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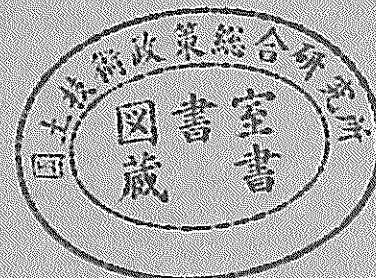
STRONG-MOTION EARTHQUAKE RECORDS  
ON THE 1994 SANRIKU-HARUKA-OKI EARTHQUAKE IN PORT AREAS

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1994年三陸はるか沖地震の港湾地域における強震記録

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## 1994年三陸はるか沖地震の港湾地域における強震記録

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### 要旨

1994年12月28日21時19分20秒、三陸地方の東方沖を震源とする気象庁マグニチュード7.5の地震が発生した。気象庁によって、この地震は「平成6年（1994年）三陸はるか沖地震」と命名された。本地震の震源位置は、北緯40度25.6分、東経143度44.9分、深さ0kmであった。本地震によって、青森県の八戸で震度VIの烈震、盛岡、青森、むつで震度Vの強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、港湾施設においても八戸港を中心に被害が発生した。

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18港27地点で強震計が作動し、18港24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。デジタル記録が得られた港湾は、釧路港（地表・地中基盤）、十勝港、浦河港、宮古港、釜石港、大船渡港（構造物2地点）、苫小牧港、八戸港、塩釜港、仙台港（地表・地中基盤）、小樽港、室蘭港、青森港、函館港（地表・地中基盤・構造物）、秋田港（地表・地中基盤）、酒田港、川崎港、新潟港であった。釜石港（地中基盤）、川崎港（地中基盤・構造物）については計器が異常値を示していたため、記録をデジタル化せず加速度の最大値のみの読み取りにとどまった。

本資料で報告する記録は、三陸はるか沖地震本震の際に港湾地域強震観測網で観測された21個の地表・地中の強震記録、ならびに1994年12月30日00時29分29秒に発生した余震の記録（2港2地点）及び1995年1月7日07時37分37秒に発生した余震の記録（10港12地点）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。また、地中基盤と地表の2層同時観測を行っている地点については、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、港湾、強震観測、デジタル化加速度記録、応答スペクトル

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Synopsis

The 1994 Sanriku-Haruka-Oki Earthquake of JMA ( Japan Meteorological Agency ) Magnitude 7.5 occurred in far east off Sanriku region ( Pacific coast of north-east Honshu island ) in Japan at 21:19:20, December 28, 1994. This earthquake triggered 27 accelerographs installed at 18 ports in the strong-motion earthquake observation network of the Port and Harbour Research Institute. 24 accelerograms out of 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 21 digitized acceleration records obtained on and in ground by the main shock. The records of after shock at 00:29:29, December 30, 1994 and at 07:37:37, January 7, 1995 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 analyses. Amplification of accelerations of the main shock and after shocks are also presented because surface ground motion and base motion were observed simultaneously in Hakodate port, Kushiro port, Sendai port and Akita port. Attenuation relations of acceleration, velocity and displacement of main shock are also presented in this report.

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

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## 1. Introduction

At 21:19:20, December 28, 1994, an earthquake of JMA Magnitude 7.5 hit north-east Pacific coast of Japan. The epicenter of the earthquake was located in far east off Sanriku area ( Pacific coast of north-east part of Honshu island ) in Japan. The earthquake was named as ' 1994 SANRIKU-HARUKA-OKI EARTHQUAKE ' by the Japan Meteorological Agency ( JMA ). This earthquake caused strong ground motion in northern part of Japan. Structures were damaged by the earthquake.

This earthquake triggered 27 accelerographs installed at 18 ports in the strong-motion earthquake observation network of the Port and Harbour Research Institute ( PHRI ). 24 accelerograms at 18 ports out of 27 accelerograms at 18 ports were obtained as digital acceleration data of three components. Ports where digitized accelerograms were obtained were Kushiro port ( in ground and on surface ), Tokachi port, Urakawa port, Miyako port, Kamaishi port, Ofunato port ( 2 points on structures ), Tomakomai port, Hachinohe port, Shiogama port, Sendai port ( in ground and on surface ), Otaru port, Muroran port, Aomori port, Hakodate port ( on ground surface, in ground and on structure ), Akita port ( in ground and on surface ), Sakata port, Kawasaki port and Niigata port. The three of triggered accelerograms, which were Kamaishi port ( in ground ) and Kawasaki port ( in ground and on structure ) were not able to be digitized because of abnormal response of accelerographs.

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 ports since 1963 <sup>1) - 28)</sup>. When great earthquakes occurred, such as the 1968 Tokachi-Oki Earthquake, the 1978 Miyagi-Ken-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 <sup>29) - 38)</sup>.

This report presents the strong-motion earthquake observation results of this earthquake and the following results of preliminary analyses of the 21 digitized acceleration records obtained on and in ground by the main shock. The records of after shock at 00:29:29, December 30, 1994 and at 07:37:37, January 7, 1995 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 analyses. Amplification of accelerations of the main shock and after shocks at Hakodate port, Kushiro port, Sendai port and Akita port are also presented because surface ground motion and base motion were observed simultaneously there. Attenuation relations of acceleration, velocity and displacement of main shock are also presented in this report.

- 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

Amplification of accelerations at Hakodate port, Kushiro port, Sendai port and Akita port are also presented as square root of the ratio of power spectrum of surface ground motion to that of base motion because surface ground motion and base motion by the main shock and the after shocks were observed simultaneously at these ports.

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 1994 Sanriku-Haruka-Oki Earthquake at 21:19:20, December 28, 1994 triggered 27 accelerographs installed at 18 ports in the network of PHRI. The after shock at 00:29:29, December 30, 1994 triggered 2 accelerographs at 2 ports and the after shock at 07:37:37, January 7, 1995 triggered 12 accelerographs at 10 ports. Details of these three earthquakes are listed in Table 1<sup>44)</sup>. Locations of epicenter of the main shock and the after shocks, which are slightly different from those by the Jishin-Kazan-Gaikyo published by JMA as a prompt report, are shown in Figure 1<sup>44), 45)</sup>.

The triggered stations in the network of PHRI, the maximum of original accelerations without instrument correction and JMA seismic intensity scale of main shock are shown in Figure 2. Dots in Figure 2 indicate ports where triggered accelerographs were 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 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 sit characteristics<sup>39) - 42)</sup>.

Table 1 Details of Earthquakes

Earthquakes	Details	
Main shock  1994 Sanriku - Haruka - Oki Earthquake	Date Time Hypocenter Epicenter Region Latitude Longitude Depth JMA Magnitude	December 28, 1994 21:19:20.9  FAR E OFF SANRIKU 40° 25.6' N 143° 44.9E 0km 7.5
After Shock	Date Time Hypocenter Epicenter Region Latitude Longitude Depth JMA Magnitude	December 30, 1994 00:29:29.1  E OFF AOMORI PREF 40° 43.8' N 142° 11.0' E 53km 5.6
After Shock	Date Time Hypocenter Epicenter Region Latitude Longitude Depth JMA Magnitude	January 7, 1995 07:37:37.1  NE OFF IWATE PREF 40° 13.2' N 142° 18.5' E 48km 7.2



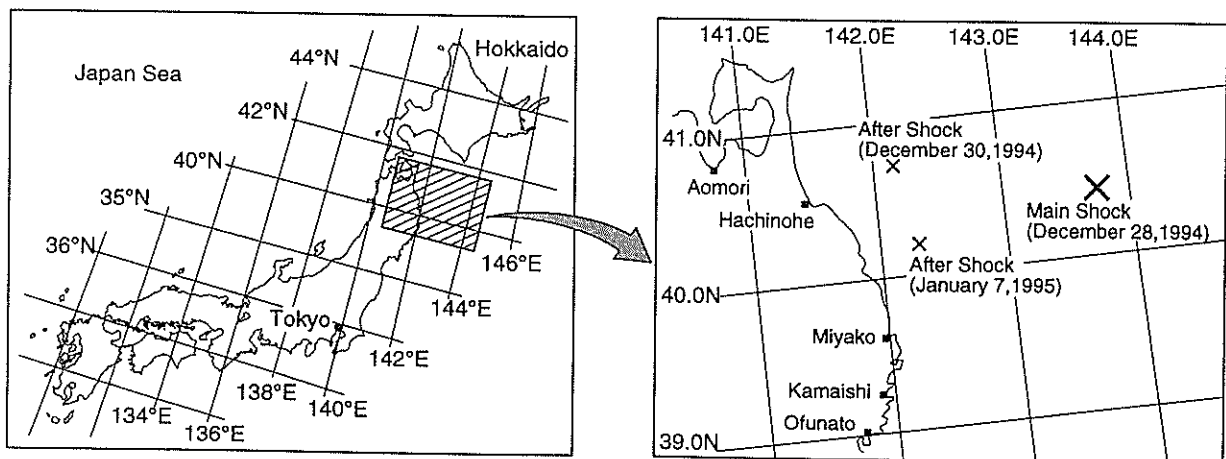
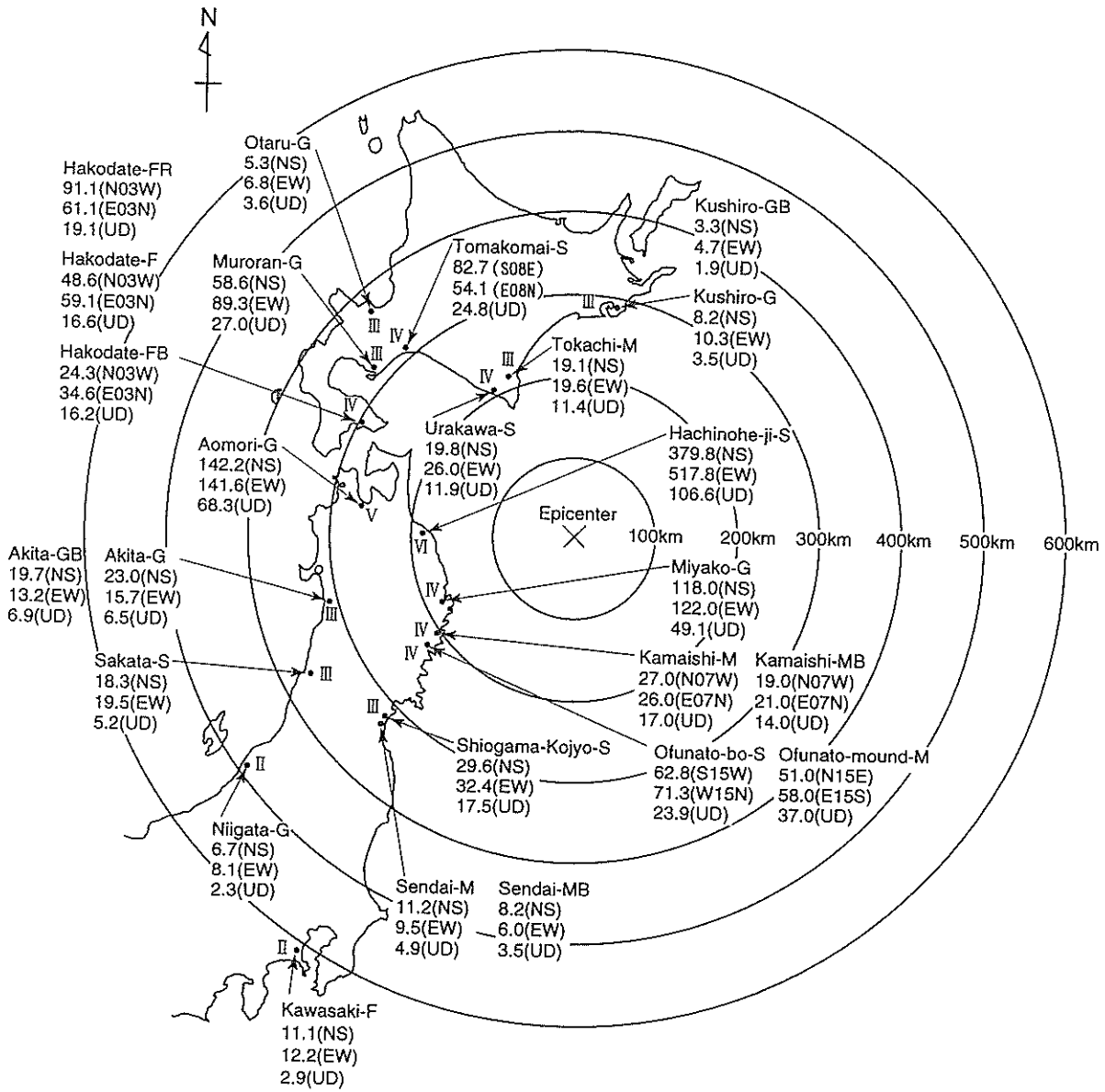


Figure 1 Locations of Epicenter of the Main Shock and After Shocks

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 Kushiro	1 Kushiro-G	ERS-G	ground surface	298
	2 Kushiro-GB	ERS-G	in ground	
2 Tokachi	3 Tokachi-M	ERS-C	ground surface	351
3 Urakawa	4 Urakawa-S	SMAC-B2	ground surface	
4 Miyako	5 Miyako-G	ERS-G	ground surface	351
5 Kamaishi	6 Kamaishi-M	ERS-C	ground surface	
	7 Kamaishi-MB	ERS-D	in ground	
6 Ofunato	8 Ofunato-mound-M	ERS-C	on structure	34
	9 Ofunato-bo-S	SMAC-B2	ground surface	
7 Tomakomai	10 Tomakomai-S	SMAC-B2	ground surface	107
8 Hachinohe	11 Hachinohe-ji-S	SMAC-B2	ground surface	34, 107
9 Shiogama	12 Shiogama-Kojyo-S	SMAC-B2	ground surface	34, 107, 156
10 Sendai	13 Sendai-M	ERS-C	ground surface	351
	14 Sendai-MB	ERS-D	in ground	351
11 Otaru	15 Otaru-G	ERS-G	ground surface	34
12 Muroran	16 Muroran-G	ERS-G	ground surface	
13 Aomori	17 Aomori-G	ERS-G	ground surface	34
14 Hakodate	18 Hakodate-FR	ERS-F	on structure	
	19 Hakodate-F	ERS-F	ground surface	
15 Akita	20 Hakodate-FB	ERS-F	in ground	
	21 Akita-G	ERS-G	ground surface	
16 Sakata	22 Akita-GB	ERS-G	in ground	34
	23 Sakata-S	SMAC-B2	ground surface	
17 Kawasaki	24 Kawasaki-FR	ERS-F	on structure	34
	25 Kawasaki-F	ERS-F	ground surface	
18 Niigata	26 Kawasaki-FB	ERS-F	in ground	34
	27 Niigata-G	ERS-G	ground surface	

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



Acceleration : Maximum of Original Acceleration(GAL)=(cm/s<sup>2</sup>)  
 Roman Numerals : JMA Seismic Intensity Scale

- Name of Port-S : SMAC-B2 Type
  - Name of Port-M : ERS-M Type
  - Name of Port-F : ERS-F Type
  - Name of Port-G : ERS-G Type
- SMAC-B2 : Mechanical type (analog recorder)  
 ERS type : Mechanical type (analog recorder or digital recorder)  
 Suffix B : Accelrograph is installed in ground.

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

### 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 to Table 6. Name of stations, record numbers, type of accelerographs, installation conditions, epicentral and hypocentral distance are shown 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 velocity and integrated displacement are presented in these tables. Computed plots of these records are also presented in 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 has 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 accelerograph, 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 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 directly 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 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 which cut off frequency is varied according to the content of low frequency components of 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 the maximum acceleration of the 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.

Table 3 Results of Preliminary Analyses of the Main Shock at 21:19:20, December 28, 1994

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 - 726	ERS-G	Epical Dist. = 174 Hypocentral Dist. = 174	Original Acceleration(cm/s <sup>2</sup> )	118.0	122.0	49.1
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	73.9	68.8	25.0
			Corrected Acceleration(cm/s <sup>2</sup> )	118.8	122.6	47.1
			Integrated Velocity - fixed(cm/s)	5.07	4.28	2.48
			Integrated Velocity - variable(cm/s)	5.63	3.93	2.44
Integrated Displacement - fixed(cm)	0.67	1.20	0.71			
Integrated Displacement - variable(cm)	1.93	0.87	1.86			
Hachinohe-ji-S S - 2597	SMAC-B2	Epical Dist. = 191 Hypocentral Dist. = 191	Original Acceleration(cm/s <sup>2</sup> )	379.8	517.8	106.6
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	470.4	675.5	132.0
			Corrected Acceleration(cm/s <sup>2</sup> )	30.91	51.10	11.93
			Integrated Velocity - fixed(cm/s)	34.05	44.97	11.69
			Integrated Velocity - variable(cm/s)	11.08	14.01	3.01
Integrated Displacement - fixed(cm)	11.55	12.38	3.07			
Integrated Displacement - variable(cm)						
Urakawa-S S - 2599	SMAC-B2	Epical Dist. = 210 Hypocentral Dist. = 210	Original Acceleration(cm/s <sup>2</sup> )	19.8	26.0	11.9
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	25.9	35.3	13.7
			Corrected Acceleration(cm/s <sup>2</sup> )	3.20	3.09	1.58
			Integrated Velocity - fixed(cm/s)	2.97	3.35	1.53
			Integrated Velocity - variable(cm/s)	1.50	1.60	0.93
Integrated Displacement - fixed(cm)	0.75	0.70	0.30			
Integrated Displacement - variable(cm)						
Tokachi-M M - 1534	ERS-C	Epical Dist. = 210 Hypocentral Dist. = 210	Original Acceleration(cm/s <sup>2</sup> )	19.1	19.6	11.4
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	14.0	16.8	9.3
			Corrected Acceleration(cm/s <sup>2</sup> )	20.2	18.7	10.1
			Integrated Velocity - fixed(cm/s)	2.04	1.66	1.68
			Integrated Velocity - variable(cm/s)	1.39	1.37	0.97
Integrated Displacement - fixed(cm)	1.24	1.09	1.31			
Integrated Displacement - variable(cm)	0.40	0.22	0.31			
Aomori-G F - 692	ERS-G	Epical Dist. = 257 Hypocentral Dist. = 257	Original Acceleration(cm/s <sup>2</sup> )	142.2	141.6	68.3
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	133.0	131.9	65.3
			Corrected Acceleration(cm/s <sup>2</sup> )	142.7	141.2	68.5
			Integrated Velocity - fixed(cm/s)	22.04	25.33	14.00
			Integrated Velocity - variable(cm/s)	20.69	24.53	15.27
Integrated Displacement - fixed(cm)	8.20	6.98	4.27			
Integrated Displacement - variable(cm)	7.77	12.18	11.21			

(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 - 698	ERS-G	Epical Dist. = 291 Hypocentral Dist. = 291	Original Acceleration(cm/s <sup>2</sup> )	8.2	10.3	3.5
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	7.6	7.8	2.5
			Corrected Acceleration(cm/s <sup>2</sup> )	8.2	10.1	3.4
			Integrated Velocity - fixed(cm/s)	1.39	1.08	0.40
Integrated Velocity - variable(cm/s)	1.13	1.05	0.26			
Integrated Displacement - fixed(cm)	0.38	0.36	0.23			
Integrated Displacement - variable(cm)	0.39	0.41	0.11			
Kushiro-GB F - 697	ERS-G	Epical Dist. = 291 Hypocentral Dist. = 291	Original Acceleration(cm/s <sup>2</sup> )	3.3	4.7	1.9
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	2.5	3.5	1.6
			Corrected Acceleration(cm/s <sup>2</sup> )	3.2	4.7	1.8
			Integrated Velocity - fixed(cm/s)	0.70	0.64	0.46
Integrated Velocity - variable(cm/s)	0.61	0.70	0.37			
Integrated Displacement - fixed(cm)	0.30	0.34	0.24			
Integrated Displacement - variable(cm)	0.28	0.97	0.21			
Hakodate-FB F - 687	ERS-F	Epical Dist. = 294 Hypocentral Dist. = 294	Original Acceleration(cm/s <sup>2</sup> )	24.3 N03W	34.6 E03N	16.2
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	22.1	31.3	13.6
			Corrected Acceleration(cm/s <sup>2</sup> )	24.0	34.7	16.3
			Integrated Velocity - fixed(cm/s)	5.15	4.23	2.11
Integrated Velocity - variable(cm/s)	5.99	4.98	4.21			
Integrated Displacement - fixed(cm)	3.17	2.23	1.50			
Integrated Displacement - variable(cm)	3.44	8.27	9.51			
Hakodate-F F - 689	ERS-F	Epical Dist. = 294 Hypocentral Dist. = 294	Original Acceleration(cm/s <sup>2</sup> )	48.6 N03W	59.1 E03N	16.6
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	43.5	53.7	15.3
			Corrected Acceleration(cm/s <sup>2</sup> )	49.2	59.6	16.8
			Integrated Velocity - fixed(cm/s)	6.12	10.33	3.17
Integrated Velocity - variable(cm/s)	9.31	11.85	4.59			
Integrated Displacement - fixed(cm)	2.62	4.92	1.46			
Integrated Displacement - variable(cm)	22.23	16.63	7.67			
Hakodate-FR F - 691	ERS-F (on structure)	Epical Dist. = 294 Hypocentral Dist. = 294	Original Acceleration(cm/s <sup>2</sup> )	91.1 N03W	61.1 E03N	19.1
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	77.3	47.7	17.9
			Corrected Acceleration(cm/s <sup>2</sup> )	89.4	59.9	19.9
			Integrated Velocity - fixed(cm/s)	8.38	10.66	3.30
Integrated Velocity - variable(cm/s)	8.99	11.54	4.18			
Integrated Displacement - fixed(cm)	2.79	5.18	1.55			
Integrated Displacement - variable(cm)	11.39	9.45	6.78			

(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
Tomakomai-S S - 2600	SMAC-B2	Epical Dist. = 302 Hypocentral Dist. = 302	Original Acceleration(cm/s <sup>2</sup> )	82.7 S08E	54.1 E08N	24.8
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )			
			Corrected Acceleration(cm/s <sup>2</sup> )	91.3	65.1	26.3
			Integrated Velocity - fixed(cm/s)	15.51	6.32	1.85
			Integrated Velocity - variable(cm/s)	17.45	6.25	1.30
Integrated Displacement - fixed(cm)	5.70	2.76	1.16			
Integrated Displacement - variable(cm)	4.92	1.81	0.33			
Muroran-G F - 700	ERS-G	Epical Dist. = 316 Hypocentral Dist. = 316	Original Acceleration(cm/s <sup>2</sup> )	58.6	89.3	27.0
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	48.2	81.9	21.6
			Corrected Acceleration(cm/s <sup>2</sup> )	58.5	88.9	27.0
			Integrated Velocity - fixed(cm/s)	4.51	8.20	2.58
			Integrated Velocity - variable(cm/s)	4.85	7.61	2.55
Integrated Displacement - fixed(cm)	1.13	1.30	0.60			
Integrated Displacement - variable(cm)	2.12	4.04	3.52			
Akita-G F - 709	ERS-G	Epical Dist. = 322 Hypocentral Dist. = 322	Original Acceleration(cm/s <sup>2</sup> )	23.0	15.7	6.5
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	21.3	14.1	6.4
			Corrected Acceleration(cm/s <sup>2</sup> )	22.7	15.5	6.6
			Integrated Velocity - fixed(cm/s)	5.03	3.70	2.21
			Integrated Velocity - variable(cm/s)	5.84	4.72	2.64
Integrated Displacement - fixed(cm)	2.24	1.33	1.37			
Integrated Displacement - variable(cm)	6.08	7.47	4.22			
Akita-GB F - 708	ERS-G	Epical Dist. = 322 Hypocentral Dist. = 322	Original Acceleration(cm/s <sup>2</sup> )	19.7	13.2	6.9
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	19.4	12.7	6.7
			Corrected Acceleration(cm/s <sup>2</sup> )	19.6	13.2	6.9
			Integrated Velocity - fixed(cm/s)	5.13	3.48	2.34
			Integrated Velocity - variable(cm/s)	5.77	4.98	3.06
Integrated Displacement - fixed(cm)	2.23	1.26	1.45			
Integrated Displacement - variable(cm)	7.21	8.60	5.13			
Shiogama-kojyo-S S - 2602	SMAC-B2	Epical Dist. = 329 Hypocentral Dist. = 329	Original Acceleration(cm/s <sup>2</sup> )	29.6	32.4	17.5
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )			
			Corrected Acceleration(cm/s <sup>2</sup> )	36.9	40.8	22.2
			Integrated Velocity - fixed(cm/s)	3.14	4.11	1.65
			Integrated Velocity - variable(cm/s)	3.05	3.75	1.24
Integrated Displacement - fixed(cm)	0.82	1.39	0.59			
Integrated Displacement - variable(cm)	0.37	0.66	0.10			

(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
Sakata-S S - 2604	SMAC-B2	Epicentral Dist. = 374  Hypocentral Dist. = 374	Original Acceleration(cm/s <sup>2</sup> )	18.3	19.5	5.2
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )			
			Corrected Acceleration(cm/s <sup>2</sup> )	17.5	20.2	5.4
			Integrated Velocity - fixed(cm/s)	4.95	6.04	2.28
			Integrated Velocity - variable(cm/s)	7.06	5.69	1.48
Integrated Displacement - fixed(cm)	3.12	2.94	0.94			
Integrated Displacement - variable(cm)	3.27	4.52	0.60			
Otaru-G F - 694	ERS-G	Epicentral Dist. = 380  Hypocentral Dist. = 380	Original Acceleration(cm/s <sup>2</sup> )	5.3	6.8	3.6
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	4.8	6.5	3.4
			Corrected Acceleration(cm/s <sup>2</sup> )	5.2	6.9	3.7
			Integrated Velocity - fixed(cm/s)	0.94	1.32	0.66
			Integrated Velocity - variable(cm/s)	1.29	1.59	1.41
Integrated Displacement - fixed(cm)	0.53	0.54	0.42			
Integrated Displacement - variable(cm)	2.00	1.38	3.00			
Niigata-G F - 705	ERS-G	Epicentral Dist. = 489  Hypocentral Dist. = 489	Original Acceleration(cm/s <sup>2</sup> )	6.7	8.1	2.3
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	6.5	8.0	2.2
			Corrected Acceleration(cm/s <sup>2</sup> )	6.6	8.0	2.4
			Integrated Velocity - fixed(cm/s)	2.28	2.83	1.03
			Integrated Velocity - variable(cm/s)	3.71	3.99	1.12
Integrated Displacement - fixed(cm)	2.06	1.82	0.63			
Integrated Displacement - variable(cm)	3.66	4.10	0.98			
Kawasaki-F F - 739	ERS-F	Epicentral Dist. = 648  Hypocentral Dist. = 648	Original Acceleration(cm/s <sup>2</sup> )	11.1 N16W	12.2 E16N	2.9
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	10.8	12.0	2.7
			Corrected Acceleration(cm/s <sup>2</sup> )	11.0	12.2	2.9
			Integrated Velocity - fixed(cm/s)	2.12	2.79	0.60
			Integrated Velocity - variable(cm/s)	2.10	2.76	0.53
Integrated Displacement - fixed(cm)	0.63	0.62	0.24			
Integrated Displacement - variable(cm)	0.67	0.61	0.17			
Kawasaki-FB F - 738 (Abnormal)	ERS-F	Epicentral Dist. = 648  Hypocentral Dist. = 648	Original Acceleration(cm/s <sup>2</sup> )	3.4 N16W	0.4 E16N	1.9
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )			
			Corrected Acceleration(cm/s <sup>2</sup> )			
			Integrated Velocity - fixed(cm/s)			
			Integrated Velocity - variable(cm/s)			
Integrated Displacement - fixed(cm)						
Integrated Displacement - variable(cm)						

(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
Kamaishi-M M - 1537	ERS-C	Epicentral Dist. = 203  Hypocentral Dist. = 203	Original Acceleration(cm/s <sup>2</sup> )	24.4 N07W	27.6 E07N	17.3
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	16.1	18.9	10.2
			Corrected Acceleration(cm/s <sup>2</sup> )	27.6	27.0	17.0
			Integrated Velocity - fixed(cm/s)	1.73	2.32	1.39
			Integrated Velocity - variable(cm/s)	1.86	2.08	1.38
Integrated Displacement - fixed(cm)	0.64	0.80	0.38			
Integrated Displacement - variable(cm)	0.57	0.74	0.33			
Kamaishi-MB M - 1540 (Abnormal)	ERS-D	Epicentral Dist. = 203  Hypocentral Dist. = 203	Original Acceleration(cm/s <sup>2</sup> )	19.2 N07W	21.1 E07N	13.6
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )			
			Corrected Acceleration(cm/s <sup>2</sup> )			
			Integrated Velocity - fixed(cm/s)			
			Integrated Velocity - variable(cm/s)			
Integrated Displacement - fixed(cm)						
Integrated Displacement - variable(cm)						
Ofunato-mound-M M - 1535	ERS-C (on structure)	Epicentral Dist. = 232  Hypocentral Dist. = 232	Original Acceleration(cm/s <sup>2</sup> )	55.8 N15E	58.1 E15S	44.6
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	43.5	52.8	33.3
			Corrected Acceleration(cm/s <sup>2</sup> )	56.7	57.3	44.9
			Integrated Velocity - fixed(cm/s)	3.53	6.68	2.31
			Integrated Velocity - variable(cm/s)	3.47	6.49	2.29
Integrated Displacement - fixed(cm)	0.76	1.50	0.44			
Integrated Displacement - variable(cm)	0.48	1.13	0.28			
Ofunato-bo-S S - 2601	SMAC-B2	Epicentral Dist. = 232  Hypocentral Dist. = 232	Original Acceleration(cm/s <sup>2</sup> )	62.8 S15W	71.3 W15N	23.9
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )			
			Corrected Acceleration(cm/s <sup>2</sup> )	73.7	79.6	26.5
			Integrated Velocity - fixed(cm/s)	6.46	8.11	1.97
			Integrated Velocity - variable(cm/s)	6.47	8.34	1.87
Integrated Displacement - fixed(cm)	1.08	1.86	0.55			
Integrated Displacement - variable(cm)	0.71	1.25	0.20			
Sendai-M M-1536	ERS-C	Epicentral Dist. = 334  Hypocentral Dist. = 334	Original Acceleration(cm/s <sup>2</sup> )	11.1	8.9	4.4
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	8.6	6.4	3.5
			Corrected Acceleration(cm/s <sup>2</sup> )	11.2	9.1	4.6
			Integrated Velocity - fixed(cm/s)	1.00	1.12	0.72
			Integrated Velocity - variable(cm/s)	0.85	1.04	0.60
Integrated Displacement - fixed(cm)	0.38	0.50	0.26			
Integrated Displacement - variable(cm)	0.23	0.27	0.12			

(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-MB M - 1547	ERS-D	Epicentral Dist. = 334  Hypocentral Dist. = 334	Original Acceleration(cm/s <sup>2</sup> )	8.3	6.5	3.8
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	7.8	5.8	3.5
			Corrected Acceleration(cm/s <sup>2</sup> )	8.2	6.2	4.0
			Integrated Velocity - fixed(cm/s)	0.84	0.99	0.76
			Integrated Velocity - variable(cm/s)	0.75	0.96	0.65
Integrated Displacement - fixed(cm)	0.35	0.34	0.32			
Integrated Displacement - variable(cm)	0.21	0.21	0.15			
Kawasaki-FR F - 740 (Abnormal)	ERS-F (on structure)	Epicentral Dist. = 648  Hypocentral Dist. = 648	Original Acceleration(cm/s <sup>2</sup> )	11.6 N16W	0.4 E16N	2.1
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	_____	_____	_____
			Corrected Acceleration(cm/s <sup>2</sup> )	_____	_____	_____
			Integrated Velocity - fixed(cm/s)	_____	_____	_____
			Integrated Velocity - variable(cm/s)	_____	_____	_____
Integrated Displacement - fixed(cm)	_____	_____	_____			
Integrated Displacement - variable(cm)	_____	_____	_____			

(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 Analyses of the After Shock at 00:29:29, December 30, 1994

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 - 2598	SMAC-B2	Epicentral Dist. = 62  Hypocentral Dist. = 81	Original Acceleration(cm/s <sup>2</sup> )	63.8	54.9	8.1
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )			
			Corrected Acceleration(cm/s <sup>2</sup> )	80.0	68.9	12.4
			Integrated Velocity - fixed(cm/s)	4.41	4.13	0.80
			Integrated Velocity - variable(cm/s)	3.60	3.38	0.63
Integrated Displacement - fixed(cm)	0.49	0.42	0.31			
Integrated Displacement - variable(cm)	0.35	0.36	0.08			
Miyako-G F - 730	ERS-G	Epicentral Dist. = 122  Hypocentral Dist. = 133	Original Acceleration(cm/s <sup>2</sup> )	14.7	17.6	6.2
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	8.3	9.4	6.1
			Corrected Acceleration(cm/s <sup>2</sup> )	14.5	17.6	3.6
			Integrated Velocity - fixed(cm/s)	0.39	0.53	0.17
			Integrated Velocity - variable(cm/s)	0.35	0.51	0.16
Integrated Displacement - fixed(cm)	0.02	0.03	0.01			
Integrated Displacement - variable(cm)	0.02	0.02	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)

Table 5 Results of Preliminary Analyses of the After Shock at 07:37:37, January 7, 1995

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 - 2606	SMAC-B2	Epical Dist. = 78 Hypocentral Dist. = 92	Original Acceleration(cm/s <sup>2</sup> )	239.3	275.7	71.2
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	—	—	—
			Corrected Acceleration(cm/s <sup>2</sup> )	294.5	551.7	139.7
			Integrated Velocity - fixed(cm/s)	17.92	29.56	7.03
			Integrated Displacement - fixed(cm)	17.22	27.69	7.24
Integrated Displacement - variable(cm)	3.73	9.51	2.53			
Integrated Displacement - variable(cm)	4.14	15.76	1.41			
Urakawa-S S - 2608	SMAC-B2	Epical Dist. = 219 Hypocentral Dist. = 224	Original Acceleration(cm/s <sup>2</sup> )	11.4	14.5	6.8
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	—	—	—
			Corrected Acceleration(cm/s <sup>2</sup> )	13.6	13.5	6.3
			Integrated Velocity - fixed(cm/s)	1.73	1.86	0.93
			Integrated Displacement - fixed(cm)	1.60	1.61	0.69
Integrated Displacement - variable(cm)	1.18	1.07	0.85			
Integrated Displacement - variable(cm)	0.36	0.50	0.20			
Soma-S S - 2610	SMAC-B2	Epical Dist. = 290 Hypocentral Dist. = 294	Original Acceleration(cm/s <sup>2</sup> )	10.2	14.4	7.4
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	—	—	—
			Corrected Acceleration(cm/s <sup>2</sup> )	14.5	15.2	6.1
			Integrated Velocity - fixed(cm/s)	1.58	2.64	1.47
			Integrated Displacement - fixed(cm)	1.42	1.72	0.94
Integrated Displacement - variable(cm)	1.07	1.35	1.28			
Integrated Displacement - variable(cm)	0.25	0.57	0.37			
Shiogama-koyjo-S S - 2612	SMAC-B2	Epical Dist. = 238 Hypocentral Dist. = 242	Original Acceleration(cm/s <sup>2</sup> )	33.4	25.2	14.1
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	—	—	—
			Corrected Acceleration(cm/s <sup>2</sup> )	36.4	29.2	16.7
			Integrated Velocity - fixed(cm/s)	3.30	2.59	1.17
			Integrated Displacement - fixed(cm)	3.32	2.13	1.15
Integrated Displacement - variable(cm)	1.23	1.11	0.95			
Integrated Displacement - variable(cm)	0.41	0.27	0.11			
Muroran-G F - 701	ERS-G	Epical Dist. = 261 Hypocentral Dist. = 266	Original Acceleration(cm/s <sup>2</sup> )	25.2	31.3	9.2
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	17.7	24.6	7.5
			Corrected Acceleration(cm/s <sup>2</sup> )	25.2	31.1	9.3
			Integrated Velocity - fixed(cm/s)	1.95	2.74	0.71
			Integrated Displacement - fixed(cm)	1.87	2.52	0.59
Integrated Displacement - variable(cm)	0.42	0.58	0.30			
Integrated Displacement - variable(cm)	0.36	0.42	0.15			

(to be continued)

(Table 5 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
Aomori-G F - 713	ERS-G	Epicentral Dist. = 147 Hypocentral Dist. = 155	Original Acceleration (cm/s <sup>2</sup> )	41.6	34.7	27.4
			SMAC-B2 Equivalent Acceleration (cm/s <sup>2</sup> )	35.0	28.9	18.7
			Corrected Acceleration (cm/s <sup>2</sup> )	41.3	34.9	27.7
			Integrated Velocity - fixed (cm/s)	7.12	5.32	3.04
Integrated Velocity - variable (cm/s)	7.29	4.81	2.98			
Integrated Displacement - fixed (cm)	2.98	1.90	0.96			
Integrated Displacement - variable (cm)	2.56	1.83	0.93			
Miyako-G F - 734	ERS-G	Epicentral Dist. = 70 Hypocentral Dist. = 85	Original Acceleration (cm/s <sup>2</sup> )	212.3	192.0	59.9
			SMAC-B2 Equivalent Acceleration (cm/s <sup>2</sup> )	106.8	99.8	32.9
			Corrected Acceleration (cm/s <sup>2</sup> )	214.1	189.9	60.3
			Integrated Velocity - fixed (cm/s)	5.63	6.29	1.97
Integrated Velocity - variable (cm/s)	5.73	6.02	1.88			
Integrated Displacement - fixed (cm)	0.27	1.53	0.31			
Integrated Displacement - variable (cm)	0.28	1.46	0.19			
Hakodate-FB F - 888	ERS-F	Epicentral Dist. = 218 Hypocentral Dist. = 223	Original Acceleration (cm/s <sup>2</sup> )	8.7 N03W	8.8 E03N	6.2
			SMAC-B2 Equivalent Acceleration (cm/s <sup>2</sup> )	8.3	7.9	5.2
			Corrected Acceleration (cm/s <sup>2</sup> )	8.6	8.8	6.1
			Integrated Velocity - fixed (cm/s)	2.66	1.80	0.88
Integrated Velocity - variable (cm/s)	2.54	1.88	0.86			
Integrated Displacement - fixed (cm)	1.44	0.99	0.44			
Integrated Displacement - variable (cm)	1.46	0.93	0.38			
Hakodate-F F - 891	ERS-F	Epicentral Dist. = 218 Hypocentral Dist. = 223	Original Acceleration (cm/s <sup>2</sup> )	15.1 N03W	18.1 E03N	7.6
			SMAC-B2 Equivalent Acceleration (cm/s <sup>2</sup> )	13.2	16.4	6.7
			Corrected Acceleration (cm/s <sup>2</sup> )	15.1	18.0	7.7
			Integrated Velocity - fixed (cm/s)	2.83	4.70	1.55
Integrated Velocity - variable (cm/s)	3.06	4.92	1.34			
Integrated Displacement - fixed (cm)	1.53	2.52	0.49			
Integrated Displacement - variable (cm)	1.22	2.36	0.39			
Akita-GB F - 904	ERS-G	Epicentral Dist. = 198 Hypocentral Dist. = 203	Original Acceleration (cm/s <sup>2</sup> )	9.0	7.5	3.2
			SMAC-B2 Equivalent Acceleration (cm/s <sup>2</sup> )	8.2	7.2	3.1
			Corrected Acceleration (cm/s <sup>2</sup> )	9.0	7.4	3.1
			Integrated Velocity - fixed (cm/s)	1.42	1.18	1.04
Integrated Velocity - variable (cm/s)	1.88	1.19	0.78			
Integrated Displacement - fixed (cm)	0.83	0.48	0.52			
Integrated Displacement - variable (cm)	1.32	0.72	0.56			

(to be continued)

(Table 5 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
Akita-G F - 905	ERS-G	Epicentral Dist. = 199 Hypocentral Dist. = 203	Original Acceleration(cm/s <sup>2</sup> )	11.7	8.1	3.4
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	10.2	7.7	3.1
			Corrected Acceleration(cm/s <sup>2</sup> )	11.8	7.9	3.3
			Integrated Velocity - fixed(cm/s)	1.47	1.25	0.97
			Integrated Velocity - variable(cm/s)	1.76	1.13	0.71
Integrated Displacement - fixed(cm)	0.80	0.44	0.49			
Integrated Displacement - variable(cm)	1.08	0.49	0.45			
Kawasaki-F F - 985	ERS-F	Epicentral Dist. = 569 Hypocentral Dist. = 571	Original Acceleration(cm/s <sup>2</sup> )	6.0 N16W	7.5 E16N	1.9
			SMAC-B2 Equivalent Acceleration(cm/s <sup>2</sup> )	5.8	7.1	1.8
			Corrected Acceleration(cm/s <sup>2</sup> )	5.9	7.4	1.8
			Integrated Velocity - fixed(cm/s)	1.28	1.51	0.28
			Integrated Velocity - variable(cm/s)	1.23	1.51	0.29
Integrated Displacement - fixed(cm)	0.43	0.42	0.12			
Integrated Displacement - variable(cm)	0.32	0.34	0.06			

(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)

#### 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. Though there exists attenuation relationship for both horizontal and vertical acceleration in Figure 3, existence of attenuation for displacements is not clear in Figure 5. In these analysis, site characteristics of the stations, such as shear wave velocity profile, are not considered here.

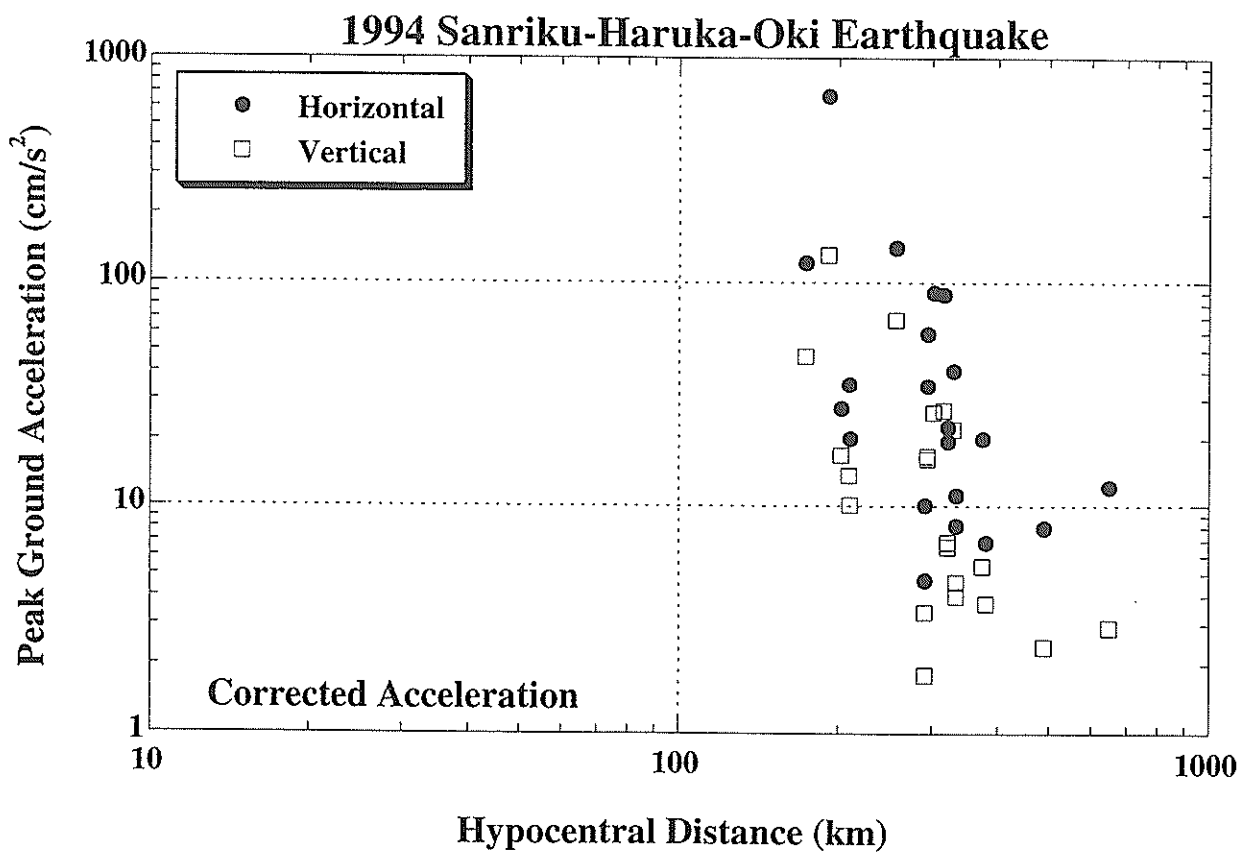
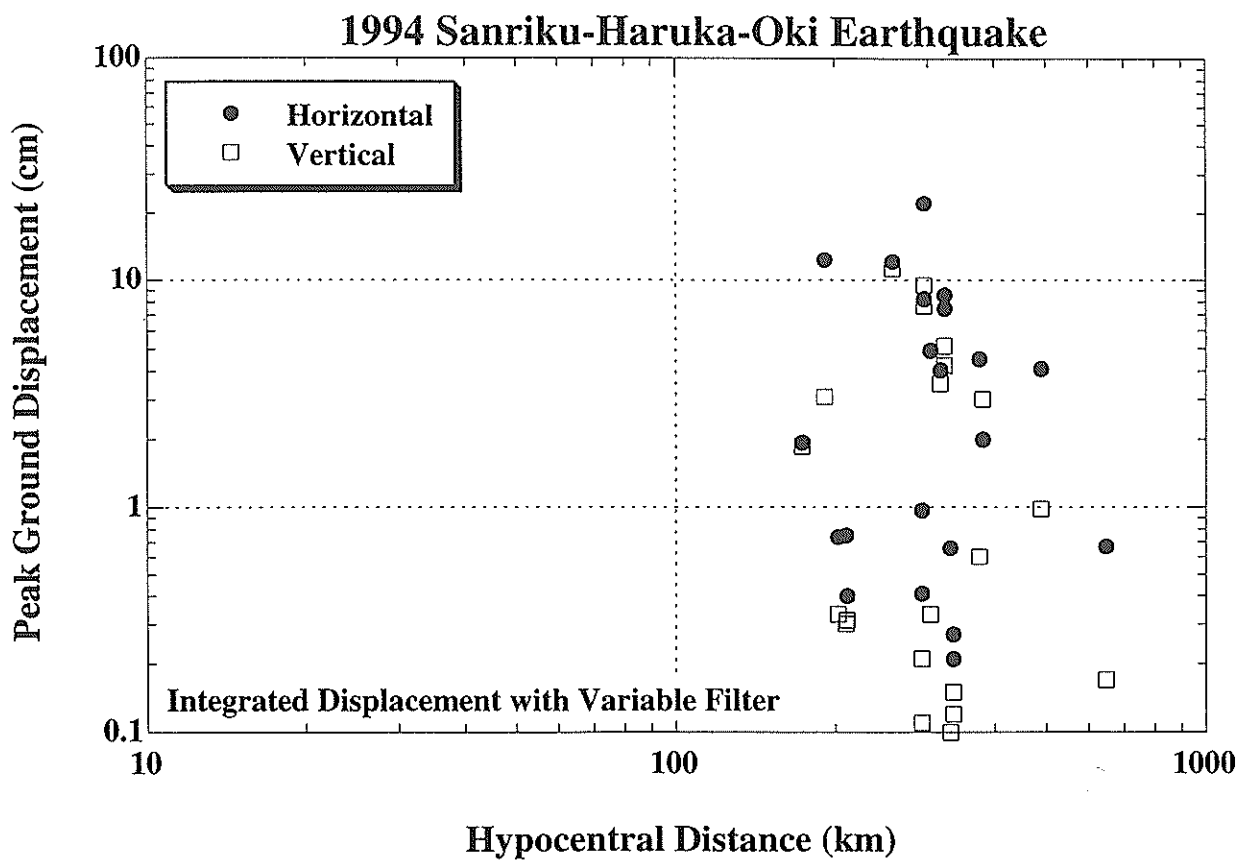
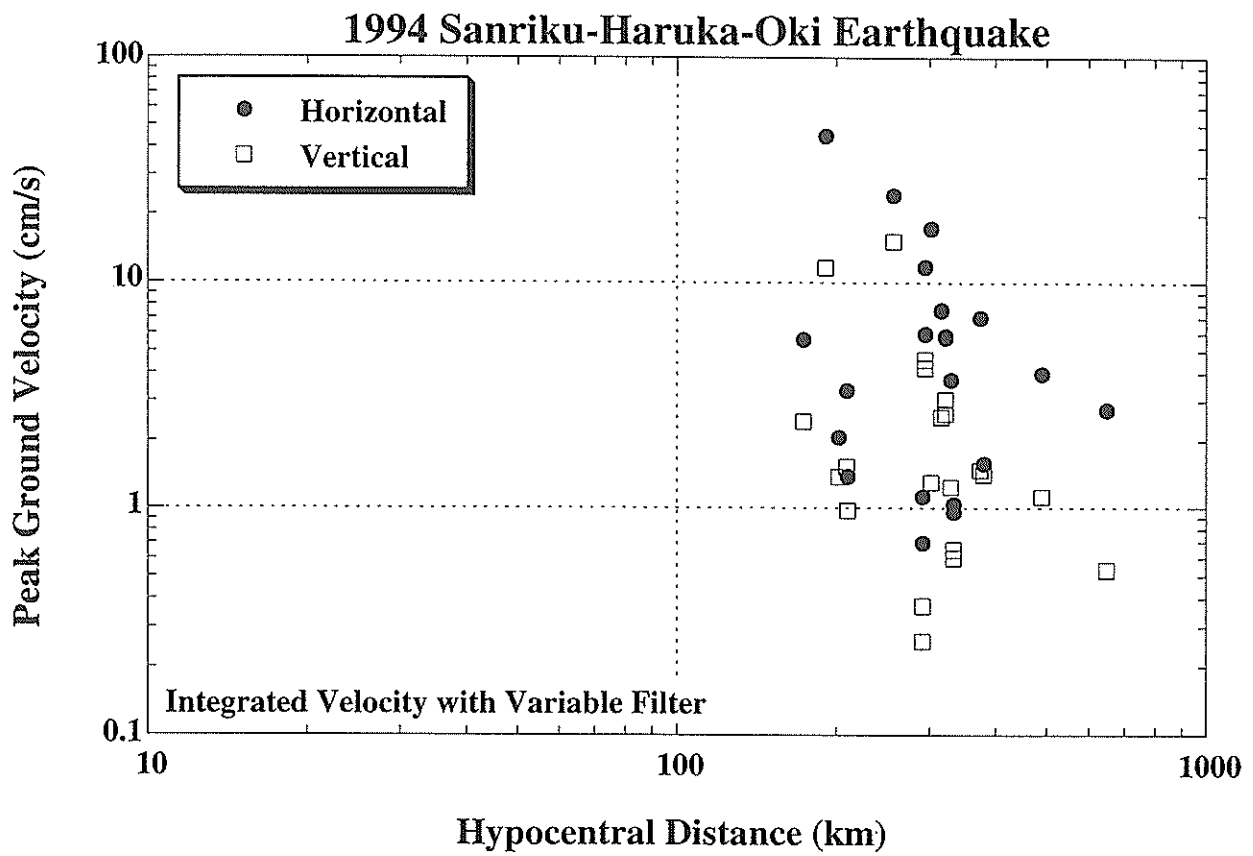


Figure 3 Attenuation Relation of Peak Ground Acceleration





## 5. Amplification of Acceleration

Surface ground motion and base motion of the main shock were observed simultaneously at Hakodate port, Kushiro port, Sendai port and Akita port. Amplification of accelerations, which are computed by square root of ratio of power spectrum of surface ground motion to that of base motion, are shown in Figure 6 to Figure 11. In Hakodate port, acceleration components around 3 Hz are amplified in the horizontal at the main shock and after shock. In Kushiro port, acceleration components around 1-2 Hz are amplified in the main shock. This amplification of acceleration components around 1-2 Hz in Kushiro port was also observed at the 1994 Hokkaido-Toho-Oki Earthquake. In Akita port, acceleration components around 4-6 Hz are amplified in the main shock and after shock. Since the depth of basement rock is shallow ( 6.7m ), amplification of acceleration components is observed only in high frequency ( around 9 Hz ) in Sendai port. In these analyses, power spectra are smoothed using Parzen window with band width 0.5 Hz or 1.0 Hz.

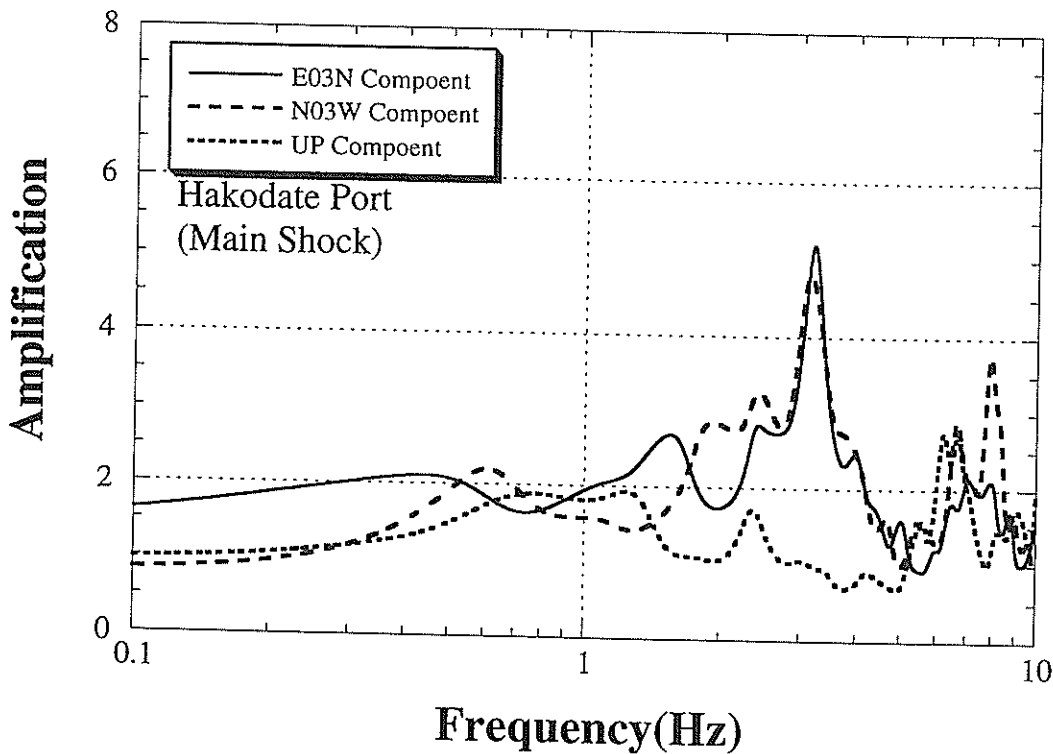


Figure 6 Amplification of Acceleration at Hakodate Port (Main Shock on December 28)

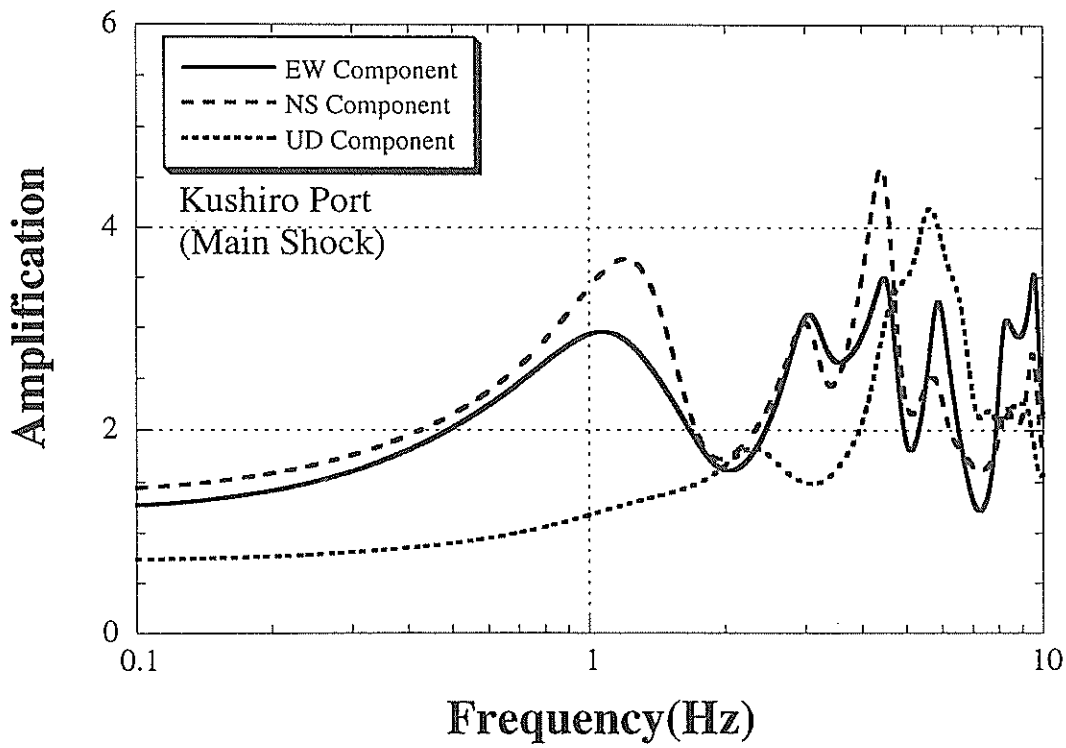


Figure 7 Amplification of Acceleration at Kushiro Port (Main Shock on December 28)

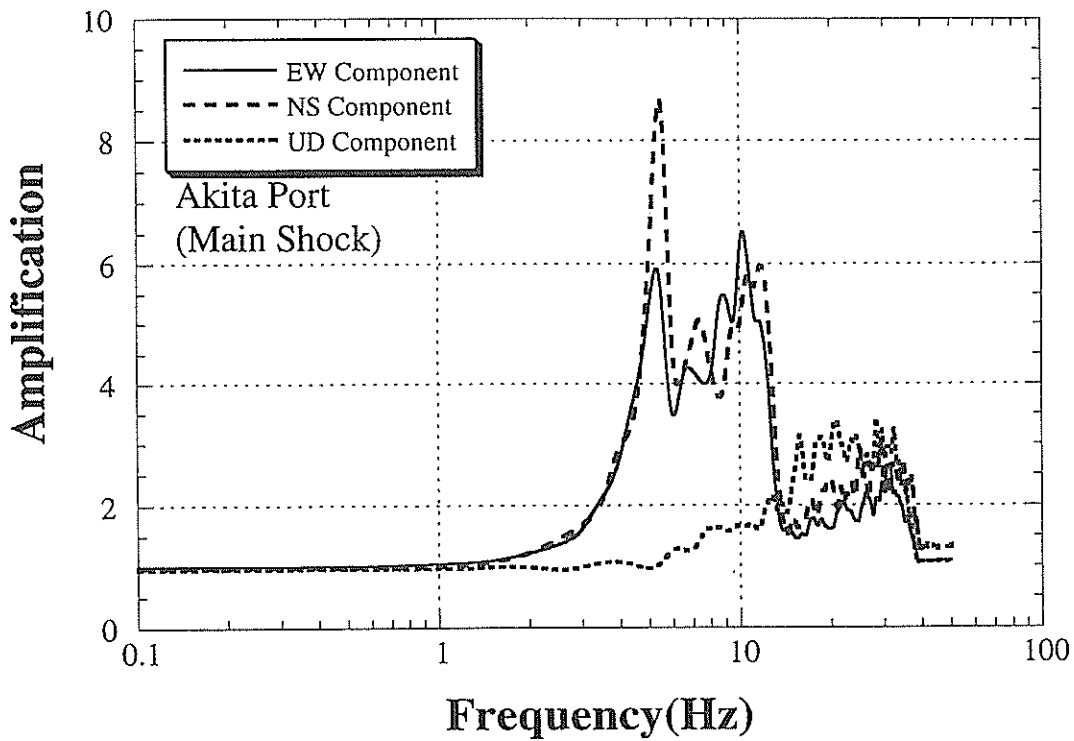


Figure 8 Amplification of Acceleration at Akita Port (Main Shock on December 28)

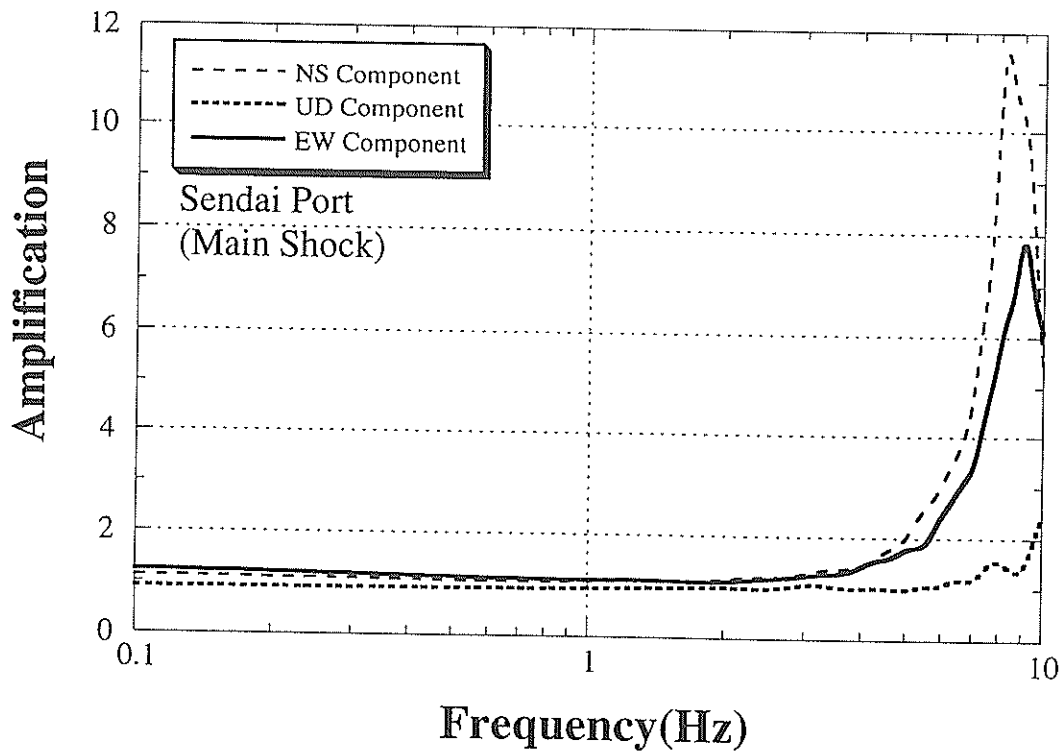


Figure 9 Amplification of Acceleration at Sendai Port (Main Shock on December 28)

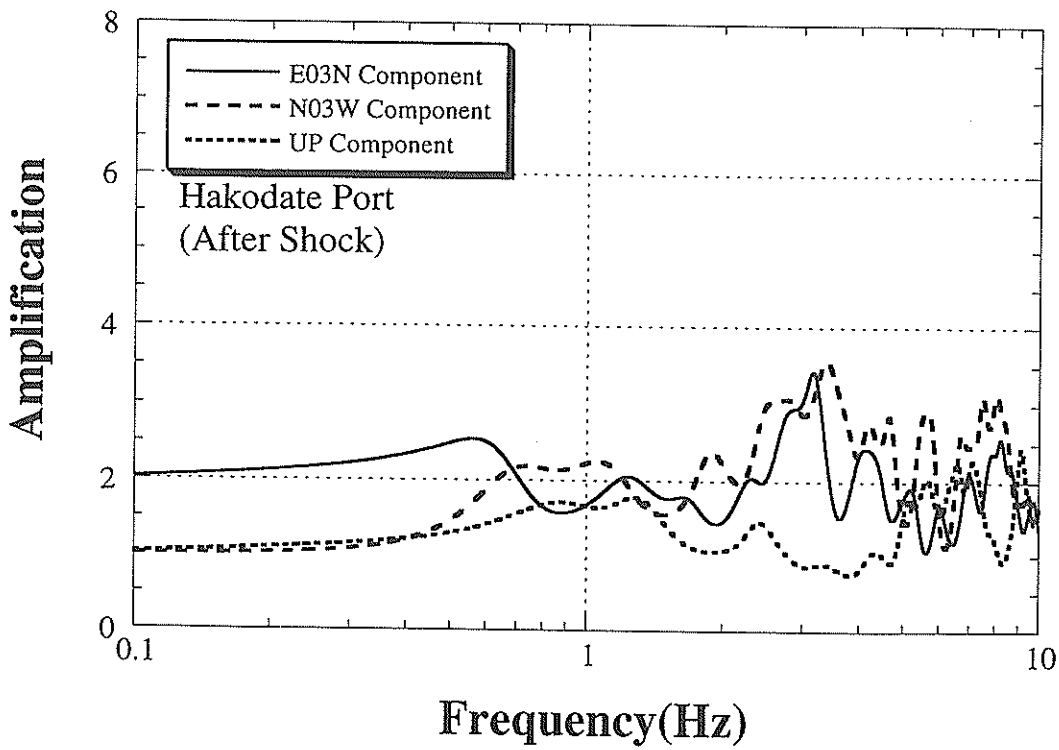


Figure 10 Amplification of Acceleration at Hakodate Port (After Shock on January 7)

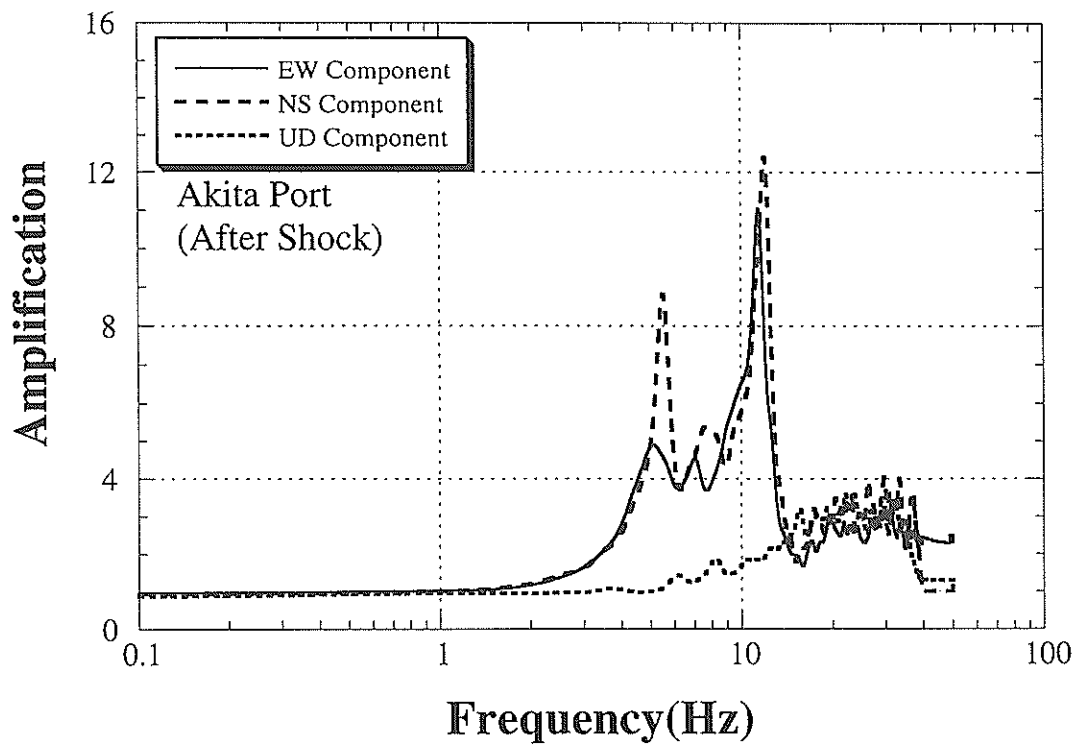


Figure 11 Amplification of Acceleration at Akita Port (After Shock on January 7)

## 6. Remarks for Records

### 6.1 Remarks for Records with long period components

The cut-off frequency of a high pass filter for integration of digitized accelerogram should be varied in accordance with frequency characteristics of an accelerogram from a point of view that SN ratio should be higher than some constant level for every frequency component and at the same time the physically real signals should be preserved as much as possible. On the other hand, cut-off frequency of the high pass filter should be constant for any accelerograms from a point of view that the preserved real seismic signals should be filtered out by same filter for purpose of comparison between two or more velocities or displacements even if integrated errors are more or less included in them. In order to satisfy a wide range of applications of the strong-motion record from the various view points, the authors proposed two method of correction of an accelerogram to obtain integrated velocities and displacements. One is a method with a fixed filter and the other is a method with a variable filter<sup>2\*)</sup>.

Cut-off frequency of the fixed filter is 0.154 Hz. Therefore wave components lower than 0.154 Hz is removed. On the other hand, cut-off frequency of the variable filter varies with each record. Therefore results of velocity and displacement are different for each record.

For example, cut-off frequency of the record obtained at Hakodate port ( on surface ) by the main shock is about 0.017-0.026 Hz. Therefore time history of the velocity and displacement with fixed filter are quite different from those with variable filter. Maximum velocity and displacement are also different for each other. We can find that ground motion of Hakodate port ( F-689 ) contains long period components.

### 6.2 Remarks for Records at Hakodate-FB station

Preliminary analyses of the records at Hakodate-F and FB stations indicated that the direction of the accelerograph at the base rock ( Hakodate-FB ) is rotated about 47 degrees relative to that at the ground surface. Since a more comprehensive study is currently underway, the records from Hakodate-FB station published in this and previous reports are not corrected for the direction rotation. The readers should be aware of this remarks when they use the records from Hakodate-FB station.

## 7. Summary

The 1994 Sanriku-Haruka-Oki Earthquake of JMA (Japan Meteorological Agency) Magnitude 7.5 occurred in far east off Sanriku region ( Pacific coast of north-east Honsyu island) in Japan at 21:19:20, December 28, 1994. This earthquake caused strong ground motion in northern part of Japan. Structures were damaged by the earthquake.

The earthquake triggered 27 accelerographs installed at 18 ports in the strong-motion earthquake observation network of the Port and Harbour Research Institute. 24 accelerograms out of 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 21 digitized acceleration records obtained on ground surface and in ground by the main shock. The records of after shock at 00:29:29, December 30, 1994 and at 07:37:37, January 7, 1995 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 analyses. Amplification of accelerations of the main shock and after shocks at Hakodate port are also presented. Attenuation relations of acceleration, velocity and displacement of main shock are also presented in this report.

## Acknowledgements

The Network of Strong-Motion Earthquake Observation in port area have been supported with cooperation of related organizations and efforts of partners at each site. The authors greatly acknowledged their cooperation and the list of cooperative organizations and partners are summarized in 1994 annual report of Strong-Motion Earthquake Observation in port area. The authors also acknowledged the secretaries of Geotechnical Earthquake Engineering Laboratory, Ms. Chieko Tsuchitani and Ms. Yuko Hoshino, for her great contribution in digitization of Strong-Motion records.

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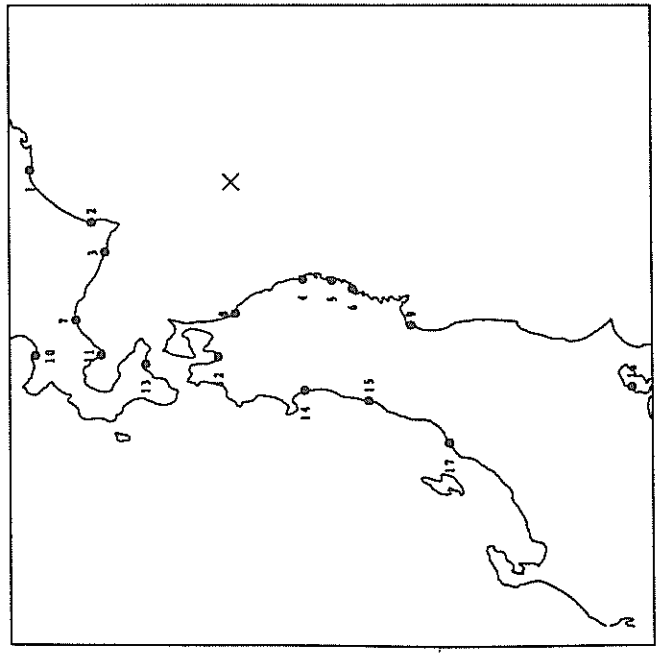
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Strong-Motion Earthquake Observation Results  
of the Main Shock at 21:19:20, December 28, 1994

STRONG-MOTION EARTHQUAKE OBSERVATION RESULTS

21:19 DEC. 28, 1994  
 FAR E OFF SANRIKU  
 DEPTH : 0.0KM MAGNITUDE : 7.5  
 JMA INTENSITIES  
 VI : HACHINOHE  
 V : MORIOKA, AOHORI, MUTSU  
 IV : OFUNATO, MIYAKO, HAKODATE,  
 OBIHIRO, TOHAKONAI,  
 URAKAWA

STATION	CONDITION	RECORD NUMBER	MAX. ACC. (GAL) (NS) (EW)	DIST. (KM)
1 KUSHIRO-G	ON GROUND	F-698	8 10 4	290
1 KUSHIRO-GB	IN GROUND	F-697	3 5 2	290
2 TOKACHI-M	ON GROUND	M-1534	18 19 10	210
3 URAKAWA-S	ON GROUND	S-2599	19 21 12	209
4 MIYAKO-G	ON GROUND	F-726	118 122 49	174
5 KAWAISHI-MB	IN GROUND	M-1540	19 21 14	203
5 KAWAISHI-M	ON GROUND	M-1537	27 26 17	203
6 OFUNATO-MOUND-H	ON STRUC.	M-1535	51 58 37	232
6 OFUNATO-BO-S	ON STRUC.	S-2601	61 70 21	232
7 TOHAKONAI-S	ON GROUND	S-2600	68 44 9	302
8 HACHINOHE-JI-S	ON GROUND	S-2597	381 545 105	191
9 SHIOGAWA-KOJYO-S	ON GROUND	S-2602	28 29 16	330
10 OTARU-G	ON GROUND	F-694	5 7 4	379
9 SENDAI-MB	IN GROUND	M-1547	8 6 4	334
9 SENDAI-M	ON GROUND	M-1536	11 10 5	334
11 MURORAN-G	ON GROUND	F-700	59 89 27	315
12 AOHORI-G	ON GROUND	F-692	142 142 68	256
13 HAKODATE-FR	ON STRUC.	F-691	91 61 19	294
13 HAKODATE-F	ON GROUND	F-689	49 59 17	294
13 HAKODATE-FB	IN GROUND	F-687	24 35 16	294
14 AKITA-G	ON GROUND	F-709	23 16 7	321
15 SAKATA-S	ON GROUND	F-708	20 13 7	321
15 SAKATA-S	ON GROUND	S-2604	18 19 6	374
16 KAWASAKI-FR	ON STRUC.	F-740	12	649
16 KAWASAKI-F	ON GROUND	F-739	11 12 3	649
16 KAWASAKI-FB	IN GROUND	F-738	3	649
17 NIIGATA-G	ON GROUND	F-705	7 8 2	489



Results of Preliminary Analyses  
of the Main Shock at 21:19:20, December 28, 1994

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 STATION : MIYAKO-G

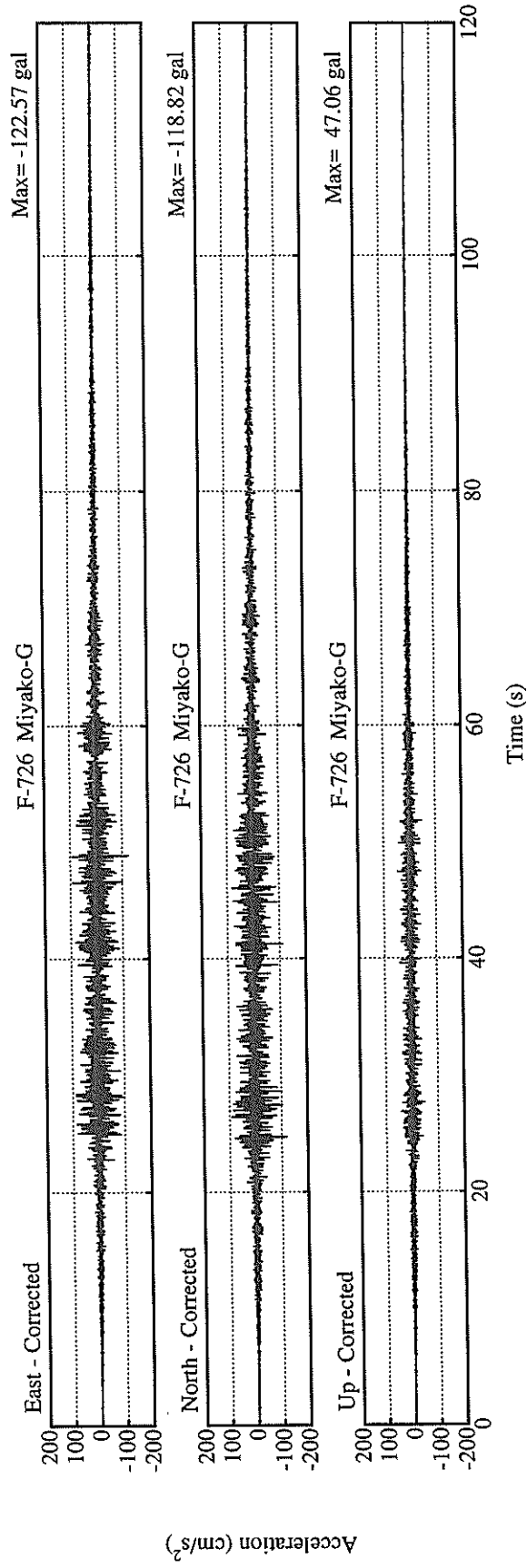
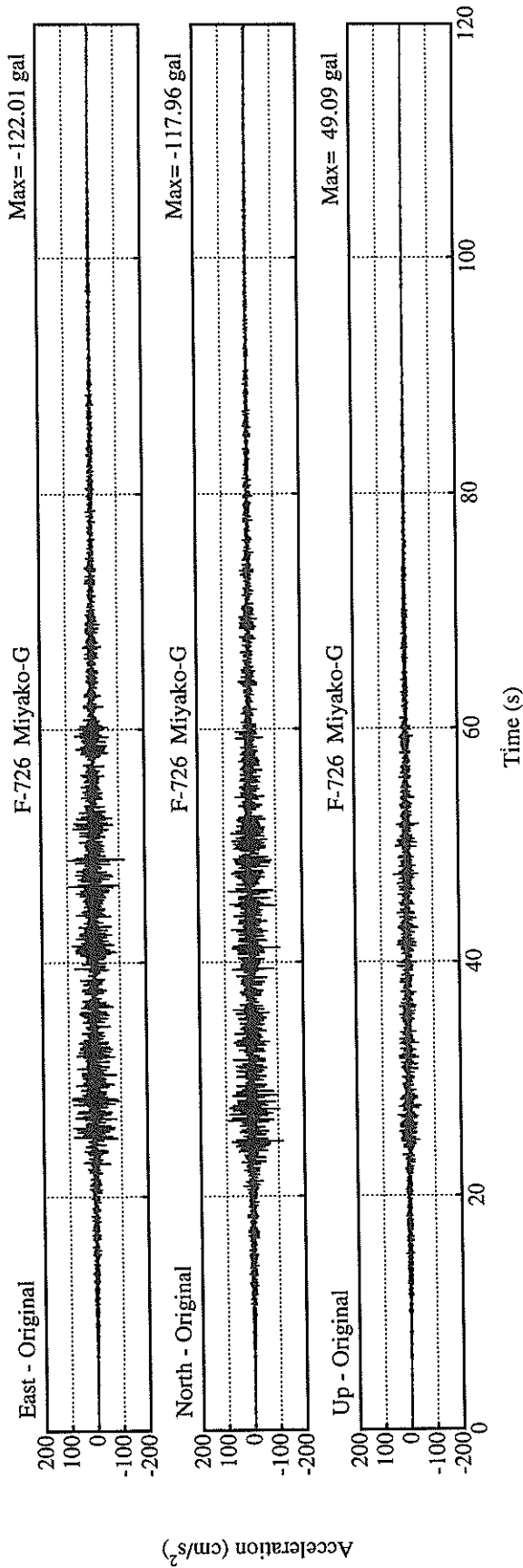
EARTHQUAKE DATA

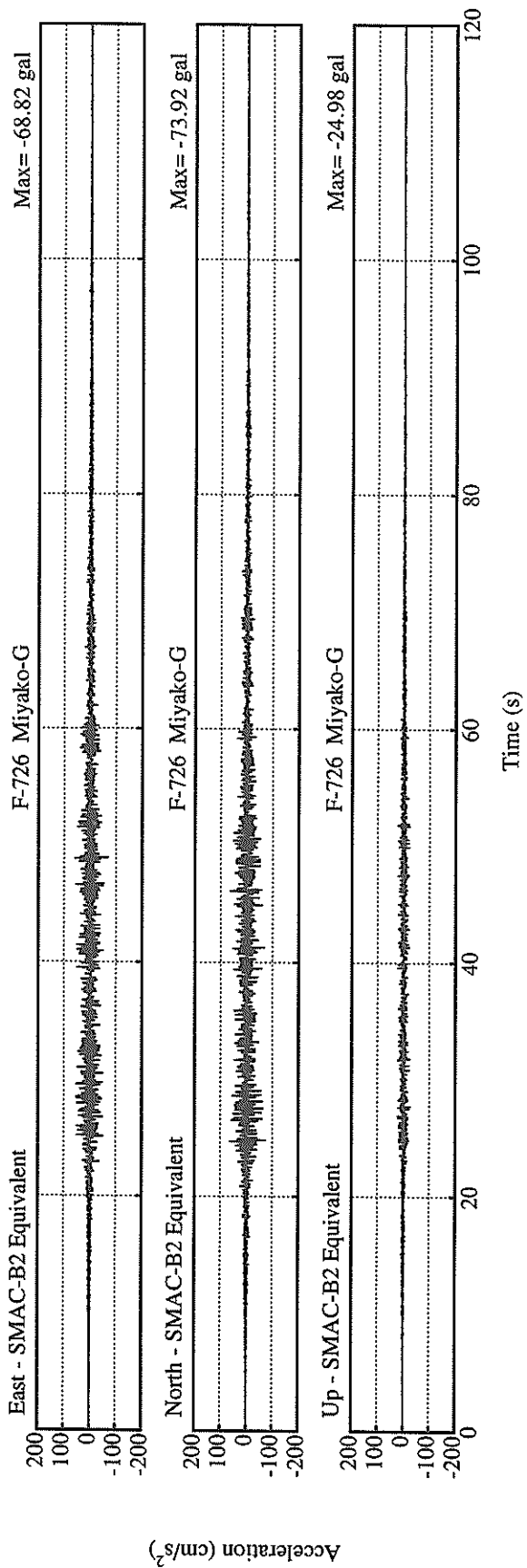
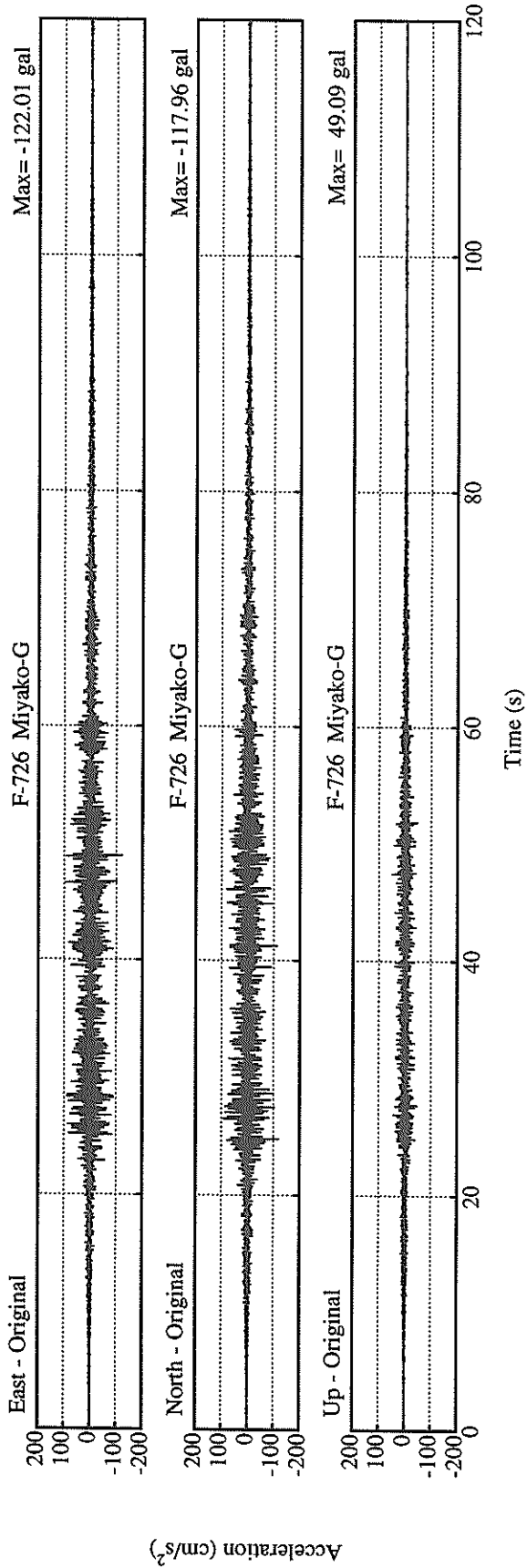
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 DATE AND TIME 21:19 DEC.28,1994  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION FAR E OFF SANRIKU  
 LATITUDE 40° 25.6' N  
 LONGITUDE 143° 44.9' E  
 DEPTH 0.0KM  
 JMA MAGNITUDE 7.5  
 \*\*\*\*\*

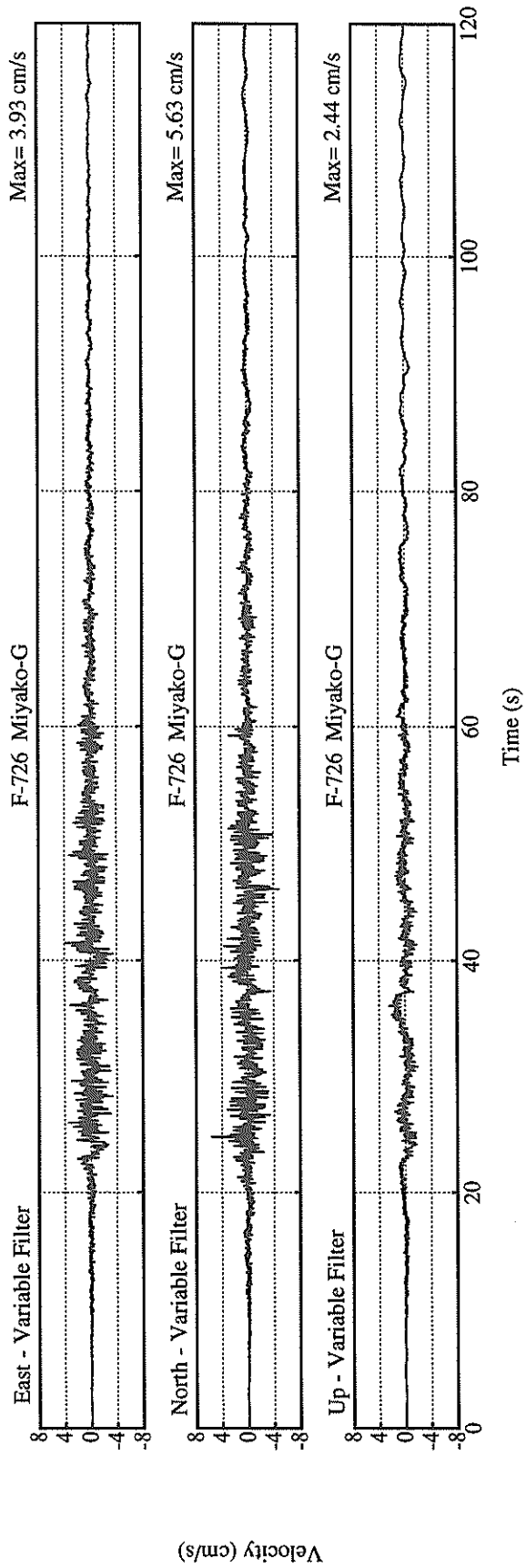
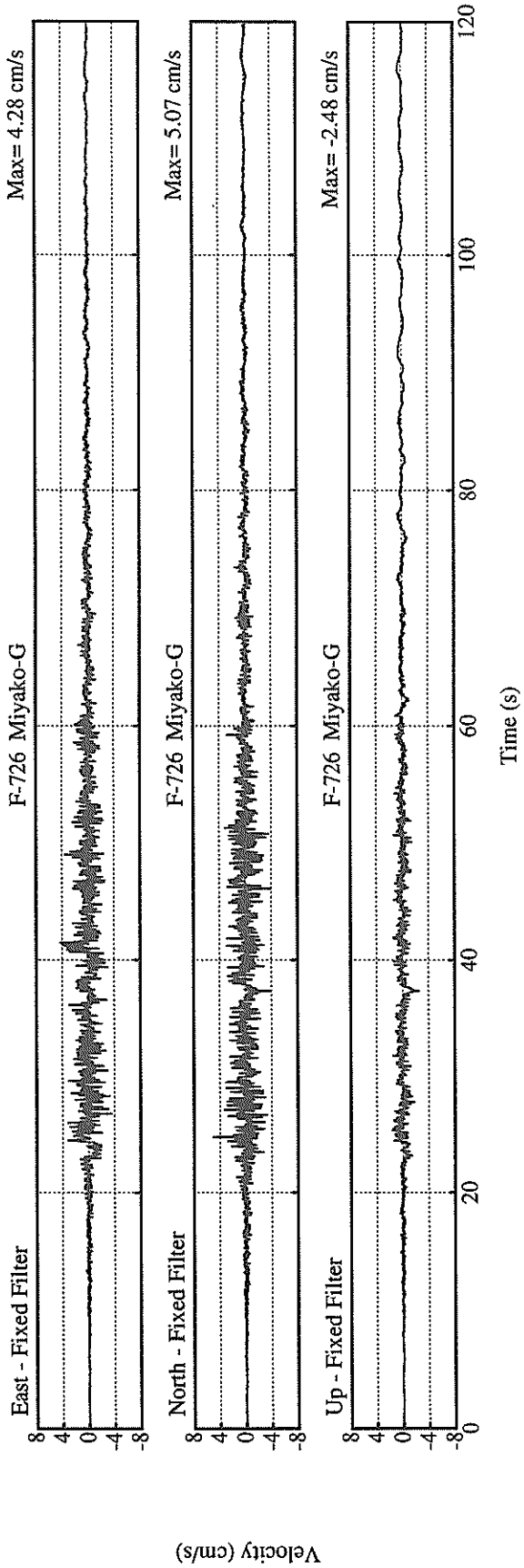
PEAK VALUES OF COMPONENTS

	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.055	0.116	0.061	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	73.9	68.8	25.0	76.7
ORIGINAL	118.0	122.0	49.1	124.9
CORRECTED	118.8	122.6	47.1	125.1
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	5.07	4.28	2.48	5.09
VARIABLE FILTER	5.63	3.93	2.44	5.65
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.67	1.20	0.71	1.20
VARIABLE FILTER	1.93	0.87	1.86	1.93

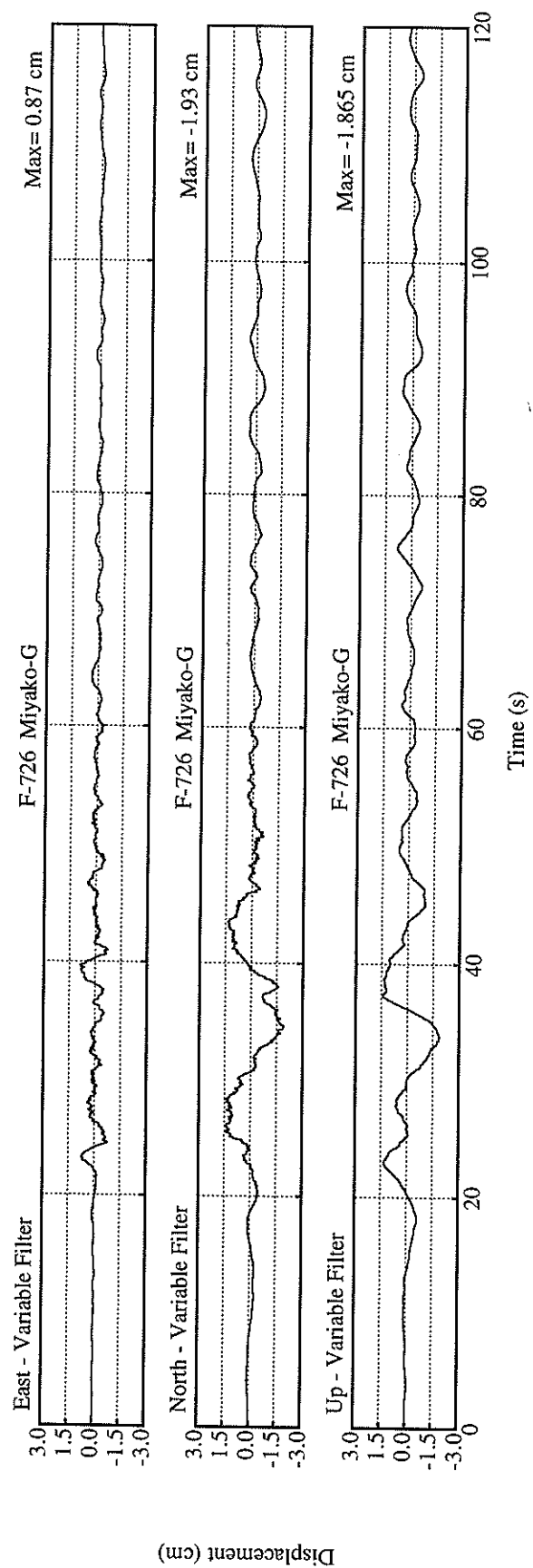
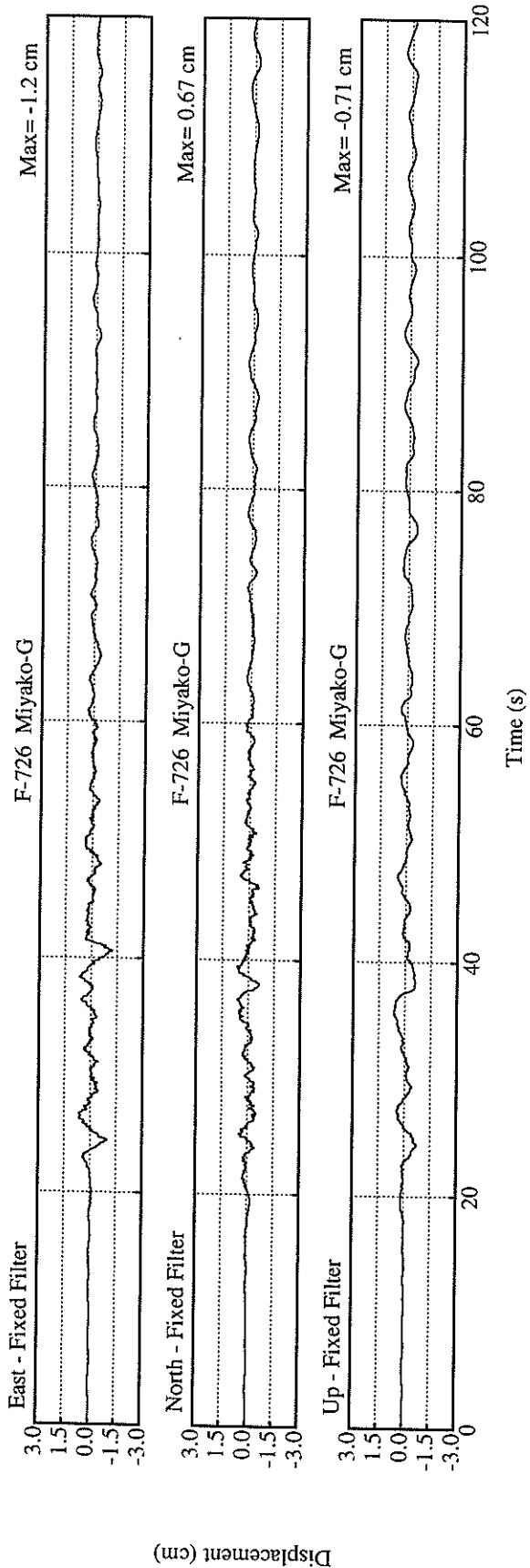
\* RESULTANT OF HORIZONTAL COMPONENTS

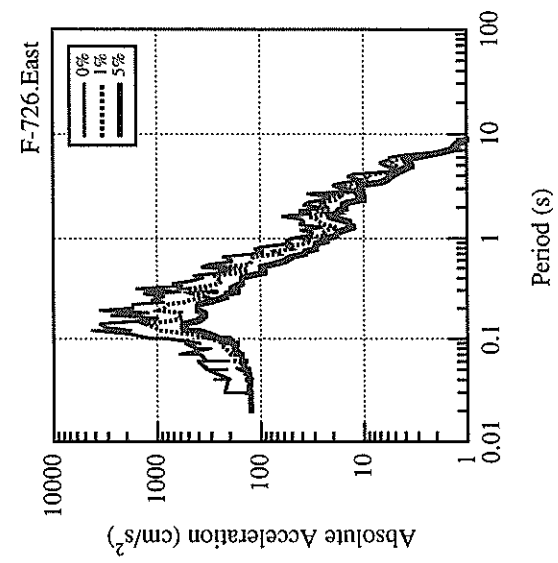
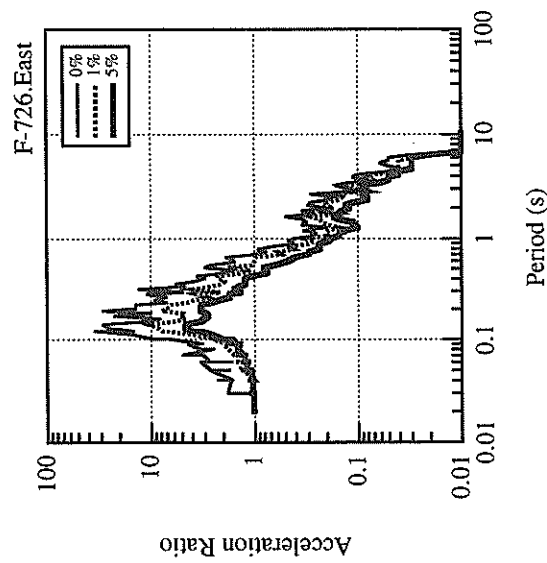
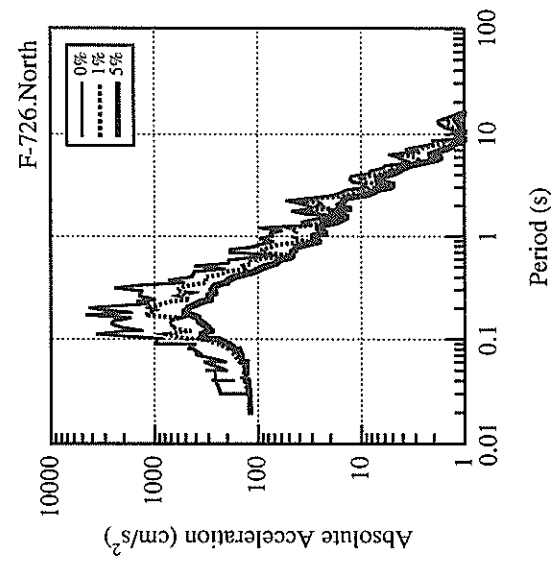
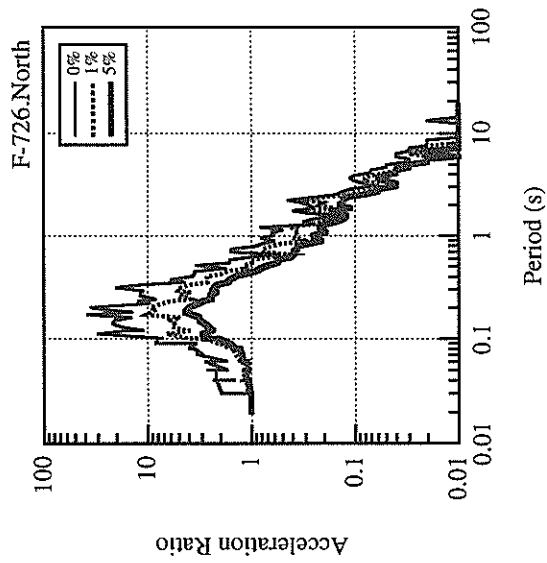
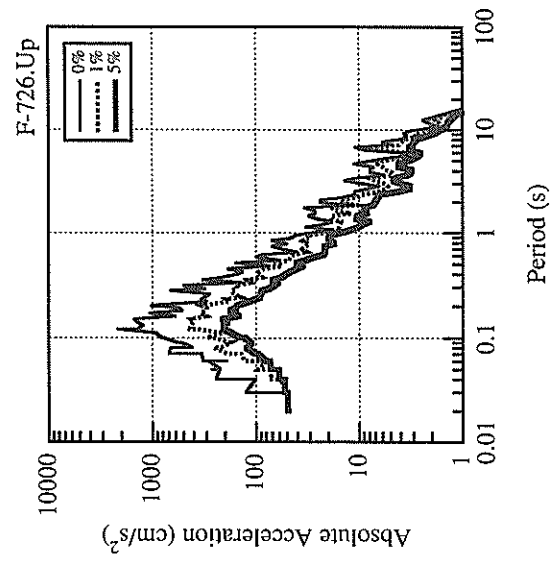
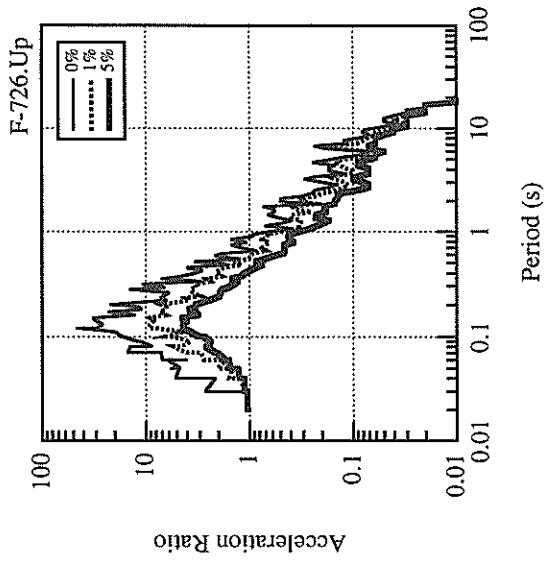


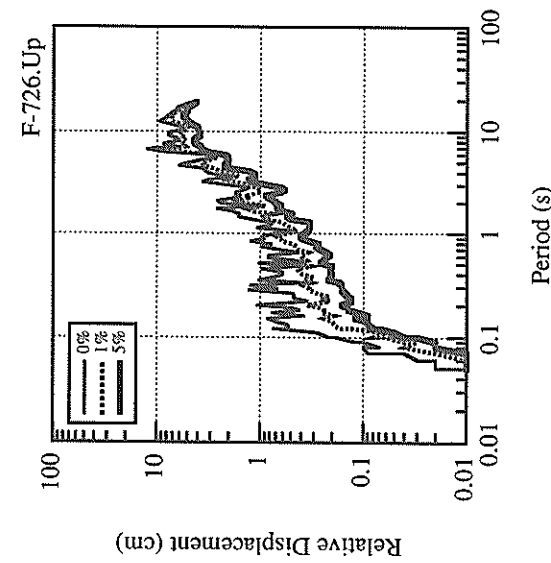
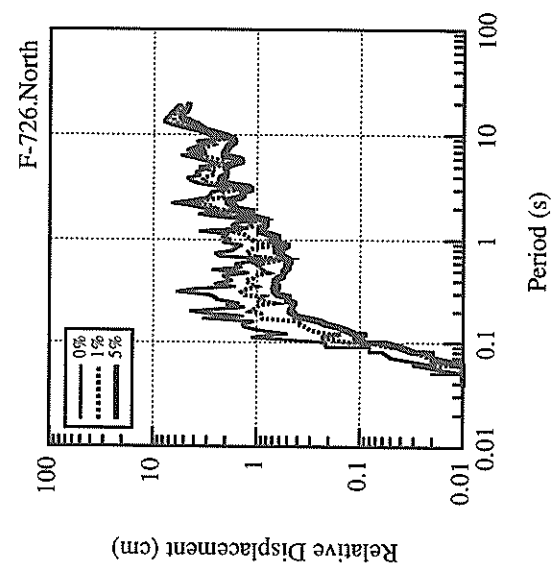
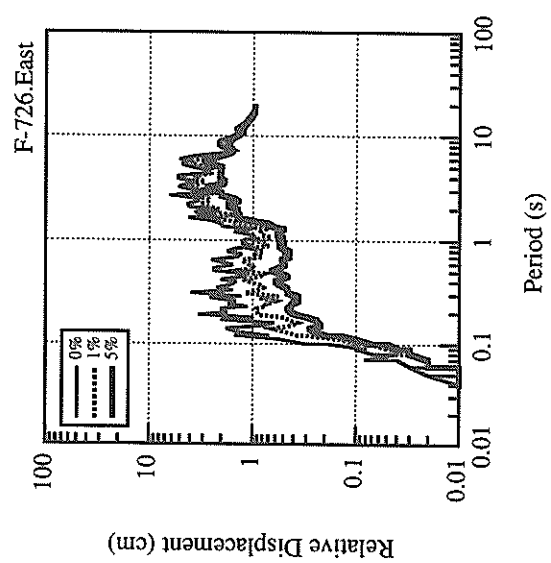
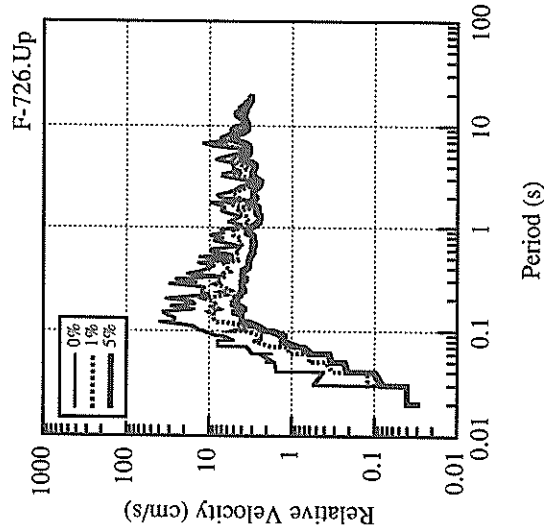
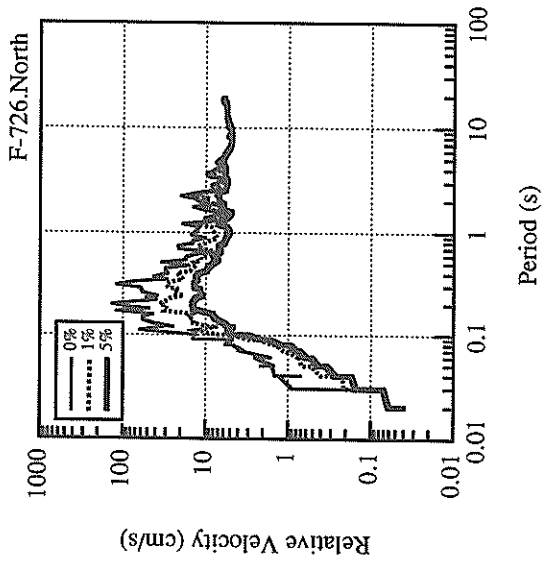
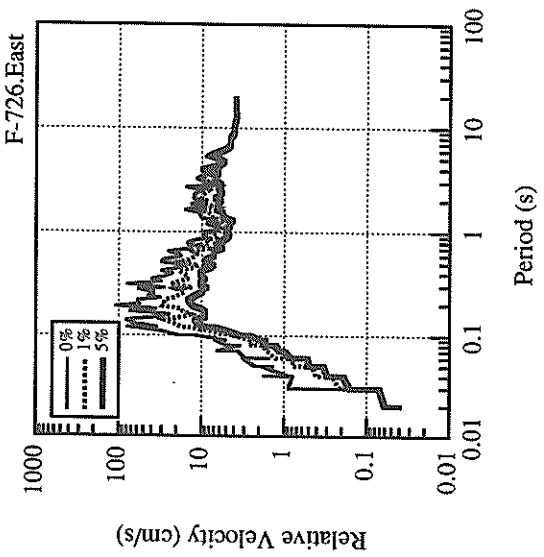


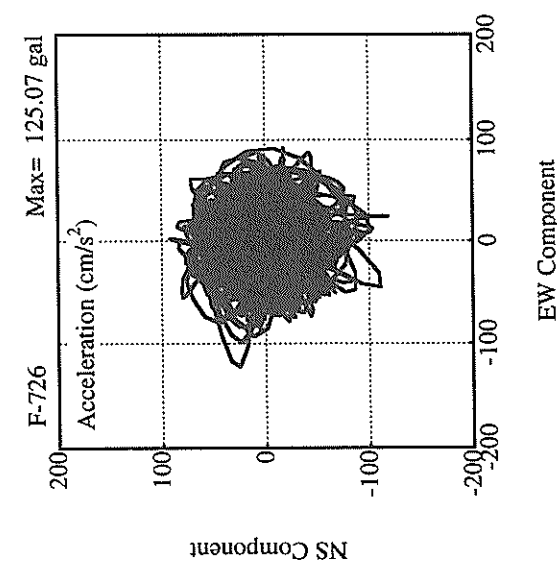
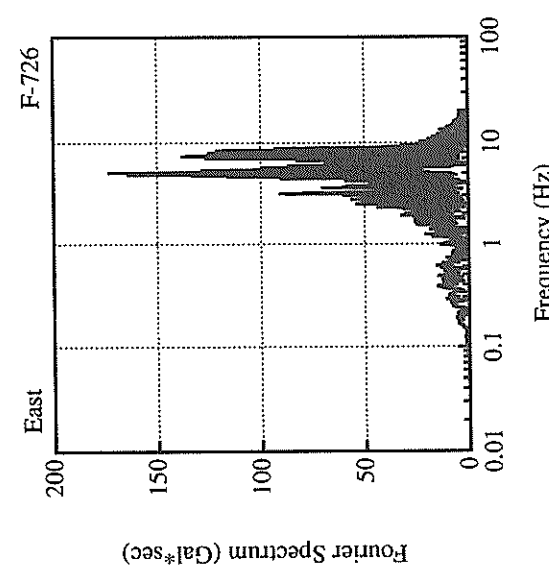
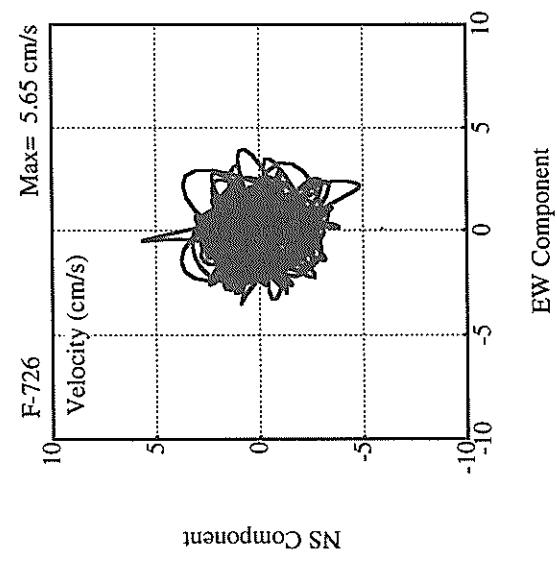
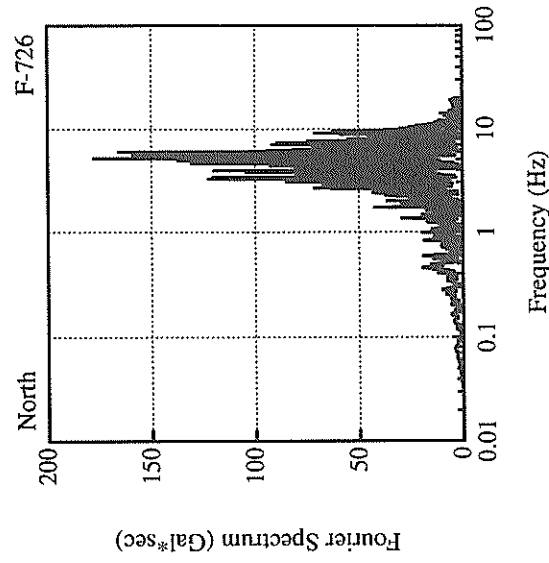
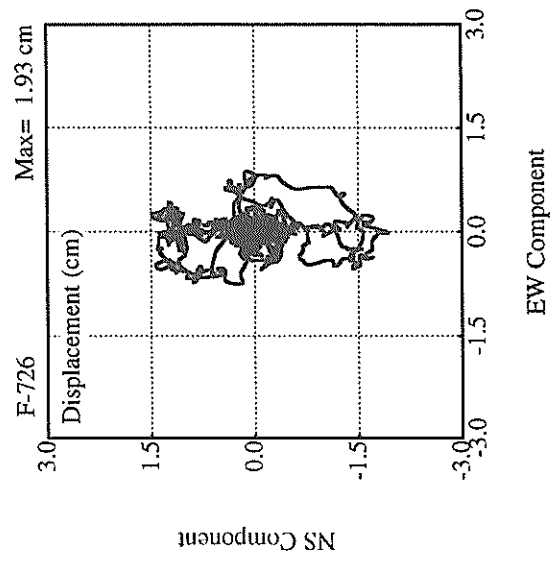
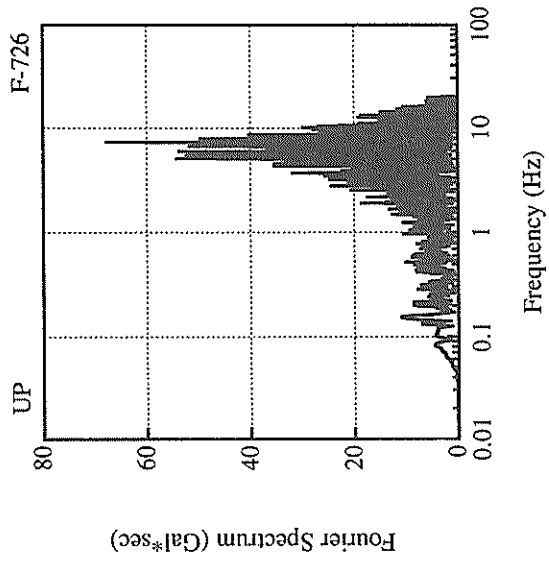












