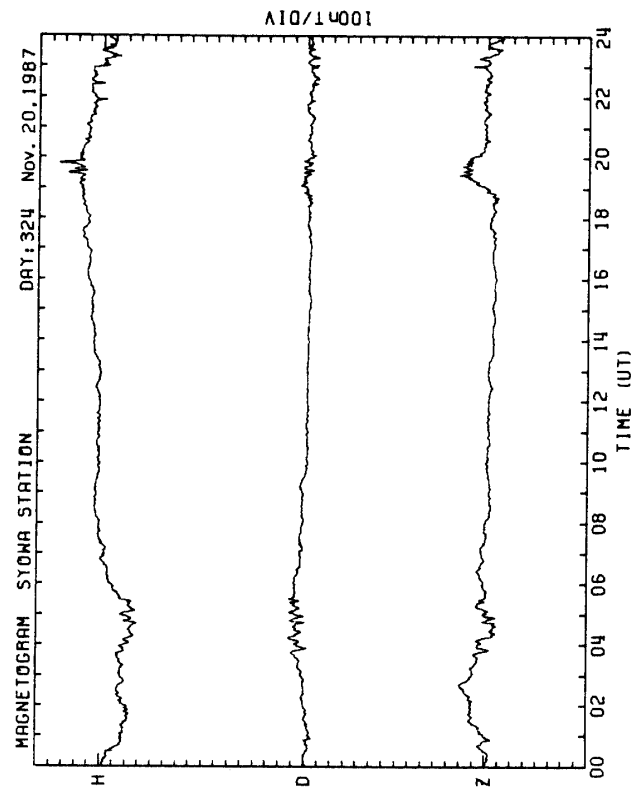


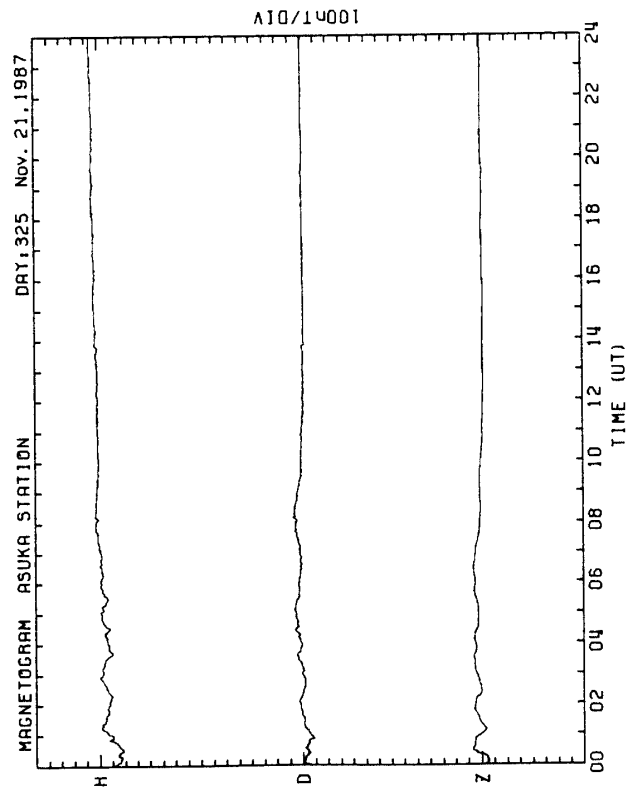
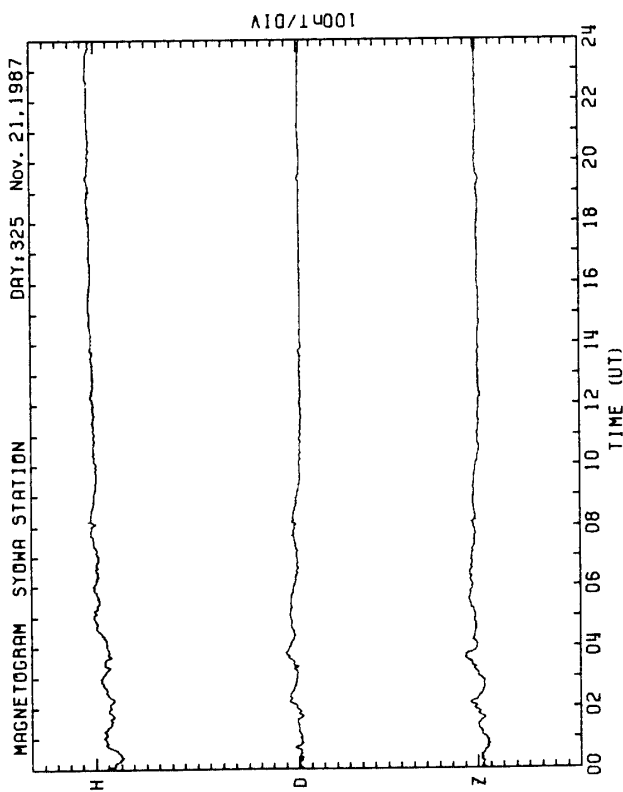
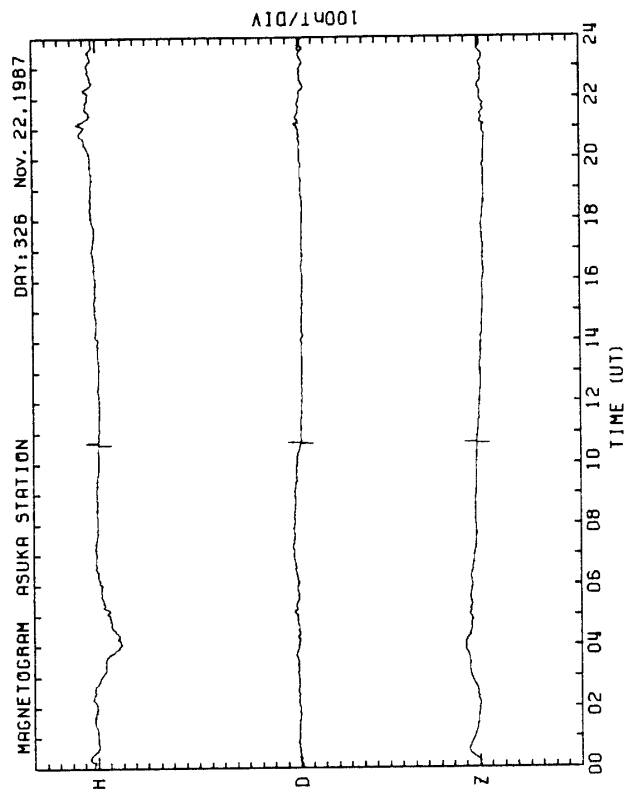
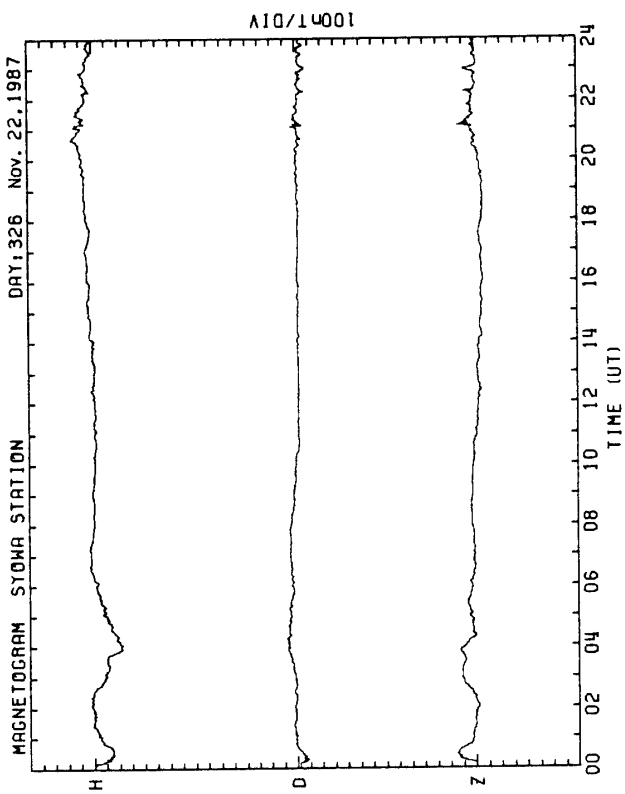


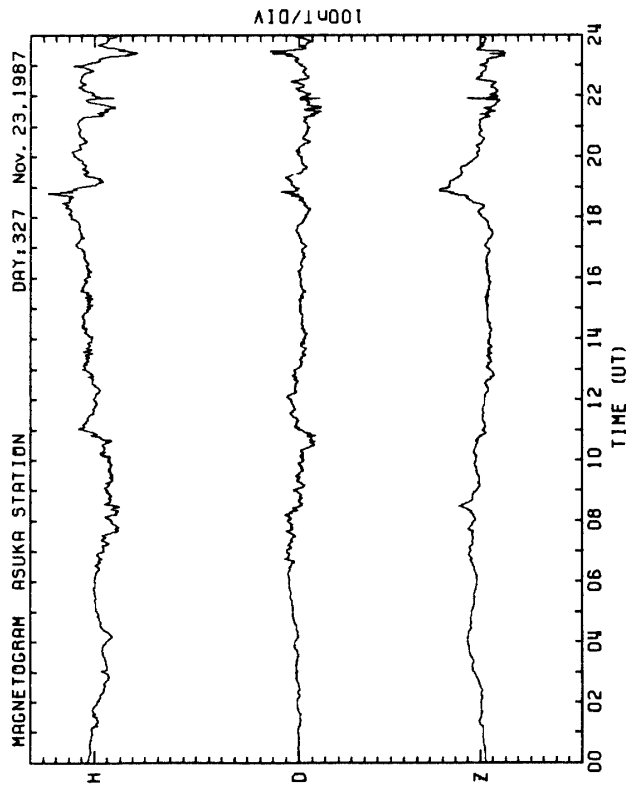
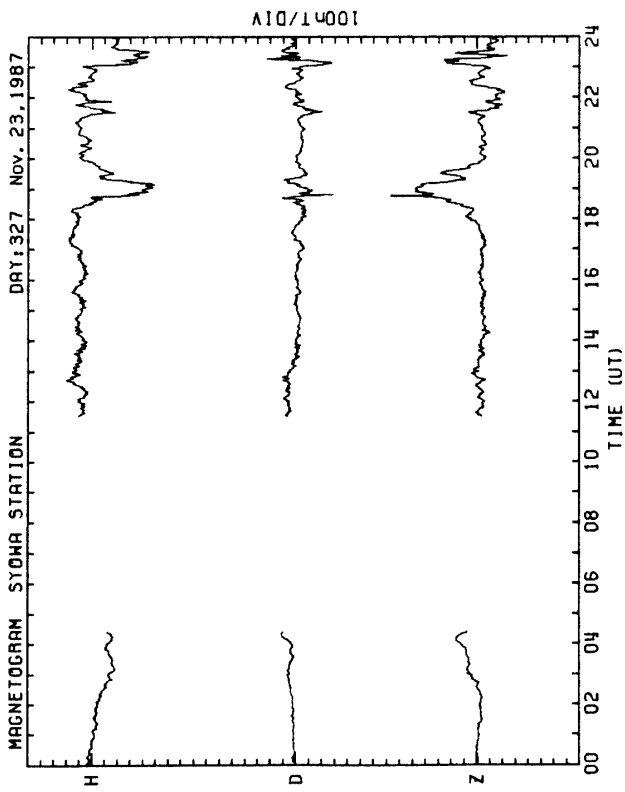
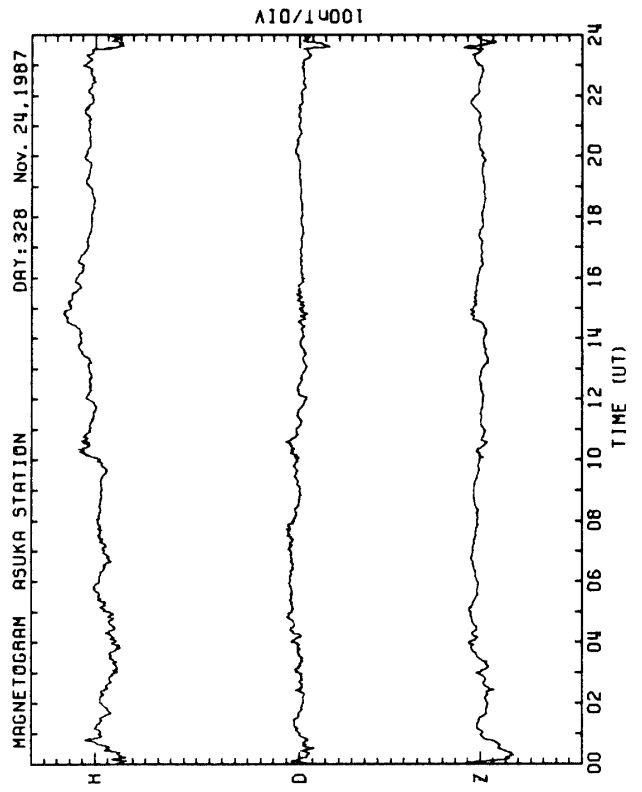
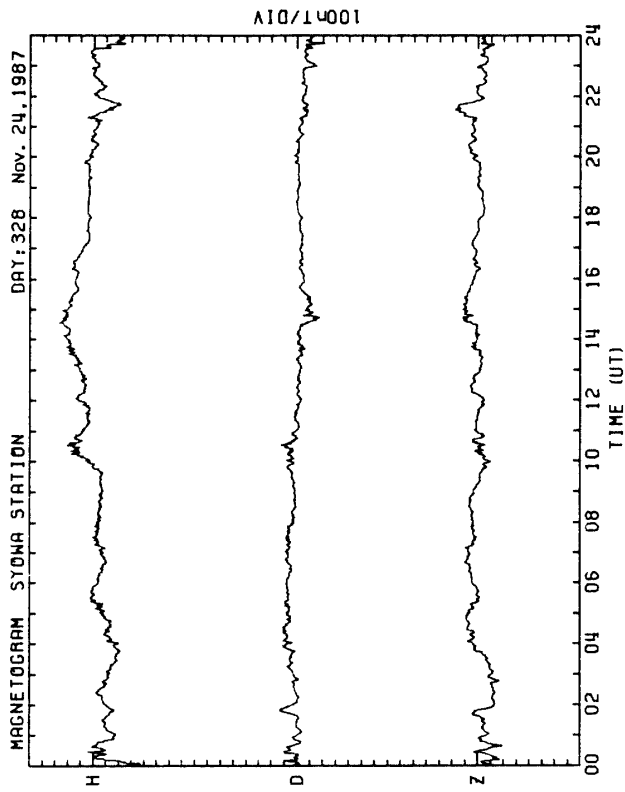


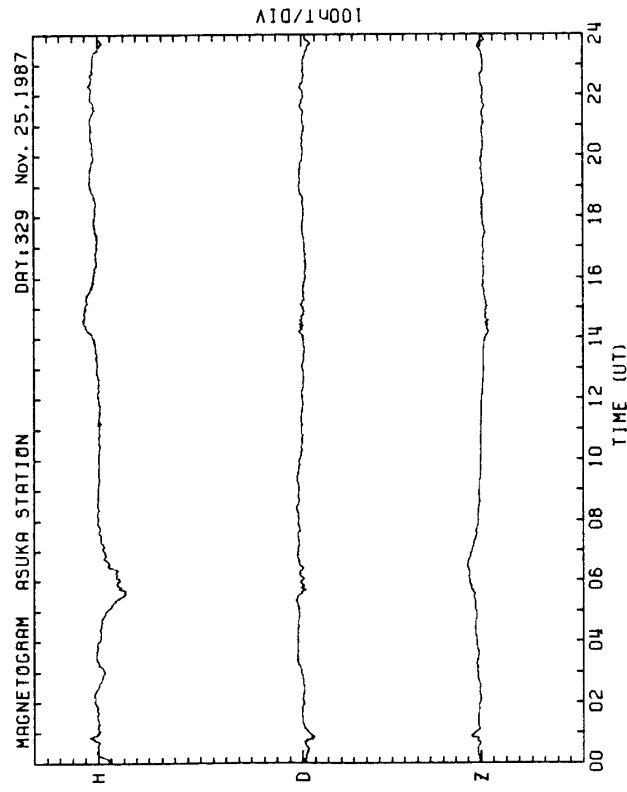
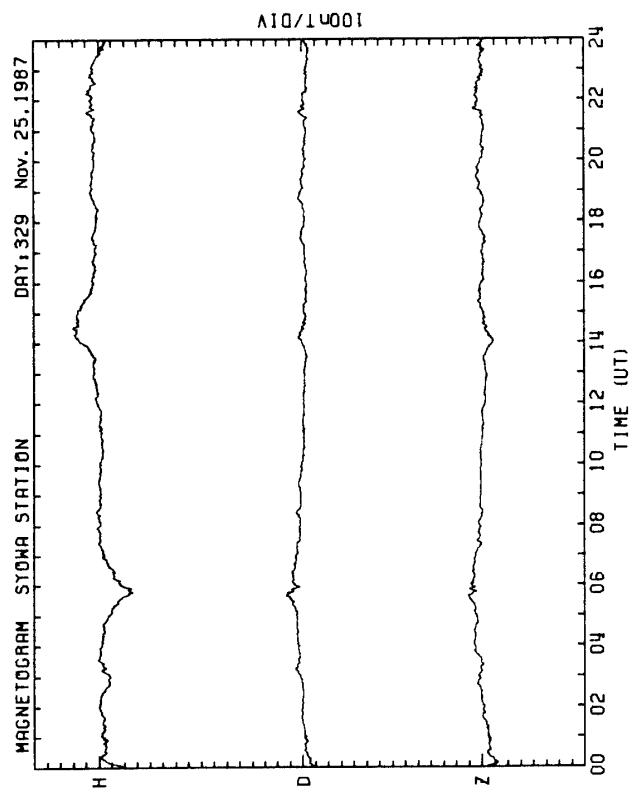
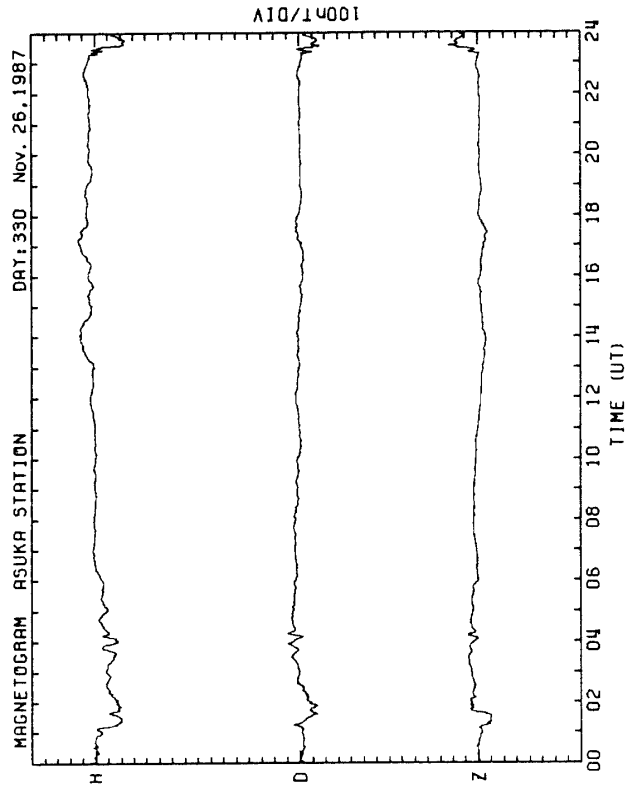
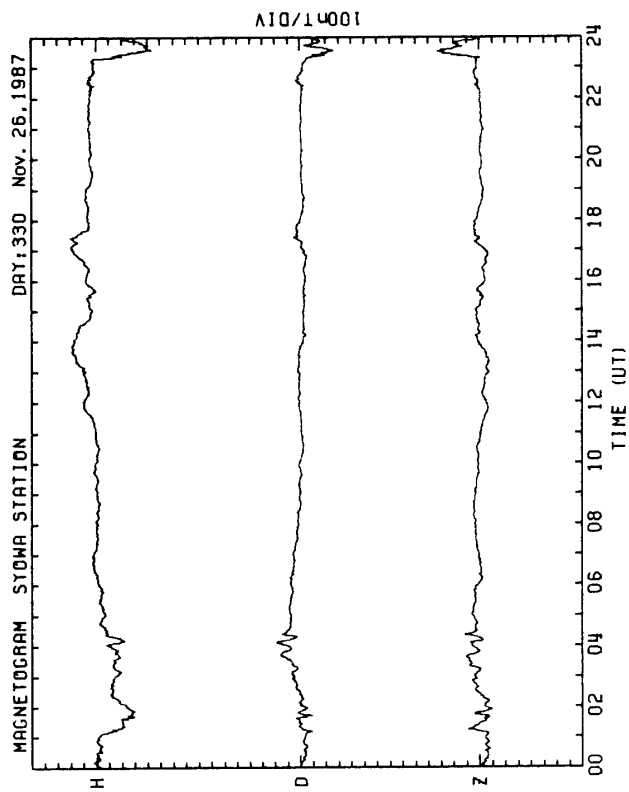


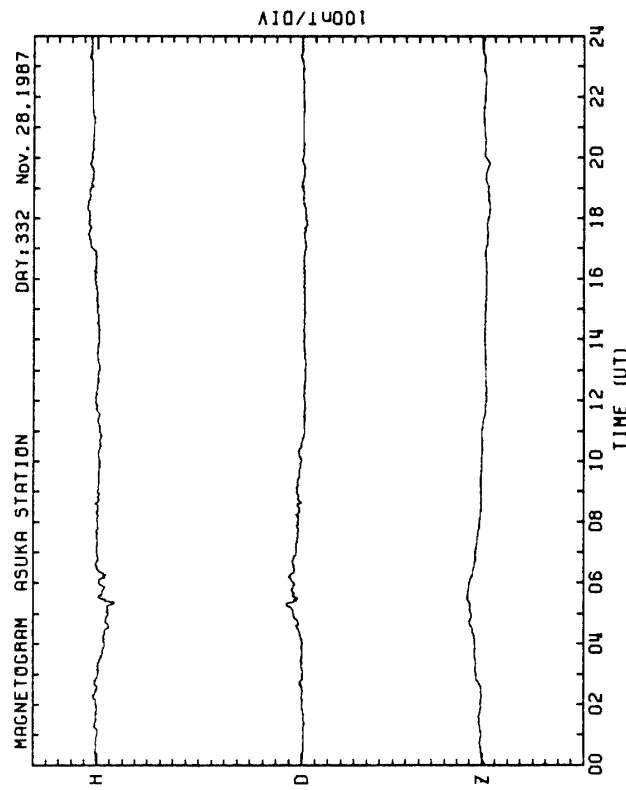
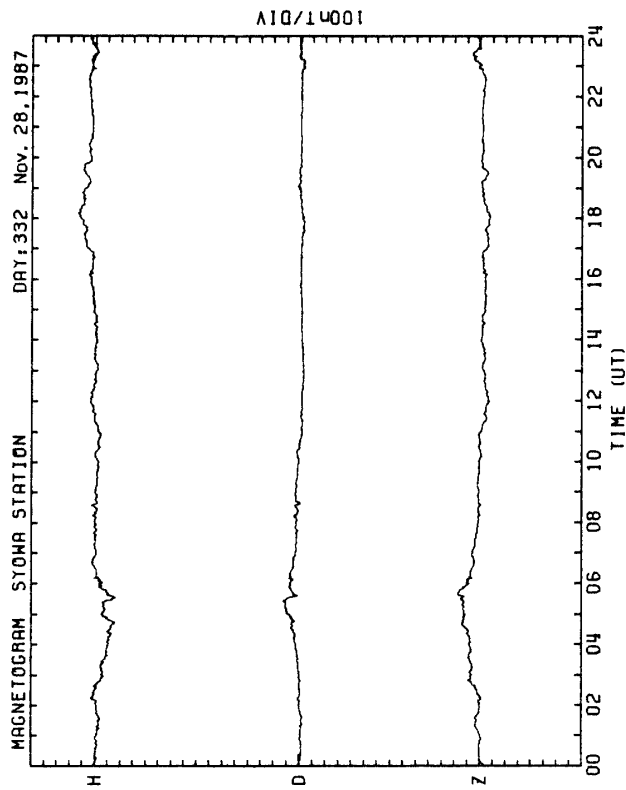
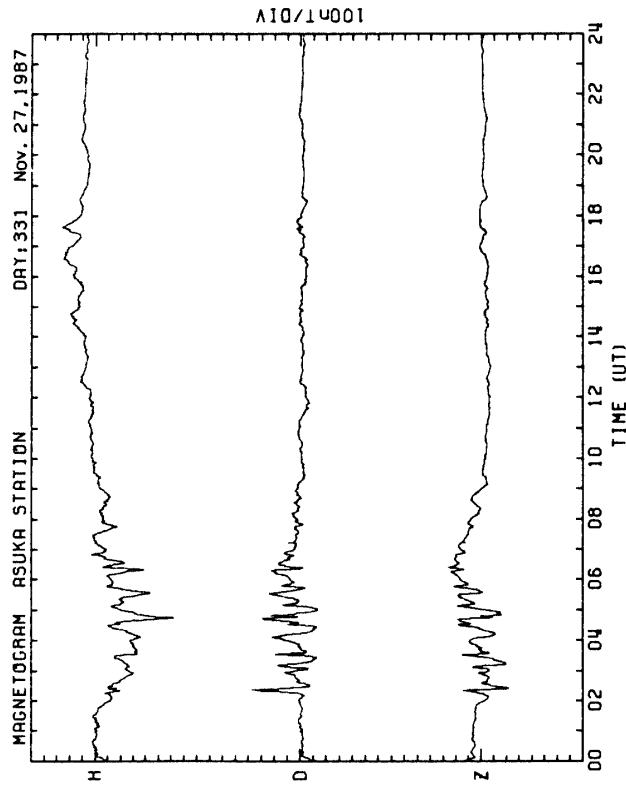
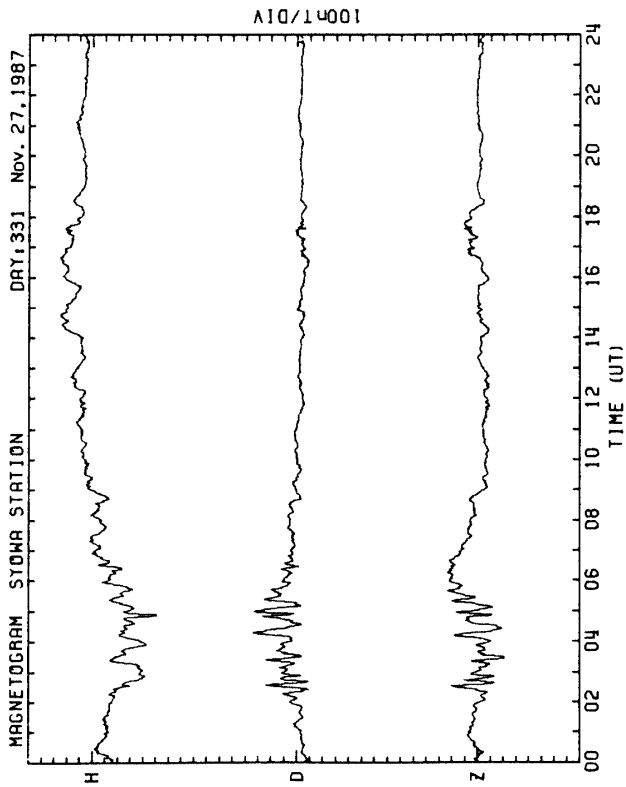


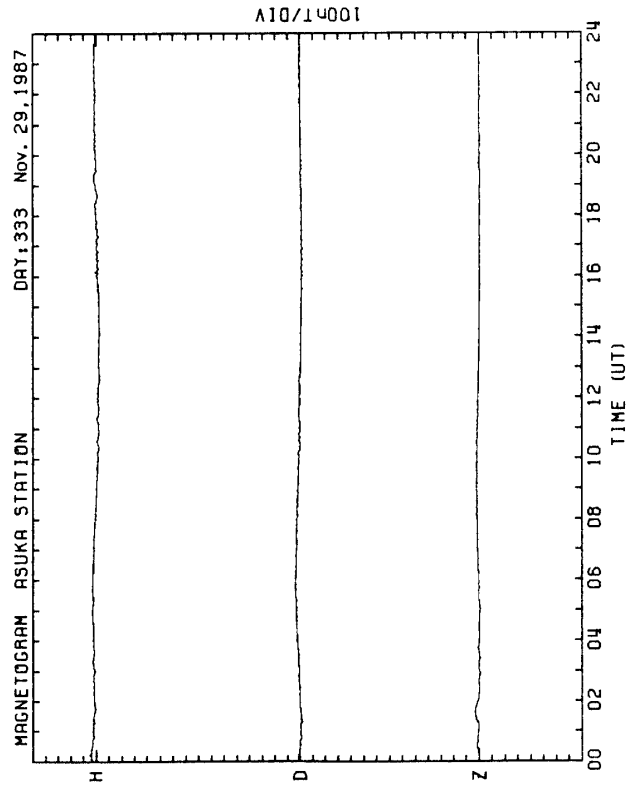
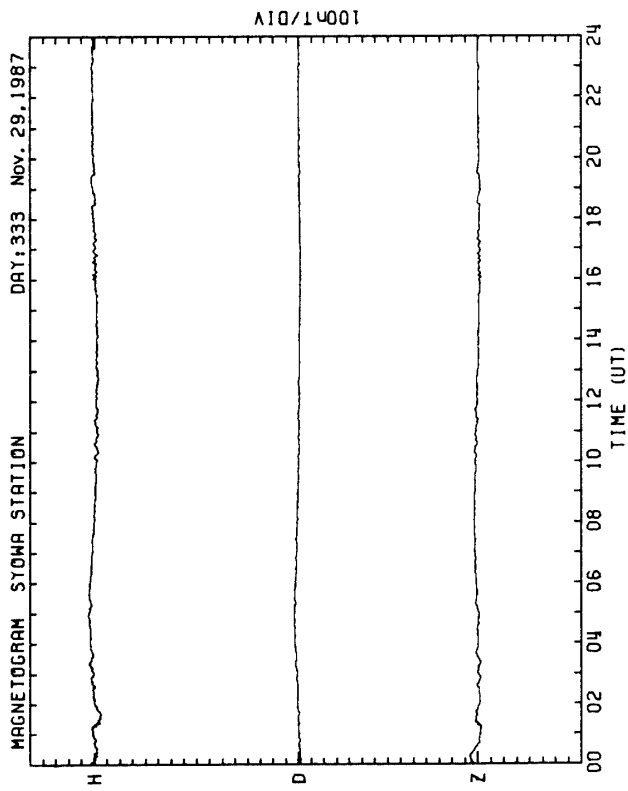
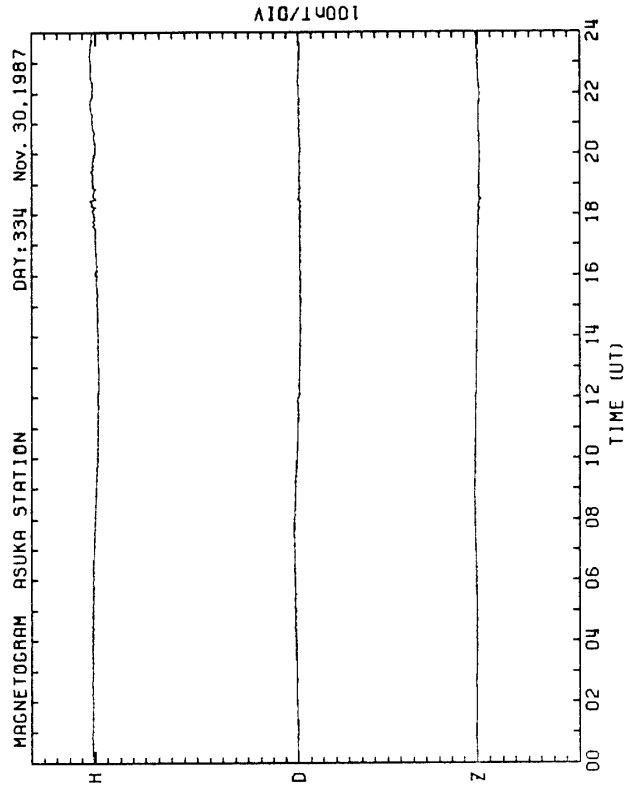
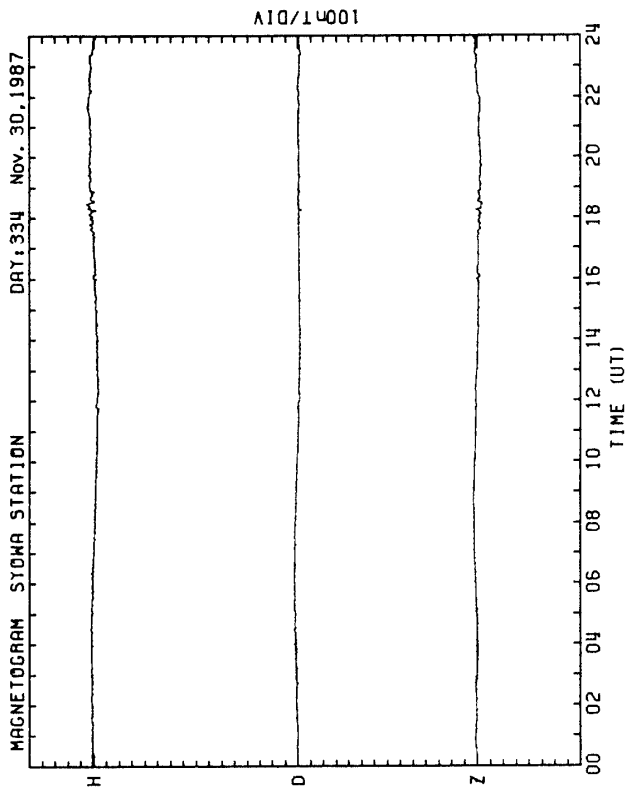


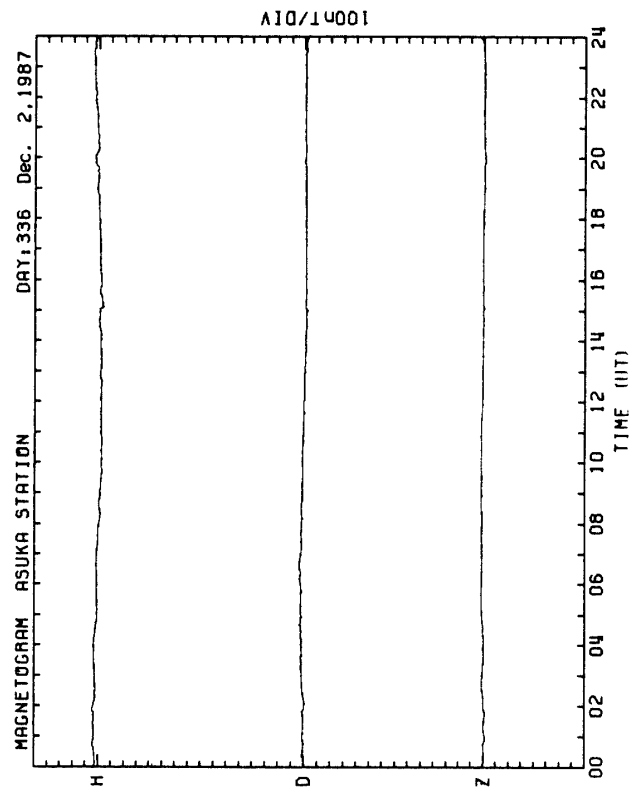
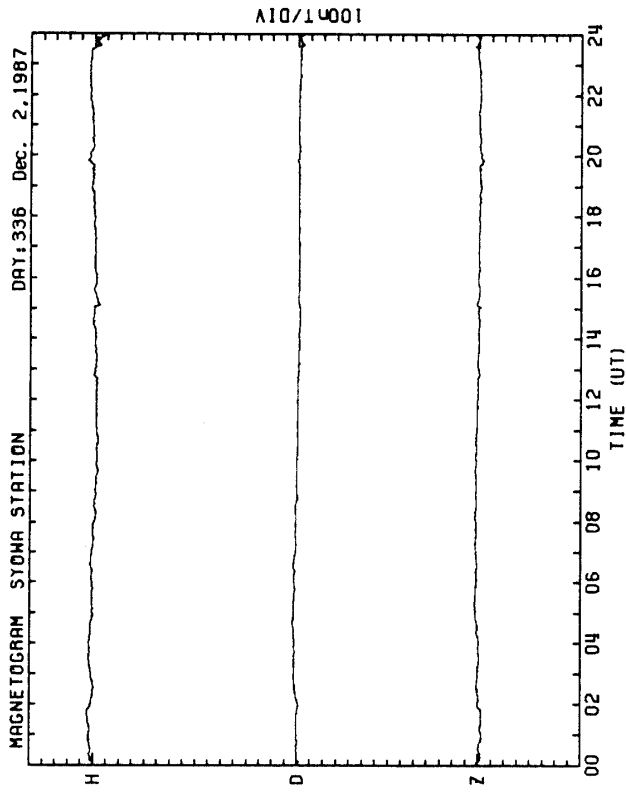
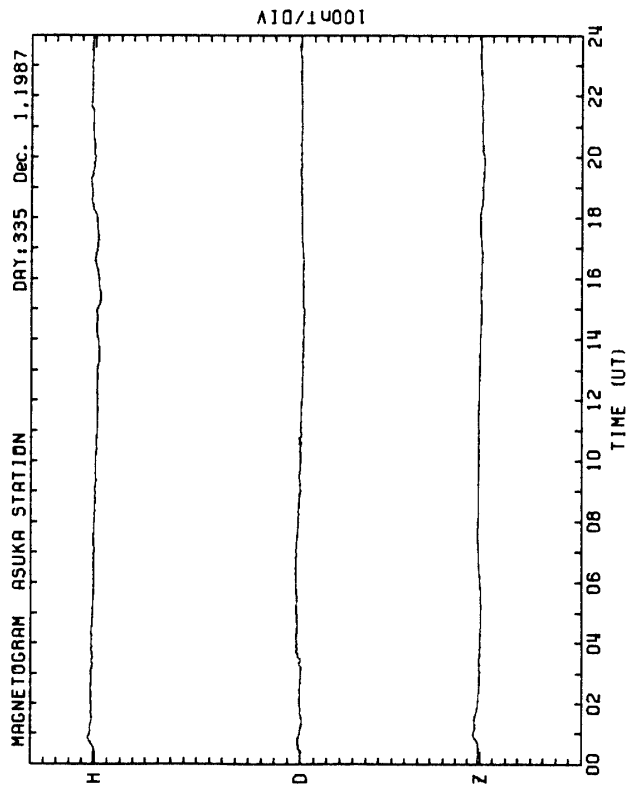
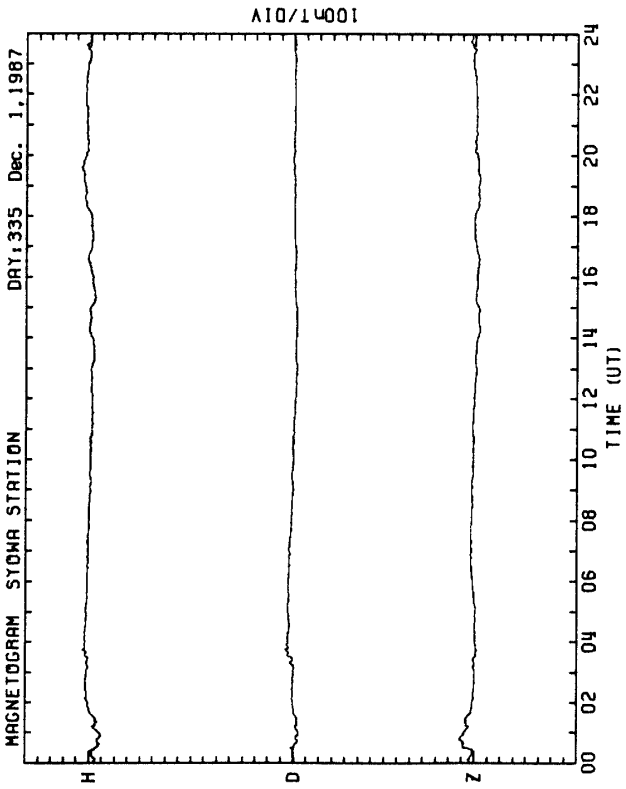


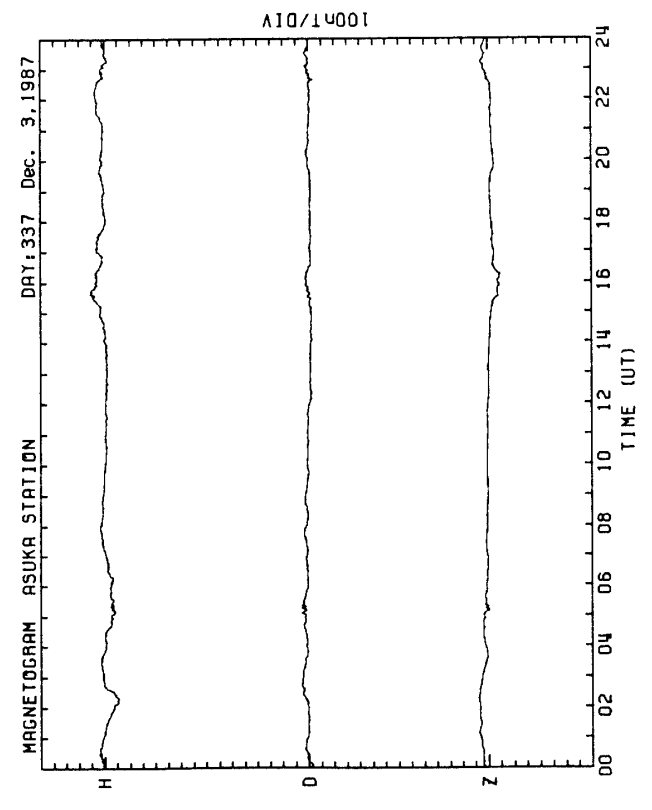
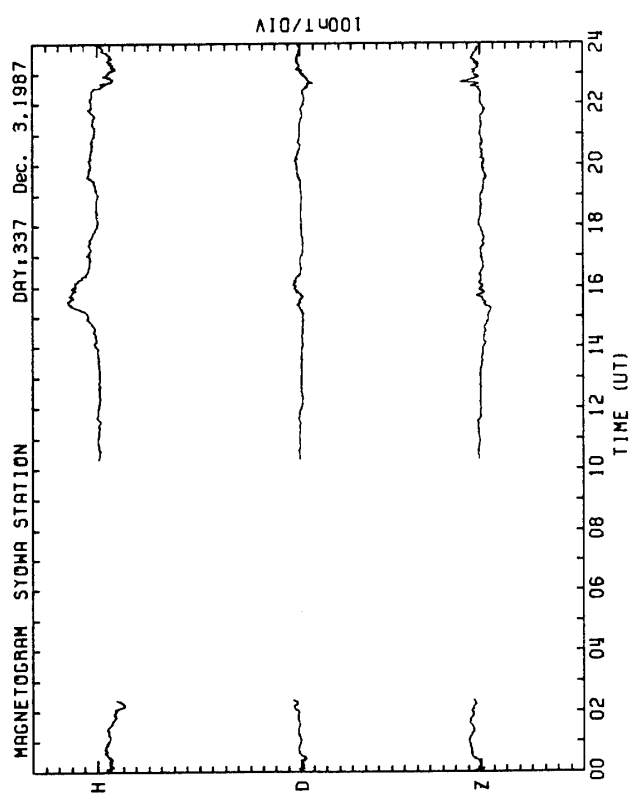
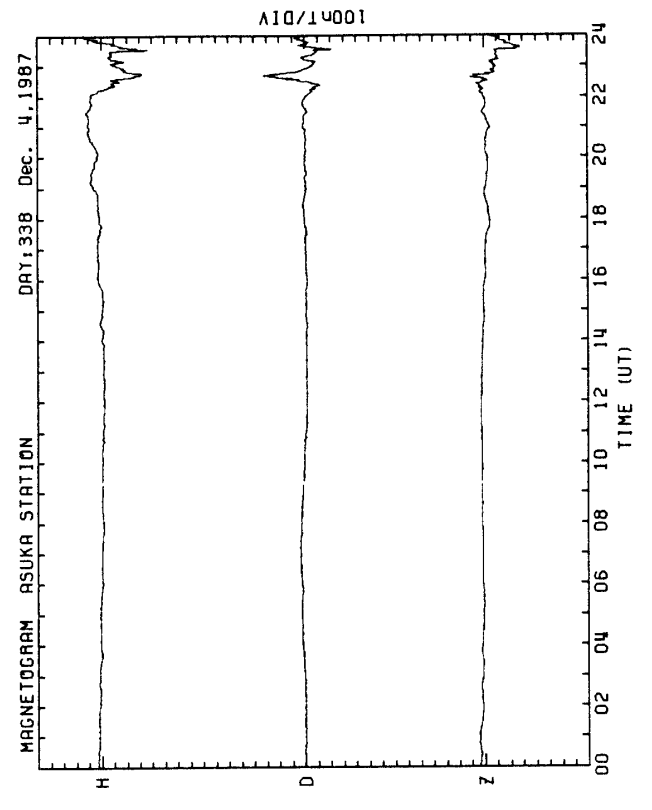
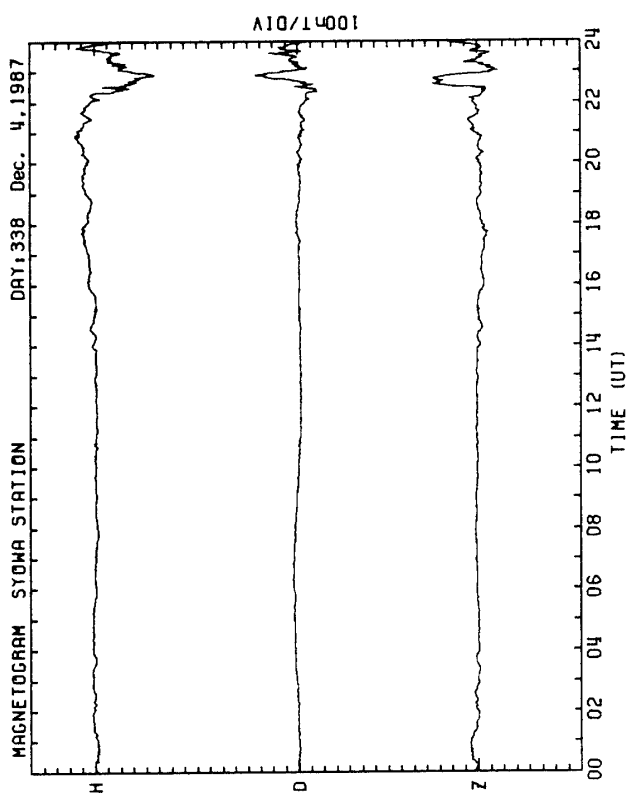


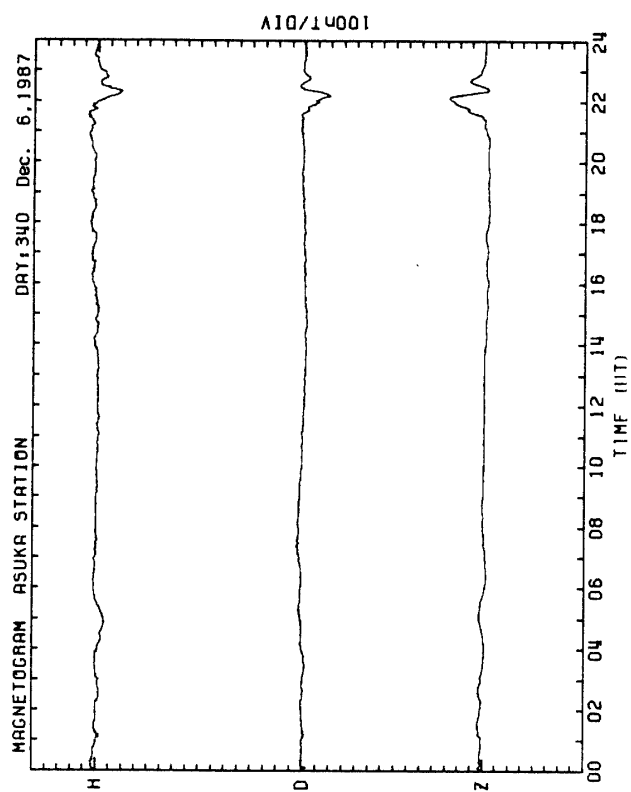
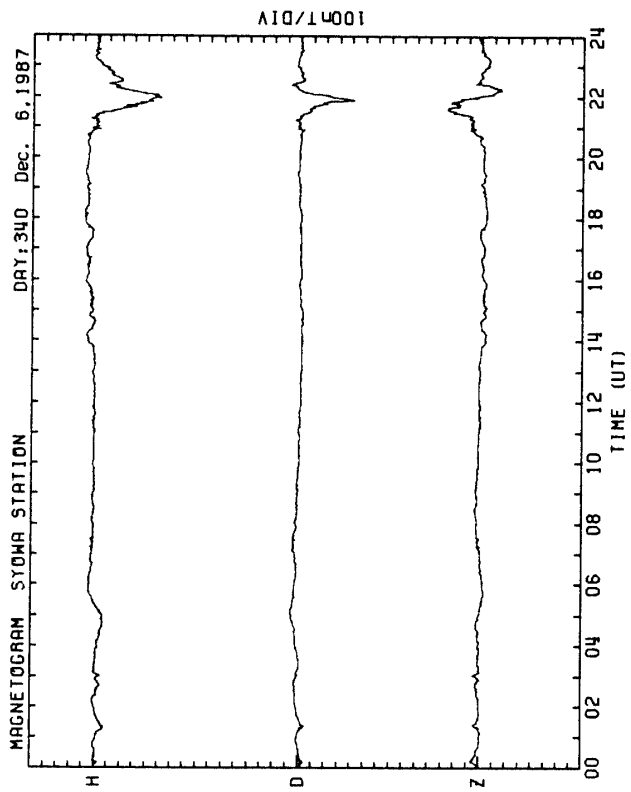
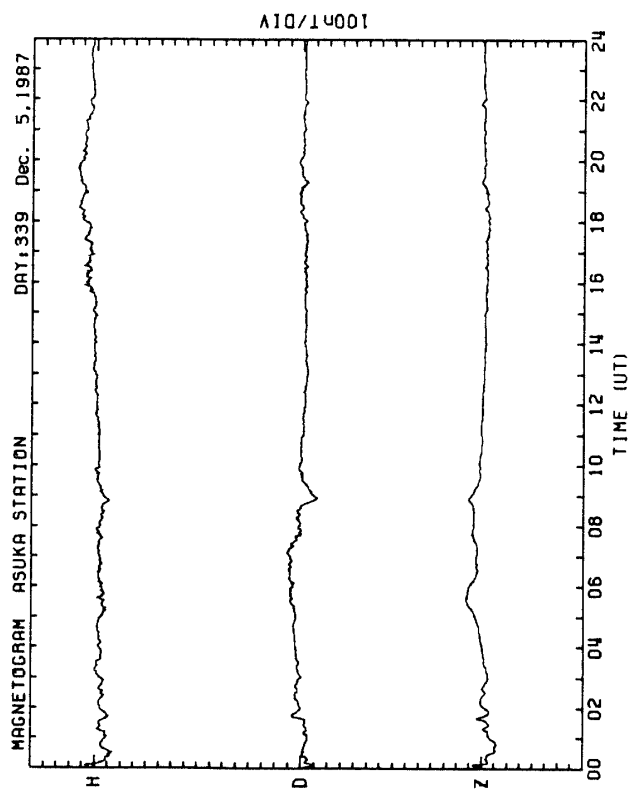
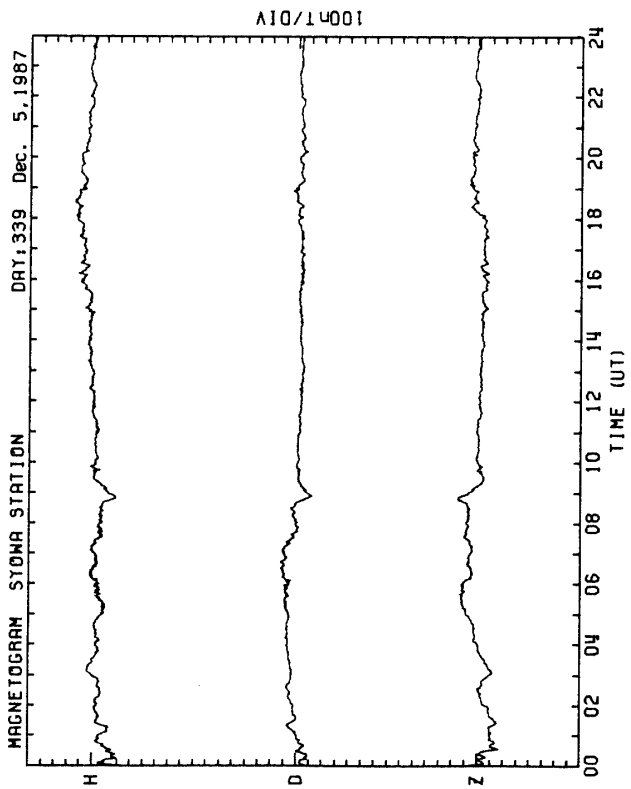


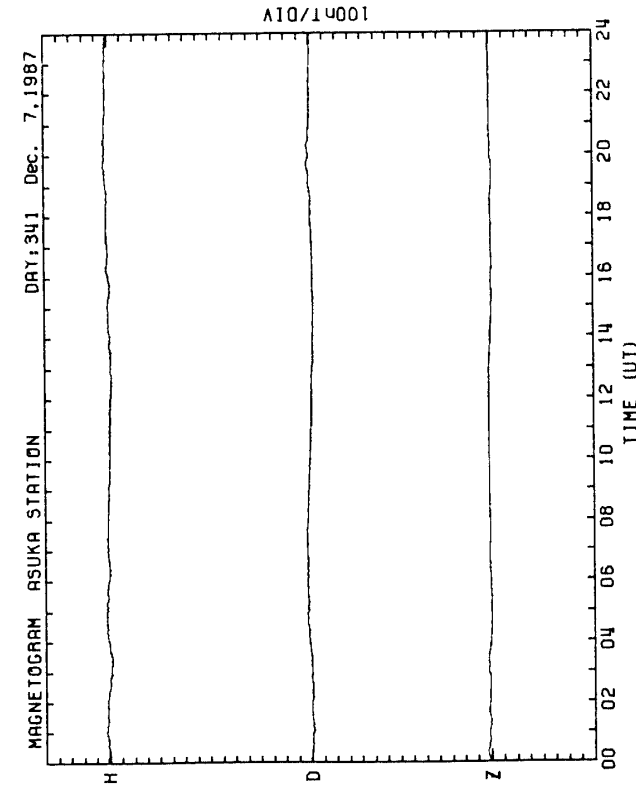
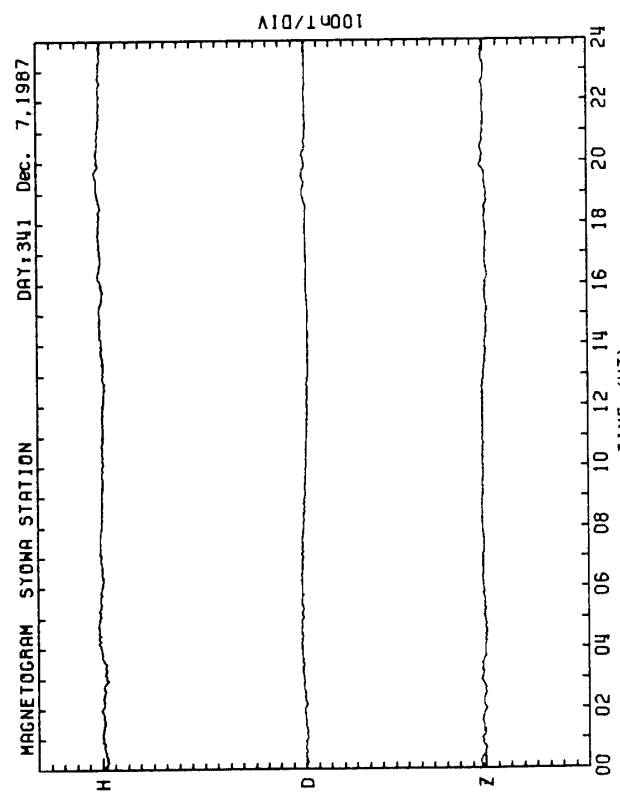
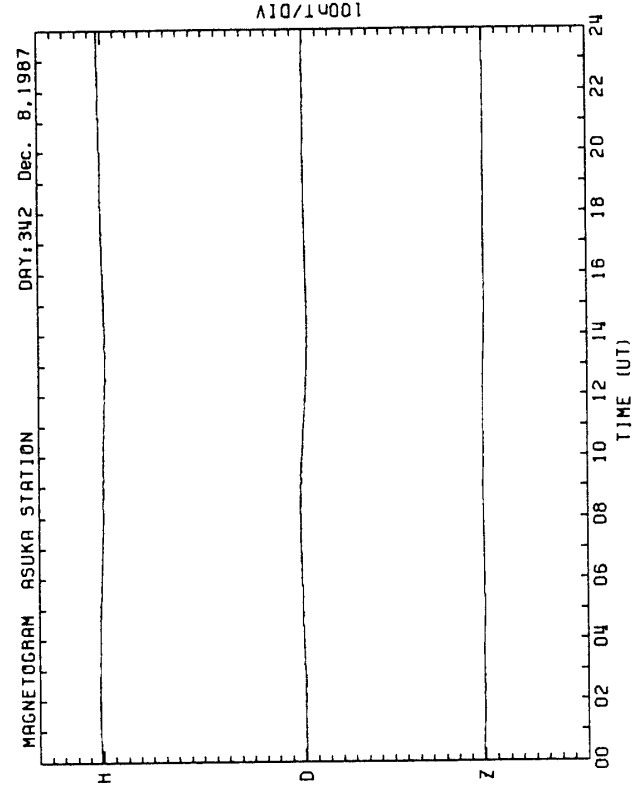
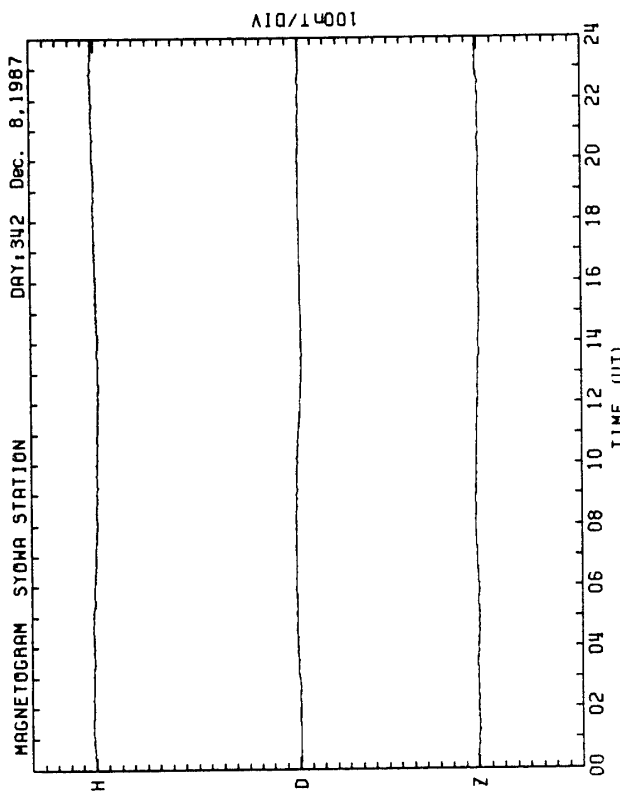


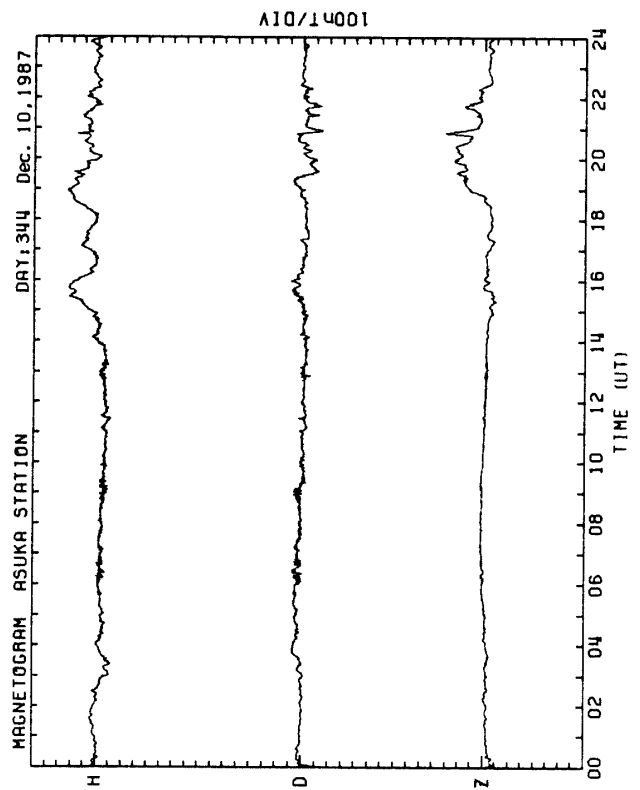
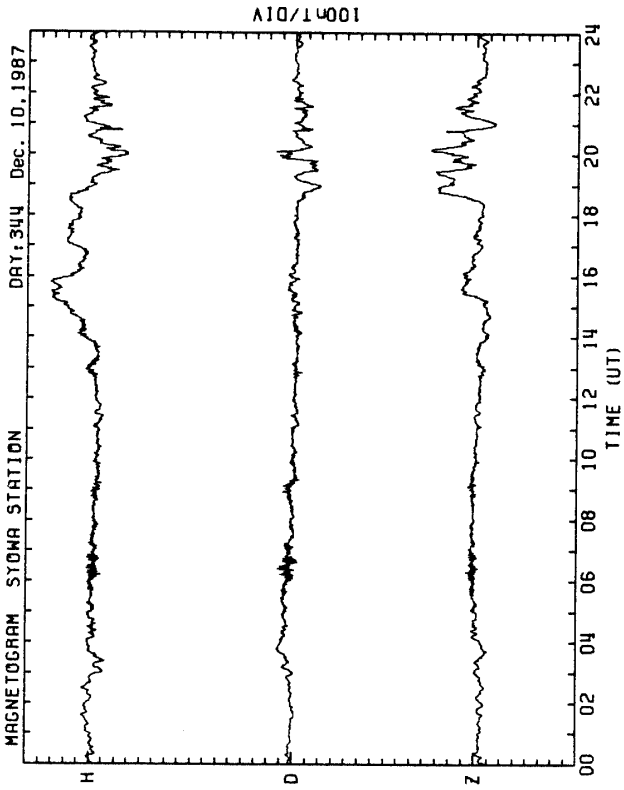
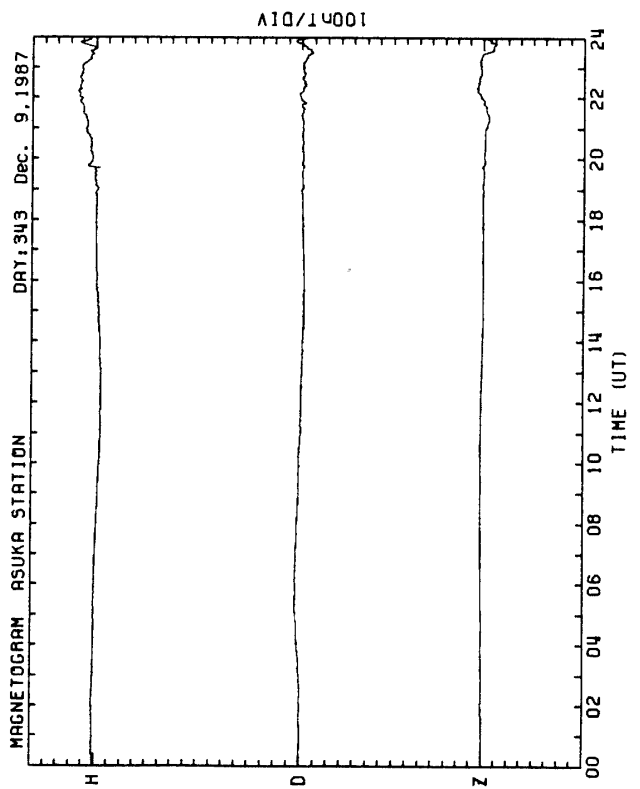
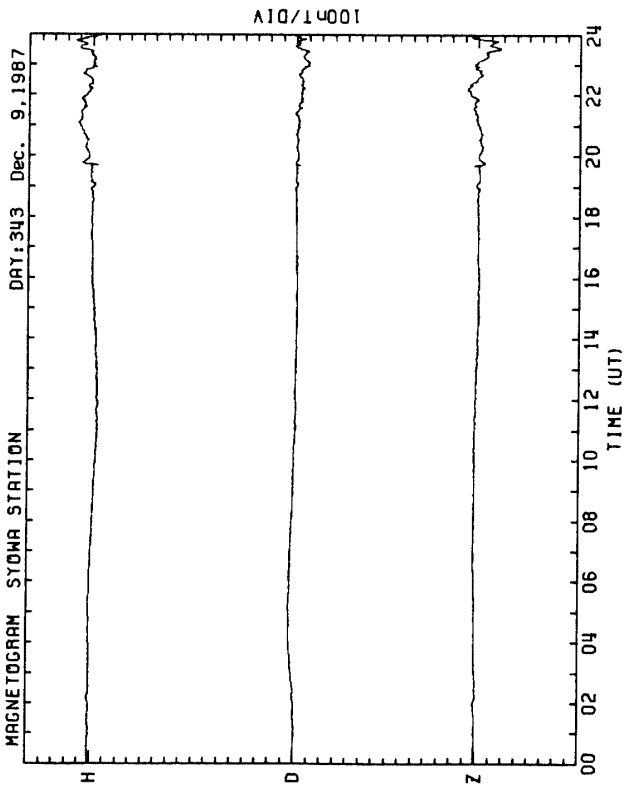


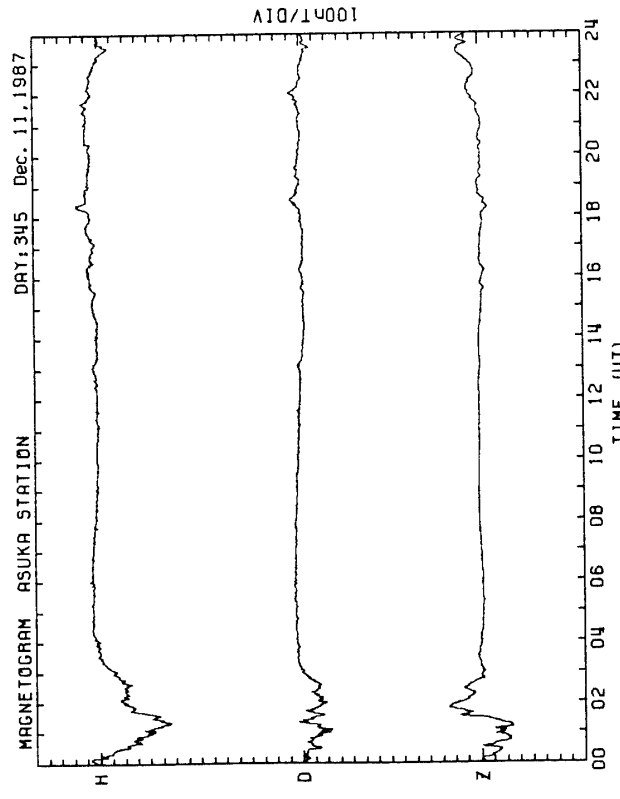
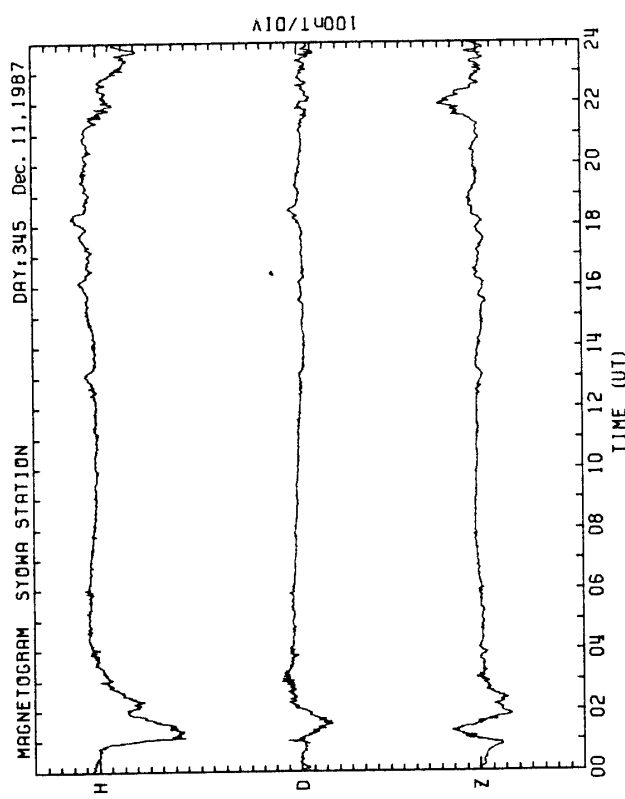
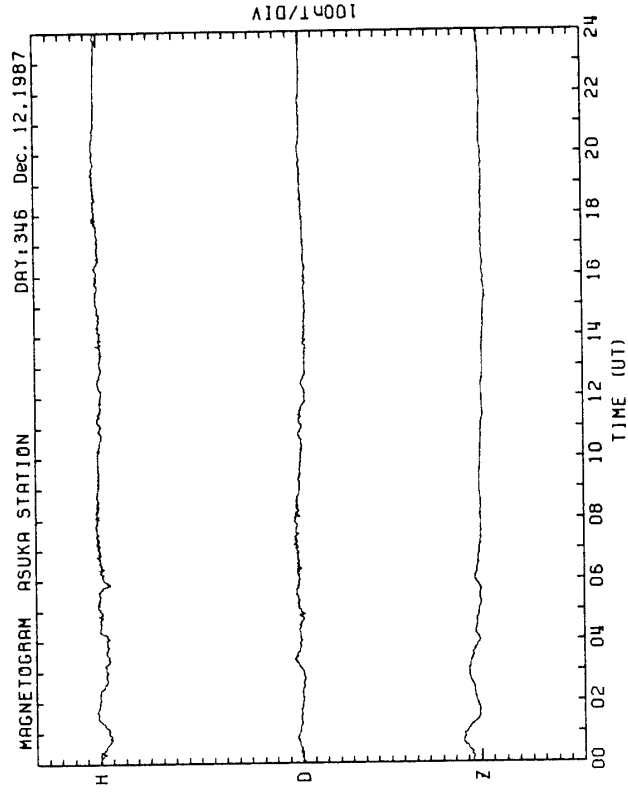
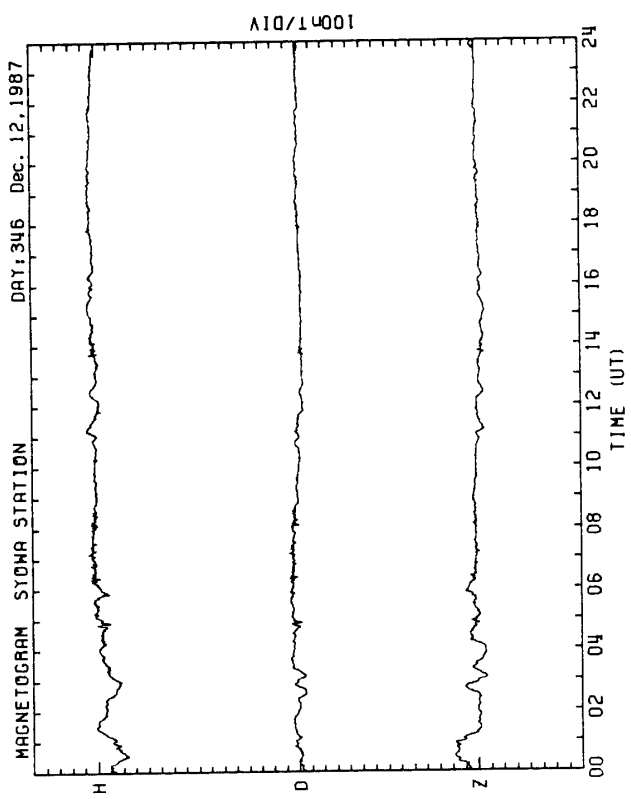


