港湾技研資料

TECHNICAL NOTE OF
THE PORT AND HARBOUR RESEARCH INSTITUTE
MINISTRY OF TRANSPORT, JAPAN

No. 777 June 1994

STRONG-MOTION EARTHQUAKE RECORDS ON THE 1993 KUSHIRO-OKI EARTHQUAKE IN PORT AREAS

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1993年釧路沖地震の港湾地域における強震記録

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１９９３年釧路沖地震の港湾地域における強震記録

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要旨

1993年 1月15日20時06分07秒，北海道太平洋岸の釧路沖を震源とする気象庁マグニチュード 7.8の地震が発生した。気象庁によって，この地震は「平成 5年（1993年）釧路沖地震」と命名された。本地震の震源位置は，北緯42度53.5分，東経 144度22.4分，深さ 103kmに位置し，その震央位置は釧路港の南方約12kmにあった。本地震によって，釧路で震度VIの烈震が記録されたのをはじめ，北海道および東北の各地に激しい地震動がもたらされ，港湾施設の被害額は約 129億円に達した。

1962年より観測が開始され，1963年から記録が得られている港湾地域強震観測網においては，本地震によって21港27地点で強震計が作動し，17港22地点でデジタルデータとしての加速度記録を得ることができた。記録が得られた港は，釧路港（地表・地中基盤），花咲港，十勝港，浦河港，室蘭港，苫小牧港，函館港（地表・地中基盤・構造物），小樽港，青森港，八戸港，宮古港，釜石港（地表・地中基盤），大船渡港，仙台港（地表・地中基盤），相馬港，常陸那珂港，鹿島港の17湾22地点であった。塩釜港，酒田港で得られた記録については，アナログ記録の不鮮明のために，東京港（地表・地中基盤），横浜港で得られた記録については，記録の加速度値が小さかったために，それぞれ記録をデジタル化することができず加速度の最大値のみの読み取りに留まった。

本資料で報告する記録は，釧路沖地震の際に港湾地域強震観測網によって観測された22個の強震記録，ならびに1993年 2月 4日23時43分14秒に発生した余震の際に釧路港の地表および地中基盤で観測された強震記録である。報告する内容は，それぞれの記録について，1)未補正加速度記録，2)計器特性による補正加速度記録，3）SMAC-B2型強震計の計器特性と等価なものに換算した補正加速度記録，4)積分により求めた速度・変位，5)応答スペクトル，6)フーリエスペクトル，7)加速度・速度・変位の軌跡，を示している。地中基盤と地表の２層同時観測を行っている地点（釧路港，函館港，釜石港，仙台港）では，更に加速度の増幅率を示している。また，本震の全記録を対象として，加速度・速度・変位の距離減衰関係を併せて示している。

キーワード：　地震，強震観測，数字化加速度記録，応答スペクトル，港湾

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STRONG-MOTION EARTHQUAKE RECORDS ON THE 1993 KUSHIRO-OKI EARTHQUAKE IN PORT AREAS

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Synopsis

The 1993 Kushiro-Oki Earthquake of JMA(Japan Meteorological Agency) Magnitude 7.8 occurred in east off Hokkaido island in Japan at 20:06:07,January 15,1993. This earthquake triggered 27 accelerographs installed at 21 ports in the strong-motion earthquake observation network of the Port and Harbour Research Institute. 22 accelerograms out of the 27 were obtained as digital acceleration data of three components observed in port areas in Japan.

This report presents the strong-motion earthquake observation results of this earthquake and the results of preliminary analyses of the 22 digitized acceleration records obtained by this earthquake. The records of the after shock at 23:43:14,February 4,1993, which were observed at Kushiro port, are also presented. Original acceleration without instrument correction, corrected acceleration, SMAC-B2 equivalent acceleration, integrated velocity and displacement, response spectra, Fourier spectra and loci of accelerations, velocities and displacements are presented as results of preliminary analysis. In the case surface ground motion and base motion are observed simultaneously, amplification of accelerations are presented. Attenuation relations of acceleration, velocity and displacement of the main shock are also presented in this report.

Key Words : Earthquake, Strong-Motion Earthquake Observation, Digitized Acceleration Record, Response Spectra, Port

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1. Introduction

At 20:06:07,January 15,1993, an earthquake of JMA magnitude 7.8 hit northern part of Japan. The epicenter was located at about 12 km south of Kushiro city which is one of the largest city in eastern part of Hokkaido island in Japan. The earthquake was named as '1993 KUSHIRO-OKI EARTHQUAKE' by the Japan Meteorological Agency (JMA). Lifeline facilities such as electricity, water and gas supply as well as engineering structures were damaged by this earthquake.

The earthquake triggered 27 accelerographs installed at 21 ports in the strong-motion earthquake observation network of the Port and Harbour Research Institute (PHRI). Among them, 22 accelerograms at 17 ports were obtained as digital acceleration data of three components. Ports where digitized accelerograms were obtained were Kushiro port (ground surface and in ground), Hanasaki port, Tokachi port, Urakawa port, Muroran port, Tomakomai port, Hakodate port (ground surface, in ground and on structure), Otaru port, Aomori port, Hachinohe port, Miyako port, Kamaishi port (ground surface and in ground), Ofunato port, Sendai port (ground surface and in ground), Soma port, Hitachinaka port and Kashima port. Five of triggered accelerograms, which were obtained at Shiogama port, Sakata port, Tokyo port and Yokohama port, were not able to be digitized because of unclear analog traces of accelerograms at Shiogama port and Sakata port, and because of small amplitude of analog traces of accelerograms at Tokyo port and Yokohama port.

It was noteworthy that the peak horizontal ground acceleration of 469.3 (cm/s^2) without instrument correction was observed at Kushiro port, which was the largest peak horizontal ground acceleration among the records which had been ever recorded in the network of PHRI since 1963, and the base motion at the depth of ground level -77m was observed simultaneously.

The strong-motion earthquake observation in port areas in Japan was started by PHRI in 1962 and the strong-motion records observed in the network of PHRI have been published as annual reports on strong-motion earthquake records in Japanese port since 1963[1)-27)]. When great earthquakes occurred, such as 1968 Tokachi-Oki Earthquake, the 1978 Miyagi-Ken-Oki Earthquake, the 1983 Nipponkai-Chubu Earthquake and the 1993 Hokkaido-Nansei-Oki earthquake, etc., special volumes on records obtained by these great earthquakes have been compiled besides annual reports because there exist many accelerograms with large maximum acceleration observed at the same time and it is convenient to use records for investigating damage of structures by compilation[28)-35)].

This report presents the strong-motion earthquake observation results of this earthquake and the following results of preliminary analyses of the 22 digitized acceleration records observed in the network by the main shock at 20:06:07, January 15 1993. Two accelerograms were also observed at Kushiro port by the after shock at 23:43:14, February 4 1993. and results of preliminary analyses of these records are also presented.

- Original Acceleration
- Corrected Acceleration
- SMAC-B2 Equivalent Acceleration
- Integrated Velocity and Displacement
- Response Spectra and Fourier Spectra of Corrected Acceleration
- Loci of Corrected Accelerations, Integrated Velocities and Displacements

In the case surface ground motion and base motion are observed simultaneously, such as stations at Kushiro port, Hakodate port, Kamaishi port and Sendai port, amplification of acceleration are presented as square root of the ratio of power spectrum of the surface ground motion to that of the base motion. Attenuation relations of acceleration, velocity and displacement of the main shock are also presented in this report.

Following organizations cooperated with PHRI in the strong-motion earthquake observation in port areas in Japan.

- The Bureau for Ports and Harbours of the Ministry of Transport
- The Regional Bureaus for Port Construction of the Ministry of Transport
- The Port and Harbour Division, The Hokkaido Development Bureau of the Hokkaido Development Agency
- The Okinawa General Office of the Okinawa Development Agency
- The Harbour Bureau of the Tokyo Metropolitan Government
- The Harbour Bureau of the Osaka Municipal Government
- The Harbour Section of the Shizuoka Prefectural Government
- The Harbour Section of the Miyazaki Prefectural Government

2. Earthquakes and Triggered Stations

The 1993 Kushiro-Oki Earthquake at 20:06:07,January 15,1993, triggered 27 accelerographs installed at 21 ports in the network of PHRI and the after shock at 23:43:14,February 4,1993, triggered 2 accelerographs installed at Kushiro port. Details of these earthquakes are listed in **Table 1**[40]. **Locations of epicenter of the main shock and the after shock, which are slightly different from those by the Jishin-Kazan-Gaikyo published by JMA as a prompt report, are shown in Figure 1**[41,42].

Table 1 Details of Earthquakes

Earthquakes	Details	
Main Shock 1993 Kushiro-oki Earthquake	Date	January 15, 1993
	Time	20:06:07
	Hypocenter	
	Epicenter Region	south east off Tokachi
	Latitude	42° 53.5' ±1.4' N
	Longitude	144° 22.4' ±0.9' E
	Depth	103.2±2.5 km
	JMA Magnitude	7.8
After Shock	Date	February 4, 1993
	Time	23:43:14
	Hypocenter	
	Epicenter Region	Kushiro Region
	Latitude	42° 57.2' ±0.6' N
	Longitude	144° 16.9' ±0.6' E
	Depth	94.7±1.8 km
	JMA Magnitude	4.9

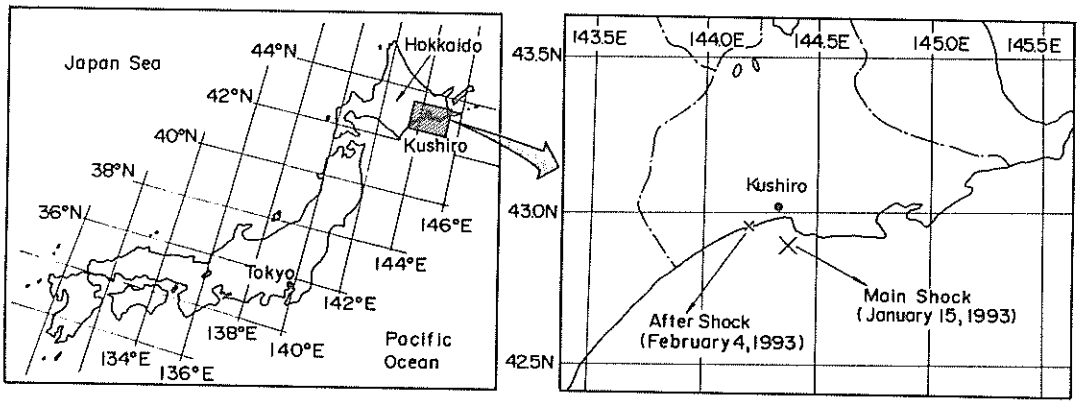


Figure 1 Location of Epicenter of the Main Shock and the After Shock

Table 2 List of Strong-Motion Earthquake Observation Stations of PHRI triggered by the Main Shock

Name of port		Name of station	Type of accelerograph	Installation condition	Ref. No. *
1 Hanasaki	1	Hanasaki-F	ERS-F	ground surface	
2 Kushiro	2	Kushiro-G	ERS-G	ground surface	
	3	Kushiro-GB	ERS-G	in ground	
3 Tokachi	4	Tokachi-M	ERS-C	ground surface	298
4 Urakawa	5	Urakawa-S	SMAC-B2	ground surface	
5 Tomakomai	6	Tomakomai-S	SMAC-B2	ground surface	107
6 Muroran	7	Muroran-G	ERS-G	ground surface	34, 107
7 Otaru	8	Otaru-G	ERS-G	ground surface	107
8 Hakodate	9	Hakodate-M	ERS-C	ground surface	298
	10	Hakodate-FB	ERS-F	in ground	
	11	Hakodate-FR	ERS-F	on structure	
9 Aomori	12	Aomori-S	SMAC-B2	ground surface	107, 156
10 Hachinohe	13	Hachinohe-ji-S	SMAC-B2	ground surface	34, 107
11 Miyako	14	Miyako-G	ERS-G	ground surface	34, 107
12 Kamaishi	15	Kamaishi-M	ERS-C	ground surface	351
	16	Kamaishi-MB	ERS-D	in ground	351
13 Ofunato	17	Ofunato-mound-M	ERS-C	on structure	
14 Shiogama	18	Shiogama-kojyo-S	SMAC-B2	ground surface	34, 107, 156
15 Sendai	19	Sendai-M	ERS-C	ground surface	351
	20	Sendai-MB	ERS-D	in ground	351
16 Soma	21	Soma-S	SMAC-B2	ground surface	
17 Hitachinaka	22	Hitachinaka-F	ERS-F	ground surface	
18 Kashima	23	Kashima-zokan-S	SMAC-B2	ground surface	156
19 Sakata	24	Sakata-S	SMAC-B2	ground surface	34
20 Tokyo	25	Shinagawa-S	SMAC-B2	ground surface	34, 107
	26	Shinagawa-MB	ERD-D	in ground	
21 Yokohama	27	Keihin-ji-S	SMAC-B2	ground surface	34

* The numbers correspond to those of the Technical Note of the Port and Harbour Research Institute, in which site characteristics of stations are given.

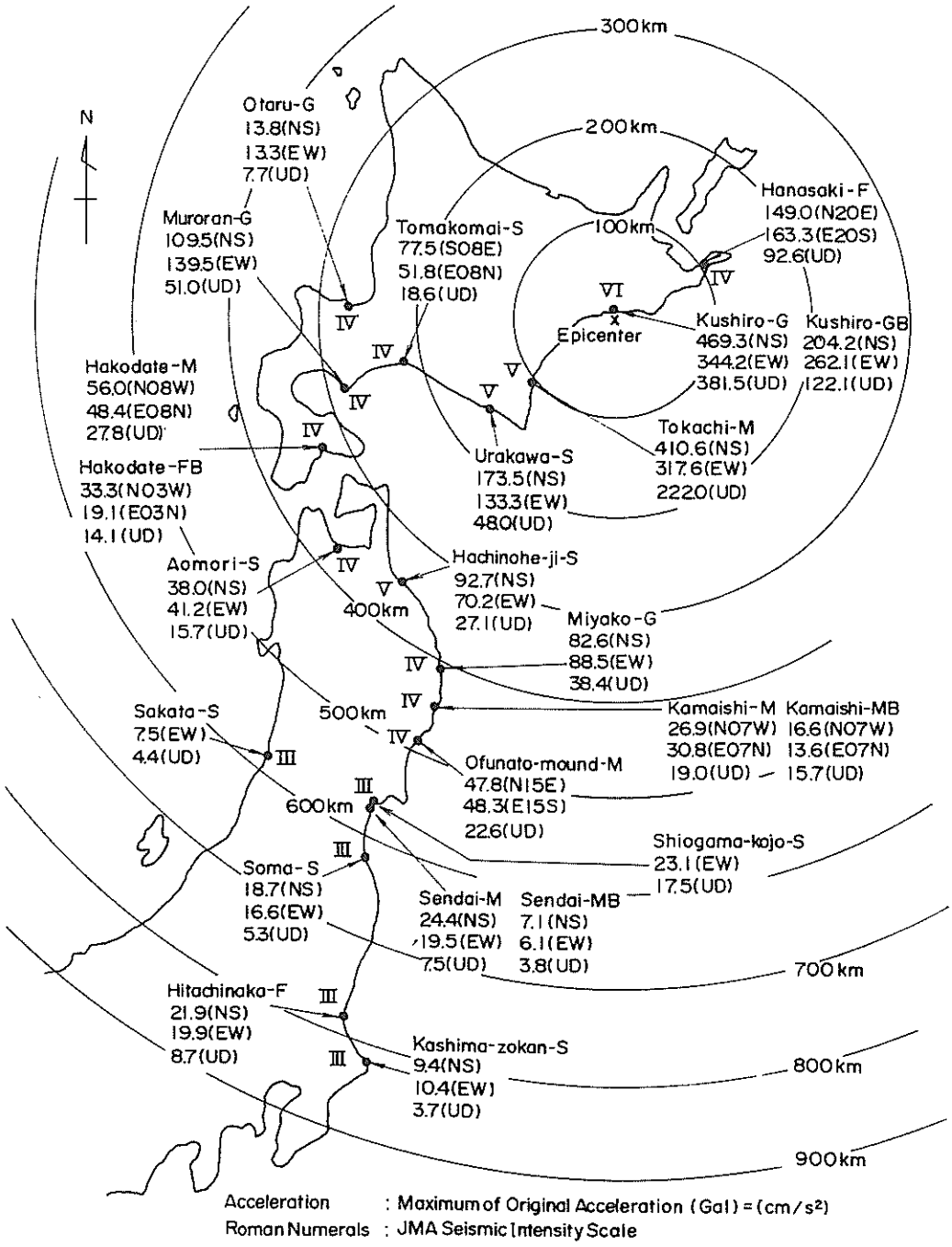


Figure 2 Triggered Stations of PHRI, Maximum Original Acceleration and JMA Seismic Intensity Scale of the Main shock

The triggered stations in the network of PHRI, the maximum of original accelerations without instrument correction and JMA seismic intensity scale of the main shock are shown in Figure 2. Observation results of the stations of Hakodate-FR at Hakodate port, Shinagawa-S and Shinagawa-MB at Tokyo port and Keihin-ji-S at Yokohama port, which are listed in **Table 2**, are excepted in this figure. Dots in **Figure 2** indicate ports where triggered accelerographs are installed and roman numerals attached to ports represent JMA seismic intensity scale in its area.

All the triggered stations by the main shock are listed in **Table 2** with name of locations, name of stations, type of accelerographs and installation conditions. The name of stations are composed of name of ports, type of accelerographs and installation conditions. As for the type of accelerographs, two kinds of accelerographs have been used in the strong-motion earthquake observation network of PHRI. One is the SMAC-B2 accelerograph of mechanical type and the other is the ERS accelerograph of electrical type equipped with either analog or digital recorder. There are several kinds of the ERS accelerograph and the ERS-G type is the newest type at present. Detailed descriptions of name of stations and accelerographs are reported in the preceding annual reports. Site conditions of the stations, which are listed in the right column of **Table 2** as the number of the Technical Note of the Port and Harbour Research Institute, are also available in the reports on site characteristics[36-40].

3. Digitization and Preliminary Analyses

Procedures of digitization and preliminary analyses are identical with those described in the preceding annual reports and are not described here.

The results of preliminary analyses of the main shock and the after shocks are summarized in **Table 3** and **Table 4**. Name of stations, record numbers, type of accelerographs, installation conditions, epicentral and hypocentral distance are shown in these tables with the results of preliminary analyses. As results of preliminary analyses, the maximum of each component of original acceleration without instrument correction, SMAC-B2 equivalent acceleration, corrected acceleration, integrated velocities and displacements are presented in these tables. Computer plots of these records are also presented in the later part of this report with response spectra, Fourier spectra and loci of accelerations, velocities and displacements.

Original acceleration used in this report denotes the digitized acceleration data with base line correction and without instrument correction.

SMAC-B2 equivalent acceleration denotes the acceleration data corrected by the frequency characteristics of the SMAC-B2 accelerograph of mechanical type. The SMAC-B2 accelerograph had been a main accelerograph in the network of PHRI and many accelerograms have been recorded by this accelerograph. Because frequency characteristics of the SMAC-B2 accelerographs, however, are not very sensitive in high frequency range in comparison with those of the ERS accelerograph of electrical type, the maximum accelerations of records by the SMAC-B2 accelerograph are tend to be smaller than those by the ERS accelerograph. By this procedure of computing SMAC-B2 equivalent acceleration, the maximum acceleration of all the records, which were recorded by the ERS accelerographs, can be directory compared with those by the SMAC-B2 accelerograph so far.

Corrected acceleration denotes the acceleration data with instrument correction processed through the variable filter which is briefly described in the preceding annual reports. For the records by the SMAC-B2 accelerograph, acceleration components around 10 Hz in frequency domain are amplified by this procedure. For the records by the ERS accelerograph of earlier type (ERS-B, -C and -D type), acceleration is slightly amplified in accordance with frequency. For the records by the recent type of the ERS accelerograph (ERS-F and -G type), phase characteristics of records are only corrected.

Integrations for computing velocities and displacements are conducted by using two types of low cut filter. One is the fixed filter of which cut off frequency is fixed and the other is the variable filter of which cut off frequency is varied according to the content of low frequency components of

Table 3 Results of Preliminary Analyes of the Main Shock at 20:06:07,January 15,1993

Name of Station & Number of Record	Type of Accelerograph	Distance (km)	Type of Data	Maximum of N-S Component	Maximum of E-W Component	Maximum of U-D Component
Hachinohe-ji-S S - 2486	SMAC-B2 Ground Surface	Epicentral Dist. = 353 Hypocentral Dist. = 368	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	92.7 -------- 150.2 6.15 6.14 1.80 1.07	70.2 -------- 99.5 8.33 8.57 1.99 1.54	27.1 -------- 41.2 2.81 2.39 0.80 0.44
Soma-S S - 2487	SMAC-B2 Ground Surface	Epicentral Dist. = 632 Hypocentral Dist. = 641	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	18.7 -------- 32.7 1.09 0.84 0.54 0.10	16.6 -------- 29.6 1.45 0.94 0.28 0.14	5.3 -------- 7.5 0.47 0.29 0.19 0.02
Aomori-S S - 2488	SMAC-B2 Ground Surface	Epicentral Dist. = 378 Hypocentral Dist. = 392	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	38.0 -------- 43.6 5.90 6.03 3.14 2.30	41.2 -------- 51.6 6.31 5.78 1.76 1.60	15.7 -------- 19.7 2.98 2.35 1.02 0.53
Sakata-S S - 2489 (Not digitized)	SMAC-B2 Ground Surface	Epicentral Dist. = 583 Hypocentral Dist. = 592	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	-------- -------- -------- -------- -------- -------- --------	7.5 -------- -------- -------- -------- -------- --------	4.4 -------- -------- -------- -------- -------- --------

(to be continued)

(Table 3 Continued)

Name of Station & Number of Record	Type of Accelerograph	Distance (km)	Type of Data	Maximum of N-S Component	Maximum of E-W Component	Maximum of U-D Component
Urakawa-S S - 2490	SMAC-B2 Ground Surface	Epicentral Dist. = 154 Hypocentral Dist. = 186	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	173.5 -------- 317.1 24.16 17.69 8.42 5.98	133.3 -------- 170.2 20.53 18.91 6.85 6.72	48.0 -------- 87.9 5.87 5.43 2.02 1.05
Tomakomai-S S - 2491	SMAC-B2 Ground Surface	Epicentral Dist. = 227 Hypocentral Dist. = 250	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	77.5 S08E -------- 93.0 18.22 24.00 10.56 12.87	51.8 E08N -------- 90.4 13.21 15.96 6.47 5.93	18.6 -------- 27.2 5.00 3.73 3.05 2.45
Kashima-zokan-S S - 2492	SMAC-B2 Ground Surface	Epicentral Dist. = 835 Hypocentral Dist. = 841	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	9.4 -------- 10.9 0.97 0.74 0.38 0.09	10.4 -------- 11.7 1.20 0.88 0.28 0.10	3.7 -------- 6.0 0.56 0.18 0.29 0.01
Shiogama-kojo-S S - 2493 (Not digitized)	SMAC-B2 Ground Surface	Epicentral Dist. = 581 Hypocentral Dist. = 590	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	-------- -------- -------- -------- -------- -------- --------	23.1 -------- -------- -------- -------- -------- --------	17.5 -------- -------- -------- -------- -------- --------

(to be continued)

(Table 3 Continued)

Name of Station & Number of Record	Type of Accelerograph	Distance (km)	Type of Data	Maximum of N-S Component	Maximum of E-W Component	Maximum of U-D Component
Shinagawa-S S - 2494 (Not digitized)	SMAC-B2 Ground Surface	Epicentral Dist. = 899 Hypocentral Dist. = 905	Original Acceleration (cm/s²)	8.8 S03E	7.5 E03N	3.1
			SMAC-B2 Equivalent Acceleration (cm/s²)	--------	--------	--------
			Corrected Acceleration (cm/s²)	--------	--------	--------
			Integrated Velocity - fixed (cm/s)	--------	--------	--------
			Integrated Velocity - variable (cm/s)	--------	--------	--------
			Integrated Displacement - fixed (cm)	--------	--------	--------
			Integrated Displacement - variable (cm)	--------	--------	--------
Keihin-ji-S S - 2499 (Not digitized)	SMAC-B2 Ground Surface	Epicentral Dist. = 922 Hypocentral Dist. = 927	Original Acceleration (cm/s²)	6.3 N33E	5.6 W33N	2.5
			SMAC-B2 Equivalent Acceleration (cm/s²)	--------	--------	--------
			Corrected Acceleration (cm/s²)	--------	--------	--------
			Integrated Velocity - fixed (cm/s)	--------	--------	--------
			Integrated Velocity - variable (cm/s)	--------	--------	--------
			Integrated Displacement - fixed (cm)	--------	--------	--------
			Integrated Displacement - variable (cm)	--------	--------	--------
Tokachi-M M - 1443	ERS-C Ground Surface	Epicentral Dist. = 109 Hypocentral Dist. = 150	Original Acceleration (cm/s²)	410.6	317.6	222.0
			SMAC-B2 Equivalent Acceleration (cm/s²)	209.0	260.0	95.7
			Corrected Acceleration (cm/s²)	406.4	319.5	223.7
			Integrated Velocity - fixed (cm/s)	15.27	17.68	9.49
			Integrated Velocity - variable (cm/s)	14.49	16.91	11.04
			Integrated Displacement - fixed (cm)	3.92	3.95	5.16
			Integrated Displacement - variable (cm)	2.66	2.93	4.68
Hakodate-M M - 1444	ERS-C Ground Surface	Epicentral Dist. = 325 Hypocentral Dist. = 341	Original Acceleration (cm/s²)	56.0 N08W	48.4 E08N	27.8
			SMAC-B2 Equivalent Acceleration (cm/s²)	47.5	40.7	24.8
			Corrected Acceleration (cm/s²)	52.2	47.3	28.2
			Integrated Velocity - fixed (cm/s)	12.68	7.20	5.41
			Integrated Velocity - variable (cm/s)	13.72	6.55	4.80
			Integrated Displacement - fixed (cm)	5.17	2.67	1.42
			Integrated Displacement - variable (cm)	3.98	2.12	1.26

(to be continued)

(Table 3 Continued)

Name of Station & Number of Record	Type of Accelerograph	Distance (km)	Type of Data	Maximum of N-S Component	Maximum of E-W Component	Maximum of U-D Component
Sendai-M M - 1445	ERS-C Ground Surface	Epicentral Dist. = 585 Hypocentral Dist. = 594	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	24.4 10.8 26.1 0.81 0.77 0.39 0.16	19.5 10.5 19.2 0.68 0.57 0.33 0.08	7.5 3.3 7.7 0.39 0.27 0.26 0.06
Sendai-MB M - 1446	ERS-C GL-8.7m	Epicentral Dist. = 585 Hypocentral Dist. = 594	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	7.1 5.6 7.2 0.70 0.63 0.19 0.09	6.1 4.5 6.2 0.57 0.41 0.16 0.07	3.8 2.8 3.9 0.33 0.23 0.17 0.05
Kamaishi-M M - 1447	ERS-C Ground Suriace	Epicentral Dist. = 453 Hypocentral Dist. = 464	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	26.9 N07W 17.7 26.9 1.26 1.33 0.40 0.22	30.8 E07N 14.0 29.7 1.30 1.11 0.51 0.36	19.0 10.3 19.1 1.00 1.11 0.45 0.23
Kamaishi-MB M - 1448	ERS-C GL-11.2m	Epicentral Dist. = 453 Hypocentral Dist. = 464	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	16.6 N07W 11.5 16.2 1.19 1.28 0.24 0.15	13.6 E07N 10.3 13.8 1.35 1.13 0.29 0.19	15.7 10.0 15.4 0.88 0.85 0.31 0.17

(to be continued)

(Table 3 Continued)

Name of Station & Number of Record	Type of Accelerograph	Distance (km)	Type of Data	Maximum of N-S Component	Maximum of E-W Component	Maximum of U-D Component
Ofunato-mound-M M - 1450	ERS-C on Rubble Mound	Epicentral Dist. = 484 Hypocentral Dist. = 495	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	47.8 N15E 29.4 46.8 2.61 2.66 0.47 0.26	48.3 E15S 40.2 48.9 3.60 3.60 0.54 0.45	22.6 16.7 23.1 1.59 1.52 0.27 0.14
Shinagawa-MB M - 1451 (Not digitized)	ERS-D GL-36.0m	Epicentral Dist. = 899 Hypocentral Dist. = 905	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	2.4 N03W -------- -------- -------- -------- -------- --------	2.9 E03N -------- -------- -------- -------- -------- --------	1.7 -------- -------- -------- -------- -------- --------
Muroran-G F - 505	ERS-G Ground Surface	Epicentral Dist. = 287 Hypocentral Dist. = 305	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	109.5 89.6 108.7 8.82 7.27 2.85 3.16	139.5 118.5 139.1 9.61 11.10 2.56 2.25	51.0 34.7 51.5 3.68 3.58 1.10 1.00
Kushiro-GB F - 506	ERS-G GL-77.0m	Epicentral Dist. = 12 Hypocentral Dist. = 104	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	204.2 155.4 204.4 17.12 18.00 6.47 9.16	262.1 184.7 264.6 12.94 13.78 2.10 1.89	122.1 50.0 109.5 5.82 5.74 0.88 0.86

(to be continued)

(Table 3 Continued)

Name of Station & Number of Record	Type of Accelerograph	Distance (km)	Type of Data	Maximum of N-S Component	Maximum of E-W Component	Maximum of U-D Component
Kushiro-G F - 507	ERS-G Ground Surface	Epicentral Dist. = 12 Hypocentral Dist. = 104	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	469.3 314.7 467.8 64.12 62.65 16.17 19.48	344.2 246.1 343.9 24.27 27.18 5.30 4.81	381.5 91.1 342.4 7.64 7.16 1.01 0.99
Hakodate-FB F - 508	ERS-F GL-201.0m	Epicentral Dist. = 325 Hypocentral Dist. = 341	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	33.3 N03W 30.0 33.2 7.46 6.14 2.89 3.17	19.1 E03N 17.6 19.3 4.51 4.50 2.33 2.54	14.1 12.9 14.0 2.43 2.52 0.74 0.77
Hakodate-FR F - 509	ERS-F On Structure	Epicentral Dist. = 325 Hypocentral Dist. = 341	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	47.4 N03W 43.6 47.8 12.37 12.80 5.72 4.76	36.5 E03N 34.2 36.3 6.24 7.23 3.25 2.80	21.7 20.8 21.1 4.20 3.68 1.14 1.02
Hanasaki-F F - 510	ERS-F Ground Surface	Epicentral Dist. = 108 Hypocentral Dist. = 149	Original Acceleration (cm/s²) SMAC-B2 Equivalent Acceleration (cm/s²) Corrected Acceleration (cm/s²) Integrated Velocity - fixed (cm/s) Integrated Velocity - variable (cm/s) Integrated Displacement - fixed (cm) Integrated Displacement - variable (cm)	149.0 N20E 110.9 146.9 9.98 8.49 2.56 3.09	163.3 E20S 75.1 158.4 6.04 6.96 1.61 1.57	92.6 42.9 93.3 2.98 3.23 0.59 0.52

(to be continued)

(Table 3 Continued)

Name of Station & Number of Record	Type of Accelerograph	Distance (km)	Type of Data	Maximum of N-S Component	Maximum of E-W Component	Maximum of U-D Component
Miyako-G F - 514	ERS-G Ground Surface	Epicentral Dist. = 413 Hypocentral Dist. = 426	Original Acceleration (cm/s²)	82.6	88.5	38.4
			SMAC-B2 Equivalent Acceleration (cm/s²)	47.2	51.9	20.9
			Corrected Acceleration (cm/s²)	82.6	90.3	39.2
			Integrated Velocity - fixed (cm/s)	2.84	2.70	1.18
			Integrated Velocity - variable (cm/s)	2.64	2.64	1.00
			Integrated Displacement - fixed (cm)	0.28	0.19	0.18
			Integrated Displacement - variable (cm)	0.21	0.15	0.08
Hitachinaka-F F - 525	ERS-F Ground Surface	Epicentral Dist. = 791 Hypocentral Dist. = 797	Original Acceleration (cm/s²)	21.9	19.9	8.7
			SMAC-B2 Equivalent Acceleration (cm/s²)	10.6	11.5	5.0
			Corrected Acceleration (cm/s²)	22.4	19.5	8.9
			Integrated Velocity - fixed (cm/s)	0.84	1.07	0.43
			Integrated Velocity - variable (cm/s)	0.86	0.99	0.37
			Integrated Displacement - fixed (cm)	0.26	0.21	0.10
			Integrated Displacement - variable (cm)	0.18	0.17	0.06
Otaru-G F - 536	ERS-G Ground Surface	Epicentral Dist. = 274 Hypocentral Dist. = 292	Original Acceleration (cm/s²)	13.8	13.3	7.7
			SMAC-B2 Equivalent Acceleration (cm/s²)	11.9	11.3	6.7
			Corrected Acceleration (cm/s²)	13.9	13.2	7.7
			Integrated Velocity - fixed (cm/s)	3.43	3.72	1.78
			Integrated Velocity - variable (cm/s)	3.13	4.18	1.62
			Integrated Displacement - fixed (cm)	1.30	1.50	0.65
			Integrated Displacement - variable (cm)	1.42	1.42	0.57

(Remark)

Original Acceleration : Digitized acceleration without instrument correction
SMAC-B2 Equivalent Acceleration : Acceleration corrected by the SMAC-B2 equivalent filter
Corrected Acceleration : Acceleration with each instrument correction
Integrated Velocity - fixed : Velocity integrated by the fixed filter (cut-off frequency of low-cut filter is constant)
Integrated Velocity - variable : Velocity integrated by the variable filter (cut-off frequency of low-cut filter is varied)
Integrated Displacement - fixed : Displacement integrated by the fixed filter (cut-off frequency of low-cut filter is constant)
Integrated Displacement - variable : Displacement integrated by the variable filter (cut-off frequency of low-cut filter is varied)

Table 4 Results of Preliminary,Anaylyses of the After Shock at 23:43:14,February 4,1993

Name of Station & Number of Record	Type of Accelerograph	Distance (km)	Type of Data	Maximum of N-S Component	Maximum of E-W Component	Maximum of U-D Component
Kushiro-GB F - 527	ERS-G GL-77.0m	Epicentral Dist. = 8 Hypocentral Dist. = 95	Original Acceleration (cm/s²)	8.2	9.3	2.0
			SMAC-B2 Equivalent Acceleration (cm/s²)	3.8	5.9	1.2
			Corrected Acceleration (cm/s²)	8.0	9.2	1.9
			Integrated Velocity - fixed (cm/s)	0.18	0.34	0.06
			Integrated Velocity - variable (cm/s)	0.17	0.30	0.05
			Integrated Displacement - fixed (cm)	0.02	0.02	0.01
			Integrated Displacement - variable (cm)	0.01	0.01	0.00
Kushiro-G F - 528	ERS-G Ground Surface	Epicentral Dist. = 8 Hypocentral Dist. = 95	Original Acceleration (cm/s²)	18.7	16.5	6.6
			SMAC-B2 Equivalent Acceleration (cm/s²)	9.2	11.3	2.7
			Corrected Acceleration (cm/s²)	18.4	16.4	6.3
			Integrated Velocity - fixed (cm/s)	0.48	0.65	0.14
			Integrated Velocity - variable (cm/s)	0.42	0.62	0.12
			Integrated Displacement - fixed (cm)	0.04	0.03	0.02
			Integrated Displacement - variable (cm)	0.01	0.03	0.00

(Remark)

Original Acceleration : Digitized acceleration without instrument correction
SMAC-B2 Equivalent Acceleration : Acceleration corrected by the SMAC-B2 equivalent filter
Corrected Acceleration : Acceleration with each instrument correction
Integrated Velocity - fixed : Velocity integrated by the fixed filter (cut-off frequency of low-cut filter is constant)
Integrated Velocity - variable : Velocity integrated by the variable filter (cut-off frequency of low-cut filter is varied)
Integrated Displacement - fixed : Displacement integrated by the fixed filter (cut-off frequency of low-cut filter is constant)
Integrated Displacement - variable : Displacement integrated by the variable filter (cut-off frequency of low-cut filter is varied)

records. Detailed descriptions of these filtering procedures are reported in the preceding annual reports.

Response spectra, Fourier spectra and loci of corrected accelerations, velocities and displacements of each record are also presented with the computer plots of time history data of accelerations, velocities and displacements. As for response spectra, acceleration ratio of absolute acceleration response to input motion, absolute acceleration response, relative velocity response and relative displacement response are presented. As for loci, corrected accelerations and integrated velocities and displacements computed with the variable filter are used for plots.

4. Attenuation Relations

Attenuation relations of peak ground acceleration of corrected acceleration, peak ground velocity and displacement computed with the variable filter are shown in **Figure 3** to **Figure 5**. Results of horizontal and vertical motions are shown together in these figures. As for horizontal motion, larger of two horizontal components is used. There exist clear attenuation relations in both horizontal and vertical acceleration data. Site characteristics of the stations, such as shear wave velocity profile, are not considered here.

5. Amplification of Acceleration

Surface ground motion and base motion of the main shock were observed simultaneously at Kushiro port, Hakodate port, Kamaishi port and Sendai port, and those of the after shock were observed at Kushiro port. In order to examine amplification characteristics of accelerations at these ports, amplification of accelerations, which are calculated by square root of the ratio of power

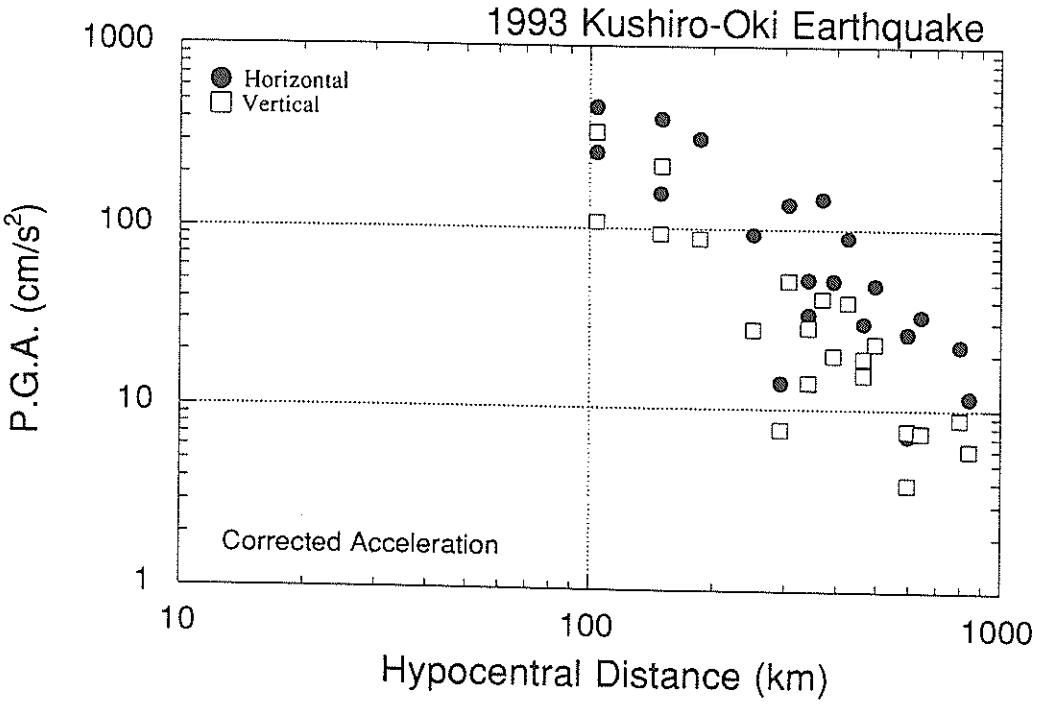


Figure 3 Attenuation Relation of Peak Ground Acceleration

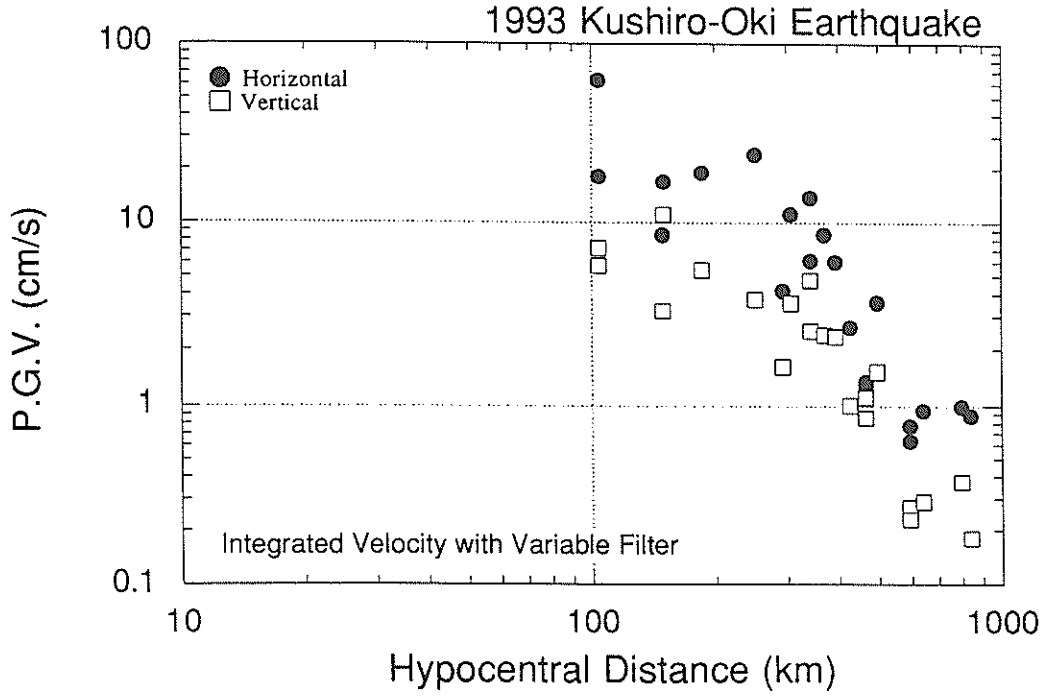


Figure 4 Attention Relation of Peak Ground Velocity

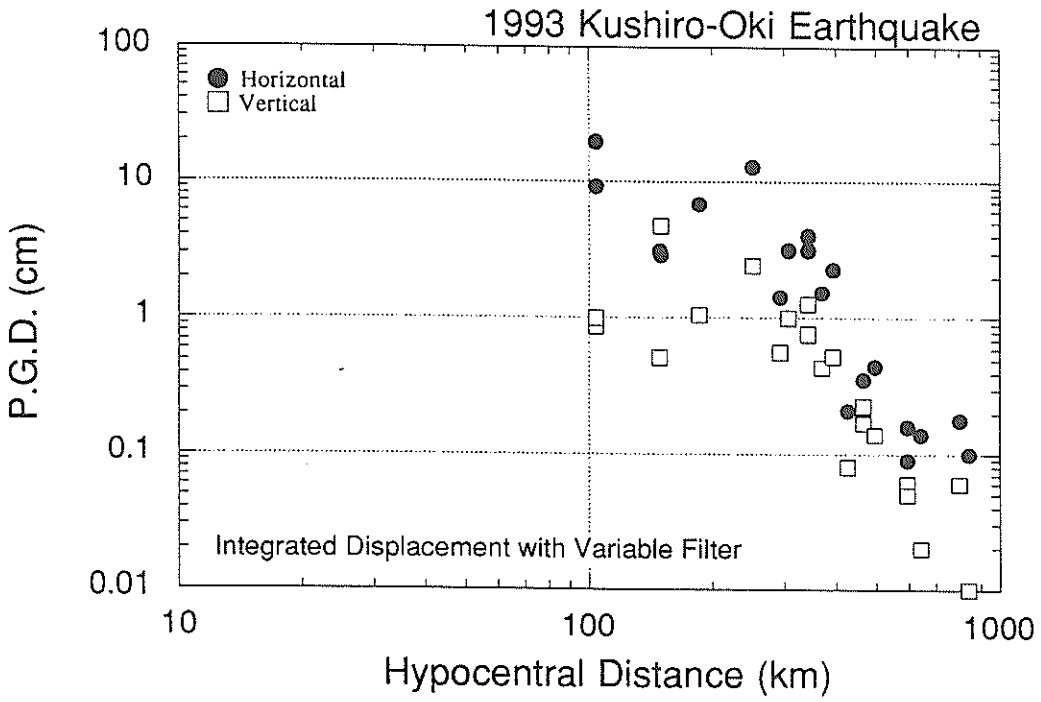


Figure 5 Attenuation Relation of Peak Ground Displacement

spectrum of the surface ground motion to that of the base motion, are shown in **Figure 6** to **Figure 10**.

Amplification of accelerations of the main shock and the after shock at Kushiro port are shown in **Figure 6** and **Figure 10**. Acceleration components around 0.8 Hz are amplified in the horizontal motions and 5 Hz for the vertical motion of the main shock. In the horizontal motions of the after shock, however, acceleration components about 1 Hz are amplified and amplifications are larger than those of the main shock. In particular, amplification of the after shock in the NS component becomes about two times larger than that of the main shock. Frequency at peak amplification of the main shock are slightly shifted to the lower frequency side and amplifications become smaller in compavison with the after shock.

The records by the station of Hakodate-M, which is the different accelerograph from the station of Hakodate-FB for the base motion and installed near the Hakodate-F station, are used for computing amplification of accelerations at Hakodate port shown in **Figure 7** because the station of Hakodate-F for the surface ground motion, which were to be triggered with Hakodate-FB simultaneously, did not work because of the problem of power supply. Acceleration components around 0.5 Hz and 3 Hz are amplified in the horizontal motion.

Amplification of accelerations at Kamaishi port are shown in **Figure 8**. acceleration components around 0.2 Hz and 14 Hz are amplified for the horizontal motion. As for the amplification at Sendai port which are shown in **Figure 9**, acceleration components around 0.2 Hz and 8 Hz are amplified.

6. Summary

The 1993 Kushiro-Oki Earthquake of JMA Magnitude 7.8 occurred in east off Hokkaido island

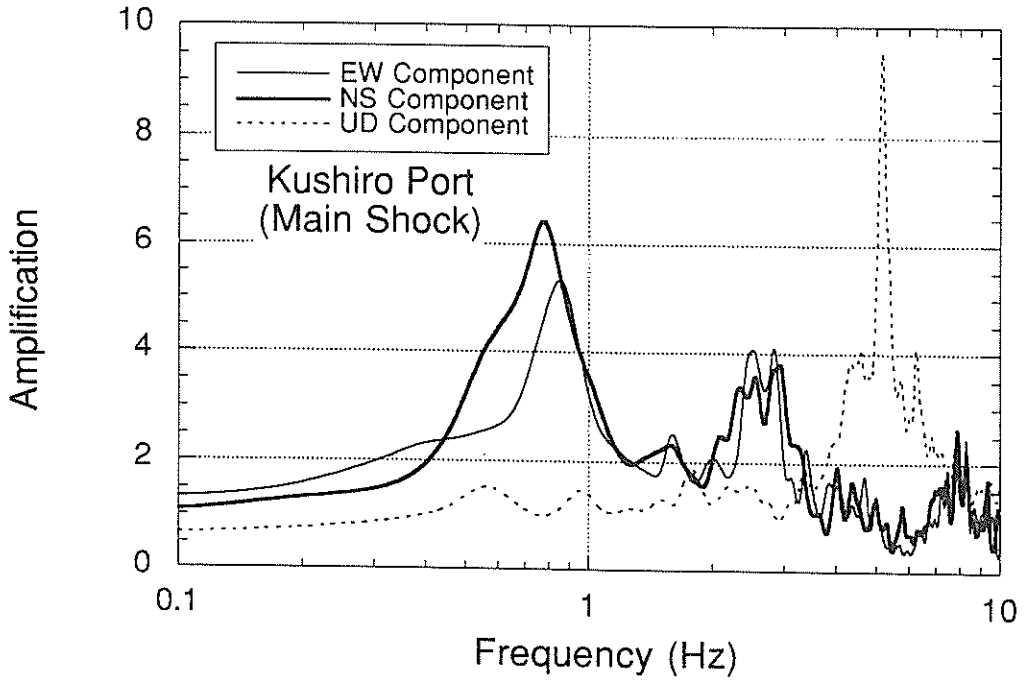


Figure 6 Amplification of Acceleration at Kushiro Port(Main Shock)

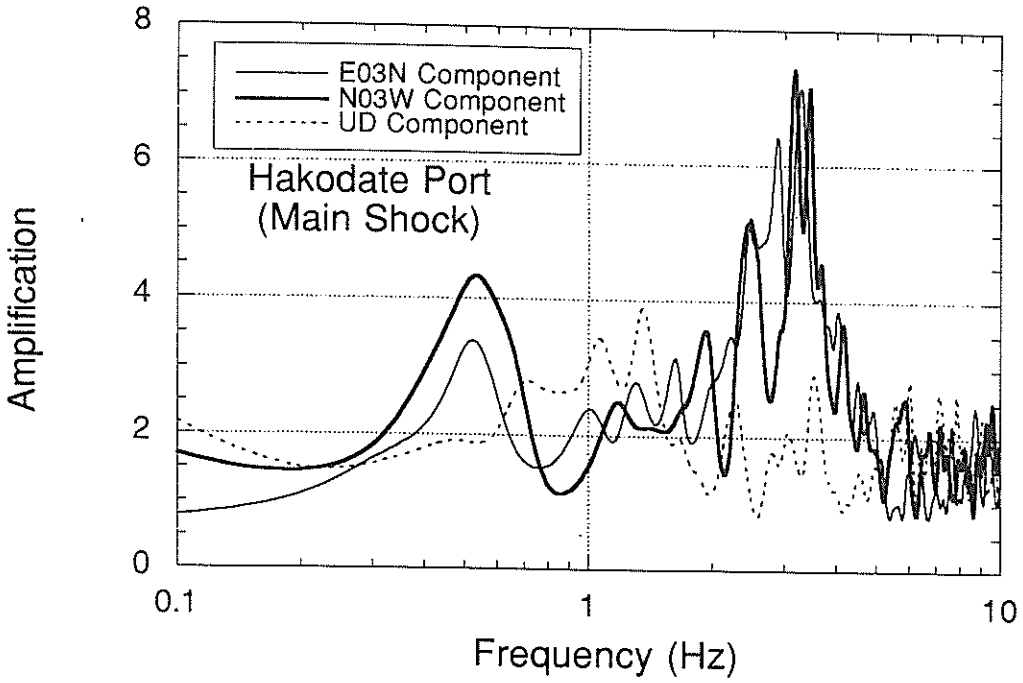


Figure 7 Amplification of Acceleration at Hakodate Port (Main Shock)

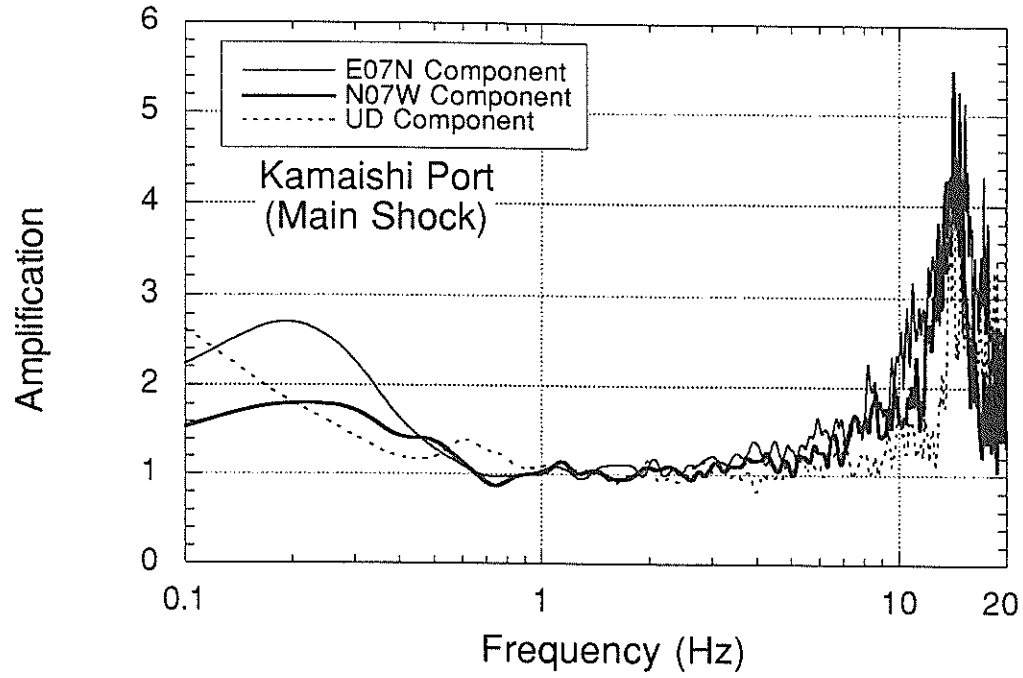


Figure 8 Amplification of Acceleration at Kamaishi Port (Main Shock)

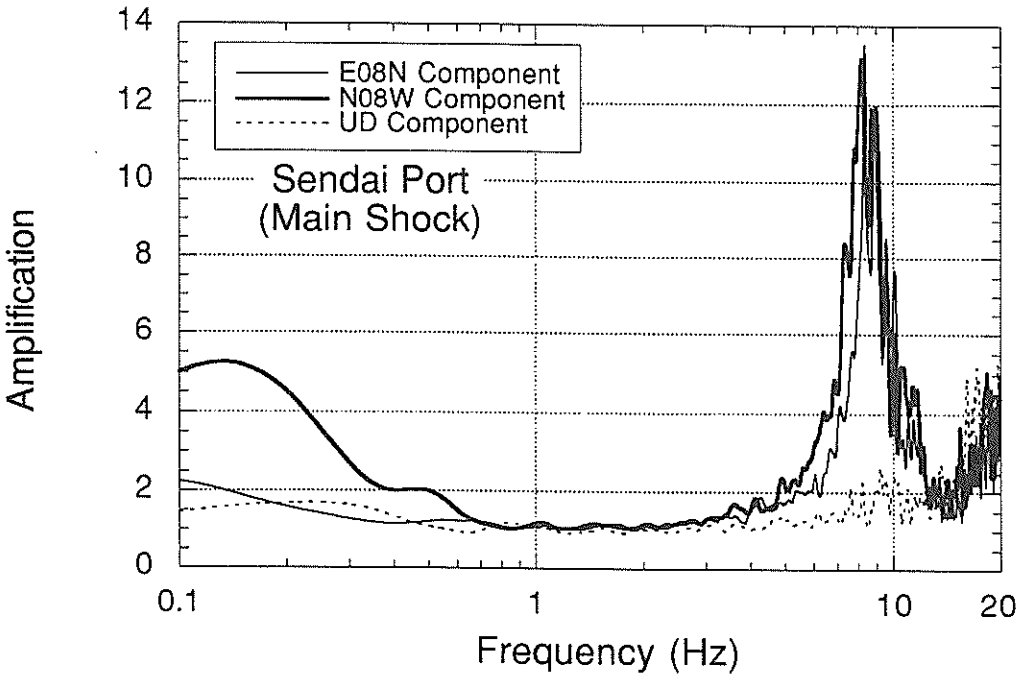


Figure 9 Amplification of Acceleration at Sendai Port(Main Shock)

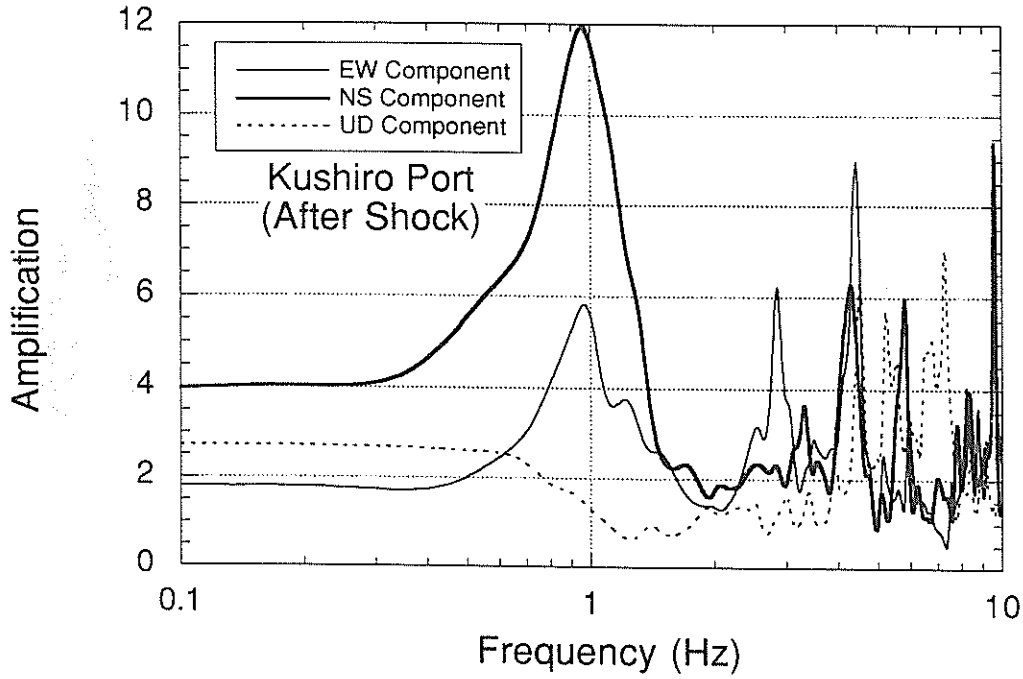


Figure 10 Amplification of Acceleration at Kushiro Port(After Shock)

at 20:06:07,January 15,1993. Lifeline facilities as well as engineering structures were damaged by this earthquake. The earthquake triggered 27 accelerographs at 21 ports in the strong-motion earthquake observation network of the Port and Harbour Research Institute. 22 accelerograms at 17 ports out of 27 accelerograms at 21 ports were obtained as digital acceleration data of three components.

The records of the main shock, and of the after shock at 23:43:14,February 4,1993 are presented in this report. Original acceleration without instrument correction, corrected acceleration, SMAC-B2 equivalent acceleration, integrated velocity and displacement, response spectra, Fourier spectra and loci of accelerations, velocities and displacements are reported as results of preliminary analyses. Attenuation relations of acceleration, velocity and displacement of the main shock are also shown in this report. In the case surface ground motion and base motion are observed simultaneously, amplification of acceleration is presented.

It was noteworthy that the peak horizontal ground acceleration of 469.3 (cm/s^2) without instrument correction was observed at Kushiro port, which was the largest peak horizontal ground acceleration among the records which had been ever recorded in the network of PHRI since 1963, and the base motion at the depth of ground level -77m was observed at the same time.

References

1) Hajime Tsuchida, Teiichiro Yamada, Eiichi Kurata and Katsuko Sudo: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1963 and 1964), Technical Note of the Port and Harbour Research Institute, No.55, September 1968.

2) Hajime Tsuchida, Teiichiro Yamada, Eiichi Kurata and Katsuko Sudo: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1965 and 1966), Technical Note of the Port and Harbour Research Institute, No.62, December 1968.

3) Hajime Tsuchida, Eiichi Kurata and Katsuko Sudo: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1967),Technical Note of the Port and Harbour Research Institute, No.64, March 1962.

4) Hajime Tsuchida, Eiichi Kurata and Katsuko Sudo: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1968),Technical Note of the Port and Harbour Research Institute, No.98, March 1970.

5) Hajime Tsuchida, Eiichi Kurata and Katsuko Sudo: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1969),Technical Note of the Port and Harbour Research Institute, No.100, June 1970.

6) Hajime Tsuchida, Eiichi Kurata and Katsuko Sudo: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1970),Technical Note of the Port and Harbour Research Institute, No.116, March 1971.

7) Eiichi Kurata, Tokuzo Ishizaka and Hajime Tsuchida: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1971), Technical Note of the Port and Harbour Research Institute, No.136, March 1972.

8) Eiichi Kurata, Tokuzo Ishizaka and Hajime Tsuchida: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1972), Technical Note of the Port and Harbour Research Institute, No.160, March 1973.

9) Eiichi Kurata, Tokuzo Ishizaka and Hajime Tsuchida: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1973), Technical Note of the Port and Harbour Research

Institute, No.181, March 1974.
10) Eiichi Kurata, Tokuzo Ishizaka and Hajime Tsuchida: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1974), Technical Note of the Port and Harbour Research Institute, No.202, March 1975.
11) Eiichi Kurata, Susumu Iai and Hajime Tsuchida: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1975),Technical Note of the Port and Harbour Research Institute, No.236, March 1976.
12) Eiichi Kurata, Susumu Iai and Hajime Tsuchida: Annual Report on Strong-Motion Earthquake Records in Japanese Ports, Supplementary (1963 through 1975, Vertical component), Technical Note of the Port and Harbour Research Institute, No.250, December 1976.
13) Eiichi Kurata, Susumu Iai and Hajime Tsuchida: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1976 and 1977), Technical Note of the Port and Harbour Research Institute, No.287, March 1978.
14) Eiichi Kurata, Susumu Iai, Yoshiko Yokoyama and Hajime Tsuchida: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1978 and 1979), Technical Note of the Port and Harbour Research Institute, No.338, June 1980.
15) Eiichi Kurata, Susumu Iai, Yoshiko Yokoyama and Setsuo Noda: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1980), Technical Note of the Port and Harbour Research Institute, No.374, June 1981.
16) Eiichi Kurata and Setsuo Noda: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1981), Technical Note of the Port and Harbour Research Institute, No.426, June 1982.
17) Eiichi Kurata, Tetsuo Fukuhara and Setsuo Noda: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1982), Technical Note of the Port and Harbour Research Institute, No.446, June 1983.
18) Eiichi Kurata, Tetsuo Fukuhara and Setsuo Noda: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1983),Technical Note of the Port and Harbour Research Institute, No.487, June 1984.
19) Eiichi Kurata, Tetsuo Fukuhara and Setsuo Noda: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1984),Technical Note of the Port and Harbour Research Institute, No.519, June 1985.
20) Eiichi Kurata, Tetsuo Fukuhara and Setsuo Noda: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1985),Technical Note of the Port and Harbour Research Institute, No.547, June 1986.
21) Eiichi Kurata, Susumu Iai and Setsuo Noda: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1986), Technical Note of the Port and Harbour Research Institute, No.588, June 1987.
22) Eiichi Kurata and Susumu Iai: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1987), Technical Note of the Port and Harbour Research Institute, No.618, June 1988.
23) Eiichi Kurata and Susumu Iai: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1988), Technical Note of the Port and Harbour Research Institute, No.649, June 1989.
24) Eiichi Kurata and Susumu Iai: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1989), Technical Note of the Port and Harbour Research Institute, No.676, June

1990.
25) Eiichi Kurata and Susumu Iai: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1990), Technical Note of the Port and Harbour Research Institute, No.705, June 1991.
26) Eiichi Kurata and Susumu Iai: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1991), Technical Note of the Port and Harbour Research Institute, No.727, June 1992.
27) Yasuo Matsunaga, Hirotaka Sakurai, Toshikazu Morita and Susumu Iai: Annual Report on Strong-Motion Earthquake Records in Japanese Ports (1992 & 1993), Technical Note of the Port and Harbour Research Institute, No.776, June 1994.
28) Hajime Tsuchida, Eiichi Kurata and Katsuko Sudo: Strong-Motion Earthquake Records on the 1968 Tokachi-Oki Earthquake and Its Aftershocks, Technical Note of the Port and Harbour Research Institute, No.80, June 1969.
29) Eiichi Kurata, Susumu Iai and Hajime Tsuchida: Strong-Motion Earthquake Records on the 1978 Izu-Oshima-Kinkai Earthquake in Port Areas, Technical Note of the Port and Harbour Research Institute, No.317, March 1979.
30) Eiichi Kurata, Susumu Iai, Yoshiko Yokoyama and Hajime Tsuchida: Strong-Motion Earthquake Records on the 1978 Miyagi-Ken-Oki Earthquake in Port Areas, Technical Note of the Port and Harbour Research Institute, No.319, June 1979.
31) Eiichi Kurata and Setsuo Noda: Strong-Motion Earthquake Records on the 1982 Urakawa-Oki Earthquake in Port Areas, Technical Note of the Port and Harbour Research Institute, No.442, March 1983.
32) Eiichi Kurata, Tetsuo Fukuhara and Setsuo Noda: Strong-Motion Earthquake Records on the 1983 Nipponkai-Chubu Earthquake in Port Areas, Technical Note of the Port and Harbour Research Institute, No.458, September 1983.
33) Eiichi Kurata, Tetsuo Fukuhara and Setsuo Noda: Strong-Motion Earthquake Records on the 7 August 1984 Hyuga-nada Earthquake in Port Areas, Technical Note of the Port and Harbour Research Institute, No.503, December 1984.
34) Eiichi Kurata, Setsuo Noda and Toyoshi Higuchi: Strong-Motion Earthquake Records on the 17 December 1987 Chiba-ken-Toho-Oki Earthquake in Port Areas, Technical Note of the Port and Harbour Research Institute, No.619, June 1988.
35) Yasuo Matsunaga, Hirotaka Sakurai, Toshikazu Morita and Susumu Iai: Strong-Motion Earthquake Records on the 1993 Hokkaido-Nansei-Oki Earthquake in Port Areas, Technical Note of the Port and Harbour Research Institute, No.778, June 1994.
36) Hajime Tsuchida, Teiichiro Yamada and Eiichi Kurata: Site Characteristics of Strong-Motion Earthquake Stations in Ports and Harbour in Japan (Part 1), Technical Note of the Port and Harbour Research Institute, No.34, November 1967.
37) Eiichi Kurata, Hajime Tsuchida and Katsuko Sudo: Site Characteristics of Strong-Motion Earthquake Stations in Ports and Harbour in Japan (Part 2), Technical Note of the Port and Harbour Research Institute, No.107, December 1970.
38) Eiichi Kurata and Tokuzo Ishizaka: Site Characteristics of Strong-Motion Earthquake Stations in Ports and Harbours in Japan (Part 3), Technical Note of the Port and Harbour Research Institute, No.156, March 1973.
39) Yoshiko Yokoyama and Eiichi Kurata: Site Characteristics of Strong-Motion Earthquake Stations in Ports and Harbours in Japan (Part 4), Technical Note of the Port and Harbour

Research Institute, No.298, June 1978.
40) Yoshiko Yokoyama and Eiichi Kurata: Site Characteristics of Strong-Motion Earthquake Stations in Ports and Harbours in Japan (Part 5), Technical Note of the Port and Harbour Research Institute, No.351, September 1980.
41) The Seismological Bulletin of the Japan Meteorological Agency for 1993, The Japan Meteorological Agency, 1994.
42) Jishin-Kazan-Gaikyo of the Japan Meteorological Agency for January 1993, The Japan Meteorological Agency, 1993.

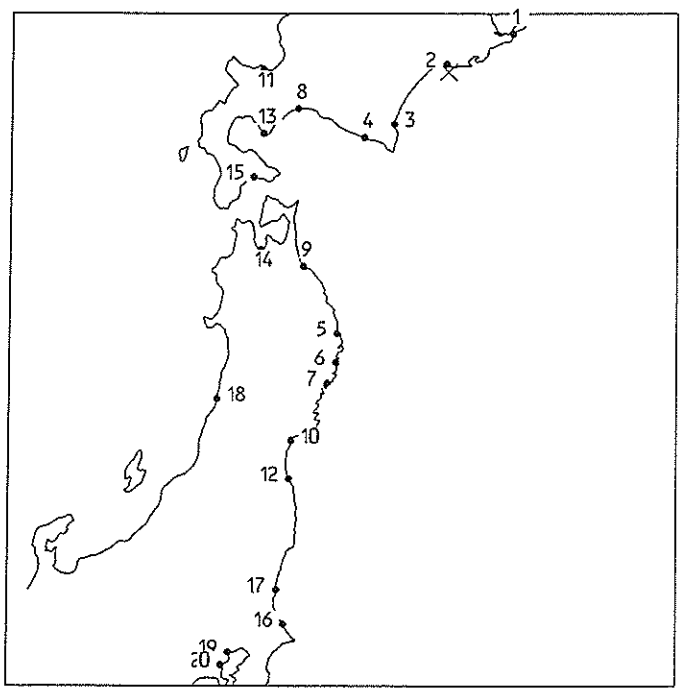
Strong-Motion Earthquake Observation Results of the Main Shock at 20:06:07, January 15, 1993

STRONG-MOTION EARTHQUAKE OBSERVATION RESULTS

20:06 JAN. 15,1993
SE OFF TOKACHI
EPICENTER : 42°53.5'N 144°22.4'E
DEPTH : 103.2KM MAGNITUDE : 7.8

JMA INTENSITIES

Ⅵ : KUSHIRO
Ⅴ : HIROO,OBIHIRO,URAKAWA,
HACHINOHE
Ⅳ : NEMURO,TOMAKOMAI,OTARU,
MURORAN,HAKODATE
Ⅲ : AKITA,SAKATA,SENDAI,
TOKYO,YOKOHAMA



	STATION	CONDITION	RECORD NUMBER	MAX.ACC.(GAL) (NS)	(EW)	(UD)	DIST. (KM)
1	HANASAKI-F	ON GROUND	F- 510	149	163	93	107
2	KUSHIRO-G	ON GROUND	F- 507	469	344	382	11
2	KUSHIRO-GB	IN GROUND	F- 506	204	262	122	11
3	TOKACHI-M	ON GROUND	M-1443	411	318	222	108
4	URAKAWA-S	ON GROUND	S-2490	174	133	48	153
5	MIYAKO-G	ON GROUND	F- 514	83	89	38	412
6	KAMAISHI-MB	IN GROUND	M-1448	17	14	16	452
6	KAMAISHI-M	ON GROUND	M-1447	27	31	19	452
7	OFUNATO-MOUND-M	ON STRUC.	M-1450	48	48	23	484
8	TOMAKOMAI-S	ON GROUND	S-2491	78	52	19	226
9	HACHINOHE-JI-S	ON GROUND	S-2486	93	70	27	353
10	SHIOGAMA-KOJYO-S	ON GROUND	S-2493		23	18	581
11	OTARU-G	ON GROUND	F- 536	14	13	8	272
10	SENDAI-MB	IN GROUND	M-1446	7	6	4	585
10	SENDAI-M	ON GROUND	M-1445	24	20	8	585
12	SOMA-S	ON GROUND	S-2487	19	17	5	632
13	MURORAN-G	ON GROUND	F- 505	110	140	51	286
14	AOMORI-S	ON GROUND	S-2488	38	41	16	377
15	HAKODATE-FR	ON STRUC.	F- 509	47	37	22	323
15	HAKODATE-FB	IN GROUND	F- 508	33	19	14	323
15	HAKODATE-M	ON GROUND	M-1444	56	48	28	323
16	KASHIMA-ZOKAN-S	ON GROUND	S-2492	9	10	4	835
17	HITACHINAKA-F	ON GROUND	F- 525	22	20	9	791
18	SAKATA-S	ON GROUND	S-2489		8	4	582
19	SHINAGAWA-MB	IN GROUND	M-1451	2	3	2	900
19	SHINAGAWA-S	ON GROUND	S-2494	9	8	3	900
20	KEIHIN-JI-S	ON GROUND	S-2499	6	6	3	921

Results of Preliminary Analyses of the Main Shock

at 20:06:07, January 15, 1993

RECORD NUMBER : S-2486

STATION : HACHINOHE-JI-S

EARTHQUAKE DATA

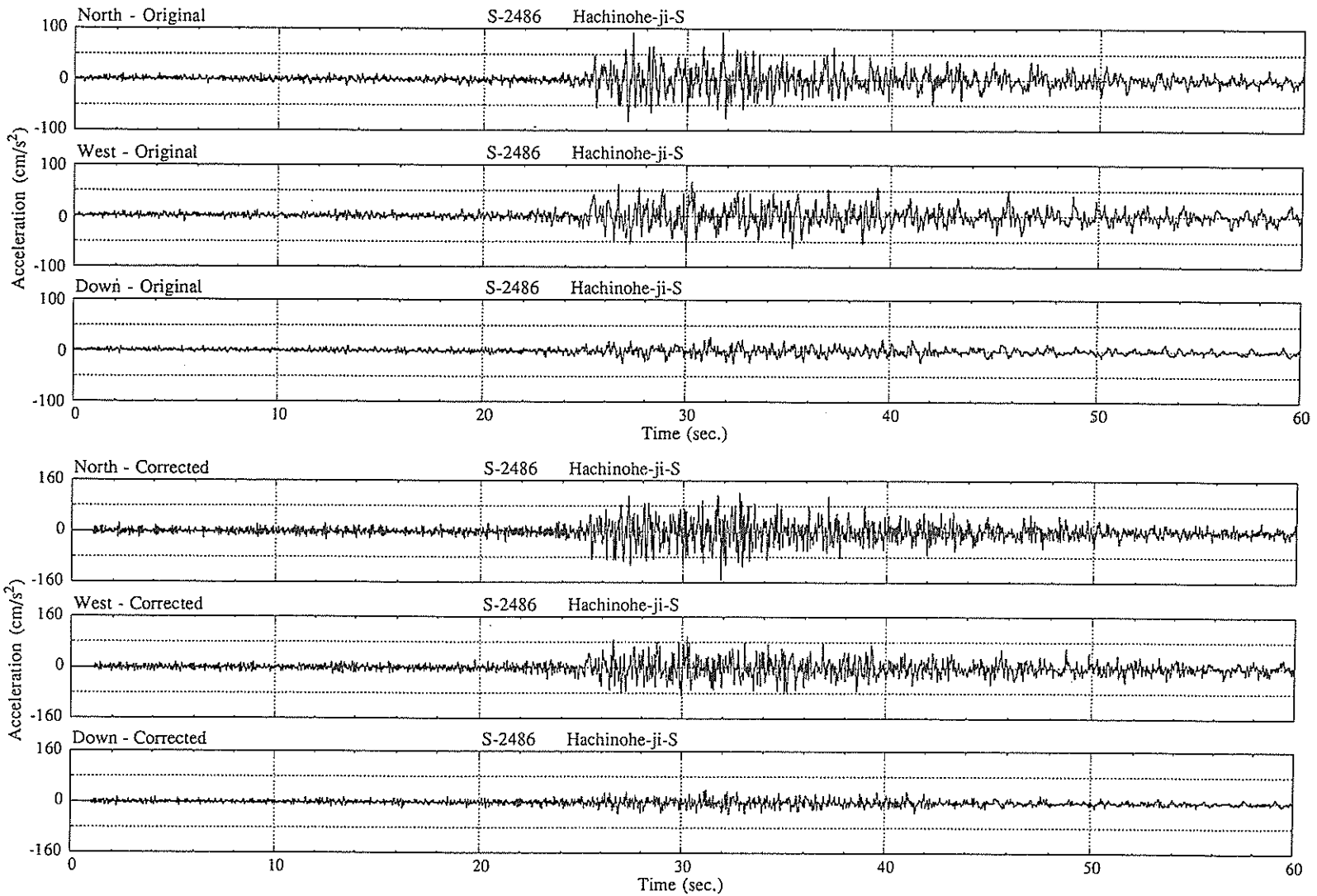
****

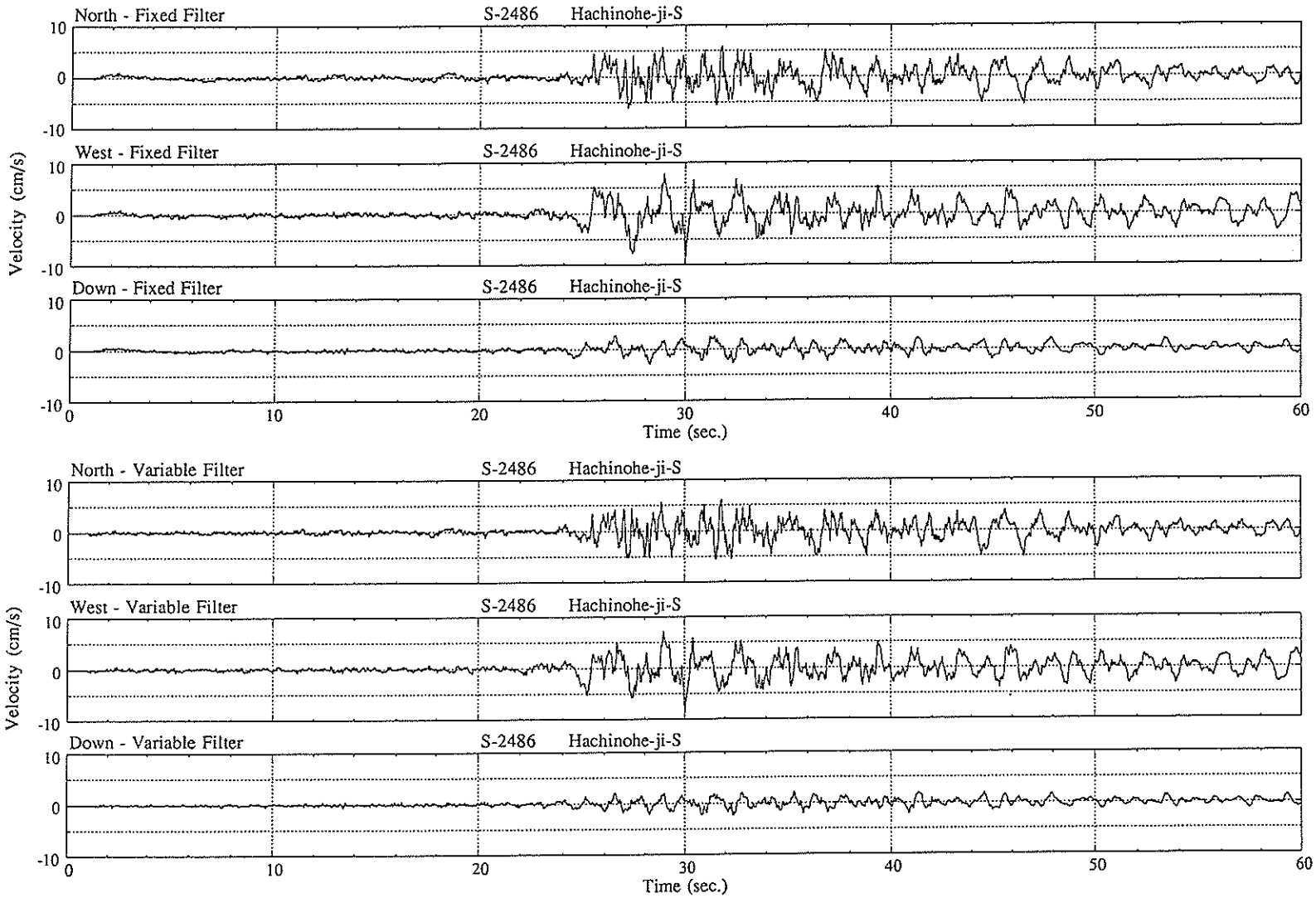
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

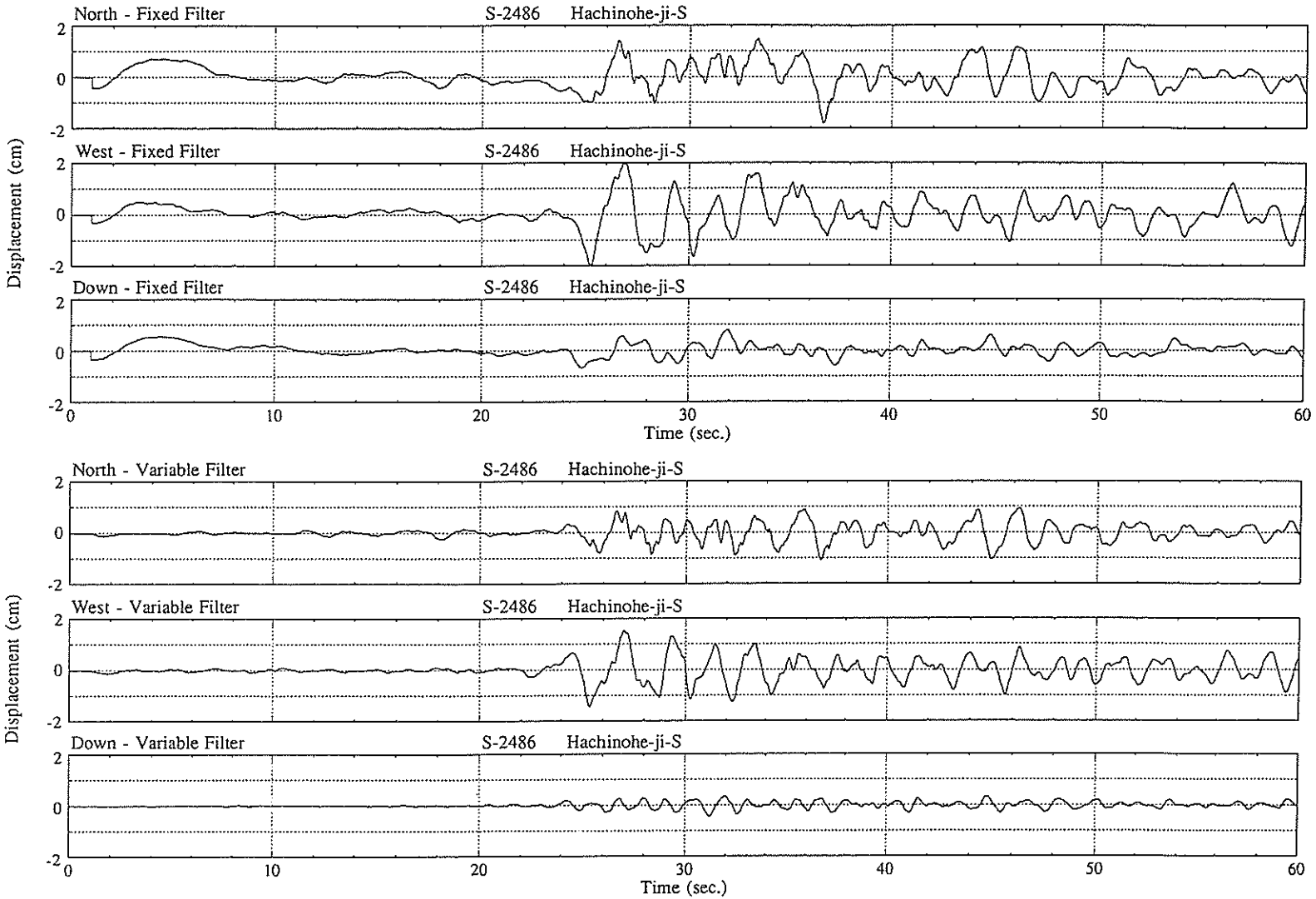
****

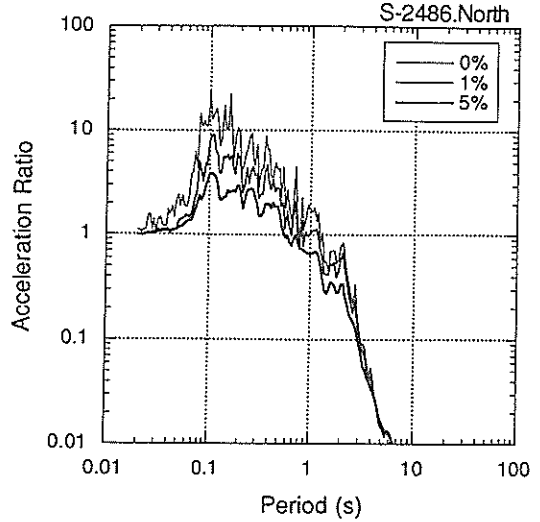
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.256	0.256	0.427	
MAXIMUM ACCELERATION (GAL)				
ORIGINAL	92.7	70.2	27.1	94.7
CORRECTED	150.2	99.5	41.2	151.8
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	6.15	8.33	2.81	8.60
VARIABLE FILTER	6.14	8.57	2.39	8.63
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	1.80	1.99	0.80	2.22
VARIABLE FILTER	1.07	1.54	0.44	1.72

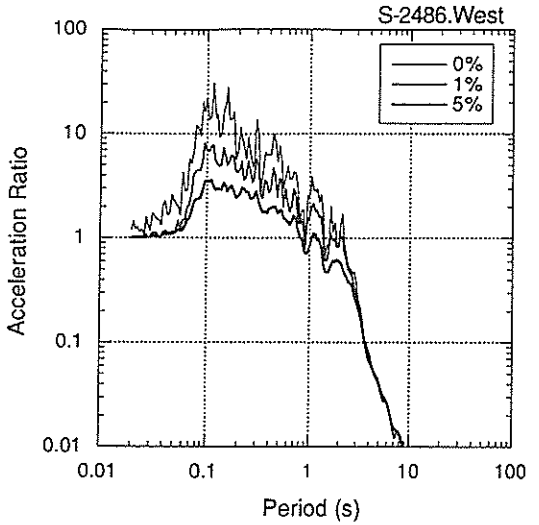
* RESULTANT OF HORIZONTAL COMPONENTS

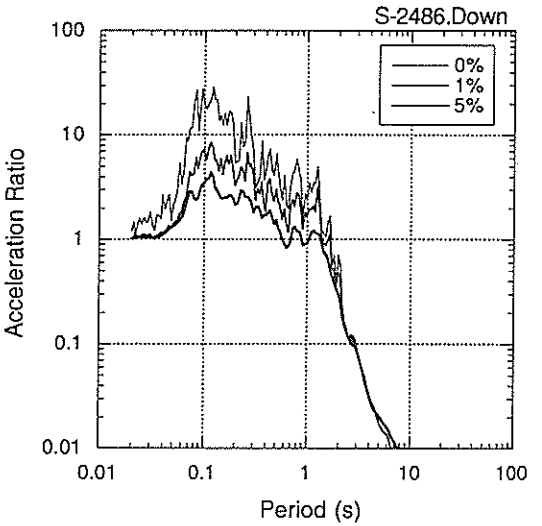

North - Original
S-2486 Hachinohe-ji-S
West - Original
S-2486 Hachinohe-ji-S
Down - Original
S-2486 Hachinohe-ji-S
Acceleration (cm/s²)
100
0
-100
0
10
20
30
40
50
60
Time (sec.)
North - Corrected
S-2486 Hachinohe-ji-S
West - Corrected
S-2486 Hachinohe-ji-S
Down - Corrected
S-2486 Hachinohe-ji-S
160
0
-160

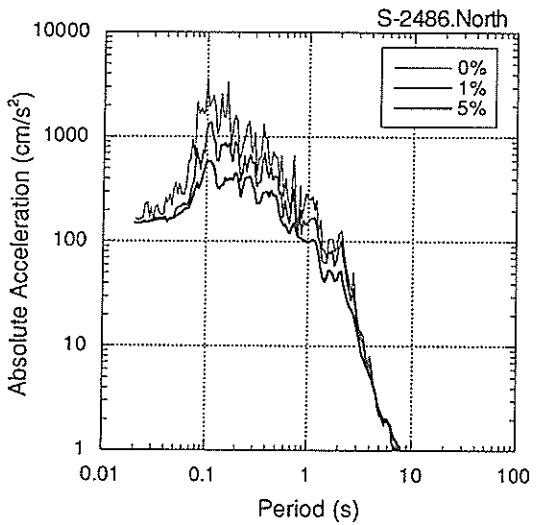

North - Fixed Filter
S-2486 Hachinohe-ji-S
West - Fixed Filter
S-2486 Hachinohe-ji-S
Down - Fixed Filter
S-2486 Hachinohe-ji-S
Velocity (cm/s)
10
0
-10
0
10
20
30
40
50
60
Time (sec.)
North - Variable Filter
S-2486 Hachinohe-ji-S
West - Variable Filter
S-2486 Hachinohe-ji-S
Down - Variable Filter
S-2486 Hachinohe-ji-S
Velocity (cm/s)
Time (sec.)

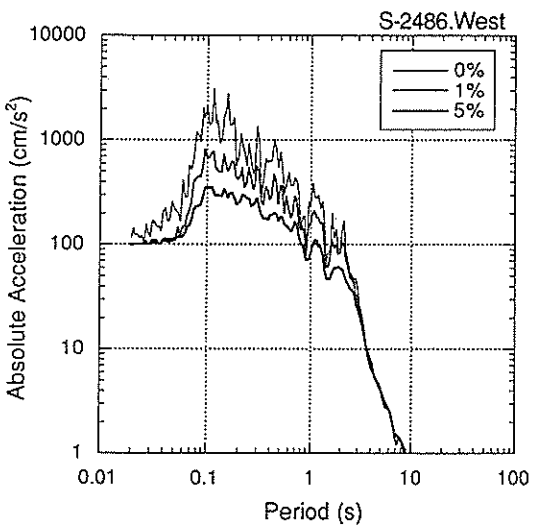

North - Fixed Filter S-2486 Hachinohe-ji-S
West - Fixed Filter S-2486 Hachinohe-ji-S
Down - Fixed Filter S-2486 Hachinohe-ji-S
Displacement (cm)
Time (sec.)
North - Variable Filter S-2486 Hachinohe-ji-S
West - Variable Filter S-2486 Hachinohe-ji-S
Down - Variable Filter S-2486 Hachinohe-ji-S
Displacement (cm)
Time (sec.)

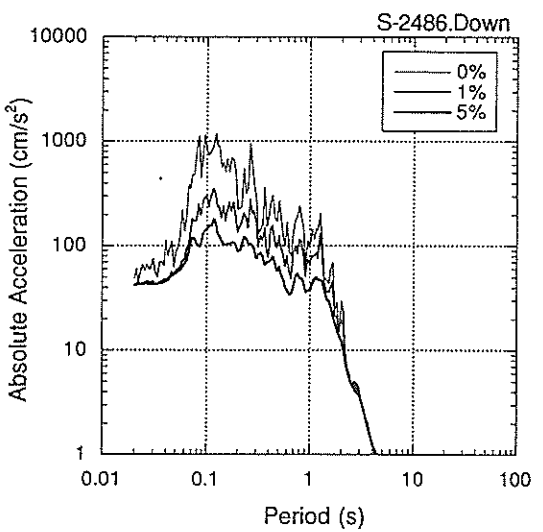

S-2486.North
0%
1%
5%
Acceleration Ratio
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

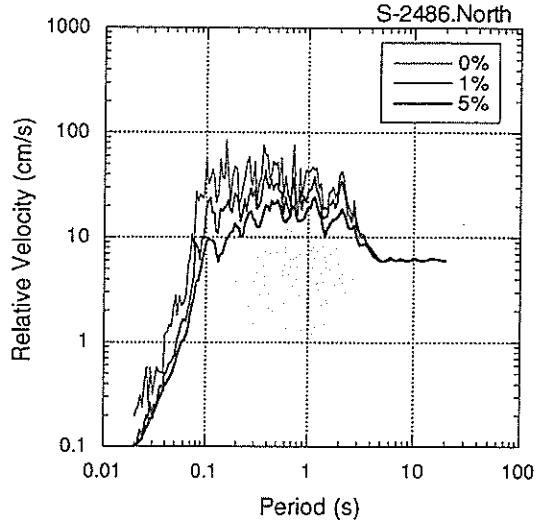

S-2486.West
0%
1%
5%
Acceleration Ratio
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

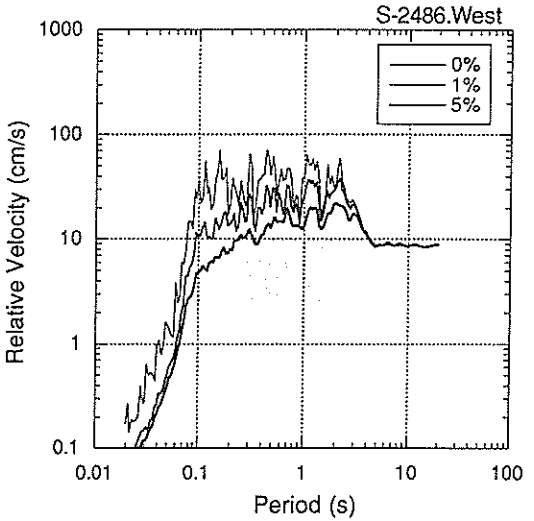

S-2486.Down
0%
1%
5%
Acceleration Ratio
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

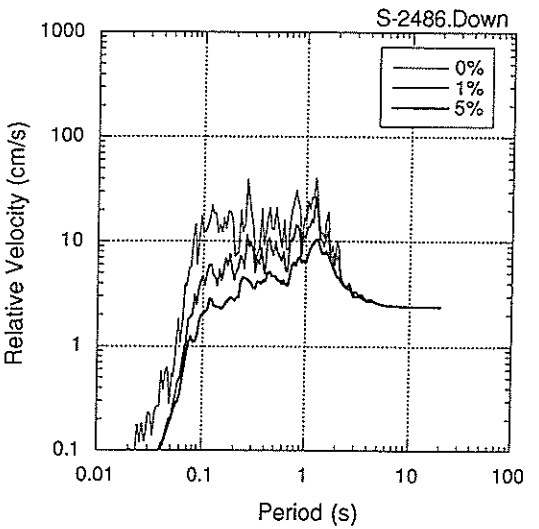

S-2486.North
0%
1%
5%
Absolute Acceleration (cm/s²)
Period (s)
10000
1000
100
10
1
0.01
0.1
1
10
100

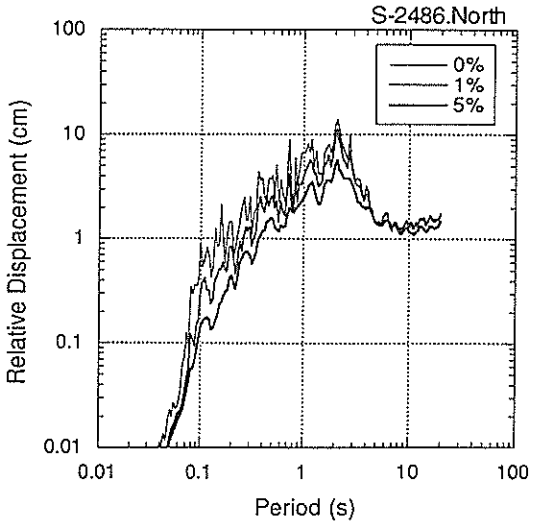

S-2486.West
0%
1%
5%
Absolute Acceleration (cm/s²)
Period (s)
10000
1000
100
10
1
0.01
0.1
1
10
100

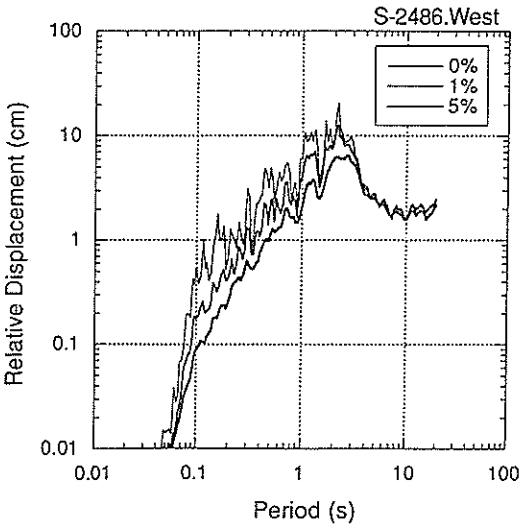

S-2486.Down
0%
1%
5%
Absolute Acceleration (cm/s²)
Period (s)
10000
1000
100
10
1
0.01
0.1
1
10
100

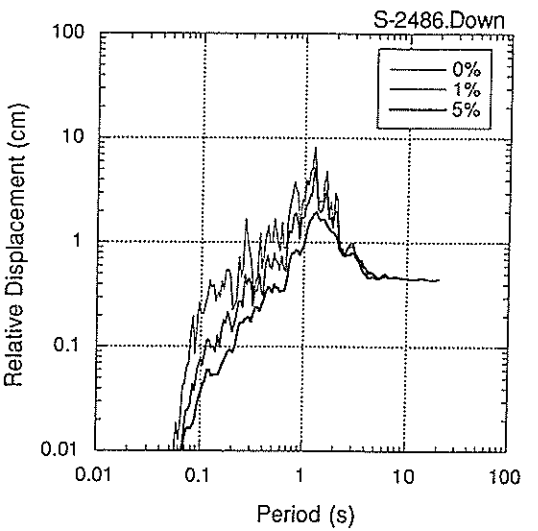

S-2486.North
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100

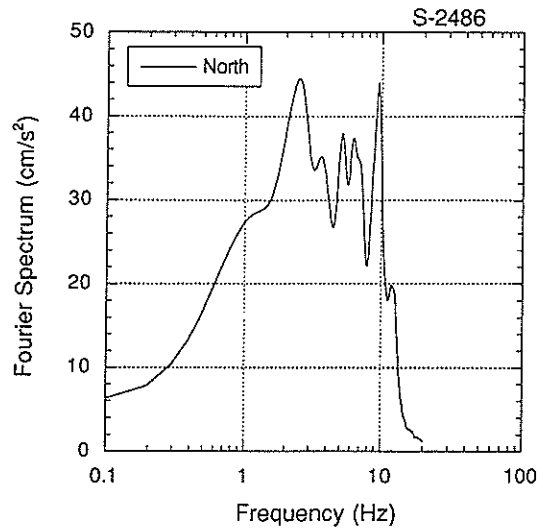

S-2486.West
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100

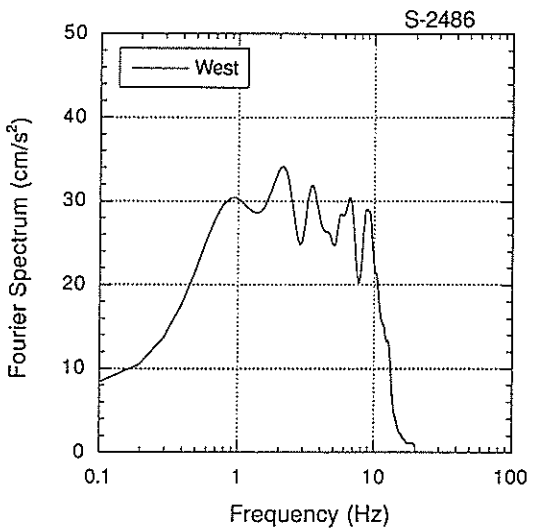

S-2486.Down
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100

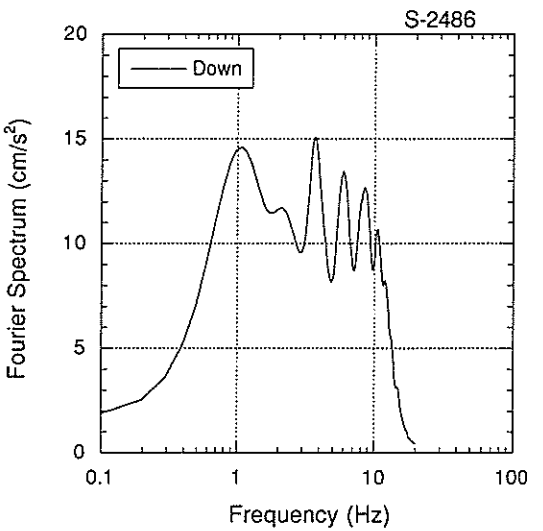

S-2486.North
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

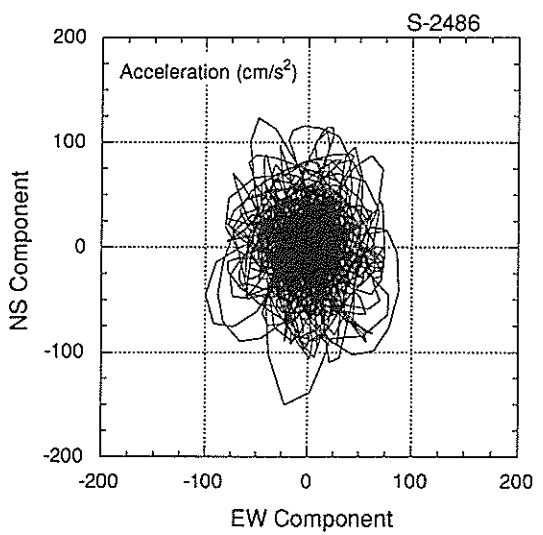

S-2486.West
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

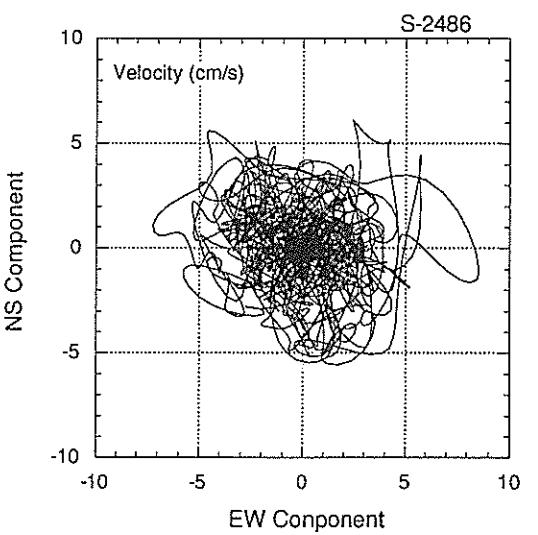

S-2486.Down
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

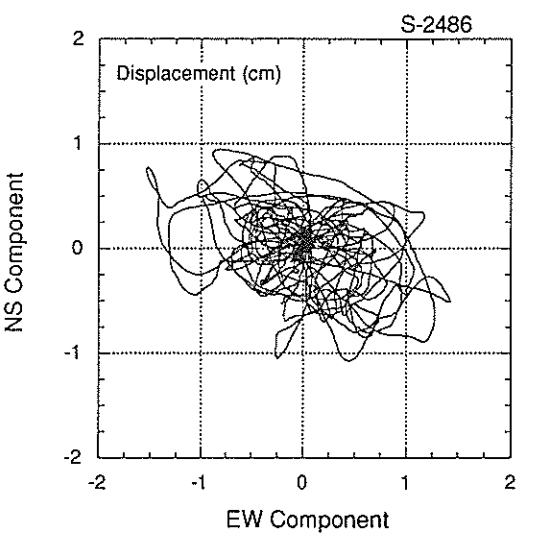

S-2486
North
Fourier Spectrum (cm/s²)
Frequency (Hz)


S-2486
West
Fourier Spectrum (cm/s²)
Frequency (Hz)


S-2486
Down
Fourier Spectrum (cm/s²)
Frequency (Hz)


S-2486
Acceleration (cm/s²)
NS Component
EW Component


S-2486
Velocity (cm/s)
NS Component
EW Conponent


S-2486
Displacement (cm)
NS Component
EW Component

RECORD NUMBER : S-2487

STATION : SOMA-S

EARTHQUAKE DATA

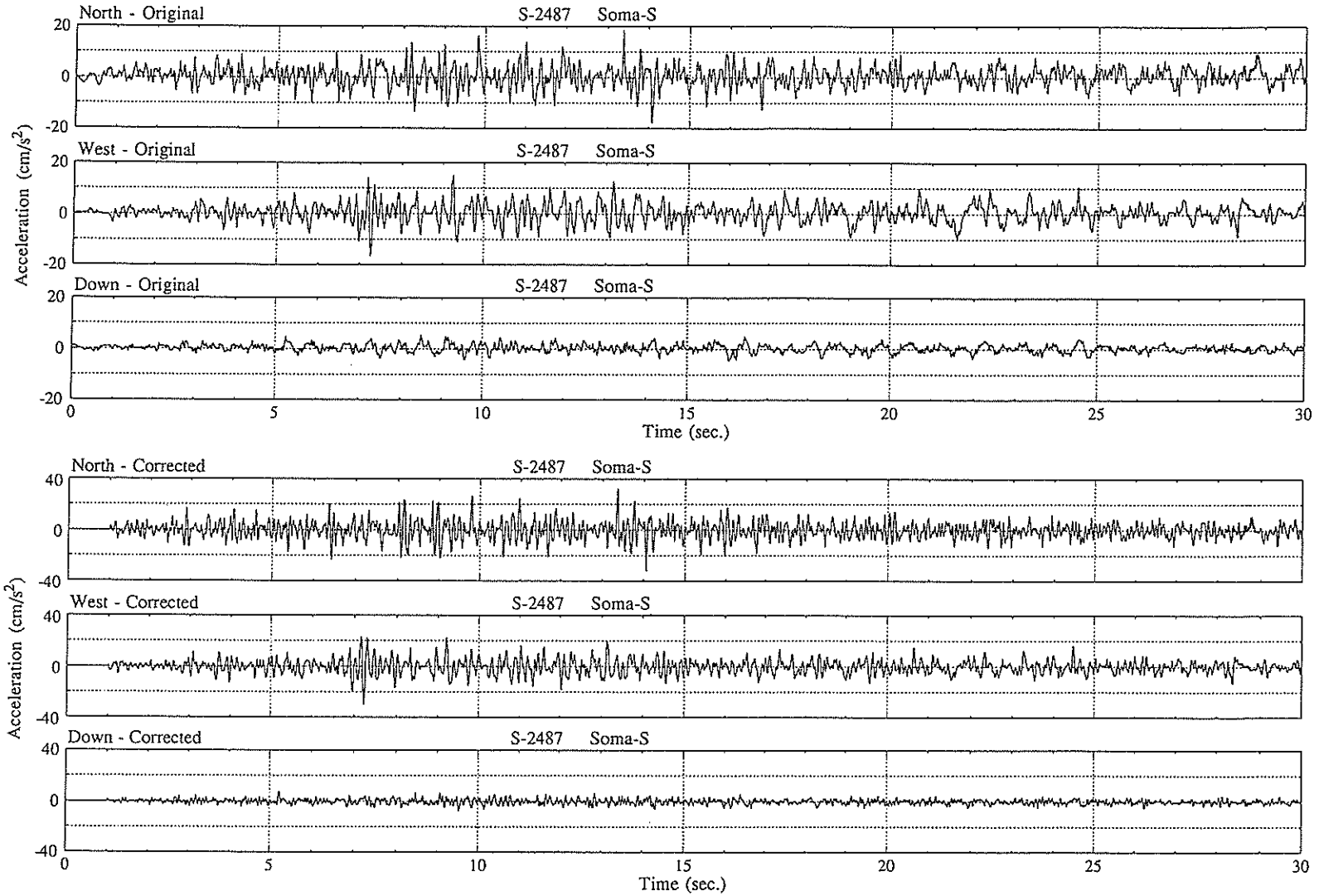
****

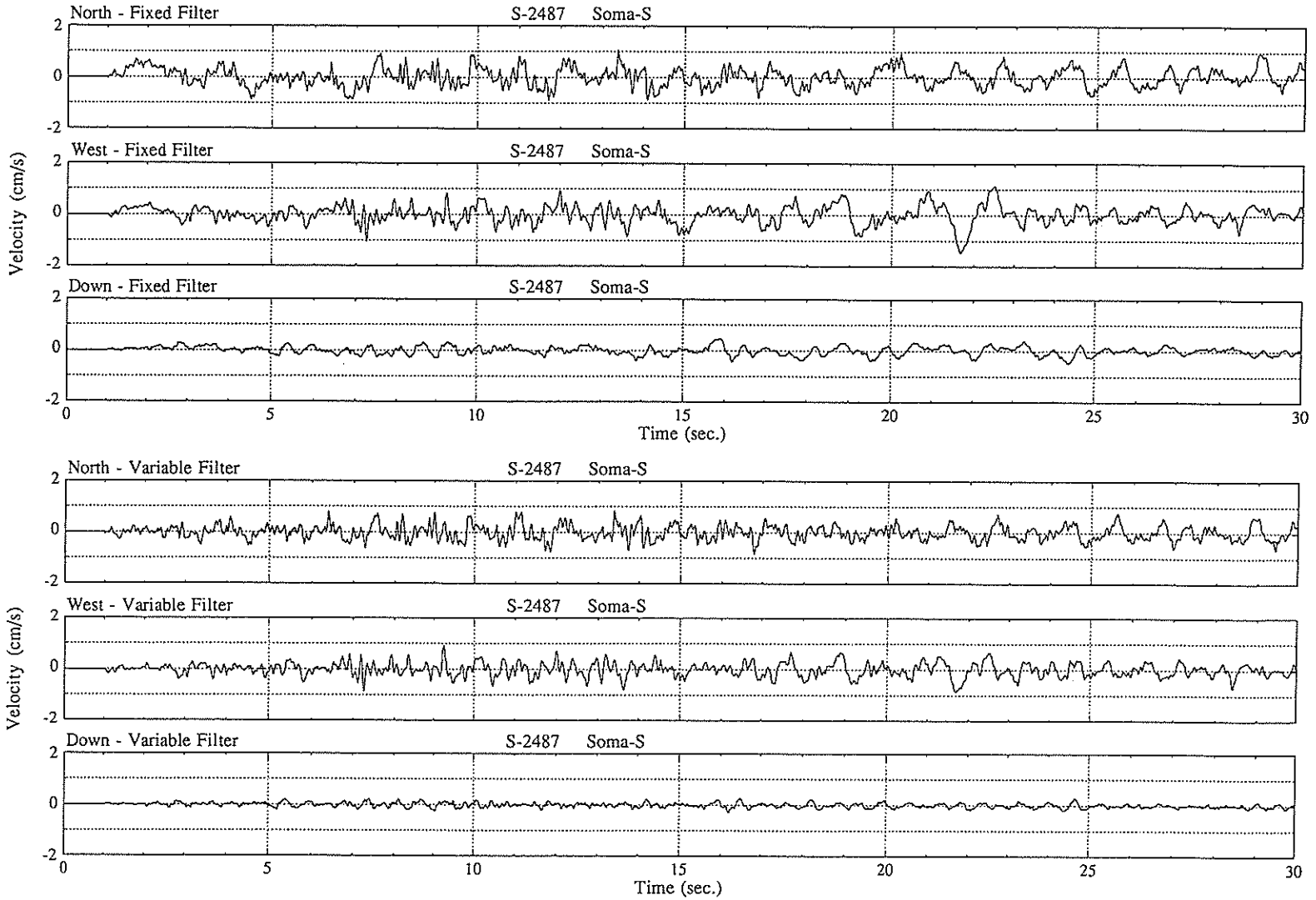
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

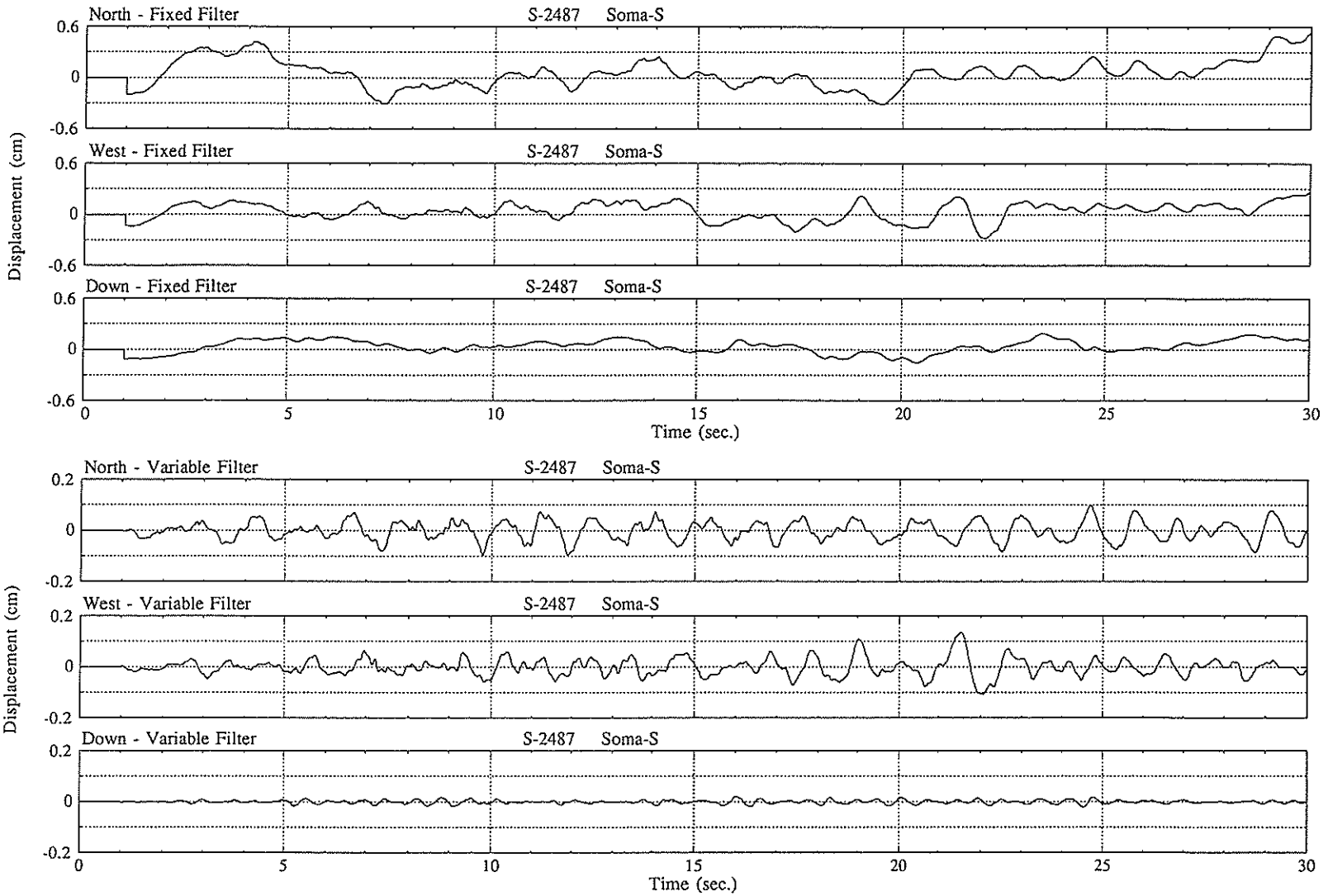
****

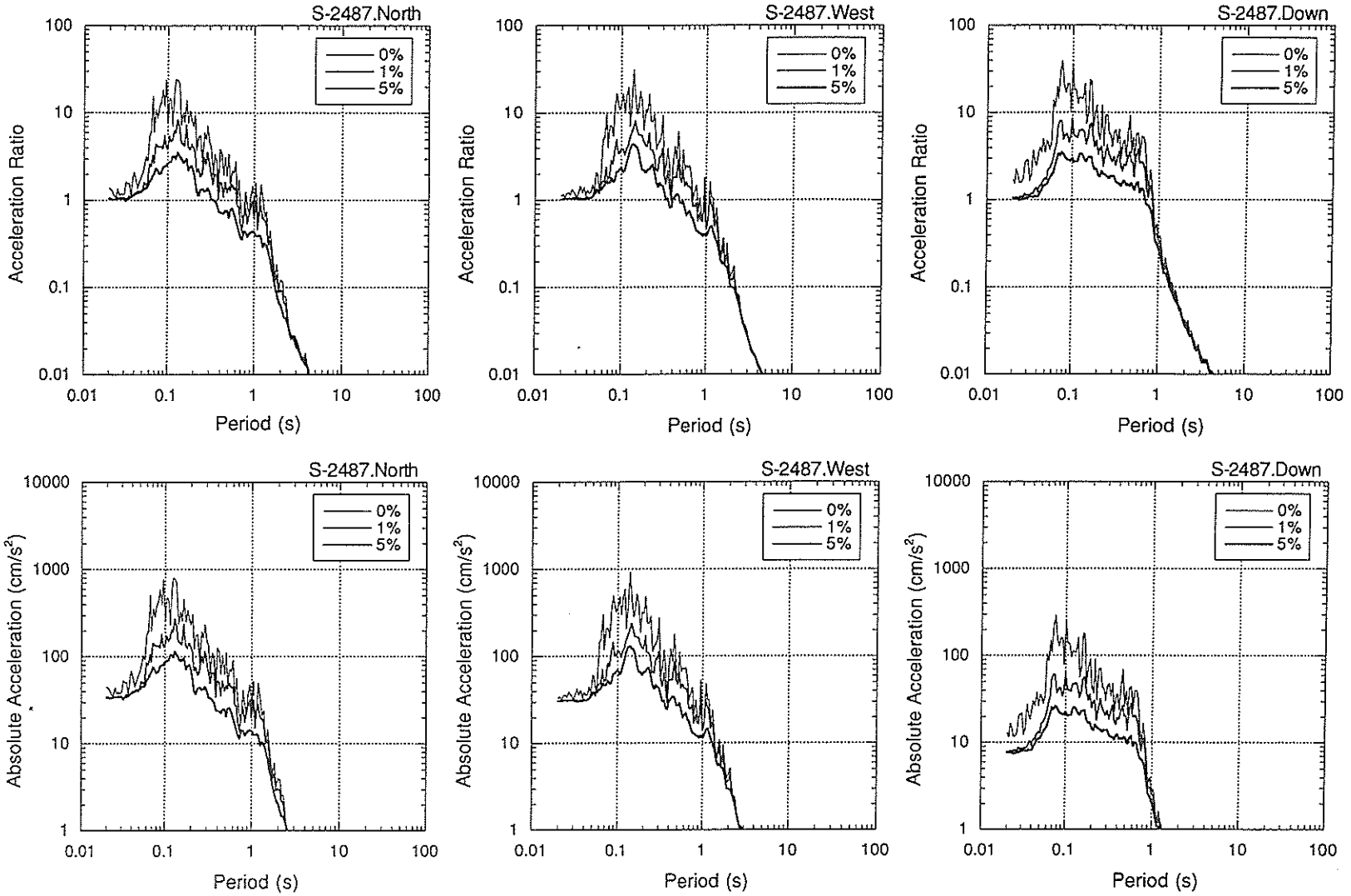
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.585	0.597	1.244	
MAXIMUM ACCELERATION (GAL)				
ORIGINAL	18.7	16.6	5.3	19.3
CORRECTED	32.7	29.6	7.5	33.3
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	1.09	1.45	0.47	1.47
VARIABLE FILTER	0.84	0.94	0.29	1.03
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.54	0.28	0.19	0.60
VARIABLE FILTER	0.10	0.14	0.02	0.14

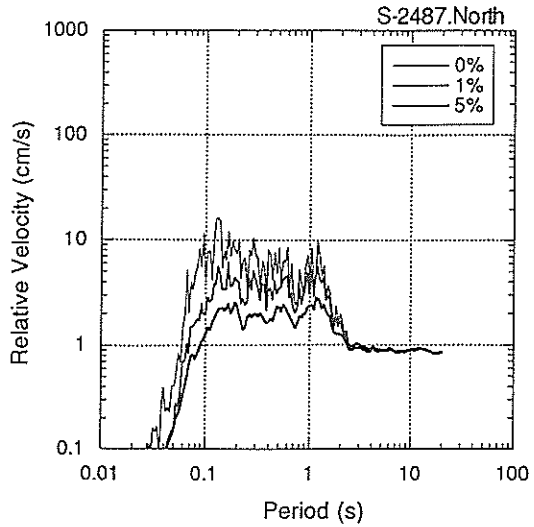
* RESULTANT OF HORIZONTAL COMPONENTS

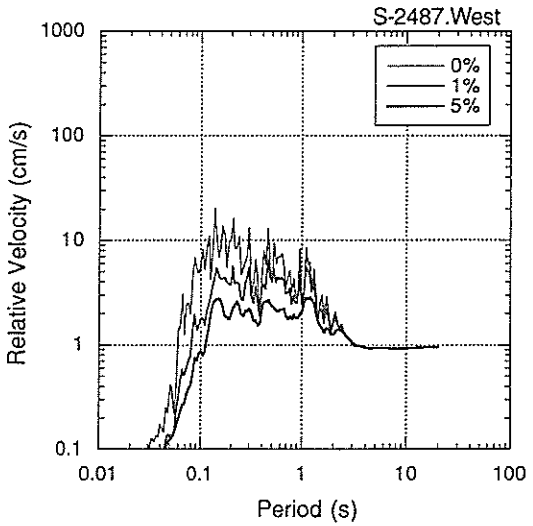

North - Original
S-2487 Soma-S
West - Original
S-2487 Soma-S
Down - Original
S-2487 Soma-S
Acceleration (cm/s²)
Time (sec.)
North - Corrected
S-2487 Soma-S
West - Corrected
S-2487 Soma-S
Down - Corrected
S-2487 Soma-S
Acceleration (cm/s²)
Time (sec.)