RECORD NUMBER : S-2597  
 STATION : HACHINOHE-JI-S

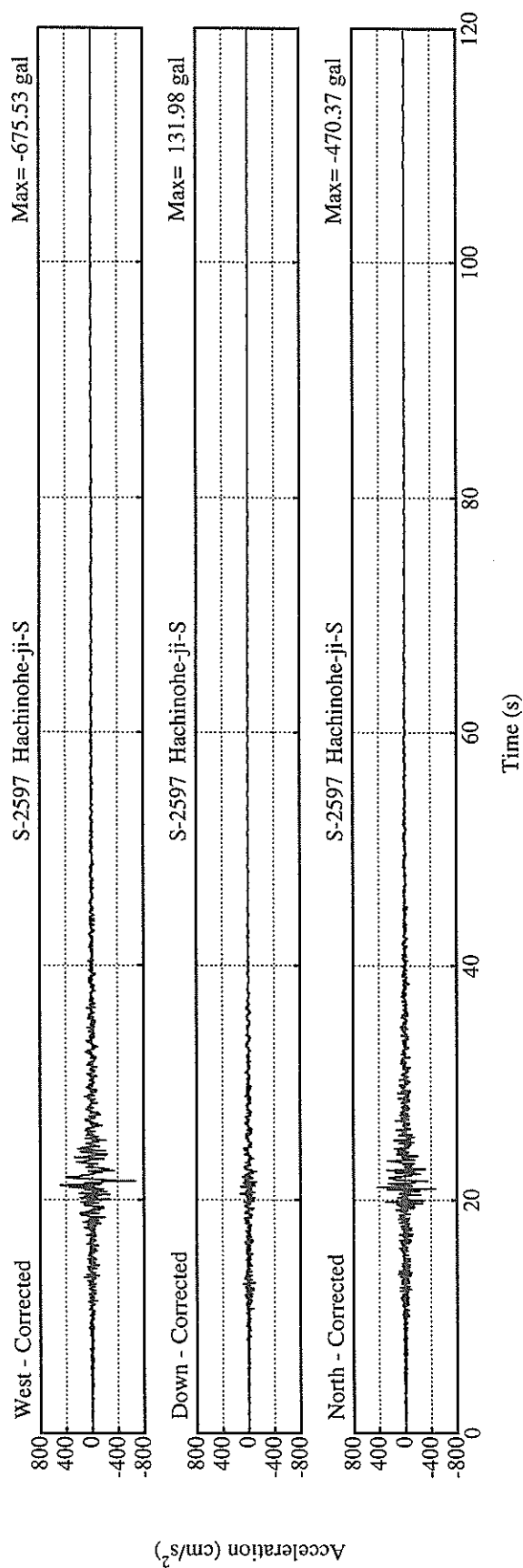
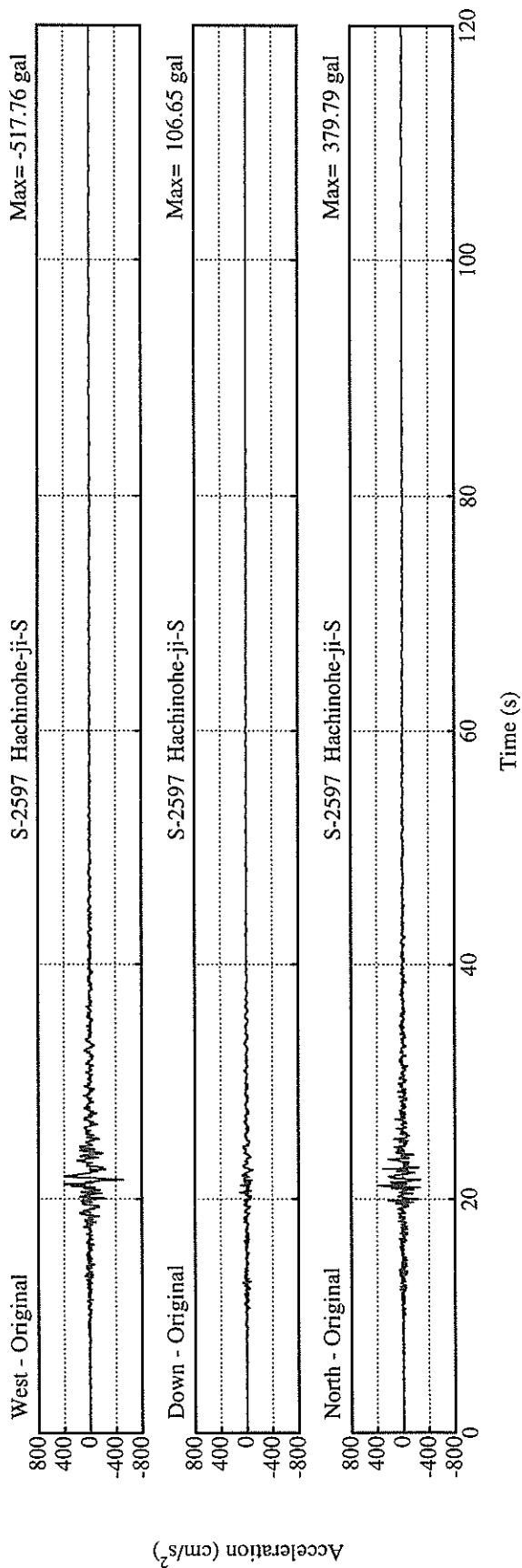
EARTHQUAKE DATA

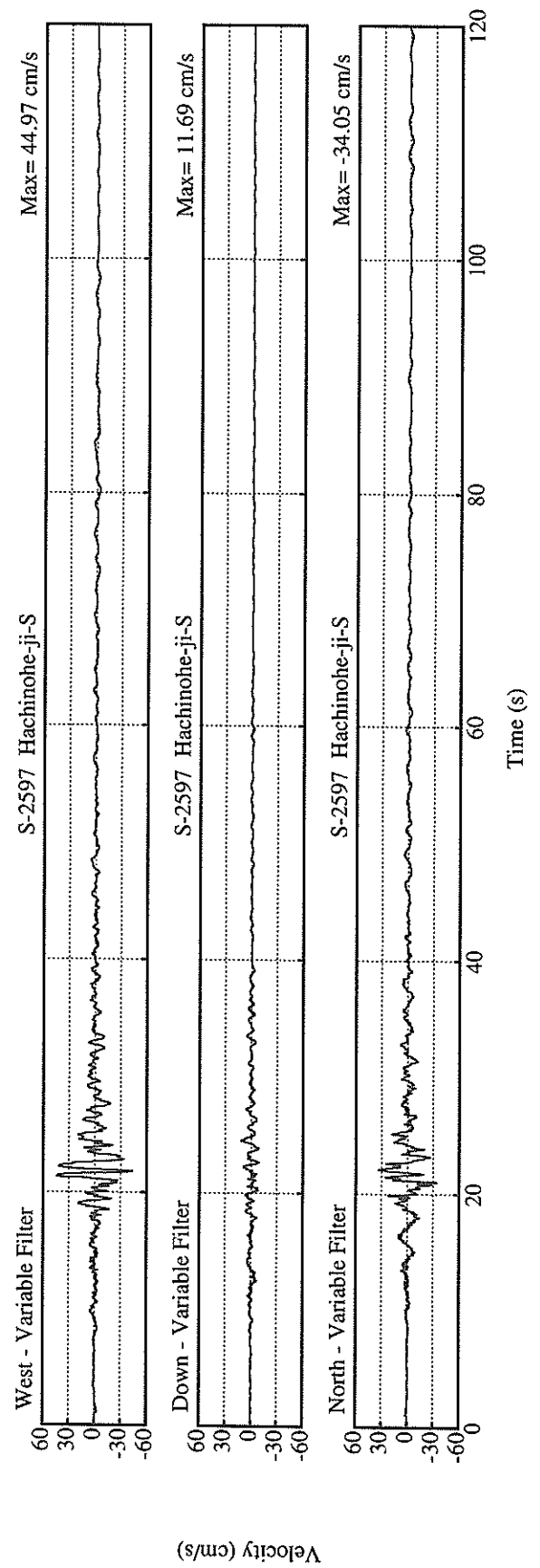
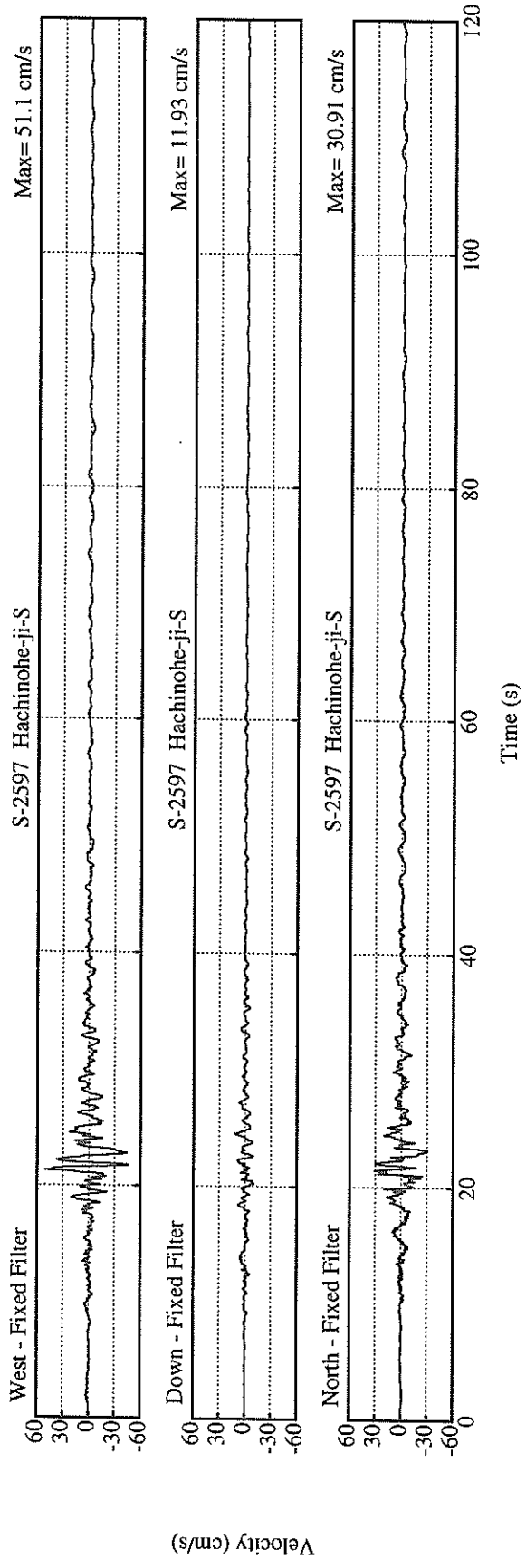
```
*****
DATE AND TIME                21:19 DEC.28,1994
LOCATION OF HYPOCENTER
  EPICENTRAL REGION          FAR E OFF SANRIKU
  LATITUDE                   40° 25.6' N
  LONGITUDE                   143° 44.9' E
  DEPTH                       0.0KM
  JMA MAGNITUDE              7.5
*****
```

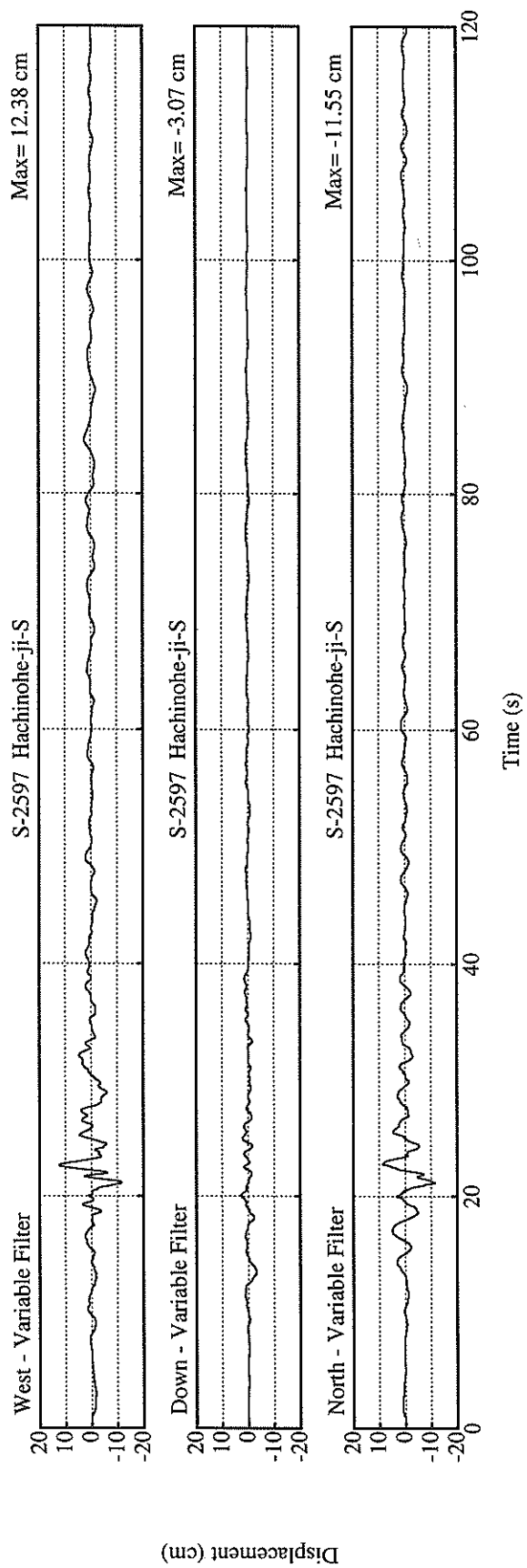
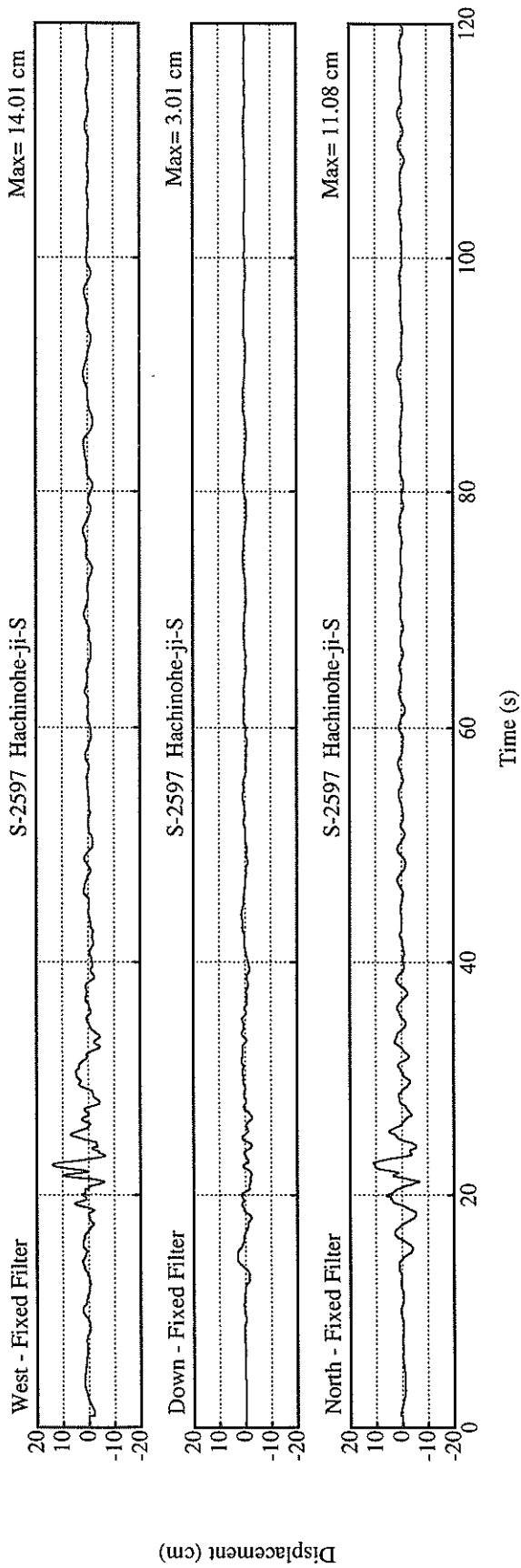
PEAK VALUES OF COMPONENTS

	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.109	0.109	0.127	
MAXIMUM ACCELERATION (GAL)				
ORIGINAL	379.8	517.8	106.6	556.0
CORRECTED	470.4	675.5	132.0	751.1
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	30.91	51.10	11.93	54.09
VARIABLE FILTER	34.05	44.97	11.69	50.45
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	11.08	14.01	3.01	17.39
VARIABLE FILTER	11.55	12.38	3.07	16.34

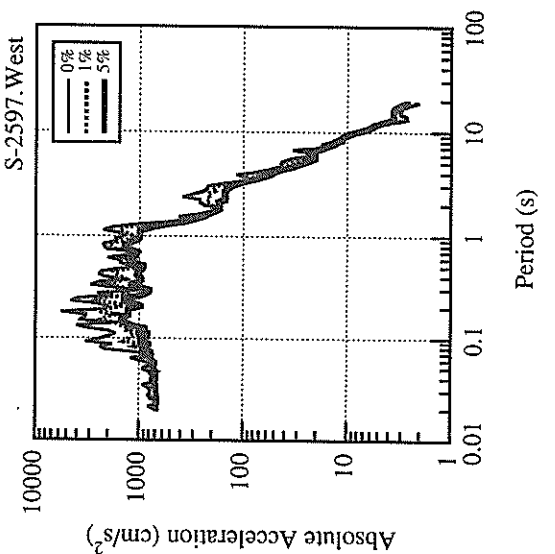
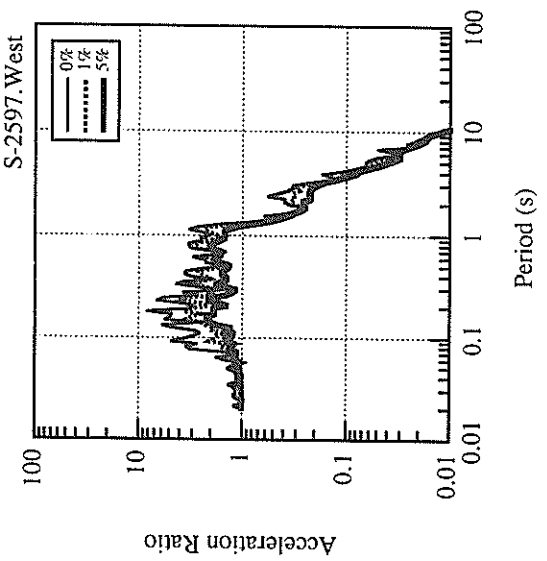
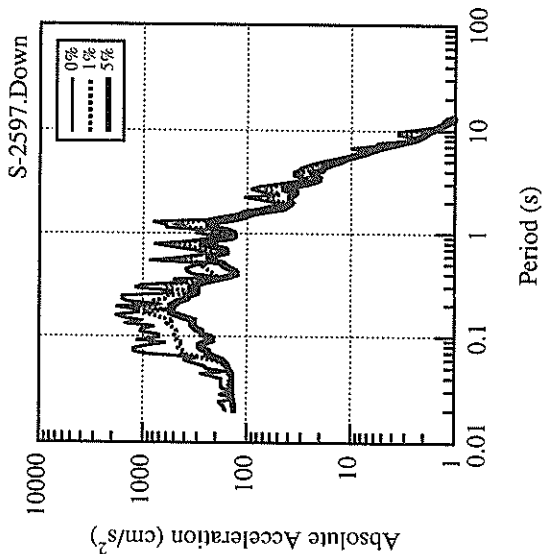
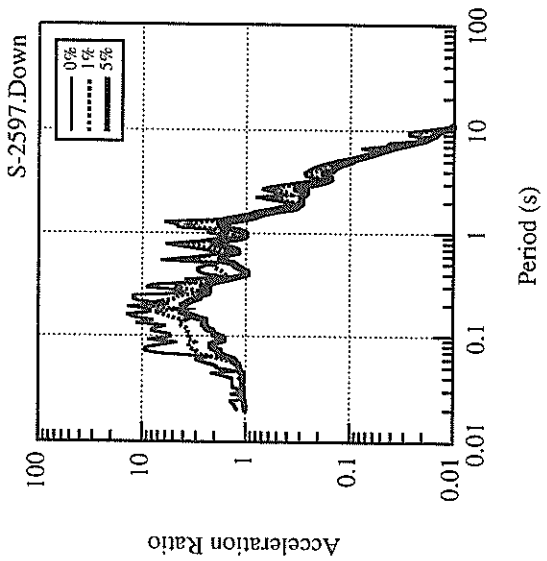
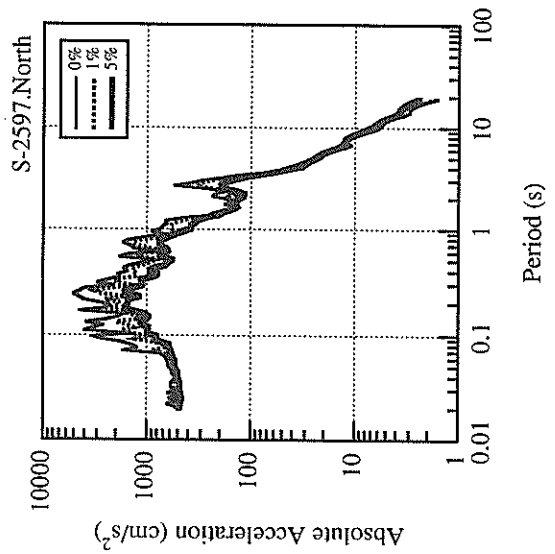
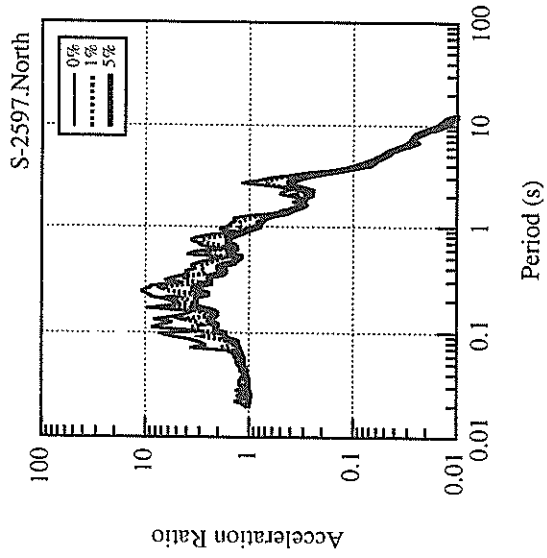
\* RESULTANT OF HORIZONTAL COMPONENTS

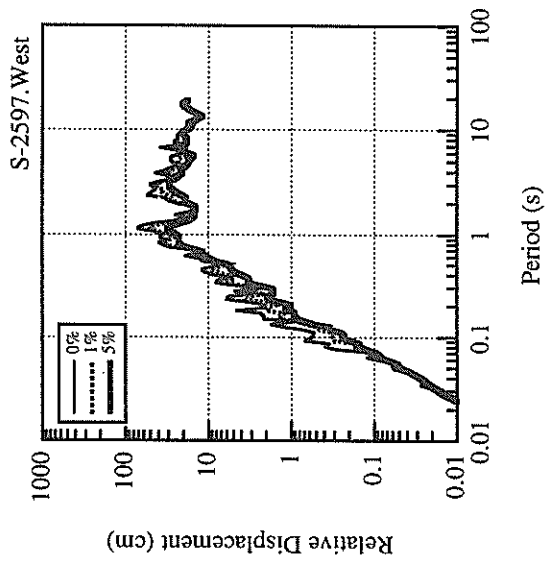
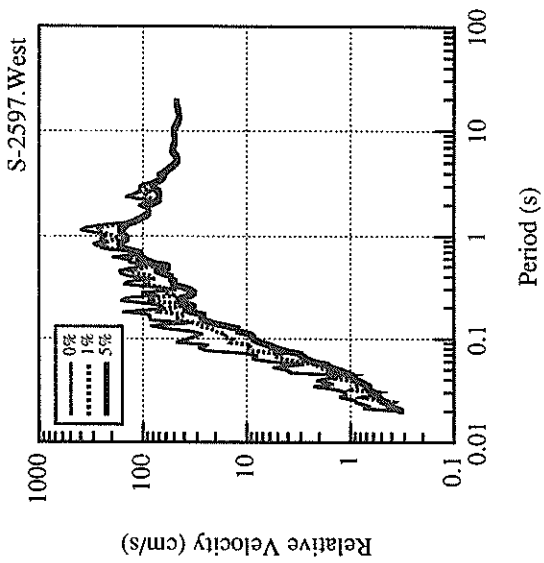
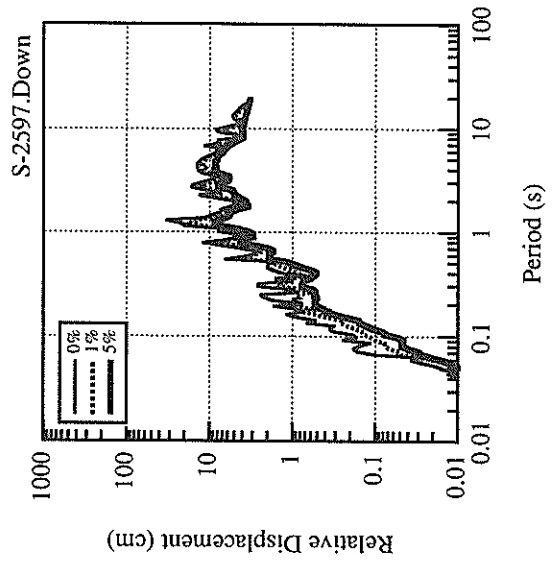
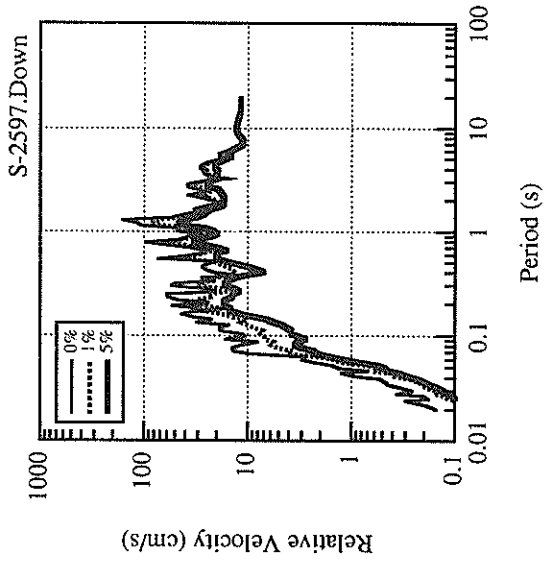
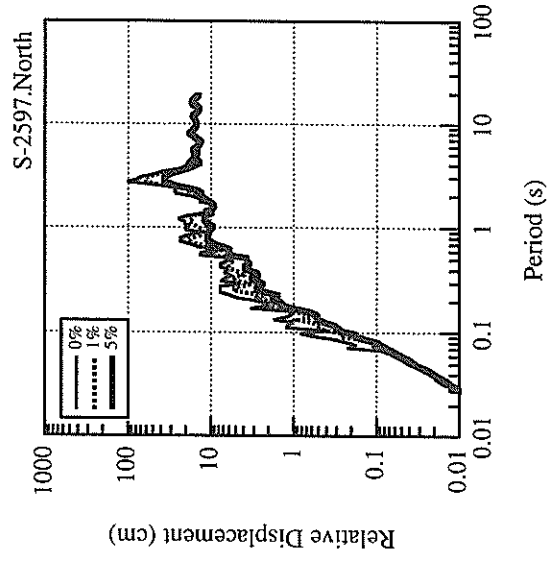
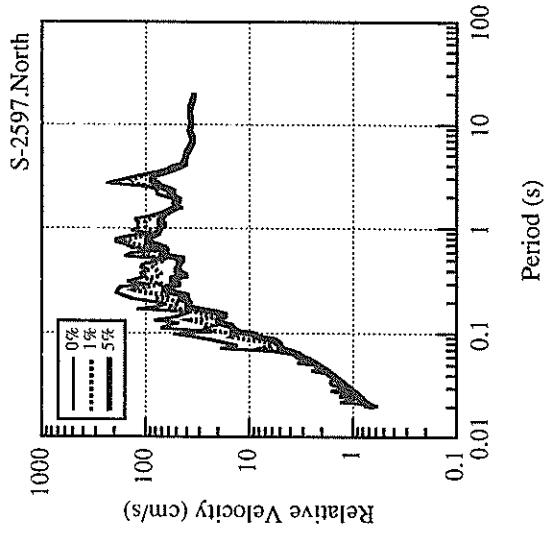


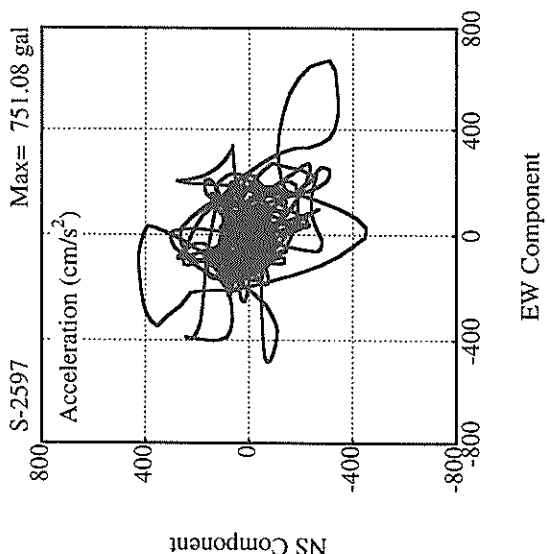
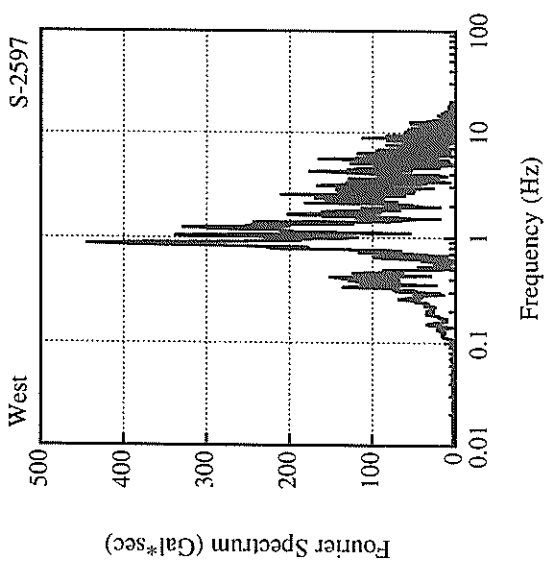
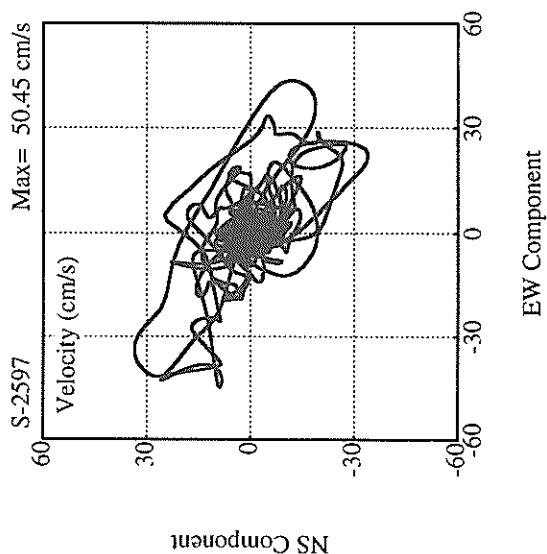
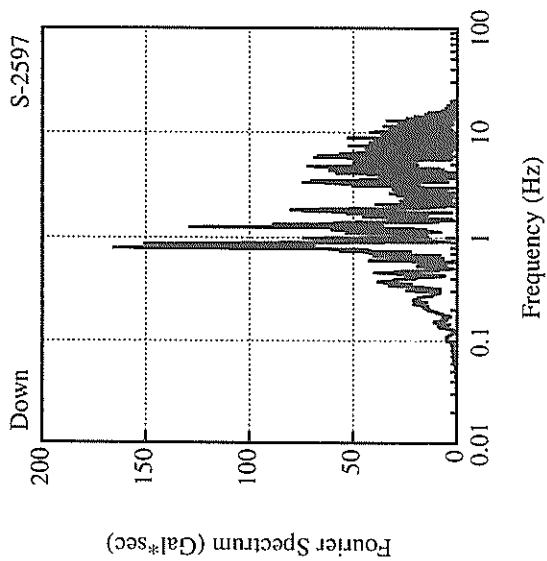
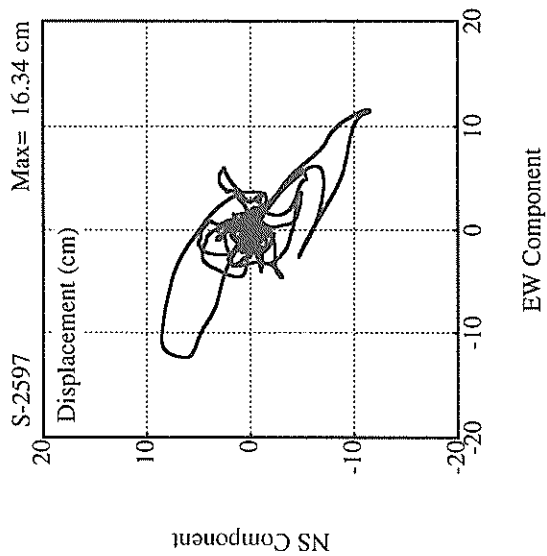
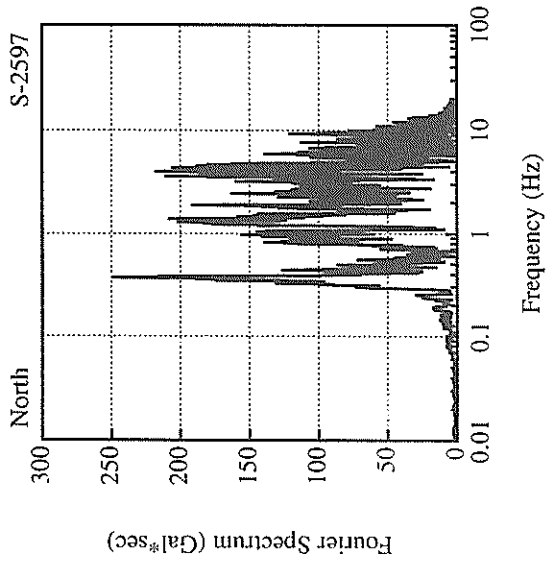












RECORD NUMBER : S-2599  
 STATION : URAKAWA-S

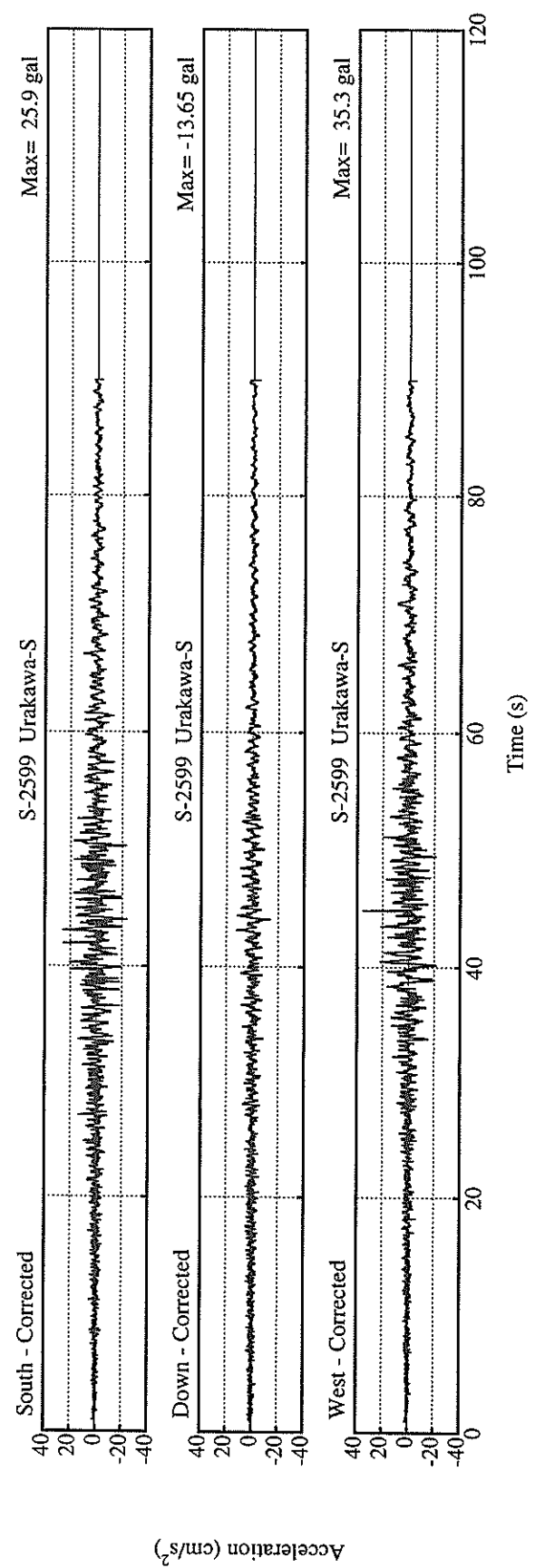
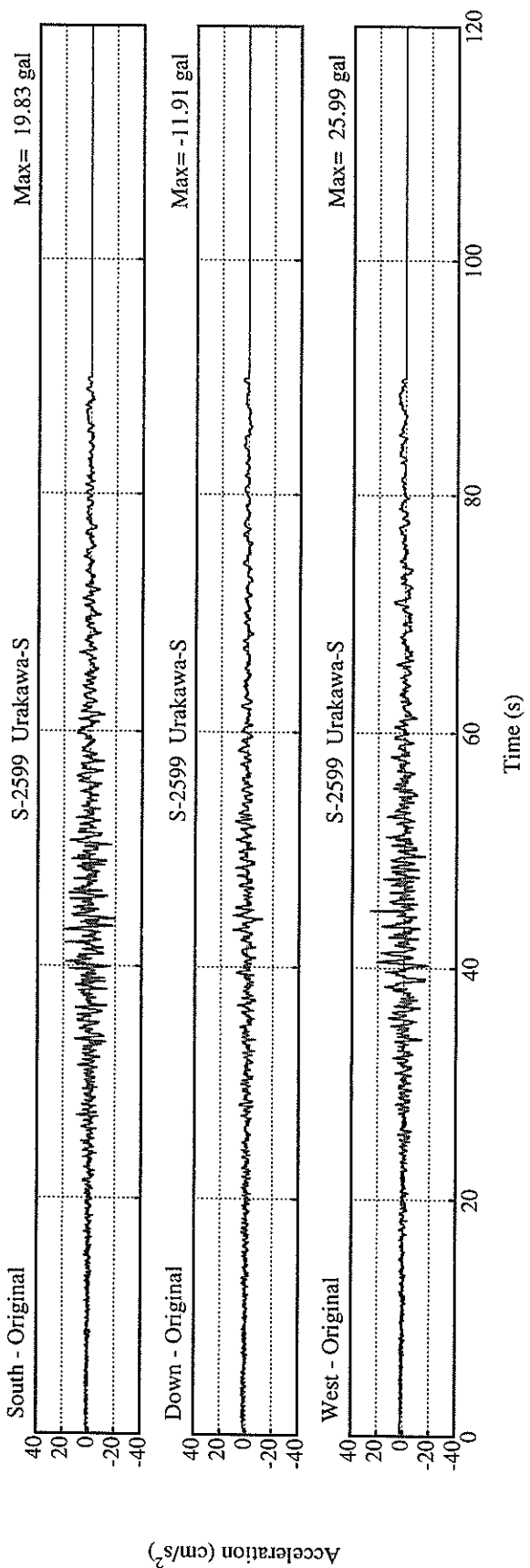
EARTHQUAKE DATA

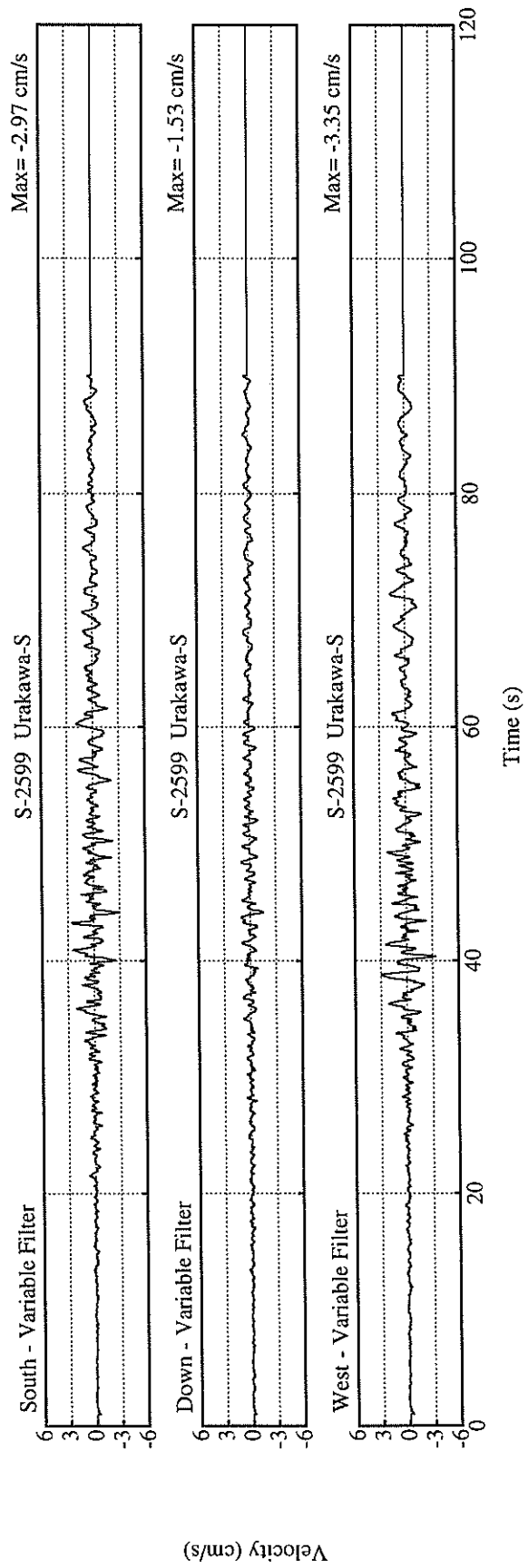
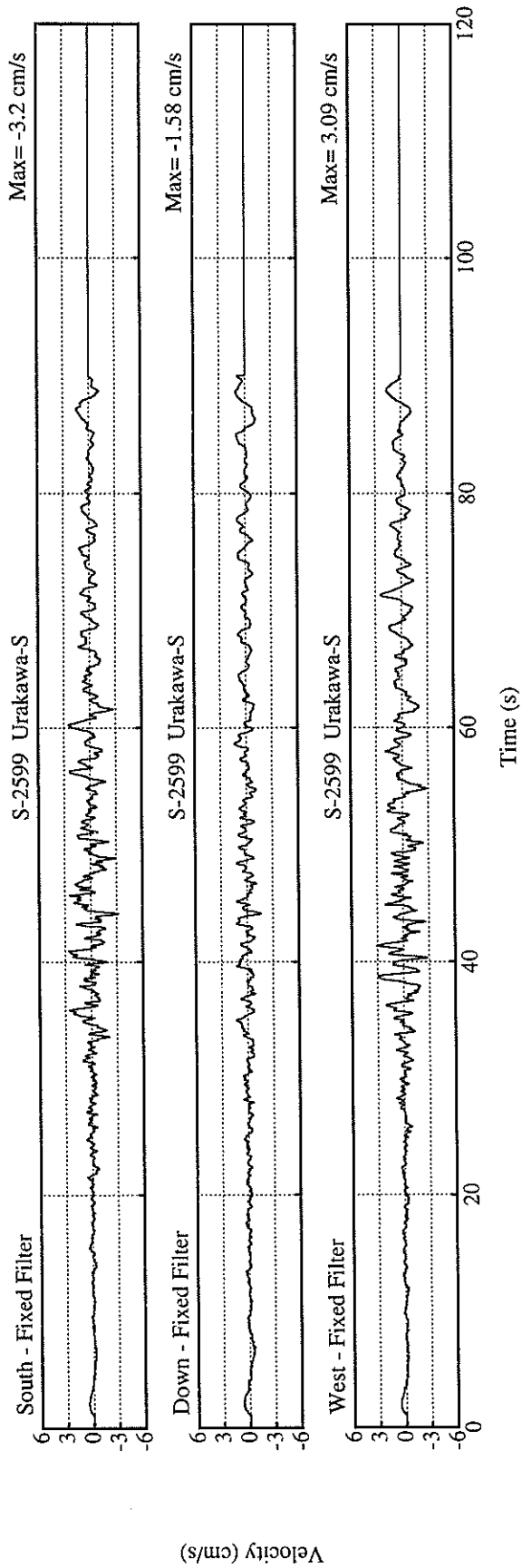
```
*****
DATE AND TIME                21:19 DEC.28,1994
LOCATION OF HYPOCENTER
  EPICENTRAL REGION          FAR E OFF SANRIKU
  LATITUDE                   40°25.6' N
  LONGITUDE                  143°44.9' E
  DEPTH                      0.0KM
JMA MAGNITUDE                7.5
*****
```

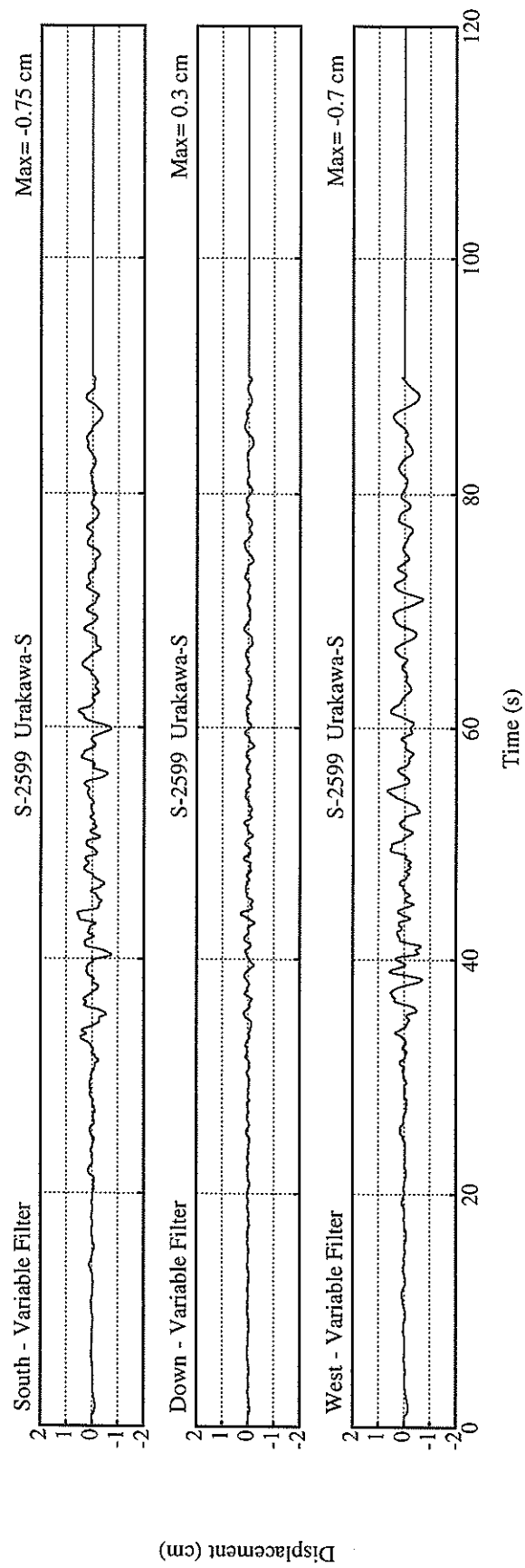
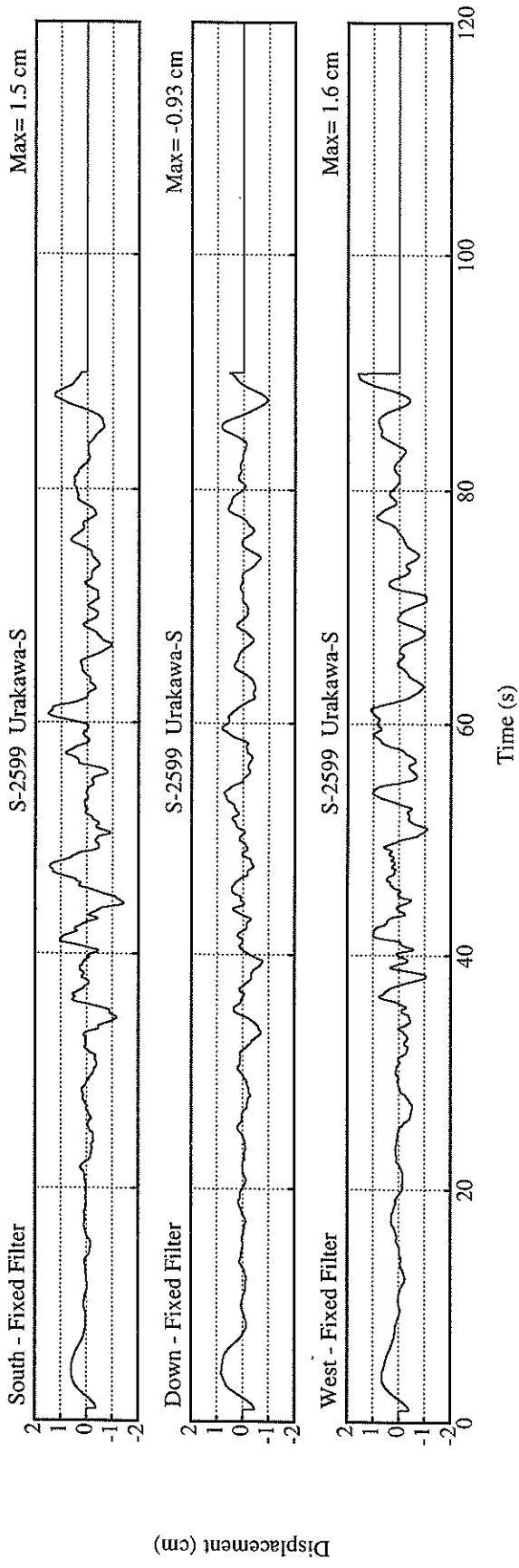
PEAK VALUES OF COMPONENTS

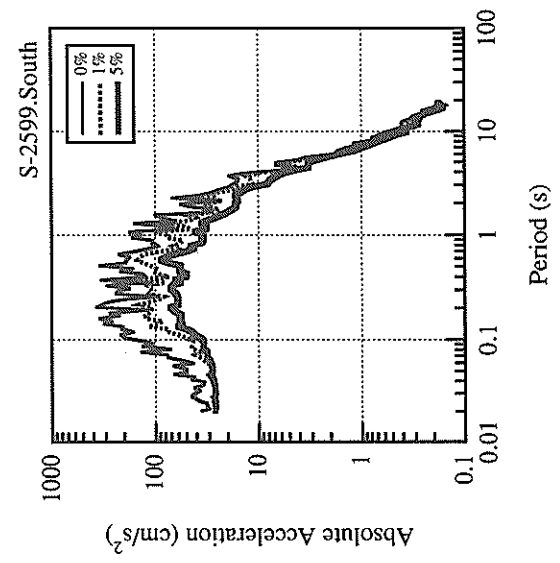
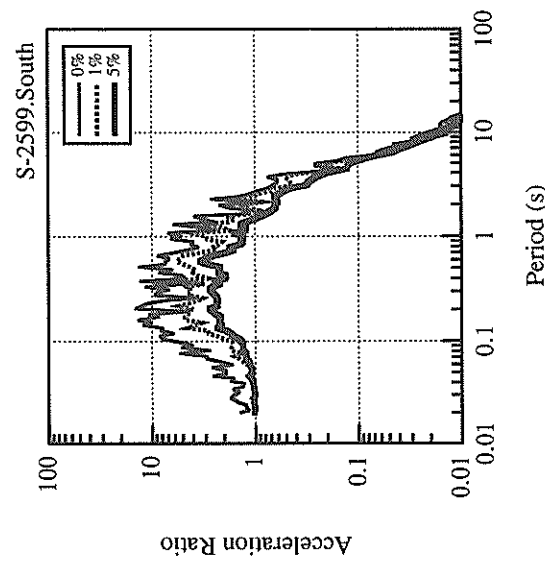
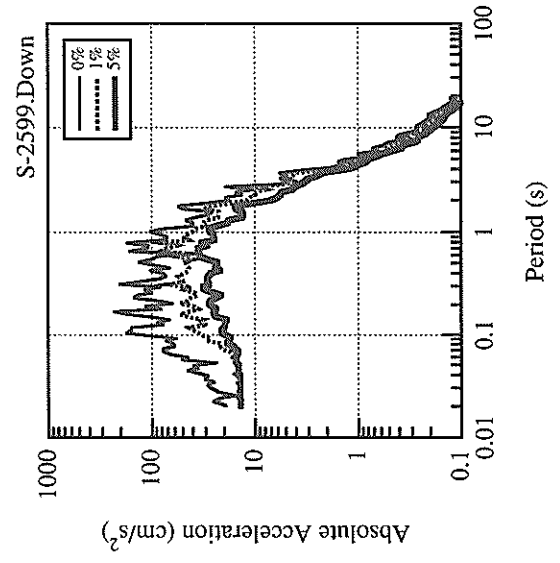
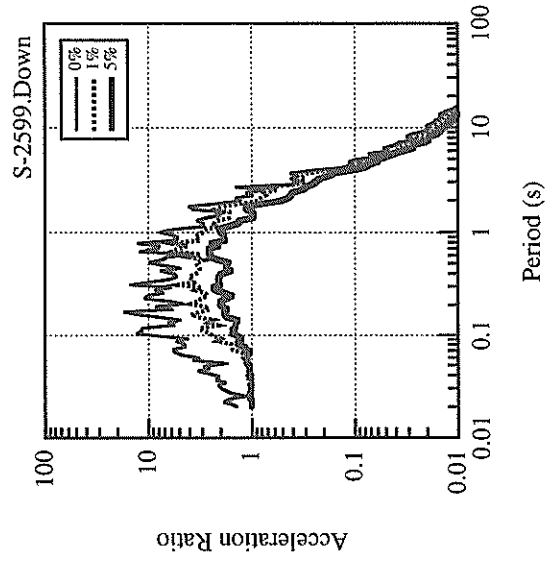
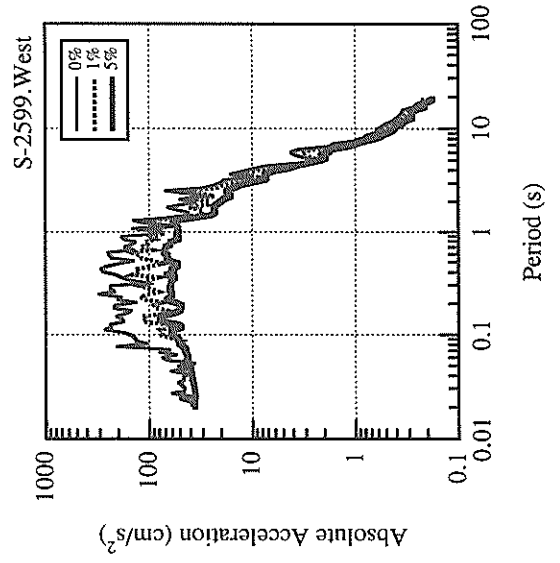
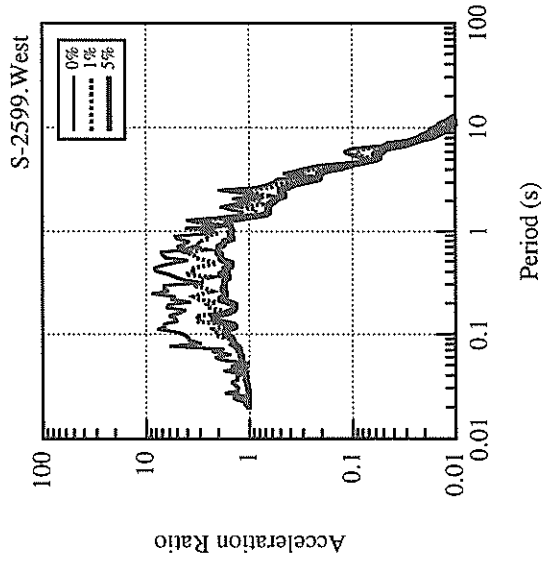
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.225	0.213	0.329	
MAXIMUM ACCELERATION (GAL)				
ORIGINAL	19.8	26.0	11.9	26.3
CORRECTED	25.9	35.3	13.7	35.6
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	3.20	3.09	1.58	3.20
VARIABLE FILTER	2.97	3.35	1.53	3.38
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	1.50	1.60	0.93	1.78
VARIABLE FILTER	0.75	0.70	0.30	0.81

\* RESULTANT OF HORIZONTAL COMPONENTS

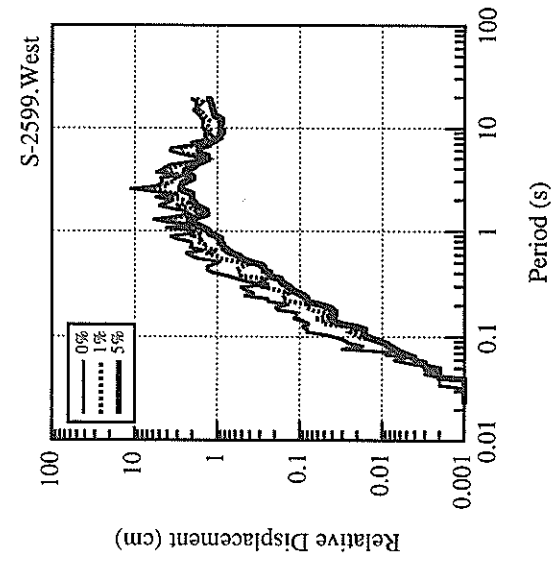
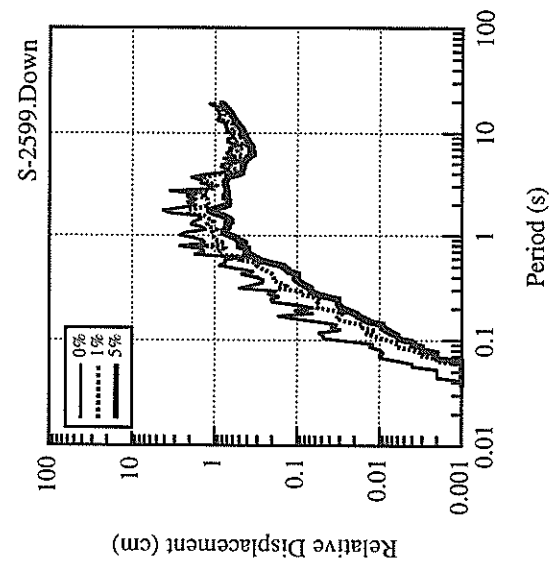
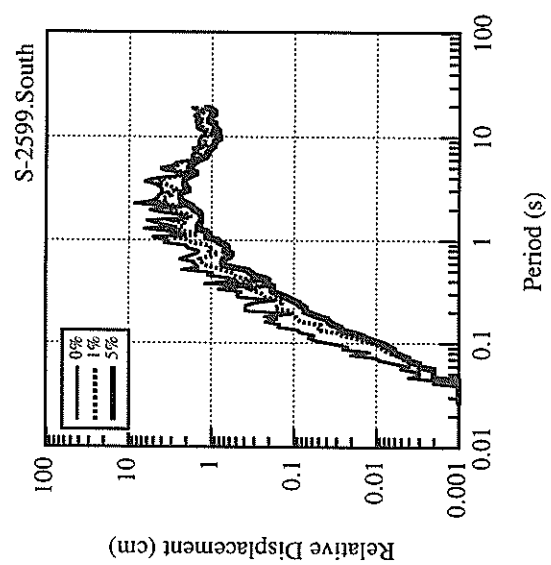
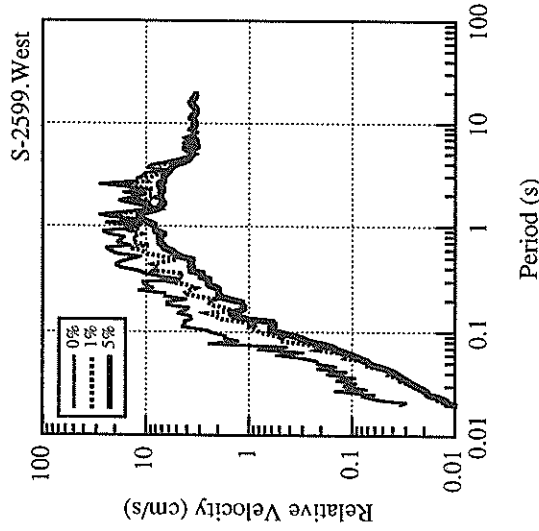
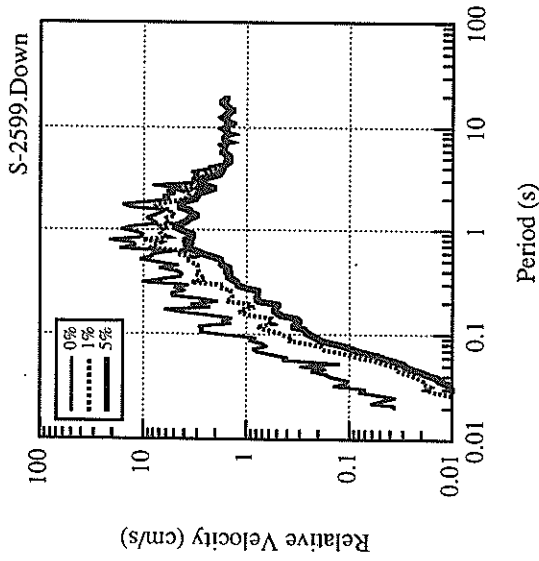
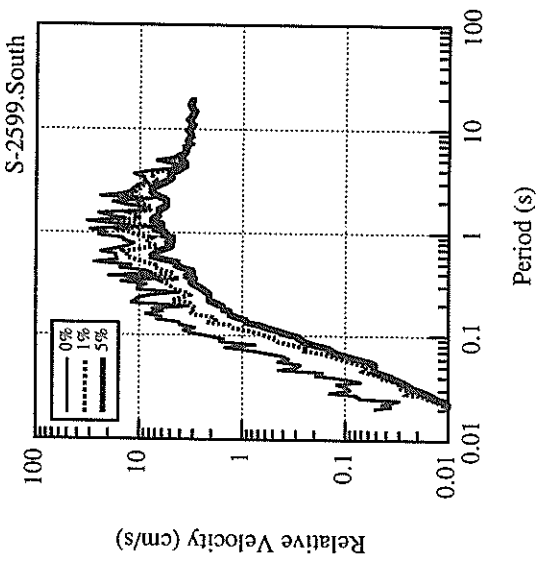


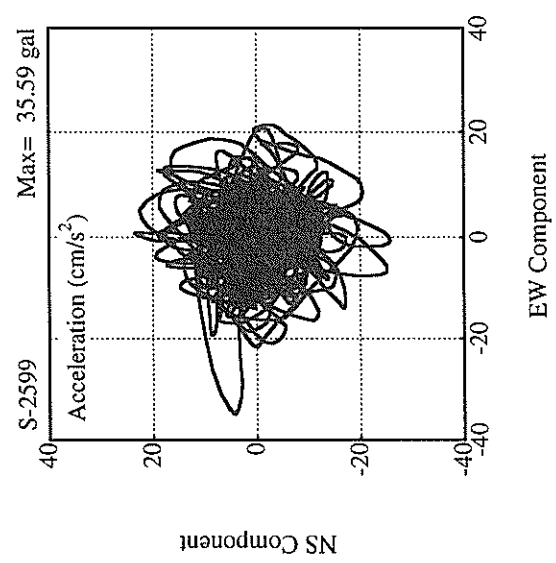
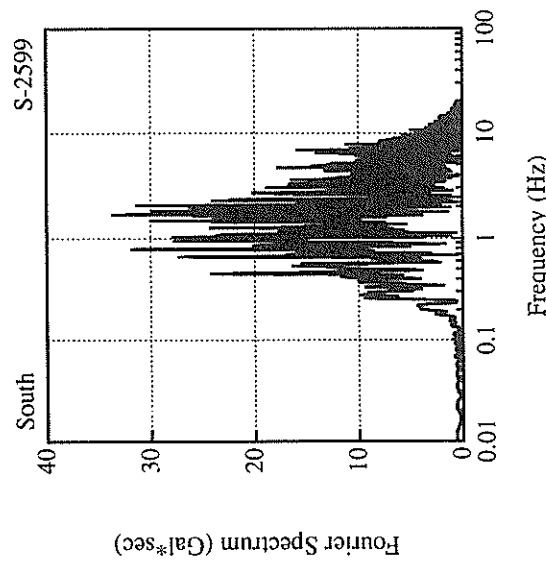
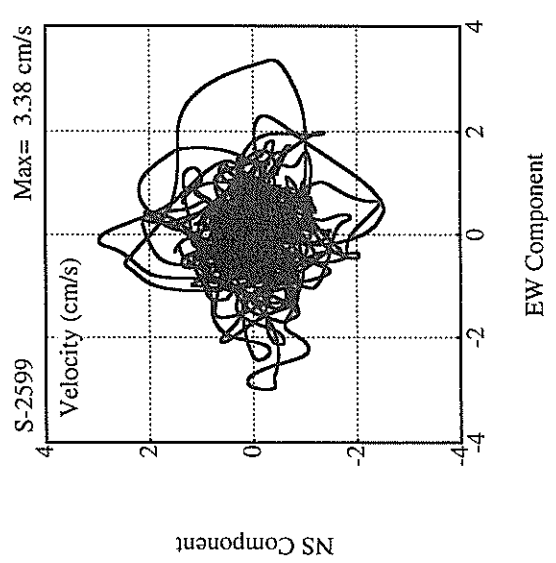
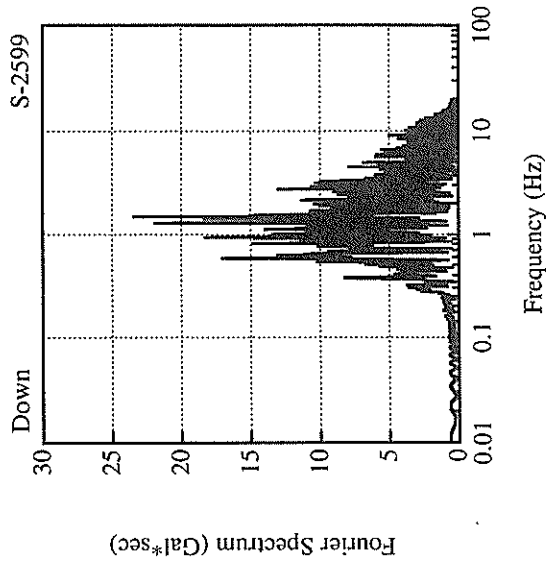
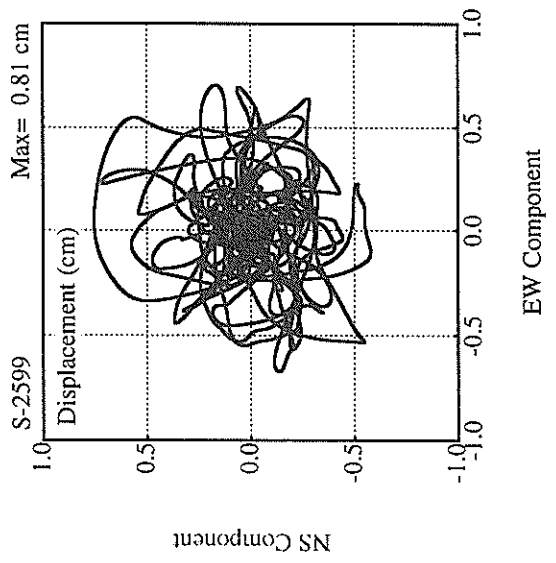
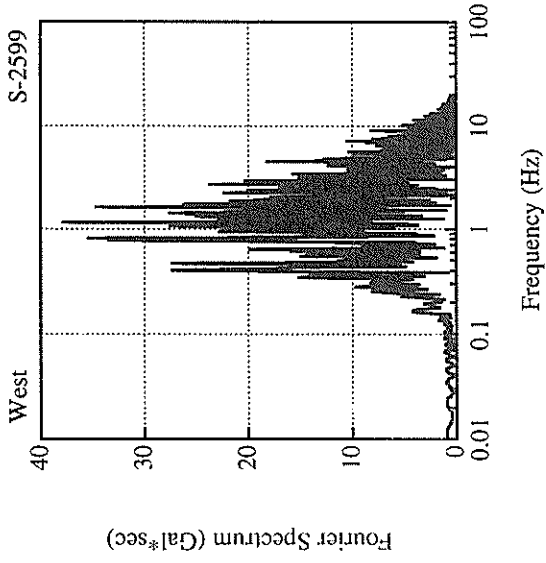












RECORD NUMBER : M-1534  
 STATION : TOKACHI-M

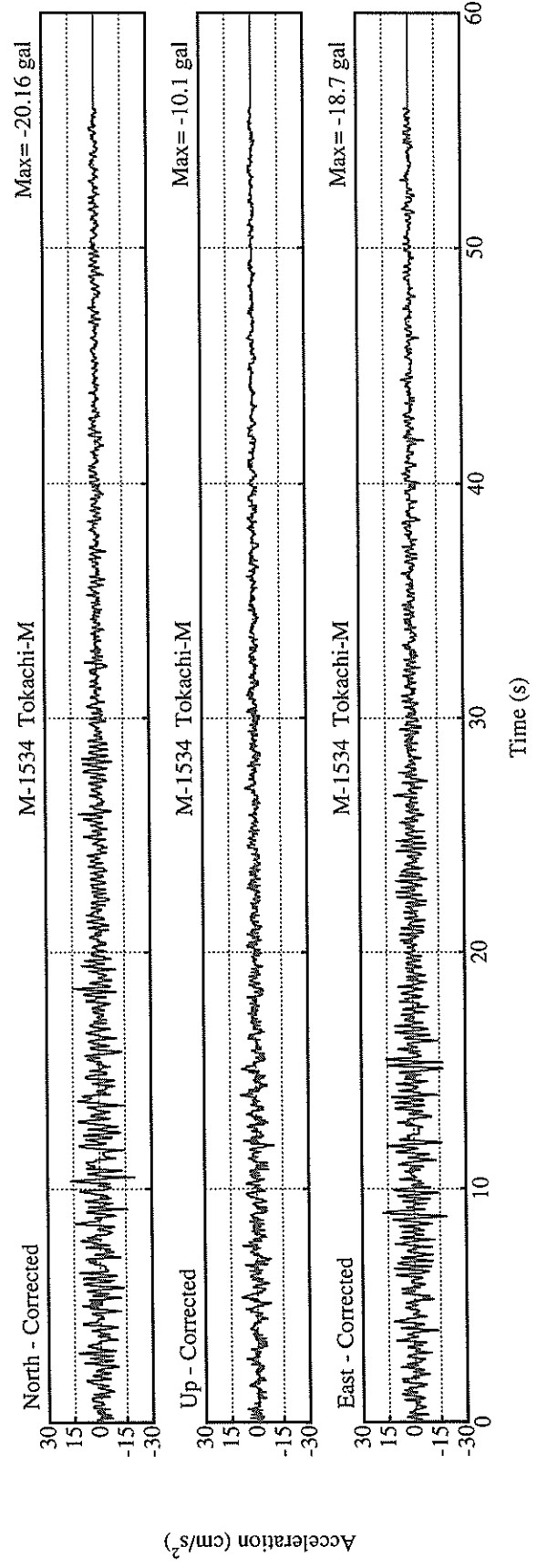
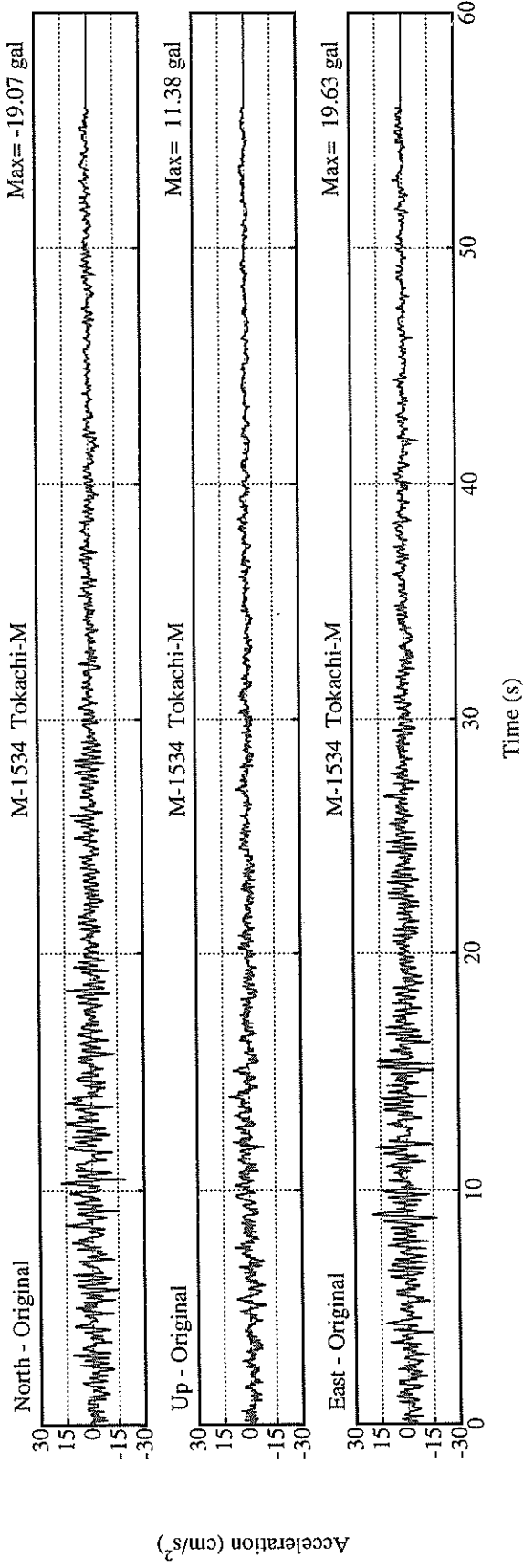
EARTHQUAKE DATA

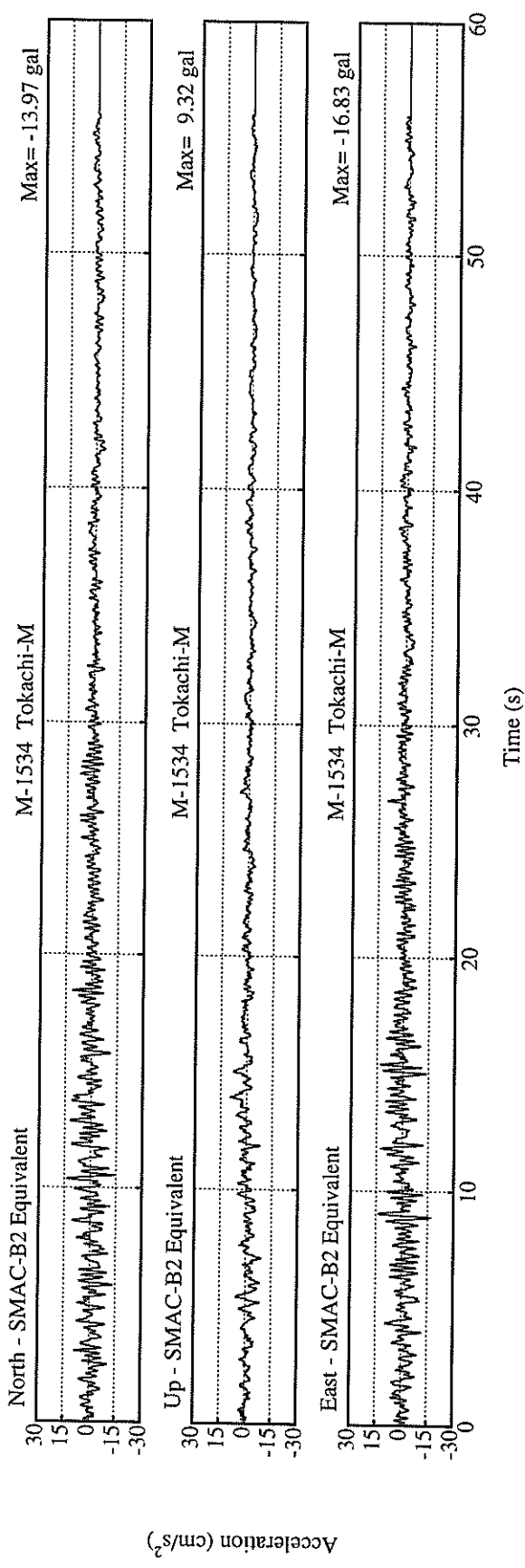
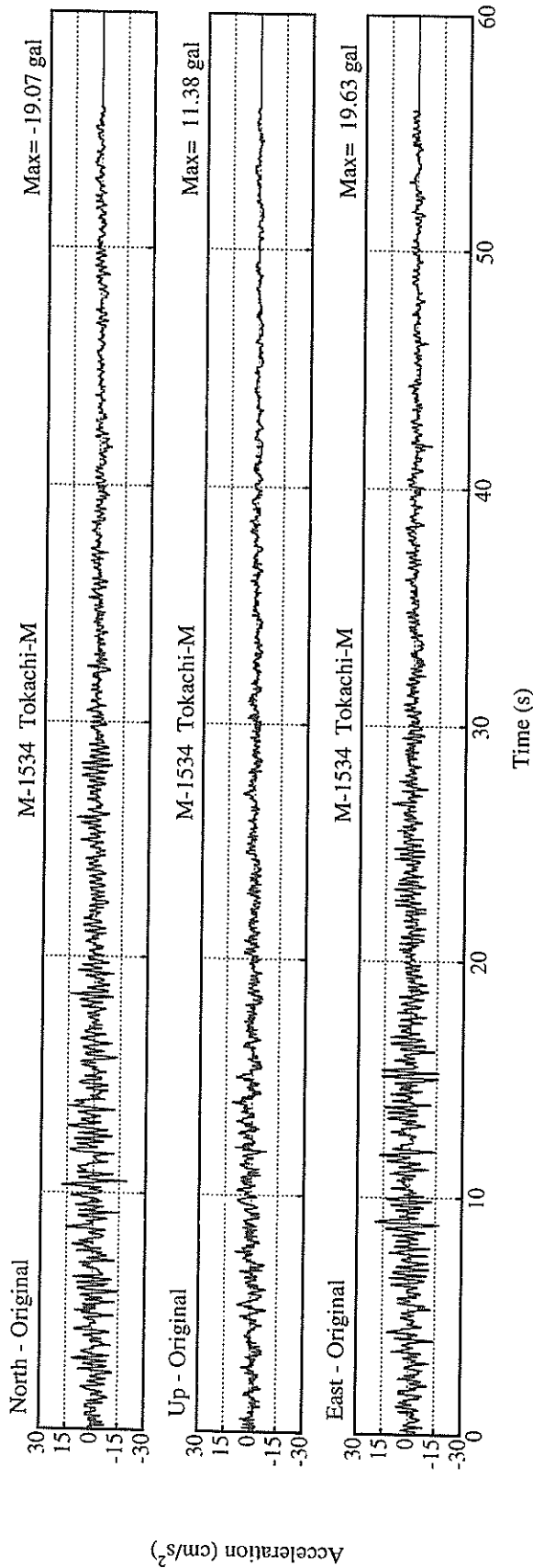
\*\*\*\*\*  
 DATE AND TIME 21:19 DEC.28,1994  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION FAR E OFF SANRIKU  
 LATITUDE 40°25.6' N  
 LONGITUDE 143°44.9' E  
 DEPTH 0.0KM  
 JMA MAGNITUDE 7.5  
 \*\*\*\*\*

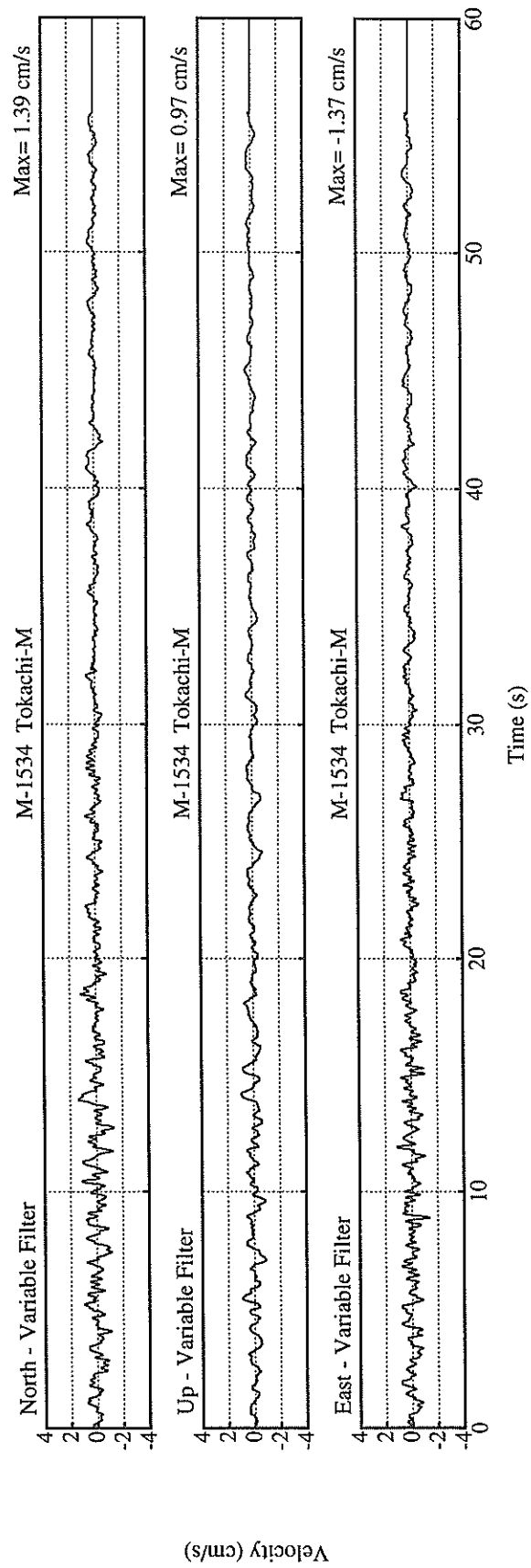
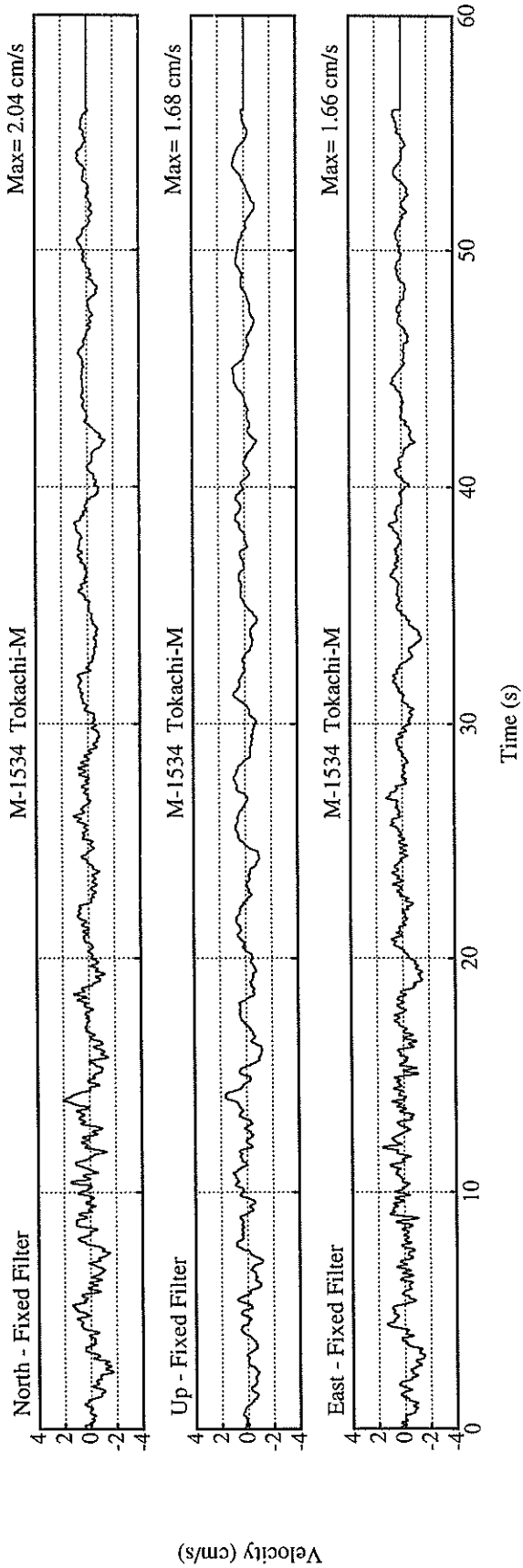
PEAK VALUES OF COMPONENTS

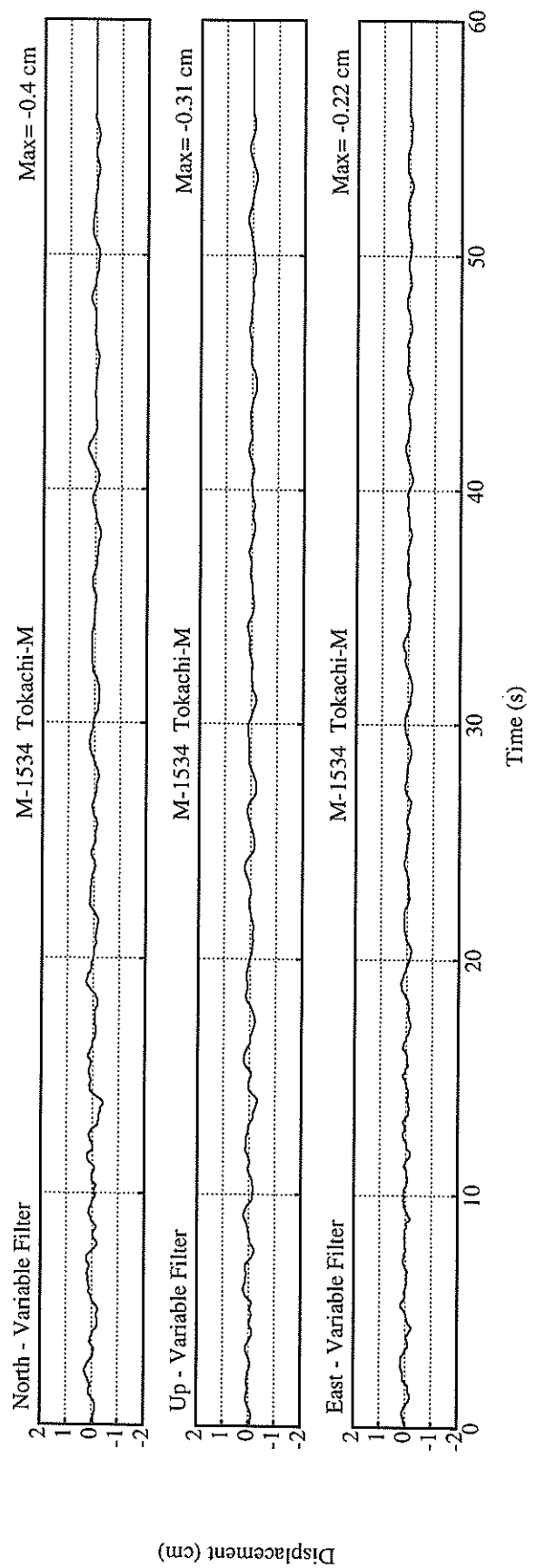
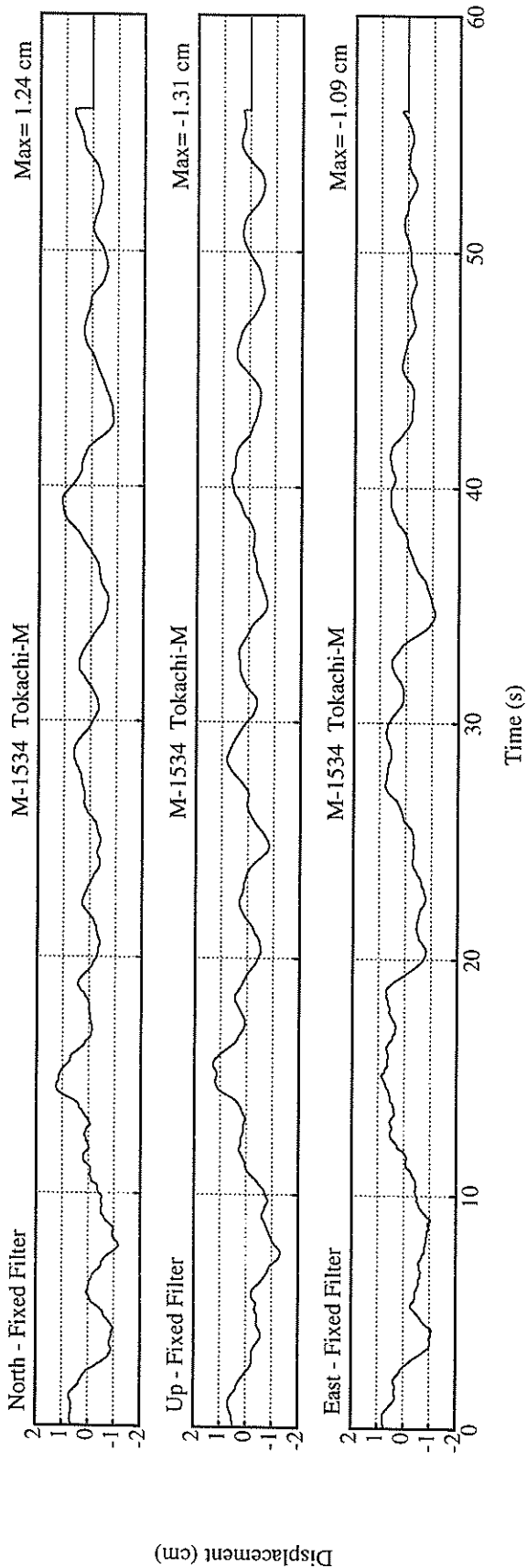
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.248	0.321	0.273	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	14.0	16.8	9.3	17.6
ORIGINAL	19.1	19.6	11.4	21.7
CORRECTED	20.2	18.7	10.1	20.2
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	2.04	1.66	1.68	2.11
VARIABLE FILTER	1.39	1.37	0.97	1.39
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	1.24	1.09	1.31	1.45
VARIABLE FILTER	0.40	0.22	0.31	0.41

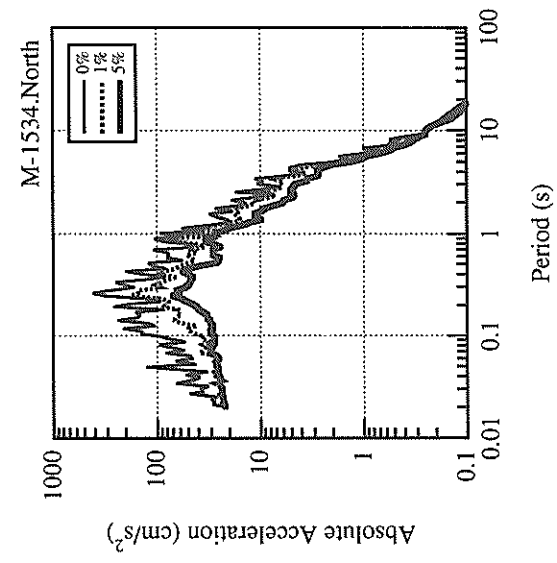
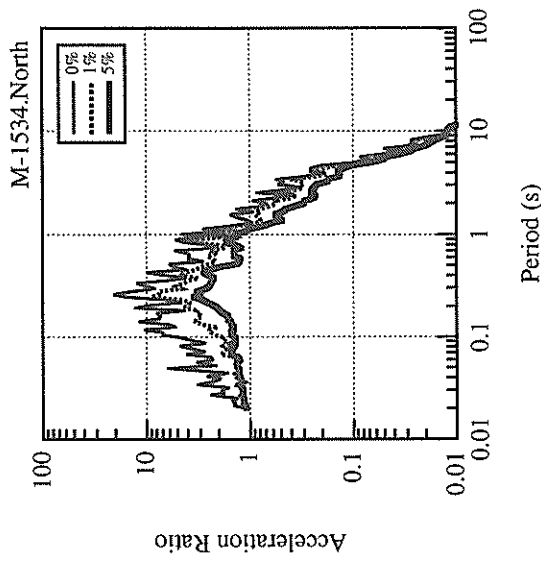
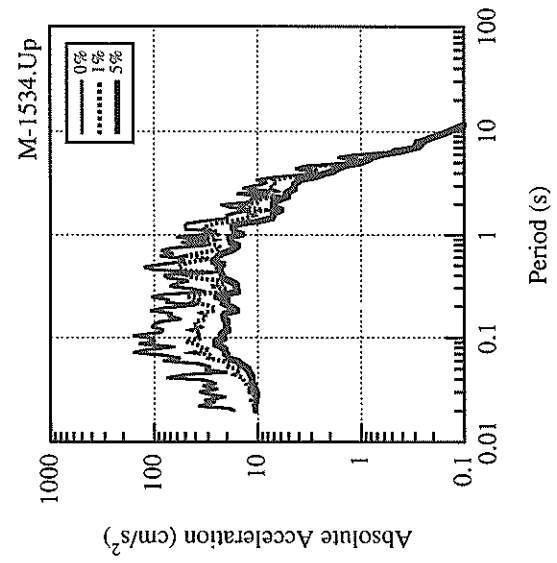
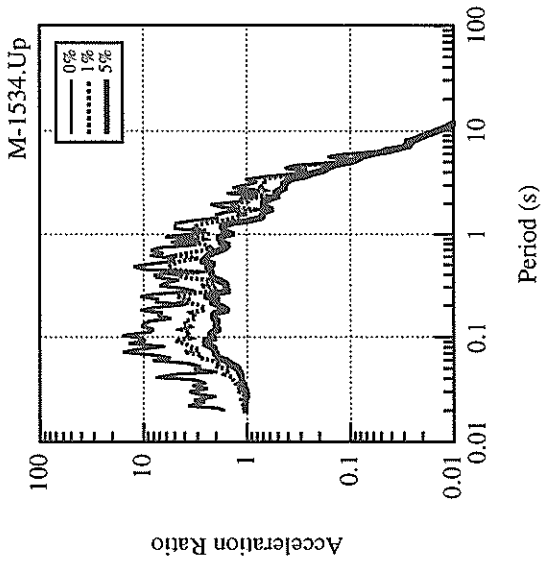
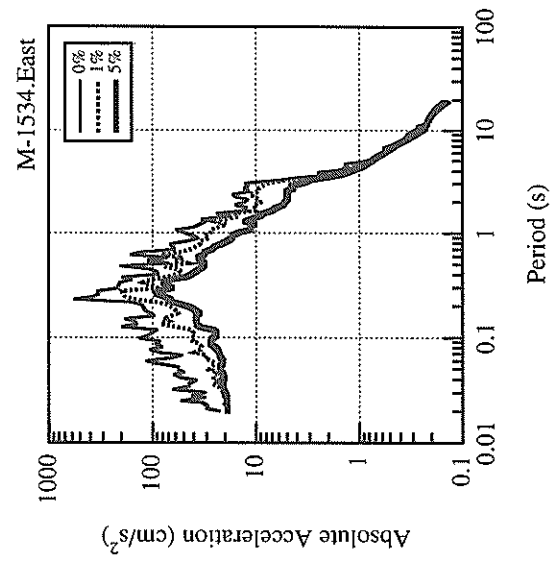
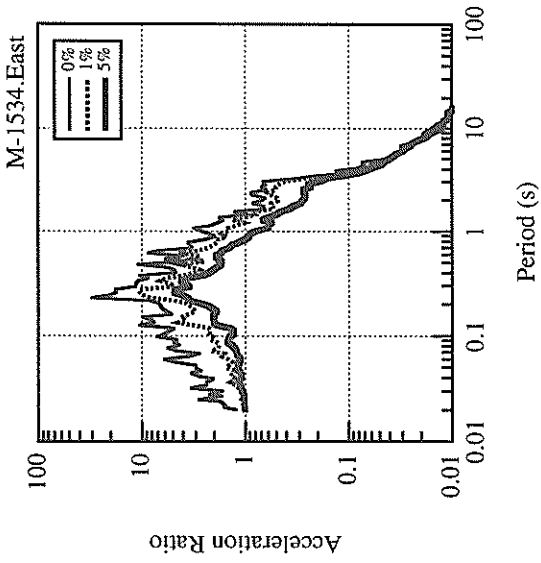
\* RESULTANT OF HORIZONTAL COMPONENTS



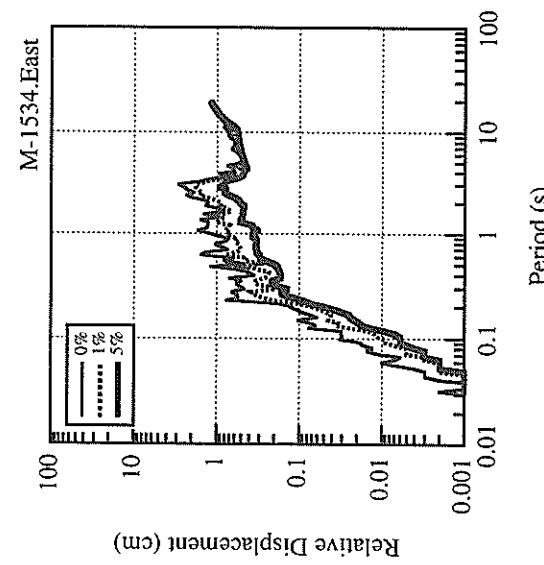
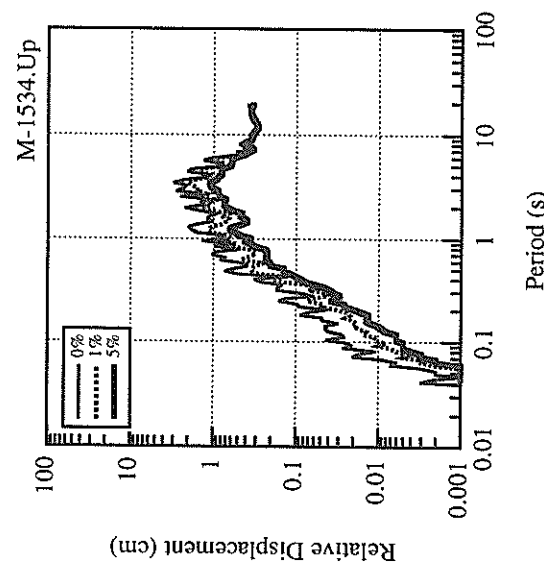
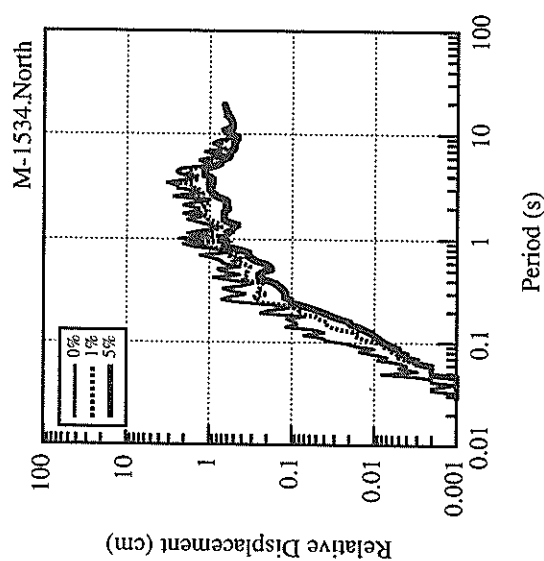
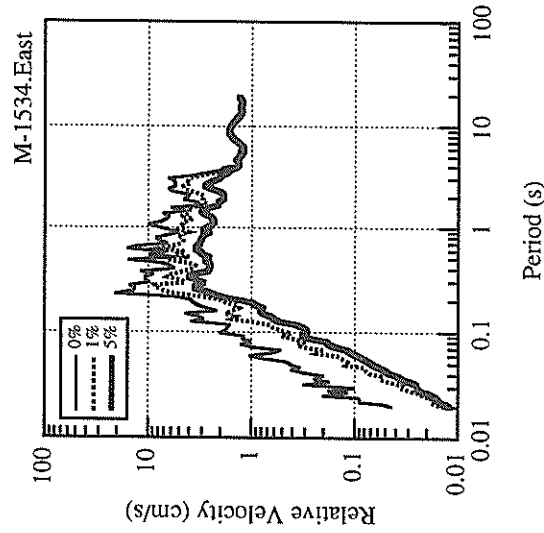
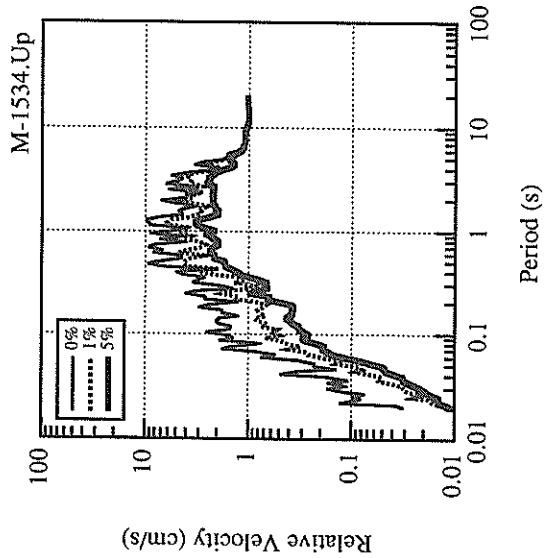
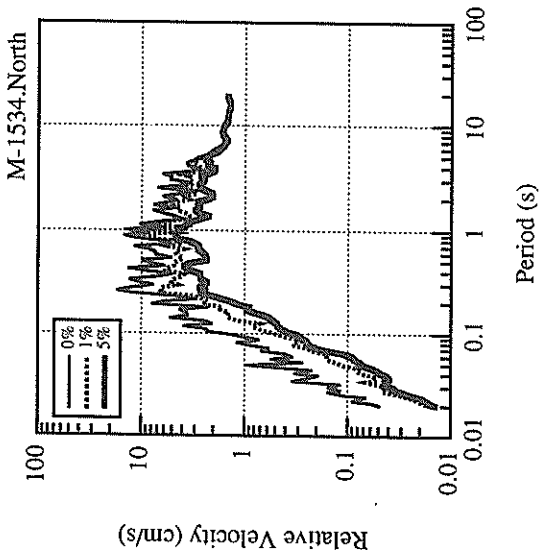


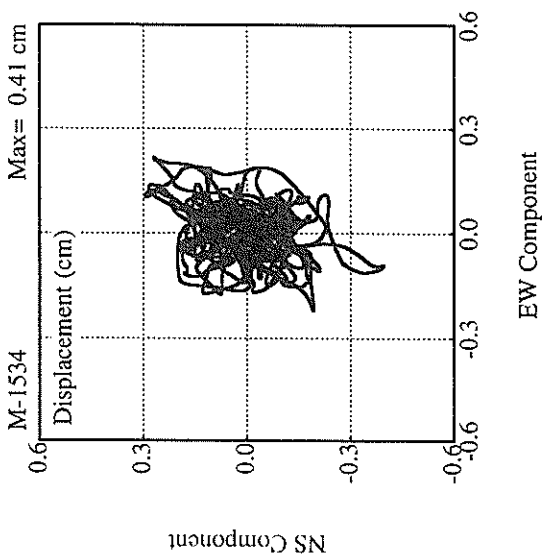
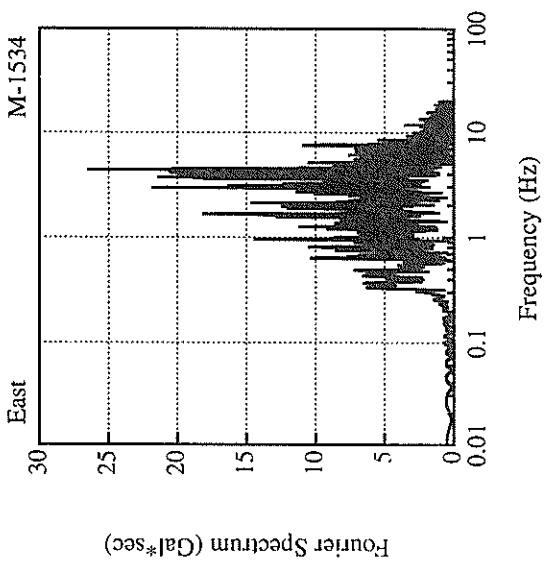
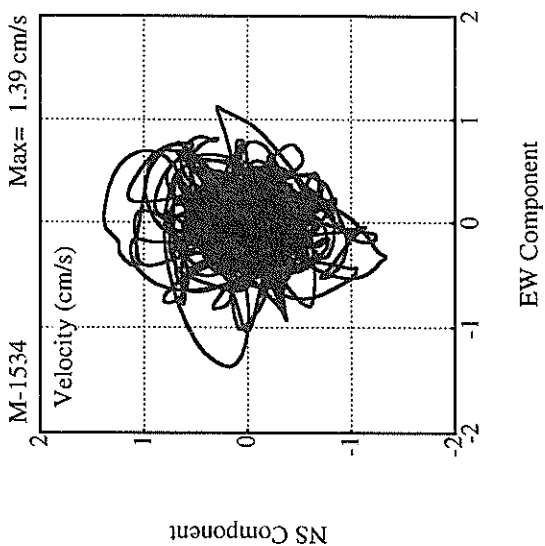
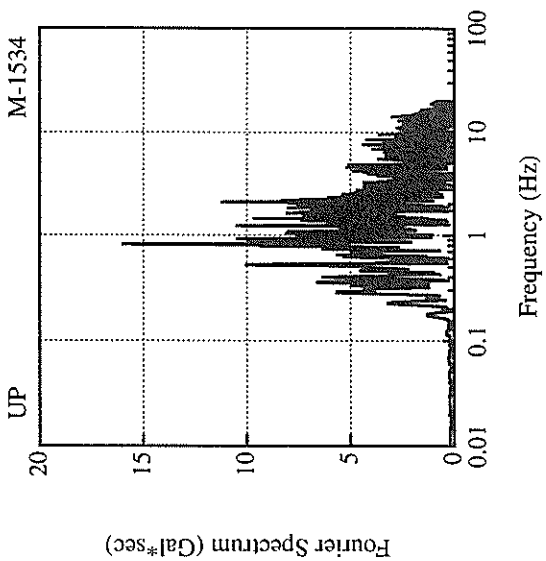
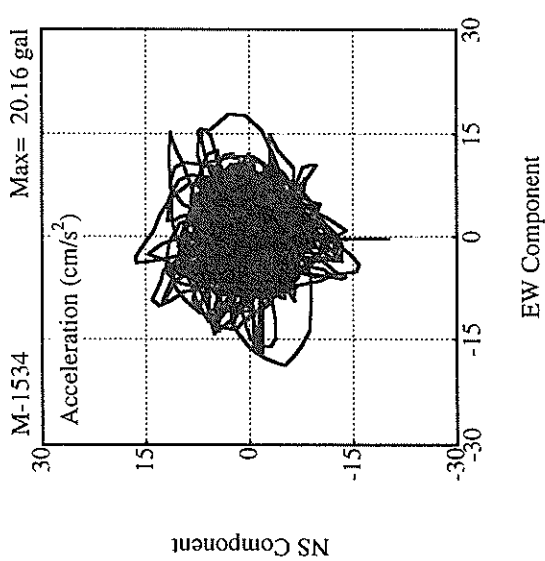
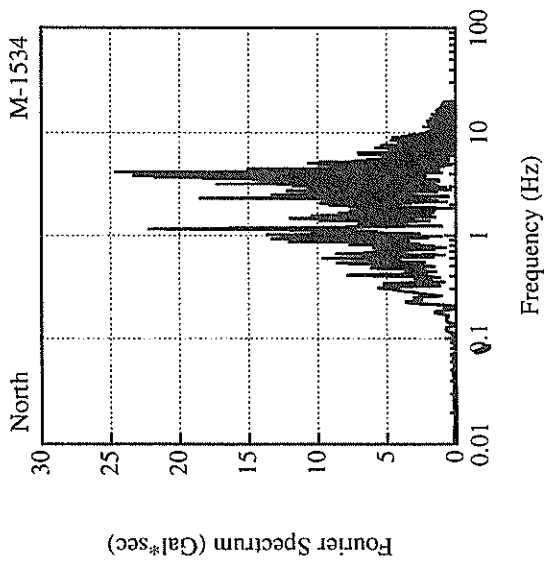












RECORD NUMBER : F-692  
 STATION : AOMORI-G

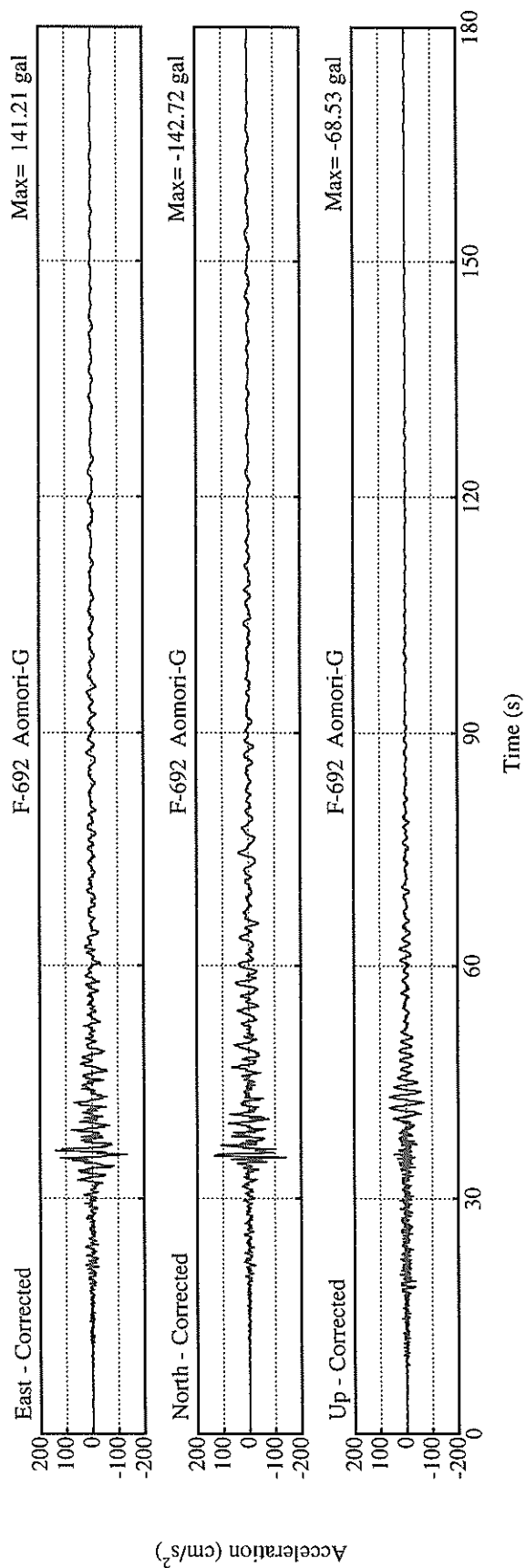
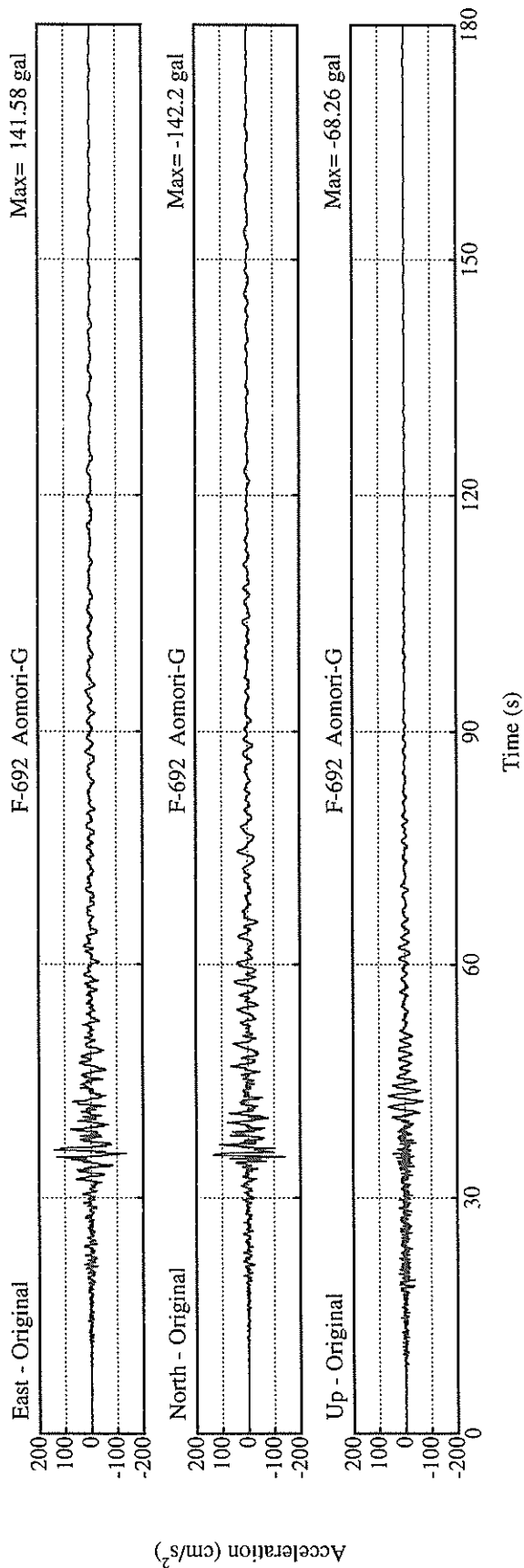
EARTHQUAKE DATA

