

UPPER ATMOSPHERE PHYSICS DATA,  
SYOWA AND ASUKA STATIONS, 1990

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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 1990. 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 (0-15 kHz) signal of ELF-VLF emissions
- 3) Ionosphere : Cosmic noise absorption at 30 MHz
- 4) Aurora : All sky camera  
Panchromatic auroral images recorded on B/W films  
: Scanning photometer  
Meridian scanning record at three wavelengths  
427.8 nm (N<sub>2</sub><sup>+</sup> 1NG), 630.0 nm (OI) and 486.1 nm (H $\beta$ )

- : Fixed directional photometer
  - Auroral intensity of 427.8 nm ( $N_2^+$  1NG) in three directions
  - 30° poleward, zenith and 30° equatorward
- : Multi-channel photometer
  - Photometer for multi-wavelengths directed to the magnetic zenith
  - Observation items and wavelengths ;
  - $N_2$  1P : 670.5 nm, 646.9 nm,  $N_2^+$  1NG : 427.8 nm
  - OI : 630.0 nm, 557.7 nm, 844.6 nm
- : All sky TV
  - Panchromatic TV images of aurora
- : Monochromatic CCD TV
  - Monochromatic TV observations of aurora
- : Fabry-Perot Doppler Imaging System
  - Thermospheric temperature and wind vector measurement

The following are observation items for Asuka Station:

- 1) Geomagnetism: H-, D-, and Z-components of magnetic variations
  - : H-, D-, and Z-components of magnetic pulsations
- 2) Ionosphere : Cosmic noise absorption at 30 MHz
  - : Differential doppler measurement of NNSS telemetry signals
- 3) Aurora : All sky camera
  - : Fixed directional photometer for 427.8 nm ( $N_2^+$  1NG)

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 in the period of January 1-December 31, 1990 for Syowa Station and Asuka Station are given in Appendix 1.

All sky camera film data, 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 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 real-time 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; Miyaoka *et al.*, 1990; Sato *et al.*, 1991 ; Kadokura *et al.*, 1992), and this report forms the 10th volume of this series.

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

The electric power of the remote station has been supplied by a solar 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 remote station. During the months of polar night, the rechargeable batteries with the capacity of 200 Ah were charged up once a month by a 16 kVA diesel-engine dynamo.

At Syowa Station, the sensors of fluxgate and proton magnetometers were set up about 150 m apart from the data processing building. All the auroral photometric observation instruments 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, a computer system and two sets of the TEAC DR-200 digital data logger system since January 1987. An 8 mm video tape recorder is used for the wide-band recording of VLF emissions. One volume of the tape can record the data for 24 hours.

All the data were recorded referring the universal time supplied from a precise timing system. This system consisted of NNSS satellite timing receiver, a quartz frequency standard with a stability of  $2 \times 10^{-11}$ /day, and a time code generator. The time code generator supplies modulated IRIG-A, -B and slow code for analog data recorders and 36-bit BCD code for digital recording system. The absolute accuracy of this system is about 1 ms.

## 2.2. Asuka Station

A block diagram of the upper atmosphere physics monitoring system is shown in Fig. 2. Sensors of an induction and a fluxgate magnetometers, and 30 MHz riometer were fixed under snow at the locations approximately 150 m southeast of the observation building. A fixed direction photometer was placed on the roof of the observation building. An all sky camera was installed inside the 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.

Observation signals from the induction, the fluxgate magnetometers and the riometer 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. Data from photometer was recorded by using another digital data logger system, and chart recorders. The time code generator (ECHO AQ-9000) which was automatically corrected within  $\pm 10$  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 ranges of H-component was changed on February 8, 1990 to avoid a saturation due to a big storm. The full scale ranges were +1250 -3750 nT for H- component and  $\pm 2500$  nT for D- and Z-components, 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 recorded in digital form with sampling rate of 1 Hz. The H-component of the magnetometer was also recorded by chart recorder and a long-term analog data recorder, R-950L.

Continuous computer plots of magnetogram in the period of January 1 to December 31, 1990 are given in Appendix 1. In these plots, positive signs of the H-, D-, and Z-components indicate northward, westward and downward, 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.

###### (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 $\phi$ , 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 recorded by a long-term analog data recorder R-950L, a chart recorder and digital data recorder. The sampling frequency of the digital data was 1 Hz for each component.

###### (4) Base line of the magnetic field and K-index

The ordinary magnetogram was available also on chart papers with a recording speed of 5 cm/h. The sensitivities of the H-, D-, and Z-components on the chart papers are 118 nT/cm, 100 nT/cm, and 111 nT/cm, respectively. According to the maximum deviations of the H- and D-component from these 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 1 and 2 give the baseline values and K-indices at Syowa Station in 1990. 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/m<sup>2</sup> Hz were detected by this system. These data were recorded with a sampling rate of 1 Hz. The wide-band ELF-VLF signals up to 15 kHz were recorded on 8 mm video tape recorders.

### 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 s, respectively. The riometer was also installed at the remote station.

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 for Ionosphere  
Communications Research Laboratory  
Ministry of Posts and Telecommunications  
2-1, Nukui-Kitamachi 4-chome, Koganei-shi, Tokyo 184, Japan.

#### 3.1.4. Aurora

##### (1) All sky camera

Black and white all sky aurora images were observed by using a 35 mm cine-pulse camera with a fish-eye lens of f/1.4 and an exposure time of 7 s. The observations were carried out during clear nights in 1990, as given in Table 3. Inquiries or requests for the all sky data copies should be addressed to World Data Center C2 for Aurora of NIPR.

##### (2) Meridian scanning photometer

The auroral emission at the wavelengths of 427.8 nm ( $N_2^+$  1NG), 630.0 nm (OI) and 486.1 nm ( $H\beta$ ) were observed by a meridian scanning photometer installed in 1987. The interference filter for  $H\beta$  was tilted with 1 s period measuring a doppler effect of the auroral  $H\beta$  emission. The field of view of the photometer was 3° for 427.8 nm and 630.0 nm, and 5° for  $H\beta$  emissions. The scanning from the poleward horizon to the equatorward horizon required 30 s. The meridian scanning photometer data were recorded with a sampling frequency of 10 or 25 Hz. Observation periods are appeared in Tables 4 and 5 with noted as PHO.

##### (3) Fixed directional photometer

A three-direction photometer detected 427.8 nm emission at three zenith angles (zenith, 30° poleward and 30° equatorward). The field of view was 5°. The measurable auroral intensity was within the range from 7 R to 28 kR. Observation periods are appeared in Tables 4 and 5 with noted as PHO.

##### (4) Multi-channel photometer

A multi-channel photometer directed the magnetic zenith of Syowa was installed in 1990. The photometer has a narrow field of view ( $1^\circ$ ) with a high sampling rate (10 or 25 Hz). A detailed description of the multi-channel photometer has been made by Ono *et al.* (1992). Observation periods are appeared in Tables 4 and 5 with noted as PHO.

#### (5) All sky TV

Panchromatic TV imaging of aurora by using a fish-eye lens with a field of view of  $180^\circ$ . Observed images were recorded by using VTR in NTSC format and selected images every 10 s were recorded in Optical Video Disk (OVD) system which can store 108000 pictures in one disk. Observation periods are appeared in Tables 4 and 5 with noted as SIT.

#### (6) Monochromatic CCD TV

Monochromatic imaging of aurora by using intensified CCD imageries. Observation wavelengths were selected from 630.0 nm (OI), 557.7 nm (OI), 427.8 nm ( $N_2^+ 1NG$ ) and 486.1 nm (H $\beta$ ). Observed data were recorded in PCM format and also recorded in VTR and OVD. Observation periods are appeared in Tables 4 and 5 with noted as CCD.

#### (7) Fabry-Perot Doppler Imaging System

Temperature and wind vector measurement by using the Fabry-Perot Interferometer for auroral emissions. Observation wavelengths were selected from 630.0 nm (OI) and 557.7 nm (OI). Observation periods are appeared in Tables 4 and 5 with noted as FPDIS.

### 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 ranges were +1250 -3750 nT for H-component and  $\pm 2500$  nT for D- and Z- components, and the frequency response was DC-2 Hz. The noise level was less than 0.5 nT. The fluxgate magnetometer was set in the sensor area about 150 m southeast of the observation building. 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 1 Hz.

Continuous computer plots of magnetogram in the period of January 1 to December 31, 1990 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, westward and downward, 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 also 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 sampling frequency of the digital data was 1 Hz.

### 3.2.3. Ionosphere

Cosmic noise absorption at 30 MHz was measured with a riometer made by La Jolla Science, the same type as used at Syowa Station. The bandwidth and time constant of the receiver were 150 kHz and 0.25 s, respectively. The riometer was also set in the sensor area about 150 m southeast of the observation building in December 1988. The riometer data were also supplied to the R-950L data logger. The sampling frequency of the digital data was 1 Hz.

A differential doppler frequency measurement for the NNSS telemetry signals (150 and 400 MHz) was made by using a NNSS receiver during 1990. The differential doppler frequency gives variation of the total content of electrons varying along the satellite path. The measured frequency was recorded by using a personal computer on a floppy disks every 1 s.

### 3.2.4. Aurora

#### (1) Fixed directional photometer

A photometer installed in December 1988 detecting 427.8 nm ( $N_2^+$  1NG) emission at zenith direction. The data was recorded by the 8-channel chart recorder and the DR-200 digital data logger with the sampling frequency of 1 Hz.

#### (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/2.8. A picture was taken every 30 s with an exposure time of 20 s using KODAK 4-X (ISO 400) high-sensitive film. The observations were carried out during clear nights in 1990, as given in Table 6. Inquiries or requests for the all sky data copies should be addressed to World Data Center C2 for Aurora of NIPR.

## 4. Compiled Digital Tape Format

### 4.1. Syowa Station

Digital recordings had been continued with almost the same system as those used in Iceland for the geomagnetic conjugate observations since 1984. The compile 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	: 28848 bytes
Logical record length	: 48 bytes
Label	: Non-label
Filing	: Multi-file (1 file/day)

In these tapes, 24 kinds of upper atmospheric data are recorded every 1 s in the following sequence.

Word No.	Observation item	Word No.	Observation item
1	H-component of magn. field	13	VLF 8 kHz
2	D-component of magn. field	14	VLF 30 kHz
3	Z-component of magn. field	15	VLF 60 kHz
4	H-component of ULF waves	16	VLF 95 kHz
5	D-component of ULF waves	17	Total magn. force
6	Z-component 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	MBR E30°
10	VLF 1.2 kHz	22	MBR S30°
11	VLF 2 kHz	23	MBR Zenith
12	VLF 4 kHz	24	MBR N30°

Each datum 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 min 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:

$$\text{H, D, Z-component of the geomagn. field (nT)} = \text{DATA} * 2500 / 2048$$

$$\text{H-component of ULF waves (nT/s)} = \text{DATA} / 141$$

$$\text{D-component of ULF waves (nT/s)} = \text{DATA} / 158$$

$$\text{Z-component of ULF waves (nT/s)} = \text{DATA} / 316$$

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. Figure 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 TEAC DR-200 MT data were reported by Uchida *et al.* (1988).

#### 4.2. Asuka Station

The digital data recording with a TEAC DR-200/MT-800GP system started since 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 specification of the compiled digital tapes are as follows:

Track	: 9
Record density	: 6250 BPI
Record format	: FB
Block length	: 9616 bytes

Logical record length : 16 bytes  
Label : Non-label  
Filing : Multi-file (1 file/day)

In these tapes, 8 kinds of upper atmospheric data are recorded every 2 s in the following sequence.

Word No.	Observation item
1	H-component of magnetic field
2	D-component of magnetic field
3	Z-component of magnetic field
4	H-component of ULF waves
5	D-component of ULF waves
6	Z-component of ULF waves
7	CNA (30 MHz)
8	Auroral photo emission at zenith direction (427.8 nm)

H, D, Z-components of the geomagnetic field (nT) are obtained by DATA\*2500/2048. Figure 4 illustrates the structure of the compiled digital tape for Asuka Station. The sampling frequency of the digital data was 1 Hz. Its block length is 9616 bytes because 1 block (10 min data) contains 601 logical records (1 s data and a time header, 16 bytes). 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-680D computer system of the Information Science Center. The center has various kinds of software such as tape-to-tape copy, displays and spectrum analysis program.

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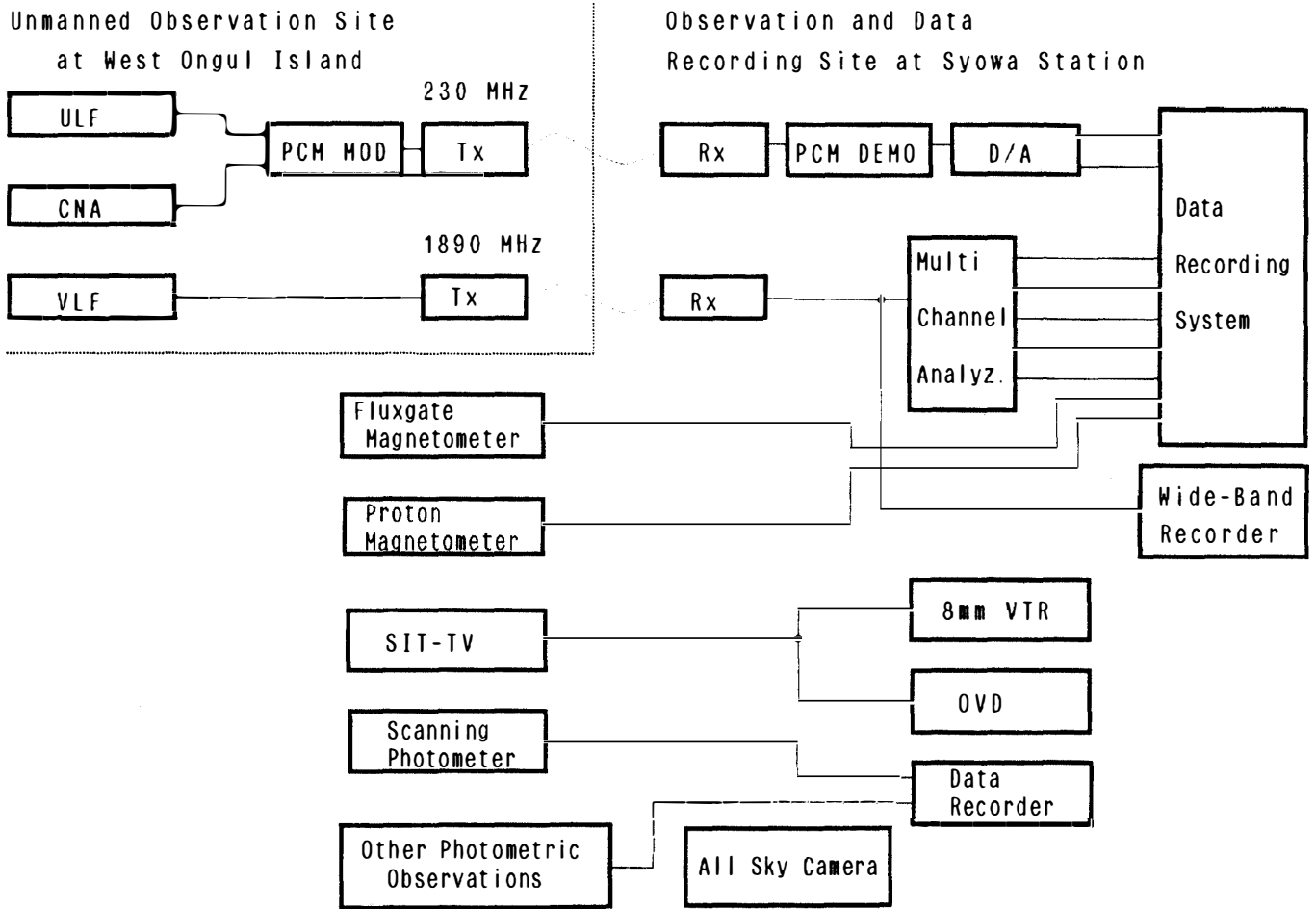


Fig. 1. Block diagram of the "Upper Atmosphere Physics" monitoring system at Syowa Station.

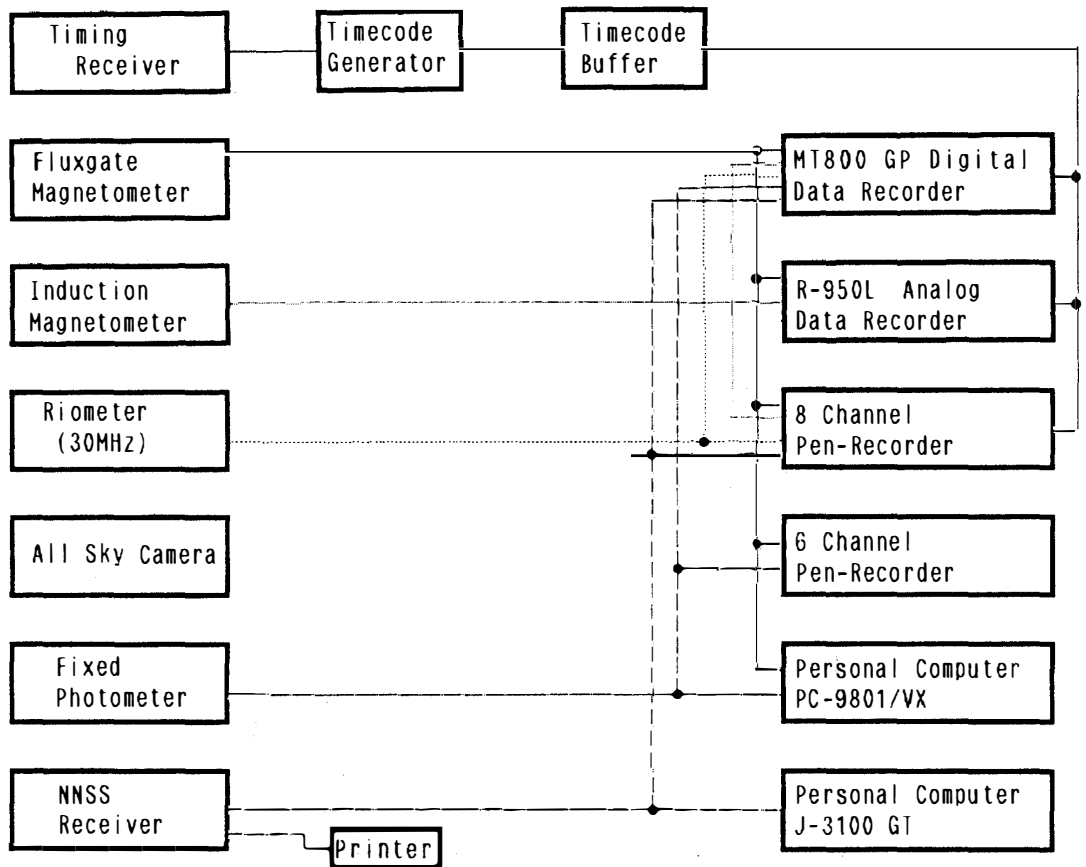


Fig. 2. Block diagram of the "Upper Atmosphere Physics" monitoring system at Asuka Station.

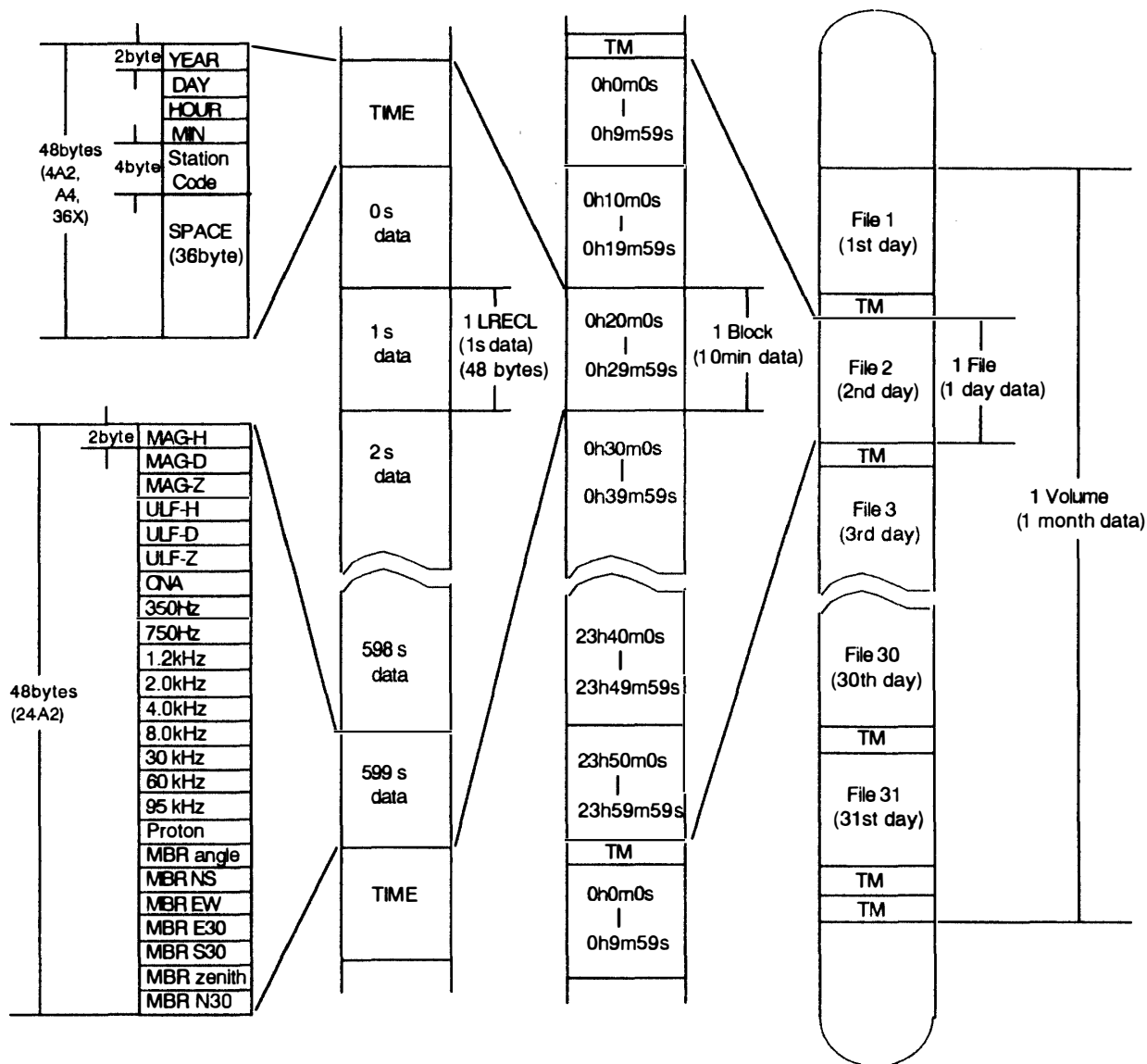


Fig. 3. The structure of the compiled digital tape format for Syowa Station.

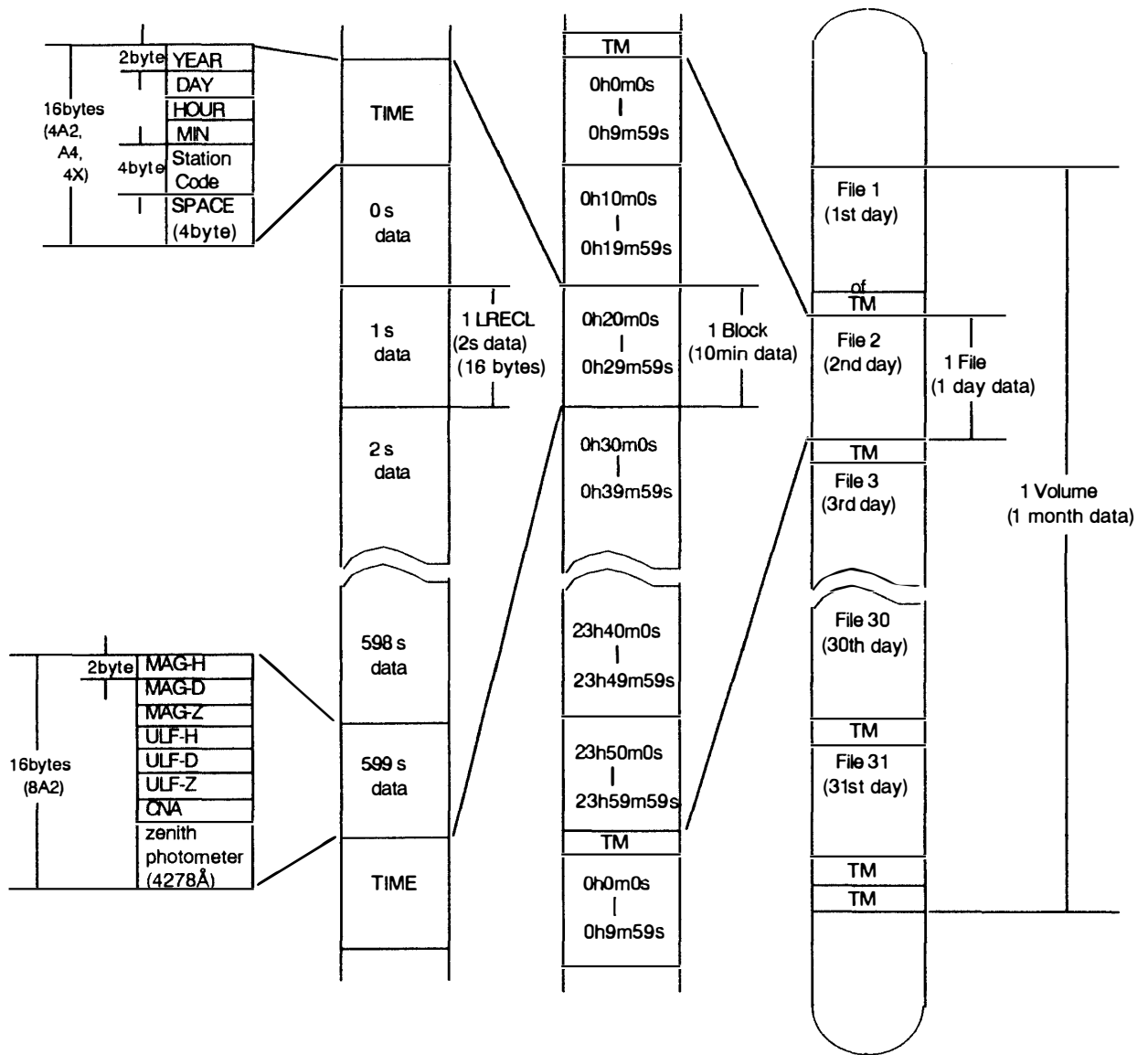


Fig. 4. The structure of the compiled digital tape format for Asuka Station.



Table 1. Baselines of the geomagnetic field at Syowa Station in 1990.

Data	Time (UT)	Total int. (nT)	Horizontal int. (nT)	Vertical int. (nT)	Declination	Dip angle
Feb. 8 1990	11h 23m	44007	19045	39673	-47° 11.4'	-64° 21.4'
	11h 37m	44017	19051	39681	-47° 10.9'	-64° 21.2'
	12h 00m	44020	19049	39685	47° 11.4'	64° 21.5'
	12h 10m	44012	19037	39682	-47° 11.4'	-64° 22.3'
	11h 49m	44014	19046	39680	-47° 11.3'	-64° 21.6'
Apr. 1	13h 50m	44009	19043	39676	-47° 17.7'	-64° 21.7'
	13h 59m	44010	19044	39677	-47° 16.6'	-64° 21.6'
	14h 13m	44005	19041	39672	-47° 17.7'	-64° 21.6'
	14h 21m	44005	19037	39674	-47° 17.9'	-64° 22.0'
	14h 06m	44007	19041	39675	47° 17.5'	64° 21.7'
May 7	12h 16m	44001	19056	39661	-47° 19.3'	64° 20.2'
	12h 25m	44004	19057	39664	-47° 17.1'	64° 20.3'
	12h 41m	43996	19052	39657	-47° 16.4'	-64° 20.4'
	12h 51m	43996	19050	39658	47° 16.9'	-64° 20.6'
	12h 33m	43999	19054	39660	-47° 17.4'	-64° 20.4'
June 30	11h 28m	43978	19062	39632	-47° 18.8'	-64° 18.8'
	11h 39m	43977	19059	39632	-47° 19.0'	-64° 19.0'
	11h 50m	43974	19058	39630	47° 18.6'	-64° 19.0'
	11h 59m	43974	19057	39630	-47° 18.4'	-64° 19.1'
	11h 45m	43976	19059	39631	-47° 18.7'	-64° 19.0'
Aug. 31	14h 01m	43978	19051	39637	-47° 19.5'	64° 19.7'
	14h 11m	43983	19062	39638	-47° 18.5'	-64° 19.0'
	14h 31m	43984	19066	39637	-47° 17.9'	-64° 18.7'
	14h 40m	43980	19062	39634	-47° 19.1'	-64° 18.8'
	14h 21m	43981	19060	39636	-47° 18.7'	-64° 19.1'
Sep. 30	14h 22m	43959	19047	39618	-47° 19.1'	-64° 19.4'
	14h 29m	43960	19050	39618	-47° 18.4'	-64° 19.2'
	14h 44m	43960	19052	39617	47° 18.1'	-64° 19.0'
	14h 52m	43960	19048	39618	-47° 18.6'	64° 19.3'
	14h 37m	43960	19049	39618	-47° 18.5'	64° 19.2'

Data	Time (UT)	Total int. (nT)	Hori-zonal int. (nT)	Vertical int. (nT)	Declination	Dip angle
Nov. 29	18h 10m	43959	19062	39611	-47° 20.8'	-64° 18.1'
	18h 20m	43970	19069	39619	47° 19.8'	-64° 17.9'
	18h 39m	43977	19083	39621	-47° 19.3'	-64° 17.0'
	18h 50m	43967	19072	39616	-47° 19.1'	-64° 17.6'
	18h 30m	43968	19072	39617	-47° 19.8'	-64° 17.6'
Dec. 31	11h 01m	43927	19046	39583	-47° 19.7'	-64° 18.3'
	11h 08m	43929	19041	39588	49° 16.7'	-64° 18.8'
	11h 25m	43939	19041	39599	-47° 14.6'	-64° 19.2'
	11h 32m	43946	19044	39606	47° 13.7'	-64° 19.2'
	11h 17m	43935	19043	39594	-47° 16.2'	-64° 18.9'
Jan. 30	11h 02m	43892	19031	39552	47° 21.3'	-64° 18.3'
	11h 20m	43898	19031	39558	-47° 20.6'	-64° 18.5'
	11h 45m	43905	19030	39566	-47° 20.6'	-64° 18.8'
	12h 04m	43904	19028	39567	-47° 21.1'	-64° 19.0'
	11h 32m	43900	19030	39561	-47° 20.9'	-64° 18.7'

Table 2. K-indices at Syowa Station in 1990.

	Feb. (1990)		Mar.		Apr.		May		June		July		Aug.		Sep.		Oct.		Nov.		Dec.		Jan. (1991)	
1	2442	3454	6533	3445	5210	0031	3312	1011	4421	2232	1111	0024	1132	4365	4422	6431	2311	0101	3221	1134	3320	2222		
2	5533	3555	5543	2344	2122	1211	2232	2312	2221	1121	5522	0000	5531	0114	0111	1000	1111	1122	4531	1133	2222	2333	4522	3433
3	5222	2333	3332	2333	2322	3243	3533	2224	1110	1111	1531	0001	4213	2135	0011	0010	2322	1034	3322	2223	2220	2333	4433	2213
4	5452	2466	1222	1134	4332	2230	4232	2334	1221	0002	3011	0124	4321	1012	1111	0235	3332	2354	2221	1111	4533	3435	3432	1333
5	5554	3333	4522	-124	2122	1122	3133	1132	1100	1112	3311	3333	2000	1115	5532	2122	4522	2125	1211	0012	3233	3443	4222	3133
6	5431	1110	6541	3332	2112	1114	1222	1113	5521	2214	2110	0133	4311	0244	5122	2224	2322	2224	1211	1012	3322	2333	2222	2222
7	2334	4565	3421	2111	3211	1322	2211	-200	4642	2244	2121	1003	4111	0223	5423	2324	3321	2134	2222	2224	4322	2212	2221	1122
8	4421	1100	2312	2112	3211	0013	3421	1014	5533	1234	1432	2225	4410	0003	4312	1235	3221	2121	2221	2444	1322	3333	4432	2333
9	1222	2212	3212	2212	2244	2233	4342	3345	5564	3221	4300	0111	4311	0121	4322	2134	2211	2345	5431	2432	3222	3322	2332	3124
10	3122	2222	2221	1132	5665	5556	4564	2353	6522	2226	1431	2111	0111	0013	6341	0126	6665	3332	5432	3344	2221	0222	3231	3324
11	3222	2334	5422	2132	6643	3463	6652	3345	4632	2224	1121	1153	5323	0113	3333	2336	6553	2465	3532	3222	2220	1212	2322	2343
12	5431	1000	4422	1455	5764	4475	6431	1001	5455	5667	3442	2103	5621	1114	5552	2343	4563	2355	2221	1123	2221	2334	5343	2443
13	1212	1325	4322	2356	5543	3365	1111	1244	8655	6453	5633	0234	3543	2333	5522	2335	5532	2235	3221	1112	5533	2223	3551	1342
14	4654	2211	5433	4333	6555	3465	2111	1002	6634	4534	4011	3255	4543	2224	5542	2343	5442	2346	3211	1012	4431	2321	1221	1221
15	2333	3466	5421	1135	6642	3234	2111	1000	3421	0124	5531	1132	4433	4445	5542	3243	5432	3444	2221	1223	3222	1333	5532	3143
16	5553	4355	4331	1125	5532	1135	0111	0000	4210	0011	5210	0121	4454	4436	5543	3224	3332	2234	3454	5443	4323	3322	3232	2224
17	6543	3246	3111	1001	6446	4346	0110	0112	0000	0001	1220	1114	6641	1333	4331	1235	3321	0012	2333	4445	3322	1332	4312	4434
18	5553	2356	1222	3365	6541	1135	4033	3445	0022	2334	4311	0111	4333	1223	1333	3333	1121	2334	4322	4444	2222	2212	3321	2445
19	5433	4456	6422	1114	4410	0135	5521	1325	5521	1100	2532	4244	6532	2225	6431	1346	5432	2133	3422	1223	2221	1212	2222	2332
20	5463	4465	4533	3457	5342	1374	5522	2363	0001	0101	4443	3244	4652	2333	6211	1356	2433	3455	3322	2222	2322	3442	2122	2331
21	4432	3333	7655	3454	6532	1001	5412	3345	0010	1033	3212	1234	4243	4556	4332	2335	4442	2113	5641	2233	1331	0222	2521	2022
22	5552	2256	5544	3455	2421	2226	4555	3345	4420	0003	4311	1112	5754	3456	5552	2344	4432	2212	2221	1121	3221	1012	3321	1122
23	5444	4455	5654	3455	5653	2435	5332	1213	3112	2212	2311	0122	6765	4576	5632	2222	1222	1125	2121	2323	2232	1214	2223	2223
24	5554	4465	5533	2256	3365	4335	1211	0024	0111	1123	1321	0011	5653	3221	3442	2433	5553	3333	3321	1012	2432	4565	4544	3542
25	5544	4365	6534	3455	4532	2226	5533	3344	3232	1122	1111	0000	3111	1233	6521	0154	5521	2224	2222	2233	3442	2433	2222	2453
26	5433	3154	6562	3455	6742	1103	4532	3255	3222	1124	0110	0135	3376	5444	3412	1142	3122	2333	4422	3313	3321	2112	3432	2224
27	4663	3234	5643	3566	3633	3335	4664	2324	3012	3223	3222	1123	5332	2111	4421	1123	3432	2324	5443	4654	3522	2212	2222	2234
28	6763	3354	5543	3365	4543	3354	3212	1112	4332	1101	4364	4577	2211	0000	5411	1124	3222	1101	4542	2353	3221	1122	3222	2222
29			4522	3556	5664	2345	4222	1226	1431	1122	6666	5436	0222	1144	5212	0024	0112	1243	3321	1222	3221	1332	2221	1112
30			5676	3332	6552	2135	4544	3245	3200	0102	1243	2325	4544	3334	4111	0023	6532	2234	4322	3434	4332	2232	2221	2331
31			2222	1114			5422	2234			4232	1001	5442	2213			3543	3374			2222	4543	4443	2334

Table 3. Observation periods of a 35 mm all sky camera at Syowa Station in 1990.

Date		Hours (Universal time)									K-Index	
		h	m	s	h	m	s	h	m	s		
Mar.	8				19	01	00	-22	00	07	2312	2112
	10							18	31	00	2221	1132
	11	-01	00	07				17	40	00	5422	2132
	12	-01	29	07				21	23	00	4422	1455
	13	-00	59	07	21	24	00	-23	43	07	4322	2356
	19				18	00	00	-20	59	07	6422	1114
	25	01	20	00	-02	29	07	20	05	00	6534	3455
	26	-02	30	07							6562	3455
	28				17	45	00	-21	49	37	5543	3365
	29				17	20	00	-23	35	07	4522	3556
	30							17	00	00	5676	3332
31	-02	00	07							2222	1114	
Apr.	1							17	55	00	5210	0031
	2	-01	59	37				17	00	00	2122	1211
	3	-01	58	07							2322	3243
	4							17	10	00	4332	2230
	5	-02	00	07				17	00	00	2122	1122
	6	-02	00	07							2112	1114
	11							16	30	00	6643	3463
	12	-00	24	37				17	00	00	5764	4475
	13	-03	00	07							5543	3365
	17							21	00	00	6446	4346
	18	-02	59	37							6541	1135
	19							16	00	00	4410	0135
	20	-03	00	07				16	01	00	5342	1374
	21	-00	14	07				16	02	00	6532	1001
	22	-02	59	37				16	10	00	2421	2226
	23	-02	59	37							5653	2435
	24							22	11	00	3365	4335
25	-02	59	37				15	30	00	4532	2226	
26	-03	00	07	15	31	00	-16	37	37	6742	1103	
27	00	28	00	-02	00	07	15	00	00	3633	3335	
28	-03	29	37	15	00	01	-20	01	07	4543	3354	
							21	14	00	4543	3354	

Date	Hours (Universal time)									K-Index	
	h	m	s	h	m	s	h	m	s		
Apr. 29	-00	22	57	00	32	00	-03	03	07	5664	2345
							22	30	00	5664	2345
30	-03	30	07				16	57	00	6552	2135
May 1	-03	29	37				16	00	00	3312	1011
	-03	30	07							2232	2312
5	16	30	00	-18	07	37	22	35	00	3133	1132
6	-03	30	07							1222	1113
9							19	05	00	4342	3345
10	-02	52	07				14	33	00	4564	2353
11	-03	30	07				14	30	00	6652	3345
12	-03	30	07				14	30	00	6431	1001
13	-04	30	07				14	30	00	1111	1244
14	-03	42	37							2111	1002
15							17	23	00	2111	1000
16	-04	30	07				14	30	00	0111	0000
17	-04	29	37				14	45	00	0110	0112
18	-04	29	37	14	00	00	-20	57	37	4033	3445
							21	11	00	4033	3445
19	-04	29	37	15	00	00	-19	00	07	5521	1325
20							14	25	00	5522	2363
21	-04	30	07	14	00	00	-23	26	27	5412	3345
26							19	43	00	4532	3255
27	-04	59	37				20	40	00	4064	2324
28	-04	59	37				17	20	00	3212	1112
29	-04	59	37							4222	1226
30	00	00	00	-03	39	37				4544	3245
June 3							14	30	00	1110	1111
	-04	50	07				14	45	00	1221	0002
5	-04	59	37				14	46	00	1100	1112
6	-02	42	07							5521	2214
7	00	30	00	-04	59	37				4642	2244
9							17	00	00	5564	3221
10	-00	29	37				17	01	00	6522	2226
11	-00	29	37	14	45	00	-22	19	37	4632	2224
12							14	34	00	5455	5667
13	-05	59	37				14	31	00	8655	6453

Date	Hours (Universal time)									K-Index	
	h	m	s	h	m	s	h	m	s		
June 14	-00	36	37	14	30	00	-21	19	37	6634	4534
15							14	30	00	3421	0124
16	-05	59	37	14	31	00	20	05	07	4210	0011
20							22	38	00	0001	0101
21	-05	59	37				13	50	00	0010	1033
22	-05	59	37				13	51	00	4420	0003
23	-06	00	07				15	00	00	3112	2212
24	-01	44	37	14	30	00	17	25	37	0111	1123
July 12							20	33	00	3442	2103
13	-04	29	37	14	00	00	-20	59	37	5633	0234
14				14	01	00	20	59	37	4011	3255
15				15	00	00	-20	00	07	5531	1132
23				14	03	00	-23	10	07	2311	0122
24							15	05	00	1321	0011
25	-04	19	37				14	00	00	1111	0000
26	-04	20	07				14	00	00	0110	0135
27	-04	16	37				14	02	00	3222	1123
28	-04	20	07				14	00	00	4364	4577
29	-04	00	07							6666	5436
Aug. 3							14	00	00	4213	2135
4	-04	00	07				14	01	00	4321	1012
5	-20	07	07							2000	1115
6				14	40	00	19	28	07	4311	0244
7							15	24	00	4111	0223
8	-04	00	07							4410	0003
9	01	15	00	-03	59	37				4311	0121
10							18	20	00	0111	0013
11	-00	00	07							5323	0113
12							15	00	00	5621	1114
13	-02	59	37				14	30	00	3543	2333
14	-03	29	37	14	30	00	-21	30	37	4543	2224
							22	02	00	4543	2224
15	-03	59	37				14	31	00	4433	4445
16	-03	29	07							4454	4436
17	00	01	00	-03	30	07	17	00	00	6641	1333
18	-03	29	37	17	01	00	-23	59	37	4333	1223

Date		Hours (Universal time)									K-Index	
		h	m	s	h	m	s	h	m	s		
Aug.	19							17	01	00	6532	2225
	20	-03	29	37				15	04	00	4652	2333
	21	-03	29	37				15	00	00	4243	4556
	22	-03	30	07				15	00	00	5754	3456
	23	-01	36	57				15	03	00	6765	4576
	24	-03	20	07				15	01	00	5653	3221
	25	-02	59	37				15	01	00	3111	1233
	26	-02	59	37	15	01	00	-18	46	07	3376	5444
	30							19	10	00	4544	3334
	31	-02	59	37				15	30	00	5442	2213
Sep.	1	-02	59	37				15	30	00	4422	6431
	2	02	59	37				15	30	00	0111	1000
	3	-02	59	37				15	30	00	0011	0010
	4	-02	29	37				15	30	00	1111	0235
	5	-02	29	37				19	00	00	5532	2122
	6	-02	29	37							5122	2224
	10				16	50	00	-20	59	37	6341	0126
	11							16	41	00	3333	2336
	12	-01	59	37				16	40	00	5552	2343
	13	-01	47	07				16	40	00	5522	2335
	14	-01	59	37				16	40	00	5542	2343
	15	-01	59	37				16	40	00	5542	3243
	16	-01	59	37							5543	3224
	17							16	40	00	4331	1235
	18	-01	59	37				16	50	00	1333	3333
	19	-01	36	07				17	31	00	6431	1346
	20	-01	29	57				17	30	00	6211	1356
	21	-01	30	07	17	31	00	-19	11	27	4332	2335
	25							19	57	00	6521	0154
	26	-00	59	37							3412	1142
	27							19	01	00	4421	1123
	28	-01	00	07				19	02	00	5411	1124
	29	-00	59	37				17	31	00	5212	0024
	30	-01	00	07	17	31	00	-21	29	37	4111	0023
Oct.	4				18	00	00	-23	59	07	3332	2354
	10				18	00	00	-23	58	17	6665	3332

Table 4. Observation periods and volume numbers of recording media for auroral photometric observations at Syowa in 1990. It is noted that characters of M and W in the table show conditions of moon and weather. Double circles indicate these conditions are satisfactory.

1990 NO. 1

DATE	M	W	A S C ROL	NO	P H O	CCT	S I T	OVD	8m VTR	C C D	AMT	OVD	VTR1	VTR2	F P D I S	EXOSD Conj.
3/09	●	○	1905-2200	01												09-05
3/10	●	○	1831-0000	01												10-05, 06
3/11	●	○	1740-0130	01												11-05, 06
3/12	●	○	2300-0130	01												
3/13	●	○	2123-2343	01												13-06
3/19	●	⊙	1800-2100	01												19-06
3/25	⊙	○	2005-0230	01	1956-0155	01	2046-0132	01	001-003							25-06
3/29	⊙	×	1720-2335	01	1713-2124	01	1722-1853	01	003							29-06
3/30	⊙	○	1700-0200	01	1711-2136	01	1715-1922	01	004							30-05, 06/31-00
4/01	⊙	⊙	1750-0200	02	1745-0305	01	2320-0143	01	004-005						2357-0147	01-06 /02-00
4/02	⊙	○	1700-0200	02	1732-0135	02	1743-0134	02	005	1820-0117	01				1947-0103	02-06 /03-00
4/04	○	○	1710-0200	02	1637-0150	02	1641-0149	02	006	1944-0146	01				2121-0132	04-06, 07
4/11	●	○	1630-0200	02												11-05, 06/12-00
4/12	●	○	1700-0200	03												12-05, 06/13-00
4/17	●	×	2100-0300	03												
4/19	○	⊙	1600-0300	03	1624-0148	03	1628-0018	03	007-008	1743-2356	02-03			001-003	1929-2034	19-05, 06, 07
4/20	○	⊙	1600-0300	03	1606-0230	03	1625-0026	03	008-009	1640-0227	03-04			004-007	1752-2338	20-05, 06, 07



DATE	M	W	A S C ROLL NO	PHO	CCT	S I T	OVD	8m VTR	C C D	AMT	OVD	VTR1	VTR2	F P D I S	EXOSD Conj.	
4/21	☉	○	1600-0300	04	1605-0238	04	1618-0236	04	010-011	1634-0234	04-05		008-009	1655-0047	21-04.05.06	
4/22	☉	○	1610-0300	04	1606-0008	04	1612-2226	04	011-013	1628-2226	05		003-005	010-011	1712-2143	22-05.06
4/24	☉	○	2211-0300	04	2243-0311	05	2248-0246	05	013							24-06
4/25	☉	☉	1530-0200	04	1500-0207	05	1616-0204	05	014-017	1618-0201	06-08		005-010	012-019	2304-0207	25-04.05.06
4/26	☉	☉	1530-0200	05	1647-0250	06	1651-0249	06	017-019	1730-0247	08-09		010-011	019-022	1740-0117	26-05.06
4/27	☉	☉	1500-0300	05	1617-0310	06	1630-0308	06	019-022	1724-0308	09-10		012-016	023-031	1800-0312	27-05.06
4/28	☉	☉	1500-0330	05	1623-0218	07	1627-0215	07	023-025	1728-0201	10-11		016-018	031-035	1911-0206	28-05.06/29-00
4/29	☉	○	2230-0121	06	2234-0152	07										30-00
4/30	☉	×	1657-0330	06												
5/01	○	×	1600-0330	06												
5/05	●	×	1630-0330	06												
5/09	●	○	1905-0330	06												09-06
5/10	●	☉	1430-0330	07												10-05.06/11-00
5/11	●	☉	1430-0330	07												11-05.06/12-00
5/12	●	☉	1430-0430	07												12-05.06/13-00
5/13	●	○	1430-0430	07												13-06.07
5/15	●	○	1722-0430	08												15-06.07

DATE	M	W	A S C ROLL NO	PHO	CCT	S I T	OVD	8m VTR	C C D	AMT	OVD	VTRI	VTR2	F P D I S	EXOSD Conj.	
5/16	●	◎	1430-0430	08	1456-1957	08	1750-1859	08							16-04.05.06	
5/17	○	◎	1445-0430	08	1505-0240	08	1451-0148	08	026	1448-2032	11	01	019-021	036	1735-2038	17-04.05.06
5/18	○	◎	1400-0430	09	1348-0330	08	1359-2330	08	026-030	1418-2330	11-12	01	021-025	036-043	1606-2244	18-04.05.06
5/19	◎	×	1500-1900	09	1442-1858	09	1445-1857	09							19-04.05	
5/20	◎	◎	1425-0400	09	1414-0352	09	1421-0320	09	030-035	1420-0320	13-15	01	027-032	043-052	1448-0319	20-04.05.06
5/21	◎	◎	1400-0430	09	1404-0247	10	1420-0238	10	035-039	1420-0234	15-16	02	033-037	052-056	1930-0214	21-04.05
5/26	◎	×	1940-0500	10	1915-2019	11	1933-2016	10	040						26-06.07	
5/27	◎	○	2040-0500	10	1756-0440	12	1807-0433	11	040-042	1811-0434	16-17	02	038-041	057-059	27-05.06	
5/28	◎	○	1720-0500	10	1716-0221	12	1731-0213	12	042-044	1737-0213	17-18	03	042-043	059-061	28-05.06	
5/30	◎	◎	0000-0340	10	0003-0242	13	0010-0235	12	044	0012-0235	18	03	043-044	061-062		
6/03	○	◎	1430-1655	10												
6/04	○	◎			0151-0455	13	0156-0452	12								
6/04	●	◎	1445-0500	11											04-05.06	
6/05	●	×	1445-0242	11												
6/06	●	○	-0500	11												
6/09	●	○	-0500	11												
6/10	●	◎	1700-0030	11												

DATE	M	W	A S C ROLL NO	P H O	CCT	S I T	OVD	8m VTR	C C D	AMT	OVD	VTR1	VTR2	F P D I S	EXOSD Conj.
6/11	●	◎	1445-0600	11											11-05.06
6/12	●	◎	1430-0037	12											12-06
6/13	●	×	1430-0600	12											
6/14	○	◎	1430-2120	12	1350-2055	14	1345-2007	12	045-047	1354-2007	18-20	03	044-047	063-065	14-05.06
6/15	○	◎	1430-0600	12	1343-2156	14	1449-2153	13	047-048	1351-2106	20	03	047-049	066-067	15-05.06
6/16	○	◎	1430-0600	12	1337-0005	15	1348-2353	13	048-052	1348-2353	20-21	03	049-053	067-069	16-04.05
6/17	◎	×			1554-0232	15	1558-1636	14							17-04.05.06
6/20	◎	○	2233-0600	13	1740-0452	16	1754-0452	14	052-054	2042-0453	21	04	053-056	070-071	
6/21	◎	◎	1350-0600	13	1323-0503	17	1338-0500	14	055-060	1338-0501	21-23	04	057-064	072-076	
6/22	◎	○	1350-0600	13	1340-2304	17	1343-2228	15	060-063	1342-2228	23	04	064-067	076	
6/23	◎	○	1500-0145	13	1509-0318	18	1523-0052	16	064-066	1524-0053	23-24	05	068-071	076-077	1817-0007 23-05.07
6/24	◎	×	1430-0600	13											
6/25	◎	×			1351-0415	19	1408-1634	17		1409-2214	24	05	072-073		25-04.05
6/27	○	◎	1711-0600	14	1748-0459	20	1759-0445	17	067-072	1800-0442	24-27	05	074-079	077-084	1946-0326 27-05
6/28	○	◎			1852-0227	20	2020-0220	18	072-073	2058-0225	27-28	06	079-080	084-085	2122-0333 28-06
6/29	○	◎			2102-0452	21	2201-0444	18	073-075	2201-0444	28-29	06	081-083	086-087	2320-0356 29-06
7/01	○	◎			0036-0344	21	0042-0258	18	076	0043-0342	29-30	06	084		0150-0312

DATE	M	W	A S C ROLL NO	P H O	CCT	S I T	OVD	8m VTR	C C D	AMT	OVD	VTR1	VTR2	F P D I S	EXOSD Conj.	
7/12	○	×	2030-0430	14	1438-2210	21									12-04.05	
7/13	○	×	1430-2100	14	1338-2133	22	1402-1710	19	1400-1710	30	06	085-086		1642-2042	13-04.05	
7/14	○	×	1430-2100	14												
7/15	◎	×	1500-2000	14	1622-2156	22	1642-1719	19	1642-1719		06	087			15-05	
7/23	◎	×	1400-2310	15	1614-2259	23	1431-2254	19	077	1430-2254	30	06	088-090	1431-1916	23-05	
7/24	○	◎	1505-0420	15	1640-0415	23	1655-0412	19	078-081	1655-0412	30	06	090-094	089-090	1832-0411	24-05 /25-01
7/25	○	◎	1400-0420	15	1654-0334	24	1702-0332	20	081	1702-0332	31	07	094-096	1845-0330	25-05 /26-01	
7/26	○	◎	1400-0420	15	1846-0306	24	1906-0302	21	081-085	1906-0302	31-33	07	097-099	091-096	1950-0301	26-06 /27-01
7/27	○	◎	1400-0420	16	1755-0312	25	2052-0307	21	085-087	2052-0307	33-34	07	099-101	096-098	2118-	27-05.06/28-01
7/28	○	◎			1420-0419	26	2224-0418	22	088-090	2223-0418	34-35	08	102-103	098-102		28-05.06/29-00
8/03	●	○	1400-0400	16											03-05.06	
8/06	●	◎	1440-0400	16											06-04.05/07-00	
8/07	●	○	1520-0400	17											07-04.05/08-00	
8/09	●	○	0115-0400	17											09-01	
8/10	●	×	1820-0000	17												
8/12	◎	◎	1500-0300	17	1707-0306	26	1740-0304	22	090-094	1740-0305	35-36	08	104-107	102-104	2233-0306	12-06 /13-01
8/13	◎	◎	1430-0330	17	1434-0338	27	1532-0331	23	095-100	1512-0331	37-39	08	107-111	105-107	1614-0208	13-05.06/14-00

DATE	M	W	A S C ROLL NO	PHO	CCT	S I T	OVD	8m VTR	C C D	AMT	OVD	VTR1	VTR2	F P D I S	EXOSD Conj.	
8/14	◎	◎	1430-0400	17	1455-0335	28	1709-0334	24	100-104	1709-0334	40-41	08	111-115	108	1808-0332	14-04.05/15-00
8/15	◎	×	1430-0330	18												
8/16	◎	×	0000-0330	18												
8/17	◎	×	1700-0330	18												
8/18	◎	×	1700-0000	18												
8/19	◎	○	1700-0330	18	2055-0323	28	2104-0310	24	104-107	2104-0310	41-43	09	115-117	108-109	2208-0310	19-07 /20-01
8/20	◎	◎	1500-0330	19	1452-0310	29	1603-0304	25	107-111	1603-0304	43-44	09	117-121	109-111	1700-0316	20-5.6, 7/21-00
8/21	◎	◎	1500-0330	19	1455-0320	30	1550-0300	25	112-117	1550--300	45-46	09	121-125	112-116	1642-0304	21-4.5.6/22-00
8/22	◎	◎	1500-0230	19	1614-0303	31	1624-0301	26	117-121	1624-0301	47-48	10	125-128	116-117	1623-0305	22-05.06/23-00
8/23	○	◎	1500-0300	20	1450-0300	32	1709-0259	27	122-126	1709-0259	48-49	10	129-131	117-118	1837-0300	23-05.06/24-00
8/24	○	◎	1500-0300	20	1618-0257	33	2045-0254	27	126-129	2045-0254	50	10	132-134	119	2210-0239	24-05.06
8/25	○	○	1500-0300	20	1823-0032	34	2157-0029	28		2157-0029		11	134-135			25-06.07
9/01	●	◎	1530-0300	21												01-05.06.07
9/02	●	◎	1530-0300	21												02-5.6, 7/03-01
9/03	●	◎	1530-0230	22												03-5.6, 7/04-01
9/04	●	○	1530-0230	22												04-5.6, 7/05-01
9/05	●	○	1900-0230	22												05-05.06/06-00

DATE	M	W	A S C ROLL NO	PHO	CCT	S I T	OVD	8m VTR	C C D	AMT	OVD	VTR1	VTR2	F P D I S	EXOSD Conj.	
9/07	○	×		1659-2052	34	1658-2016	28								07-05	
9/10	◎	○	1640-0200	22	1709-0000	34	1725-1950	28	129-130	1725-1950	50	11	135-136	1820-1854	10-05, 06, 07	
9/11	◎	◎	1640-0200	22	1642-0205	35	1646-0133	28	130-134	1646-0133	50-52	11	136-139	120-121	1725-0115	11-06, 07/12-01
9/12	◎	◎	1640-0200	22	1629-0141	36	1643-0059	29	134-138	1643-0141	52-53	11	139-141	121	1727-0138	12-06, 07/13-00
9/13	◎	◎	1640-0200	23	1623-0121	37	1650-0115	30	138-142	1623-0121	53-55	11	142-145	121-122	1728-0113	13-05, 06/14-00
9/14	◎	◎	1640-0200	23	1617-0136	38	1646-0132	30	142-146	1646-0132	55-56	12	145-148	122	1742-0130	14-05, 06/15-00
9/15	◎	◎	1640-0200	23	1635-0119	39	1701-0114	31	146-150	1701-0114	56-57	12	148-151	122-123	1717-0117	15-05, 06, 07
9/17	◎	○	1640-0200	23	1706-0123	40	1728-0113	31	150-153	1728-0113	57-58	12	151-153	2047-0005	17-06, 07	
9/18	◎	◎	1650-0140	23	1635-0131	41	1719-0120	32	154-157	1719-0120	58-60	12	154-156	123	1800-0122	18-06, 07
9/19	◎	◎	1730-0130	24	1649-0104	42	1705-0102	32	157-161	1705-0102	60-62	13	156-159	124-127	1802-0053	19-06, 07
9/20	◎	◎	1730-0130	24	1646-0108	43	1716-0103	33	161-165	1716-0103	62-64	13	159-162	127-130	1843-0105	20-05, 06/21-00
9/23	●	○		2034-0035	44										23-07	
9/25	●	◎	1750-0100	25	1759-0014	44									25-06, 07	
9/27	●	◎	1901-0100	25	2138-0053	44									27-06 /28-00	
9/28	●	◎	1901-0100	25	1949-0038	45									28-06, 07	
9/29	●	◎	1730-0100	25											29-06, 07	
9/30	●	×	1730-2130	25												

DATE	M	W	A S C ROLL NO	PHO	CCT	S I T	OVD	8m VTR	C C D	AMT	OVD	VTR1	VTR2	F P D I S	EXOSD Conj.
10/4	●	◎	1800-0000	26											04-06
10	◎	◎	1800-0000	26	1821-2246	46	1900-2235	33	166-167	1900-2242	64-65	13	162163	131-132	10-06

Table 5. Monthly summary of photometric observation carried out at Syowa Station in 1990.

Mon.	A S C Film		P H O		M T		S I T - T V		8 m m V T R		C C D - T V		A M T		F P D I S		E X O S - D		
	Days	Roals	Days	Roals	Days	Roals	Days	Roals	Days	Roals	Days	Roals	Days	Roals	Days	Roals	Days	Roals	Conj. Orbs.
3	9	1	3	1	3		4												1 2
4	1 7	5	1 3	6	1 2		2 1	1 0		1 1		1 1		1 1					3 5
5	1 8	4	1 0	6	1 0		1 9	7		7		7		4					3 6
6	1 7	4	1 3	8	1 3		3 1	1 1		1 1		1 1		4					2 1
7	9	2	1 0	5	9		1 5	9		6		6		7					1 8
8	1 9	4	1 0	8	1 0		3 9	1 0		1 5		1 5		9					3 7
9	1 9	5	1 5	1 1	1 1		3 6	1 0		1 4		1 4		1 0					5 5
1 0	2	1	1	1	1		2	1		1		1							2
Sum	110 Days	26 Rol	75 Days	46 Rol	69 Days		167 Rol	58 Days		66 rol		58 Days		66 rol		45 Days			216 Orbs.



Table 6. Observation periods of a 35 mm all sky camera at Asuka Station in 1990.

Date	Hours (Universal Time)								
	h	m	s	h	m	s	h	m	s
Apr. 26	03	33	00	-03	57	04			
27	03	19	30	-03	41	34			
May 10							20	20	30
11	-02	59	34						
18							22	06	30
19	-01	02	38				19	36	00
20	-03	54	08						
29	01	47	00	-02	19	42	22	22	00
30	-06	41	38				20	55	30
31	-05	15	08						
June 7							22	00	00
8	-01	08	08						
10							21	52	00
11	-06	51	34						
12							18	00	00
13	-05	37	34						
14	01	21	00	-02	59	08			
27	00	10	30	-05	34	38			
29	05	03	30	-07	08	08			
30	03	00	00	-05	58	08	23	06	30
July 1	-03	57	38				22	45	30
2	-05	29	08						
4							21	00	00
5	-02	55	08						
13							17	55	00
14	-05	54	38						
19				21	05	00	-23	00	08
22							22	30	00
23	-06	59	38						
26							22	07	30
27	-03	27	38						
28				17	42	30	-23	28	38

Date		Hours (Universal Time)								
		h	m	s	h	m	s	h	m	s
Aug.	3							22	25	00
	4	-05	59	20						
	12							22	08	30
	13	-08	39	16				23	02	00
	14	-04	11	20				21	35	00
	15	-05	49	50	18	32	30	-19	52	24
	17							21	16	30
	18	-03	35	50						
	19				22	27	30	-23	04	20
	20				18	18	00	-20	18	50
	21	00	07	00	-03	06	20	17	00	00
	22	-02	48	20				18	35	00
	23	-00	26	54	18	06	30	-18	45	24
	23	19	39	30	-23	26	24	23	51	30
	24	-04	23	24						
	25	00	57	30	-05	03	24	20	01	00
	26	-02	50	24						
	30	01	21	00	-01	43	54	21	31	00
	31	-03	36	28						
Sep.	1	00	30	00	-03	01	28			
	2				20	00	00	-21	04	54
	4							21	35	00
	5	-01	34	28				20	00	00
	6	-03	38	28				23	15	30
	7	-03	59	54				22	50	00
	8	-03	29	54						
	9							17	00	00
	10	-00	59	54	01	30	00	-03	29	54
	10							18	30	00
	11	-02	59	54	18	51	30	-21	47	54
	11							22	25	00
	12	-03	36	54				18	33	00
	13	-03	29	54						

Date	Hours (Universal Time)								
	h	m	s	h	m	s	h	m	s
Sep. 13							17	38	00
14	-03	48	54				18	10	00
15	-03	08	24	18	00	00	-19	18	54
15							20	15	00
16	-01	19	54						
17							18	27	30
18	-02	57	54				18	05	00
19	-02	59	54				18	39	00
20	-03	24	54				18	08	00
21	-02	29	24				18	45	00
22	-02	40	24						
23	18	32	30	-18	52	24	20	00	30
24	-03	20	24				18	31	00
25	-02	47	24				18	35	00
26	-02	19	24				18	35	00
27	-00	40	24				18	31	00
28	-02	04	24				18	20	00
29	-01	59	54	19	06	30	-22	54	54
29							23	13	00
30	-01	44	54				19	03	00
Oct. 1	-01	29	54				19	00	00
2	-01	29	54				19	00	00
3	-01	32	54				19	31	00
4	-00	59	54						
5							19	43	00
6	-00	56	24				19	30	00
7	-00	35	54	19	30	00	-20	32	24
7							22	09	00
8	-00	49	54				19	38	30
9	-00	29	54				21	00	00
10	-00	26	54						

## **Appendix**

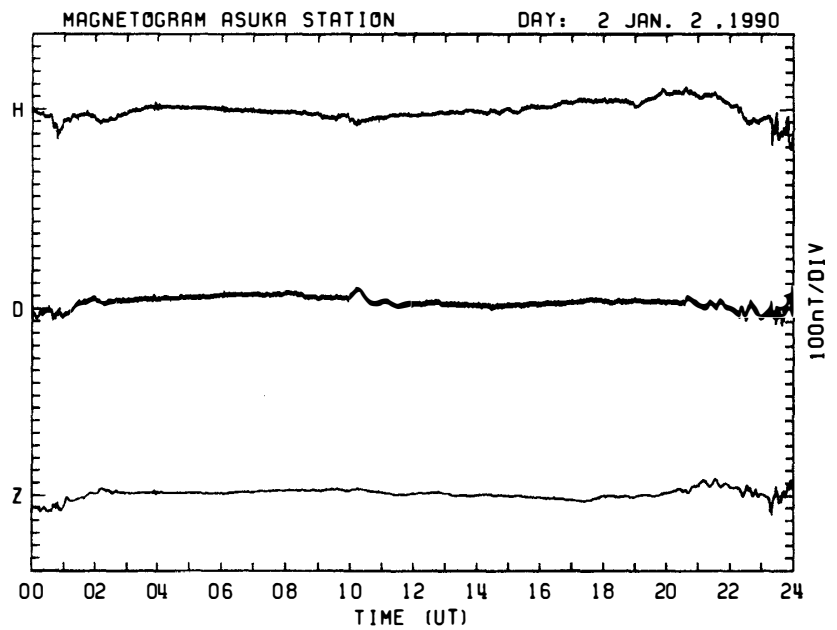
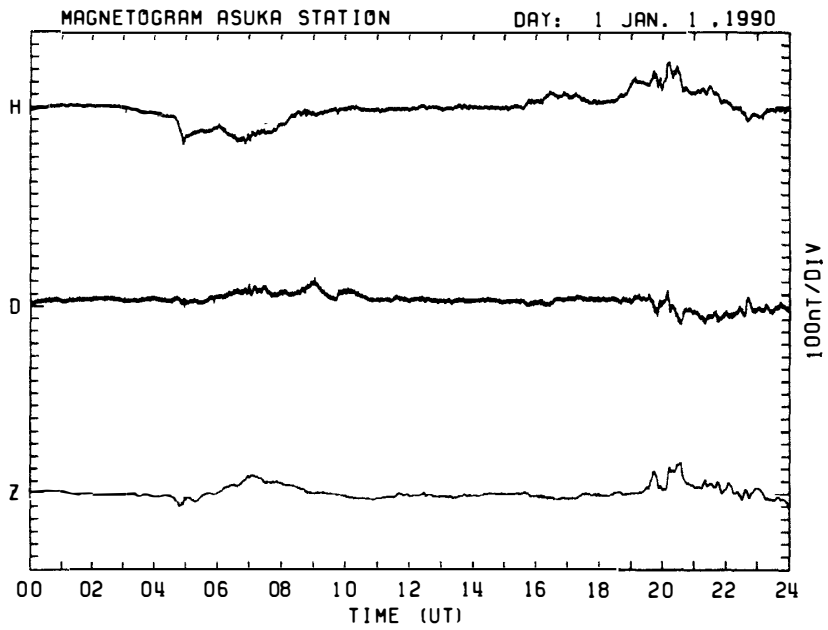
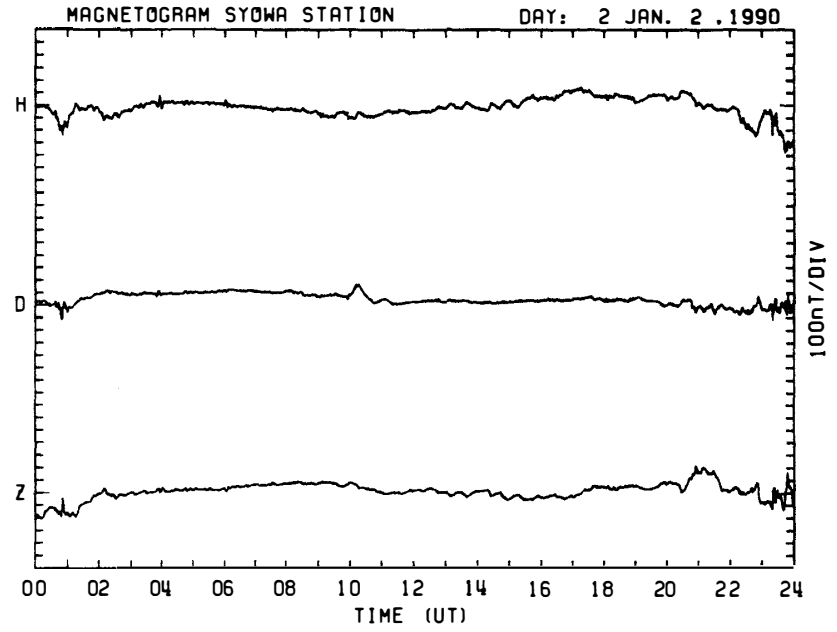
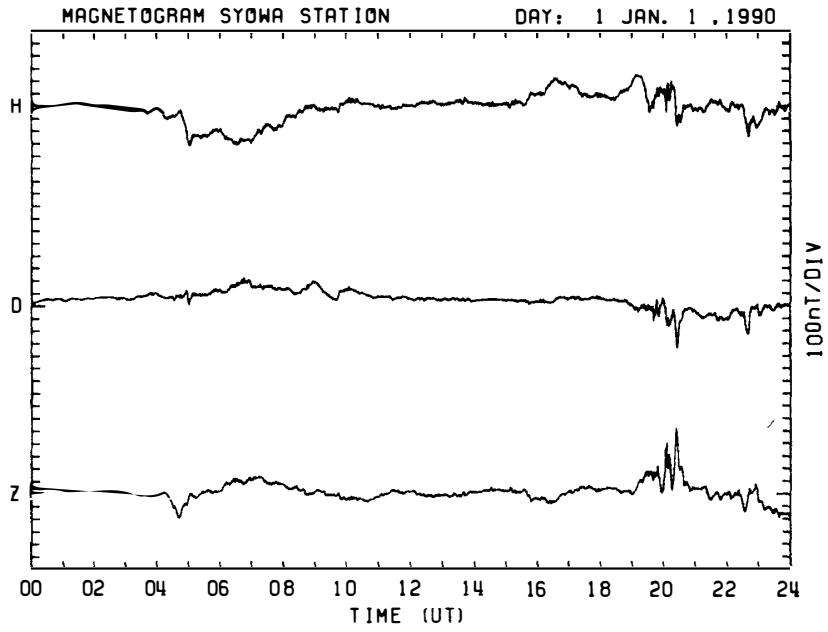
### **Continuous computer plots of magnetogram in 1990**

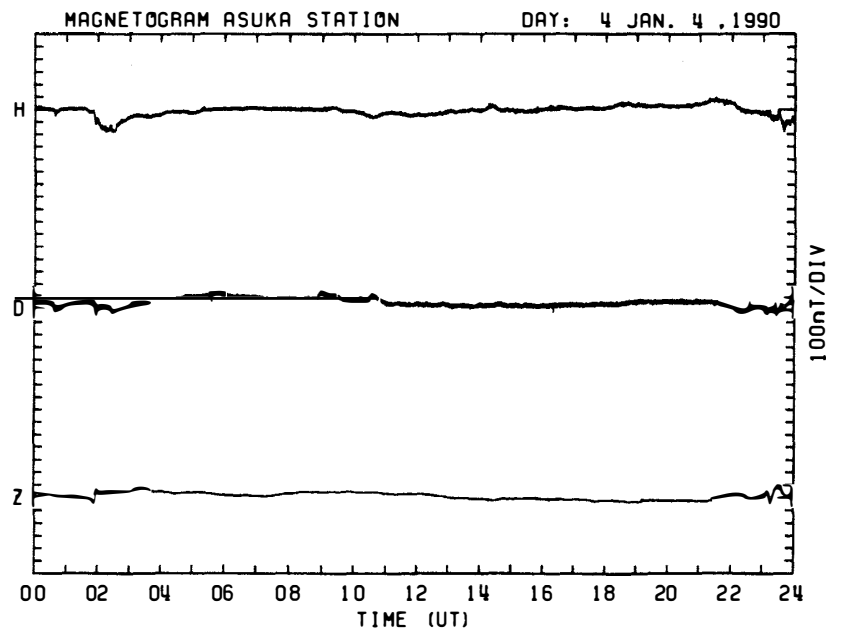
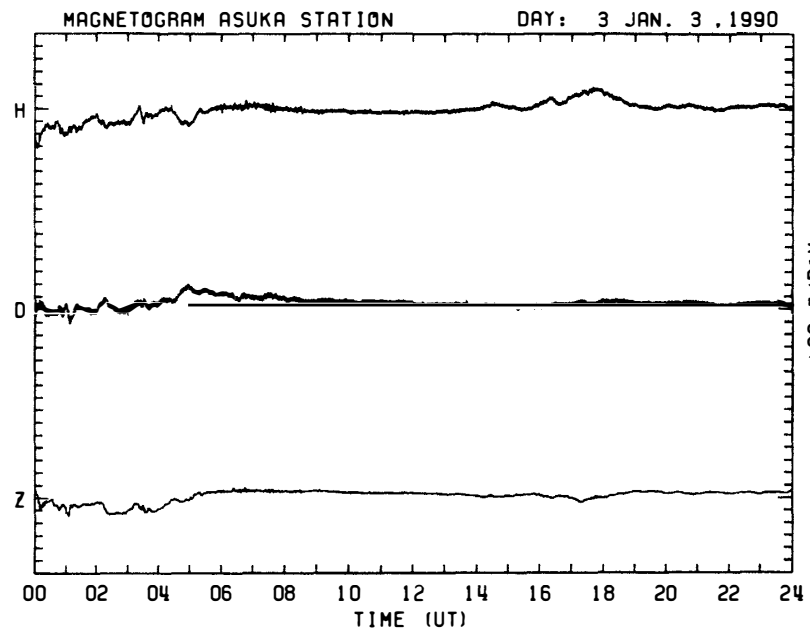
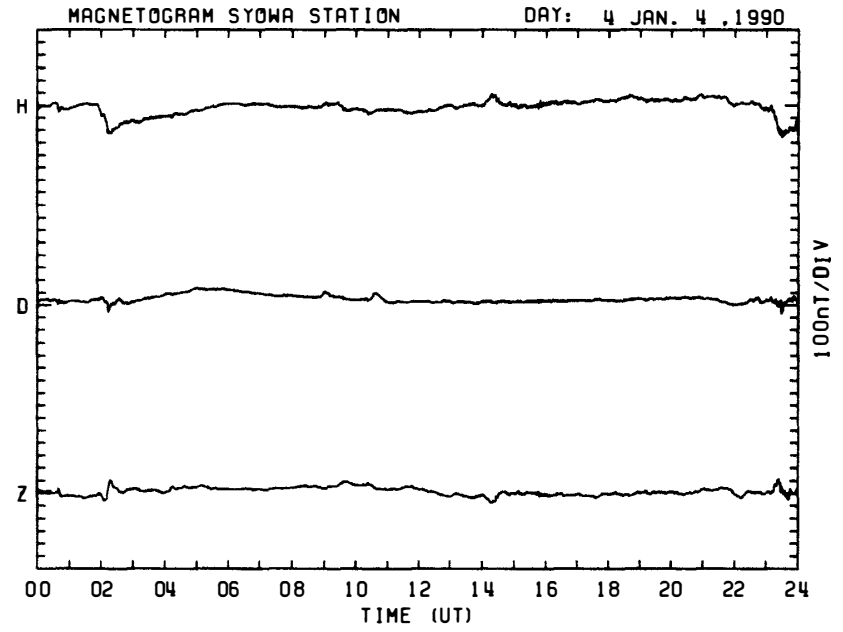
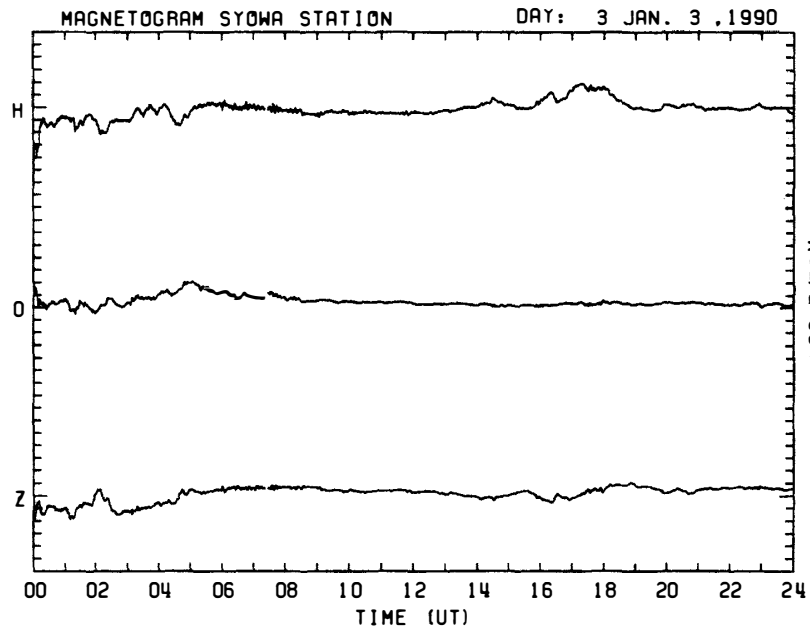
**Displacement of magnetogram trace toward the top of records indicates;**

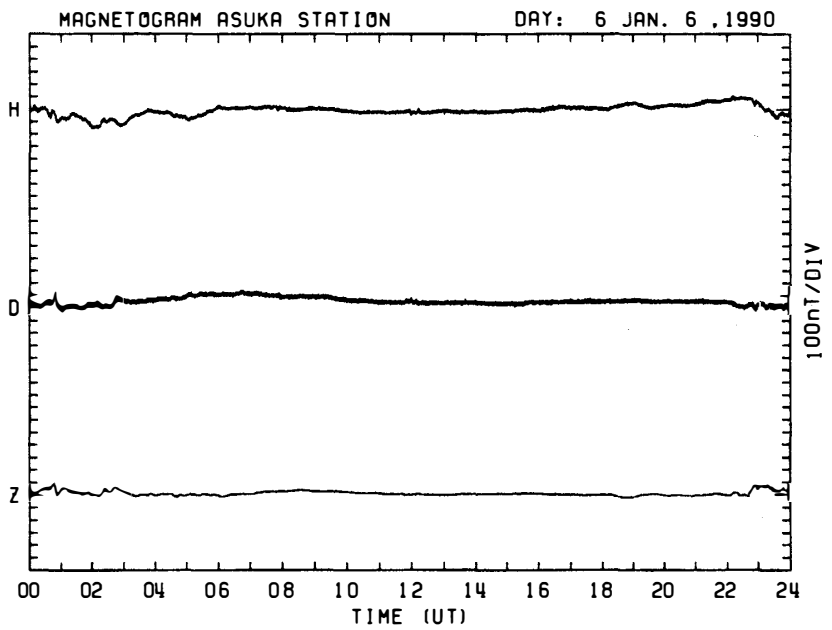
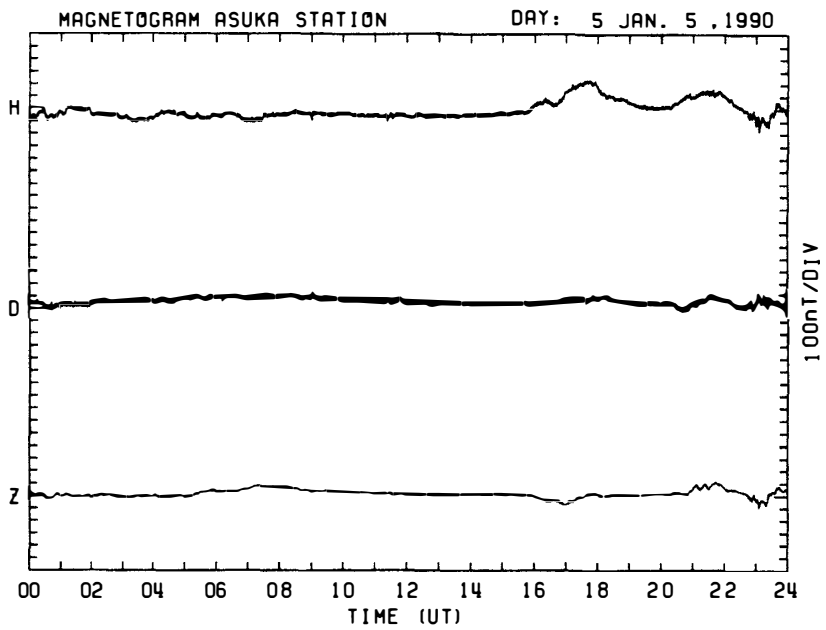
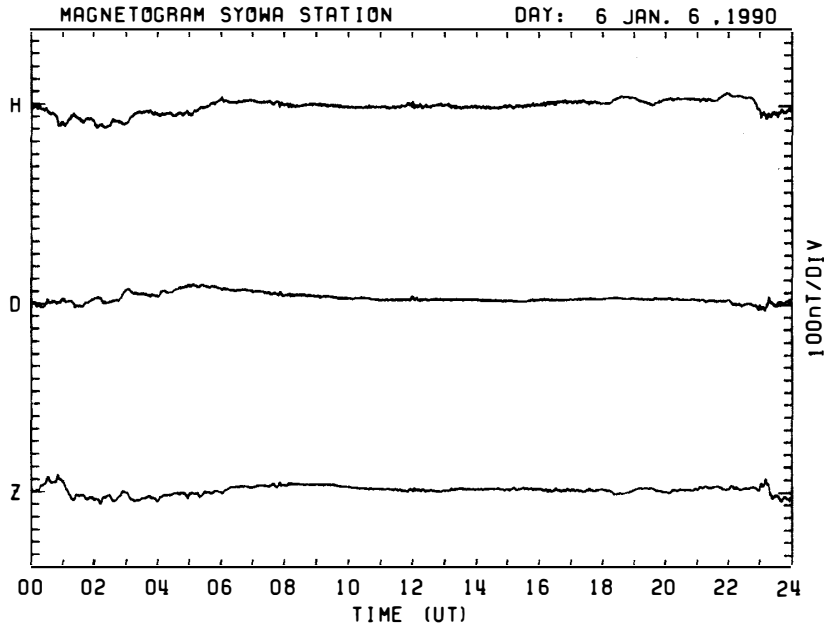
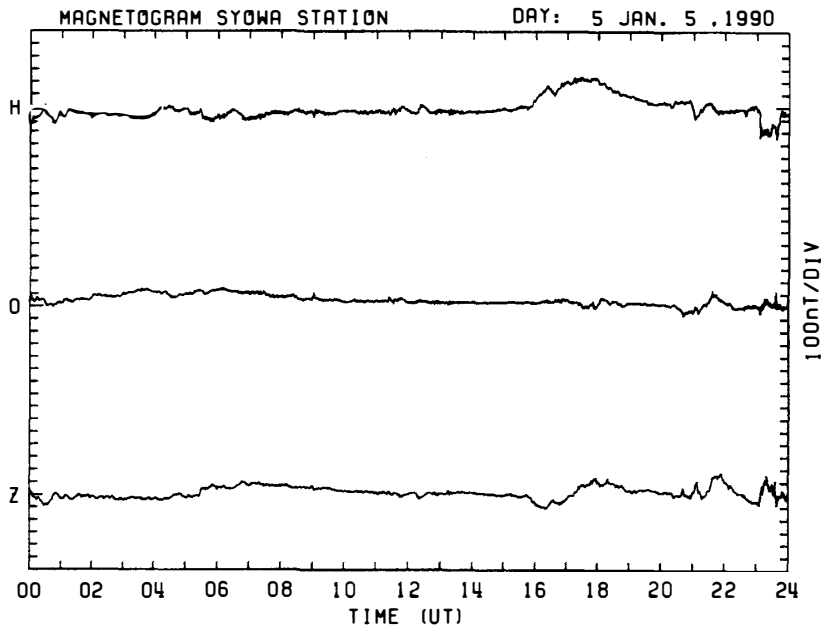
**H : northward,**

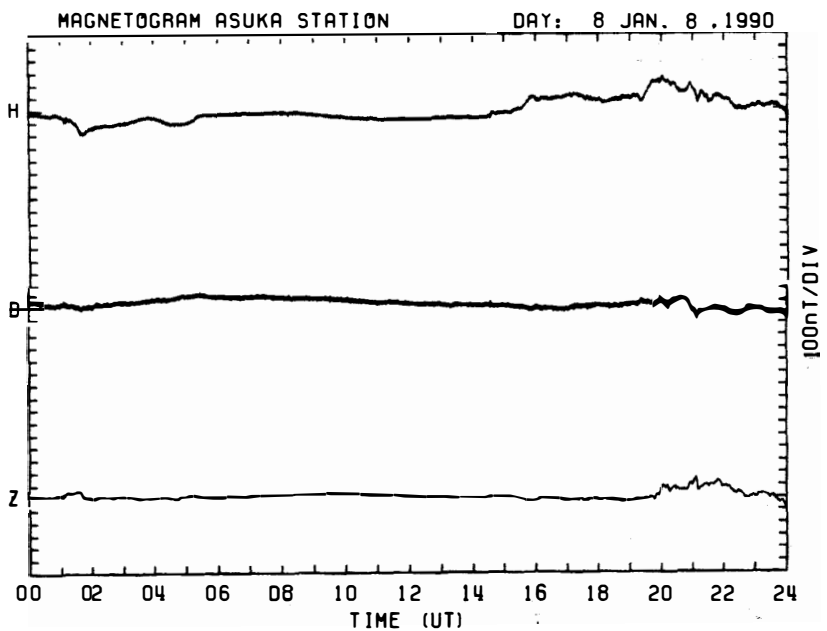
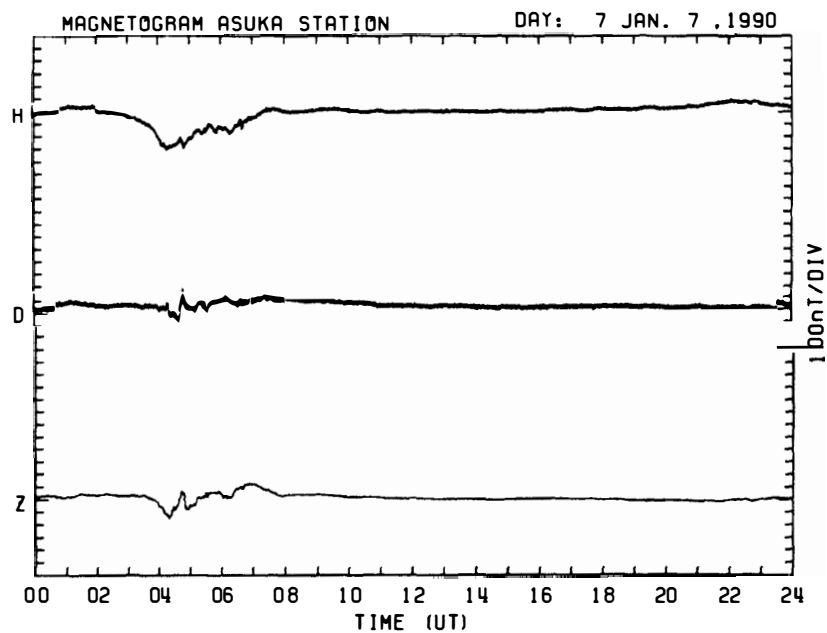
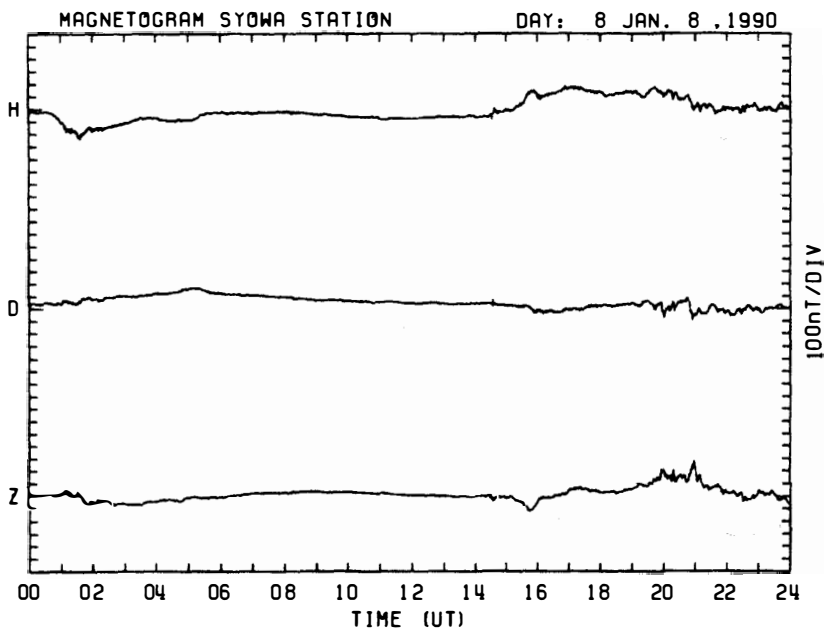
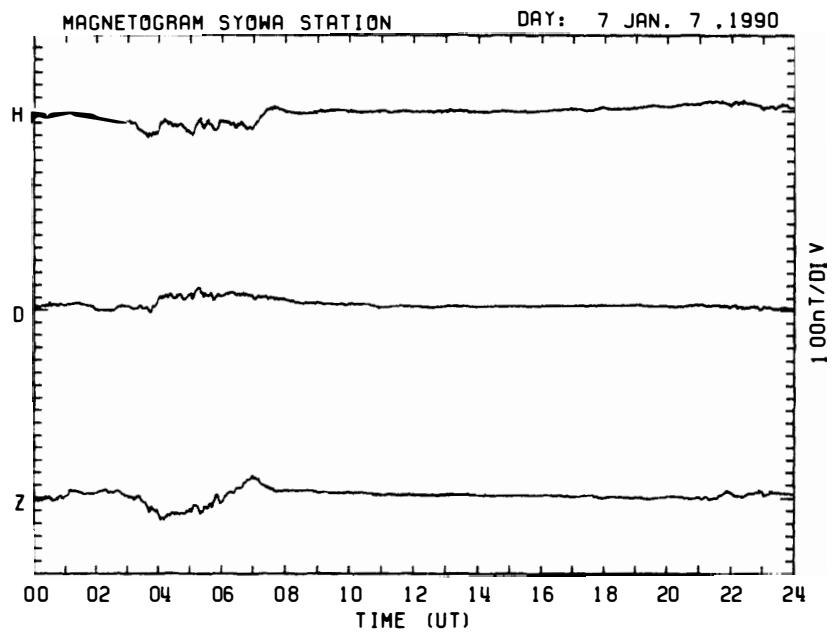
**D : westward,**

**Z : downward.**

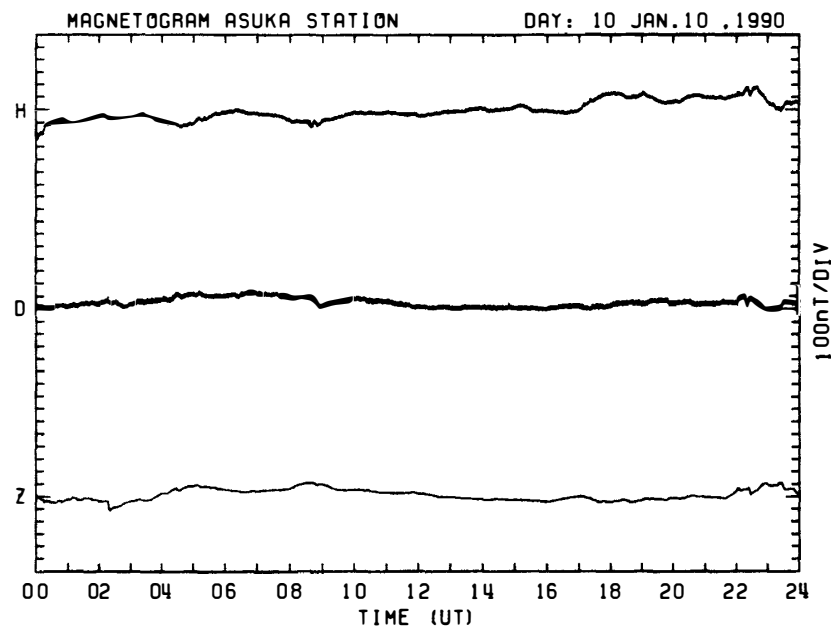
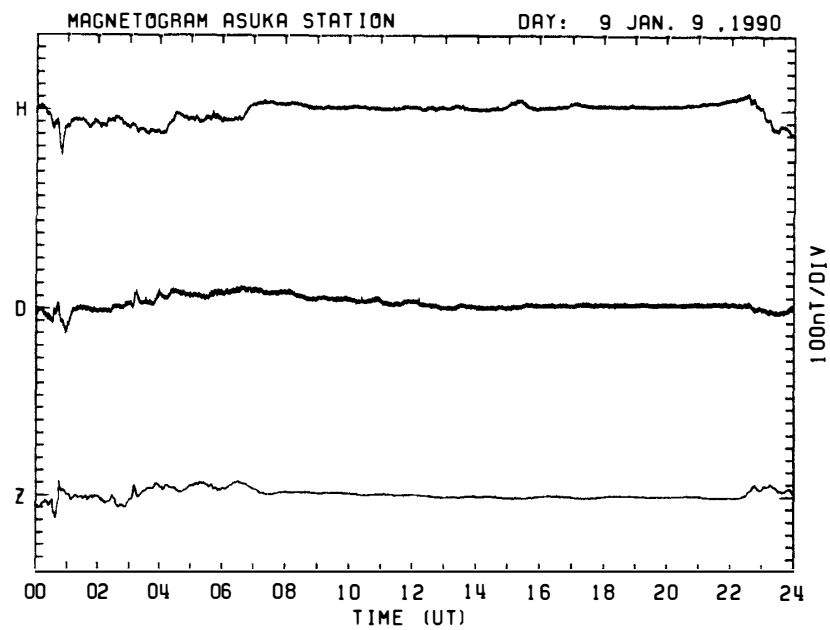
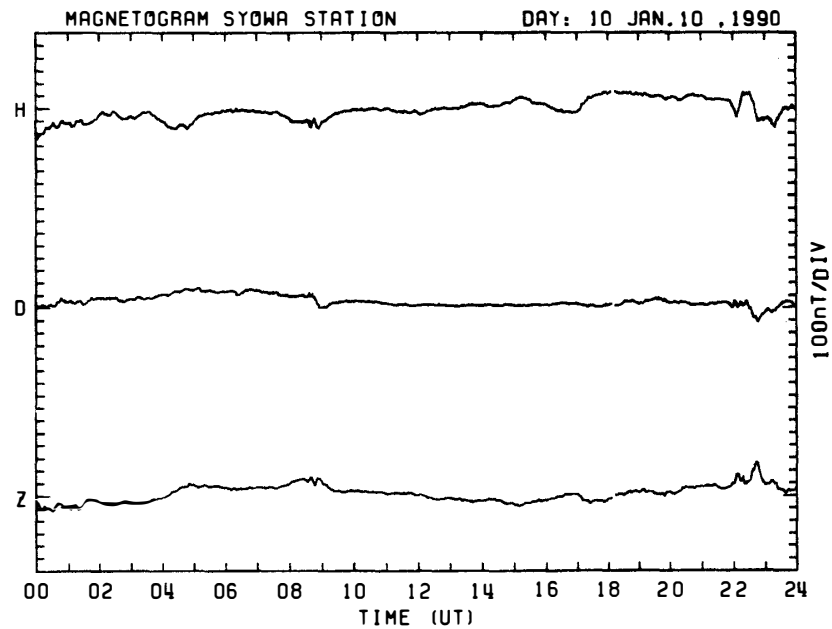
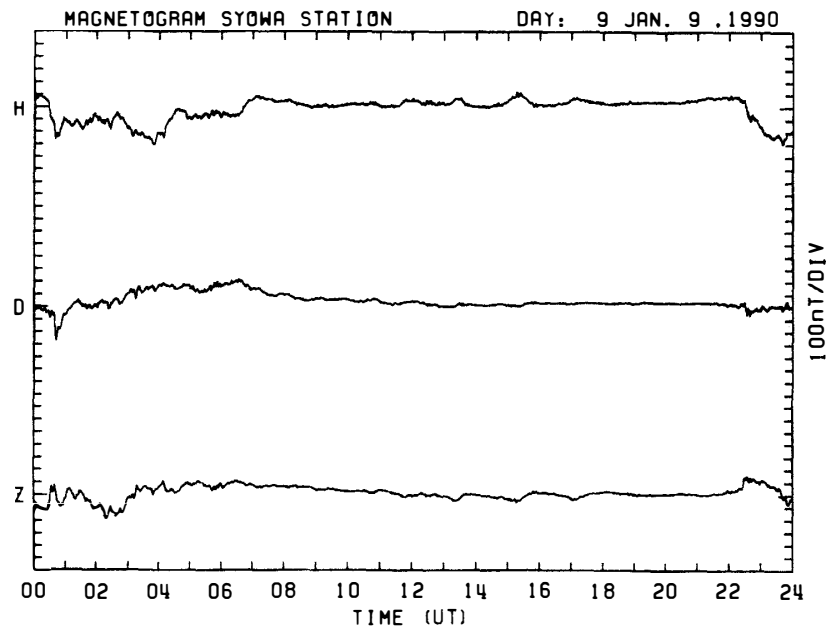


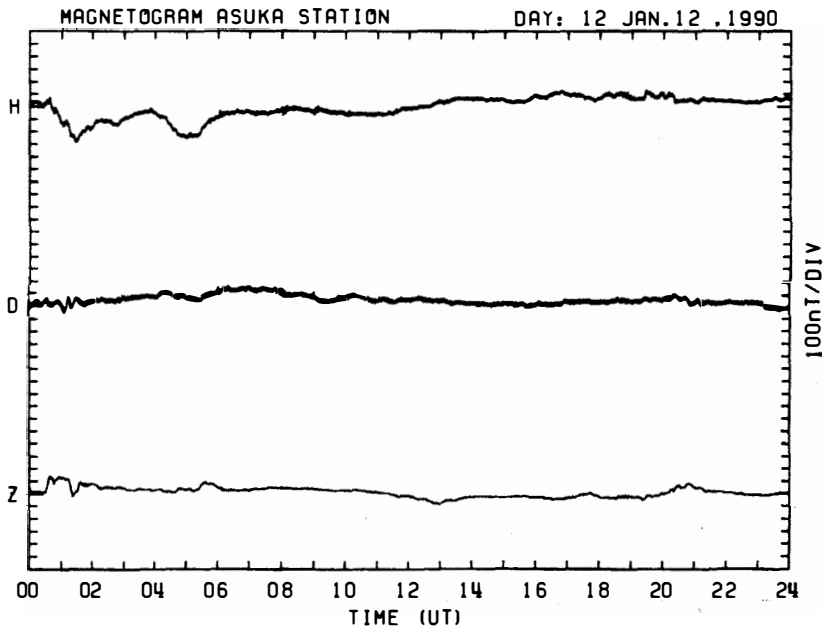
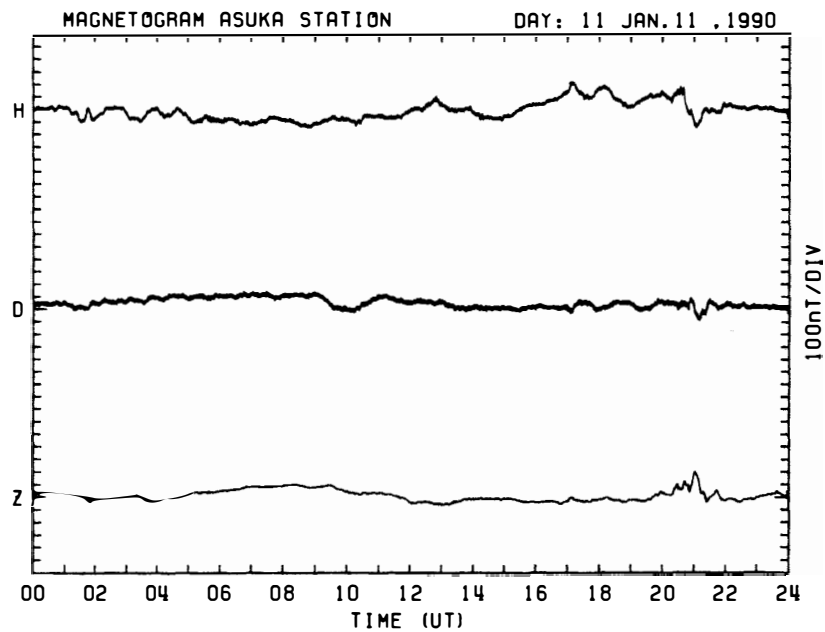
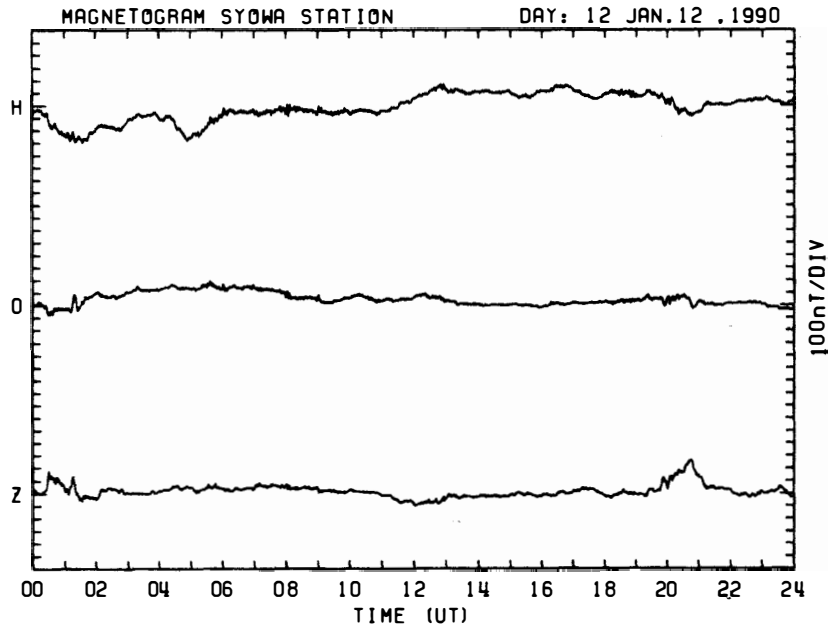
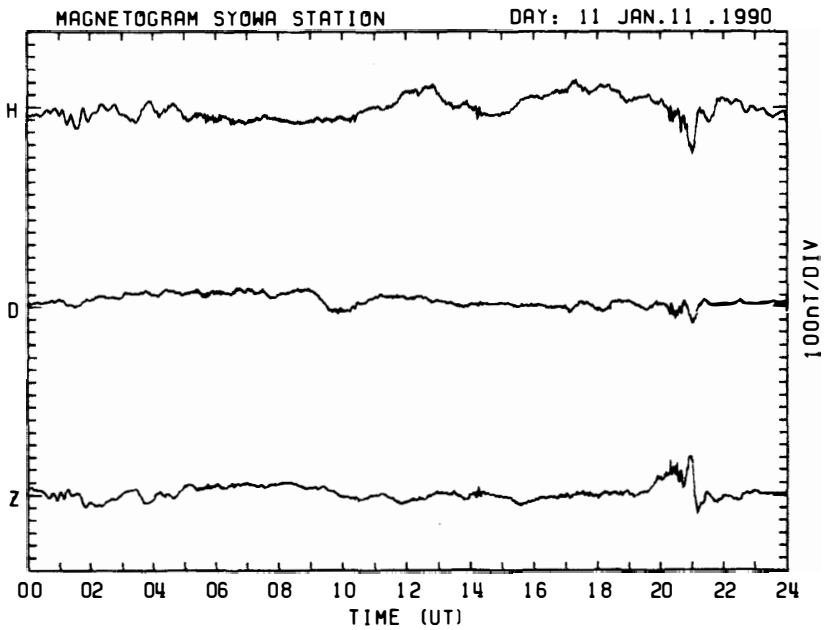


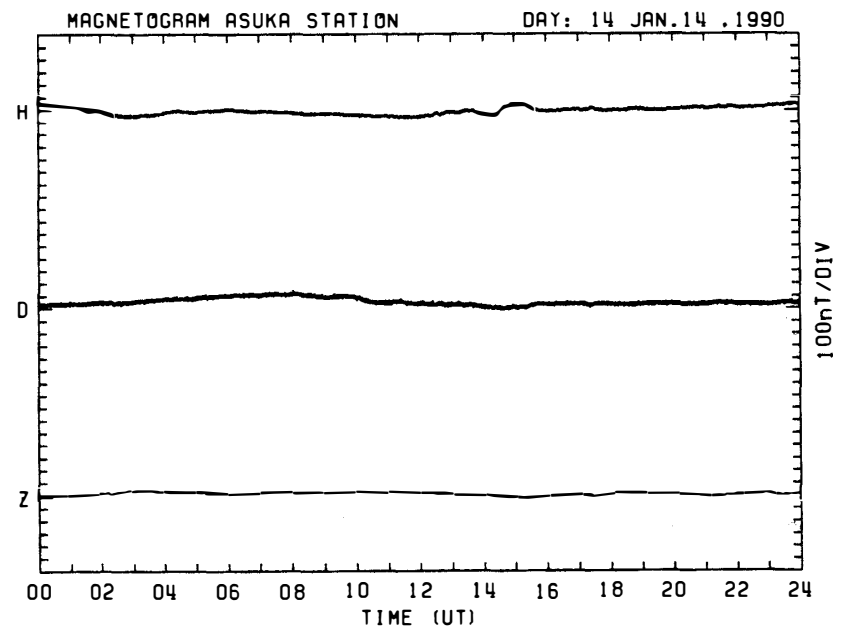
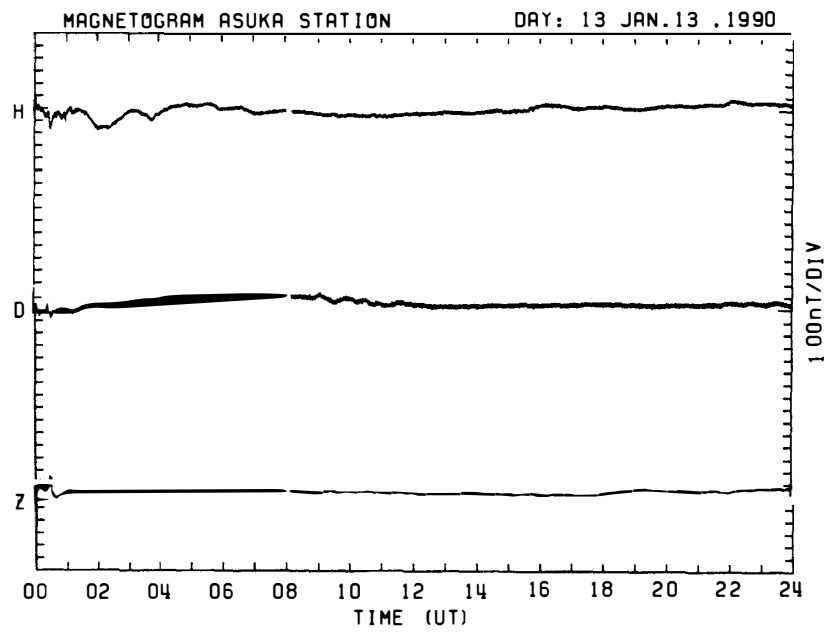
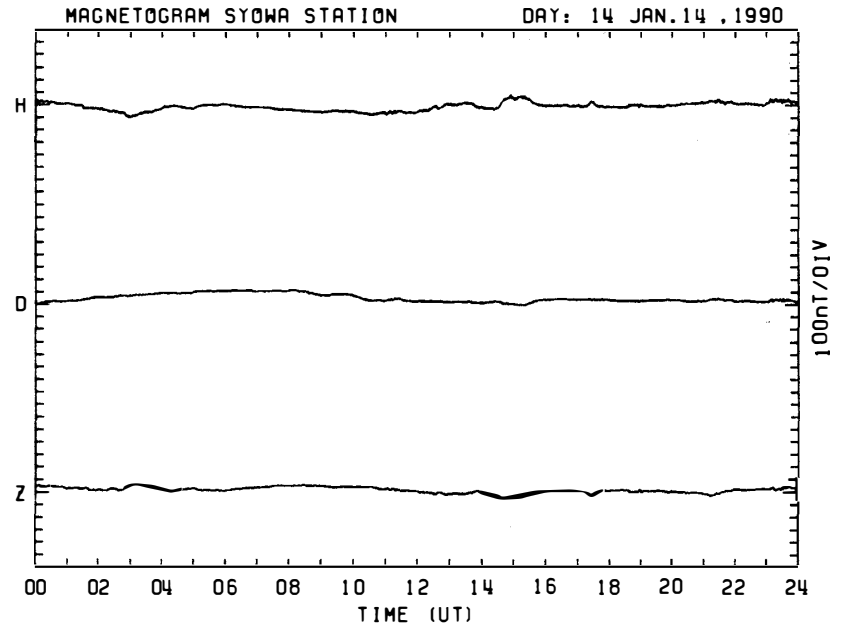
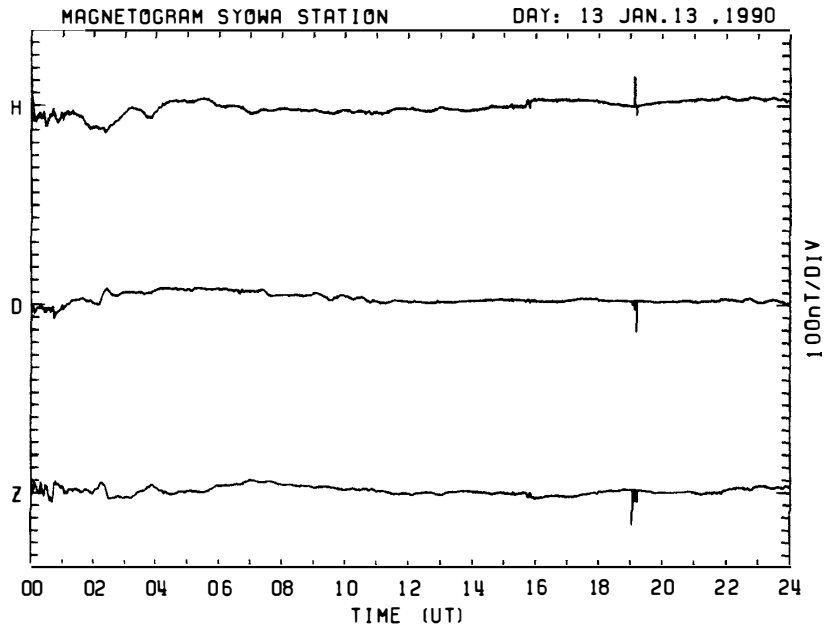


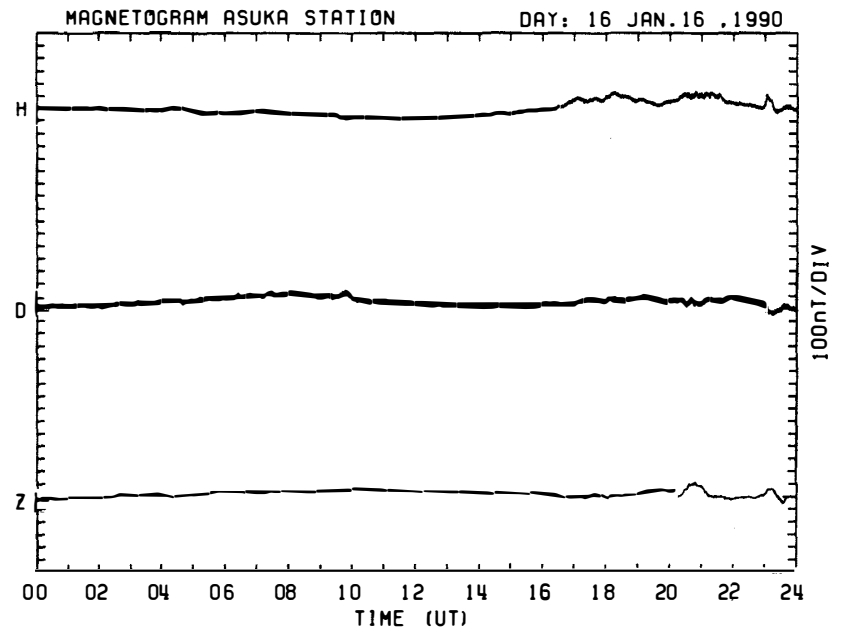
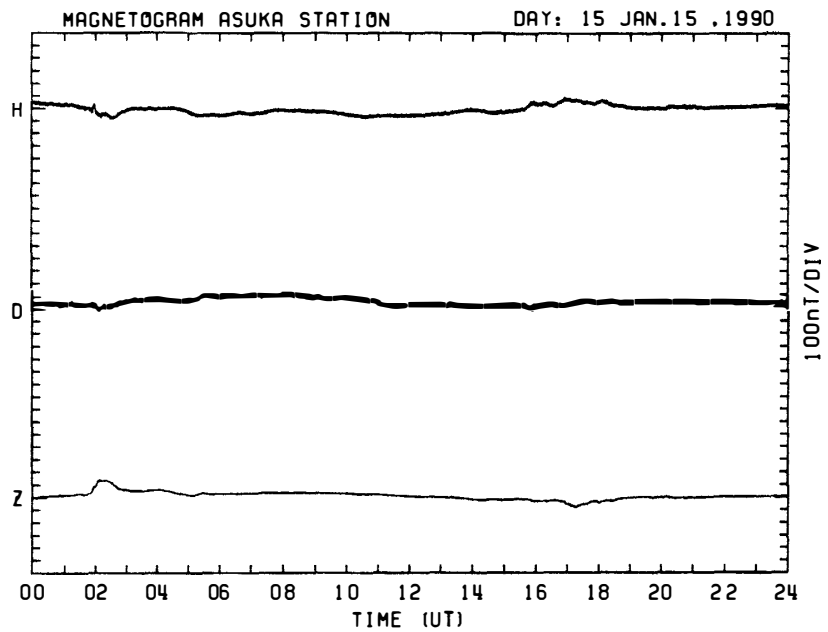
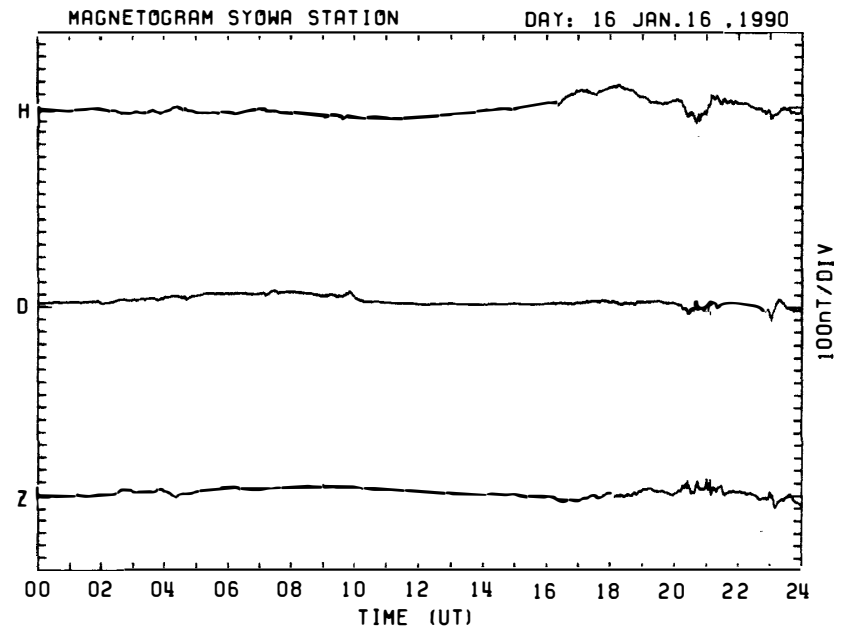
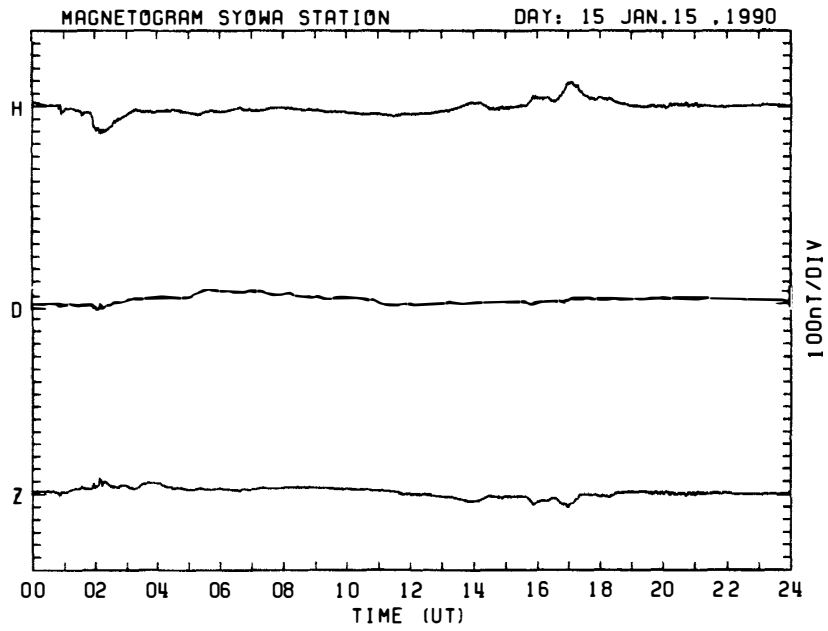


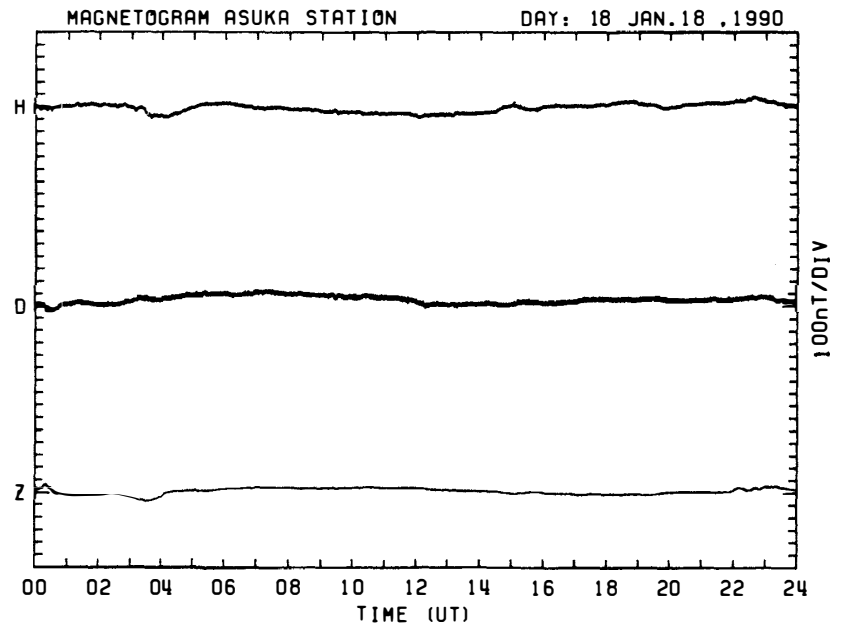
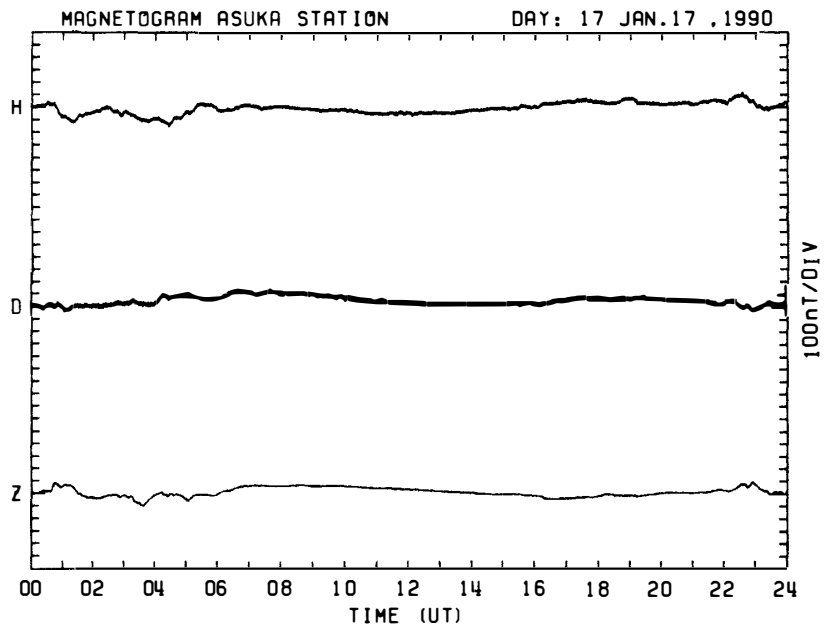
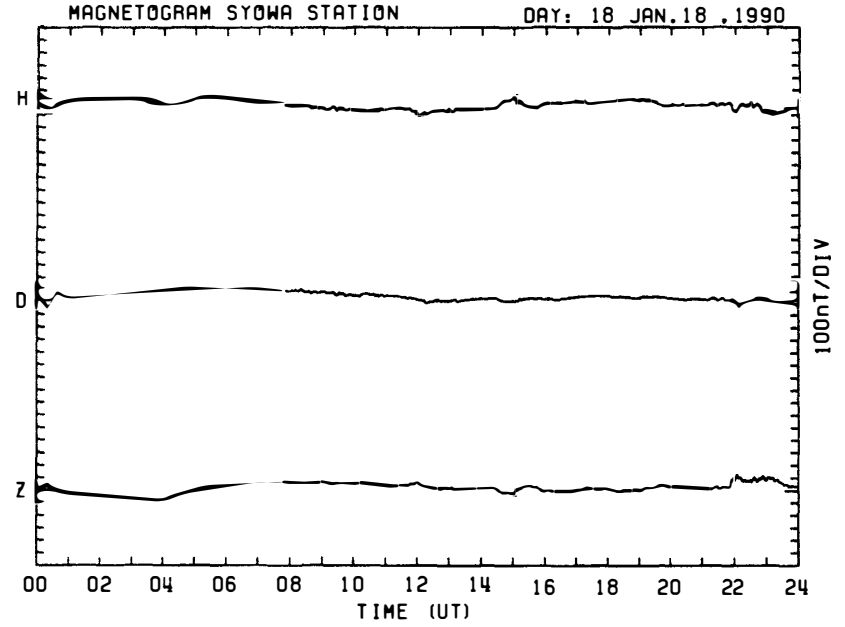
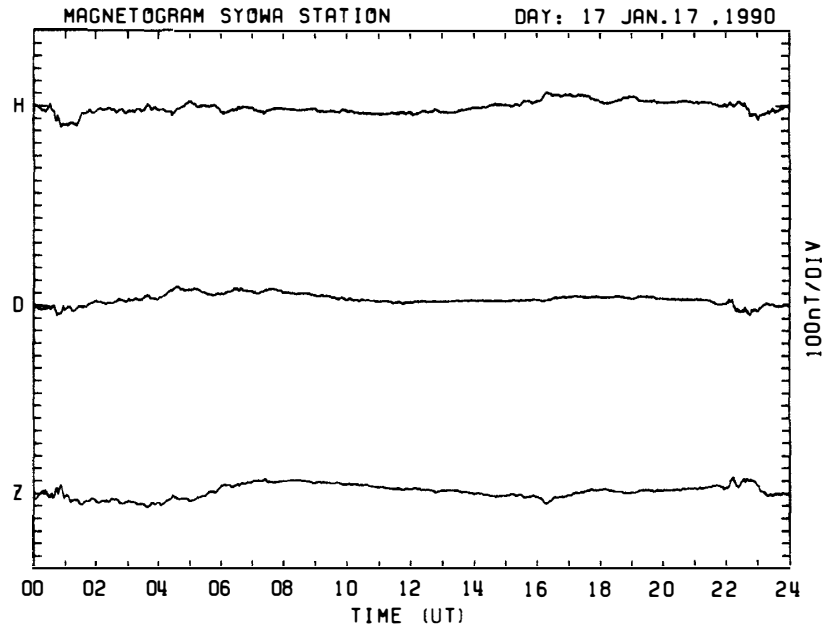


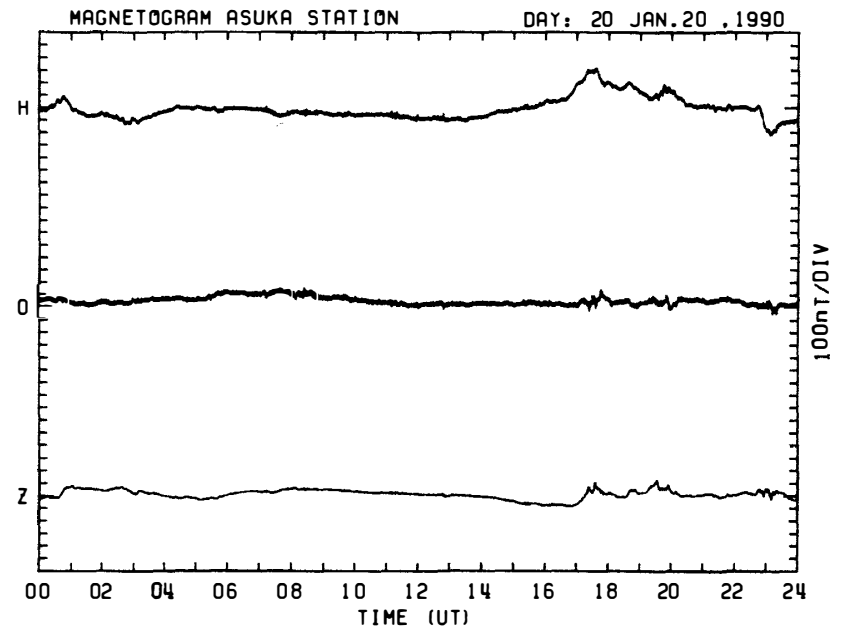
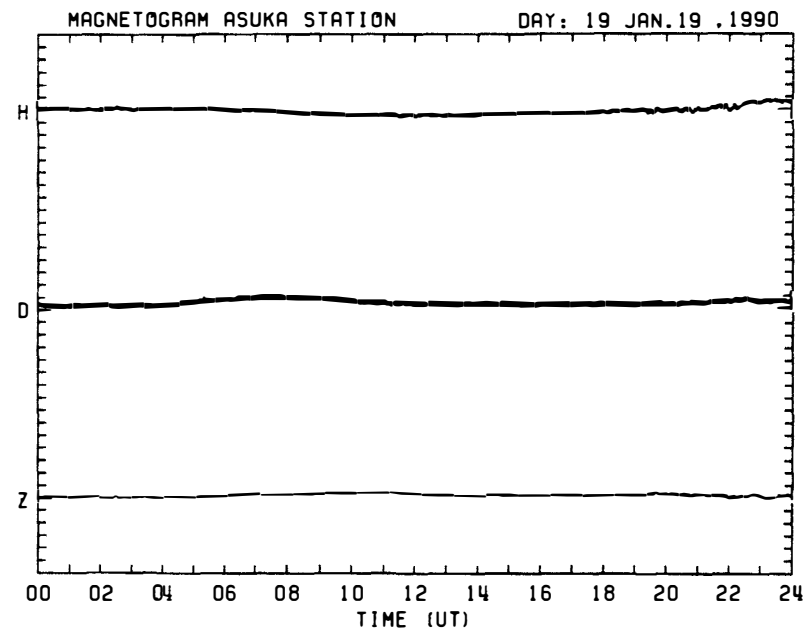
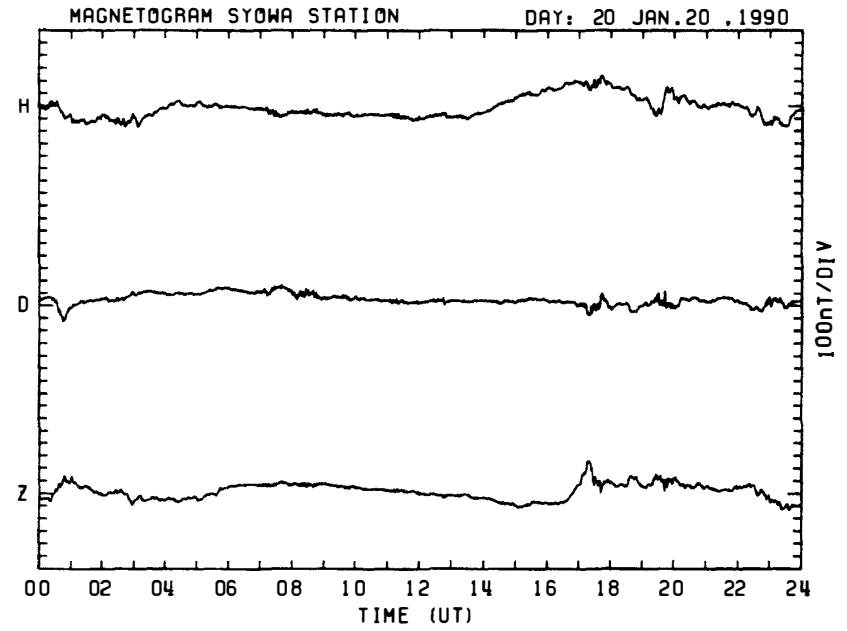
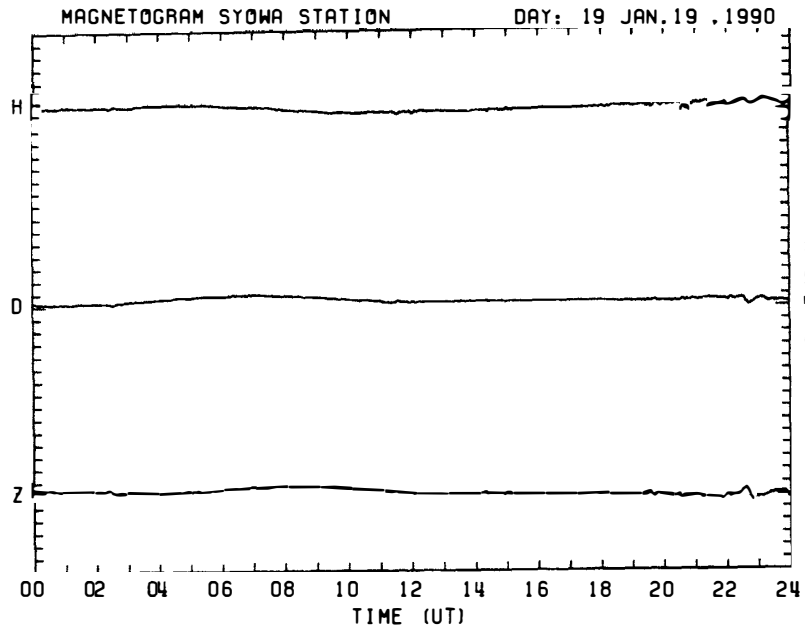


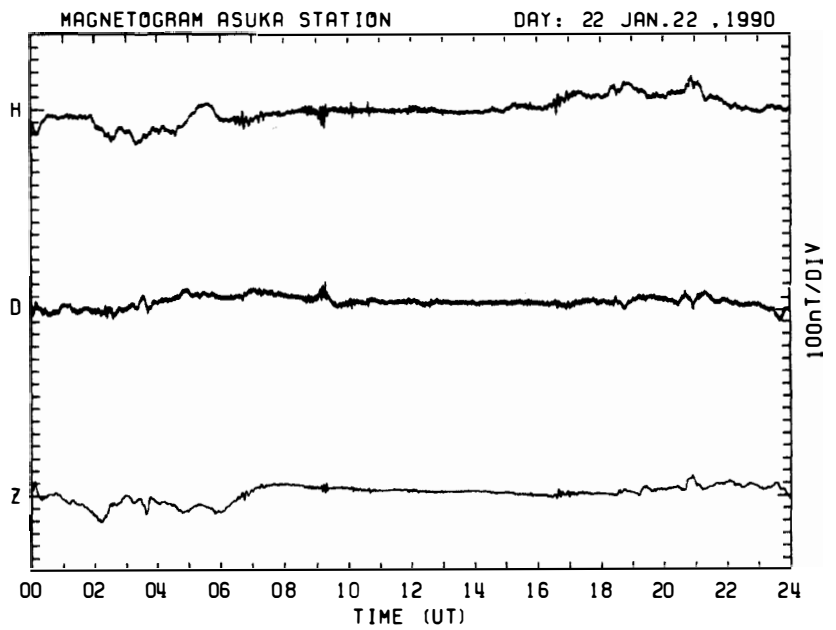
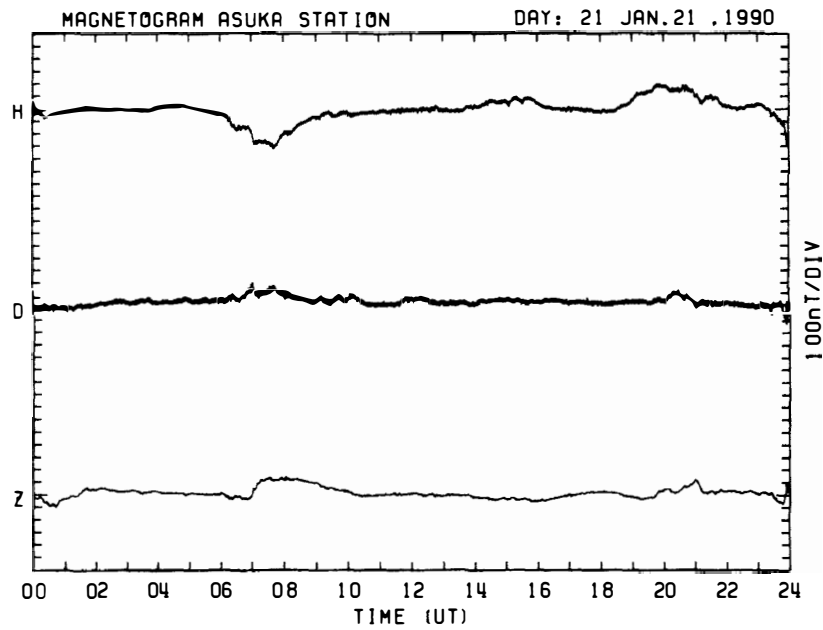
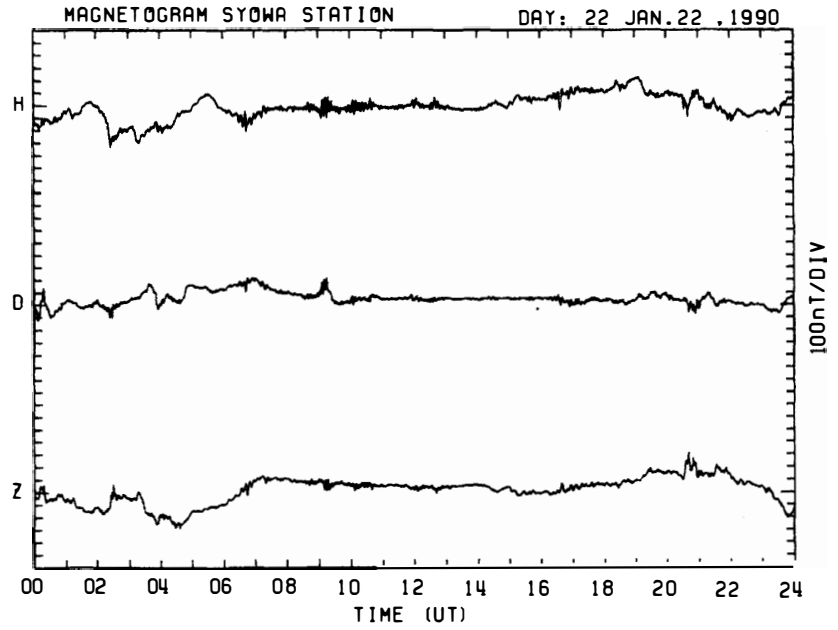
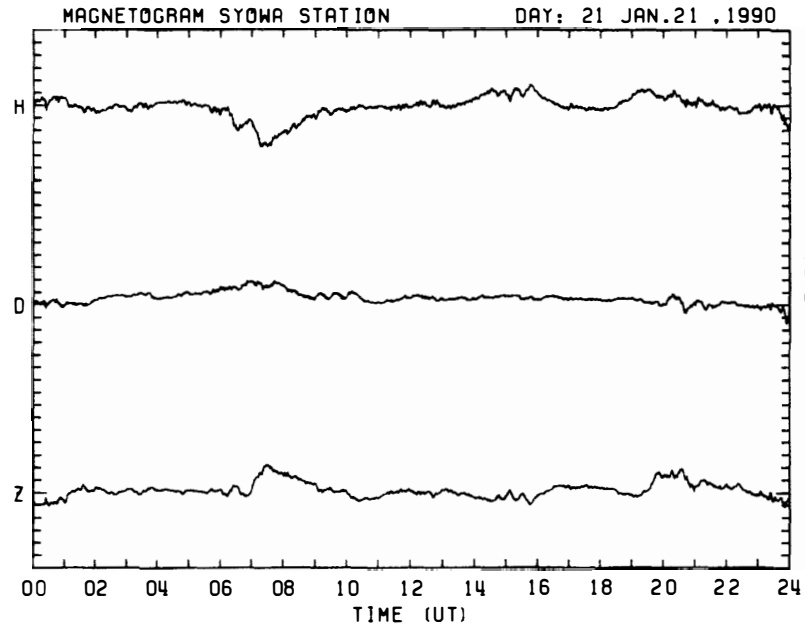


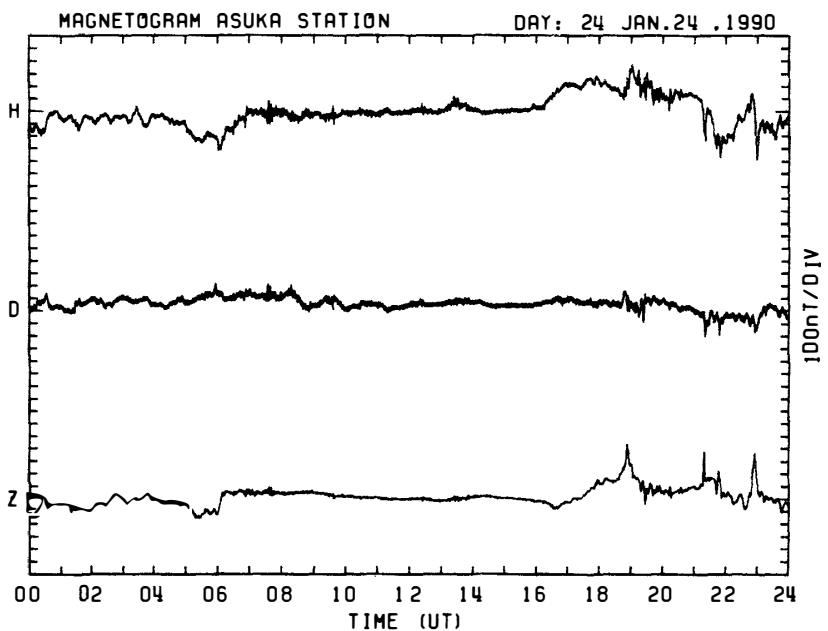
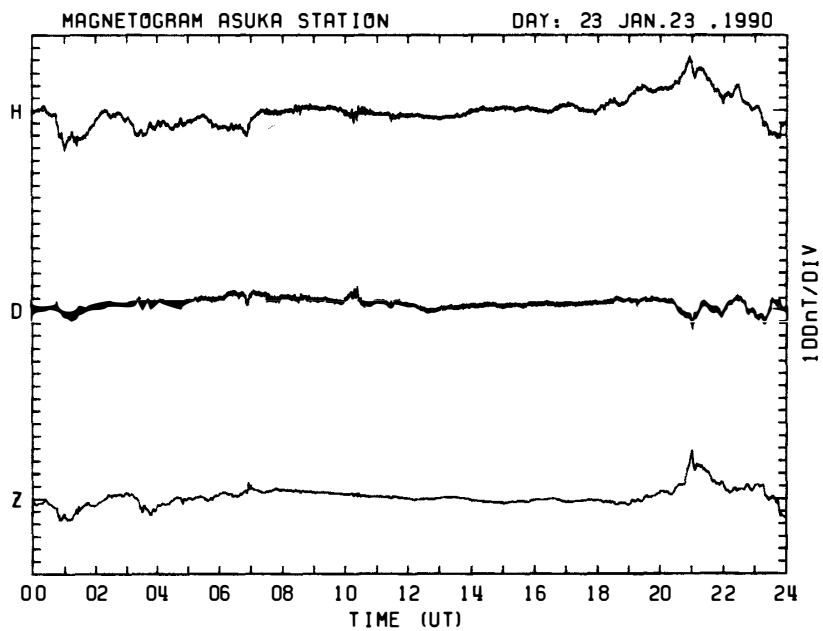
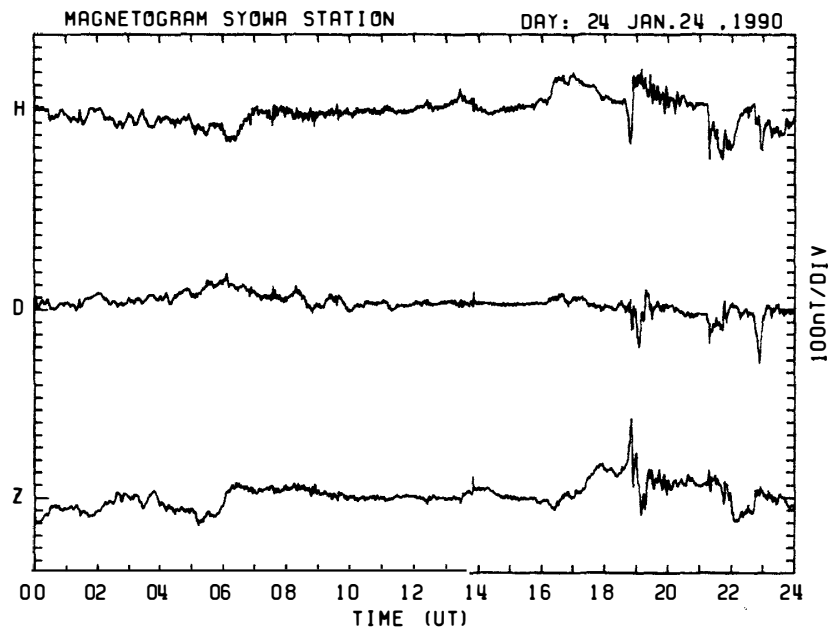
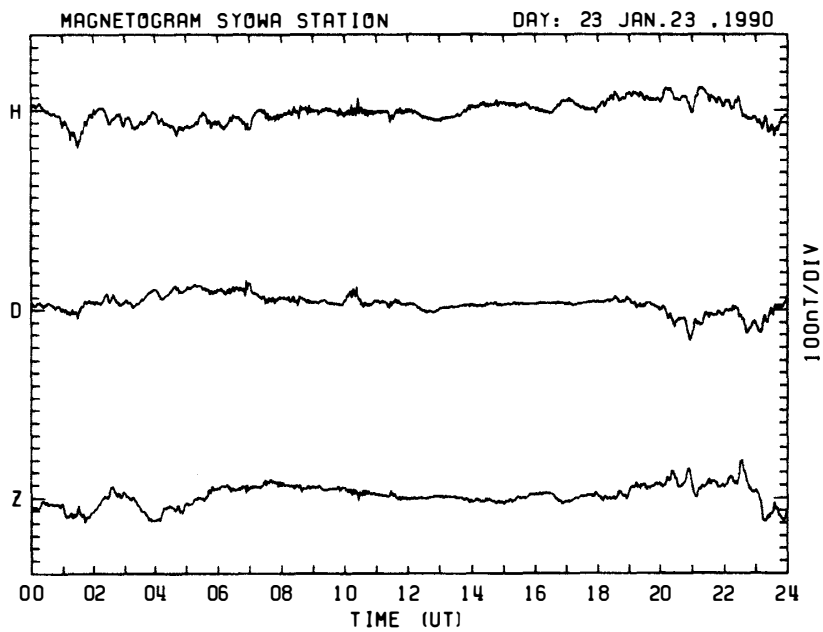




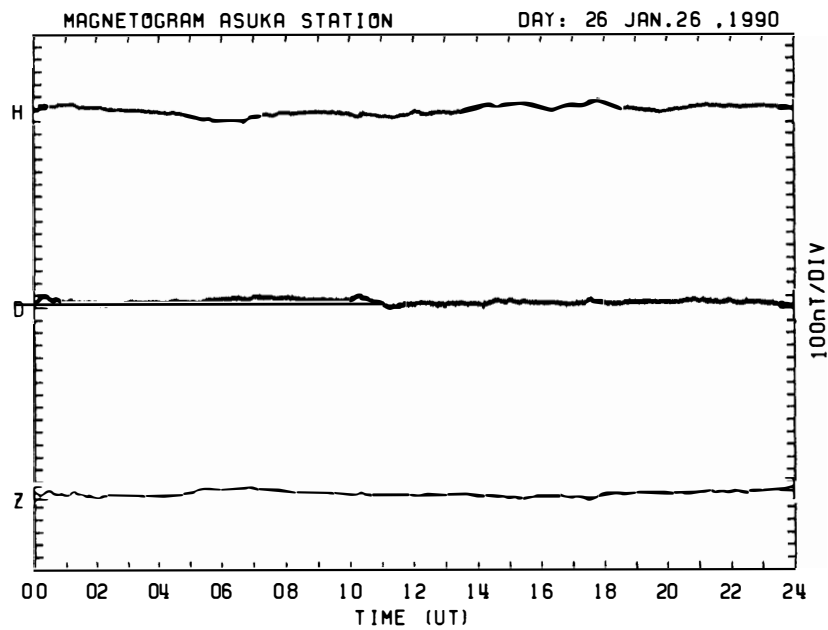
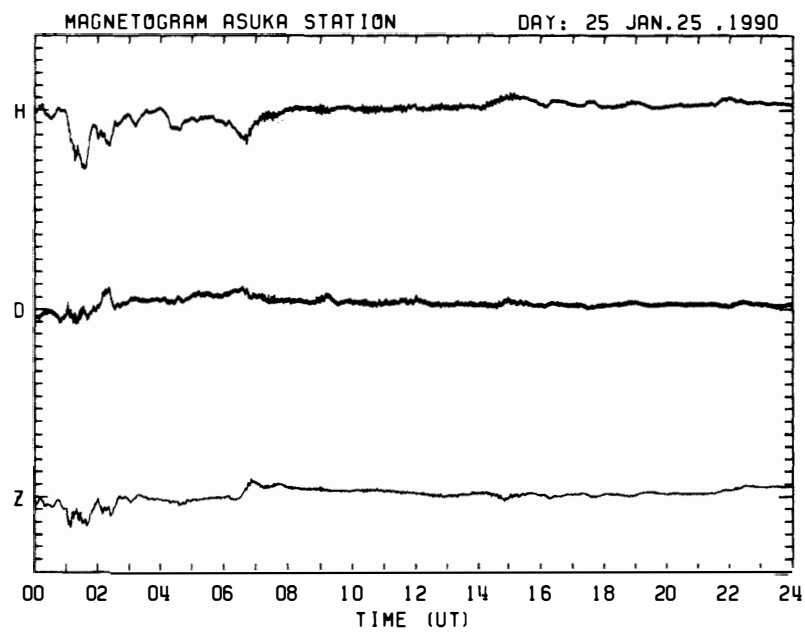
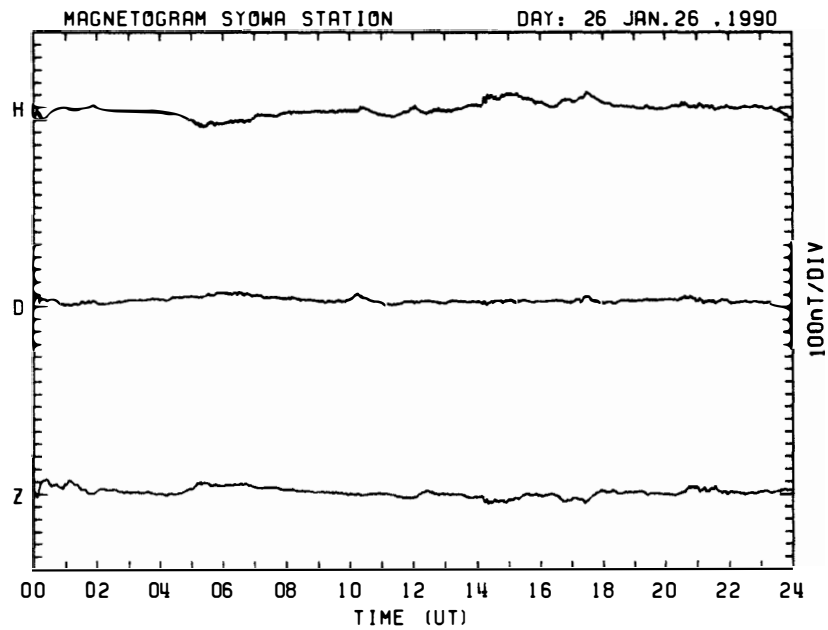
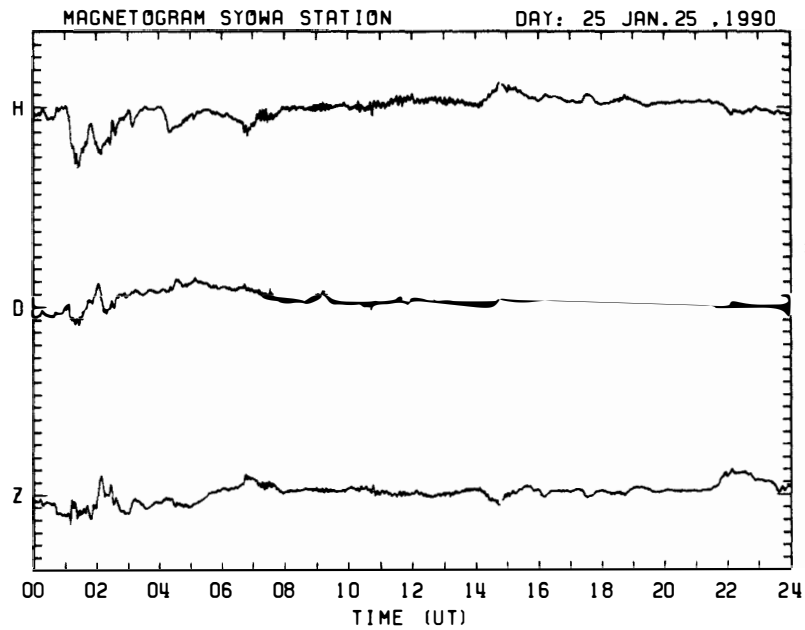


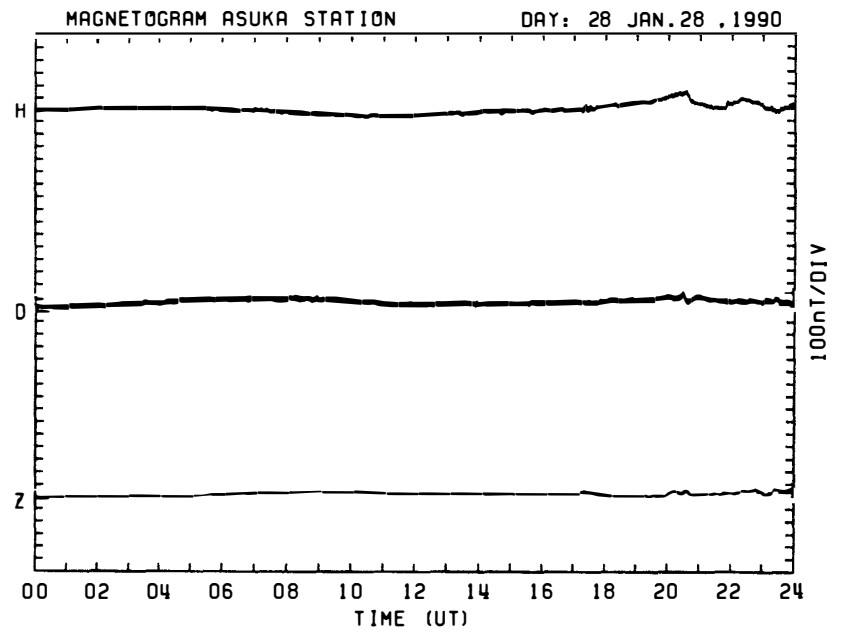
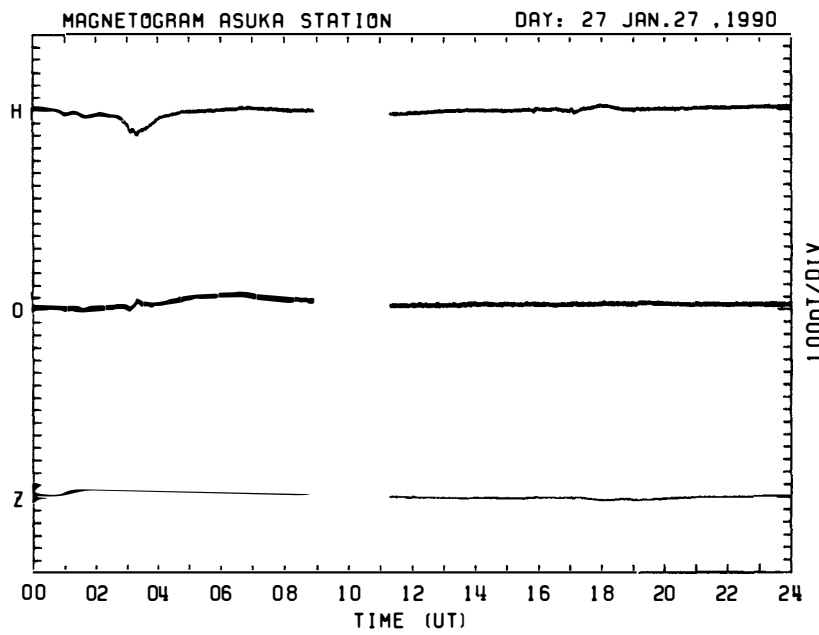
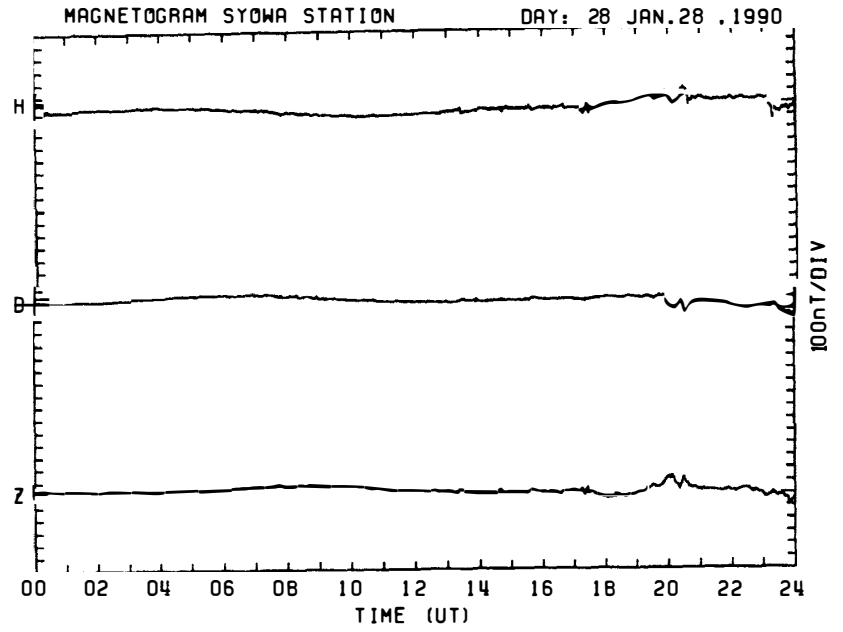
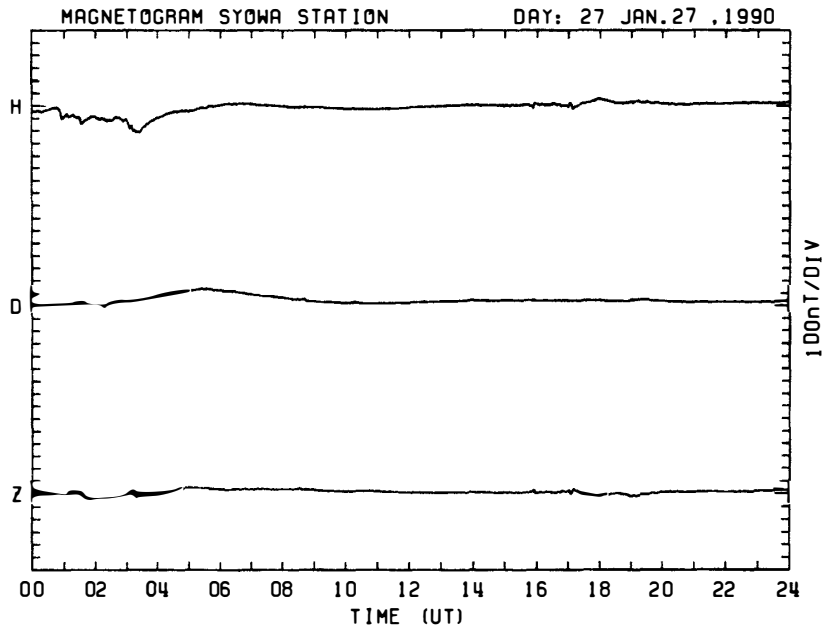