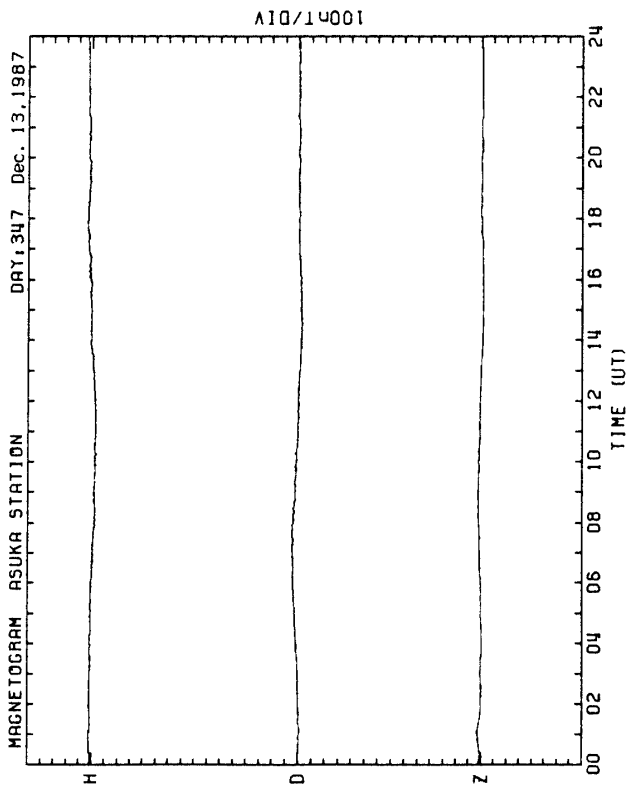
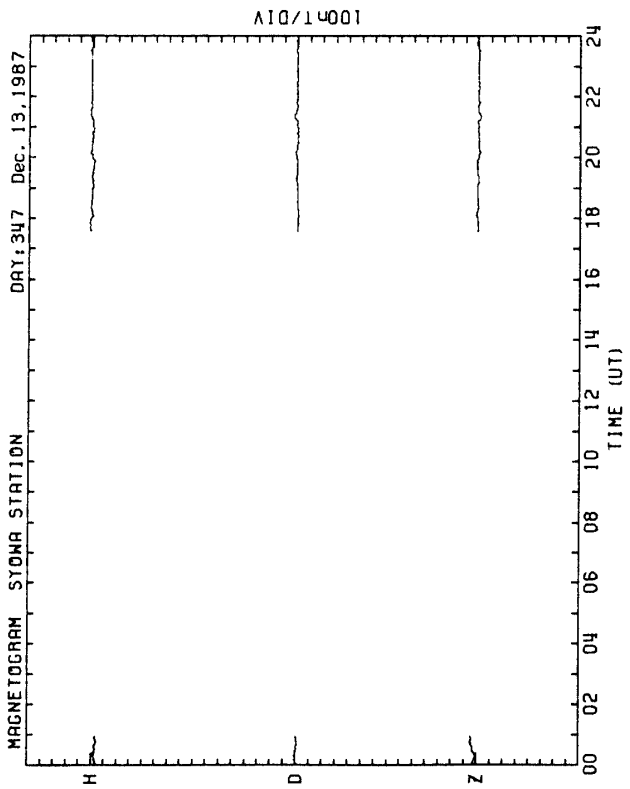
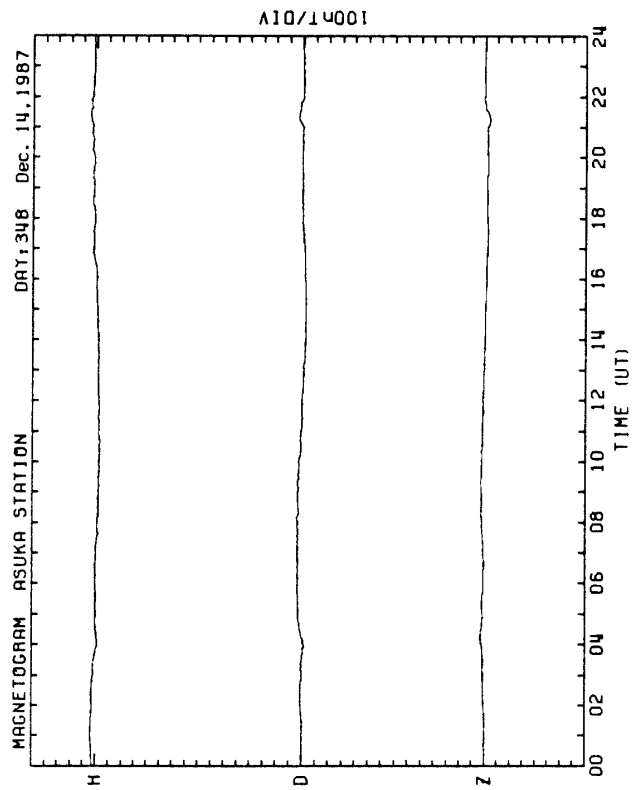
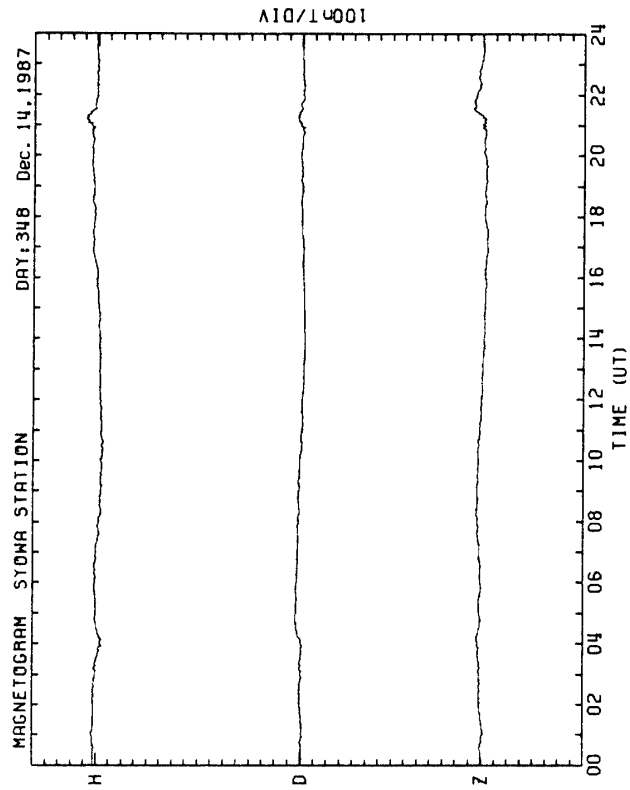


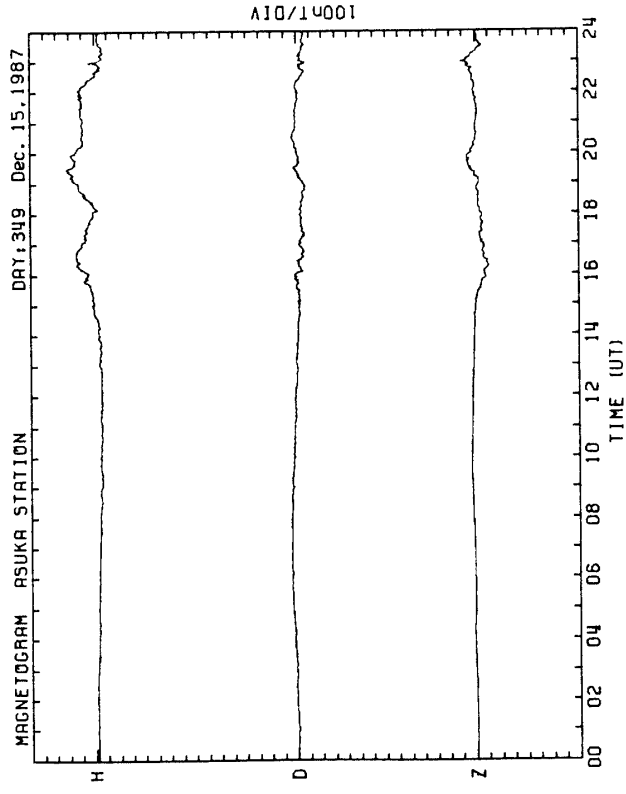
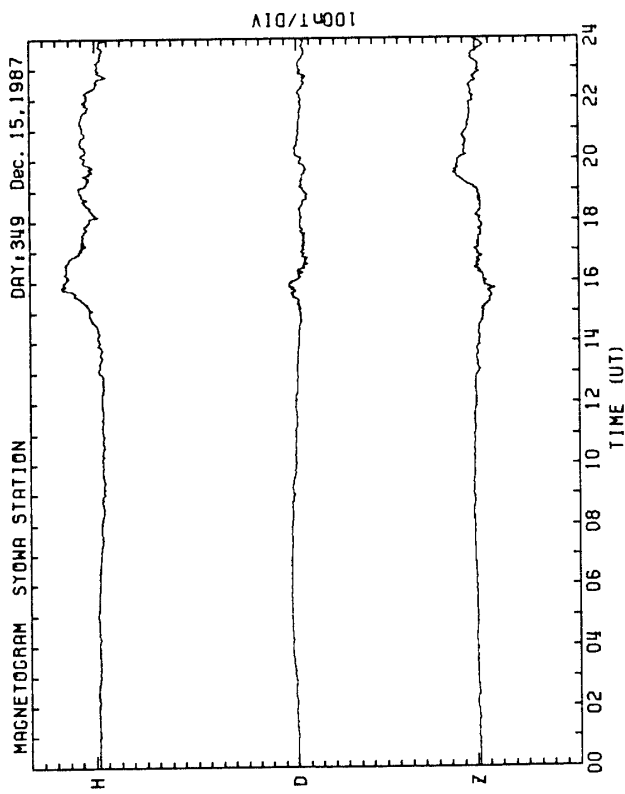
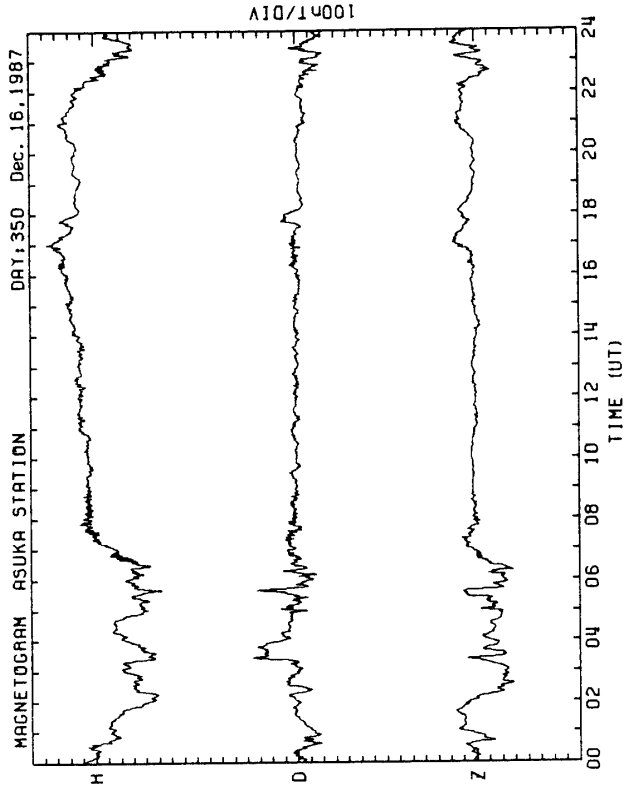
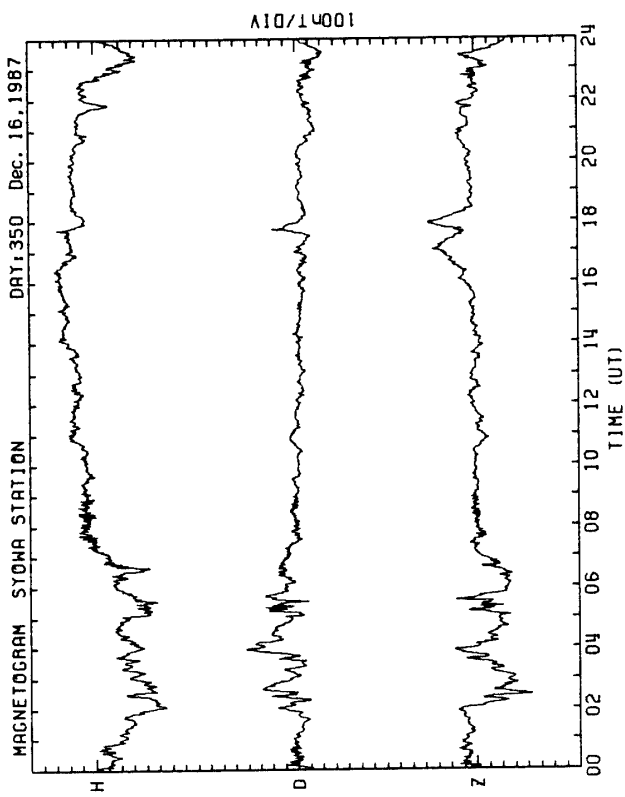


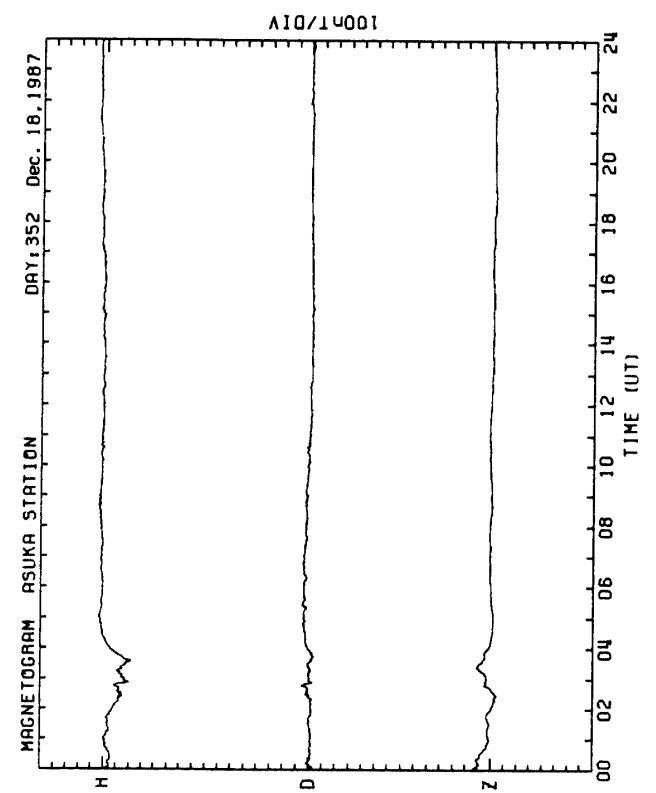
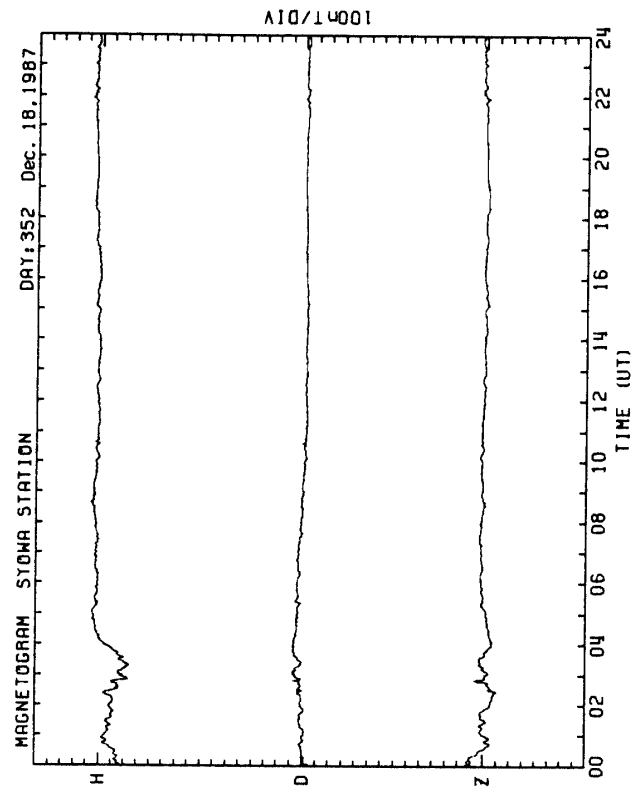
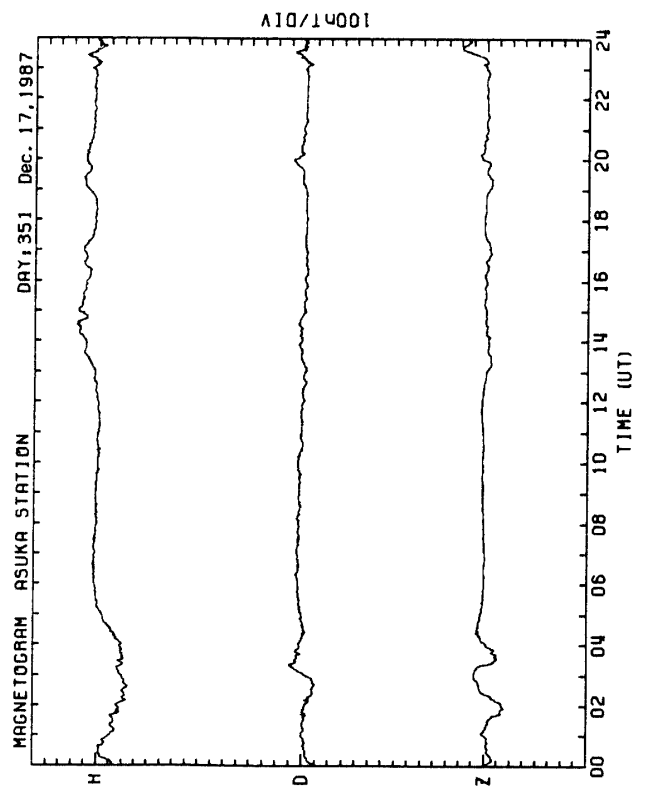
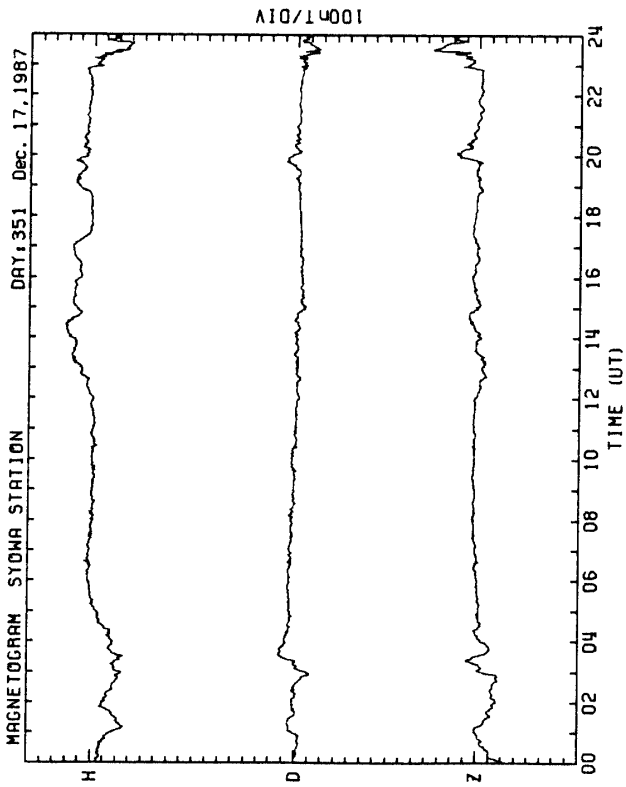


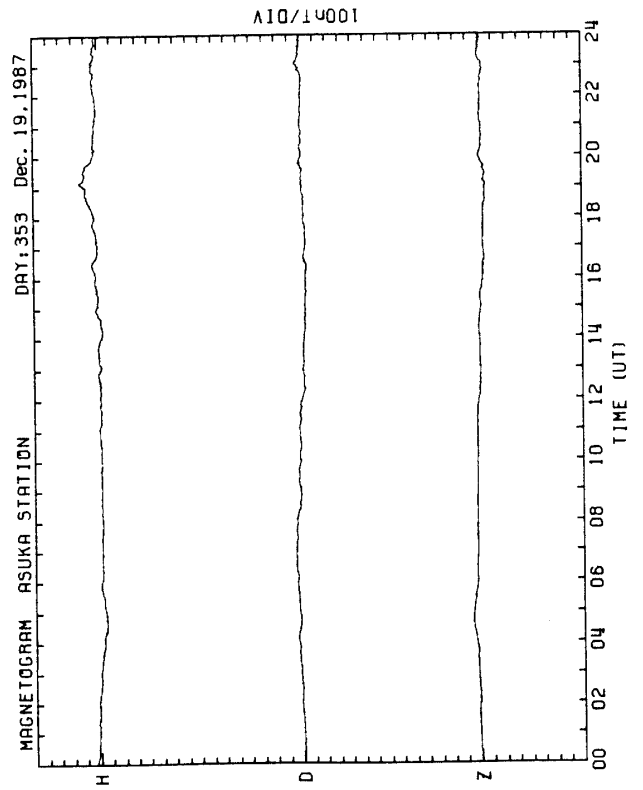
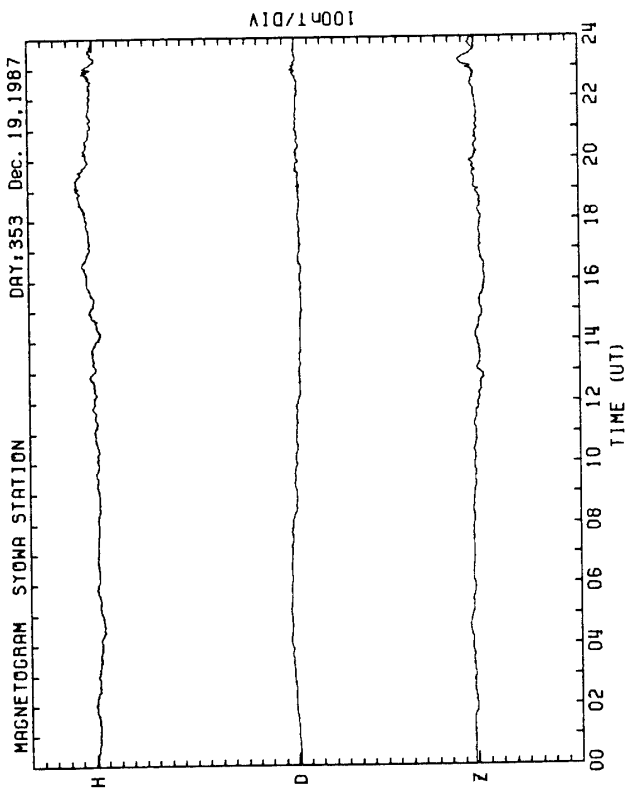
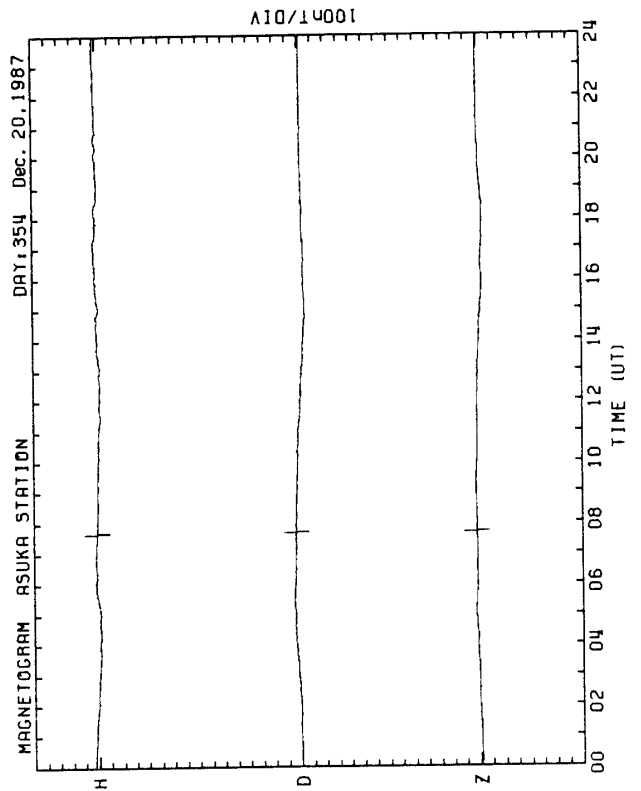
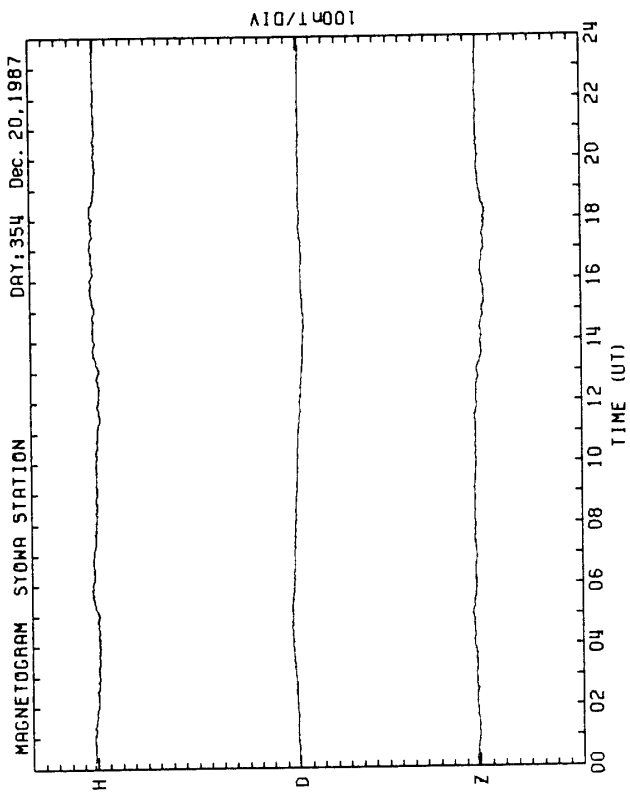


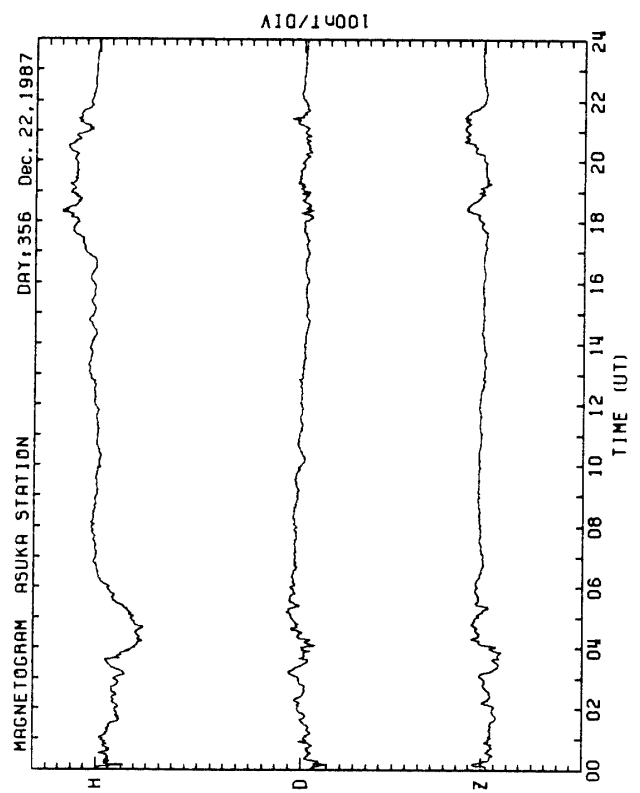
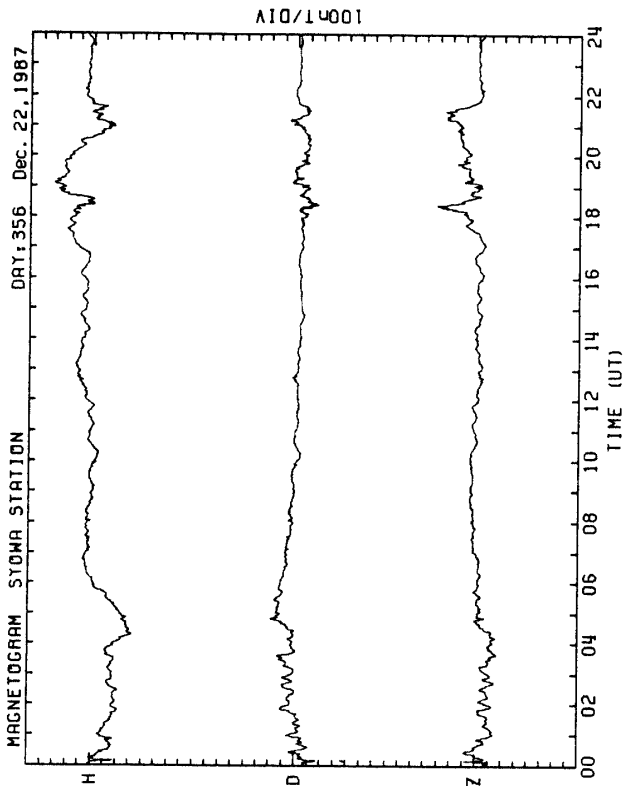
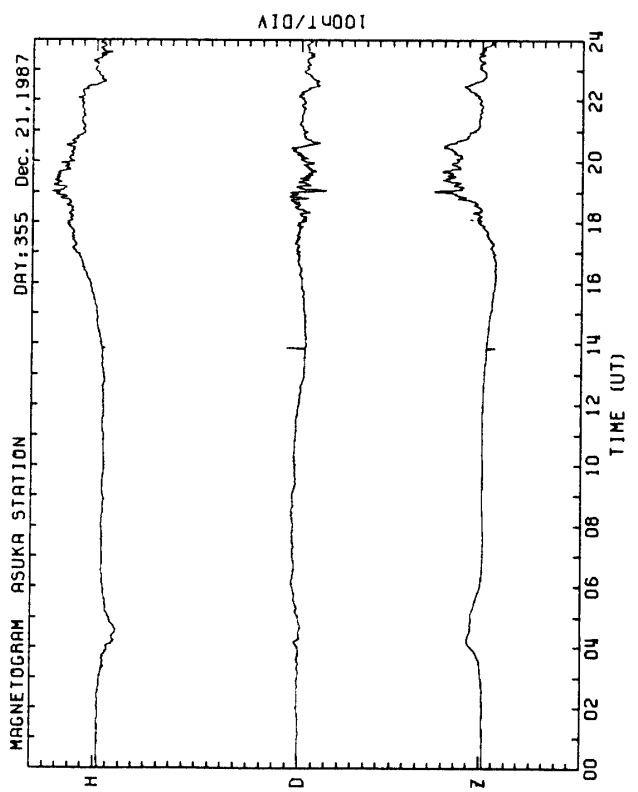
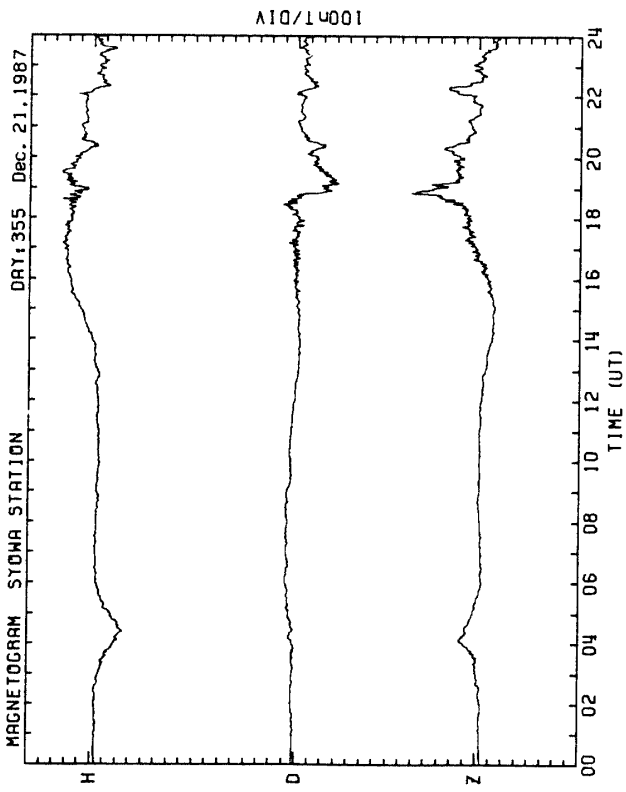


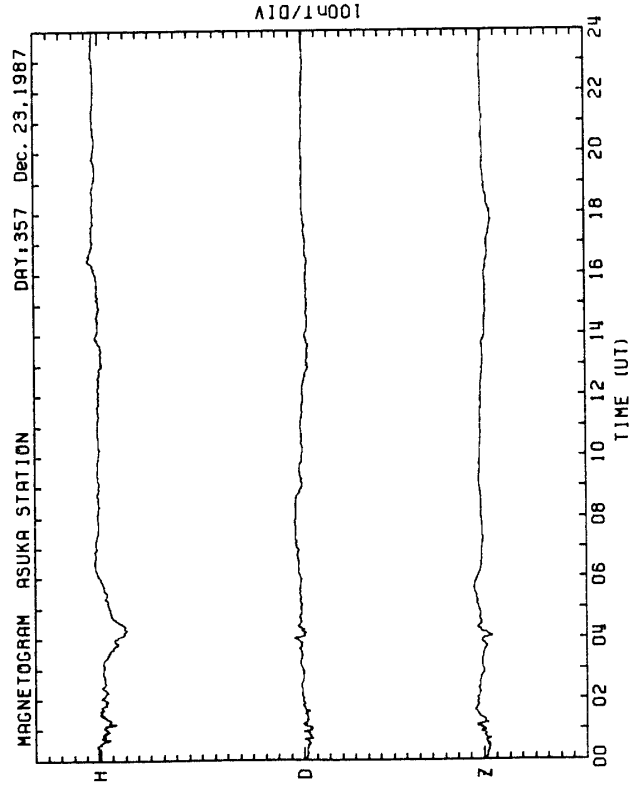
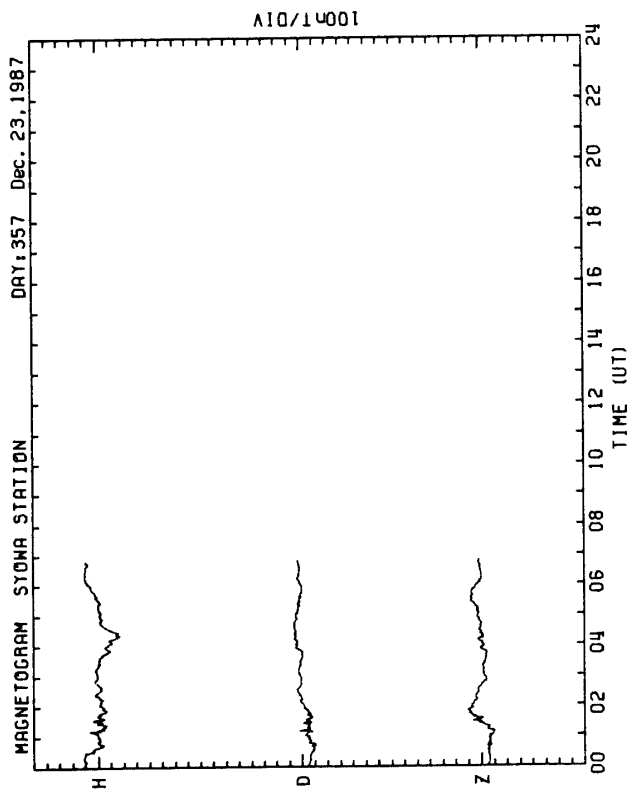
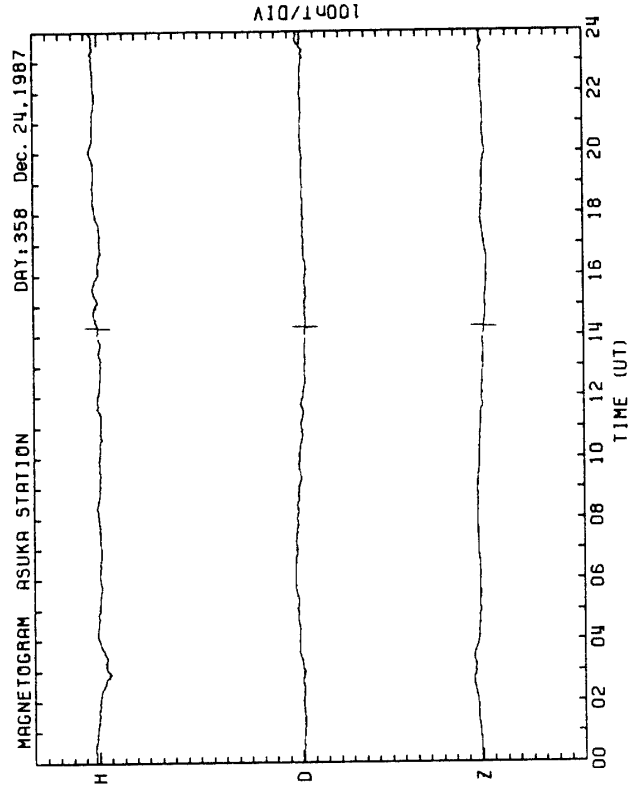
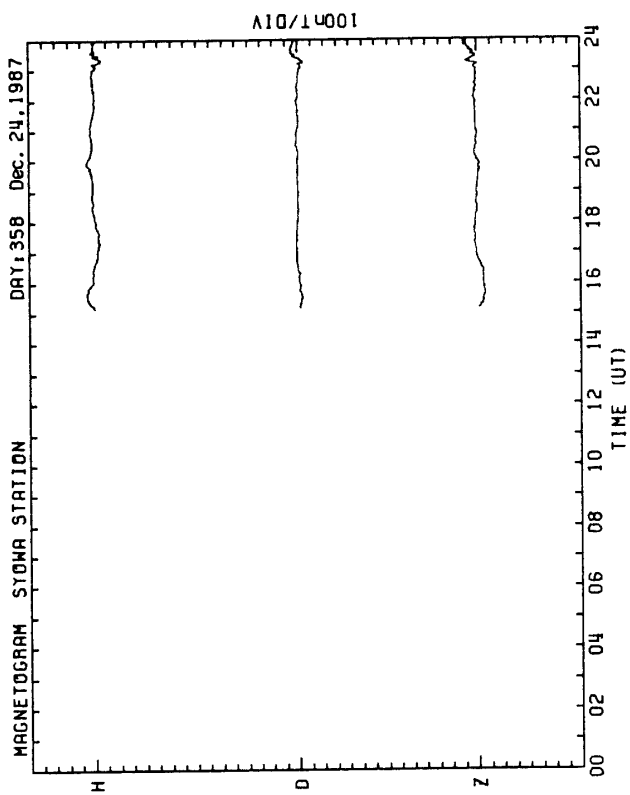


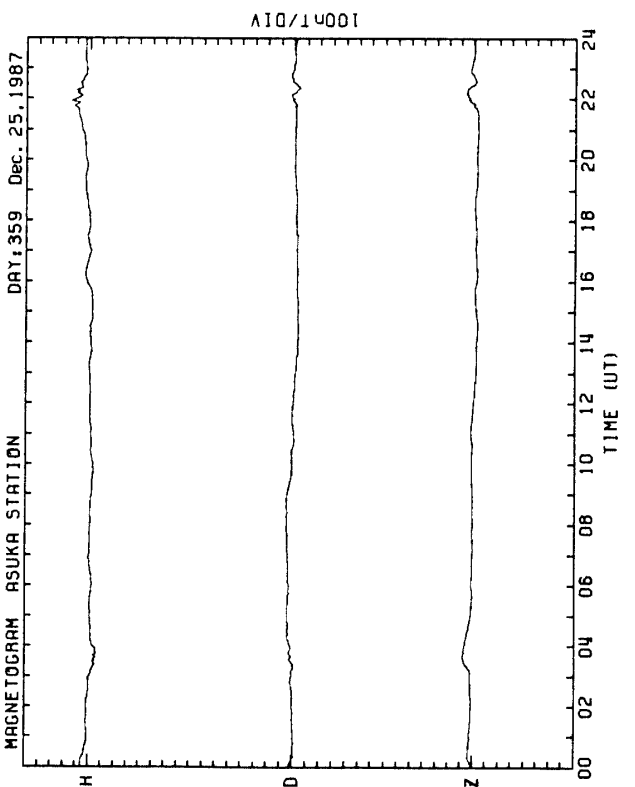
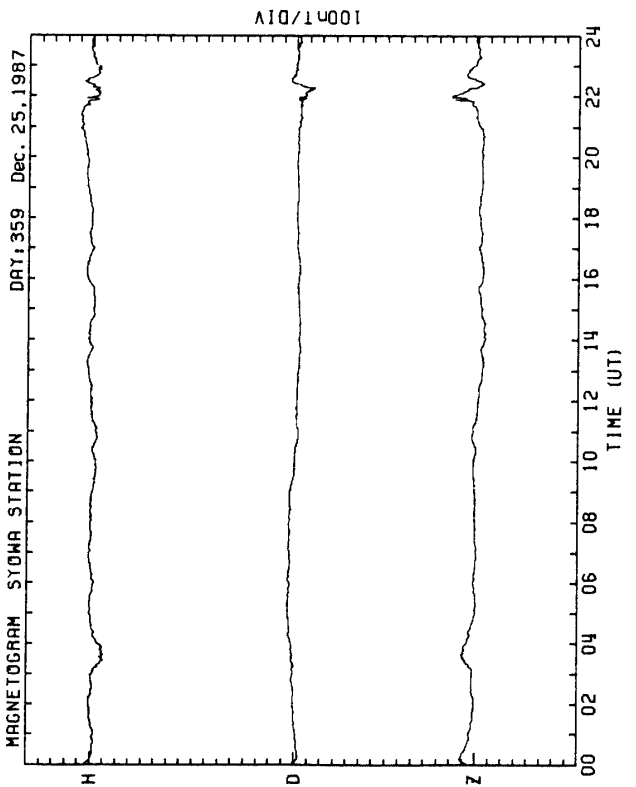
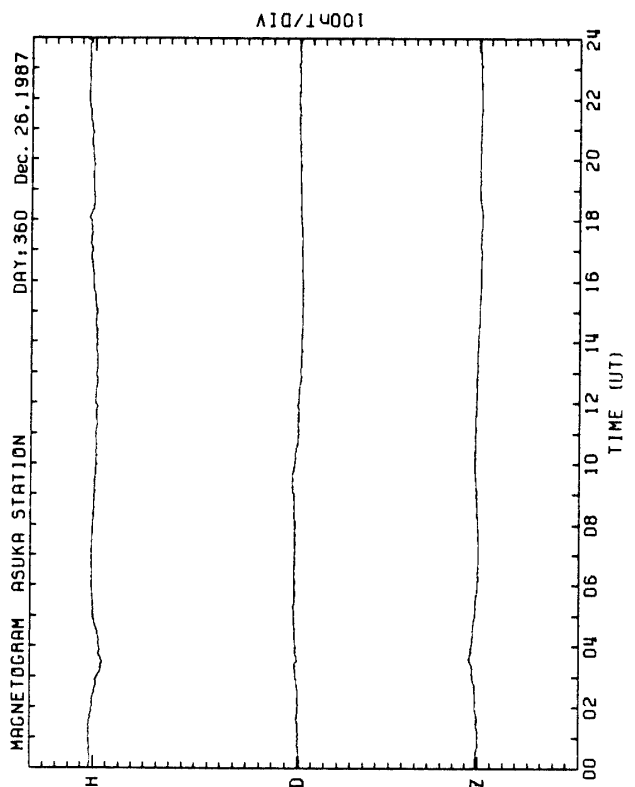
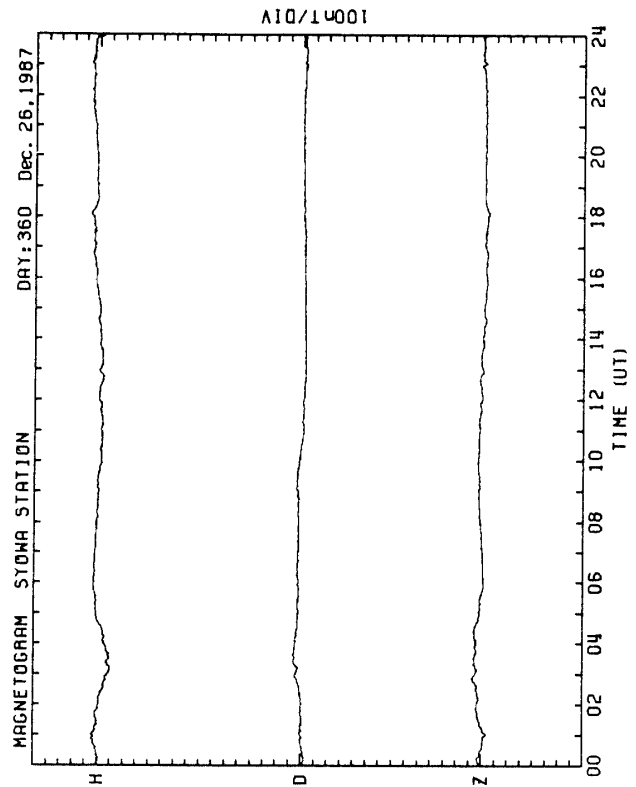


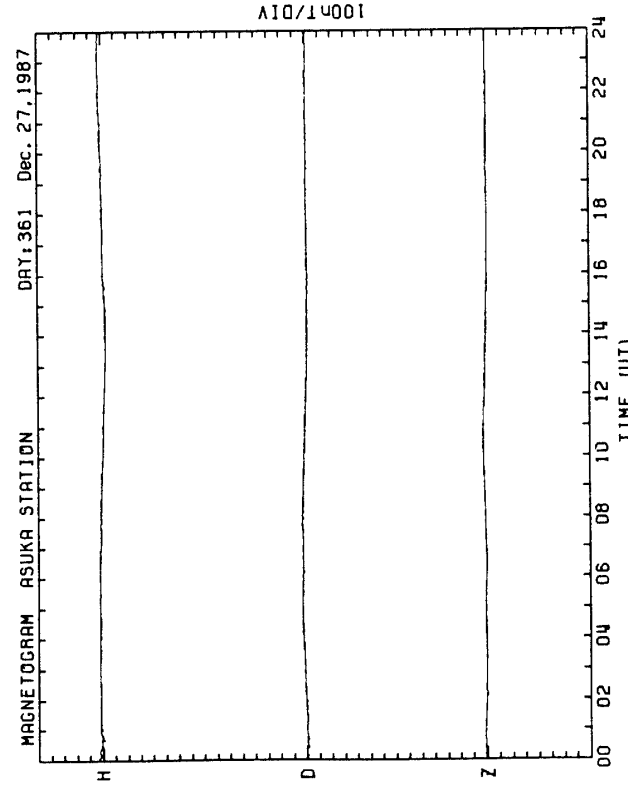
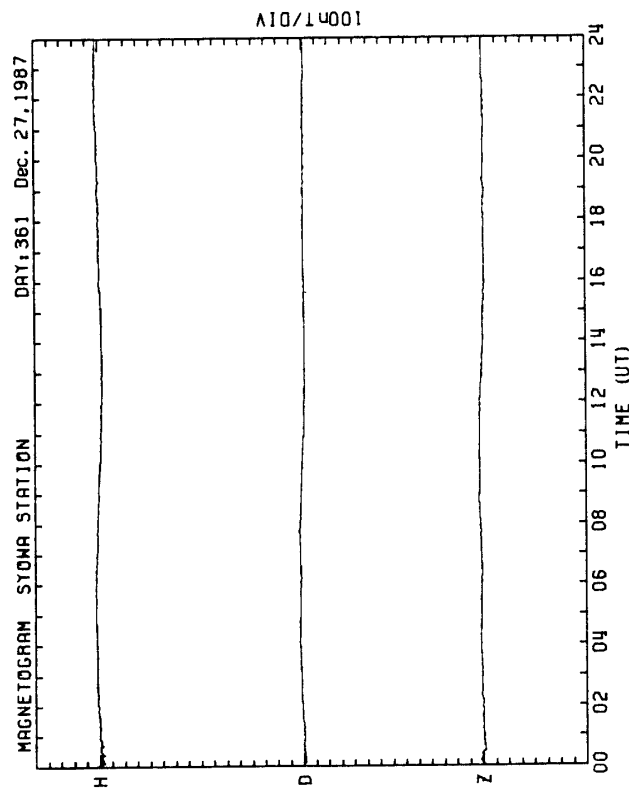
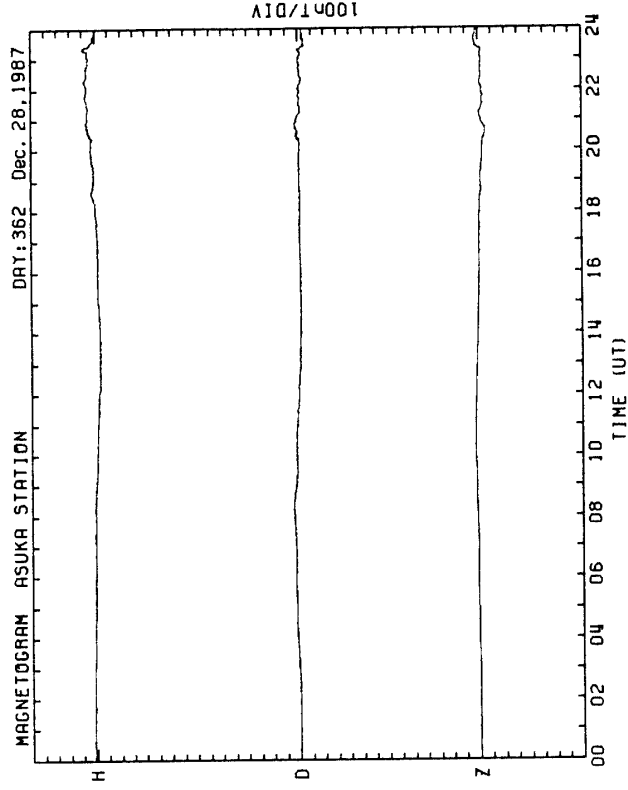
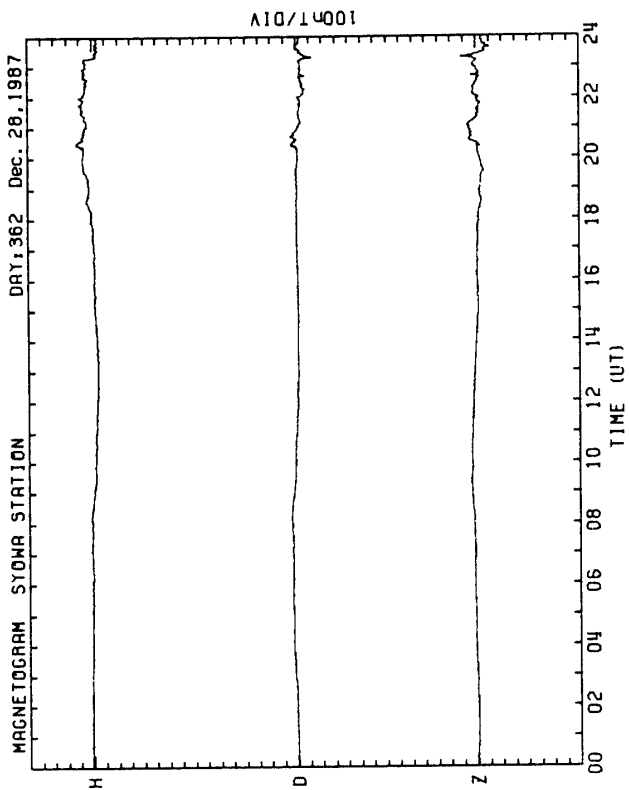


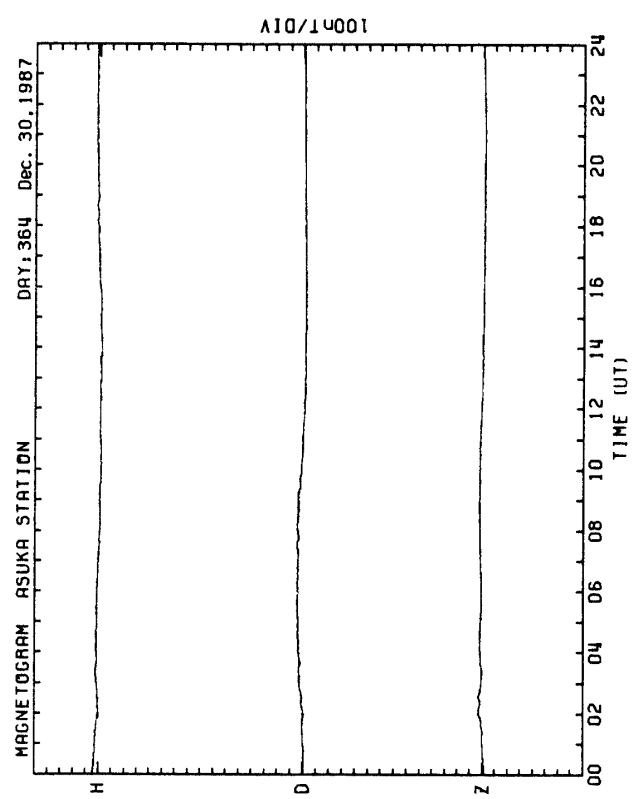
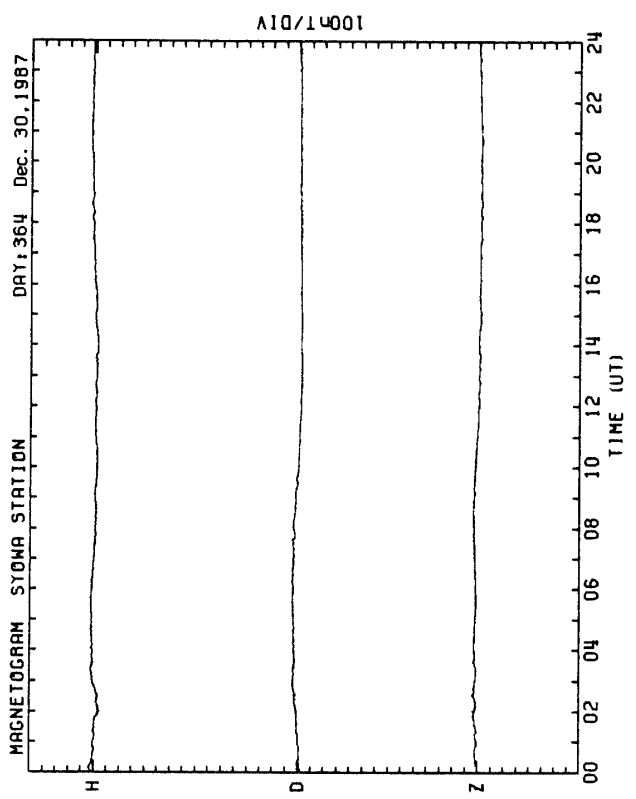
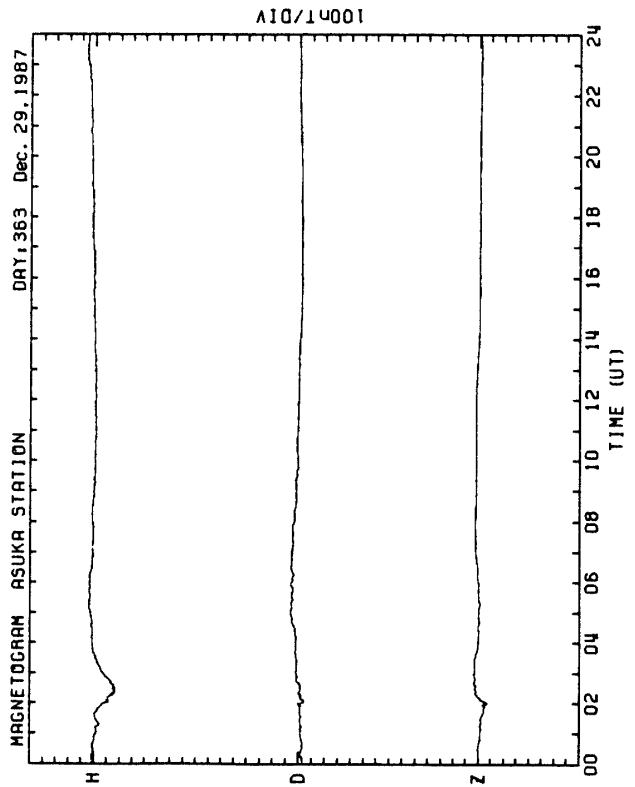
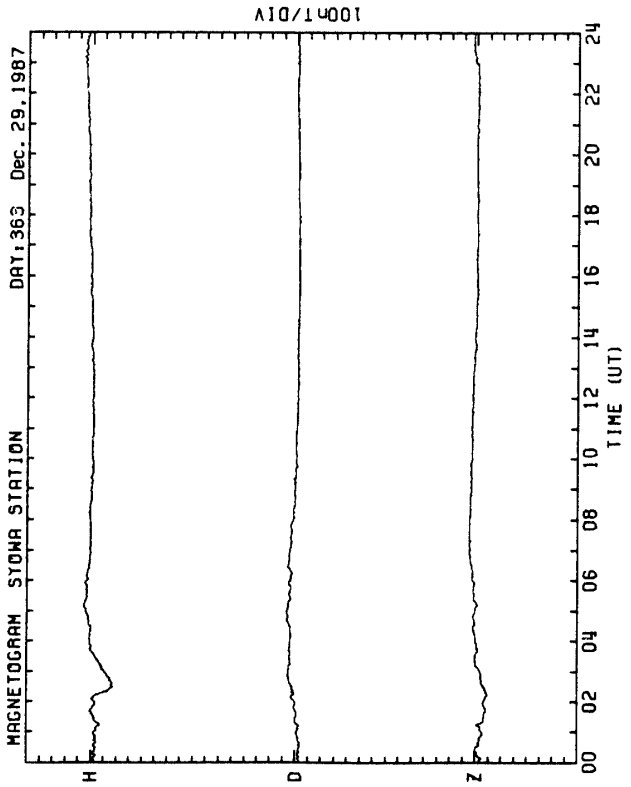


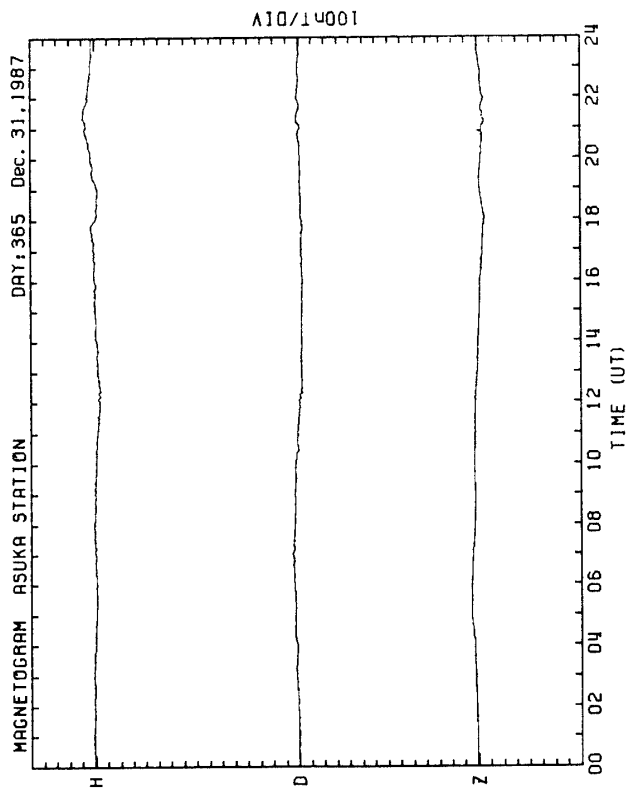
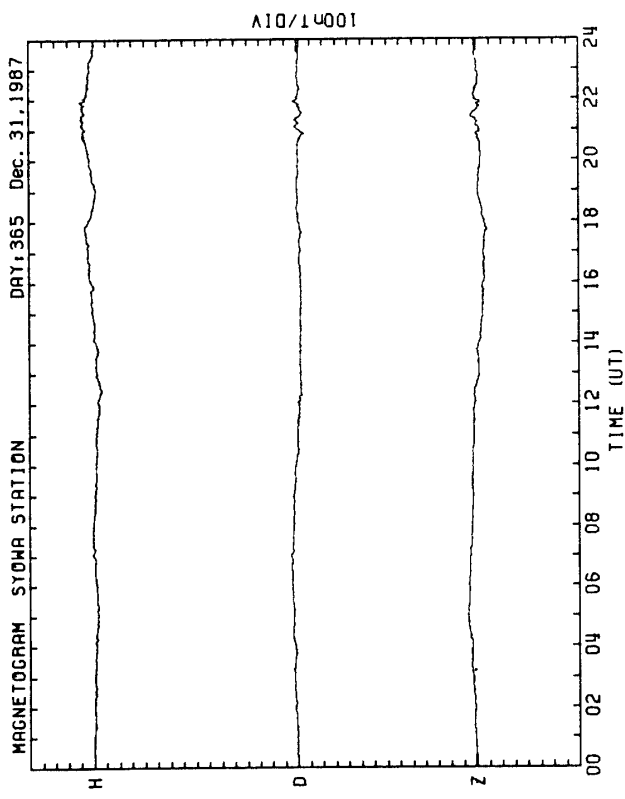








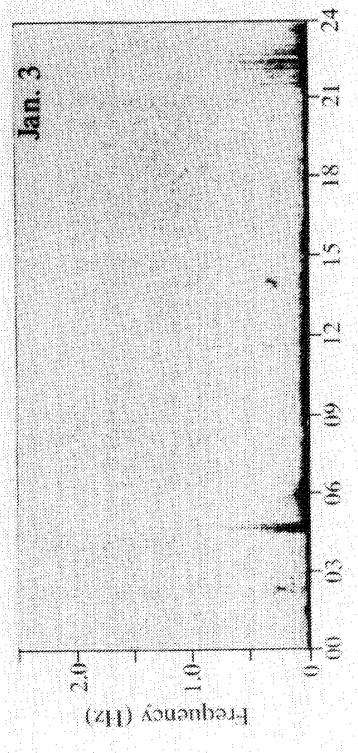
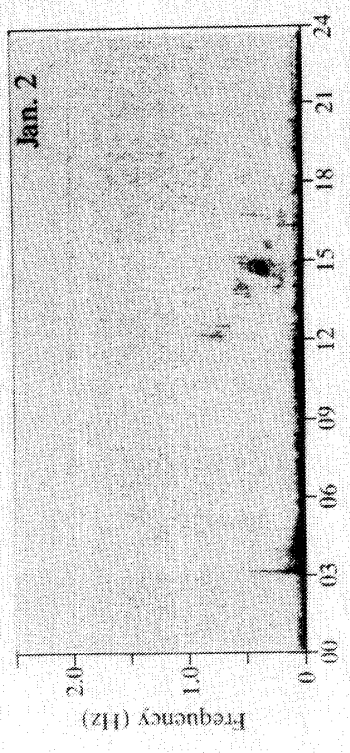
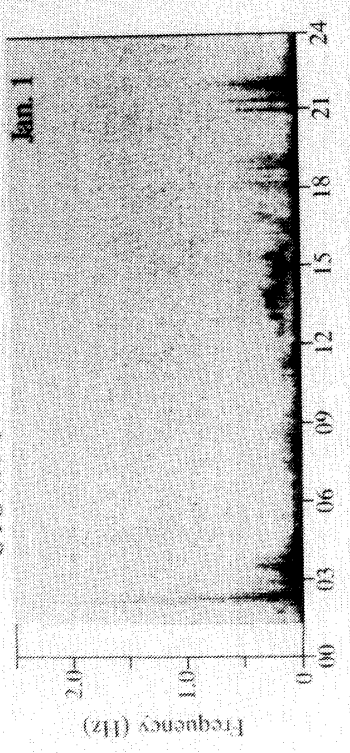




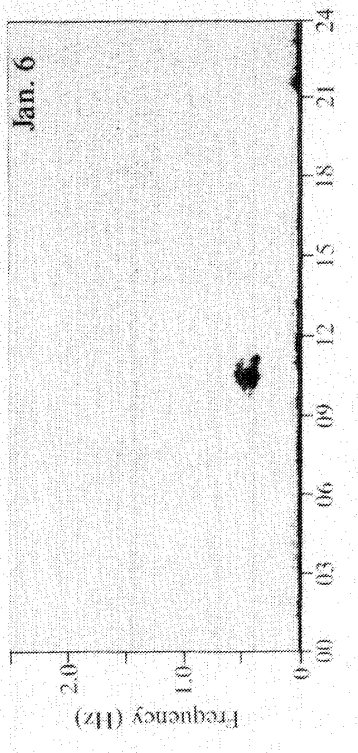
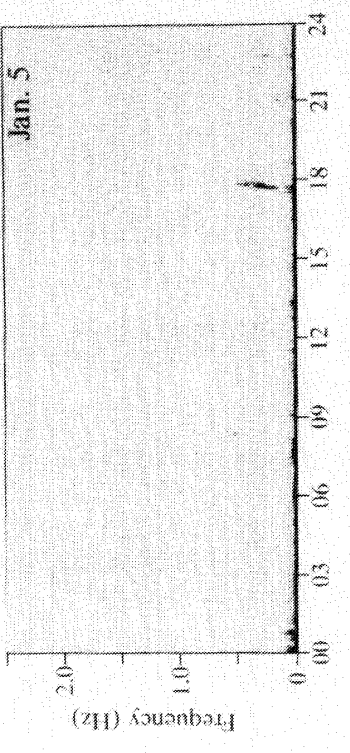
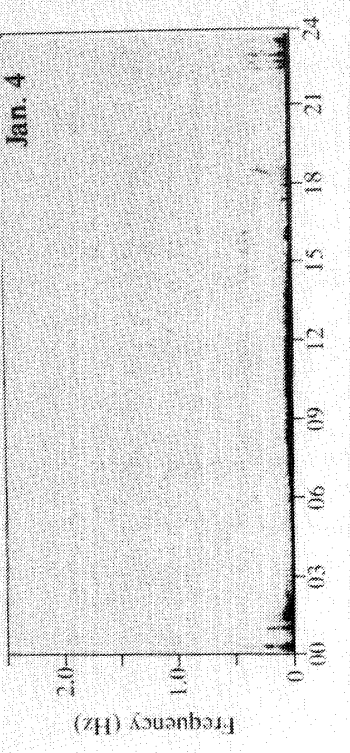
Appendix 2

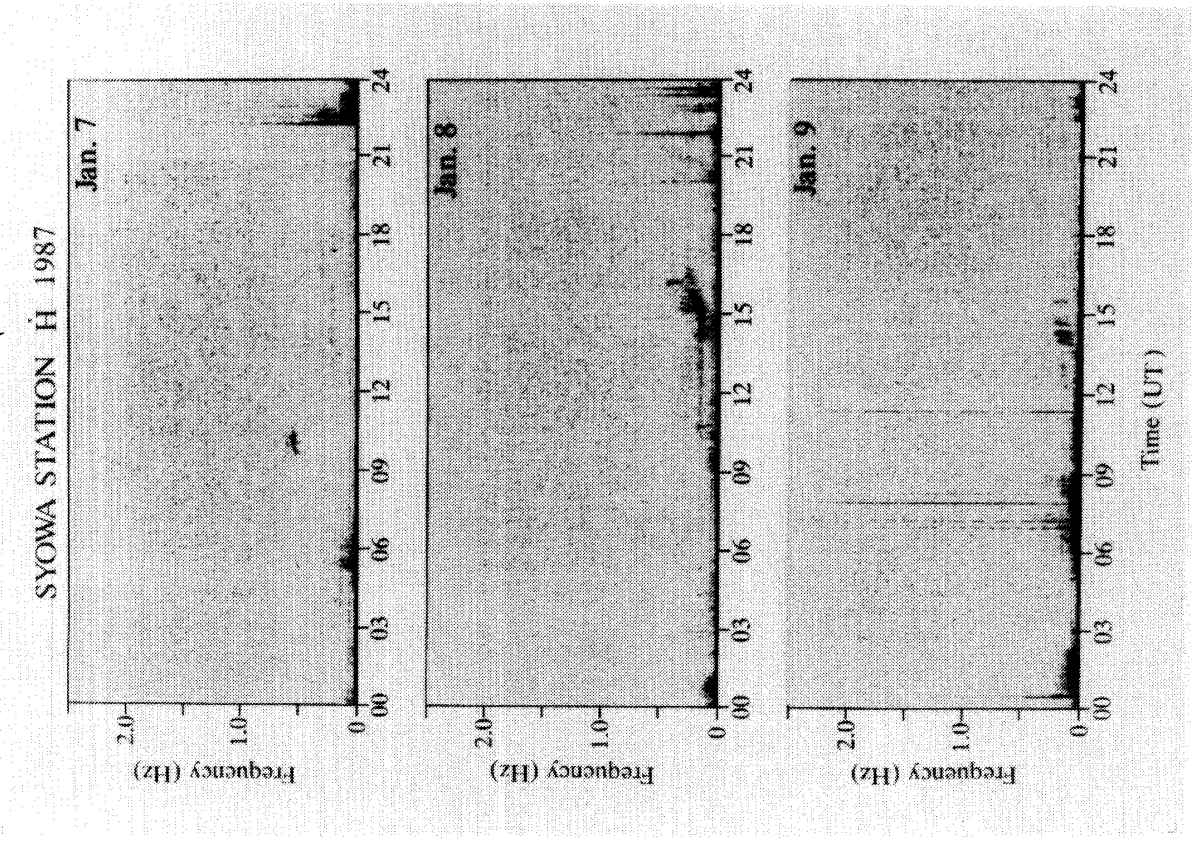
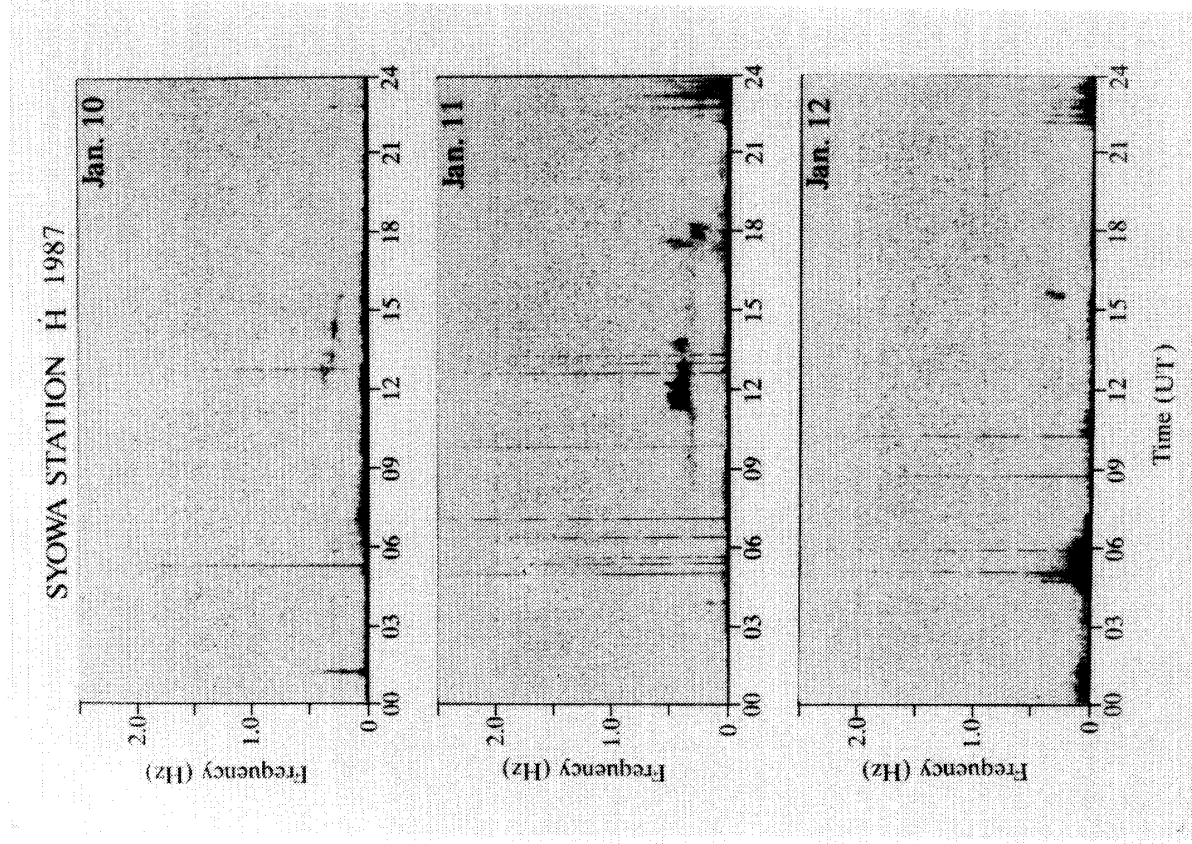
Frequency-time spectra of the H-component of
magnetic pulsations in 1987