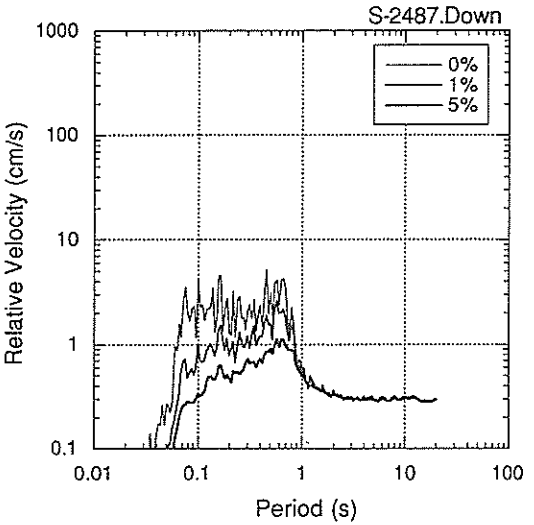

North - Fixed Filter
S-2487 Soma-S
West - Fixed Filter
S-2487 Soma-S
Down - Fixed Filter
S-2487 Soma-S
Velocity (cm/s)
2
0
-2
0
5
10
15
20
25
30
Time (sec.)
North - Variable Filter
S-2487 Soma-S
West - Variable Filter
S-2487 Soma-S
Down - Variable Filter
S-2487 Soma-S
Velocity (cm/s)
Time (sec.)

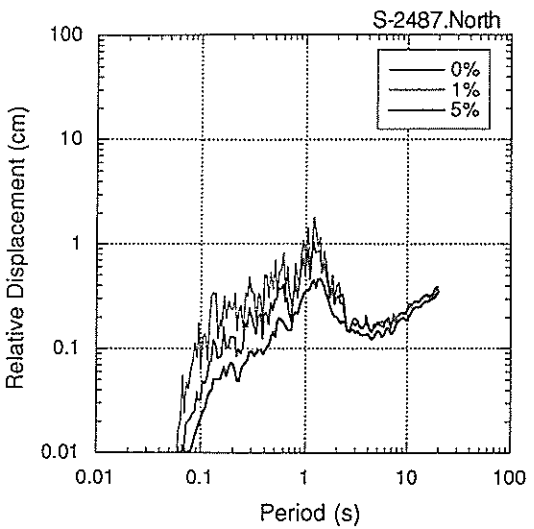

North - Fixed Filter
S-2487 Soma-S
West - Fixed Filter
S-2487 Soma-S
Down - Fixed Filter
S-2487 Soma-S
Displacement (cm)
0.6
0
-0.6
0 5 10 15 20 25 30
Time (sec.)
North - Variable Filter
S-2487 Soma-S
West - Variable Filter
S-2487 Soma-S
Down - Variable Filter
S-2487 Soma-S
Displacement (cm)
0.2
0
-0.2
0 5 10 15 20 25 30
Time (sec.)

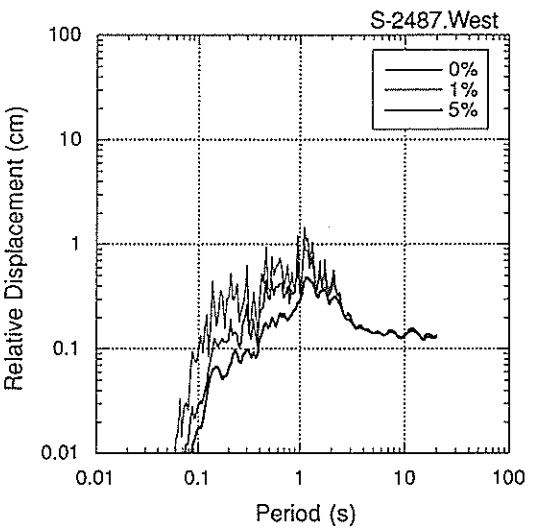

S-2487.North
S-2487.West
S-2487.Down
0%
1%
5%
Acceleration Ratio
Absolute Acceleration (cm/s²)
Period (s)
0.01
0.1
1
10
100
1000
10000

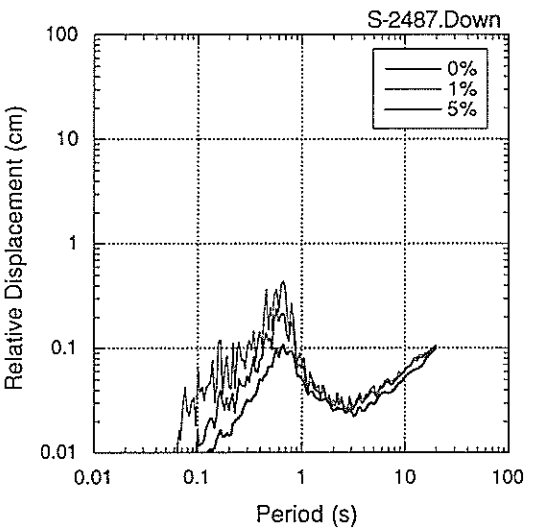

S-2487.North
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100

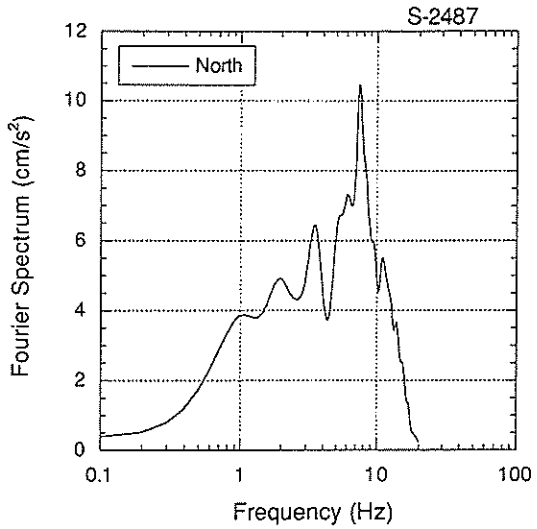

S-2487.West
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100

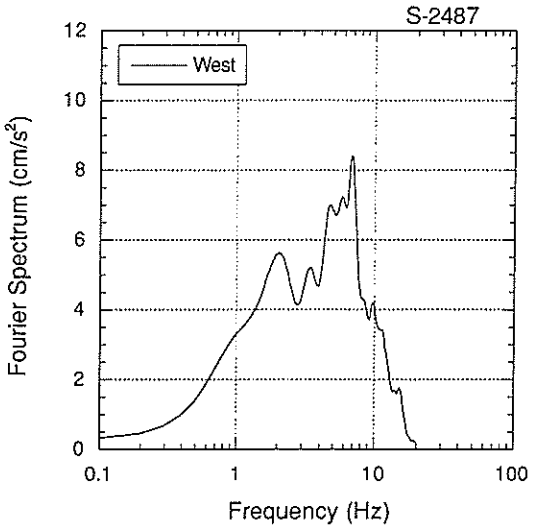

S-2487.Down
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100

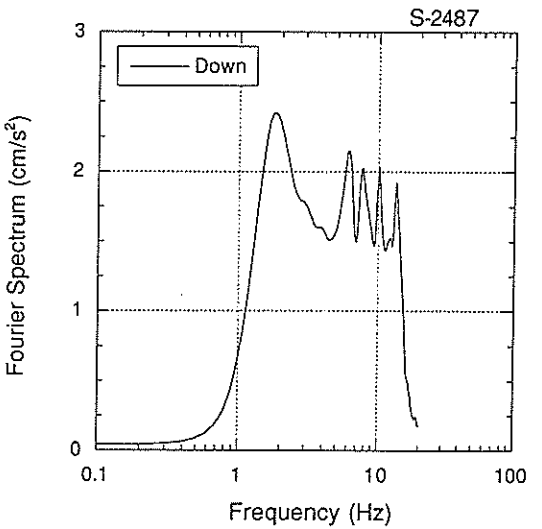

S-2487.North
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

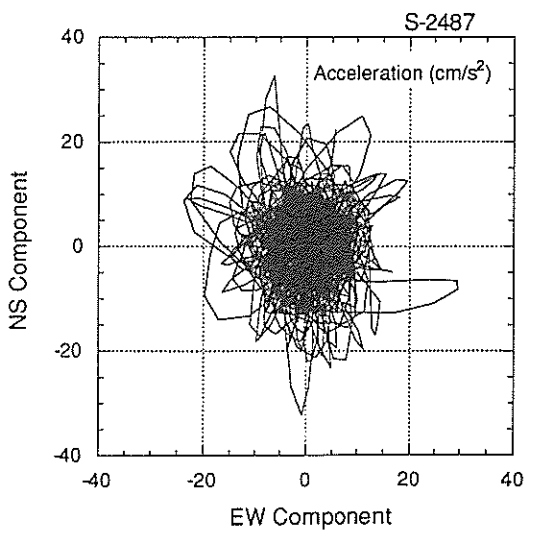

S-2487.West
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

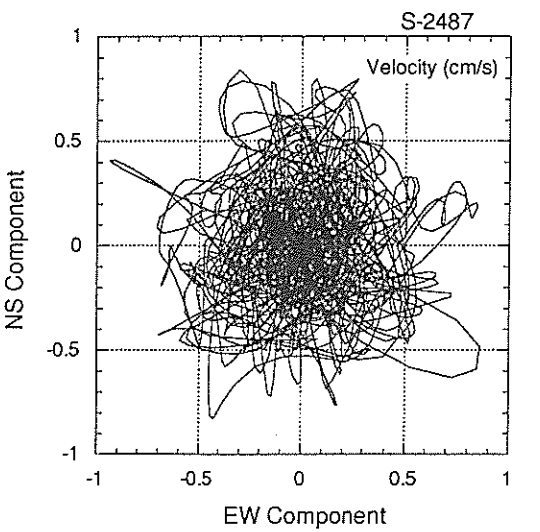

S-2487.Down
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

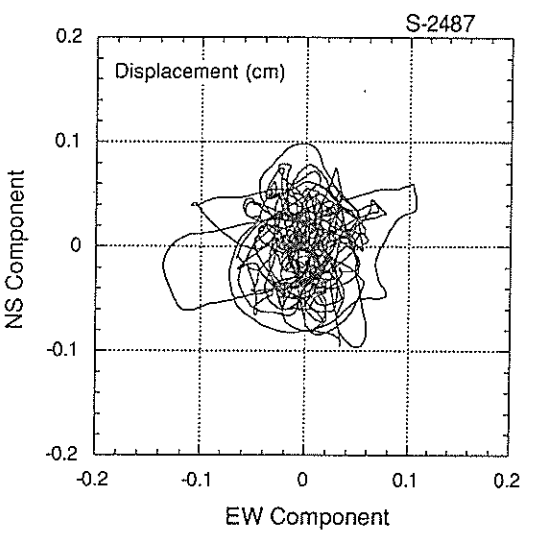

S-2487
North
Fourier Spectrum (cm/s²)
Frequency (Hz)


S-2487
West
Fourier Spectrum (cm/s²)
Frequency (Hz)


S-2487
Down
Fourier Spectrum (cm/s²)
Frequency (Hz)


S-2487
Acceleration (cm/s²)
NS Component
EW Component


S-2487
Velocity (cm/s)
NS Component
EW Component


S-2487
Displacement (cm)
NS Component
EW Component

RECORD NUMBER : S-2488

STATION : AOMORI-S

EARTHQUAKE DATA

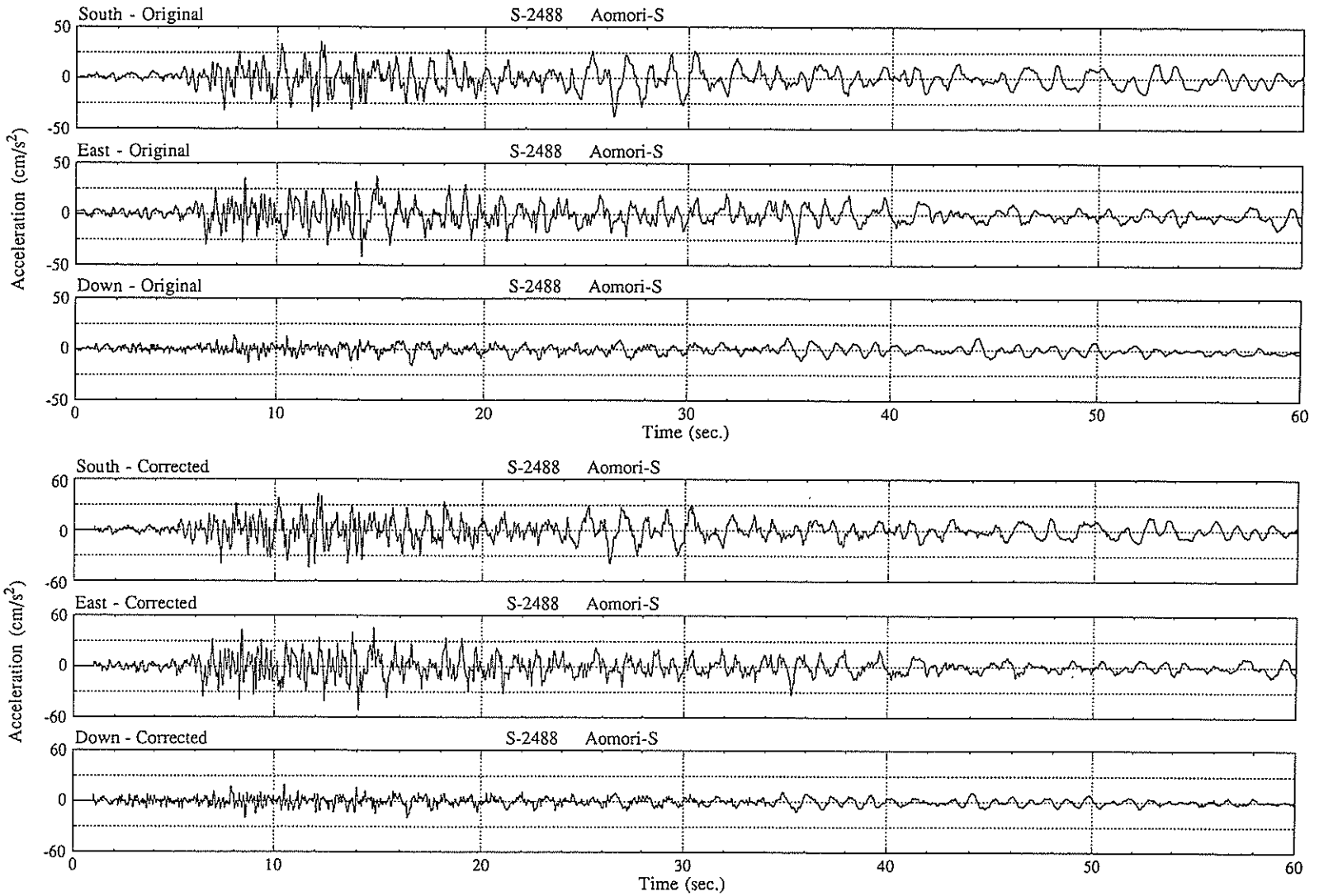
****

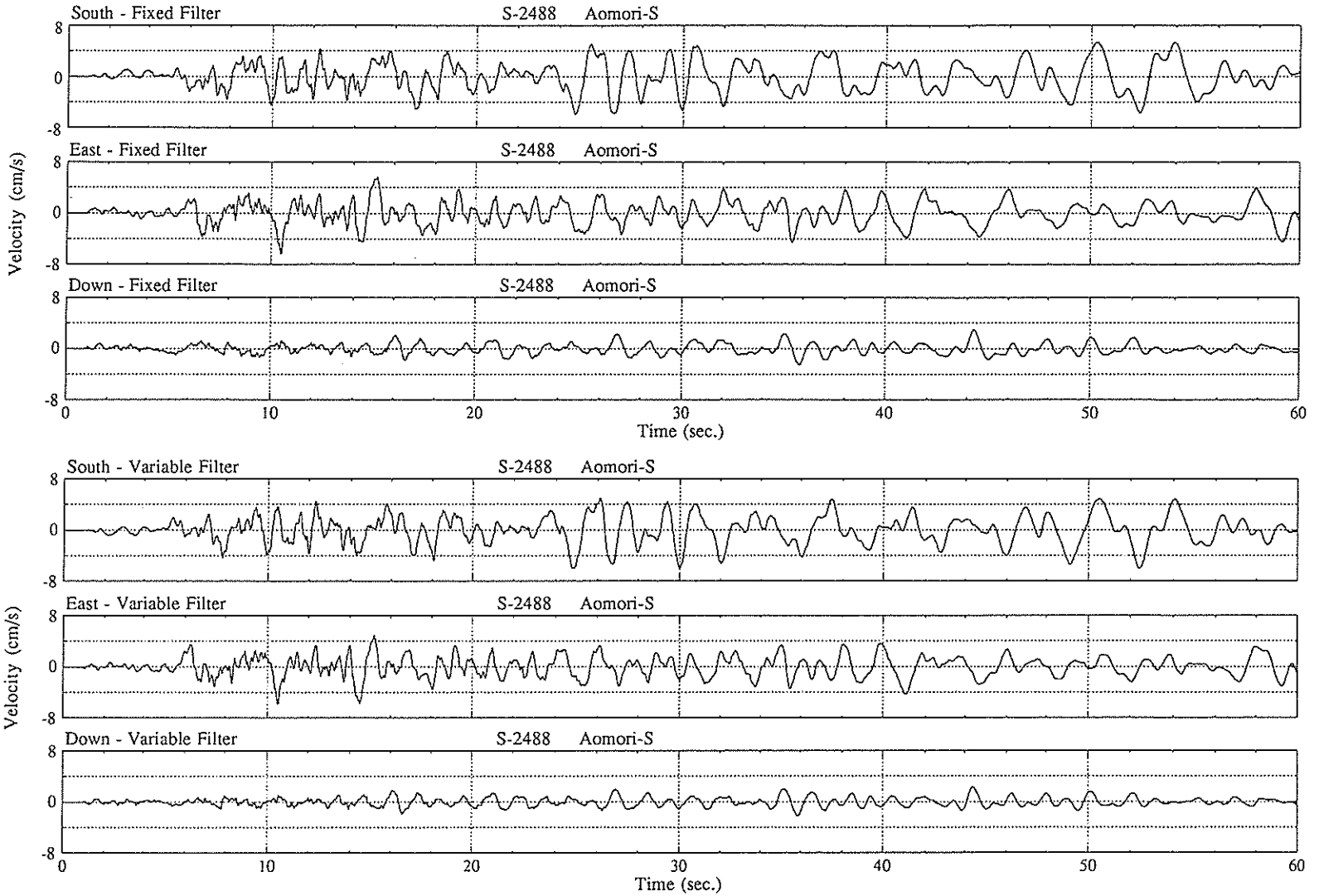
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

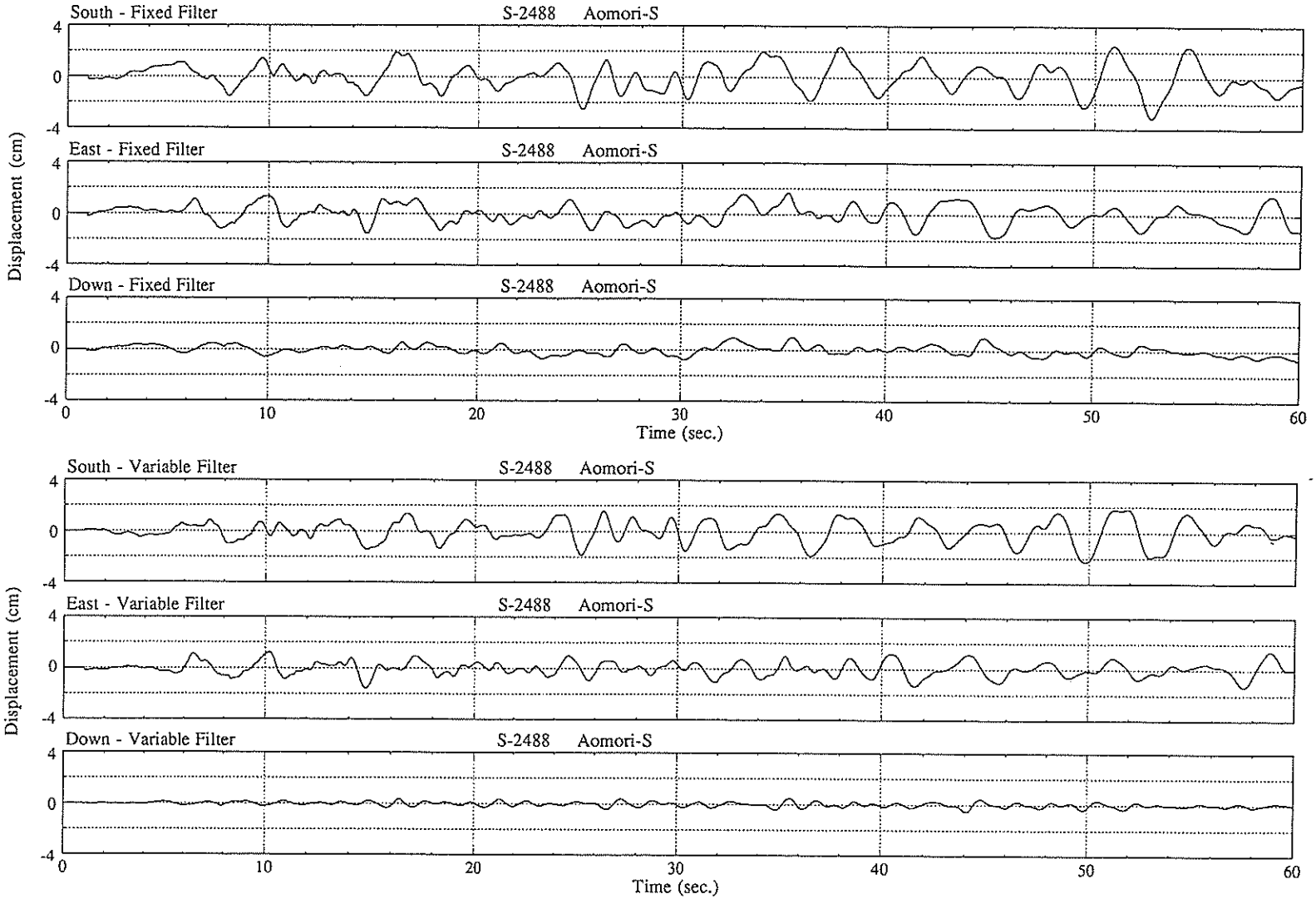
****

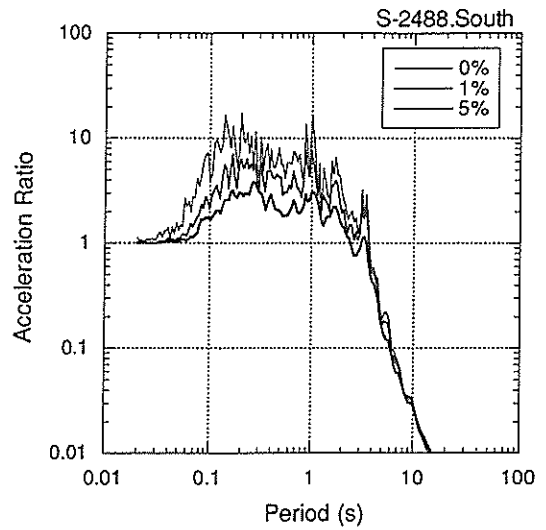
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.170	0.194	0.317	
MAXIMUM ACCELERATION (GAL)				
ORIGINAL	38.0	41.2	15.7	42.1
CORRECTED	43.6	51.6	19.7	55.0
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	5.90	6.31	2.98	6.87
VARIABLE FILTER	6.03	5.78	2.35	6.68
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	3.14	1.76	1.02	3.21
VARIABLE FILTER	2.30	1.60	0.53	2.30

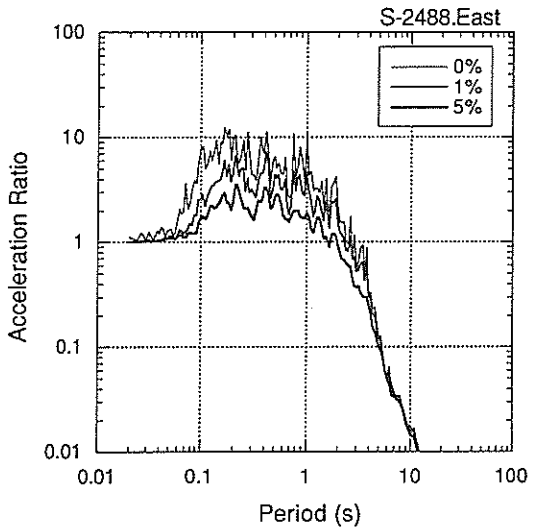
* RESULTANT OF HORIZONTAL COMPONENTS

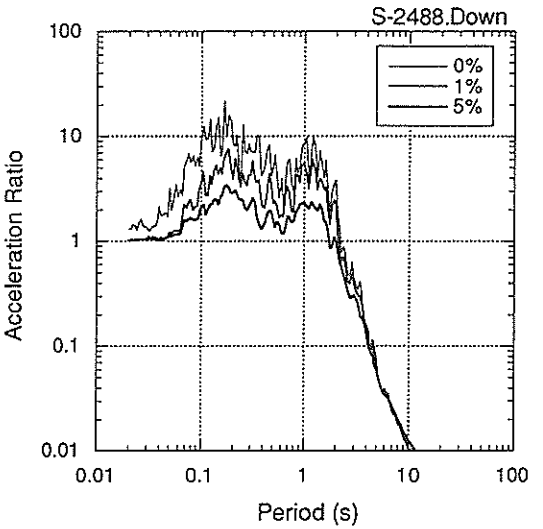

South - Original
S-2488 Aomori-S
East - Original
S-2488 Aomori-S
Down - Original
S-2488 Aomori-S
Acceleration (cm/s²)
50
0
-50
0
10
20
30
40
50
60
Time (sec.)
South - Corrected
S-2488 Aomori-S
East - Corrected
S-2488 Aomori-S
Down - Corrected
S-2488 Aomori-S
Acceleration (cm/s²)
60
0
-60
0
10
20
30
40
50
60
Time (sec.)

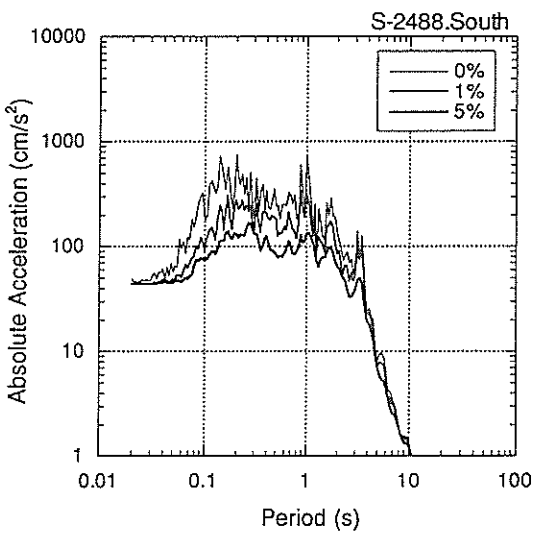

South - Fixed Filter S-2488 Aomori-S
East - Fixed Filter S-2488 Aomori-S
Down - Fixed Filter S-2488 Aomori-S
Velocity (cm/s)
8
0
-8
0
10
20
30
40
50
60
Time (sec.)
South - Variable Filter S-2488 Aomori-S
East - Variable Filter S-2488 Aomori-S
Down - Variable Filter S-2488 Aomori-S
Velocity (cm/s)
Time (sec.)

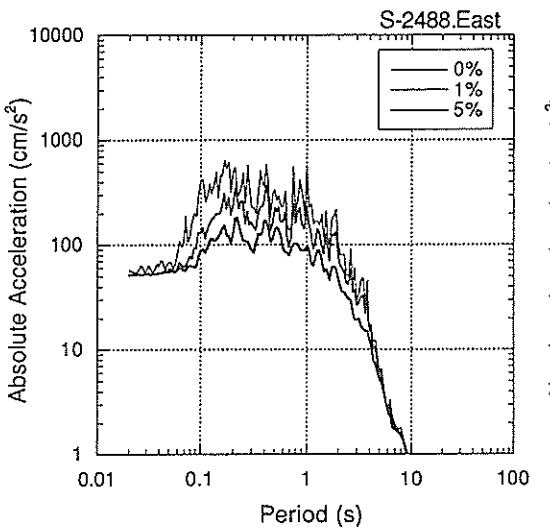

South - Fixed Filter
S-2488 Aomori-S
East - Fixed Filter
S-2488 Aomori-S
Down - Fixed Filter
S-2488 Aomori-S
Displacement (cm)
4
0
-4
0
10
20
30
40
50
60
Time (sec.)
South - Variable Filter
S-2488 Aomori-S
East - Variable Filter
S-2488 Aomori-S
Down - Variable Filter
S-2488 Aomori-S
Displacement (cm)
Time (sec.)

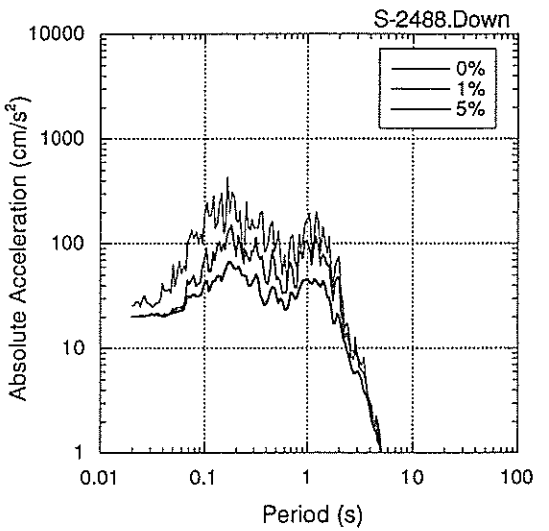

S-2488.South
0%
1%
5%
Acceleration Ratio
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

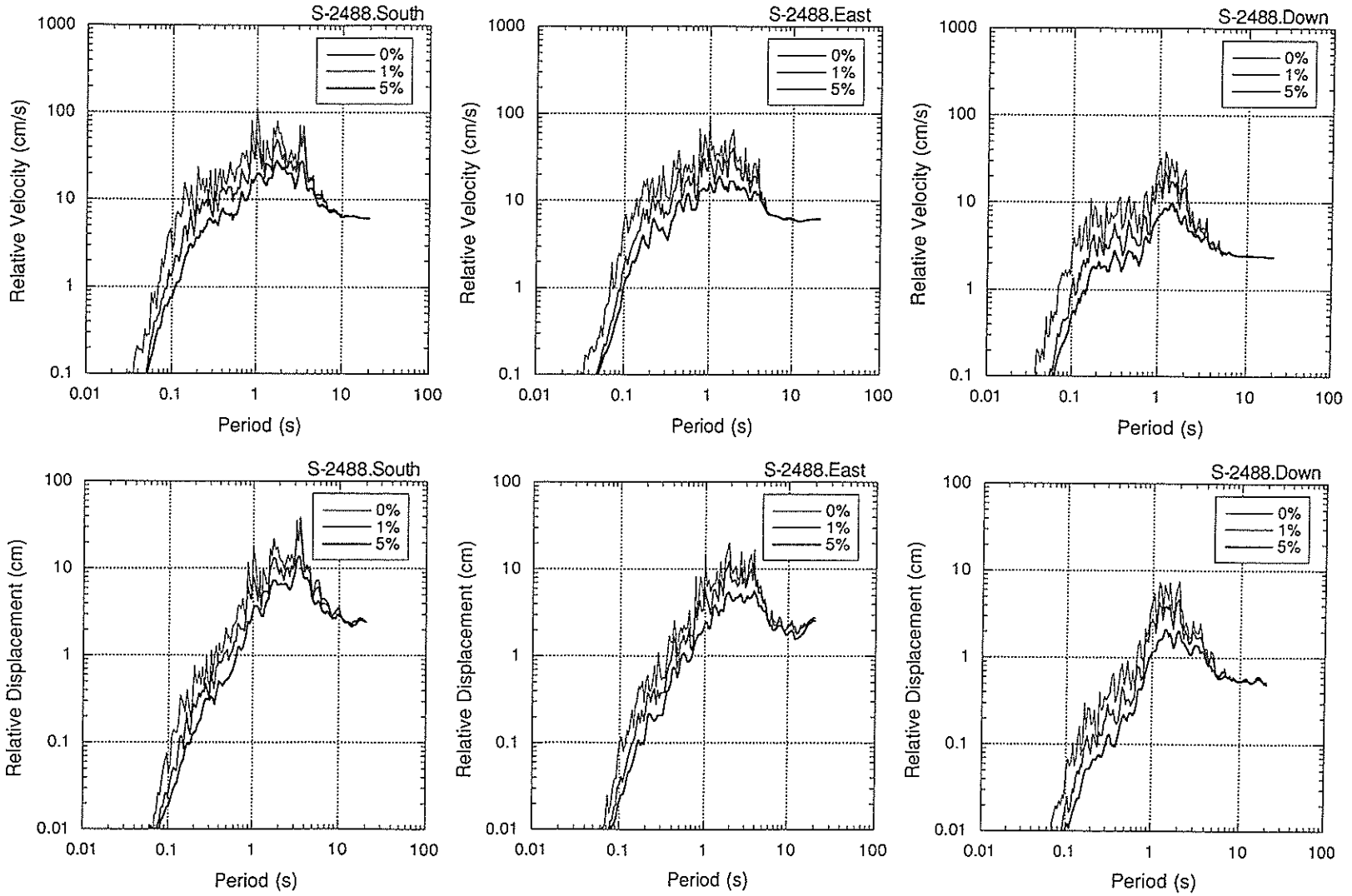

S-2488.East
0%
1%
5%
Acceleration Ratio
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

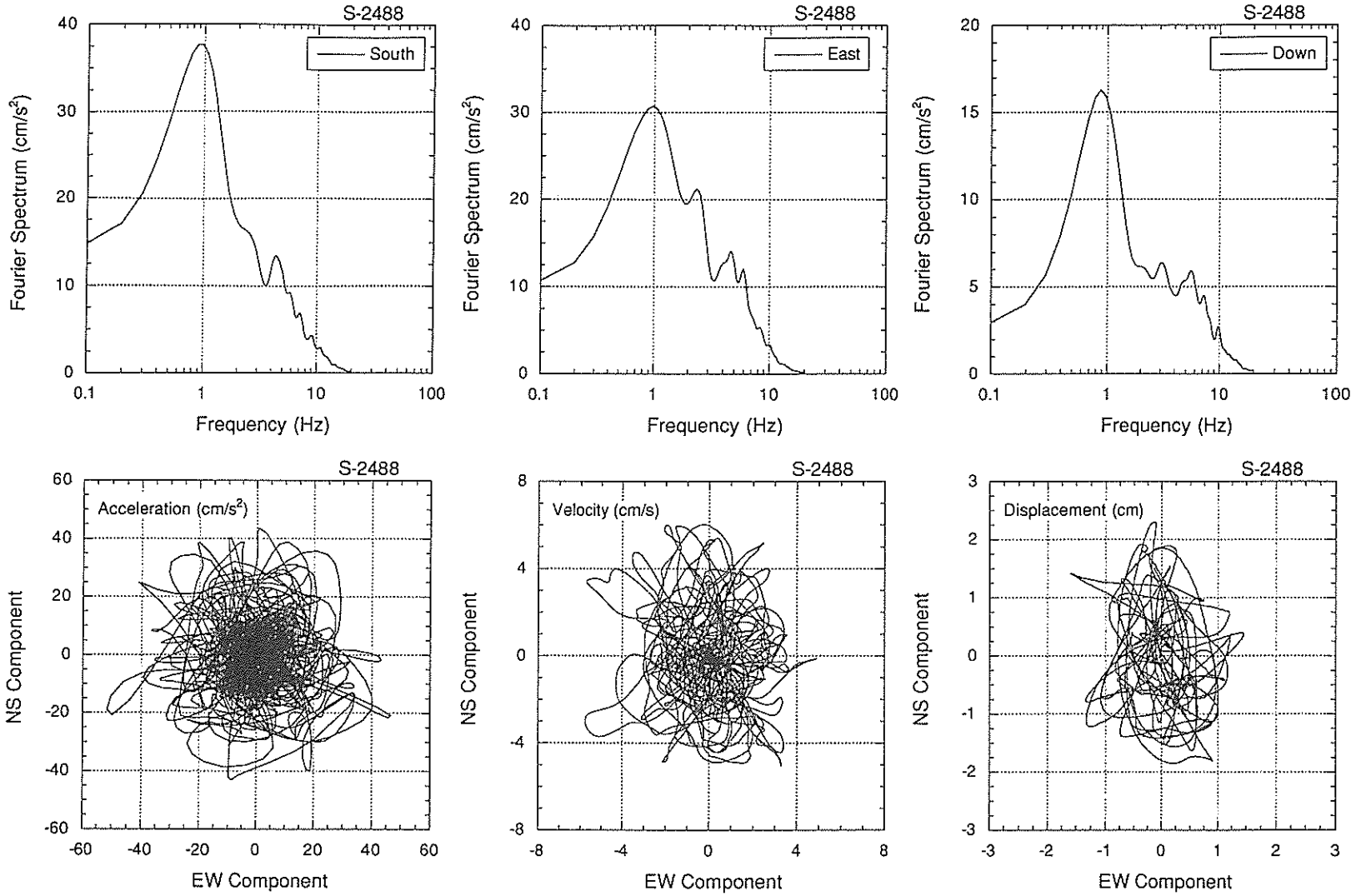

S-2488.Down
0%
1%
5%
Acceleration Ratio
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100


S-2488.South
0%
1%
5%
Absolute Acceleration (cm/s²)
Period (s)
10000
1000
100
10
1
0.01
0.1
1
10
100


S-2488.East
0%
1%
5%
Absolute Acceleration (cm/s²)
Period (s)
10000
1000
100
10
1
0.01
0.1
1
10
100


S-2488.Down
0%
1%
5%
Absolute Acceleration (cm/s²)
Period (s)
10000
1000
100
10
1
0.01
0.1
1
10
100


S-2488.South
S-2488.East
S-2488.Down
0%
1%
5%
Relative Velocity (cm/s)
Relative Displacement (cm)
Period (s)
0.01
0.1
1
10
100
1000


S-2488
South
Fourier Spectrum (cm/s²)
Frequency (Hz)
S-2488
East
Fourier Spectrum (cm/s²)
Frequency (Hz)
S-2488
Down
Fourier Spectrum (cm/s²)
Frequency (Hz)
S-2488
Acceleration (cm/s²)
NS Component
EW Component
S-2488
Velocity (cm/s)
NS Component
EW Component
S-2488
Displacement (cm)
NS Component
EW Component

RECORD NUMBER : S-2490

STATION : URAKAWA-S

EARTHQUAKE DATA

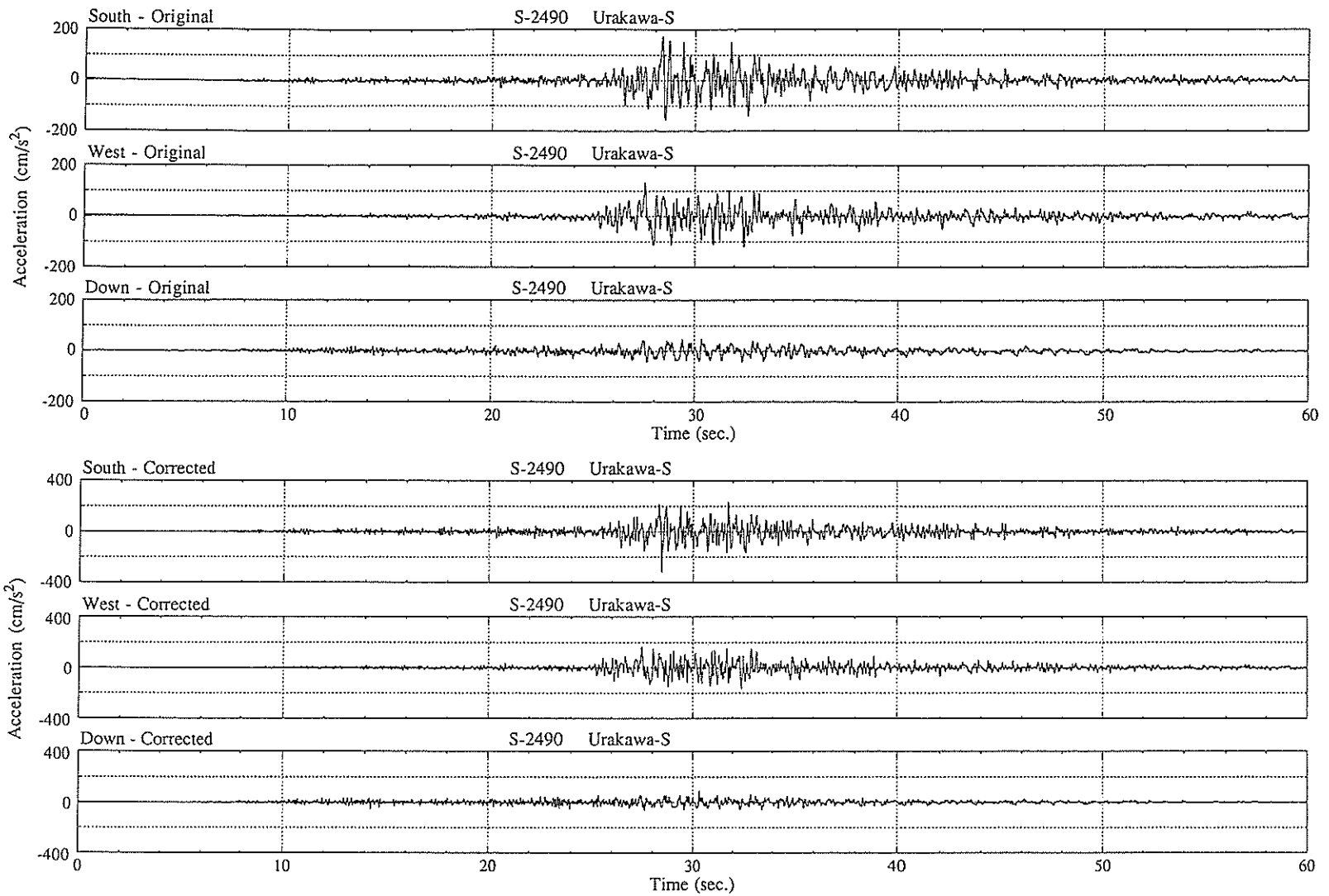
****

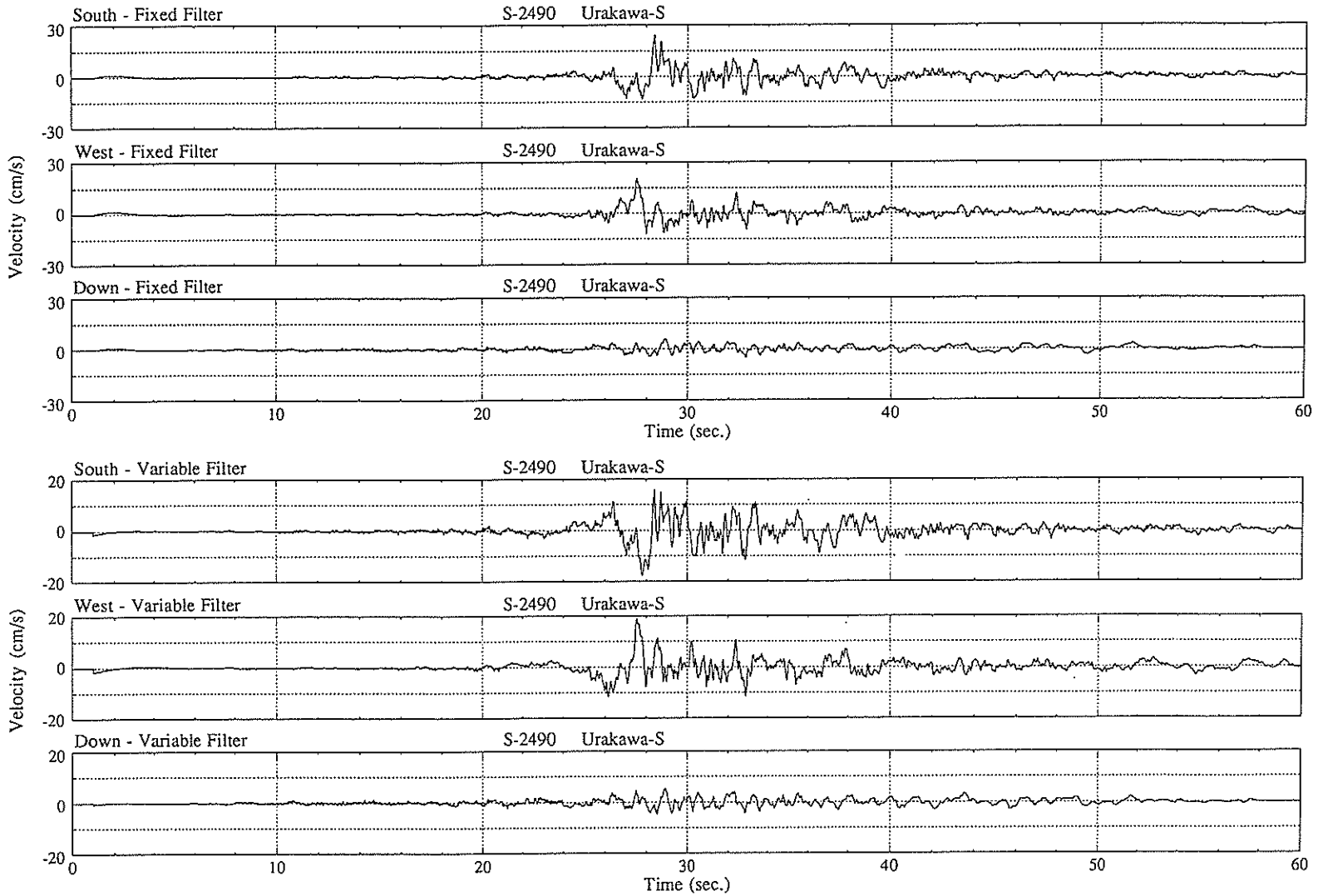
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

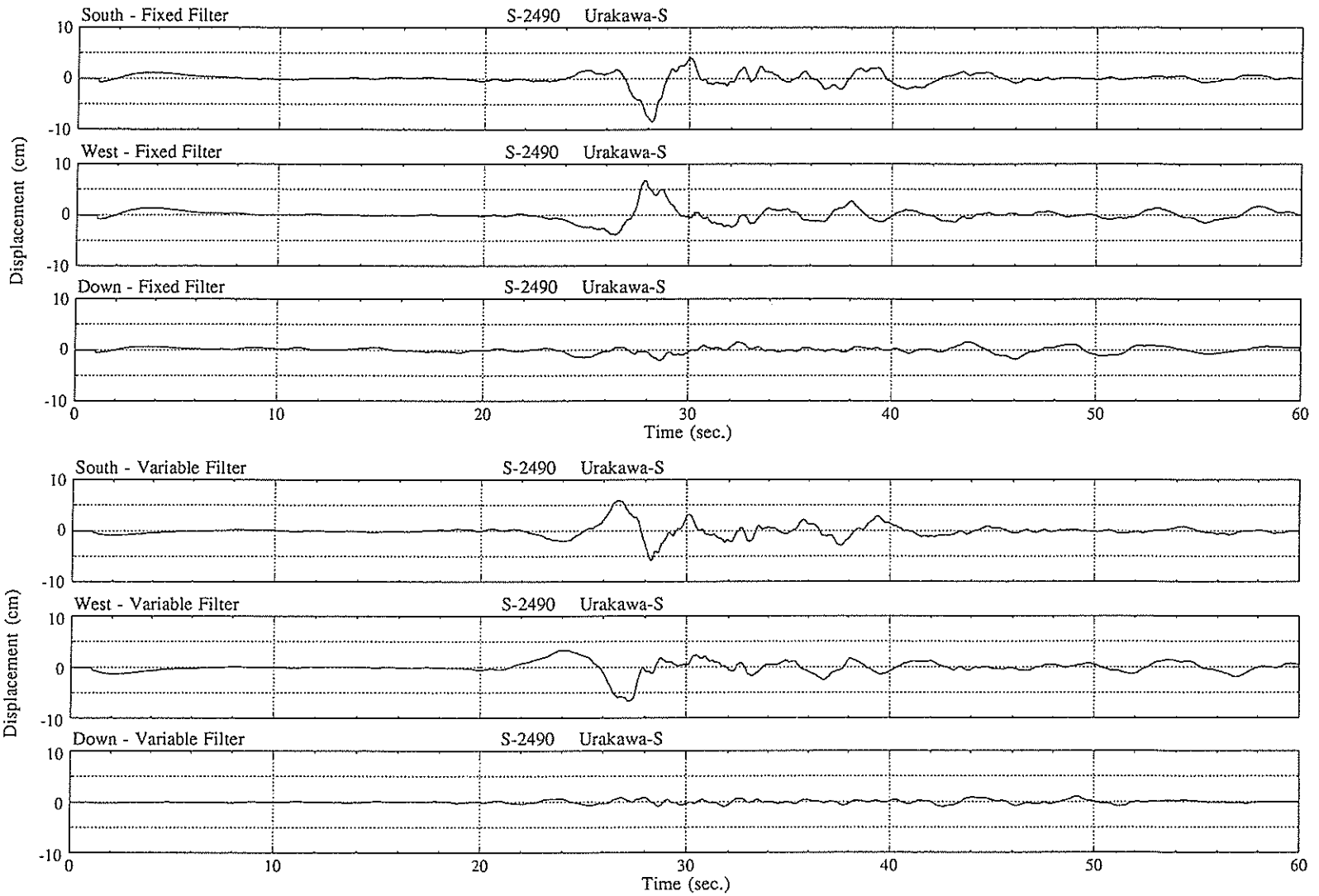
****

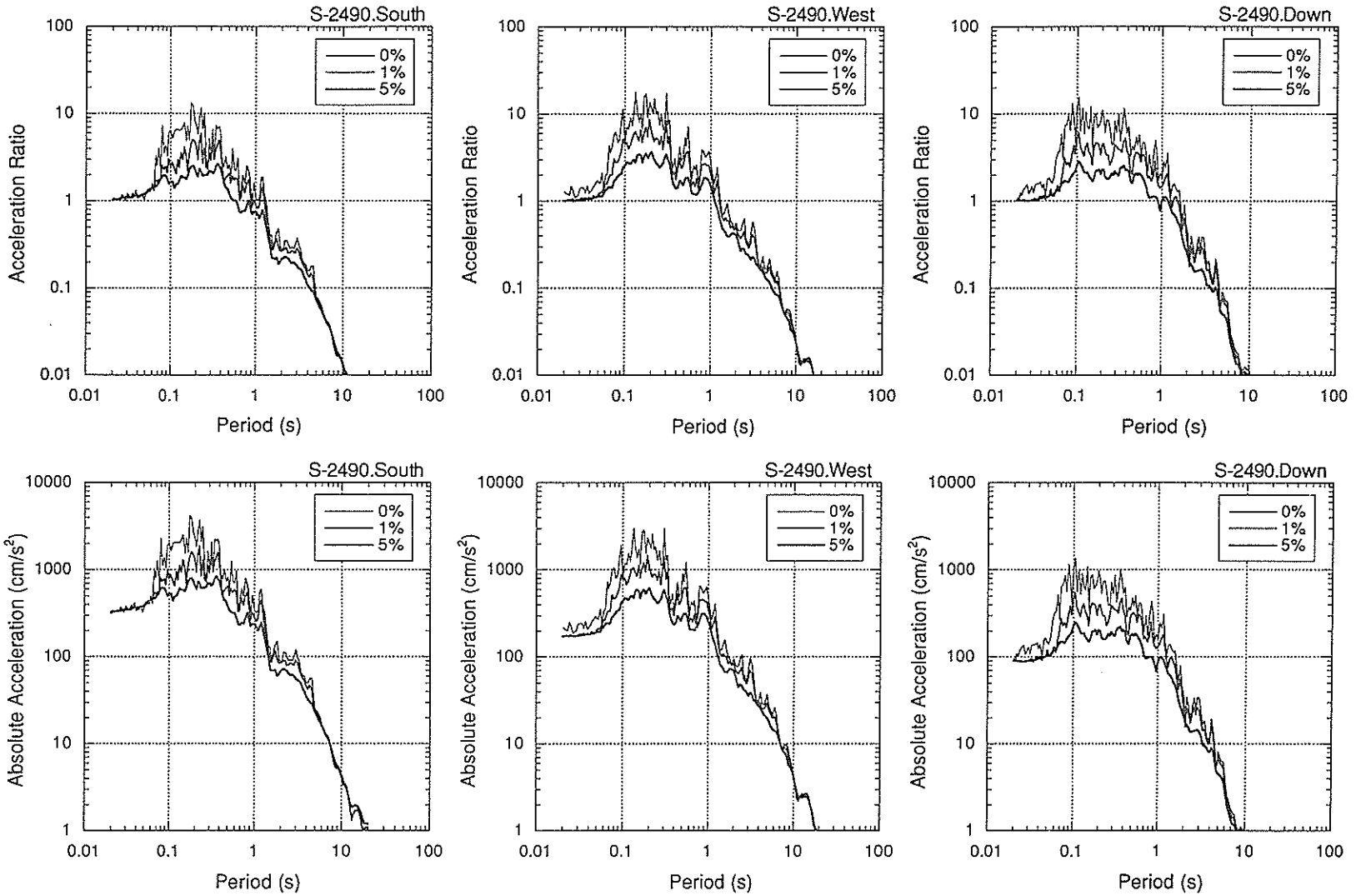
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.122	0.110	0.195	
MAXIMUM ACCELERATION (GAL)				
ORIGINAL	173.5	133.3	48.0	184.0
CORRECTED	317.1	170.2	87.9	322.1
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	24.16	20.53	5.87	24.23
VARIABLE FILTER	17.69	18.91	5.43	21.21
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	8.42	6.85	2.02	9.86
VARIABLE FILTER	5.98	6.72	1.05	8.40

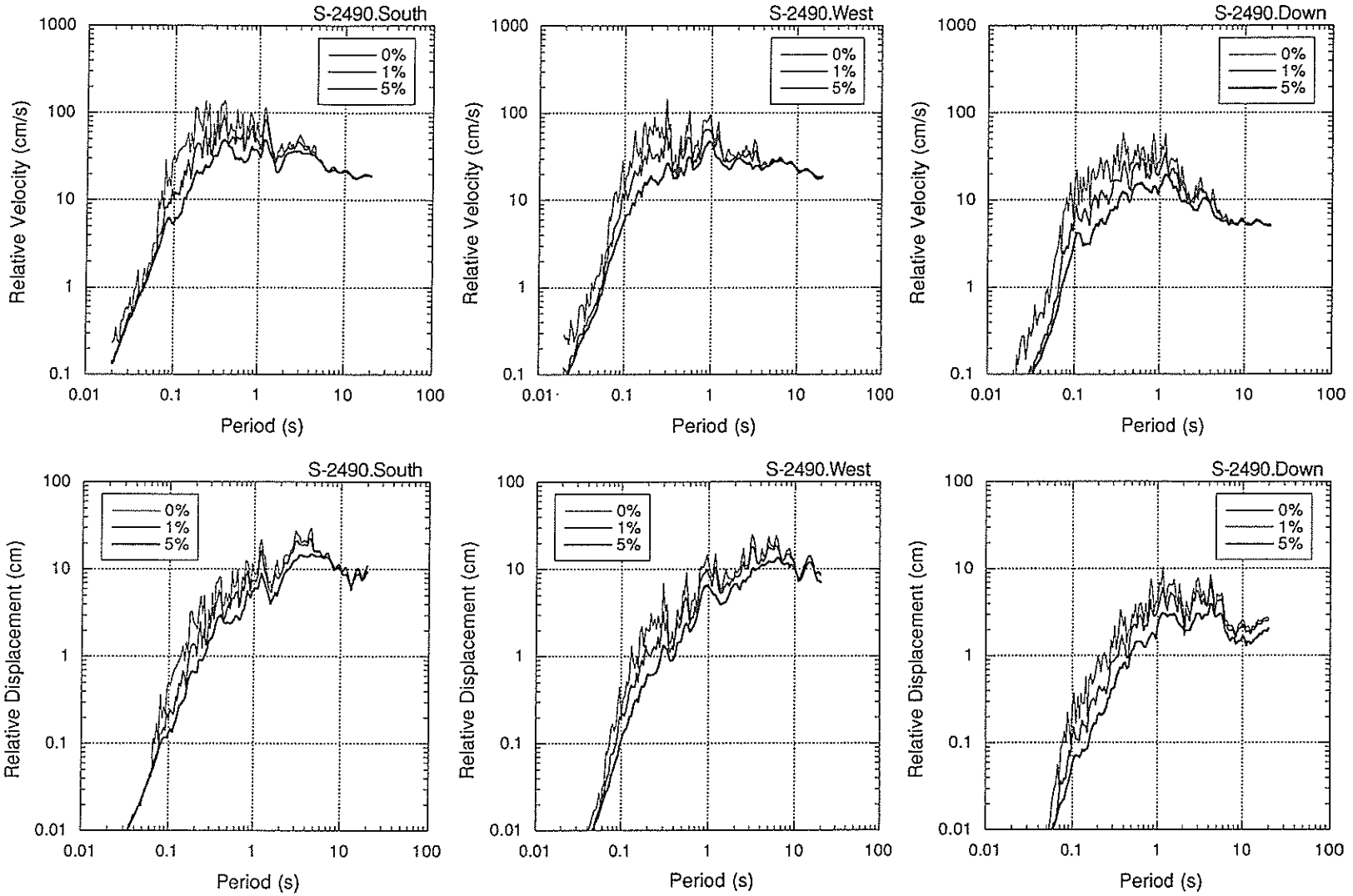
* RESULTANT OF HORIZONTAL COMPONENTS

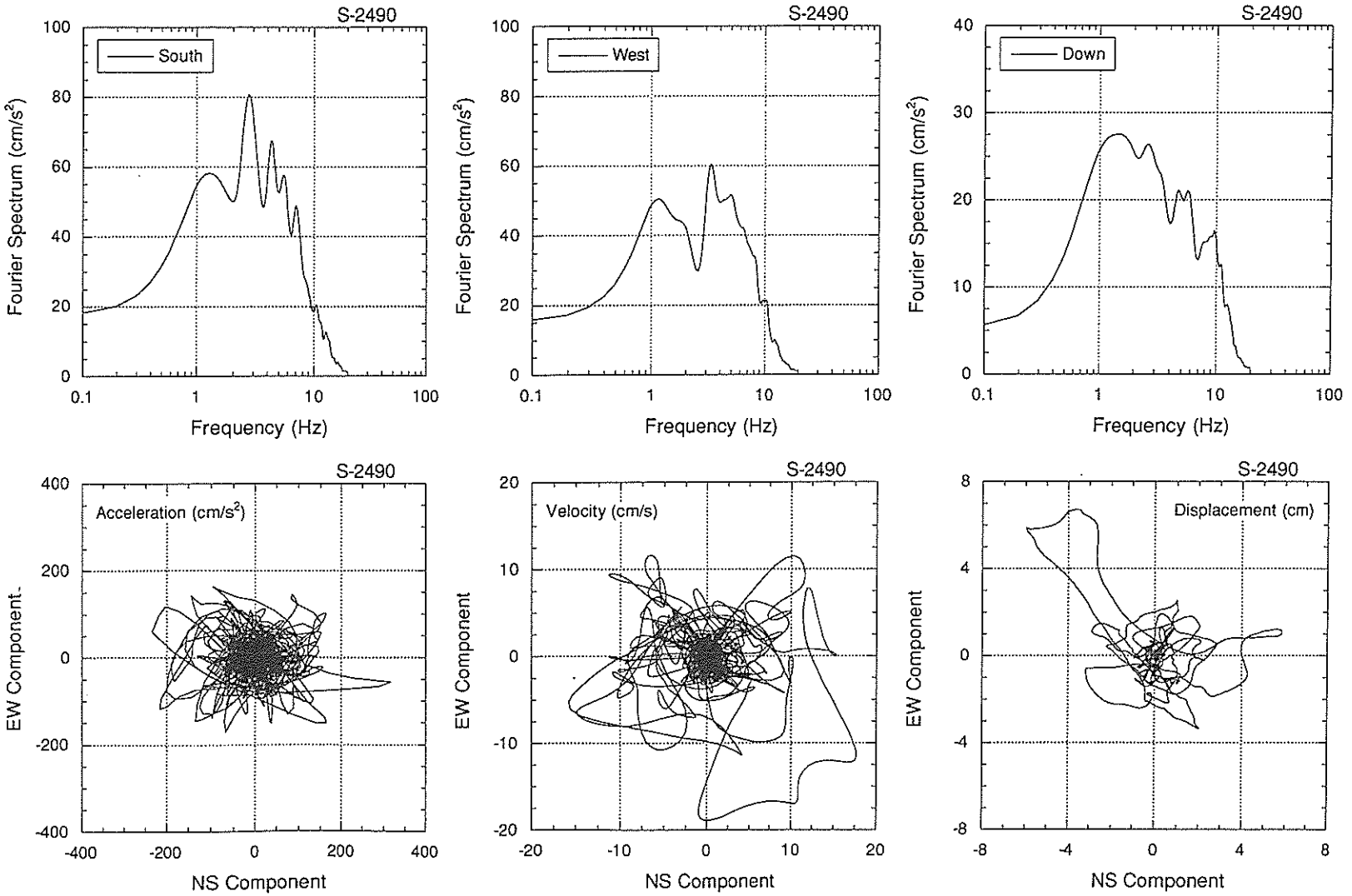

South - Original
S-2490 Urakawa-S
West - Original
S-2490 Urakawa-S
Down - Original
S-2490 Urakawa-S
Acceleration (cm/s²)
Time (sec.)
South - Corrected
S-2490 Urakawa-S
West - Corrected
S-2490 Urakawa-S
Down - Corrected
S-2490 Urakawa-S
Acceleration (cm/s²)
Time (sec.)


South - Fixed Filter
S-2490 Urakawa-S
West - Fixed Filter
S-2490 Urakawa-S
Down - Fixed Filter
S-2490 Urakawa-S
Velocity (cm/s)
30
0
-30
0
10
20
30
40
50
60
Time (sec.)
South - Variable Filter
S-2490 Urakawa-S
West - Variable Filter
S-2490 Urakawa-S
Down - Variable Filter
S-2490 Urakawa-S
Velocity (cm/s)
20
0
-20
0
10
20
30
40
50
60
Time (sec.)


South - Fixed Filter
S-2490 Urakawa-S
West - Fixed Filter
S-2490 Urakawa-S
Down - Fixed Filter
S-2490 Urakawa-S
Displacement (cm)
Time (sec.)
South - Variable Filter
S-2490 Urakawa-S
West - Variable Filter
S-2490 Urakawa-S
Down - Variable Filter
S-2490 Urakawa-S
Displacement (cm)
Time (sec.)


S-2490.South
S-2490.West
S-2490.Down
0%
1%
5%
Acceleration Ratio
Absolute Acceleration (cm/s²)
Period (s)
0.01
0.1
1
10
100
1000
10000


S-2490.South
S-2490.West
S-2490.Down
0%
1%
5%
Relative Velocity (cm/s)
Relative Displacement (cm)
Period (s)
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100


S-2490
South
Fourier Spectrum (cm/s²)
Frequency (Hz)
S-2490
West
Fourier Spectrum (cm/s²)
Frequency (Hz)
S-2490
Down
Fourier Spectrum (cm/s²)
Frequency (Hz)
S-2490
Acceleration (cm/s²)
EW Component
NS Component
S-2490
Velocity (cm/s)
EW Component
NS Component
S-2490
Displacement (cm)
EW Component
NS Component

RECORD NUMBER : S-2491

STATION : TOMAKOMAI-S

EARTHQUAKE DATA

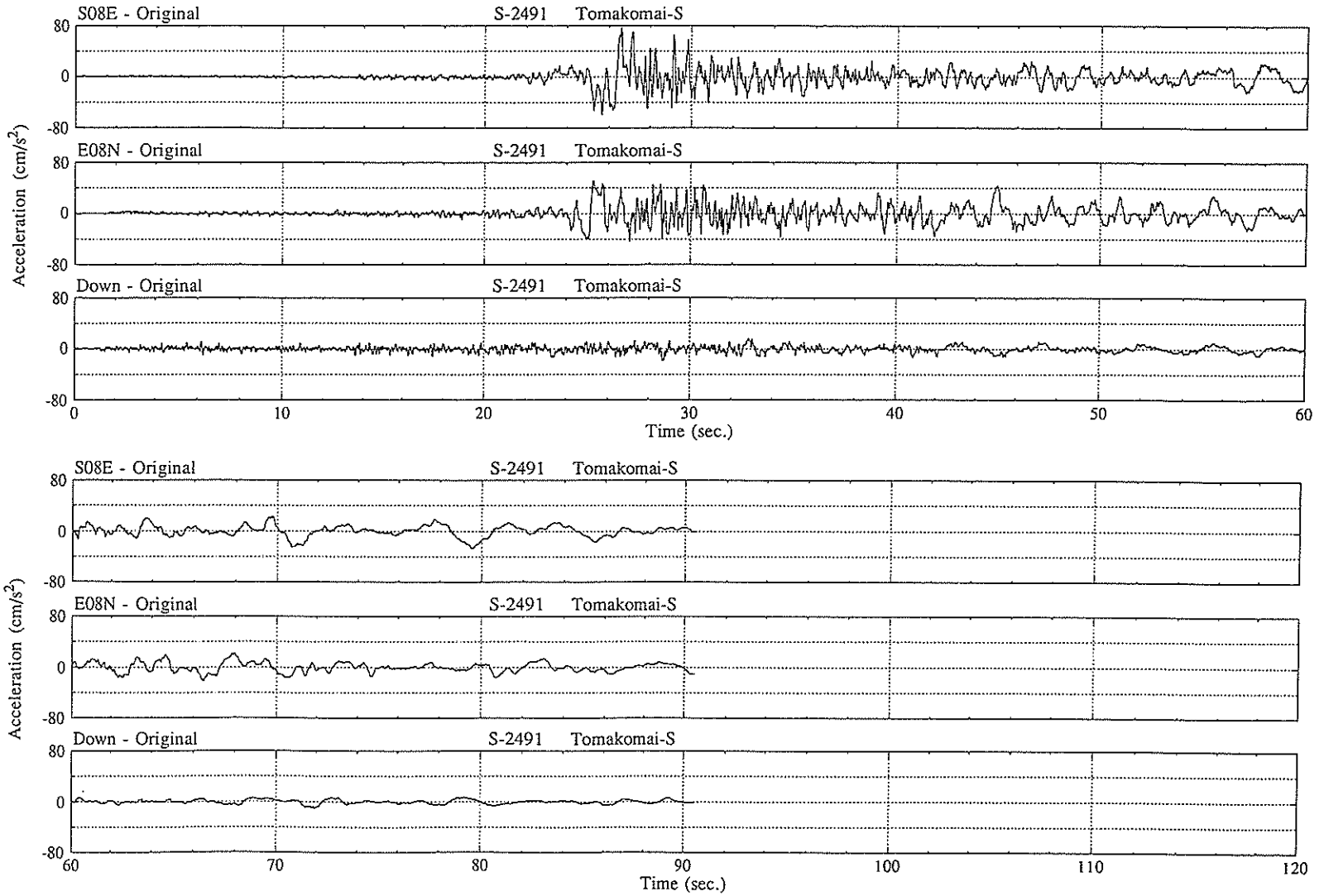
****

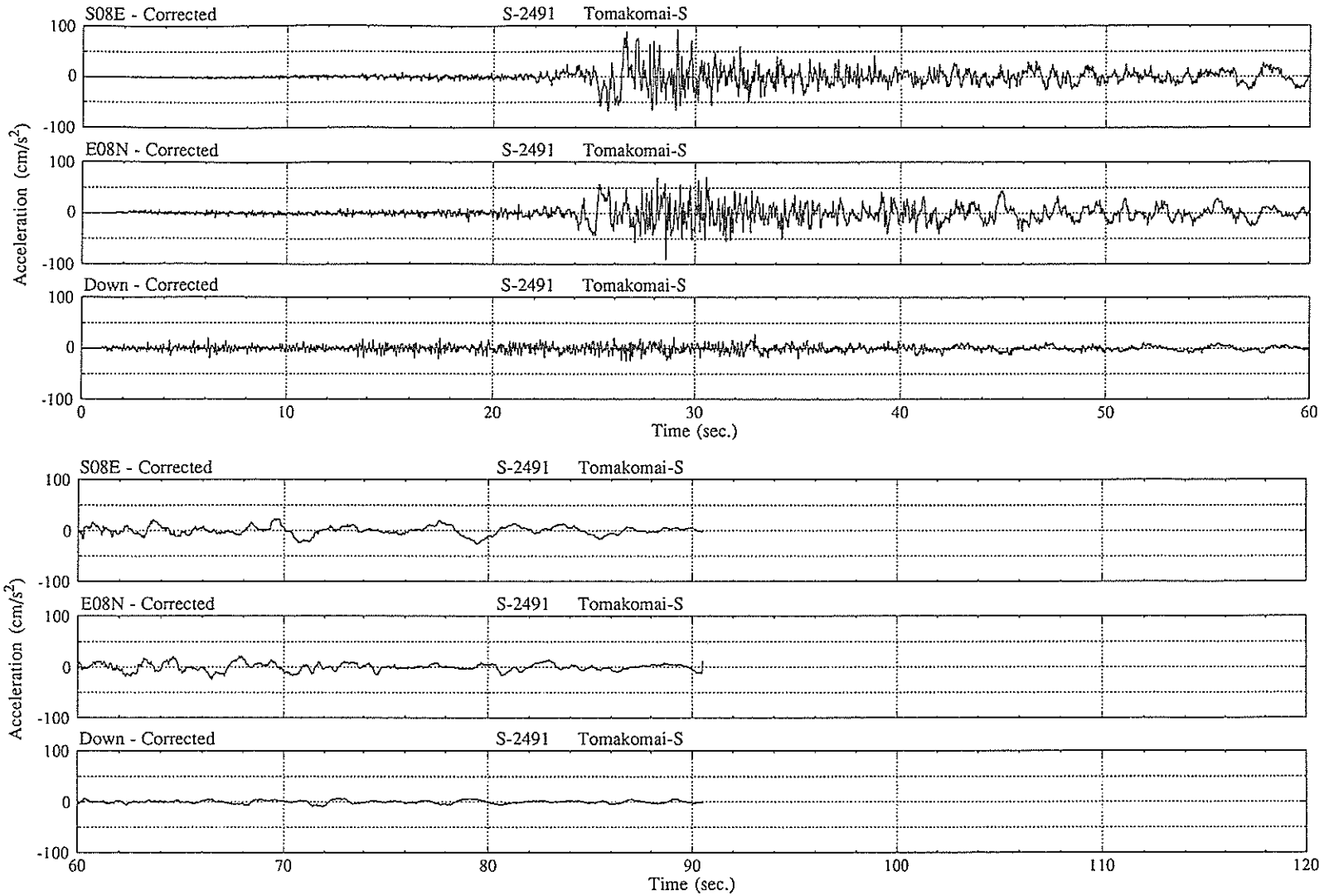
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

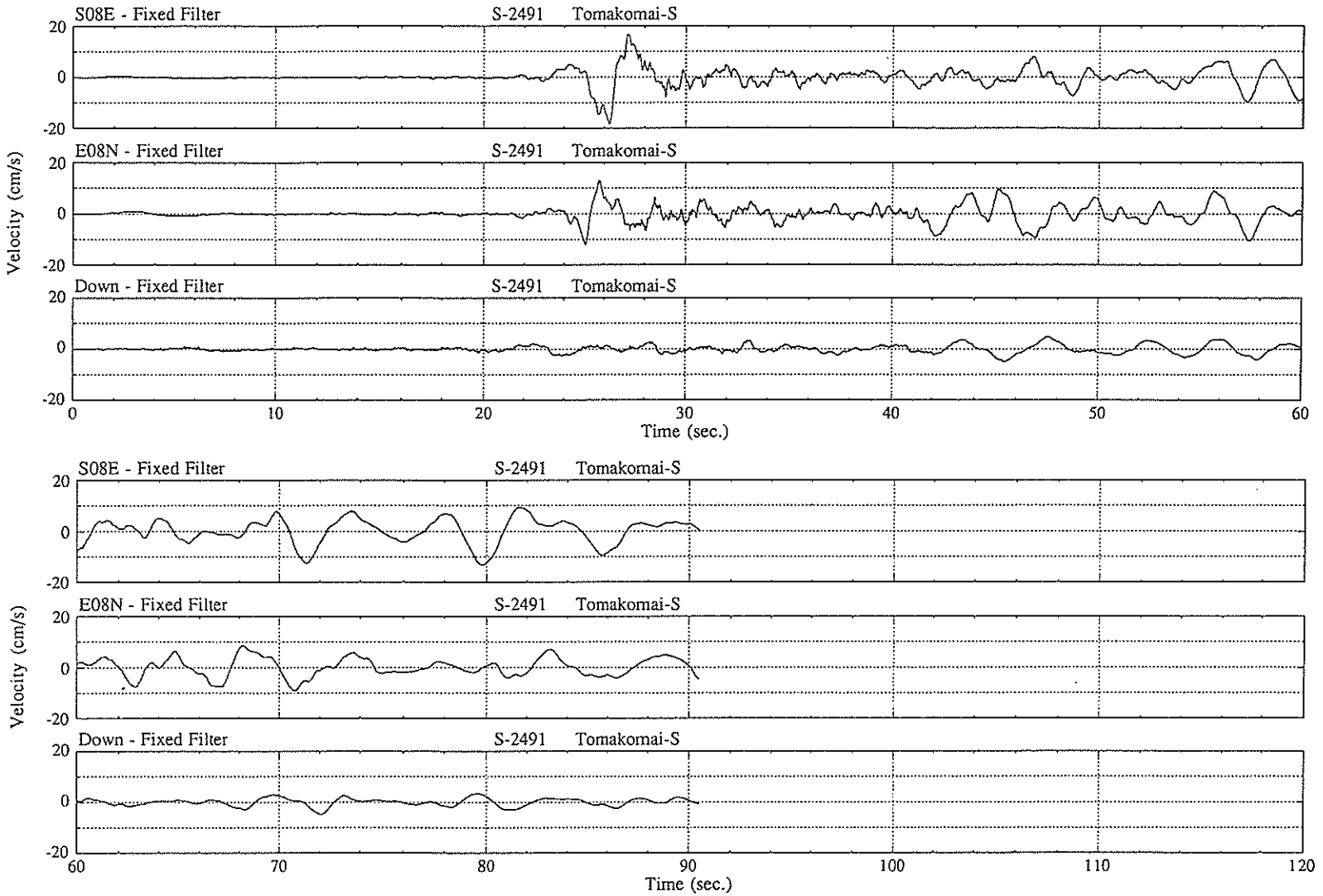
****

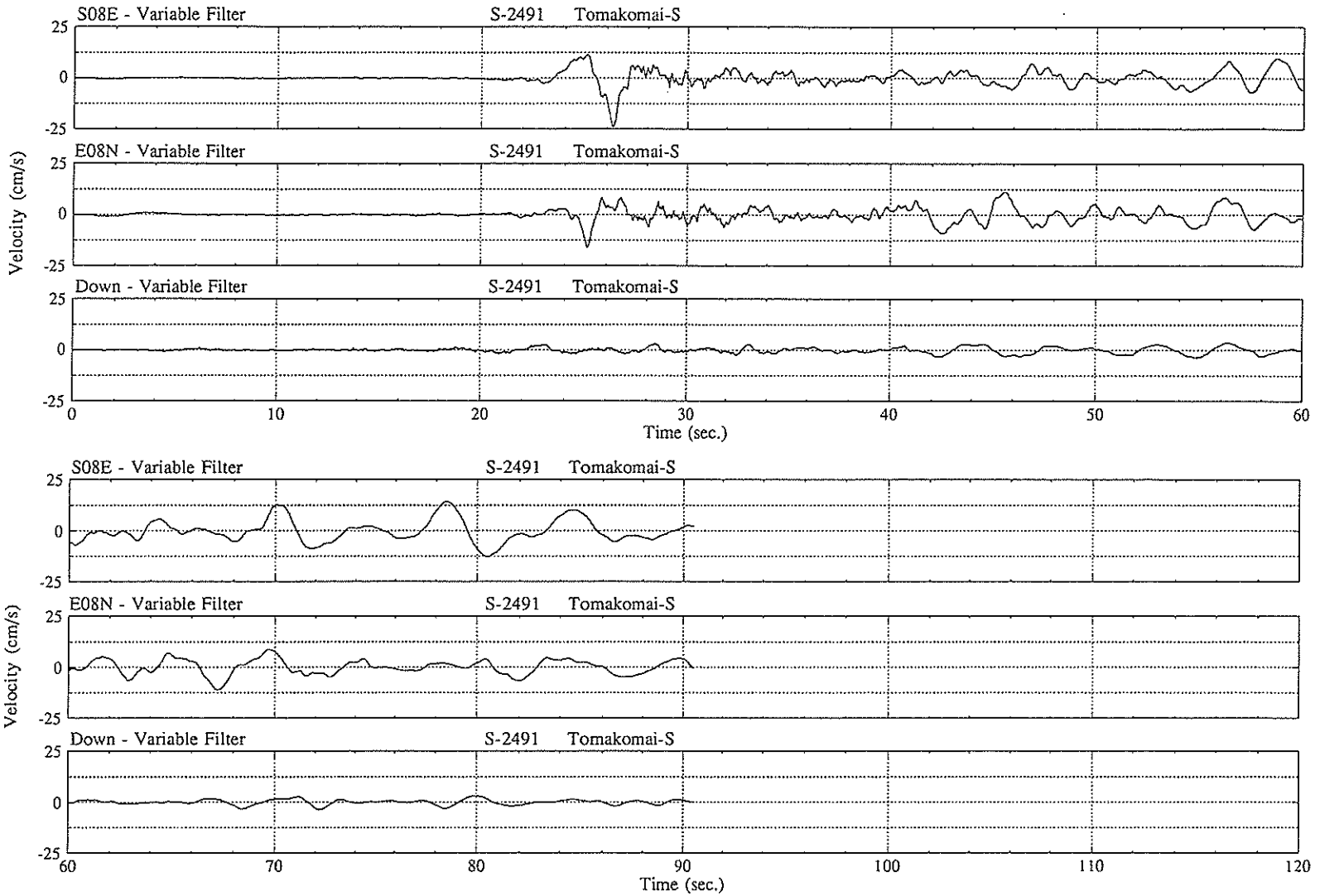
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.090	0.114	0.157	
MAXIMUM ACCELERATION (GAL)				
ORIGINAL	77.5	51.8	18.6	86.5
CORRECTED	93.0	90.4	27.2	99.3
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	18.22	13.21	5.00	19.45
VARIABLE FILTER	24.00	15.96	3.73	24.25
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	10.56	6.47	3.05	10.91
VARIABLE FILTER	12.87	5.93	2.45	12.89

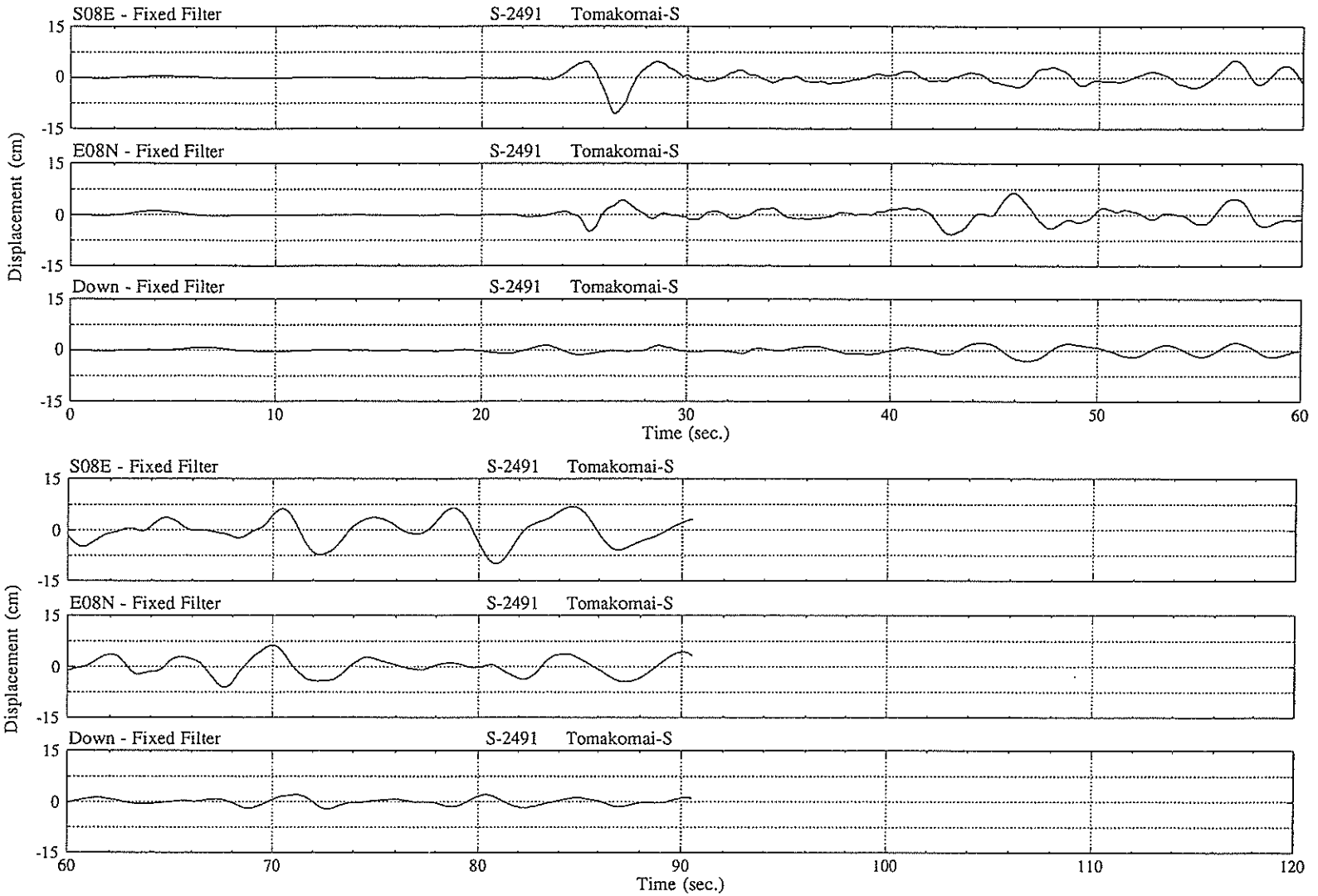
* RESULTANT OF HORIZONTAL COMPONENTS

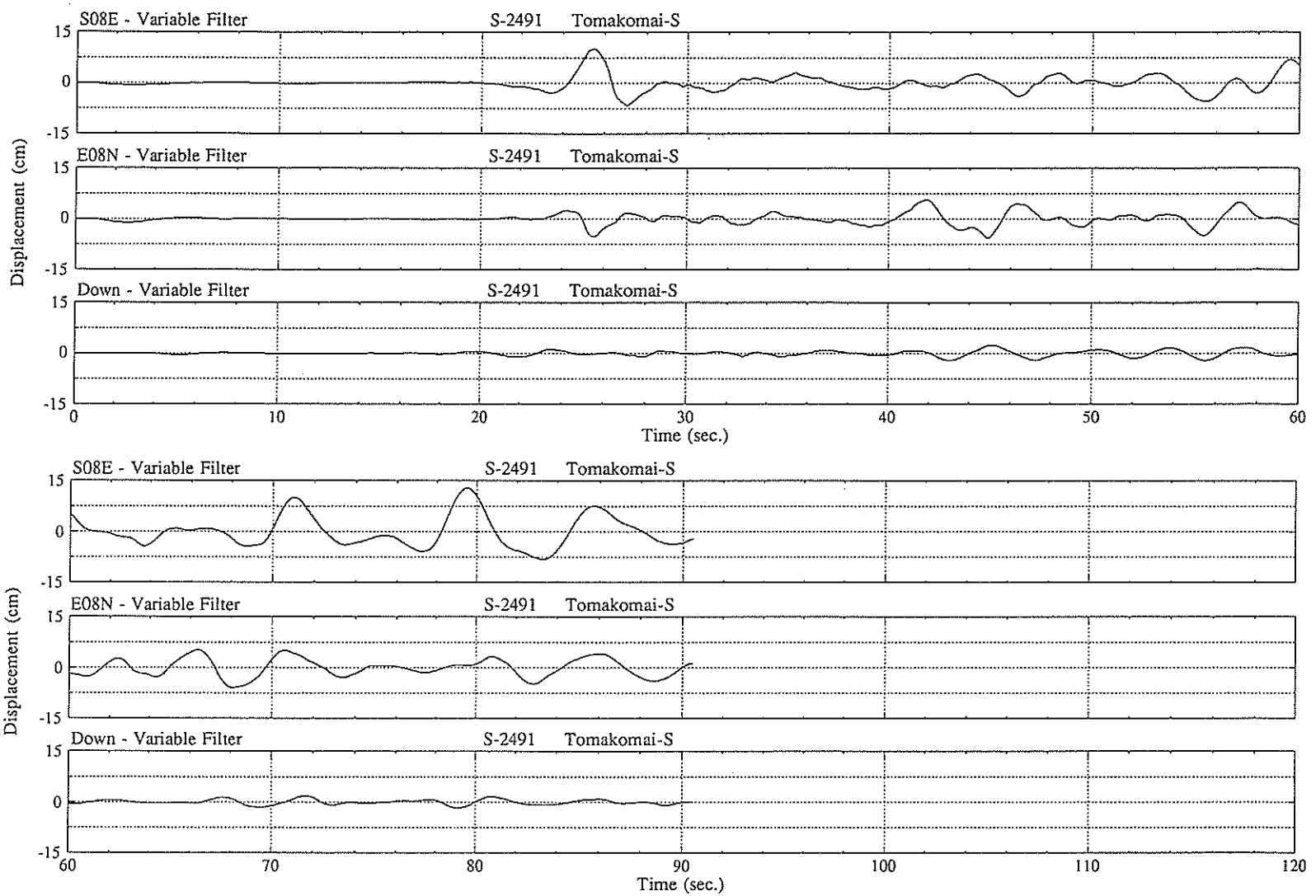

S08E - Original
S-2491 Tomakomai-S
E08N - Original
S-2491 Tomakomai-S
Down - Original
S-2491 Tomakomai-S
Acceleration (cm/s²)
80
0
-80
0
10
20
30
40
50
60
Time (sec.)
S08E - Original
S-2491 Tomakomai-S
E08N - Original
S-2491 Tomakomai-S
Down - Original
S-2491 Tomakomai-S
Acceleration (cm/s²)
60
70
80
90
100
110
120
Time (sec.)

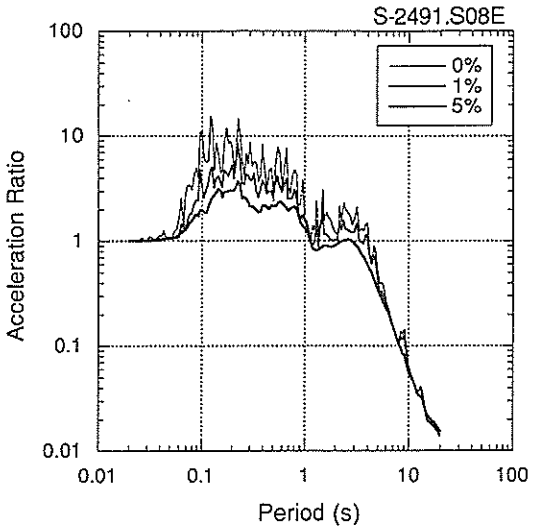

S08E - Corrected
S-2491 Tomakomai-S
E08N - Corrected
S-2491 Tomakomai-S
Down - Corrected
S-2491 Tomakomai-S
Acceleration (cm/s²)
100
0
-100
0
10
20
30
40
50
60
Time (sec.)
S08E - Corrected
S-2491 Tomakomai-S
E08N - Corrected
S-2491 Tomakomai-S
Down - Corrected
S-2491 Tomakomai-S
Acceleration (cm/s²)
60
70
80
90
100
110
120
Time (sec.)

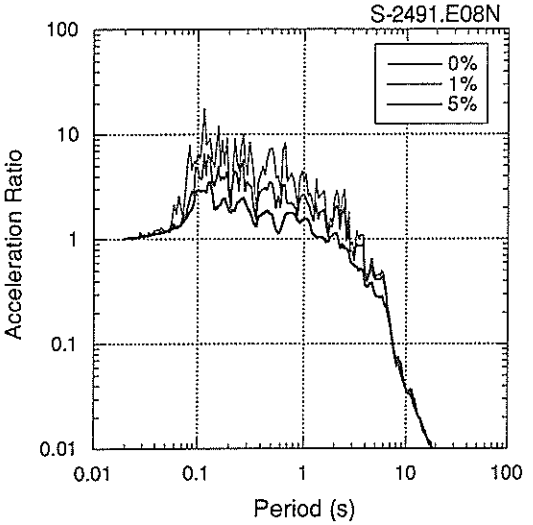

S08E - Fixed Filter
S-2491 Tomakomai-S
E08N - Fixed Filter
S-2491 Tomakomai-S
Down - Fixed Filter
S-2491 Tomakomai-S
Velocity (cm/s)
20
0
-20
0
10
20
30
40
50
60
Time (sec.)
S08E - Fixed Filter
S-2491 Tomakomai-S
E08N - Fixed Filter
S-2491 Tomakomai-S
Down - Fixed Filter
S-2491 Tomakomai-S
Velocity (cm/s)
20
0
-20
60
70
80
90
100
110
120
Time (sec.)

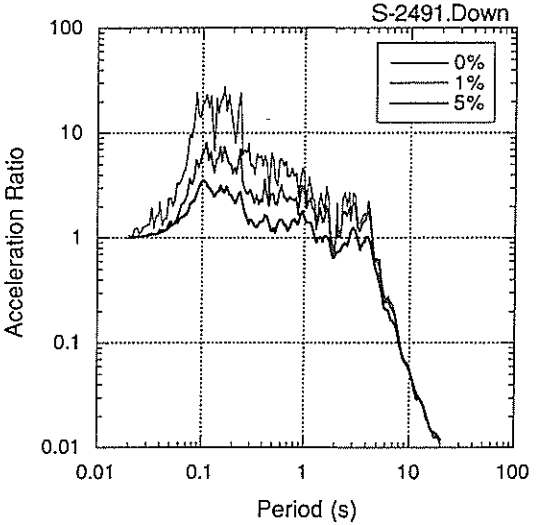

S08E - Variable Filter
S-2491 Tomakomai-S
E08N - Variable Filter
S-2491 Tomakomai-S
Down - Variable Filter
S-2491 Tomakomai-S
Velocity (cm/s)
25
0
-25
0
10
20
30
40
50
60
Time (sec.)
S08E - Variable Filter
S-2491 Tomakomai-S
E08N - Variable Filter
S-2491 Tomakomai-S
Down - Variable Filter
S-2491 Tomakomai-S
Velocity (cm/s)
60
70
80
90
100
110
120
Time (sec.)

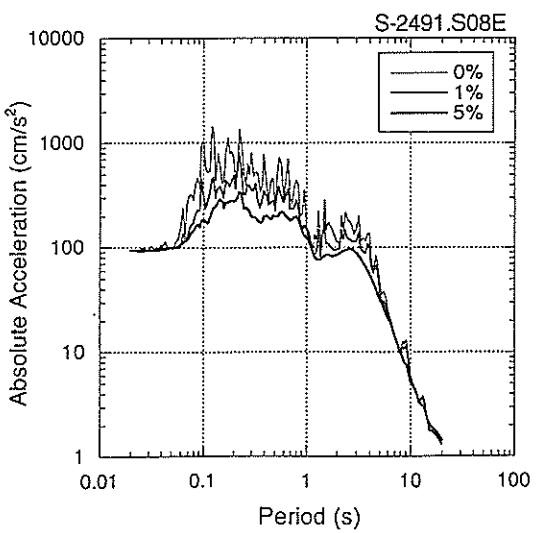

S08E - Fixed Filter
S-2491 Tomakomai-S
E08N - Fixed Filter
S-2491 Tomakomai-S
Down - Fixed Filter
S-2491 Tomakomai-S
Displacement (cm)
15
0
-15
0
10
20
30
40
50
60
Time (sec.)
S08E - Fixed Filter
S-2491 Tomakomai-S
E08N - Fixed Filter
S-2491 Tomakomai-S
Down - Fixed Filter
S-2491 Tomakomai-S
Displacement (cm)
15
0
-15
60
70
80
90
100
110
120
Time (sec.)

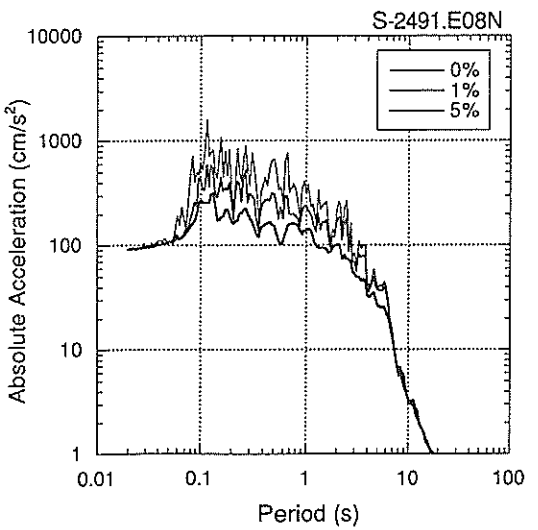

S08E - Variable Filter
S-2491 Tomakomai-S
E08N - Variable Filter
S-2491 Tomakomai-S
Down - Variable Filter
S-2491 Tomakomai-S
Displacement (cm)
15
0
-15
0
10
20
30
40
50
60
Time (sec.)
S08E - Variable Filter
S-2491 Tomakomai-S
E08N - Variable Filter
S-2491 Tomakomai-S
Down - Variable Filter
S-2491 Tomakomai-S
Displacement (cm)
15
0
-15
60
70
80
90
100
110
120
Time (sec.)