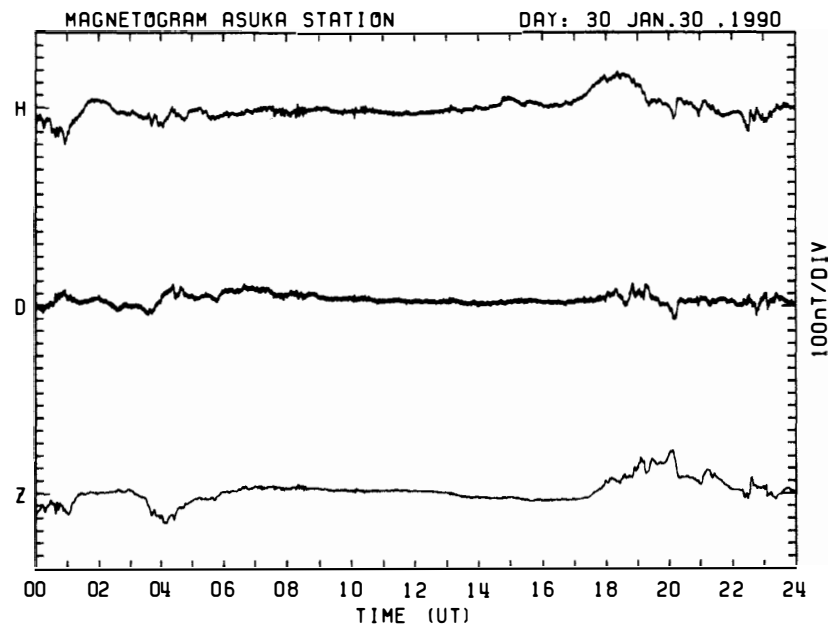
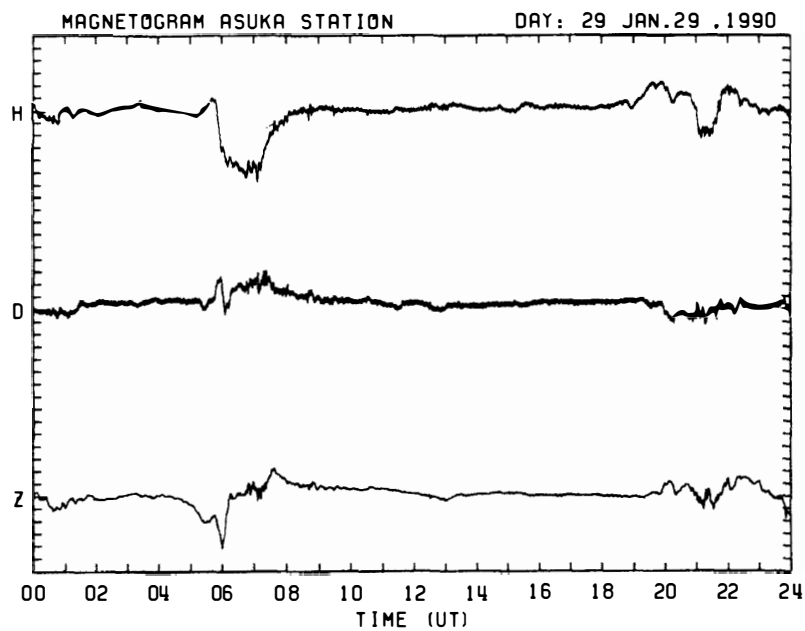
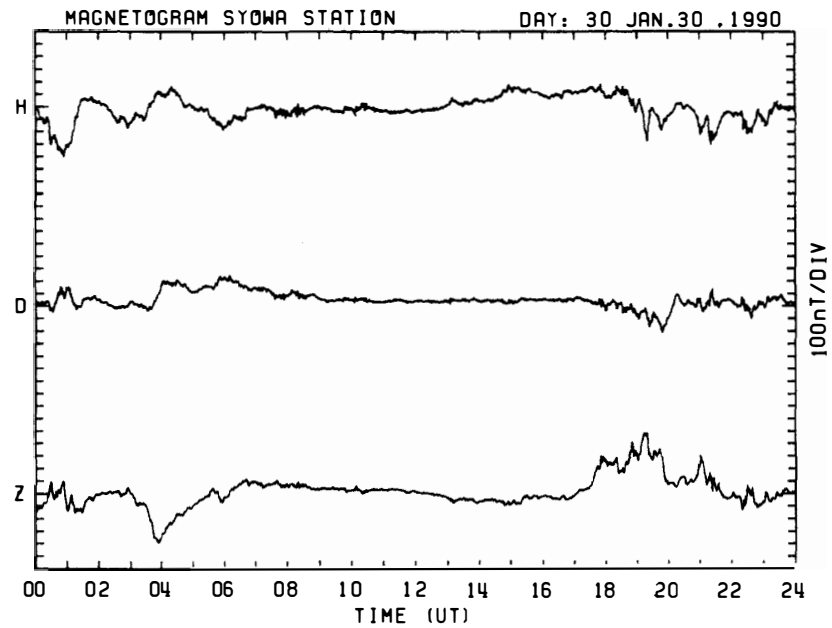
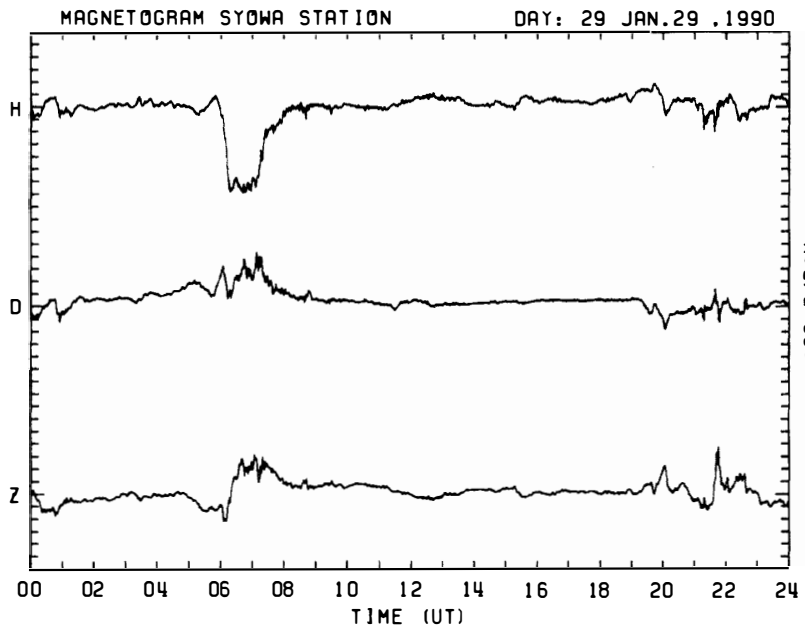


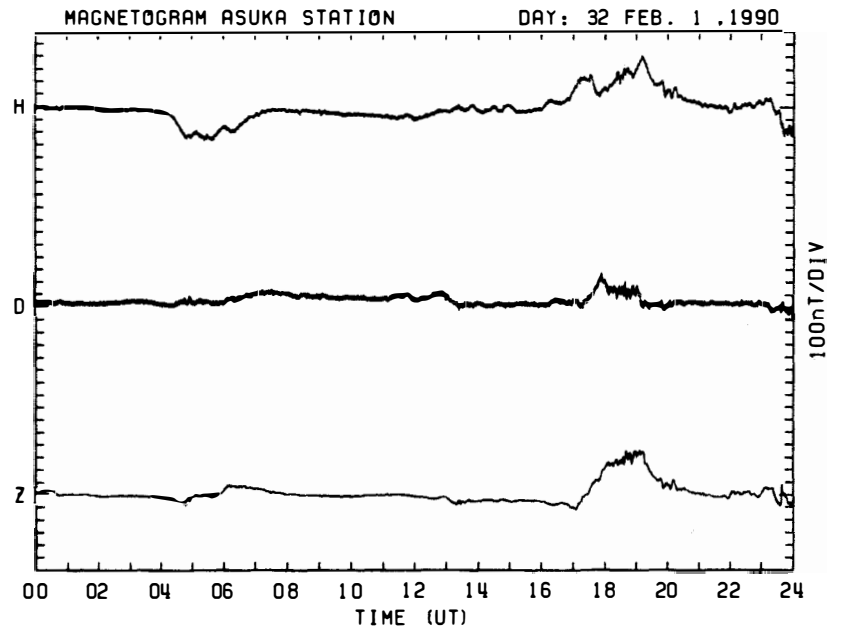
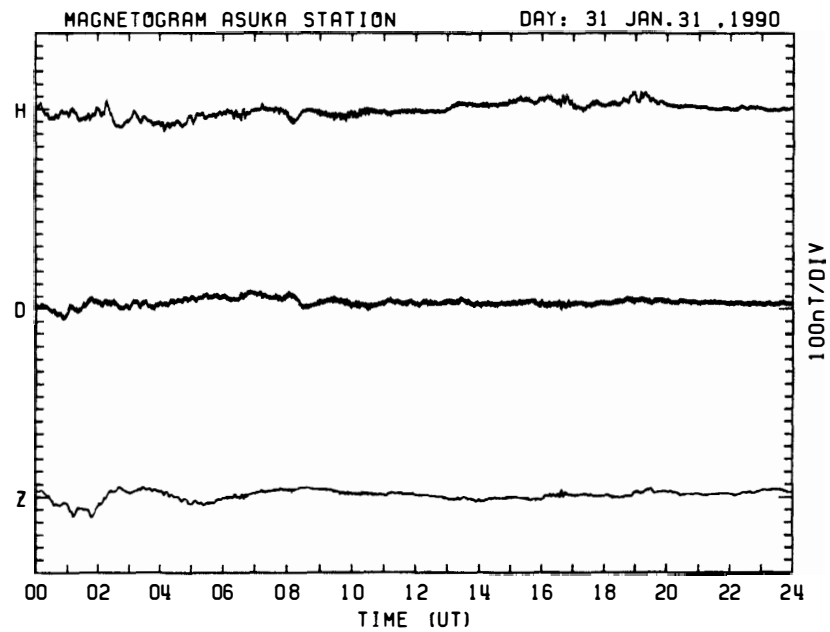
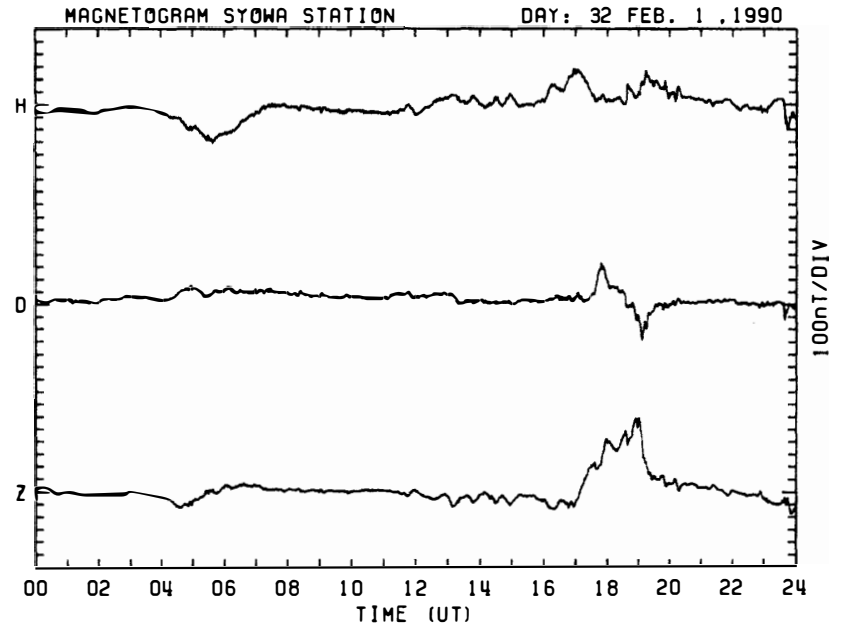
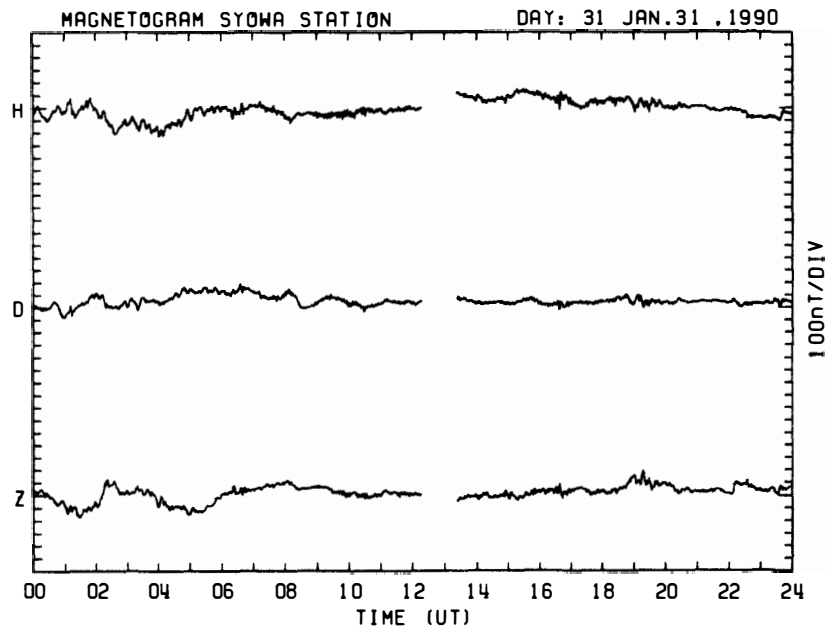


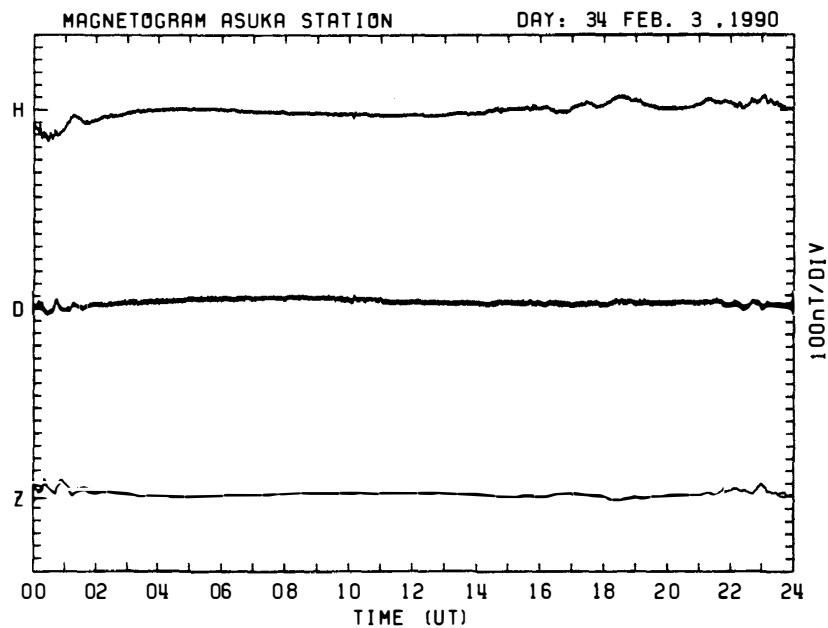
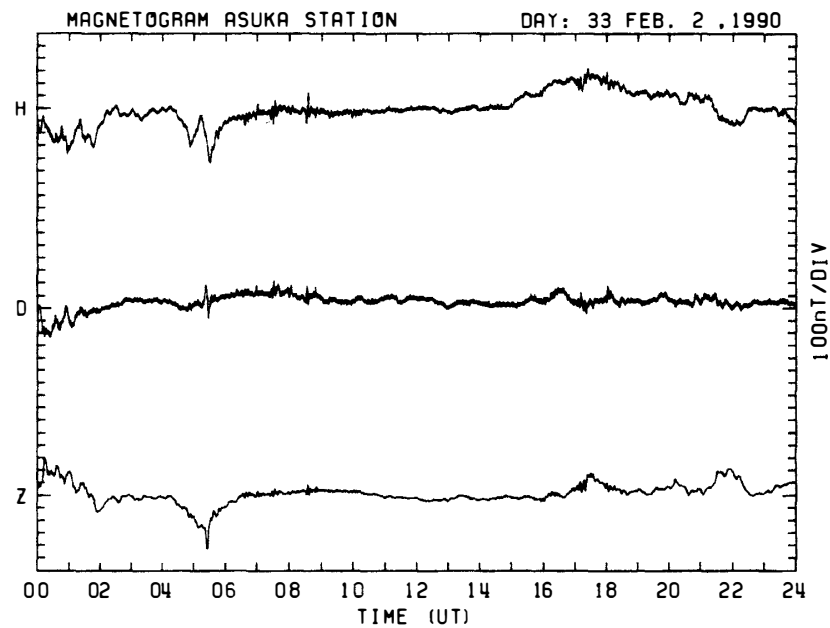
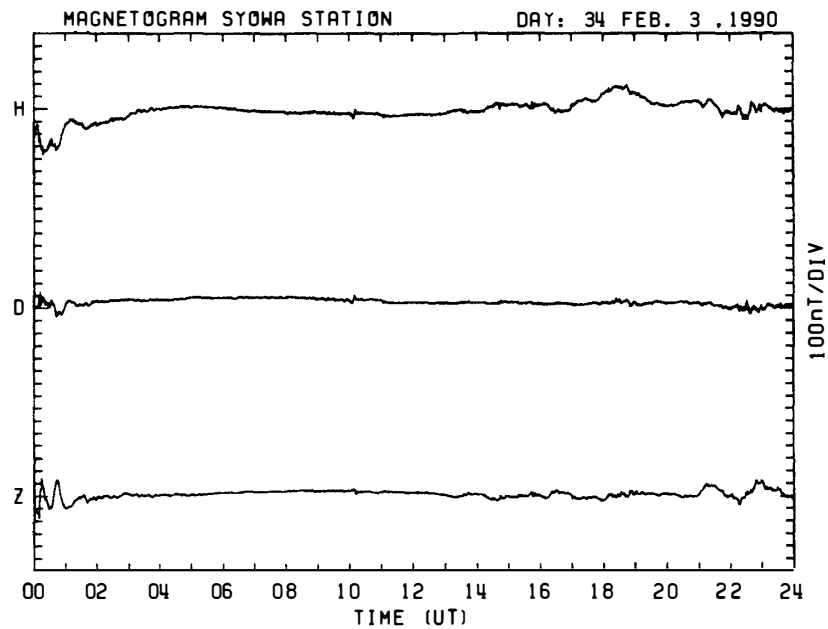
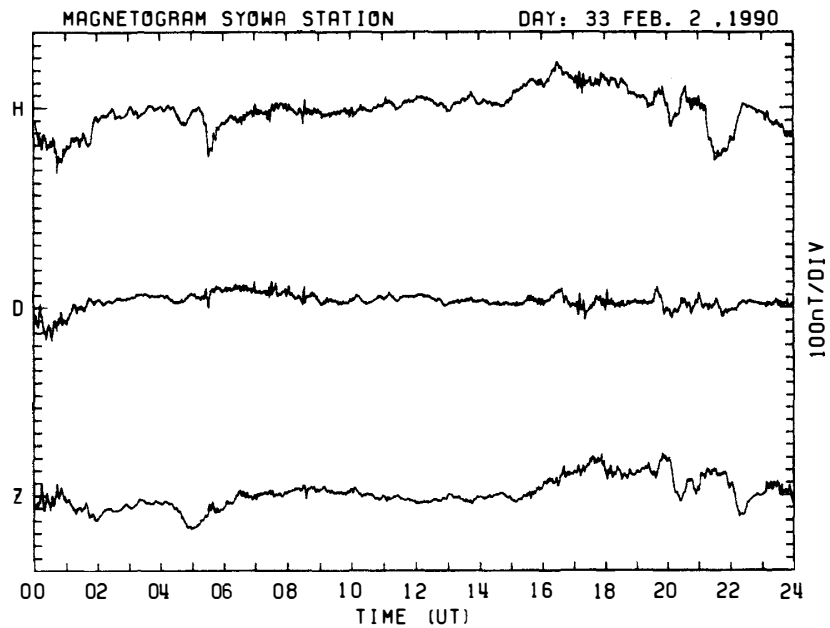


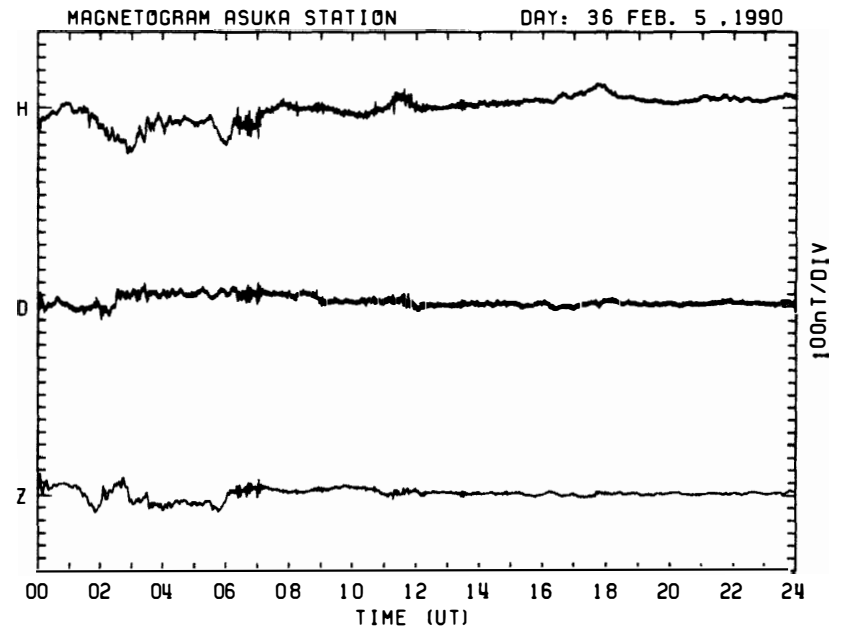
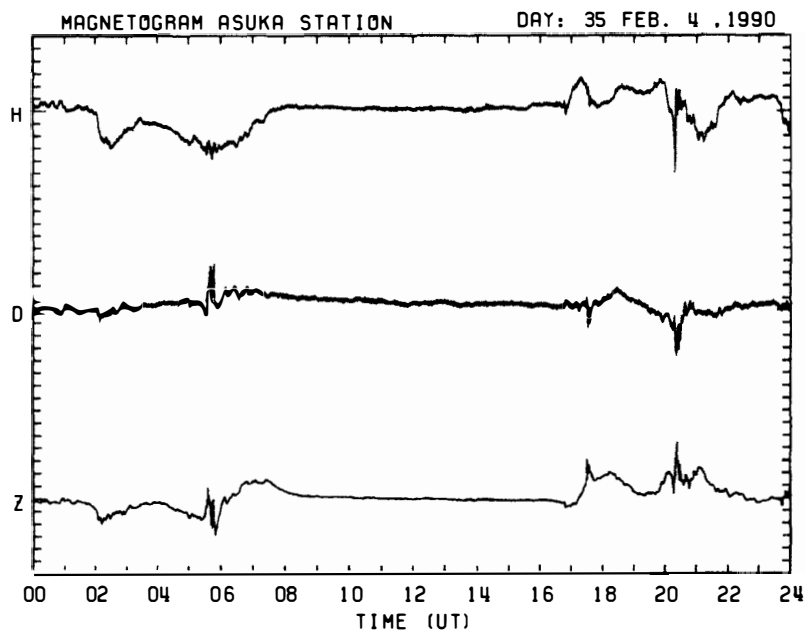
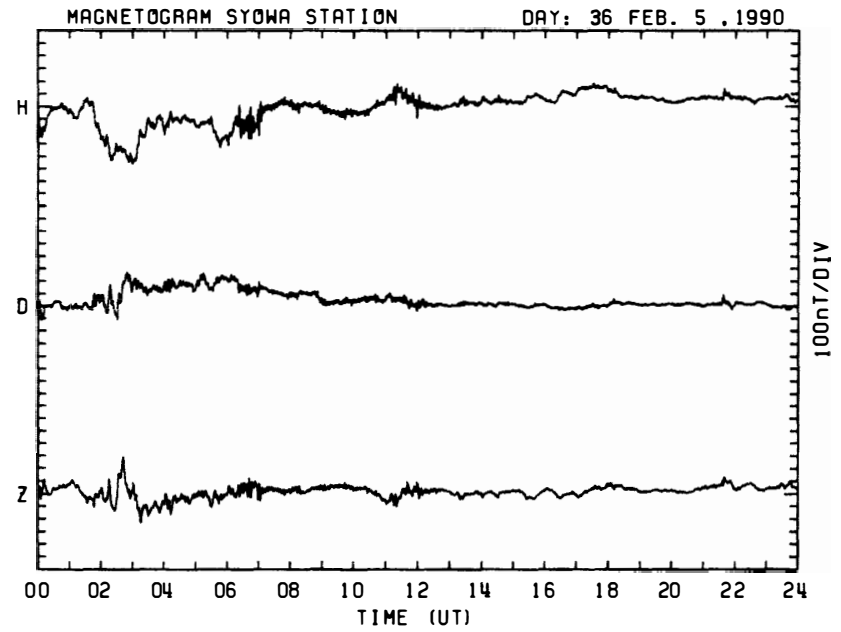
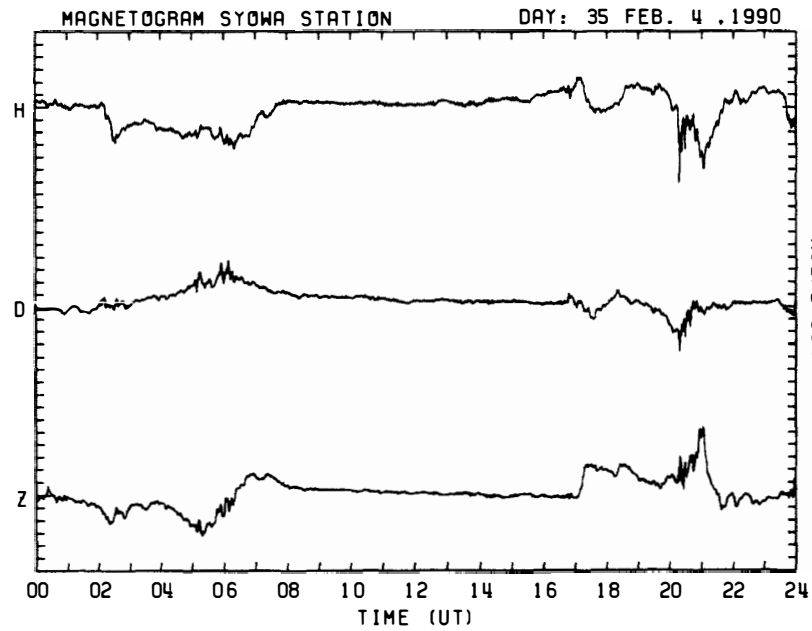


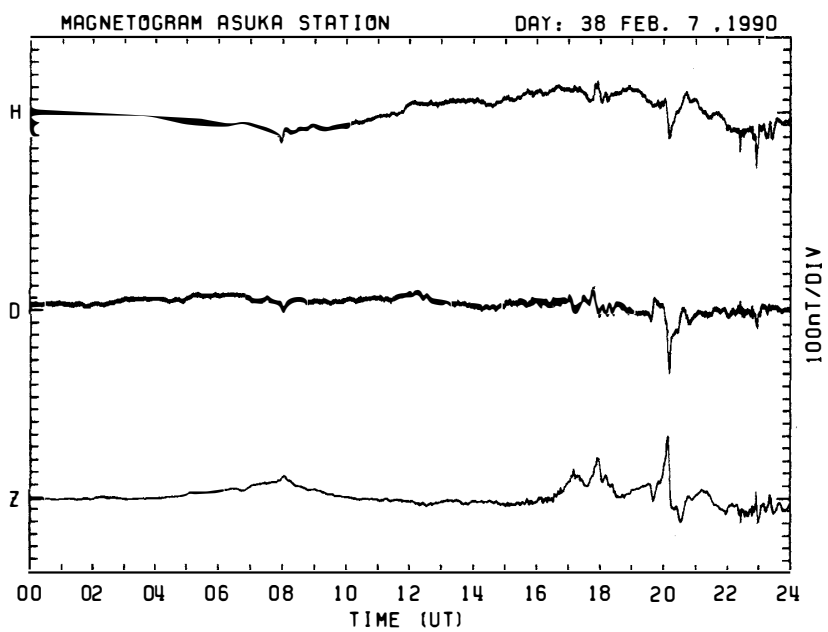
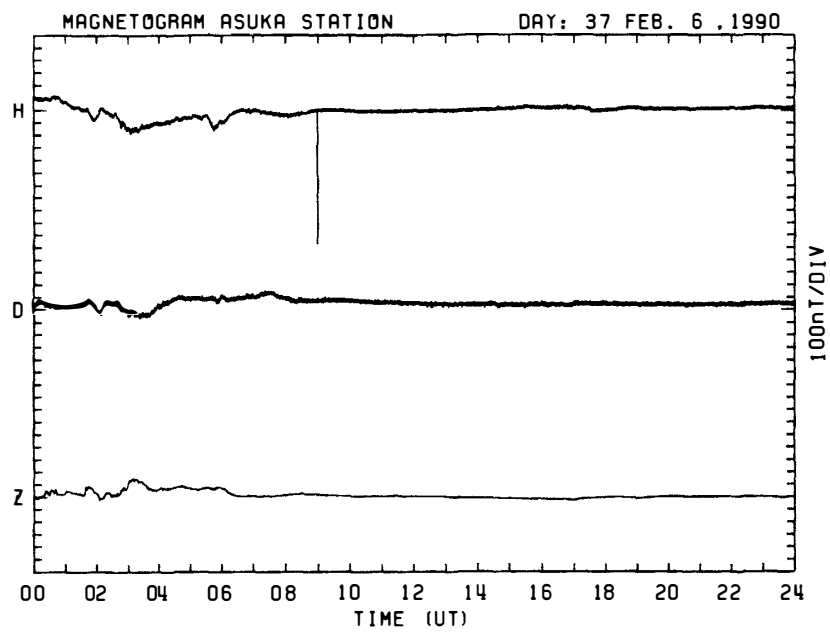
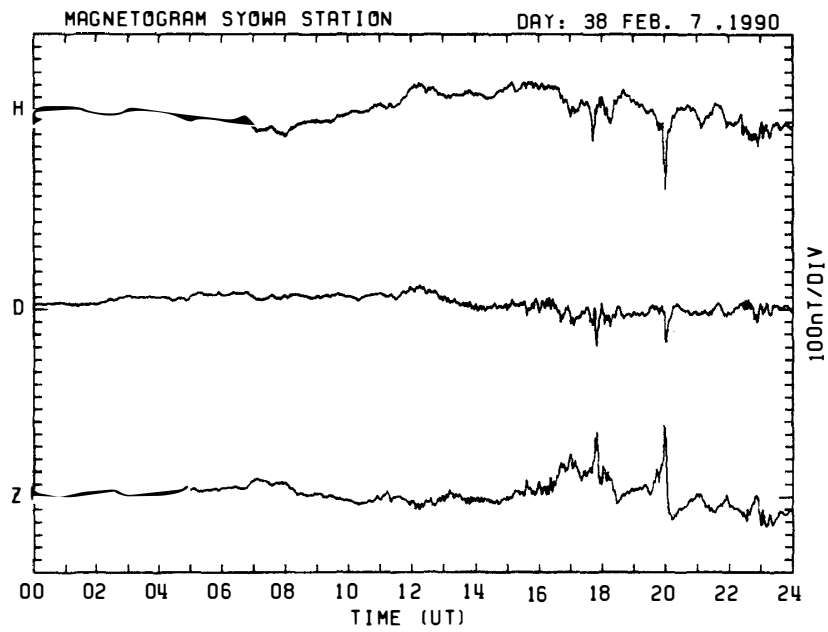
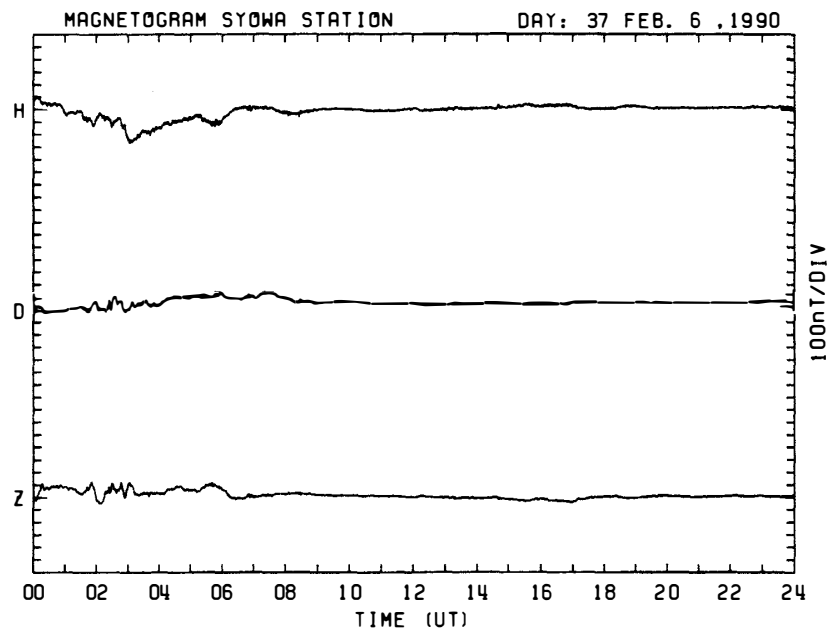


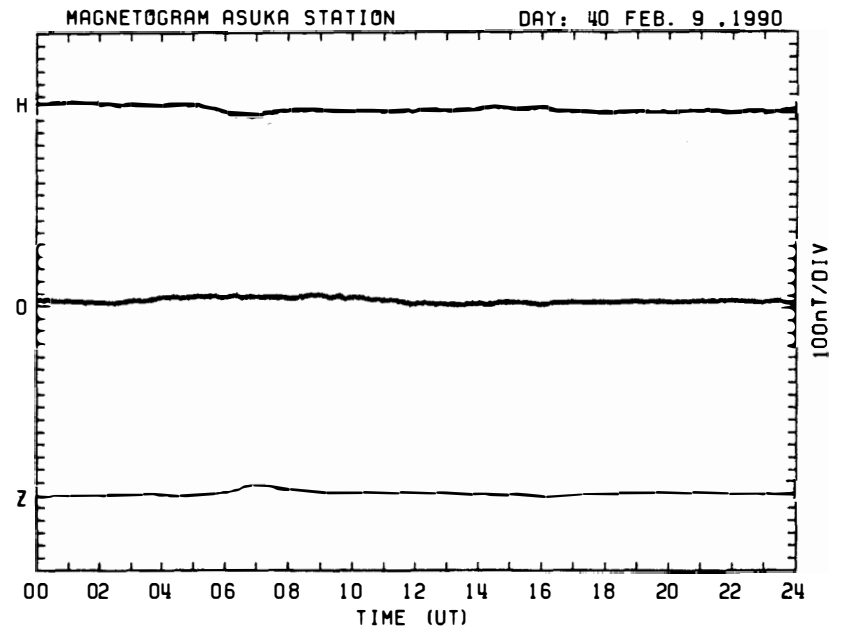
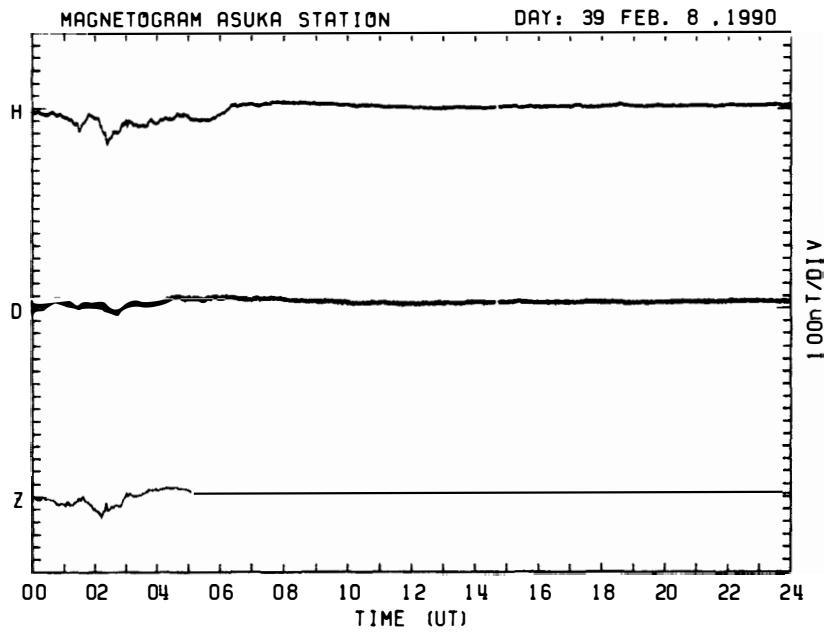
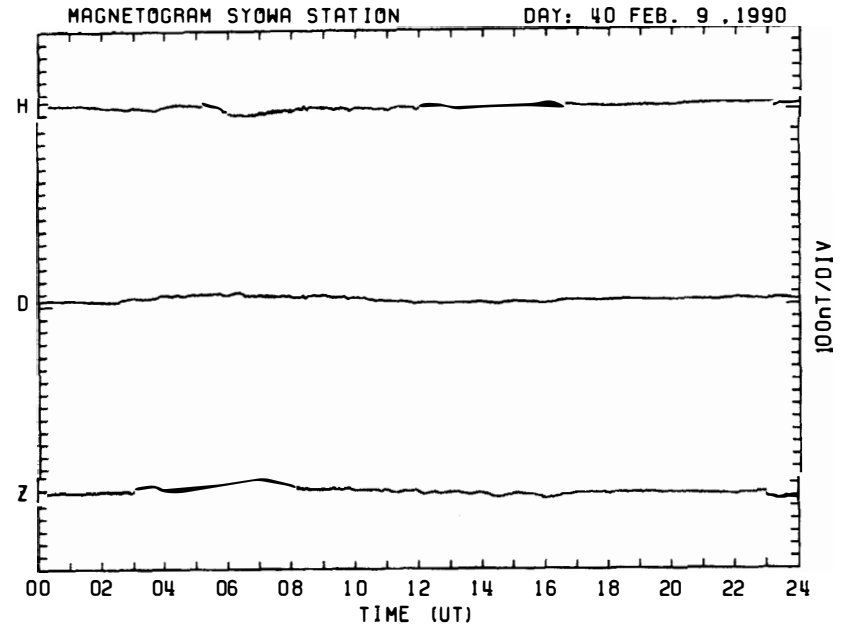
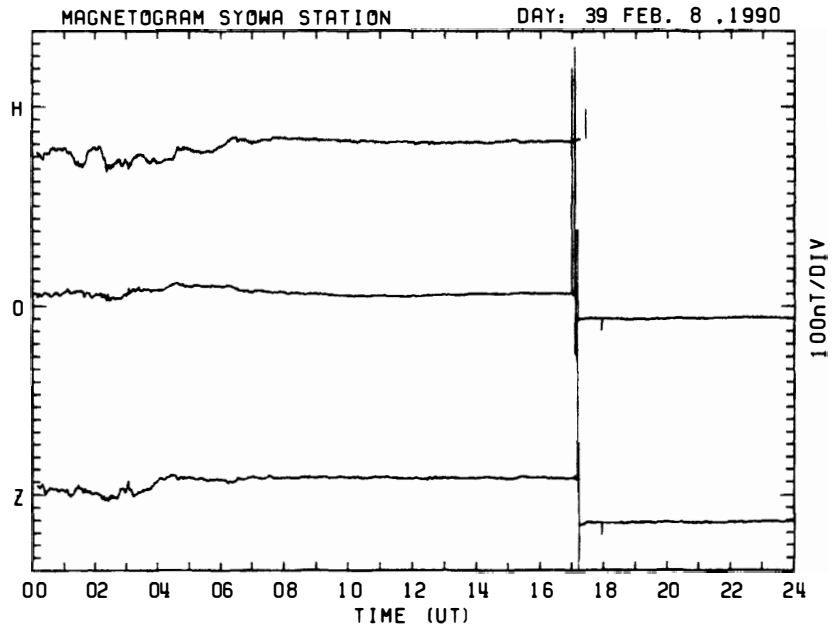




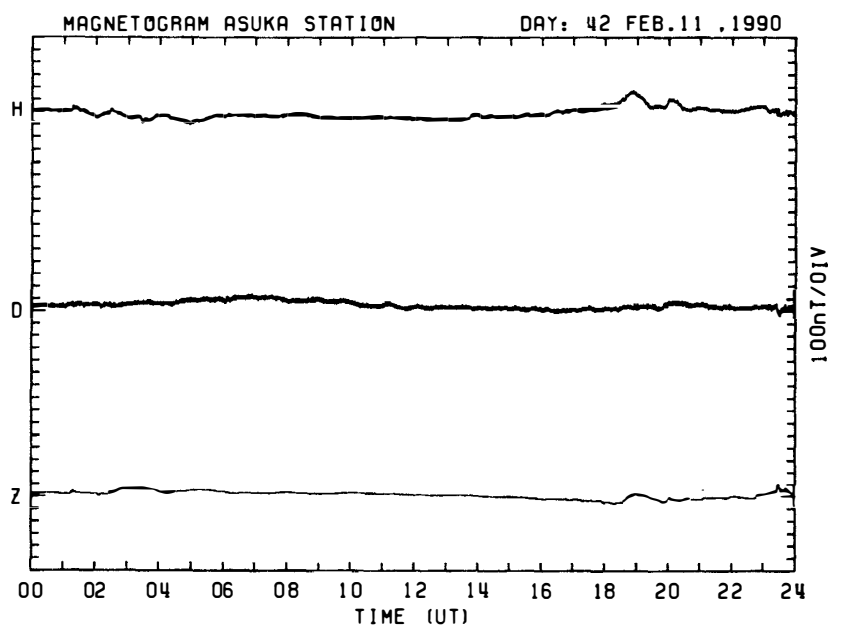
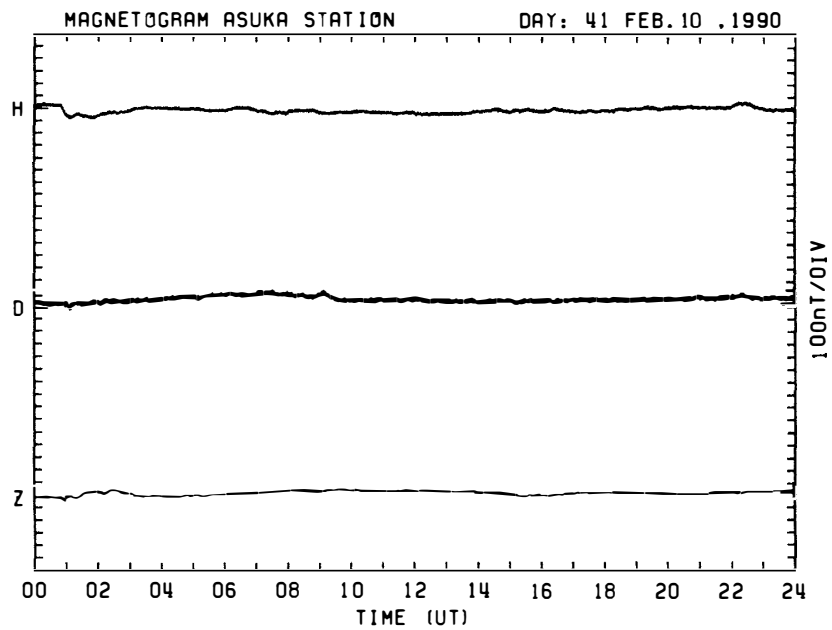
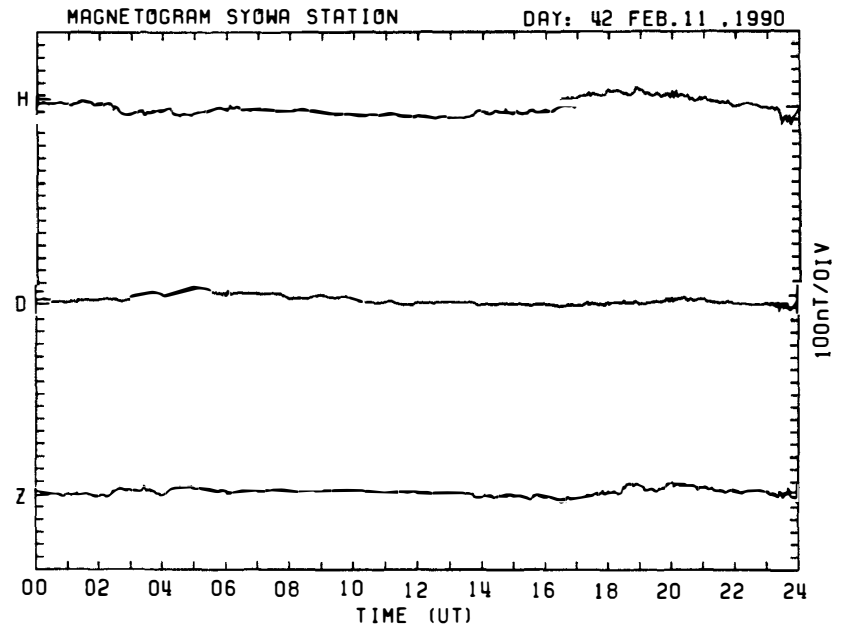
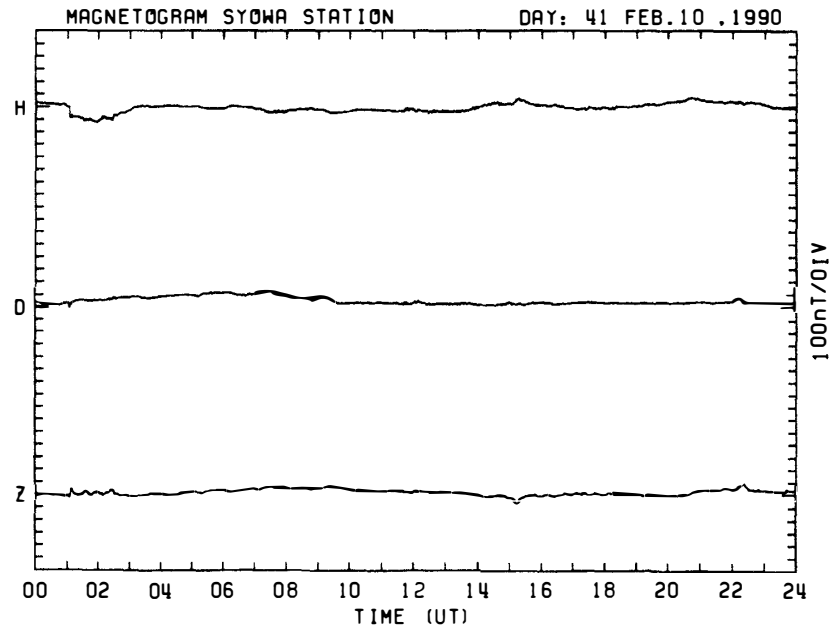


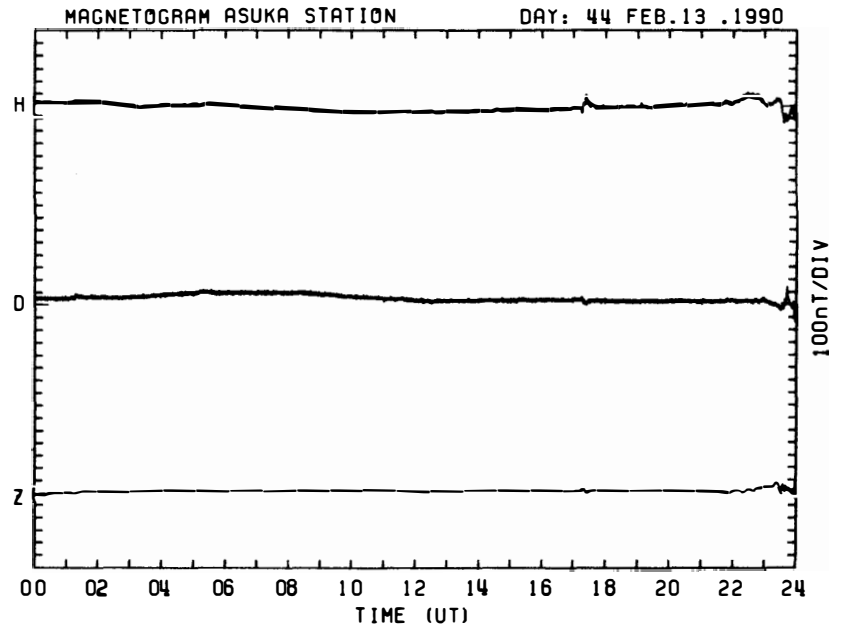
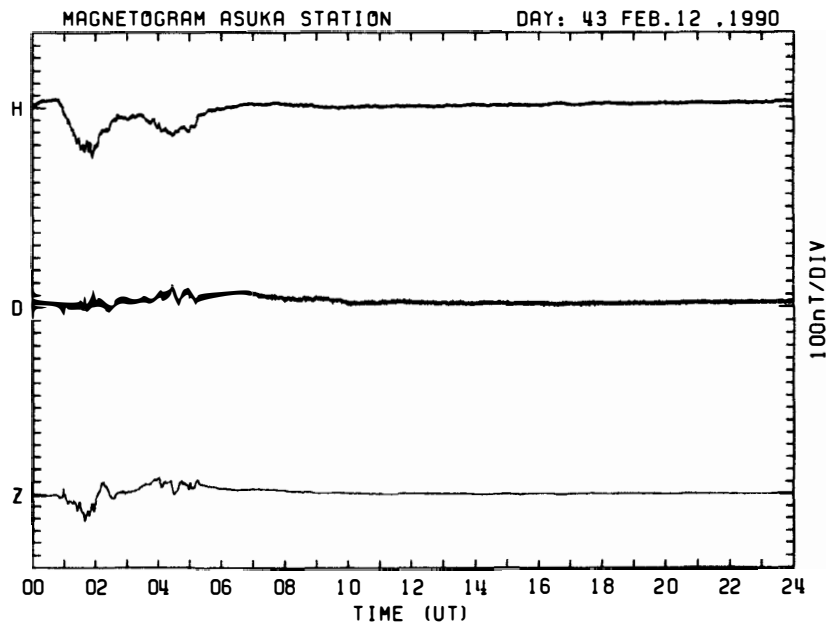
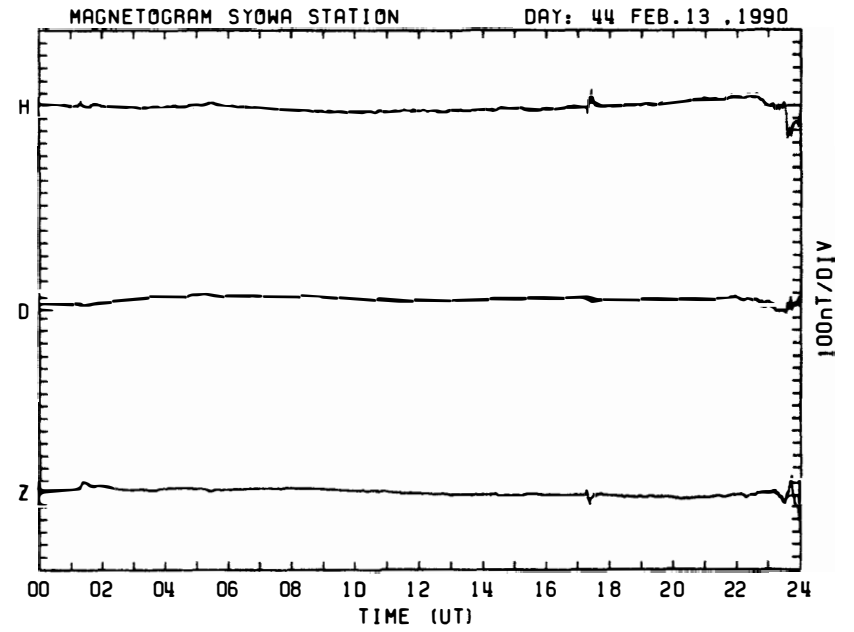
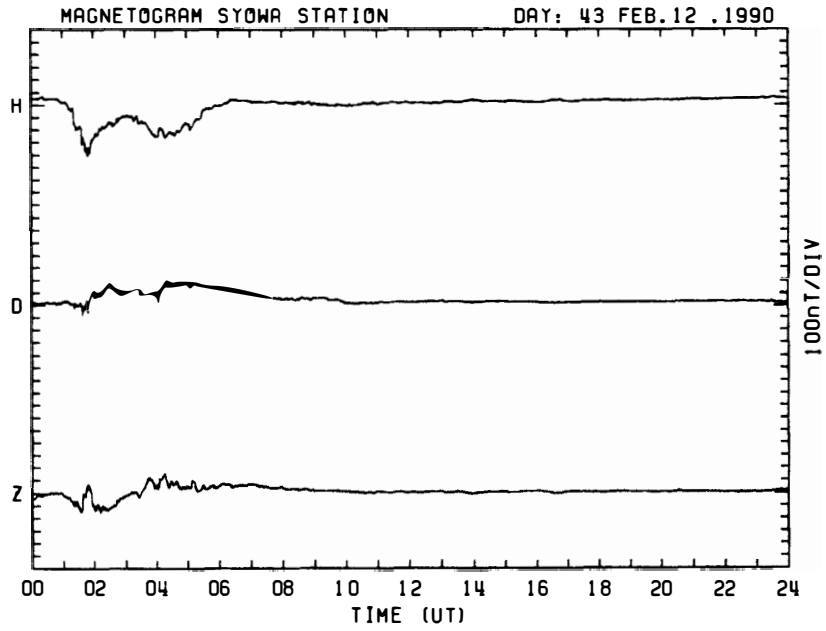


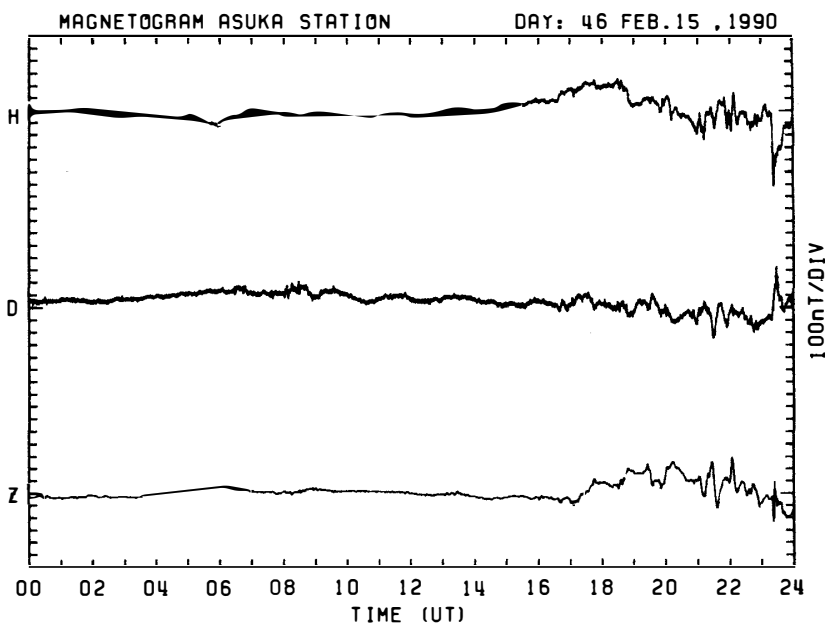
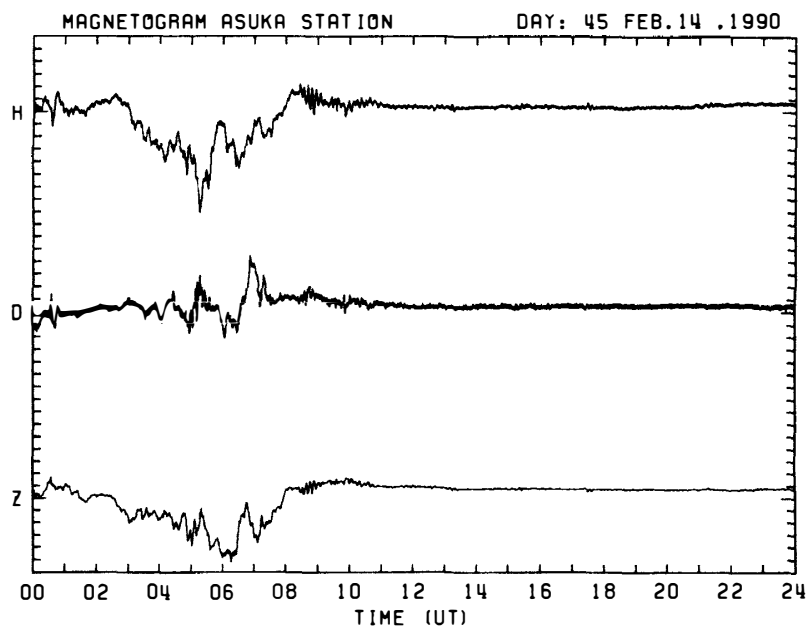
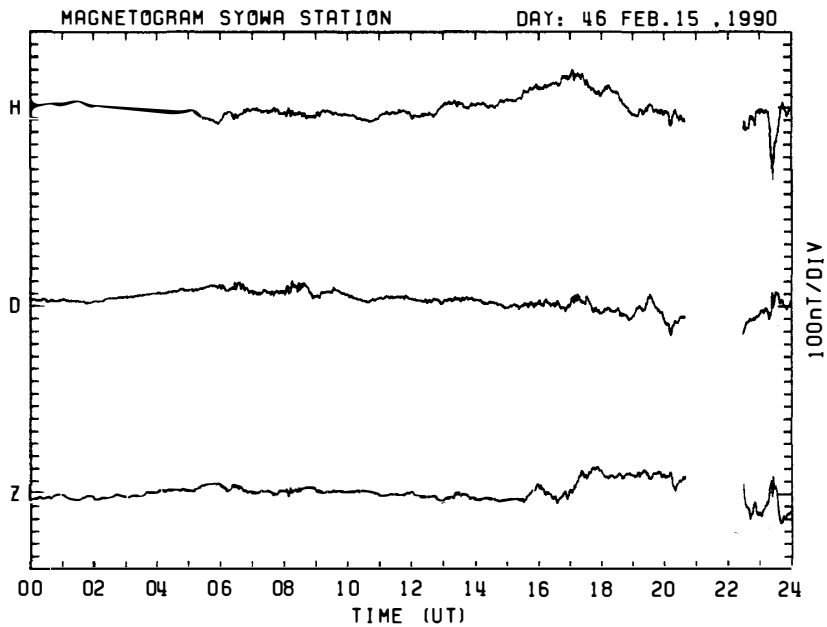
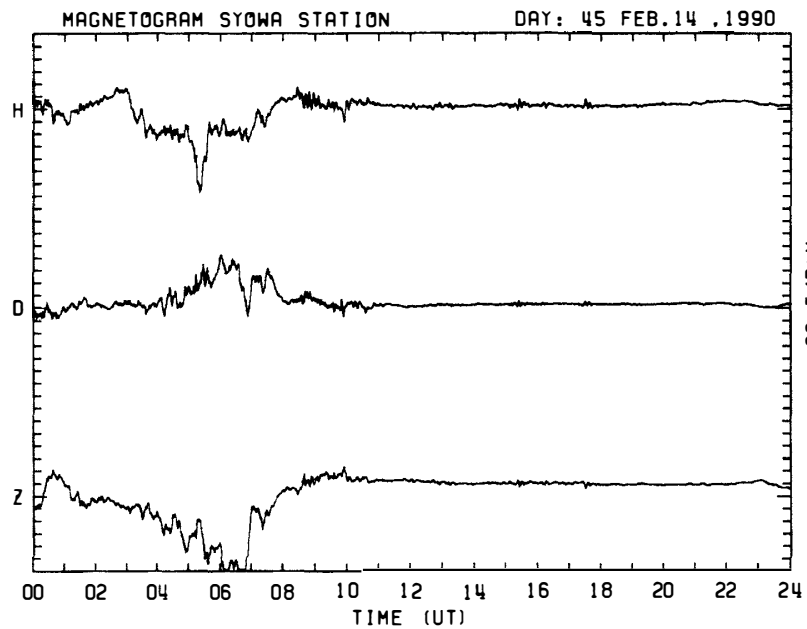


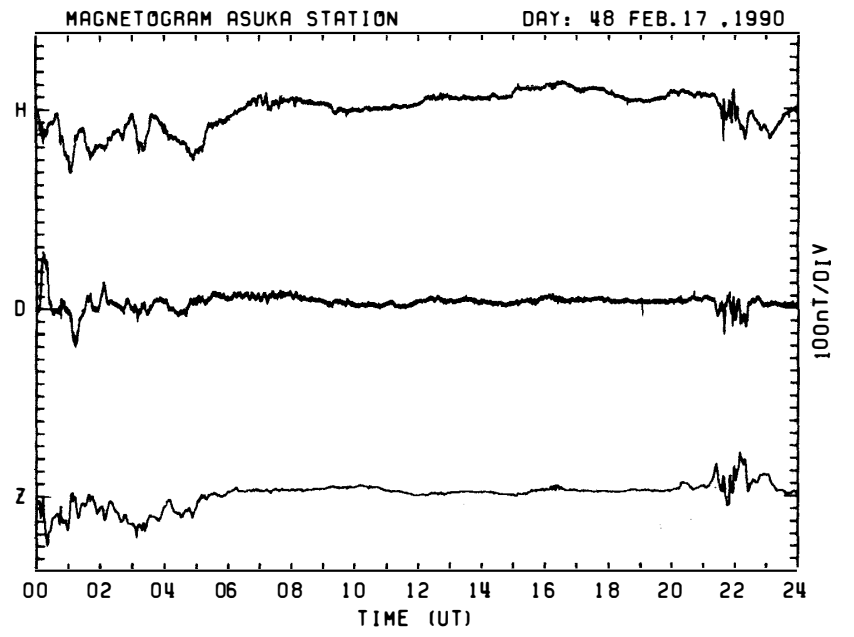
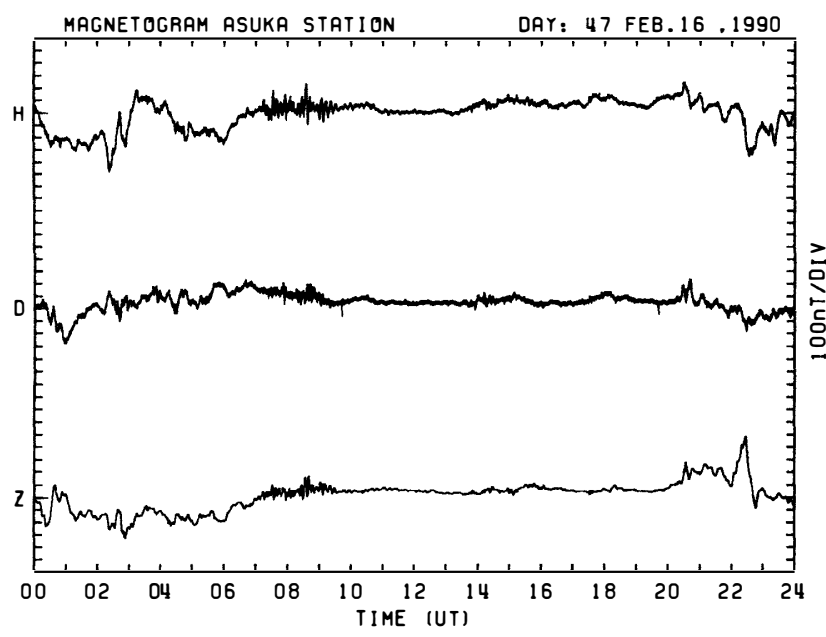
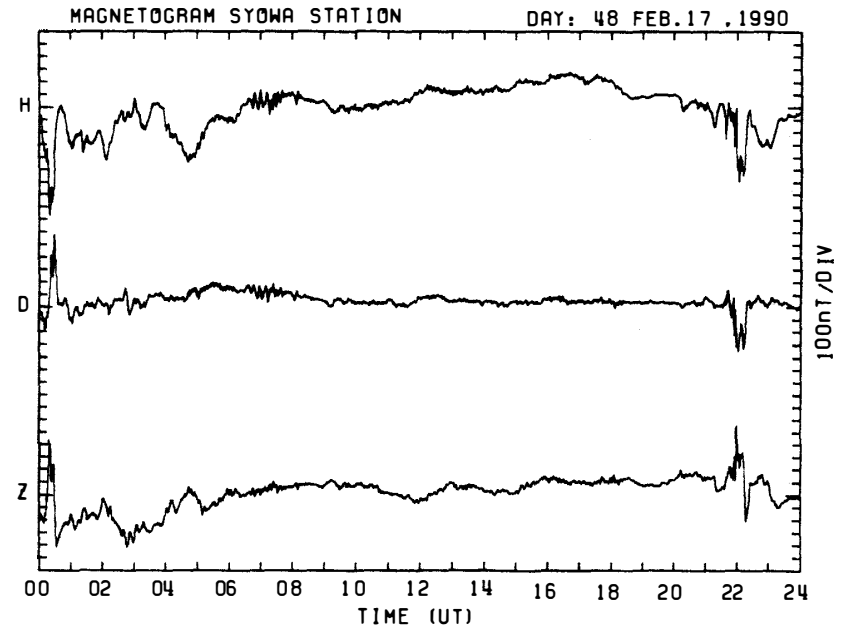
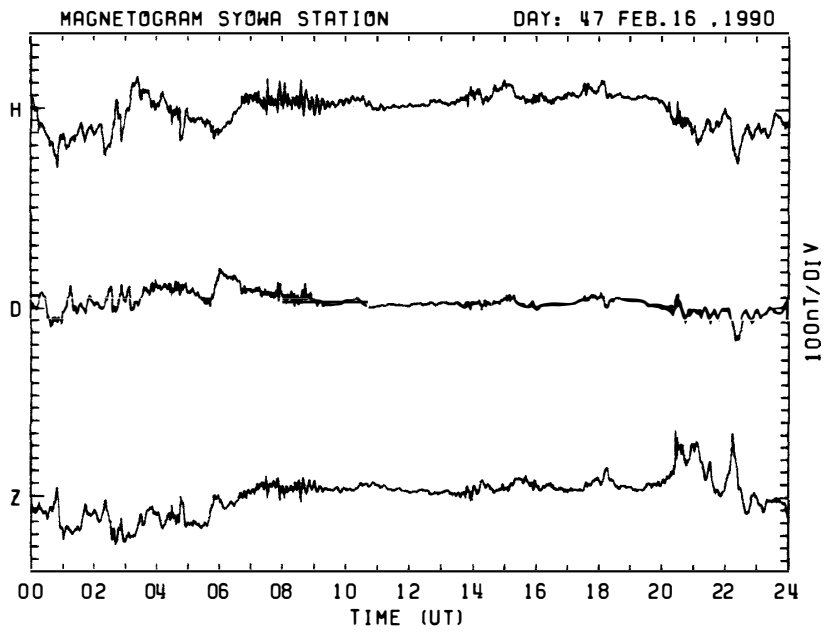


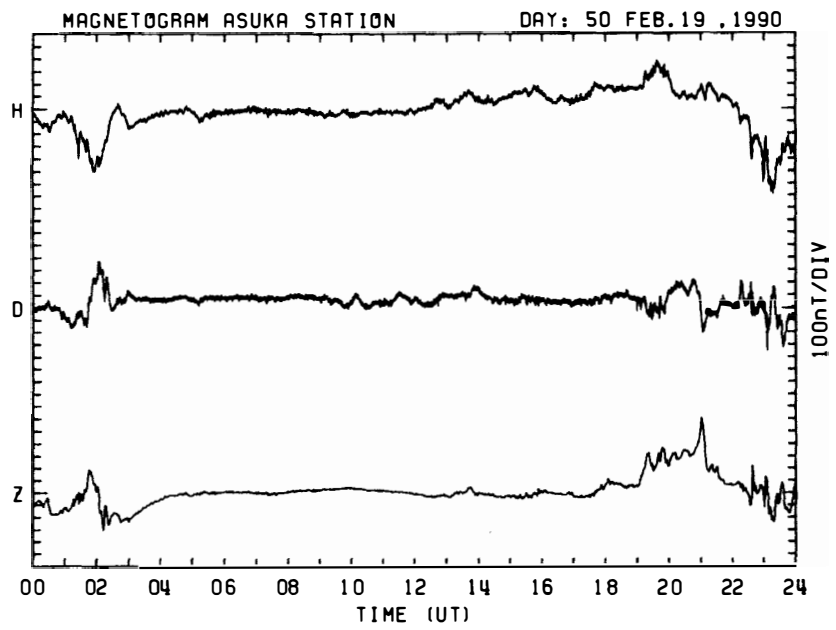
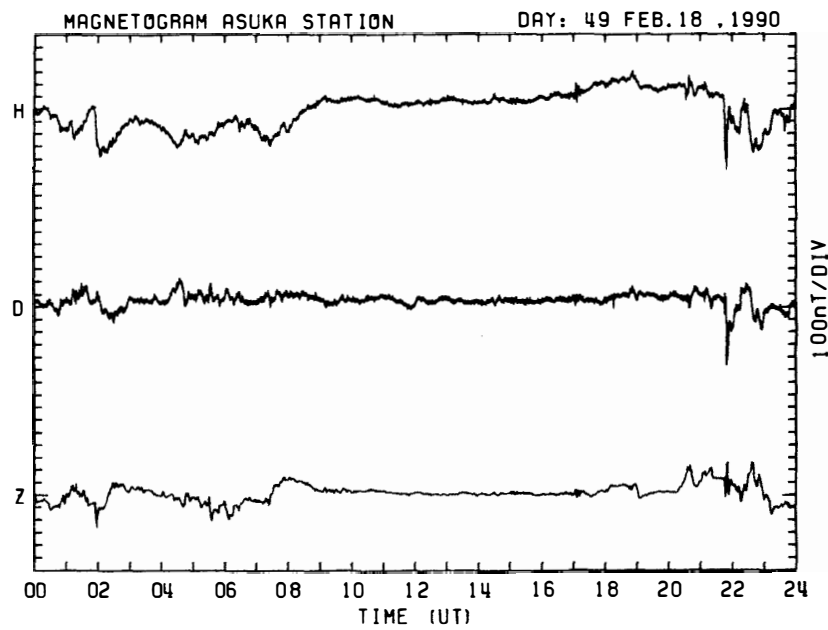
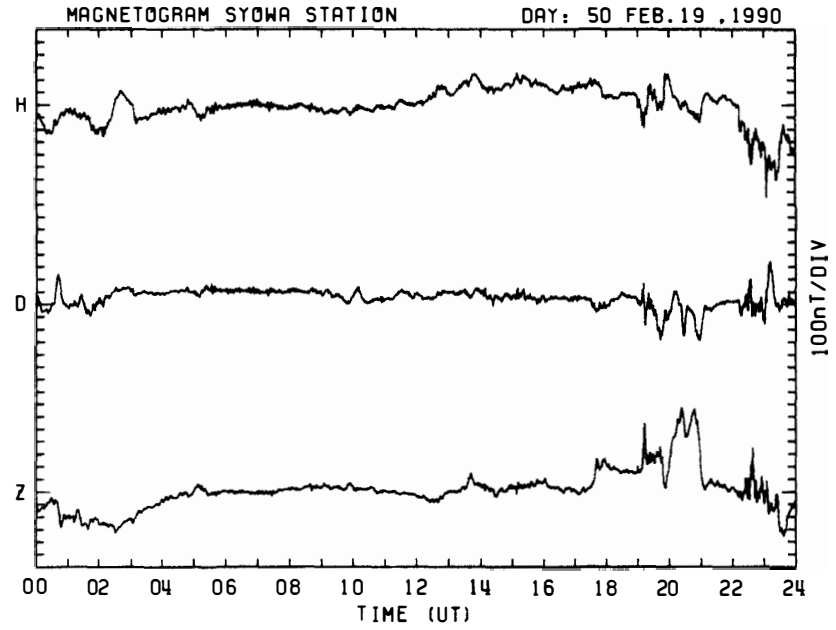
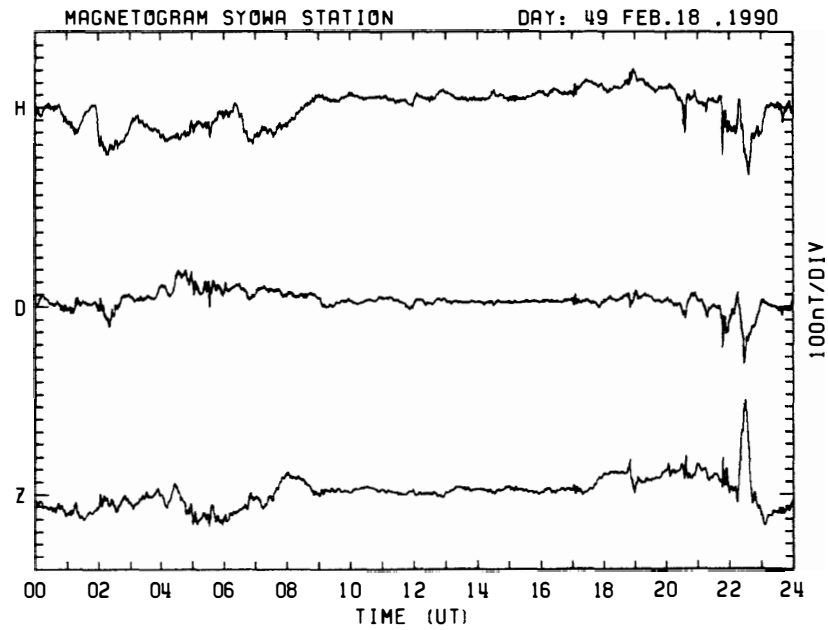


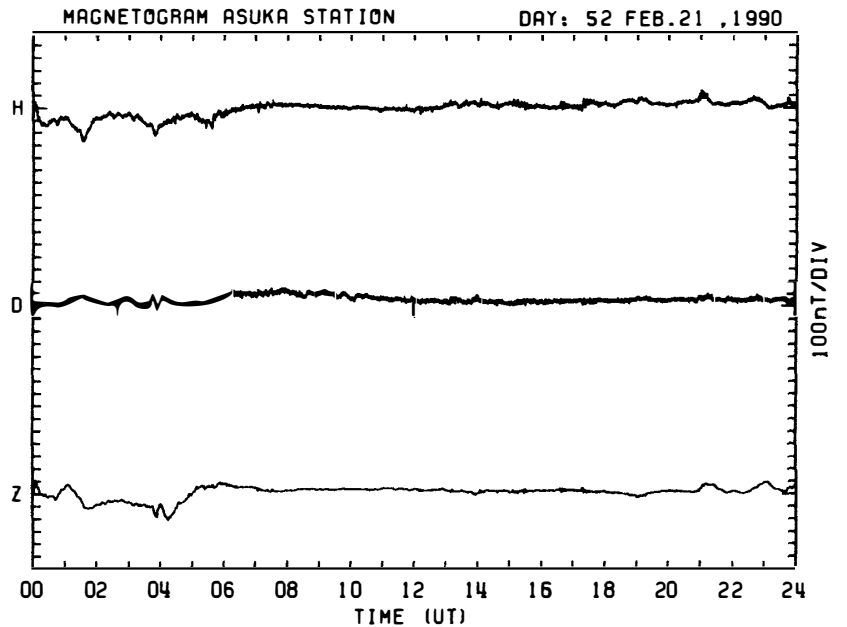
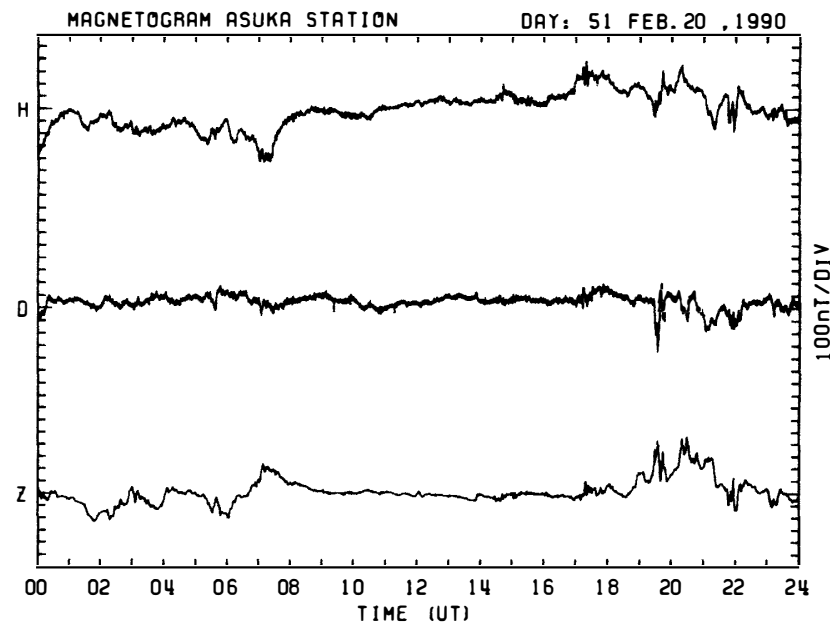
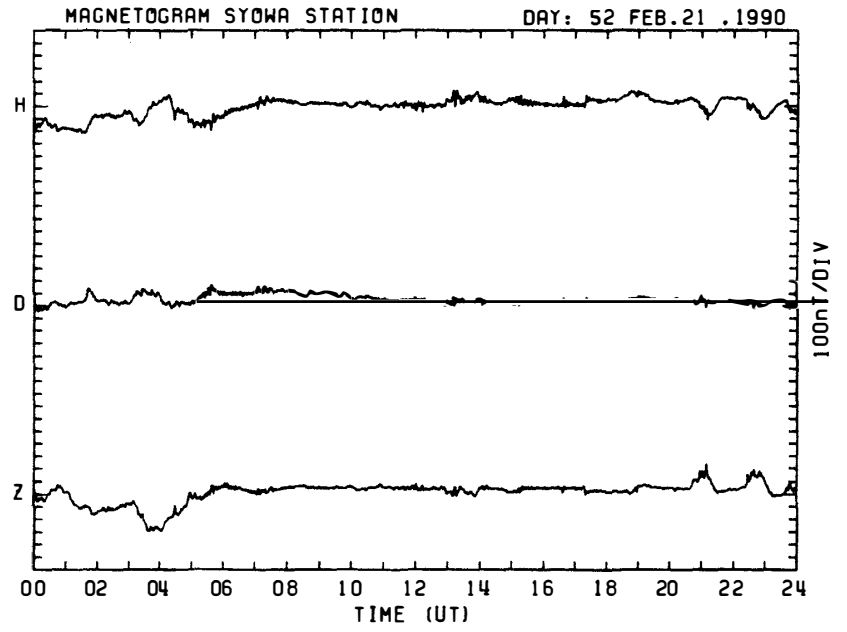
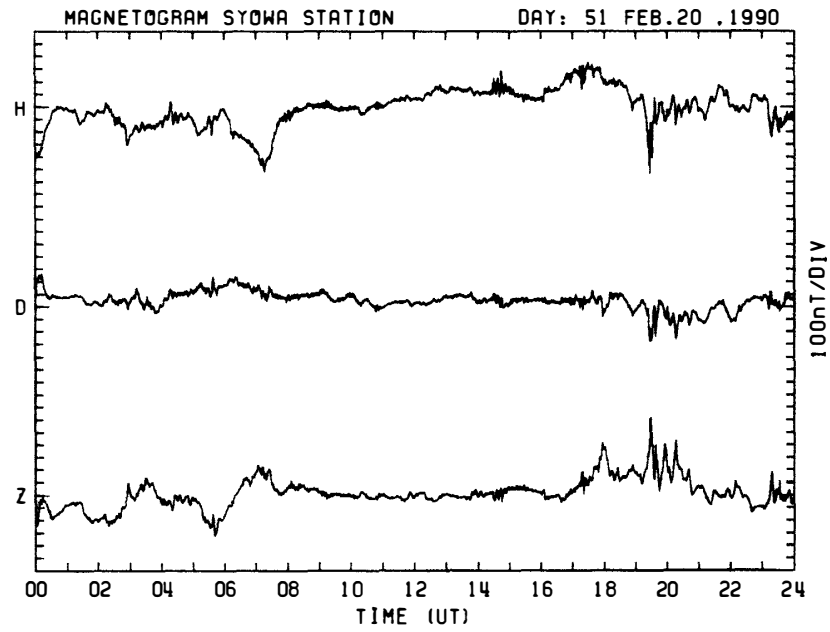


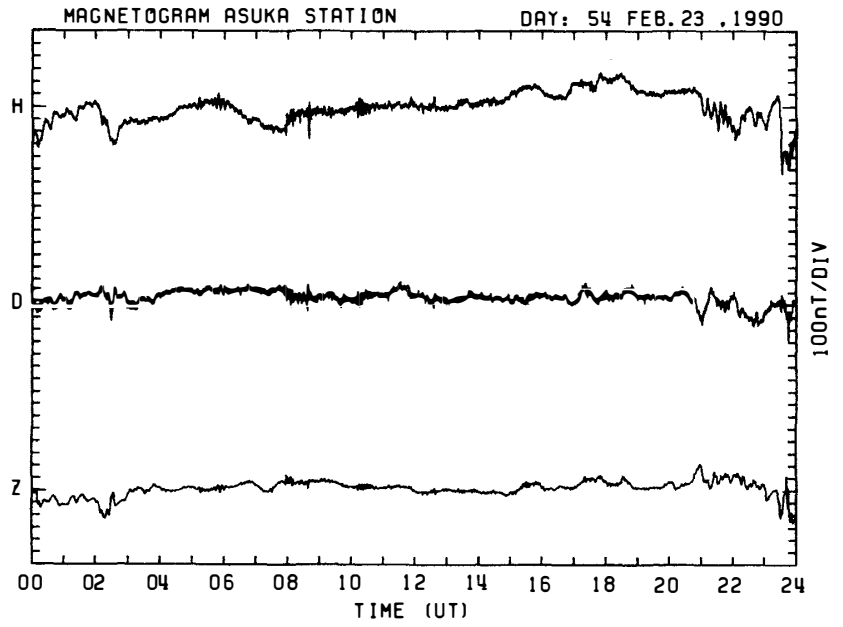
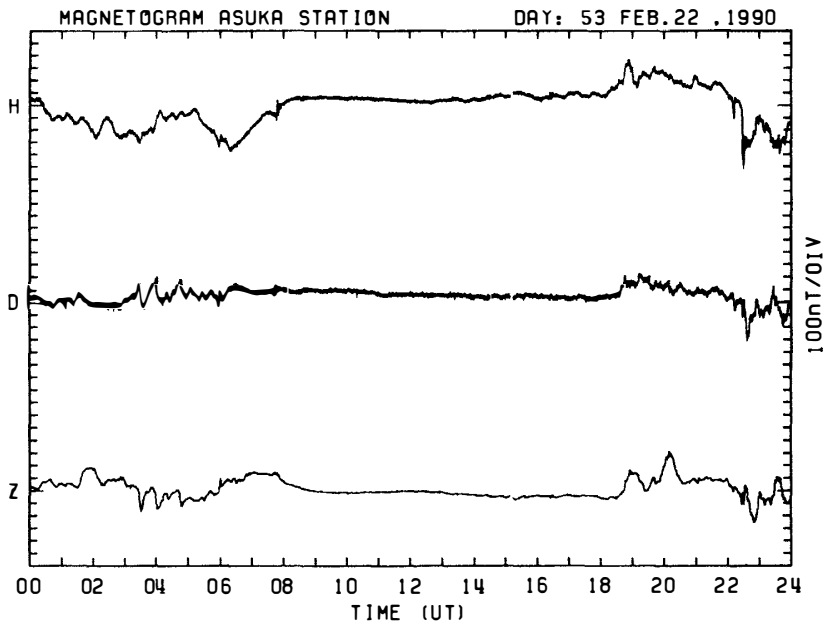
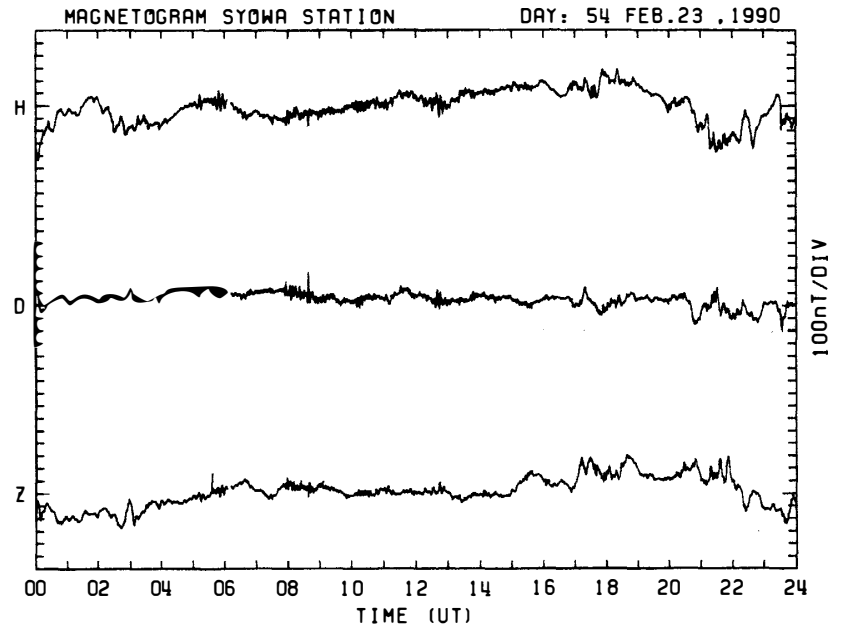
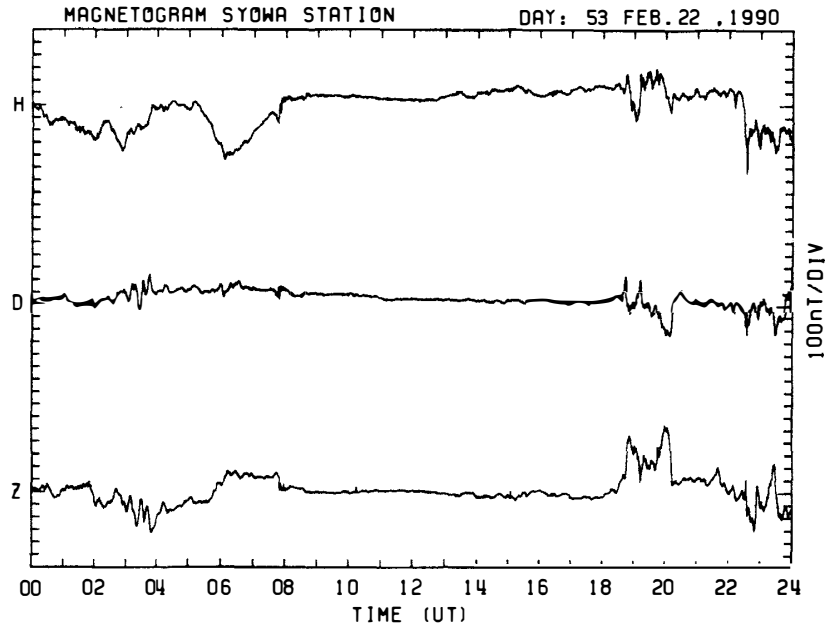


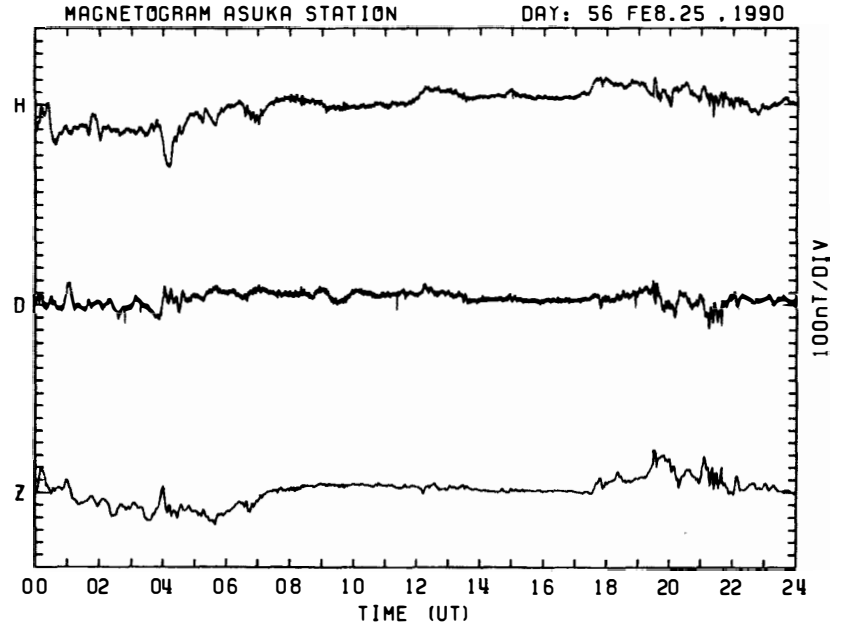
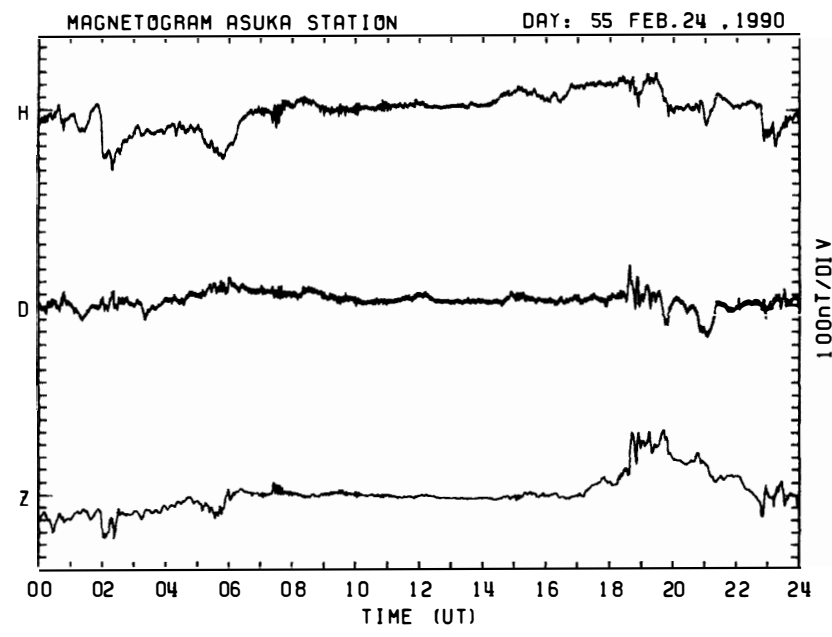
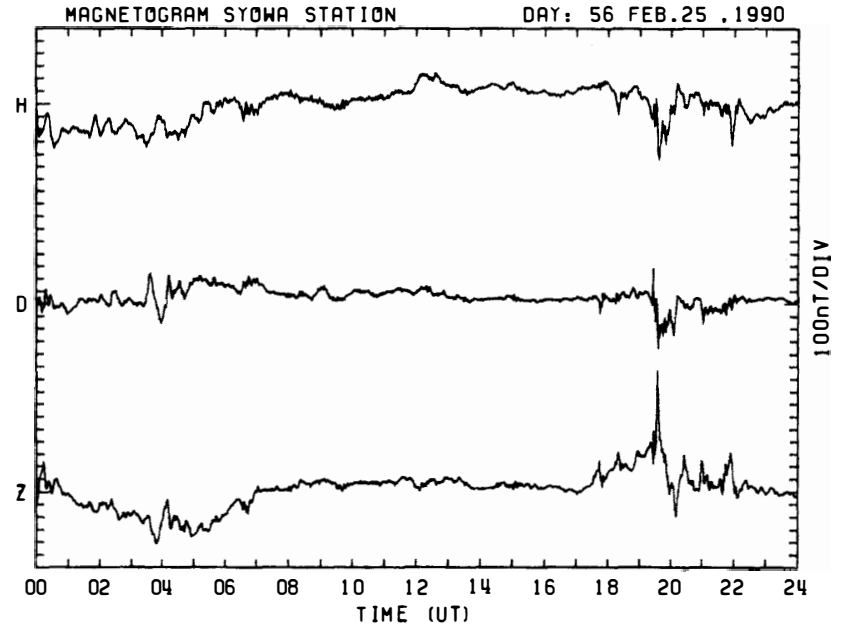
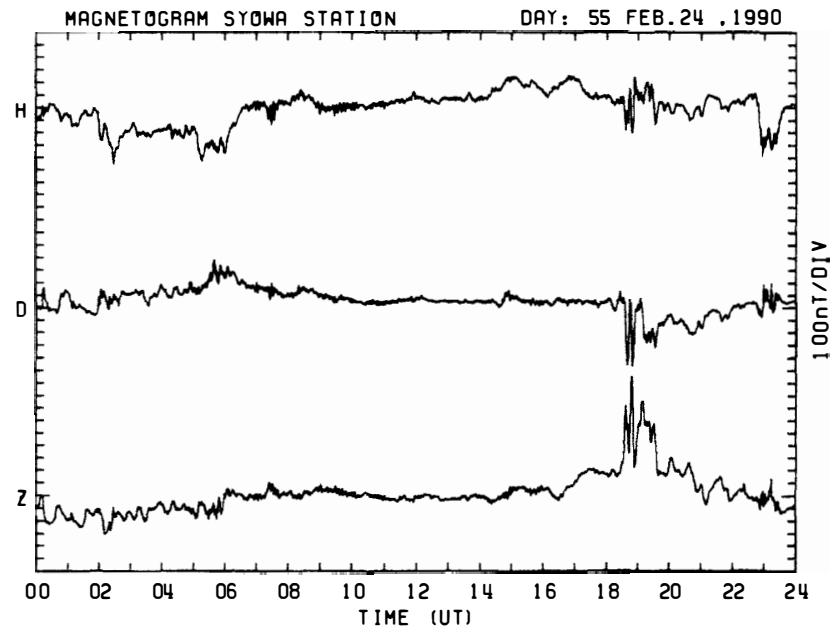




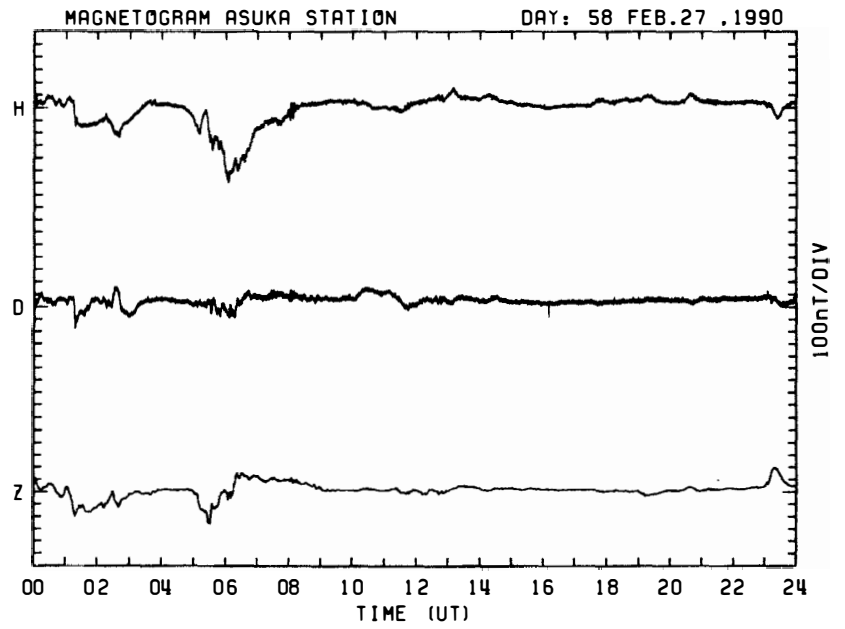
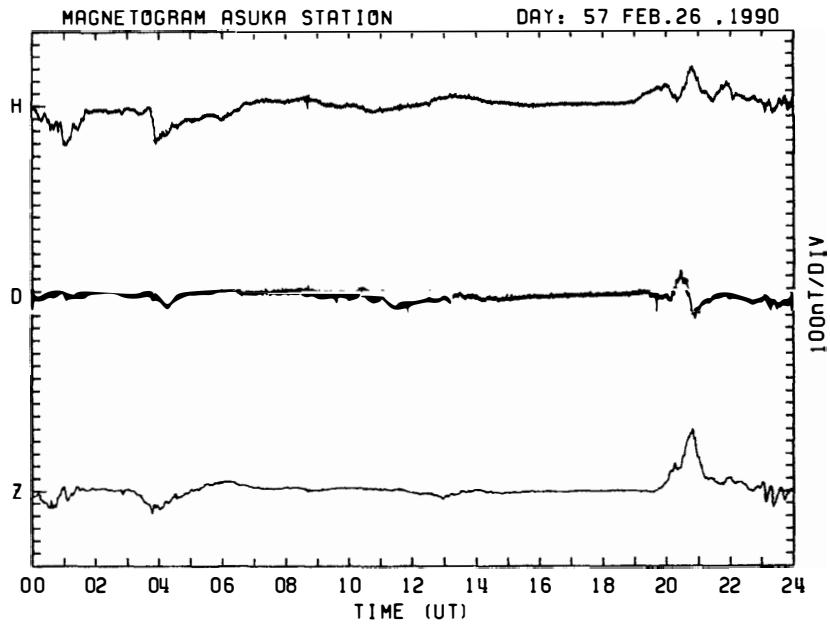
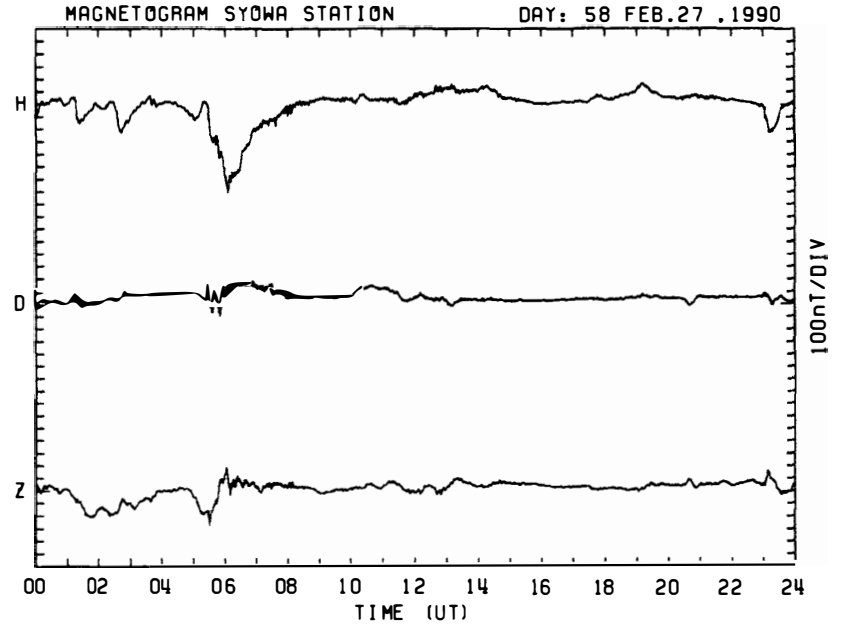
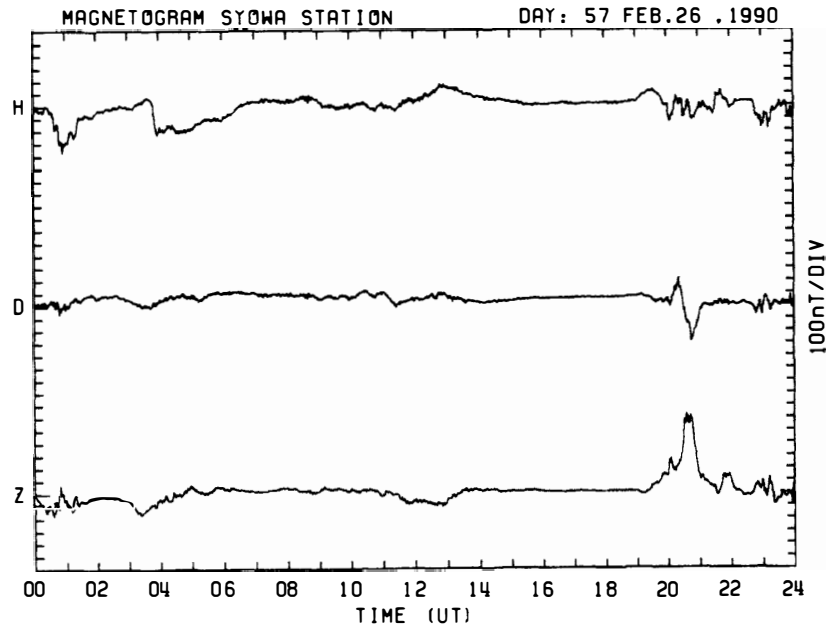


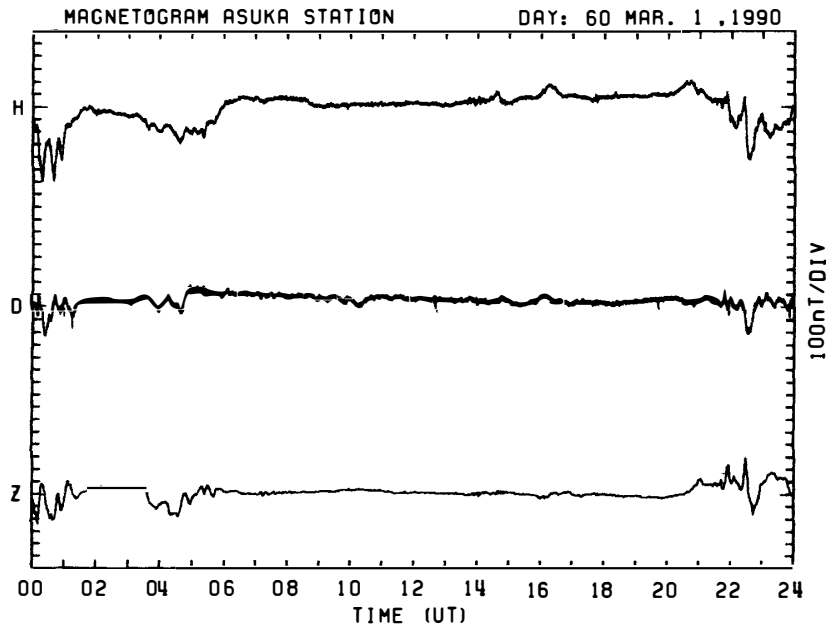
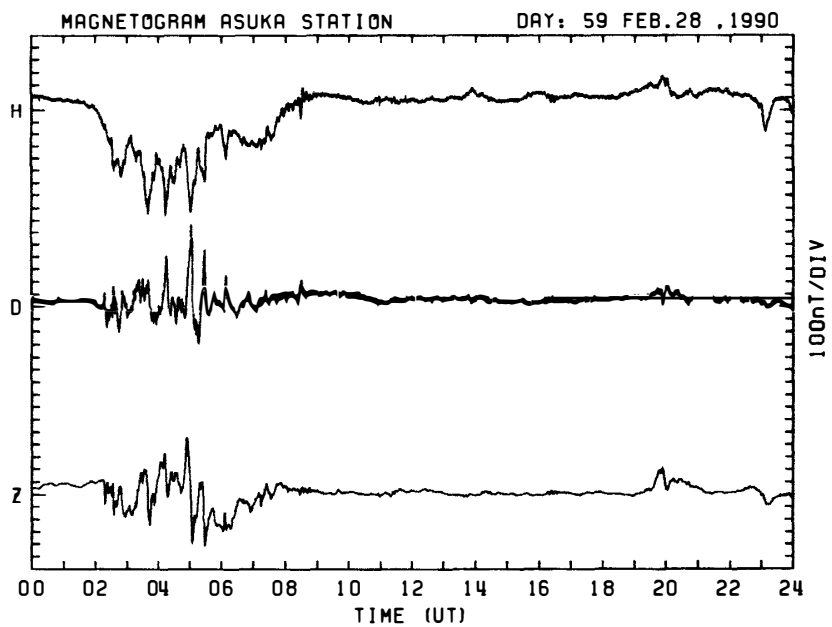
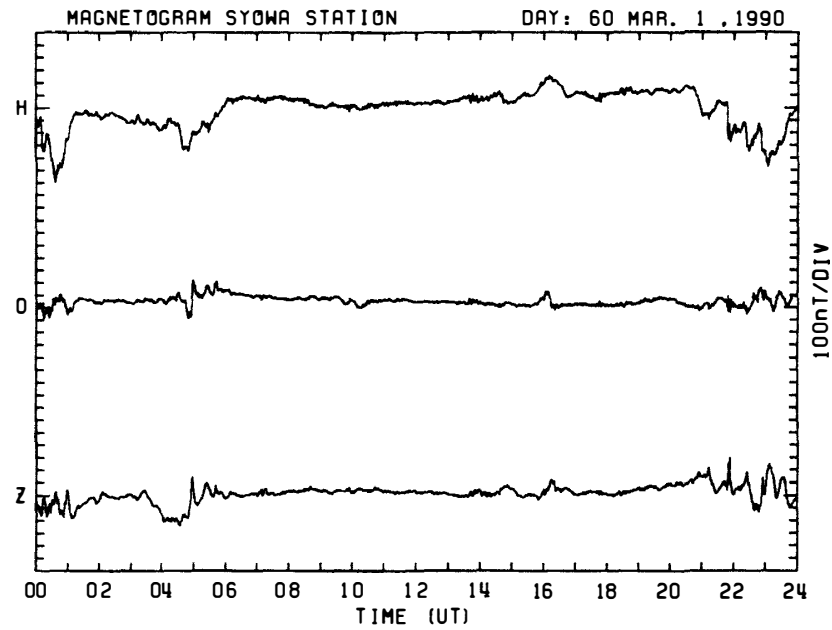
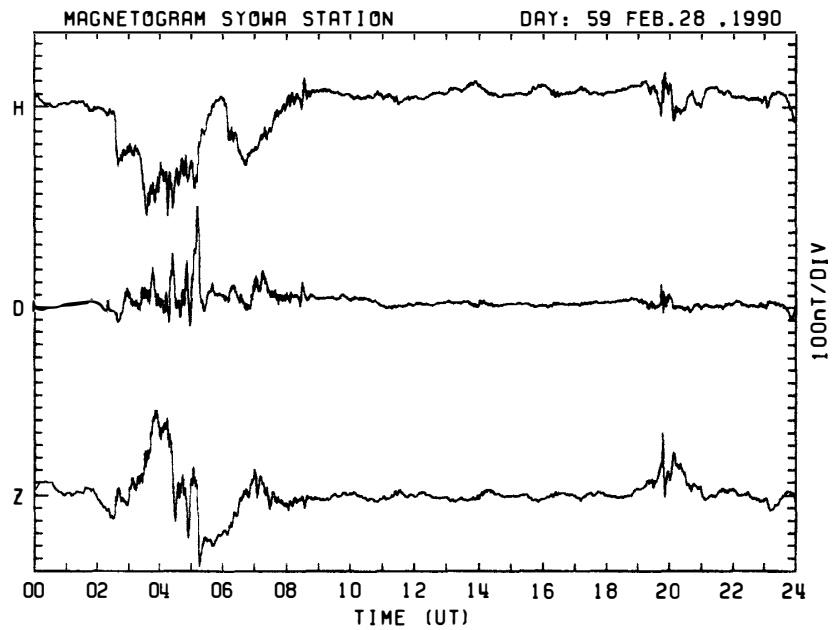


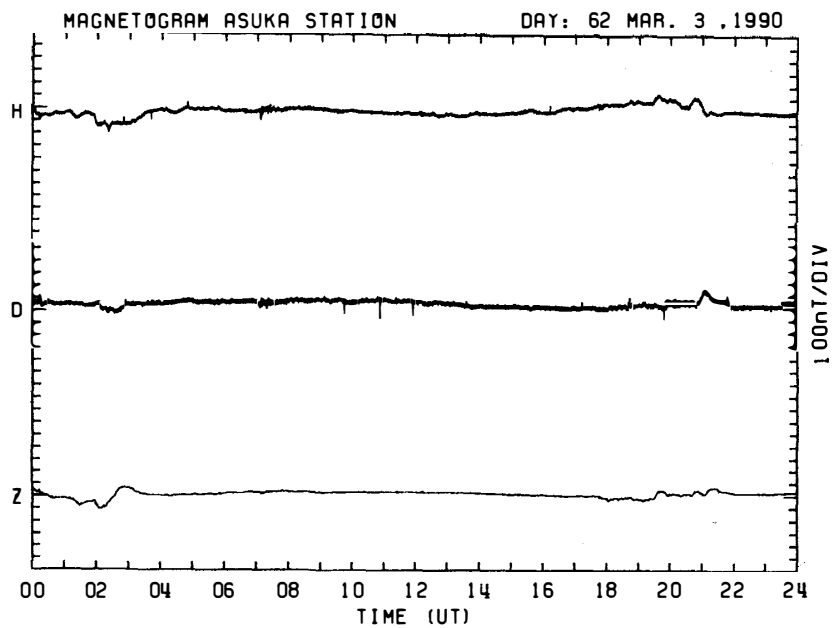
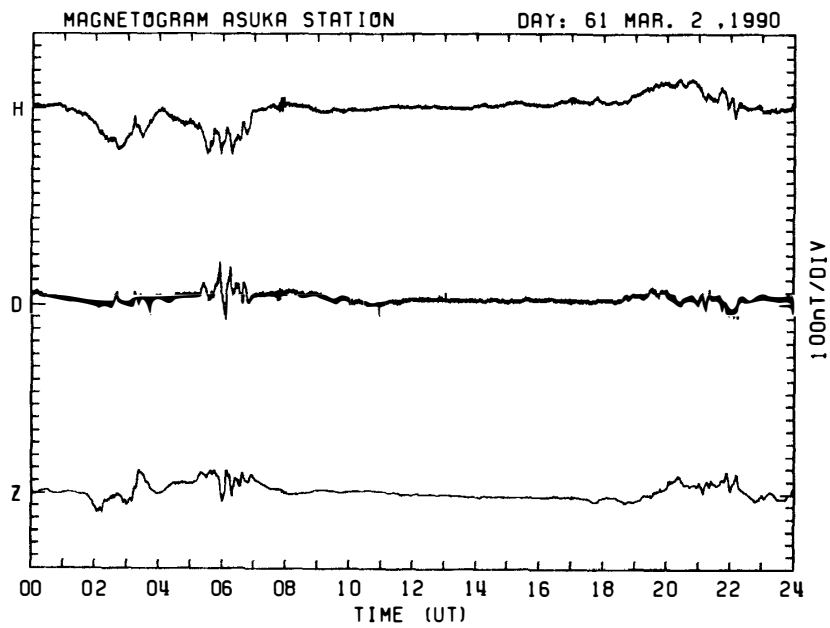
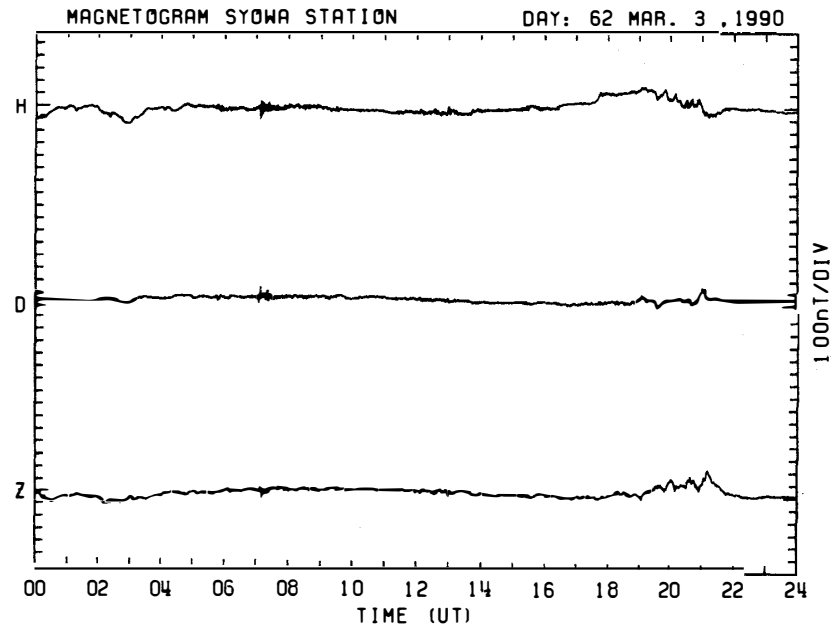
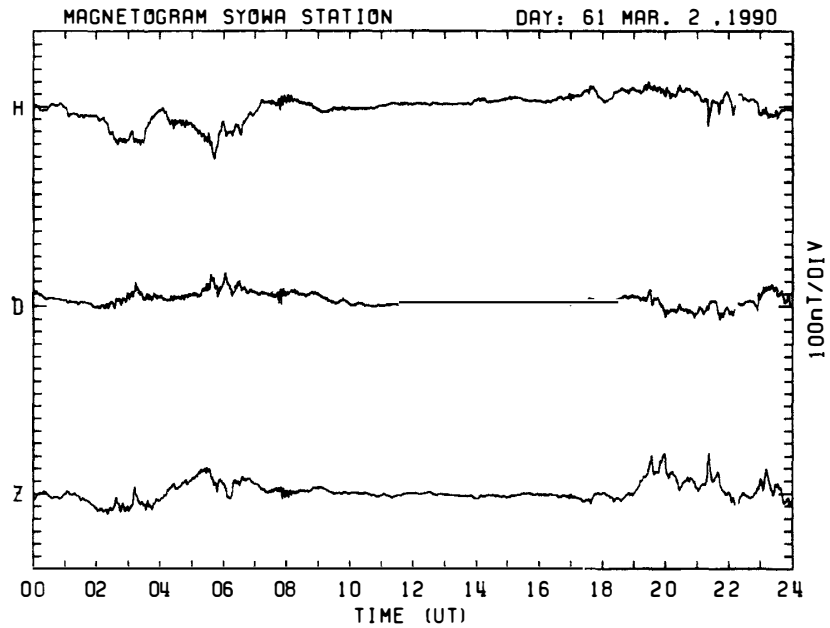


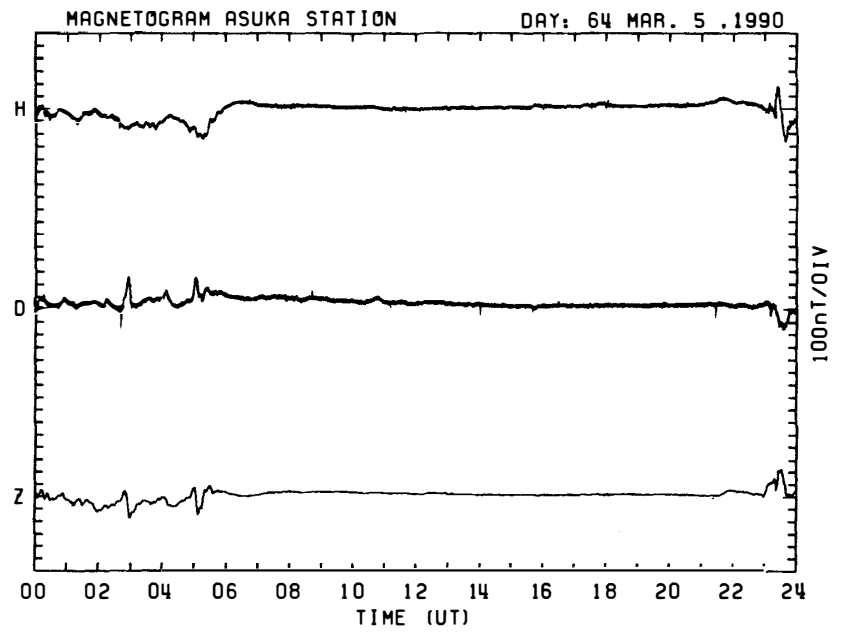
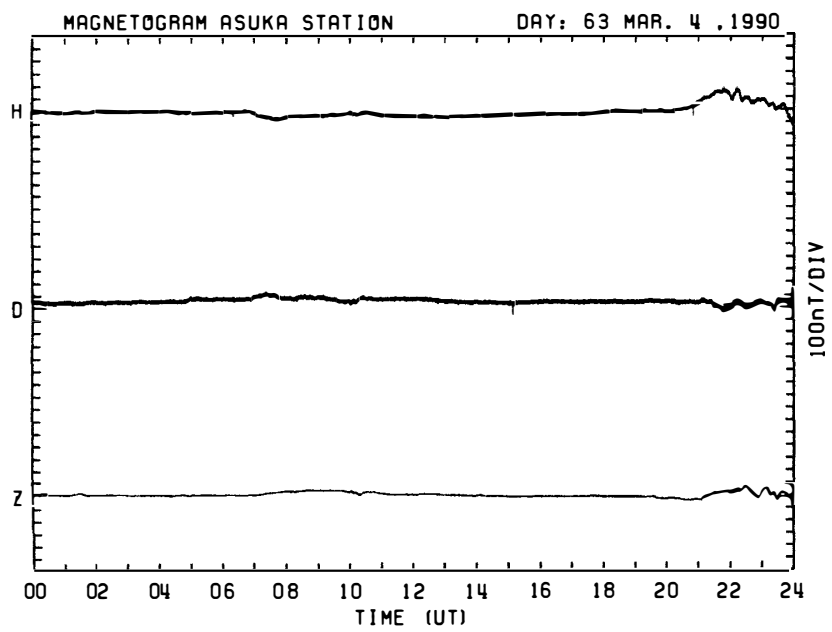
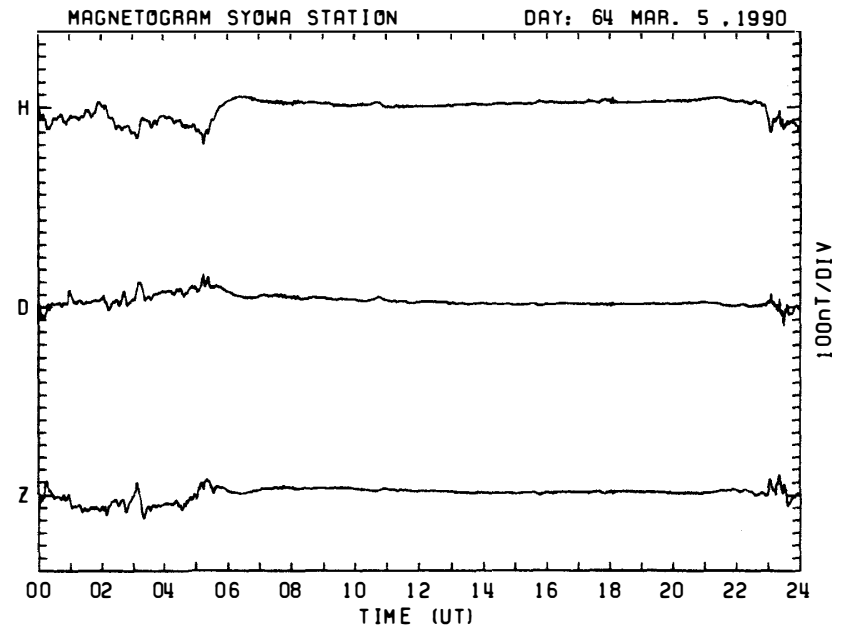
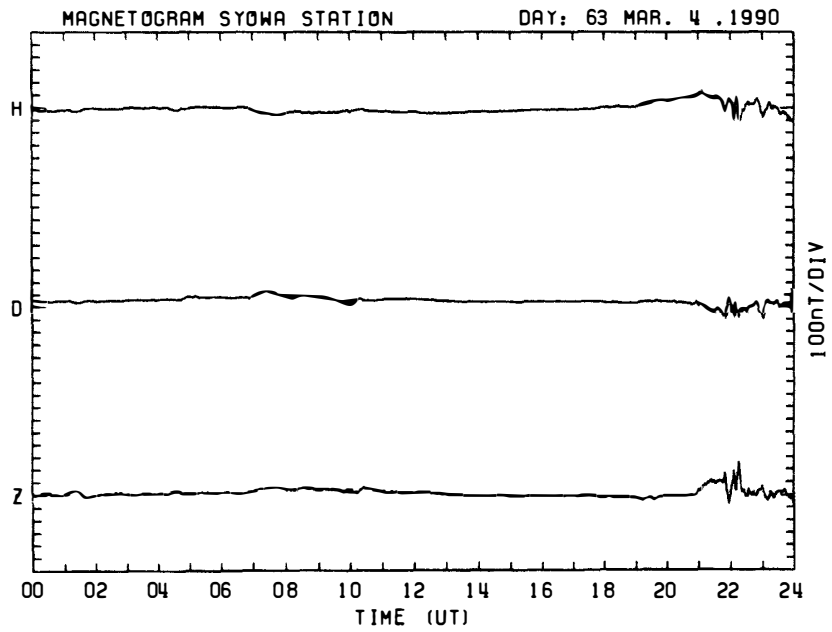


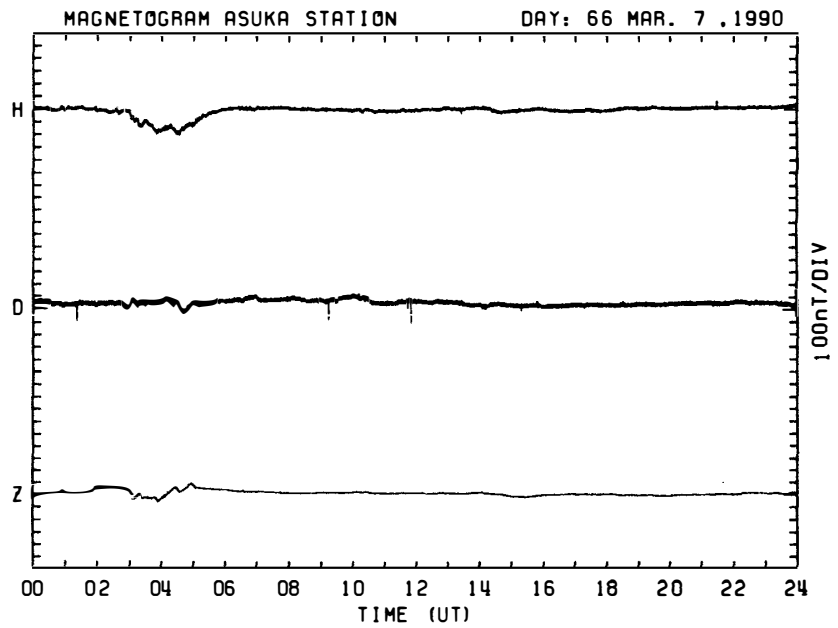
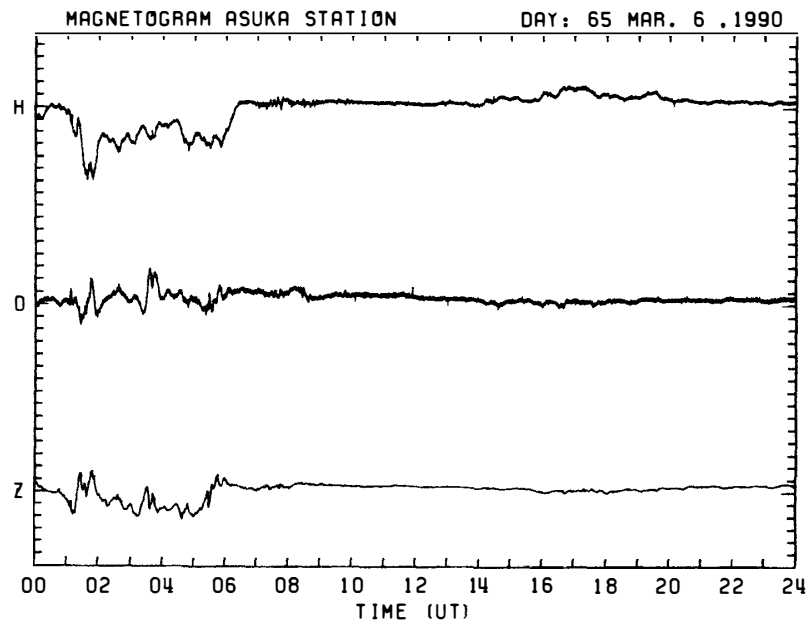
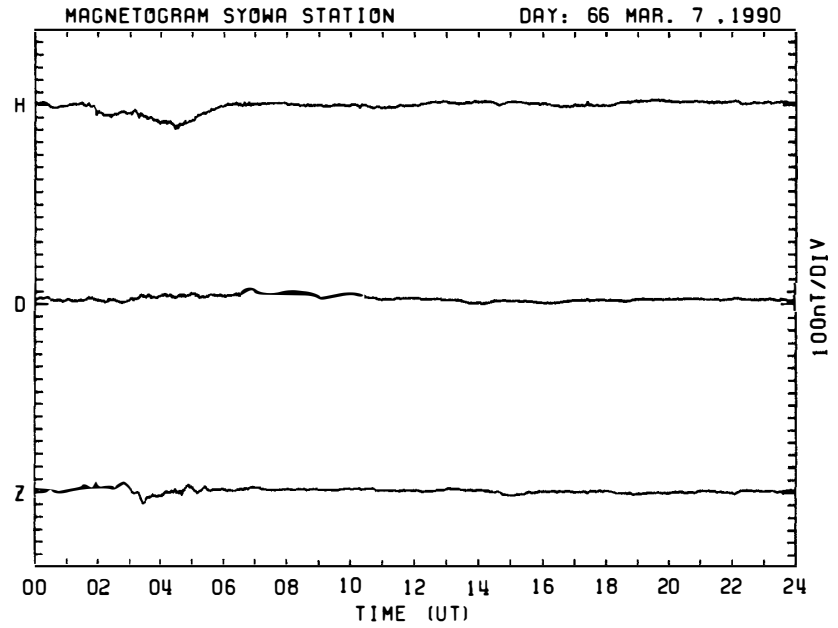
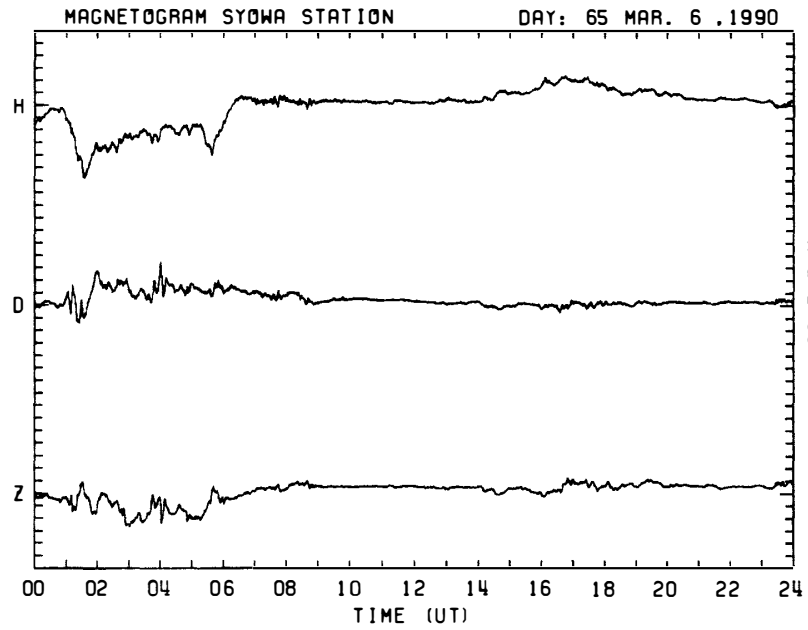


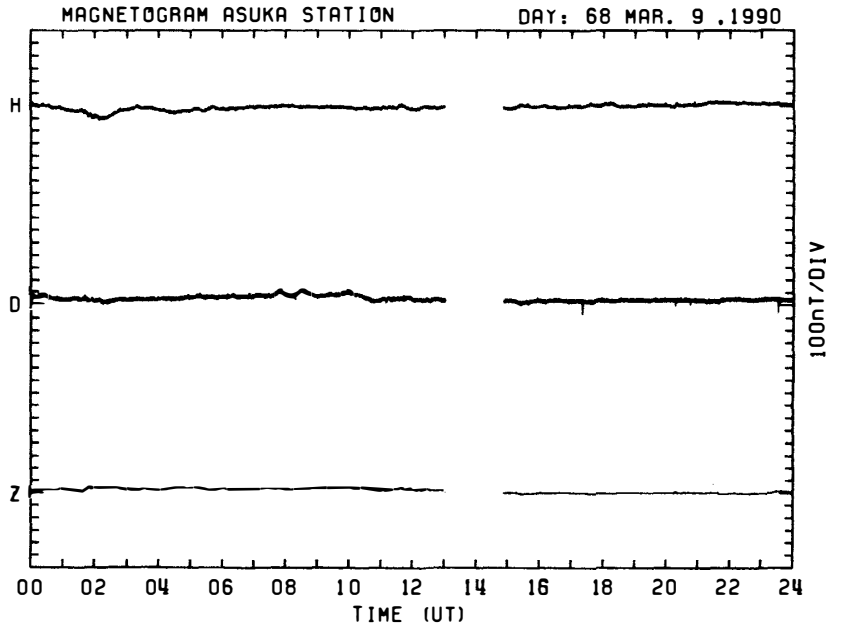
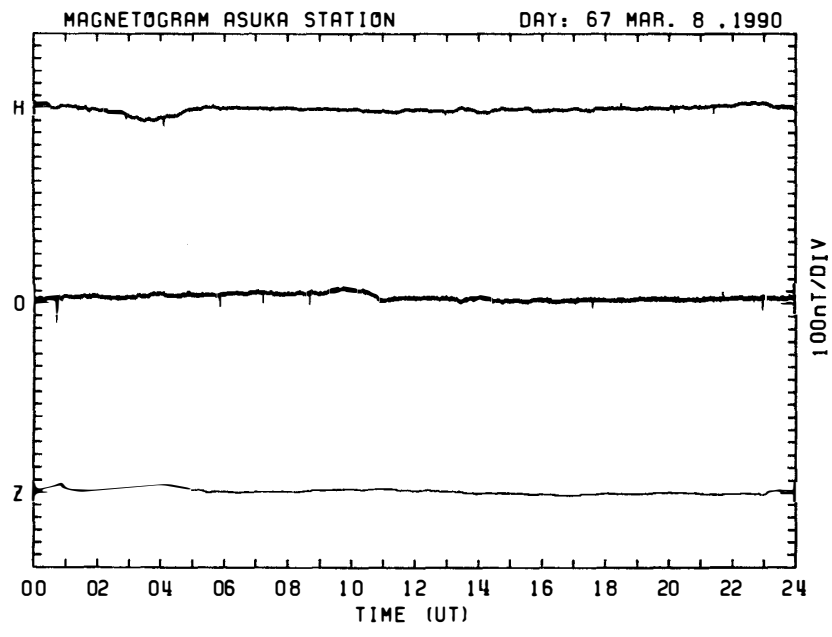
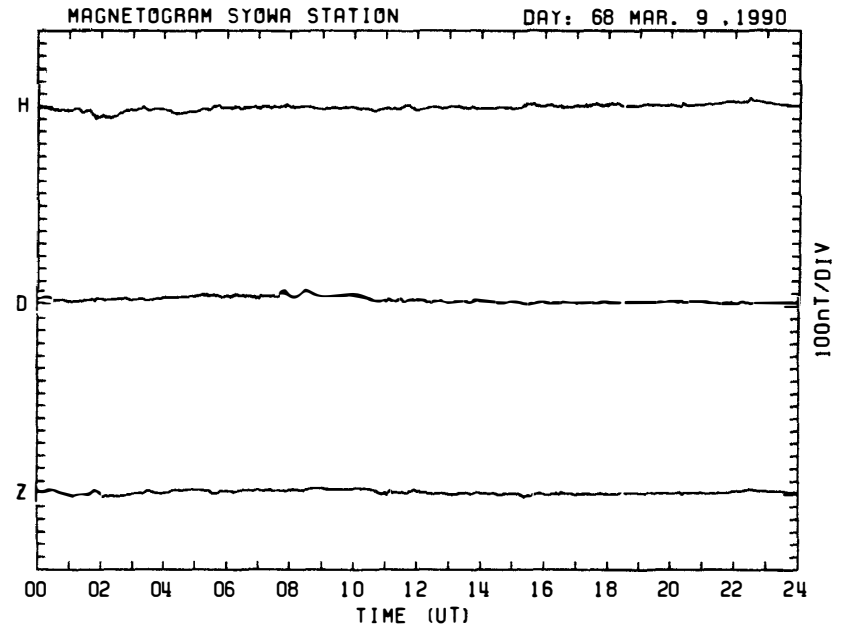
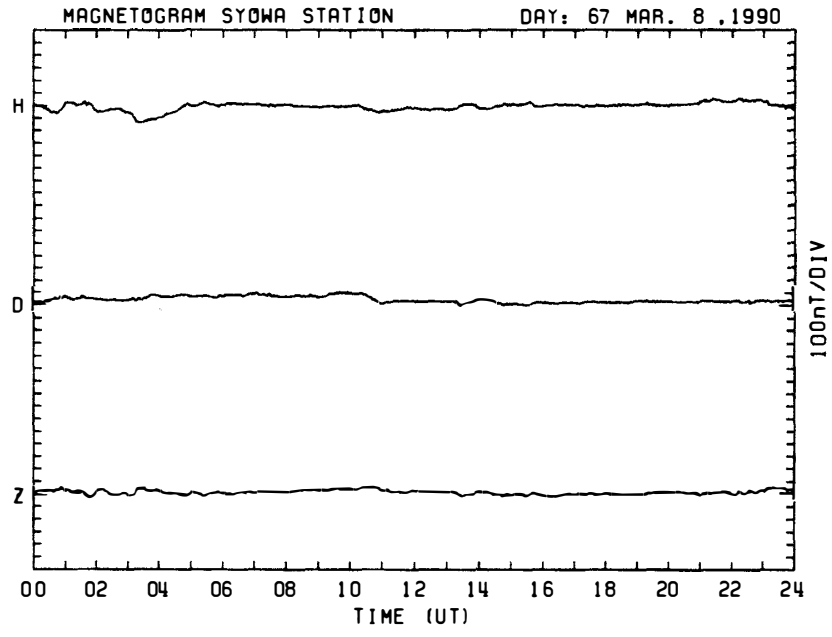


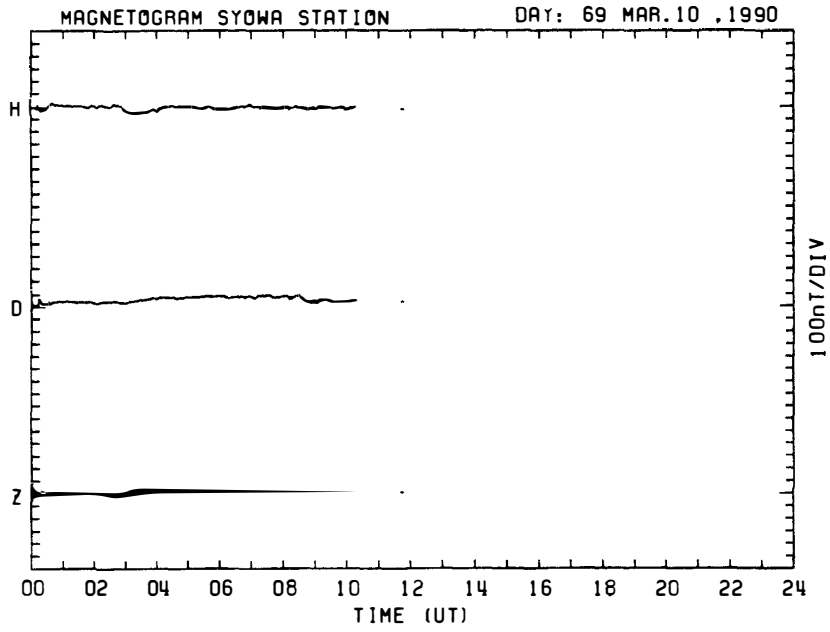




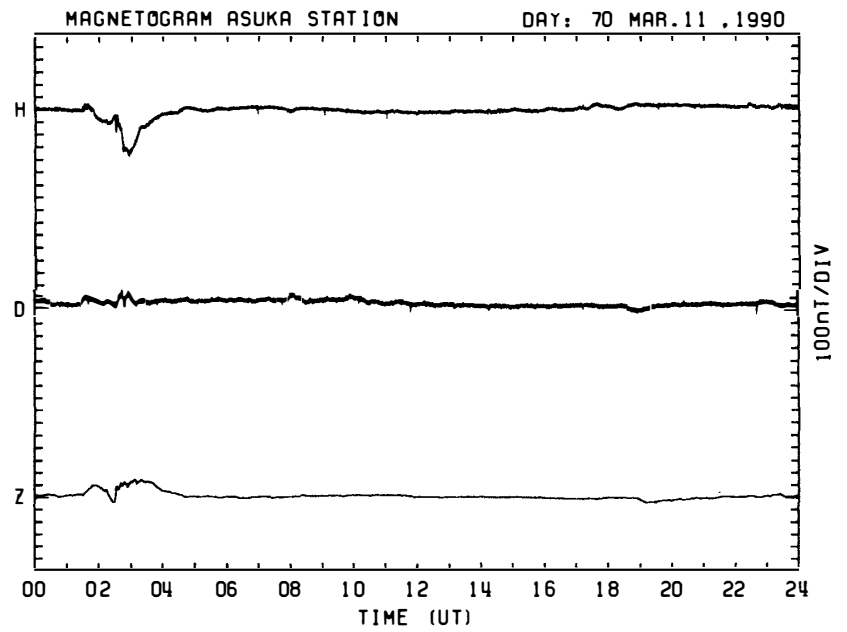
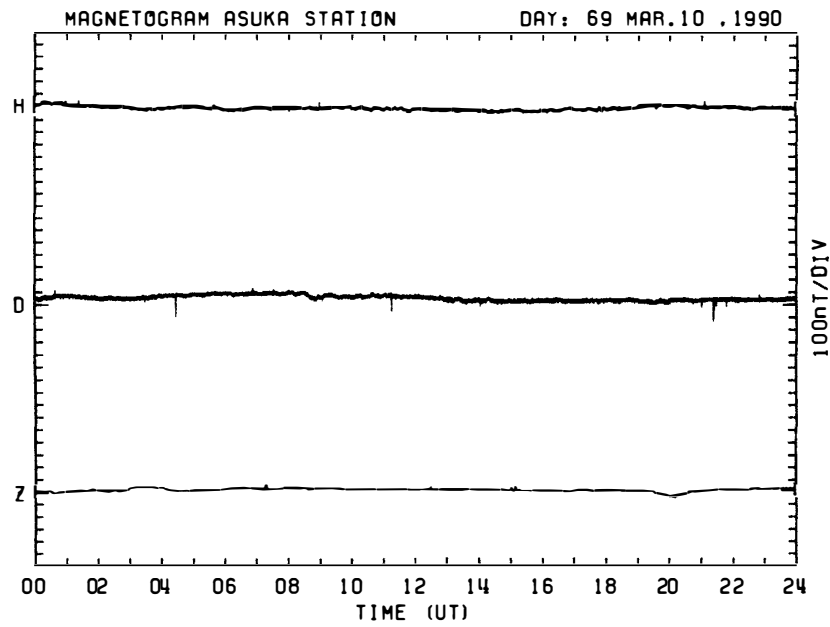


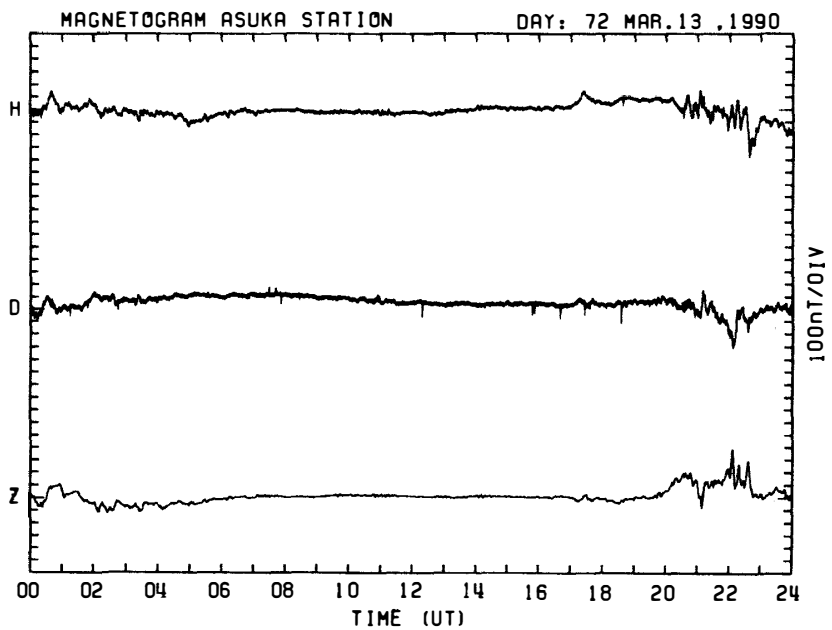
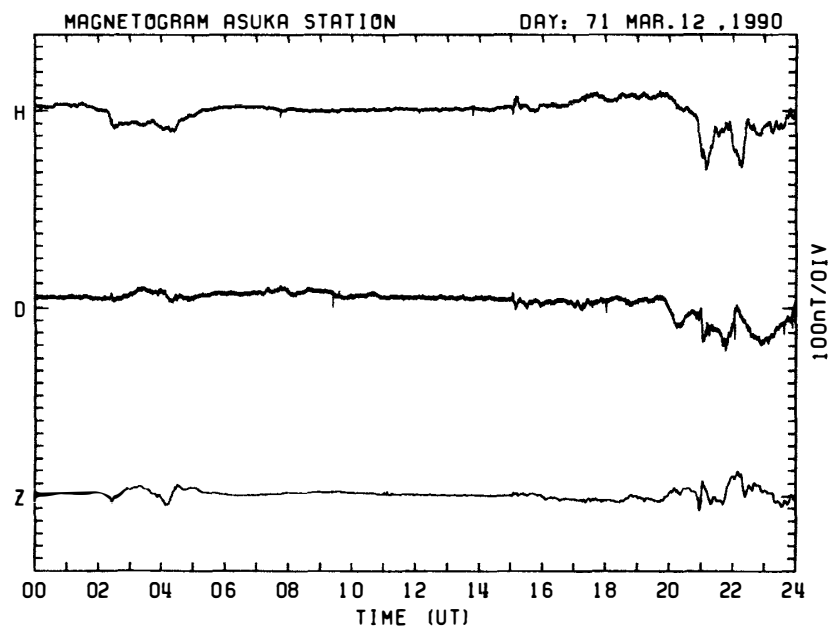
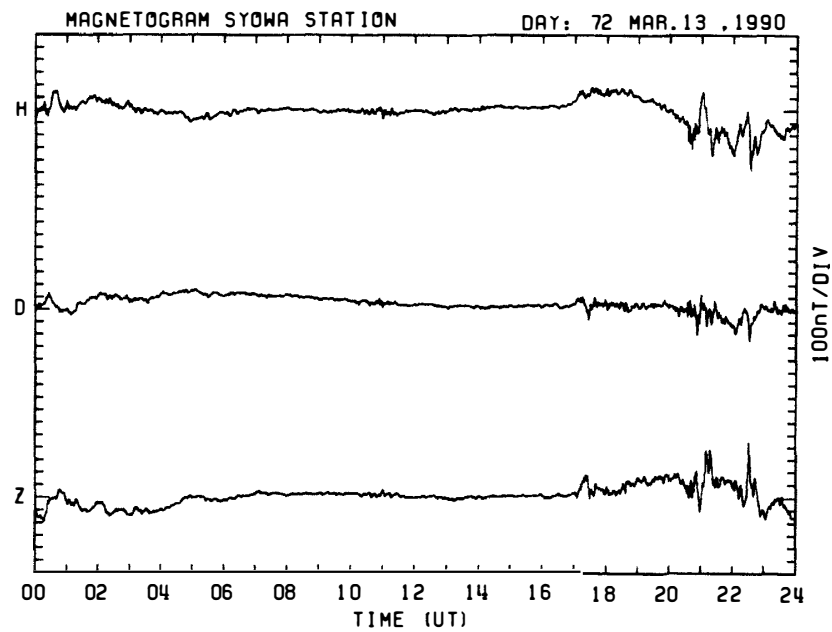
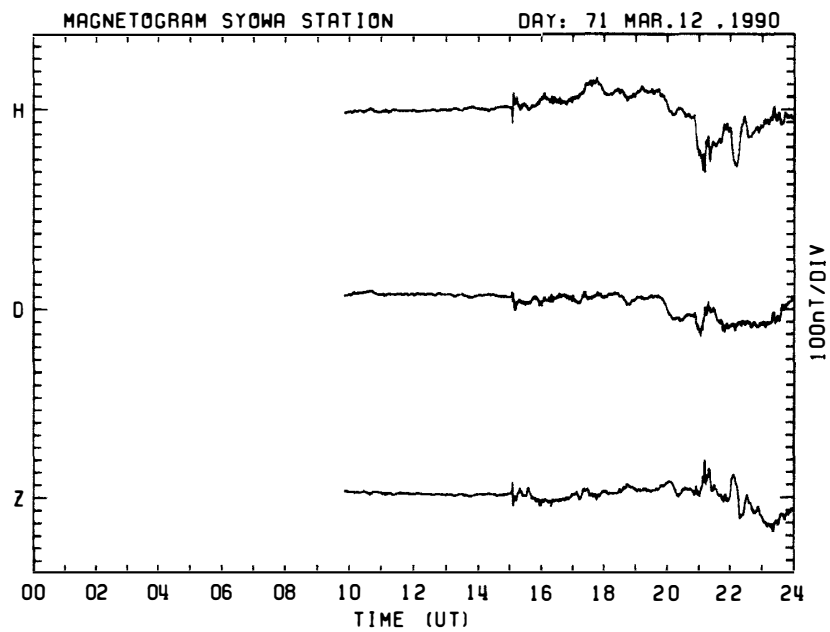




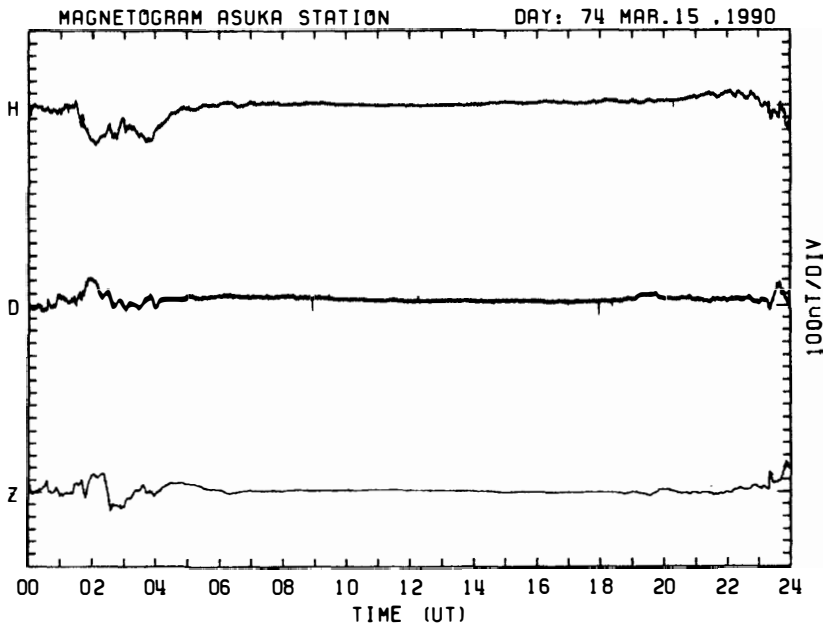
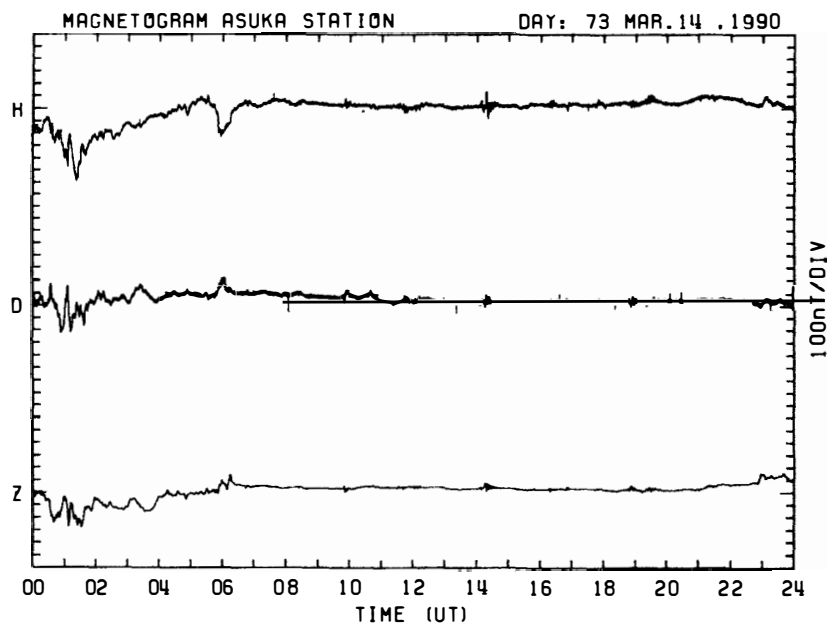
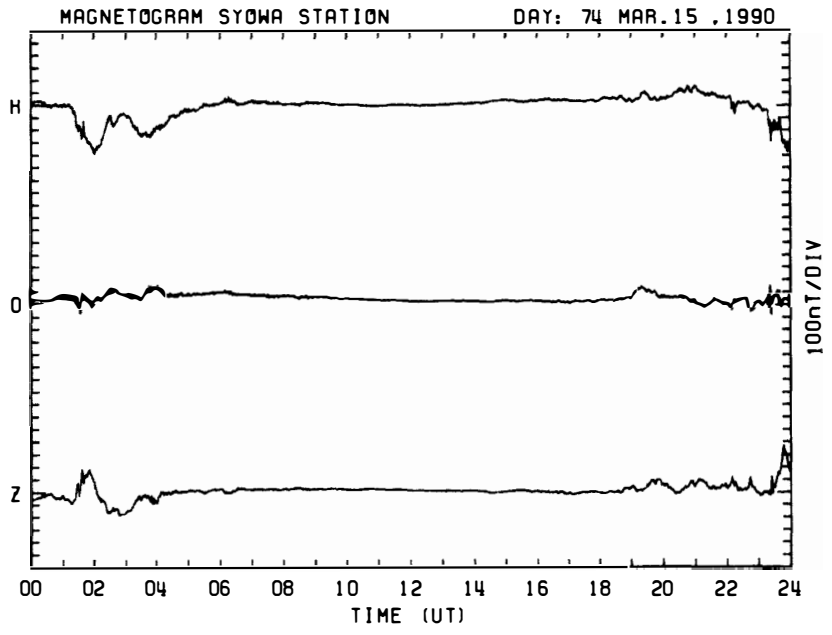
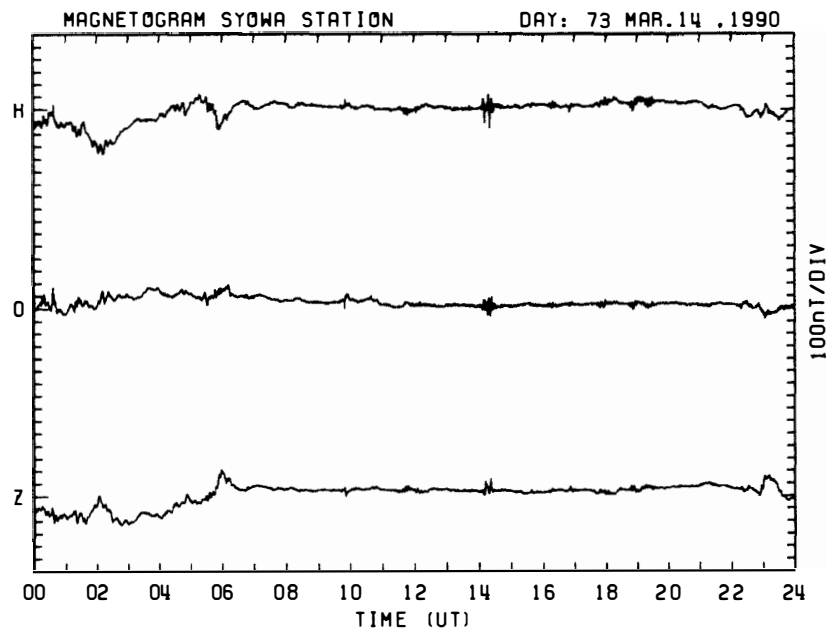