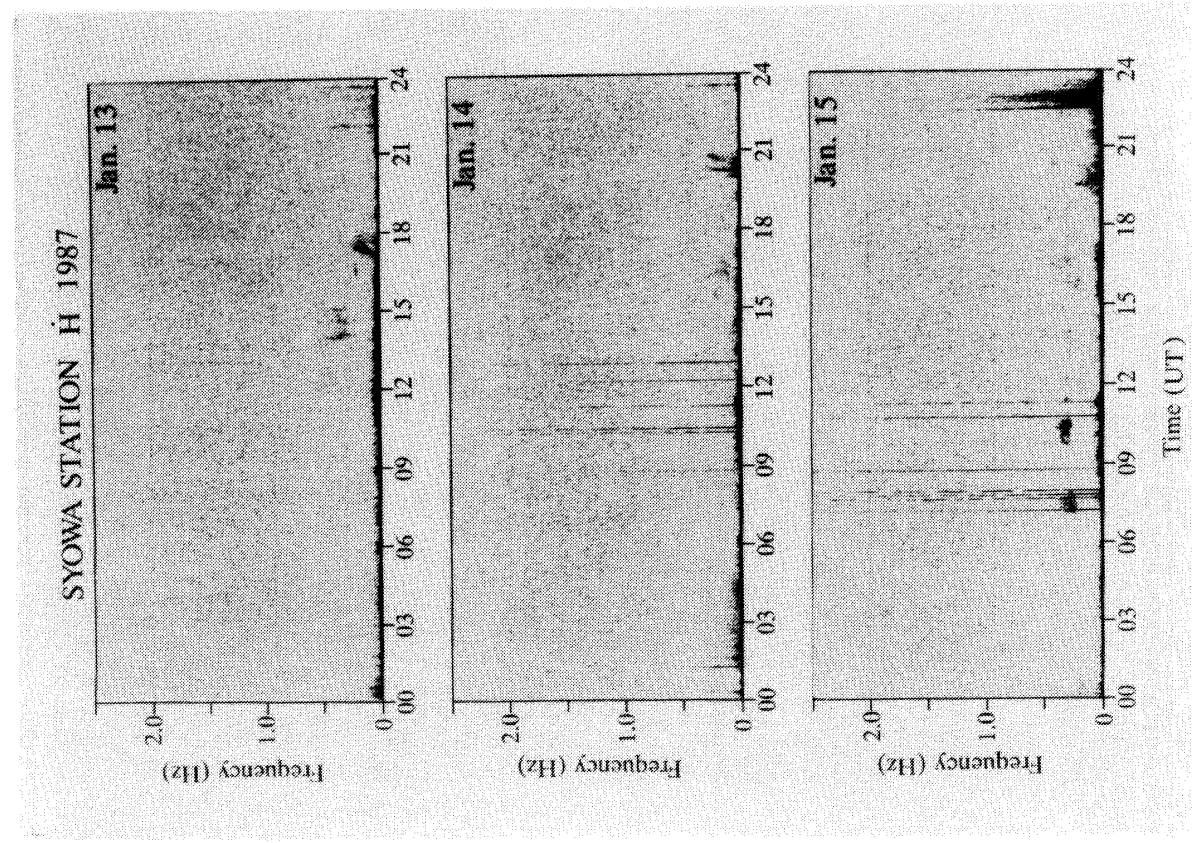
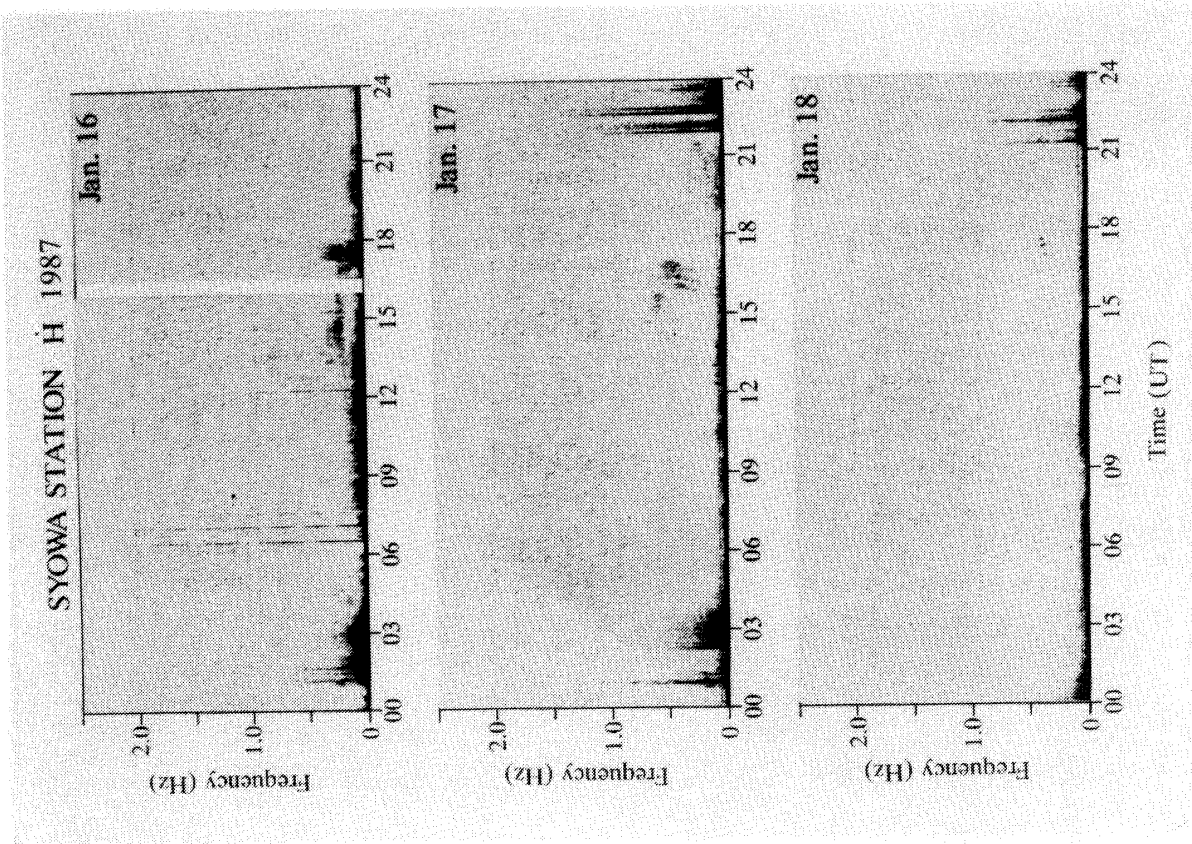
SYOWA STATION H 1987



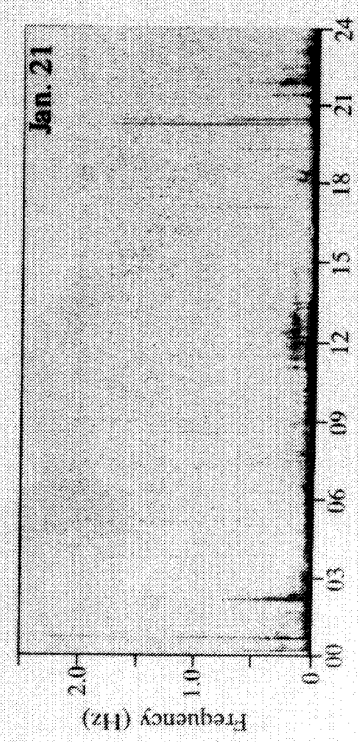
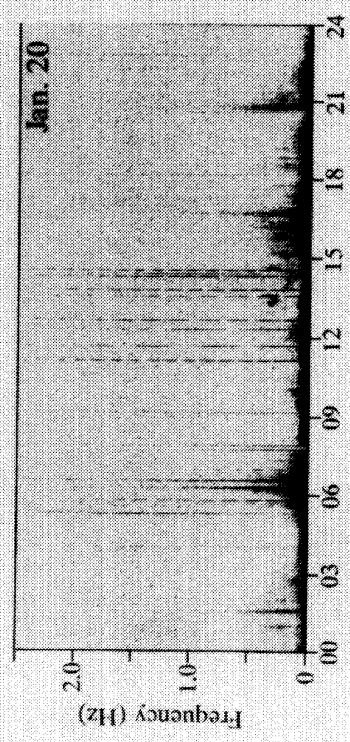
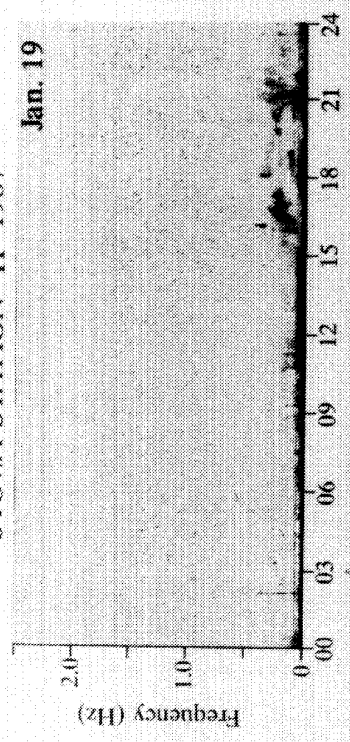
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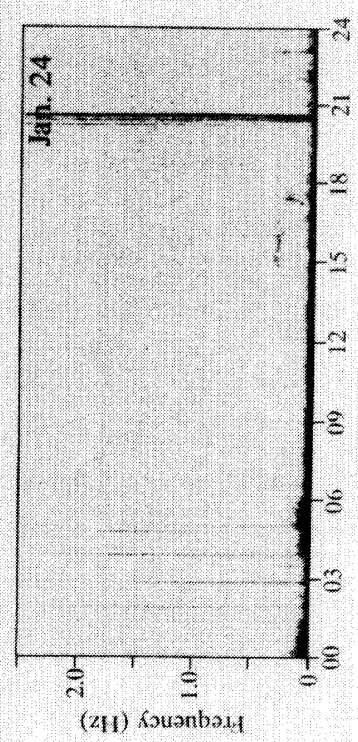
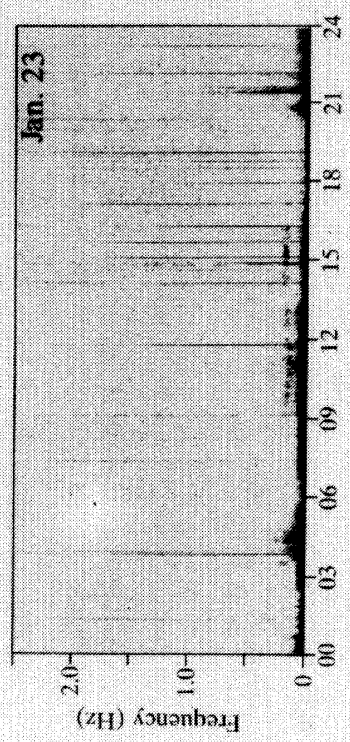
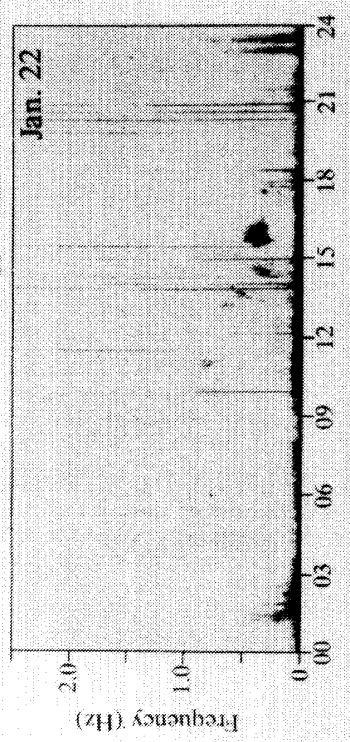


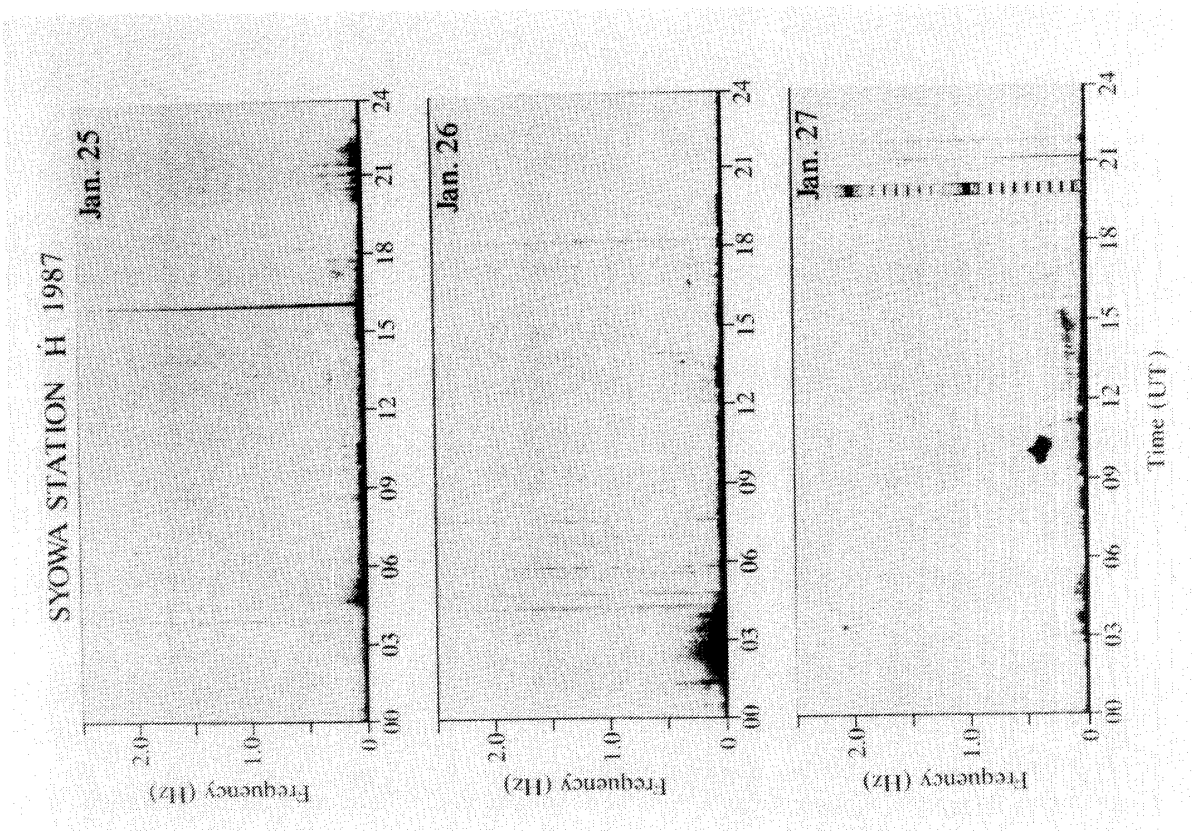
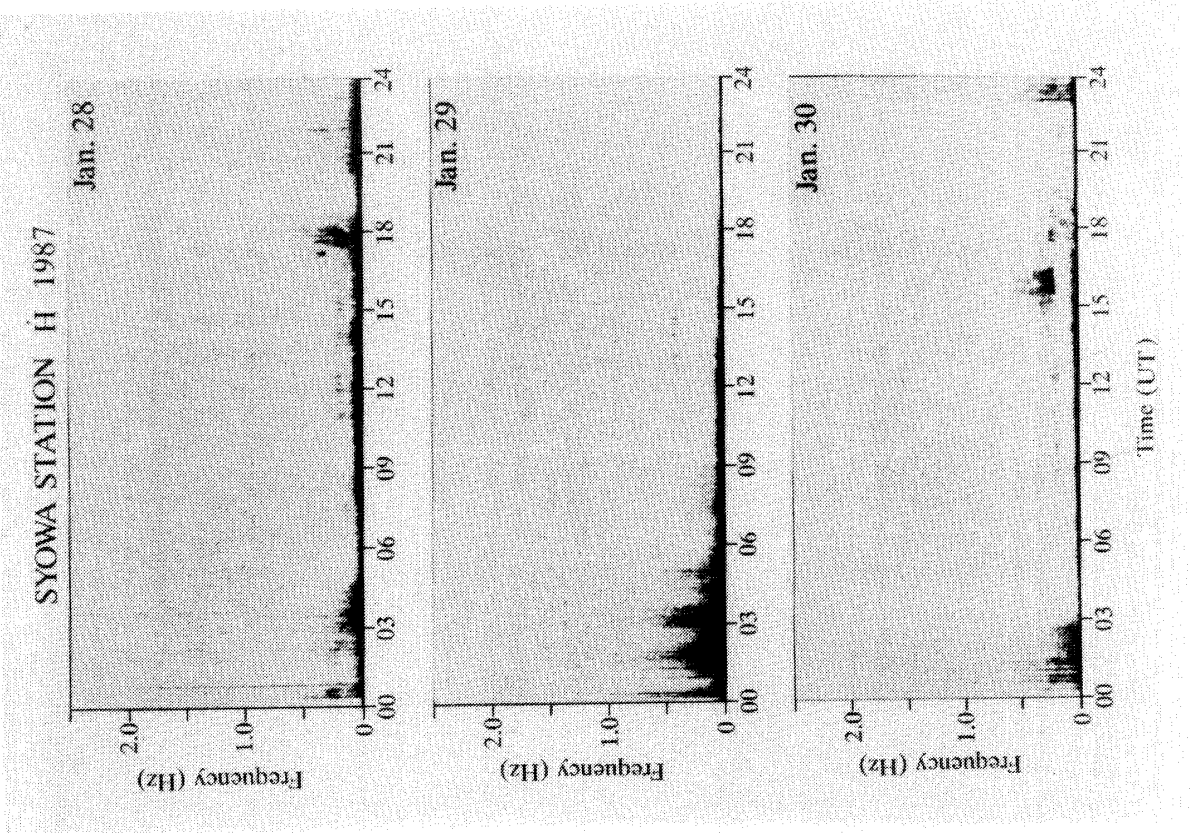


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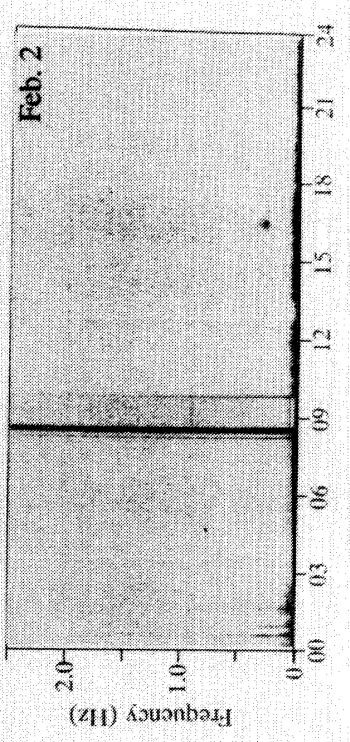
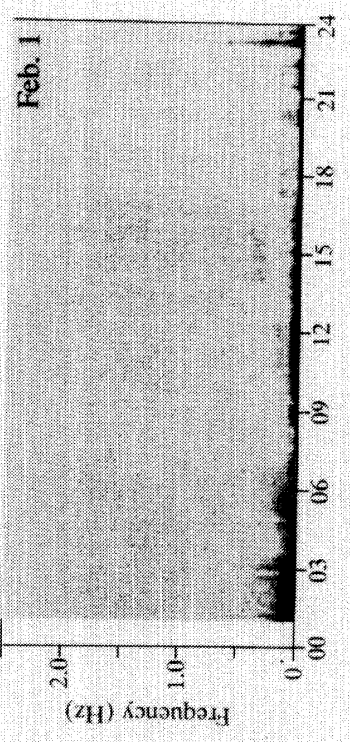
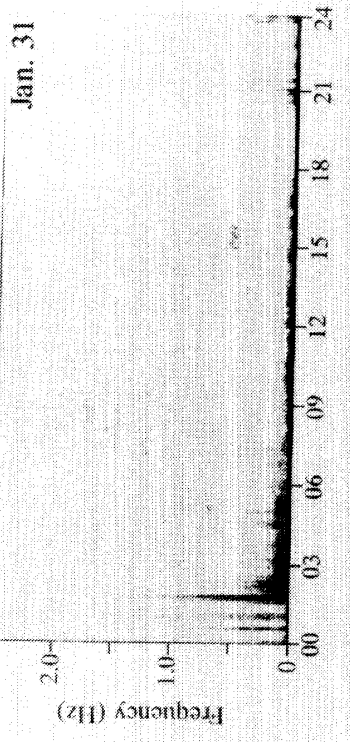


SYOWA STATION H 1987

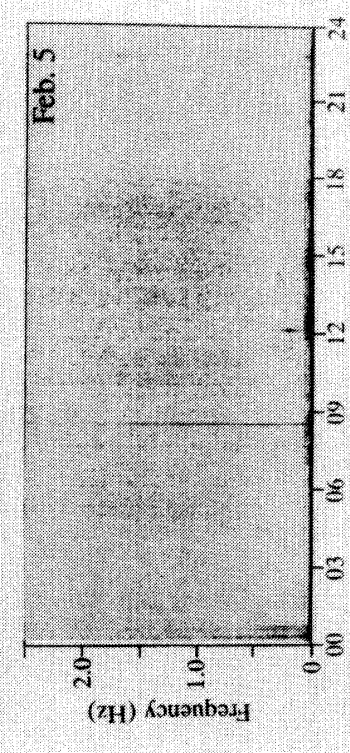
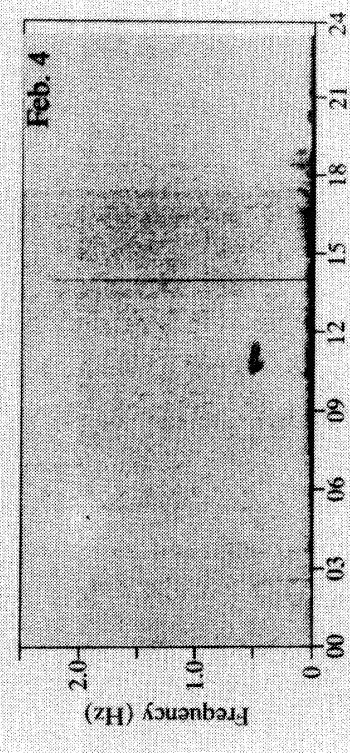
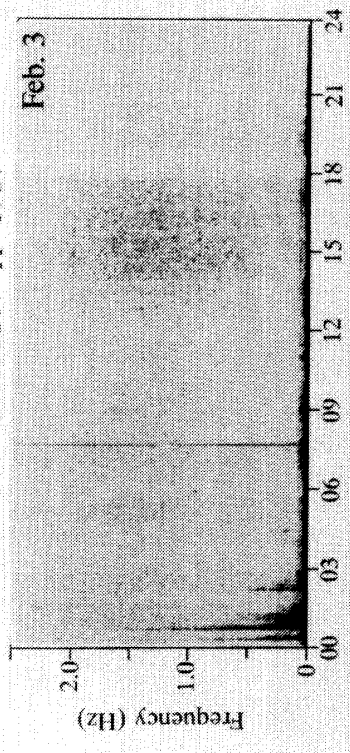




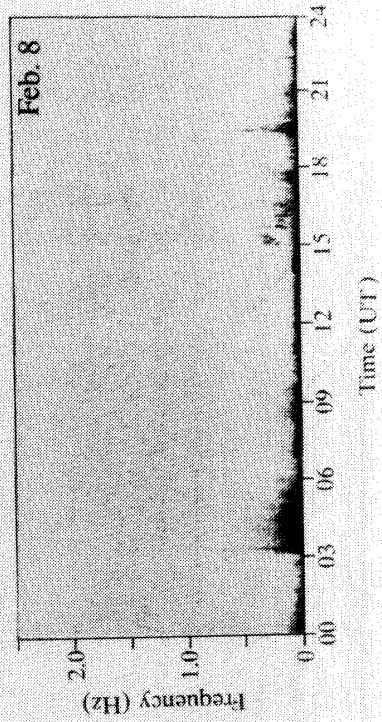
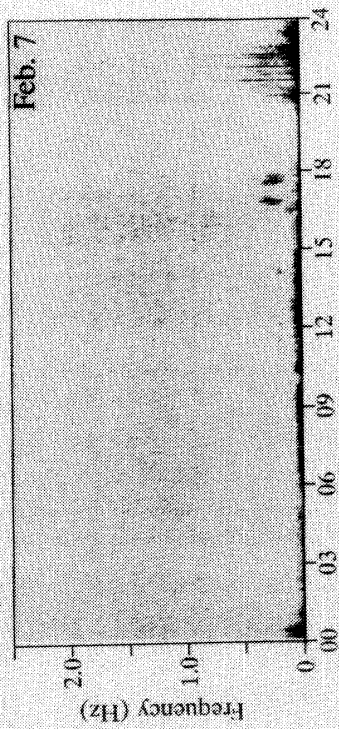
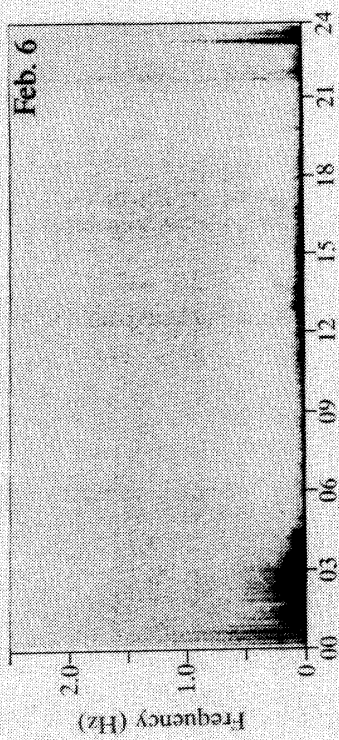
SYOWA STATION II 1987



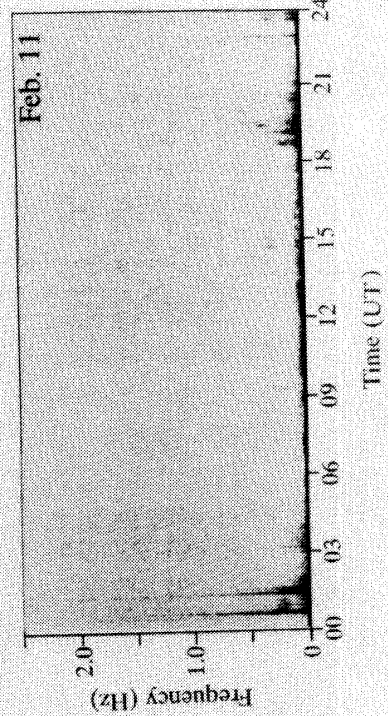
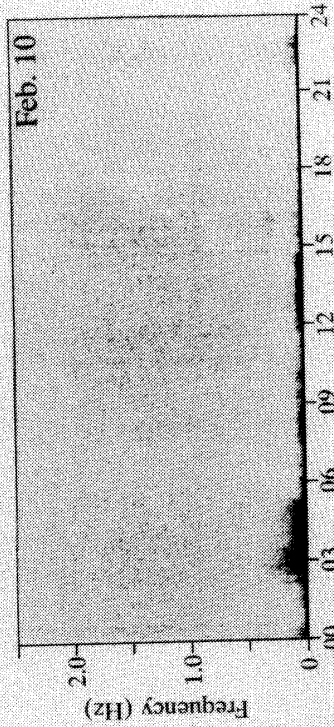
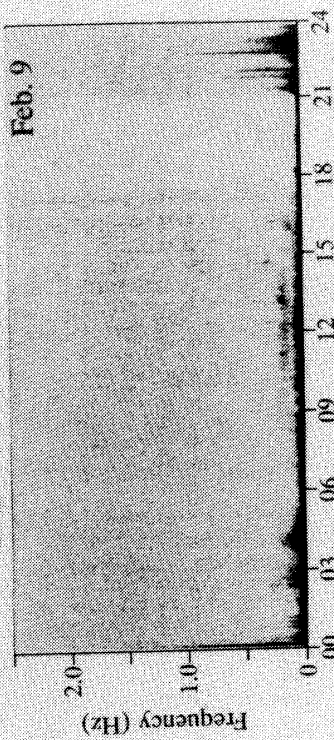
SYOWA STATION HI 1987



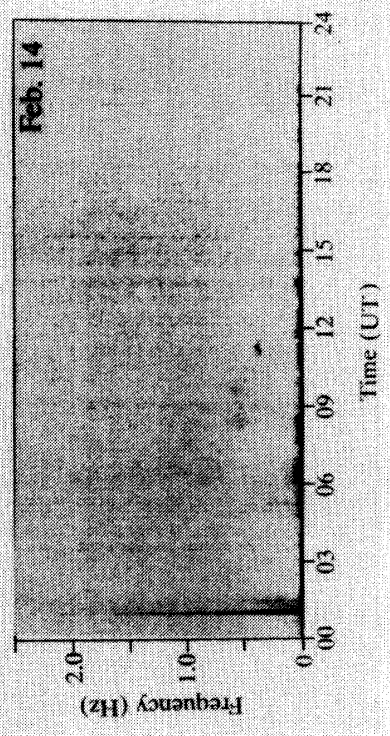
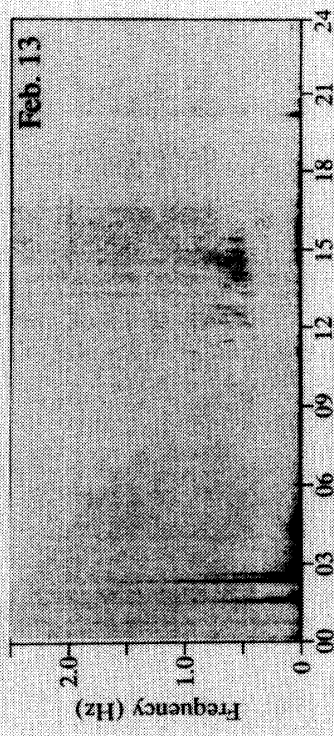
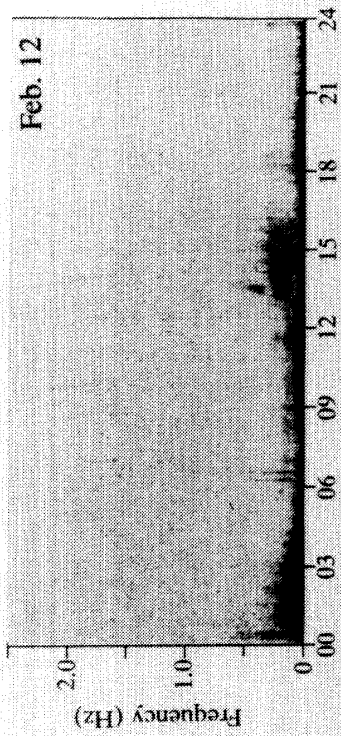
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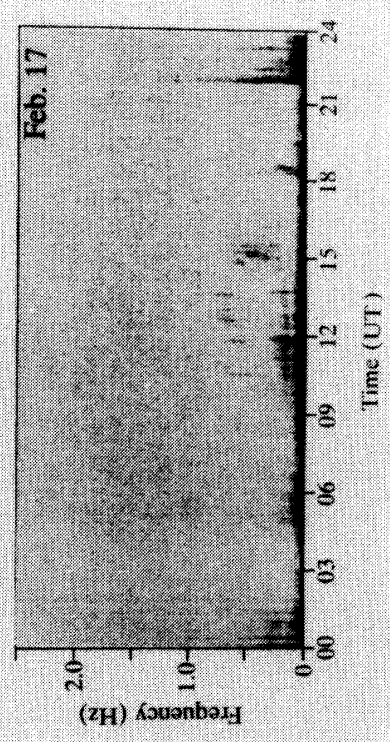
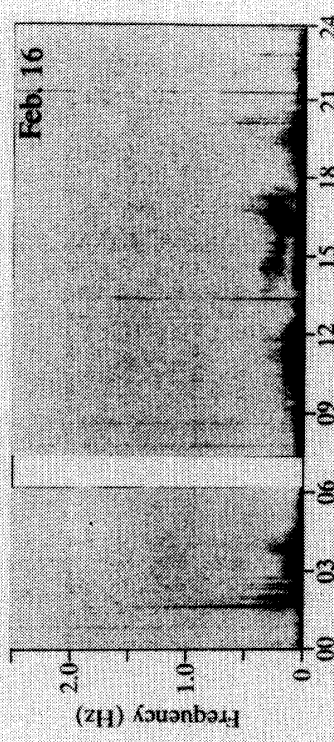
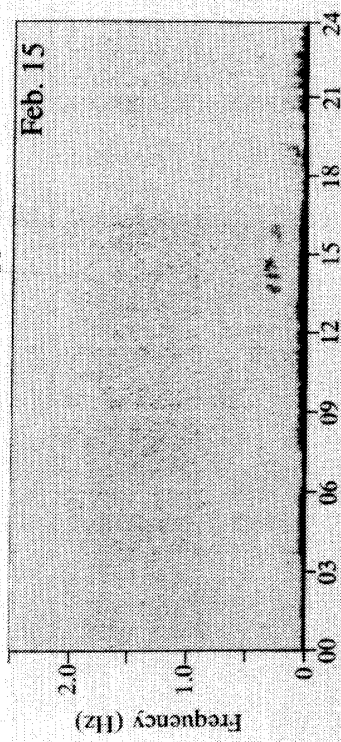
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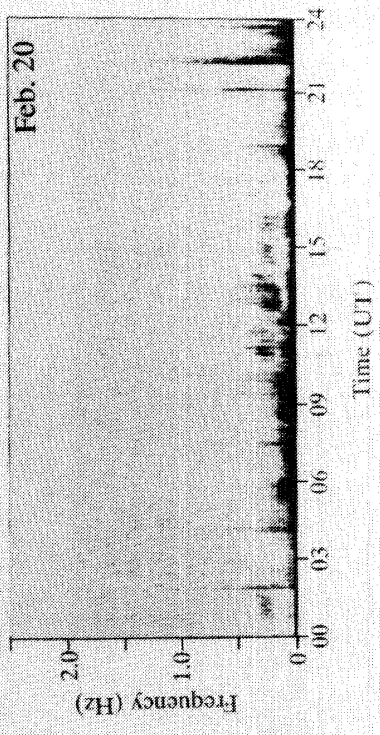
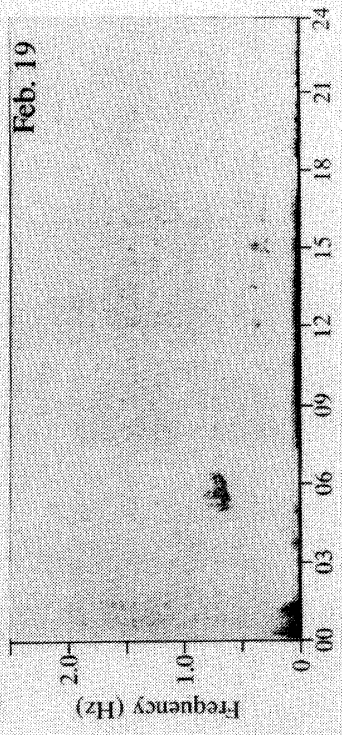
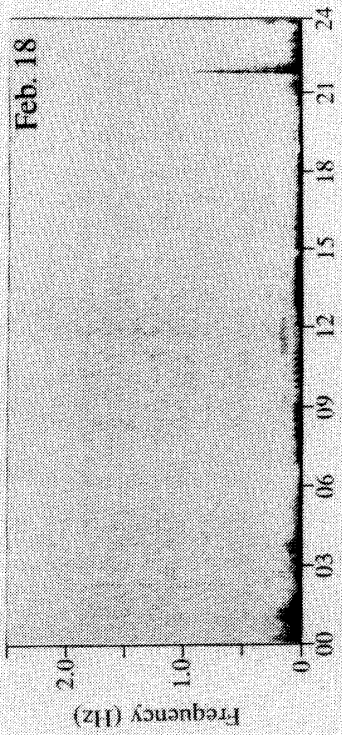
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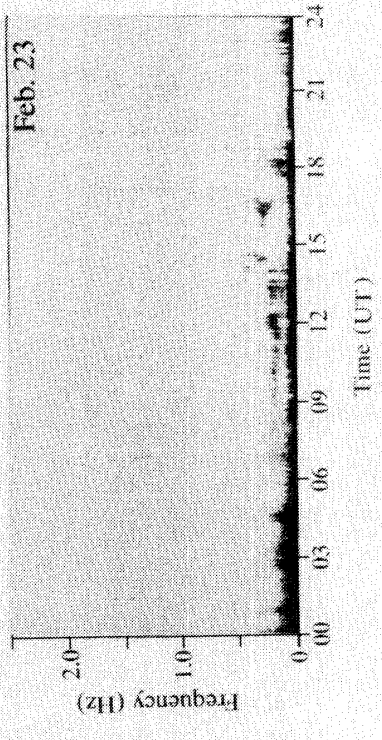
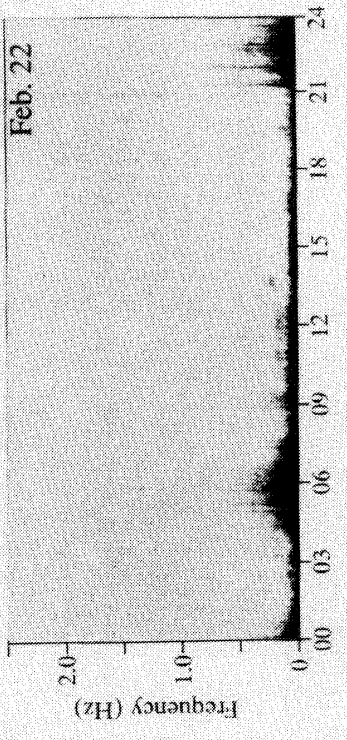
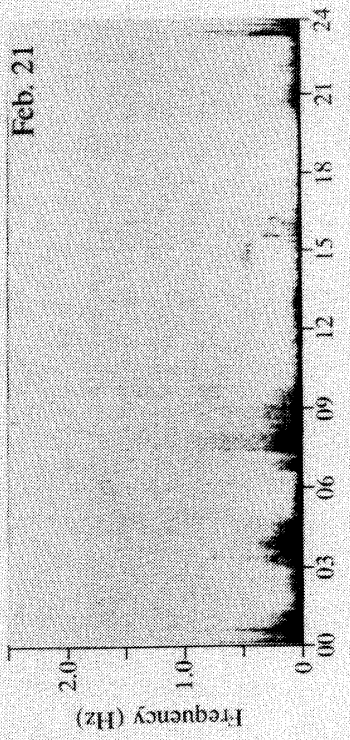
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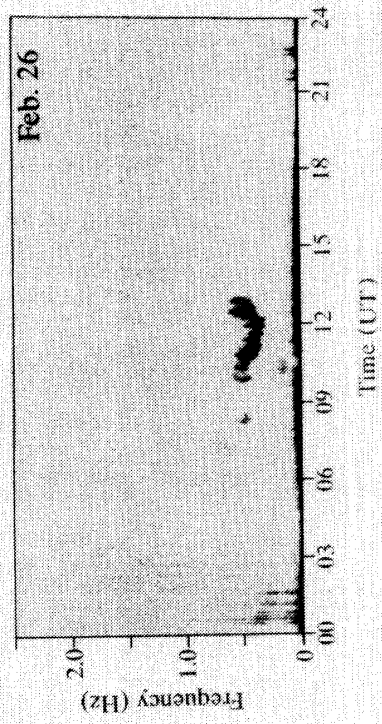
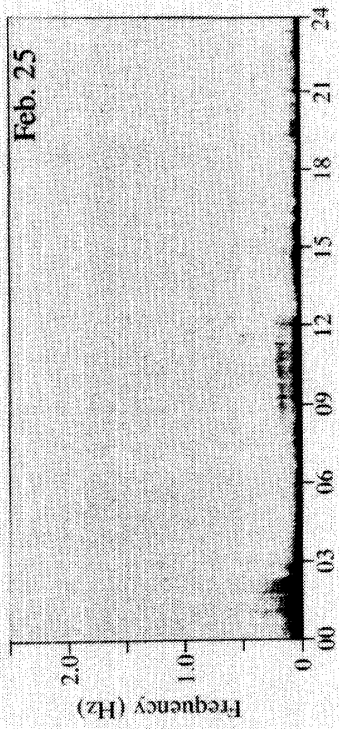
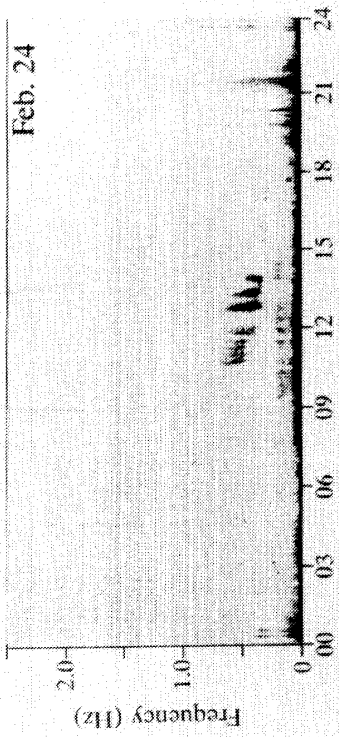
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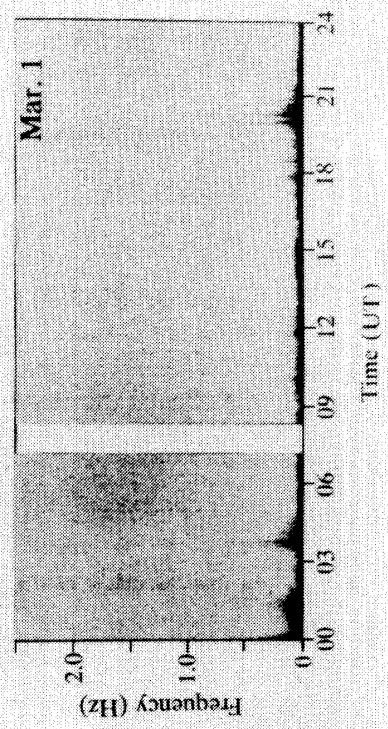
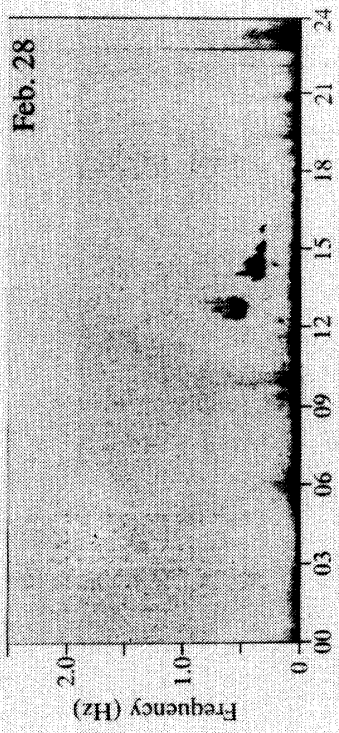
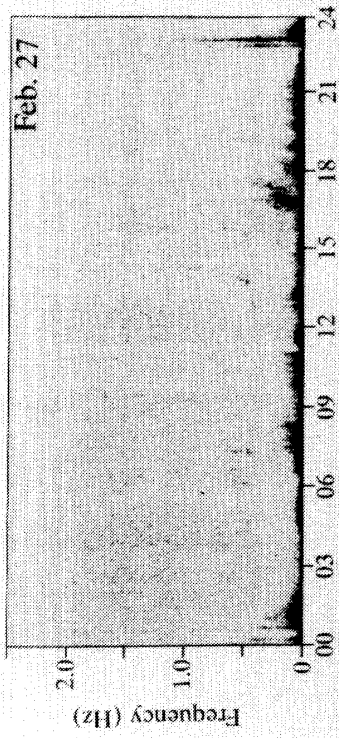
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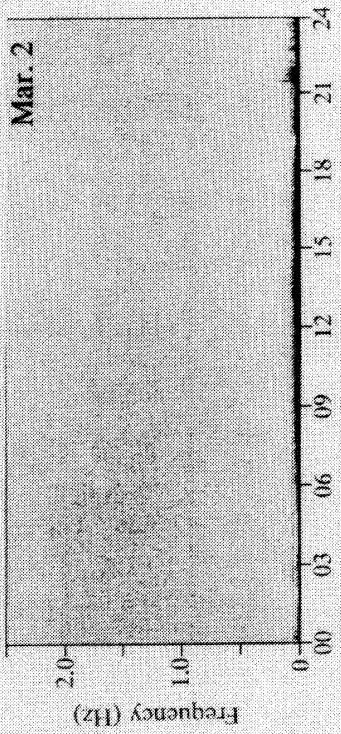
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SYOWA STATION H 1987



SYOWA STATION H 1987

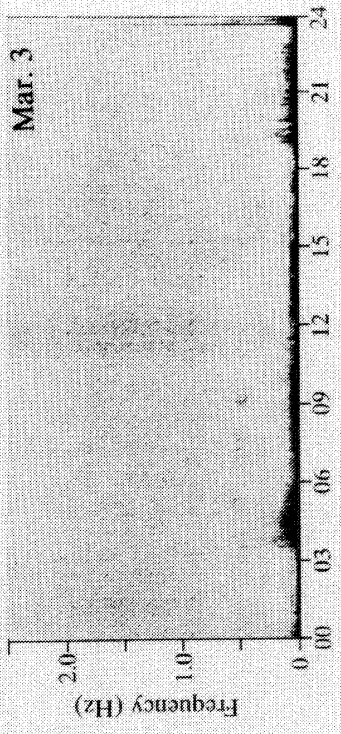


Mar. 5

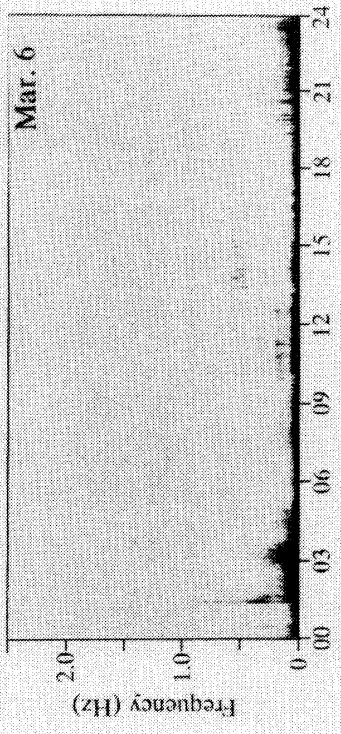
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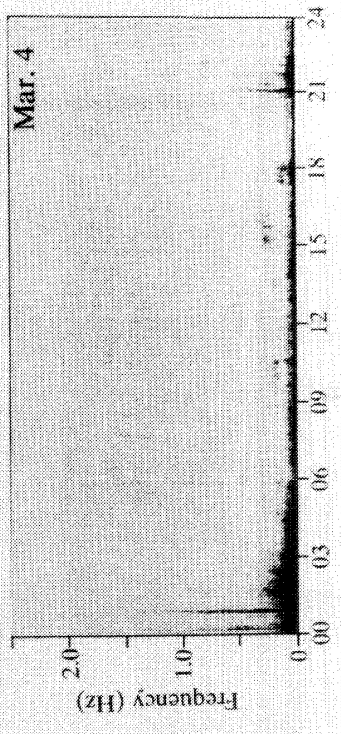
Mar. 3



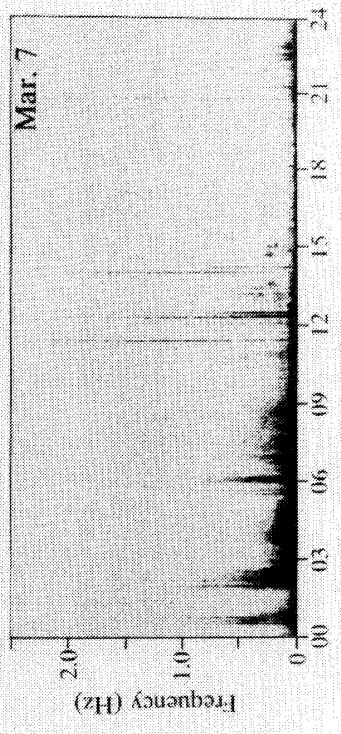
Mar. 6



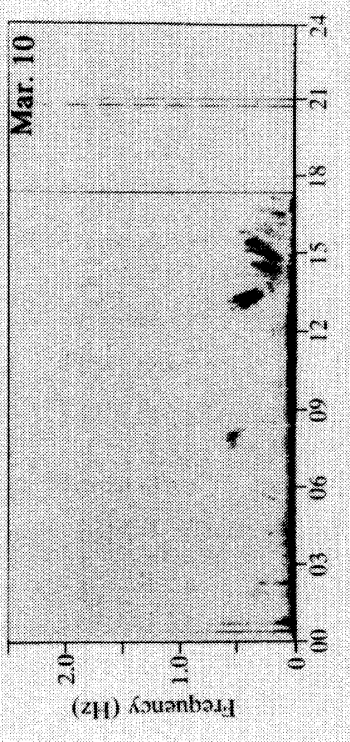
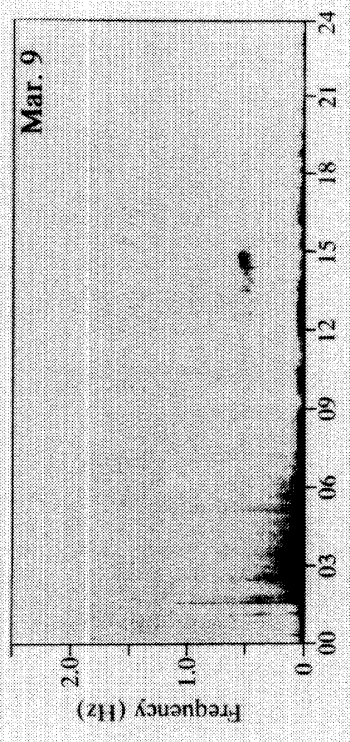
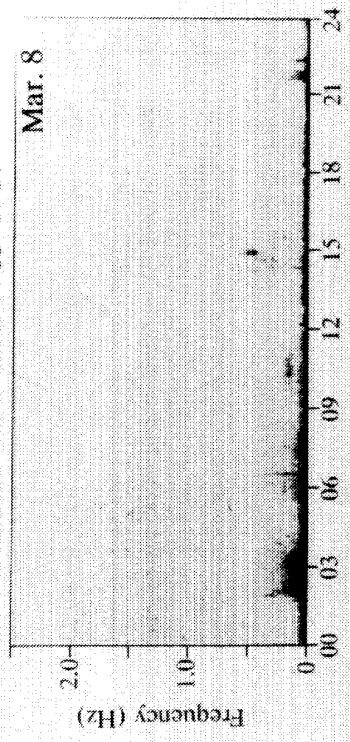
Mar. 4



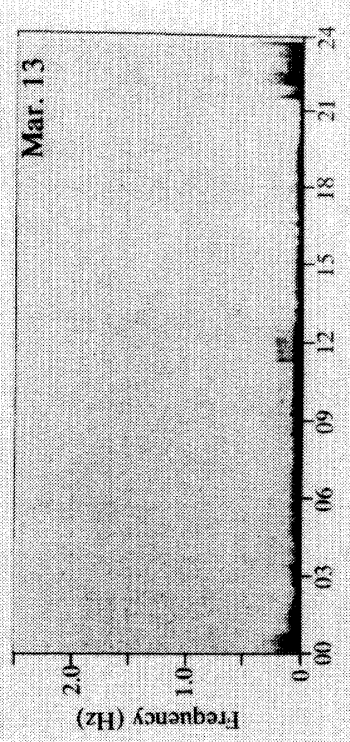
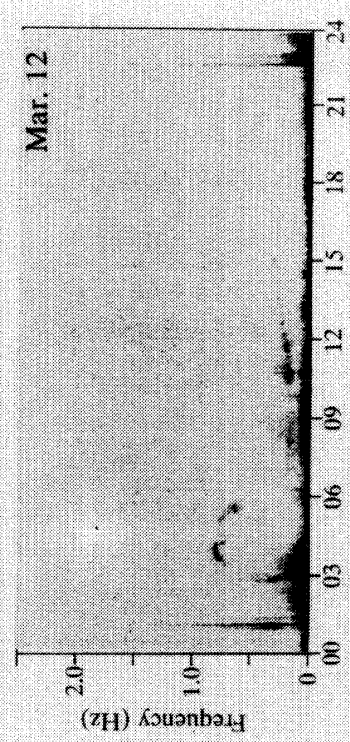
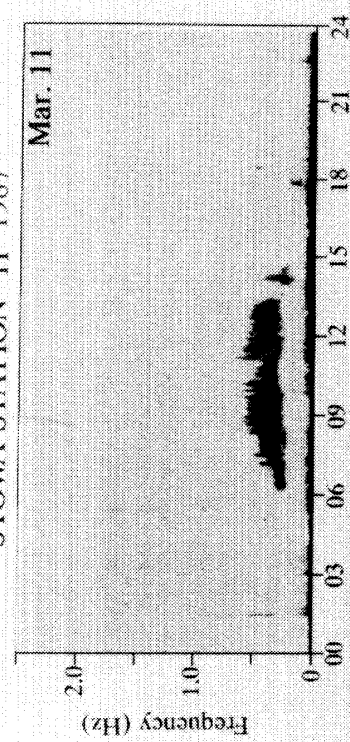
Mar. 7



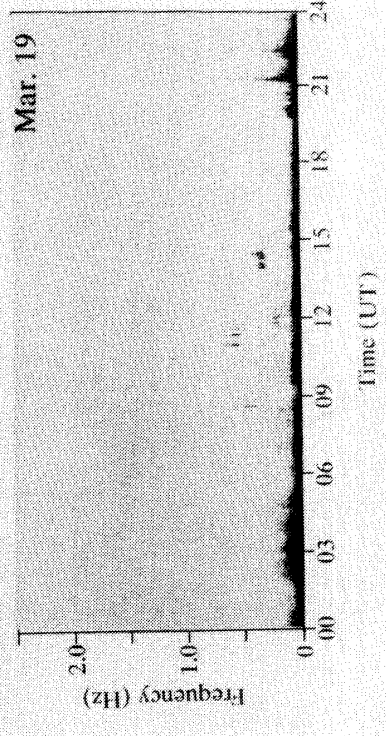
SYOWA STATION H 1987



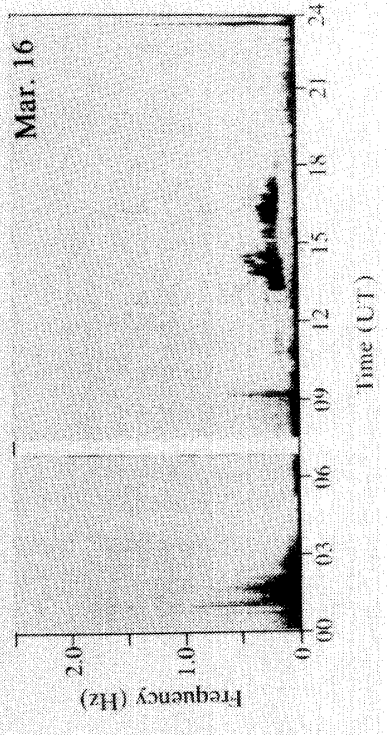
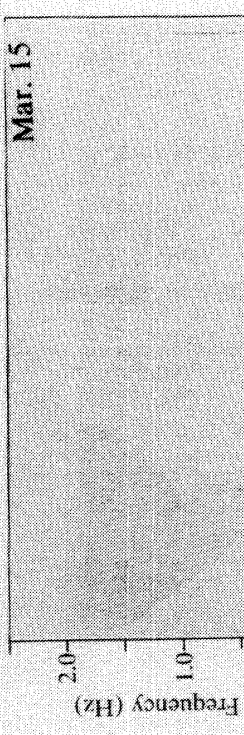
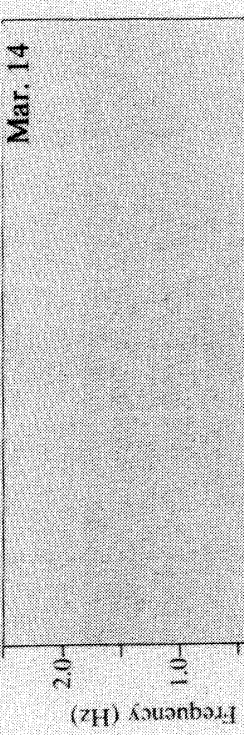
SYOWA STATION H 1987



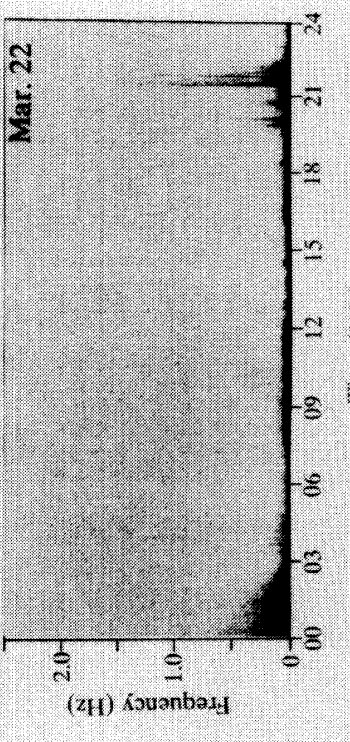
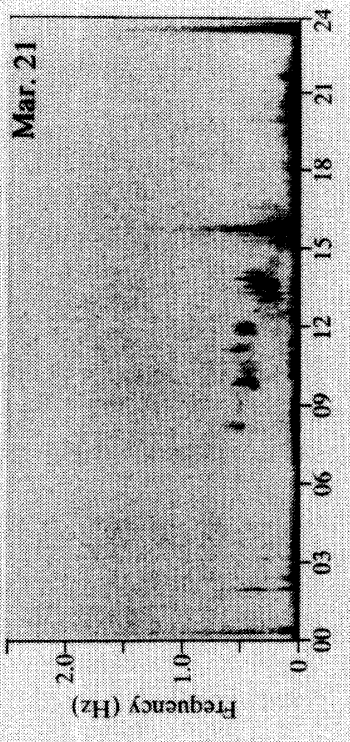
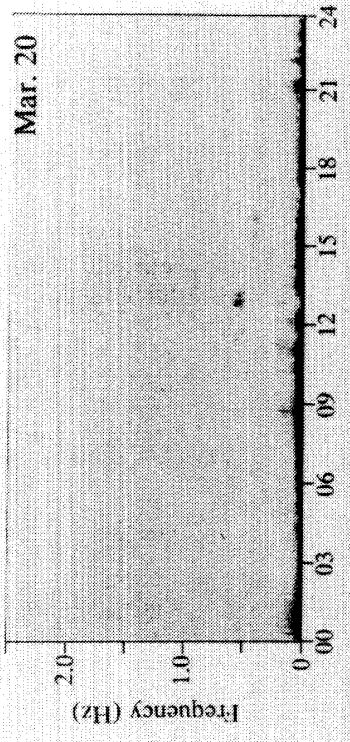
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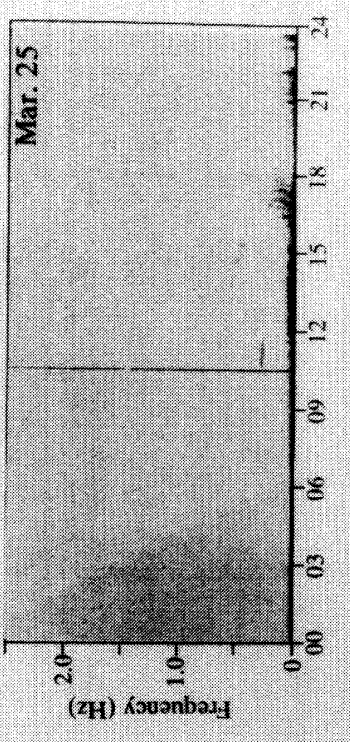
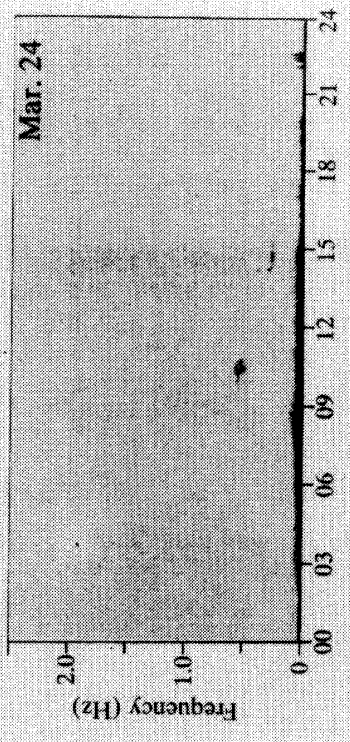
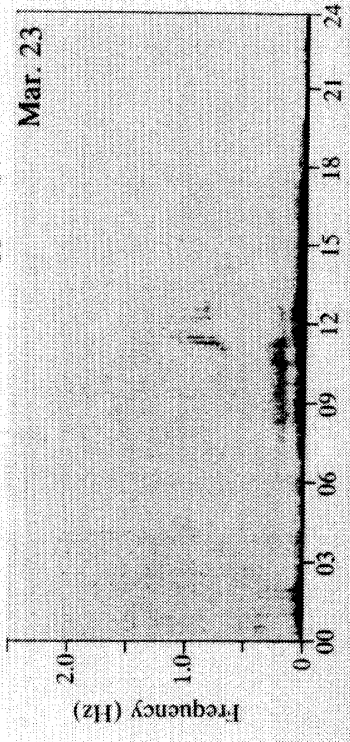
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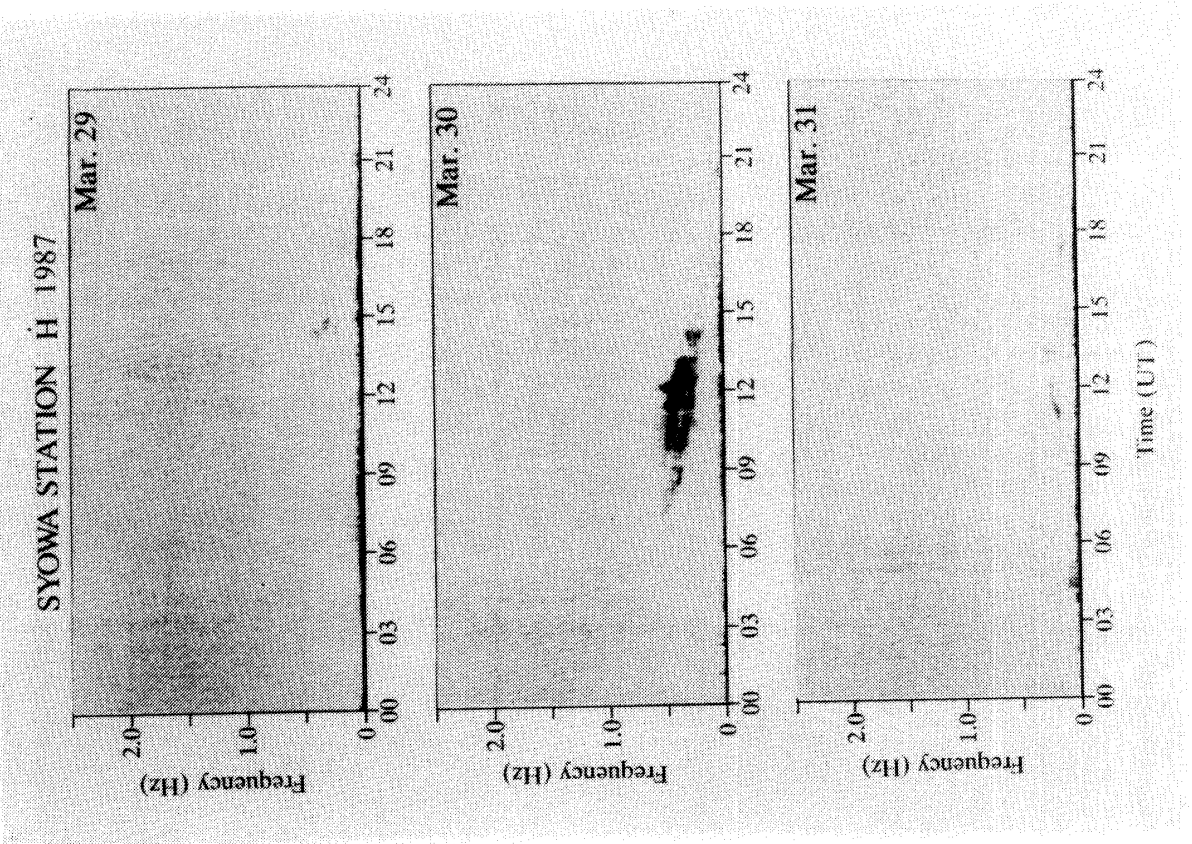
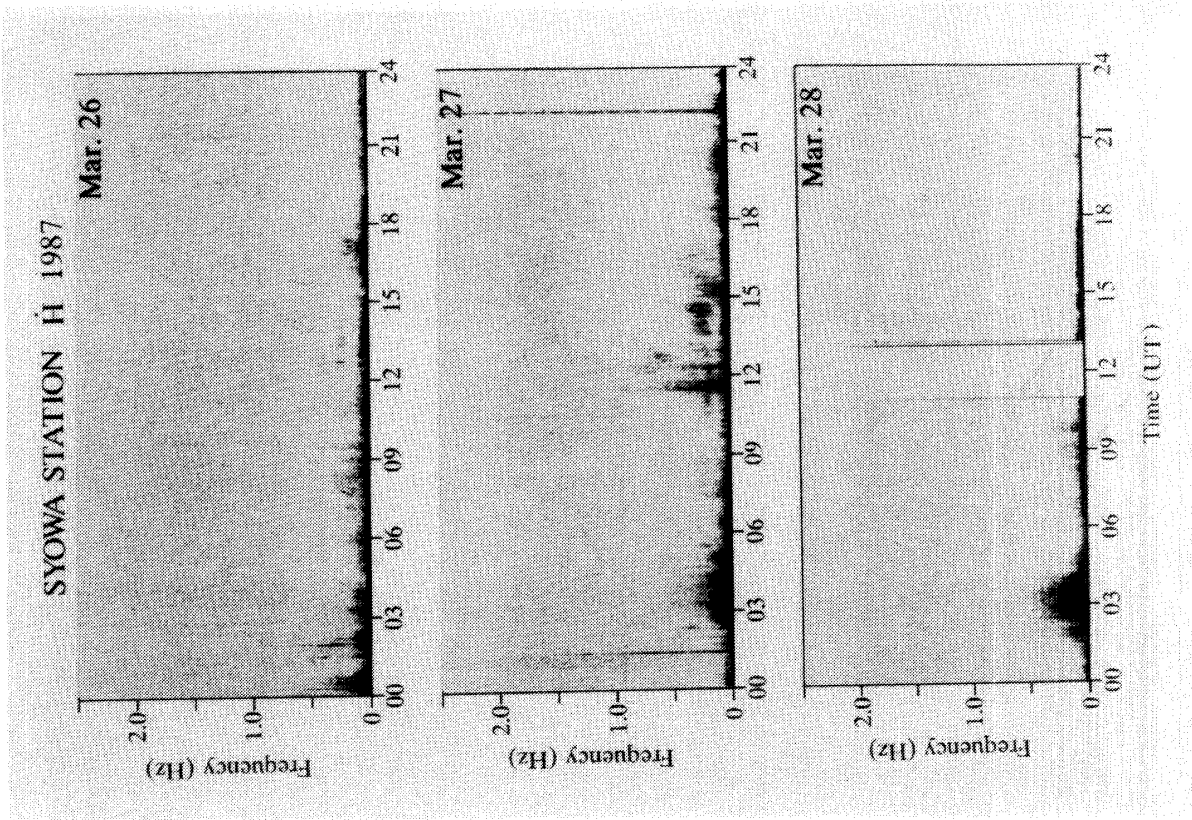


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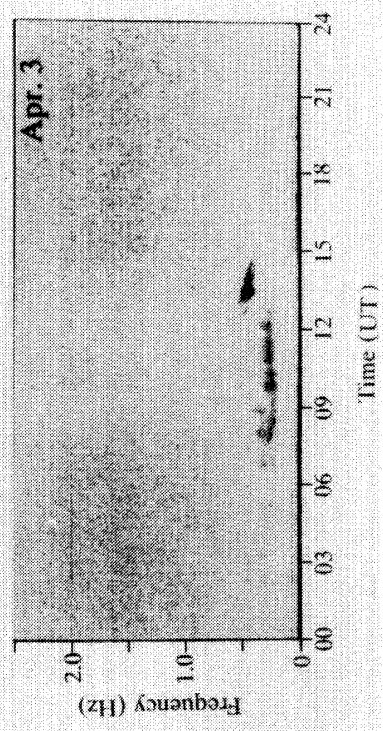
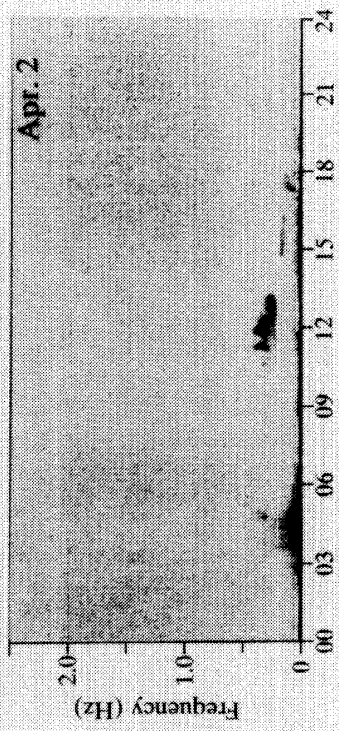
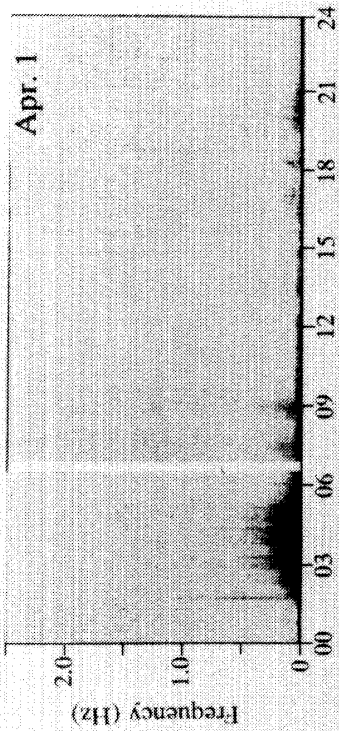