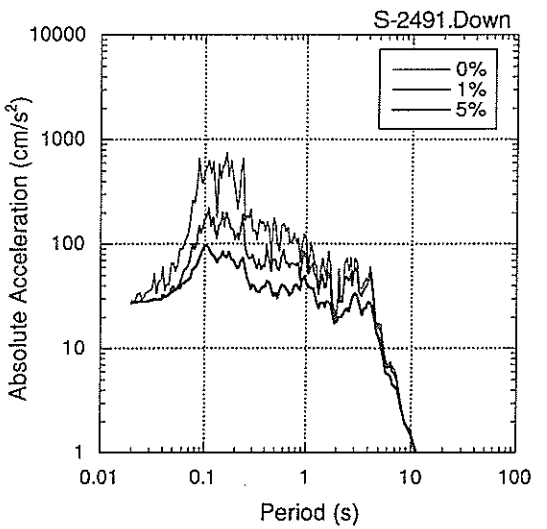

S-2491.S08E
0%
1%
5%
Acceleration Ratio
Period (s)

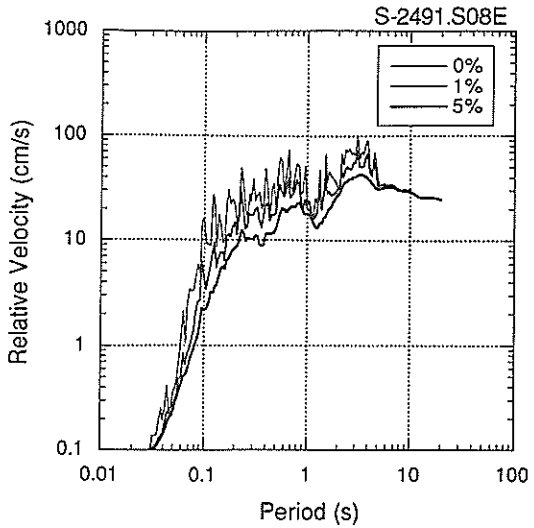

S-2491.E08N
0%
1%
5%
Acceleration Ratio
Period (s)

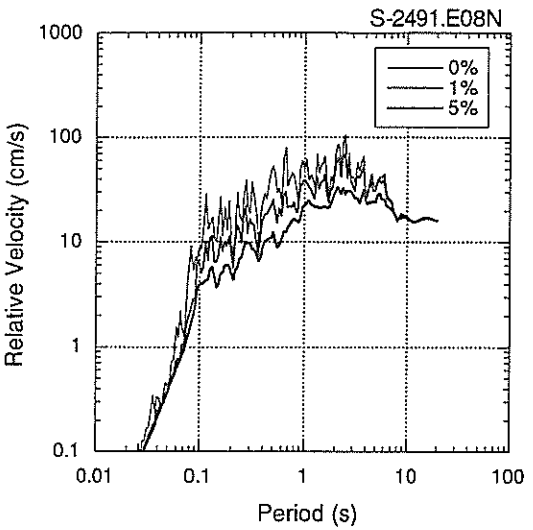

S-2491.Down
0%
1%
5%
Acceleration Ratio
Period (s)

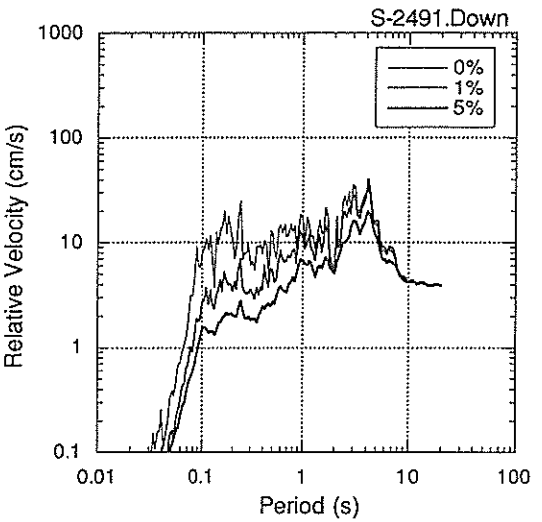

S-2491.S08E
0%
1%
5%
Absolute Acceleration (cm/s²)
Period (s)

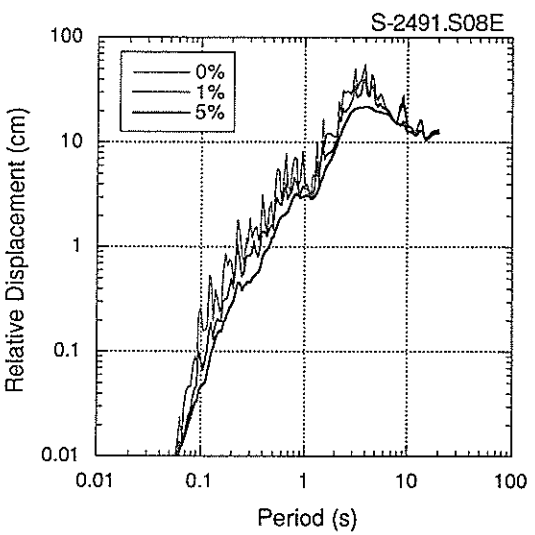

S-2491.E08N
0%
1%
5%
Absolute Acceleration (cm/s²)
Period (s)

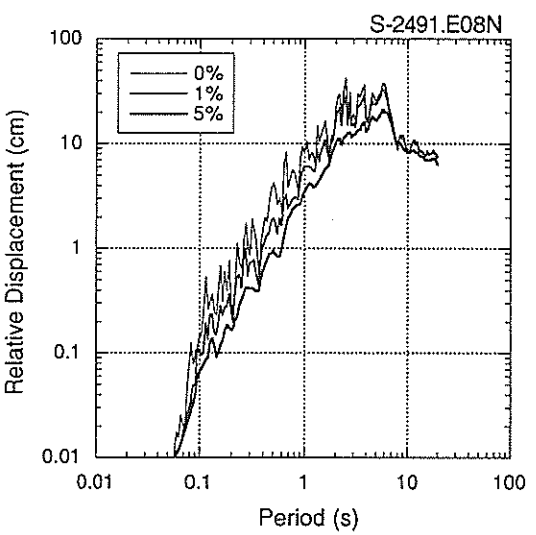

S-2491.Down
0%
1%
5%
Absolute Acceleration (cm/s²)
Period (s)

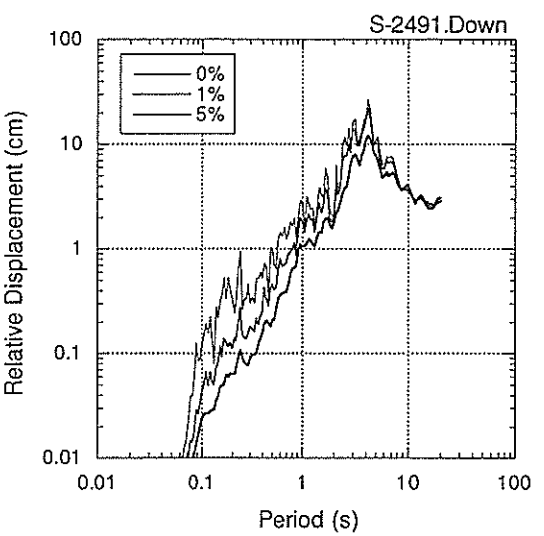

S-2491.S08E
Relative Velocity (cm/s)
Period (s)
0%
1%
5%

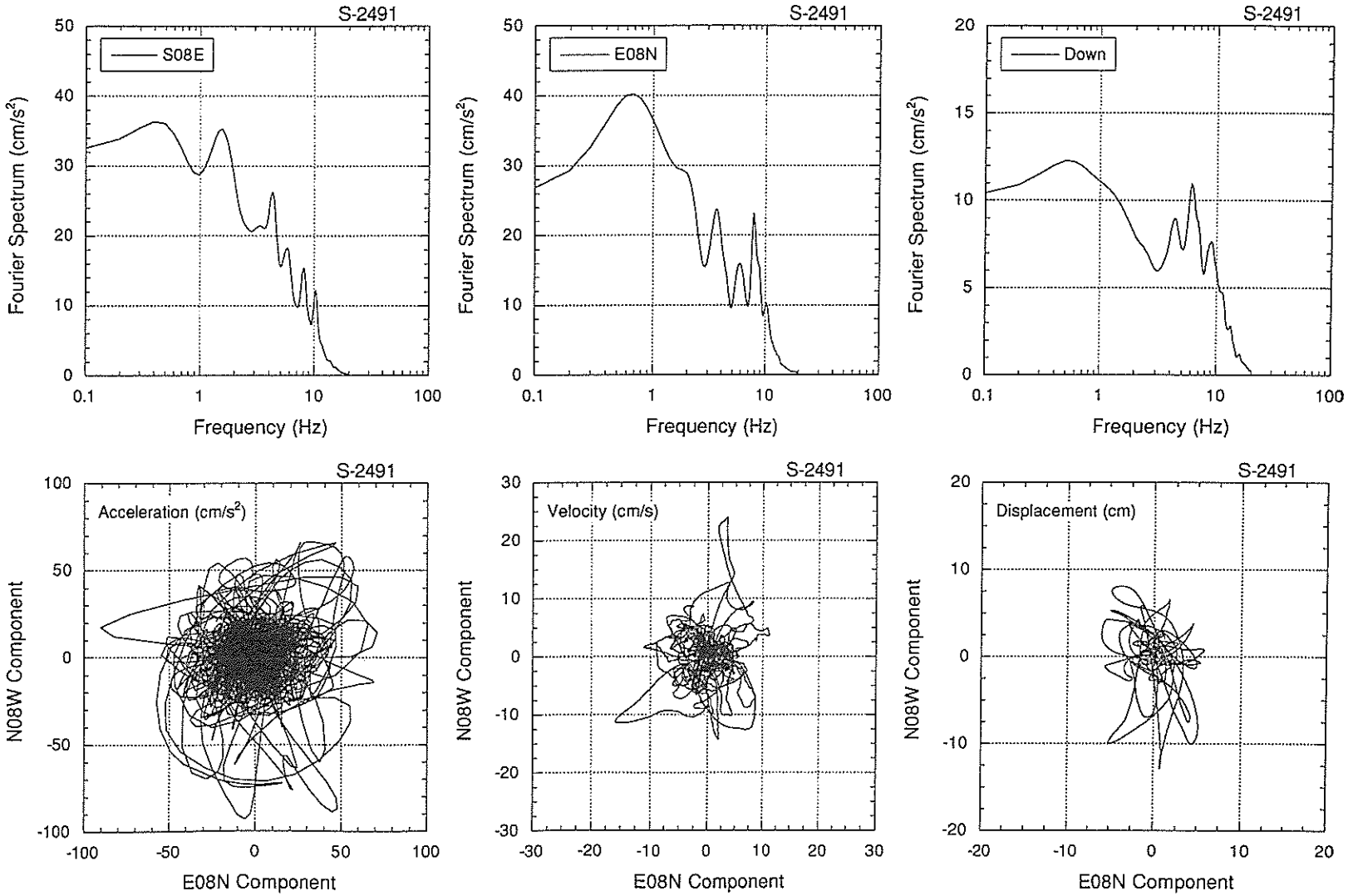

S-2491.E08N
Relative Velocity (cm/s)
Period (s)
0%
1%
5%


S-2491.Down
Relative Velocity (cm/s)
Period (s)
0%
1%
5%


S-2491.S08E
Relative Displacement (cm)
Period (s)
0%
1%
5%


S-2491.E08N
Relative Displacement (cm)
Period (s)
0%
1%
5%


S-2491.Down
Relative Displacement (cm)
Period (s)
0%
1%
5%


S-2491
S08E
Fourier Spectrum (cm/s²)
Frequency (Hz)
S-2491
E08N
Fourier Spectrum (cm/s²)
Frequency (Hz)
S-2491
Down
Fourier Spectrum (cm/s²)
Frequency (Hz)
S-2491
Acceleration (cm/s²)
N08W Component
E08N Component
S-2491
Velocity (cm/s)
N08W Component
E08N Component
S-2491
Displacement (cm)
N08W Component
E08N Component

RECORD NUMBER : S-2492

STATION : KASHIMA-ZOKAN-S

EARTHQUAKE DATA

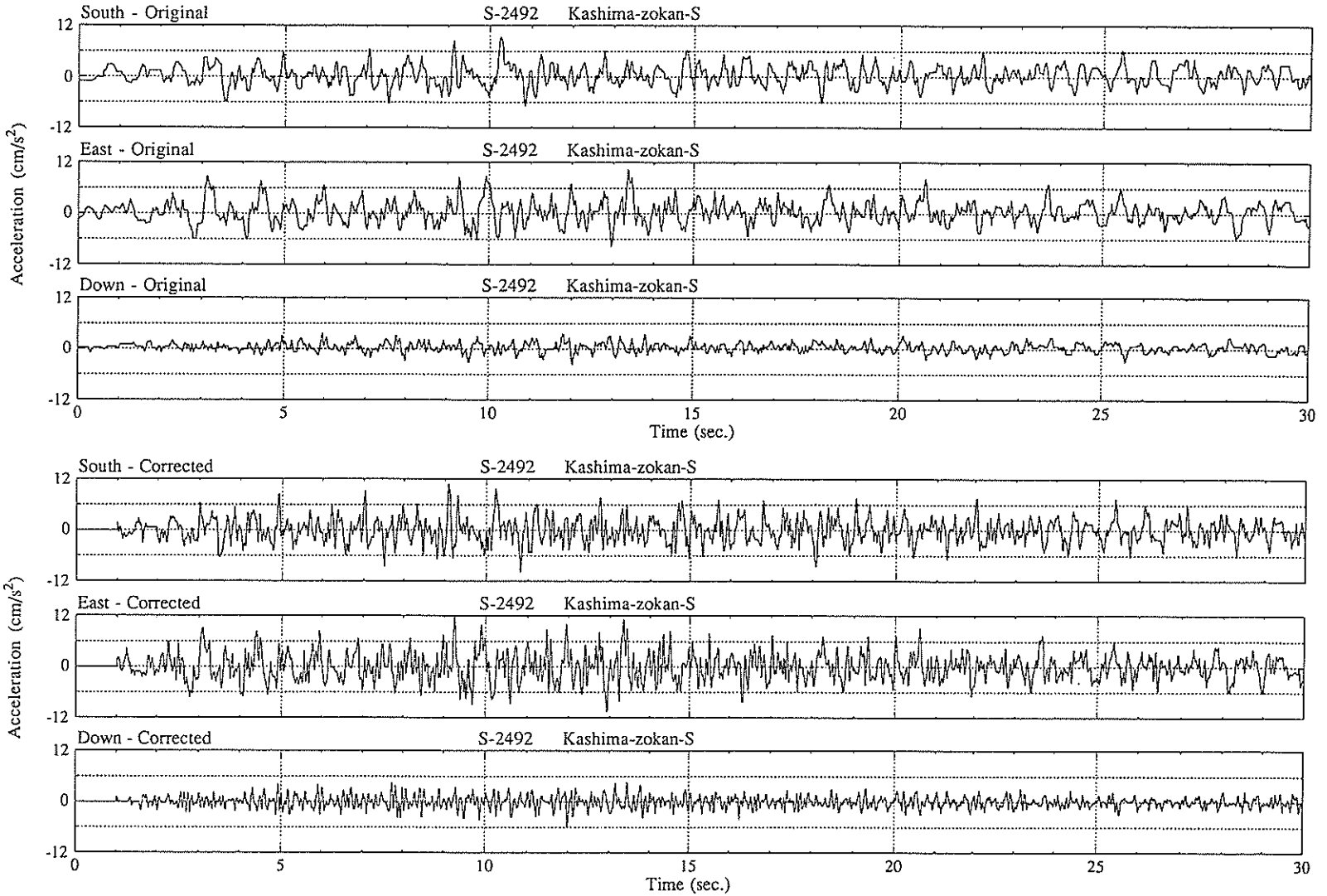
****

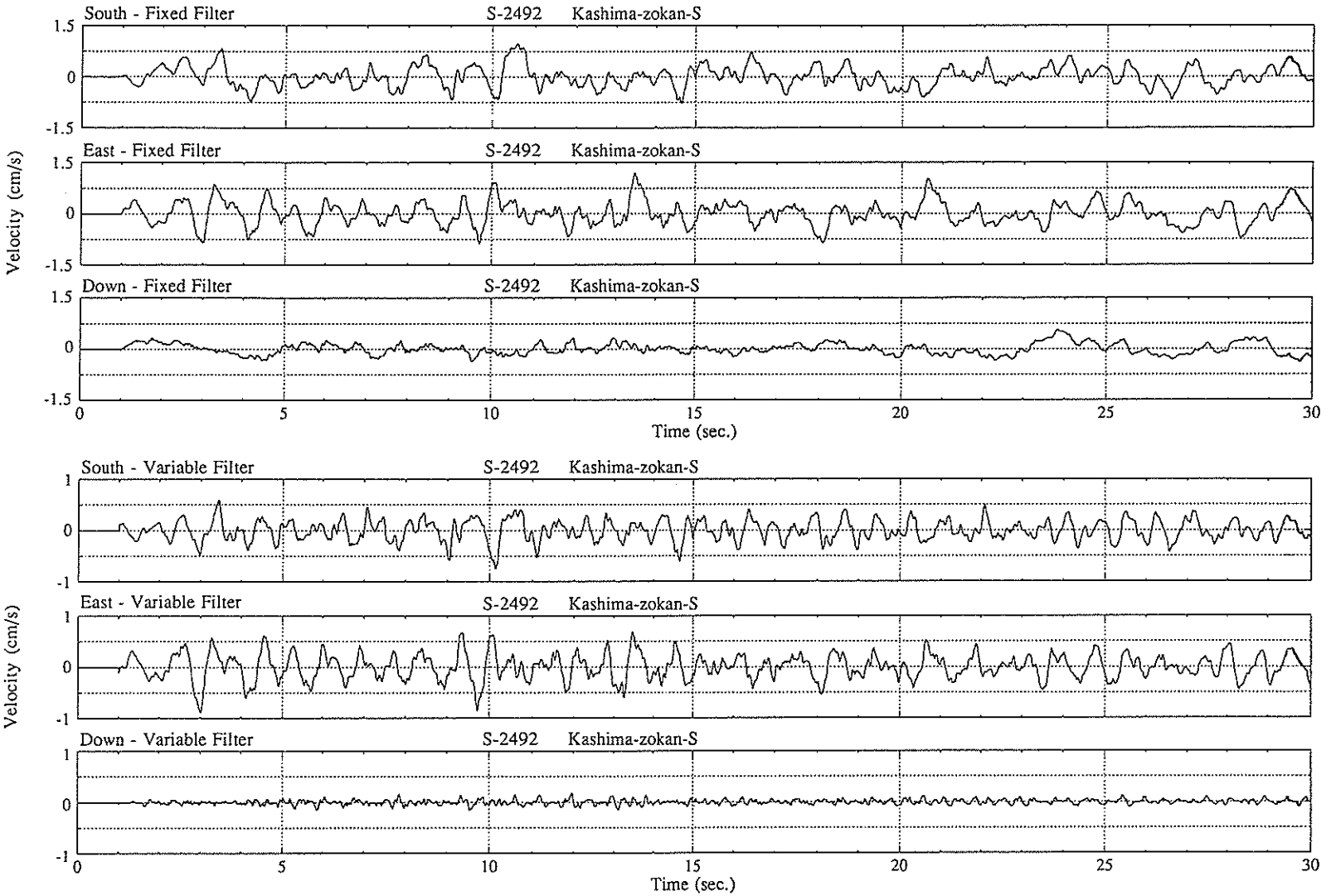
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

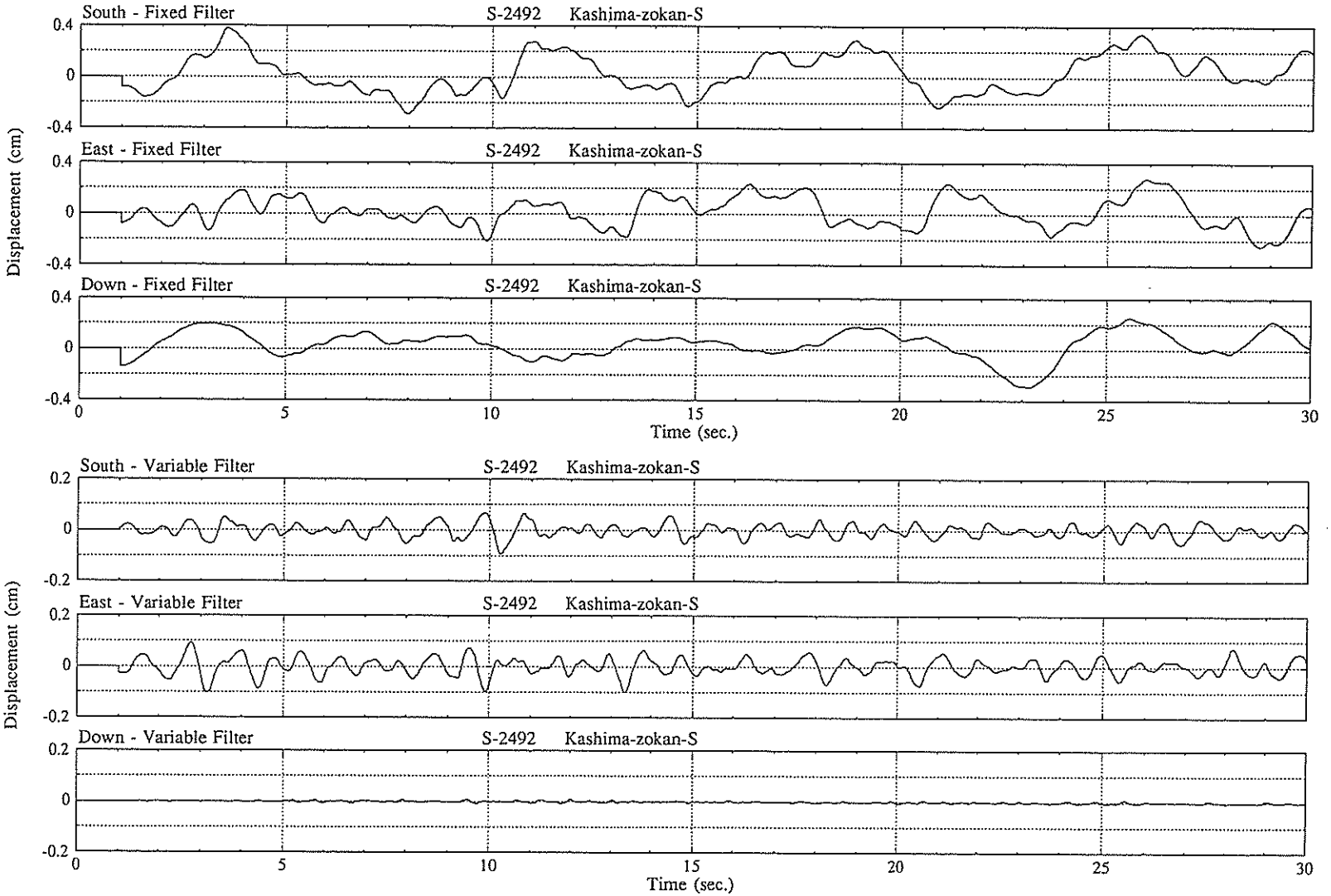
****

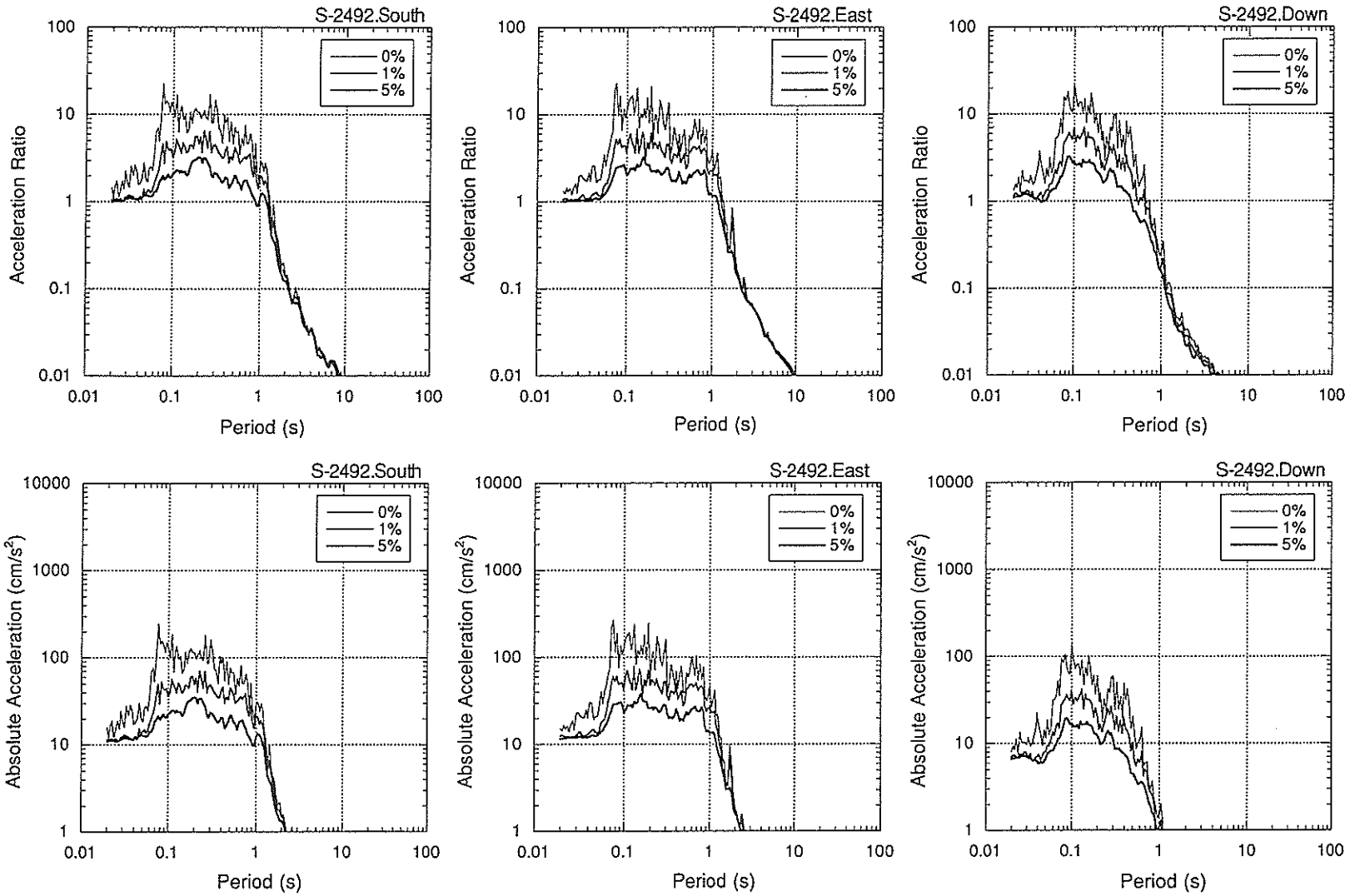
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.706	0.645	1.585	
MAXIMUM ACCELERATION (GAL)				
ORIGINAL	9.4	10.3	3.7	10.4
CORRECTED	10.9	11.6	6.0	12.3
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	0.97	1.20	0.56	1.21
VARIABLE FILTER	0.74	0.88	0.18	0.97
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.38	0.28	0.29	0.43
VARIABLE FILTER	0.09	0.10	0.01	0.12

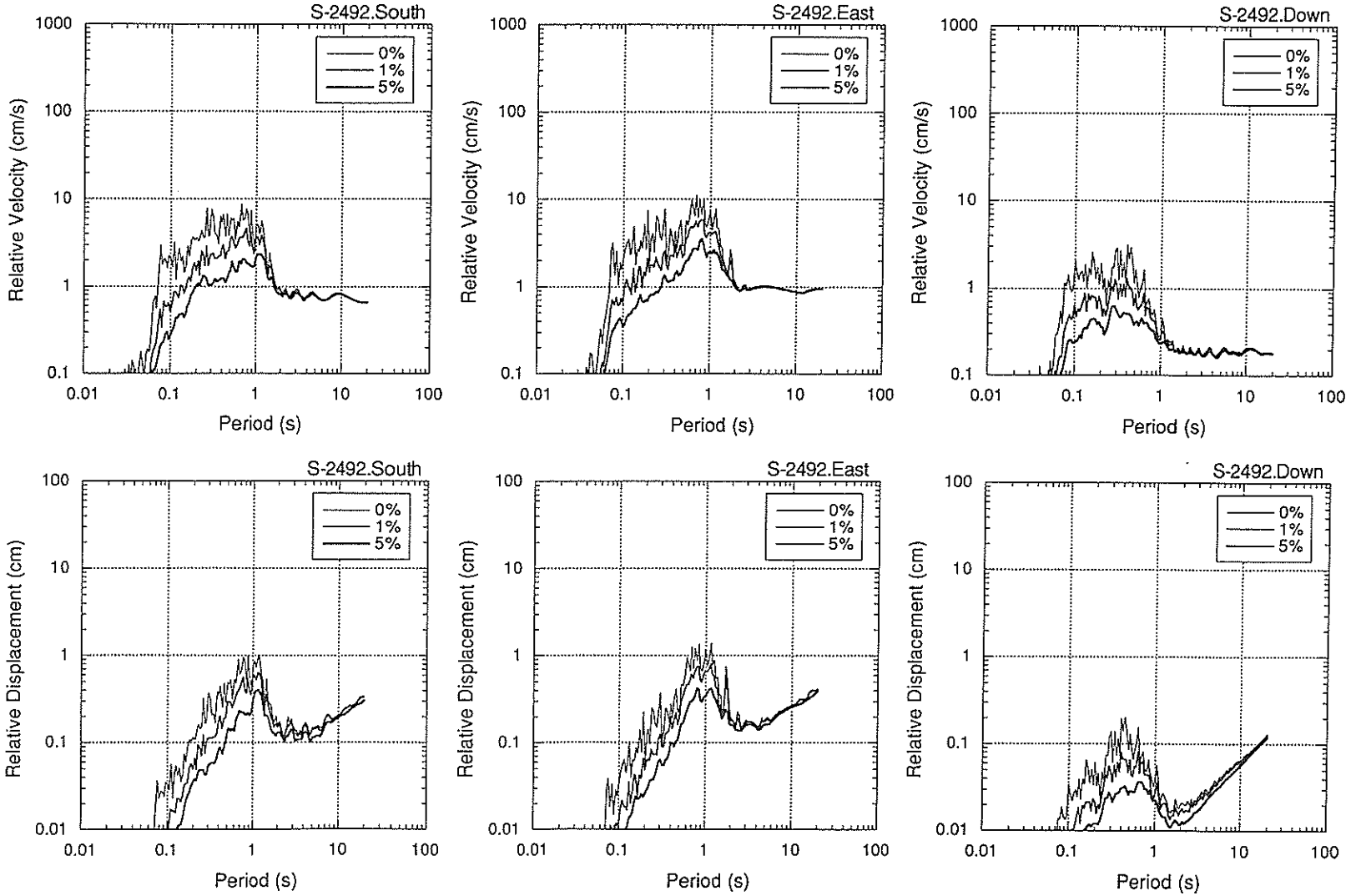
* RESULTANT OF HORIZONTAL COMPONENTS

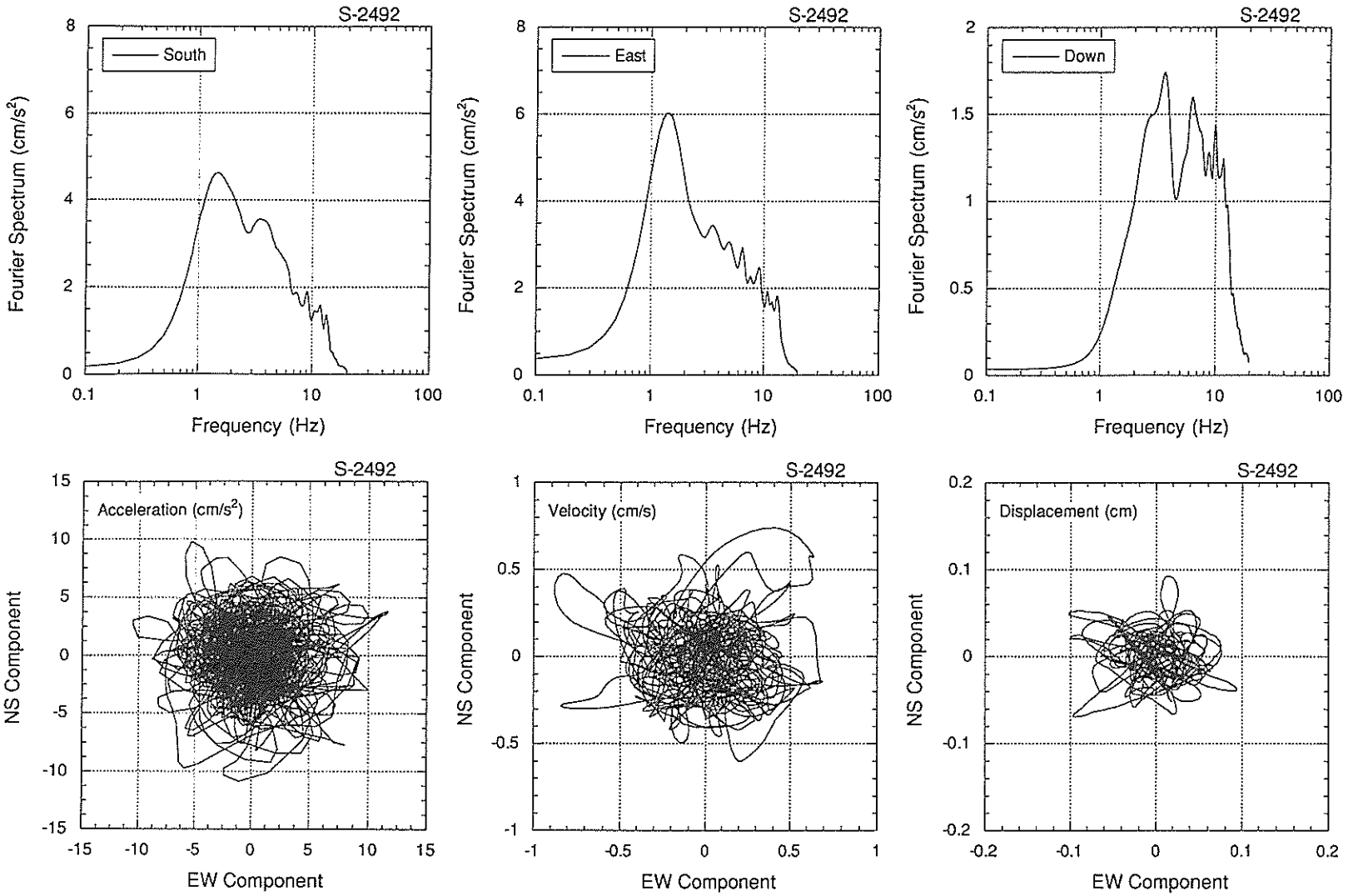

South - Original
S-2492 Kashima-zokan-S
East - Original
S-2492 Kashima-zokan-S
Down - Original
S-2492 Kashima-zokan-S
Acceleration (cm/s²)
12
0
-12
0
5
10
15
20
25
30
Time (sec.)
South - Corrected
S-2492 Kashima-zokan-S
East - Corrected
S-2492 Kashima-zokan-S
Down - Corrected
S-2492 Kashima-zokan-S
Acceleration (cm/s²)
Time (sec.)


South - Fixed Filter S-2492 Kashima-zokan-S
East - Fixed Filter S-2492 Kashima-zokan-S
Down - Fixed Filter S-2492 Kashima-zokan-S
Velocity (cm/s)
1.5
0
-1.5
0
5
10
15
20
25
30
Time (sec.)
South - Variable Filter S-2492 Kashima-zokan-S
East - Variable Filter S-2492 Kashima-zokan-S
Down - Variable Filter S-2492 Kashima-zokan-S
Velocity (cm/s)
1
0
-1
Time (sec.)


South - Fixed Filter S-2492 Kashima-zokan-S
East - Fixed Filter S-2492 Kashima-zokan-S
Down - Fixed Filter S-2492 Kashima-zokan-S
Displacement (cm)
0.4
0
-0.4
0
5
10
15
20
25
30
Time (sec.)
South - Variable Filter S-2492 Kashima-zokan-S
East - Variable Filter S-2492 Kashima-zokan-S
Down - Variable Filter S-2492 Kashima-zokan-S
Displacement (cm)
0.2
0
-0.2
Time (sec.)


S-2492.South
S-2492.East
S-2492.Down
0%
1%
5%
Acceleration Ratio
Absolute Acceleration (cm/s²)
Period (s)
0.01
0.1
1
10
100
1000
10000


S-2492.South
S-2492.East
S-2492.Down
0%
1%
5%
Relative Velocity (cm/s)
Relative Displacement (cm)
Period (s)
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100


S-2492
South
Fourier Spectrum (cm/s²)
Frequency (Hz)
S-2492
East
Fourier Spectrum (cm/s²)
Frequency (Hz)
S-2492
Down
Fourier Spectrum (cm/s²)
Frequency (Hz)
S-2492
Acceleration (cm/s²)
NS Component
EW Component
S-2492
Velocity (cm/s)
NS Component
EW Component
S-2492
Displacement (cm)
NS Component
EW Component

RECORD NUMBER : M-1443

STATION : TOKACHI-M

EARTHQUAKE DATA

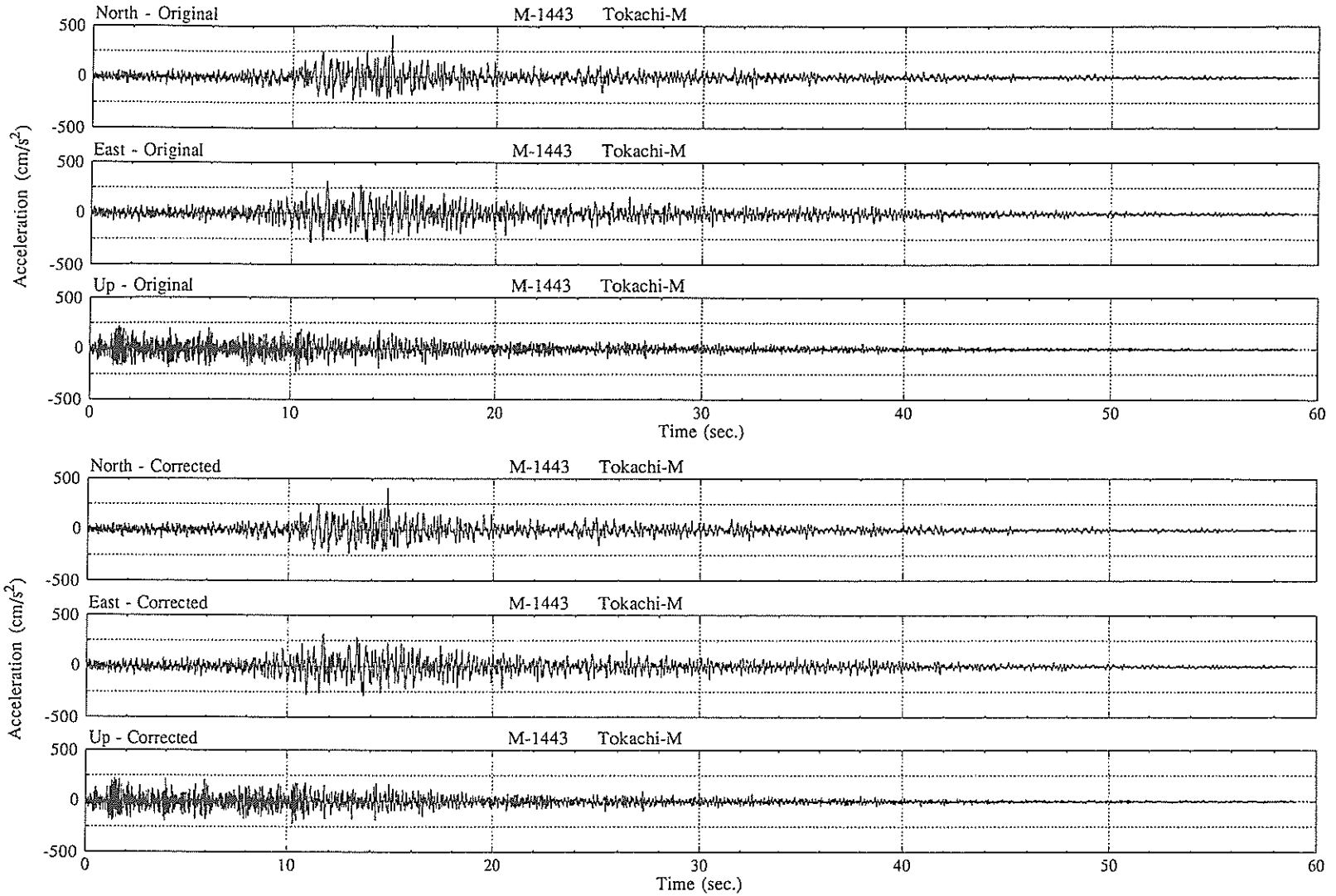
****

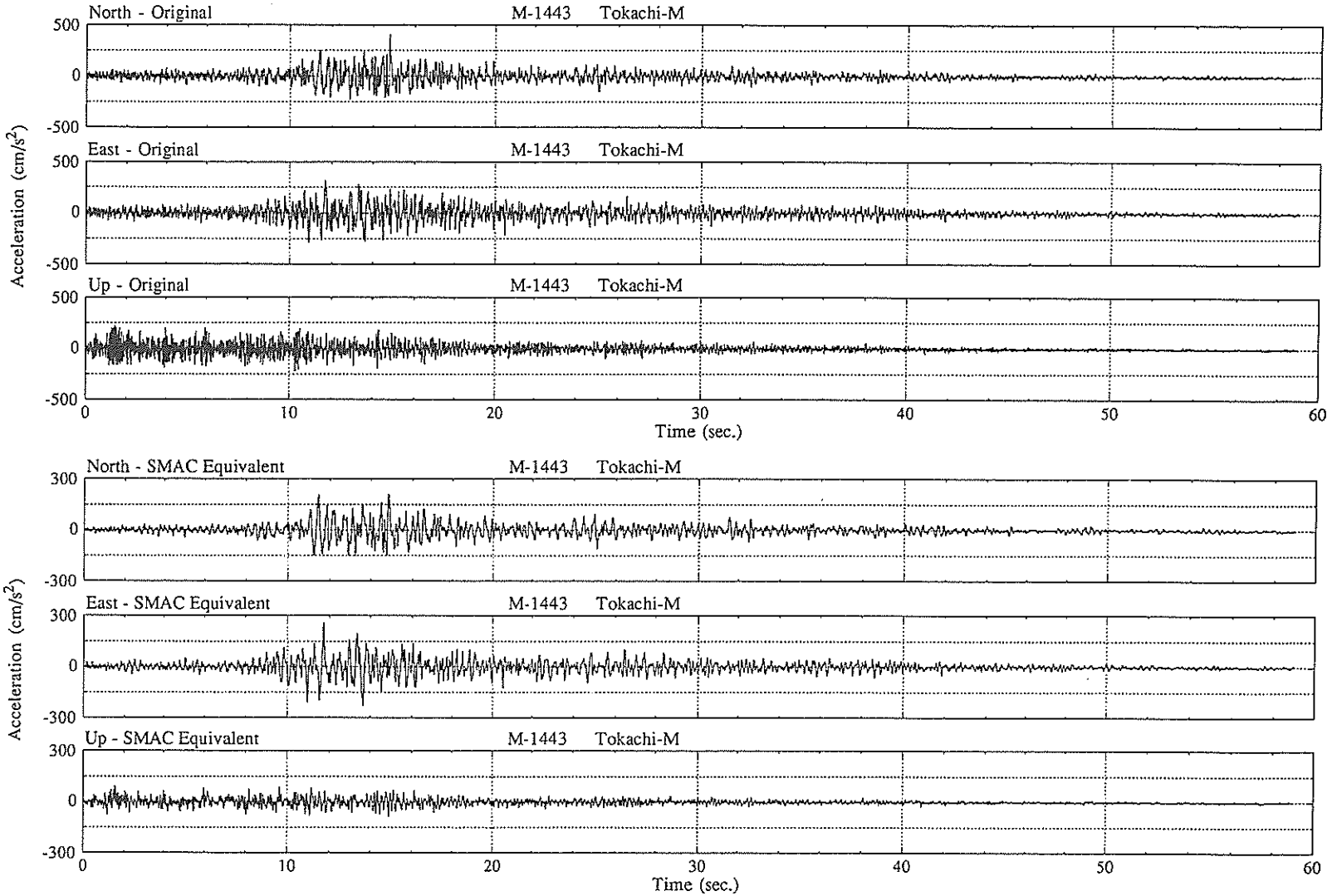
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

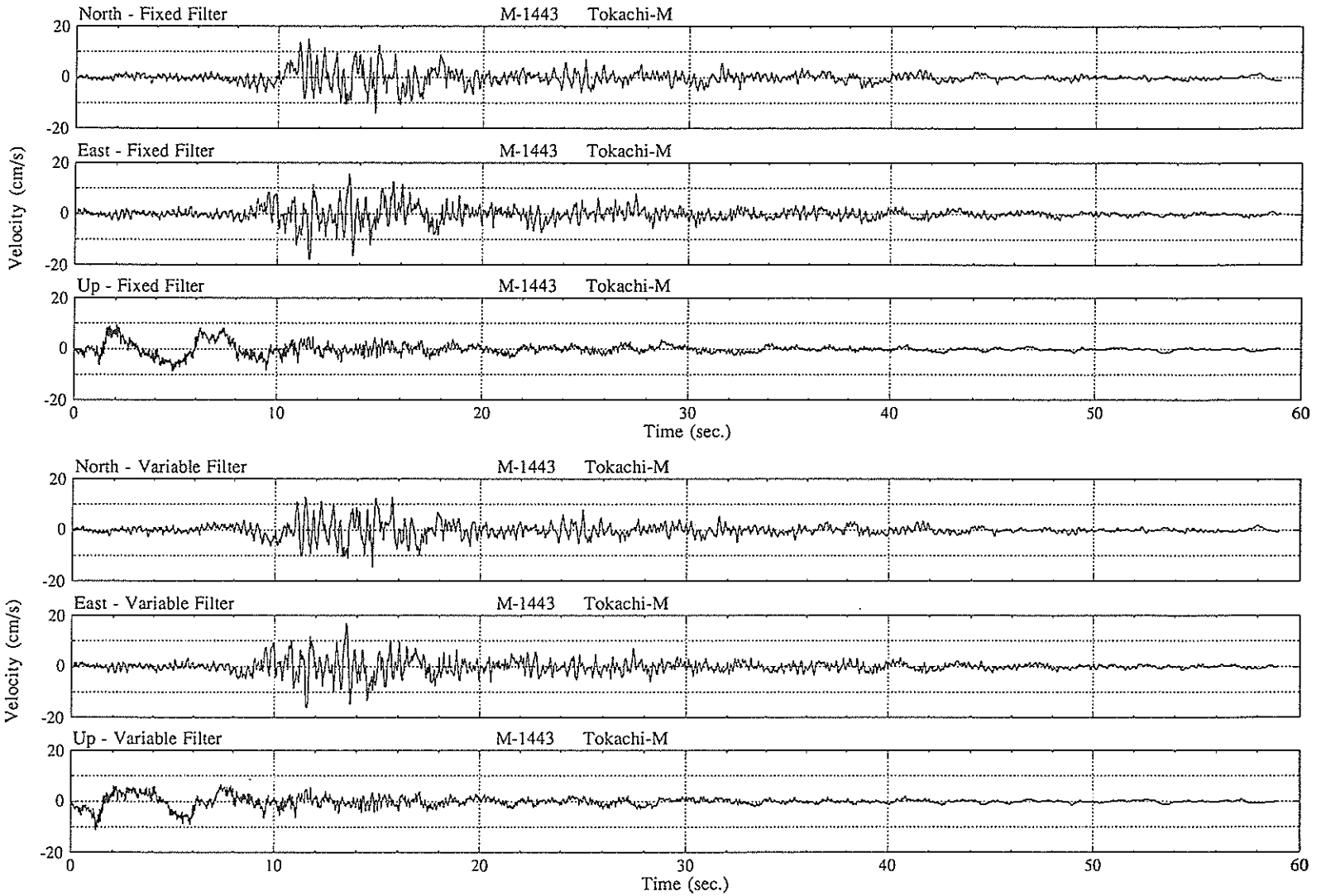
****

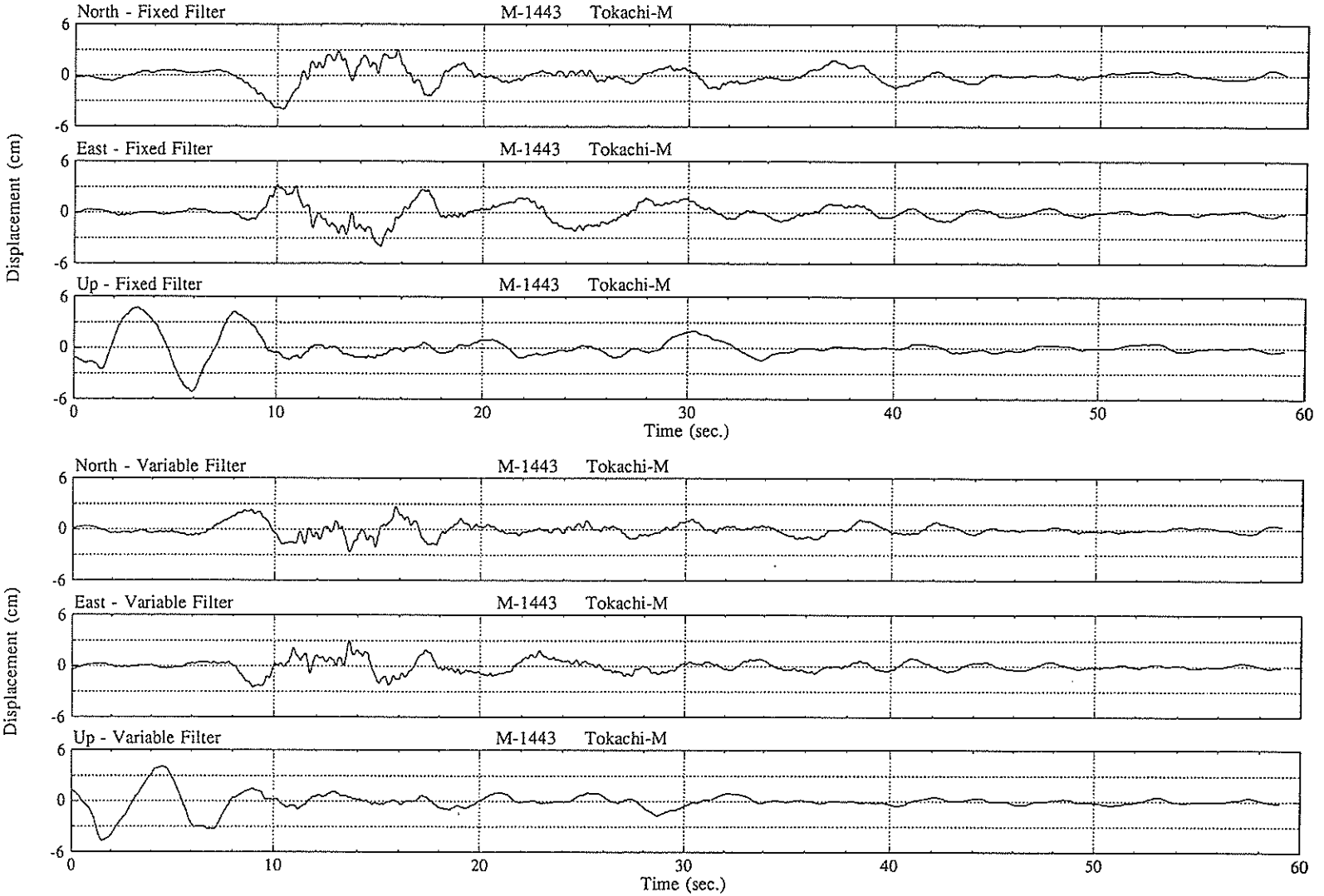
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.146	0.146	0.134	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	209.0	260.0	95.7	268.2
ORIGINAL	410.6	317.6	222.0	417.1
CORRECTED	406.4	319.5	223.6	408.8
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	15.27	17.68	9.49	20.60
VARIABLE FILTER	14.49	16.91	11.04	19.11
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	3.92	3.95	5.16	5.00
VARIABLE FILTER	2.66	2.93	4.68	3.94

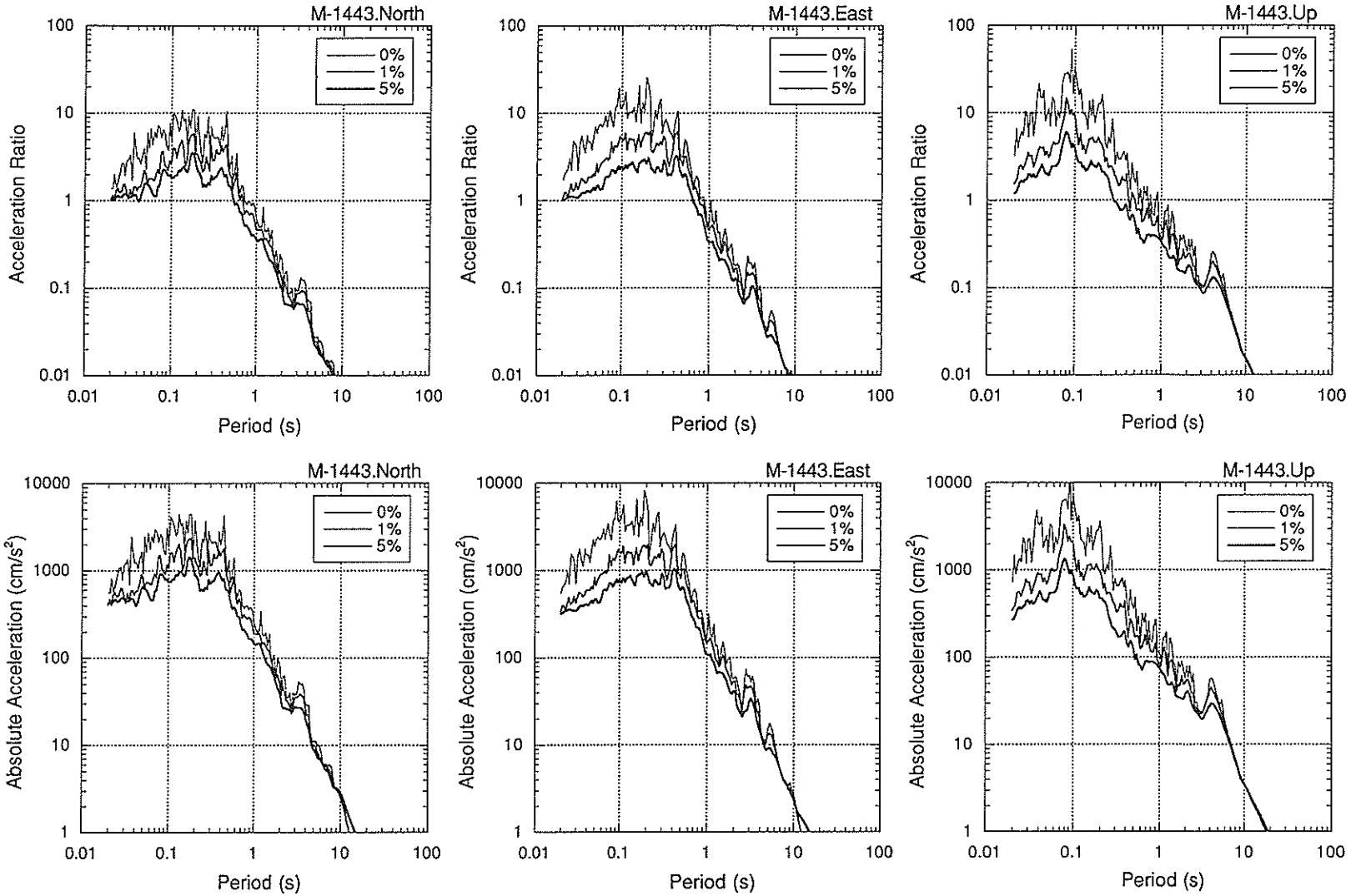
* RESULTANT OF HORIZONTAL COMPONENTS

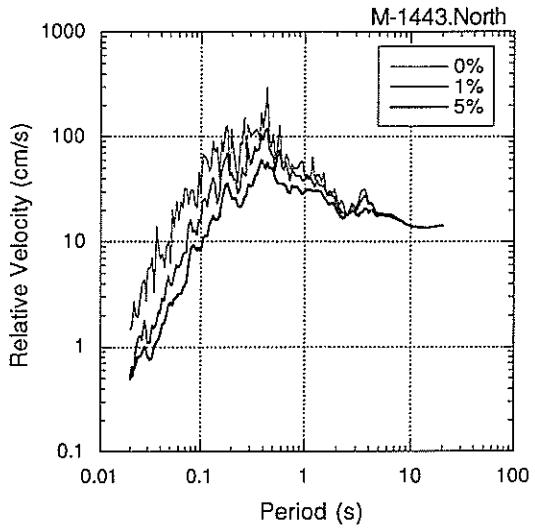

North - Original
M-1443 Tokachi-M
East - Original
M-1443 Tokachi-M
Up - Original
M-1443 Tokachi-M
Acceleration (cm/s²)
500
0
-500
0
10
20
30
40
50
60
Time (sec.)
North - Corrected
M-1443 Tokachi-M
East - Corrected
M-1443 Tokachi-M
Up - Corrected
M-1443 Tokachi-M
Acceleration (cm/s²)
Time (sec.)

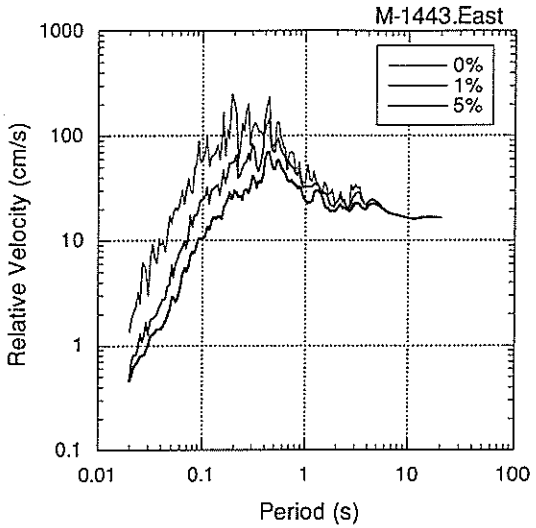

North - Original
M-1443 Tokachi-M
East - Original
M-1443 Tokachi-M
Up - Original
M-1443 Tokachi-M
Acceleration (cm/s²)
Time (sec.)
North - SMAC Equivalent
M-1443 Tokachi-M
East - SMAC Equivalent
M-1443 Tokachi-M
Up - SMAC Equivalent
M-1443 Tokachi-M
Acceleration (cm/s²)
Time (sec.)

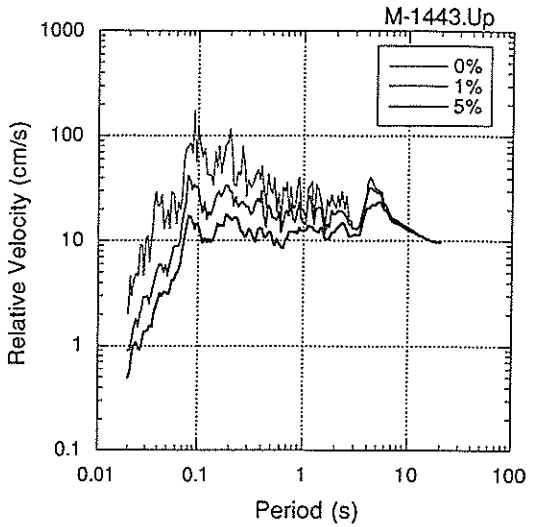

North - Fixed Filter
M-1443 Tokachi-M
East - Fixed Filter
M-1443 Tokachi-M
Up - Fixed Filter
M-1443 Tokachi-M
Velocity (cm/s)
Time (sec.)
North - Variable Filter
M-1443 Tokachi-M
East - Variable Filter
M-1443 Tokachi-M
Up - Variable Filter
M-1443 Tokachi-M
Velocity (cm/s)
Time (sec.)

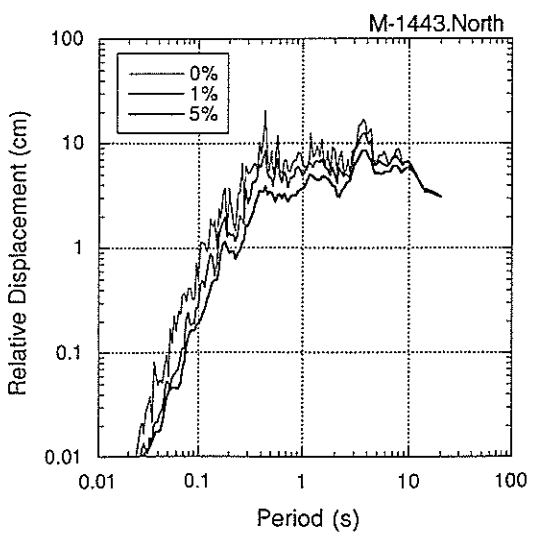

North - Fixed Filter
M-1443 Tokachi-M
East - Fixed Filter
M-1443 Tokachi-M
Up - Fixed Filter
M-1443 Tokachi-M
Displacement (cm)
Time (sec.)
North - Variable Filter
M-1443 Tokachi-M
East - Variable Filter
M-1443 Tokachi-M
Up - Variable Filter
M-1443 Tokachi-M
Displacement (cm)
Time (sec.)

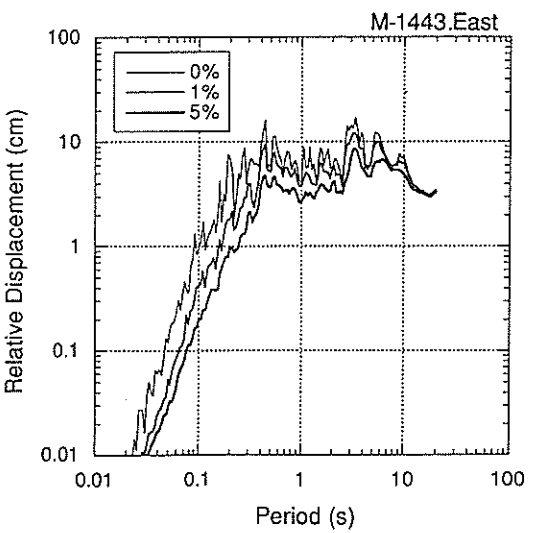

M-1443.North
M-1443.East
M-1443.Up
0%
1%
5%
Acceleration Ratio
Absolute Acceleration (cm/s²)
Period (s)
0.01
0.1
1
10
100
1000
10000

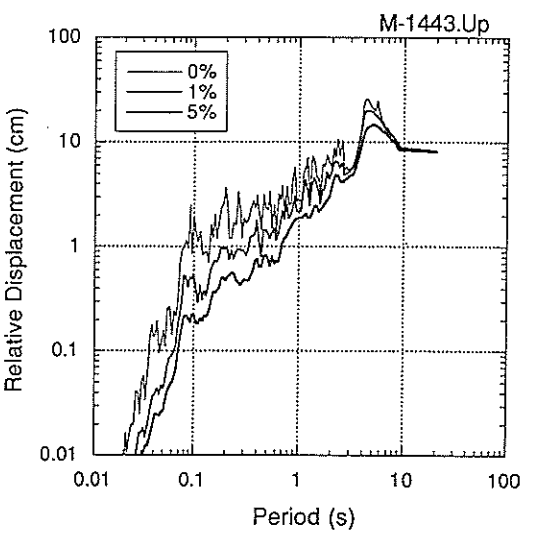

M-1443.North
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100

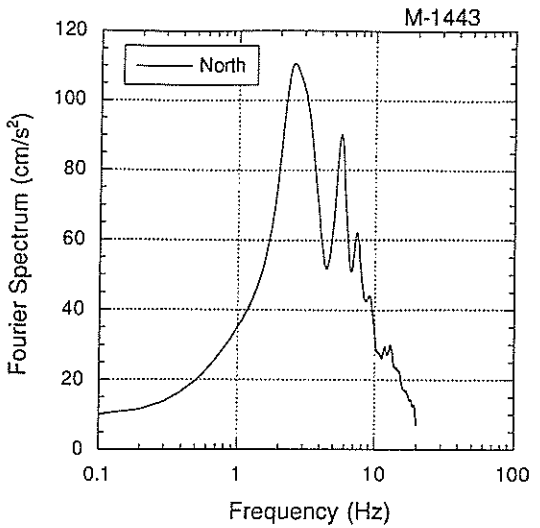

M-1443.East
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100

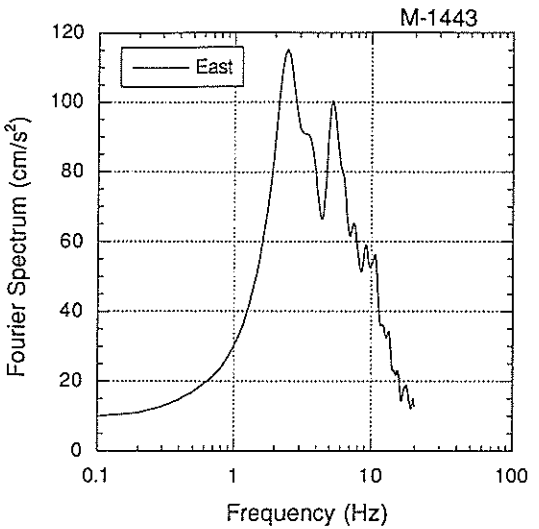

M-1443.Up
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100

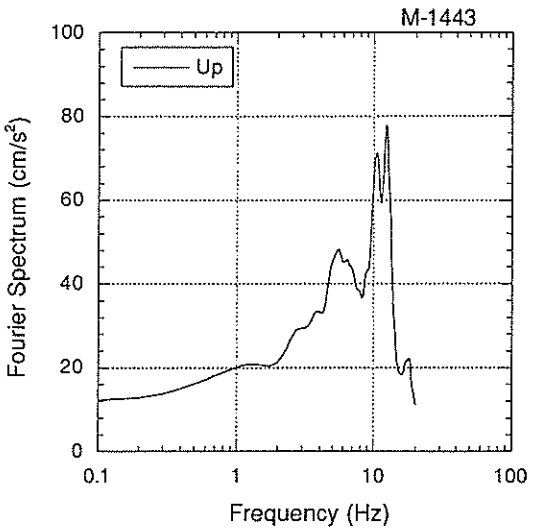

M-1443.North
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

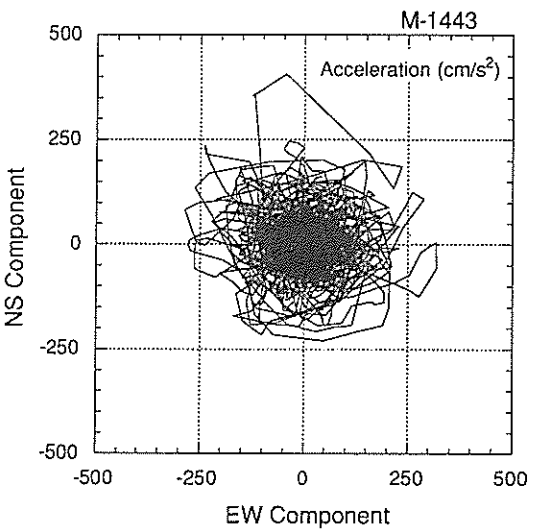

M-1443.East
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

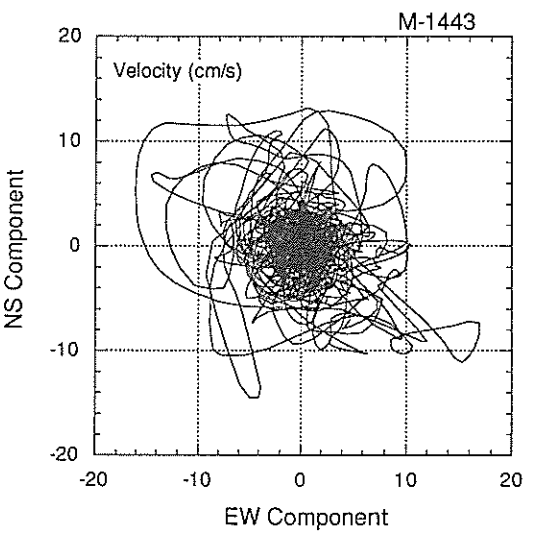

M-1443.Up
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

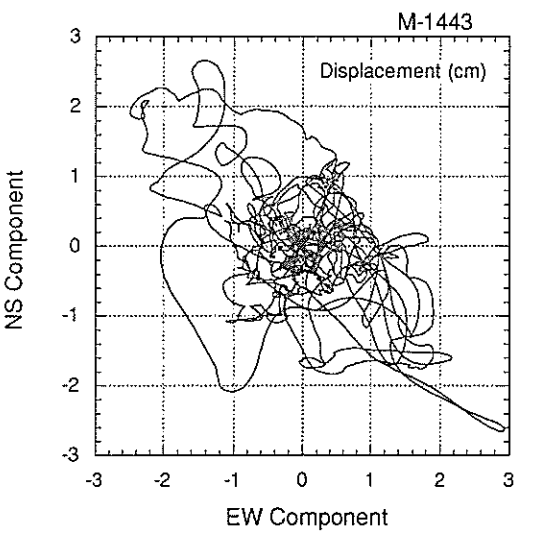

M-1443
North
Fourier Spectrum (cm/s²)
Frequency (Hz)


M-1443
East
Fourier Spectrum (cm/s²)
Frequency (Hz)


M-1443
Up
Fourier Spectrum (cm/s²)
Frequency (Hz)


M-1443
Acceleration (cm/s²)
NS Component
EW Component


M-1443
Velocity (cm/s)
NS Component
EW Component


M-1443
Displacement (cm)
NS Component
EW Component

RECORD NUMBER : M-1444

STATION : HAKODATE-M

EARTHQUAKE DATA

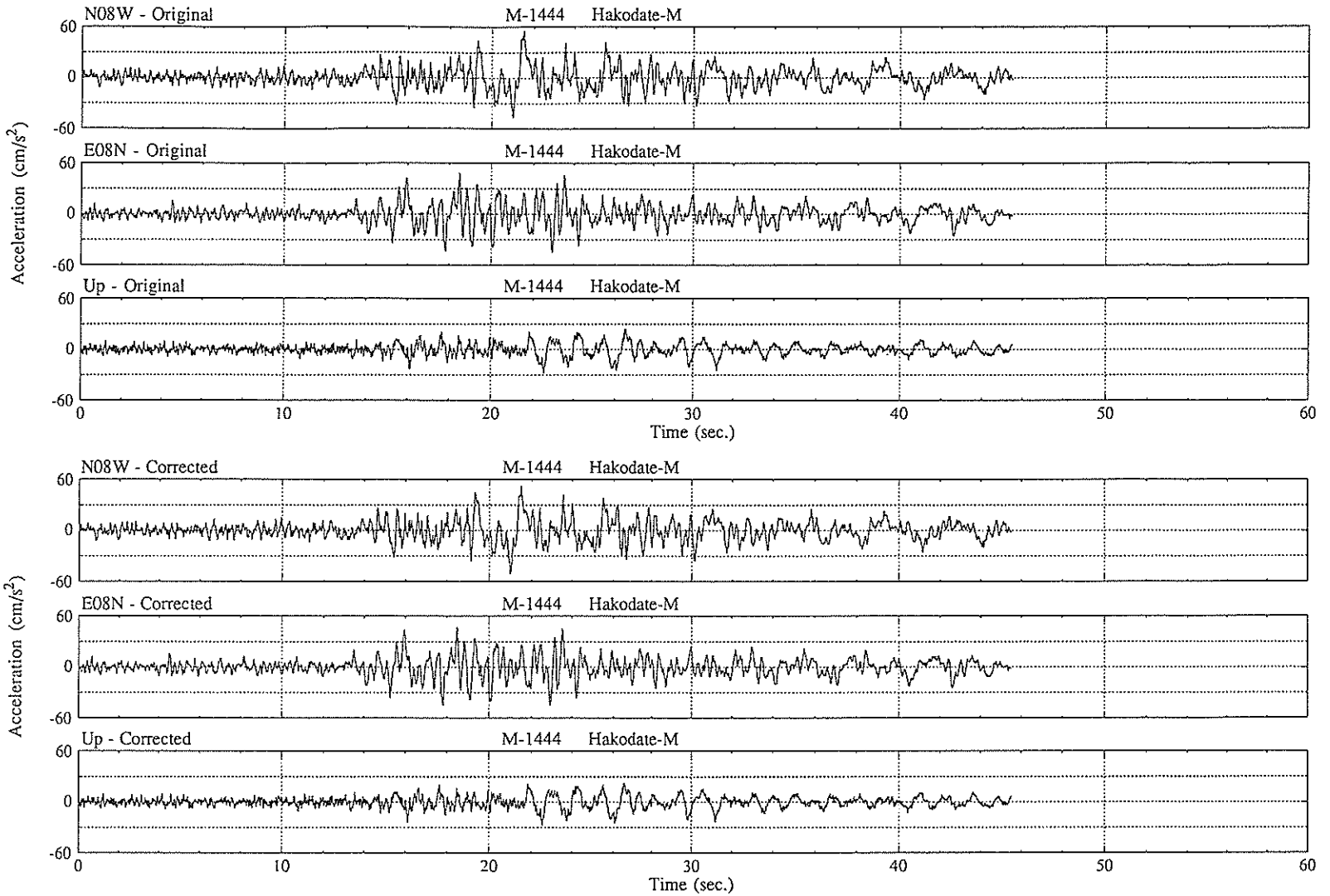
****

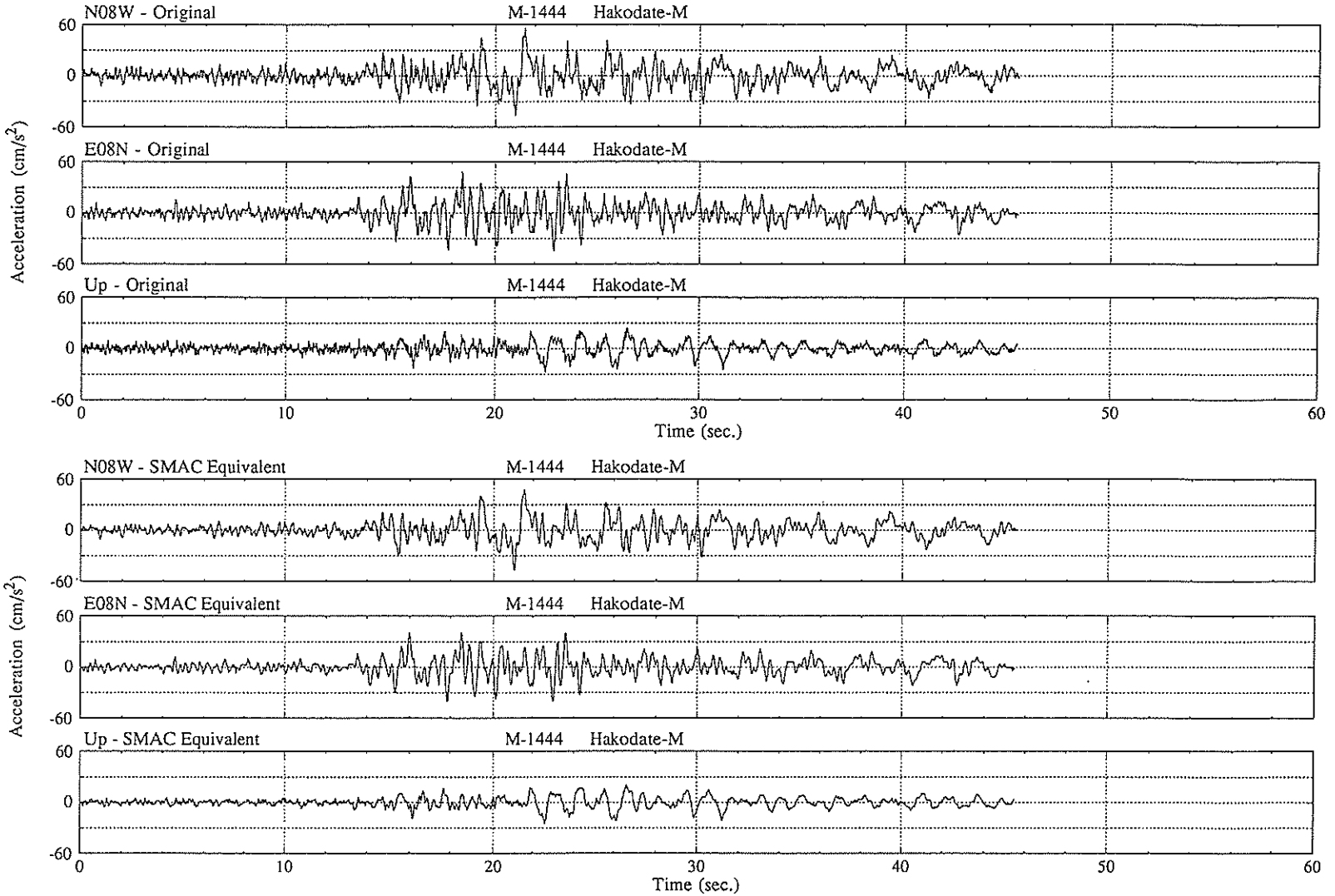
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

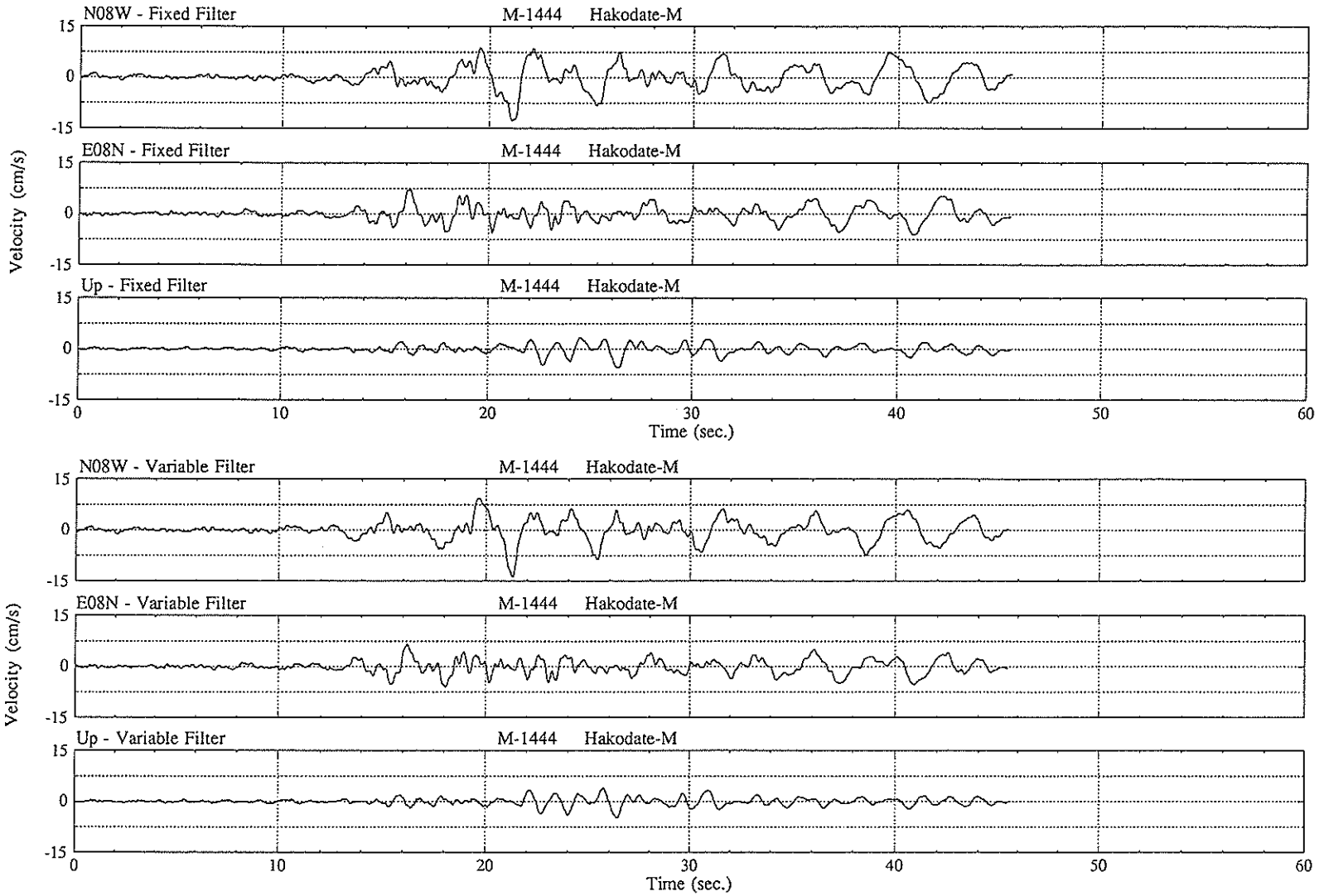
****

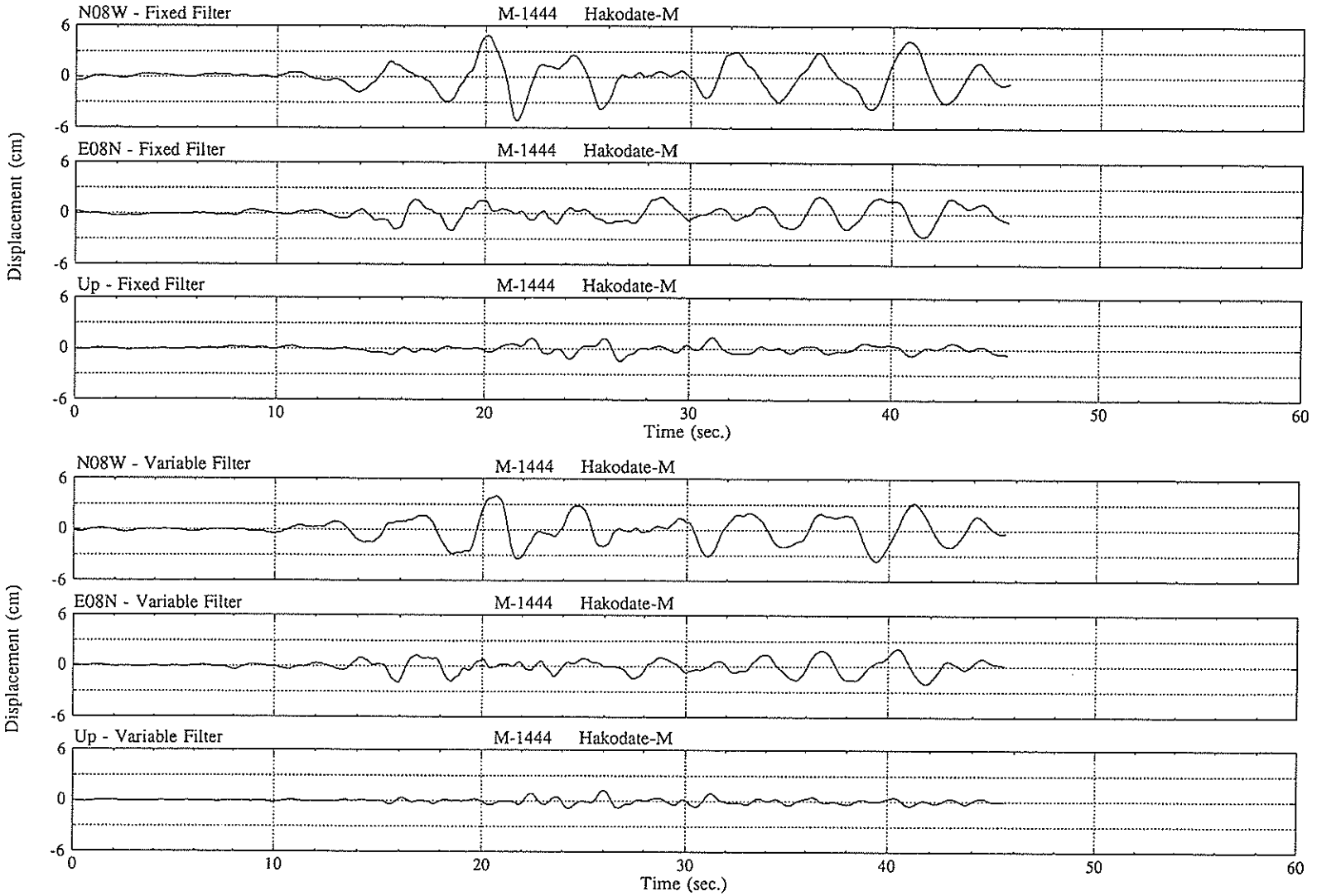
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.157	0.181	0.254	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	47.5	40.7	24.8	51.2
ORIGINAL	56.0	48.4	27.8	60.5
CORRECTED	52.2	47.3	28.2	57.5
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	12.68	7.20	5.41	12.68
VARIABLE FILTER	13.72	6.55	4.80	13.73
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	5.17	2.67	1.42	5.17
VARIABLE FILTER	3.98	2.12	1.26	3.98

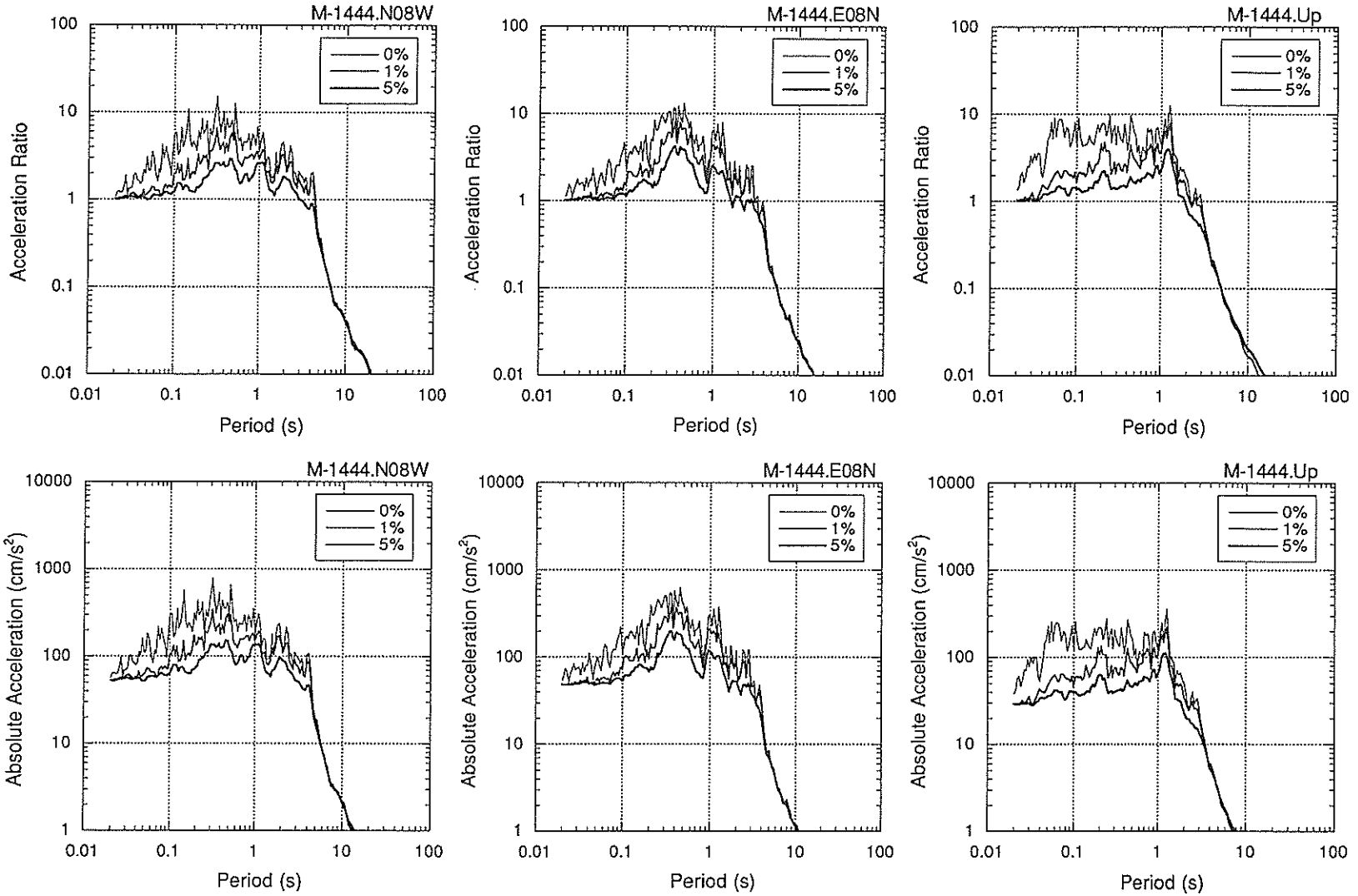
* RESULTANT OF HORIZONTAL COMPONENTS

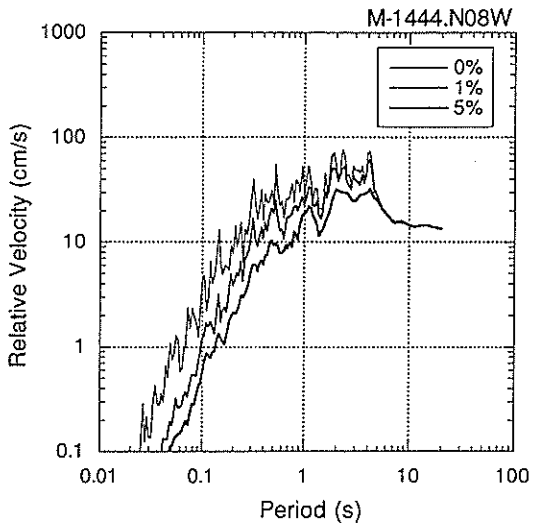

N08W - Original
M-1444 Hakodate-M
E08N - Original
M-1444 Hakodate-M
Up - Original
M-1444 Hakodate-M
Acceleration (cm/s^2)
60
0
-60
0
10
20
30
40
50
60
Time (sec.)
N08W - Corrected
M-1444 Hakodate-M
E08N - Corrected
M-1444 Hakodate-M
Up - Corrected
M-1444 Hakodate-M
Acceleration (cm/s^2)
Time (sec.)

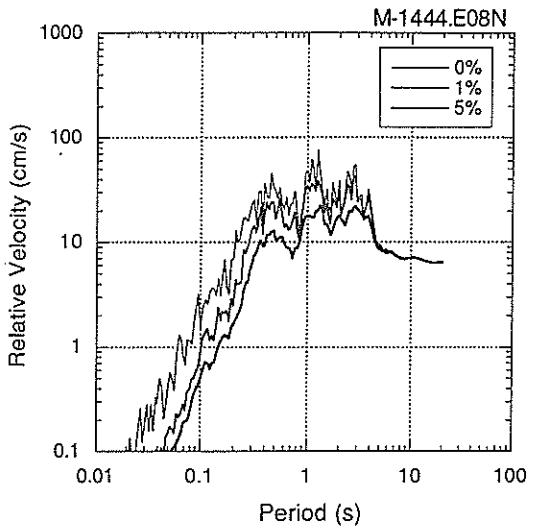

N08W - Original
M-1444 Hakodate-M
E08N - Original
M-1444 Hakodate-M
Up - Original
M-1444 Hakodate-M
Acceleration (cm/s²)
60
0
-60
0
10
20
30
40
50
60
Time (sec.)
N08W - SMAC Equivalent
M-1444 Hakodate-M
E08N - SMAC Equivalent
M-1444 Hakodate-M
Up - SMAC Equivalent
M-1444 Hakodate-M
Acceleration (cm/s²)
Time (sec.)

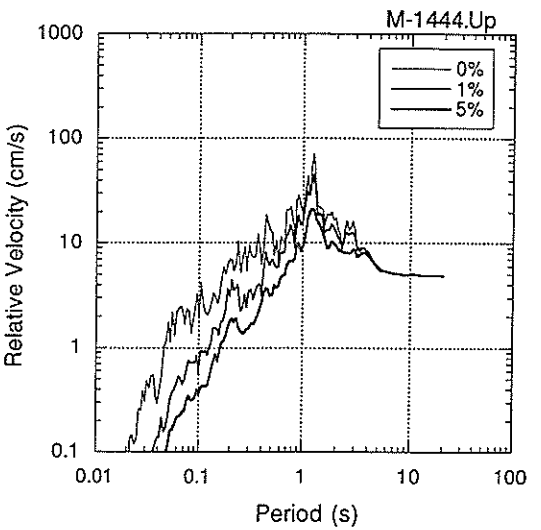

N08W - Fixed Filter
M-1444 Hakodate-M
E08N - Fixed Filter
M-1444 Hakodate-M
Up - Fixed Filter
M-1444 Hakodate-M
Velocity (cm/s)
15
0
-15
0
10
20
30
40
50
60
Time (sec.)
N08W - Variable Filter
M-1444 Hakodate-M
E08N - Variable Filter
M-1444 Hakodate-M
Up - Variable Filter
M-1444 Hakodate-M
Velocity (cm/s)
Time (sec.)

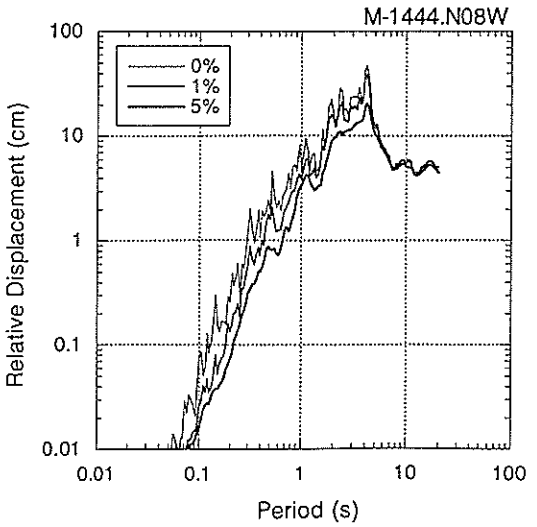

N08W - Fixed Filter
M-1444 Hakodate-M
E08N - Fixed Filter
M-1444 Hakodate-M
Up - Fixed Filter
M-1444 Hakodate-M
Displacement (cm)
6
0
-6
0
10
20
30
40
50
60
Time (sec.)
N08W - Variable Filter
M-1444 Hakodate-M
E08N - Variable Filter
M-1444 Hakodate-M
Up - Variable Filter
M-1444 Hakodate-M
Displacement (cm)
Time (sec.)

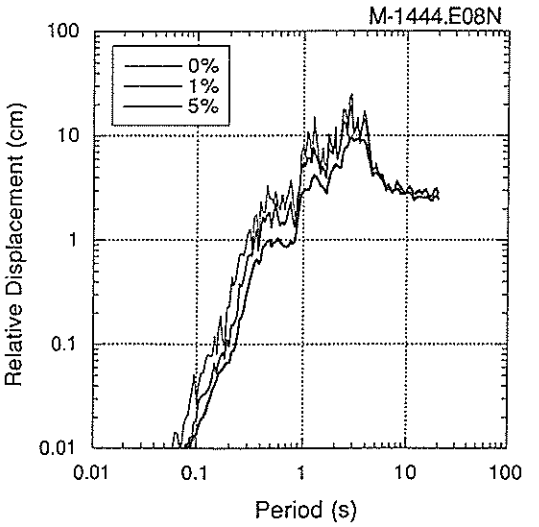

M-1444.N08W
M-1444.E08N
M-1444.Up
0%
1%
5%
Acceleration Ratio
Absolute Acceleration (cm/s²)
Period (s)
0.01
0.1
1
10
100
1000
10000

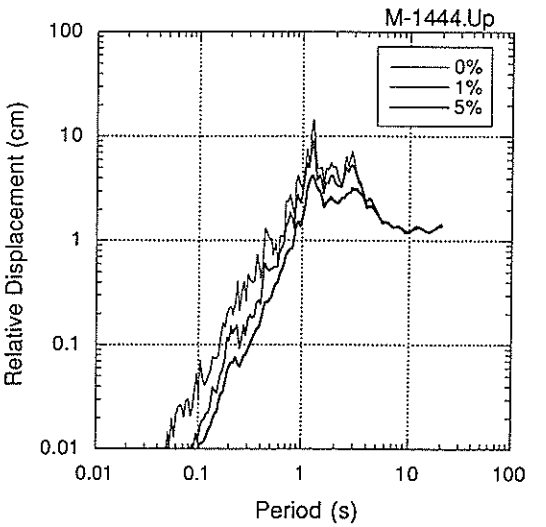

M-1444.N08W
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100

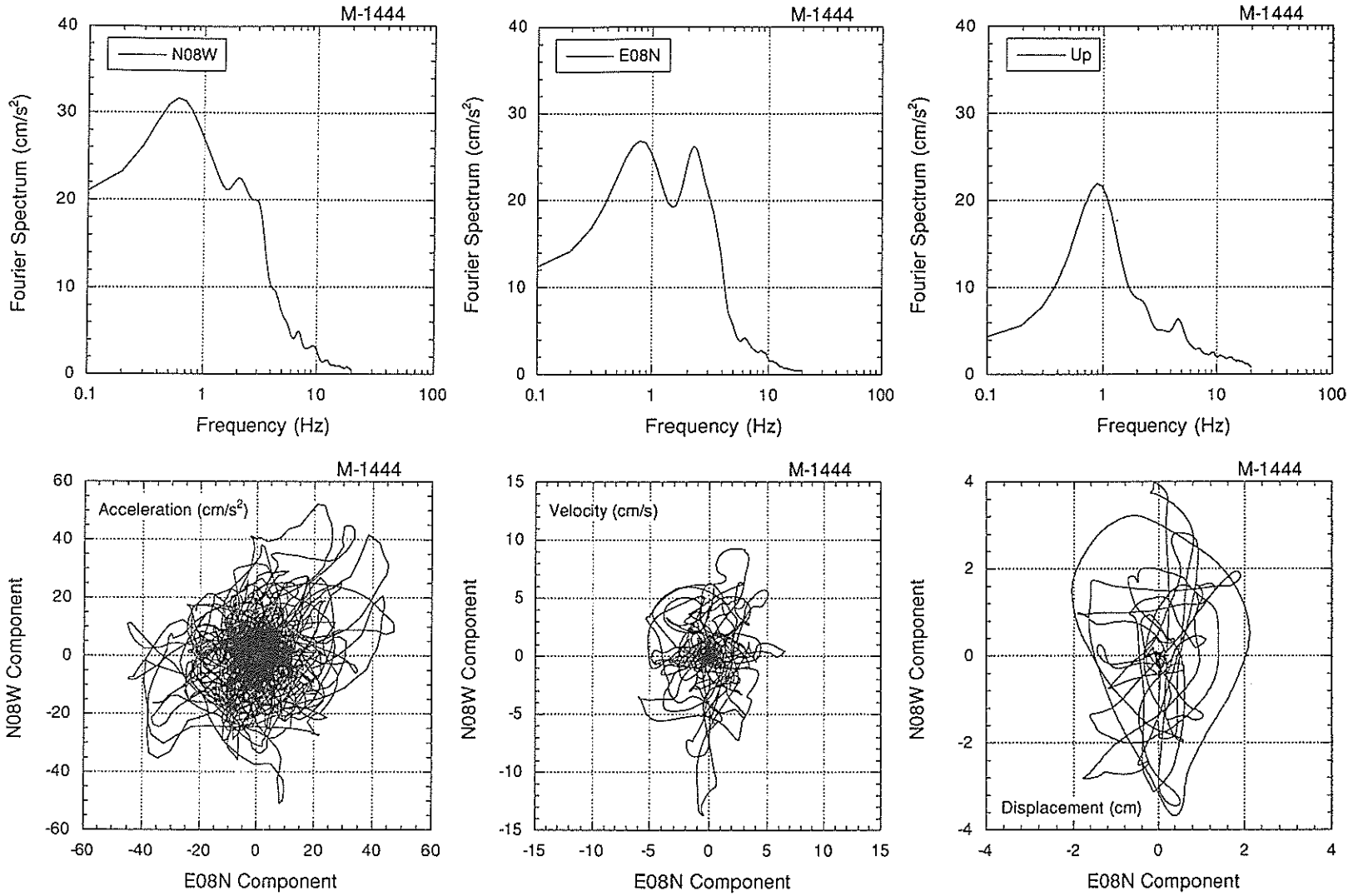

M-1444.E08N
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100


M-1444.Up
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100


M-1444.N08W
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100


M-1444.E08N
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100


M-1444.Up
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100


M-1444
N08W
Fourier Spectrum (cm/s²)
Frequency (Hz)
M-1444
E08N
Fourier Spectrum (cm/s²)
Frequency (Hz)
M-1444
Up
Fourier Spectrum (cm/s²)
Frequency (Hz)
M-1444
Acceleration (cm/s²)
N08W Component
E08N Component
M-1444
Velocity (cm/s)
N08W Component
E08N Component
M-1444
Displacement (cm)
N08W Component
E08N Component

RECORD NUMBER : M-1445

STATION : SENDAI-M

EARTHQUAKE DATA

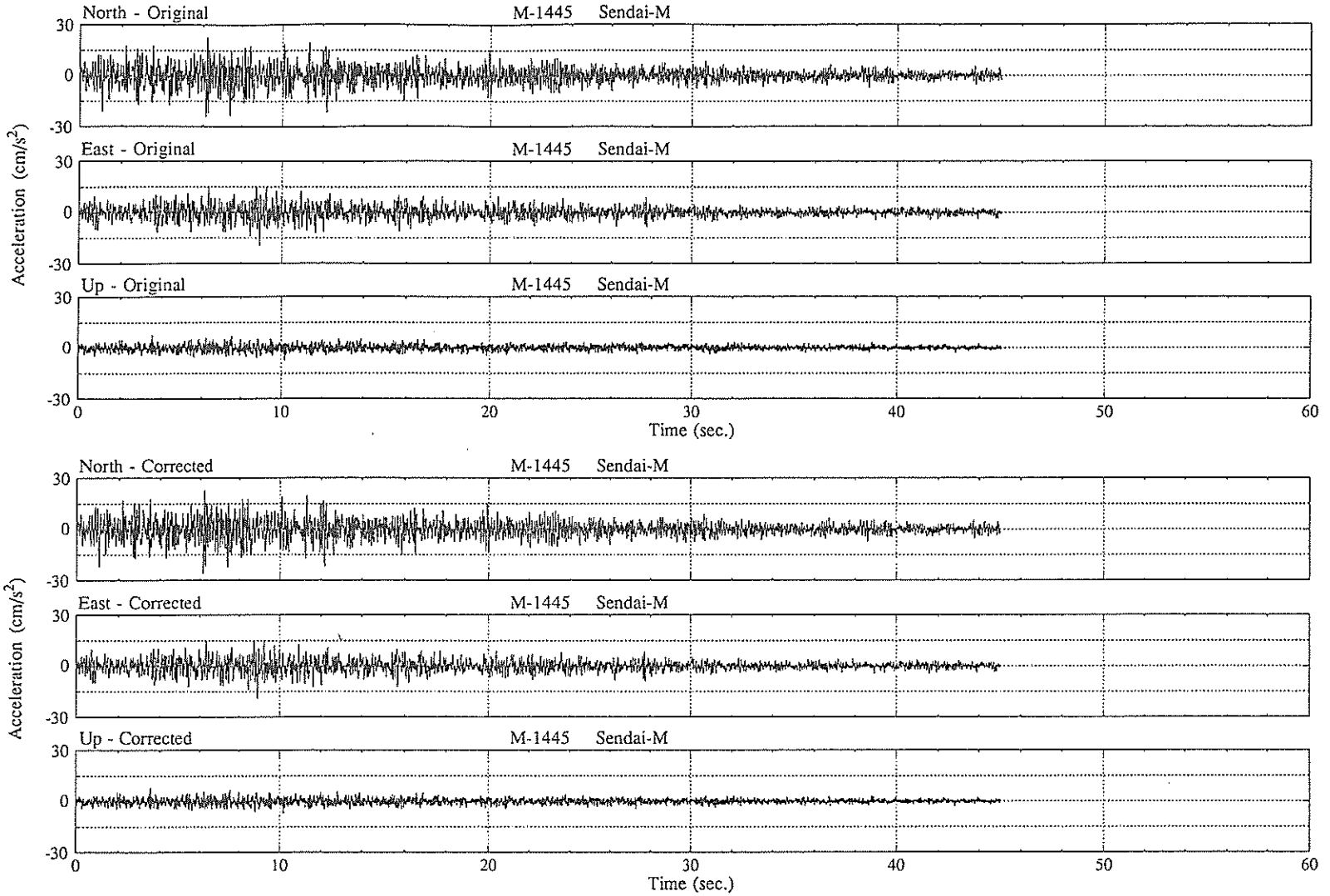
****

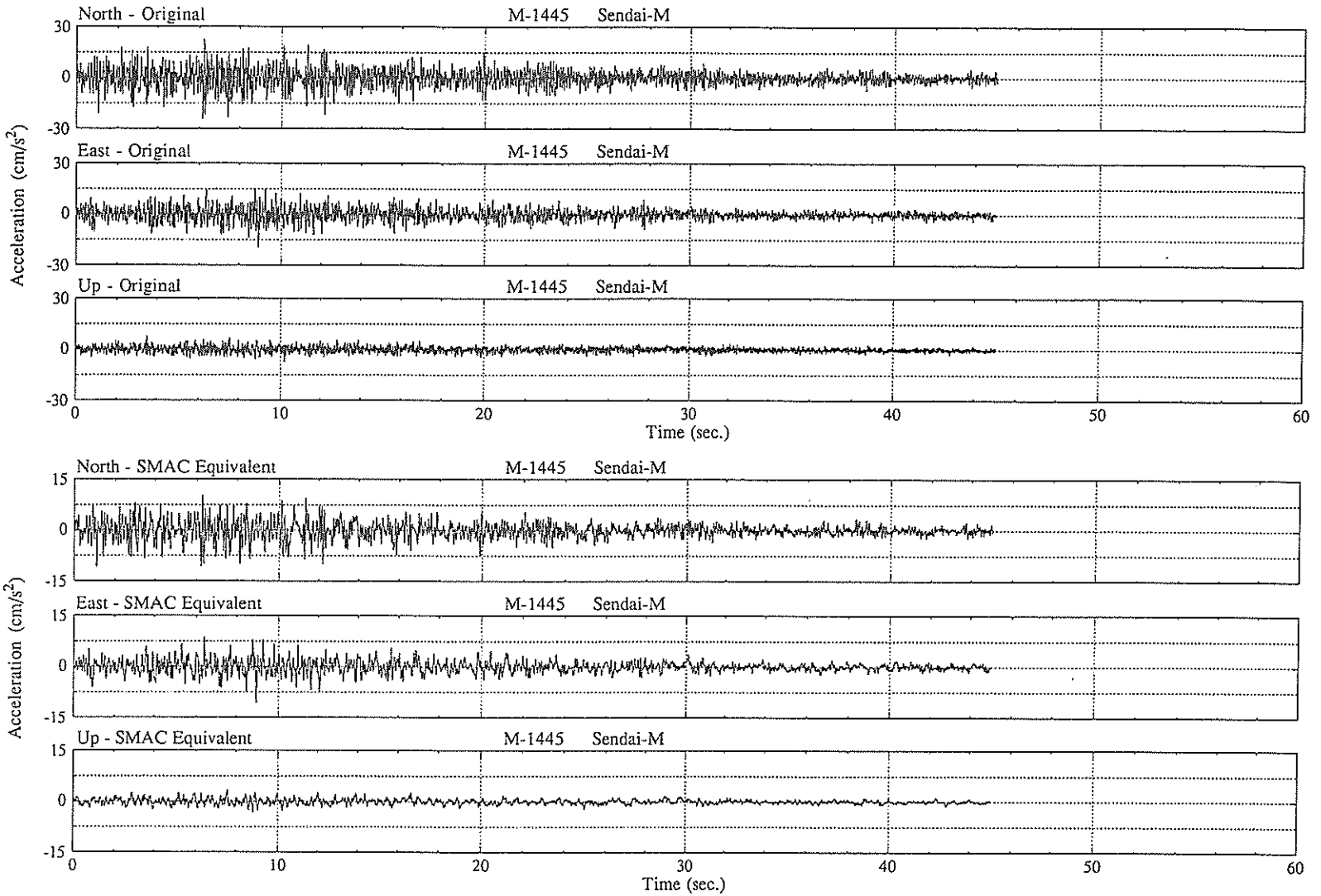
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

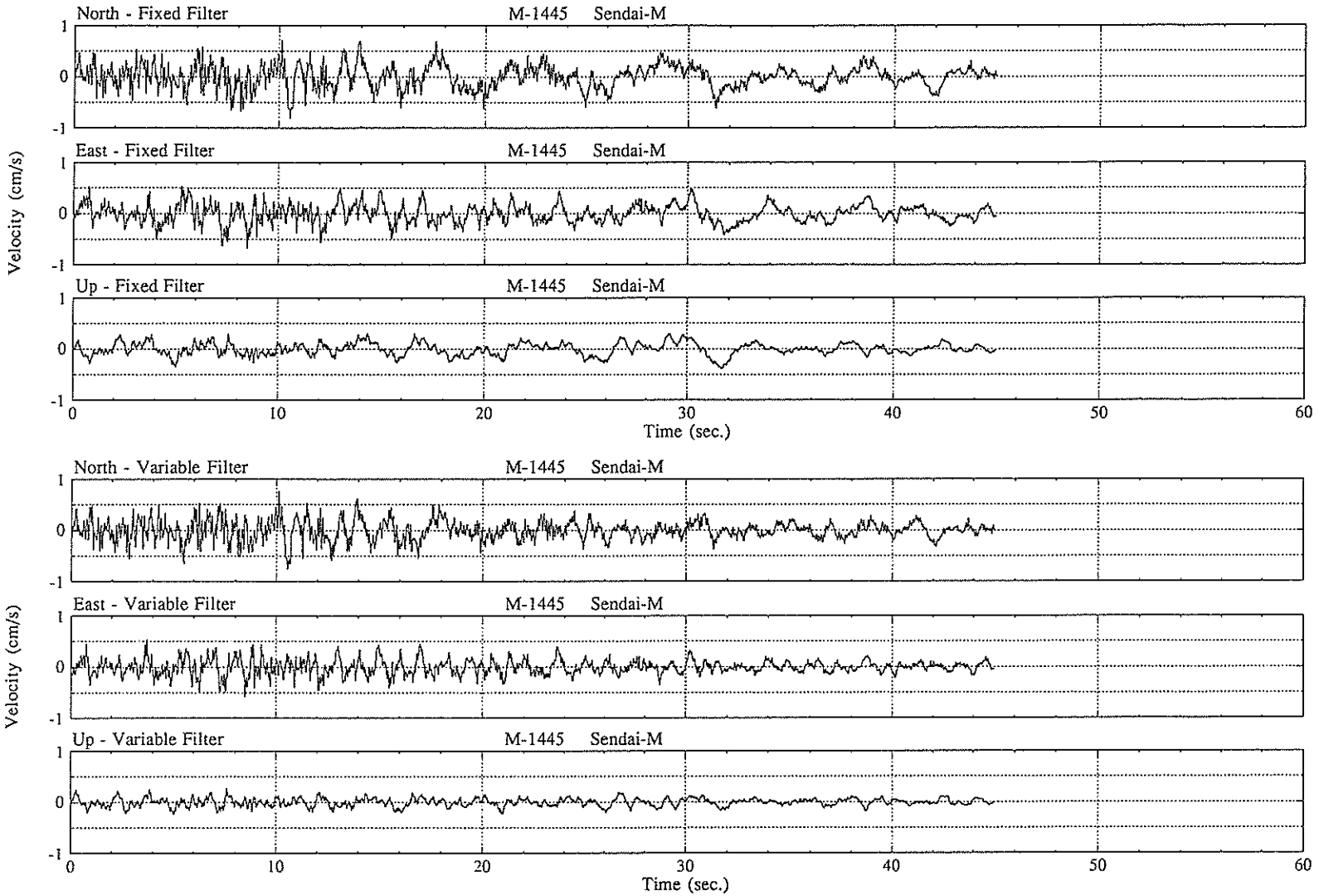
****

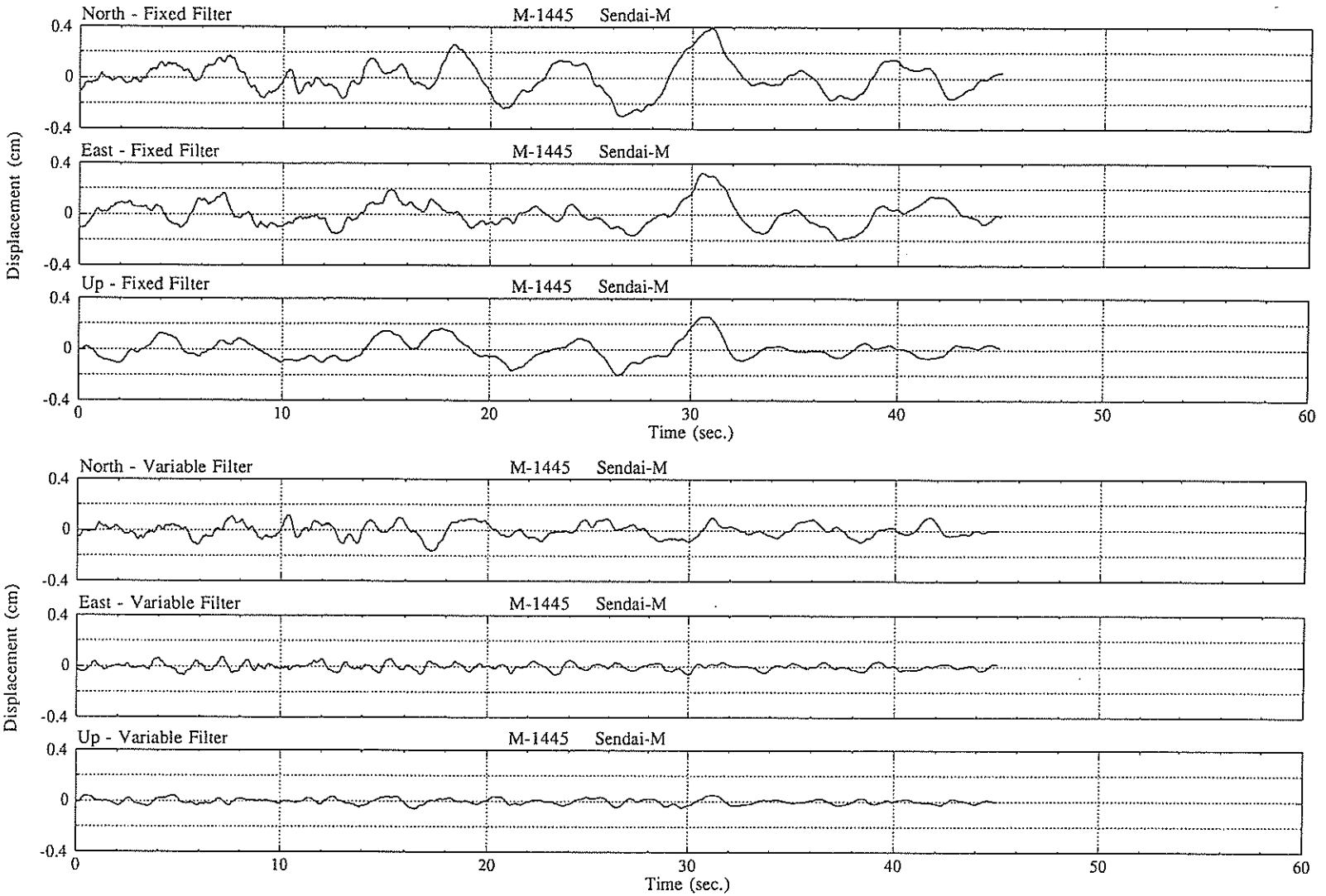
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.206	0.328	0.303	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	10.8	10.5	3.3	10.9
ORIGINAL	24.4	19.5	7.5	24.4
CORRECTED	26.1	19.2	7.7	26.1
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	0.81	0.68	0.39	0.86
VARIABLE FILTER	0.77	0.57	0.27	0.79
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.39	0.33	0.26	0.50
VARIABLE FILTER	0.16	0.08	0.06	0.17

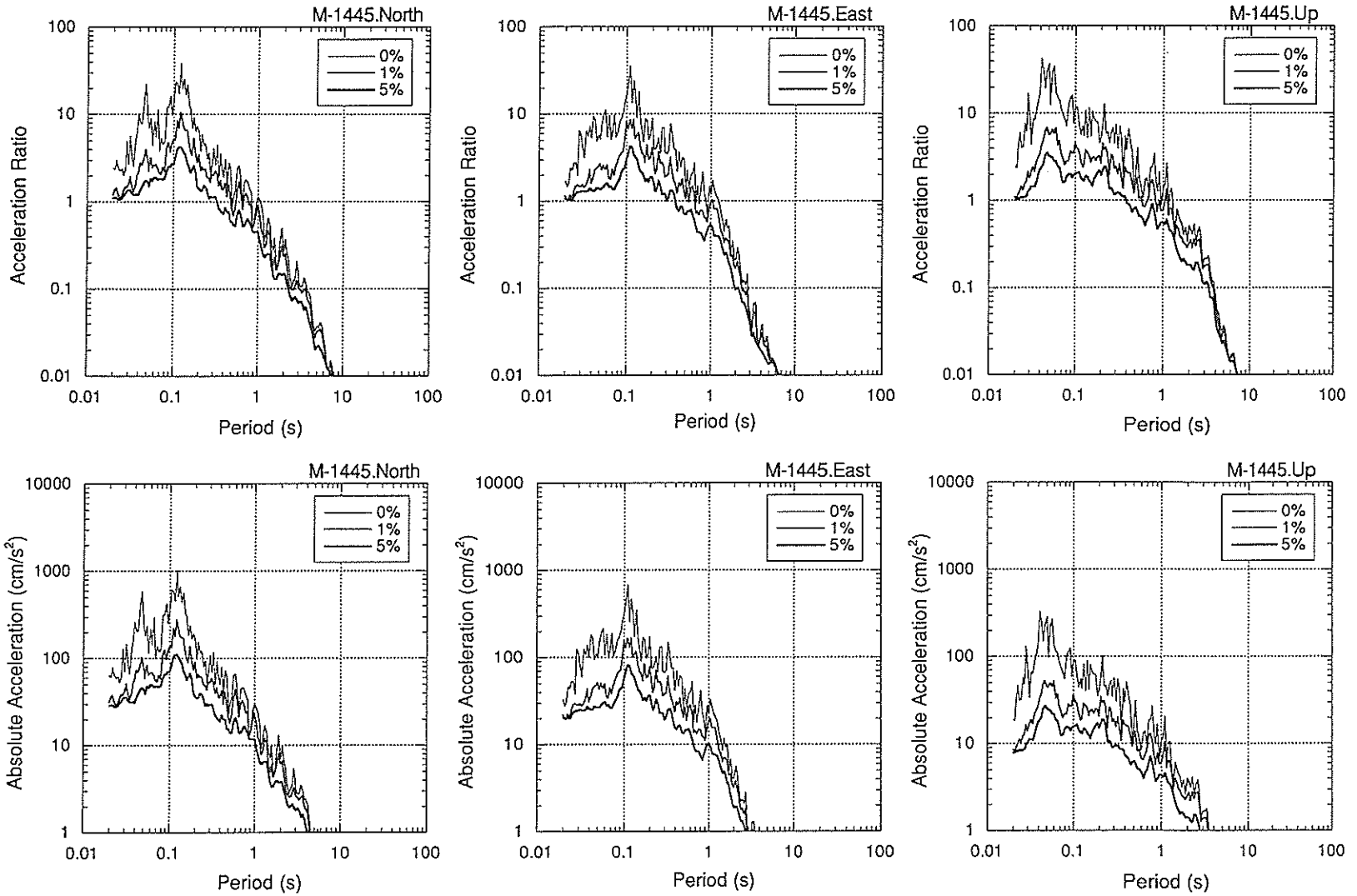
* RESULTANT OF HORIZONTAL COMPONENTS

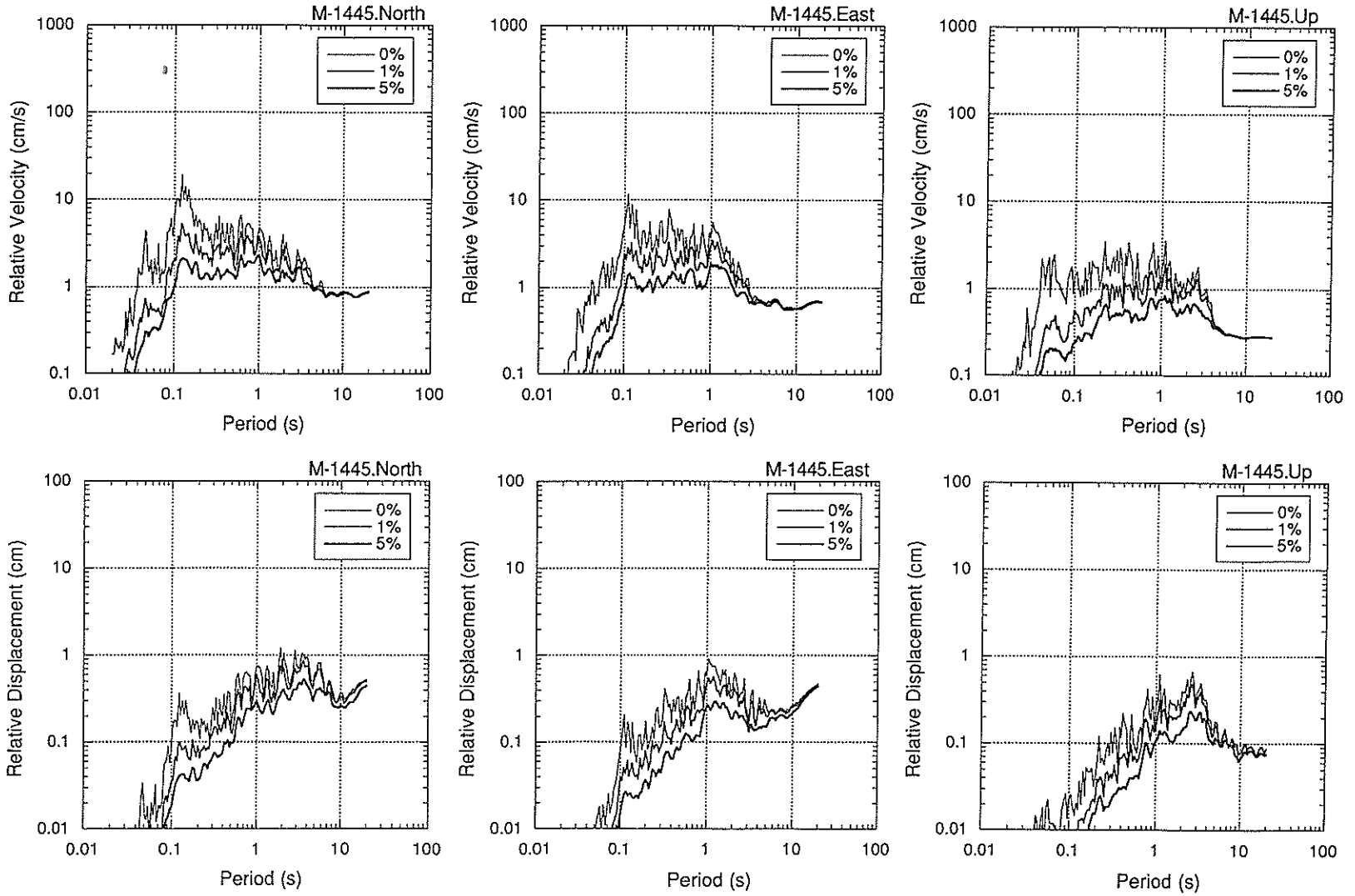

North - Original
M-1445 Sendai-M
East - Original
M-1445 Sendai-M
Up - Original
M-1445 Sendai-M
Acceleration (cm/s²)
30
0
-30
0
10
20
30
40
50
60
Time (sec.)
North - Corrected
M-1445 Sendai-M
East - Corrected
M-1445 Sendai-M
Up - Corrected
M-1445 Sendai-M
Acceleration (cm/s²)
Time (sec.)

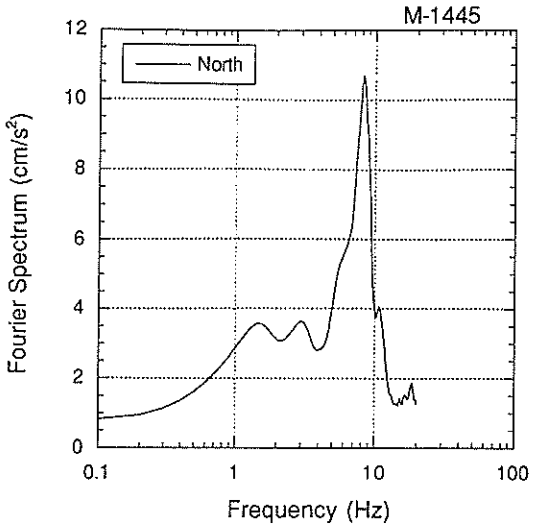

North - Original
M-1445 Sendai-M
East - Original
M-1445 Sendai-M
Up - Original
M-1445 Sendai-M
Acceleration (cm/s²)
30
0
-30
0
10
20
30
40
50
60
Time (sec.)
North - SMAC Equivalent
M-1445 Sendai-M
East - SMAC Equivalent
M-1445 Sendai-M
Up - SMAC Equivalent
M-1445 Sendai-M
Acceleration (cm/s²)
15
0
-15
Time (sec.)

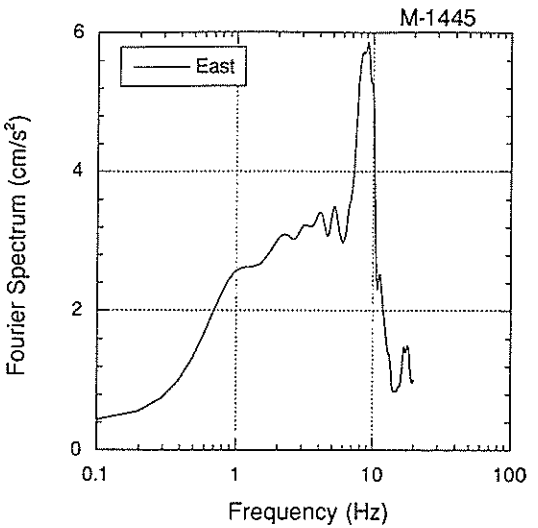

North - Fixed Filter
M-1445 Sendai-M
East - Fixed Filter
M-1445 Sendai-M
Up - Fixed Filter
M-1445 Sendai-M
Velocity (cm/s)
Time (sec.)
North - Variable Filter
M-1445 Sendai-M
East - Variable Filter
M-1445 Sendai-M
Up - Variable Filter
M-1445 Sendai-M
Velocity (cm/s)
Time (sec.)

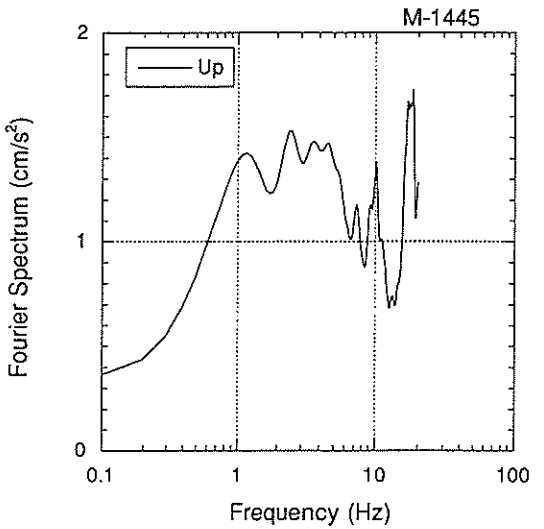

North - Fixed Filter
M-1445 Sendai-M
East - Fixed Filter
M-1445 Sendai-M
Up - Fixed Filter
M-1445 Sendai-M
Displacement (cm)
0.4
0
-0.4
0
10
20
30
40
50
60
Time (sec.)
North - Variable Filter
M-1445 Sendai-M
East - Variable Filter
M-1445 Sendai-M
Up - Variable Filter
M-1445 Sendai-M
Displacement (cm)
Time (sec.)