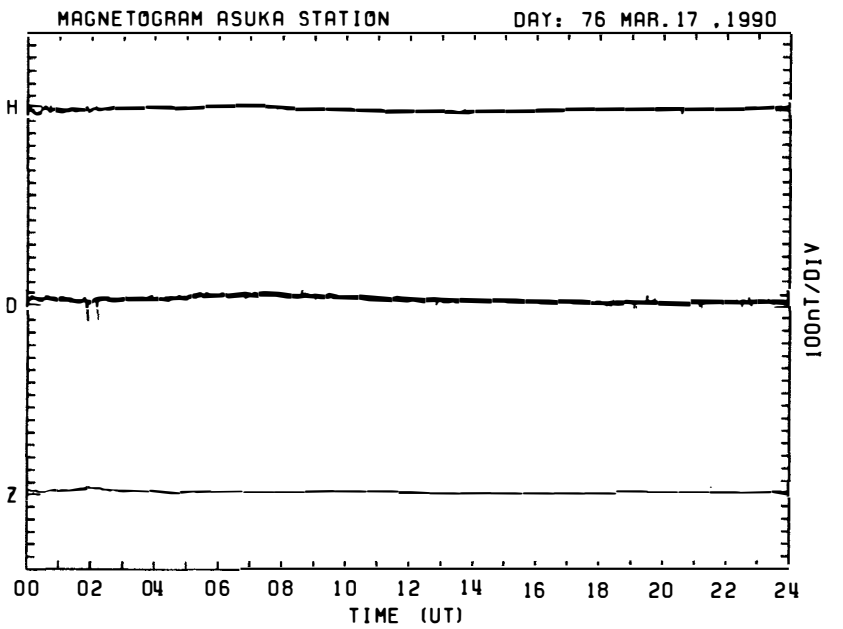
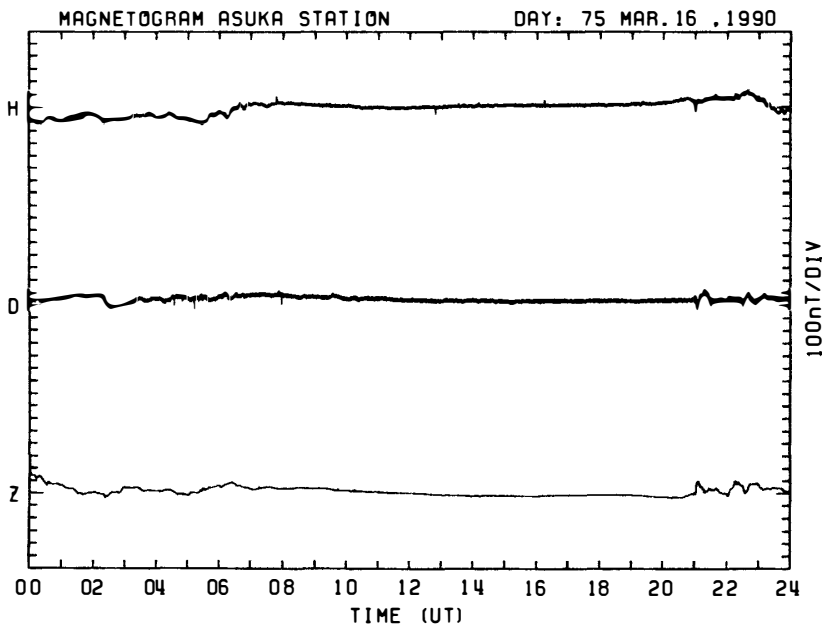
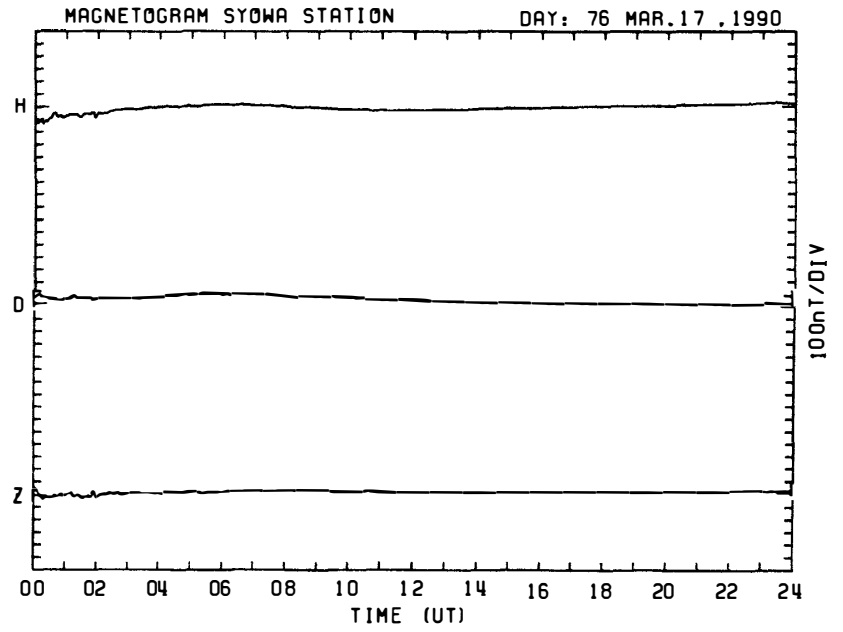
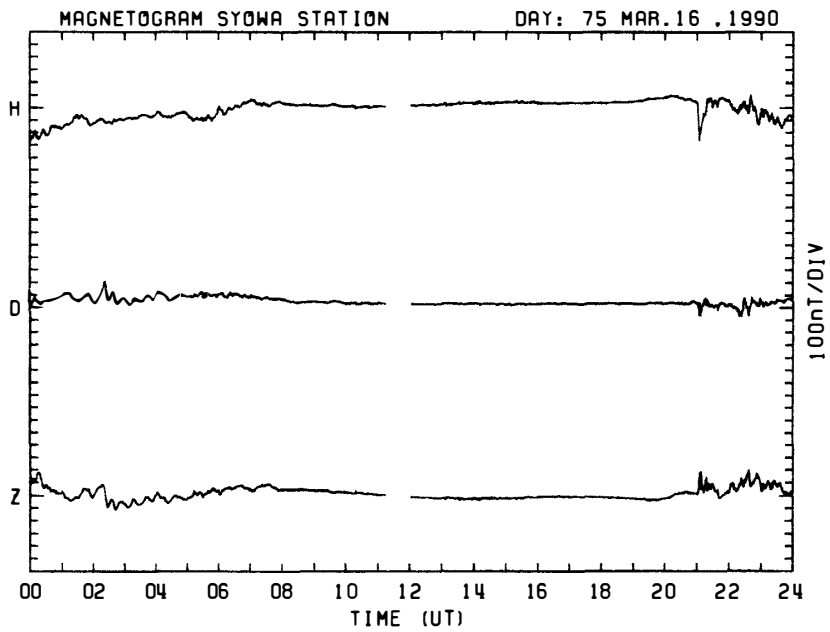
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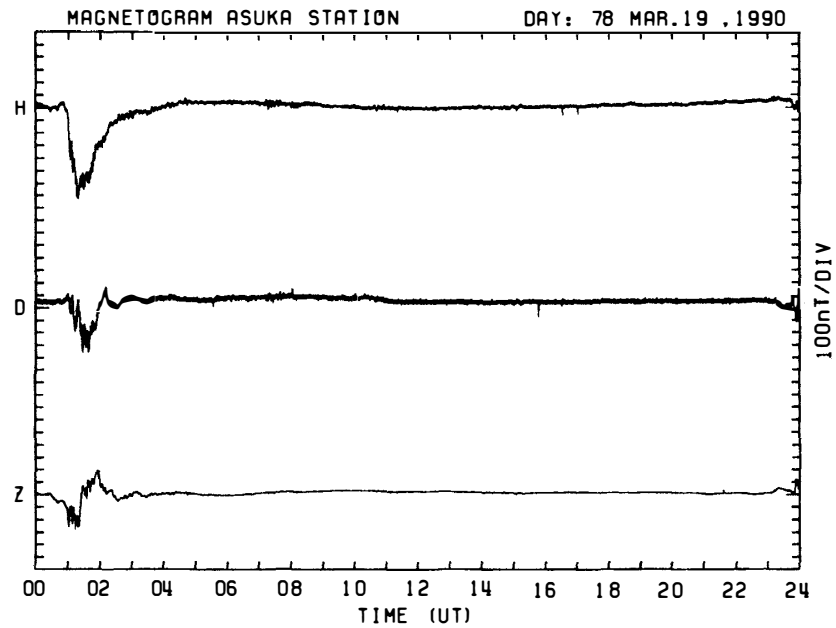
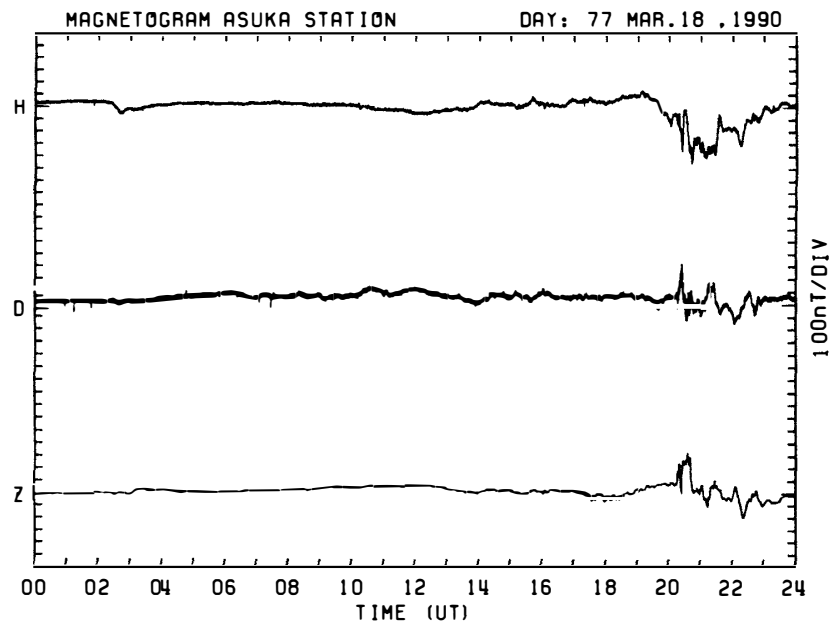
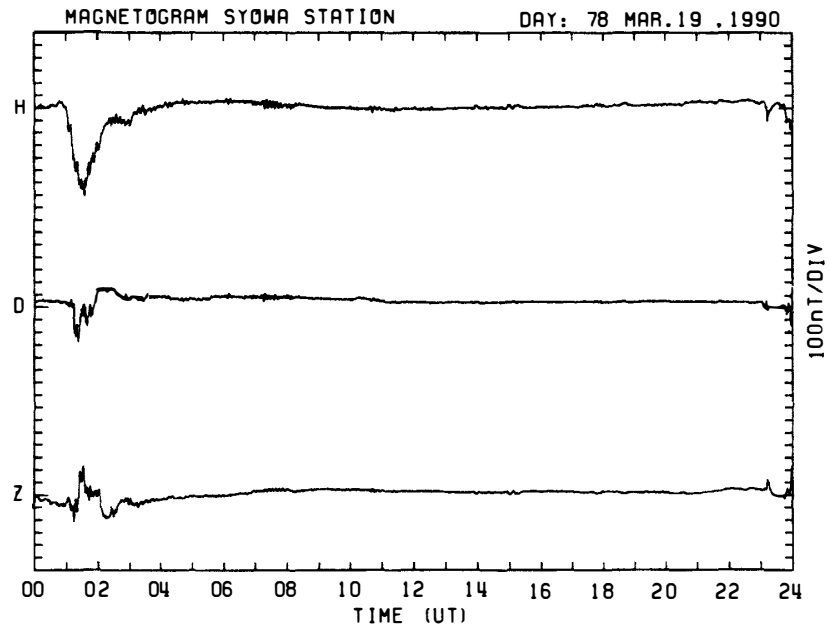
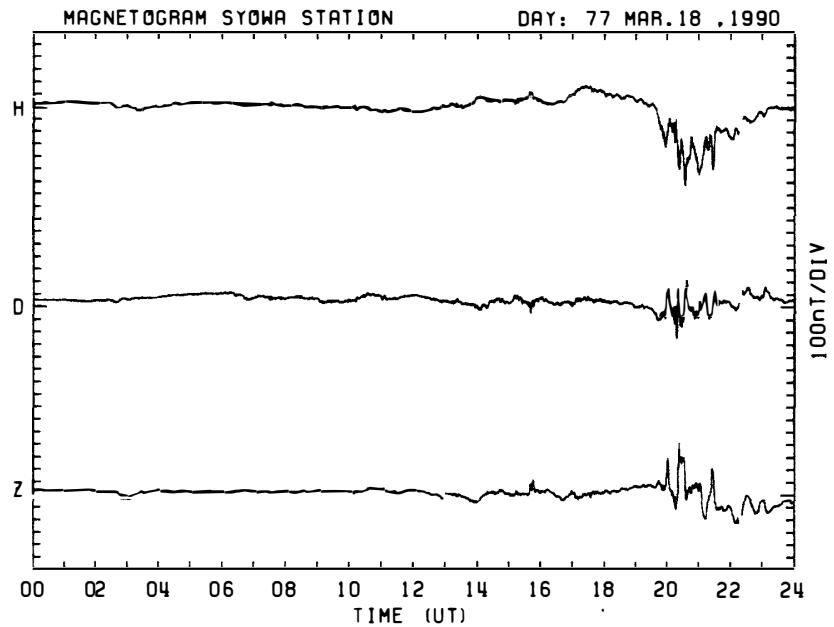


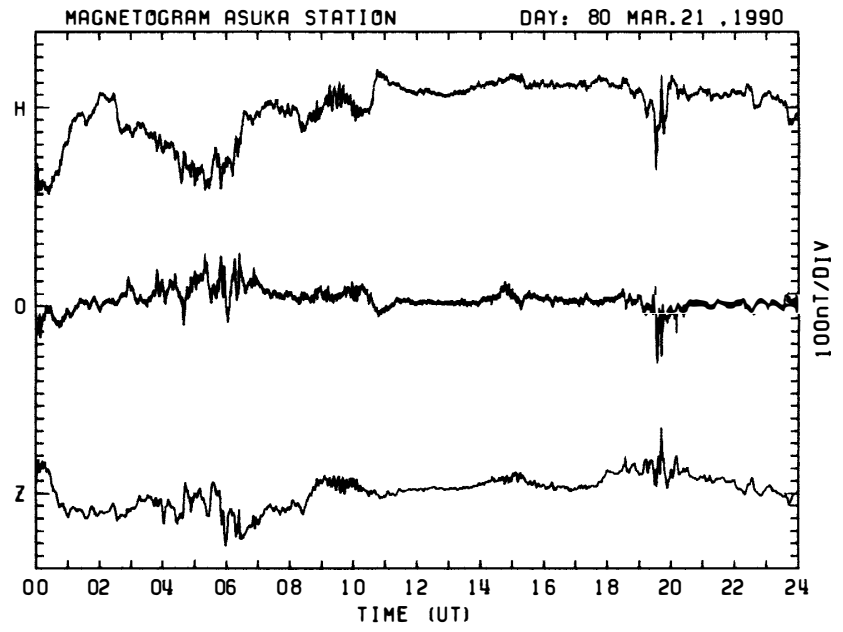
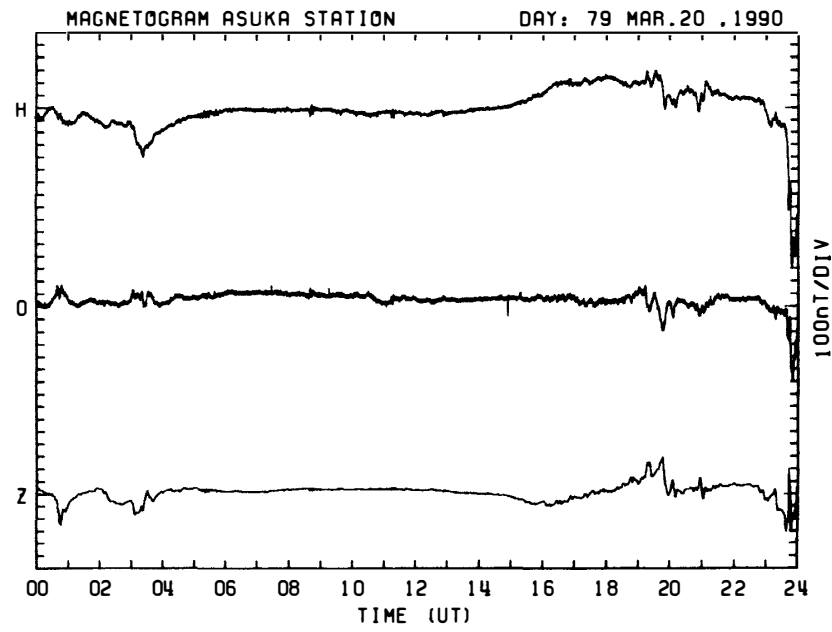
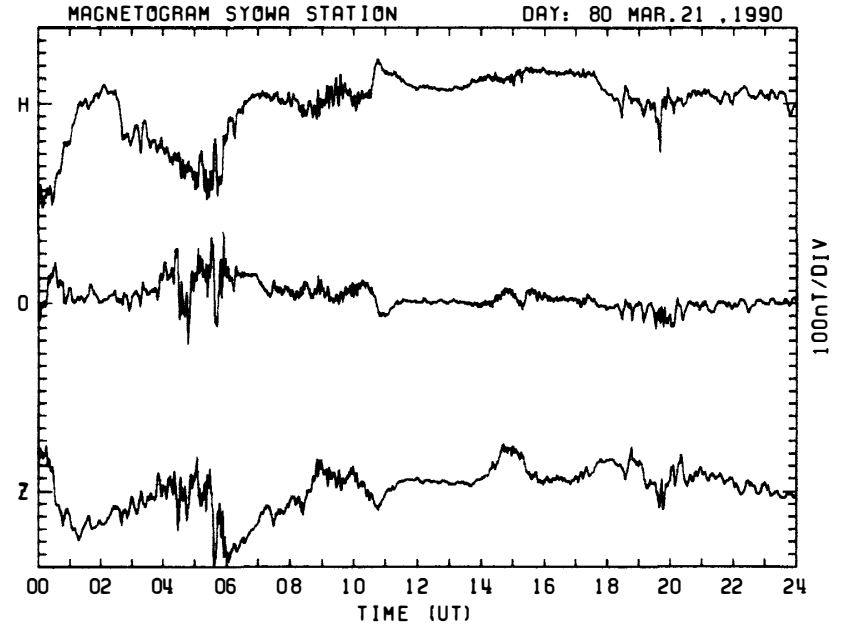
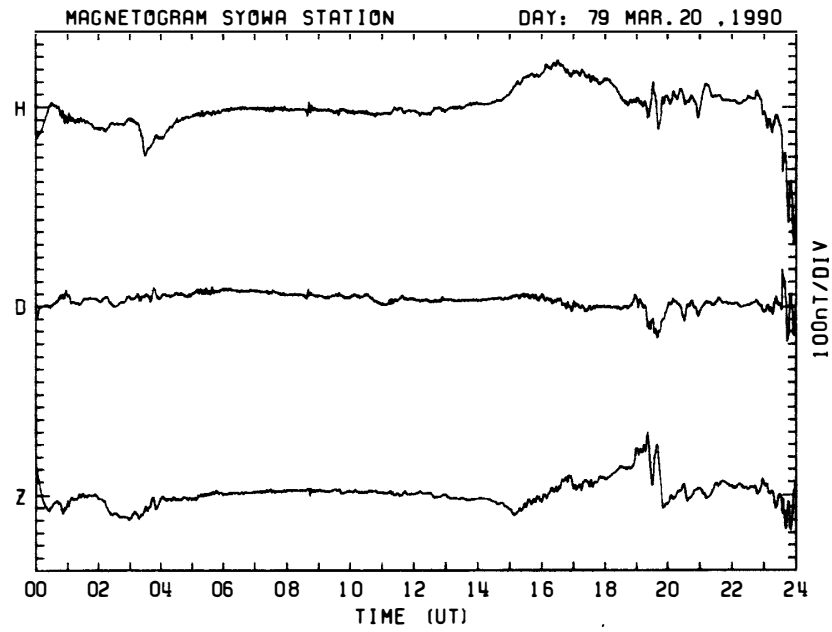


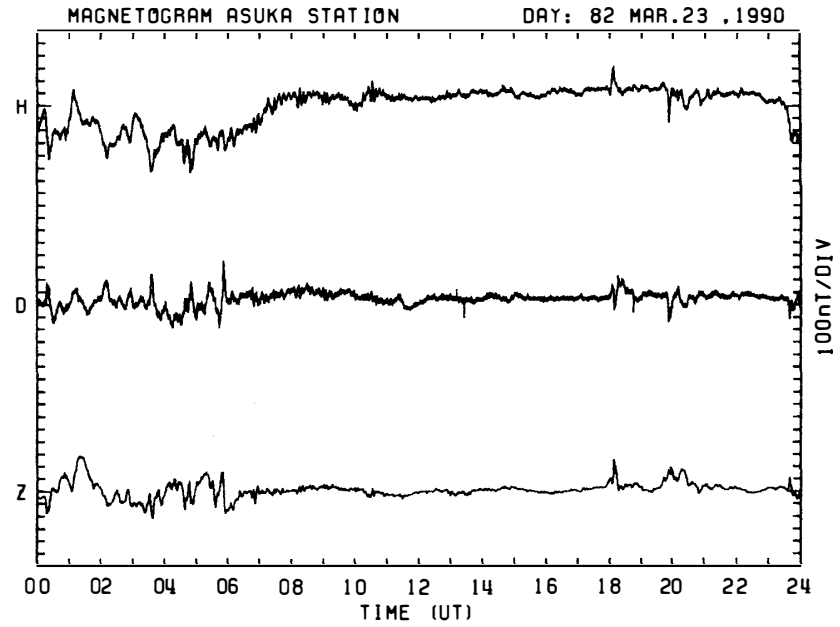
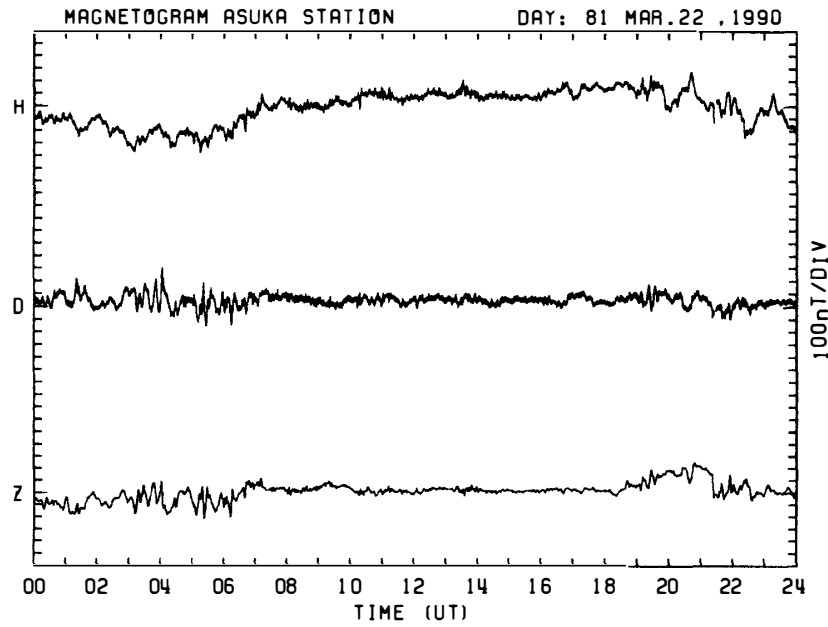
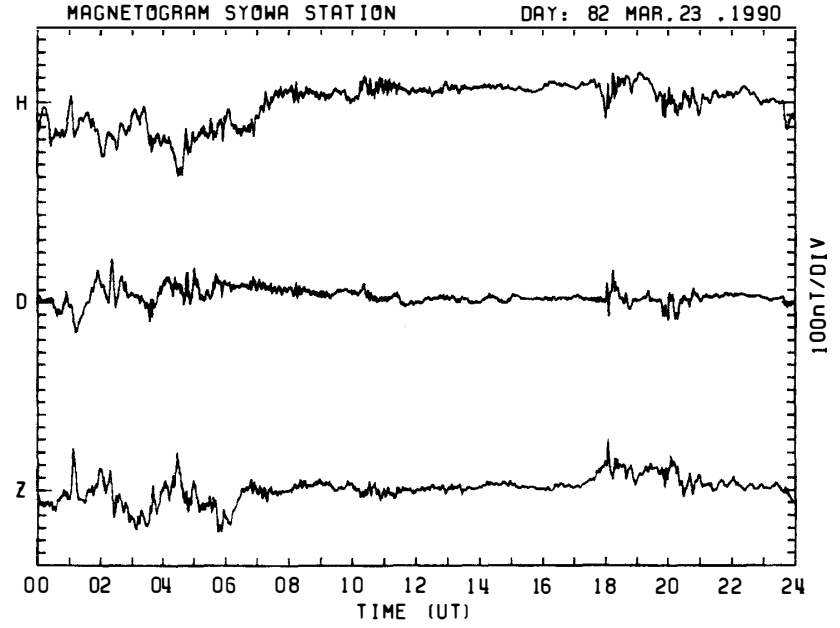
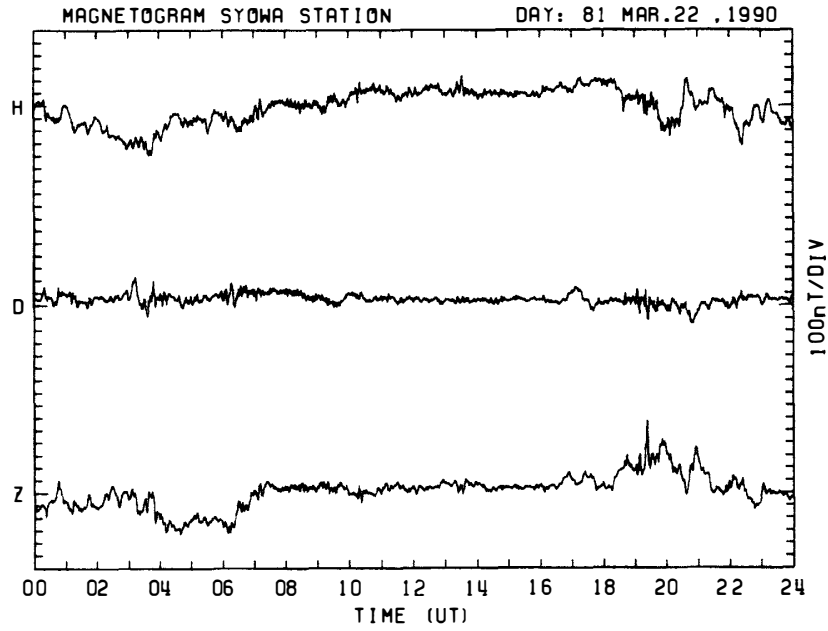


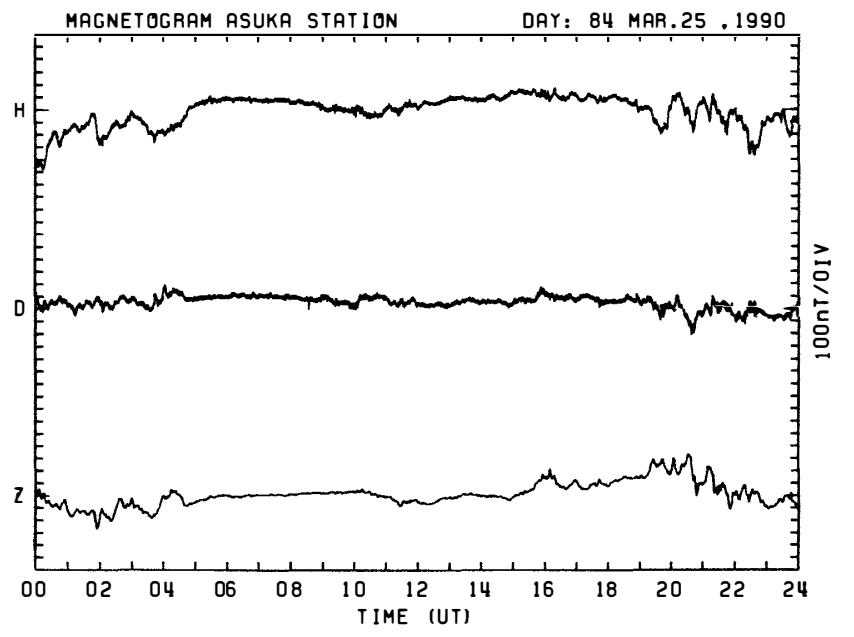
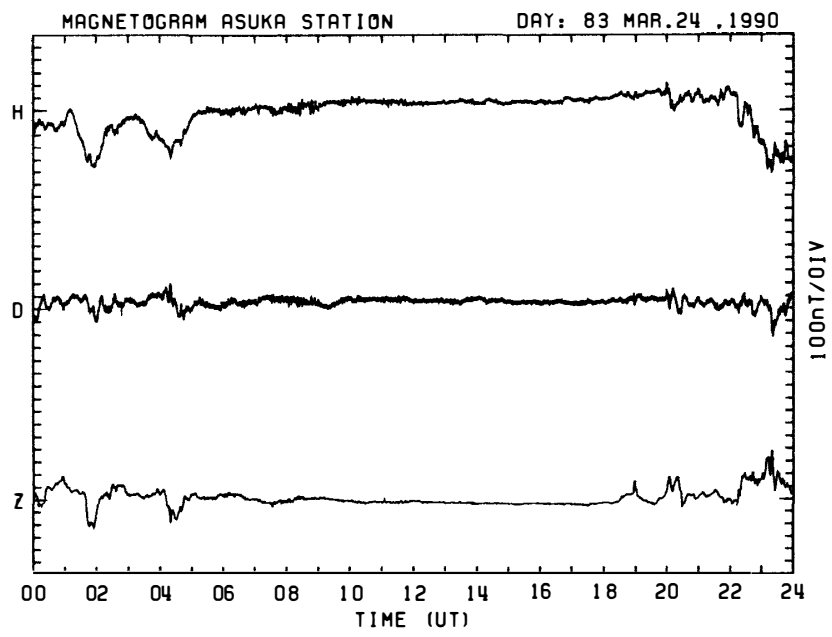
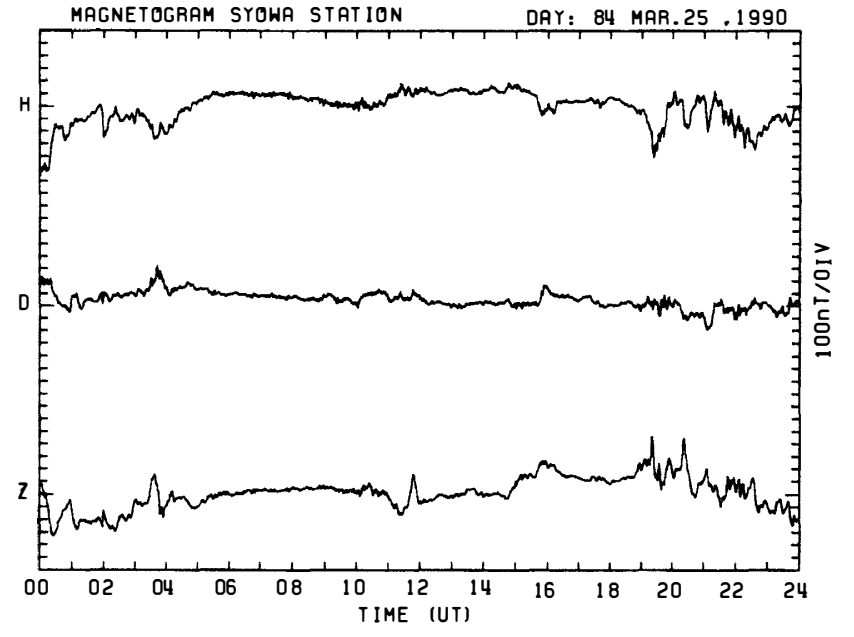
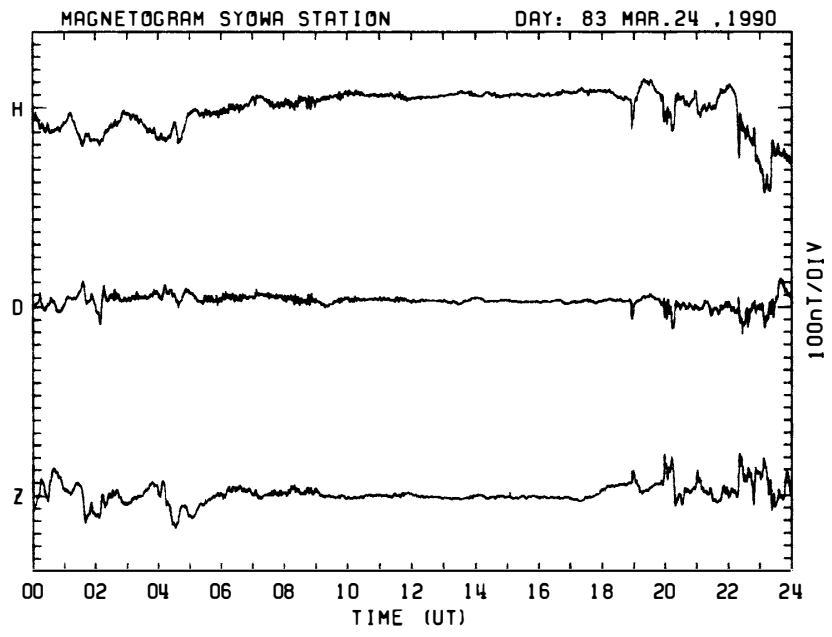


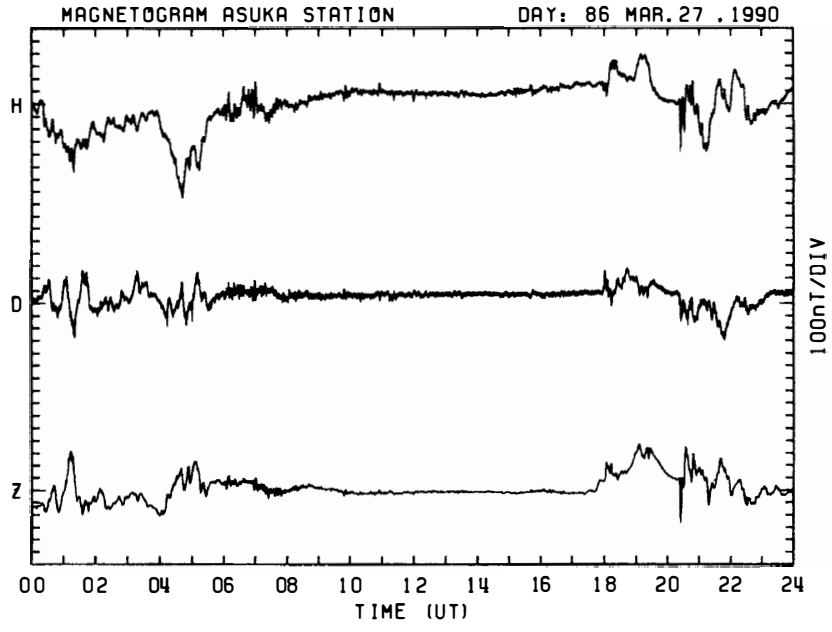
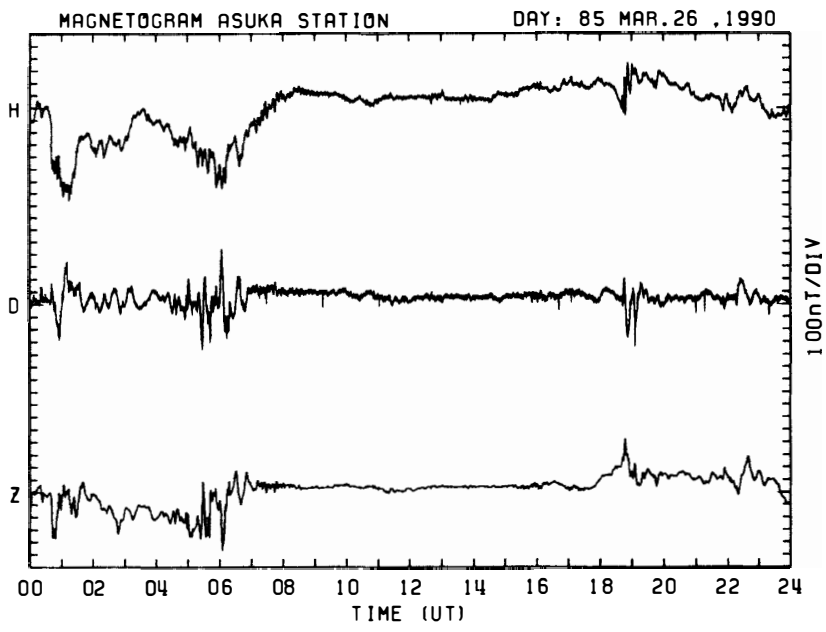
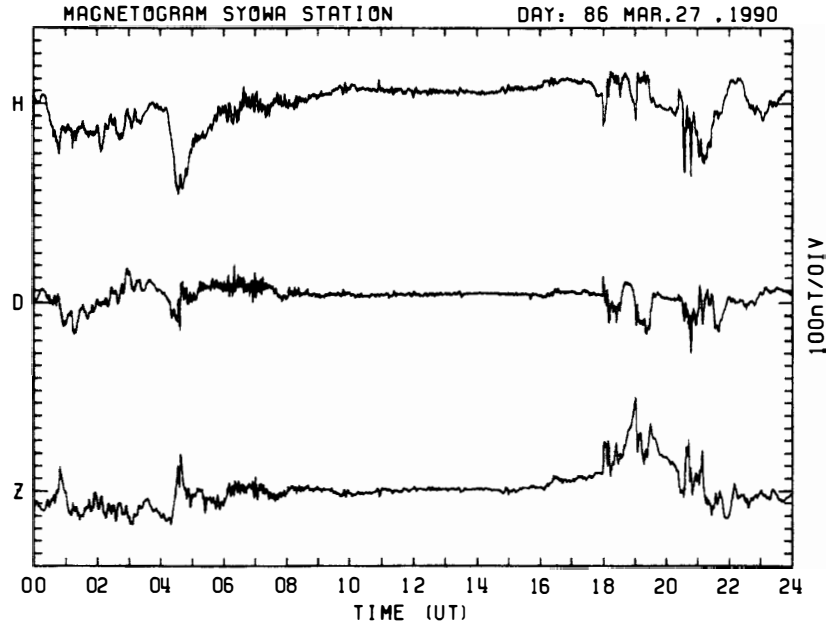
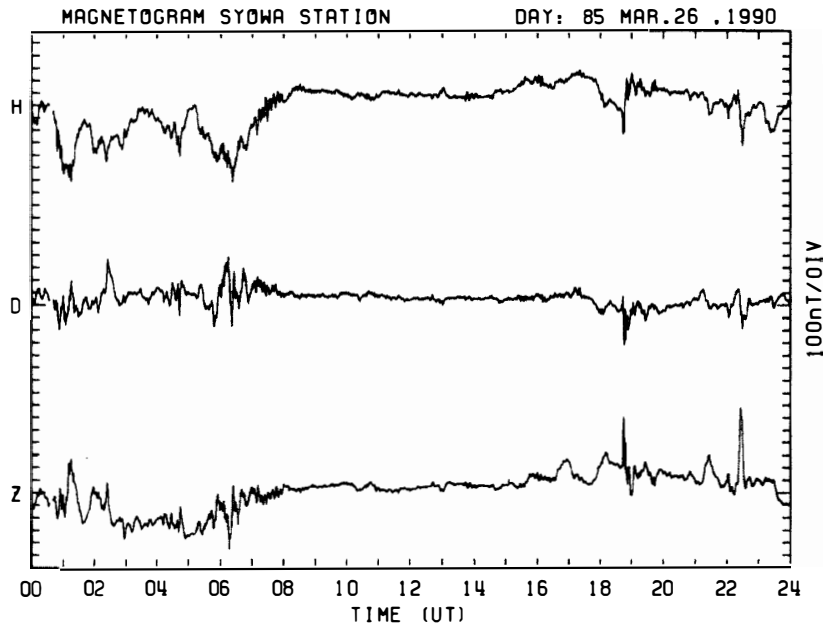


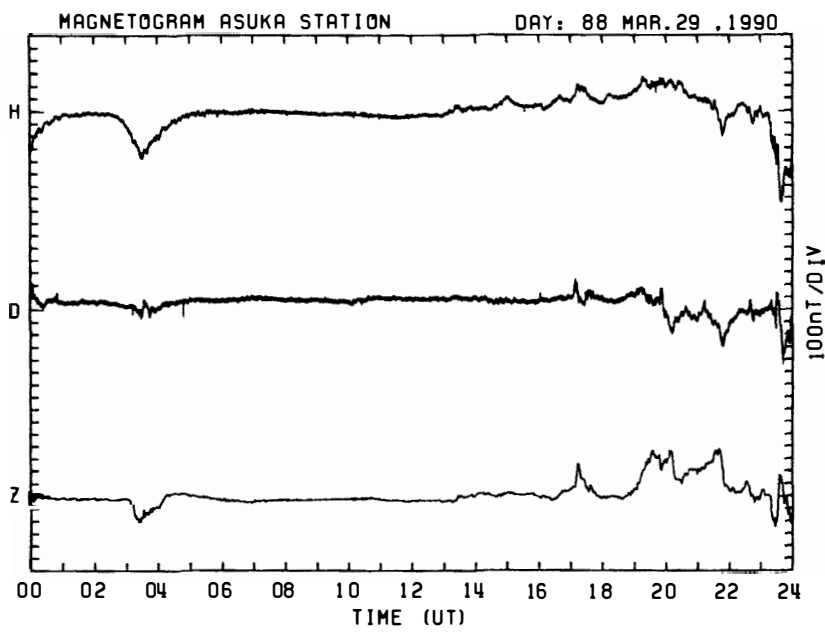
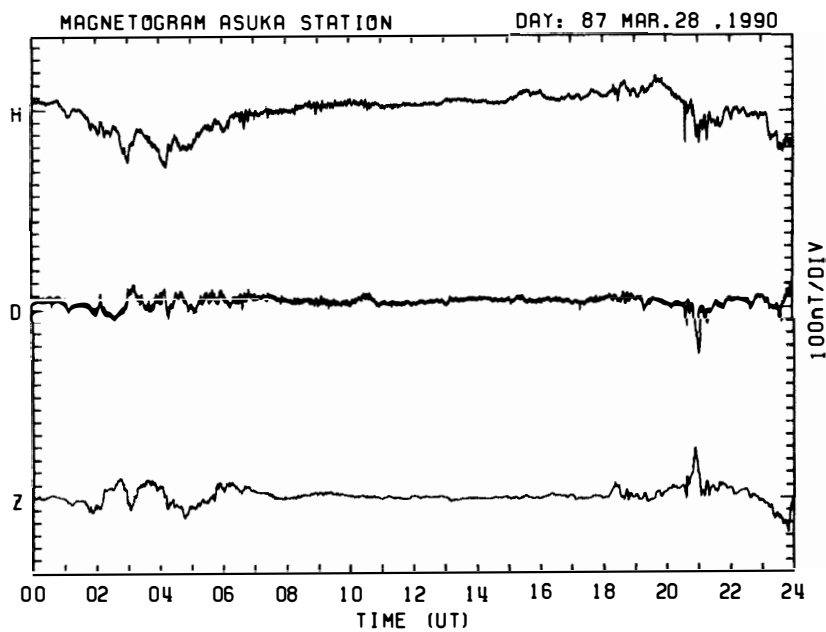
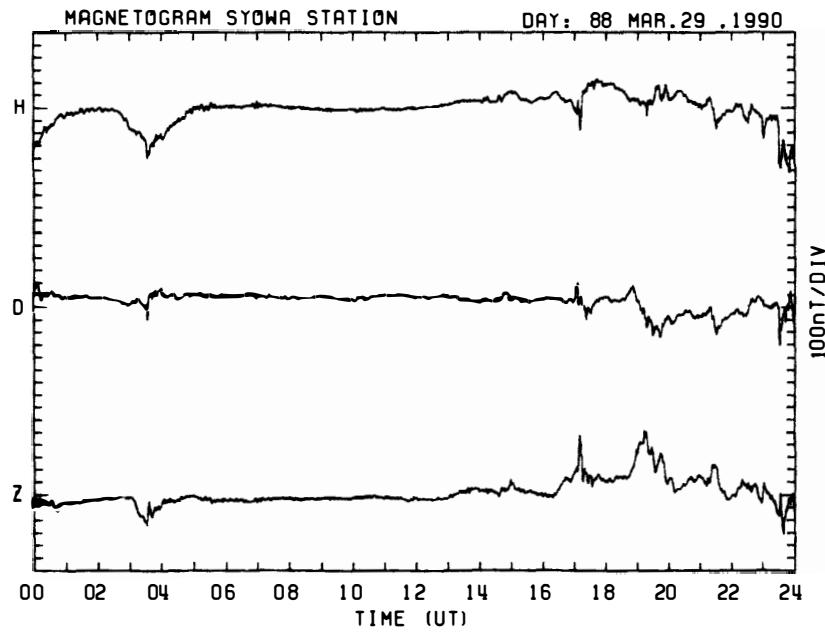
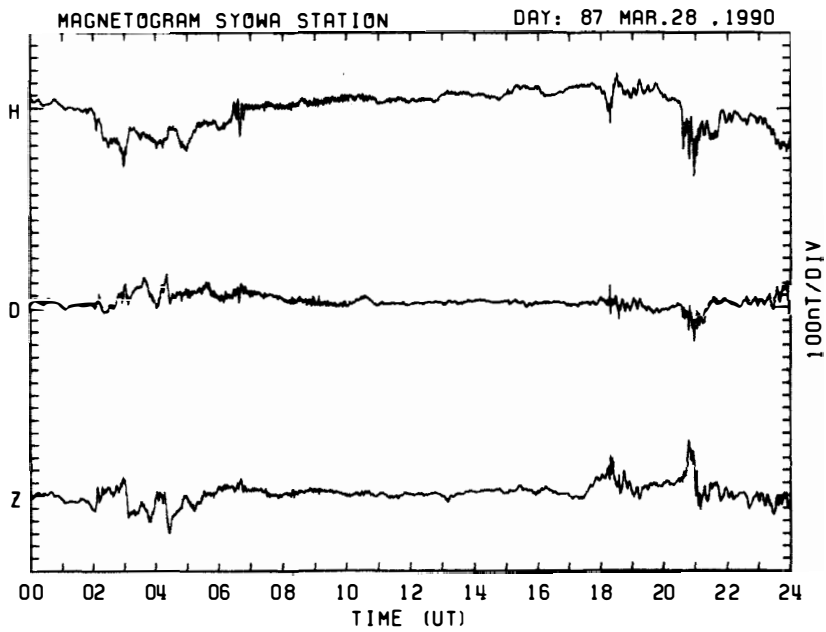




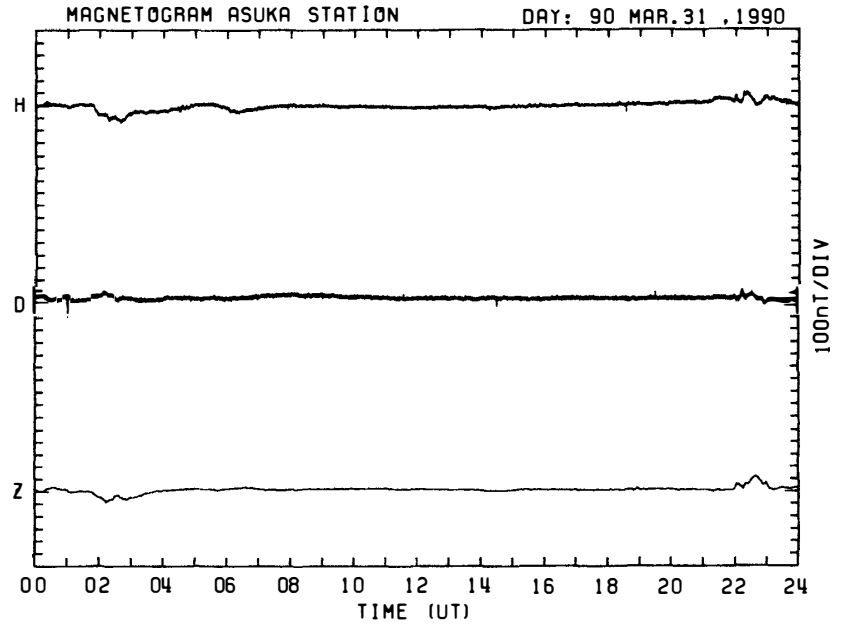
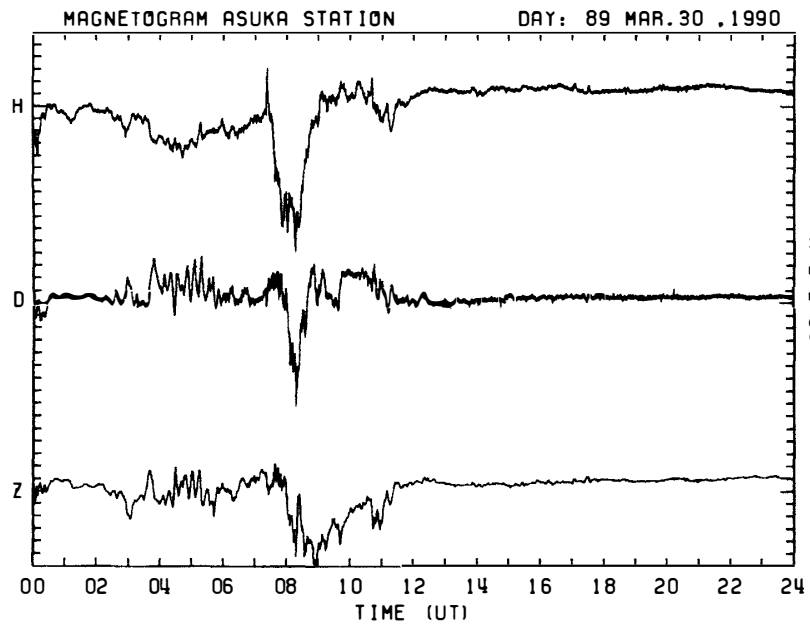
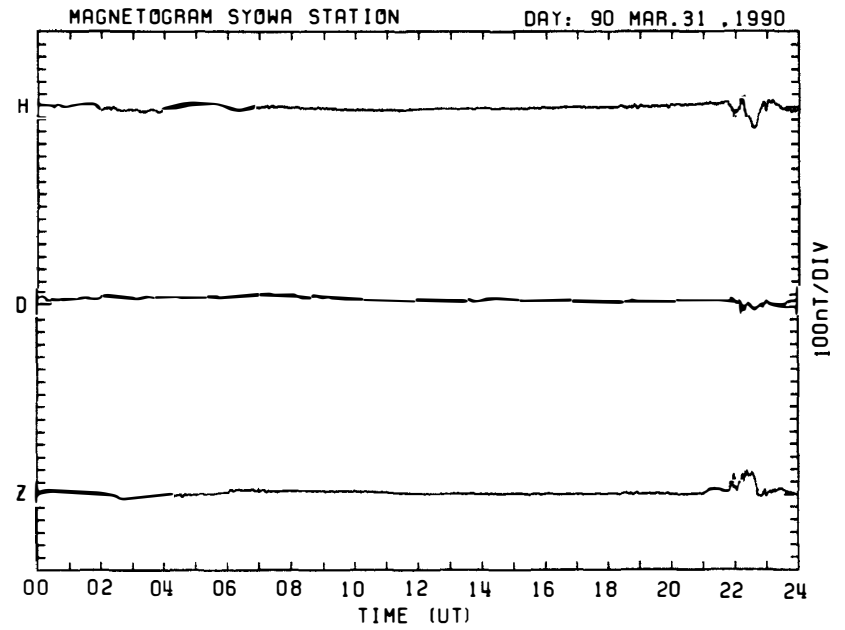
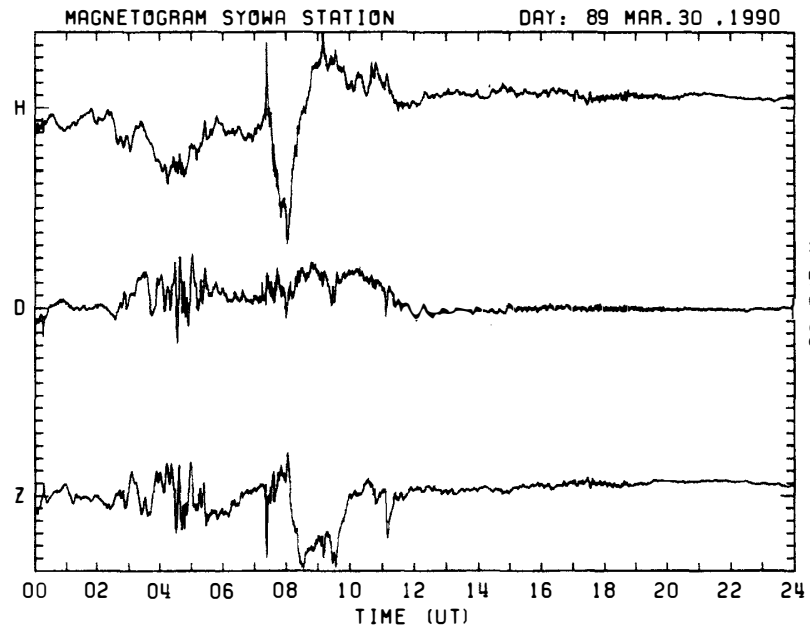


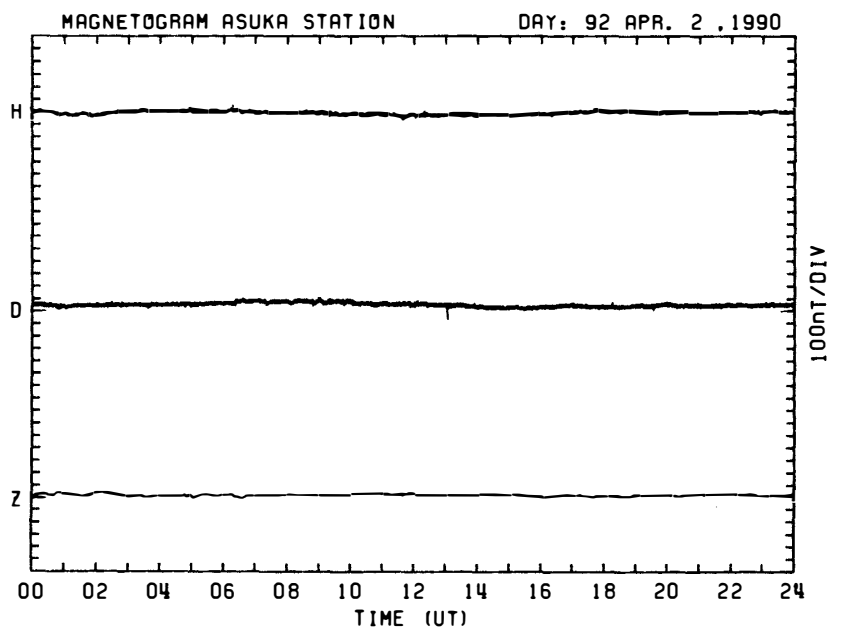
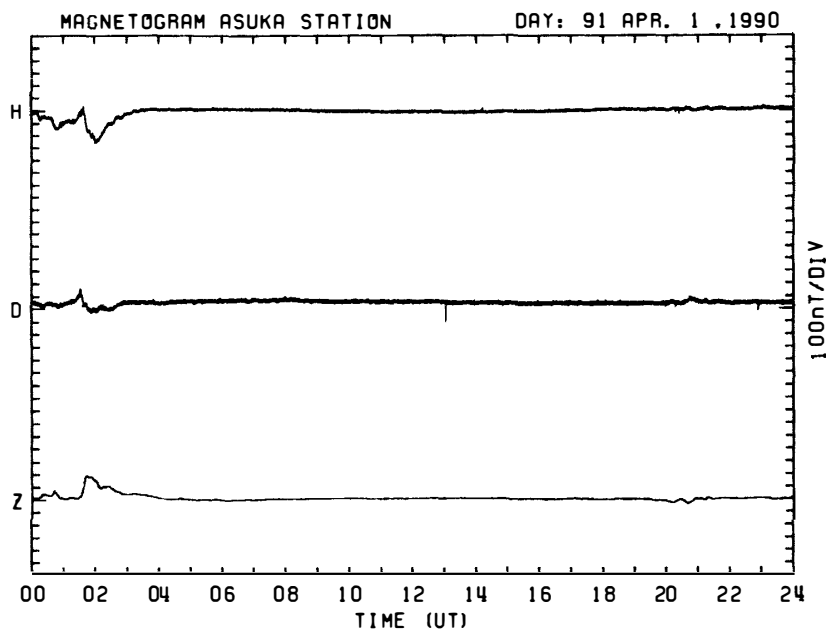
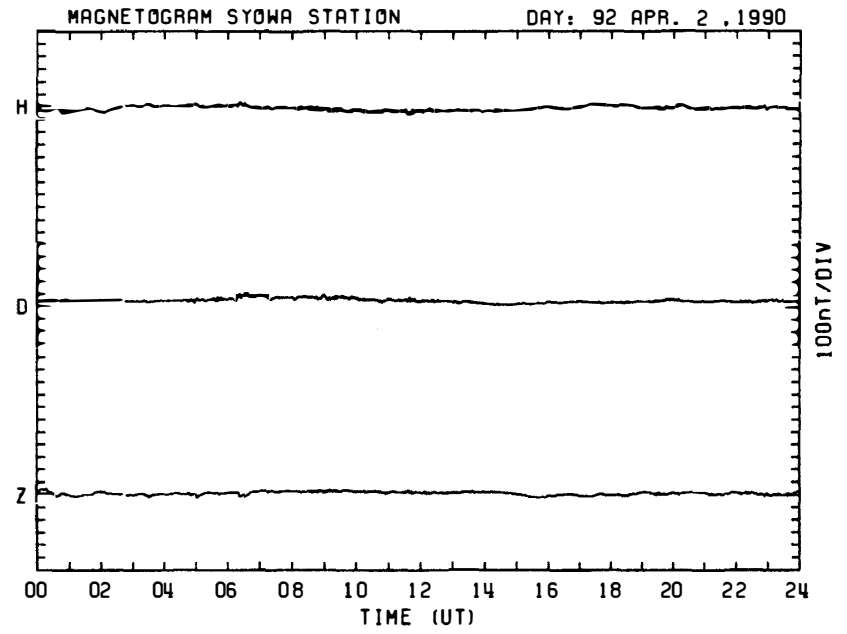
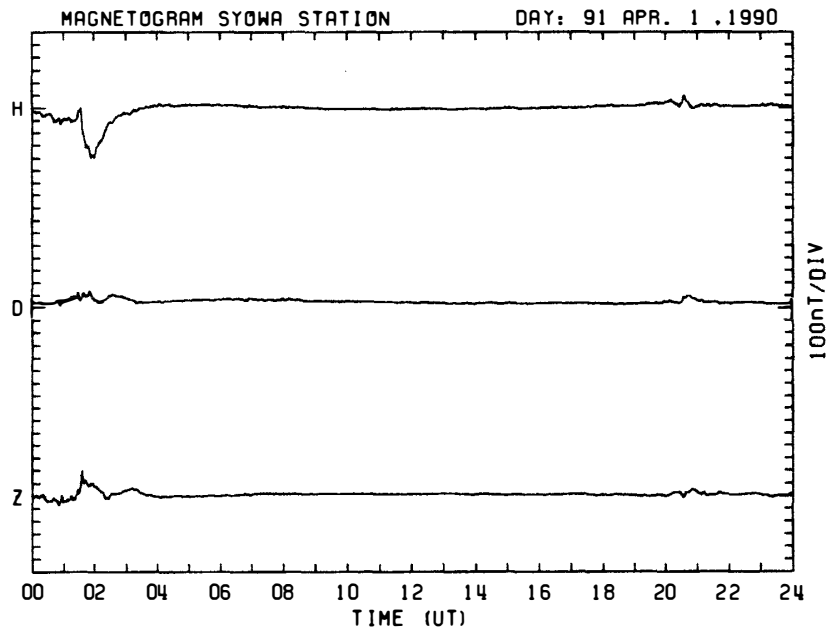


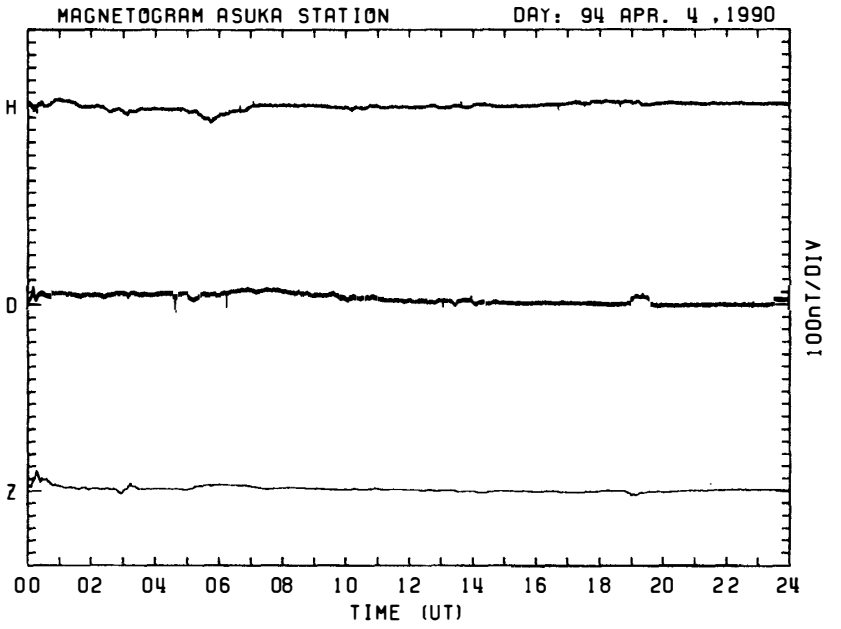
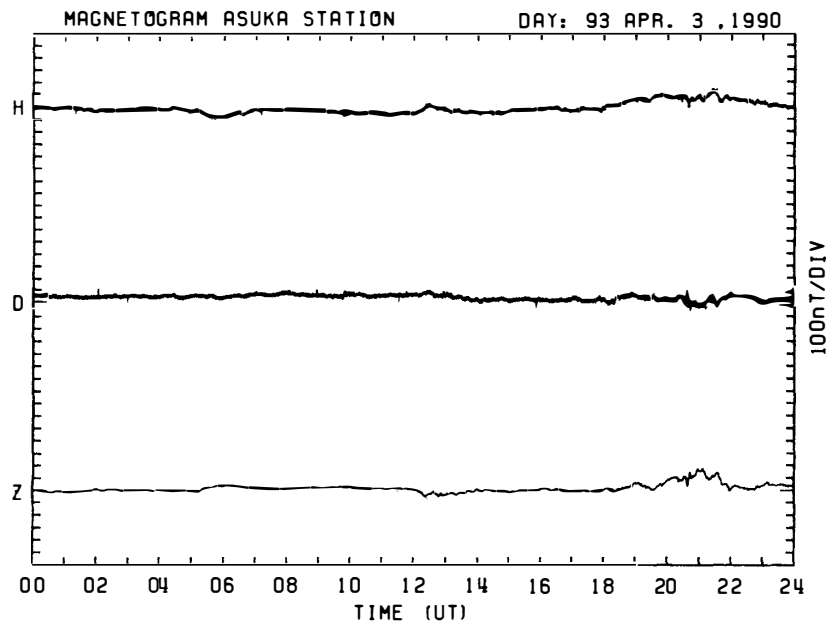
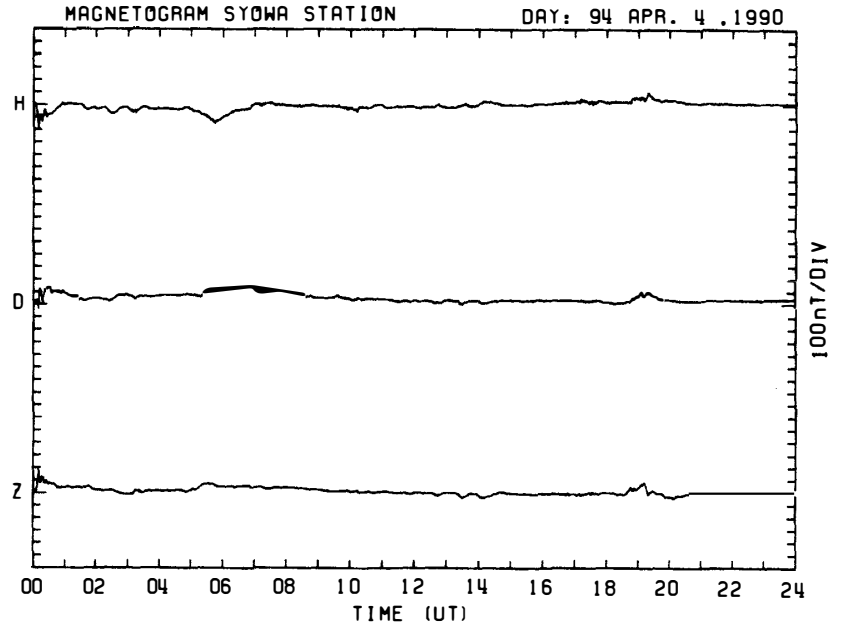
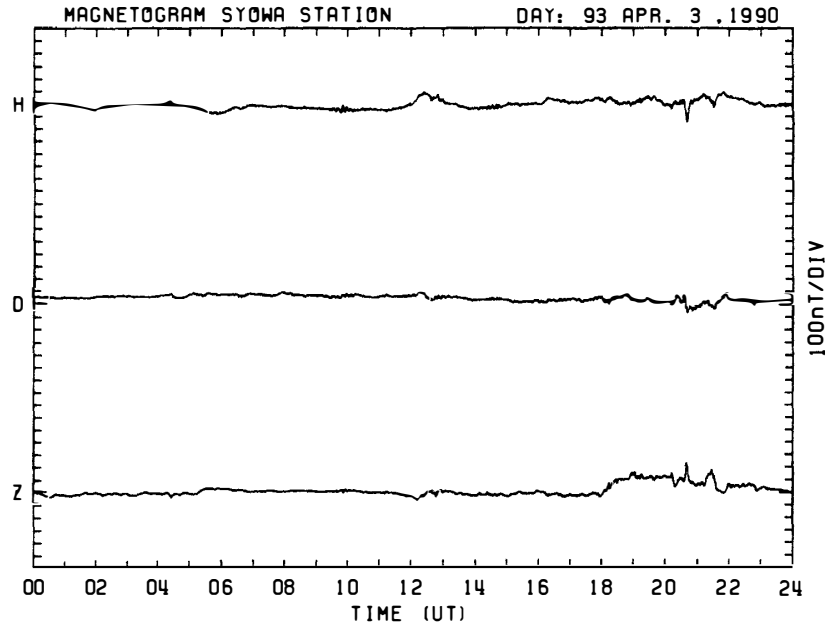


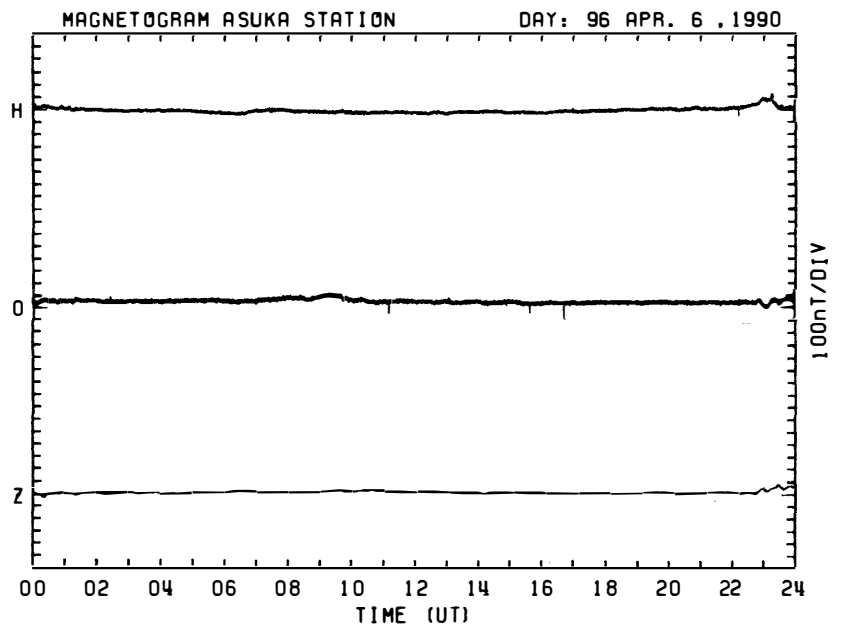
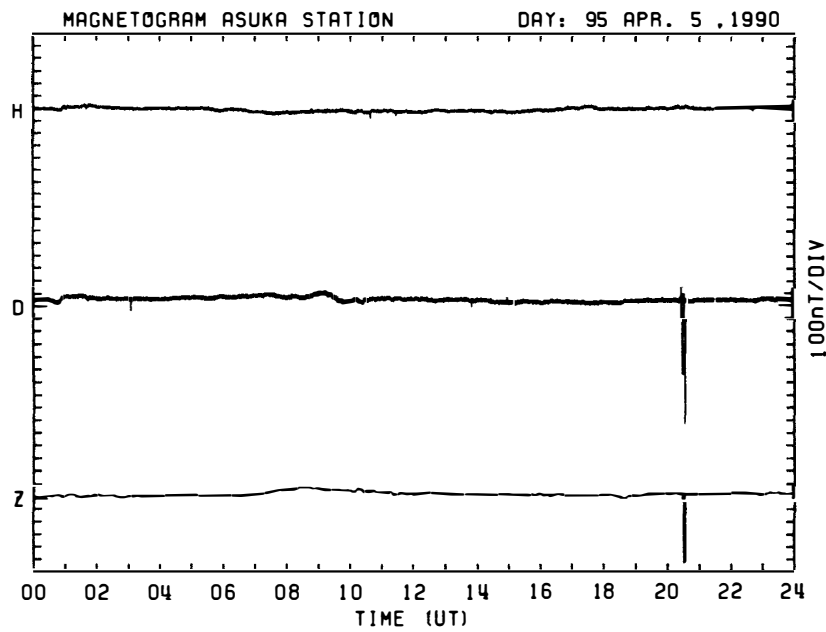
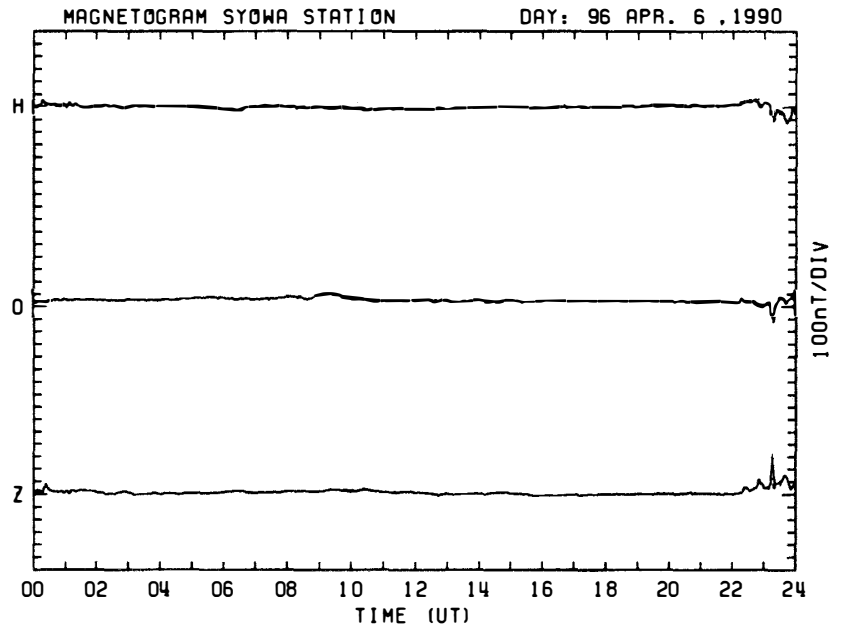
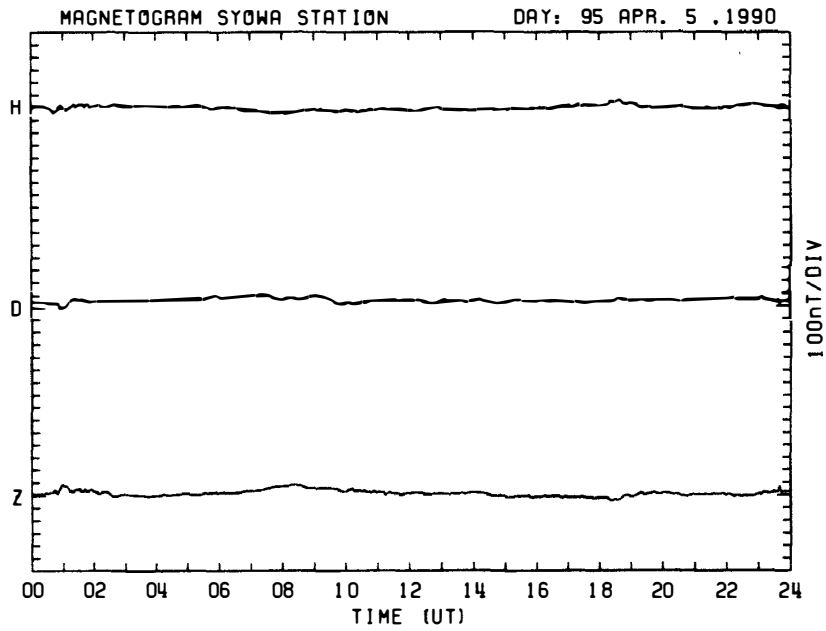




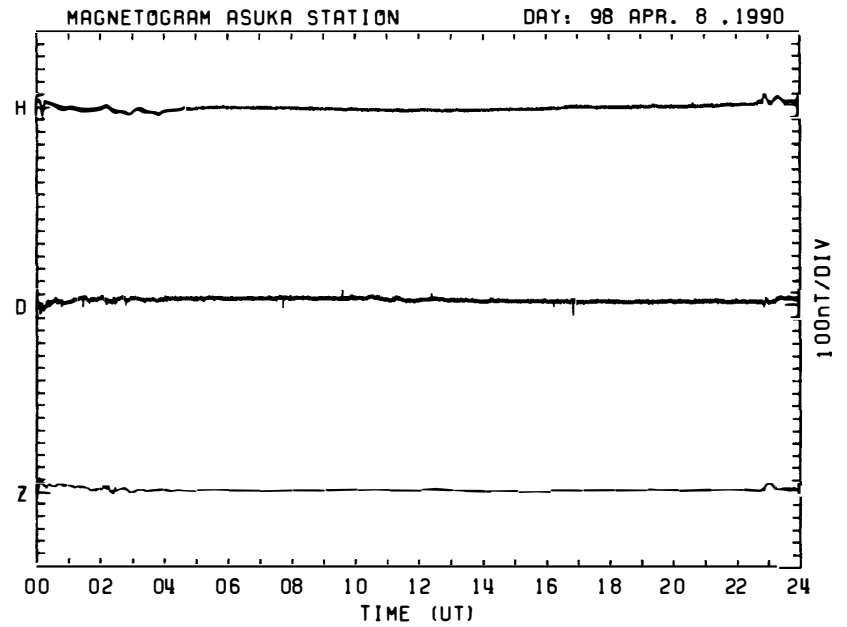
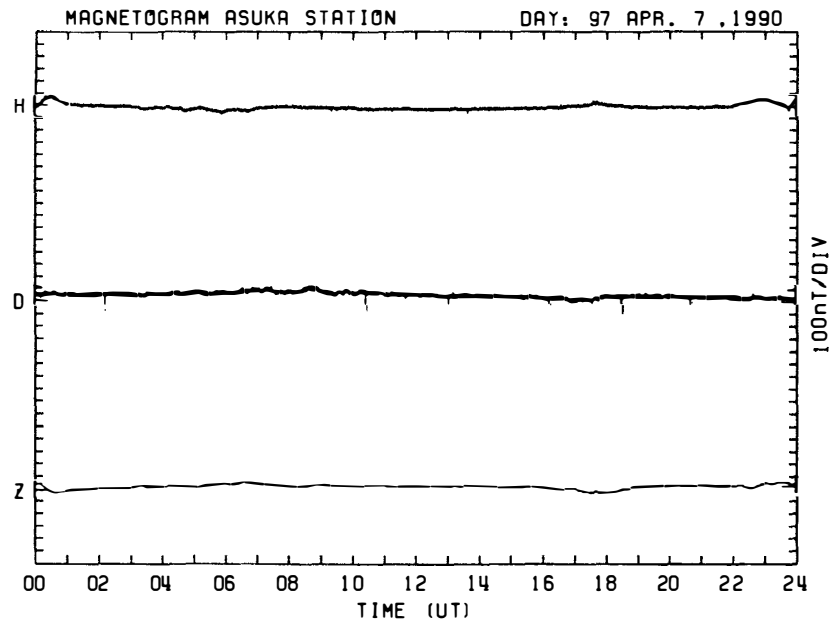
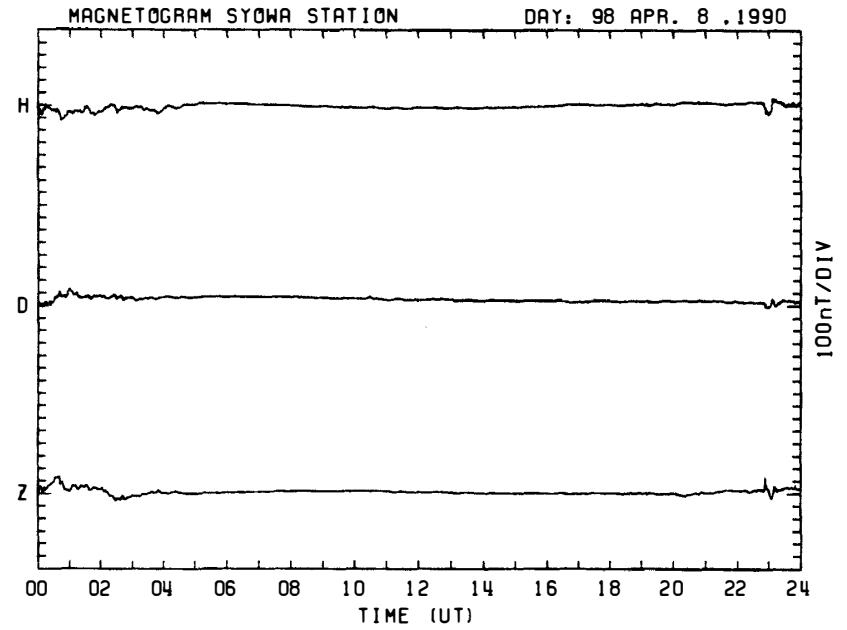


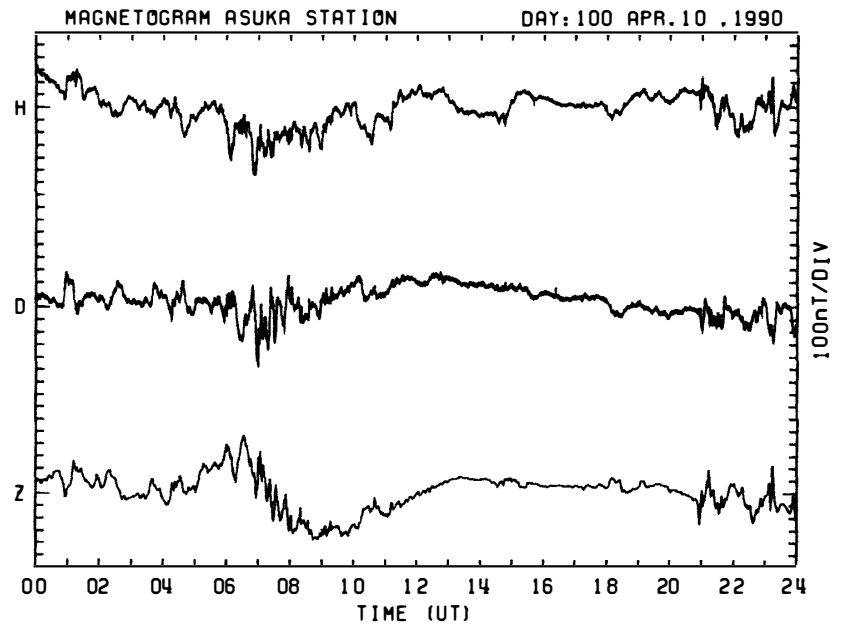
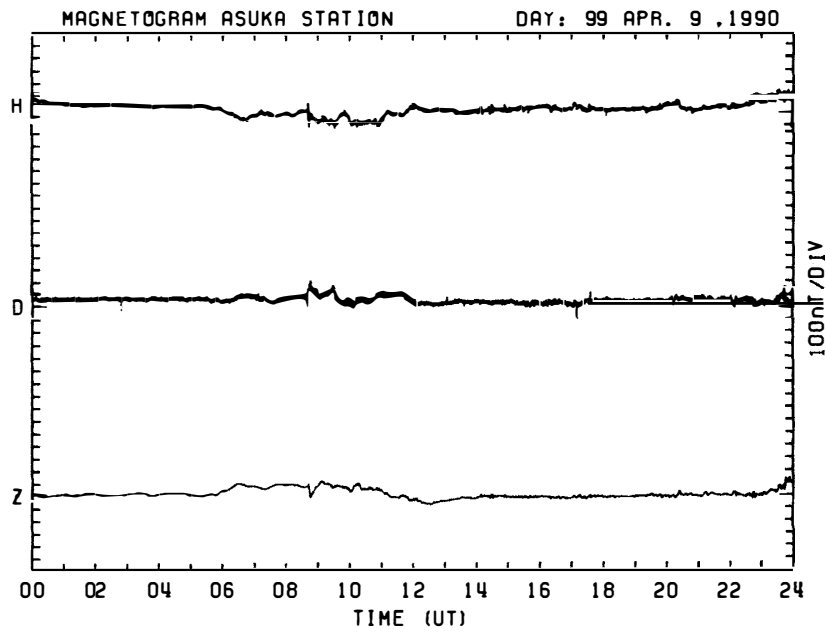
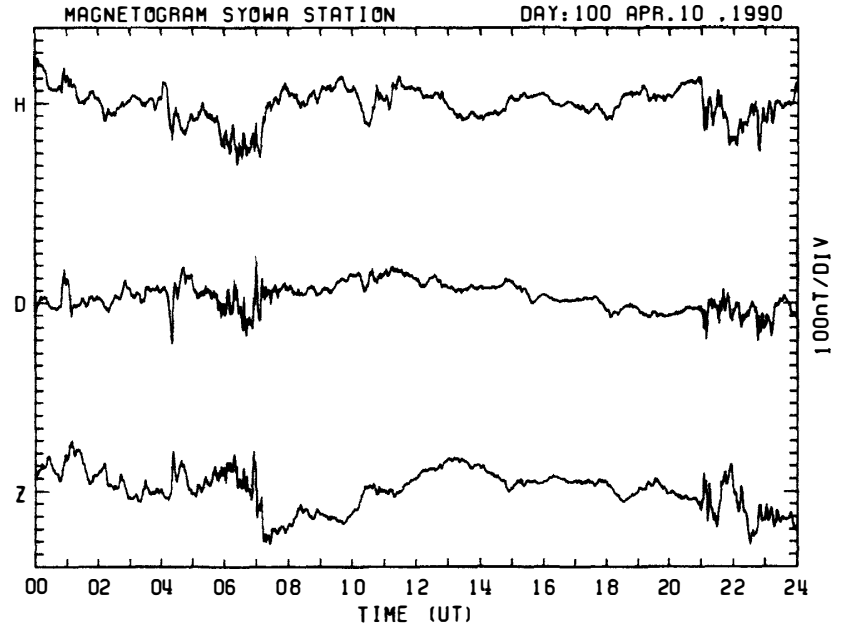
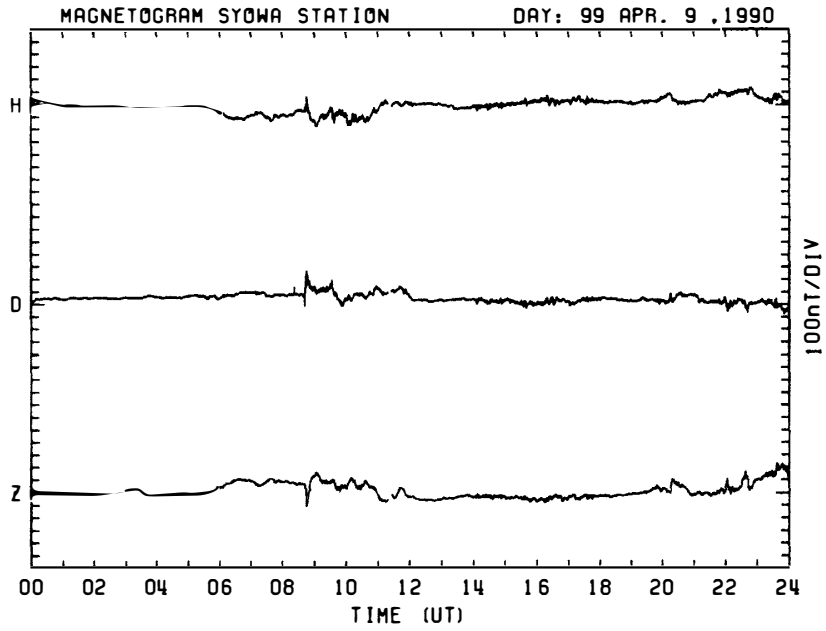


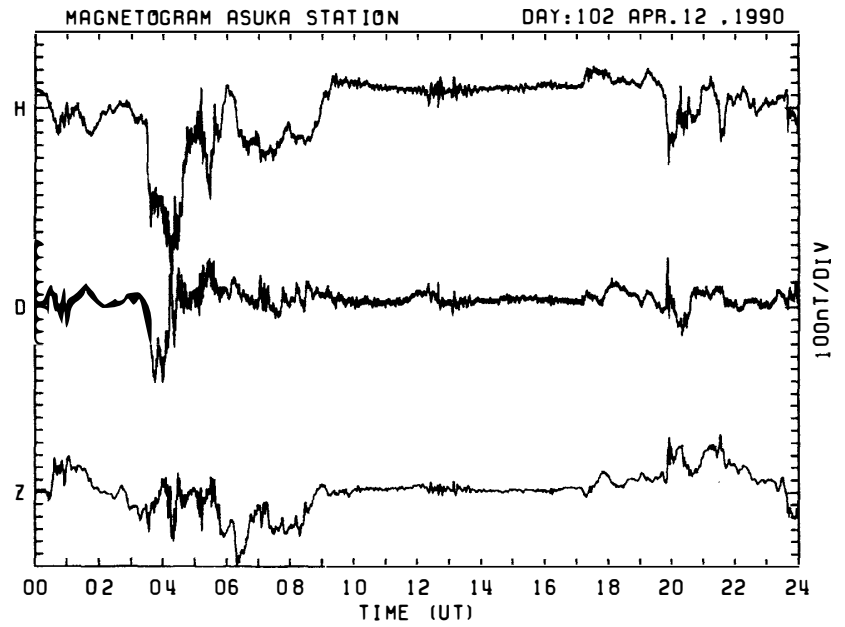
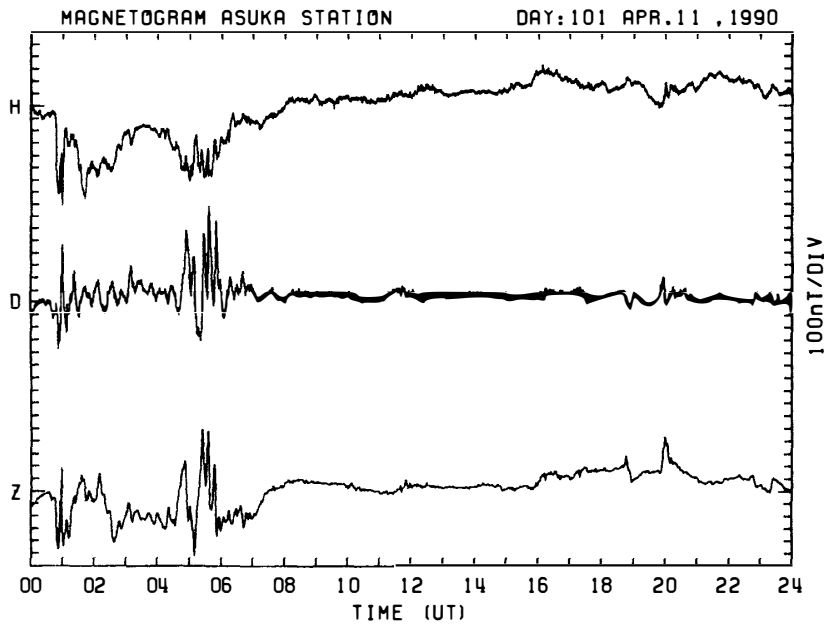
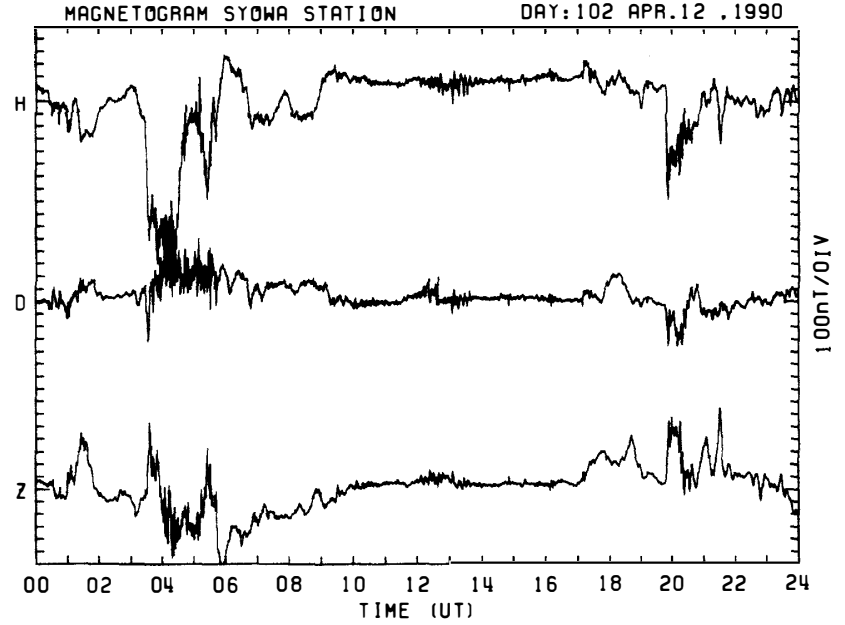
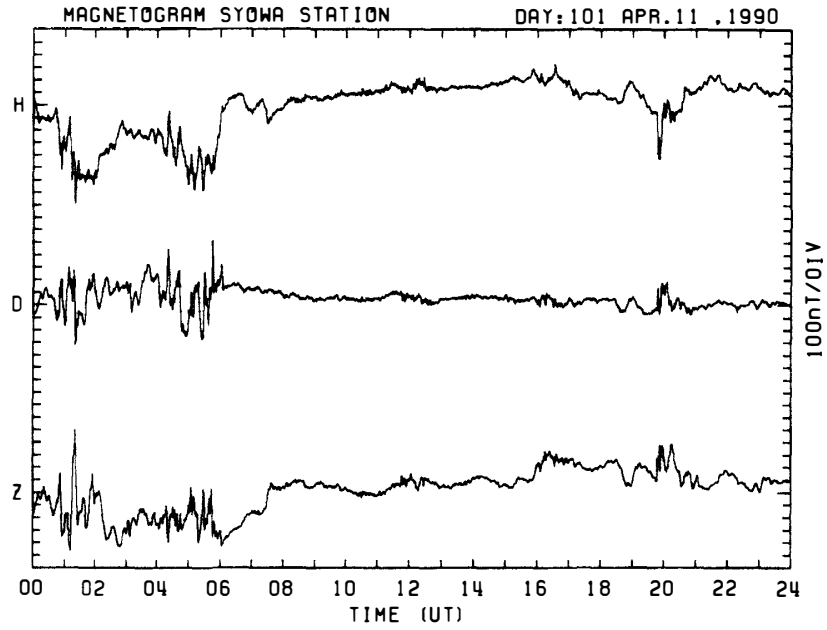


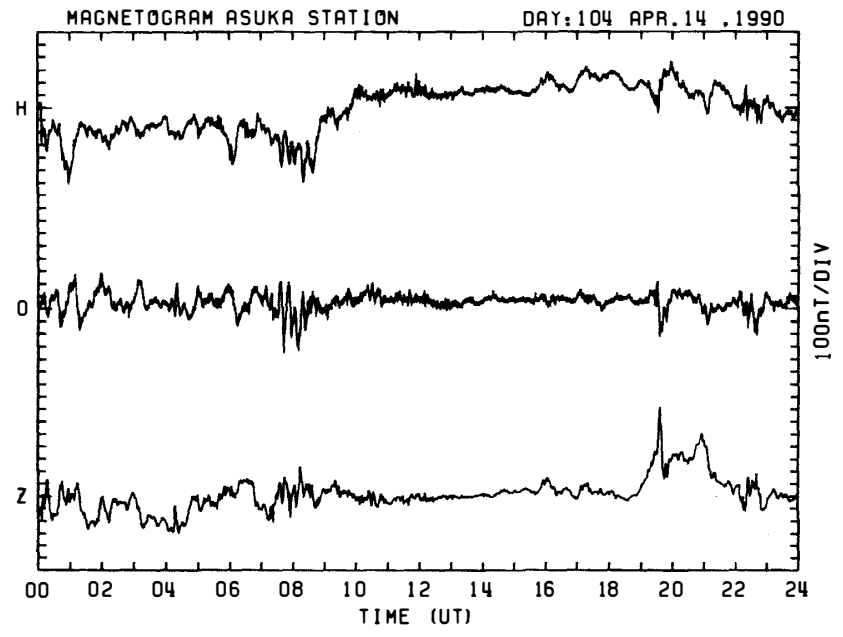
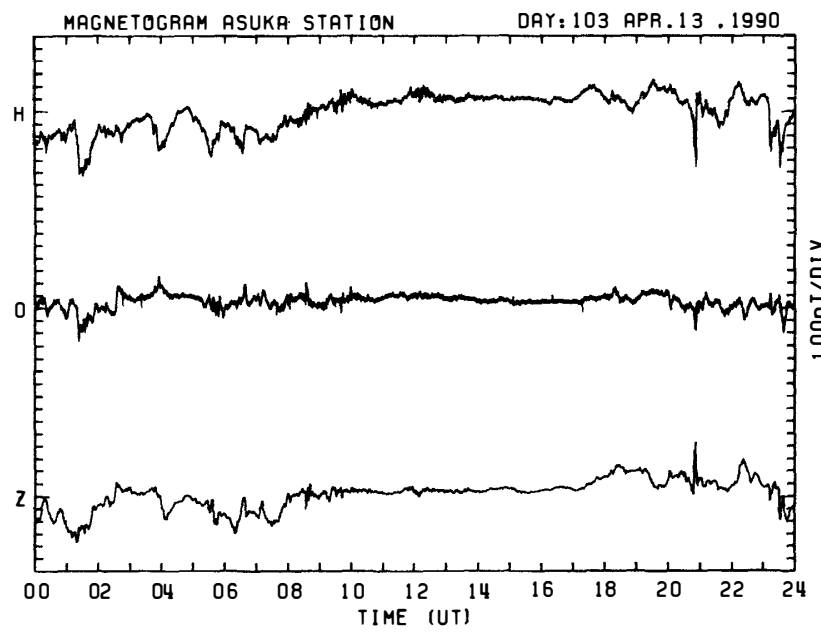
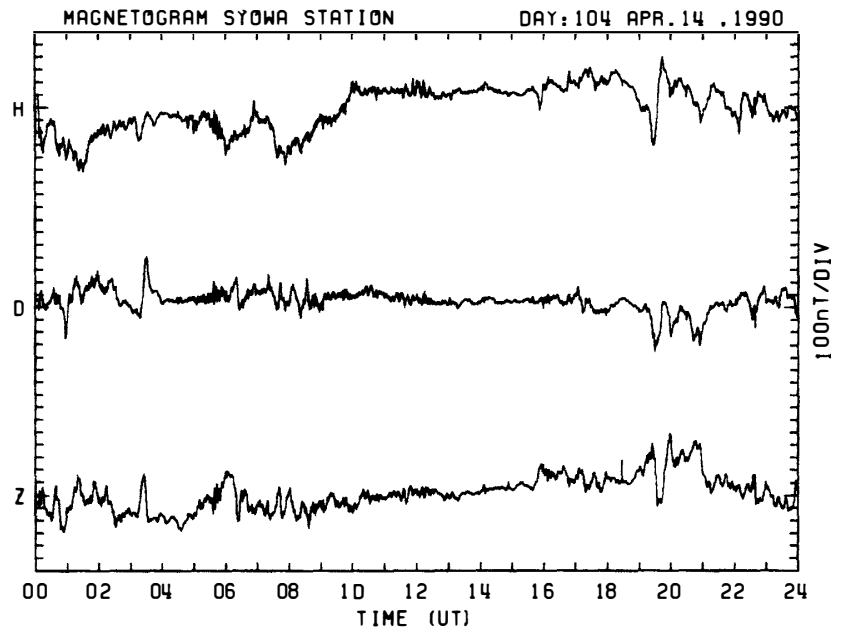
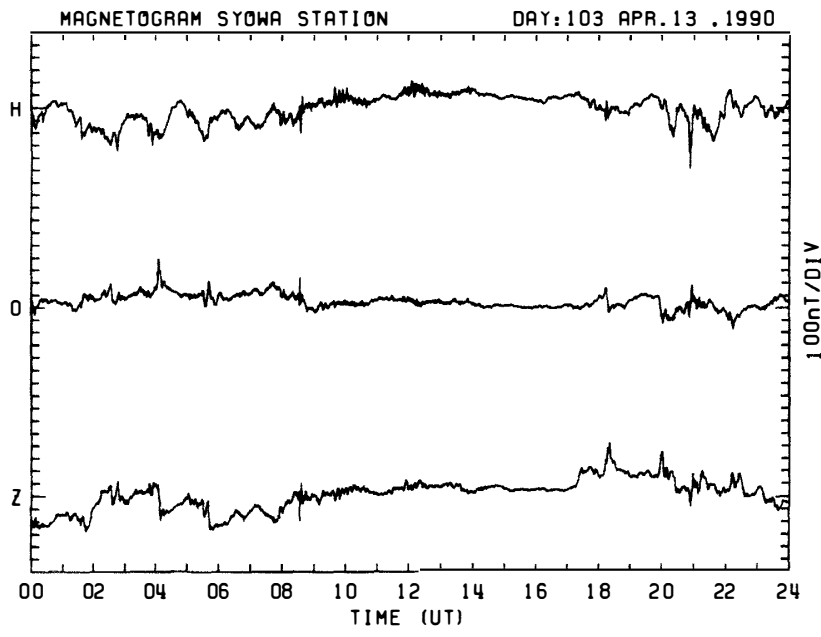


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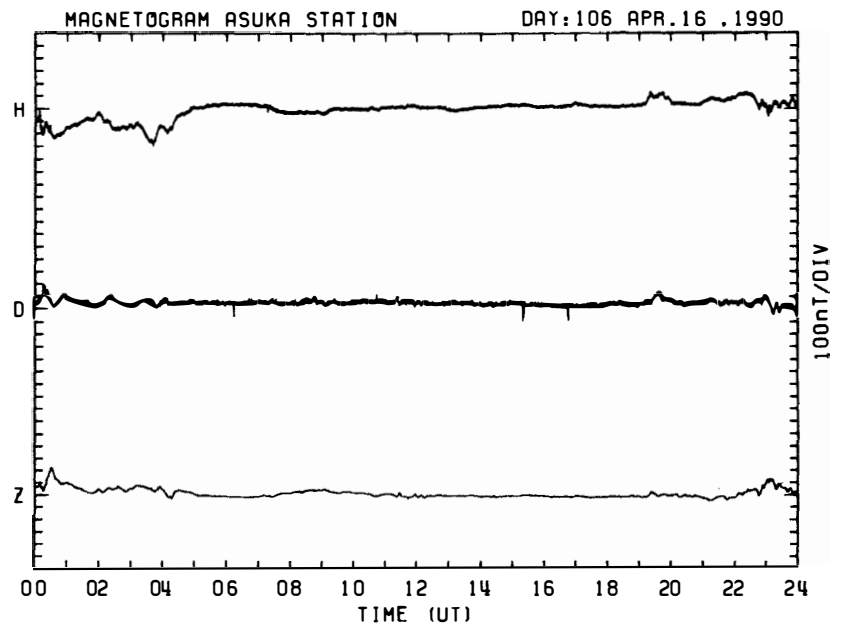
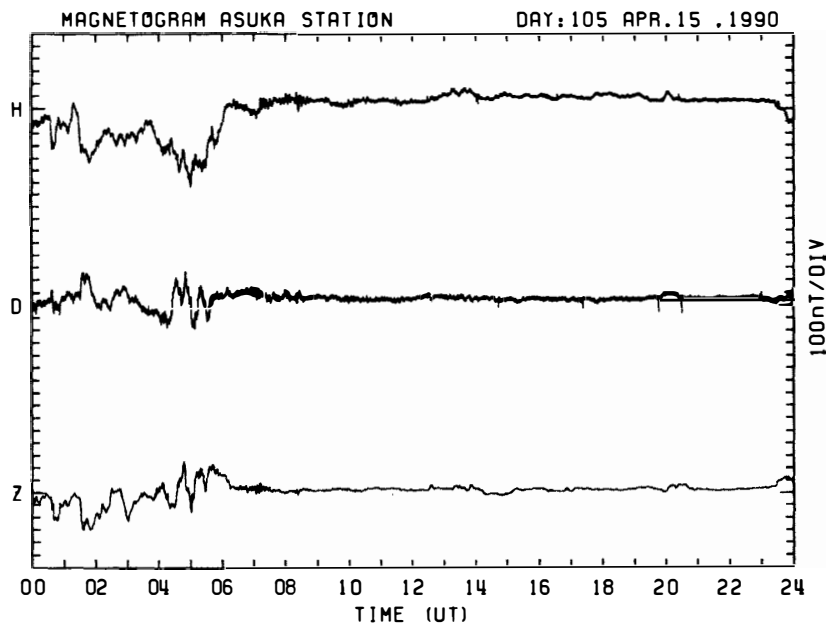
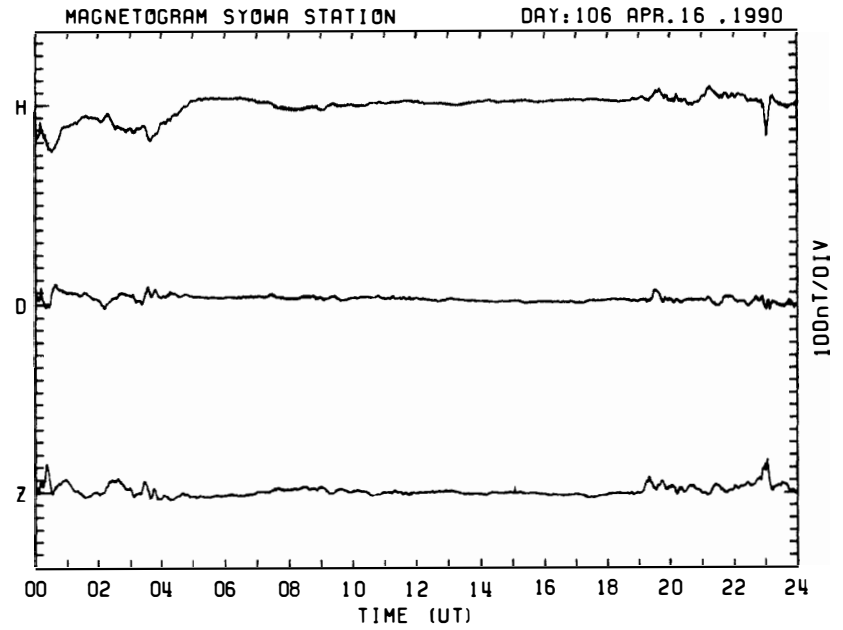
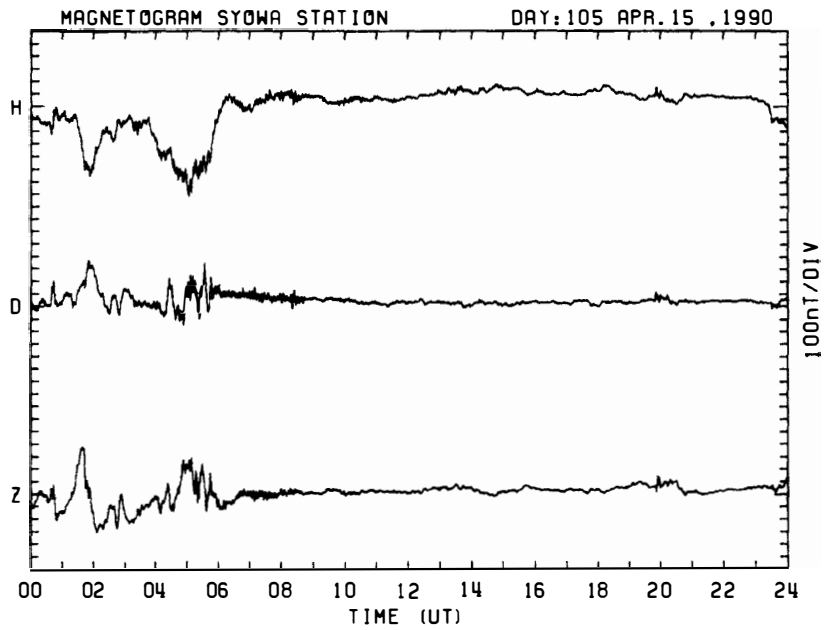


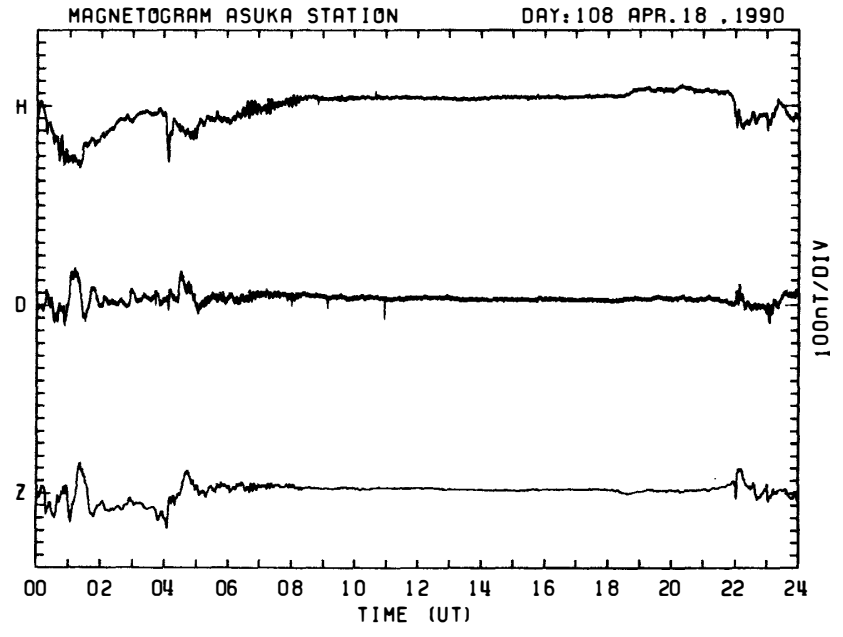
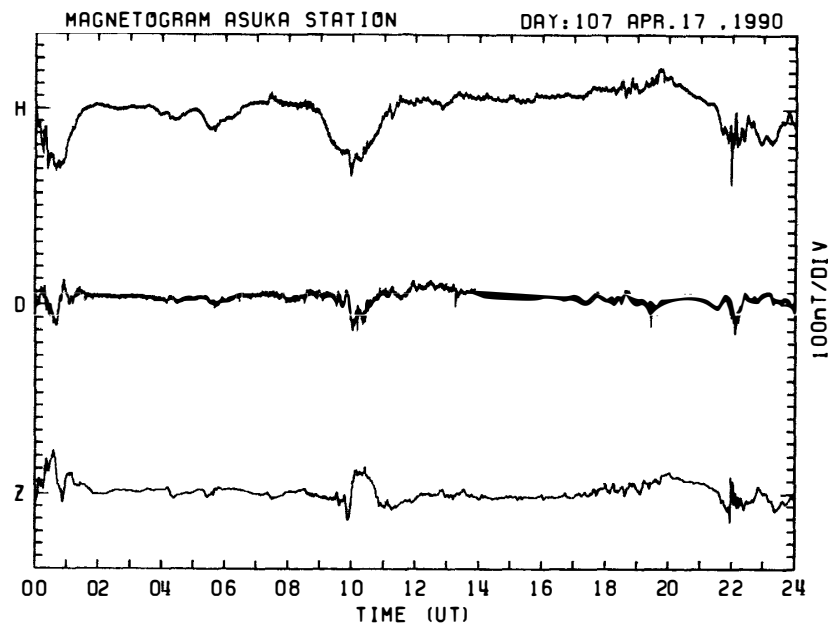
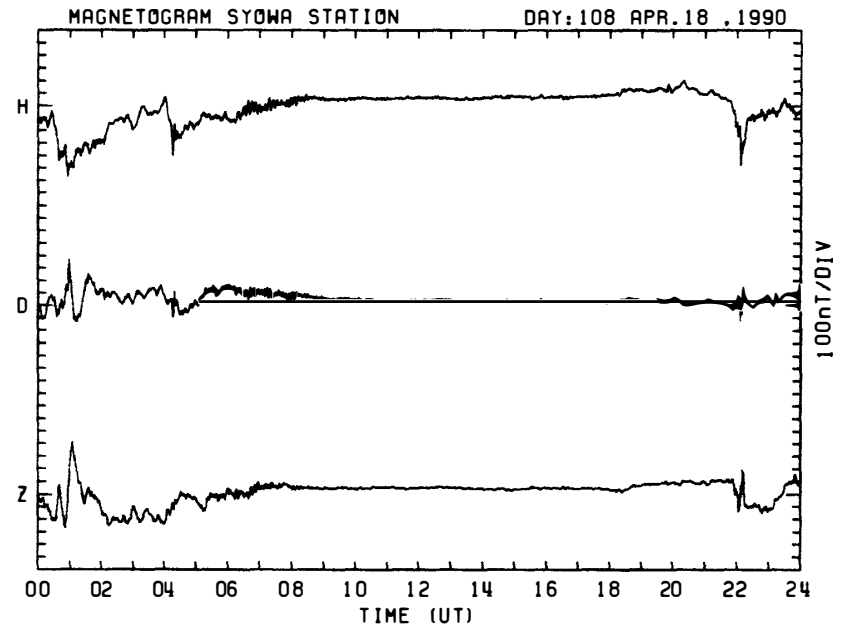
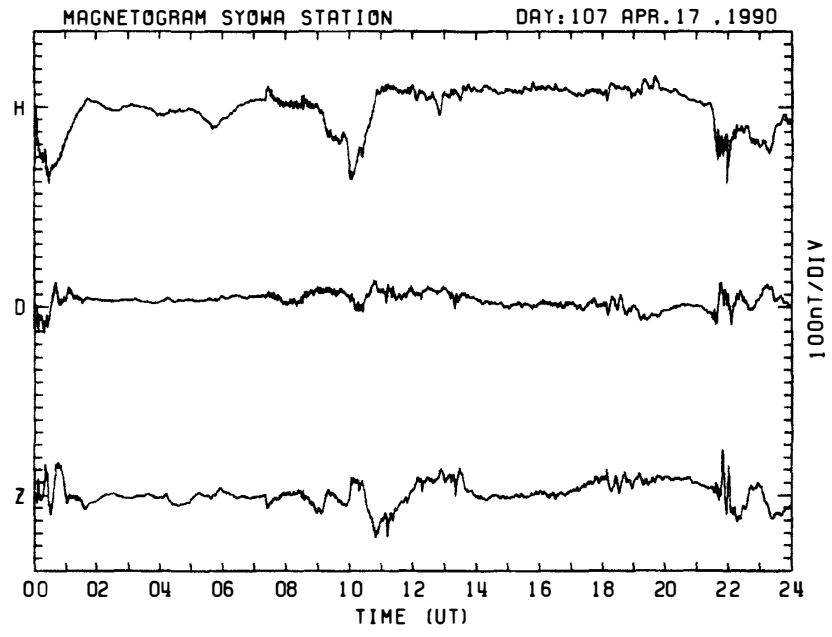


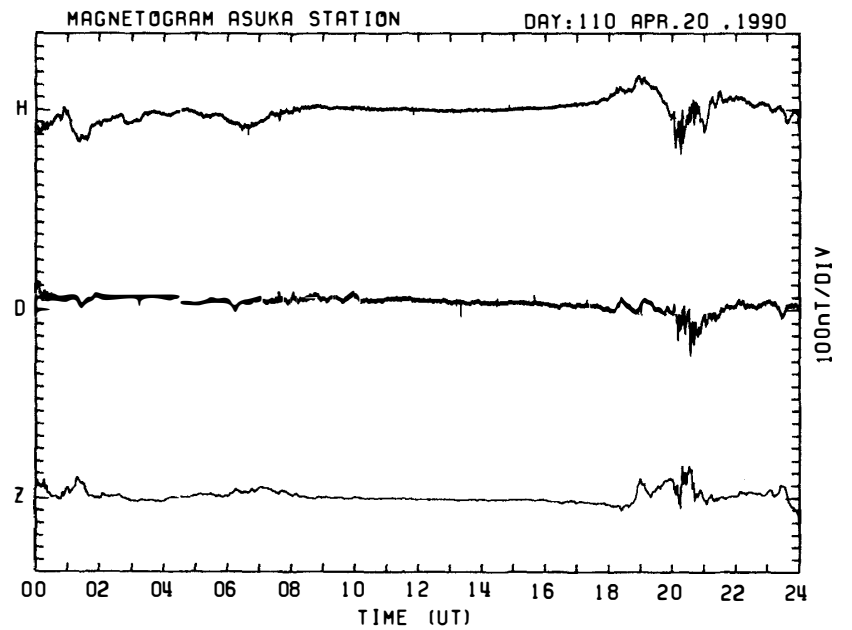
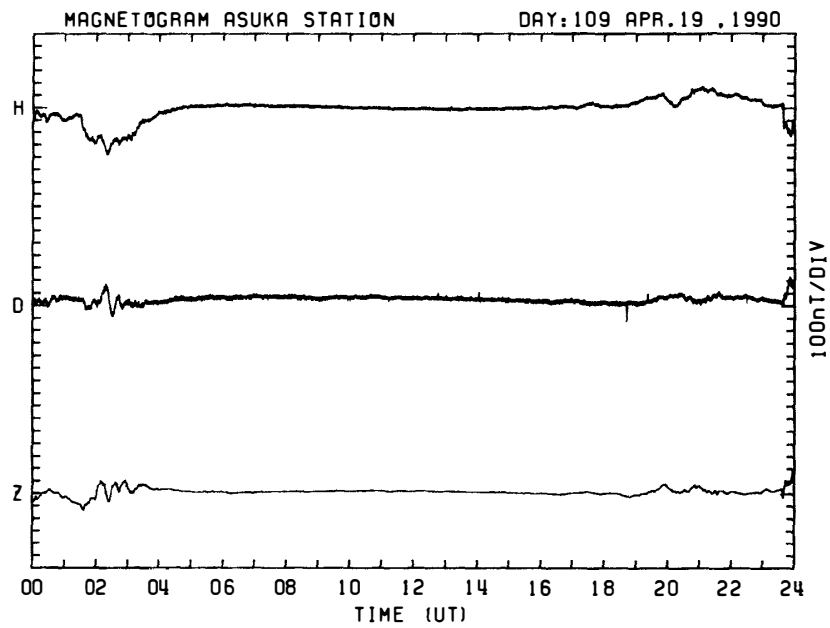
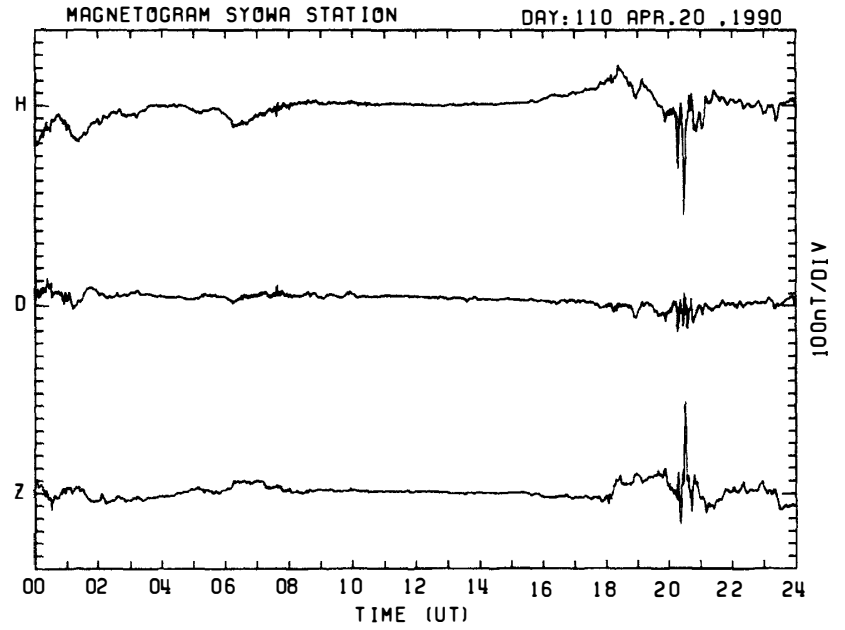
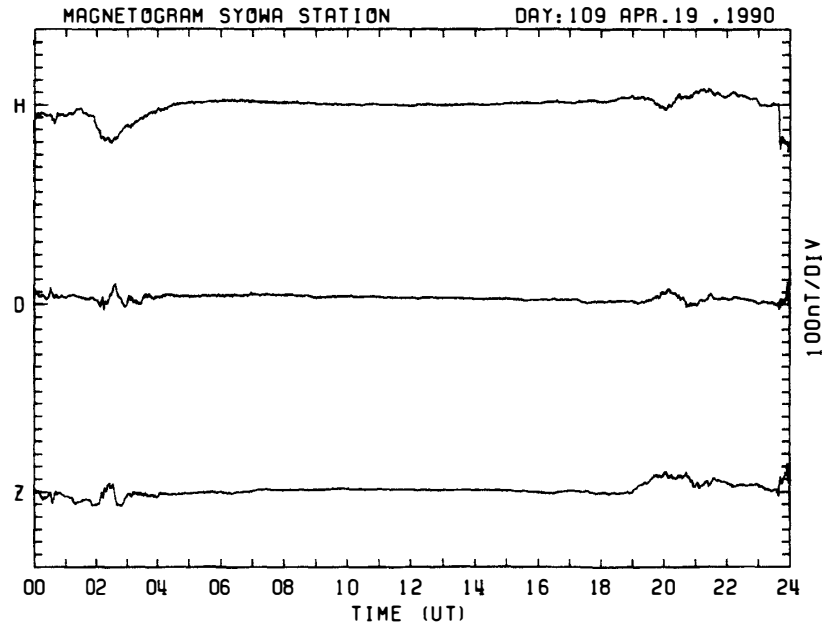


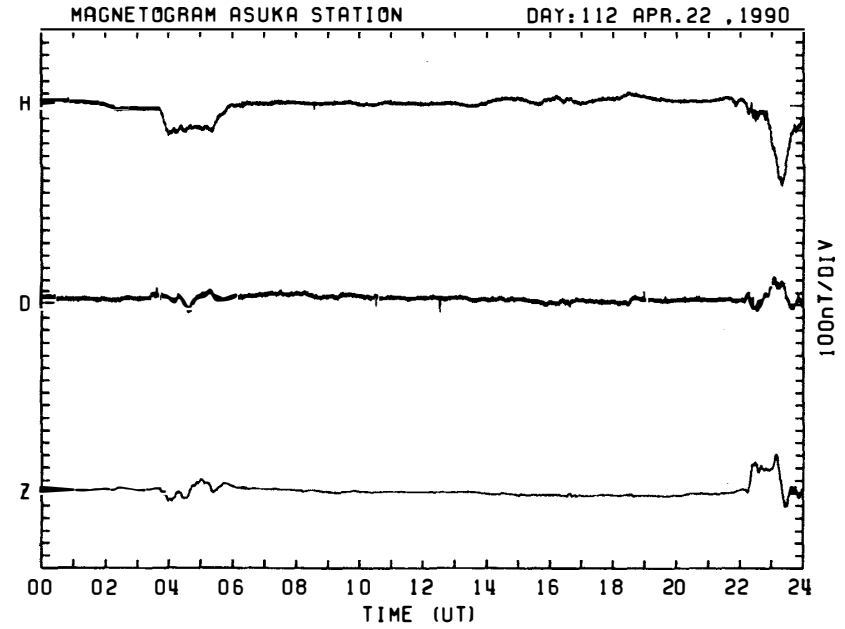
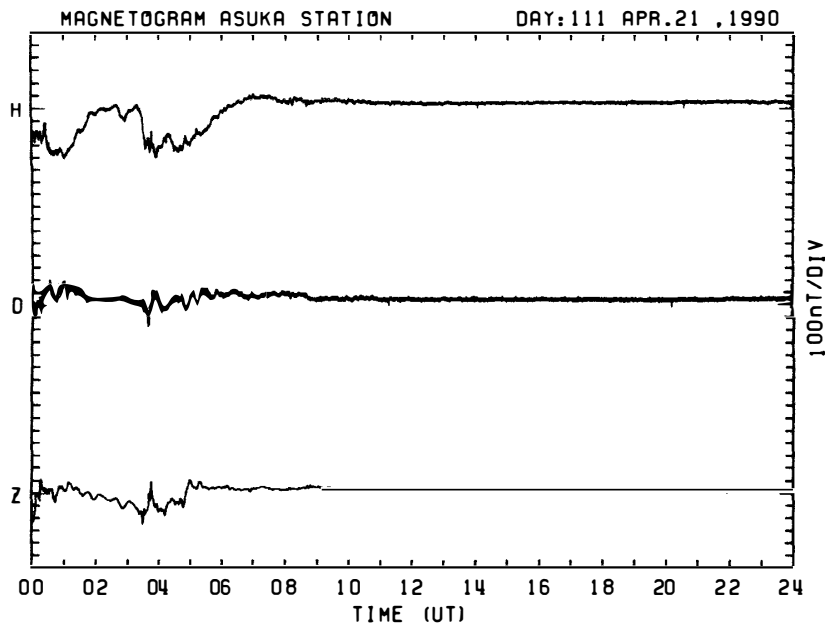
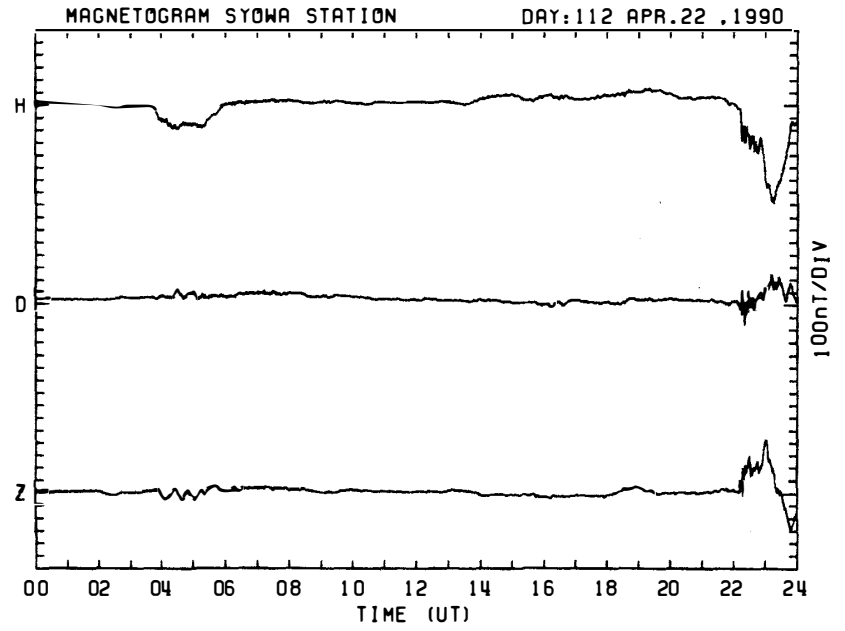
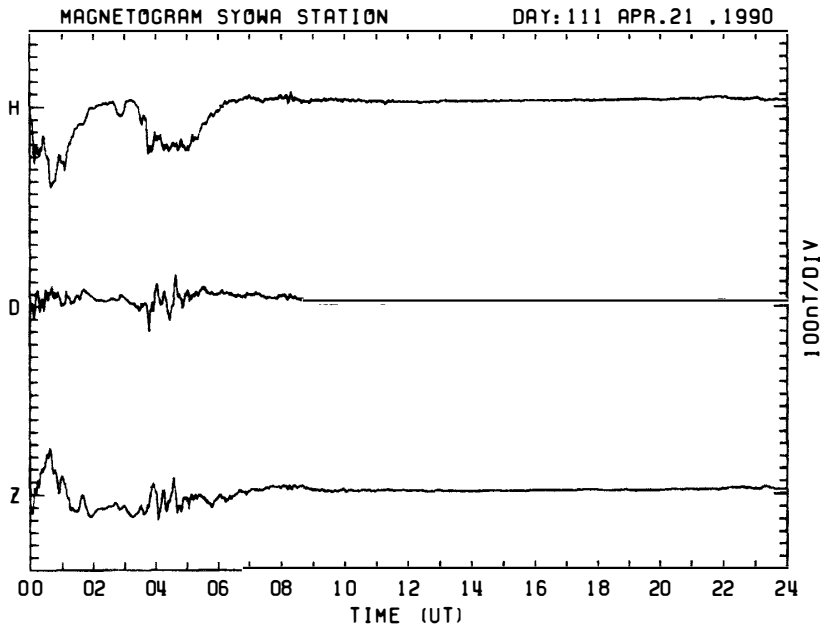


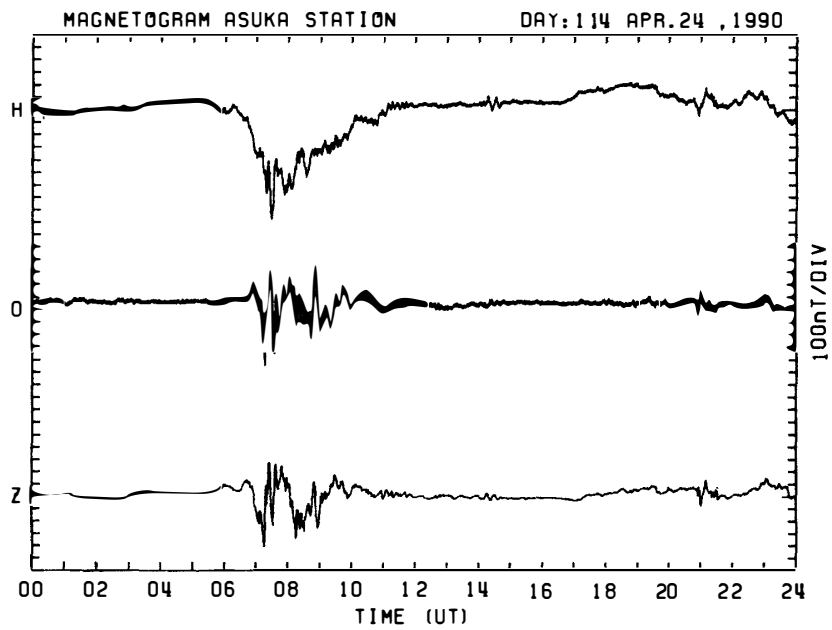
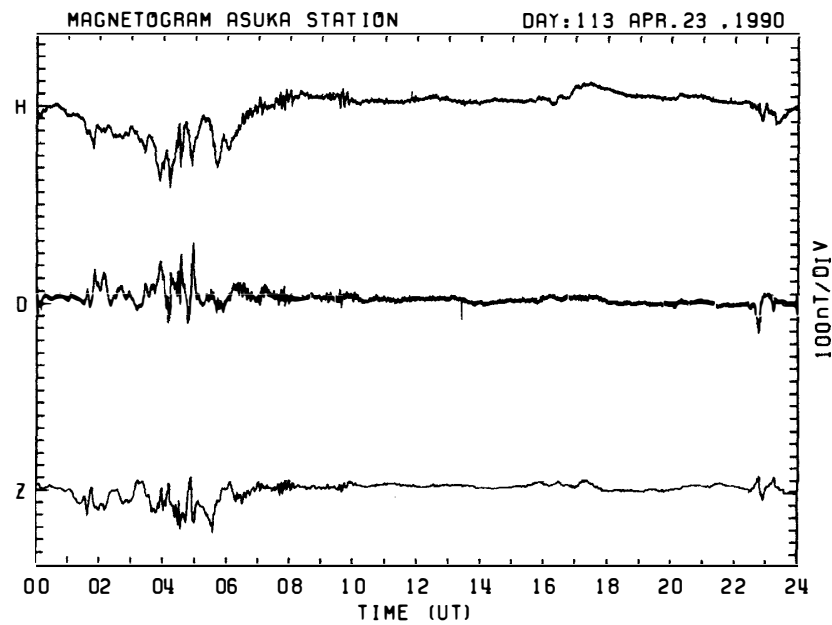
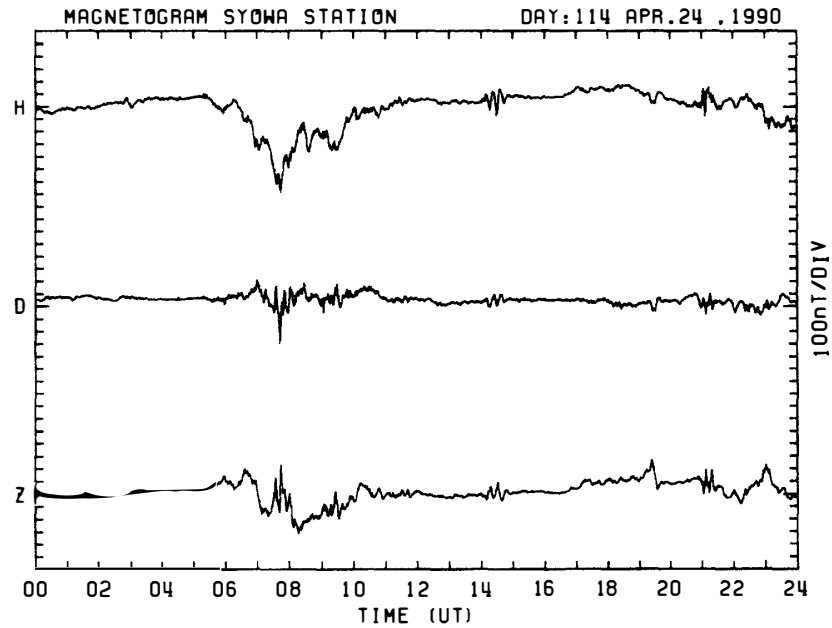
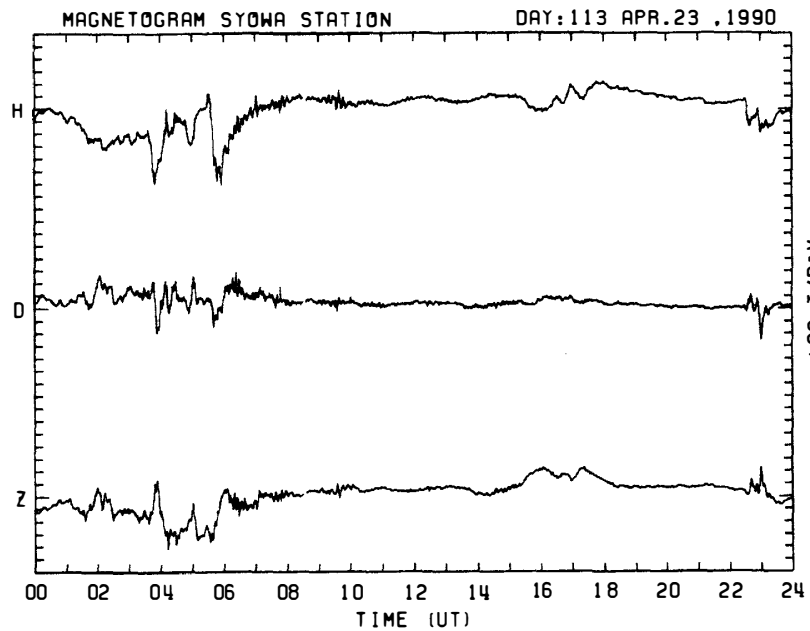


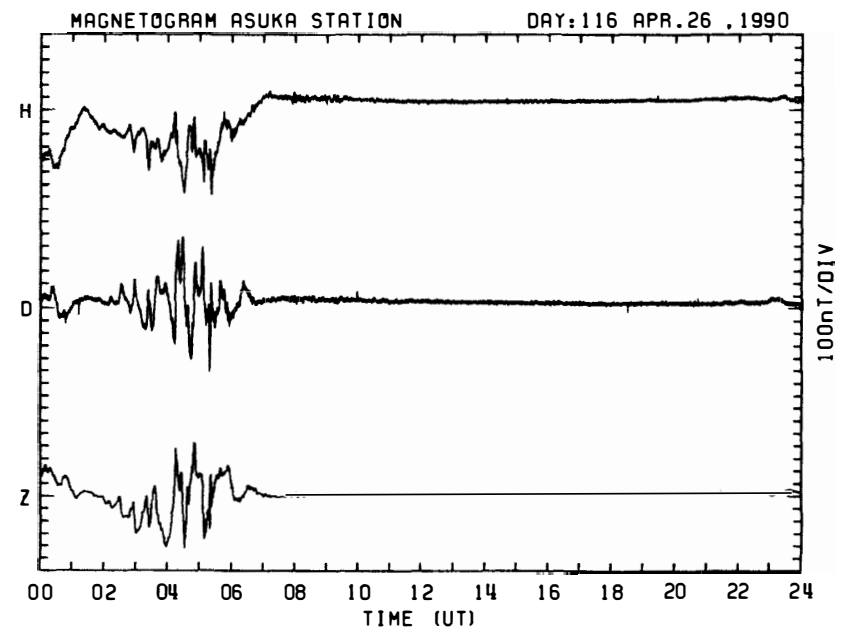
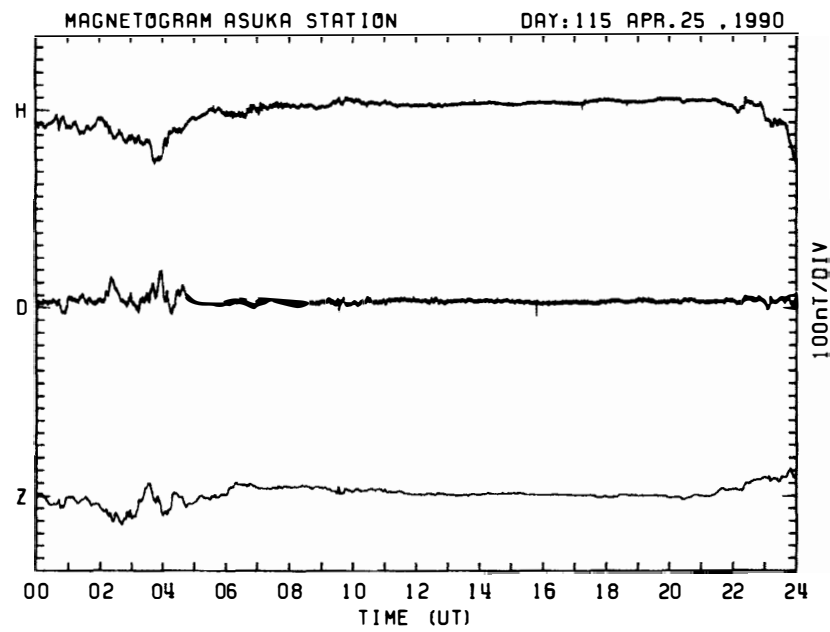
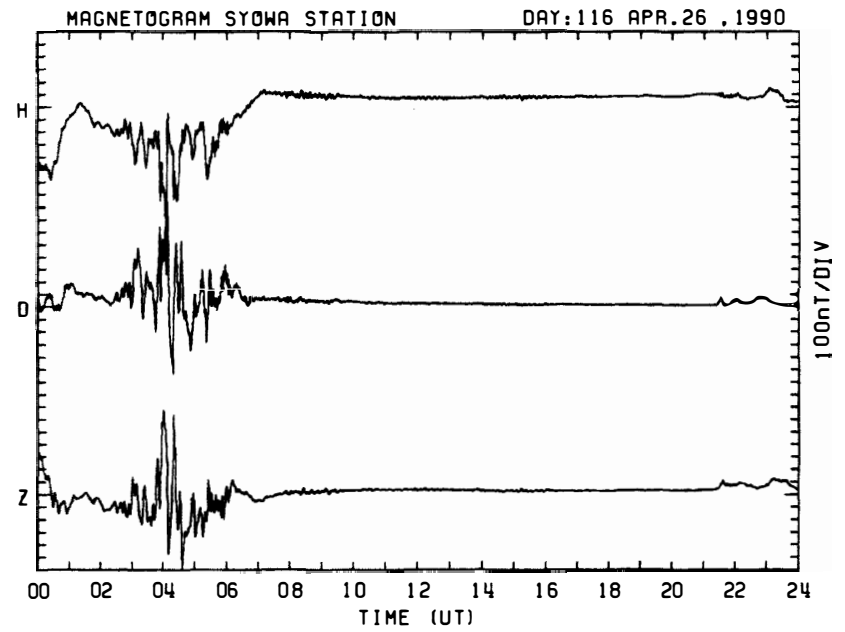
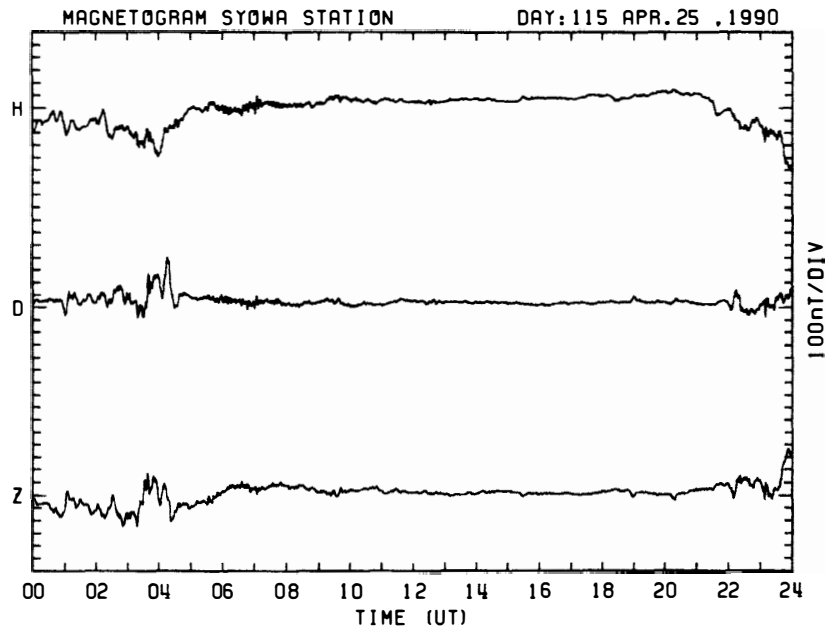


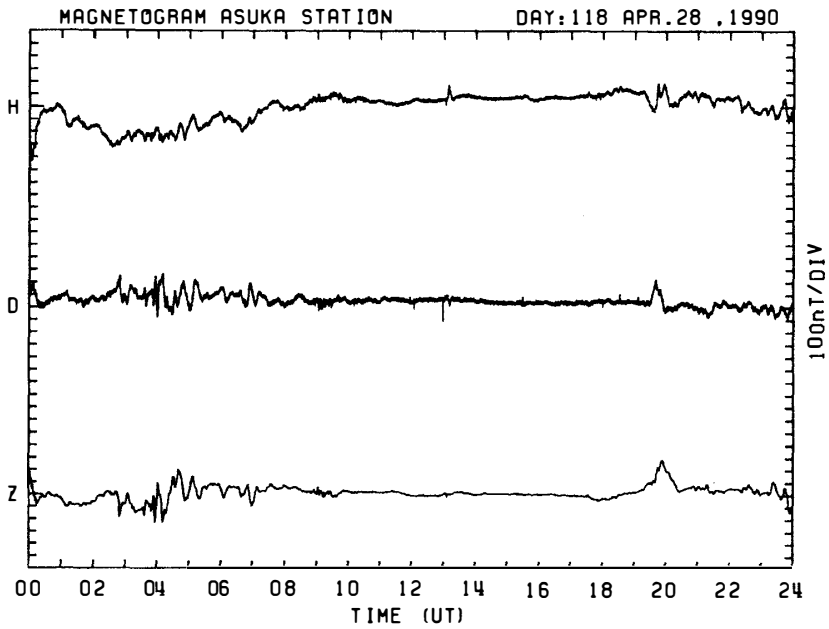
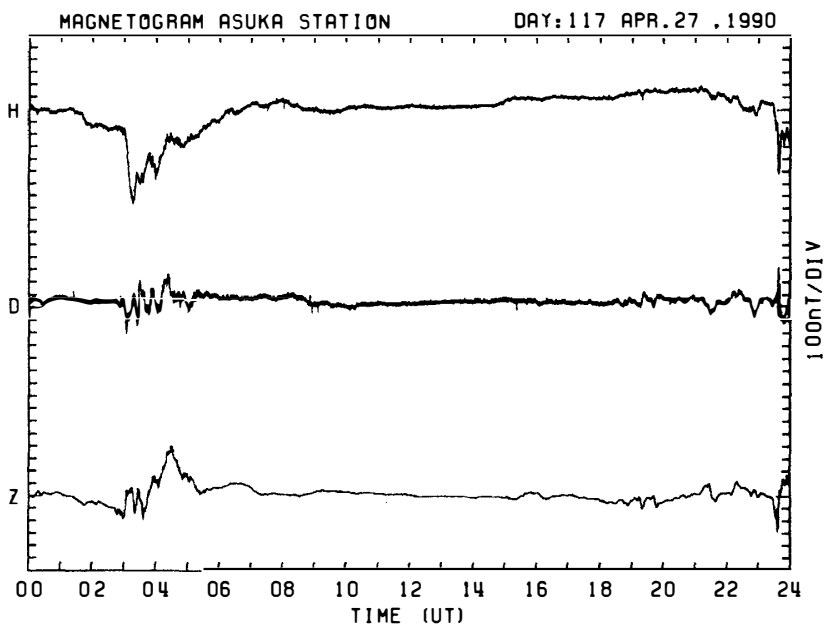
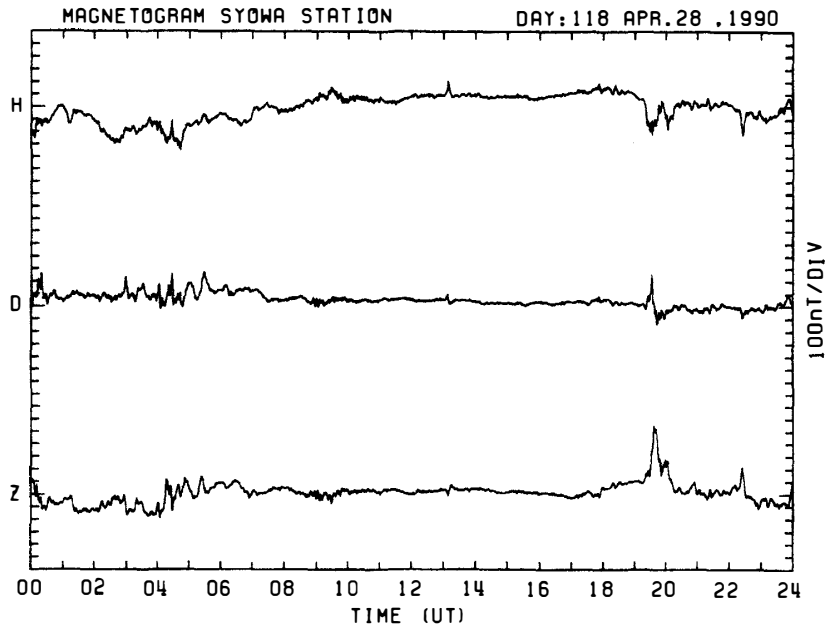
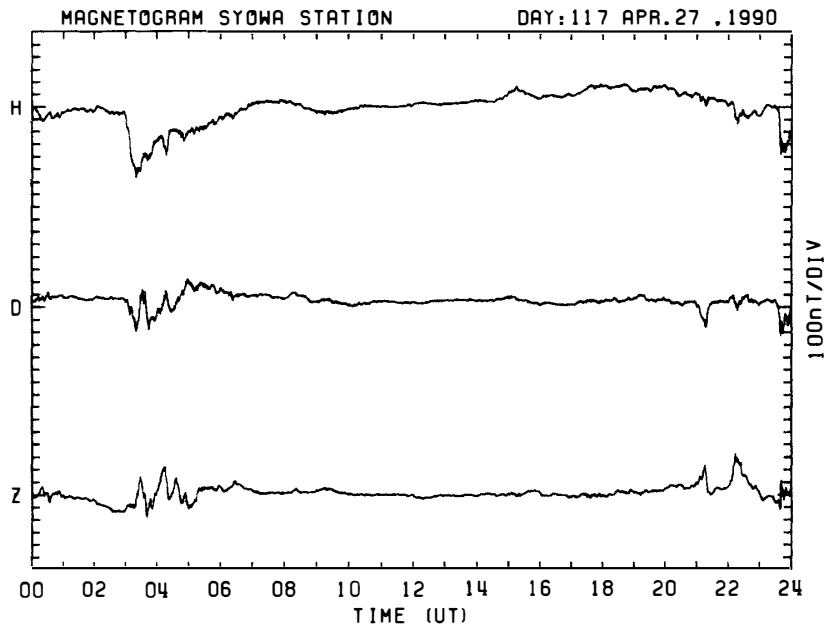


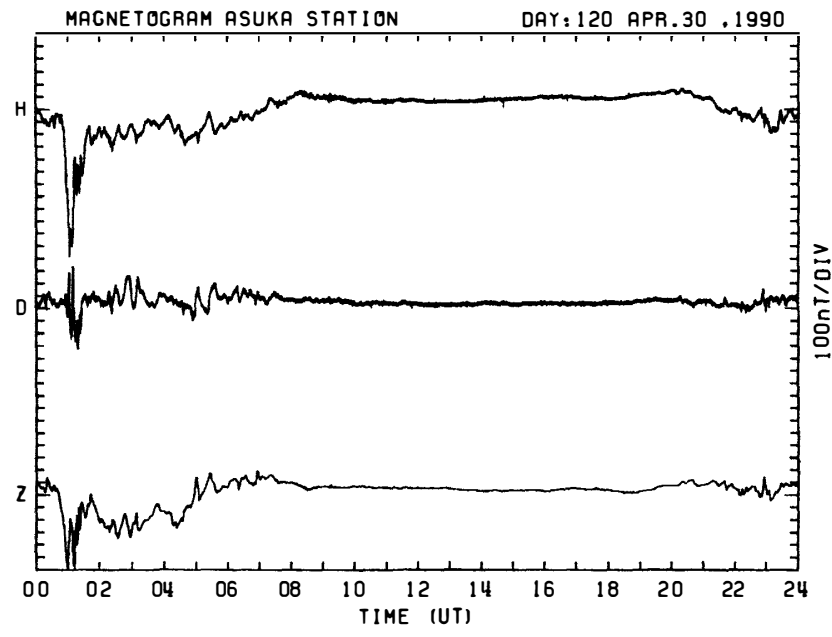
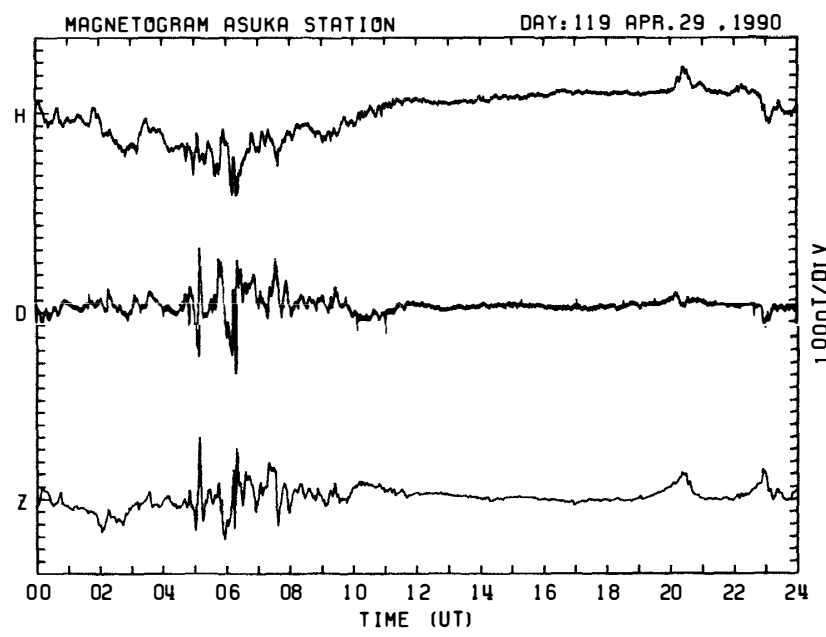
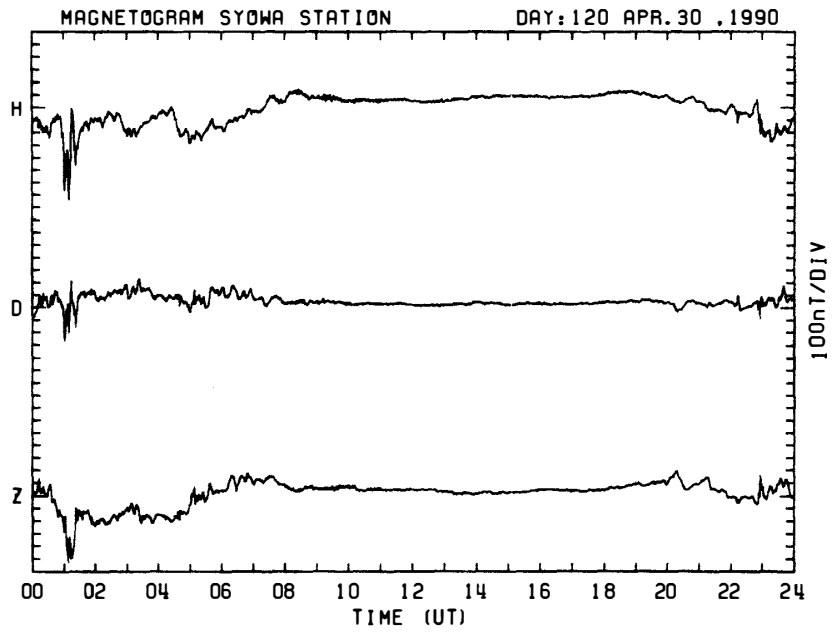
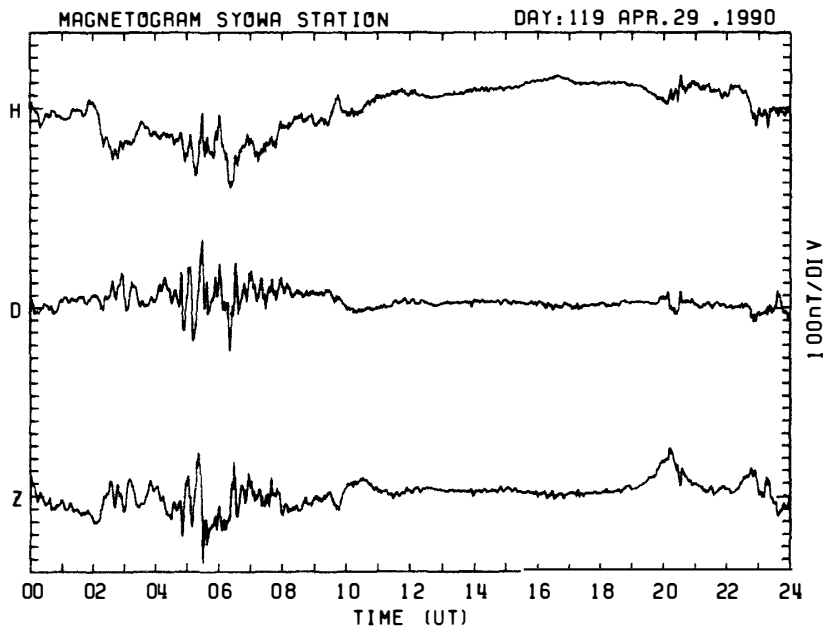




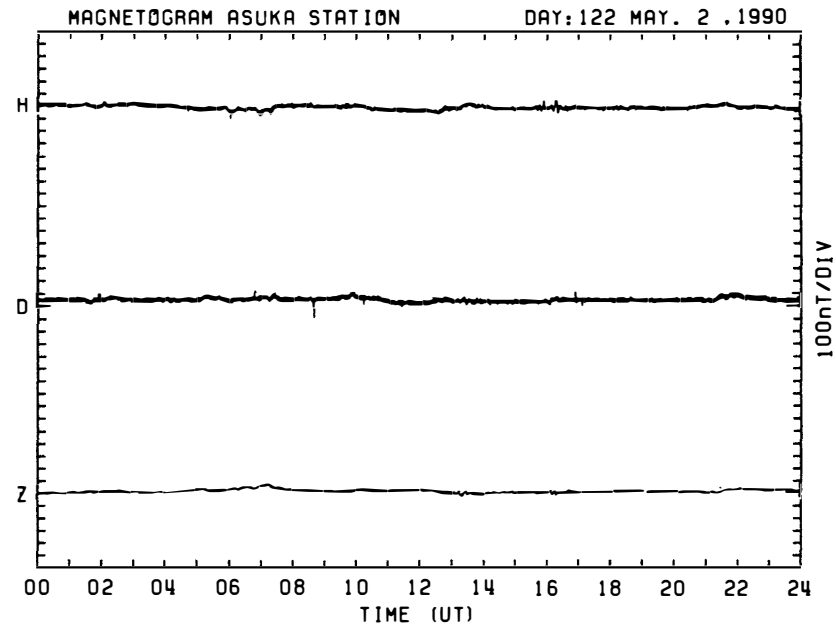
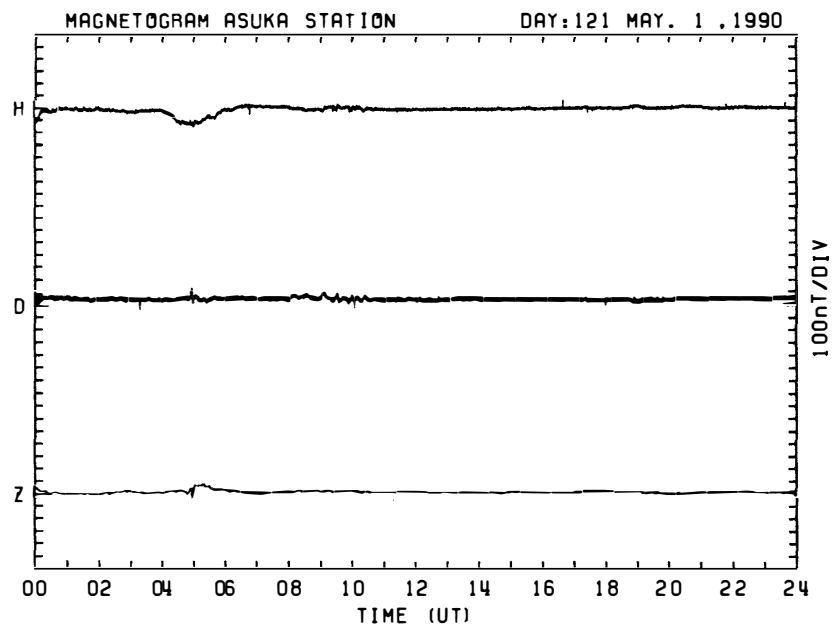
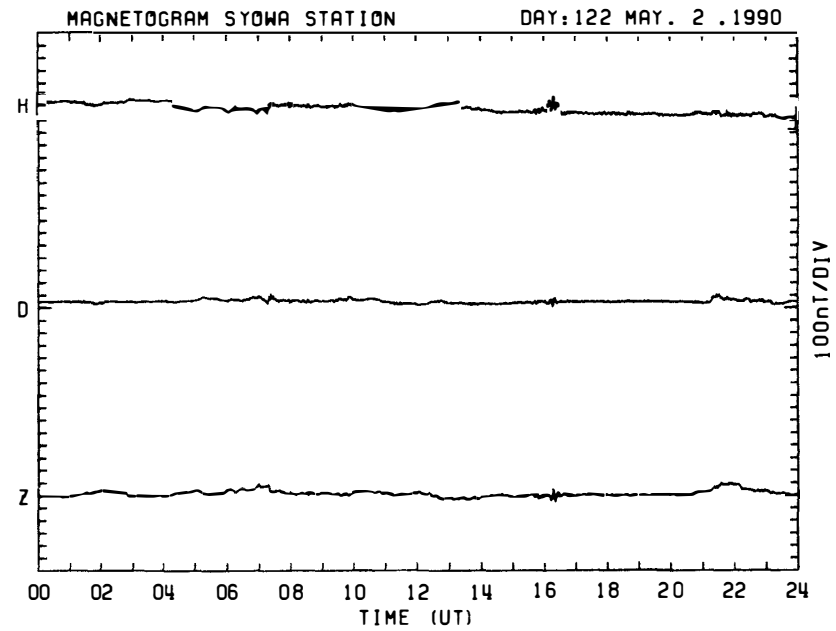
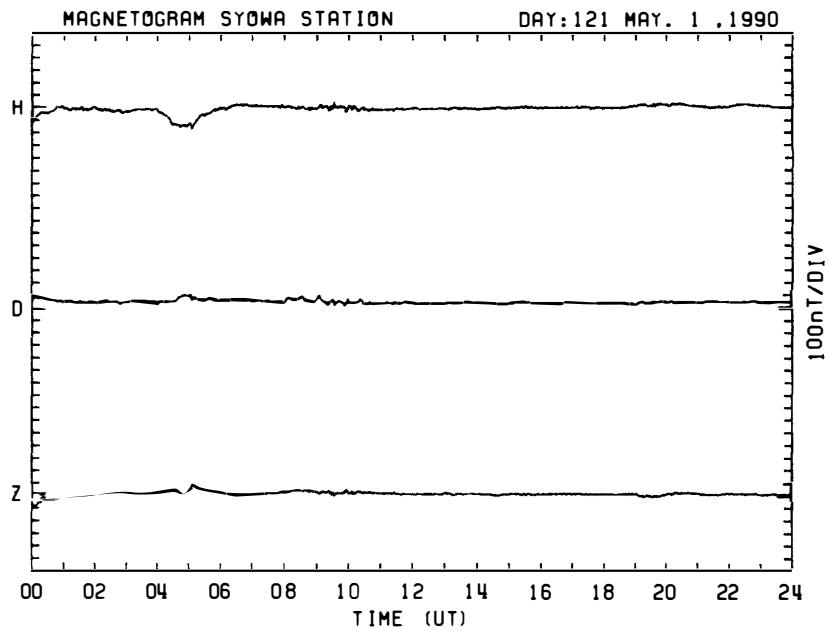