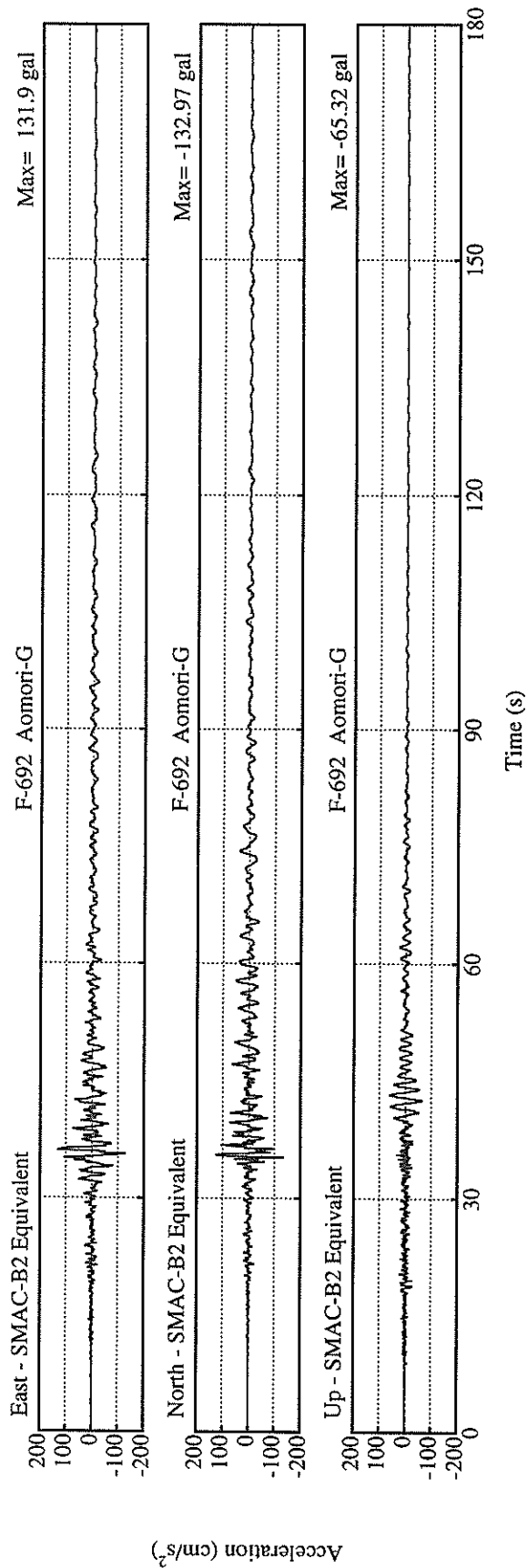
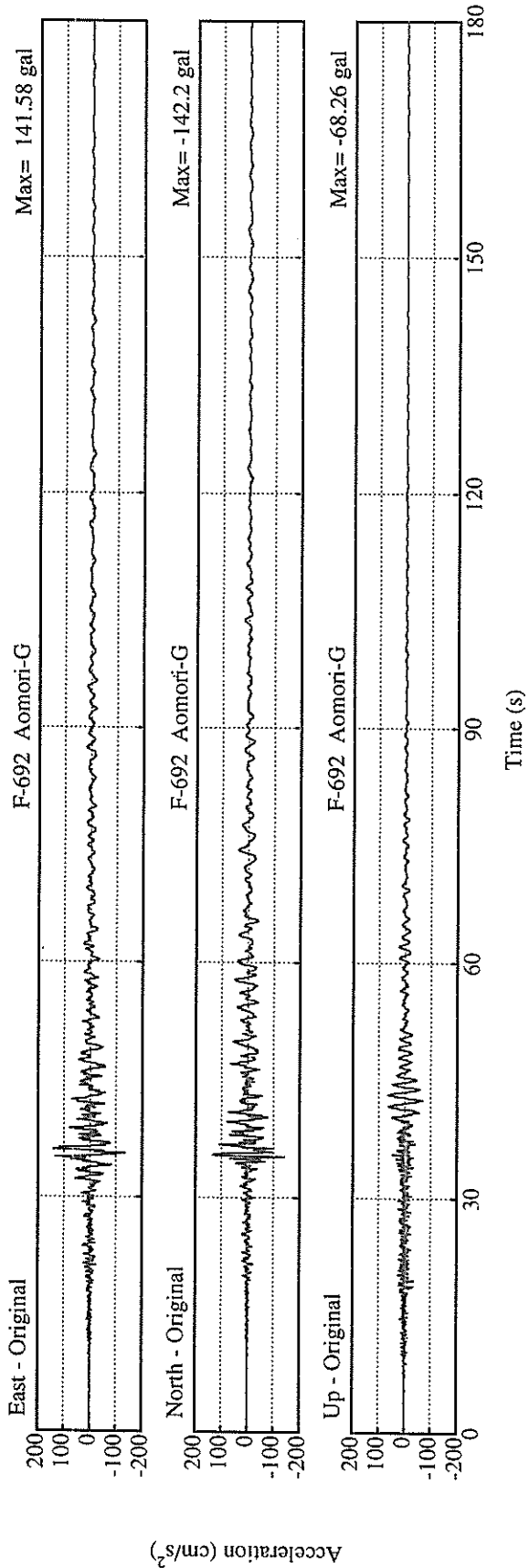
\*\*\*\*\*  
 DATE AND TIME 21:19 DEC.28,1994  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION FAR E OFF SANRIKU  
 LATITUDE 40°25.6' N  
 LONGITUDE 143°44.9' E  
 DEPTH 0.0KM  
 JMA MAGNITUDE 7.5  
 \*\*\*\*\*

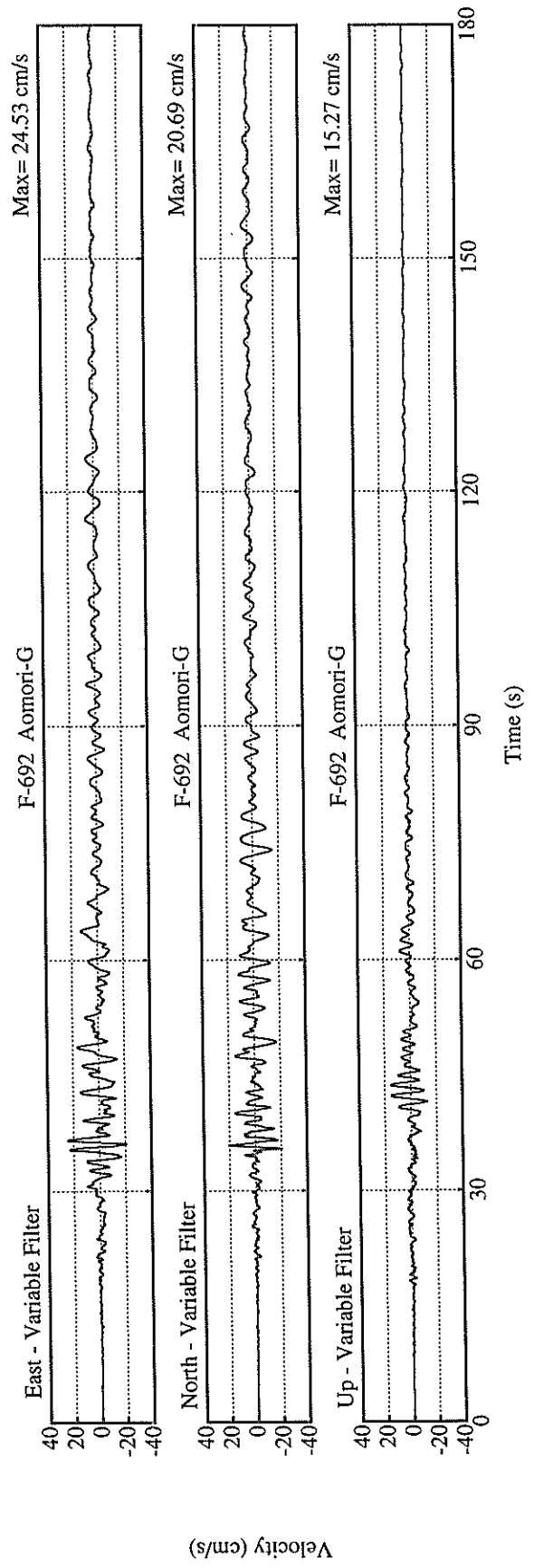
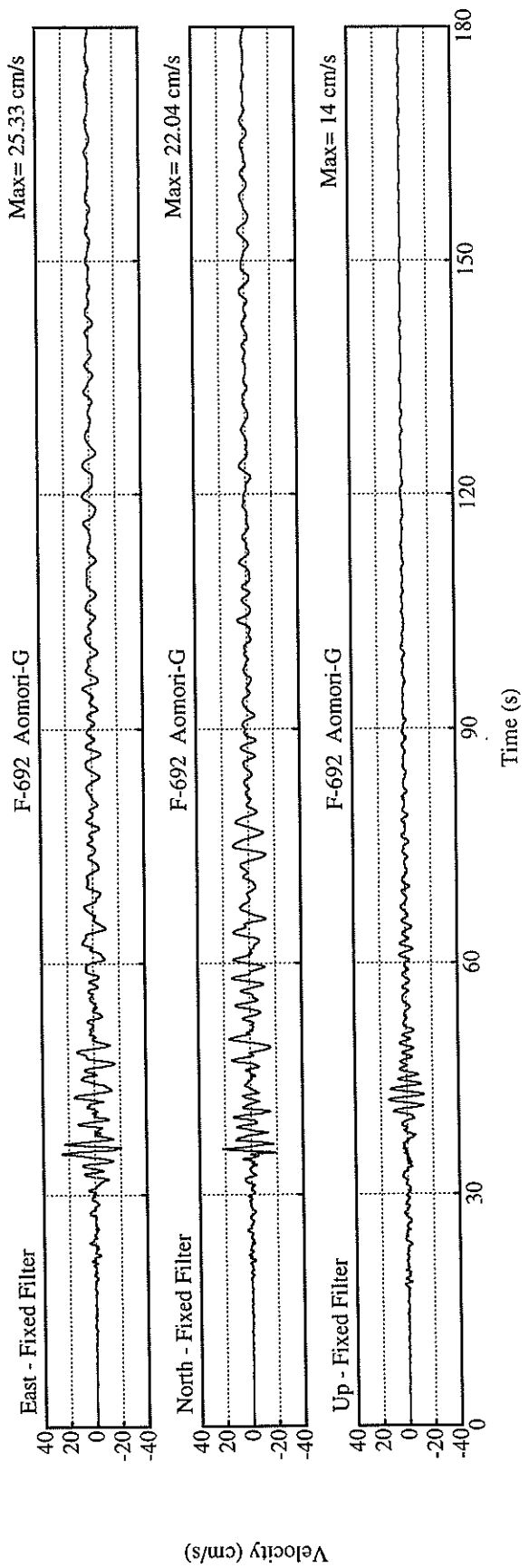
PEAK VALUES OF COMPONENTS

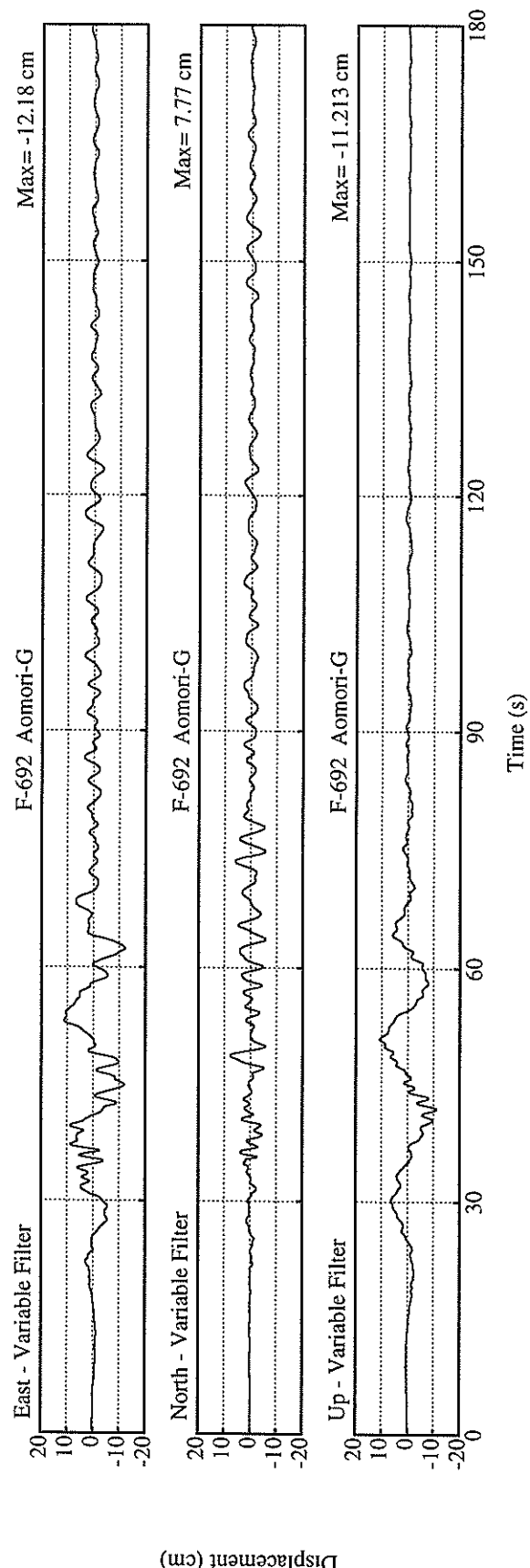
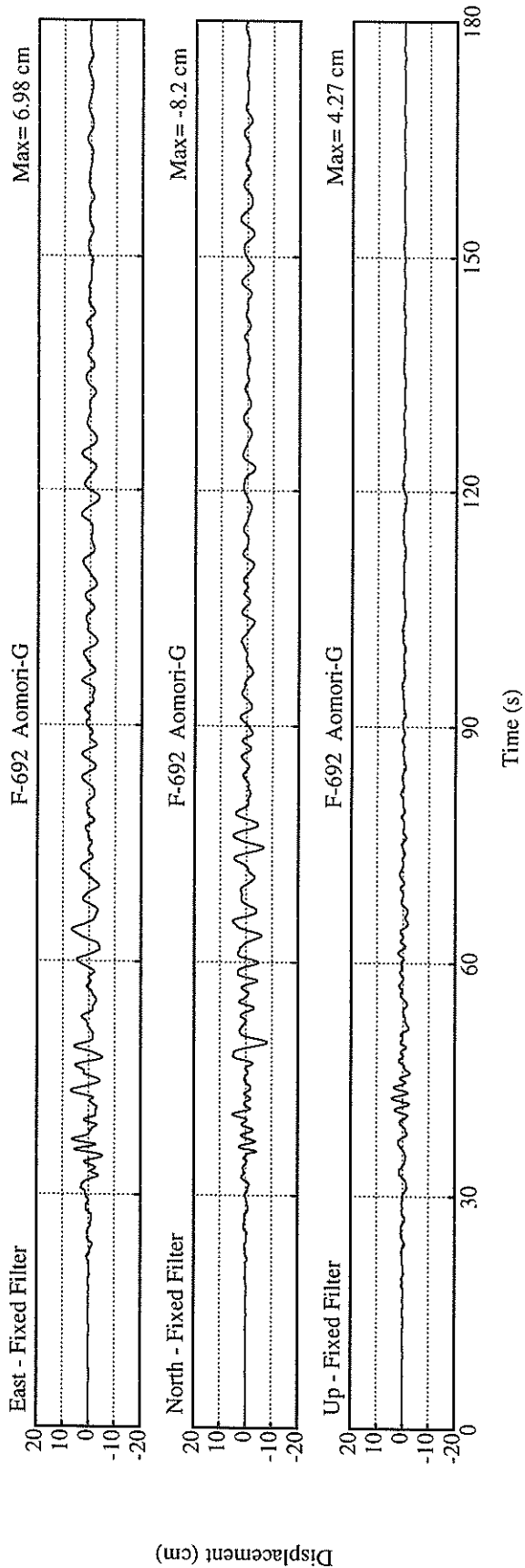
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.072	0.038	0.035	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	133.0	131.9	65.3	167.7
ORIGINAL	142.2	141.6	68.3	169.3
CORRECTED	142.7	141.2	68.5	169.4
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	22.04	25.33	14.00	29.70
VARIABLE FILTER	20.69	24.53	15.27	30.23
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	8.20	6.98	4.27	8.22
VARIABLE FILTER	7.77	12.18	11.21	12.79

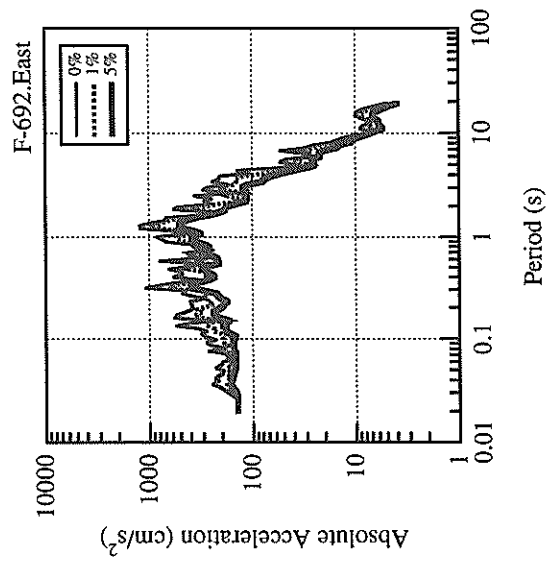
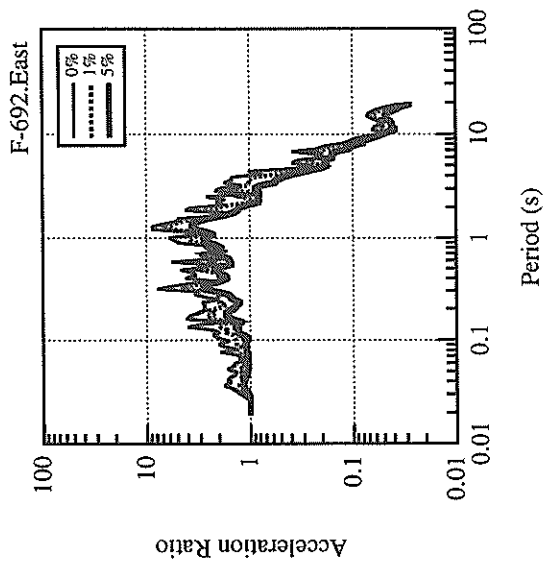
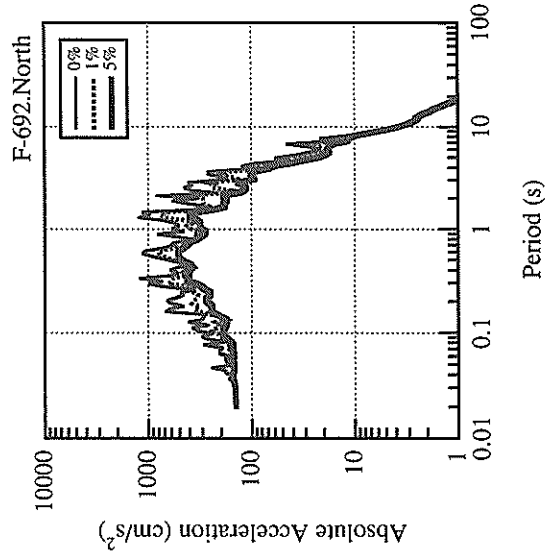
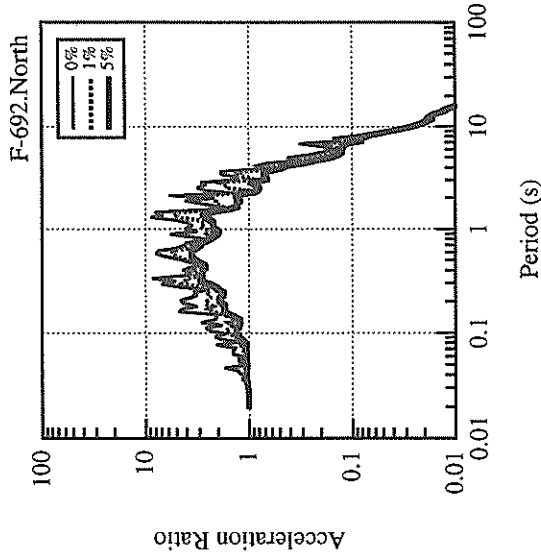
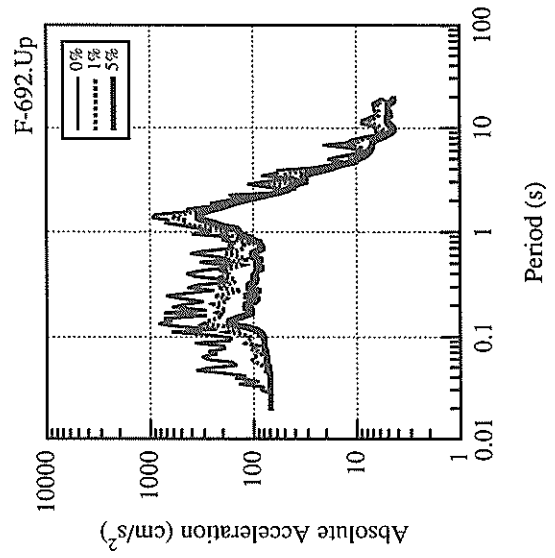
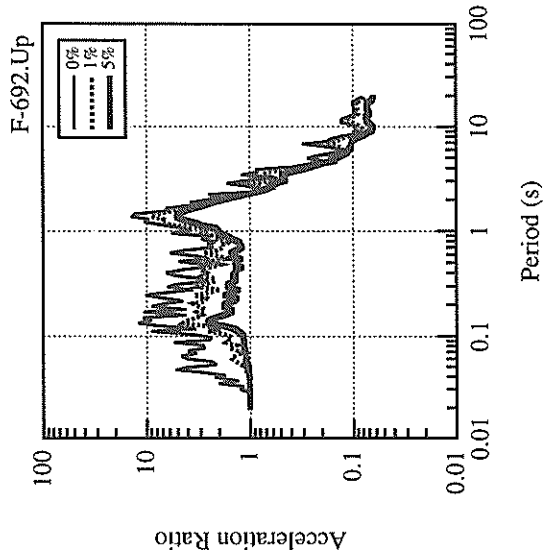
\* RESULTANT OF HORIZONTAL COMPONENTS



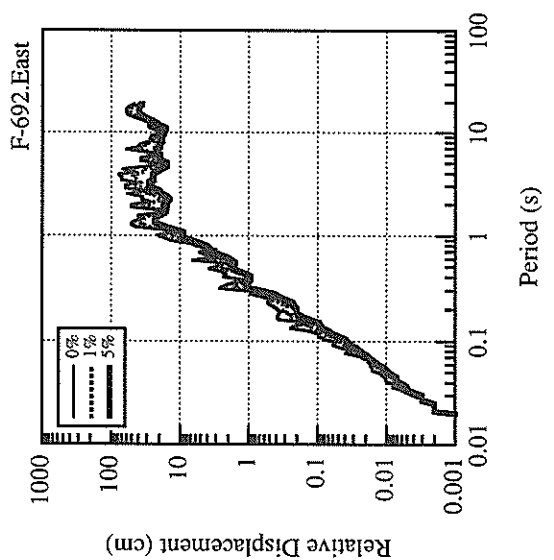
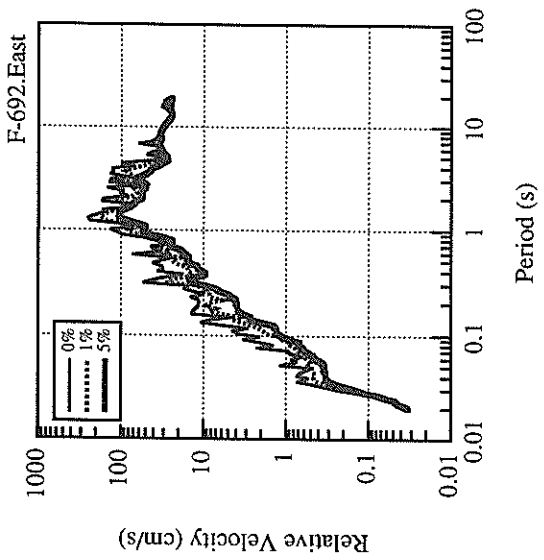
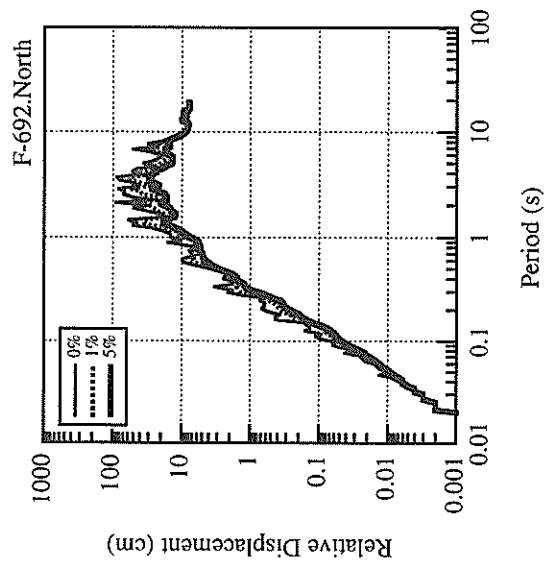
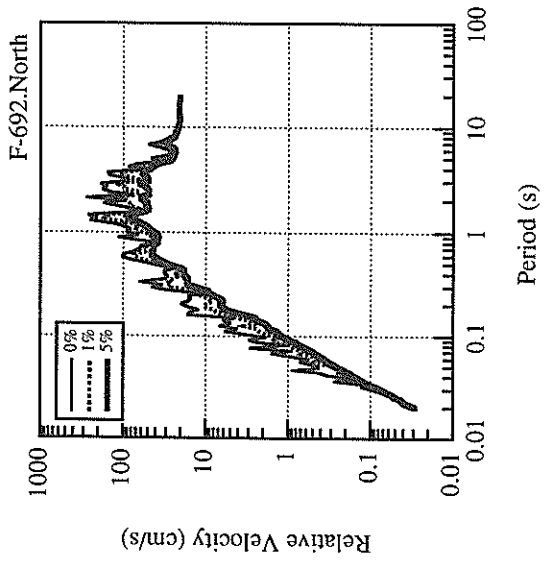
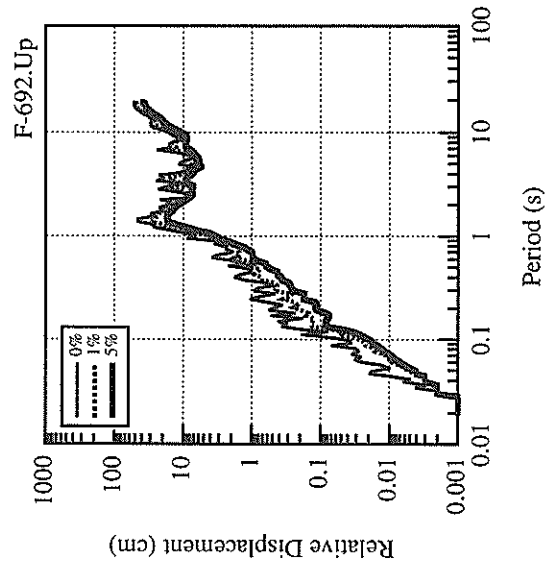
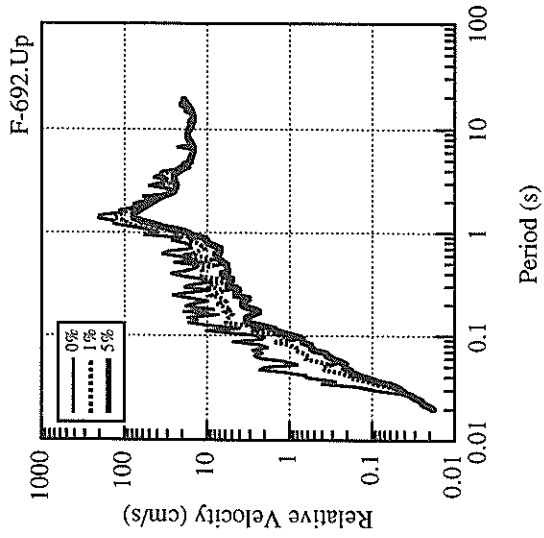


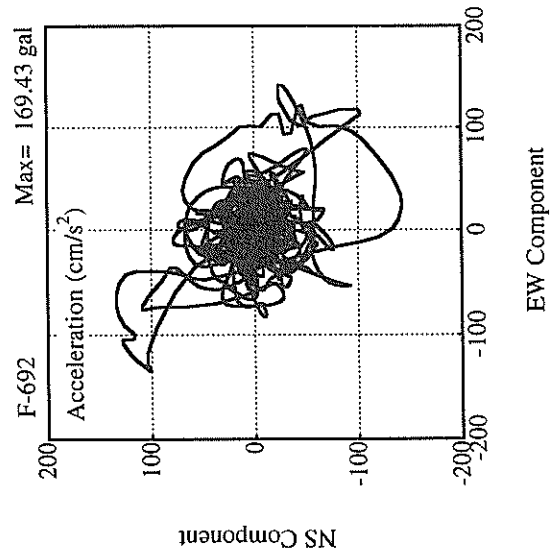
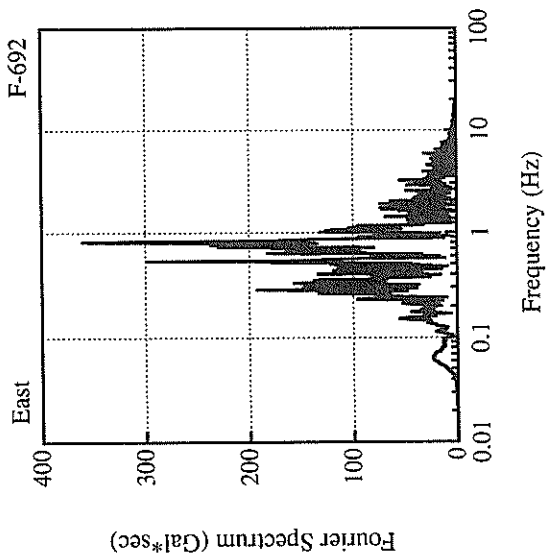
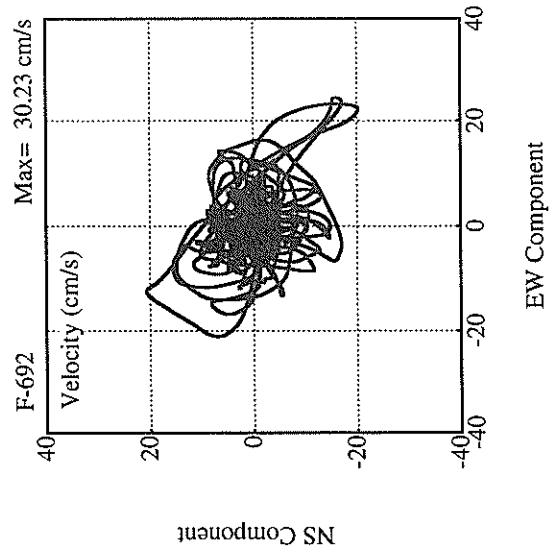
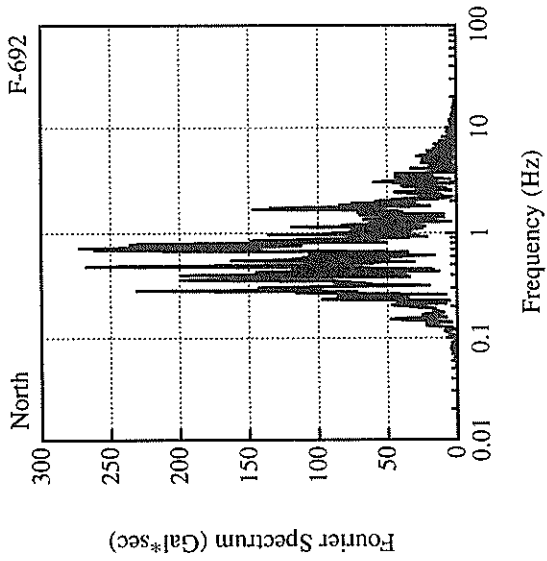
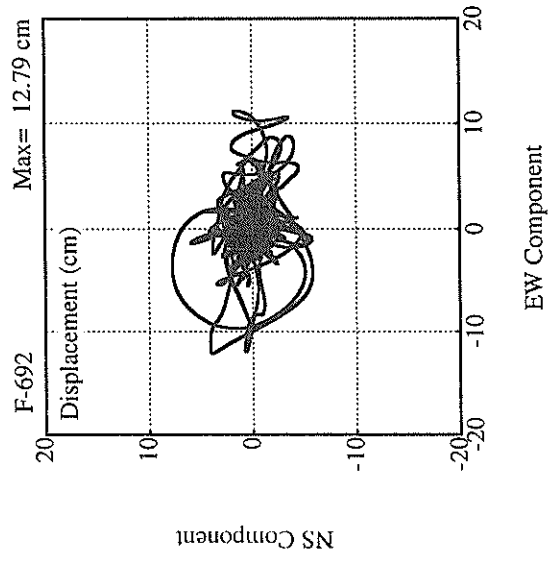
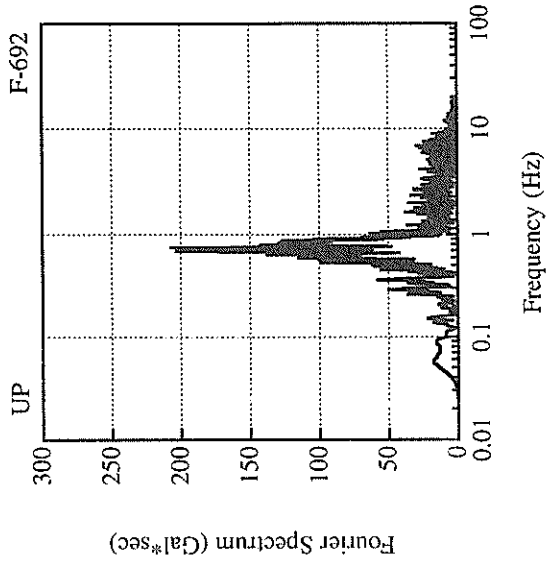












RECORD NUMBER : F-698  
 STATION : KUSHIRO-G

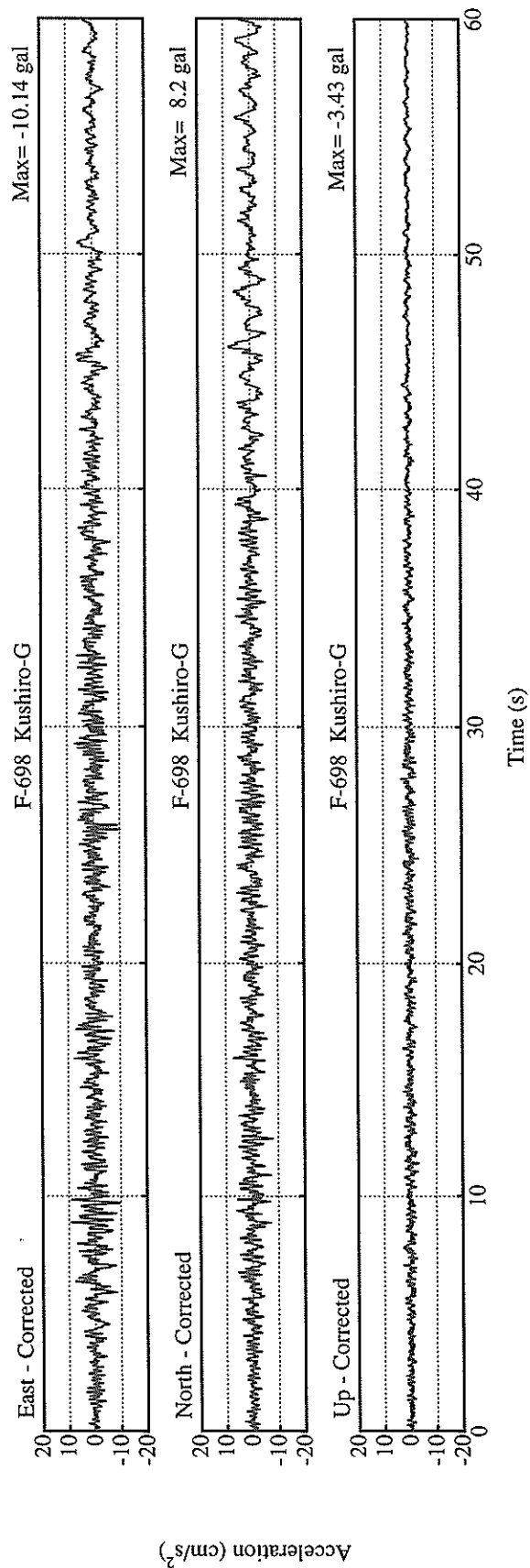
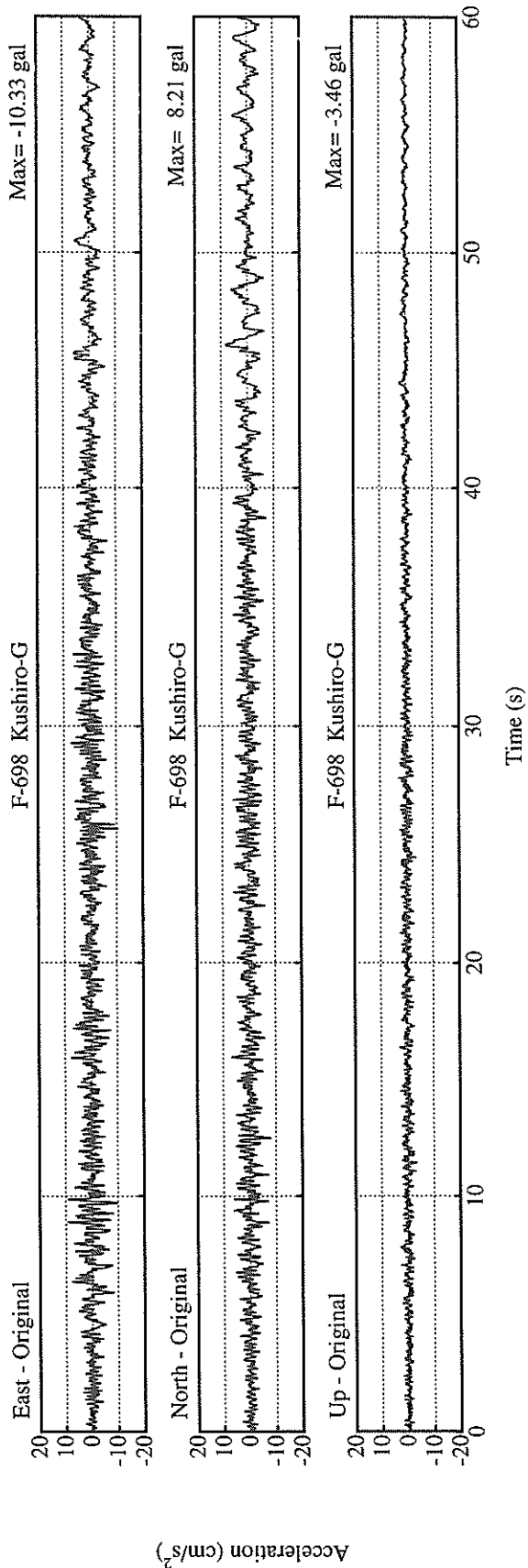
EARTHQUAKE DATA

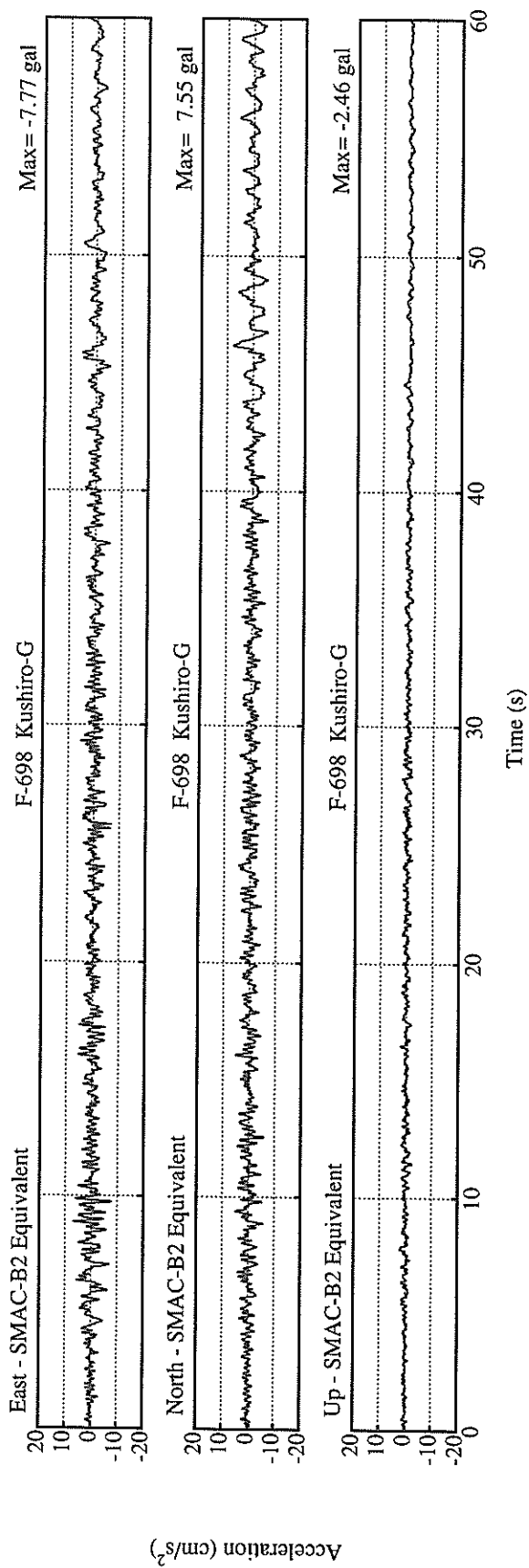
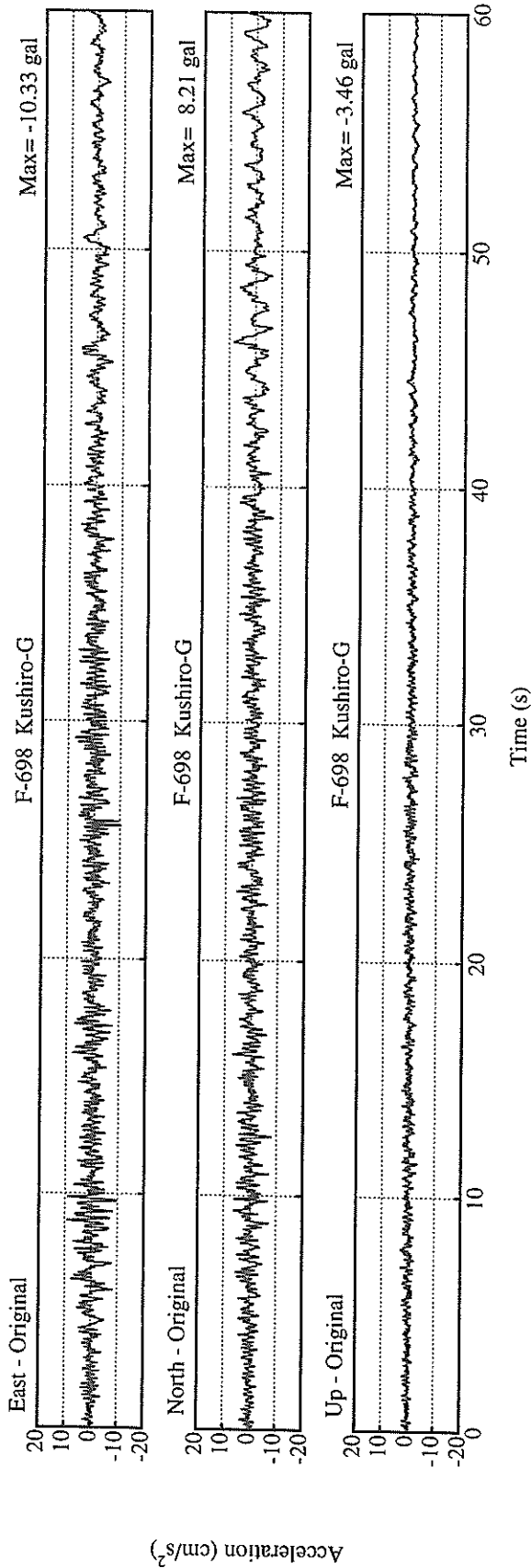
\*\*\*\*\*  
 DATE AND TIME 21:19 DEC.28,1994  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION FAR E OFF SANRIKU  
 LATITUDE 40° 25.6' N  
 LONGITUDE 143° 44.9' E  
 DEPTH 0.0KM  
 JMA MAGNITUDE 7.5  
 \*\*\*\*\*

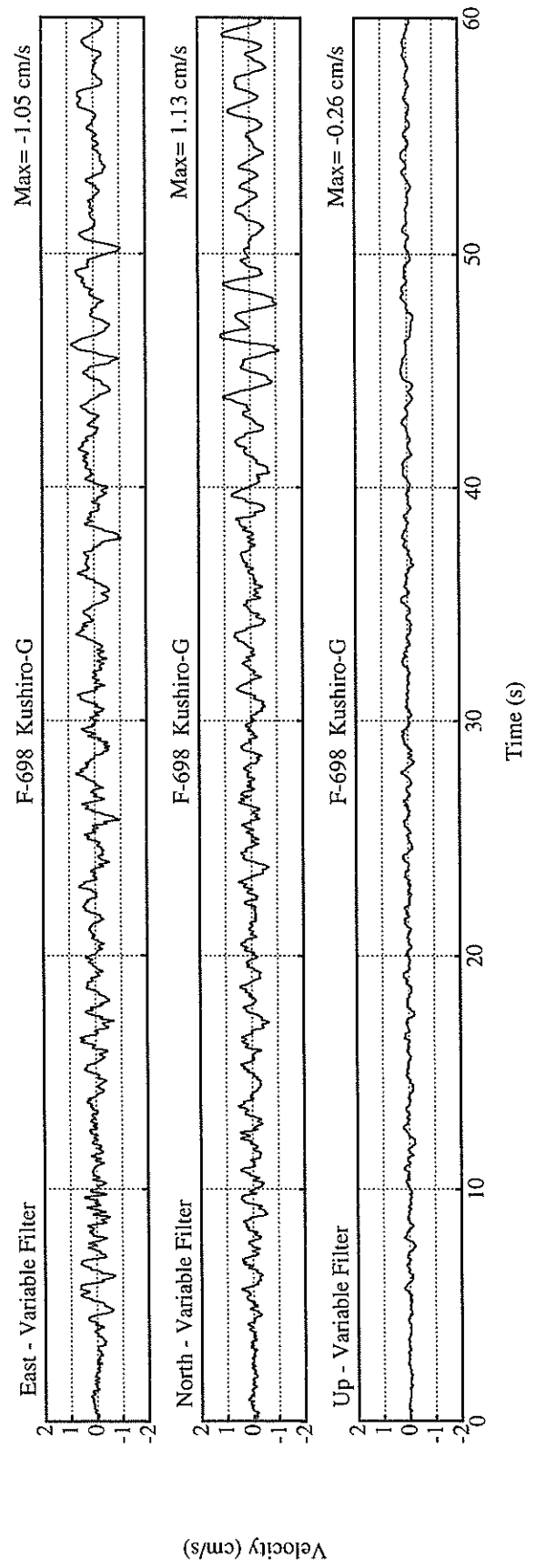
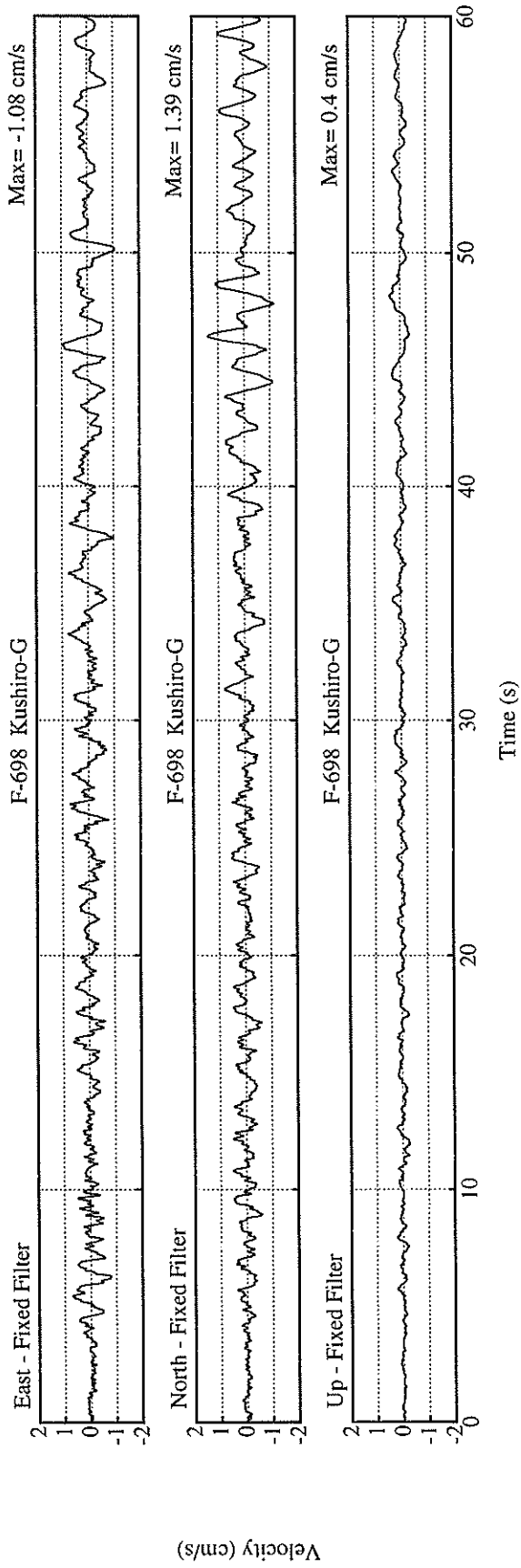
PEAK VALUES OF COMPONENTS

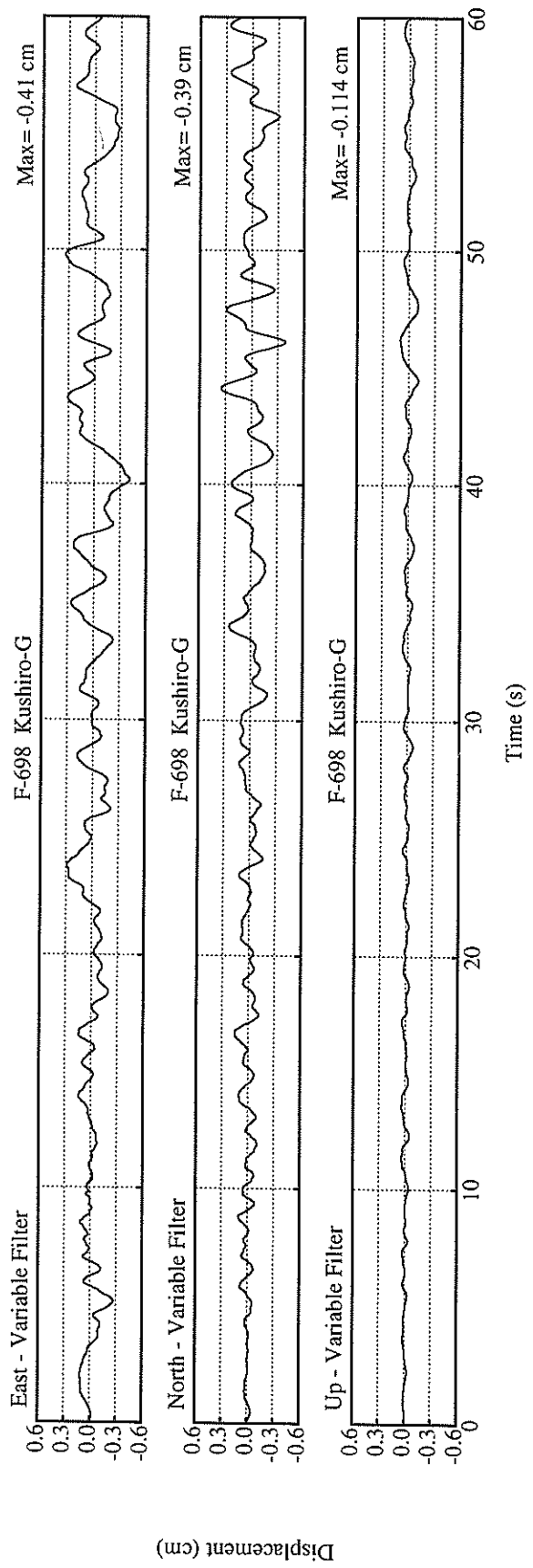
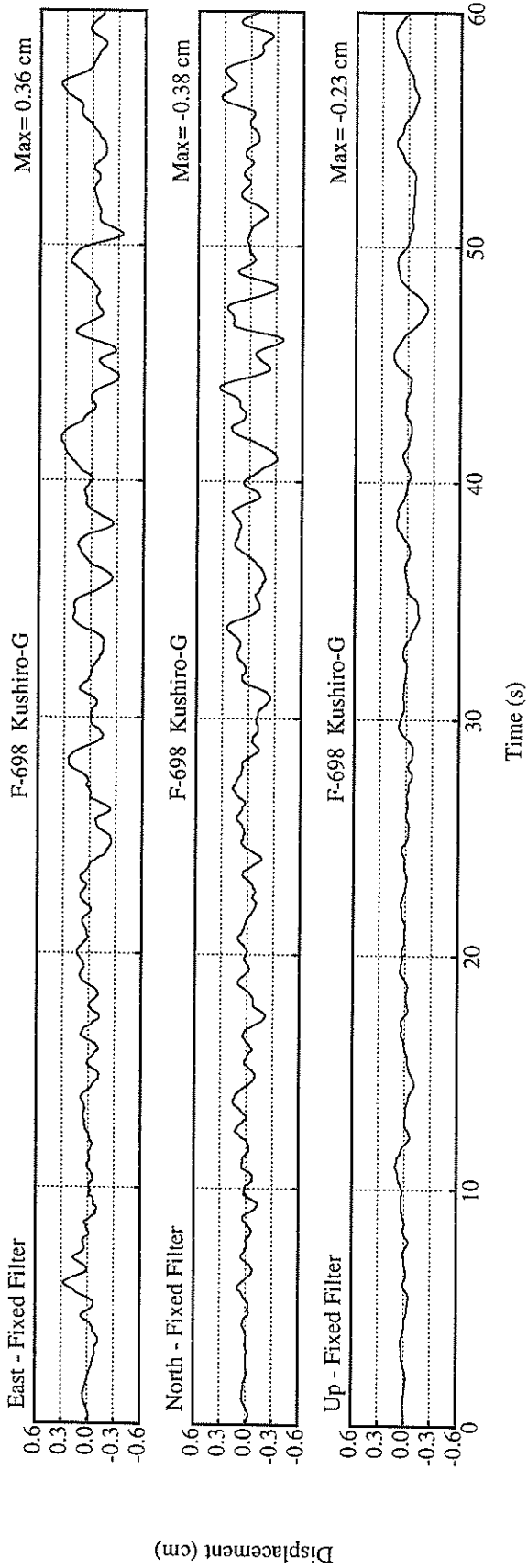
	N S	E.W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.146	0.103	0.225	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	7.6	7.8	2.5	8.4
ORIGINAL	8.2	10.3	3.5	10.6
CORRECTED	8.2	10.1	3.4	10.7
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	1.39	1.08	0.40	1.39
VARIABLE FILTER	1.13	1.05	0.26	1.24
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.38	0.36	0.23	0.43
VARIABLE FILTER	0.39	0.41	0.11	0.46

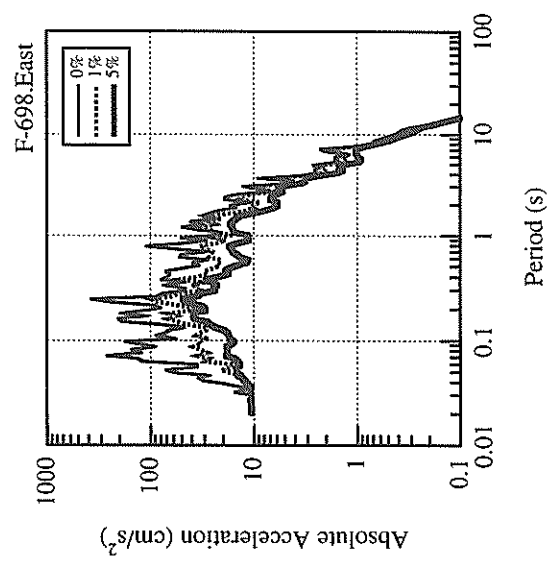
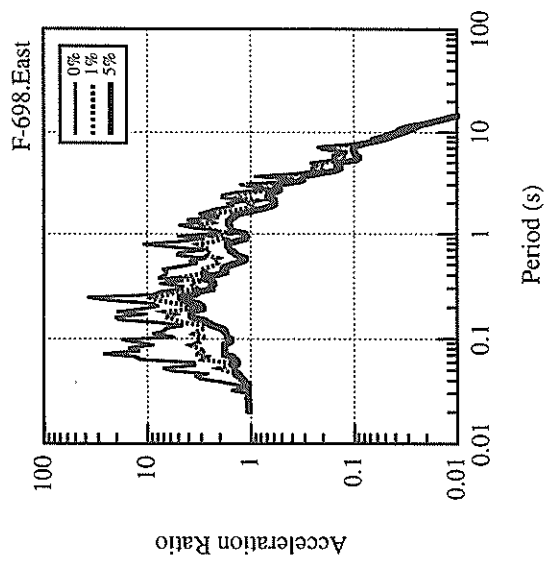
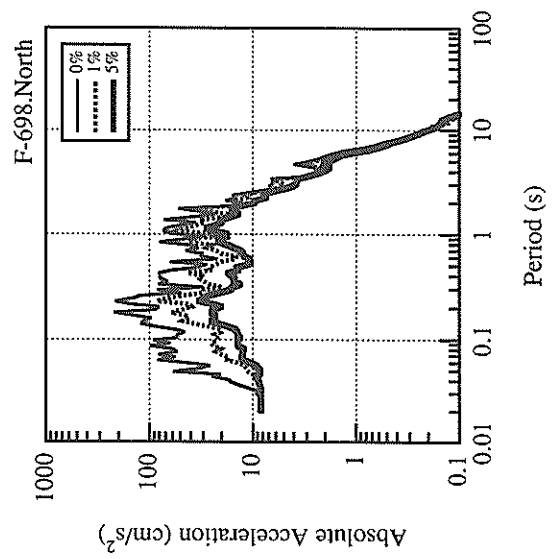
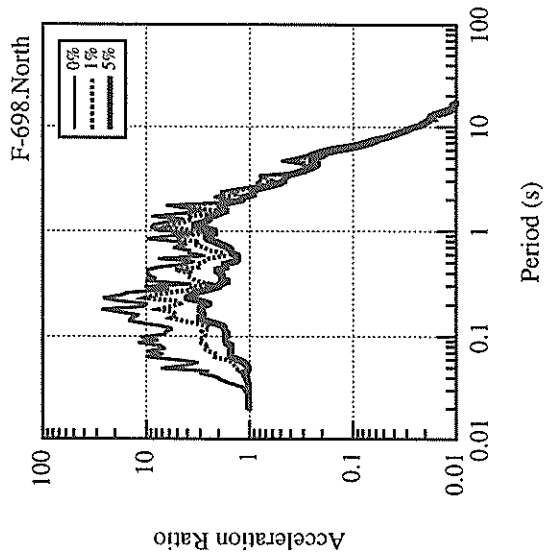
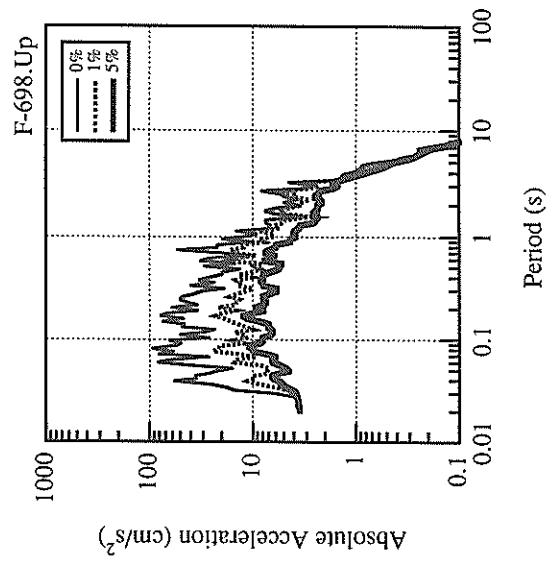
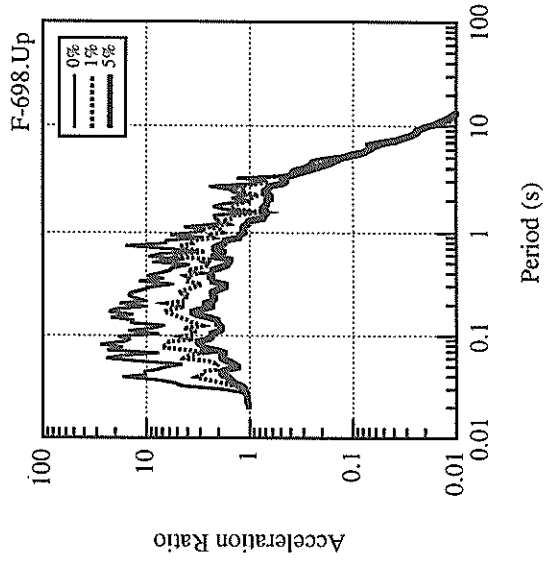
\* RESULTANT OF HORIZONTAL COMPONENTS



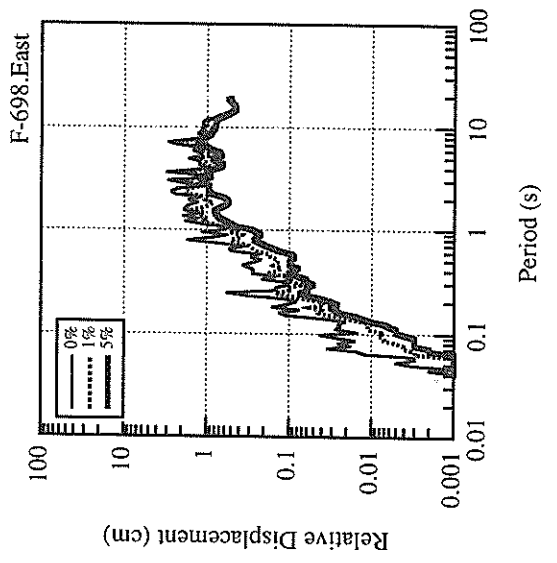
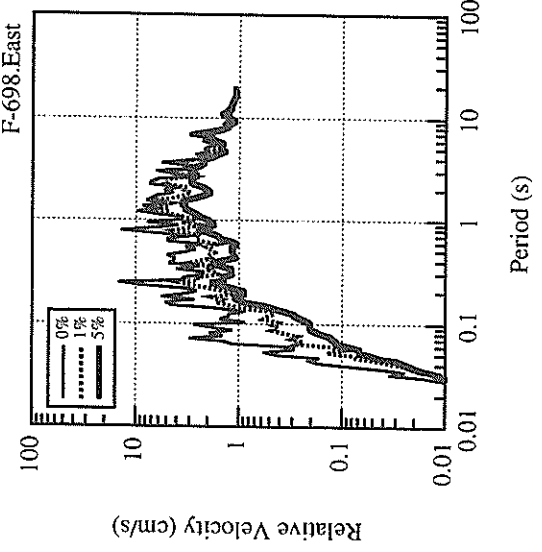
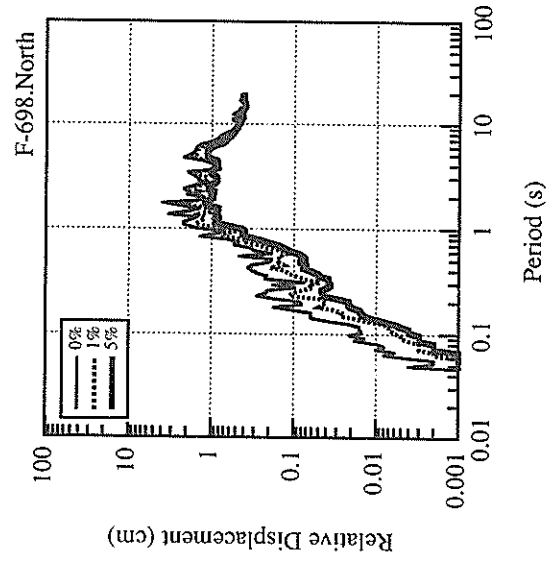
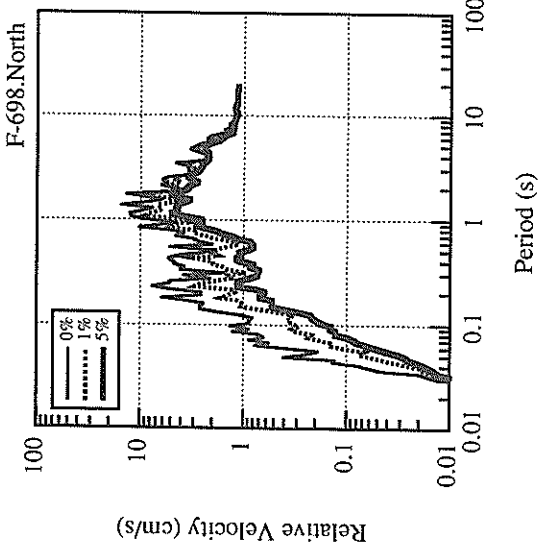
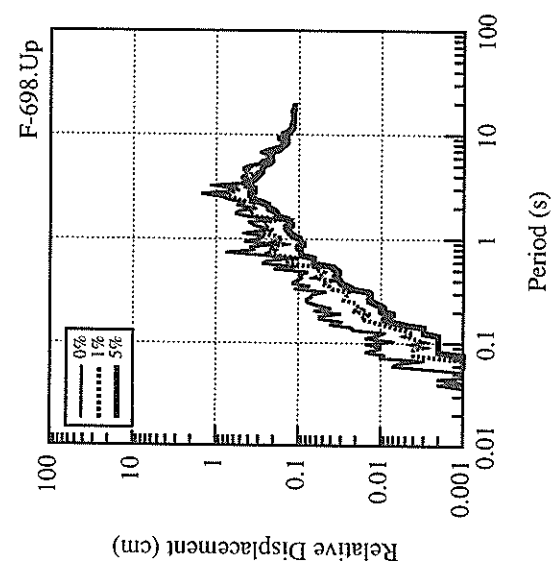
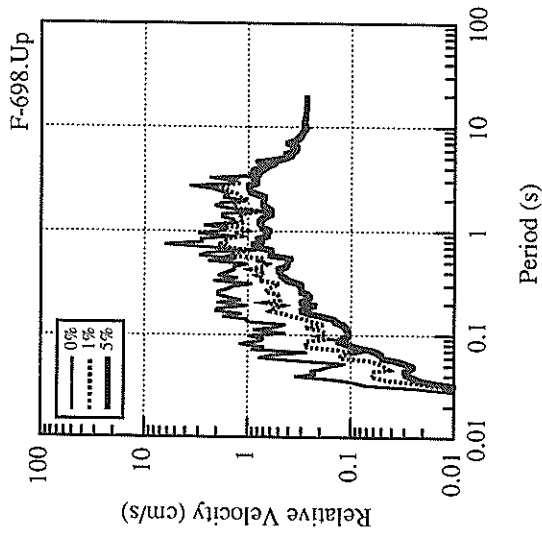


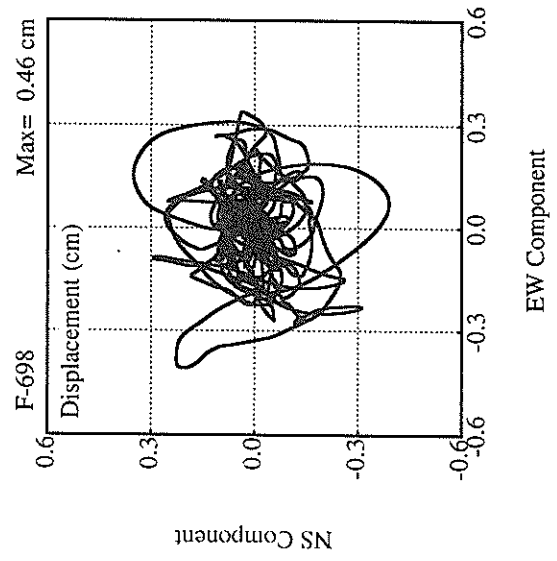
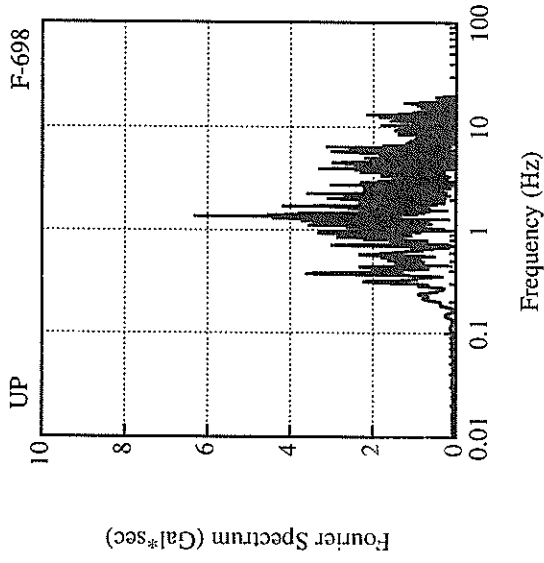
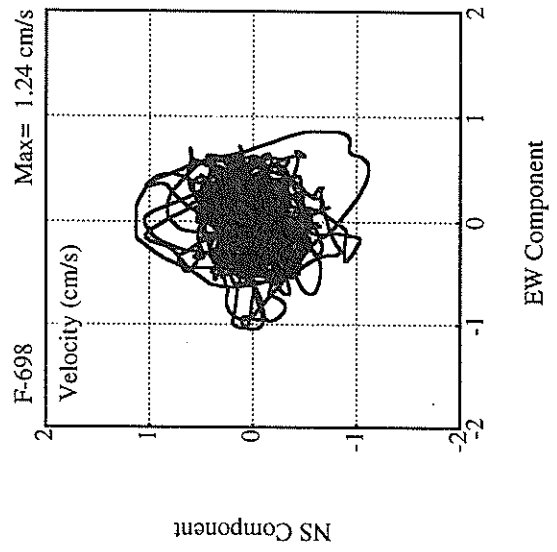
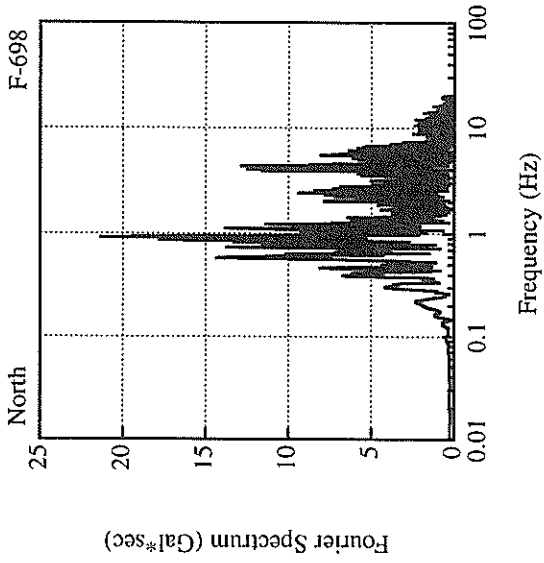
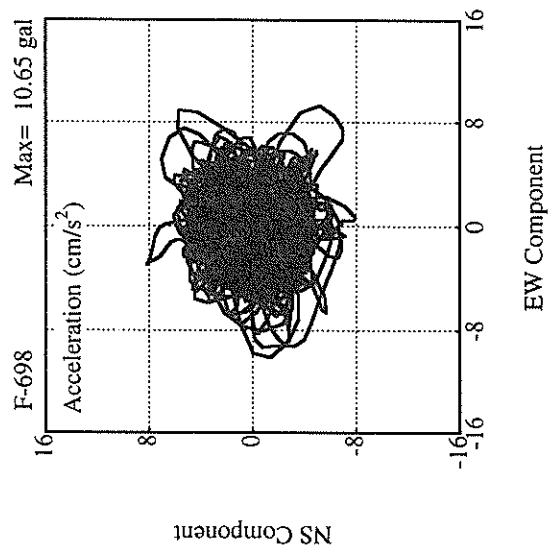
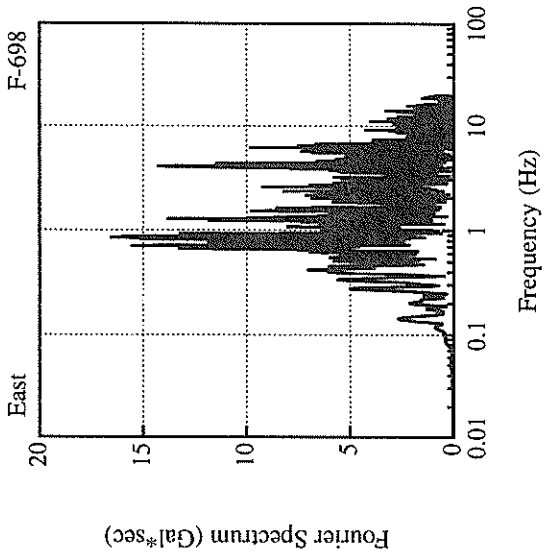












RECORD NUMBER : F-697  
 STATION : KUSHIRO-GB

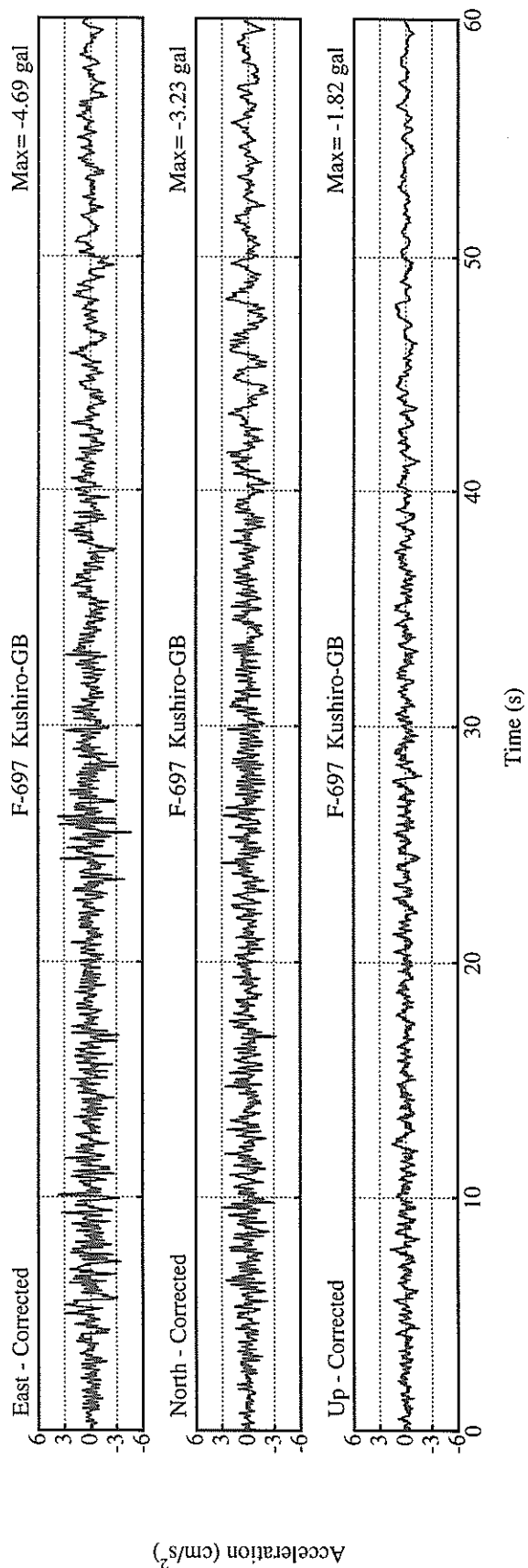
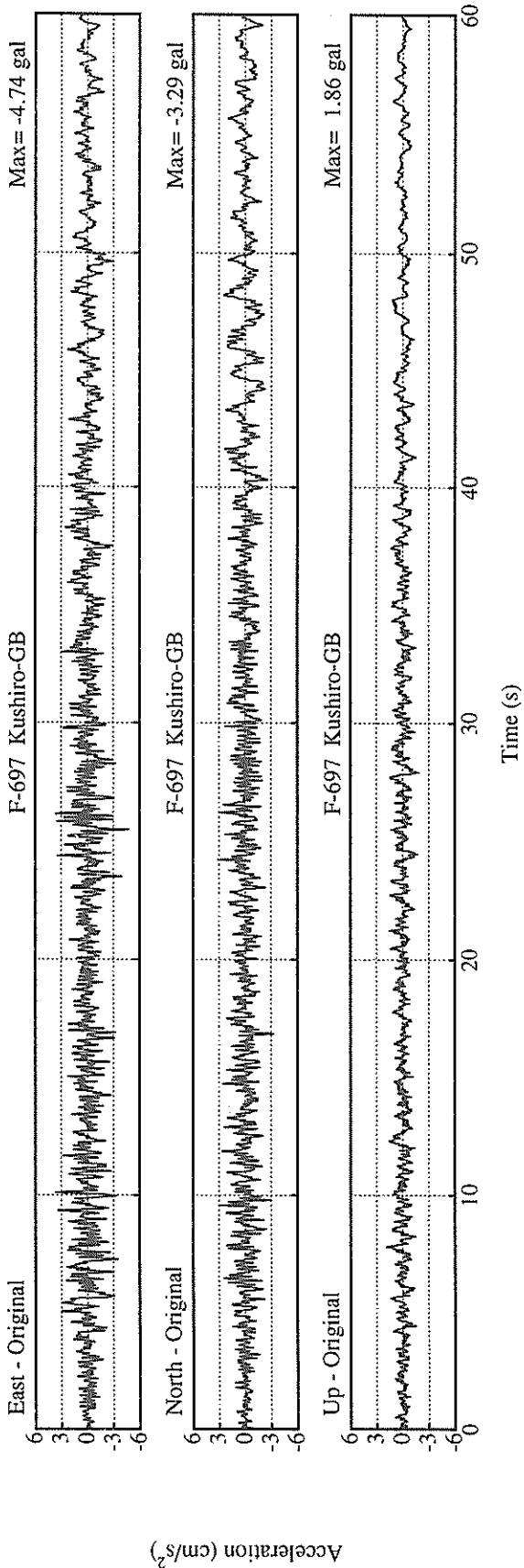
EARTHQUAKE DATA

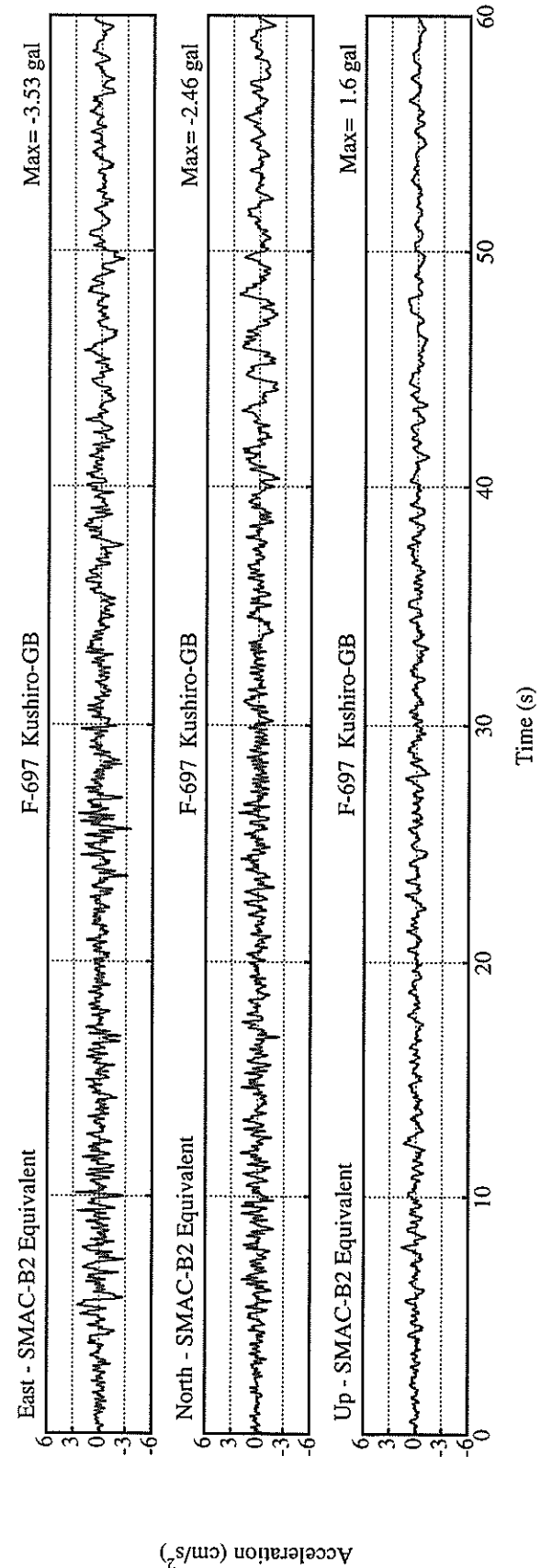
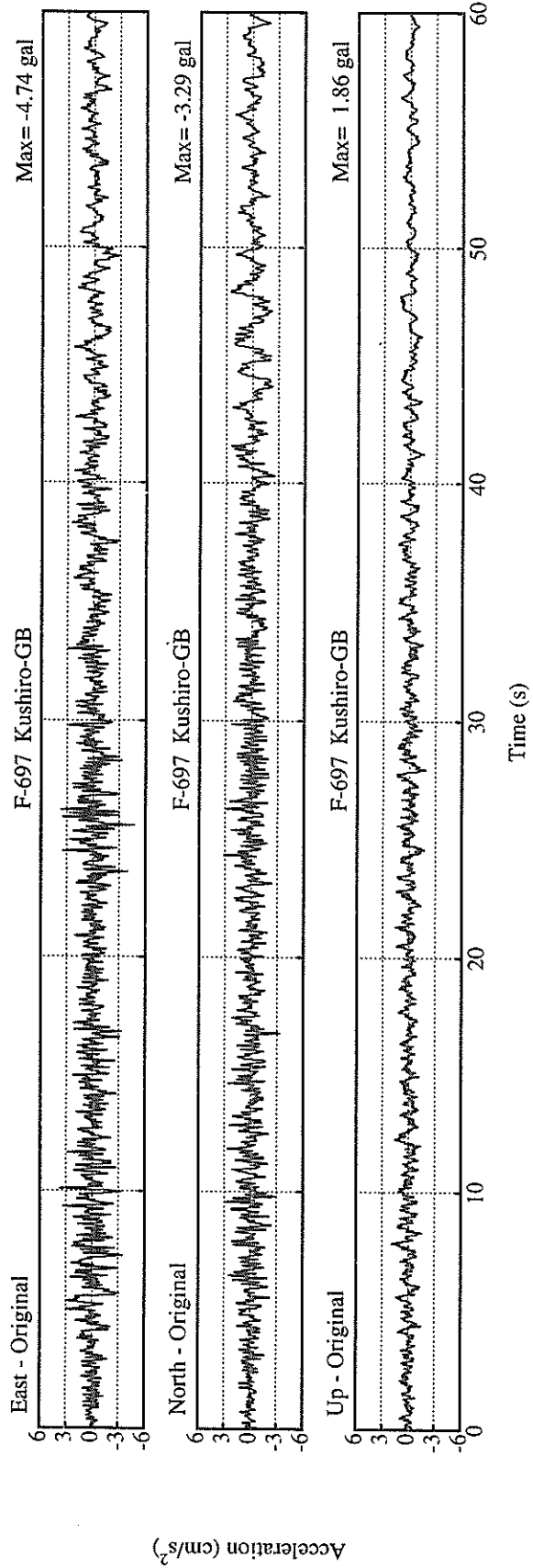
```
*****
DATE AND TIME                21:19 DEC.28,1994
LOCATION OF HYPOCENTER
  EPICENTRAL REGION          FAR E OFF SANRIKU
  LATITUDE                   40°25.6' N
  LONGITUDE                  143°44.9' E
  DEPTH                      0.0KM
  JMA MAGNITUDE              7.5
*****
```

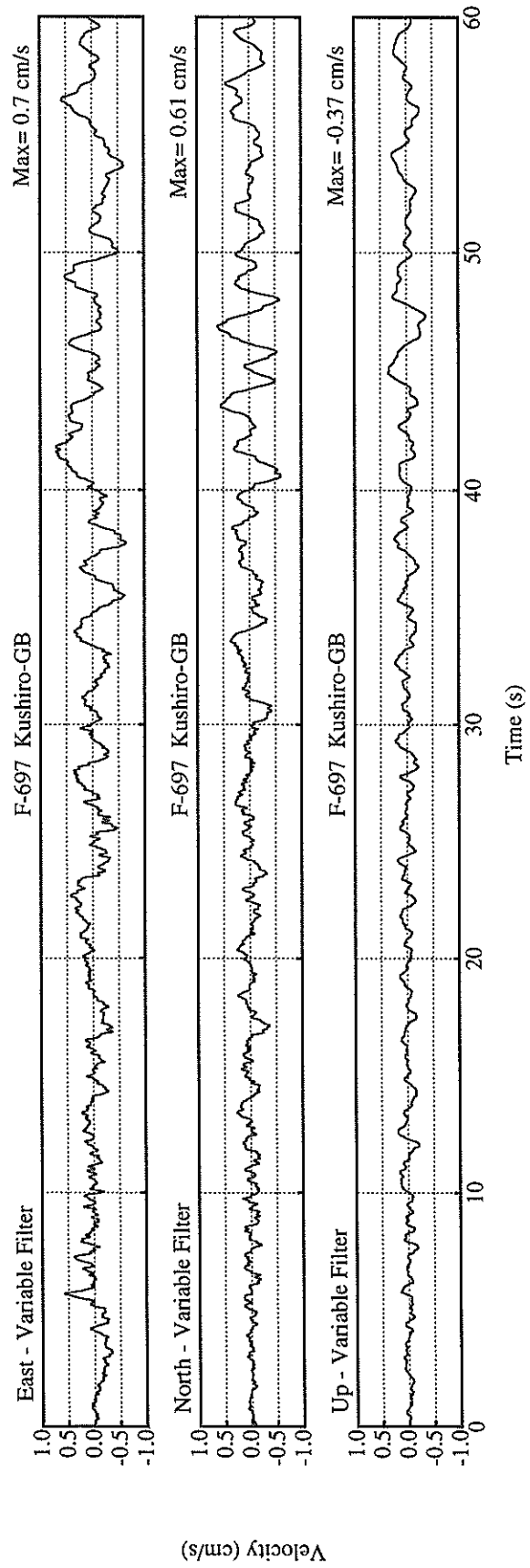
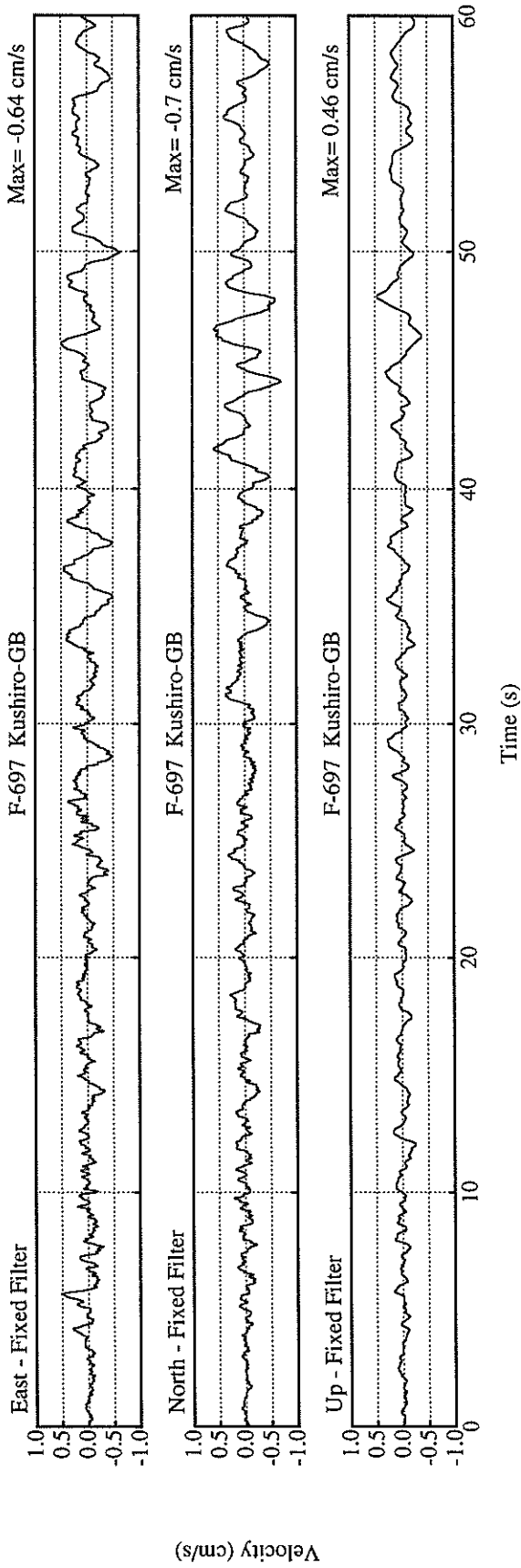
PEAK VALUES OF COMPONENTS

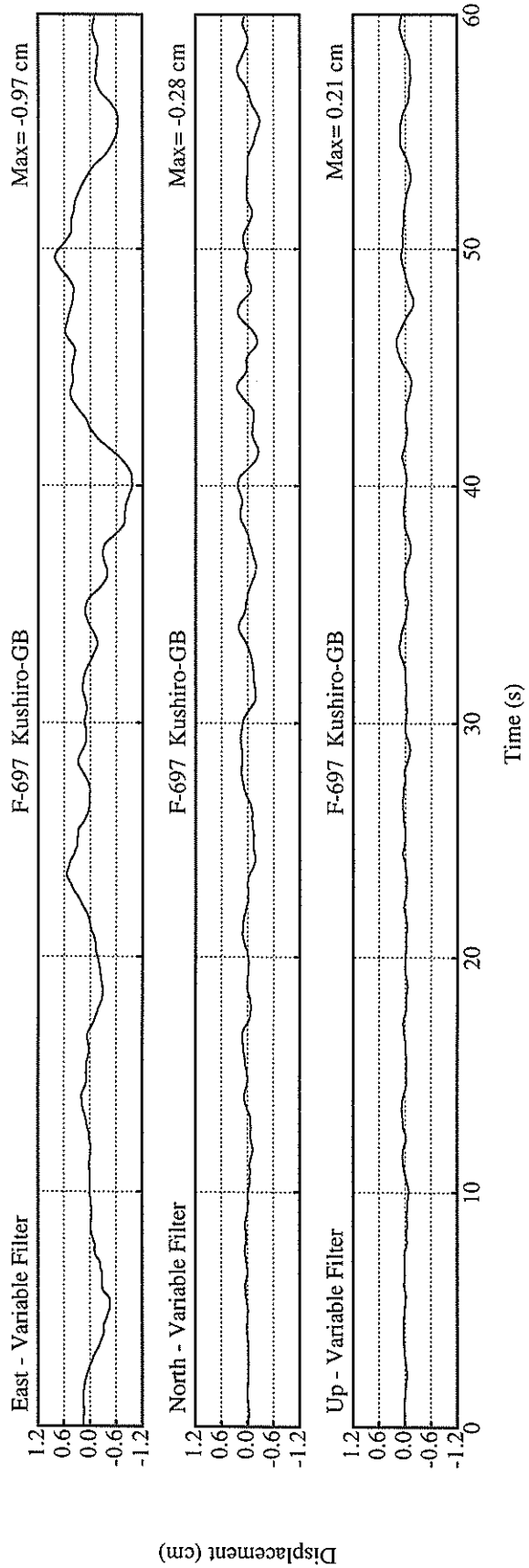
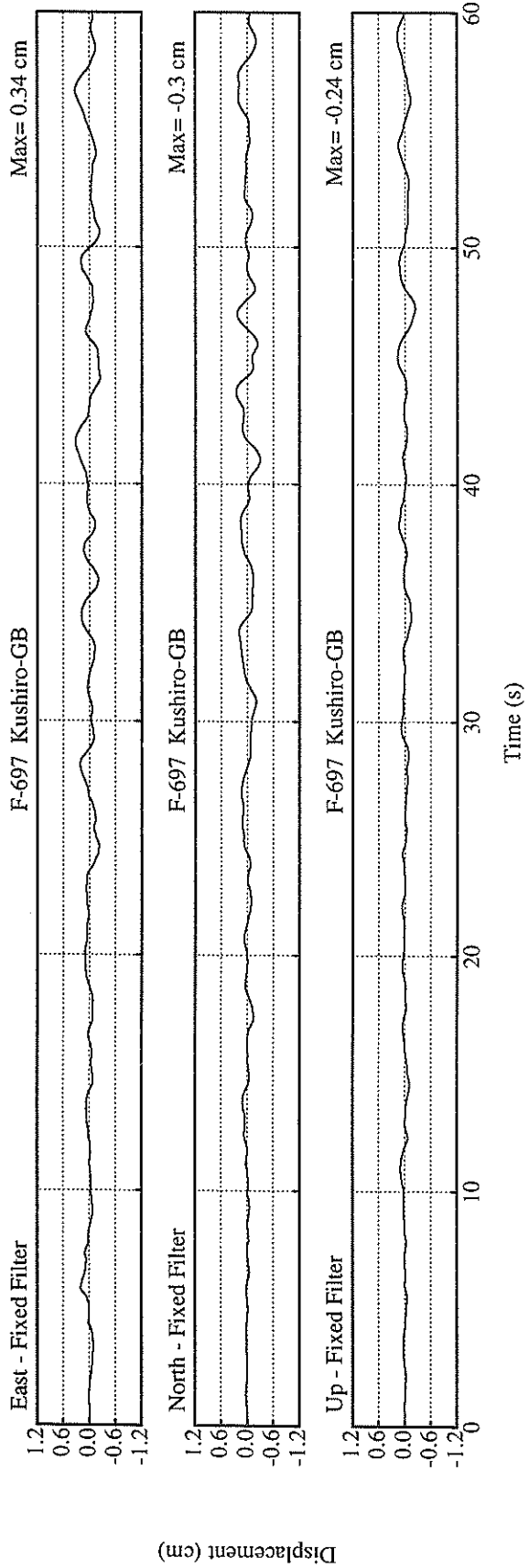
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.103	0.048	0.127	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	2.5	3.5	1.6	3.6
ORIGINAL	3.3	4.7	1.9	4.8
CORRECTED	3.2	4.7	1.8	4.8
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	0.70	0.64	0.46	0.70
VARIABLE FILTER	0.61	0.70	0.37	0.75
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.30	0.34	0.24	0.39
VARIABLE FILTER	0.28	0.97	0.21	0.99

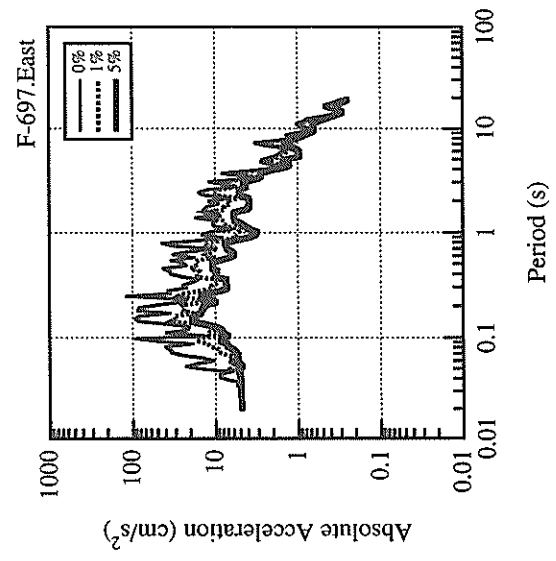
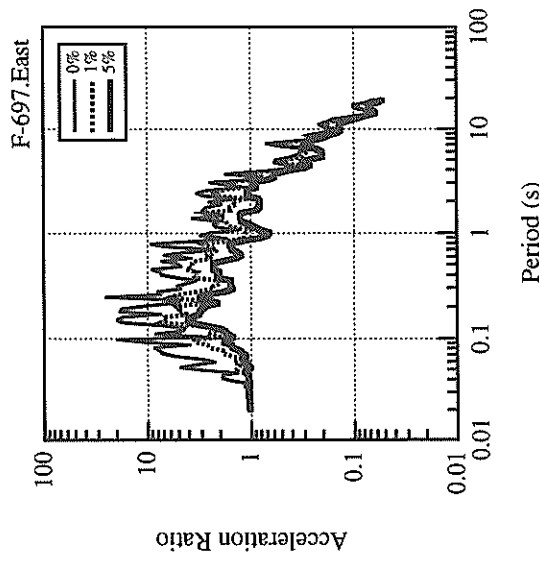
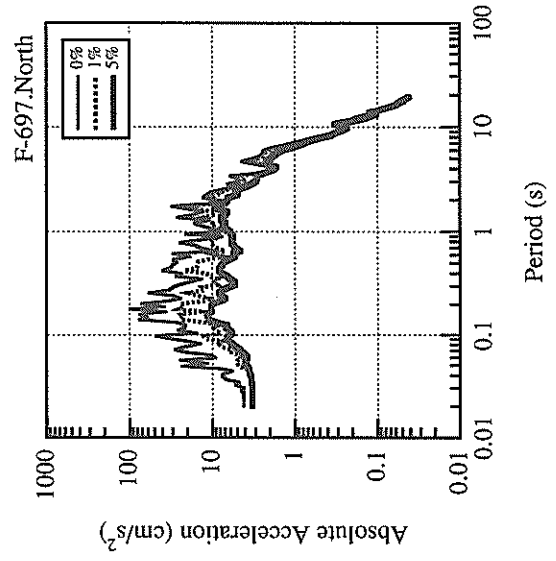
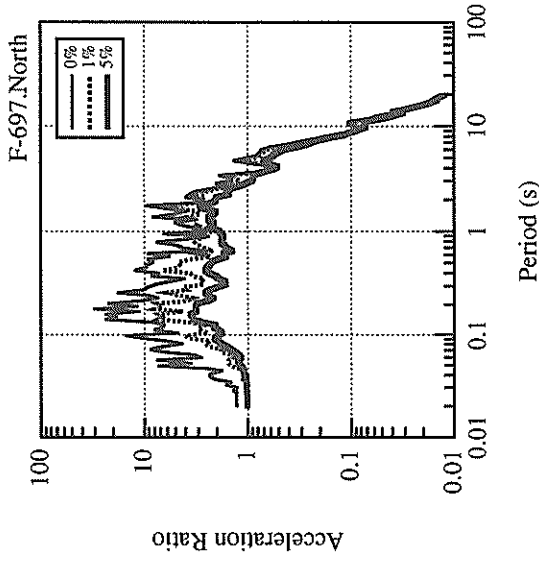
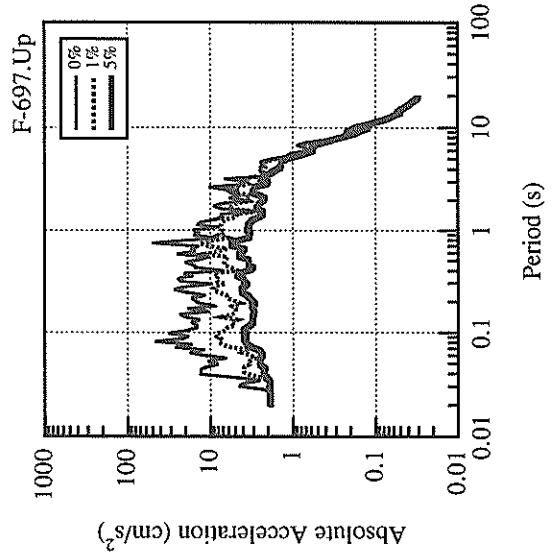
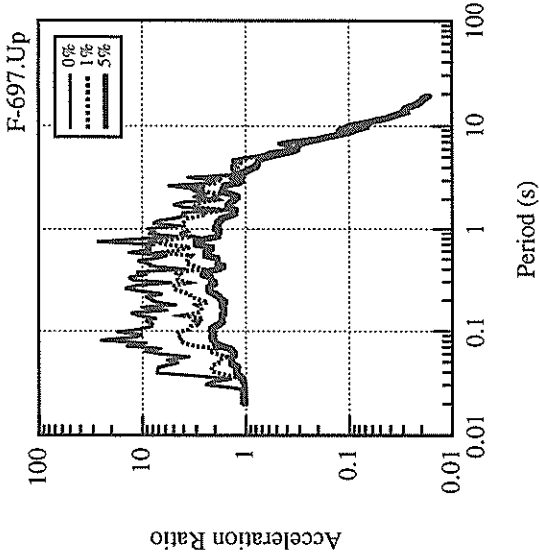
\* RESULTANT OF HORIZONTAL COMPONENTS



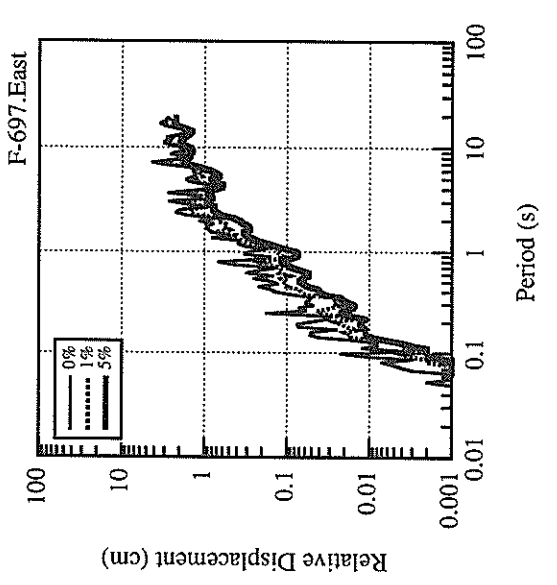
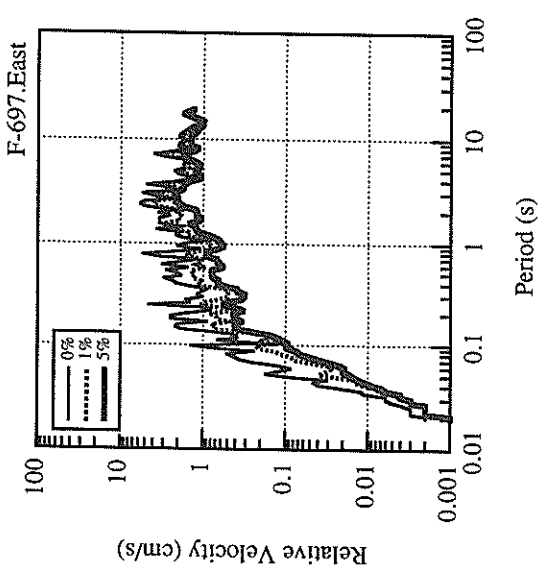
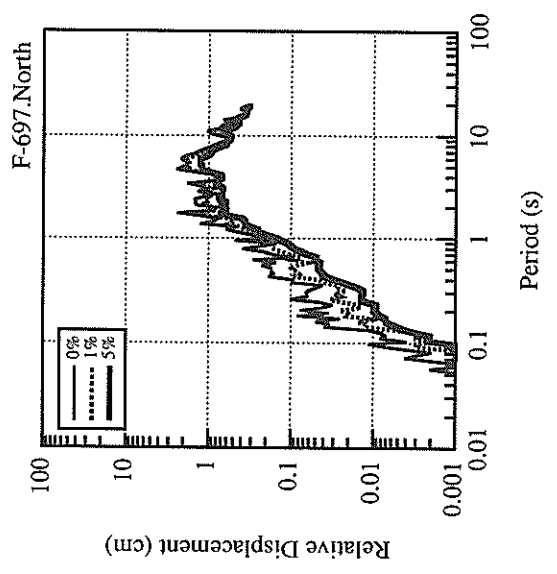
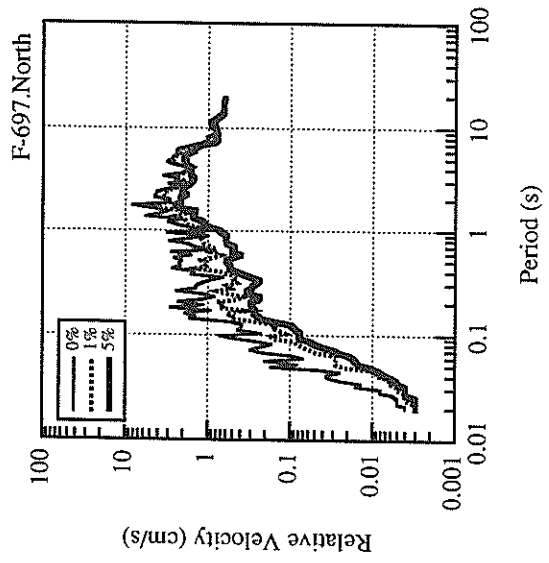
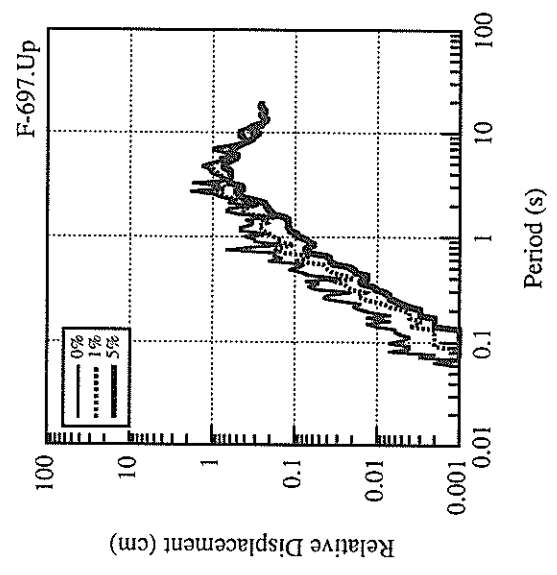
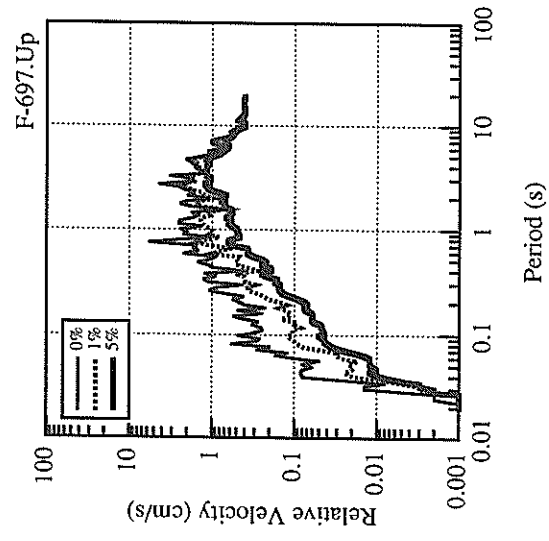


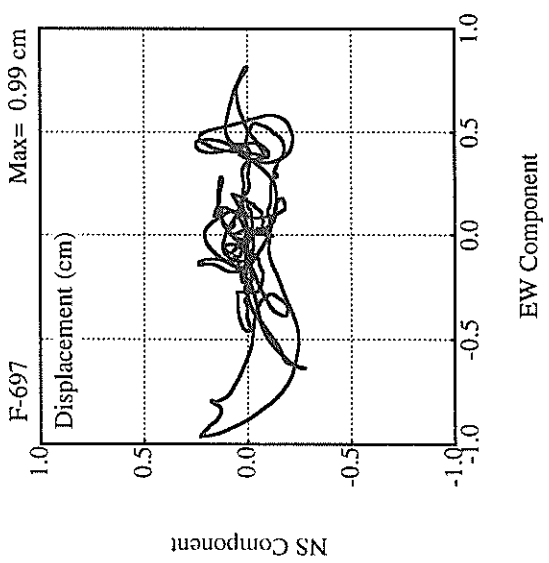
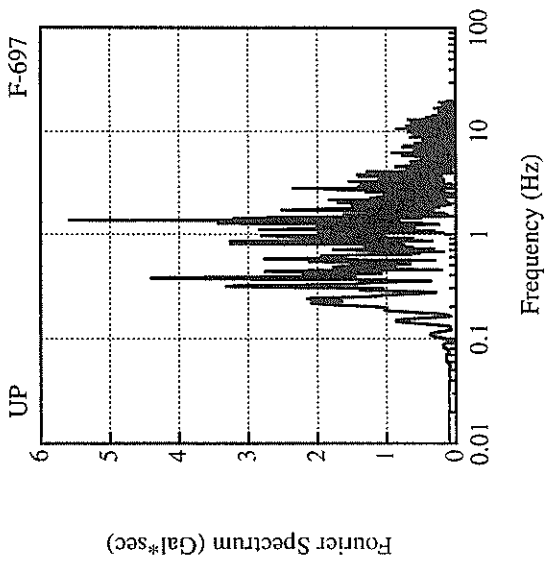
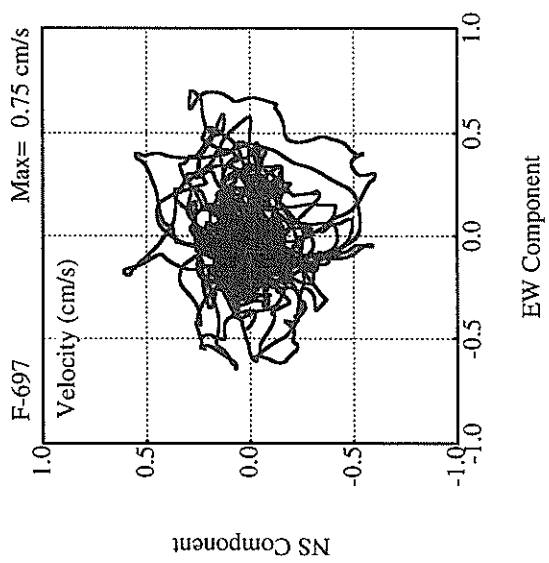
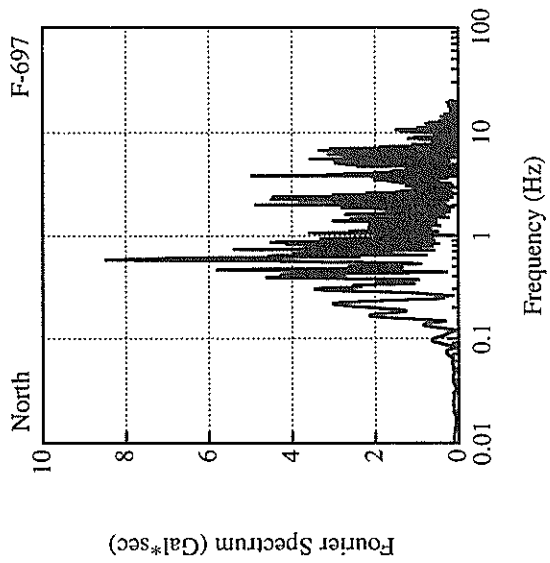
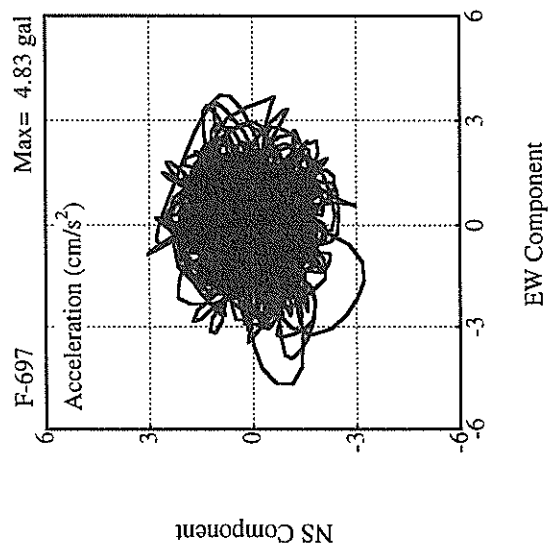
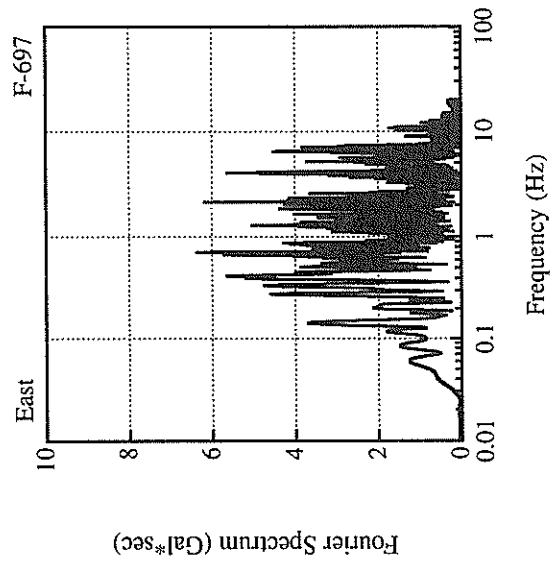