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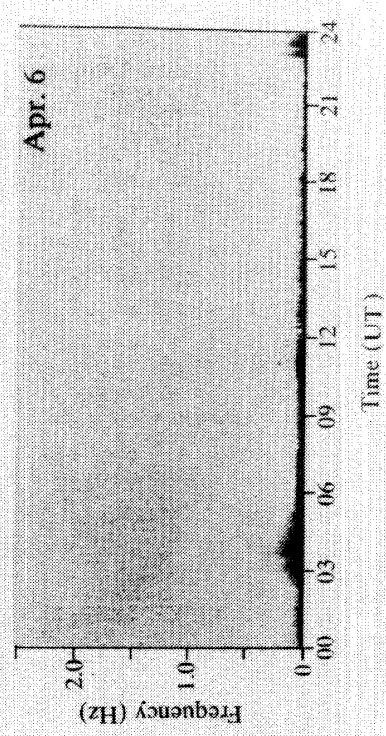
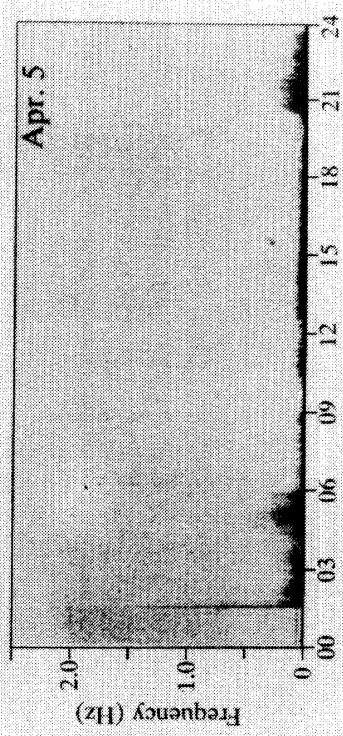
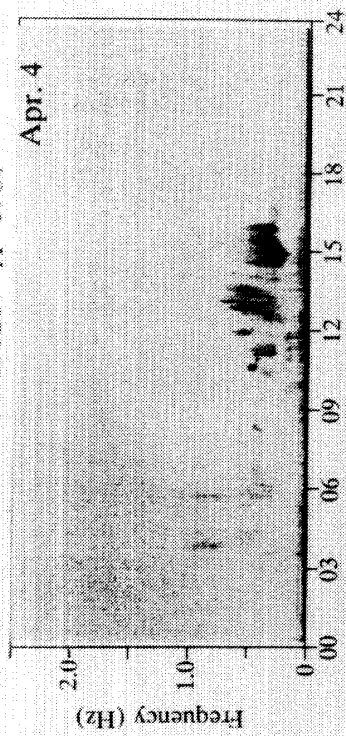




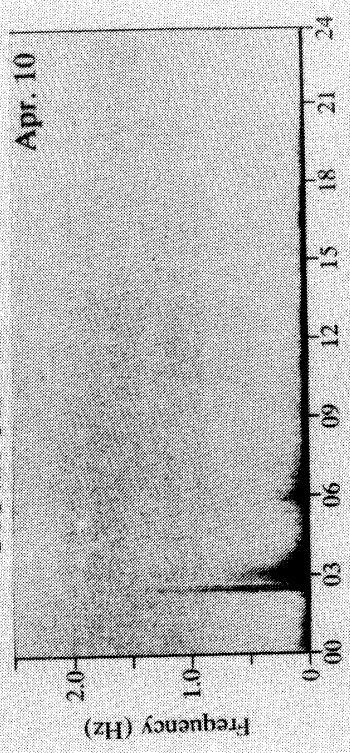
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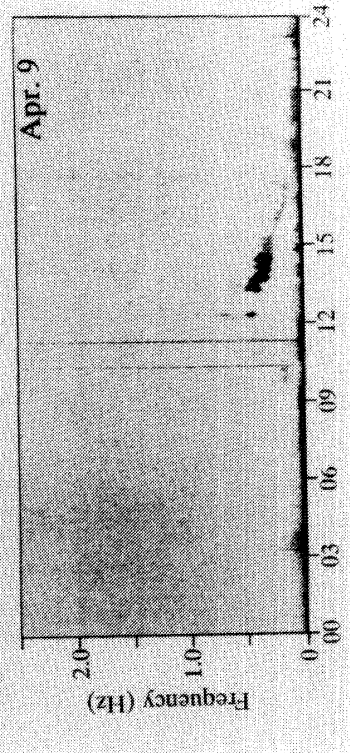
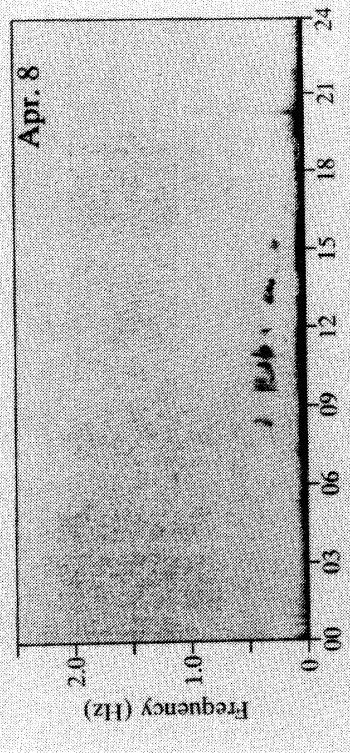
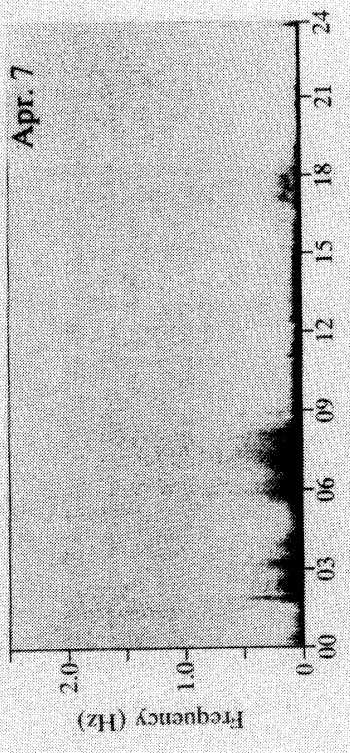
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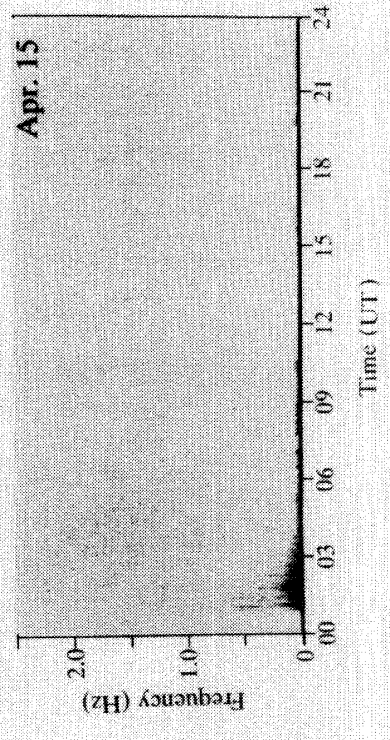
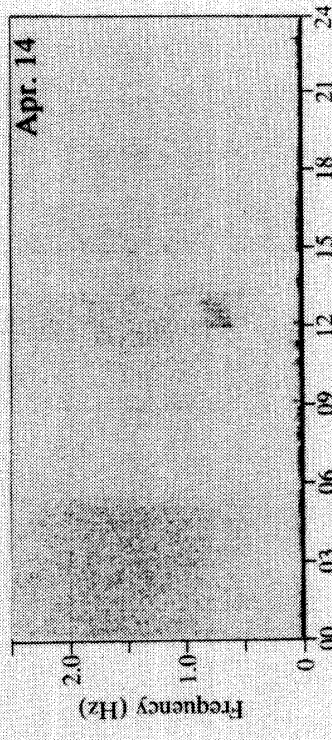
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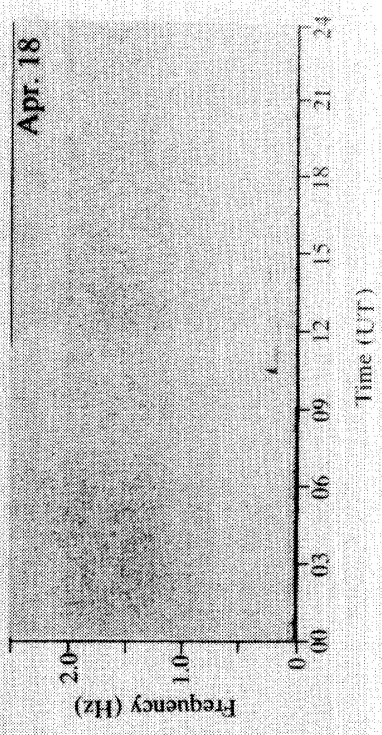
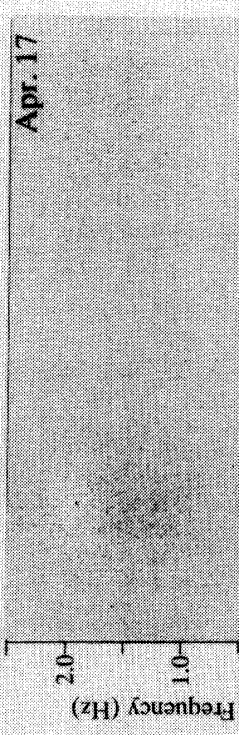
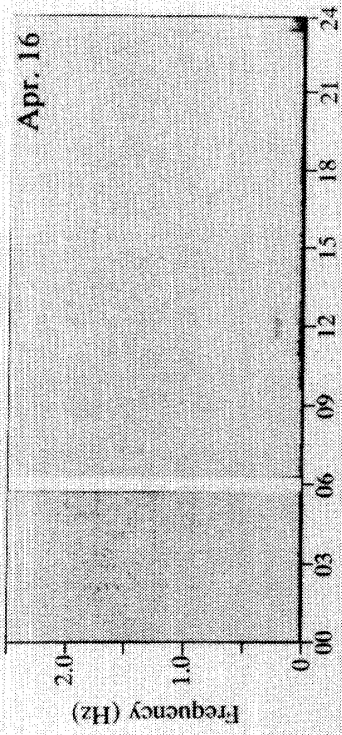
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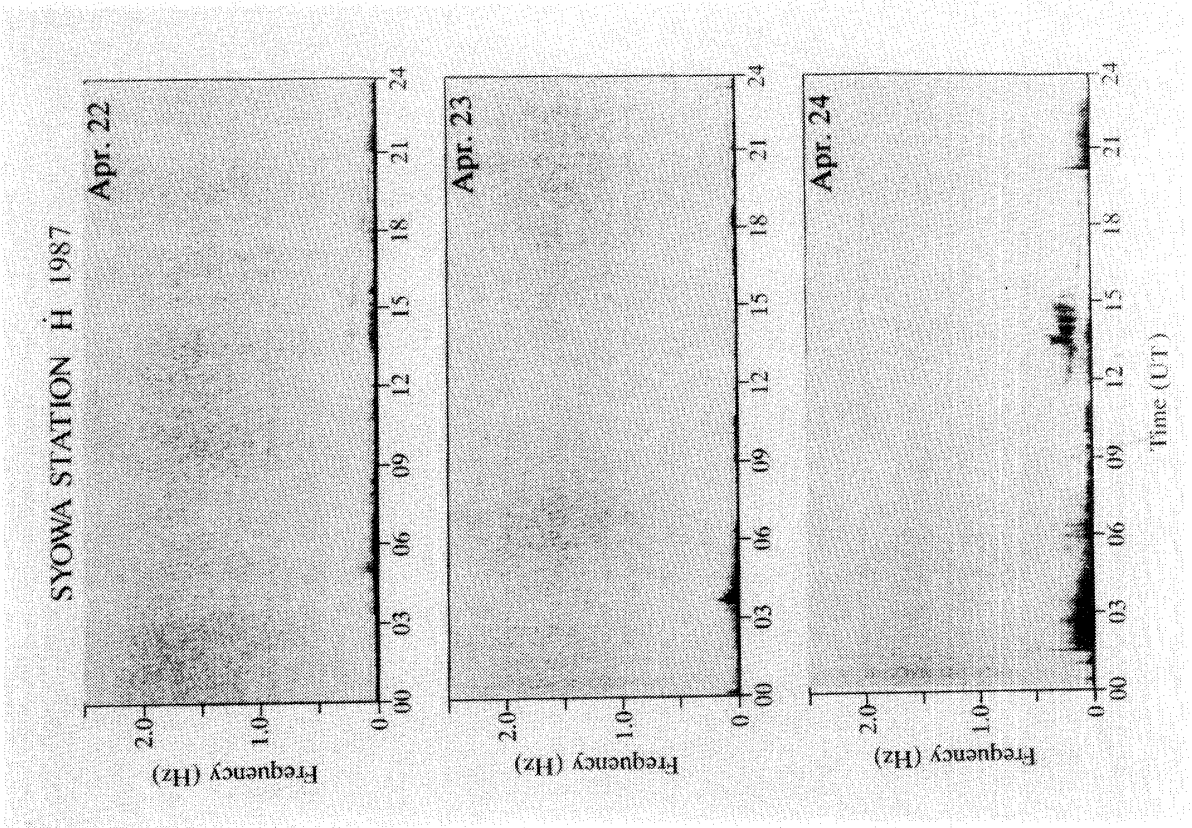
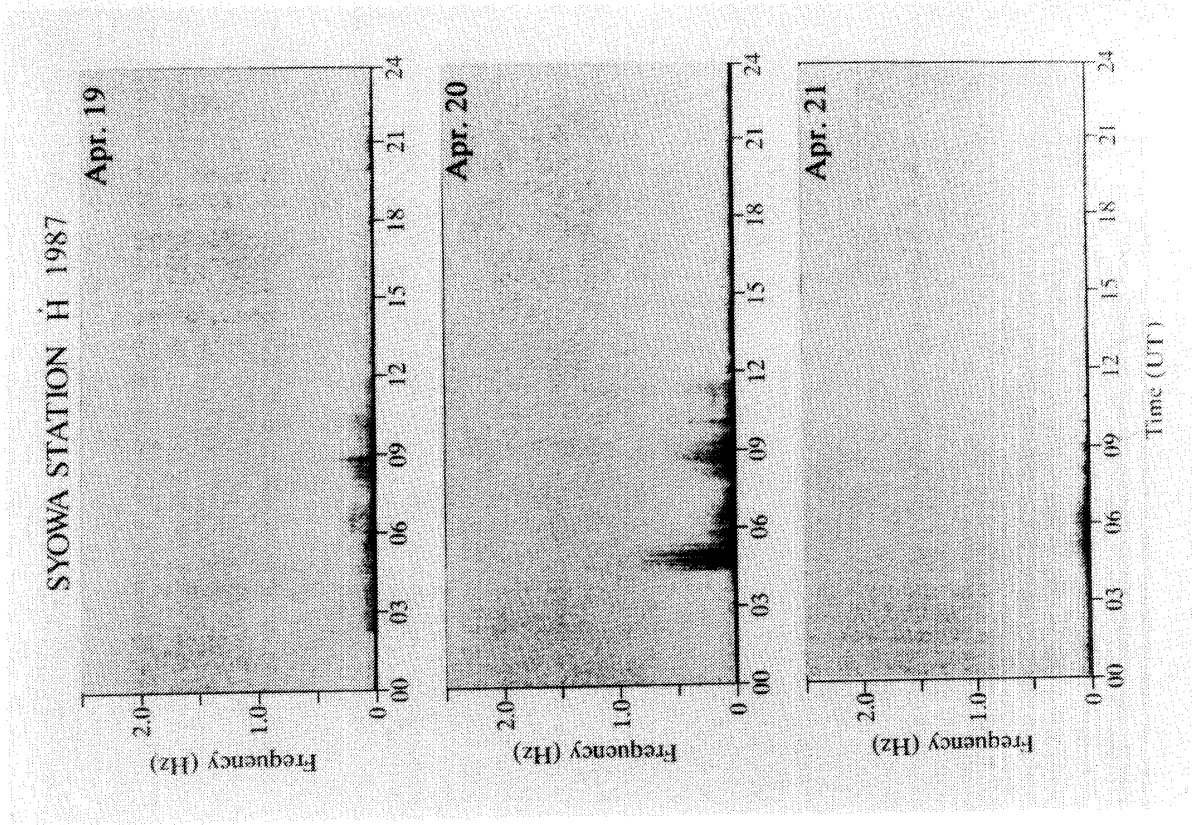


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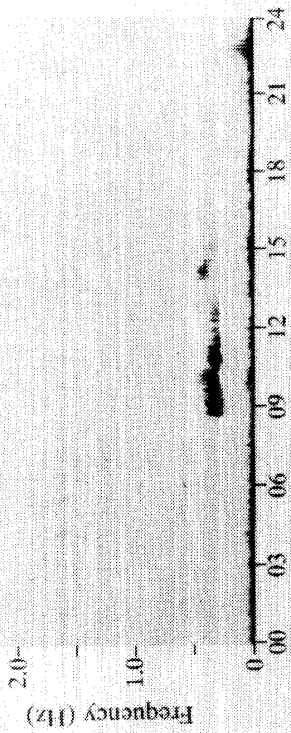
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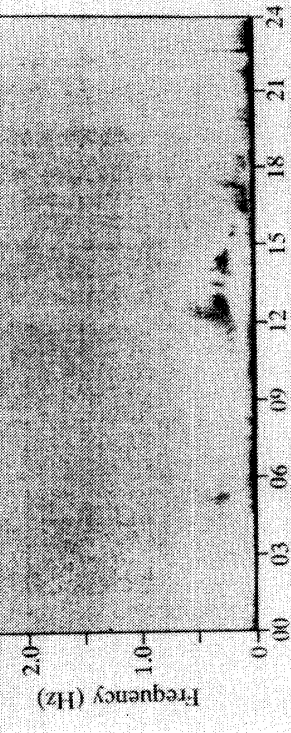
Apr. 25



Apr. 26

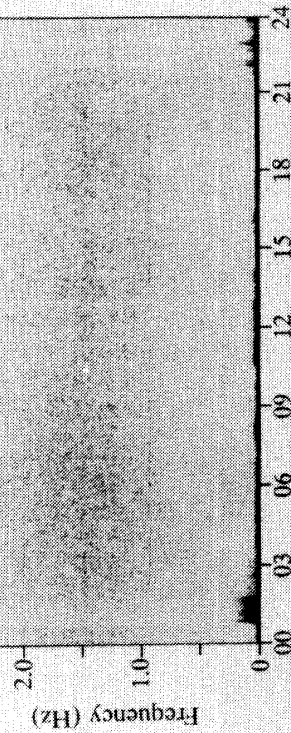


Apr. 27

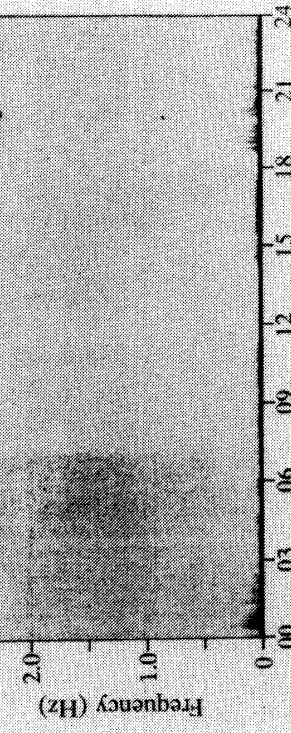


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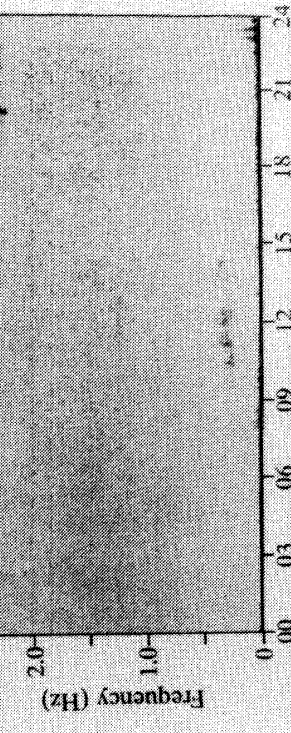
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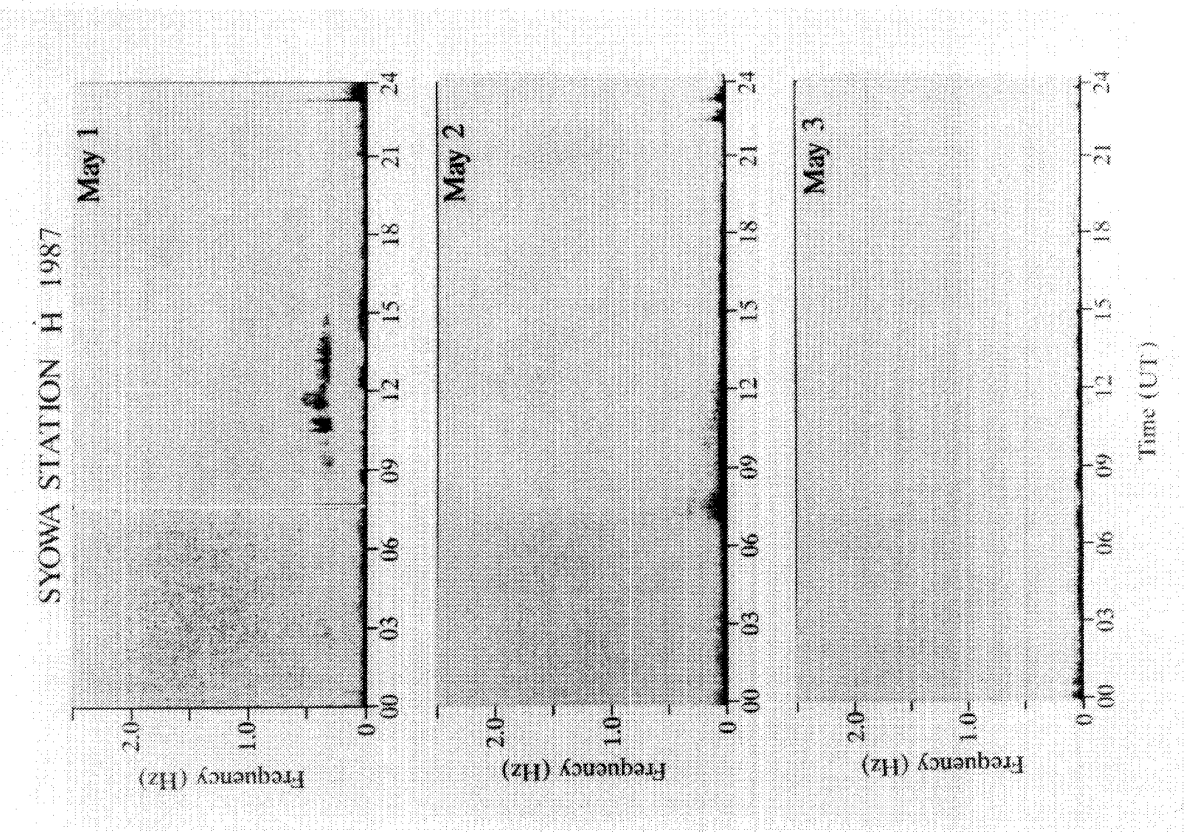
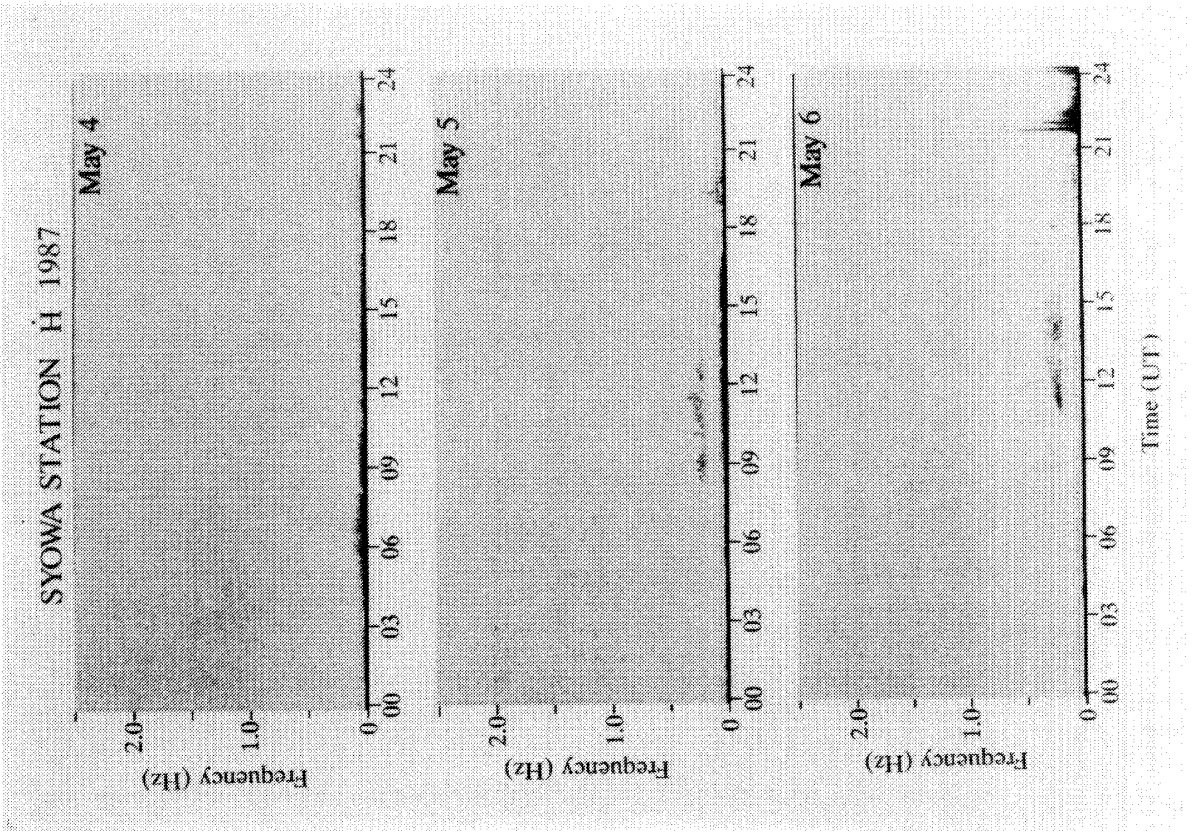


Apr. 29

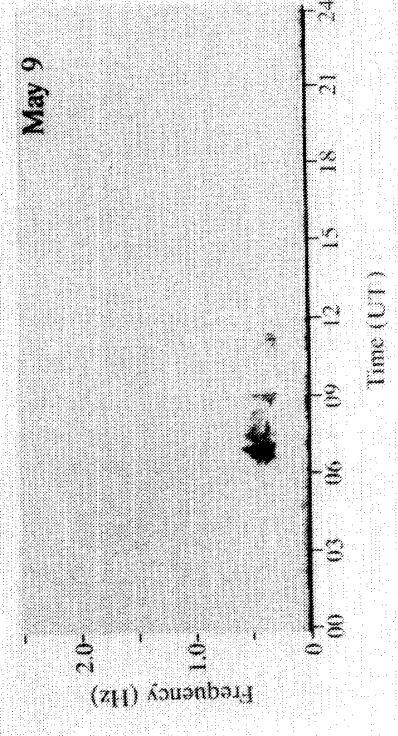
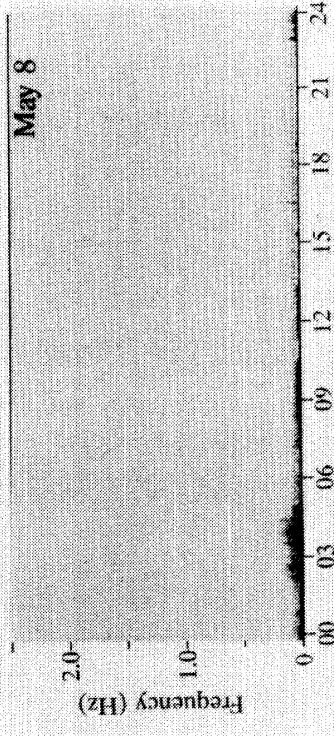
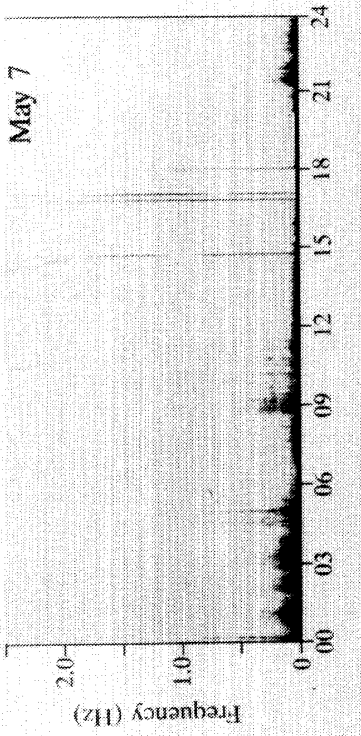


Apr. 30

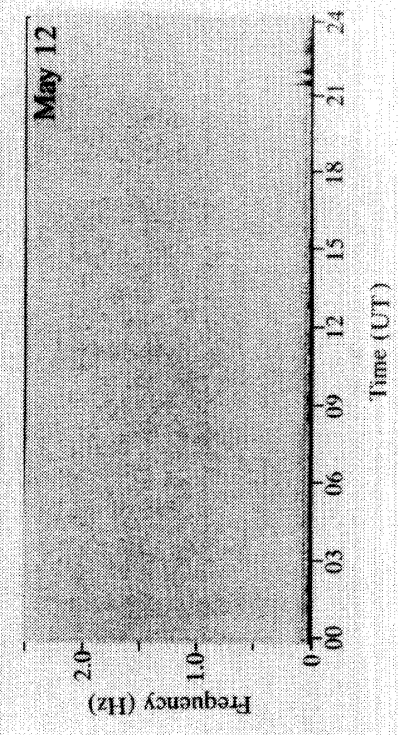
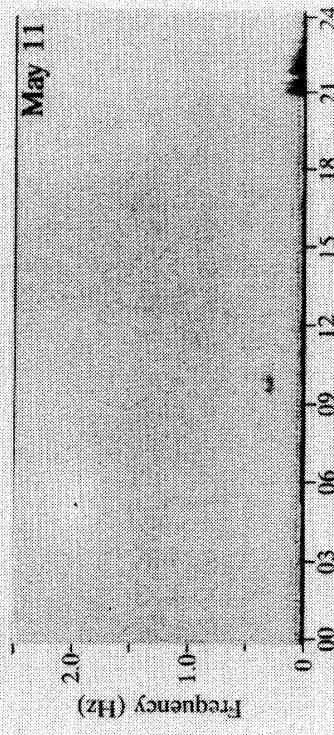
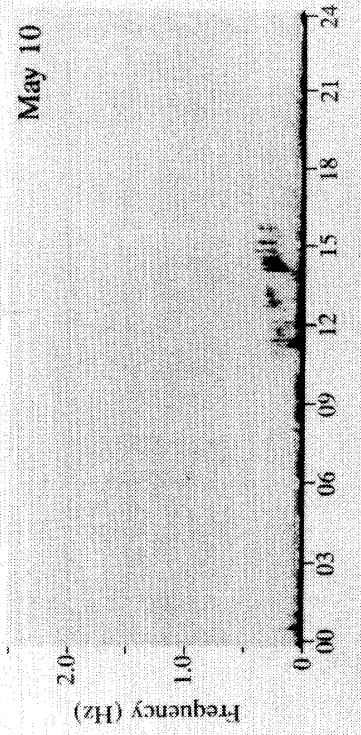




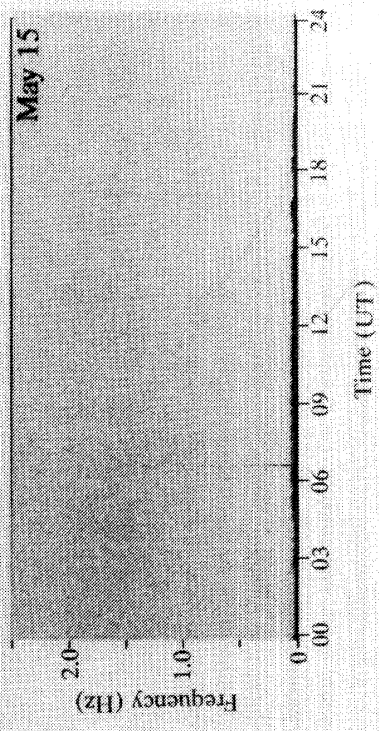
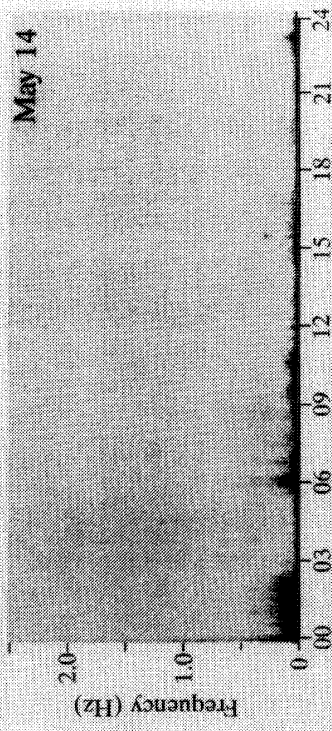
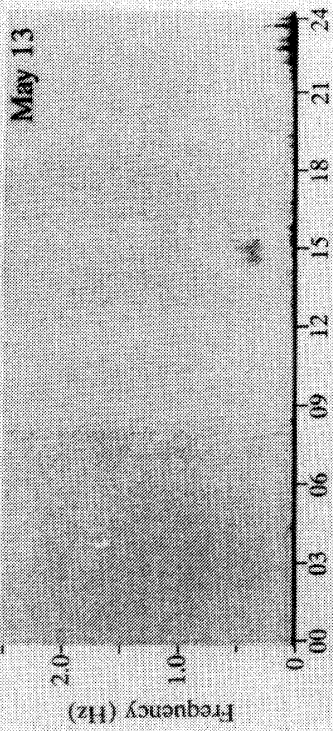
SYOWA STATION II 1987



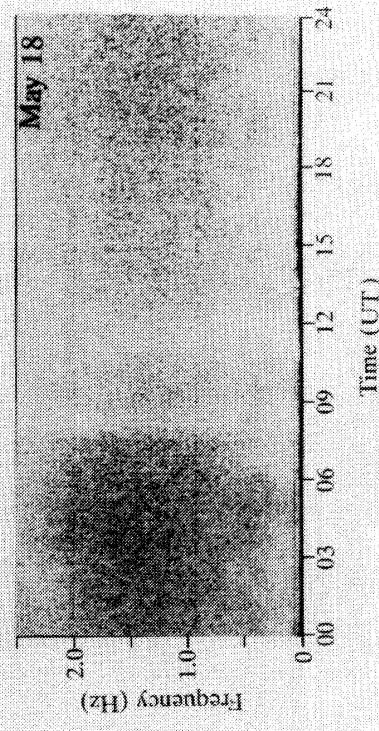
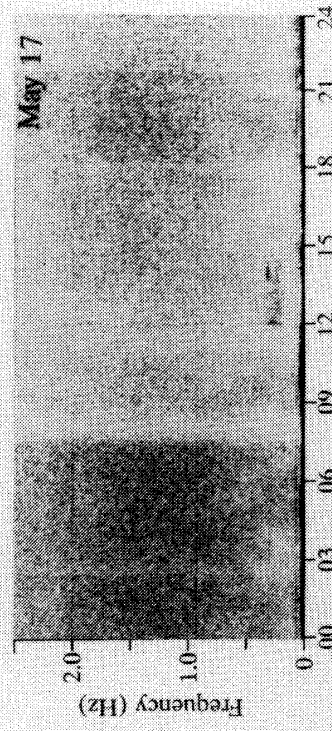
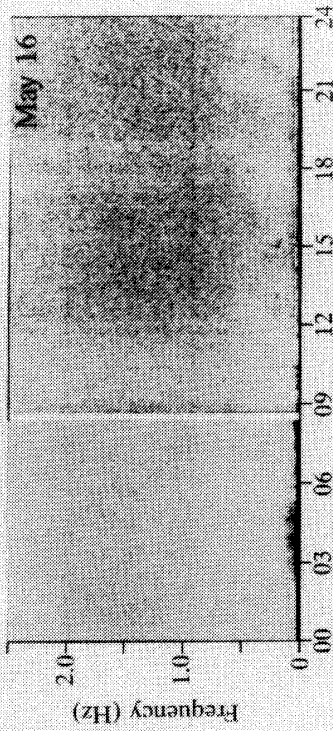
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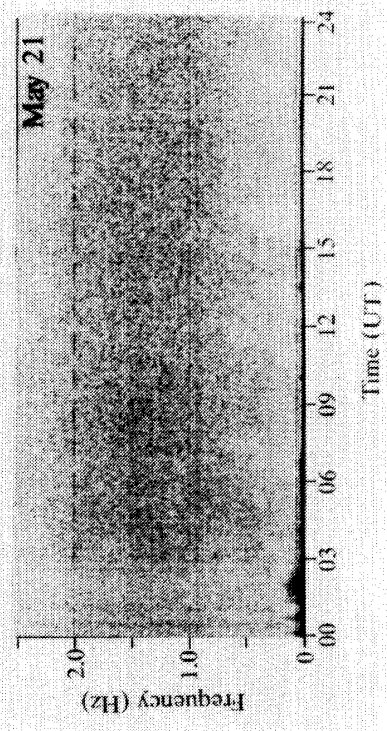
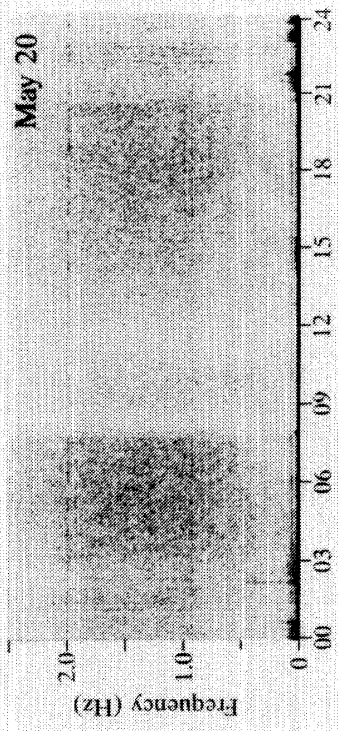
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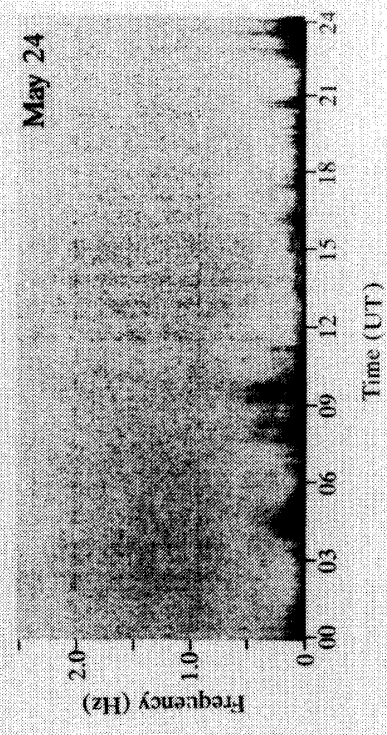
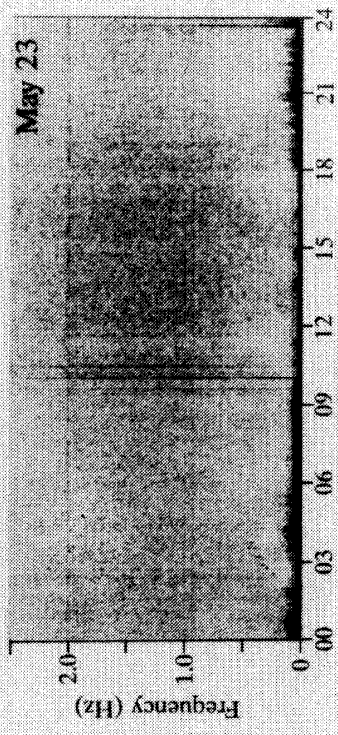
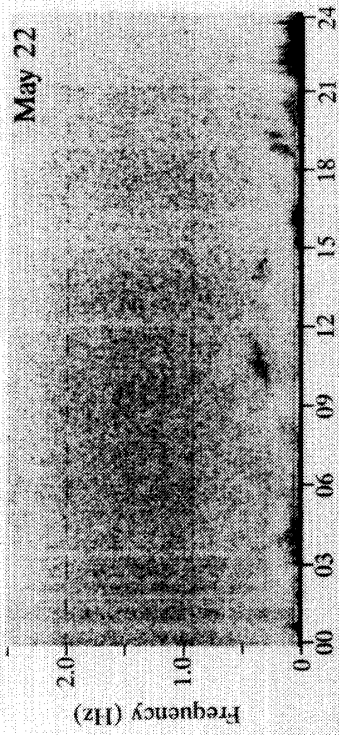
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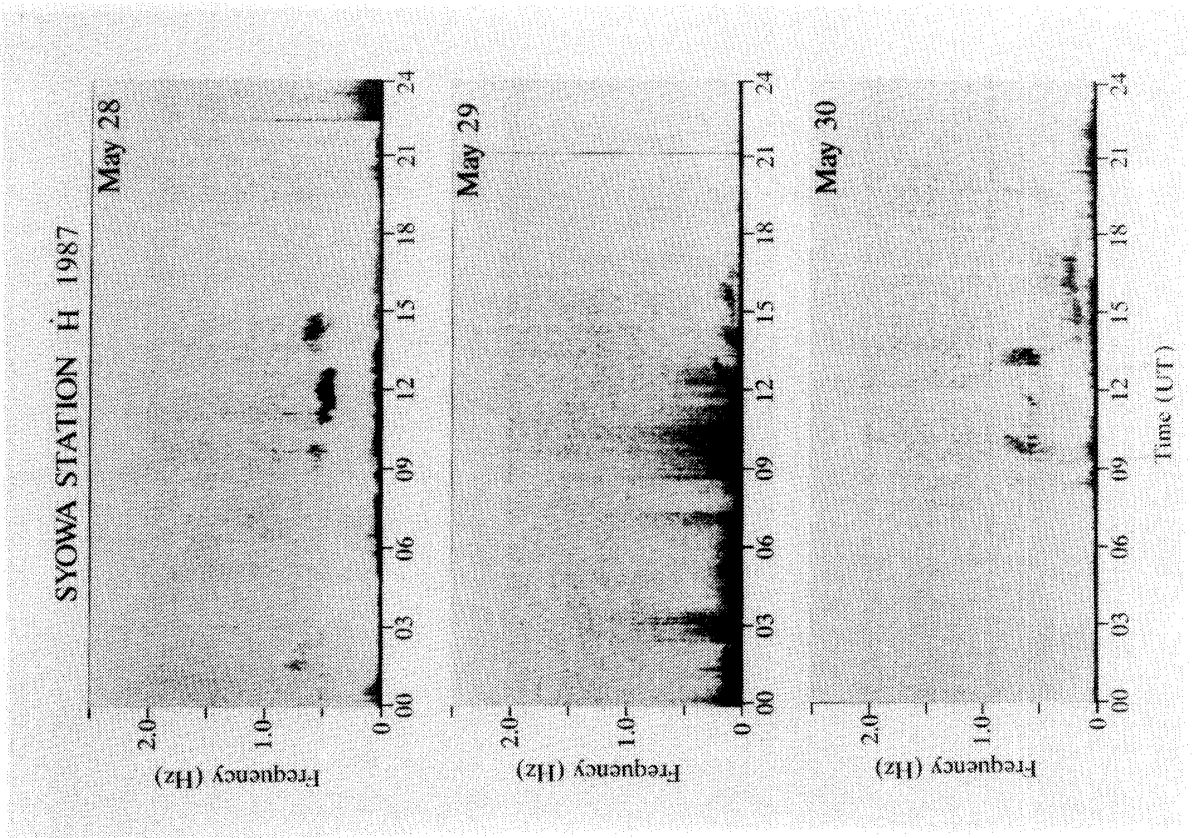
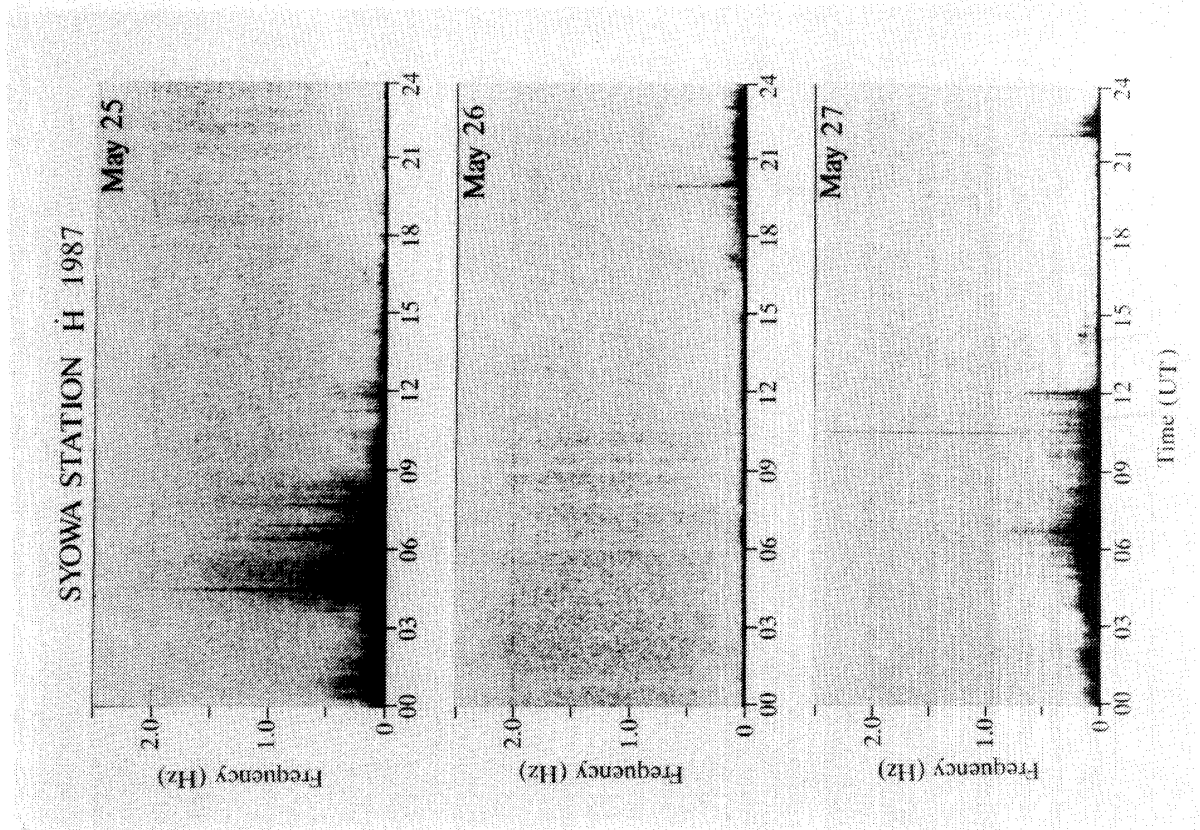


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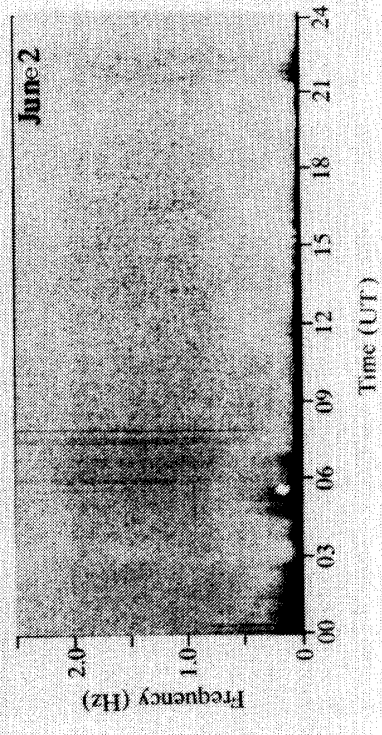
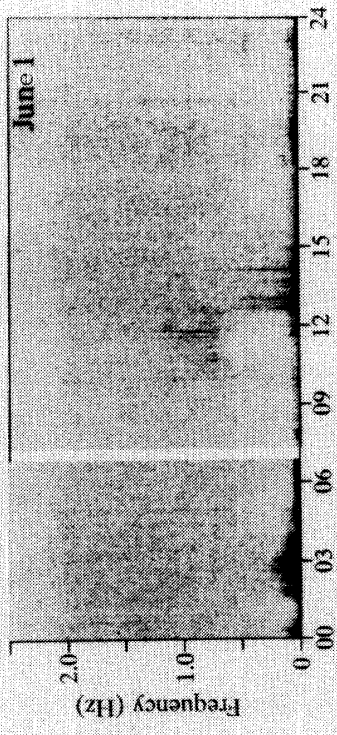
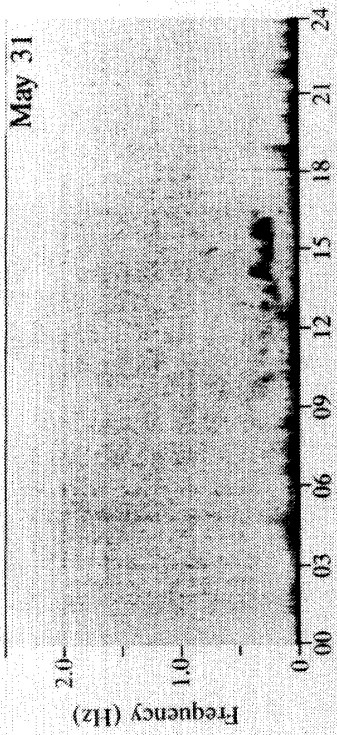


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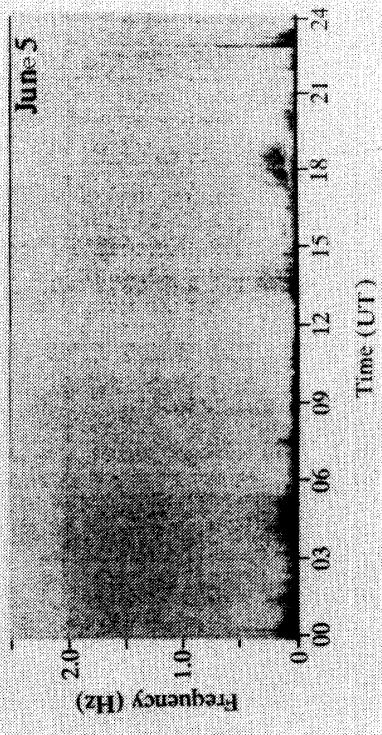
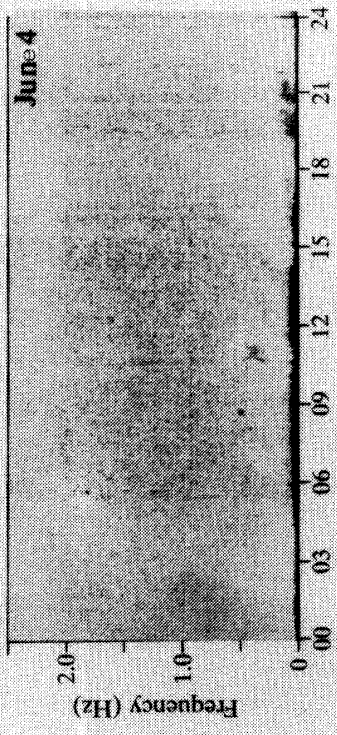
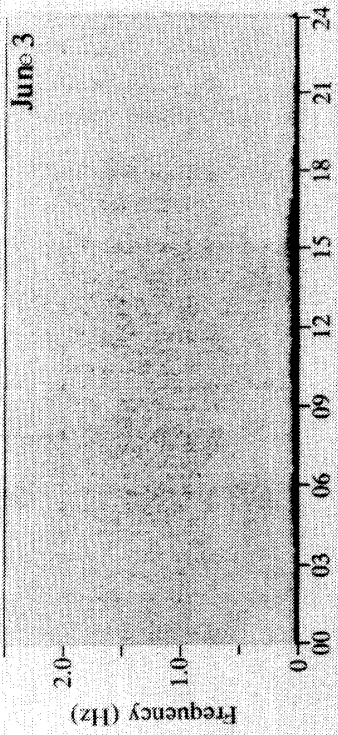


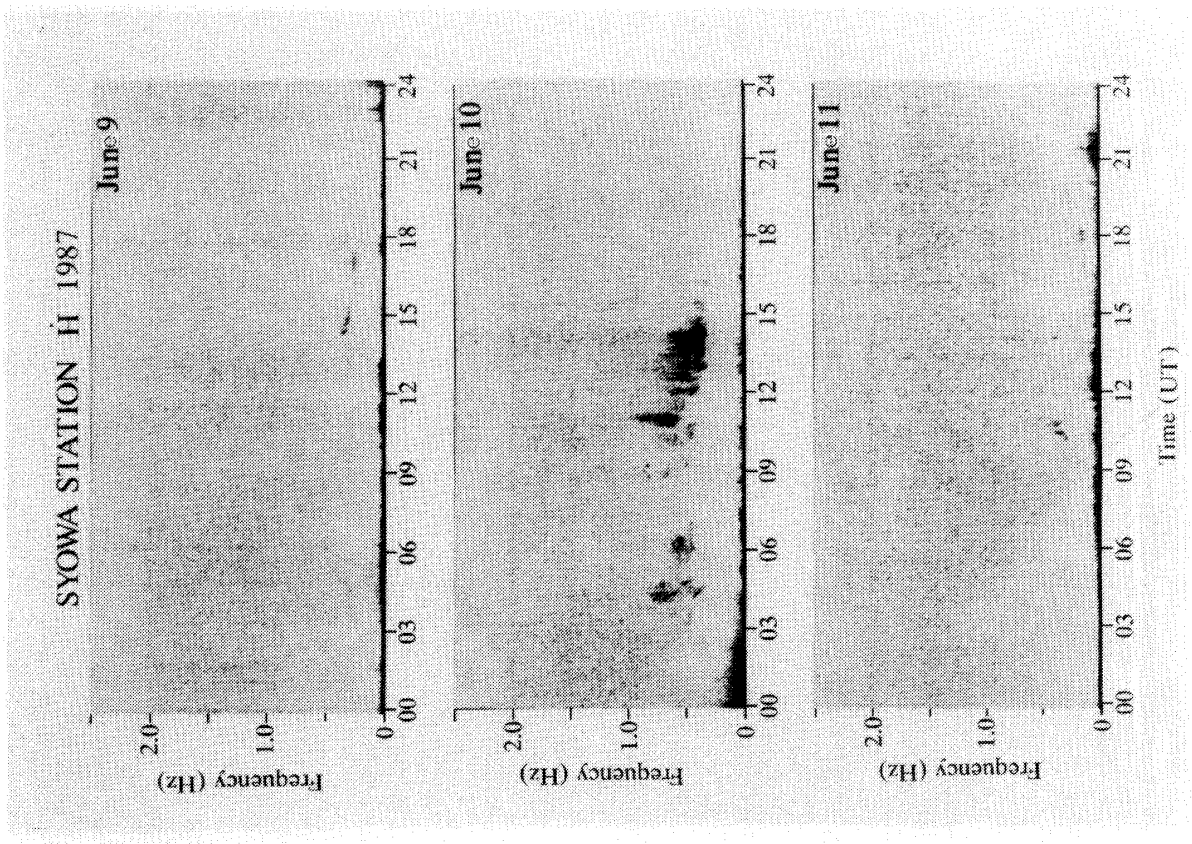
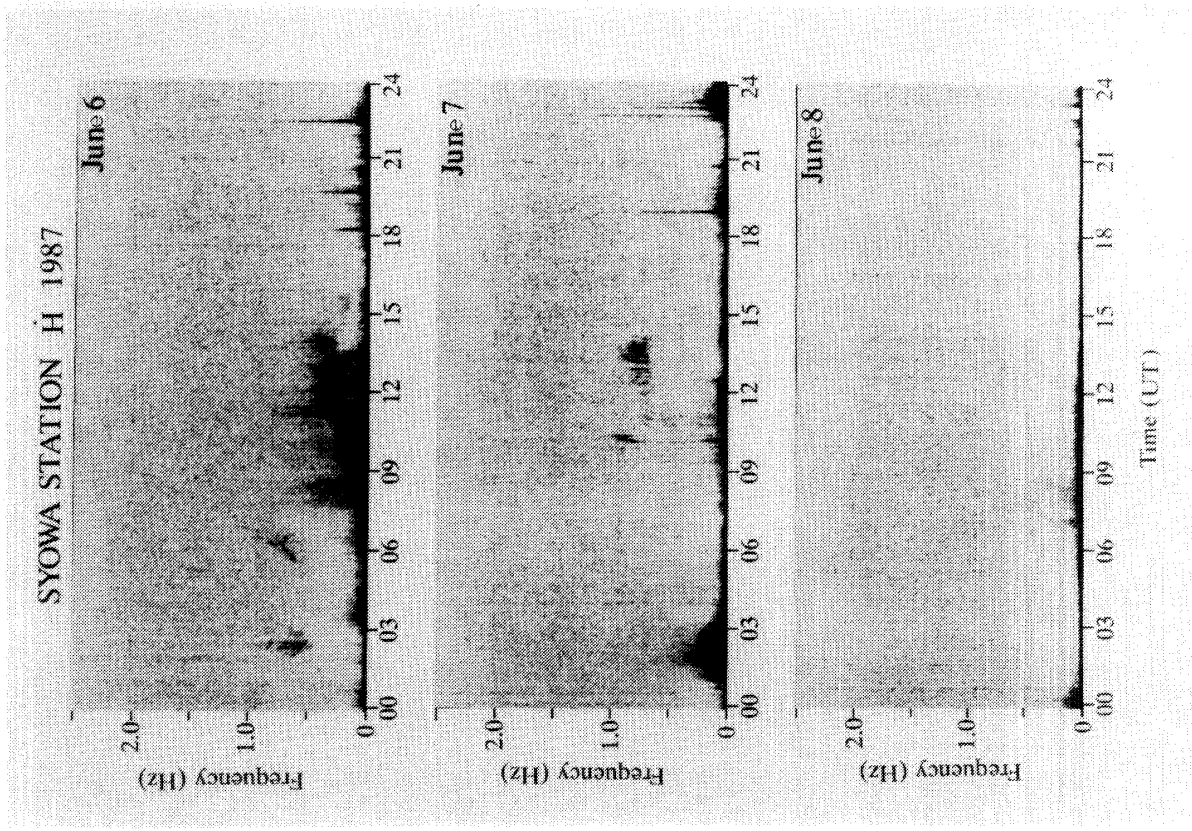


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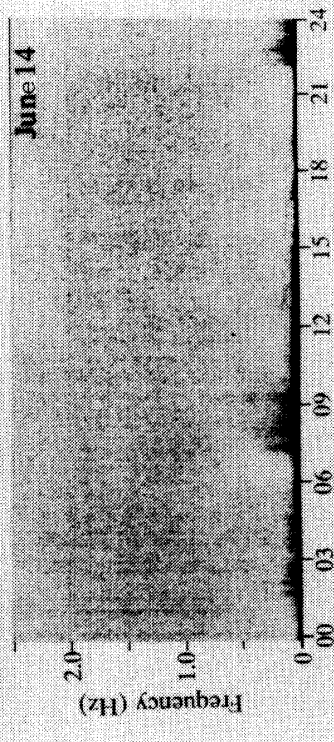
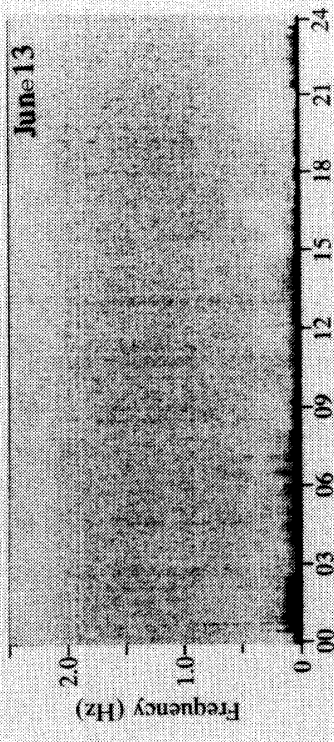
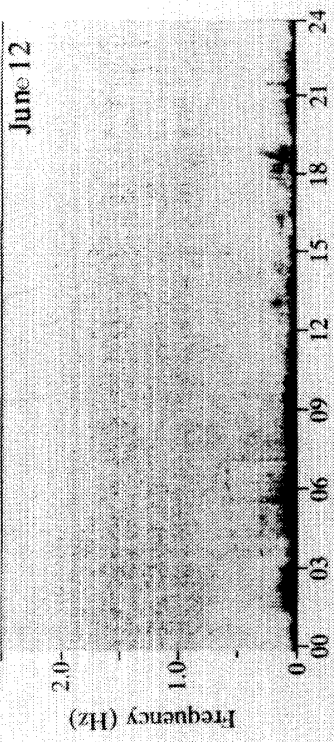


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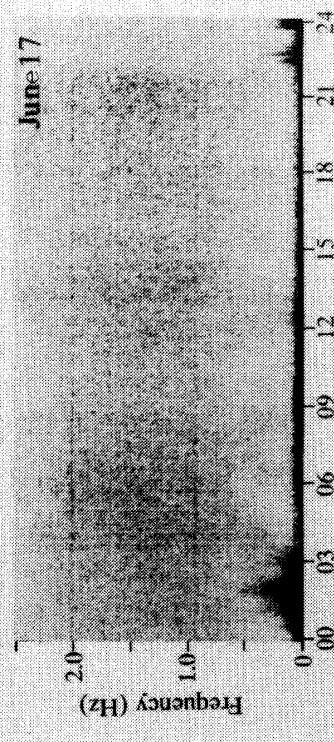
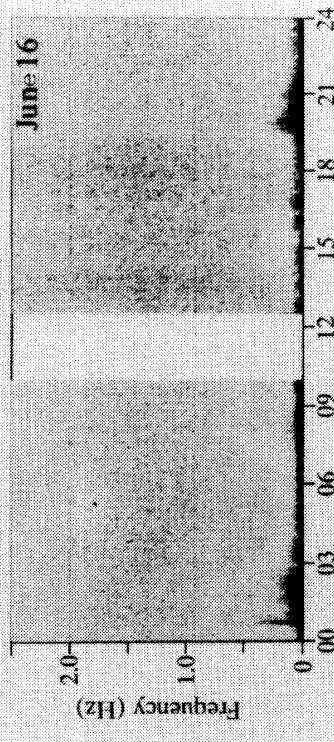
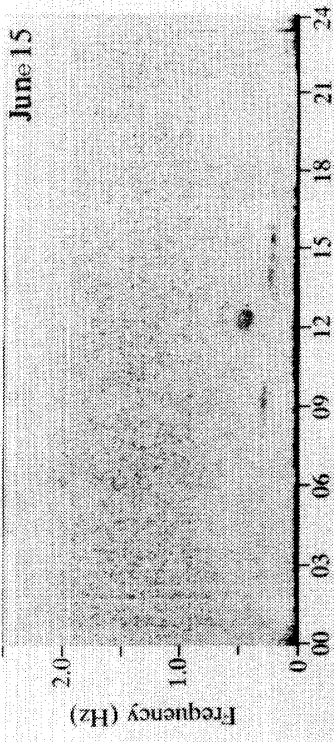


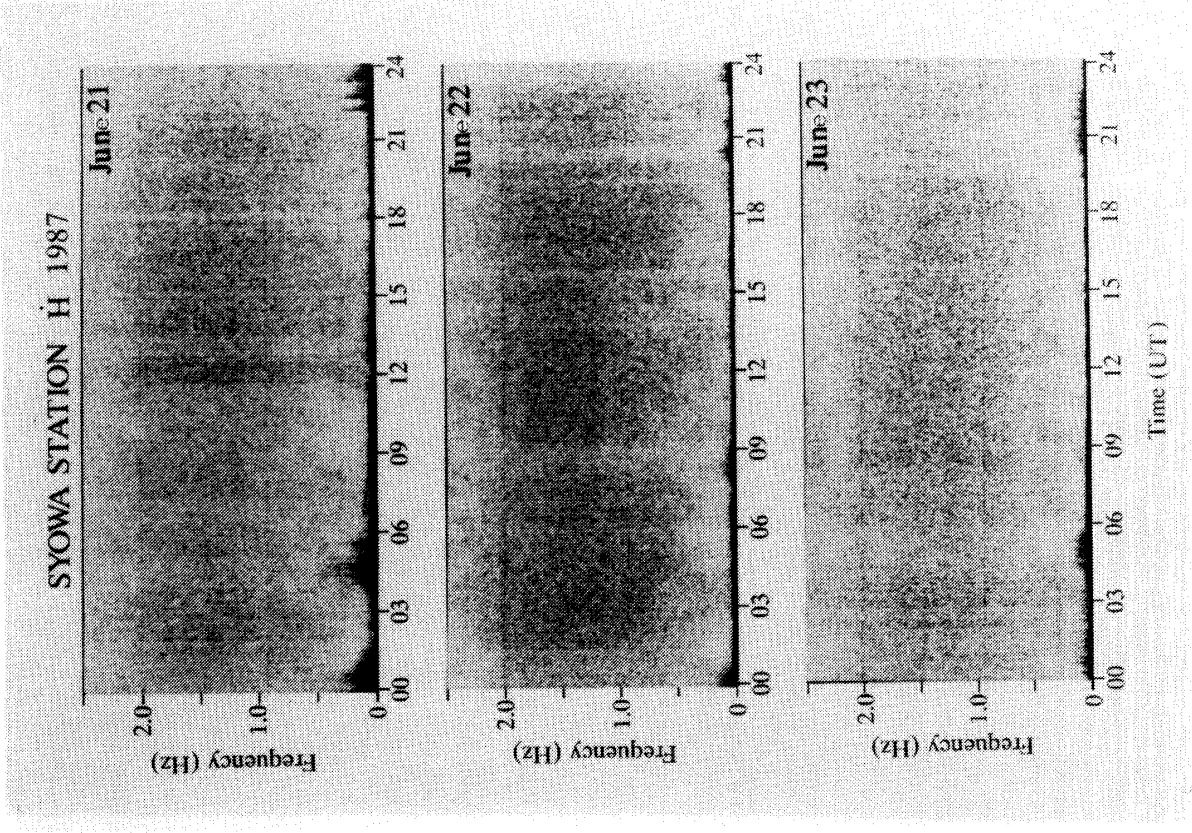
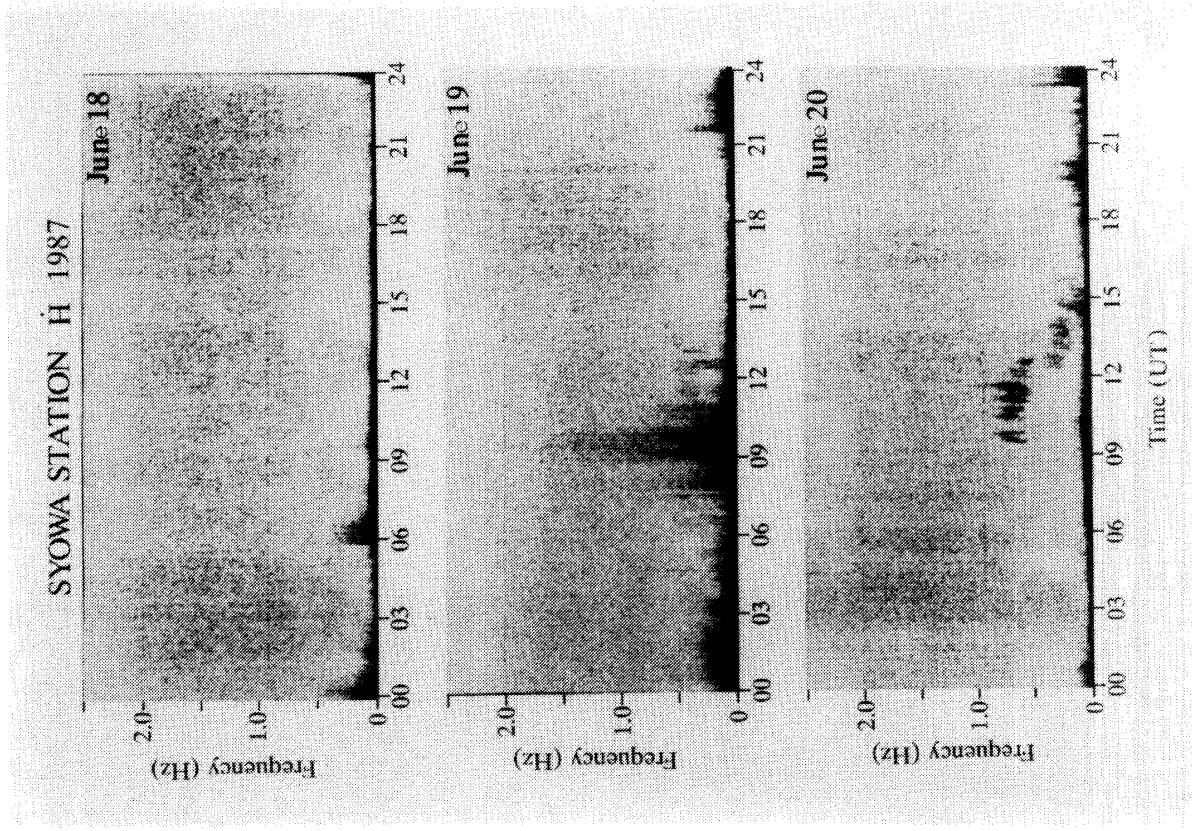