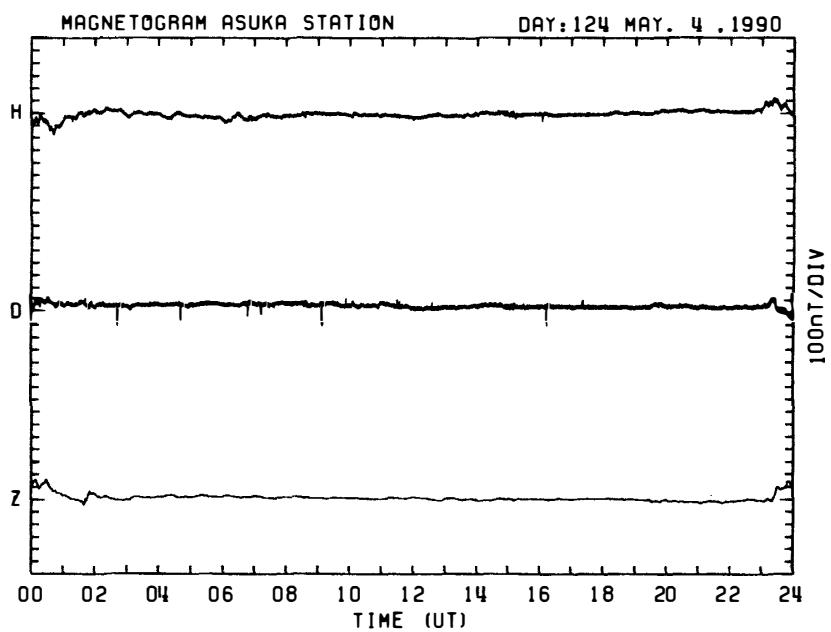
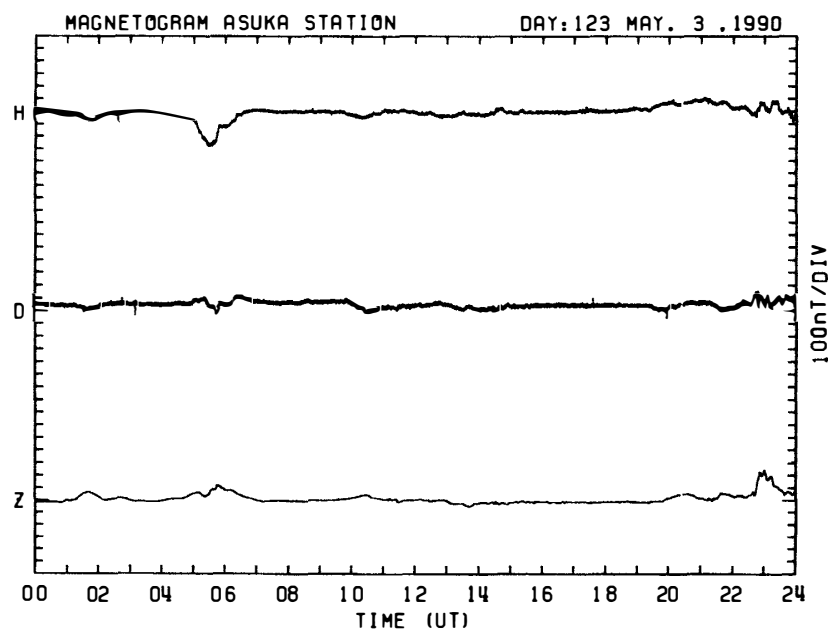
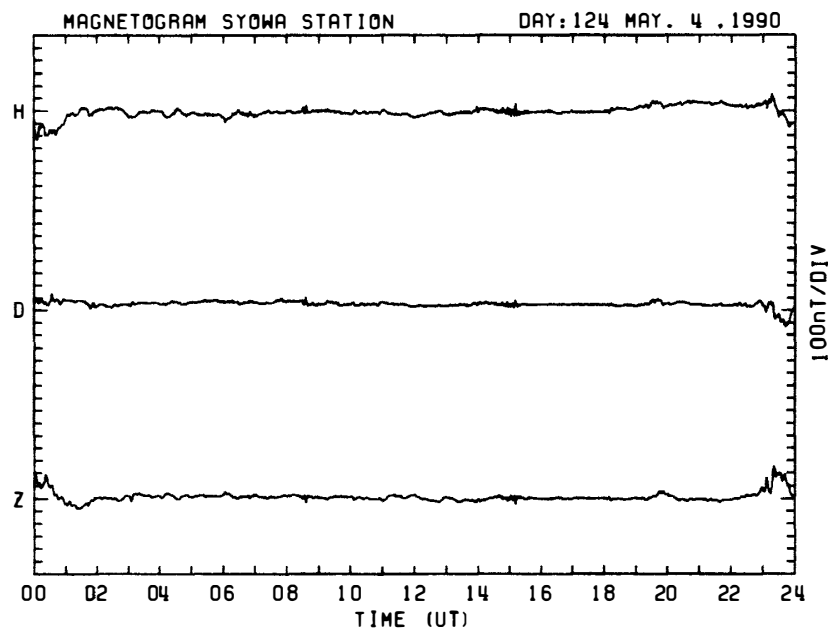
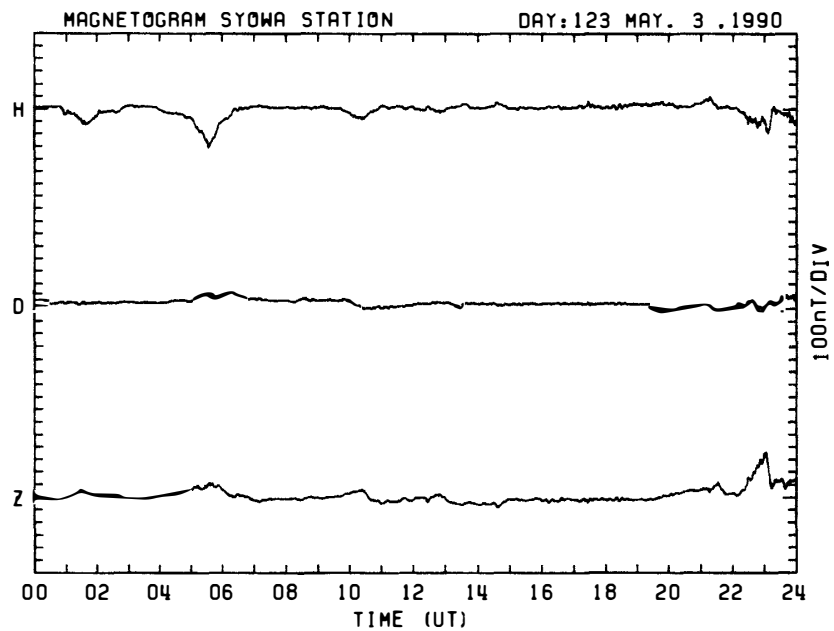


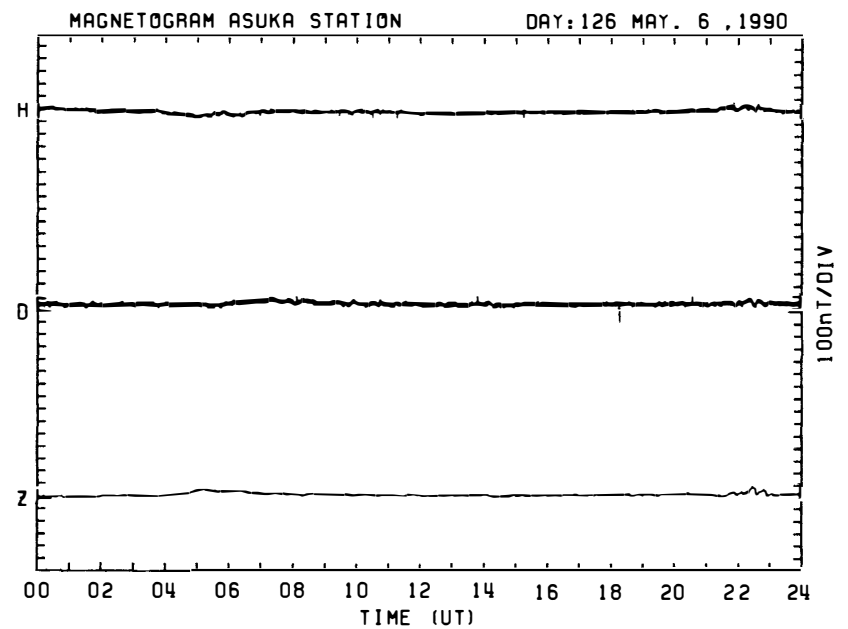
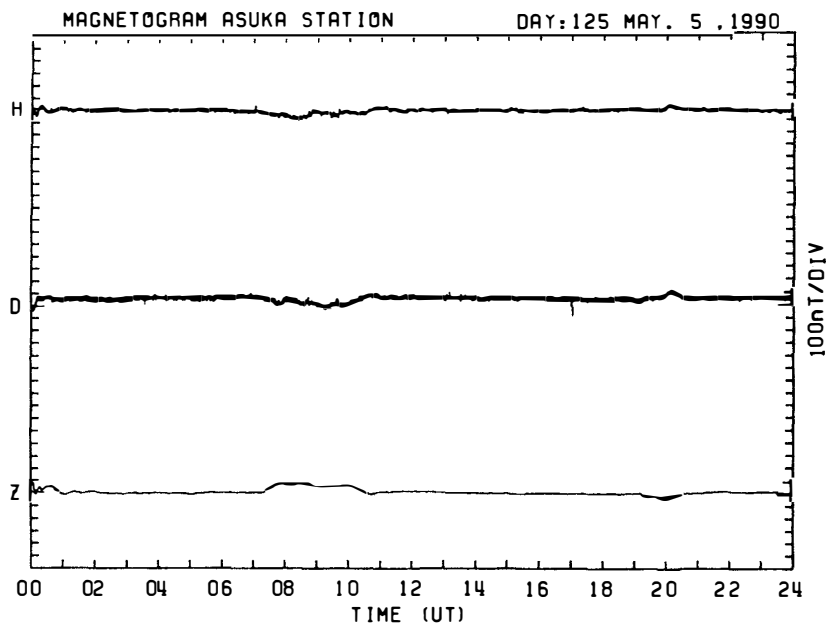
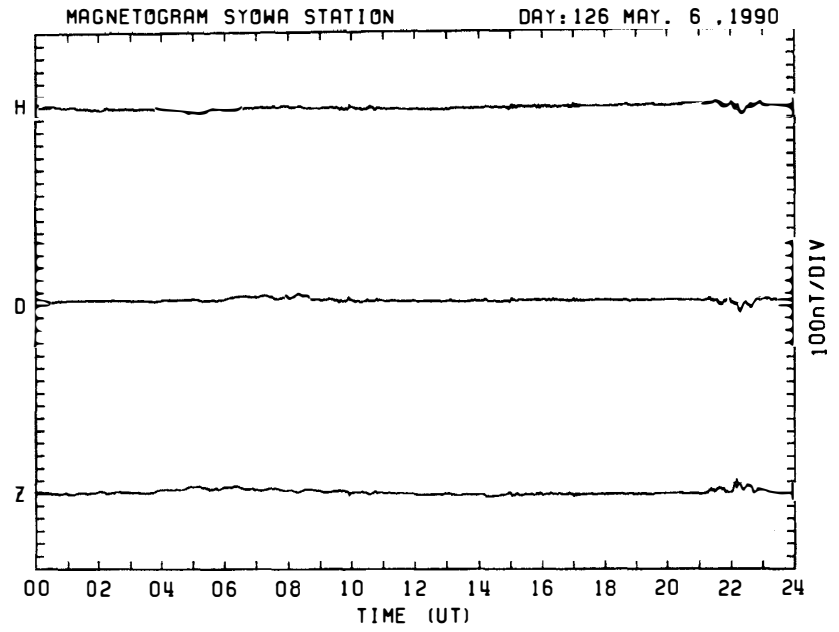
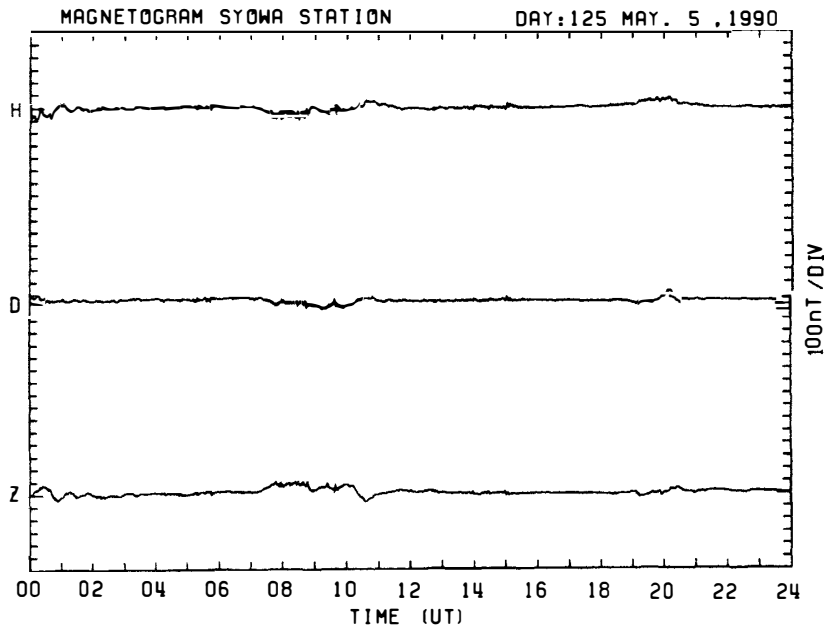


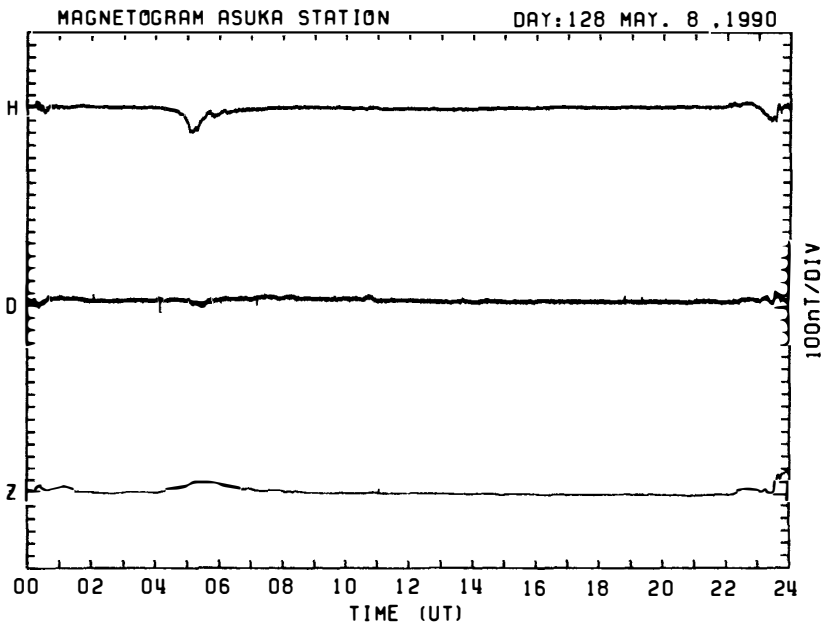
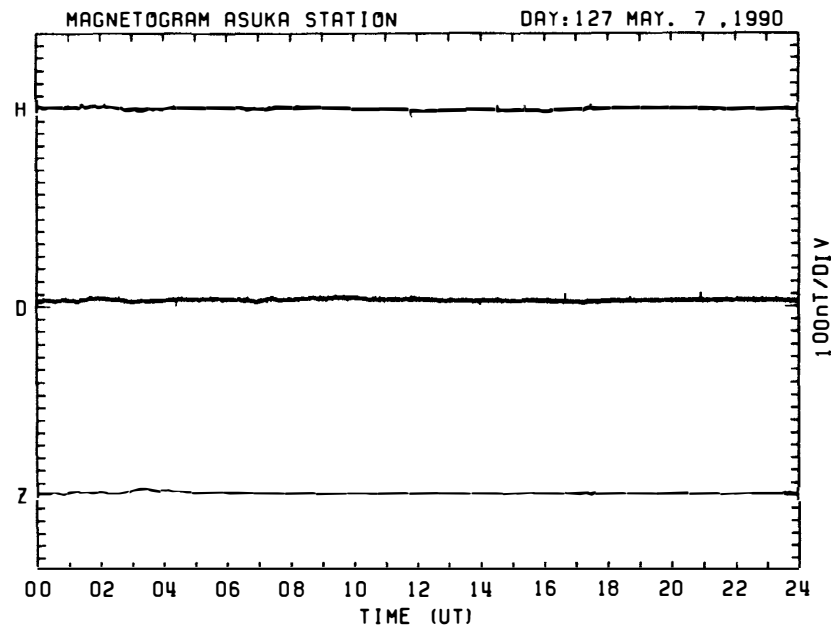
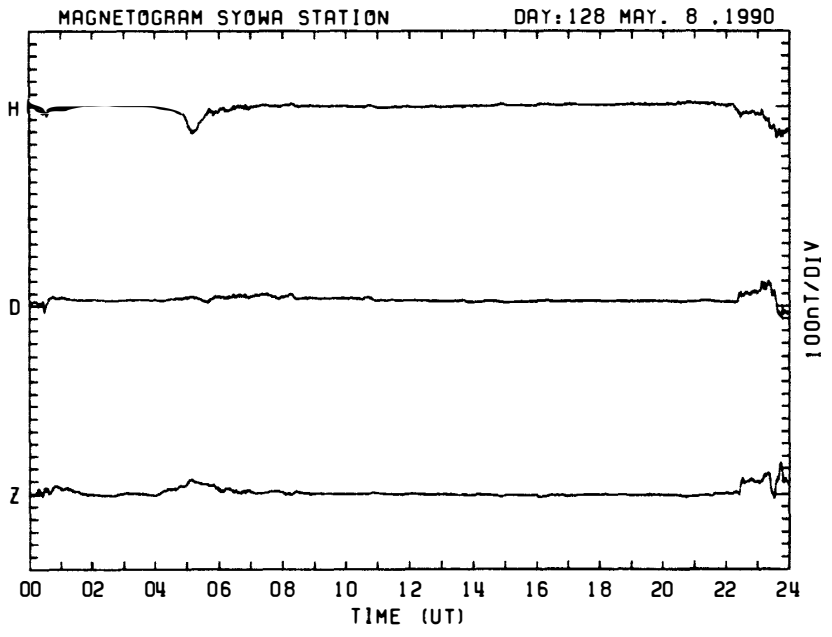
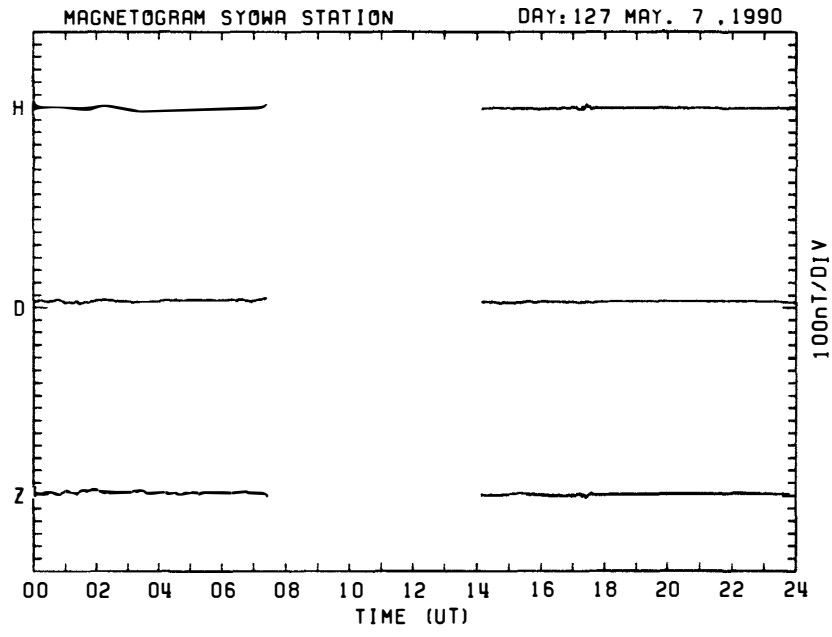


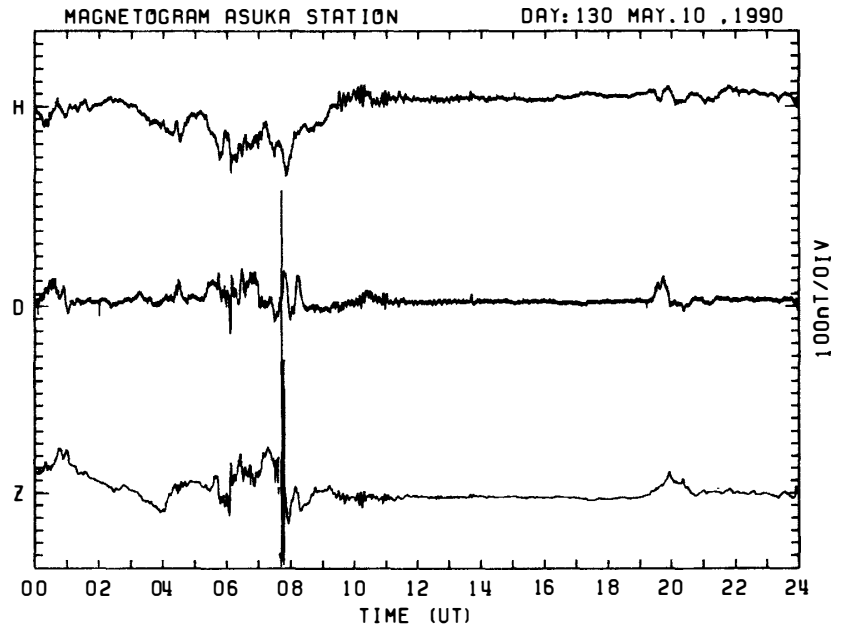
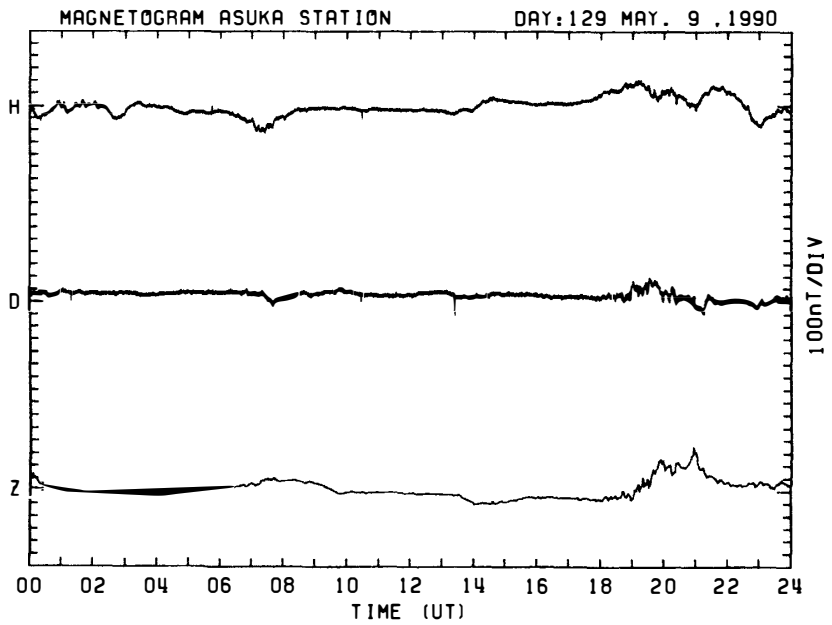
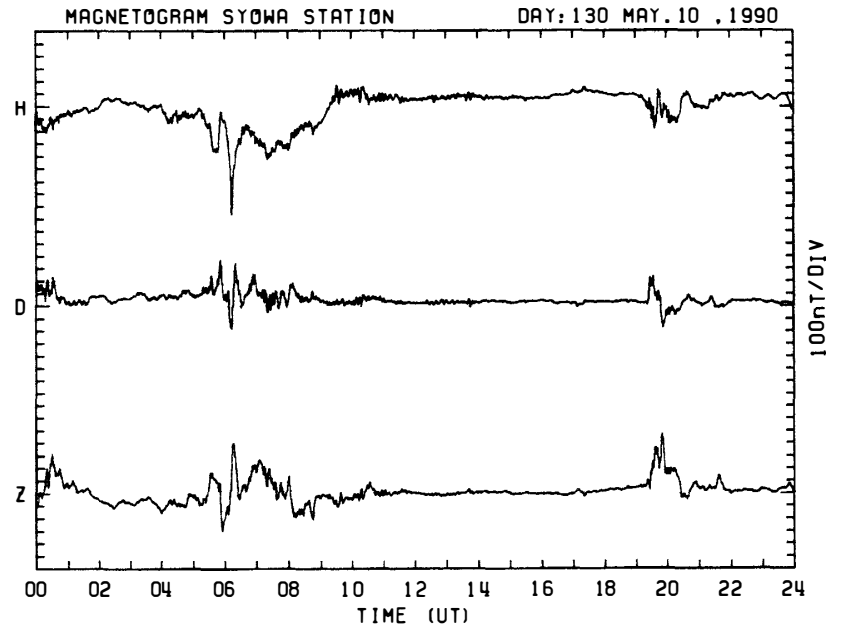
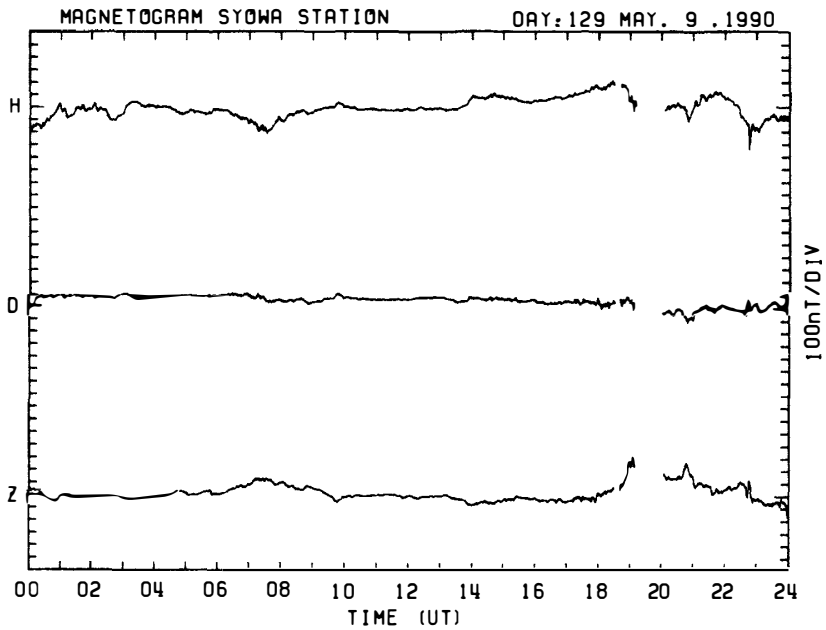


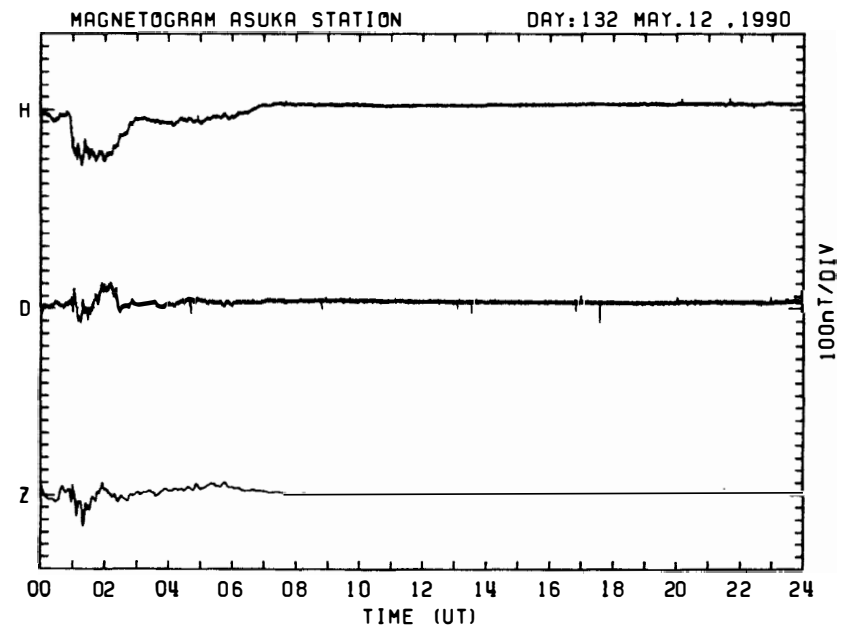
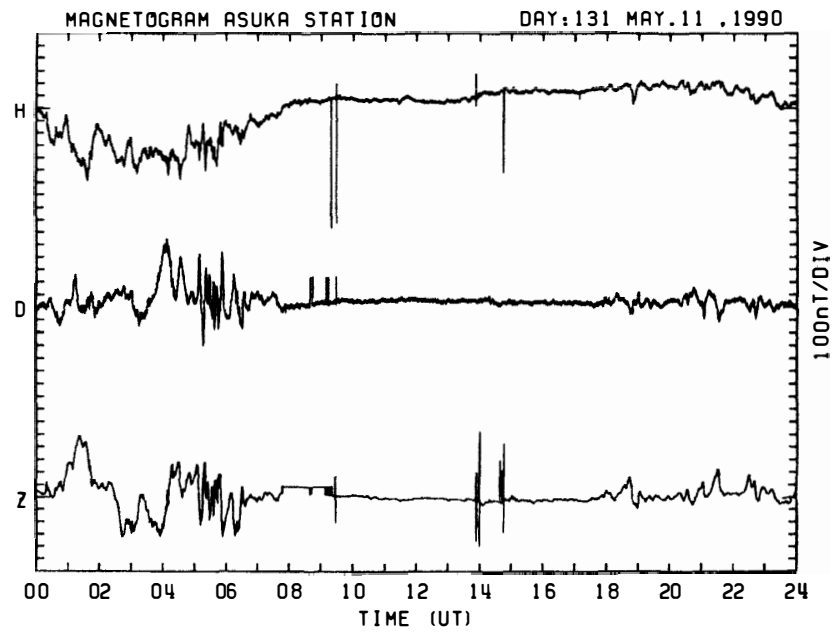
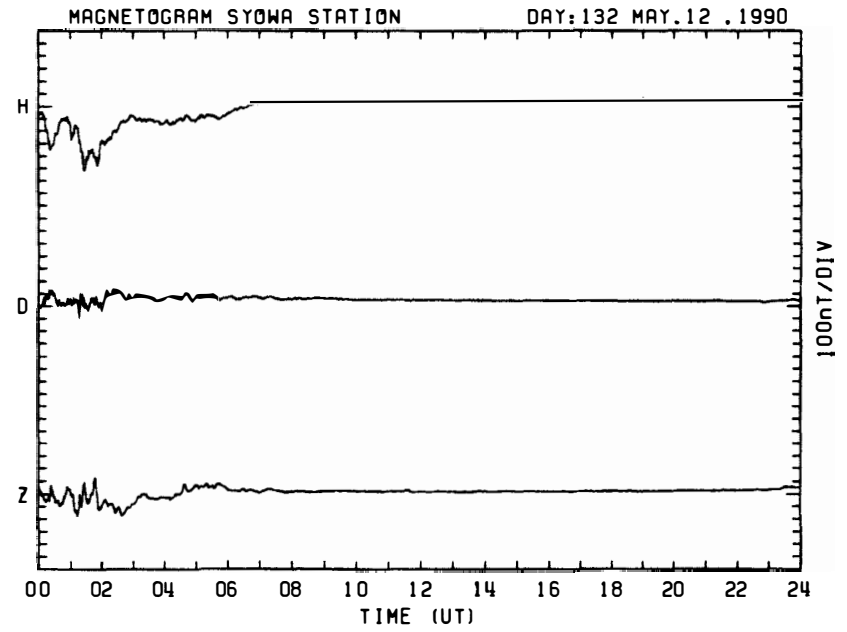
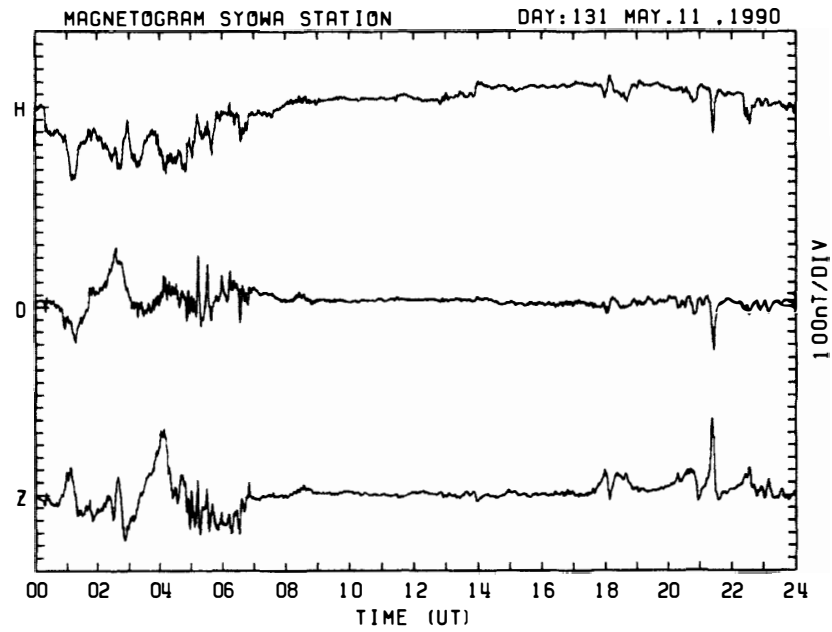


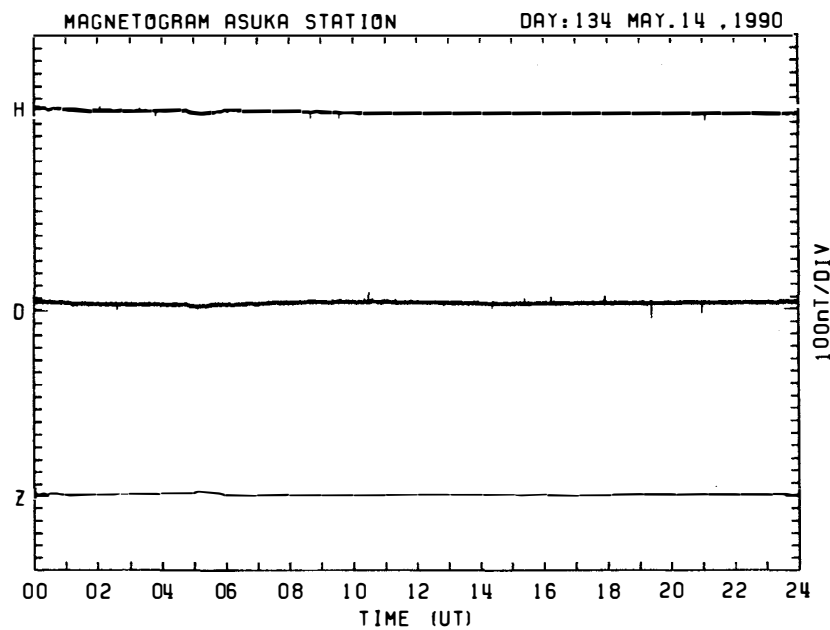
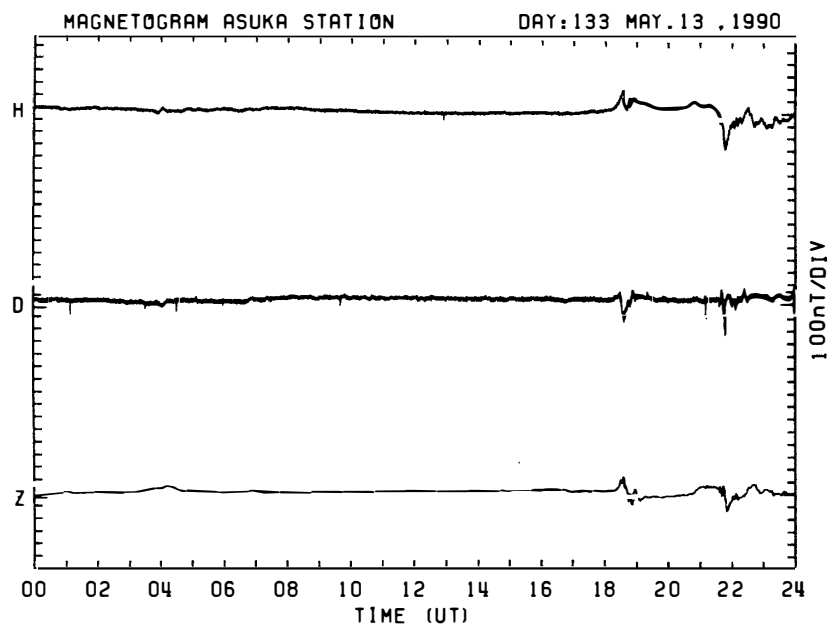
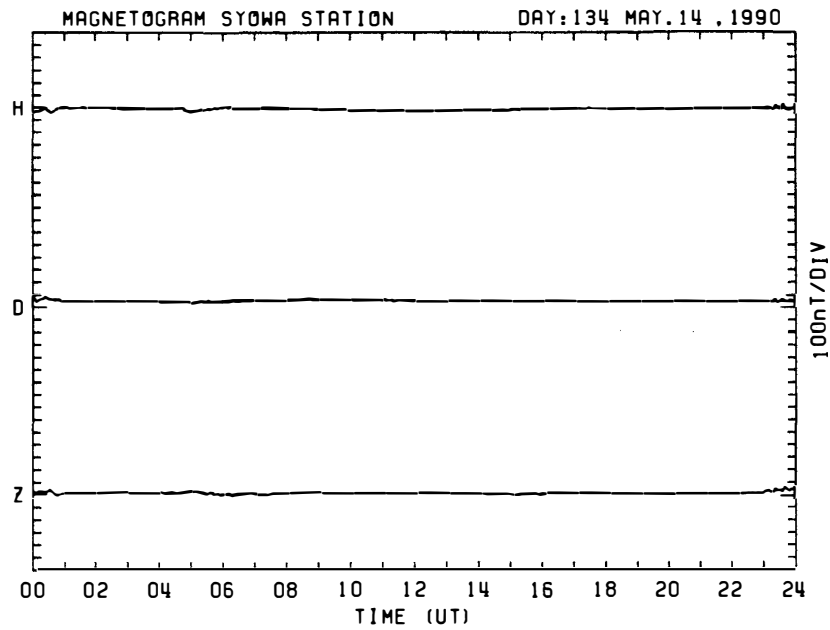
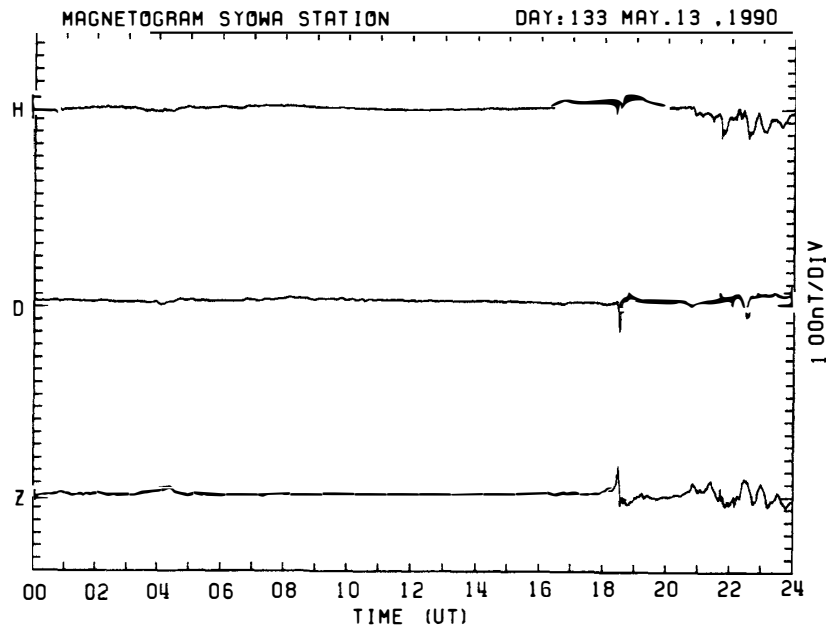


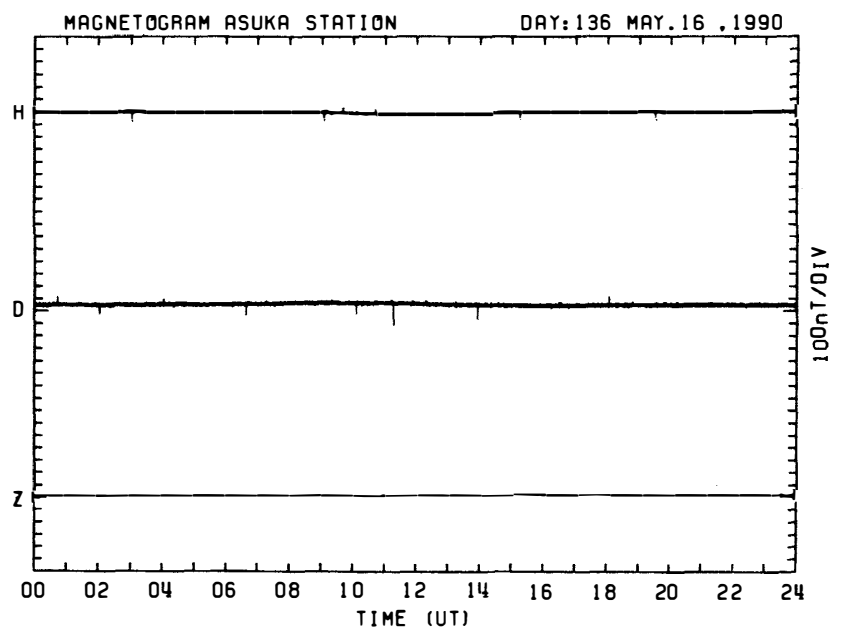
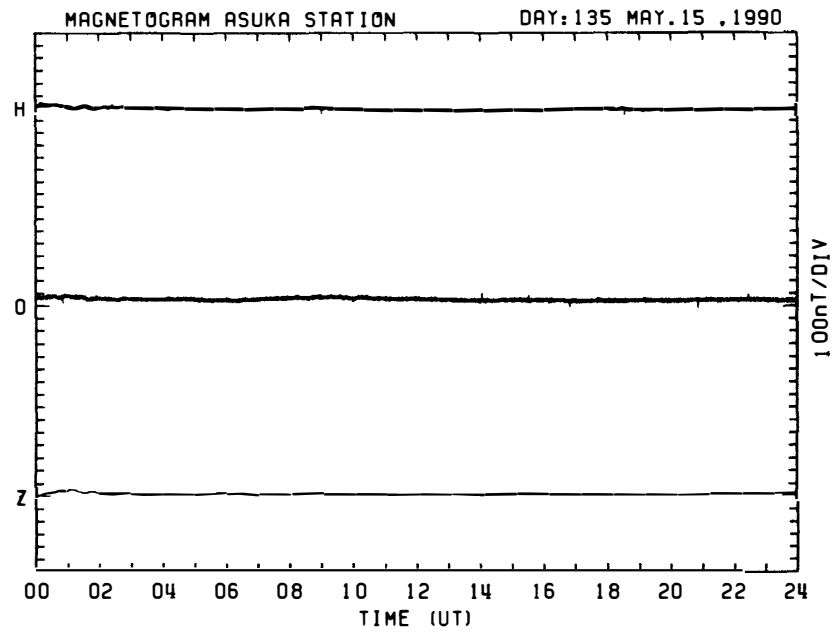
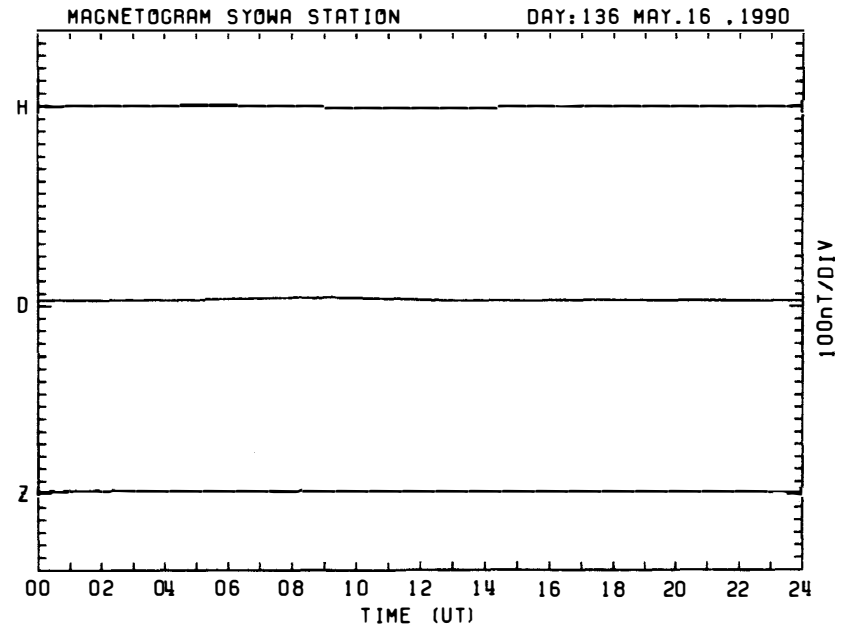
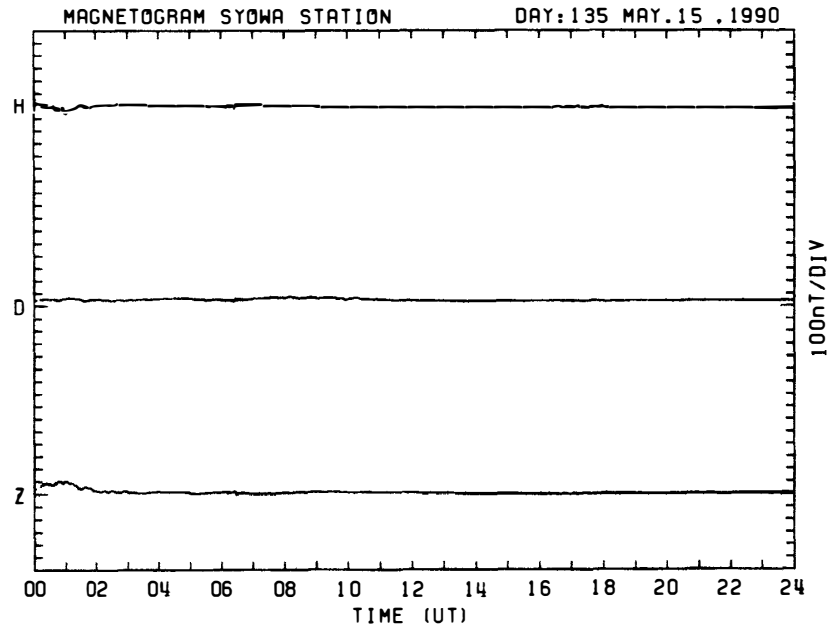




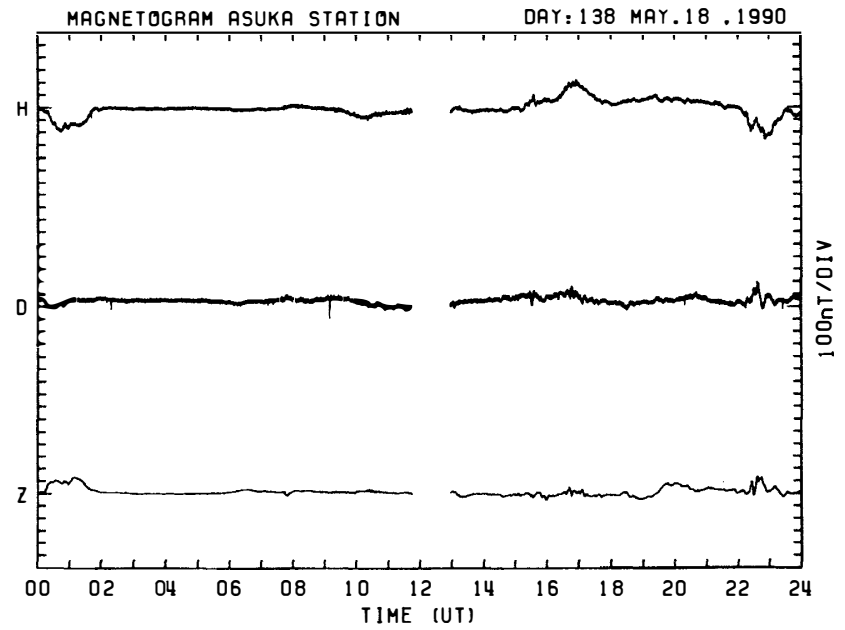
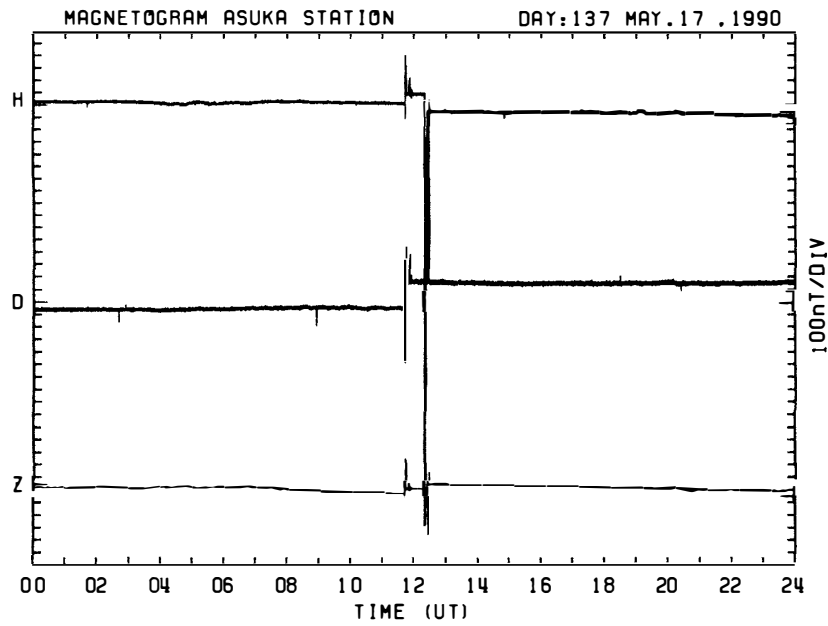
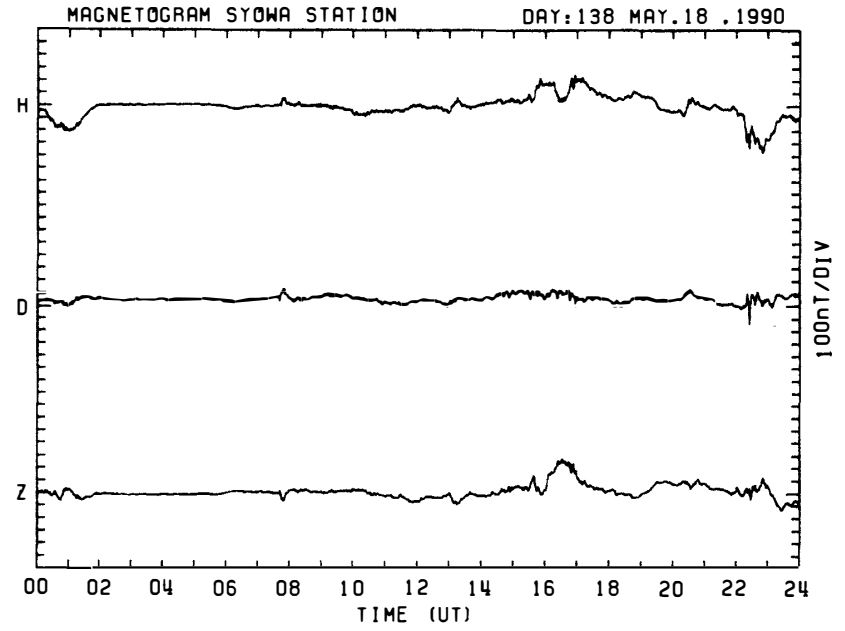
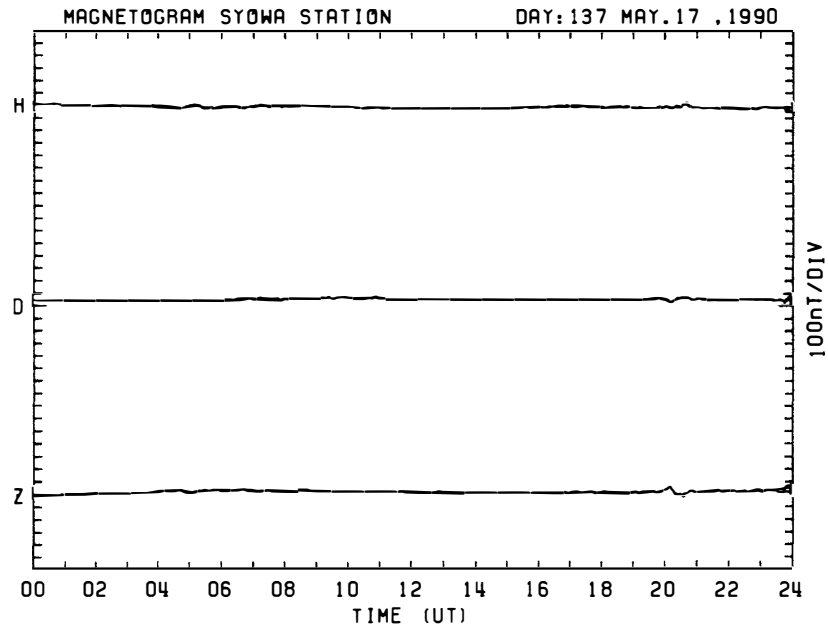


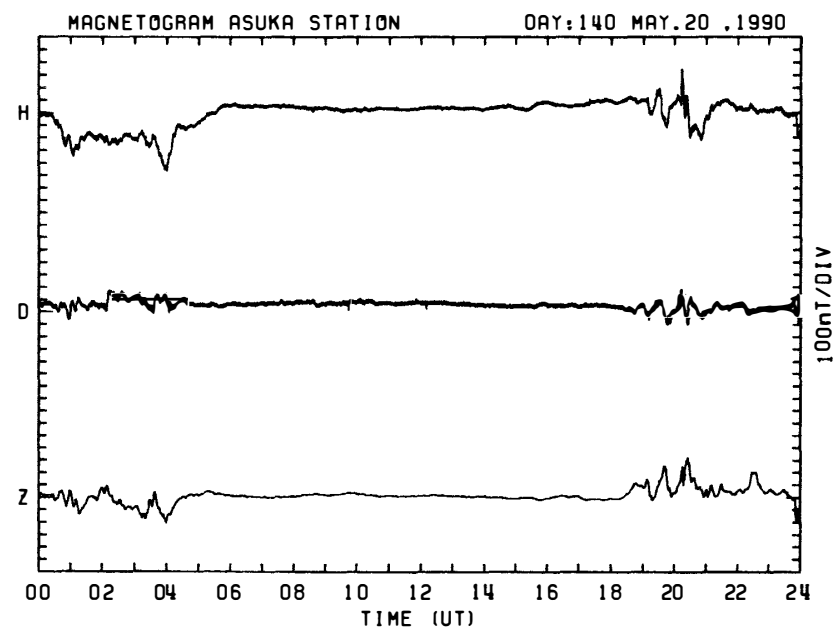
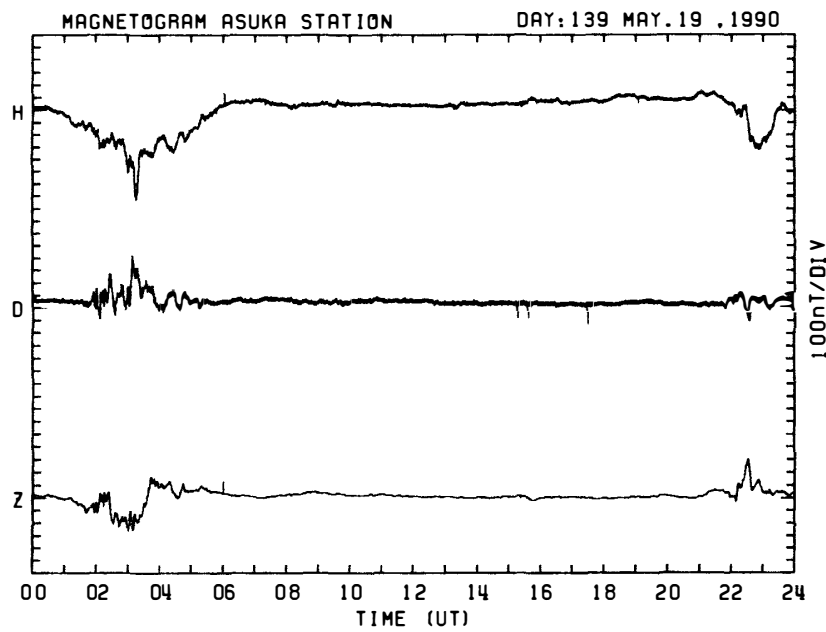
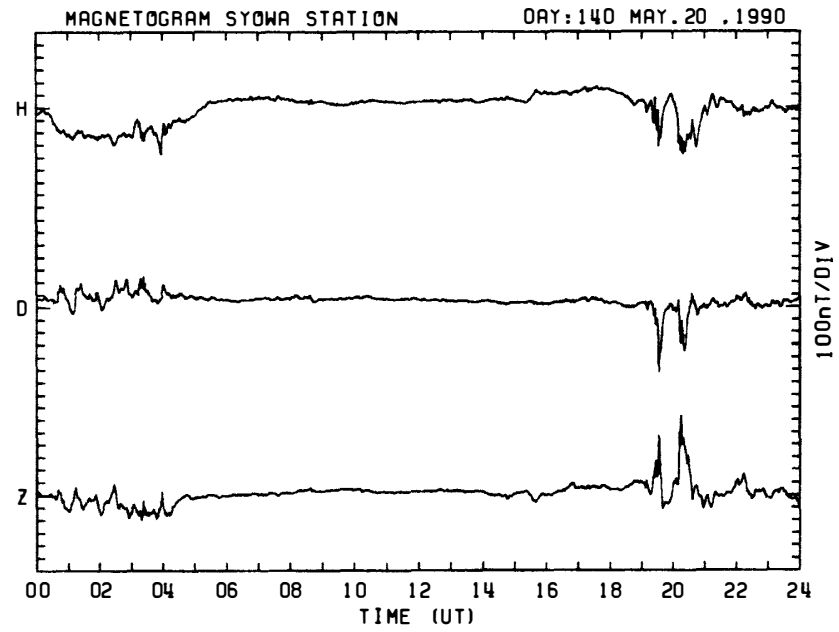
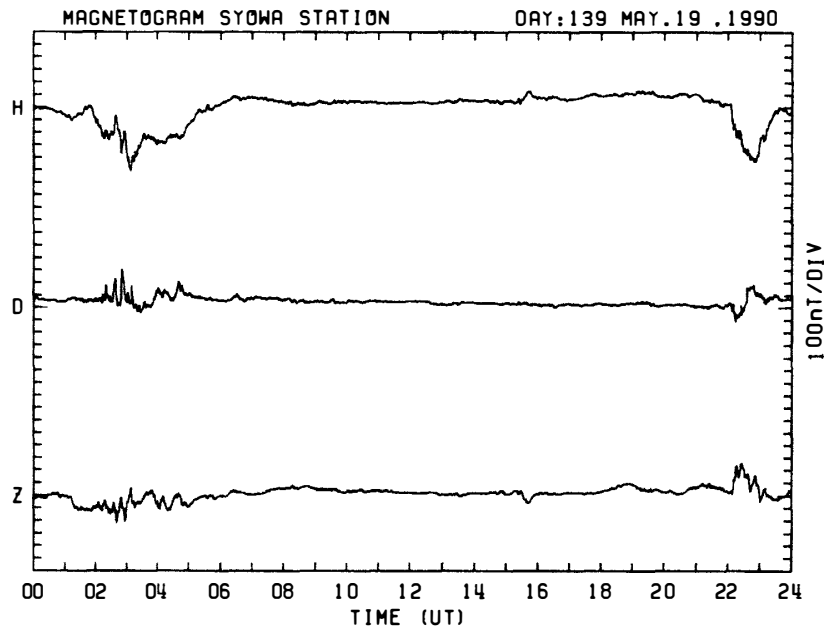




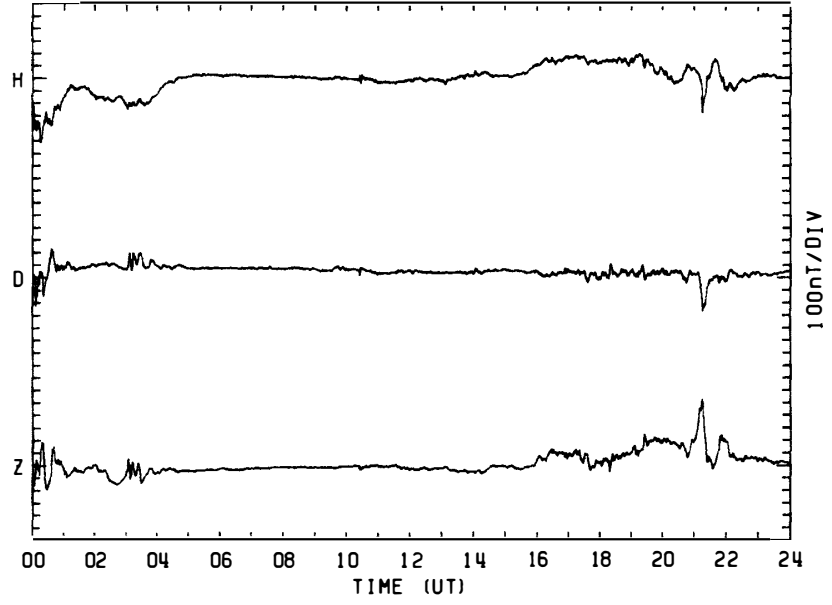




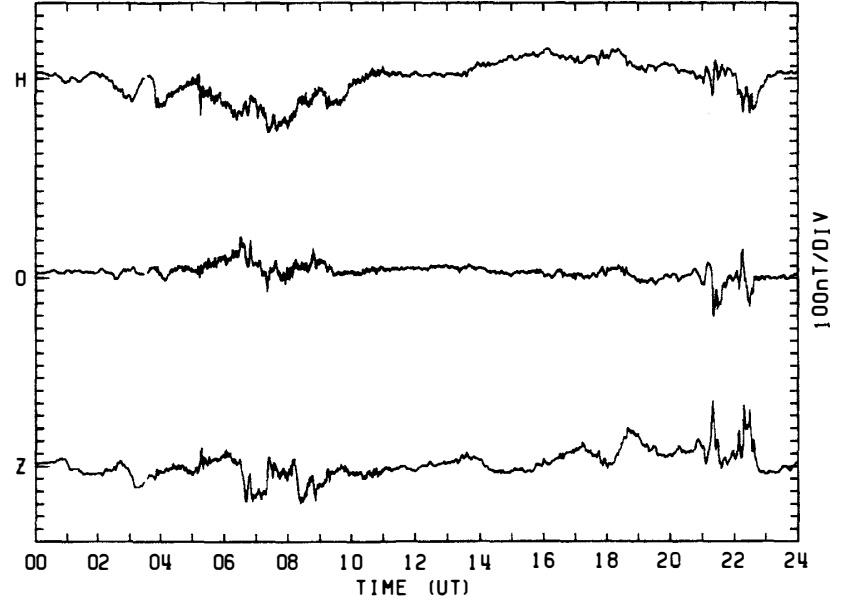




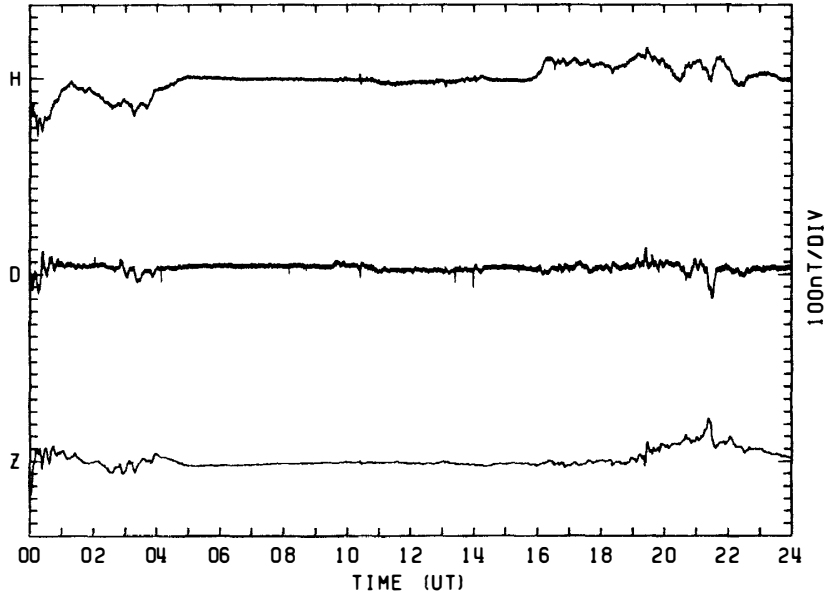
MAGNETOGRAM SYOWA STATION DAY:141 MAY.21 .1990



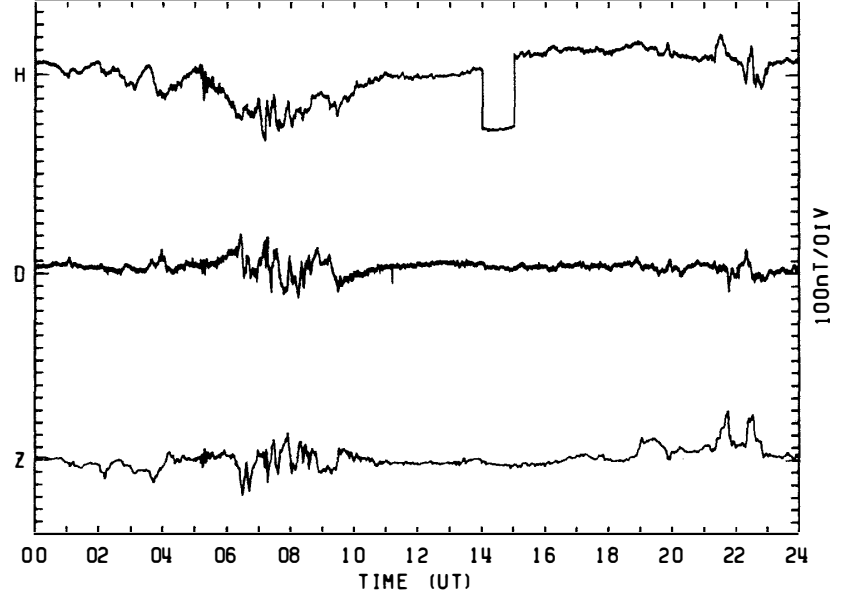
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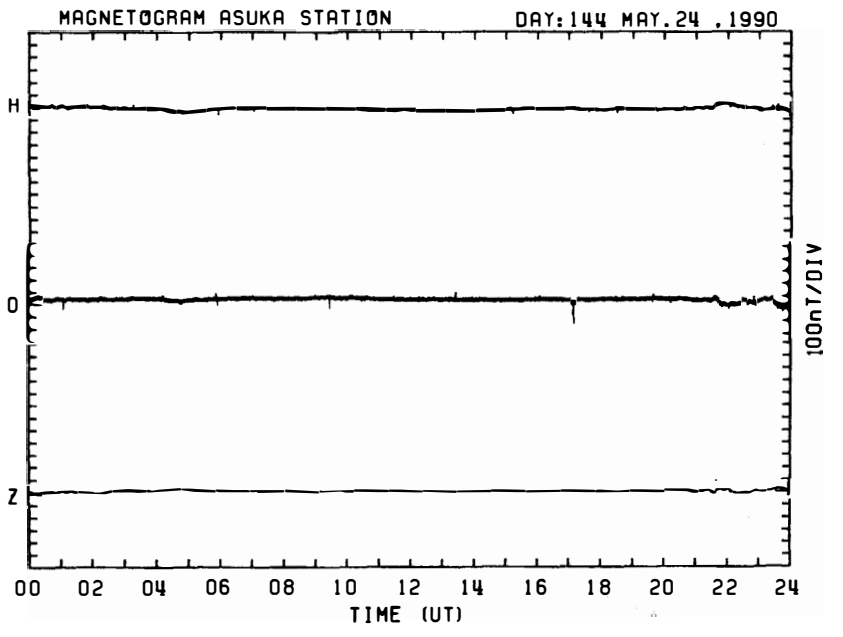
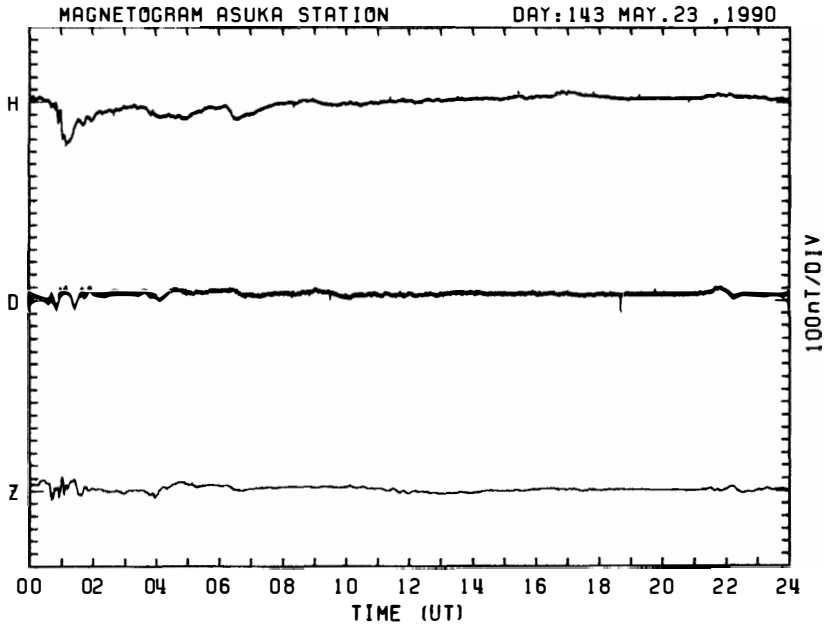
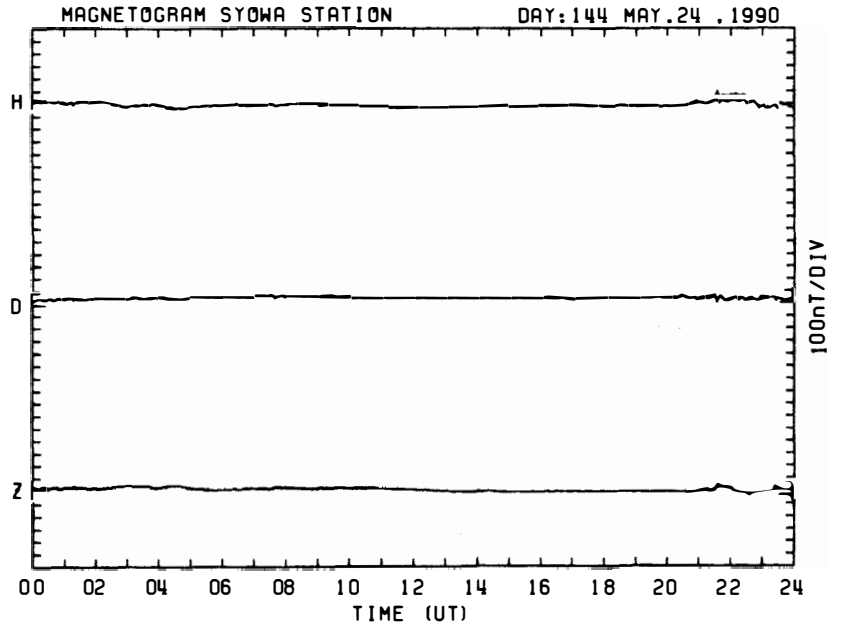
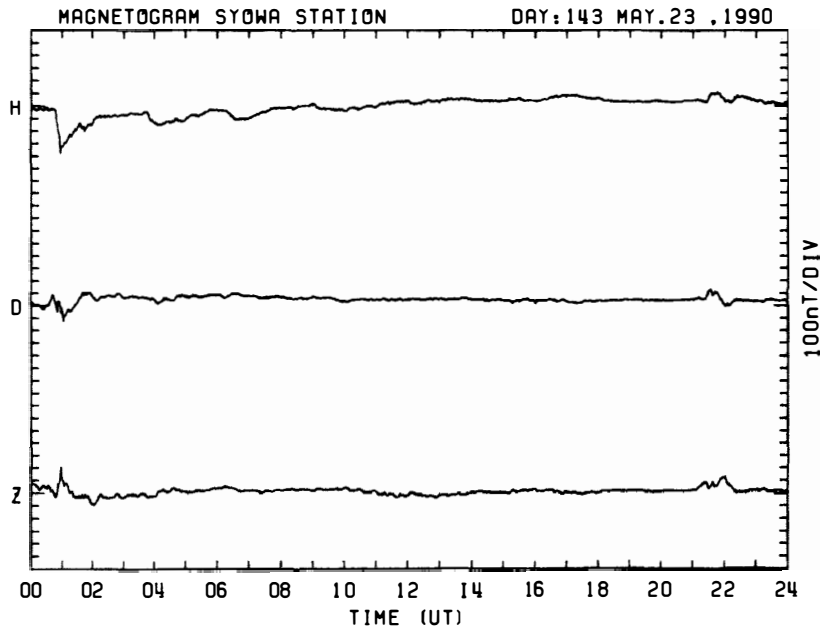


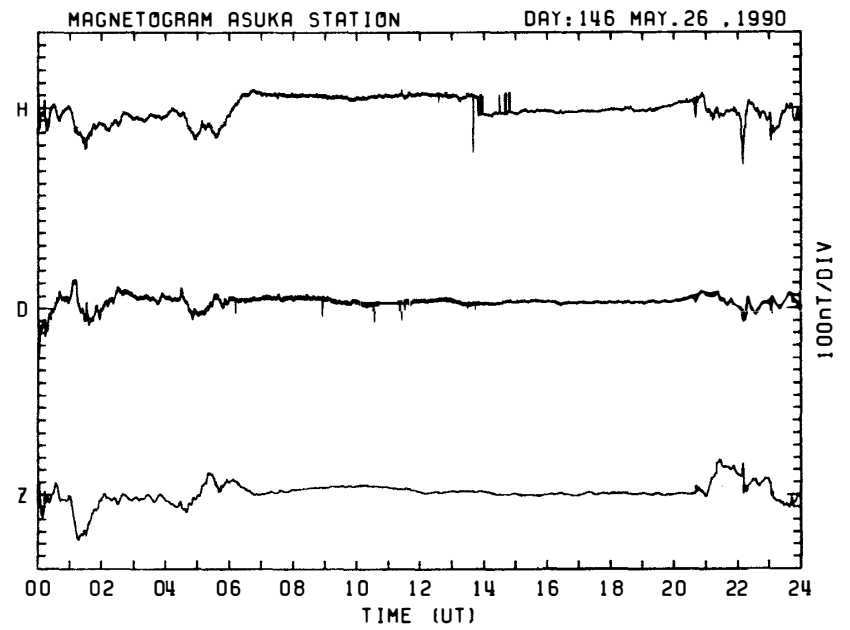
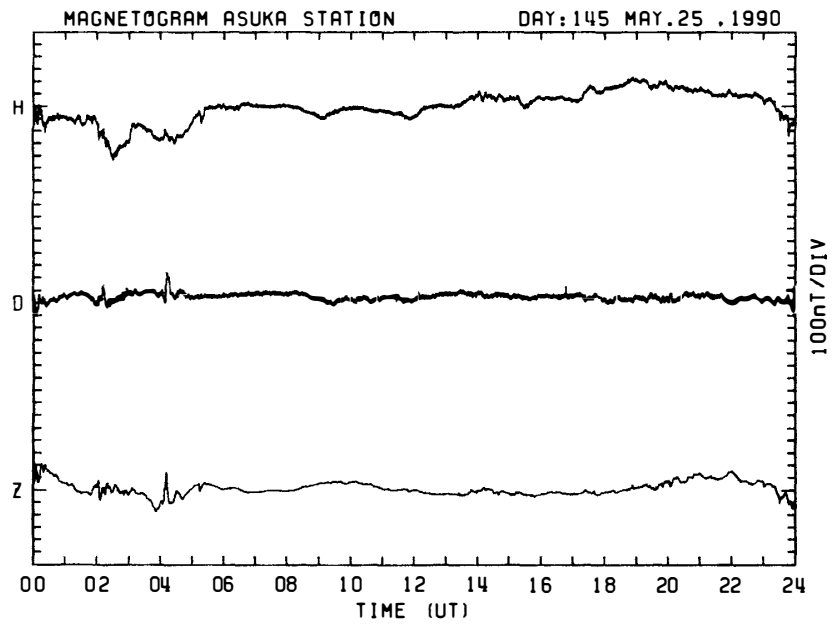
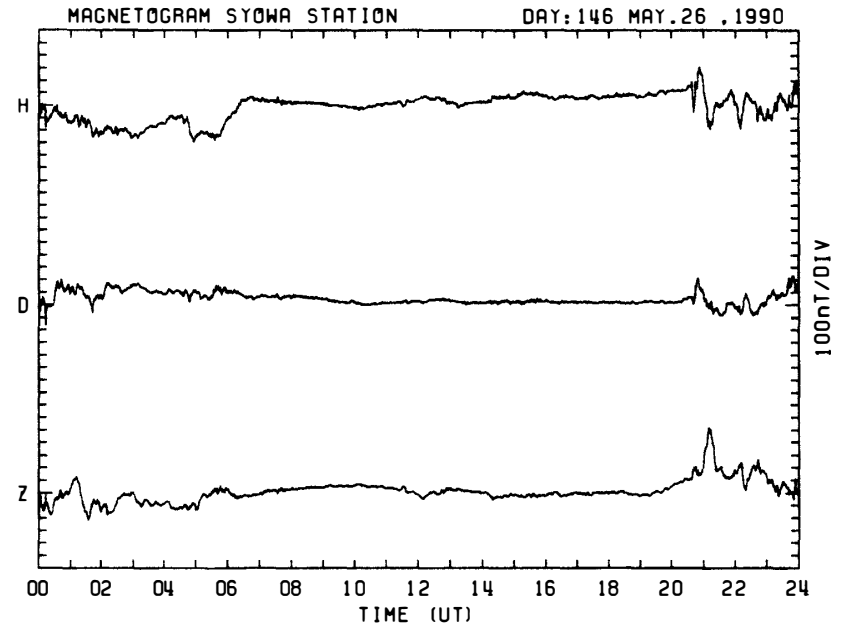
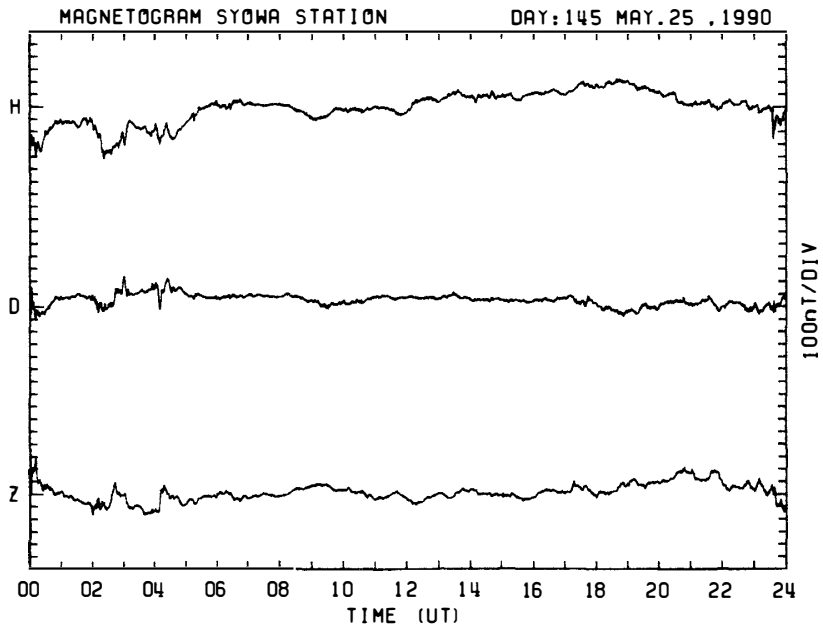
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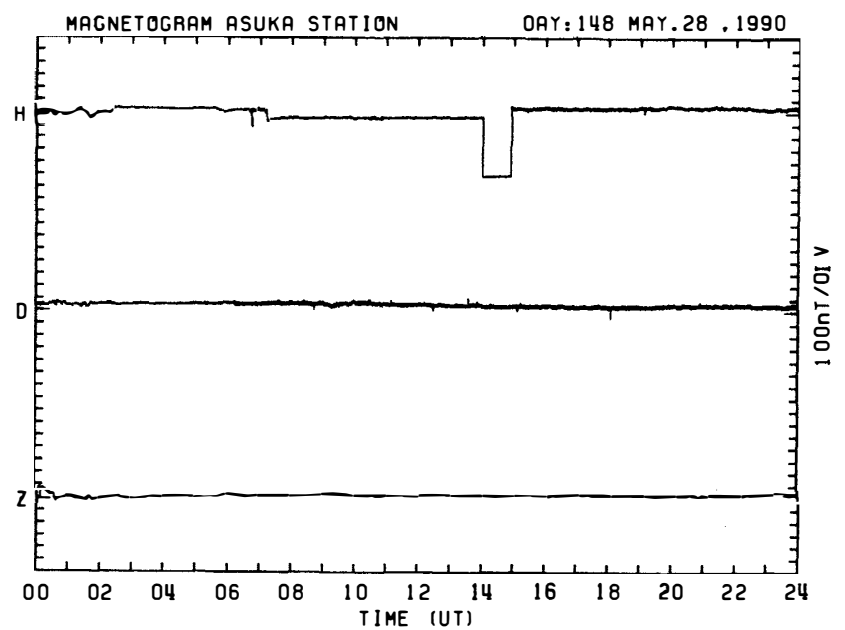
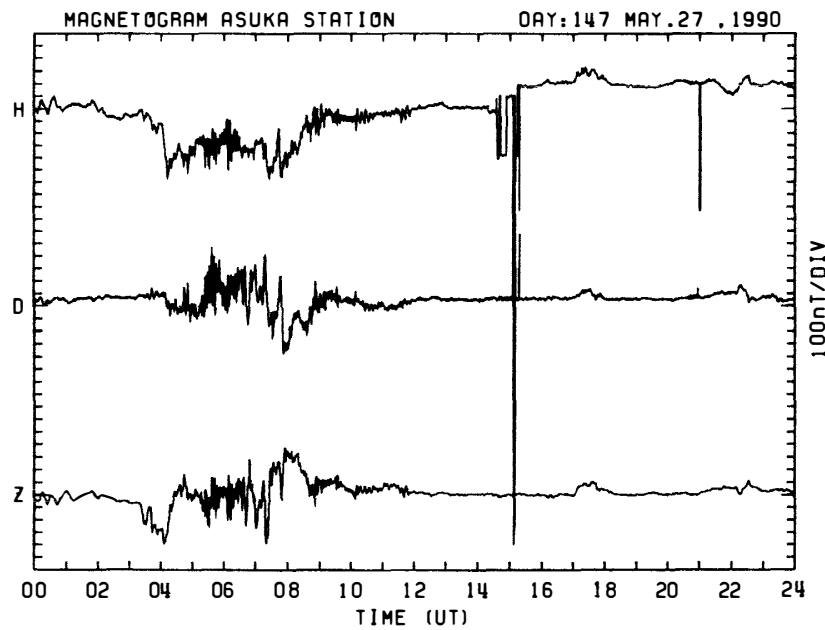
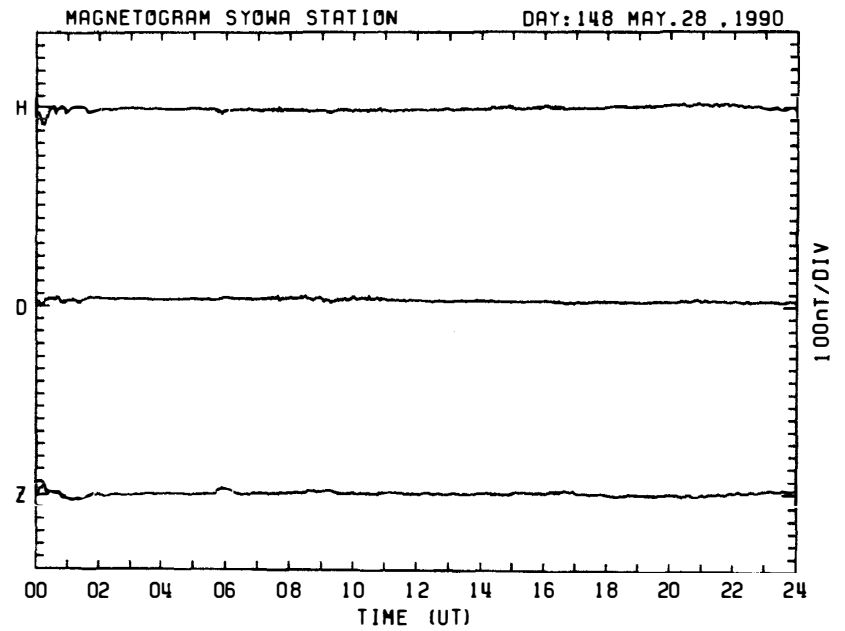
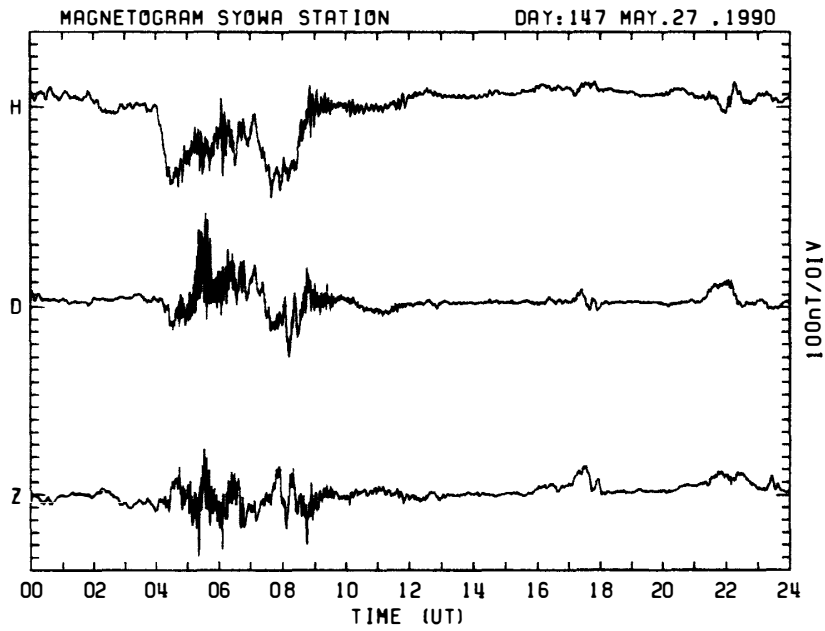


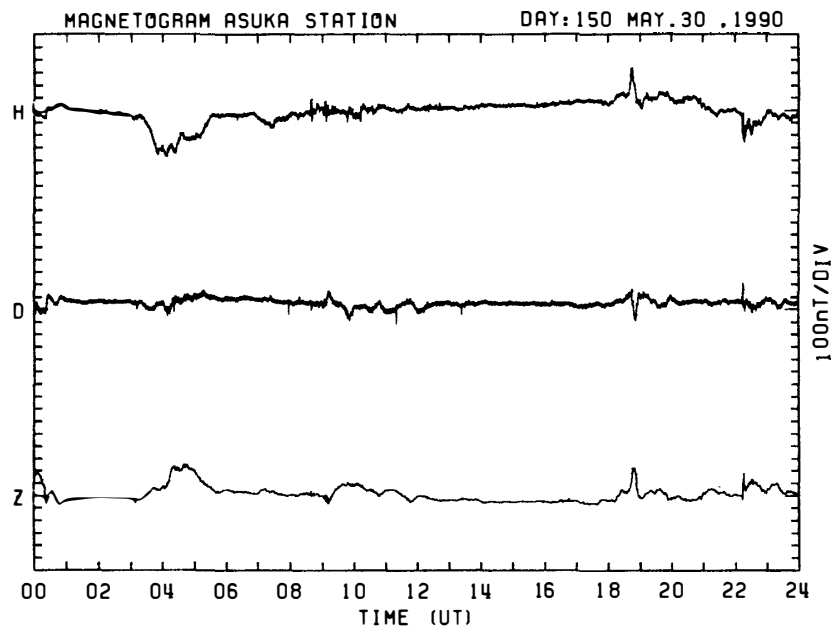
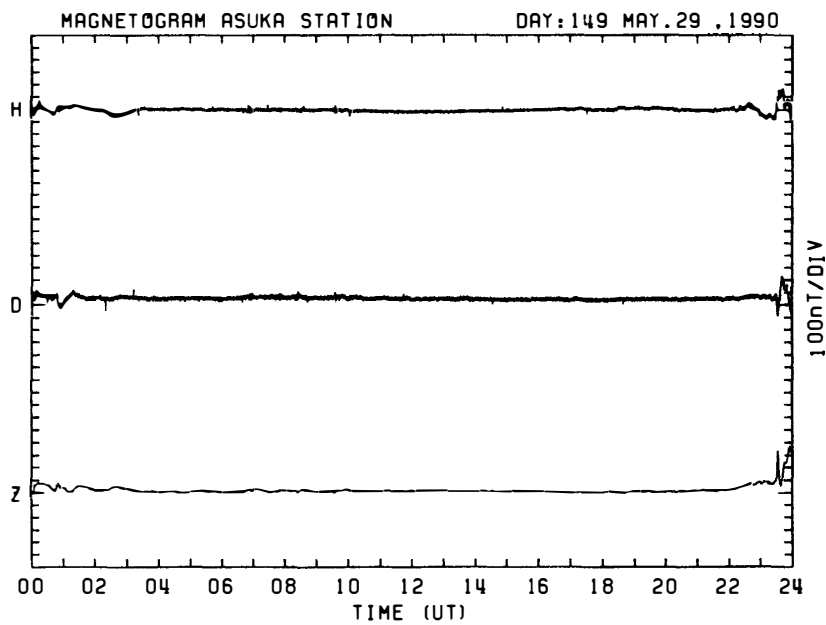
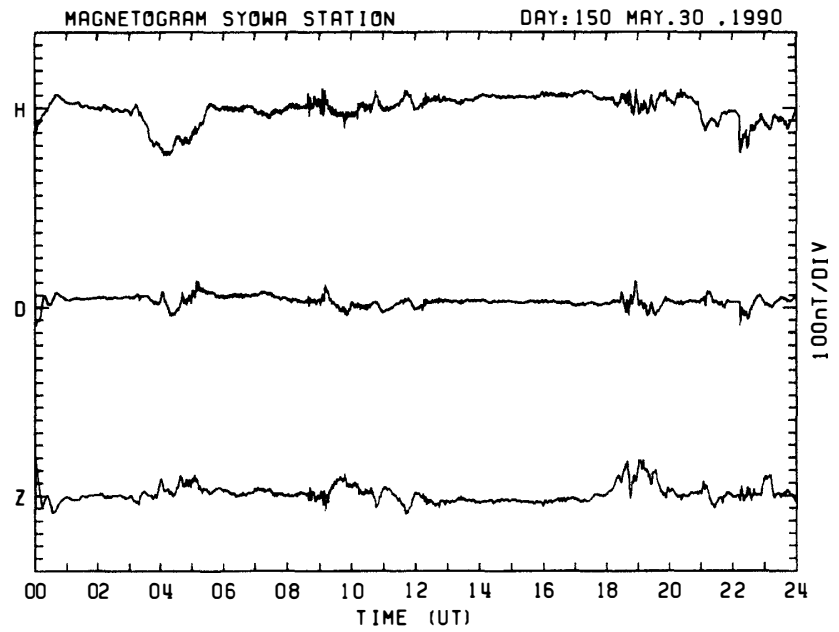
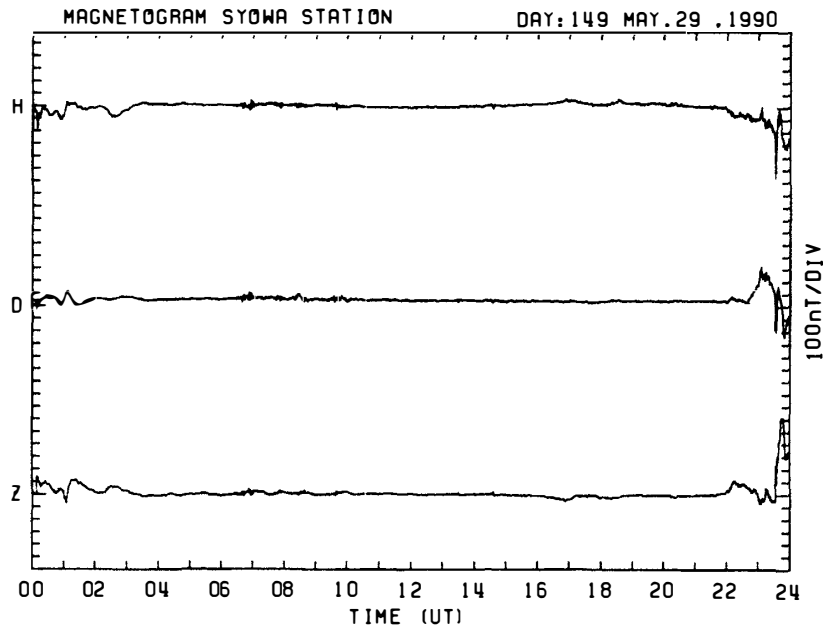
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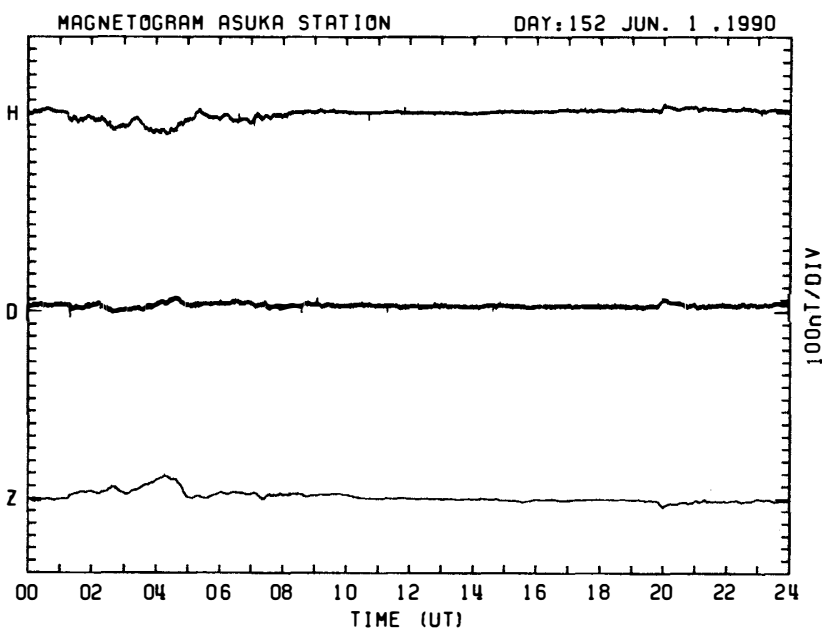
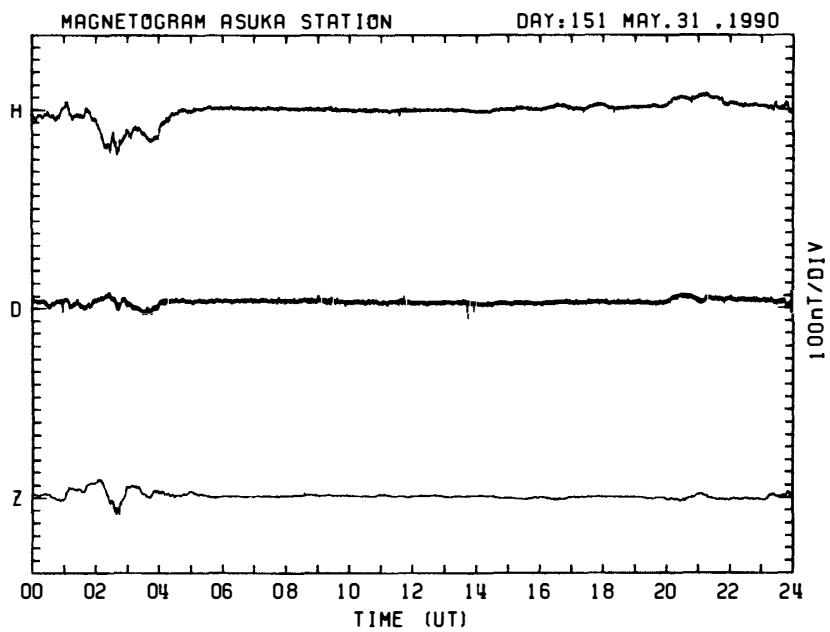
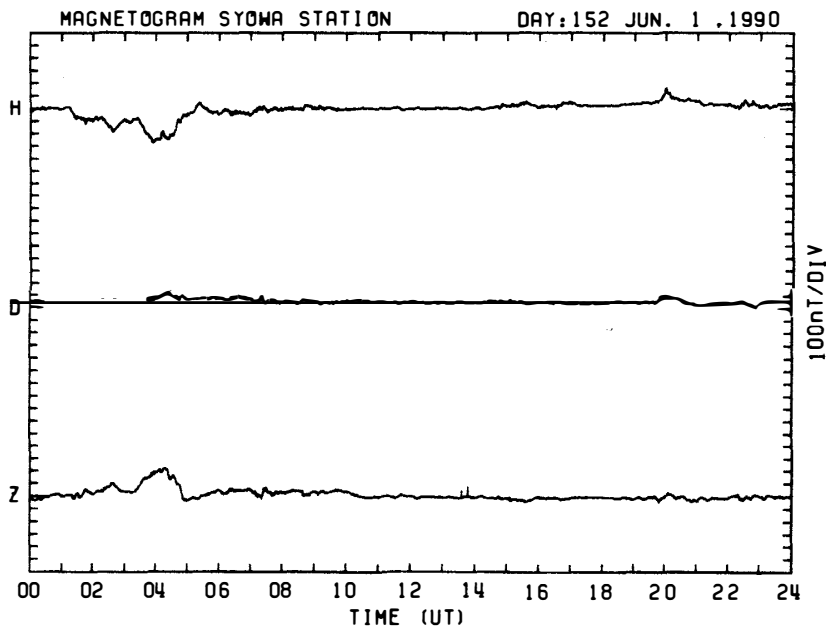
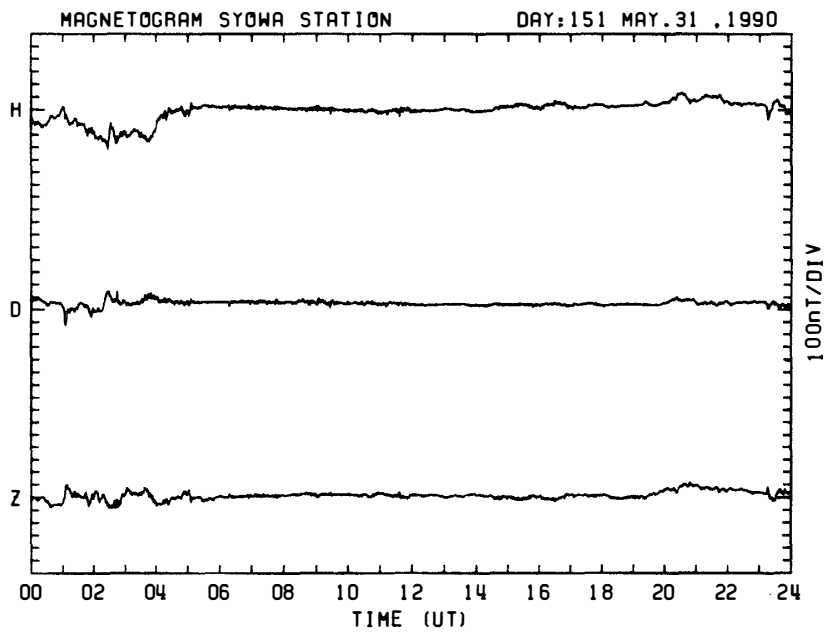




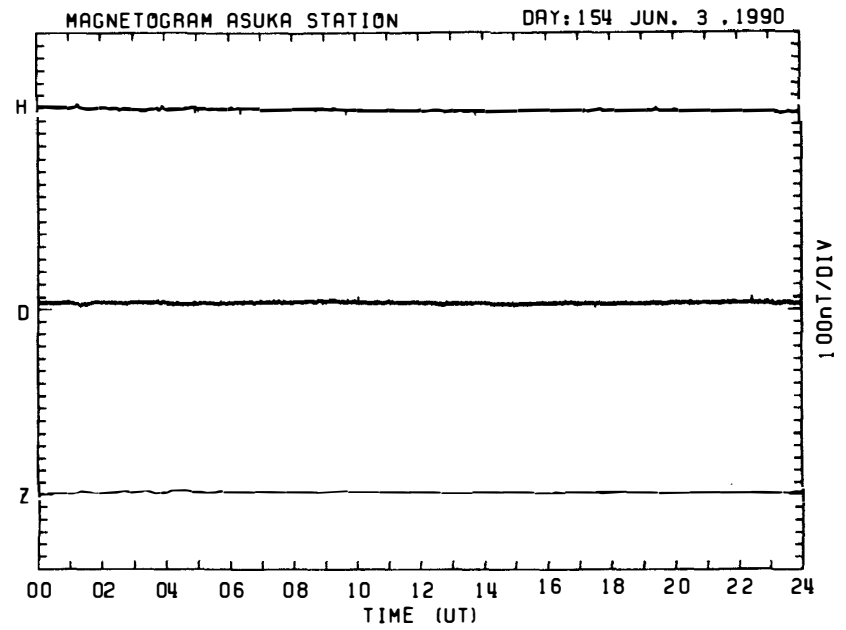
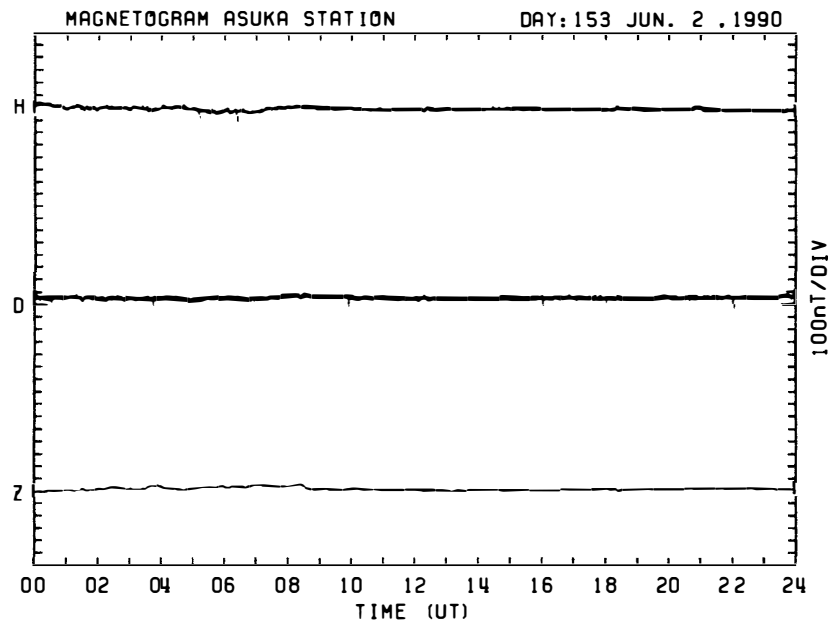
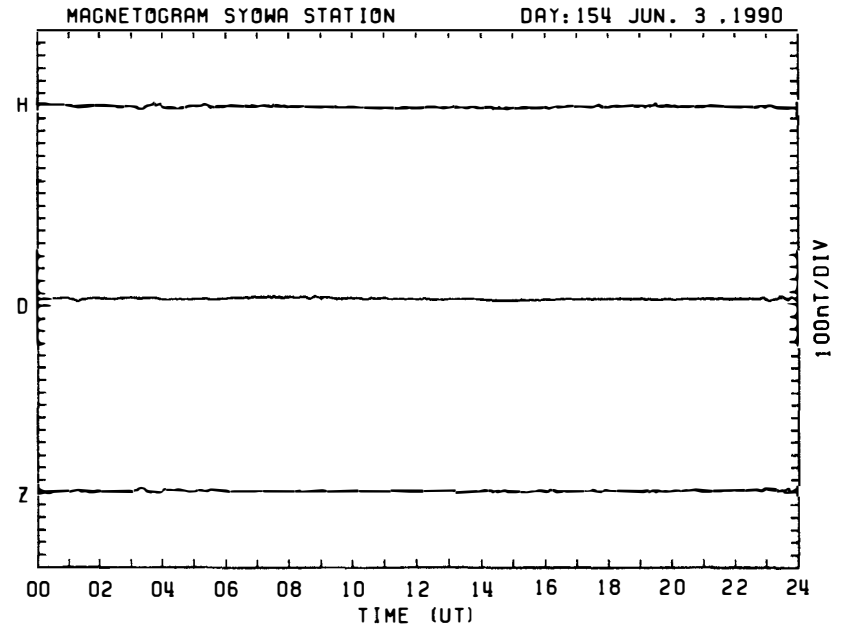
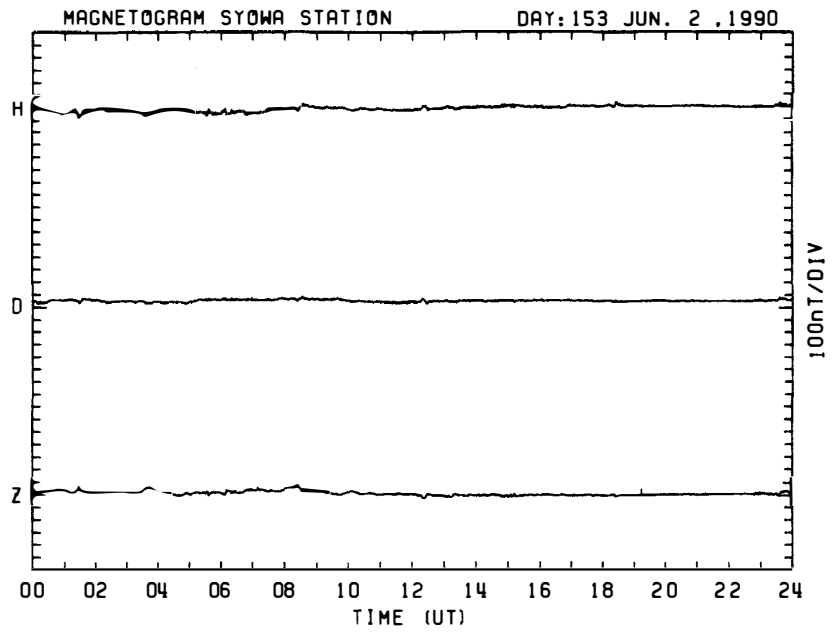


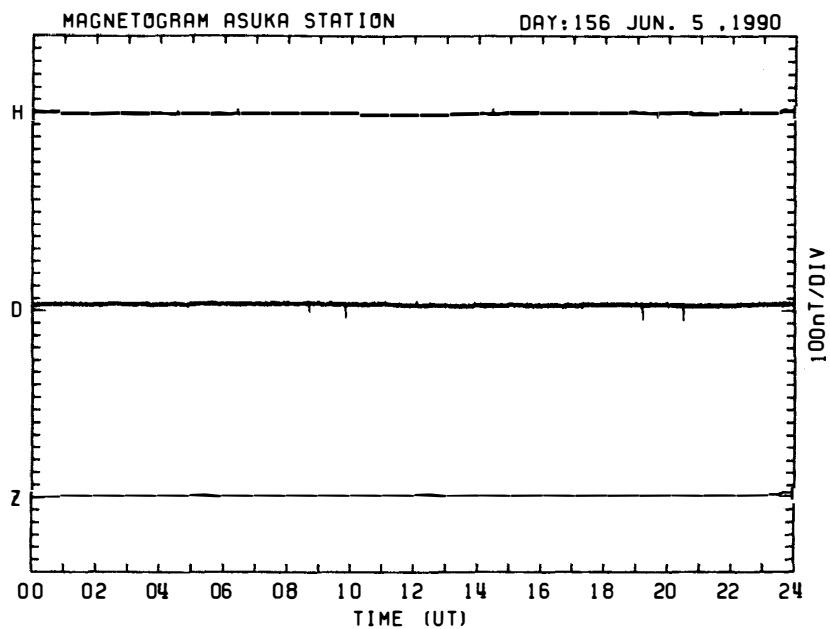
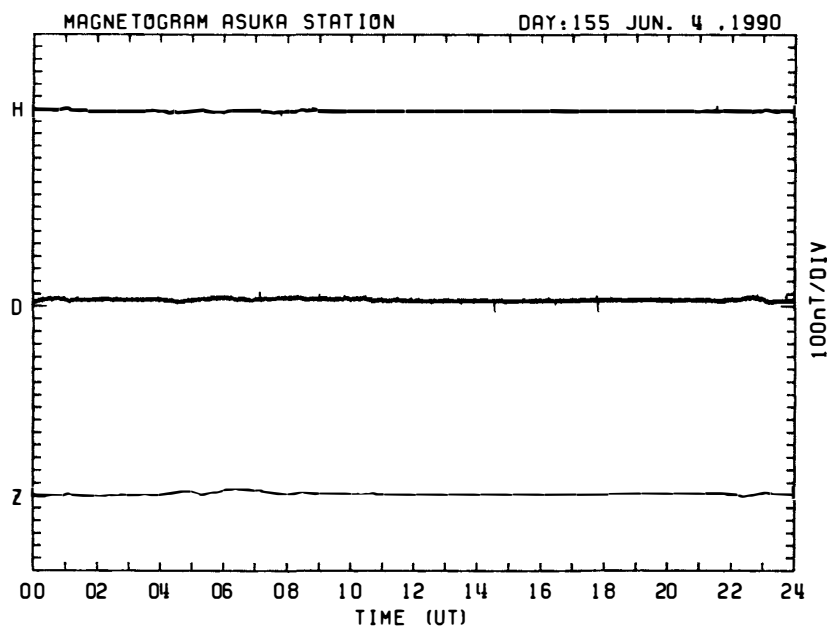
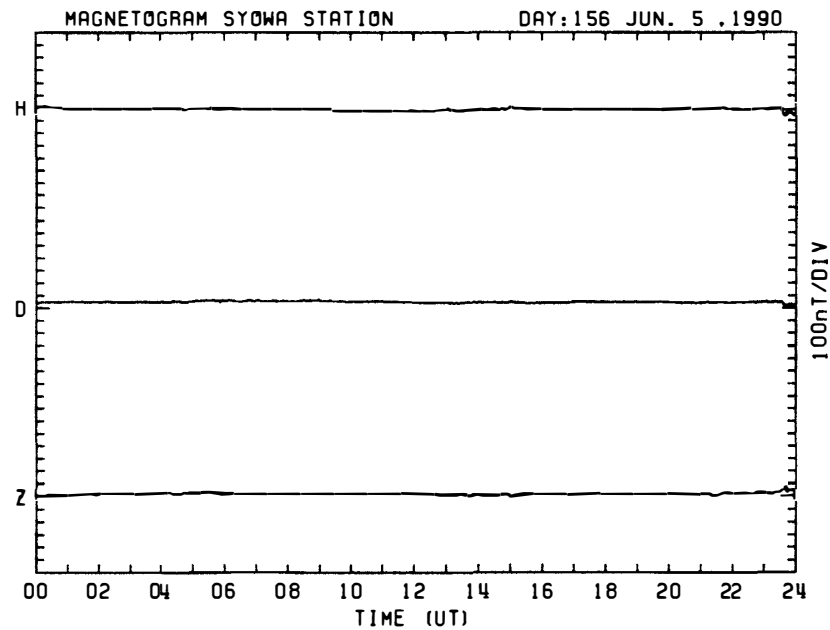
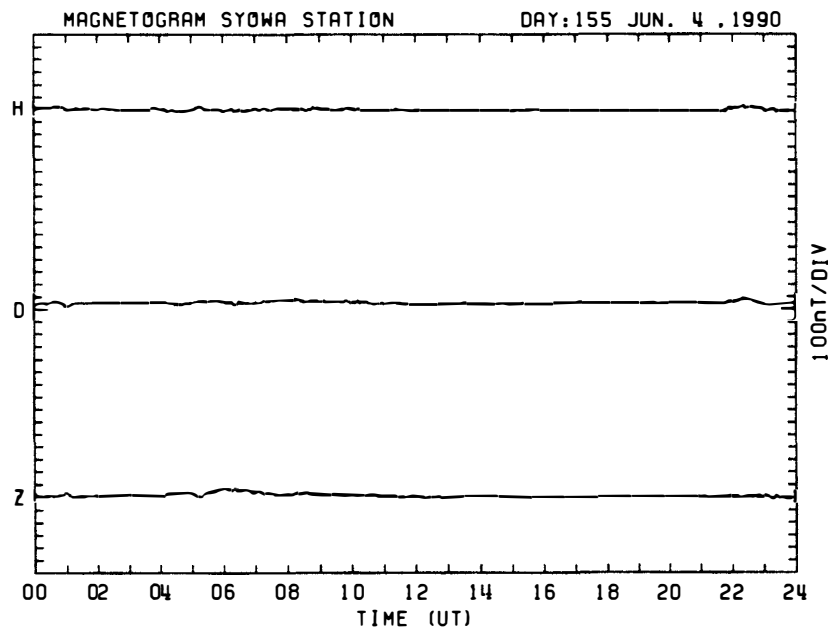


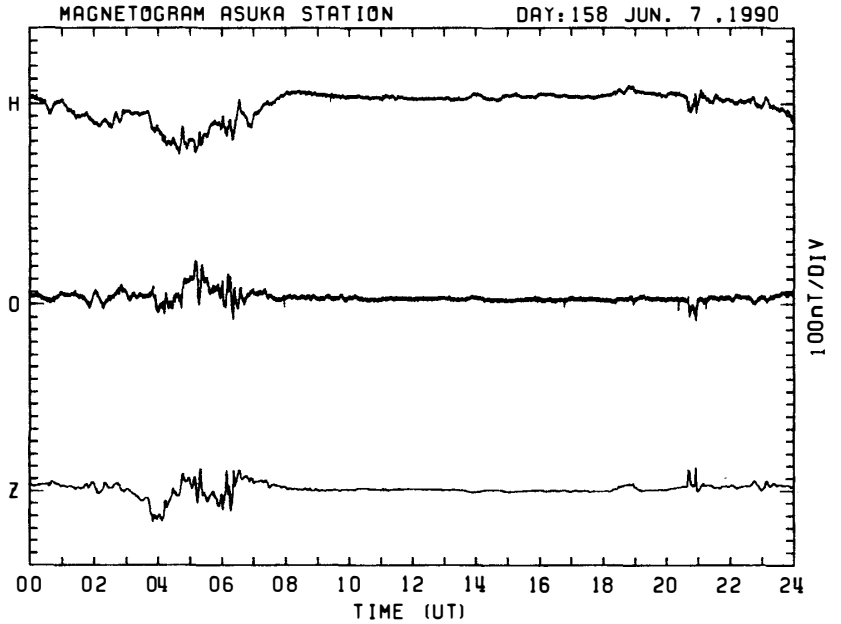
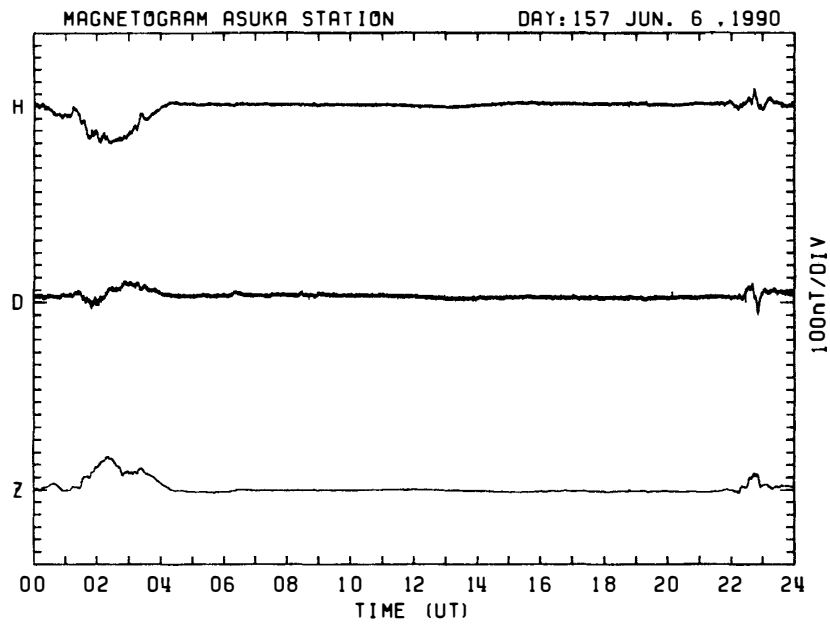
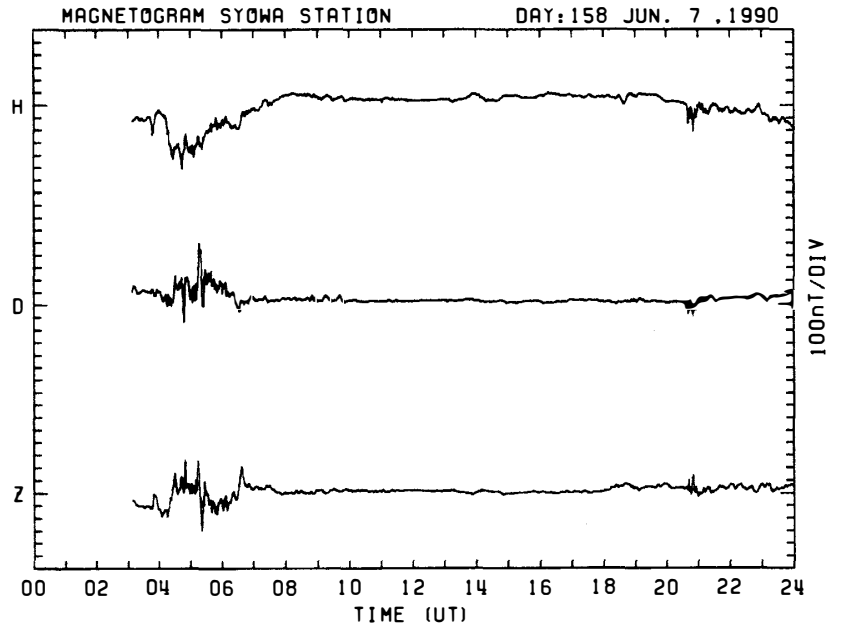
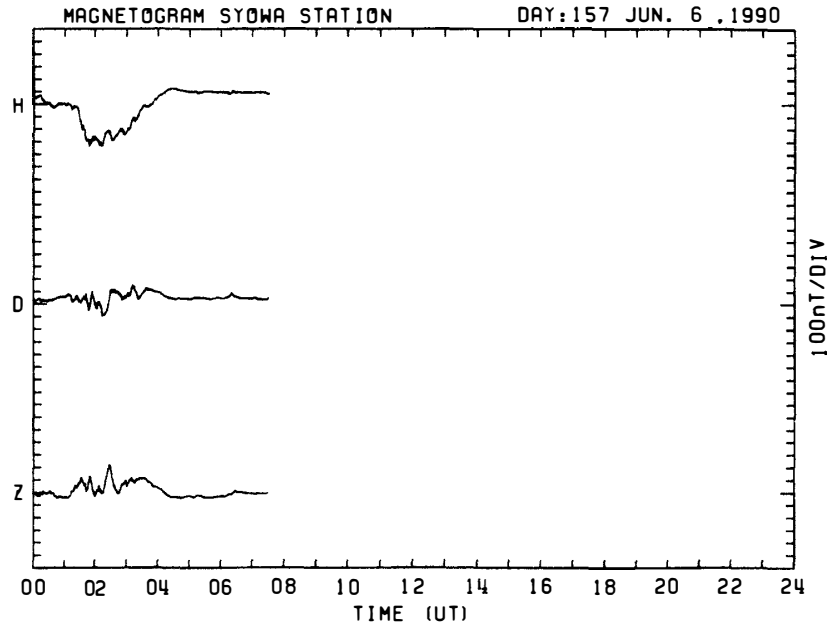


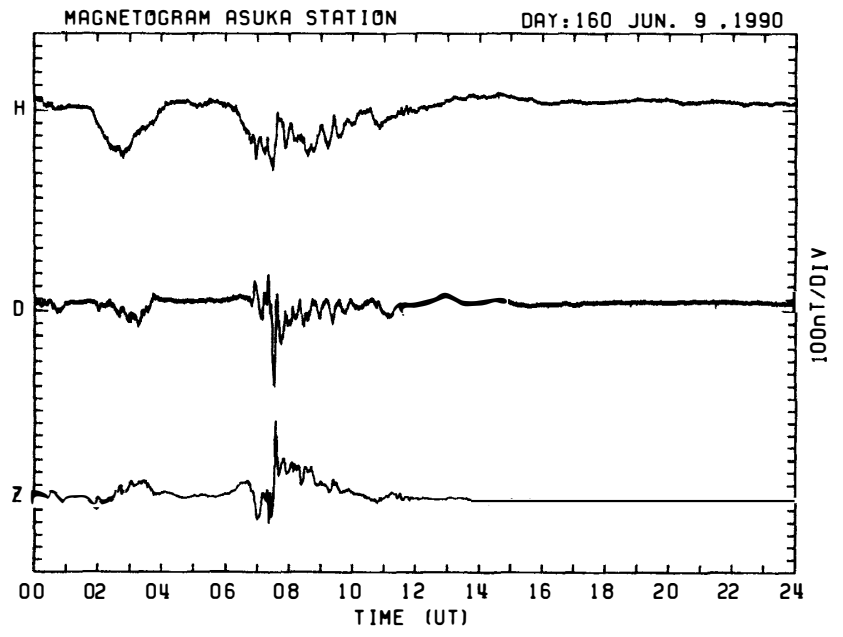
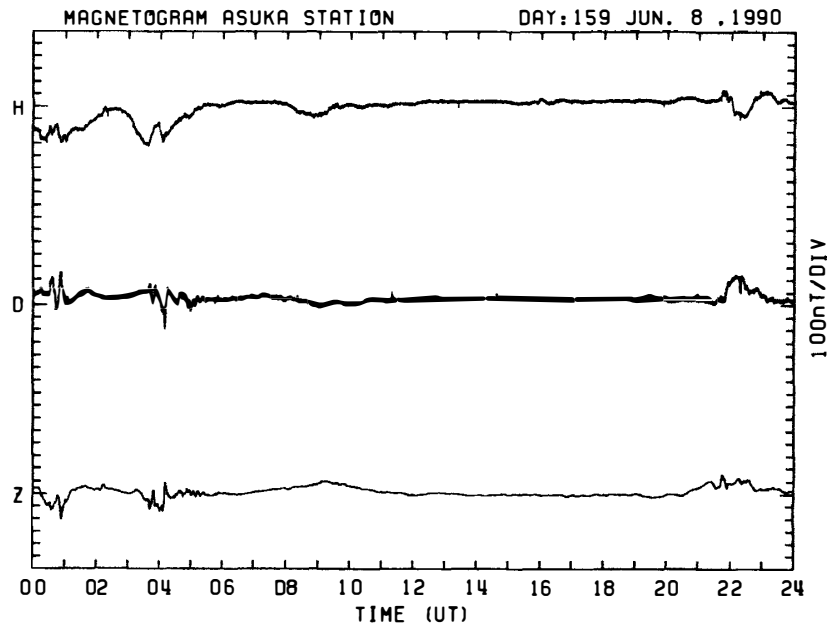
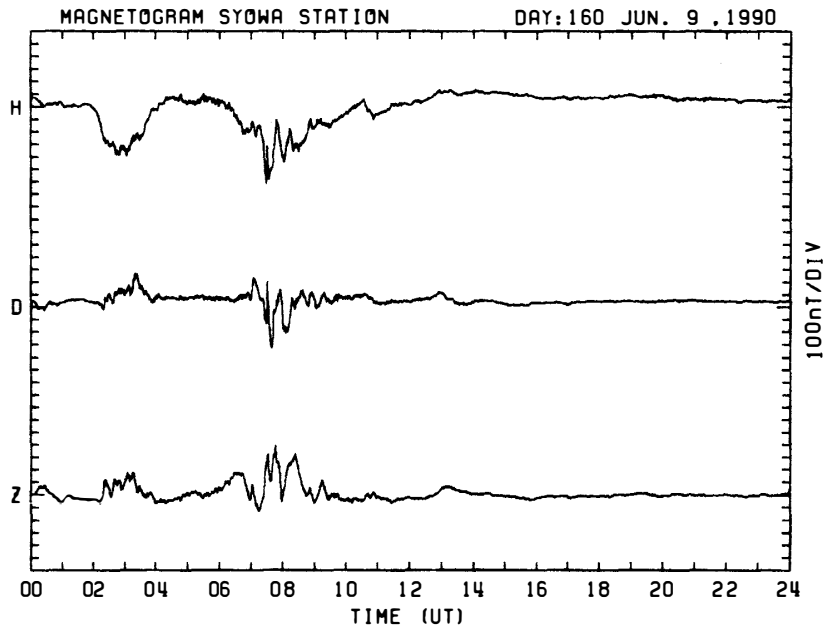
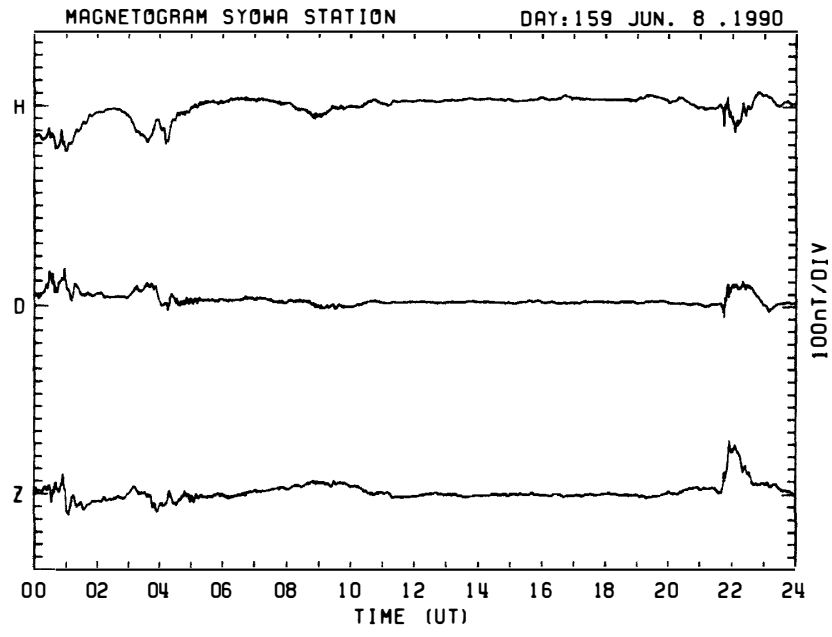


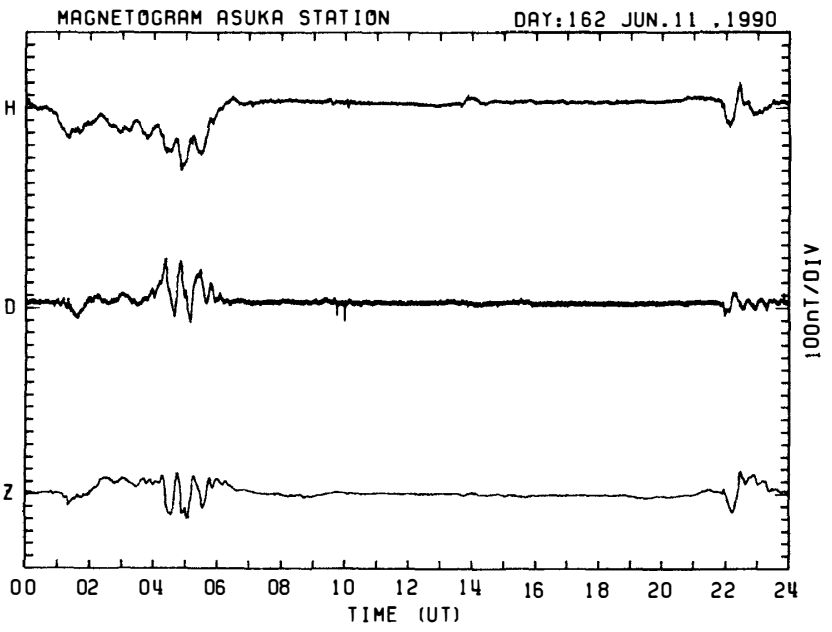
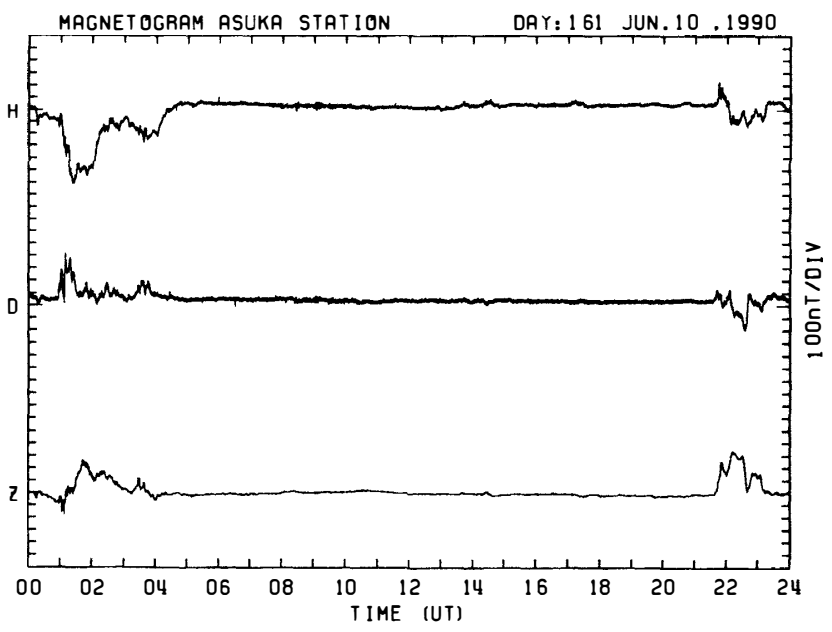
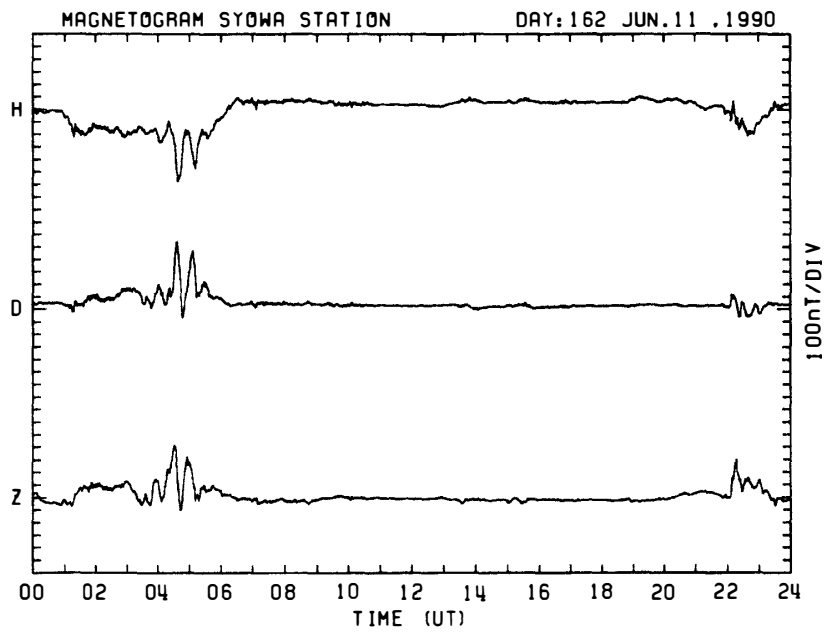
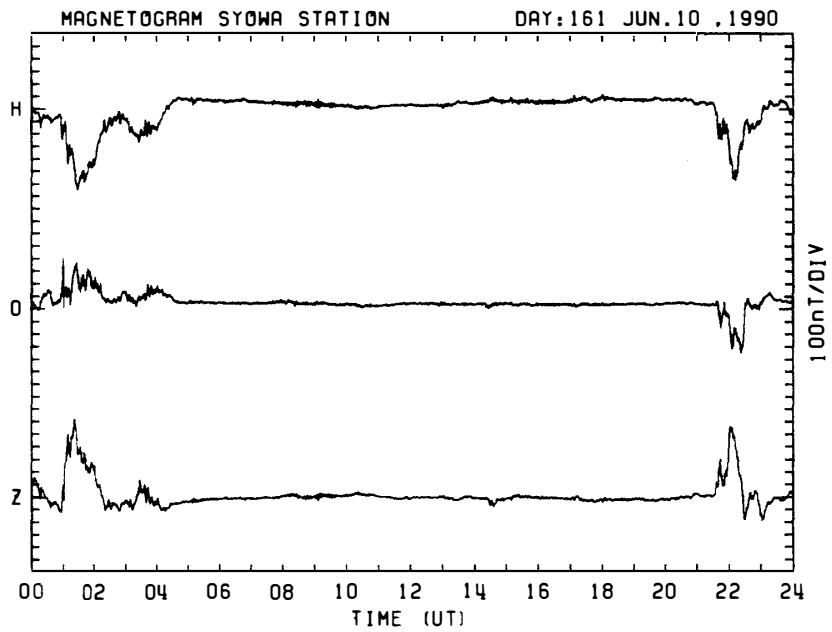


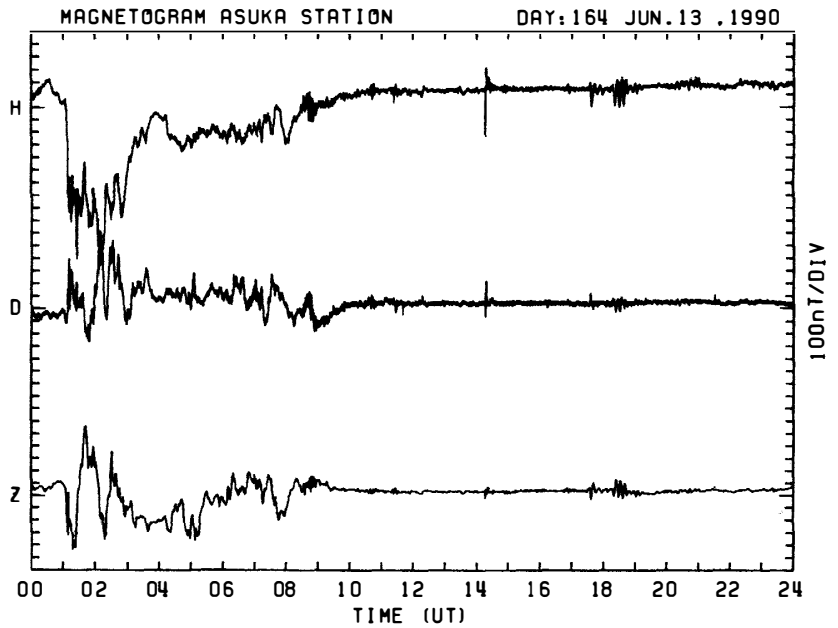
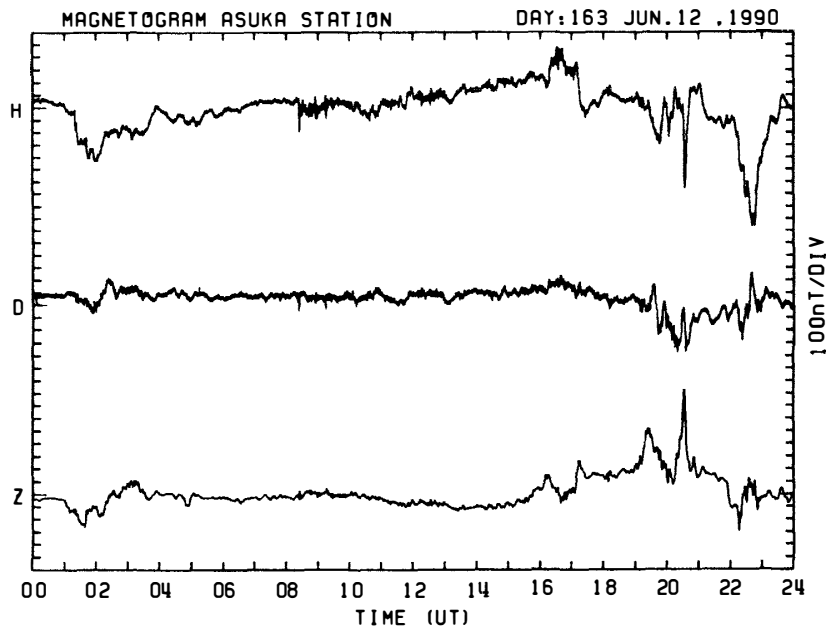
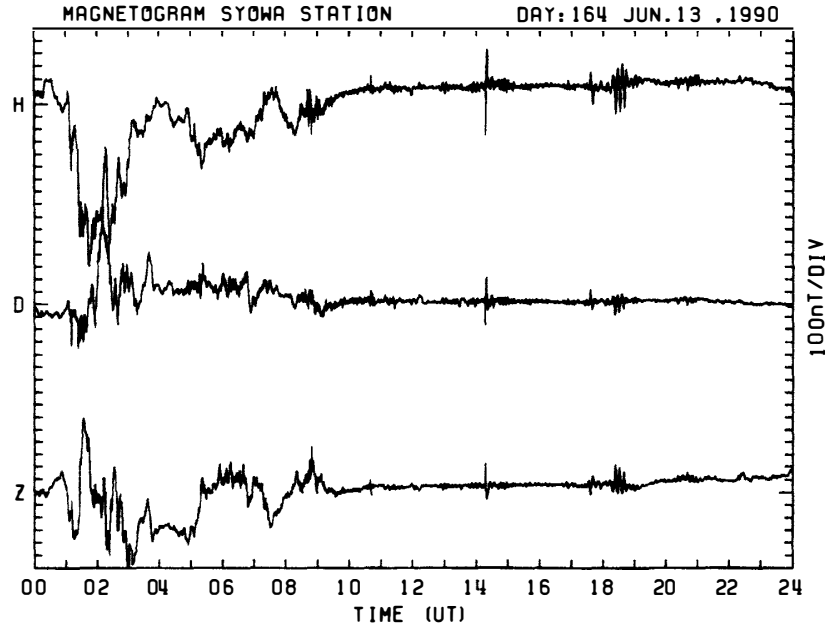
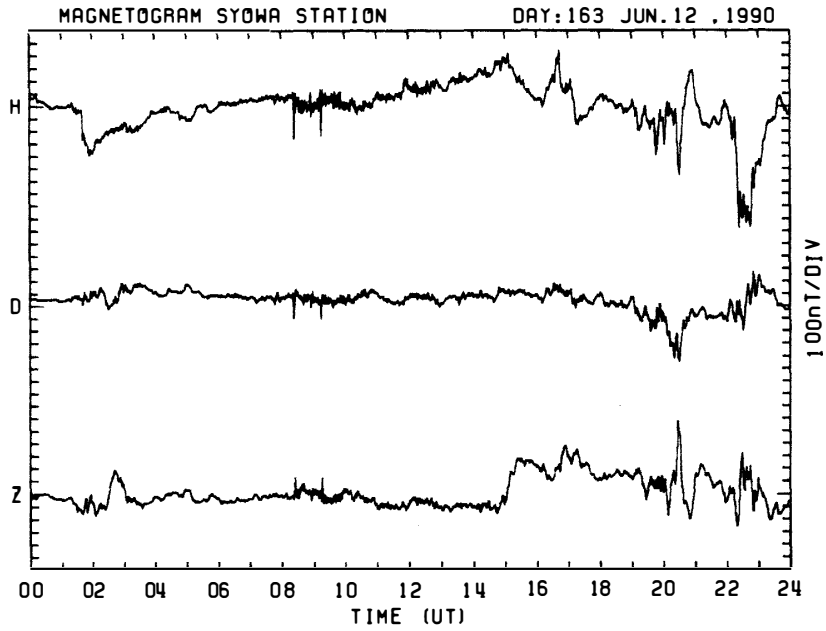


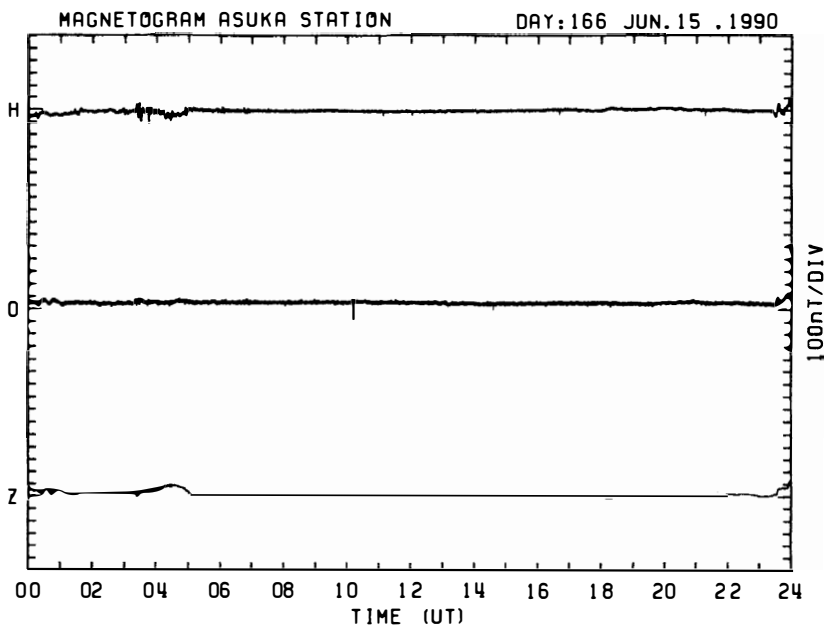
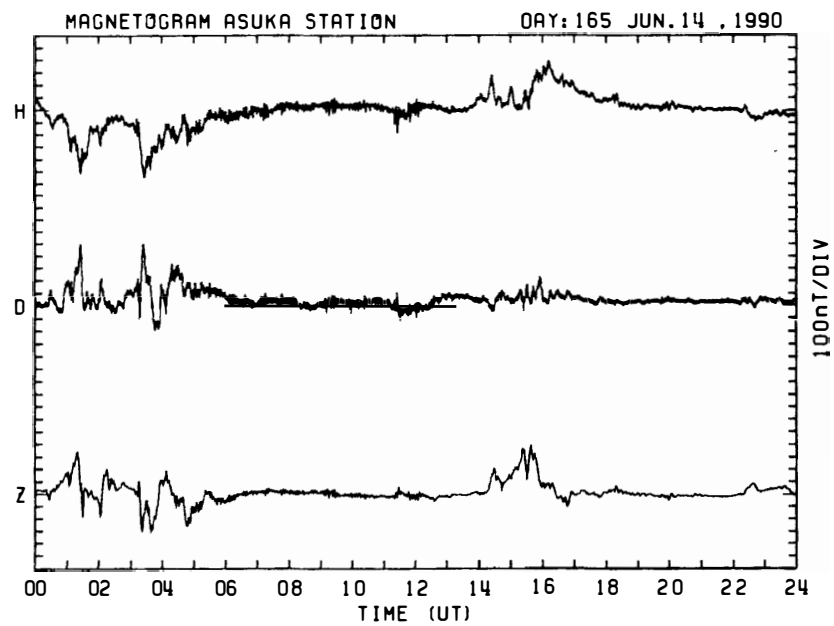
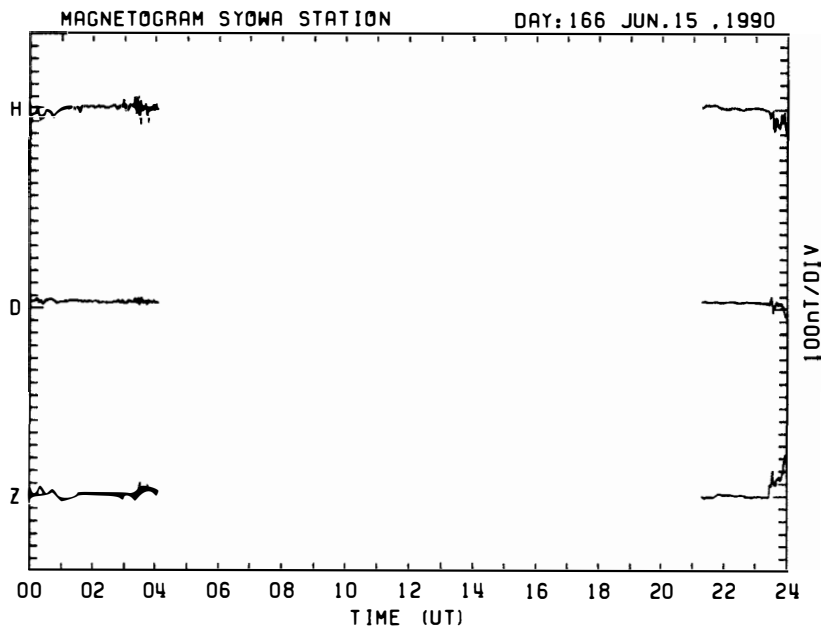
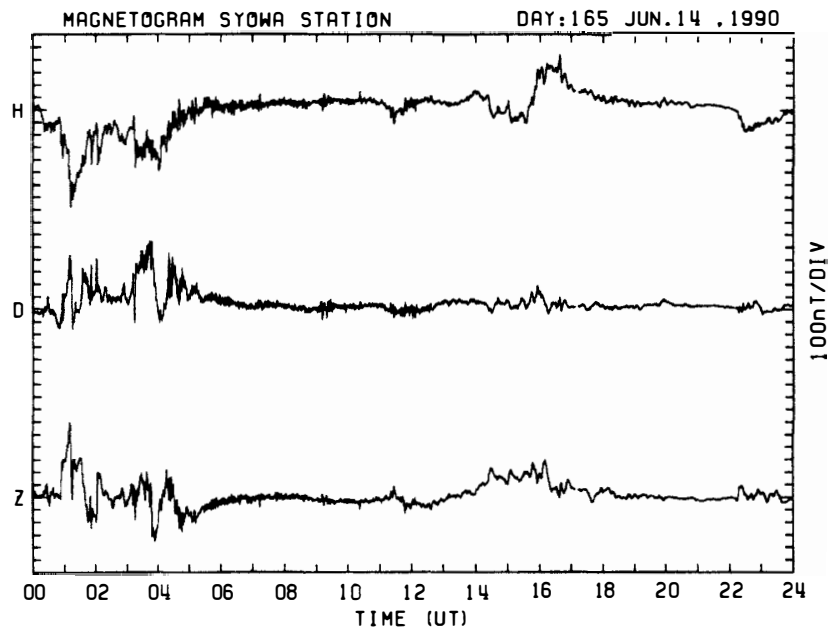


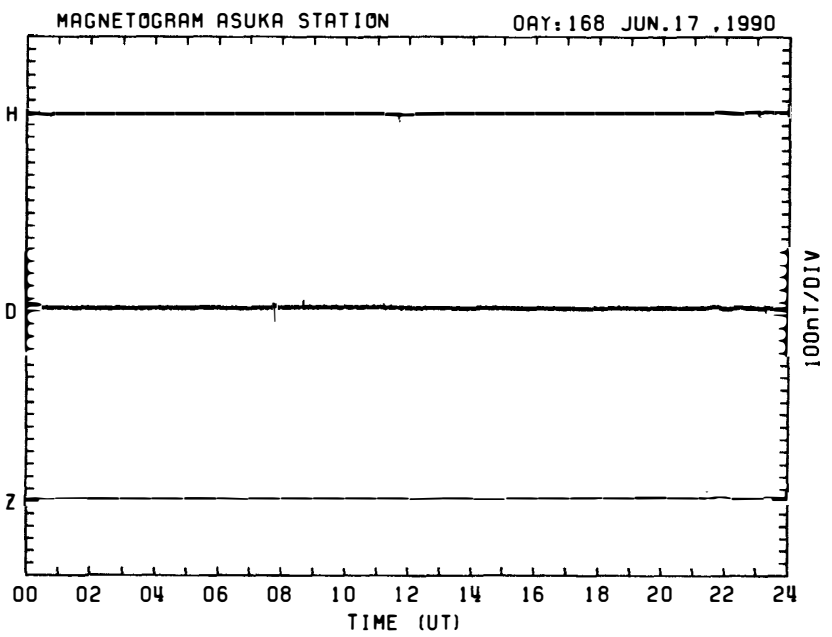
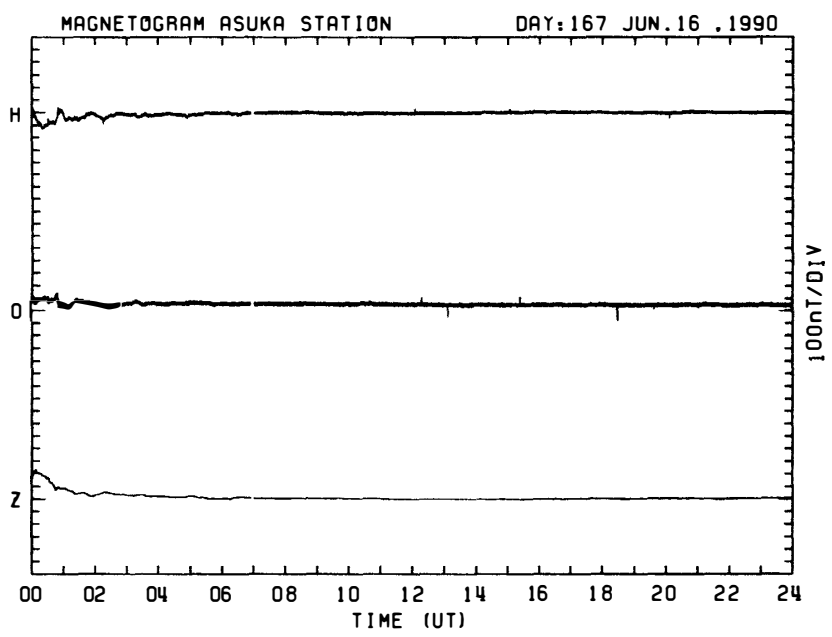
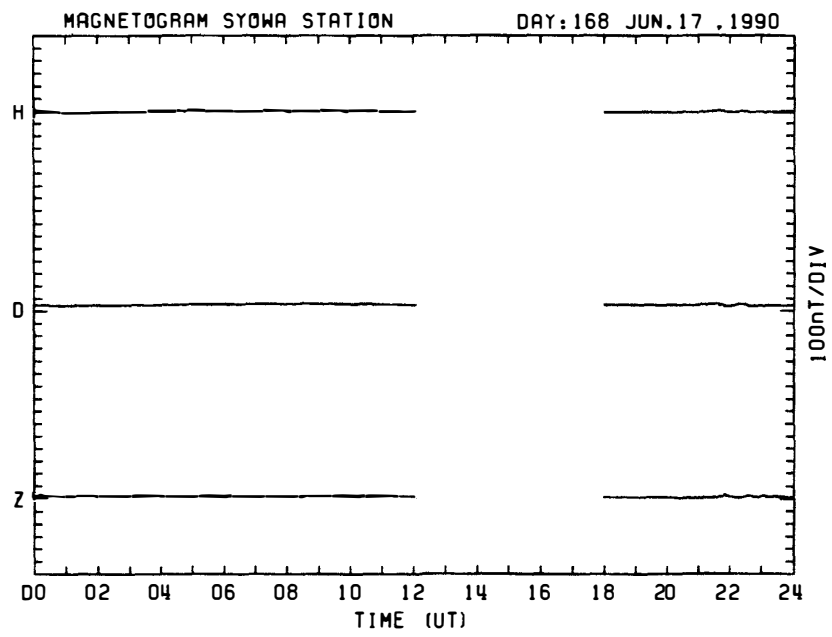
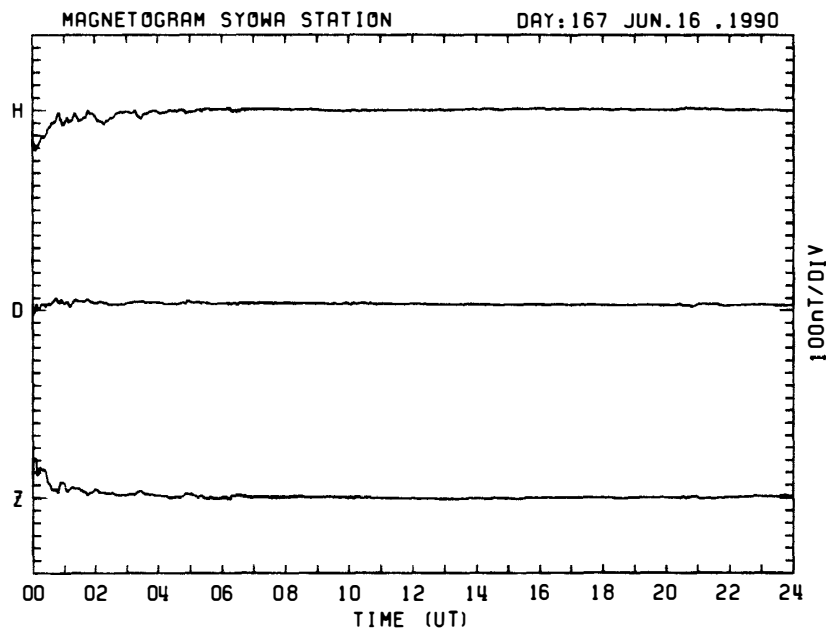




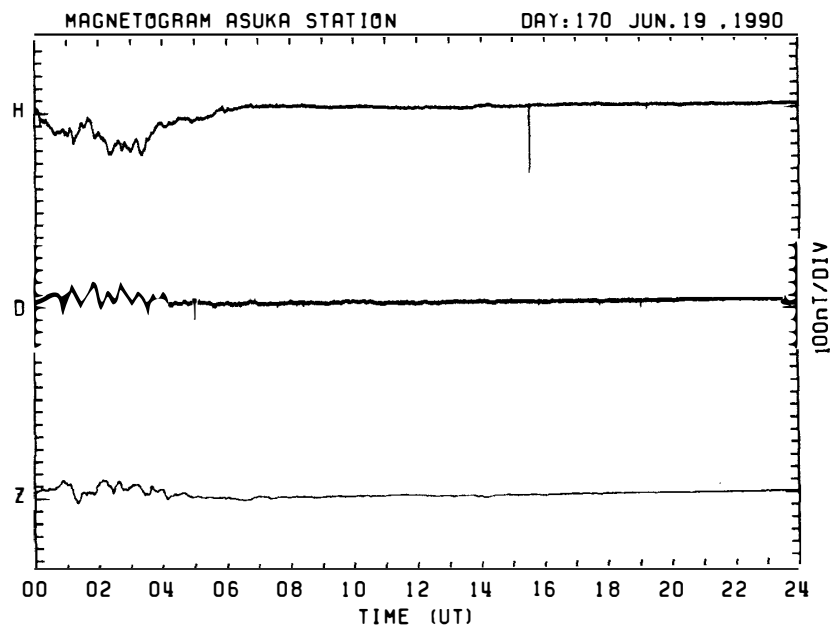
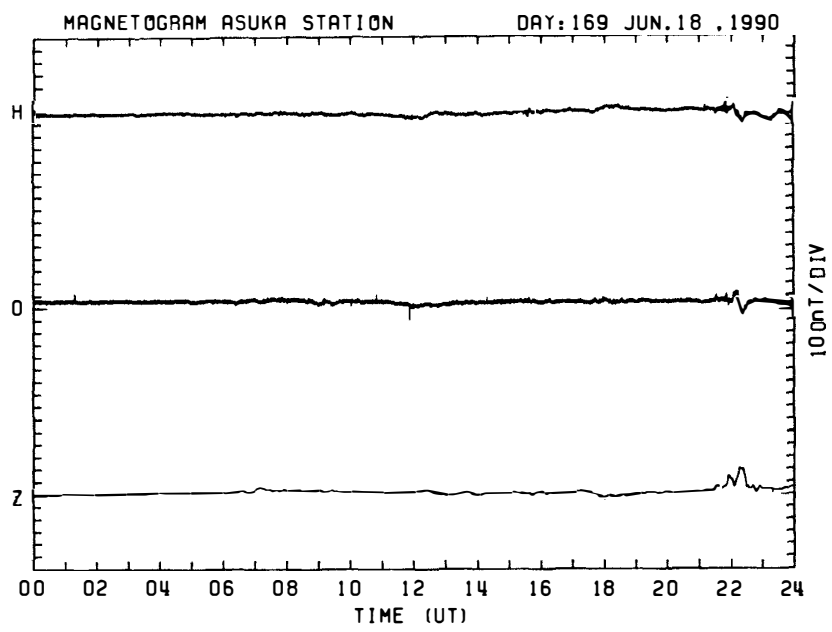
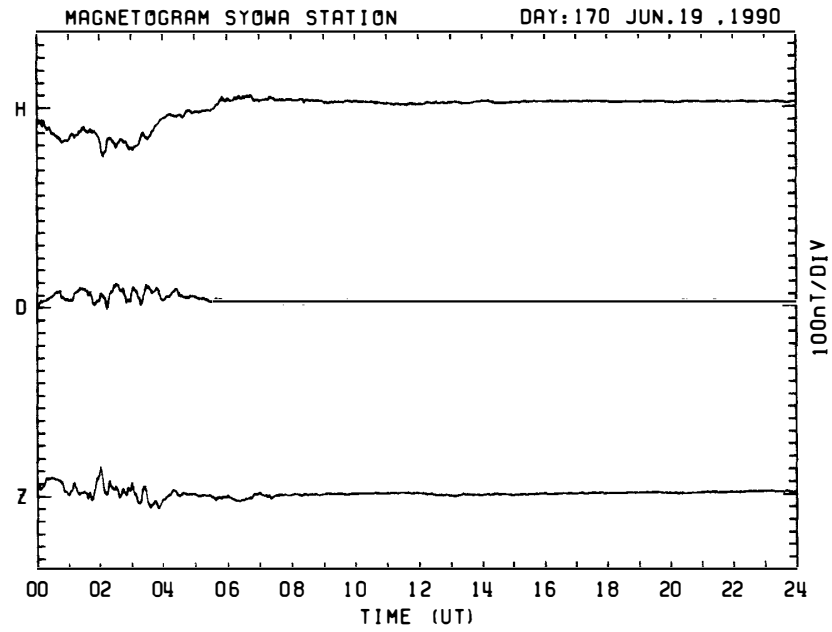
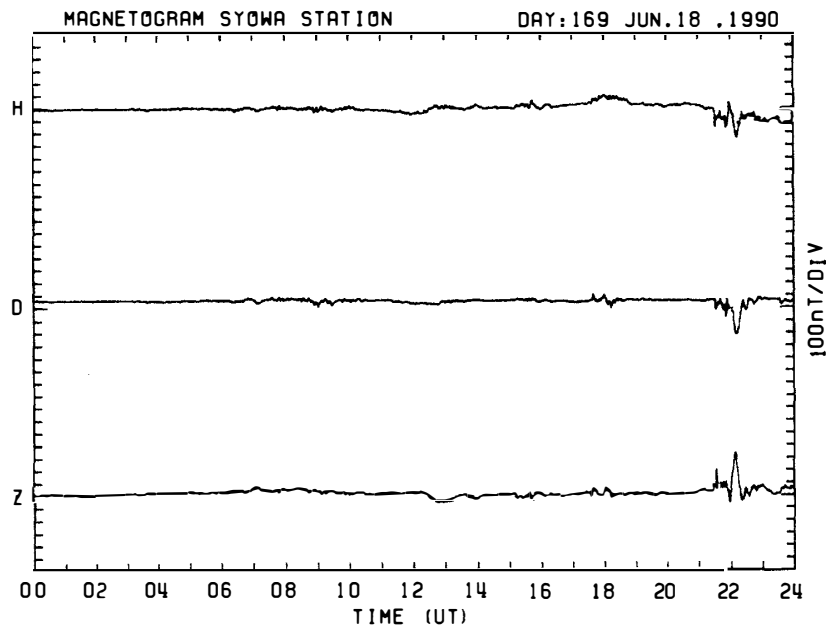