RECORD NUMBER : F-687  
 STATION : HAKODATE-FB

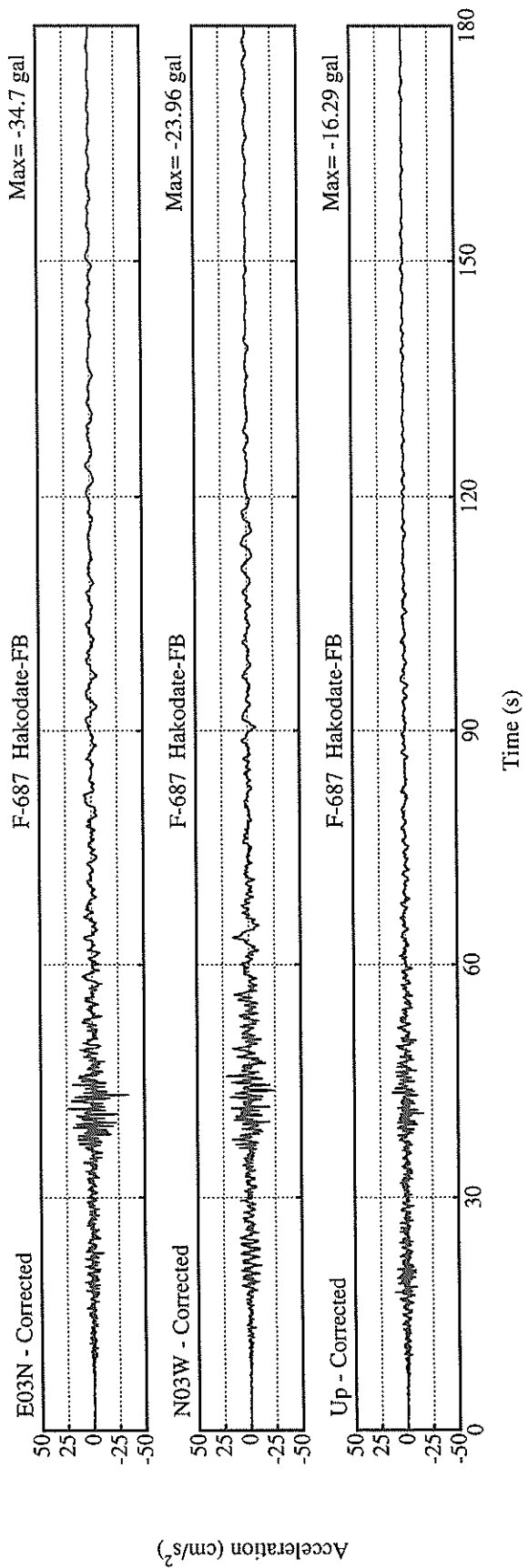
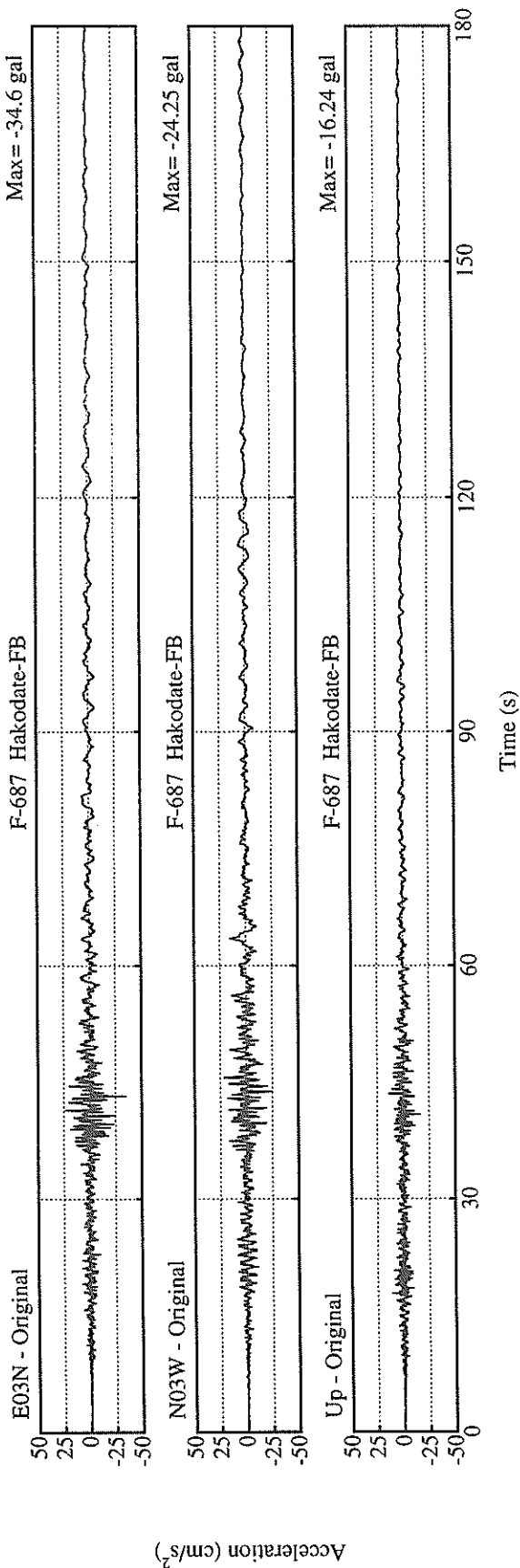
EARTHQUAKE DATA

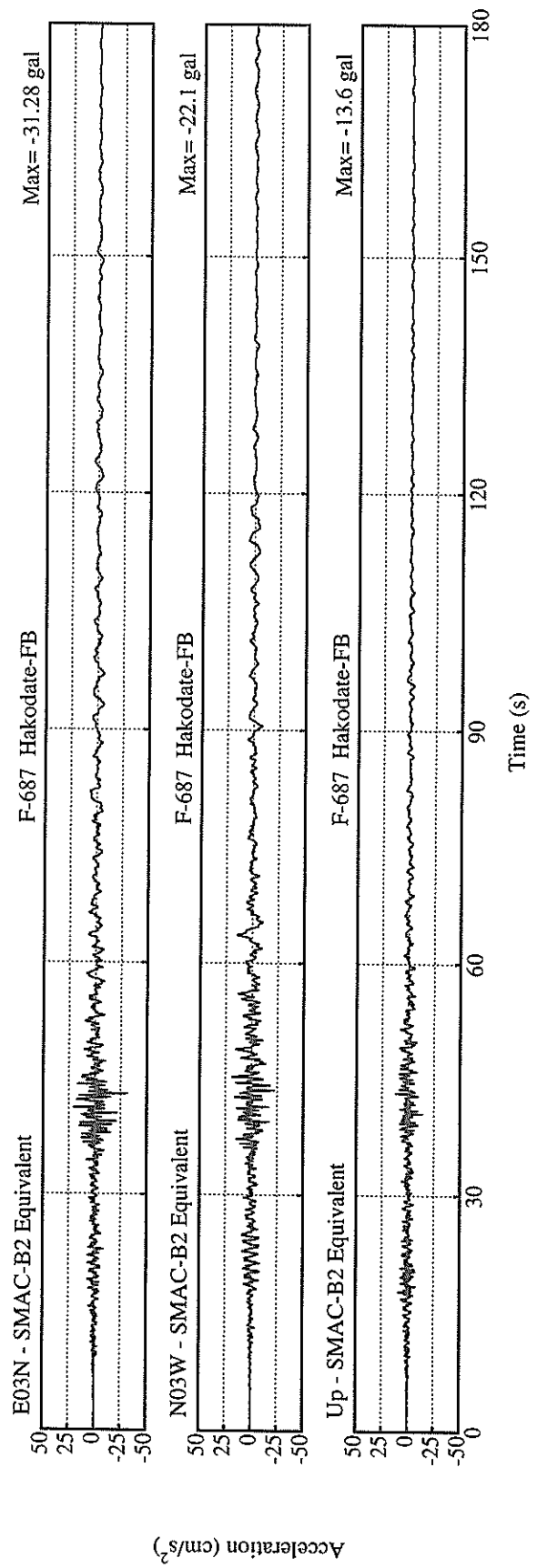
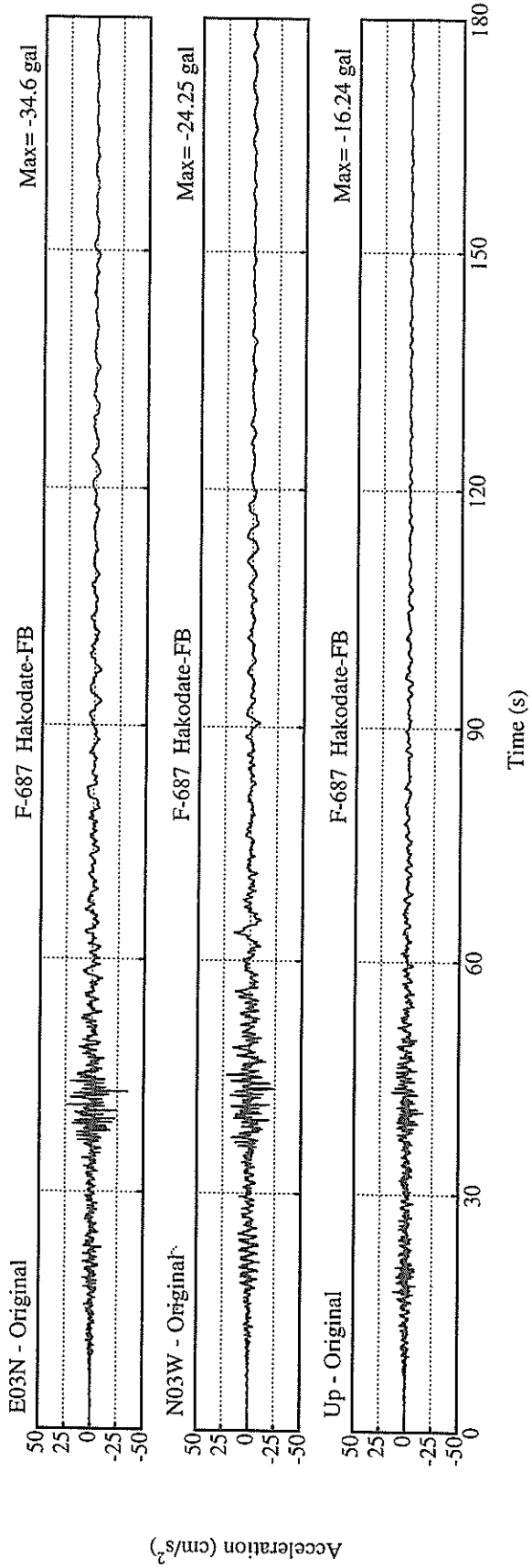
\*\*\*\*\*  
 DATE AND TIME 21:19 DEC.28,1994  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION FAR E OFF SANRIKU  
 LATITUDE 40°25.6' N  
 LONGITUDE 143°44.9' E  
 DEPTH 0.0KM  
 JMA MAGNITUDE 7.5  
 \*\*\*\*\*

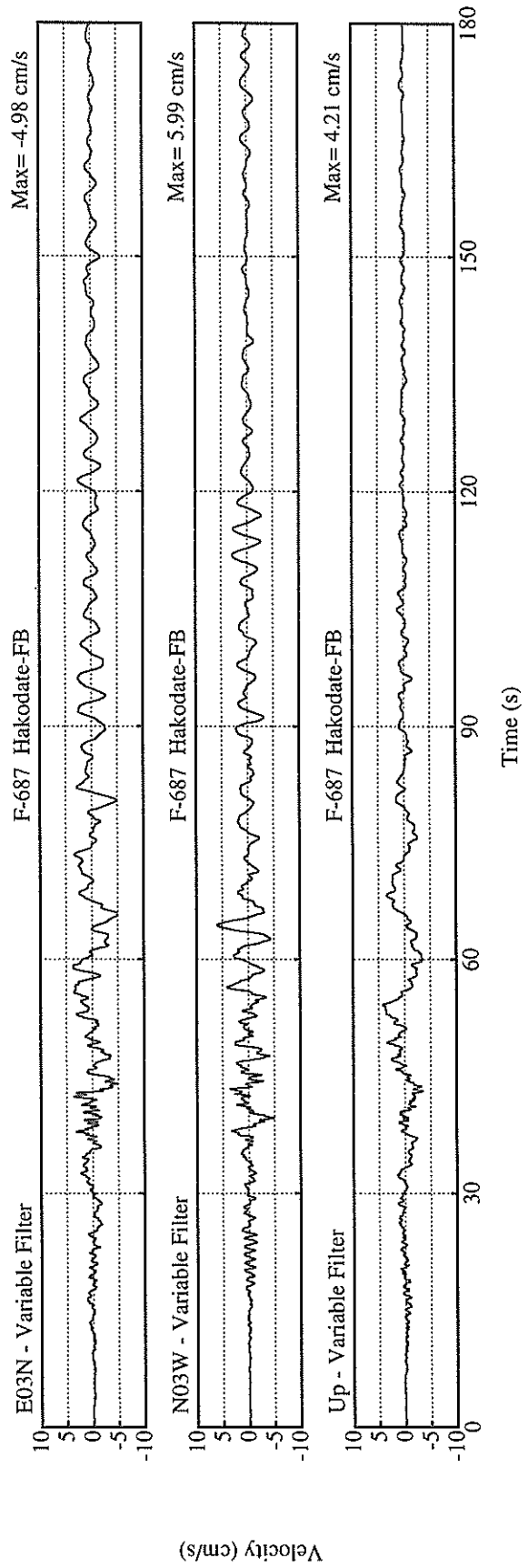
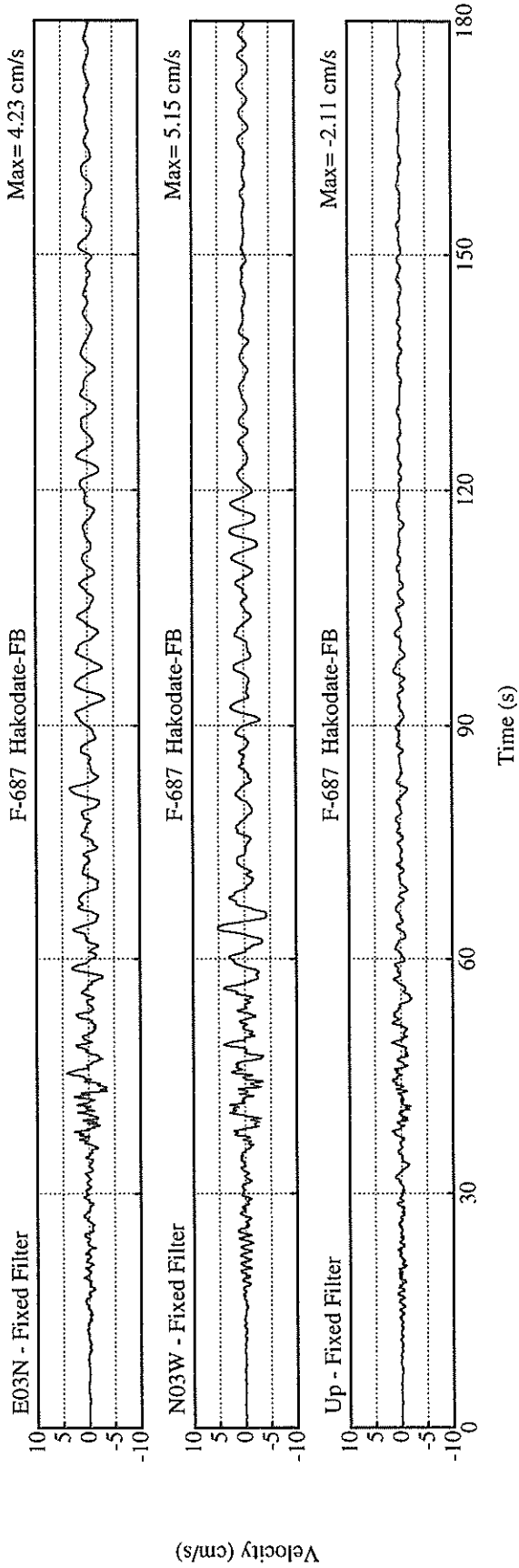
PEAK VALUES OF COMPONENTS

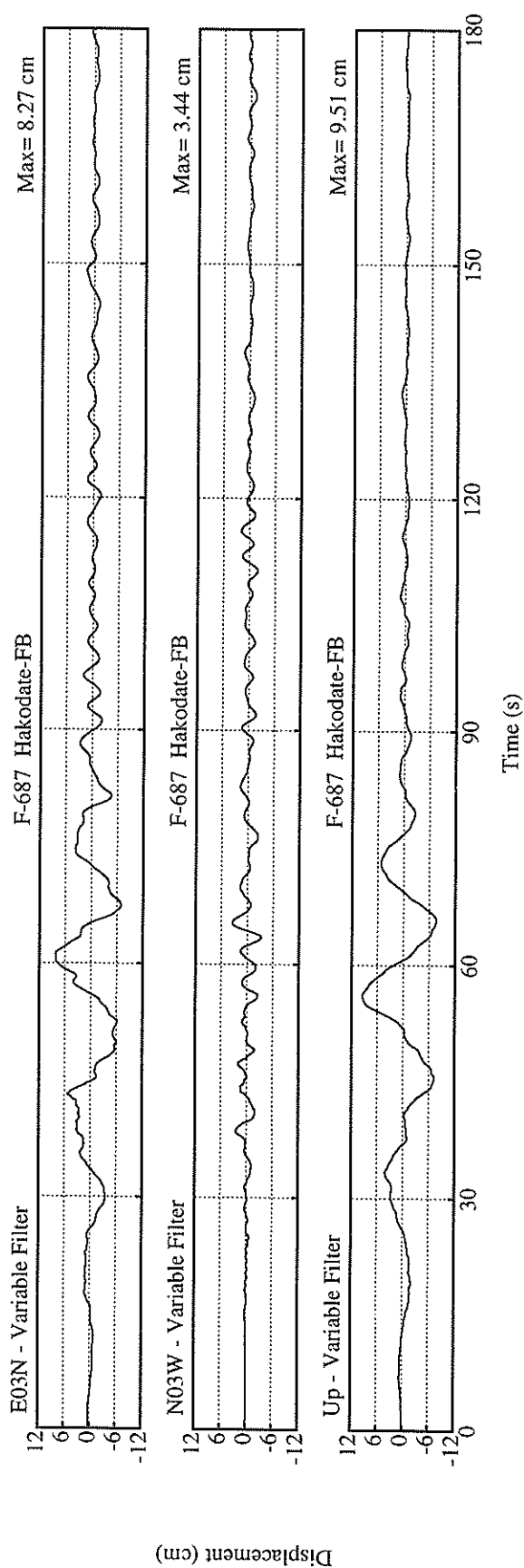
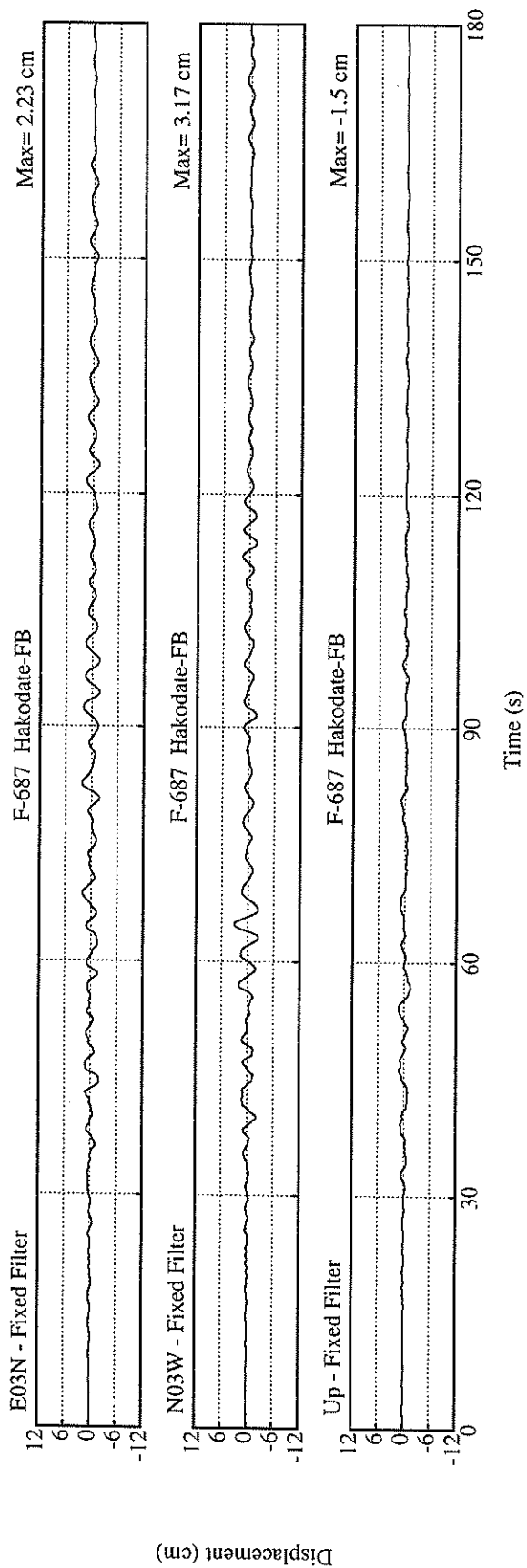
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.048	0.032	0.029	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	22.1	31.3	13.6	31.3
ORIGINAL	24.3	34.6	16.2	34.6
CORRECTED	24.0	34.7	16.3	34.7
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	5.15	4.23	2.11	5.83
VARIABLE FILTER	5.99	4.98	4.21	6.10
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	3.17	2.23	1.50	3.26
VARIABLE FILTER	3.44	8.27	9.51	8.31

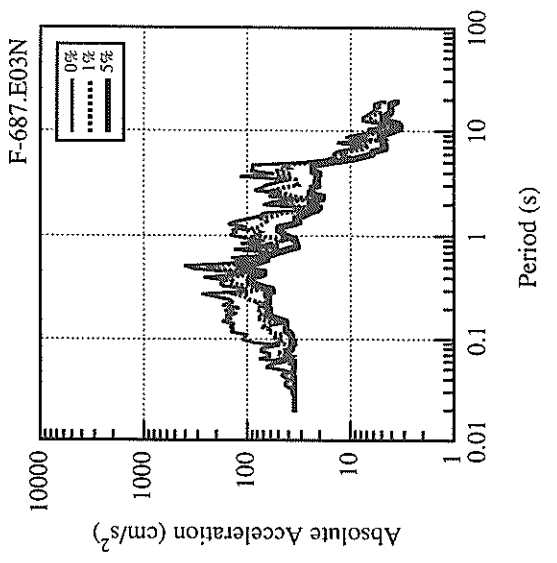
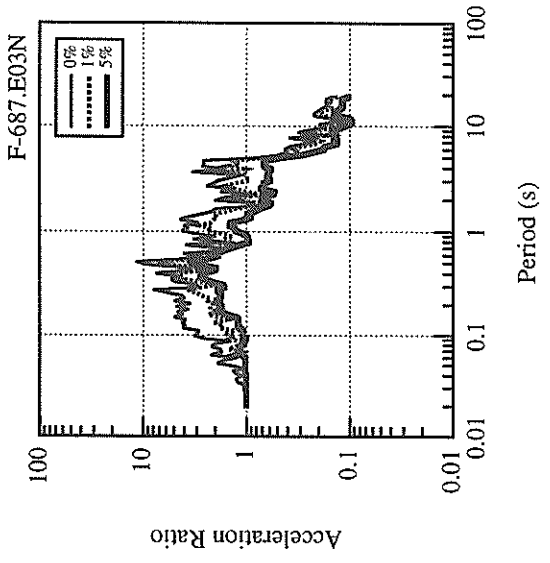
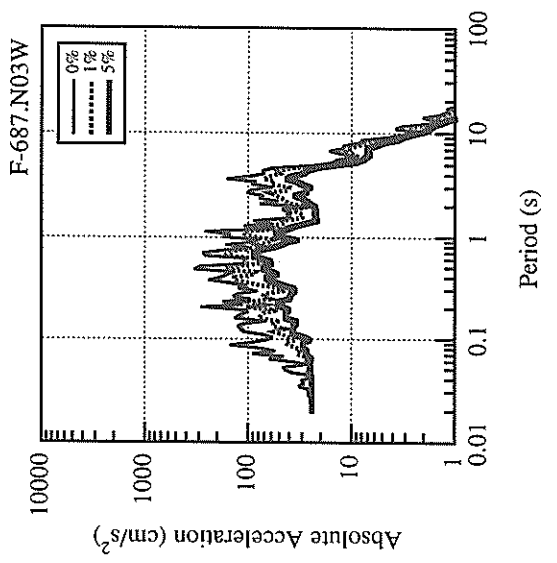
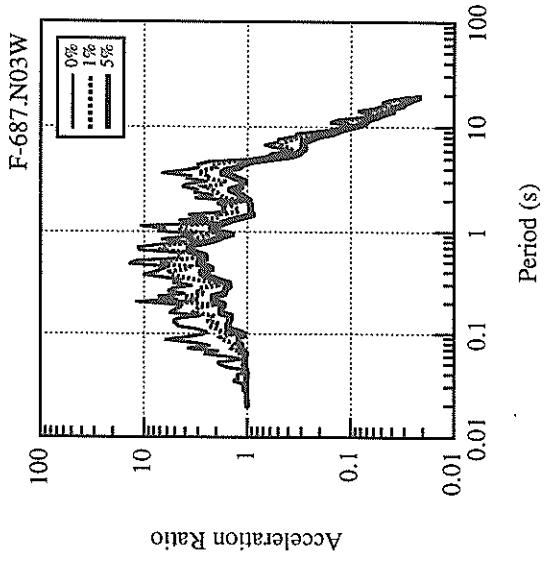
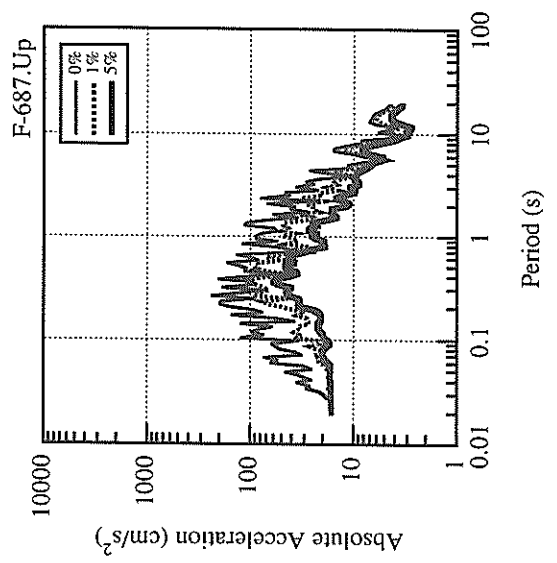
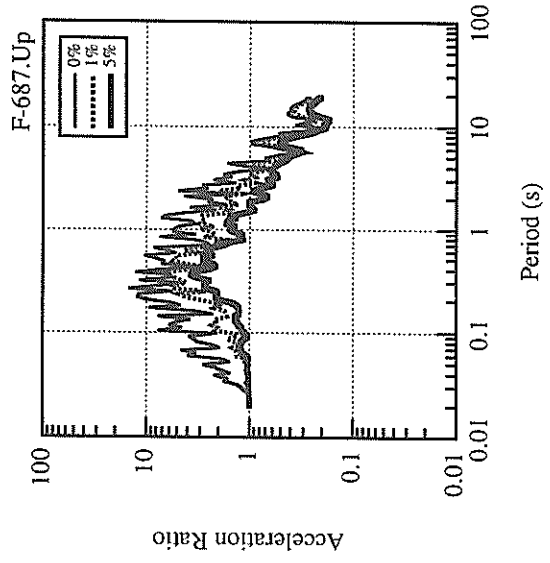
\* RESULTANT OF HORIZONTAL COMPONENTS



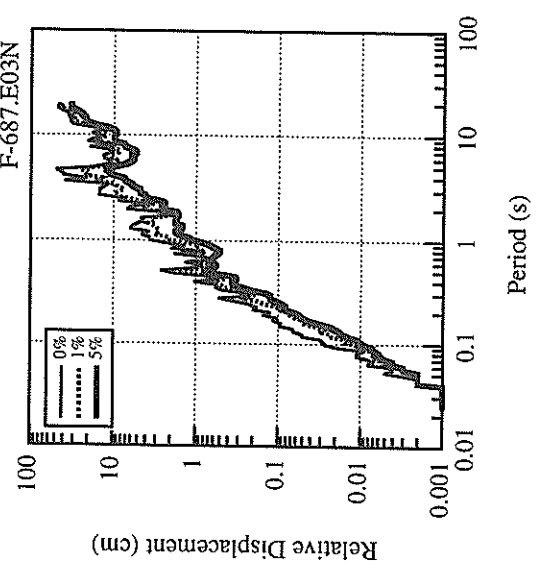
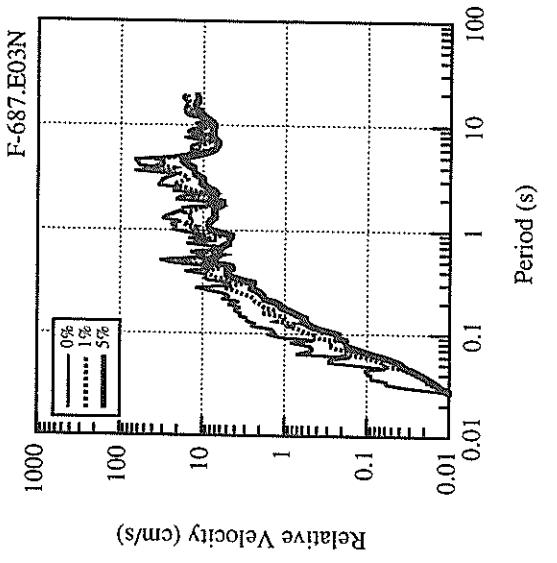
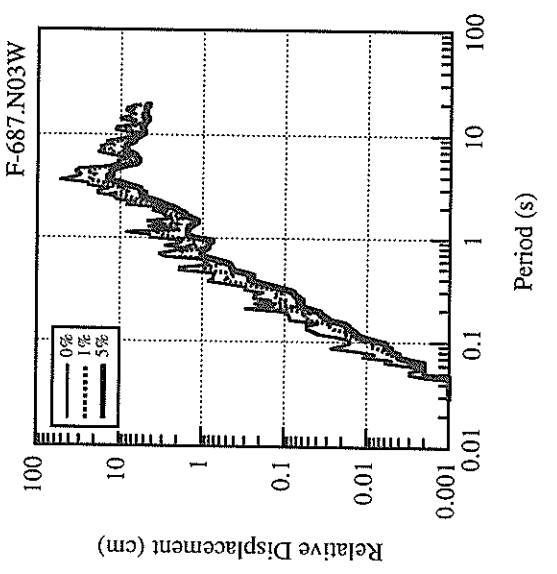
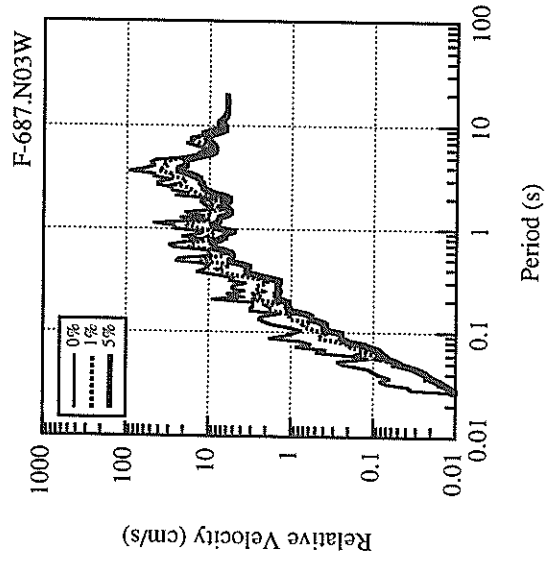
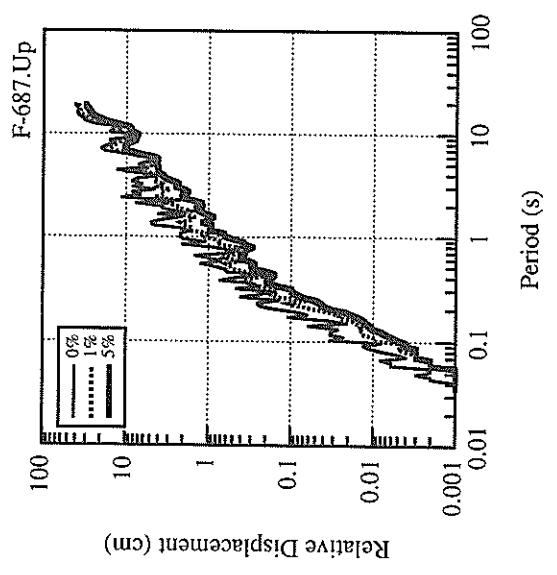
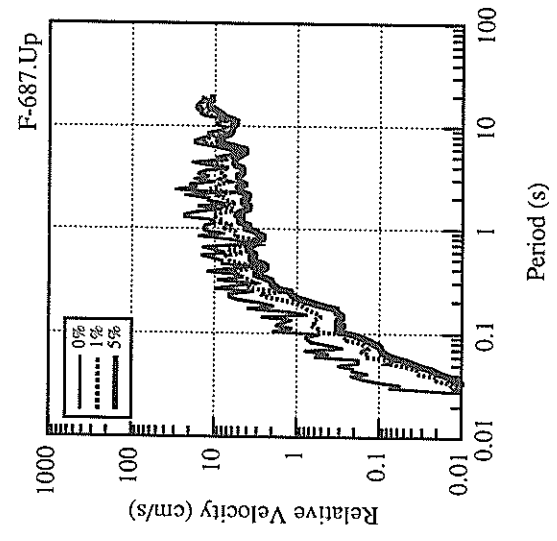


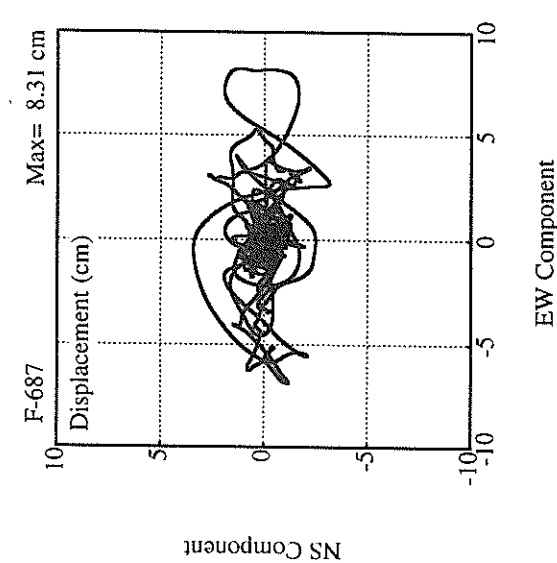
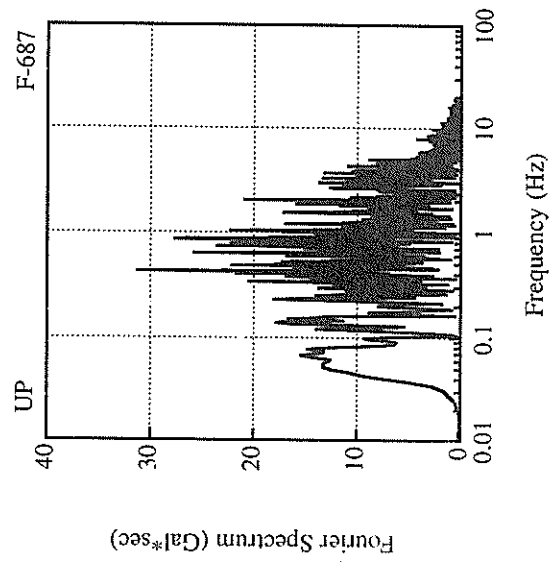
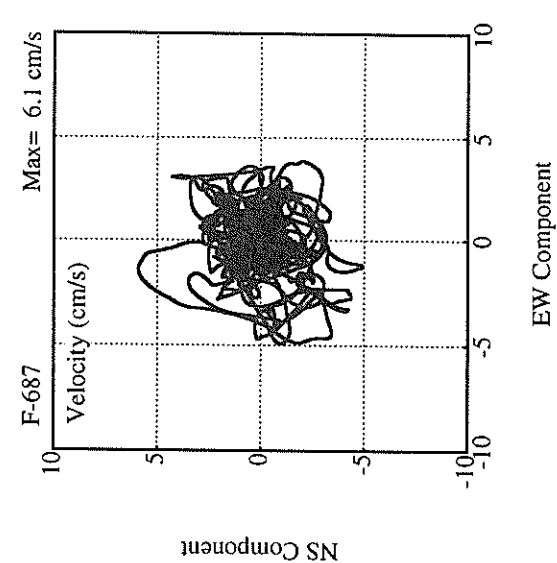
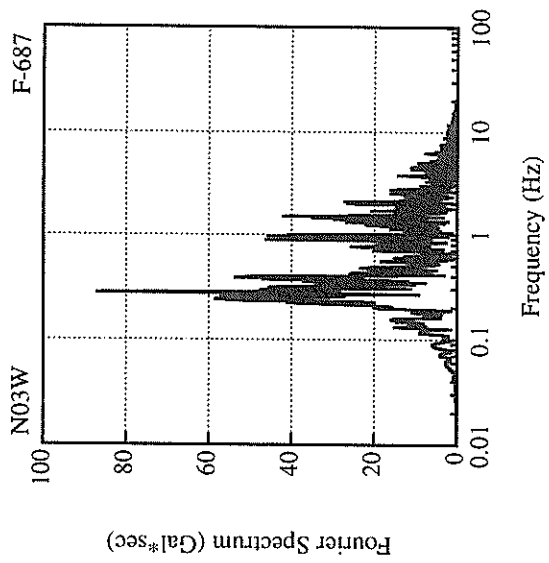
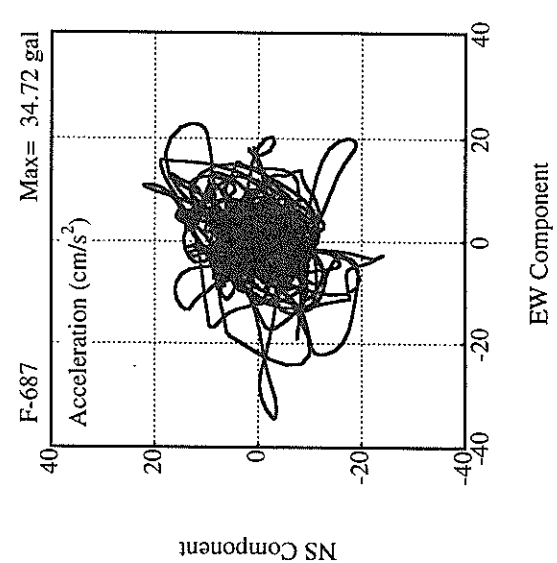
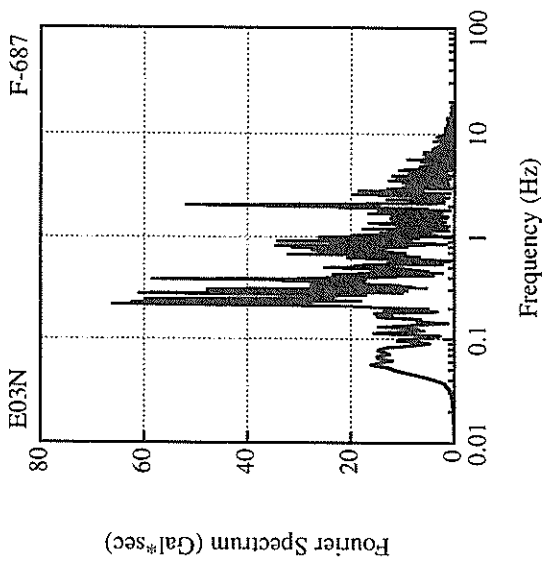












RECORD NUMBER : F-689  
 STATION : HAKODATE-F

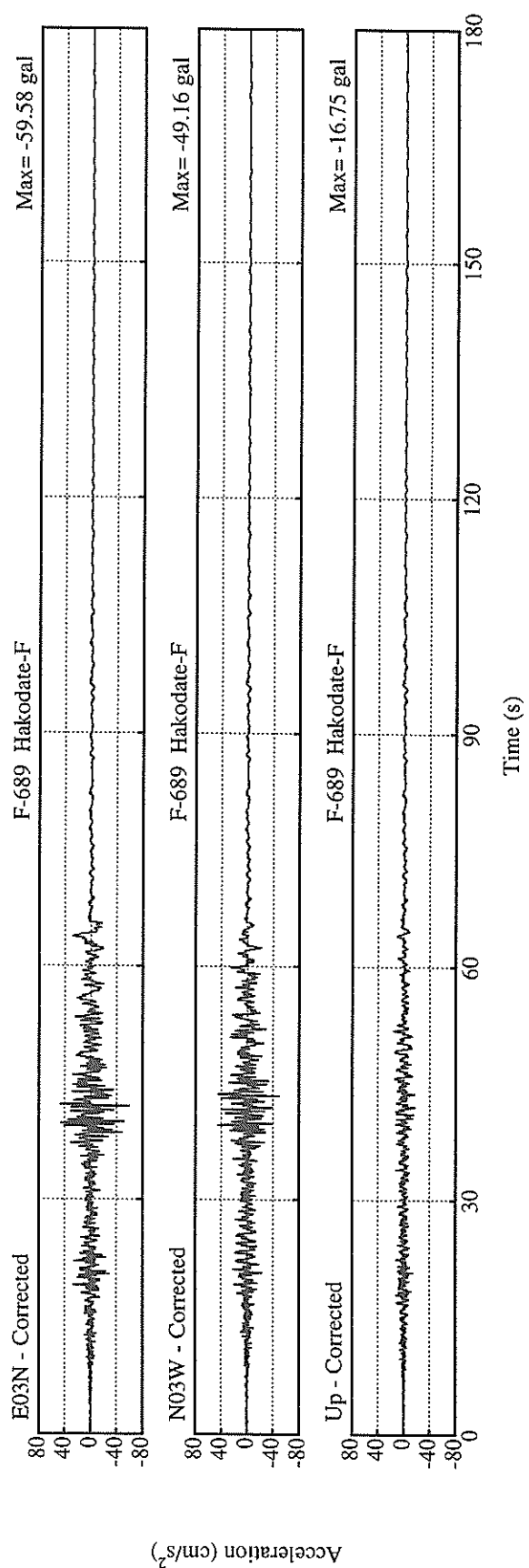
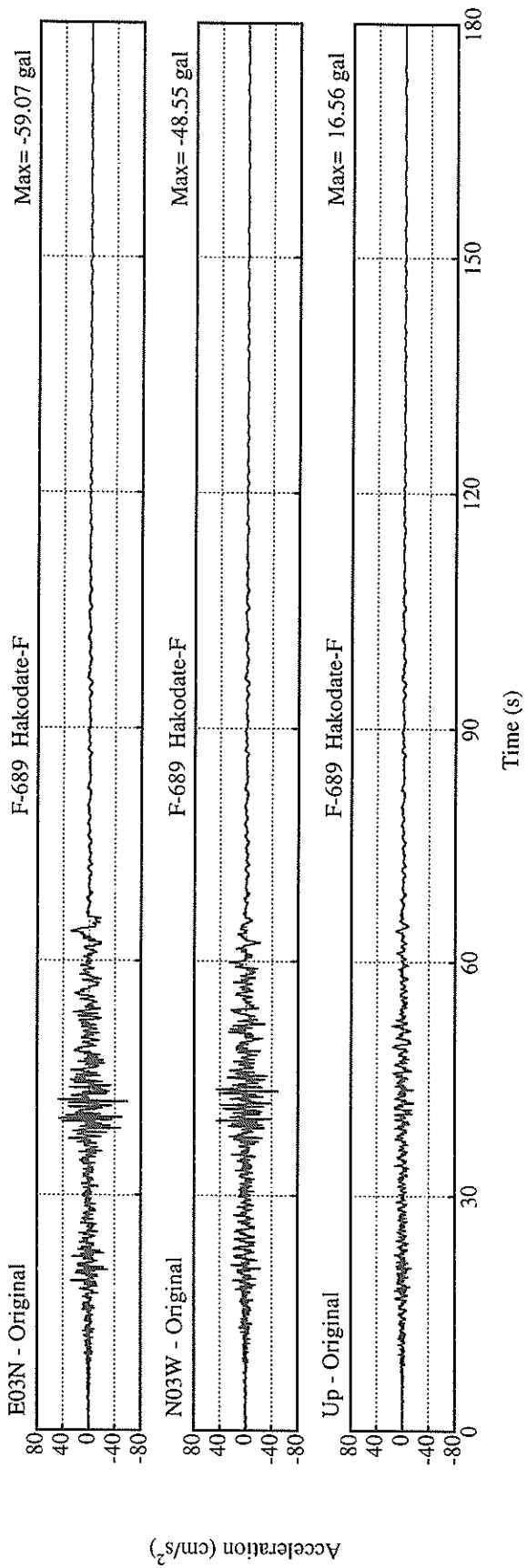
EARTHQUAKE DATA

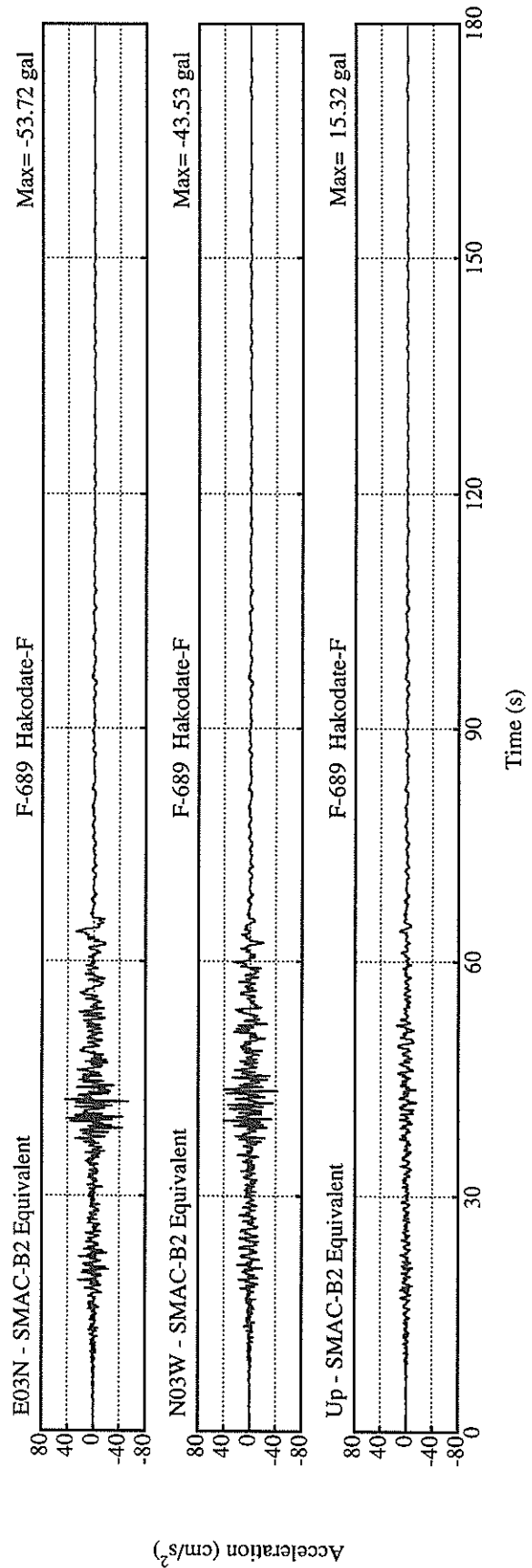
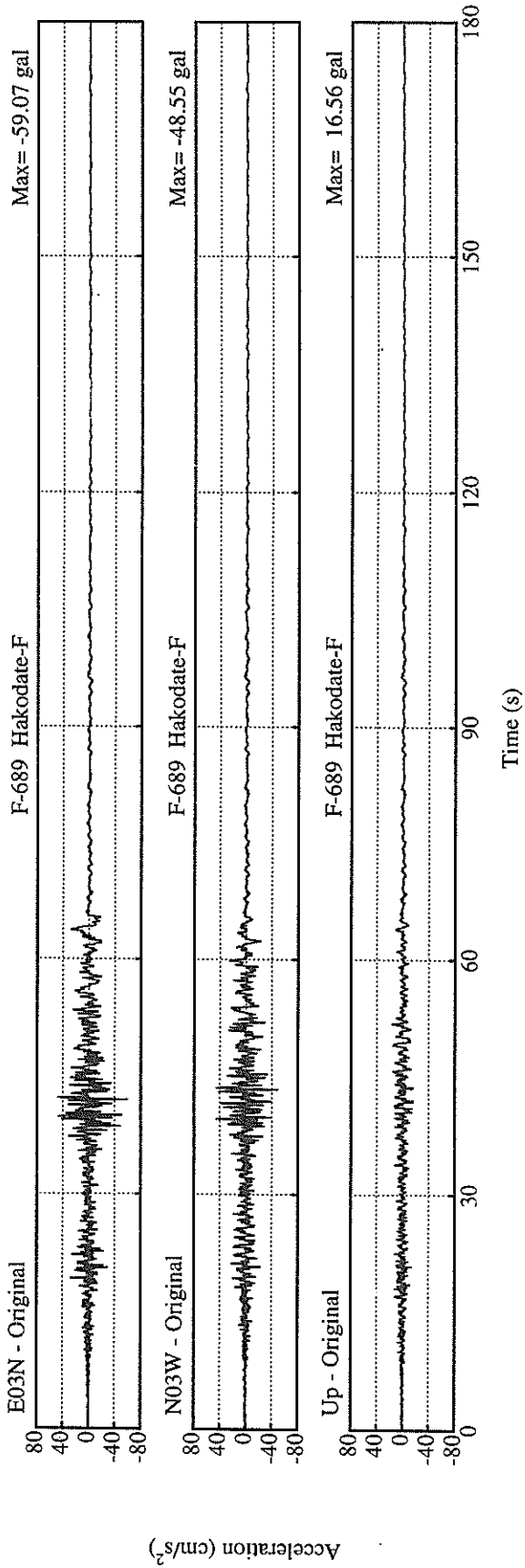
\*\*\*\*\*  
 DATE AND TIME 21:19 DEC.28,1994  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION FAR E OFF SANRIKU  
 LATITUDE 40°25.6' N  
 LONGITUDE 143°44.9' E  
 DEPTH 0.0KM  
 JMA MAGNITUDE 7.5  
 \*\*\*\*\*

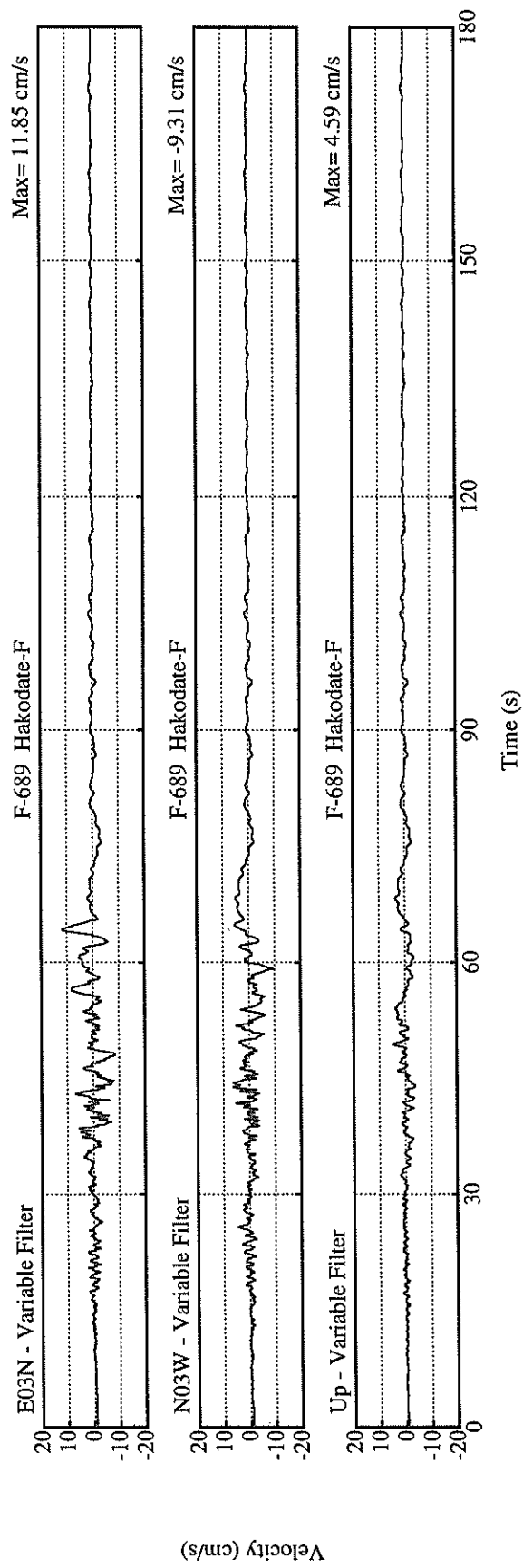
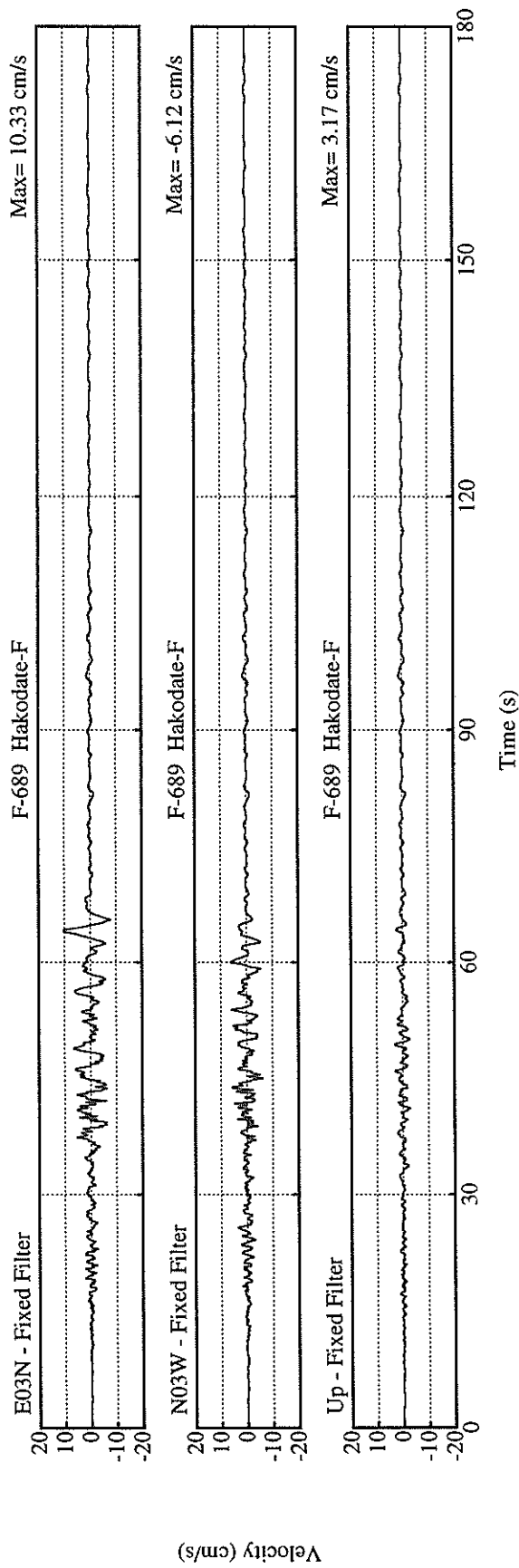
PEAK VALUES OF COMPONENTS

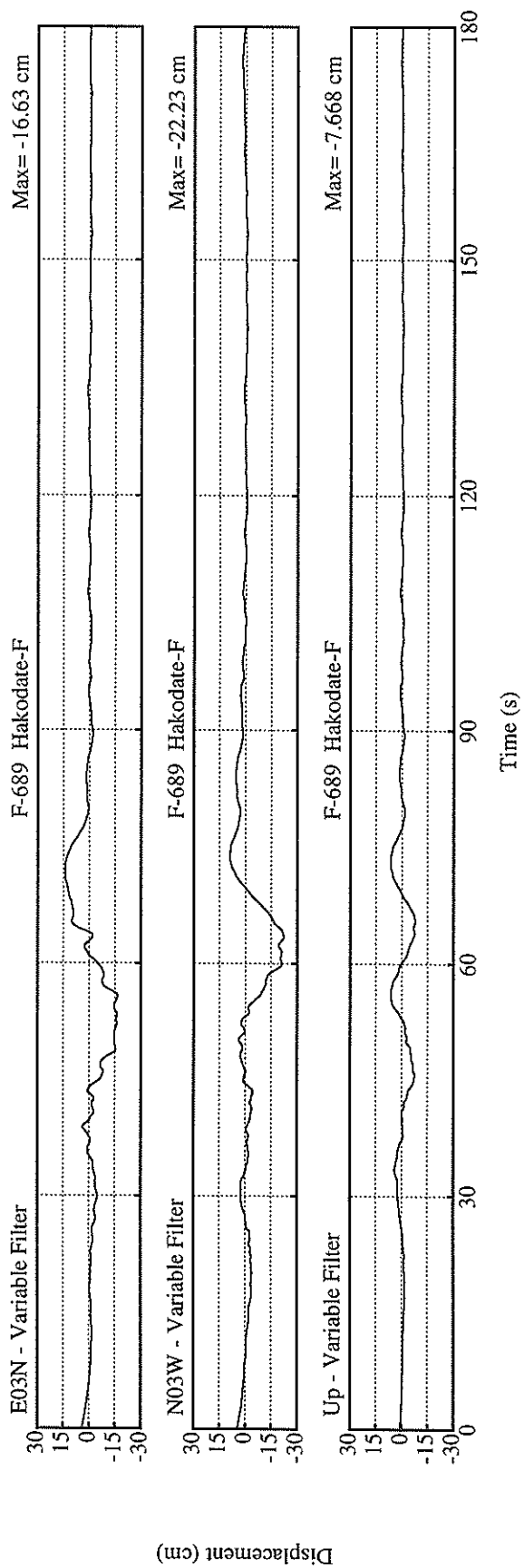
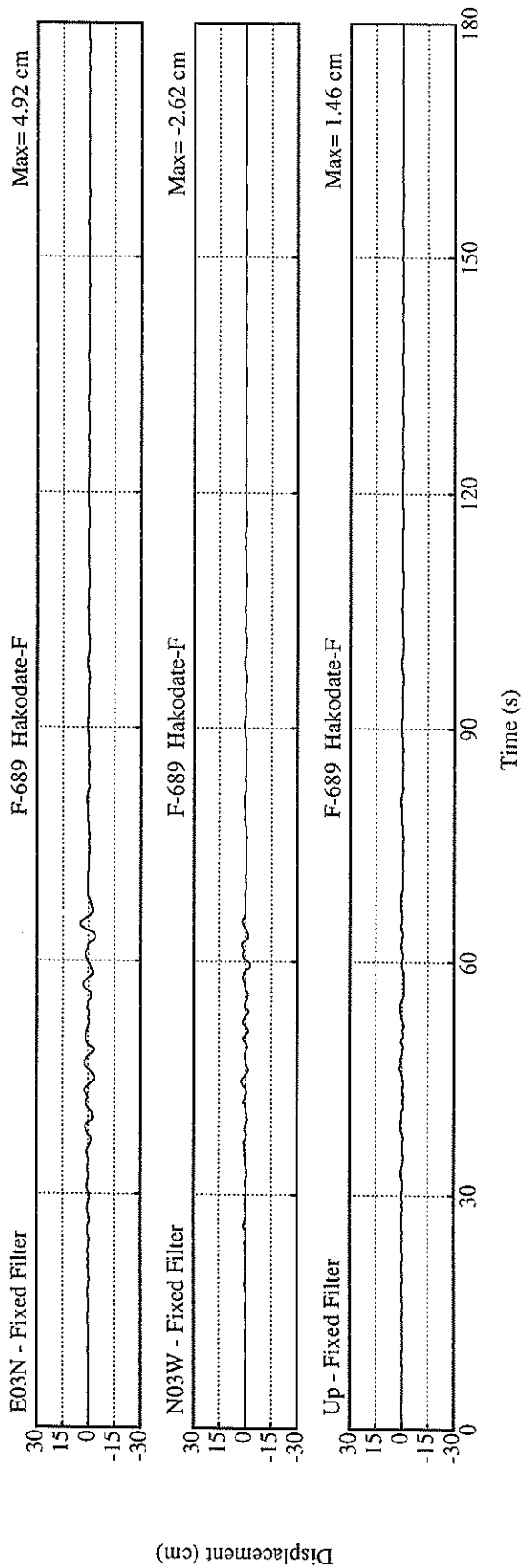
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.017	0.017	0.026	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	43.5	53.7	15.3	54.5
ORIGINAL	48.6	59.1	16.6	59.8
CORRECTED	49.2	59.6	16.8	60.4
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	6.12	10.33	3.17	10.46
VARIABLE FILTER	9.31	11.85	4.59	12.11
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	2.62	4.92	1.46	5.10
VARIABLE FILTER	22.23	16.63	7.67	22.33

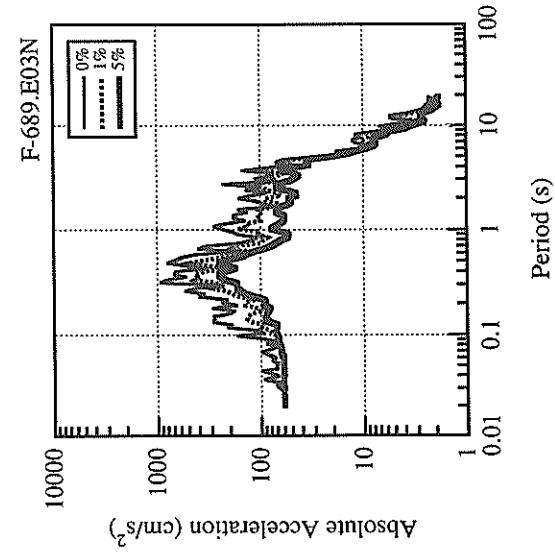
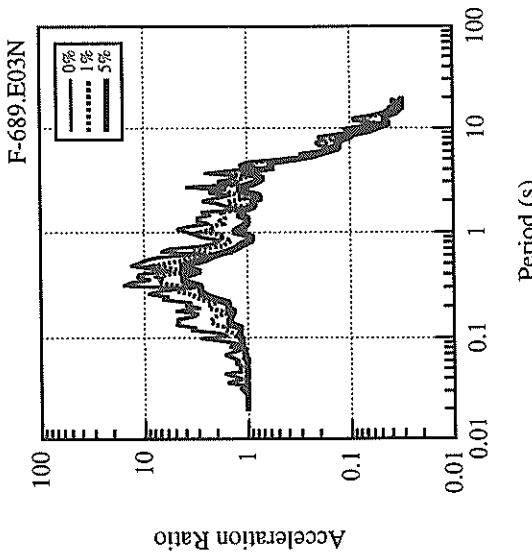
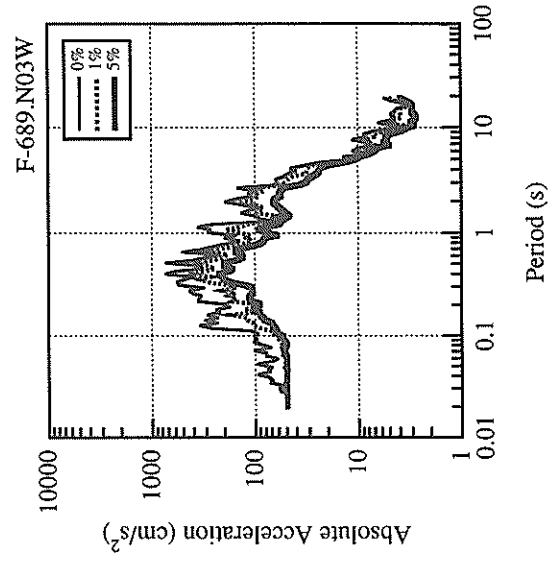
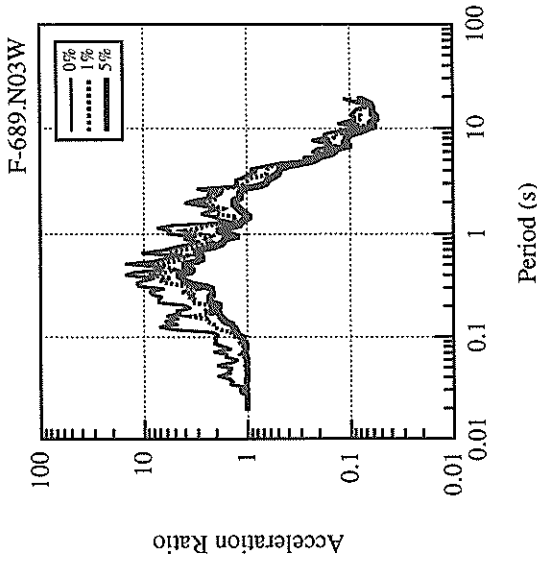
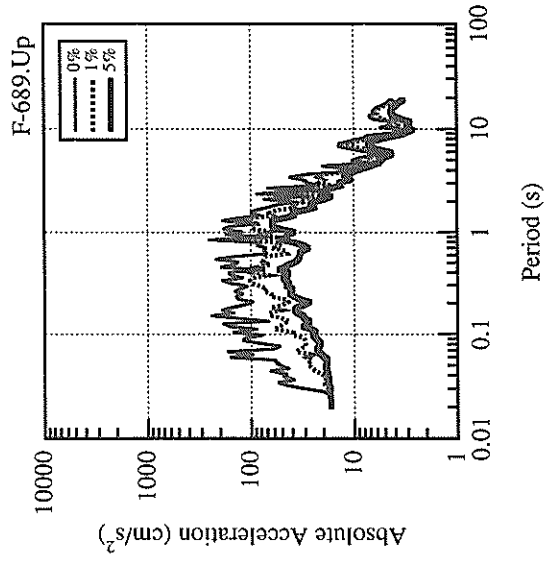
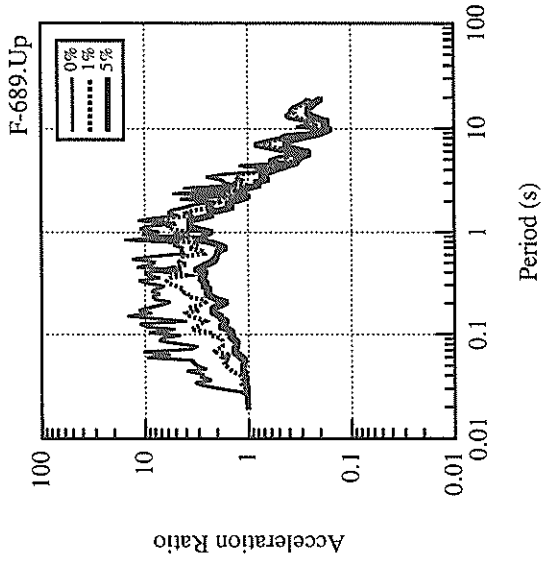
\* RESULTANT OF HORIZONTAL COMPONENTS



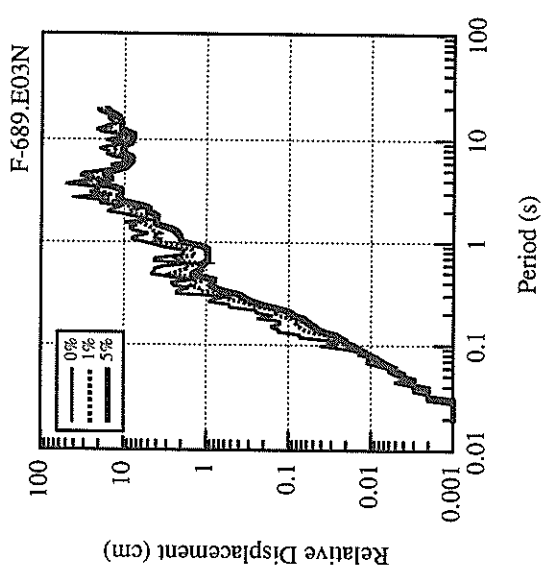
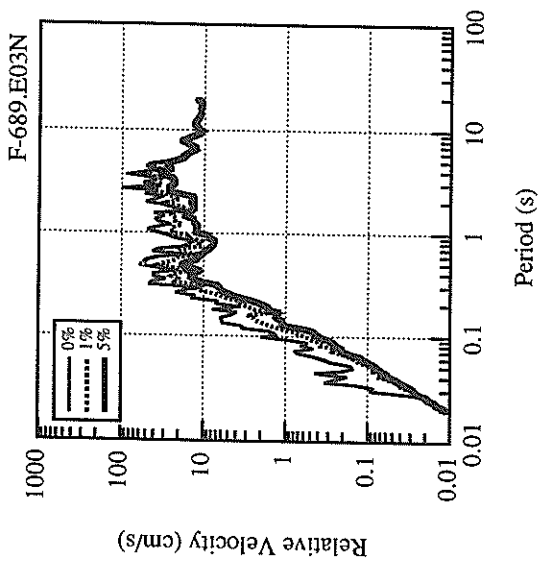
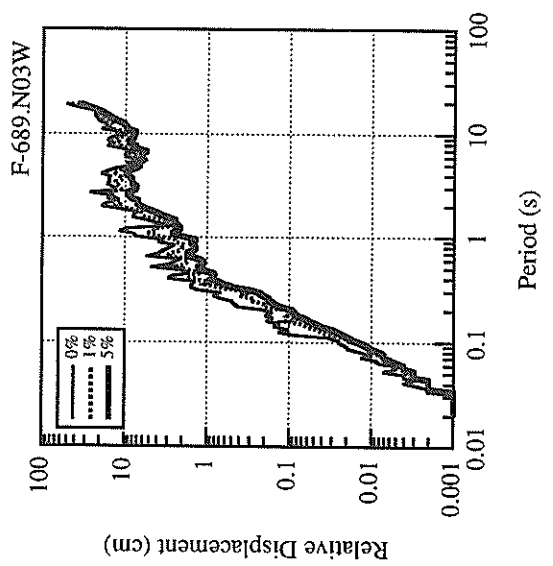
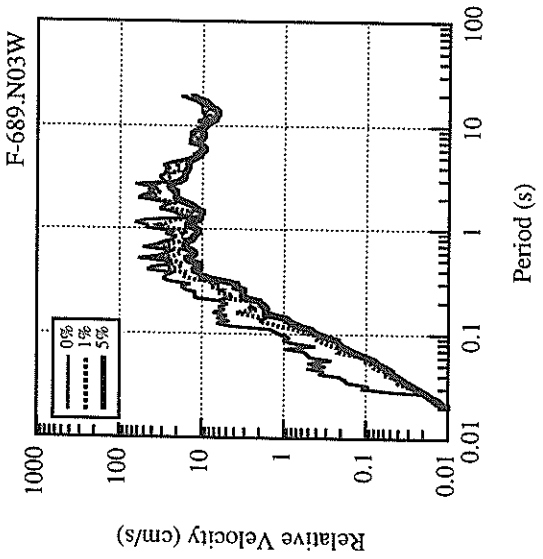
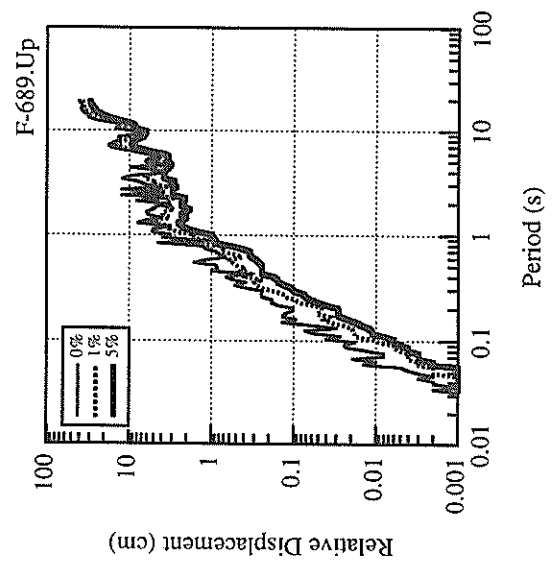
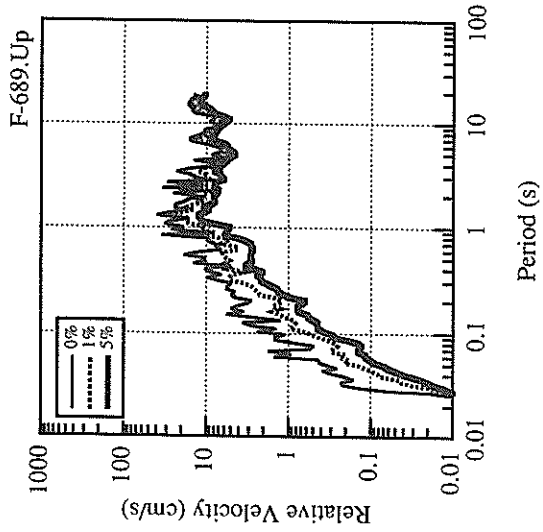


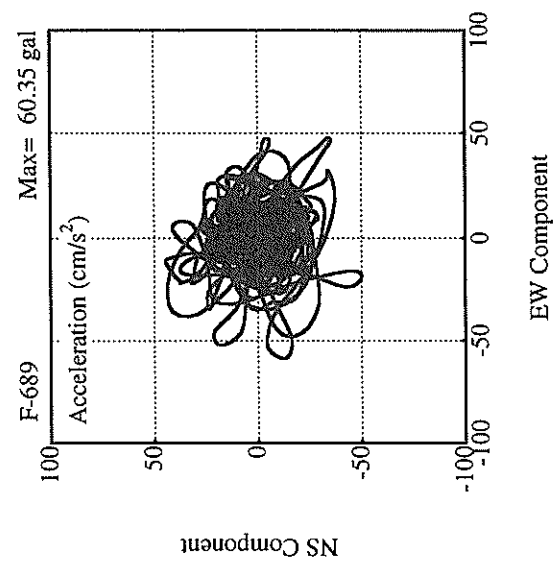
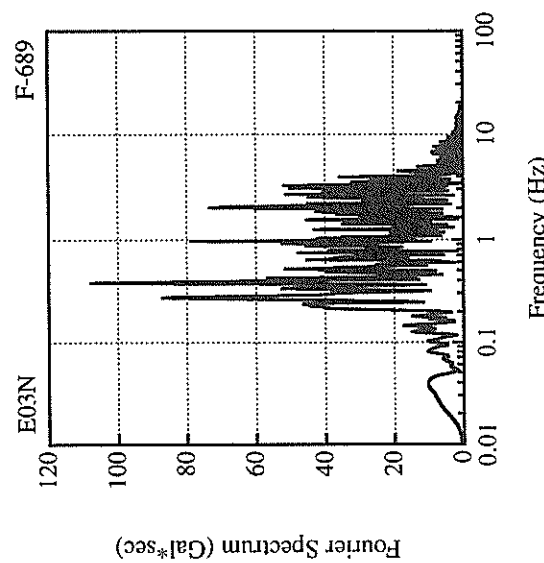
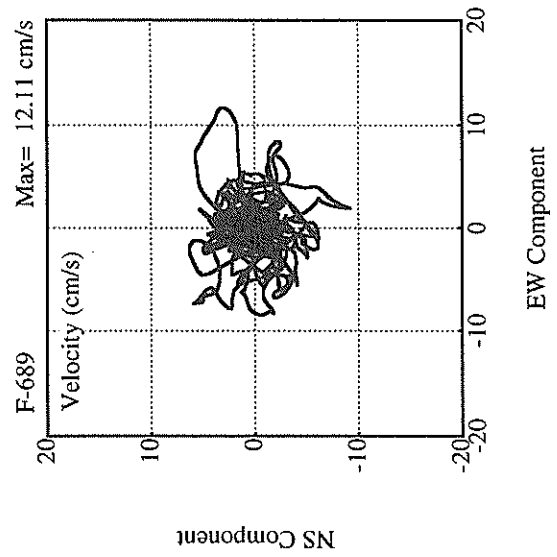
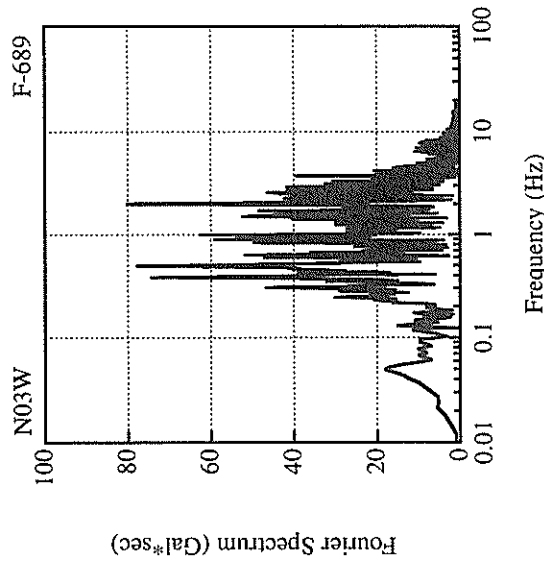
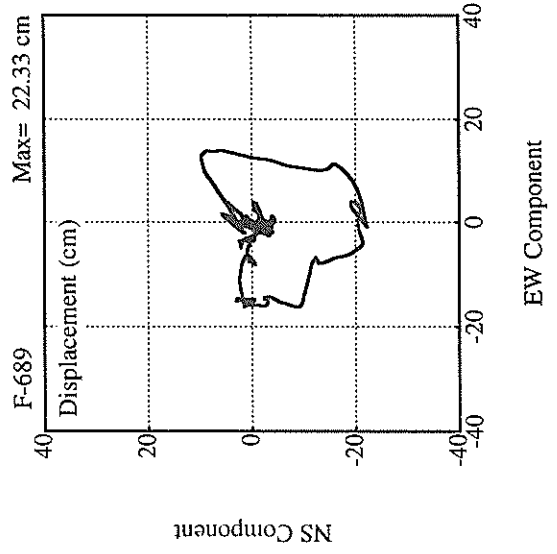
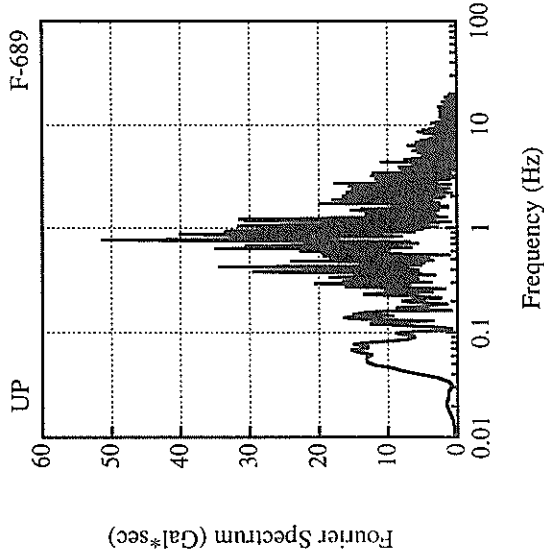












RECORD NUMBER : S-2600  
 STATION : TOMAKOMAI-S

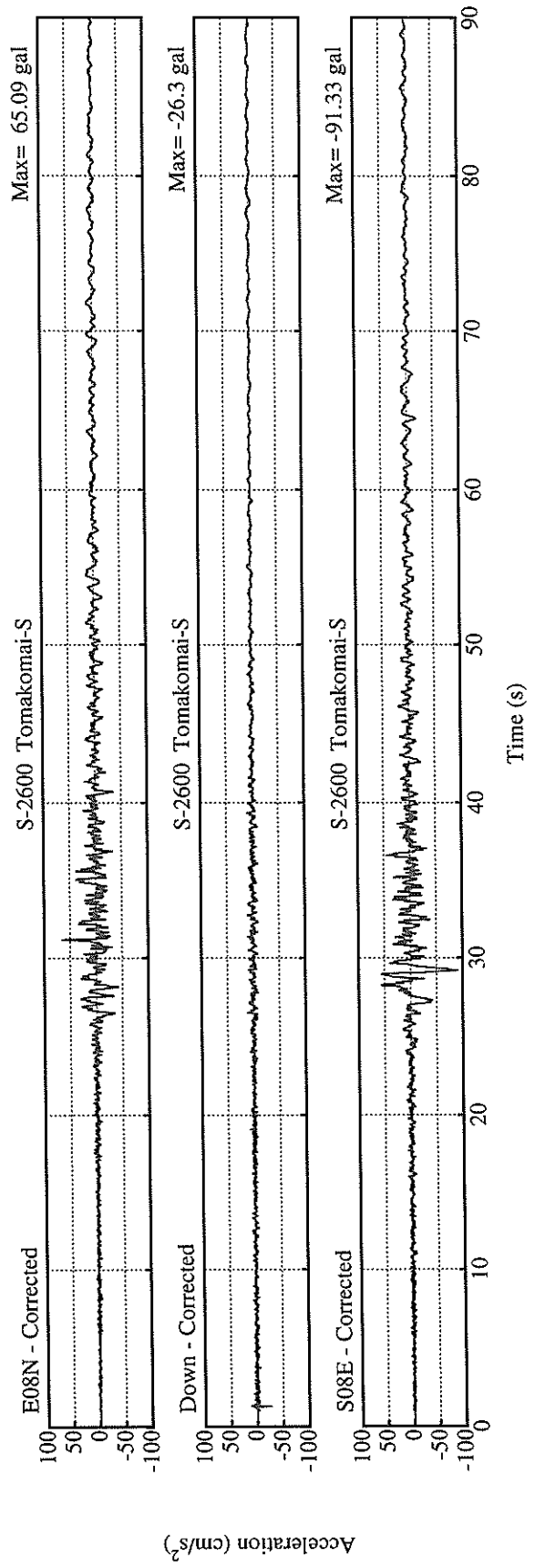
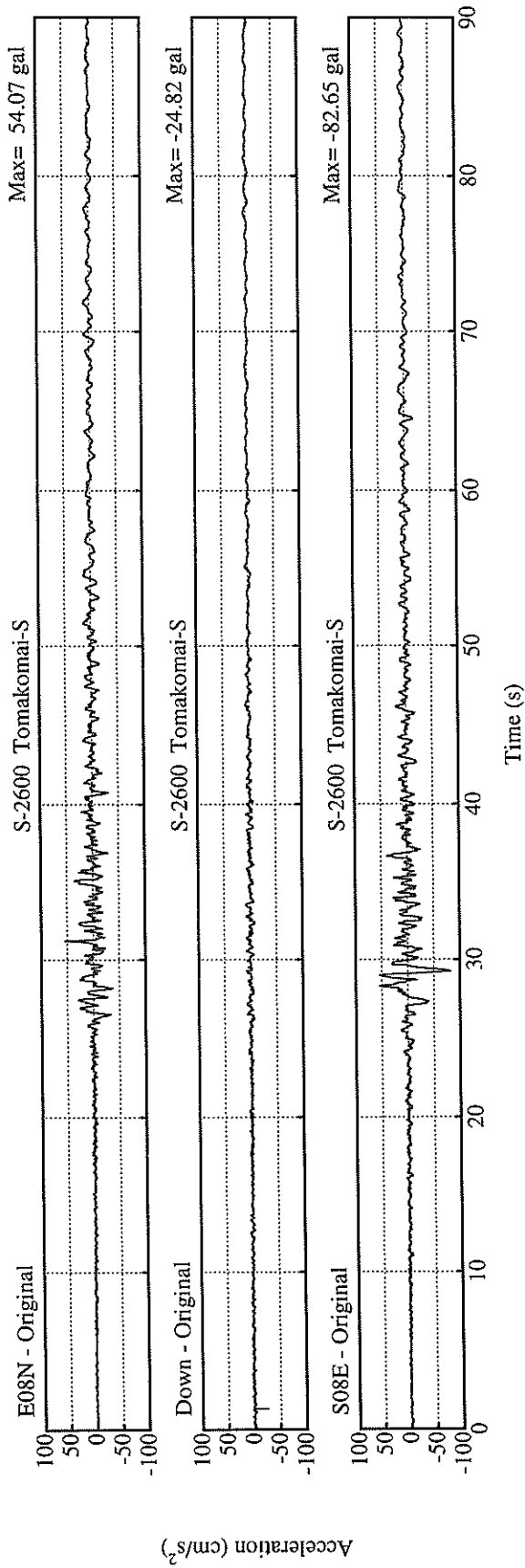
EARTHQUAKE DATA

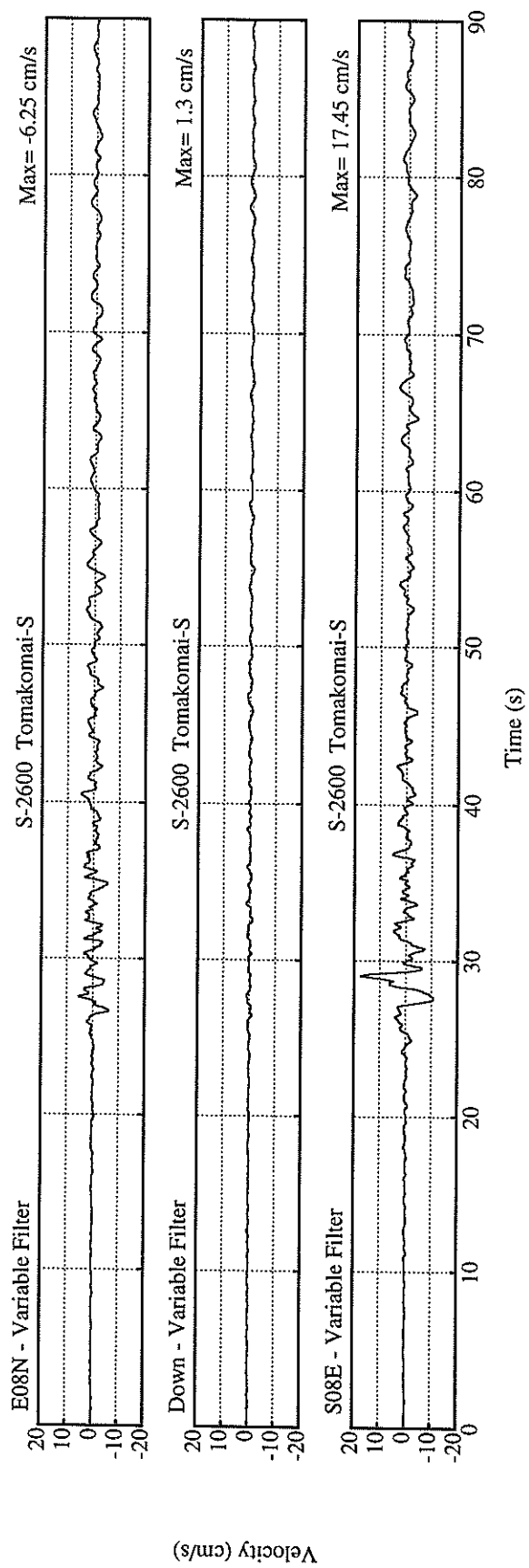
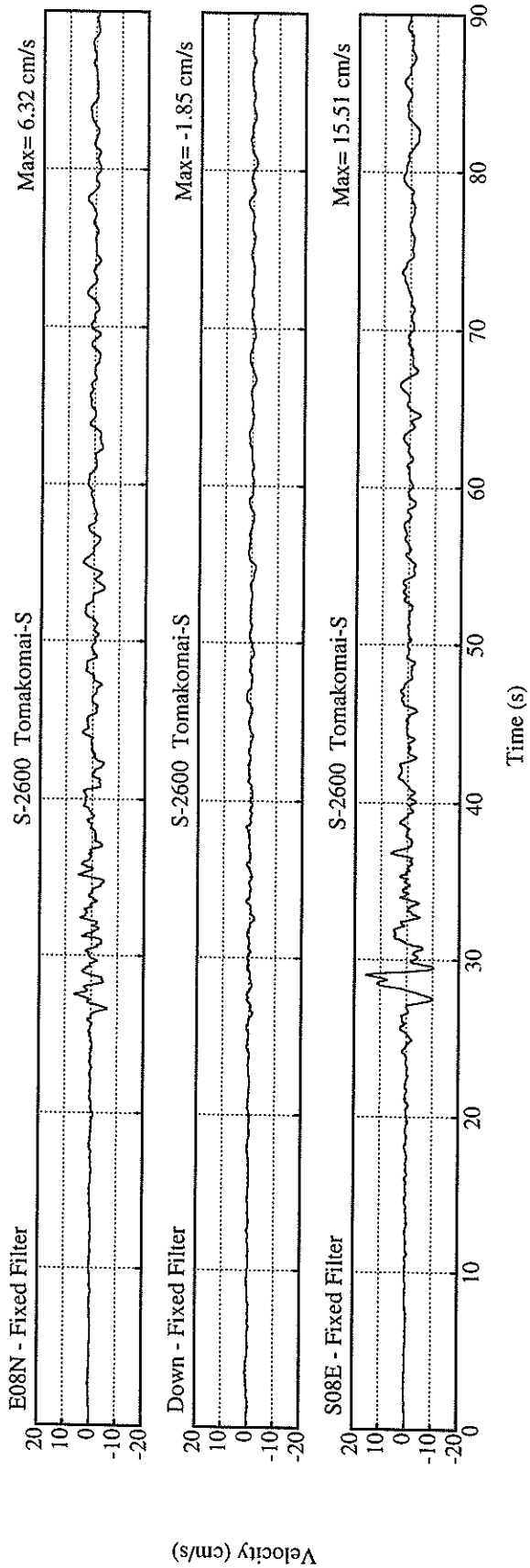
\*\*\*\*\*  
 DATE AND TIME 21:19 DEC.28,1994  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION FAR E OFF SANRIKU  
 LATITUDE 40° 25.6' N  
 LONGITUDE 143° 44.9' E  
 DEPTH 0.0KM  
 JMA MAGNITUDE 7.5  
 \*\*\*\*\*

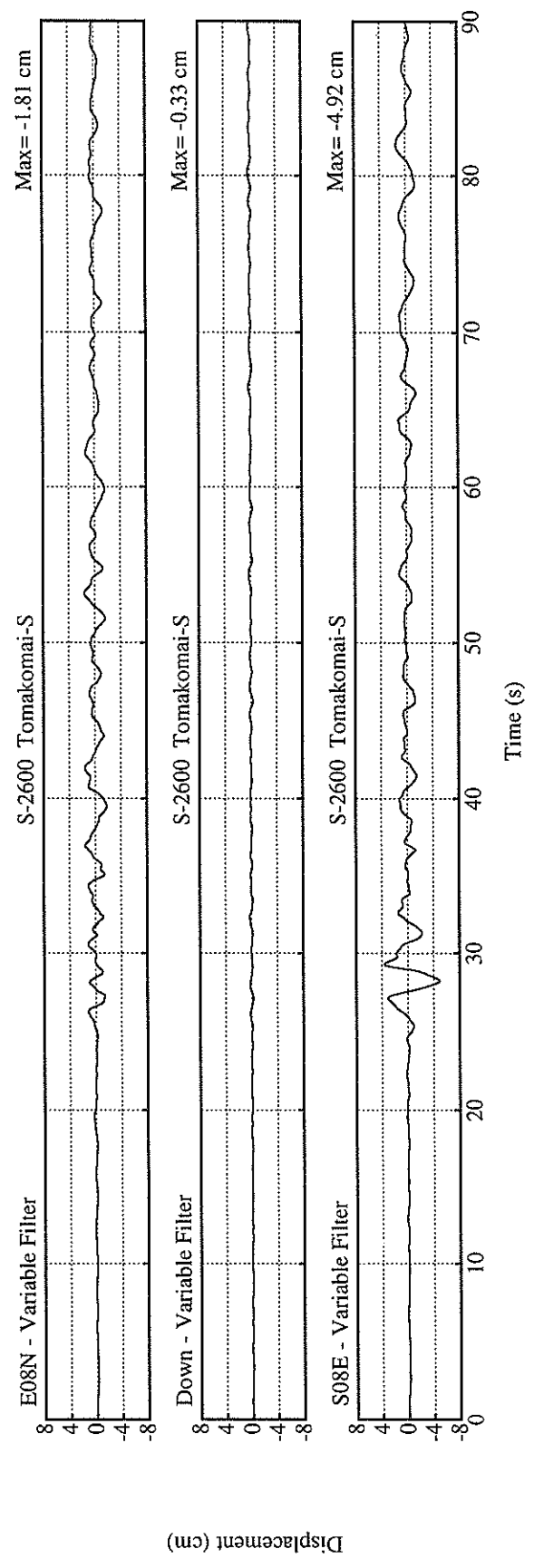
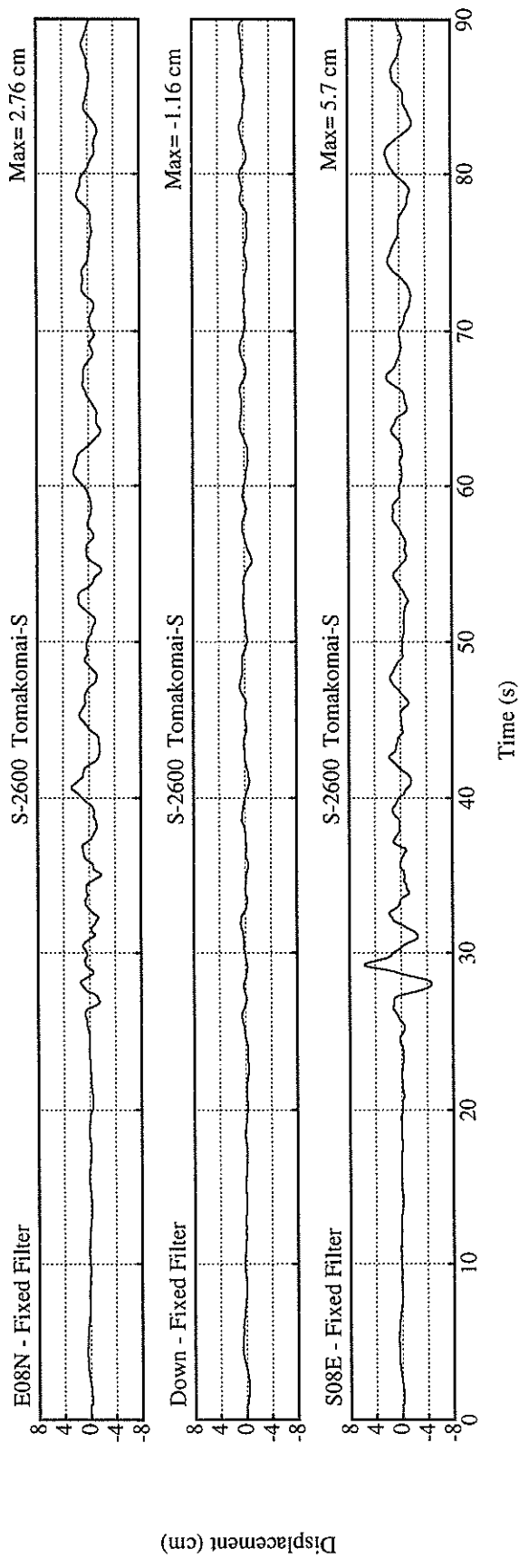
PEAK VALUES OF COMPONENTS

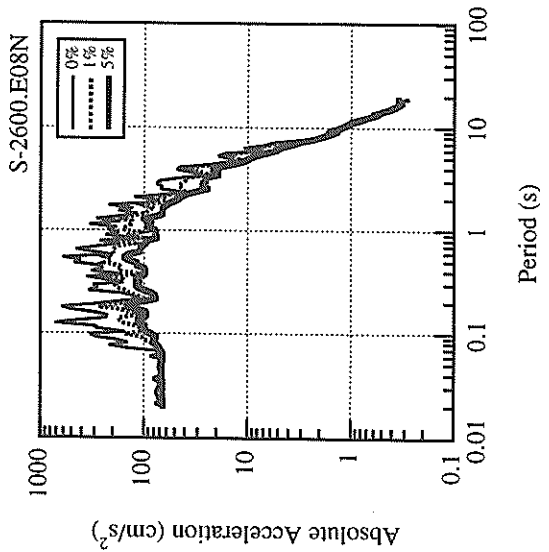
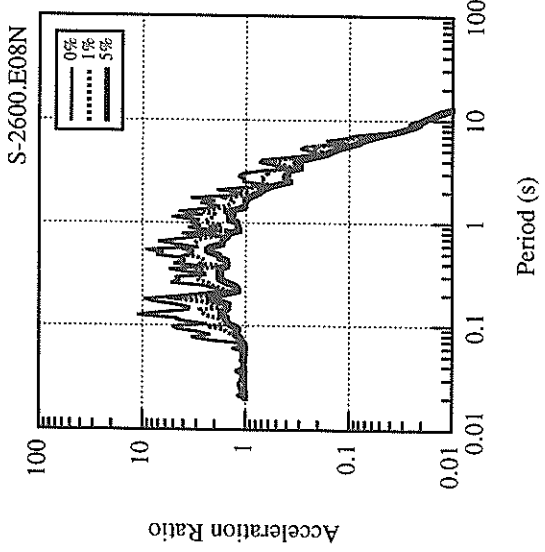
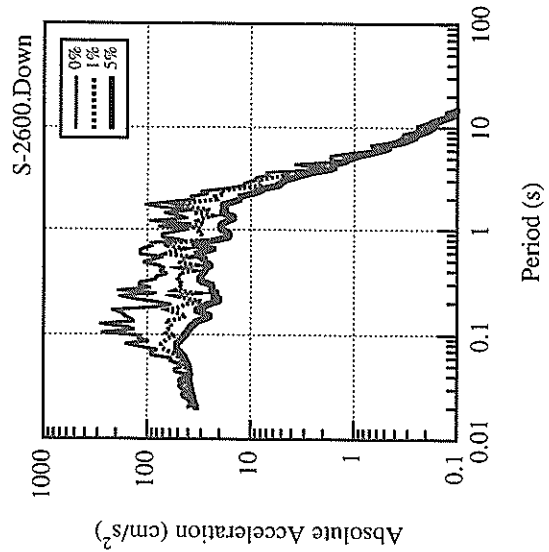
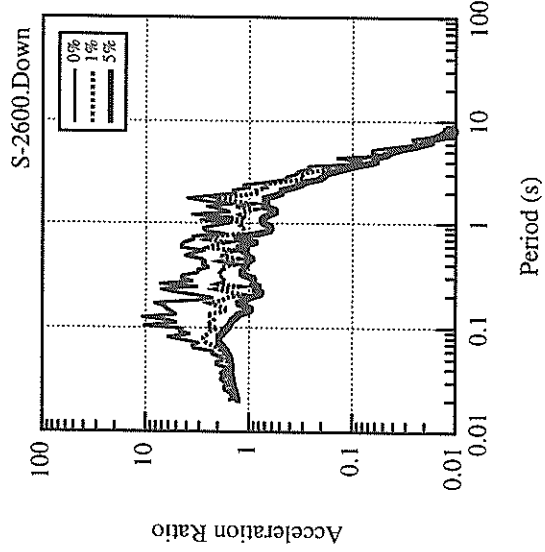
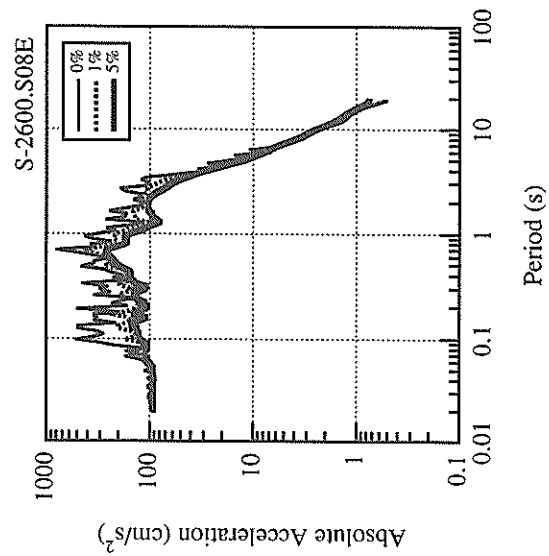
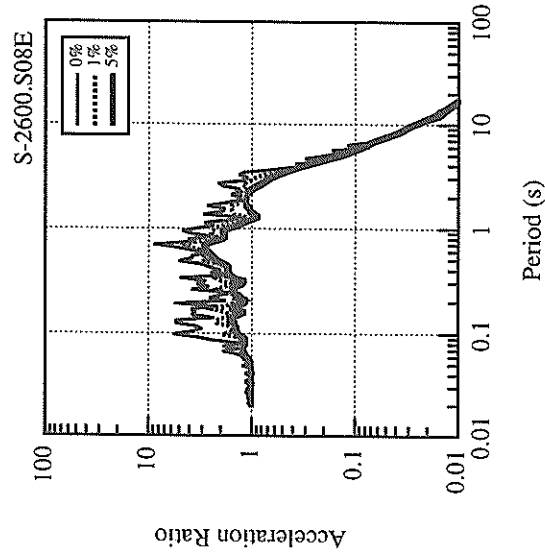
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.158	0.152	0.311	
MAXIMUM ACCELERATION (GAL)				
ORIGINAL	82.7	54.1	24.8	82.8
CORRECTED	91.3	65.1	26.3	91.4
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	15.51	6.32	1.85	15.89
VARIABLE FILTER	17.45	6.25	1.30	17.69
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	5.70	2.76	1.16	5.73
VARIABLE FILTER	4.92	1.81	0.33	4.98

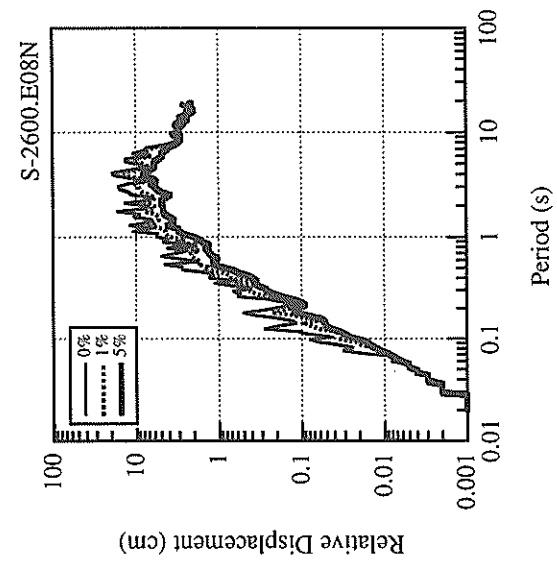
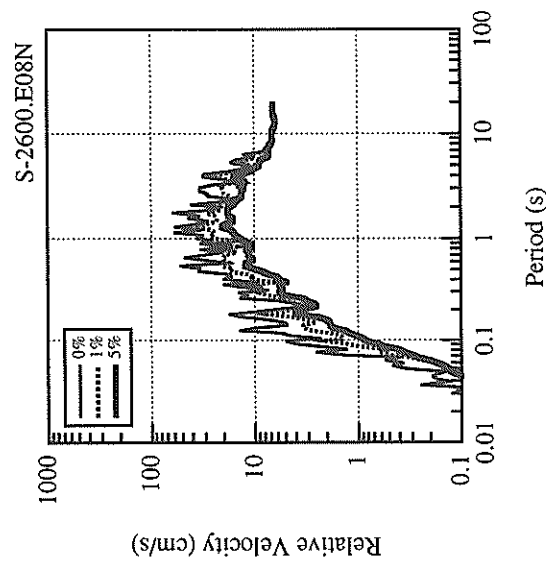
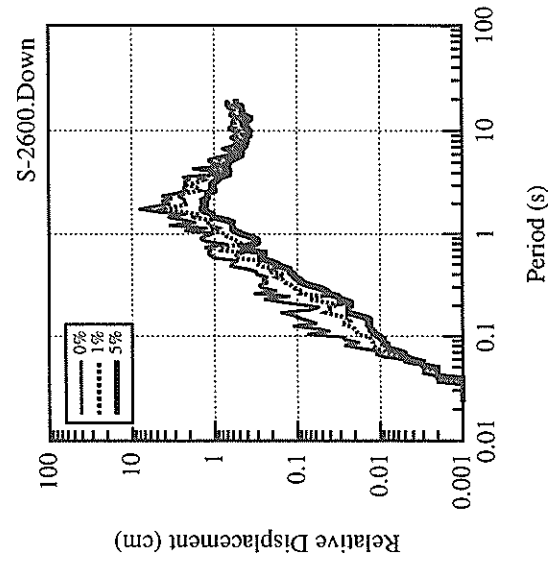
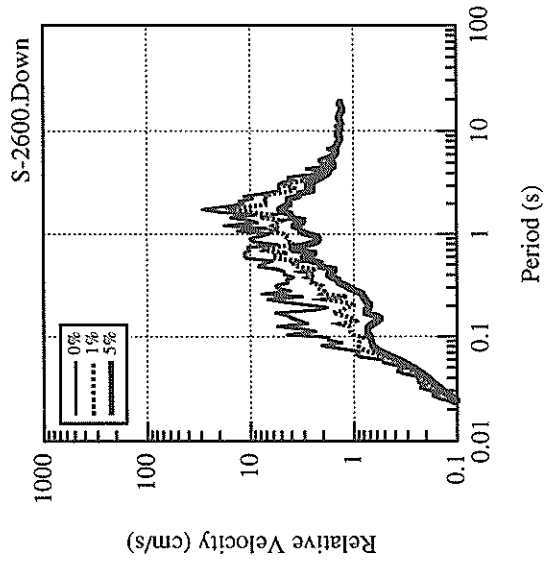
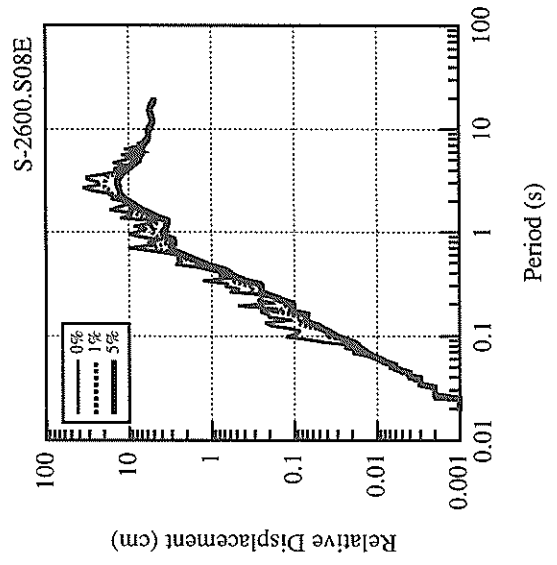
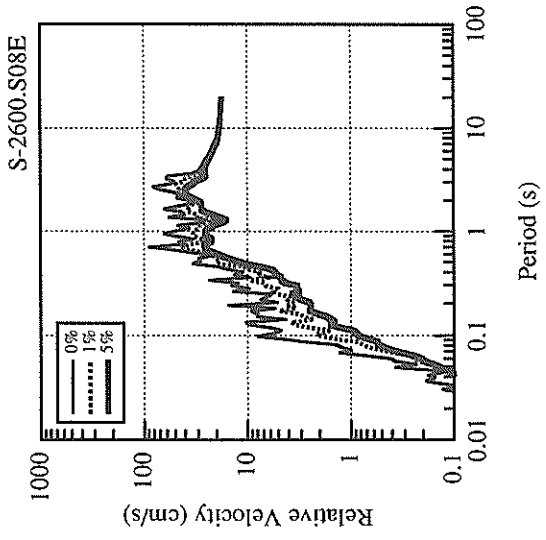
\* RESULTANT OF HORIZONTAL COMPONENTS



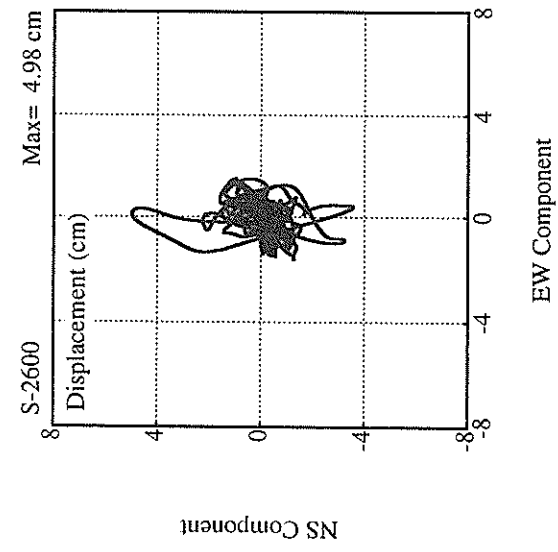
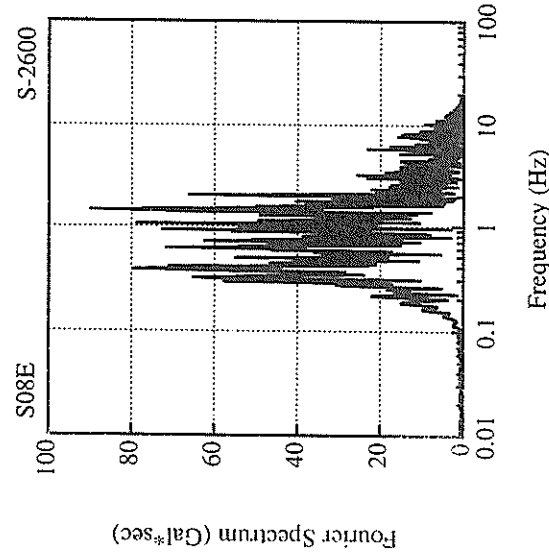
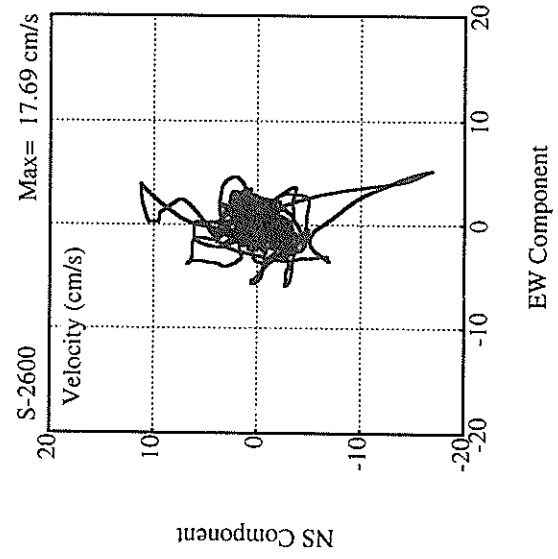
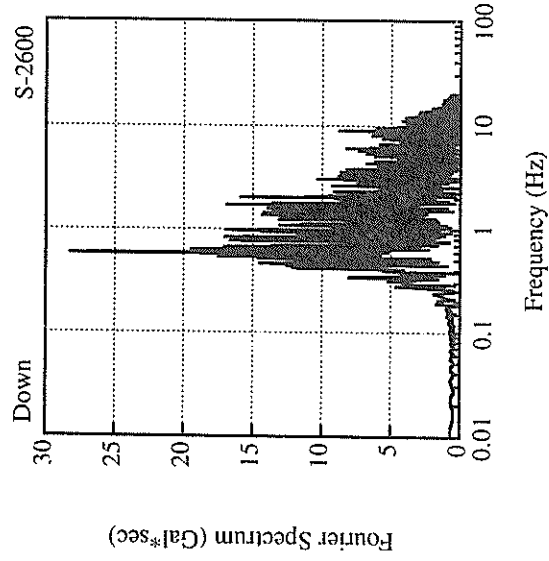
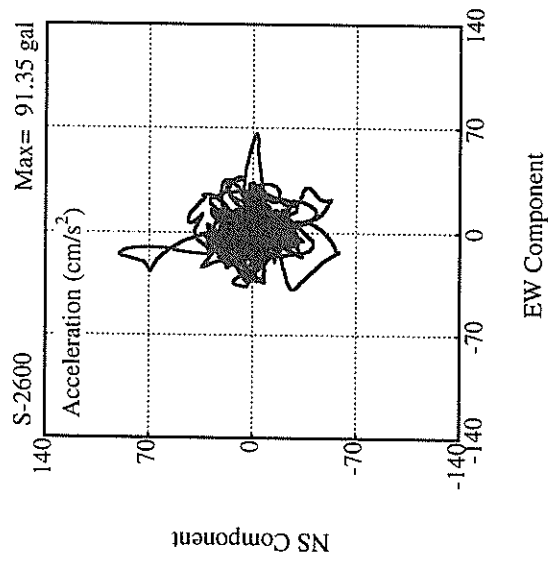
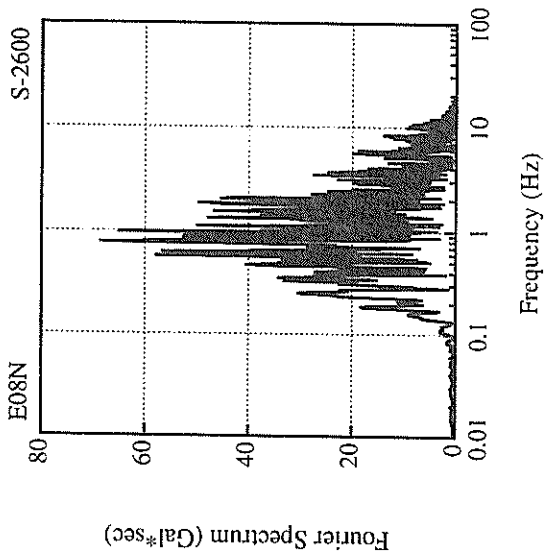