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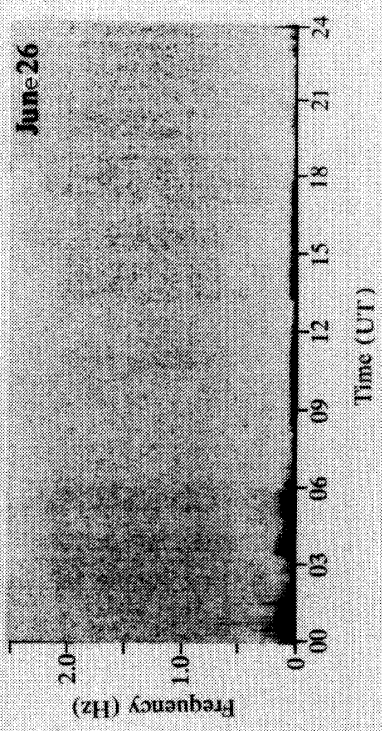
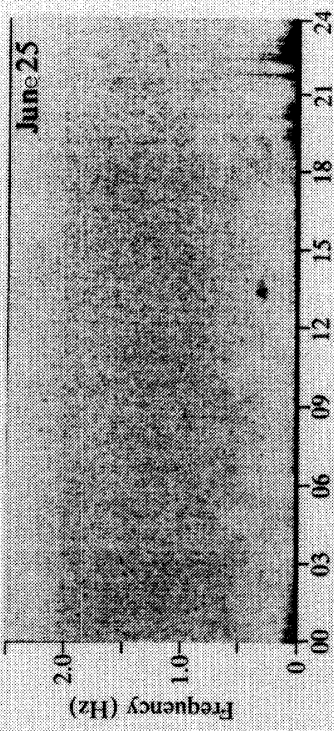


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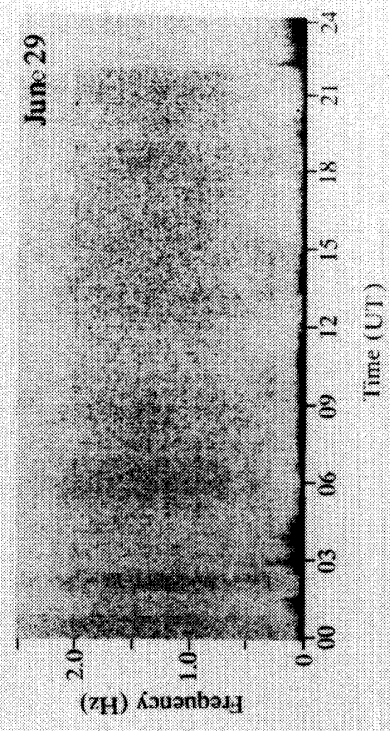
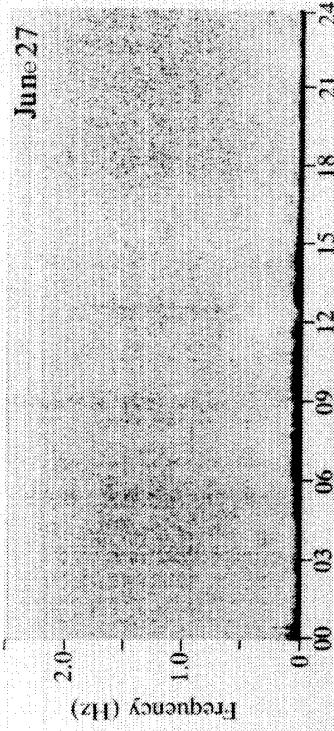


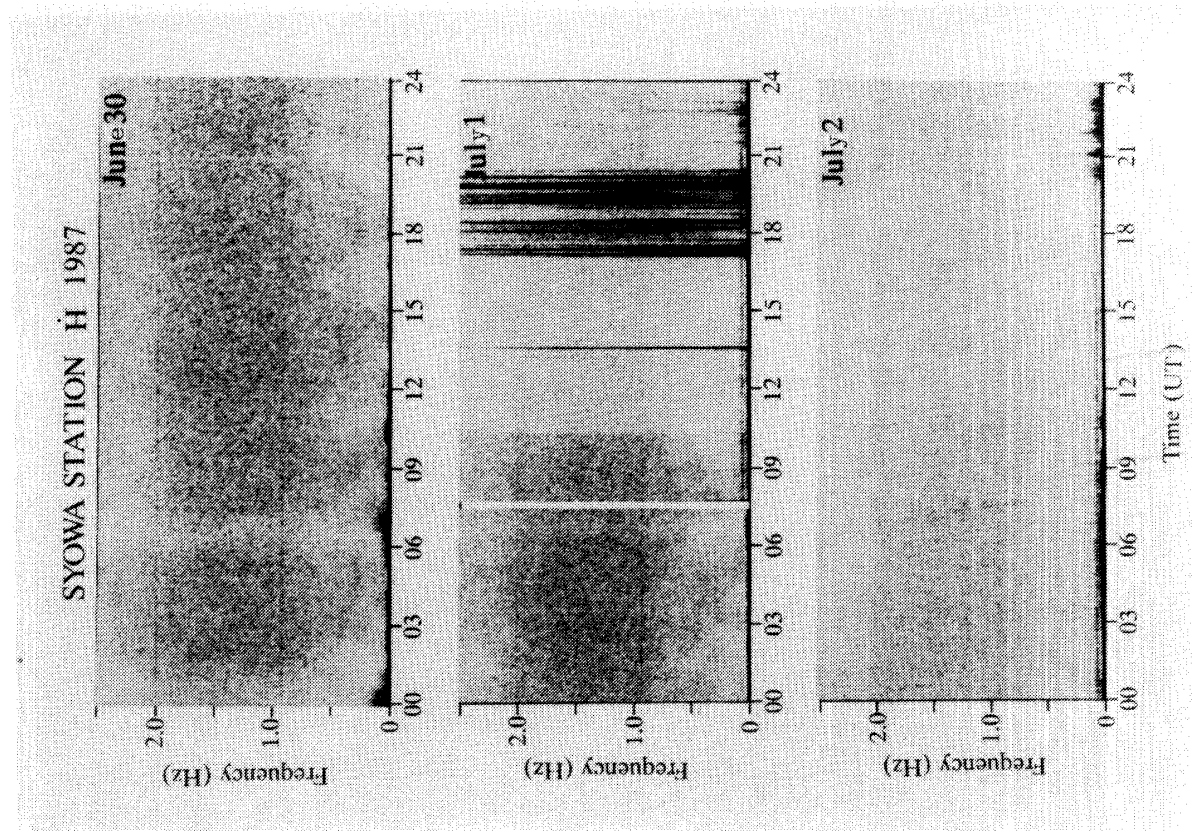
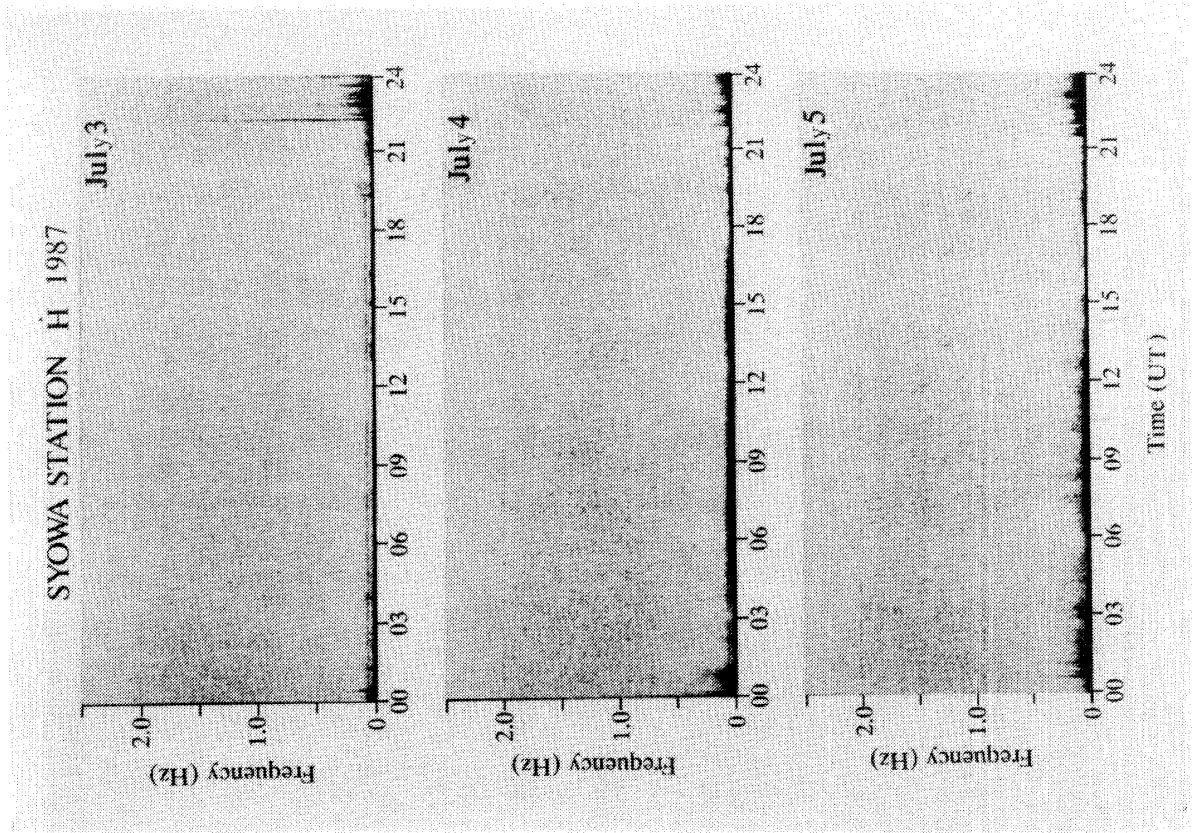


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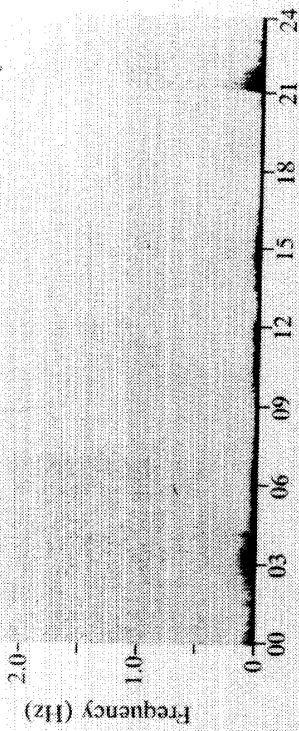
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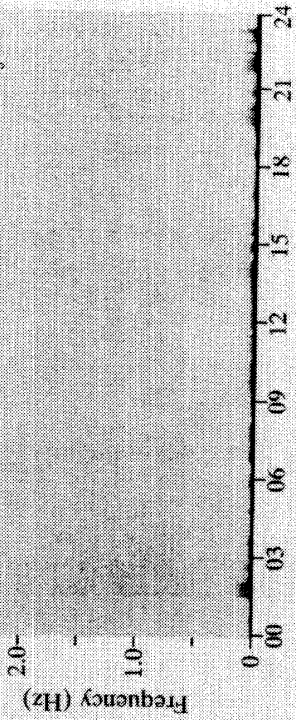


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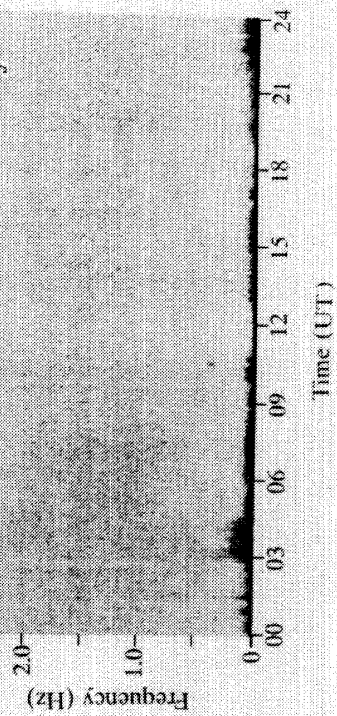
July 6



July 7

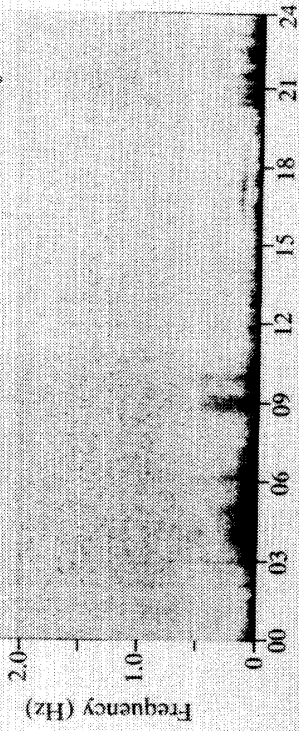


July 8

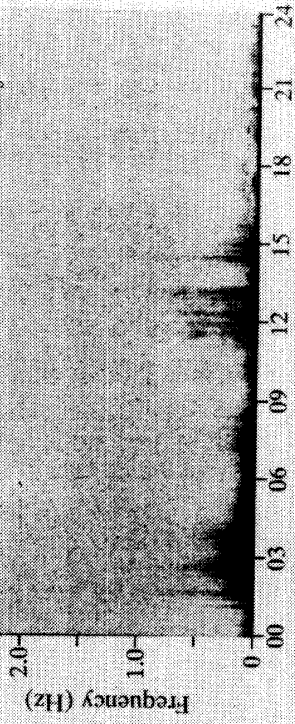


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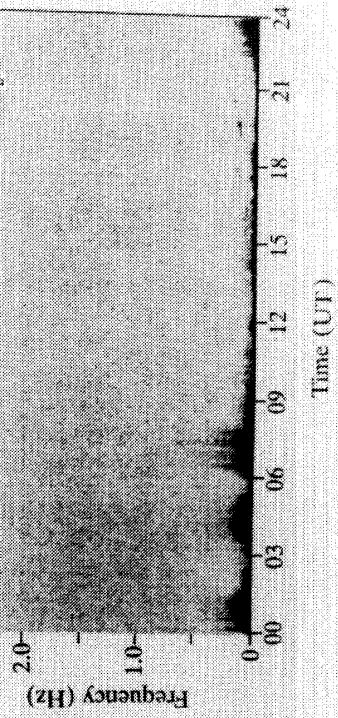
July 9



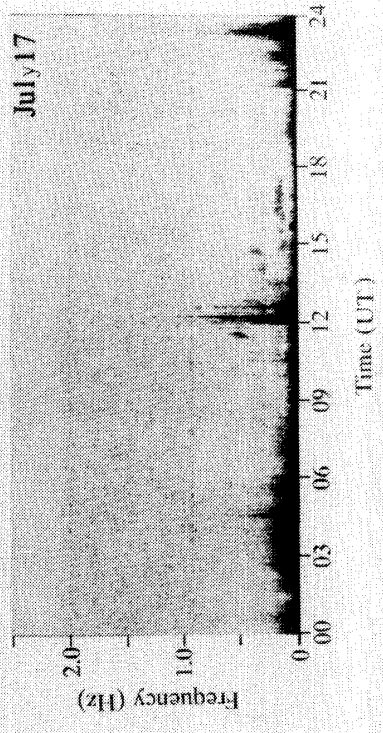
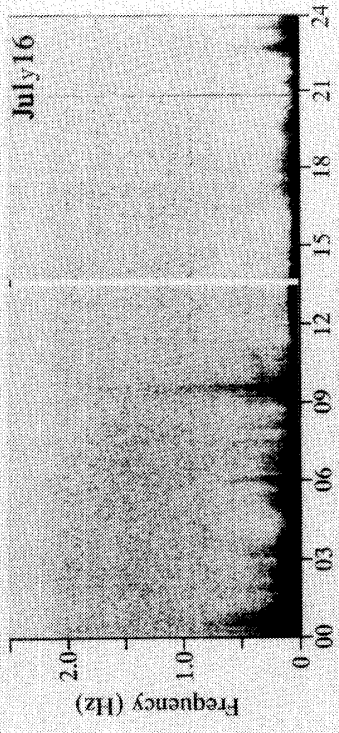
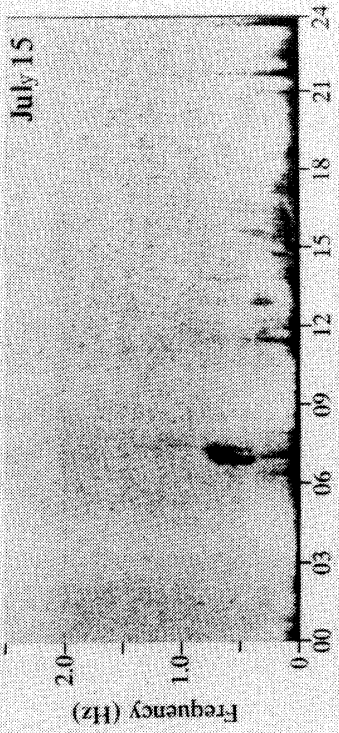
July 10



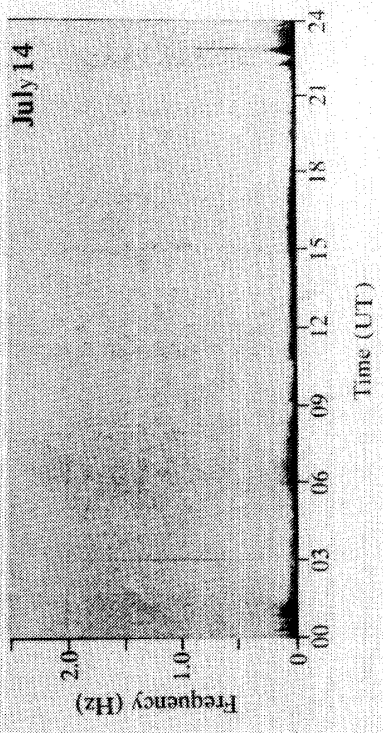
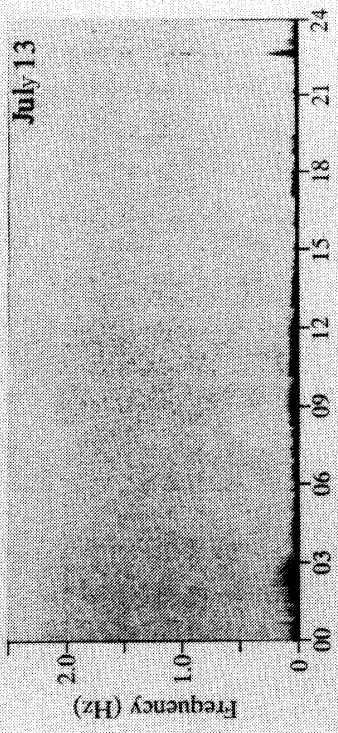
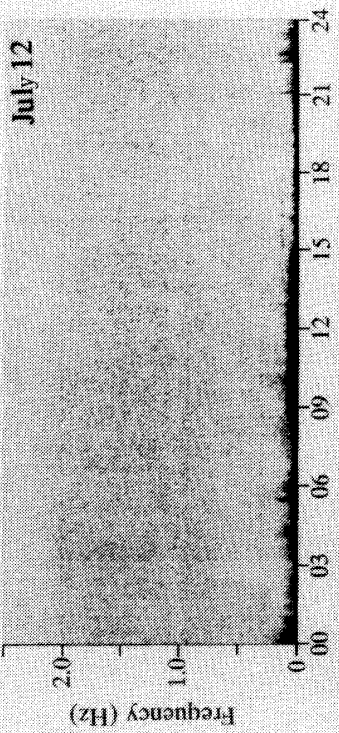
July 11



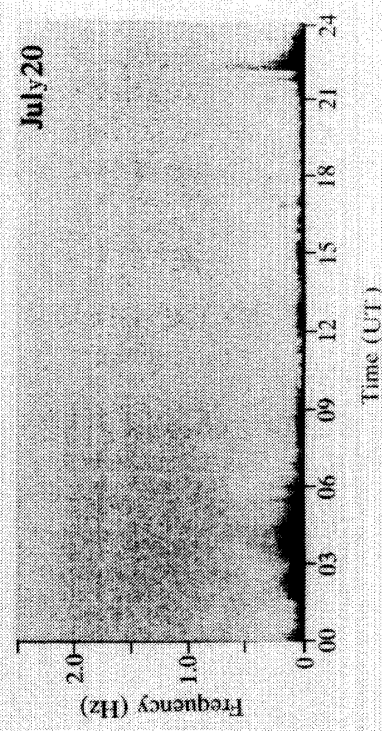
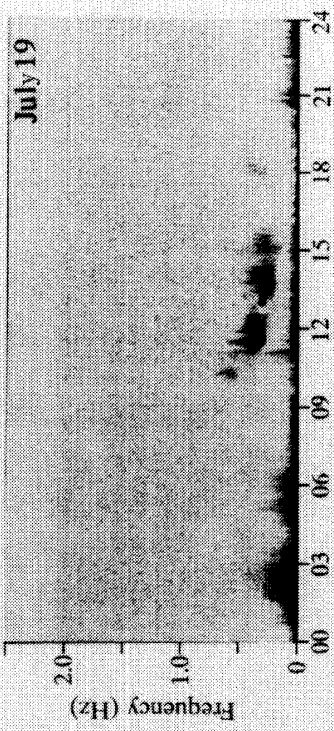
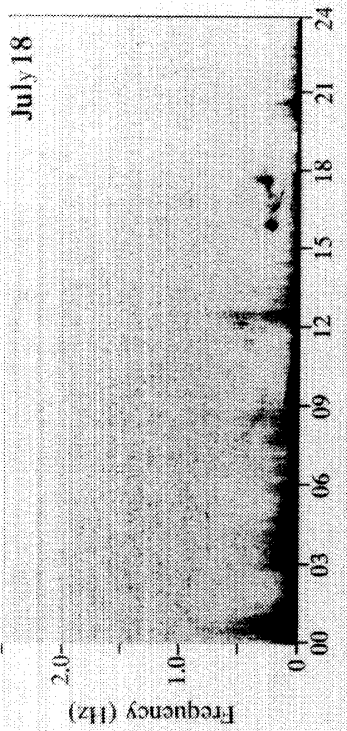
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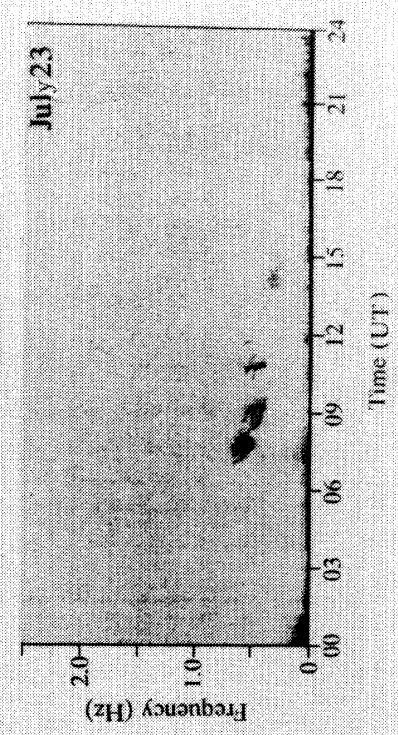
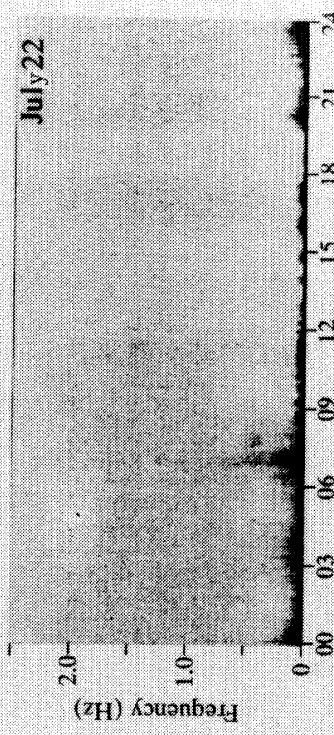
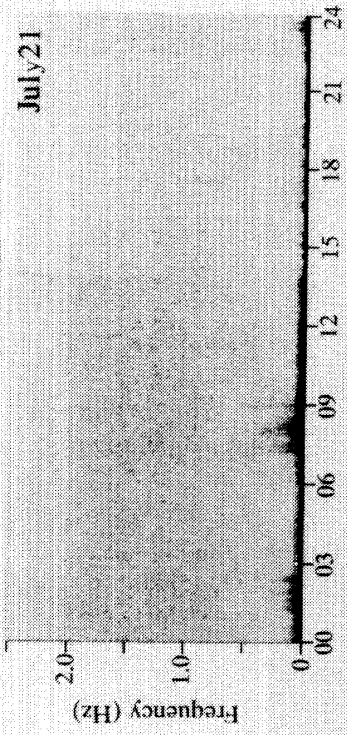
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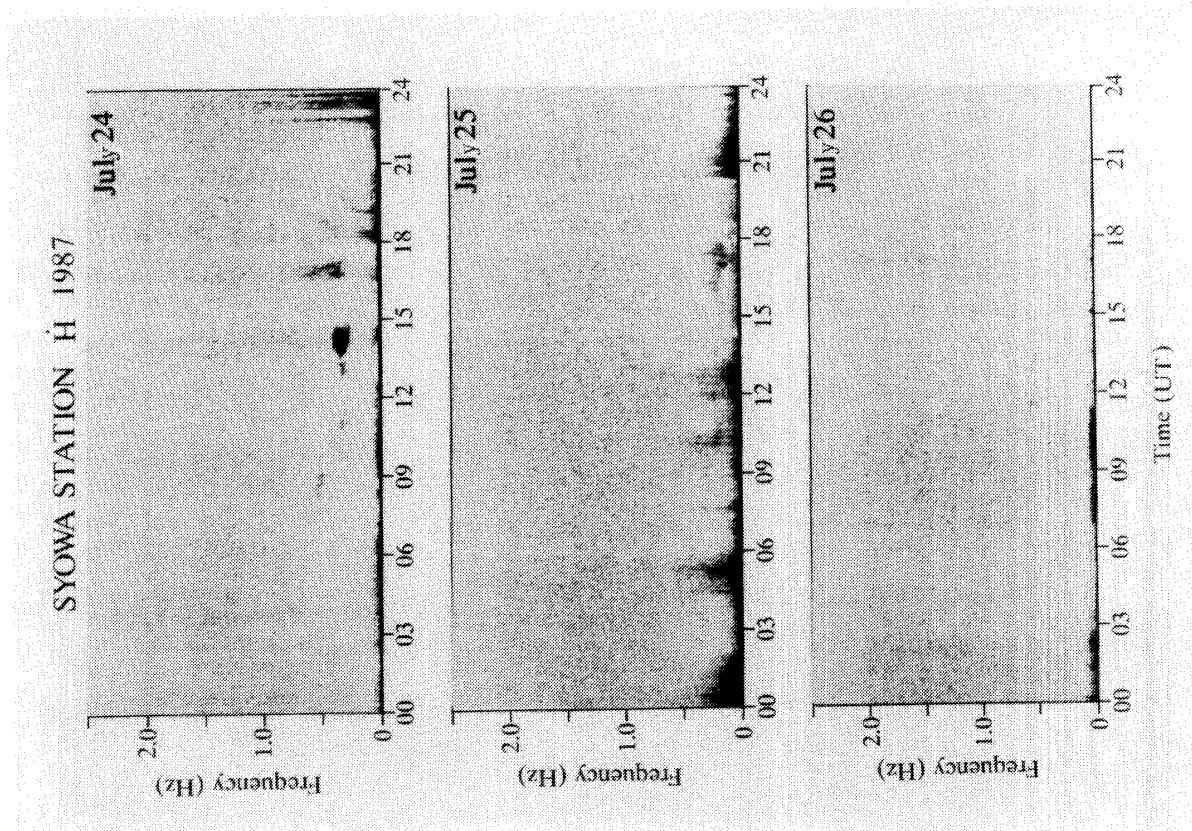
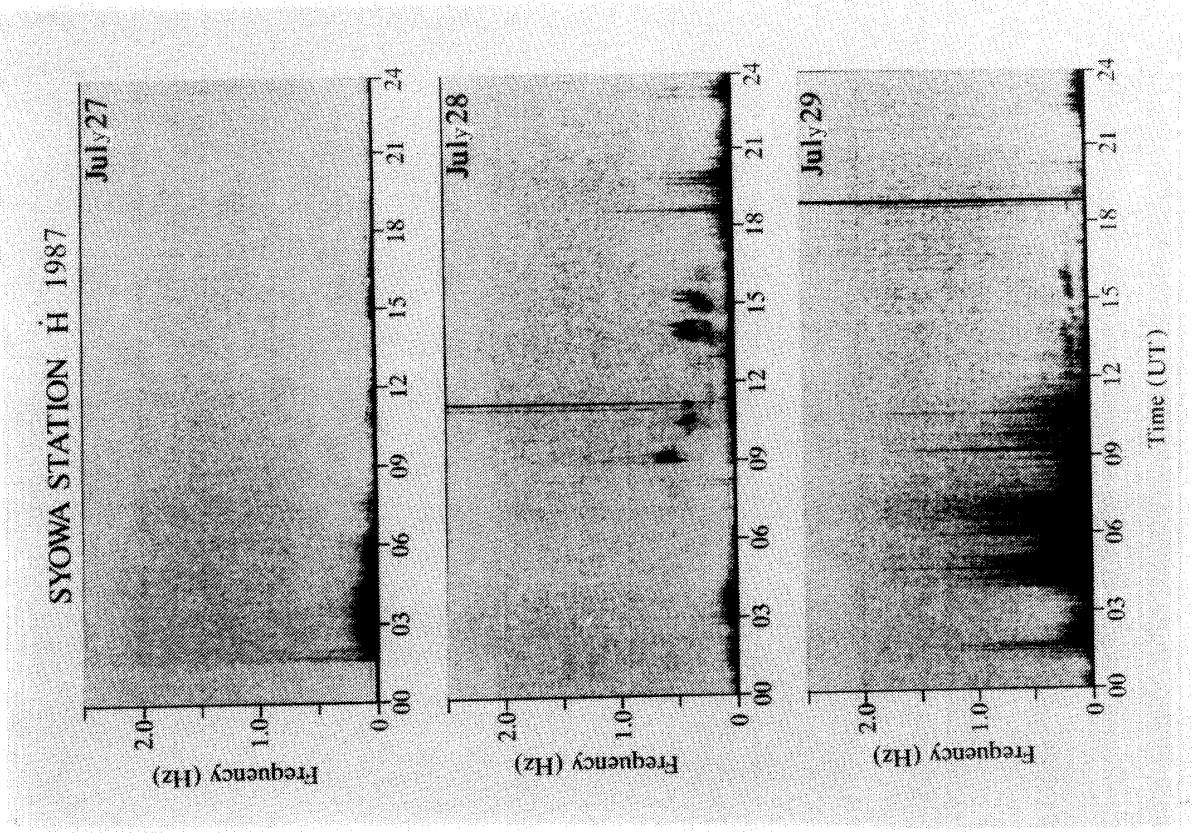


SYOWA STATION H 1987

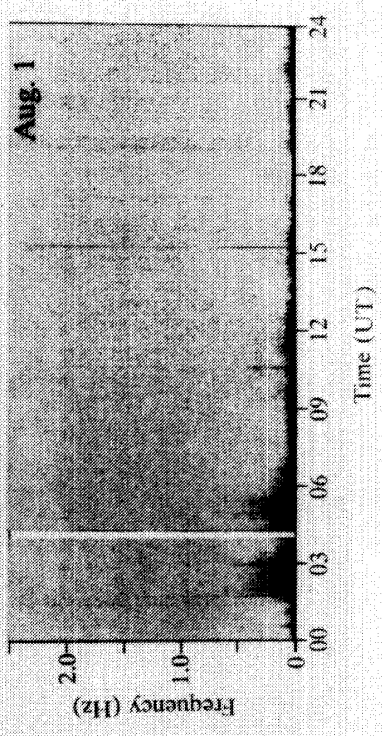
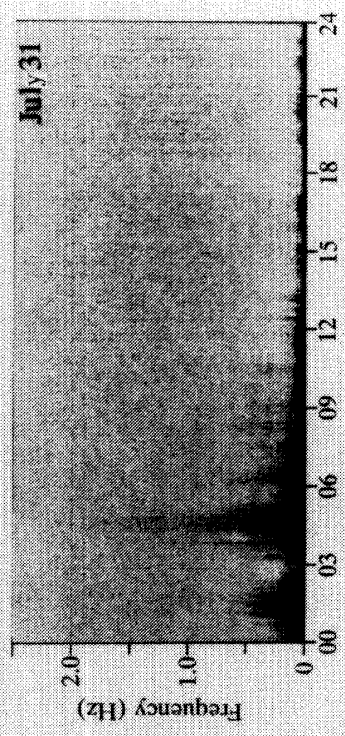
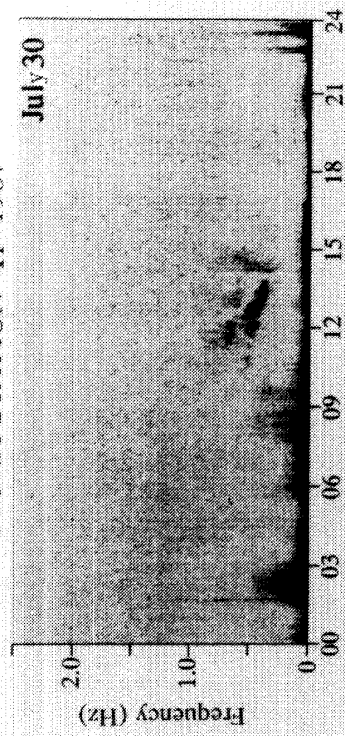


SYOWA STATION H 1987

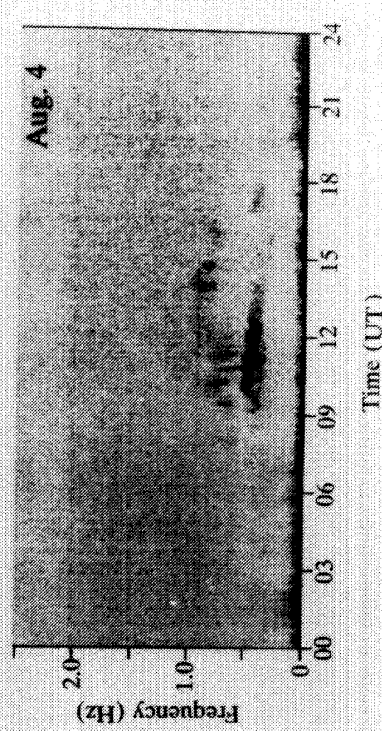
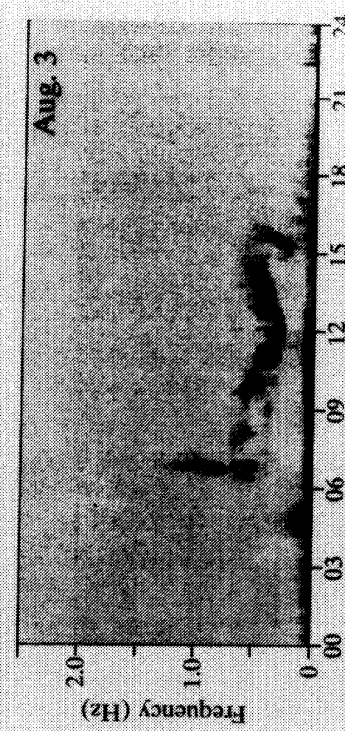
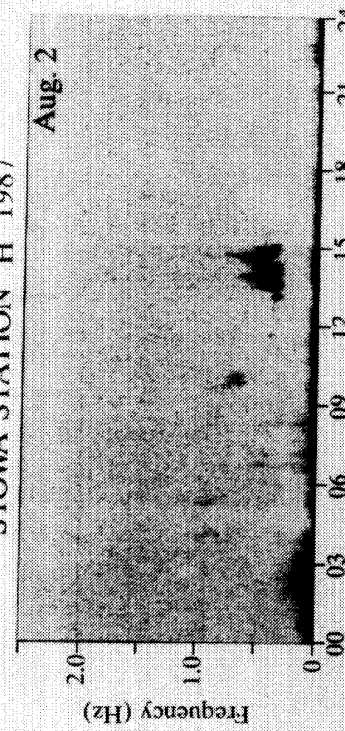




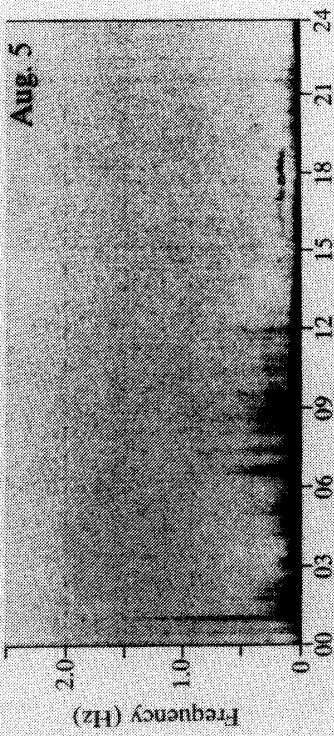
SYOWA STATION H 1987



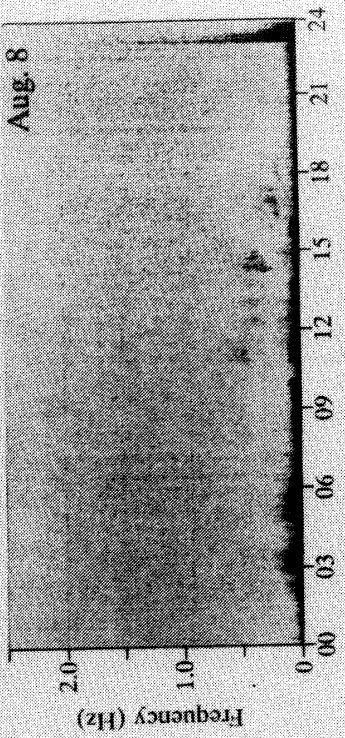
SYOWA STATION H 1987



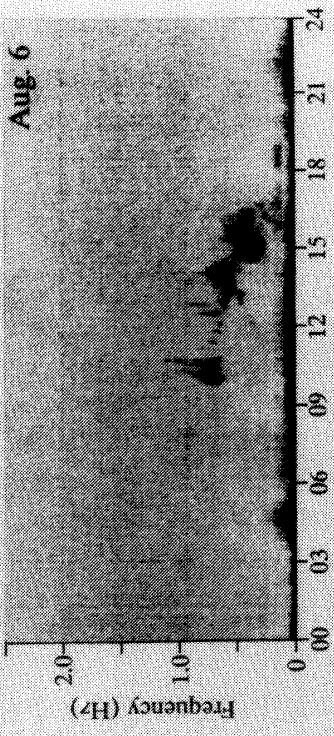
SYOWA STATION H 1987



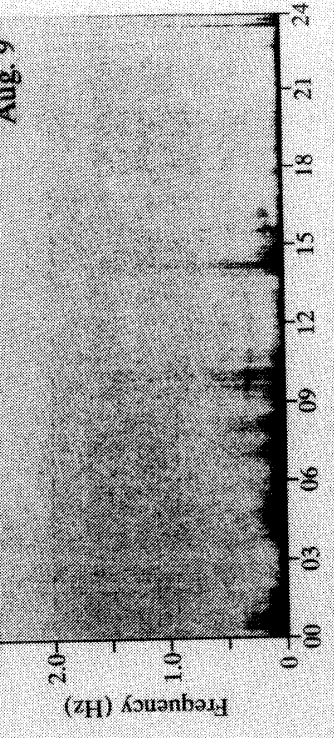
Aug. 8



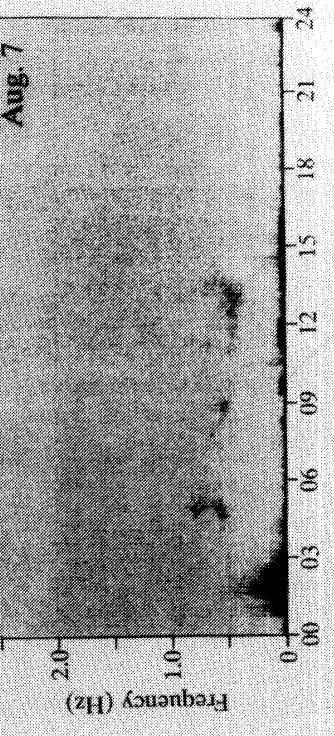
Aug. 6



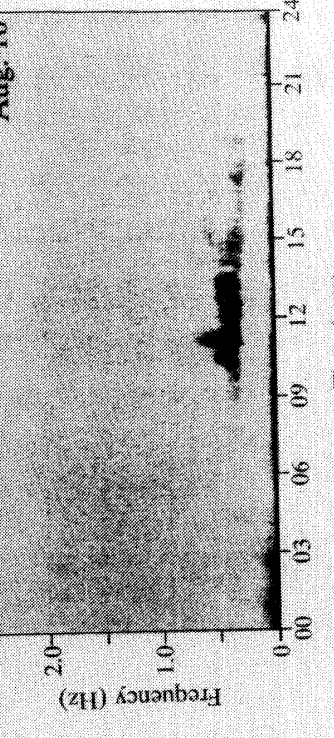
Aug. 9



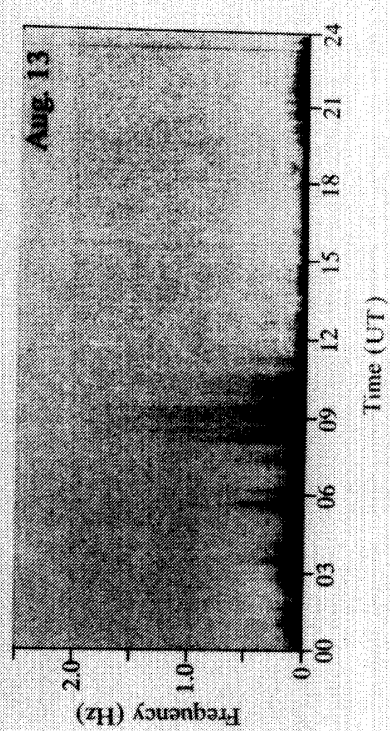
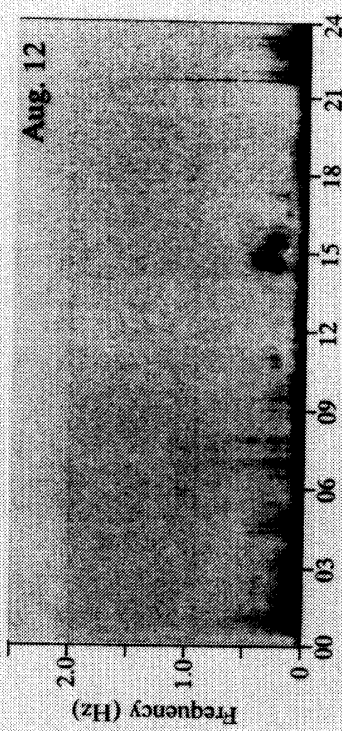
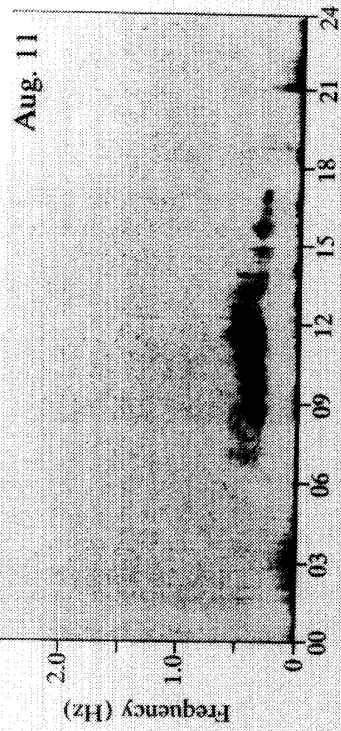
Aug. 7



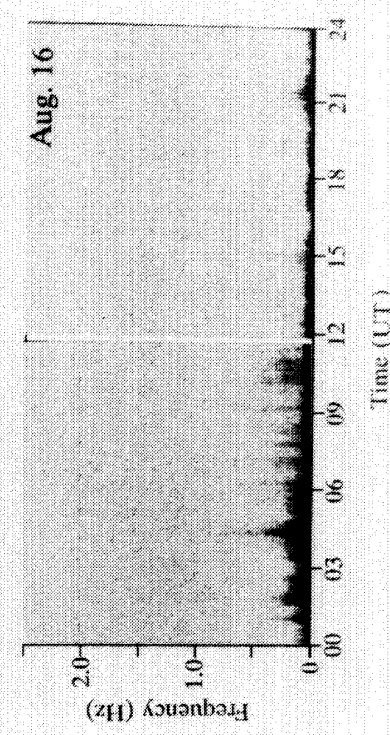
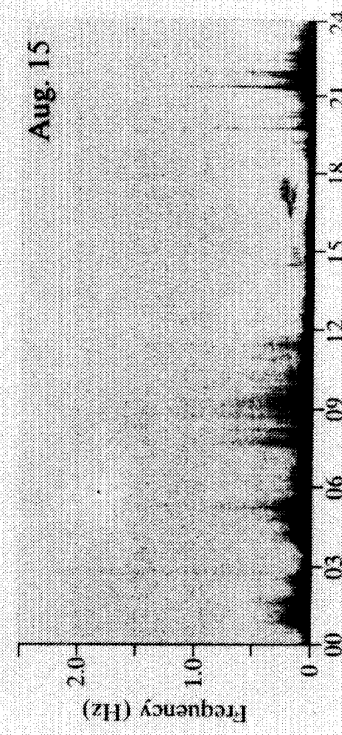
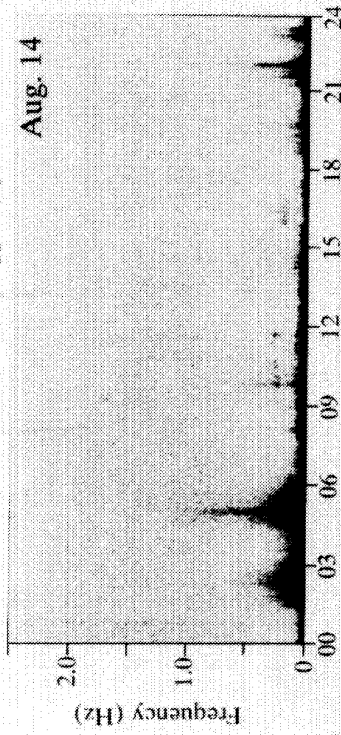
Aug. 10



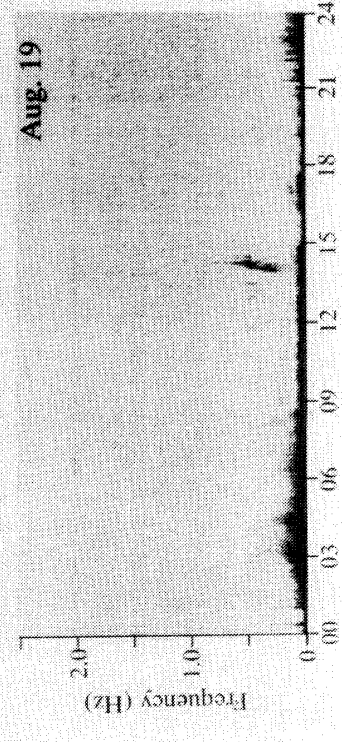
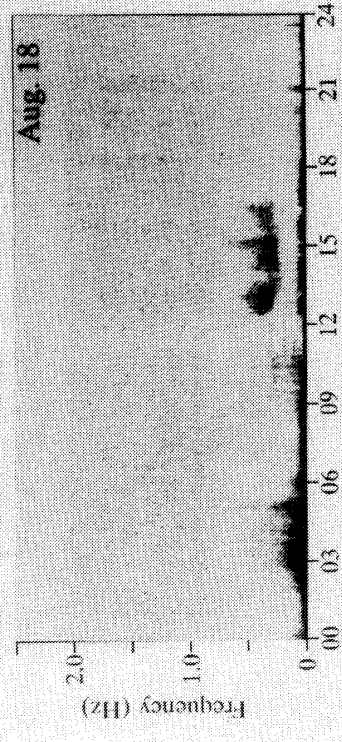
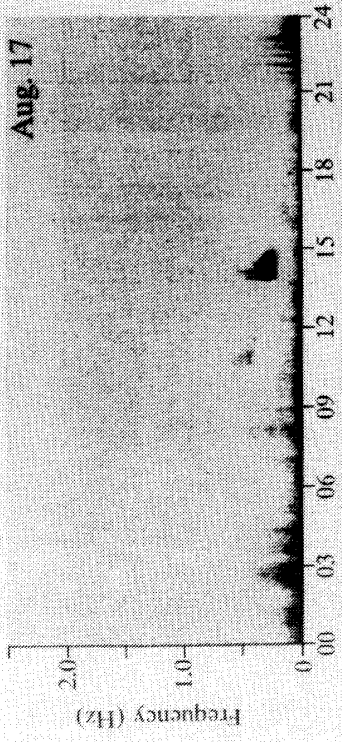
SYOWA STATION H 1987



SYOWA STATION H 1987

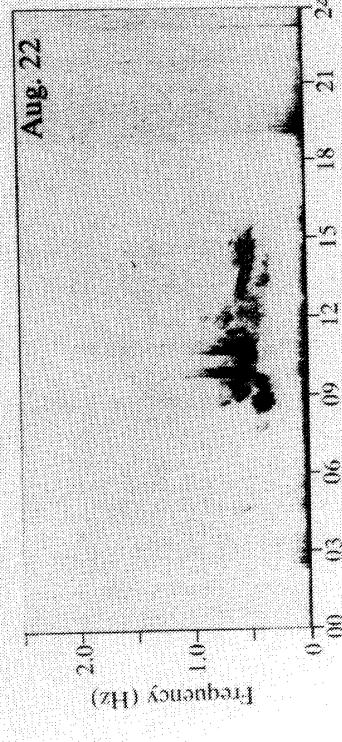
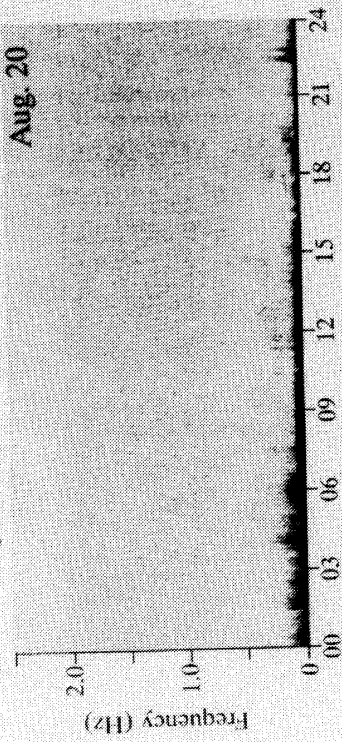


SYOWA STATION H 1987



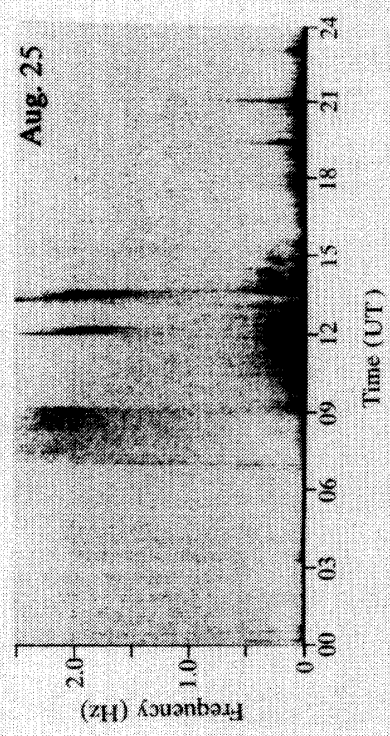
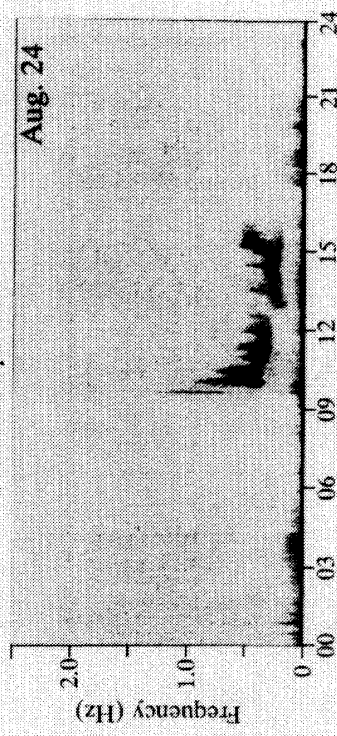
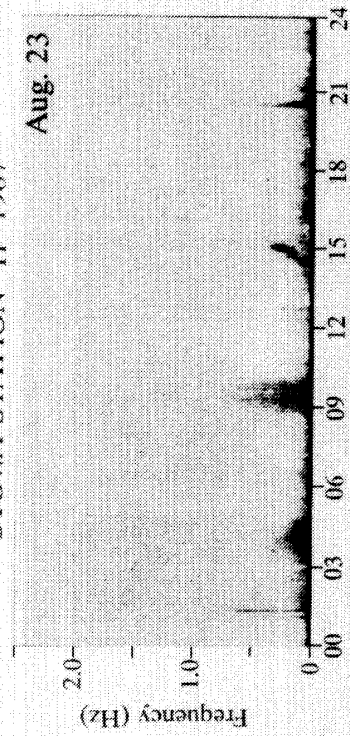
Time (UT)

SYOWA STATION H 1987

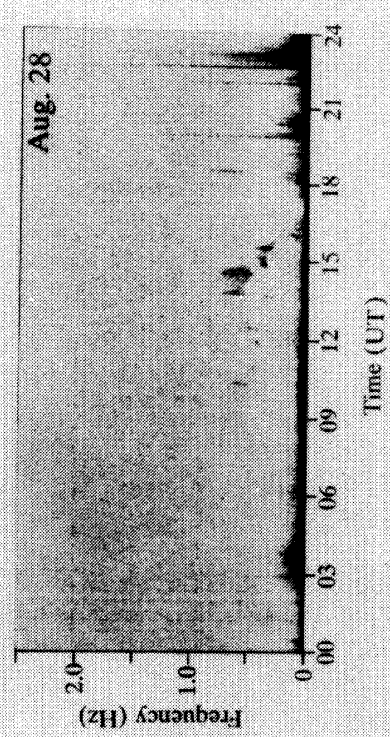
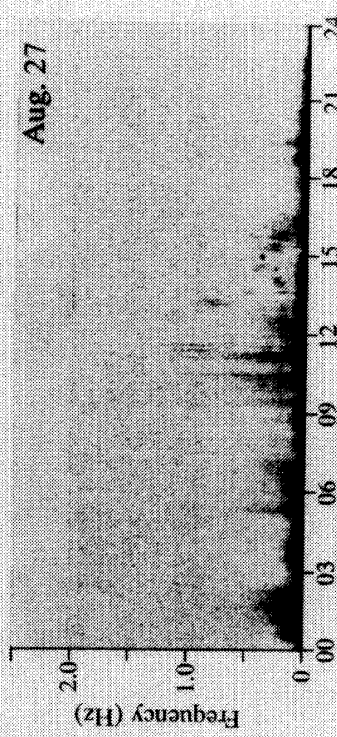
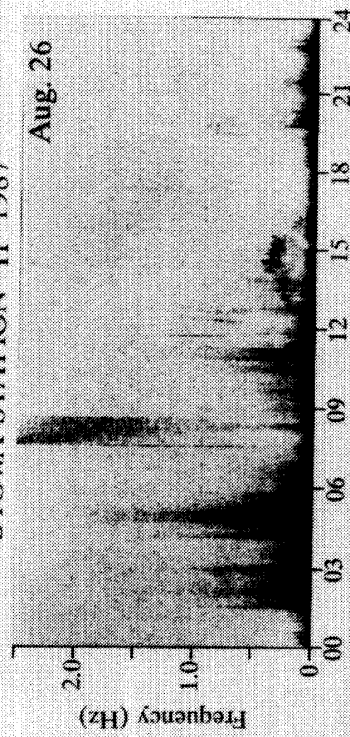


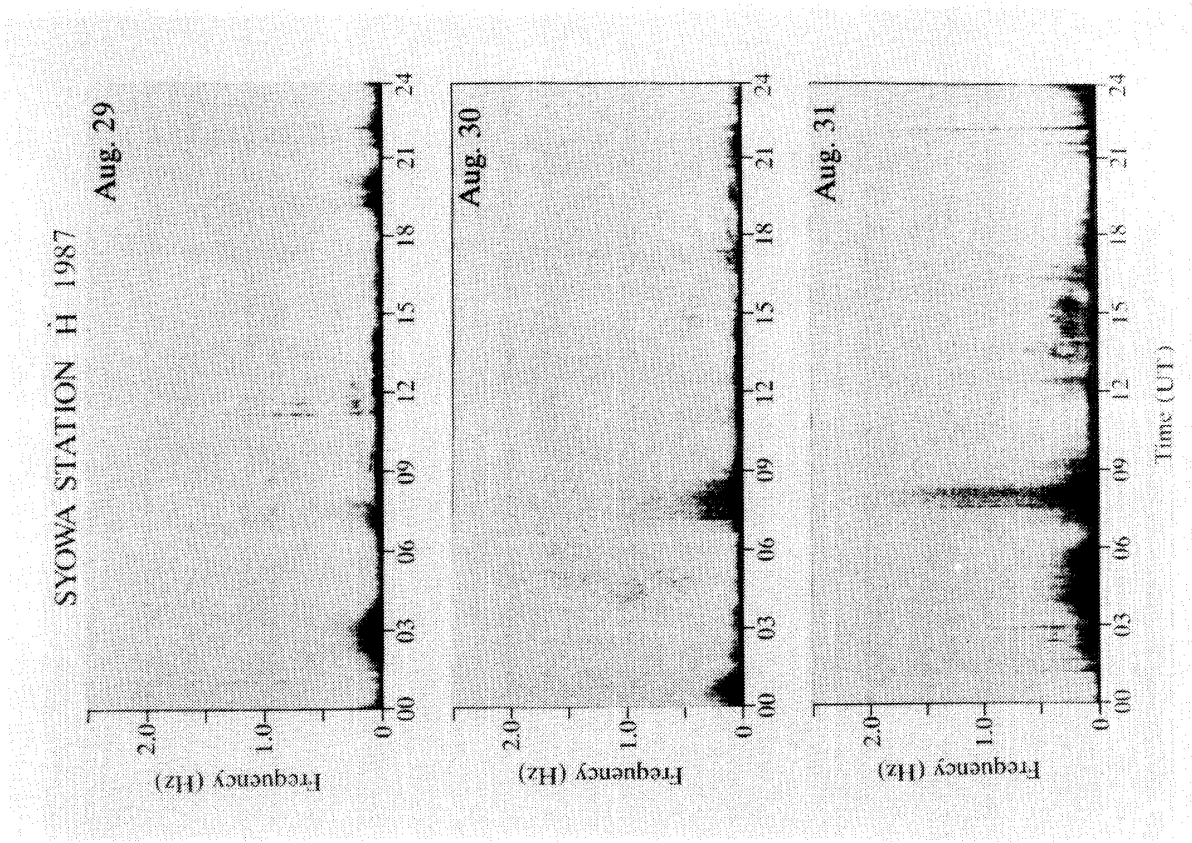
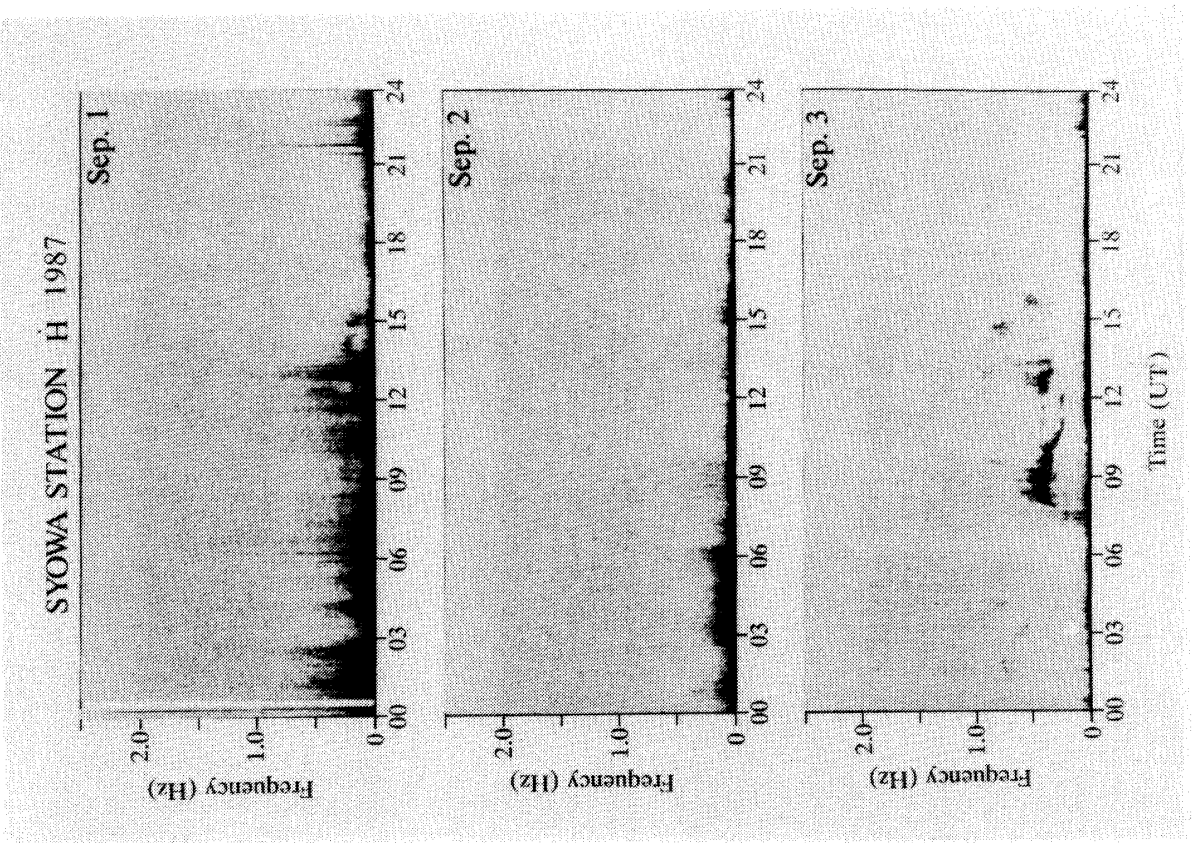
Time (UT)

SYOWA STATION H 1987

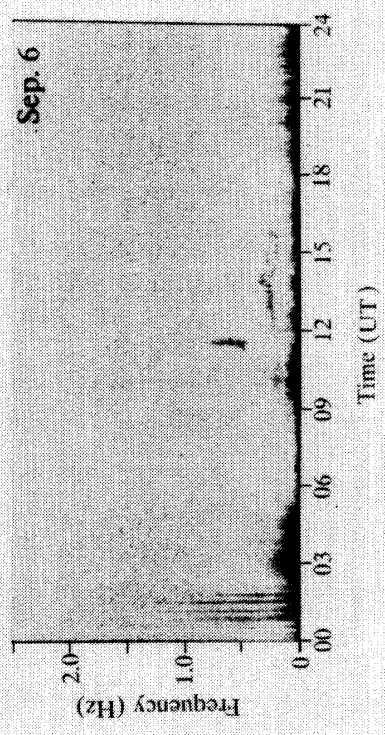
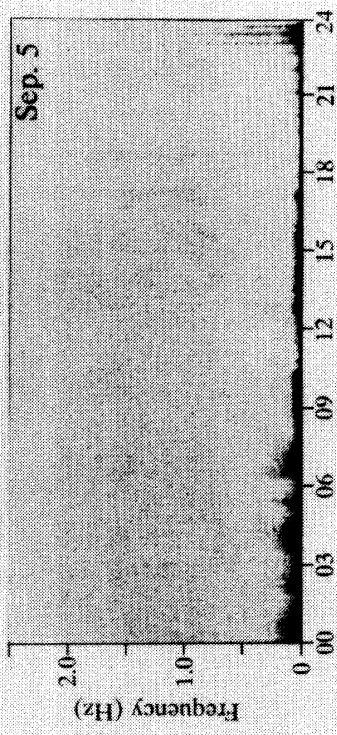
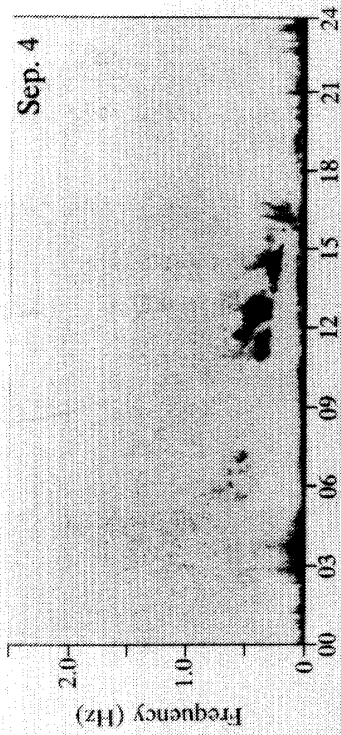


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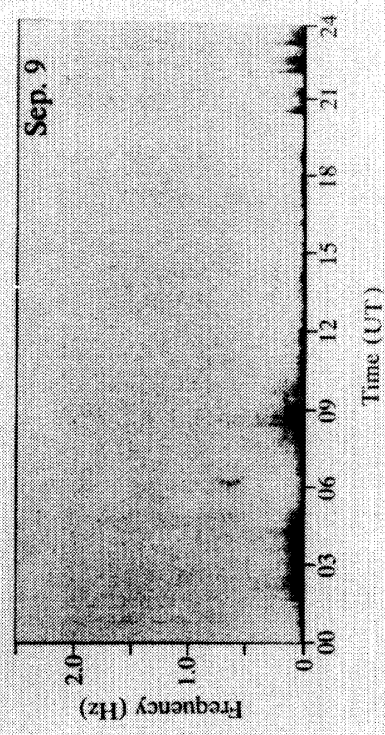
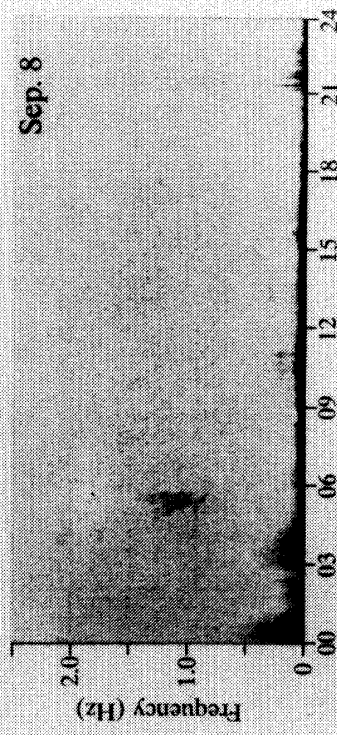




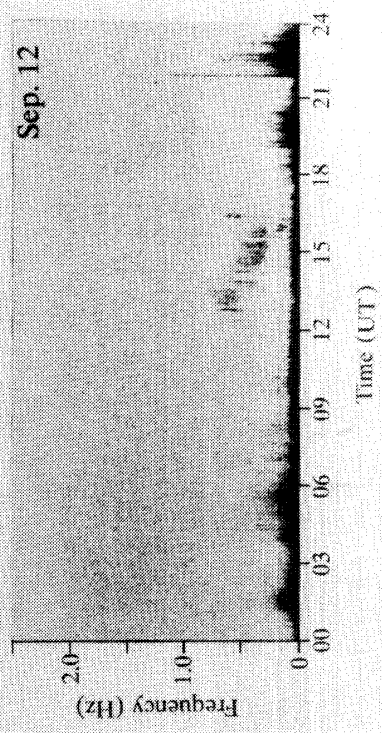
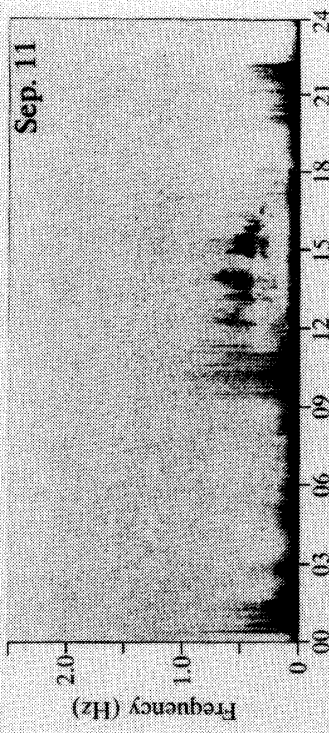
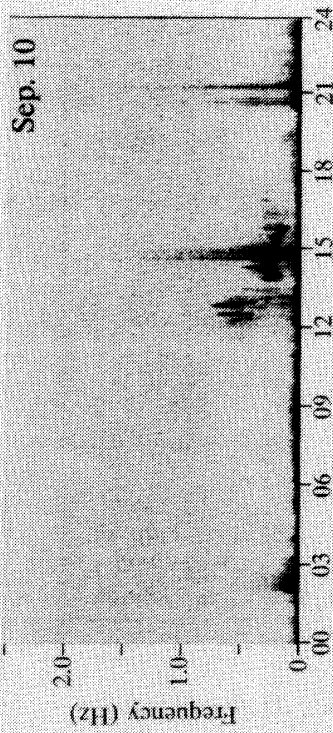
SYOWA STATION H 1987



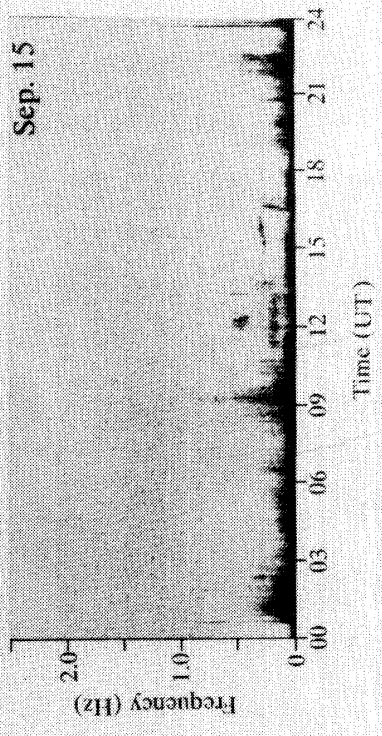
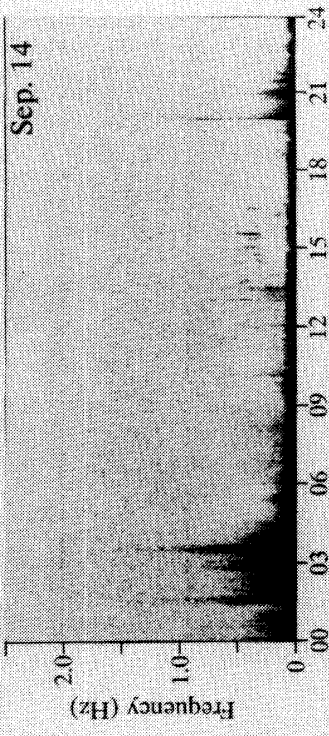
SYOWA STATION H 1987