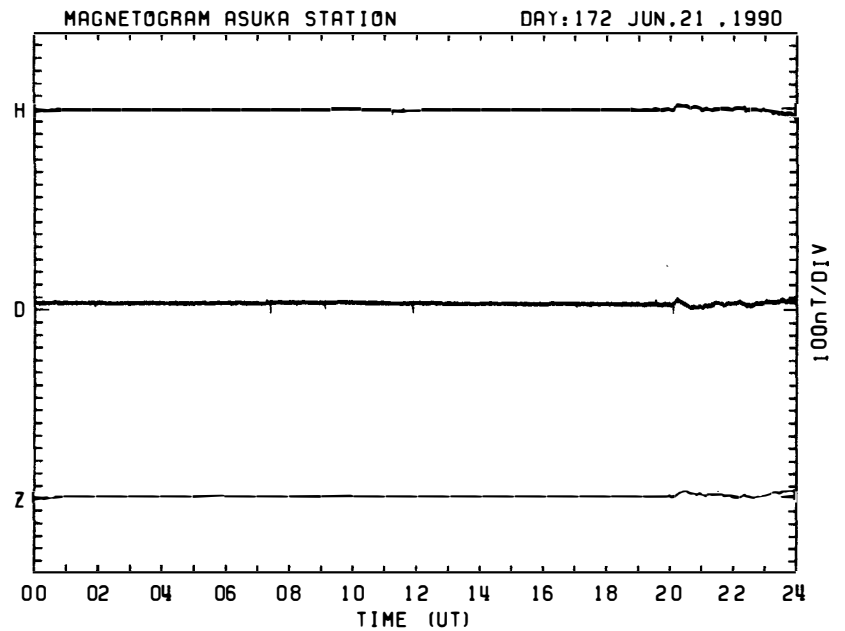
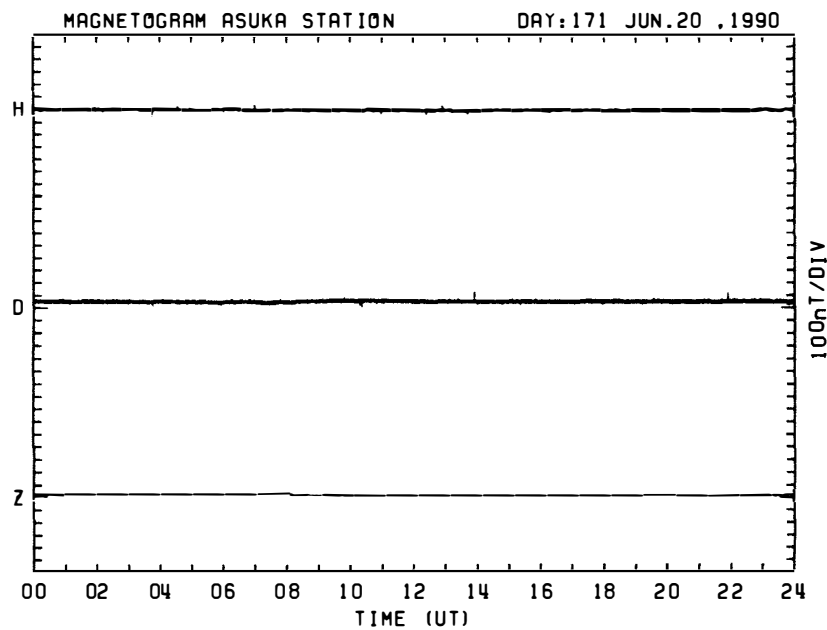
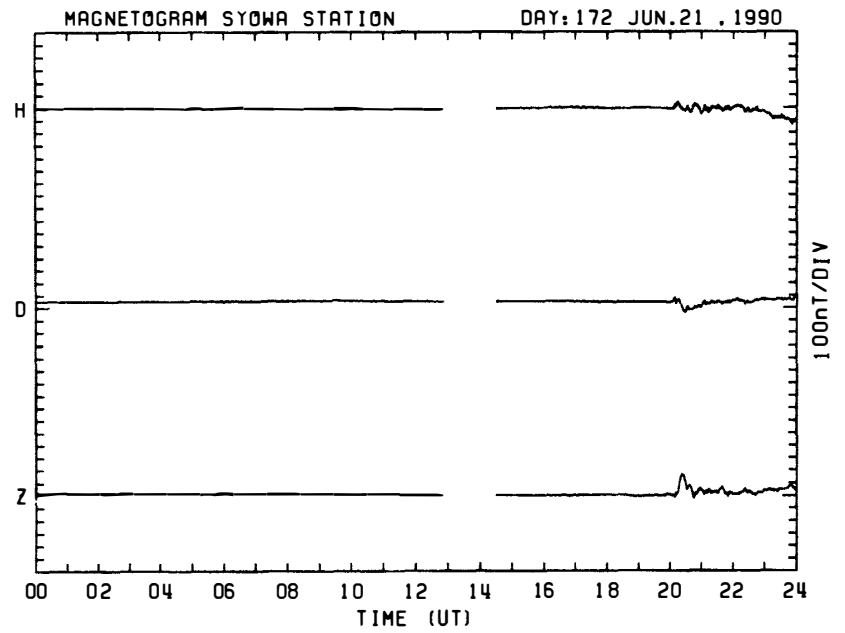
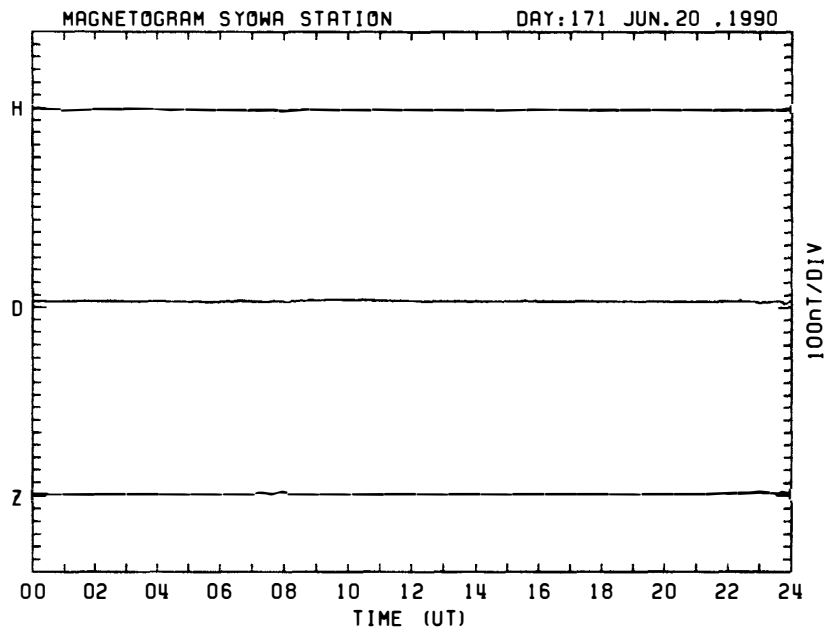


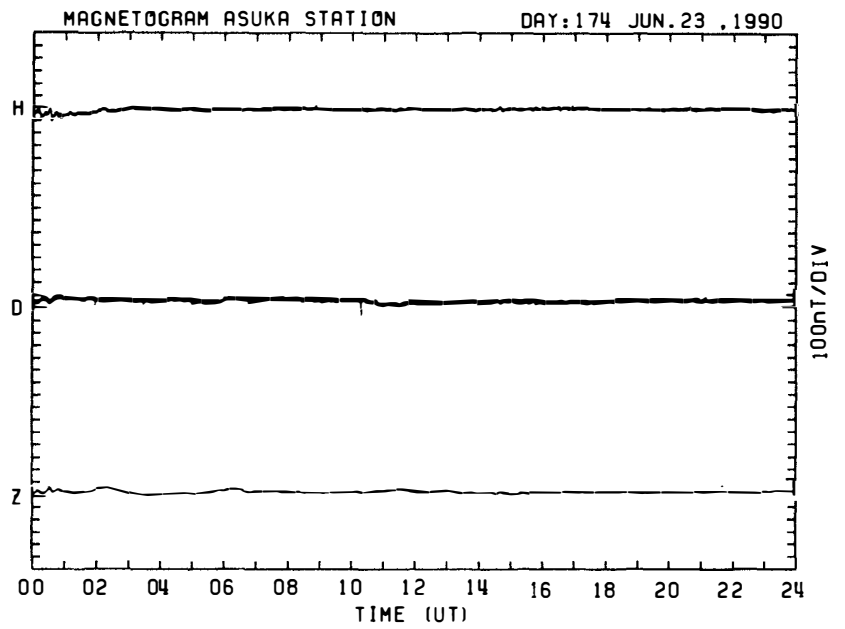
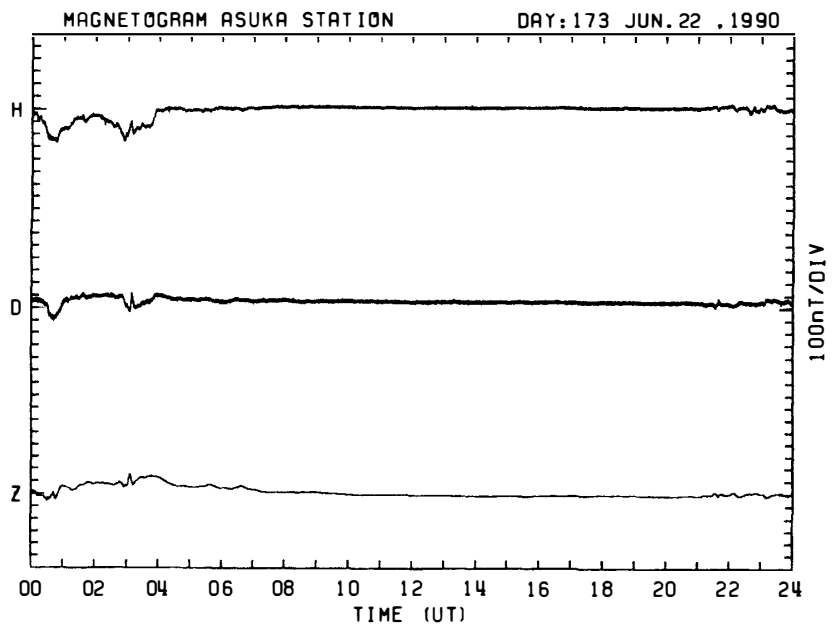
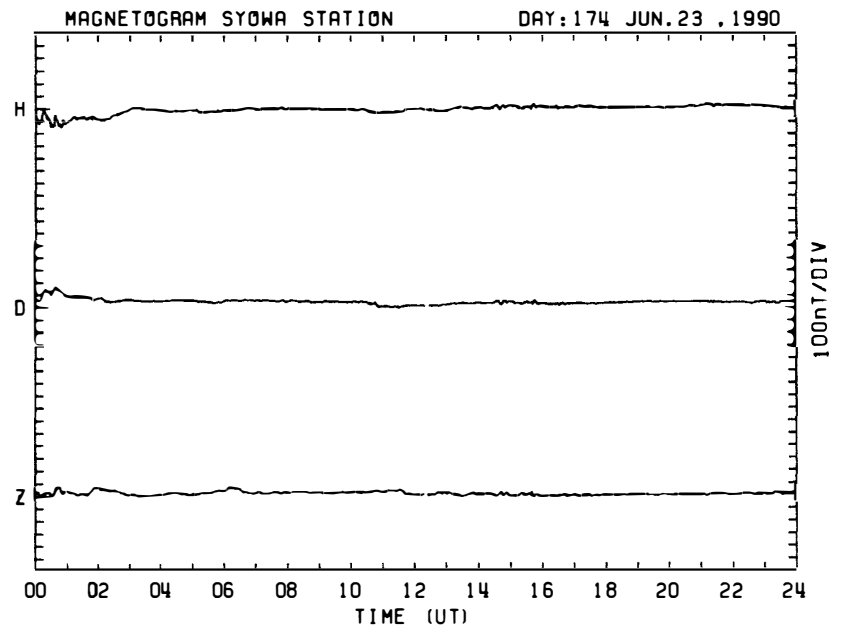
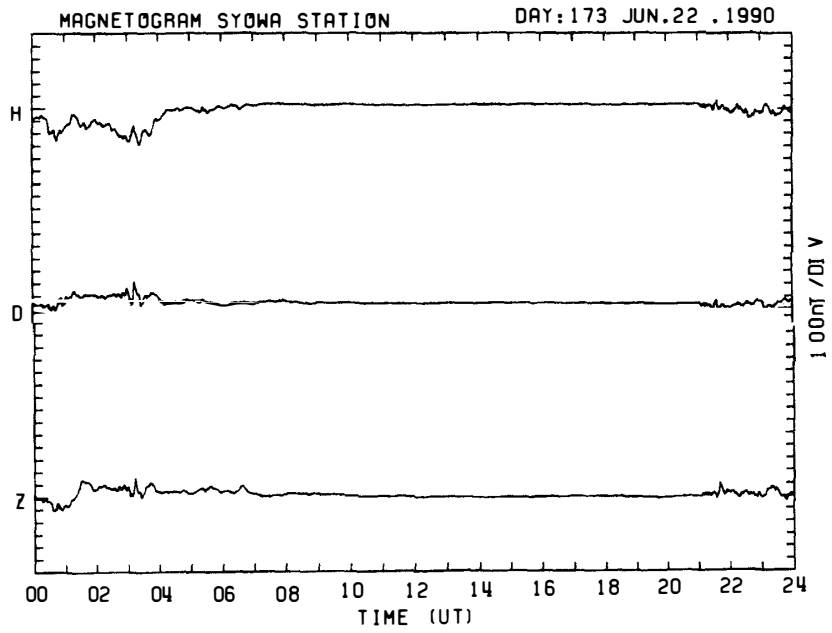


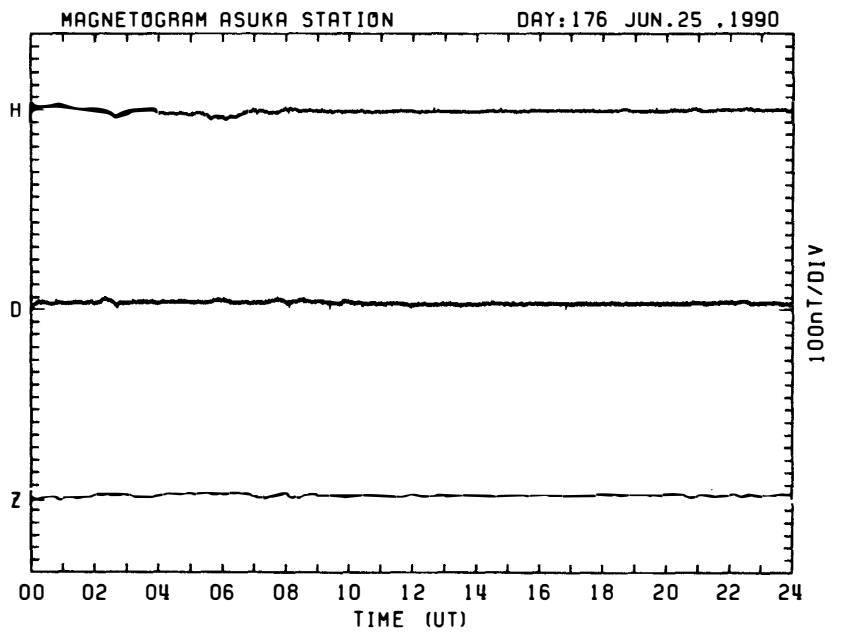
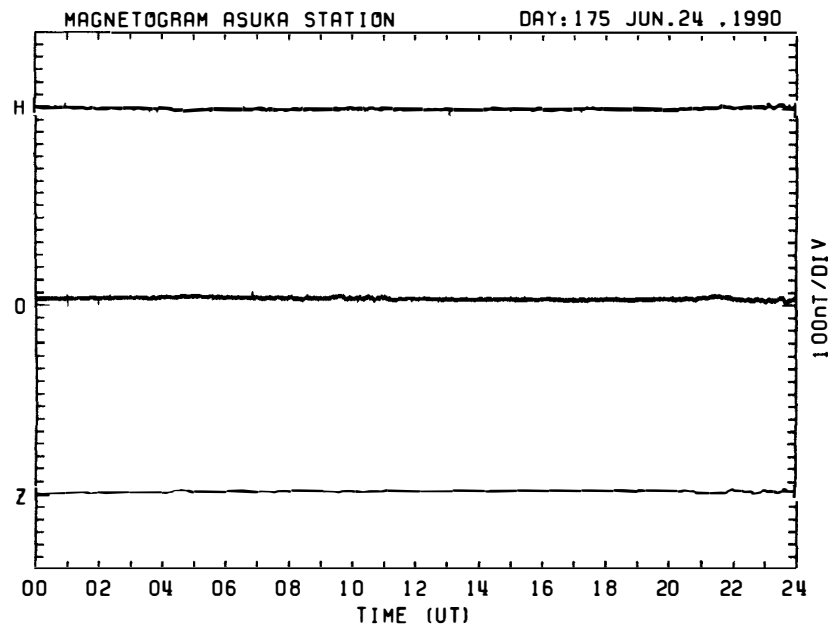
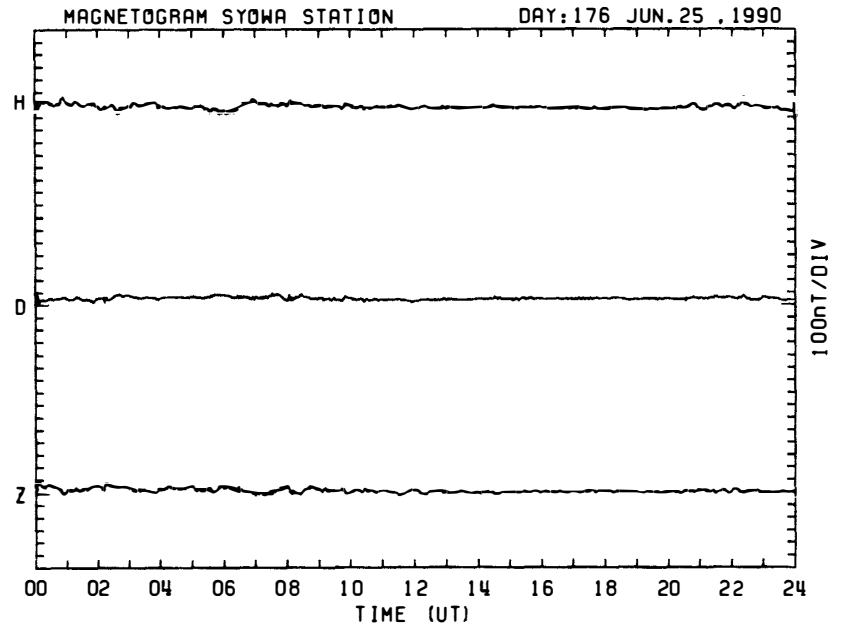
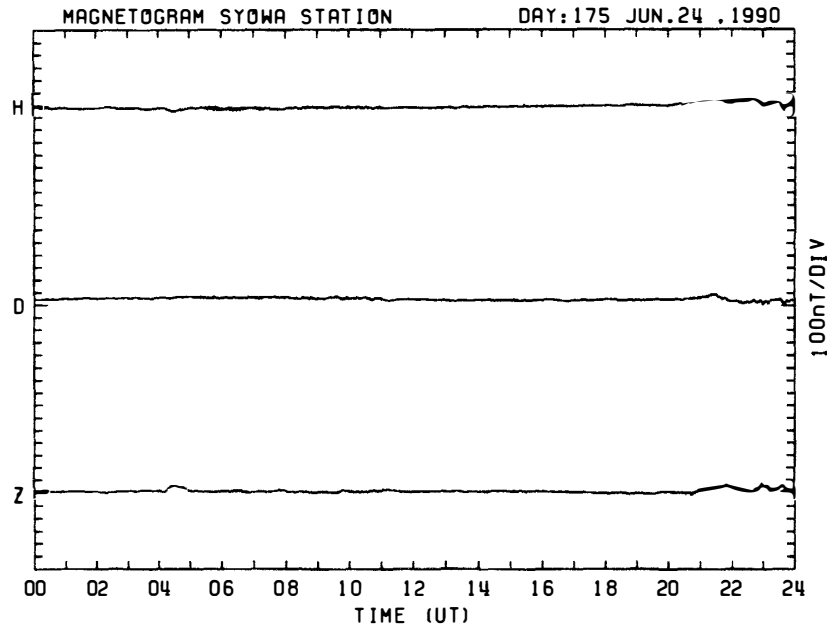


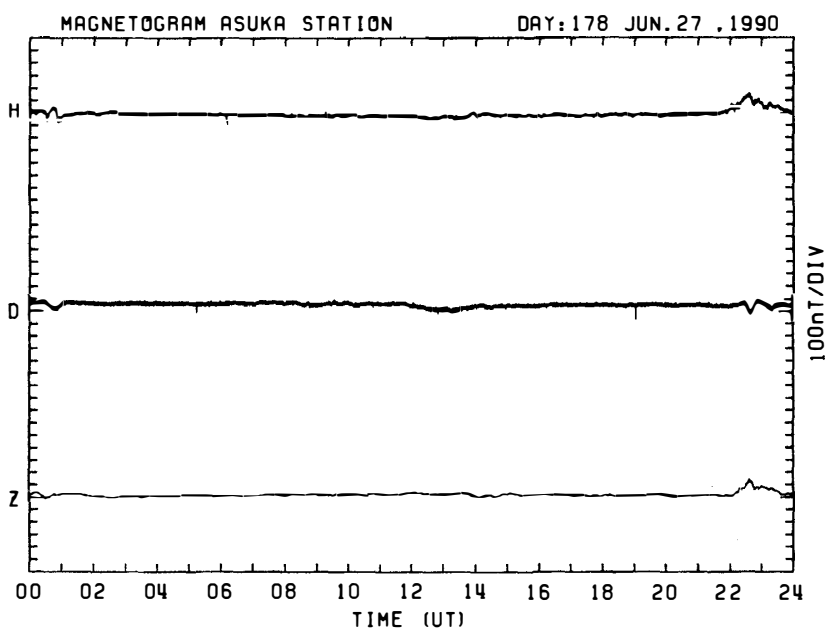
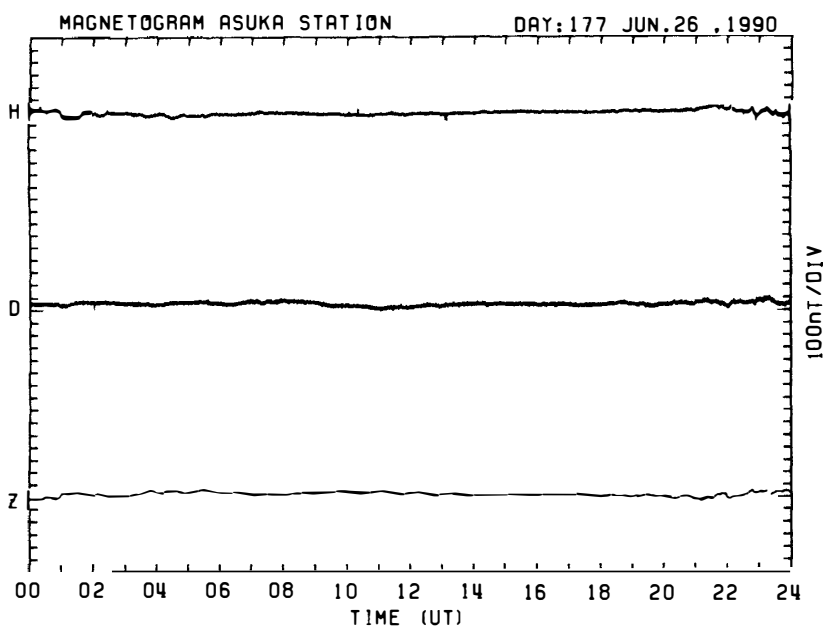
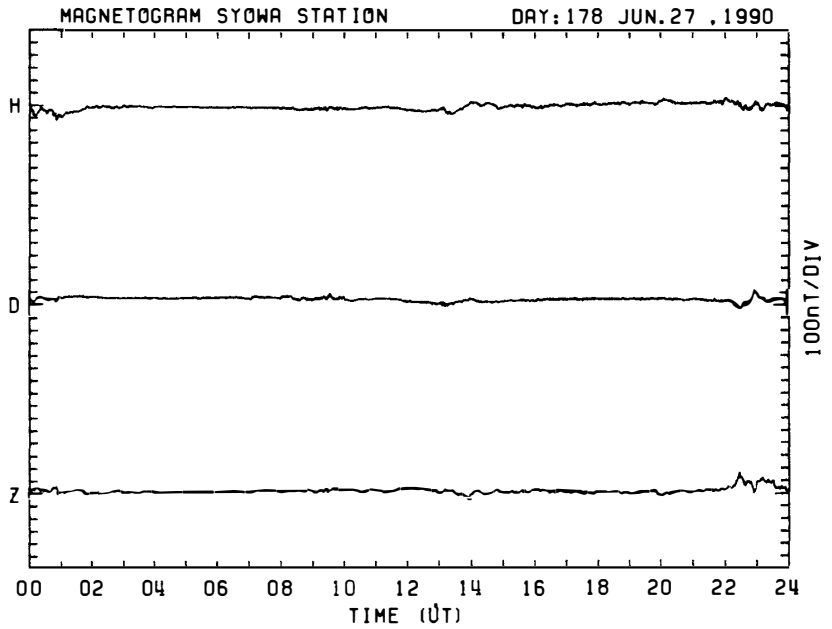
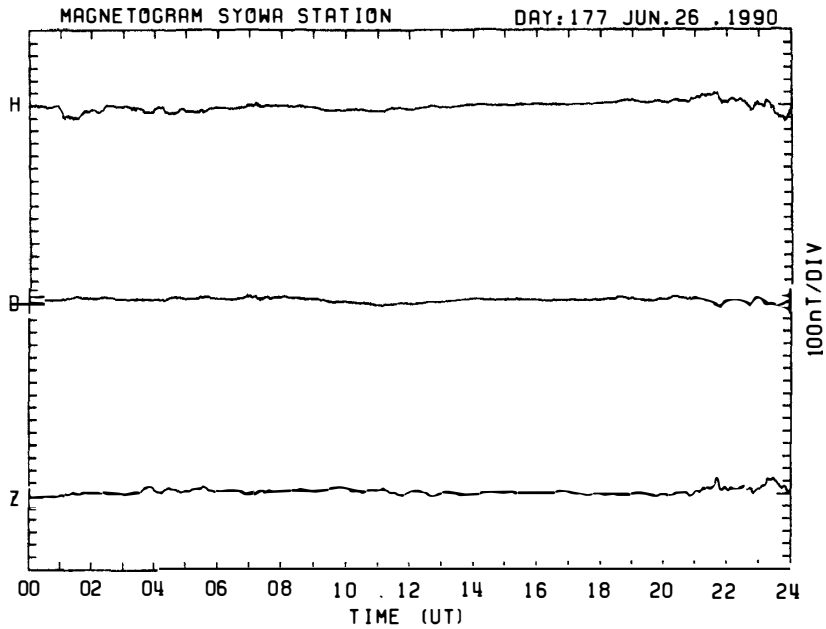


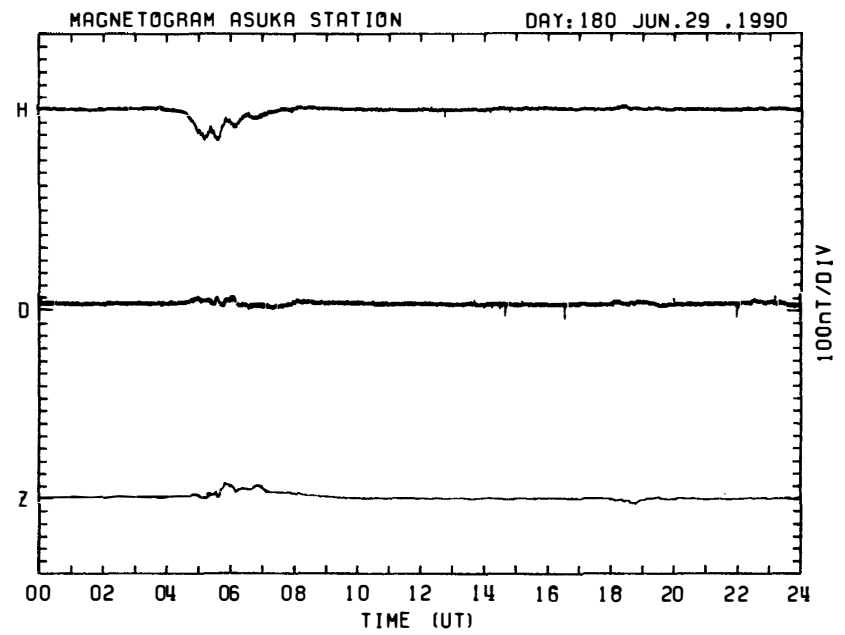
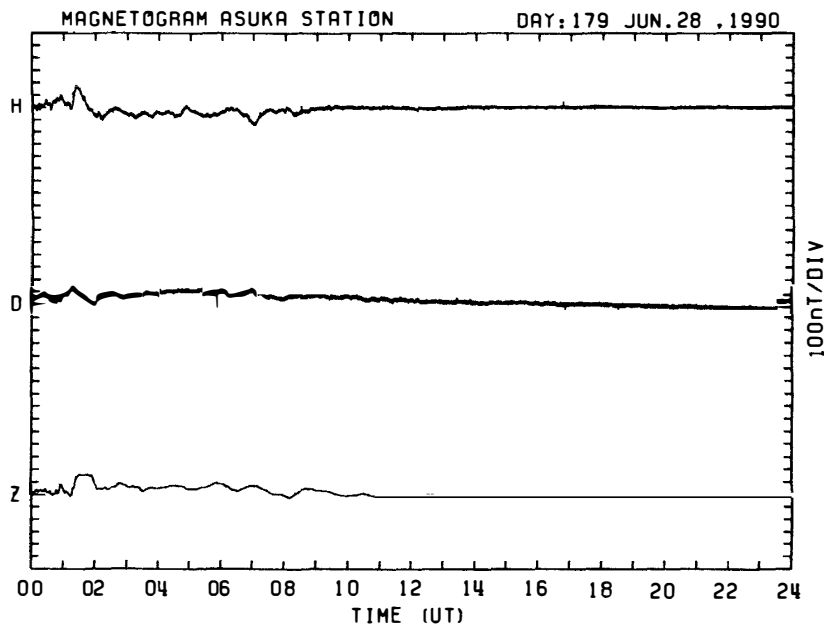
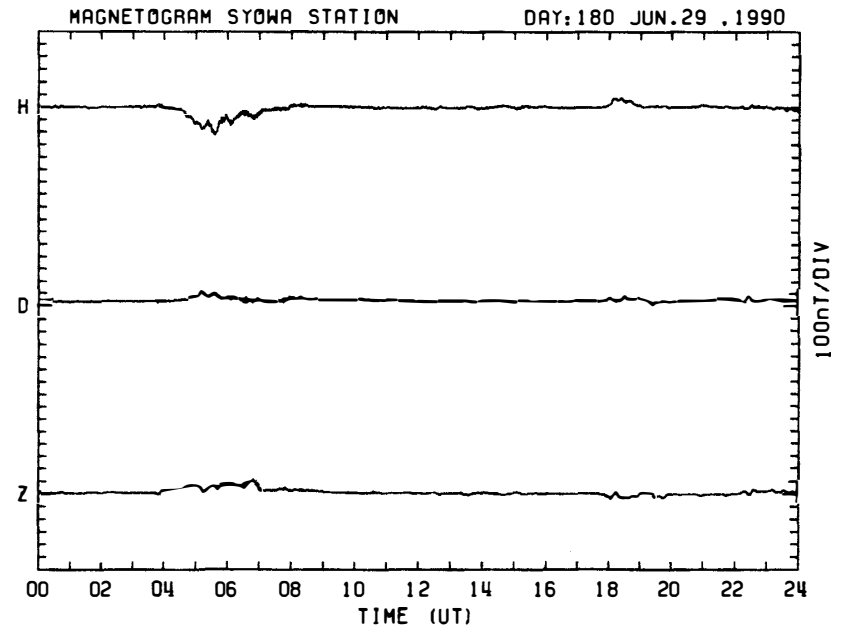
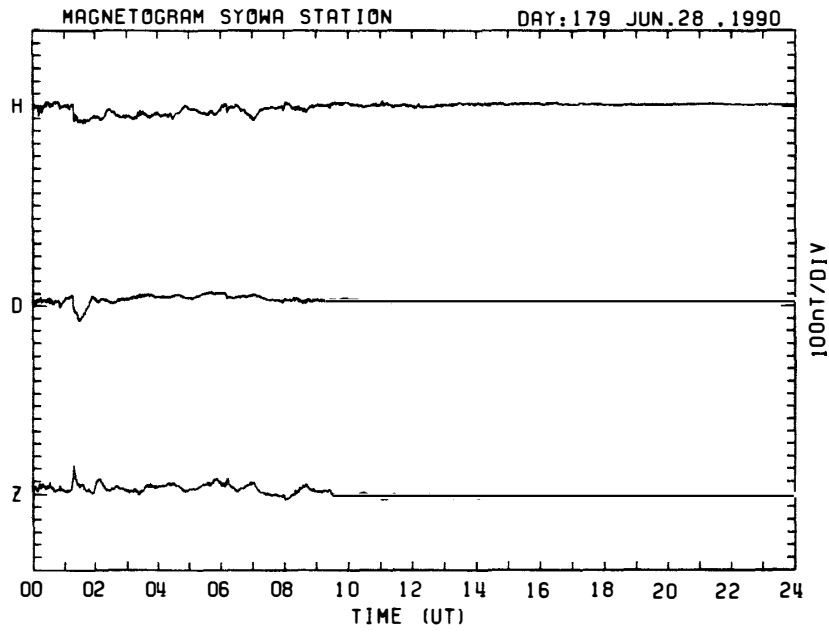


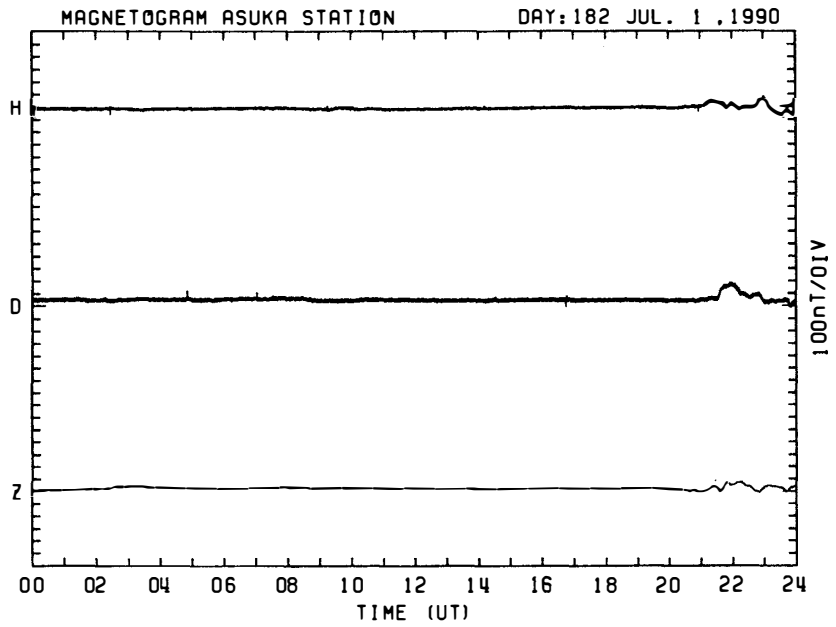
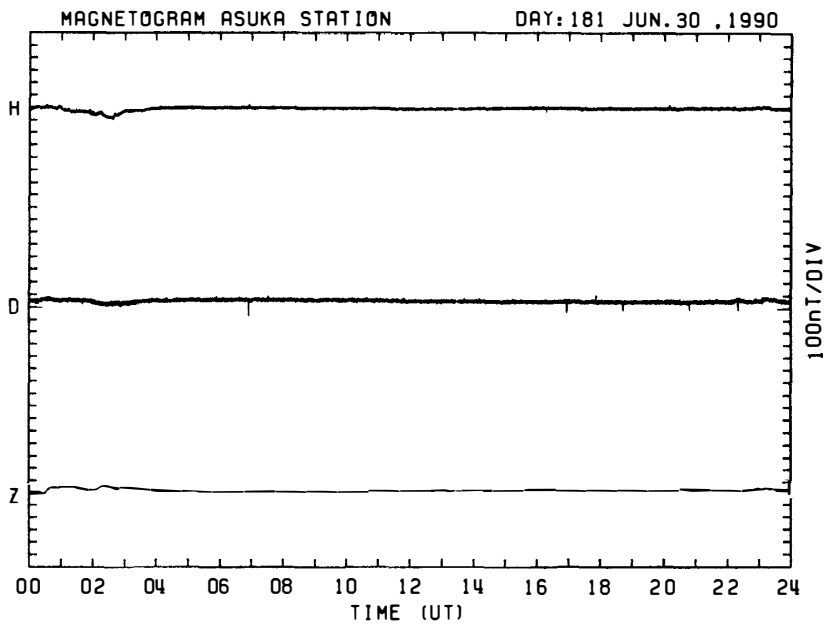
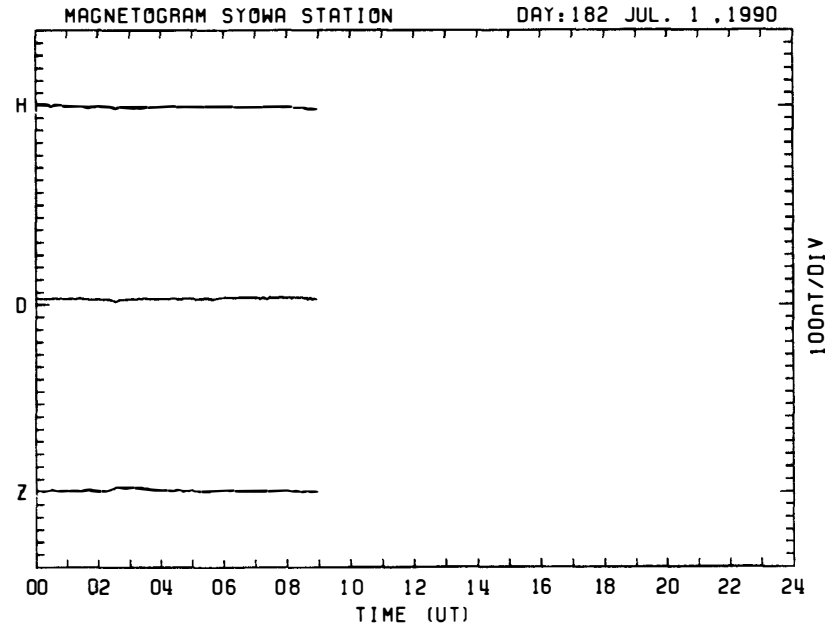
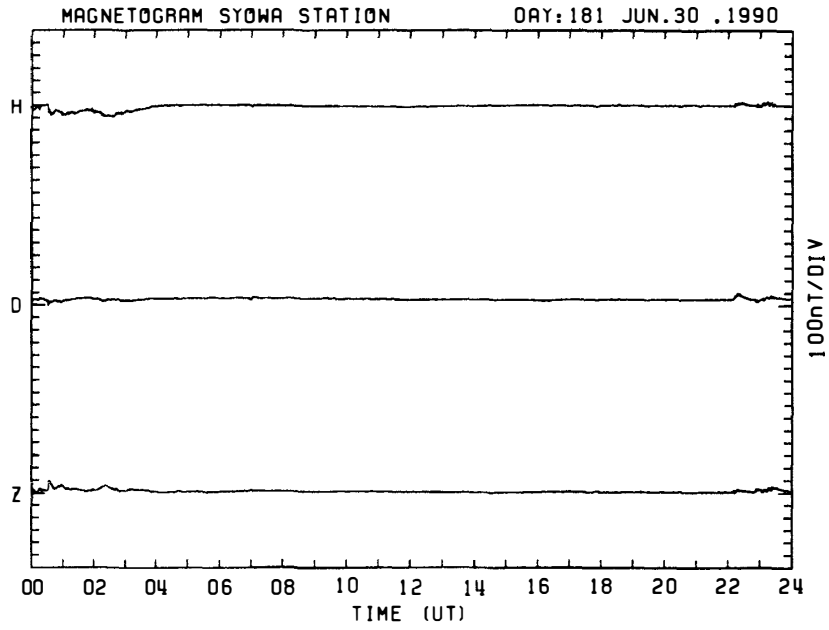


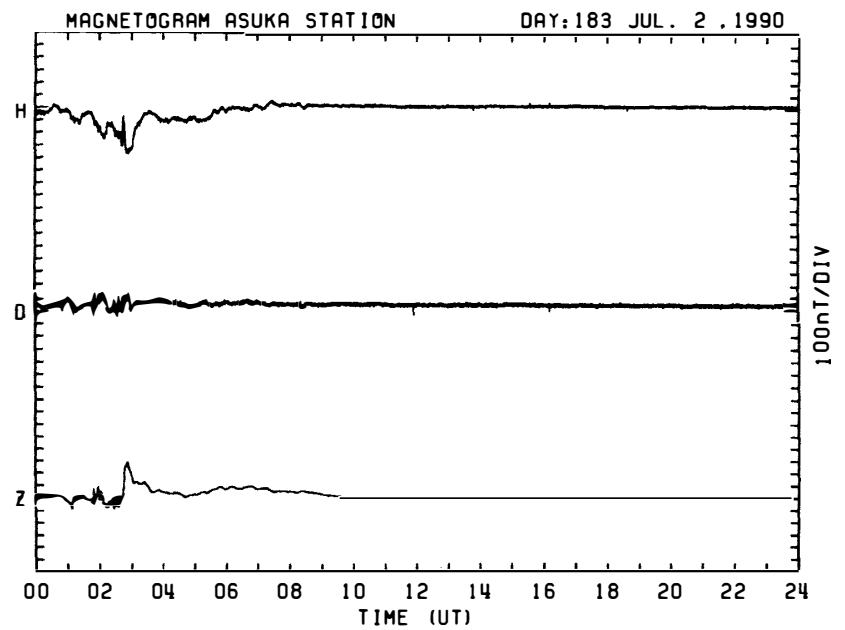
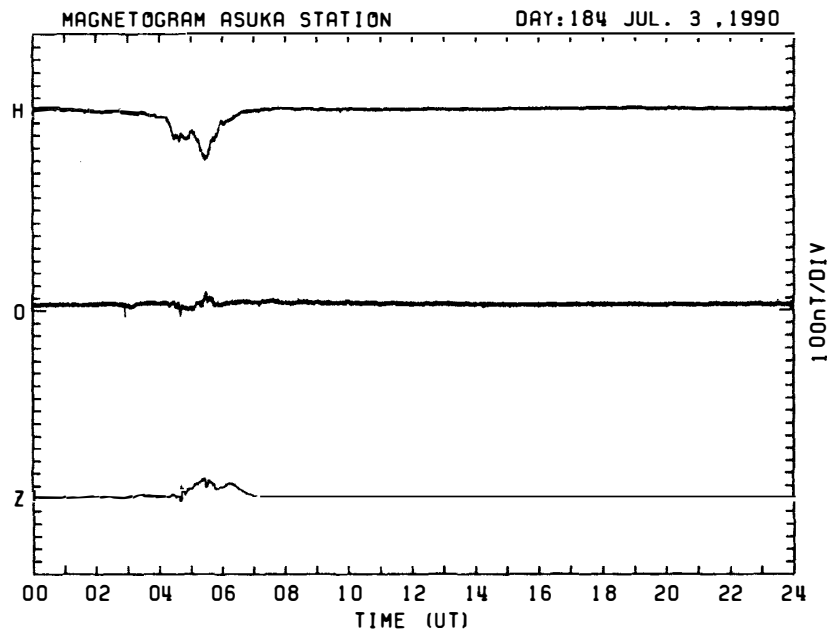
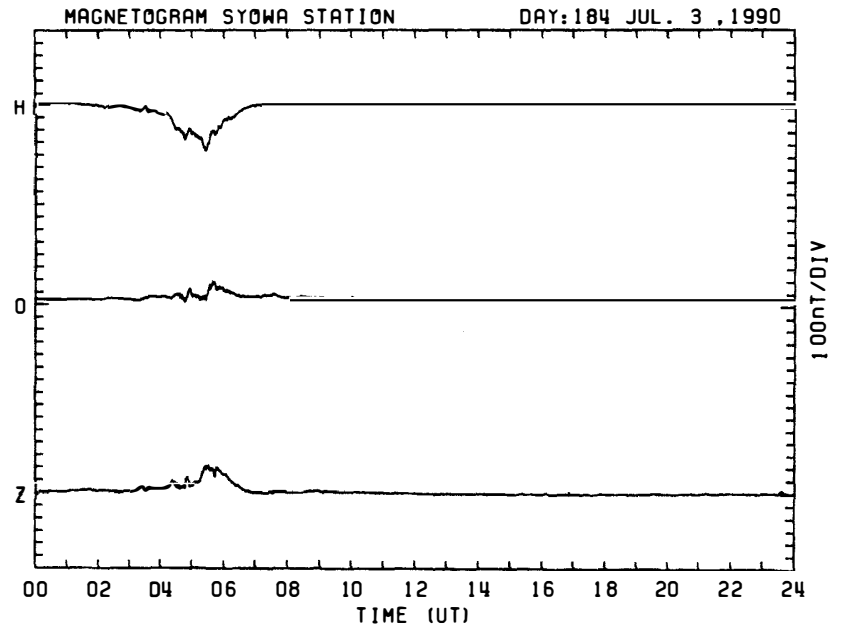
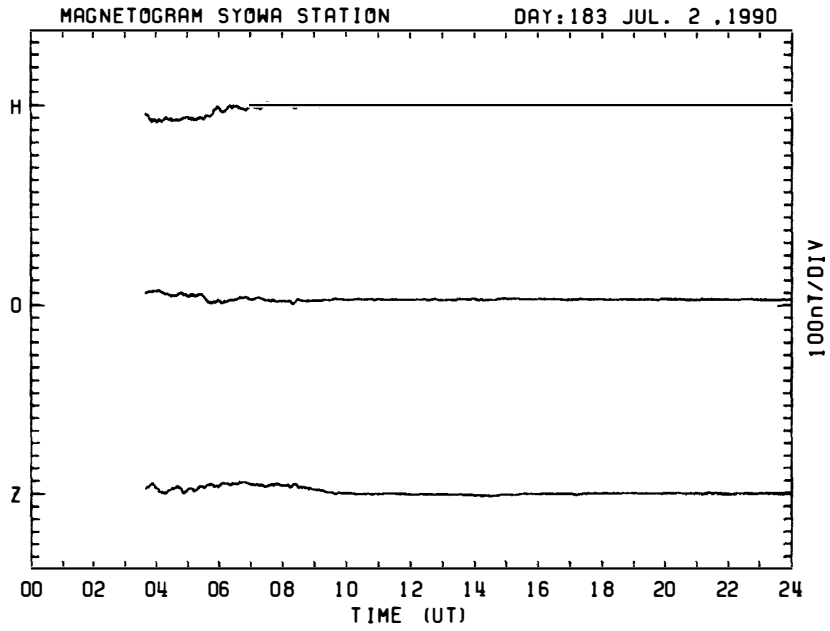




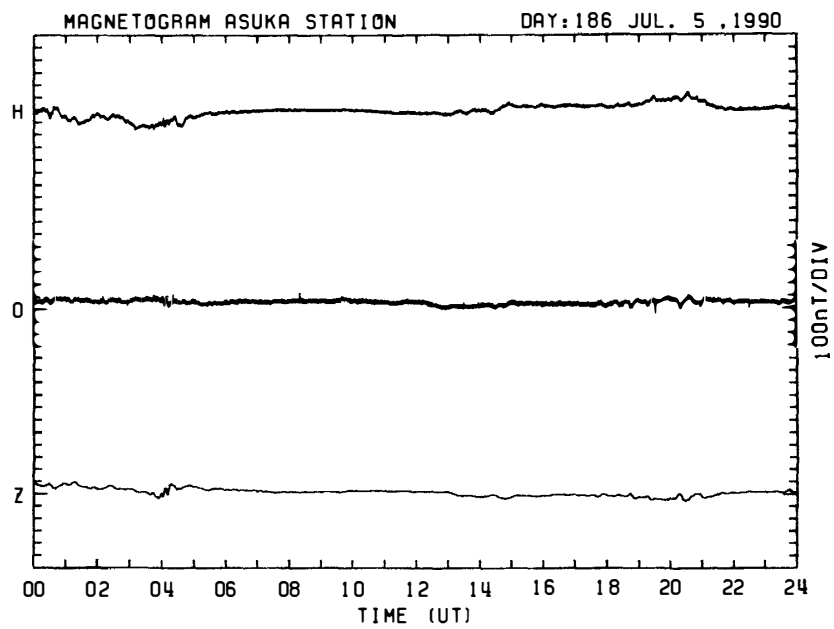
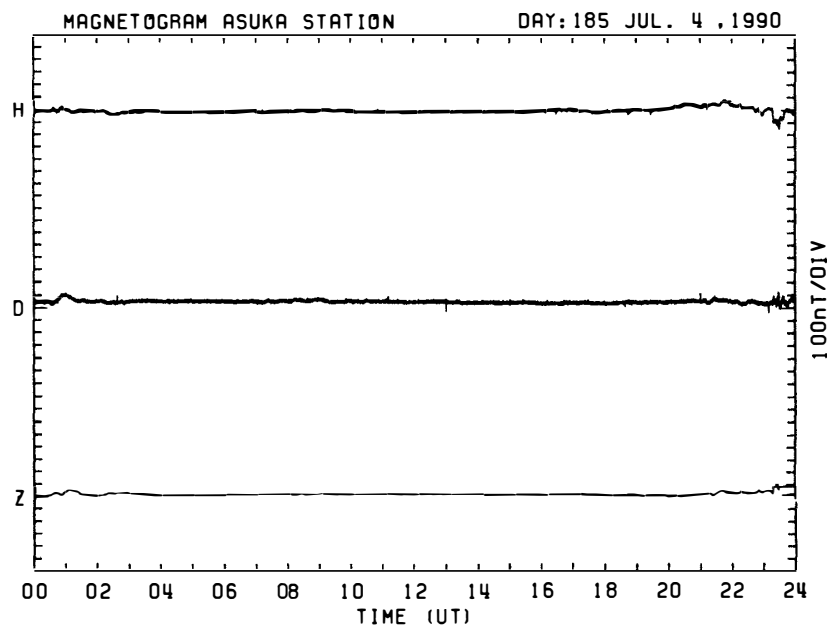
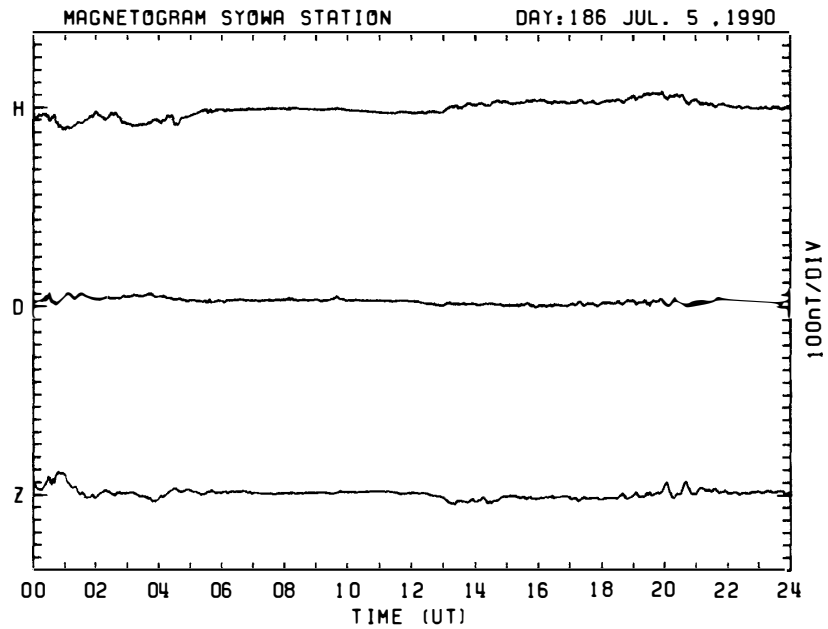
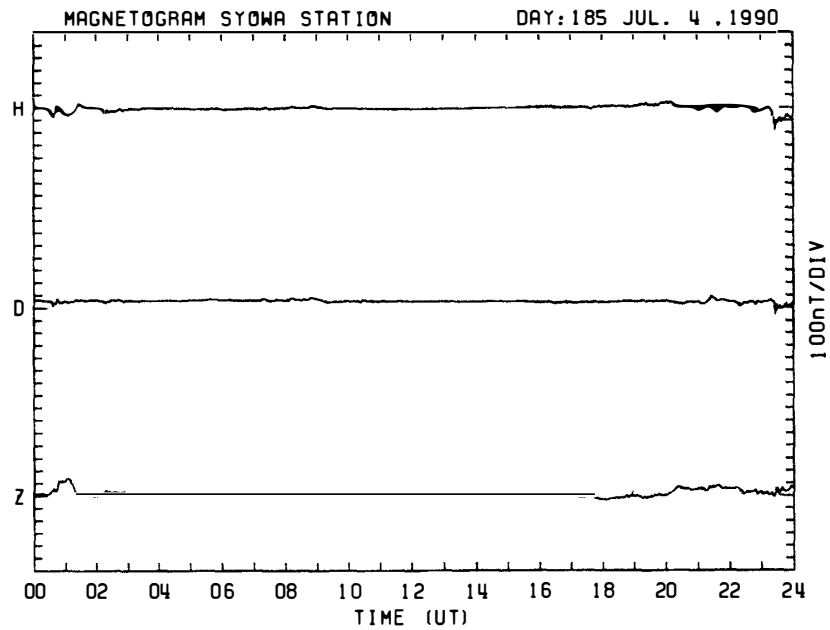


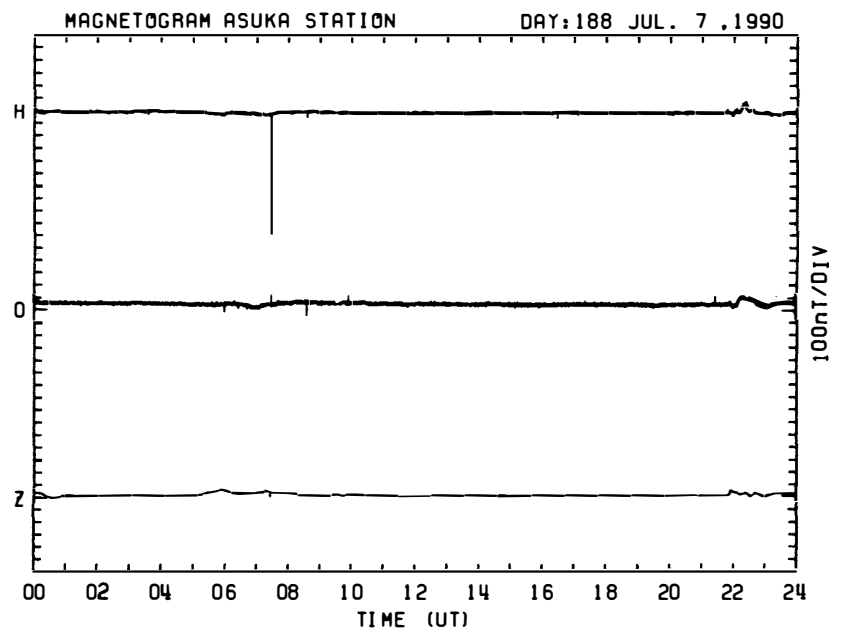
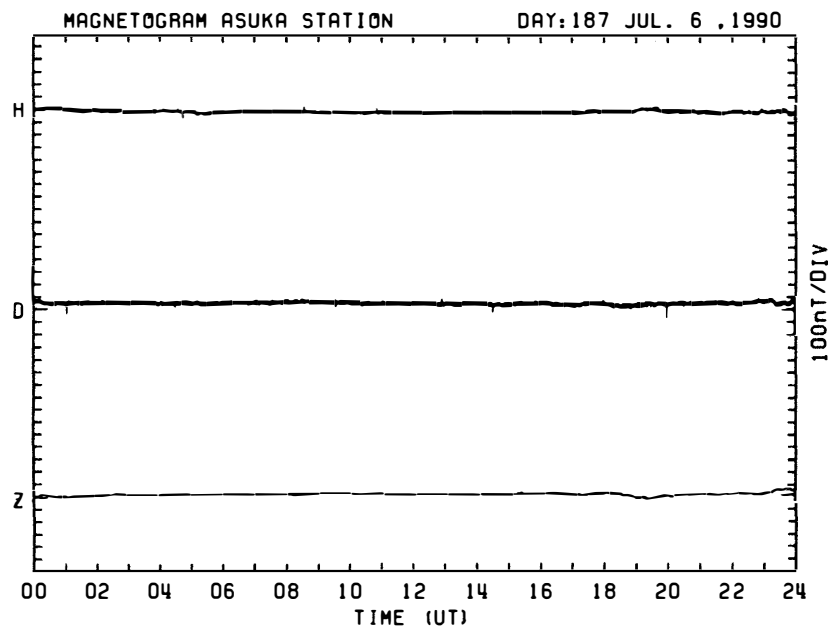
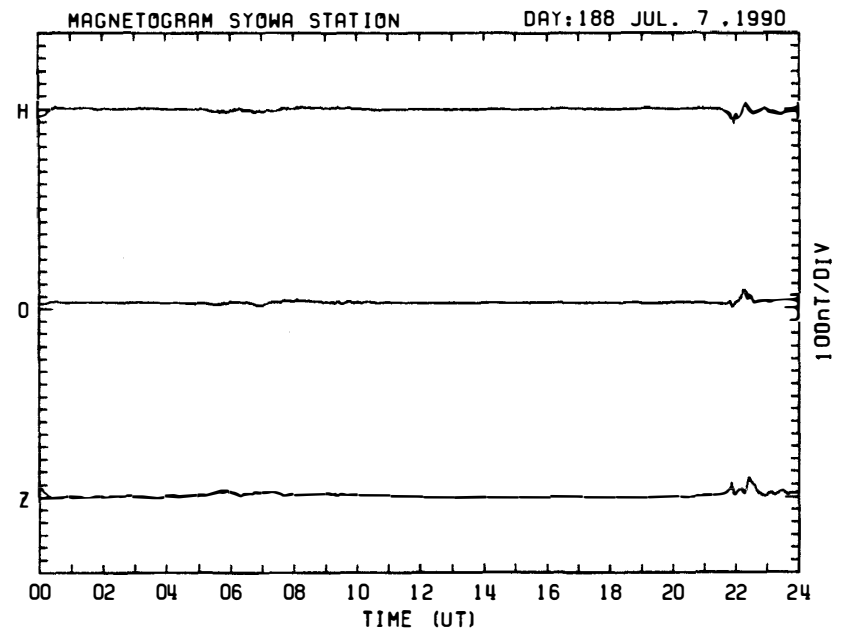
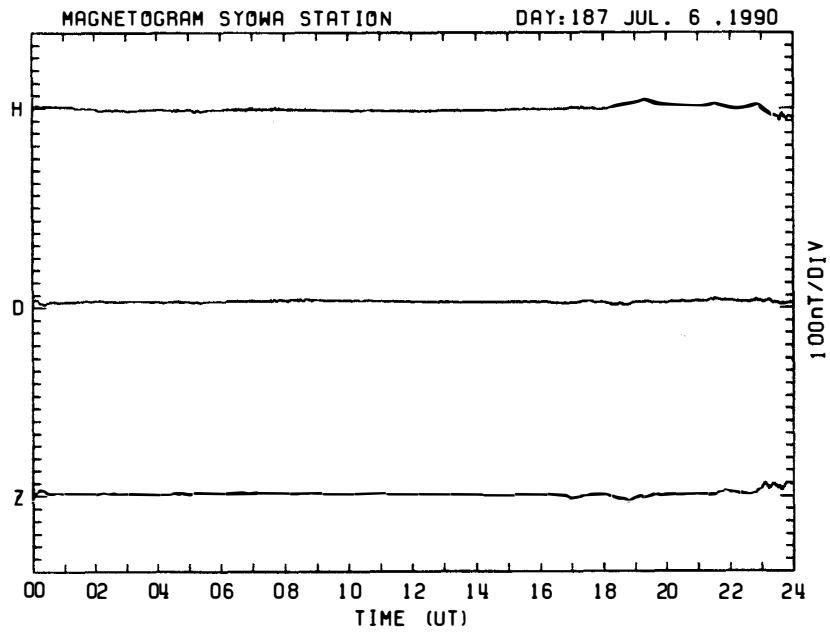


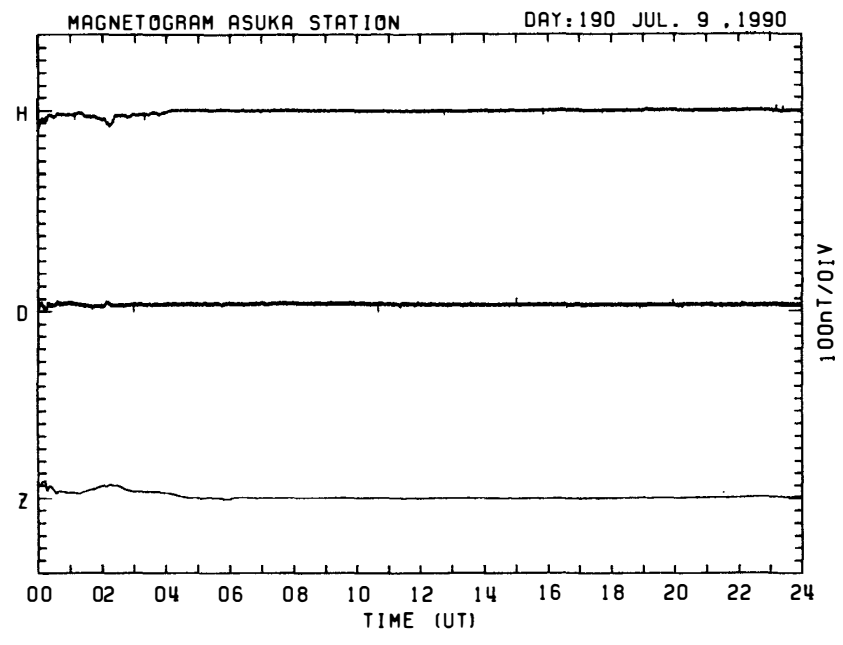
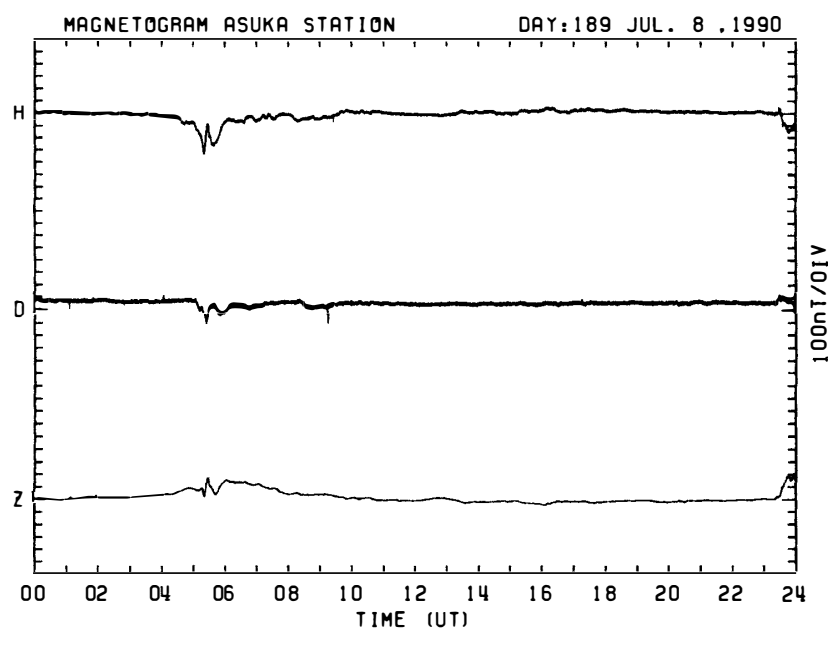
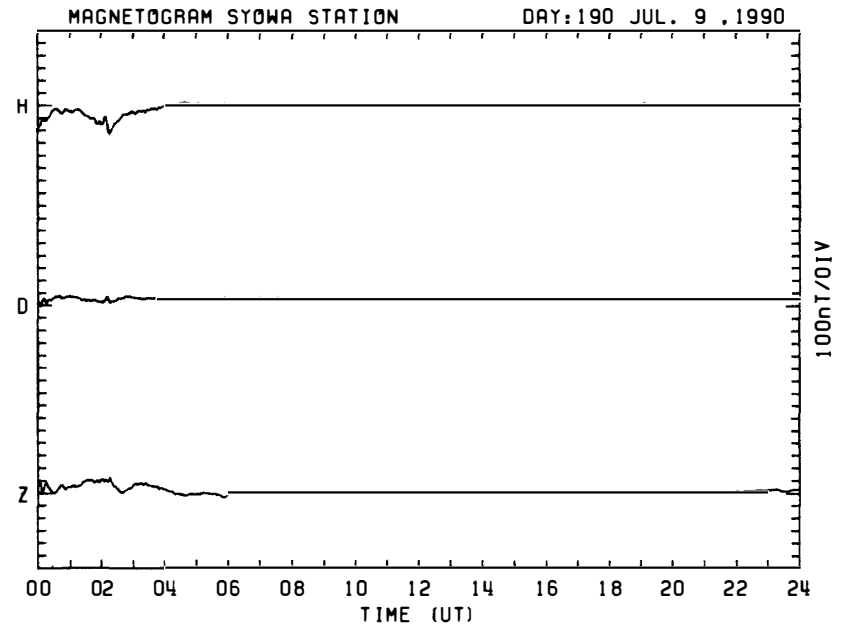
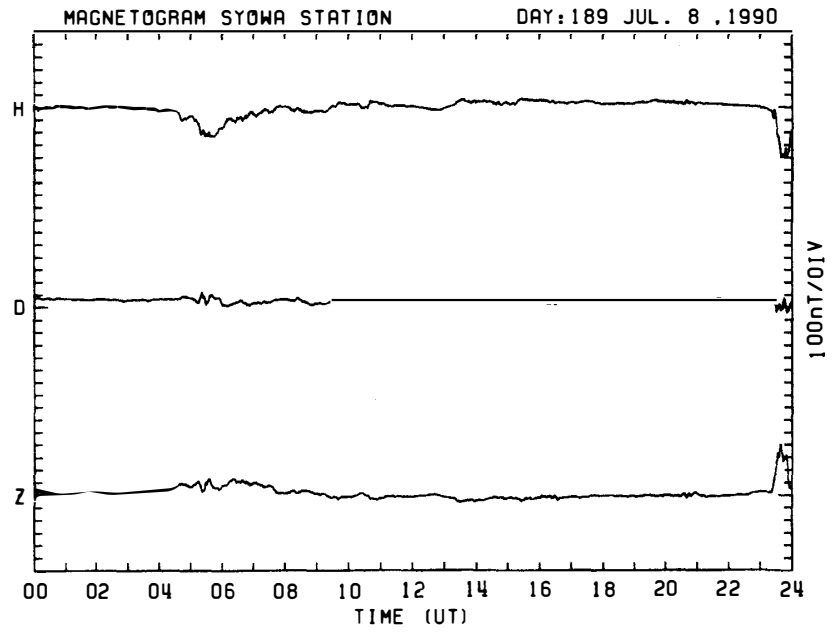


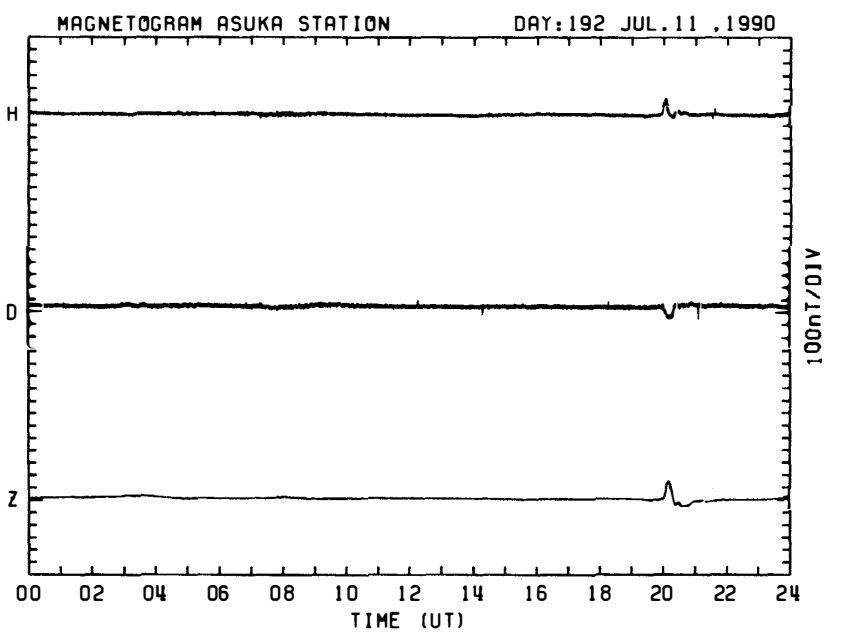
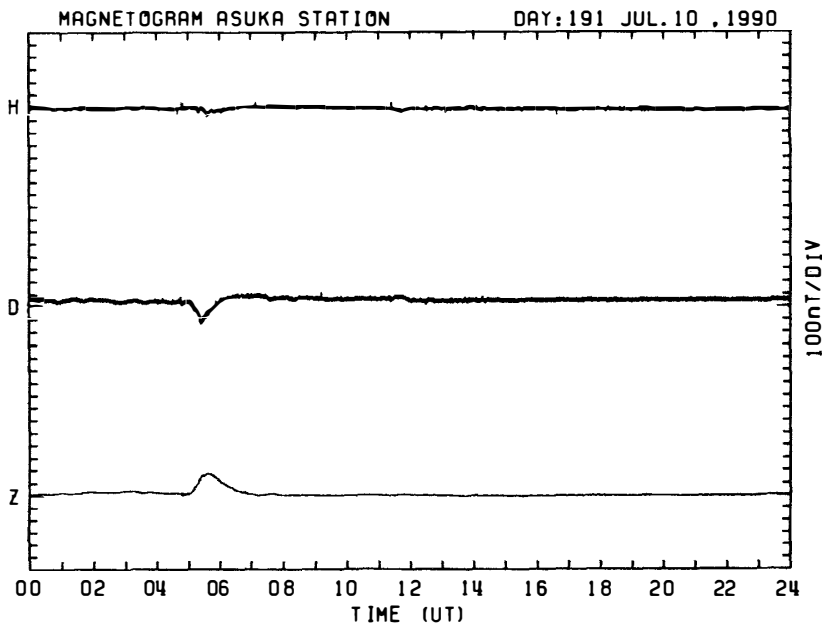
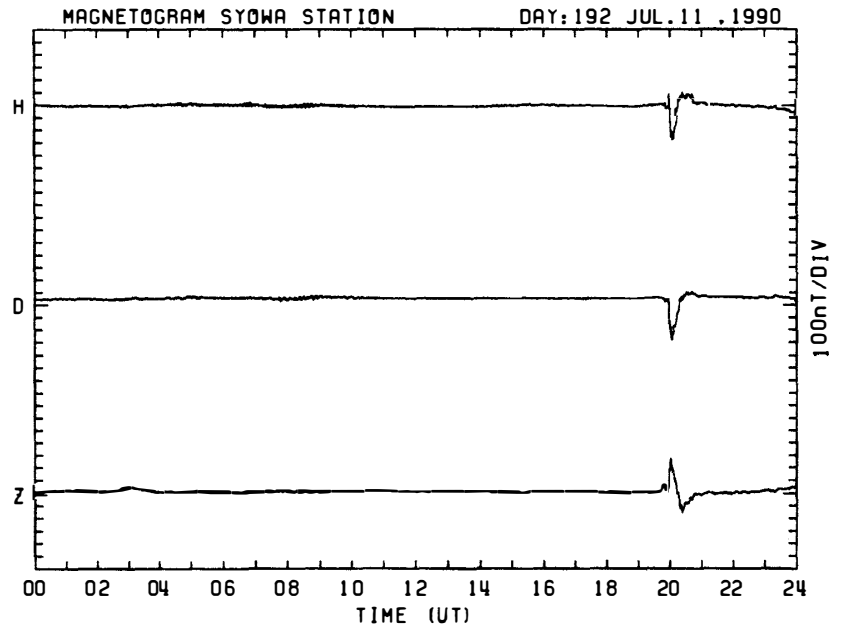
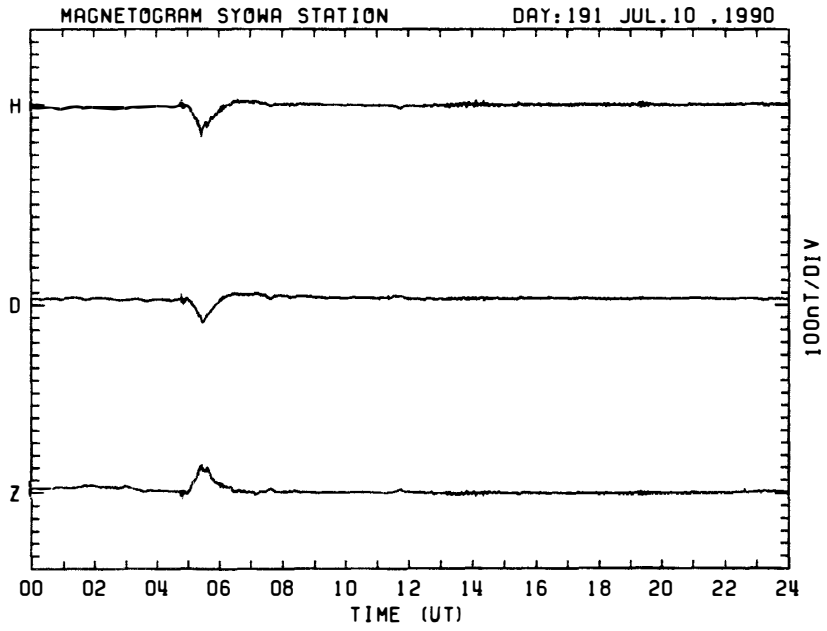


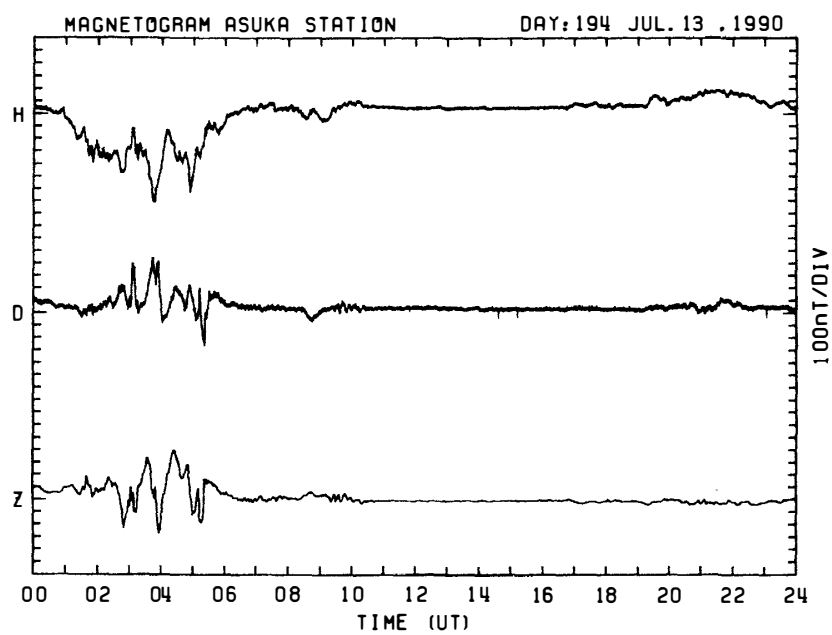
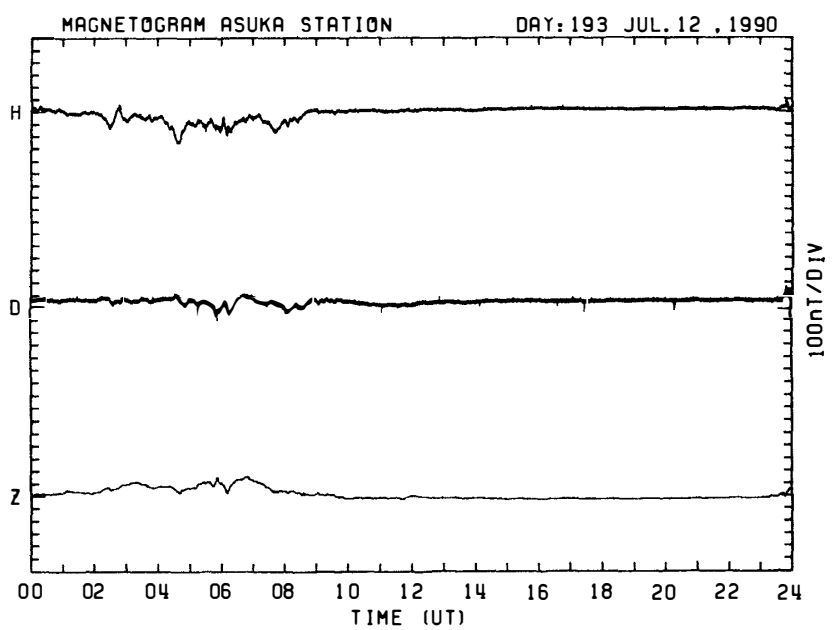
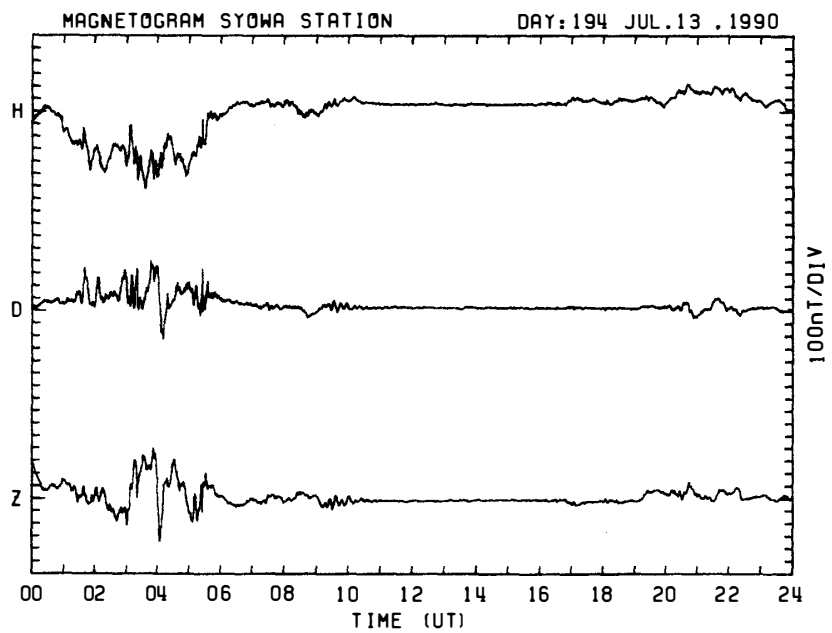
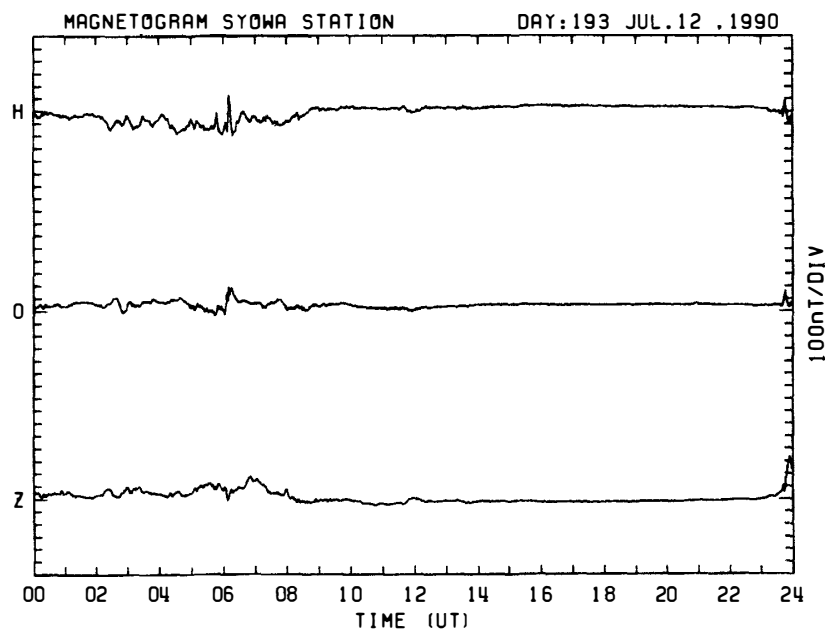


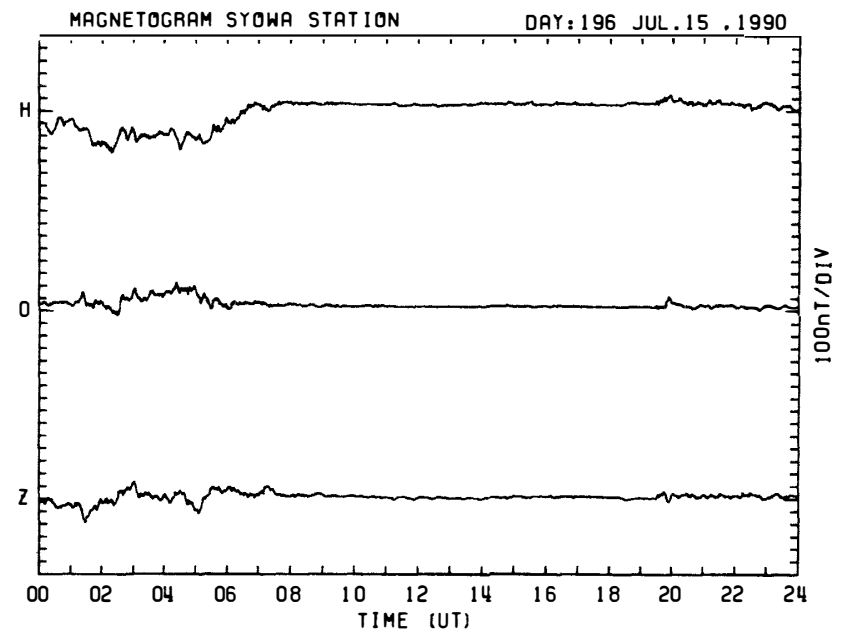
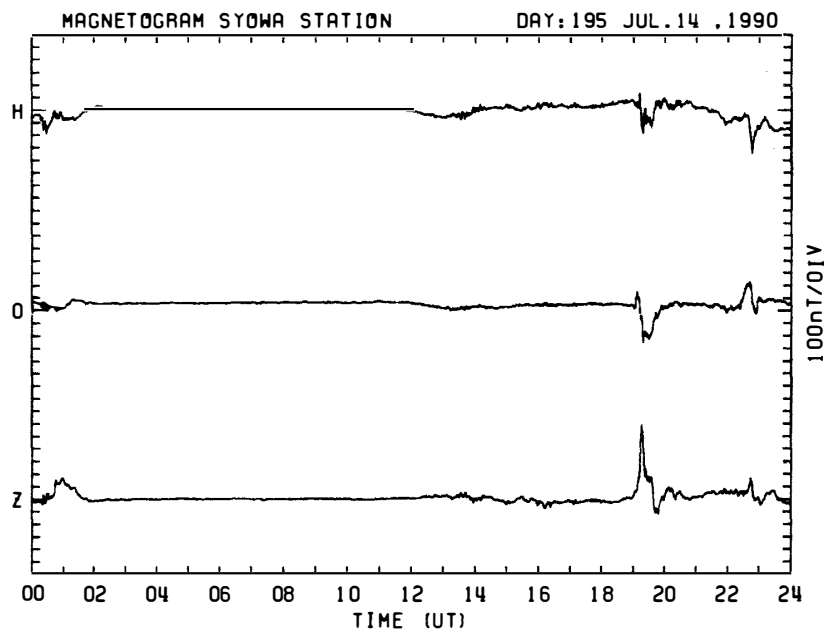
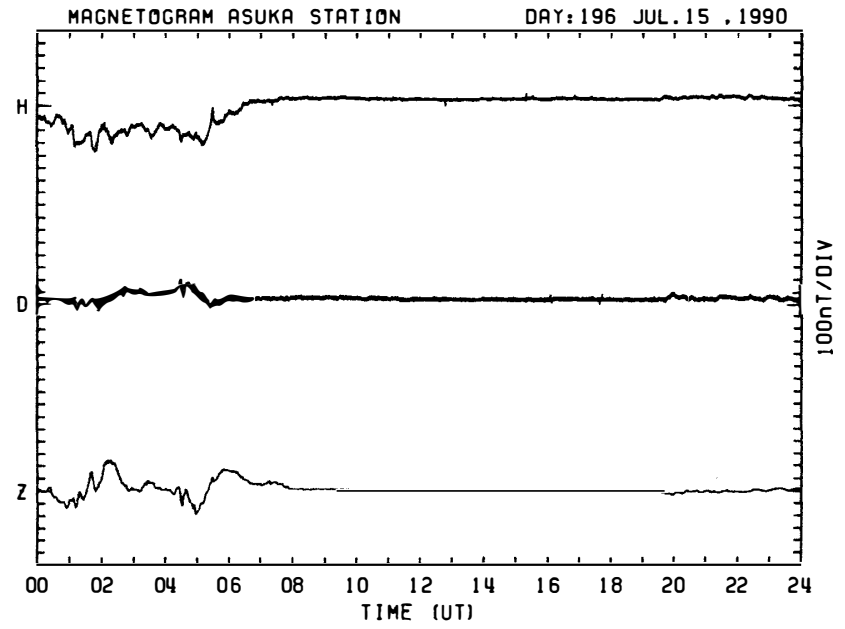
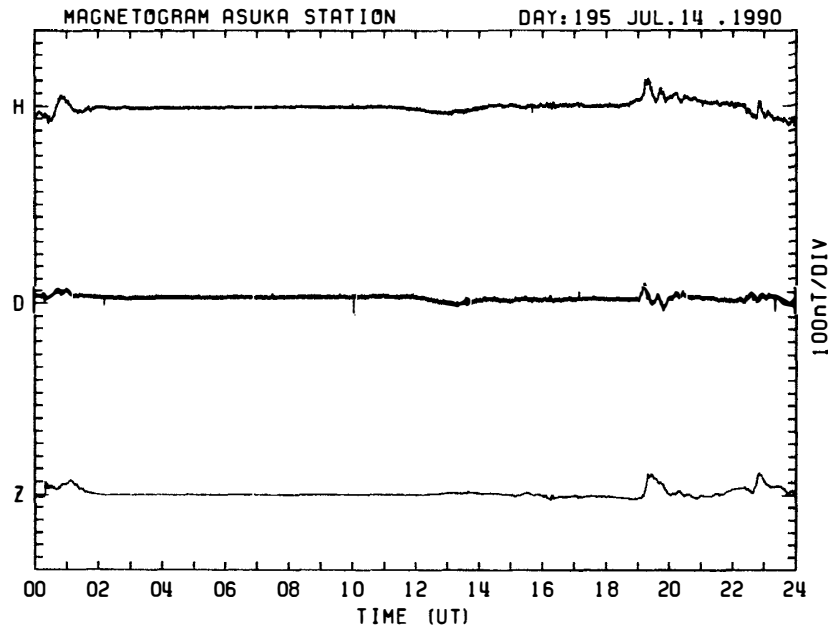


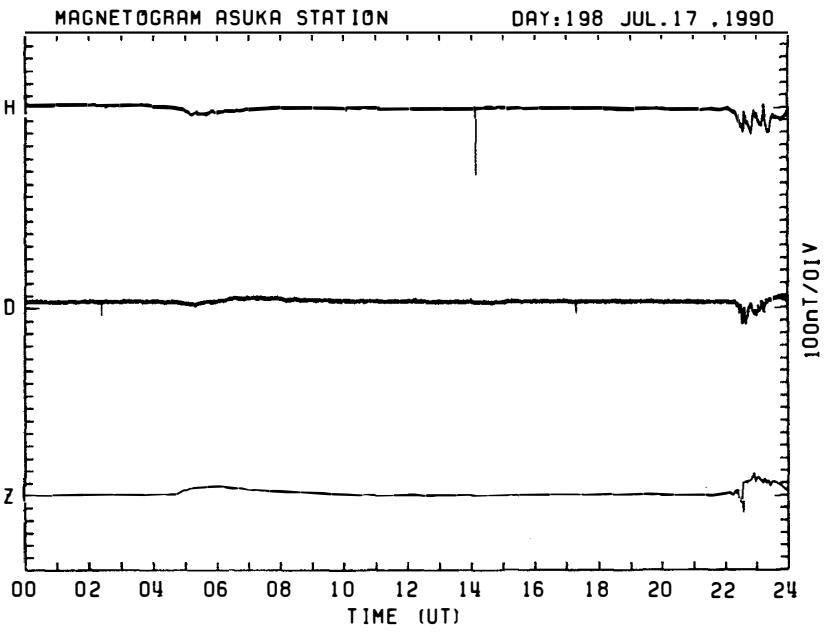
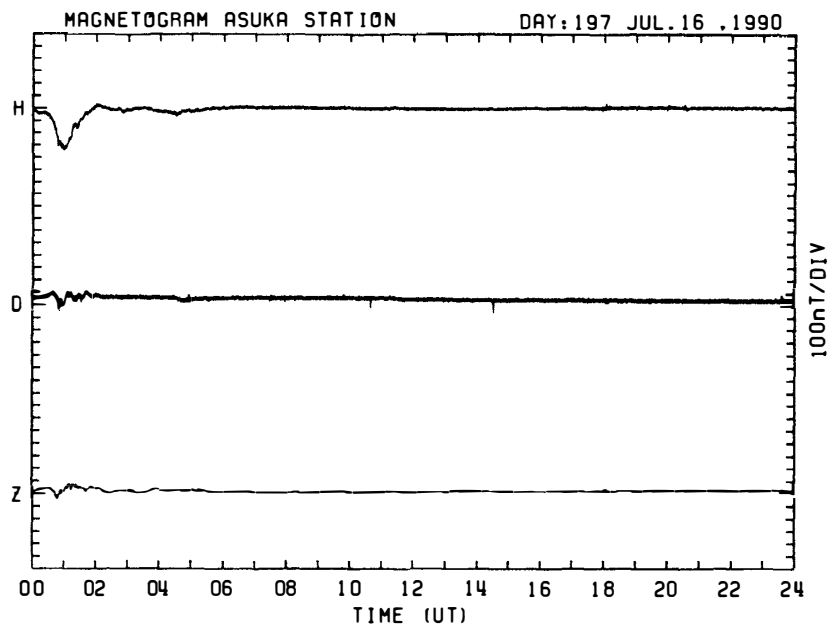
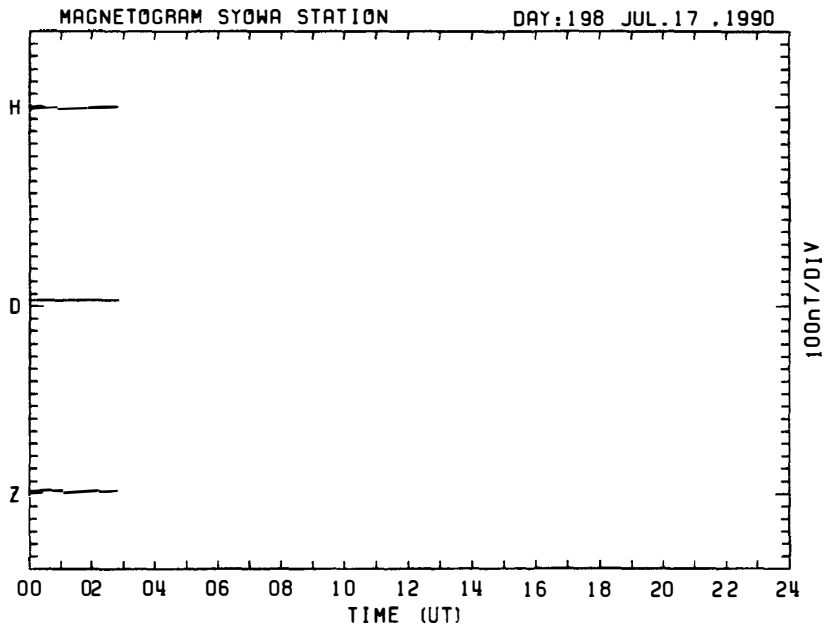
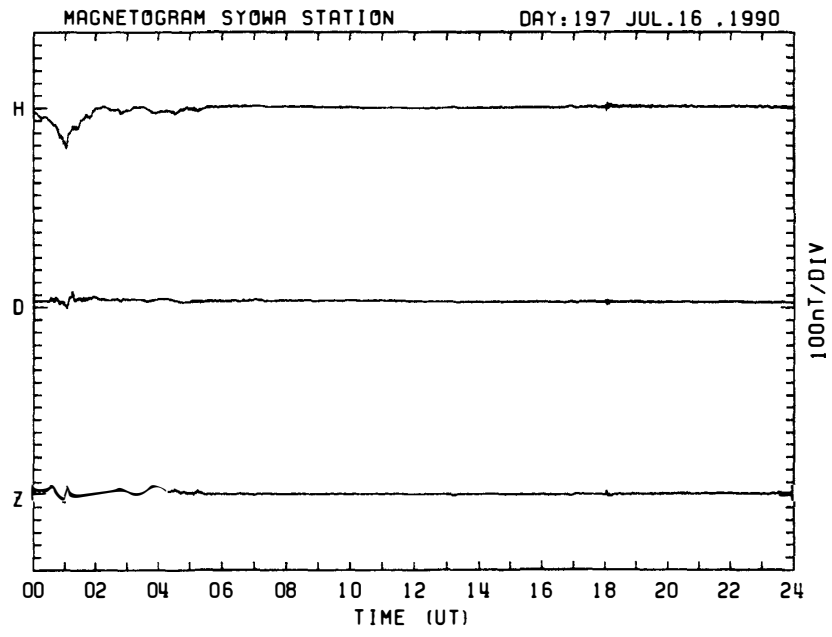




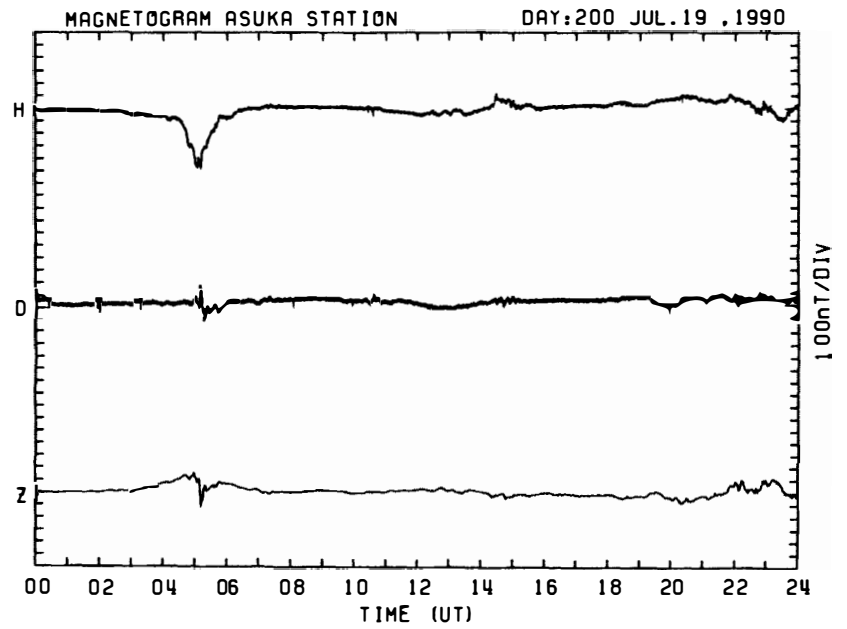
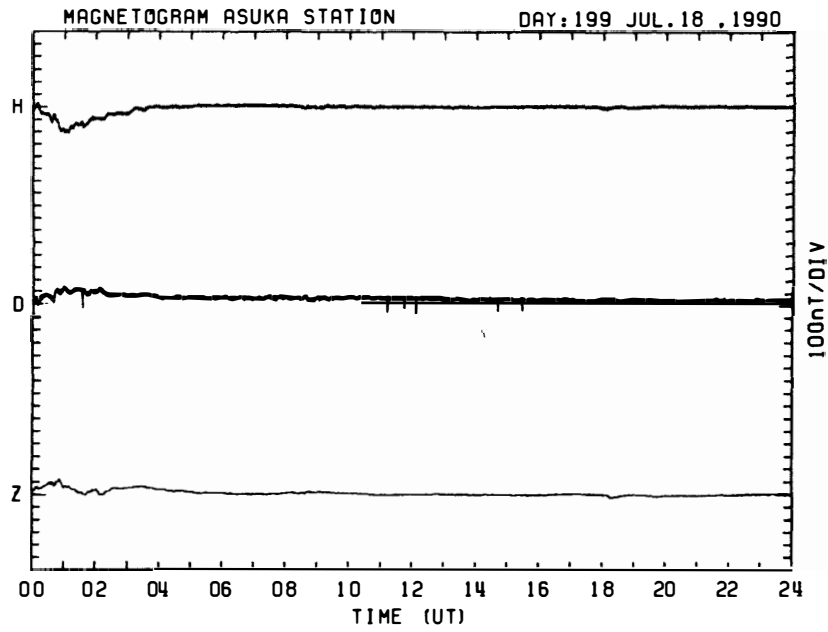
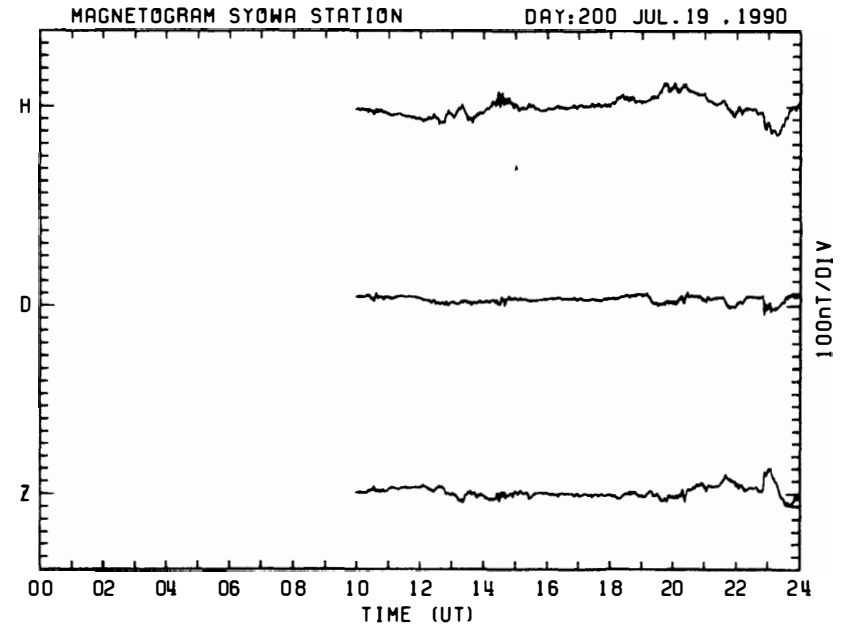




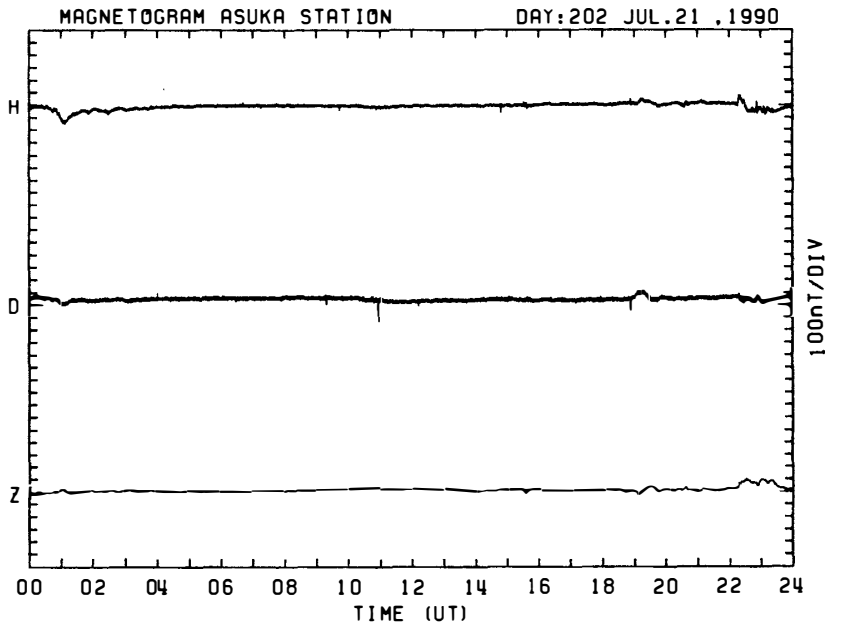
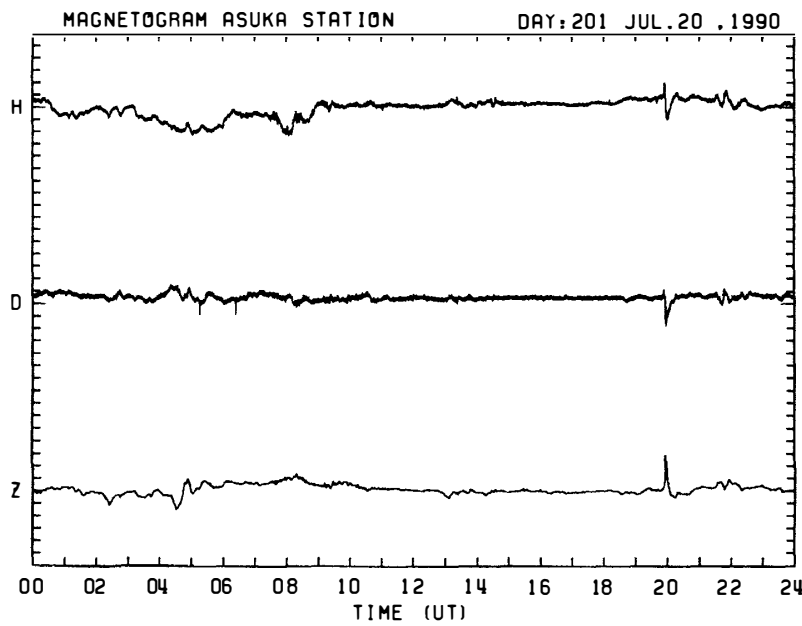
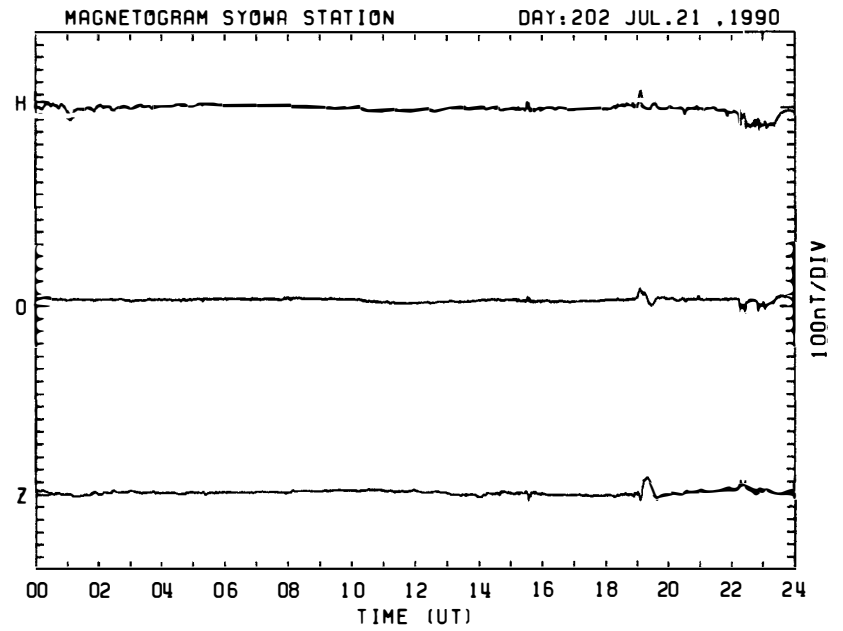
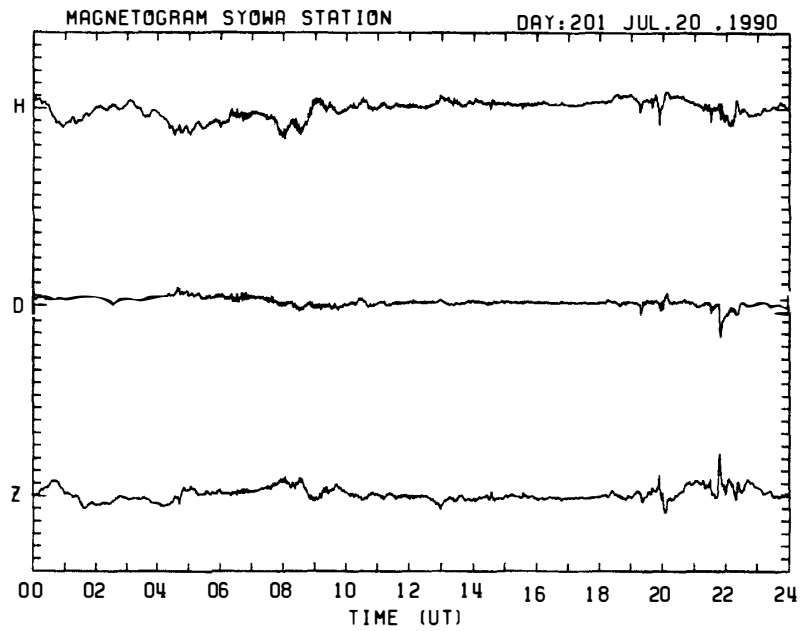


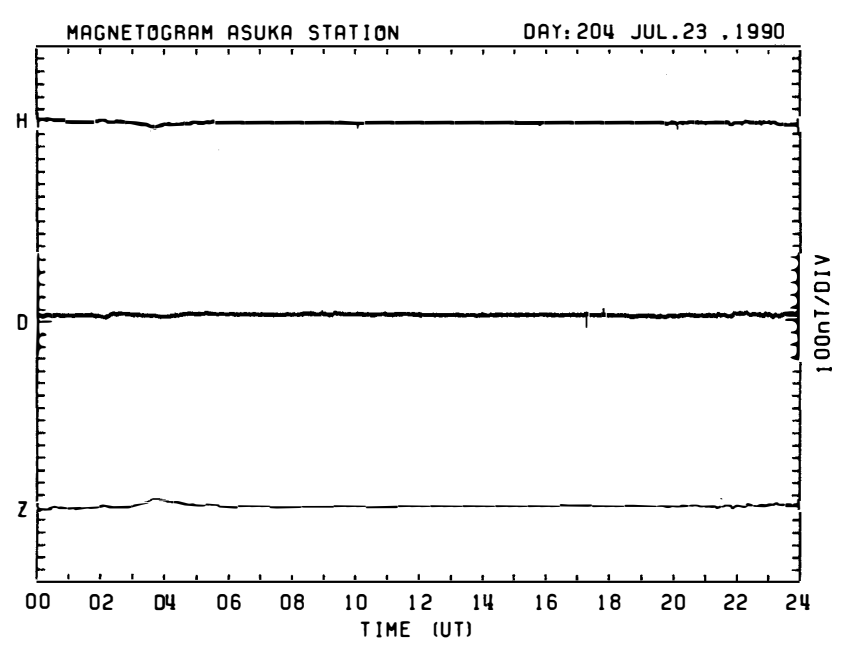
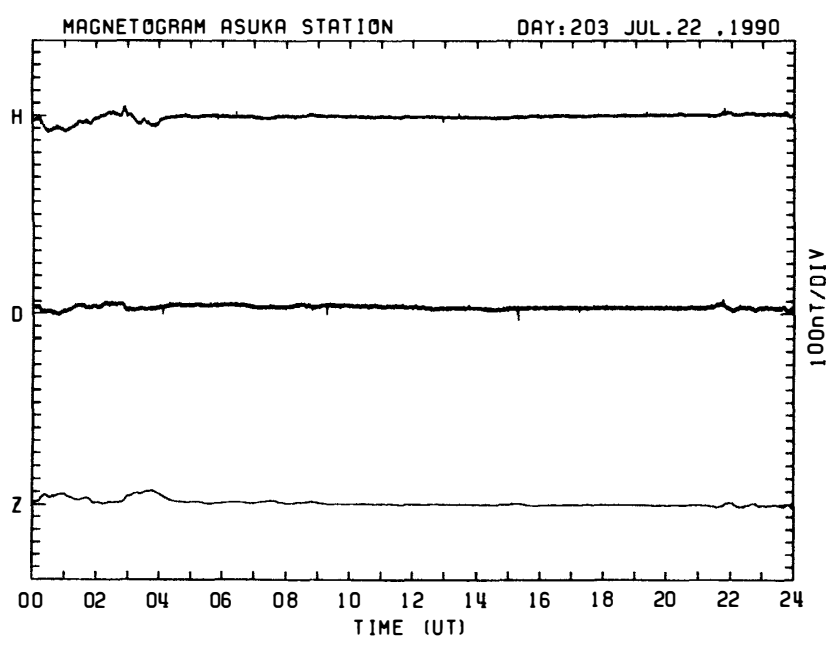
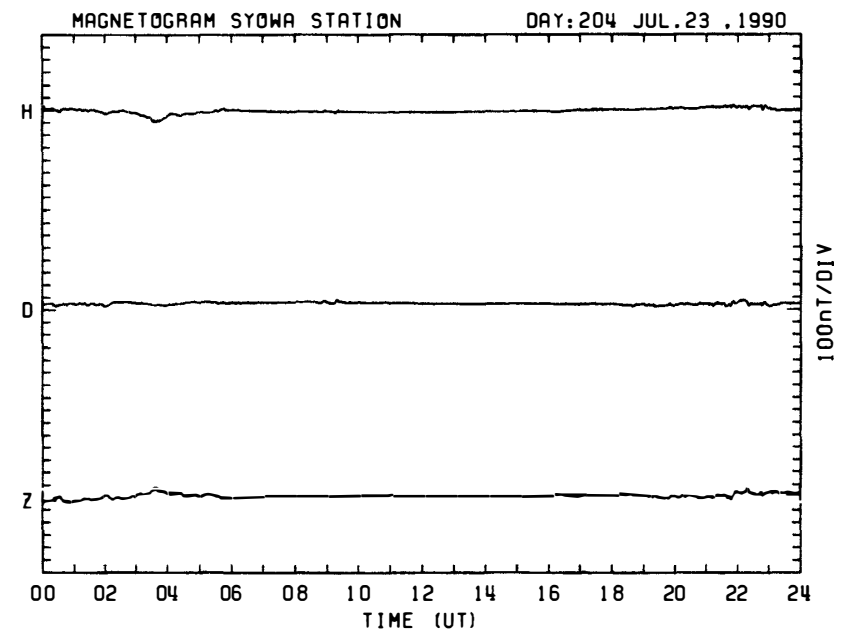
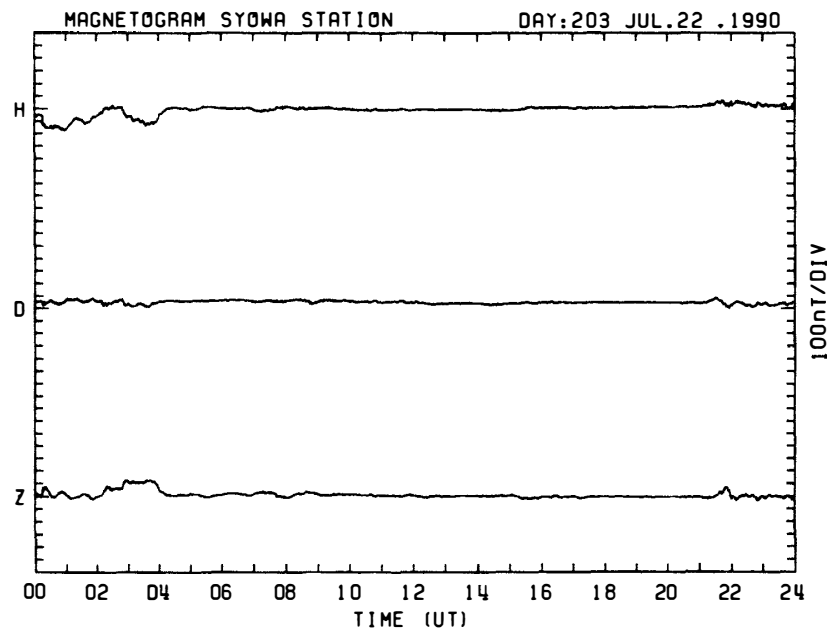


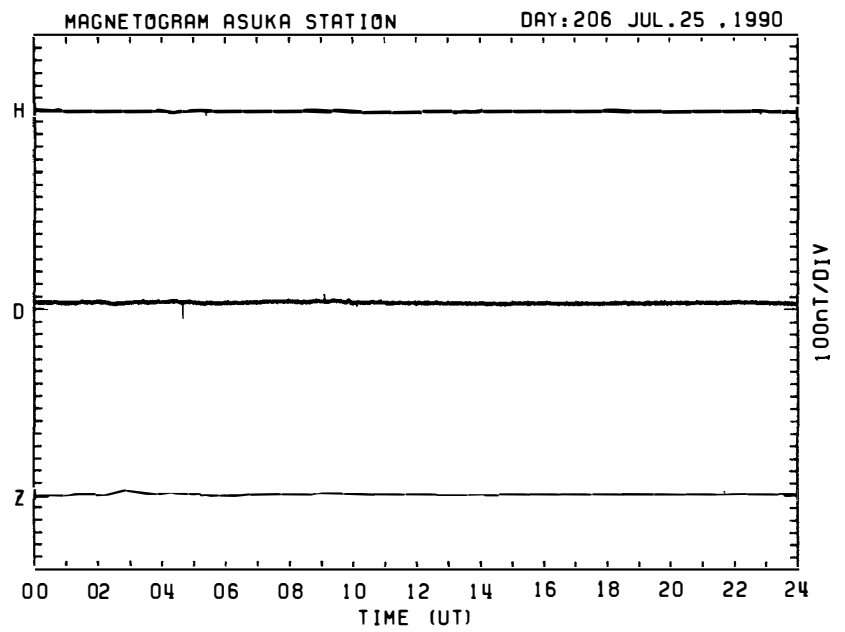
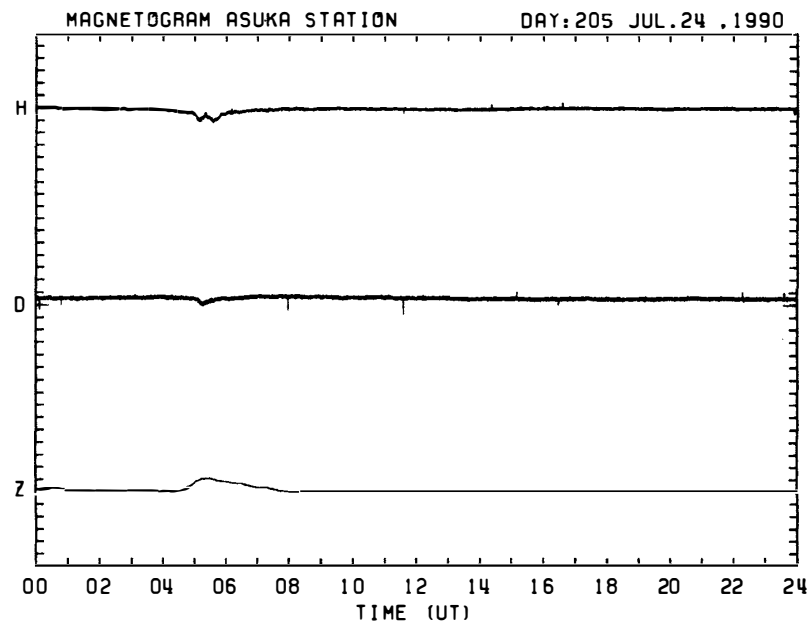
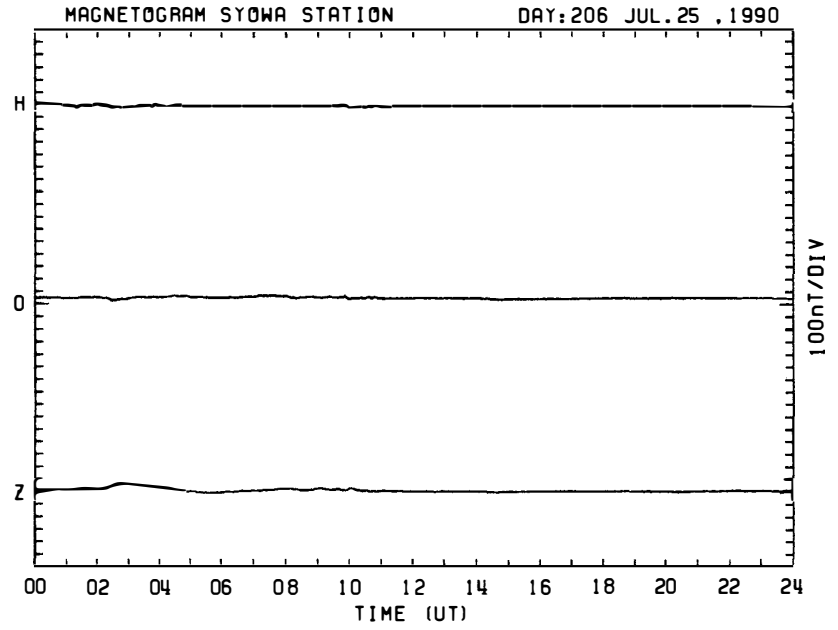
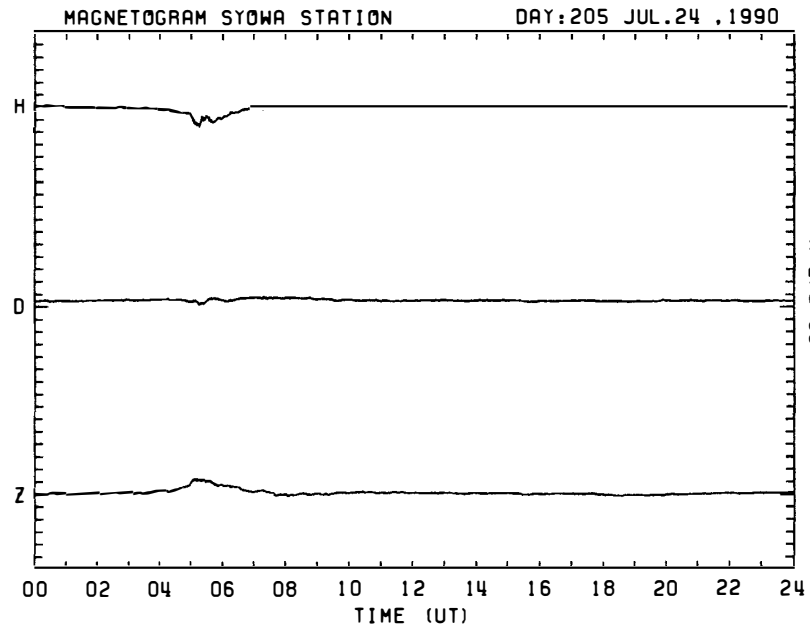
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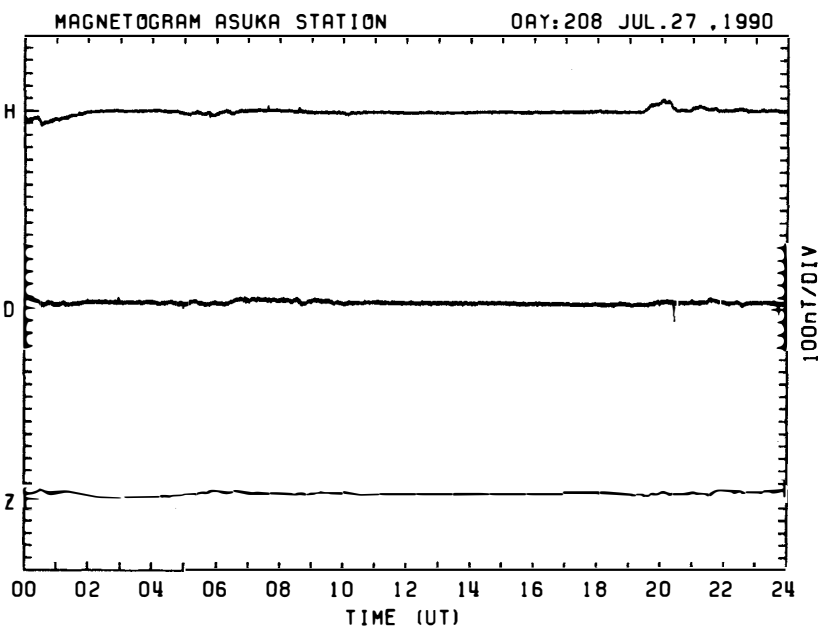
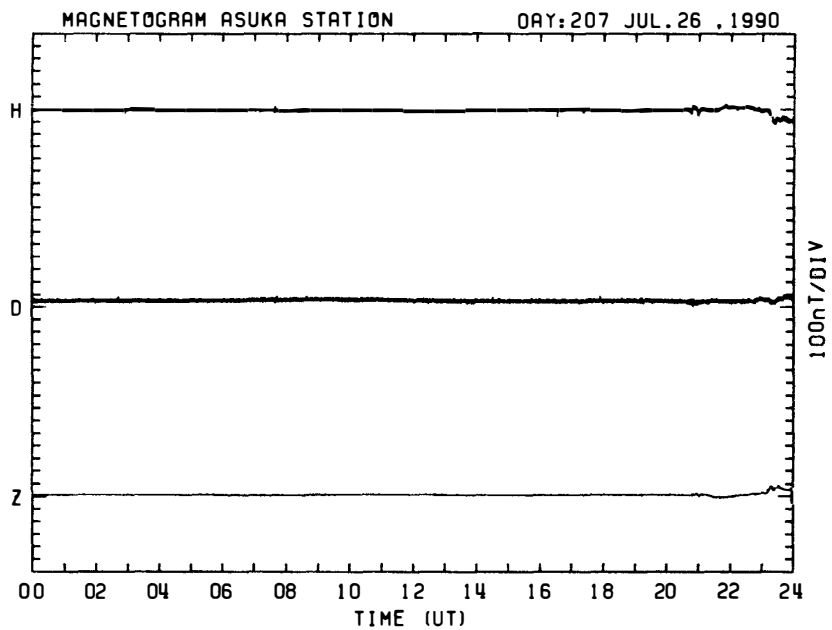
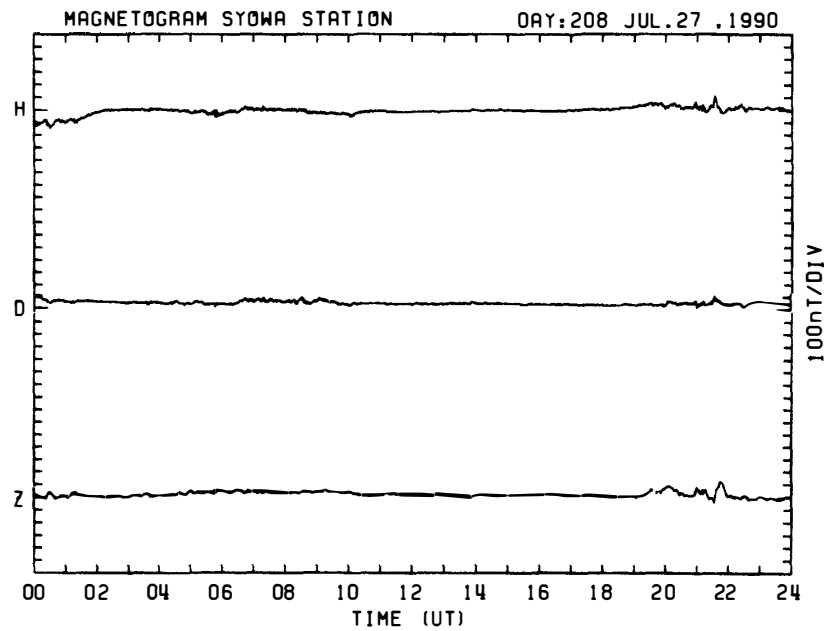
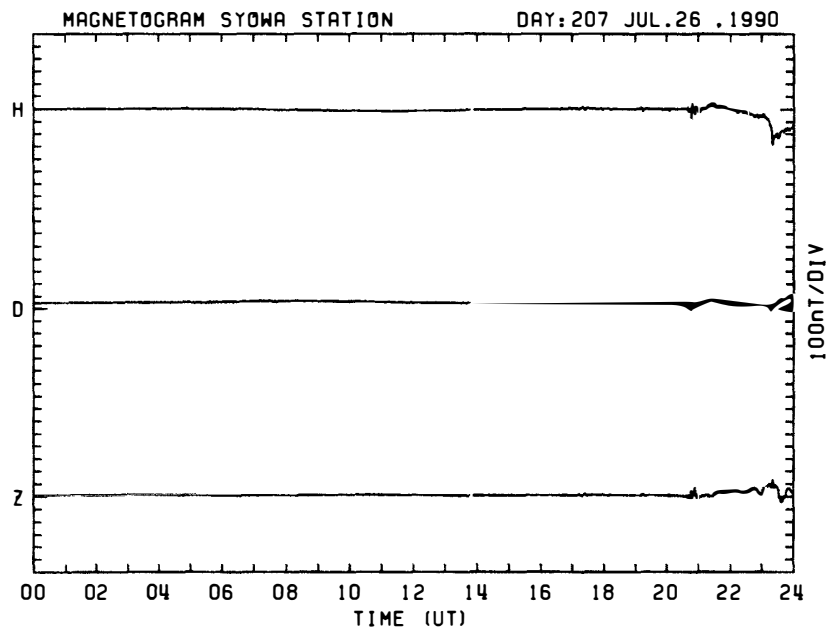


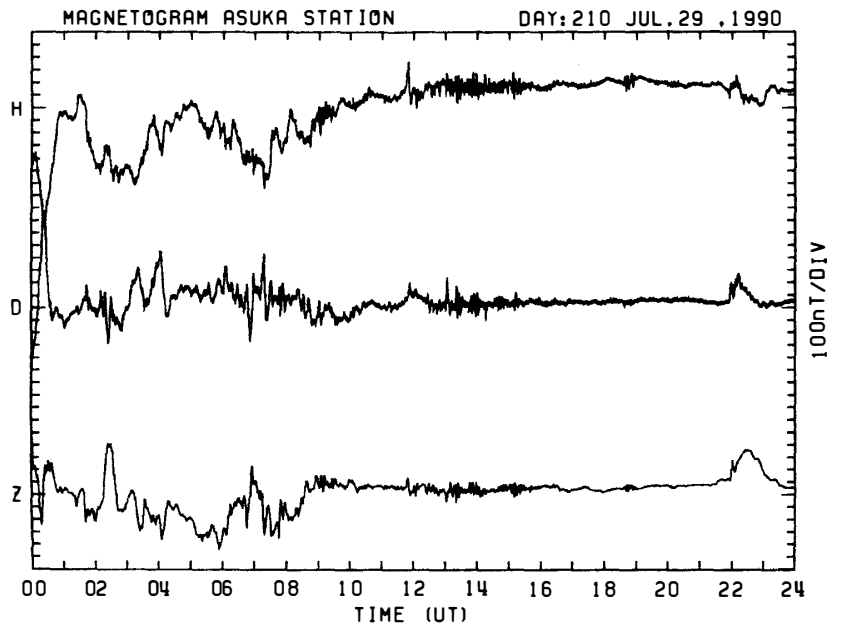
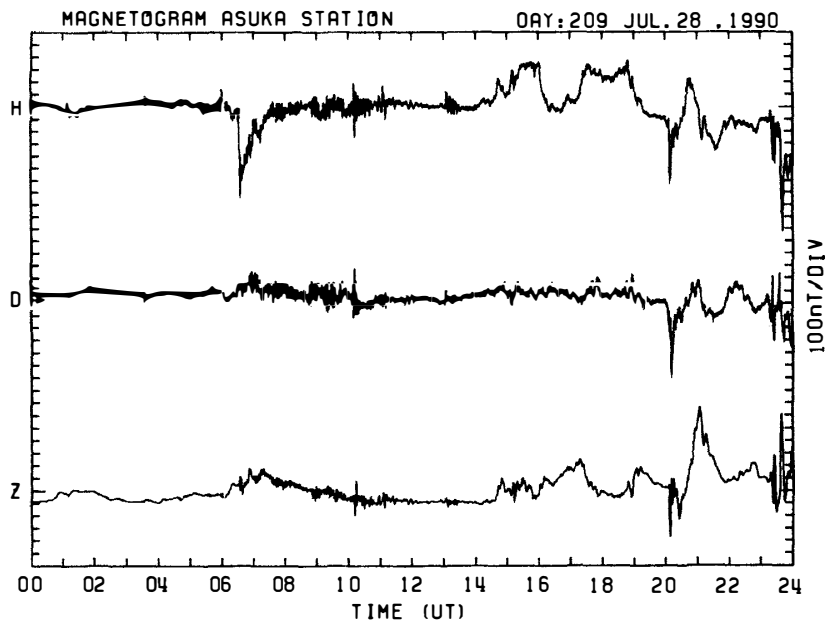
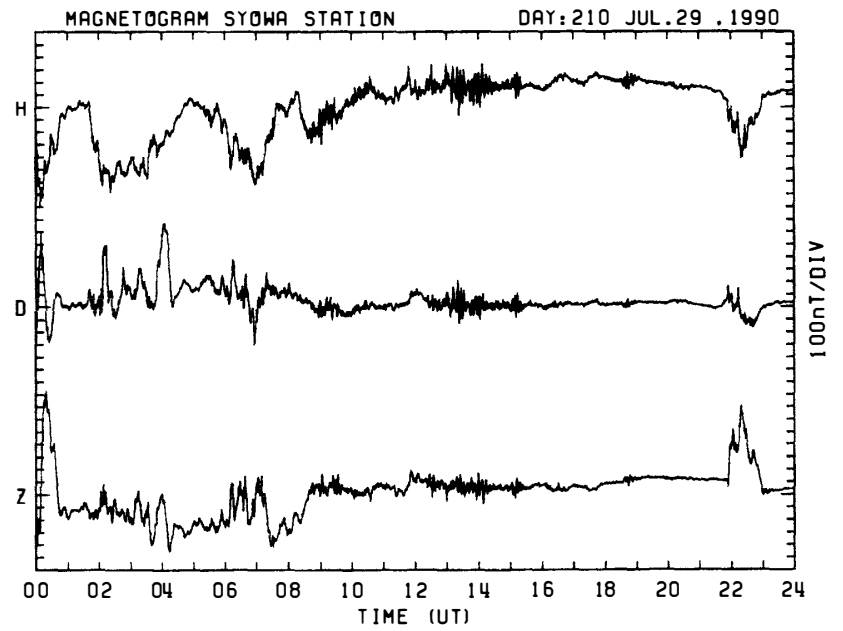
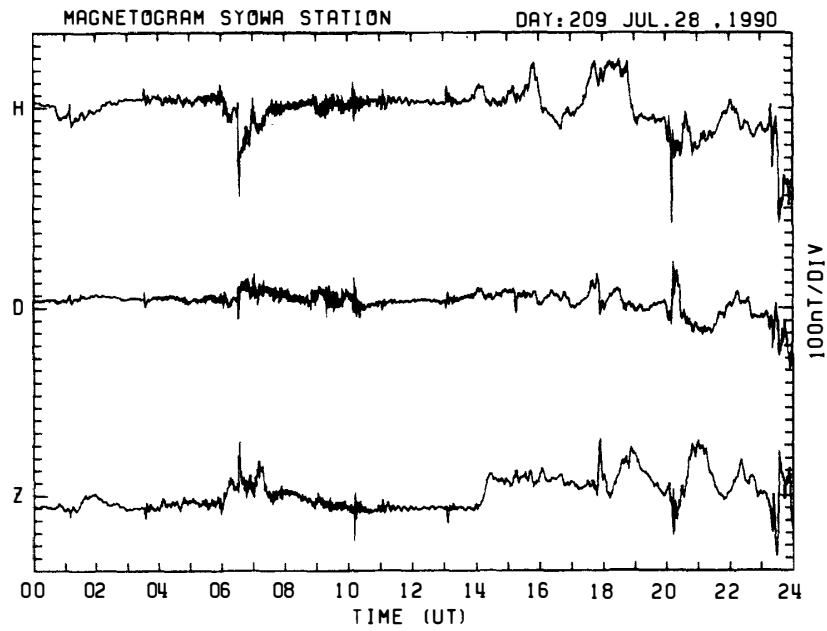


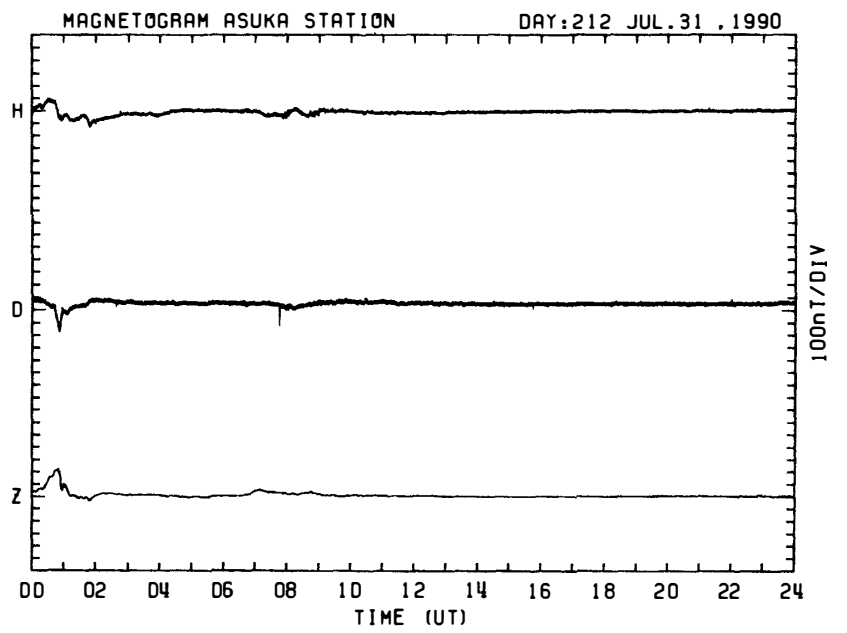
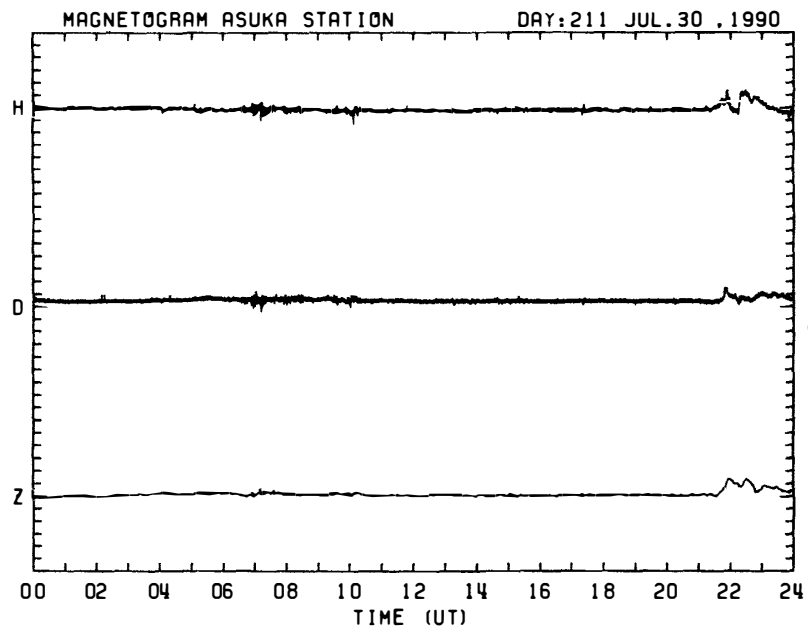
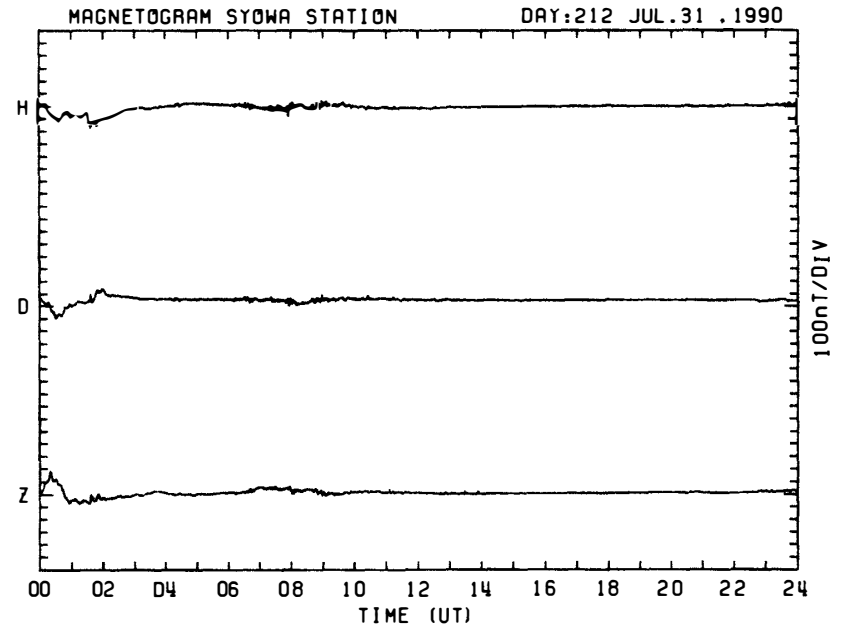
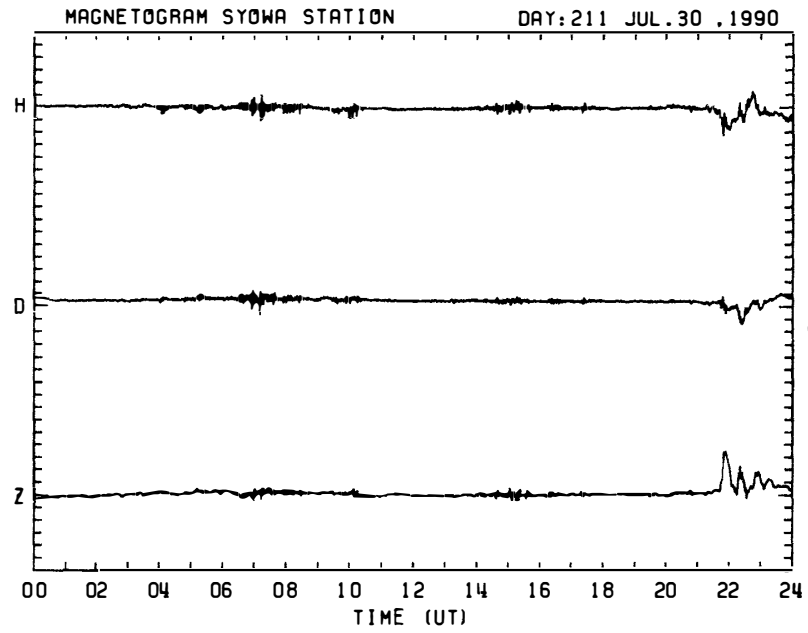


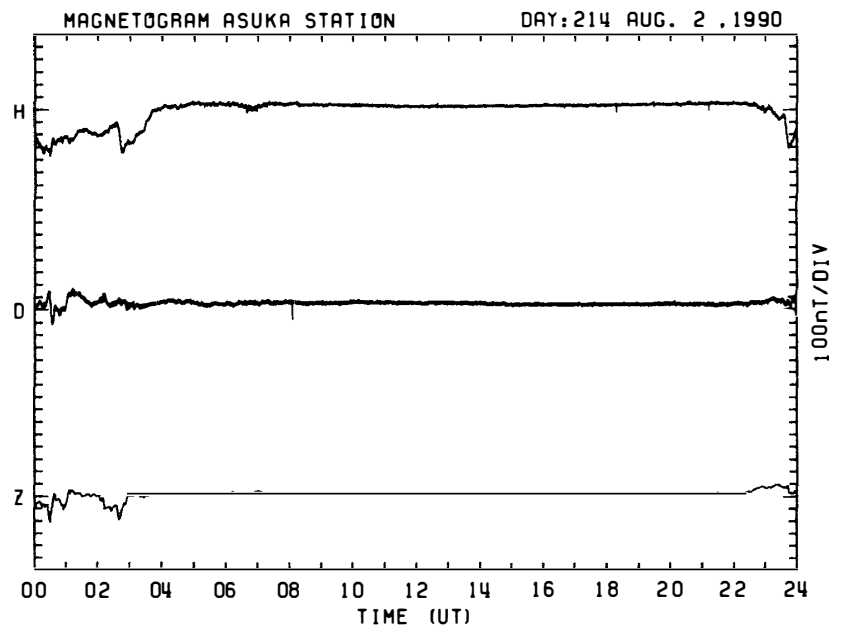
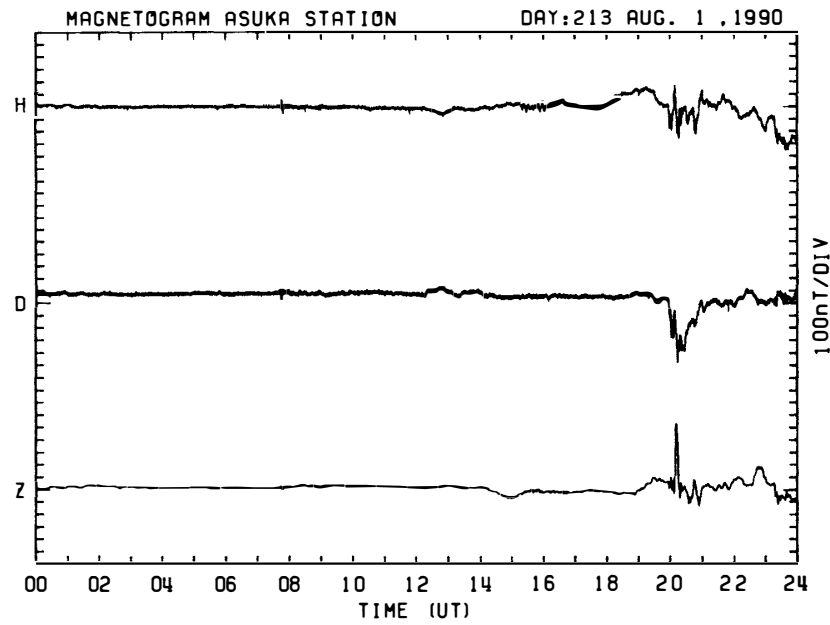
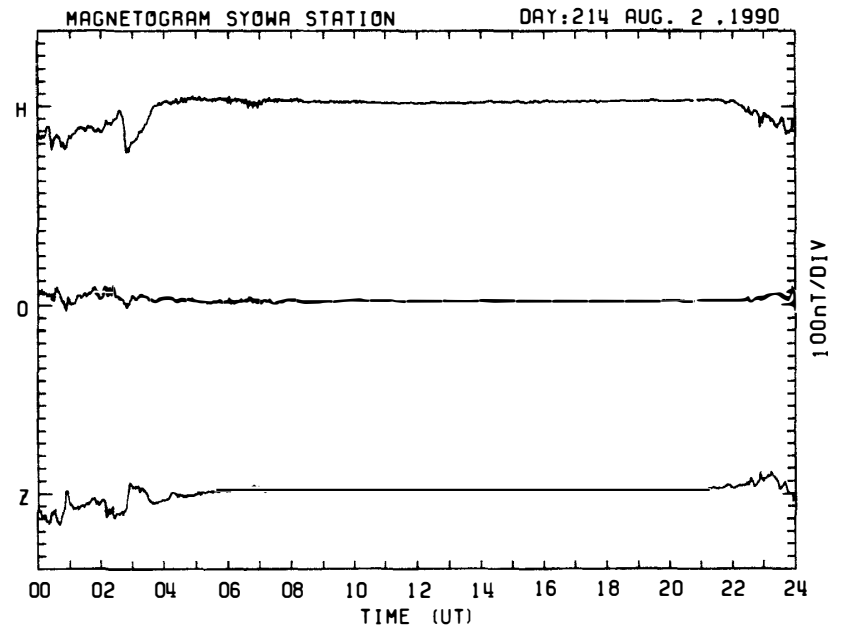
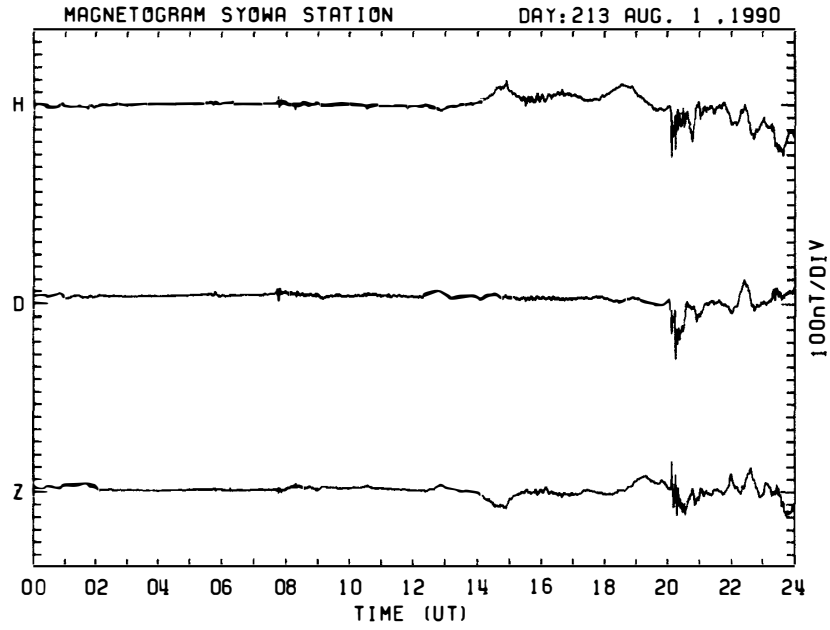


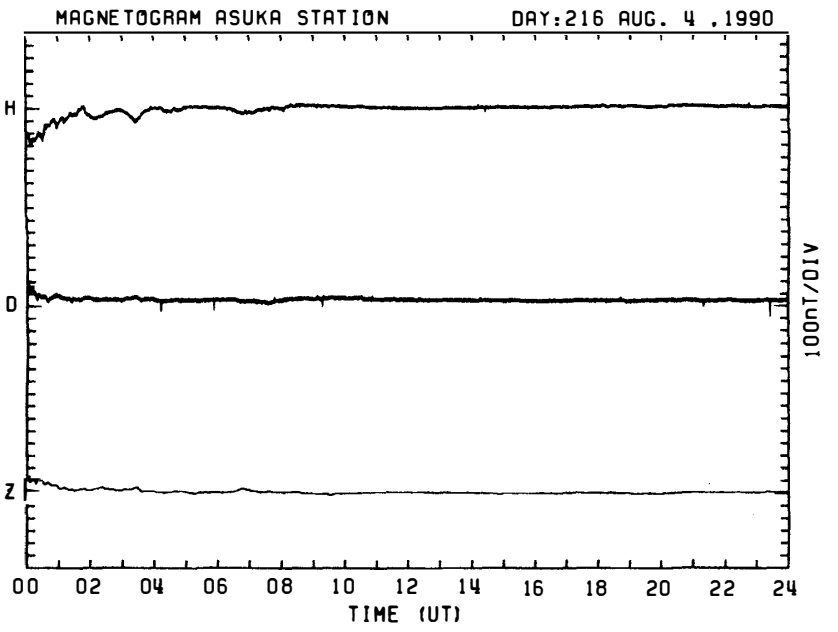
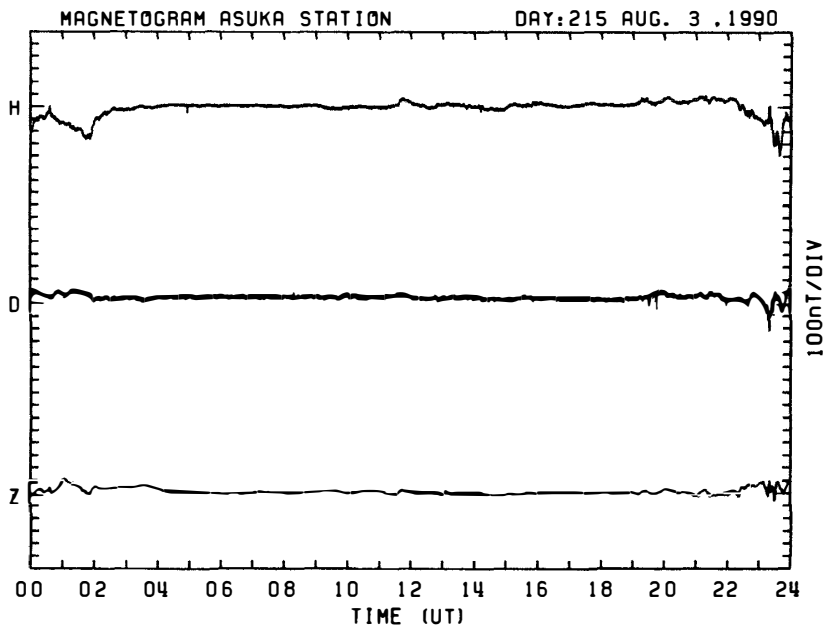
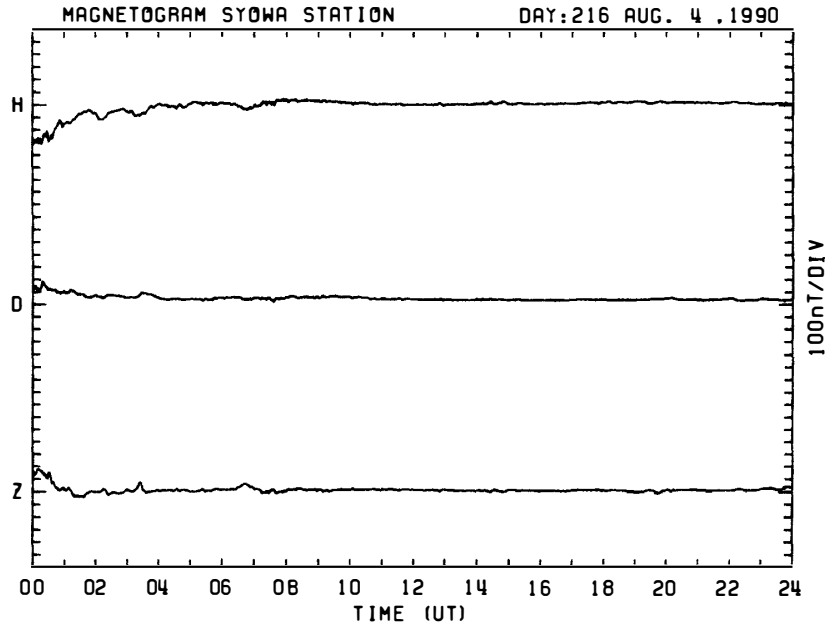
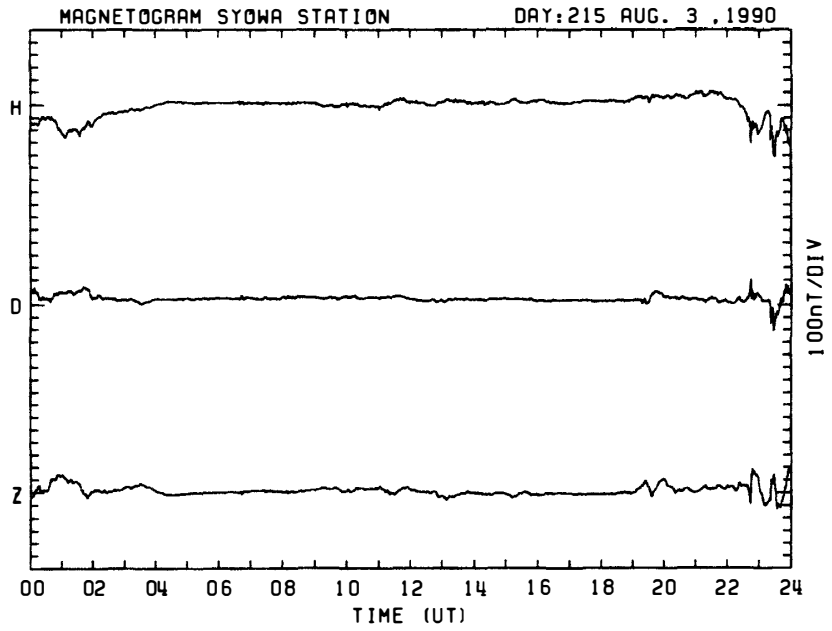