RECORD NUMBER : F-700  
 STATION : MURORAN-G

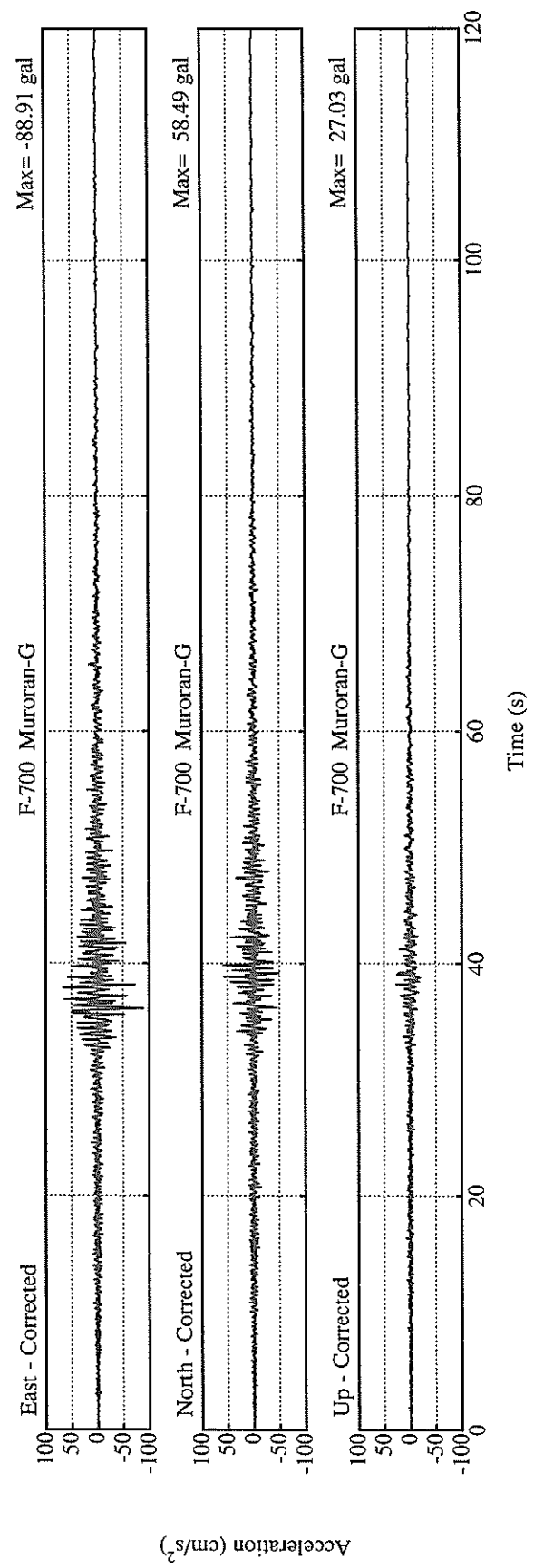
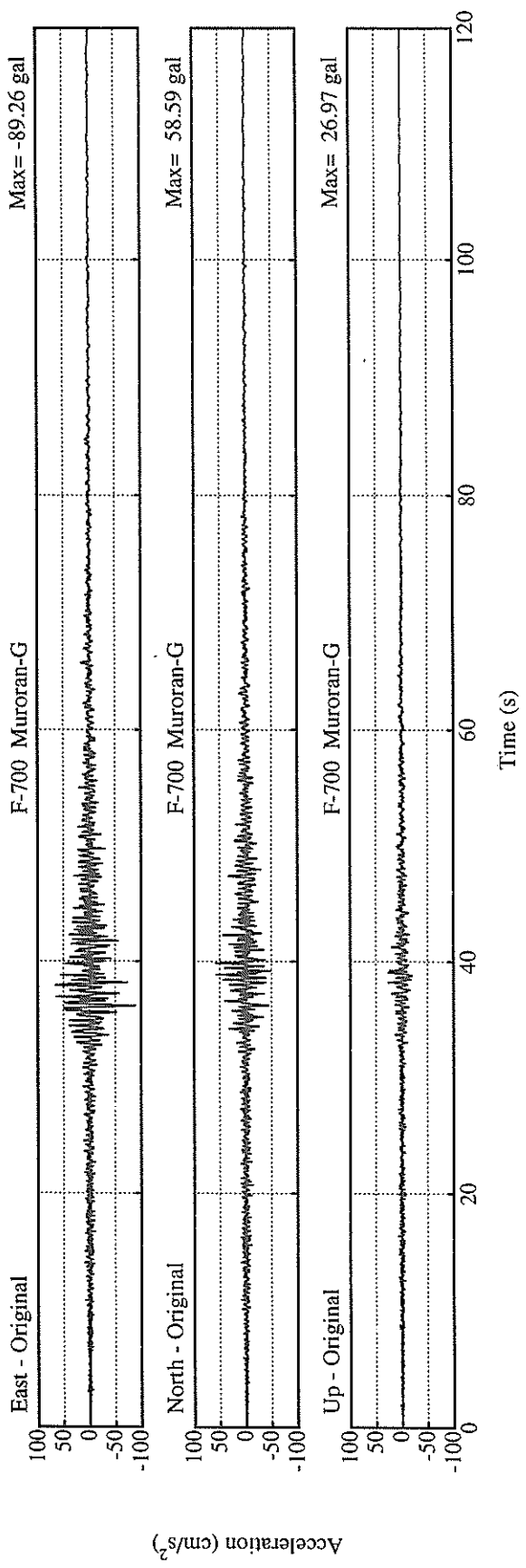
EARTHQUAKE DATA

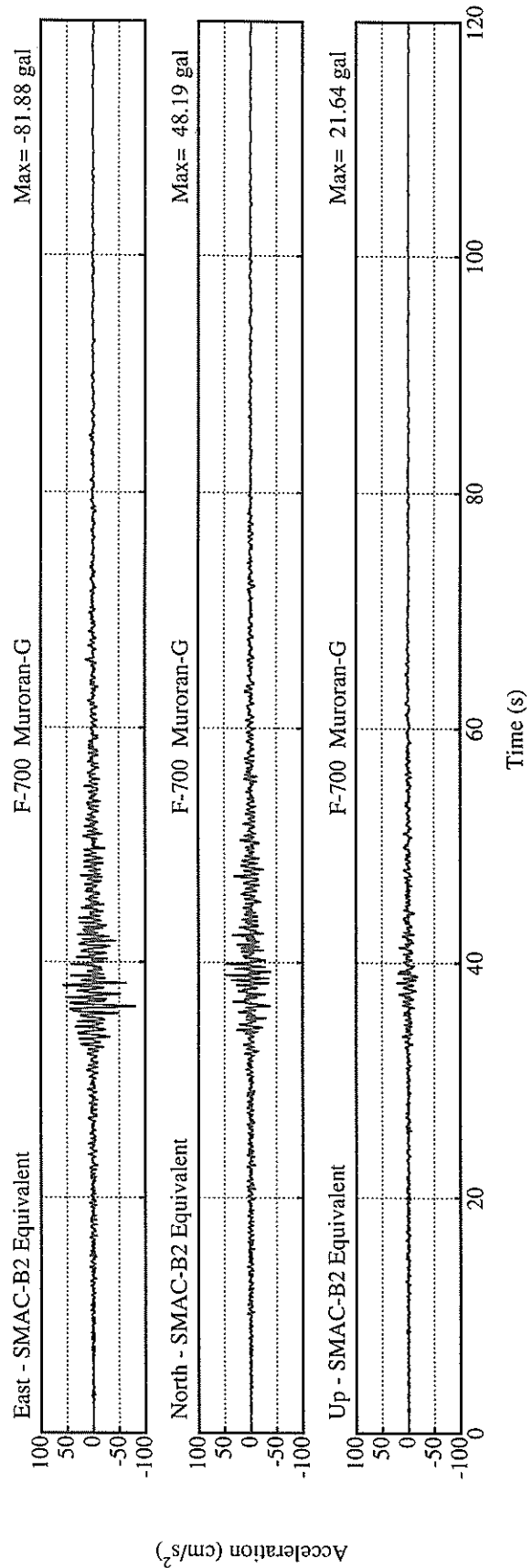
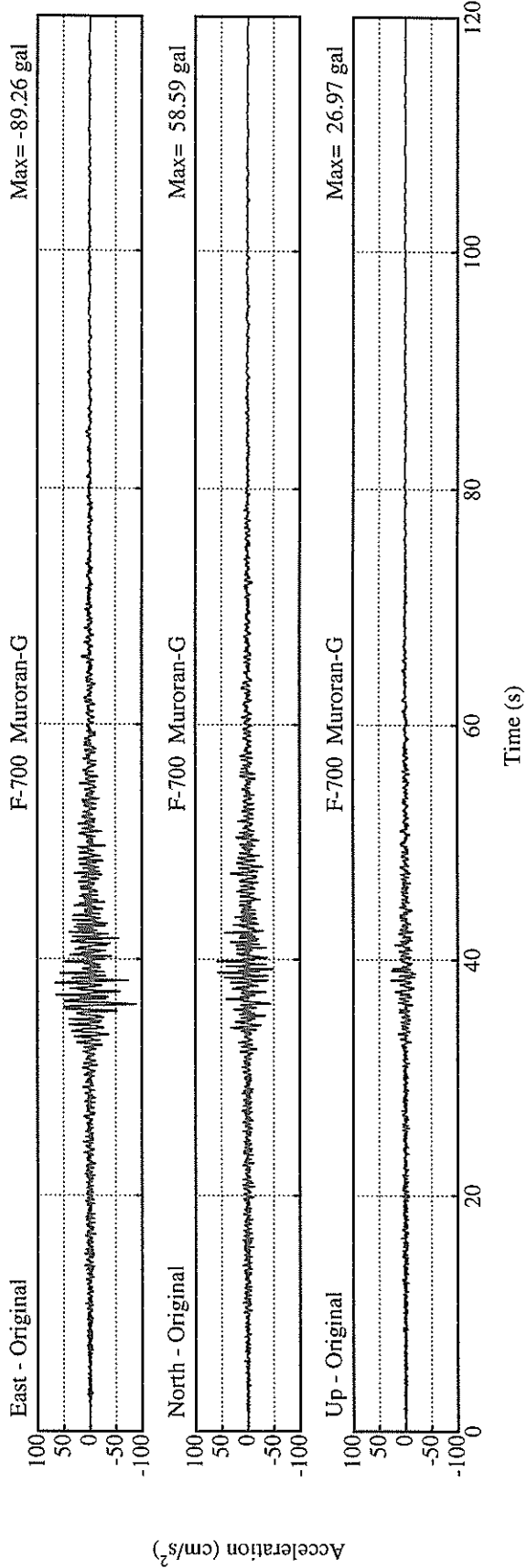
\*\*\*\*\*  
 DATE AND TIME 21:19 DEC.28,1994  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION FAR E OFF SANRIKU  
 LATITUDE 40° 25.6' N  
 LONGITUDE 143° 44.9' E  
 DEPTH 0.0KM  
 JMA MAGNITUDE 7.5  
 \*\*\*\*\*

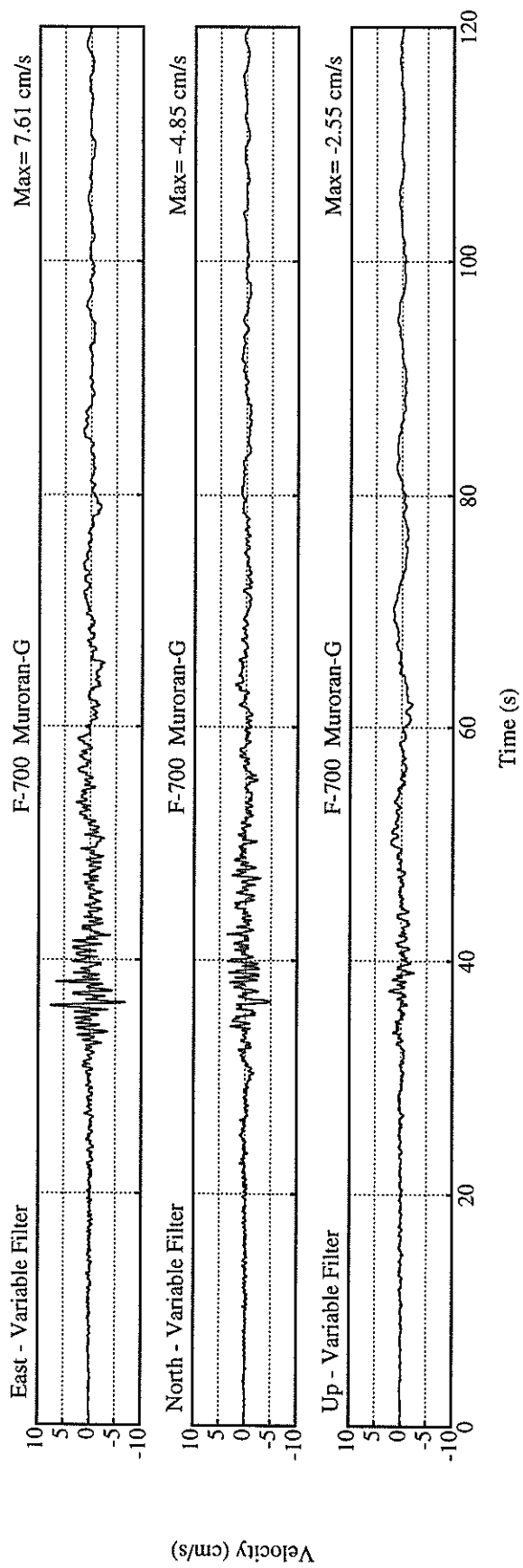
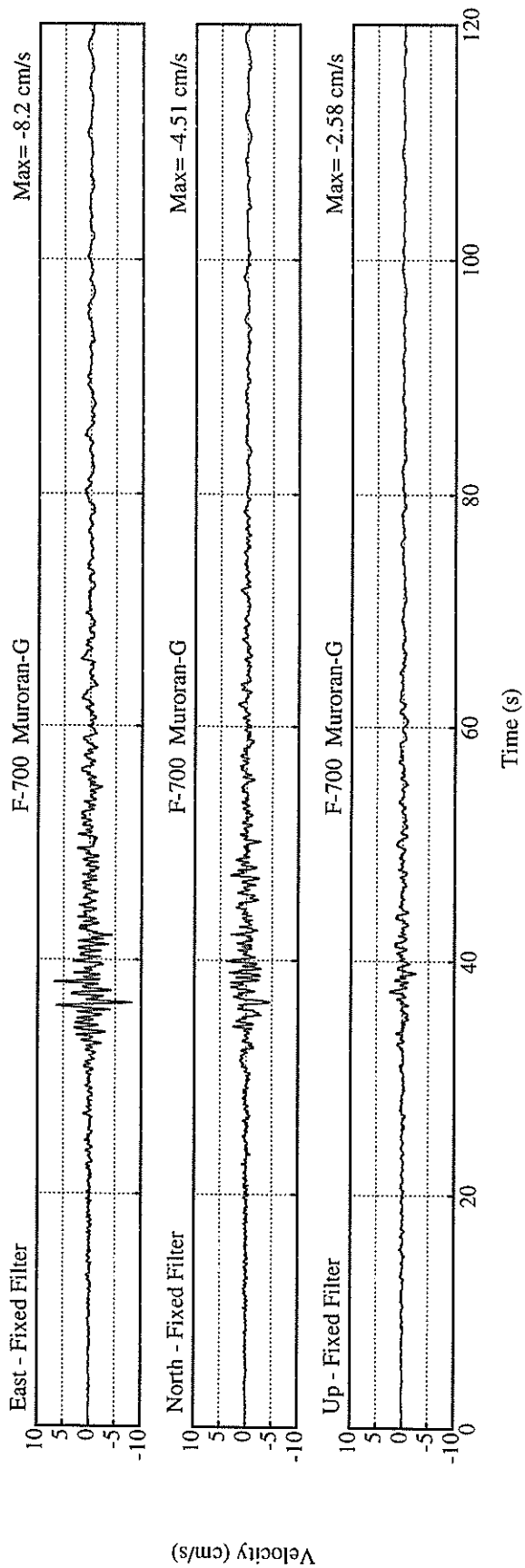
PEAK VALUES OF COMPONENTS

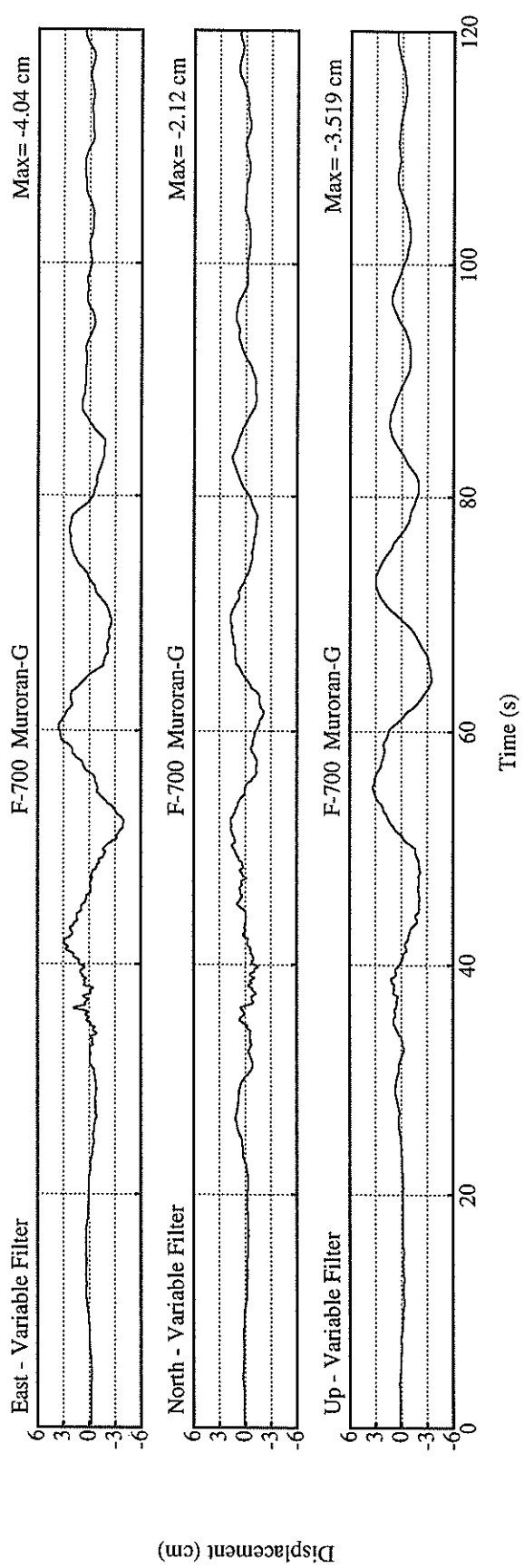
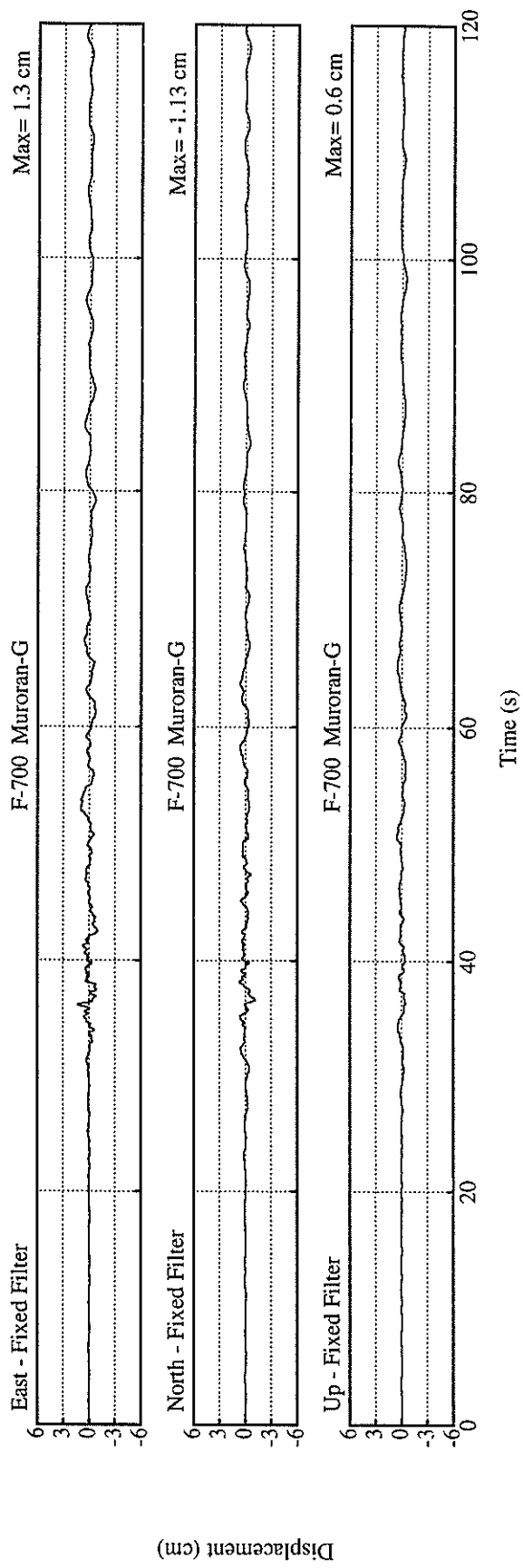
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.048	0.042	0.042	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	48.2	81.9	21.6	83.4
ORIGINAL	58.6	89.3	27.0	89.8
CORRECTED	58.5	88.9	27.0	89.7
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	4.51	8.20	2.58	8.69
VARIABLE FILTER	4.85	7.61	2.55	7.67
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	1.13	1.30	0.60	1.30
VARIABLE FILTER	2.12	4.04	3.52	4.37

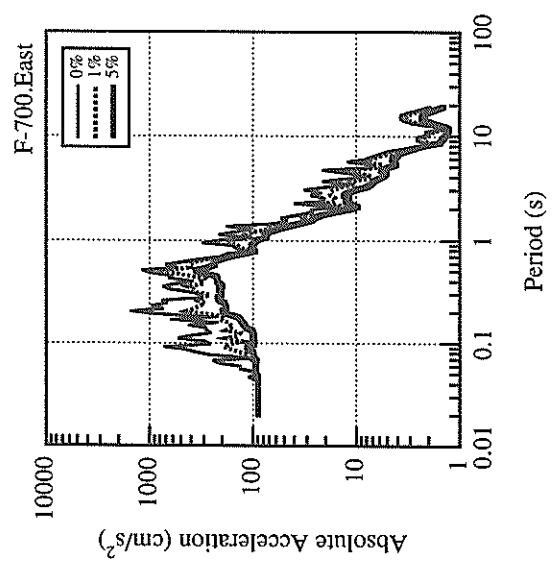
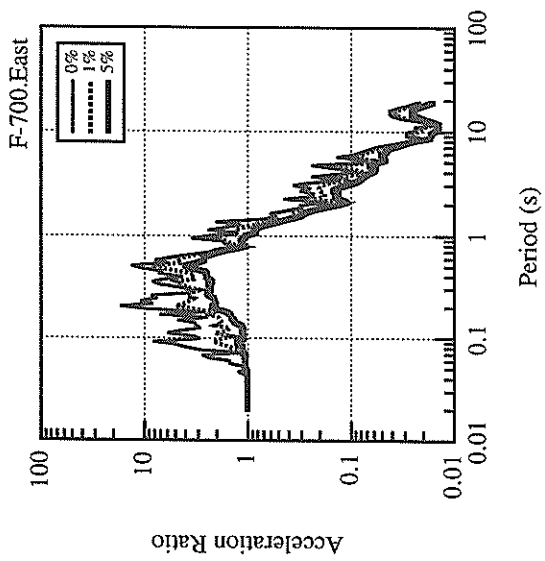
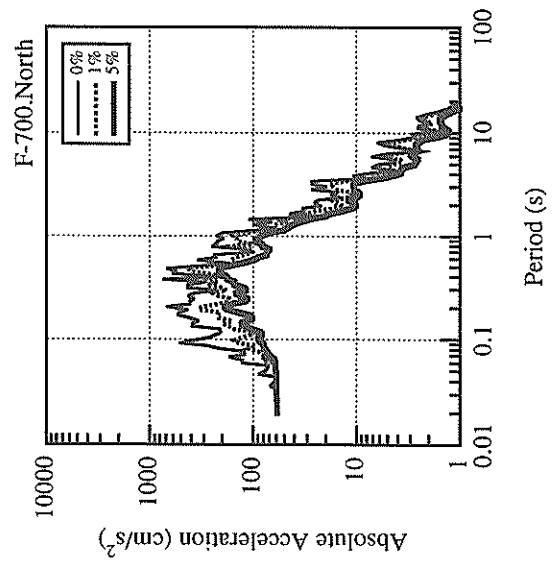
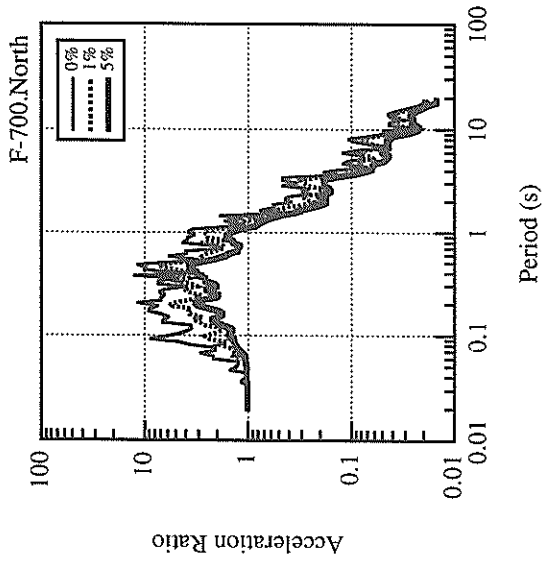
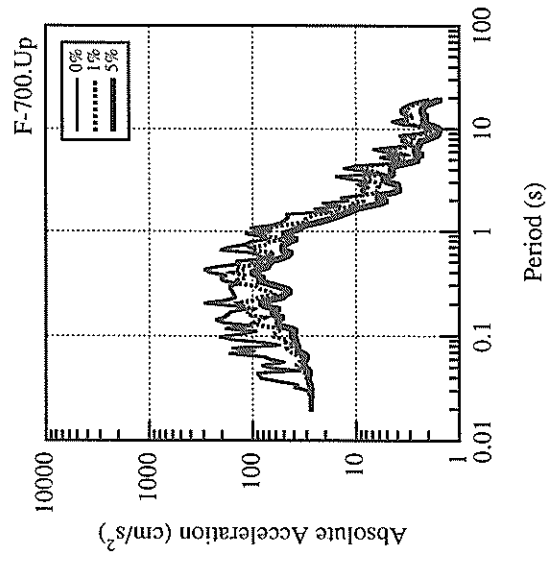
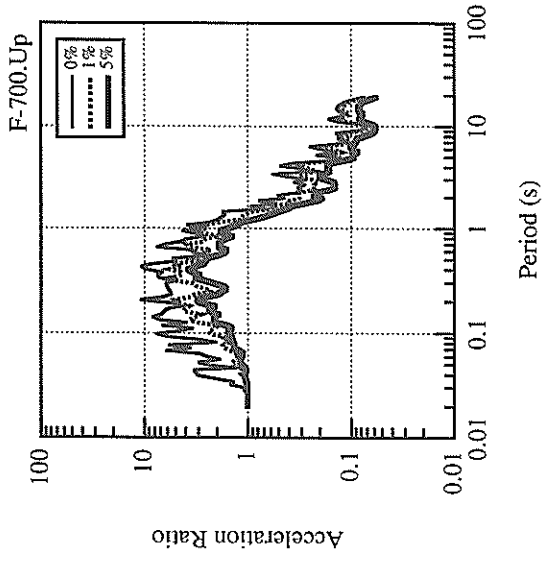
\* RESULTANT OF HORIZONTAL COMPONENTS

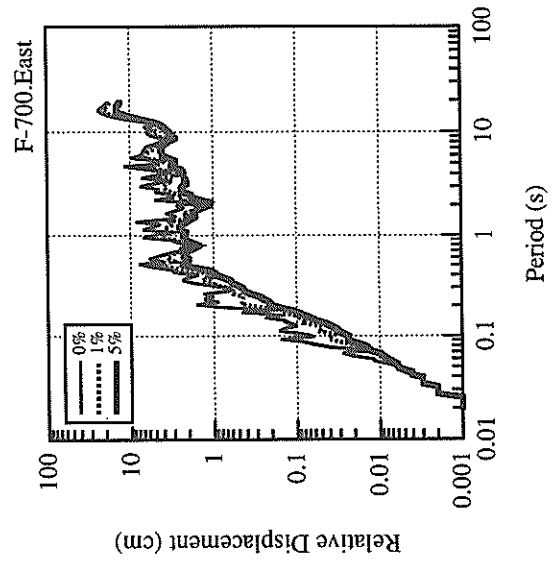
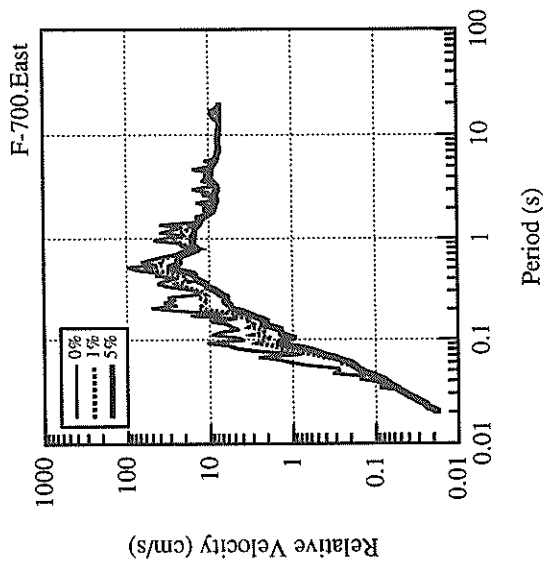
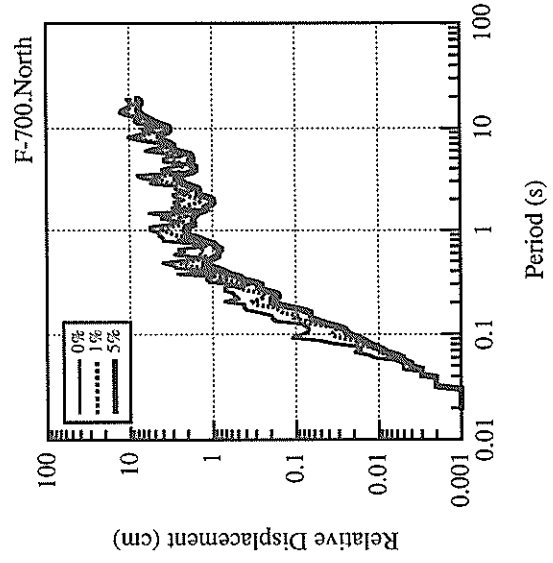
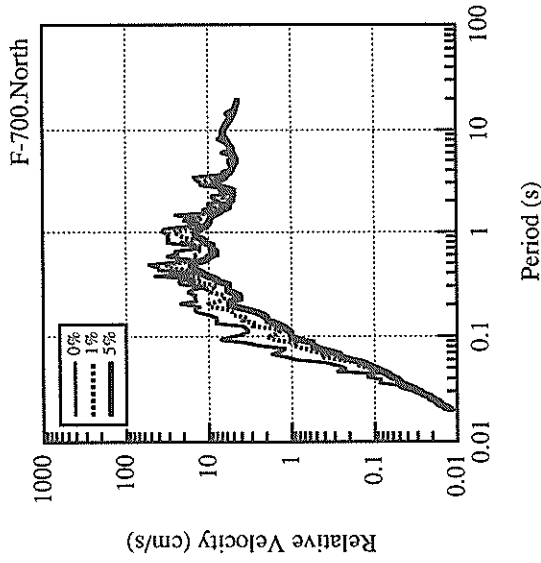
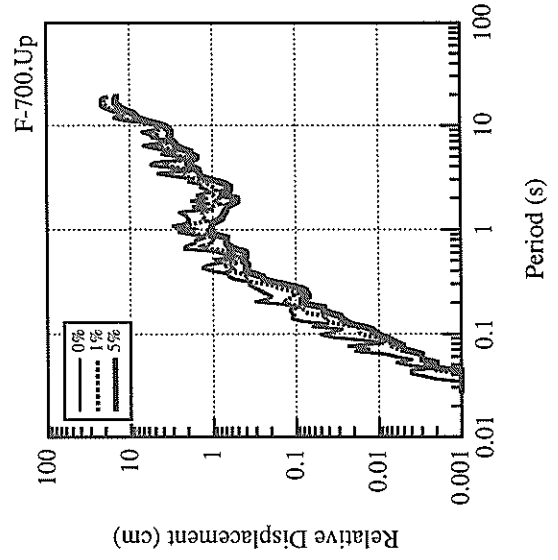
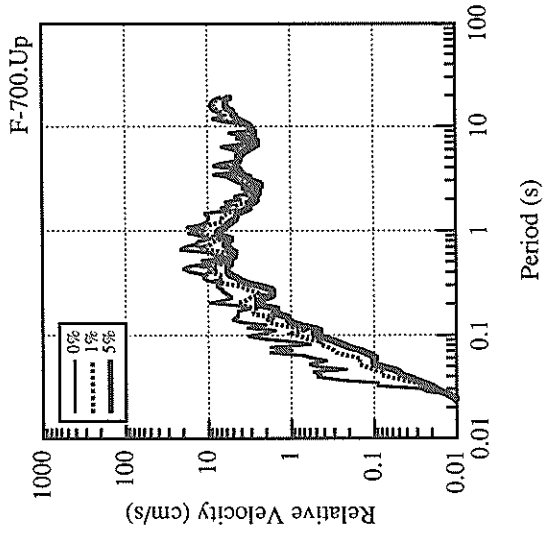




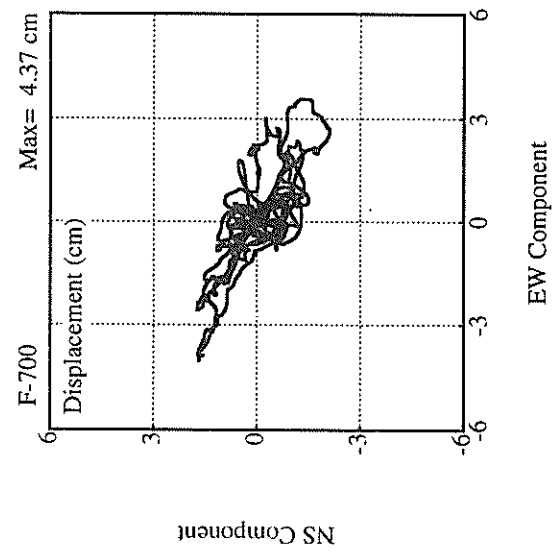
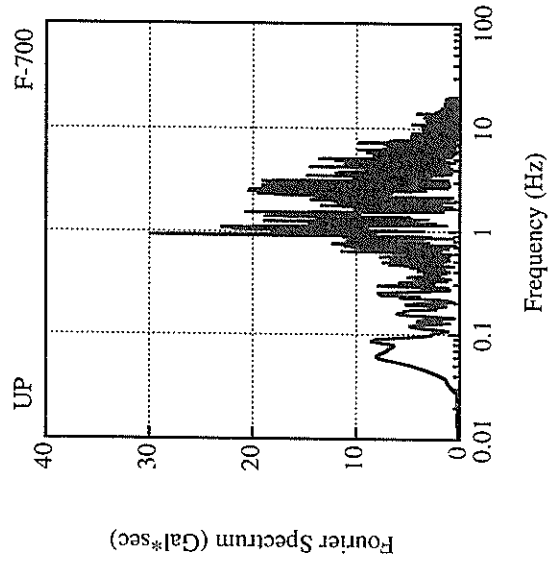
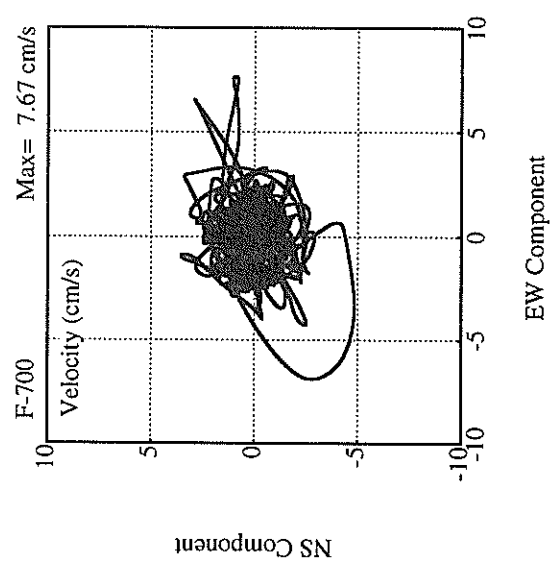
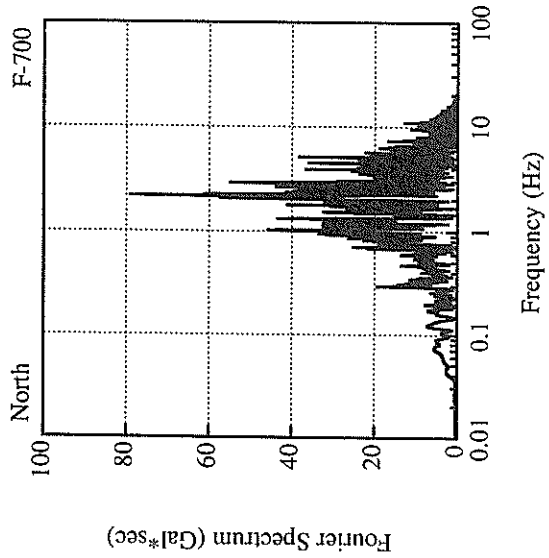
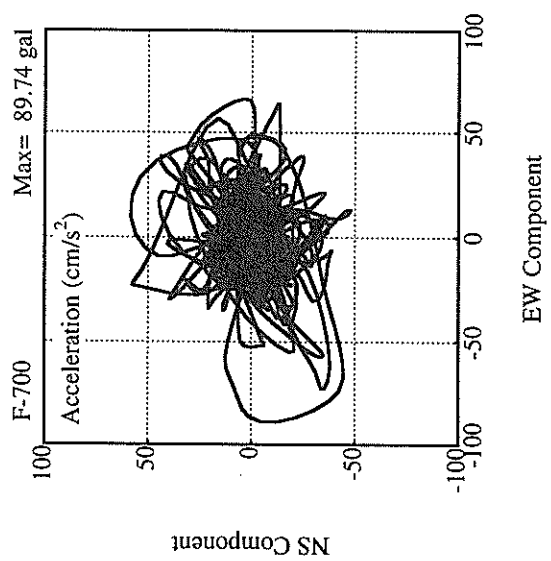
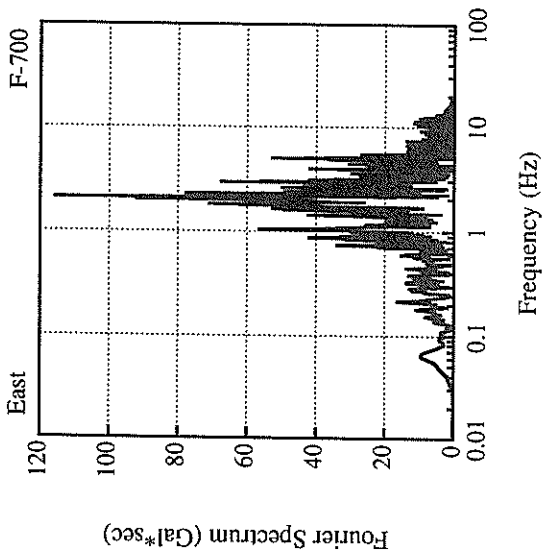












RECORD NUMBER : F-709  
 STATION : AKITA-G

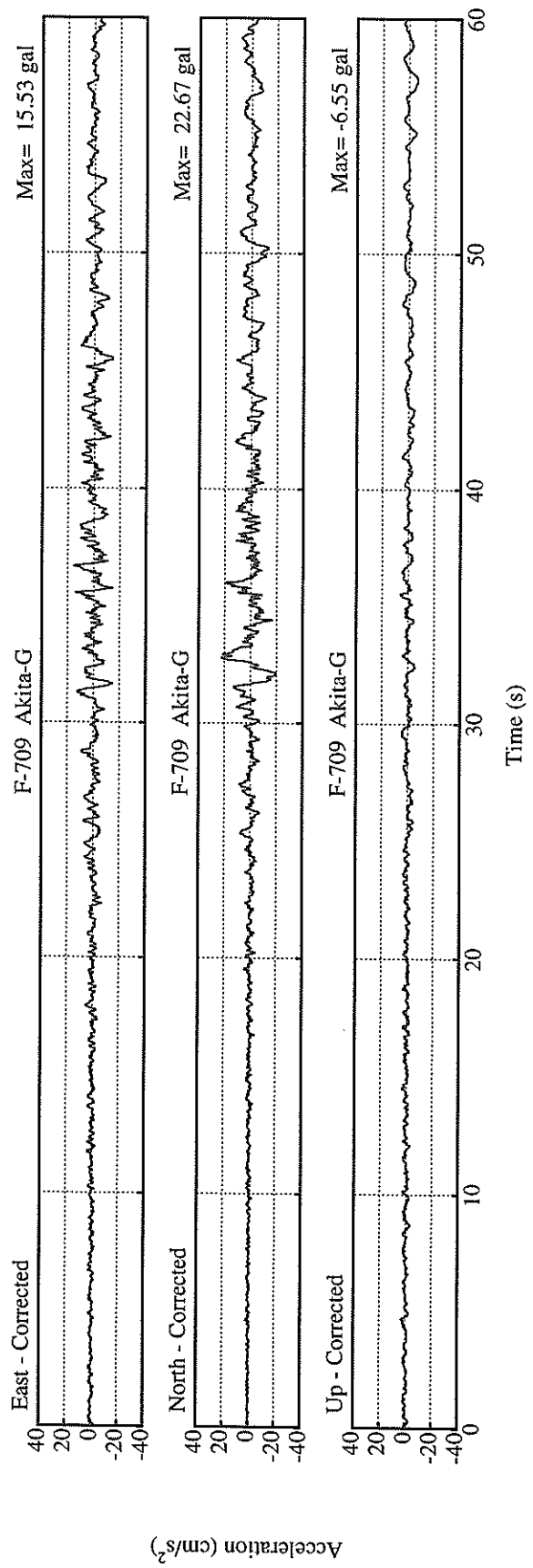
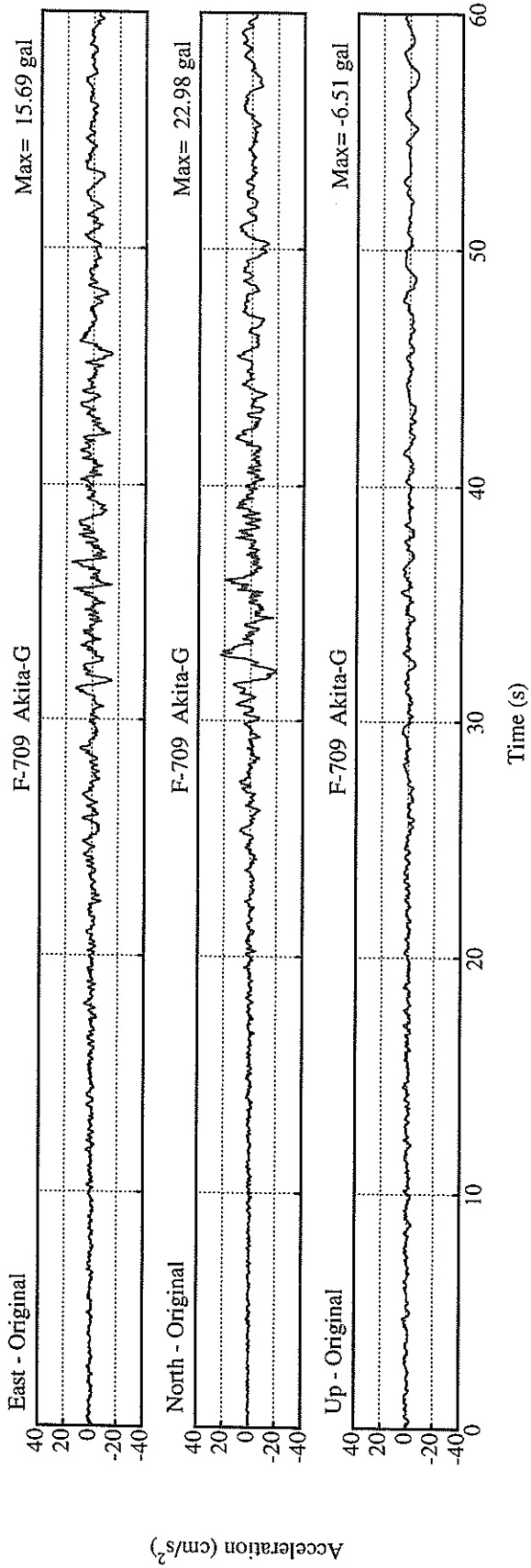
EARTHQUAKE DATA

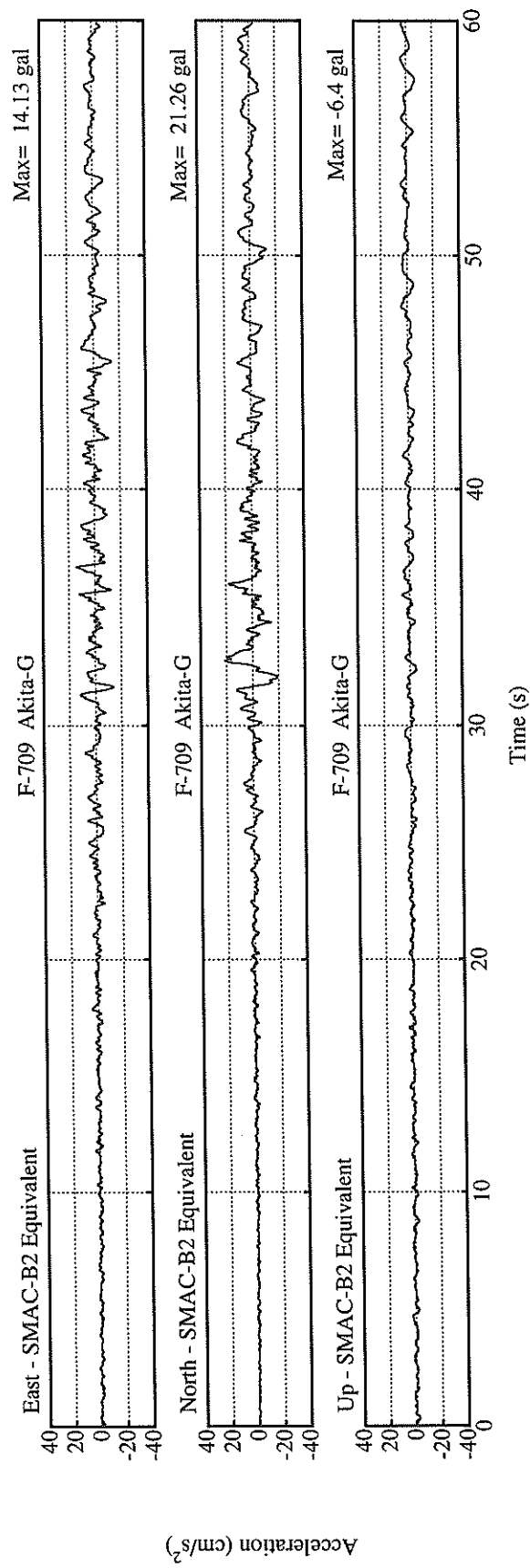
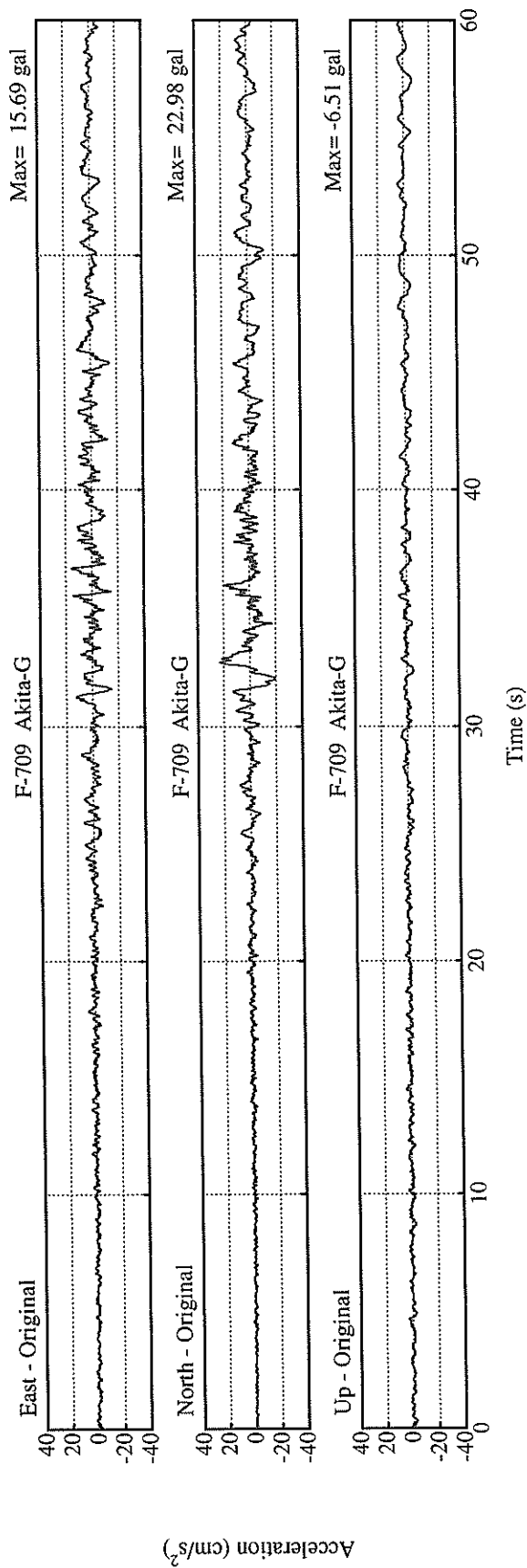
```
*****
DATE AND TIME                21:19 DEC.28,1994
LOCATION OF HYPOCENTER
  EPICENTRAL REGION          FAR E OFF SANRIKU
  LATITUDE                   40° 25.6' N
  LONGITUDE                  143° 44.9' E
  DEPTH                      0.0KM
  JMA MAGNITUDE              7.5
*****
```

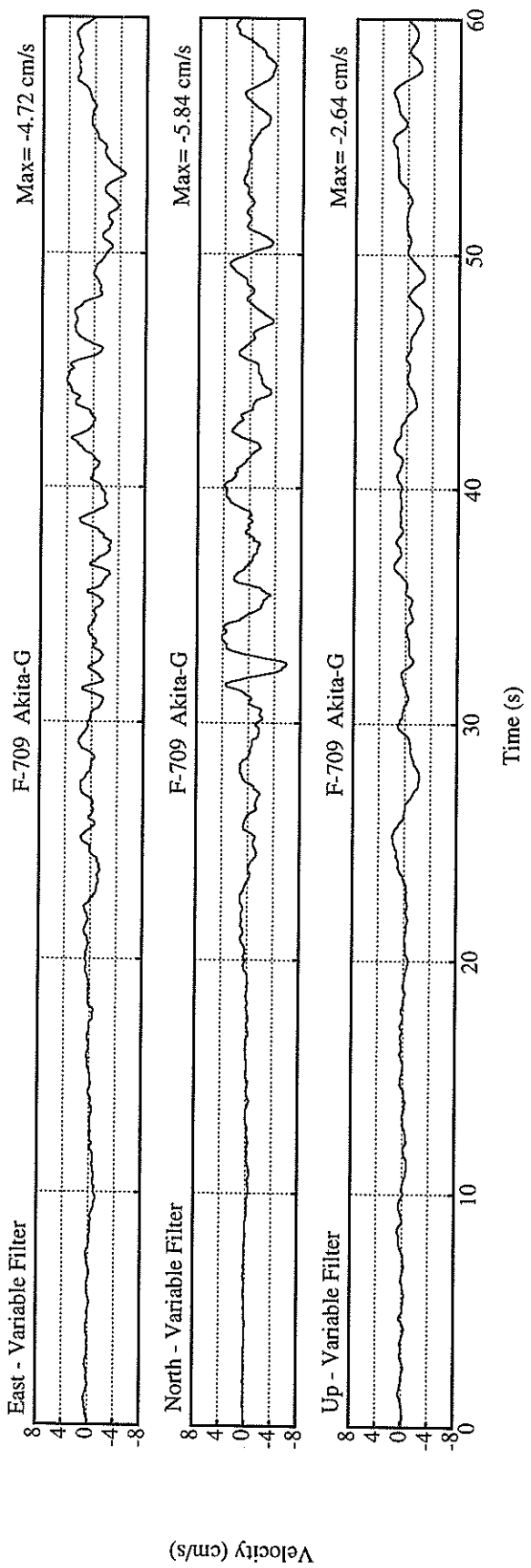
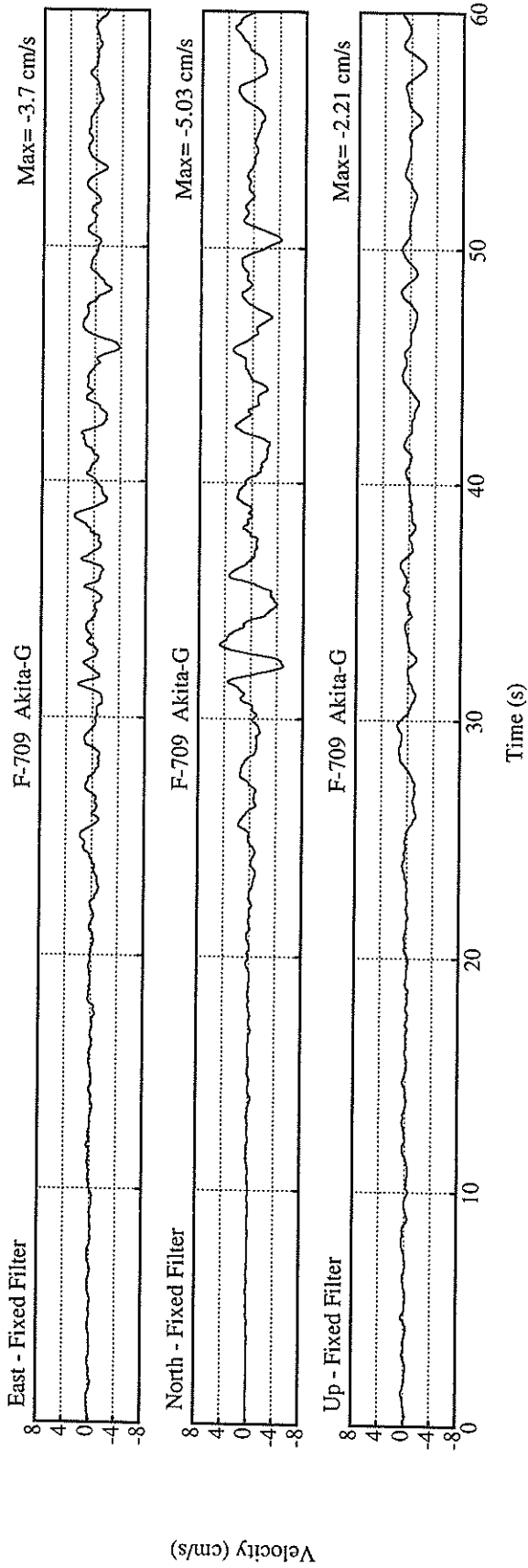
PEAK VALUES OF COMPONENTS

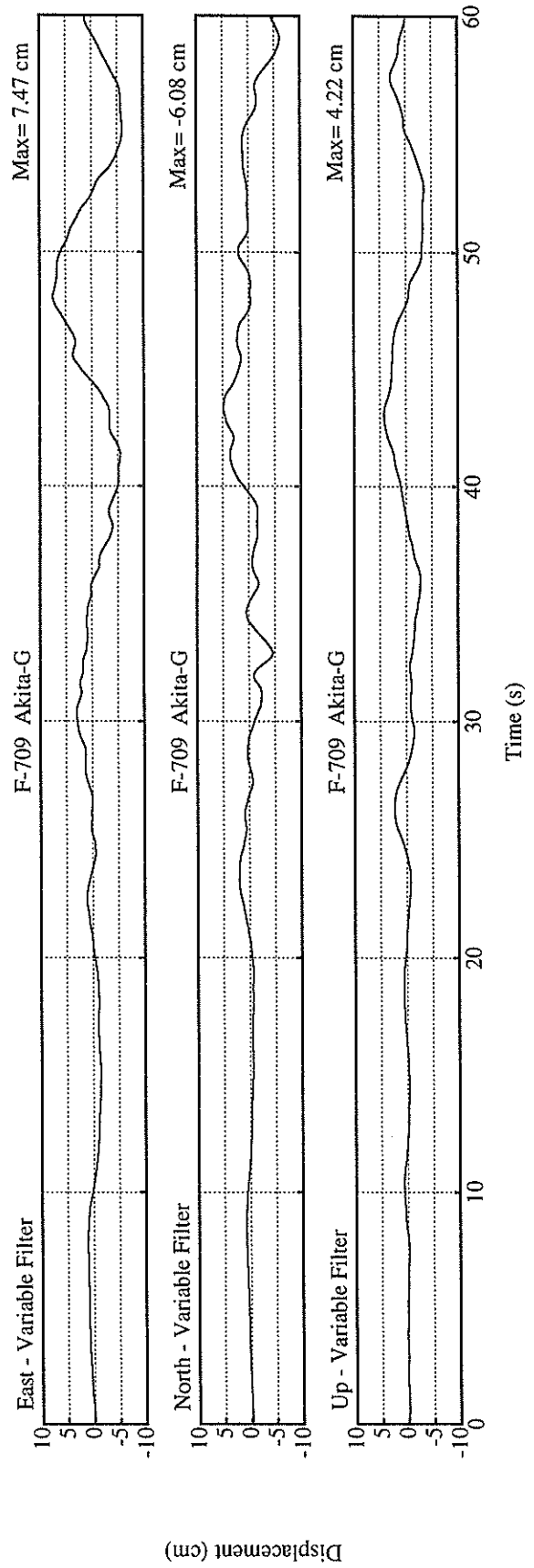
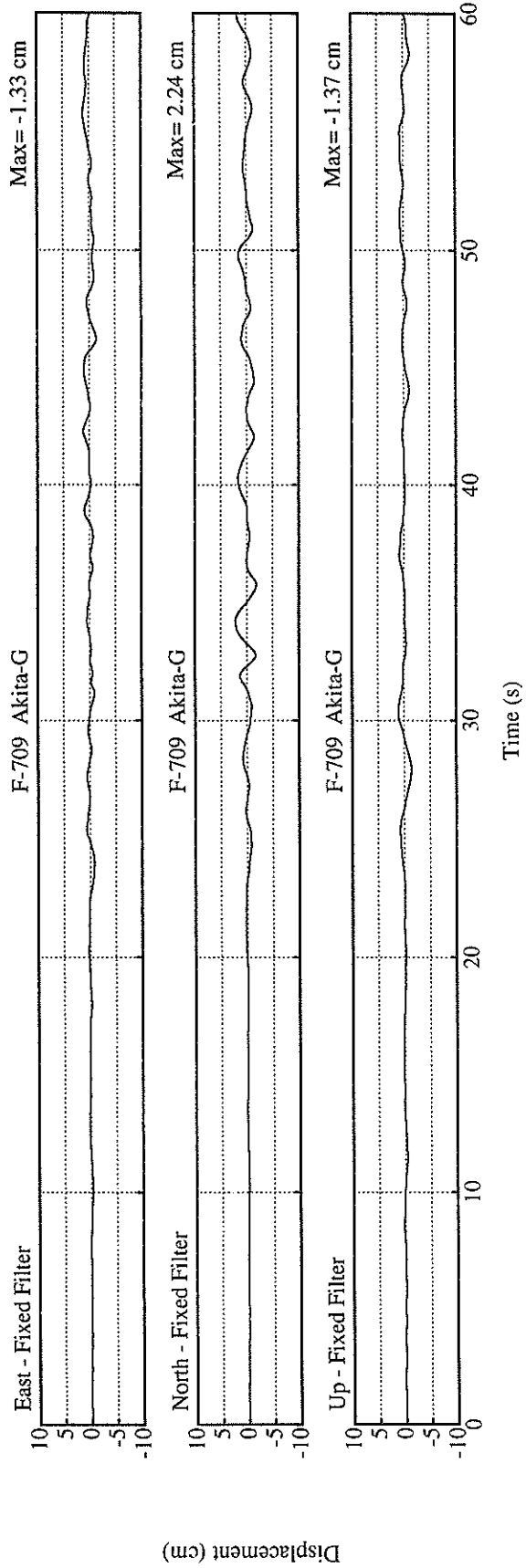
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.036	0.036	0.042	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	21.3	14.1	6.4	21.4
ORIGINAL	23.0	15.7	6.5	23.0
CORRECTED	22.7	15.5	6.6	22.7
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	5.03	3.70	2.21	5.20
VARIABLE FILTER	5.84	4.72	2.64	5.87
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	2.24	1.33	1.37	2.30
VARIABLE FILTER	6.08	7.47	4.22	7.48

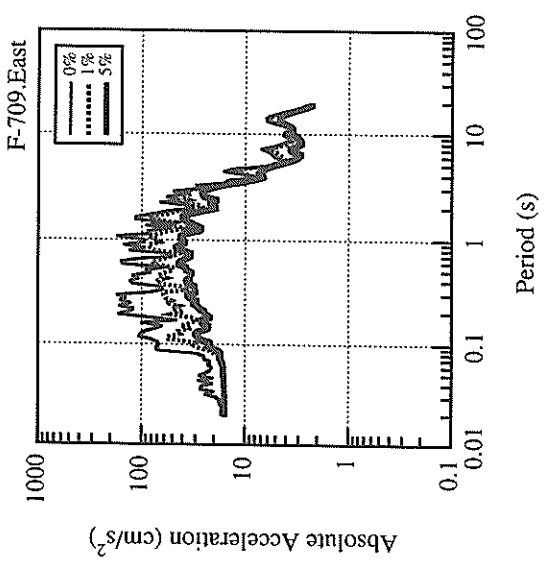
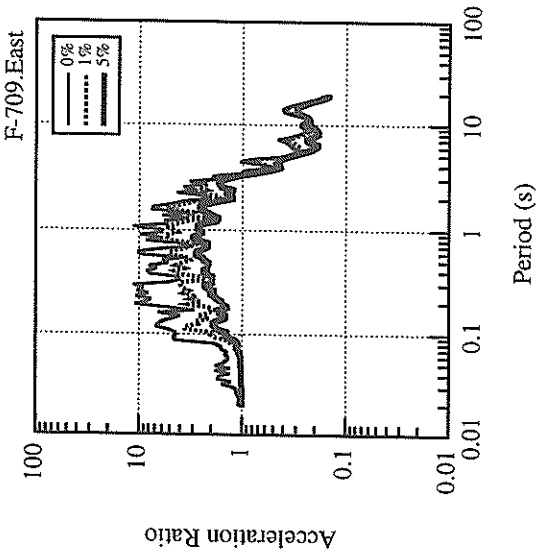
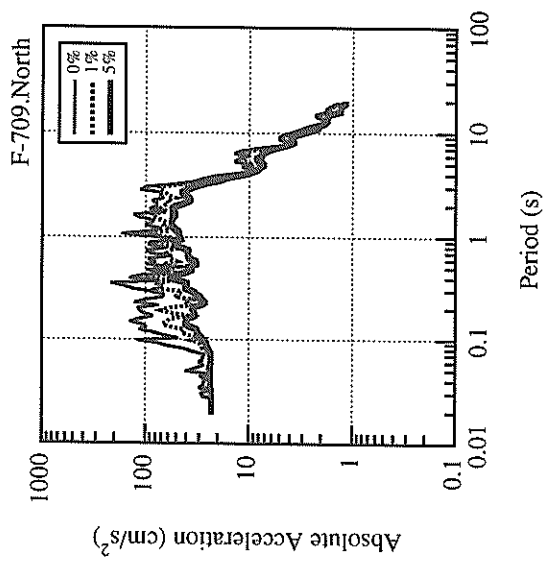
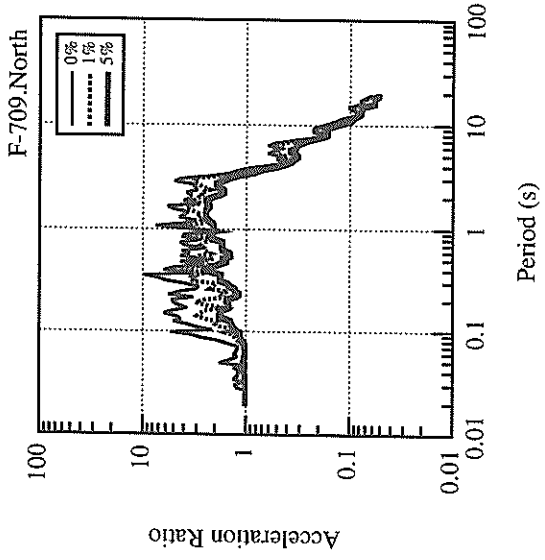
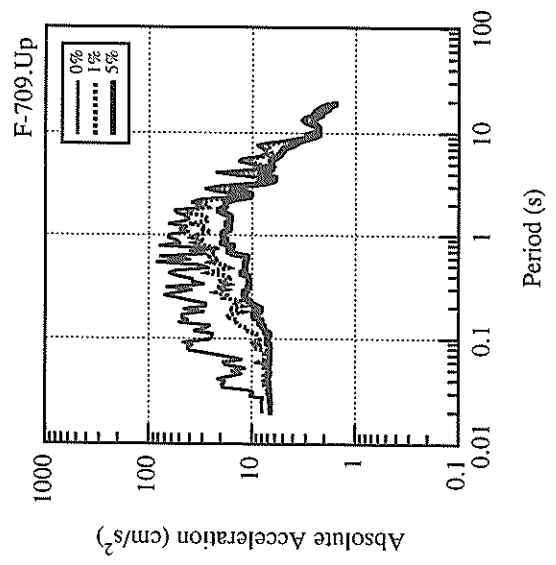
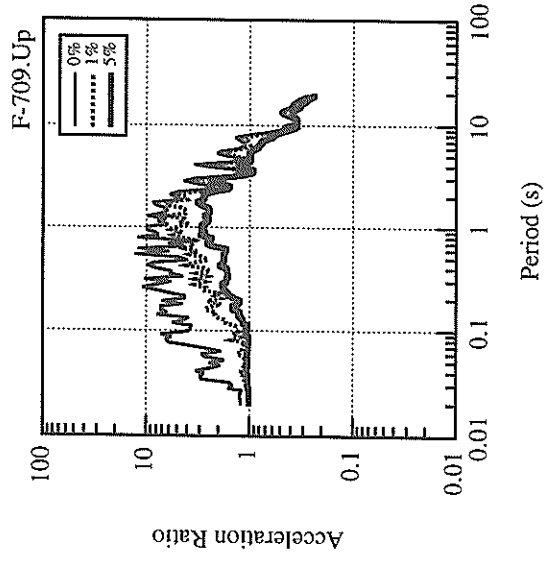
\* RESULTANT OF HORIZONTAL COMPONENTS

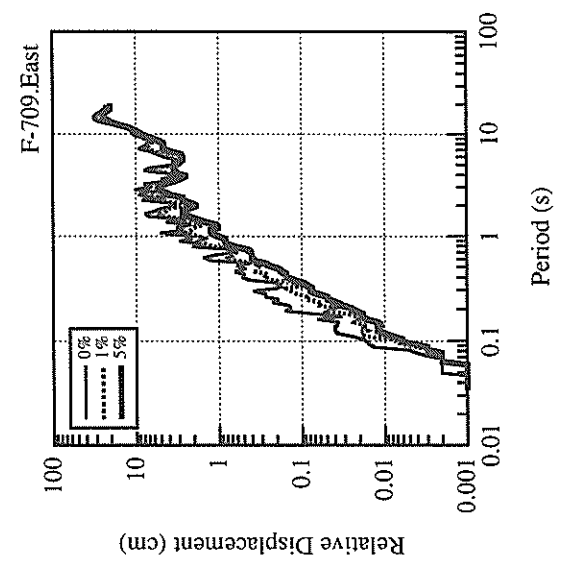
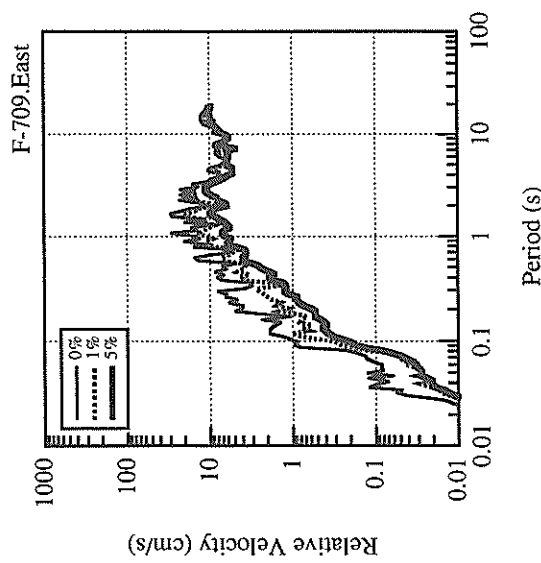
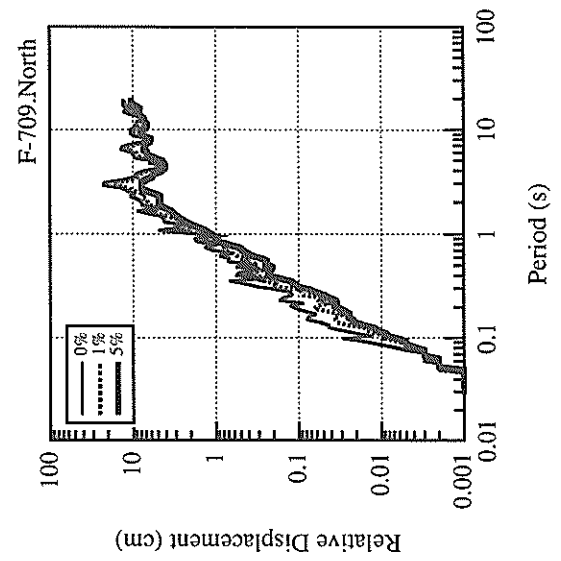
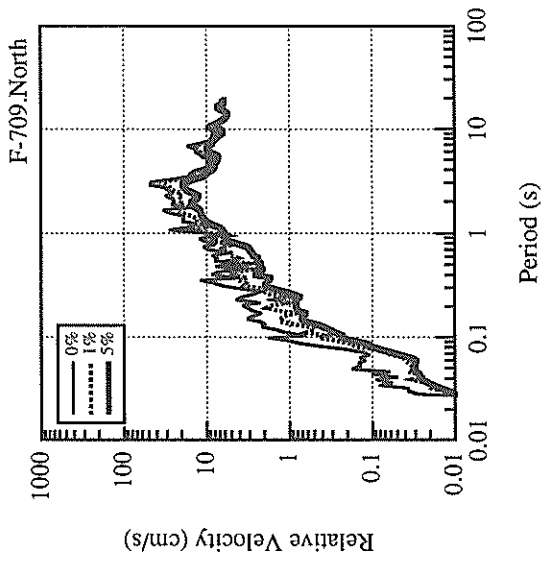
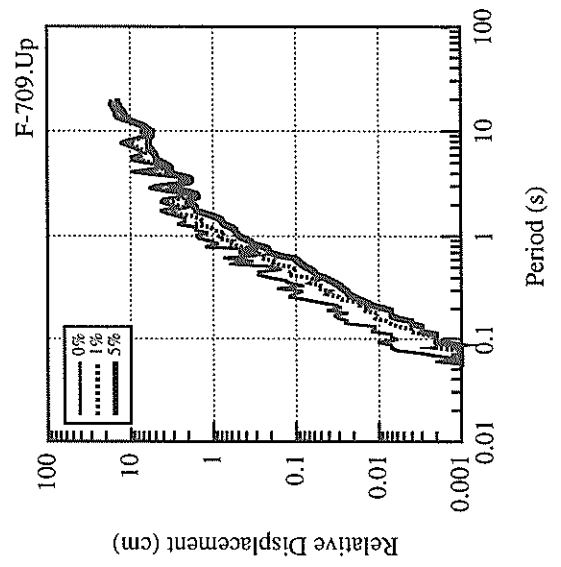
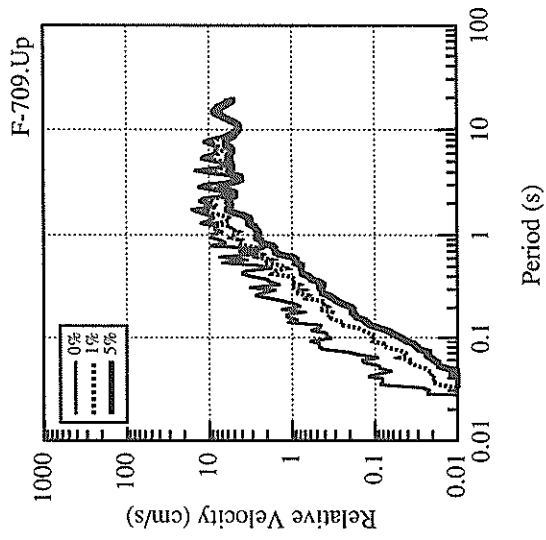




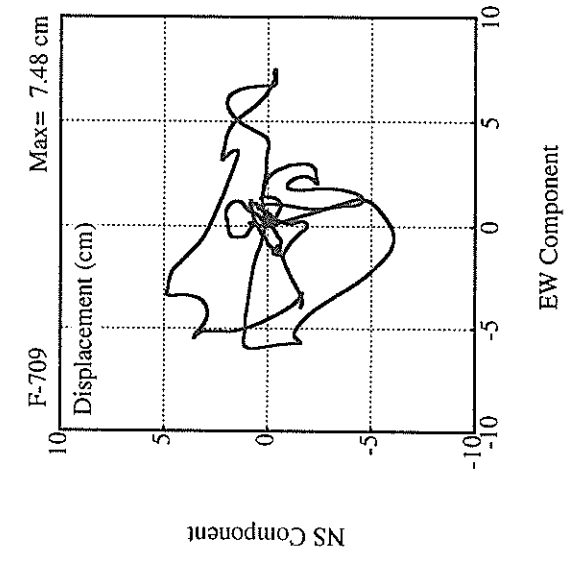
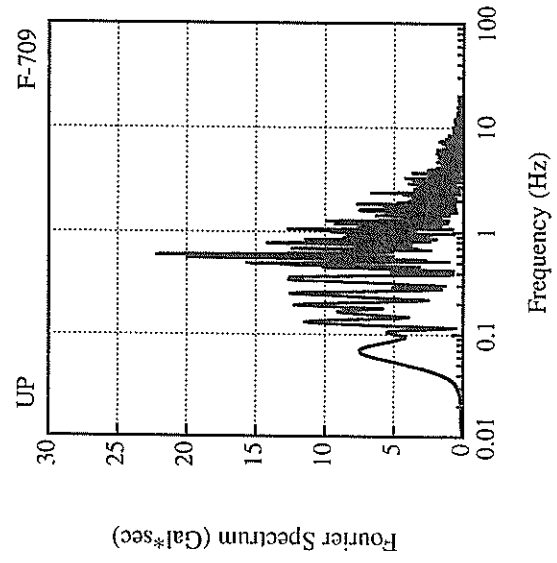
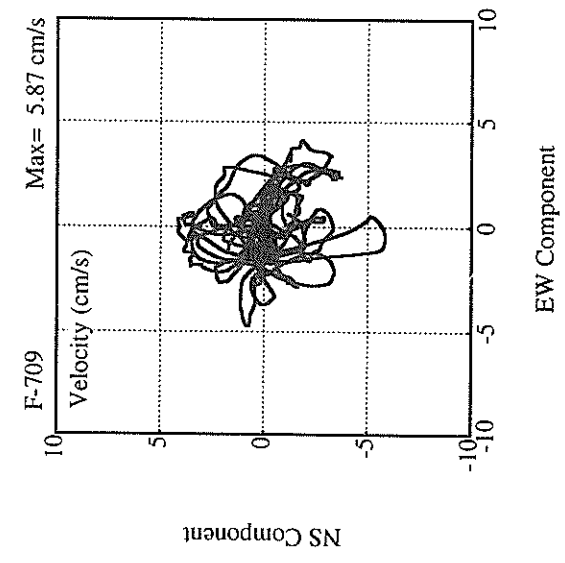
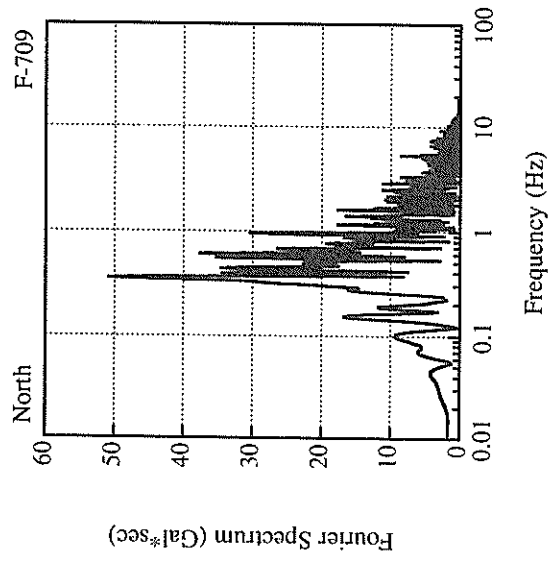
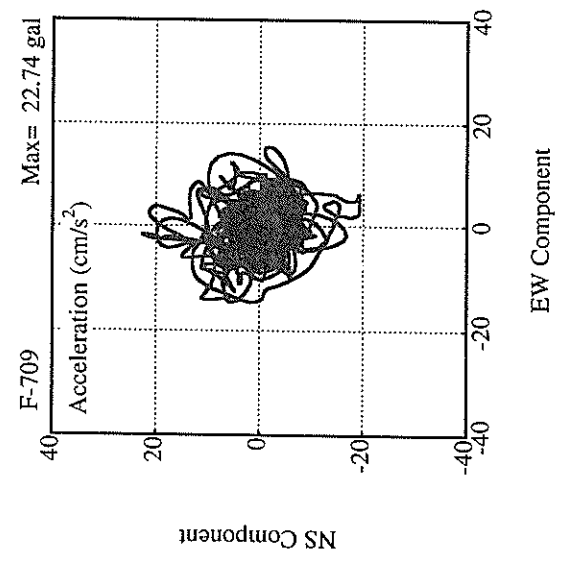
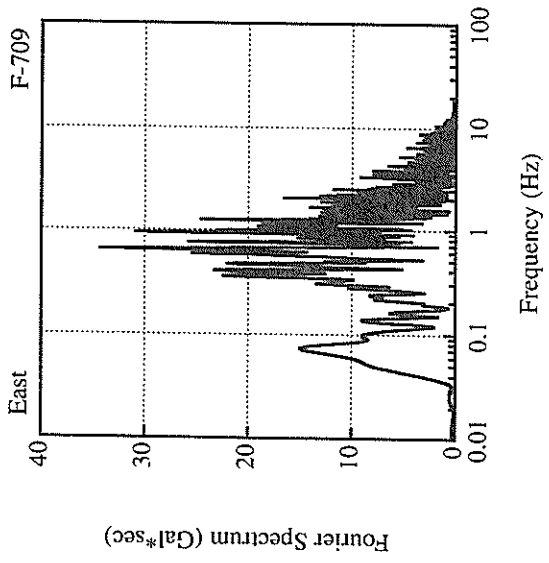












RECORD NUMBER : F-708  
 STATION : AKITA-GB

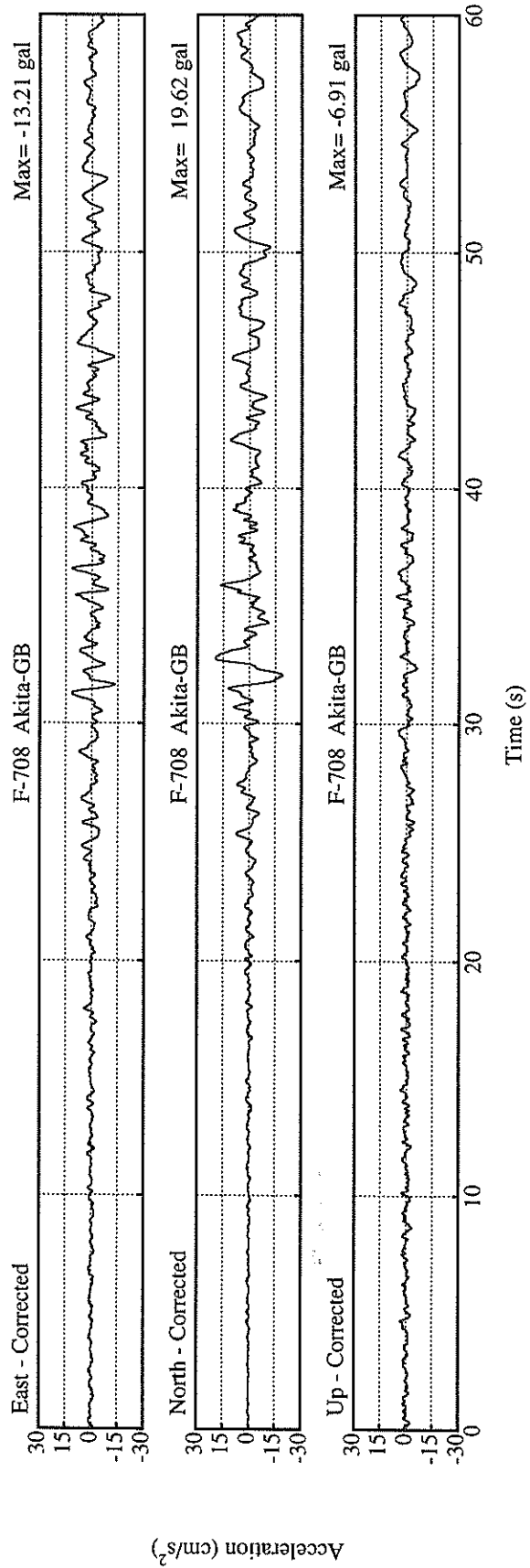
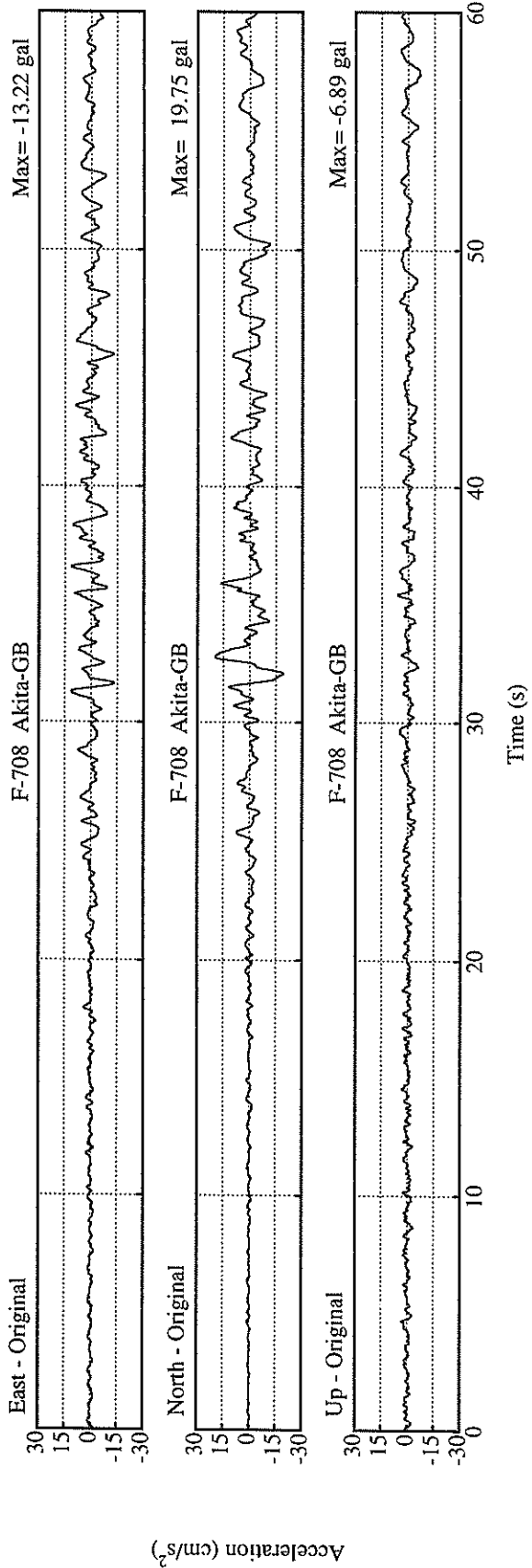
EARTHQUAKE DATA

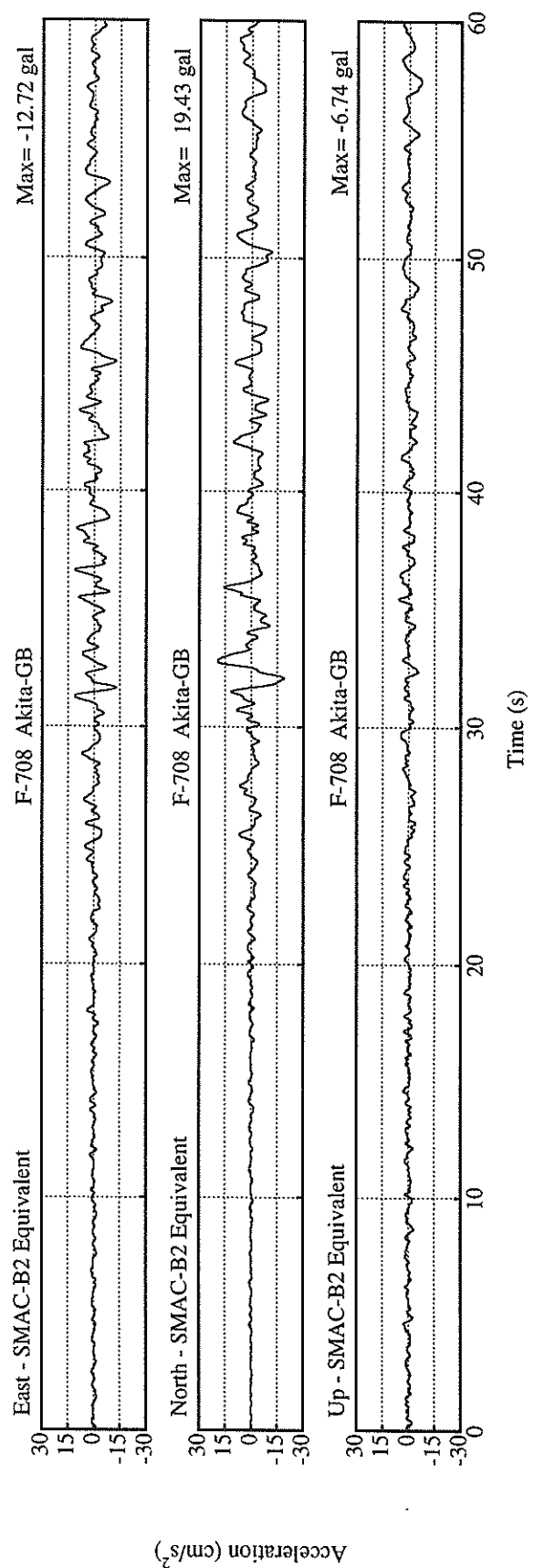
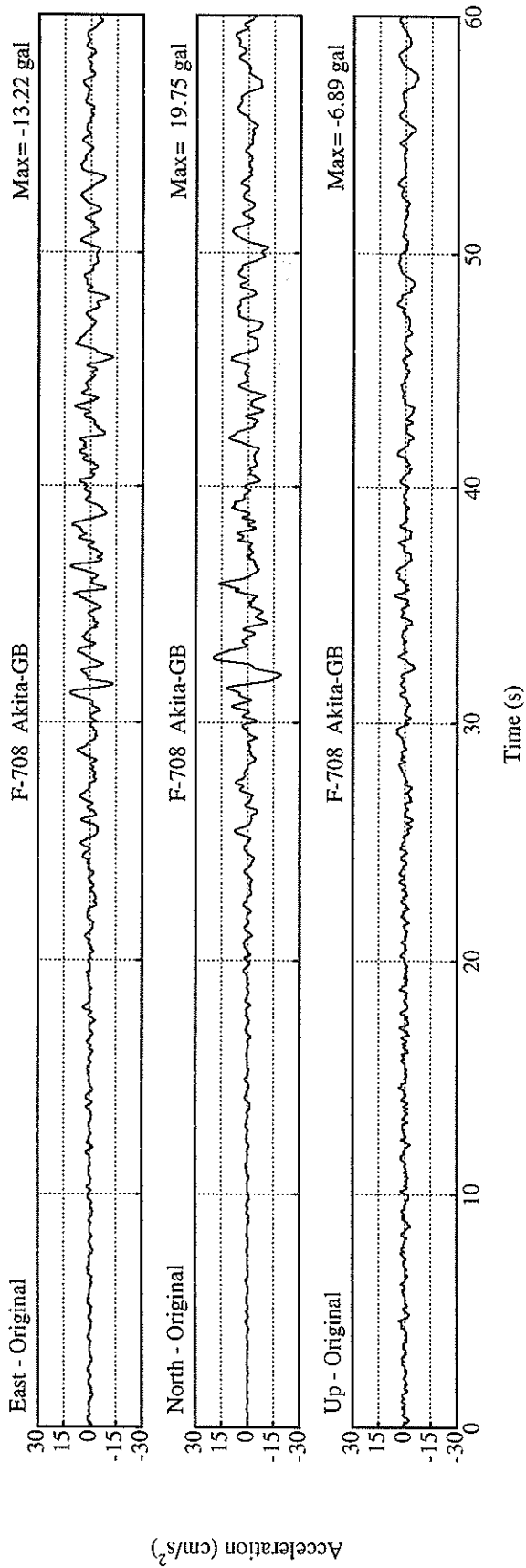
\*\*\*\*\*  
 DATE AND TIME 21:19 DEC.28,1994  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION FAR E OFF SANRIKU  
 LATITUDE 40°25.6' N  
 LONGITUDE 143°44.9' E  
 DEPTH 0.0KM  
 JMA MAGNITUDE 7.5  
 \*\*\*\*\*

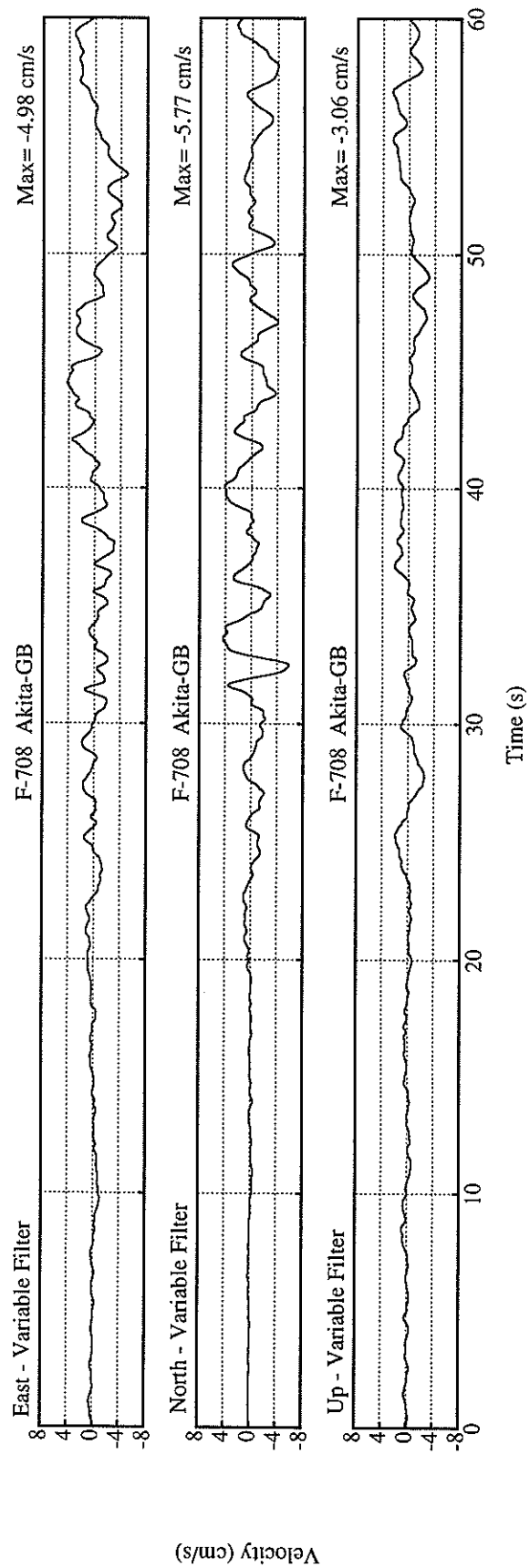
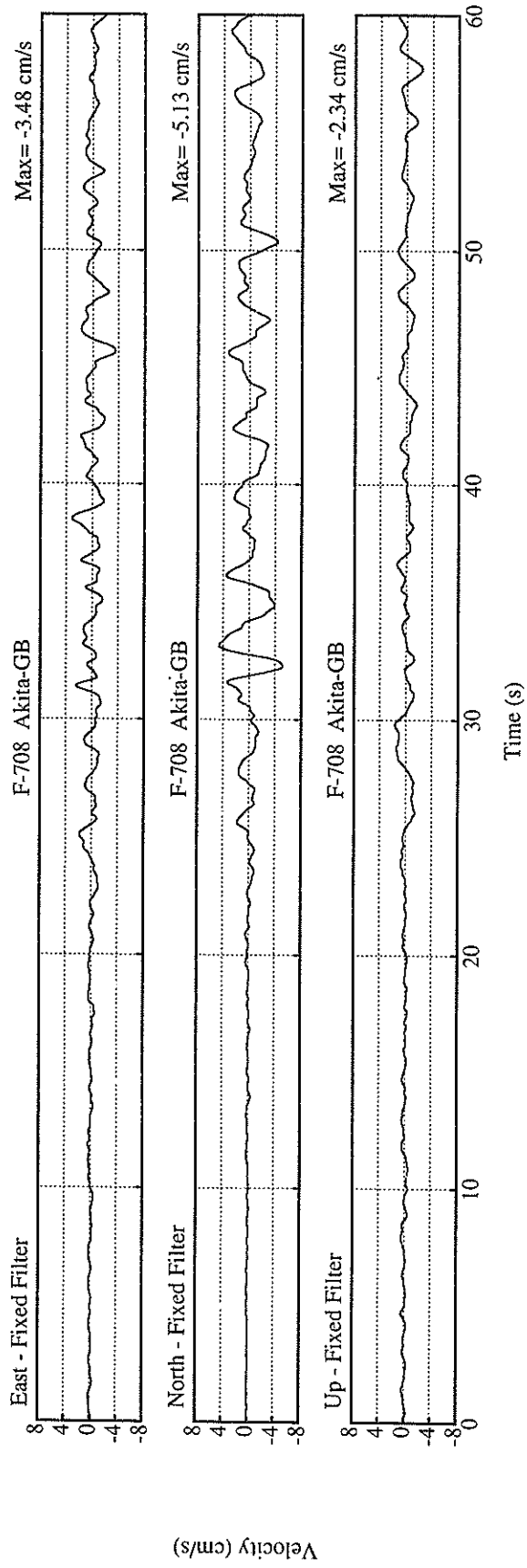
PEAK VALUES OF COMPONENTS

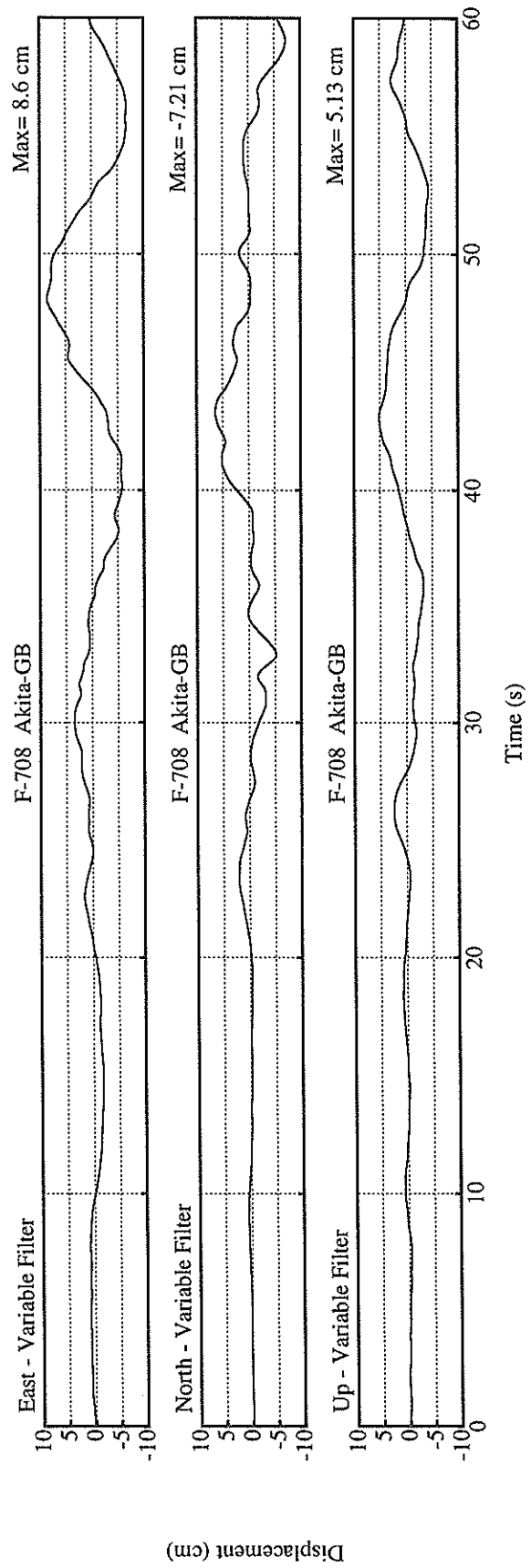
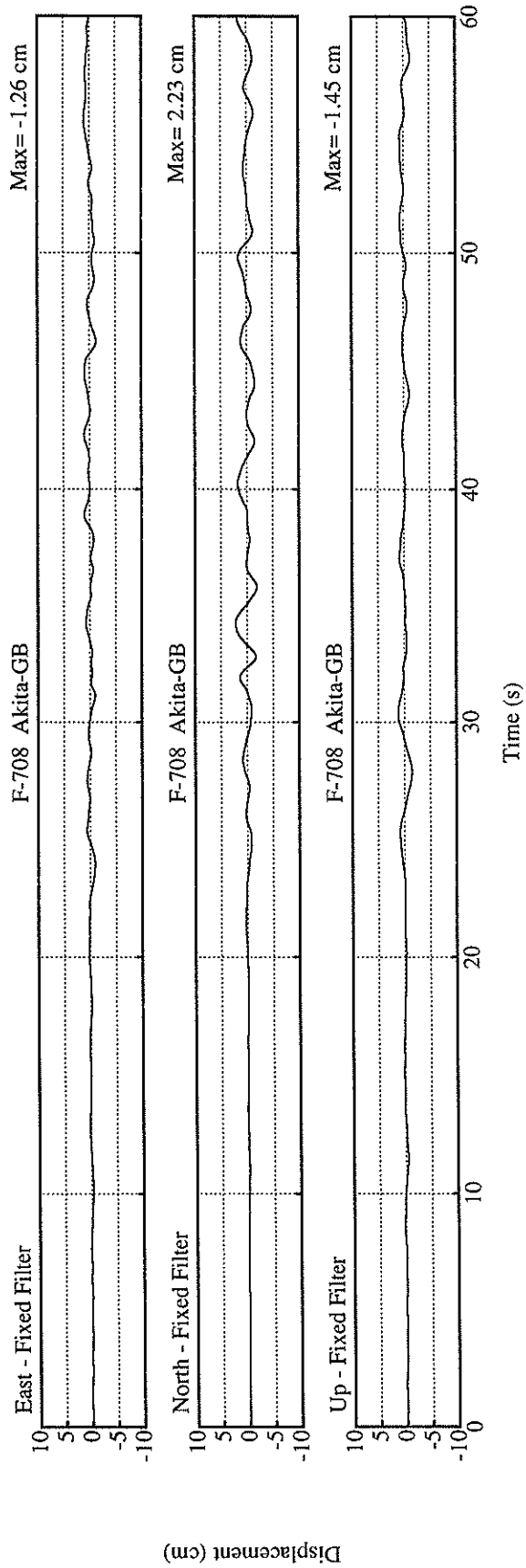
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.030	0.030	0.036	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	19.4	12.7	6.7	19.4
ORIGINAL	19.7	13.2	6.9	19.8
CORRECTED	19.6	13.2	6.9	19.6
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	5.13	3.48	2.34	5.18
VARIABLE FILTER	5.77	4.98	3.06	5.94
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	2.23	1.26	1.45	2.36
VARIABLE FILTER	7.21	8.60	5.13	8.60

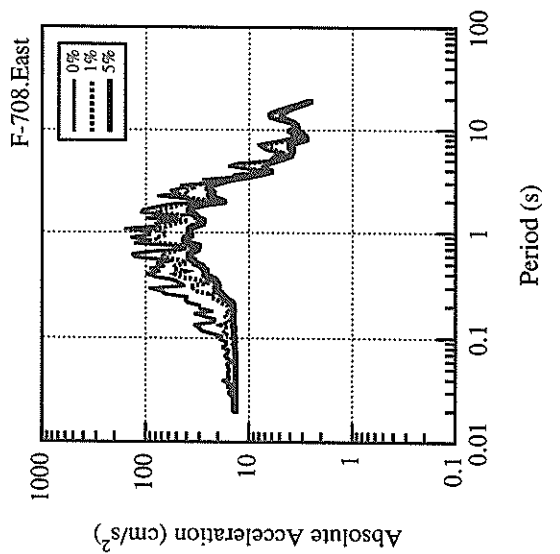
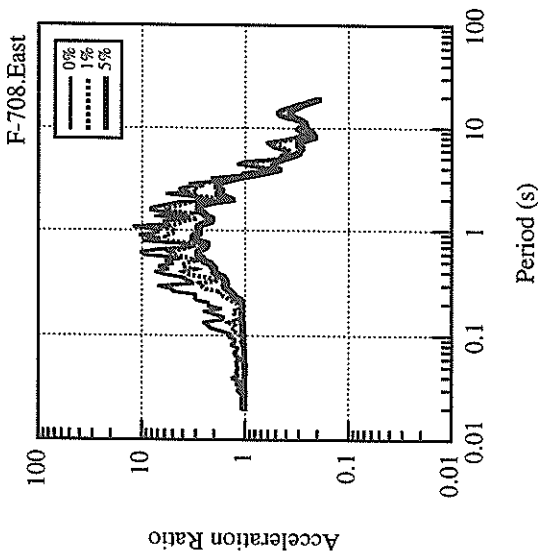
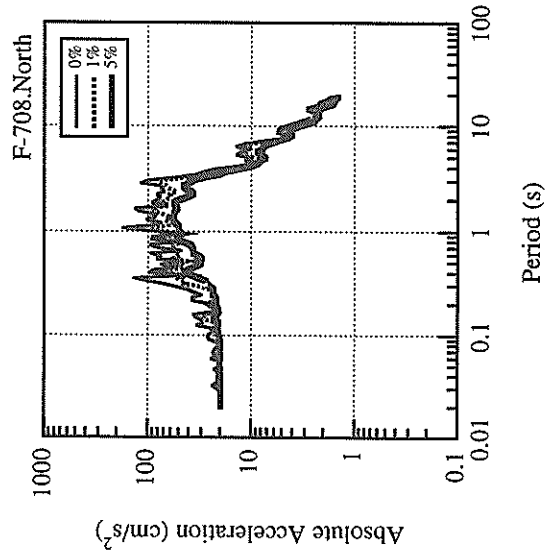
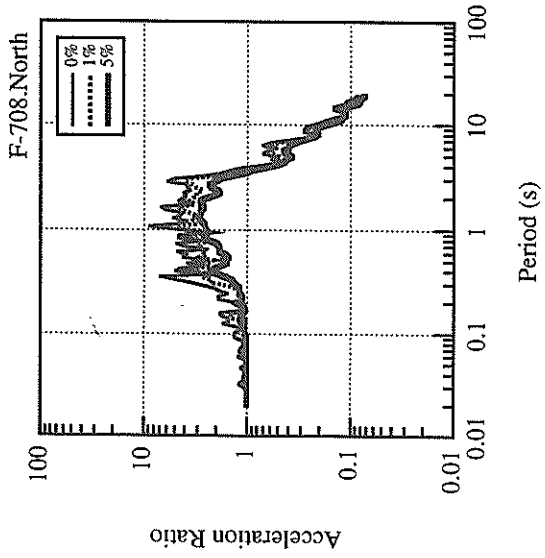
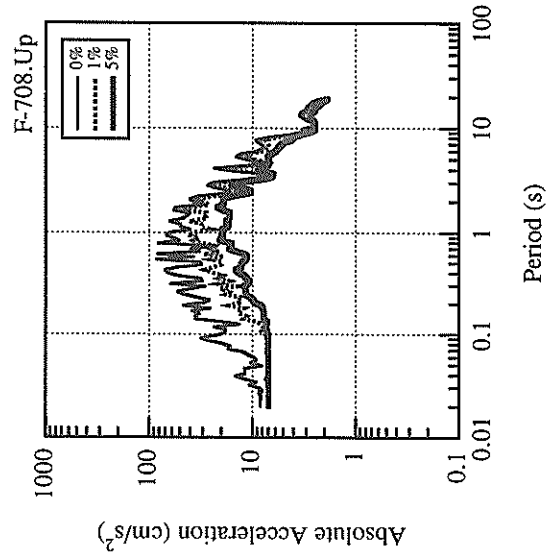
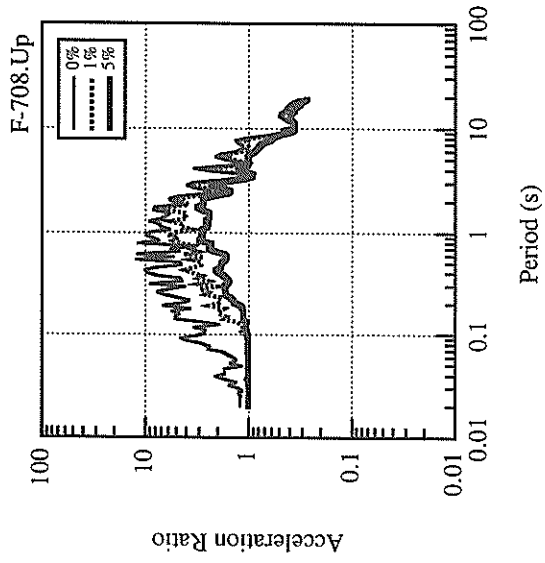
\* RESULTANT OF HORIZONTAL COMPONENTS

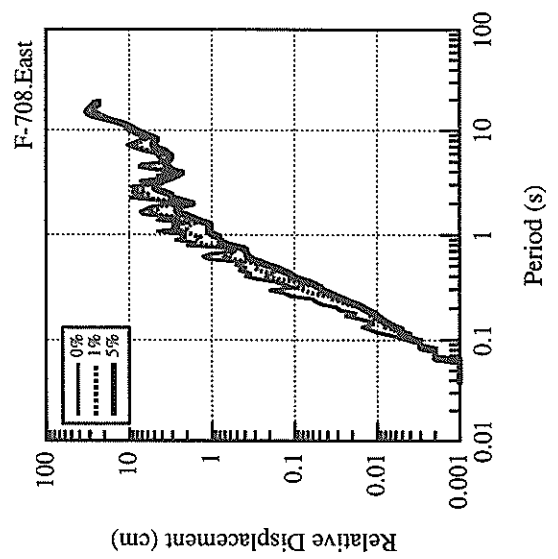
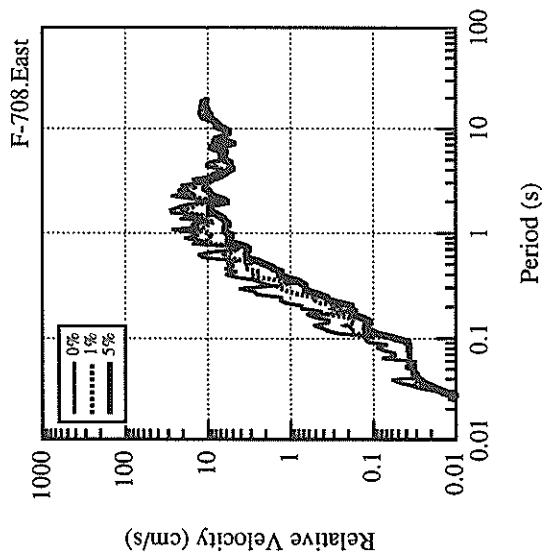
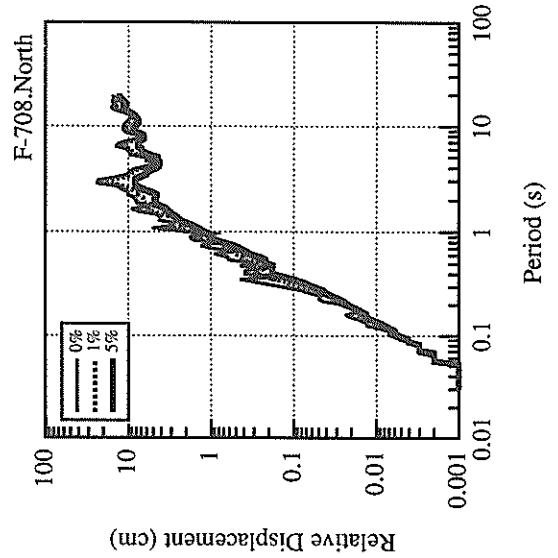
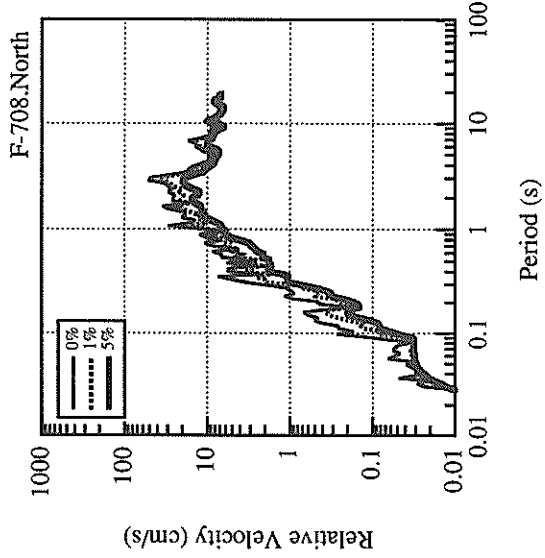
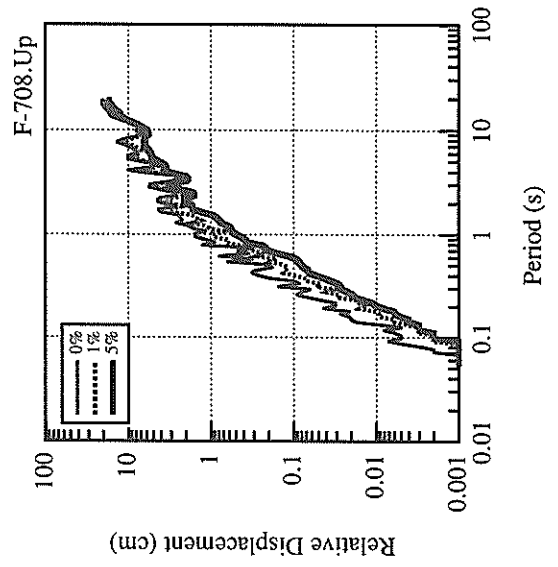
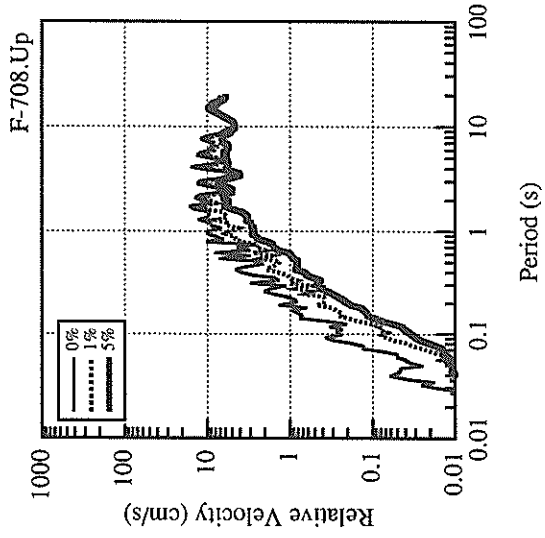