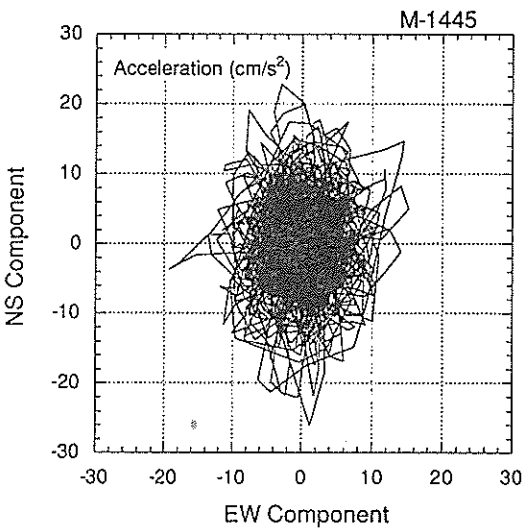

M-1445.North
M-1445.East
M-1445.Up
0%
1%
5%
Acceleration Ratio
Absolute Acceleration (cm/s²)
Period (s)
0.01
0.1
1
10
100
1000
10000

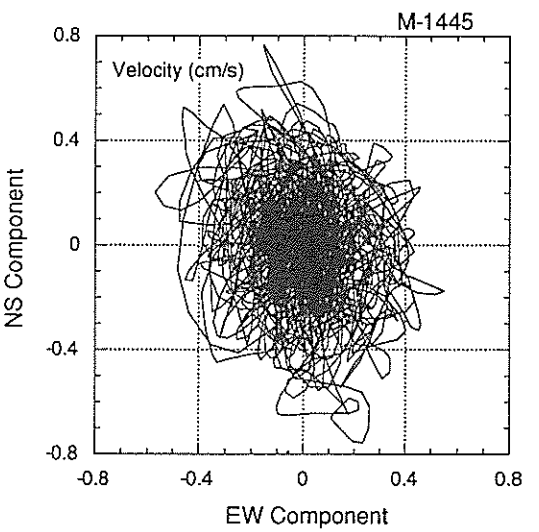

M-1445.North
M-1445.East
M-1445.Up
0%
1%
5%
Relative Velocity (cm/s)
Relative Displacement (cm)
Period (s)
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100

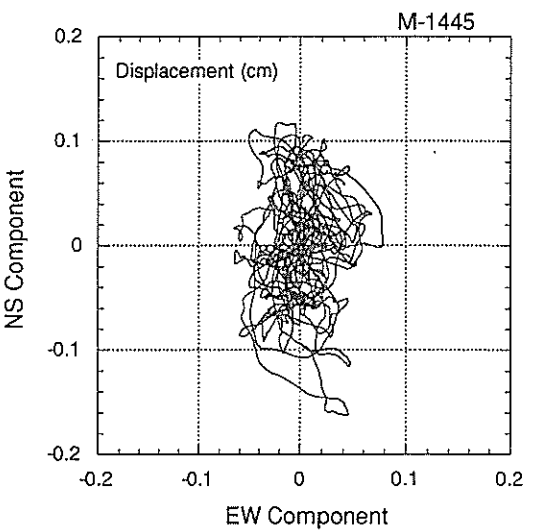

M-1445
North
Fourier Spectrum (cm/s²)
Frequency (Hz)


M-1445
East
Fourier Spectrum (cm/s²)
Frequency (Hz)


M-1445
Up
Fourier Spectrum (cm/s²)
Frequency (Hz)


M-1445
Acceleration (cm/s²)
NS Component
EW Component


M-1445
Velocity (cm/s)
NS Component
EW Component


M-1445
Displacement (cm)
NS Component
EW Component

RECORD NUMBER : M-1446

STATION : SENDAI-MB

EARTHQUAKE DATA

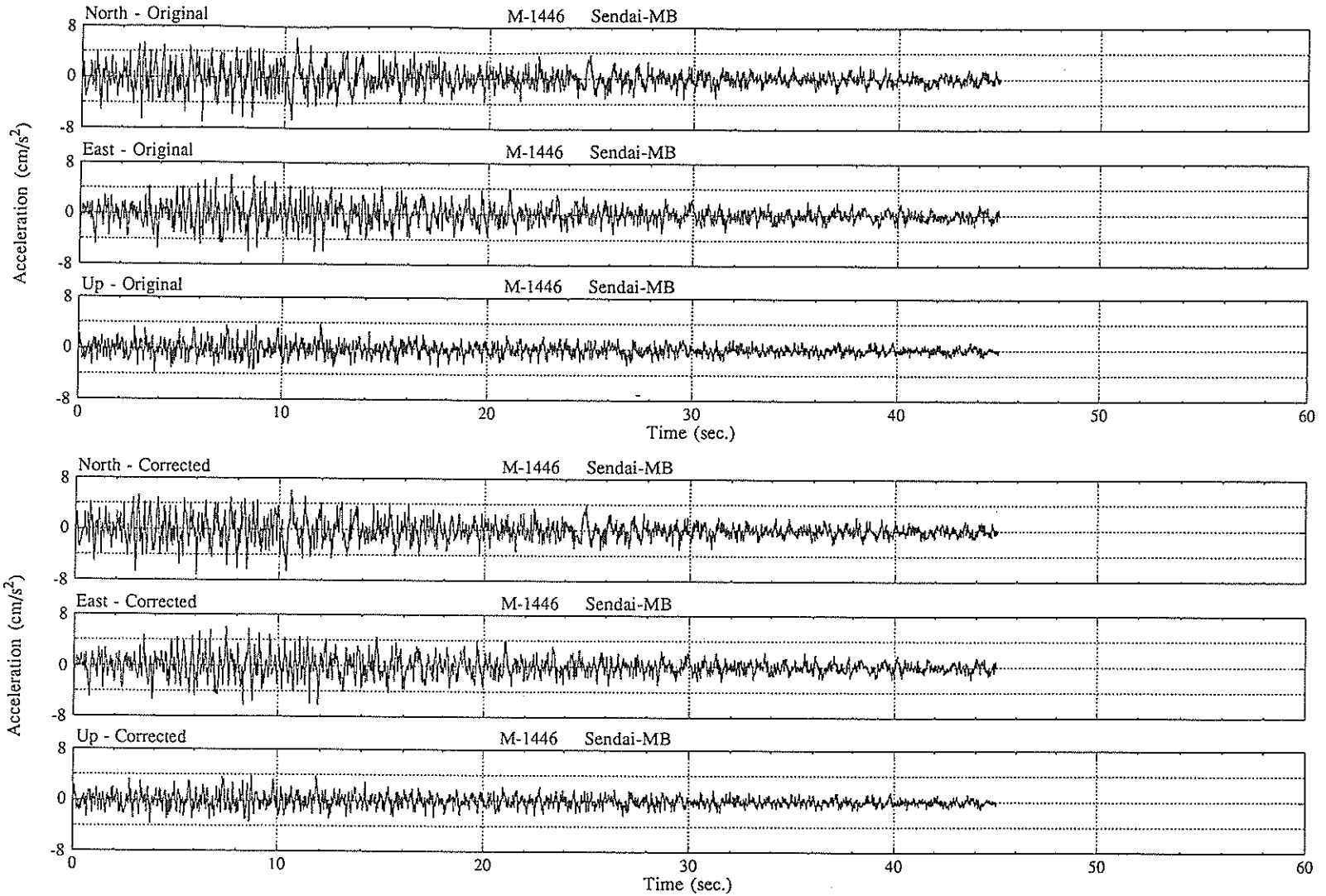
****

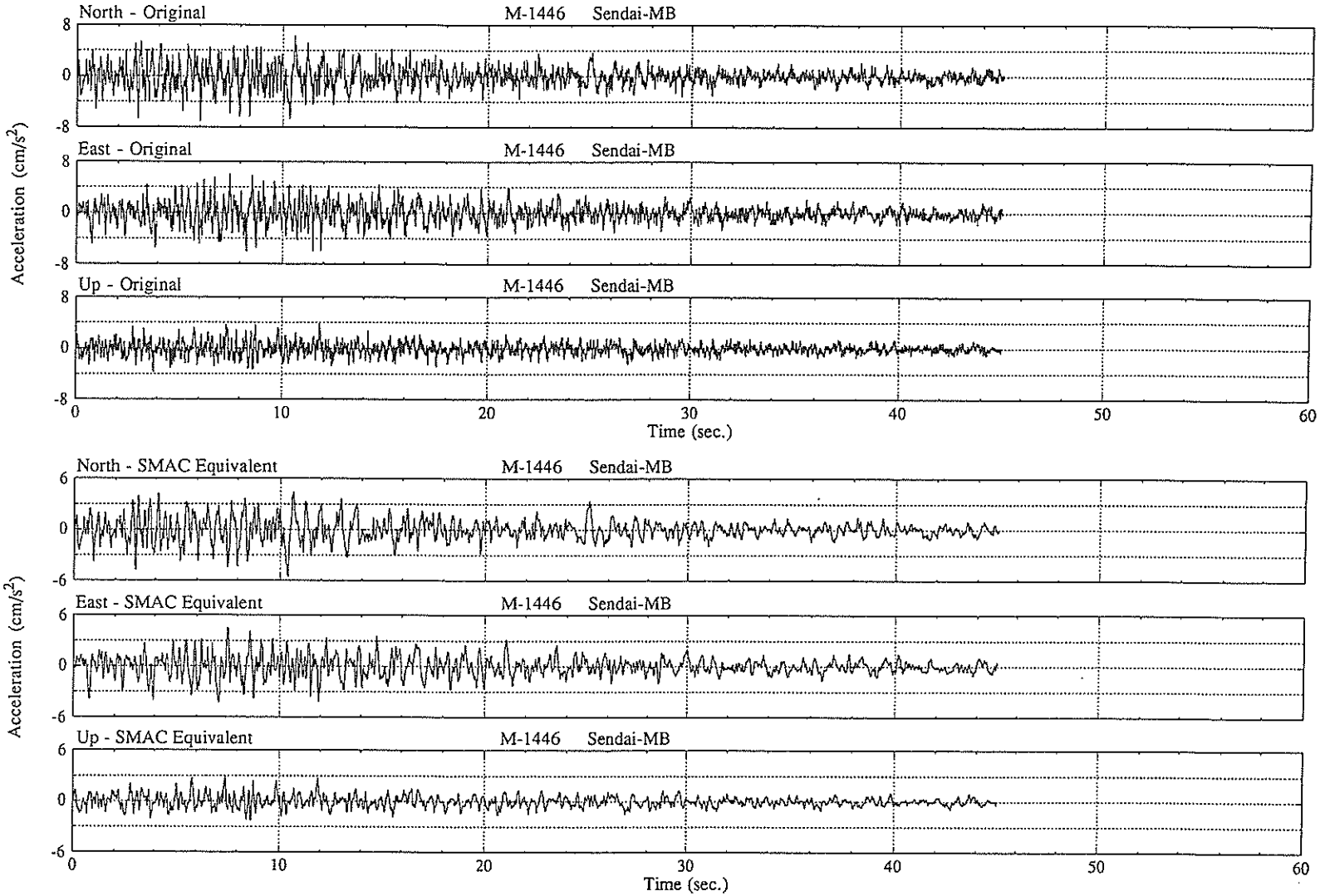
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

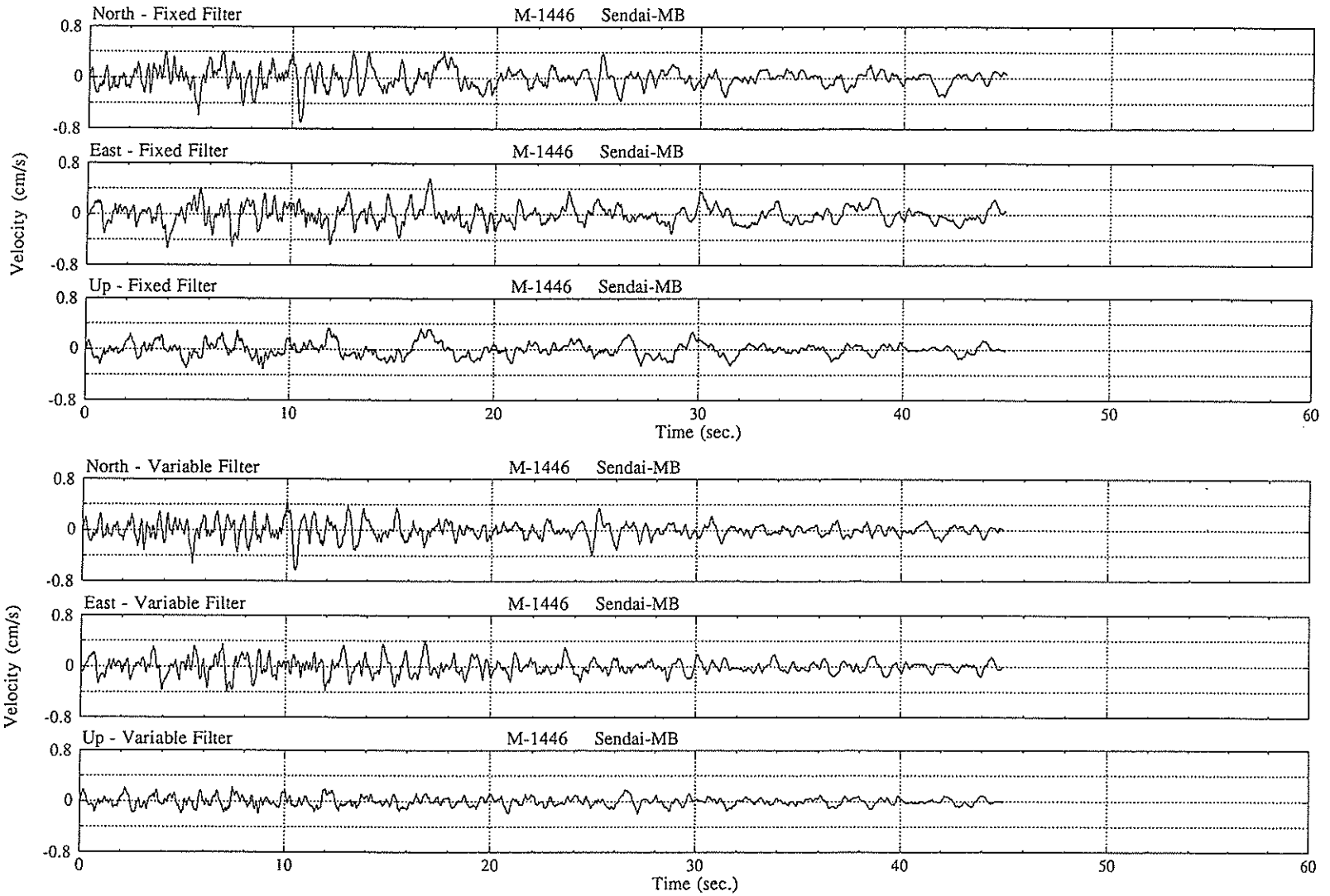
****

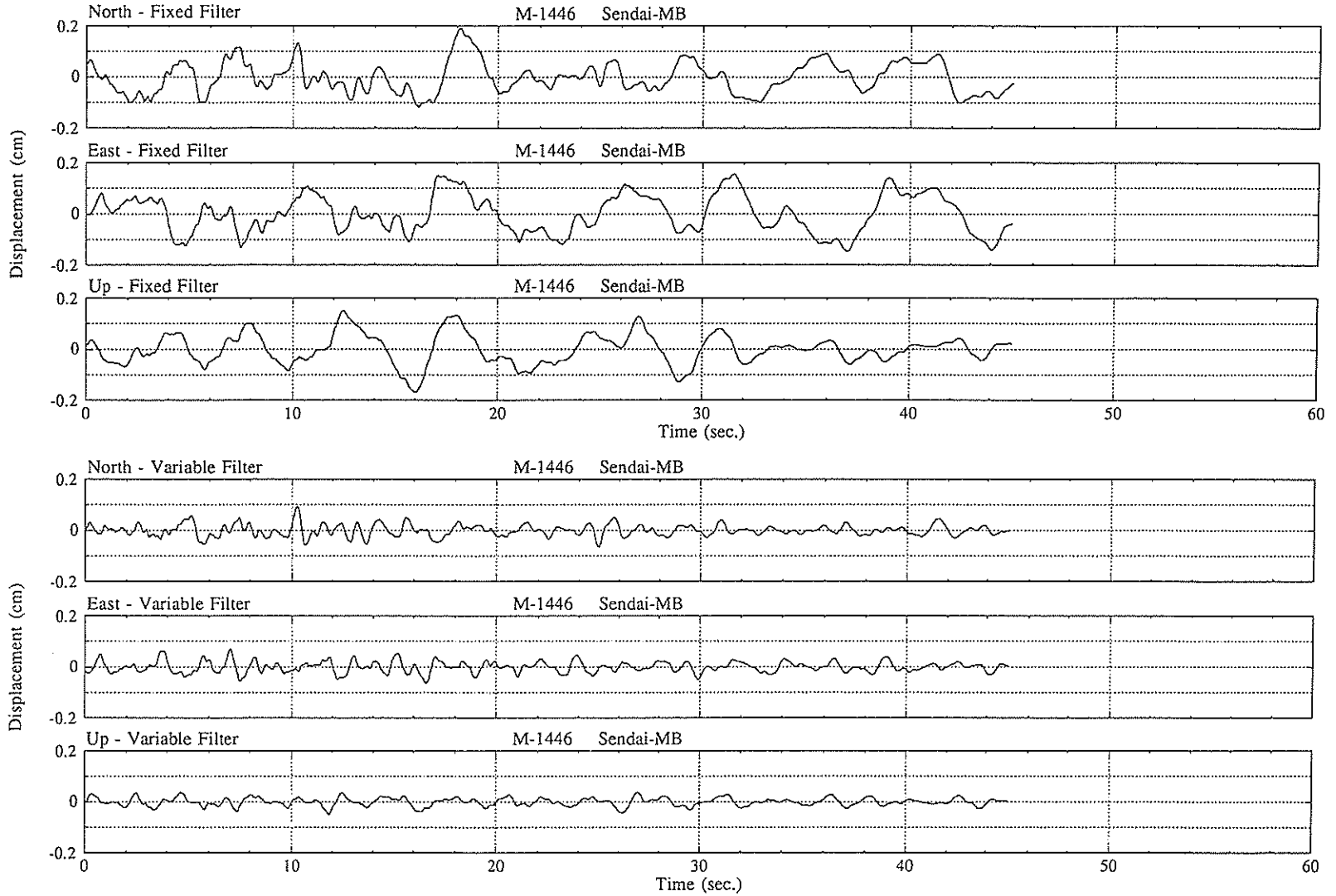
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.352	0.352	0.352	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	5.6	4.5	2.8	6.2
ORIGINAL	7.1	6.1	3.8	8.0
CORRECTED	7.2	6.2	3.8	7.8
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	0.70	0.57	0.33	0.74
VARIABLE FILTER	0.63	0.41	0.23	0.65
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.19	0.16	0.17	0.22
VARIABLE FILTER	0.09	0.07	0.05	0.10

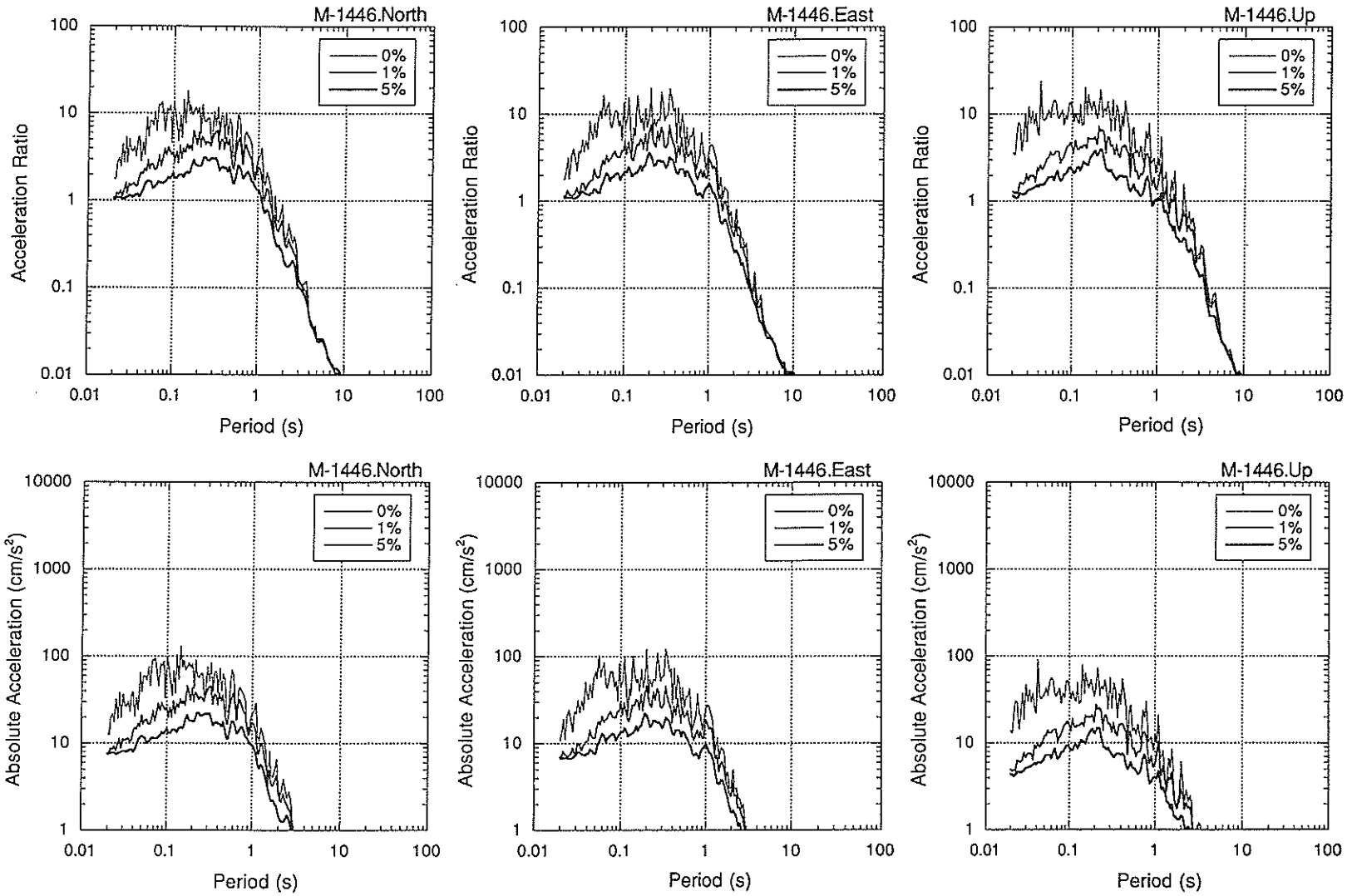
* RESULTANT OF HORIZONTAL COMPONENTS

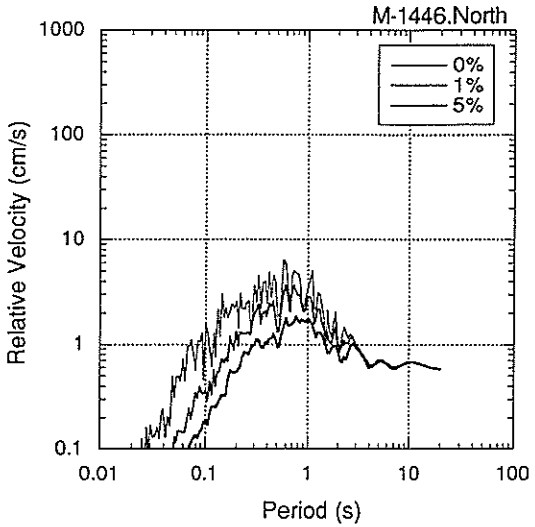

North - Original
M-1446 Sendai-MB
East - Original
M-1446 Sendai-MB
Up - Original
M-1446 Sendai-MB
Acceleration (cm/s²)
8
0
-8
0
10
20
30
40
50
60
Time (sec.)
North - Corrected
M-1446 Sendai-MB
East - Corrected
M-1446 Sendai-MB
Up - Corrected
M-1446 Sendai-MB
Acceleration (cm/s²)
Time (sec.)

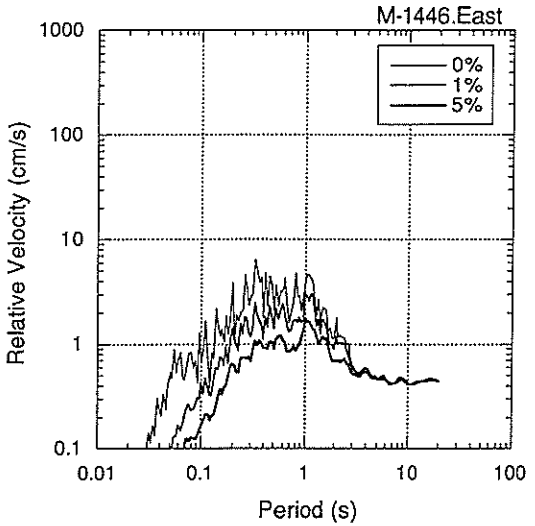

North - Original
M-1446 Sendai-MB
East - Original
M-1446 Sendai-MB
Up - Original
M-1446 Sendai-MB
Acceleration (cm/s²)
Time (sec.)
North - SMAC Equivalent
M-1446 Sendai-MB
East - SMAC Equivalent
M-1446 Sendai-MB
Up - SMAC Equivalent
M-1446 Sendai-MB
Acceleration (cm/s²)
Time (sec.)

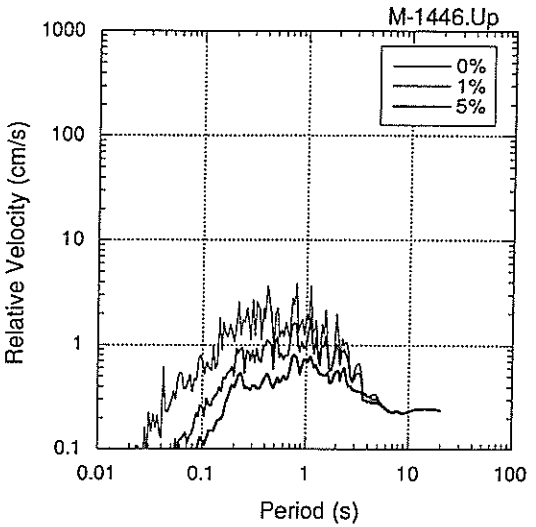

North - Fixed Filter
M-1446 Sendai-MB
East - Fixed Filter
M-1446 Sendai-MB
Up - Fixed Filter
M-1446 Sendai-MB
Velocity (cm/s)
0.8
0
-0.8
0
10
20
30
40
50
60
Time (sec.)
North - Variable Filter
M-1446 Sendai-MB
East - Variable Filter
M-1446 Sendai-MB
Up - Variable Filter
M-1446 Sendai-MB
Velocity (cm/s)
Time (sec.)

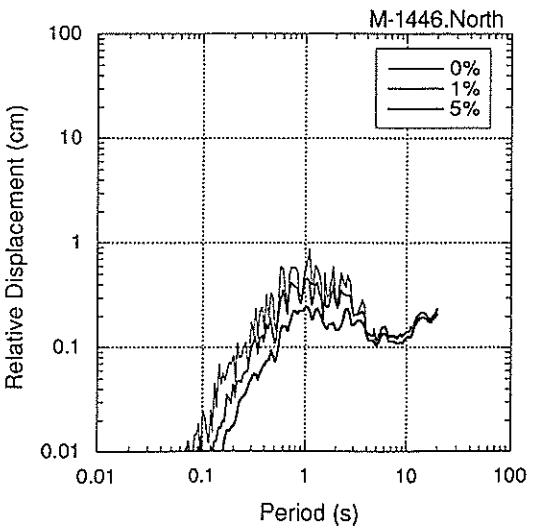

North - Fixed Filter
M-1446 Sendai-MB
East - Fixed Filter
M-1446 Sendai-MB
Up - Fixed Filter
M-1446 Sendai-MB
Displacement (cm)
0.2
0
-0.2
0
10
20
30
40
50
60
Time (sec.)
North - Variable Filter
M-1446 Sendai-MB
East - Variable Filter
M-1446 Sendai-MB
Up - Variable Filter
M-1446 Sendai-MB
Displacement (cm)
Time (sec.)

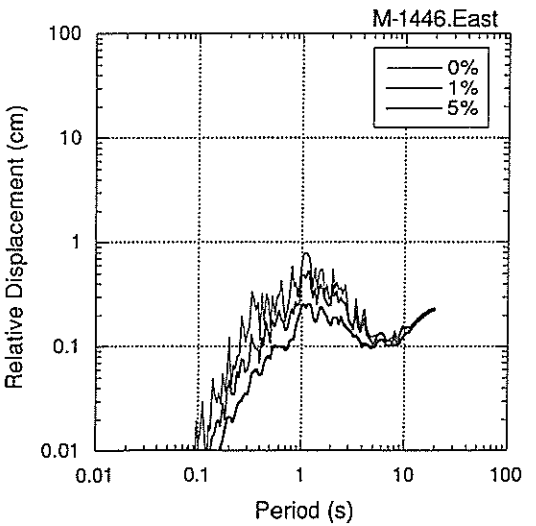

M-1446.North
M-1446.East
M-1446.Up
0%
1%
5%
Acceleration Ratio
Absolute Acceleration (cm/s²)
Period (s)
0.01
0.1
1
10
100
1000
10000

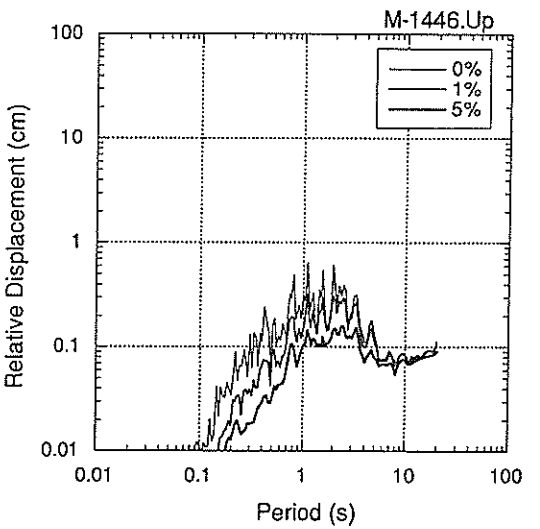

M-1446.North
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100

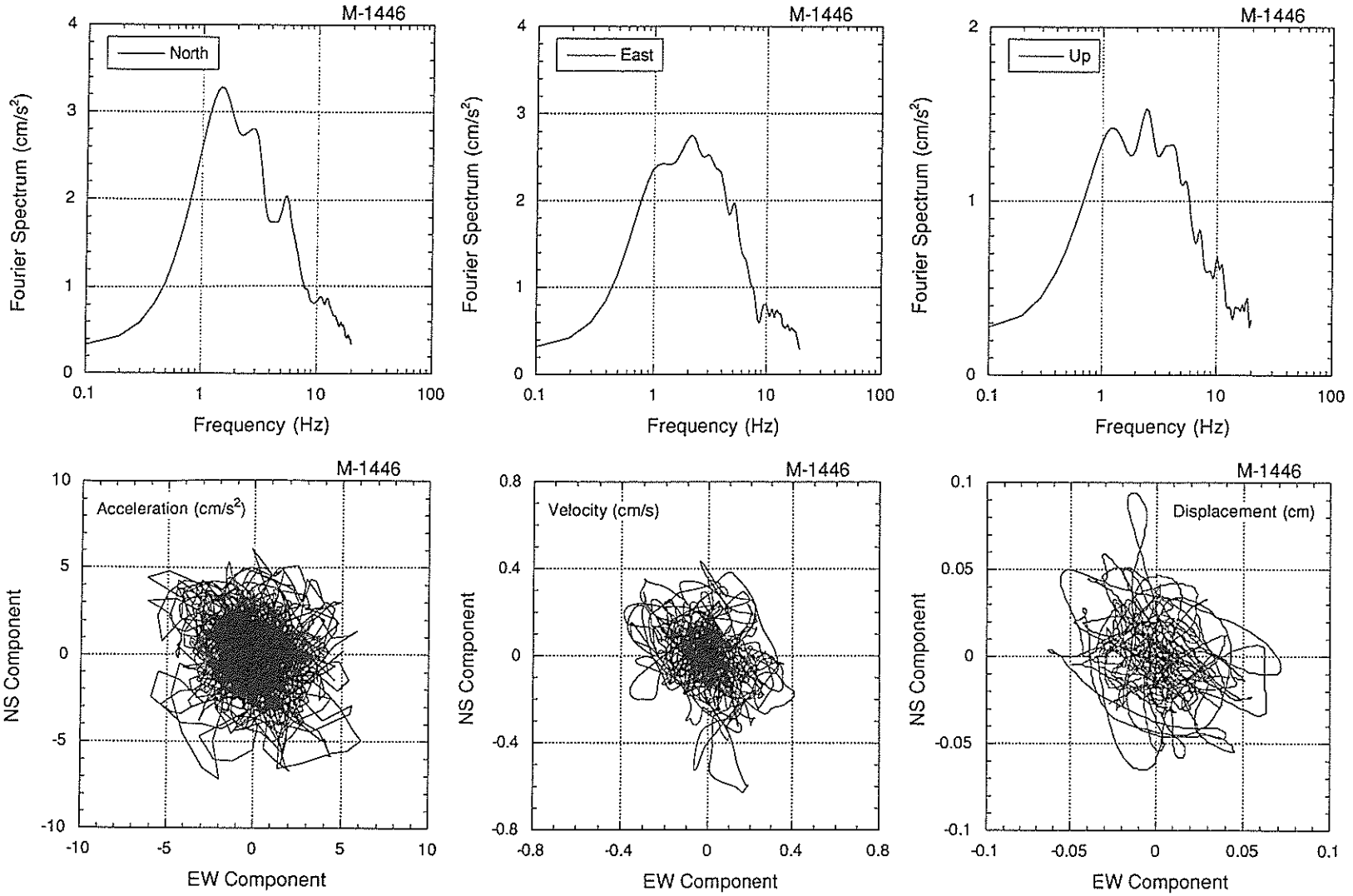

M-1446.East
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100


M-1446.Up
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100


M-1446.North
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100


M-1446.East
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100


M-1446.Up
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100


M-1446
North
Fourier Spectrum (cm/s²)
Frequency (Hz)
M-1446
East
Fourier Spectrum (cm/s²)
Frequency (Hz)
M-1446
Up
Fourier Spectrum (cm/s²)
Frequency (Hz)
M-1446
Acceleration (cm/s²)
NS Component
EW Component
M-1446
Velocity (cm/s)
NS Component
EW Component
M-1446
Displacement (cm)
NS Component
EW Component

RECORD NUMBER : M-1447

STATION : KAMAISHI-M

EARTHQUAKE DATA

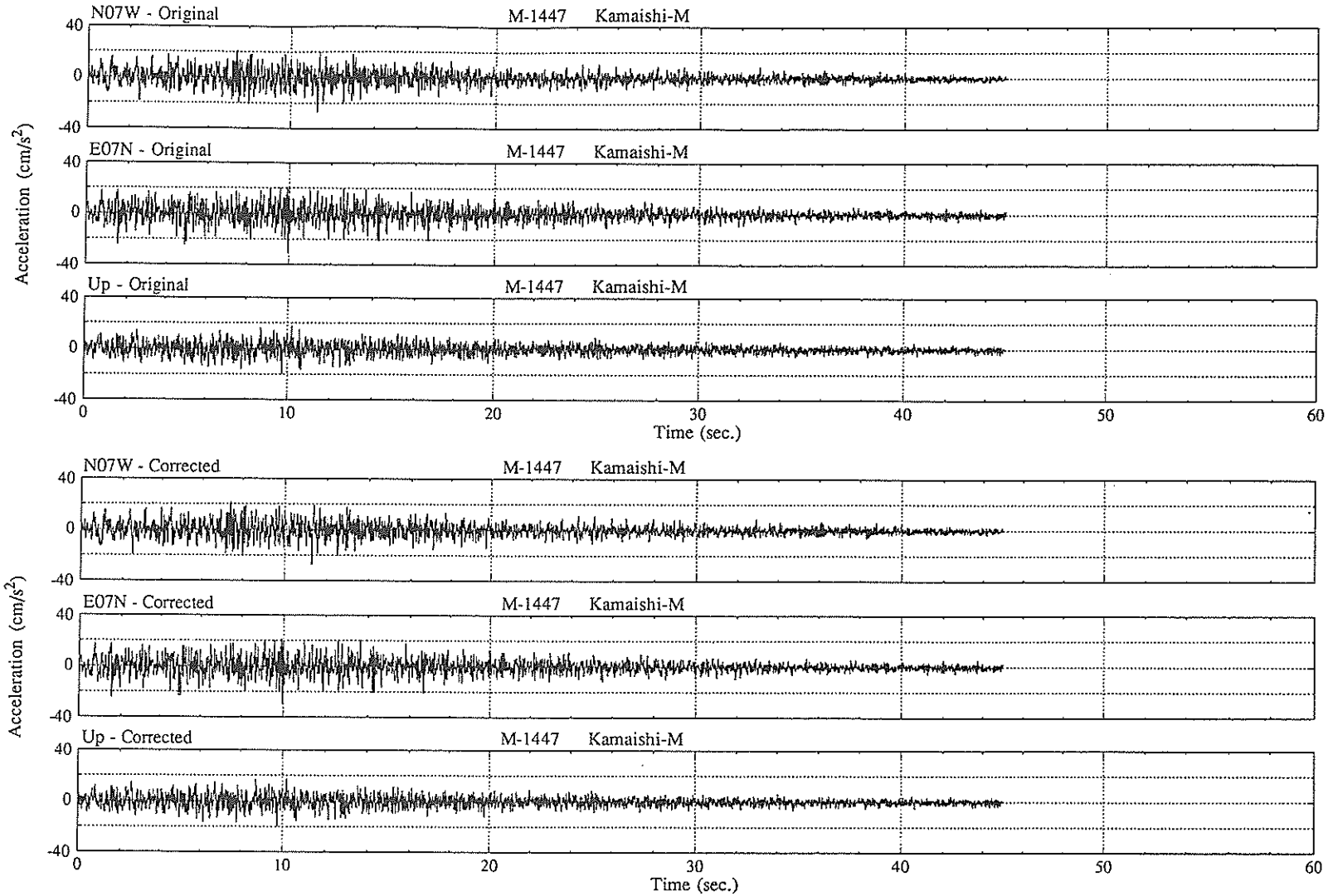
****

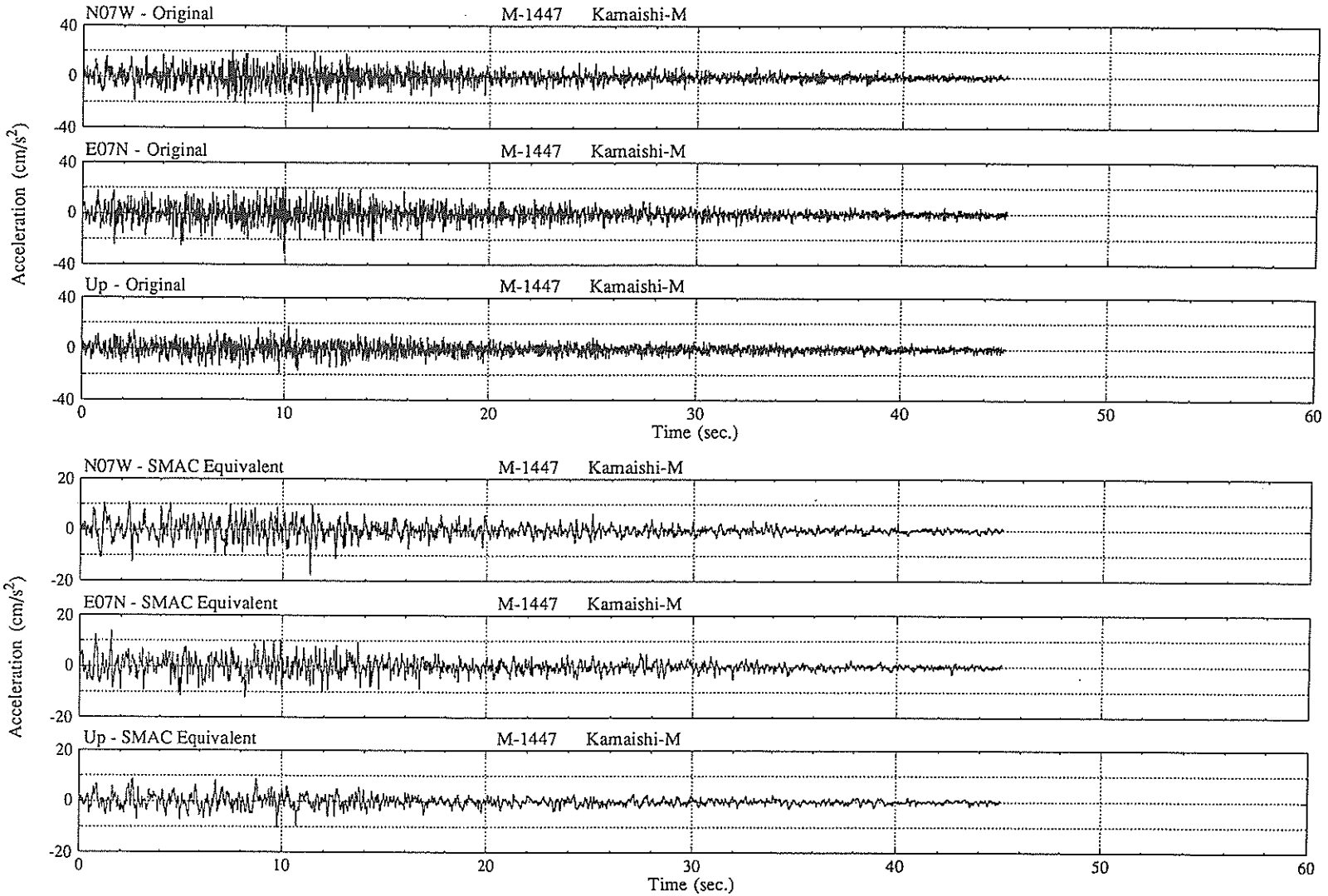
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

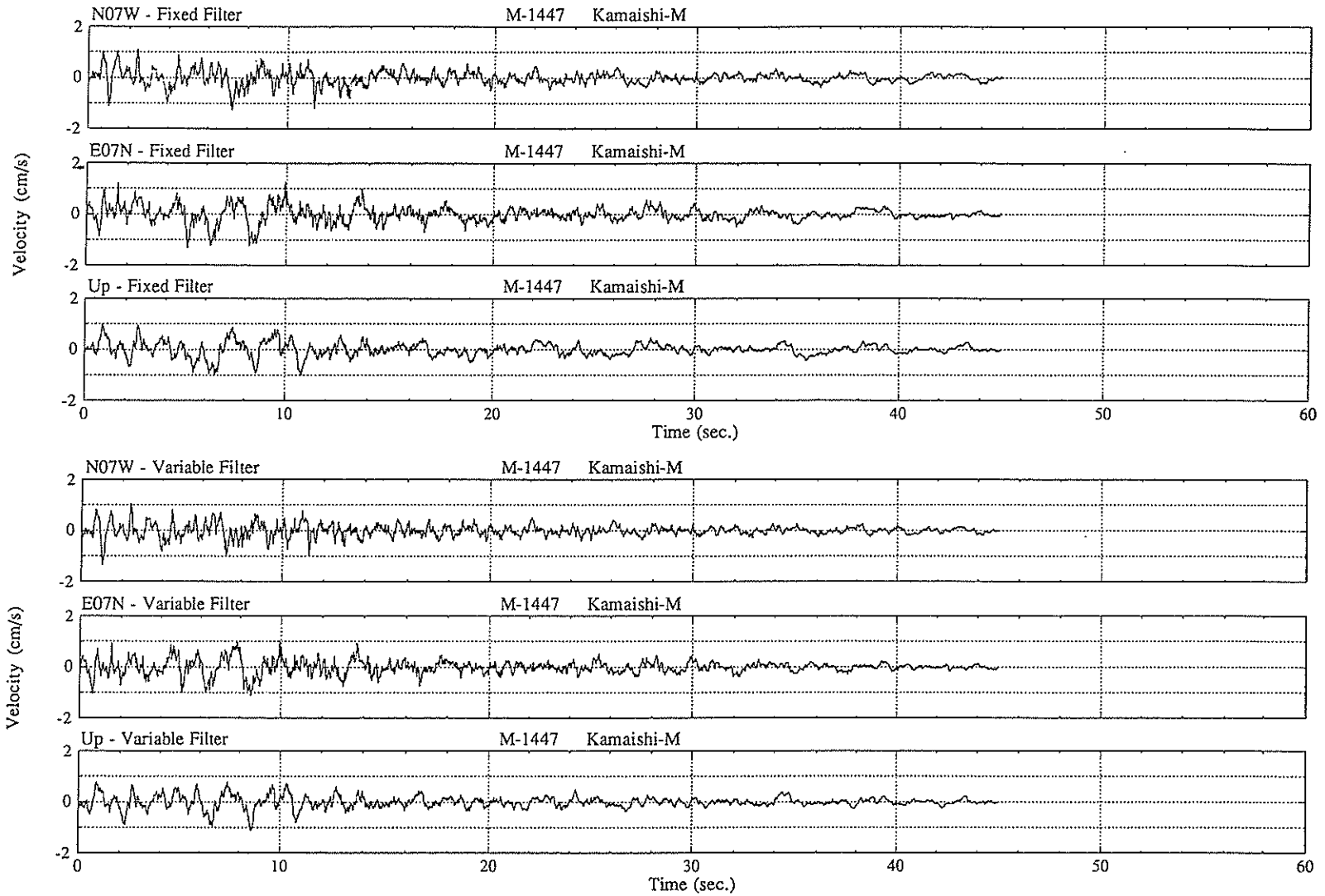
****

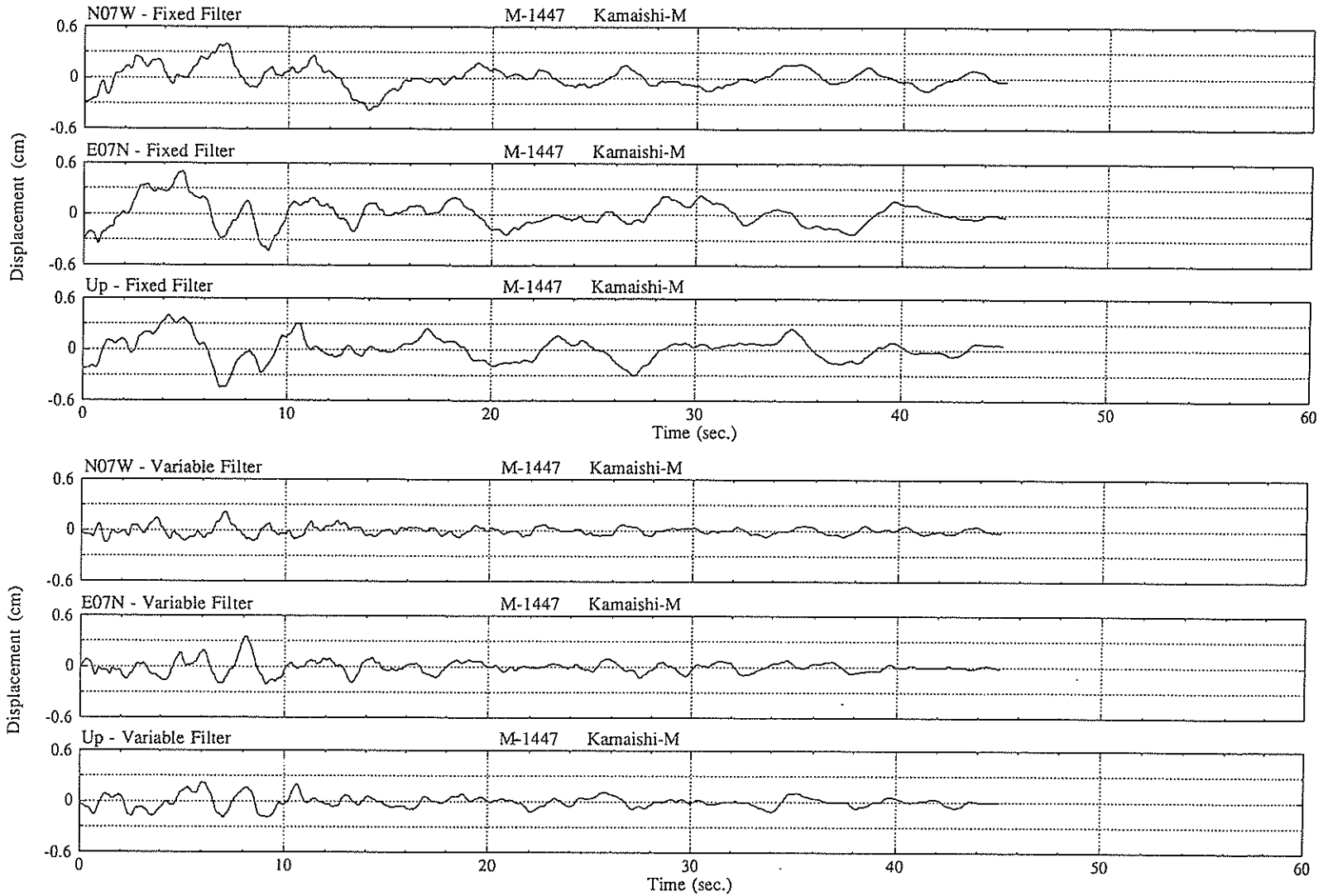
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.230	0.205	0.193	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	17.6	14.0	10.3	19.0
ORIGINAL	26.9	30.8	19.0	31.7
CORRECTED	26.9	29.7	19.1	30.3
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	1.26	1.30	1.00	1.42
VARIABLE FILTER	1.33	1.11	1.11	1.37
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.40	0.51	0.45	0.51
VARIABLE FILTER	0.22	0.36	0.23	0.37

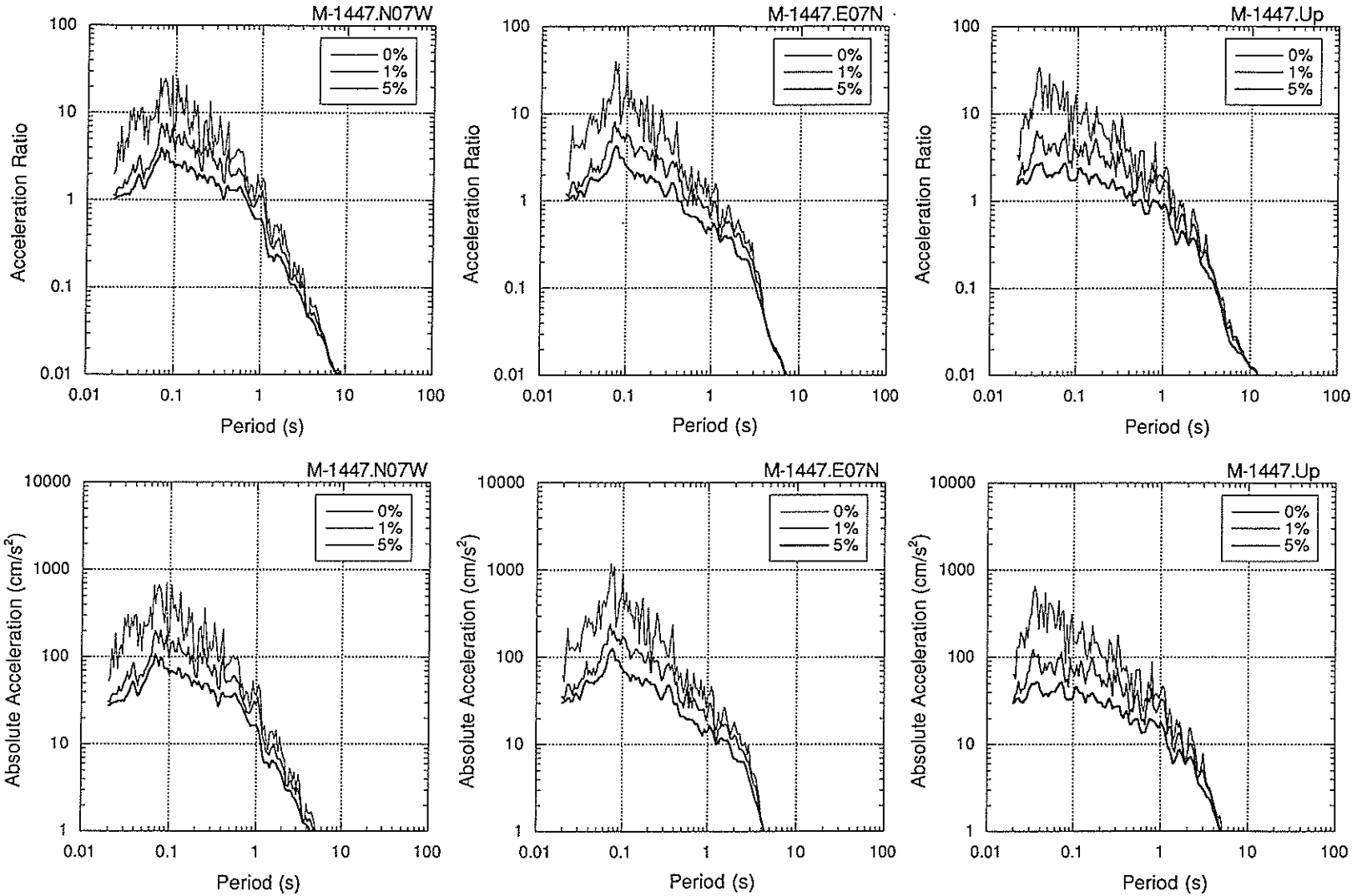
* RESULTANT OF HORIZONTAL COMPONENTS

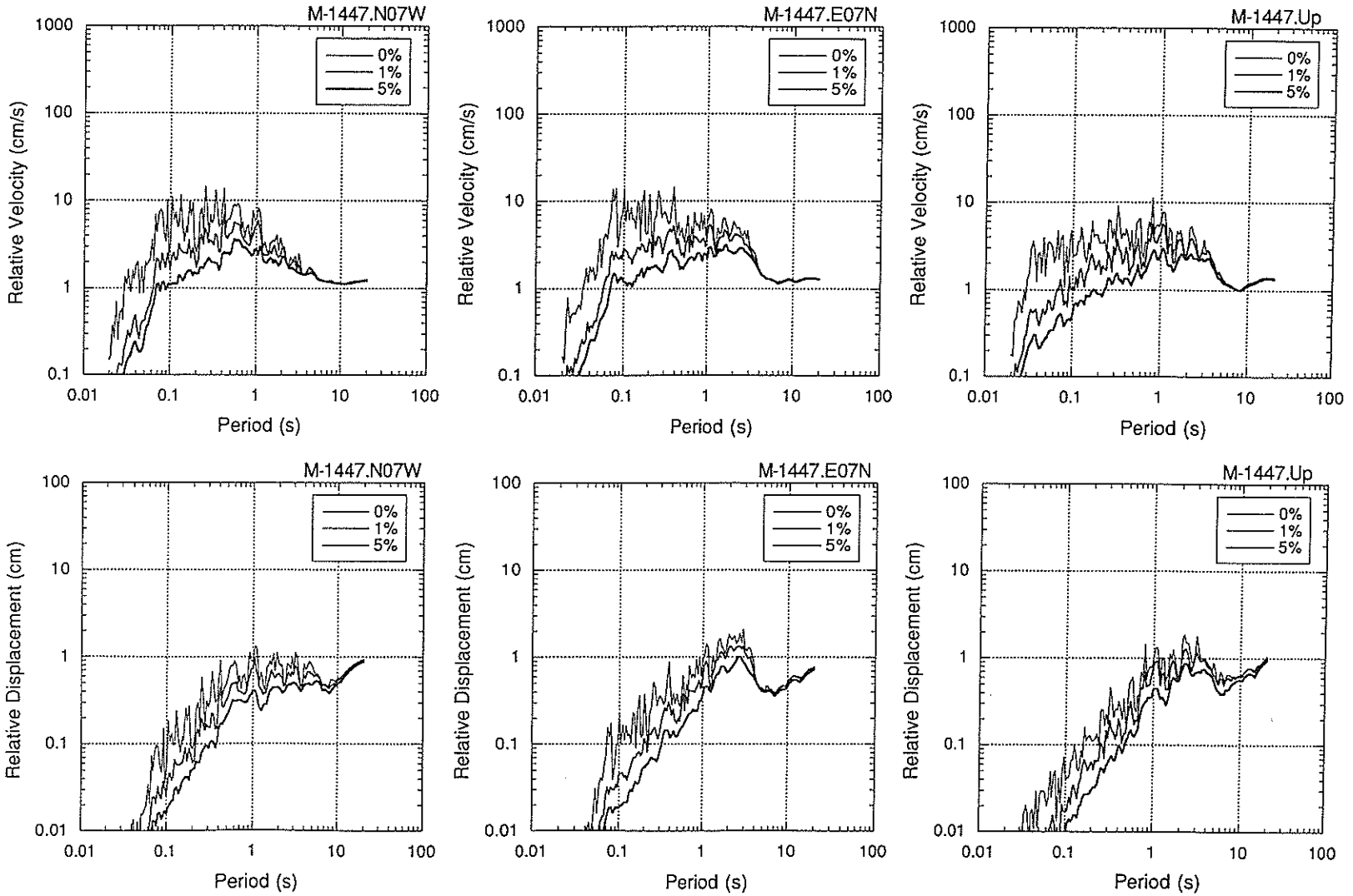

N07W - Original
M-1447 Kamaishi-M
E07N - Original
M-1447 Kamaishi-M
Up - Original
M-1447 Kamaishi-M
Acceleration (cm/s²)
40
0
-40
0
10
20
30
40
50
60
Time (sec.)
N07W - Corrected
M-1447 Kamaishi-M
E07N - Corrected
M-1447 Kamaishi-M
Up - Corrected
M-1447 Kamaishi-M
Acceleration (cm/s²)
Time (sec.)

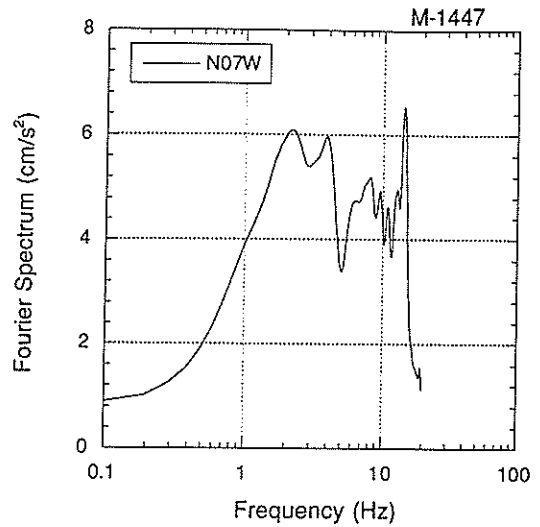

N07W - Original
M-1447 Kamaishi-M
E07N - Original
M-1447 Kamaishi-M
Up - Original
M-1447 Kamaishi-M
Acceleration (cm/s²)
Time (sec.)
N07W - SMAC Equivalent
M-1447 Kamaishi-M
E07N - SMAC Equivalent
M-1447 Kamaishi-M
Up - SMAC Equivalent
M-1447 Kamaishi-M
Acceleration (cm/s²)
Time (sec.)

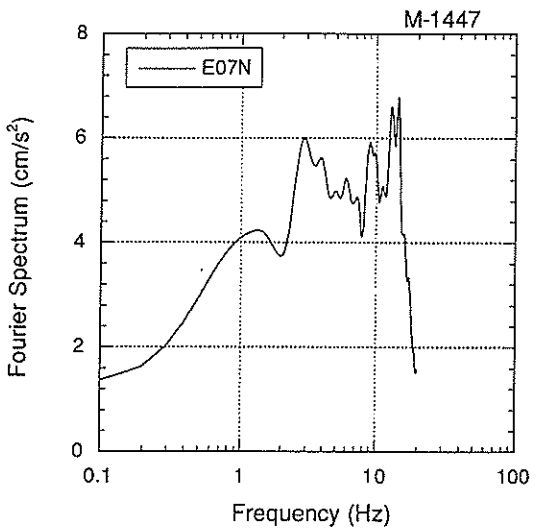

N07W - Fixed Filter
M-1447 Kamaishi-M
E07N - Fixed Filter
M-1447 Kamaishi-M
Up - Fixed Filter
M-1447 Kamaishi-M
Velocity (cm/s)
Time (sec.)
N07W - Variable Filter
M-1447 Kamaishi-M
E07N - Variable Filter
M-1447 Kamaishi-M
Up - Variable Filter
M-1447 Kamaishi-M
Velocity (cm/s)
Time (sec.)

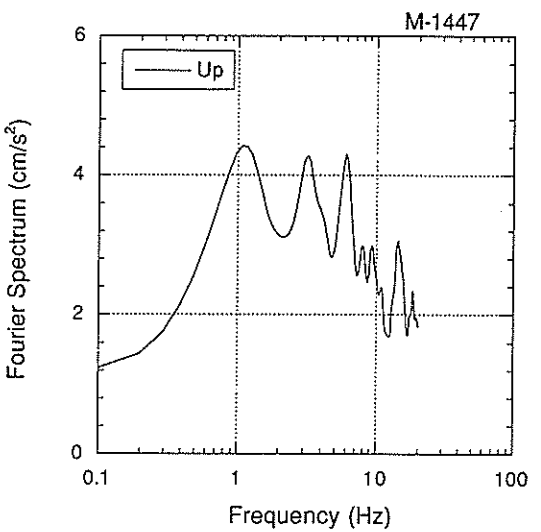

N07W - Fixed Filter
M-1447 Kamaishi-M
E07N - Fixed Filter
M-1447 Kamaishi-M
Up - Fixed Filter
M-1447 Kamaishi-M
Displacement (cm)
0.6
0
-0.6
0
10
20
30
40
50
60
Time (sec.)
N07W - Variable Filter
M-1447 Kamaishi-M
E07N - Variable Filter
M-1447 Kamaishi-M
Up - Variable Filter
M-1447 Kamaishi-M
Displacement (cm)
Time (sec.)

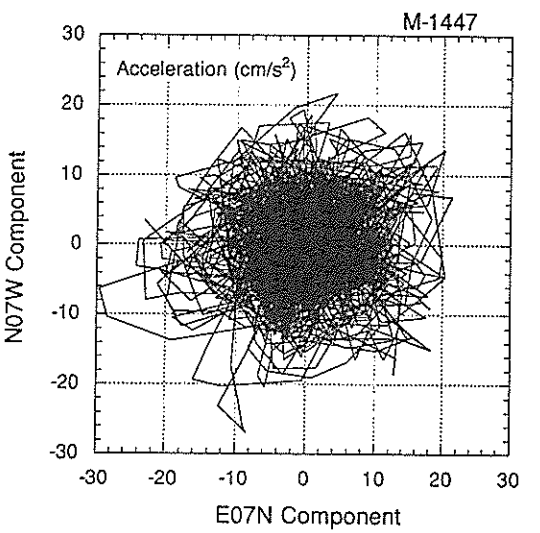

M-1447.N07W
M-1447.E07N
M-1447.Up
0%
1%
5%
Acceleration Ratio
Absolute Acceleration (cm/s²)
Period (s)
0.01
0.1
1
10
100
1000
10000

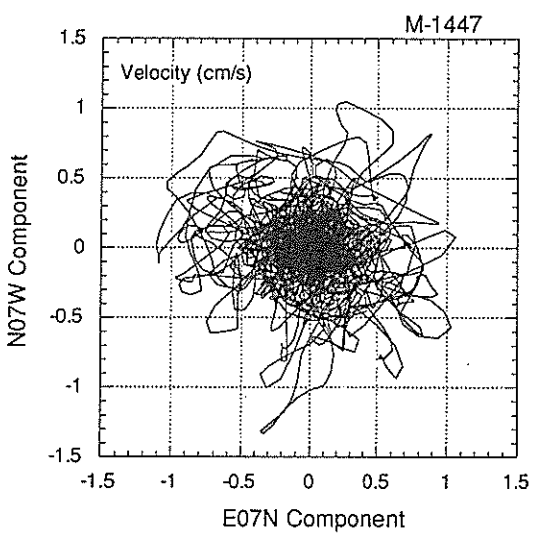

M-1447.N07W
M-1447.E07N
M-1447.Up
0%
1%
5%
Relative Velocity (cm/s)
Relative Displacement (cm)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100

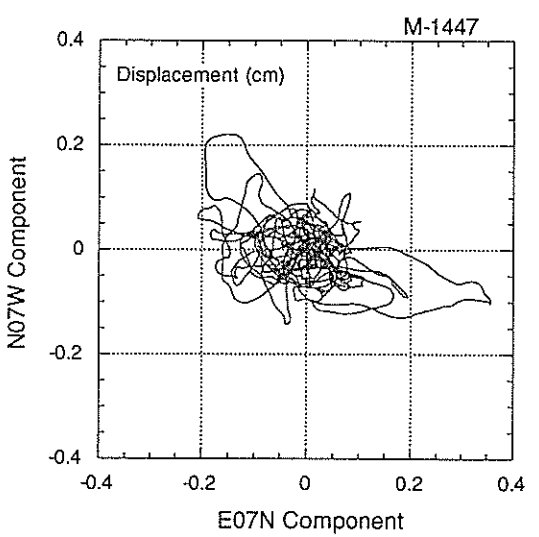

M-1447
N07W
Fourier Spectrum (cm/s²)
Frequency (Hz)


M-1447
E07N
Fourier Spectrum (cm/s²)
Frequency (Hz)


M-1447
Up
Fourier Spectrum (cm/s²)
Frequency (Hz)


M-1447
Acceleration (cm/s²)
N07W Component
E07N Component


M-1447
Velocity (cm/s)
N07W Component
E07N Component


M-1447
Displacement (cm)
N07W Component
E07N Component

RECORD NUMBER : M-1448

STATION : KAMAISHI-MB

EARTHQUAKE DATA

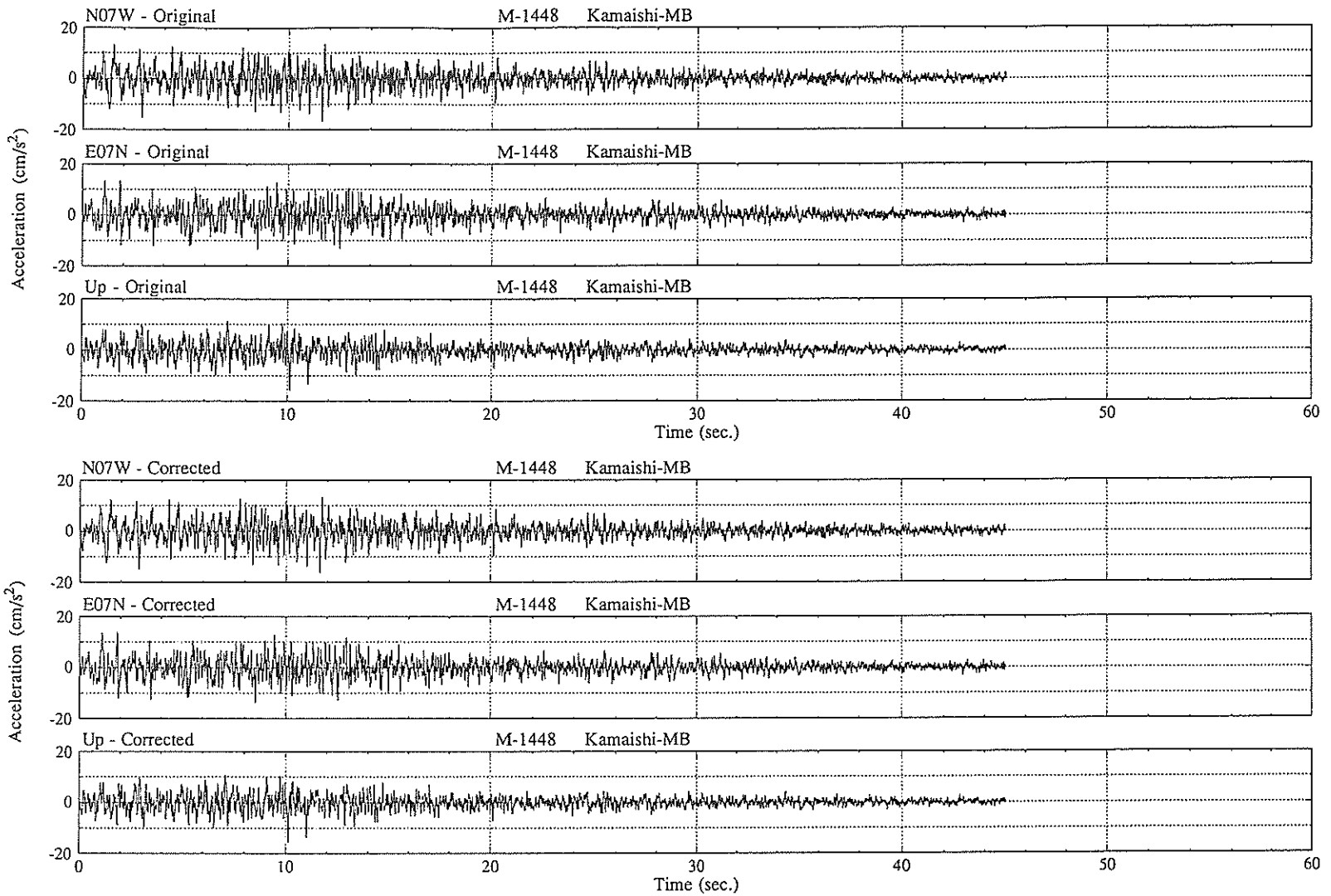
****

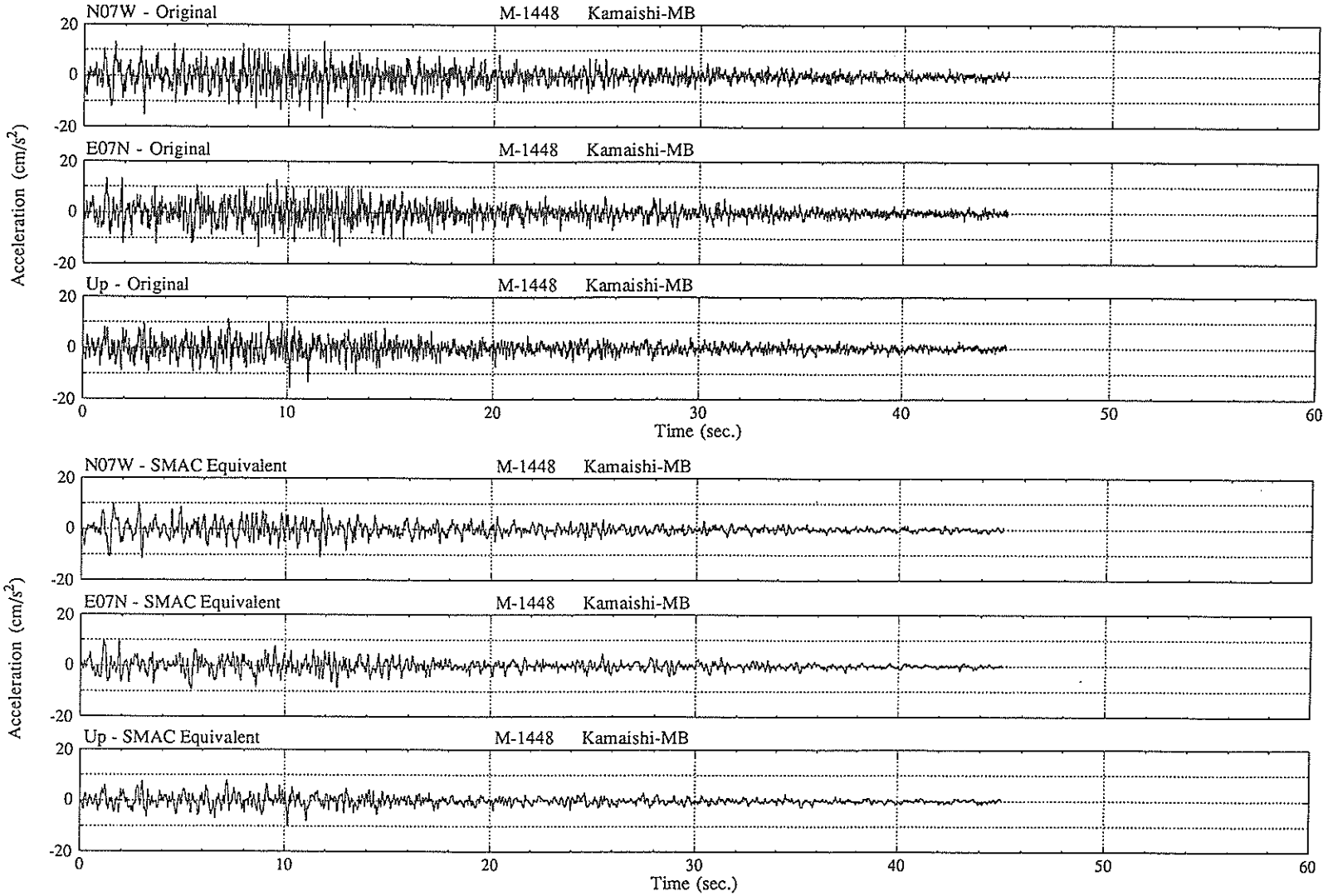
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

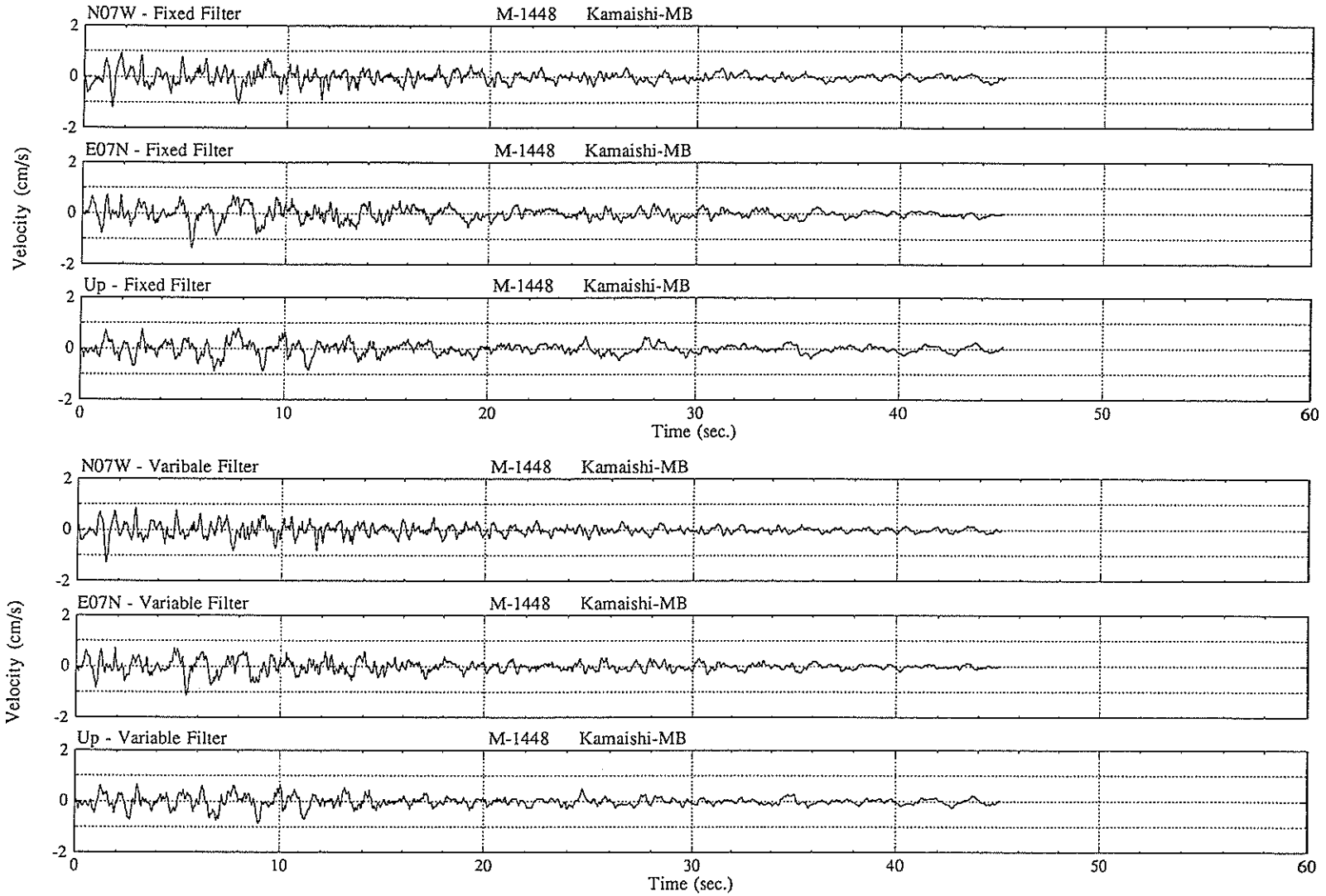
****

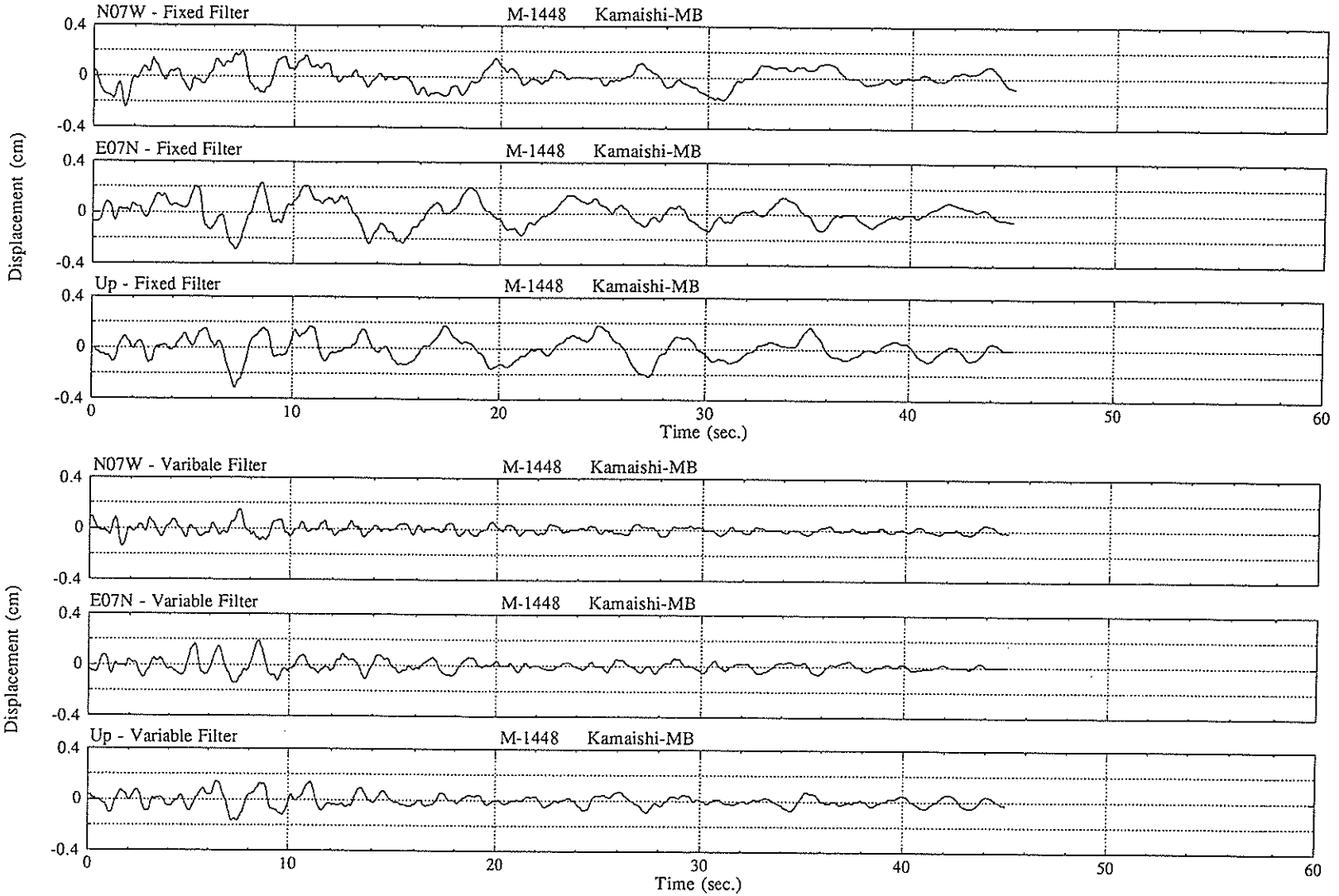
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.303	0.291	0.266	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	11.5	10.3	10.0	12.0
ORIGINAL	16.5	13.6	15.7	19.0
CORRECTED	16.2	13.8	15.4	18.8
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	1.19	1.35	0.88	1.36
VARIABLE FILTER	1.28	1.13	0.85	1.30
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.24	0.29	0.31	0.33
VARIABLE FILTER	0.15	0.19	0.17	0.21

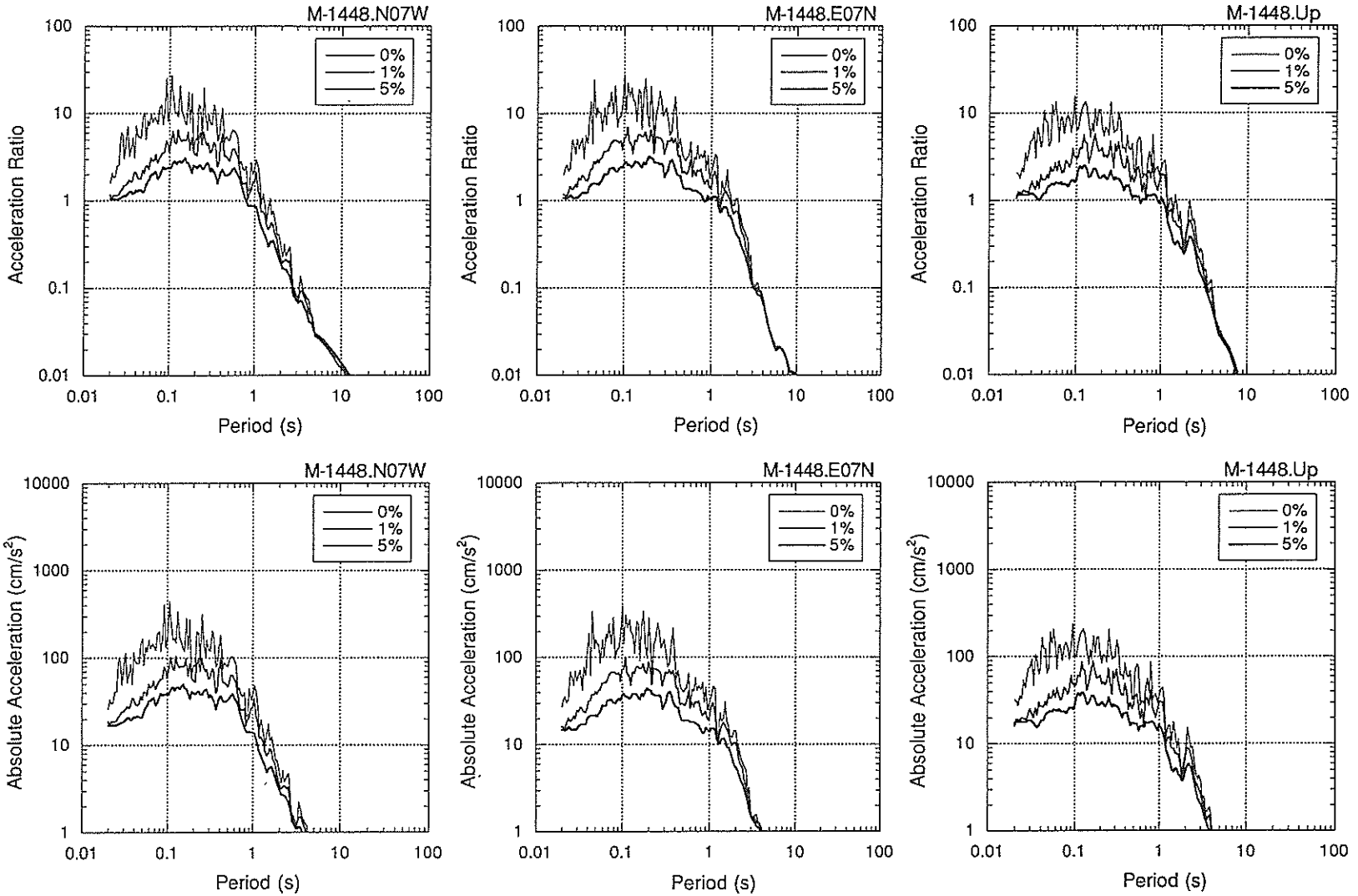
* RESULTANT OF HORIZONTAL COMPONENTS

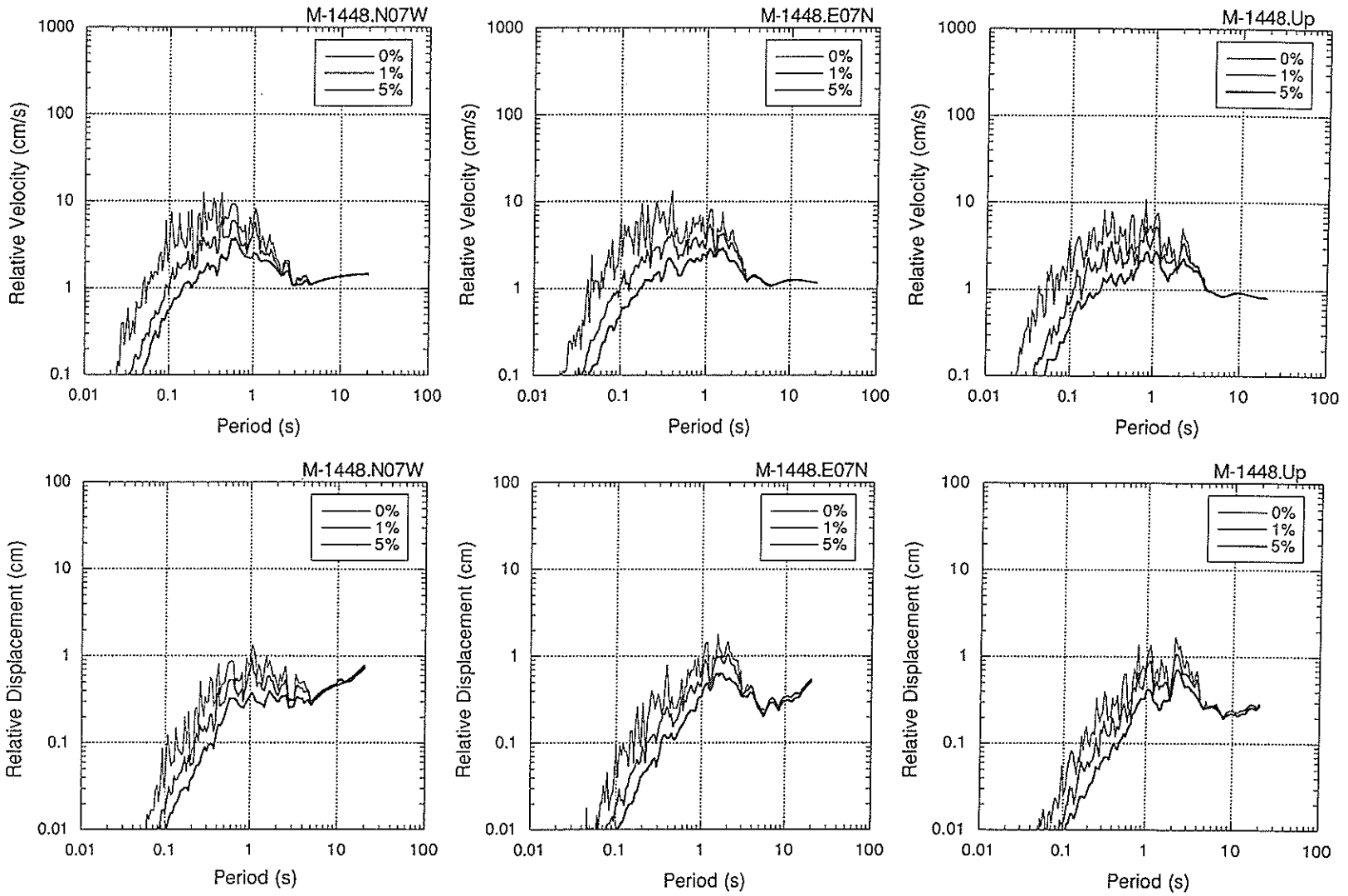

N07W - Original
M-1448 Kamaishi-MB
E07N - Original
M-1448 Kamaishi-MB
Up - Original
M-1448 Kamaishi-MB
Acceleration (cm/s²)
20
0
-20
0
10
20
30
40
50
60
Time (sec.)
N07W - Corrected
M-1448 Kamaishi-MB
E07N - Corrected
M-1448 Kamaishi-MB
Up - Corrected
M-1448 Kamaishi-MB
Acceleration (cm/s²)
Time (sec.)

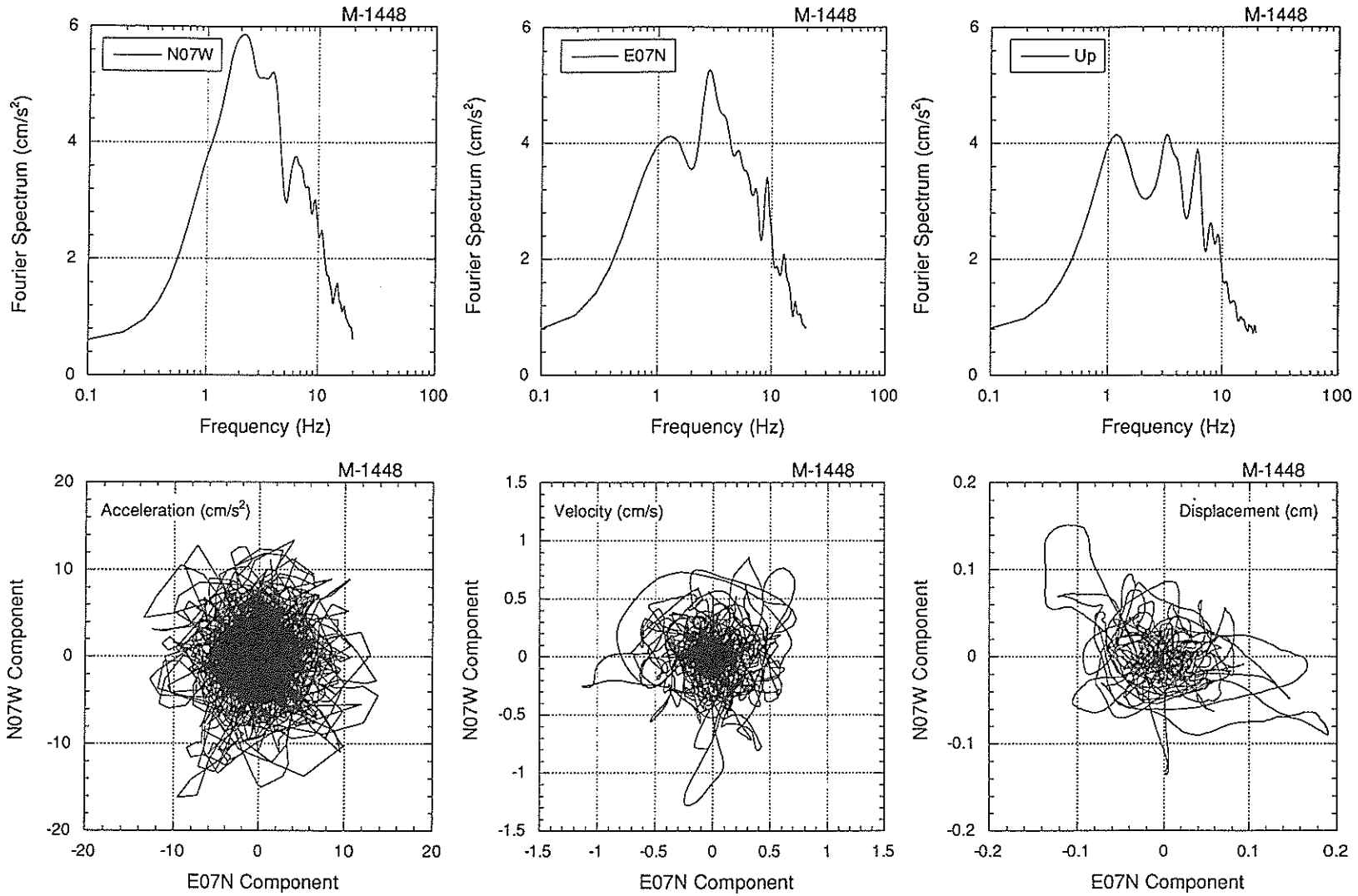

N07W - Original
M-1448 Kamaishi-MB
E07N - Original
M-1448 Kamaishi-MB
Up - Original
M-1448 Kamaishi-MB
Acceleration (cm/s²)
Time (sec.)
N07W - SMAC Equivalent
M-1448 Kamaishi-MB
E07N - SMAC Equivalent
M-1448 Kamaishi-MB
Up - SMAC Equivalent
M-1448 Kamaishi-MB
Acceleration (cm/s²)
Time (sec.)


N07W - Fixed Filter
M-1448 Kamaishi-MB
E07N - Fixed Filter
M-1448 Kamaishi-MB
Up - Fixed Filter
M-1448 Kamaishi-MB
Velocity (cm/s)
Time (sec.)
N07W - Varibale Filter
M-1448 Kamaishi-MB
E07N - Variable Filter
M-1448 Kamaishi-MB
Up - Variable Filter
M-1448 Kamaishi-MB
Velocity (cm/s)
Time (sec.)


N07W - Fixed Filter
M-1448 Kamaishi-MB
E07N - Fixed Filter
M-1448 Kamaishi-MB
Up - Fixed Filter
M-1448 Kamaishi-MB
Displacement (cm)
0.4
0
-0.4
0
10
20
30
40
50
60
Time (sec.)
N07W - Varibale Filter
M-1448 Kamaishi-MB
E07N - Variable Filter
M-1448 Kamaishi-MB
Up - Variable Filter
M-1448 Kamaishi-MB
Displacement (cm)
Time (sec.)


M-1448.N07W
M-1448.E07N
M-1448.Up
0%
1%
5%
Acceleration Ratio
Absolute Acceleration (cm/s²)
Period (s)
0.01
0.1
1
10
100
1000
10000


M-1448.N07W
M-1448.E07N
M-1448.Up
0%
1%
5%
Relative Velocity (cm/s)
Relative Displacement (cm)
Period (s)
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100


M-1448
N07W
Fourier Spectrum (cm/s²)
Frequency (Hz)
M-1448
E07N
Fourier Spectrum (cm/s²)
Frequency (Hz)
M-1448
Up
Fourier Spectrum (cm/s²)
Frequency (Hz)
M-1448
Acceleration (cm/s²)
N07W Component
E07N Component
M-1448
Velocity (cm/s)
N07W Component
E07N Component
M-1448
Displacement (cm)
N07W Component
E07N Component

RECORD NUMBER : M-1450

STATION : OFUNATO-MOUND-M

EARTHQUAKE DATA

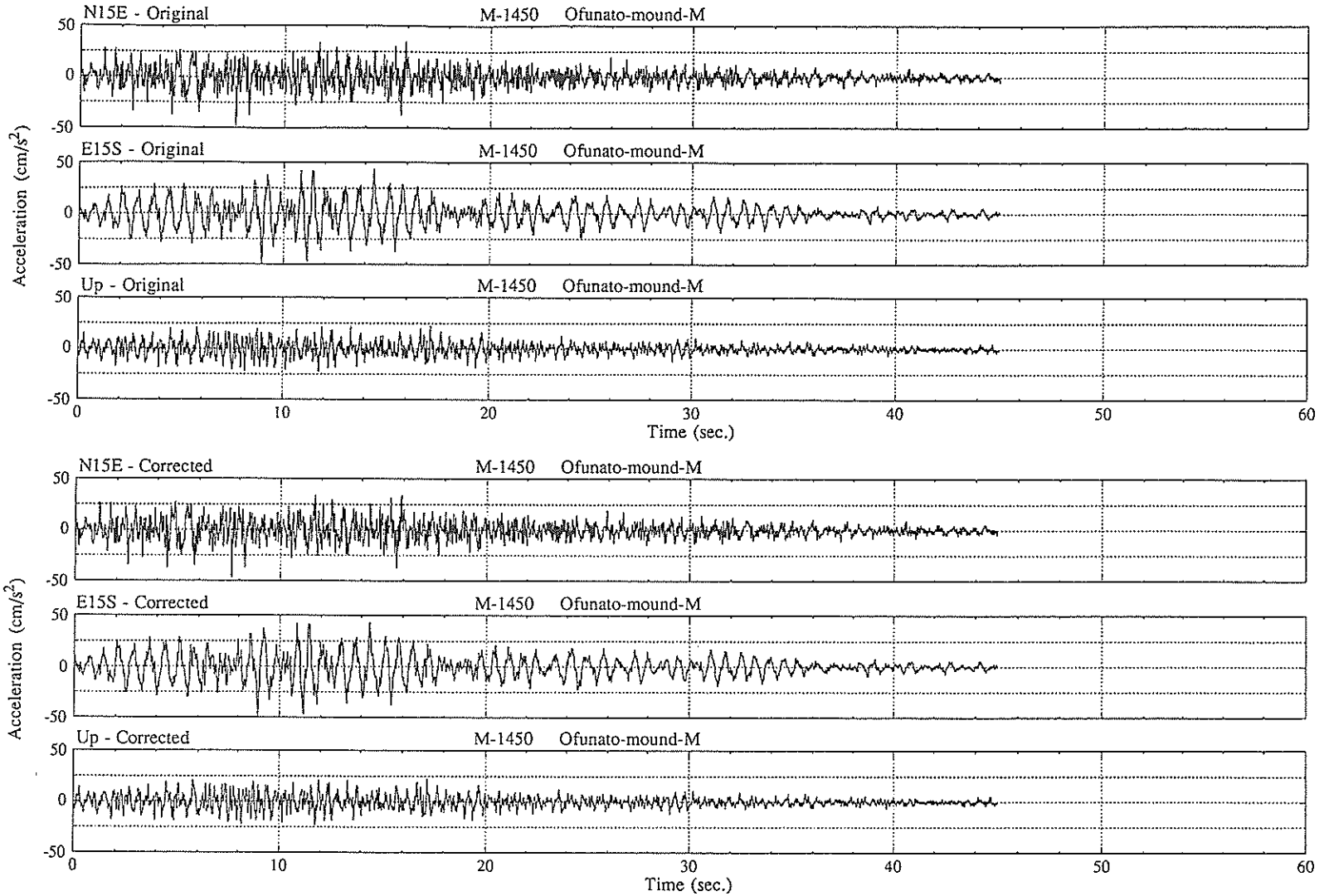
****

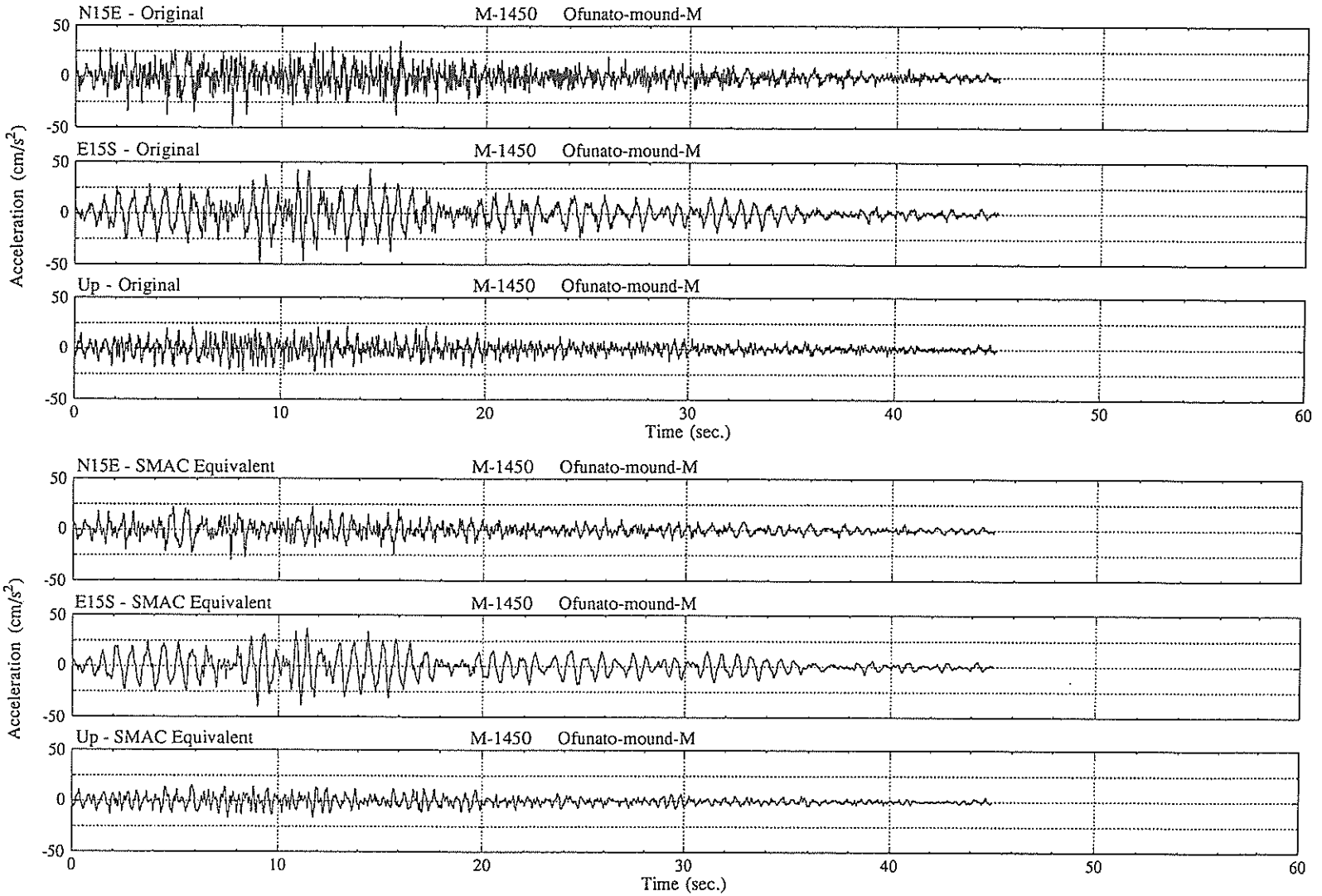
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

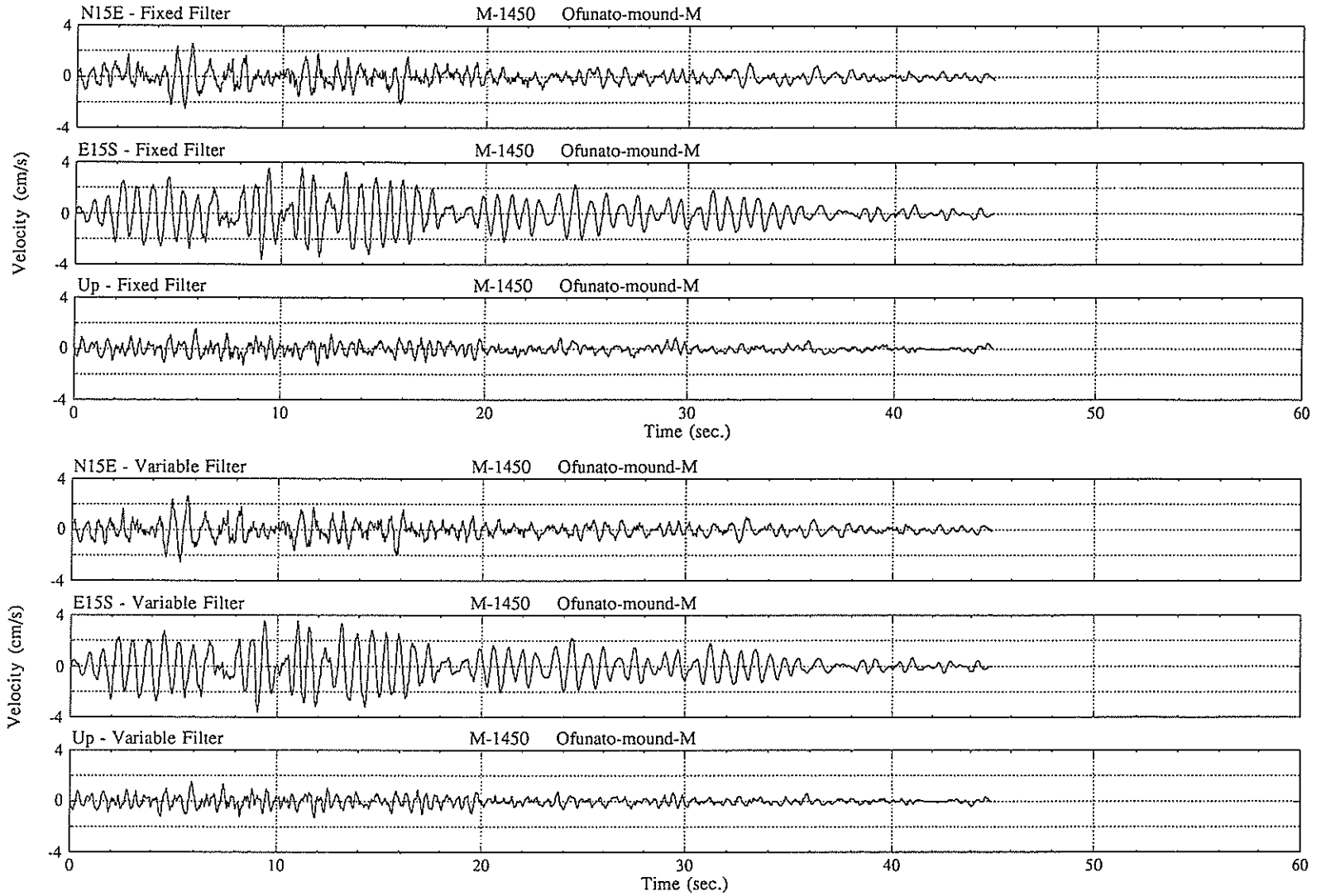
****

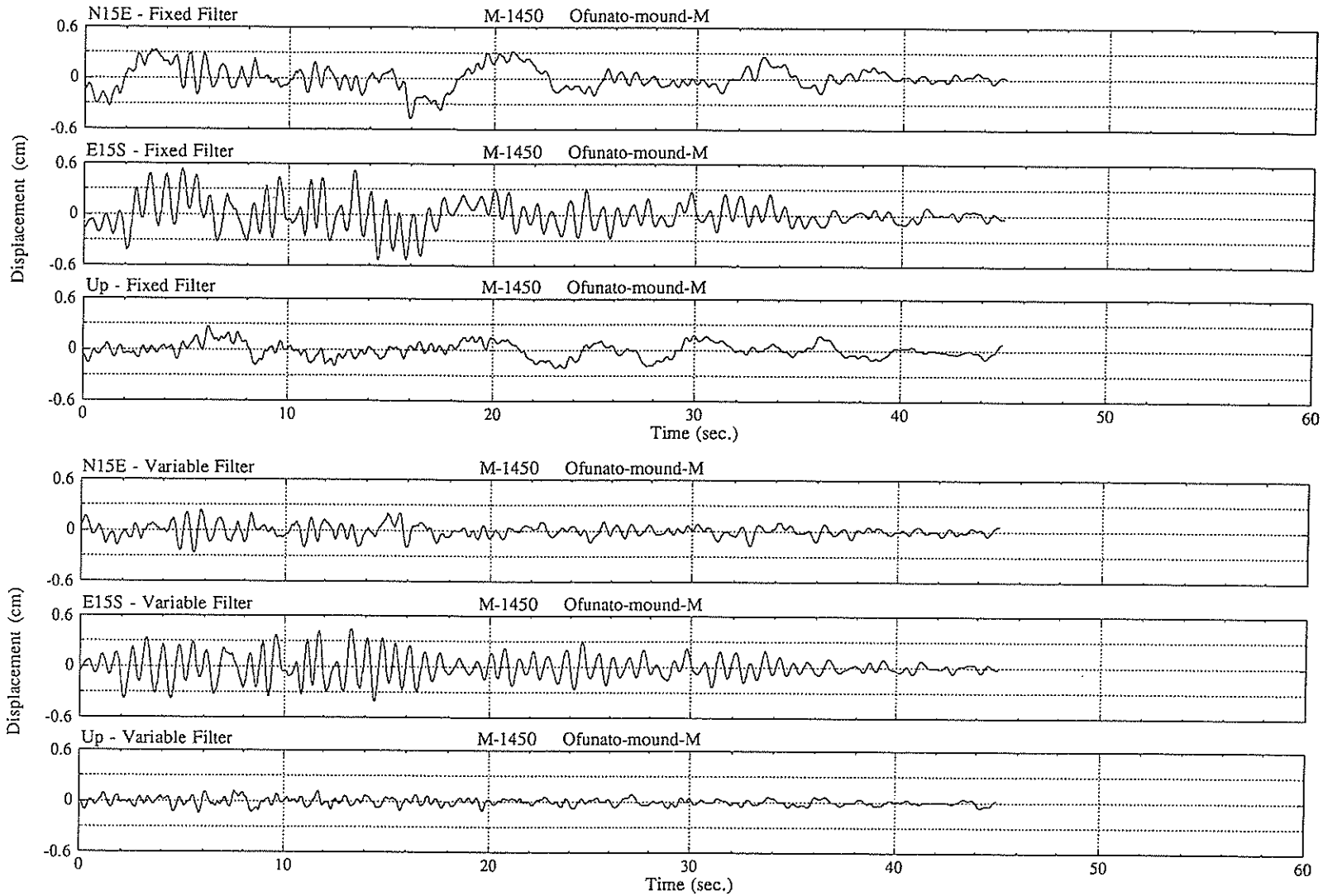
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.230	0.291	0.315	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	29.4	40.2	16.7	41.1
ORIGINAL	47.7	48.3	22.6	49.5
CORRECTED	46.8	48.9	23.1	50.4
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	2.61	3.60	1.59	3.68
VARIABLE FILTER	2.66	3.60	1.52	3.65
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.47	0.54	0.27	0.62
VARIABLE FILTER	0.26	0.45	0.14	0.45

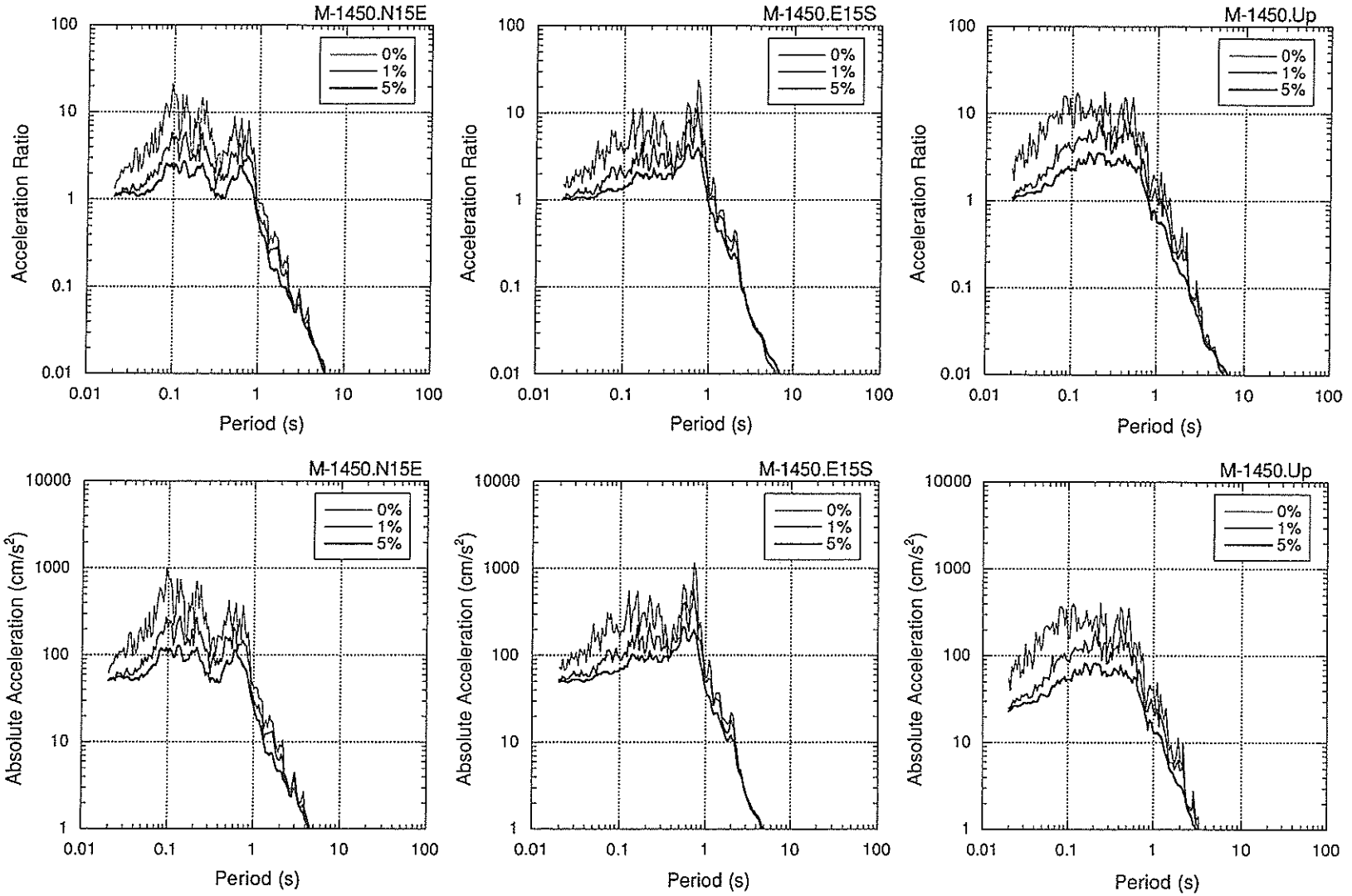
* RESULTANT OF HORIZONTAL COMPONENTS

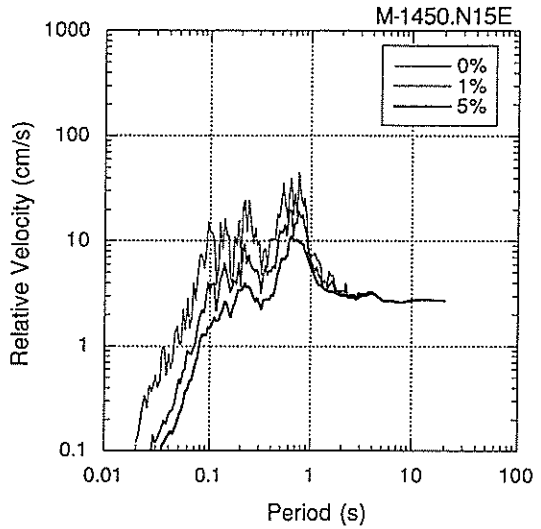

N15E - Original
M-1450 Ofunato-mound-M
E15S - Original
M-1450 Ofunato-mound-M
Up - Original
M-1450 Ofunato-mound-M
Acceleration (cm/s²)
Time (sec.)
N15E - Corrected
M-1450 Ofunato-mound-M
E15S - Corrected
M-1450 Ofunato-mound-M
Up - Corrected
M-1450 Ofunato-mound-M
Acceleration (cm/s²)
Time (sec.)

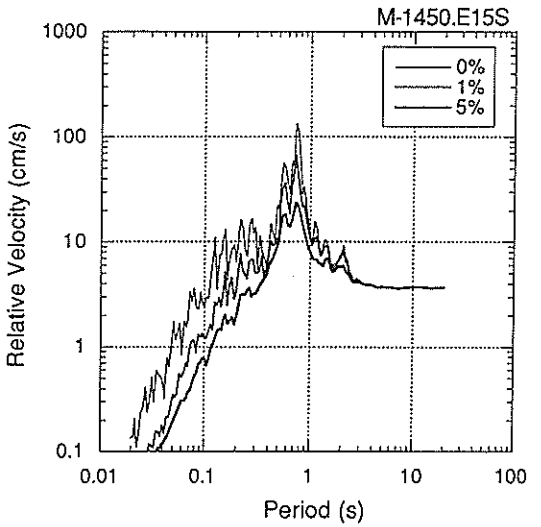

N15E - Original
M-1450 Ofunato-mound-M
E15S - Original
M-1450 Ofunato-mound-M
Up - Original
M-1450 Ofunato-mound-M
Acceleration (cm/s²)
50
0
-50
0
10
20
30
40
50
60
Time (sec.)
N15E - SMAC Equivalent
M-1450 Ofunato-mound-M
E15S - SMAC Equivalent
M-1450 Ofunato-mound-M
Up - SMAC Equivalent
M-1450 Ofunato-mound-M
Acceleration (cm/s²)
Time (sec.)

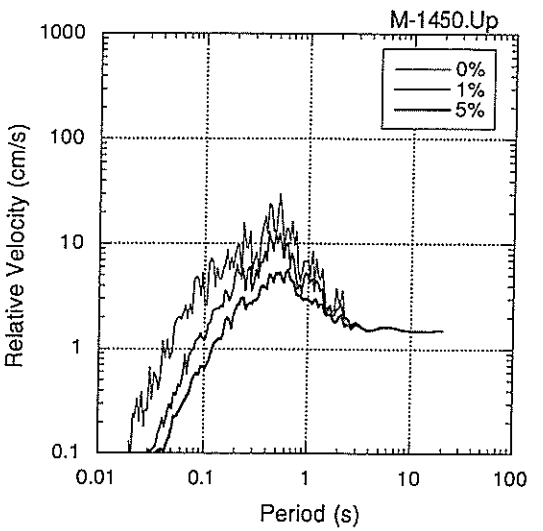

N15E - Fixed Filter
M-1450 Ofunato-mound-M
E15S - Fixed Filter
M-1450 Ofunato-mound-M
Up - Fixed Filter
M-1450 Ofunato-mound-M
Velocity (cm/s)
Time (sec.)
N15E - Variable Filter
M-1450 Ofunato-mound-M
E15S - Variable Filter
M-1450 Ofunato-mound-M
Up - Variable Filter
M-1450 Ofunato-mound-M
Velocity (cm/s)
Time (sec.)