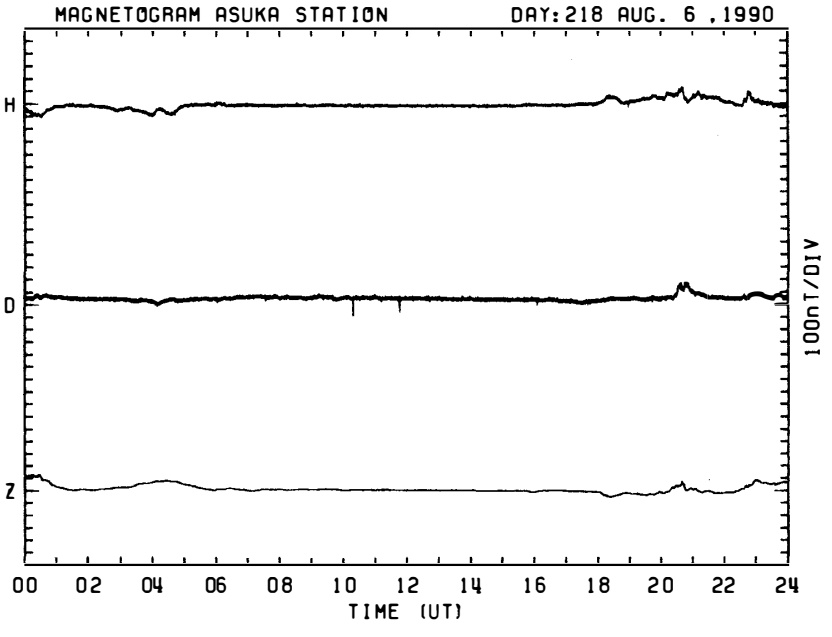
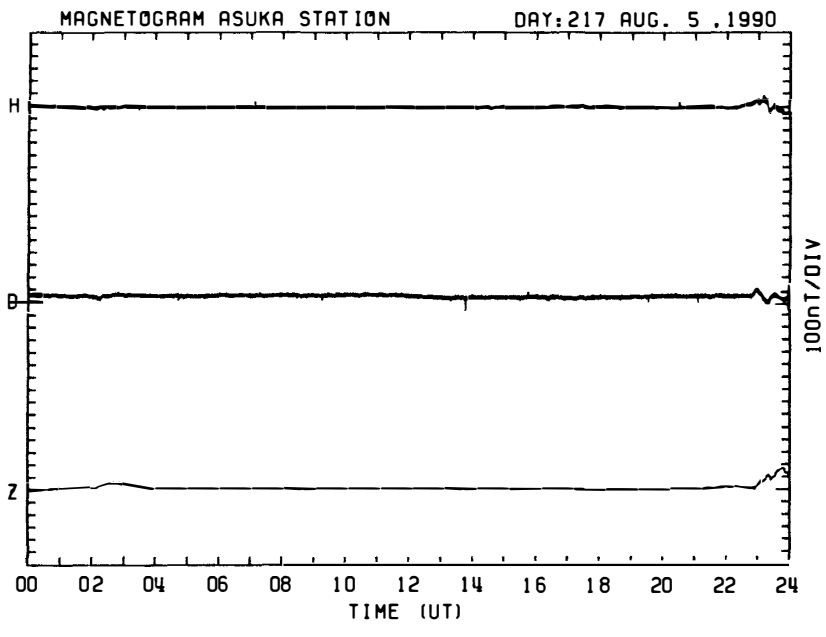
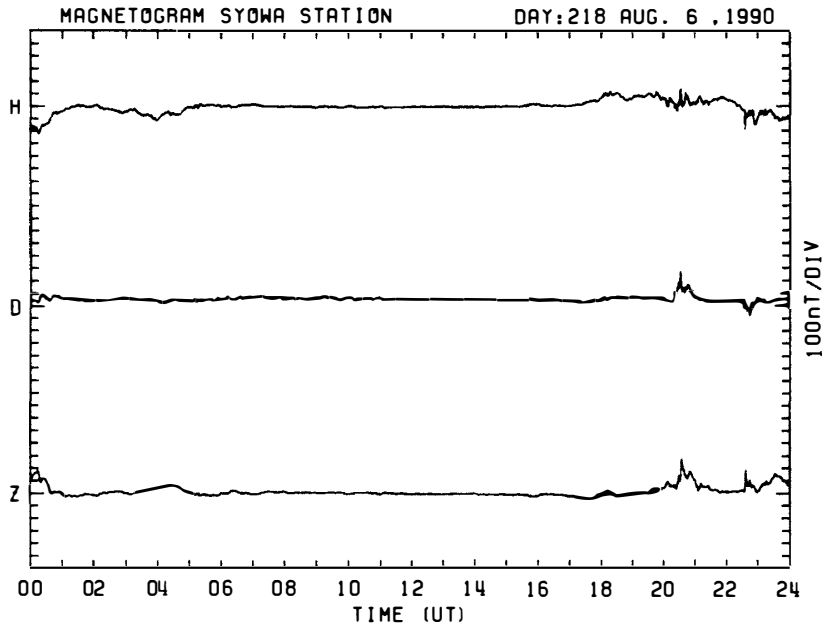
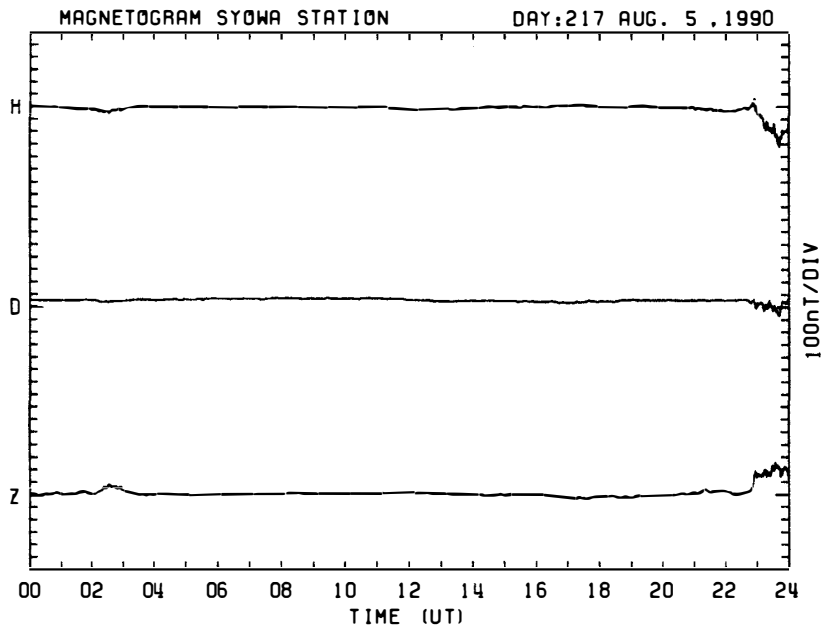


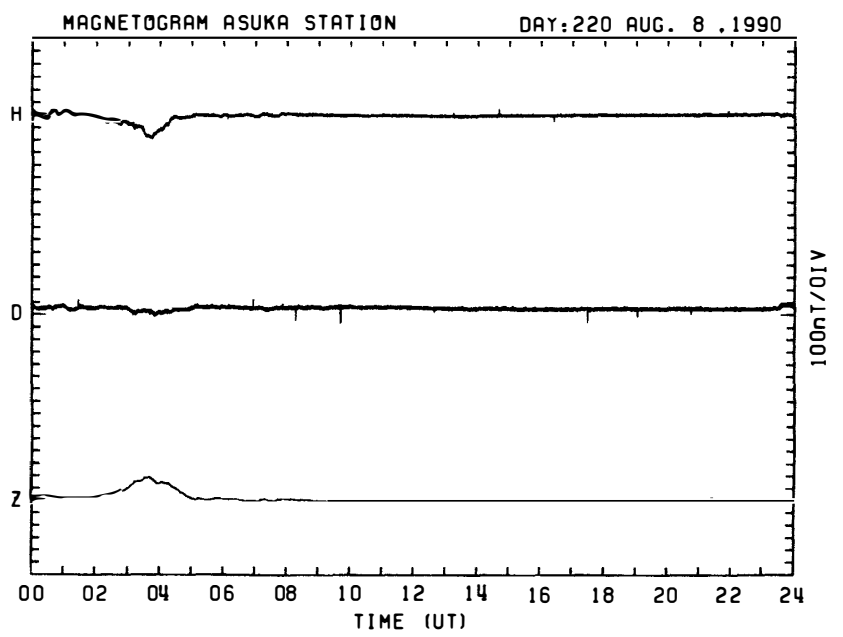
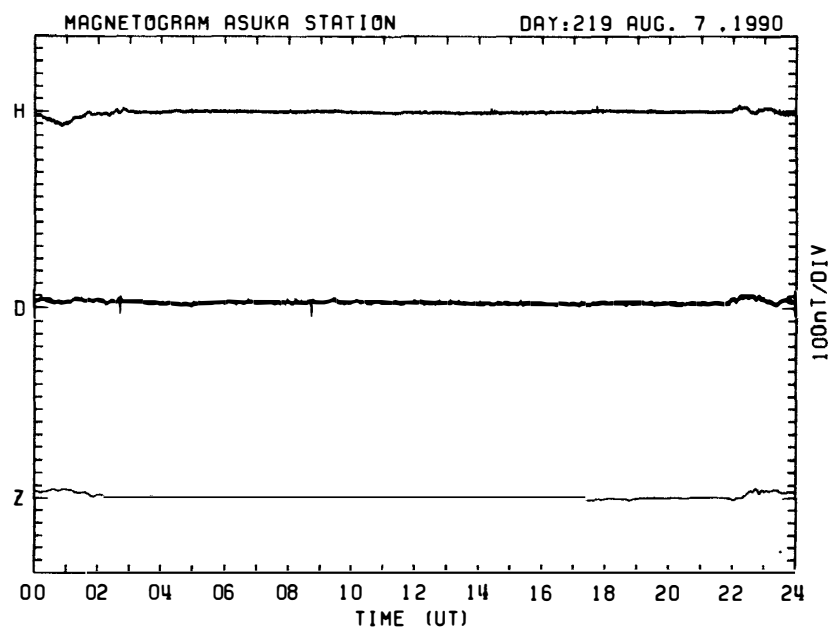
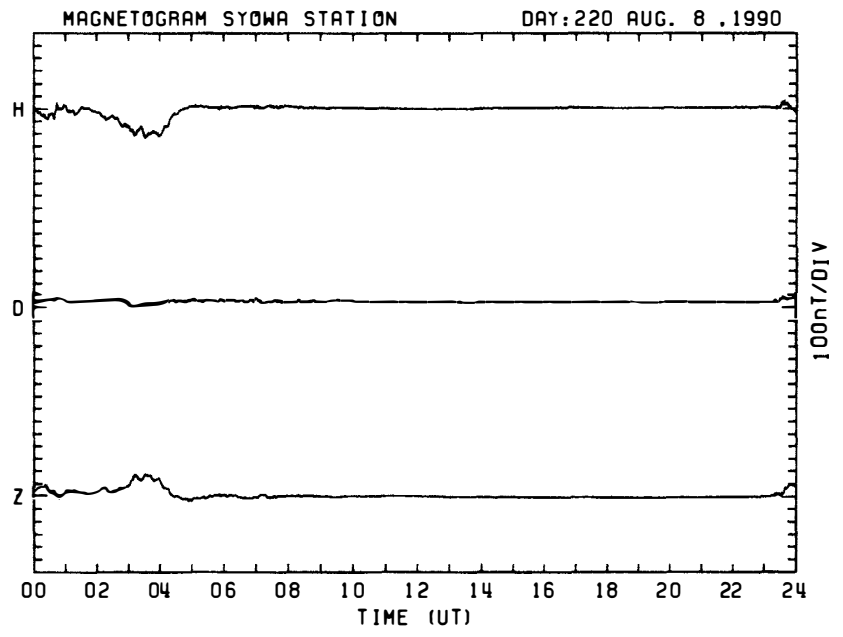
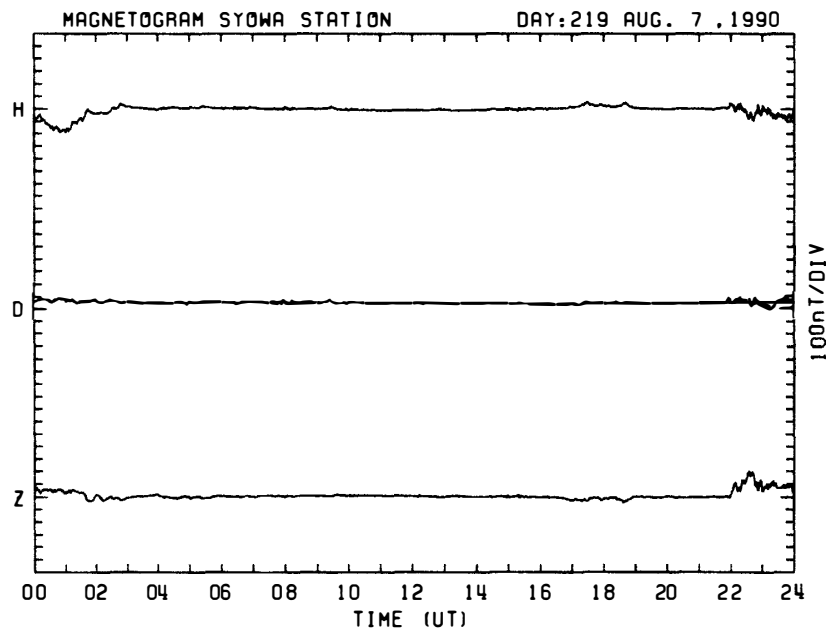


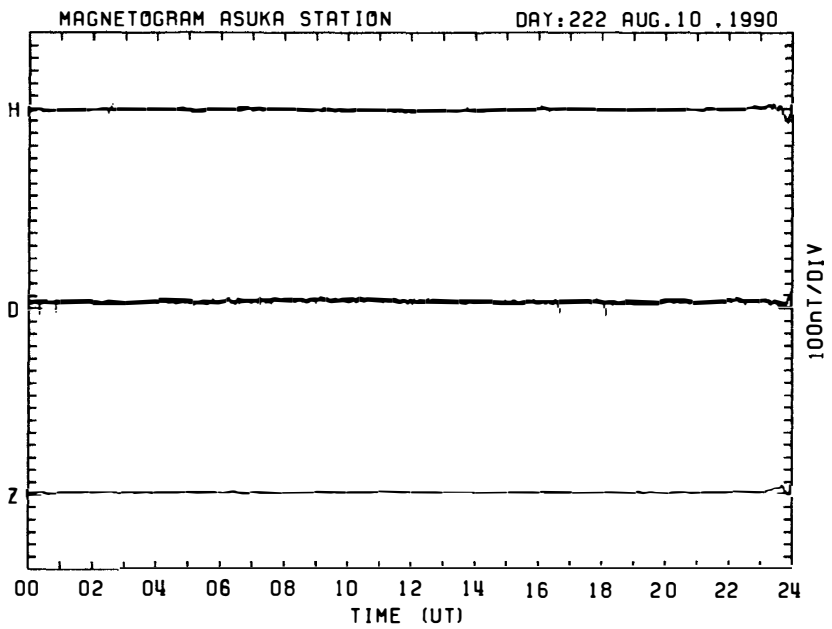
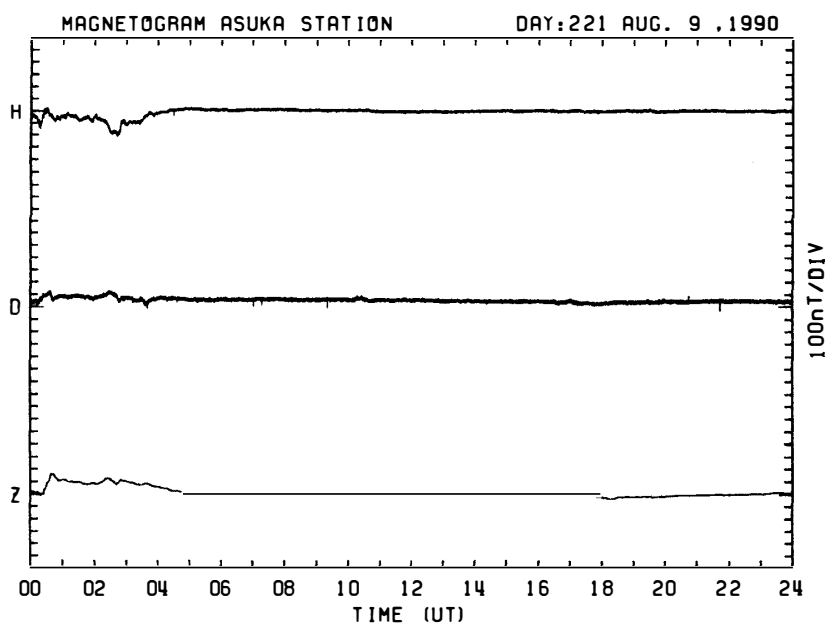
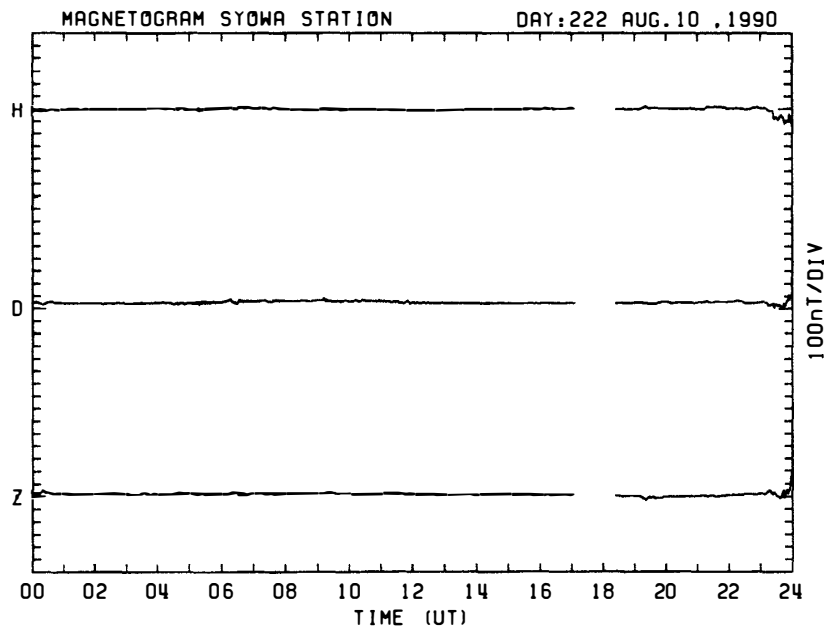
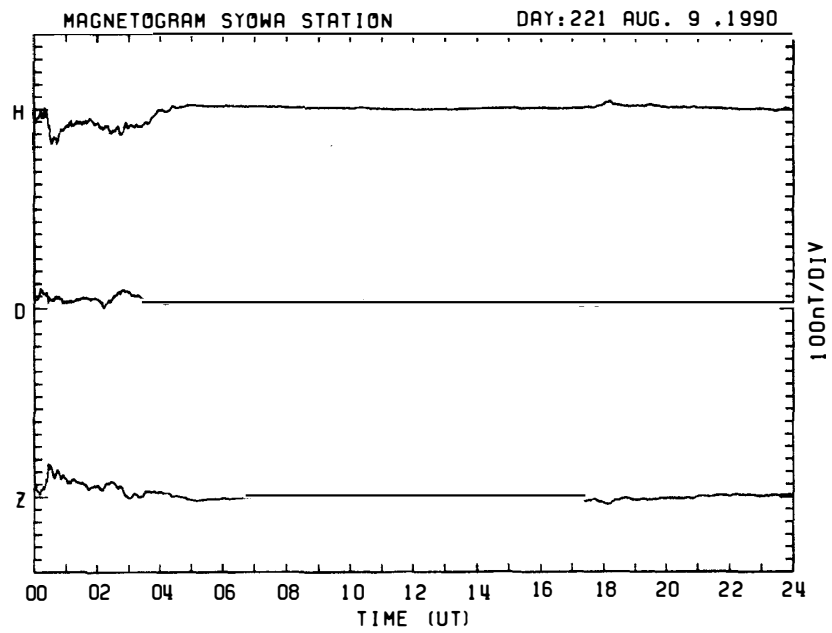


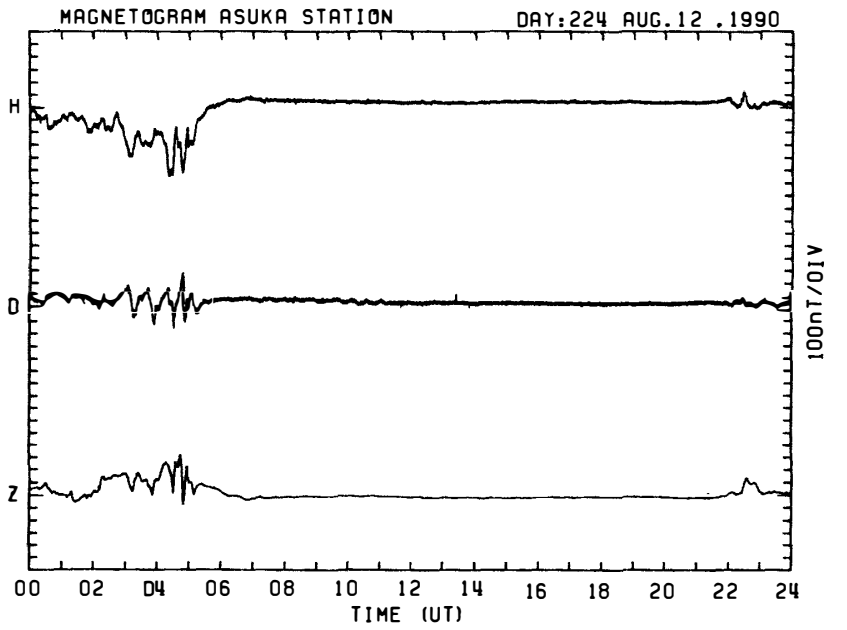
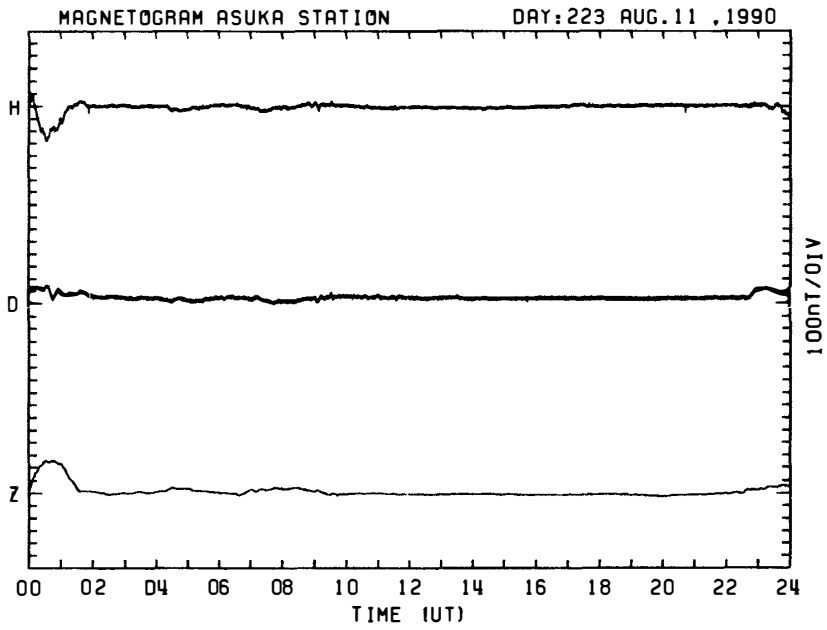
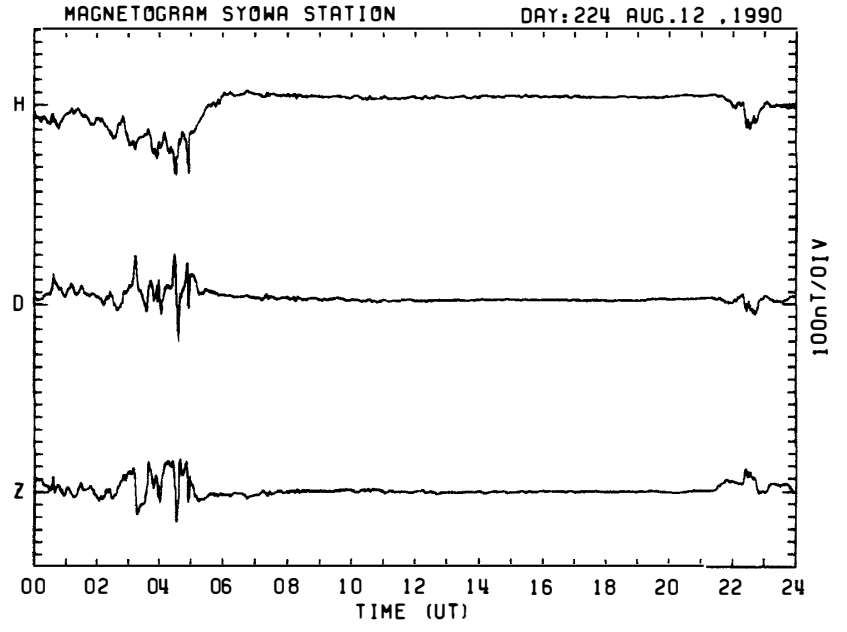
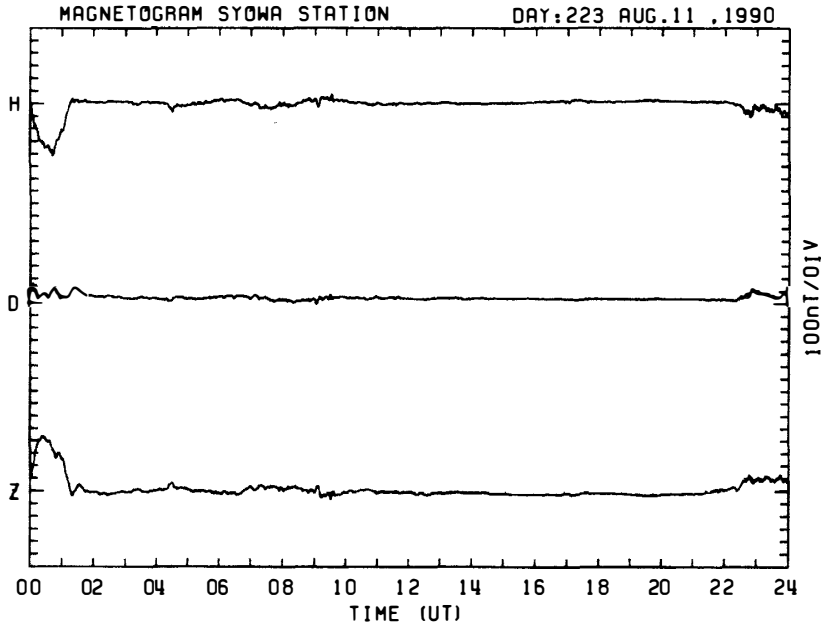


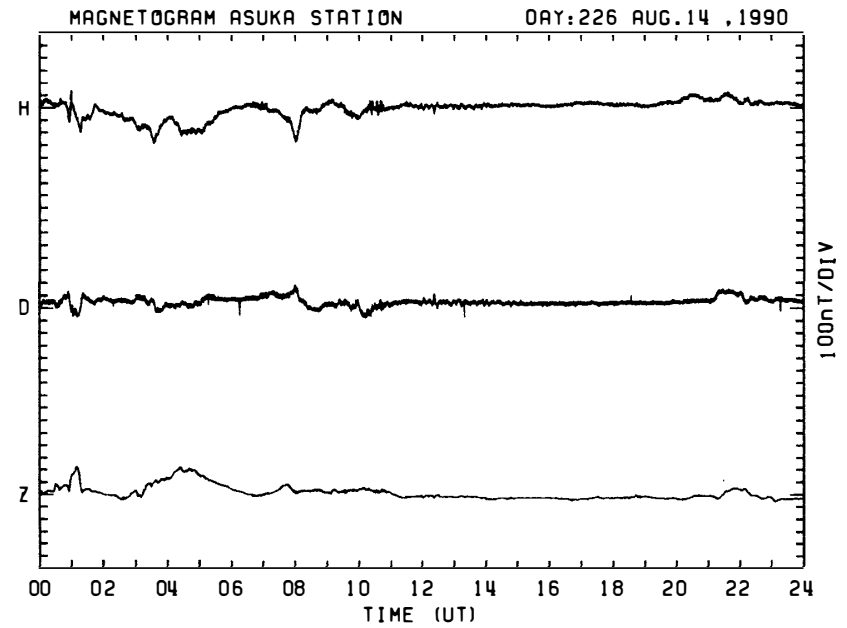
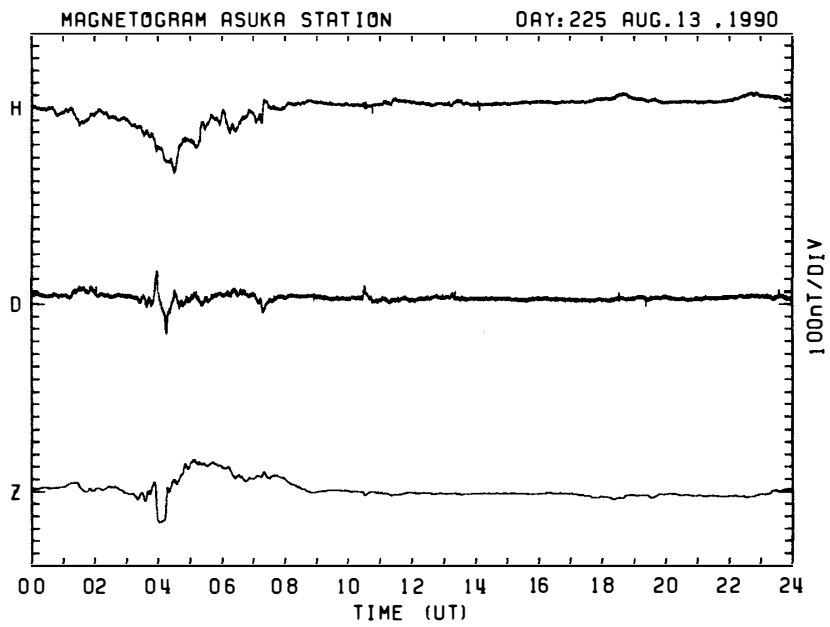
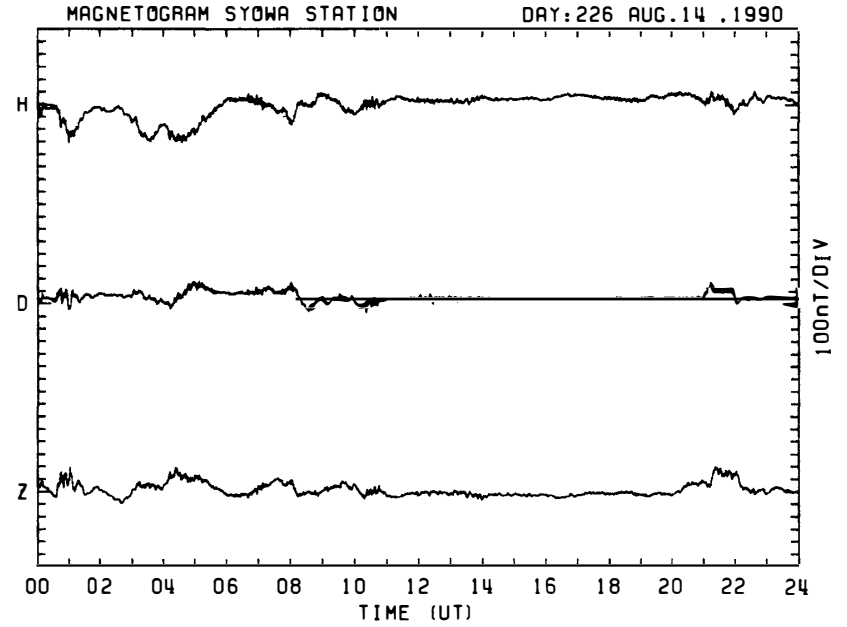
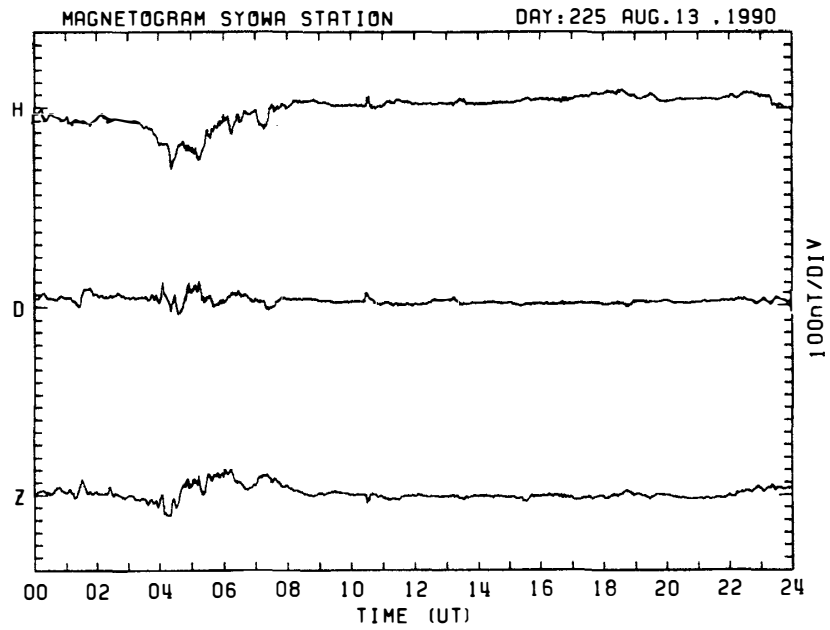


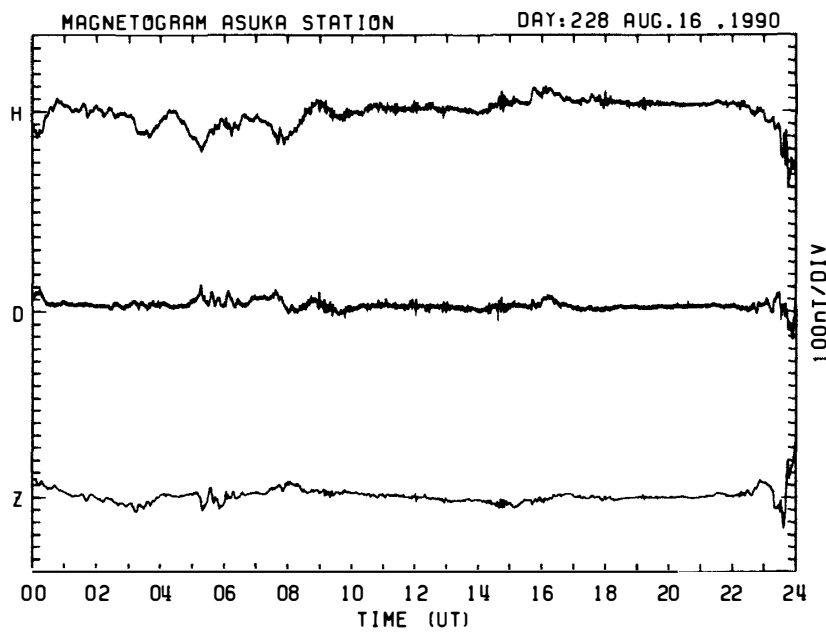
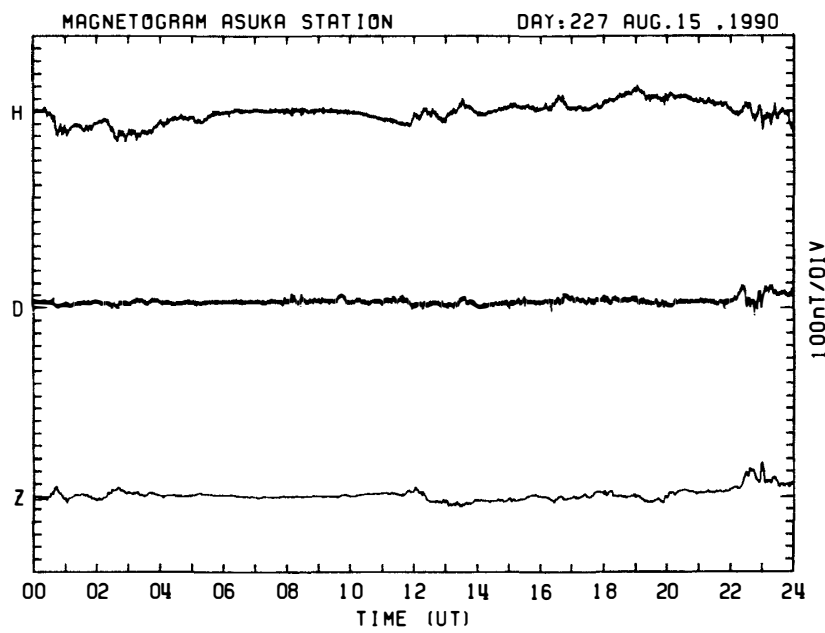
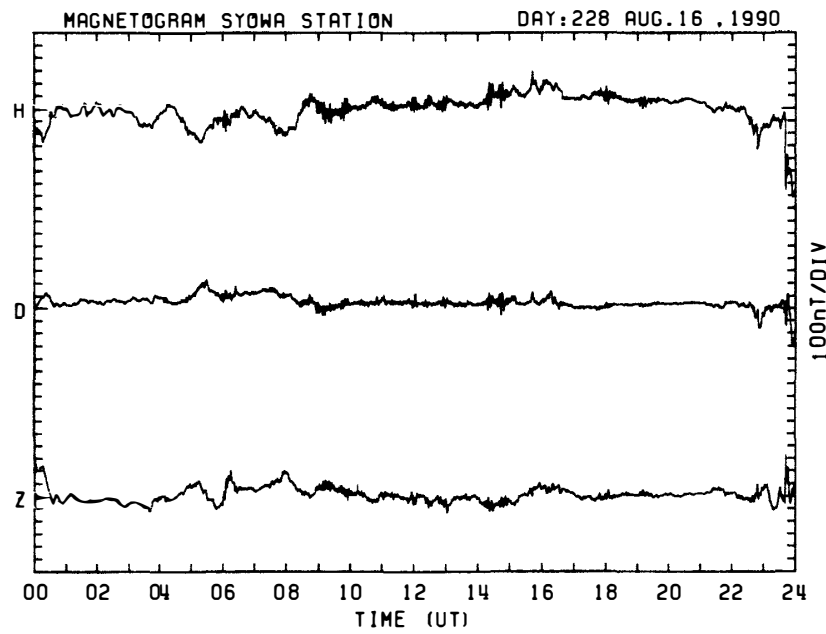
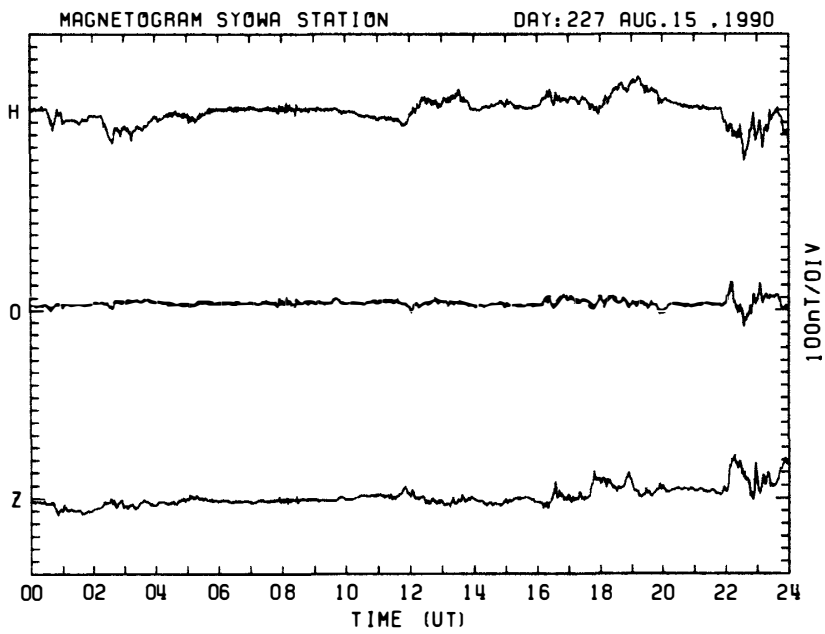


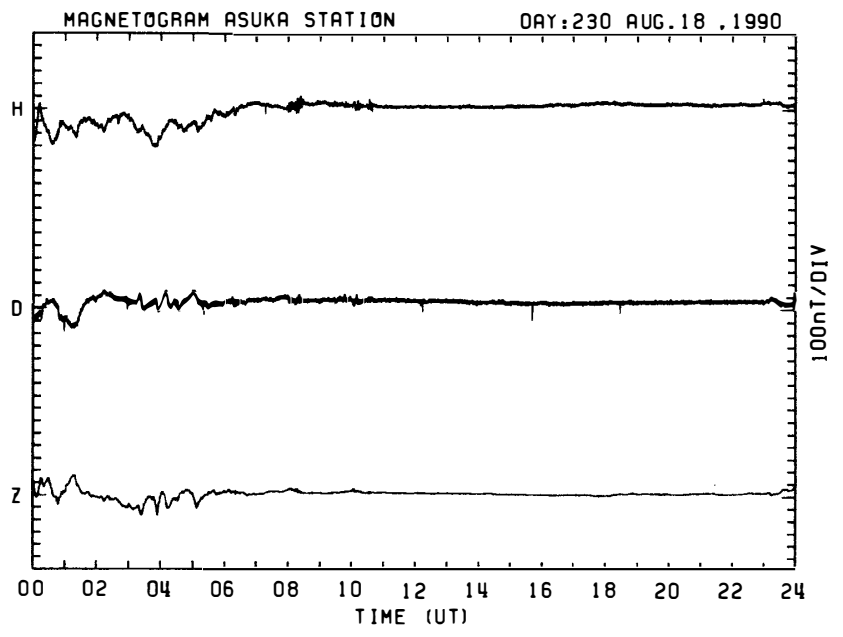
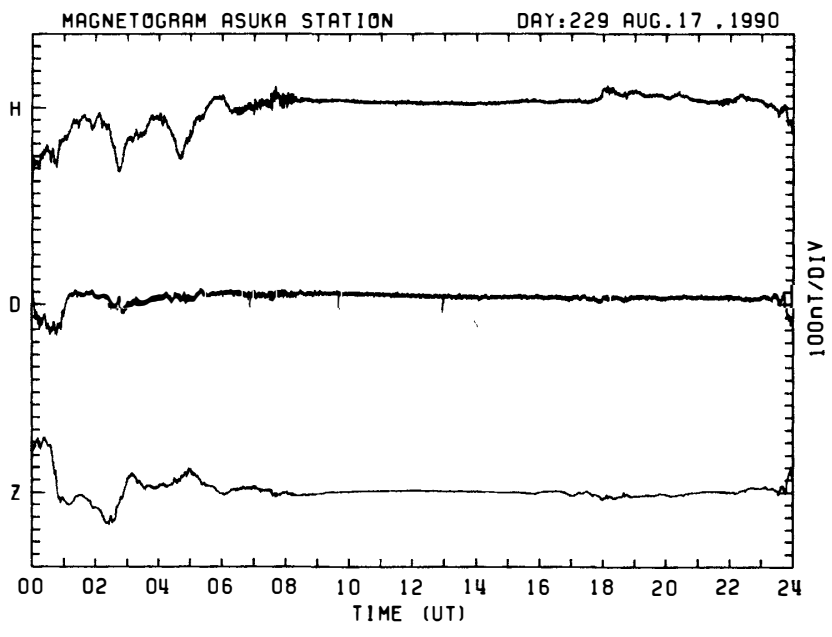
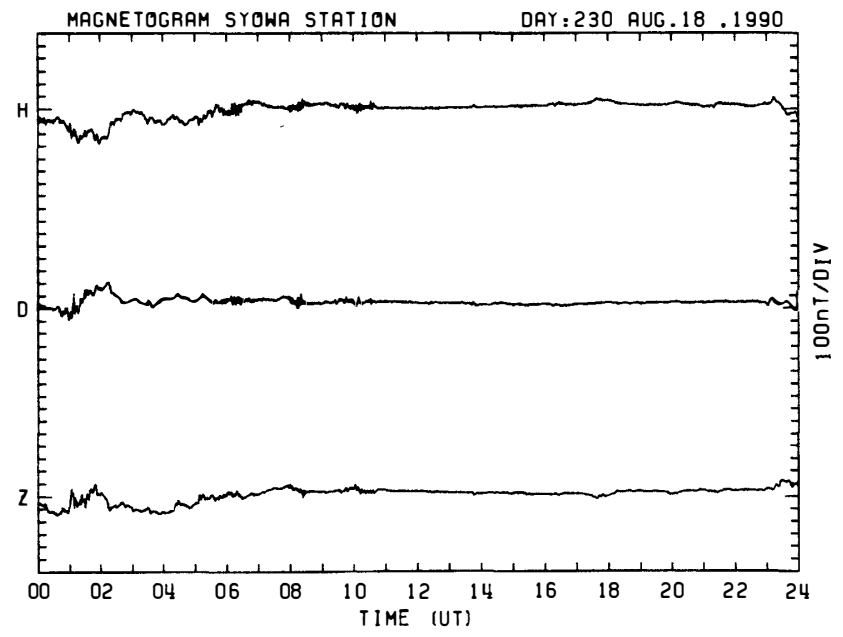
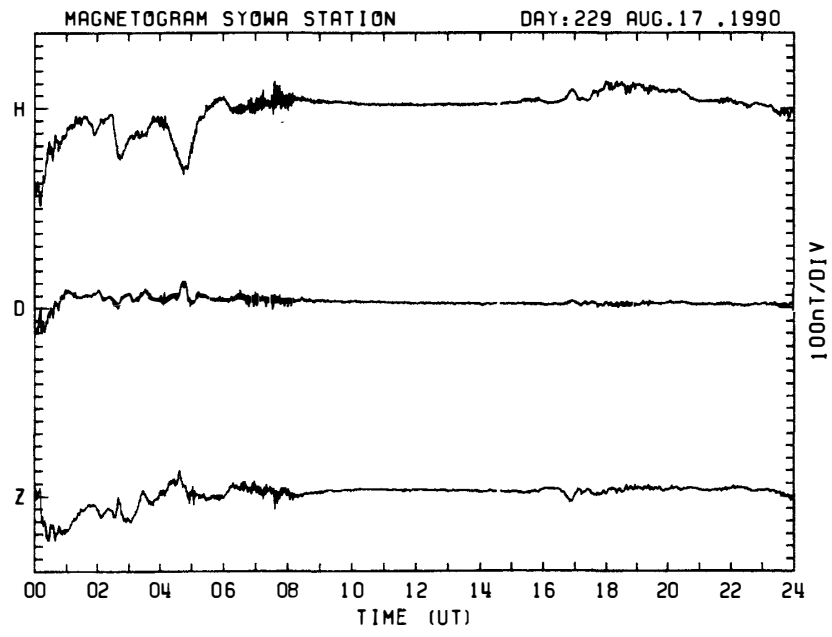


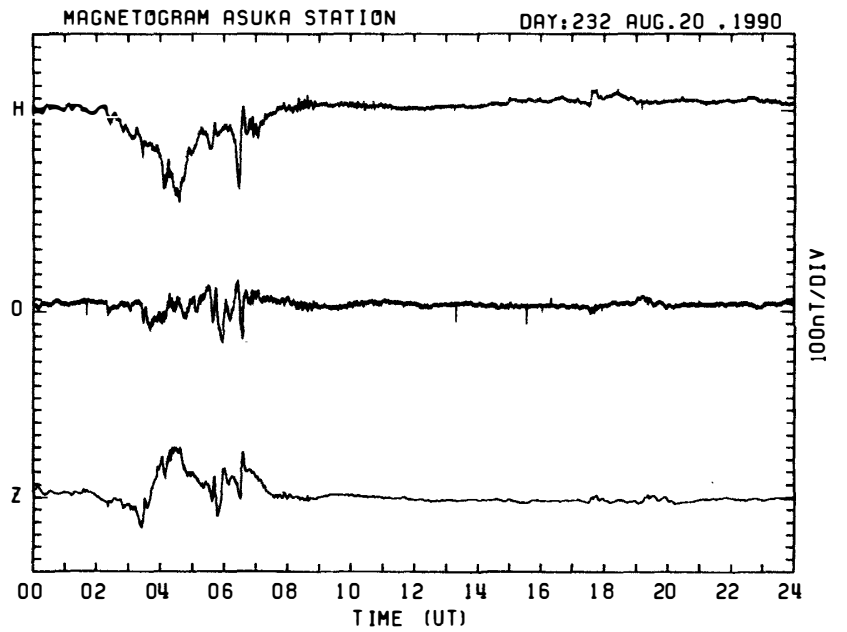
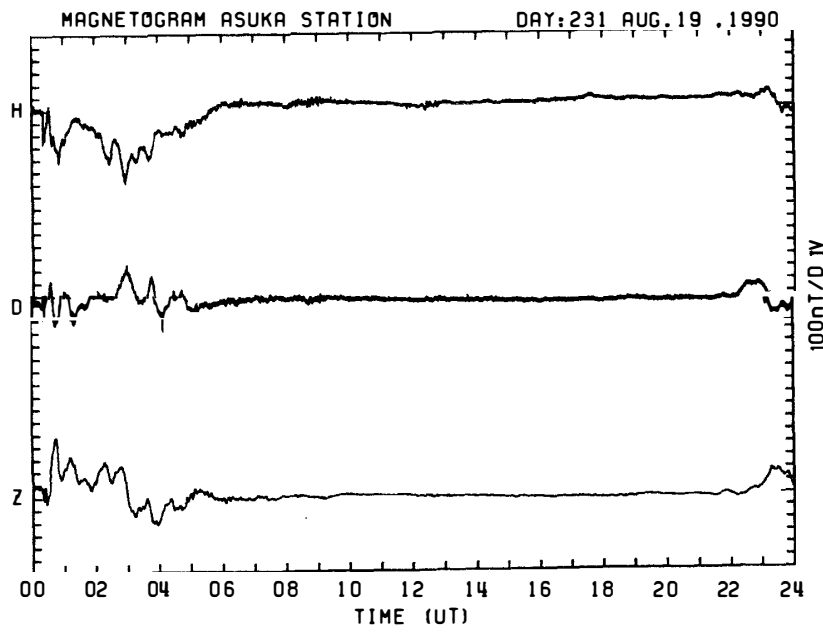
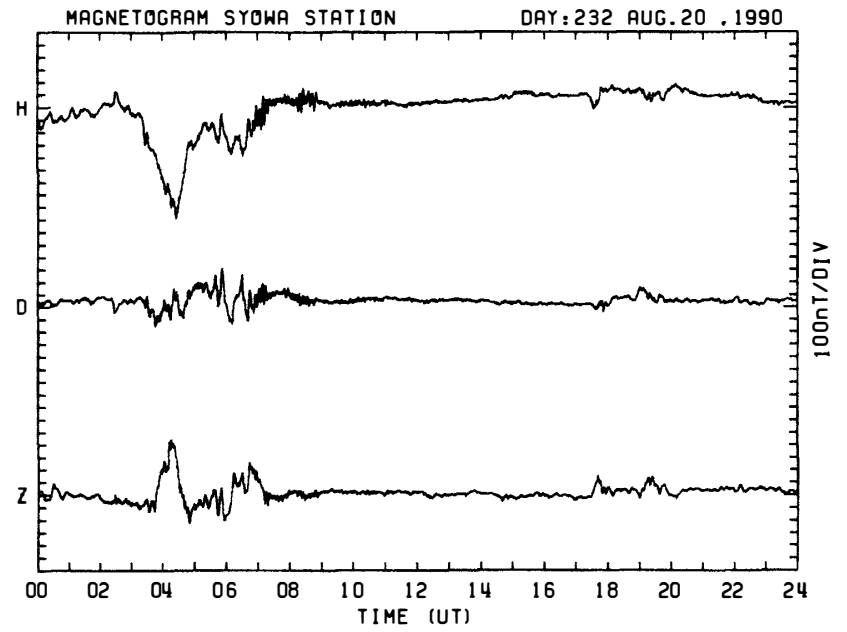
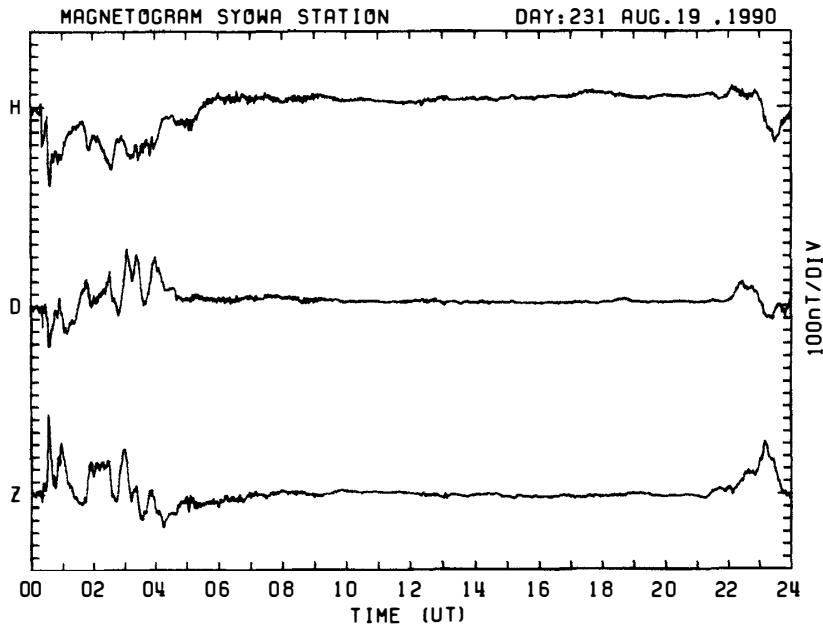




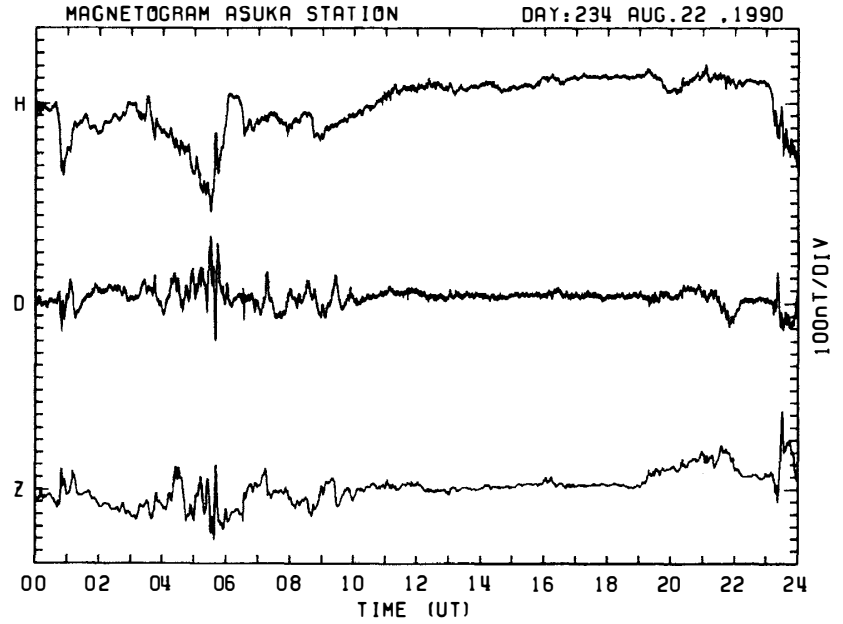
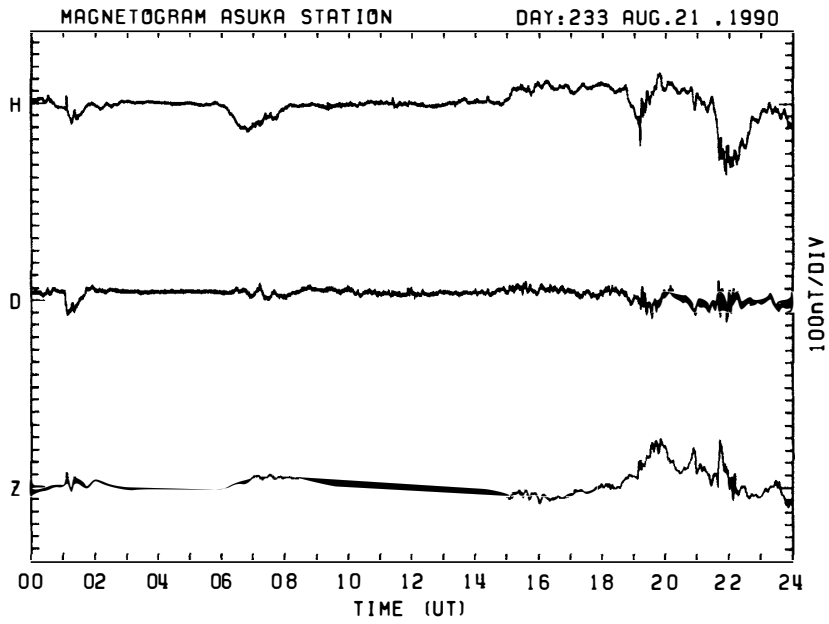
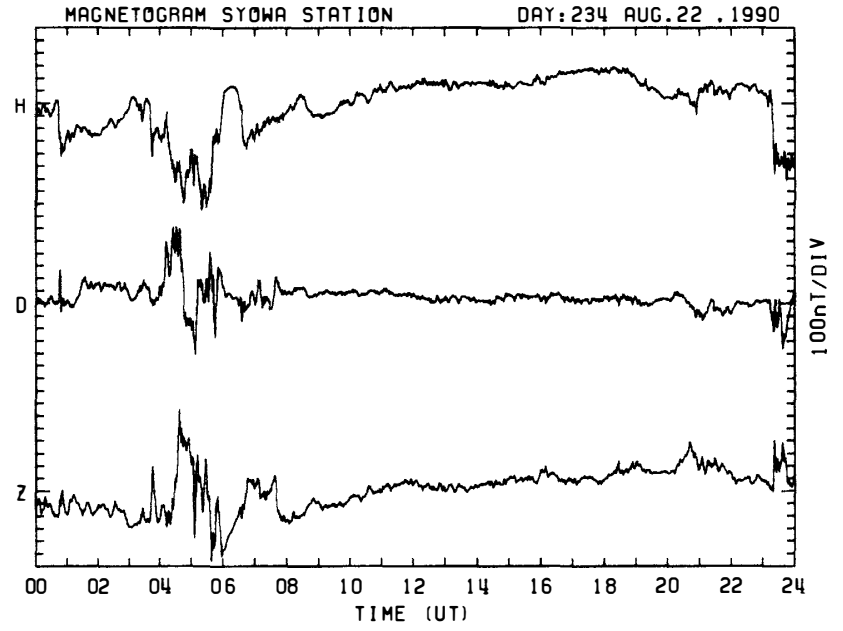
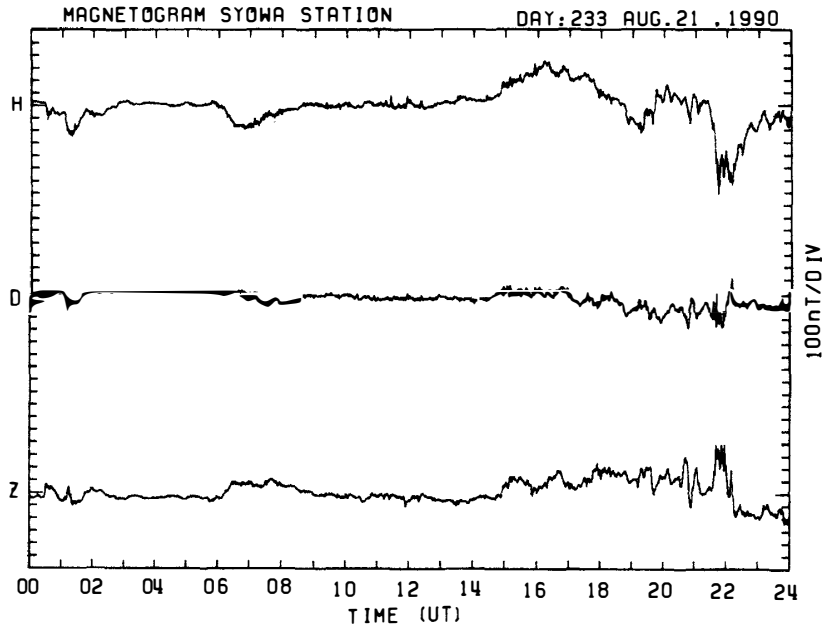


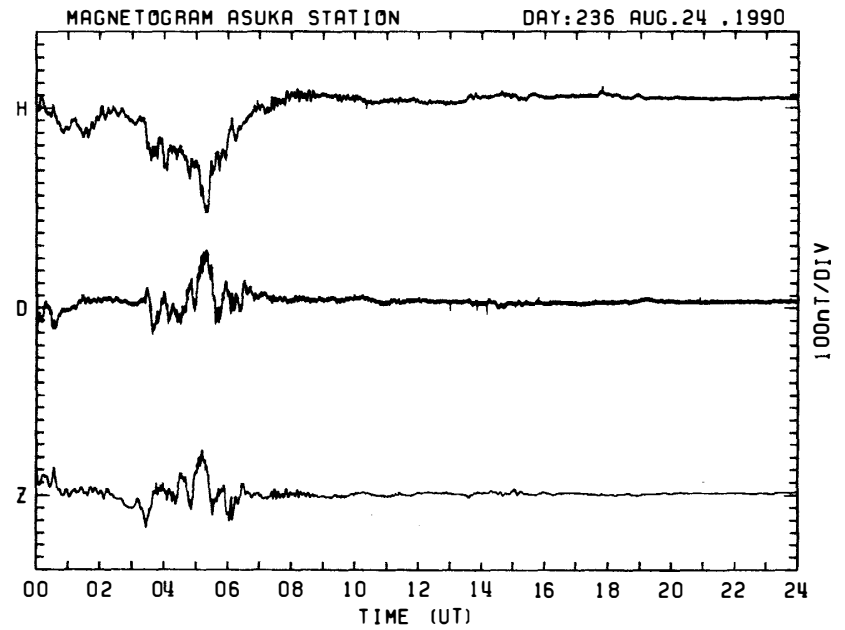
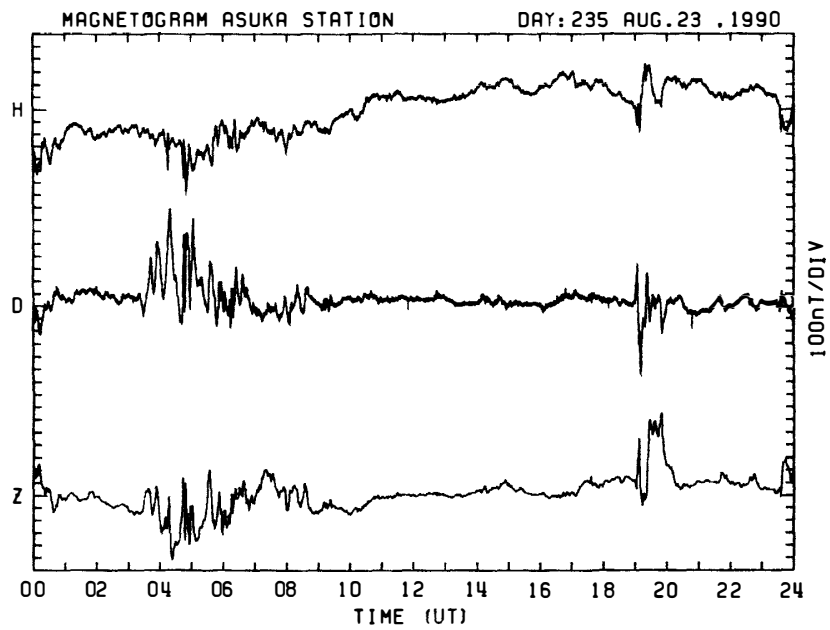
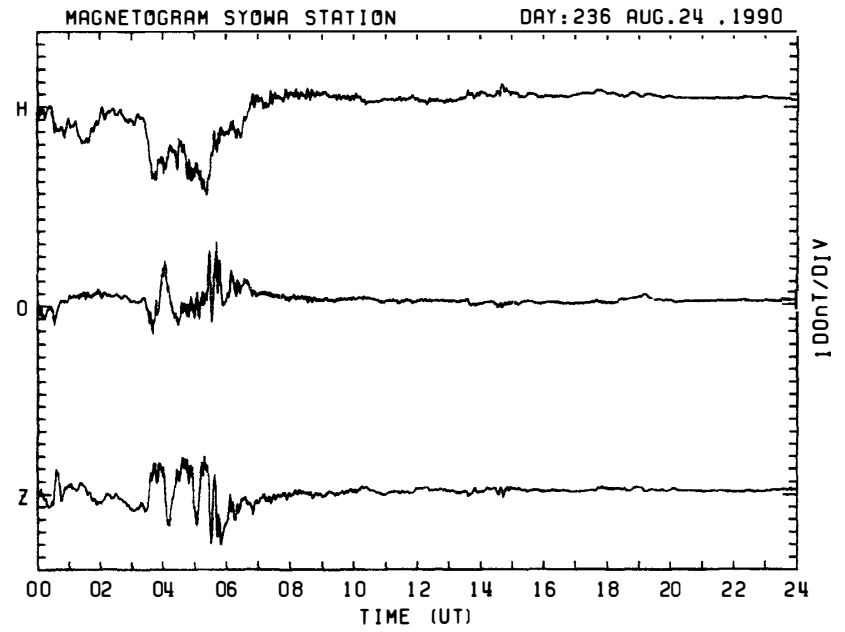
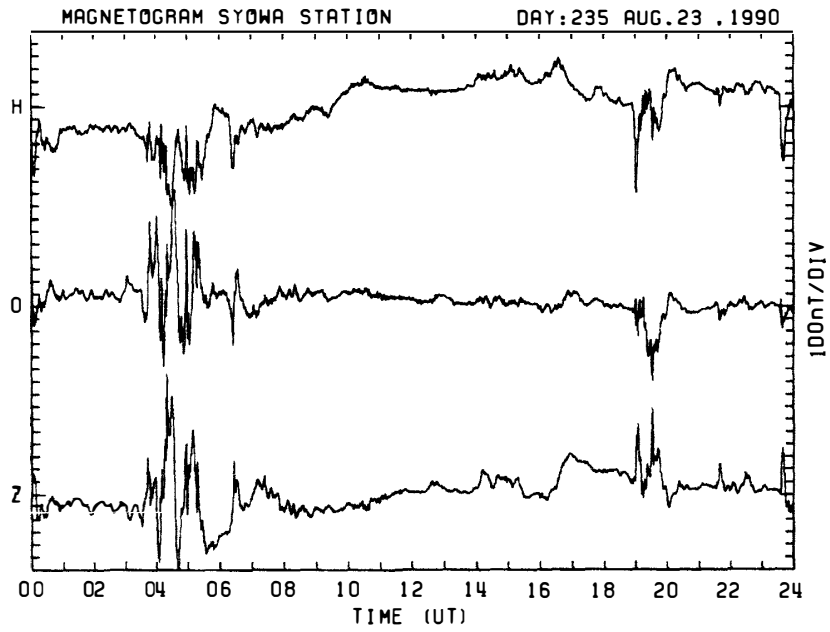


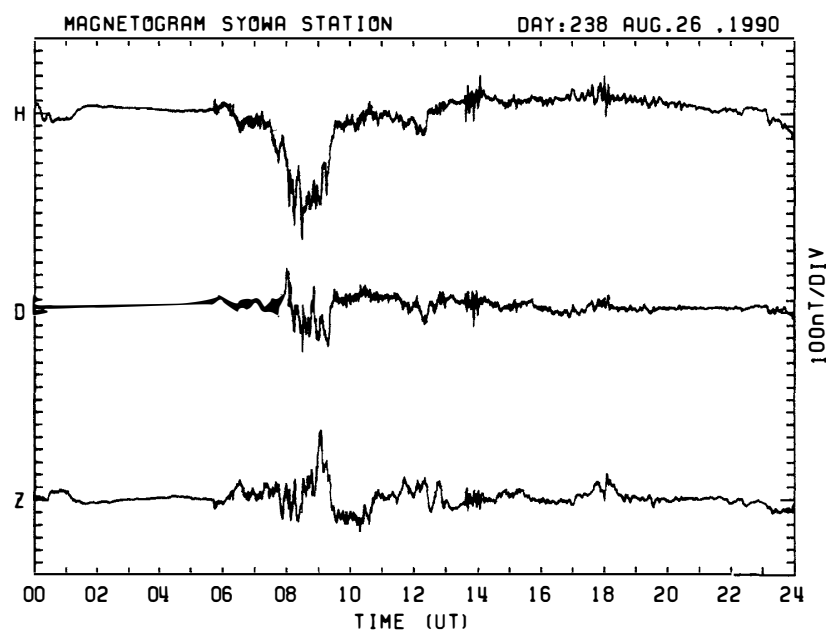
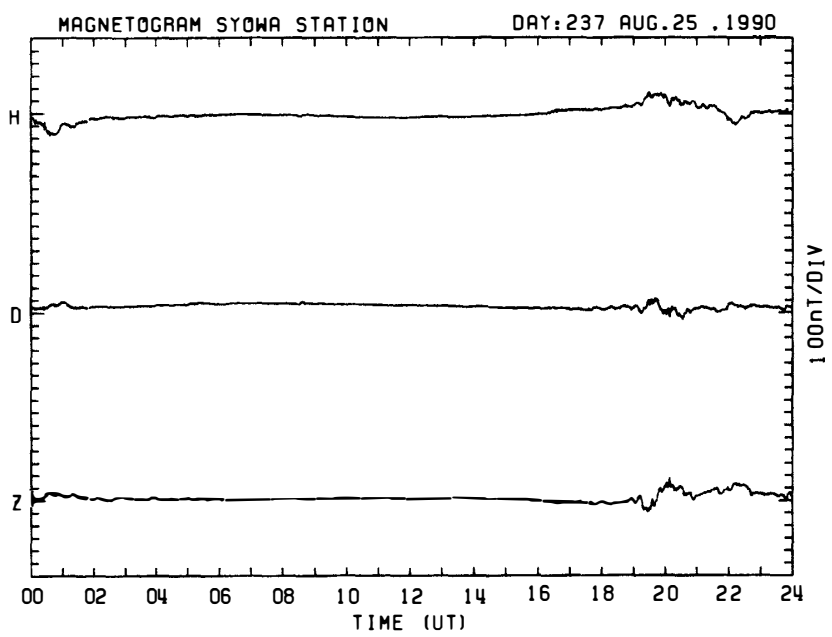
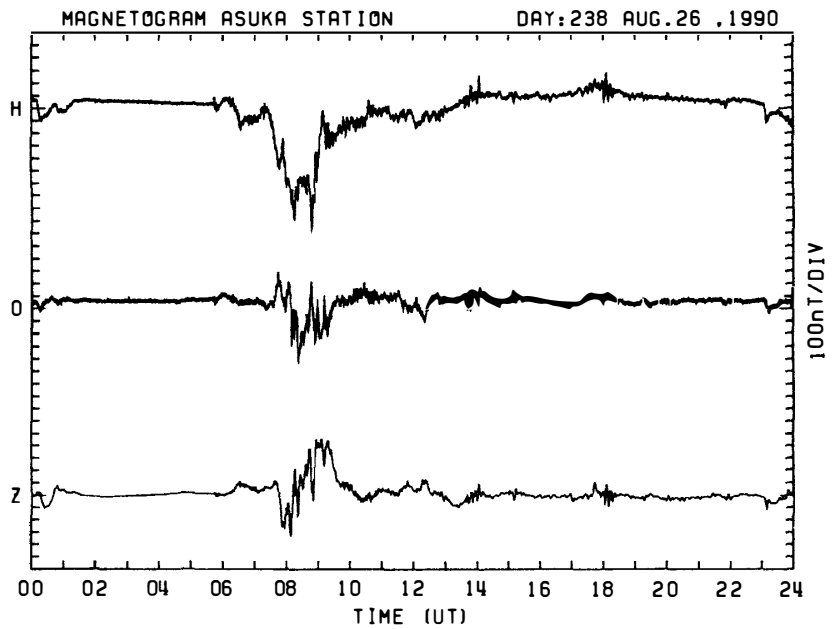
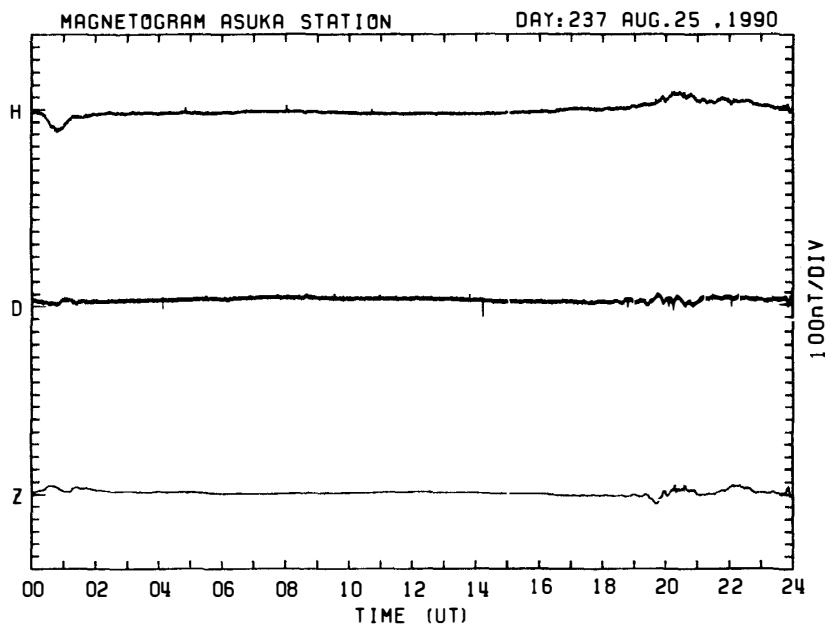


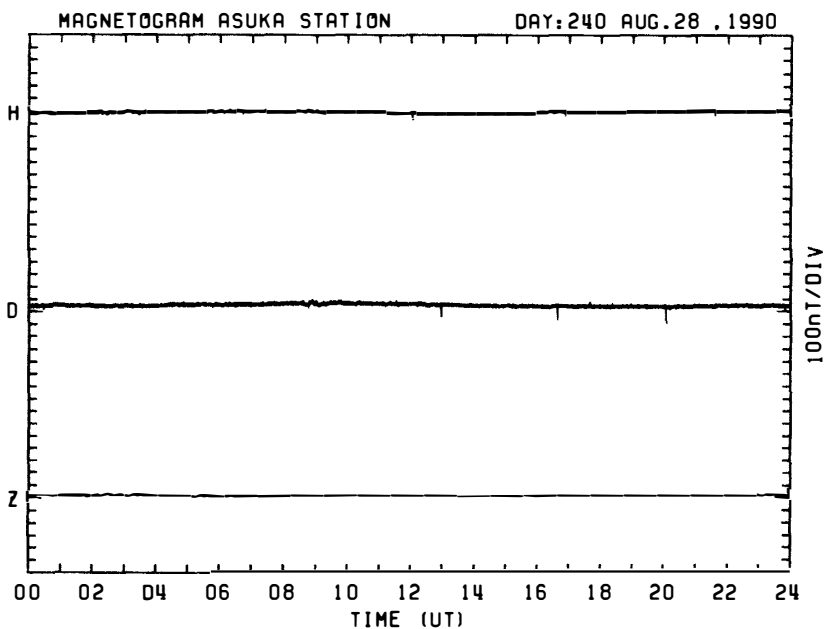
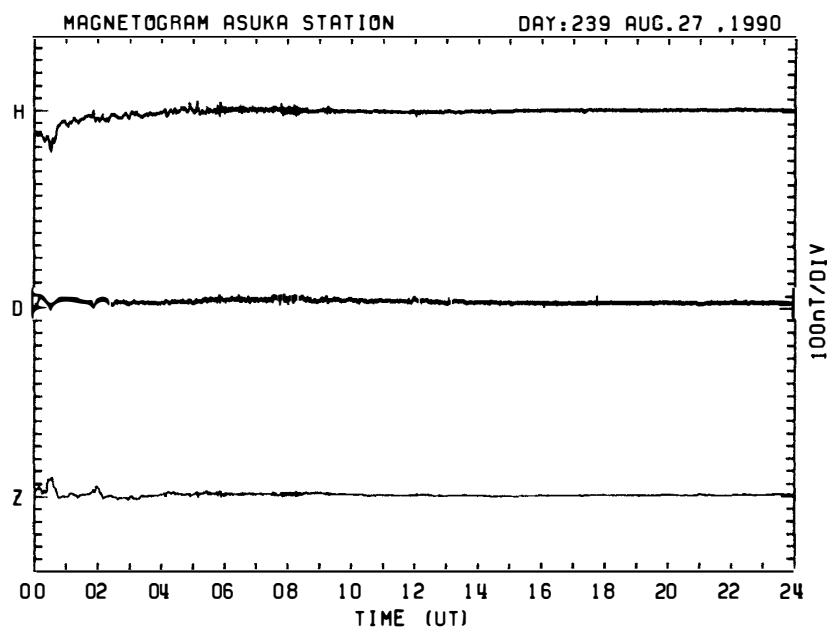
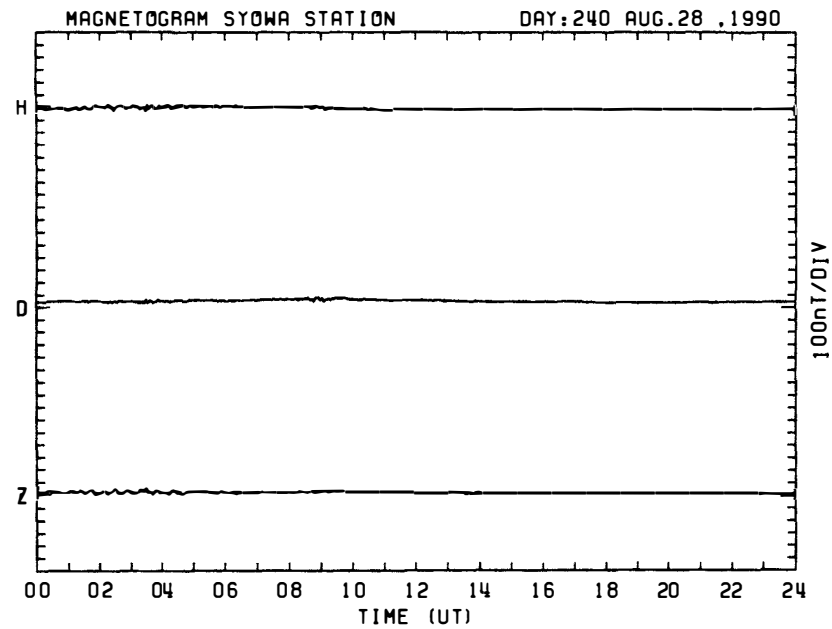
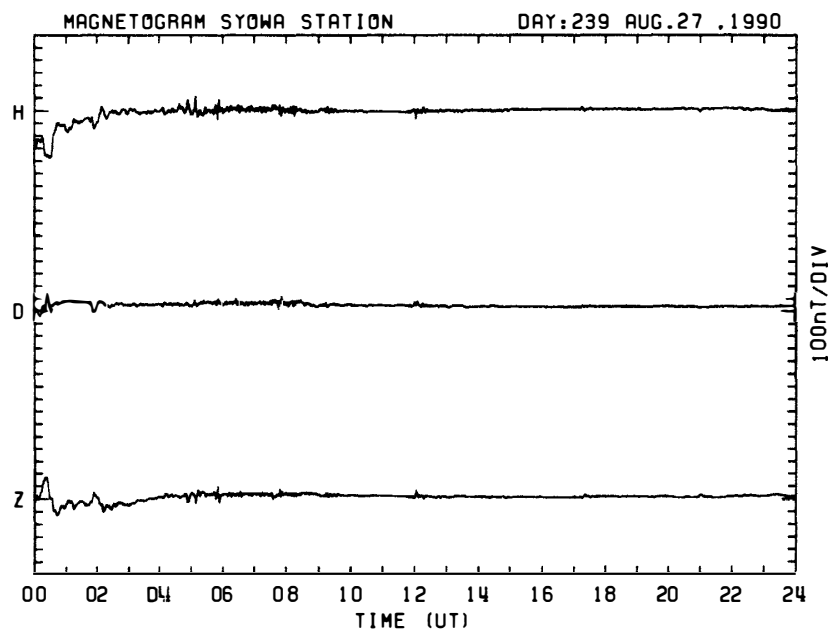


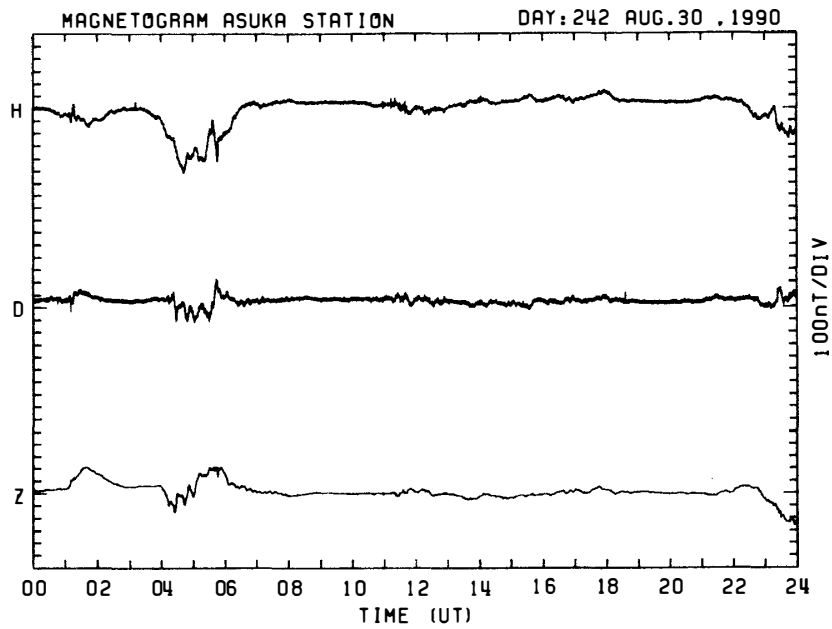
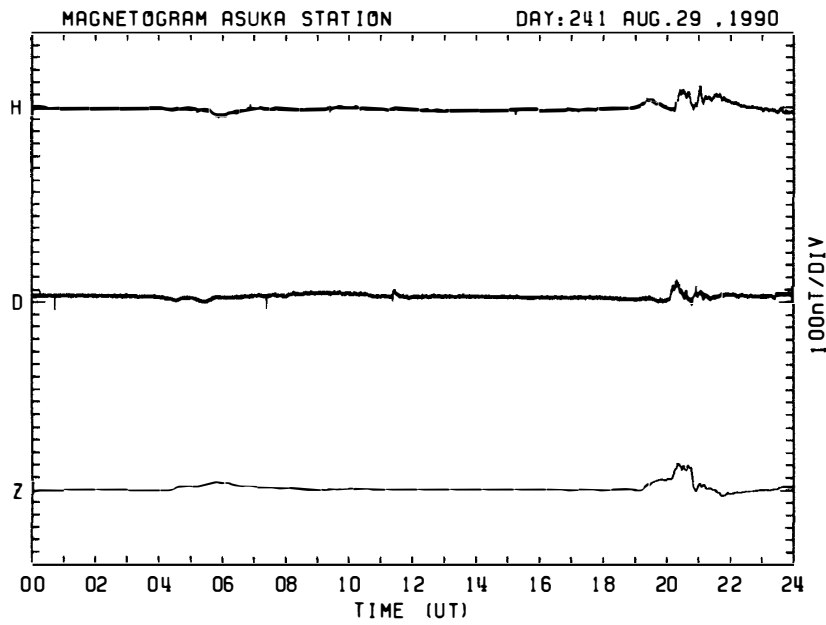
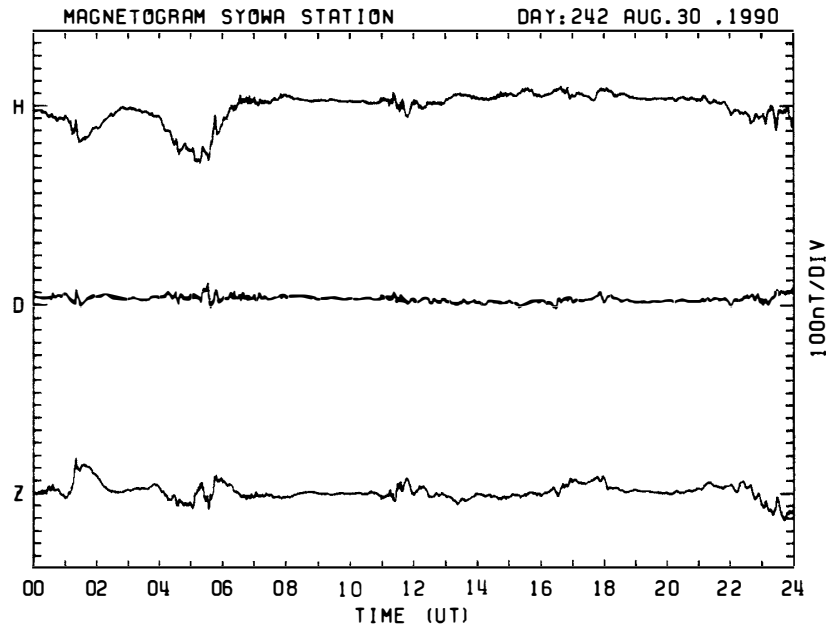
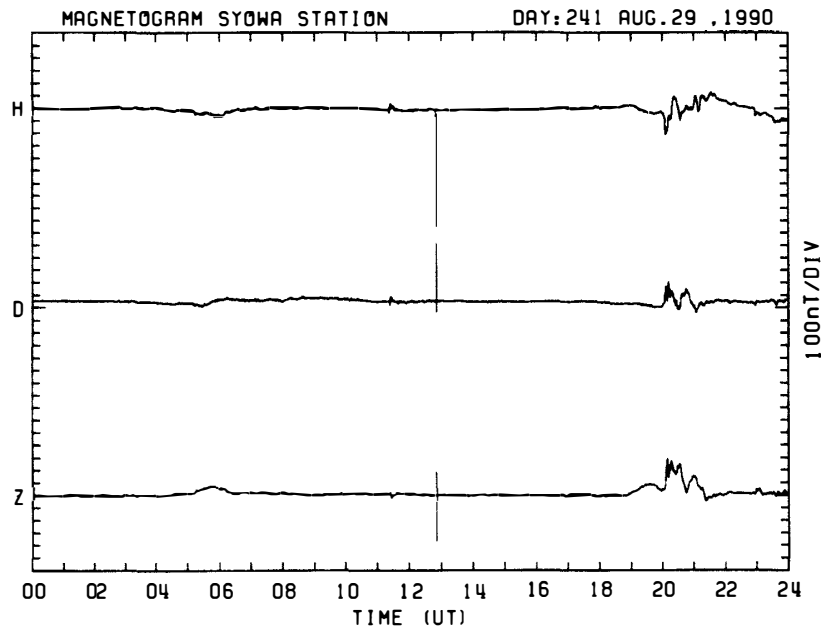


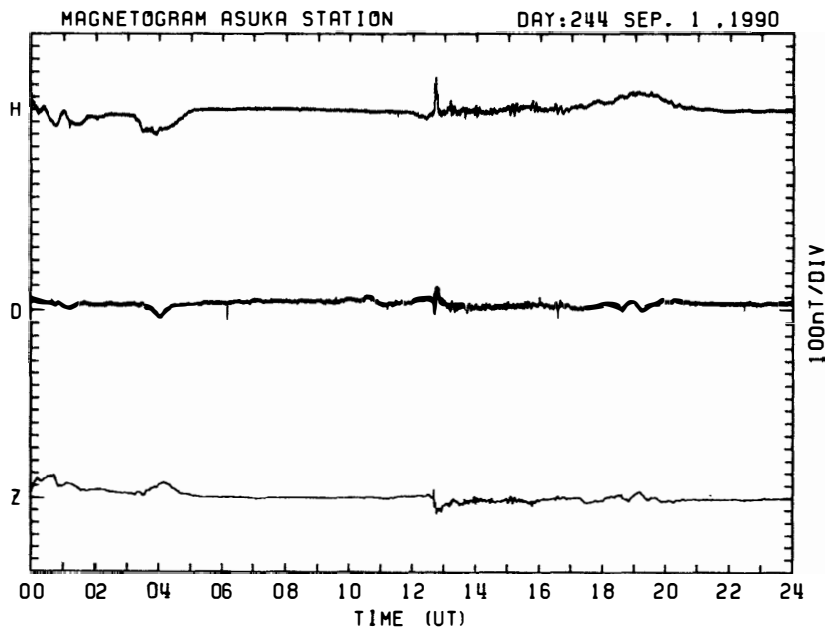
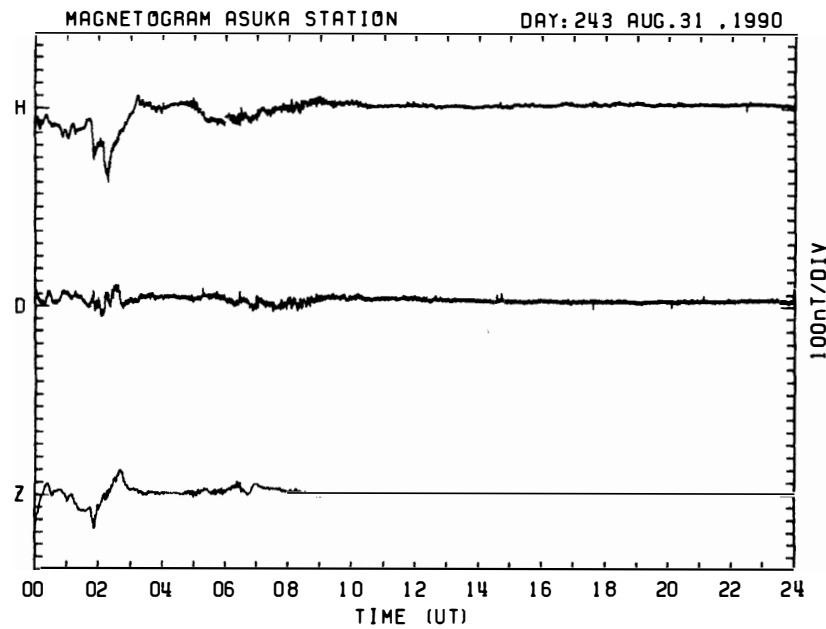
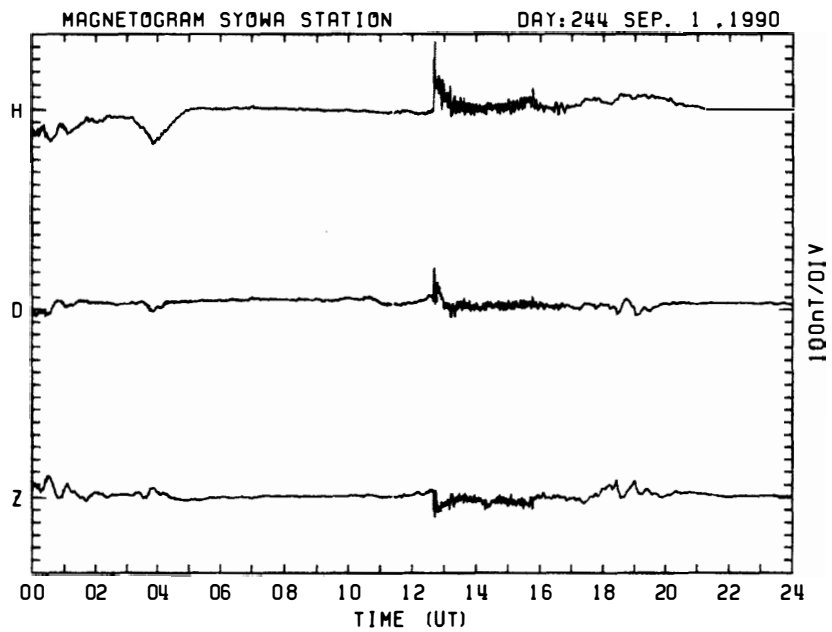
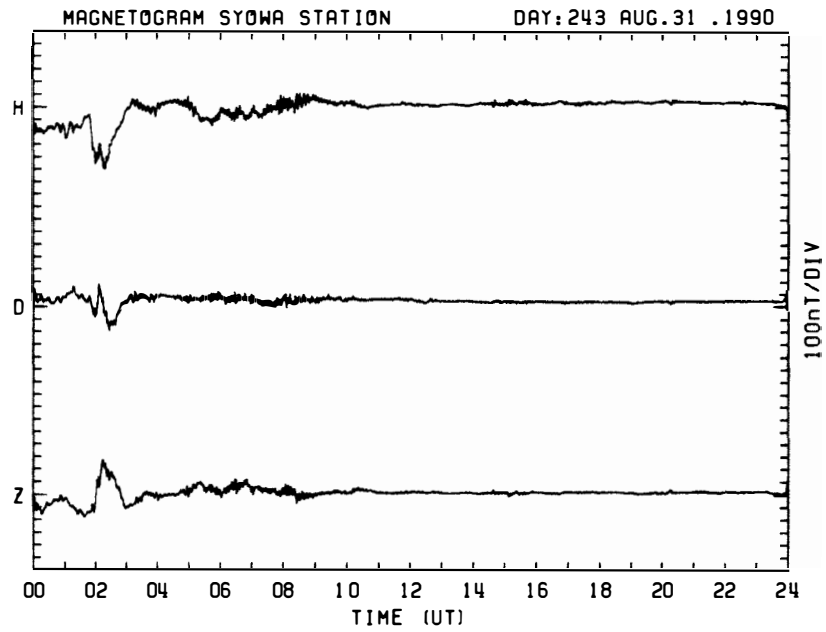


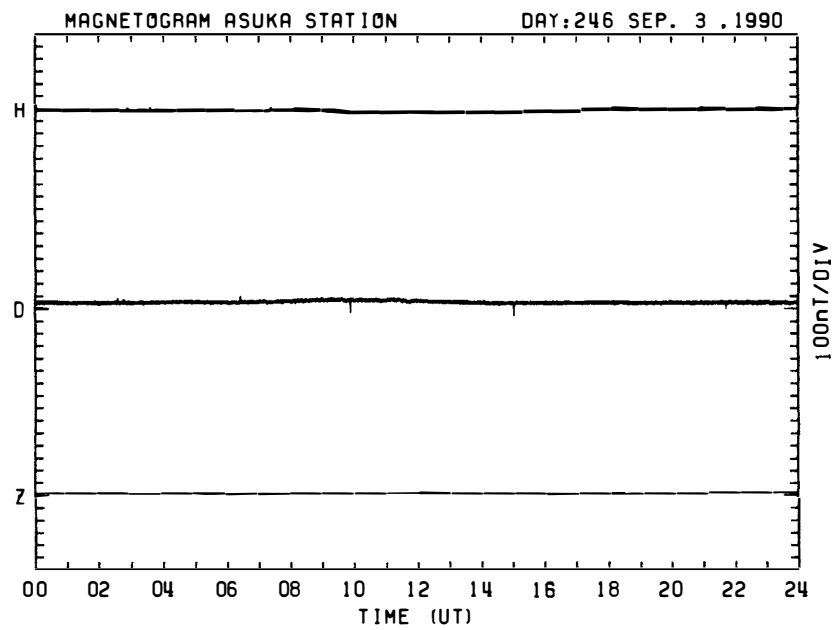
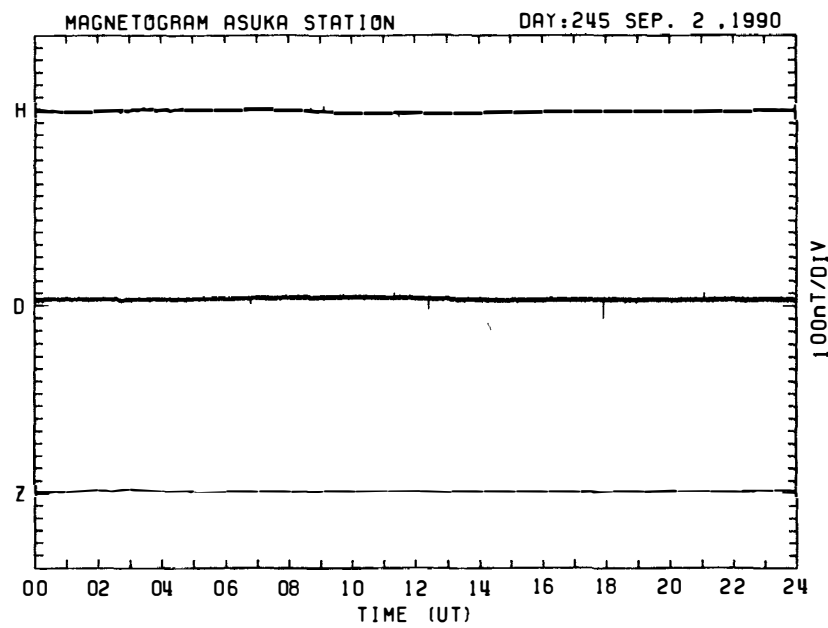
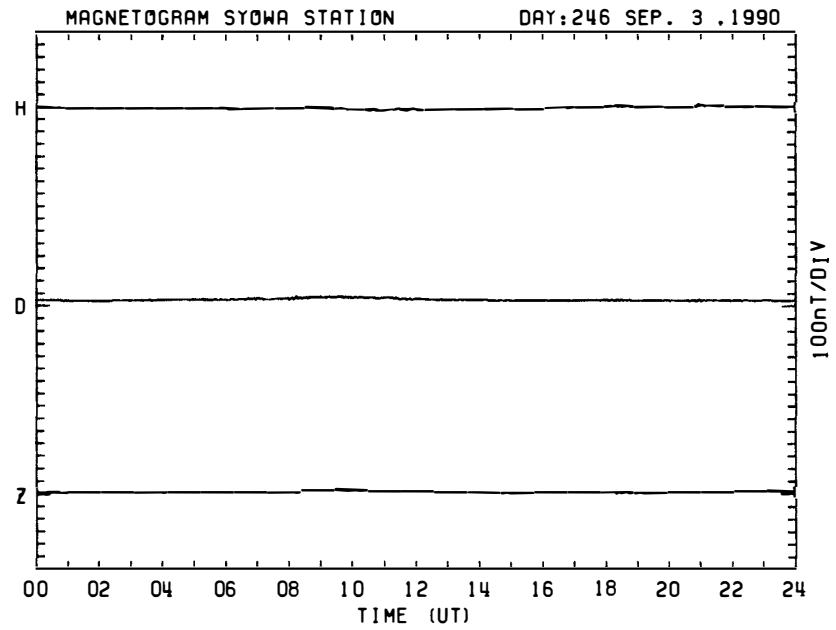
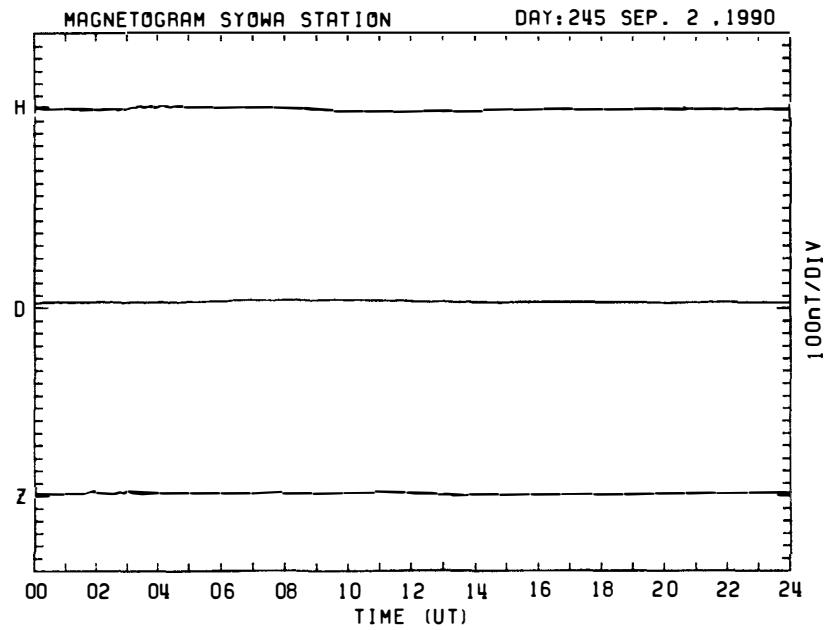


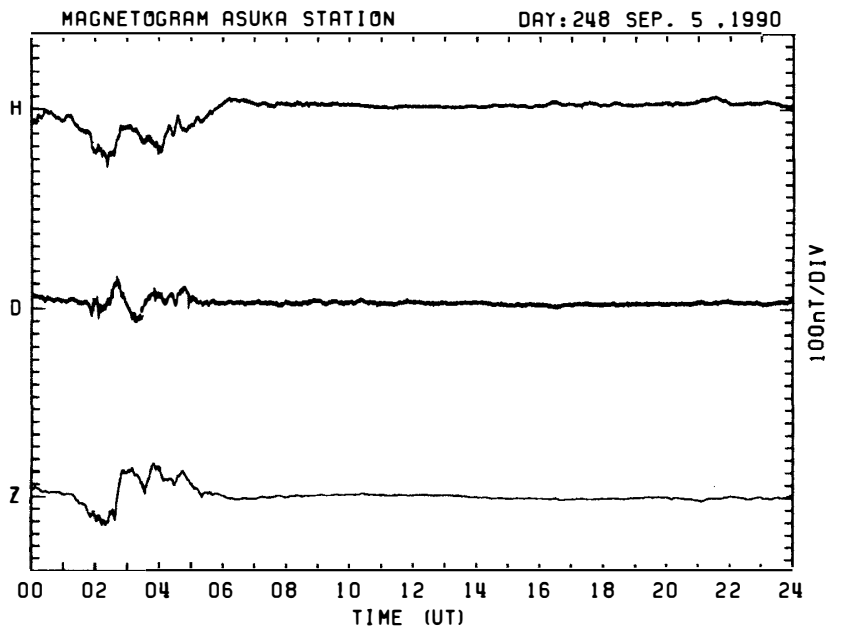
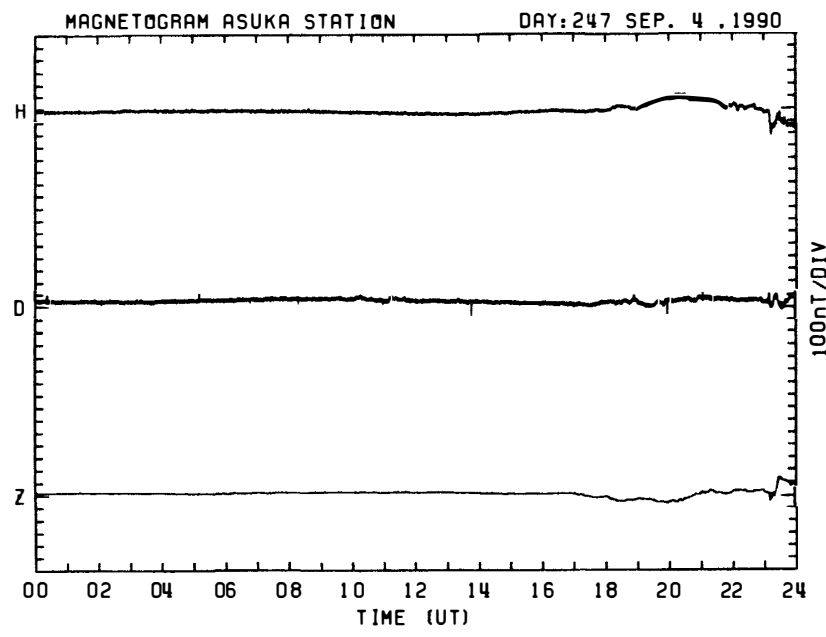
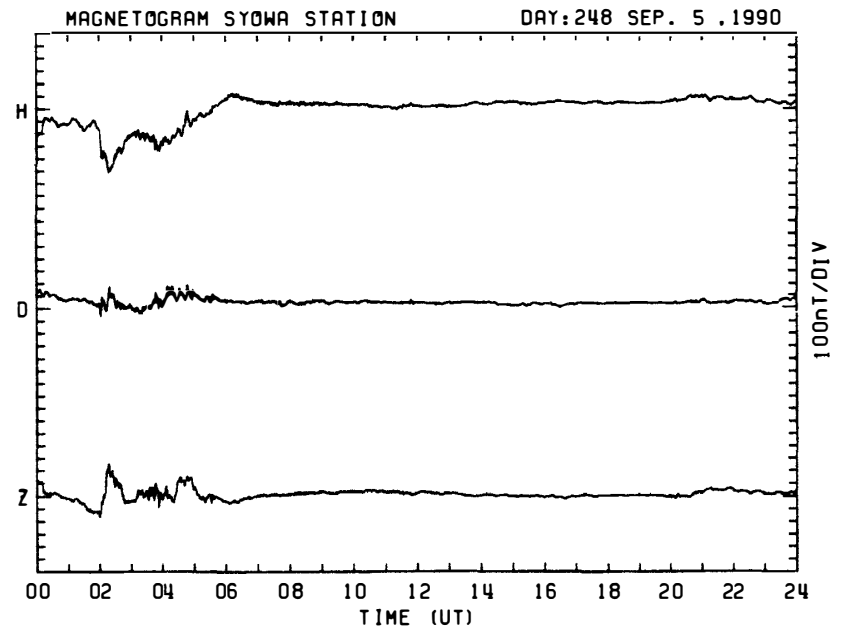
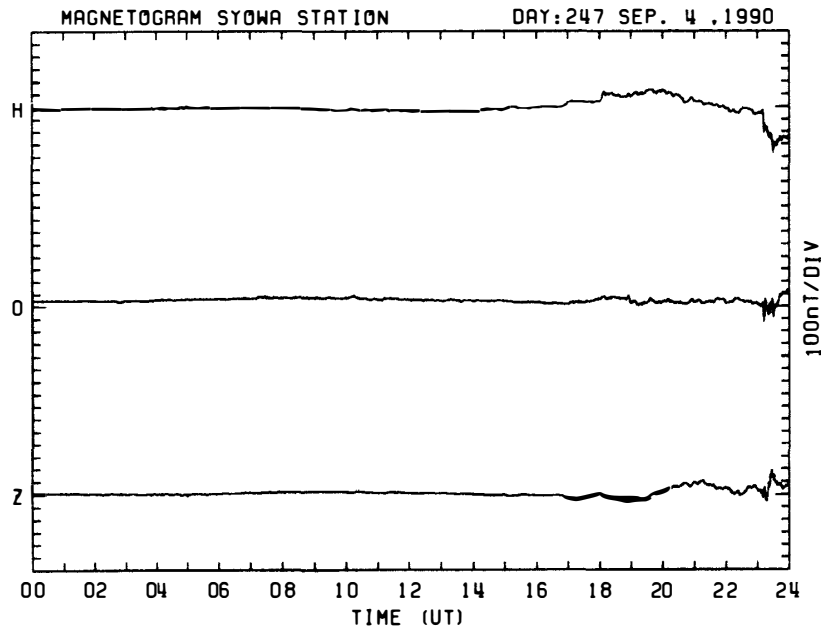




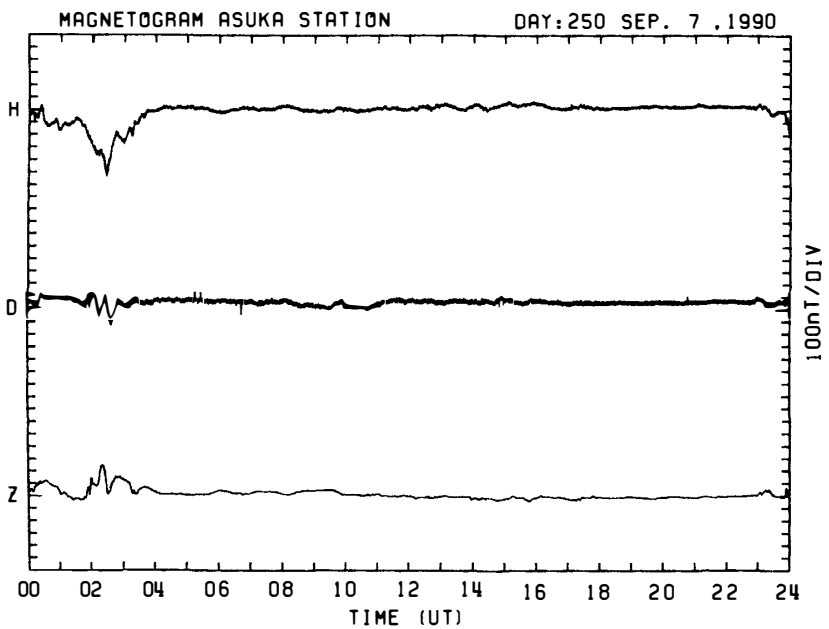
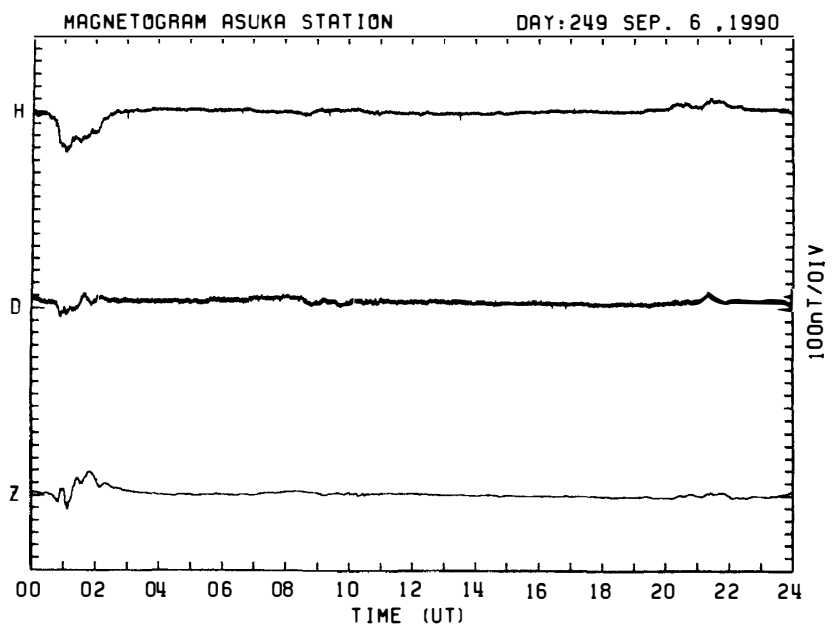
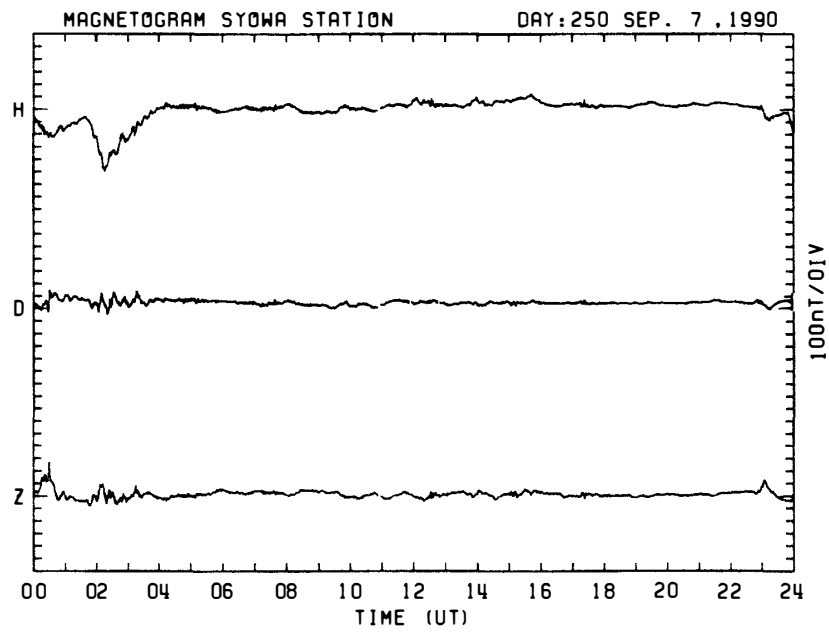
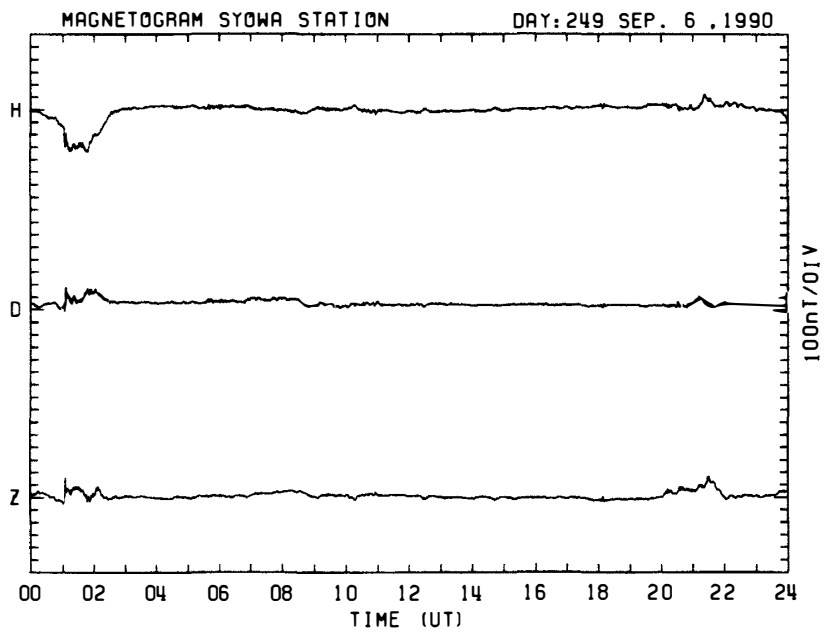


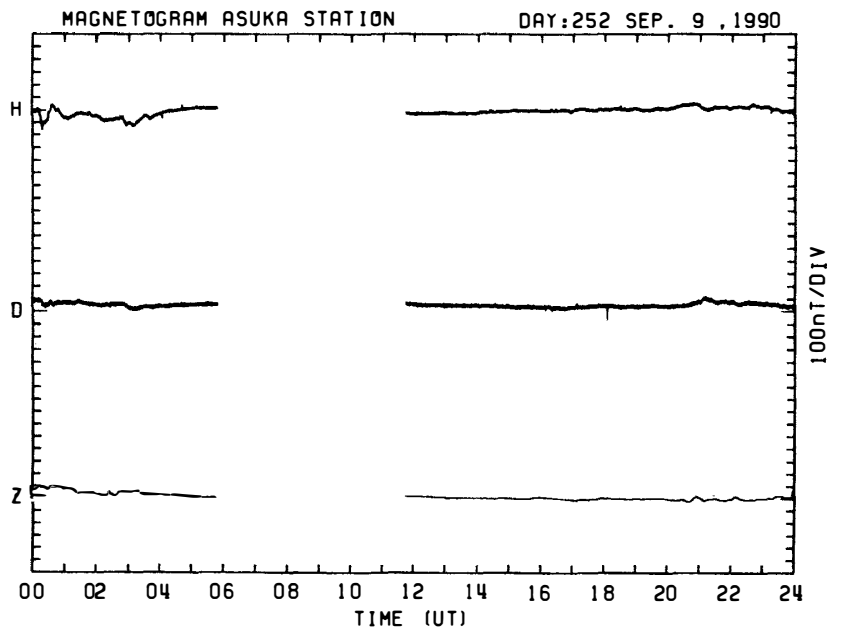
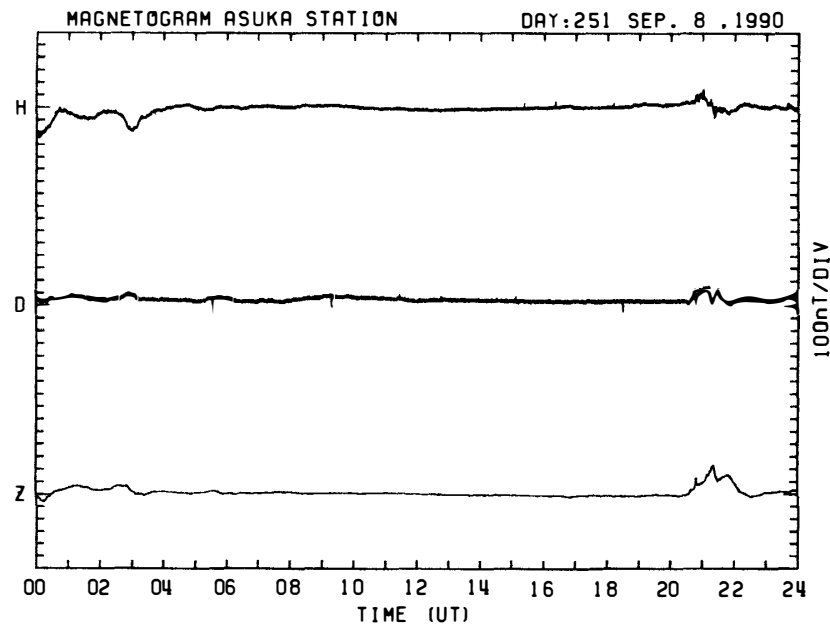
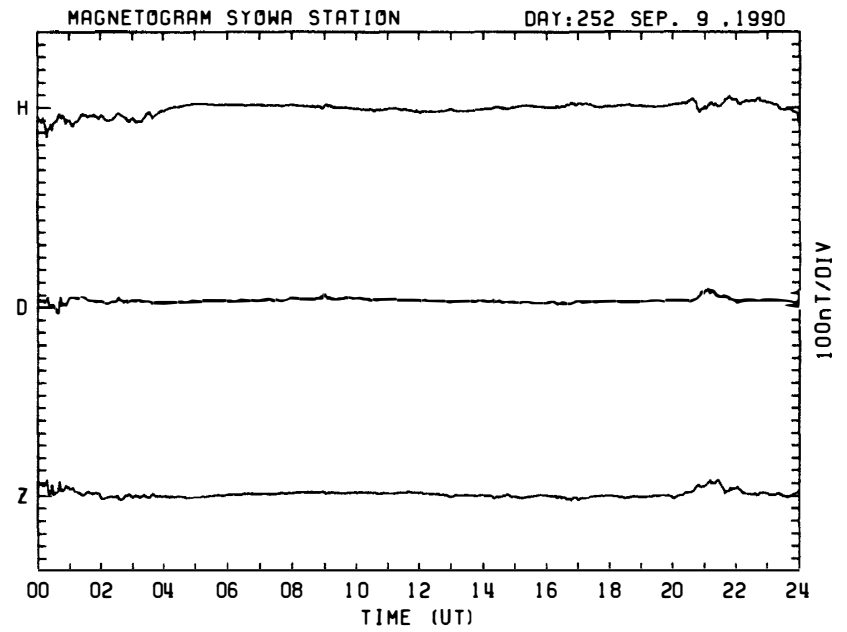
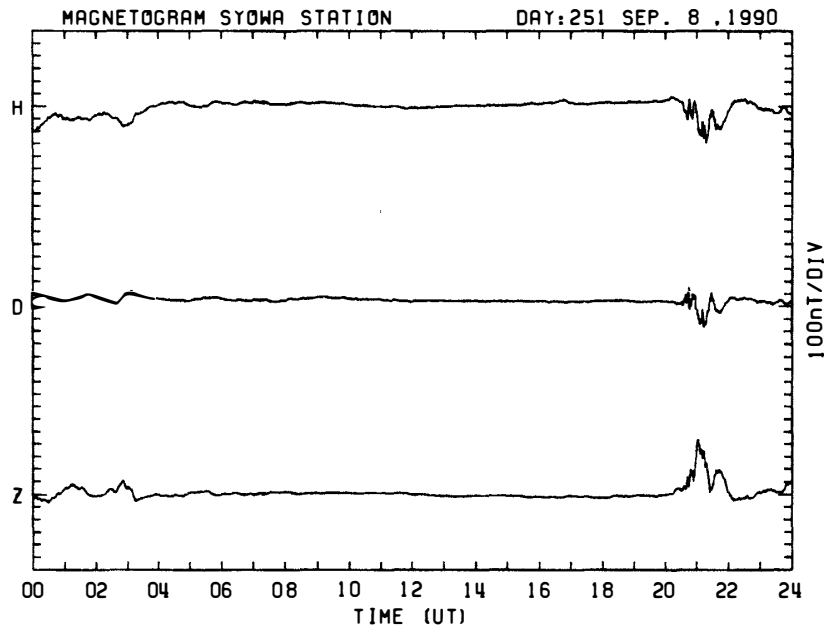


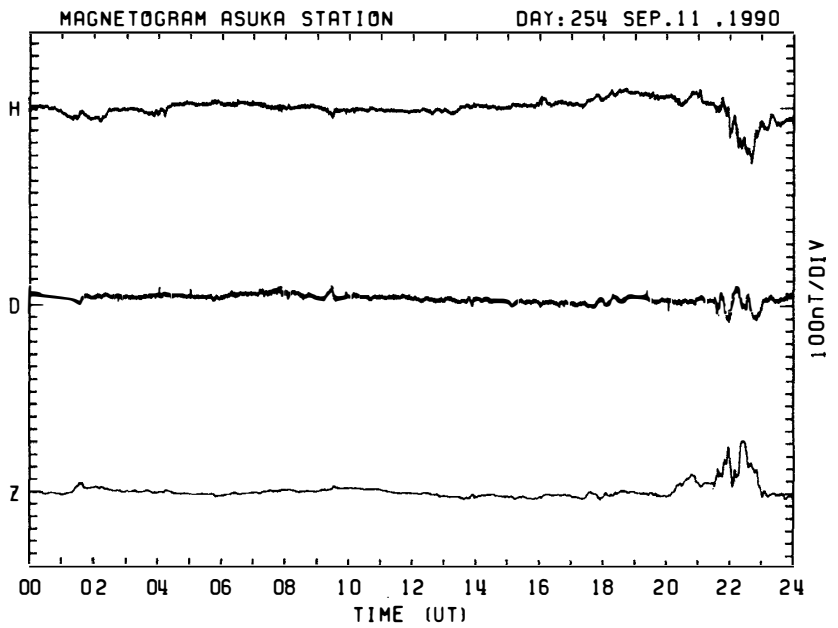
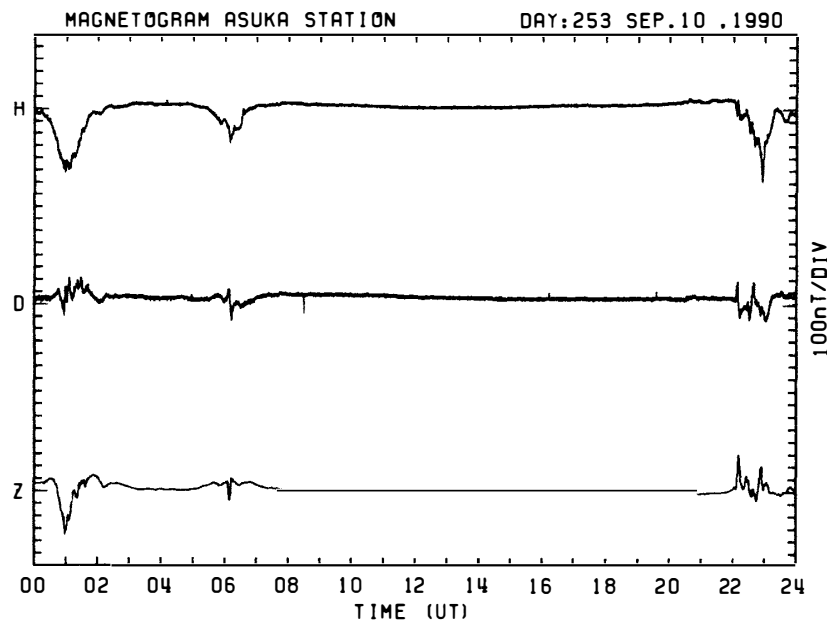
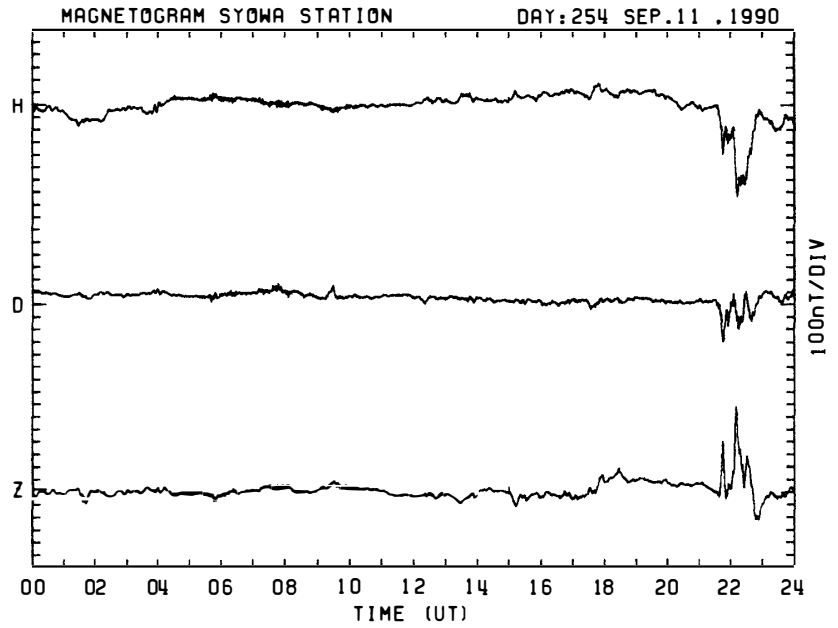
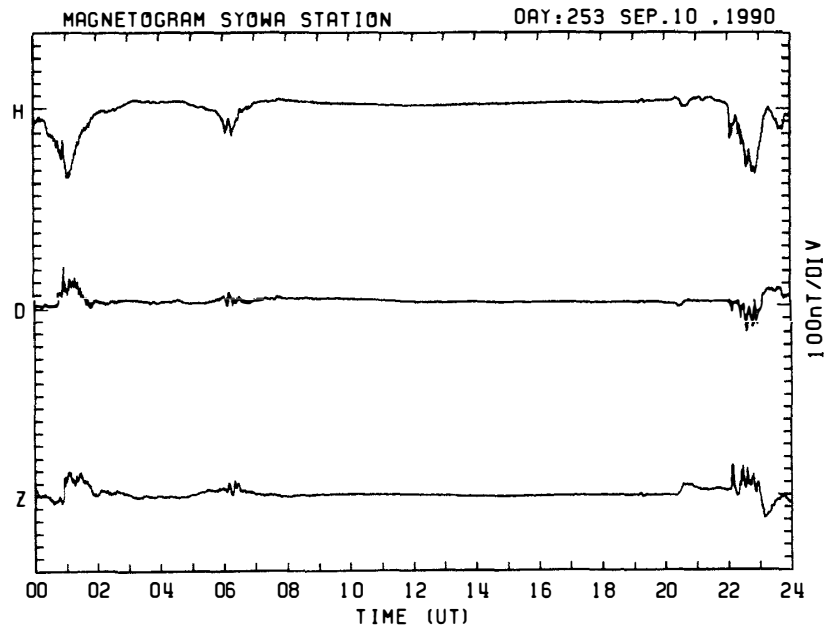


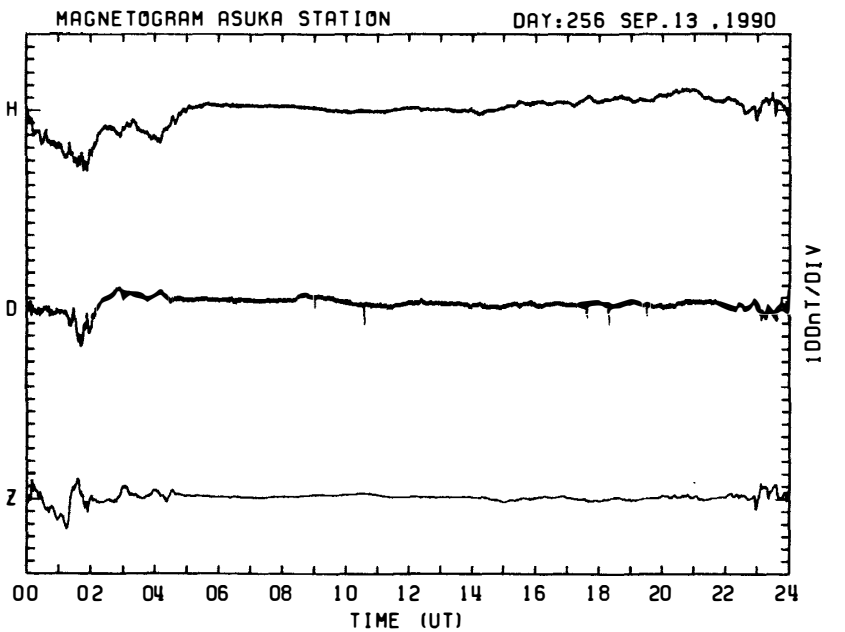
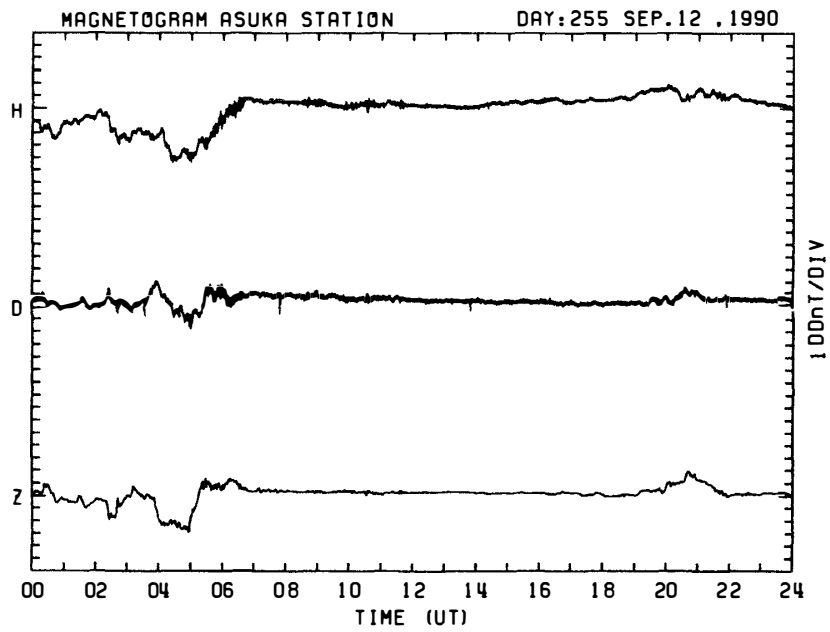
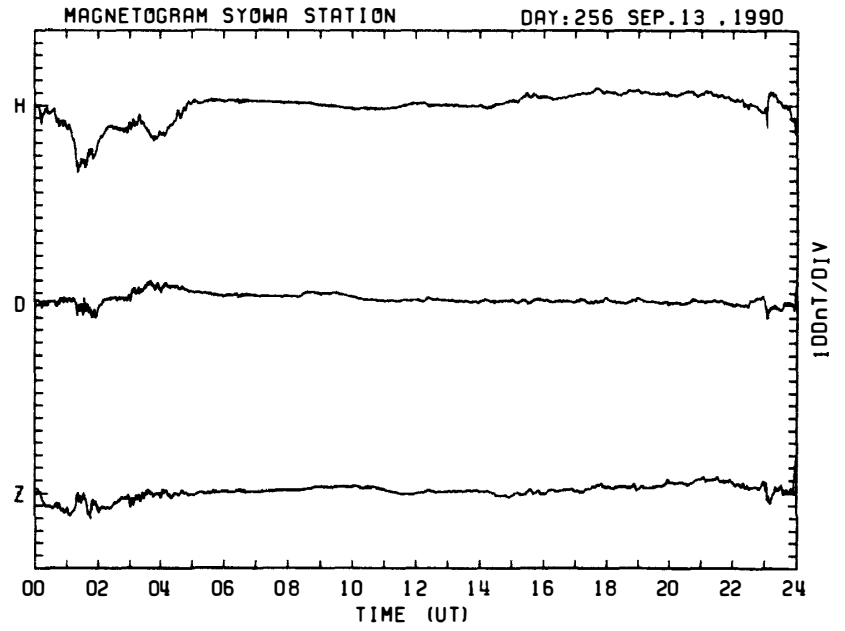
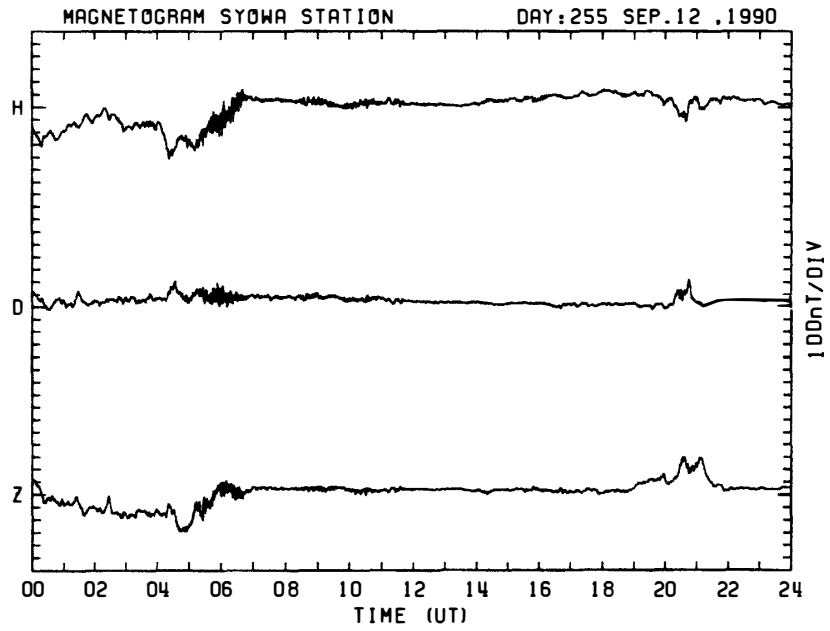


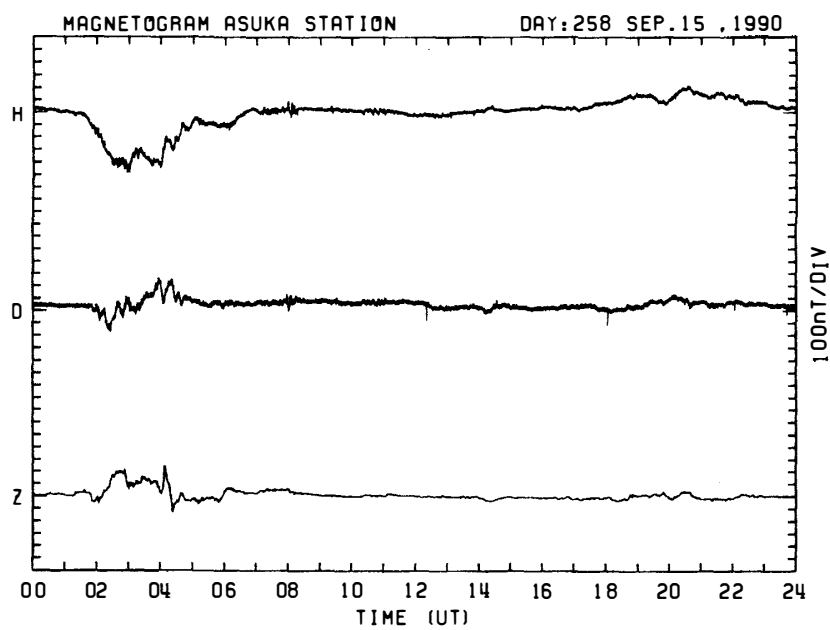
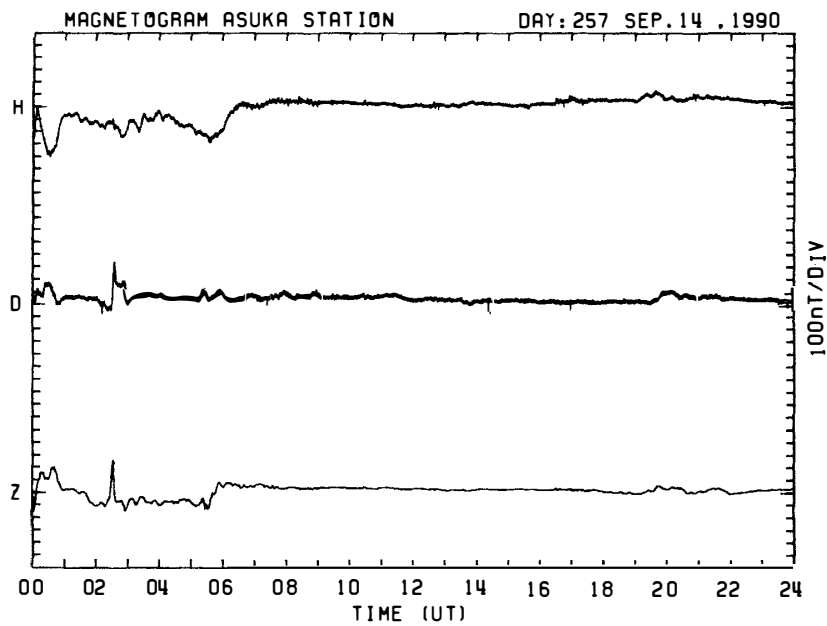
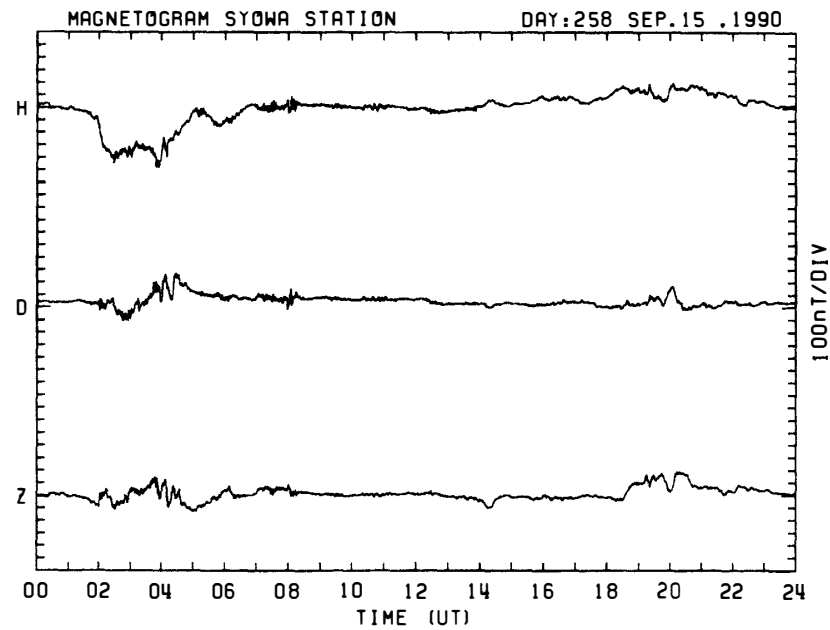
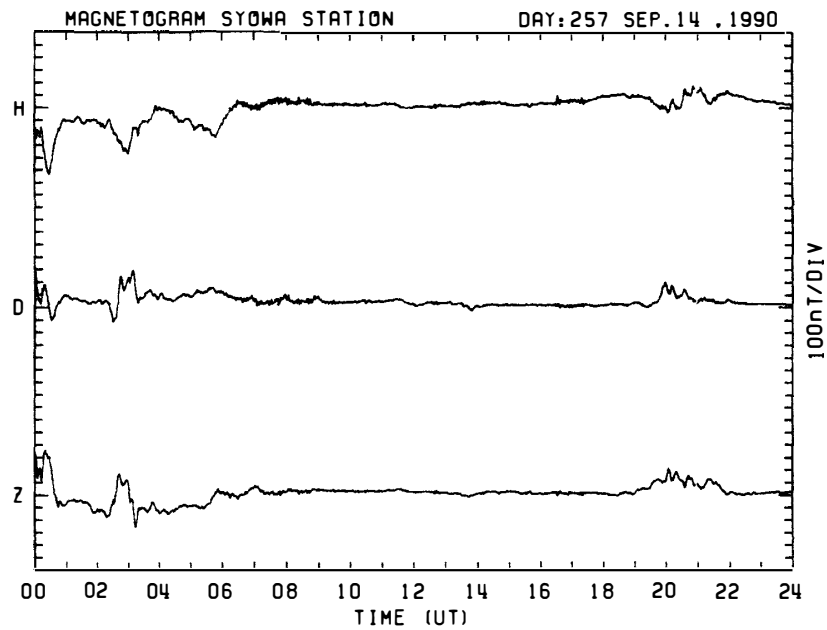


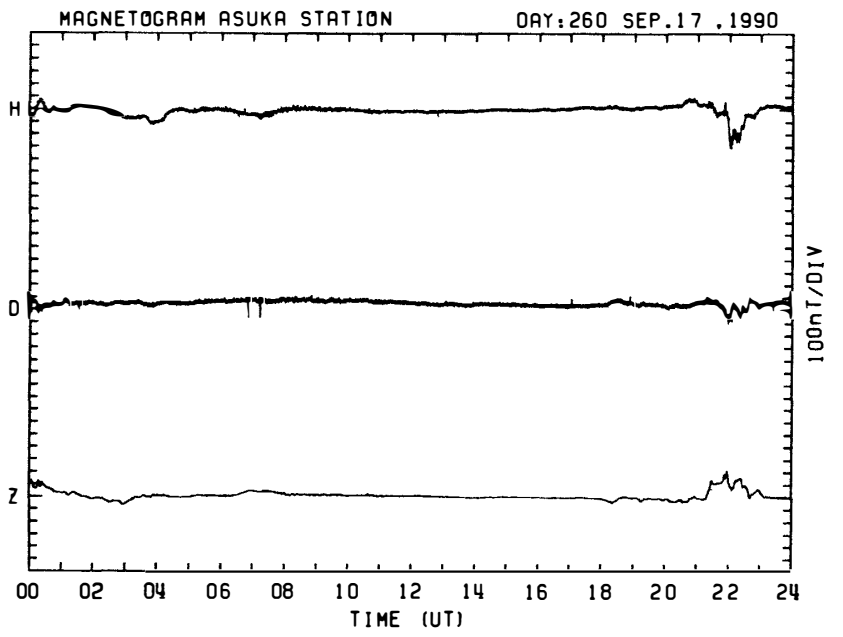
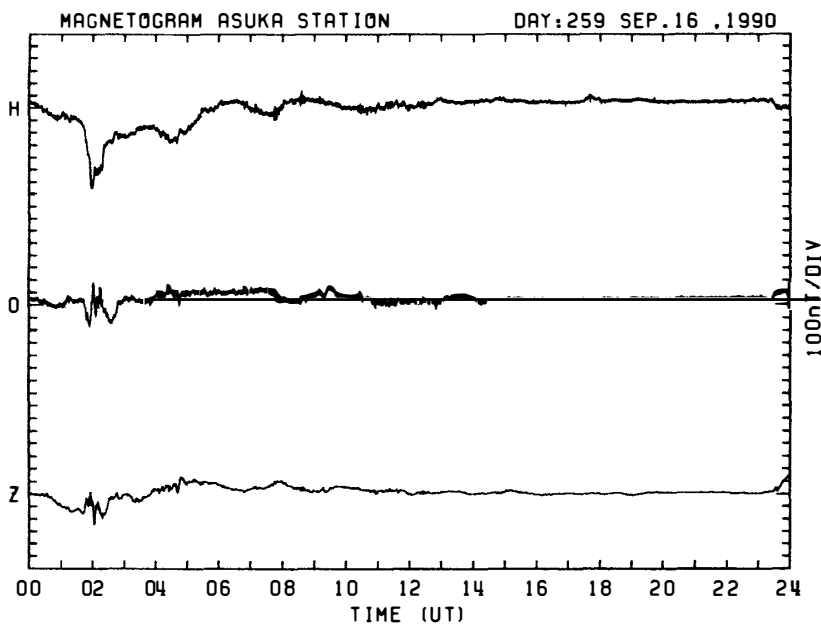
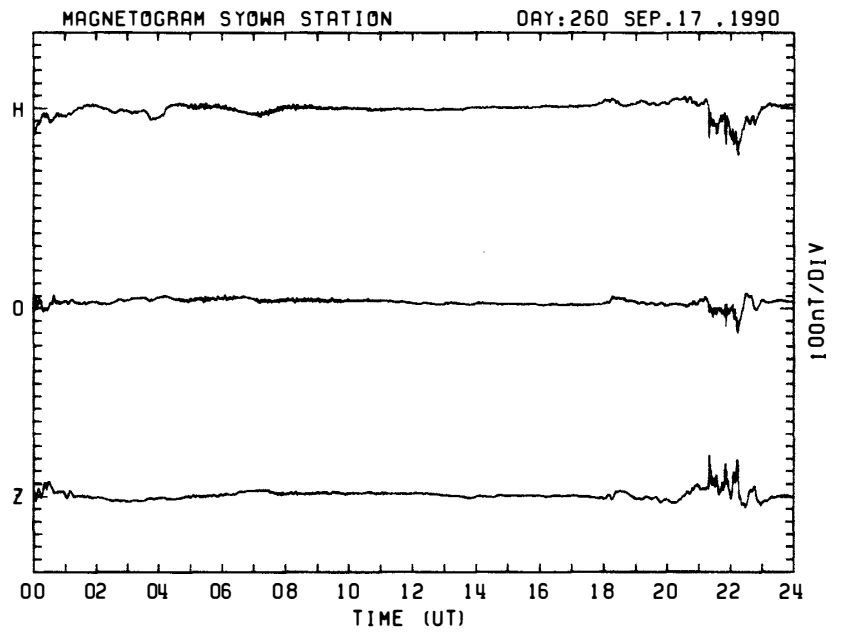
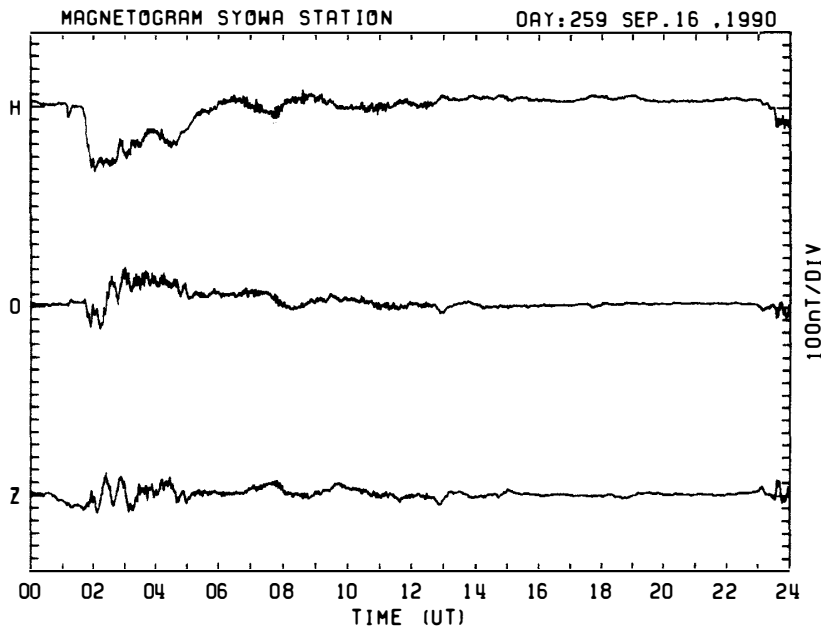


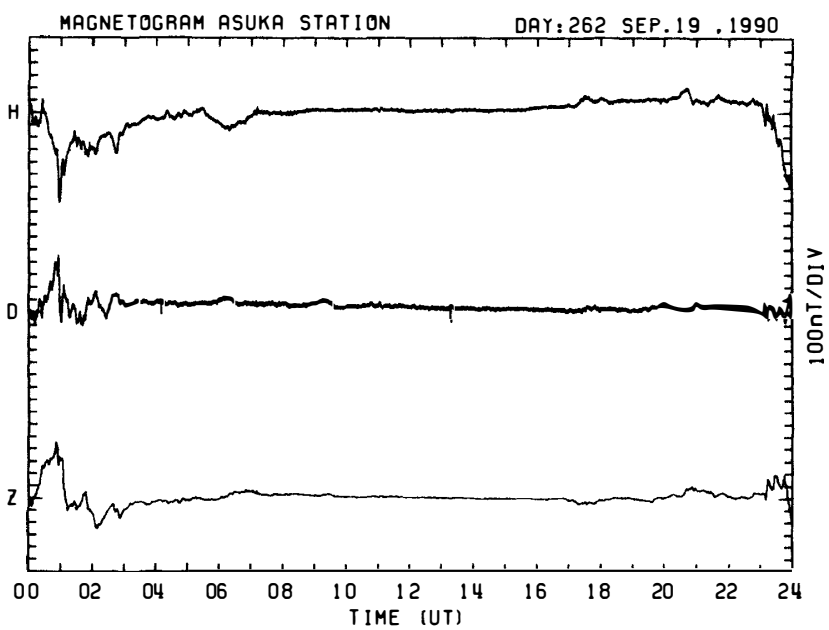
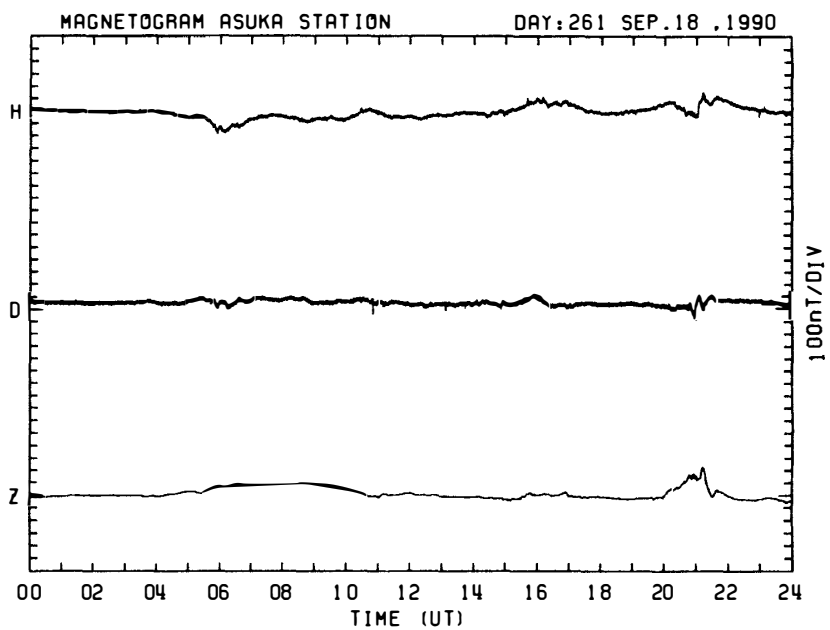
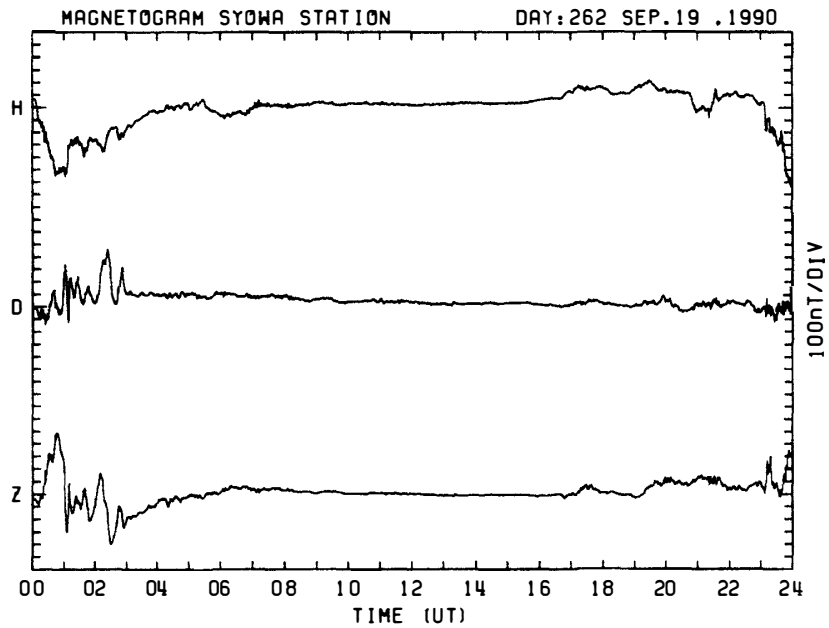
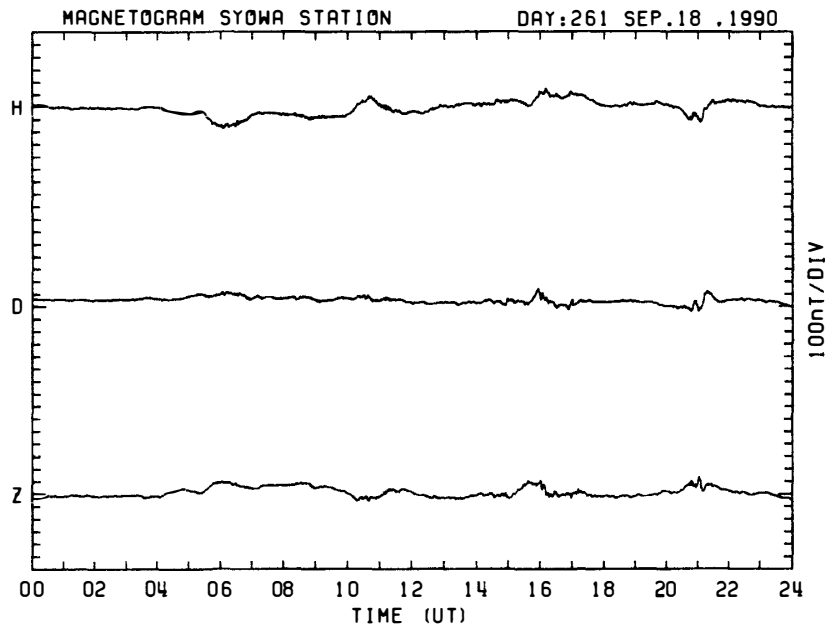


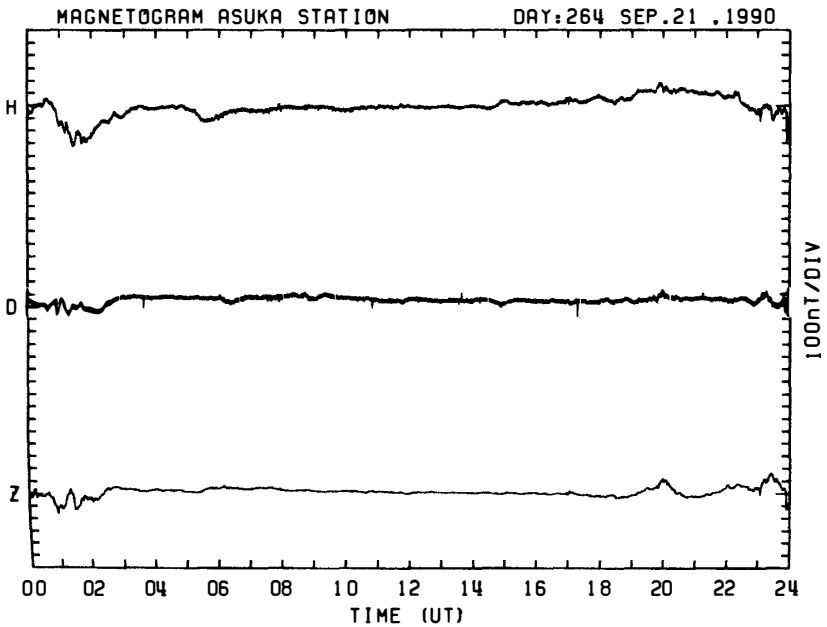
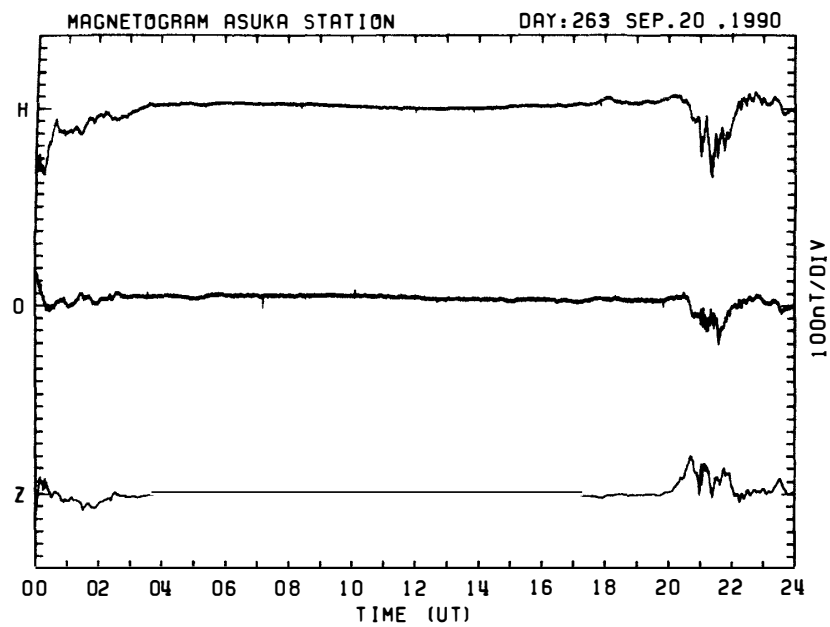
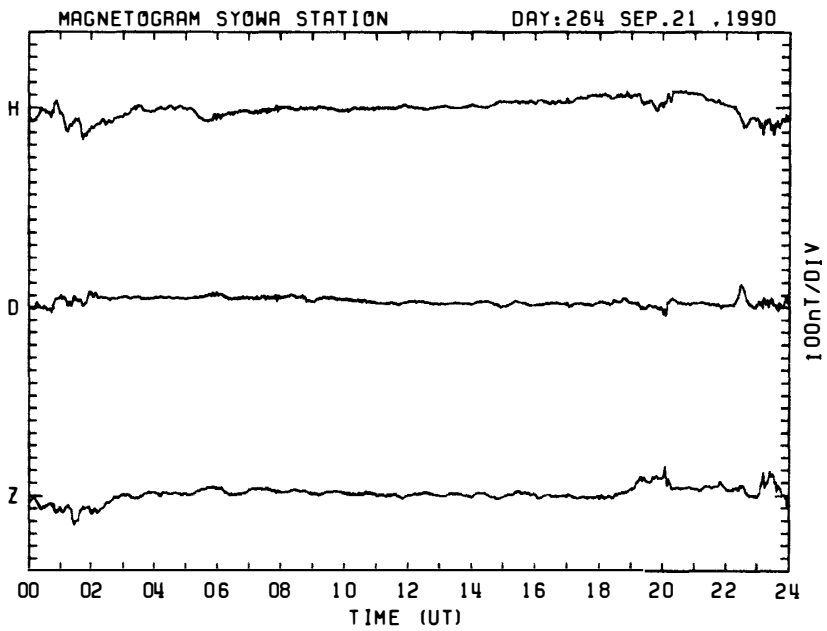
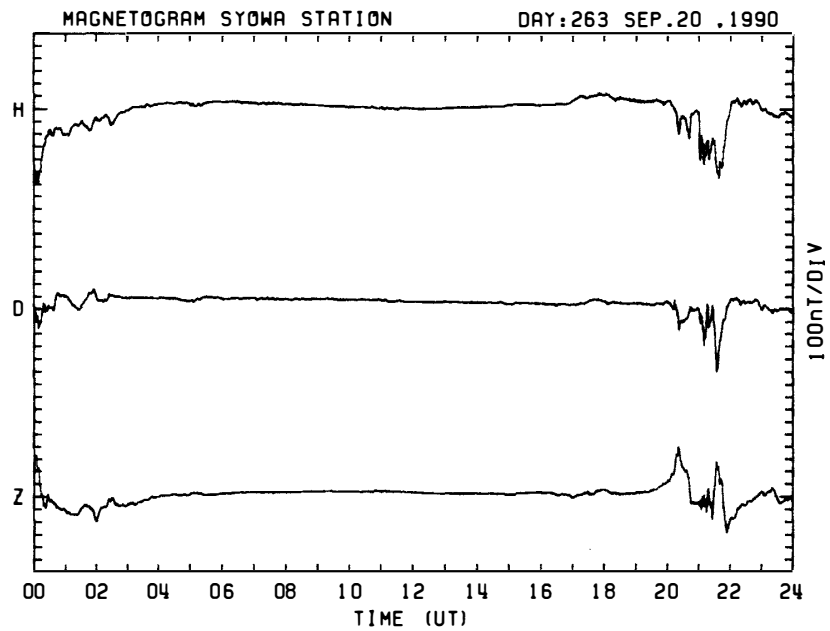