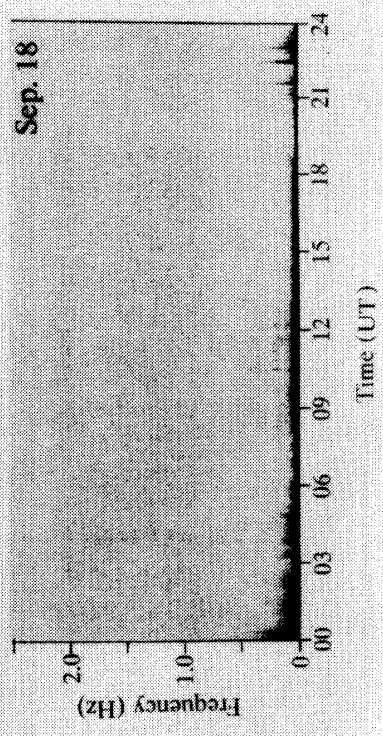
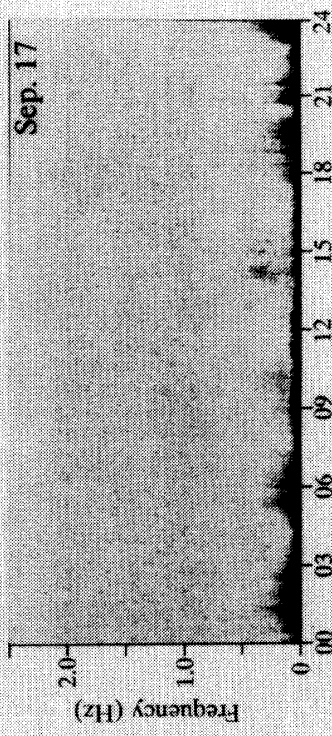
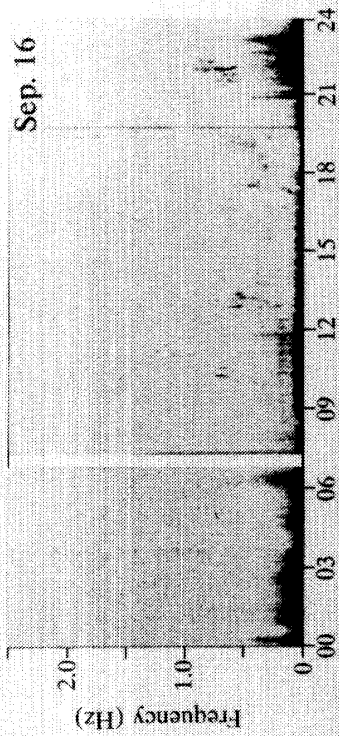
SYOWA STATION H 1987



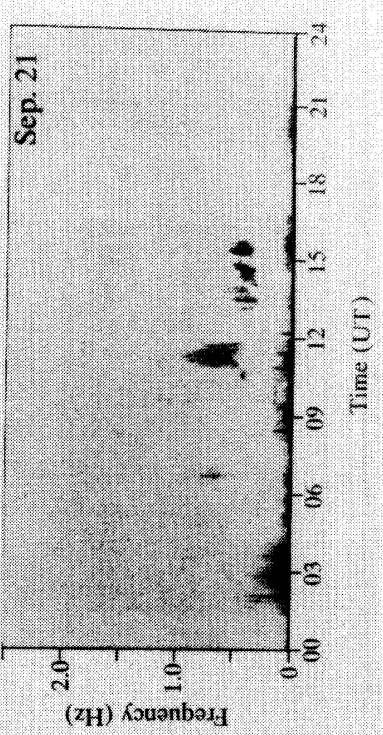
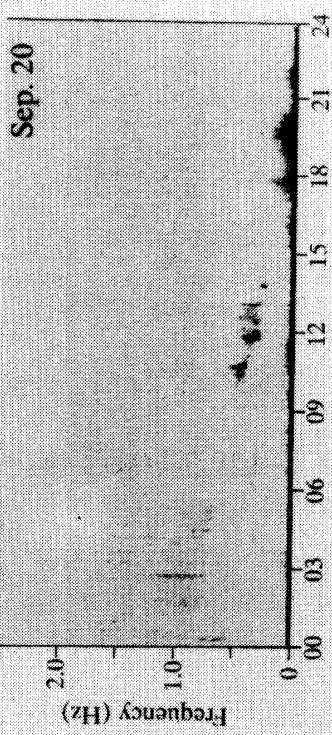
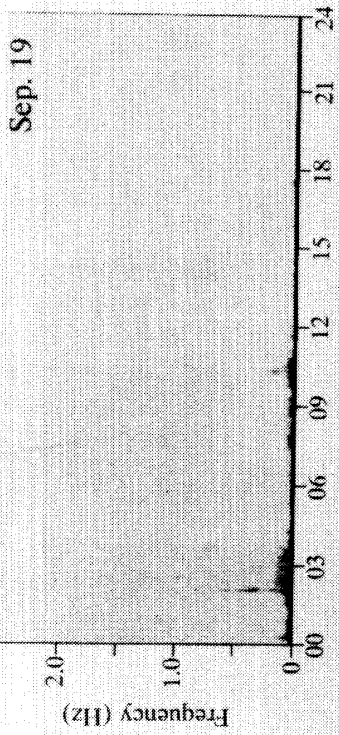
SYOWA STATION H 1987

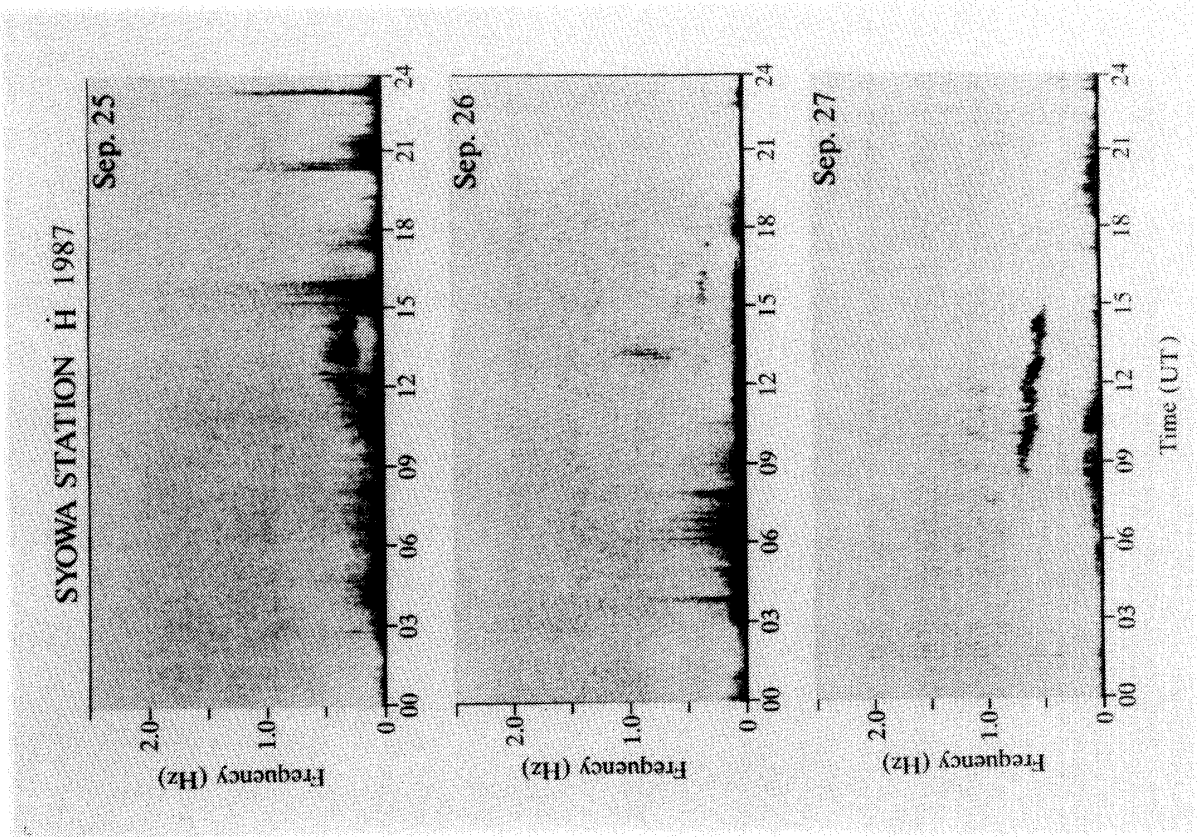
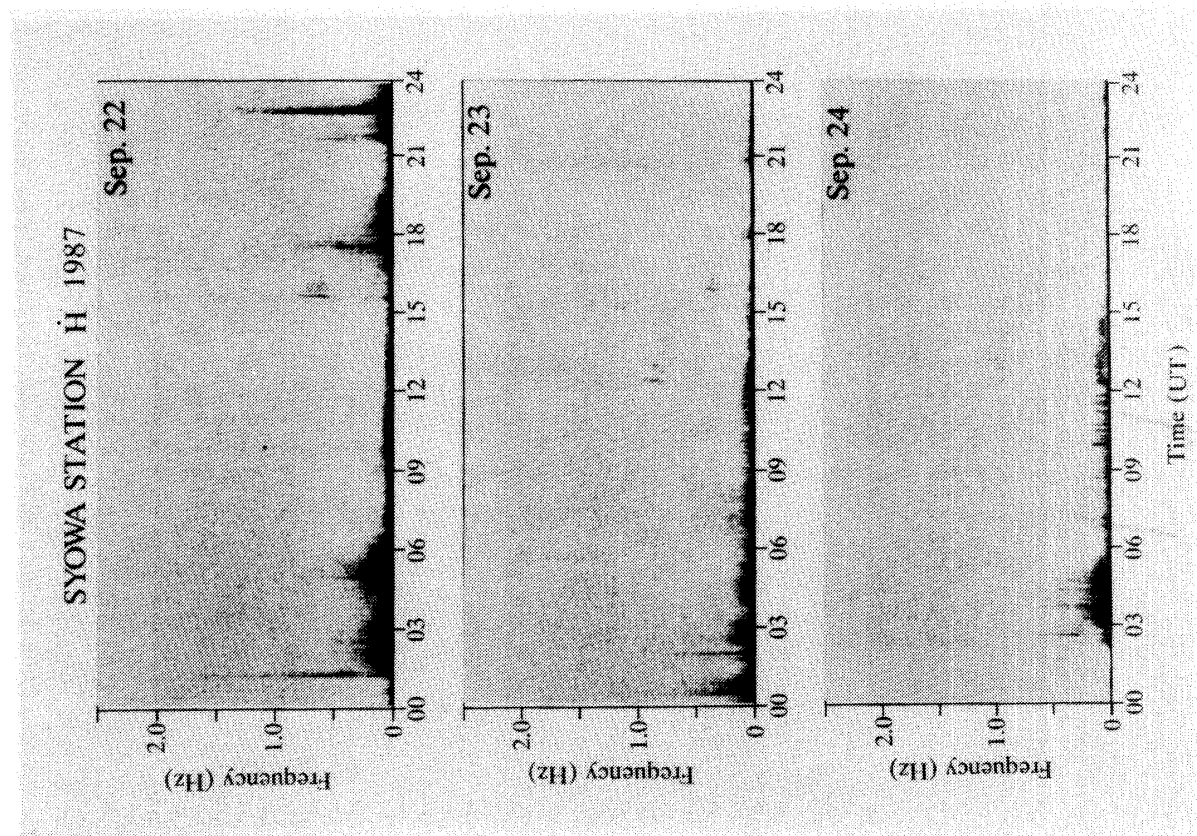


SYOWA STATION H 1987



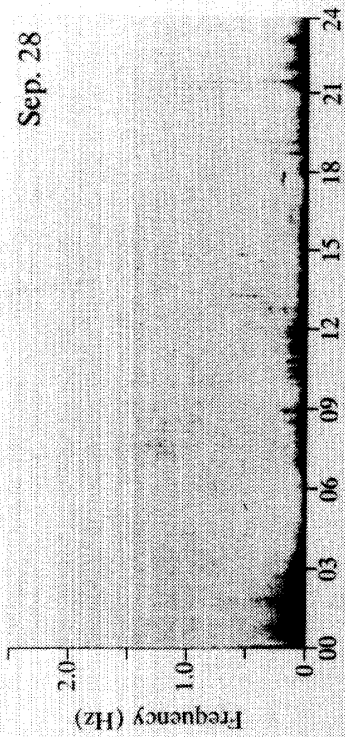
SYOWA STATION H 1987



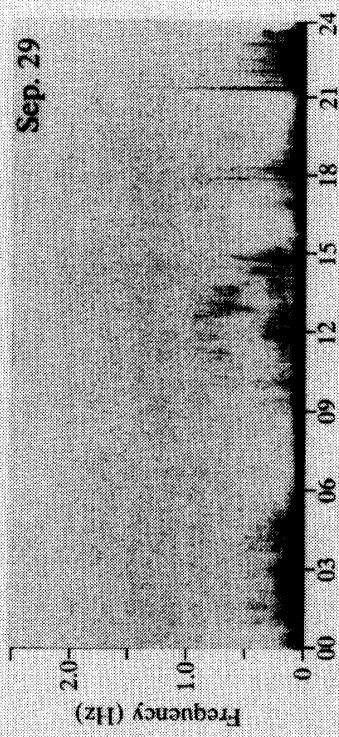


SYOWA STATION H 1987

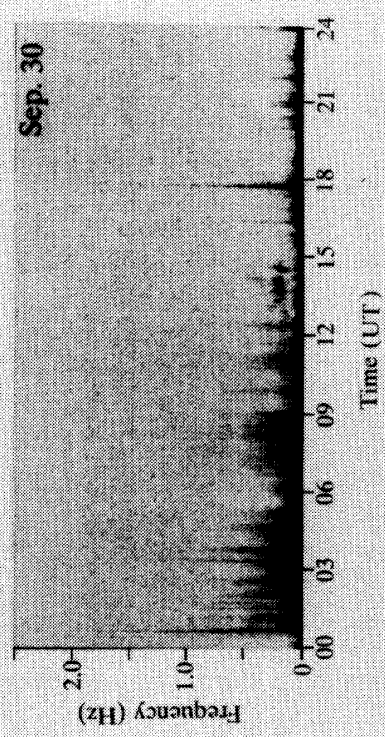
Sep. 28



Sep. 29

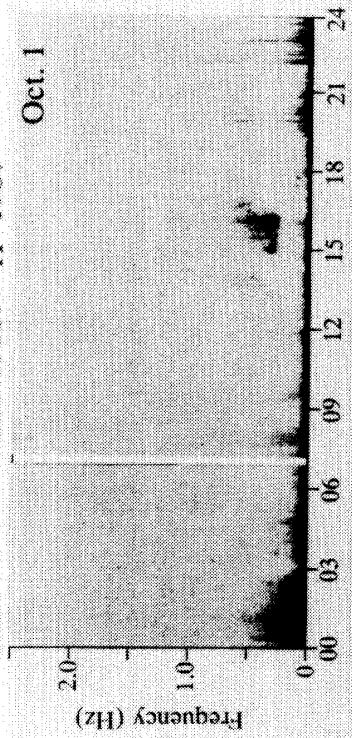


Sep. 30

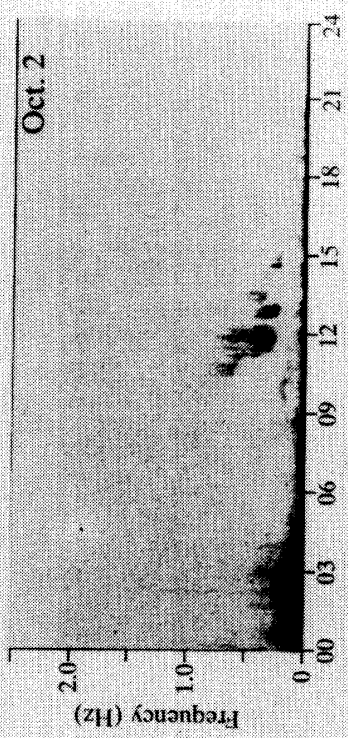


SYOWA STATION H 1987

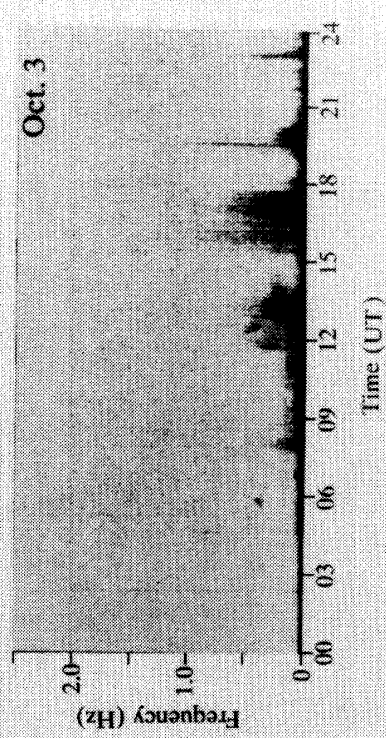
Oct. 1

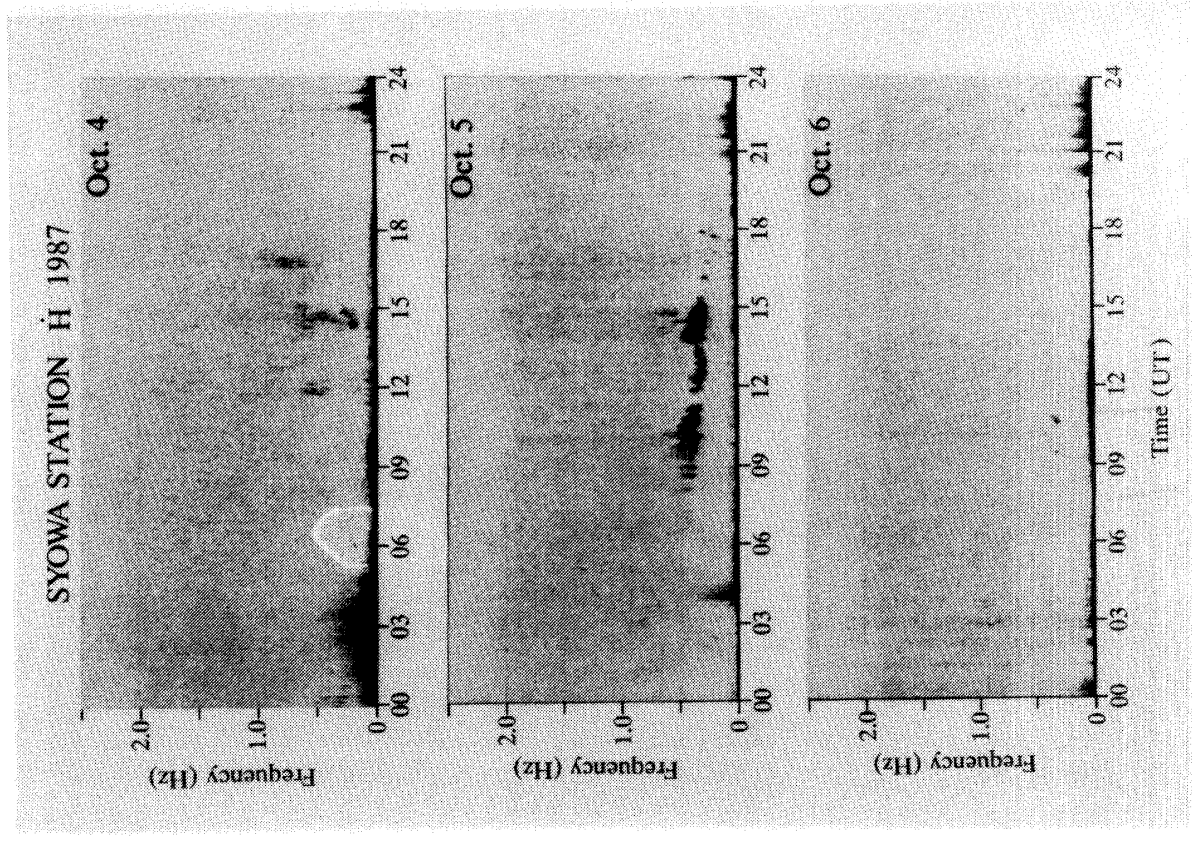
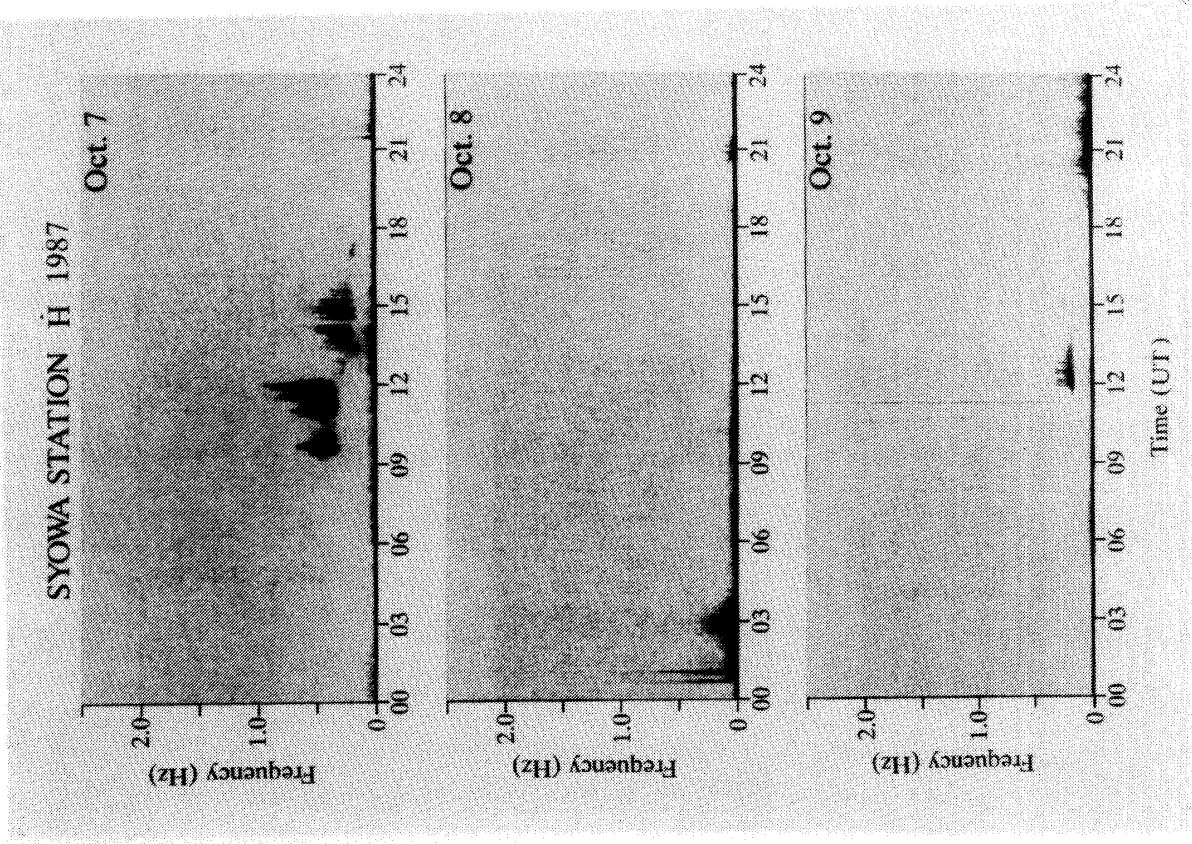


Oct. 2

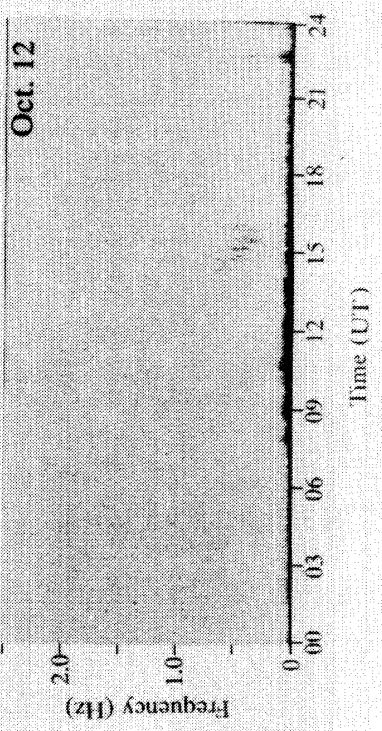
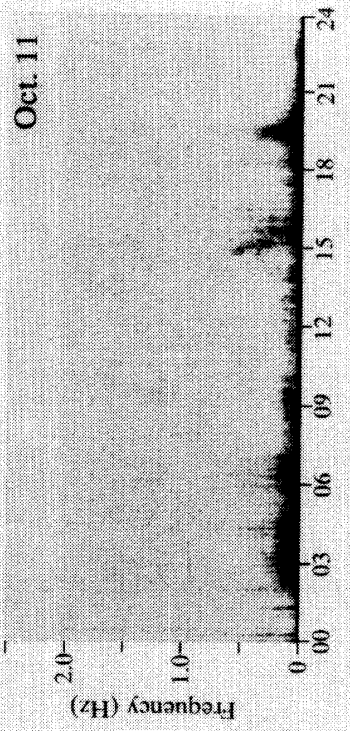
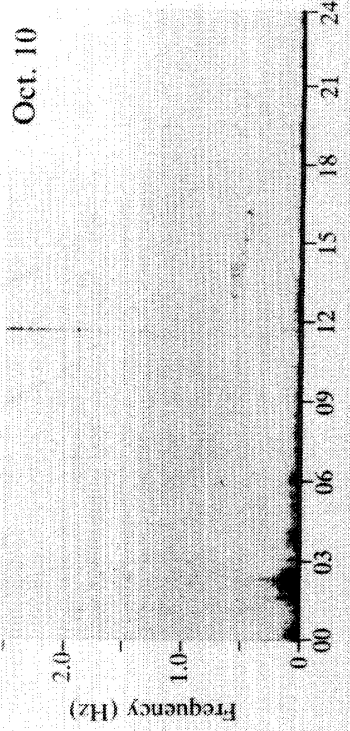


Oct. 3

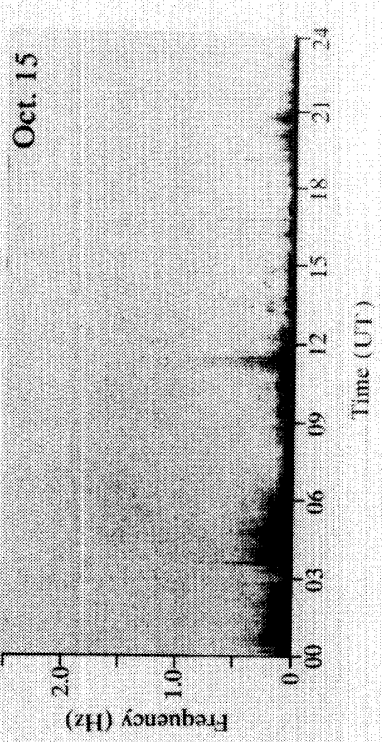
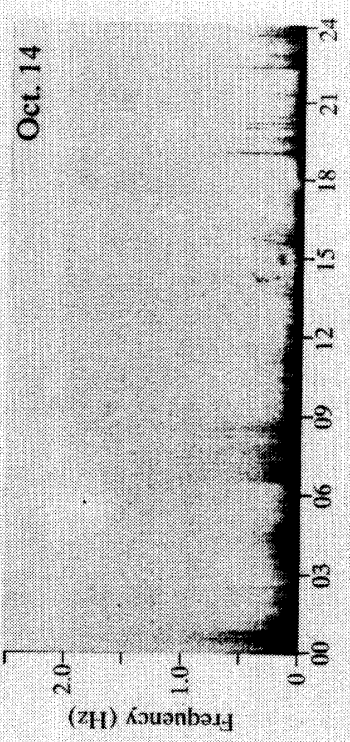
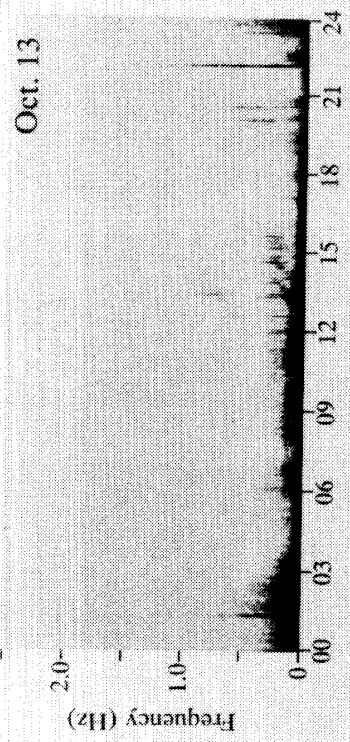


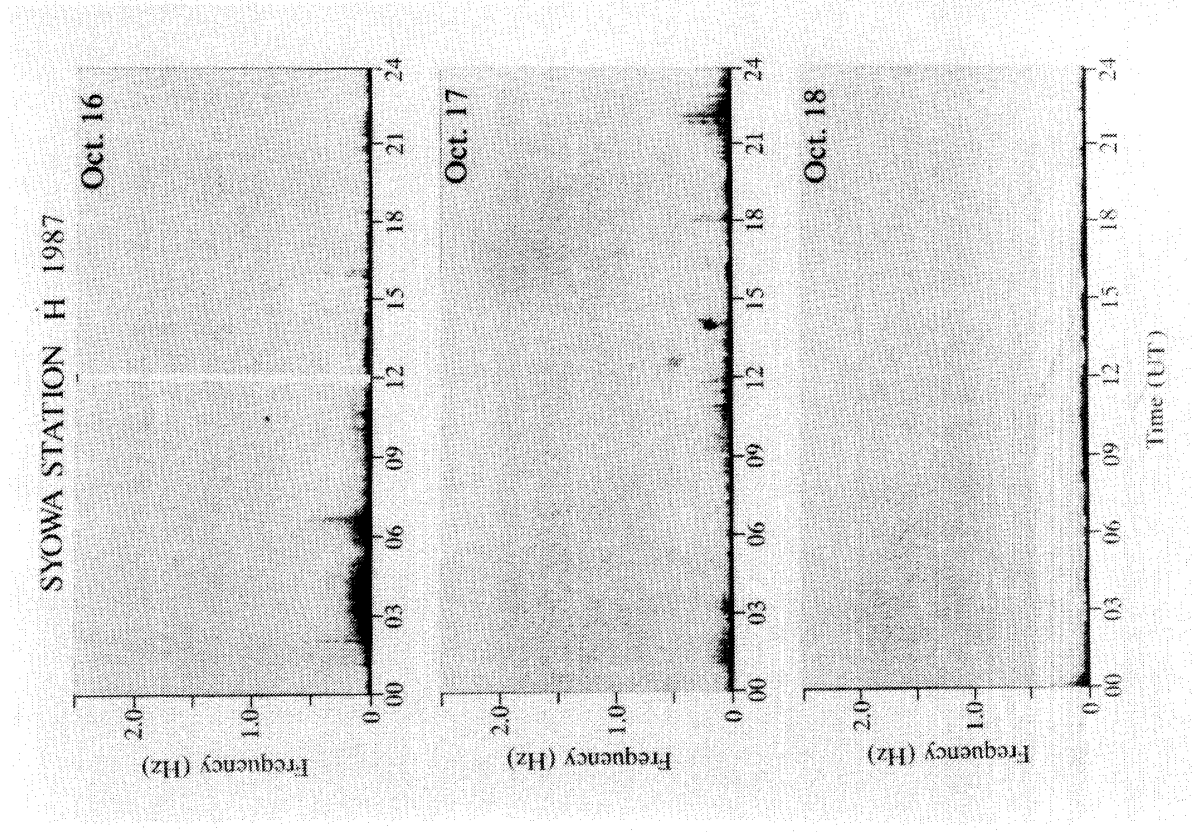
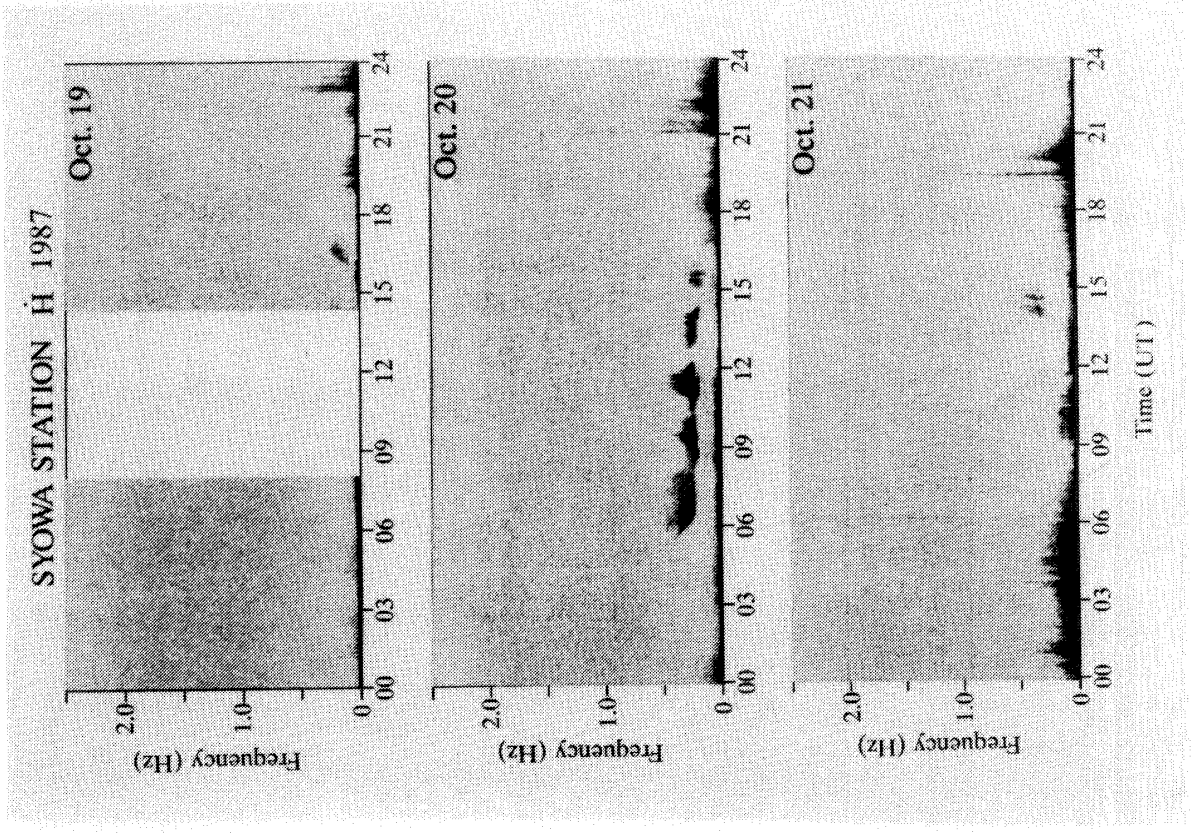


SYOWA STATION H 1987



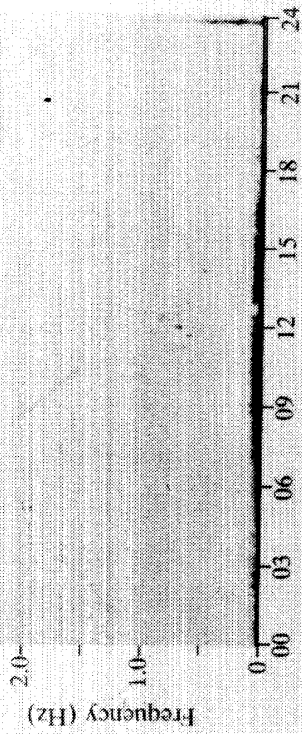
SYOWA STATION H 1987



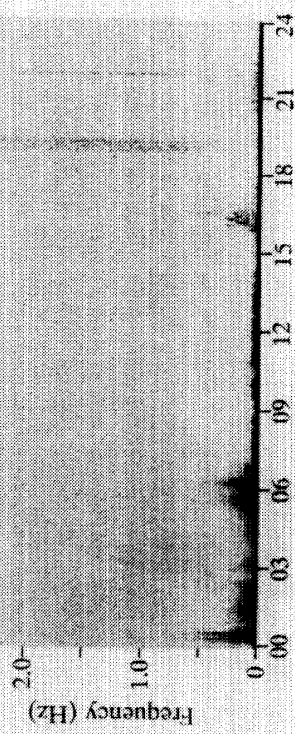


SYOWA STATION H 1987

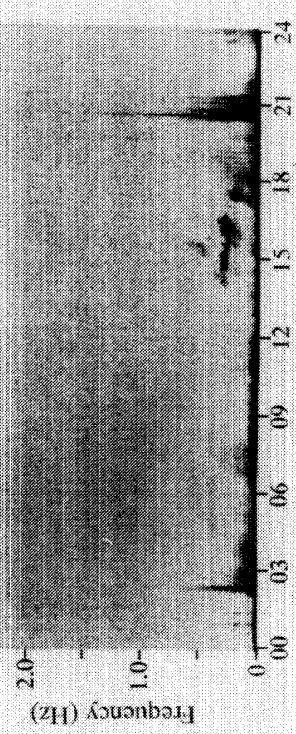
Oct. 22



Oct. 23



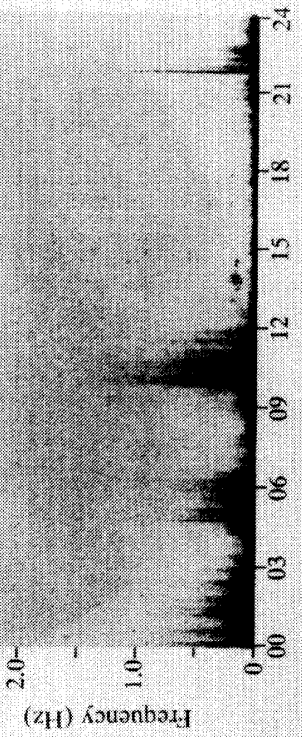
Oct. 24



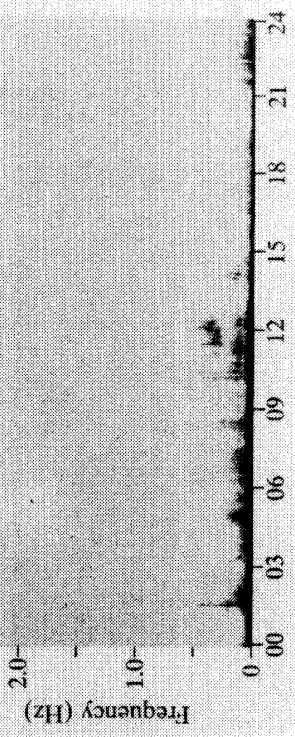
Time (UT)

SYOWA STATION H 1987

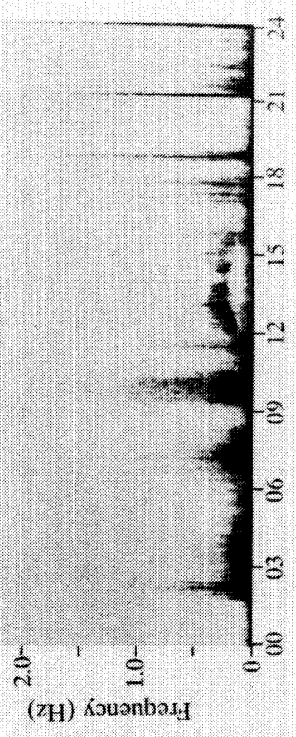
Oct. 25



Oct. 26



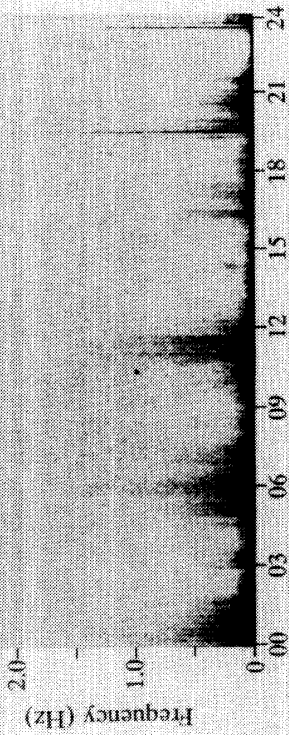
Oct. 27



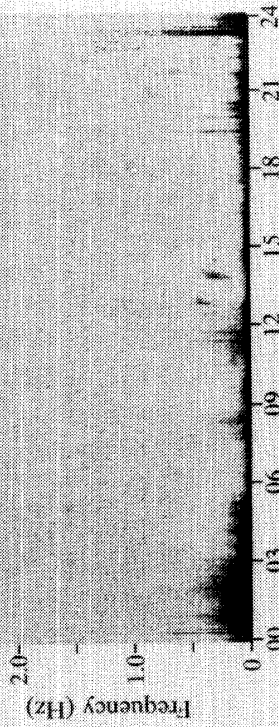
Time (UT)

SYOWA STATION H 1987

Oct. 28



Oct. 29

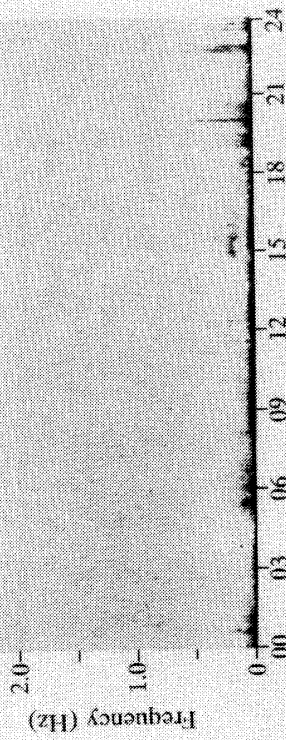


Oct. 30

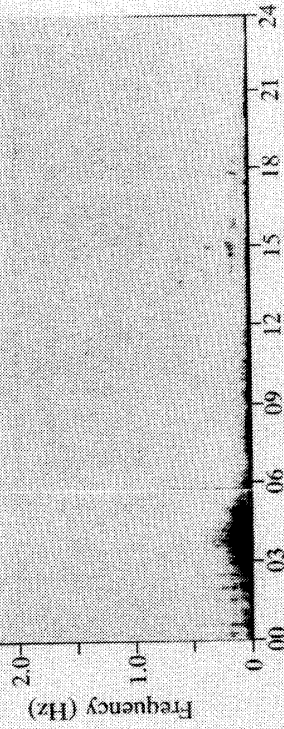


SYOWA STATION H 1987

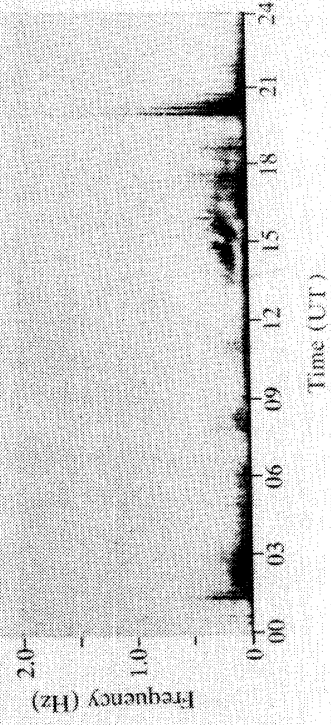
Oct. 31



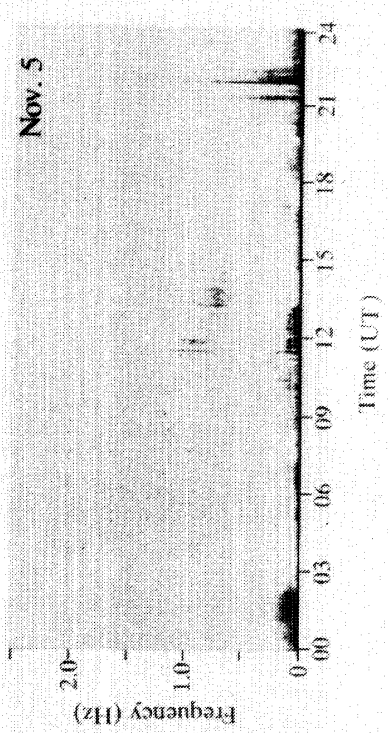
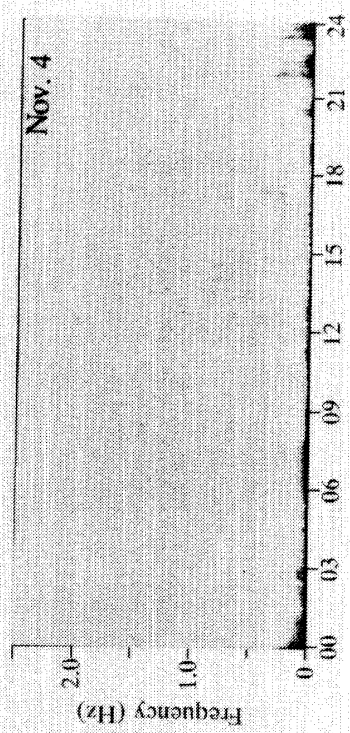
Nov. 1



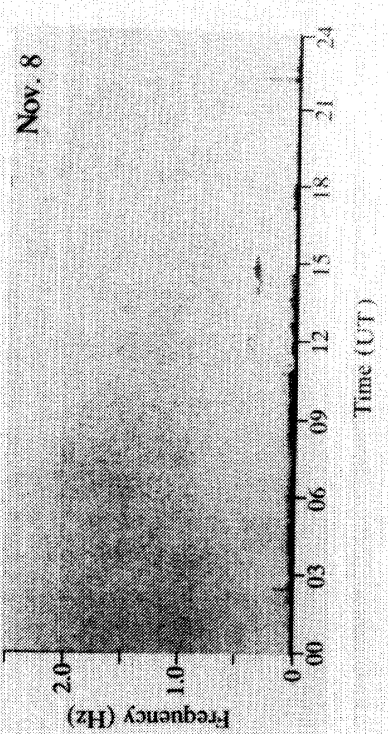
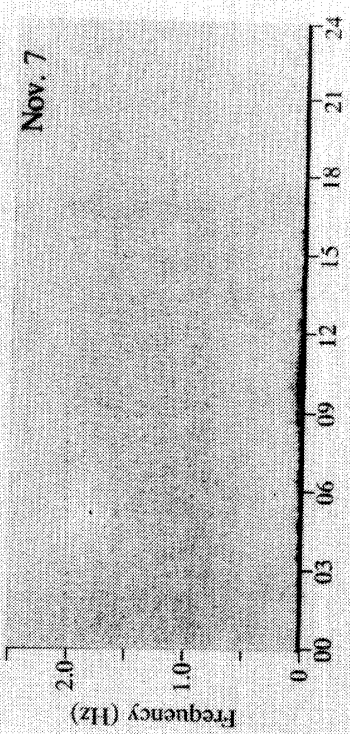
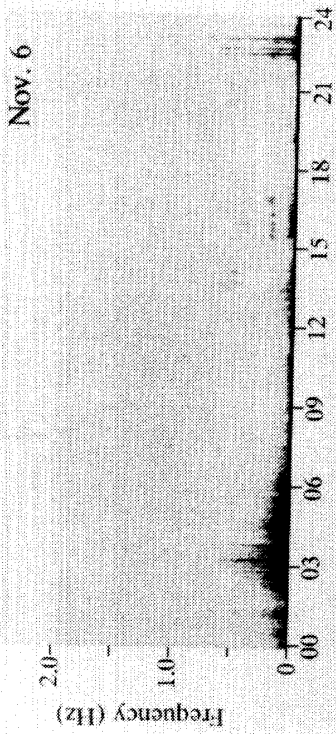
Nov. 2

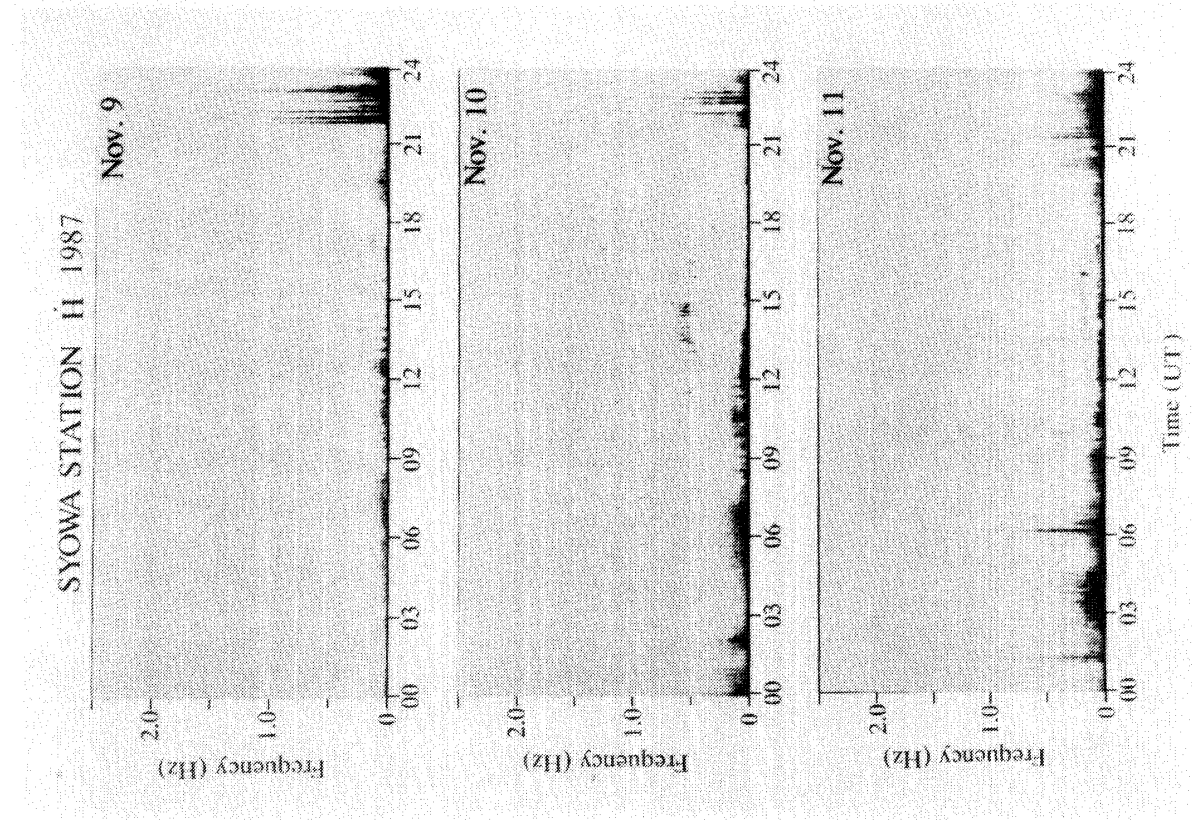
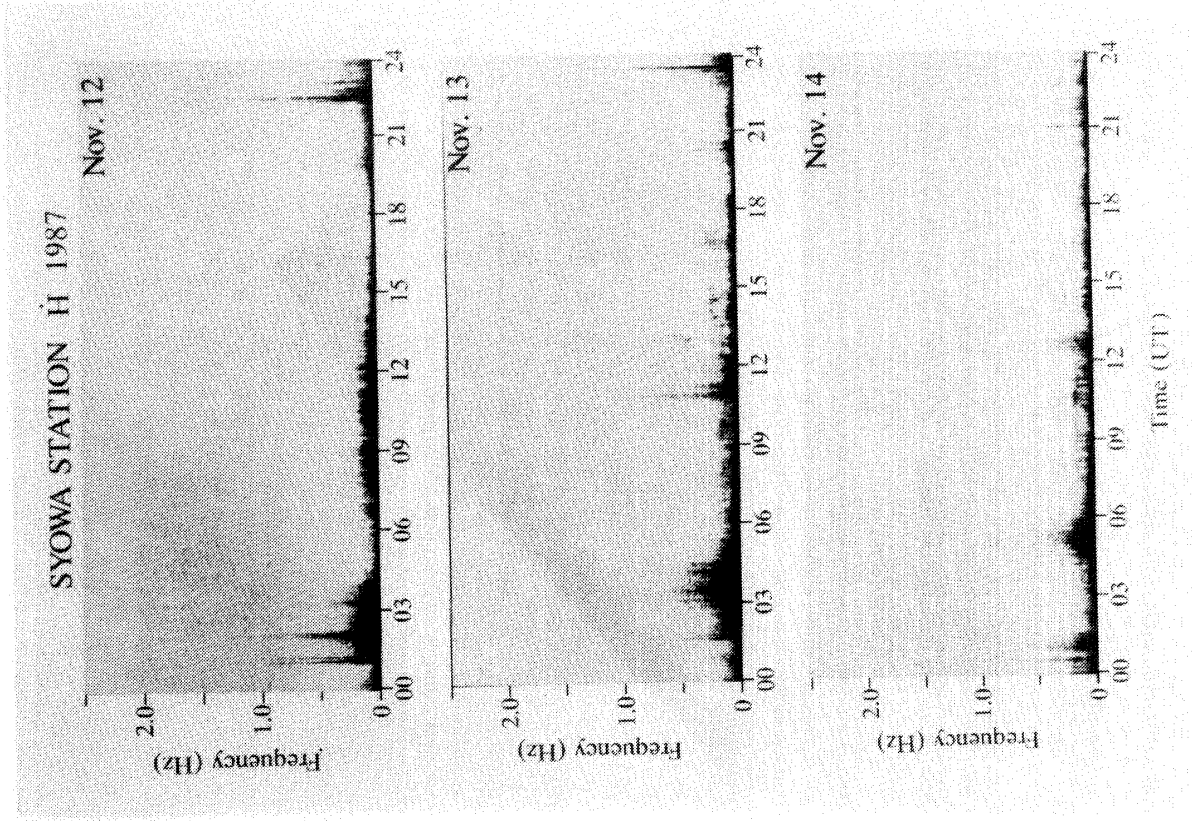


SYOWA STATION ii 1987

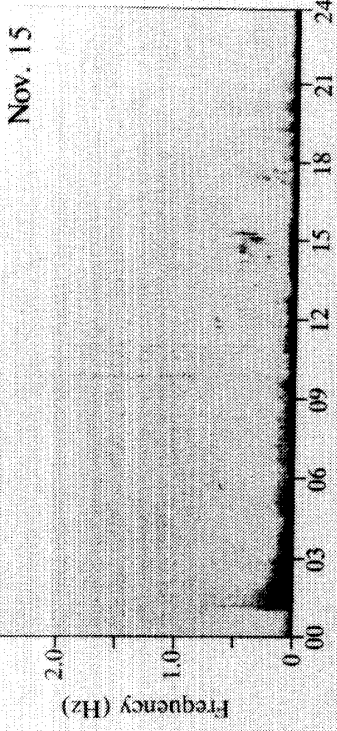


SYOWA STATION ii 1987

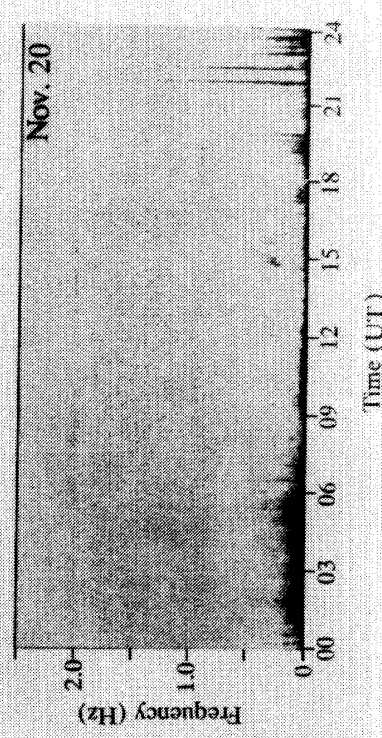
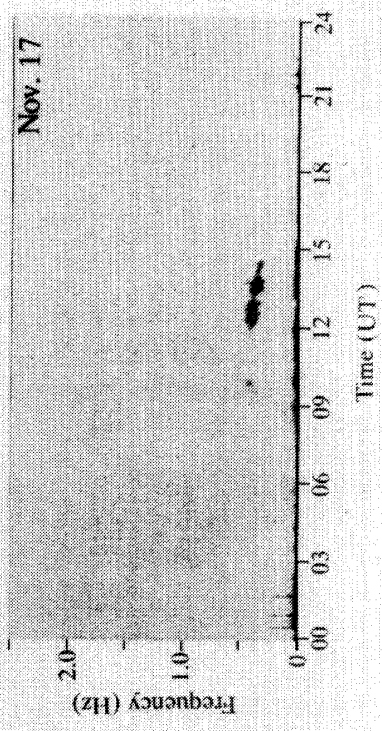
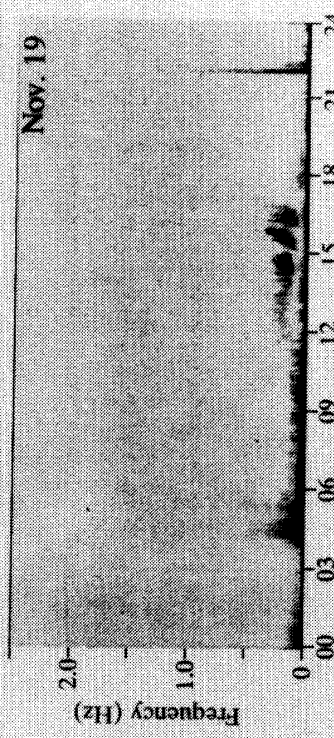
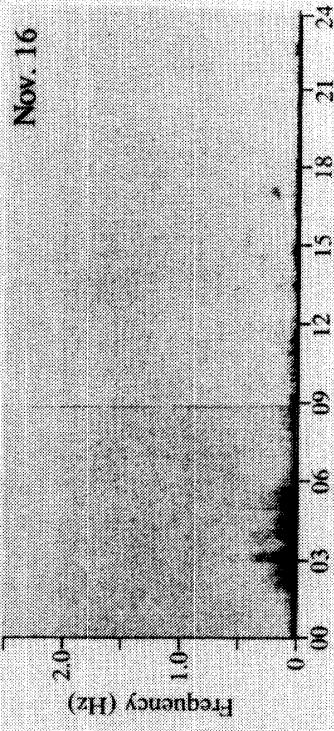
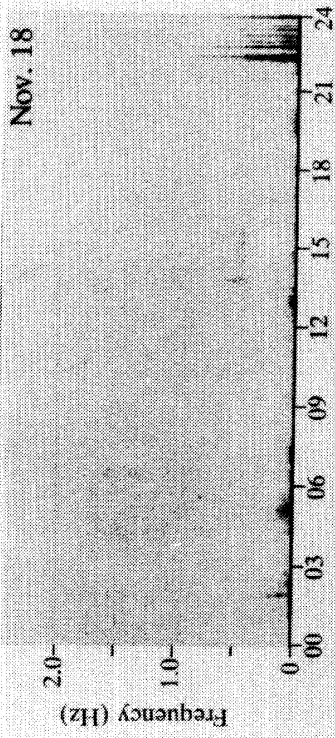




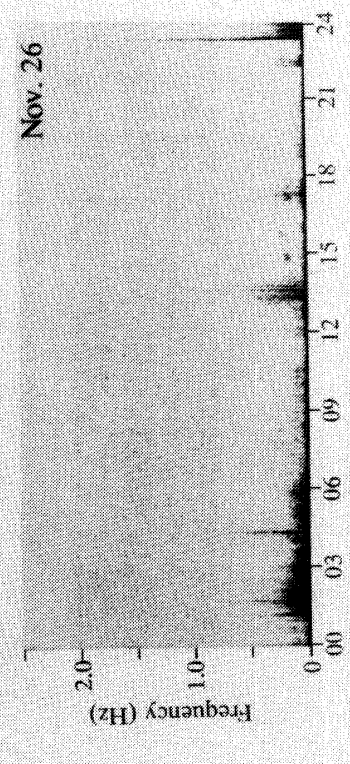
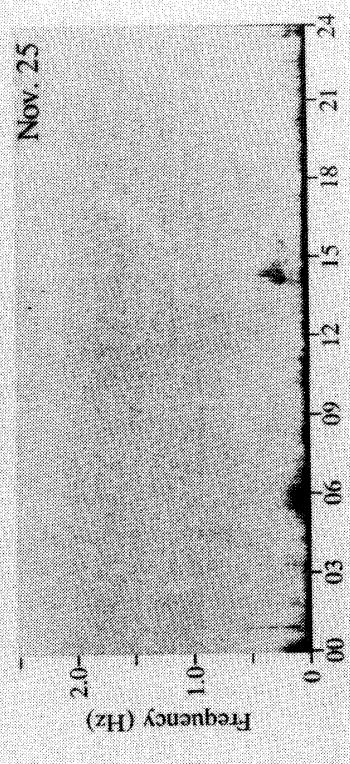
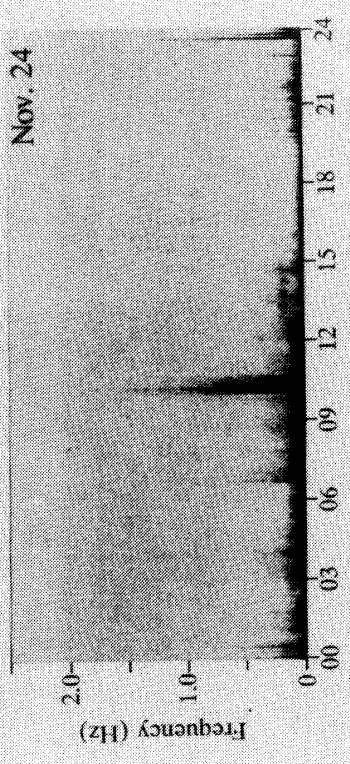
SYOWA STATION H 1987



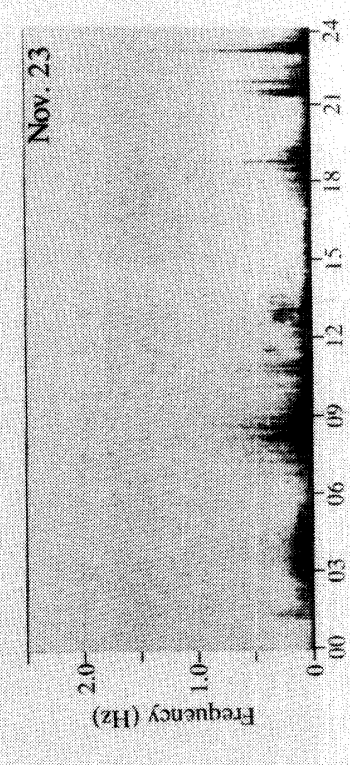
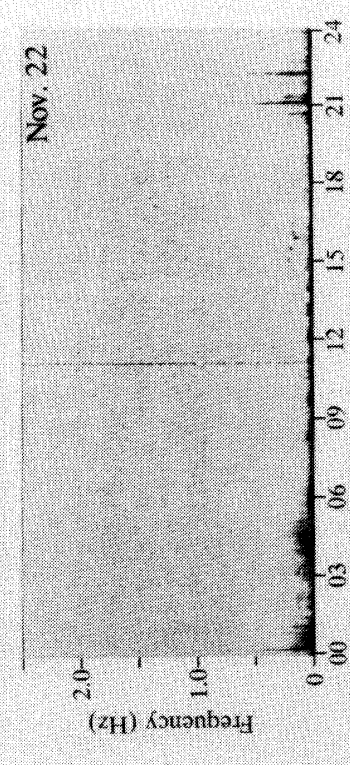
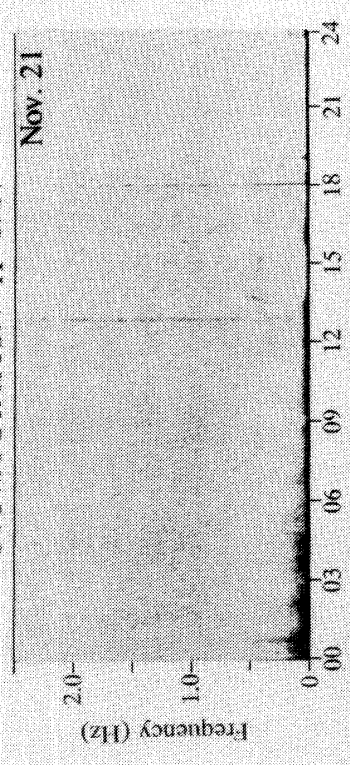
SYOWA STATION H 1987

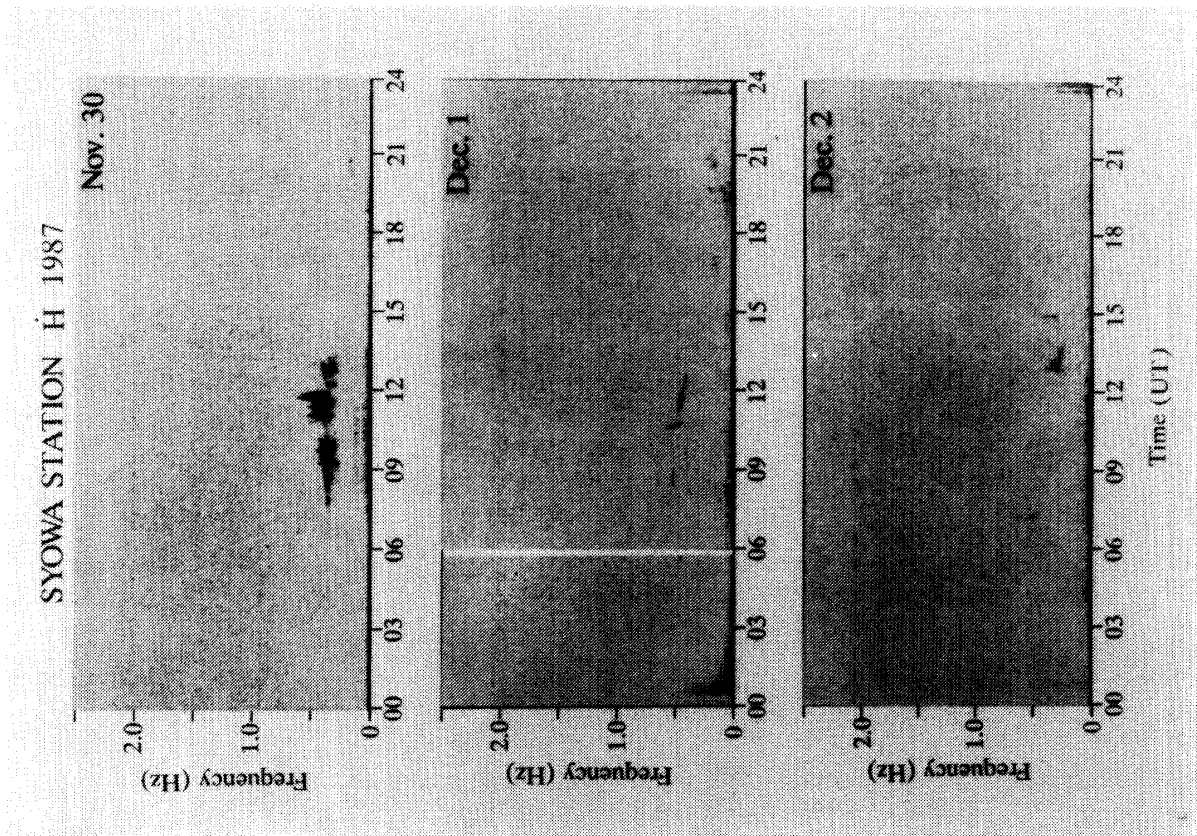
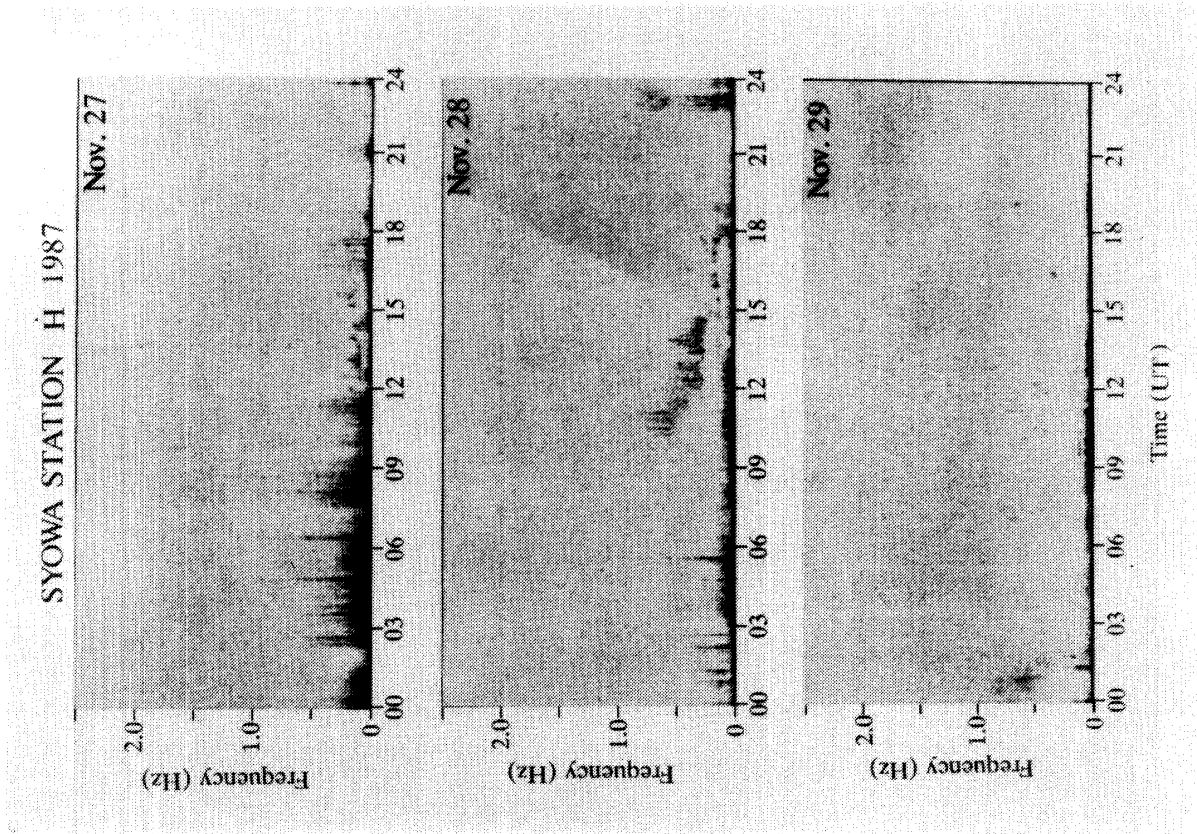


SYOWA STATION H 1987

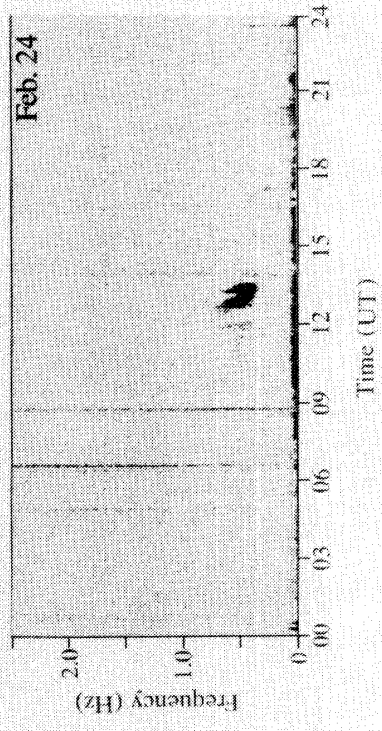
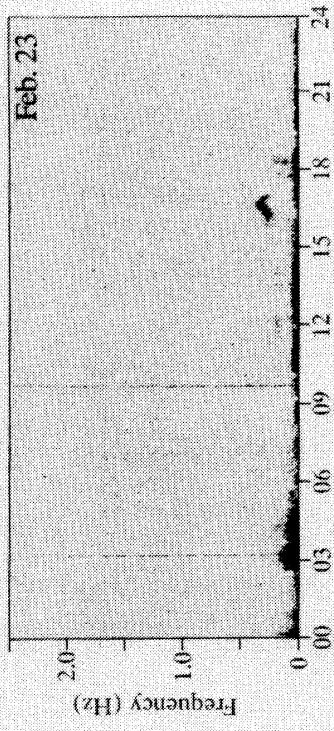
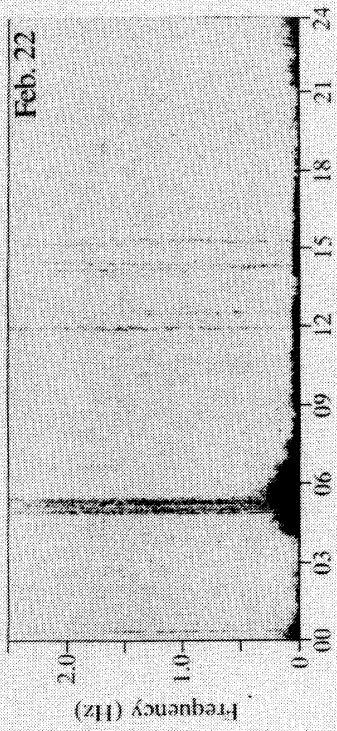