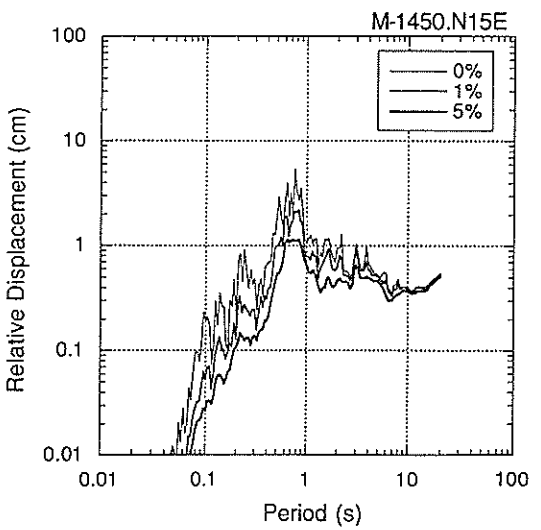

N15E - Fixed Filter
M-1450 Ofunato-mound-M
E15S - Fixed Filter
M-1450 Ofunato-mound-M
Up - Fixed Filter
M-1450 Ofunato-mound-M
Displacement (cm)
0.6
0
-0.6
0
10
20
30
40
50
60
Time (sec.)
N15E - Variable Filter
M-1450 Ofunato-mound-M
E15S - Variable Filter
M-1450 Ofunato-mound-M
Up - Variable Filter
M-1450 Ofunato-mound-M
Displacement (cm)
Time (sec.)

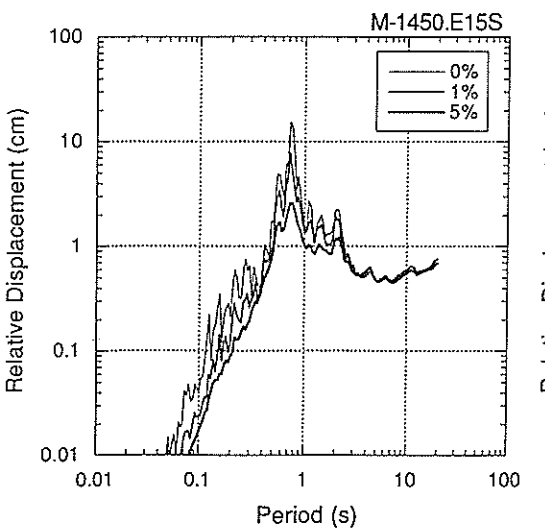

M-1450.N15E
M-1450.E15S
M-1450.Up
0%
1%
5%
Acceleration Ratio
Absolute Acceleration (cm/s²)
Period (s)
0.01
0.1
1
10
100
1000
10000

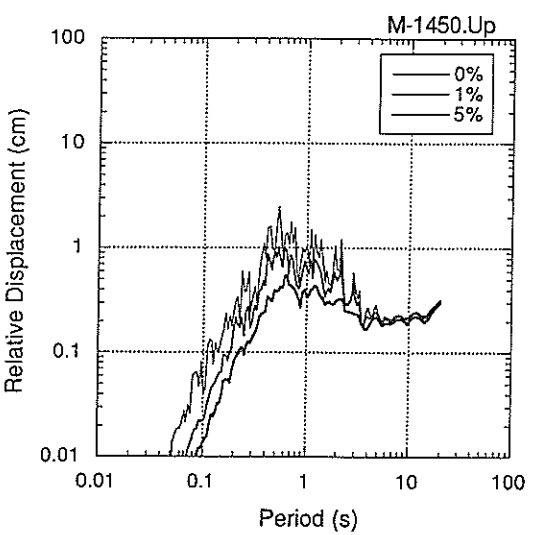

M-1450.N15E
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100

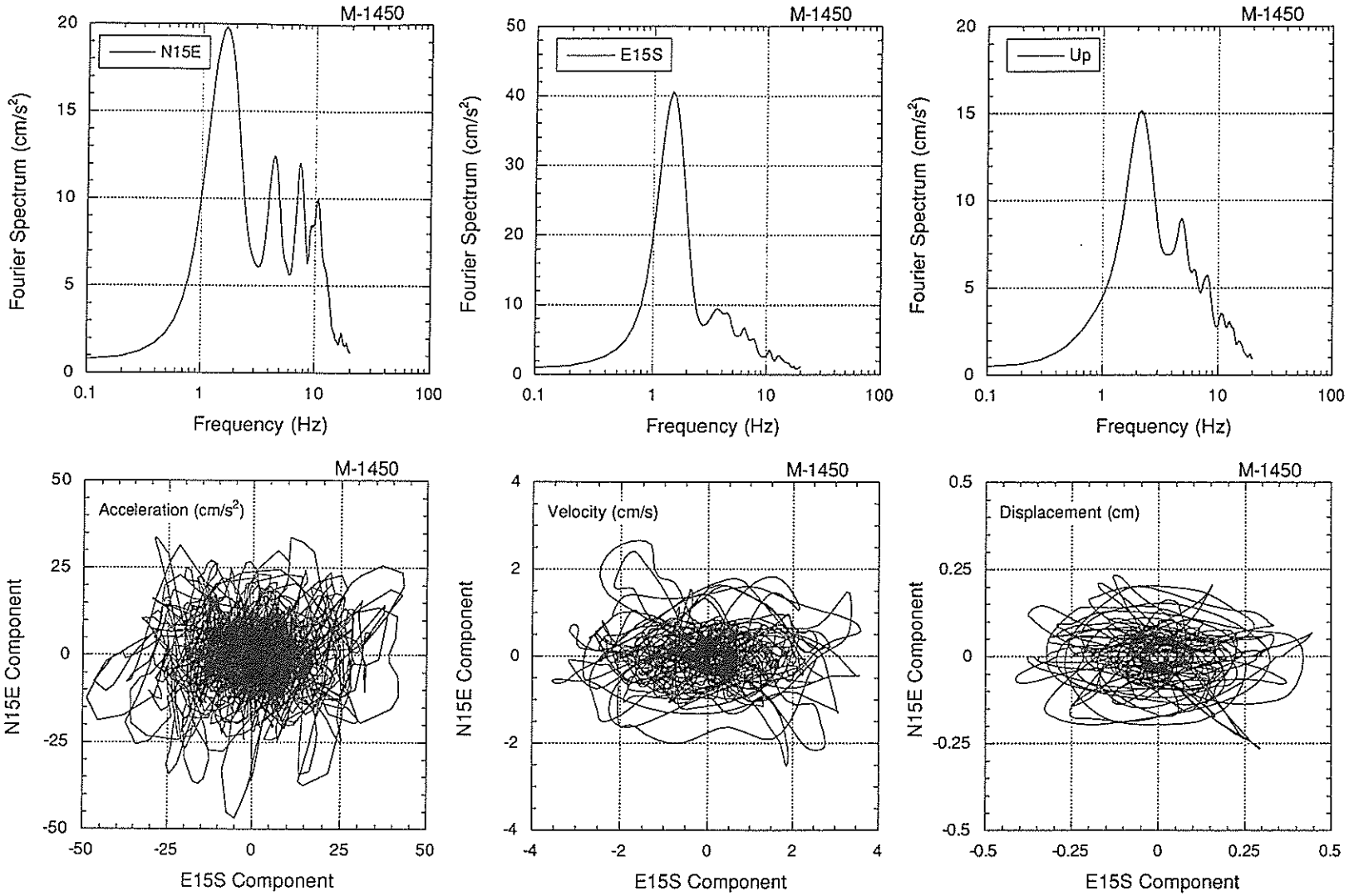

M-1450.E15S
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100


M-1450.Up
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100


M-1450.N15E
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100


M-1450.E15S
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100


M-1450.Up
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100


M-1450
N15E
Fourier Spectrum (cm/s²)
Frequency (Hz)
M-1450
E15S
Fourier Spectrum (cm/s²)
Frequency (Hz)
M-1450
Up
Fourier Spectrum (cm/s²)
Frequency (Hz)
M-1450
Acceleration (cm/s²)
N15E Component
E15S Component
M-1450
Velocity (cm/s)
N15E Component
E15S Component
M-1450
Displacement (cm)
N15E Component
E15S Component

RECORD NUMBER : F-505

STATION : MURORAN-G

EARTHQUAKE DATA

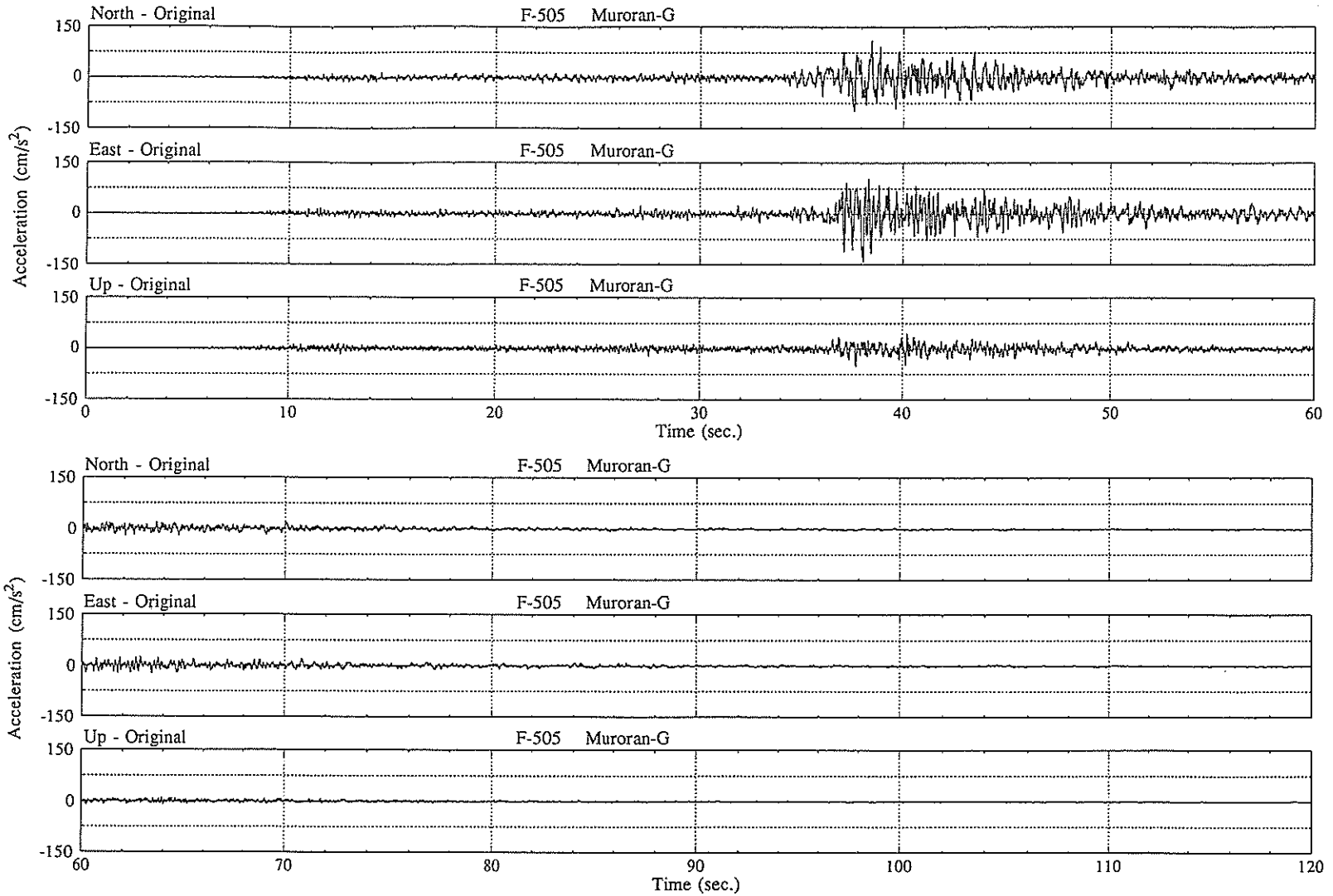
****

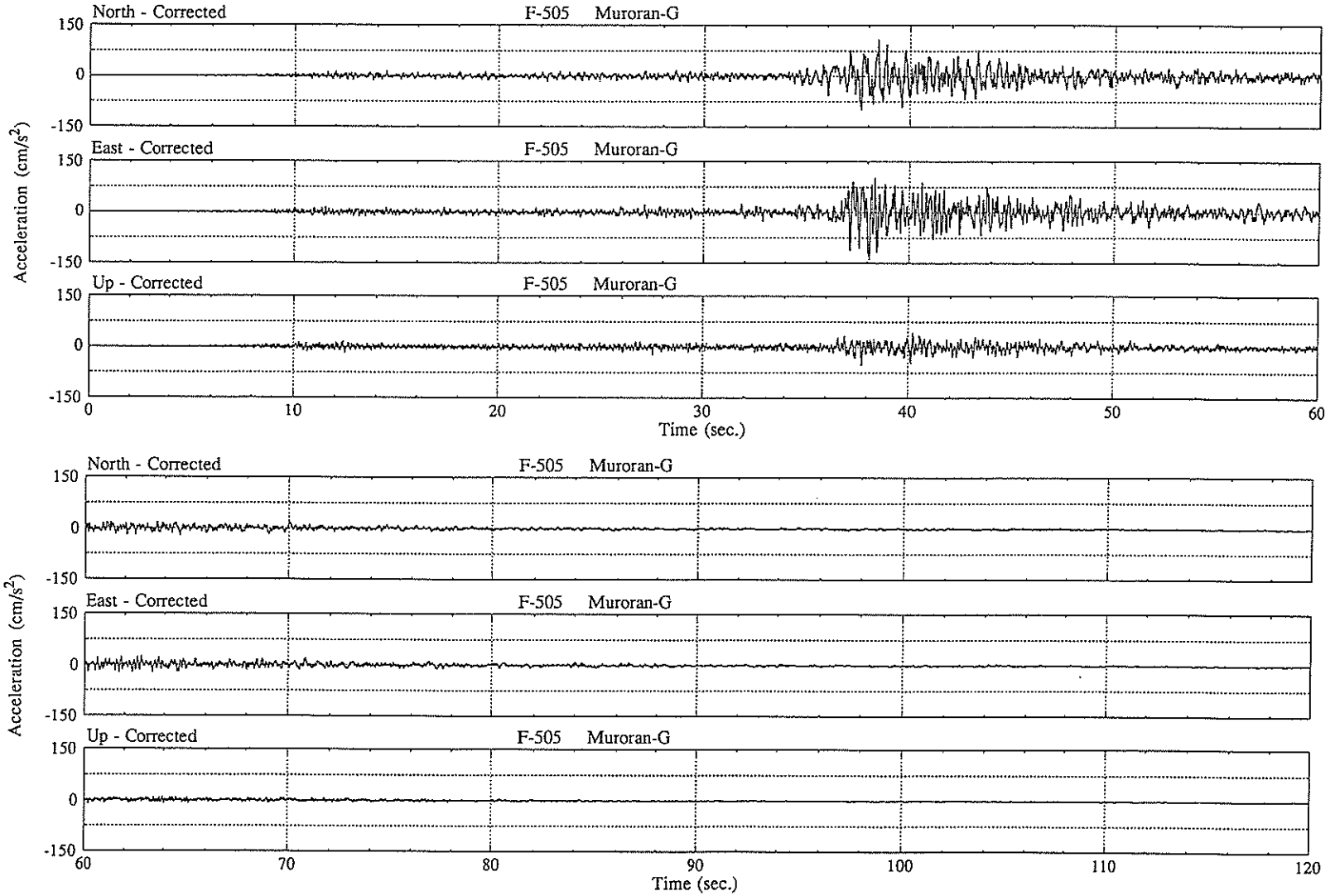
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

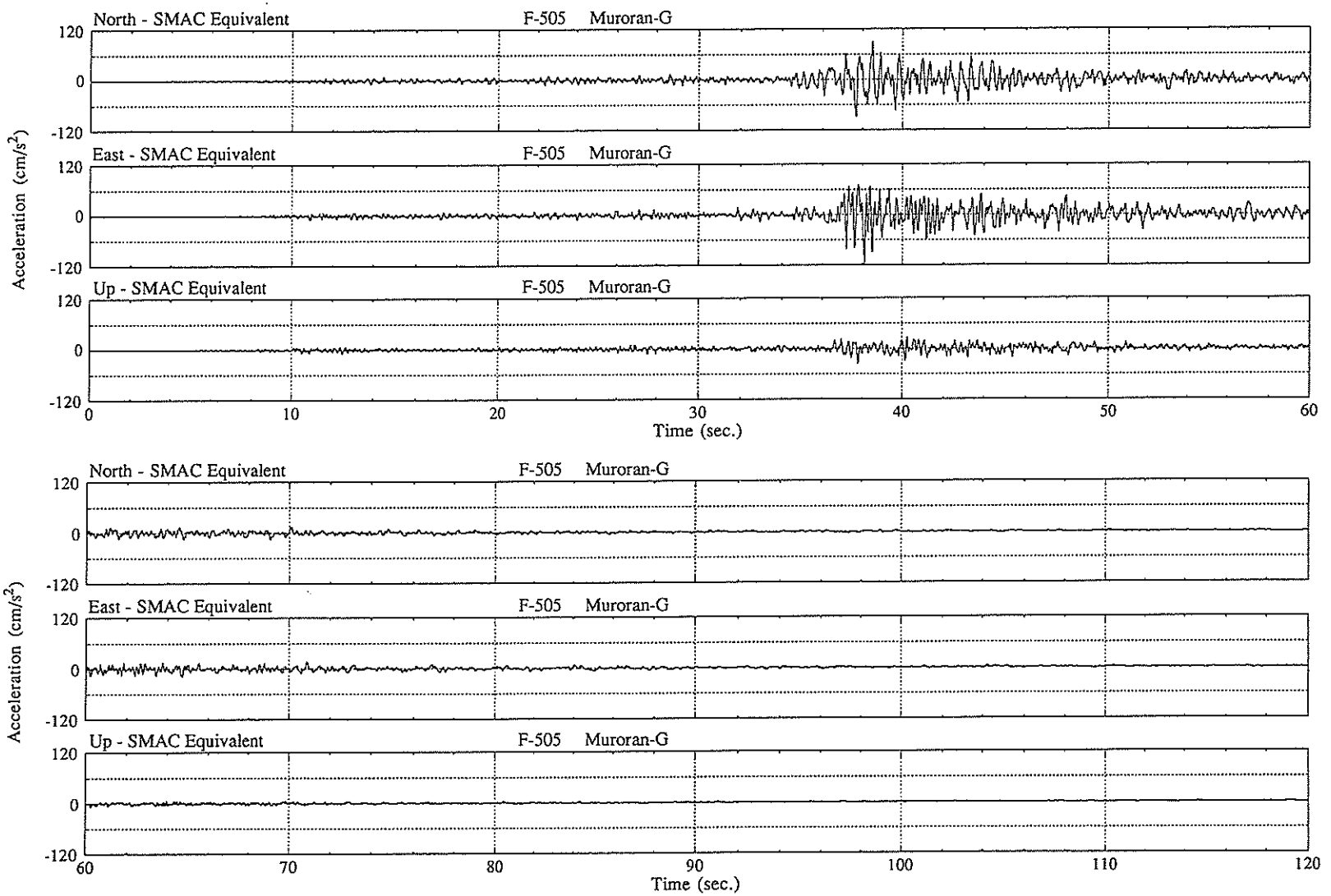
****

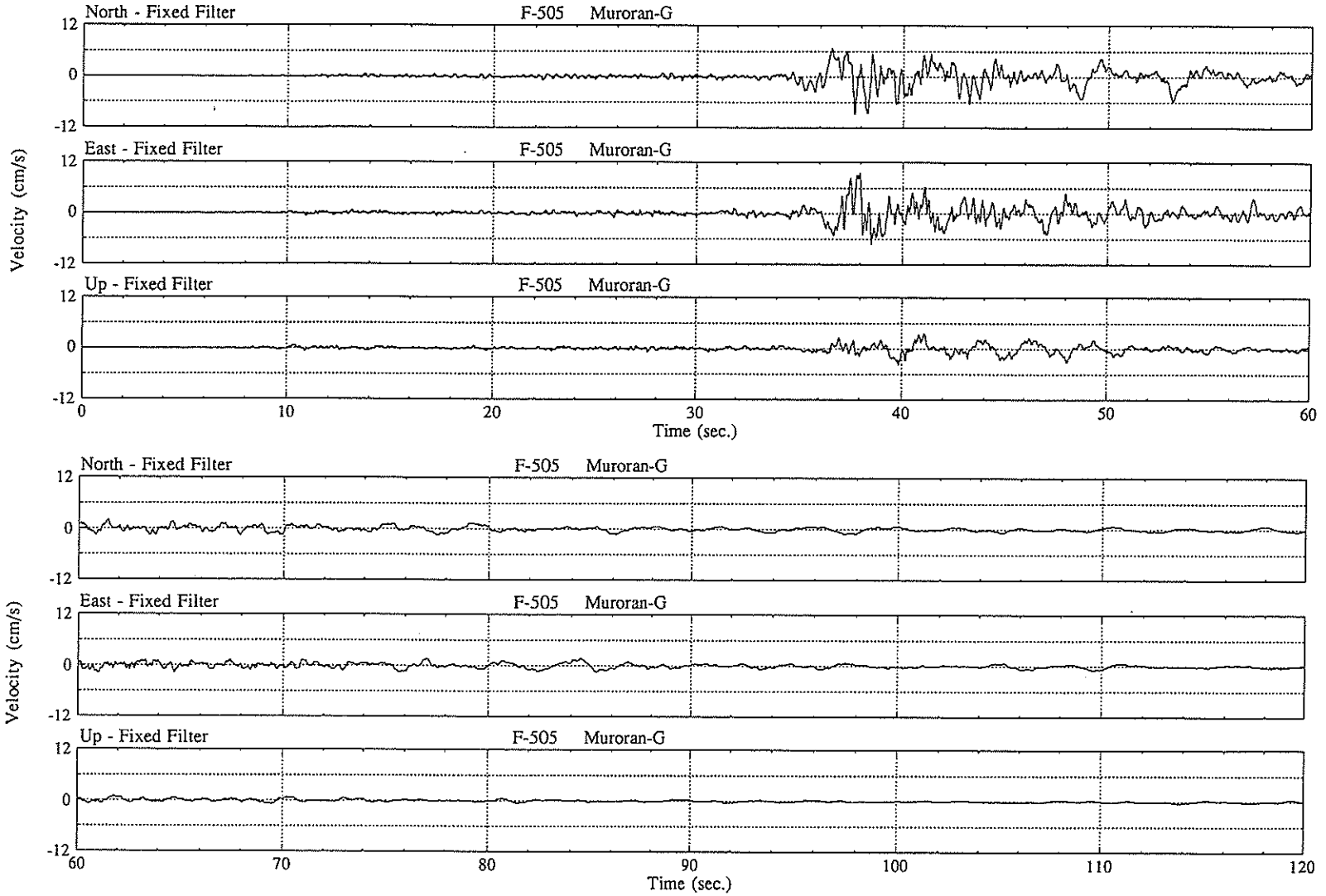
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.085	0.134	0.158	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	89.6	118.5	34.7	126.6
ORIGINAL	109.5	139.5	50.9	155.2
CORRECTED	108.7	139.1	51.5	155.6
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	8.82	9.61	3.68	10.02
VARIABLE FILTER	7.27	11.10	3.58	12.32
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	2.85	2.56	1.10	3.16
VARIABLE FILTER	3.16	2.25	1.00	3.26

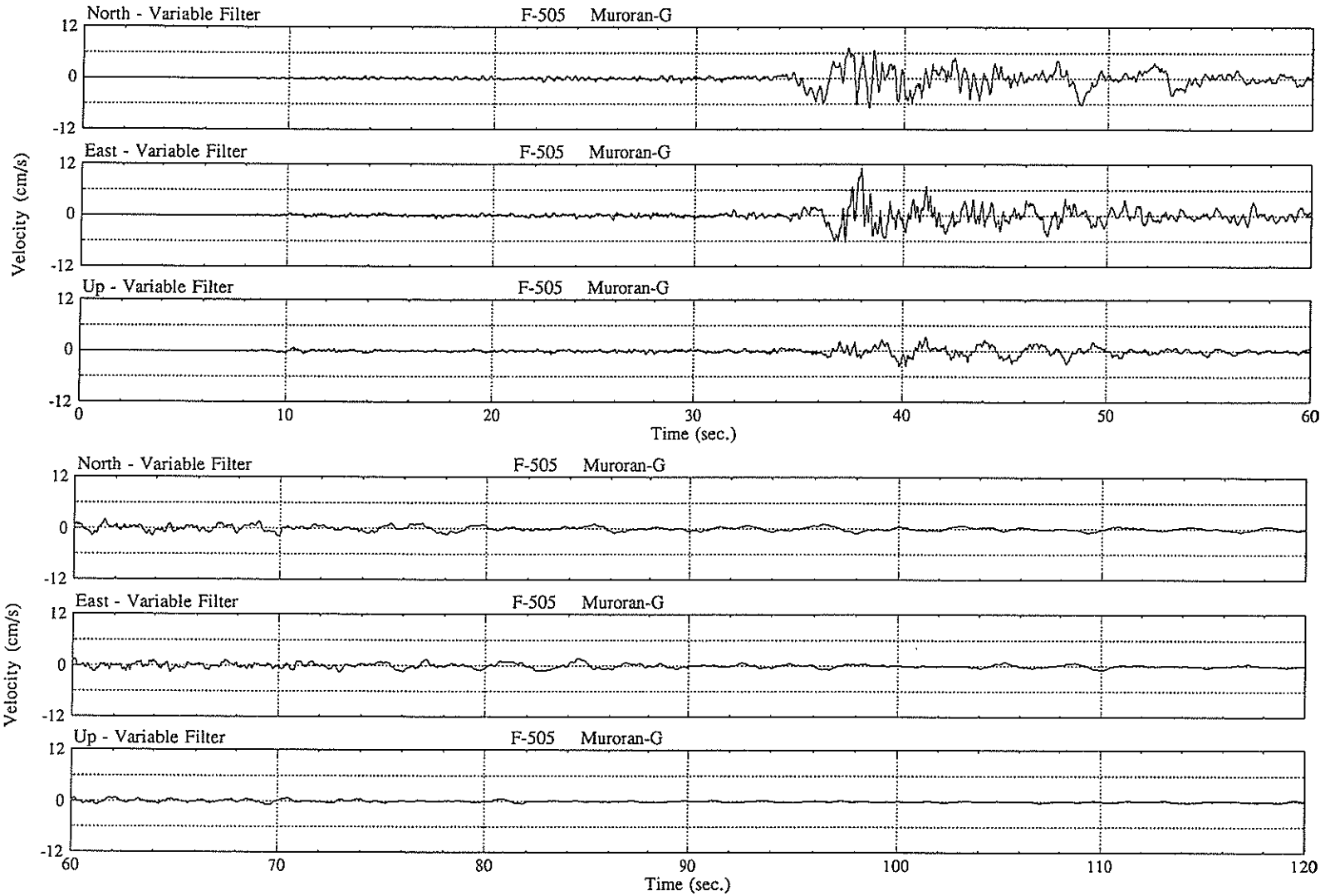
* RESULTANT OF HORIZONTAL COMPONENTS

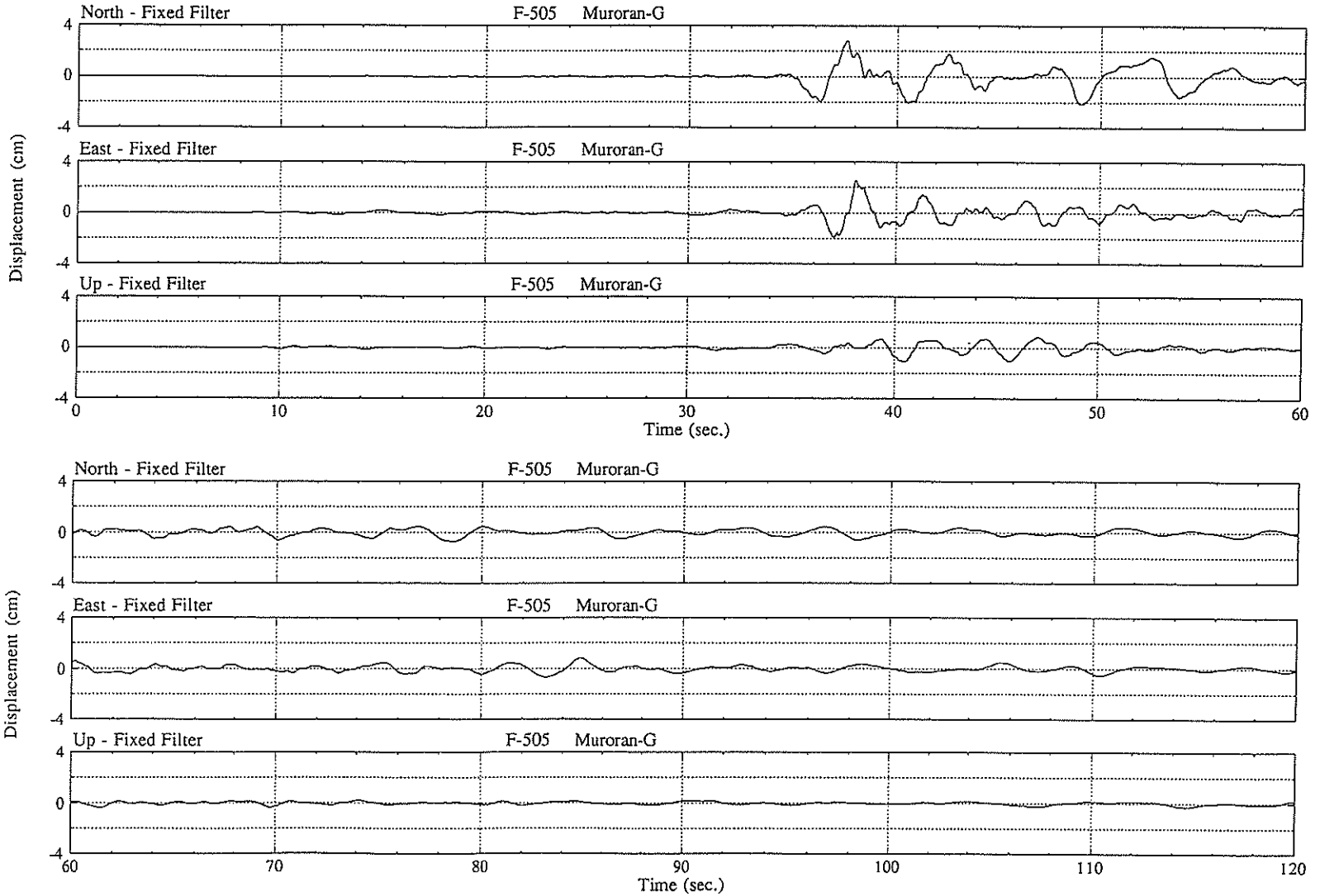

North - Original
F-505 Muroran-G
East - Original
F-505 Muroran-G
Up - Original
F-505 Muroran-G
Acceleration (cm/s²)
150
0
-150
0
10
20
30
40
50
60
Time (sec.)
North - Original
F-505 Muroran-G
East - Original
F-505 Muroran-G
Up - Original
F-505 Muroran-G
Acceleration (cm/s²)
150
0
-150
60
70
80
90
100
110
120
Time (sec.)

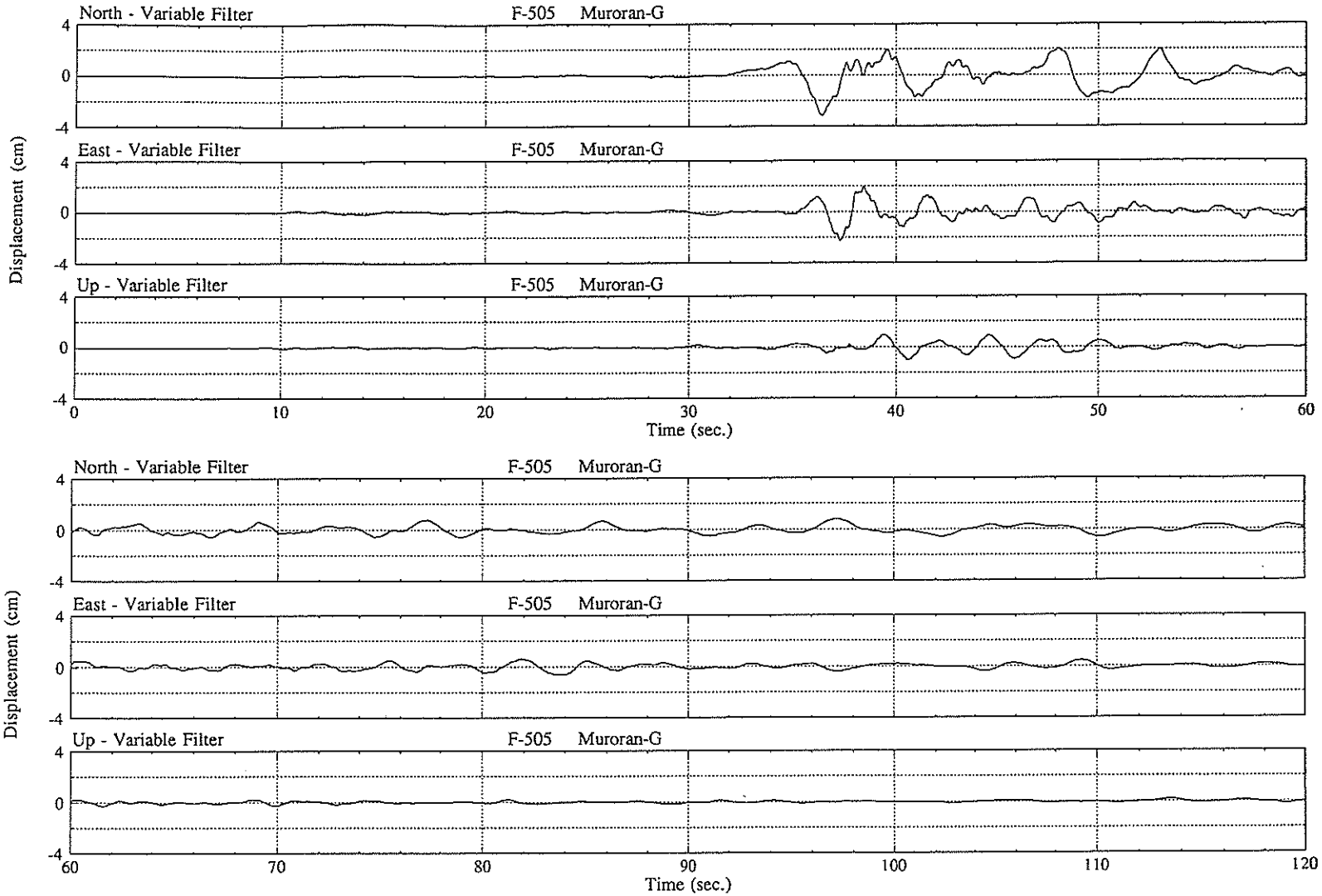

North - Corrected
F-505 Muroran-G
East - Corrected
F-505 Muroran-G
Up - Corrected
F-505 Muroran-G
Acceleration (cm/s²)
150
0
-150
0
10
20
30
40
50
60
Time (sec.)
North - Corrected
F-505 Muroran-G
East - Corrected
F-505 Muroran-G
Up - Corrected
F-505 Muroran-G
Acceleration (cm/s²)
150
0
-150
60
70
80
90
100
110
120
Time (sec.)

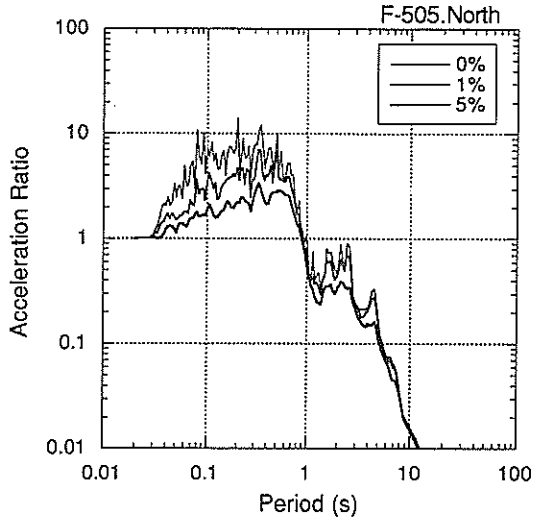

North - SMAC Equivalent
F-505 Muroran-G
East - SMAC Equivalent
F-505 Muroran-G
Up - SMAC Equivalent
F-505 Muroran-G
Acceleration (cm/s²)
120
0
-120
0
10
20
30
40
50
60
Time (sec.)
North - SMAC Equivalent
F-505 Muroran-G
East - SMAC Equivalent
F-505 Muroran-G
Up - SMAC Equivalent
F-505 Muroran-G
Acceleration (cm/s²)
60
70
80
90
100
110
120
Time (sec.)

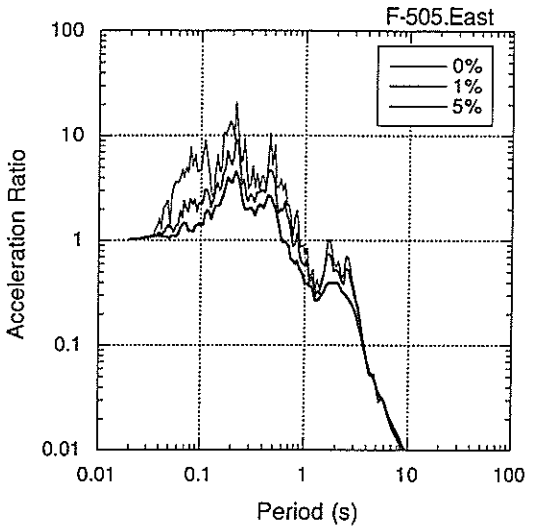

North - Fixed Filter
F-505 Muroran-G
East - Fixed Filter
F-505 Muroran-G
Up - Fixed Filter
F-505 Muroran-G
Velocity (cm/s)
12
0
-12
0
10
20
30
40
50
60
Time (sec.)
North - Fixed Filter
F-505 Muroran-G
East - Fixed Filter
F-505 Muroran-G
Up - Fixed Filter
F-505 Muroran-G
Velocity (cm/s)
60
70
80
90
100
110
120
Time (sec.)

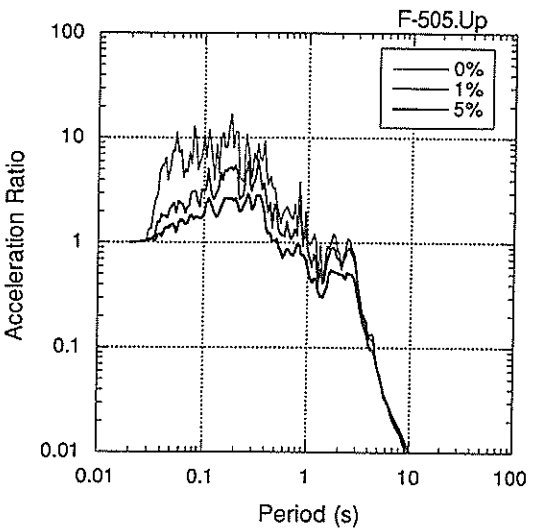

North - Variable Filter
F-505 Muroran-G
East - Variable Filter
F-505 Muroran-G
Up - Variable Filter
F-505 Muroran-G
Velocity (cm/s)
12
0
-12
0
10
20
30
40
50
60
Time (sec.)
North - Variable Filter
F-505 Muroran-G
East - Variable Filter
F-505 Muroran-G
Up - Variable Filter
F-505 Muroran-G
Velocity (cm/s)
60
70
80
90
100
110
120
Time (sec.)

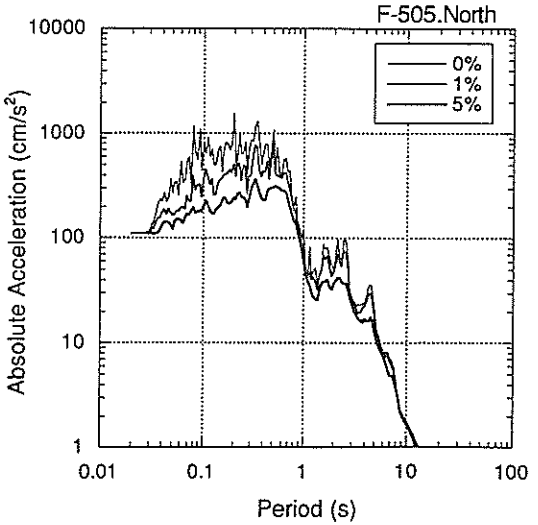

North - Fixed Filter
F-505 Muroran-G
East - Fixed Filter
F-505 Muroran-G
Up - Fixed Filter
F-505 Muroran-G
Displacement (cm)
4
0
-4
0
10
20
30
40
50
60
Time (sec.)
North - Fixed Filter
F-505 Muroran-G
East - Fixed Filter
F-505 Muroran-G
Up - Fixed Filter
F-505 Muroran-G
Displacement (cm)
60
70
80
90
100
110
120
Time (sec.)

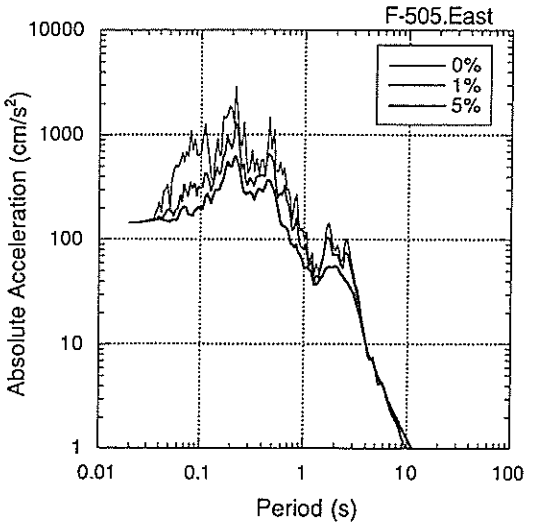

North - Variable Filter
F-505 Muroran-G
East - Variable Filter
F-505 Muroran-G
Up - Variable Filter
F-505 Muroran-G
Displacement (cm)
4
0
-4
0
10
20
30
40
50
60
Time (sec.)
North - Variable Filter
F-505 Muroran-G
East - Variable Filter
F-505 Muroran-G
Up - Variable Filter
F-505 Muroran-G
Displacement (cm)
60
70
80
90
100
110
120
Time (sec.)

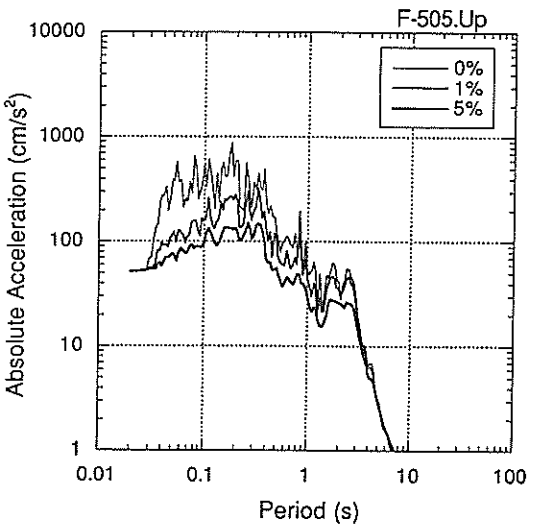

F-505.North
0%
1%
5%
Acceleration Ratio
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

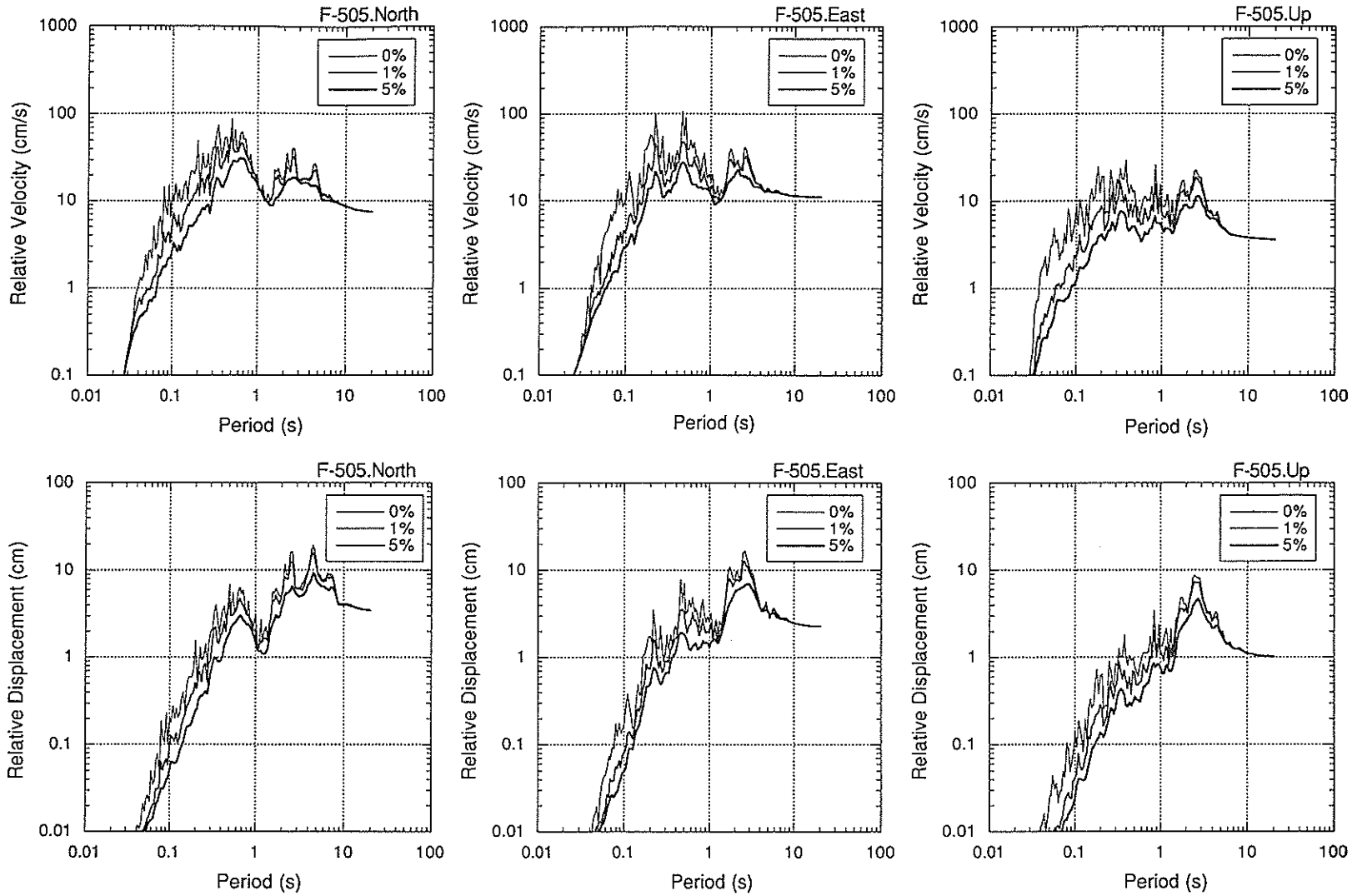

F-505.East
0%
1%
5%
Acceleration Ratio
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

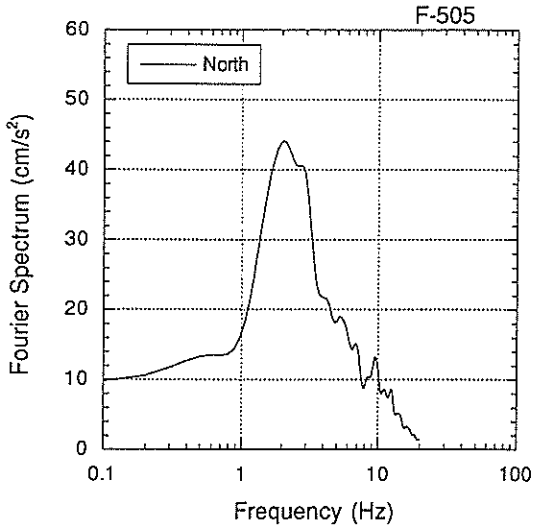

F-505.Up
0%
1%
5%
Acceleration Ratio
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

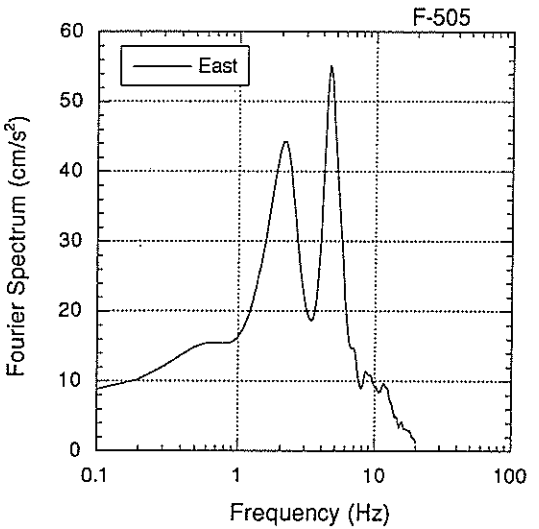

F-505.North
0%
1%
5%
Absolute Acceleration (cm/s²)
Period (s)
10000
1000
100
10
1
0.01
0.1
1
10
100

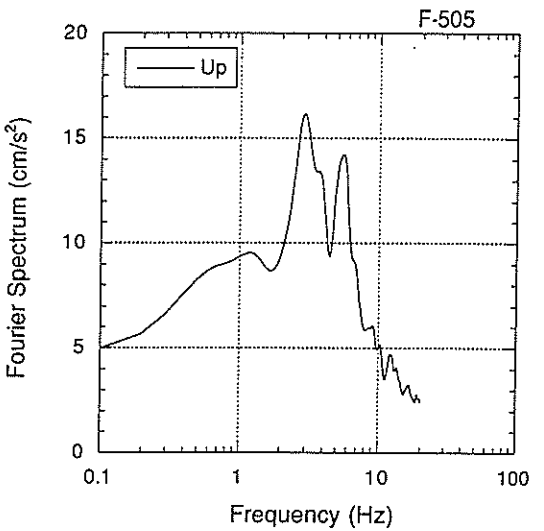

F-505.East
0%
1%
5%
Absolute Acceleration (cm/s²)
Period (s)
10000
1000
100
10
1
0.01
0.1
1
10
100

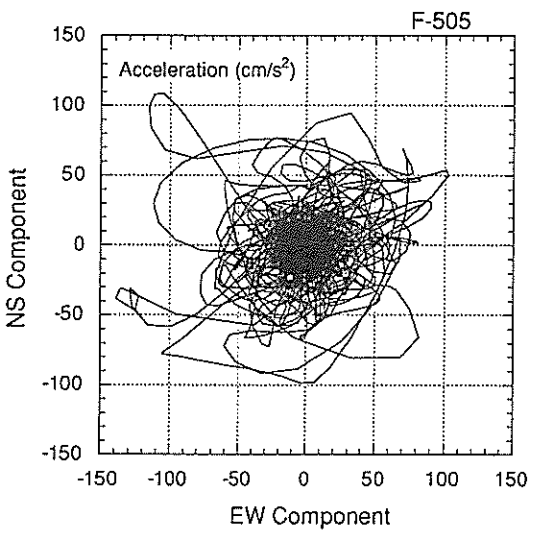

F-505.Up
0%
1%
5%
Absolute Acceleration (cm/s²)
Period (s)
10000
1000
100
10
1
0.01
0.1
1
10
100

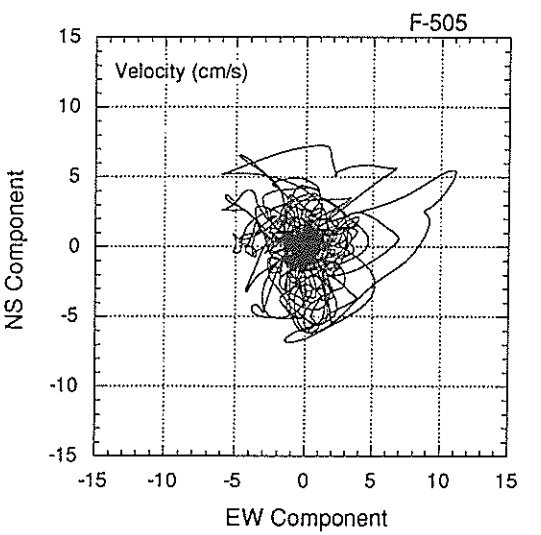

F-505.North
F-505.East
F-505.Up
0%
1%
5%
Relative Velocity (cm/s)
Relative Displacement (cm)
Period (s)
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100

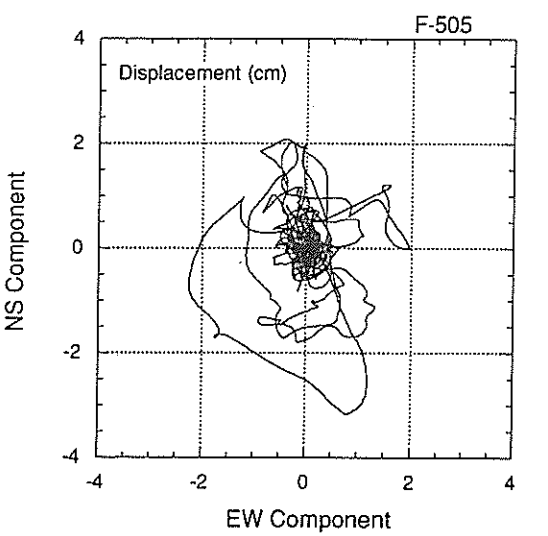

F-505
North
Fourier Spectrum (cm/s²)
Frequency (Hz)


F-505
East
Fourier Spectrum (cm/s²)
Frequency (Hz)


F-505
Up
Fourier Spectrum (cm/s²)
Frequency (Hz)


F-505
Acceleration (cm/s²)
NS Component
EW Component


F-505
Velocity (cm/s)
NS Component
EW Component


F-505
Displacement (cm)
NS Component
EW Component

RECORD NUMBER : F-506

STATION : KUSHIRO-GB

EARTHQUAKE DATA

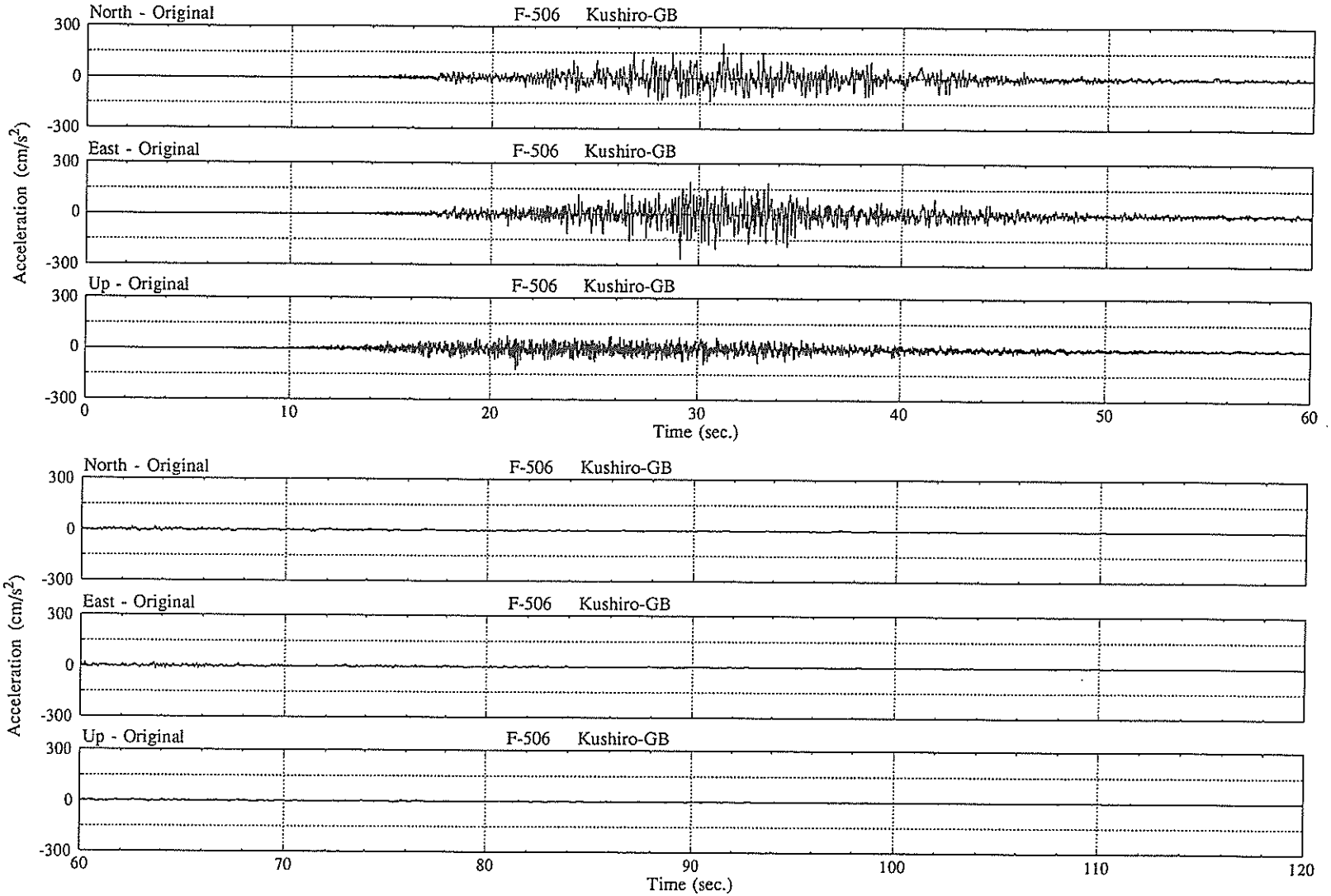
****

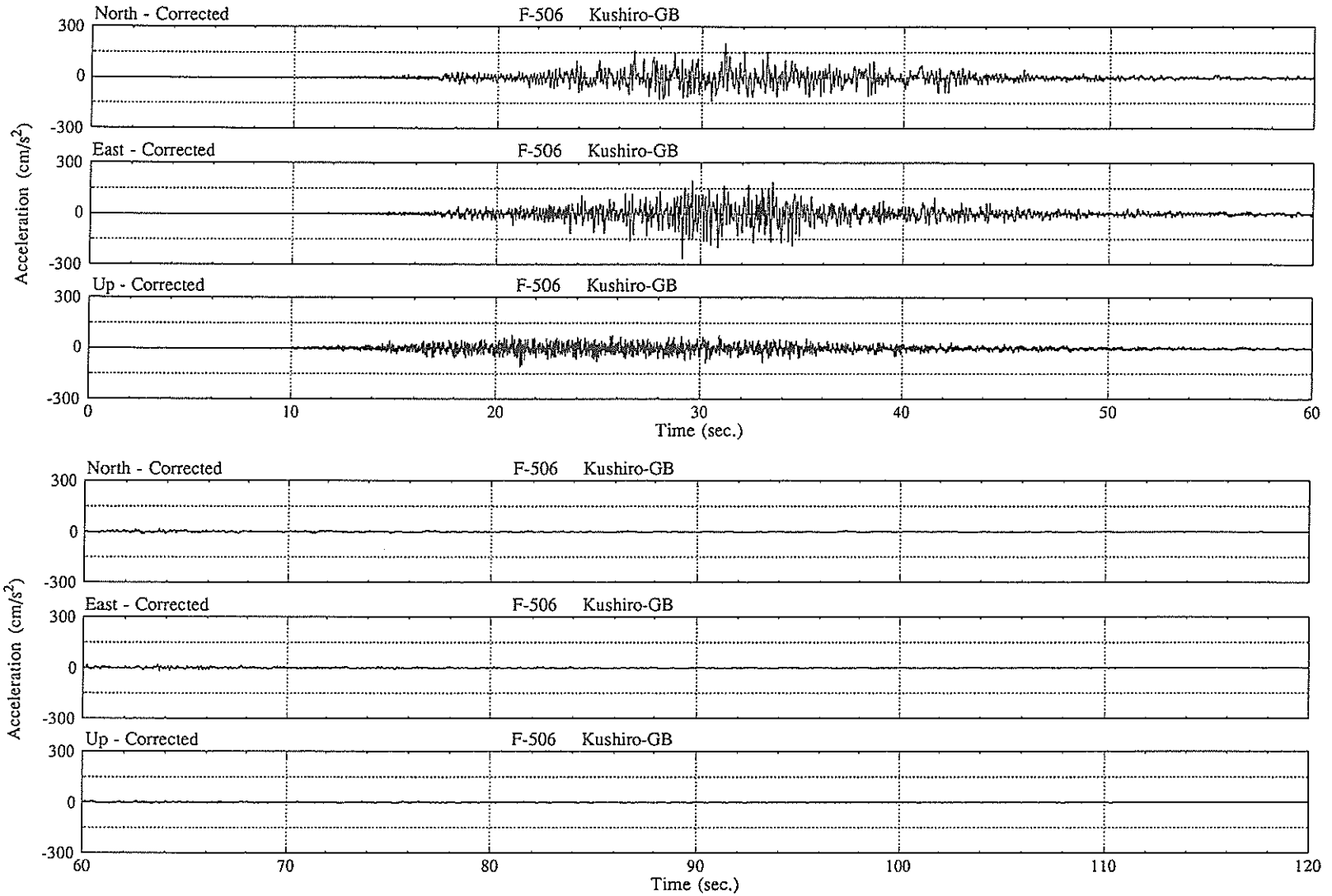
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

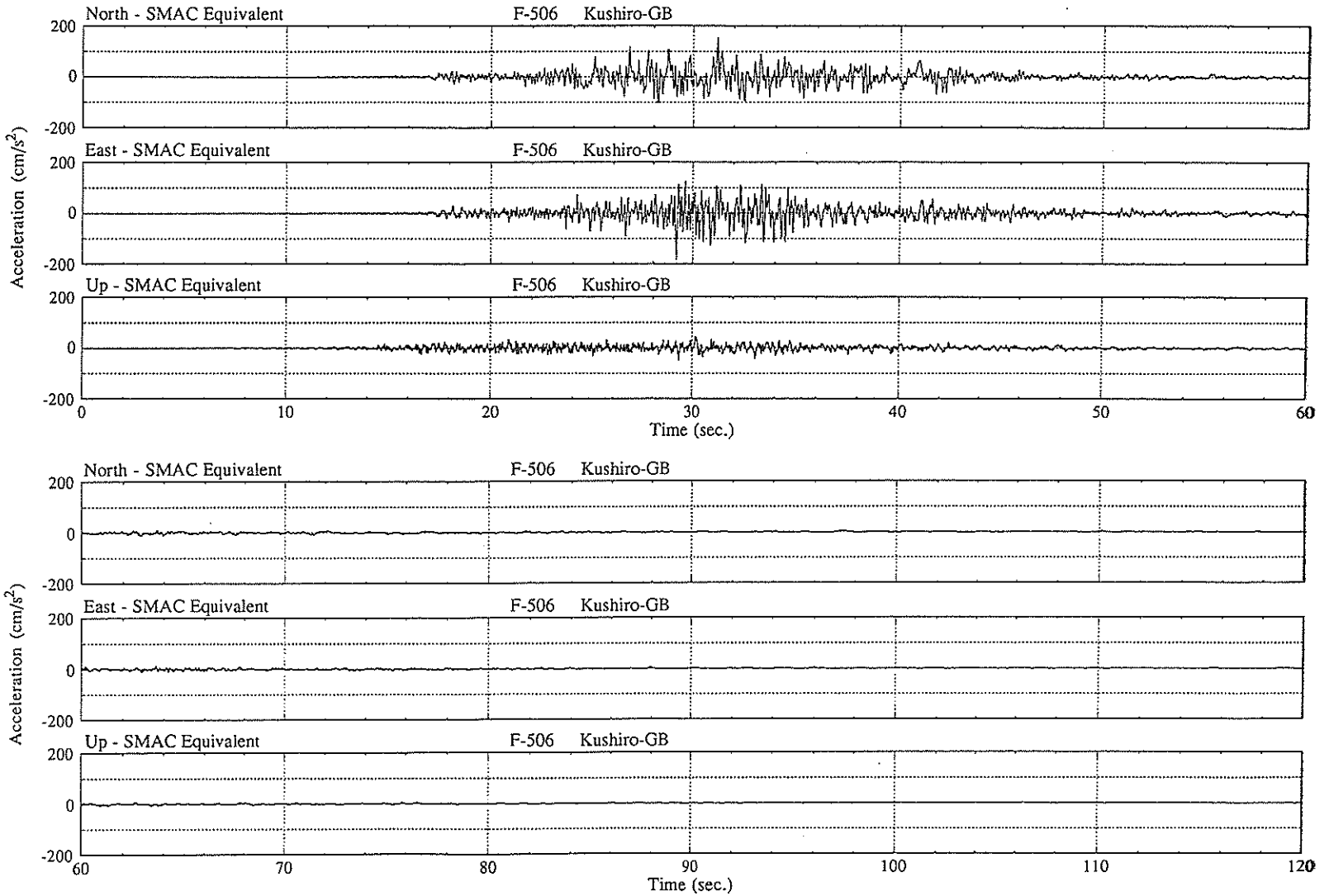
****

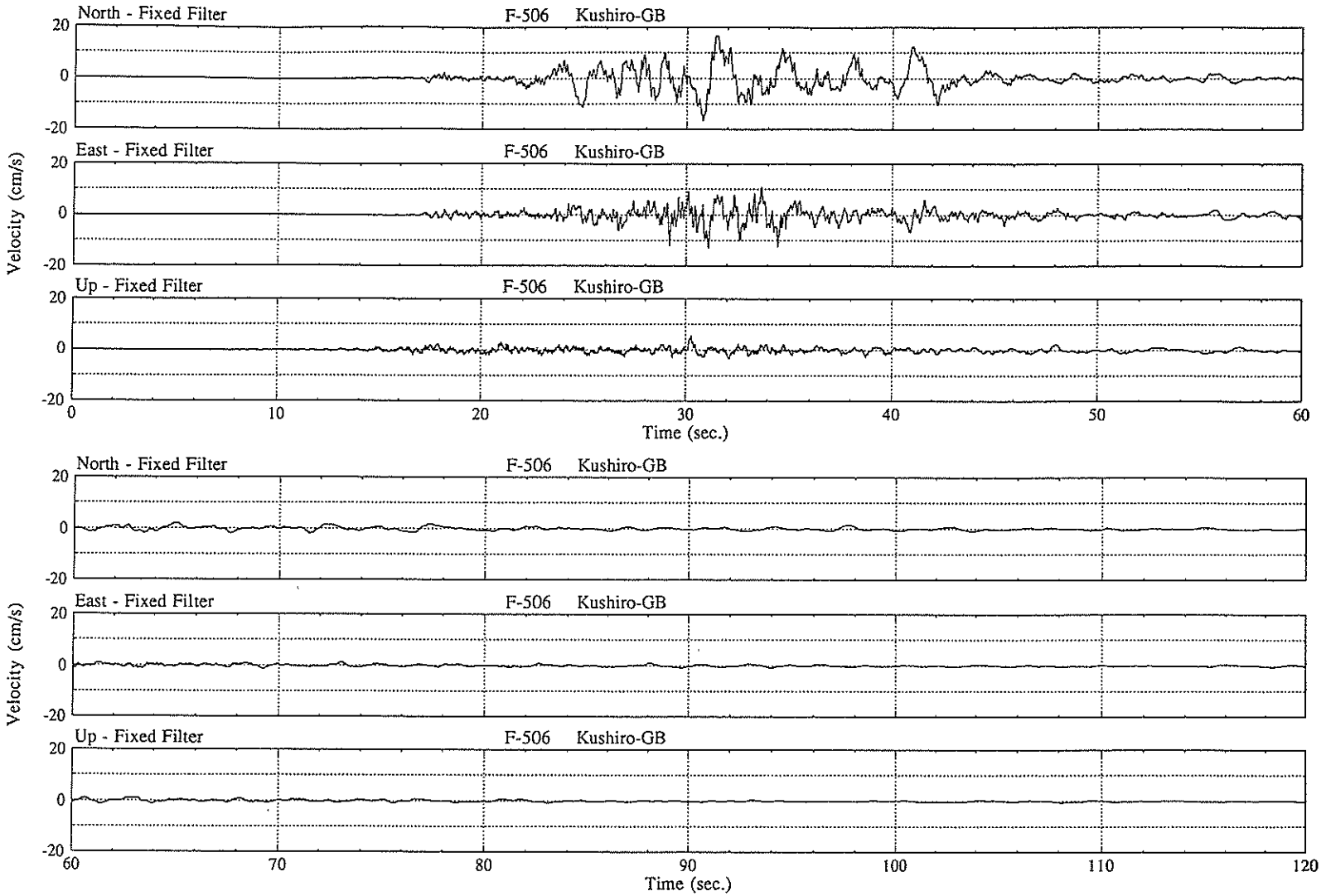
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.035	0.081	0.072	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	155.4	184.7	50.0	200.5
ORIGINAL	204.2	262.1	122.1	276.9
CORRECTED	204.4	264.6	109.5	280.8
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	17.12	12.94	5.82	18.51
VARIABLE FILTER	18.00	13.78	5.74	18.78
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	6.47	2.10	0.88	6.70
VARIABLE FILTER	9.16	1.89	0.86	9.28

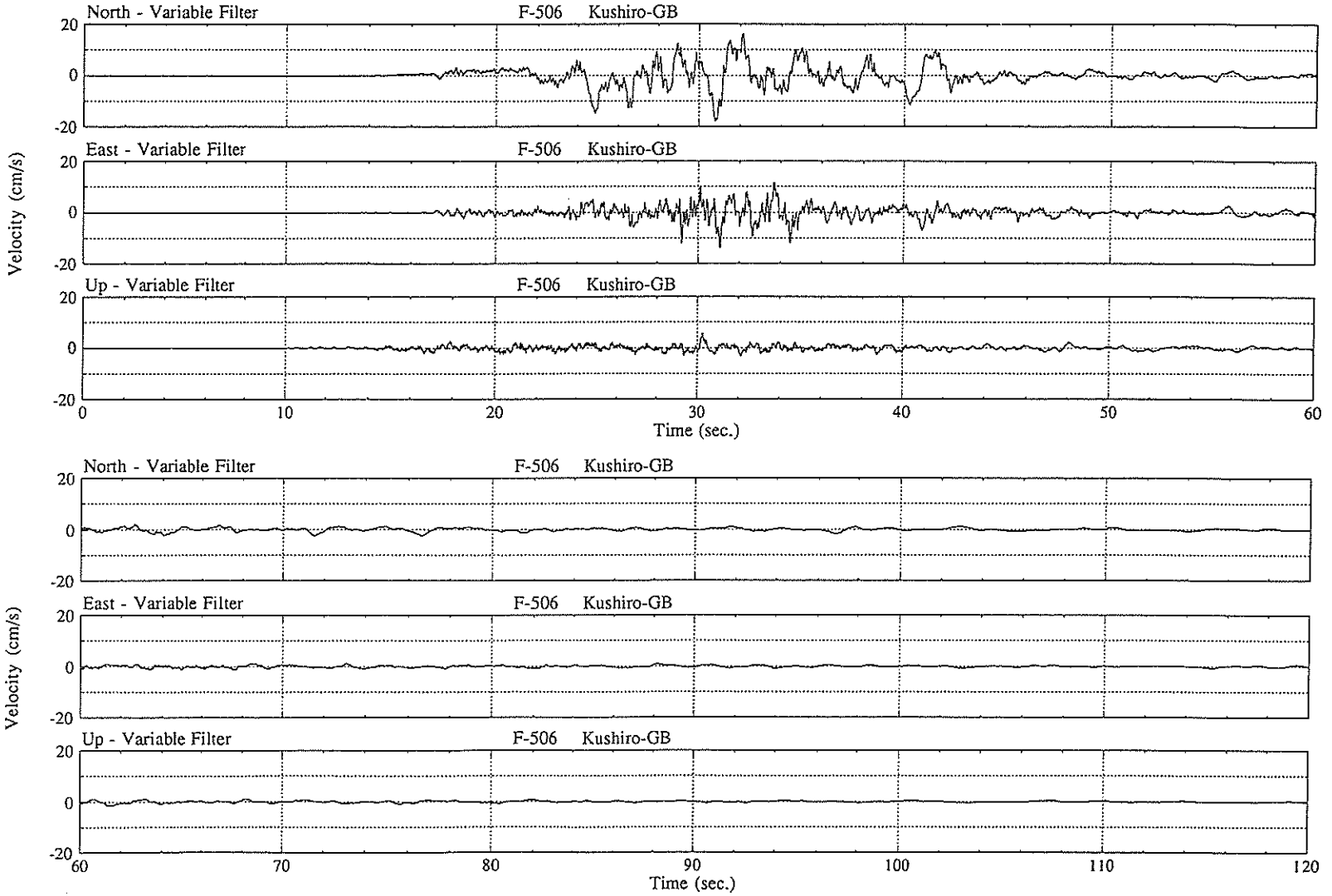
* RESULTANT OF HORIZONTAL COMPONENTS

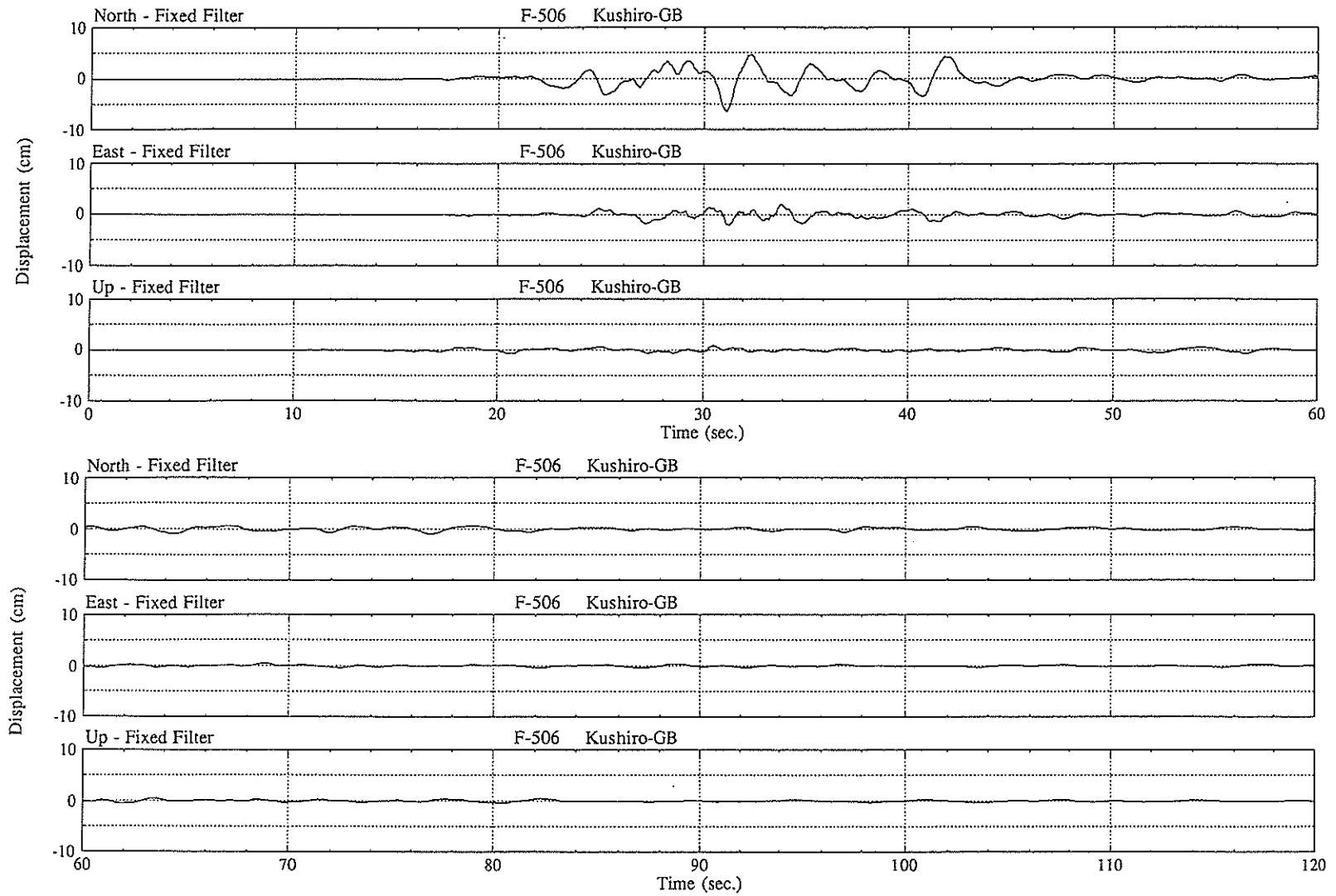

North - Original
F-506 Kushiro-GB
East - Original
F-506 Kushiro-GB
Up - Original
F-506 Kushiro-GB
Acceleration (cm/s^2)
300
0
-300
0
10
20
30
40
50
60
Time (sec.)
North - Original
F-506 Kushiro-GB
East - Original
F-506 Kushiro-GB
Up - Original
F-506 Kushiro-GB
Acceleration (cm/s^2)
300
0
-300
60
70
80
90
100
110
120
Time (sec.)

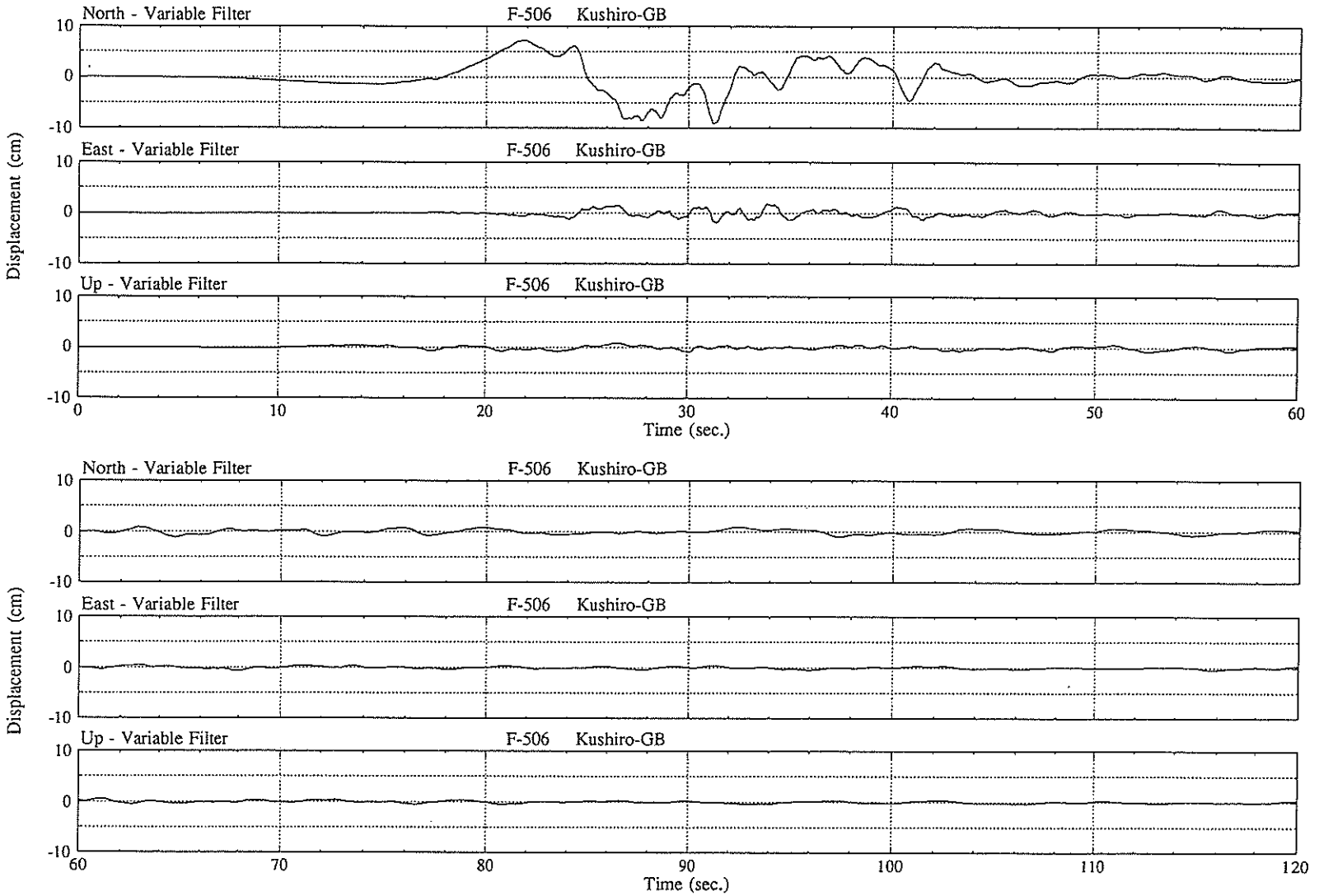

North - Corrected
F-506 Kushiro-GB
East - Corrected
F-506 Kushiro-GB
Up - Corrected
F-506 Kushiro-GB
Acceleration (cm/s²)
300
0
-300
0
10
20
30
40
50
60
Time (sec.)
North - Corrected
F-506 Kushiro-GB
East - Corrected
F-506 Kushiro-GB
Up - Corrected
F-506 Kushiro-GB
Acceleration (cm/s²)
60
70
80
90
100
110
120
Time (sec.)

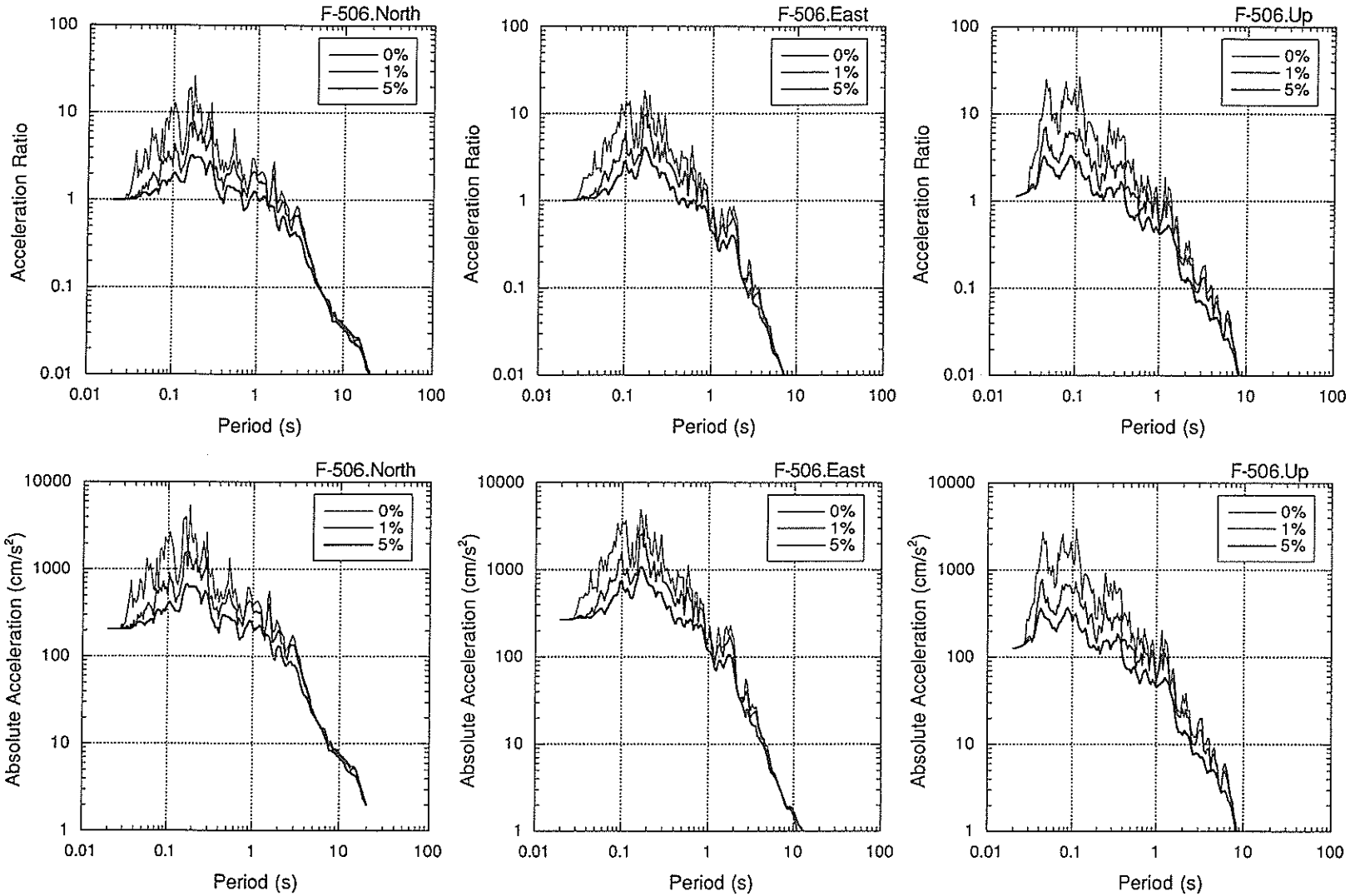

North - SMAC Equivalent
F-506 Kushiro-GB
East - SMAC Equivalent
F-506 Kushiro-GB
Up - SMAC Equivalent
F-506 Kushiro-GB
Acceleration (cm/s²)
200
0
-200
0
10
20
30
40
50
60
Time (sec.)
North - SMAC Equivalent
F-506 Kushiro-GB
East - SMAC Equivalent
F-506 Kushiro-GB
Up - SMAC Equivalent
F-506 Kushiro-GB
Acceleration (cm/s²)
200
0
-200
60
70
80
90
100
110
120
Time (sec.)

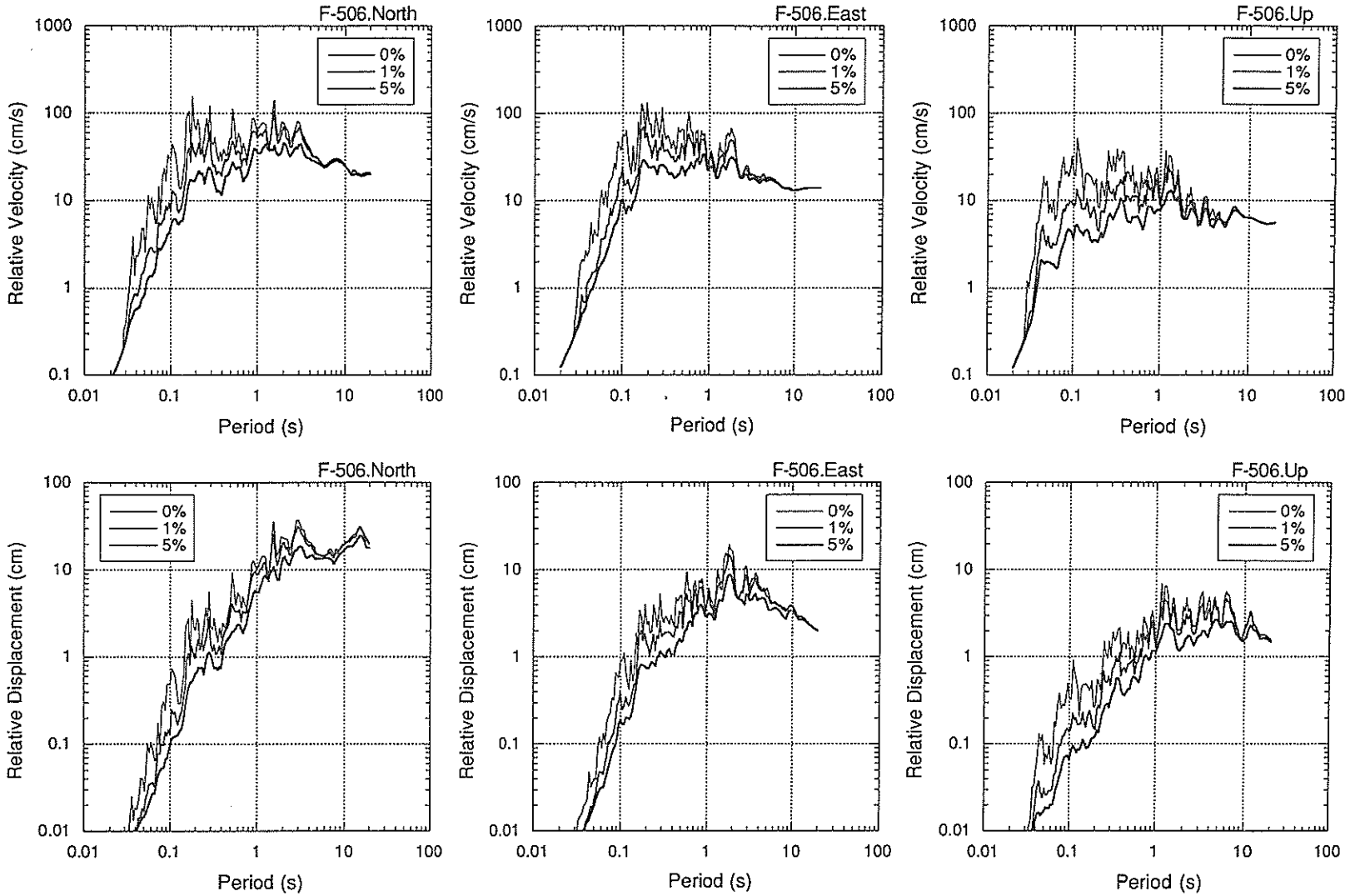

North - Fixed Filter
F-506 Kushiro-GB
East - Fixed Filter
F-506 Kushiro-GB
Up - Fixed Filter
F-506 Kushiro-GB
Velocity (cm/s)
20
0
-20
0
10
20
30
40
50
60
Time (sec.)
North - Fixed Filter
F-506 Kushiro-GB
East - Fixed Filter
F-506 Kushiro-GB
Up - Fixed Filter
F-506 Kushiro-GB
Velocity (cm/s)
60
70
80
90
100
110
120
Time (sec.)

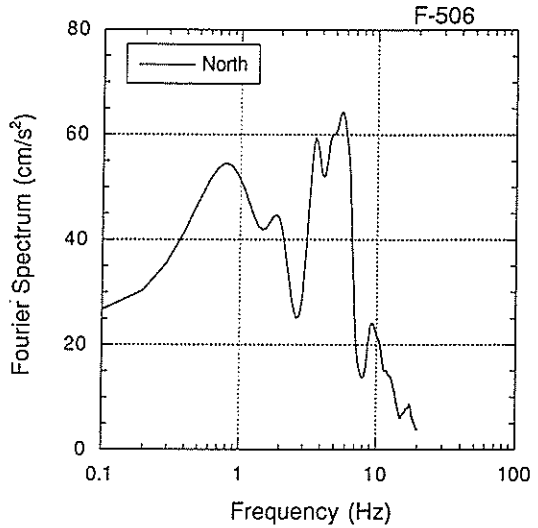

North - Variable Filter
F-506 Kushiro-GB
East - Variable Filter
F-506 Kushiro-GB
Up - Variable Filter
F-506 Kushiro-GB
Velocity (cm/s)
20
0
-20
0
10
20
30
40
50
60
Time (sec.)
North - Variable Filter
F-506 Kushiro-GB
East - Variable Filter
F-506 Kushiro-GB
Up - Variable Filter
F-506 Kushiro-GB
Velocity (cm/s)
60
70
80
90
100
110
120
Time (sec.)

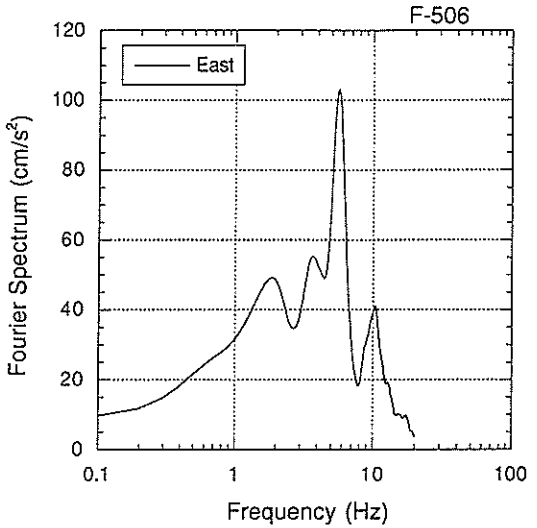

North - Fixed Filter
F-506 Kushiro-GB
East - Fixed Filter
F-506 Kushiro-GB
Up - Fixed Filter
F-506 Kushiro-GB
Displacement (cm)
10
0
-10
0
10
20
30
40
50
60
Time (sec.)
North - Fixed Filter
F-506 Kushiro-GB
East - Fixed Filter
F-506 Kushiro-GB
Up - Fixed Filter
F-506 Kushiro-GB
Displacement (cm)
60
70
80
90
100
110
120
Time (sec.)

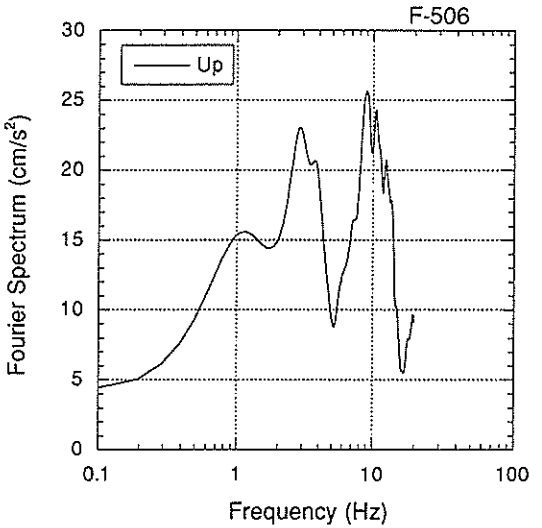

North - Variable Filter
F-506 Kushiro-GB
East - Variable Filter
F-506 Kushiro-GB
Up - Variable Filter
F-506 Kushiro-GB
Displacement (cm)
10
0
-10
0
10
20
30
40
50
60
Time (sec.)
North - Variable Filter
F-506 Kushiro-GB
East - Variable Filter
F-506 Kushiro-GB
Up - Variable Filter
F-506 Kushiro-GB
Displacement (cm)
60
70
80
90
100
110
120
Time (sec.)

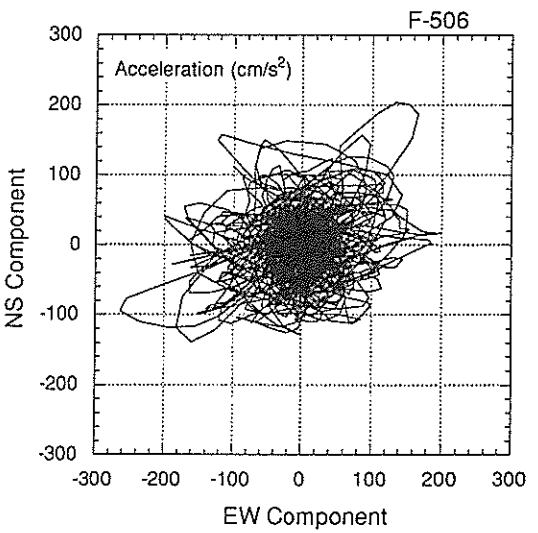

F-506.North
F-506.East
F-506.Up
0%
1%
5%
Acceleration Ratio
Absolute Acceleration (cm/s²)
Period (s)
0.01
0.1
1
10
100
1000
10000

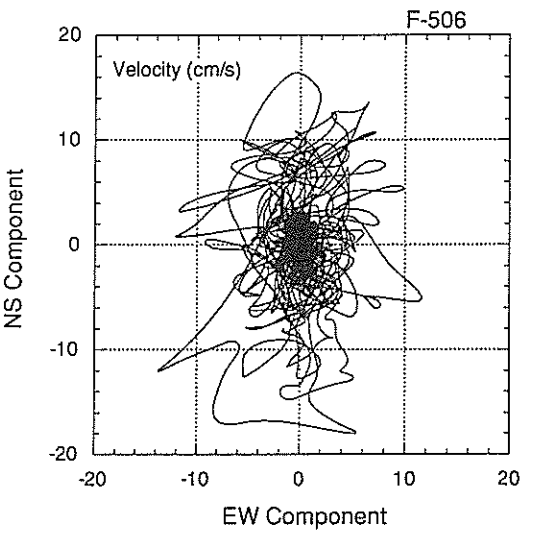

F-506.North
F-506.East
F-506.Up
0%
1%
5%
Relative Velocity (cm/s)
Relative Displacement (cm)
Period (s)
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100

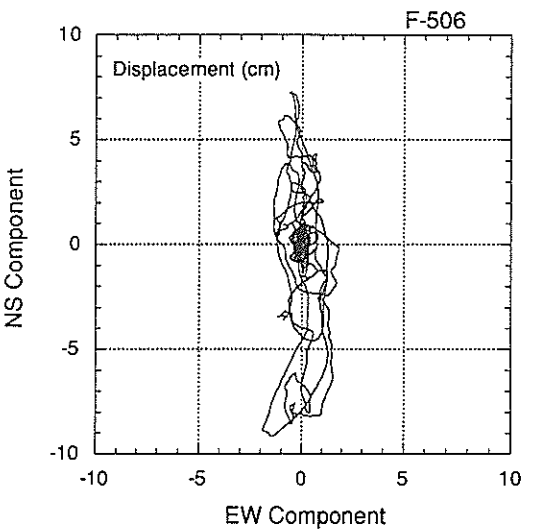

F-506
North
Fourier Spectrum (cm/s²)
Frequency (Hz)


F-506
East
Fourier Spectrum (cm/s²)
Frequency (Hz)


F-506
Up
Fourier Spectrum (cm/s²)
Frequency (Hz)


F-506
Acceleration (cm/s²)
NS Component
EW Component


F-506
Velocity (cm/s)
NS Component
EW Component


F-506
Displacement (cm)
NS Component
EW Component

RECORD NUMBER : F-507

STATION : KUSHIRO-G

EARTHQUAKE DATA

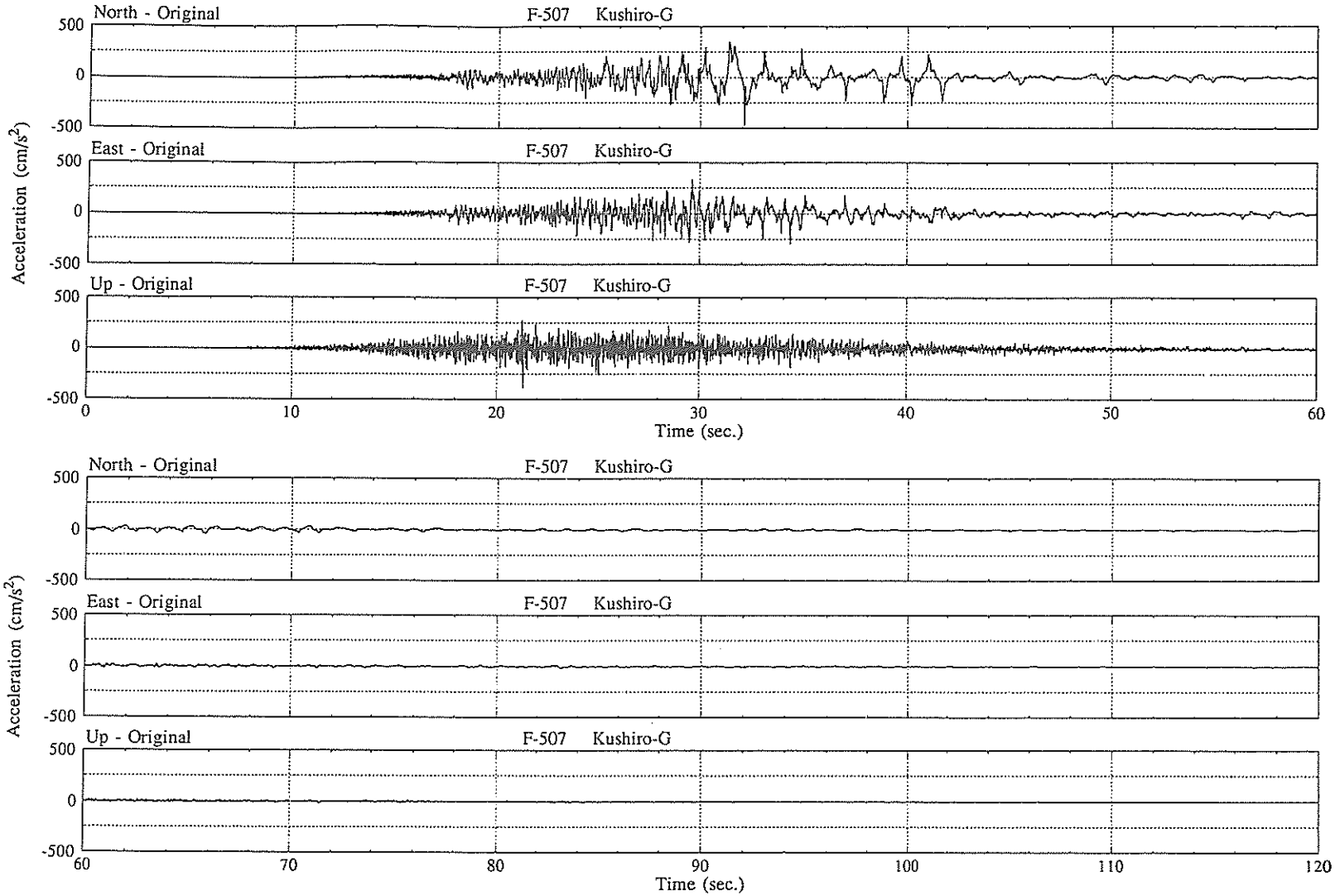
****

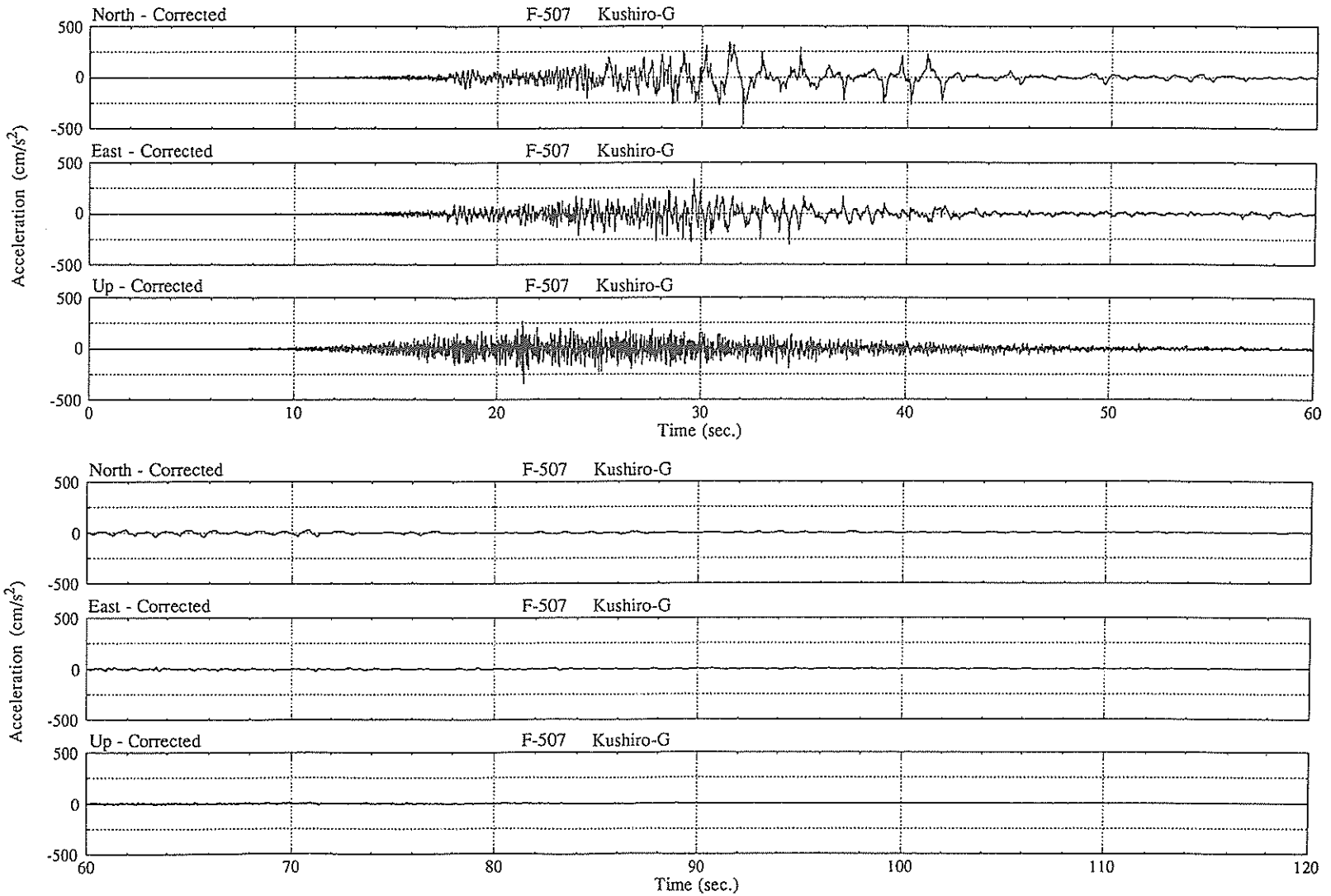
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

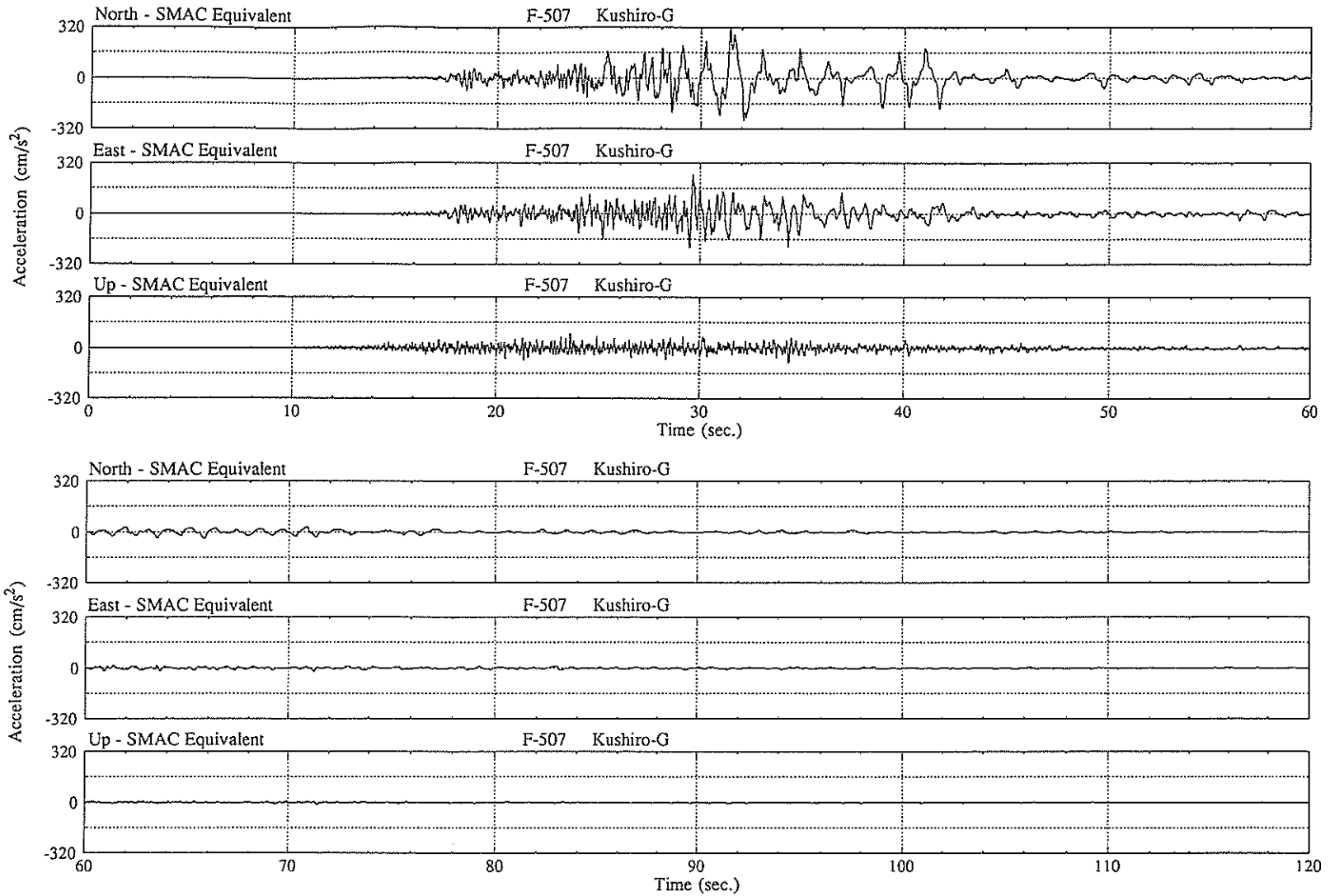
****

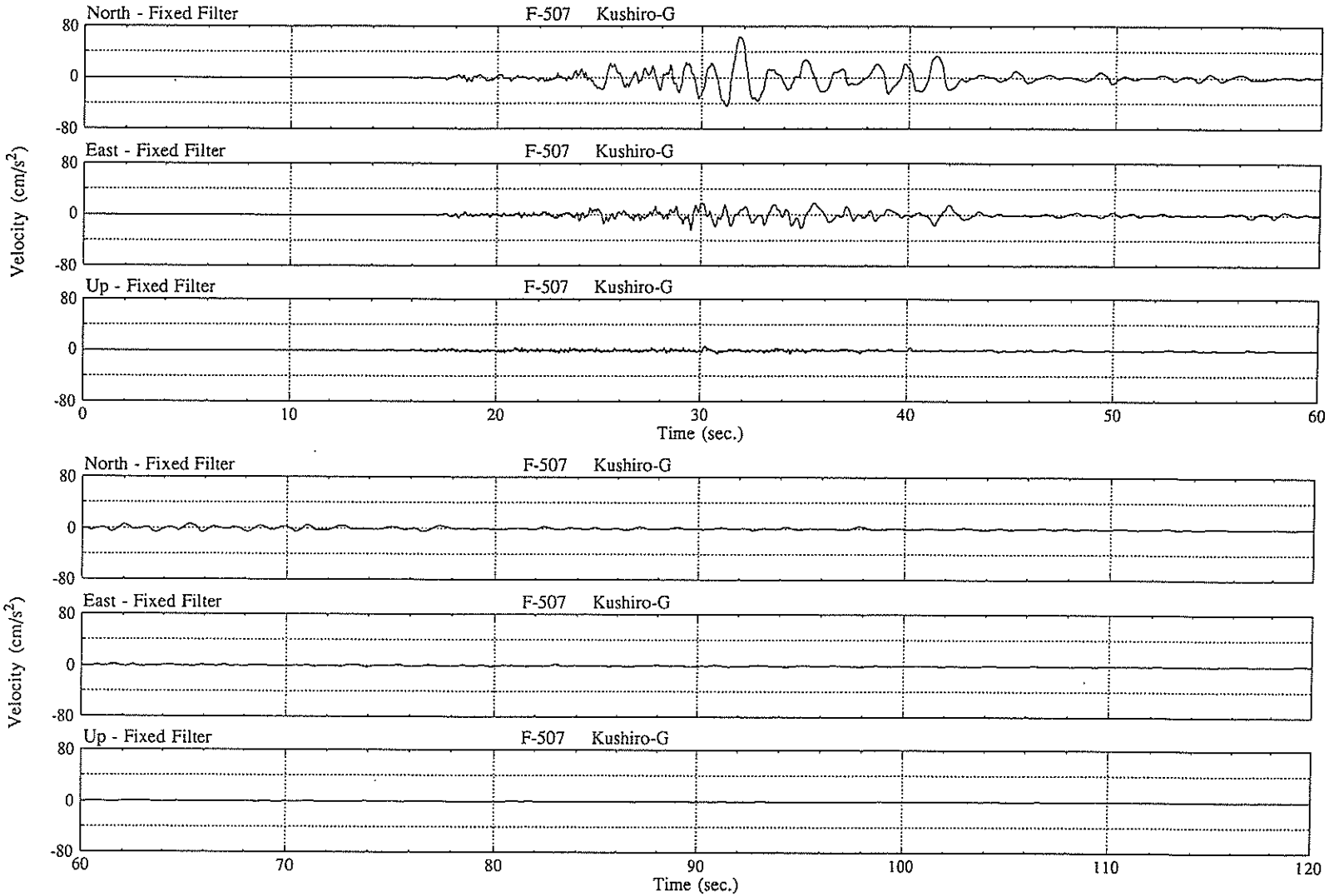
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.038	0.084	0.136	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	314.7	246.1	91.1	342.4
ORIGINAL	469.3	344.2	381.5	470.3
CORRECTED	467.8	343.9	342.4	467.8
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	64.12	24.27	7.64	64.22
VARIABLE FILTER	62.65	27.18	7.16	63.02
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	16.17	5.30	1.01	16.18
VARIABLE FILTER	19.48	4.81	0.99	19.50

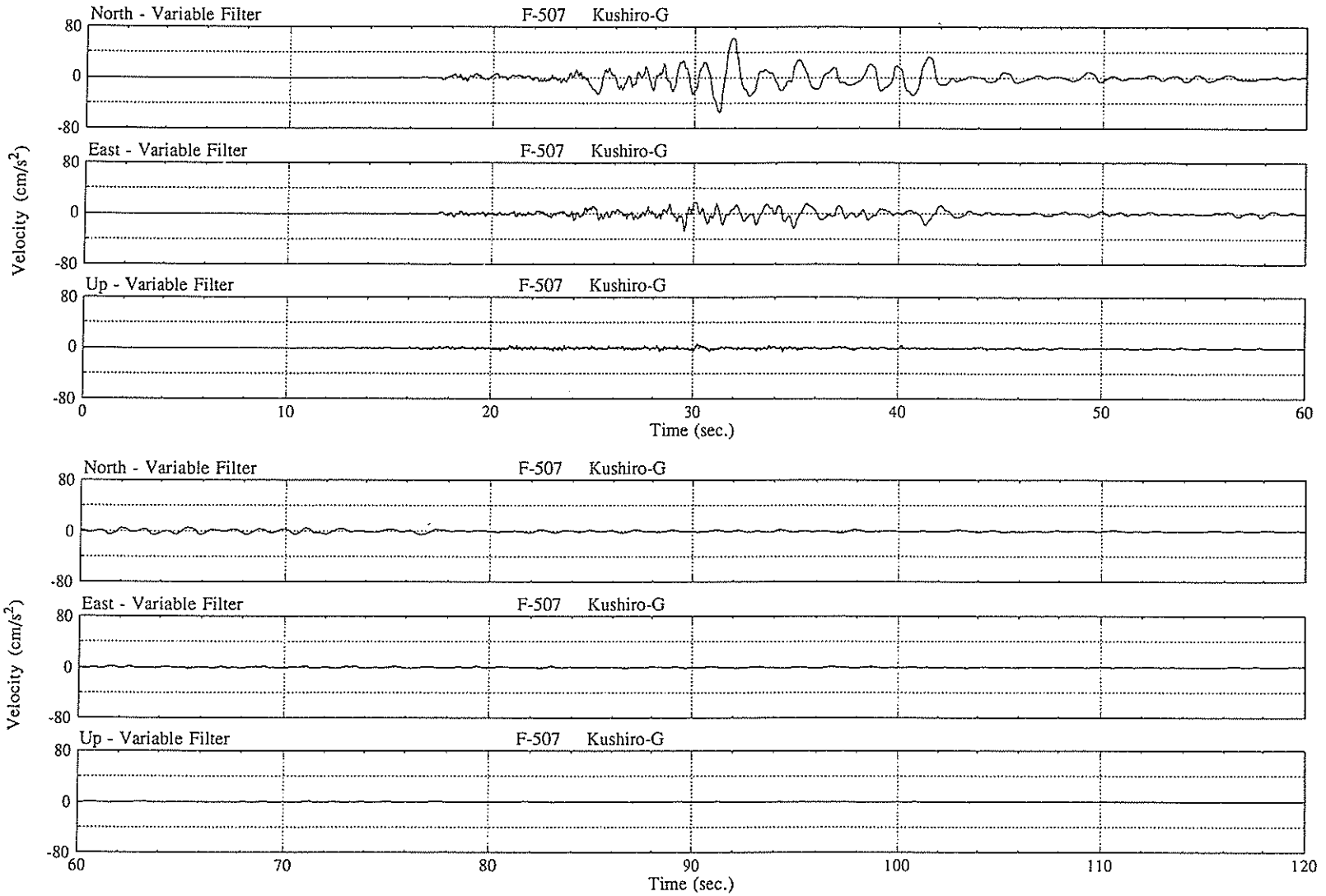
* RESULTANT OF HORIZONTAL COMPONENTS

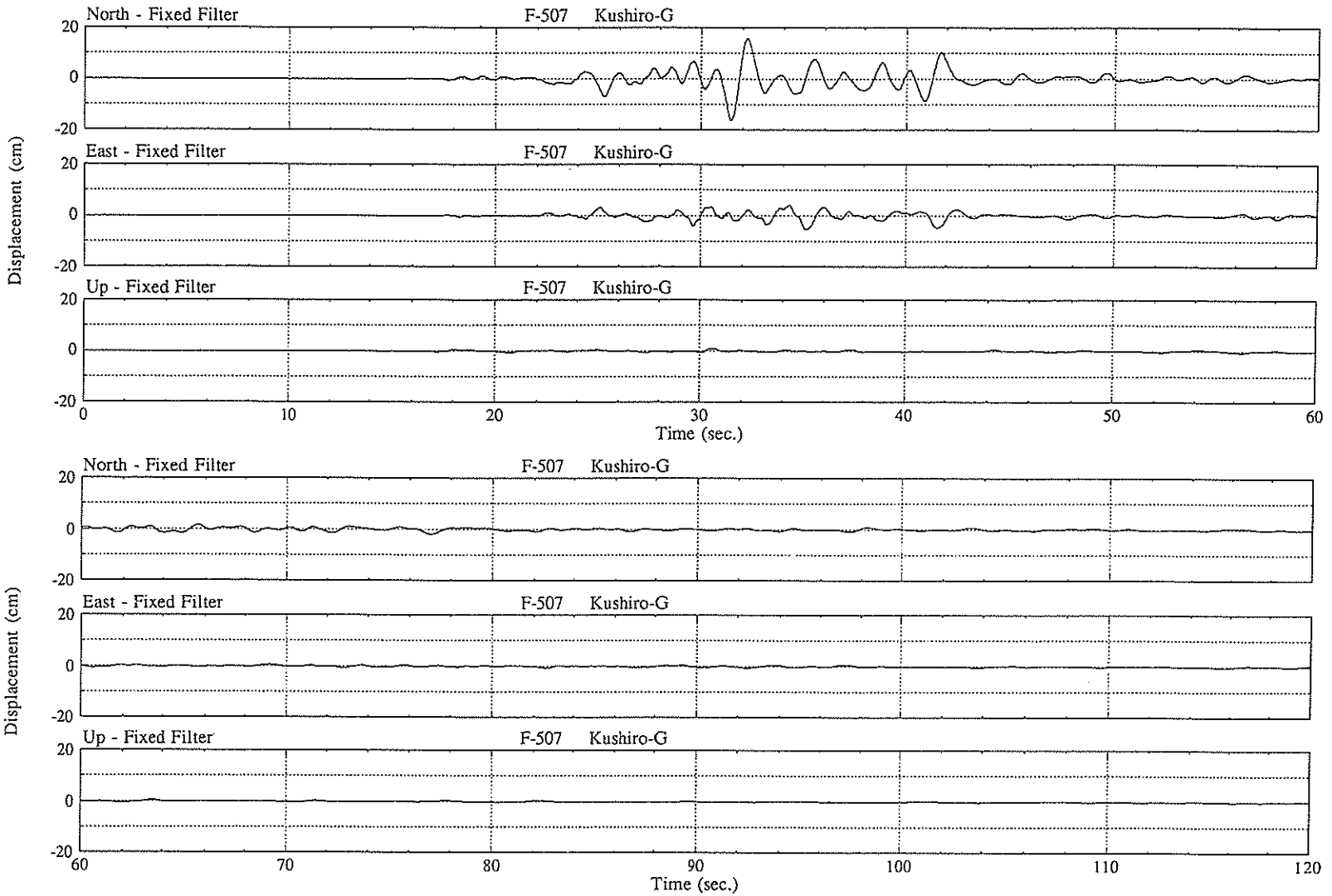

North - Original
F-507 Kushiro-G
East - Original
F-507 Kushiro-G
Up - Original
F-507 Kushiro-G
500
0
-500
Acceleration (cm/s²)
0
10
20
30
40
50
60
Time (sec.)
North - Original
F-507 Kushiro-G
East - Original
F-507 Kushiro-G
Up - Original
F-507 Kushiro-G
500
0
-500
Acceleration (cm/s²)
60
70
80
90
100
110
120
Time (sec.)