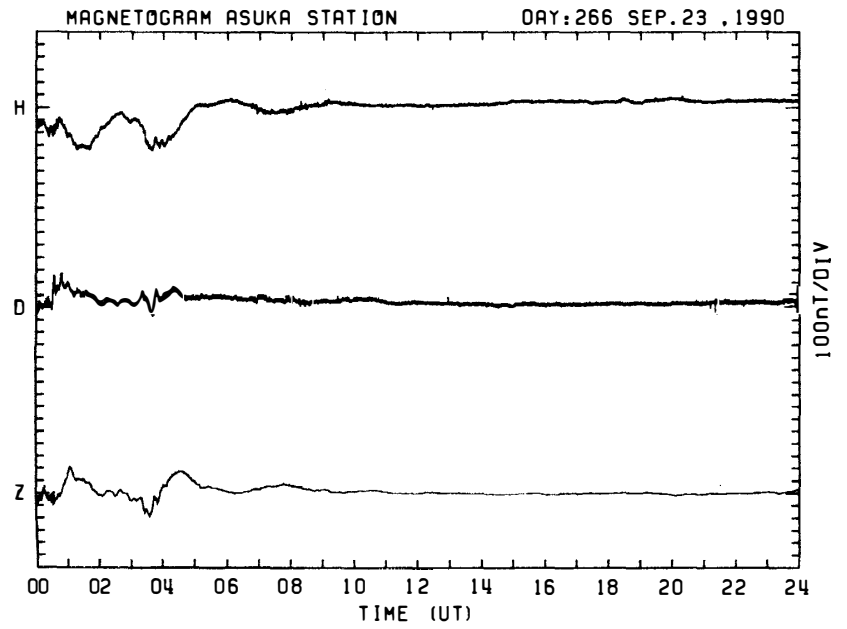
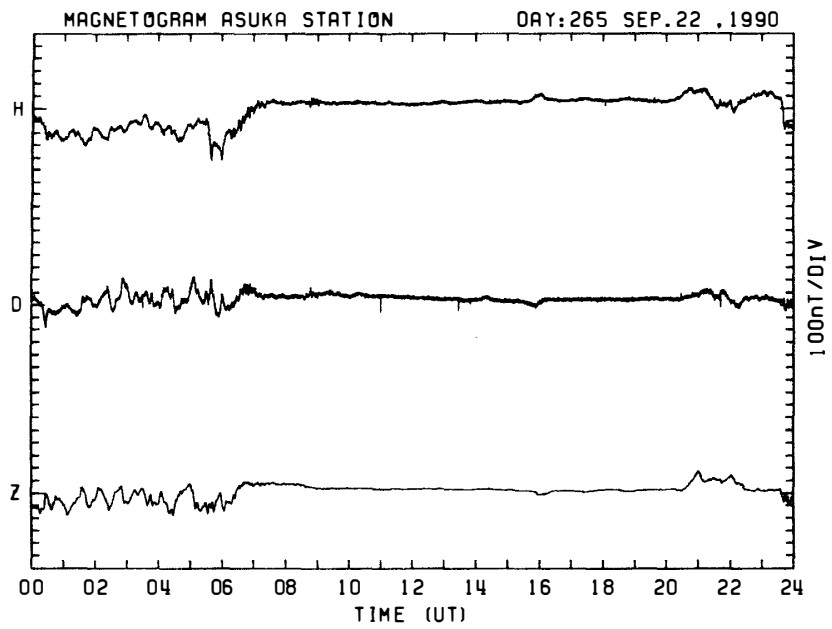
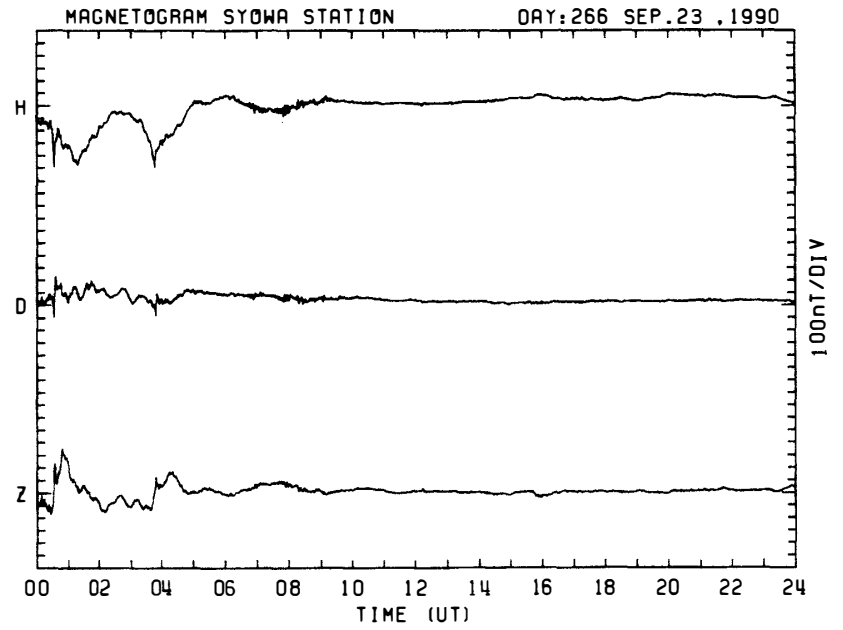
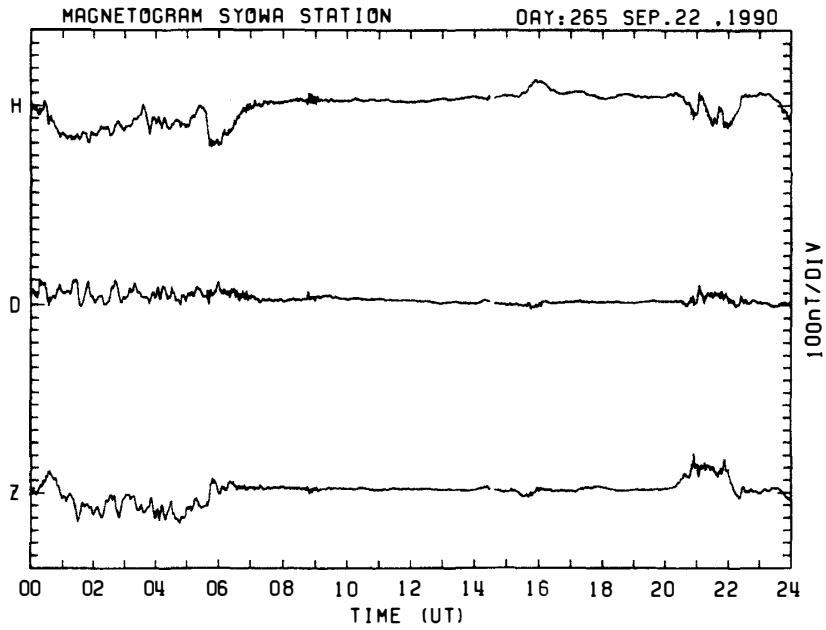


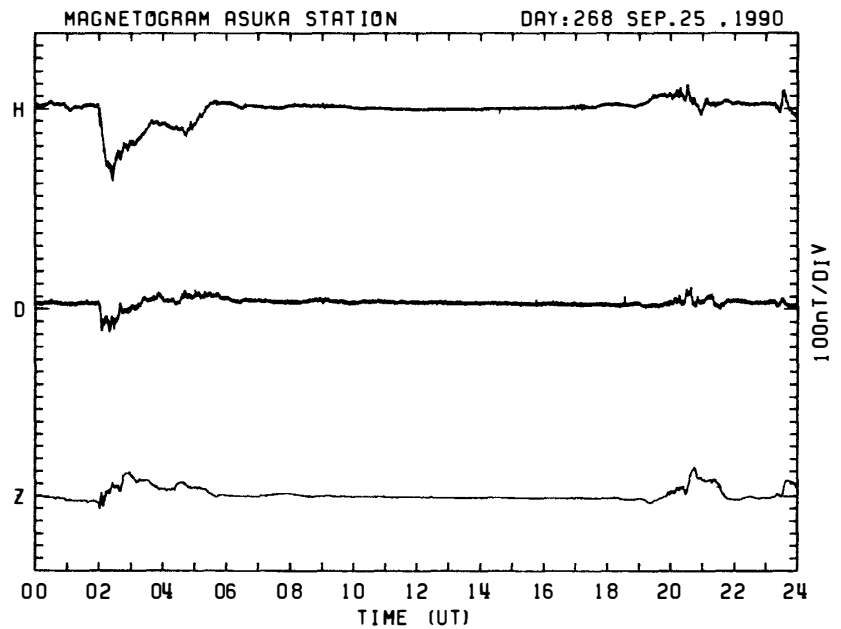
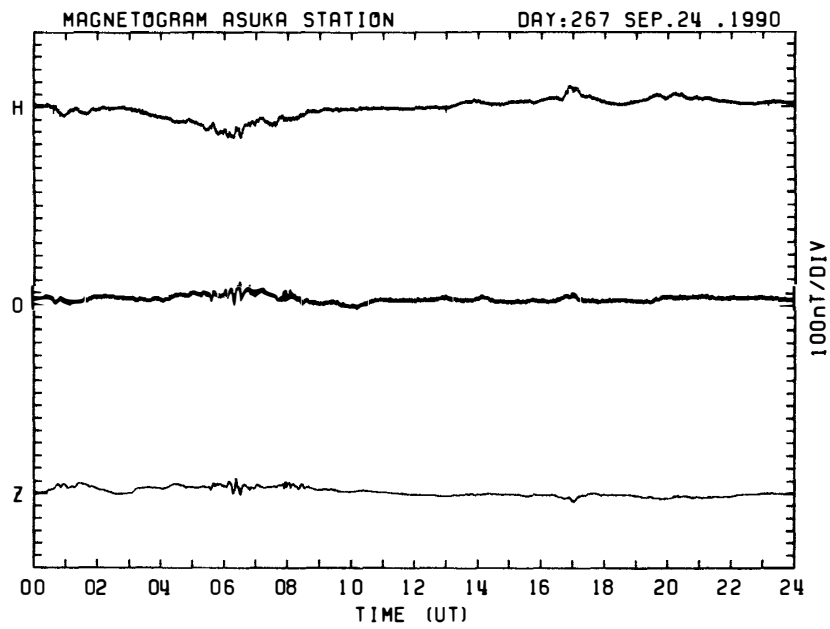
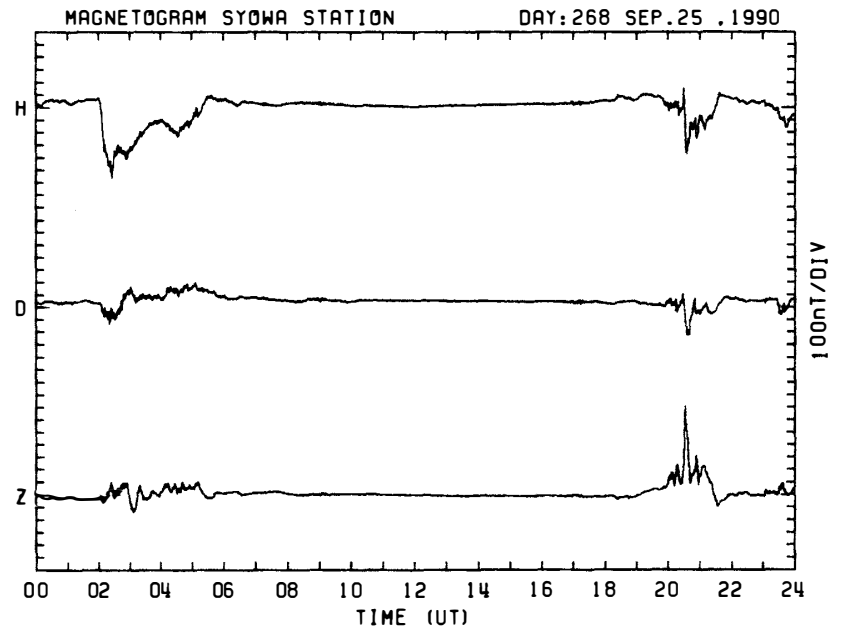
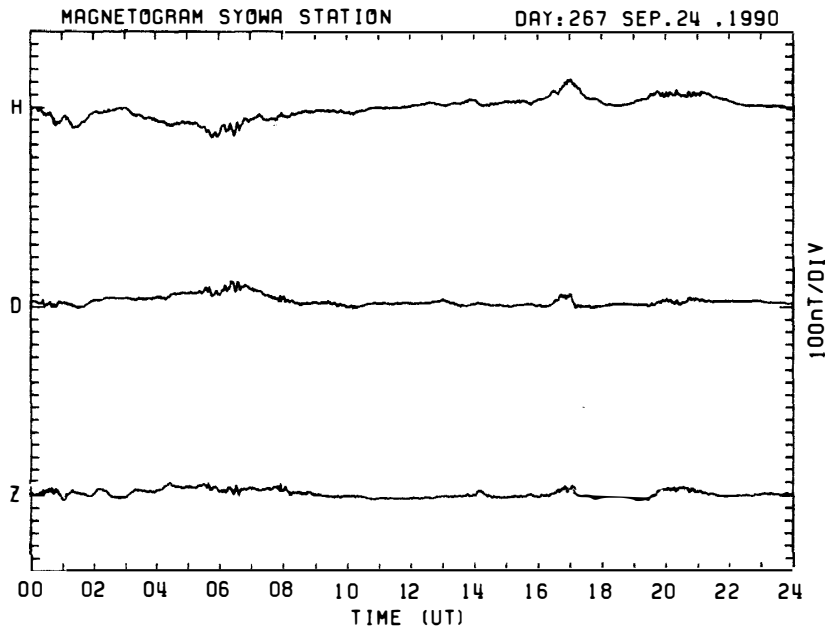


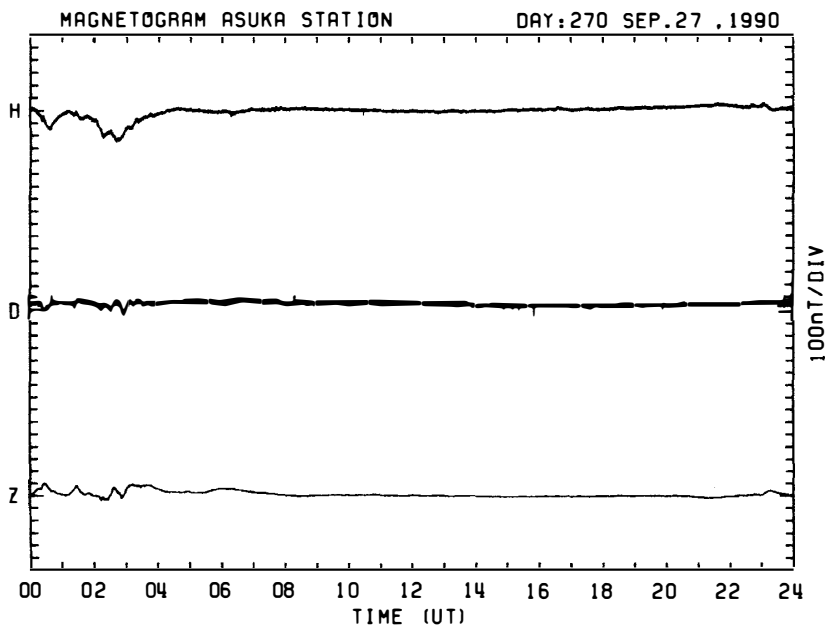
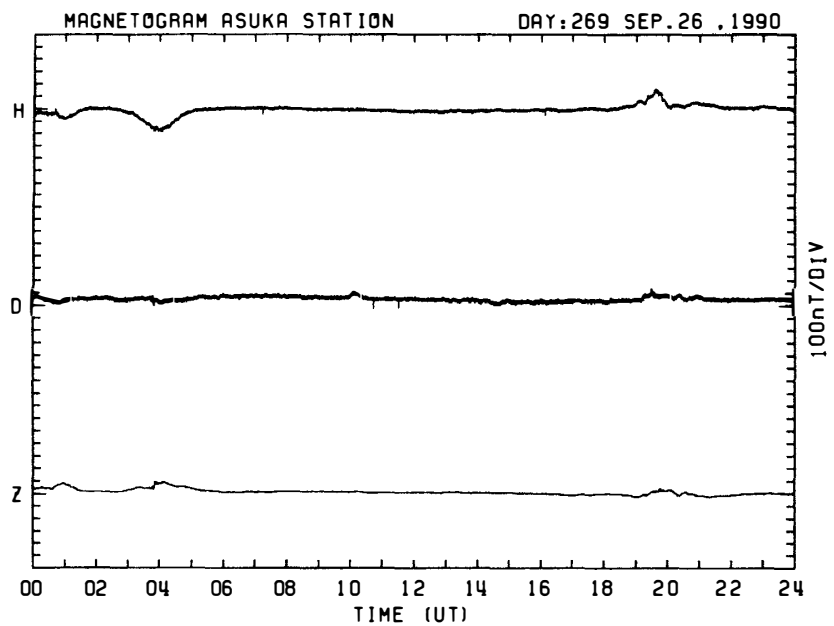
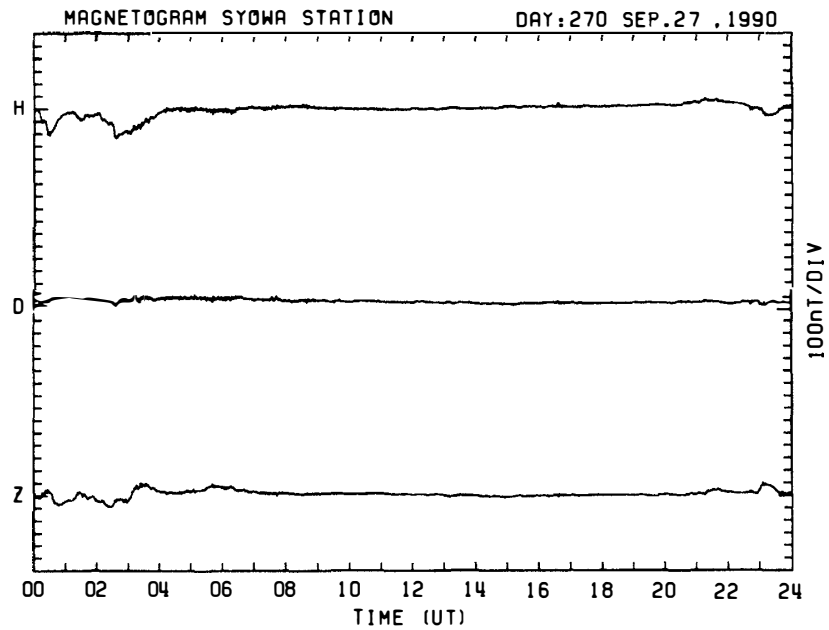
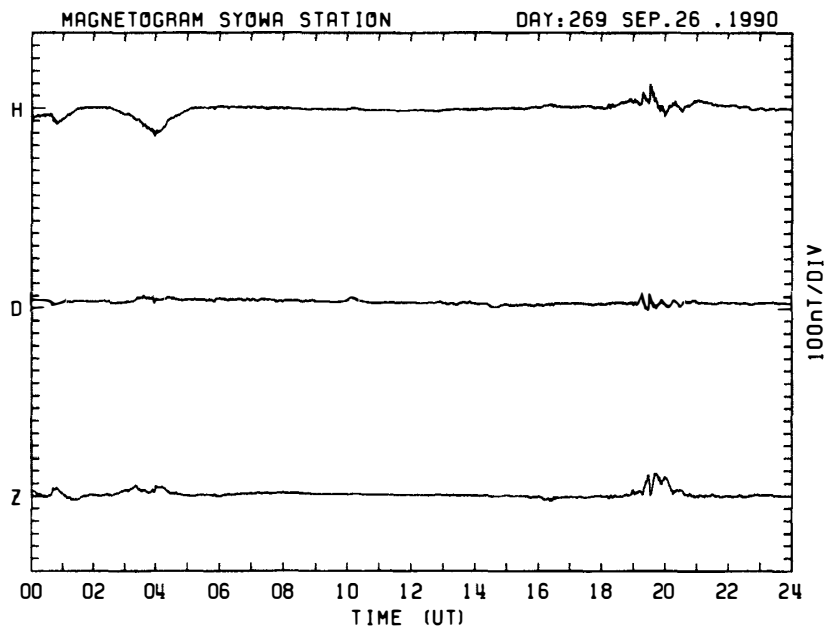


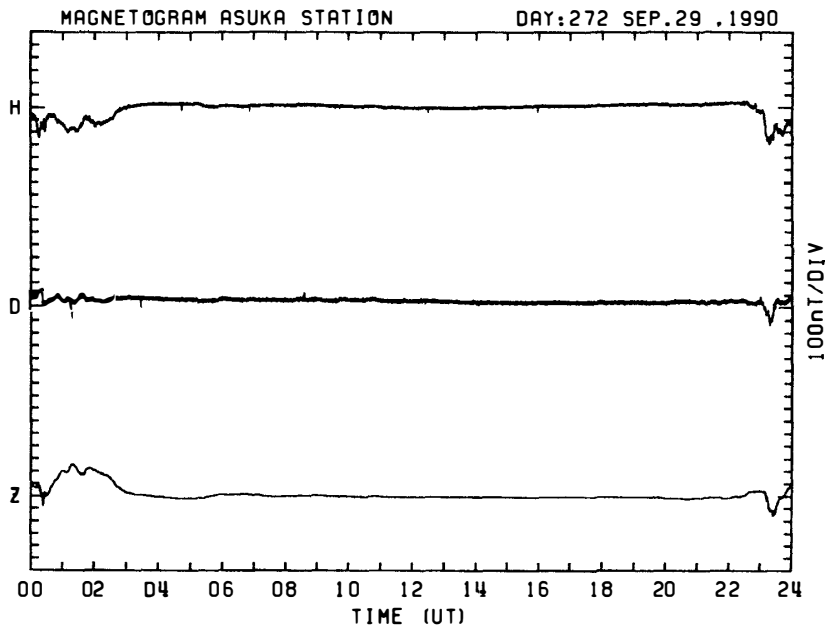
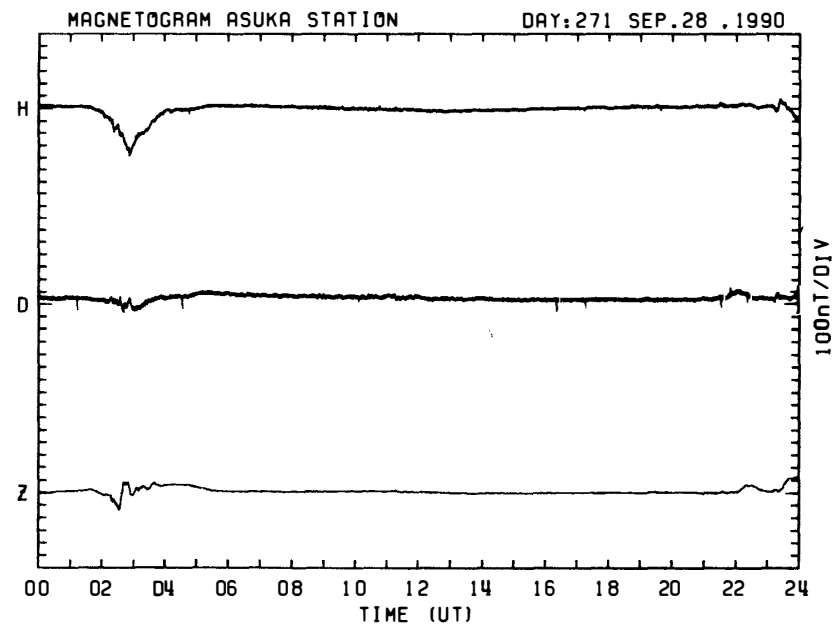
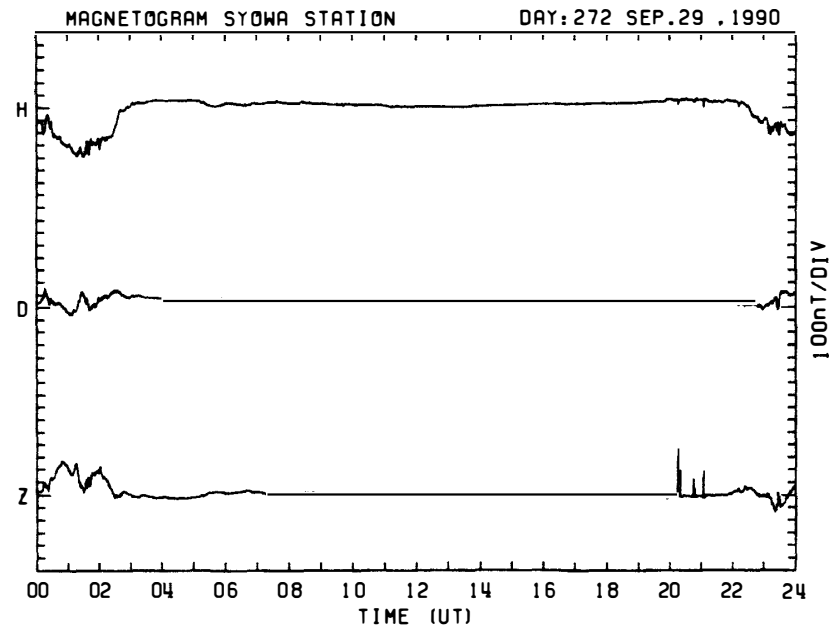
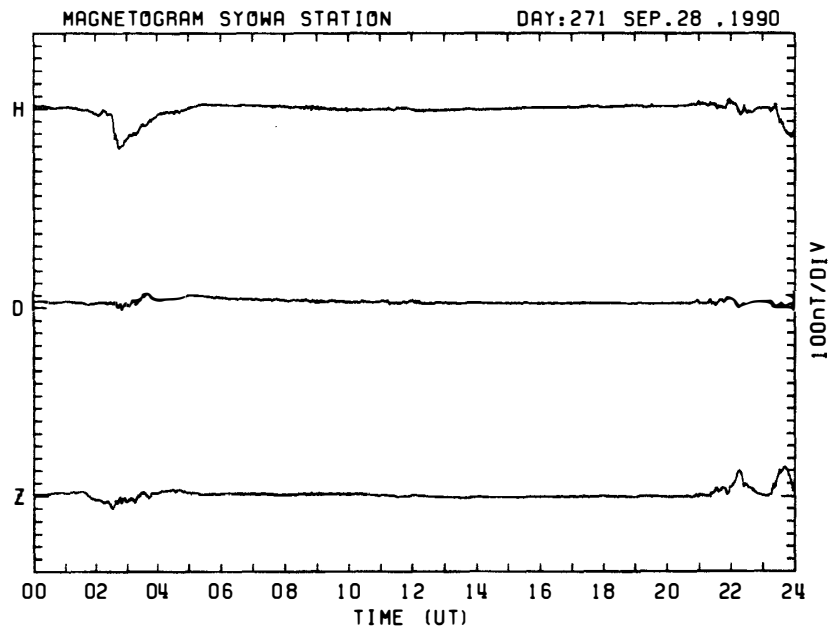


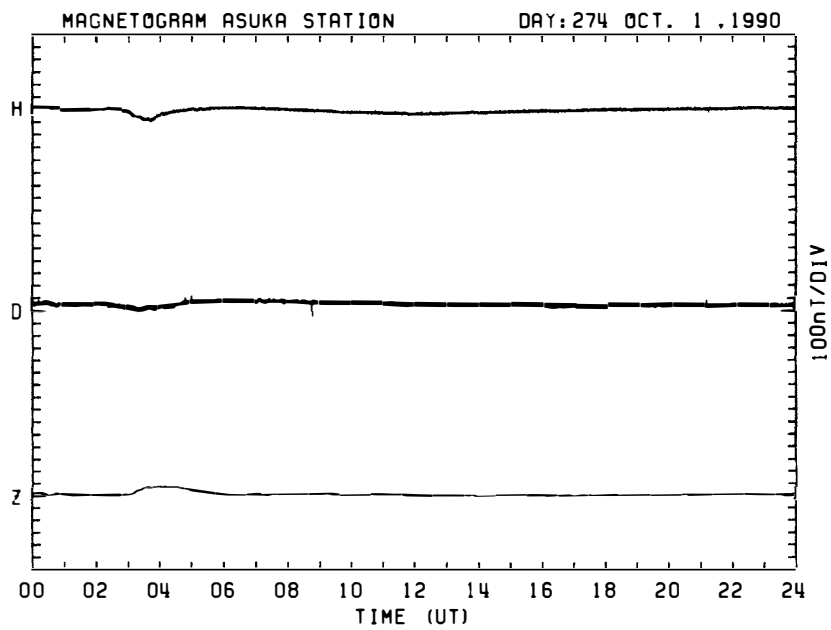
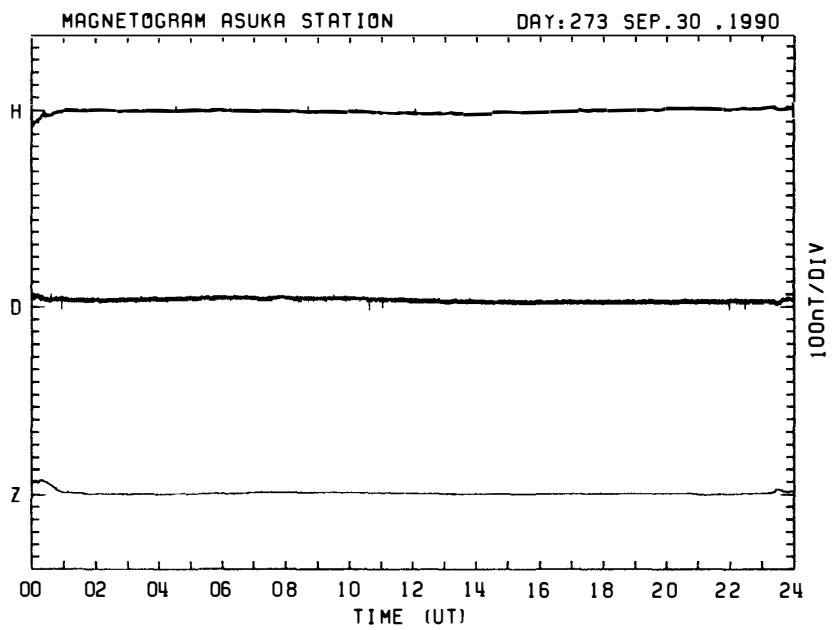
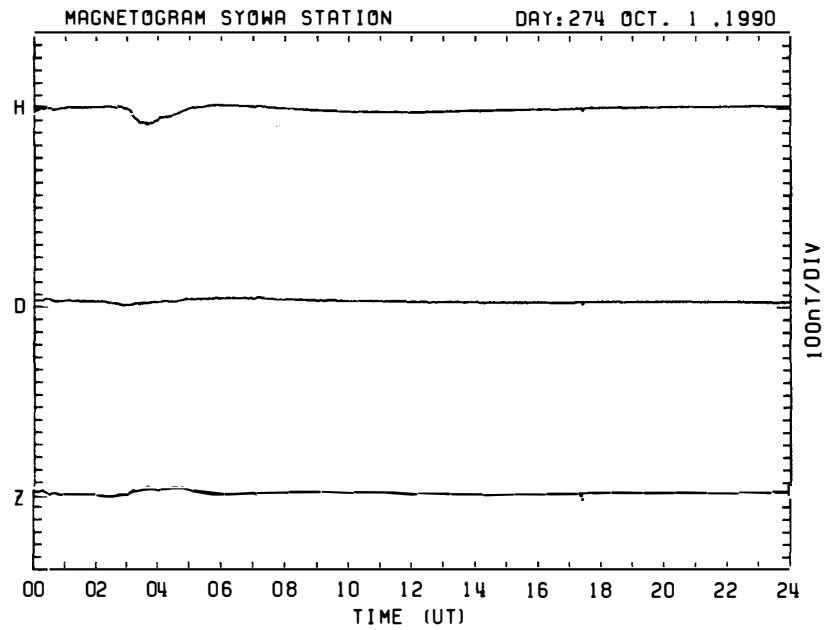
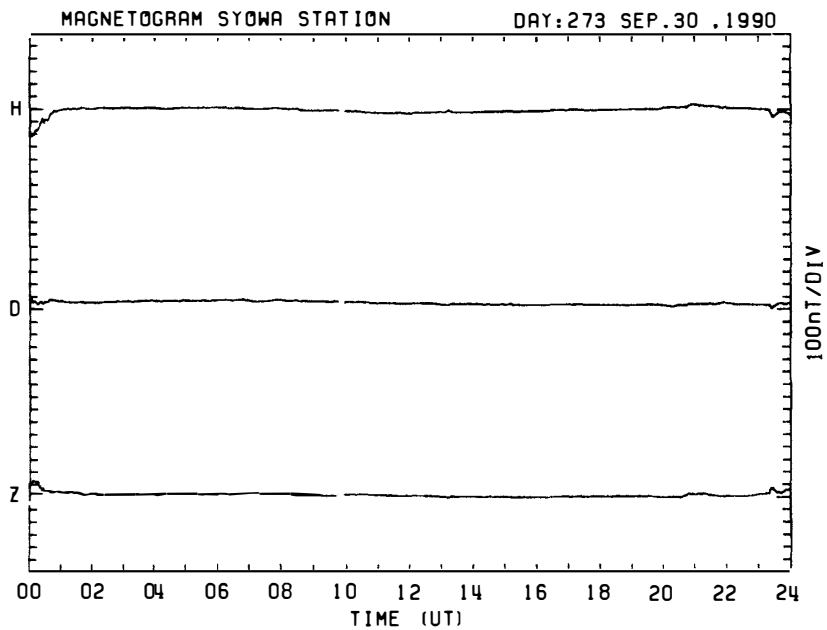


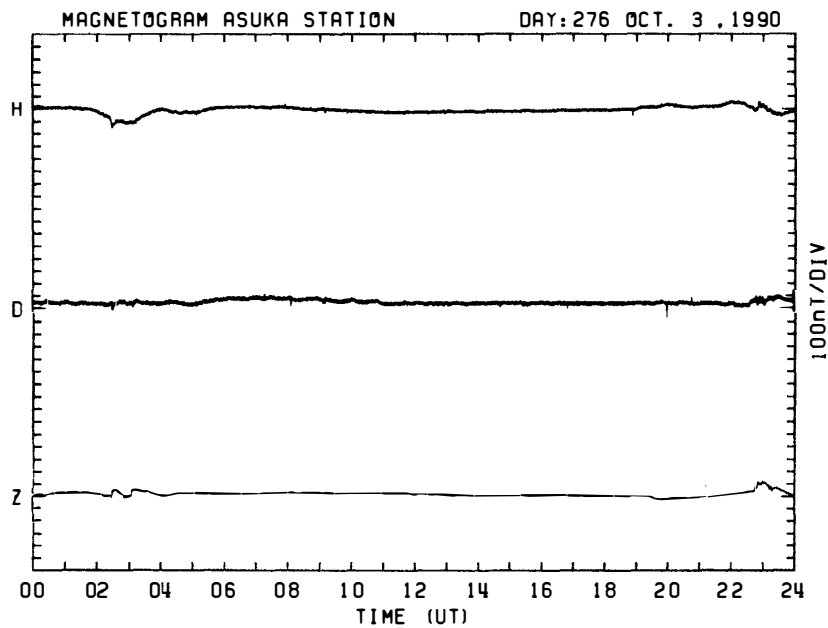
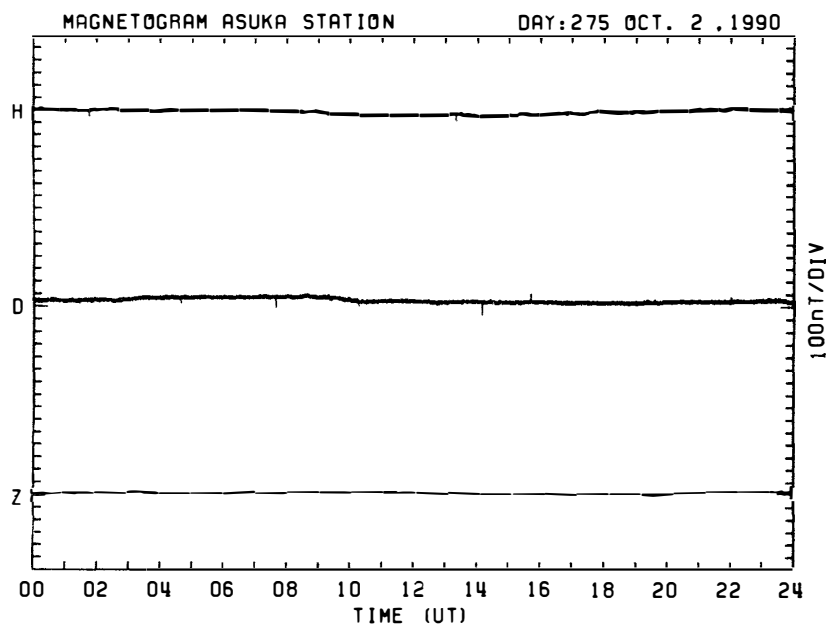
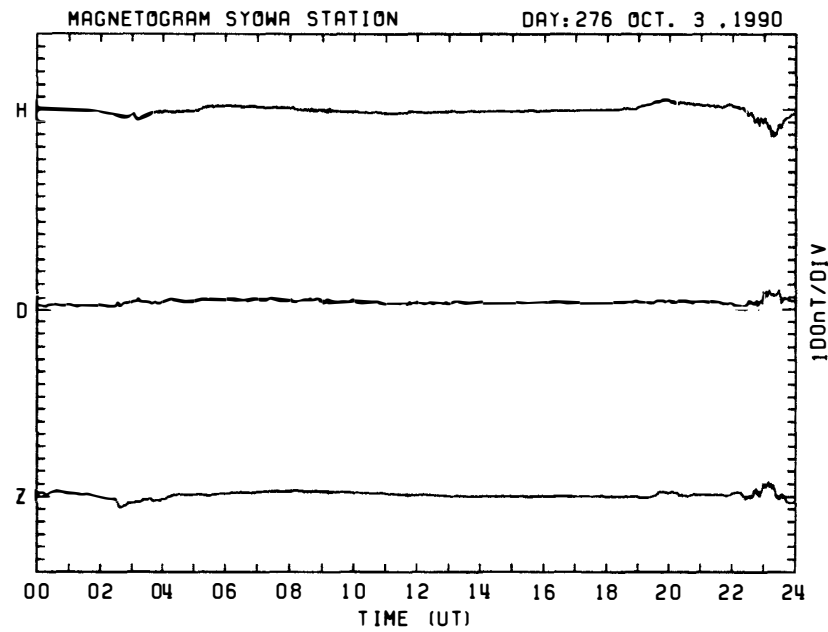
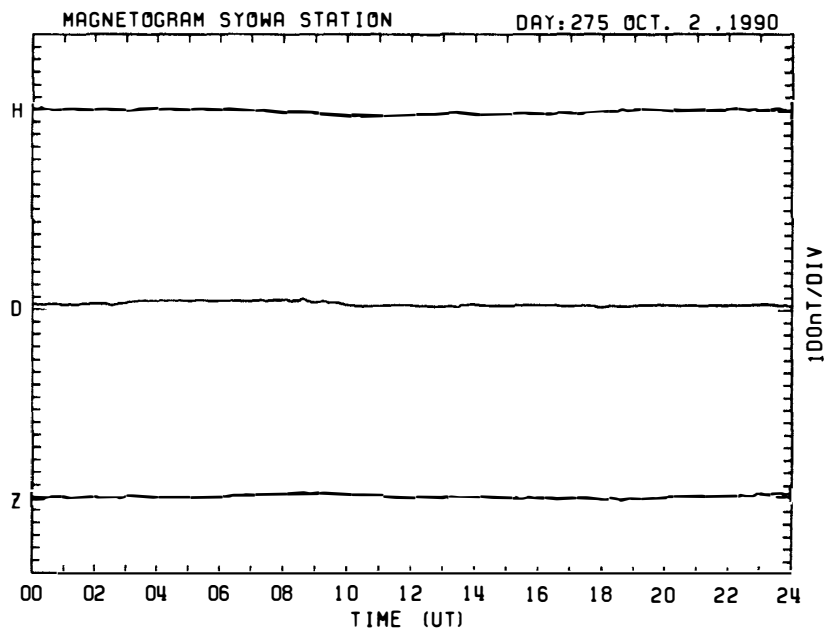


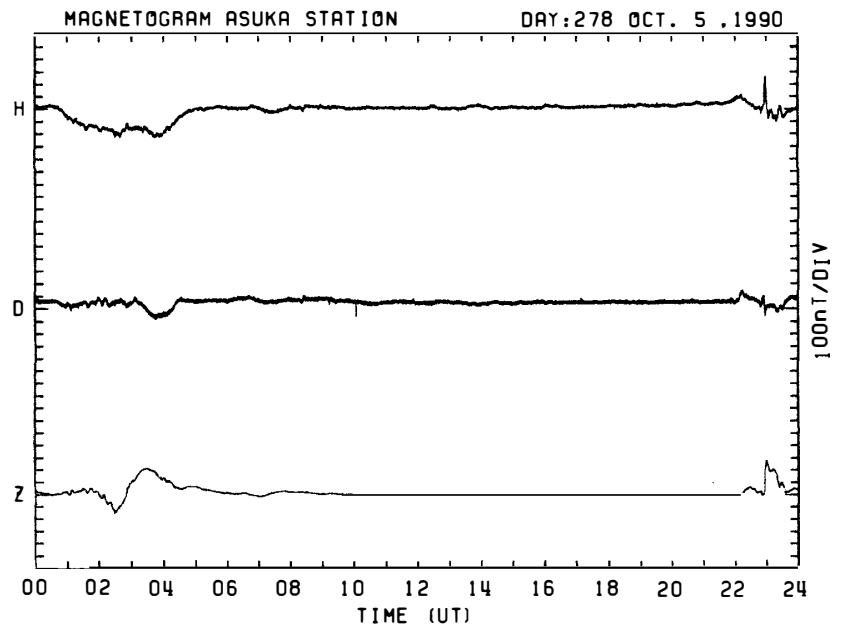
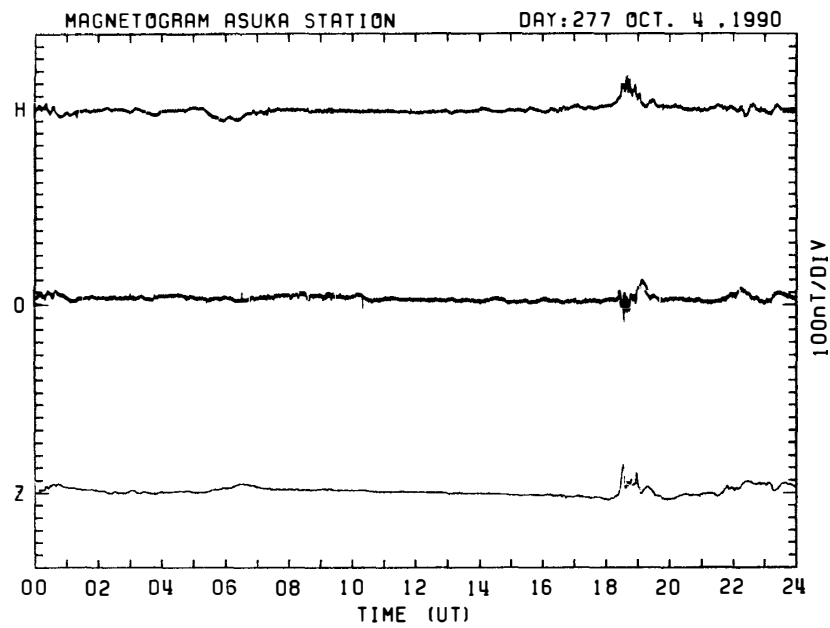
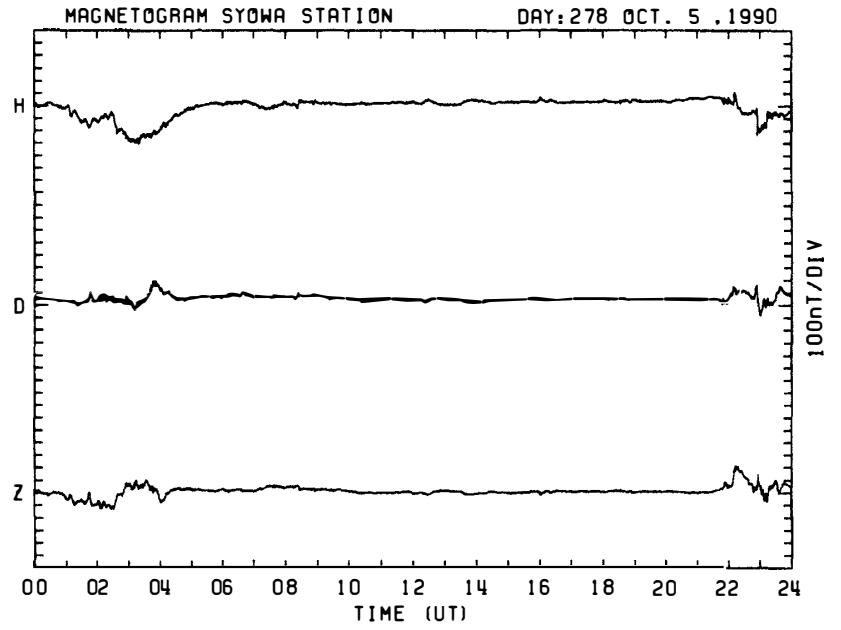
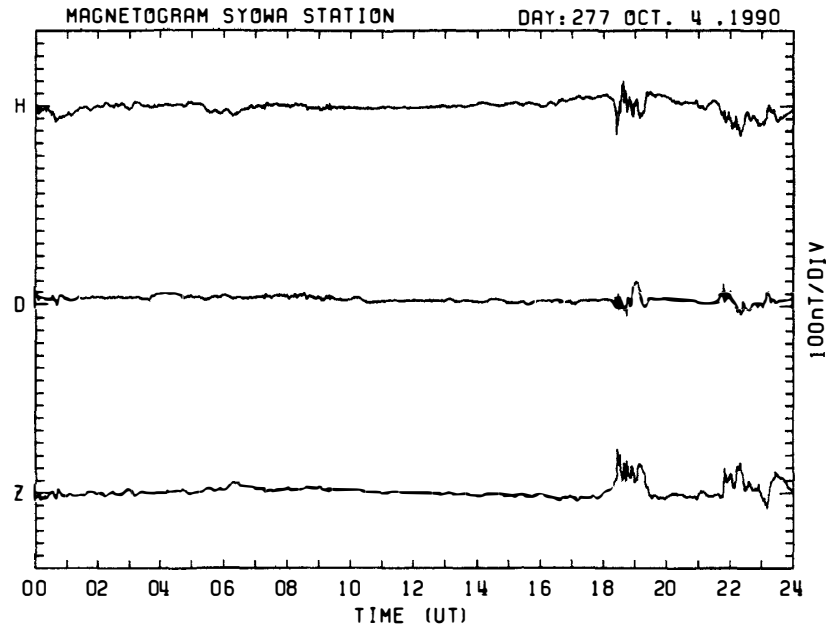


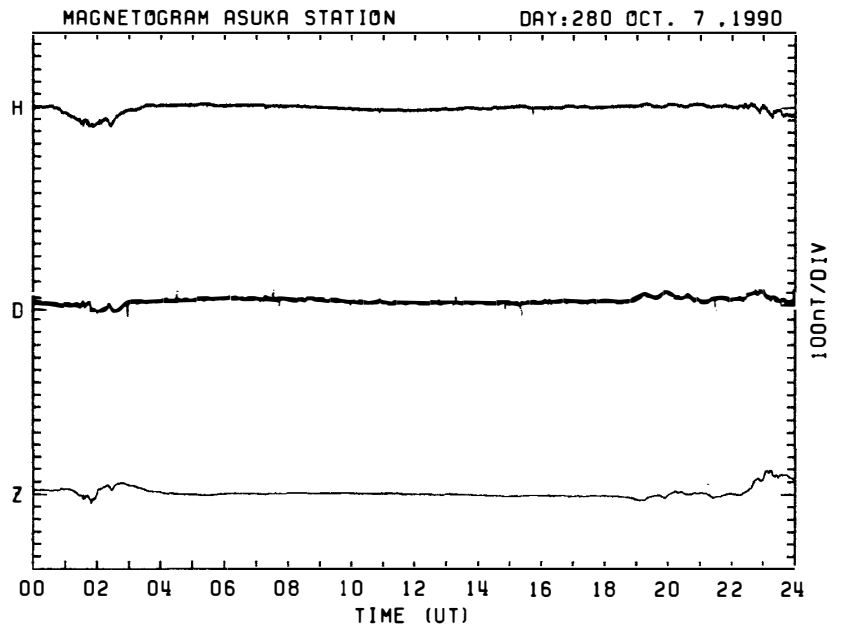
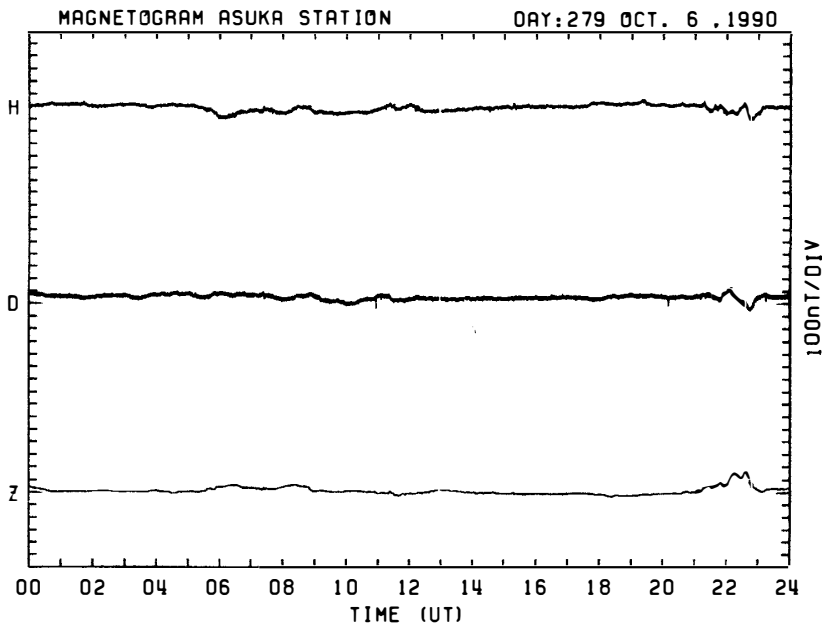
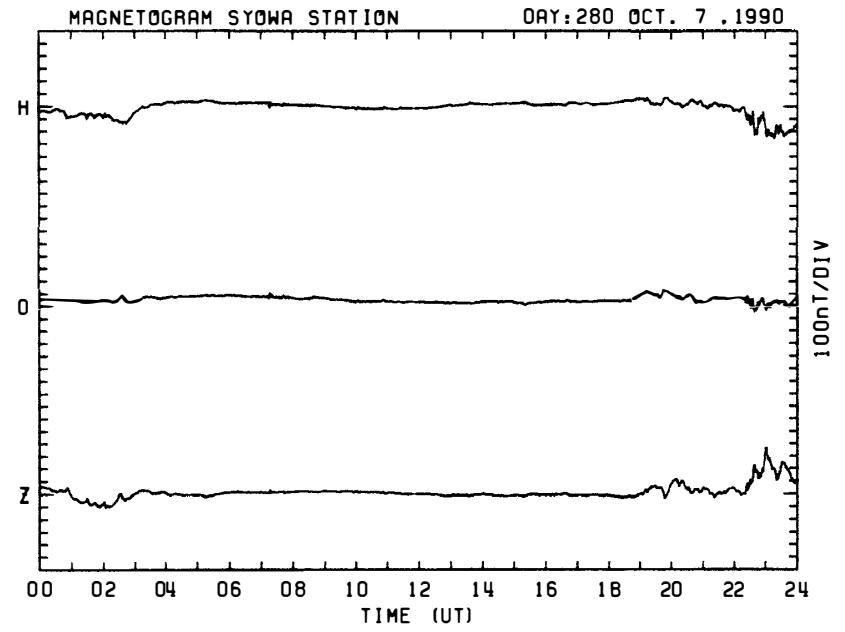
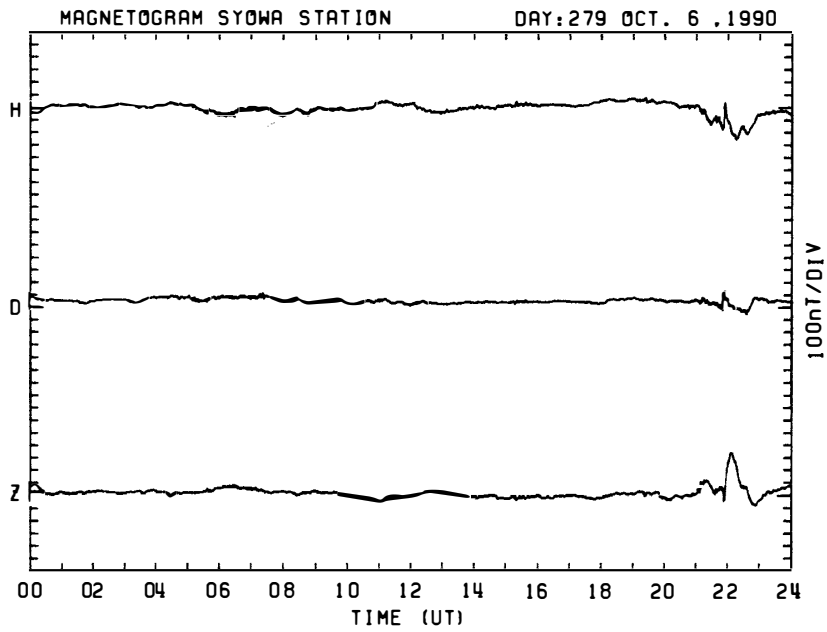




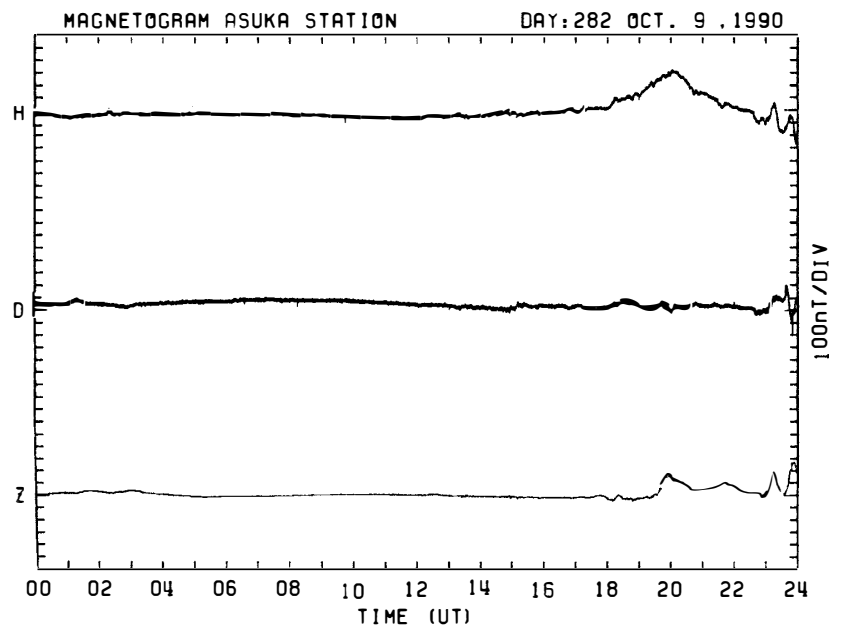
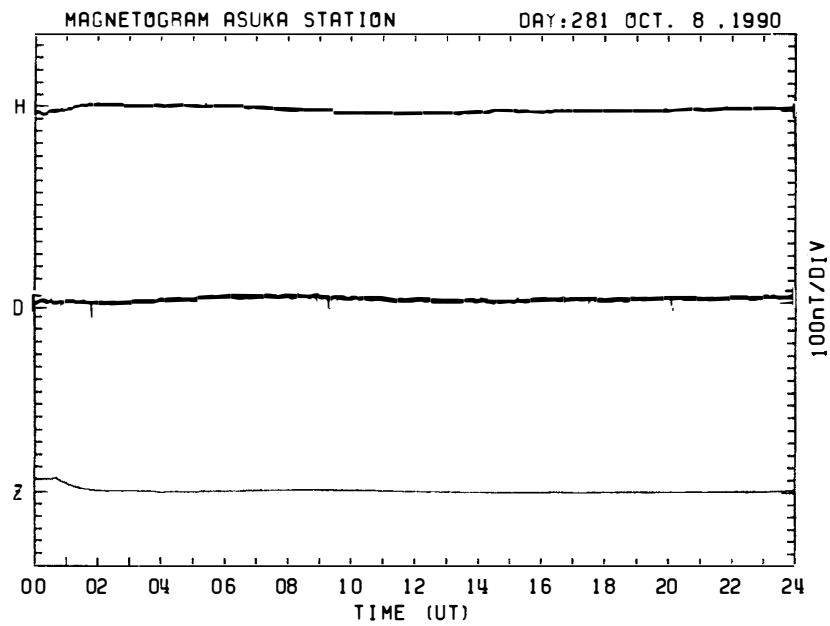
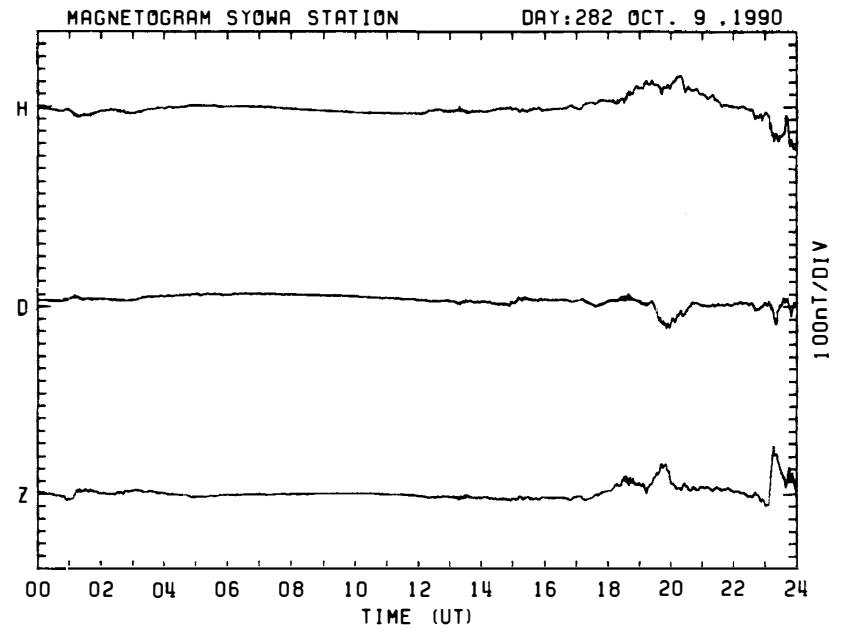
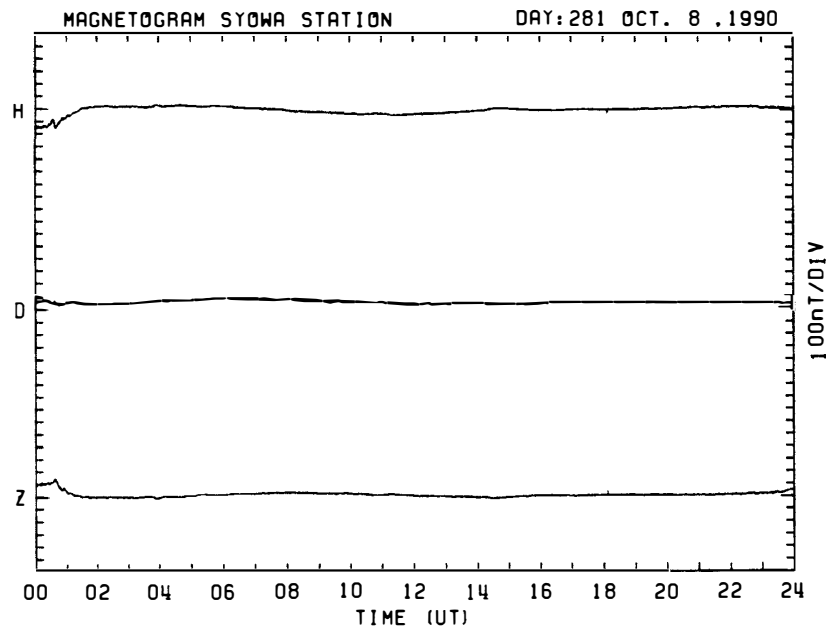


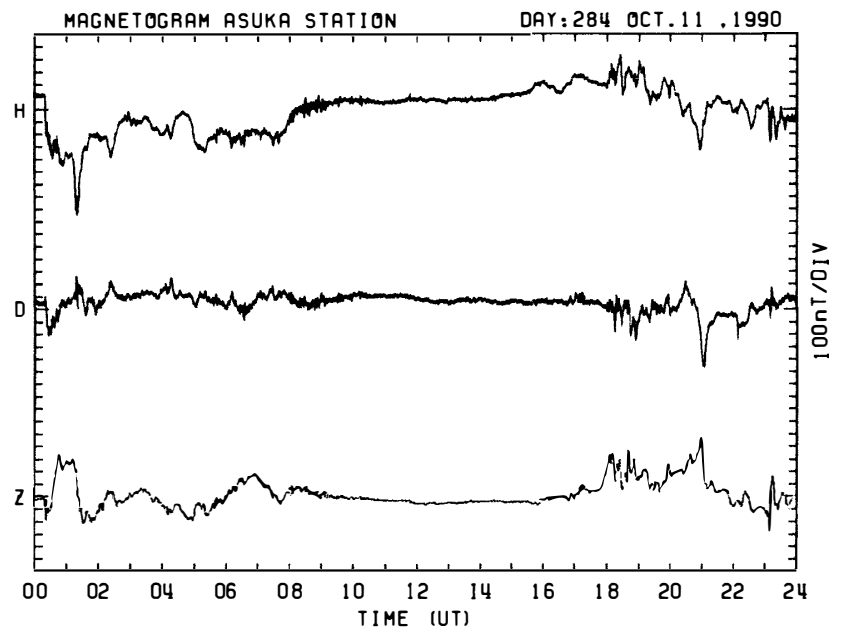
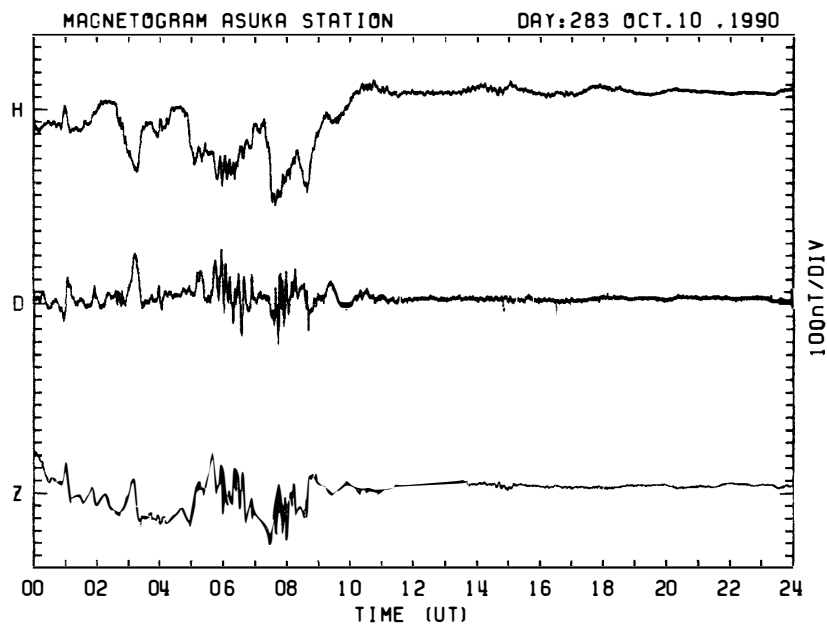
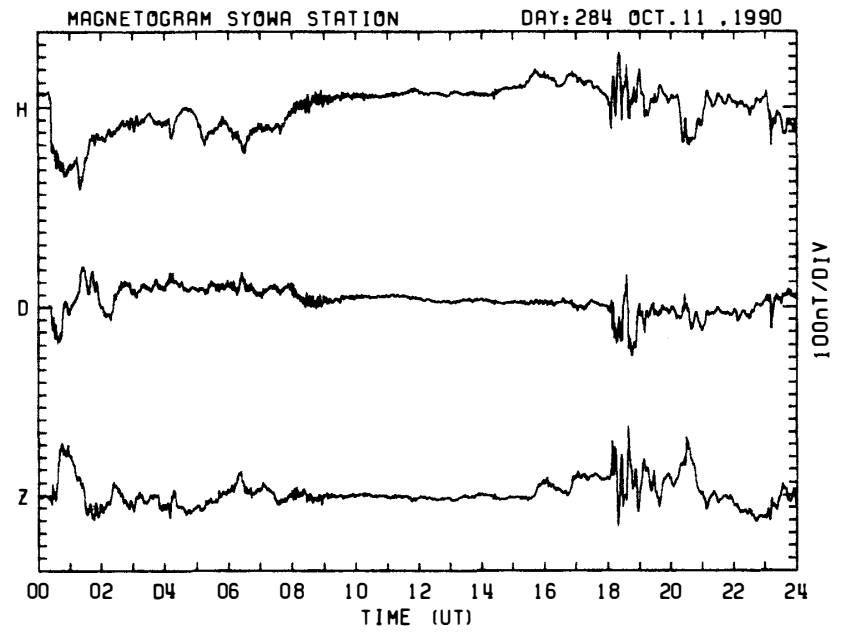
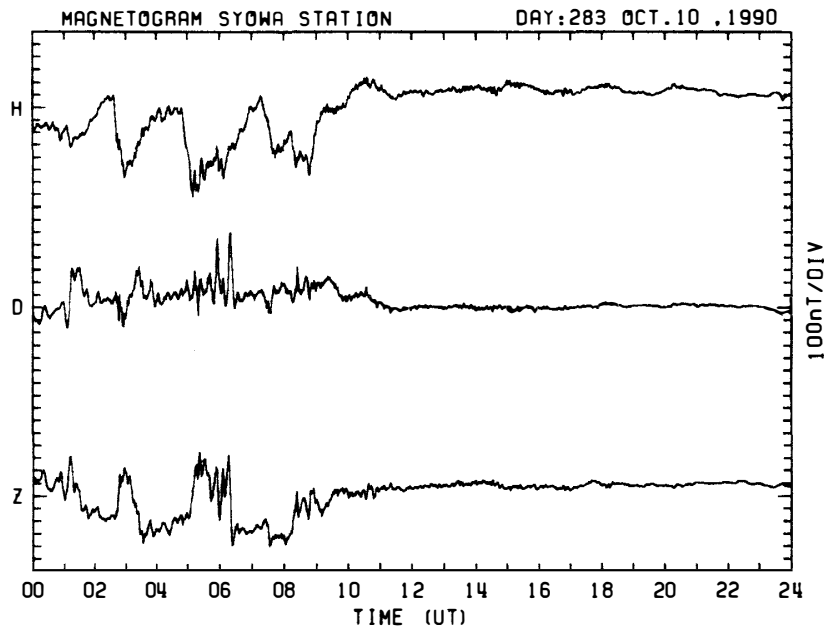






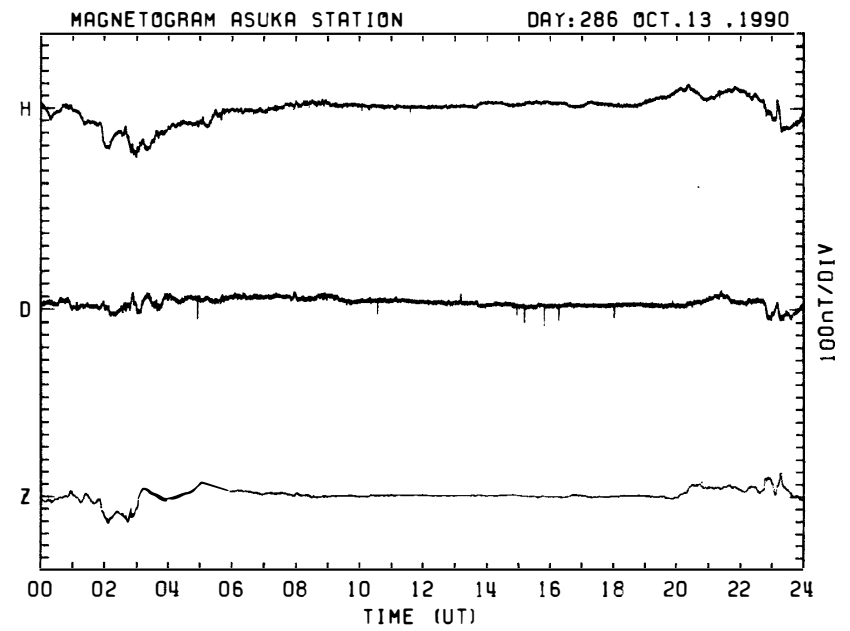
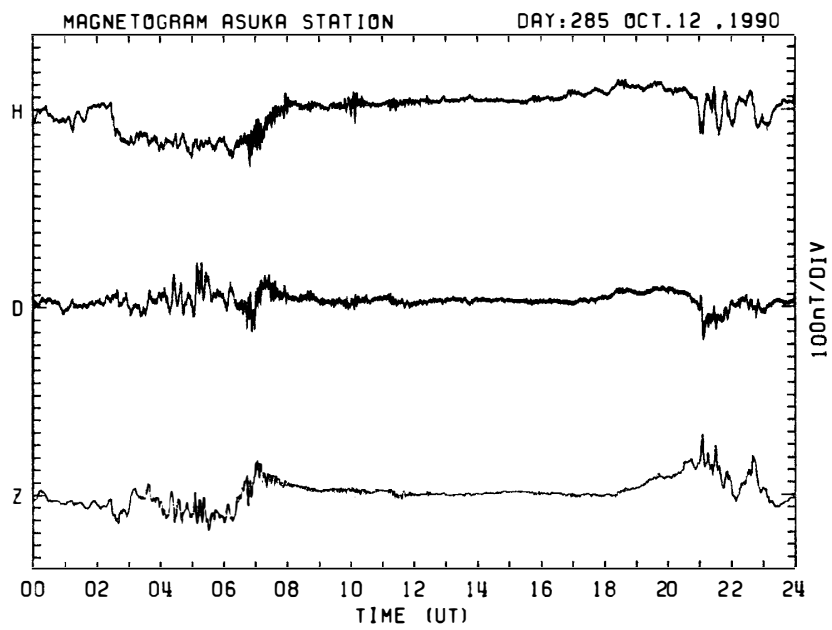


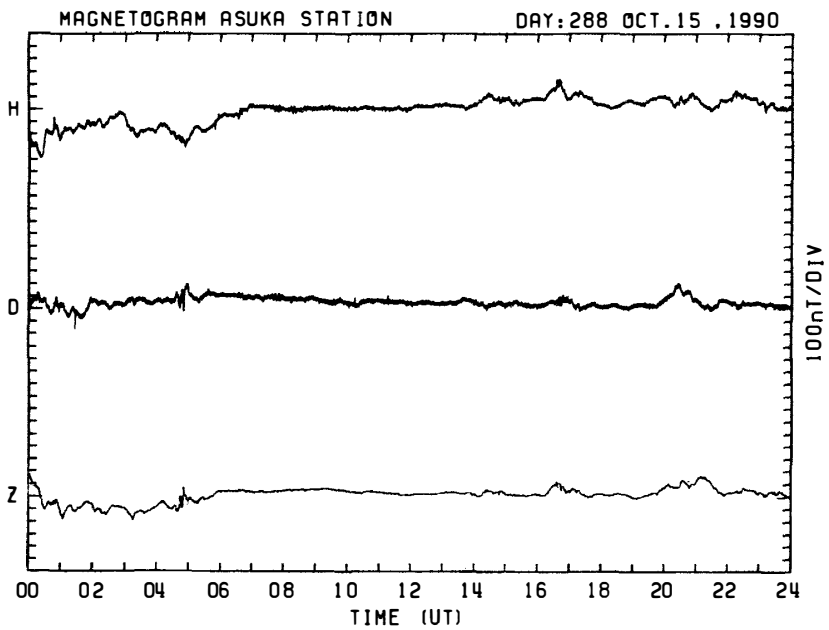
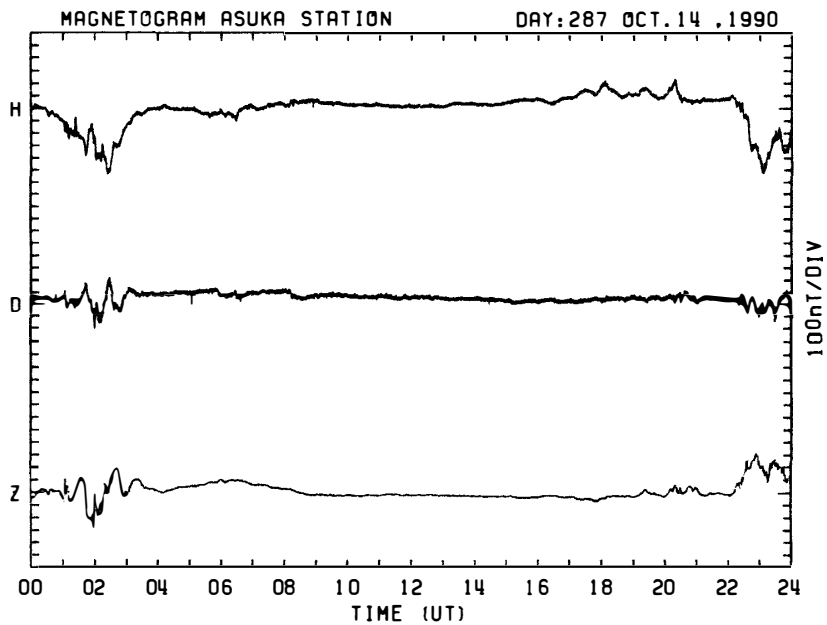
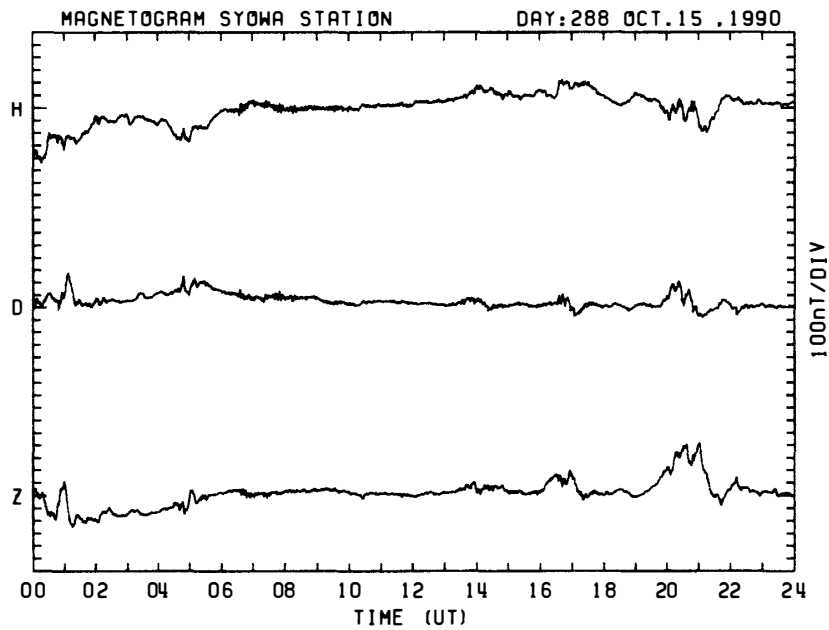
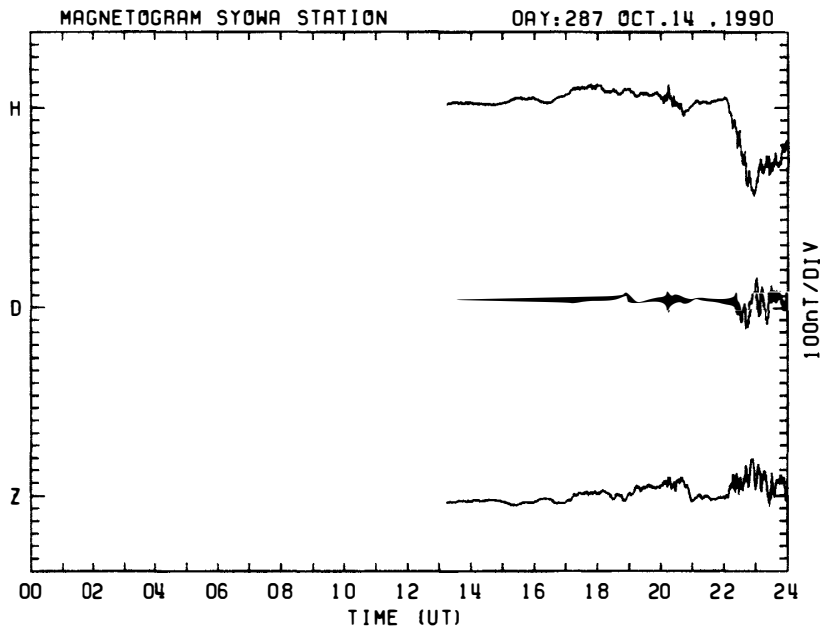


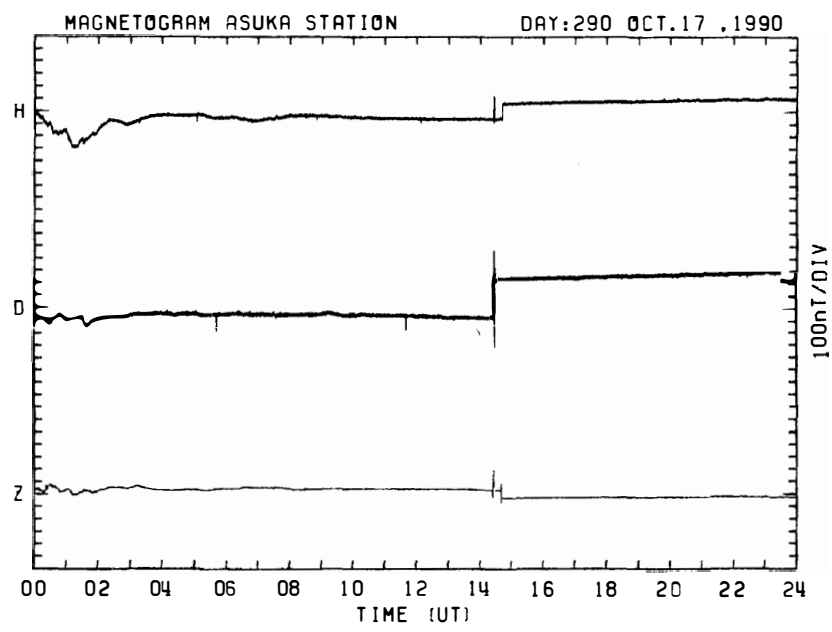
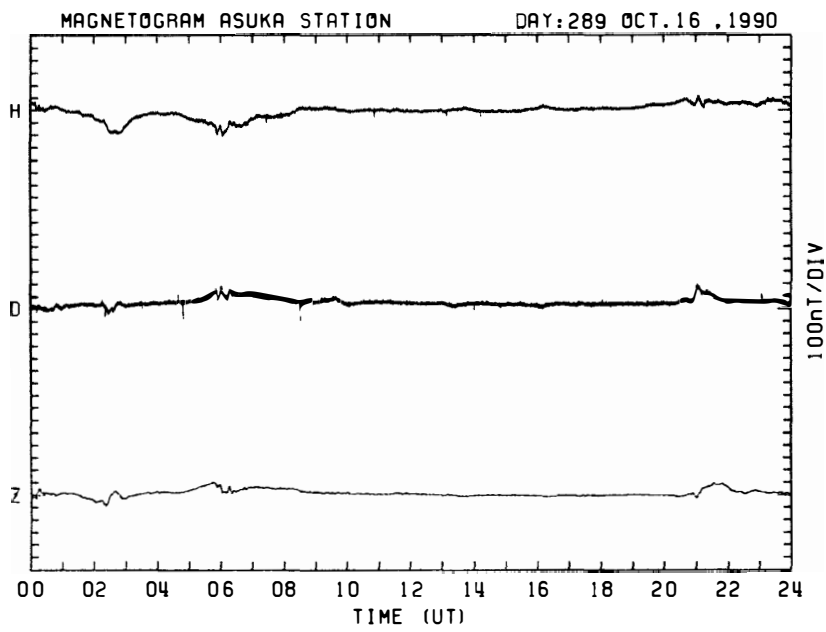
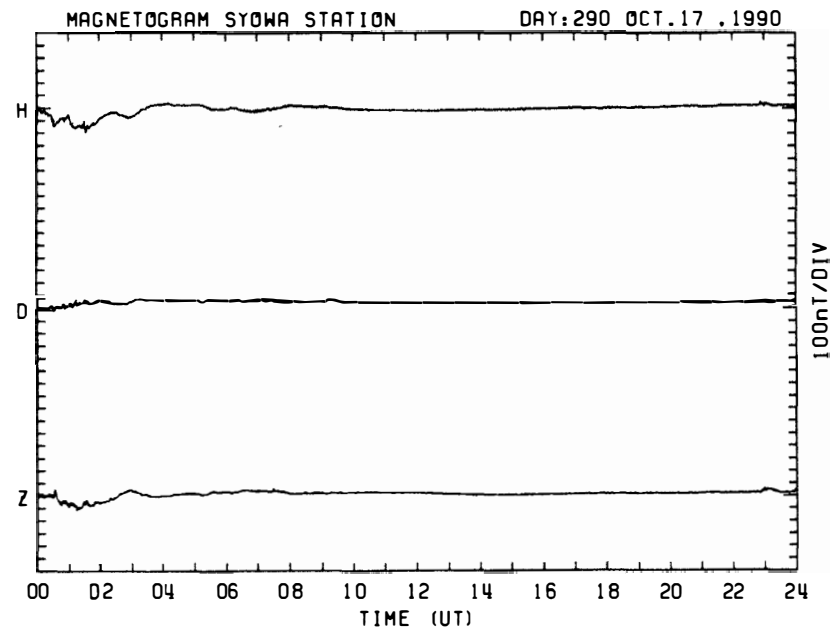
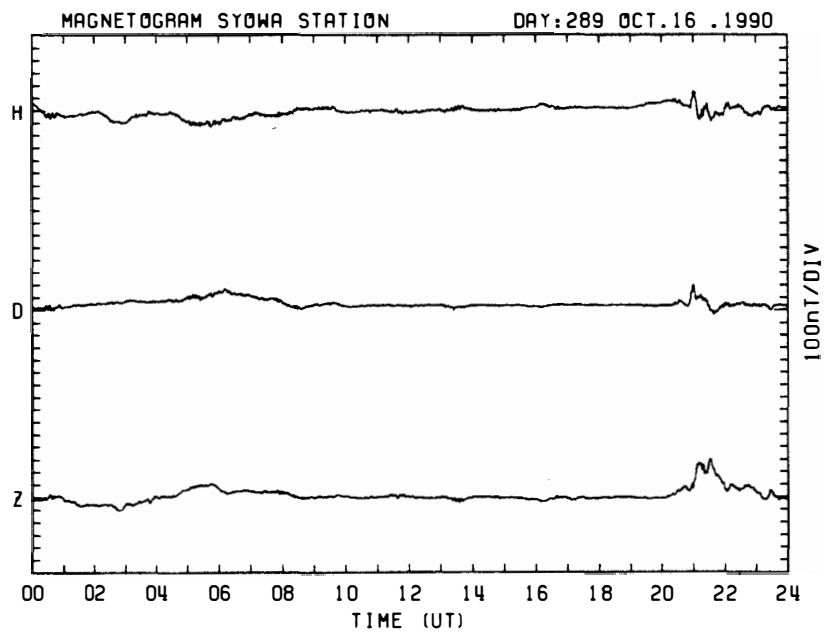


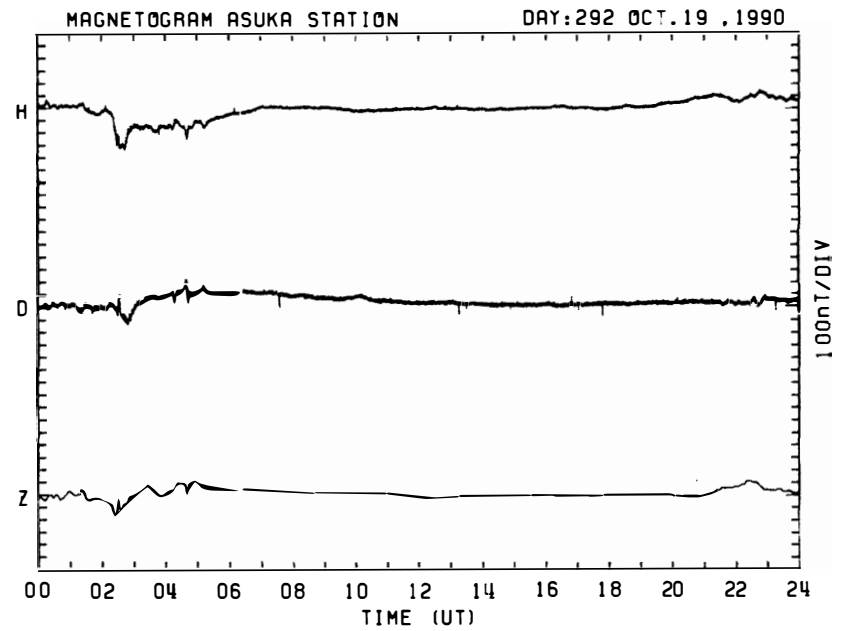
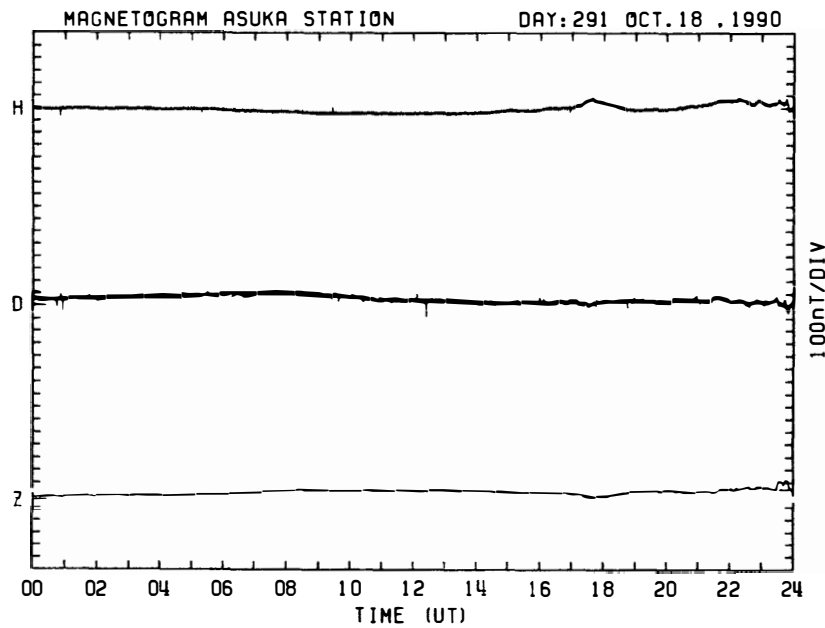
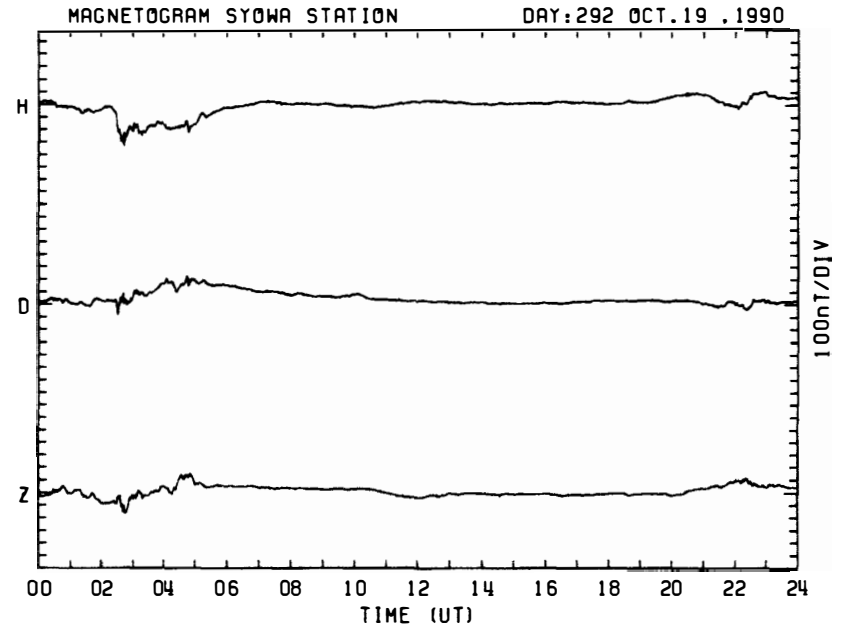
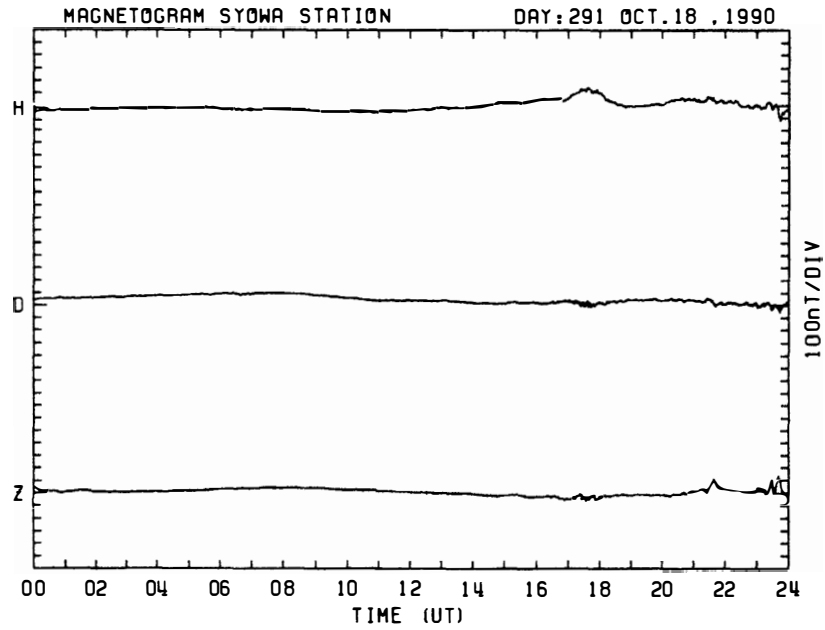
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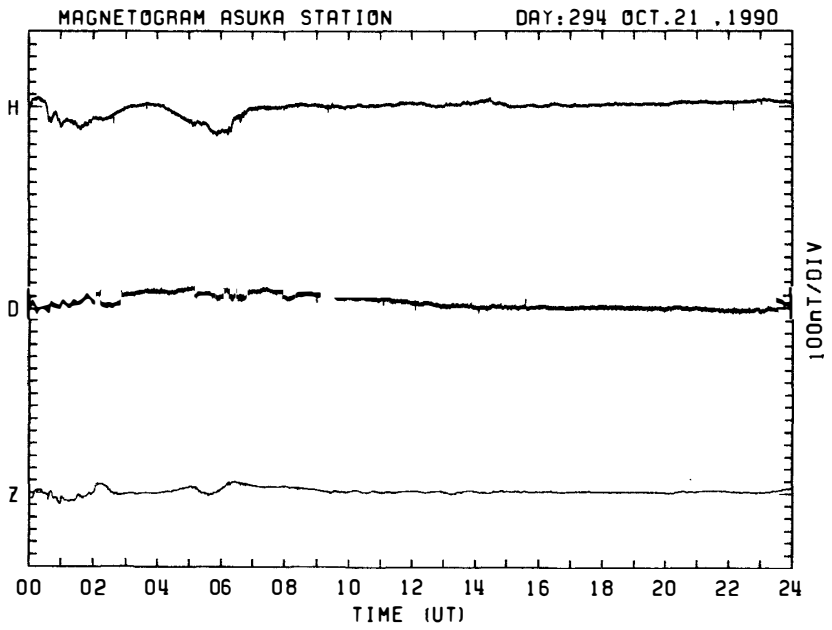
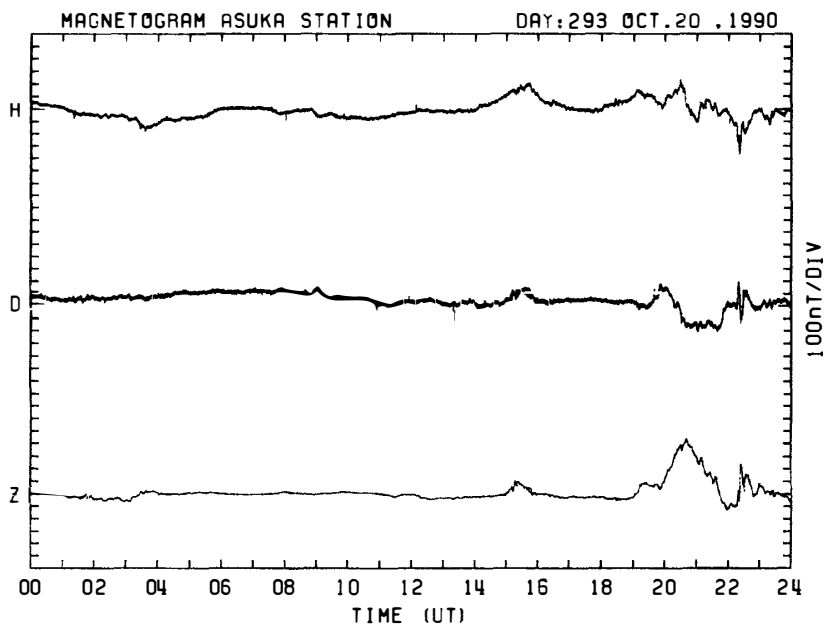
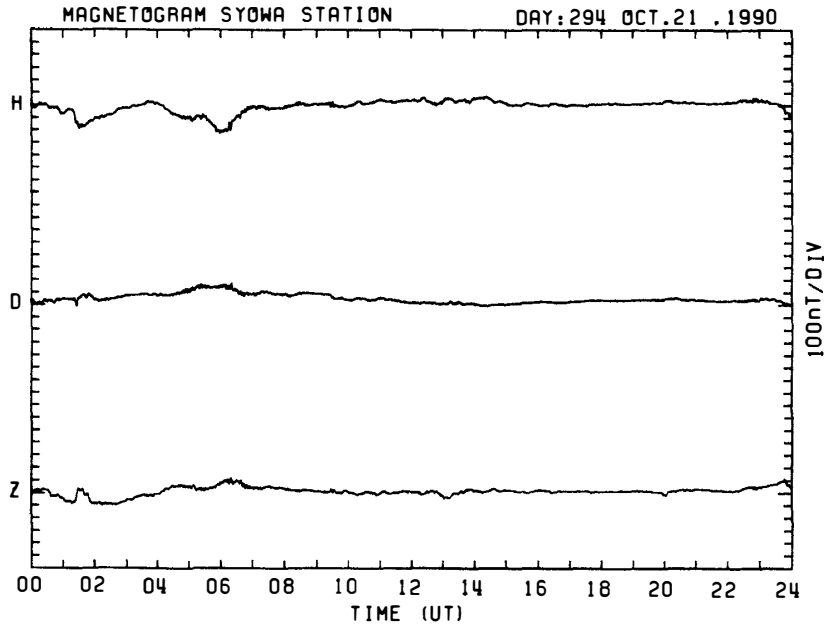
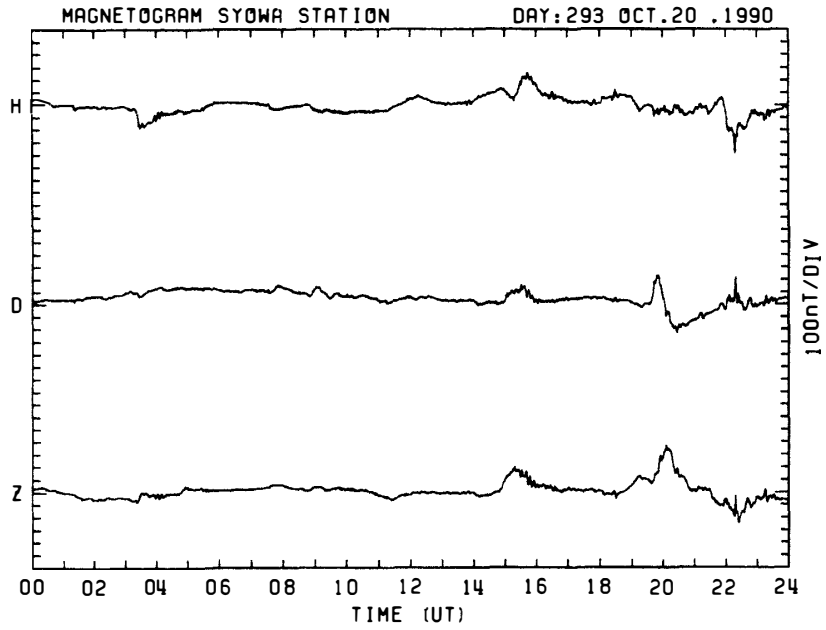
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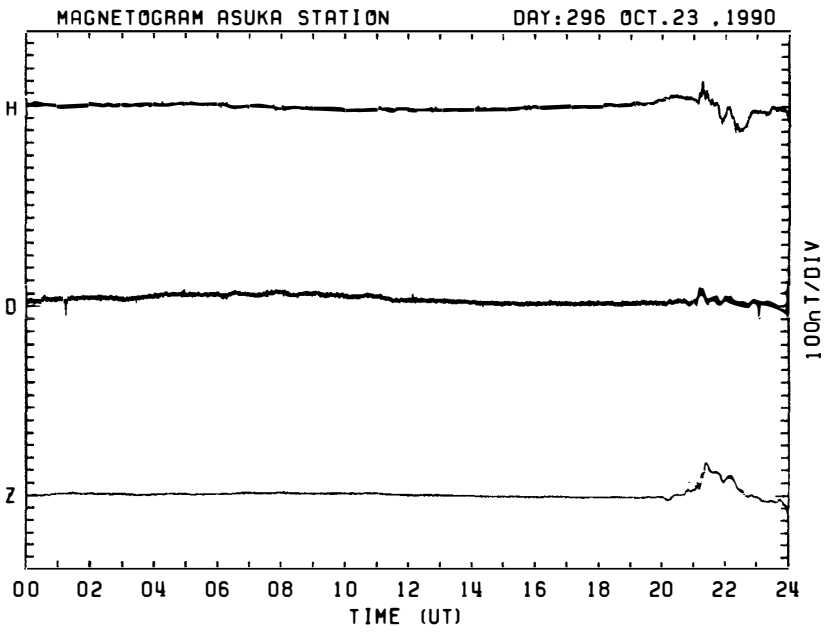
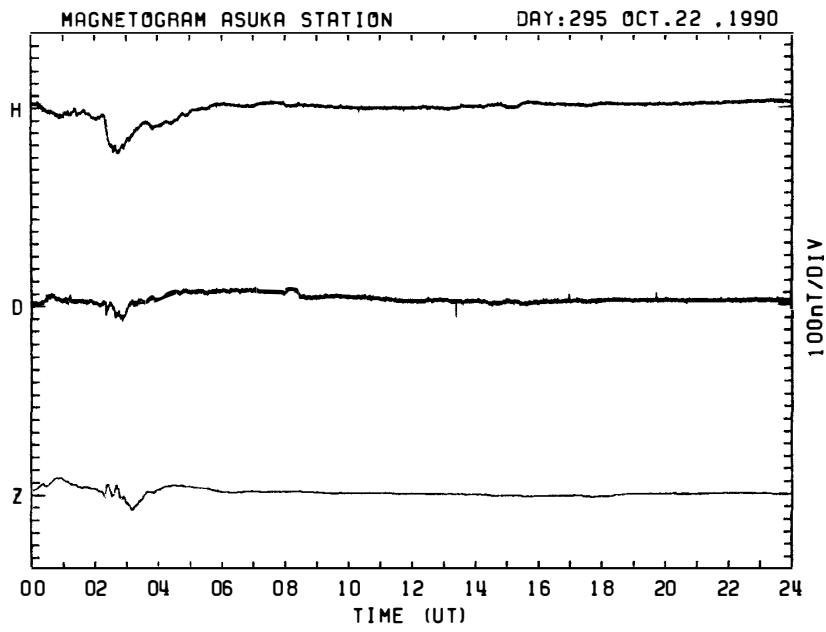
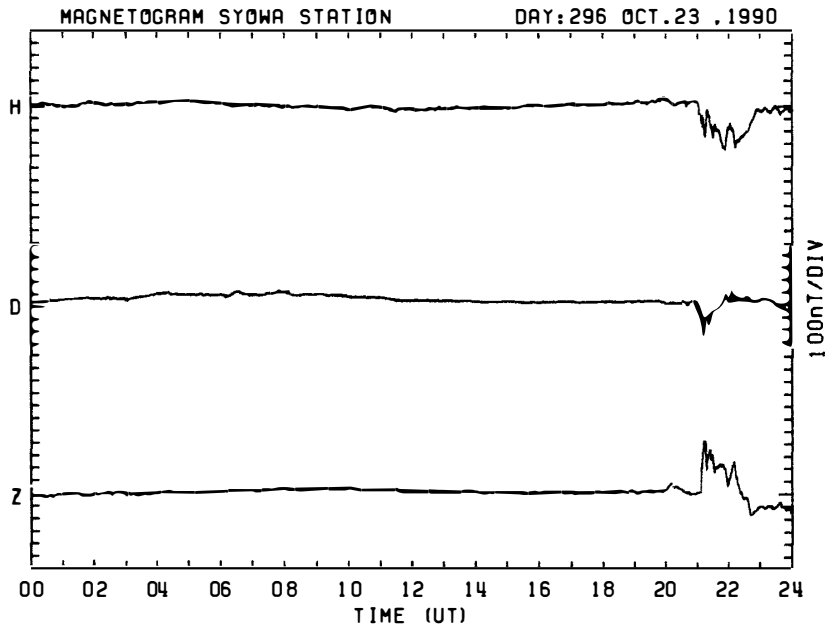
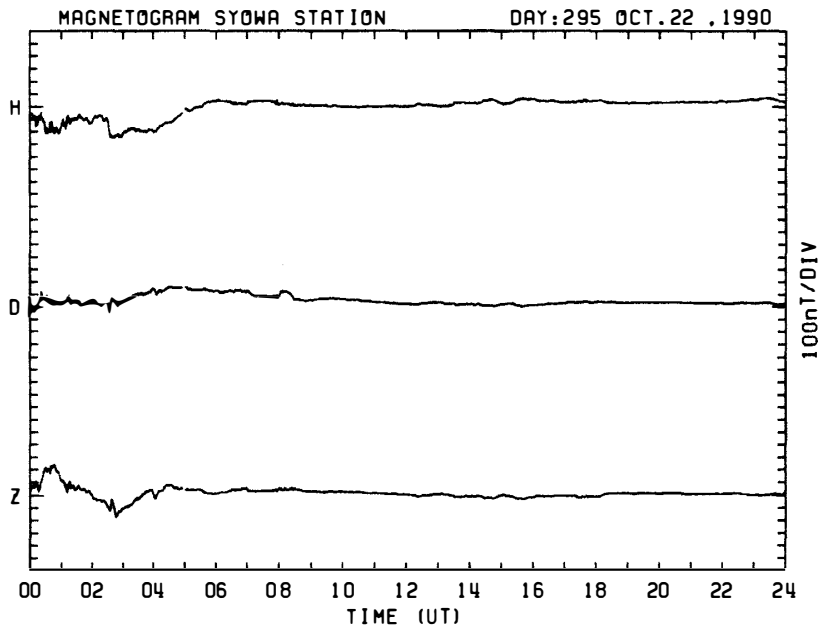




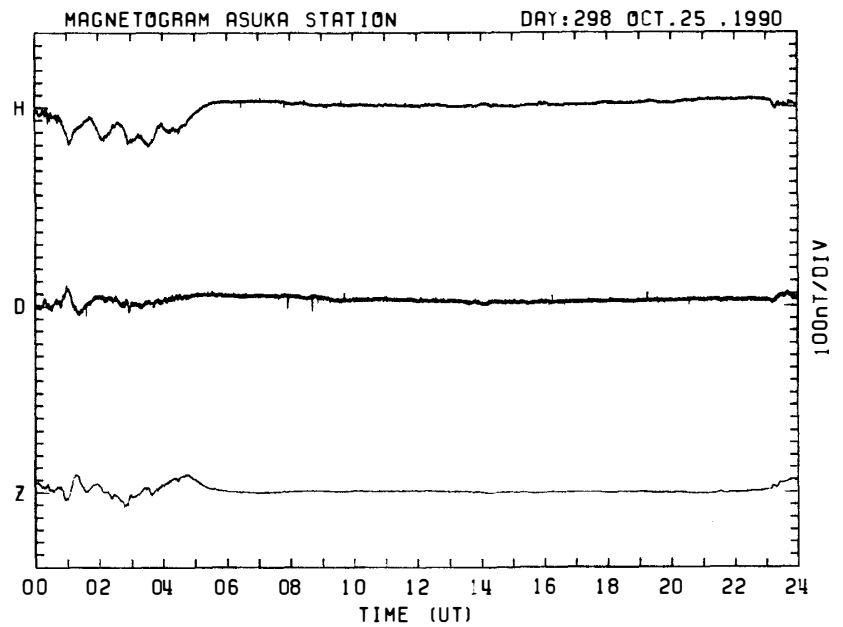
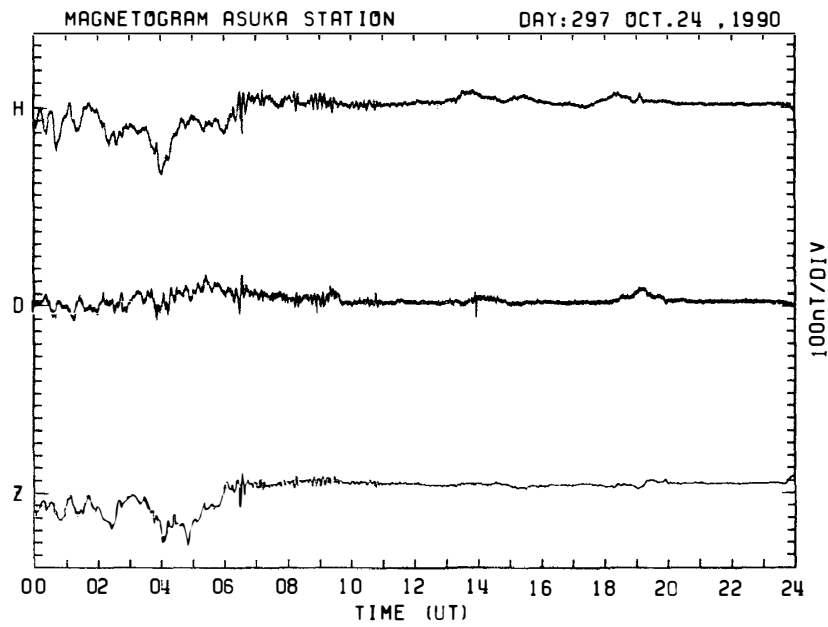
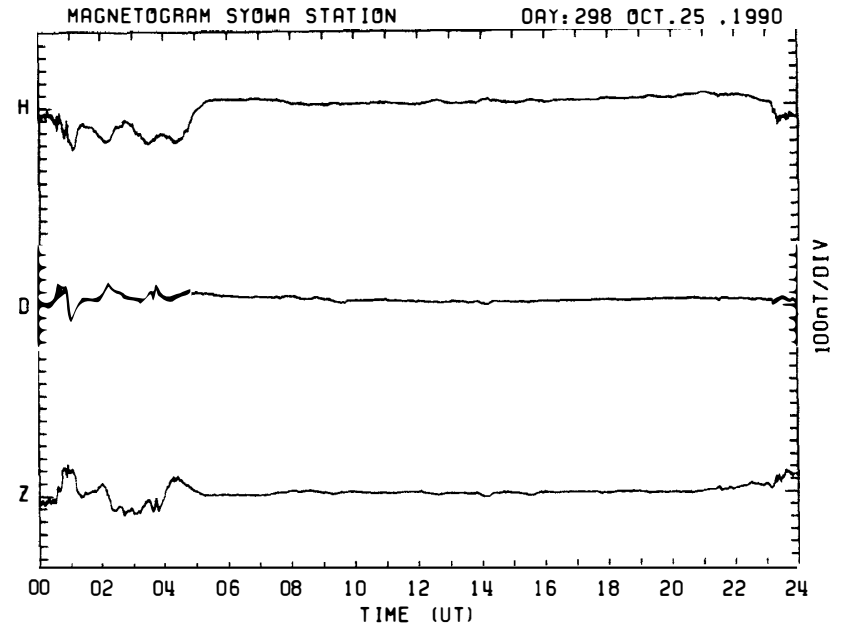
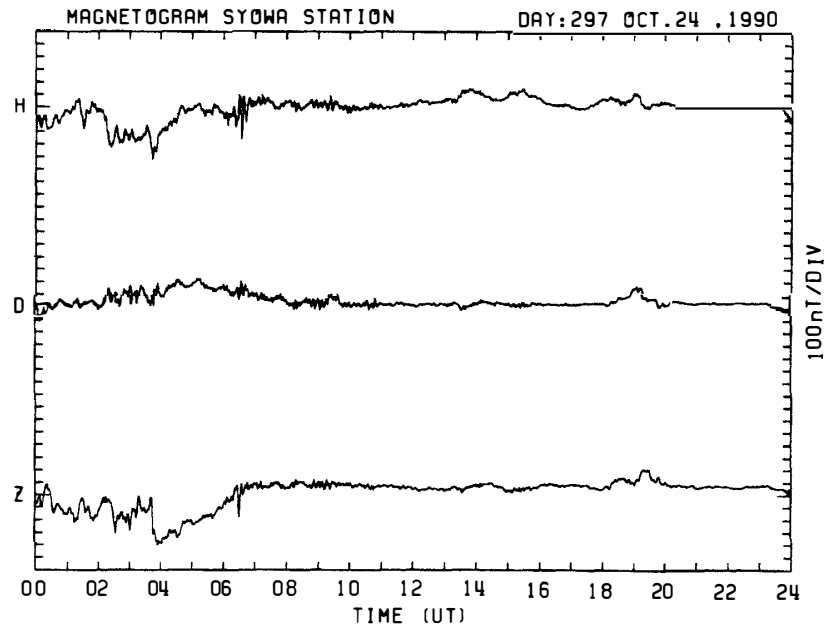


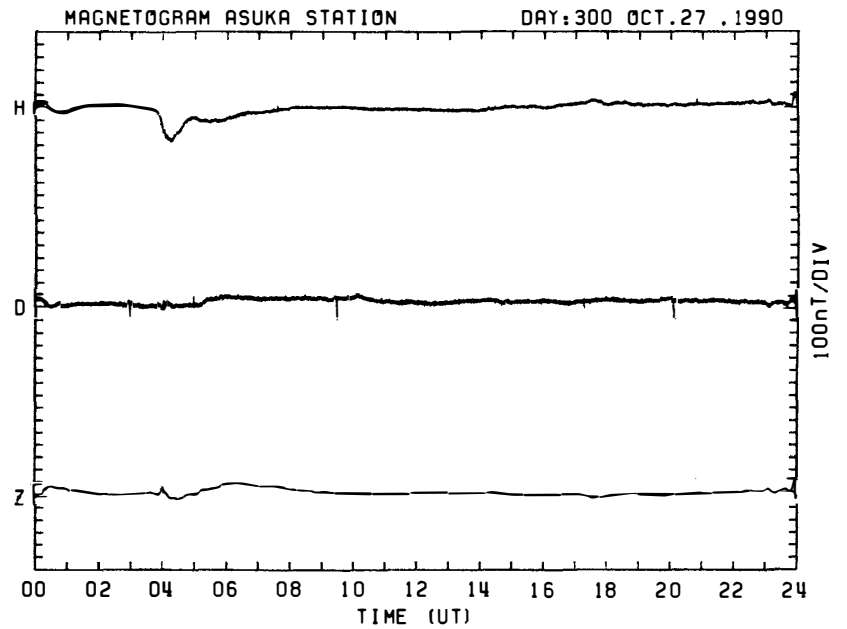
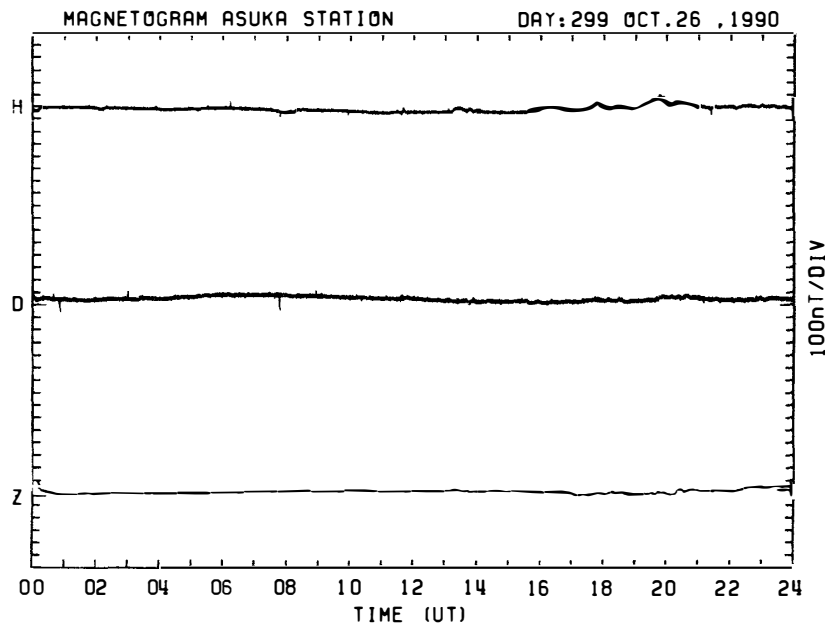
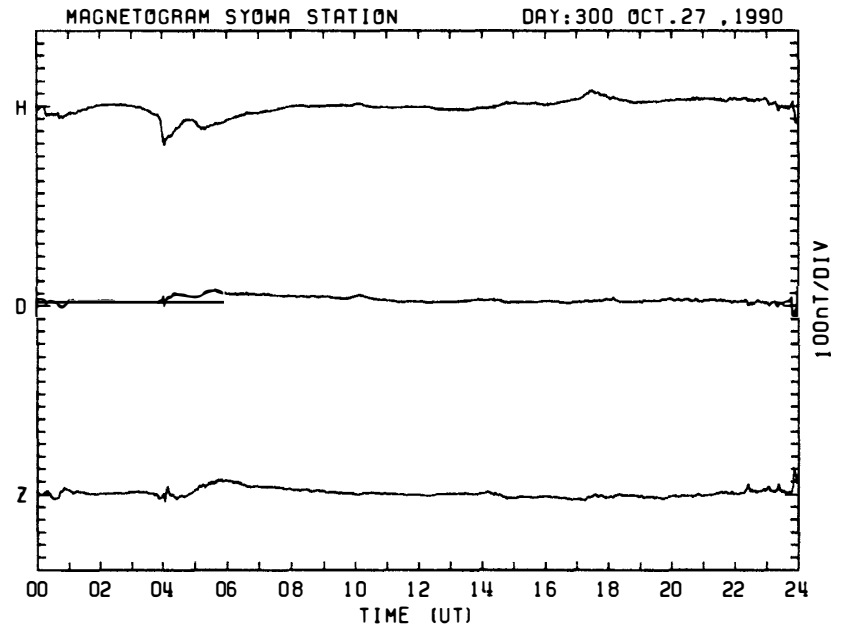
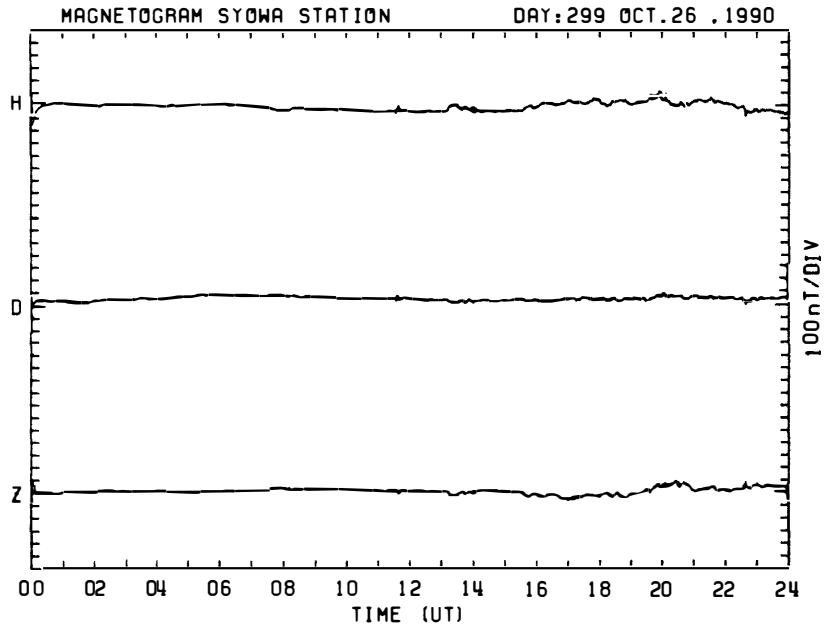


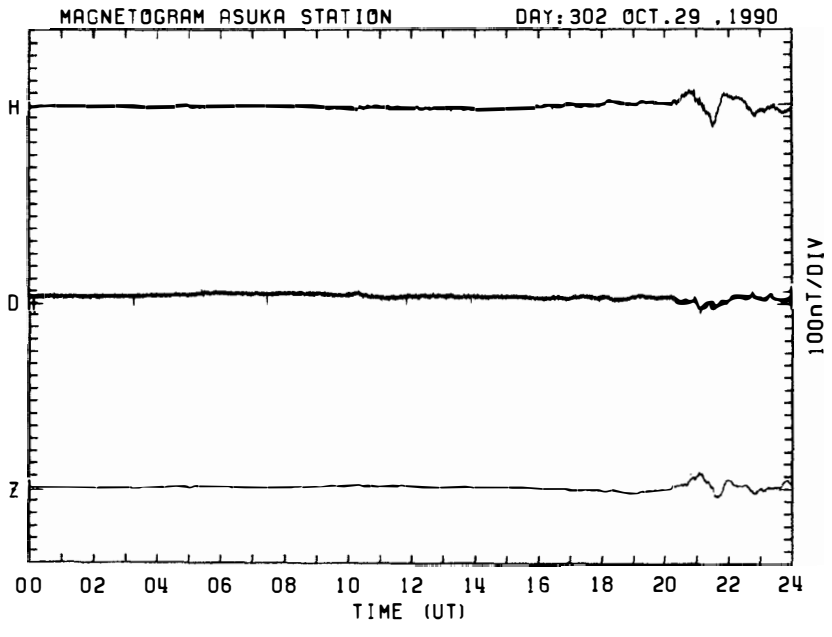
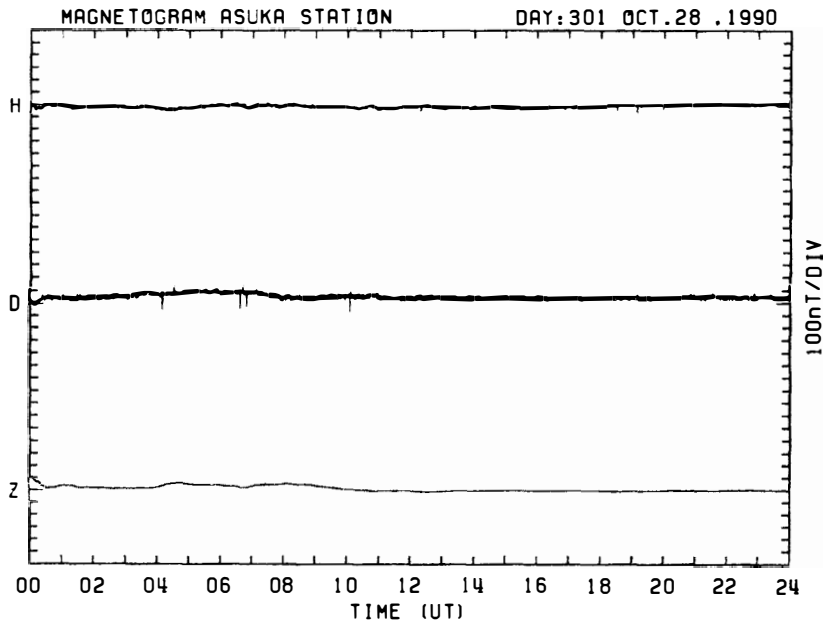
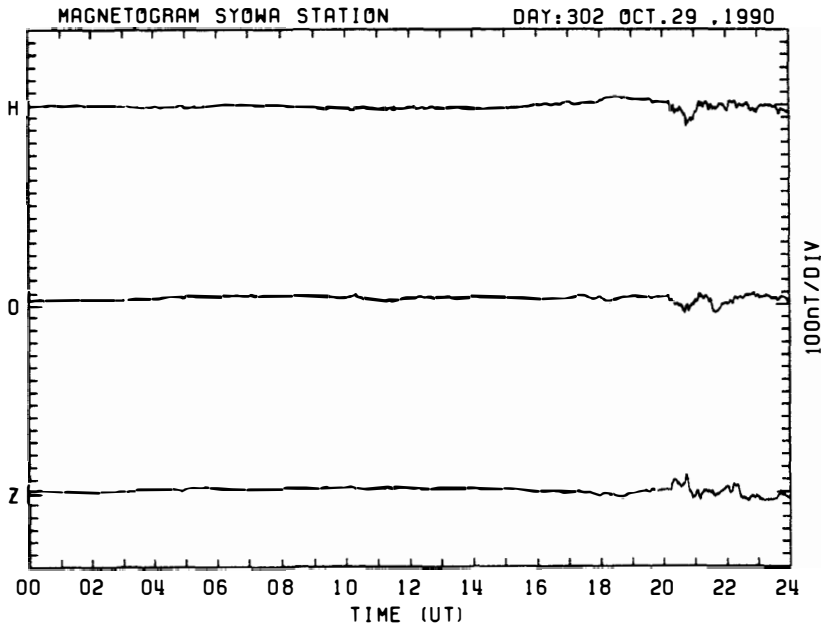
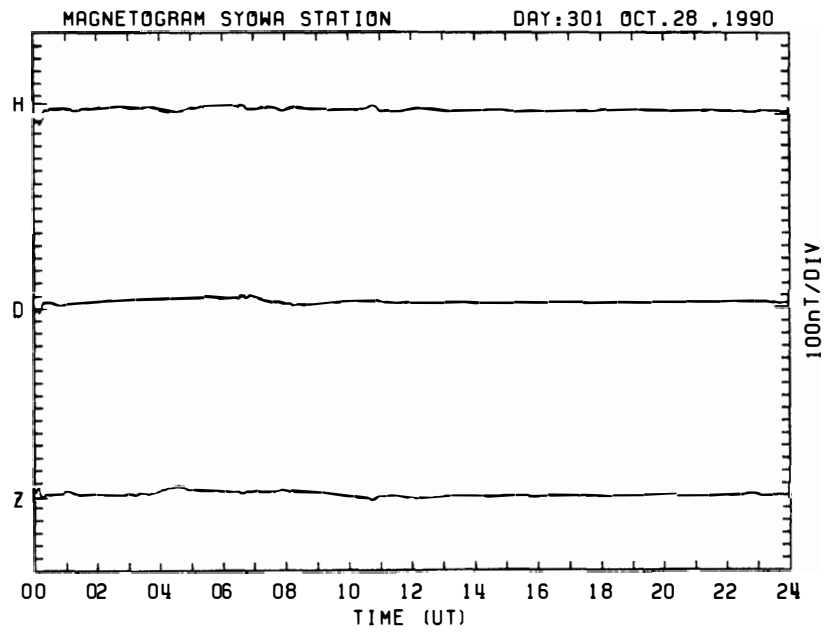


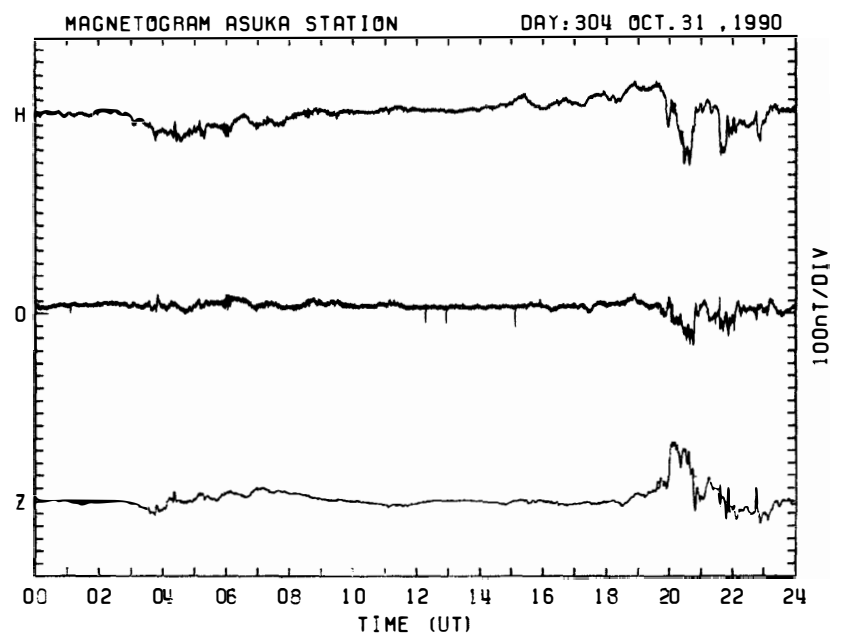
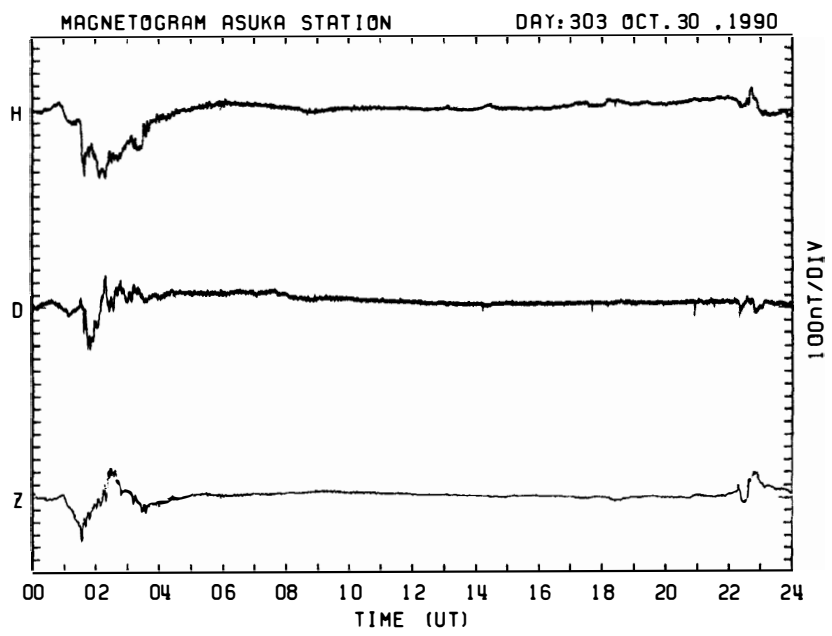
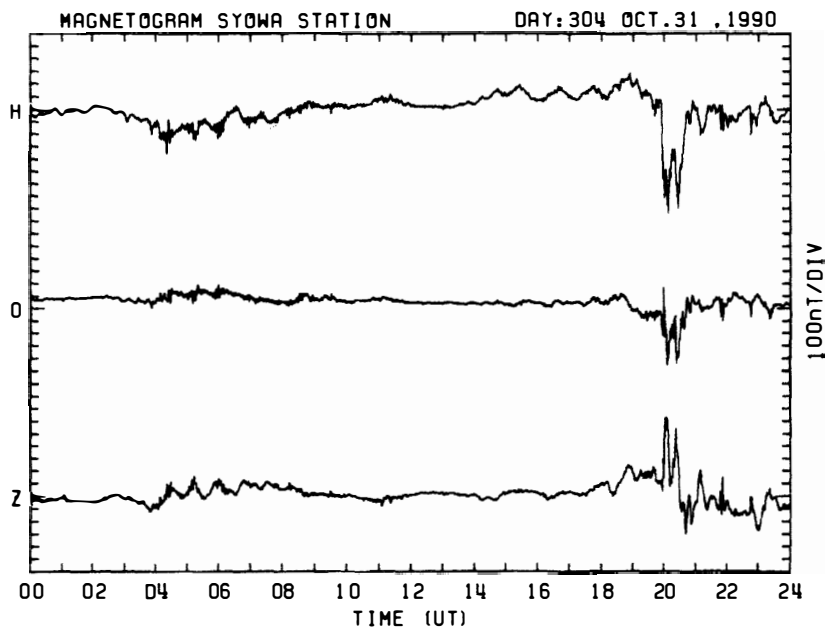
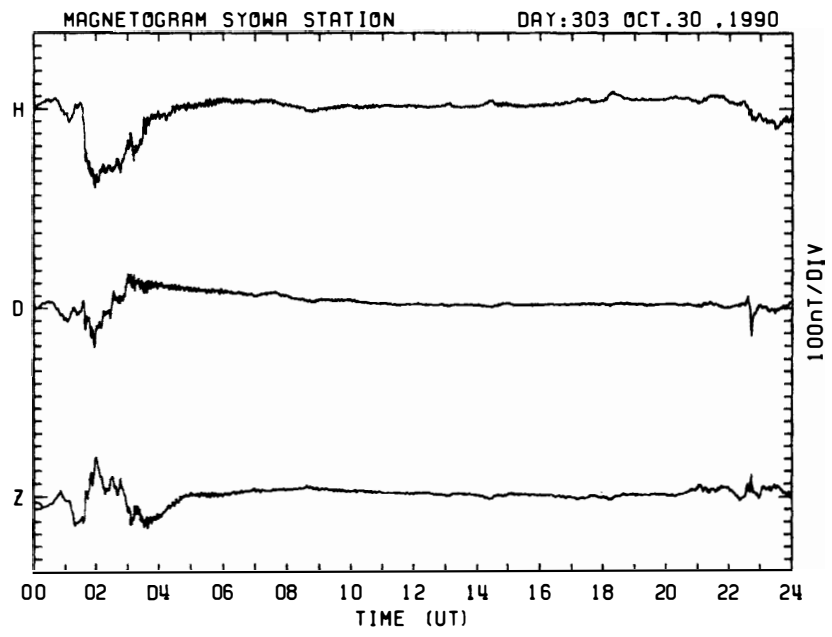


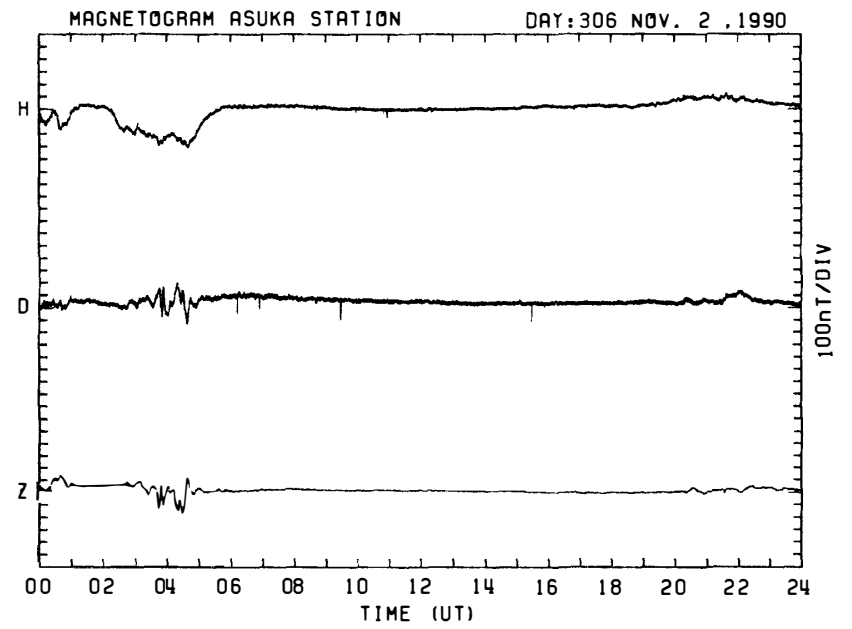
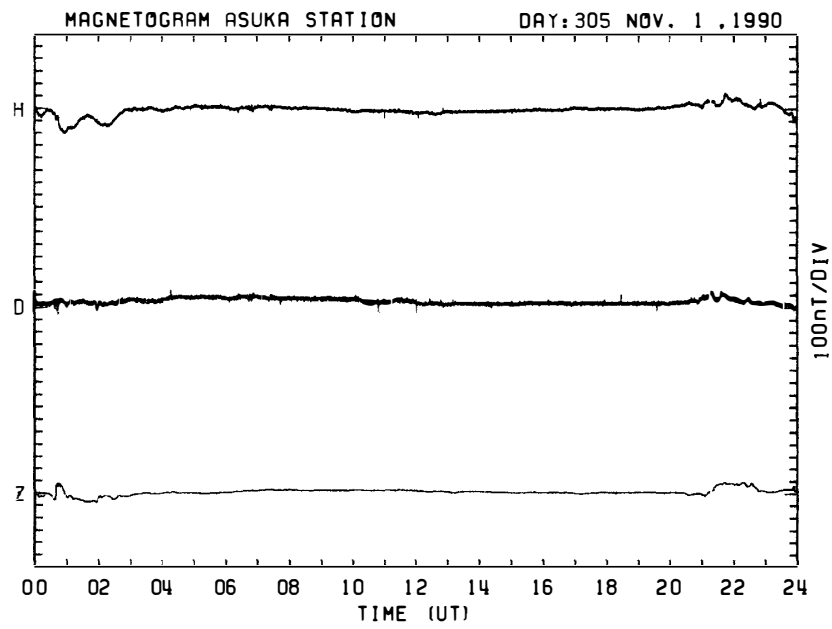
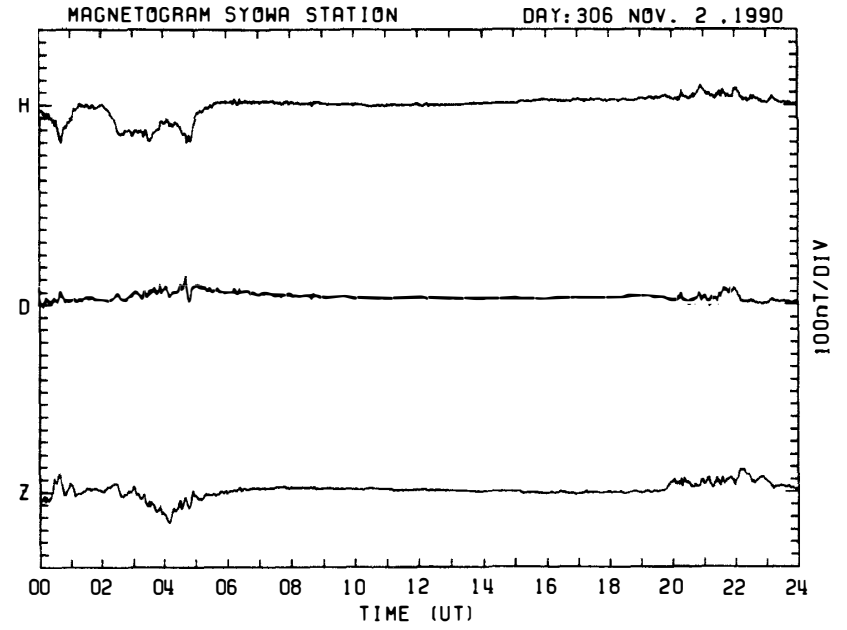
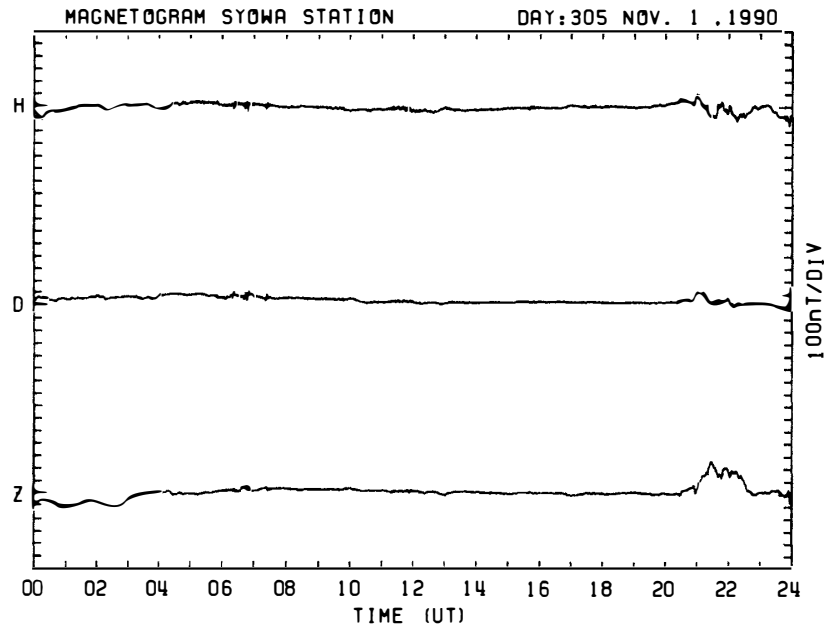


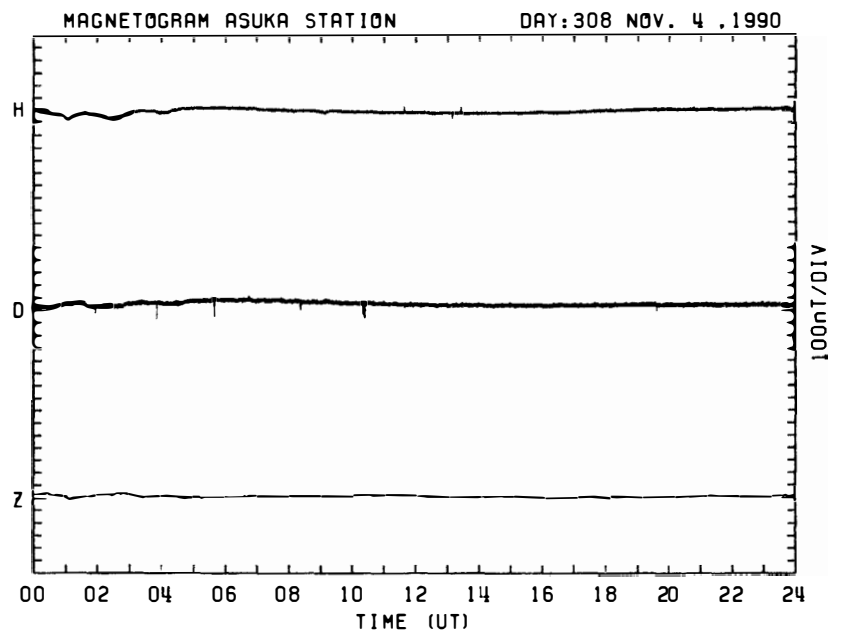
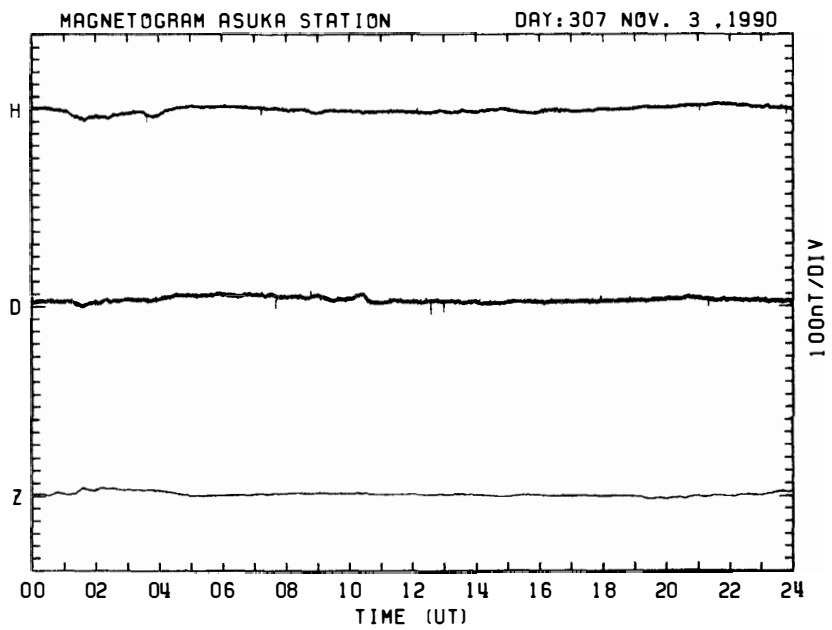
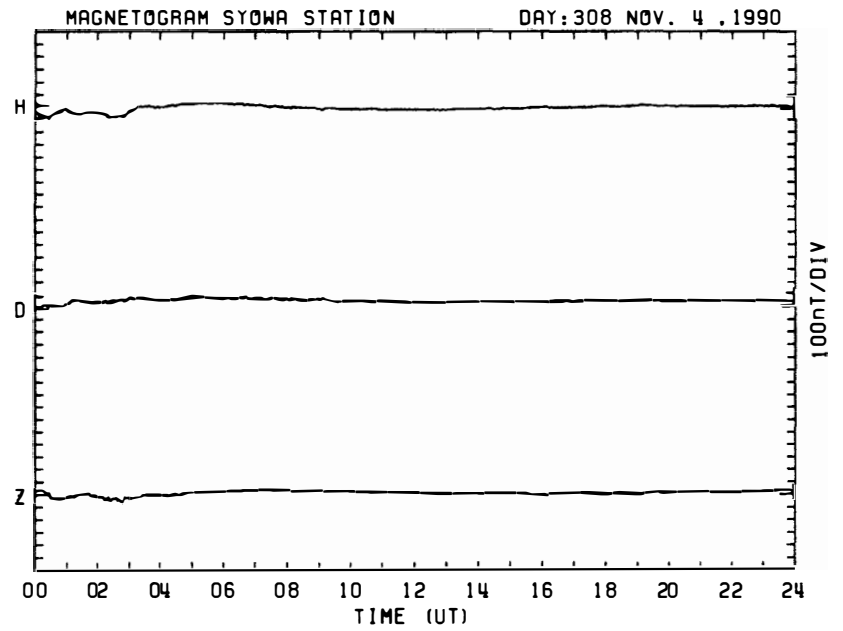
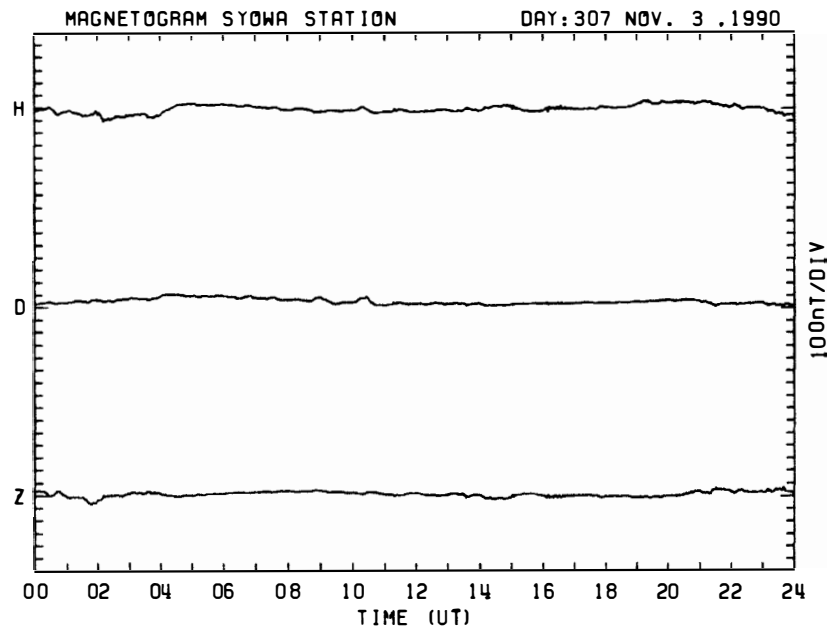


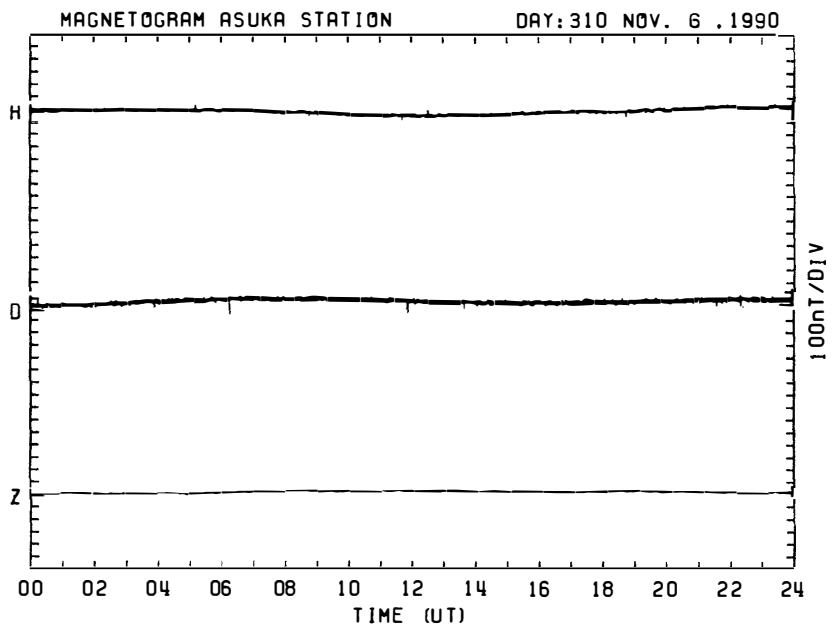
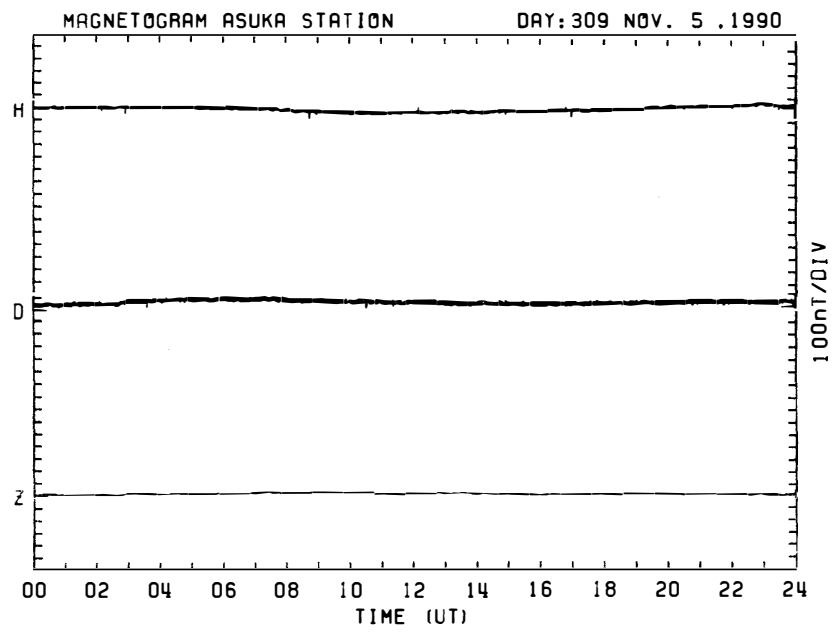
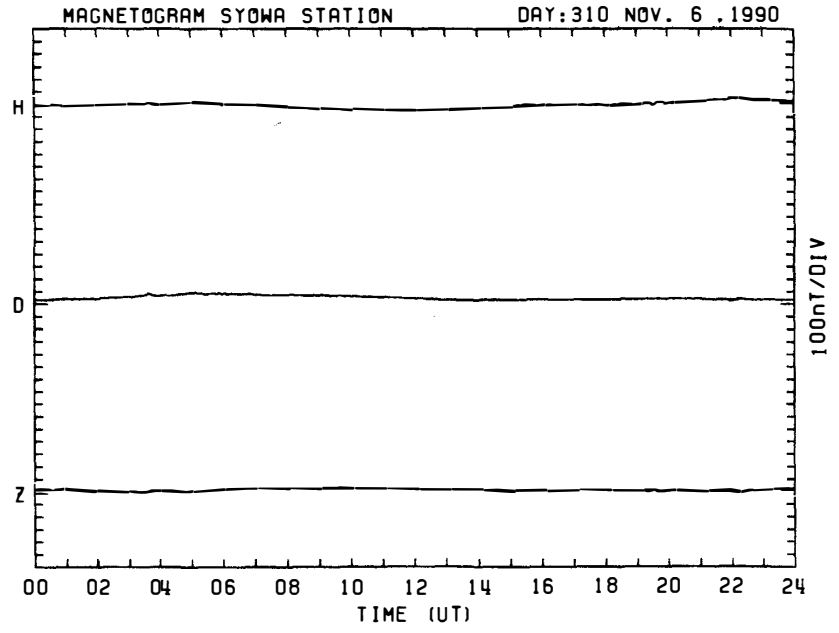
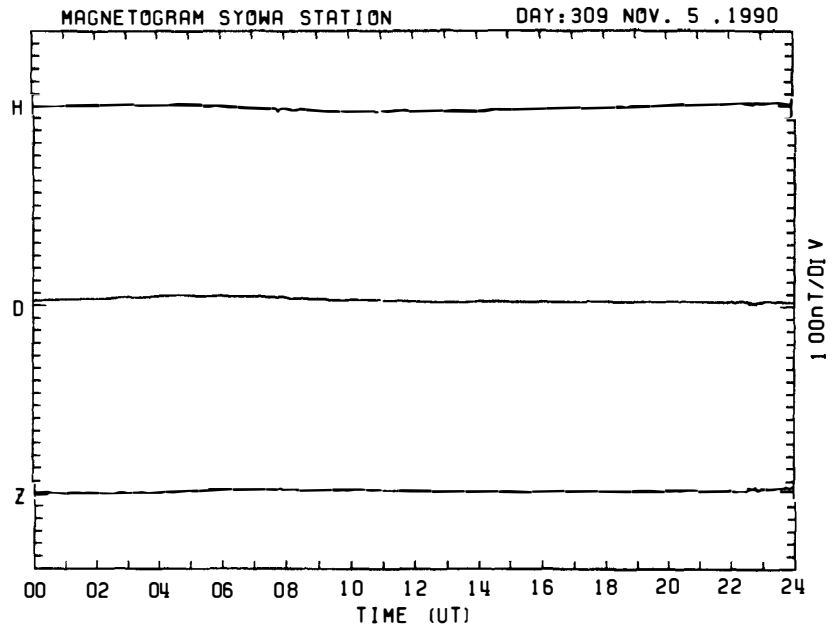


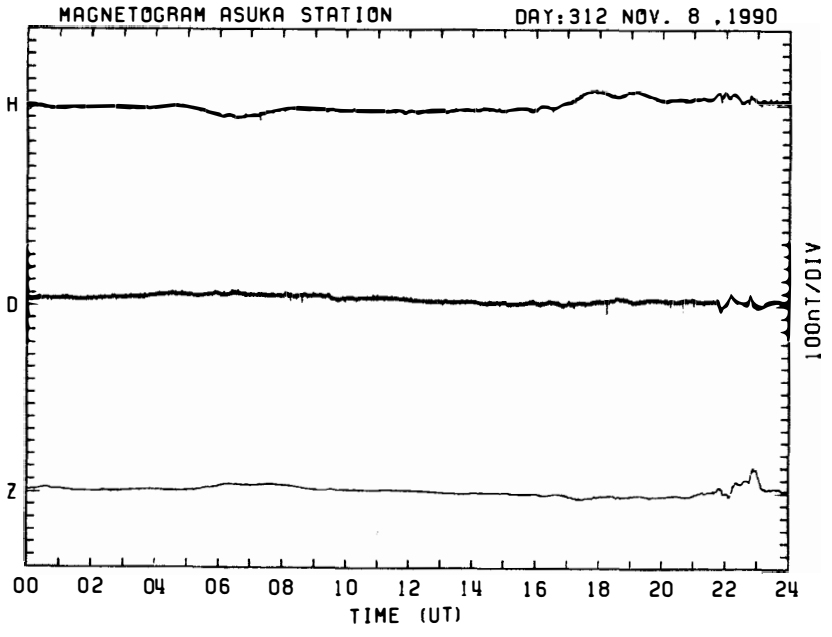
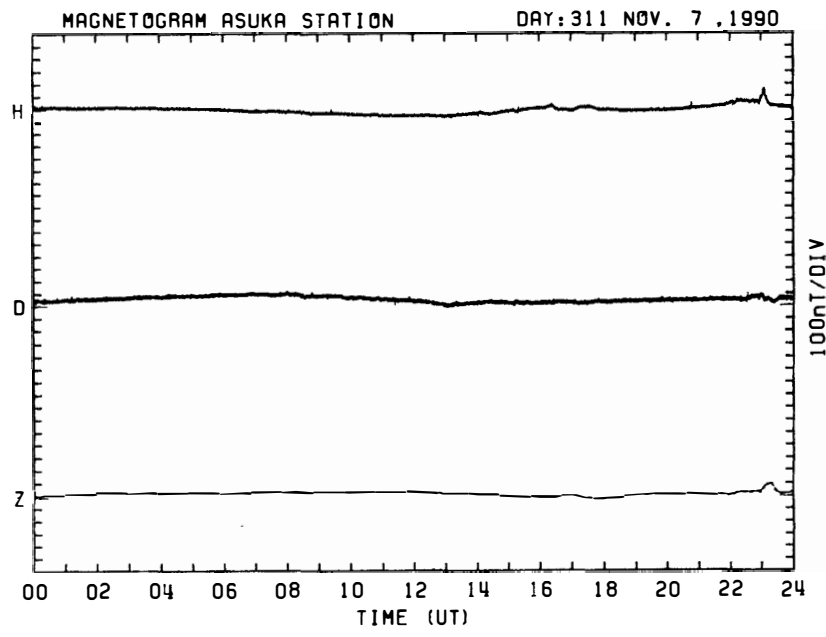
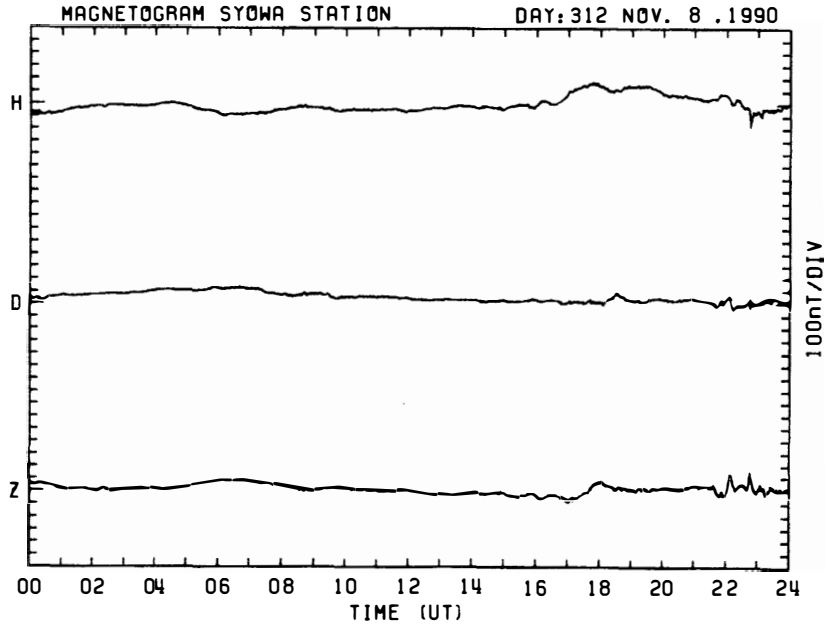
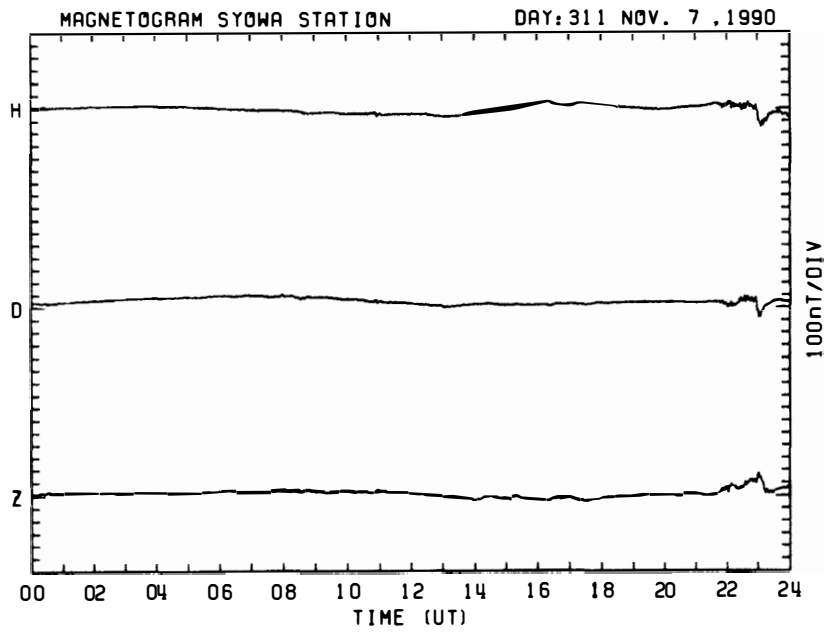