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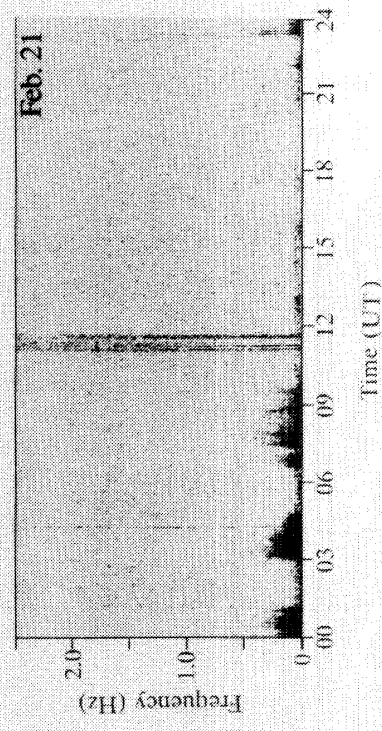
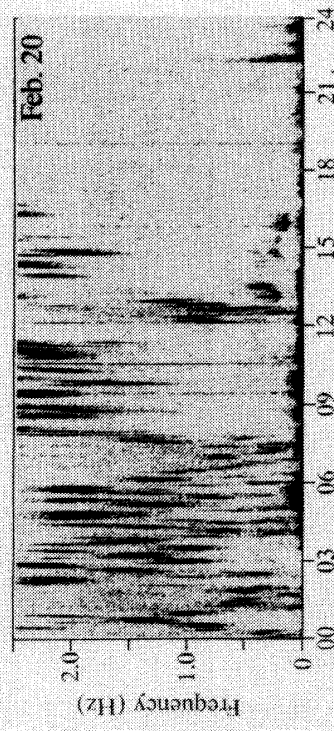
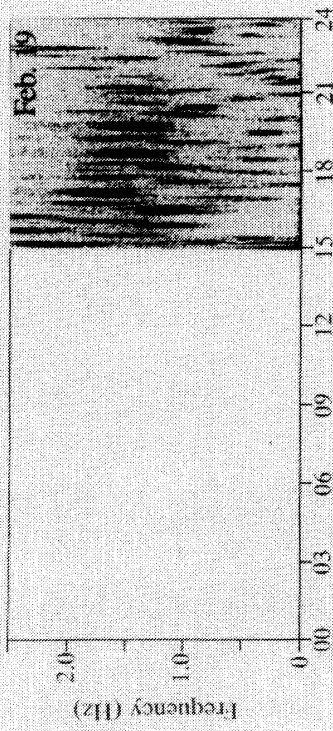




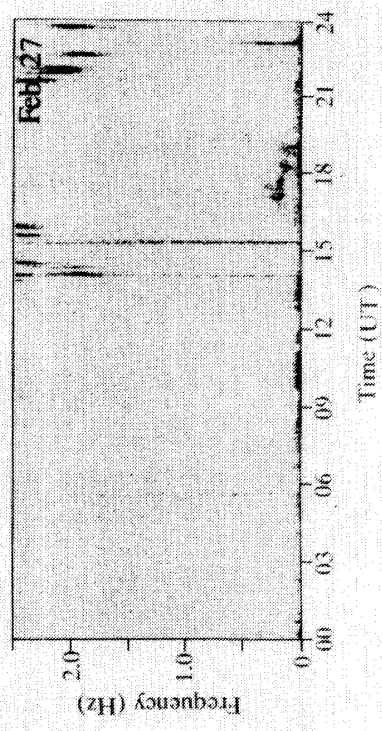
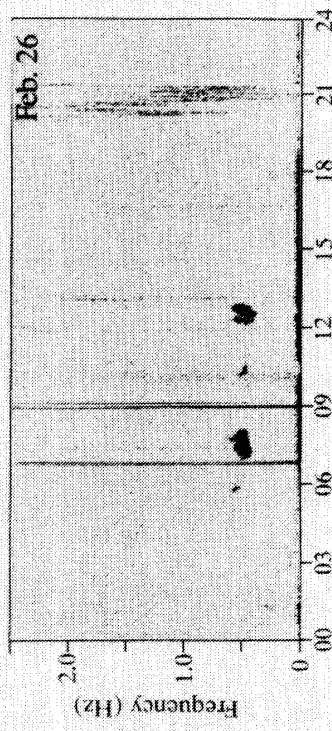
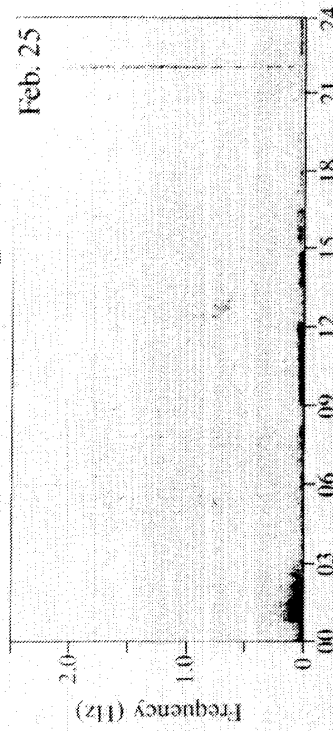
ASUKA STATION D 1987



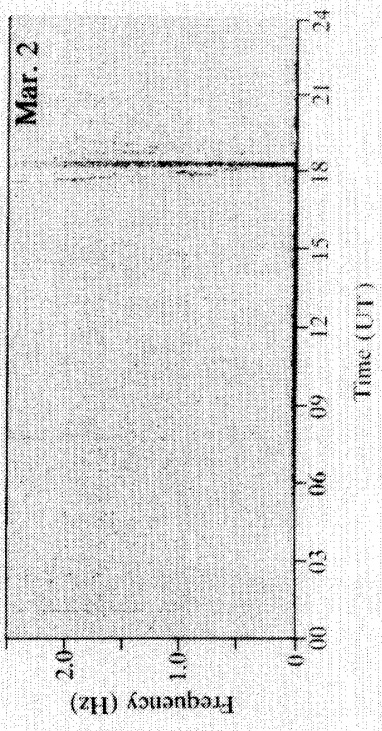
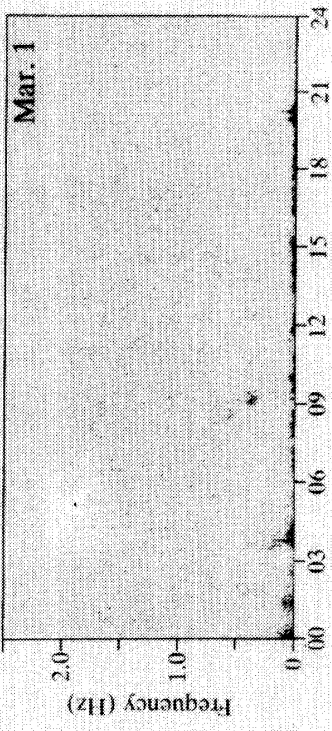
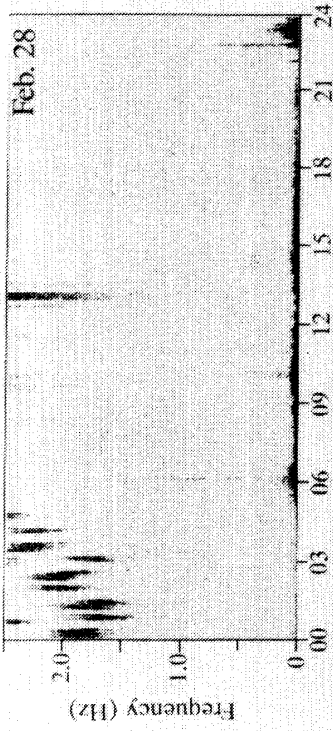
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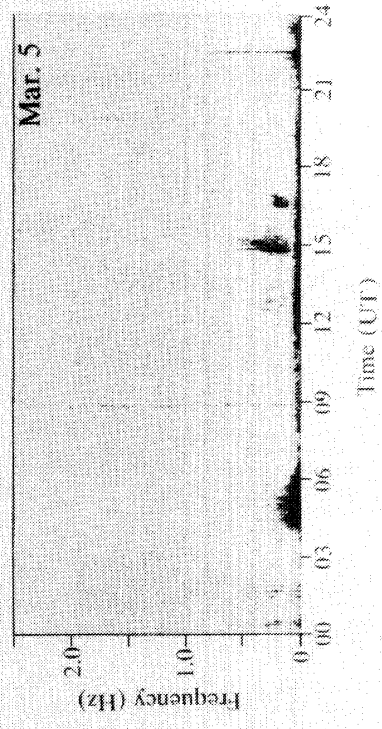
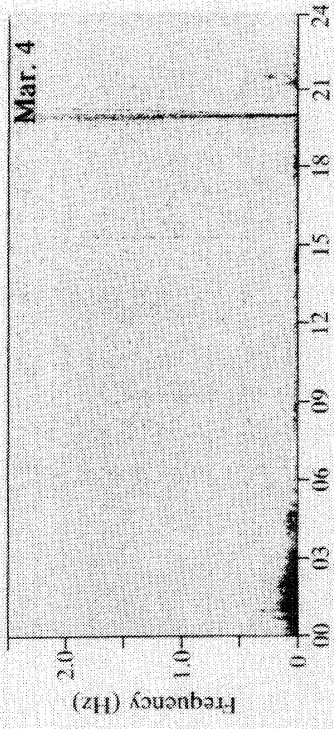
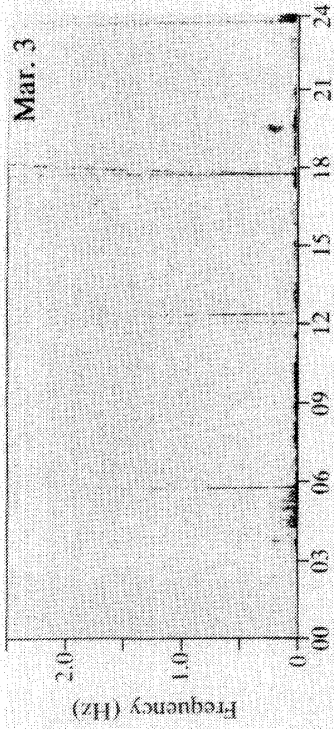
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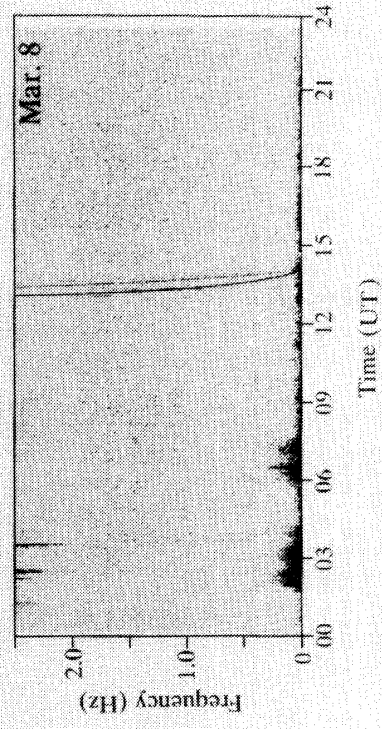
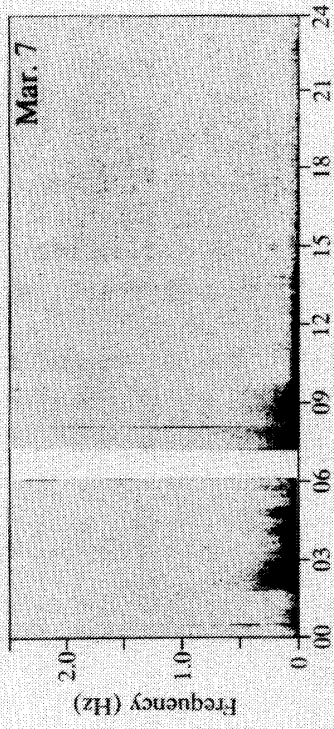
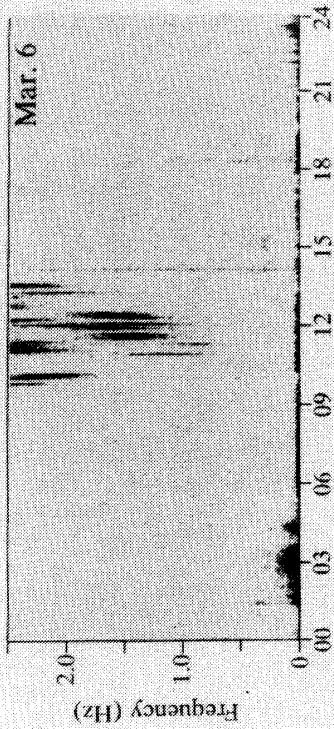
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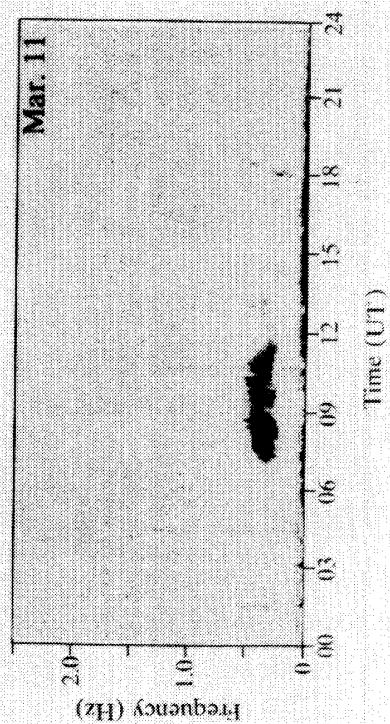
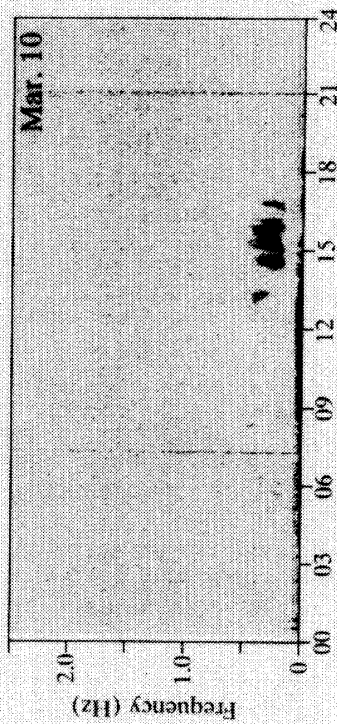
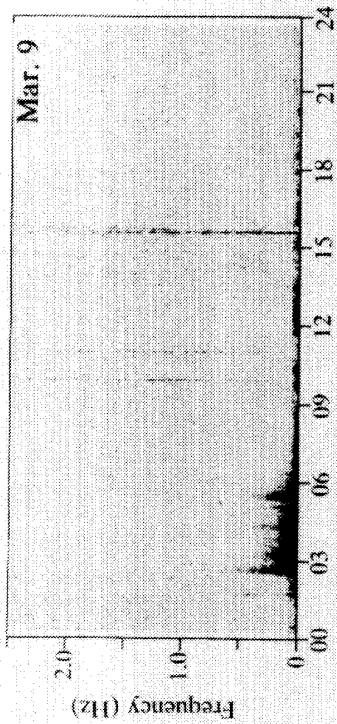
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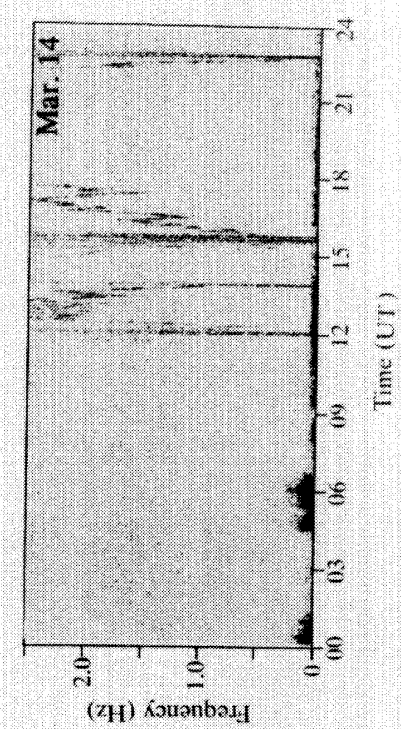
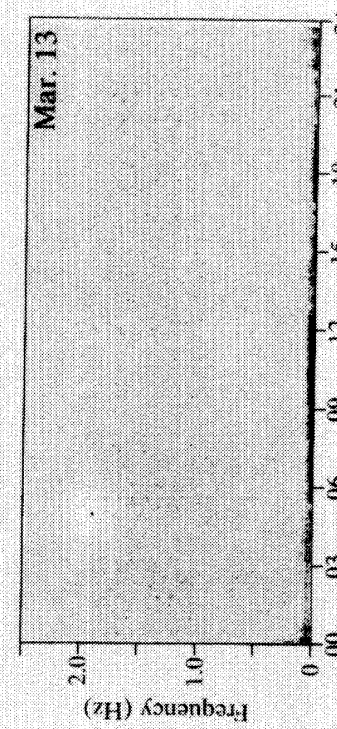
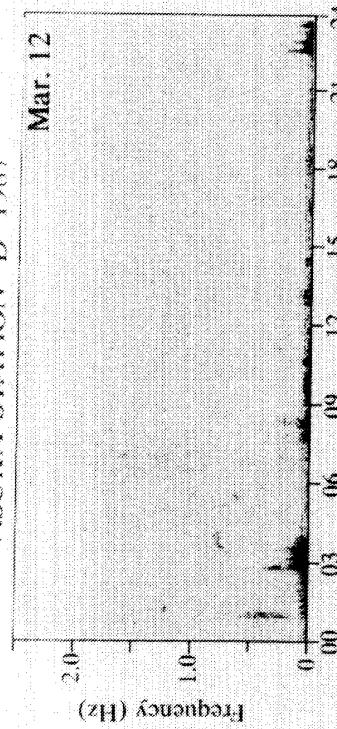
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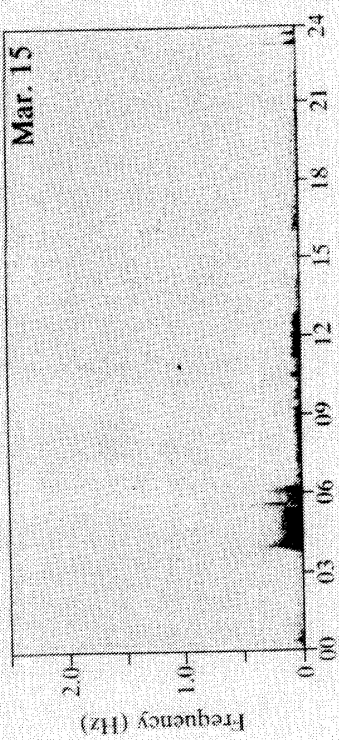
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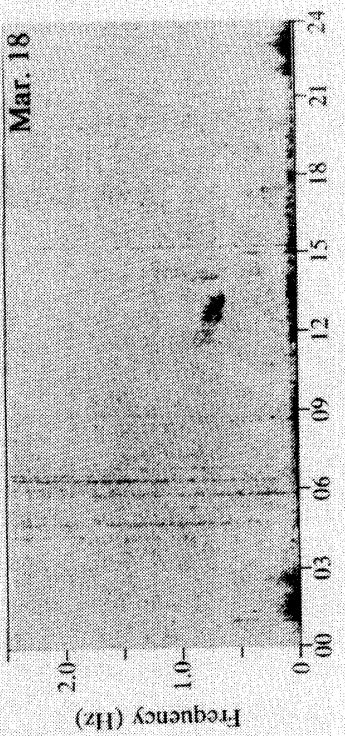
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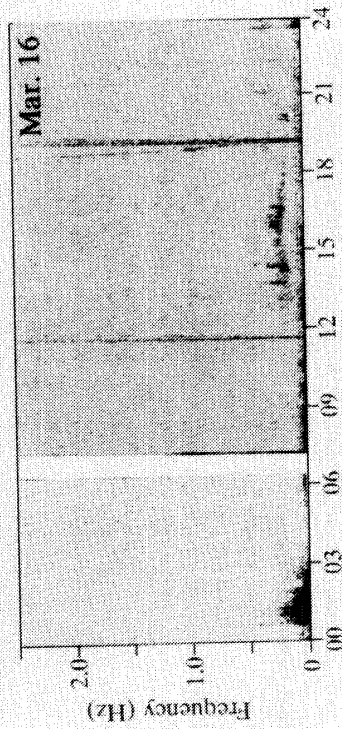
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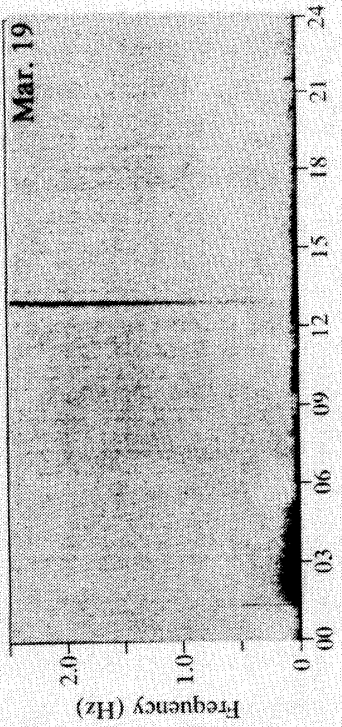
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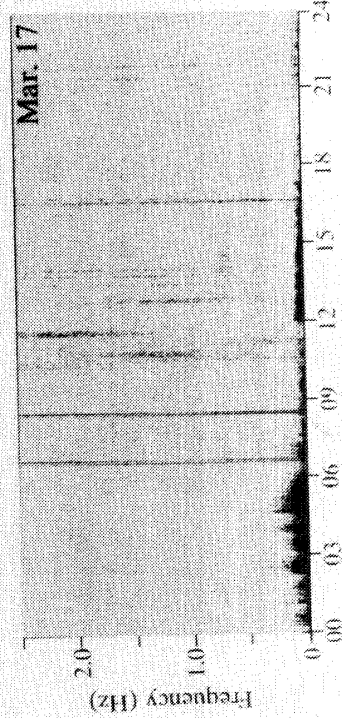
Mar. 15



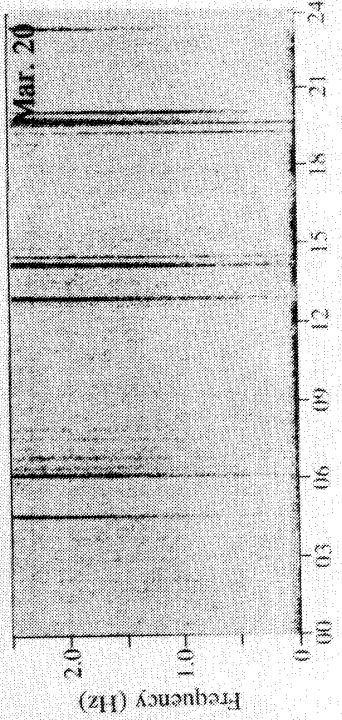
Mar. 19



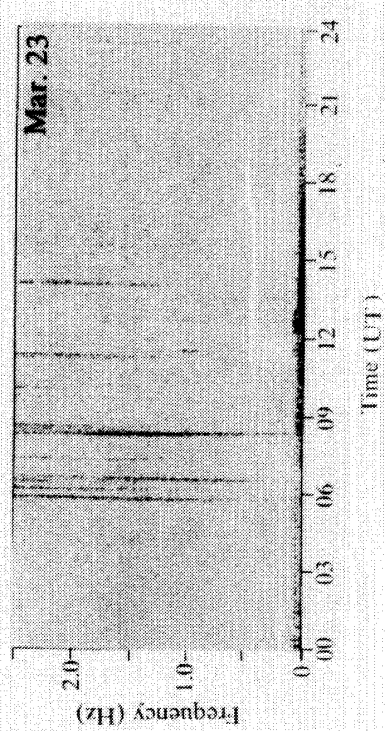
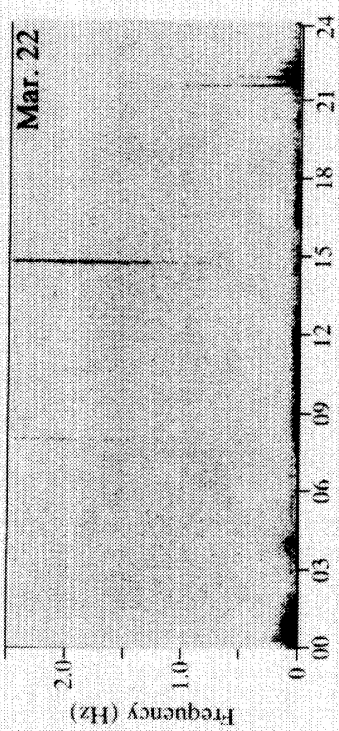
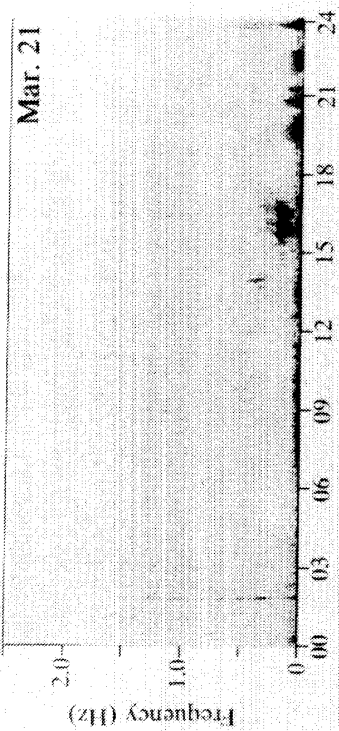
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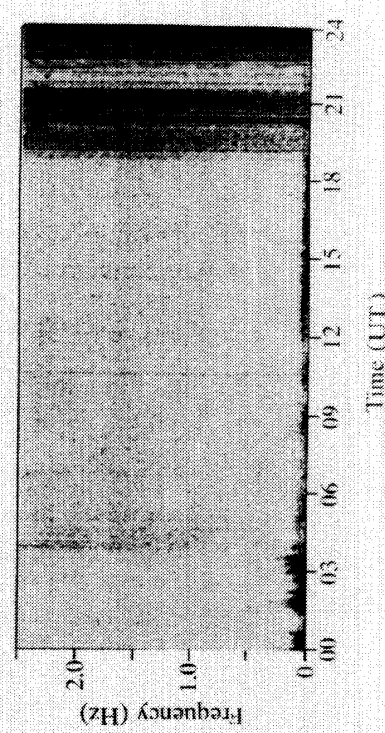
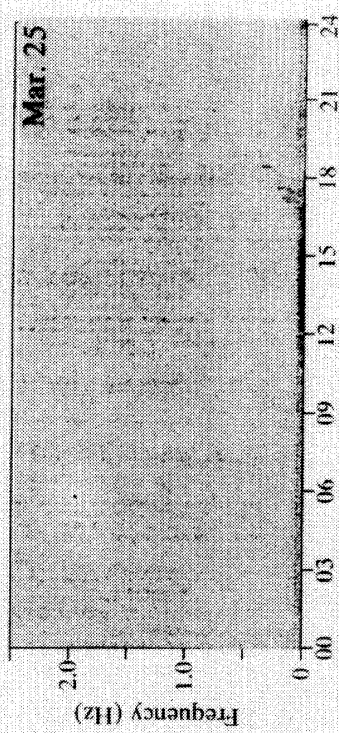
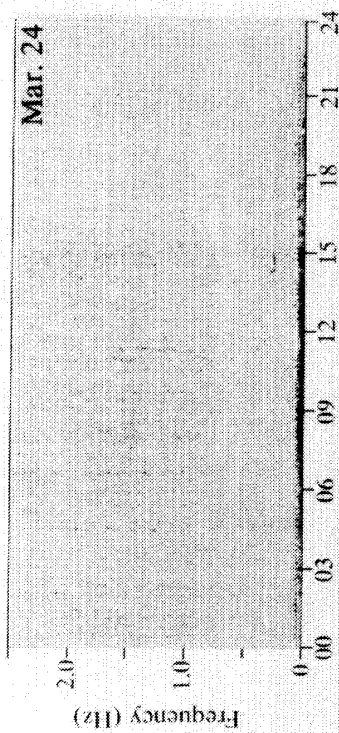
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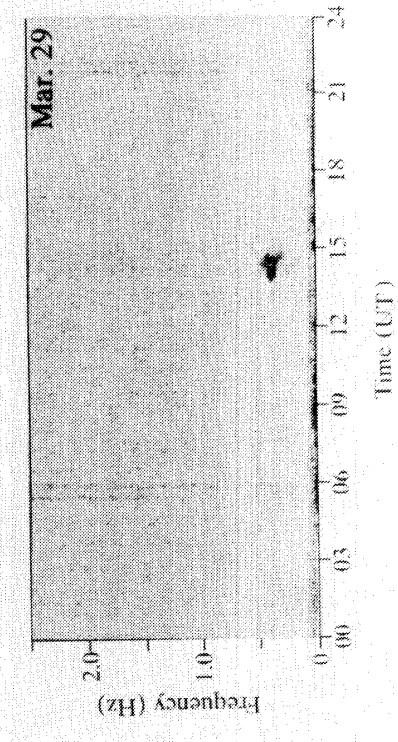
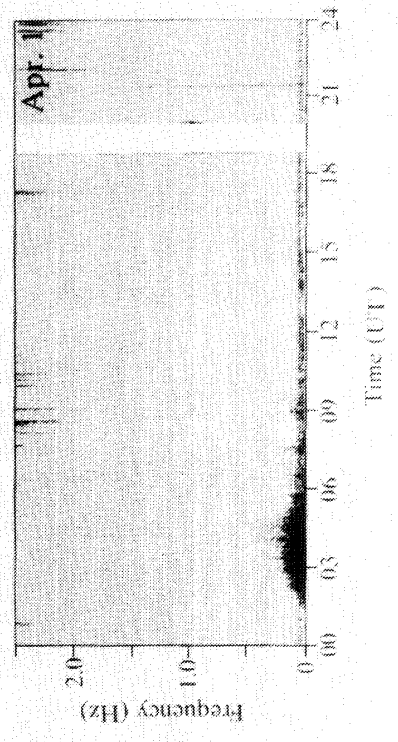
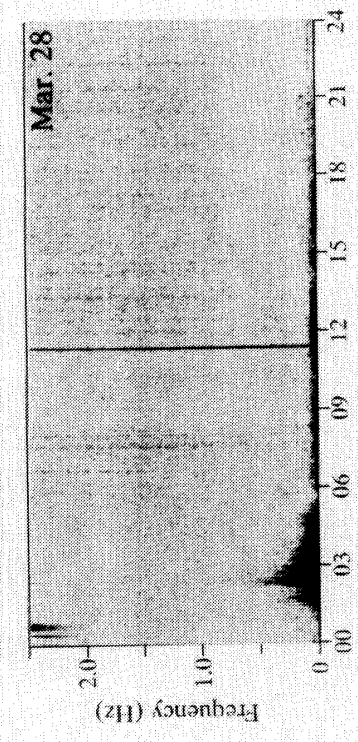
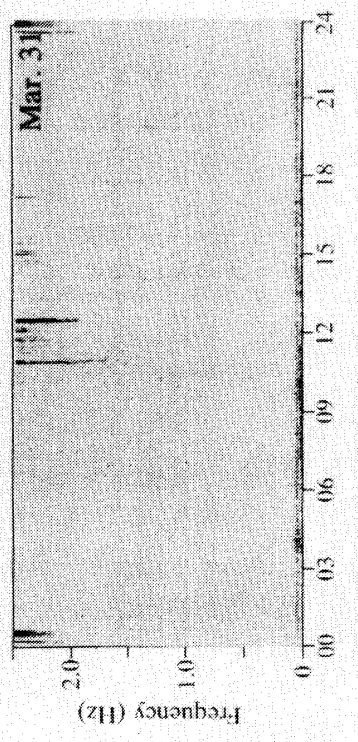
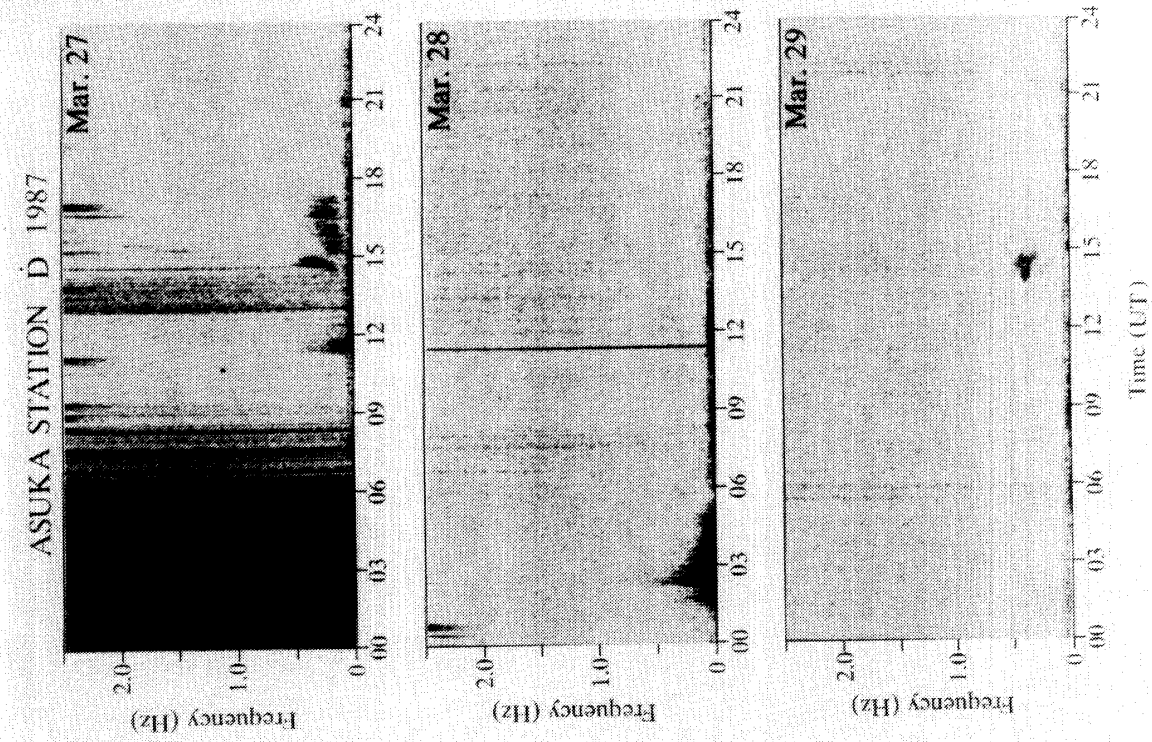
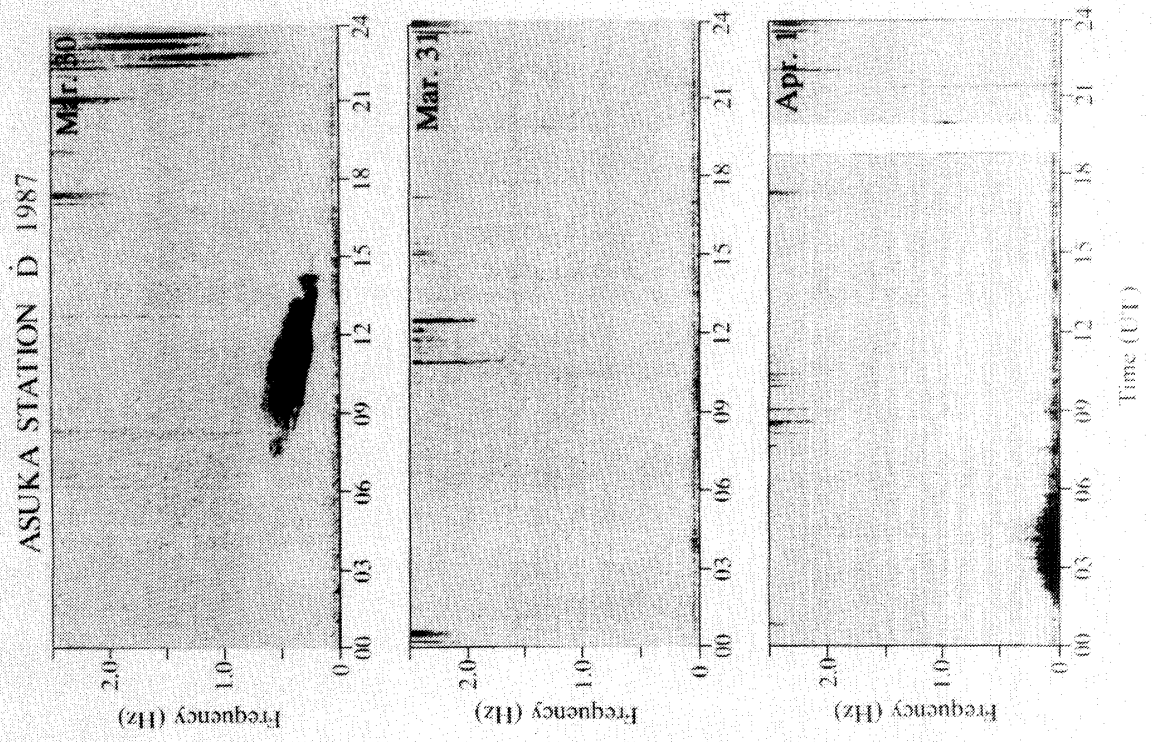


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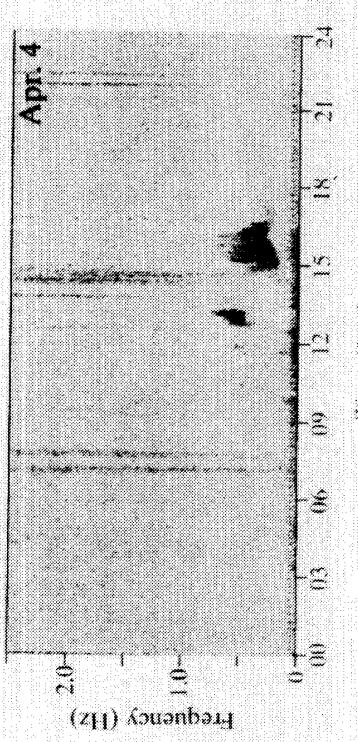
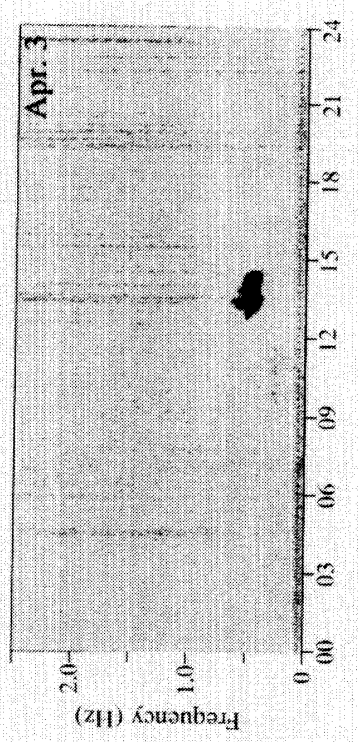
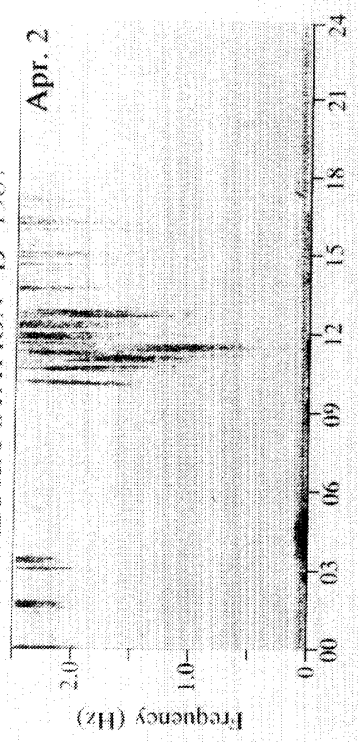


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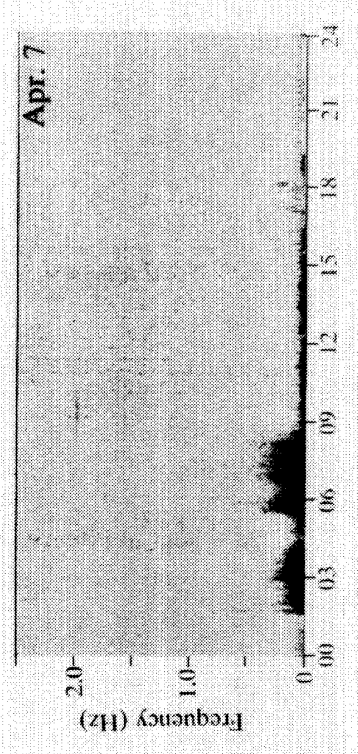
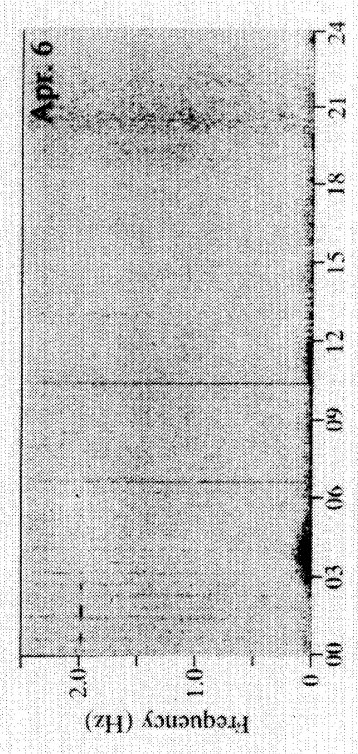
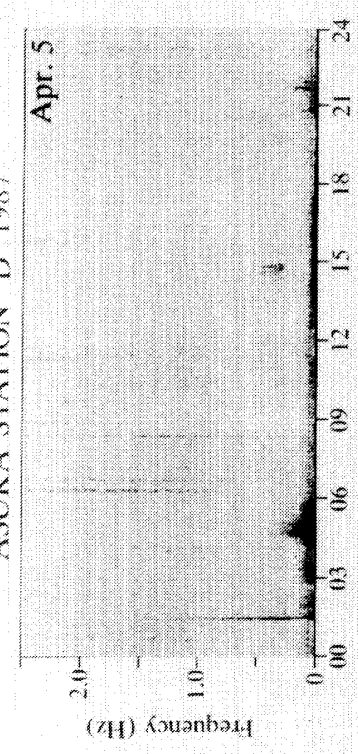




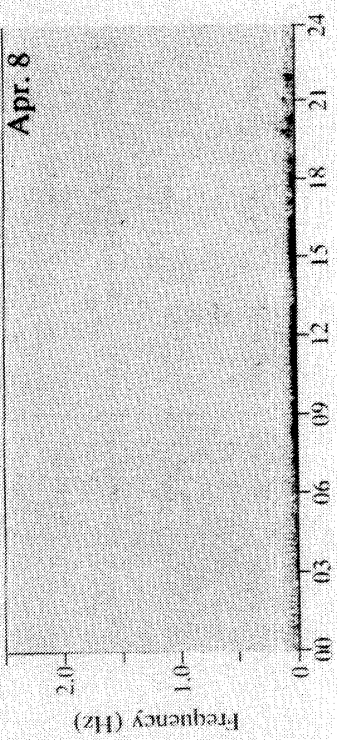
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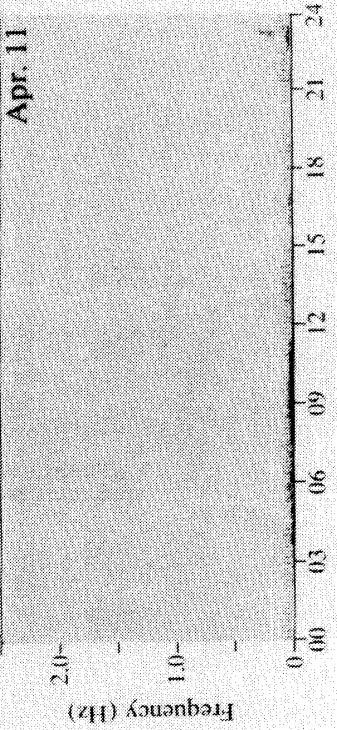
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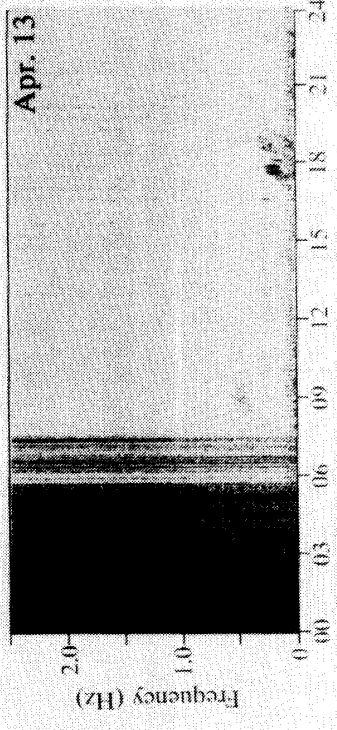
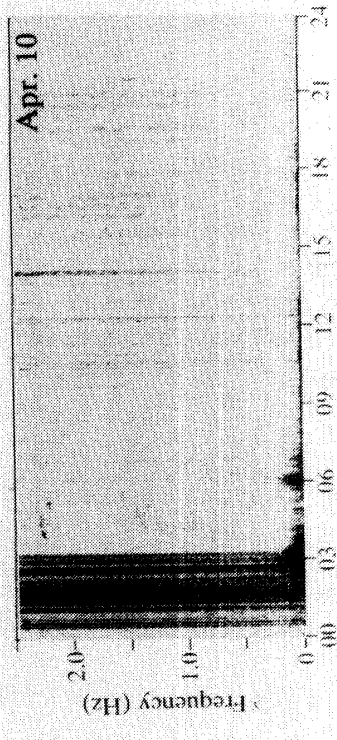
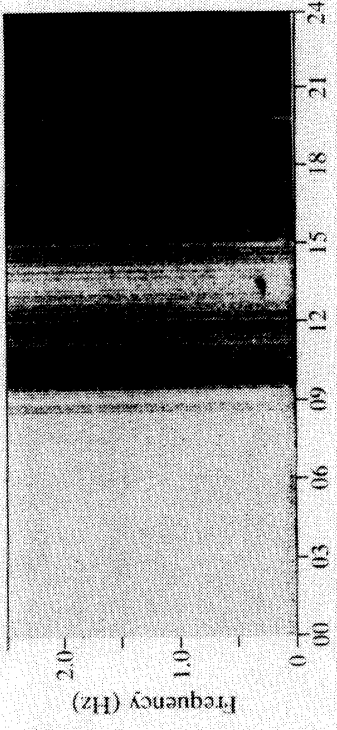
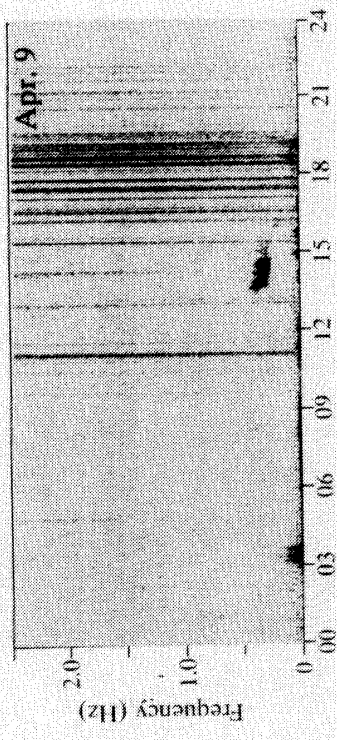
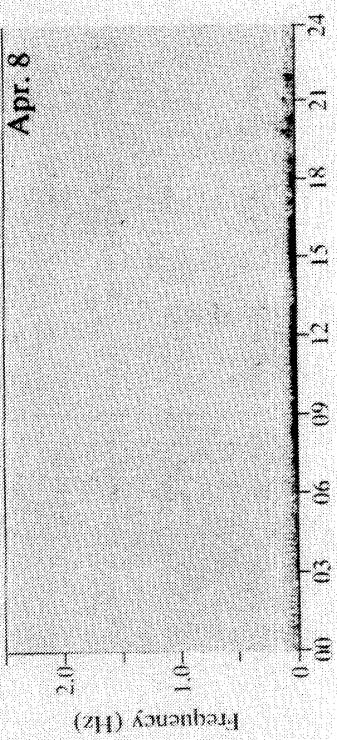
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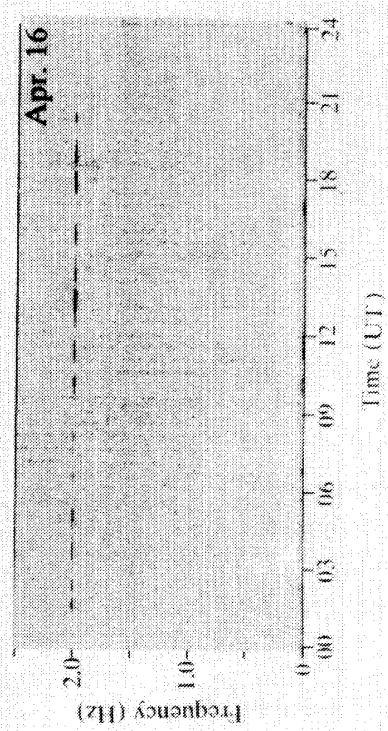
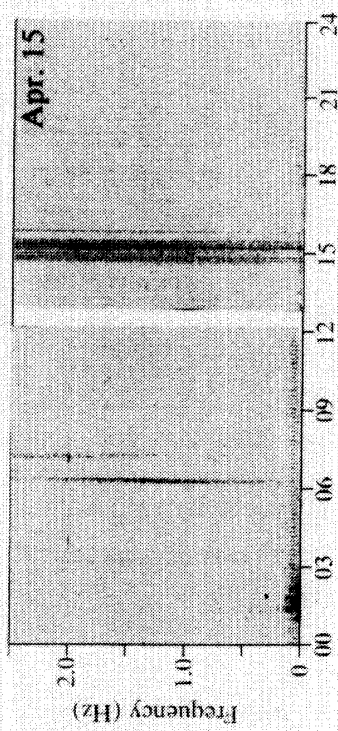
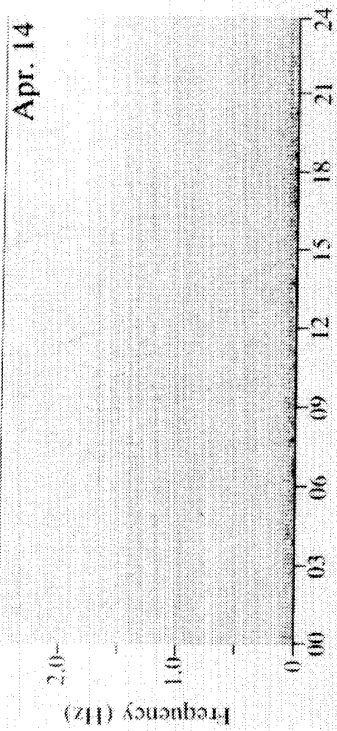
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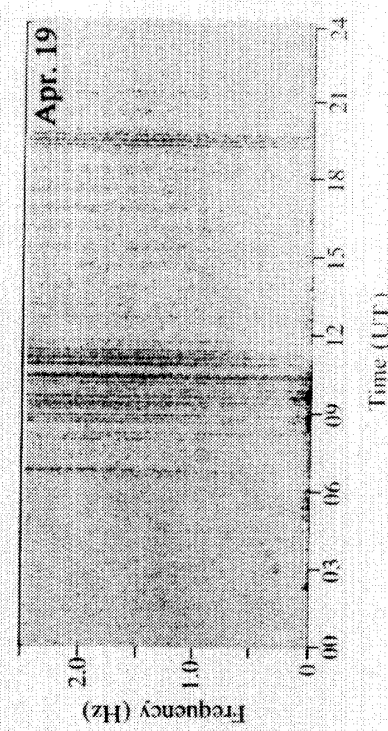
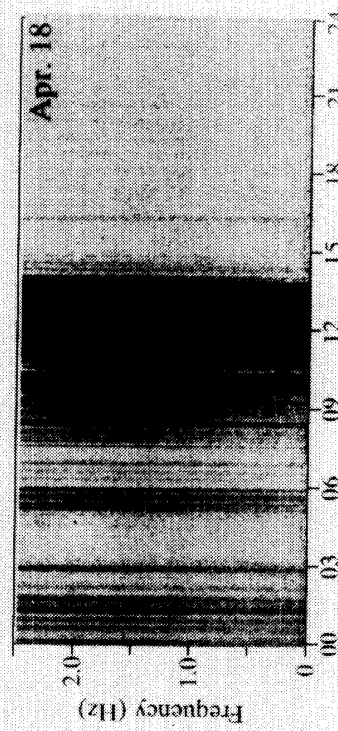
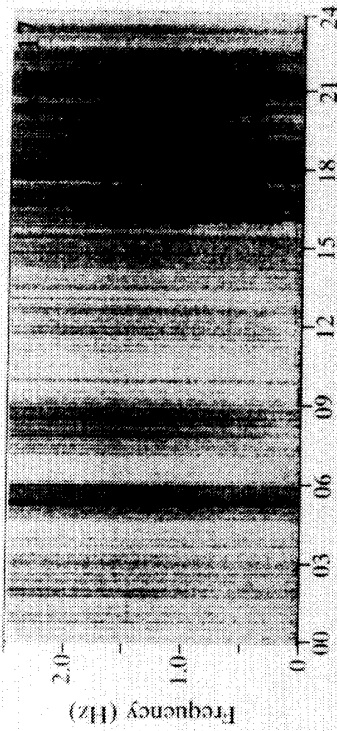
Apr. 8



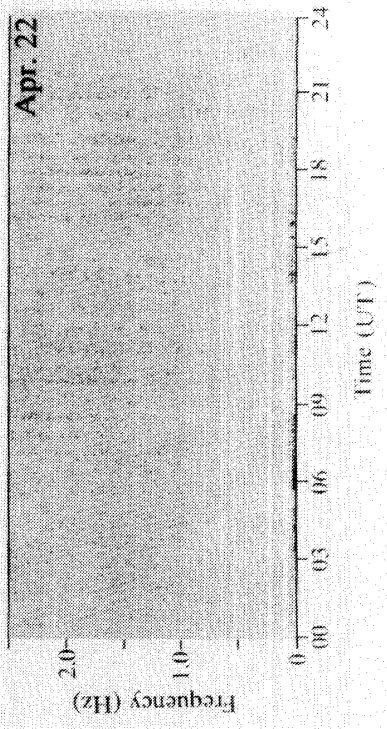
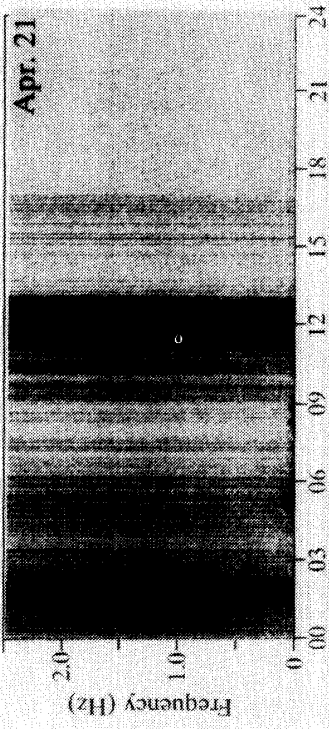
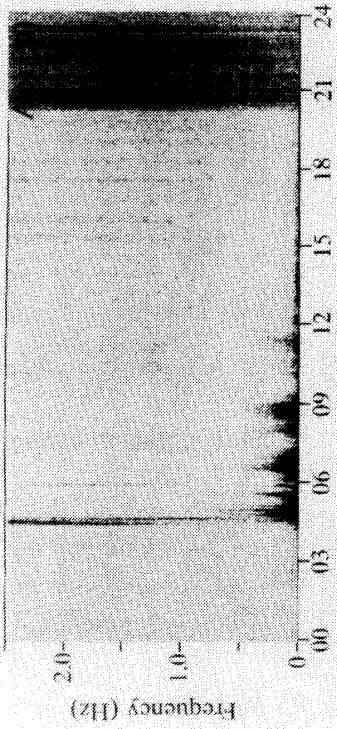
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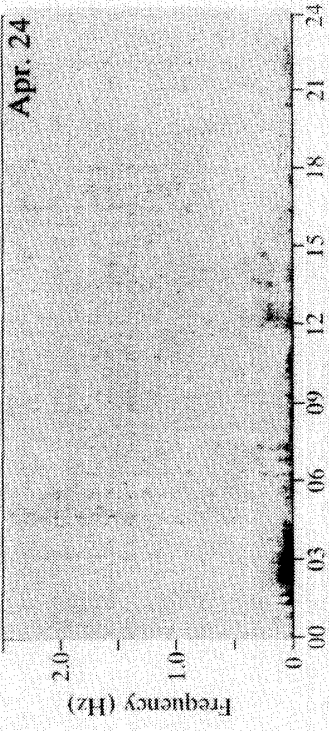
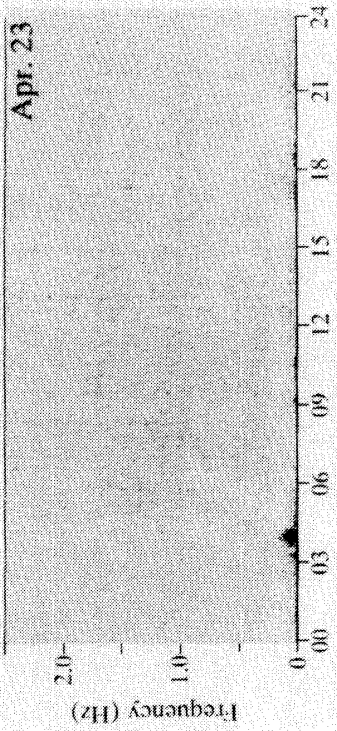
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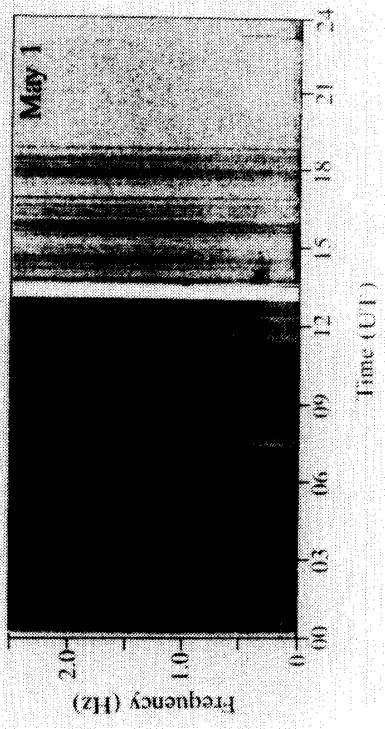
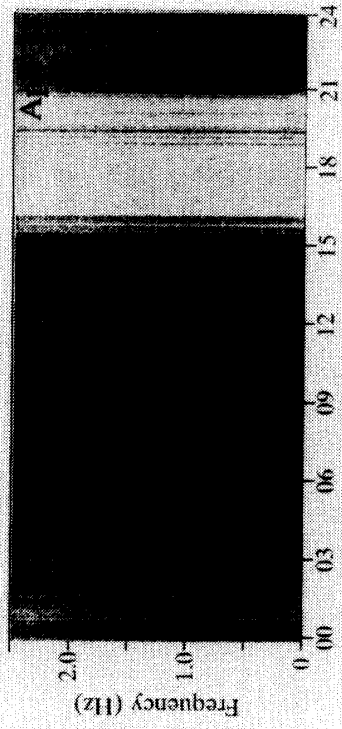
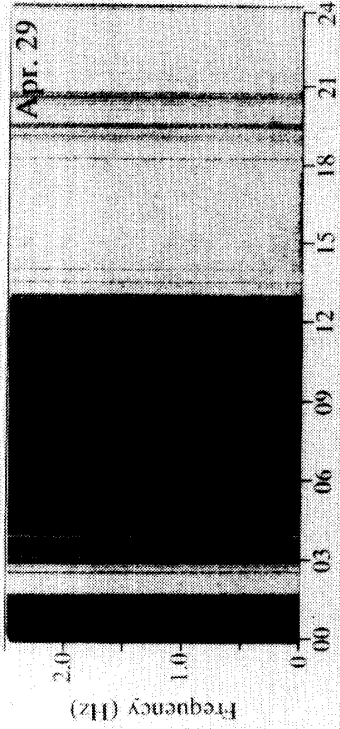
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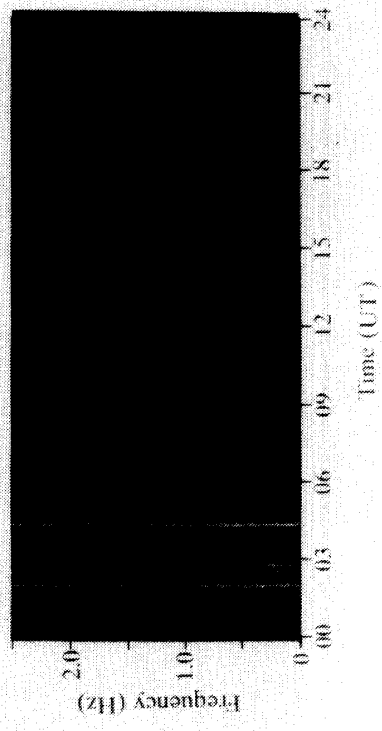
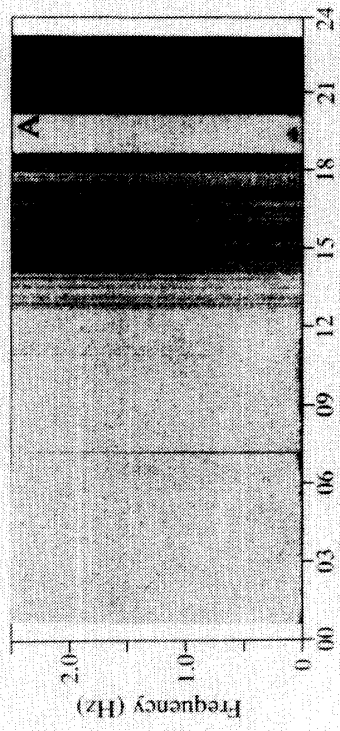
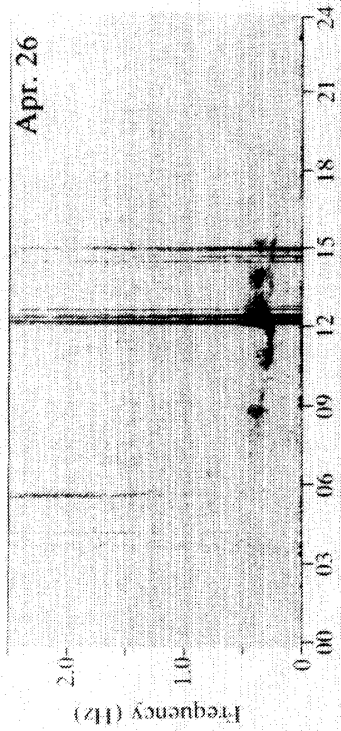
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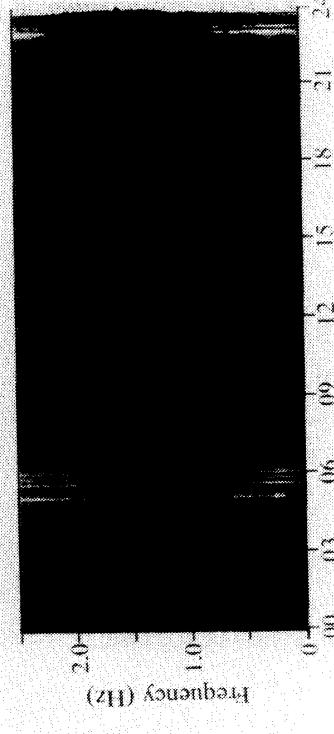
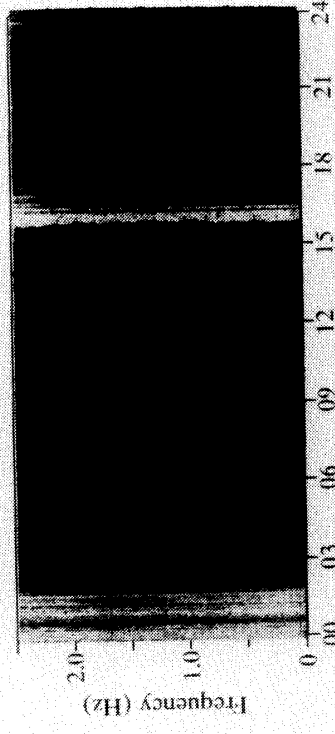
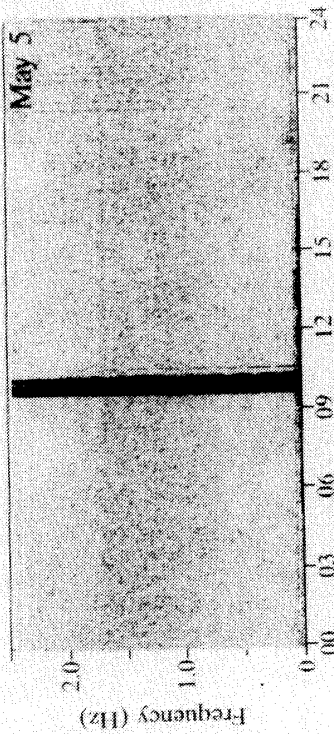
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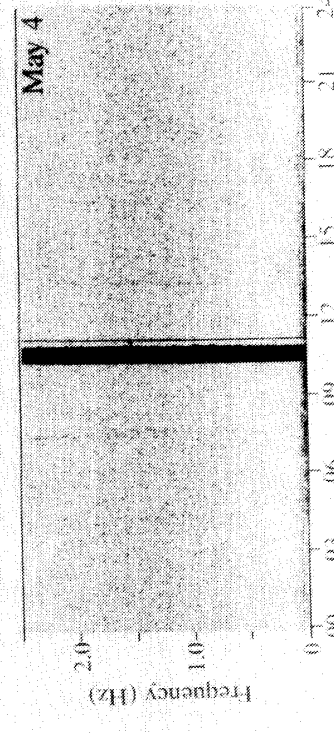
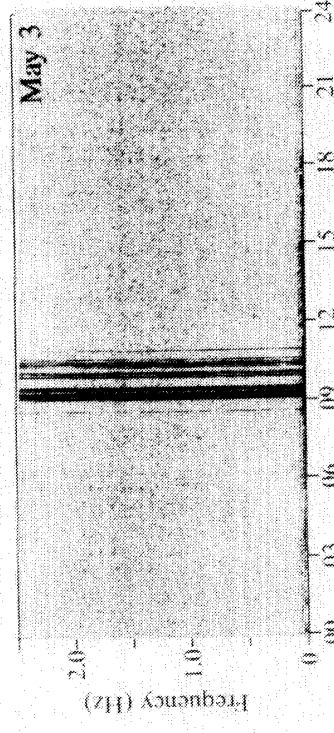
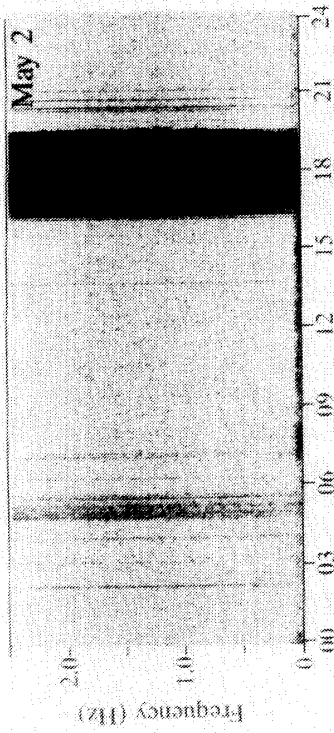
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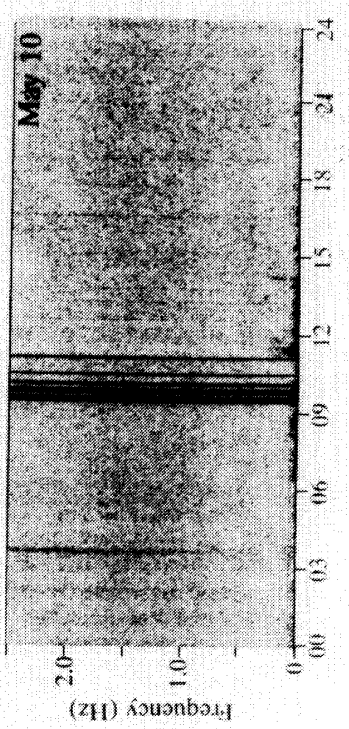
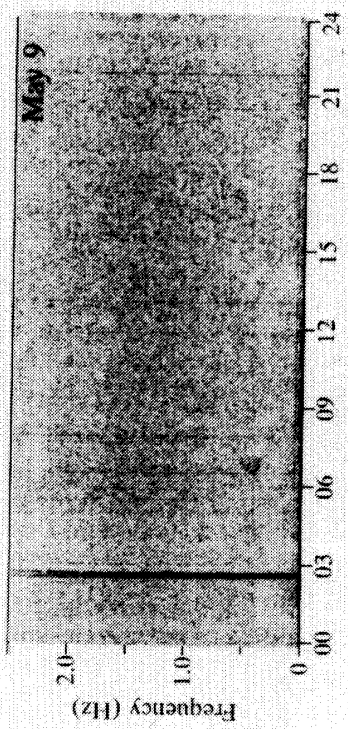
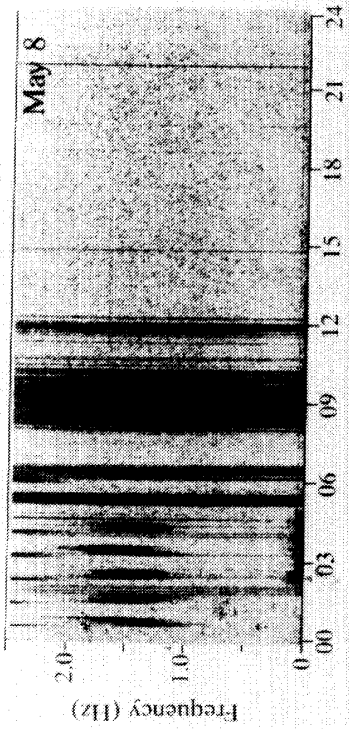
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ASUKA STATION D 1987