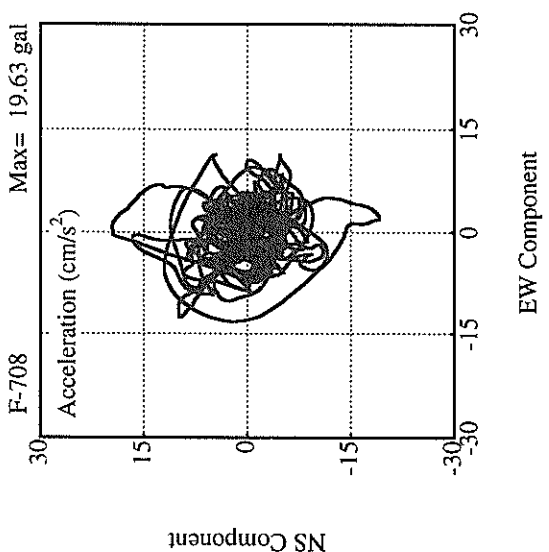
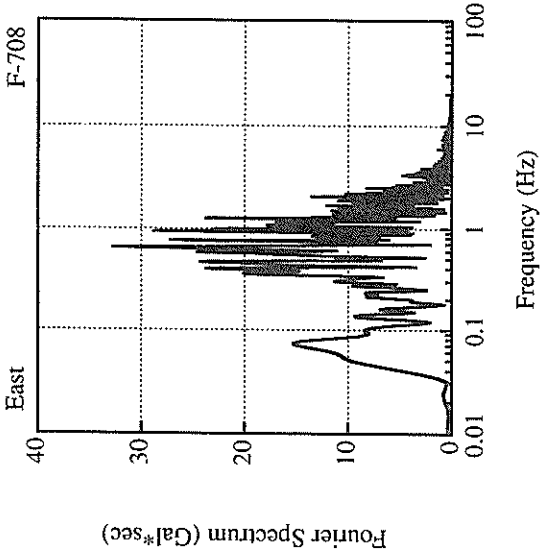
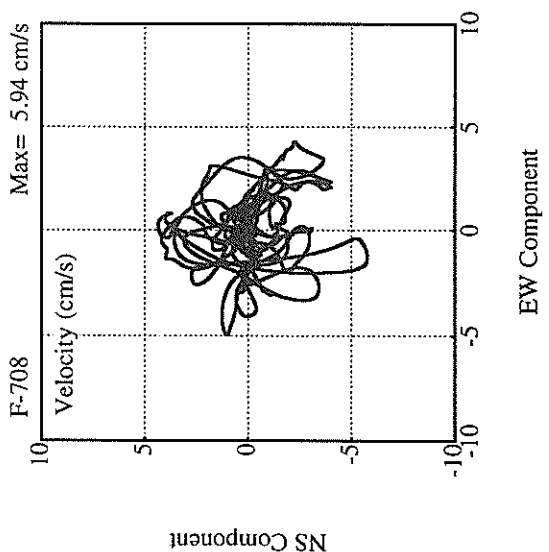
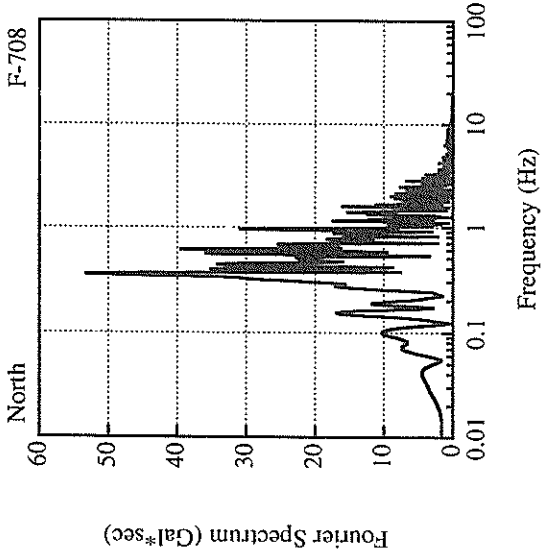
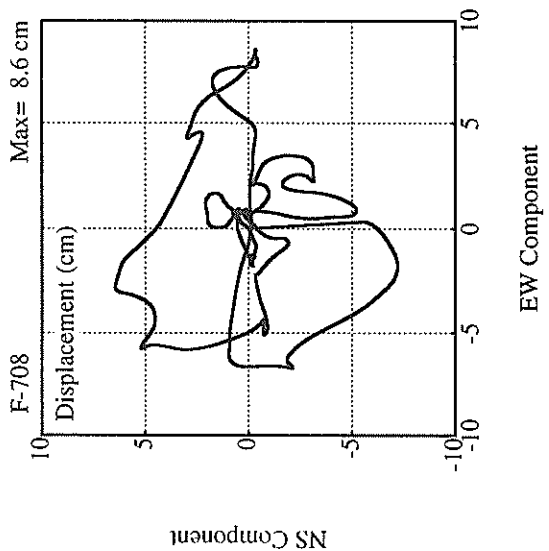
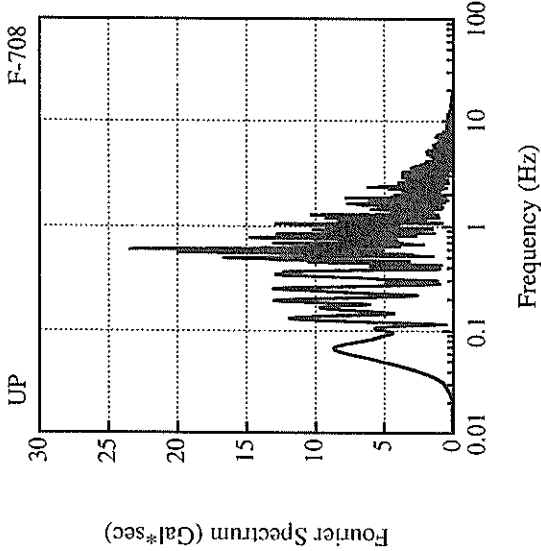












RECORD NUMBER : S-2602  
 STATION : SHIOGAMA-KOJYO-S

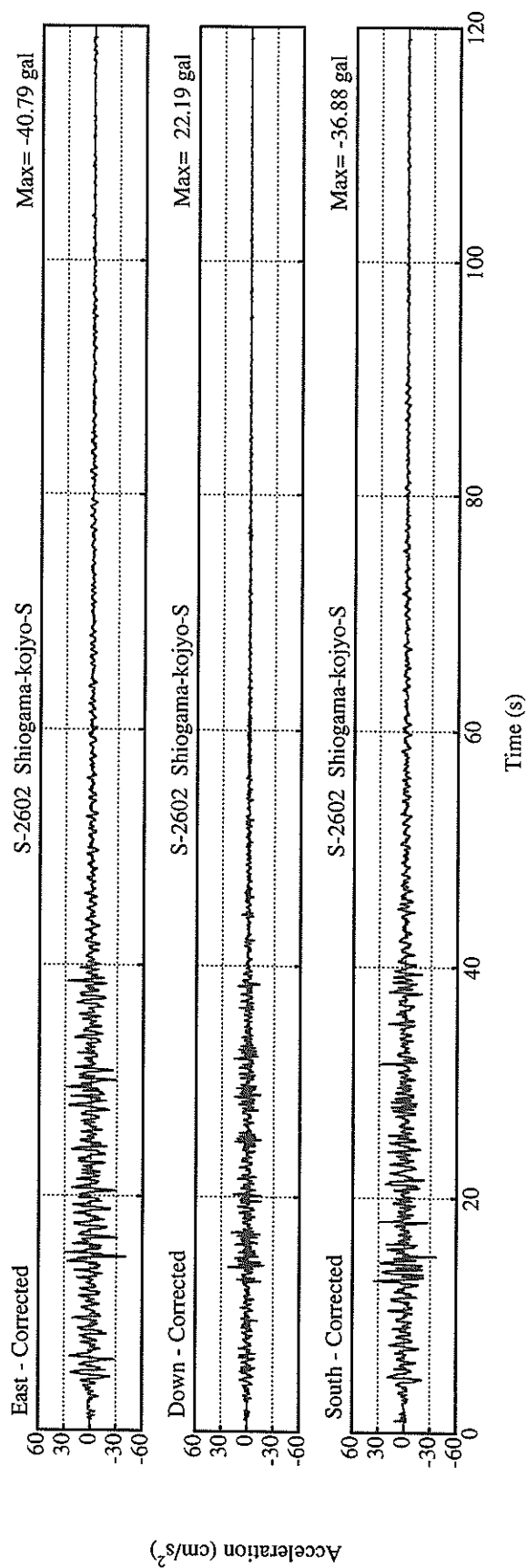
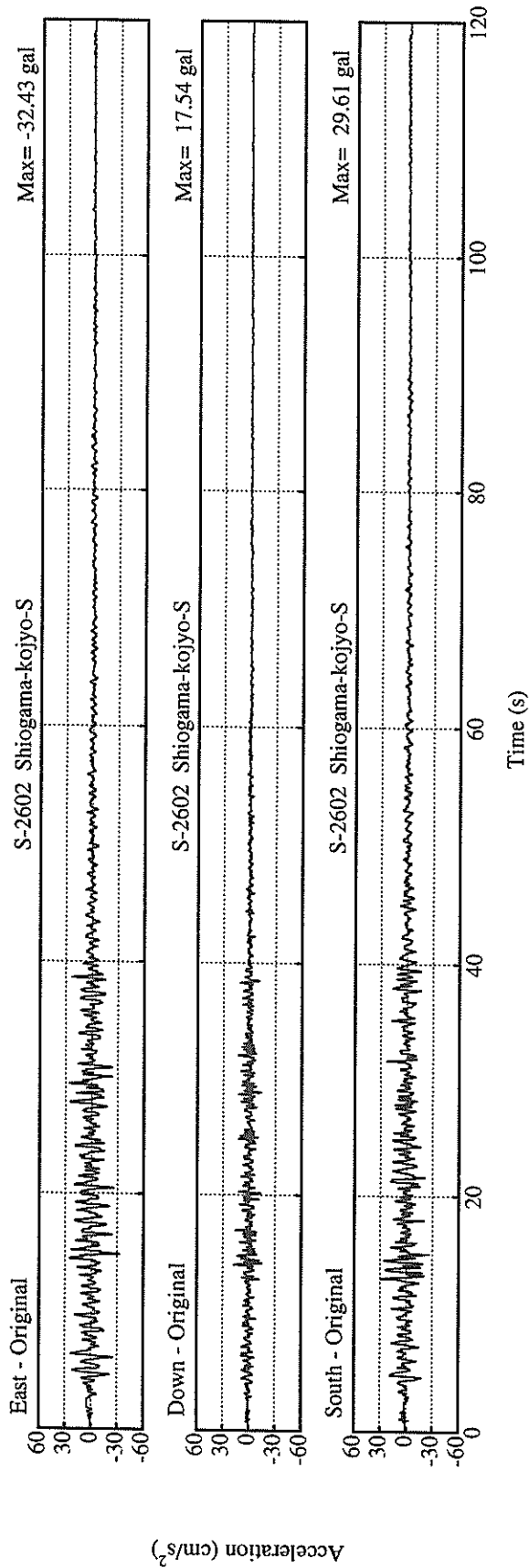
EARTHQUAKE DATA

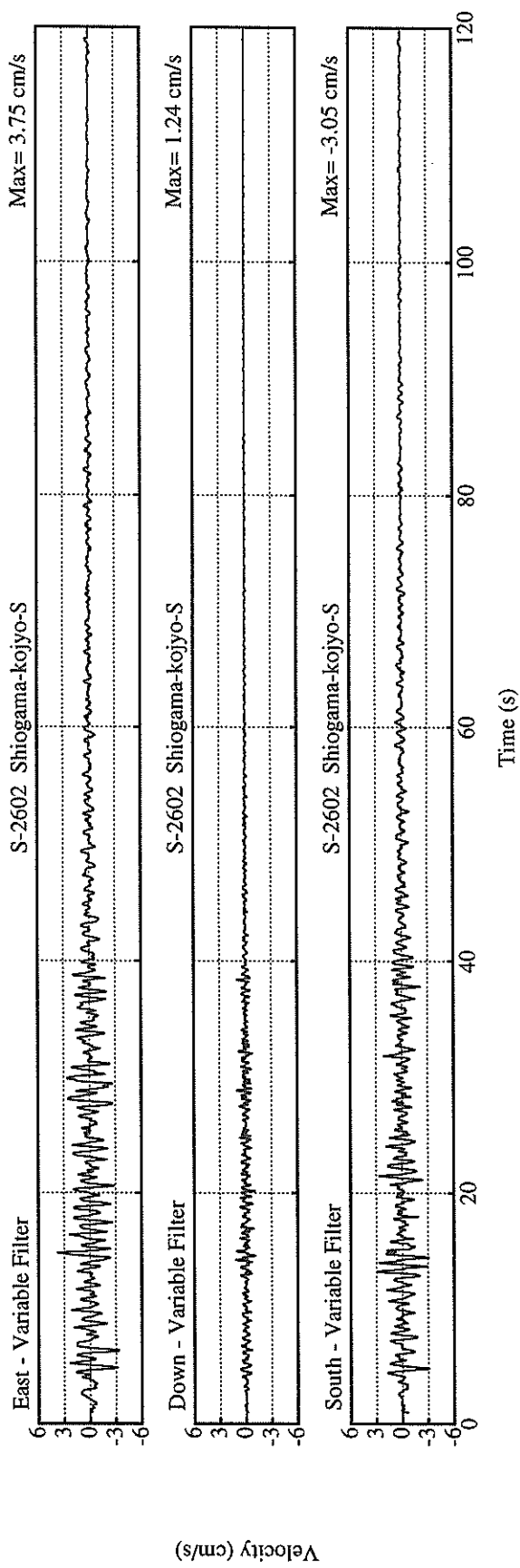
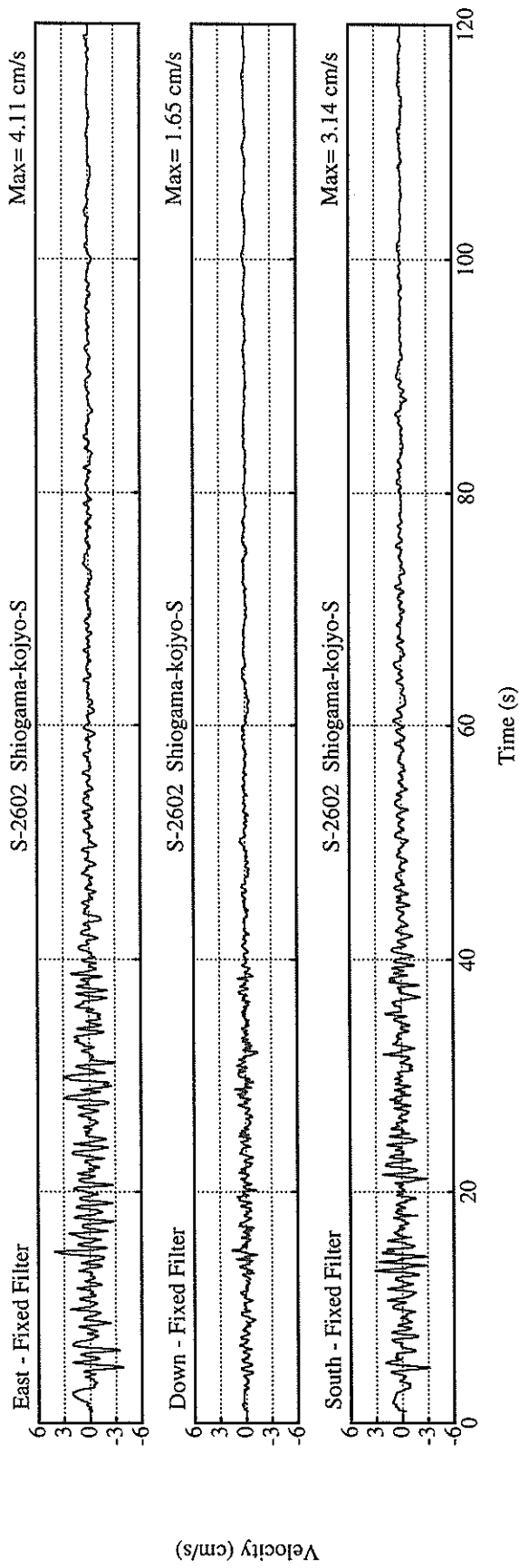
```
*****
DATE AND TIME                21:19 DEC.28,1994
LOCATION OF HYPOCENTER
  EPICENTRAL REGION          FAR E OFF SANRIKU
  LATITUDE                   40°25.6' N
  LONGITUDE                  143°44.9' E
  DEPTH                      0.0KM
JMA MAGNITUDE                7.5
*****
```

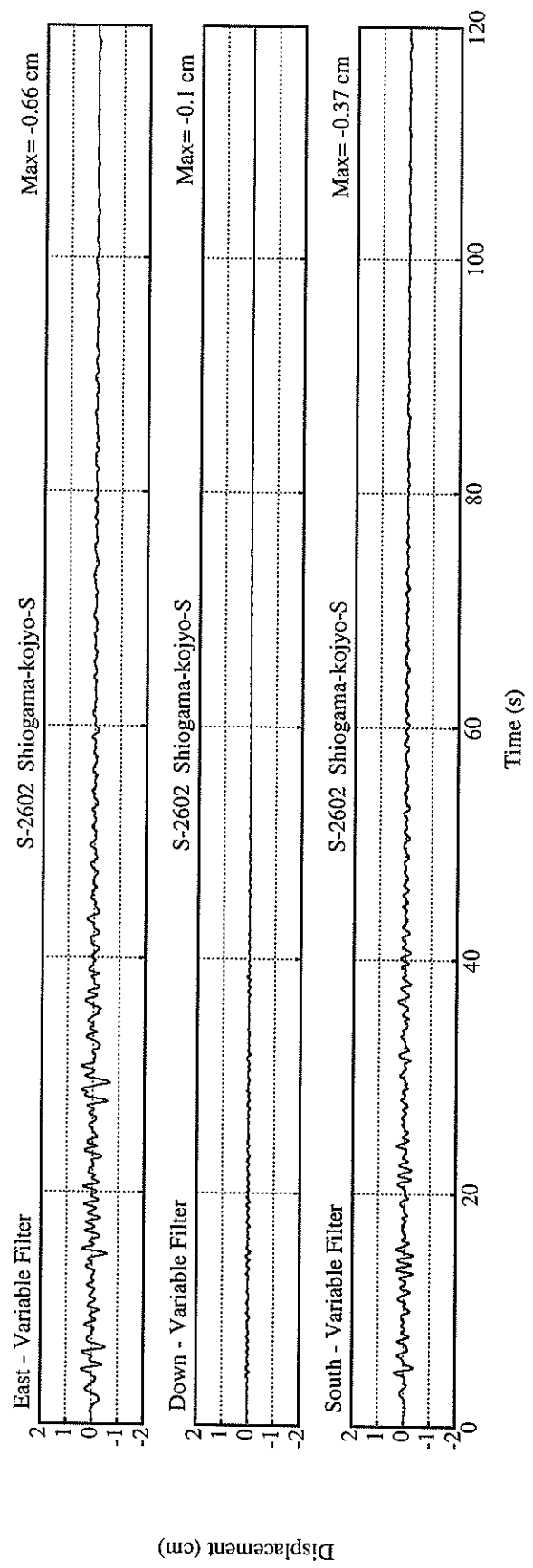
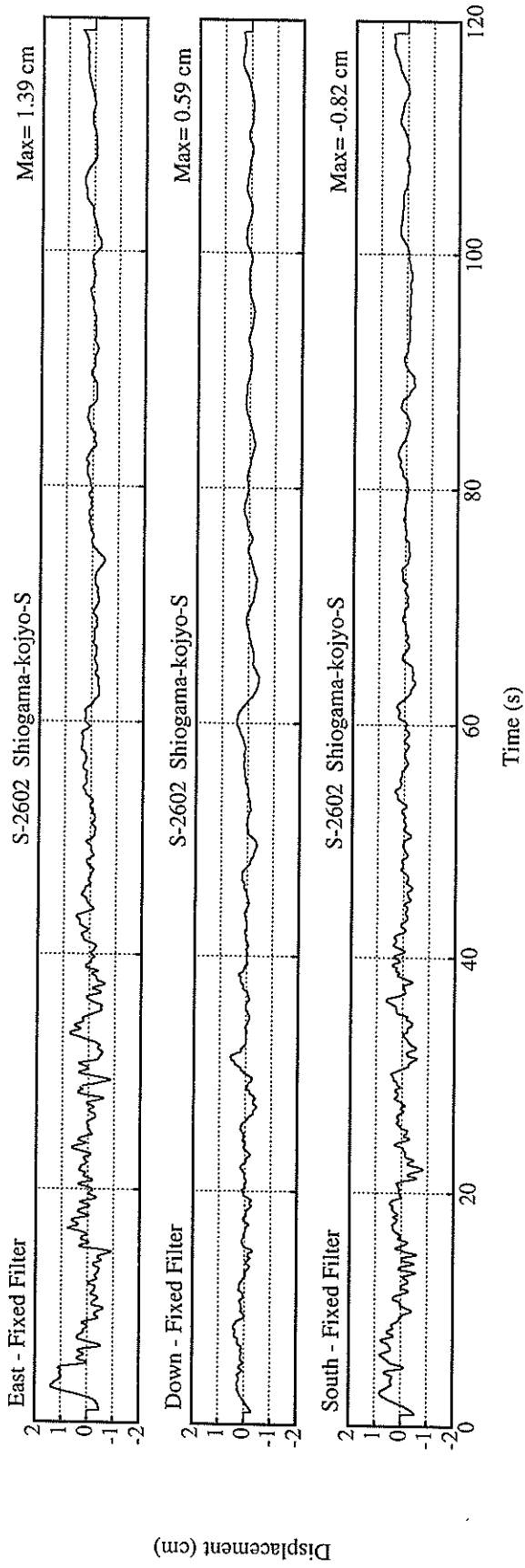
PEAK VALUES OF COMPONENTS

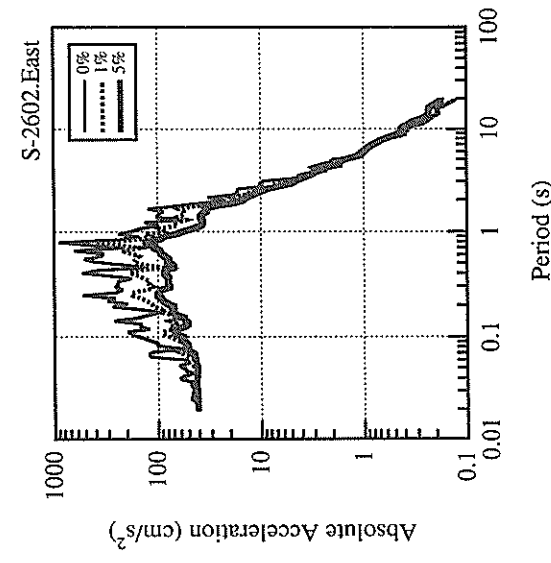
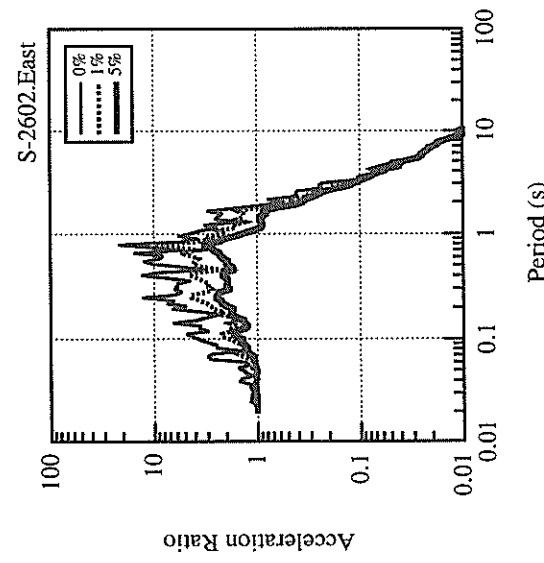
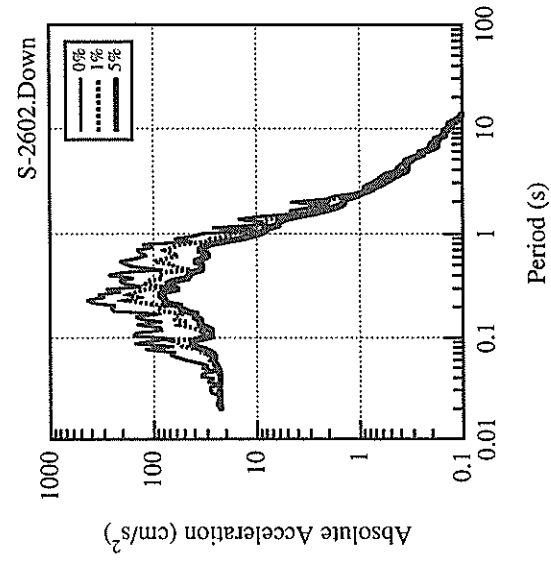
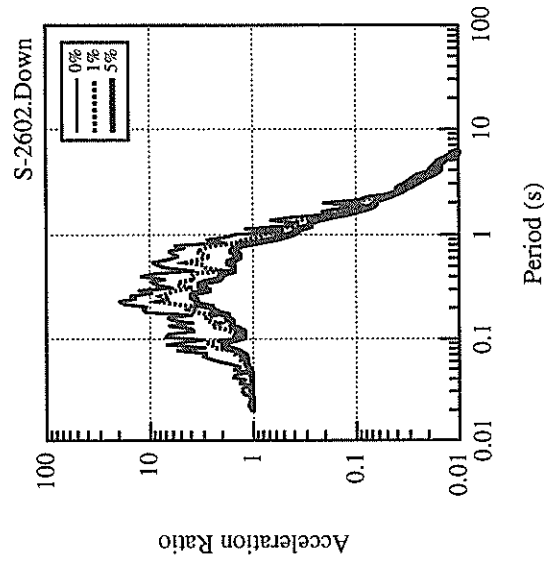
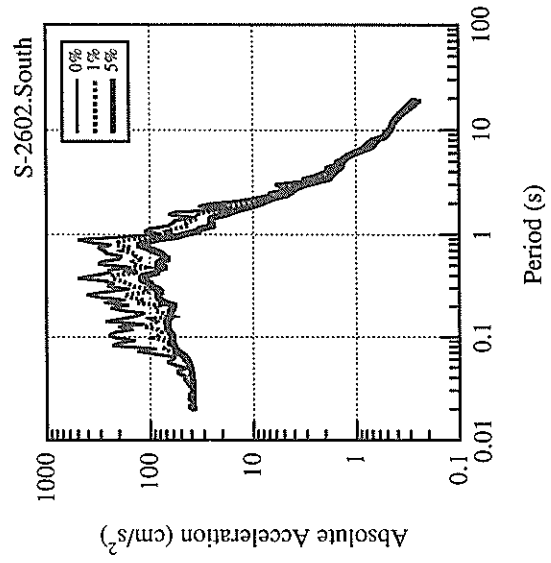
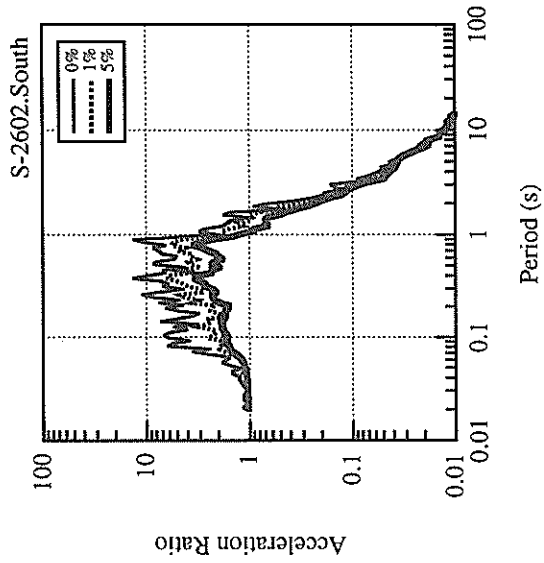
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.421	0.329	0.805	
MAXIMUM ACCELERATION (GAL)				
ORIGINAL	29.6	32.4	17.5	34.2
CORRECTED	36.9	40.8	22.2	41.2
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	3.14	4.11	1.65	4.91
VARIABLE FILTER	3.05	3.75	1.24	4.33
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.82	1.39	0.59	1.58
VARIABLE FILTER	0.37	0.66	0.10	0.66

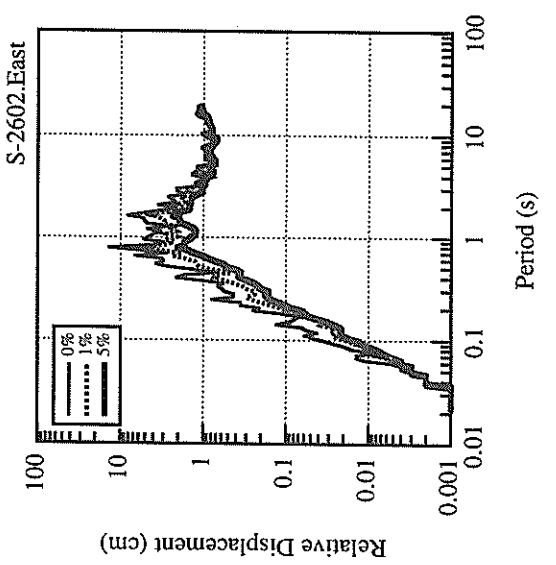
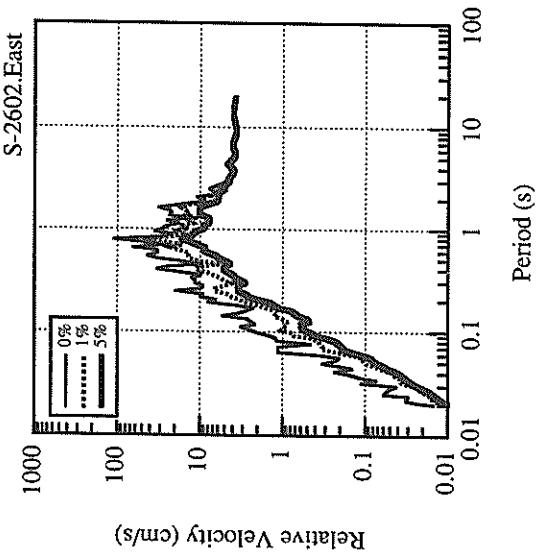
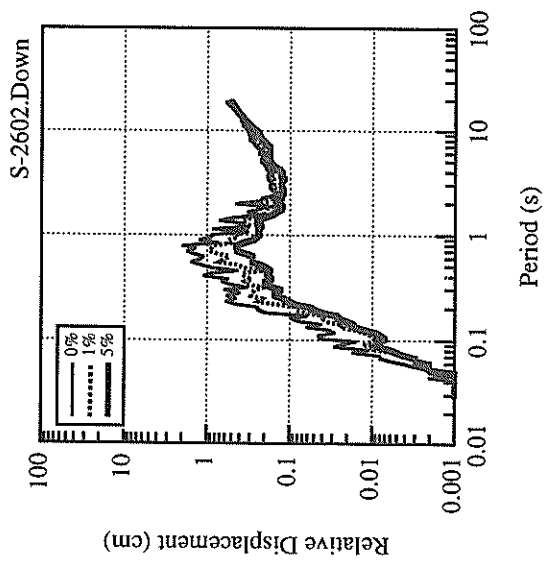
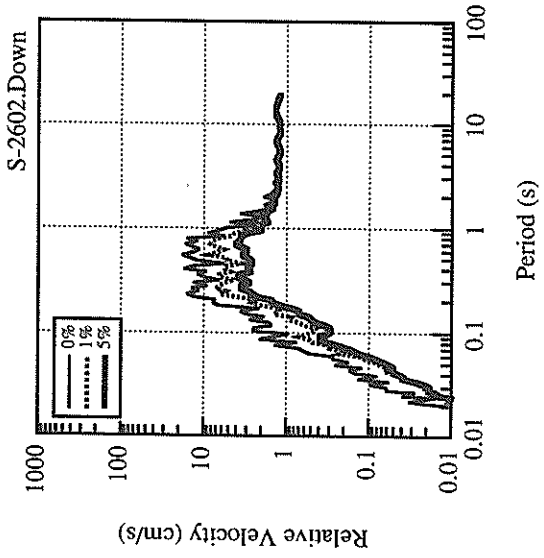
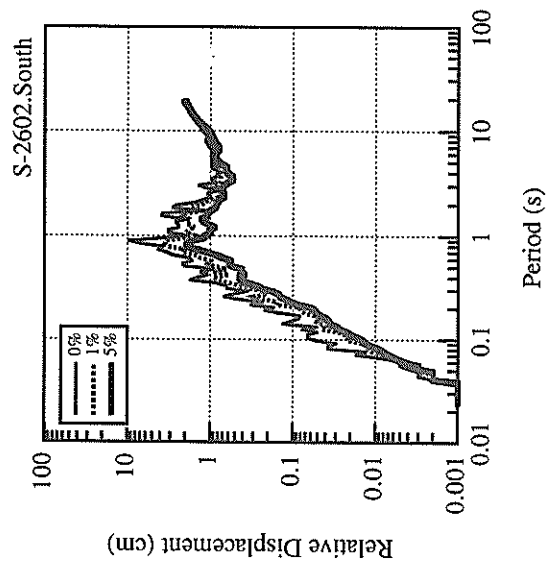
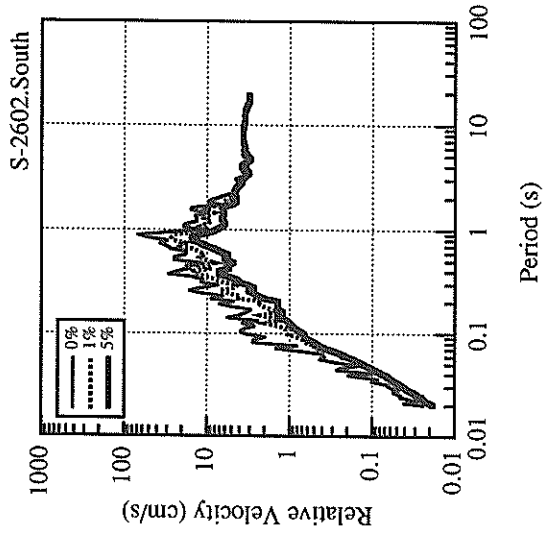
\* RESULTANT OF HORIZONTAL COMPONENTS

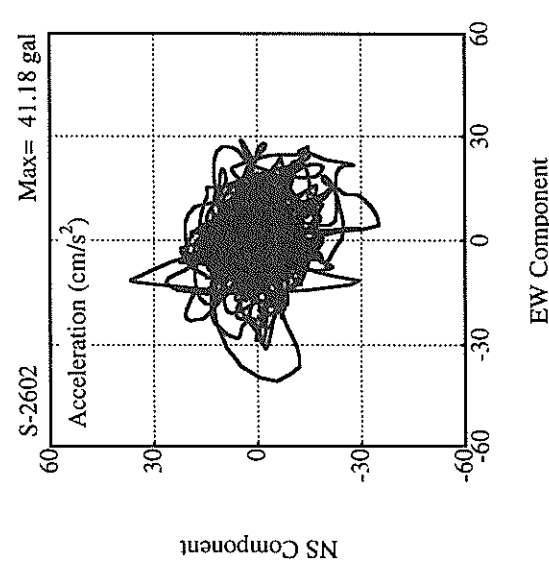
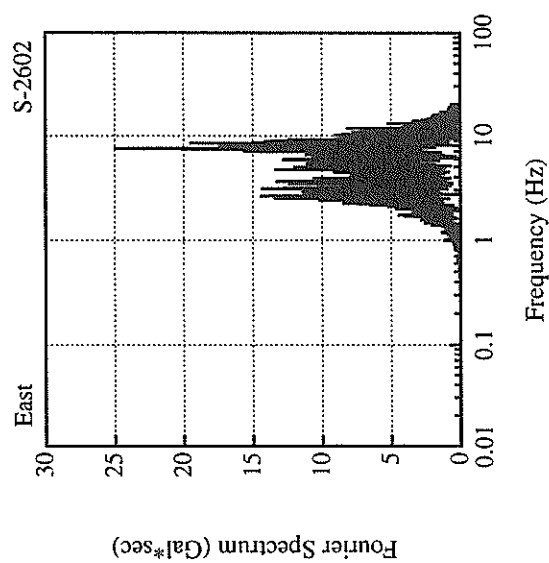
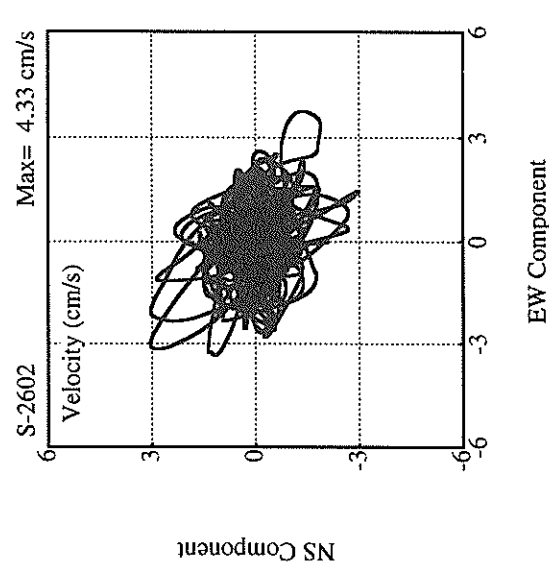
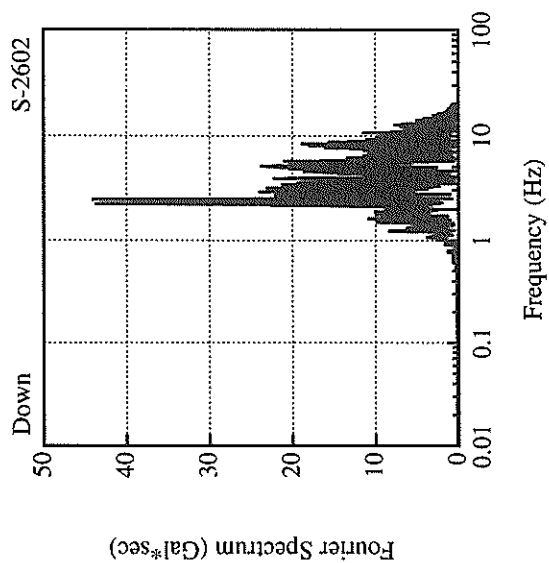
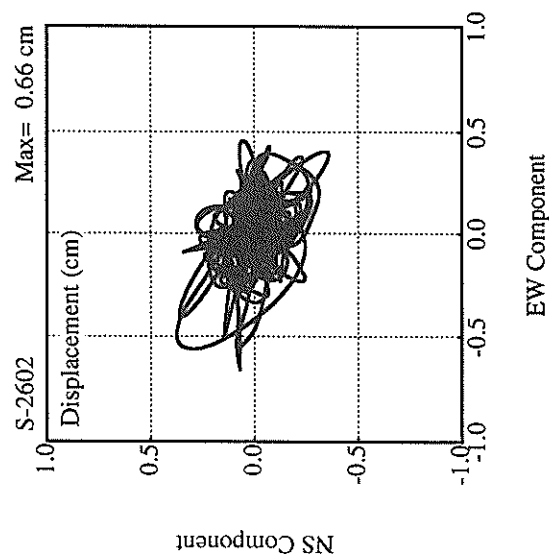
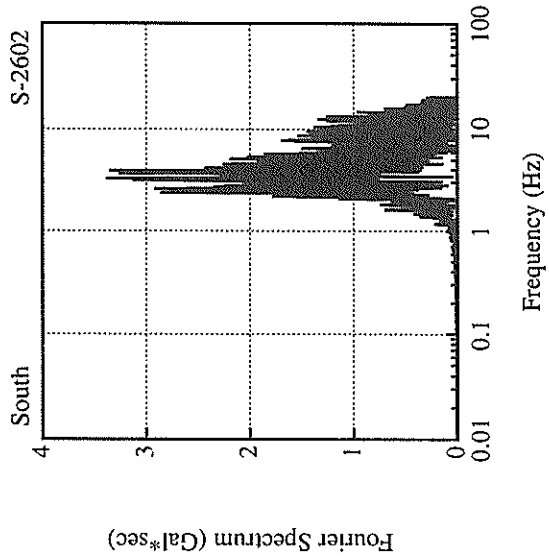














RECORD NUMBER : S-2604  
 STATION : SAKATA-S

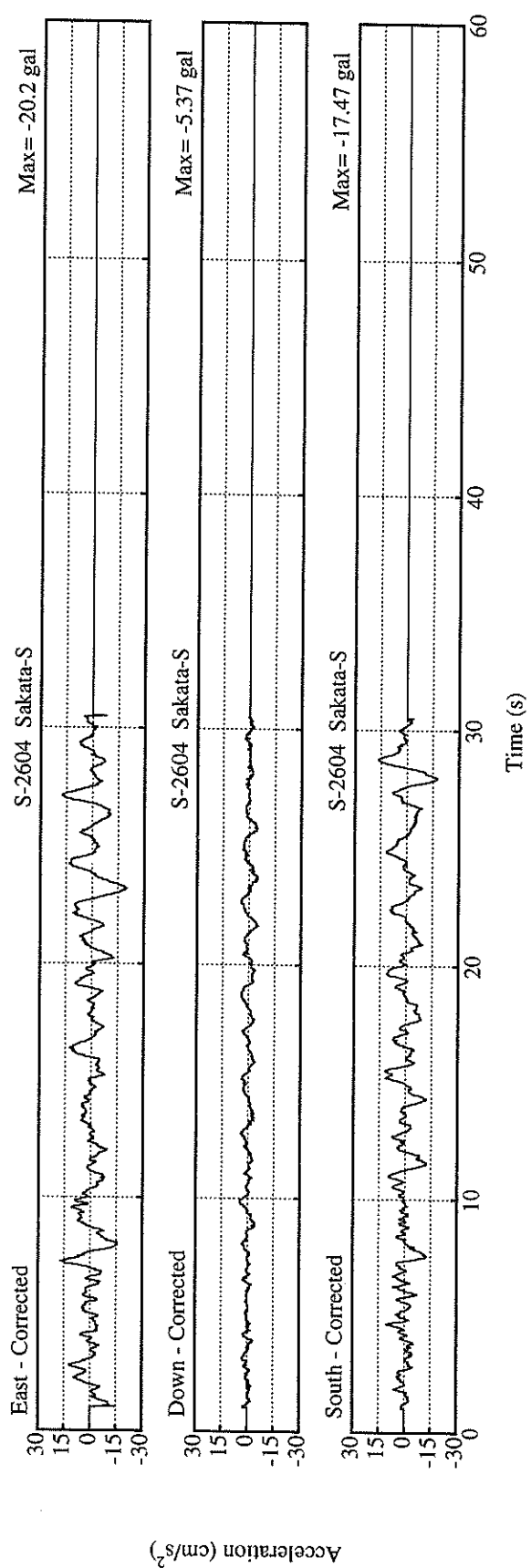
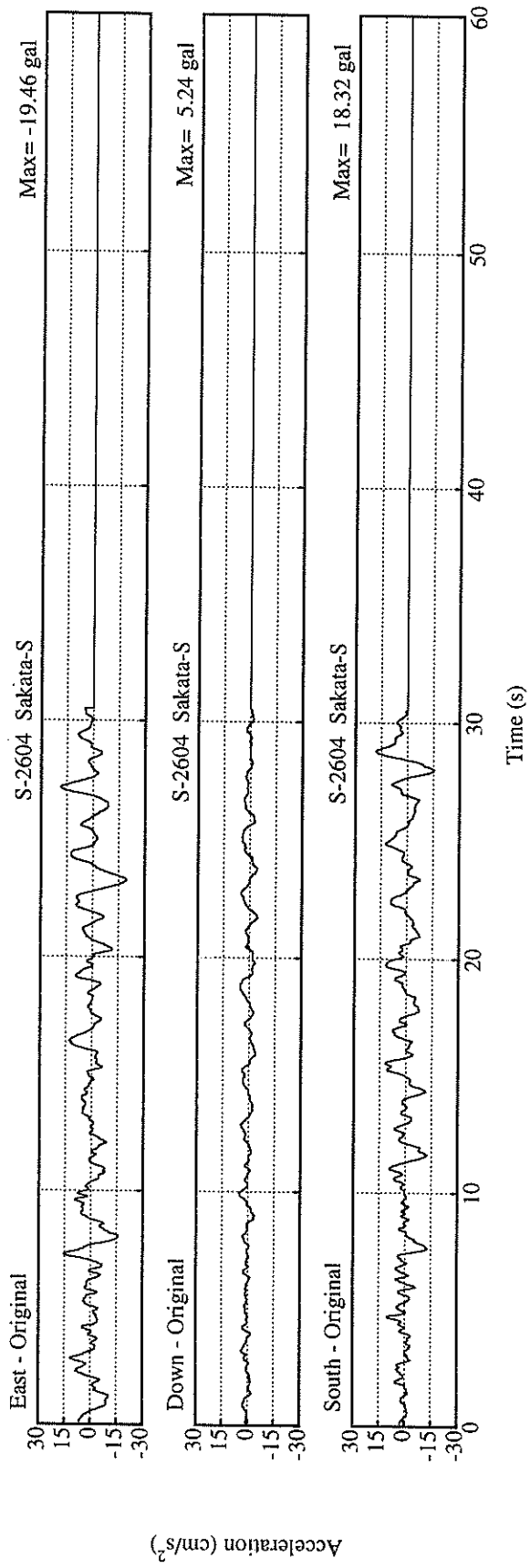
EARTHQUAKE DATA

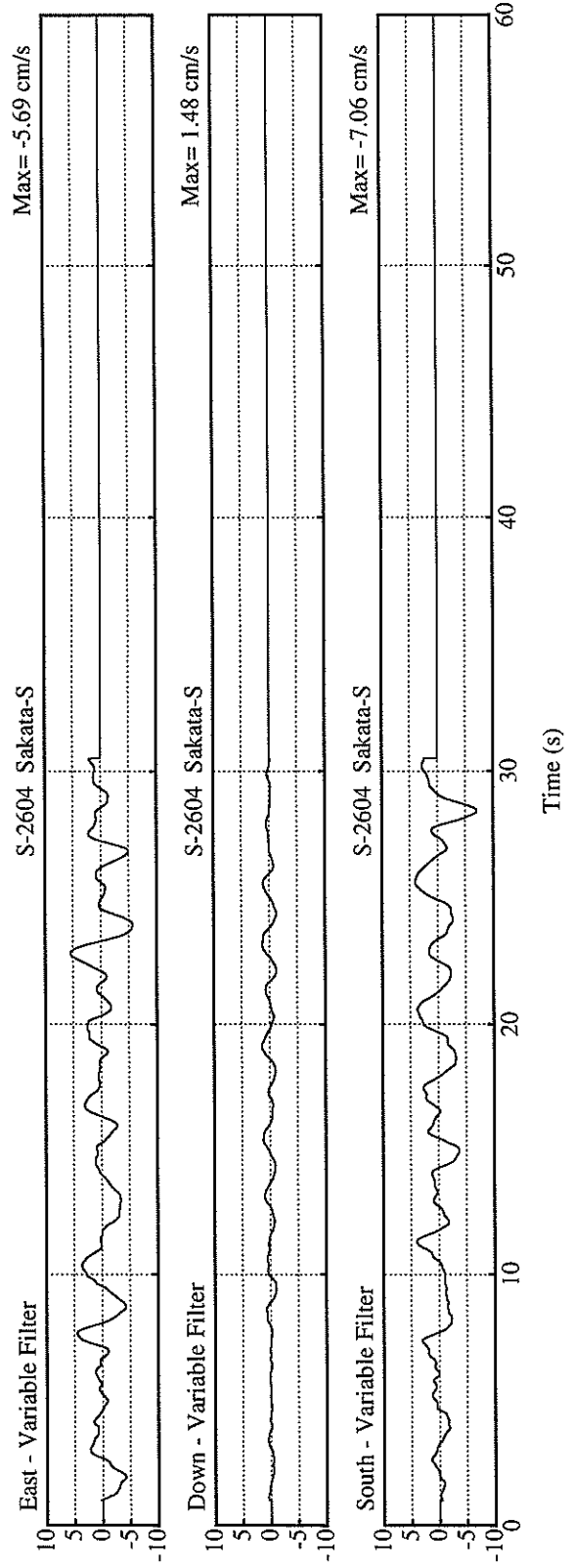
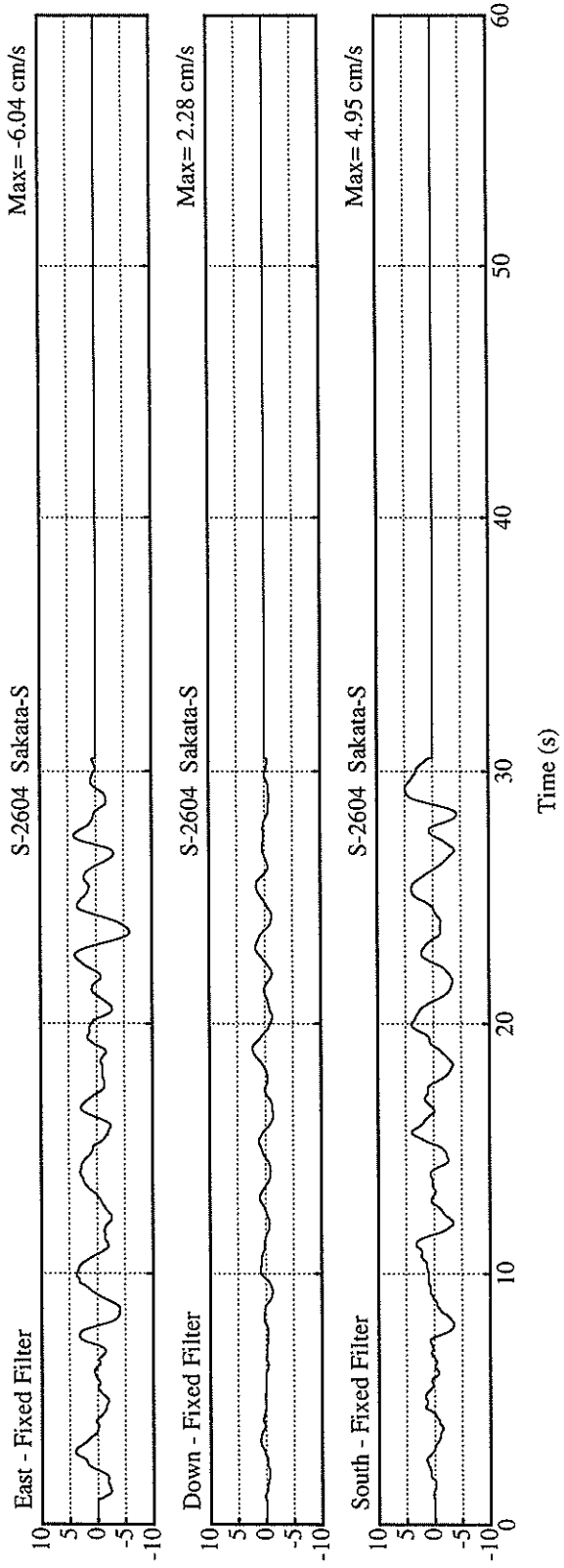
```
*****
DATE AND TIME                21:19 DEC.28,1994
LOCATION OF HYPOCENTER
  EPICENTRAL REGION          FAR E OFF SANRIKU
  LATITUDE                   40° 25.6' N
  LONGITUDE                   143° 44.9' E
  DEPTH                       0.0KM
JMA MAGNITUDE                7.5
*****
```

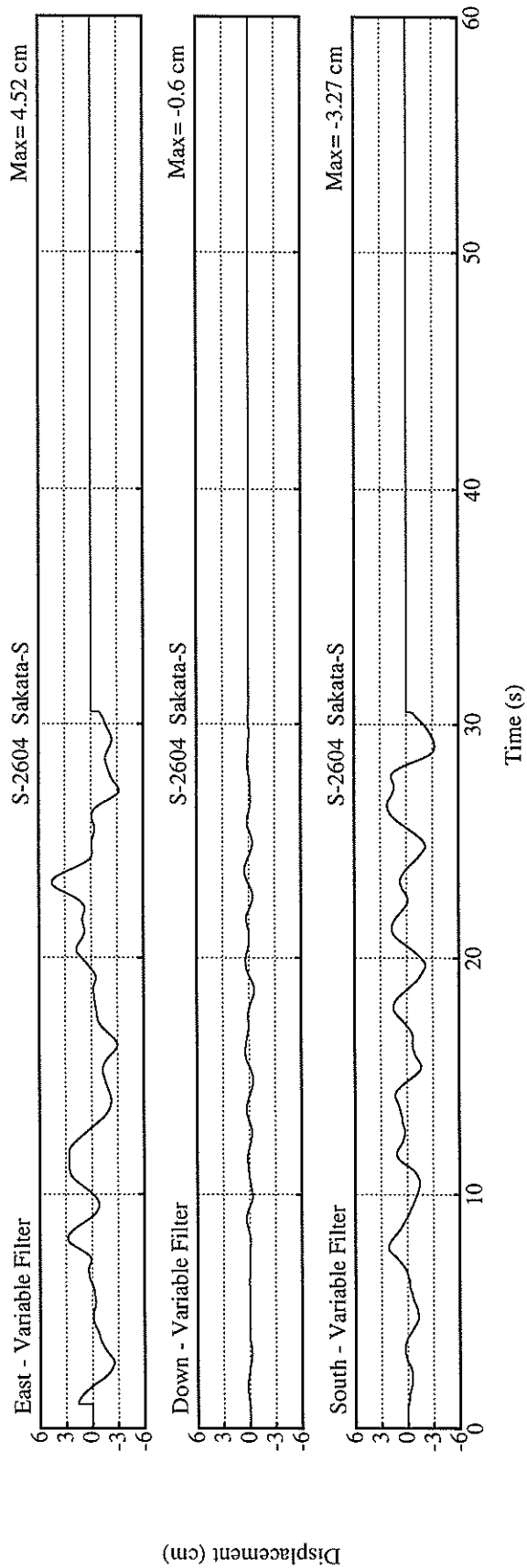
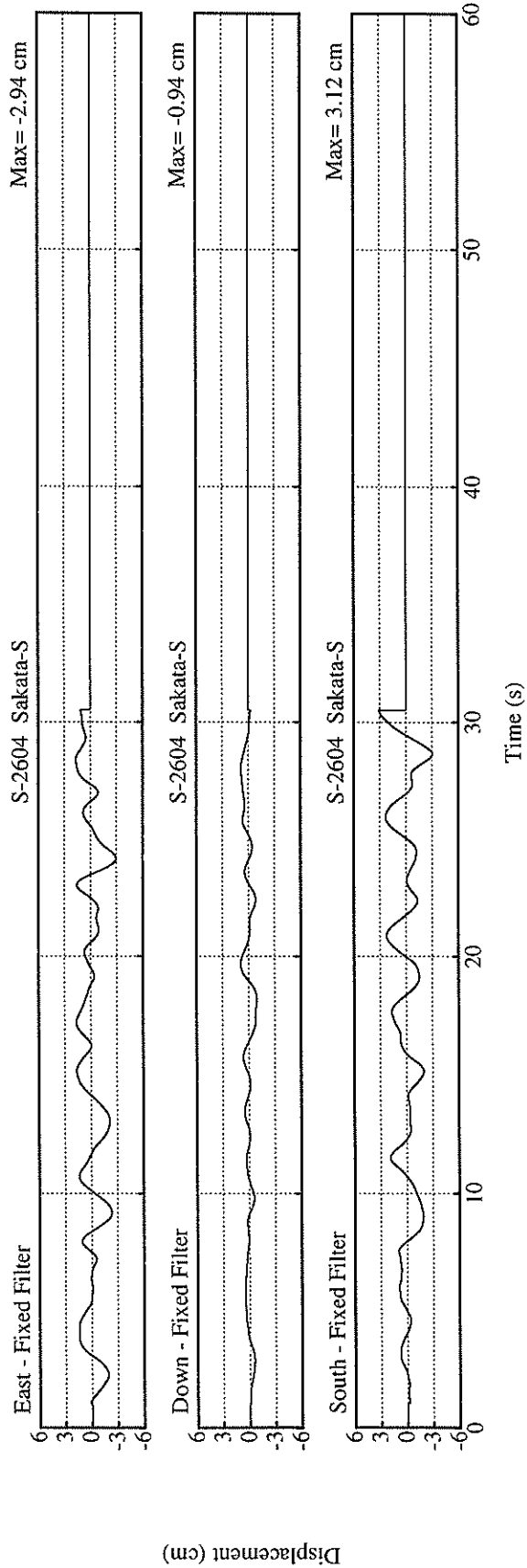
PEAK VALUES OF COMPONENTS

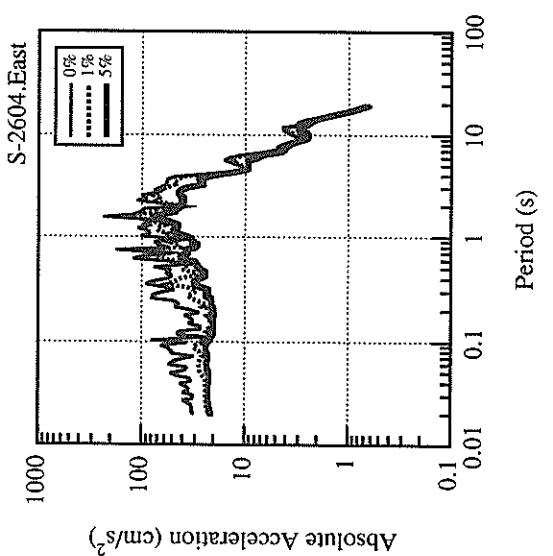
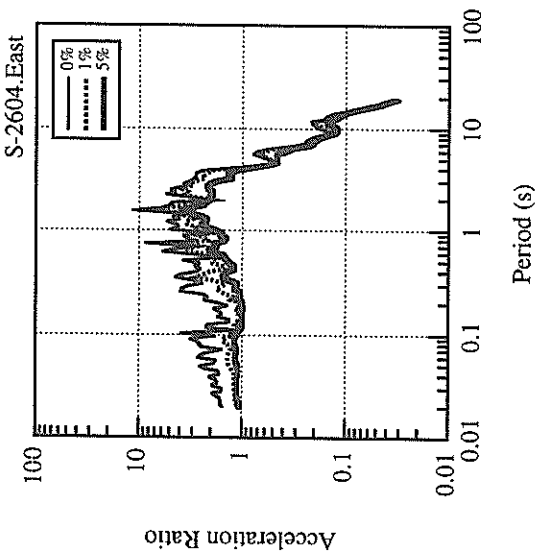
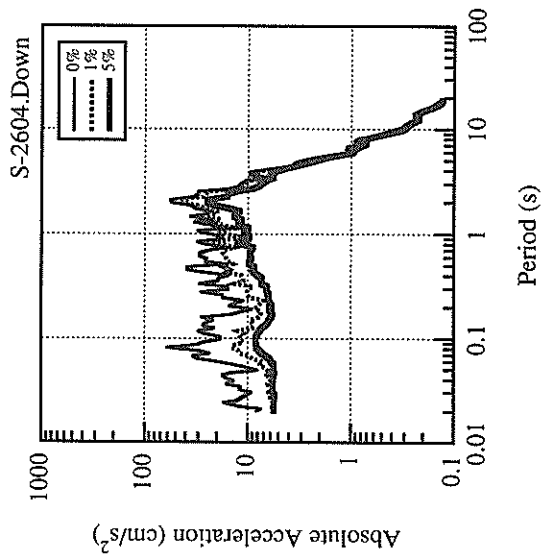
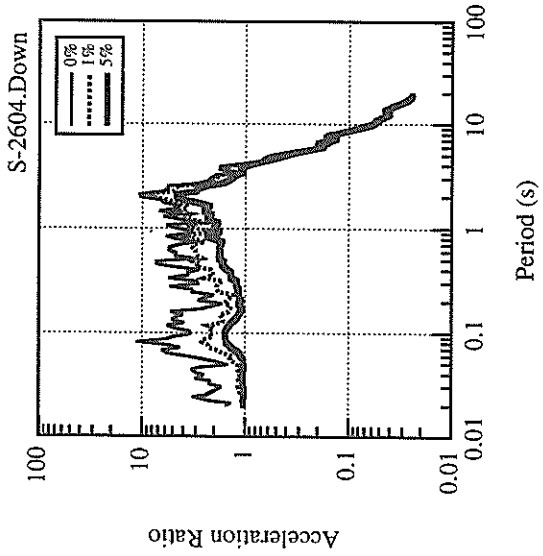
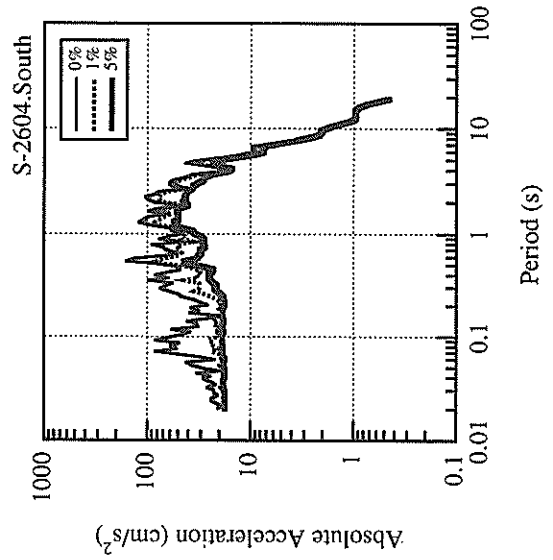
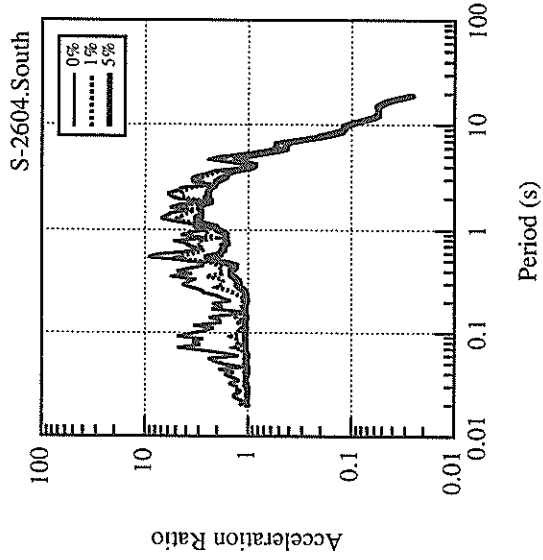
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.120	0.083	0.230	
MAXIMUM ACCELERATION (GAL)				
ORIGINAL	18.3	19.5	5.2	20.2
CORRECTED	17.5	20.2	5.4	20.8
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	4.95	6.04	2.28	6.18
VARIABLE FILTER	7.06	5.69	1.48	7.10
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	3.12	2.94	0.94	3.38
VARIABLE FILTER	3.27	4.52	0.60	4.58

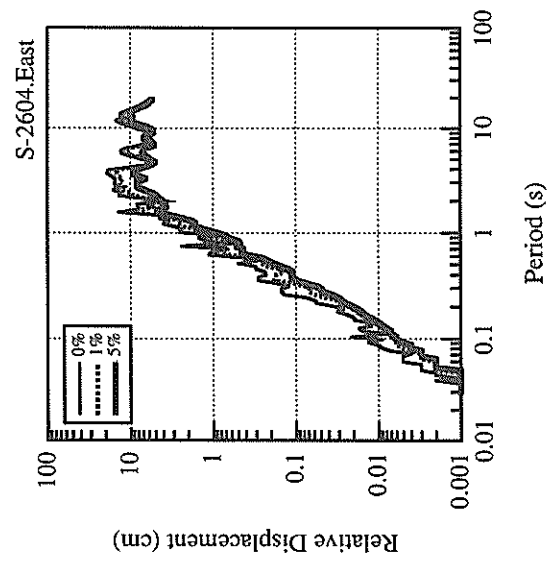
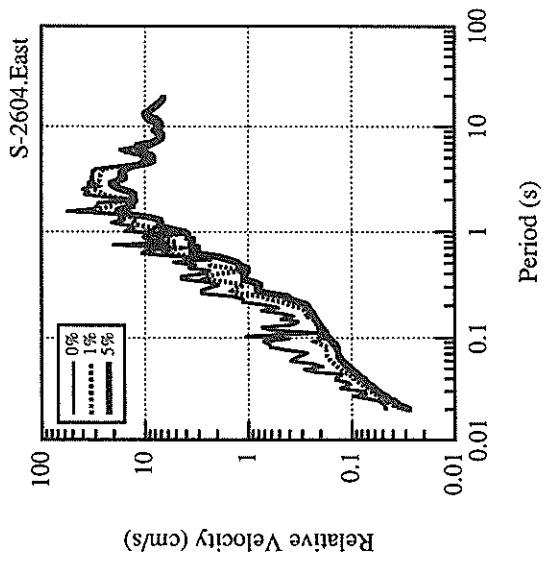
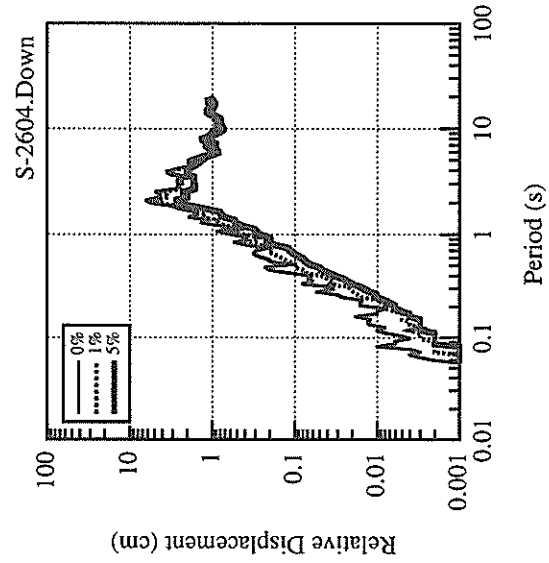
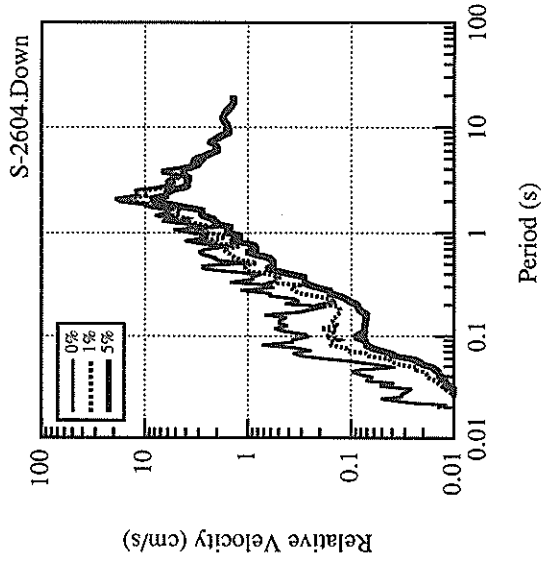
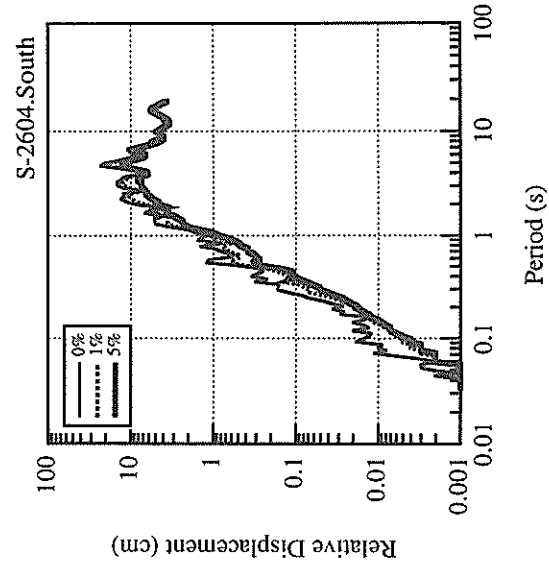
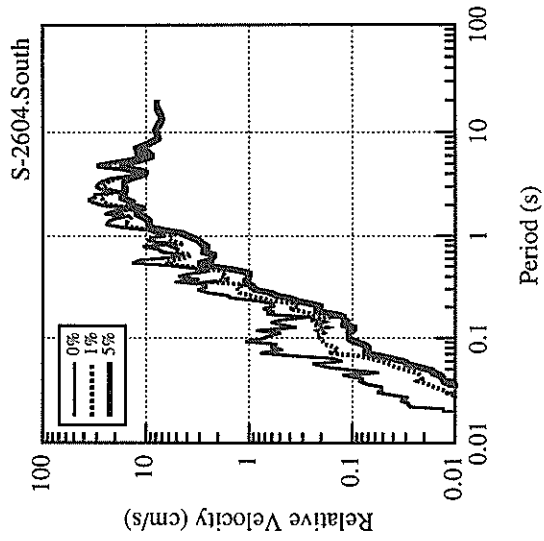
\* RESULTANT OF HORIZONTAL COMPONENTS

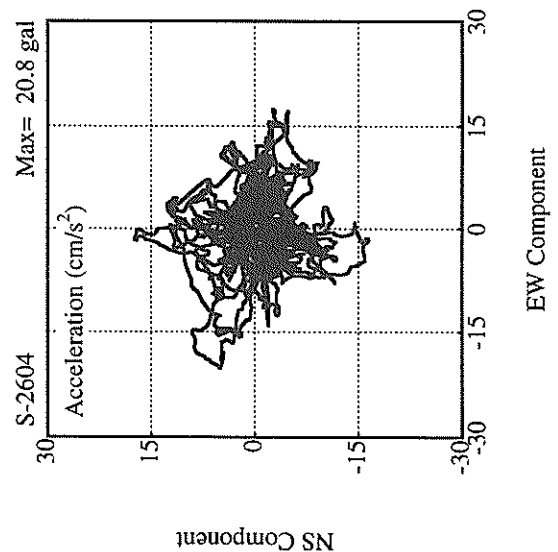
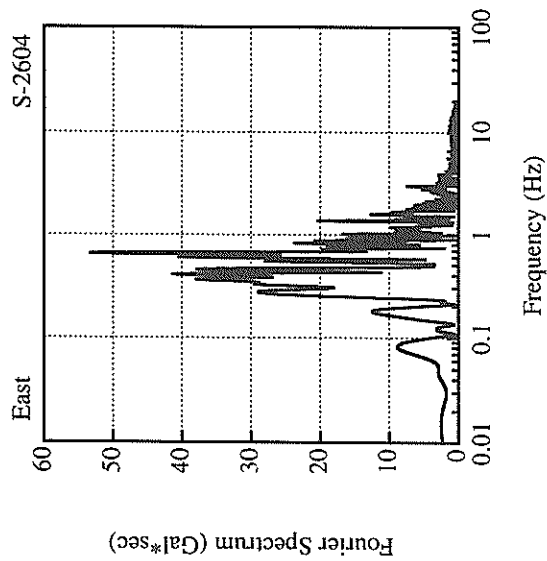
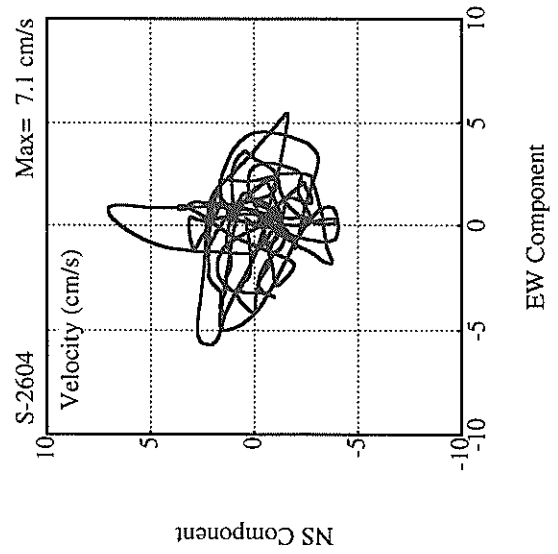
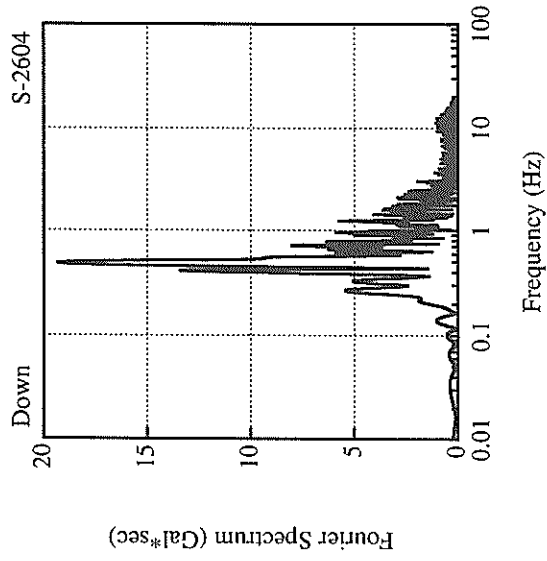
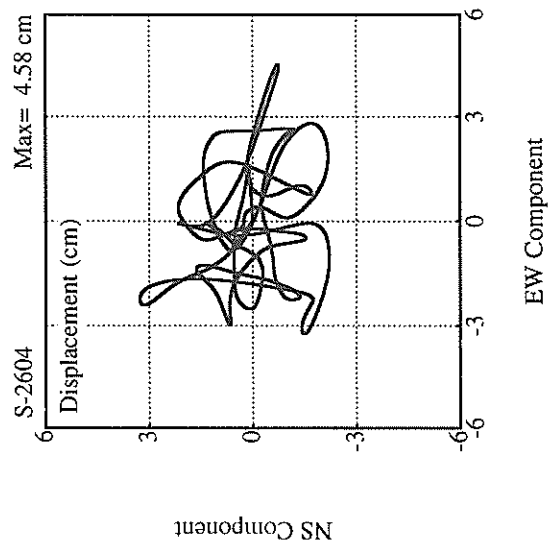
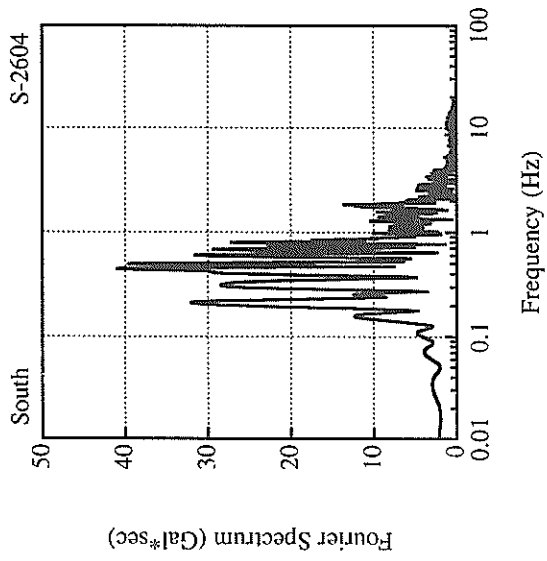












RECORD NUMBER : F-694  
 STATION : OTARU-G

EARTHQUAKE DATA

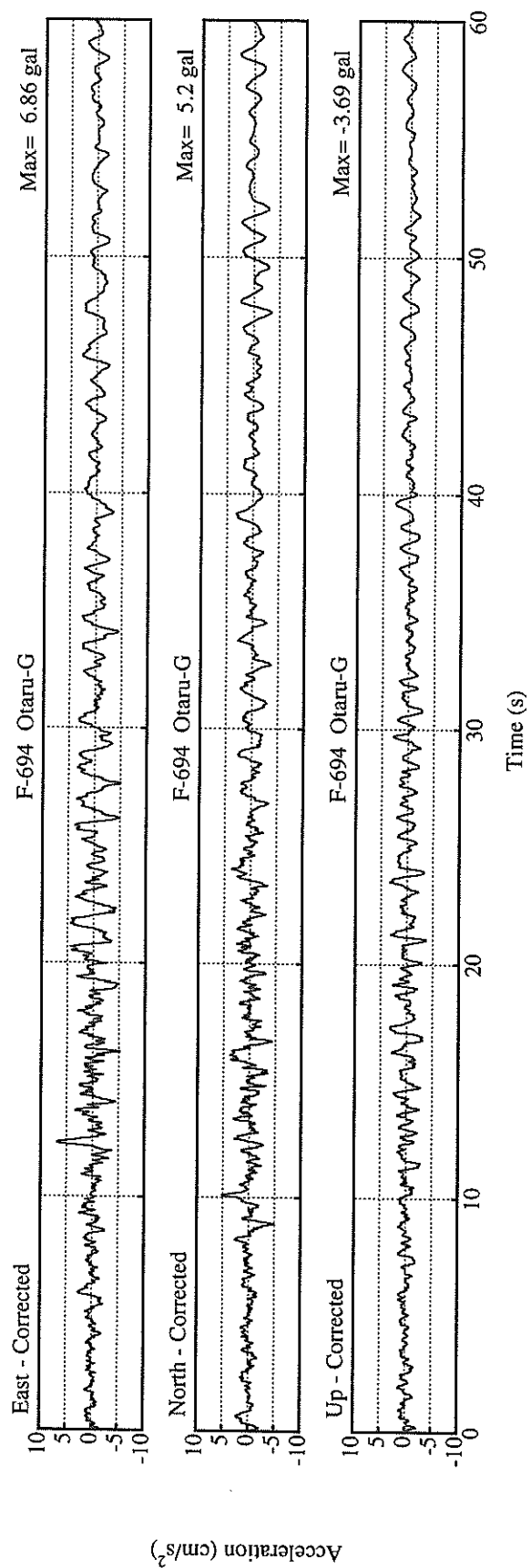
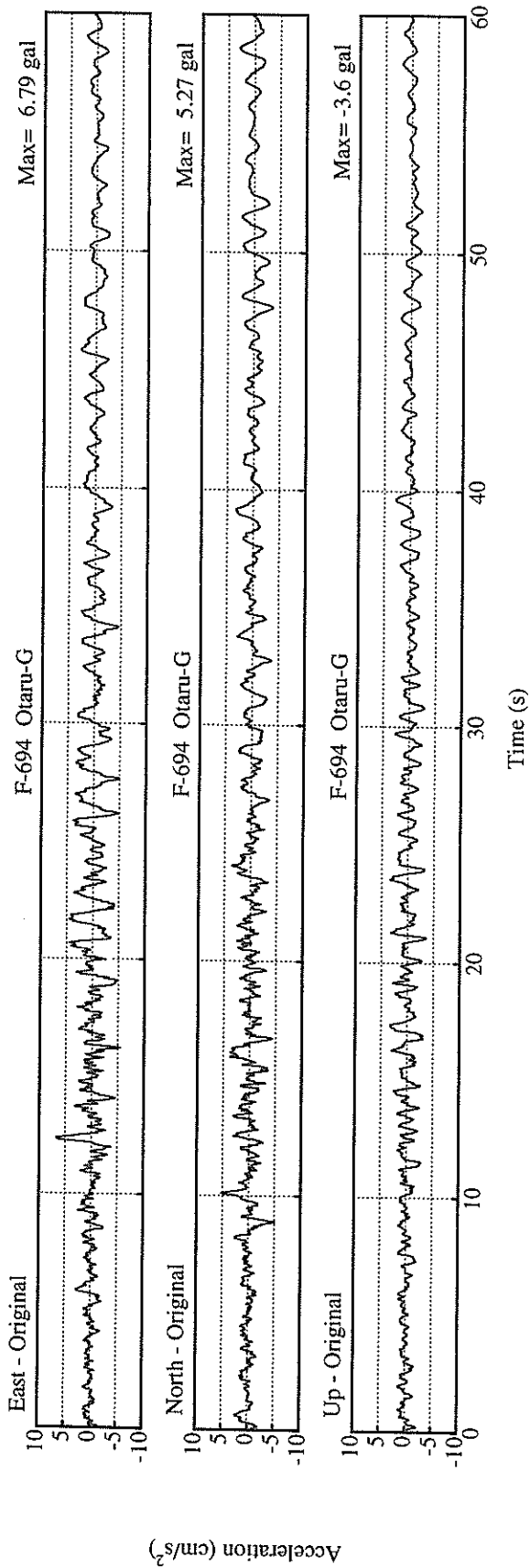
```
*****
DATE AND TIME                21:19 DEC.28,1994
LOCATION OF HYPOCENTER
EPICENTRAL REGION           FAR E OFF SANRIKU
LATITUDE                     40° 25.6' N
LONGITUDE                    143° 44.9' E
DEPTH                         0.0KM
JMA MAGNITUDE                7.5
*****
```

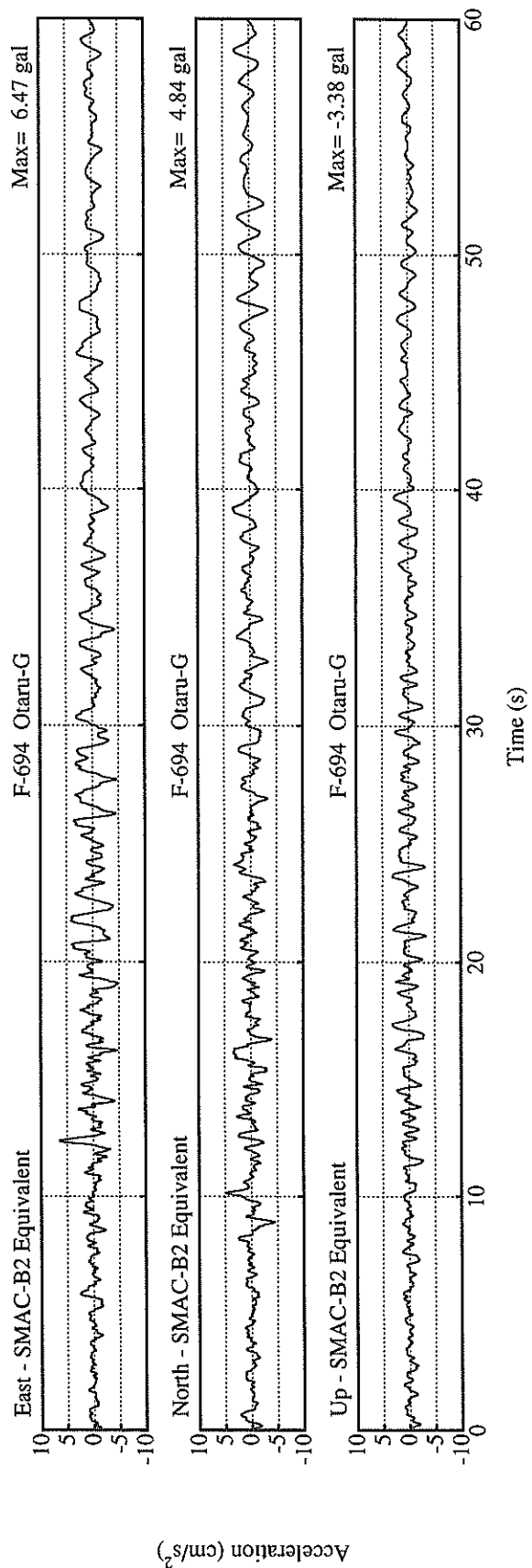
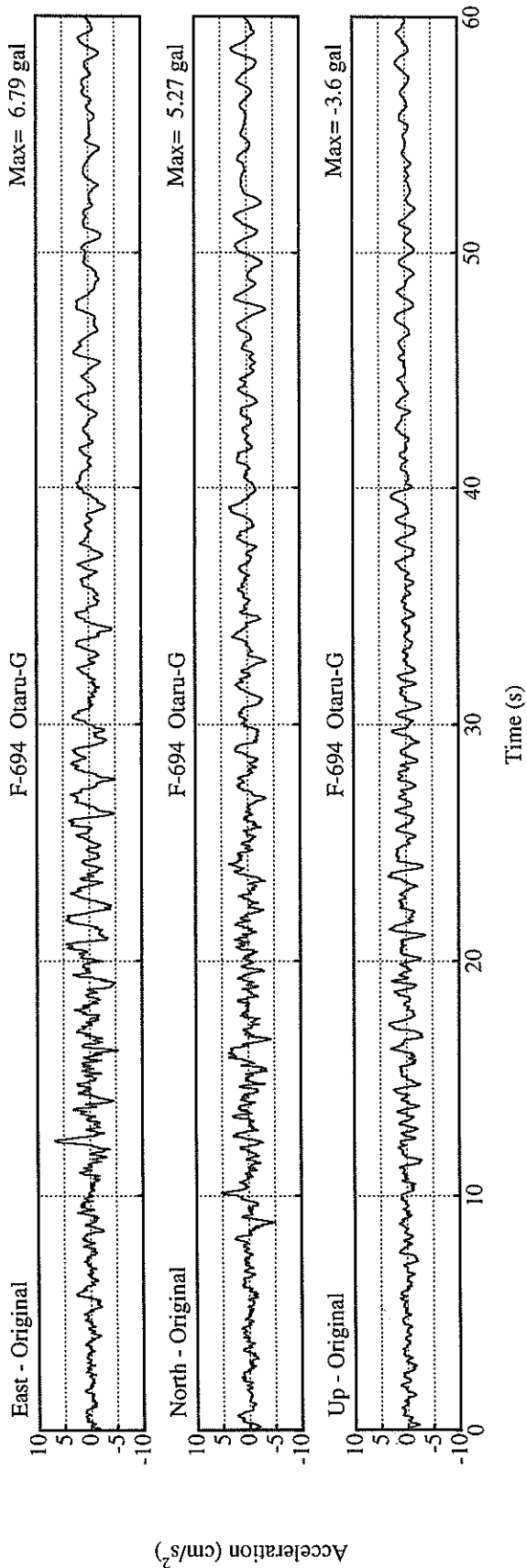
PEAK VALUES OF COMPONENTS

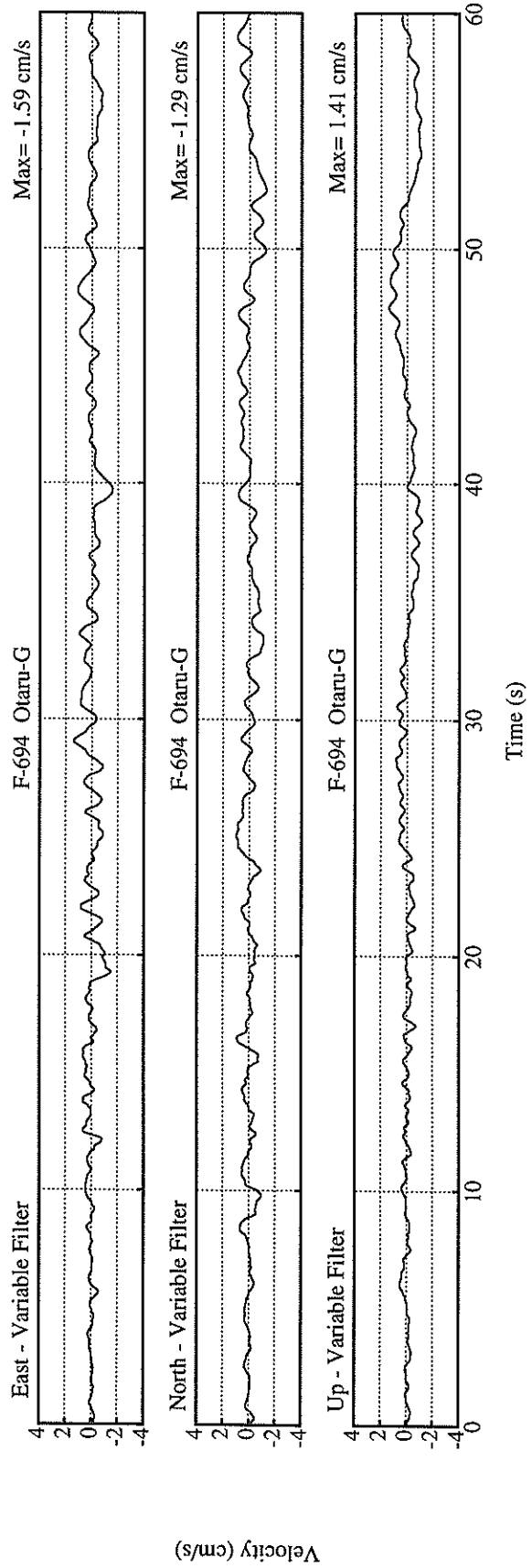
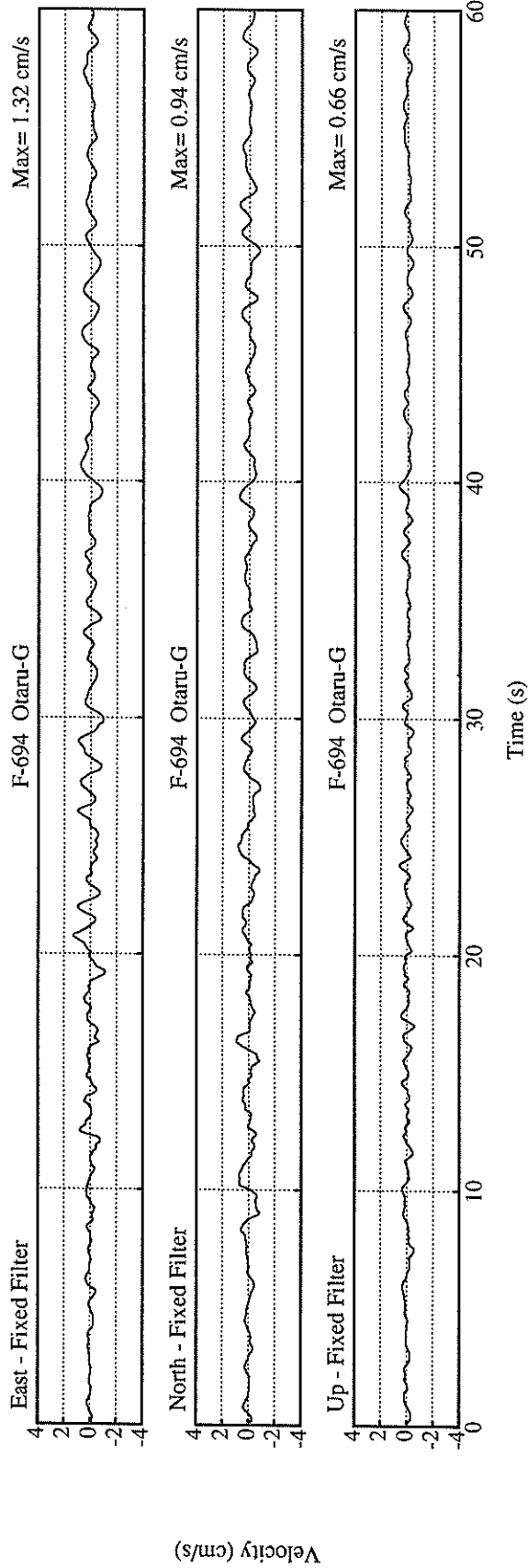
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.048	0.048	0.042	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	4.8	6.5	3.4	6.8
ORIGINAL	5.3	6.8	3.6	7.0
CORRECTED	5.2	6.9	3.7	7.1
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	0.94	1.32	0.66	1.34
VARIABLE FILTER	1.29	1.59	1.41	1.77
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.53	0.54	0.42	0.61
VARIABLE FILTER	2.00	1.38	3.00	2.11

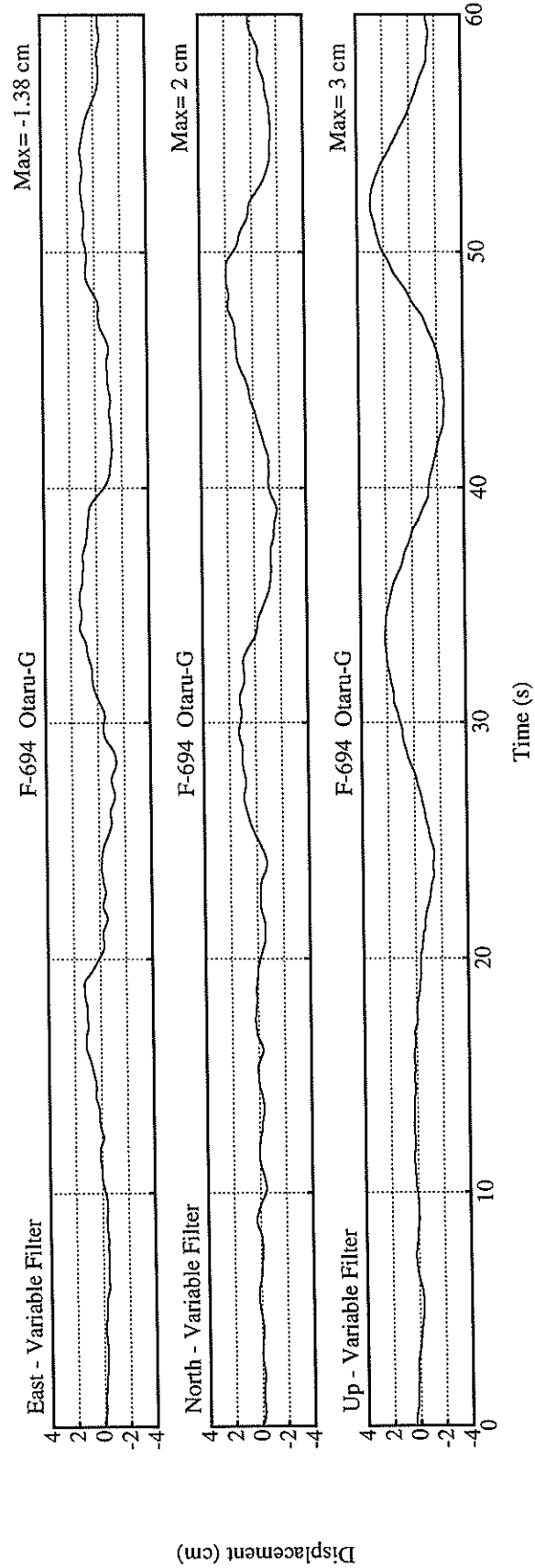
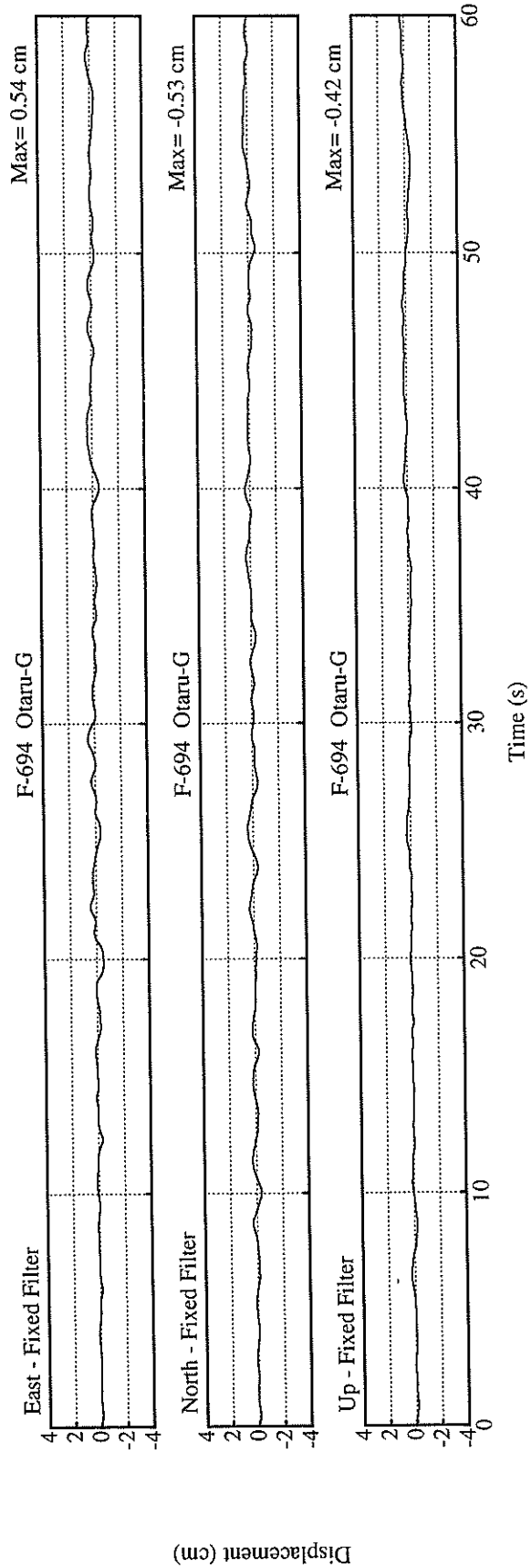
\* RESULTANT OF HORIZONTAL COMPONENTS

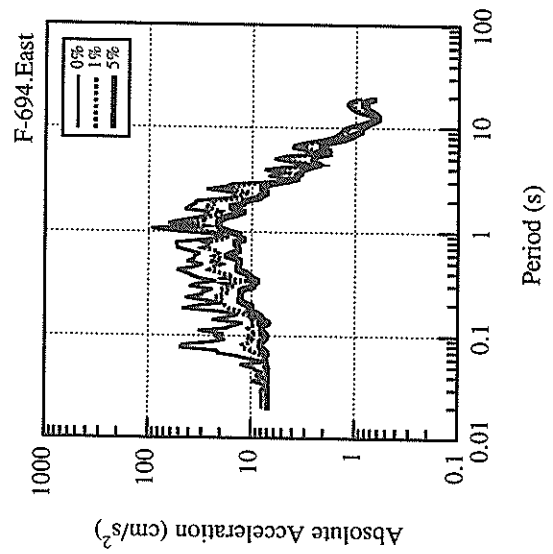
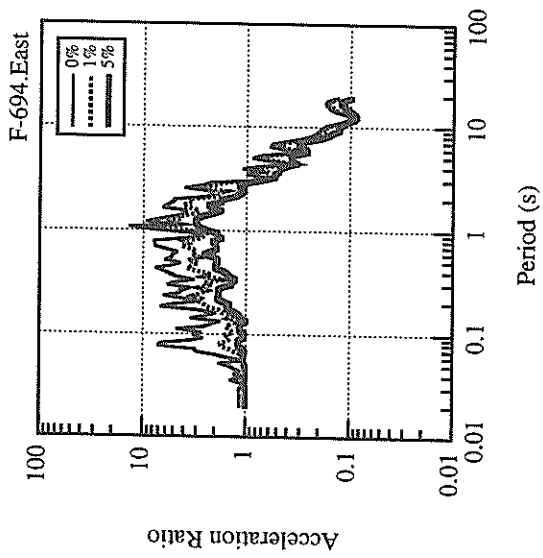
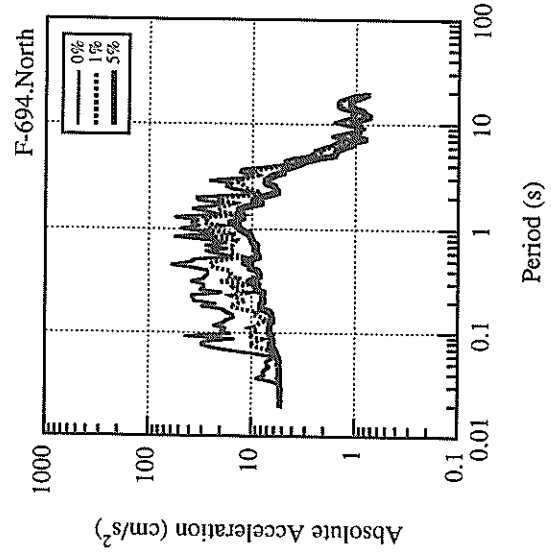
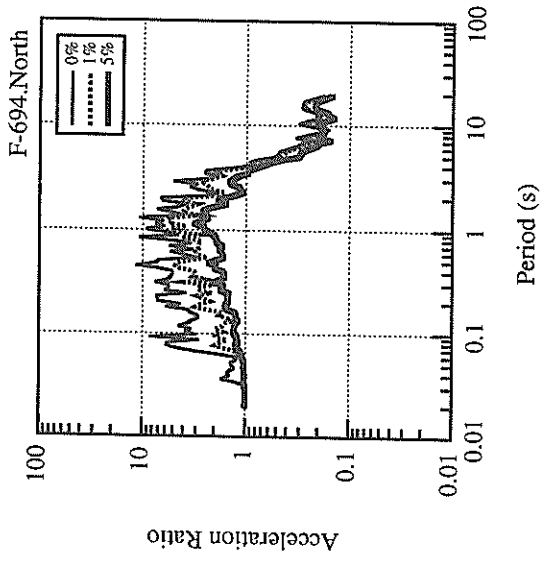
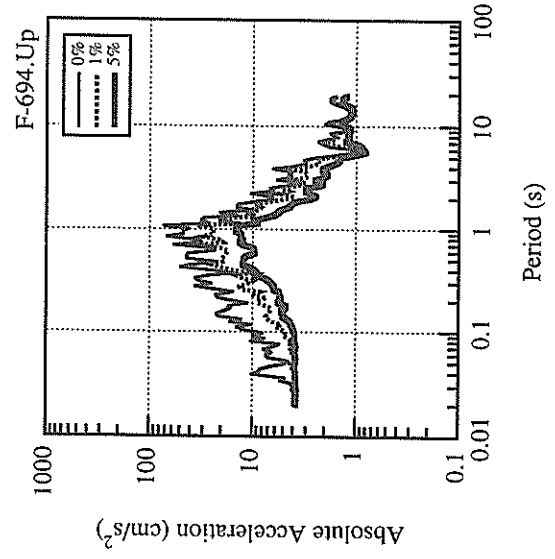
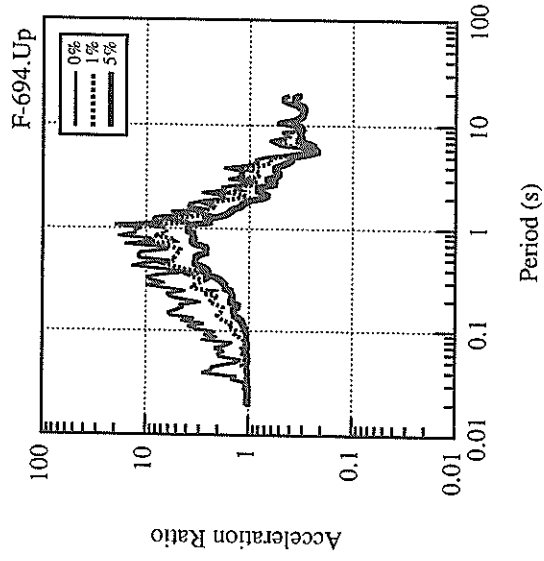


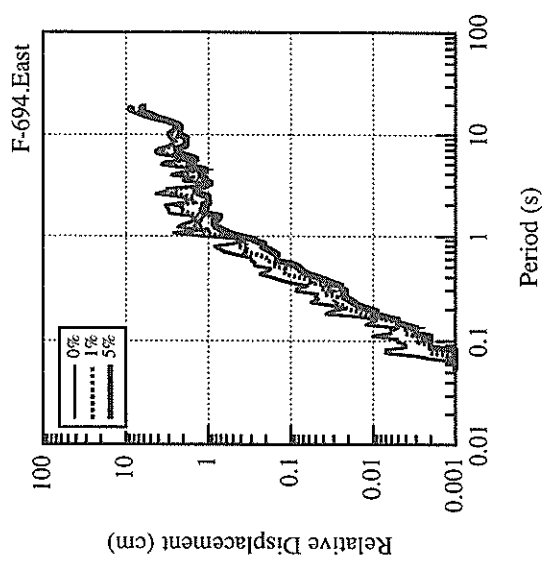
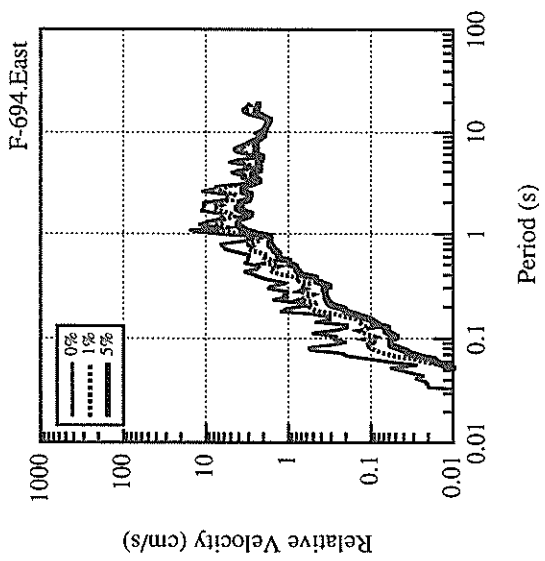
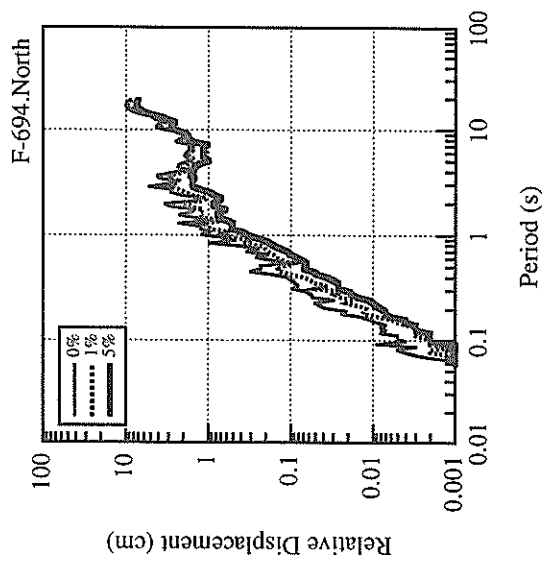
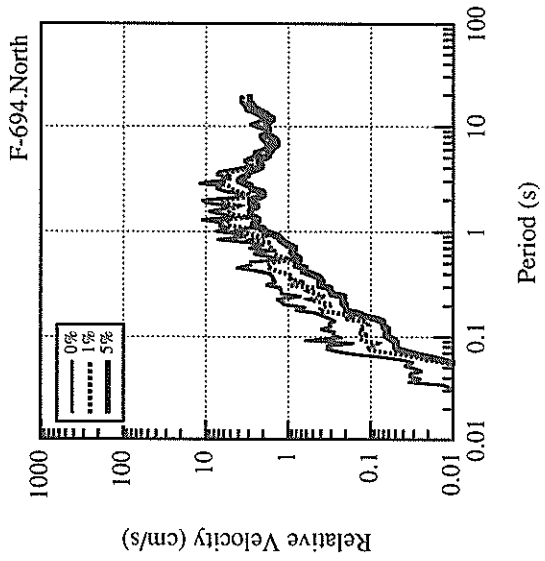
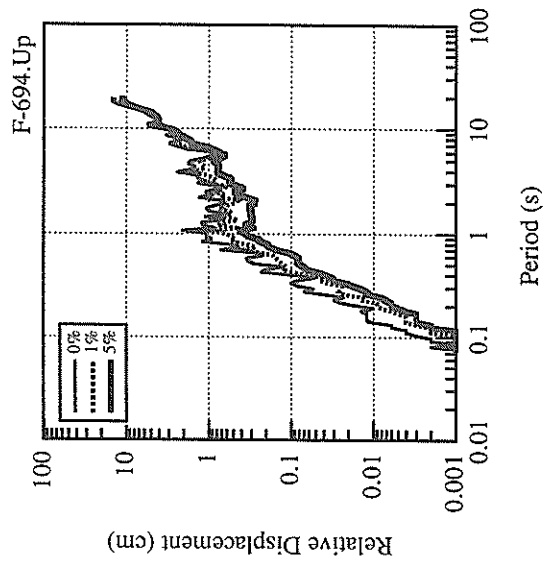
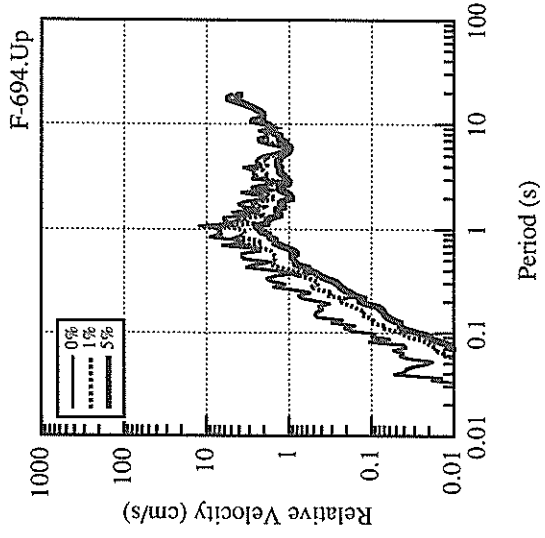