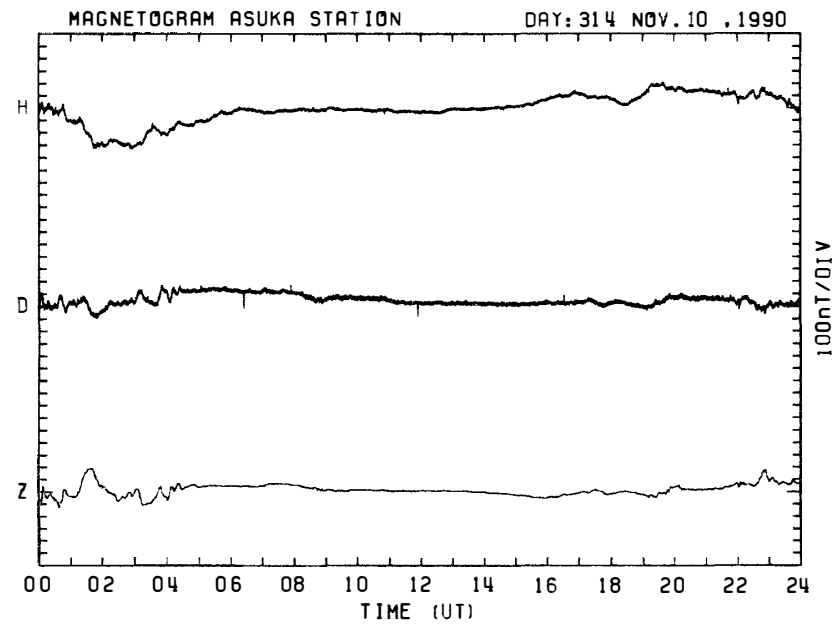
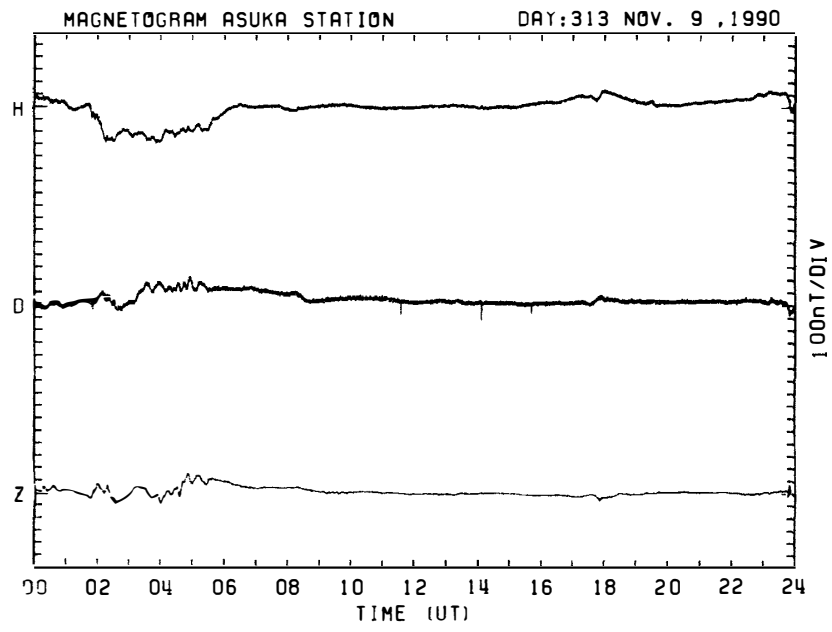
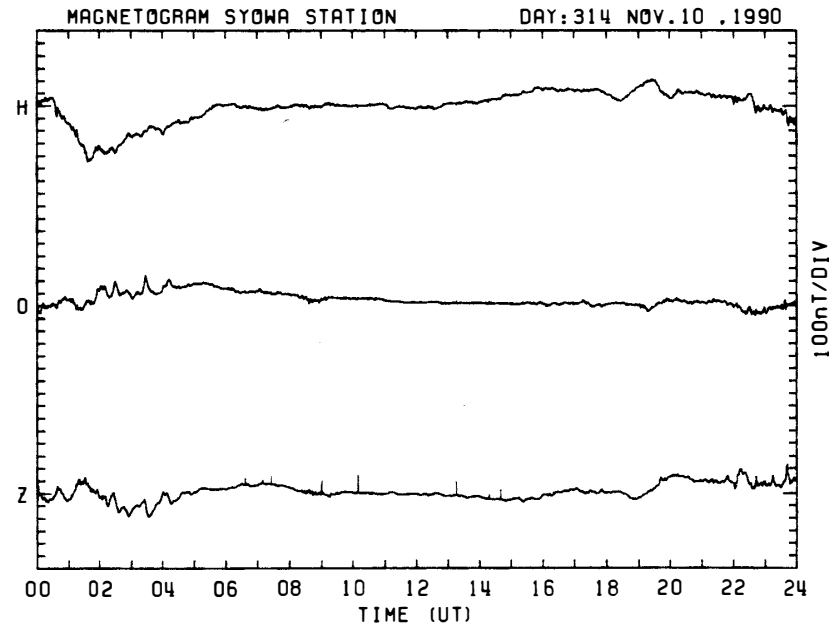
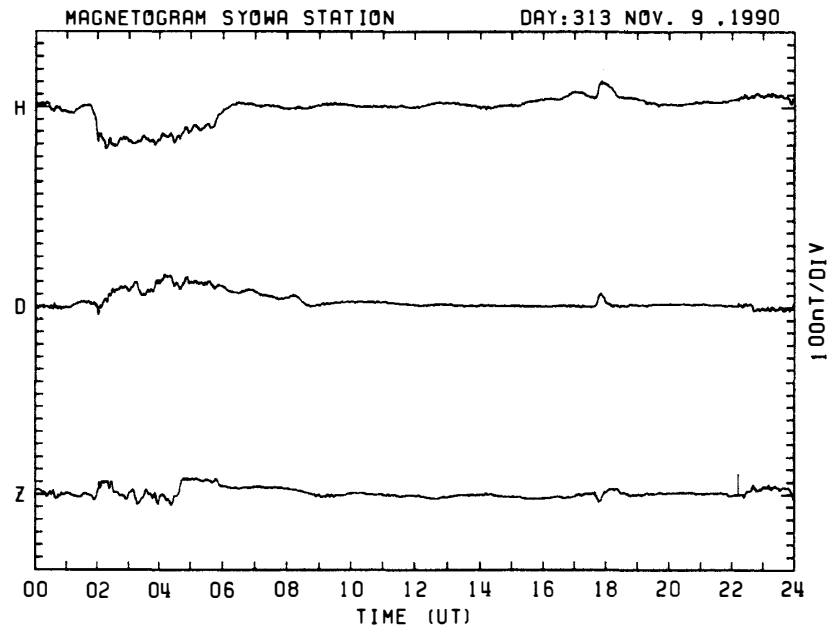


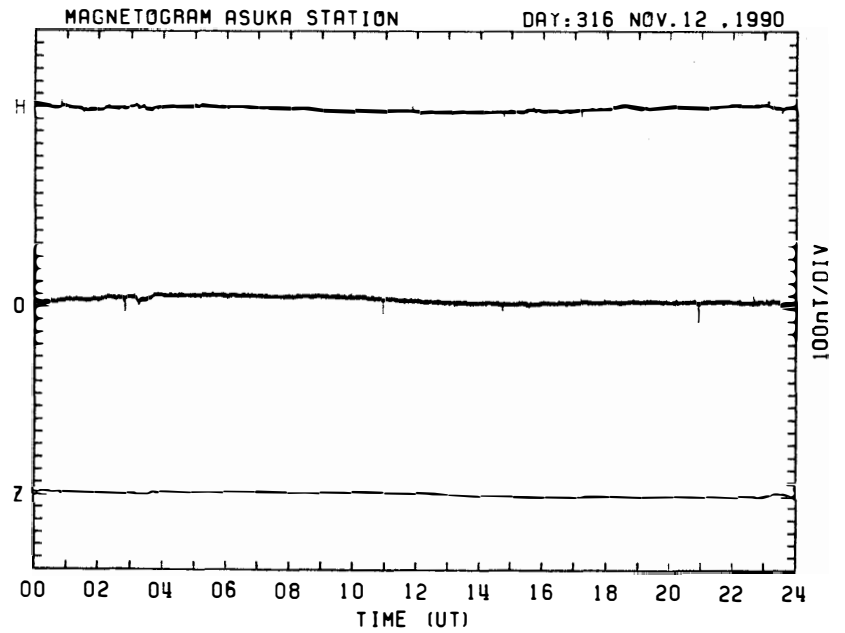
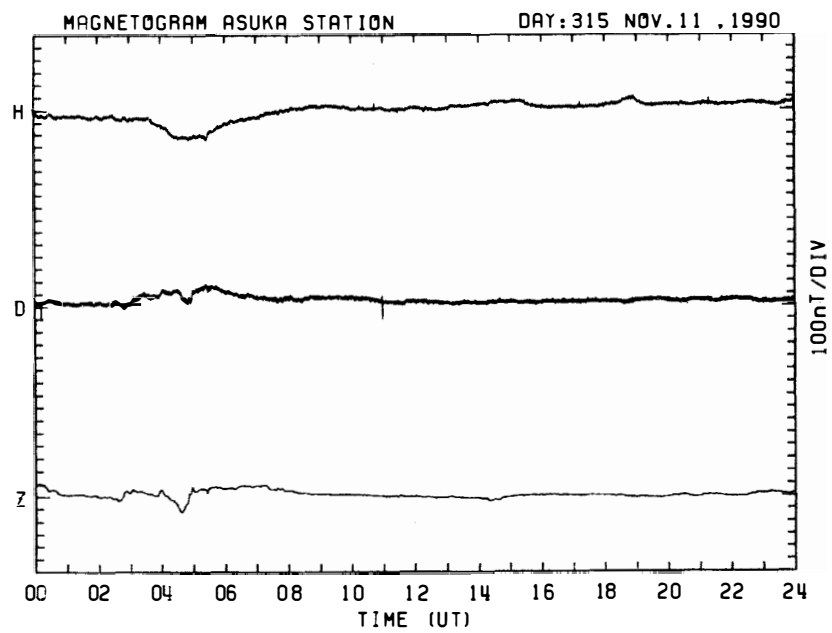
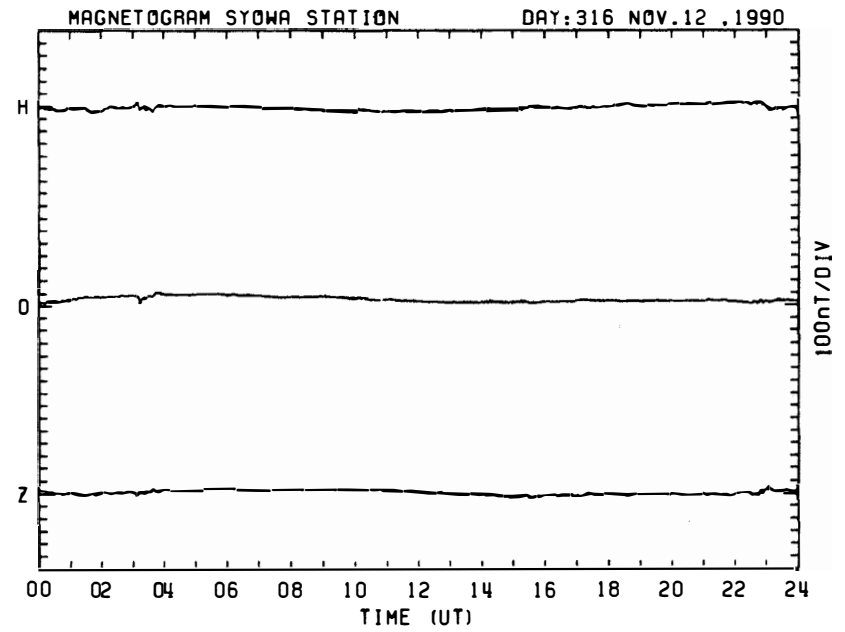
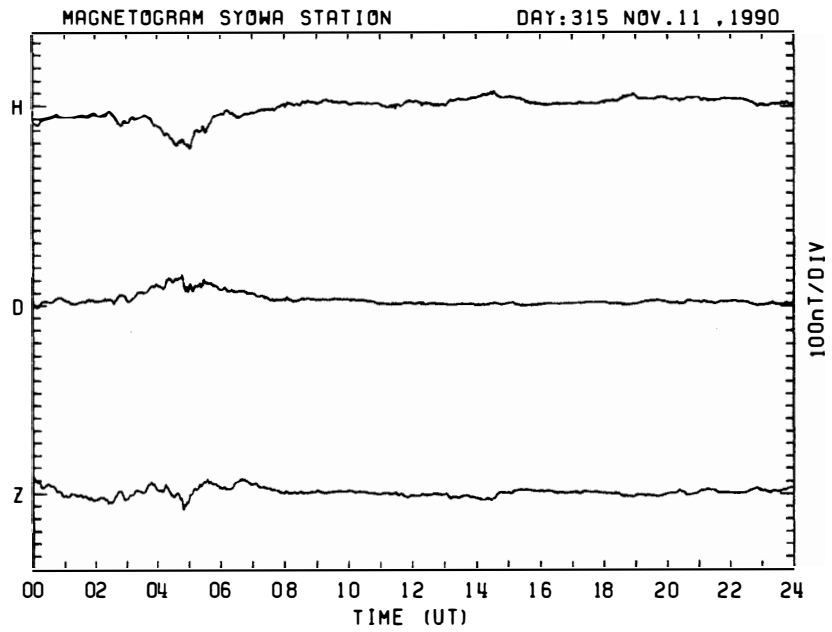


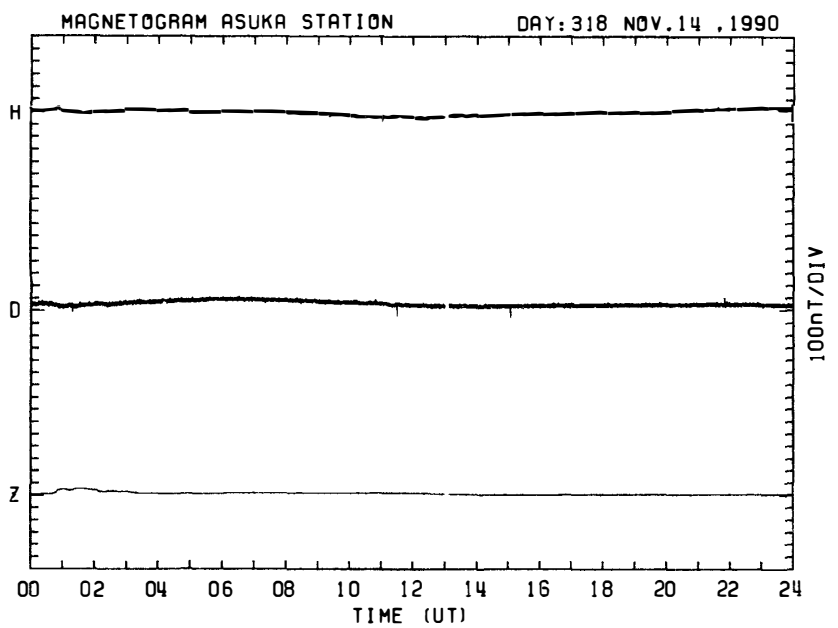
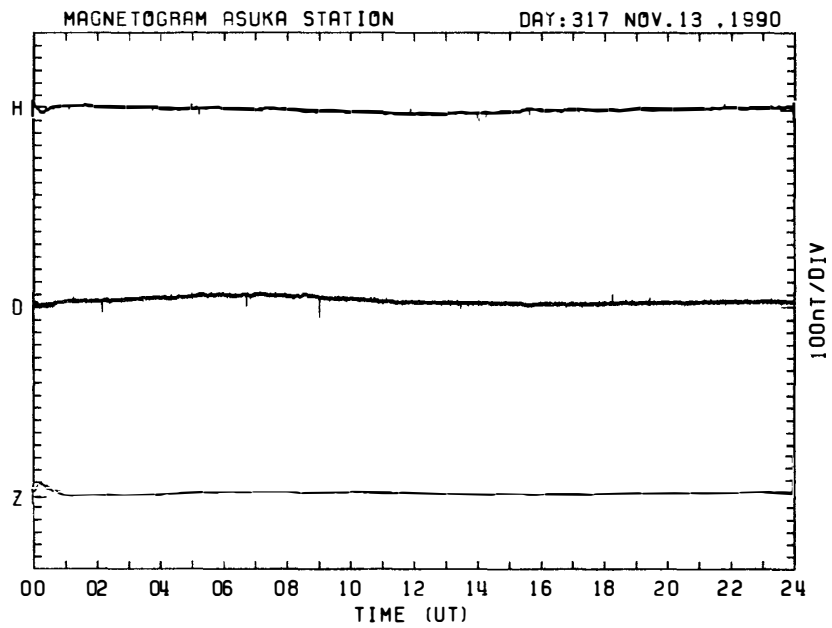
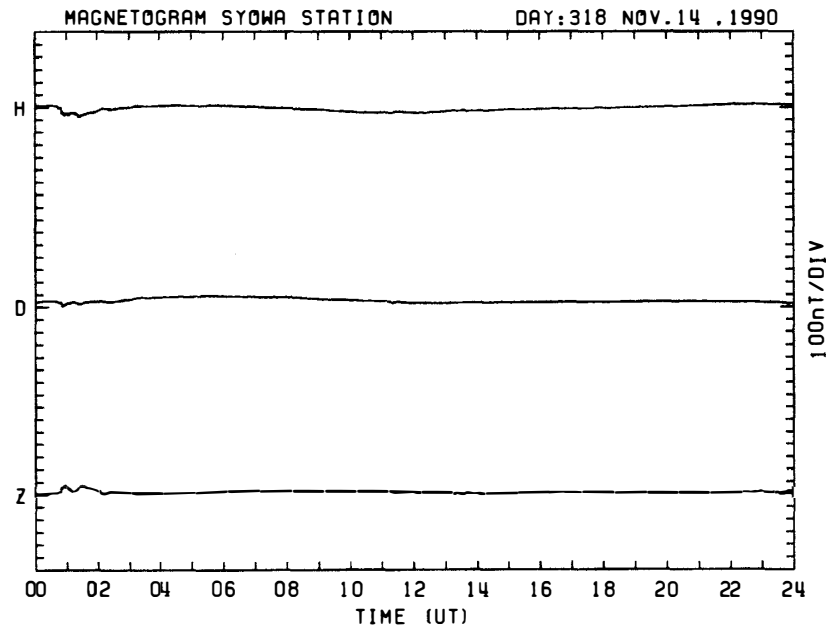
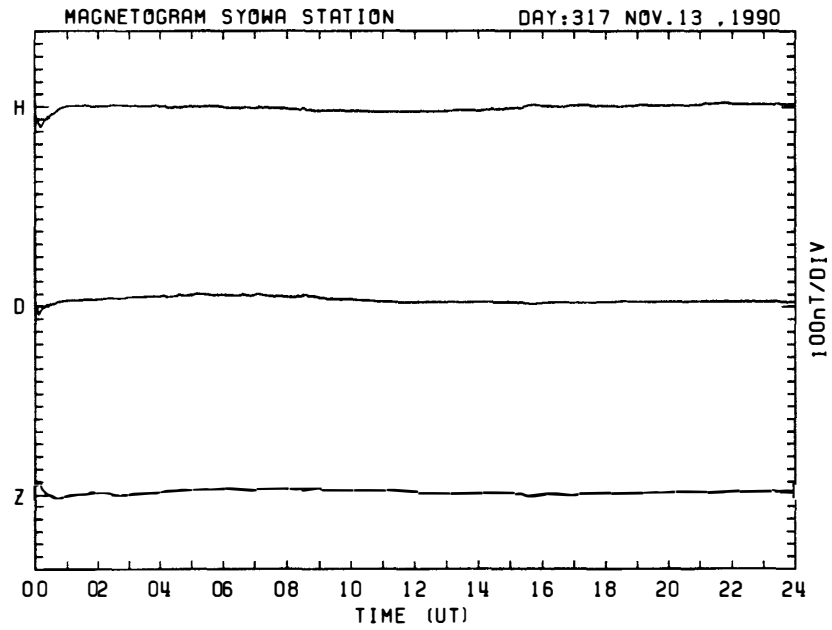


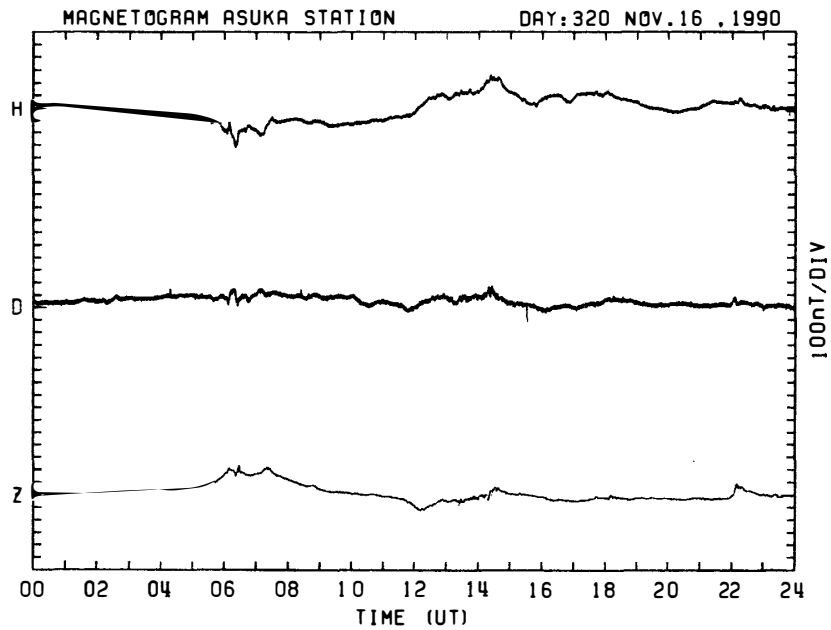
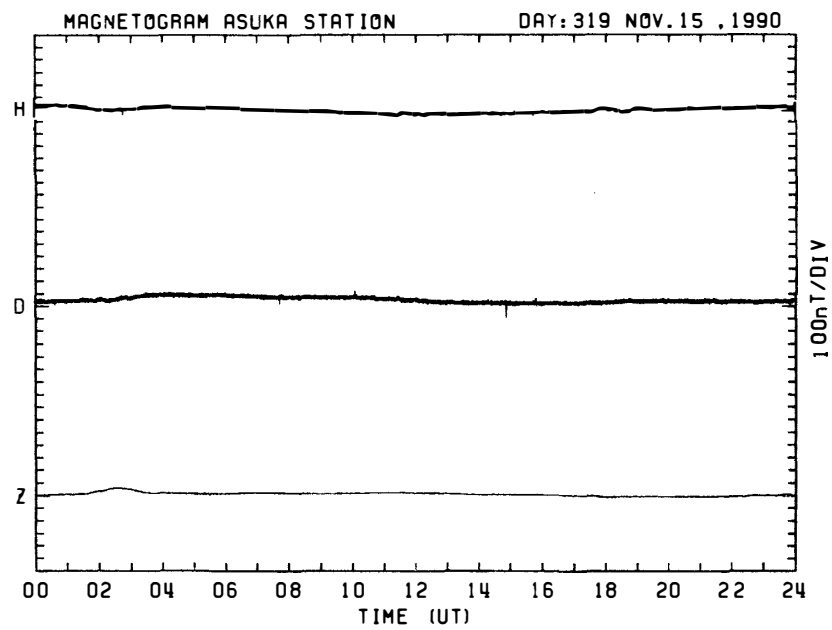
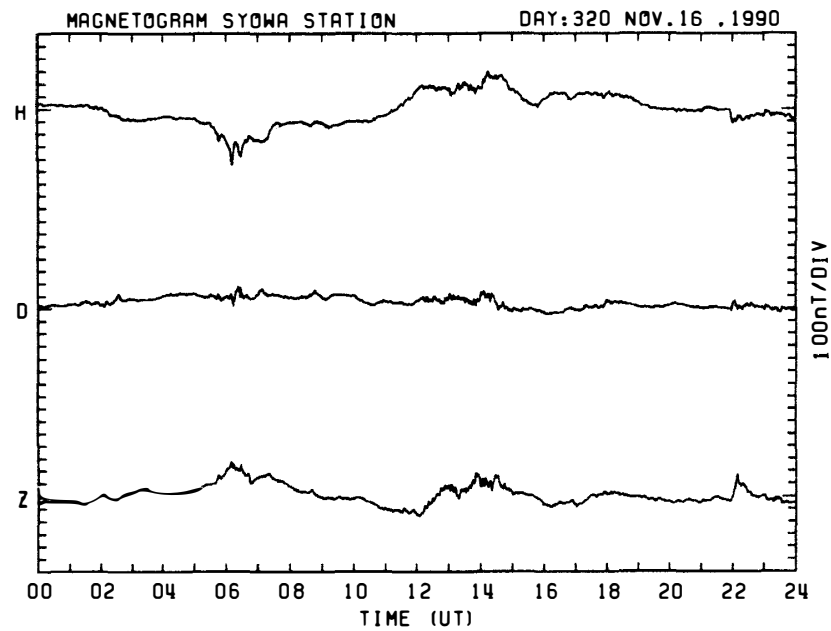
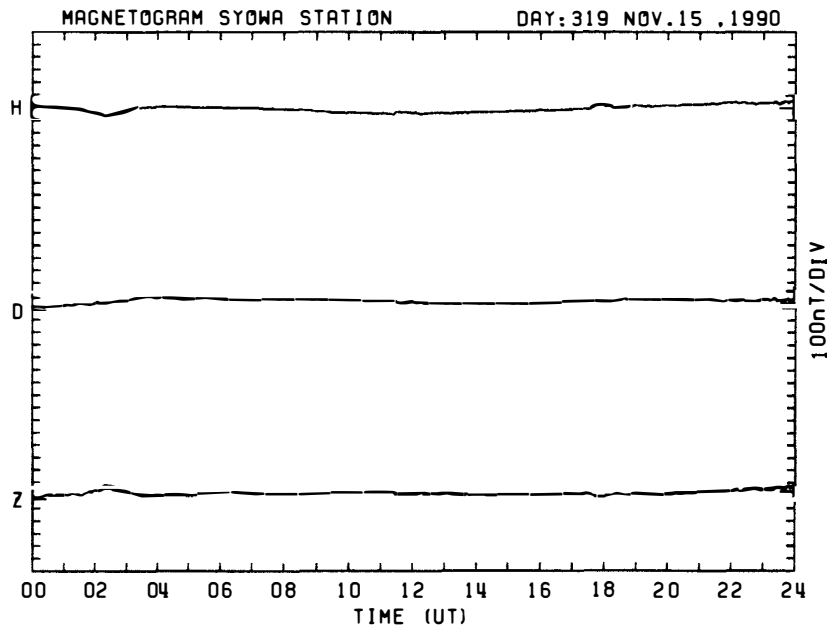


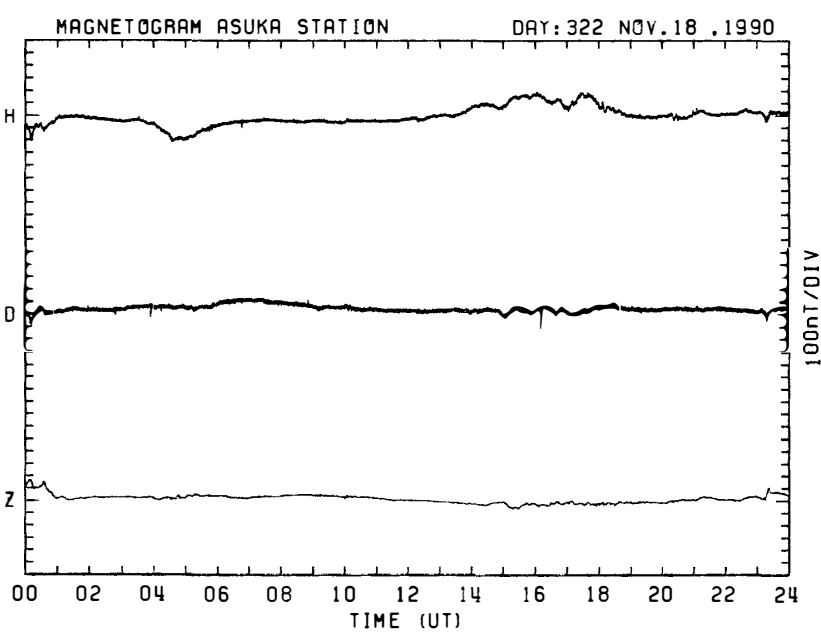
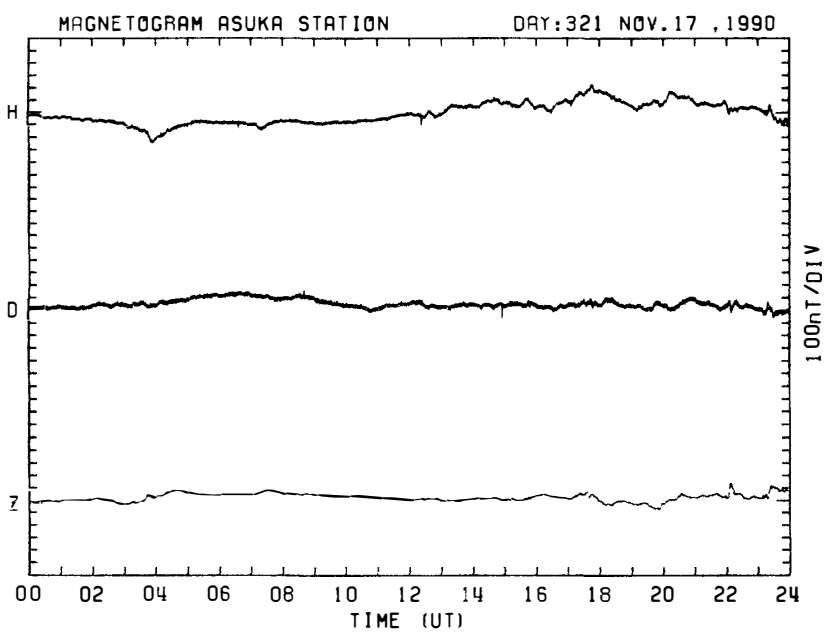
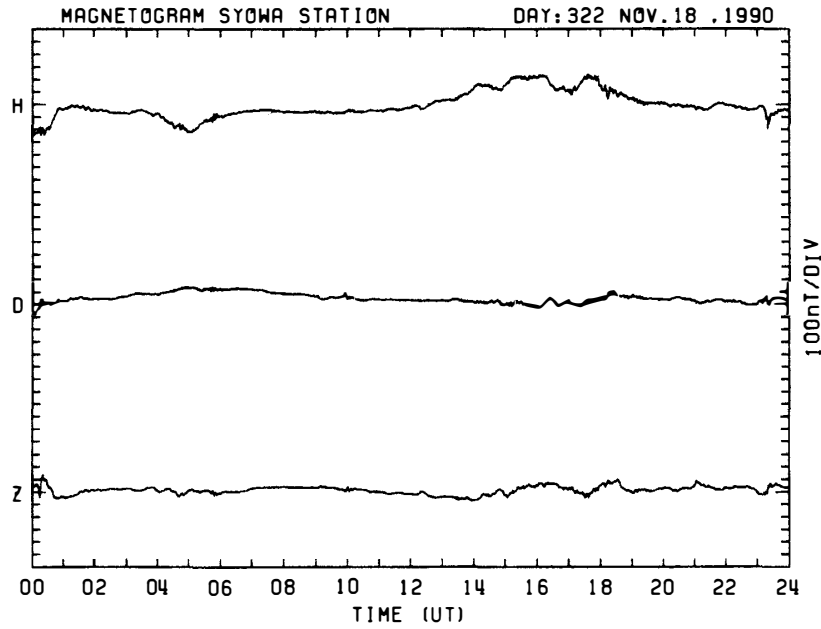
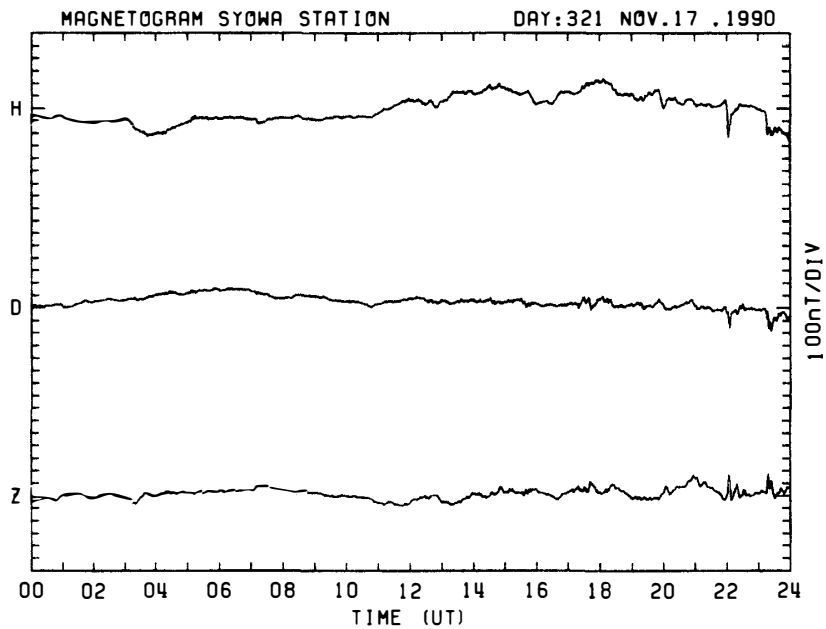


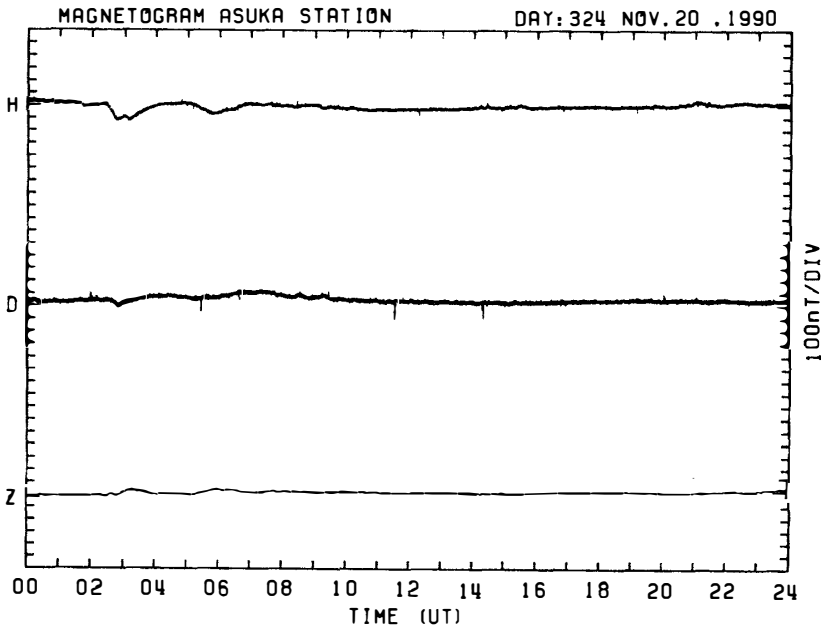
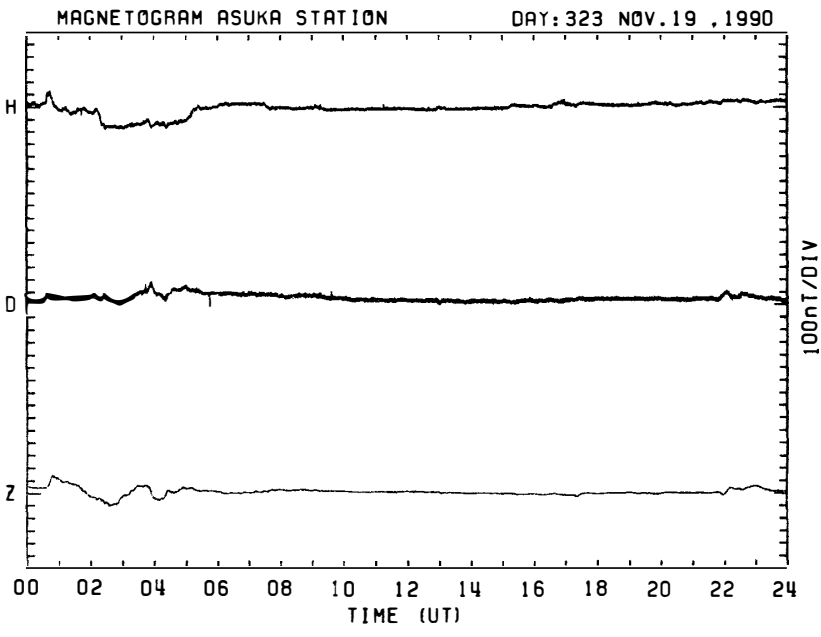
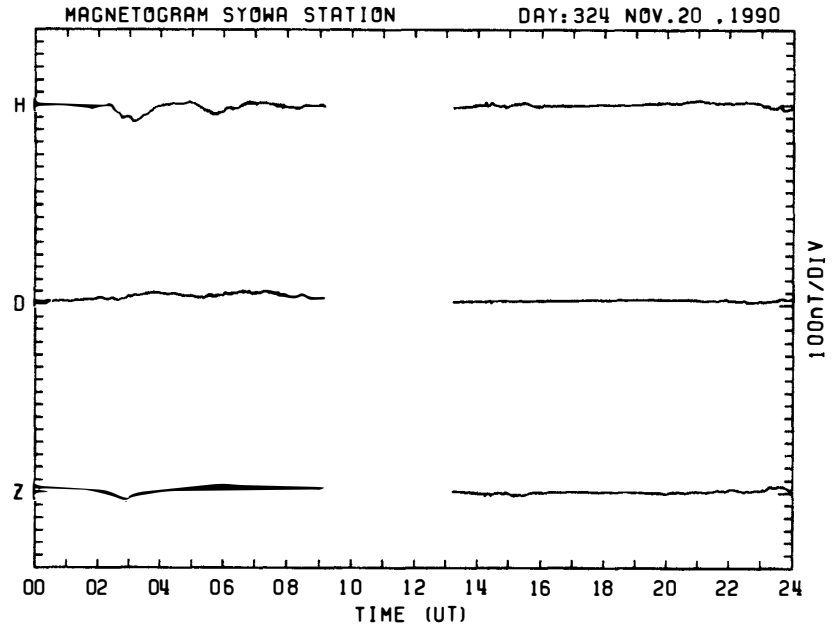
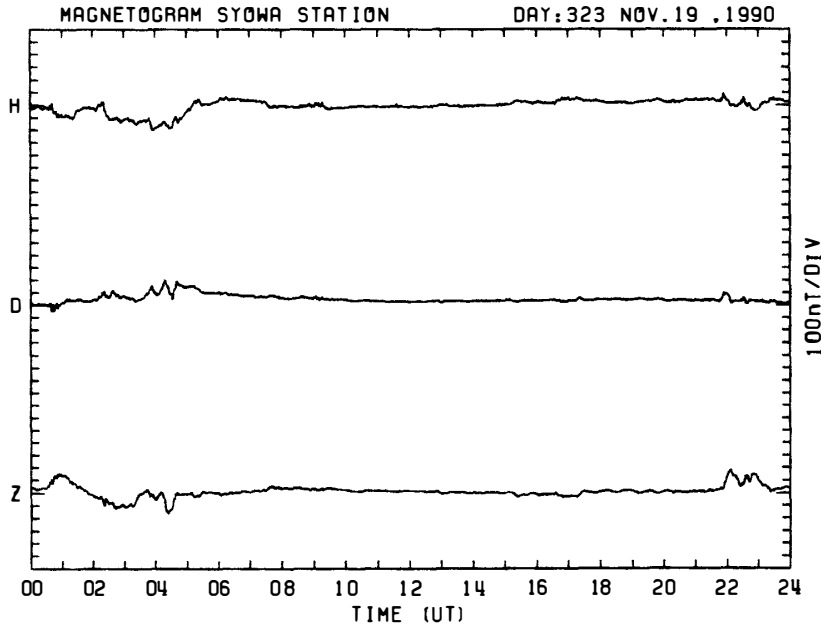


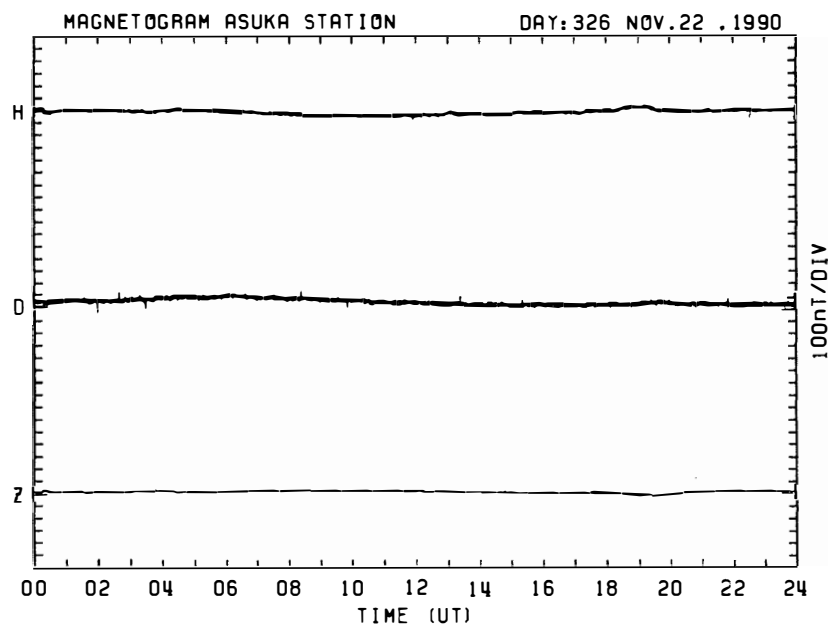
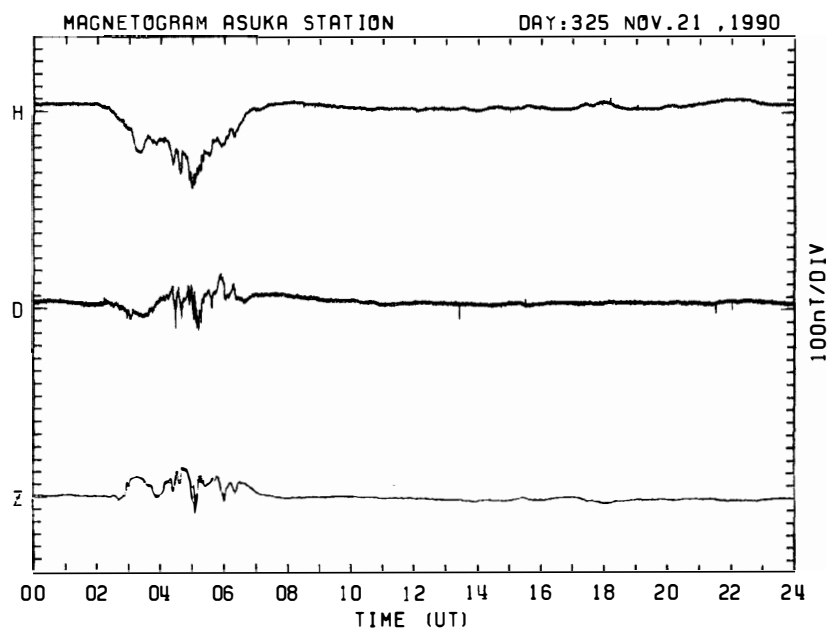
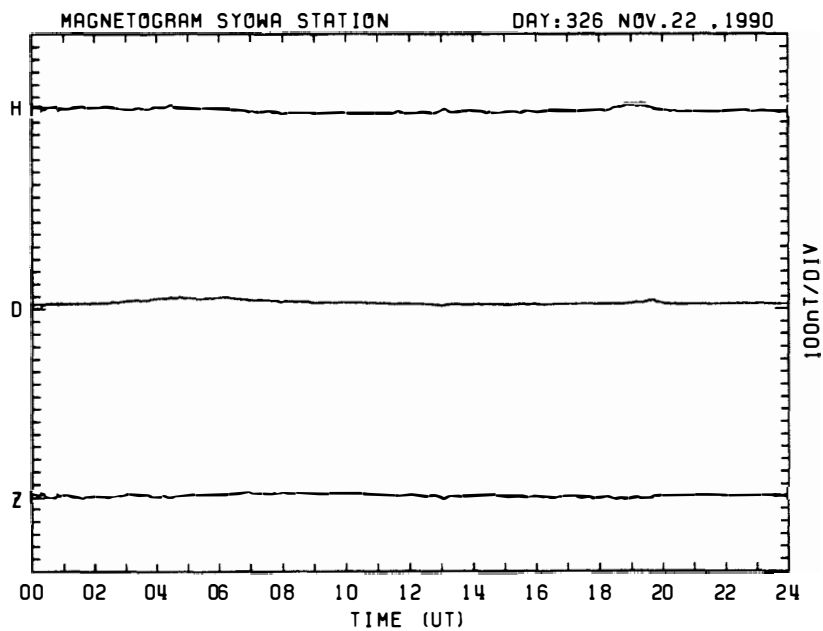
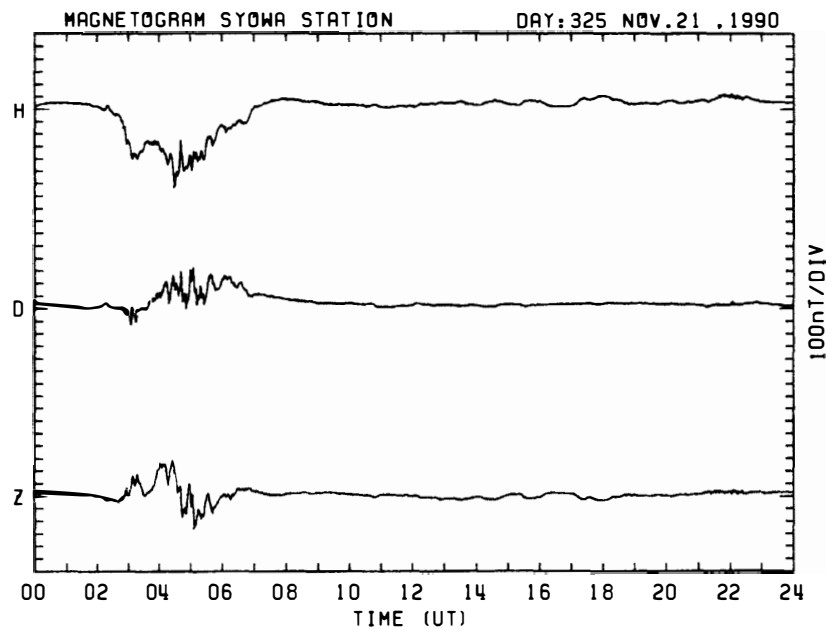


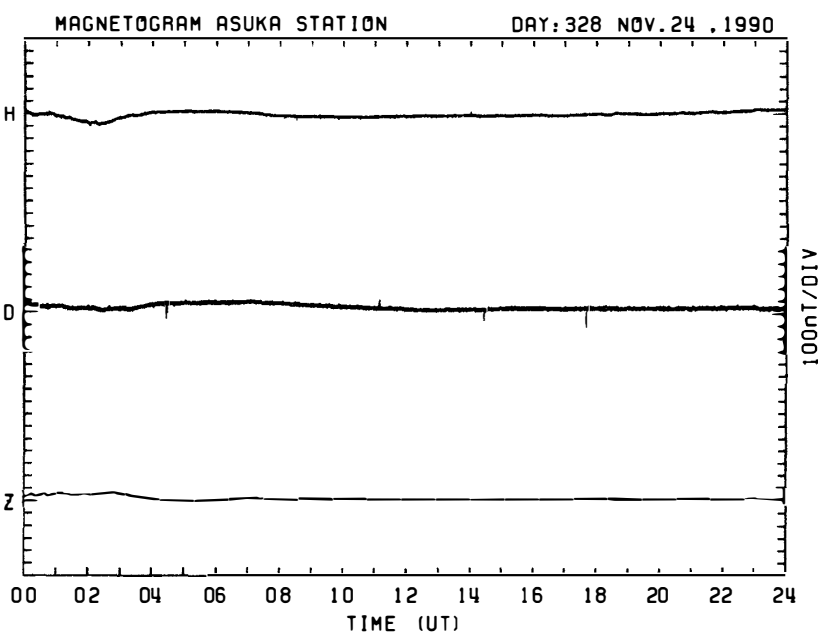
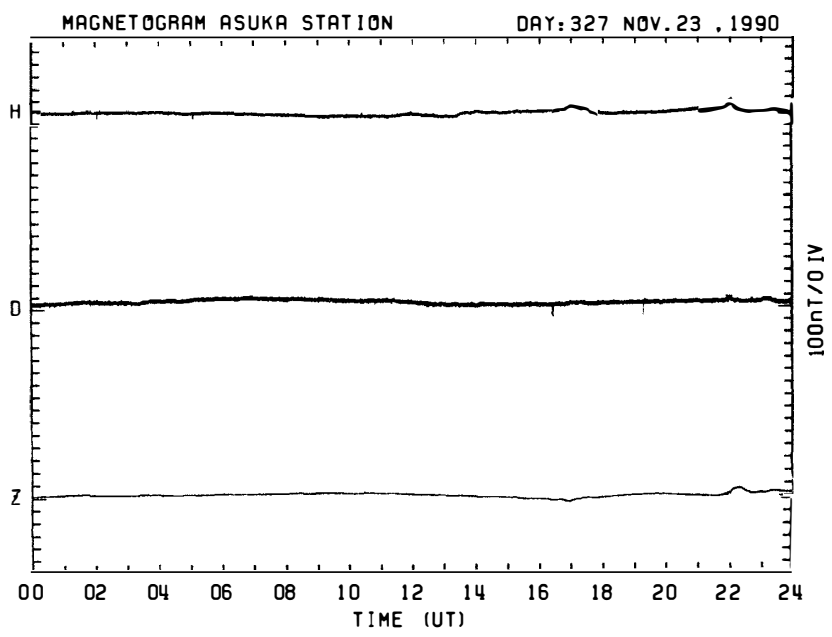
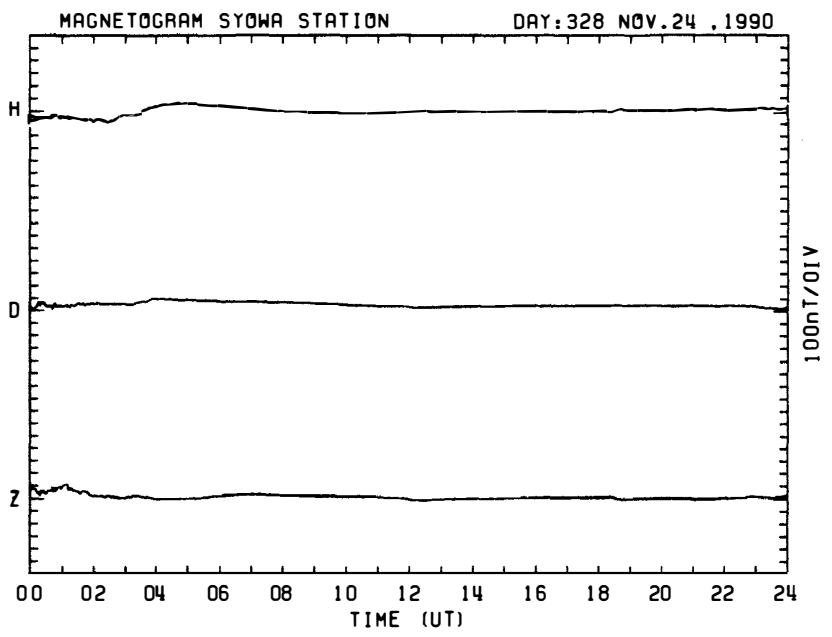
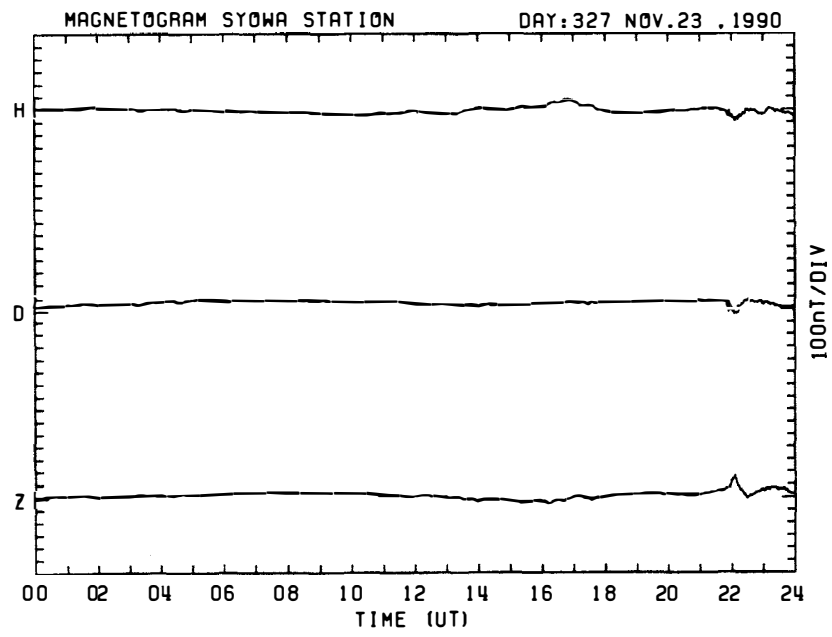




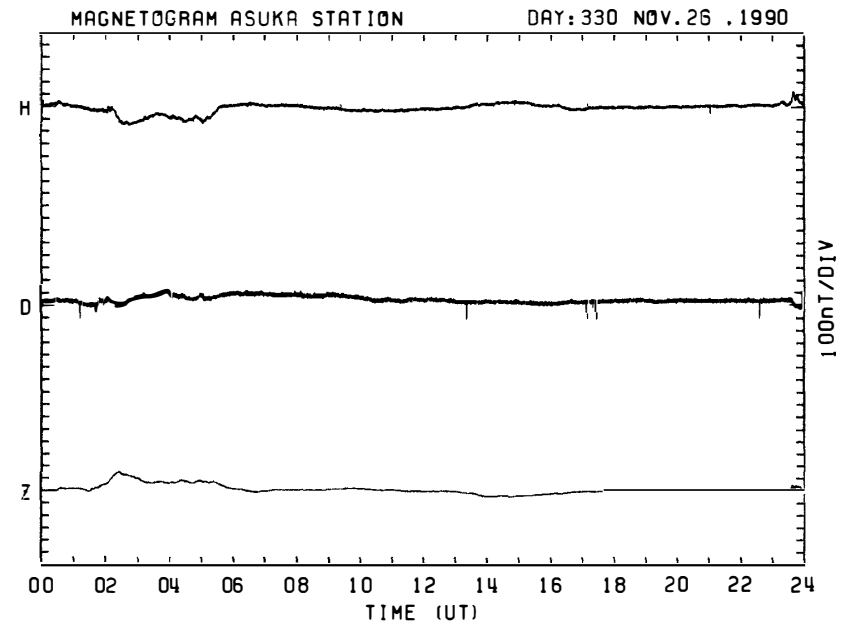
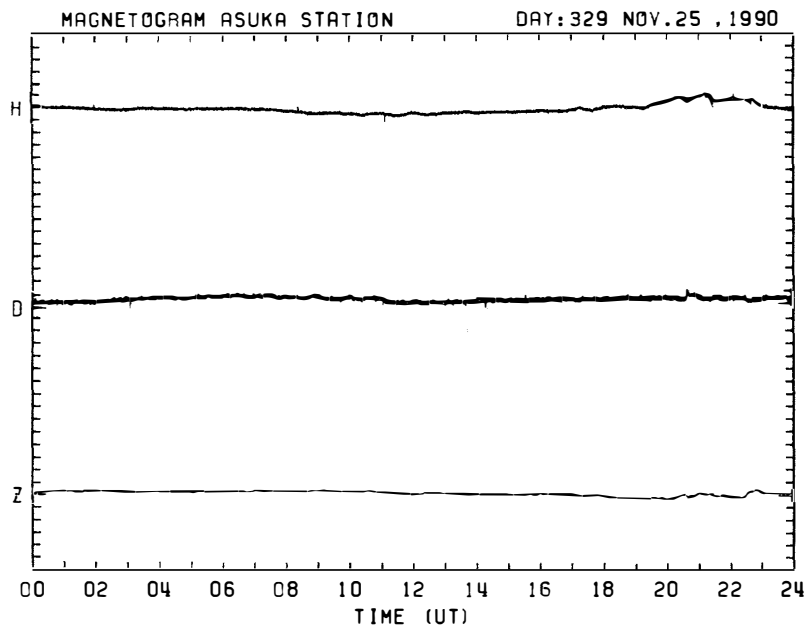
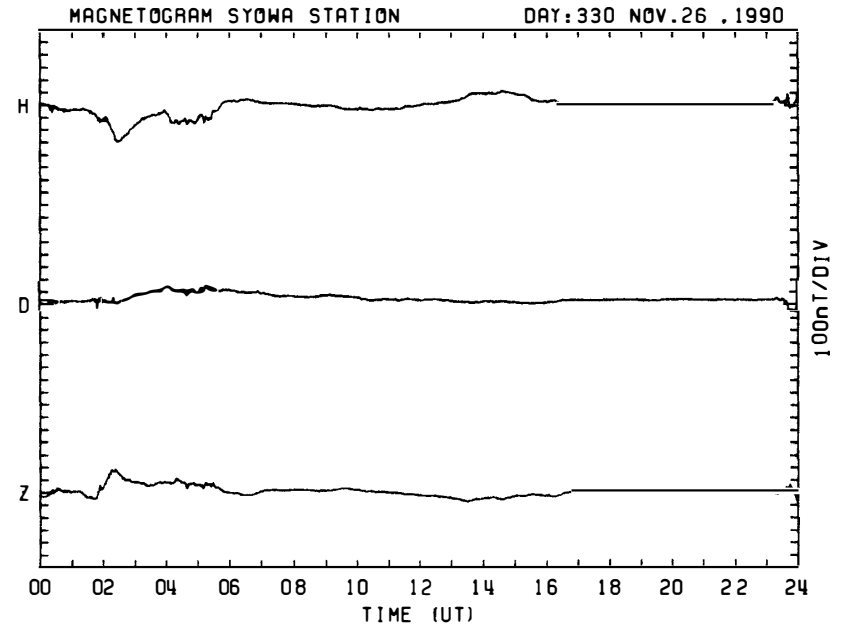
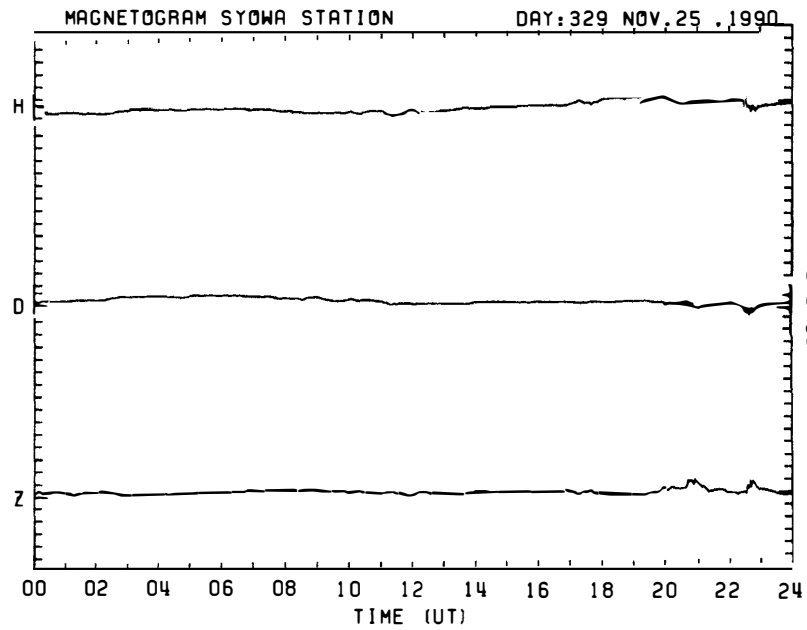


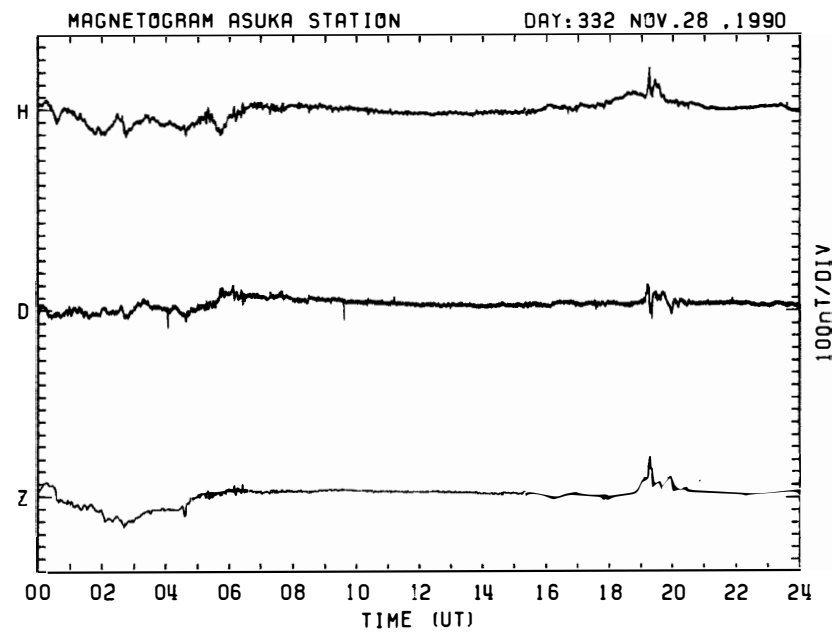
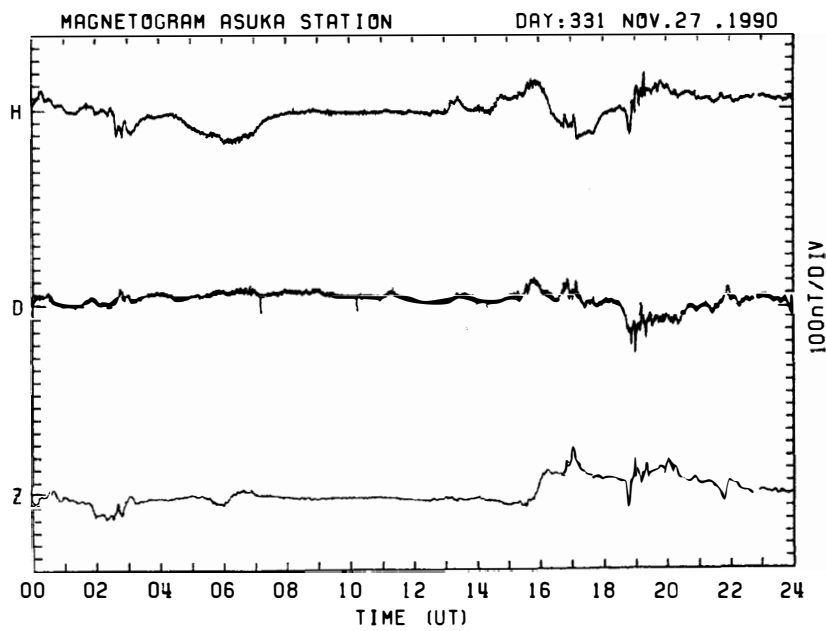
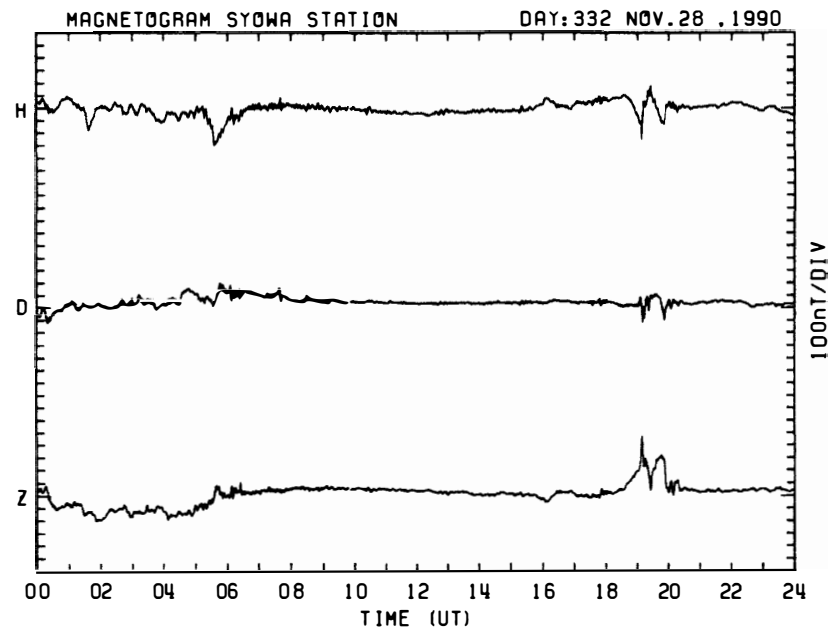
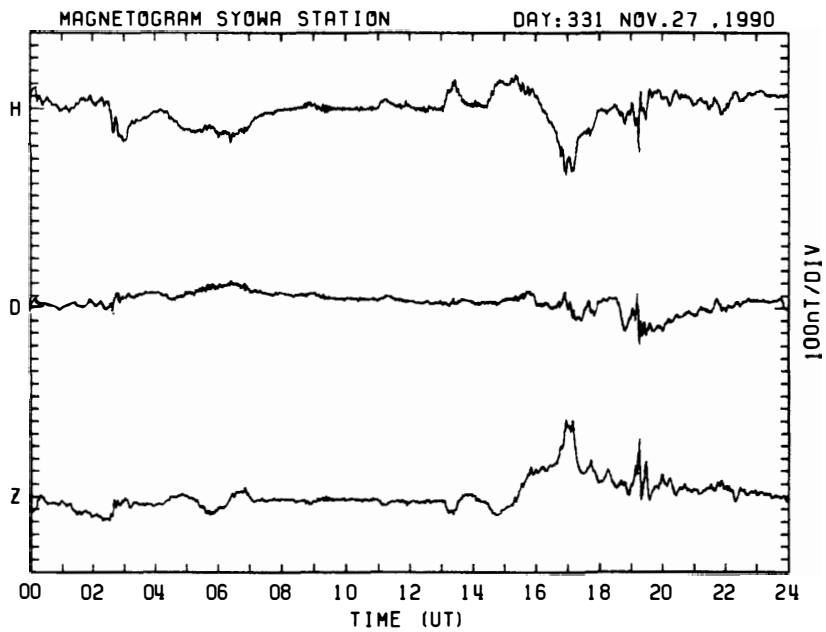


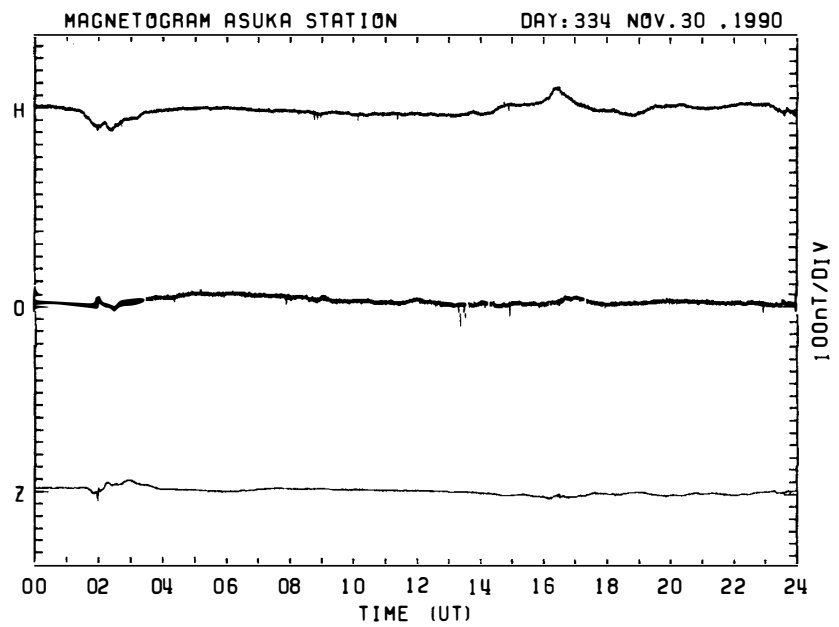
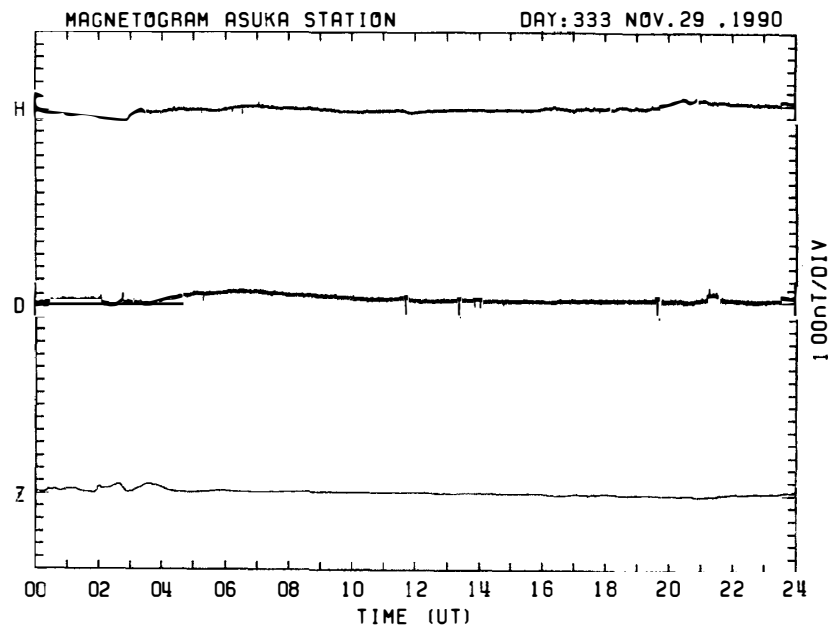
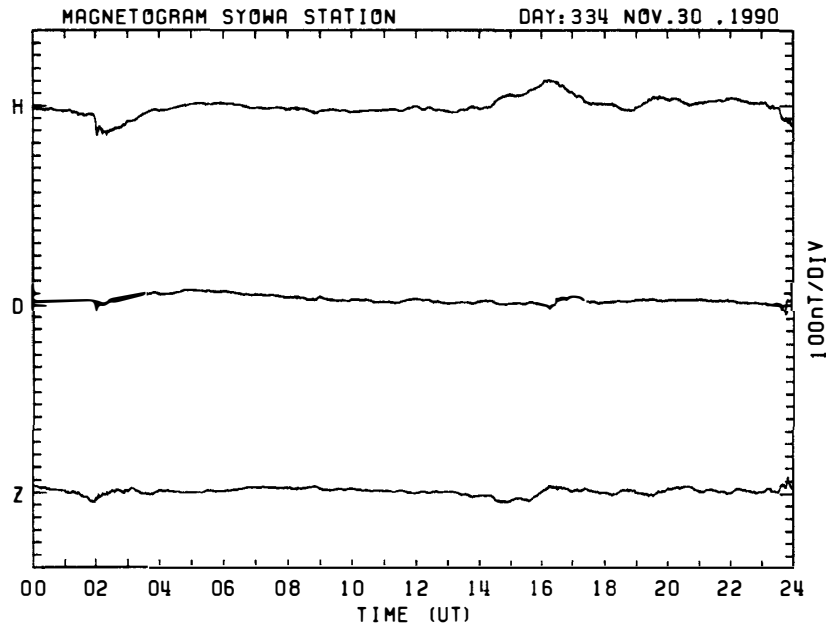
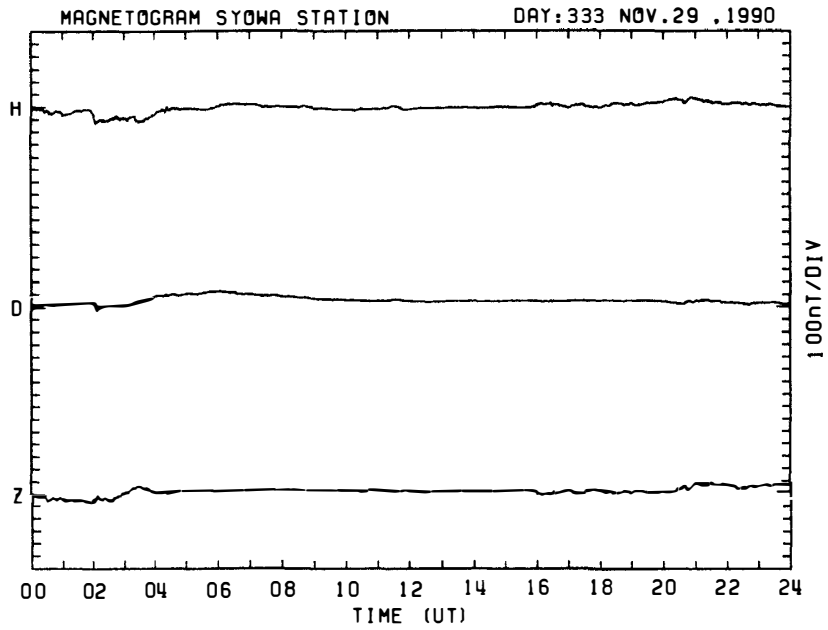


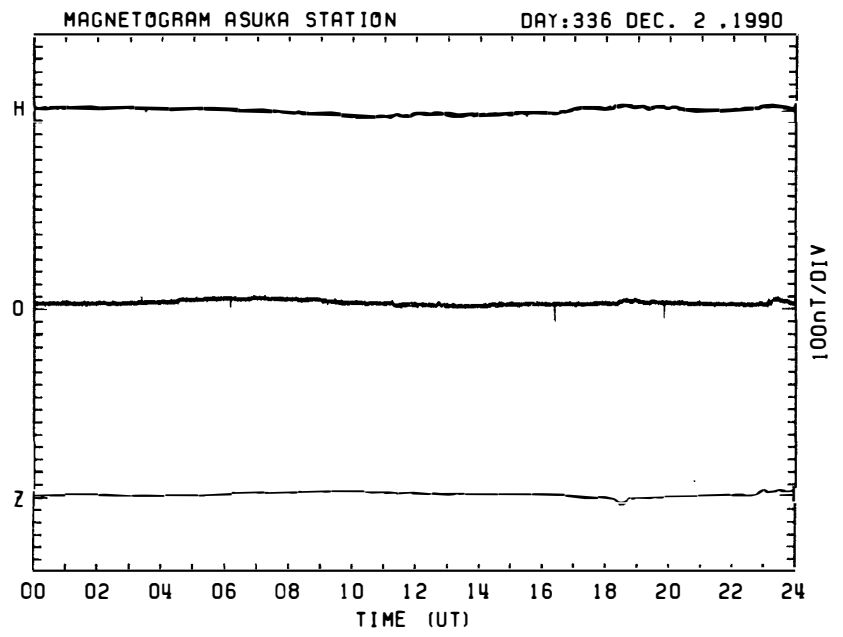
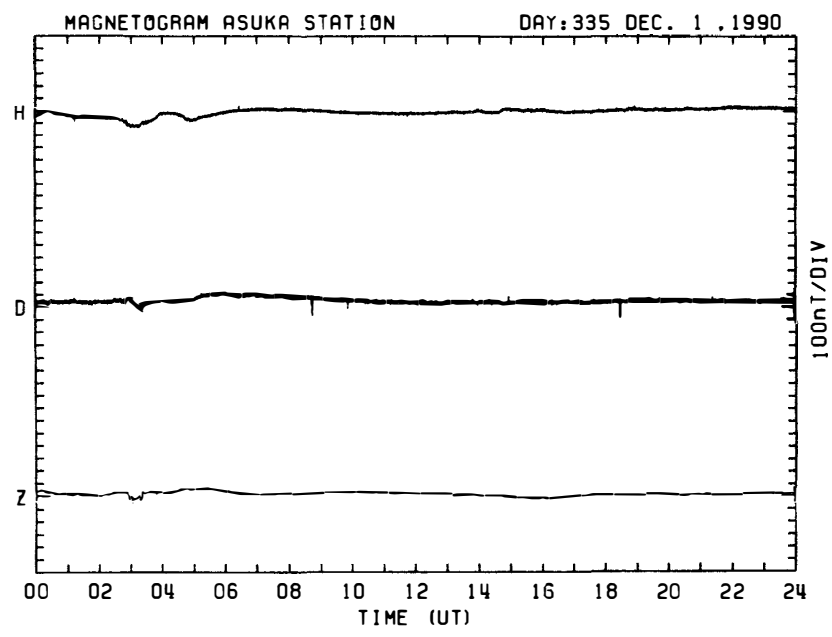
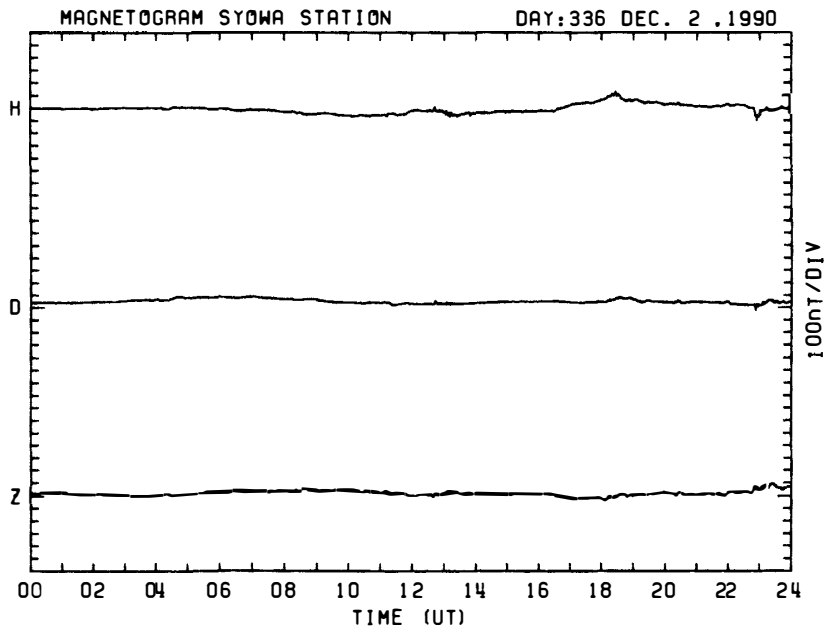
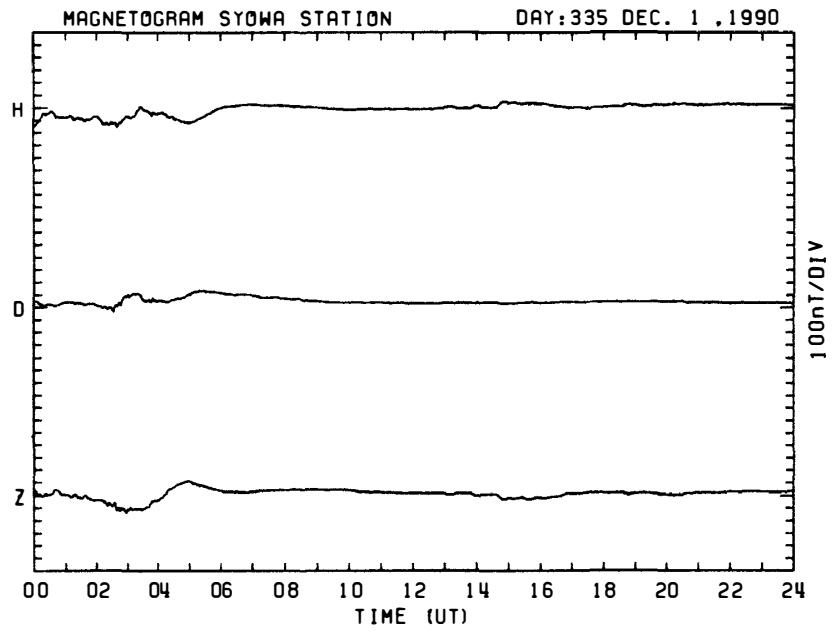


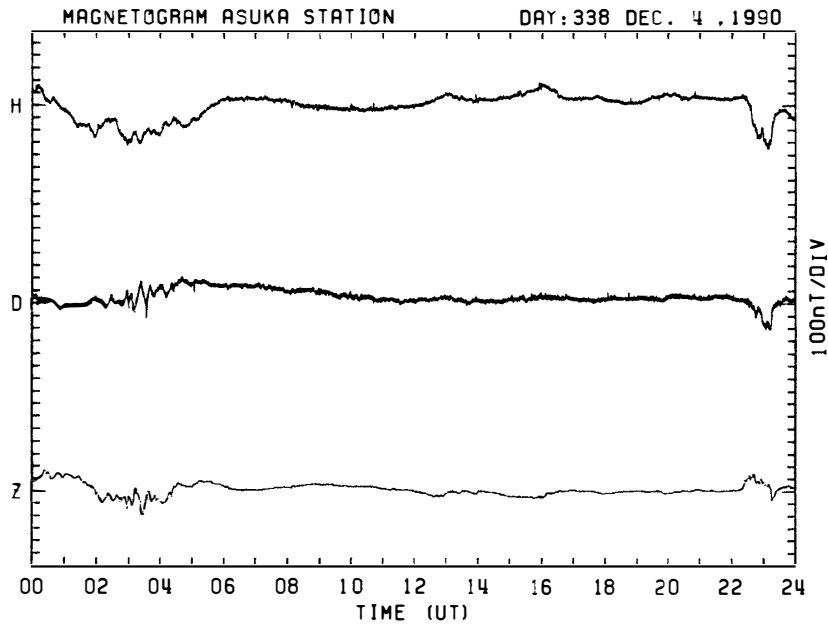
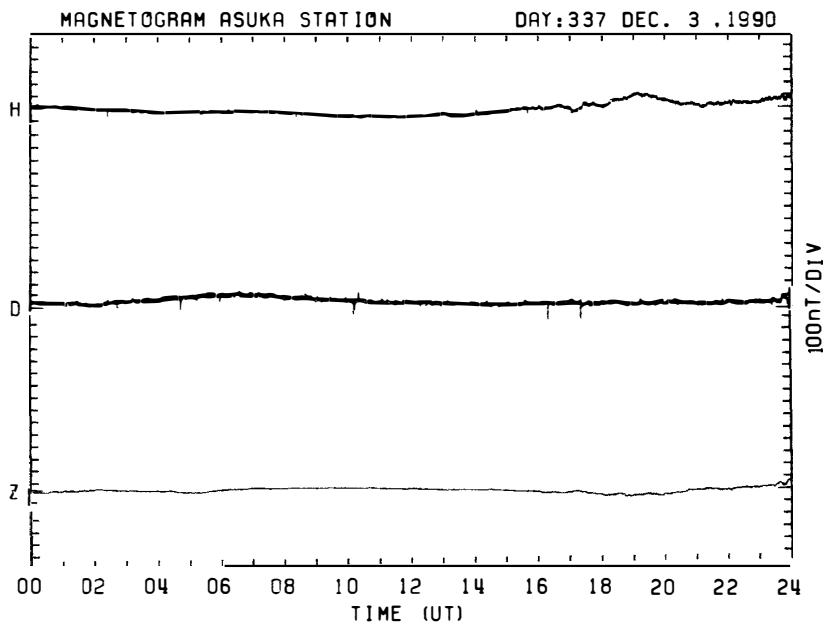
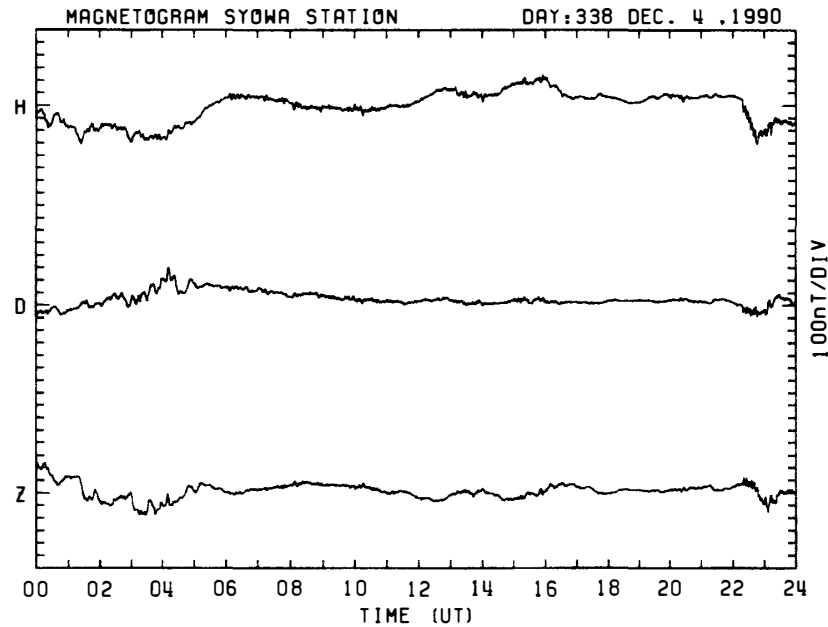
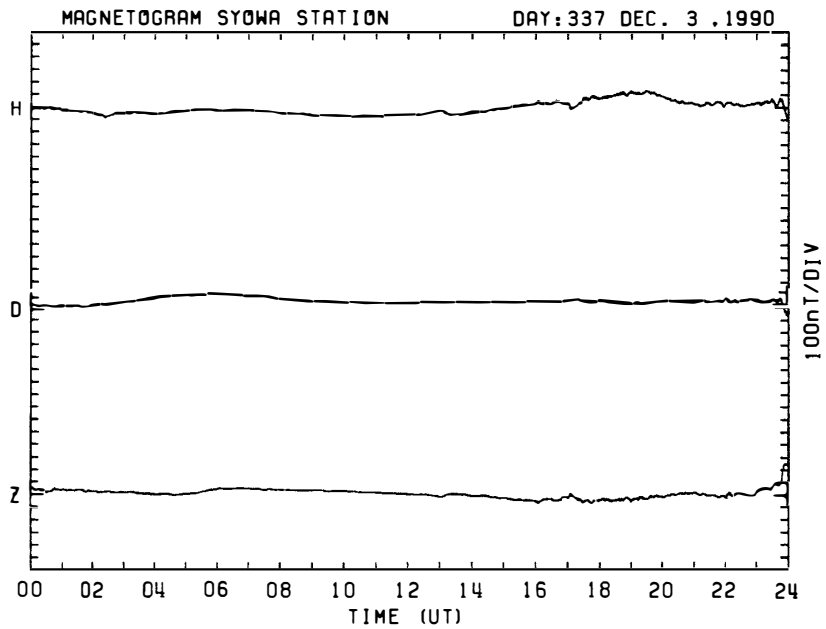


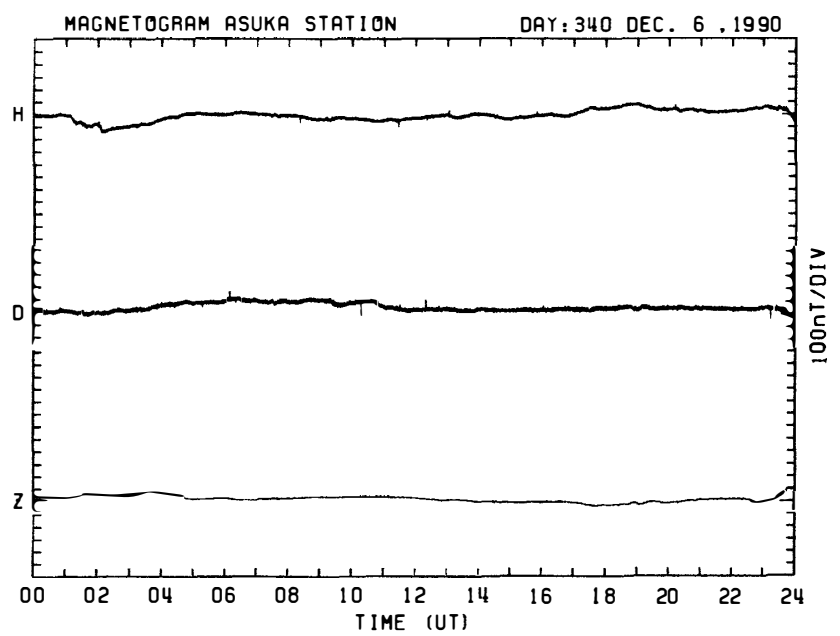
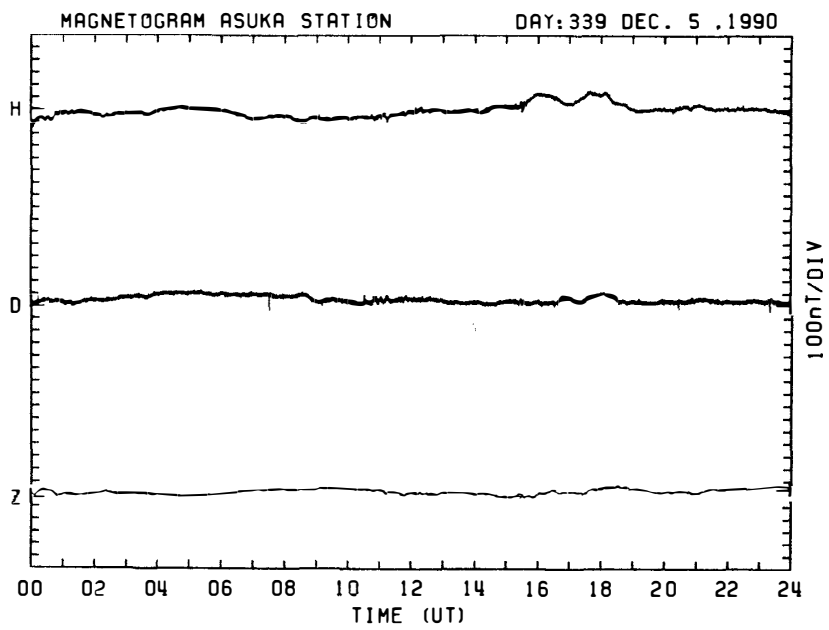
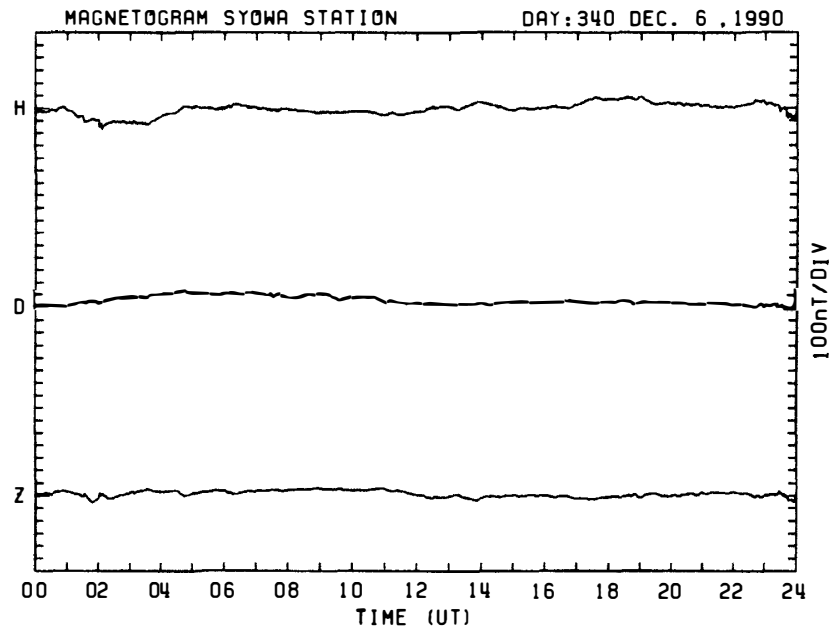
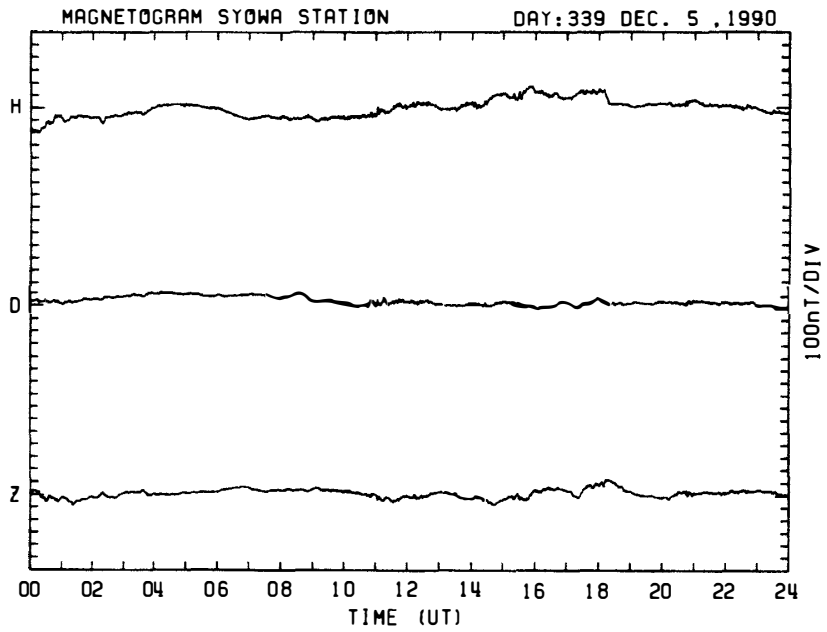


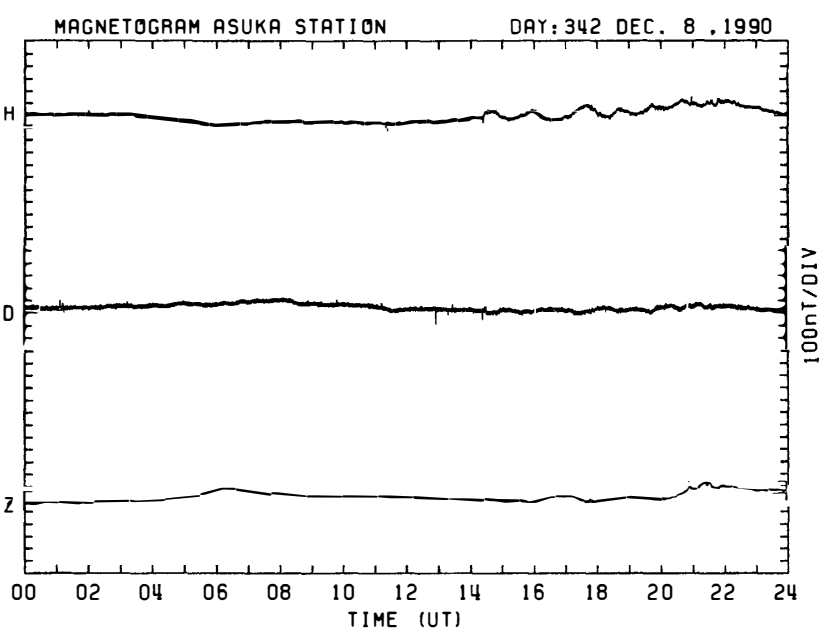
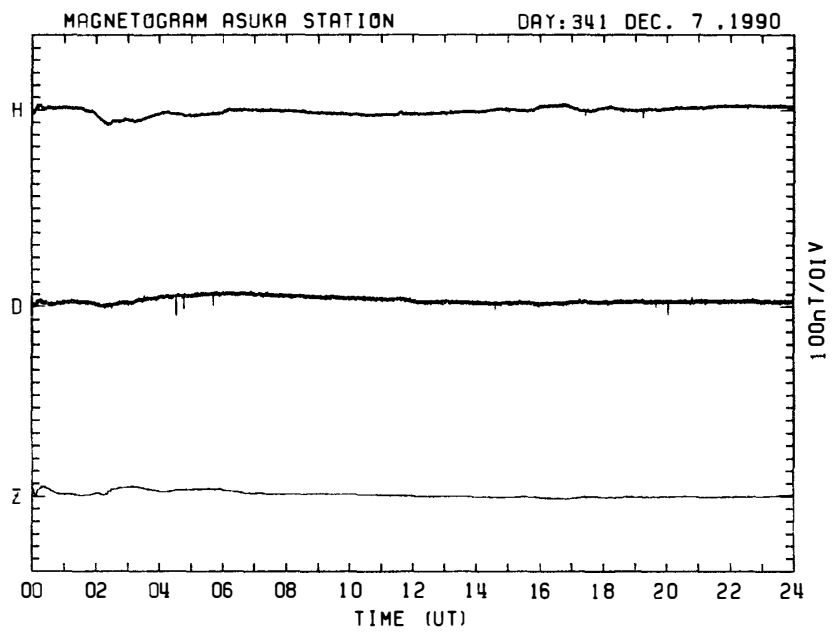
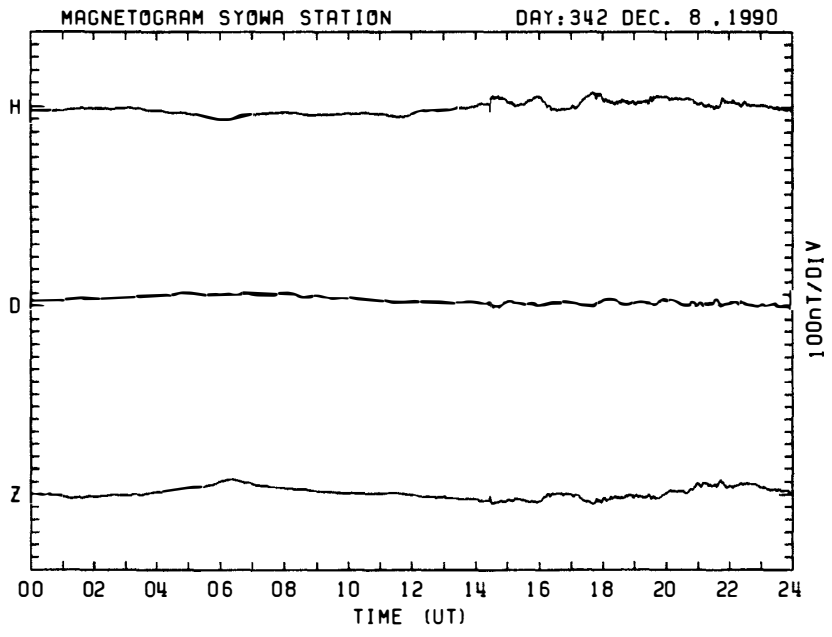
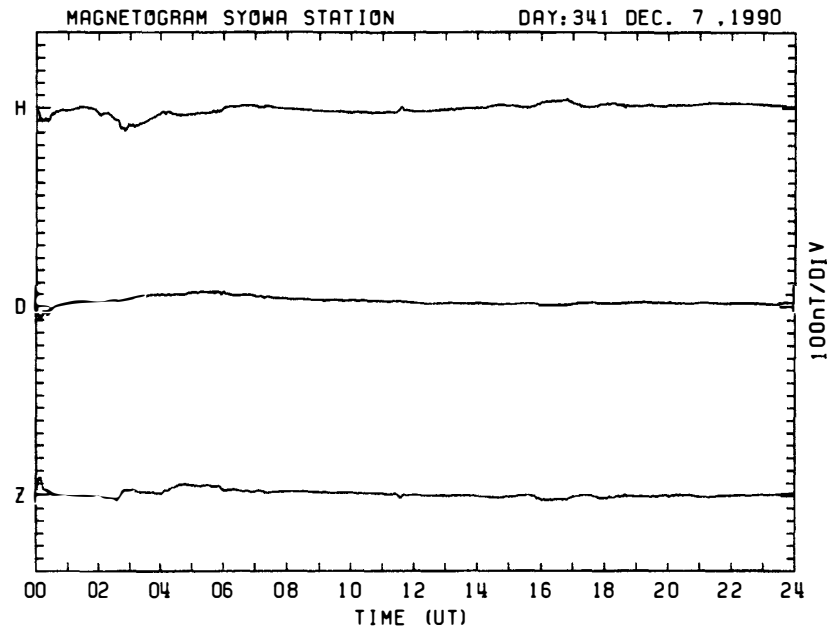


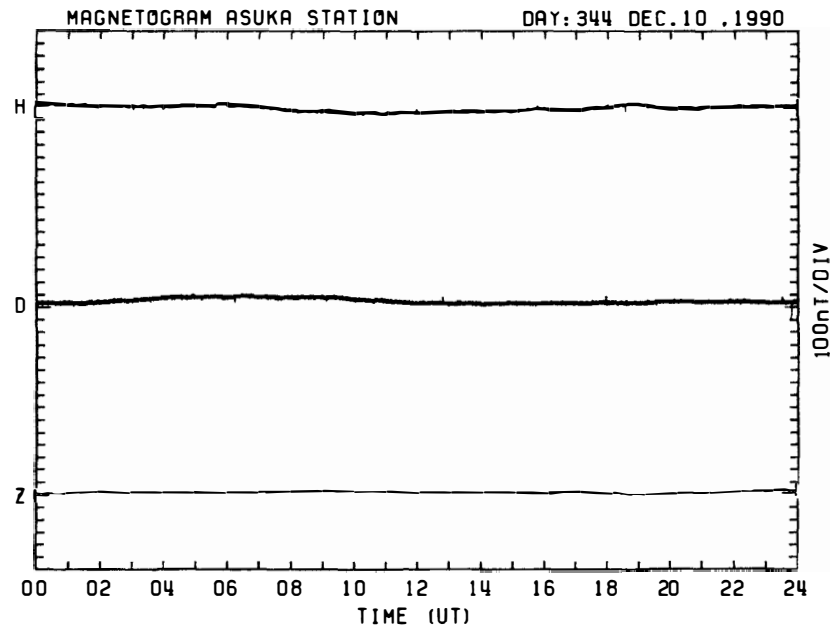
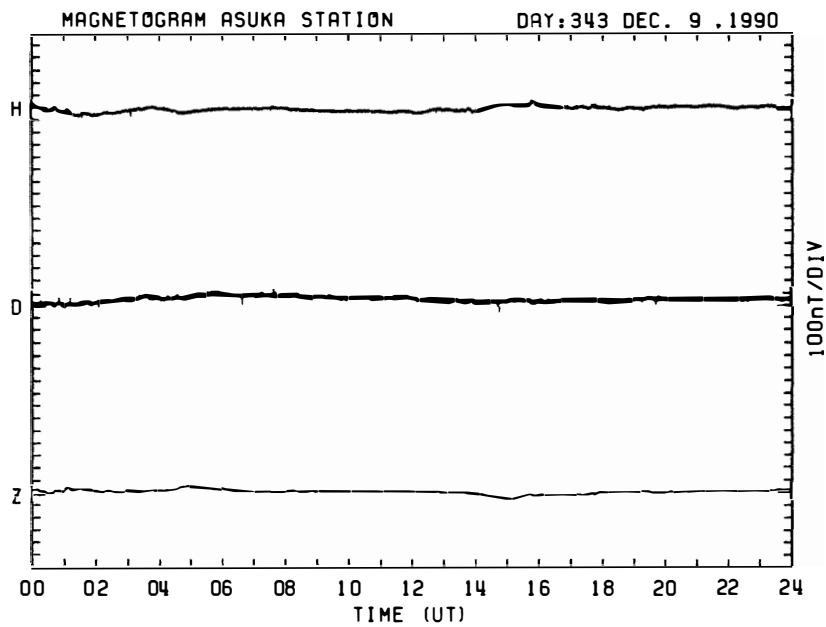
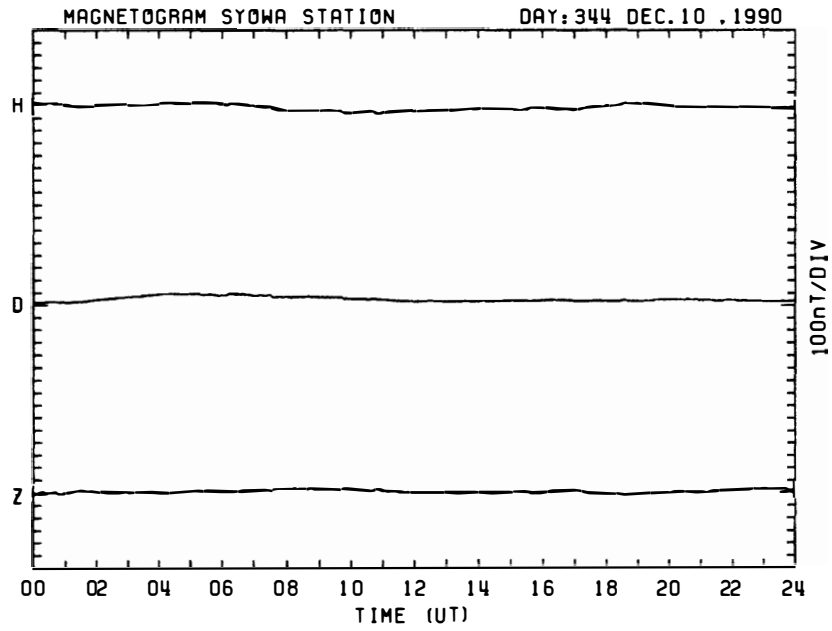
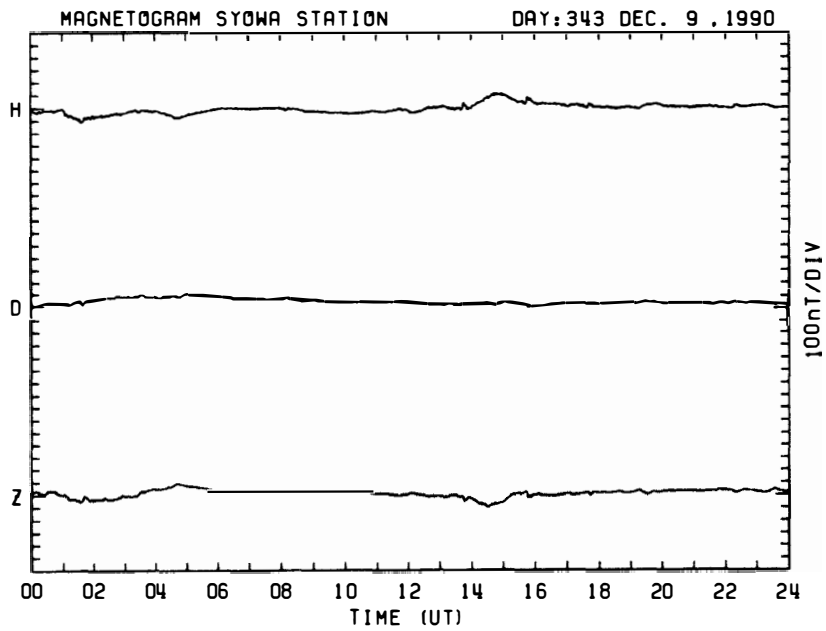




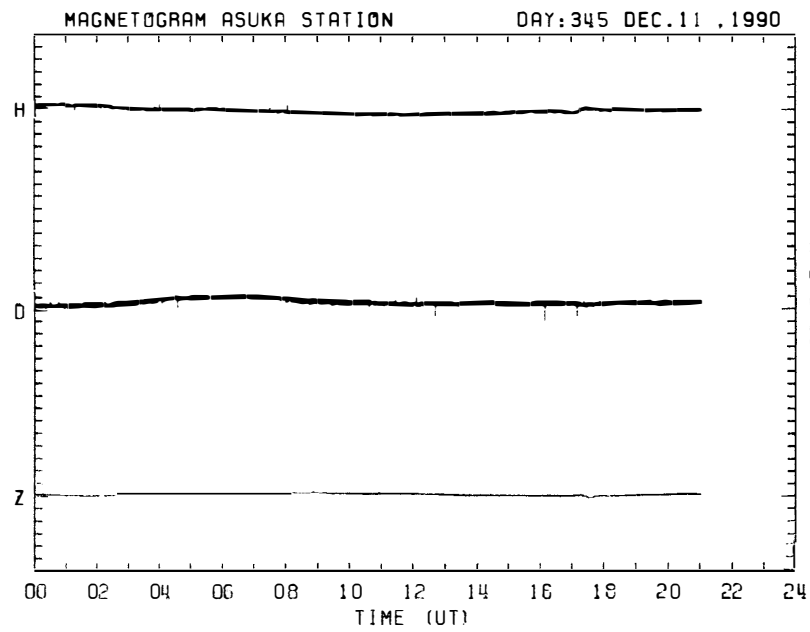
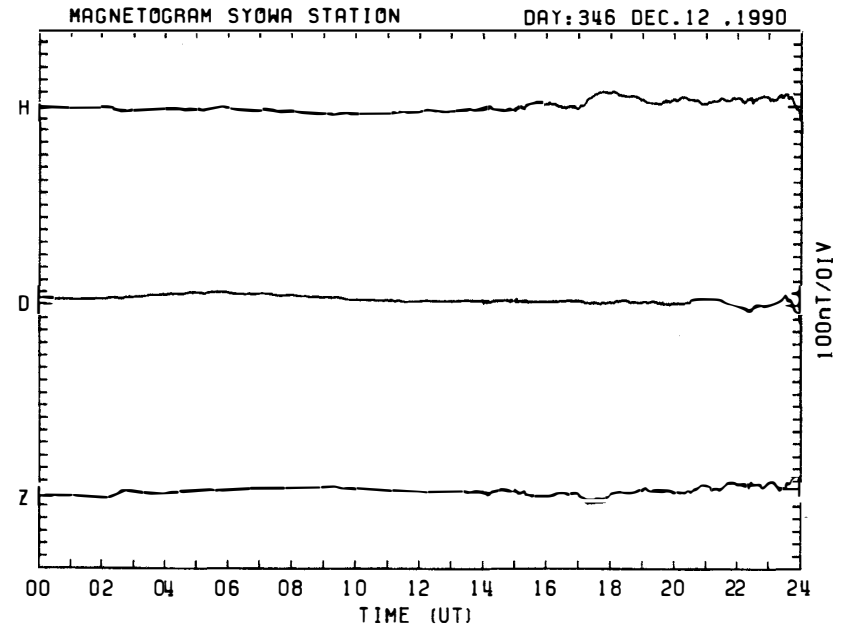
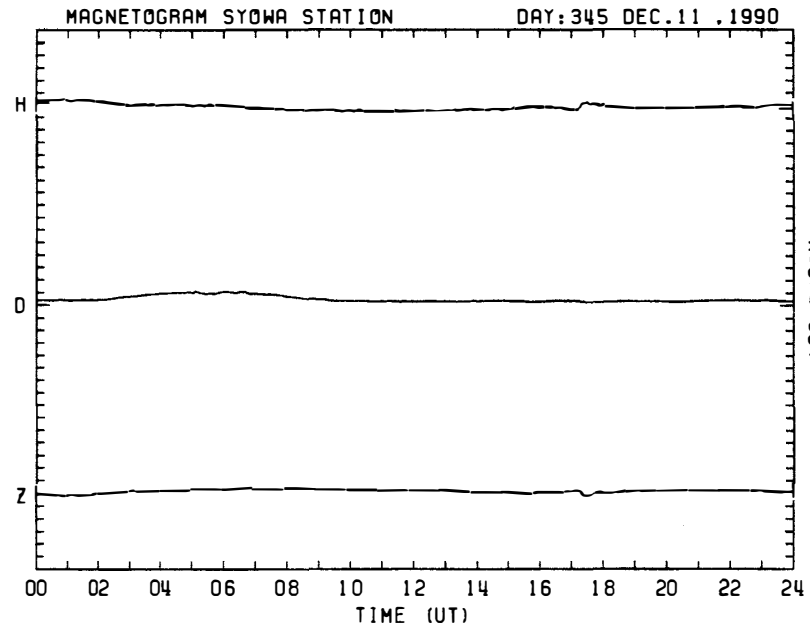




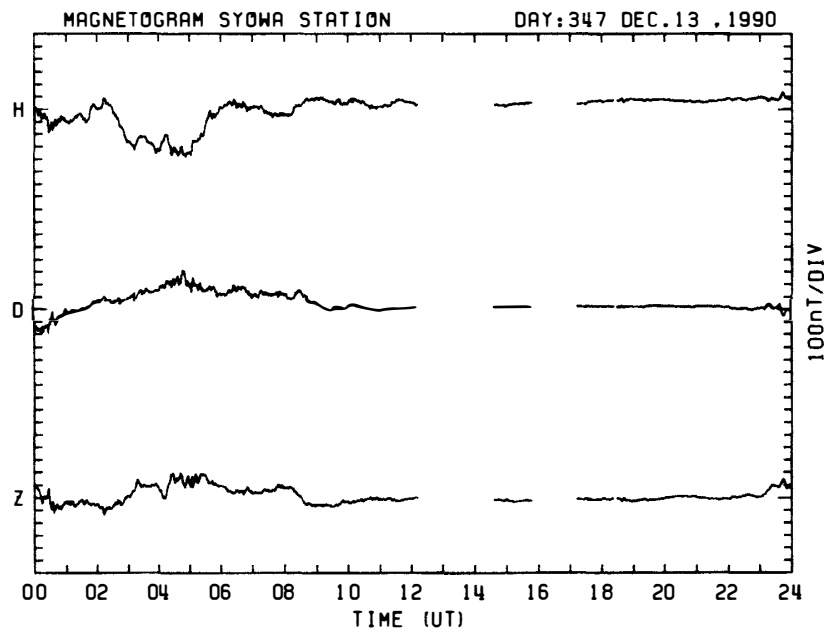




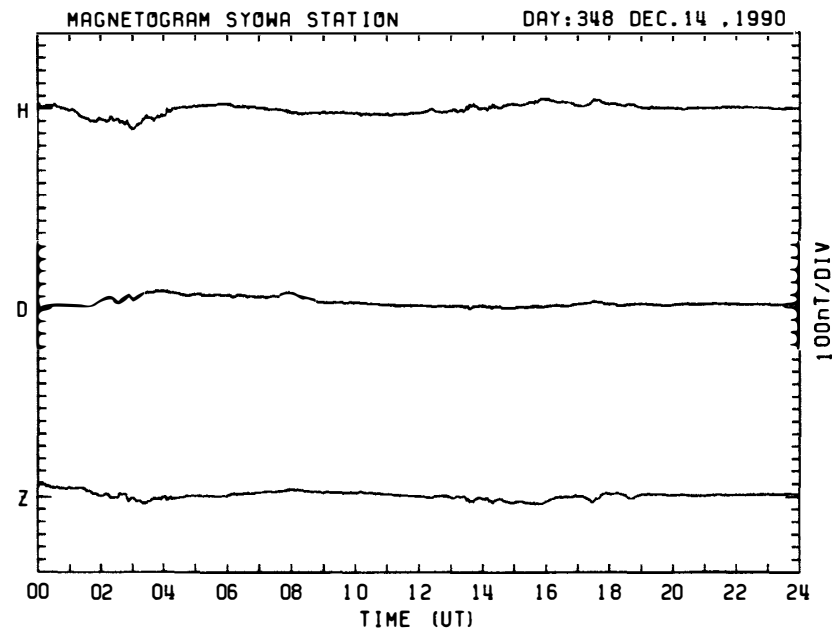




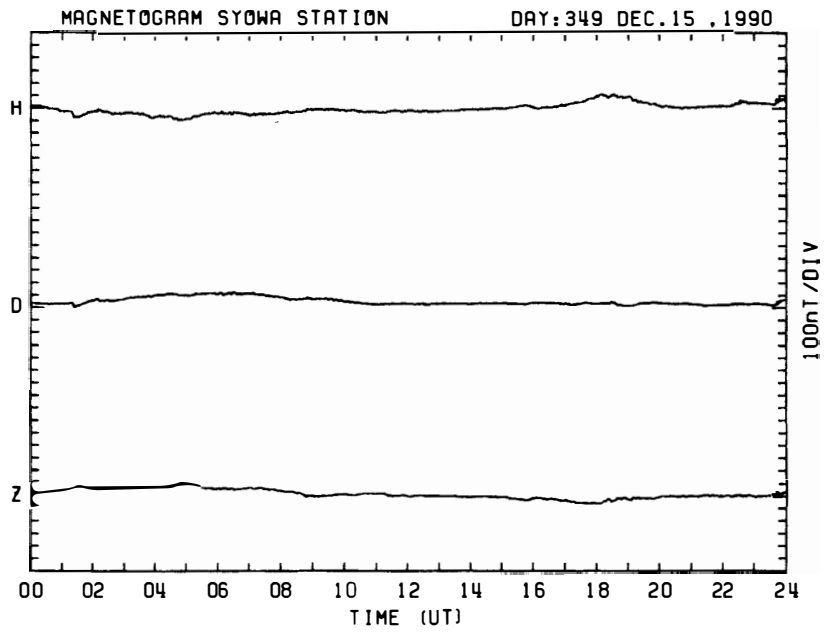
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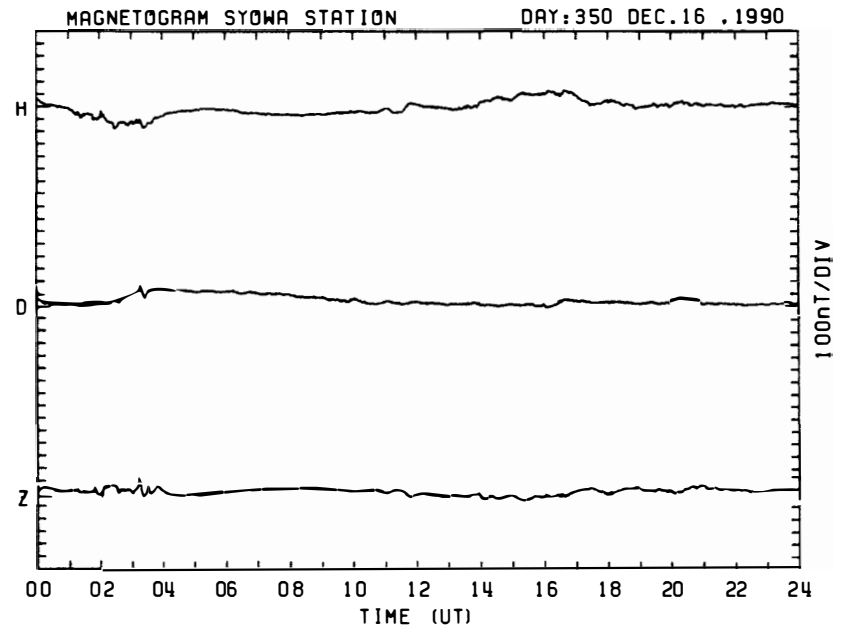
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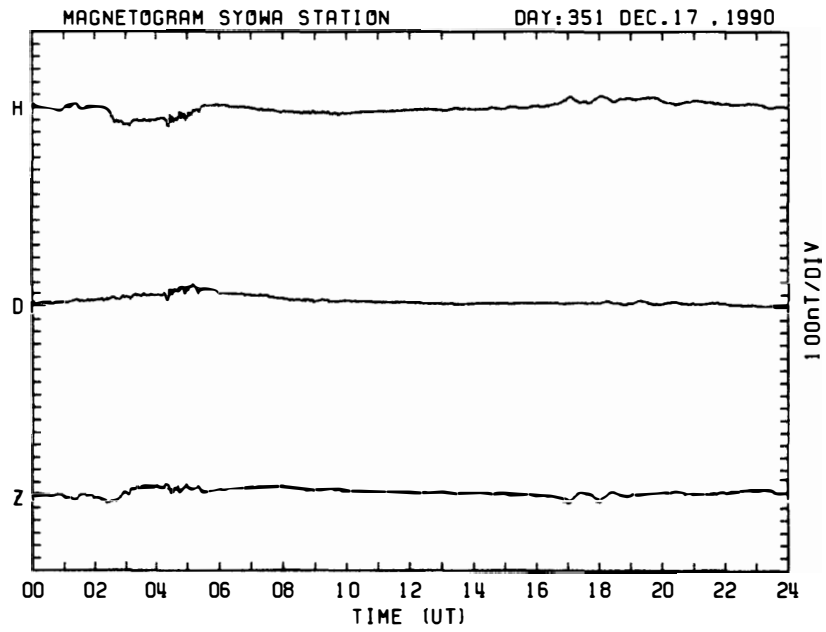
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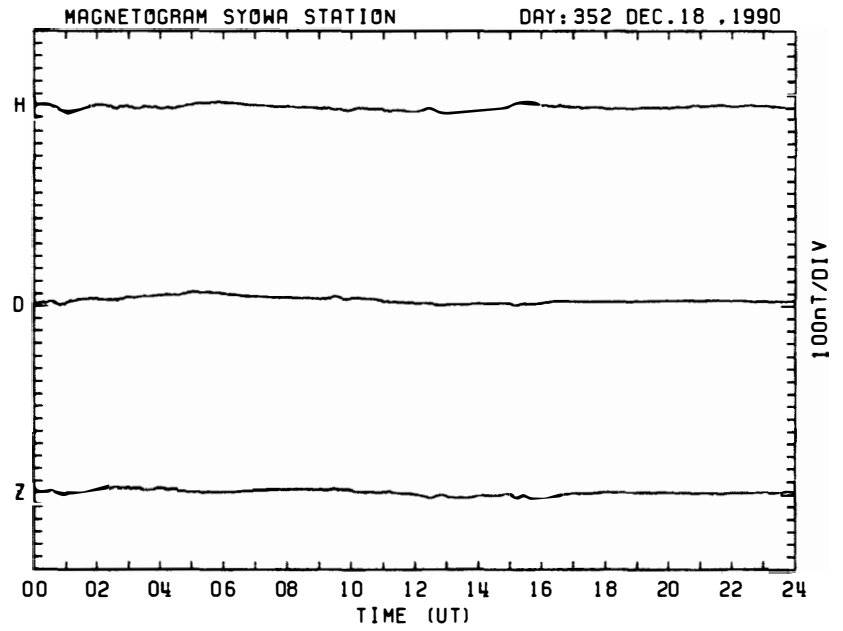
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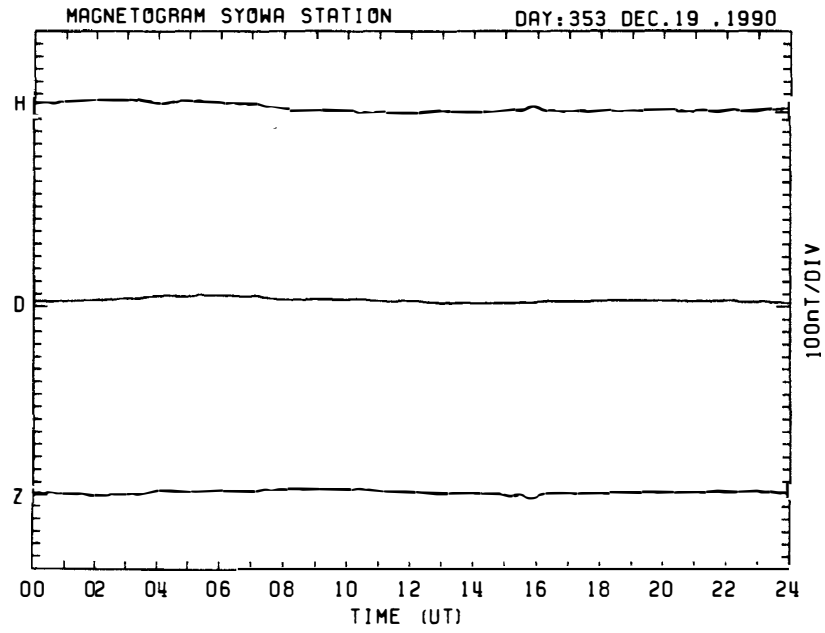
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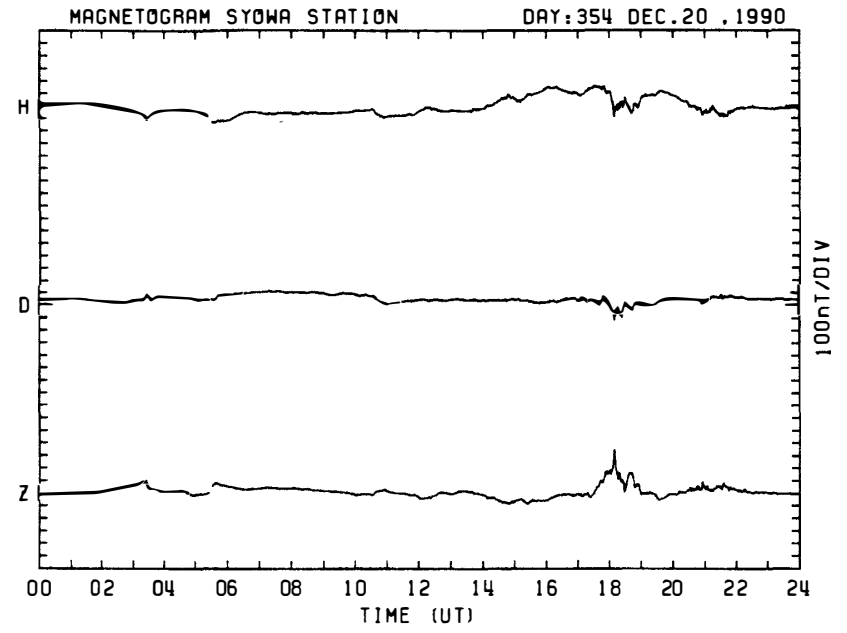
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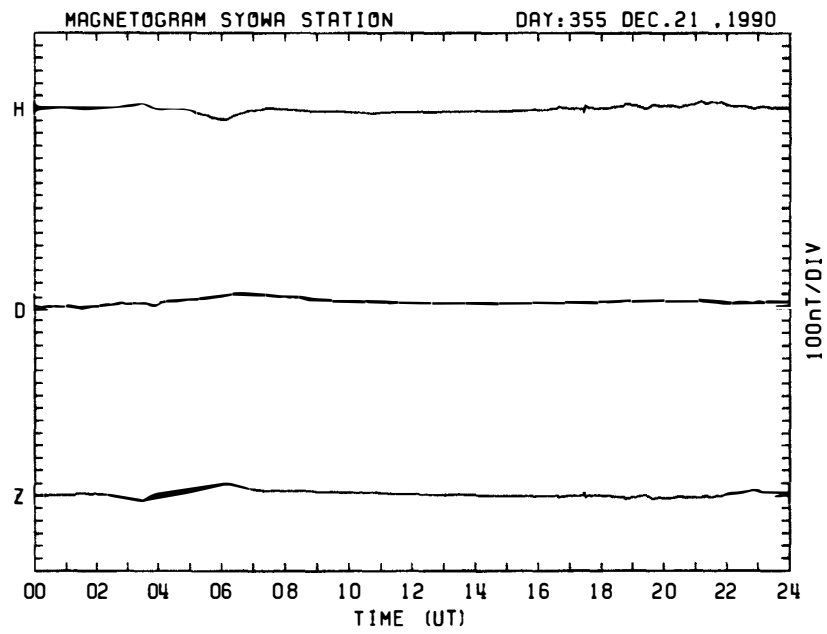
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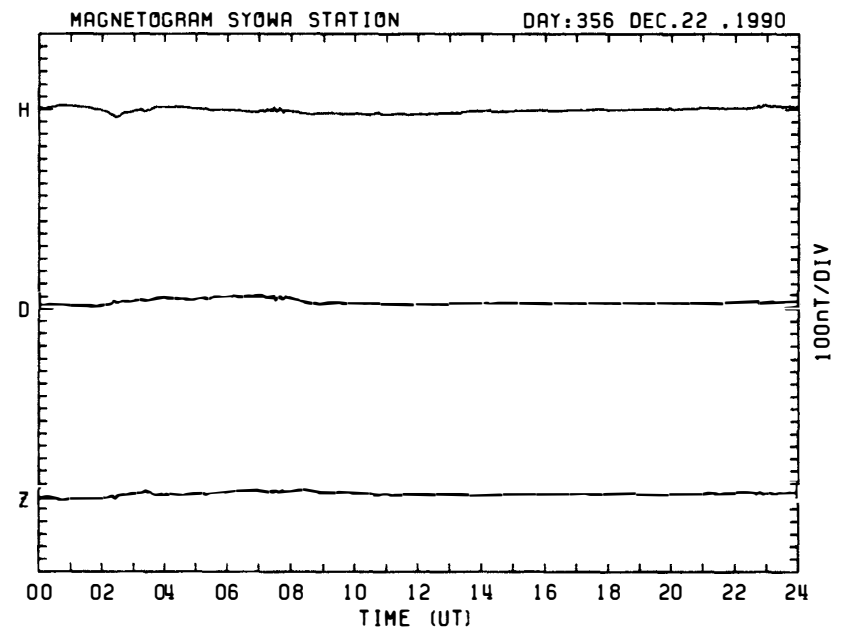
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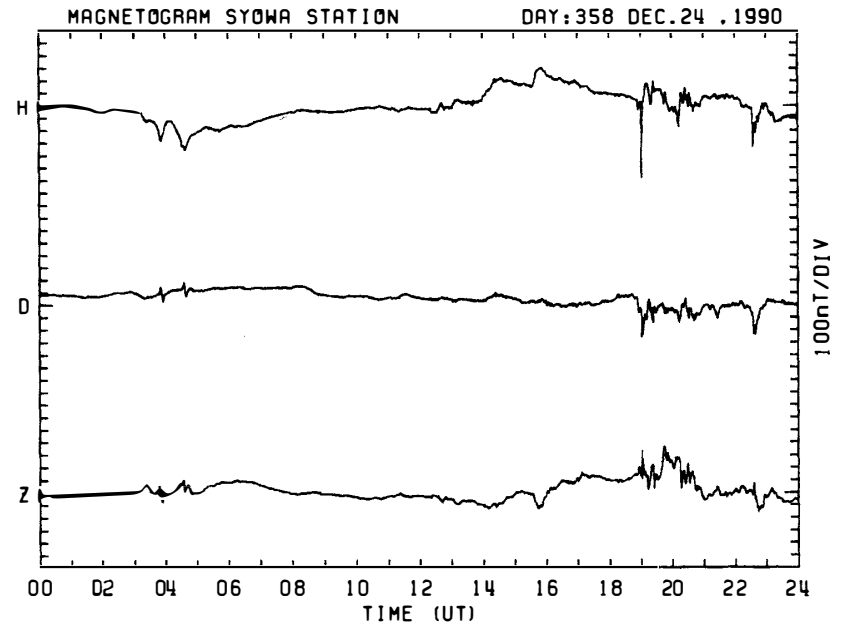
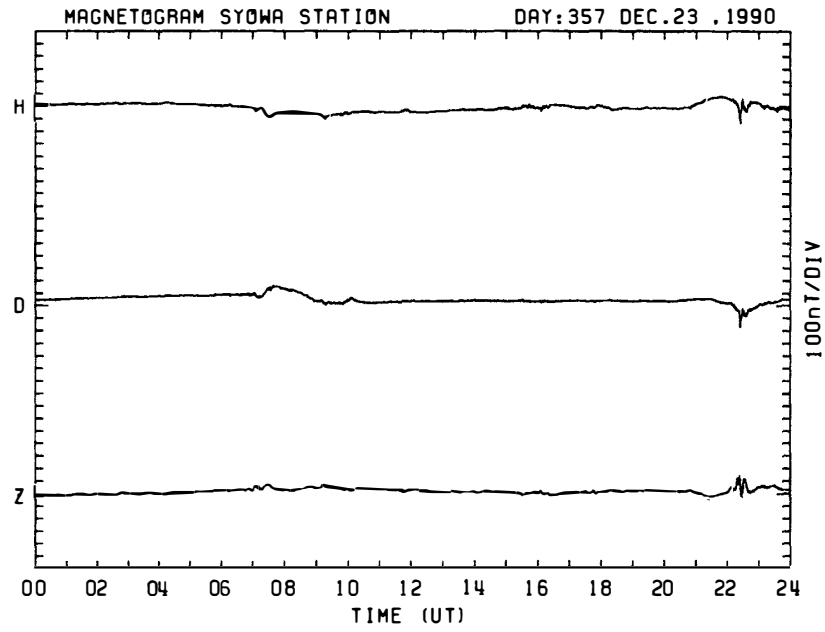
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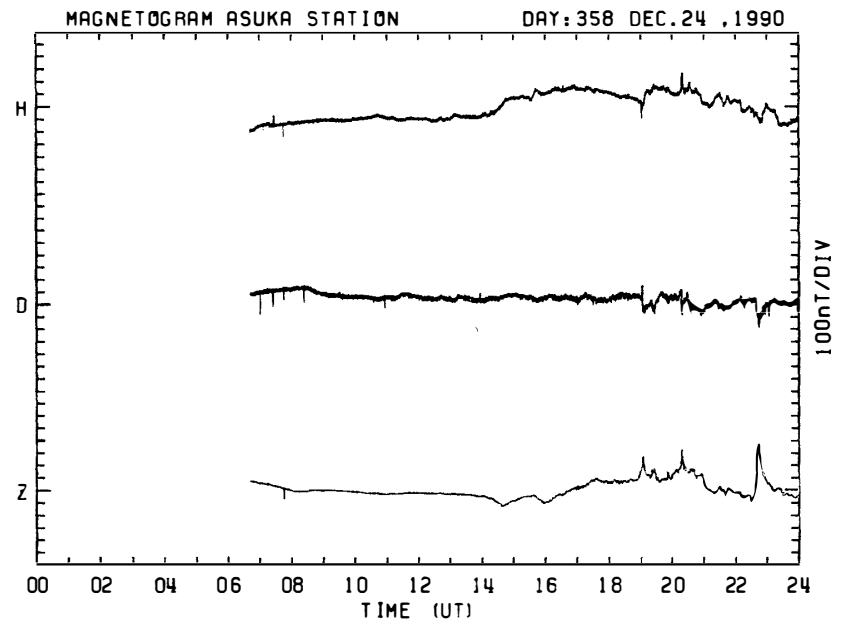
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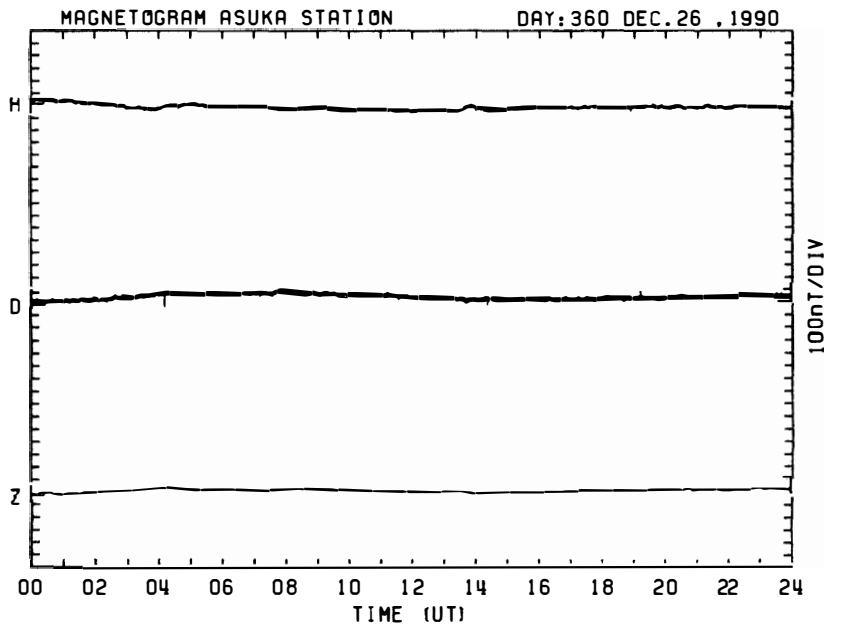
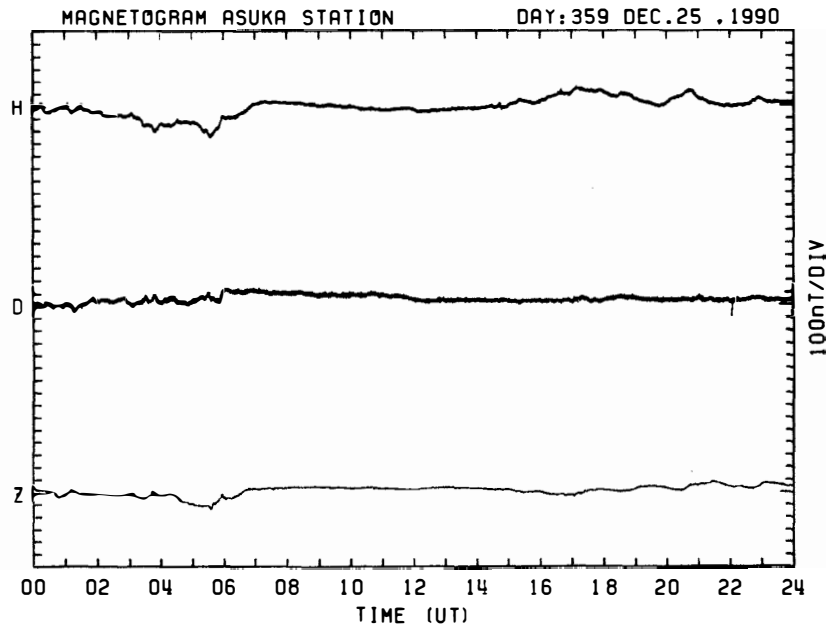
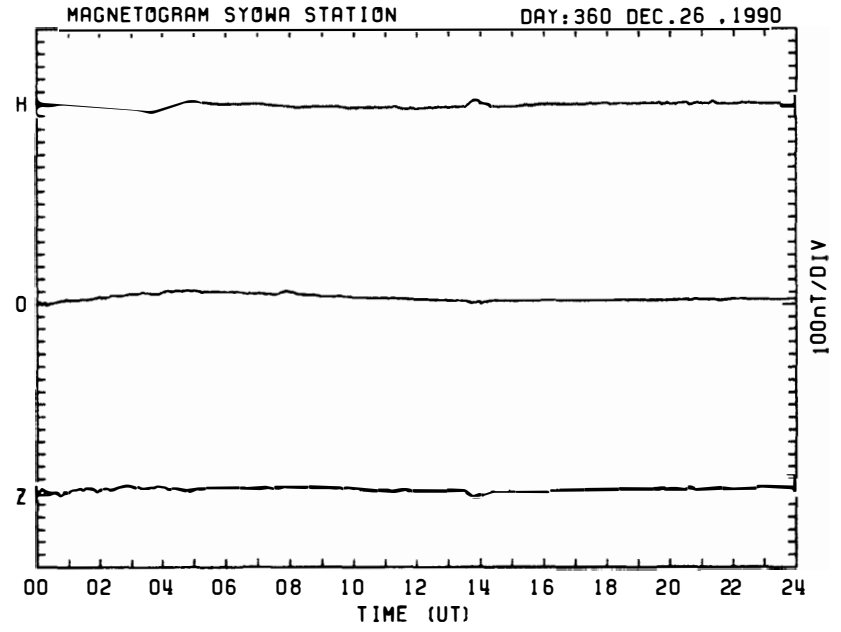
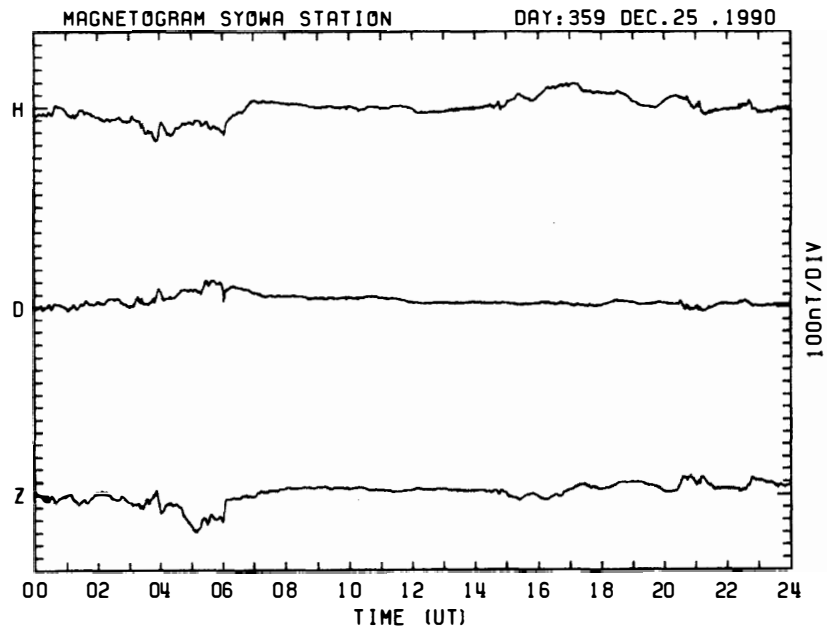


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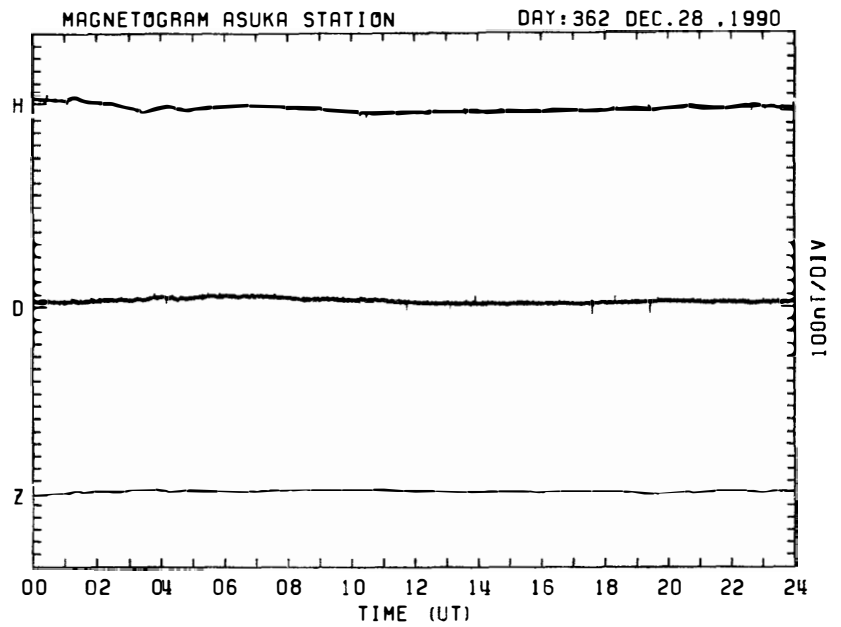
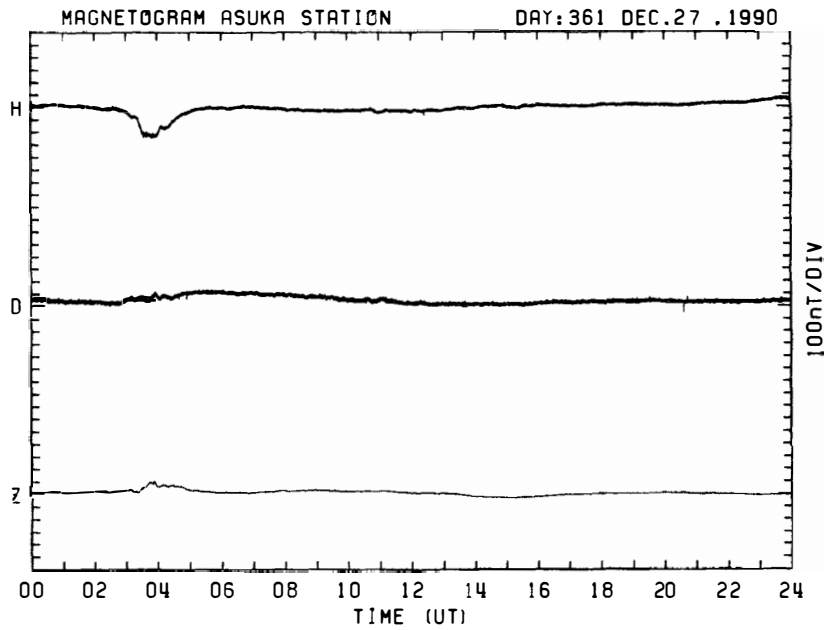
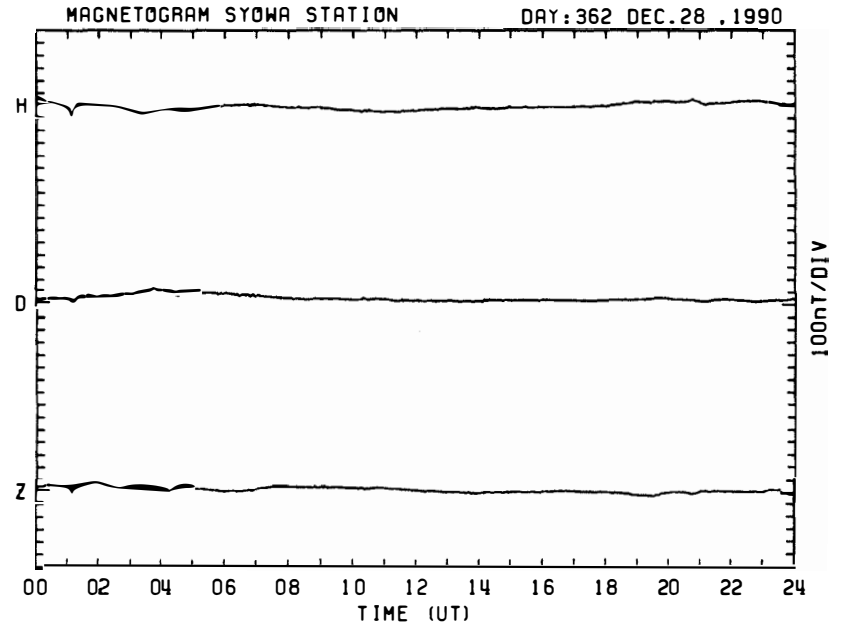
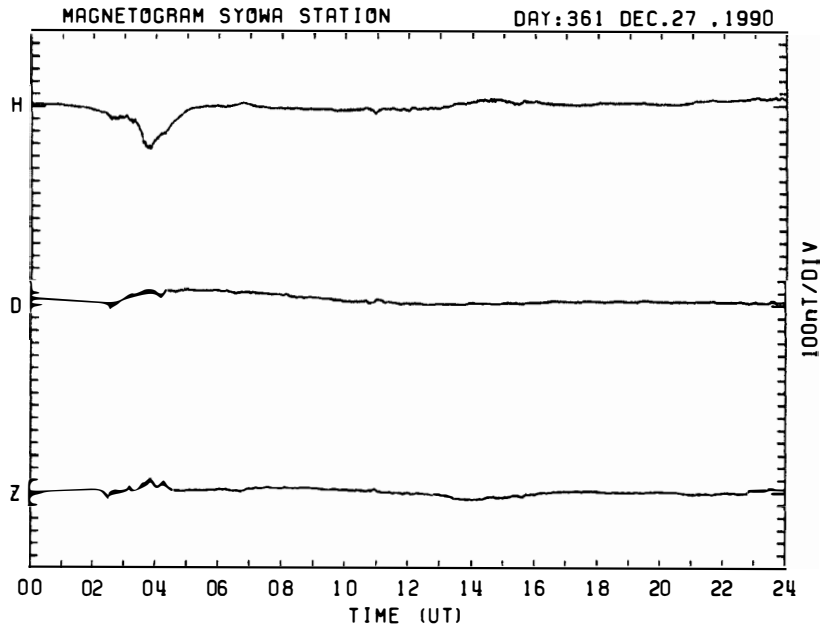


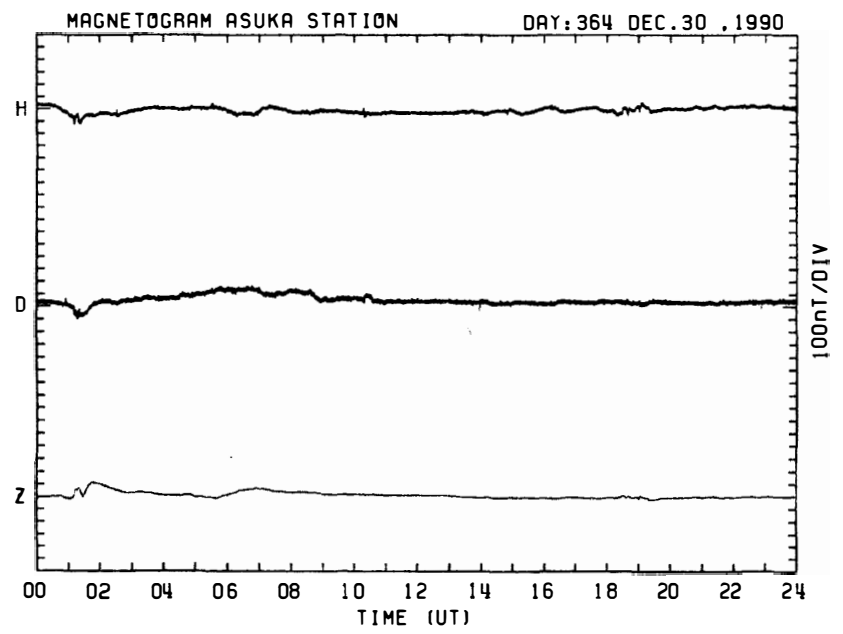
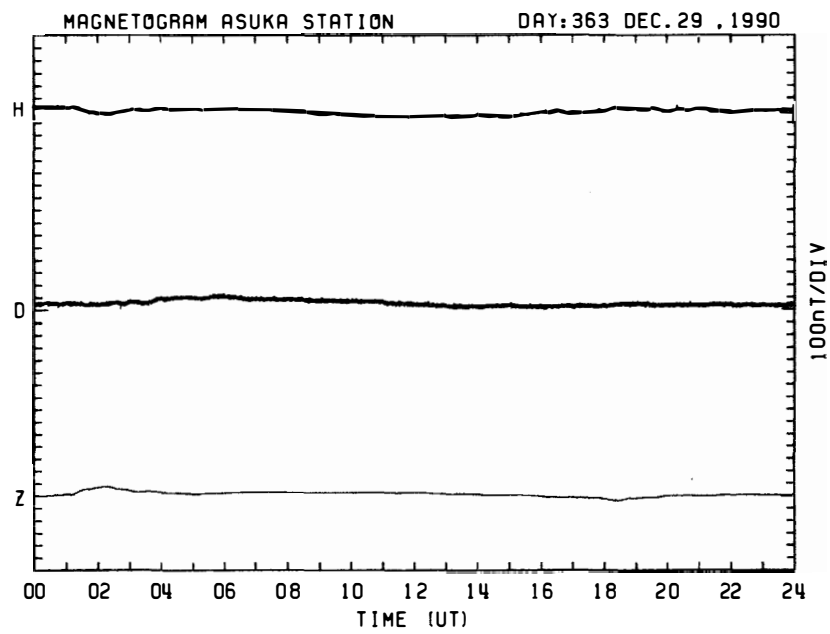
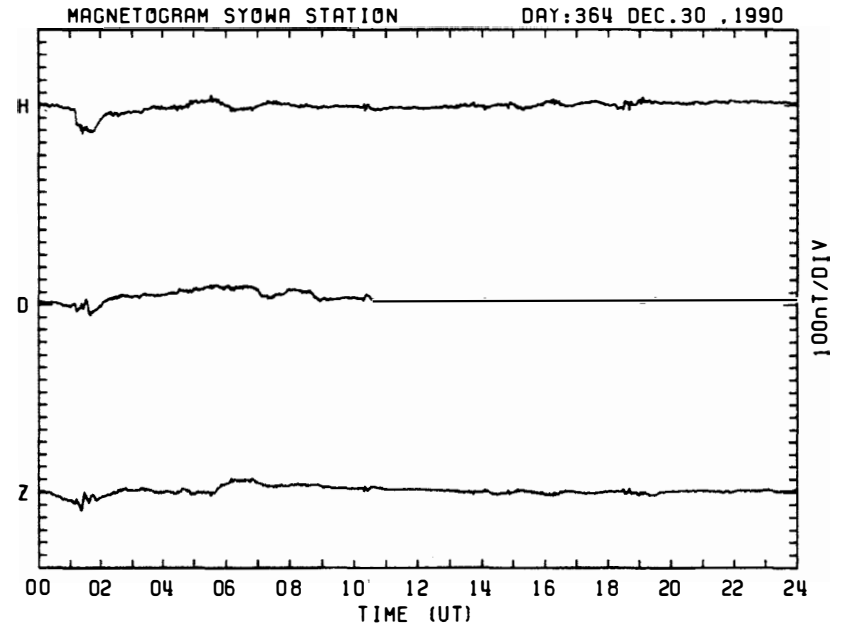
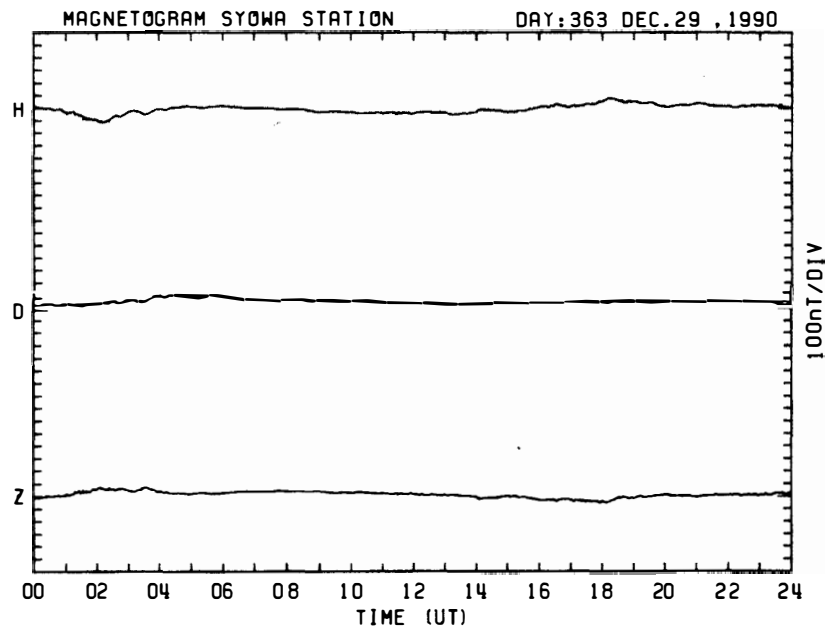
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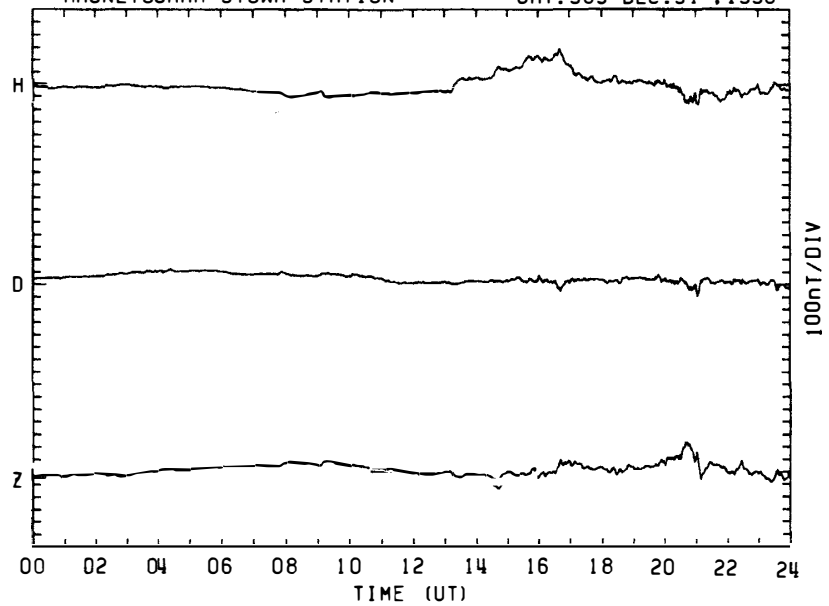








MAGNETOGRAM SYOWA STATION DAY:365 DEC.31 .1990



MAGNETOGRAM ASUKA STATION DAY:365 DEC.31 .1990