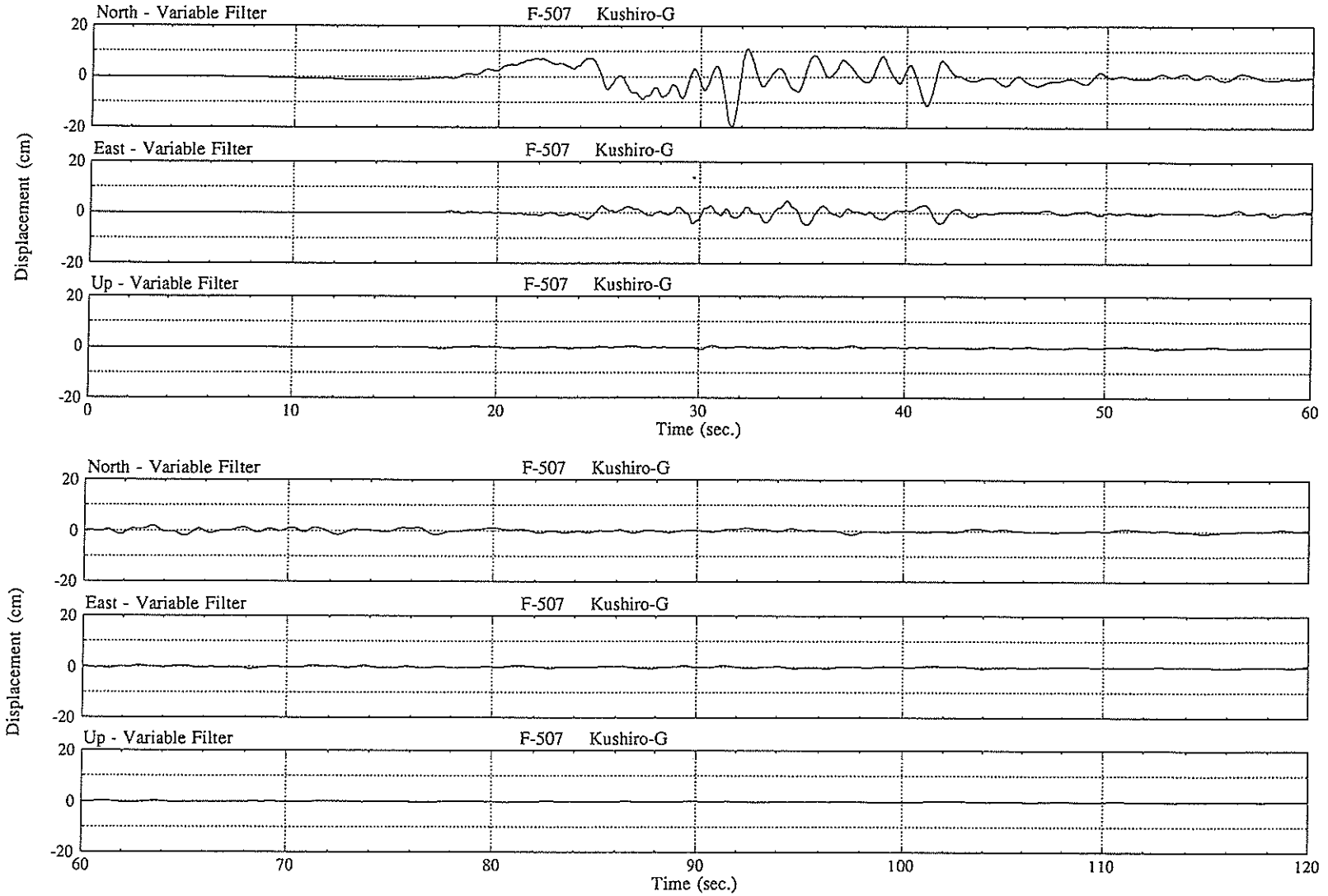

North - Corrected
F-507 Kushiro-G
East - Corrected
F-507 Kushiro-G
Up - Corrected
F-507 Kushiro-G
Acceleration (cm/s²)
500
0
-500
0
10
20
30
40
50
60
Time (sec.)
North - Corrected
F-507 Kushiro-G
East - Corrected
F-507 Kushiro-G
Up - Corrected
F-507 Kushiro-G
Acceleration (cm/s²)
500
0
-500
60
70
80
90
100
110
120
Time (sec.)

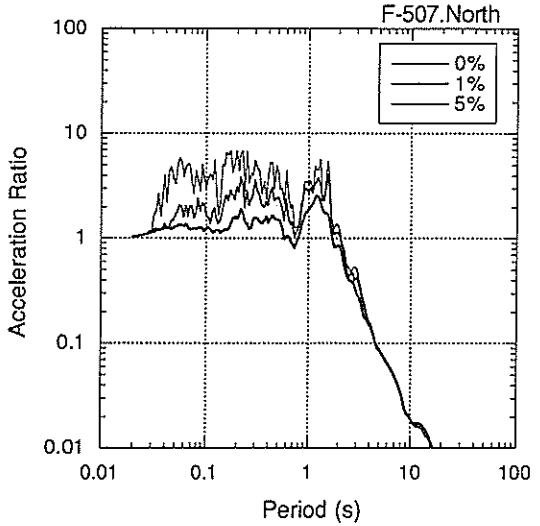

North - SMAC Equivalent
F-507 Kushiro-G
East - SMAC Equivalent
F-507 Kushiro-G
Up - SMAC Equivalent
F-507 Kushiro-G
Acceleration (cm/s²)
320
0
-320
0
10
20
30
40
50
60
Time (sec.)
North - SMAC Equivalent
F-507 Kushiro-G
East - SMAC Equivalent
F-507 Kushiro-G
Up - SMAC Equivalent
F-507 Kushiro-G
Acceleration (cm/s²)
320
0
-320
60
70
80
90
100
110
120
Time (sec.)

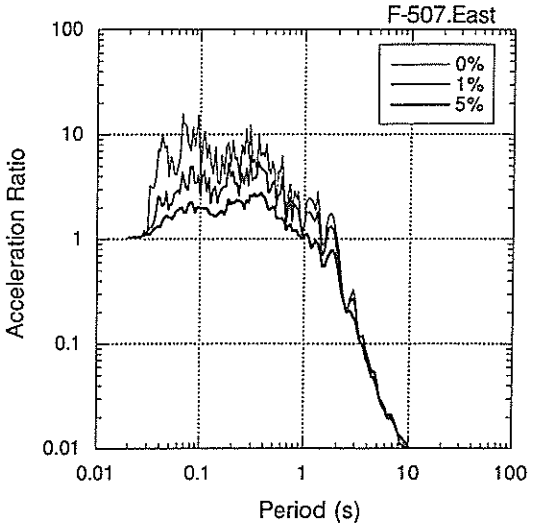

North - Fixed Filter
F-507 Kushiro-G
East - Fixed Filter
F-507 Kushiro-G
Up - Fixed Filter
F-507 Kushiro-G
Velocity (cm/s²)
80
0
-80
0
10
20
30
40
50
60
Time (sec.)
North - Fixed Filter
F-507 Kushiro-G
East - Fixed Filter
F-507 Kushiro-G
Up - Fixed Filter
F-507 Kushiro-G
Velocity (cm/s²)
60
70
80
90
100
110
120
Time (sec.)

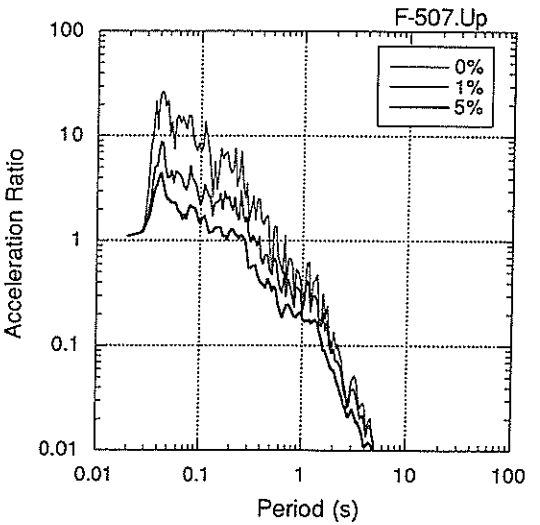

North - Variable Filter
F-507 Kushiro-G
East - Variable Filter
F-507 Kushiro-G
Up - Variable Filter
F-507 Kushiro-G
Velocity (cm/s²)
80
0
-80
0
10
20
30
40
50
60
Time (sec.)
North - Variable Filter
F-507 Kushiro-G
East - Variable Filter
F-507 Kushiro-G
Up - Variable Filter
F-507 Kushiro-G
Velocity (cm/s²)
80
0
-80
60
70
80
90
100
110
120
Time (sec.)

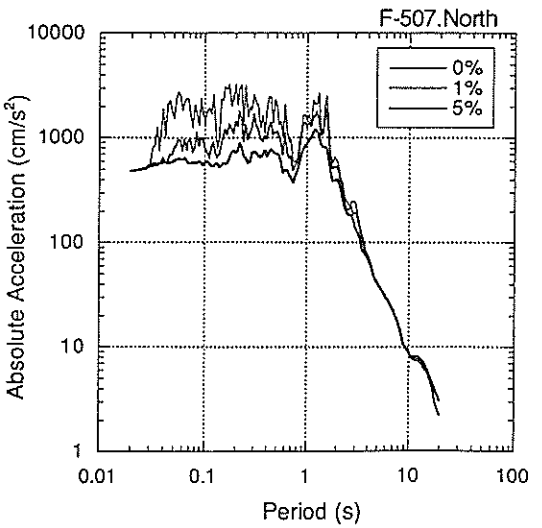

North - Fixed Filter
F-507 Kushiro-G
East - Fixed Filter
F-507 Kushiro-G
Up - Fixed Filter
F-507 Kushiro-G
Displacement (cm)
20
0
-20
0
10
20
30
40
50
60
Time (sec.)
North - Fixed Filter
F-507 Kushiro-G
East - Fixed Filter
F-507 Kushiro-G
Up - Fixed Filter
F-507 Kushiro-G
Displacement (cm)
60
70
80
90
100
110
120
Time (sec.)

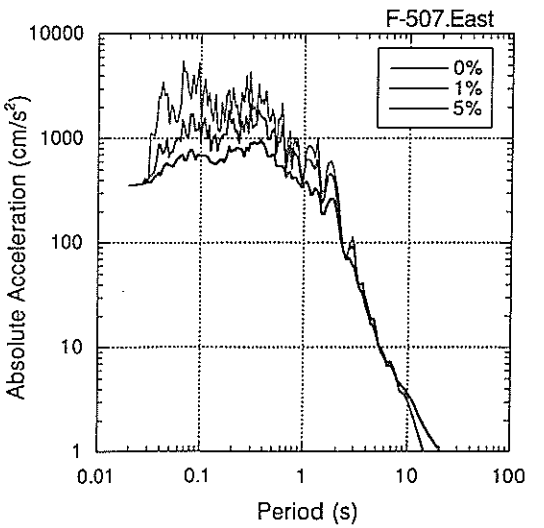

North - Variable Filter
F-507 Kushiro-G
East - Variable Filter
F-507 Kushiro-G
Up - Variable Filter
F-507 Kushiro-G
Displacement (cm)
20
0
-20
0
10
20
30
40
50
60
Time (sec.)
North - Variable Filter
F-507 Kushiro-G
East - Variable Filter
F-507 Kushiro-G
Up - Variable Filter
F-507 Kushiro-G
Displacement (cm)
60
70
80
90
100
110
120
Time (sec.)

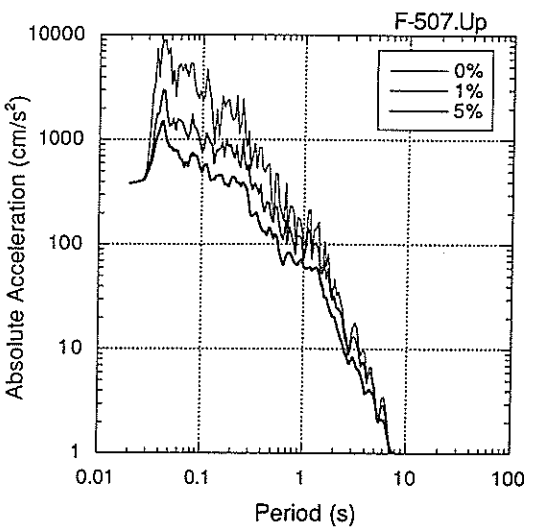

F-507.North
0%
1%
5%
Acceleration Ratio
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

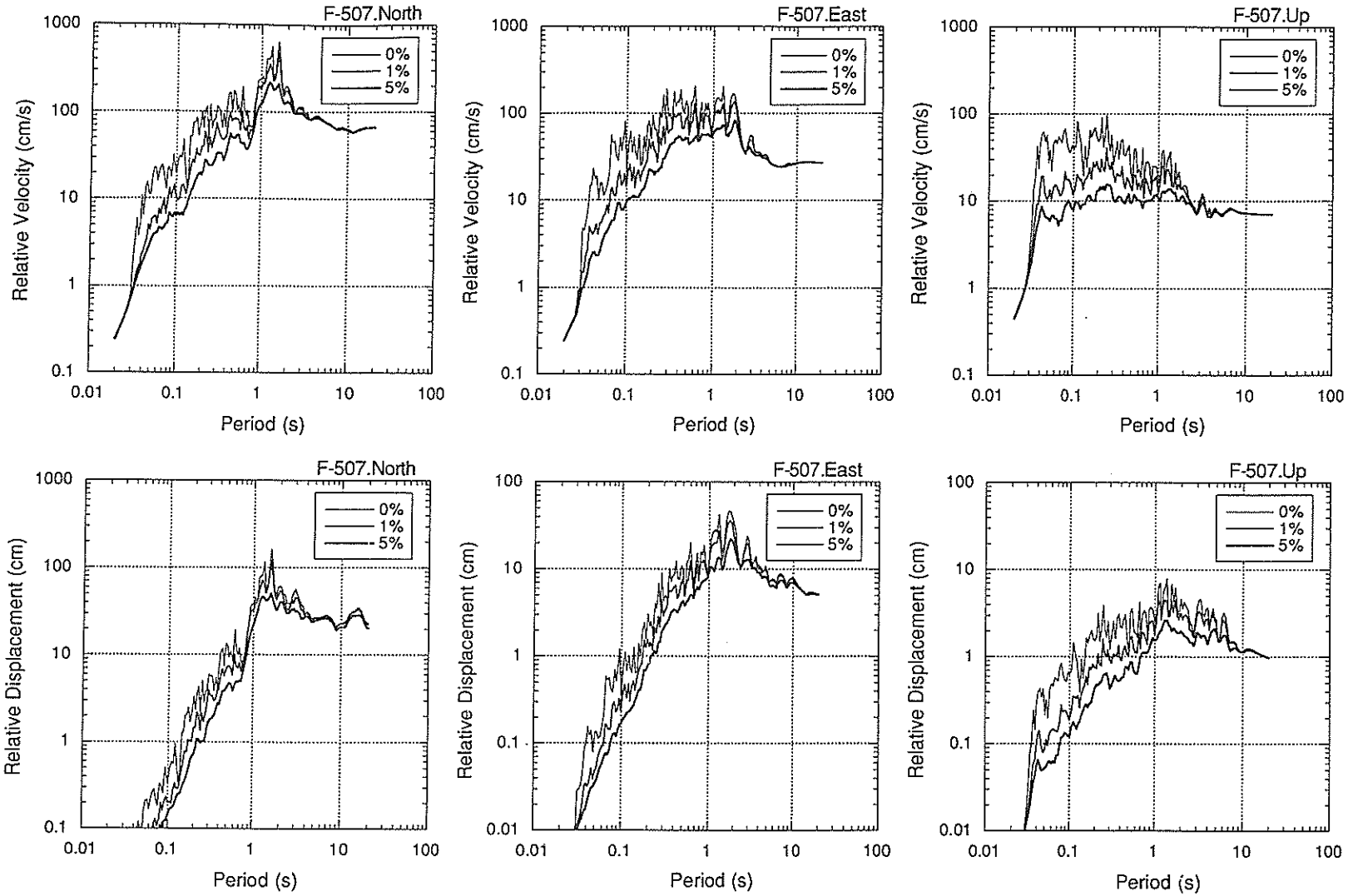

F-507.East
0%
1%
5%
Acceleration Ratio
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

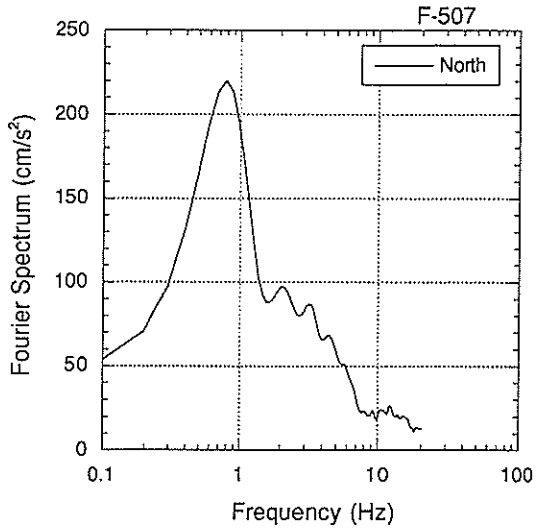

F-507.Up
0%
1%
5%
Acceleration Ratio
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

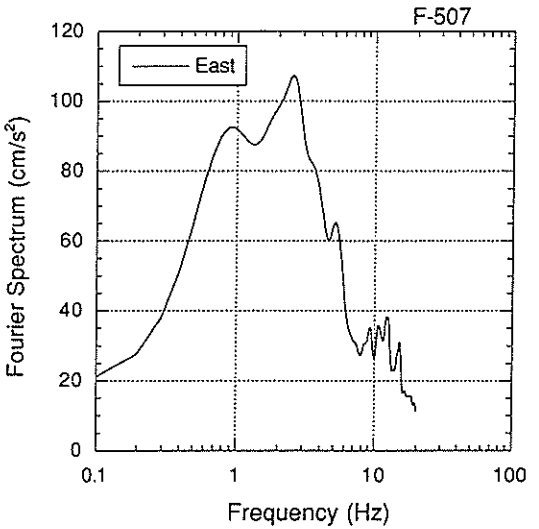

F-507.North
0%
1%
5%
Absolute Acceleration (cm/s²)
Period (s)
10000
1000
100
10
1
0.01
0.1
1
10
100

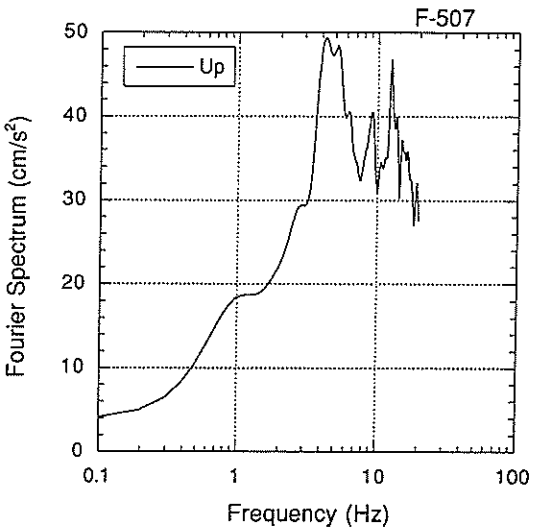

F-507.East
0%
1%
5%
Absolute Acceleration (cm/s²)
Period (s)
10000
1000
100
10
1
0.01
0.1
1
10
100

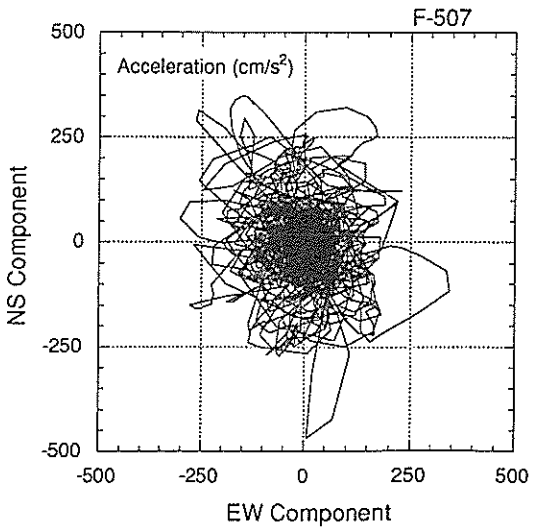

F-507.Up
0%
1%
5%
Absolute Acceleration (cm/s²)
Period (s)
10000
1000
100
10
1
0.01
0.1
1
10
100

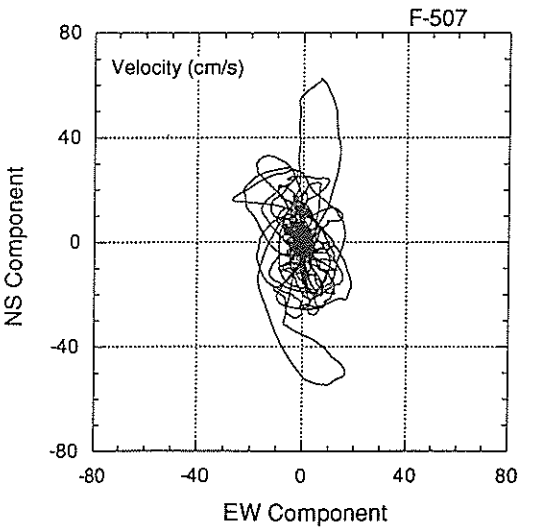

F-507.North
F-507.East
F-507.Up
0%
1%
5%
Relative Velocity (cm/s)
Relative Displacement (cm)
Period (s)
0.01
0.1
1
10
100
1000

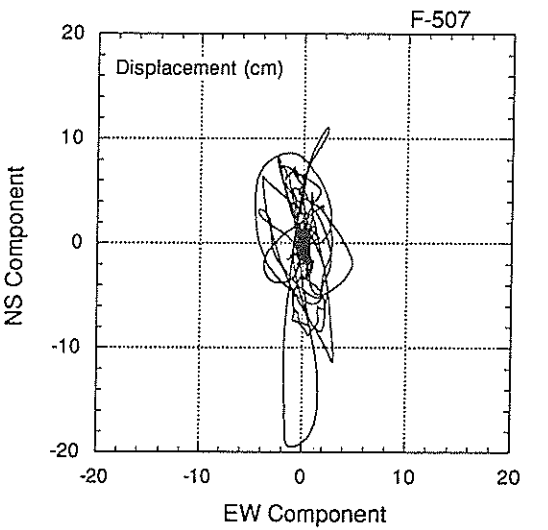

F-507
North
Fourier Spectrum (cm/s²)
Frequency (Hz)
250
200
150
100
50
0
0.1
1
10
100


F-507
East
Fourier Spectrum (cm/s²)
Frequency (Hz)
120
100
80
60
40
20
0
0.1
1
10
100


F-507
Up
Fourier Spectrum (cm/s²)
Frequency (Hz)
50
40
30
20
10
0
0.1
1
10
100


F-507
Acceleration (cm/s²)
NS Component
EW Component
500
250
0
-250
-500


F-507
Velocity (cm/s)
NS Component
EW Component
80
40
0
-40
-80


F-507
Displacement (cm)
NS Component
EW Component
20
10
0
-10
-20

RECORD NUMBER : F-508

STATION : HAKODATE-FB

EARTHQUAKE DATA

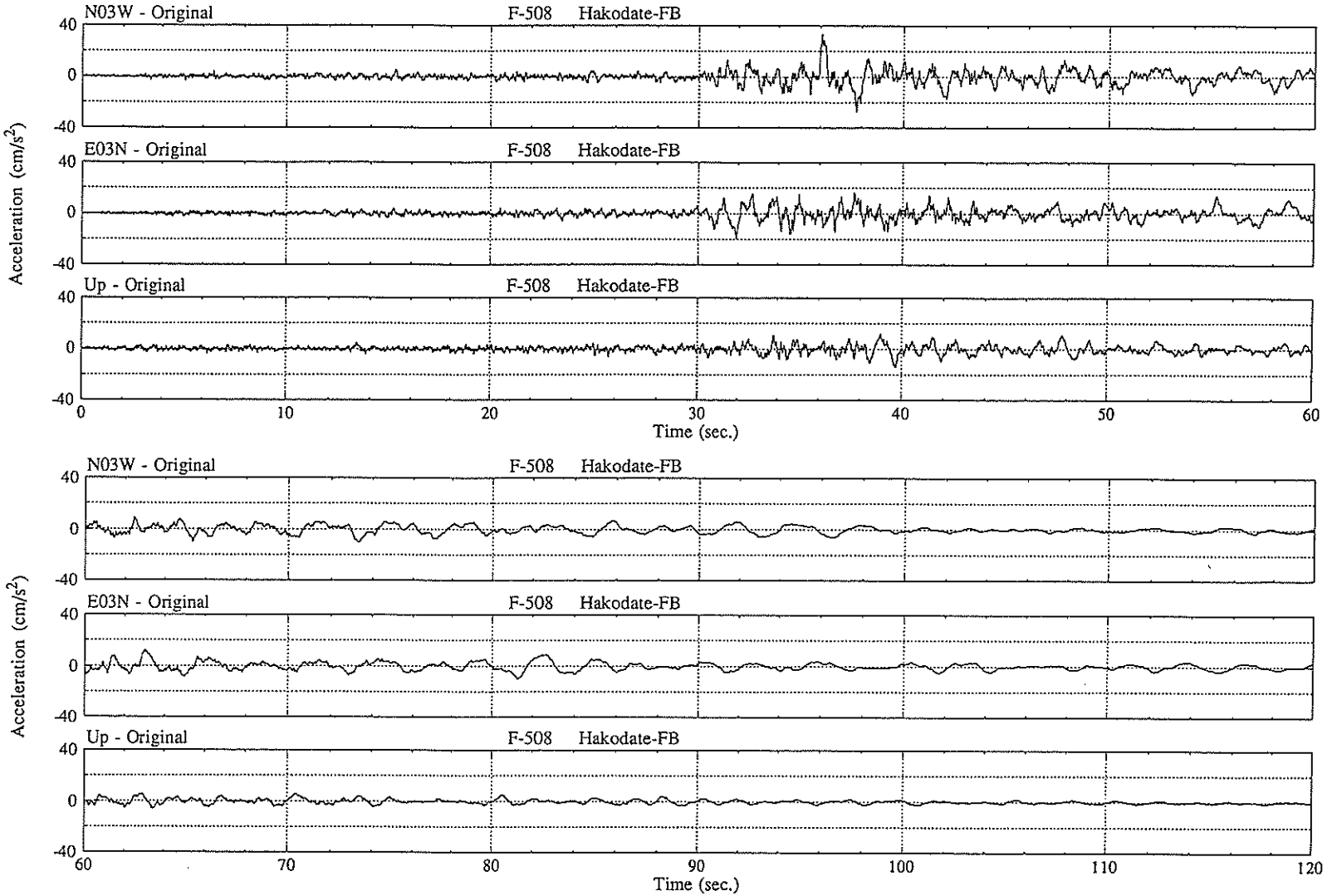
****

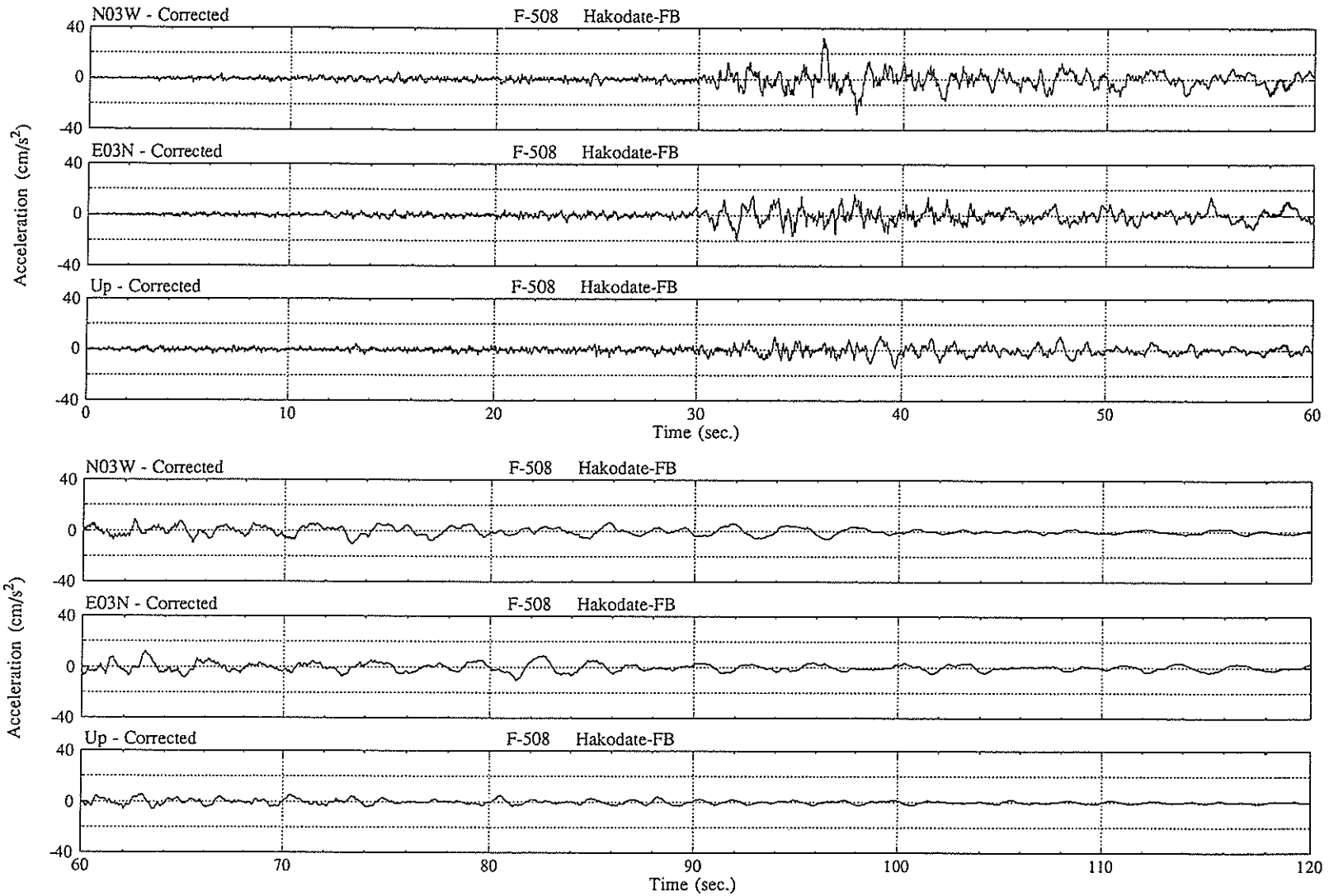
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

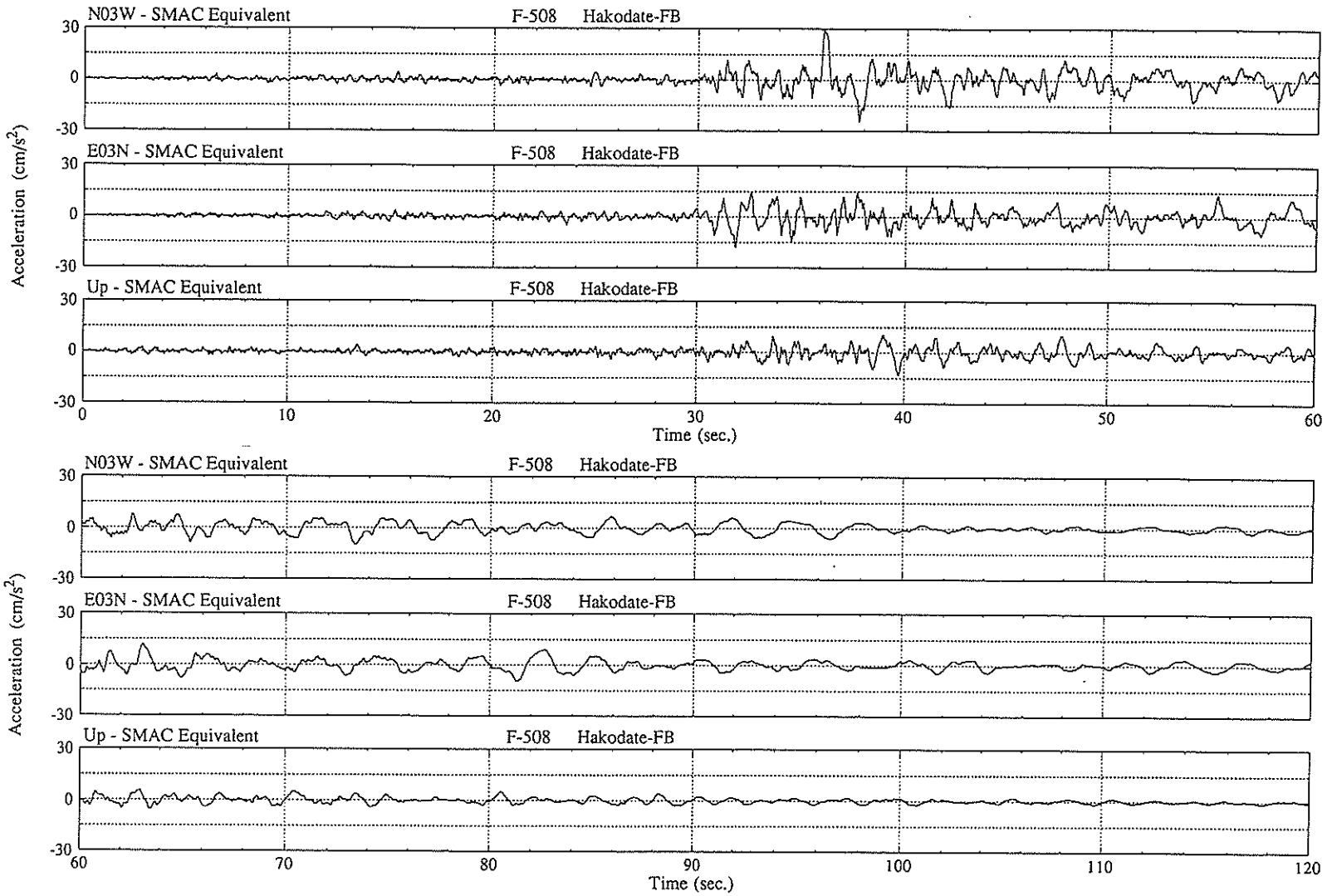
****

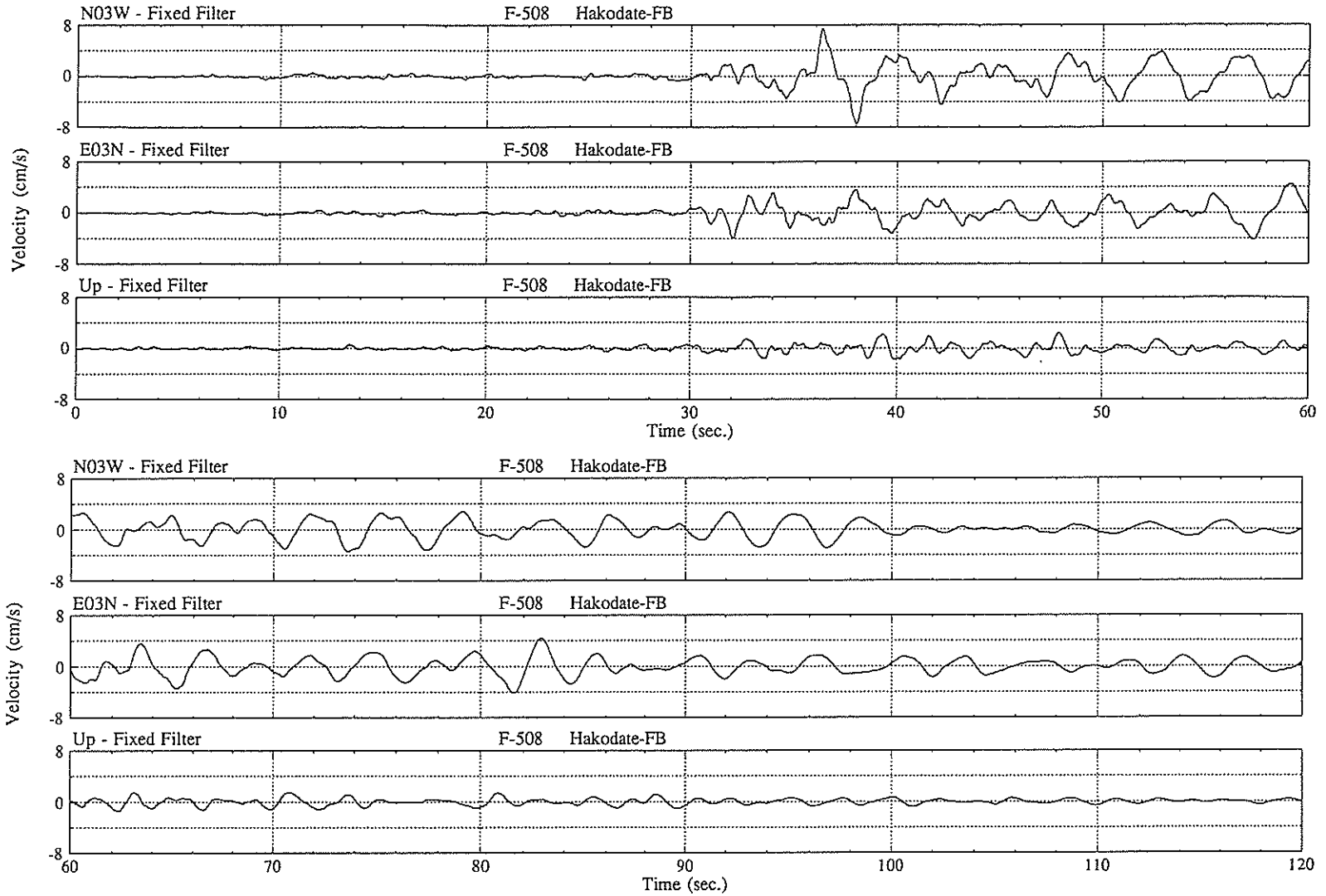
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.081	0.072	0.103	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	30.0	17.6	12.9	30.0
ORIGINAL	33.3	19.1	14.1	33.3
CORRECTED	33.2	19.3	14.0	33.2
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	7.46	4.51	2.43	8.32
VARIABLE FILTER	6.14	4.50	2.52	6.47
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	2.89	2.33	0.74	3.17
VARIABLE FILTER	3.17	2.54	0.77	3.70

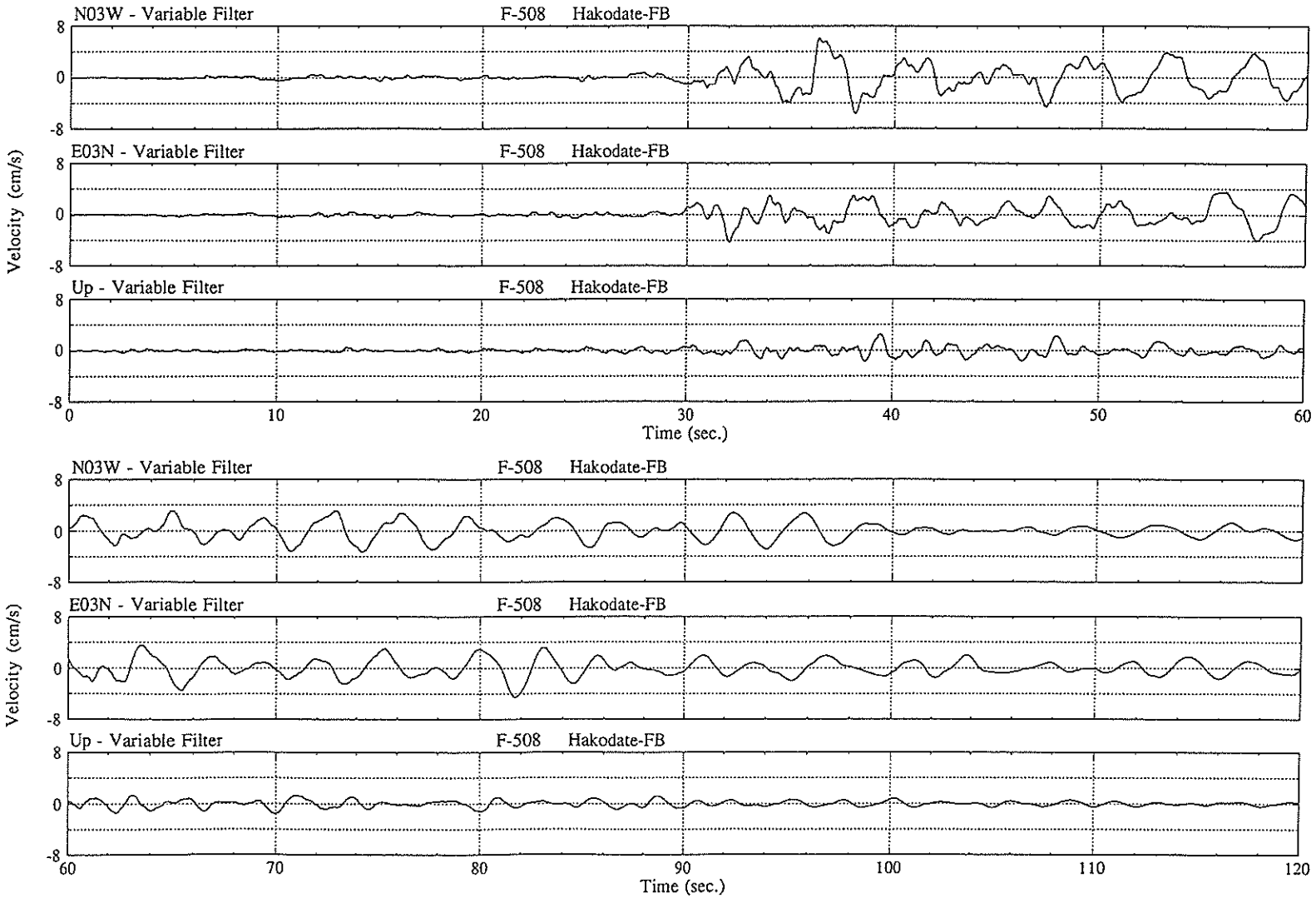
* RESULTANT OF HORIZONTAL COMPONENTS

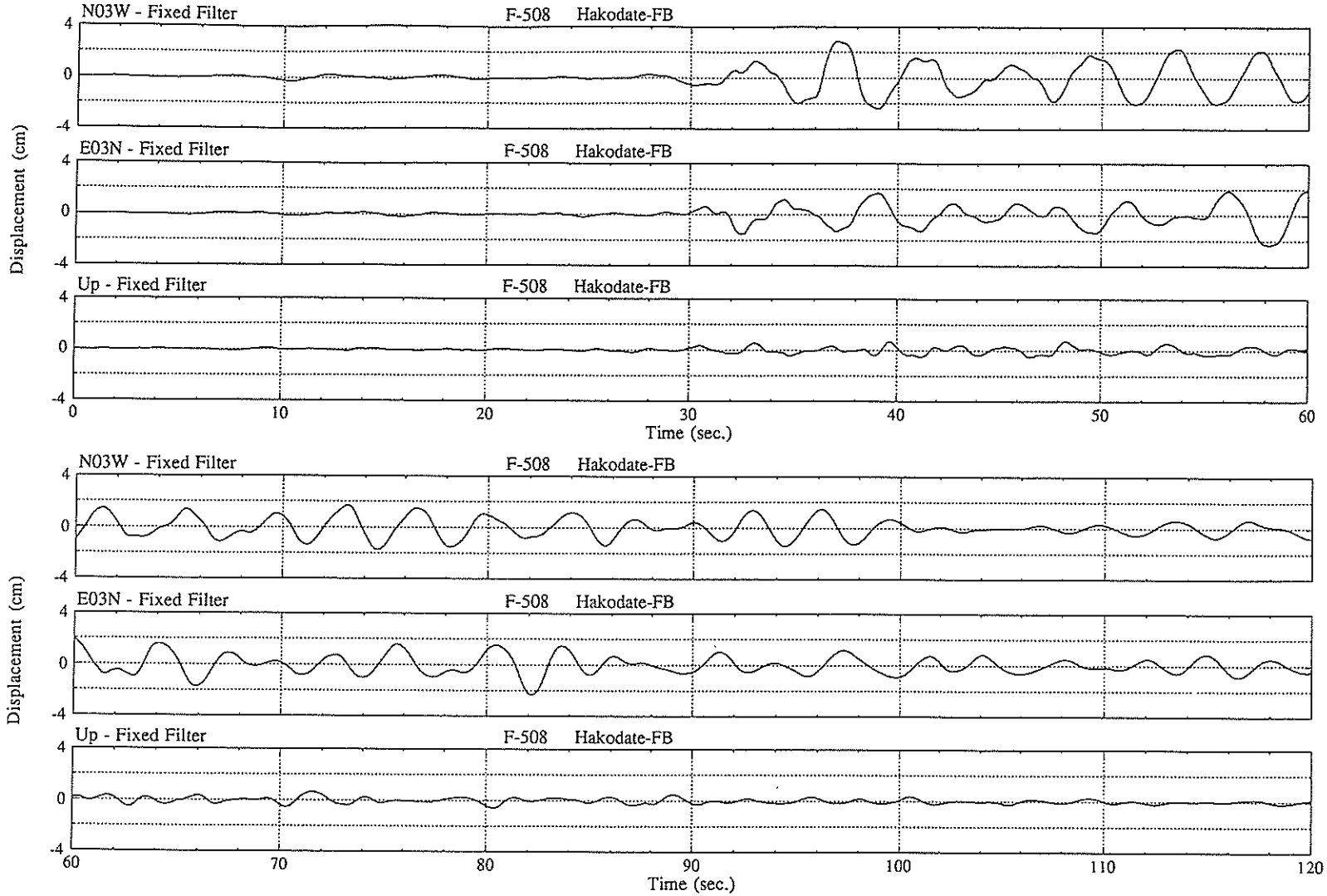

N03W - Original
F-508 Hakodate-FB
E03N - Original
F-508 Hakodate-FB
Up - Original
F-508 Hakodate-FB
Acceleration (cm/s²)
40
0
-40
0
10
20
30
40
50
60
Time (sec.)
N03W - Original
F-508 Hakodate-FB
E03N - Original
F-508 Hakodate-FB
Up - Original
F-508 Hakodate-FB
Acceleration (cm/s²)
40
0
-40
60
70
80
90
100
110
120
Time (sec.)

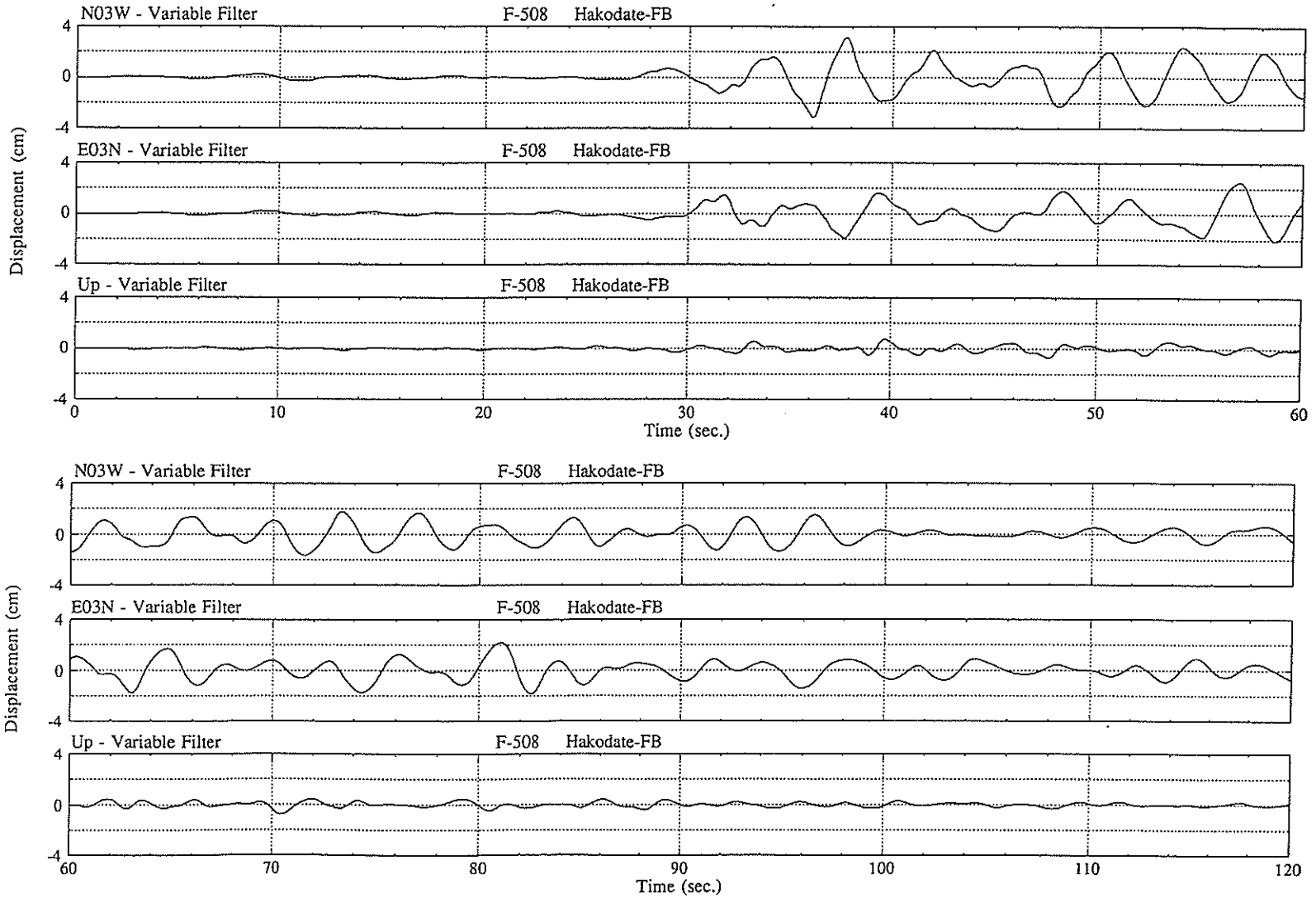

N03W - Corrected
F-508 Hakodate-FB
E03N - Corrected
F-508 Hakodate-FB
Up - Corrected
F-508 Hakodate-FB
Acceleration (cm/s²)
40
0
-40
0
10
20
30
40
50
60
Time (sec.)
N03W - Corrected
F-508 Hakodate-FB
E03N - Corrected
F-508 Hakodate-FB
Up - Corrected
F-508 Hakodate-FB
Acceleration (cm/s²)
40
0
-40
60
70
80
90
100
110
120
Time (sec.)

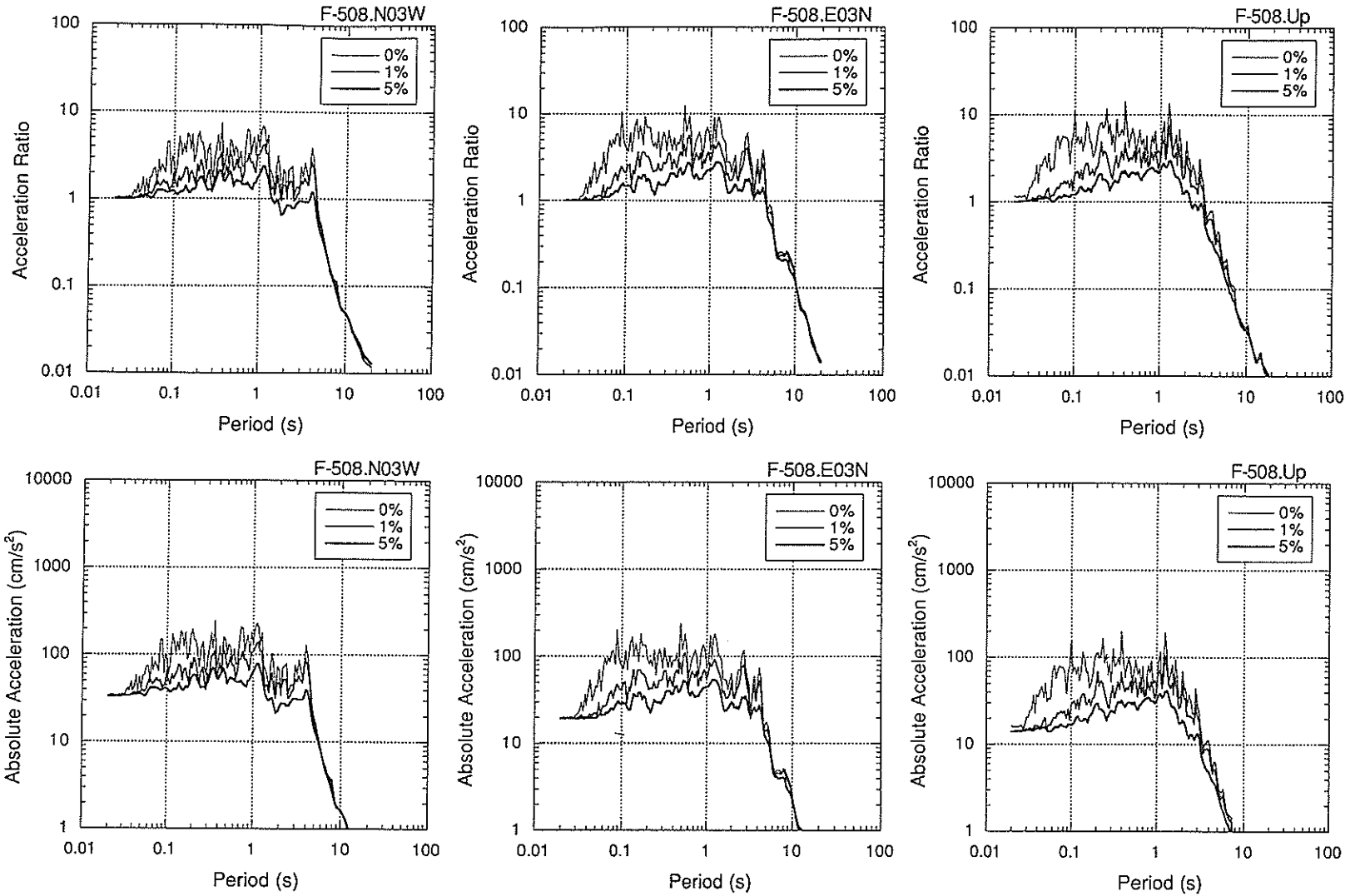

N03W - SMAC Equivalent
F-508 Hakodate-FB
E03N - SMAC Equivalent
F-508 Hakodate-FB
Up - SMAC Equivalent
F-508 Hakodate-FB
Acceleration (cm/s²)
30
0
-30
0
10
20
30
40
50
60
Time (sec.)
N03W - SMAC Equivalent
F-508 Hakodate-FB
E03N - SMAC Equivalent
F-508 Hakodate-FB
Up - SMAC Equivalent
F-508 Hakodate-FB
Acceleration (cm/s²)
60
70
80
90
100
110
120
Time (sec.)

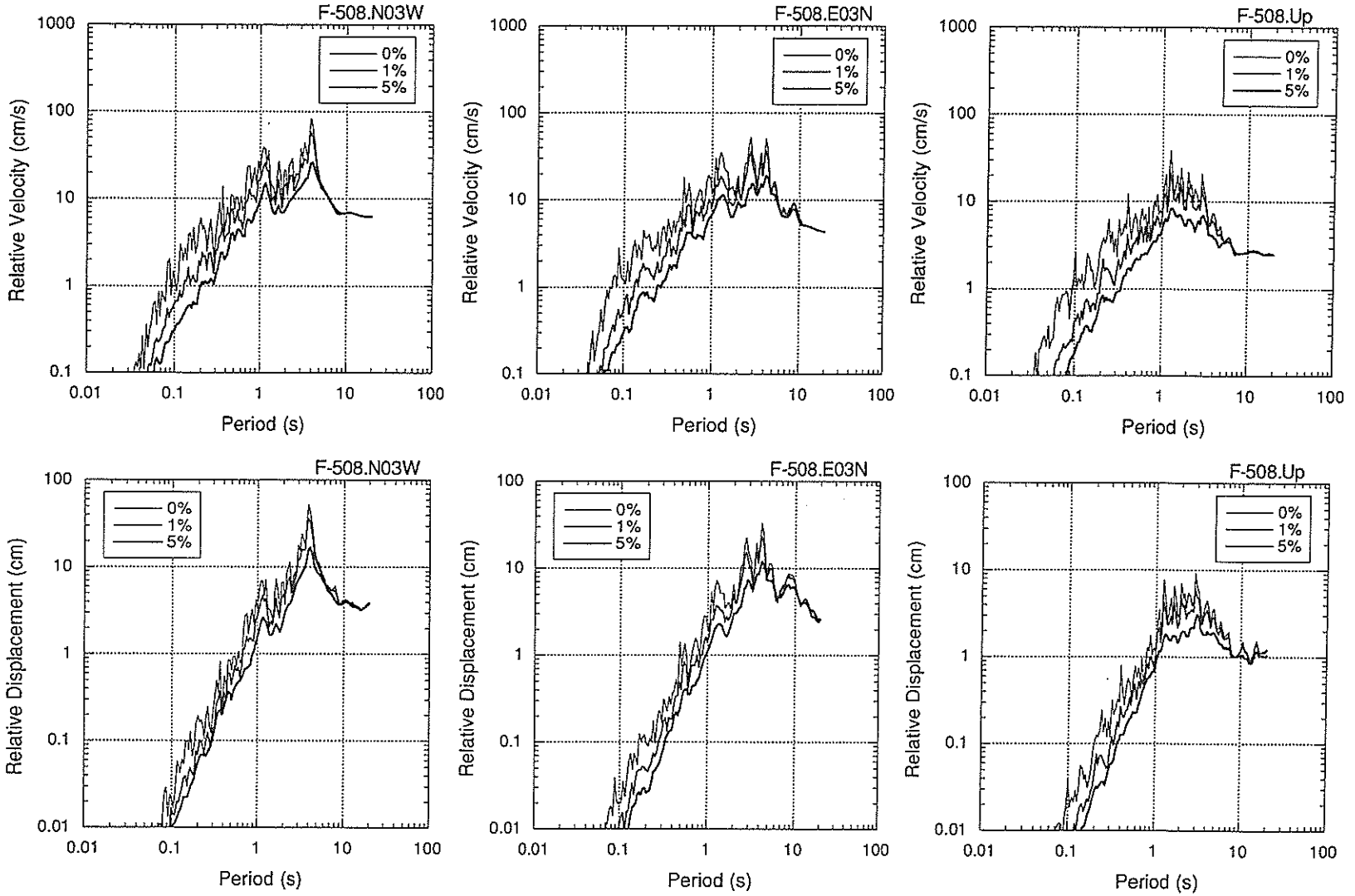

N03W - Fixed Filter
F-508 Hakodate-FB
E03N - Fixed Filter
F-508 Hakodate-FB
Up - Fixed Filter
F-508 Hakodate-FB
Velocity (cm/s)
8
0
-8
0
10
20
30
40
50
60
Time (sec.)
N03W - Fixed Filter
F-508 Hakodate-FB
E03N - Fixed Filter
F-508 Hakodate-FB
Up - Fixed Filter
F-508 Hakodate-FB
Velocity (cm/s)
60
70
80
90
100
110
120
Time (sec.)

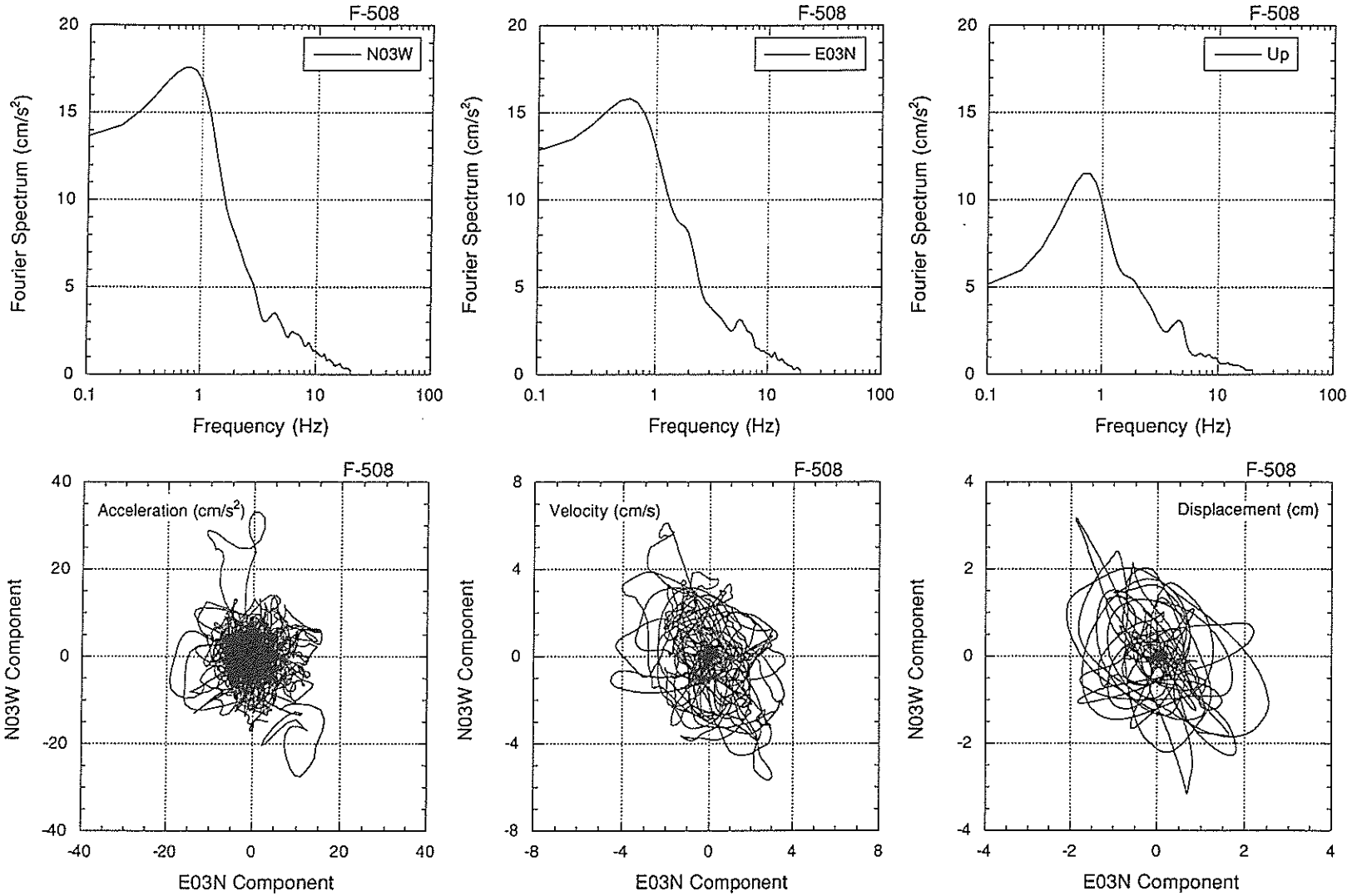

N03W - Variable Filter
F-508 Hakodate-FB
E03N - Variable Filter
F-508 Hakodate-FB
Up - Variable Filter
F-508 Hakodate-FB
Velocity (cm/s)
8
0
-8
0
10
20
30
40
50
60
Time (sec.)
N03W - Variable Filter
F-508 Hakodate-FB
E03N - Variable Filter
F-508 Hakodate-FB
Up - Variable Filter
F-508 Hakodate-FB
Velocity (cm/s)
60
70
80
90
100
110
120
Time (sec.)


N03W - Fixed Filter
F-508 Hakodate-FB
E03N - Fixed Filter
F-508 Hakodate-FB
Up - Fixed Filter
F-508 Hakodate-FB
Displacement (cm)
4
0
-4
0
10
20
30
40
50
60
Time (sec.)
N03W - Fixed Filter
F-508 Hakodate-FB
E03N - Fixed Filter
F-508 Hakodate-FB
Up - Fixed Filter
F-508 Hakodate-FB
Displacement (cm)
4
0
-4
60
70
80
90
100
110
120
Time (sec.)


N03W - Variable Filter
F-508 Hakodate-FB
E03N - Variable Filter
F-508 Hakodate-FB
Up - Variable Filter
F-508 Hakodate-FB
Displacement (cm)
4
0
-4
0
10
20
30
40
50
60
Time (sec.)
N03W - Variable Filter
F-508 Hakodate-FB
E03N - Variable Filter
F-508 Hakodate-FB
Up - Variable Filter
F-508 Hakodate-FB
Displacement (cm)
60
70
80
90
100
110
120
Time (sec.)


F-508.N03W
F-508.E03N
F-508.Up
0%
1%
5%
Acceleration Ratio
Absolute Acceleration (cm/s²)
Period (s)
0.01
0.1
1
10
100
1000
10000


F-508.N03W
F-508.E03N
F-508.Up
0%
1%
5%
Relative Velocity (cm/s)
Relative Displacement (cm)
Period (s)
0.01
0.1
1
10
100
1000


F-508
N03W
E03N
Up
Fourier Spectrum (cm/s²)
Frequency (Hz)
Acceleration (cm/s²)
Velocity (cm/s)
Displacement (cm)
N03W Component
E03N Component

RECORD NUMBER : F-509

STATION : HAKODATE-FR

EARTHQUAKE DATA

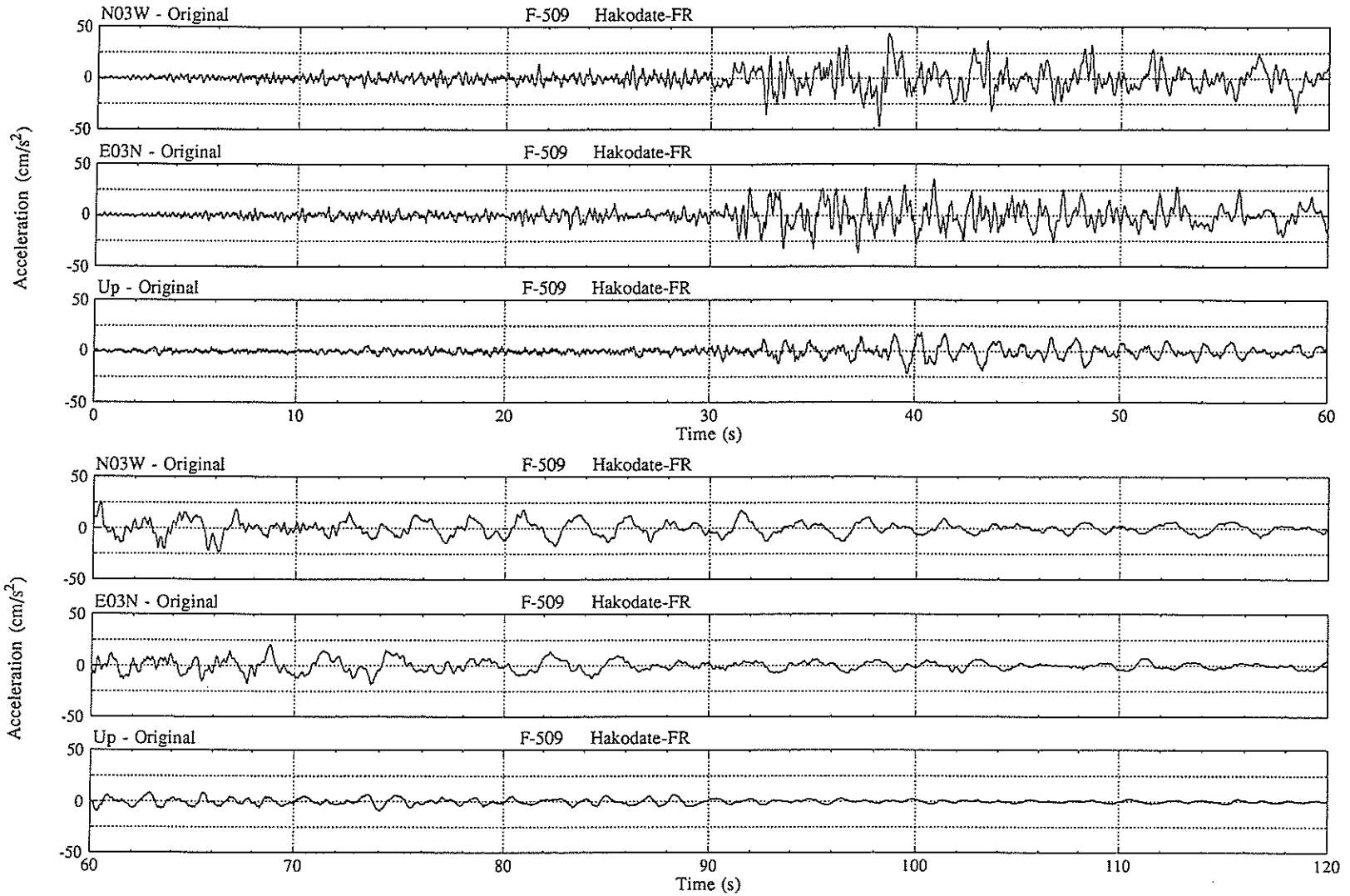
****

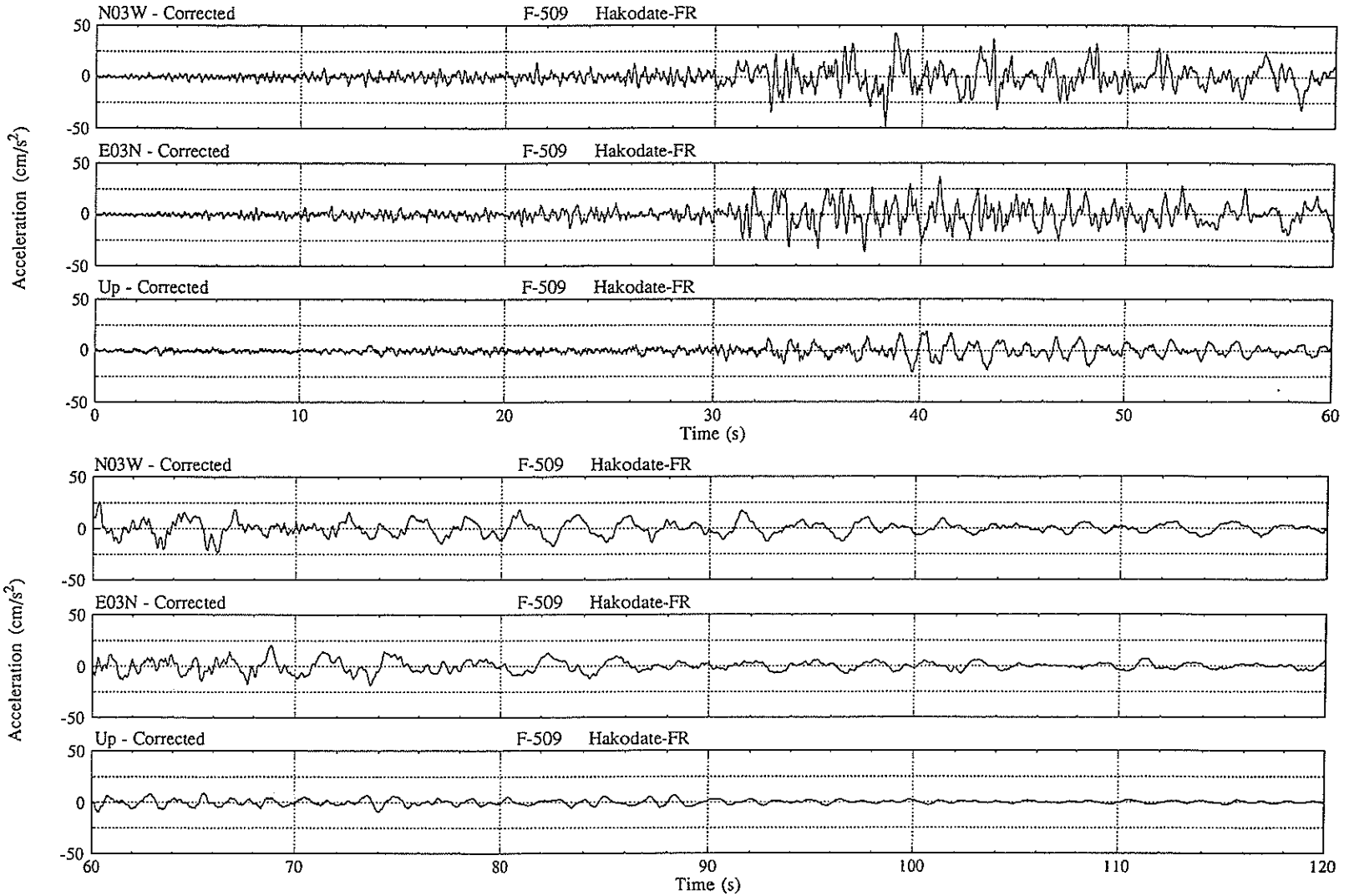
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

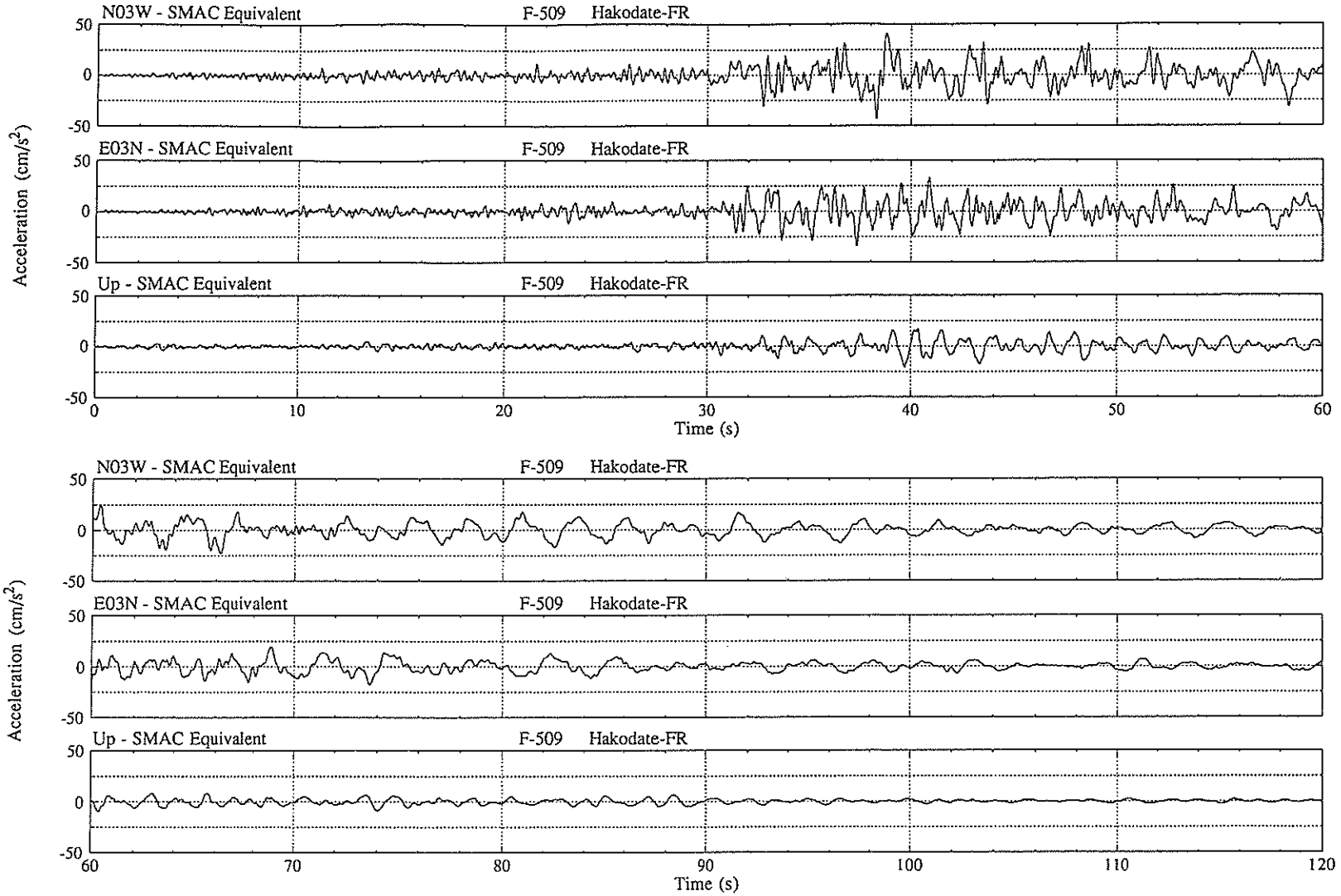
****

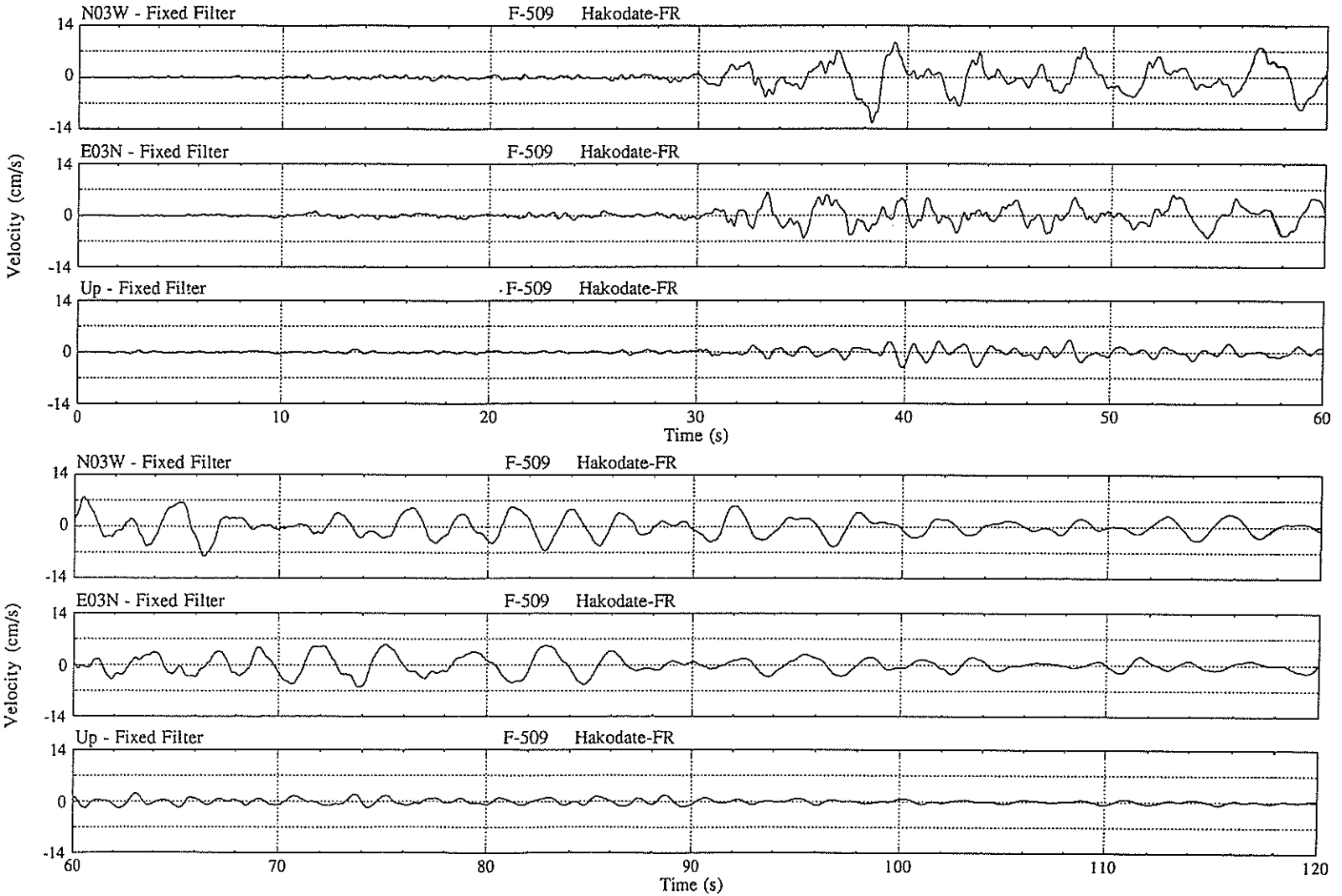
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.121	0.139	0.203	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	43.6	34.2	20.8	44.3
ORIGINAL	47.4	36.5	21.7	47.5
CORRECTED	47.8	36.3	21.1	47.9
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	12.37	6.24	4.20	12.72
VARIABLE FILTER	12.80	7.23	3.68	13.14
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	5.72	3.25	1.14	5.92
VARIABLE FILTER	4.76	2.80	1.02	4.92

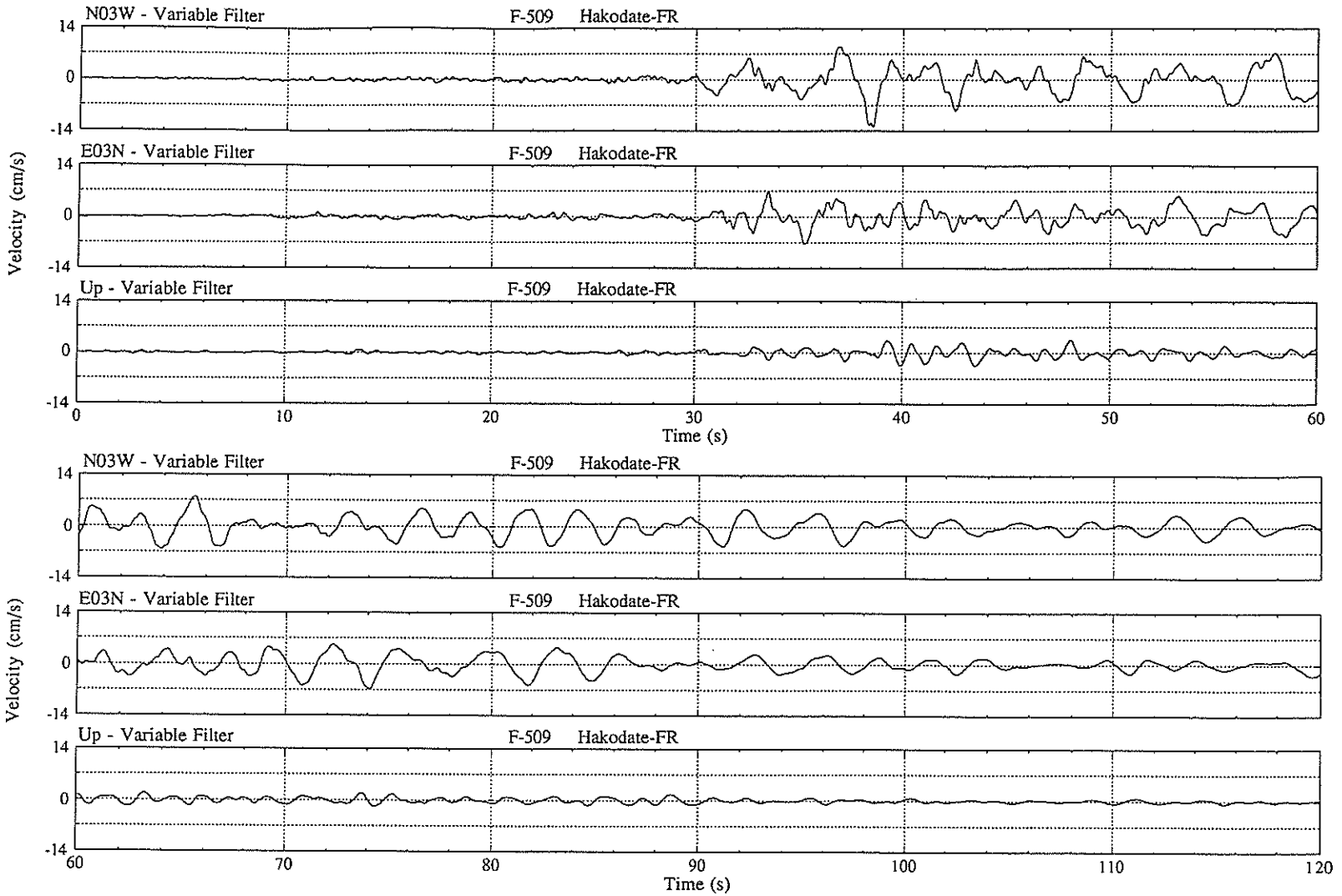
* RESULTANT OF HORIZONTAL COMPONENTS

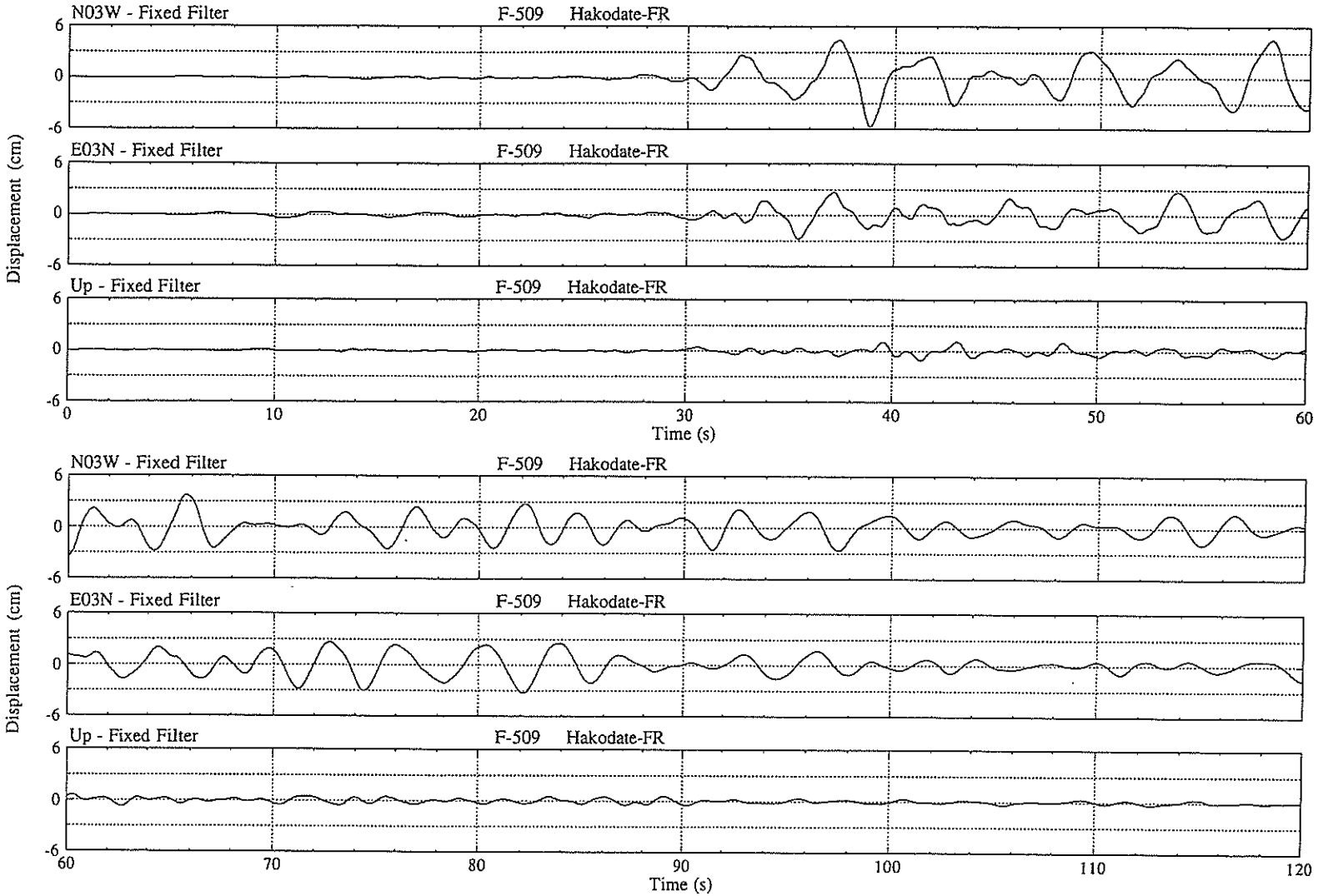

N03W - Original
F-509 Hakodate-FR
E03N - Original
F-509 Hakodate-FR
Up - Original
F-509 Hakodate-FR
Acceleration (cm/s²)
50
0
-50
0
10
20
30
40
50
60
Time (s)
N03W - Original
F-509 Hakodate-FR
E03N - Original
F-509 Hakodate-FR
Up - Original
F-509 Hakodate-FR
Acceleration (cm/s²)
50
0
-50
60
70
80
90
100
110
120
Time (s)

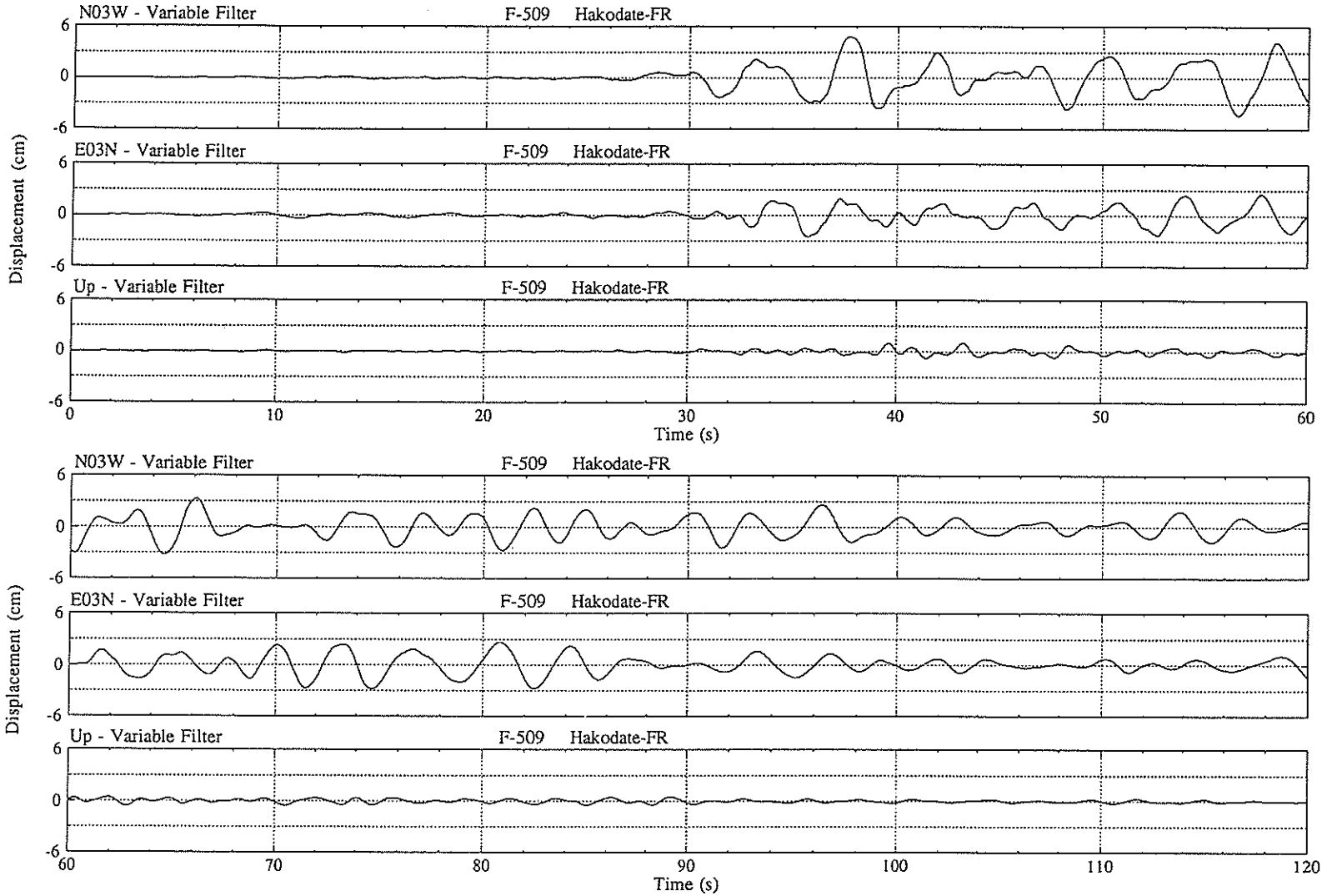

N03W - Corrected
F-509 Hakodate-FR
E03N - Corrected
F-509 Hakodate-FR
Up - Corrected
F-509 Hakodate-FR
Acceleration (cm/s²)
50
0
-50
0
10
20
30
40
50
60
Time (s)
N03W - Corrected
F-509 Hakodate-FR
E03N - Corrected
F-509 Hakodate-FR
Up - Corrected
F-509 Hakodate-FR
Acceleration (cm/s²)
50
0
-50
60
70
80
90
100
110
120
Time (s)

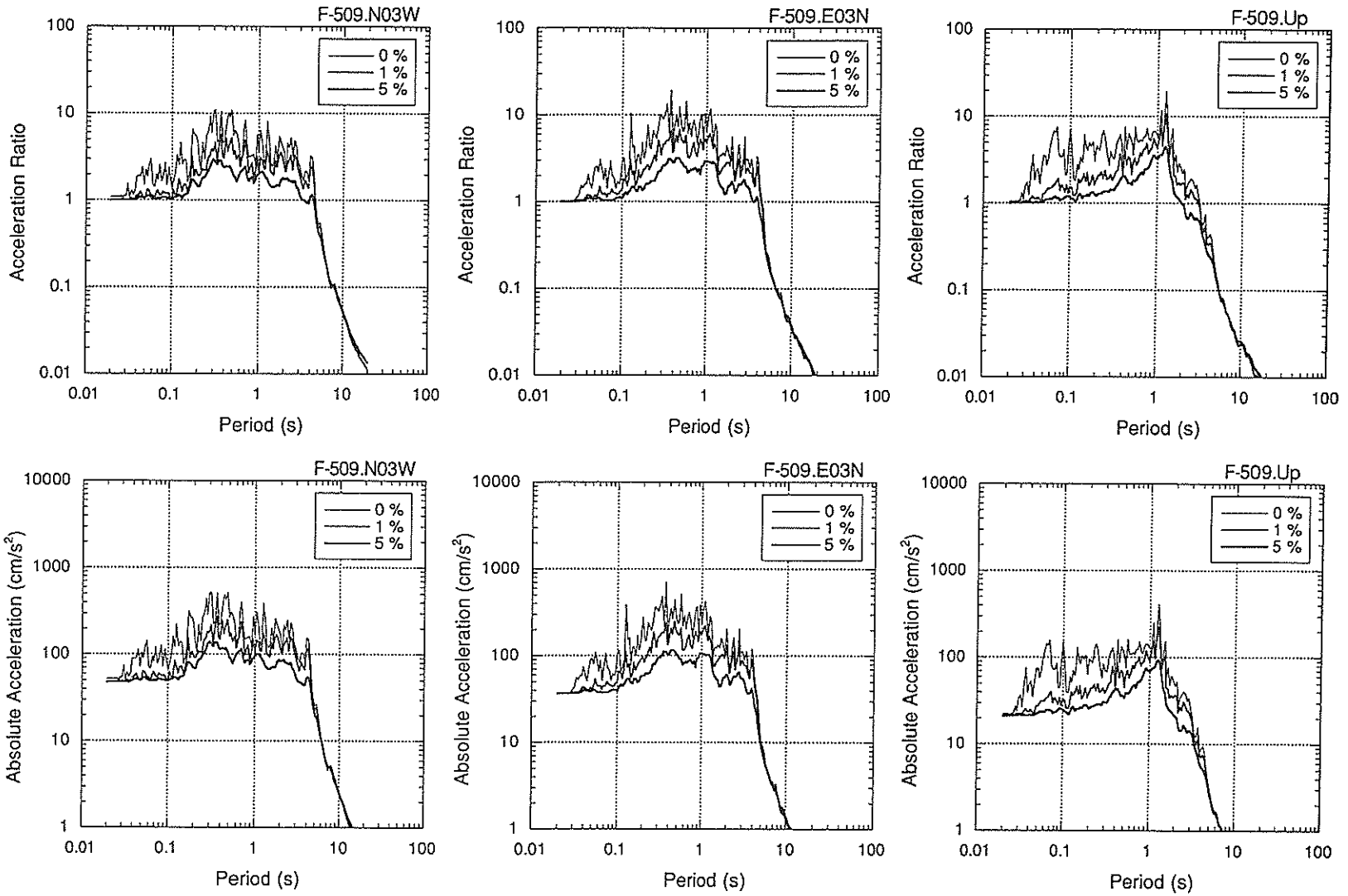

N03W - SMAC Equivalent
F-509 Hakodate-FR
E03N - SMAC Equivalent
F-509 Hakodate-FR
Up - SMAC Equivalent
F-509 Hakodate-FR
Acceleration (cm/s²)
50
0
-50
0
10
20
30
40
50
60
Time (s)
N03W - SMAC Equivalent
F-509 Hakodate-FR
E03N - SMAC Equivalent
F-509 Hakodate-FR
Up - SMAC Equivalent
F-509 Hakodate-FR
Acceleration (cm/s²)
50
0
-50
60
70
80
90
100
110
120
Time (s)

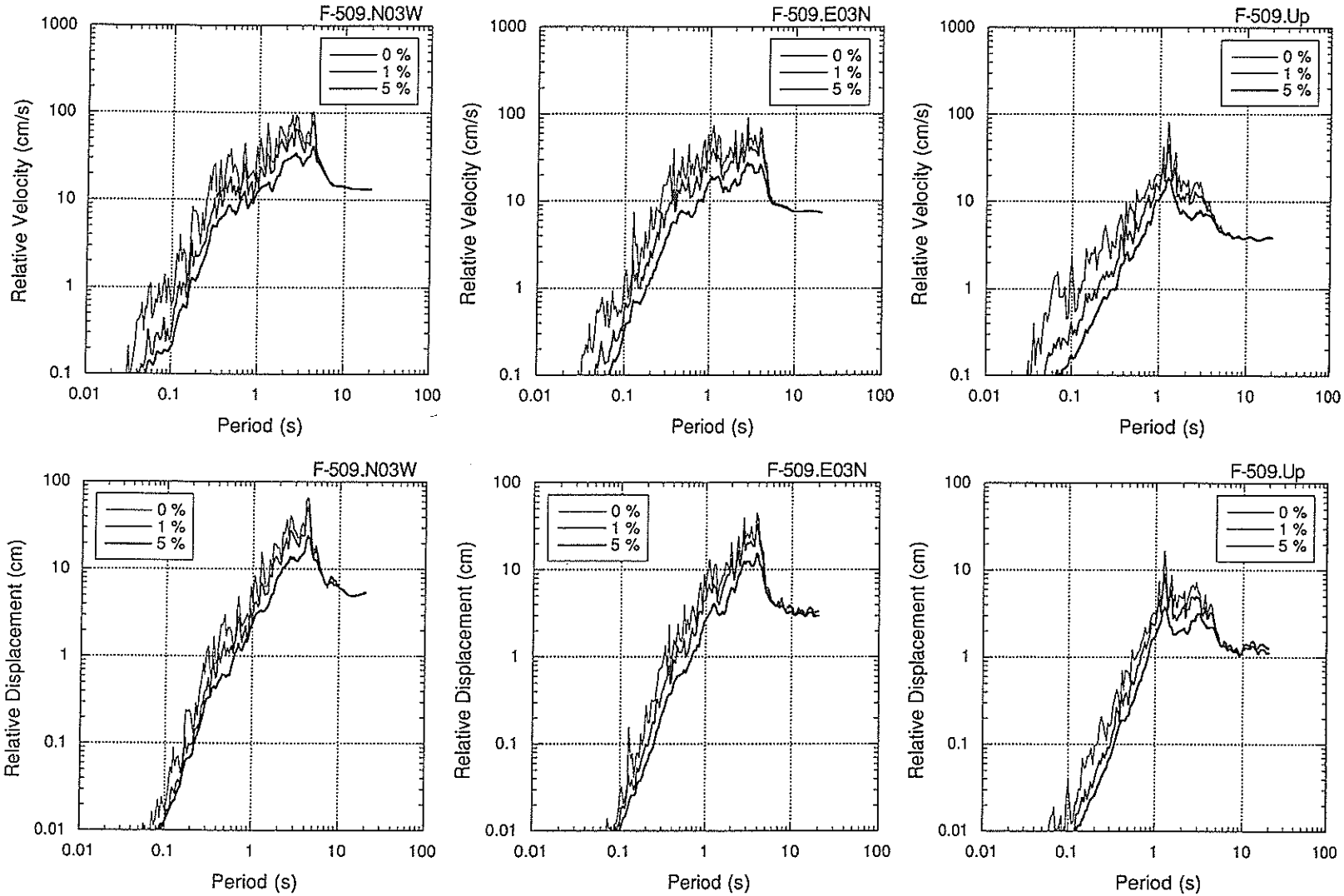

N03W - Fixed Filter
F-509 Hakodate-FR
E03N - Fixed Filter
F-509 Hakodate-FR
Up - Fixed Filter
F-509 Hakodate-FR
Velocity (cm/s)
14
0
-14
0
10
20
30
40
50
60
Time (s)
N03W - Fixed Filter
F-509 Hakodate-FR
E03N - Fixed Filter
F-509 Hakodate-FR
Up - Fixed Filter
F-509 Hakodate-FR
Velocity (cm/s)
60
70
80
90
100
110
120
Time (s)

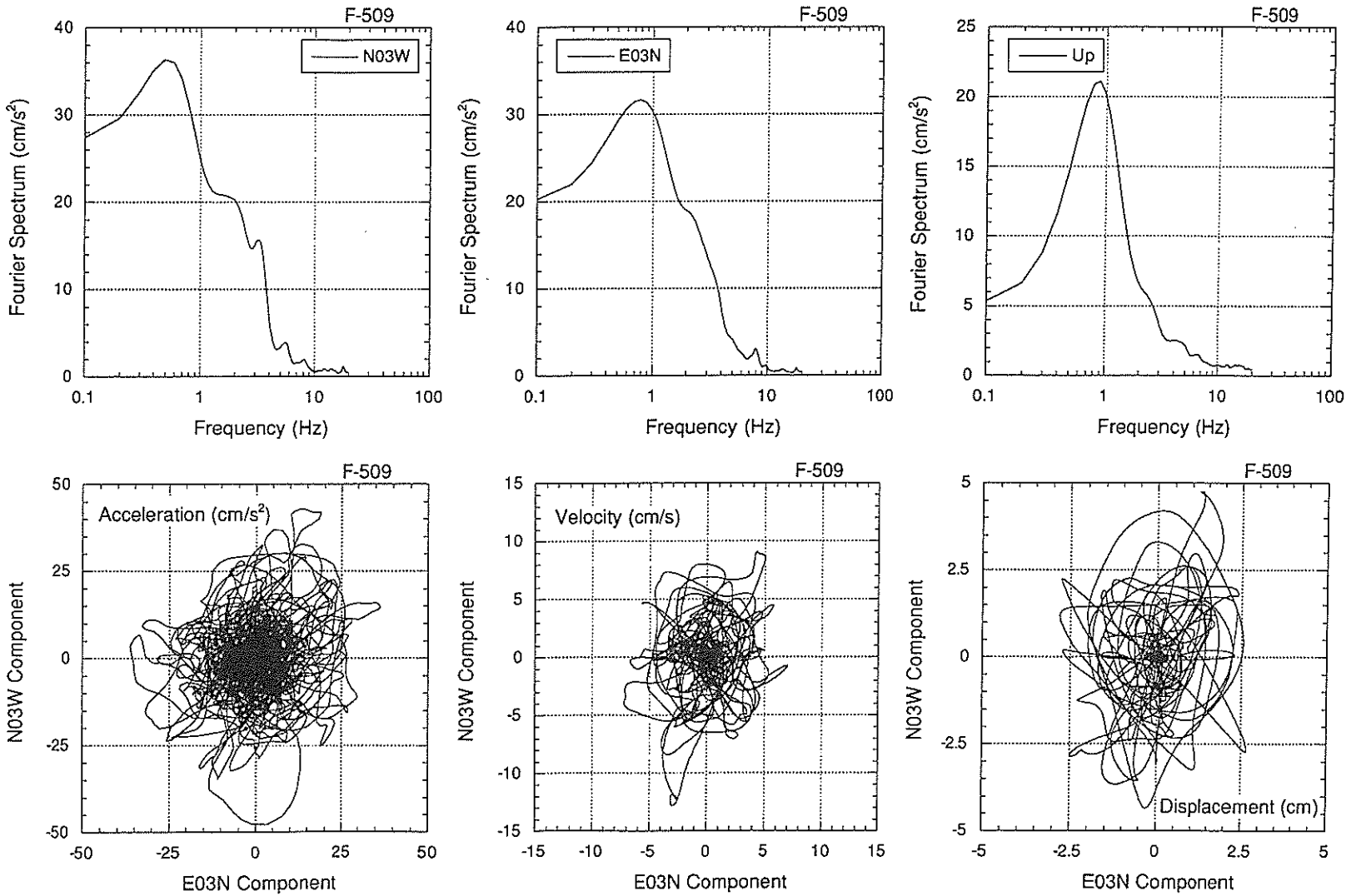

N03W - Variable Filter
F-509 Hakodate-FR
E03N - Variable Filter
F-509 Hakodate-FR
Up - Variable Filter
F-509 Hakodate-FR
14
0
-14
Velocity (cm/s)
0
10
20
30
40
50
60
Time (s)
N03W - Variable Filter
F-509 Hakodate-FR
E03N - Variable Filter
F-509 Hakodate-FR
Up - Variable Filter
F-509 Hakodate-FR
Velocity (cm/s)
60
70
80
90
100
110
120
Time (s)


N03W - Fixed Filter
F-509 Hakodate-FR
E03N - Fixed Filter
F-509 Hakodate-FR
Up - Fixed Filter
F-509 Hakodate-FR
Displacement (cm)
6
0
-6
0
10
20
30
40
50
60
Time (s)
N03W - Fixed Filter
F-509 Hakodate-FR
E03N - Fixed Filter
F-509 Hakodate-FR
Up - Fixed Filter
F-509 Hakodate-FR
Displacement (cm)
6
0
-6
60
70
80
90
100
110
120
Time (s)


N03W - Variable Filter
F-509 Hakodate-FR
E03N - Variable Filter
F-509 Hakodate-FR
Up - Variable Filter
F-509 Hakodate-FR
Displacement (cm)
6
0
-6
0
10
20
30
40
50
60
Time (s)
N03W - Variable Filter
F-509 Hakodate-FR
E03N - Variable Filter
F-509 Hakodate-FR
Up - Variable Filter
F-509 Hakodate-FR
Displacement (cm)
60
70
80
90
100
110
120
Time (s)


F-509.N03W
F-509.E03N
F-509.Up
0 %
1 %
5 %
Acceleration Ratio
Absolute Acceleration (cm/s²)
Period (s)
0.01
0.1
1
10
100
1000
10000


F-509.N03W
F-509.E03N
F-509.Up
0 %
1 %
5 %
Relative Velocity (cm/s)
Relative Displacement (cm)
Period (s)
0.01
0.1
1
10
100
1000


F-509
N03W
Fourier Spectrum (cm/s²)
Frequency (Hz)
F-509
E03N
Fourier Spectrum (cm/s²)
Frequency (Hz)
F-509
Up
Fourier Spectrum (cm/s²)
Frequency (Hz)
F-509
Acceleration (cm/s²)
N03W Component
E03N Component
F-509
Velocity (cm/s)
N03W Component
E03N Component
F-509
Displacement (cm)
N03W Component
E03N Component