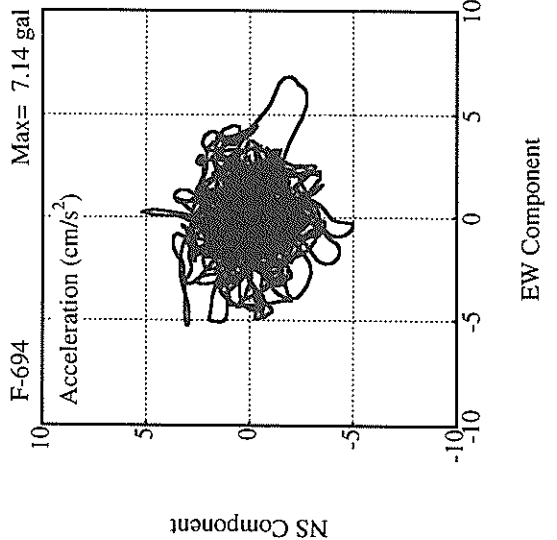
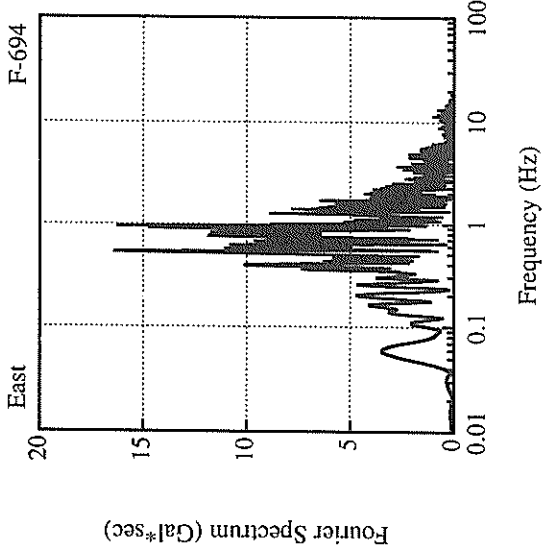
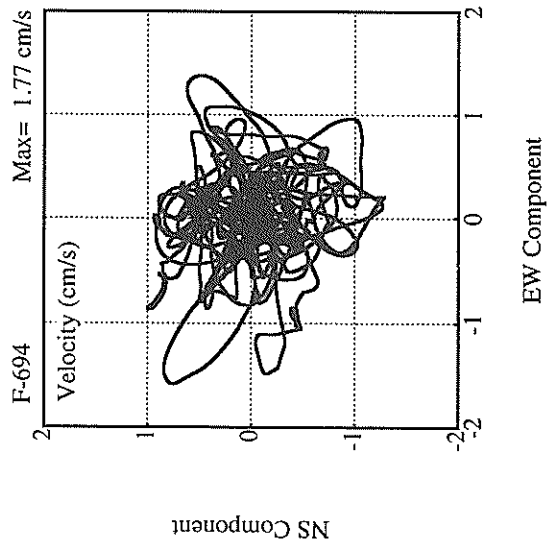
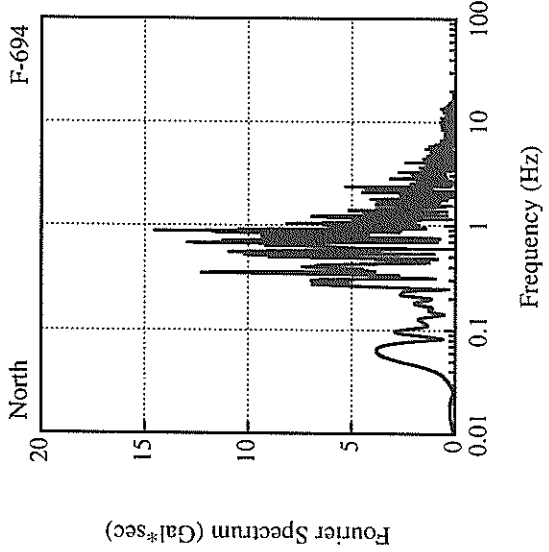
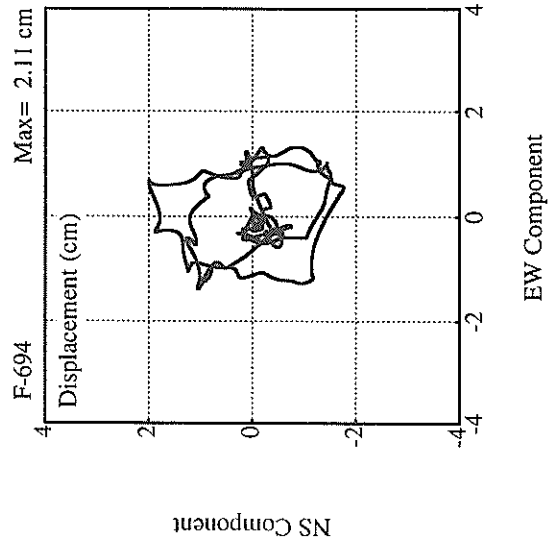
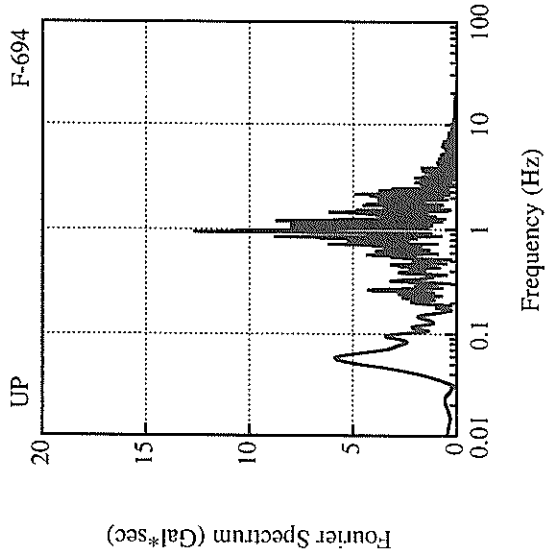












RECORD NUMBER : F-705  
 STATION : NIIGATA-G

EARTHQUAKE DATA

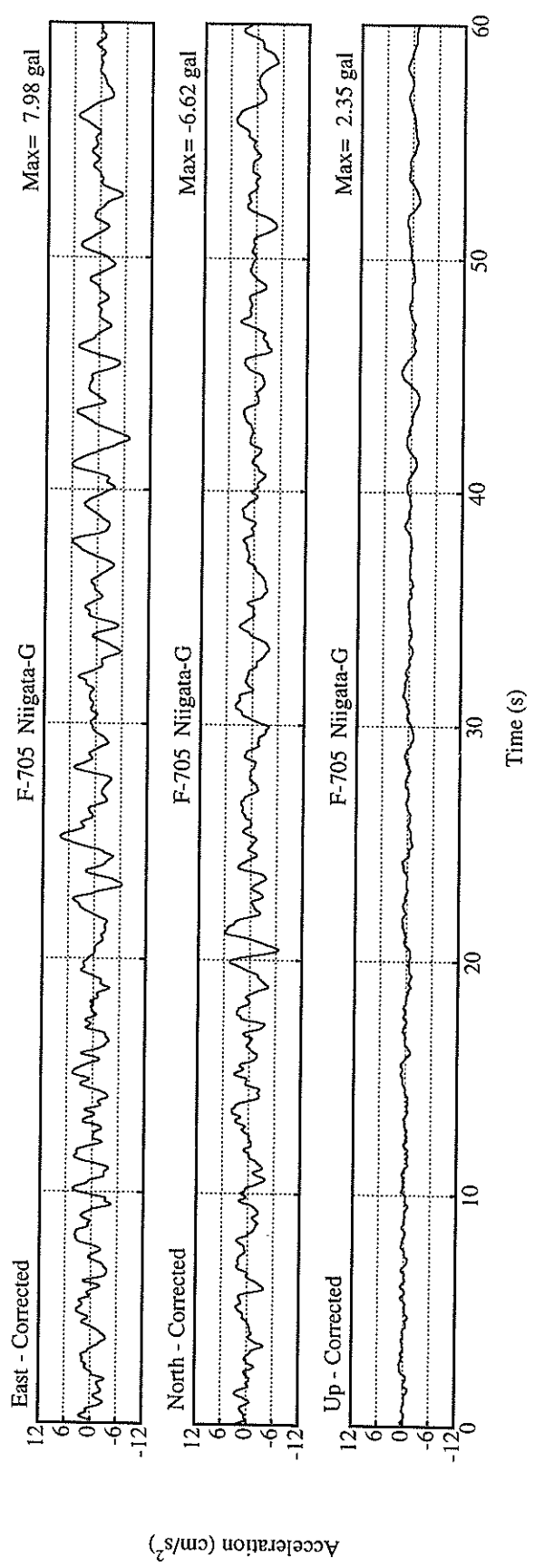
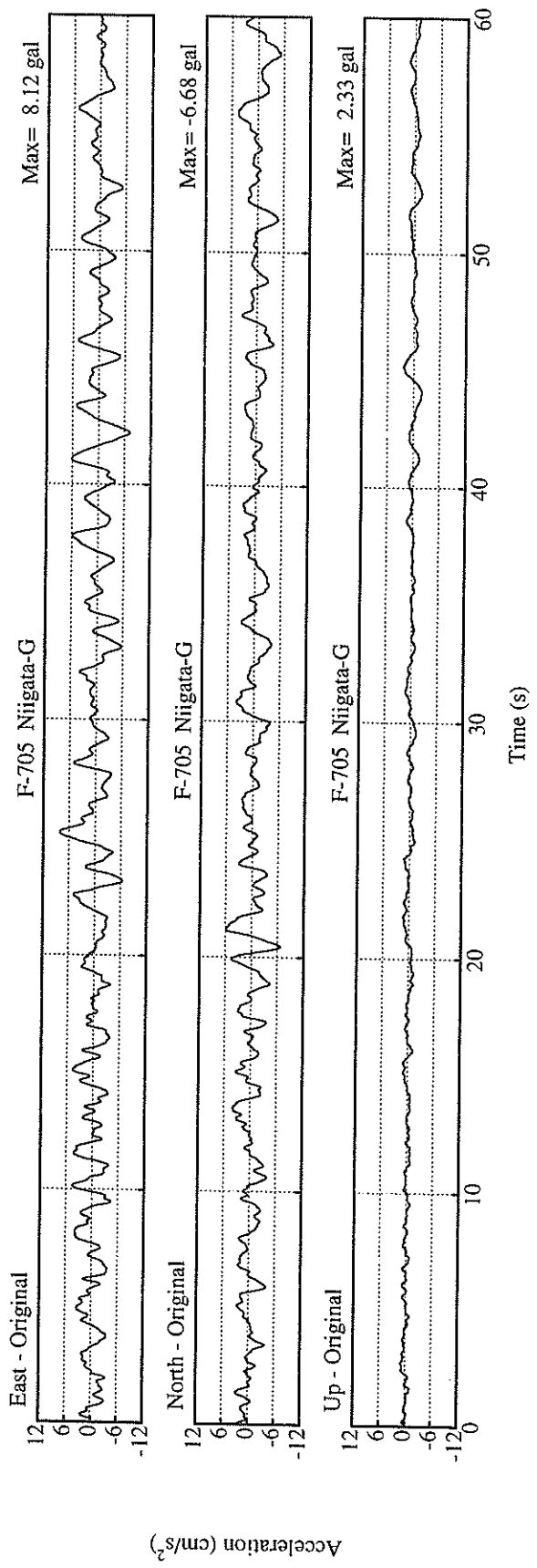
\*\*\*\*\*  
 DATE AND TIME 21:19 DEC.28,1994  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION FAR E OFF SANRIKU  
 LATITUDE 40°25.6' N  
 LONGITUDE 143°44.9' E  
 DEPTH 0.0KM  
 JMA MAGNITUDE 7.5  
 \*\*\*\*\*

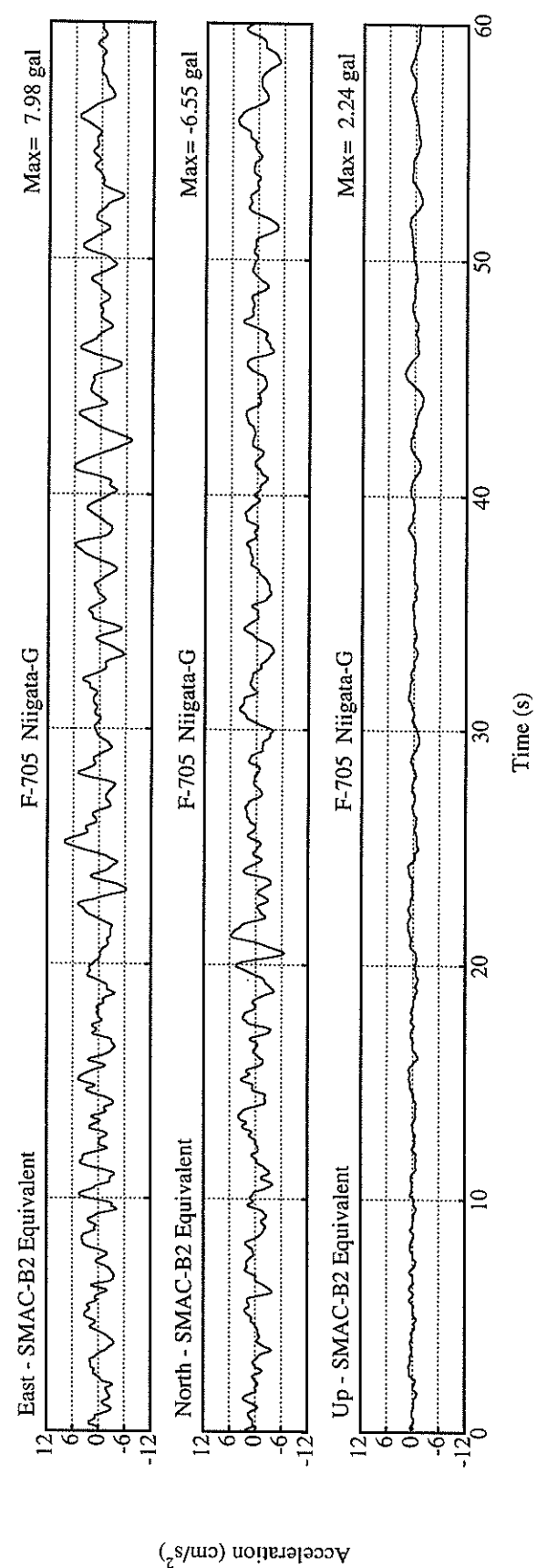
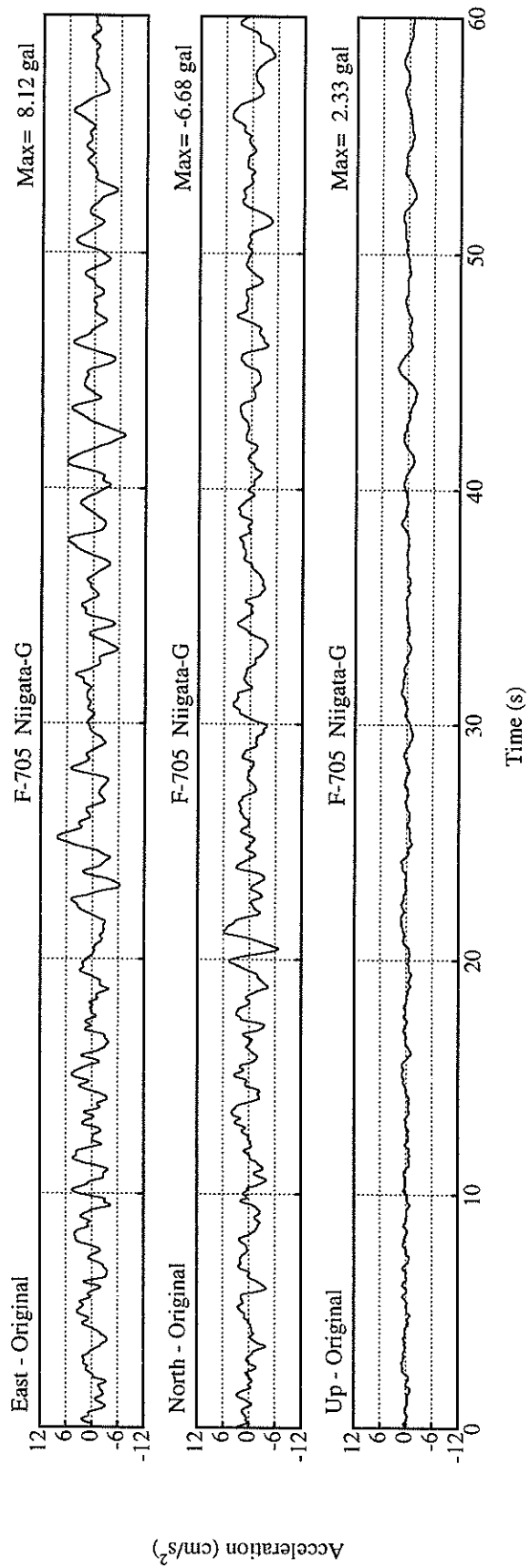
PEAK VALUES OF COMPONENTS

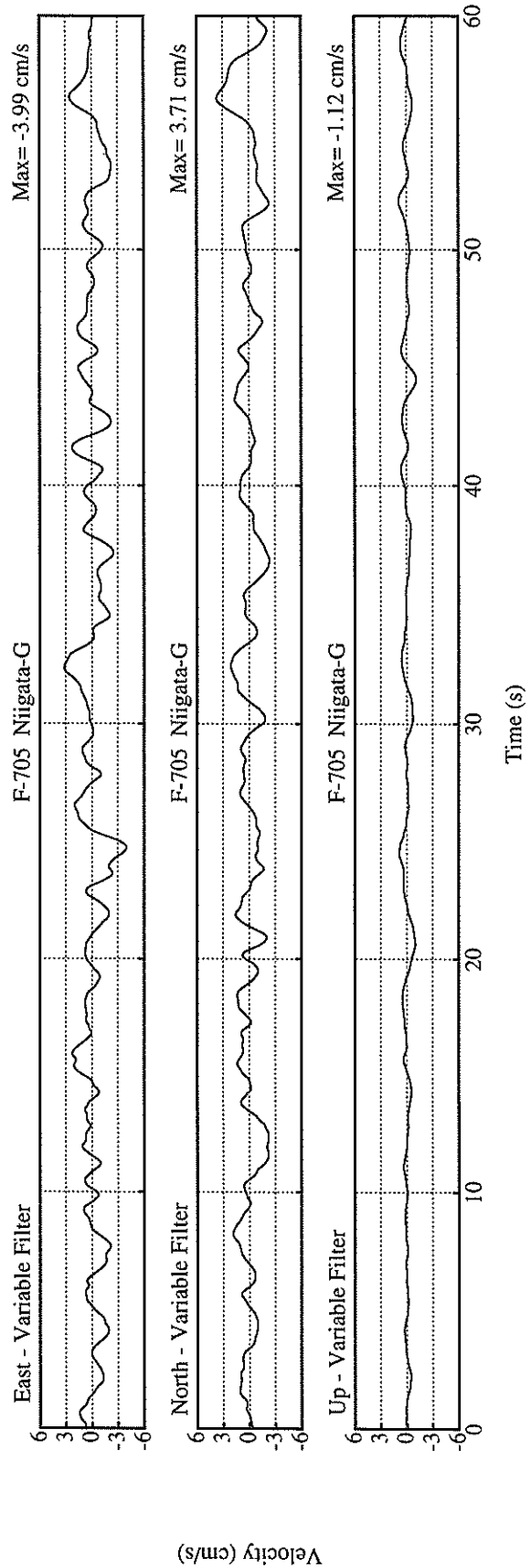
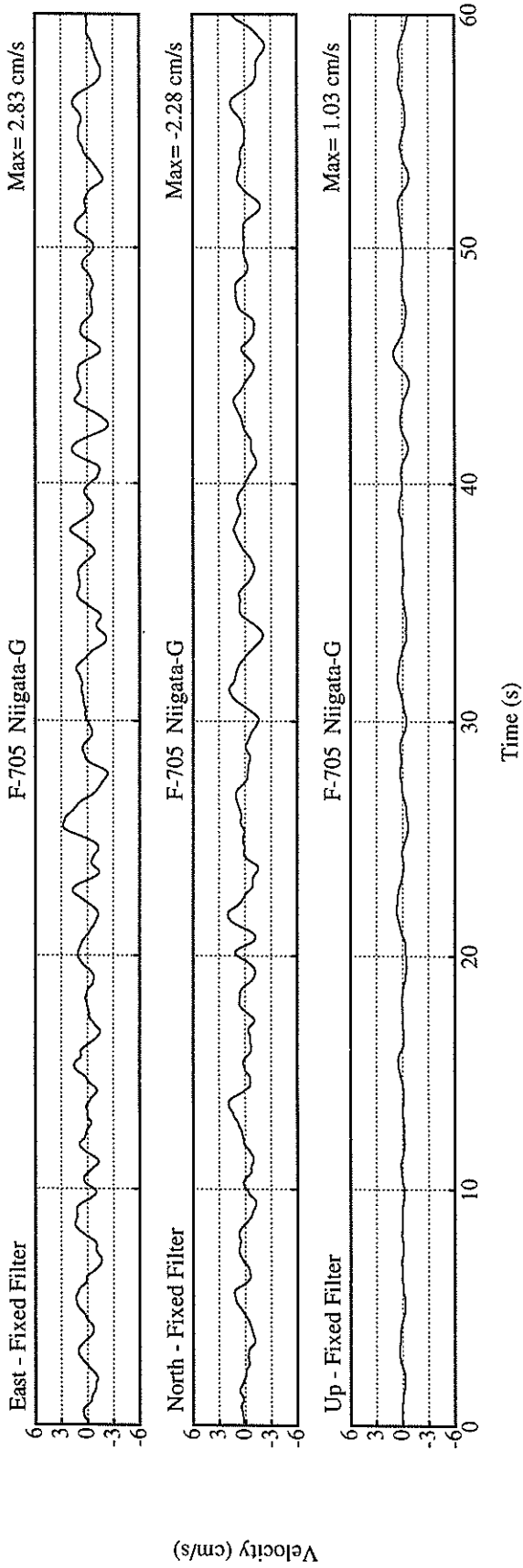
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.054	0.042	0.079	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	6.5	8.0	2.2	8.1
ORIGINAL	6.7	8.1	2.3	8.2
CORRECTED	6.6	8.0	2.4	8.1
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	2.28	2.83	1.03	2.93
VARIABLE FILTER	3.71	3.99	1.12	4.50
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	2.06	1.82	0.63	2.38
VARIABLE FILTER	3.66	4.10	0.98	4.28

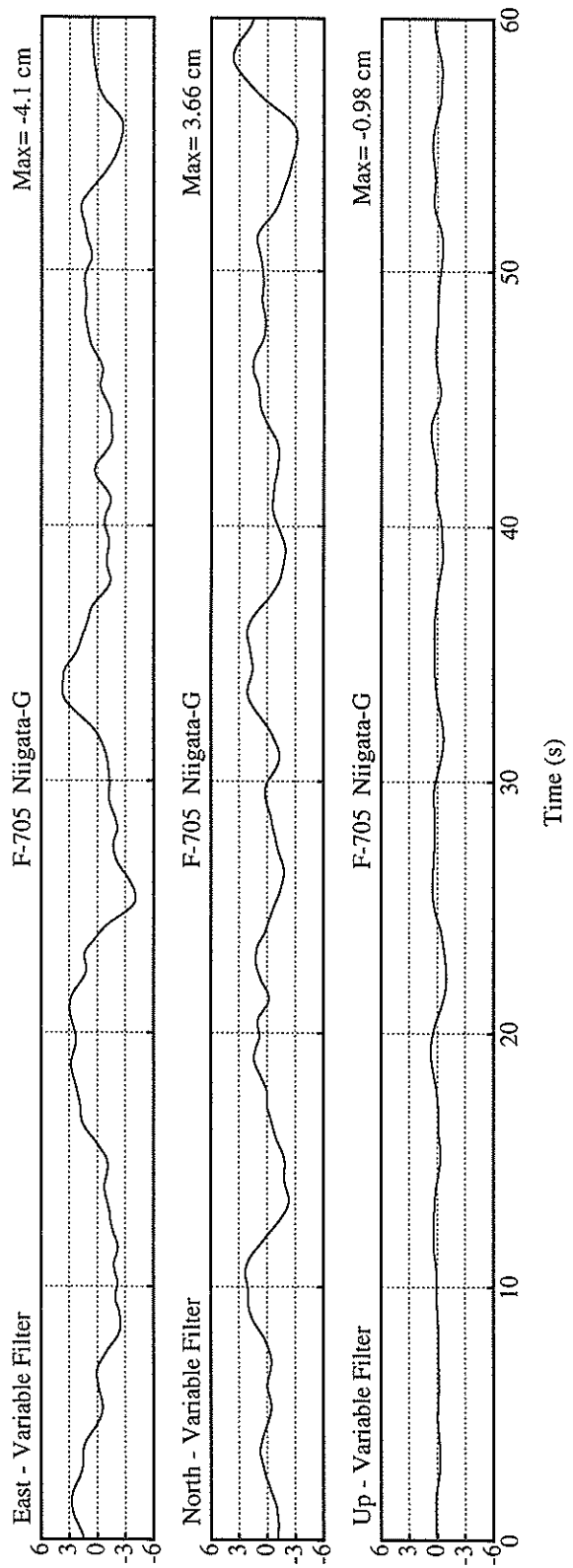
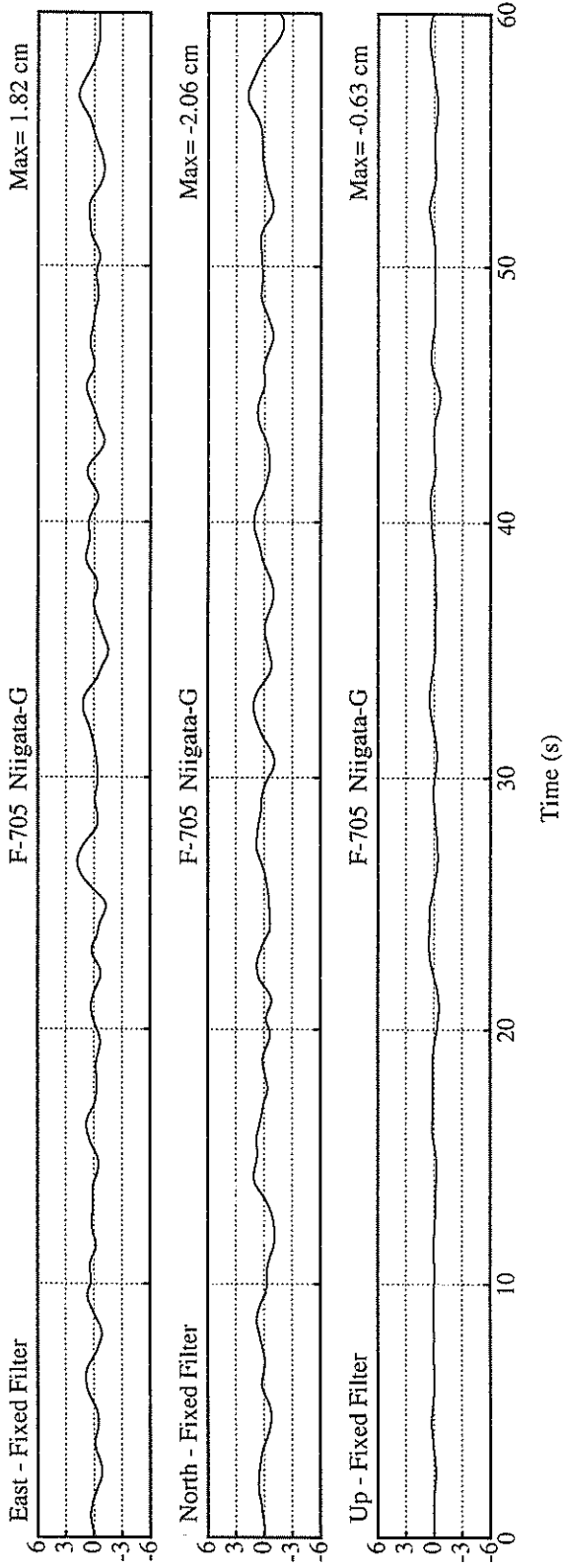
\* RESULTANT OF HORIZONTAL COMPONENTS

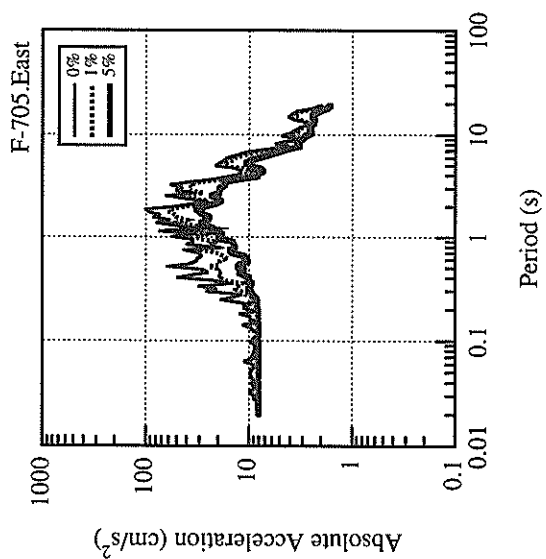
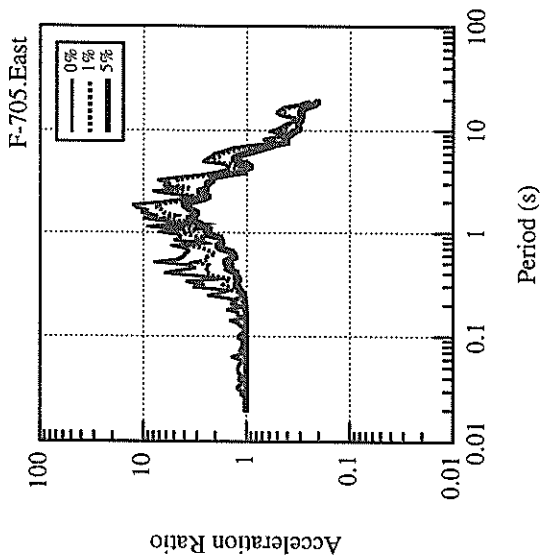
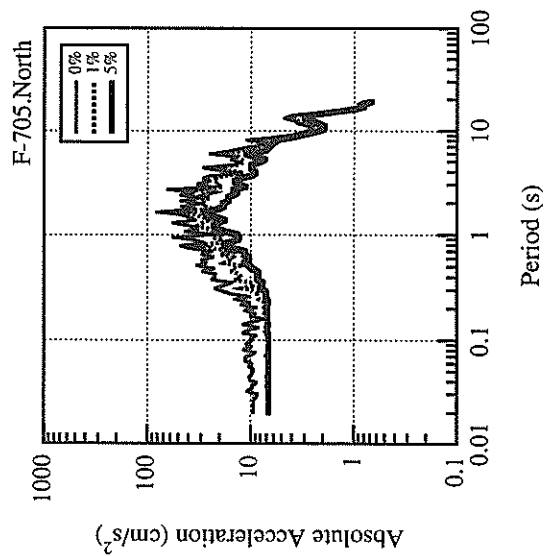
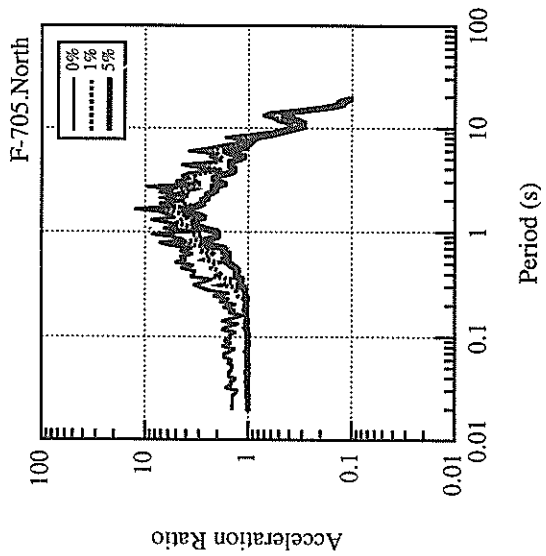
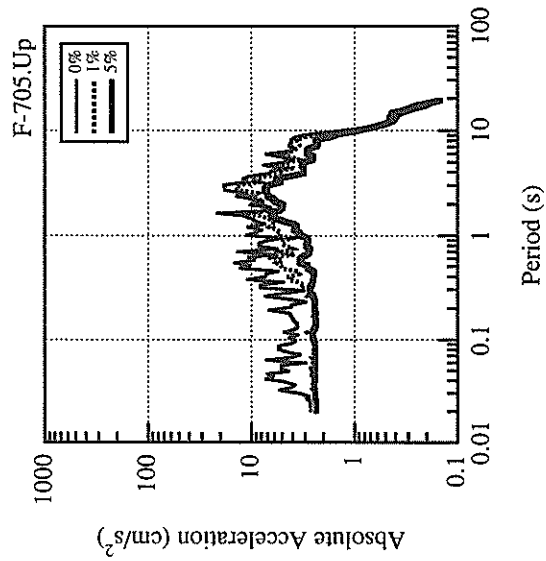
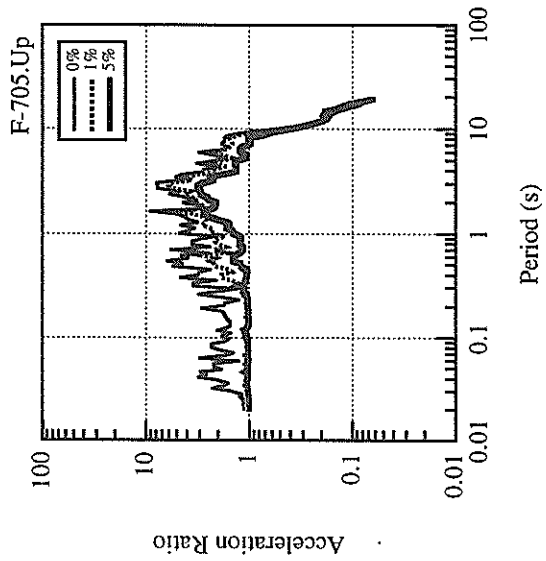


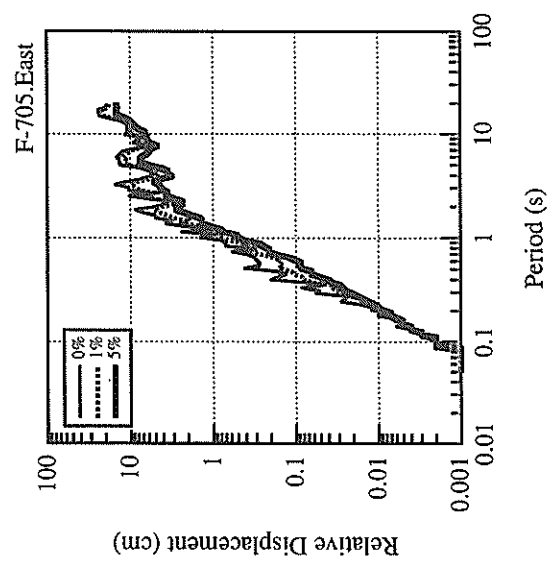
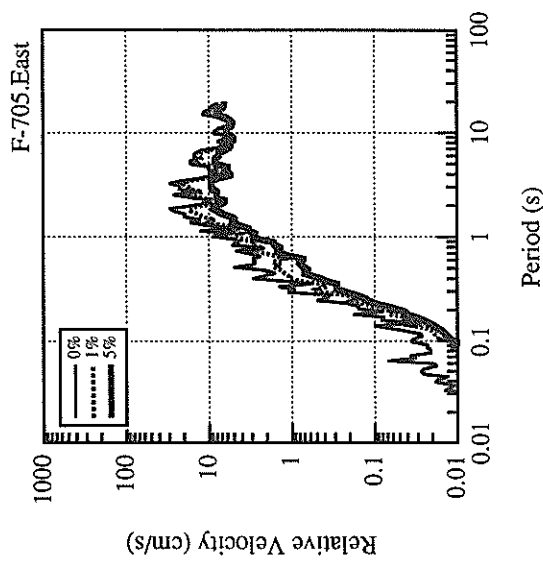
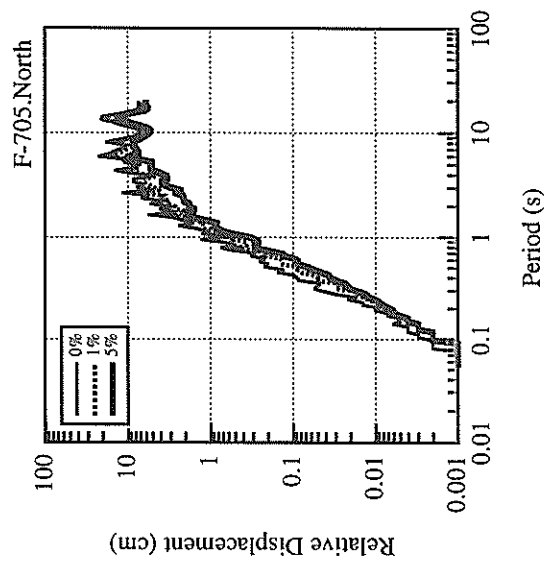
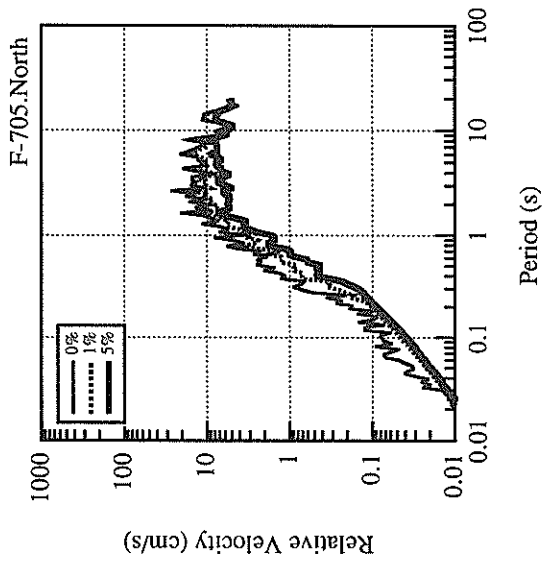
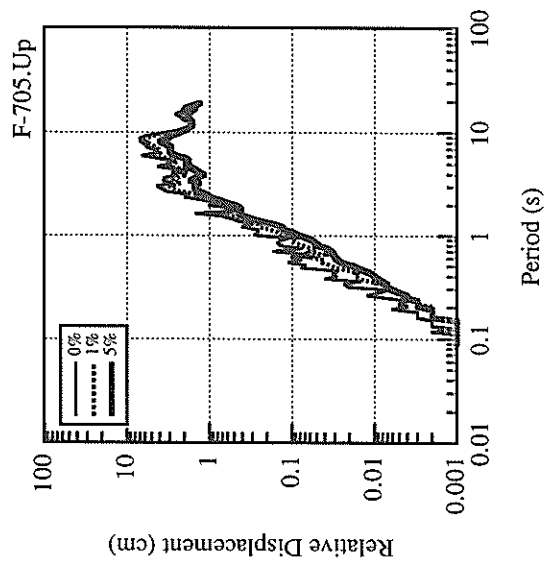
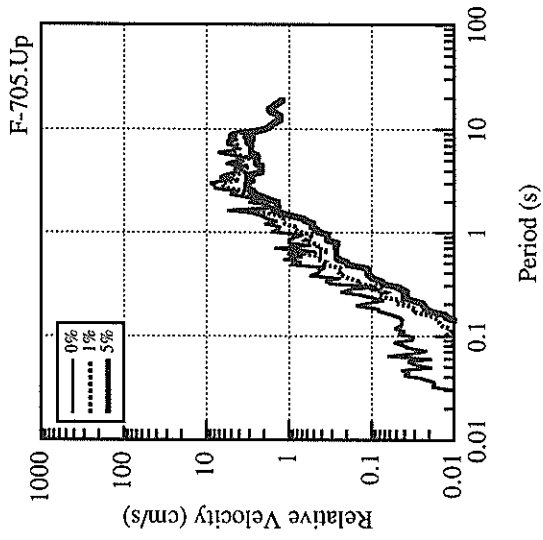


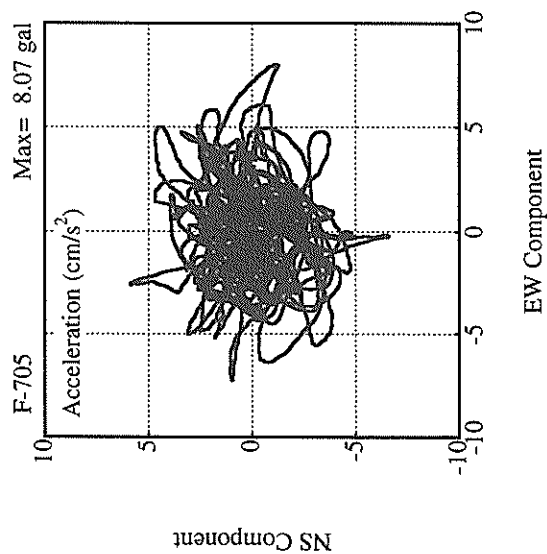
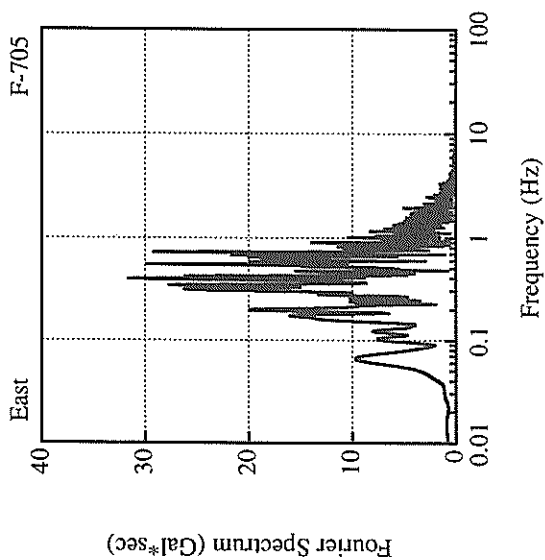
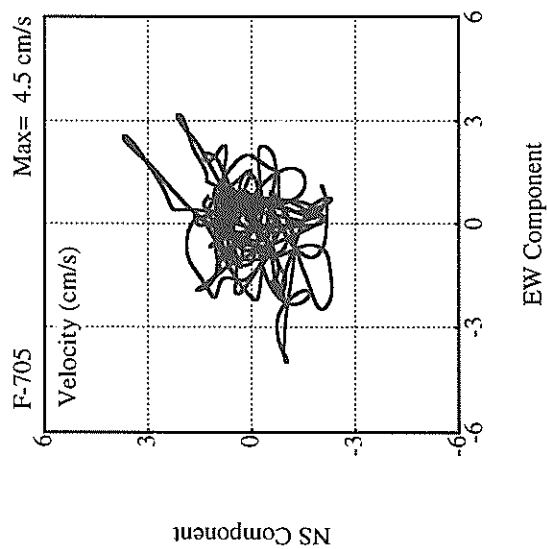
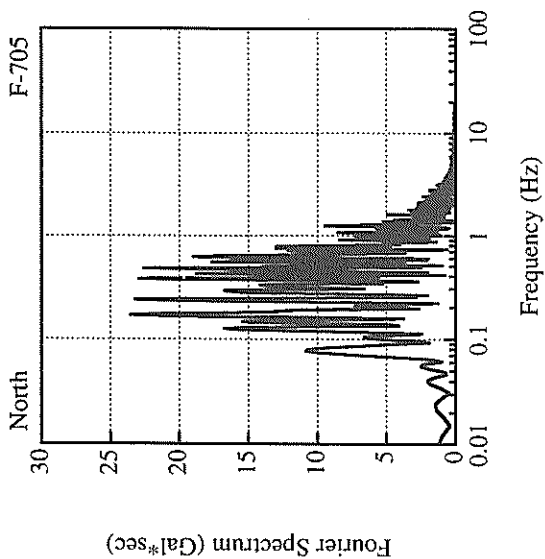
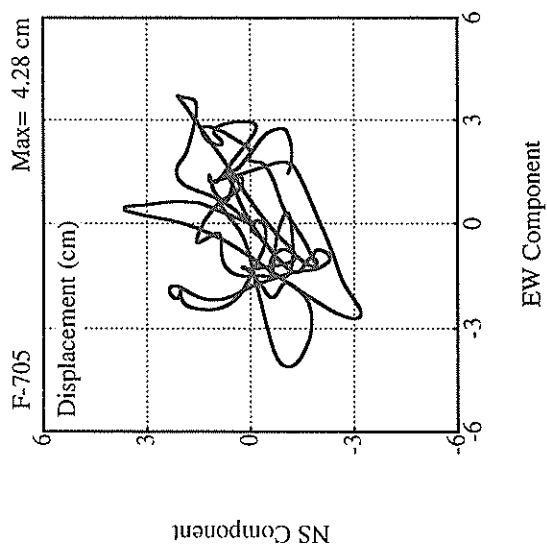
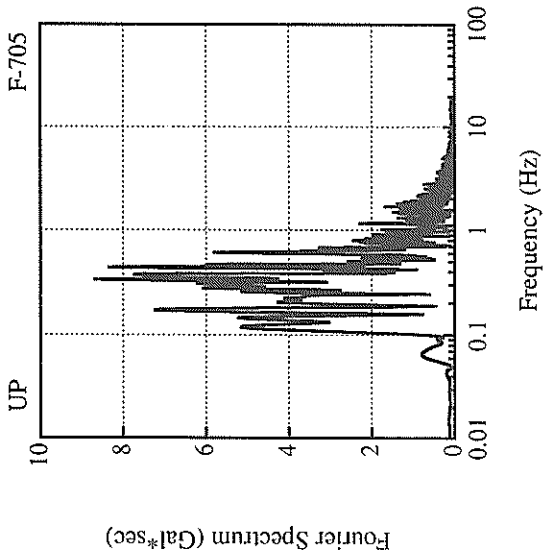












RECORD NUMBER : F-739

STATION : KAWASAKI-F

EARTHQUAKE DATA

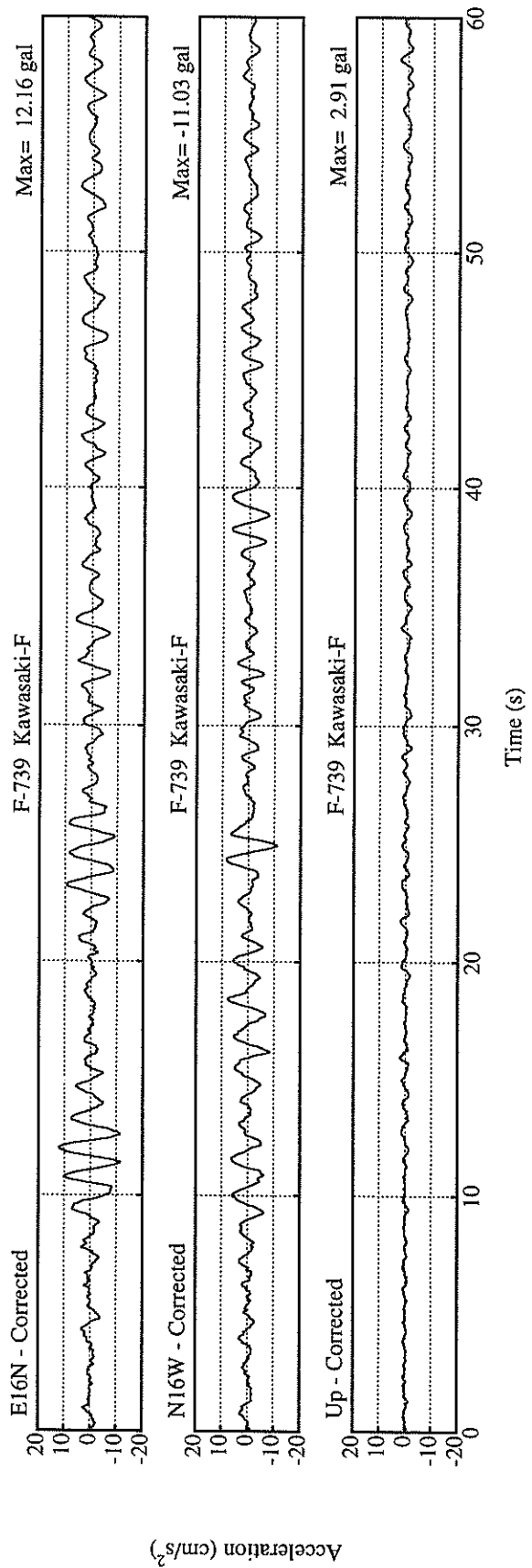
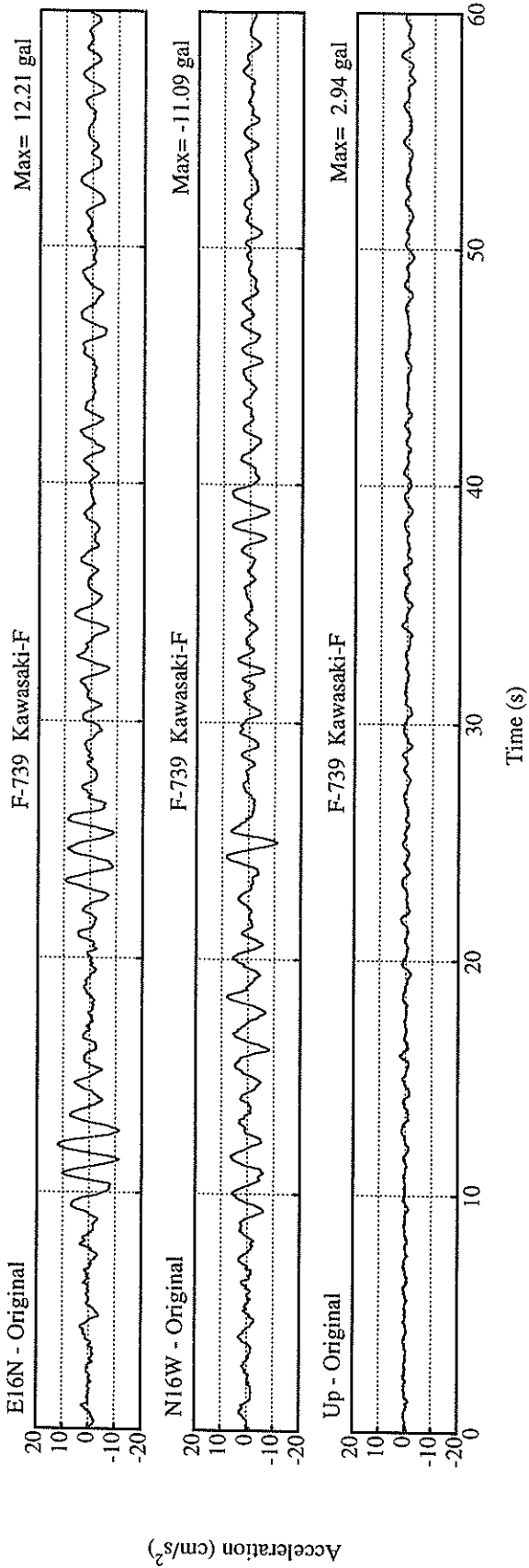
\*\*\*\*\*  
DATE AND TIME 21:19 DEC.28,1994  
LOCATION OF HYPOCENTER  
EPICENTRAL REGION FAR E OFF SANRIKU  
LATITUDE 40°25.6' N  
LONGITUDE 143°44.9' E  
DEPTH 0.0KM  
JMA MAGNITUDE 7.5  
\*\*\*\*\*

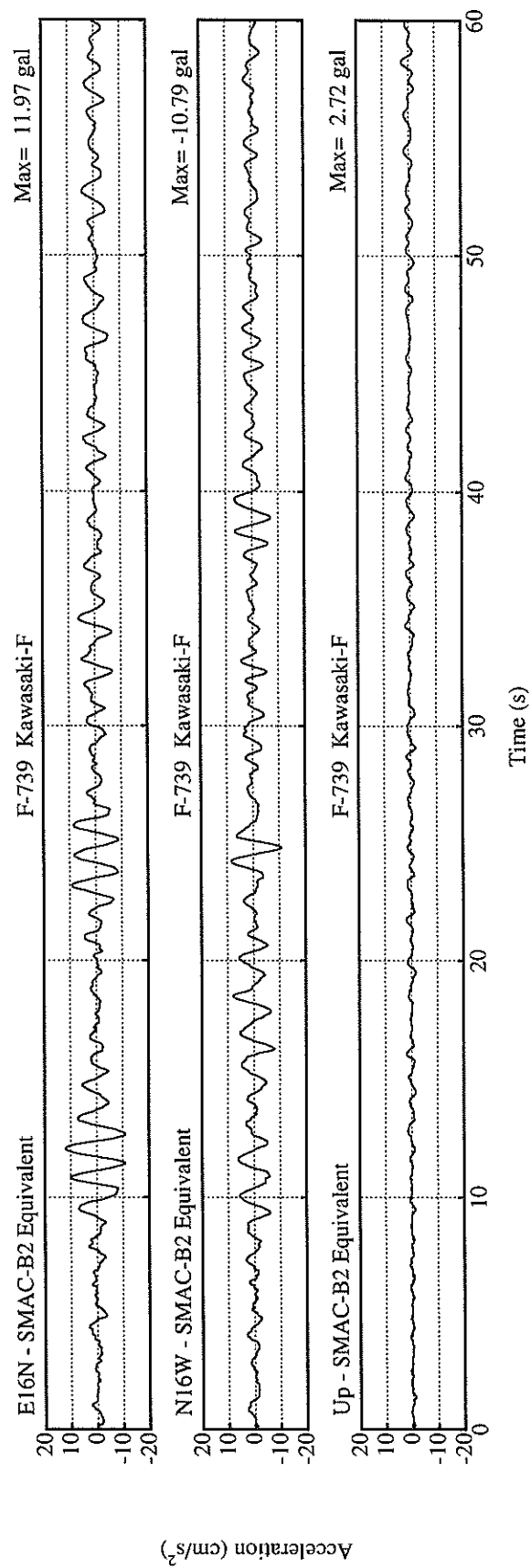
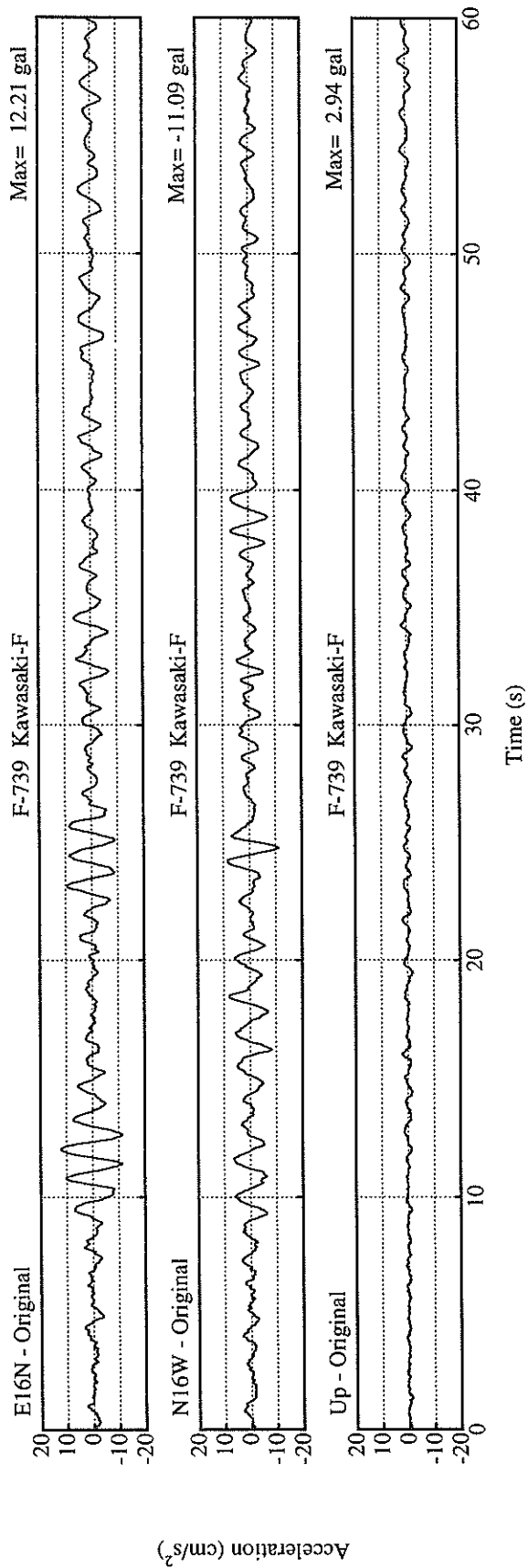
PEAK VALUES OF COMPONENTS

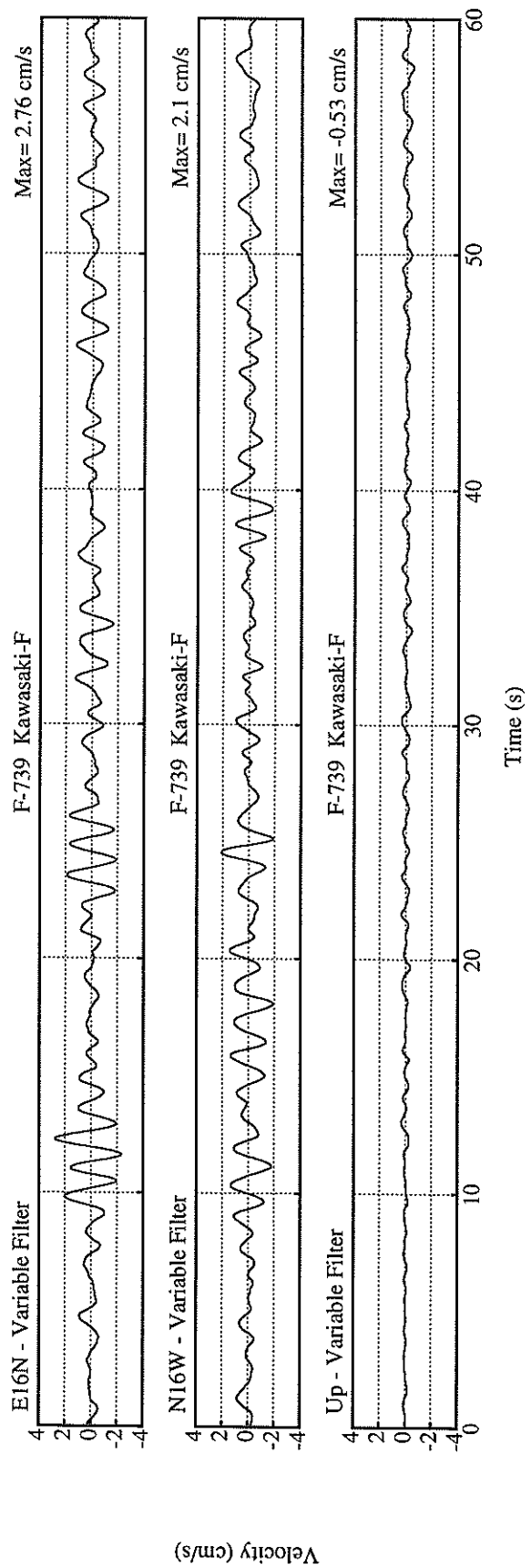
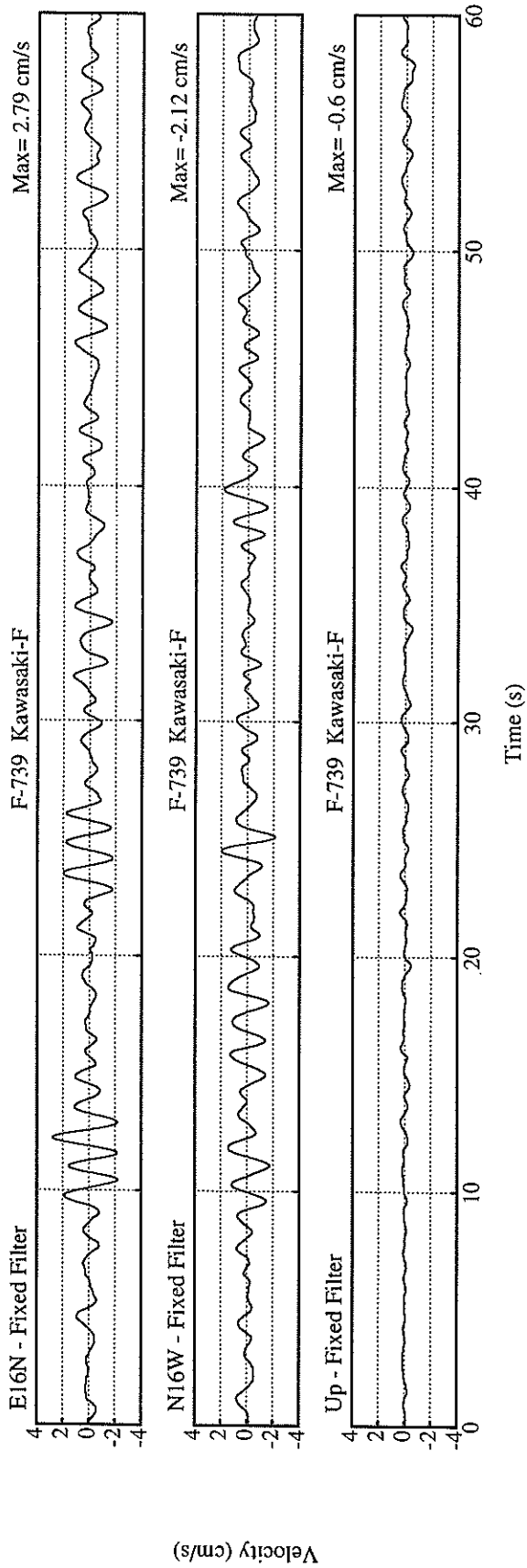
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.127	0.140	0.219	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	10.8	12.0	2.7	12.0
ORIGINAL	11.1	12.2	2.9	12.3
CORRECTED	11.0	12.2	2.9	12.4
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	2.12	2.79	0.60	2.79
VARIABLE FILTER	2.10	2.76	0.53	2.76
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.63	0.62	0.24	0.66
VARIABLE FILTER	0.67	0.61	0.17	0.68

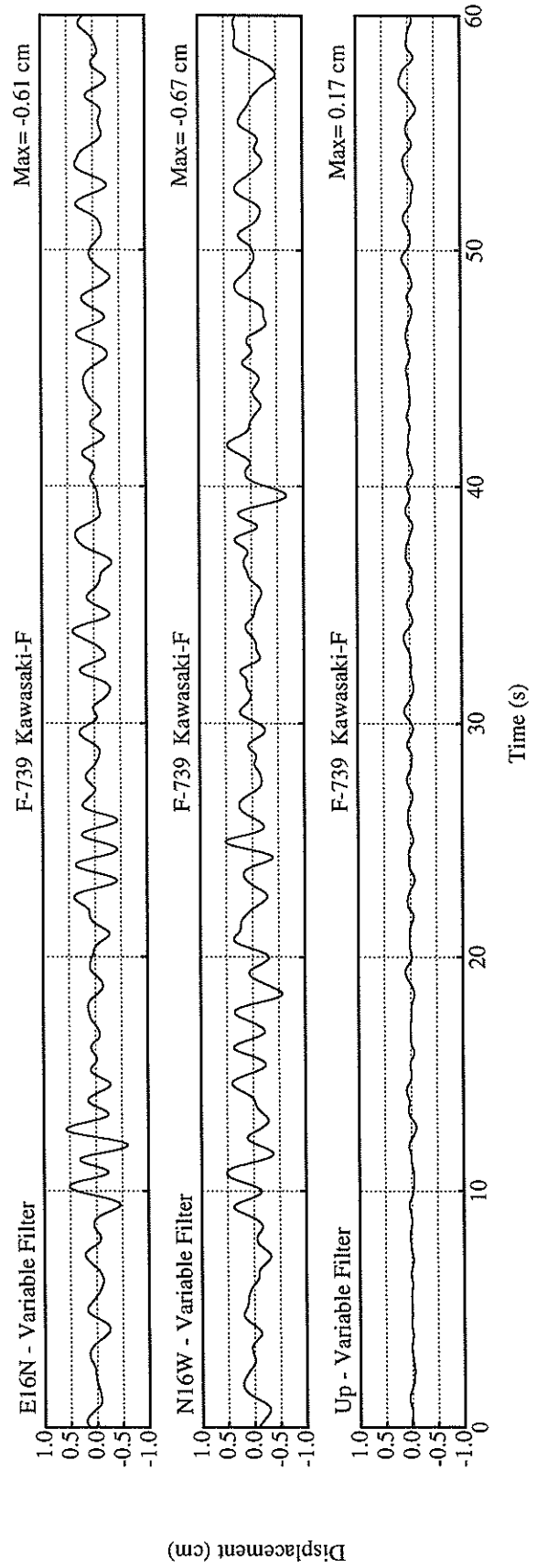
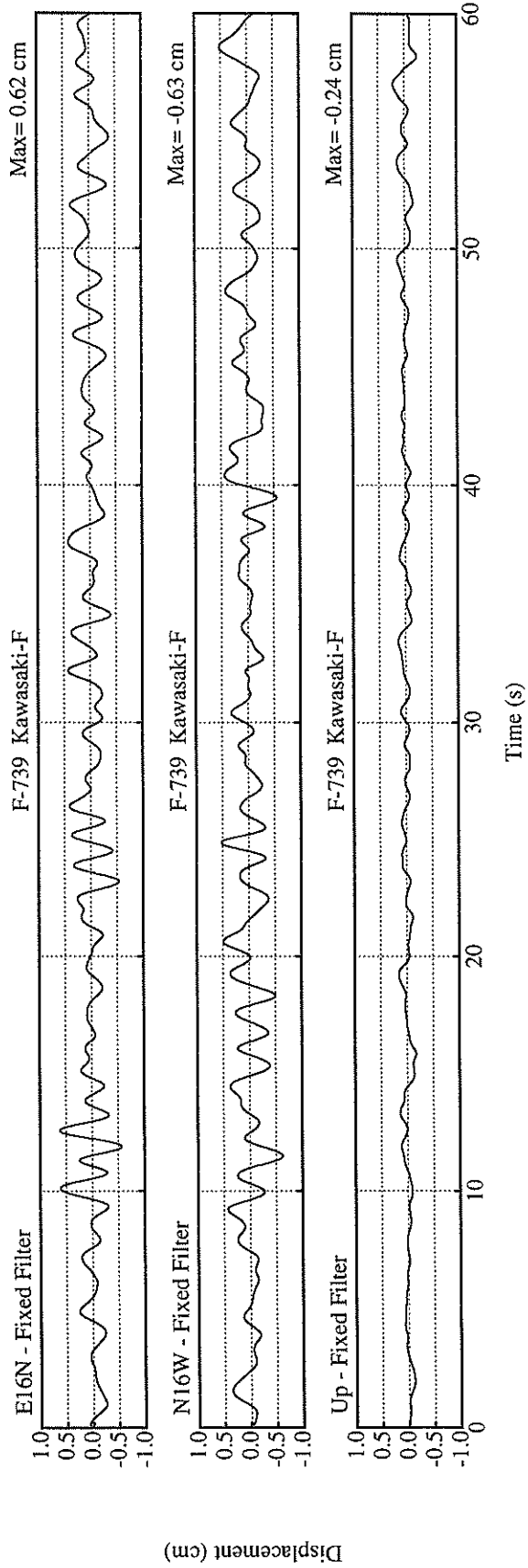
\* RESULTANT OF HORIZONTAL COMPONENTS

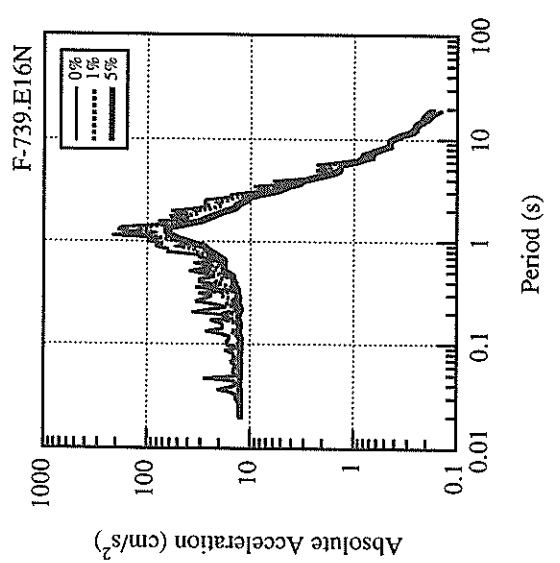
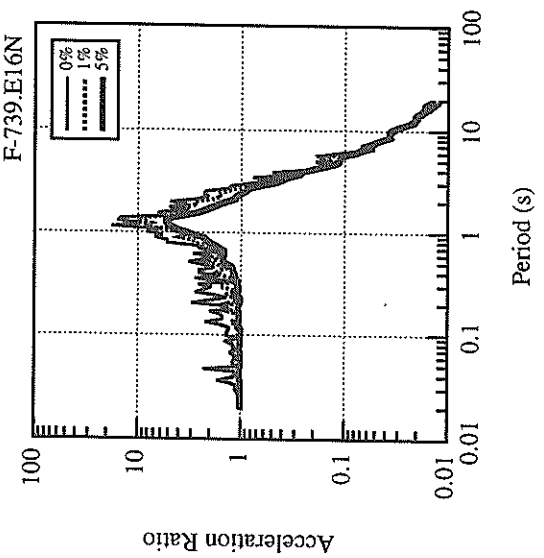
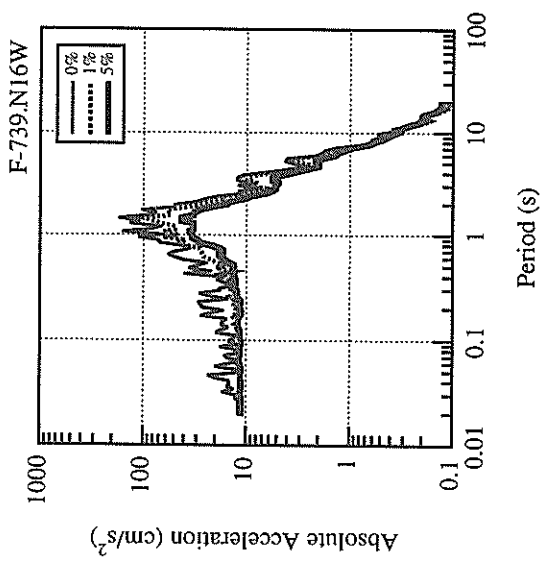
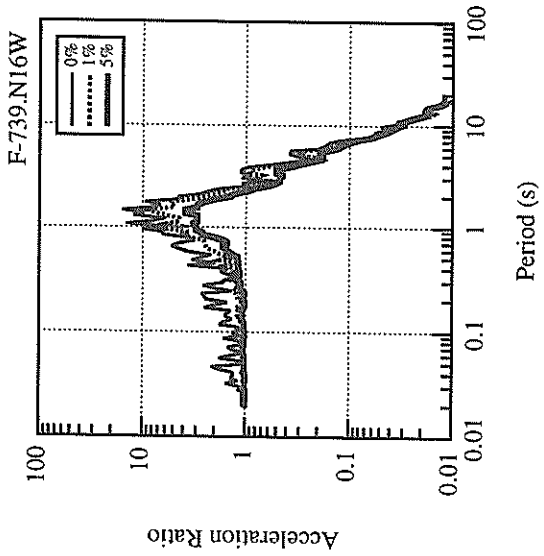
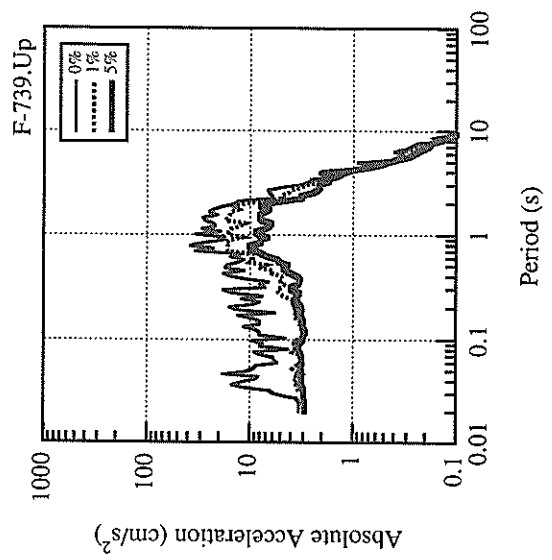
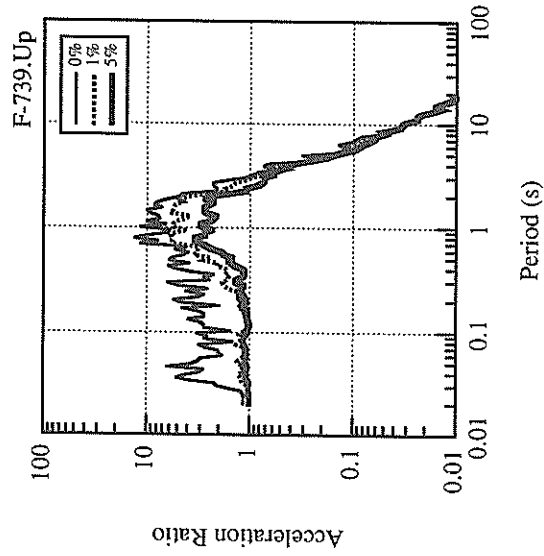


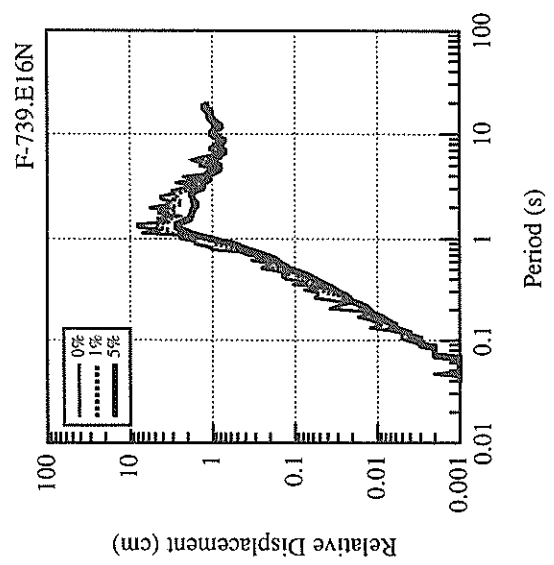
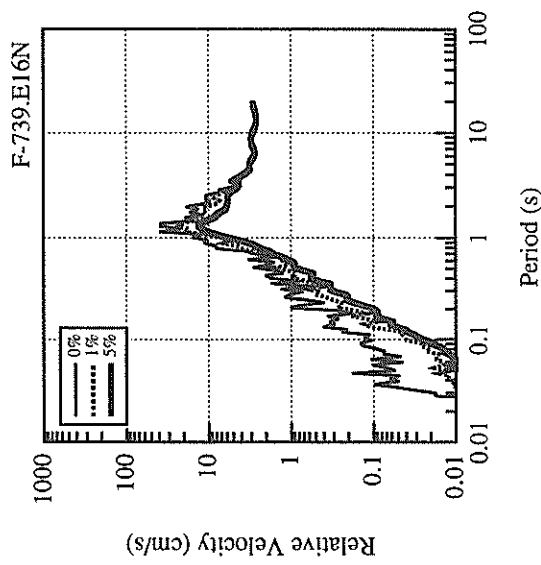
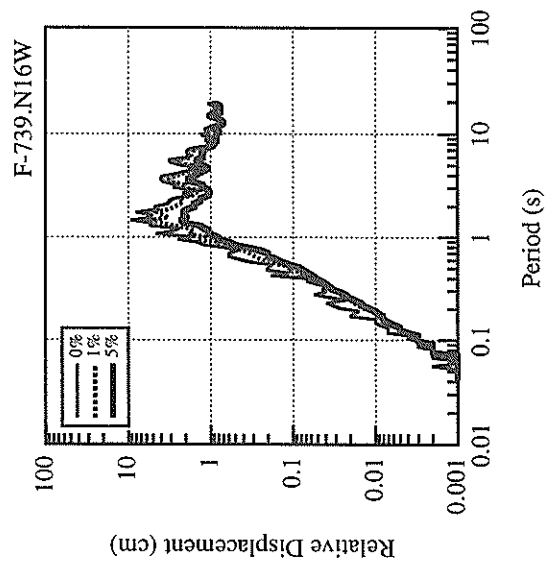
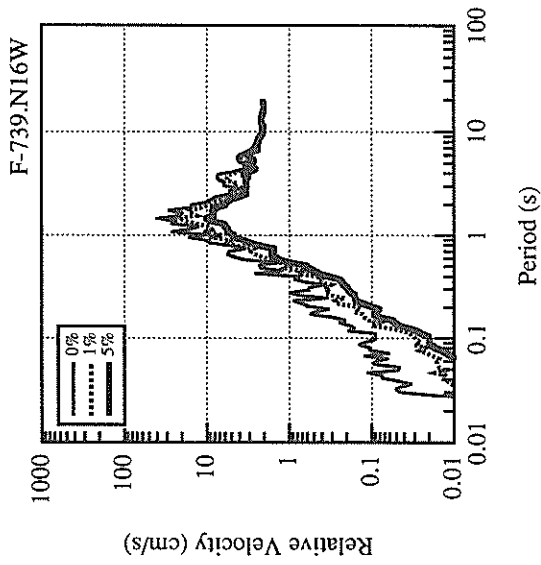
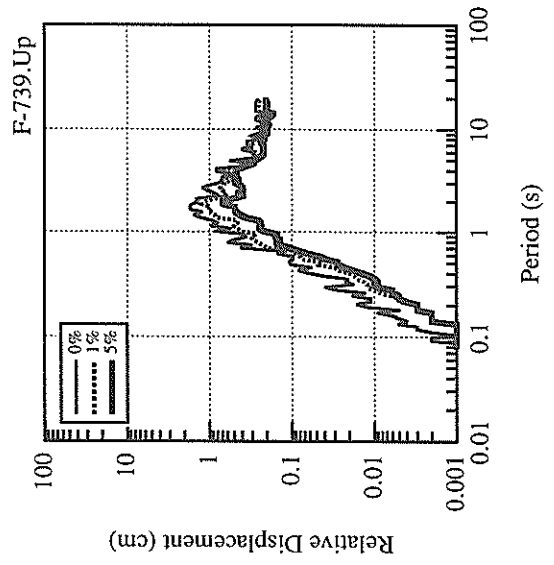
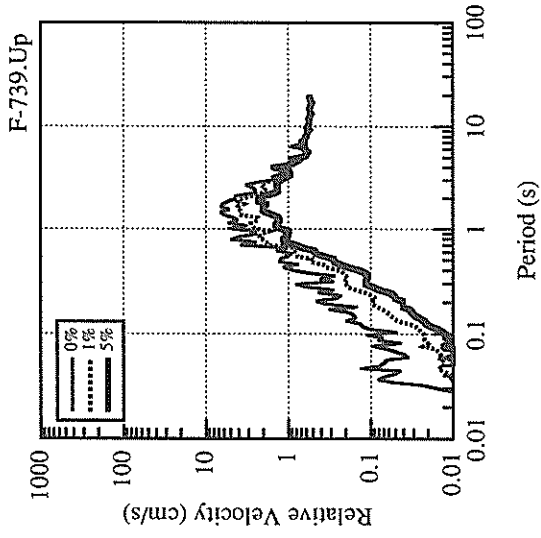


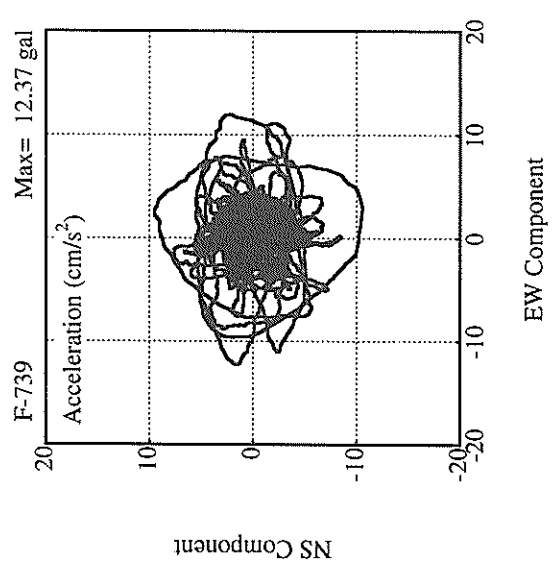
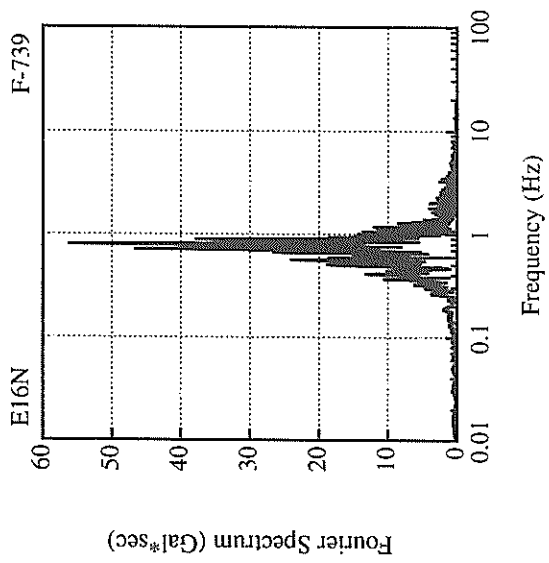
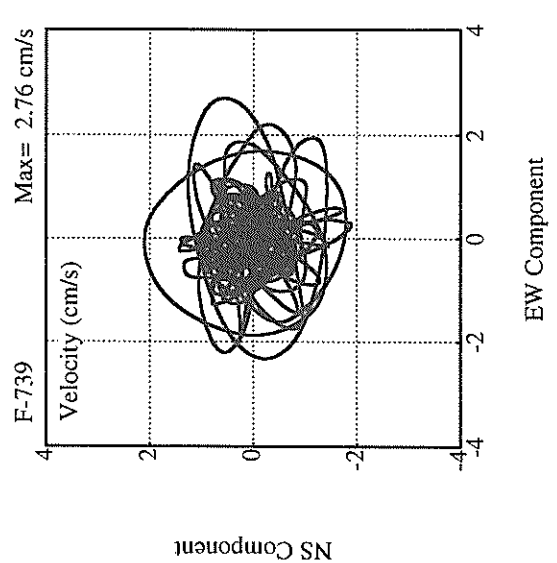
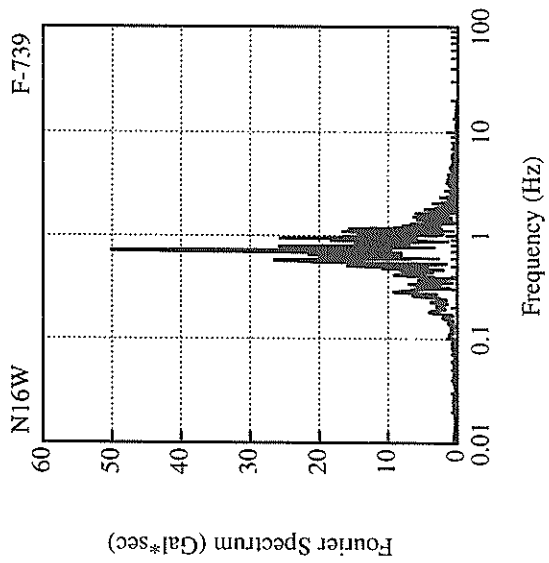
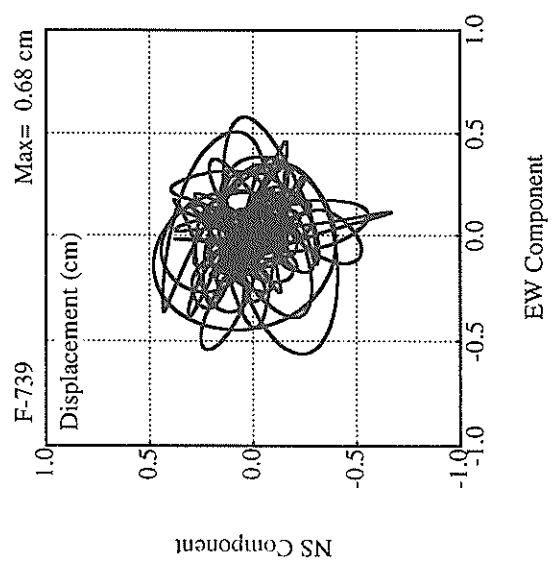
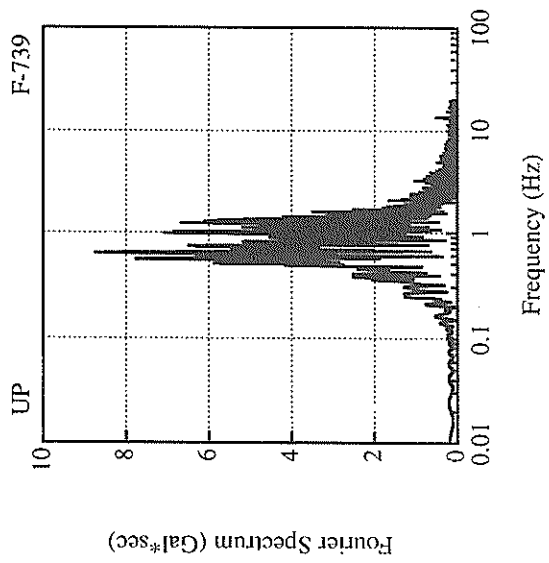












RECORD NUMBER : M-1537  
 STATION : KAMAISHI-M

EARTHQUAKE DATA

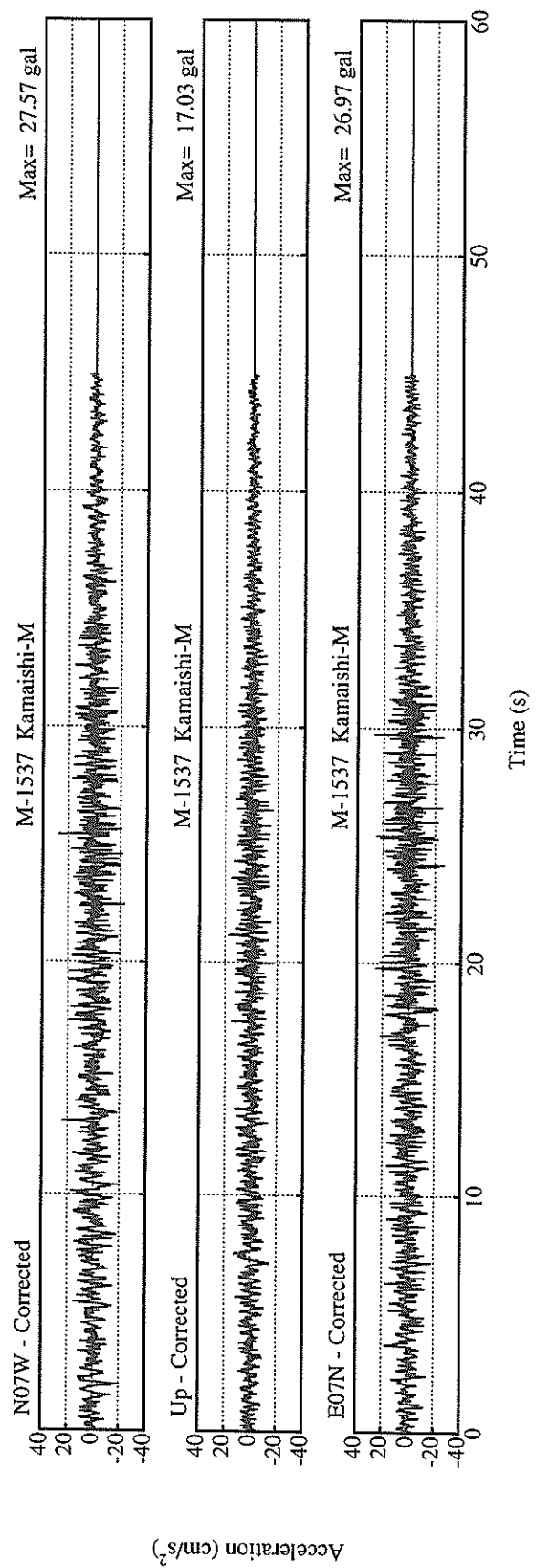
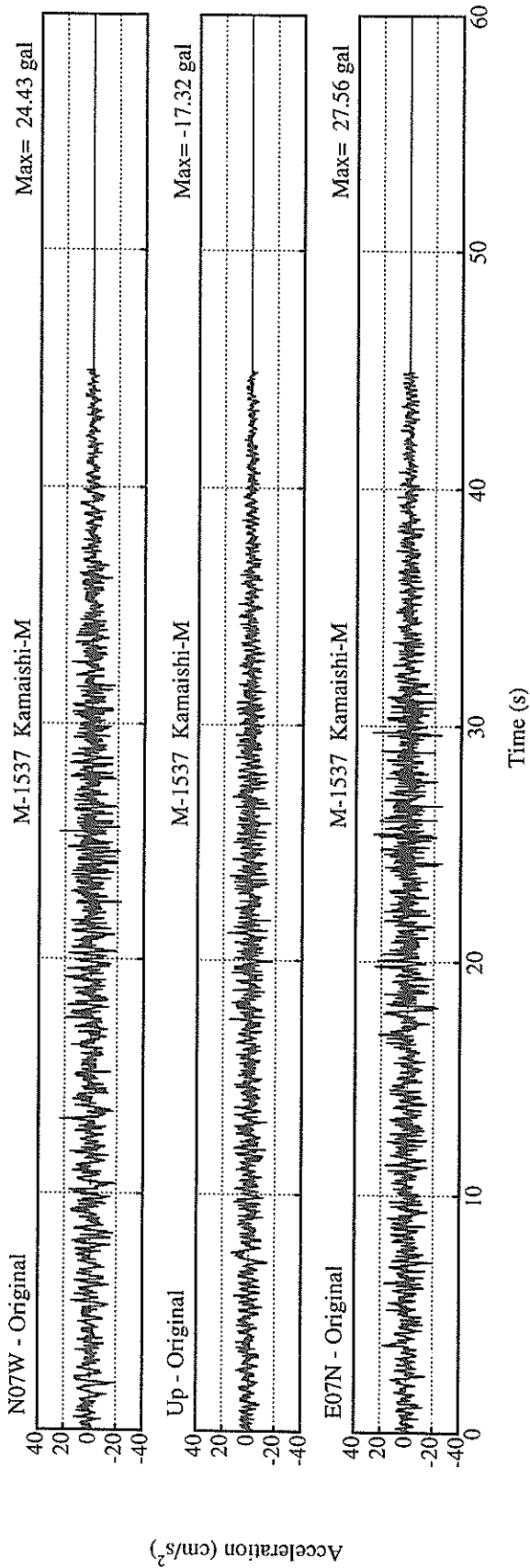
```
*****
DATE AND TIME                21:19 DEC.28,1994
LOCATION OF HYPOCENTER
  EPICENTRAL REGION          FAR E OFF SANRIKU
  LATITUDE                   40°25.6' N
  LONGITUDE                  143°44.9' E
  DEPTH                      0.0KM
JMA MAGNITUDE                7.5
*****
```

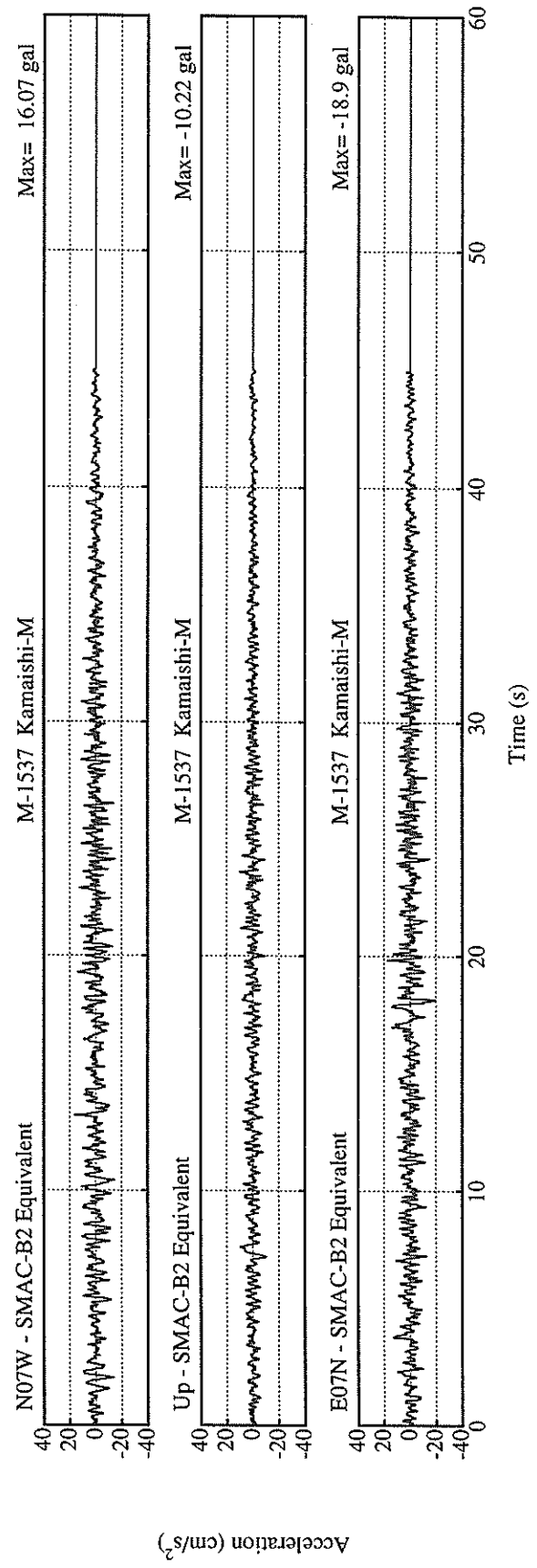
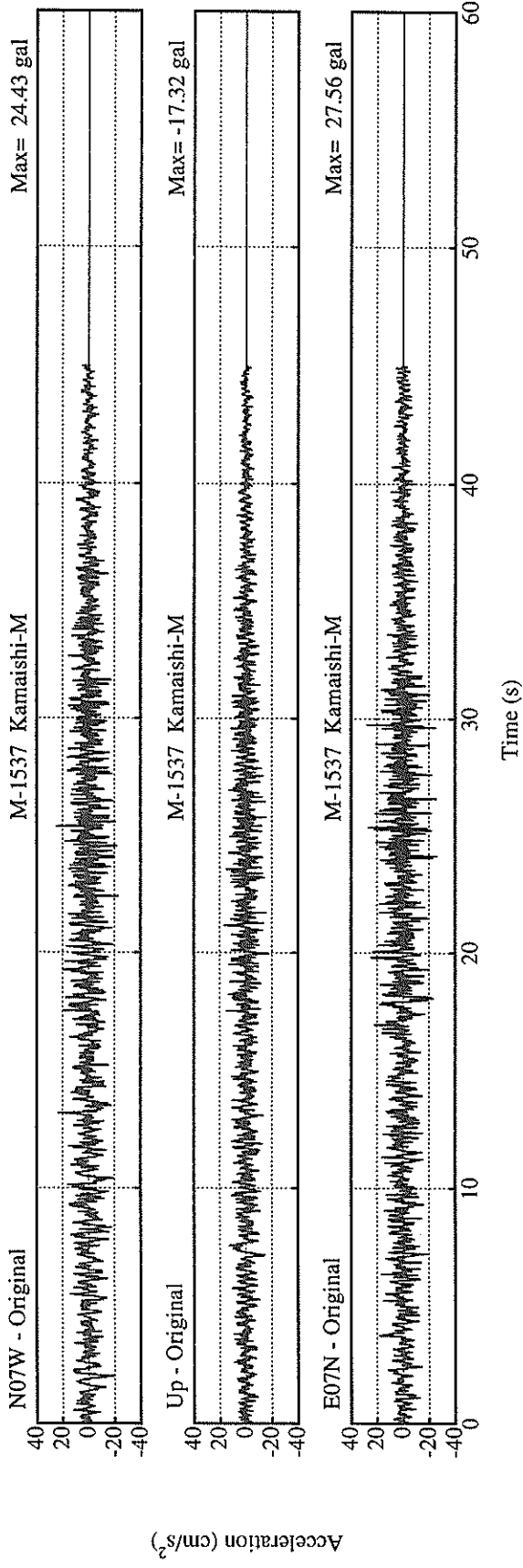
PEAK VALUES OF COMPONENTS

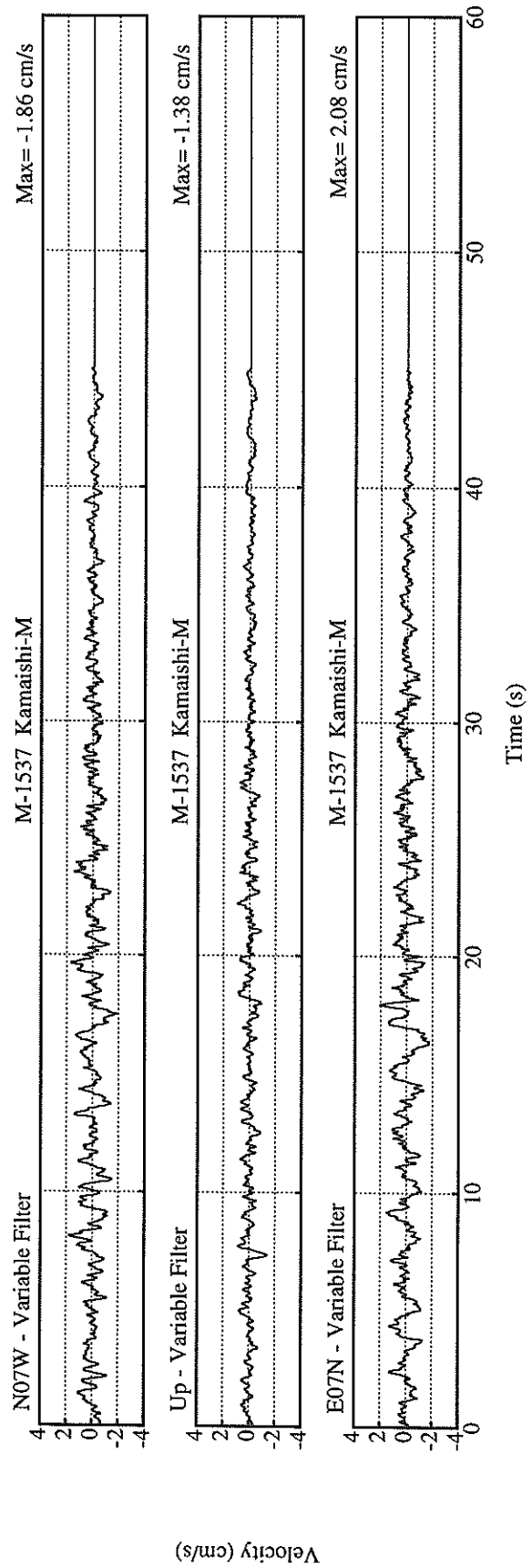
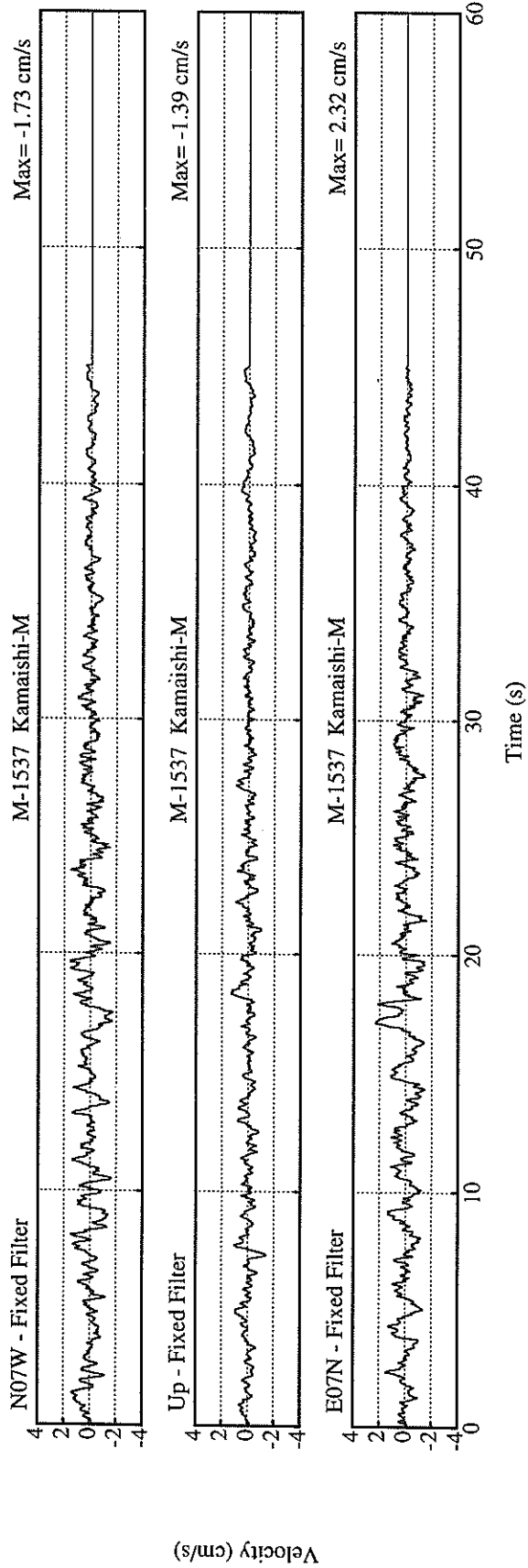
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.156	0.156	0.205	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	16.1	18.9	10.2	20.5
ORIGINAL	24.4	27.6	17.3	30.3
CORRECTED	27.6	27.0	17.0	32.6
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	1.73	2.32	1.39	2.86
VARIABLE FILTER	1.86	2.08	1.38	2.09
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.64	0.80	0.38	0.88
VARIABLE FILTER	0.57	0.74	0.33	0.93

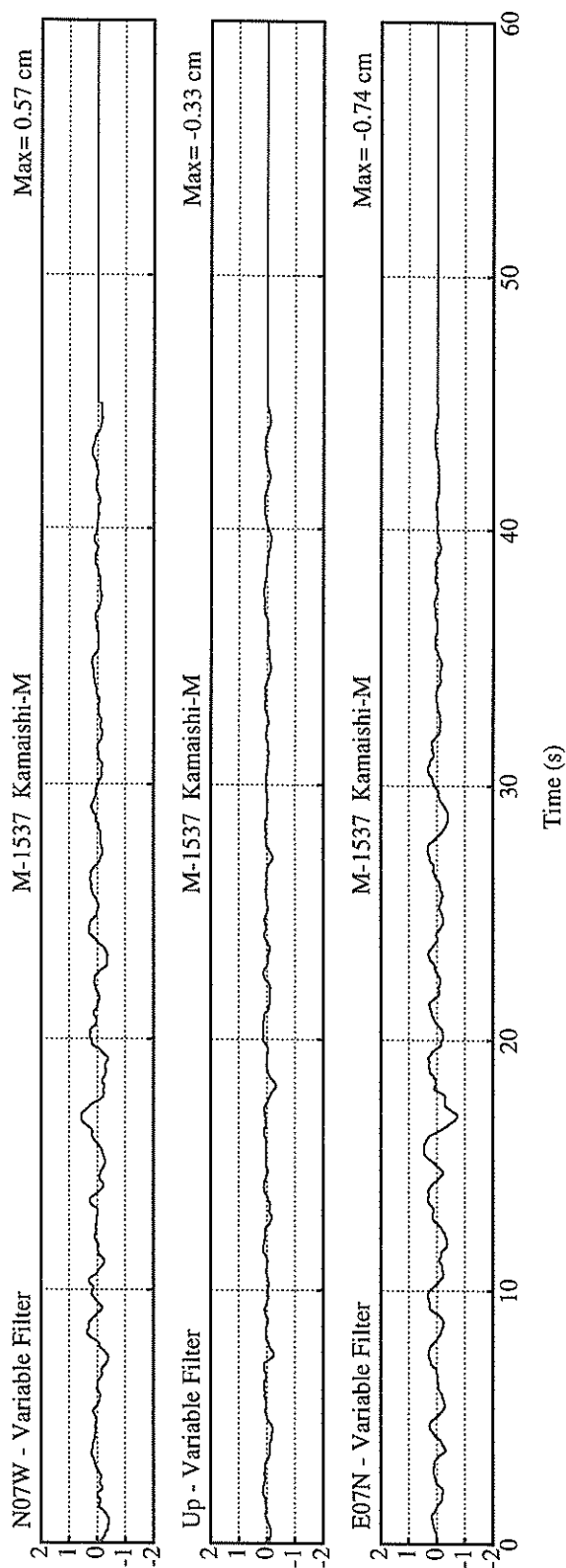
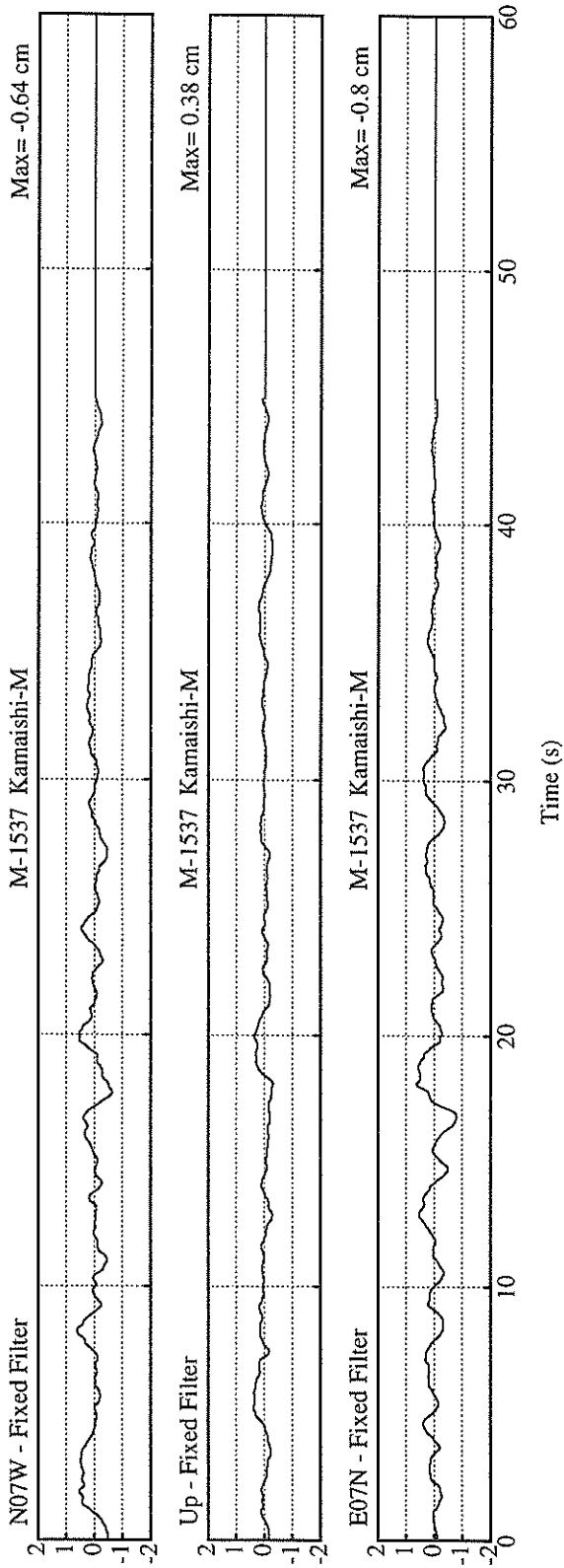
\* RESULTANT OF HORIZONTAL COMPONENTS





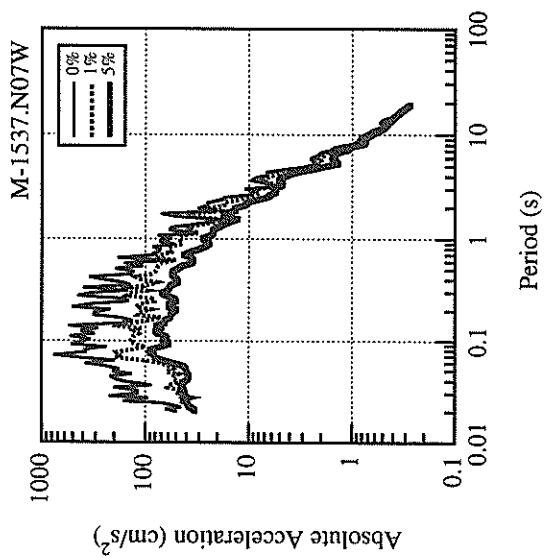
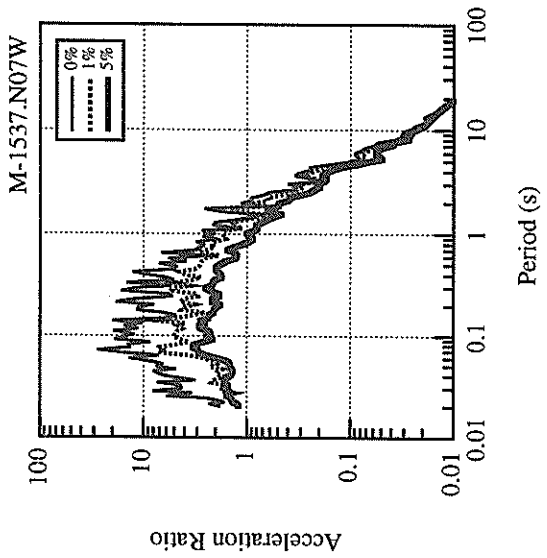
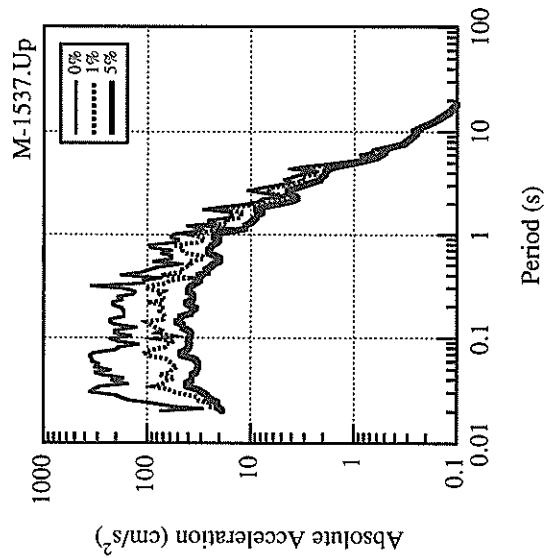
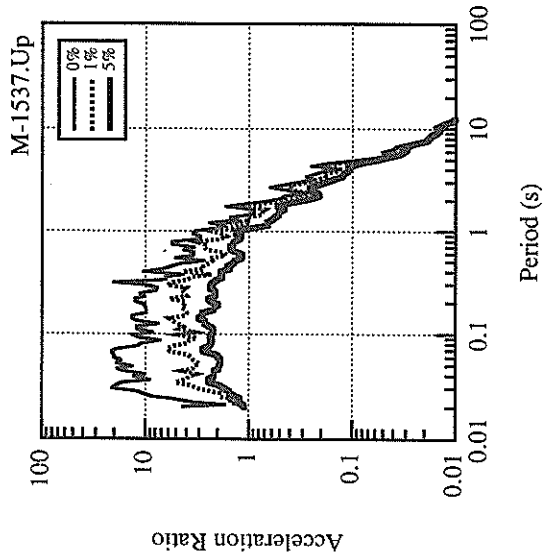
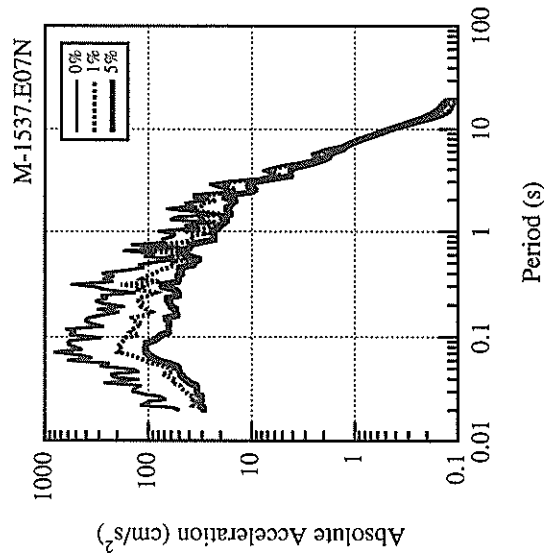
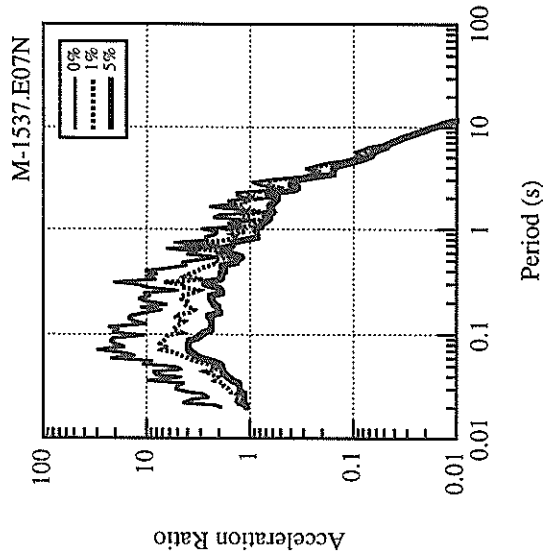