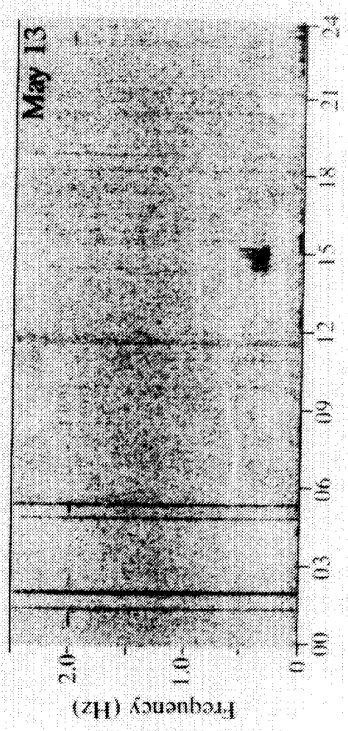
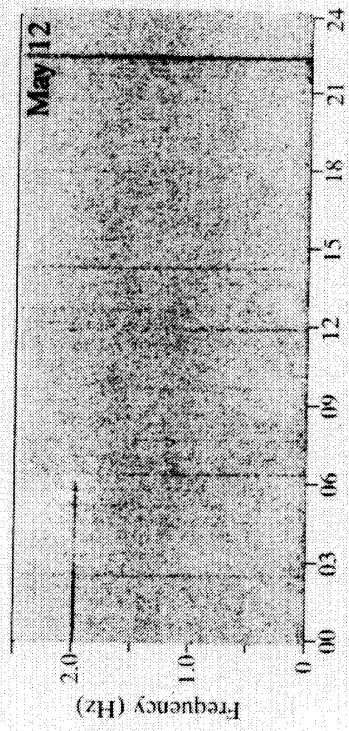
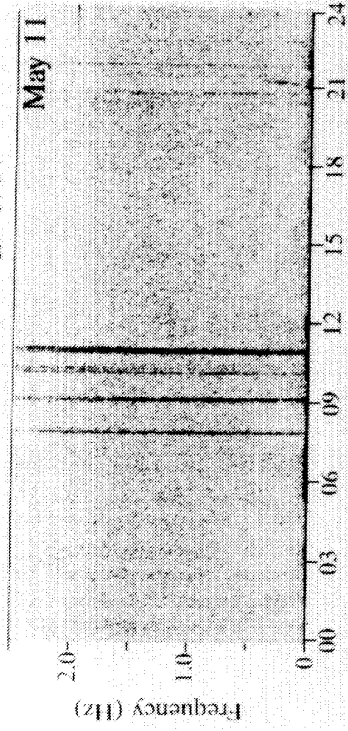


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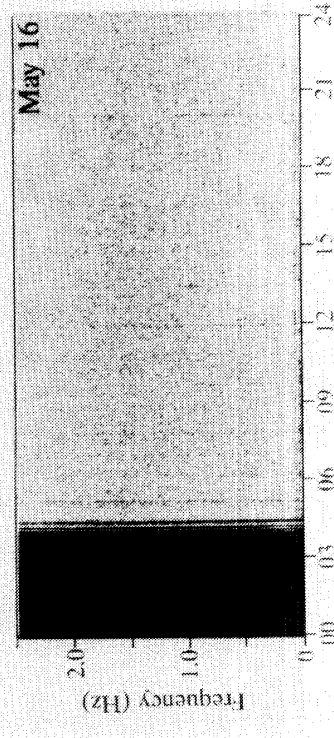
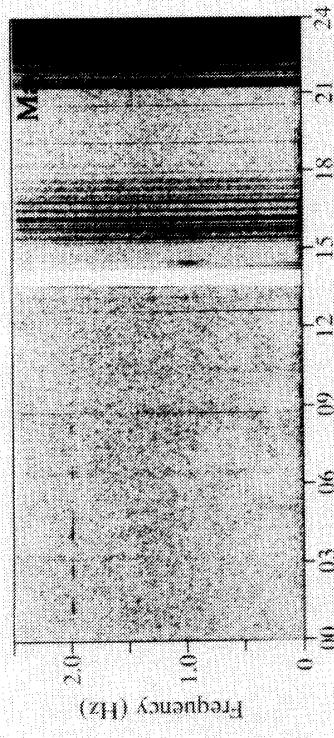
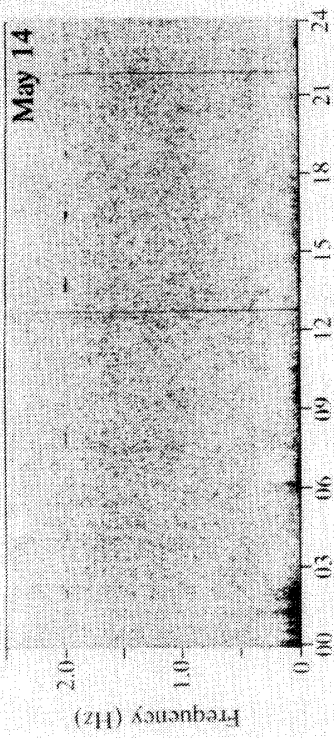
Time (UT)

ASUKA STATION D 1987

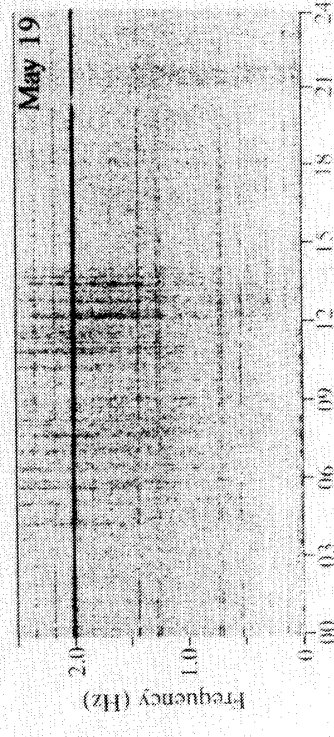
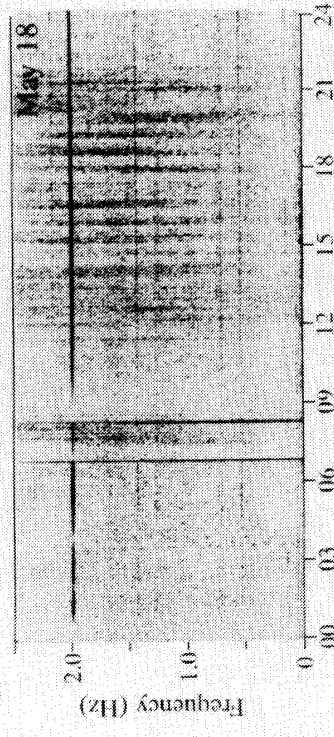
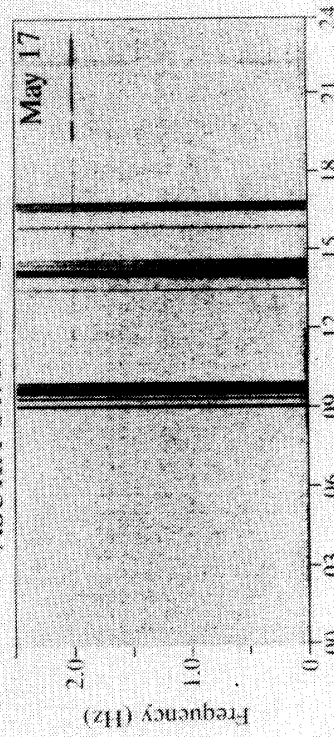


Time (UT)

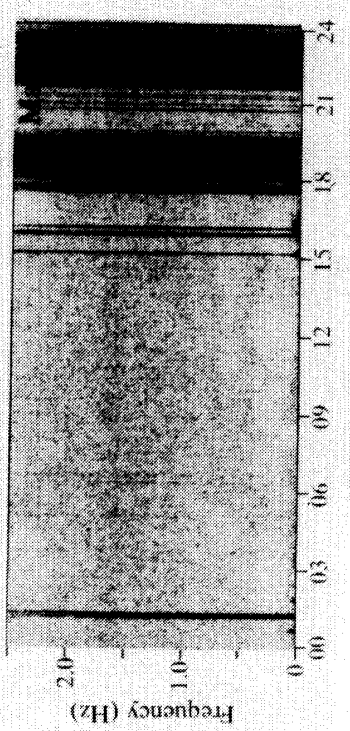
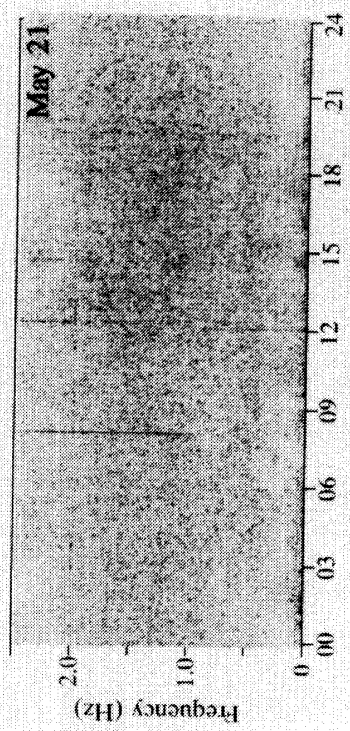
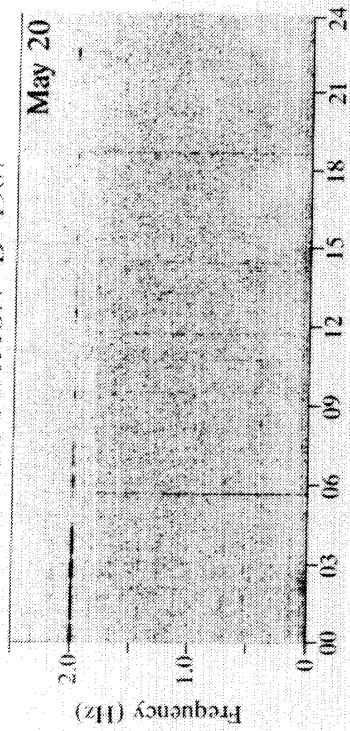
ASUKA STATION D 1987



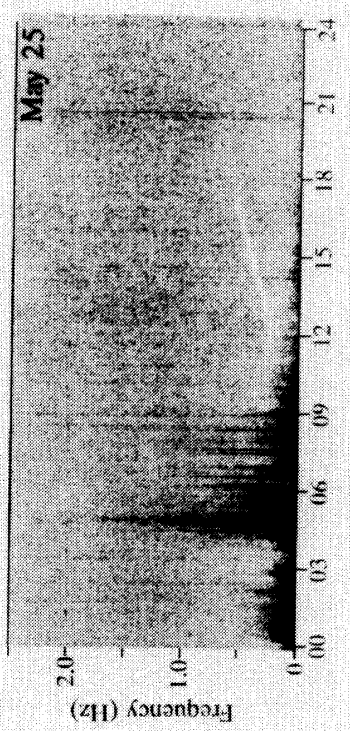
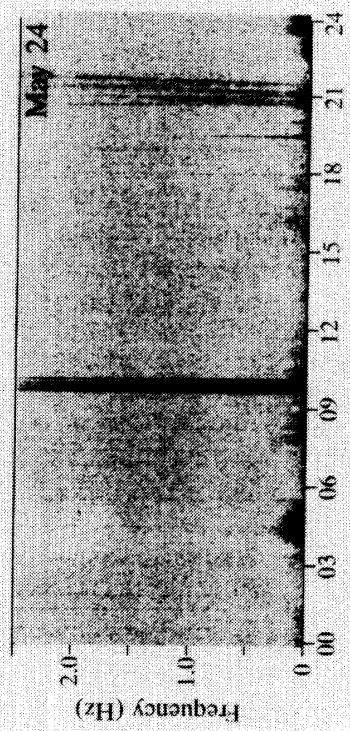
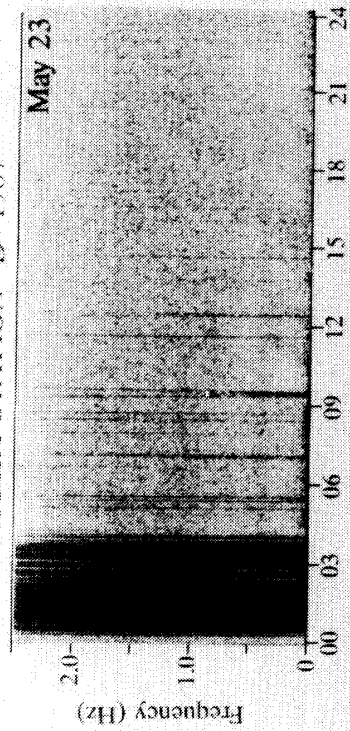
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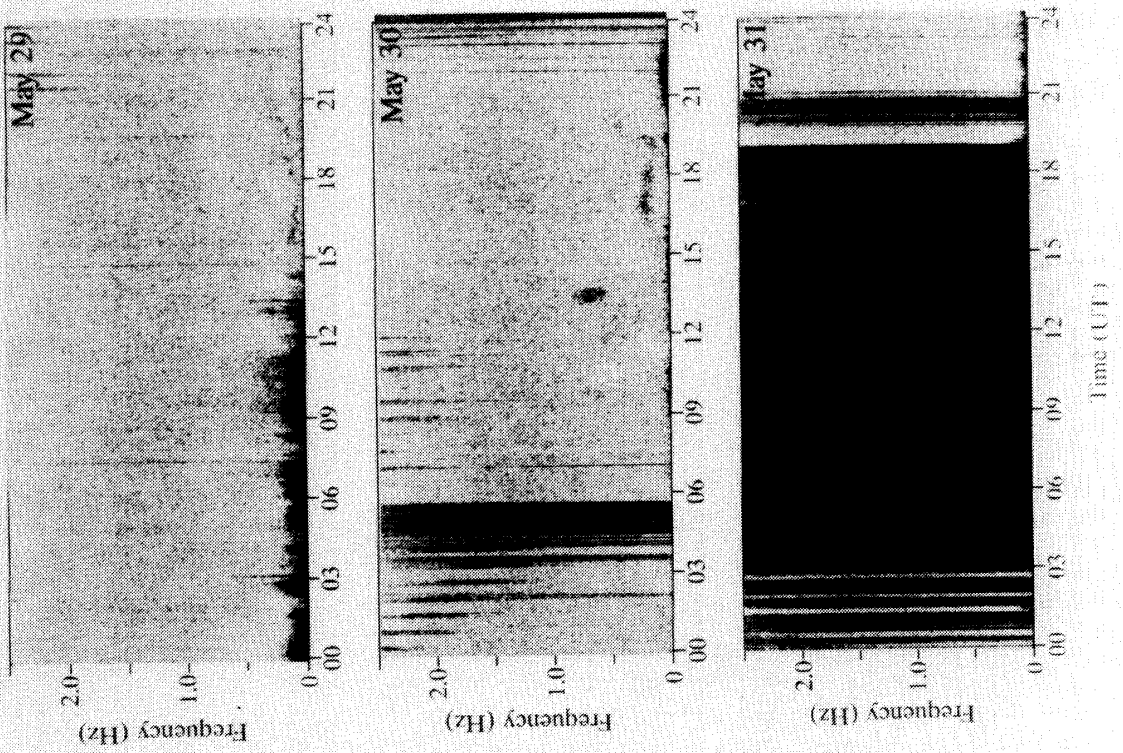
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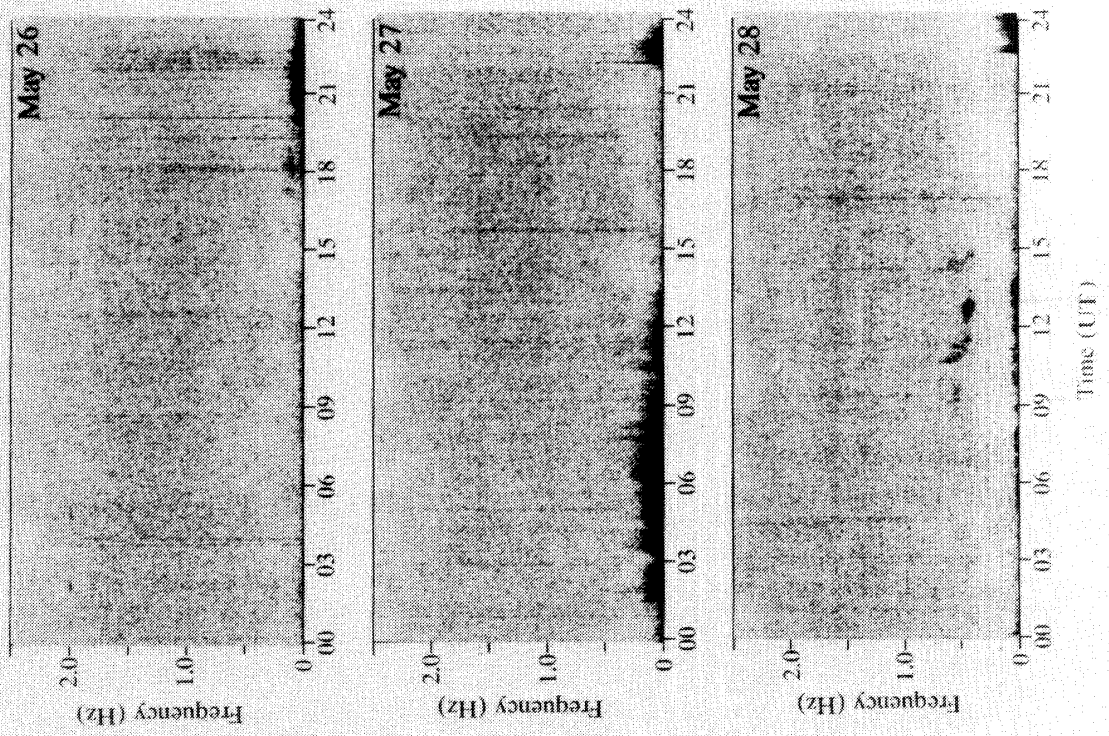
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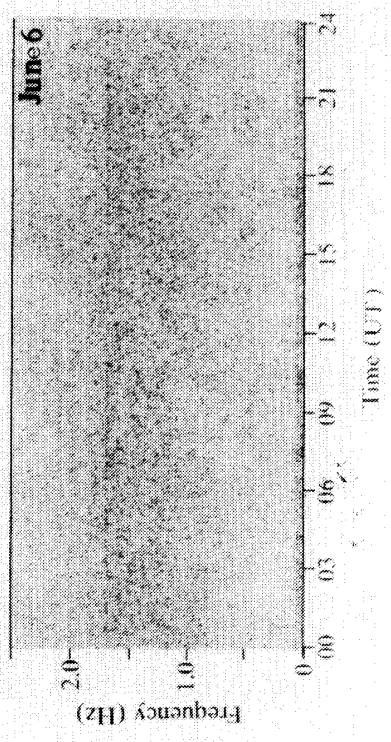
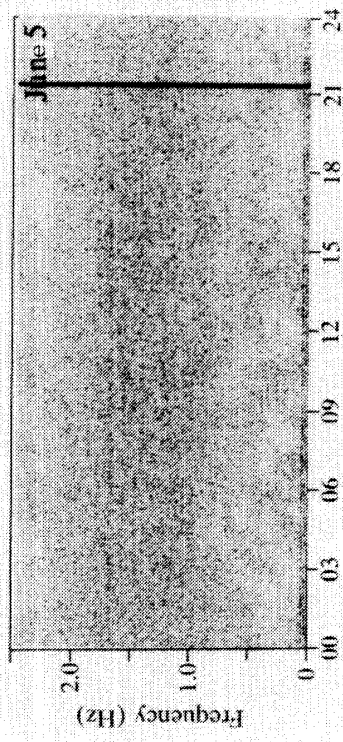
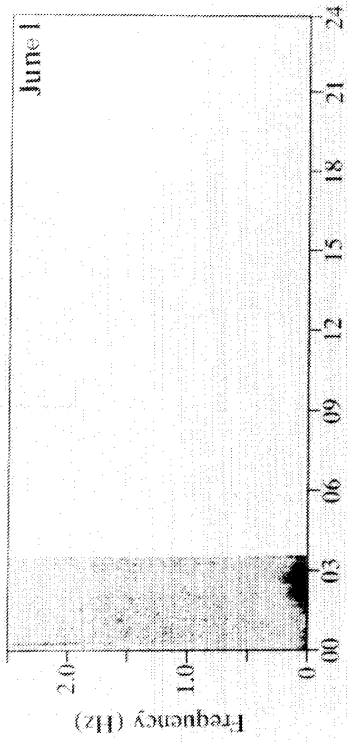
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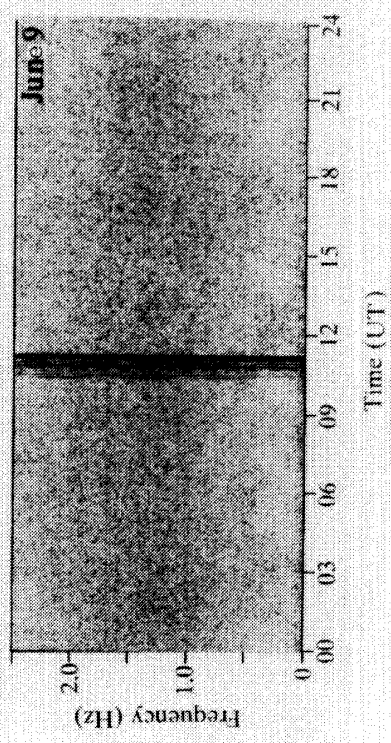
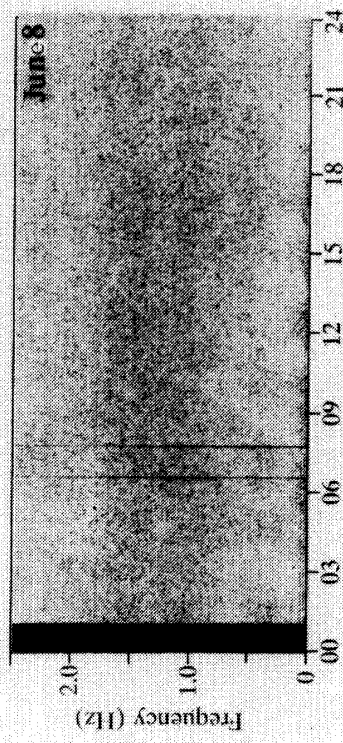
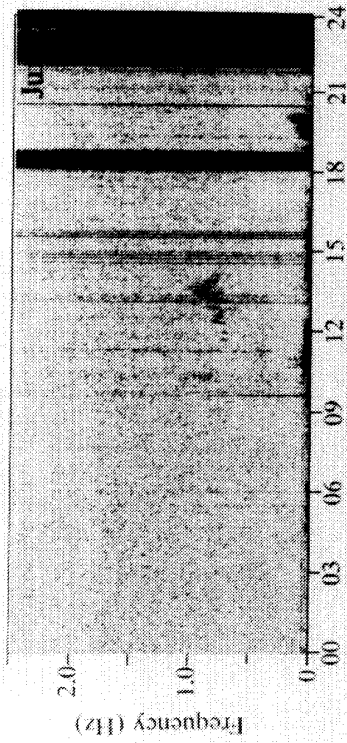
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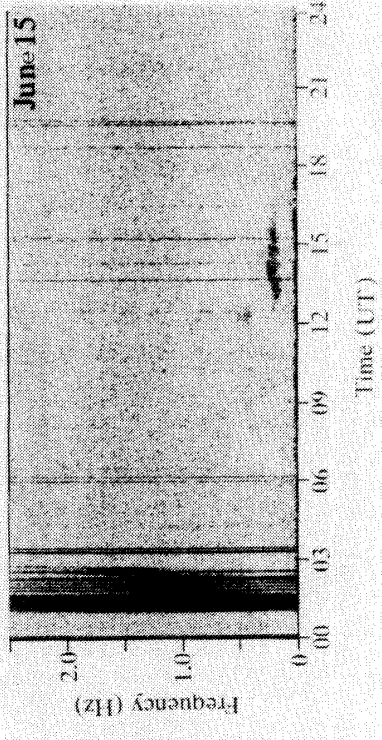
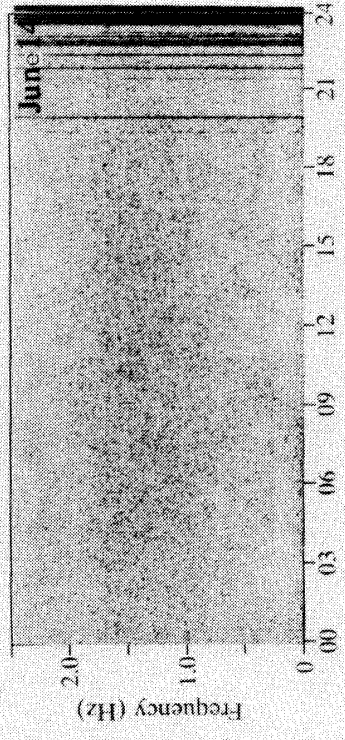
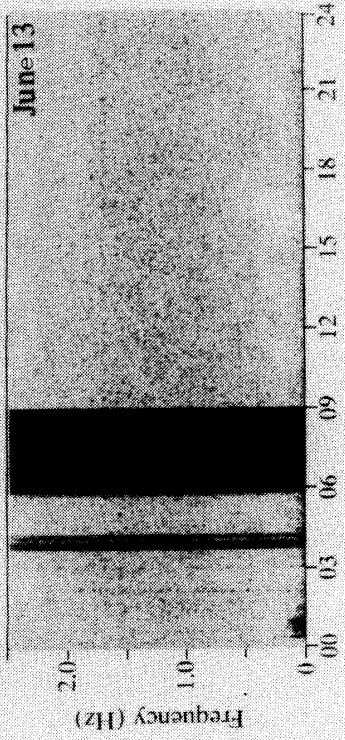
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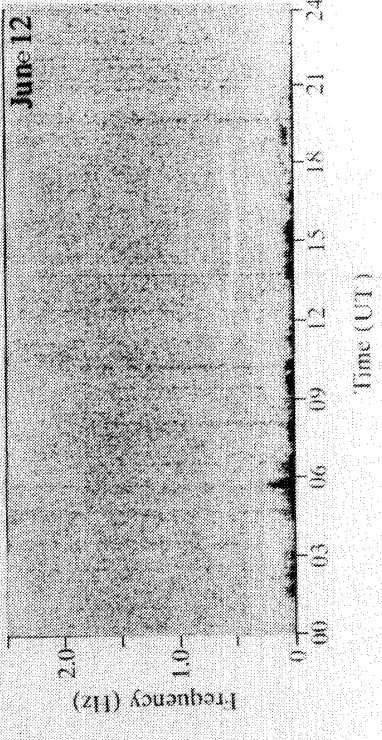
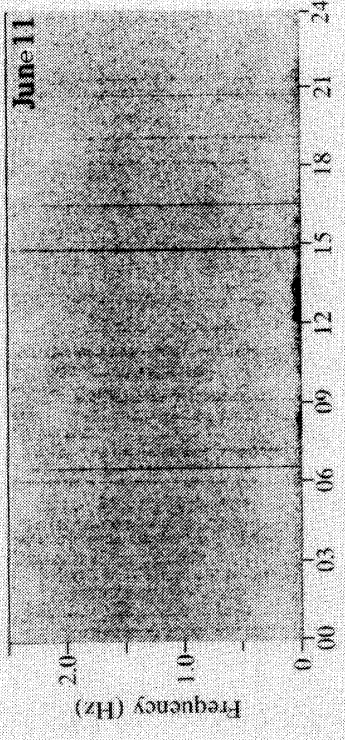
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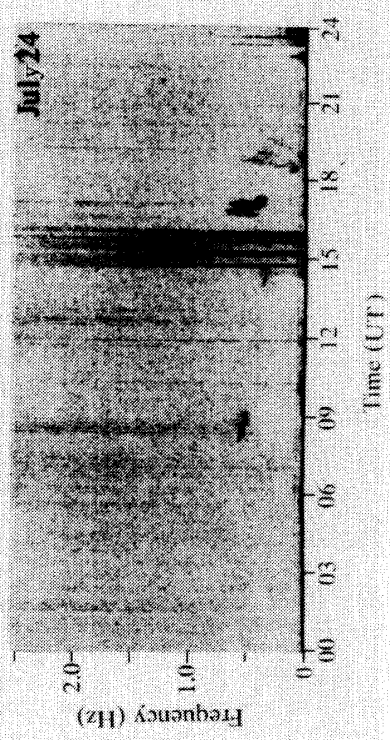
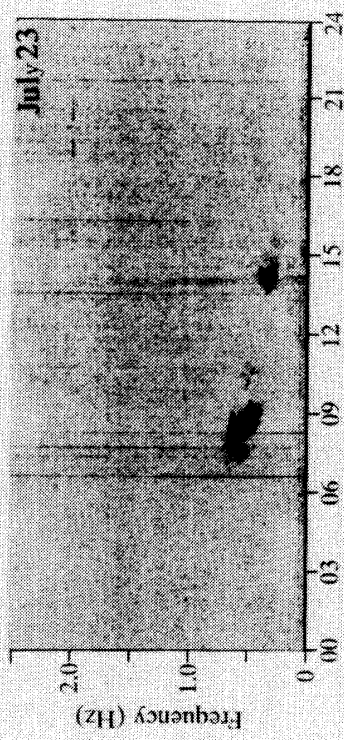
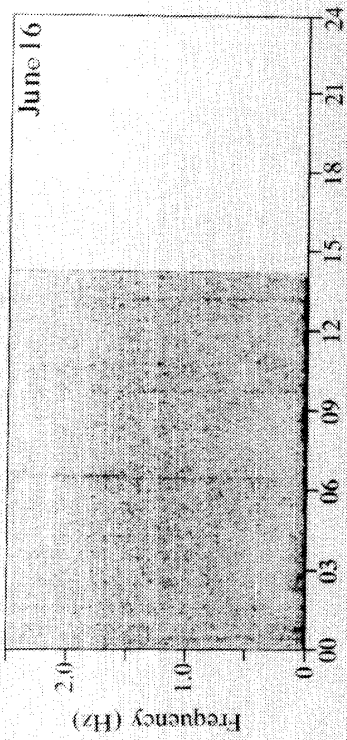
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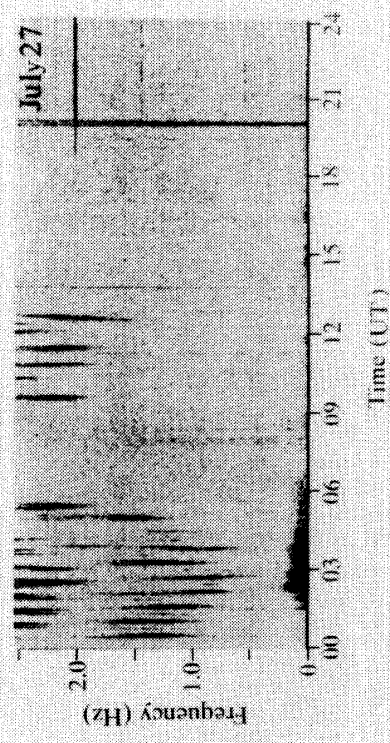
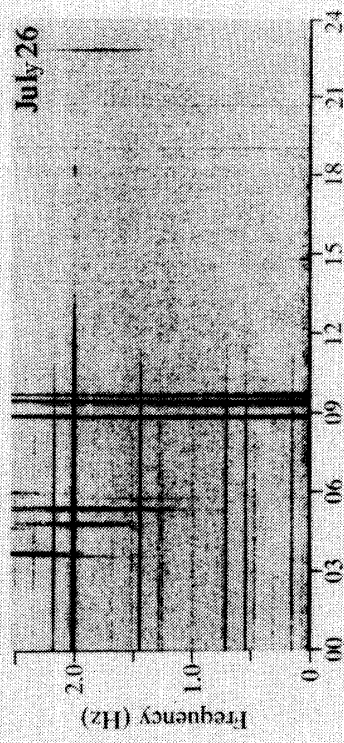
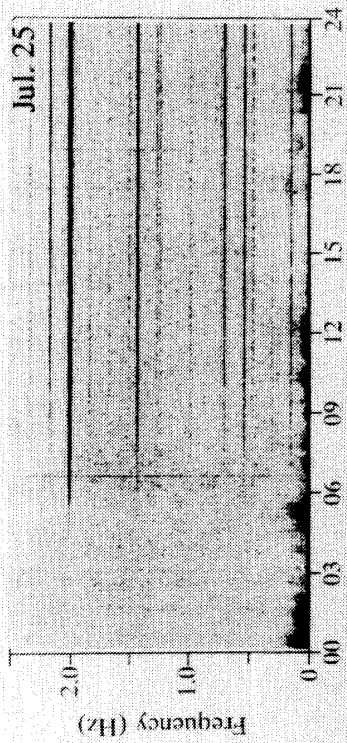
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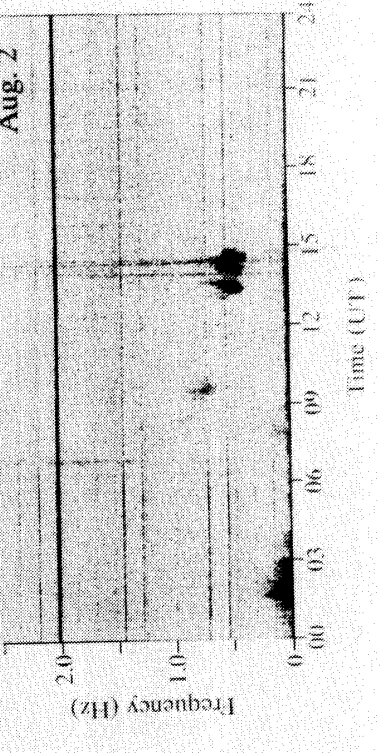
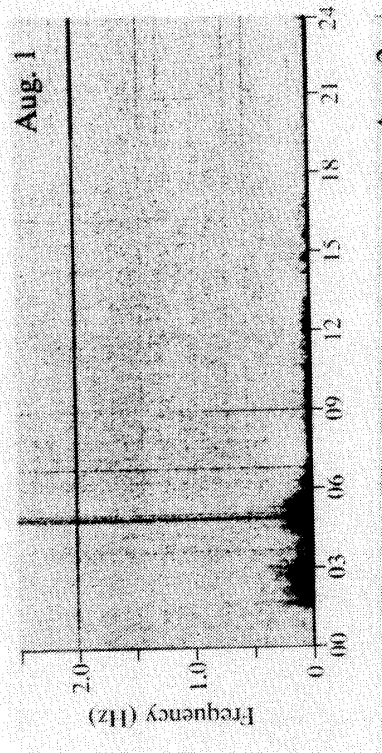
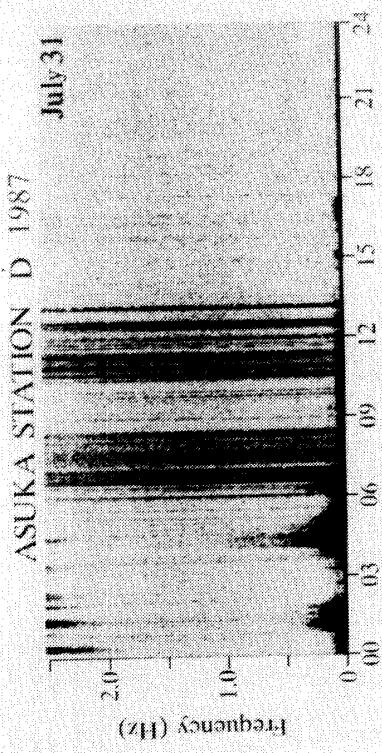
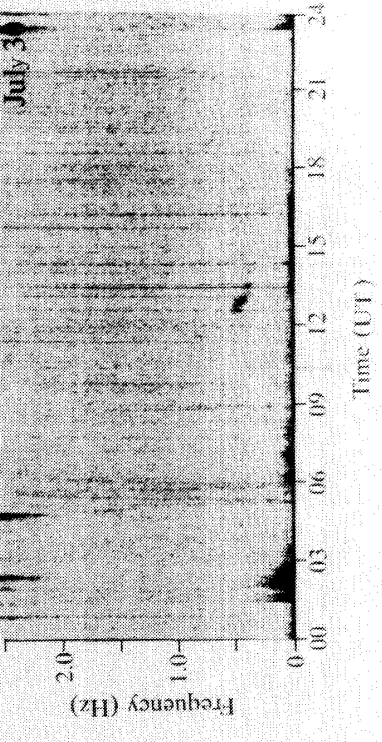
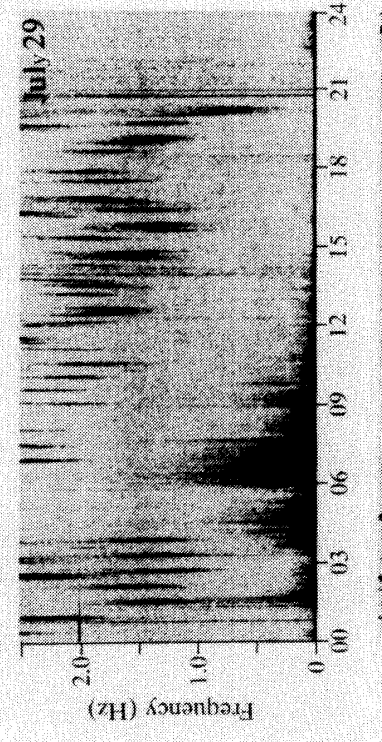
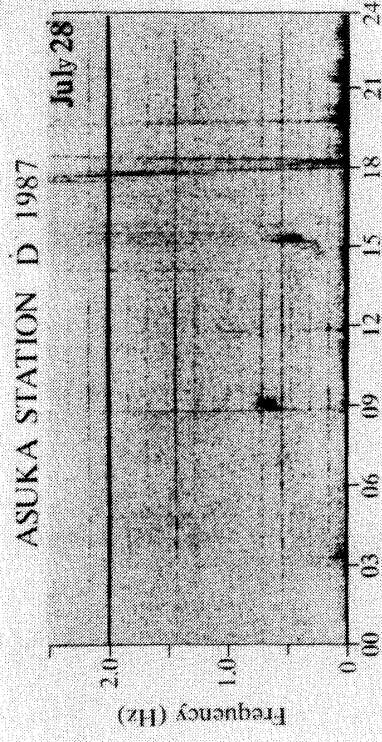


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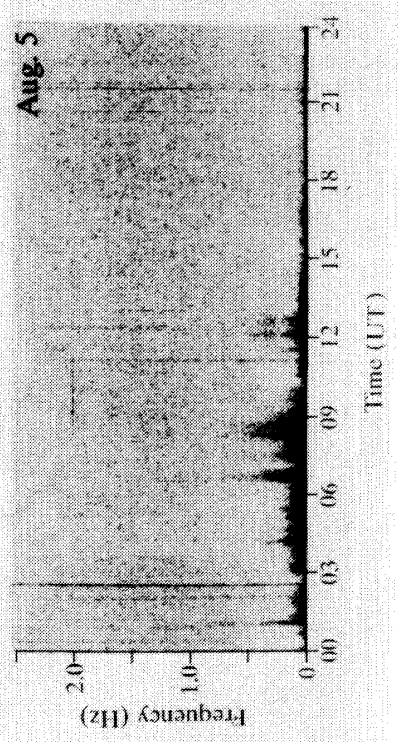
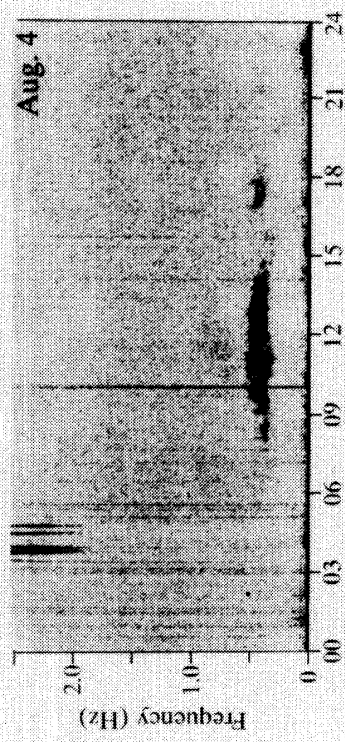
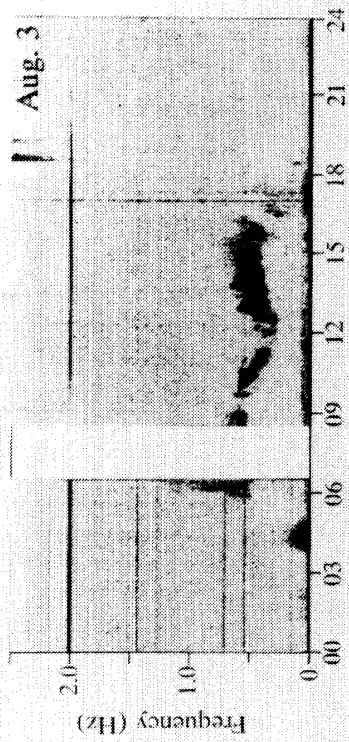


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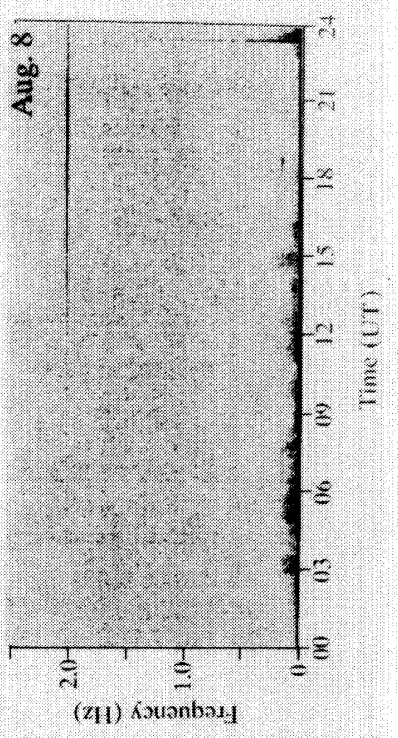
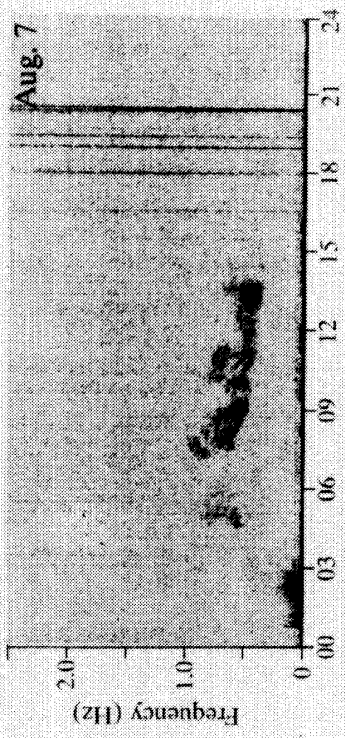
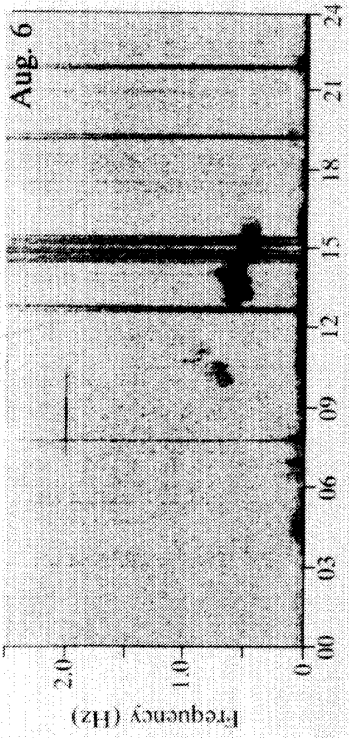




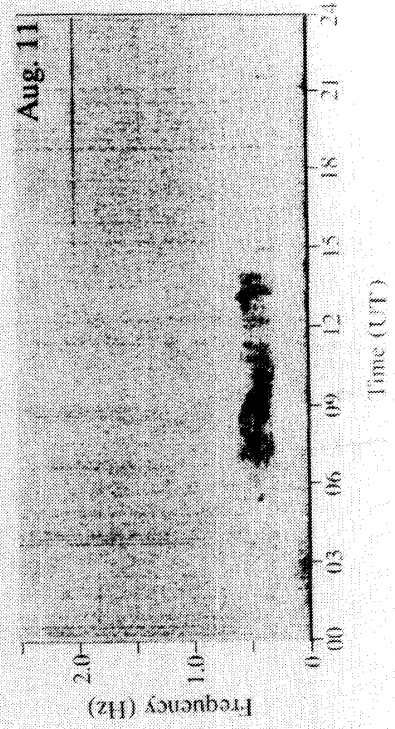
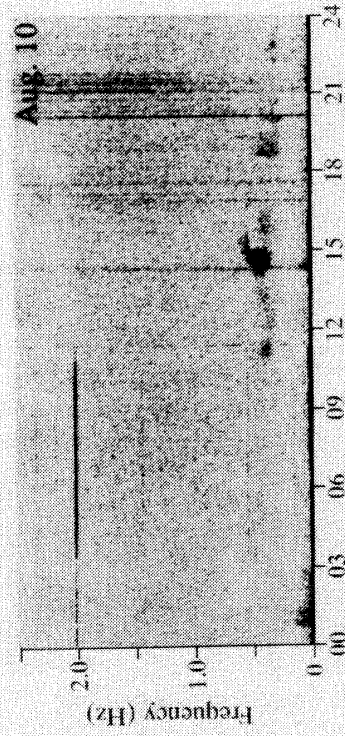
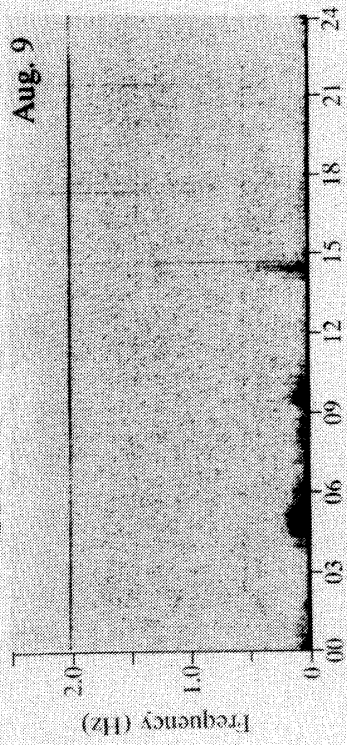
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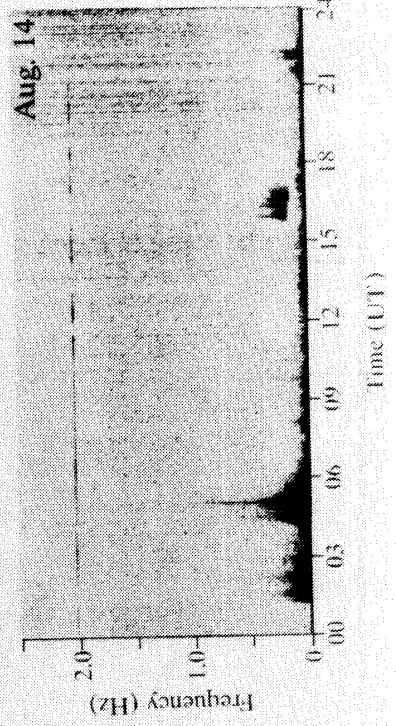
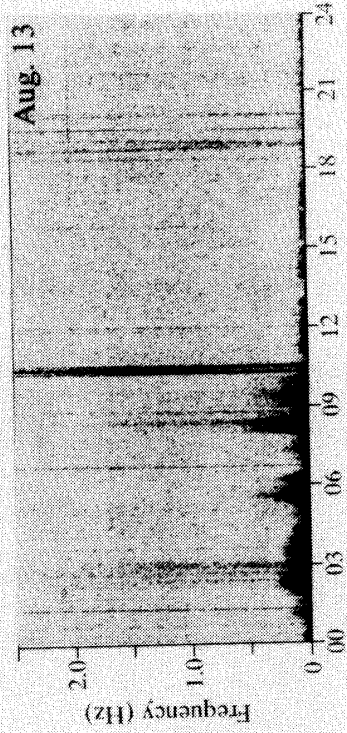
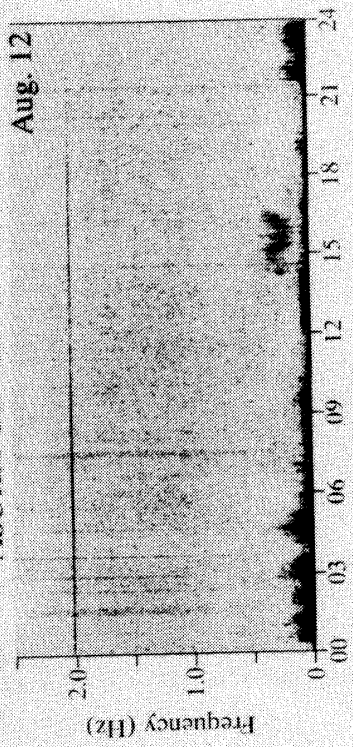
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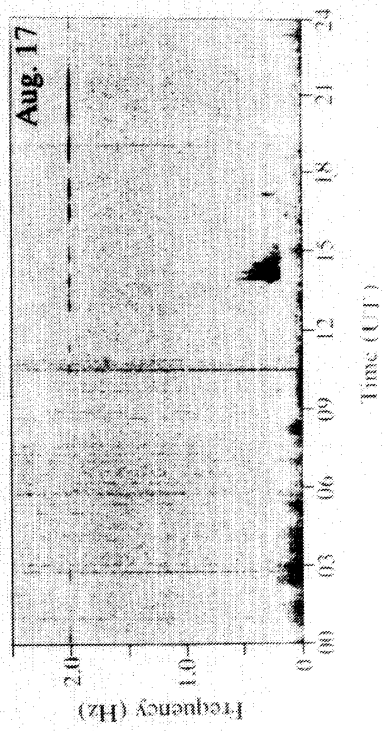
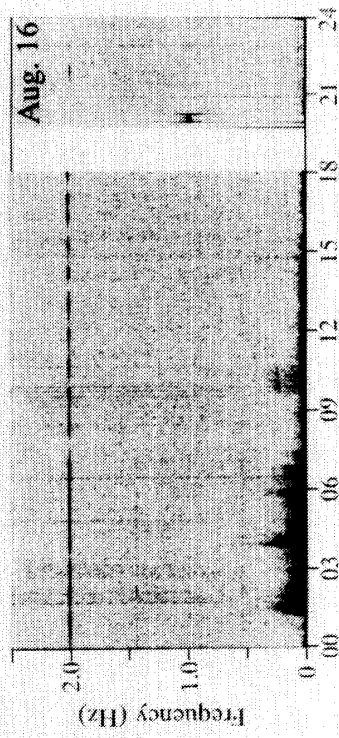
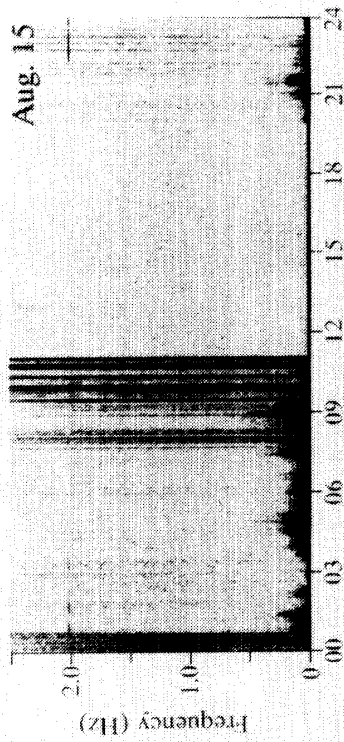
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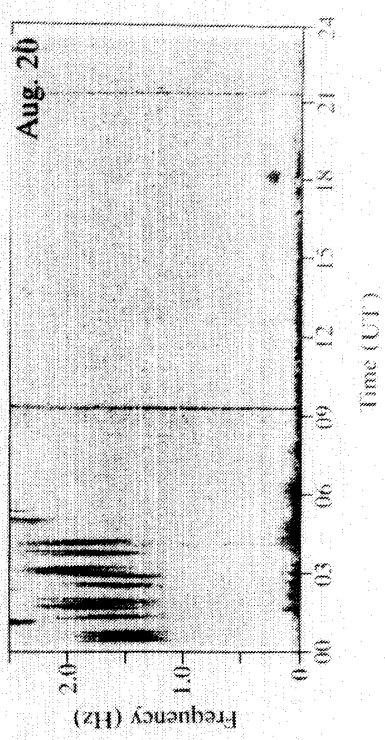
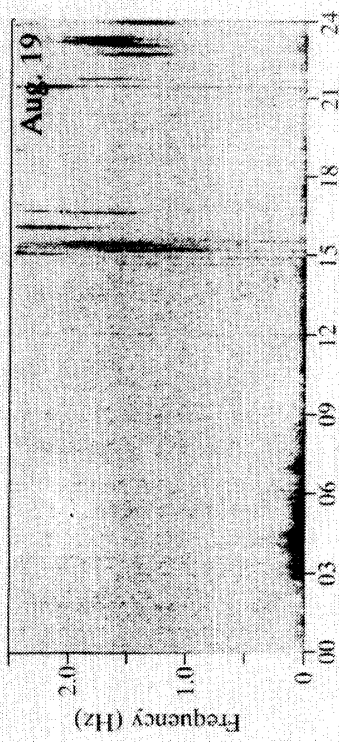
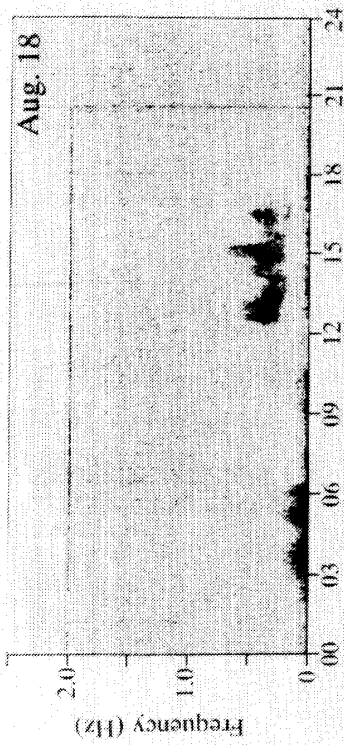
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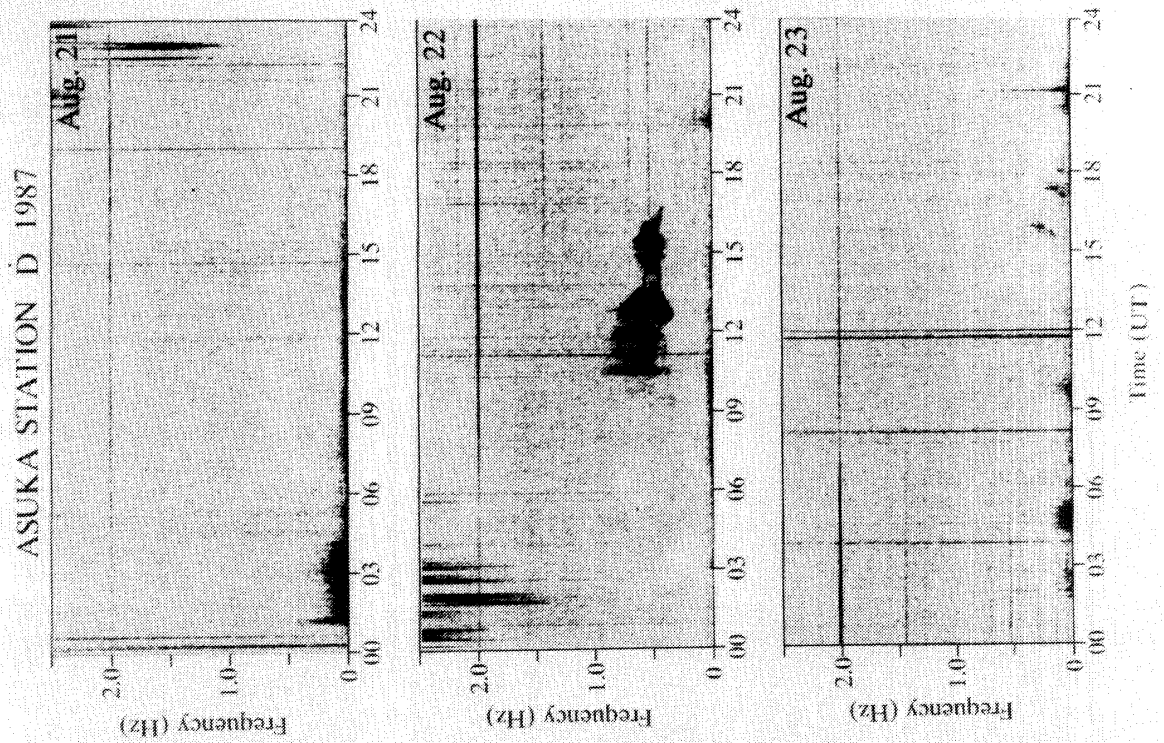
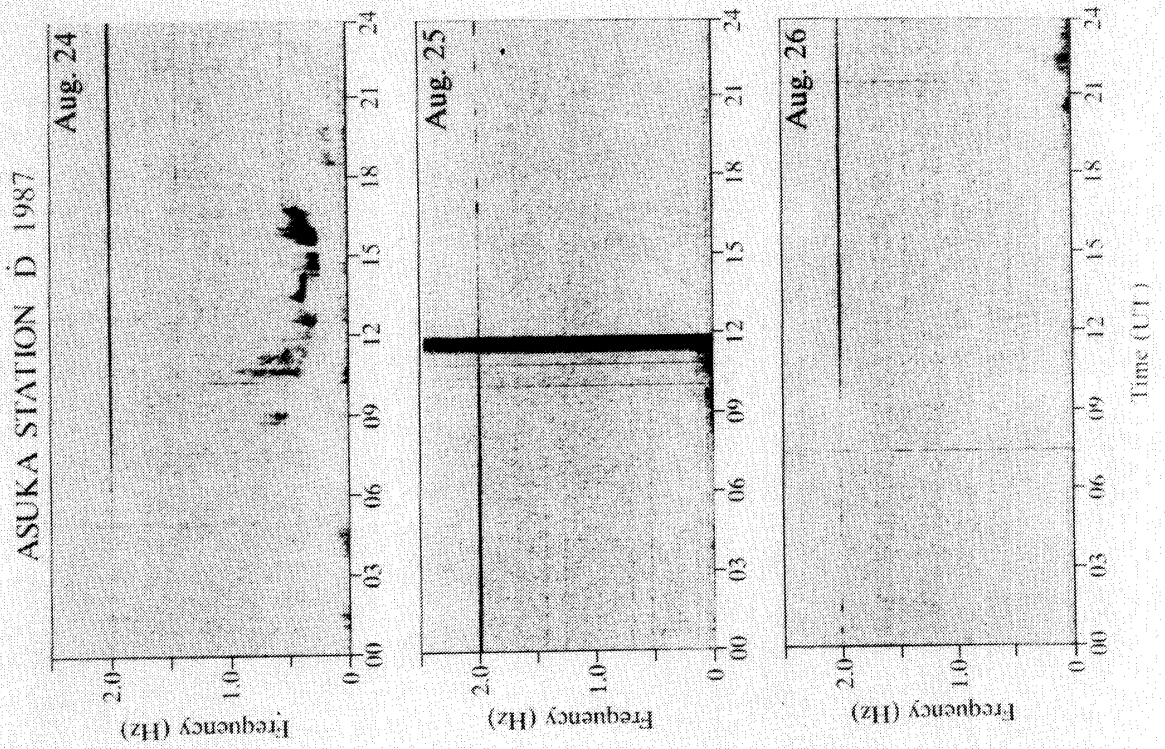


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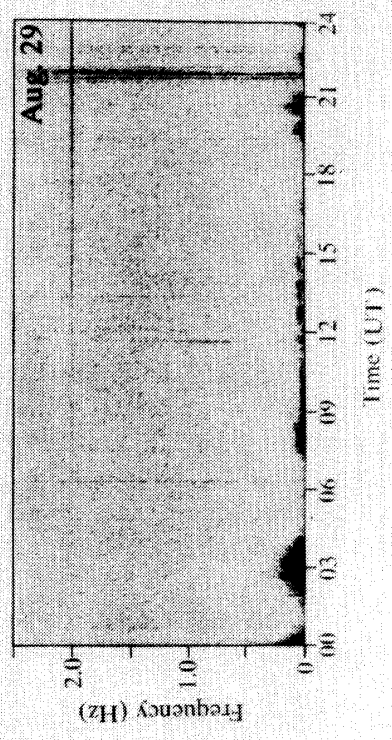
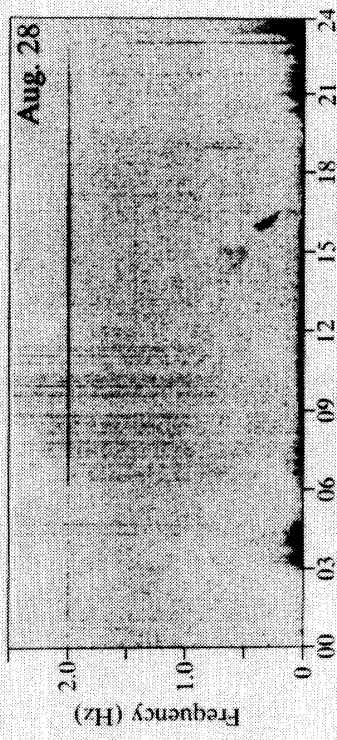
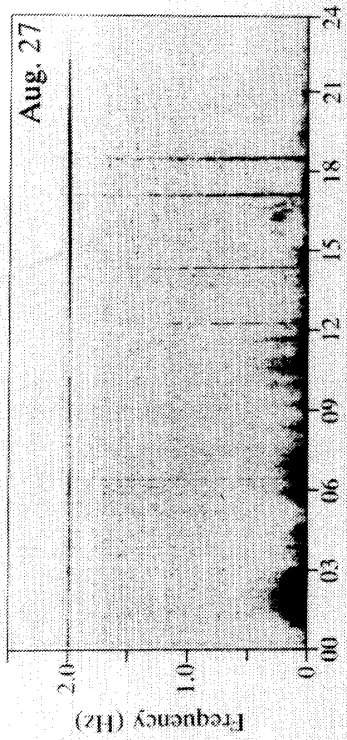


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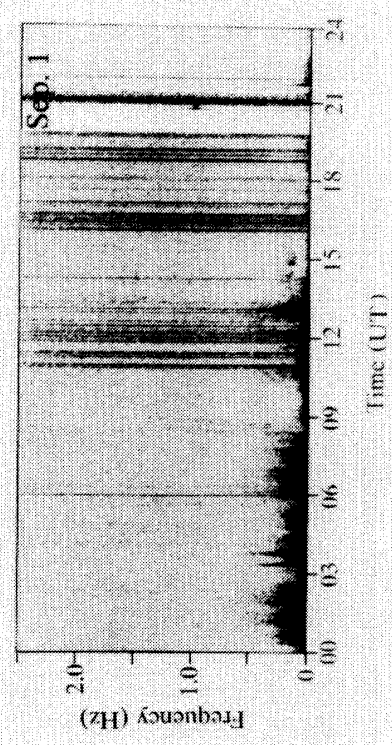
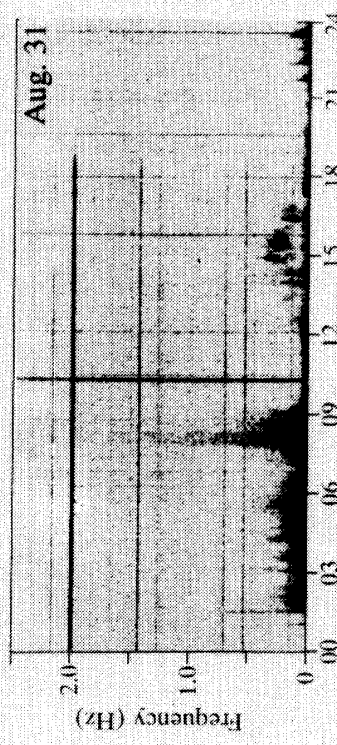
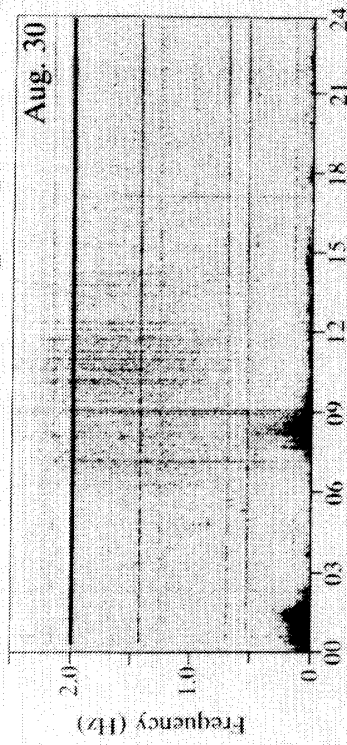




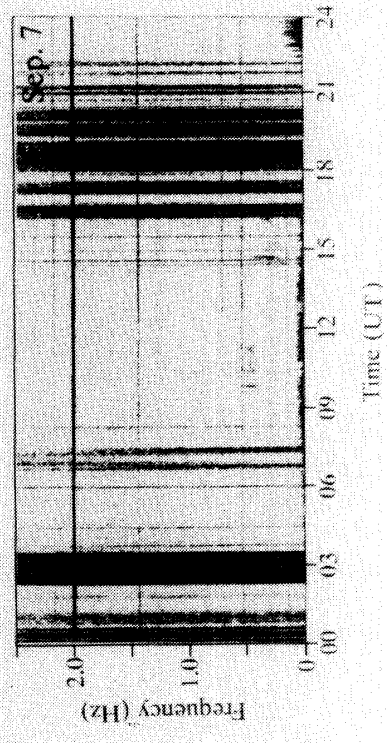
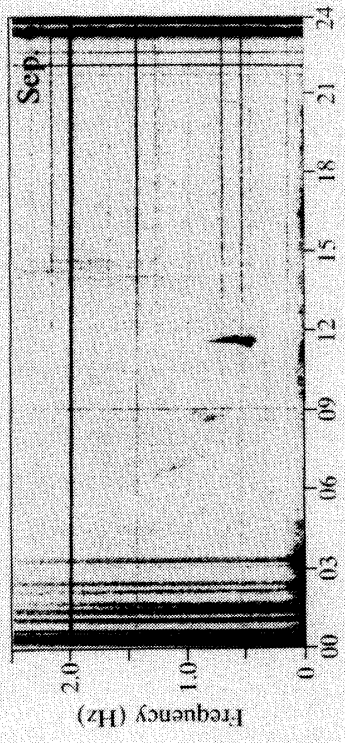
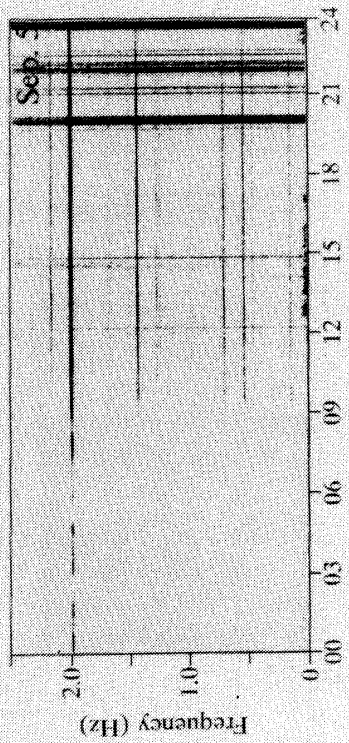
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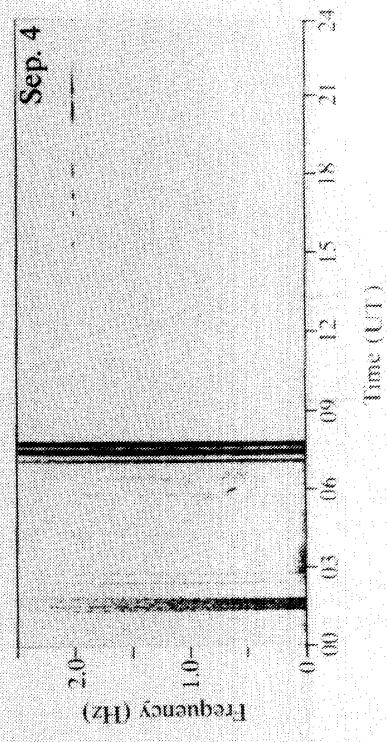
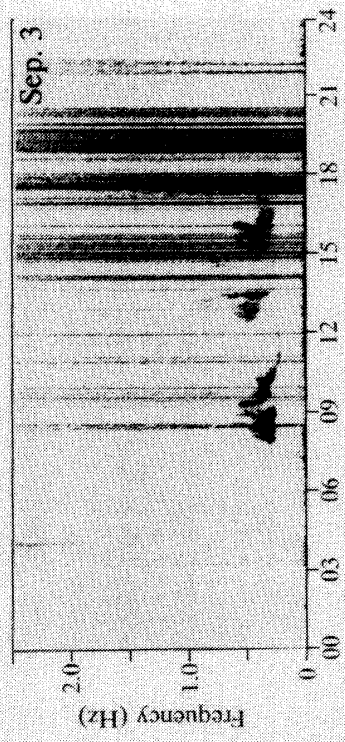
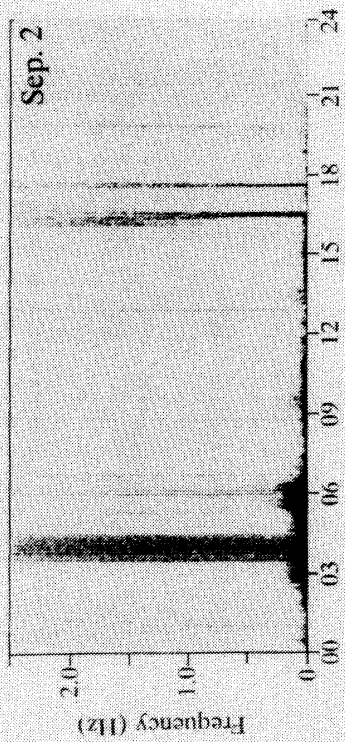
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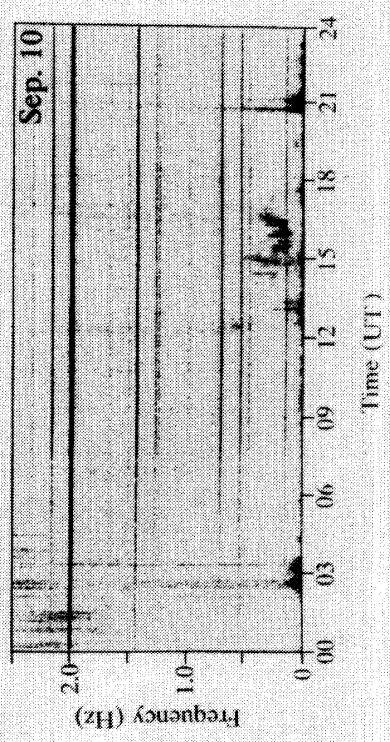
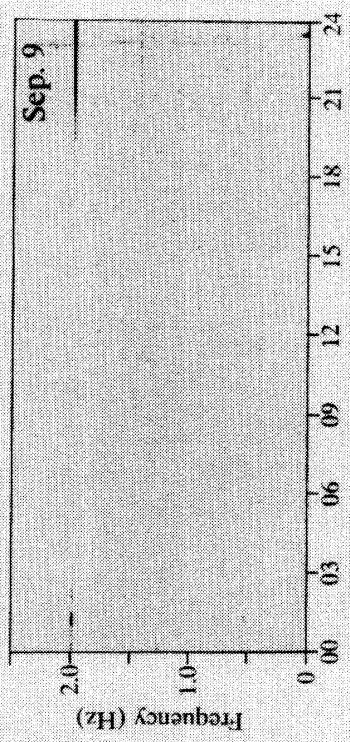
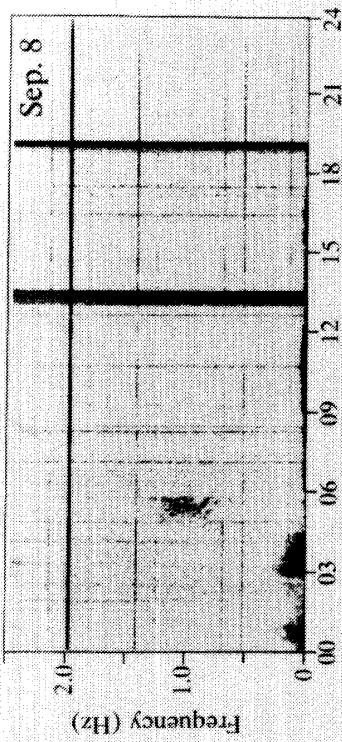
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