RECORD NUMBER : F-510

STATION : HANASAKI-F

EARTHQUAKE DATA

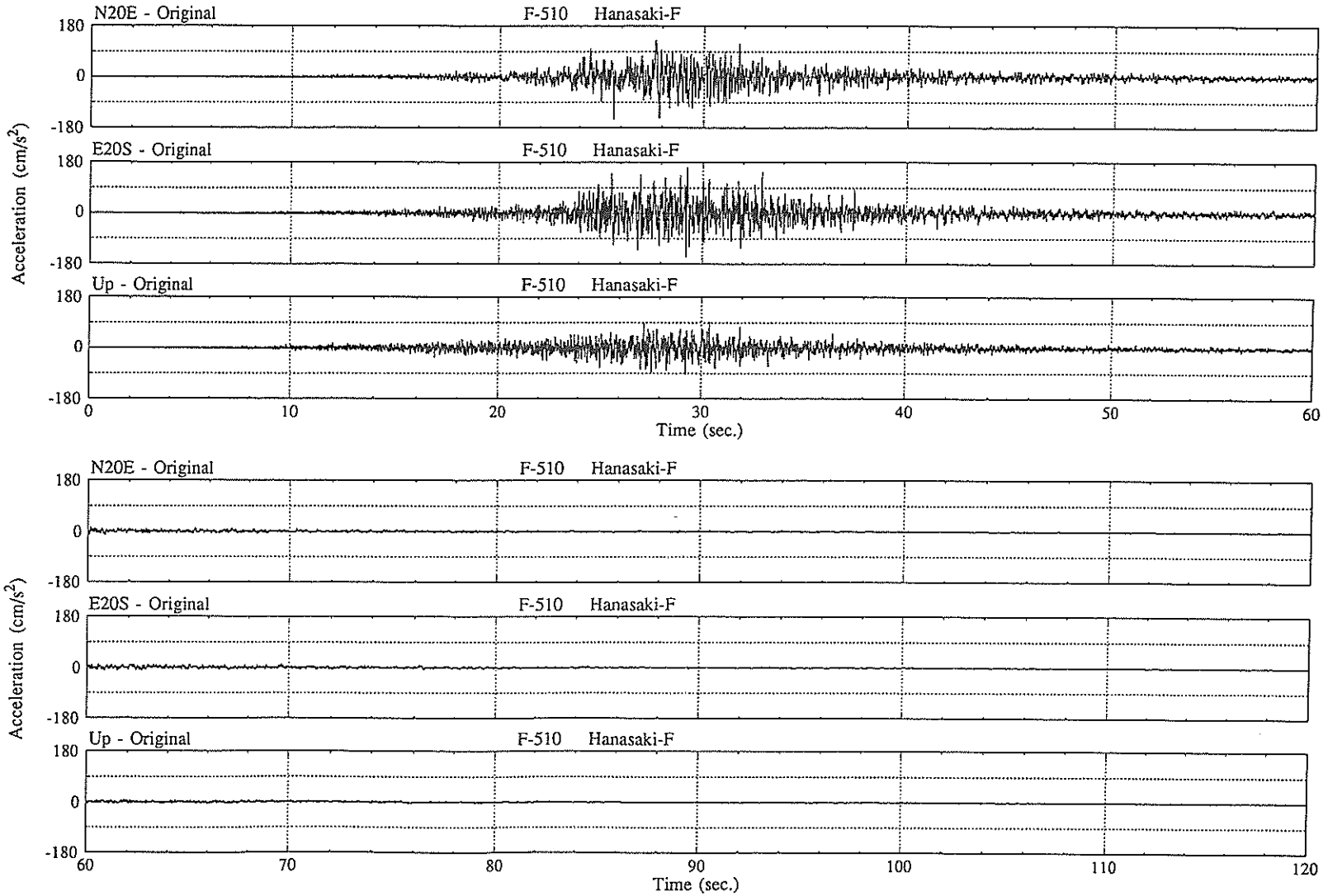
****

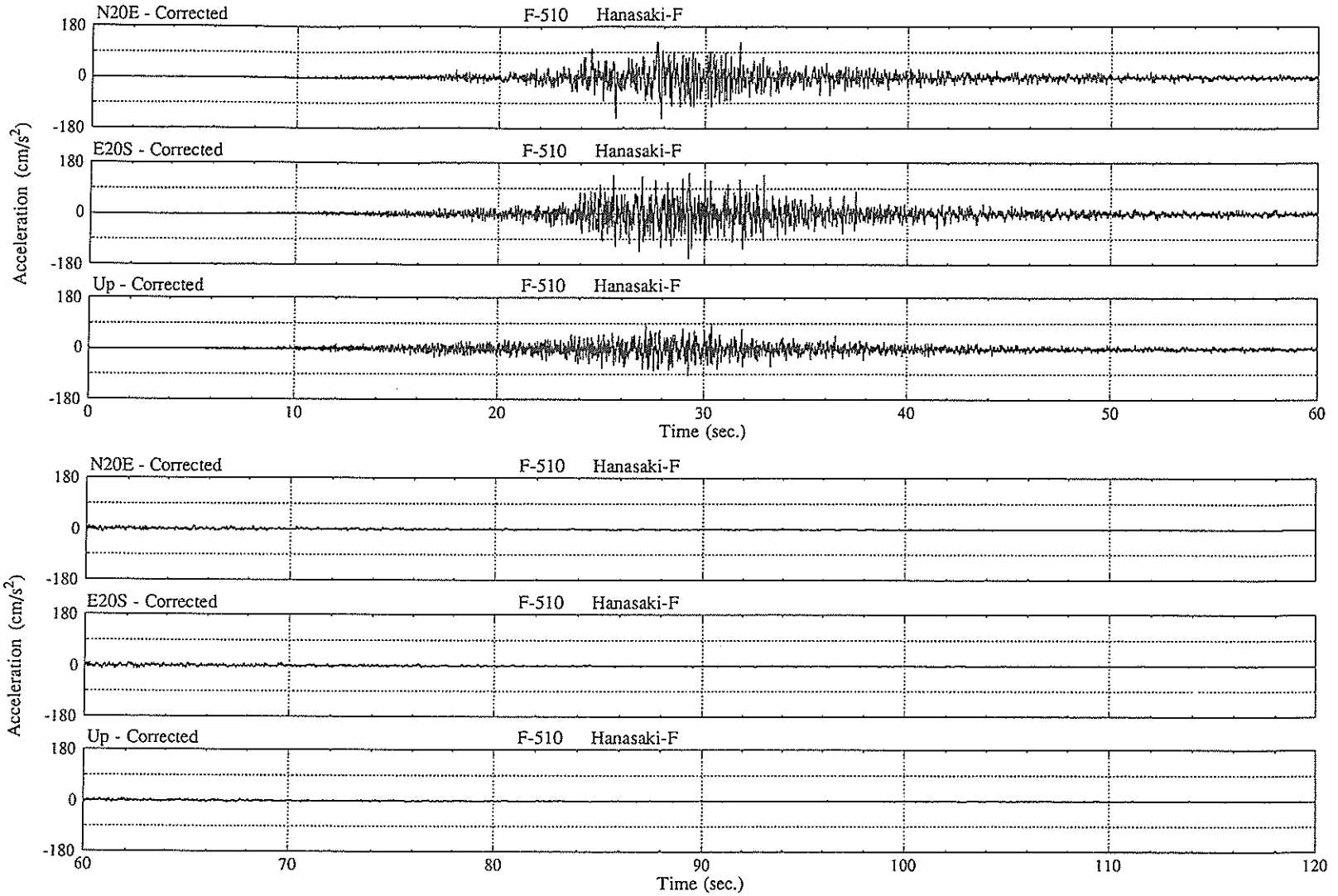
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

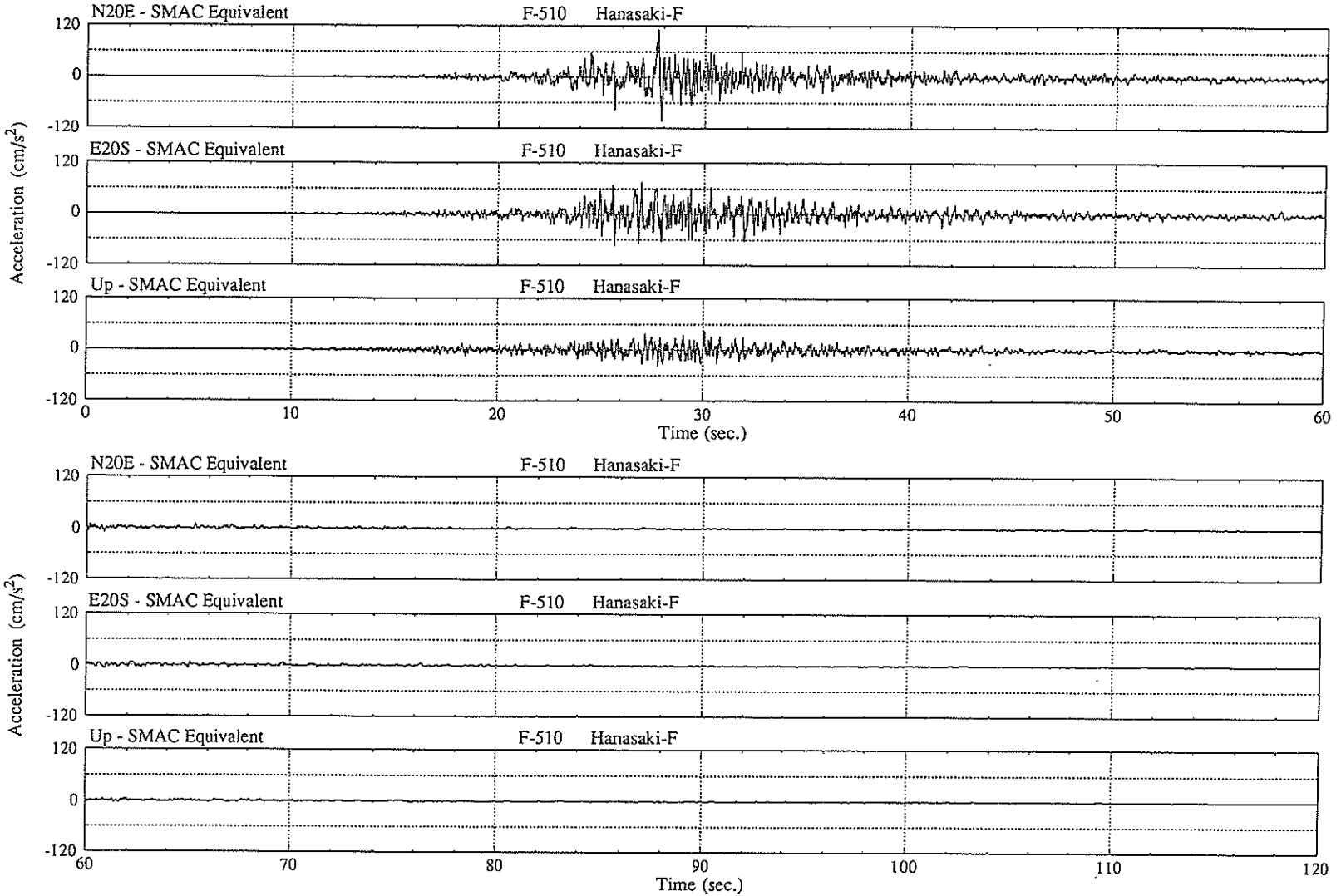
****

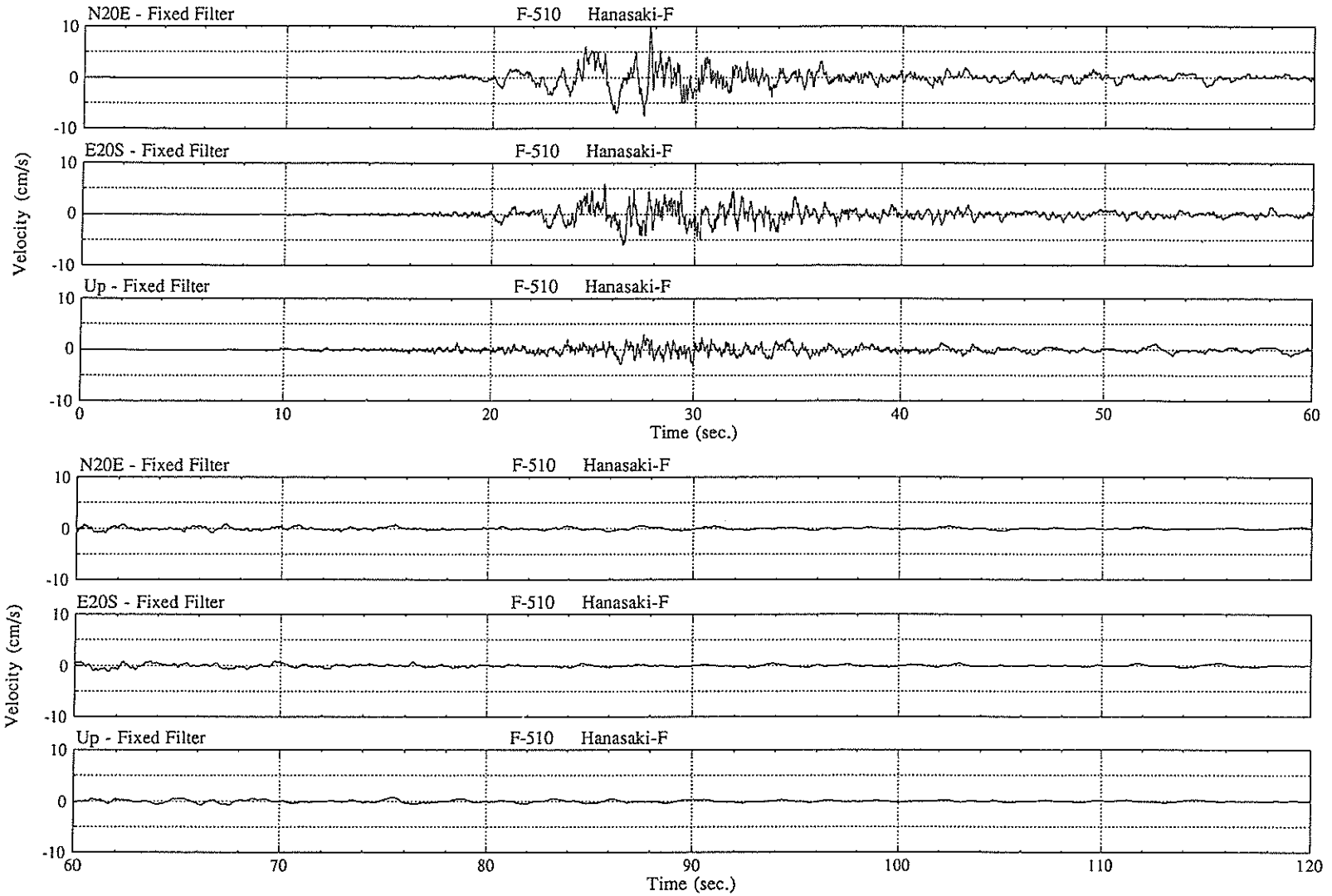
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.067	0.085	0.171	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	110.9	75.1	42.9	124.4
ORIGINAL	148.9	163.3	92.6	169.7
CORRECTED	146.9	158.4	93.3	170.0
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	9.98	6.04	2.98	10.72
VARIABLE FILTER	8.49	6.96	3.23	9.50
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	2.56	1.61	0.59	2.99
VARIABLE FILTER	3.09	1.57	0.52	3.34

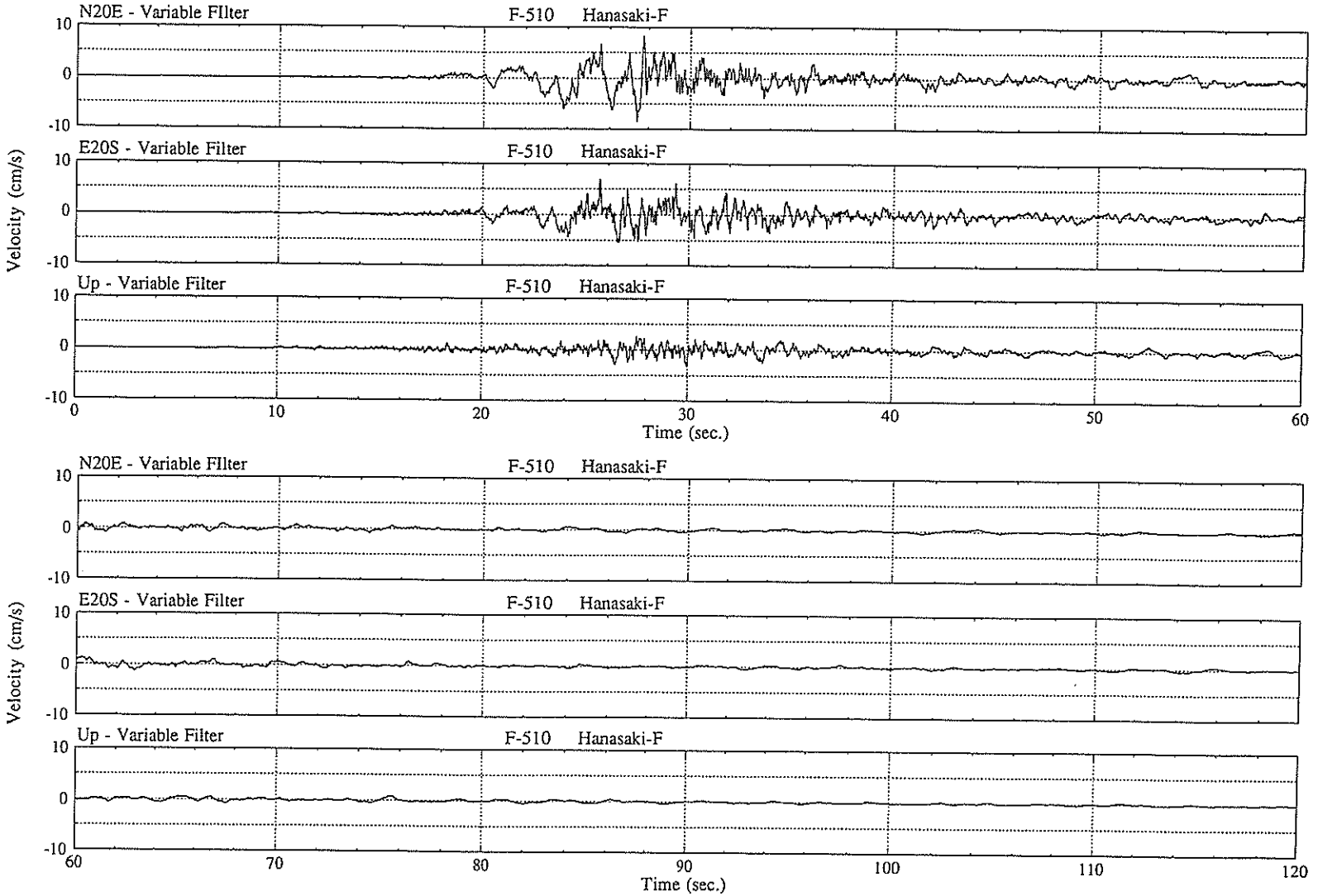
* RESULTANT OF HORIZONTAL COMPONENTS

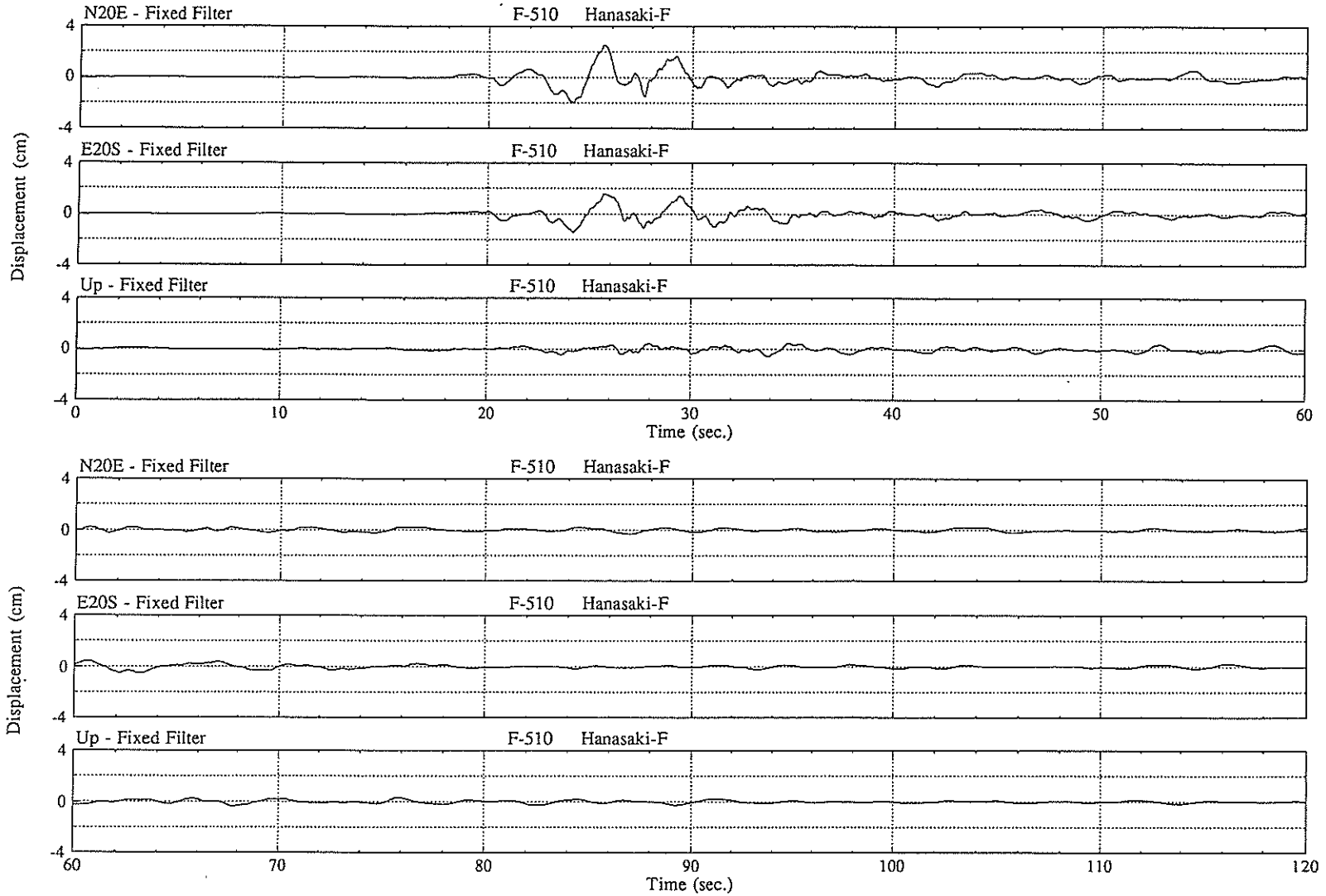

N20E - Original
F-510 Hanasaki-F
E20S - Original
F-510 Hanasaki-F
Up - Original
F-510 Hanasaki-F
180
0
-180
Acceleration (cm/s²)
0
10
20
30
40
50
60
Time (sec.)
N20E - Original
F-510 Hanasaki-F
E20S - Original
F-510 Hanasaki-F
Up - Original
F-510 Hanasaki-F
180
0
-180
Acceleration (cm/s²)
60
70
80
90
100
110
120
Time (sec.)

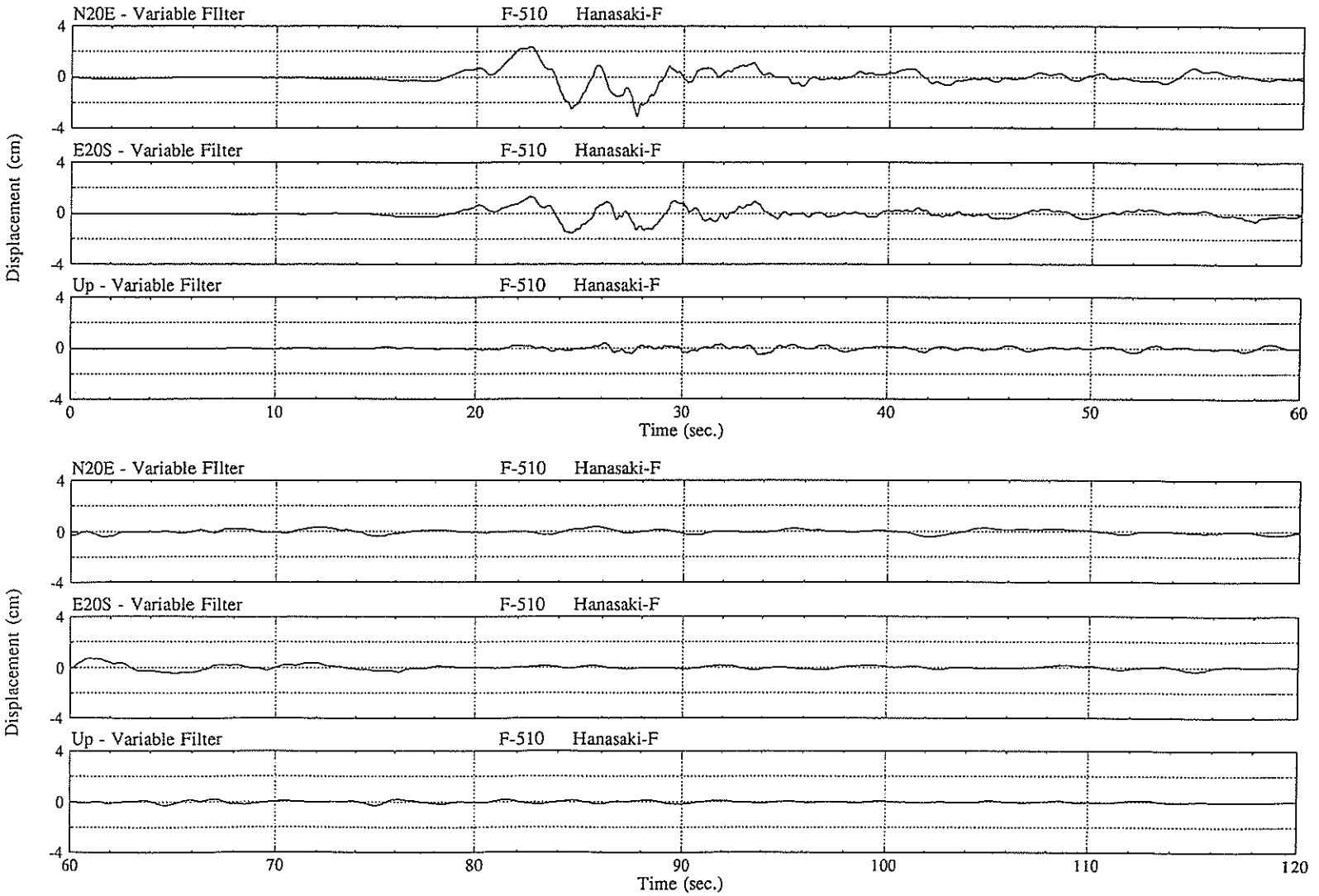

N20E - Corrected
F-510 Hanasaki-F
E20S - Corrected
F-510 Hanasaki-F
Up - Corrected
F-510 Hanasaki-F
Acceleration (cm/s²)
180
0
-180
0
10
20
30
40
50
60
Time (sec.)
N20E - Corrected
F-510 Hanasaki-F
E20S - Corrected
F-510 Hanasaki-F
Up - Corrected
F-510 Hanasaki-F
Acceleration (cm/s²)
60
70
80
90
100
110
120
Time (sec.)

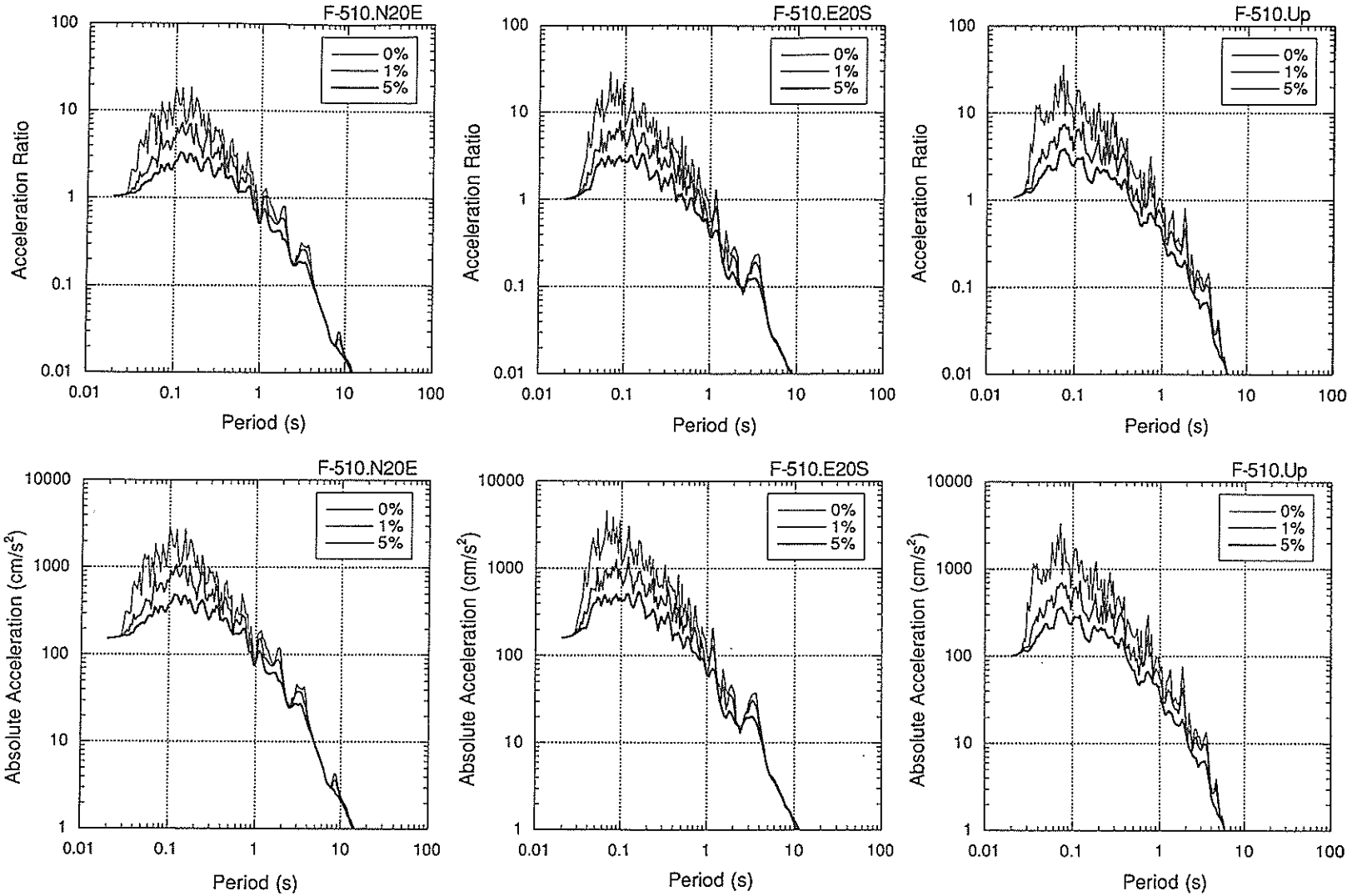

N20E - SMAC Equivalent
F-510 Hanasaki-F
E20S - SMAC Equivalent
F-510 Hanasaki-F
Up - SMAC Equivalent
F-510 Hanasaki-F
Acceleration (cm/s²)
120
0
-120
0
10
20
30
40
50
60
Time (sec.)
N20E - SMAC Equivalent
F-510 Hanasaki-F
E20S - SMAC Equivalent
F-510 Hanasaki-F
Up - SMAC Equivalent
F-510 Hanasaki-F
Acceleration (cm/s²)
120
0
-120
60
70
80
90
100
110
120
Time (sec.)

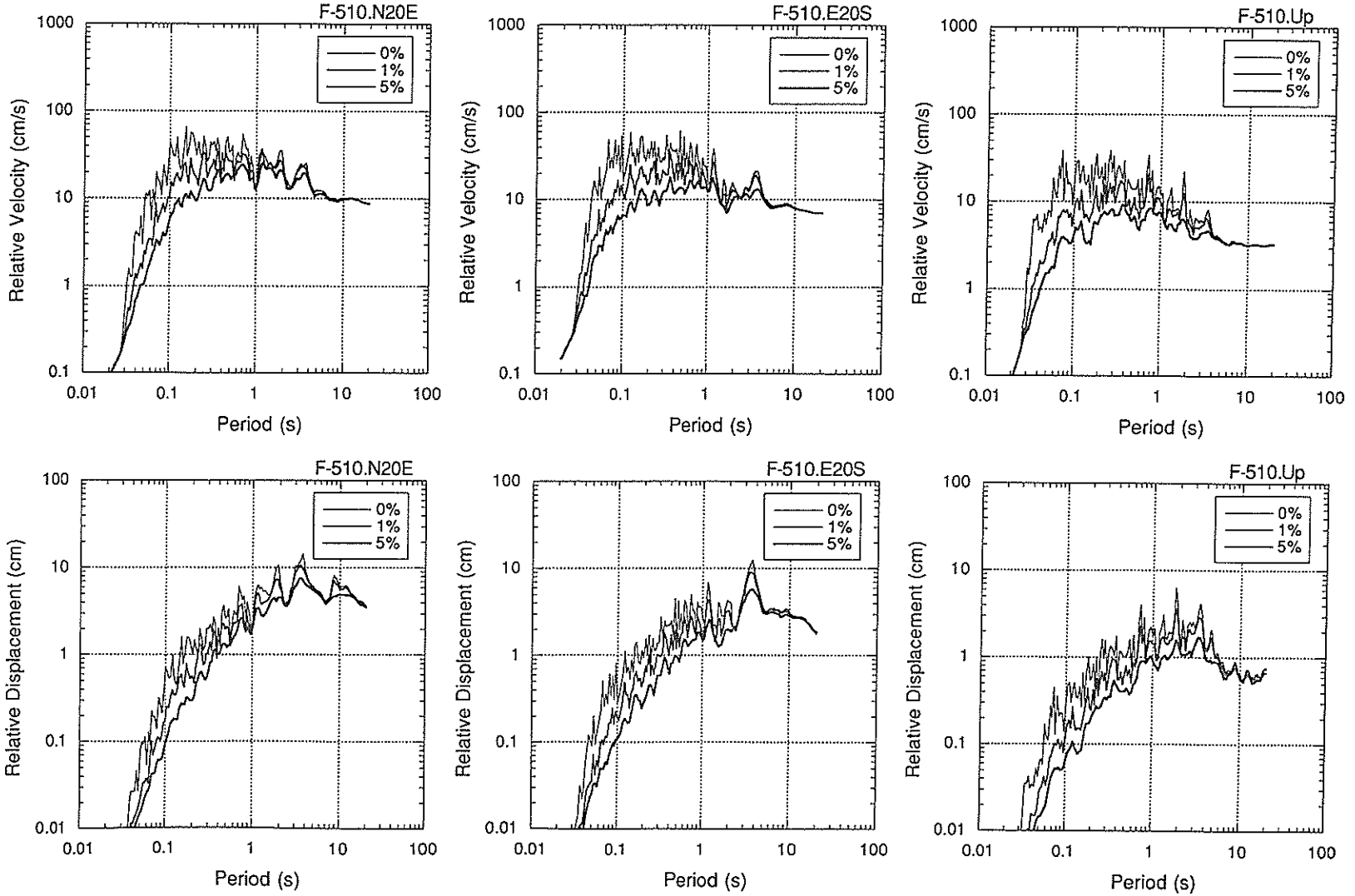

N20E - Fixed Filter
F-510 Hanasaki-F
E20S - Fixed Filter
F-510 Hanasaki-F
Up - Fixed Filter
F-510 Hanasaki-F
Velocity (cm/s)
10
0
-10
0
10
20
30
40
50
60
Time (sec.)
N20E - Fixed Filter
F-510 Hanasaki-F
E20S - Fixed Filter
F-510 Hanasaki-F
Up - Fixed Filter
F-510 Hanasaki-F
Velocity (cm/s)
60
70
80
90
100
110
120
Time (sec.)

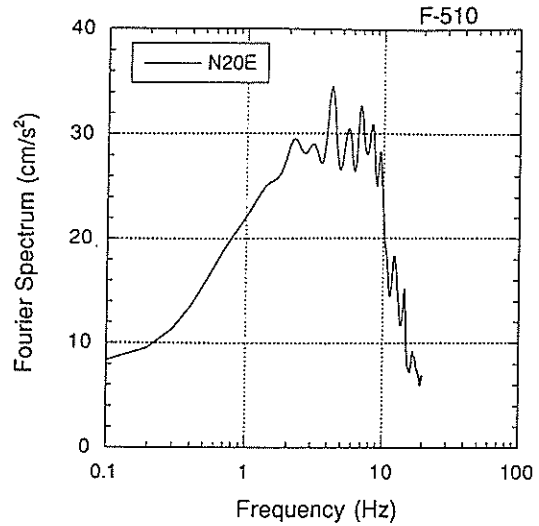

N20E - Variable FIlter
F-510 Hanasaki-F
E20S - Variable Filter
F-510 Hanasaki-F
Up - Variable Filter
F-510 Hanasaki-F
Velocity (cm/s)
10
0
-10
0
10
20
30
40
50
60
Time (sec.)
N20E - Variable FIlter
F-510 Hanasaki-F
E20S - Variable Filter
F-510 Hanasaki-F
Up - Variable Filter
F-510 Hanasaki-F
Velocity (cm/s)
60
70
80
90
100
110
120
Time (sec.)

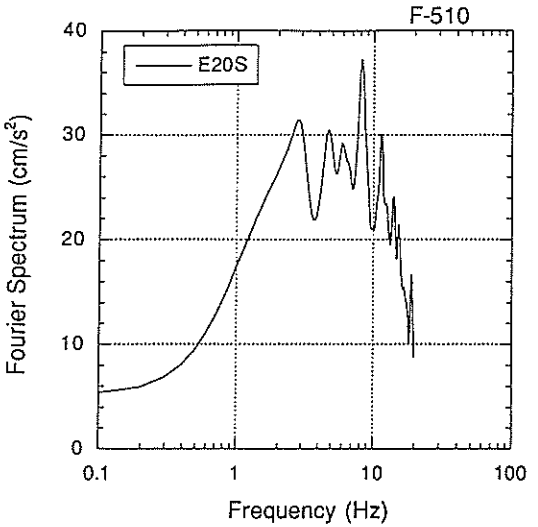

N20E - Fixed Filter
F-510 Hanasaki-F
E20S - Fixed Filter
F-510 Hanasaki-F
Up - Fixed Filter
F-510 Hanasaki-F
Displacement (cm)
4
0
-4
0
10
20
30
40
50
60
Time (sec.)
N20E - Fixed Filter
F-510 Hanasaki-F
E20S - Fixed Filter
F-510 Hanasaki-F
Up - Fixed Filter
F-510 Hanasaki-F
Displacement (cm)
60
70
80
90
100
110
120
Time (sec.)

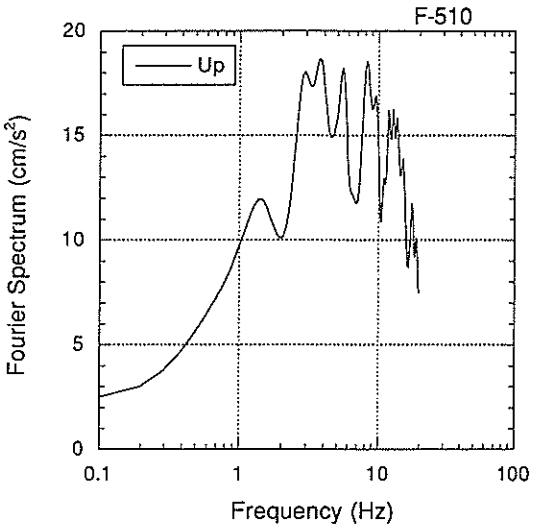

N20E - Variable FIlter
F-510 Hanasaki-F
E20S - Variable Filter
F-510 Hanasaki-F
Up - Variable Filter
F-510 Hanasaki-F
Displacement (cm)
4
0
-4
0
10
20
30
40
50
60
Time (sec.)
N20E - Variable FIlter
F-510 Hanasaki-F
E20S - Variable Filter
F-510 Hanasaki-F
Up - Variable Filter
F-510 Hanasaki-F
Displacement (cm)
60
70
80
90
100
110
120
Time (sec.)

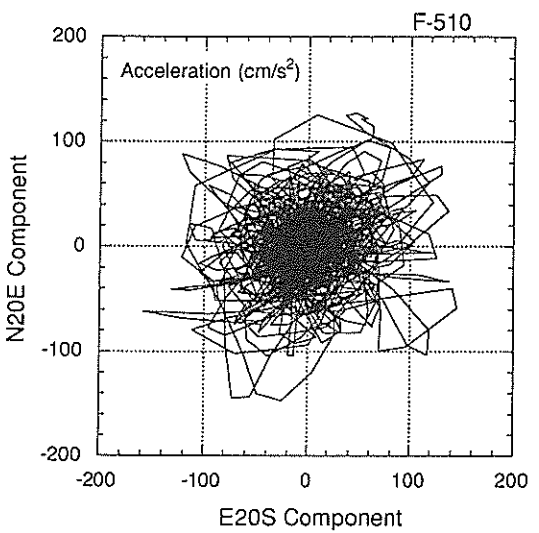

F-510.N20E
F-510.E20S
F-510.Up
0%
1%
5%
Acceleration Ratio
Absolute Acceleration (cm/s²)
Period (s)
0.01
0.1
1
10
100
1000
10000

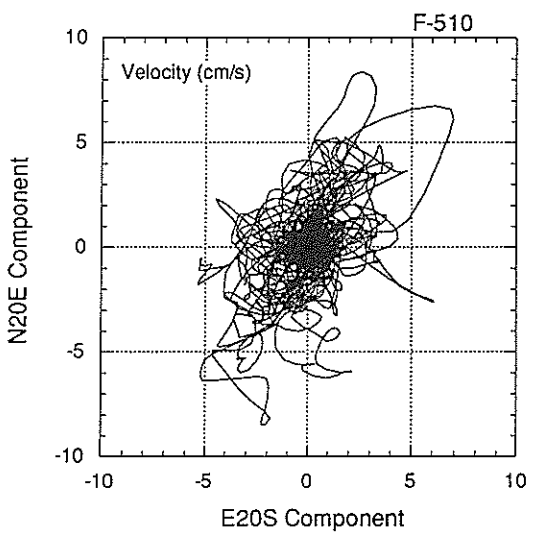

F-510.N20E
F-510.E20S
F-510.Up
Relative Velocity (cm/s)
Relative Displacement (cm)
Period (s)
0%
1%
5%
0.01
0.1
1
10
100
1000

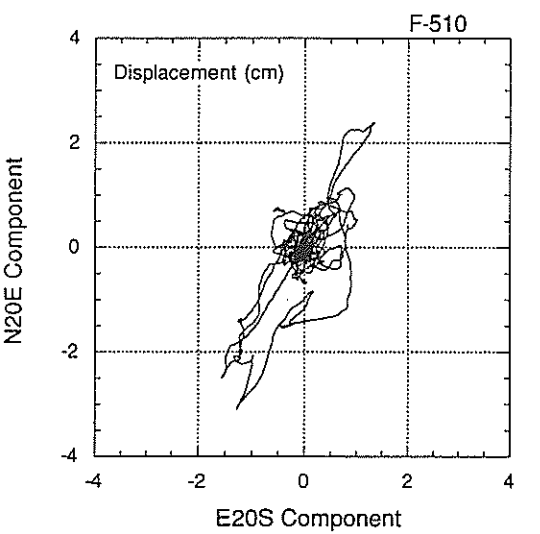

F-510
N20E
Fourier Spectrum (cm/s²)
Frequency (Hz)
0
10
20
30
40
0.1
1
10
100


F-510
E20S
Fourier Spectrum (cm/s²)
Frequency (Hz)
0
10
20
30
40
0.1
1
10
100


F-510
Up
Fourier Spectrum (cm/s²)
Frequency (Hz)
0
5
10
15
20
0.1
1
10
100


F-510
Acceleration (cm/s²)
N20E Component
E20S Component
-200
-100
0
100
200


F-510
Velocity (cm/s)
N20E Component
E20S Component
-10
-5
0
5
10


F-510
Displacement (cm)
N20E Component
E20S Component
-4
-2
0
2
4

RECORD NUMBER : F-514

STATION : MIYAKO-G

EARTHQUAKE DATA

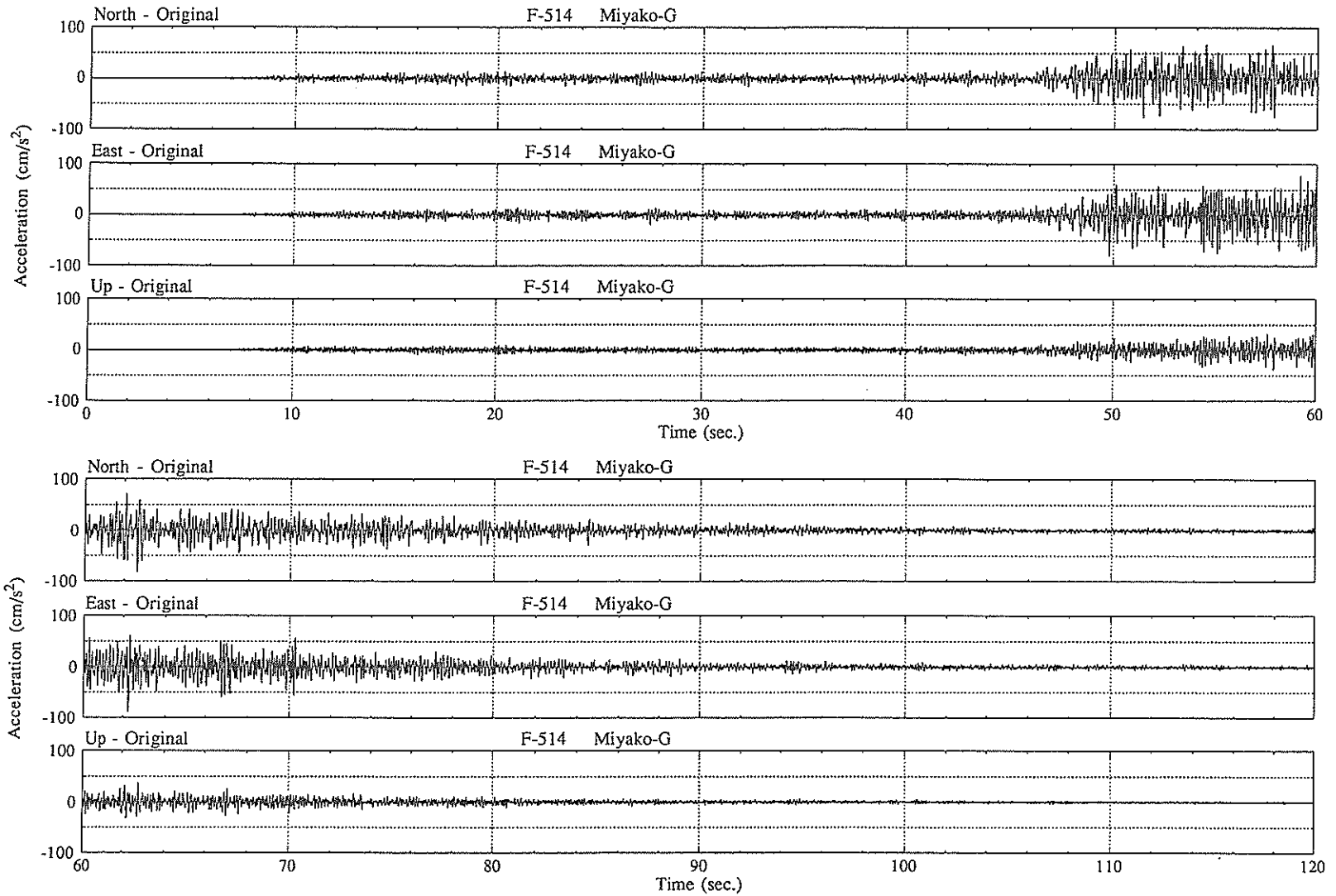
****

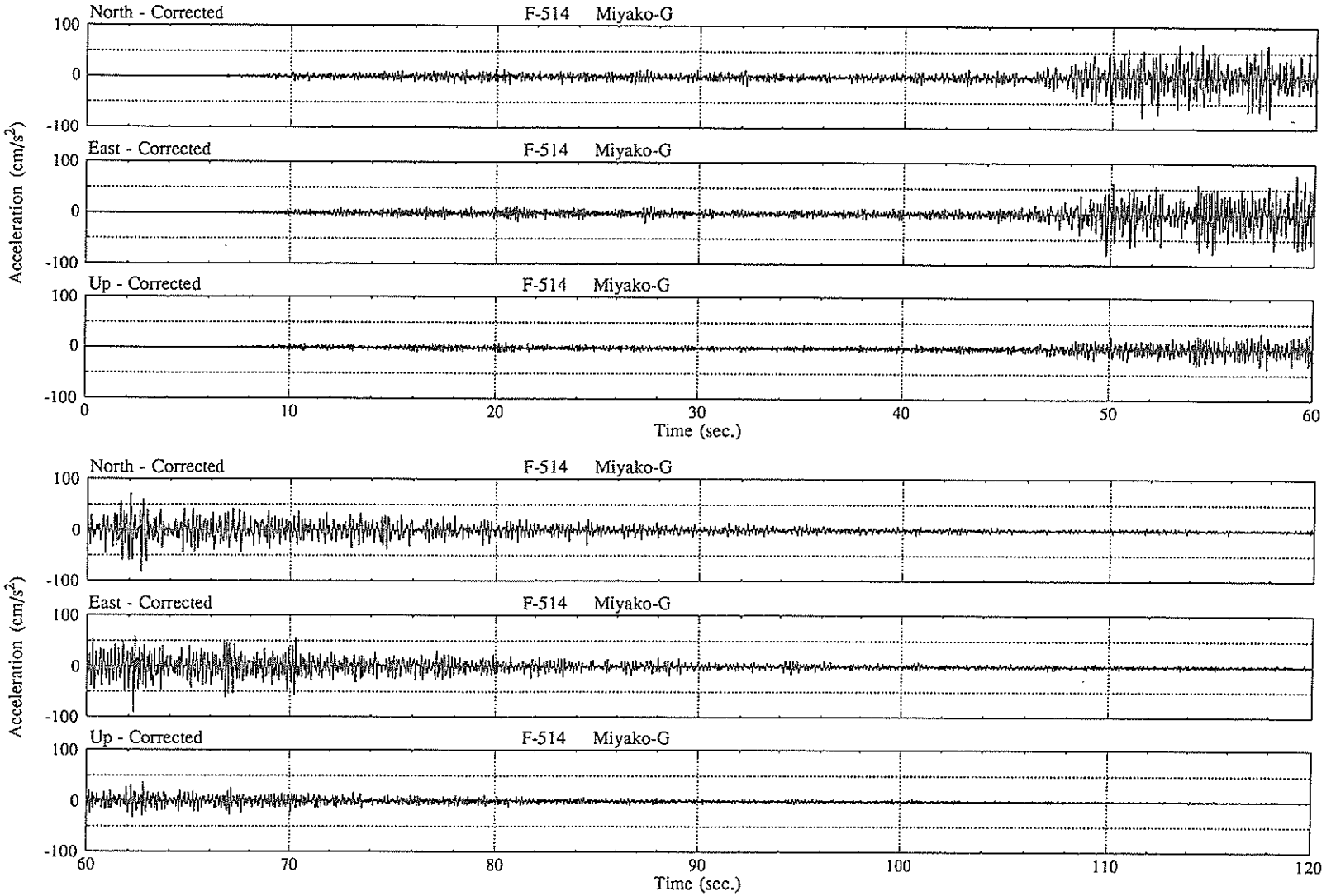
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

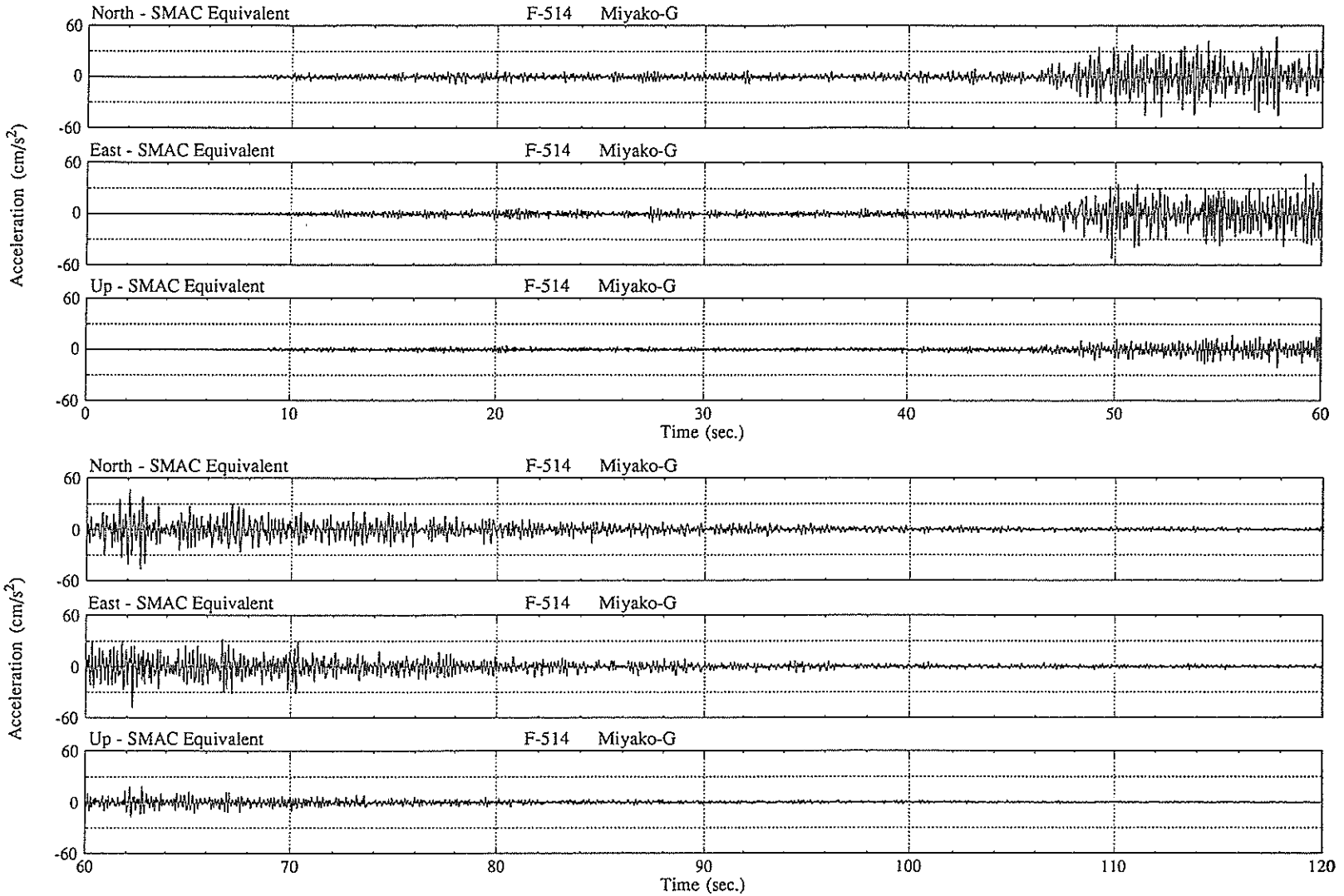
****

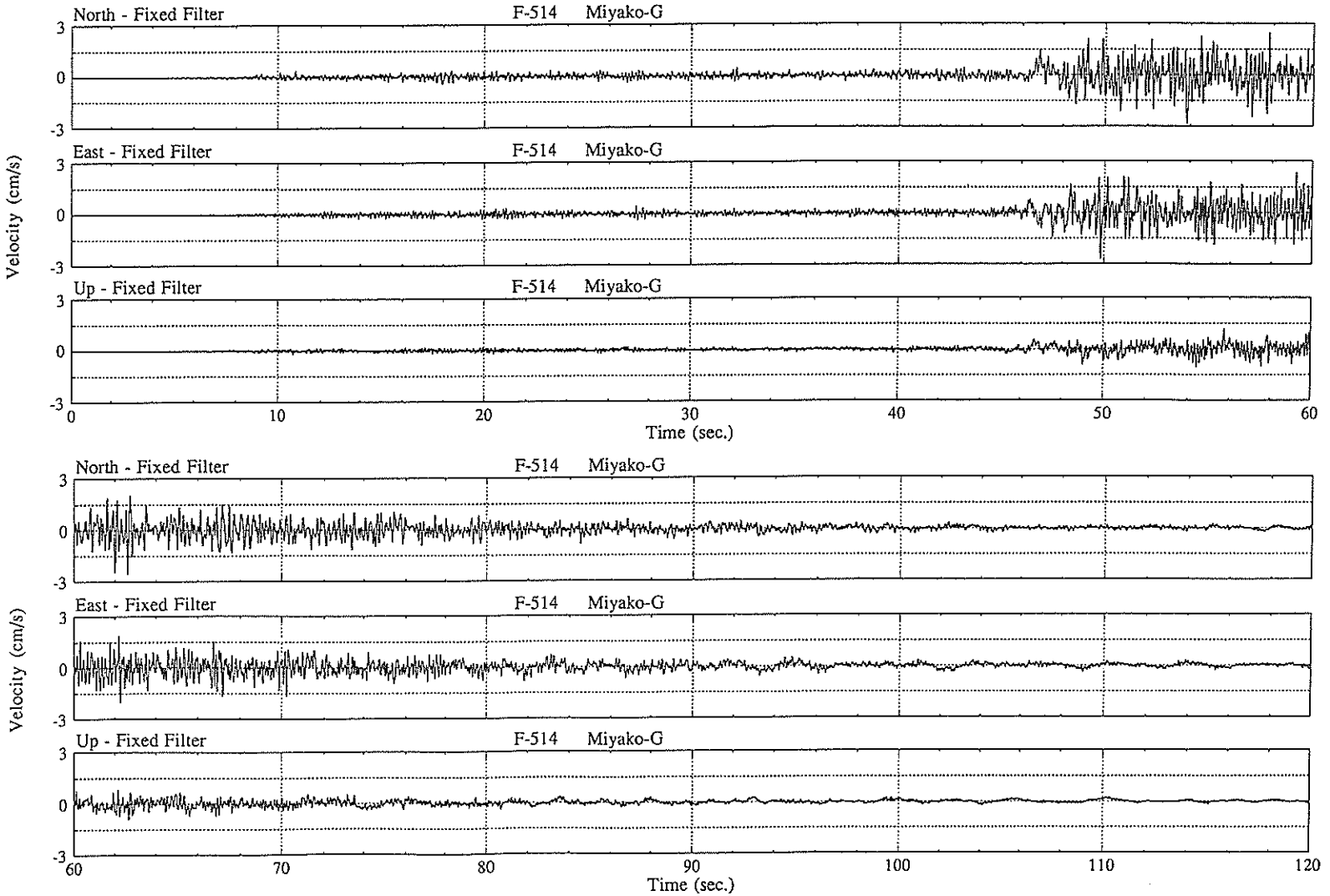
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.264	0.295	0.295	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	47.2	51.9	20.9	57.8
ORIGINAL	82.6	88.5	38.4	90.6
CORRECTED	82.6	90.3	39.2	91.9
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	2.84	2.70	1.18	3.13
VARIABLE FILTER	2.64	2.64	1.00	3.17
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.28	0.19	0.18	0.29
VARIABLE FILTER	0.21	0.15	0.08	0.21

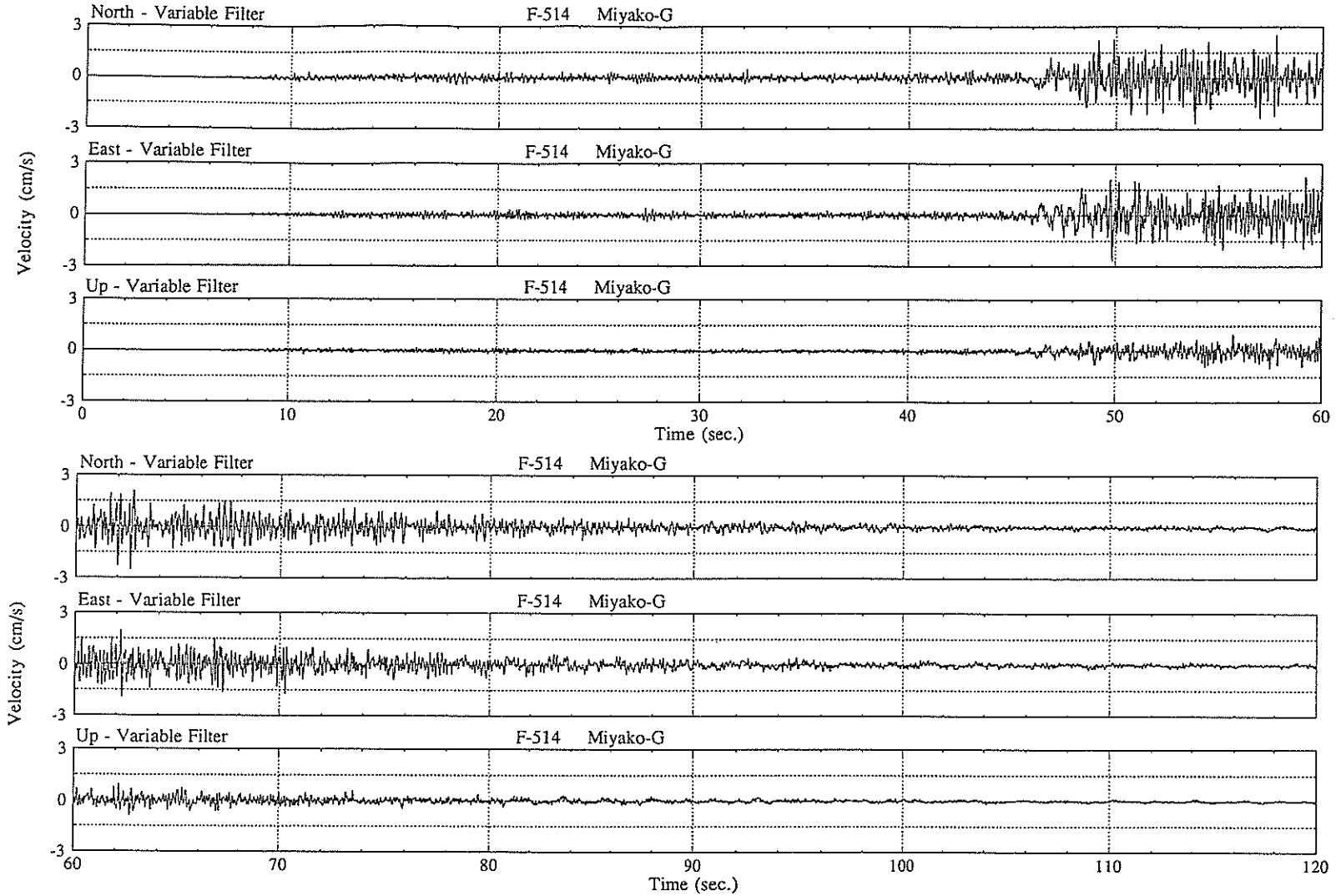
* RESULTANT OF HORIZONTAL COMPONENTS

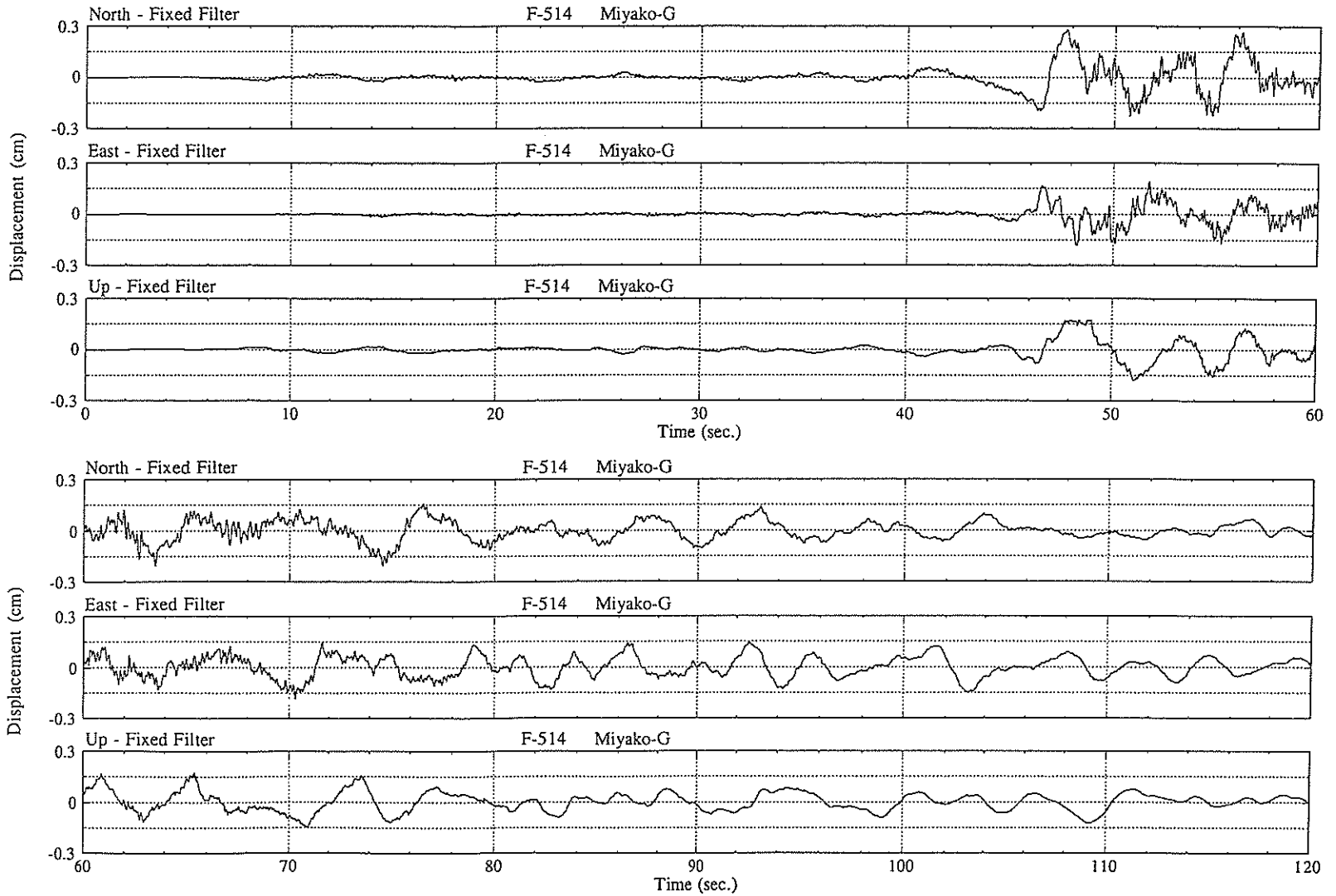

North - Original
F-514 Miyako-G
East - Original
F-514 Miyako-G
Up - Original
F-514 Miyako-G
Acceleration (cm/s²)
100
0
-100
0
10
20
30
40
50
60
Time (sec.)
North - Original
F-514 Miyako-G
East - Original
F-514 Miyako-G
Up - Original
F-514 Miyako-G
Acceleration (cm/s²)
60
70
80
90
100
110
120
Time (sec.)

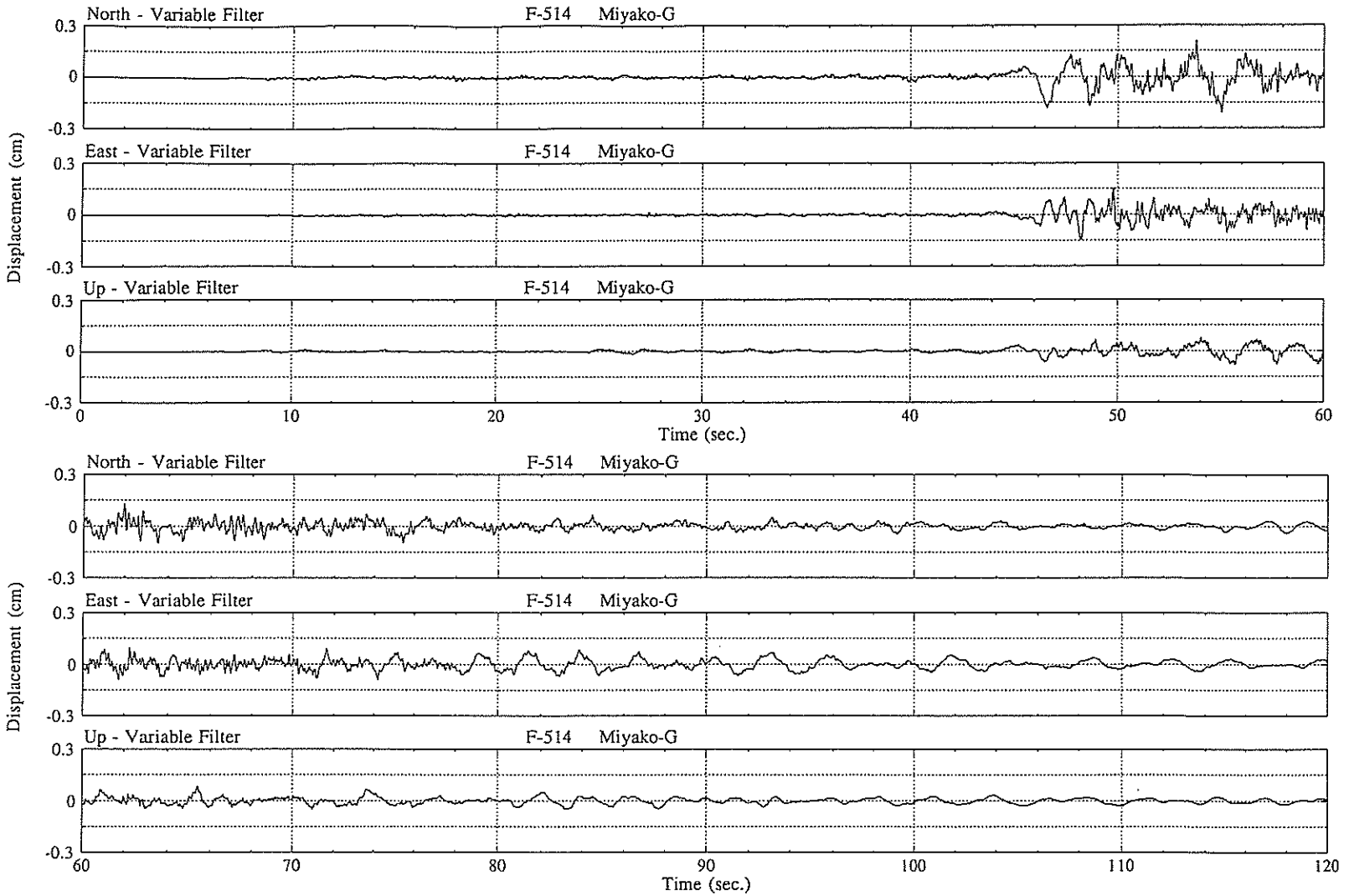

North - Corrected
F-514 Miyako-G
East - Corrected
F-514 Miyako-G
Up - Corrected
F-514 Miyako-G
Acceleration (cm/s²)
100
0
-100
0
10
20
30
40
50
60
Time (sec.)
North - Corrected
F-514 Miyako-G
East - Corrected
F-514 Miyako-G
Up - Corrected
F-514 Miyako-G
Acceleration (cm/s²)
60
70
80
90
100
110
120
Time (sec.)

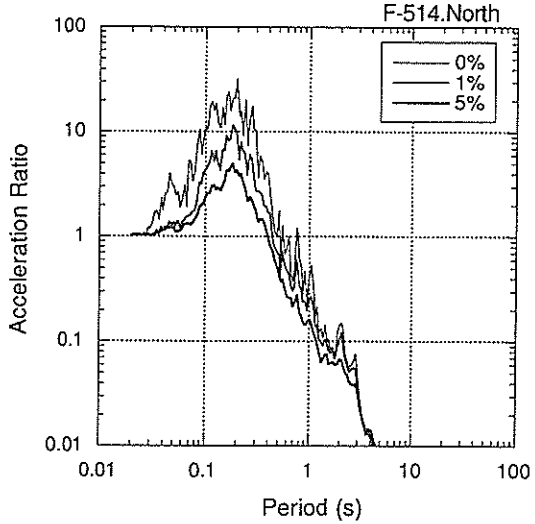

North - SMAC Equivalent F-514 Miyako-G
East - SMAC Equivalent F-514 Miyako-G
Up - SMAC Equivalent F-514 Miyako-G
Acceleration (cm/s²)
60
0
-60
0
10
20
30
40
50
60
Time (sec.)
North - SMAC Equivalent F-514 Miyako-G
East - SMAC Equivalent F-514 Miyako-G
Up - SMAC Equivalent F-514 Miyako-G
Acceleration (cm/s²)
60
70
80
90
100
110
120
Time (sec.)

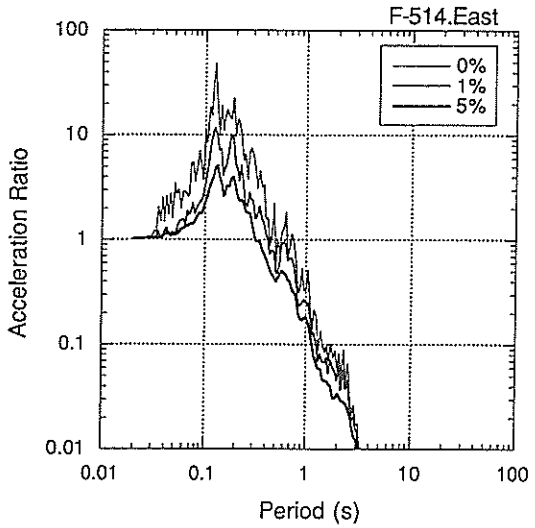

North - Fixed Filter
F-514 Miyako-G
East - Fixed Filter
F-514 Miyako-G
Up - Fixed Filter
F-514 Miyako-G
Velocity (cm/s)
3
0
-3
0
10
20
30
40
50
60
Time (sec.)
North - Fixed Filter
F-514 Miyako-G
East - Fixed Filter
F-514 Miyako-G
Up - Fixed Filter
F-514 Miyako-G
Velocity (cm/s)
60
70
80
90
100
110
120
Time (sec.)

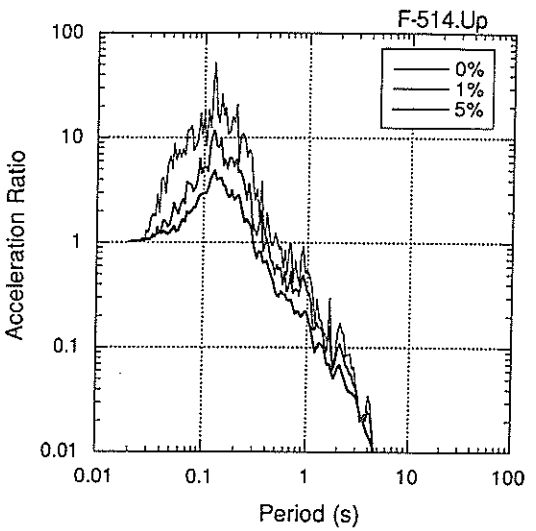

North - Variable Filter
F-514 Miyako-G
East - Variable Filter
F-514 Miyako-G
Up - Variable Filter
F-514 Miyako-G
Velocity (cm/s)
3
0
-3
0
10
20
30
40
50
60
Time (sec.)
North - Variable Filter
F-514 Miyako-G
East - Variable Filter
F-514 Miyako-G
Up - Variable Filter
F-514 Miyako-G
Velocity (cm/s)
60
70
80
90
100
110
120
Time (sec.)

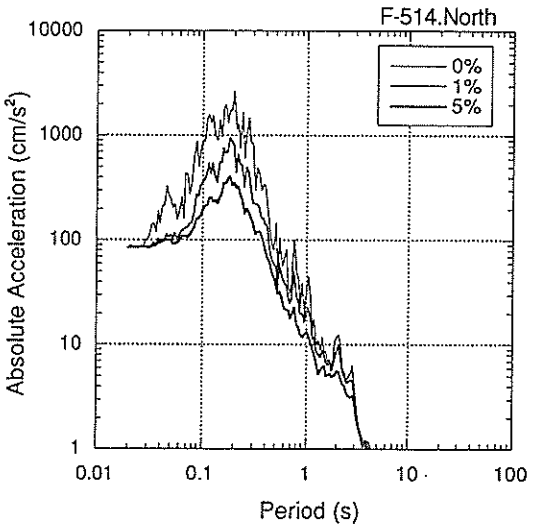

North - Fixed Filter
F-514 Miyako-G
East - Fixed Filter
F-514 Miyako-G
Up - Fixed Filter
F-514 Miyako-G
Displacement (cm)
0.3
0
-0.3
0
10
20
30
40
50
60
Time (sec.)
North - Fixed Filter
F-514 Miyako-G
East - Fixed Filter
F-514 Miyako-G
Up - Fixed Filter
F-514 Miyako-G
Displacement (cm)
60
70
80
90
100
110
120
Time (sec.)

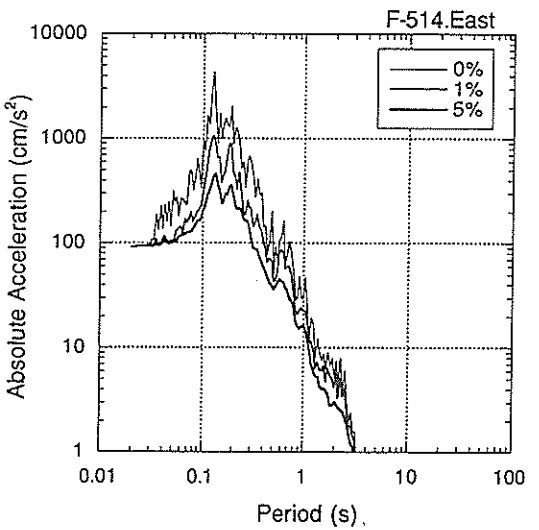

North - Variable Filter
F-514 Miyako-G
East - Variable Filter
F-514 Miyako-G
Up - Variable Filter
F-514 Miyako-G
Displacement (cm)
0.3
0
-0.3
0
10
20
30
40
50
60
Time (sec.)
North - Variable Filter
F-514 Miyako-G
East - Variable Filter
F-514 Miyako-G
Up - Variable Filter
F-514 Miyako-G
Displacement (cm)
60
70
80
90
100
110
120
Time (sec.)

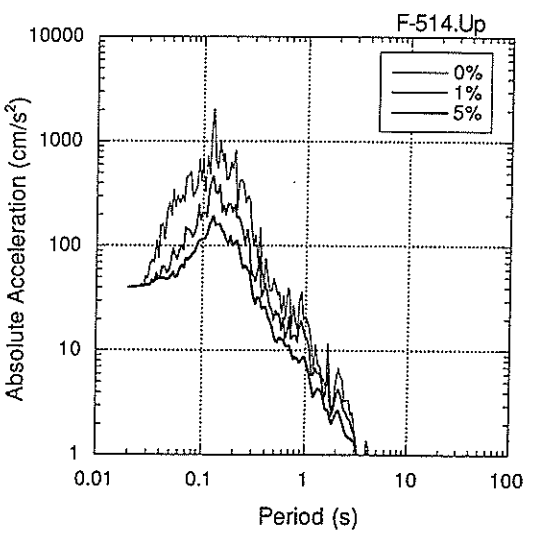

F-514.North
0%
1%
5%
Acceleration Ratio
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

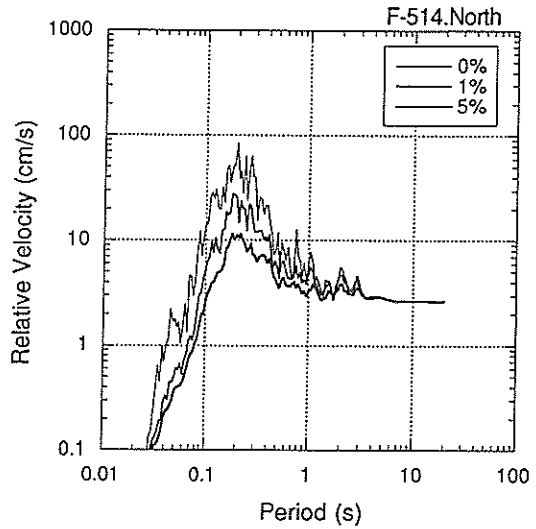

F-514.East
0%
1%
5%
Acceleration Ratio
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

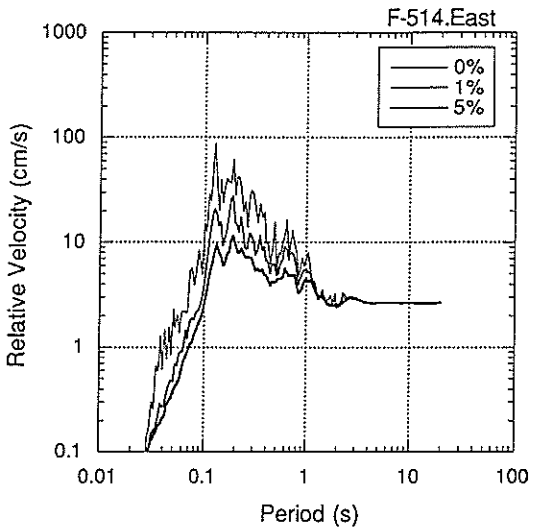

F-514.Up
0%
1%
5%
Acceleration Ratio
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

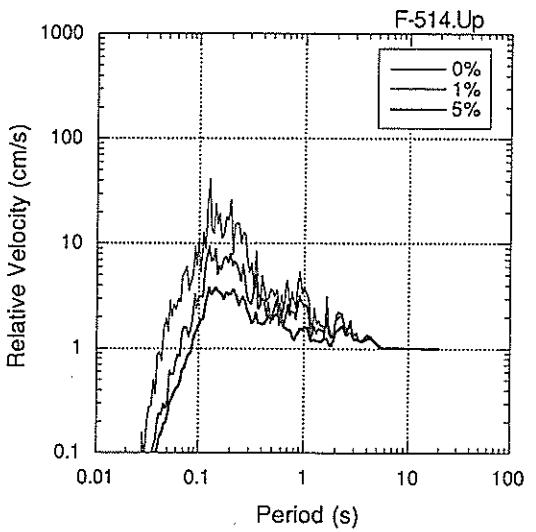

F-514.North
0%
1%
5%
Absolute Acceleration (cm/s²)
Period (s)
10000
1000
100
10
1
0.01
0.1
1
10
100

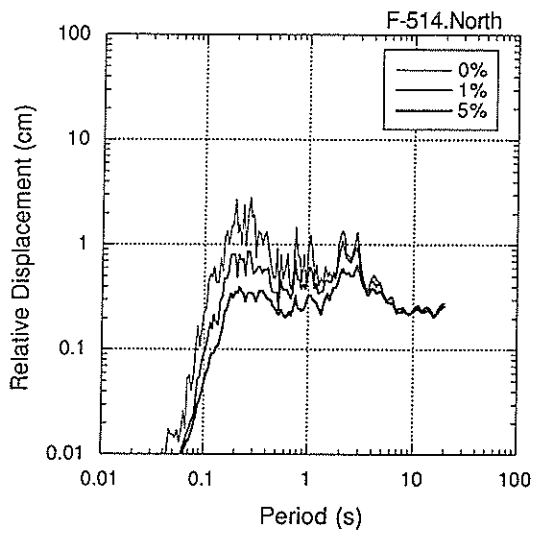

F-514.East
0%
1%
5%
Absolute Acceleration (cm/s²)
Period (s)
10000
1000
100
10
1
0.01
0.1
1
10
100

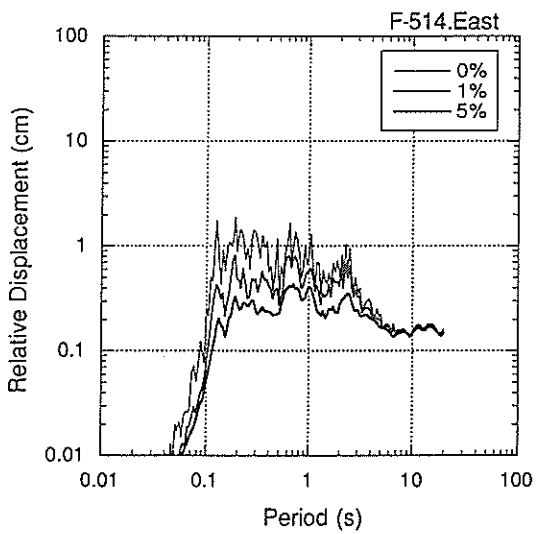

F-514.Up
0%
1%
5%
Absolute Acceleration (cm/s²)
Period (s)
10000
1000
100
10
1
0.01
0.1
1
10
100

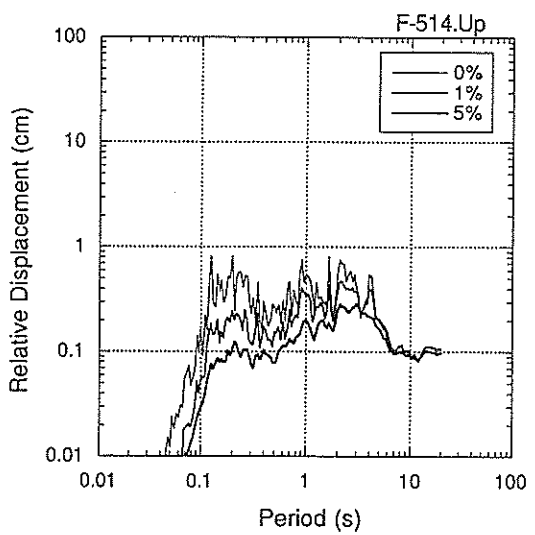

F-514.North
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100

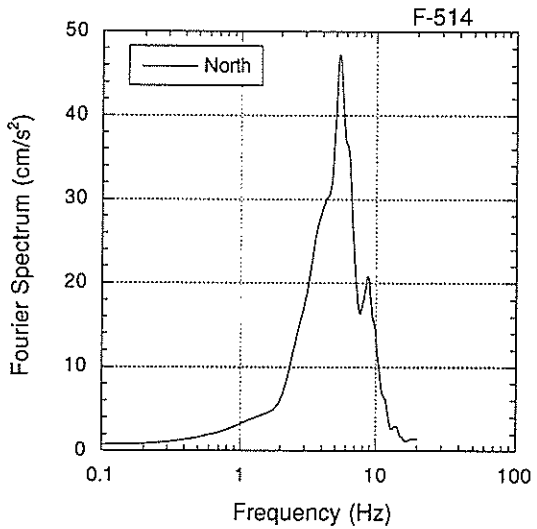

F-514.East
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100

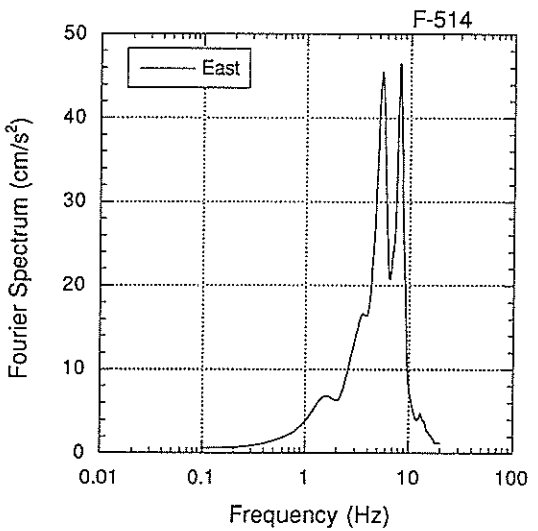

F-514.Up
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100

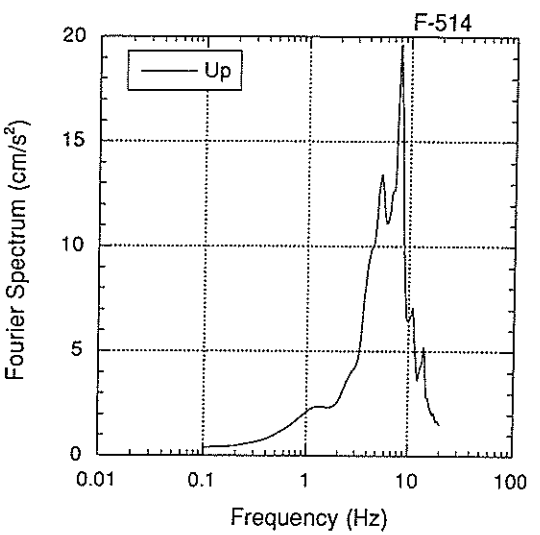

F-514.North
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

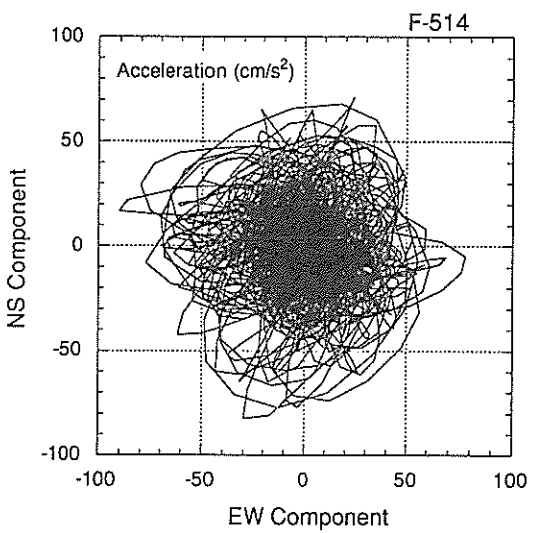

F-514.East
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

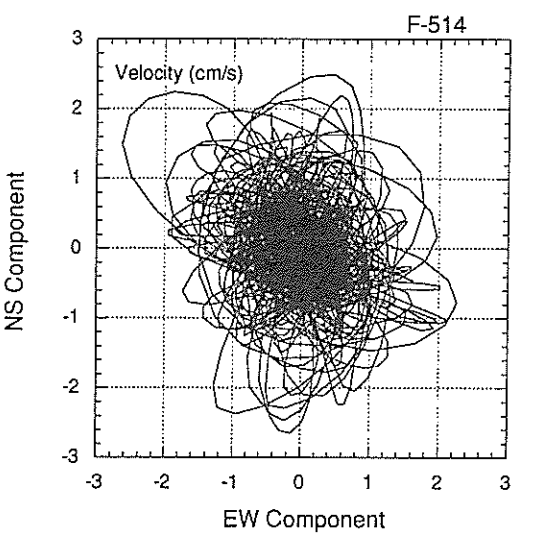

F-514.Up
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

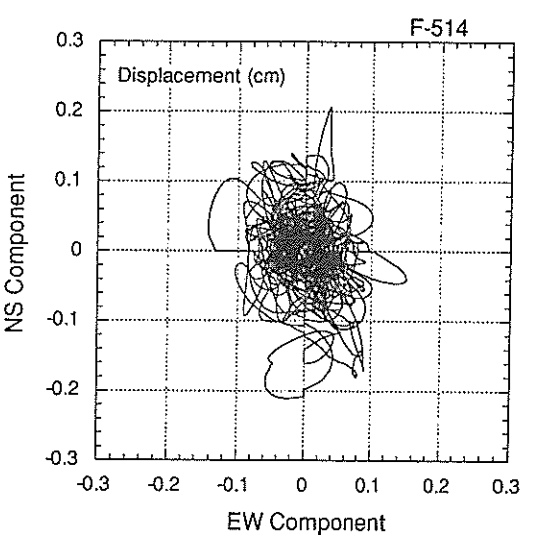

F-514
North
Fourier Spectrum (cm/s²)
Frequency (Hz)


F-514
East
Fourier Spectrum (cm/s²)
Frequency (Hz)


F-514
Up
Fourier Spectrum (cm/s²)
Frequency (Hz)


F-514
Acceleration (cm/s²)
NS Component
EW Component


F-514
Velocity (cm/s)
NS Component
EW Component


F-514
Displacement (cm)
NS Component
EW Component

RECORD NUMBER : F-525

STATION : HITACHINAKA-F

EARTHQUAKE DATA

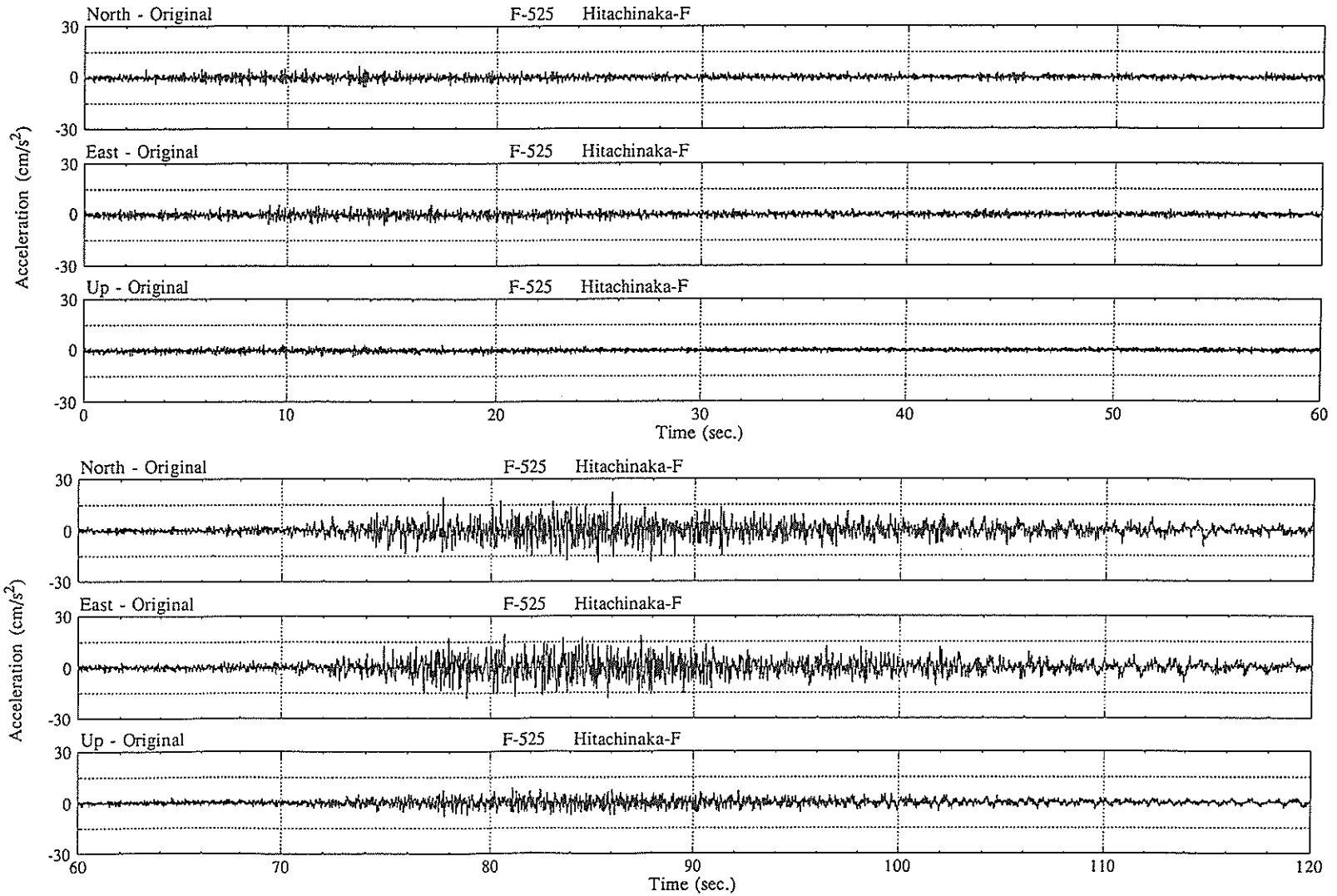
****

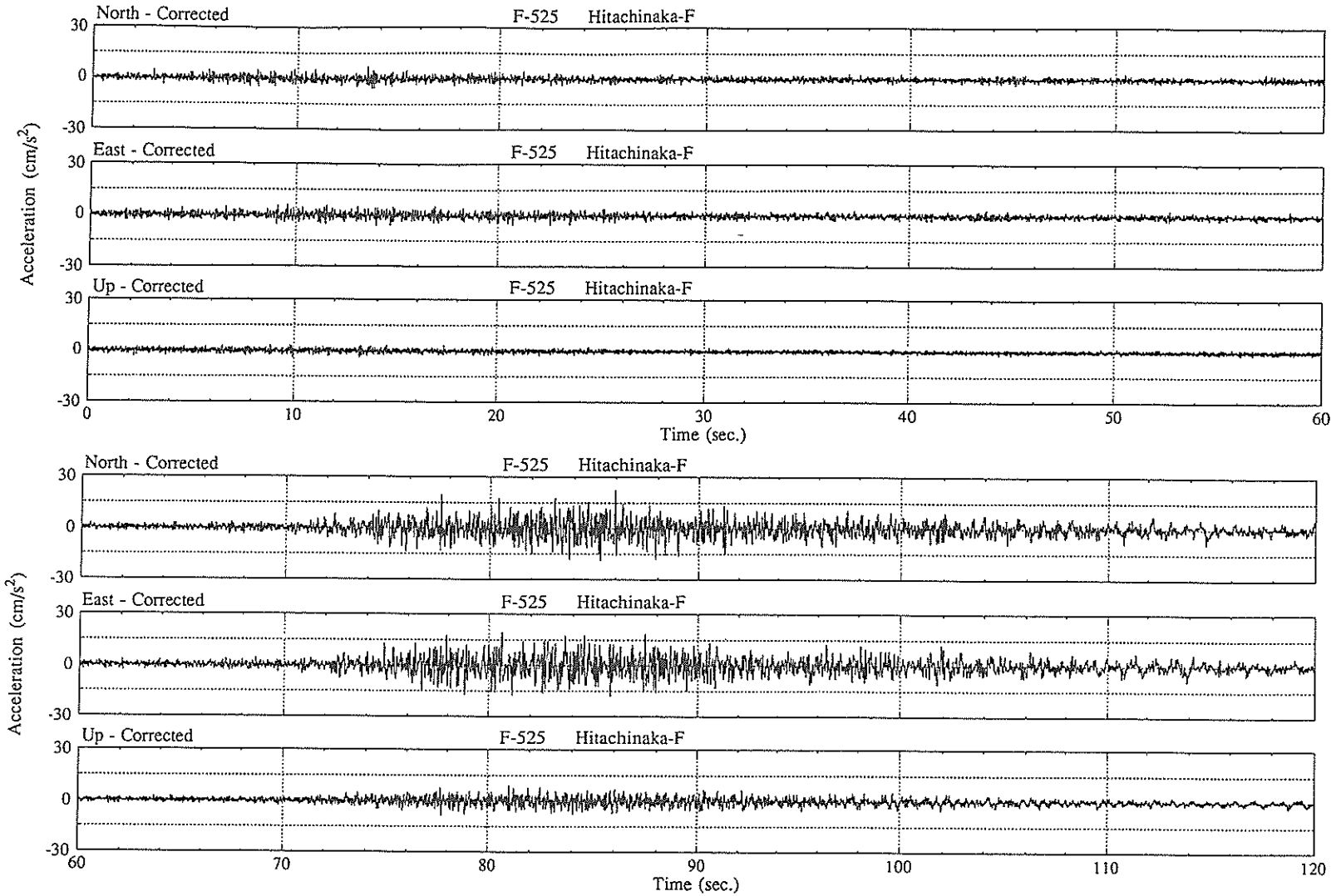
DATE AND TIME	20: 6 JAN.15,1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

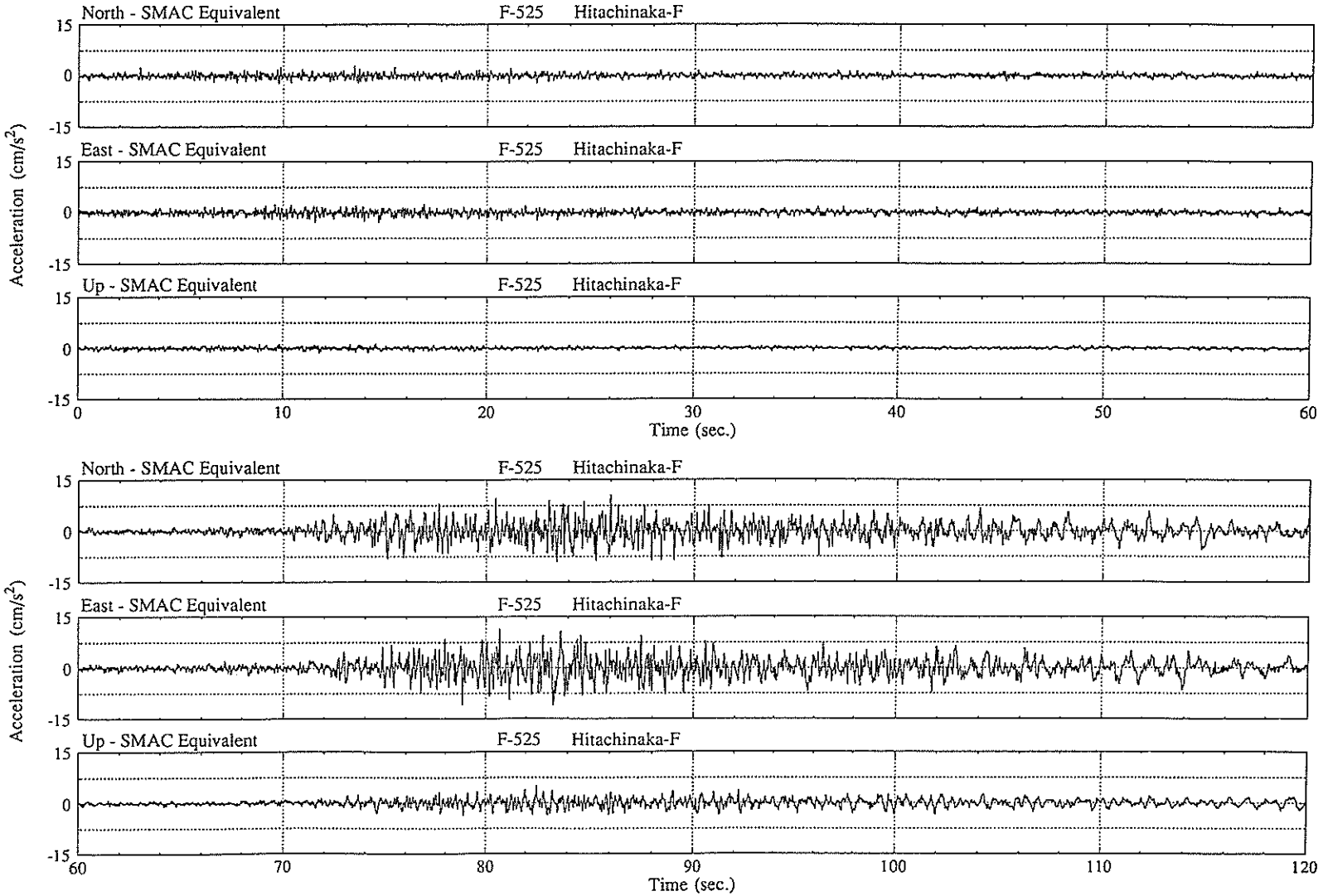
****

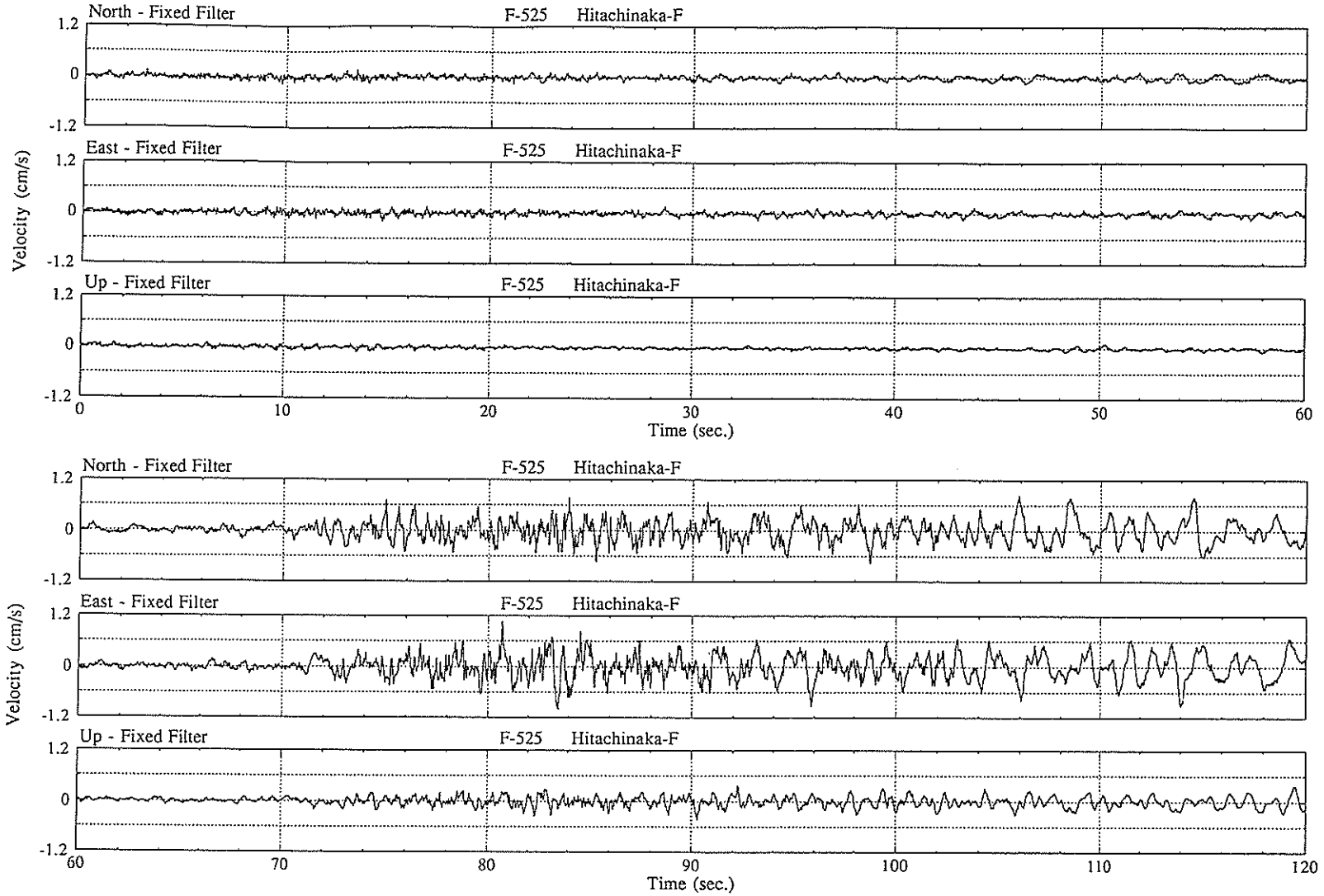
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.292	0.295	0.484	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	10.6	11.5	5.0	12.3
ORIGINAL	21.9	19.9	8.7	22.2
CORRECTED	22.4	19.5	8.9	22.6
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	0.84	1.07	0.43	1.08
VARIABLE FILTER	0.86	0.99	0.37	1.01
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.26	0.21	0.10	0.28
VARIABLE FILTER	0.18	0.17	0.06	0.20

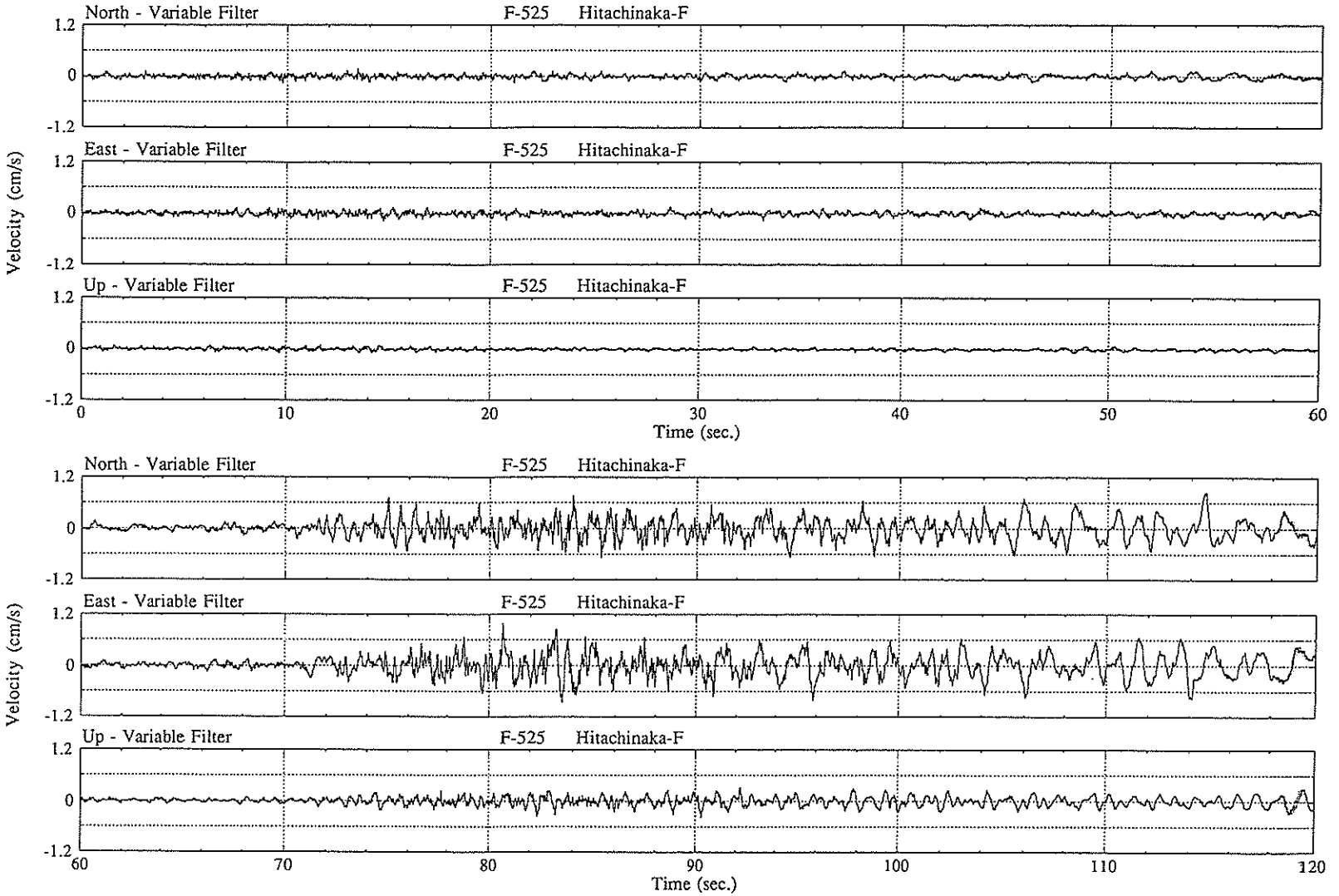
* RESULTANT OF HORIZONTAL COMPONENTS

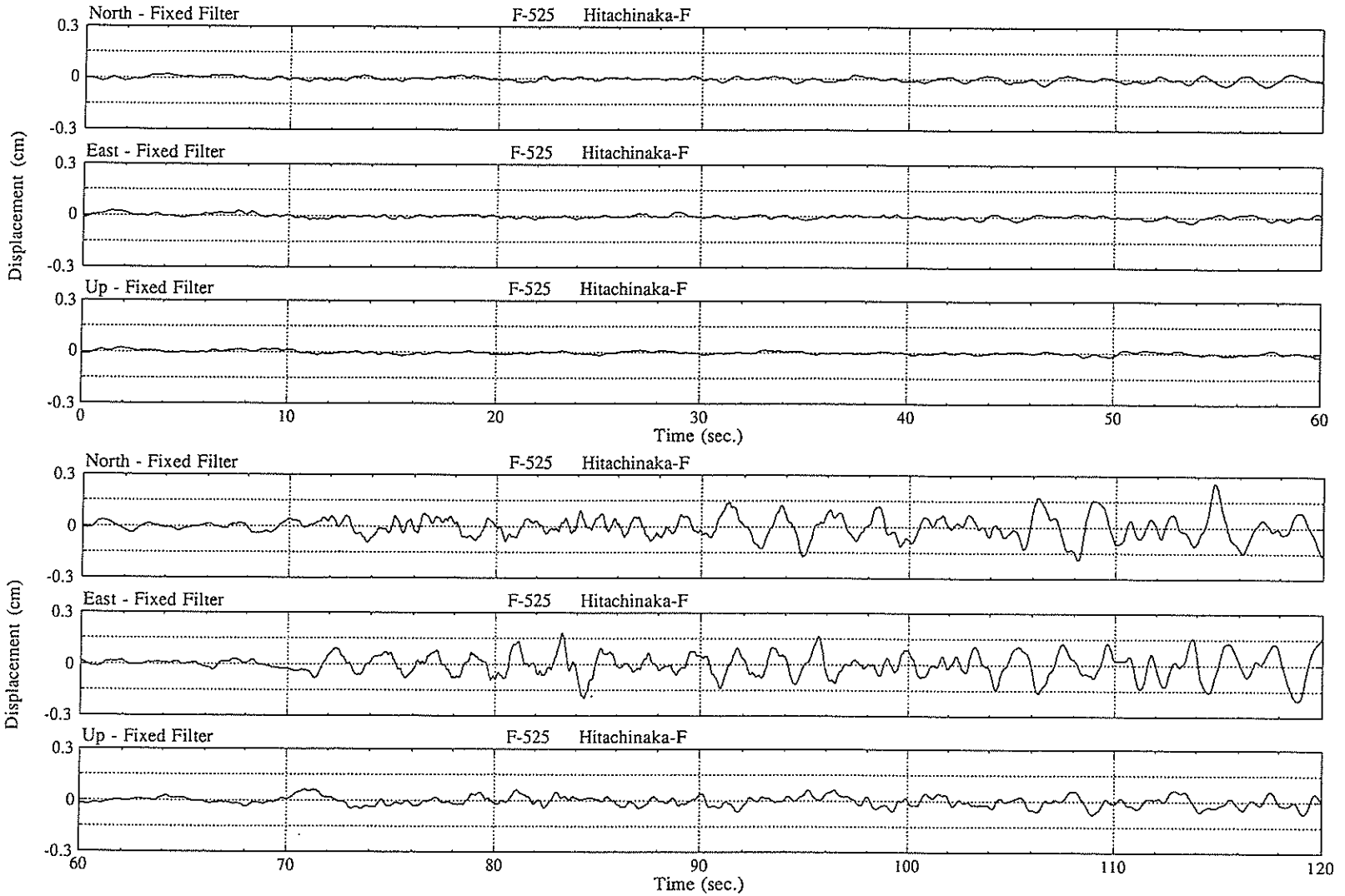

North - Original
F-525 Hitachinaka-F
East - Original
F-525 Hitachinaka-F
Up - Original
F-525 Hitachinaka-F
Acceleration (cm/s²)
30
0
-30
0
10
20
30
40
50
60
Time (sec.)
North - Original
F-525 Hitachinaka-F
East - Original
F-525 Hitachinaka-F
Up - Original
F-525 Hitachinaka-F
Acceleration (cm/s²)
30
0
-30
60
70
80
90
100
110
120
Time (sec.)

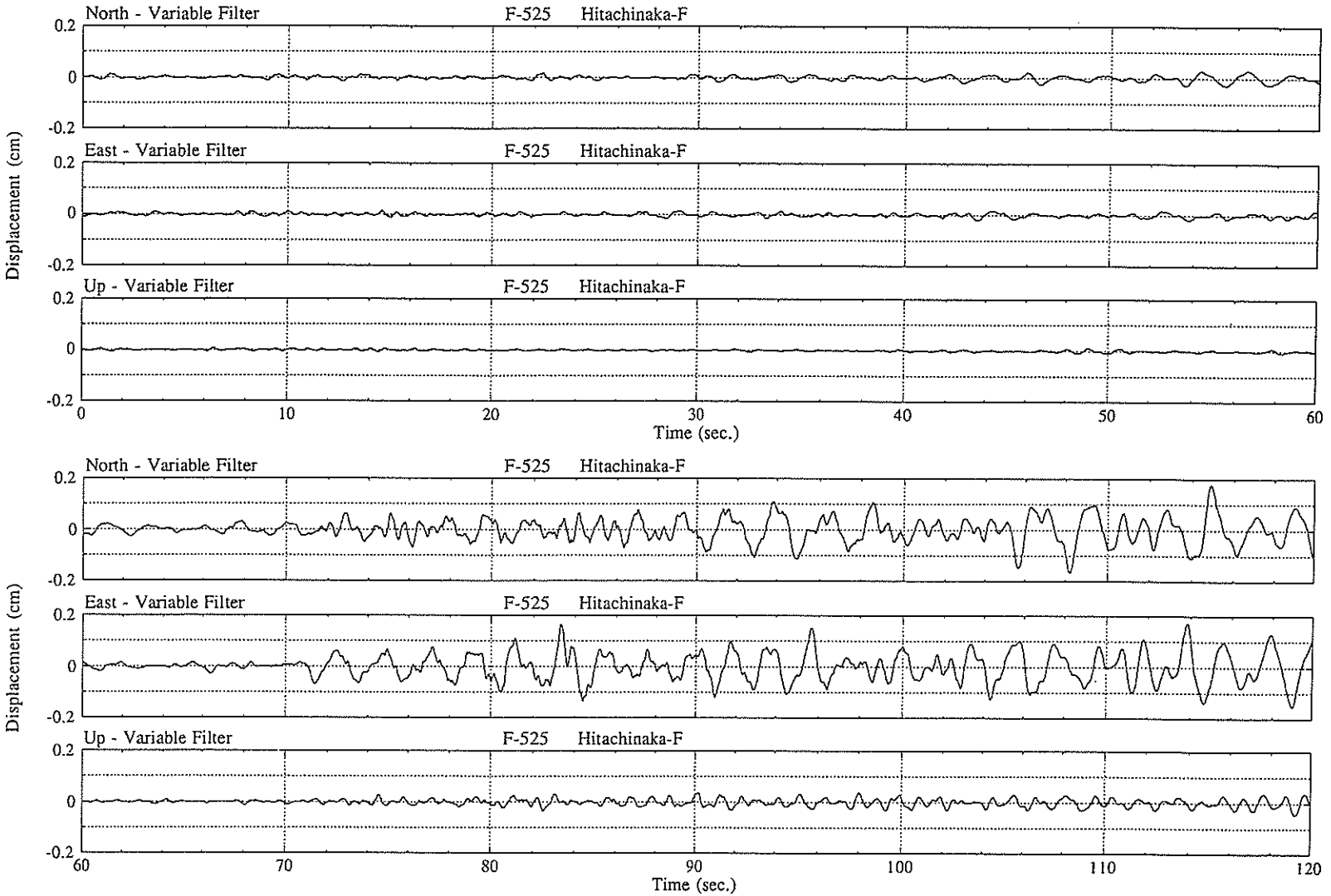

North - Corrected
F-525 Hitachinaka-F
East - Corrected
F-525 Hitachinaka-F
Up - Corrected
F-525 Hitachinaka-F
Acceleration (cm/s²)
30
0
-30
0
10
20
30
40
50
60
Time (sec.)
North - Corrected
F-525 Hitachinaka-F
East - Corrected
F-525 Hitachinaka-F
Up - Corrected
F-525 Hitachinaka-F
Acceleration (cm/s²)
60
70
80
90
100
110
120
Time (sec.)

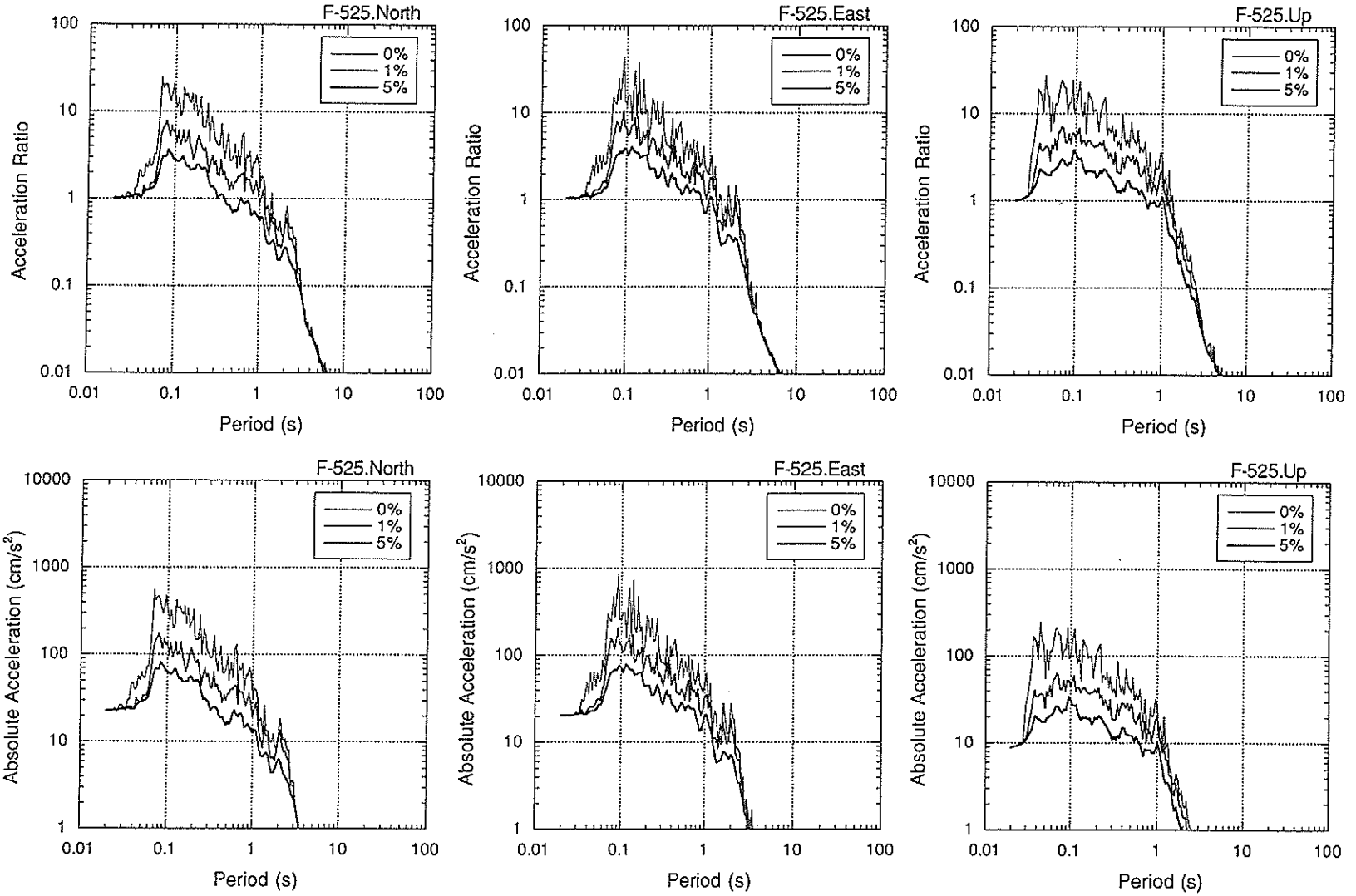

North - SMAC Equivalent F-525 Hitachinaka-F
East - SMAC Equivalent F-525 Hitachinaka-F
Up - SMAC Equivalent F-525 Hitachinaka-F
Acceleration (cm/s²)
15
0
-15
0
10
20
30
40
50
60
Time (sec.)
North - SMAC Equivalent F-525 Hitachinaka-F
East - SMAC Equivalent F-525 Hitachinaka-F
Up - SMAC Equivalent F-525 Hitachinaka-F
Acceleration (cm/s²)
60
70
80
90
100
110
120
Time (sec.)

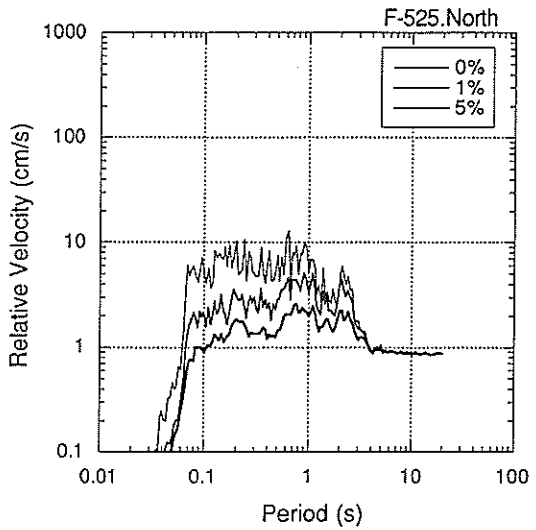

North - Fixed Filter
F-525 Hitachinaka-F
East - Fixed Filter
F-525 Hitachinaka-F
Up - Fixed Filter
F-525 Hitachinaka-F
Velocity (cm/s)
1.2
0
-1.2
0
10
20
30
40
50
60
Time (sec.)
North - Fixed Filter
F-525 Hitachinaka-F
East - Fixed Filter
F-525 Hitachinaka-F
Up - Fixed Filter
F-525 Hitachinaka-F
Velocity (cm/s)
60
70
80
90
100
110
120
Time (sec.)

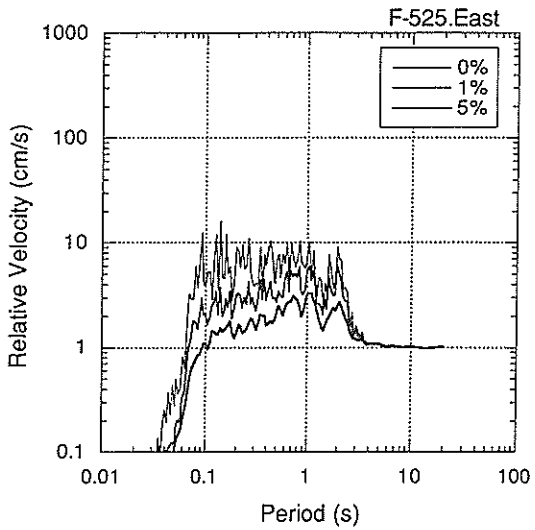

North - Variable Filter F-525 Hitachinaka-F
East - Variable Filter F-525 Hitachinaka-F
Up - Variable Filter F-525 Hitachinaka-F
Velocity (cm/s)
1.2
0
-1.2
0
10
20
30
40
50
60
Time (sec.)
North - Variable Filter F-525 Hitachinaka-F
East - Variable Filter F-525 Hitachinaka-F
Up - Variable Filter F-525 Hitachinaka-F
Velocity (cm/s)
60
70
80
90
100
110
120
Time (sec.)

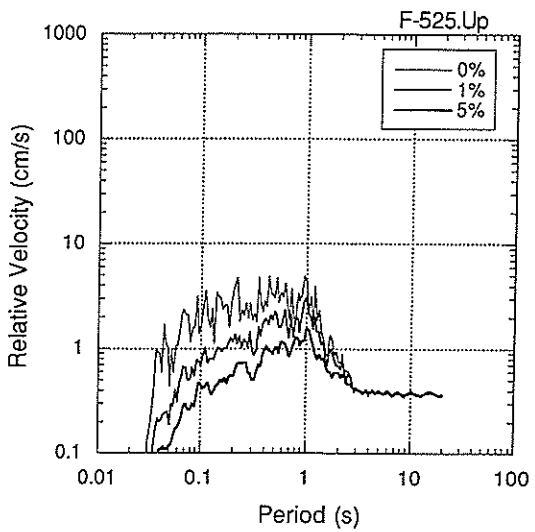

North - Fixed Filter
F-525 Hitachinaka-F
East - Fixed Filter
F-525 Hitachinaka-F
Up - Fixed Filter
F-525 Hitachinaka-F
Displacement (cm)
0.3
0
-0.3
0
10
20
30
40
50
60
Time (sec.)
North - Fixed Filter
F-525 Hitachinaka-F
East - Fixed Filter
F-525 Hitachinaka-F
Up - Fixed Filter
F-525 Hitachinaka-F
Displacement (cm)
60
70
80
90
100
110
120
Time (sec.)

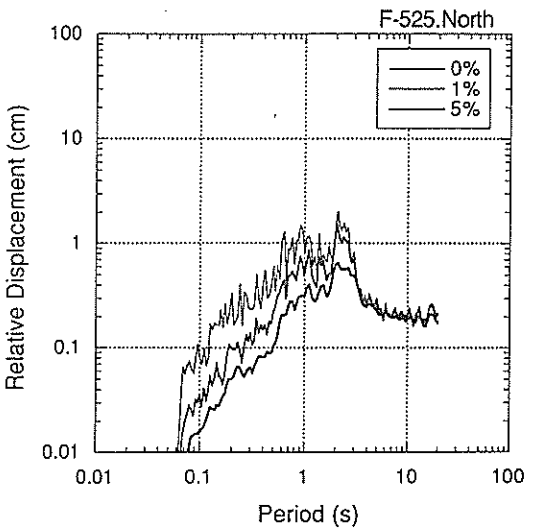

North - Variable Filter
F-525 Hitachinaka-F
East - Variable Filter
F-525 Hitachinaka-F
Up - Variable Filter
F-525 Hitachinaka-F
Displacement (cm)
0.2
0
-0.2
0
10
20
30
40
50
60
Time (sec.)
North - Variable Filter
F-525 Hitachinaka-F
East - Variable Filter
F-525 Hitachinaka-F
Up - Variable Filter
F-525 Hitachinaka-F
Displacement (cm)
0.2
0
-0.2
60
70
80
90
100
110
120
Time (sec.)

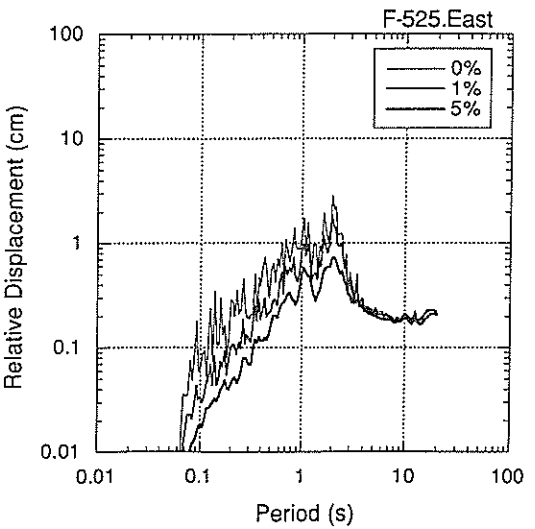

F-525.North
F-525.East
F-525.Up
0%
1%
5%
Acceleration Ratio
Absolute Acceleration (cm/s²)
Period (s)
0.01
0.1
1
10
100
1000
10000

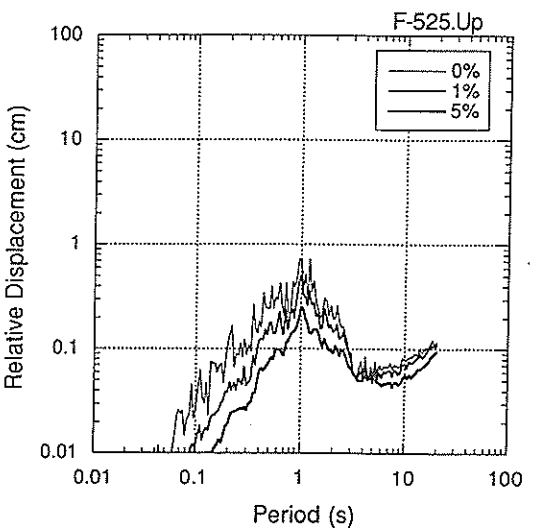

F-525.North
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100

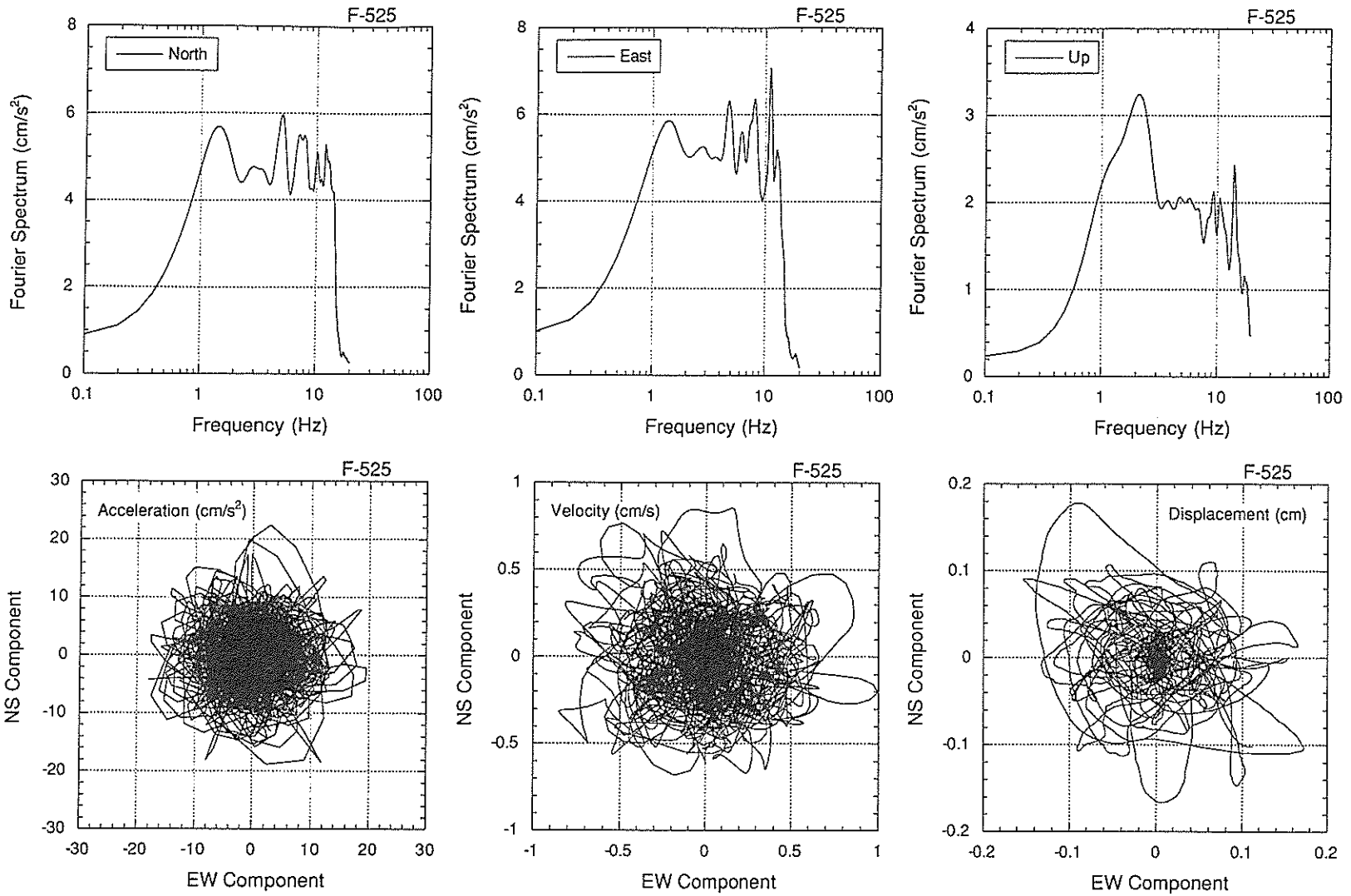

F-525.East
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100


F-525.Up
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
1000
100
10
1
0.1
0.01
0.1
1
10
100


F-525.North
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100


F-525.East
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100


F-525.Up
0%
1%
5%
Relative Displacement (cm)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100


F-525
North
Fourier Spectrum (cm/s²)
Frequency (Hz)
F-525
East
Fourier Spectrum (cm/s²)
Frequency (Hz)
F-525
Up
Fourier Spectrum (cm/s²)
Frequency (Hz)
F-525
Acceleration (cm/s²)
NS Component
EW Component
F-525
Velocity (cm/s)
NS Component
EW Component
F-525
Displacement (cm)
NS Component
EW Component

RECORD NUMBER : F-536

STATION : OTARU-G

EARTHQUAKE DATA

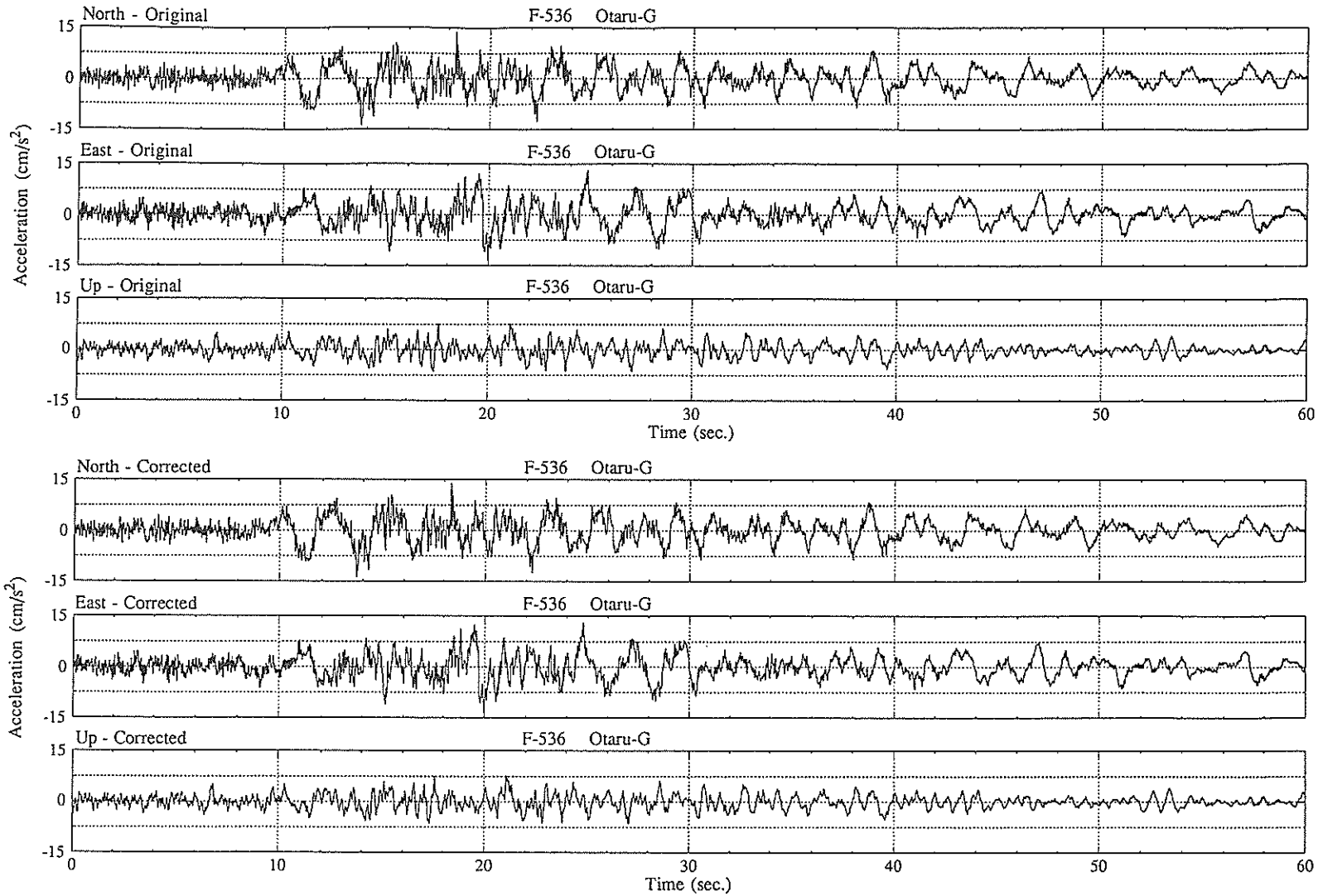
****

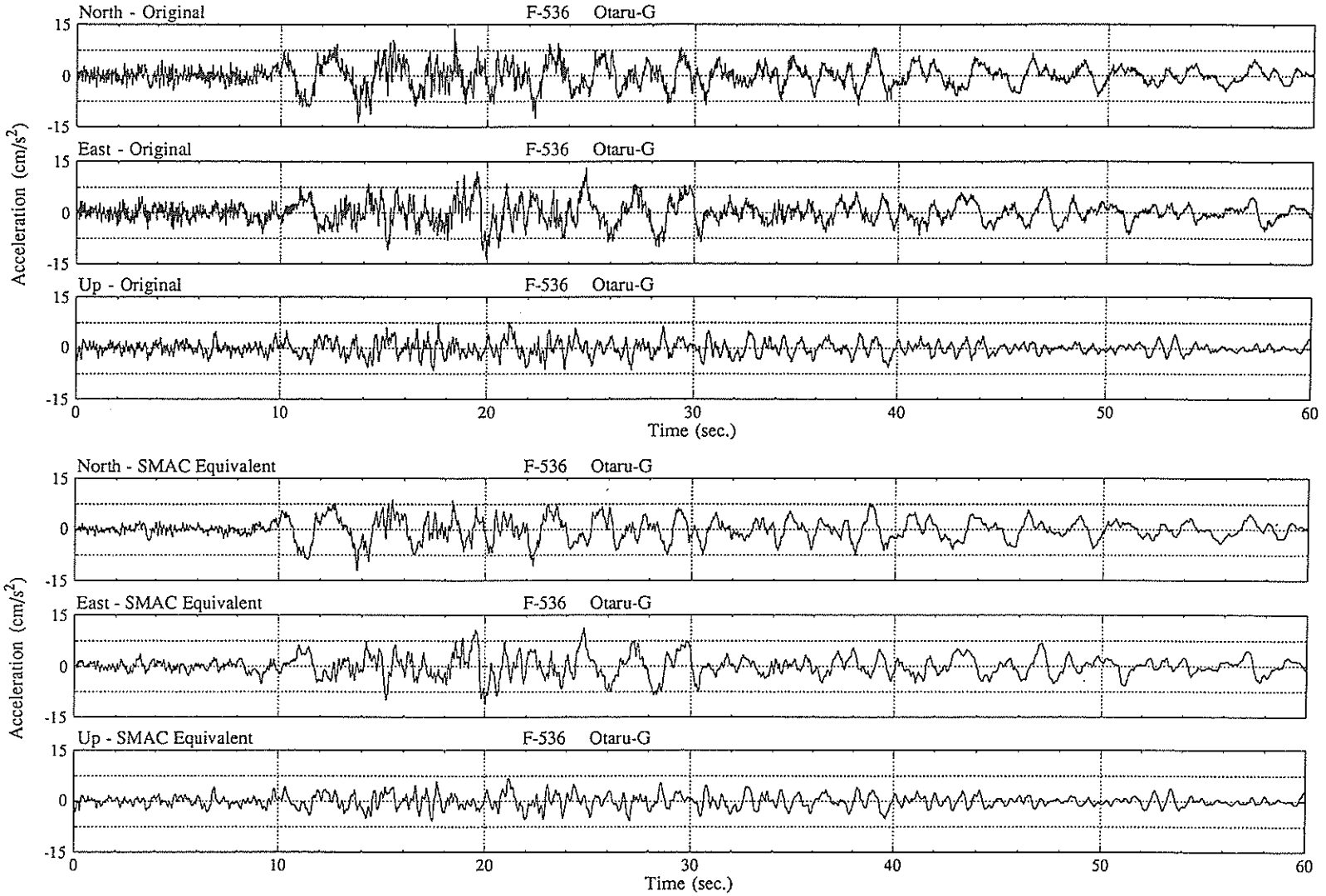
DATE AND TIME	20: 6 JAN. 15, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	SE OFF TOKACHI
LATITUDE	42°53.5' N
LONGITUDE	144°22.4' E
DEPTH	103.2KM
JMA MAGNITUDE	7.8

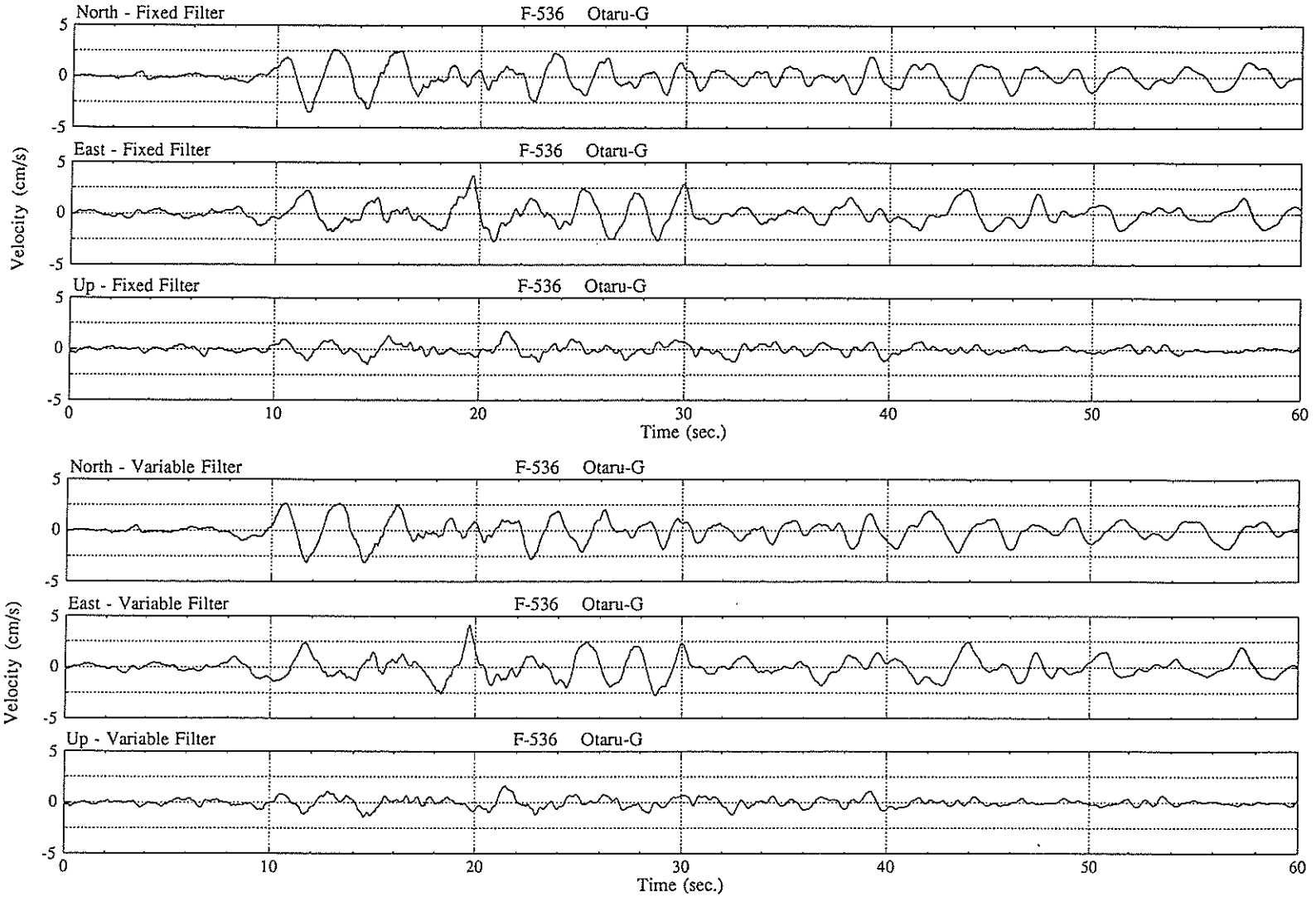
****

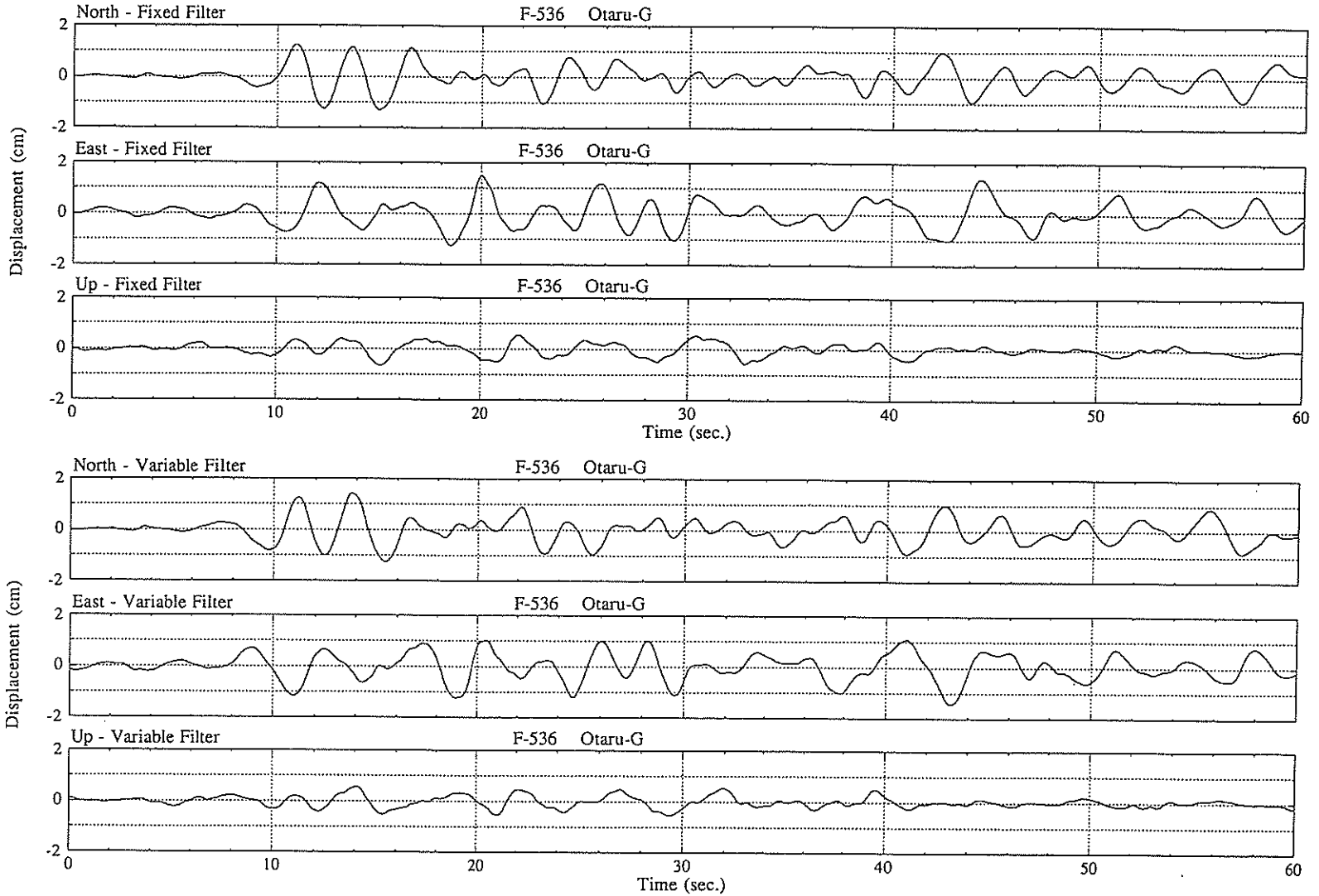
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.097	0.103	0.127	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	11.9	11.3	6.7	12.6
ORIGINAL	13.8	13.3	7.7	15.1
CORRECTED	13.9	13.2	7.7	15.2
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	3.43	3.72	1.78	4.14
VARIABLE FILTER	3.13	4.18	1.62	4.19
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	1.30	1.50	0.65	1.69
VARIABLE FILTER	1.42	1.42	0.57	1.68

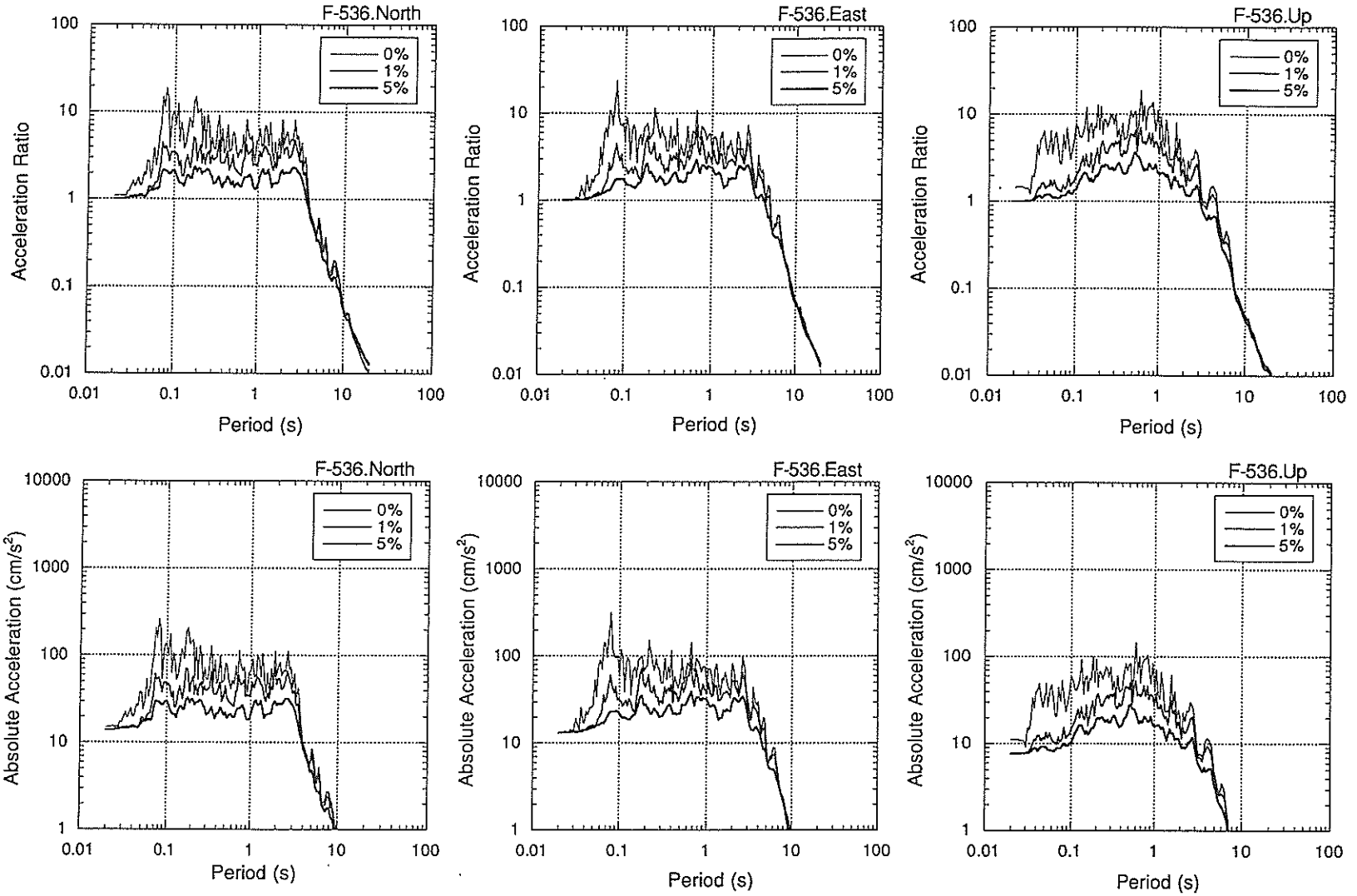
* RESULTANT OF HORIZONTAL COMPONENTS

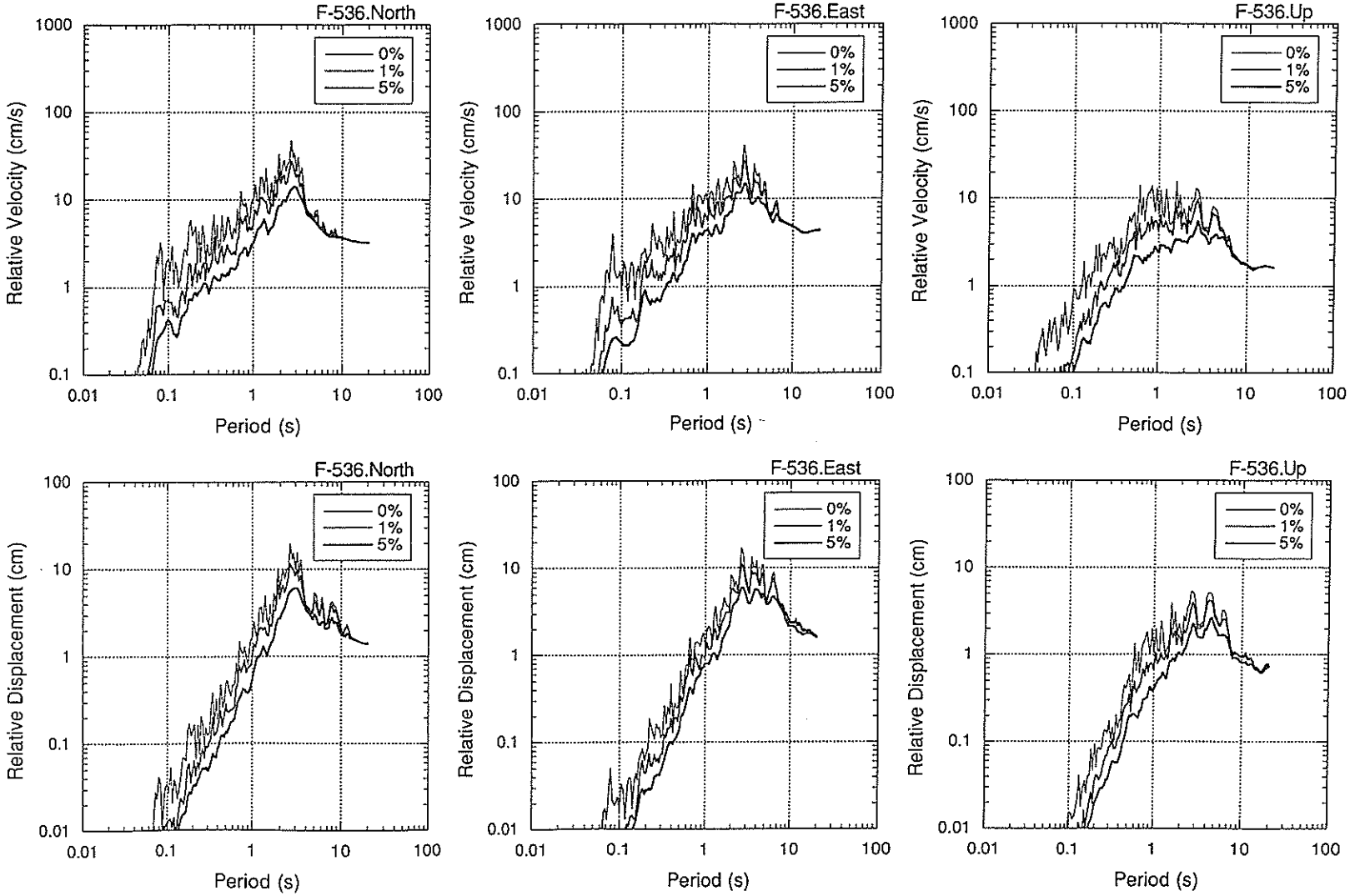

North - Original
F-536 Otaru-G
East - Original
F-536 Otaru-G
Up - Original
F-536 Otaru-G
Acceleration (cm/s²)
15
0
-15
0
10
20
30
40
50
60
Time (sec.)
North - Corrected
F-536 Otaru-G
East - Corrected
F-536 Otaru-G
Up - Corrected
F-536 Otaru-G
Acceleration (cm/s²)
Time (sec.)

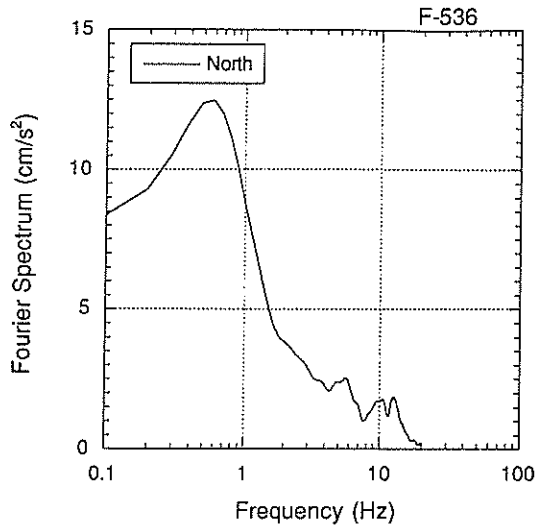

North - Original
F-536 Otaru-G
East - Original
F-536 Otaru-G
Up - Original
F-536 Otaru-G
Acceleration (cm/s²)
15
0
-15
0
10
20
30
40
50
60
Time (sec.)
North - SMAC Equivalent
F-536 Otaru-G
East - SMAC Equivalent
F-536 Otaru-G
Up - SMAC Equivalent
F-536 Otaru-G
Acceleration (cm/s²)
Time (sec.)

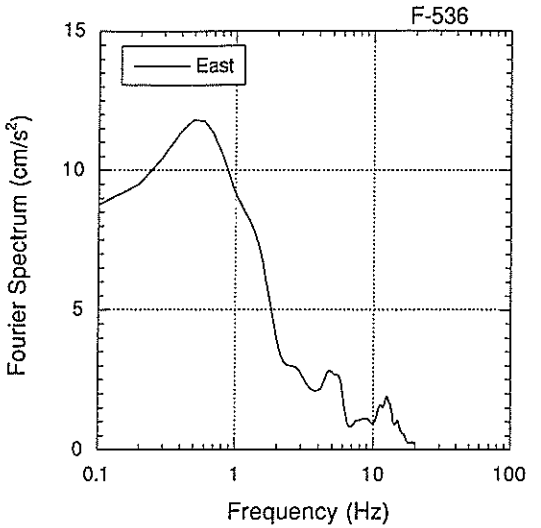

North - Fixed Filter
F-536 Otaru-G
East - Fixed Filter
F-536 Otaru-G
Up - Fixed Filter
F-536 Otaru-G
Velocity (cm/s)
Time (sec.)
North - Variable Filter
F-536 Otaru-G
East - Variable Filter
F-536 Otaru-G
Up - Variable Filter
F-536 Otaru-G
Velocity (cm/s)
Time (sec.)

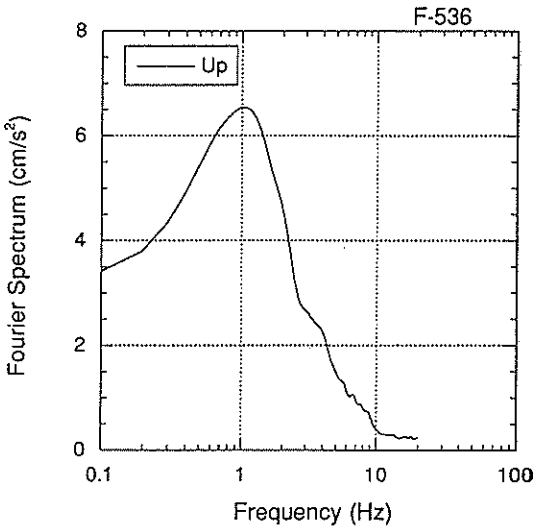

North - Fixed Filter
F-536 Otaru-G
East - Fixed Filter
F-536 Otaru-G
Up - Fixed Filter
F-536 Otaru-G
Displacement (cm)
Time (sec.)
North - Variable Filter
F-536 Otaru-G
East - Variable Filter
F-536 Otaru-G
Up - Variable Filter
F-536 Otaru-G
Displacement (cm)
Time (sec.)

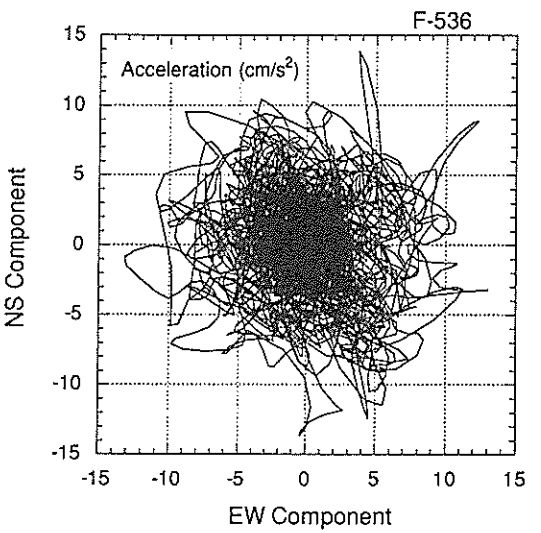

F-536.North
F-536.East
F-536.Up
0%
1%
5%
Acceleration Ratio
Absolute Acceleration (cm/s²)
Period (s)
0.01
0.1
1
10
100
1000
10000

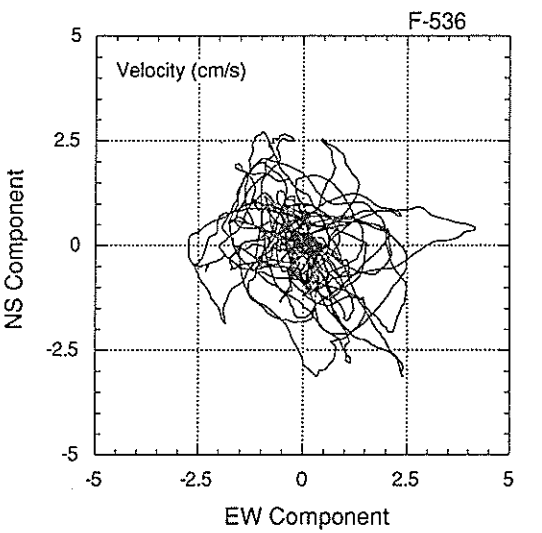

F-536.North
F-536.East
F-536.Up
0%
1%
5%
Relative Velocity (cm/s)
Relative Displacement (cm)
Period (s)
0.01
0.1
1
10
100
1000

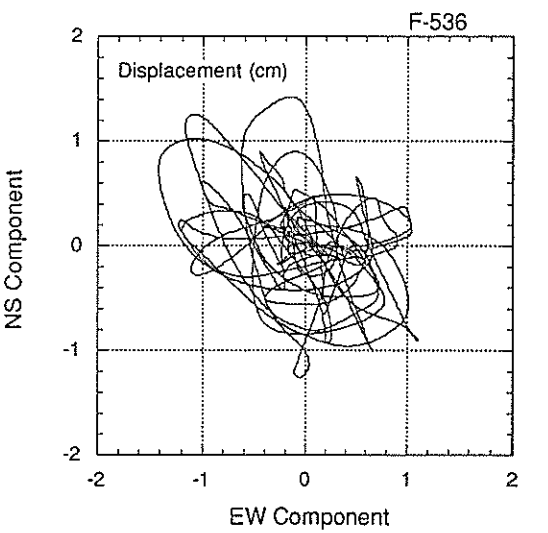

F-536
North
Fourier Spectrum (cm/s²)
Frequency (Hz)
0.1
1
10
100
0
5
10
15


F-536
East
Fourier Spectrum (cm/s²)
Frequency (Hz)
0.1
1
10
100
0
5
10
15


F-536
Up
Fourier Spectrum (cm/s²)
Frequency (Hz)
0.1
1
10
100
0
2
4
6
8


F-536
Acceleration (cm/s²)
NS Component
EW Component
-15
-10
-5
0
5
10
15


F-536
Velocity (cm/s)
NS Component
EW Component
-5
-2.5
0
2.5
5


F-536
Displacement (cm)
NS Component
EW Component
-2
-1
0
1
2

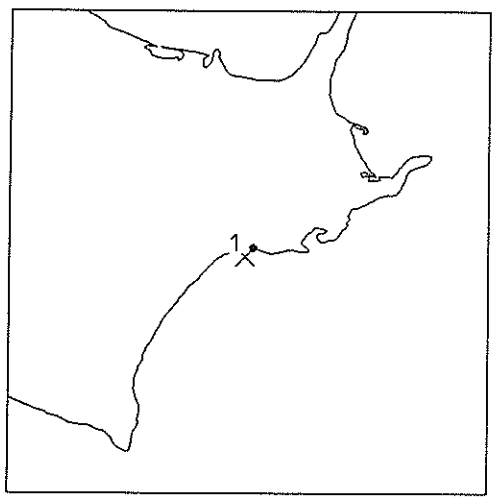
Strong-Motion Earthquake Observation Results of the After Shock at 23:43:14, February 4, 1993

STRONG-MOTION EARTHQUAKE OBSERVATION RESULTS

23:43 FEB. 4 ,1993
KUSHIRO REGION
EPICENTER : 42°57.2'N 144°16.9'E
DEPTH : 94.7KM MAGNITUDE : 4.9

JMA INTENSITIES

Ⅲ : KUSHIRO
Ⅱ : OBIHIRO,HIROO
Ⅰ : URAKAWA,HACHINOHE



	STATION	CONDITION	RECORD NUMBER	MAX.ACC.(GAL) (NS)	(EW)	(UD)	DIST. (KM)
1	KUSHIRO-G	ON GROUND	F- 528	19	17	7	7
1	KUSHIRO-GB	IN GROUND	F- 527	8	9	2	7

Results of Preliminary Analyses of the After Shock

at 23:43:14, February 4, 1993

RECORD NUMBER : F-527

STATION : KUSHIRO-GB

EARTHQUAKE DATA

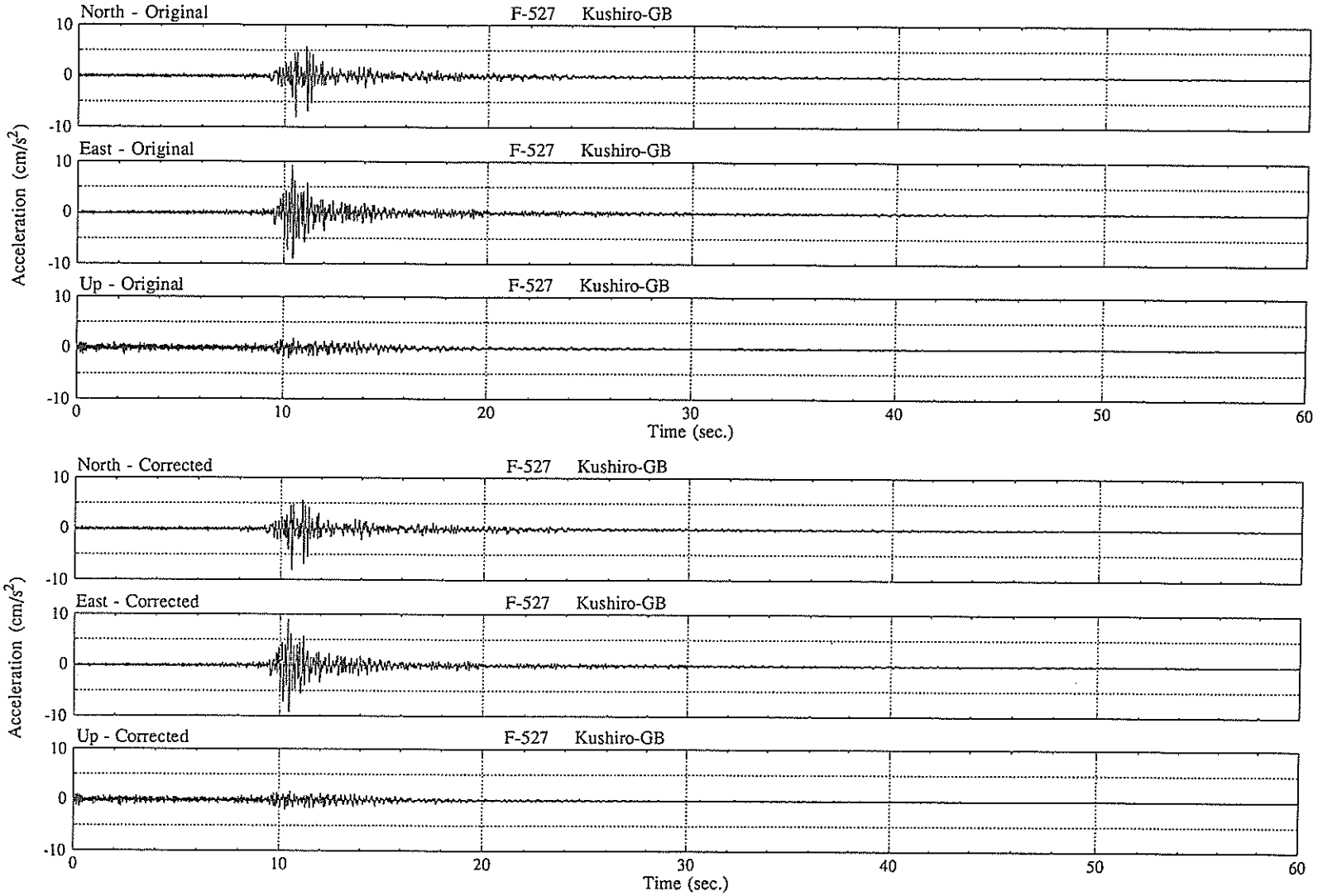
****

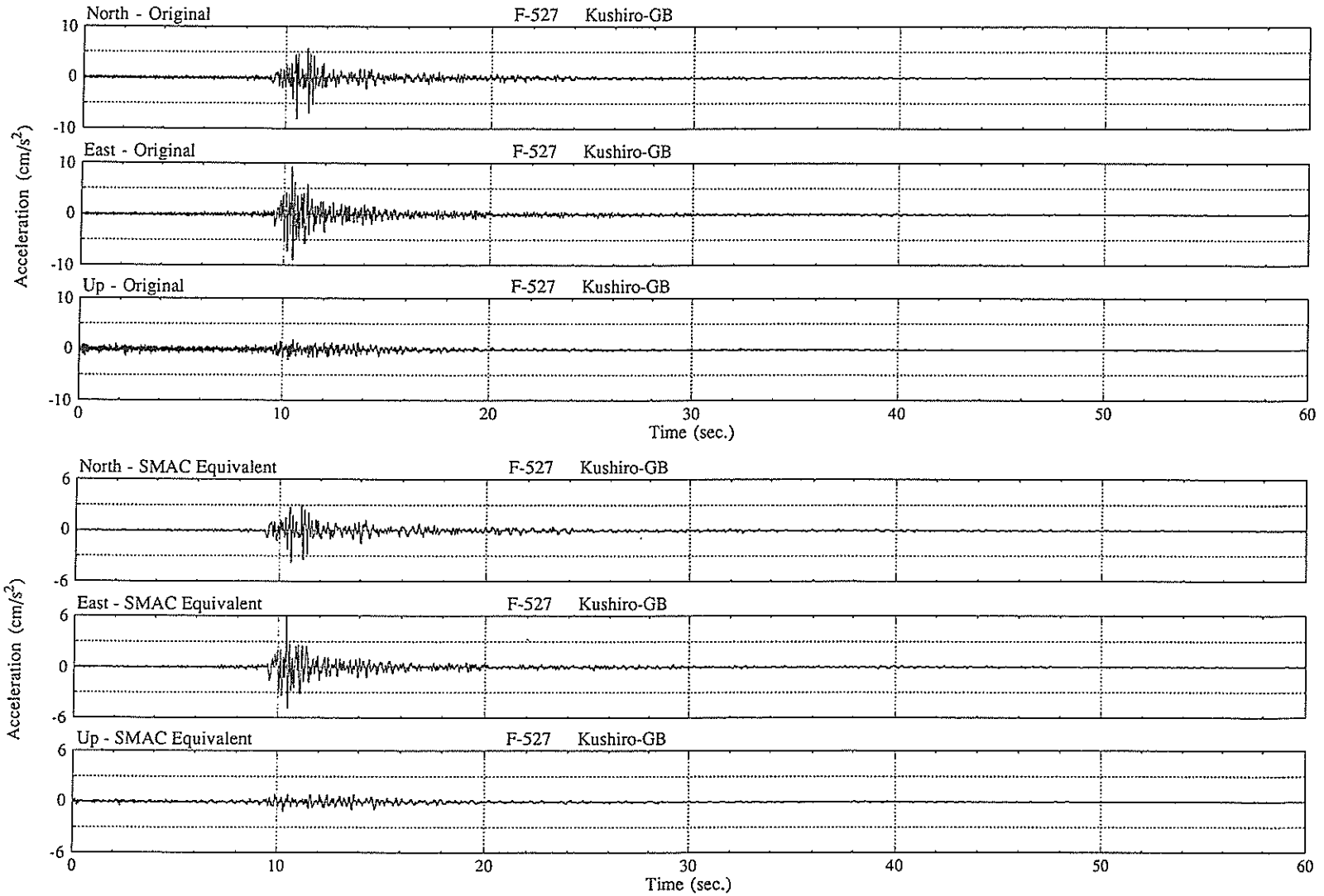
DATE AND TIME	23:43 FEB. 4, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	KUSHIRO REGION
LATITUDE	42°57.2' N
LONGITUDE	144°16.9' E
DEPTH	94.7KM
JMA MAGNITUDE	4.9

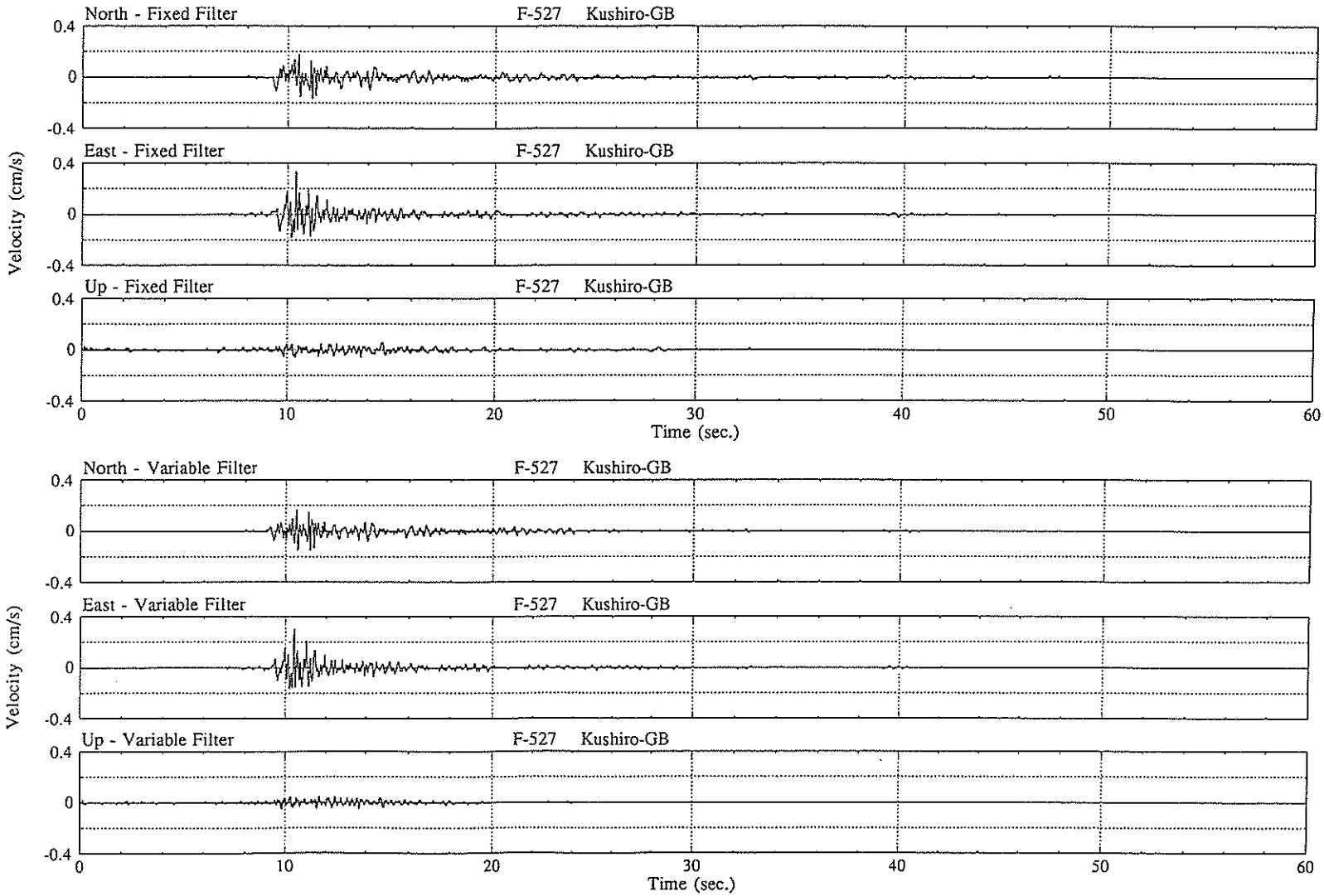
****

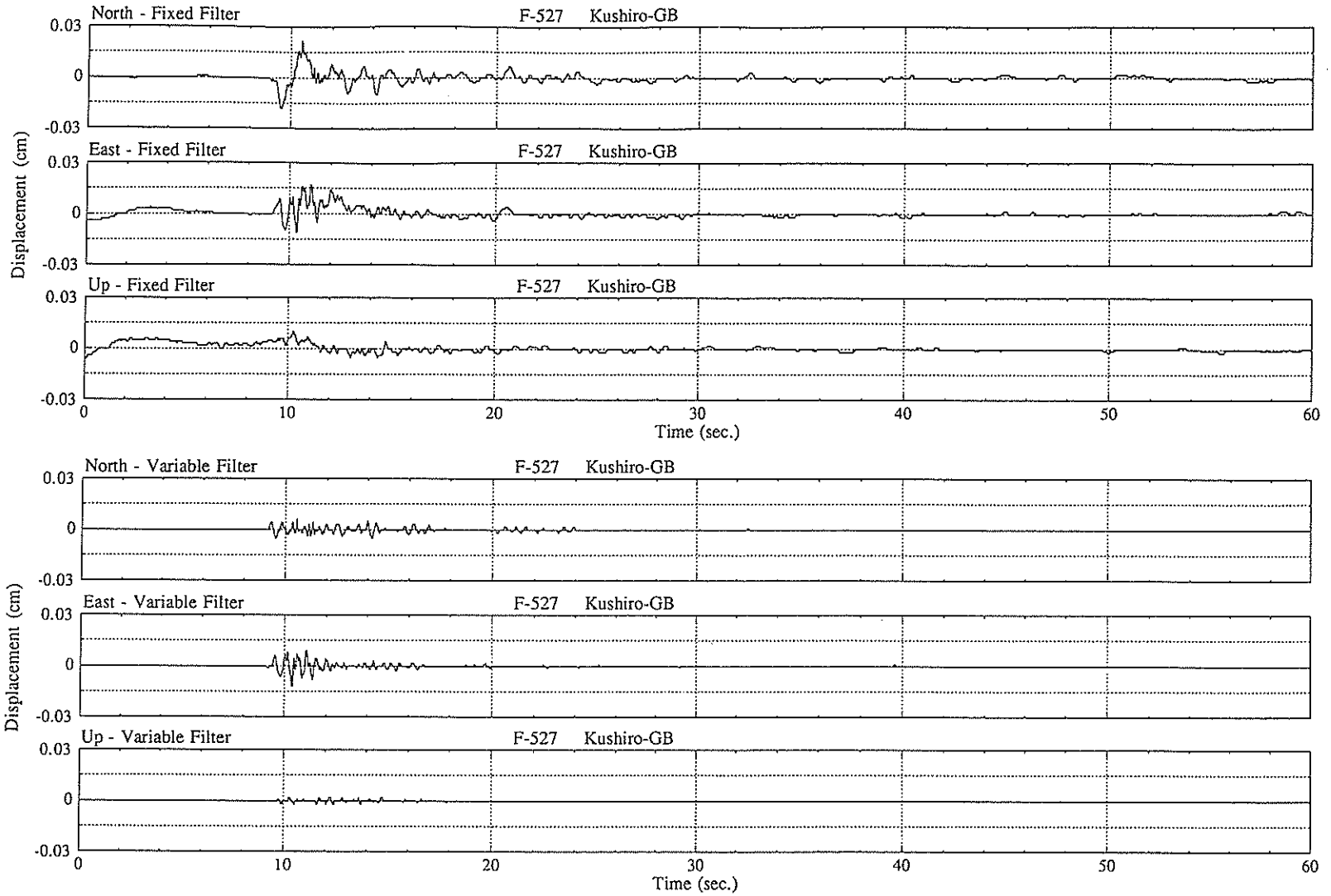
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	1.183	1.244	1.641	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	3.8	5.9	1.2	6.2
ORIGINAL	8.2	9.3	2.0	9.4
CORRECTED	8.0	9.2	1.9	9.3
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	0.18	0.34	0.06	0.34
VARIABLE FILTER	0.17	0.30	0.05	0.31
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.02	0.02	0.01	0.02
VARIABLE FILTER	0.01	0.01	0.00	0.01

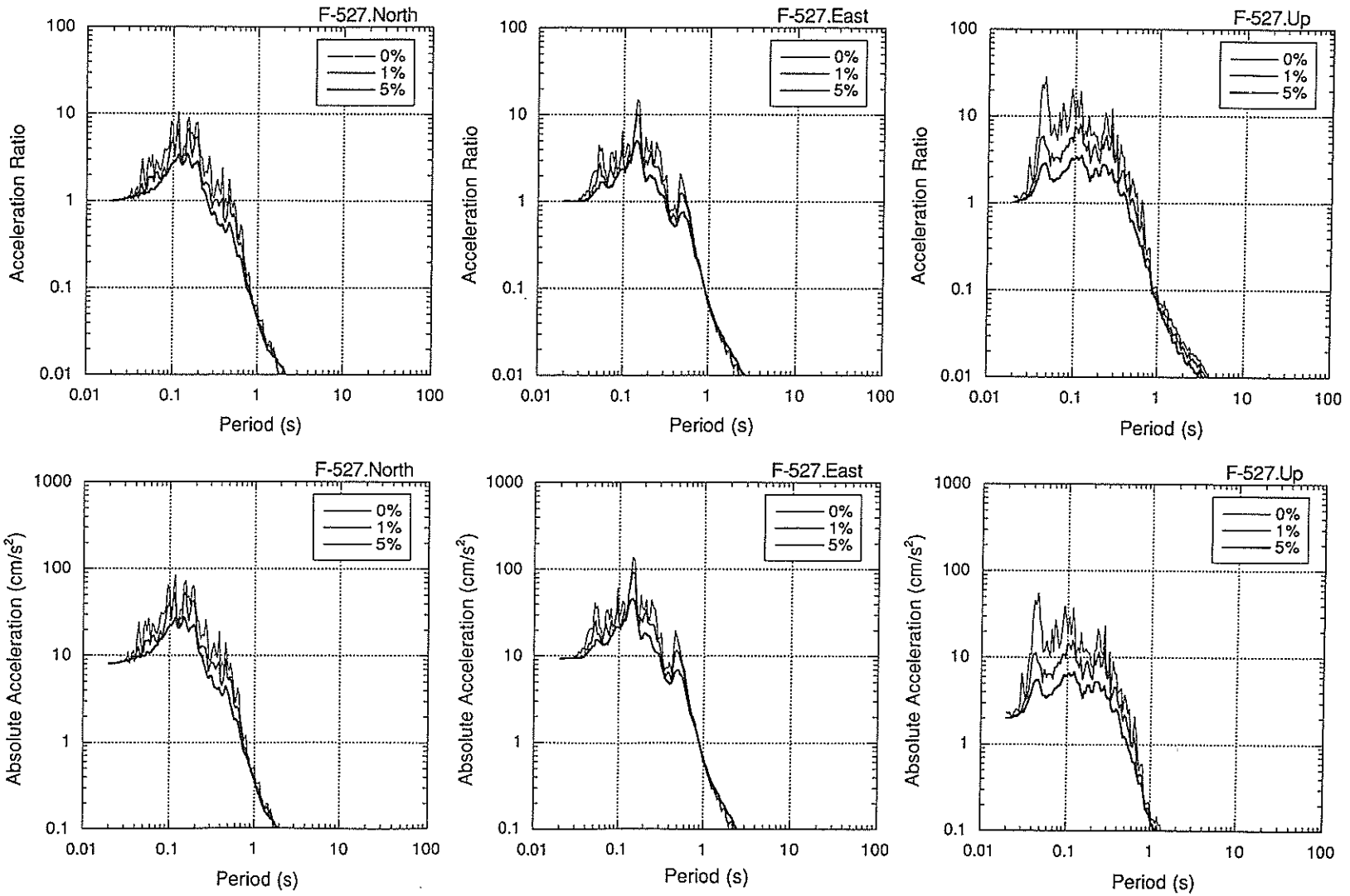
* RESULTANT OF HORIZONTAL COMPONENTS

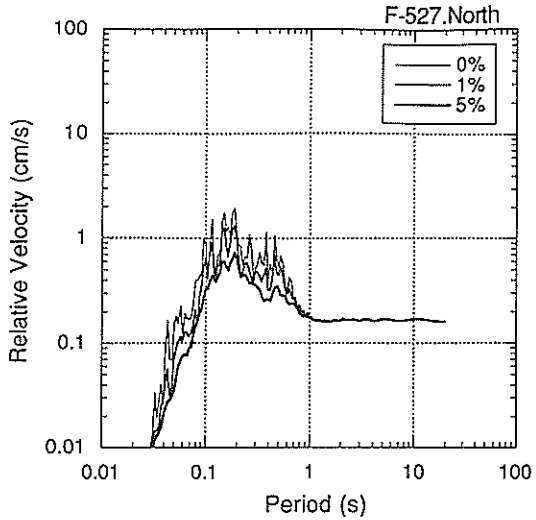

North - Original
F-527 Kushiro-GB
East - Original
F-527 Kushiro-GB
Up - Original
F-527 Kushiro-GB
Acceleration (cm/s²)
Time (sec.)
North - Corrected
F-527 Kushiro-GB
East - Corrected
F-527 Kushiro-GB
Up - Corrected
F-527 Kushiro-GB
Acceleration (cm/s²)
Time (sec.)

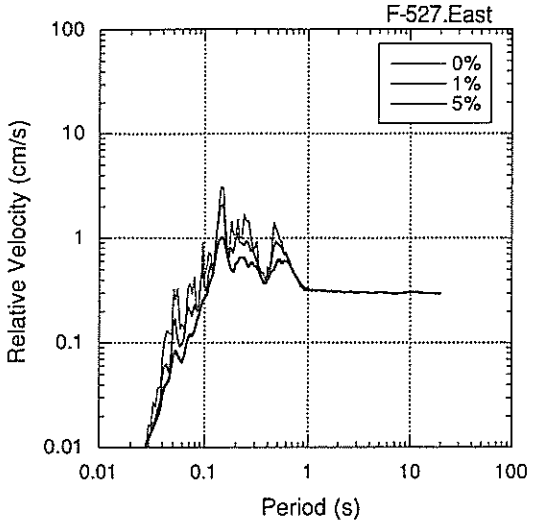

North - Original F-527 Kushiro-GB
East - Original F-527 Kushiro-GB
Up - Original F-527 Kushiro-GB
Acceleration (cm/s²)
10
0
-10
0
10
20
30
40
50
60
Time (sec.)
North - SMAC Equivalent F-527 Kushiro-GB
East - SMAC Equivalent F-527 Kushiro-GB
Up - SMAC Equivalent F-527 Kushiro-GB
Acceleration (cm/s²)
6
0
-6
0
10
20
30
40
50
60
Time (sec.)

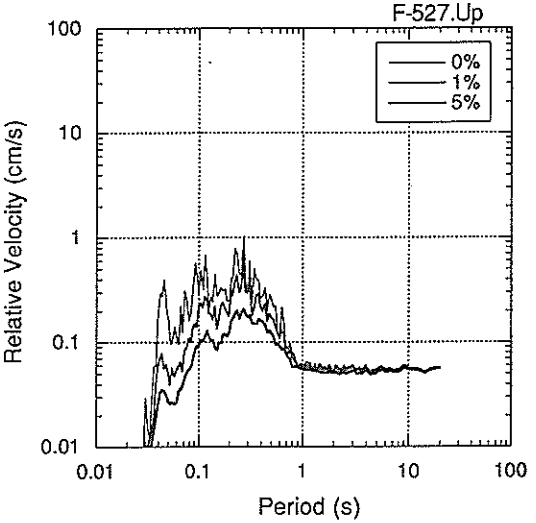

North - Fixed Filter
F-527 Kushiro-GB
East - Fixed Filter
F-527 Kushiro-GB
Up - Fixed Filter
F-527 Kushiro-GB
North - Variable Filter
F-527 Kushiro-GB
East - Variable Filter
F-527 Kushiro-GB
Up - Variable Filter
F-527 Kushiro-GB
Velocity (cm/s)
0.4
0
-0.4
0
10
20
30
40
50
60
Time (sec.)

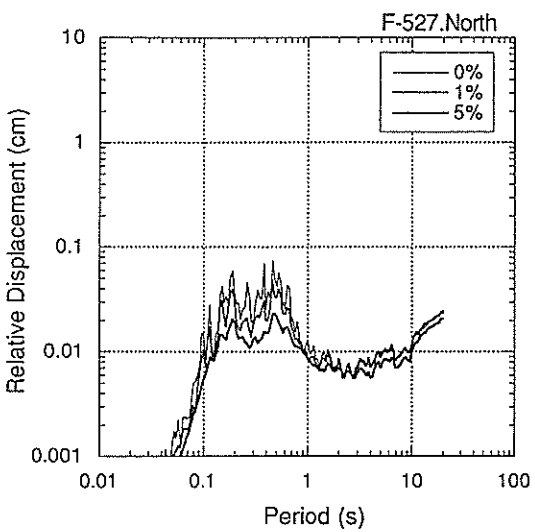

North - Fixed Filter
F-527 Kushiro-GB
East - Fixed Filter
F-527 Kushiro-GB
Up - Fixed Filter
F-527 Kushiro-GB
Displacement (cm)
0.03
0
-0.03
0
10
20
30
40
50
60
Time (sec.)
North - Variable Filter
F-527 Kushiro-GB
East - Variable Filter
F-527 Kushiro-GB
Up - Variable Filter
F-527 Kushiro-GB
Displacement (cm)
Time (sec.)

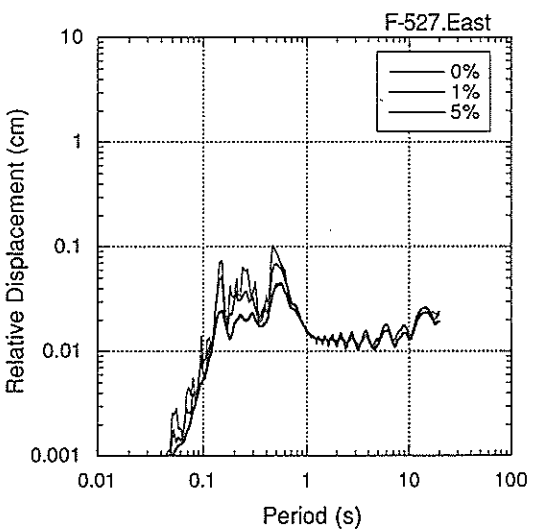

F-527.North
F-527.East
F-527.Up
0%
1%
5%
Acceleration Ratio
Absolute Acceleration (cm/s²)
Period (s)
0.01
0.1
1
10
100
1000

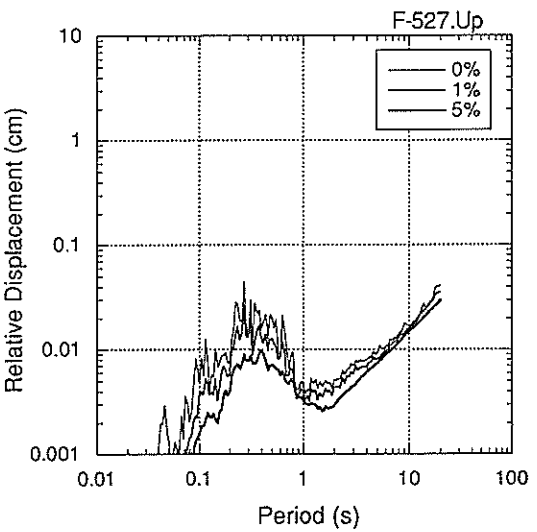

F-527.North
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

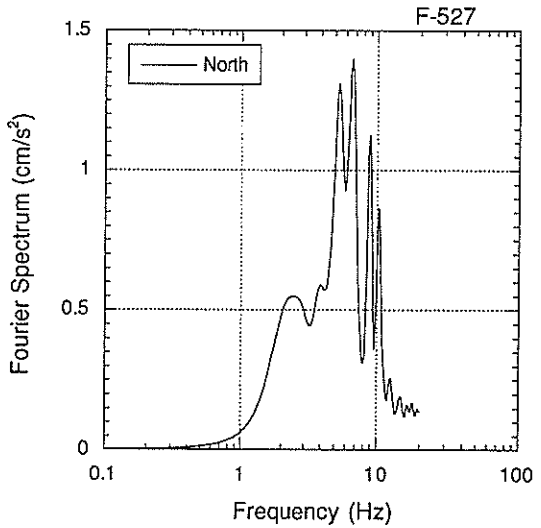

F-527.East
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

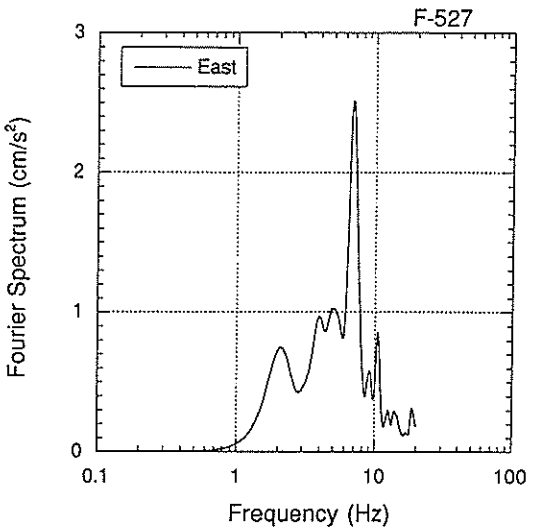

F-527.Up
0%
1%
5%
Relative Velocity (cm/s)
Period (s)
100
10
1
0.1
0.01
0.01
0.1
1
10
100

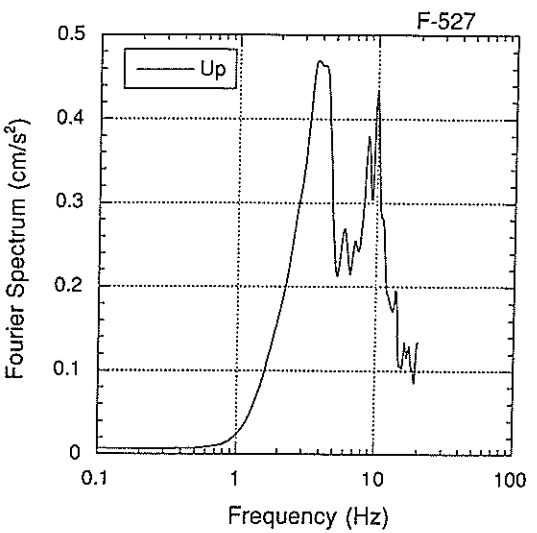

F-527.North
0%
1%
5%
Relative Displacement (cm)
Period (s)
10
1
0.1
0.01
0.001
0.01
0.1
1
10
100

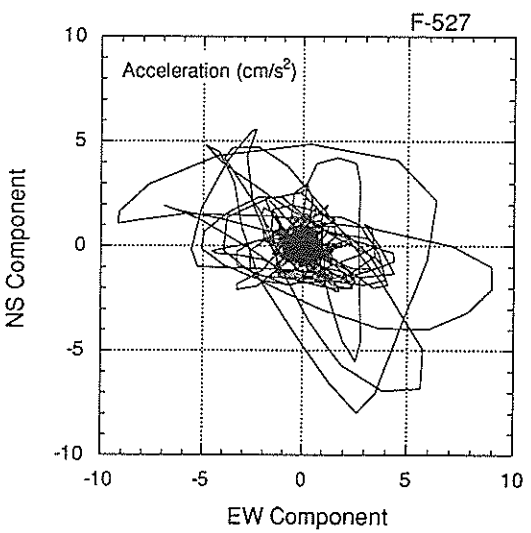

F-527.East
0%
1%
5%
Relative Displacement (cm)
Period (s)
10
1
0.1
0.01
0.001
0.01
0.1
1
10
100

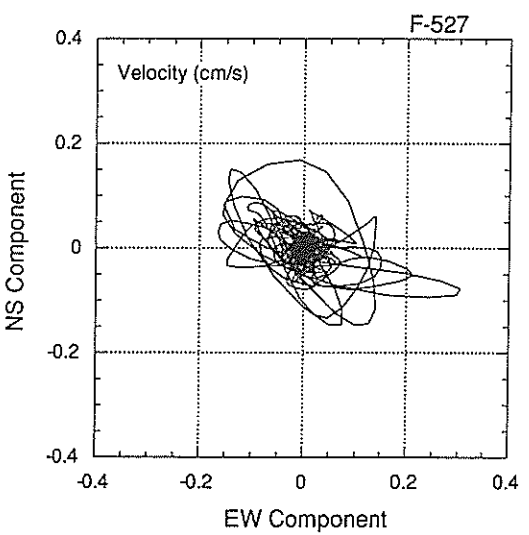

F-527.Up
0%
1%
5%
Relative Displacement (cm)
Period (s)
10
1
0.1
0.01
0.001
0.01
0.1
1
10
100

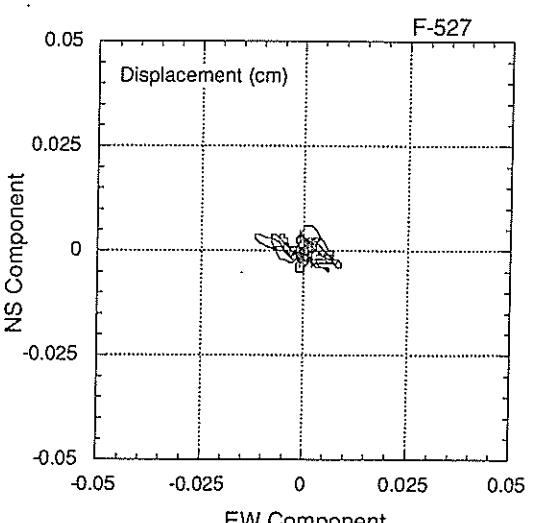

F-527
North
Fourier Spectrum (cm/s²)
Frequency (Hz)


F-527
East
Fourier Spectrum (cm/s²)
Frequency (Hz)


F-527
Up
Fourier Spectrum (cm/s²)
Frequency (Hz)


F-527
Acceleration (cm/s²)
NS Component
EW Component


F-527
Velocity (cm/s)
NS Component
EW Component


F-527
Displacement (cm)
NS Component
EW Component

RECORD NUMBER : F-528

STATION : KUSHIRO-G

EARTHQUAKE DATA

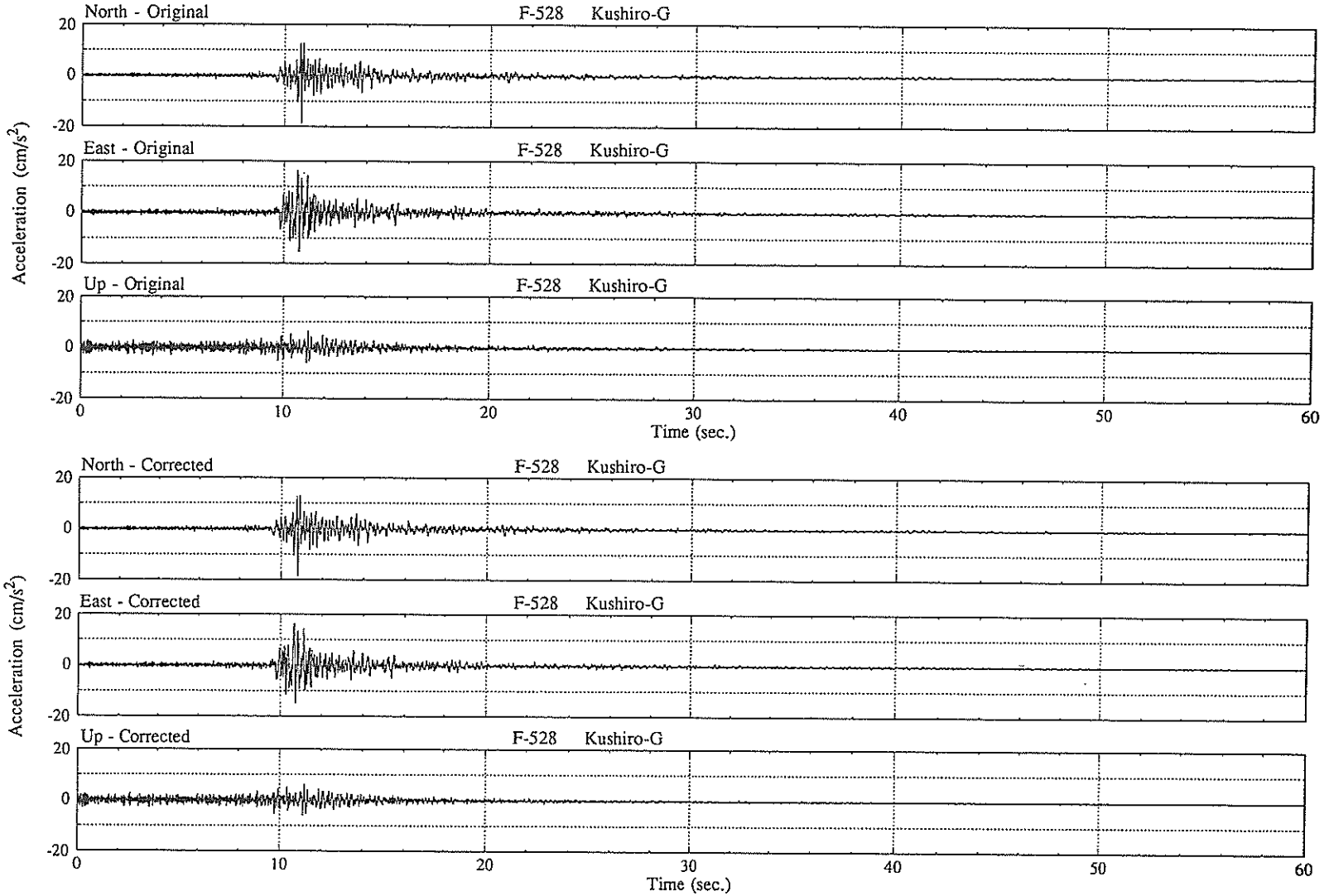
****

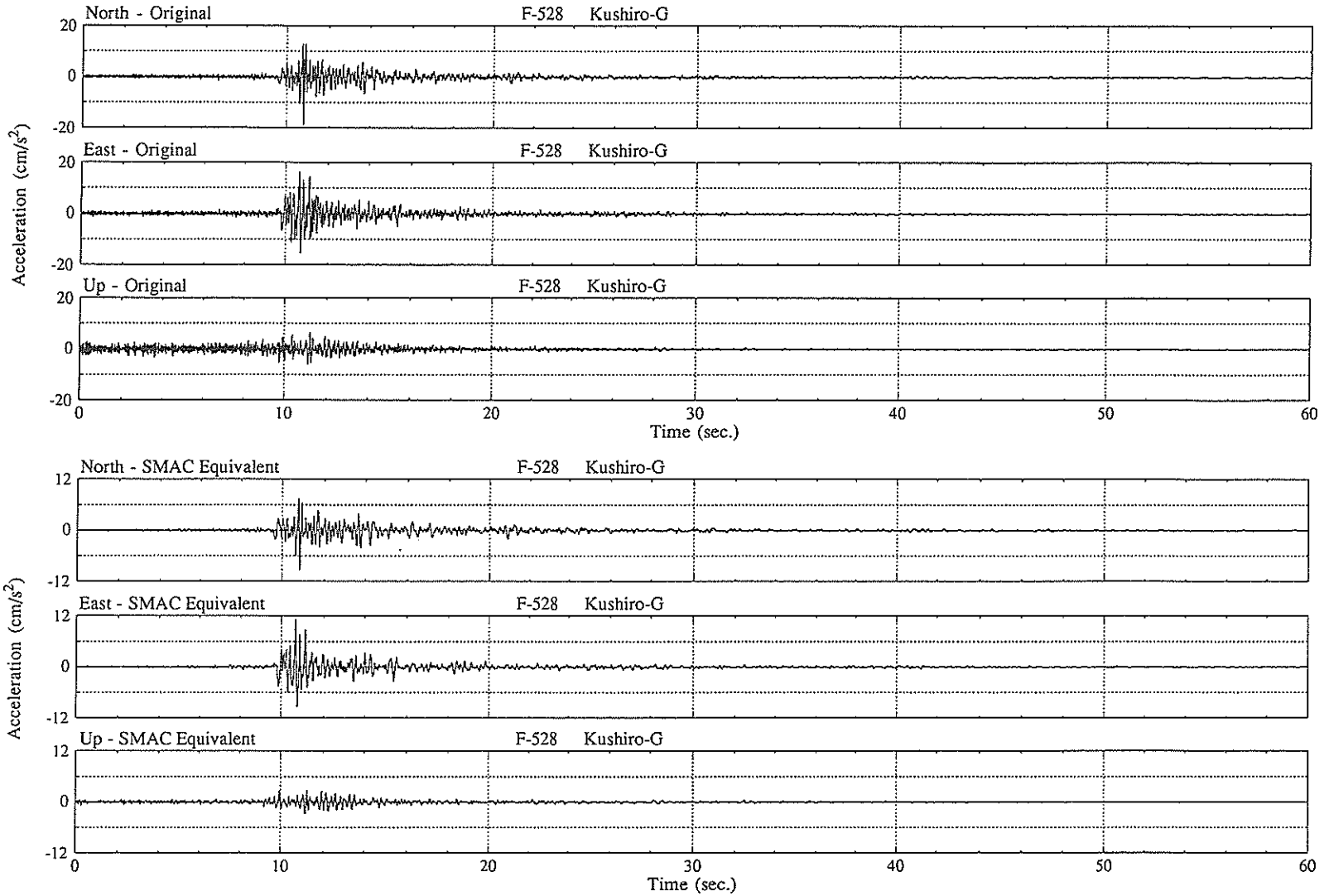
DATE AND TIME	23:43 FEB. 4, 1993
LOCATION OF HYPOCENTER	
EPICENTRAL REGION	KUSHIRO REGION
LATITUDE	42°57.2' N
LONGITUDE	144°16.9' E
DEPTH	94.7KM
JMA MAGNITUDE	4.9

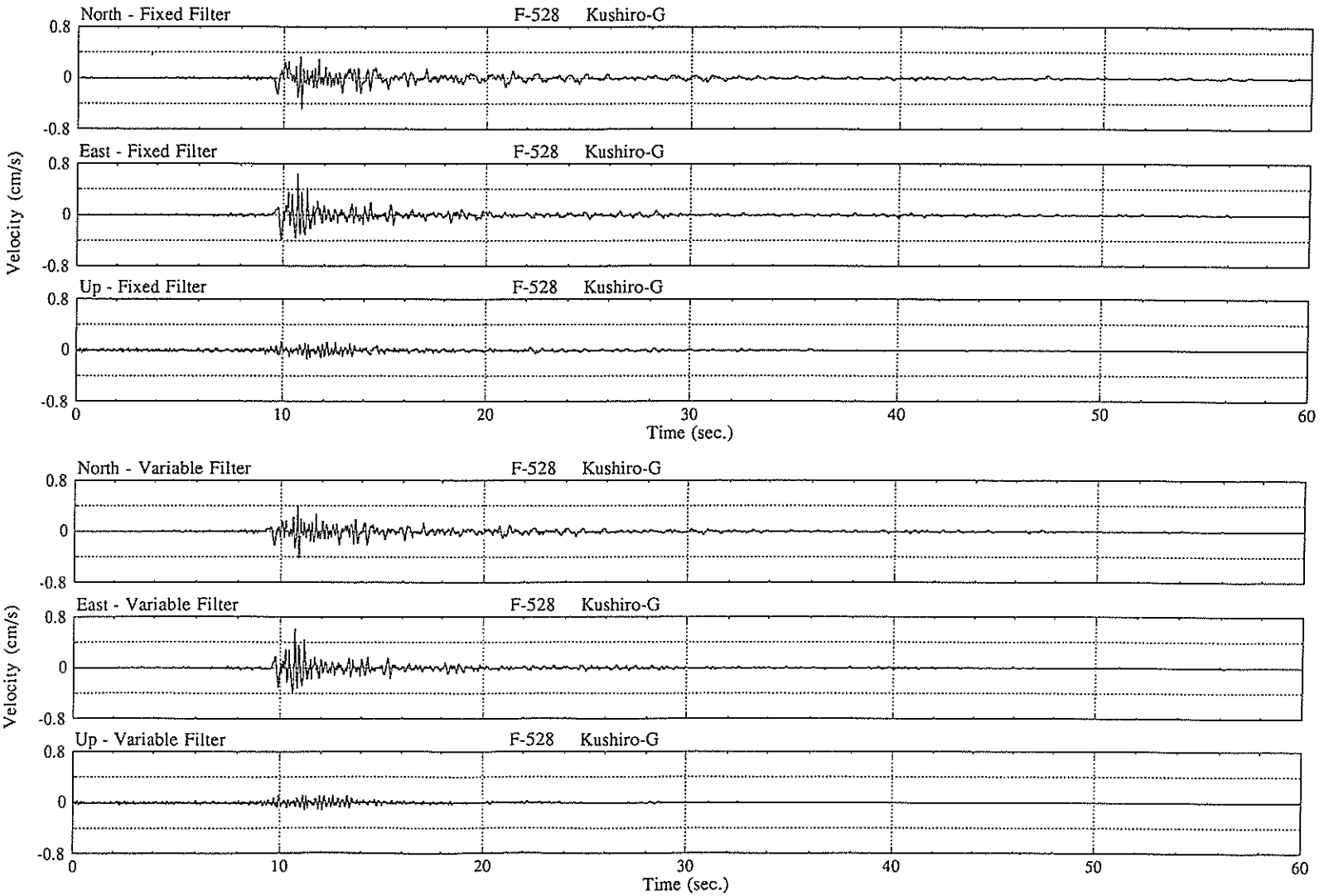
****

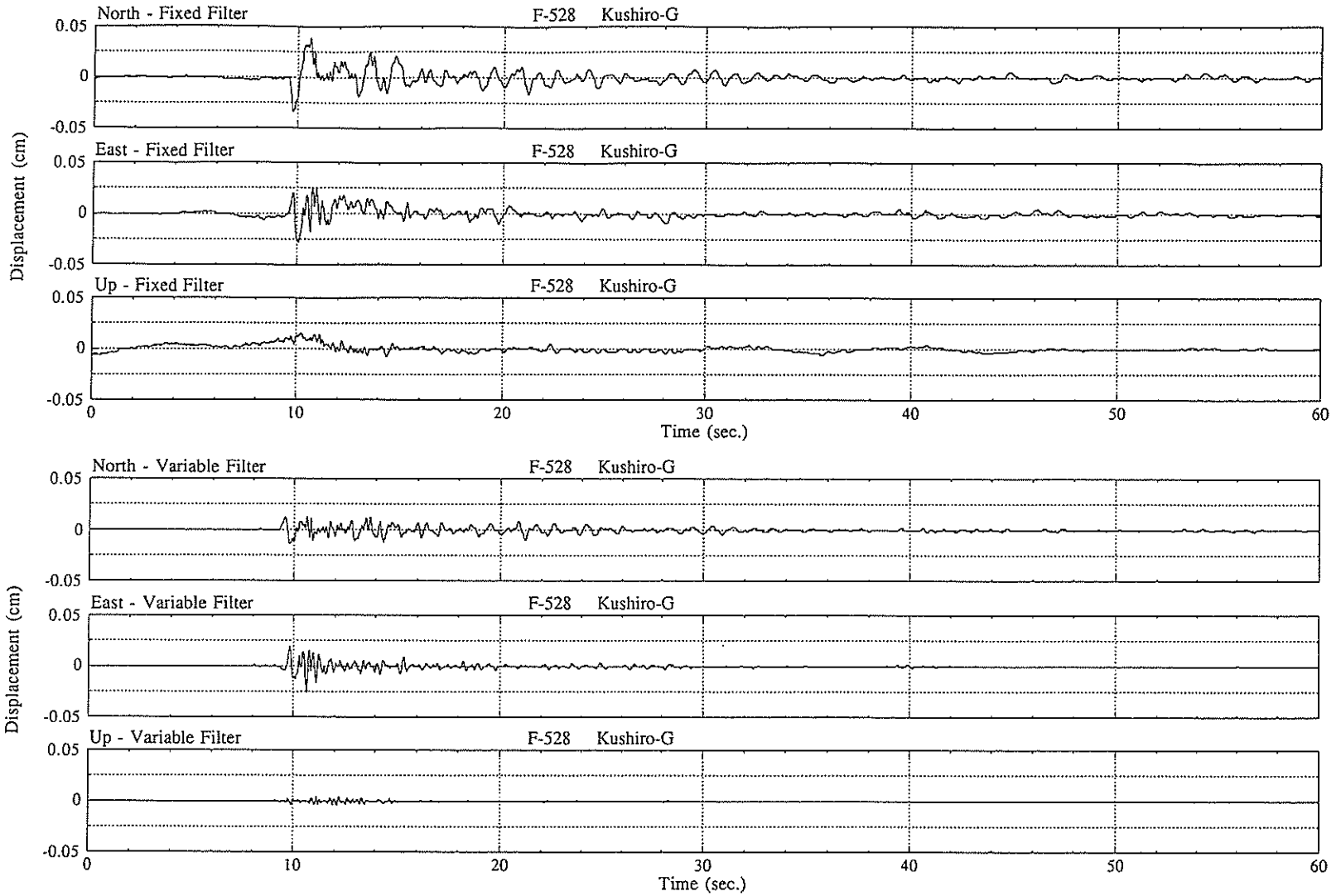
	PEAK VALUES OF COMPONENTS			
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.854	1.165	2.001	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	9.2	11.3	2.7	11.9
ORIGINAL	18.7	16.5	6.5	20.1
CORRECTED	18.4	16.4	6.3	20.0
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	0.48	0.65	0.14	0.68
VARIABLE FILTER	0.42	0.62	0.12	0.64
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.04	0.03	0.02	0.04
VARIABLE FILTER	0.01	0.03	0.00	0.03

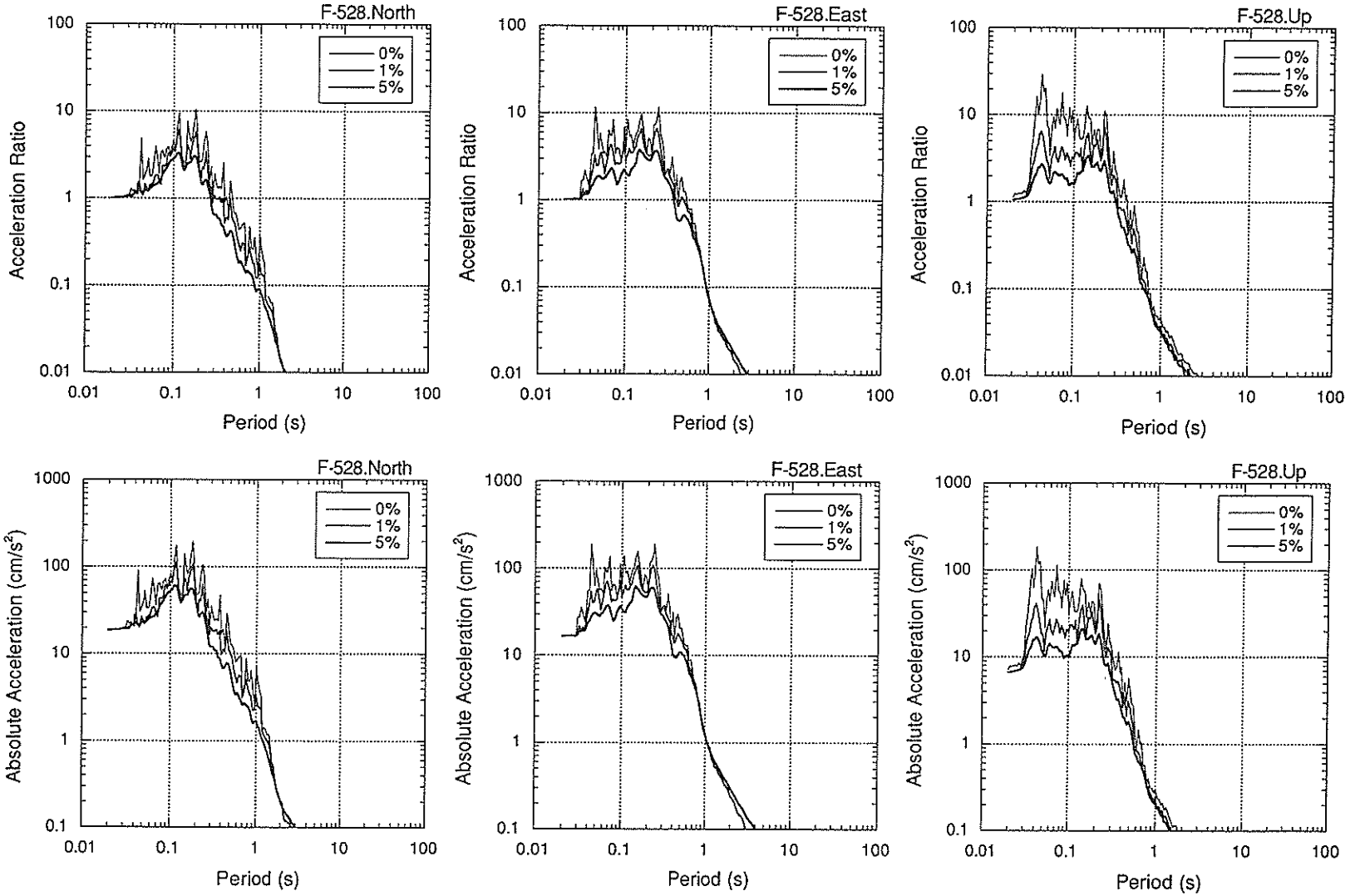
* RESULTANT OF HORIZONTAL COMPONENTS

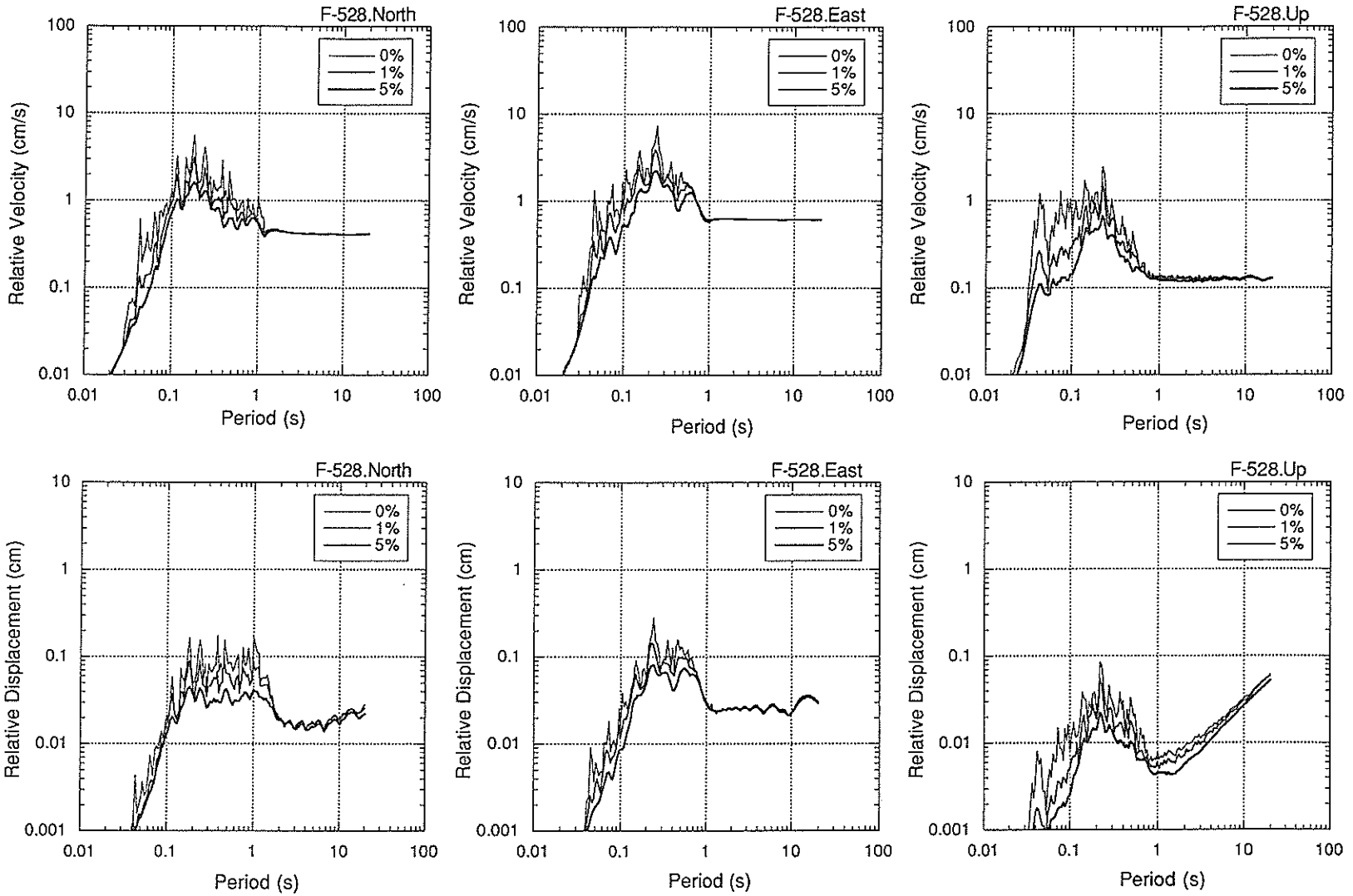

North - Original
F-528 Kushiro-G
East - Original
F-528 Kushiro-G
Up - Original
F-528 Kushiro-G
Acceleration (cm/s²)
20
0
-20
0
10
20
30
40
50
60
Time (sec.)
North - Corrected
F-528 Kushiro-G
East - Corrected
F-528 Kushiro-G
Up - Corrected
F-528 Kushiro-G
Acceleration (cm/s²)
Time (sec.)

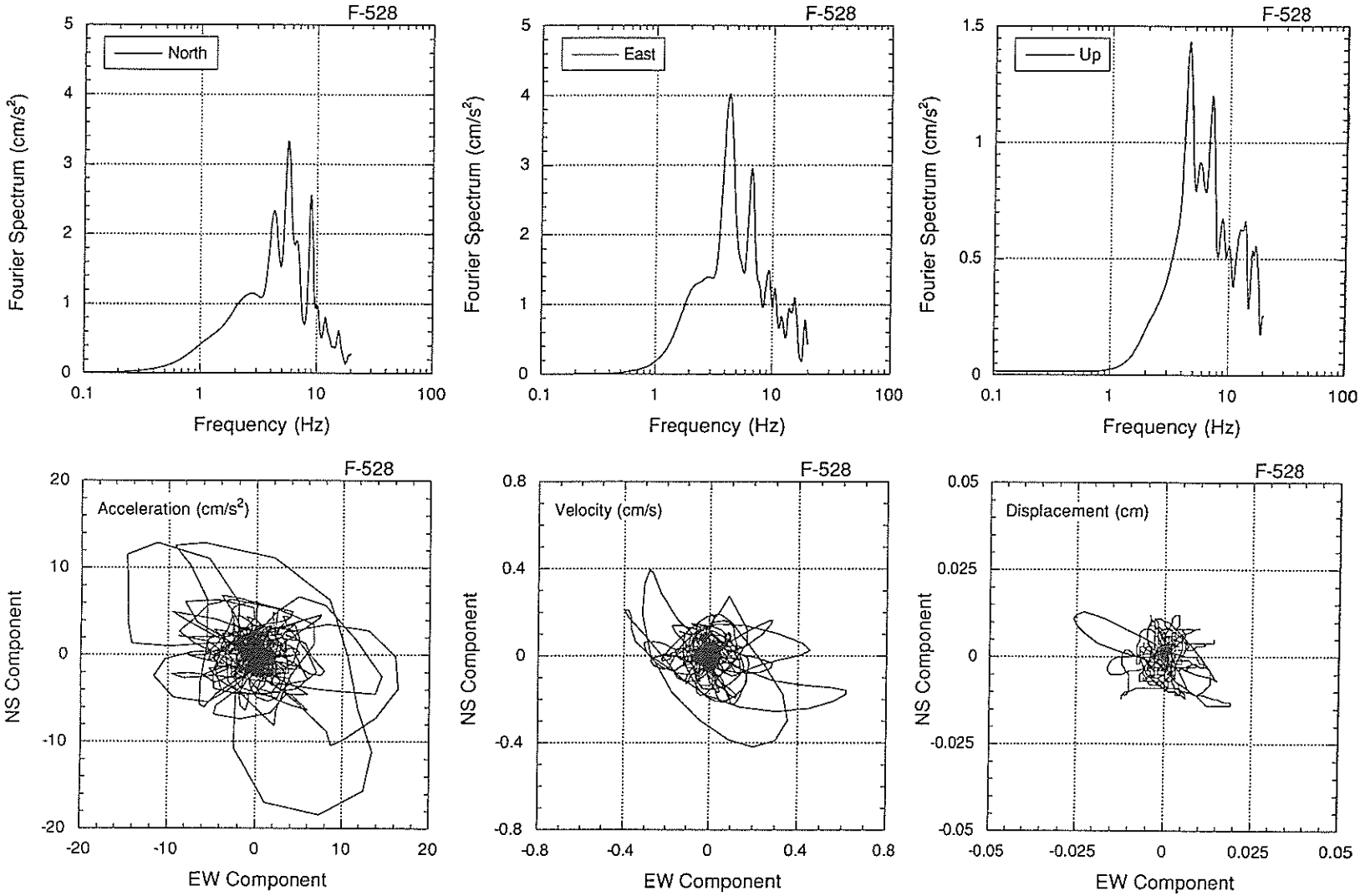

North - Original
F-528 Kushiro-G
East - Original
F-528 Kushiro-G
Up - Original
F-528 Kushiro-G
Acceleration (cm/s²)
20
0
-20
0
10
20
30
40
50
60
Time (sec.)
North - SMAC Equivalent
F-528 Kushiro-G
East - SMAC Equivalent
F-528 Kushiro-G
Up - SMAC Equivalent
F-528 Kushiro-G
Acceleration (cm/s²)
12
0
-12
Time (sec.)


North - Fixed Filter
F-528 Kushiro-G
East - Fixed Filter
F-528 Kushiro-G
Up - Fixed Filter
F-528 Kushiro-G
Velocity (cm/s)
0.8
0
-0.8
0
10
20
30
40
50
60
Time (sec.)
North - Variable Filter
F-528 Kushiro-G
East - Variable Filter
F-528 Kushiro-G
Up - Variable Filter
F-528 Kushiro-G
Velocity (cm/s)
Time (sec.)


North - Fixed Filter
F-528 Kushiro-G
East - Fixed Filter
F-528 Kushiro-G
Up - Fixed Filter
F-528 Kushiro-G
Displacement (cm)
0.05
0
-0.05
0
10
20
30
40
50
60
Time (sec.)
North - Variable Filter
F-528 Kushiro-G
East - Variable Filter
F-528 Kushiro-G
Up - Variable Filter
F-528 Kushiro-G
Displacement (cm)
Time (sec.)


F-528.North
F-528.East
F-528.Up
0%
1%
5%
Acceleration Ratio
Absolute Acceleration (cm/s²)
Period (s)
0.01
0.1
1
10
100
1000


F-528.North
F-528.East
F-528.Up
0%
1%
5%
Relative Velocity (cm/s)
Relative Displacement (cm)
Period (s)
0.01
0.1
1
10
100
0.001


F-528
North
Fourier Spectrum (cm/s²)
Frequency (Hz)
F-528
East
Fourier Spectrum (cm/s²)
Frequency (Hz)
F-528
Up
Fourier Spectrum (cm/s²)
Frequency (Hz)
F-528
Acceleration (cm/s²)
NS Component
EW Component
F-528
Velocity (cm/s)
NS Component
EW Component
F-528
Displacement (cm)
NS Component
EW Component

港湾技研資料　No.777

1994・1

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発　行　所　運輸省港湾技術研究所
横須賀市長瀬3丁目1番1号

印　刷　所　株式会社　東京プリント

Published by the Port and Harbour Research Institute
Nagase, Yokosuka, Japan.