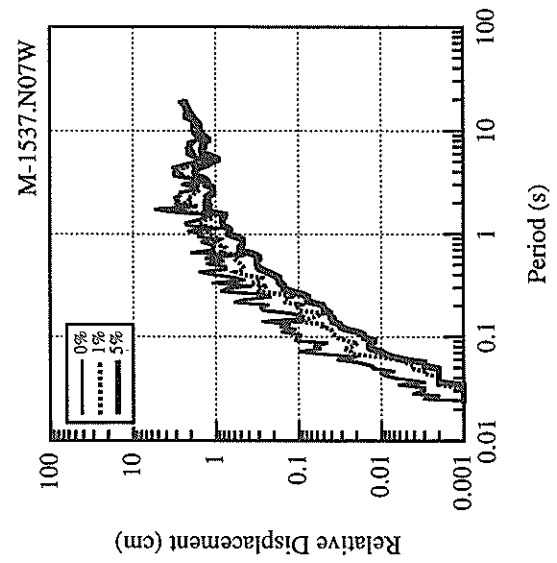
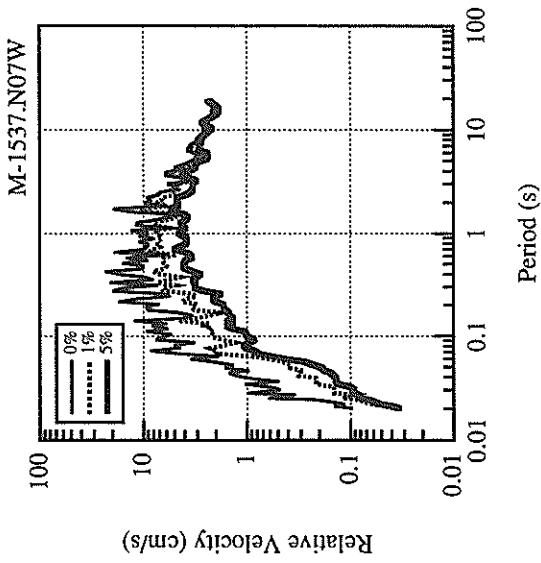
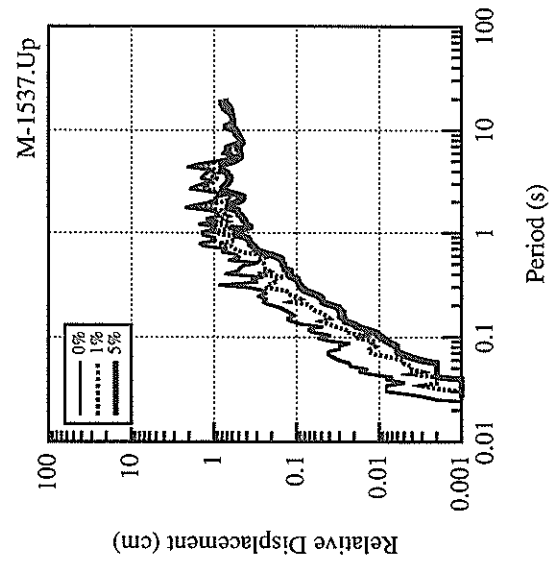
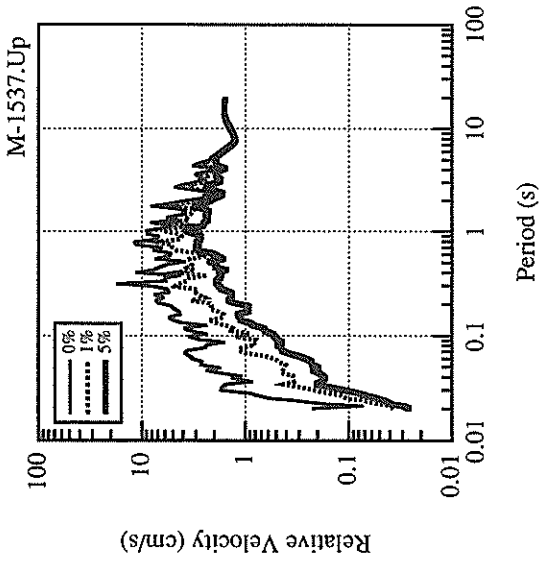
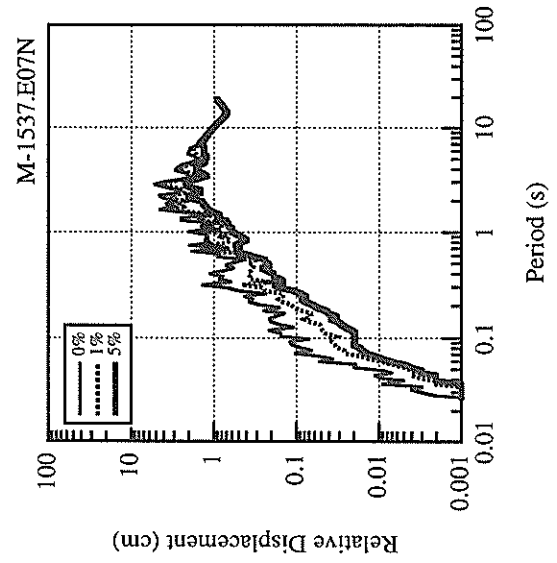
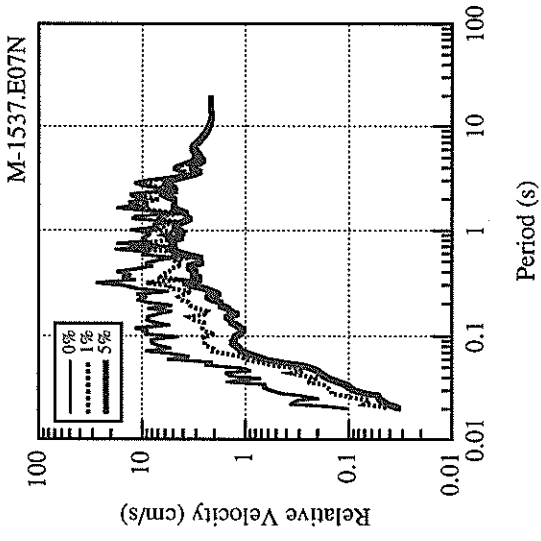


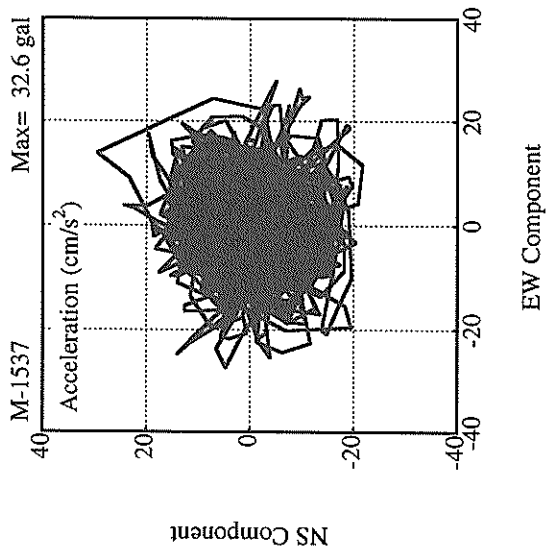
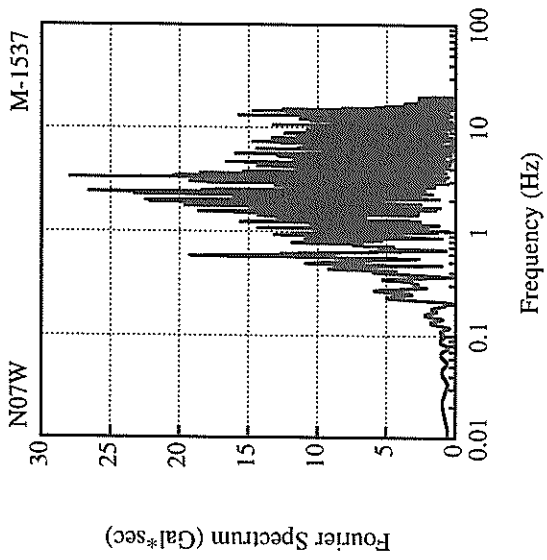
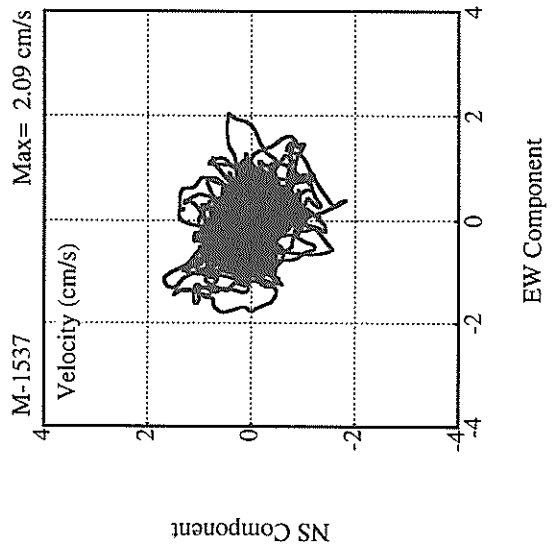
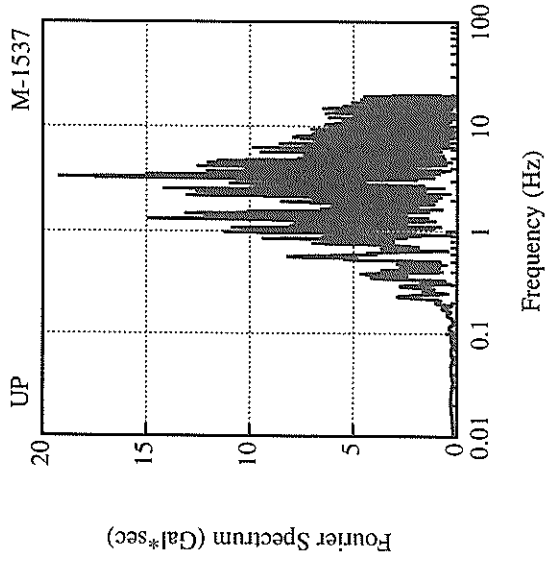
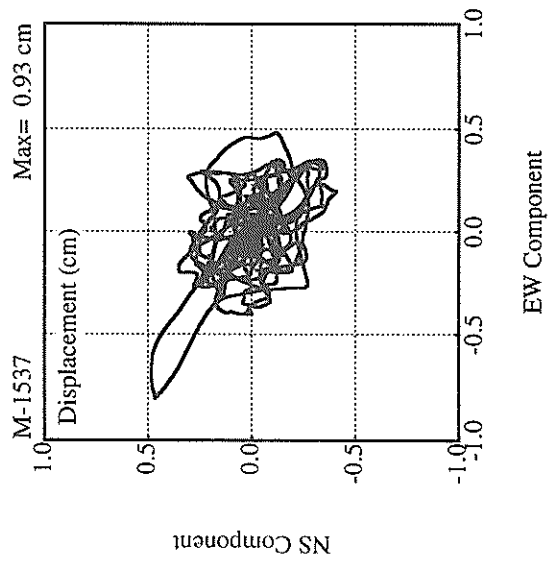
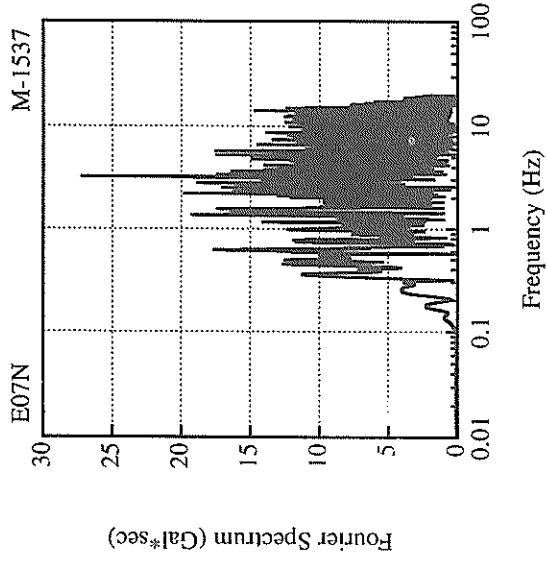


Displacement (cm)

Displacement (cm)







RECORD NUMBER : M-1536  
 STATION : SENDAI-M

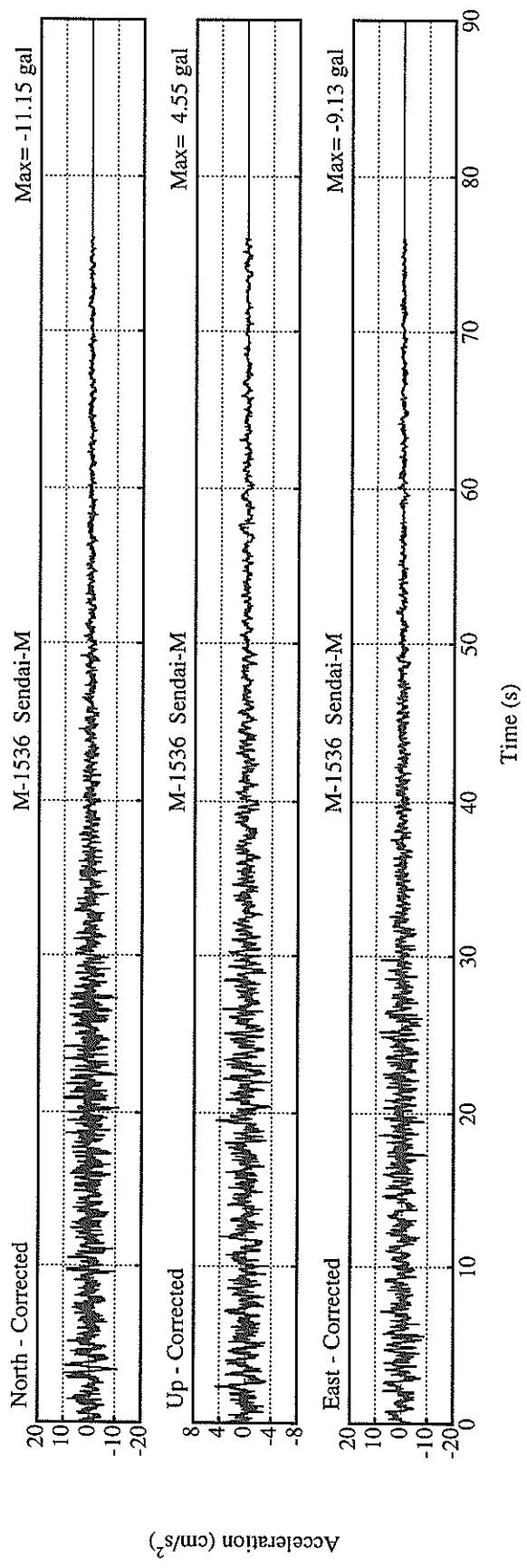
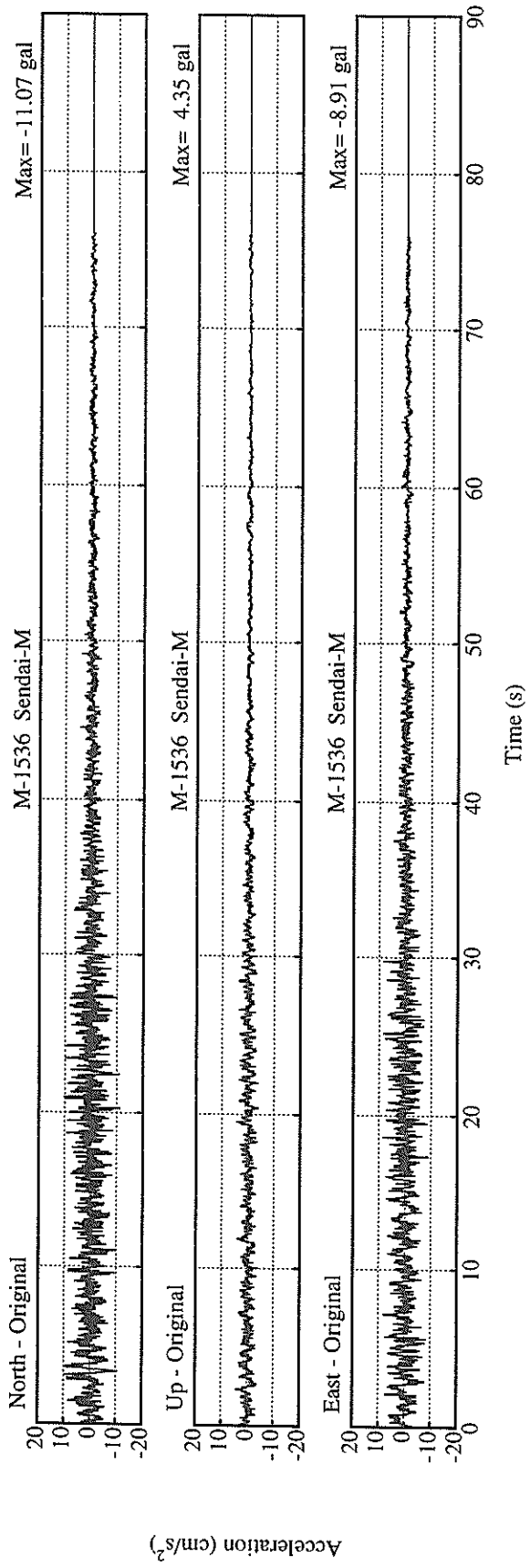
EARTHQUAKE DATA  
 \*\*\*\*\*  
 DATE AND TIME 21:19 DEC.28,1994  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION FAR E OFF SANRIKU  
 LATITUDE 40°25.6' N  
 LONGITUDE 143°44.9' E  
 DEPTH 0.0KM  
 JMA MAGNITUDE 7.5  
 \*\*\*\*\*

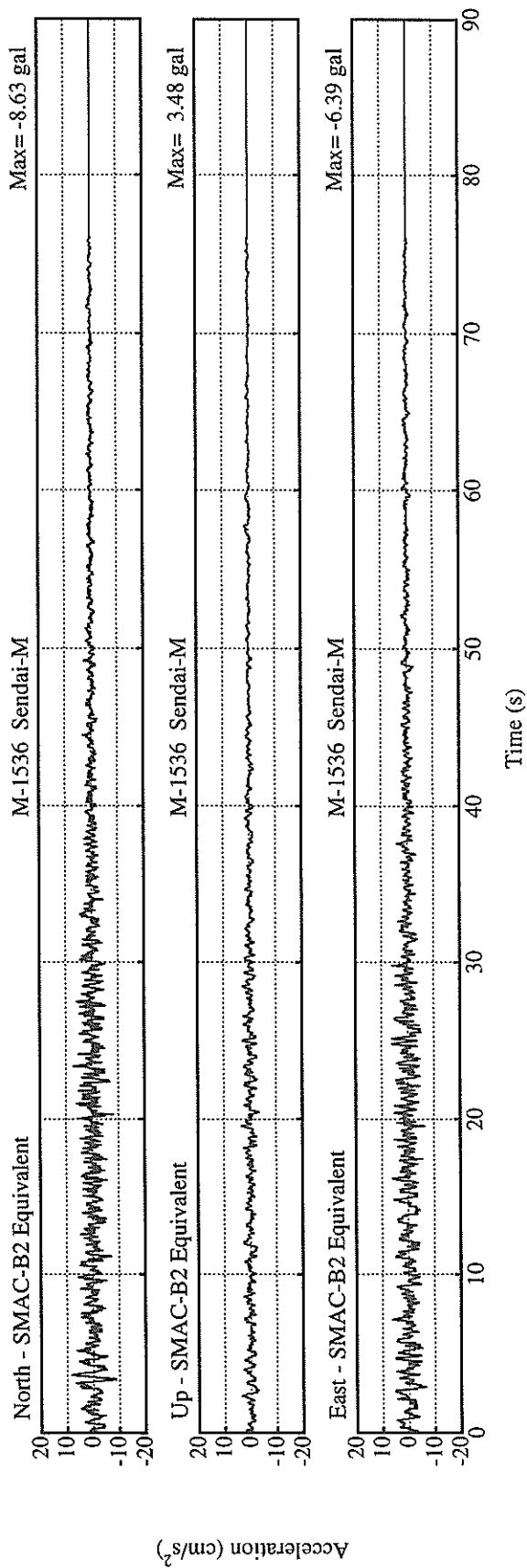
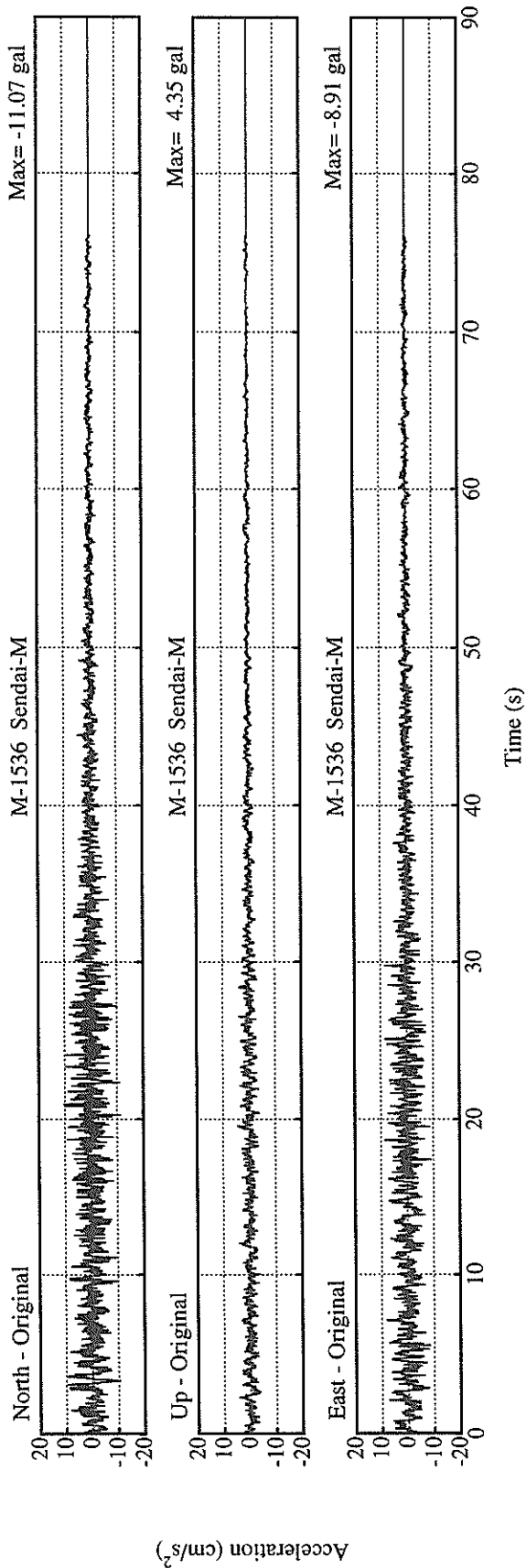
PEAK VALUES OF COMPONENTS

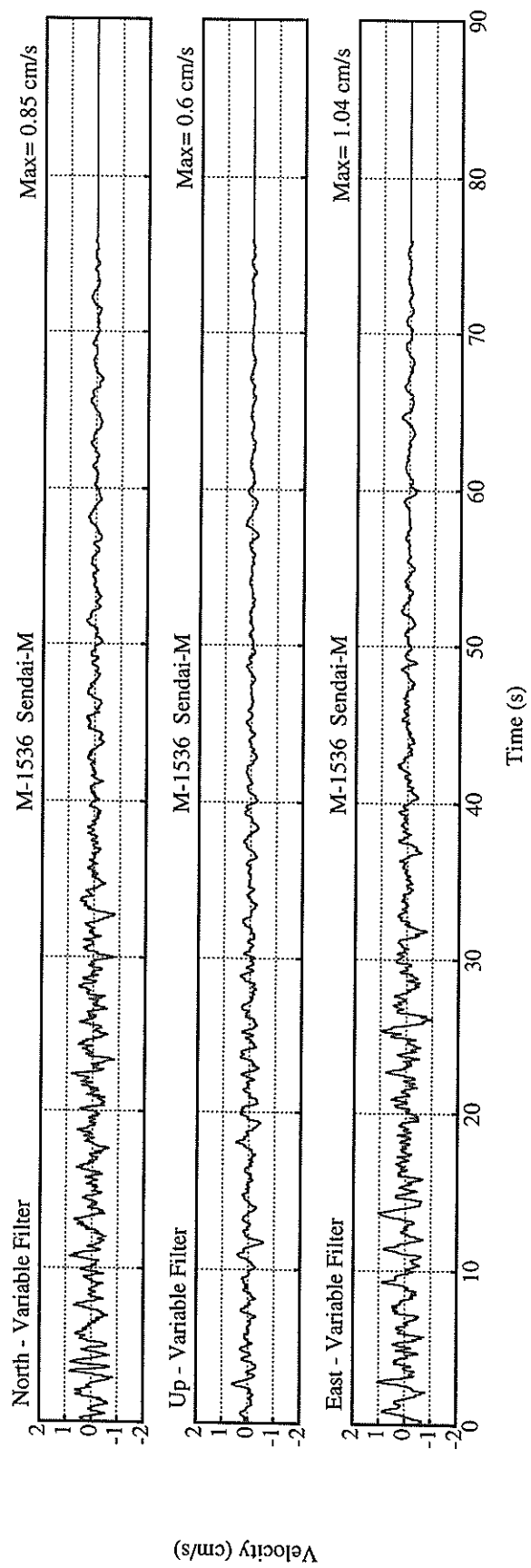
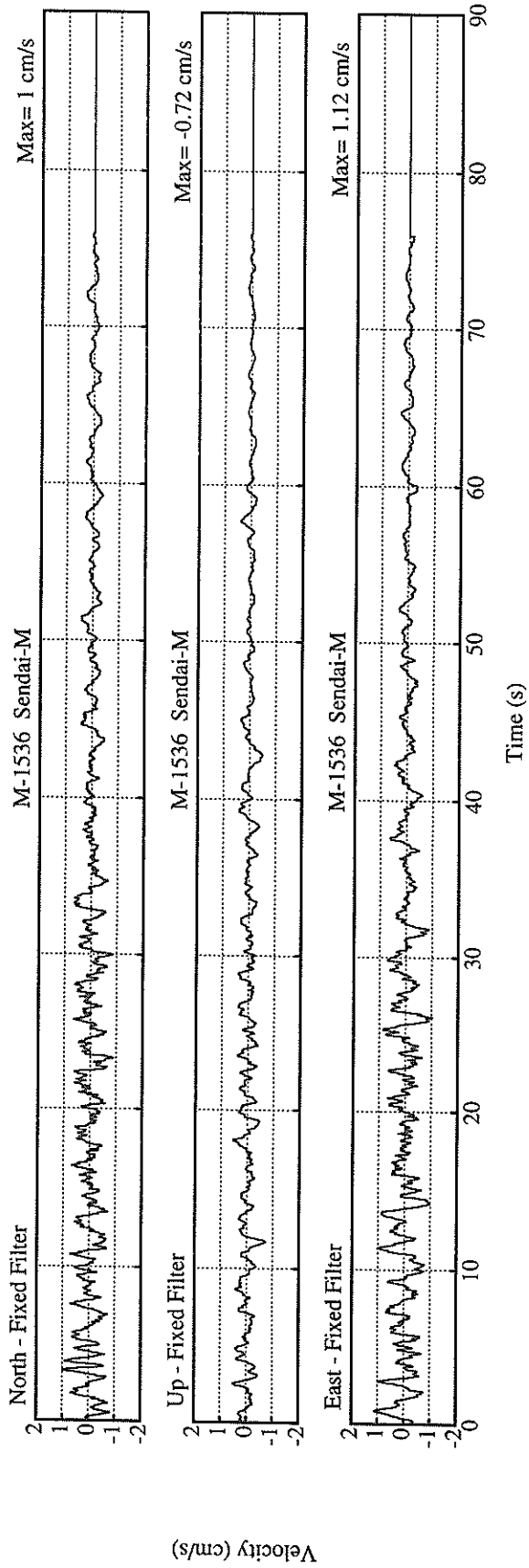
	N S	E W	U. D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.222	0.216	0.277	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	8.6	6.4	3.5	8.7
ORIGINAL	11.1	8.9	4.4	11.9
CORRECTED	11.2	9.1	4.6	11.9
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	1.00	1.12	0.72	1.16
VARIABLE FILTER	0.85	1.04	0.60	1.25
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.38	0.50	0.26	0.63
VARIABLE FILTER	0.23	0.27	0.12	0.28

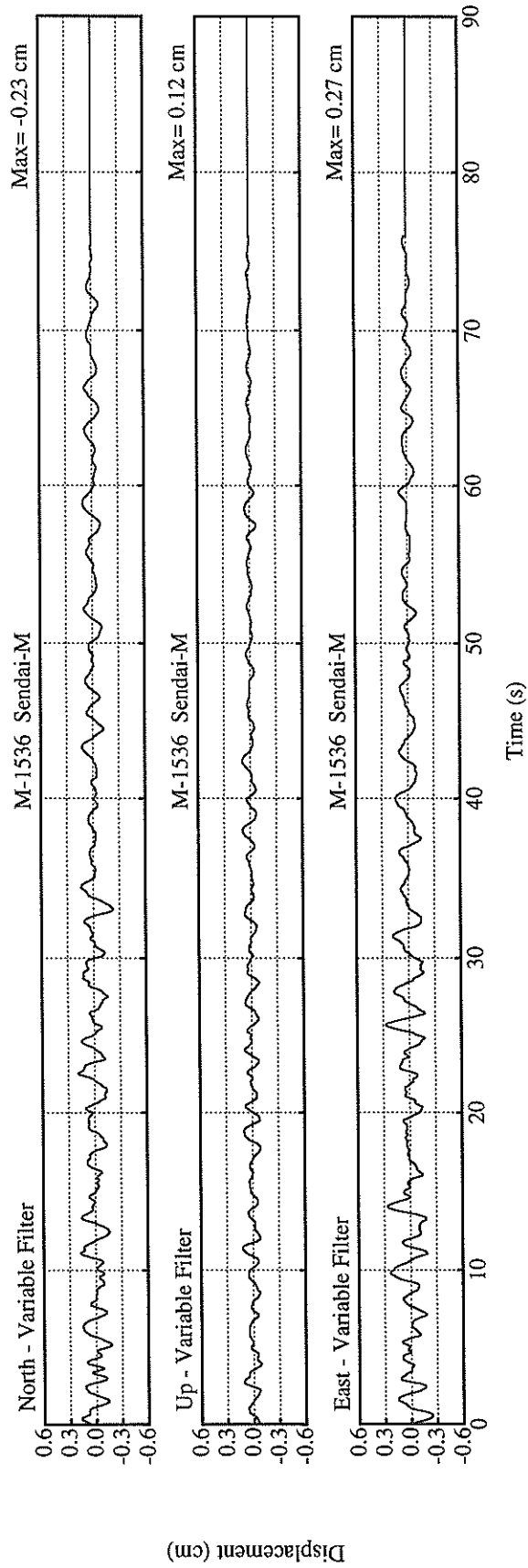
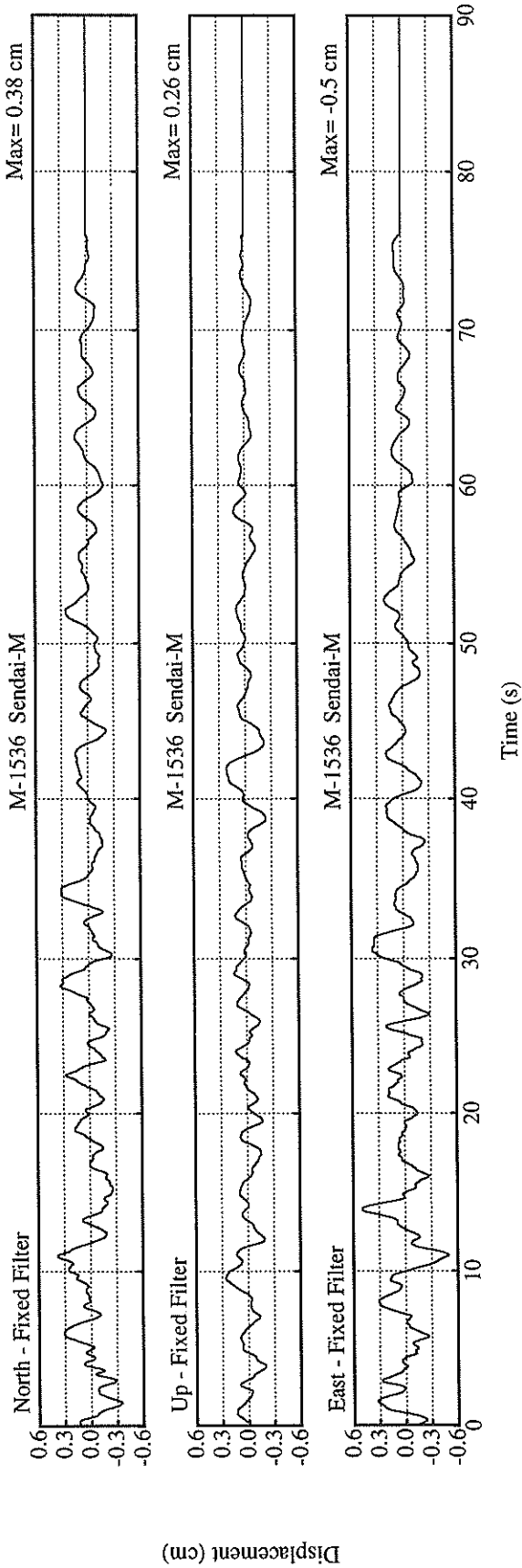
\* RESULTANT OF HORIZONTAL COMPONENTS

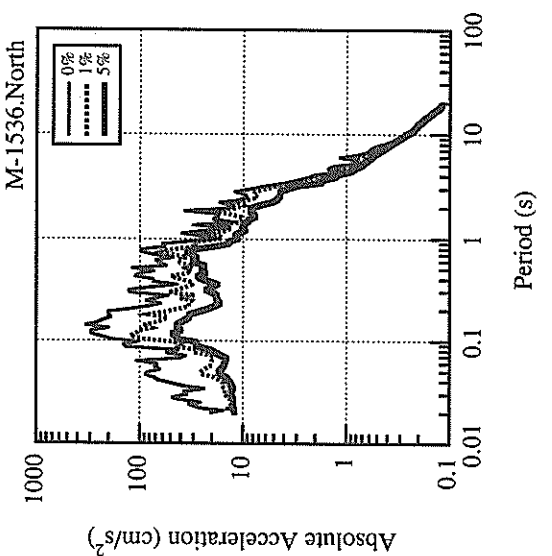
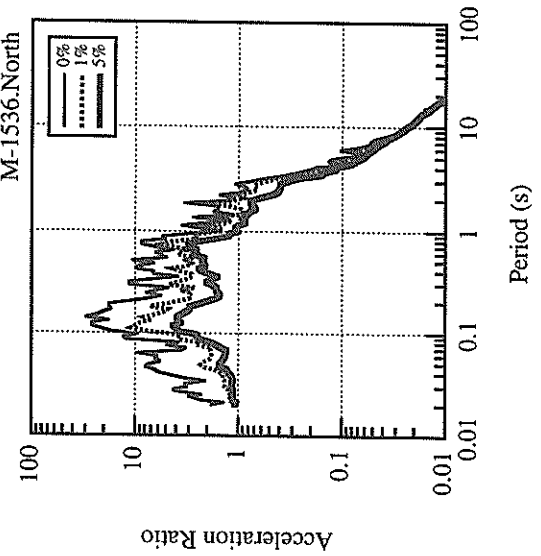
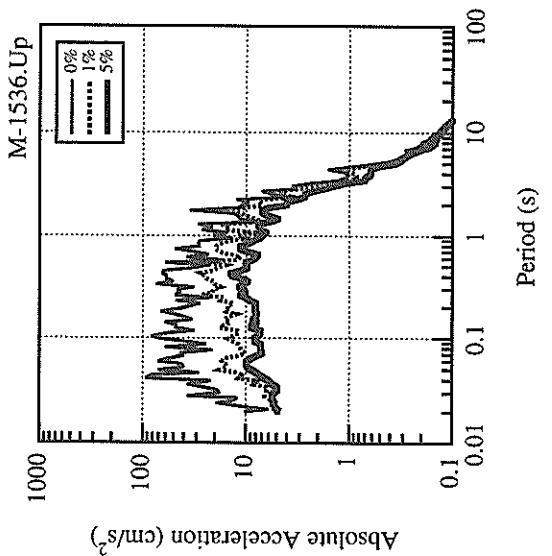
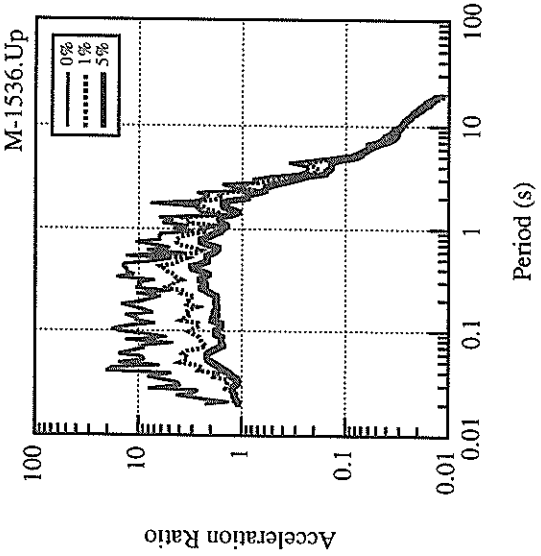
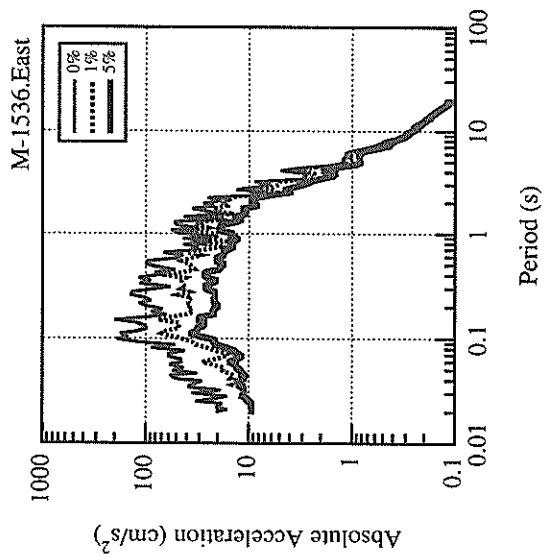
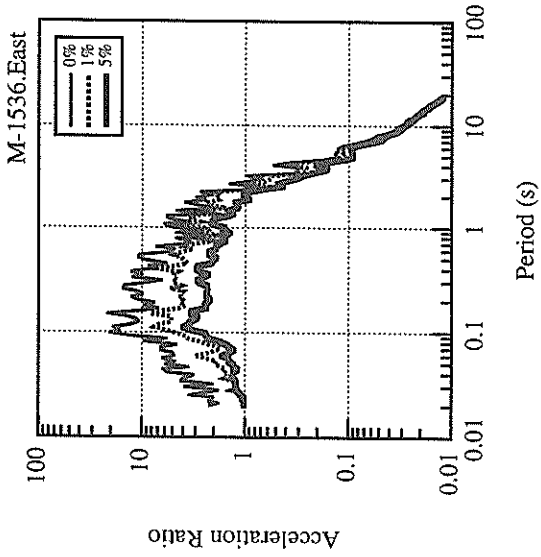


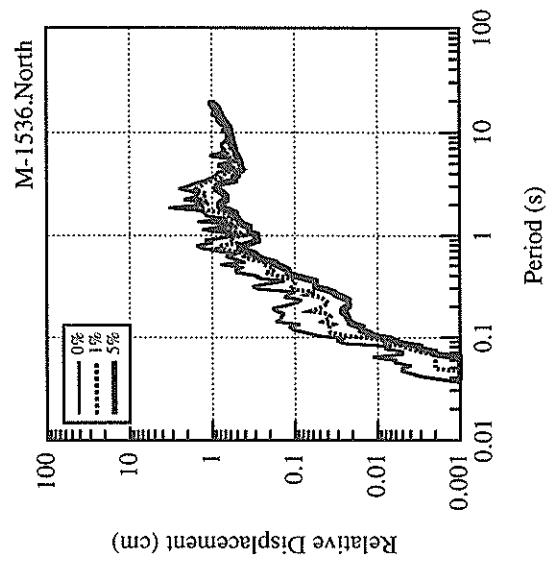
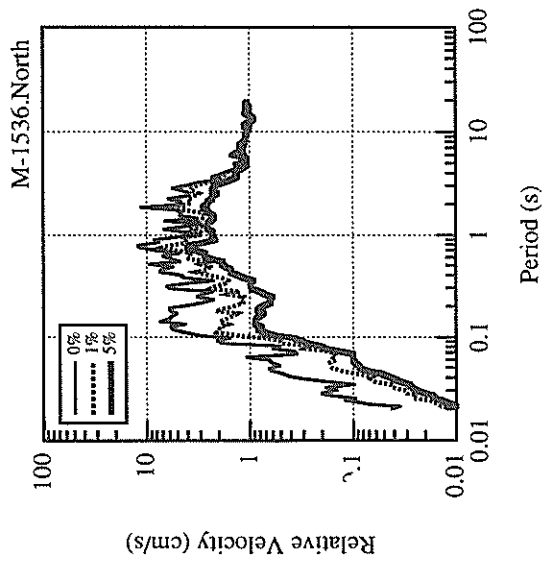
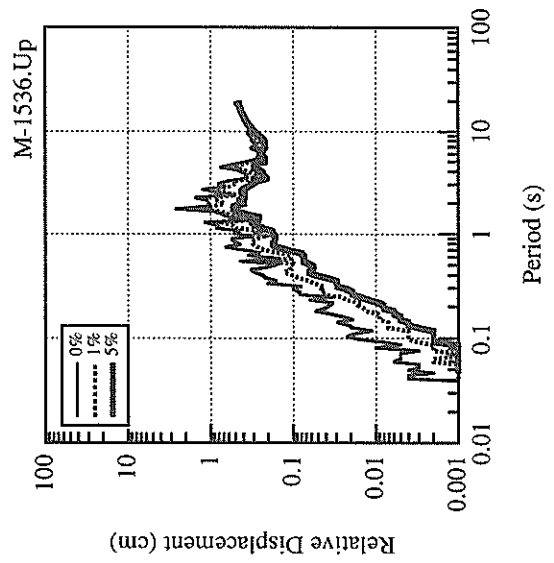
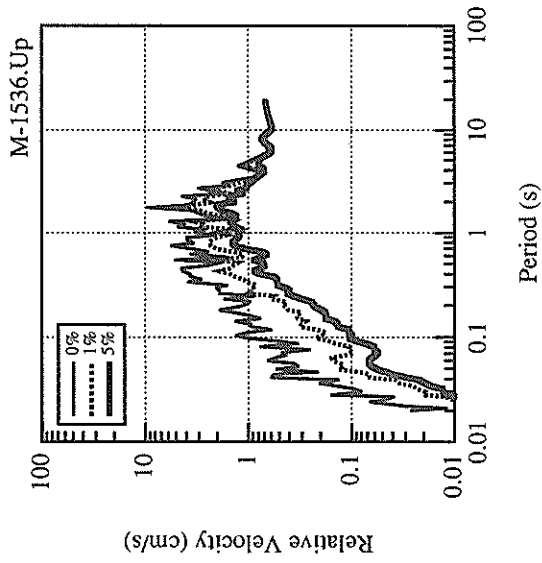
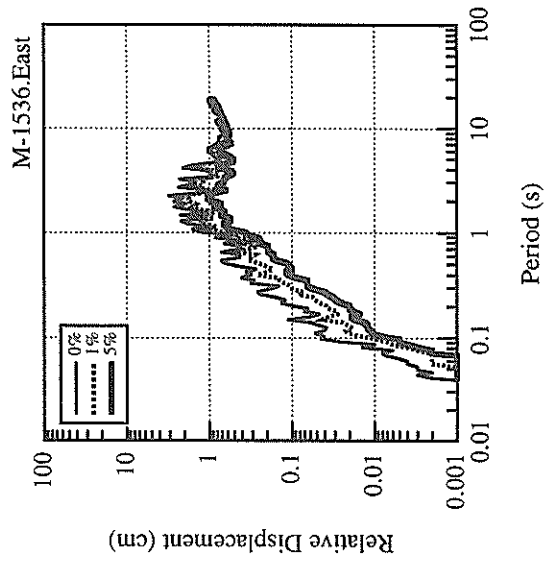
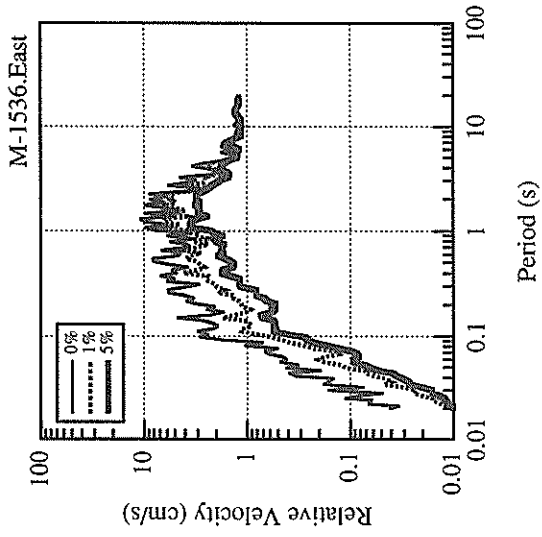


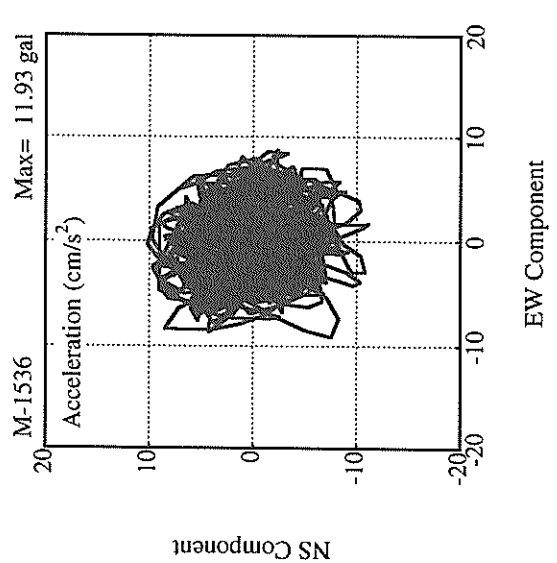
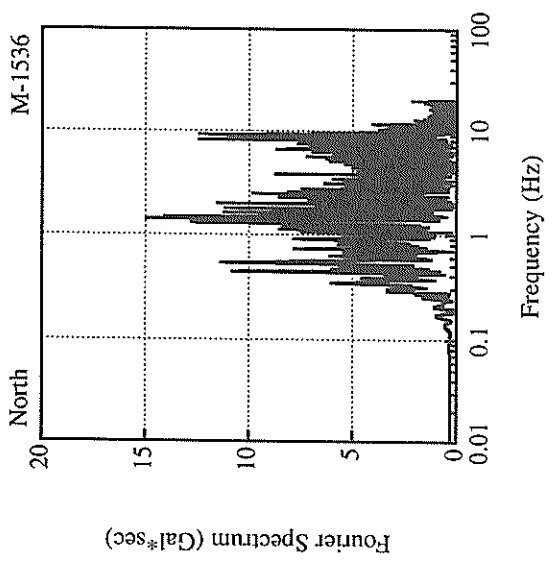
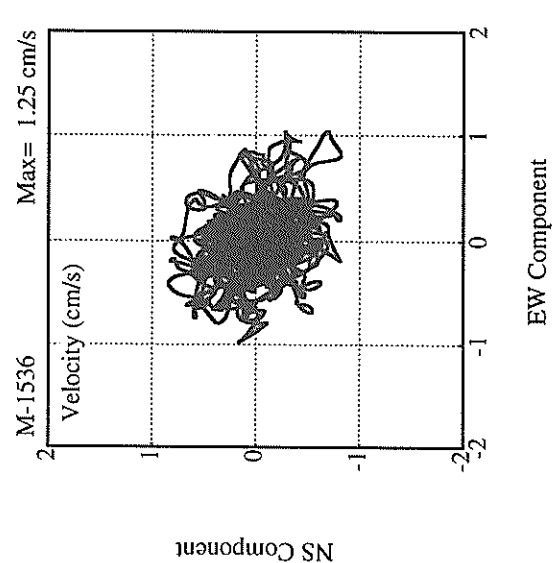
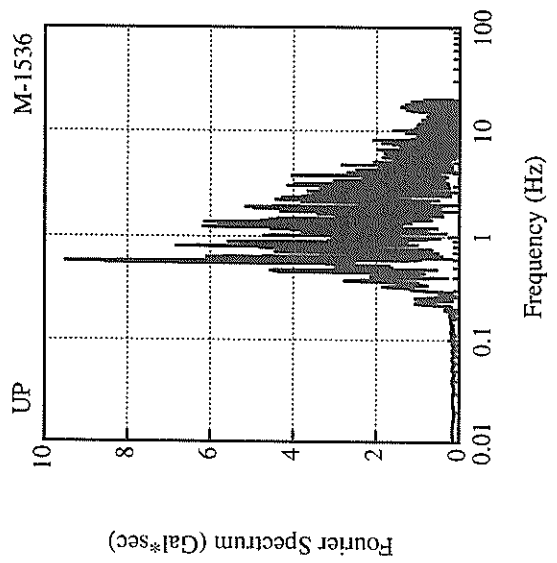
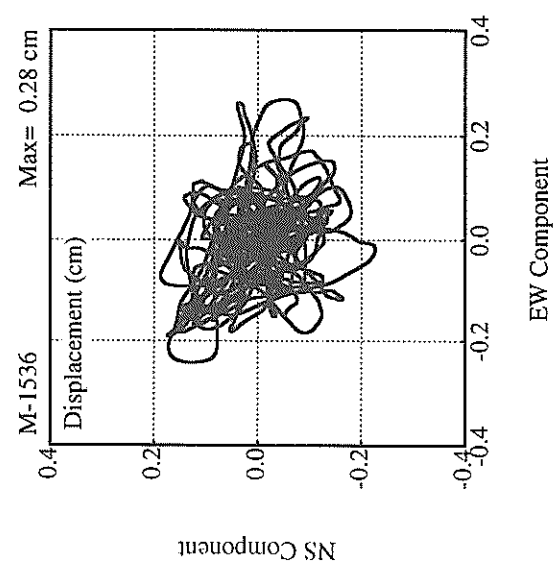
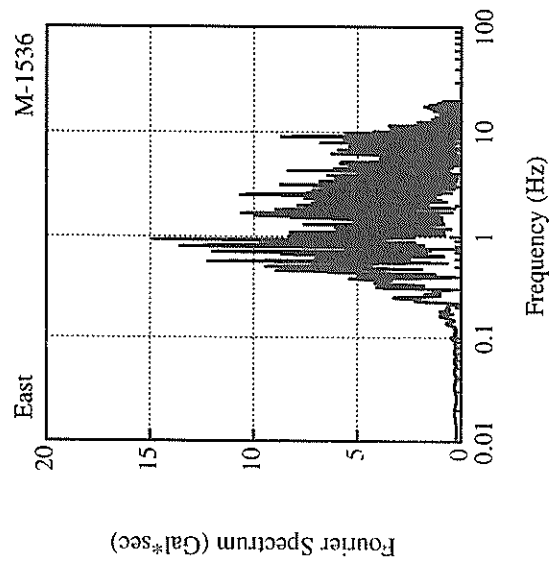












RECORD NUMBER : M-1547  
 STATION : SENDAI-MB

EARTHQUAKE DATA

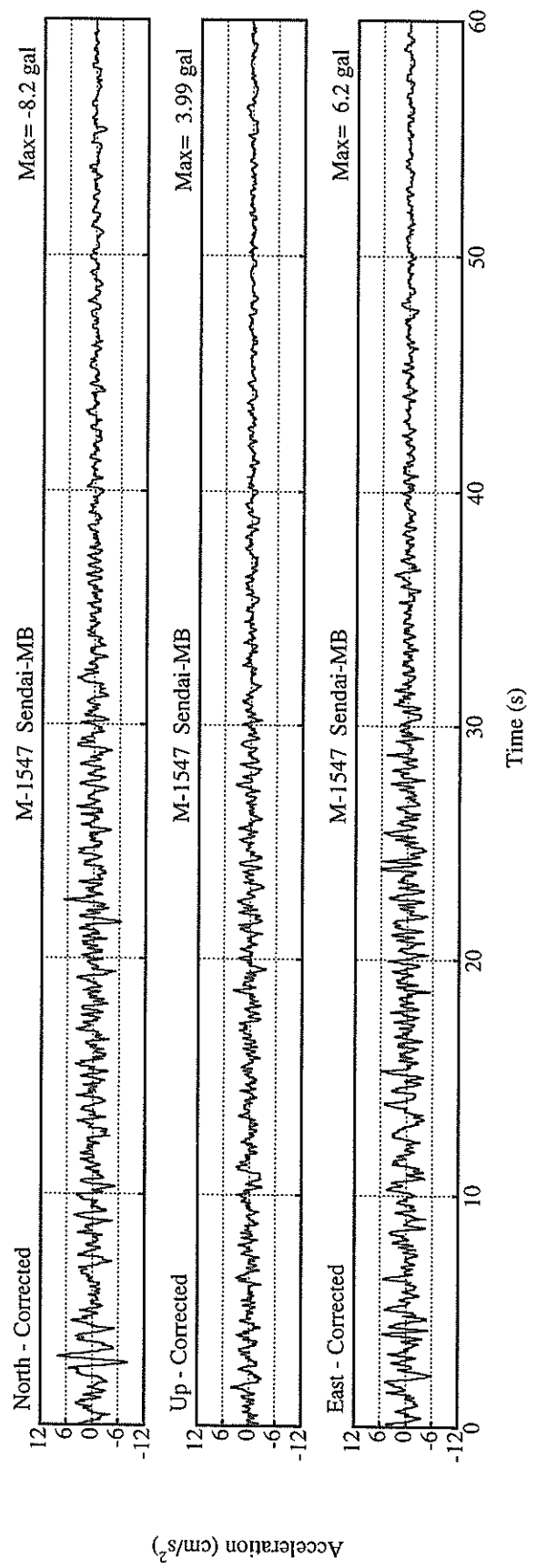
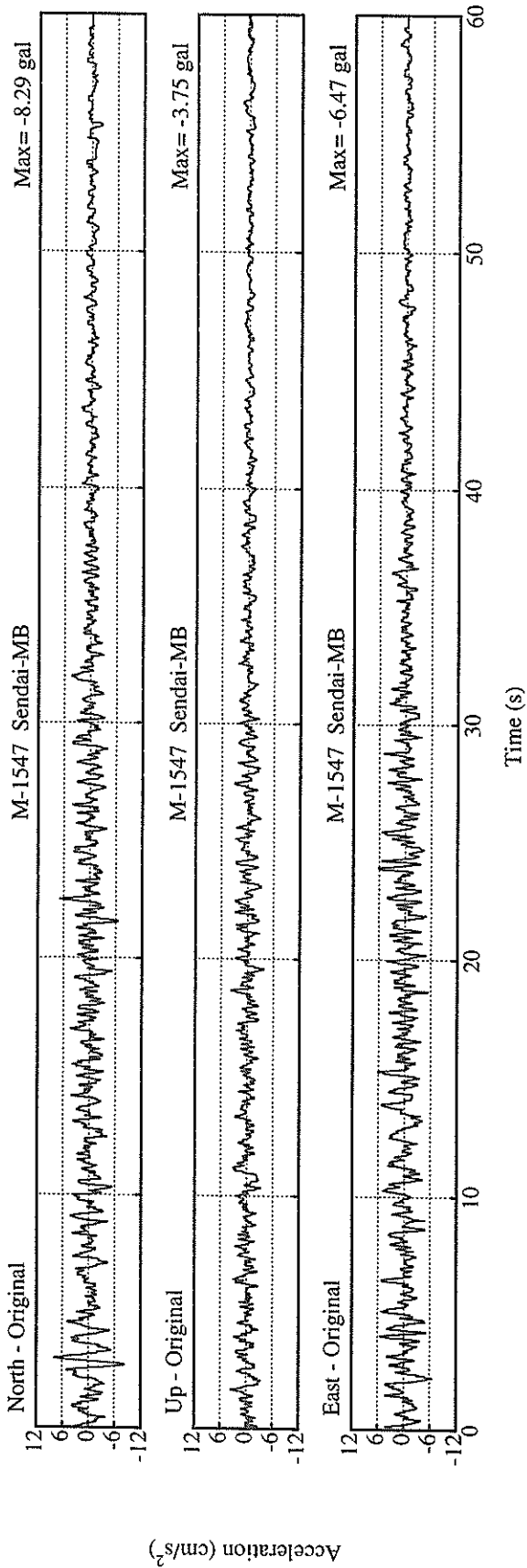
```
*****
DATE AND TIME                21:19 DEC.28,1994
LOCATION OF HYPOCENTER
  EPICENTRAL REGION          FAR E OFF SANRIKU
  LATITUDE                   40°25.6' N
  LONGITUDE                  143°44.9' E
  DEPTH                      0.0KM
  JMA MAGNITUDE              7.5
*****
```

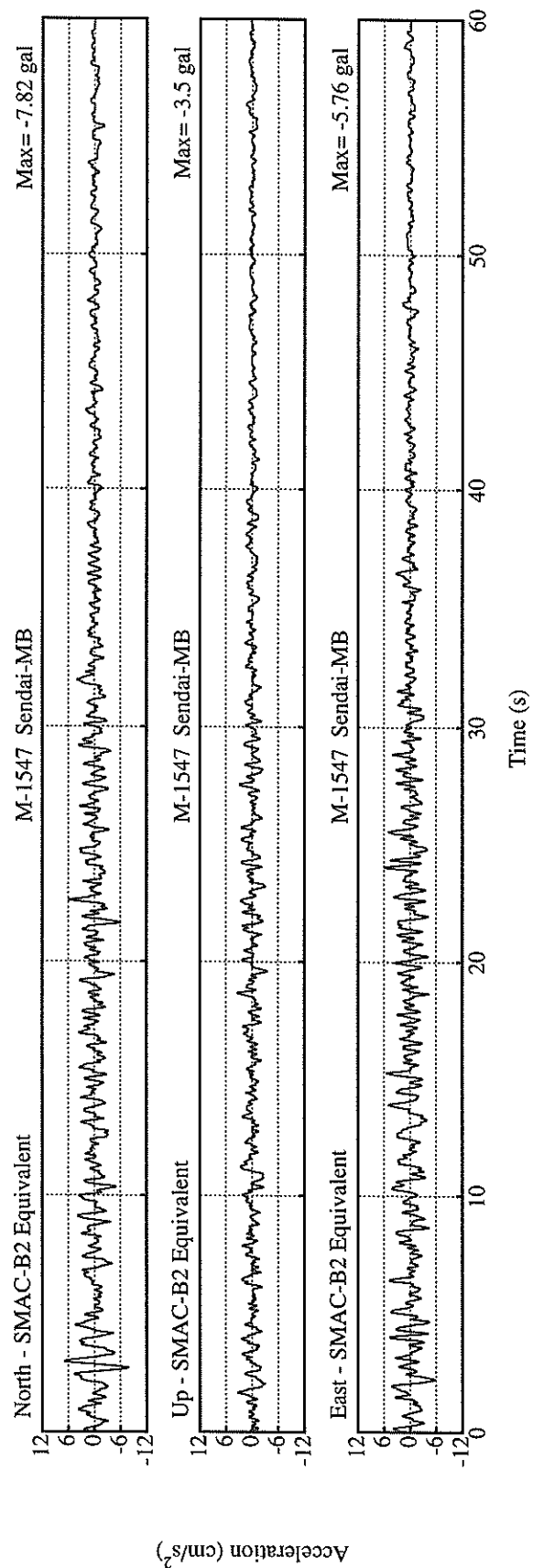
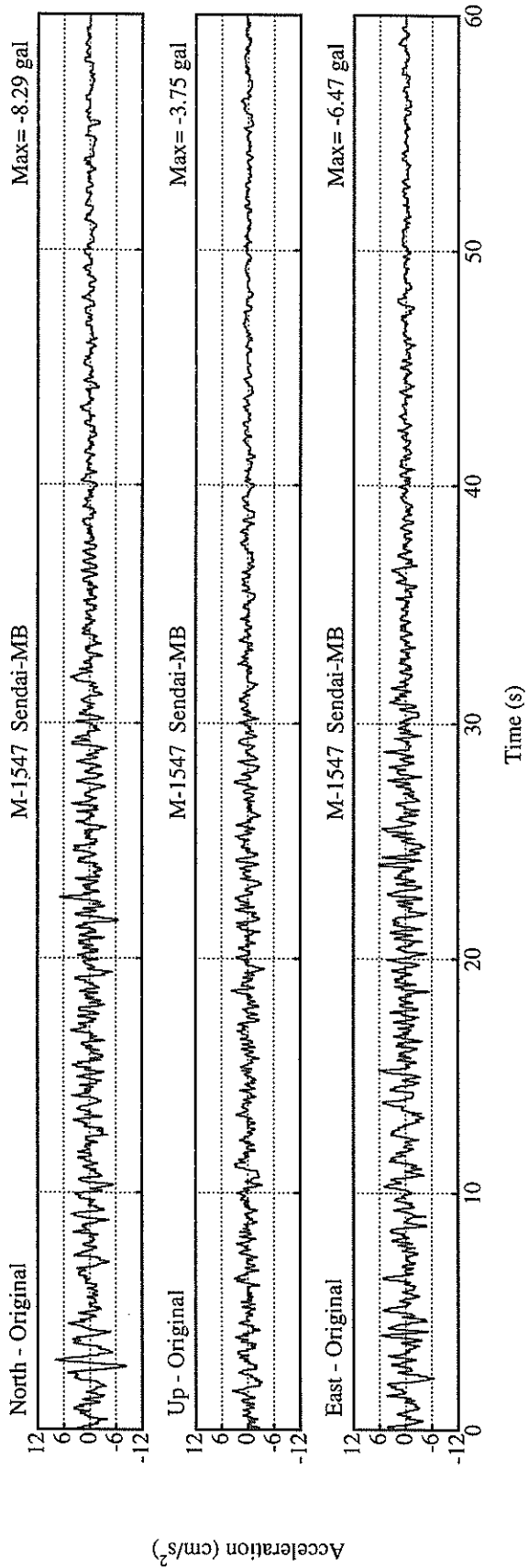
PEAK VALUES OF COMPONENTS

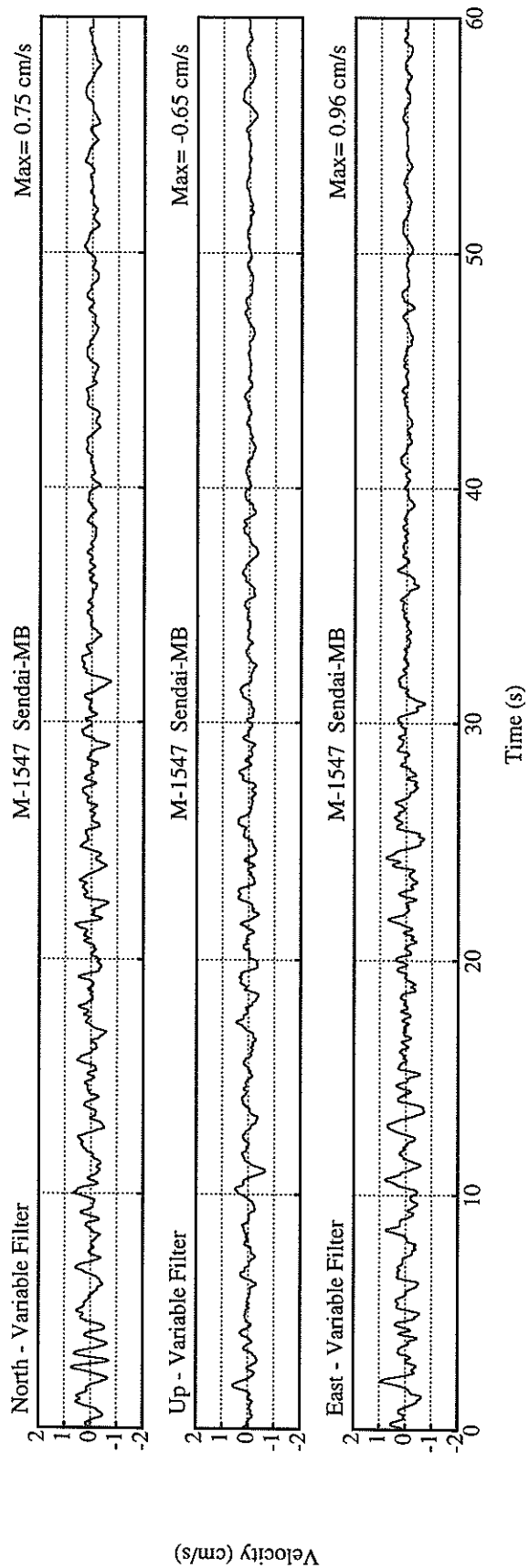
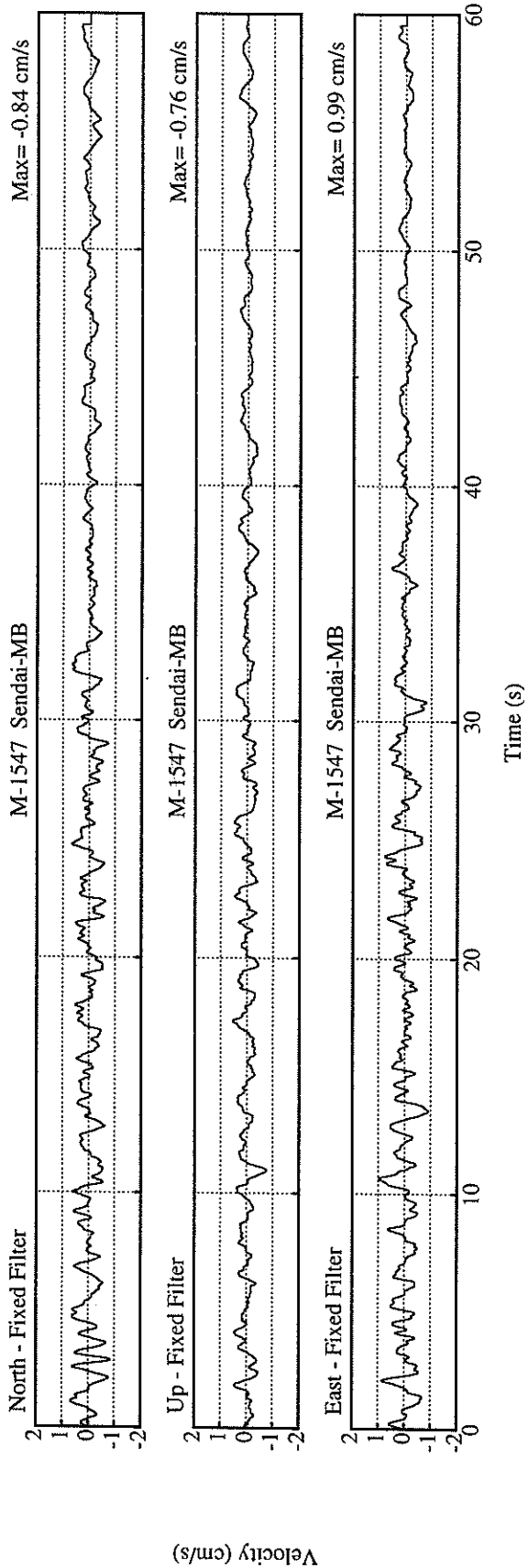
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.233	0.233	0.254	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	7.8	5.8	3.5	7.9
ORIGINAL	8.3	6.5	3.8	8.3
CORRECTED	8.2	6.2	4.0	8.2
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	0.84	0.99	0.76	1.13
VARIABLE FILTER	0.75	0.96	0.65	1.13
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.35	0.34	0.32	0.45
VARIABLE FILTER	0.21	0.21	0.15	0.24

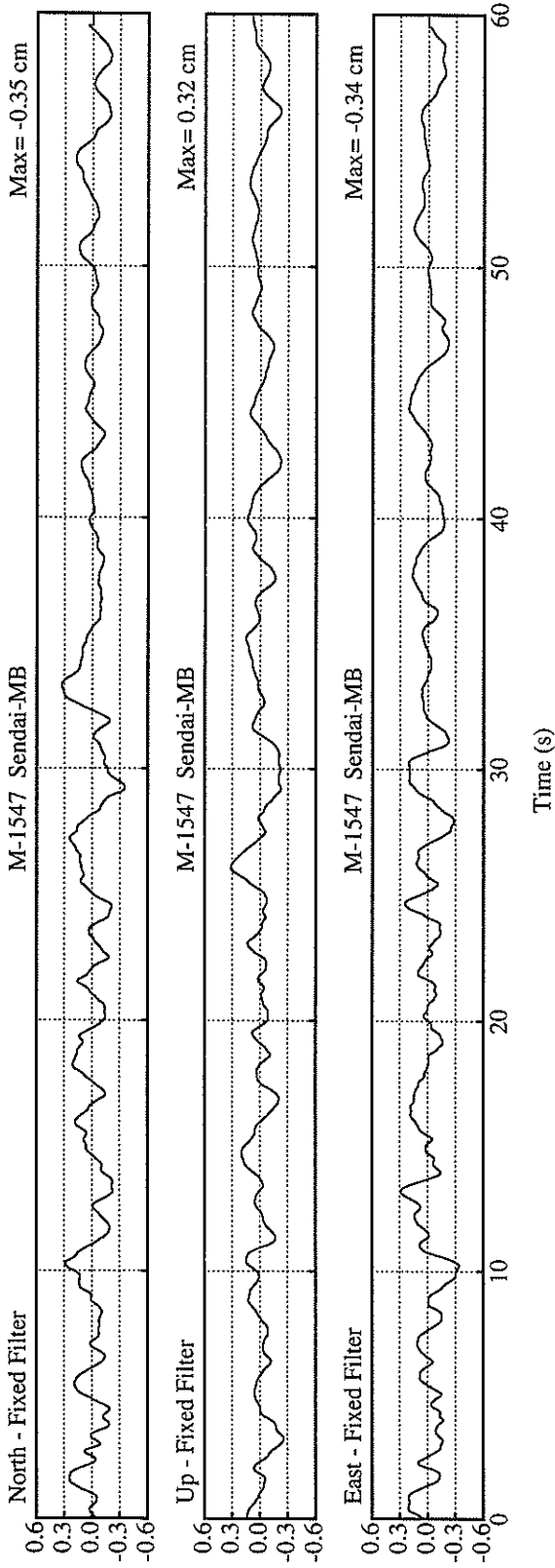
\* RESULTANT OF HORIZONTAL COMPONENTS



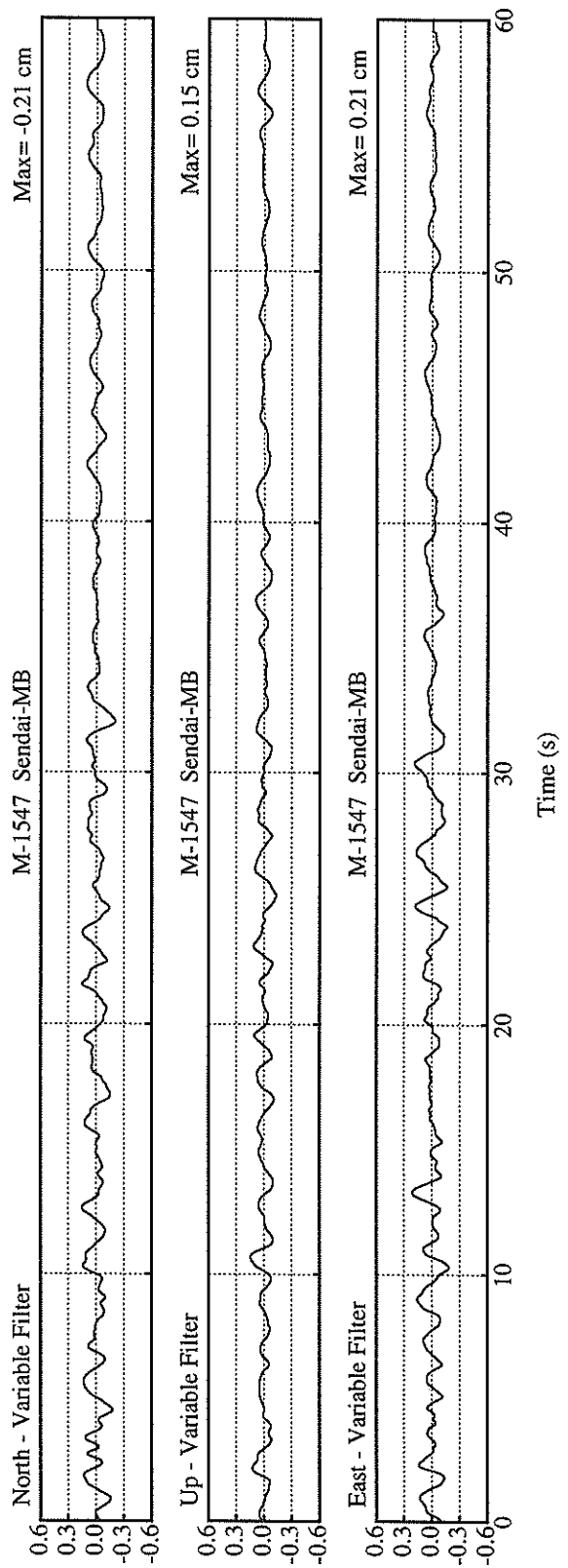




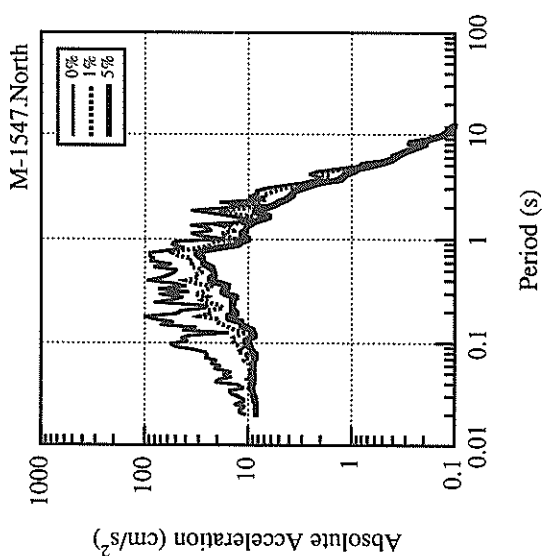
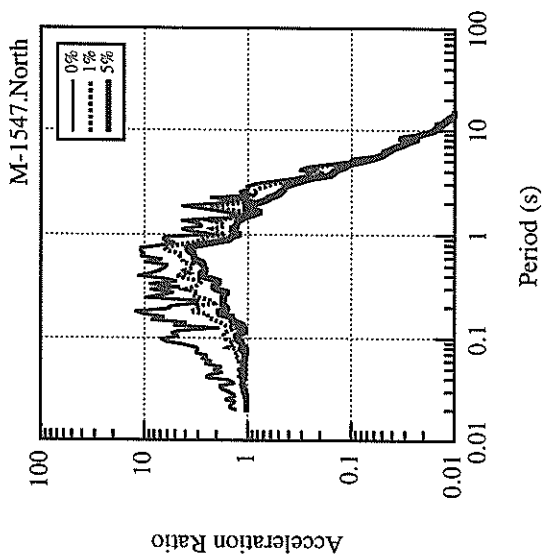
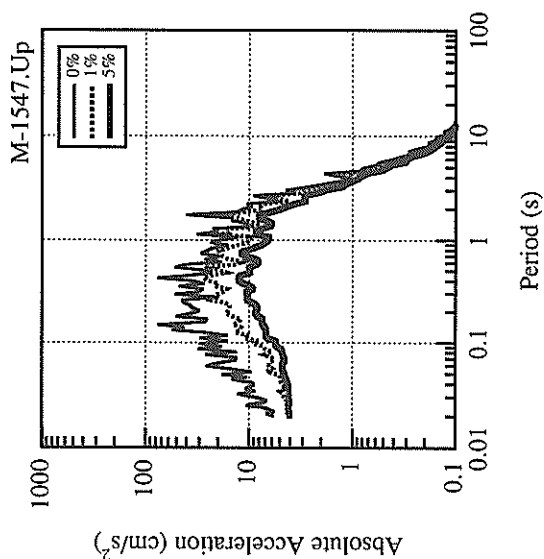
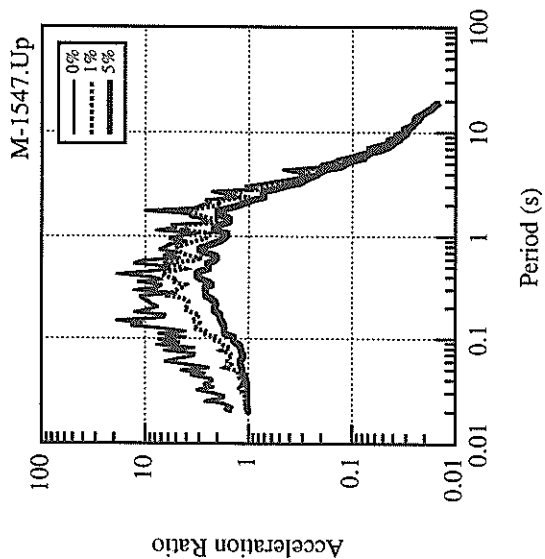
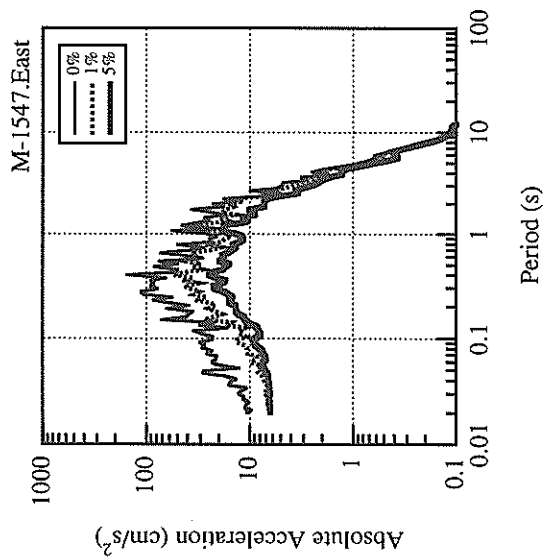
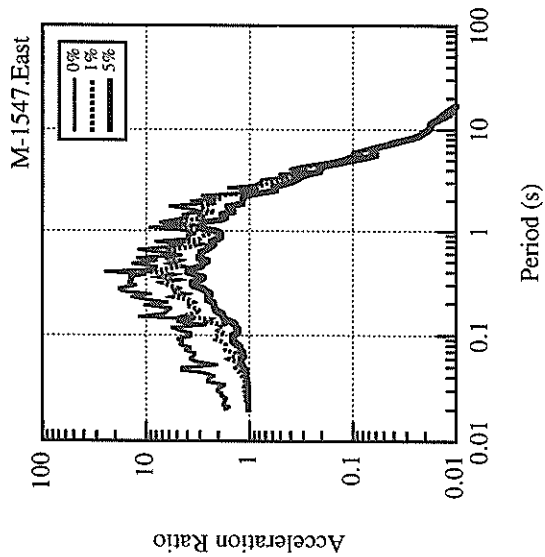


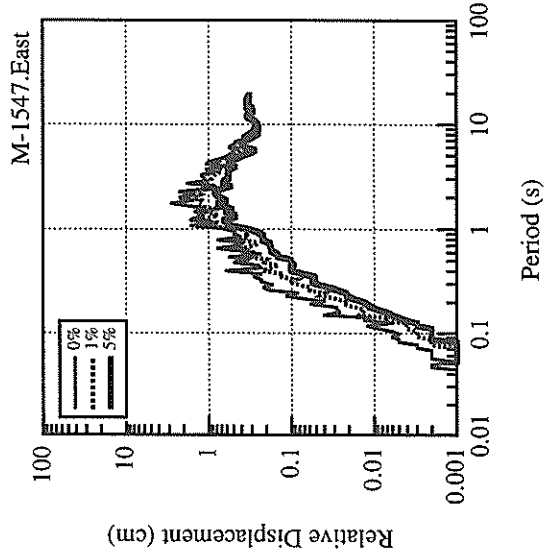
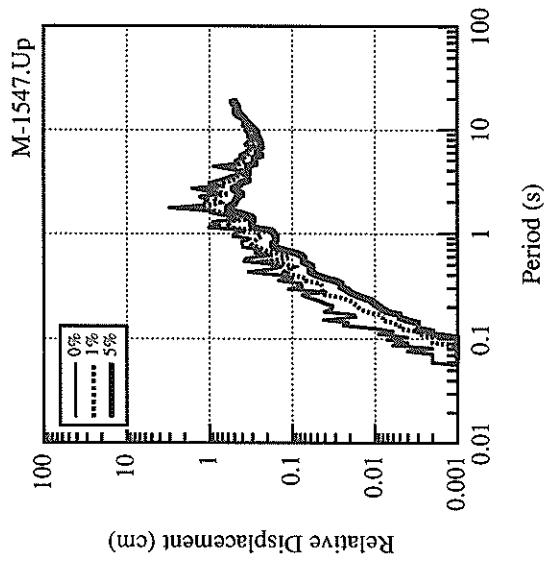
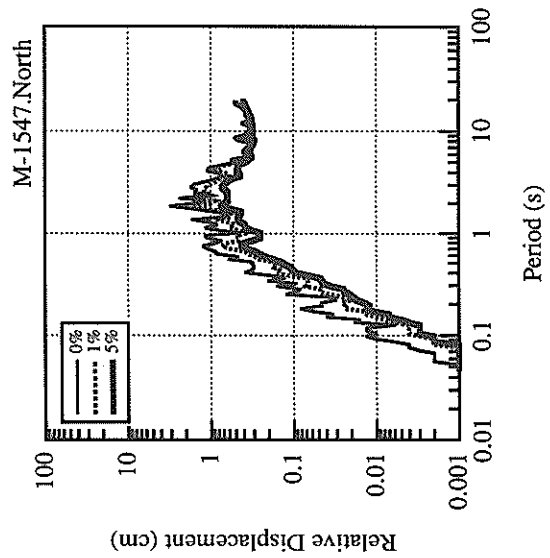
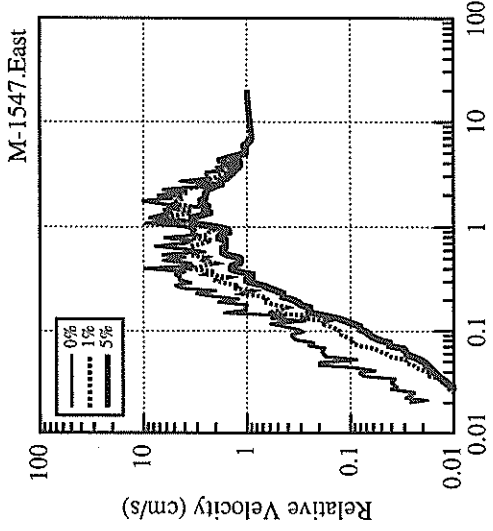
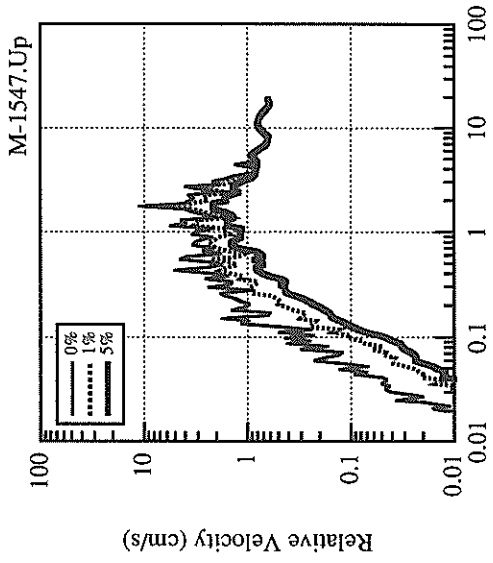
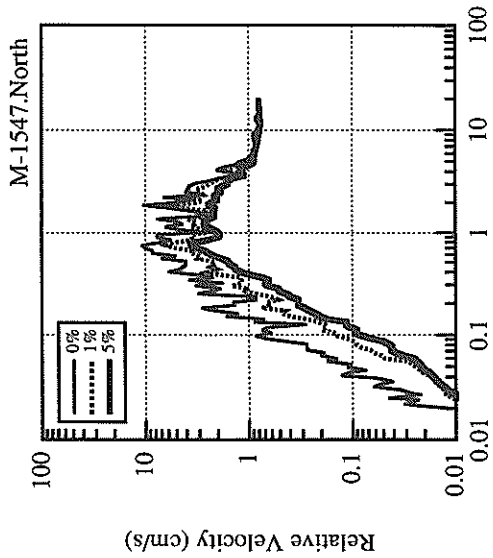


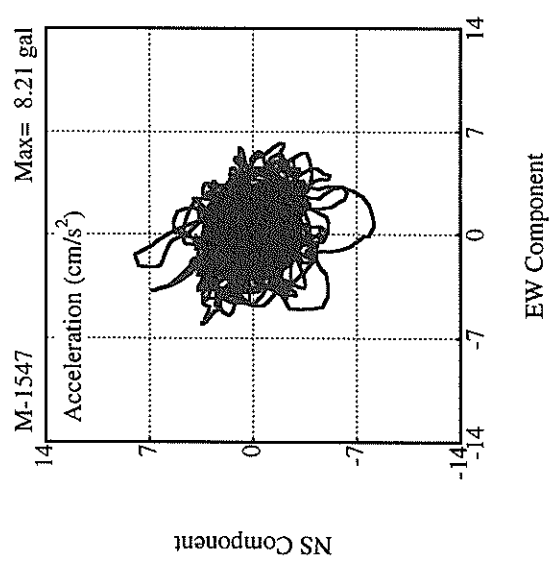
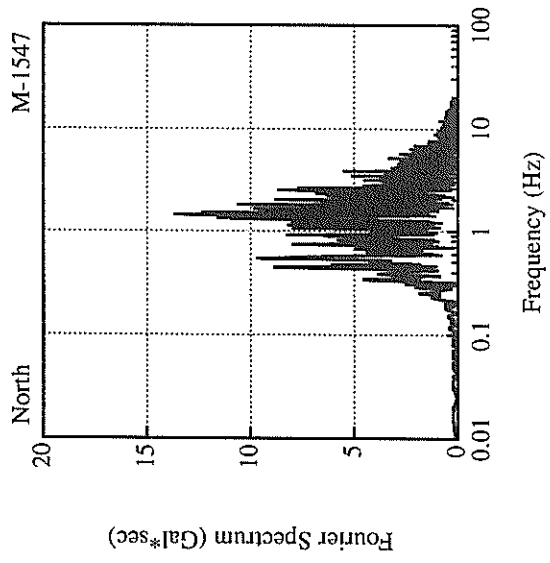
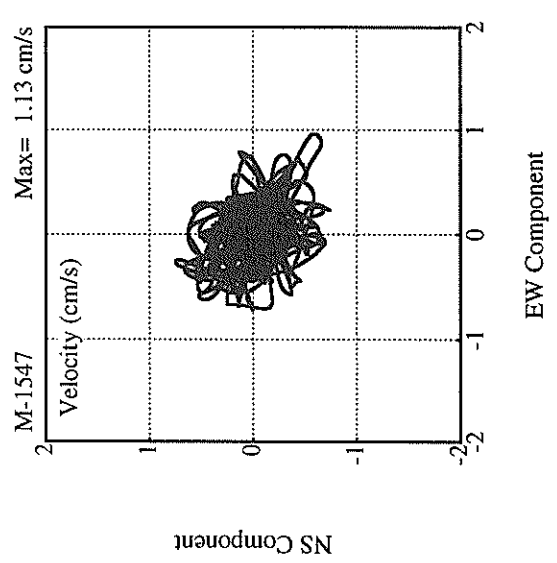
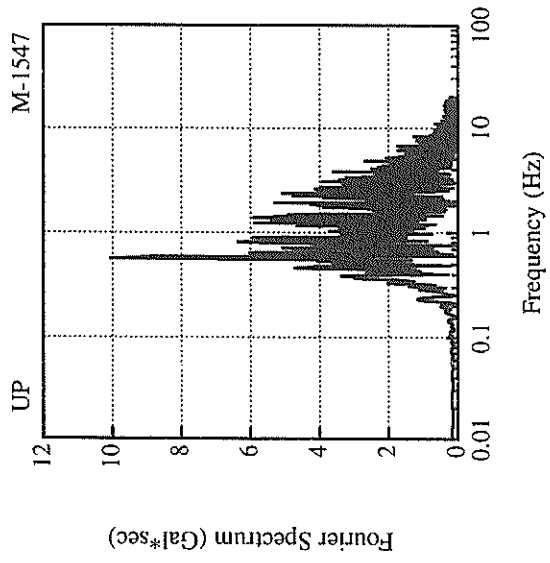
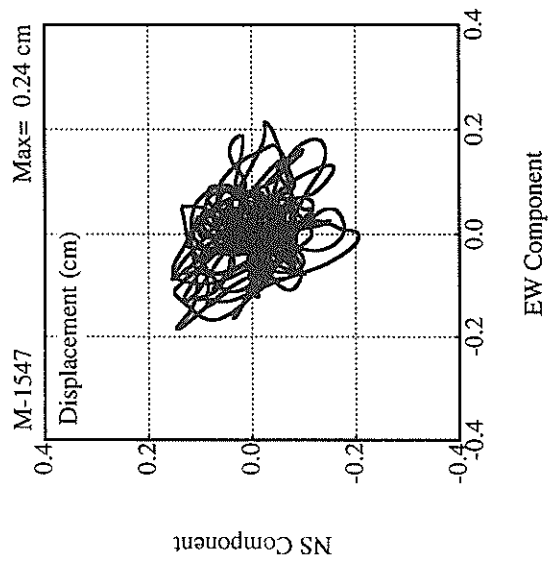
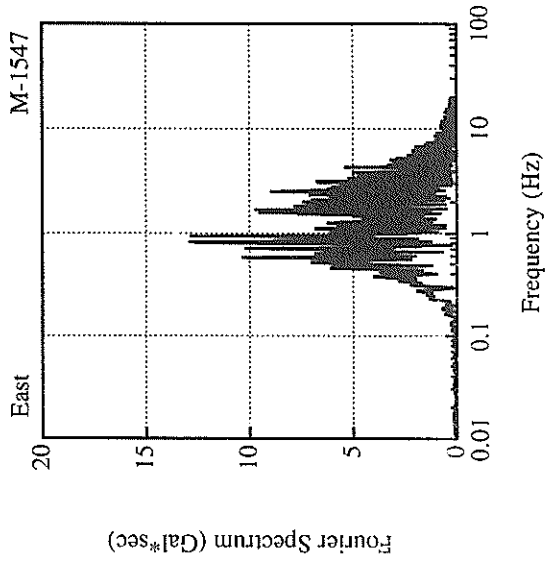
Displacement (cm)



Displacement (cm)







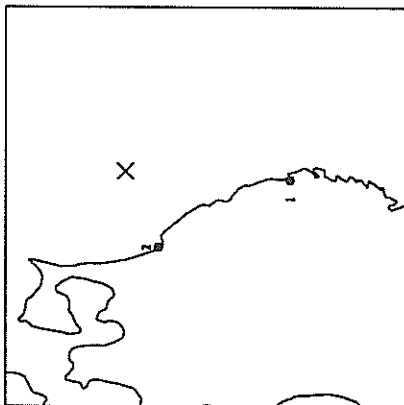
Strong-Motion Earthquake Observation Results  
of the after Shock at 00:29:29, December 30, 1994



STRONG-MOTION EARTHQUAKE OBSERVATION RESULTS

00:29 DEC. 30, 1994  
 E OFF AOMORI PREF  
 EPICENTER : 40 43.8'N 142 11.0'E  
 DEPTH : 52.5KM MAGNITUDE : 5.6

JMA INTENSITIES  
 IV : HACHINOHE  
 III : MUTSU, MORIOKA  
 II : AOMORI, HAKODATE, MIYAKO,  
 URAKAWA, OFUNATO,  
 TOKAKOMAI



STATION	CONDITION	RECORD NUMBER	MAX. ACC. (OAL)	DIST. (KM)
1 MIYAKO-G	ON GROUND	F- 730	(NS) (EW) (UD) 15 18 6	122
2 HACHINOHE-JI-S	ON GROUND	S-2598	52 42 8	61

Results of Preliminary Analyses  
of the After Shock at 00:29:29, December 30, 1994

RECORD NUMBER : S-2598  
 STATION : HACHINOHE-JI-S

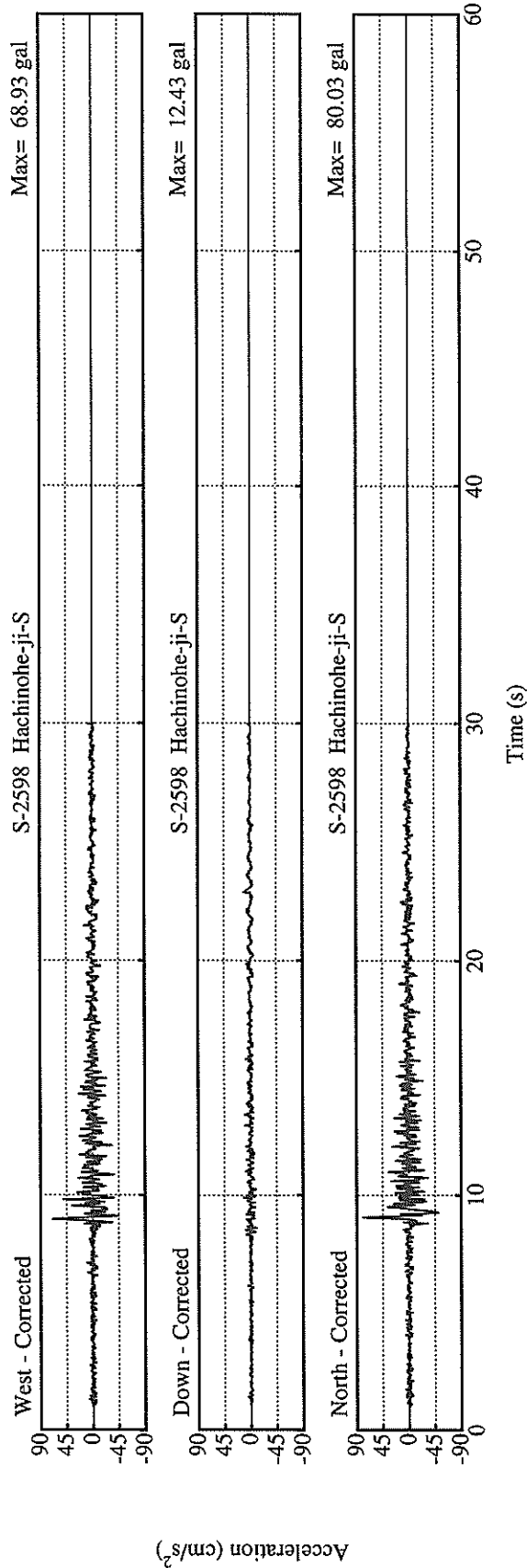
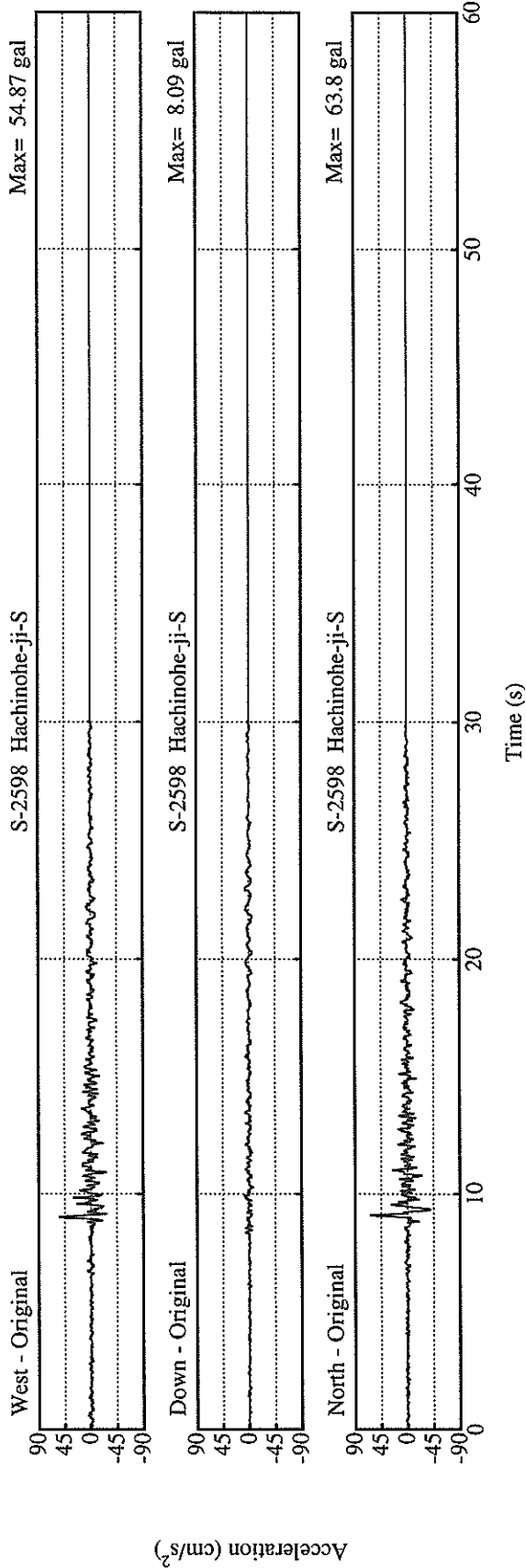
EARTHQUAKE DATA

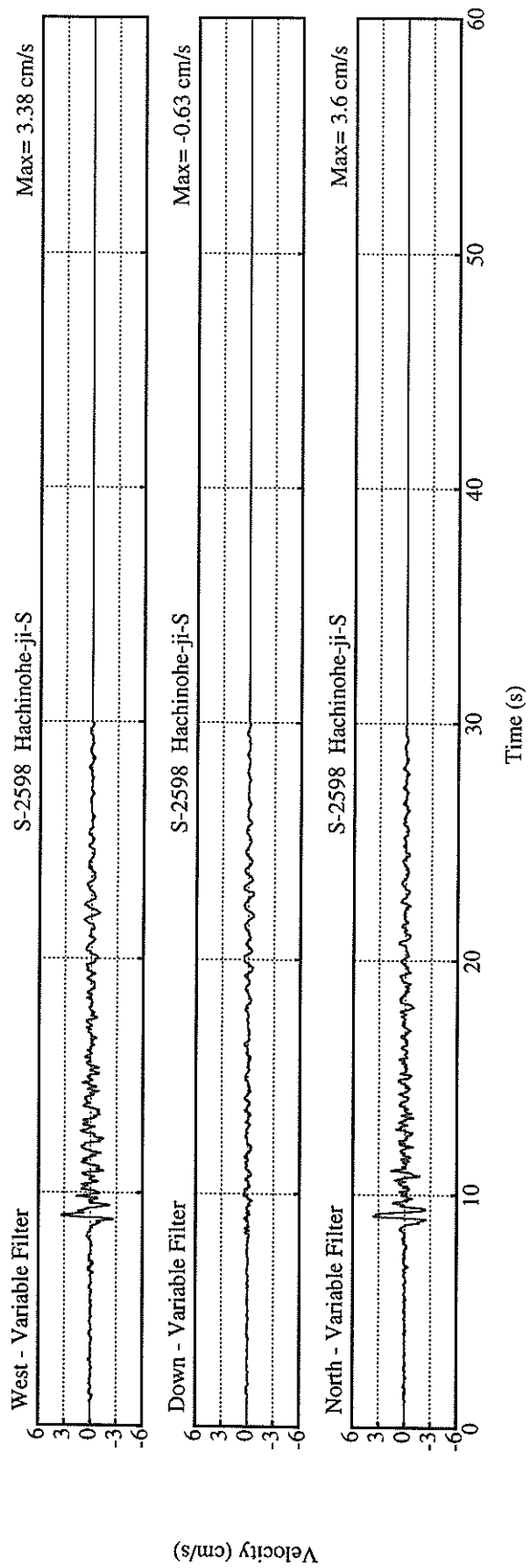
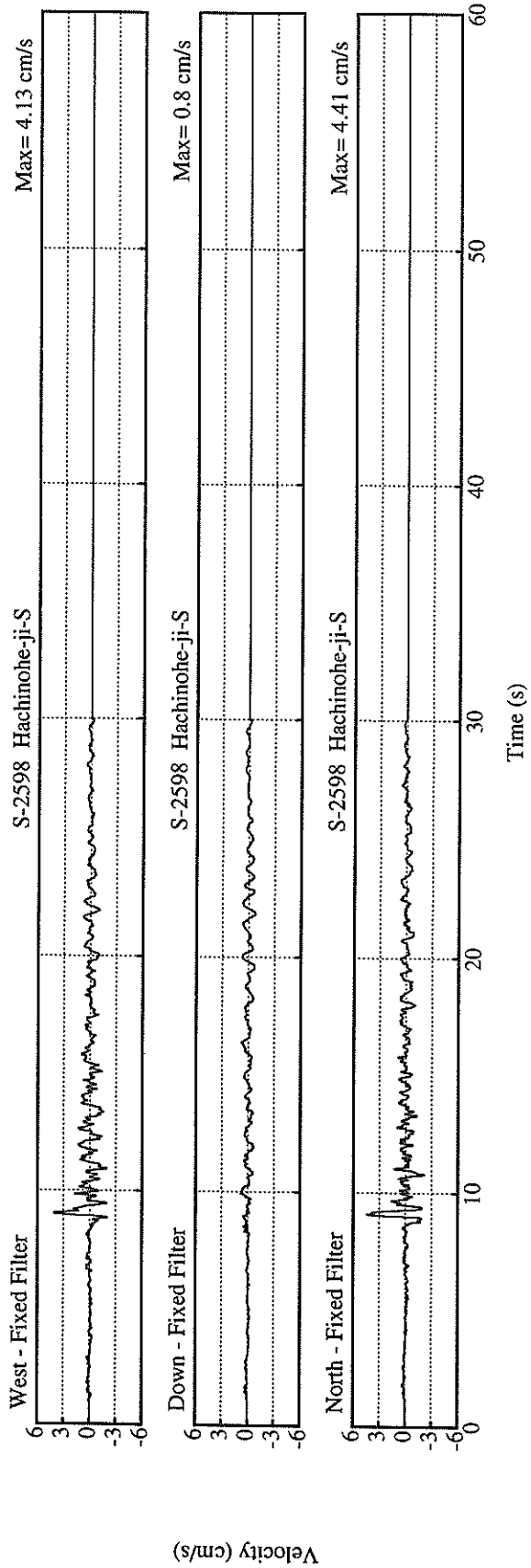
\*\*\*\*\*  
 DATE AND TIME 0:29 DEC.30,1994  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION E OFF AOMORI PEF  
 LATITUDE 40°43.8' N  
 LONGITUDE 142°11.0' E  
 DEPTH 52.5KM  
 JMA MAGNITUDE 5.6  
 \*\*\*\*\*

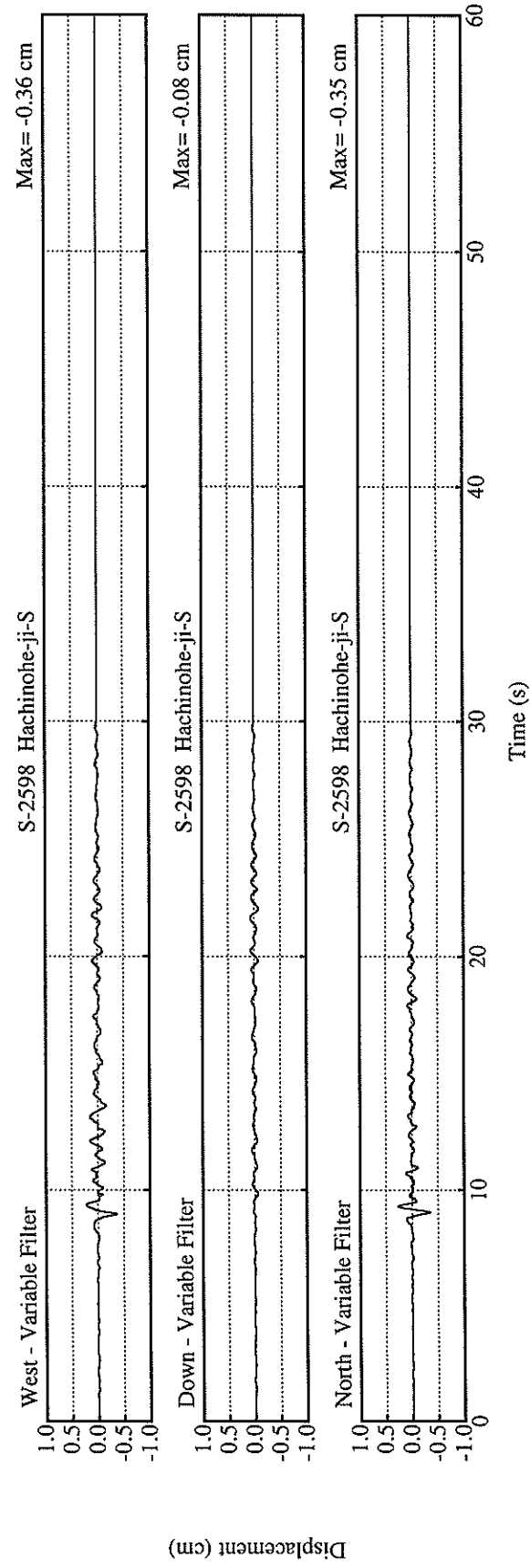
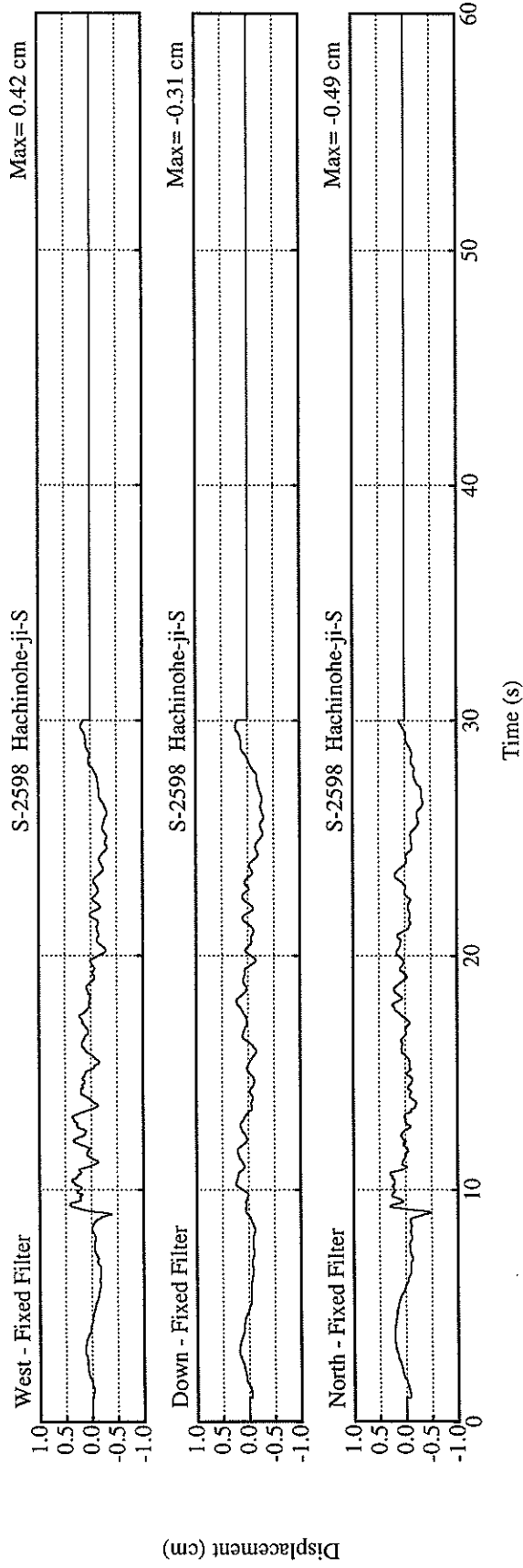
PEAK VALUES OF COMPONENTS

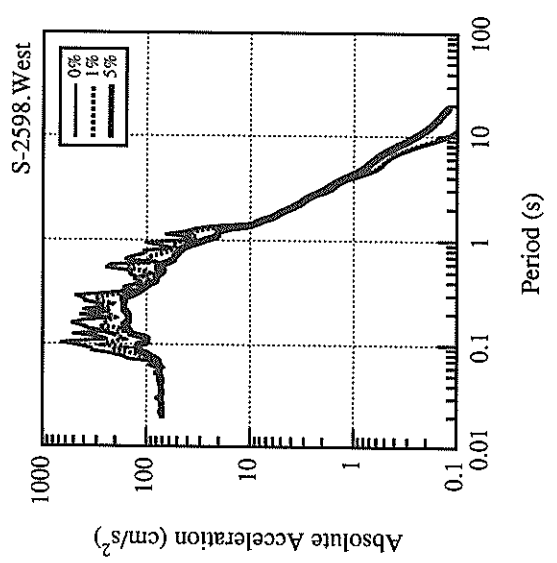
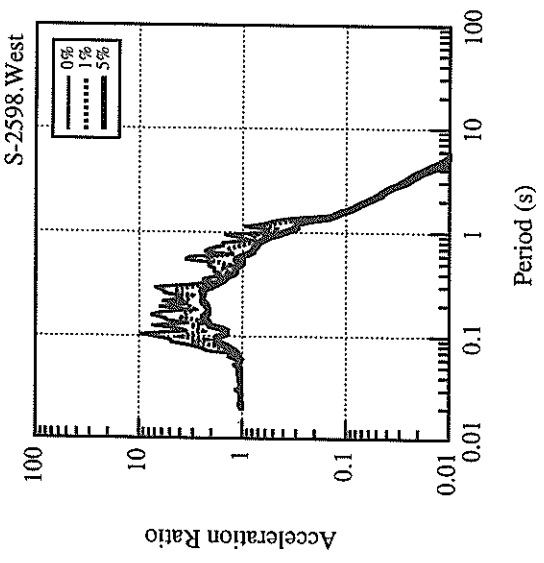
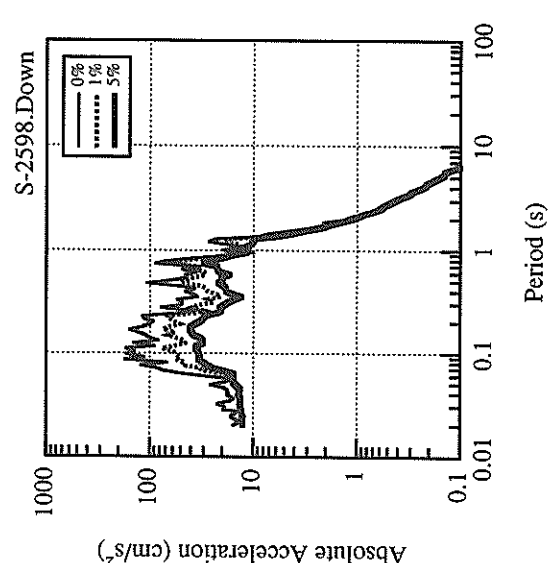
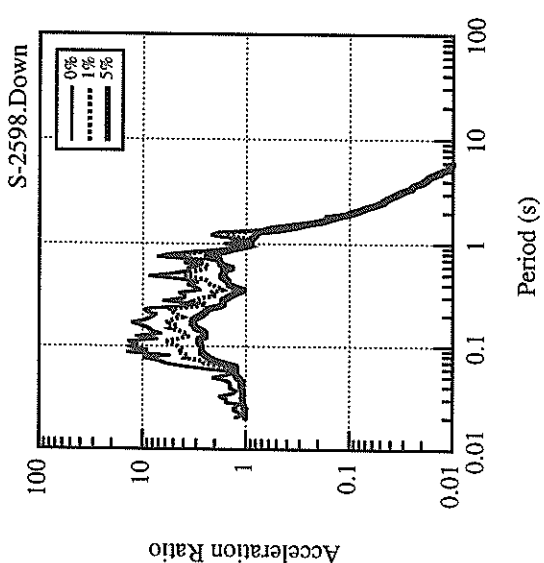
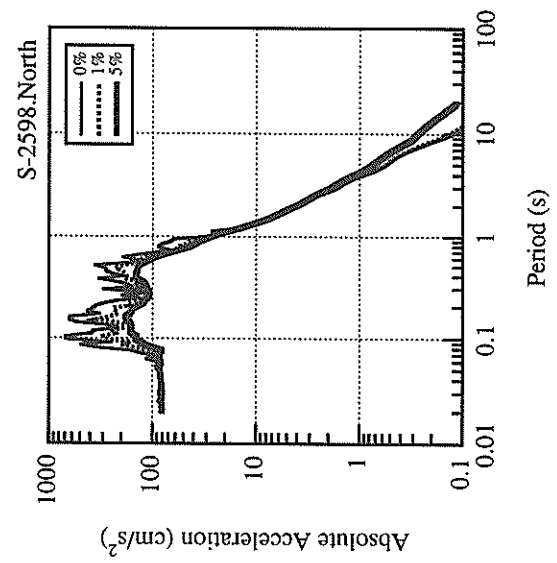
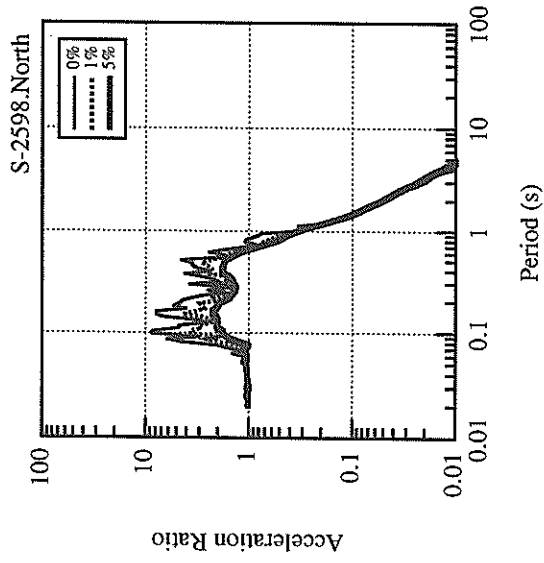
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.731	0.609	0.743	
MAXIMUM ACCELERATION (GAL)				
ORIGINAL	63.8	54.9	8.1	64.5
CORRECTED	80.0	68.9	12.4	80.1
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	4.41	4.13	0.80	5.30
VARIABLE FILTER	3.60	3.38	0.63	4.23
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.49	0.42	0.31	0.56
VARIABLE FILTER	0.35	0.36	0.08	0.44

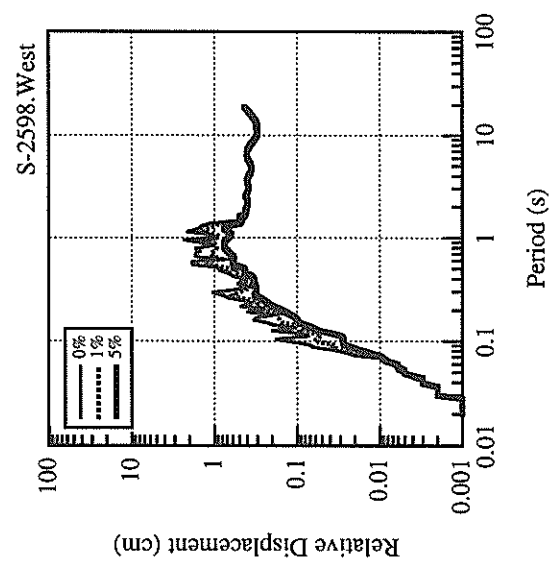
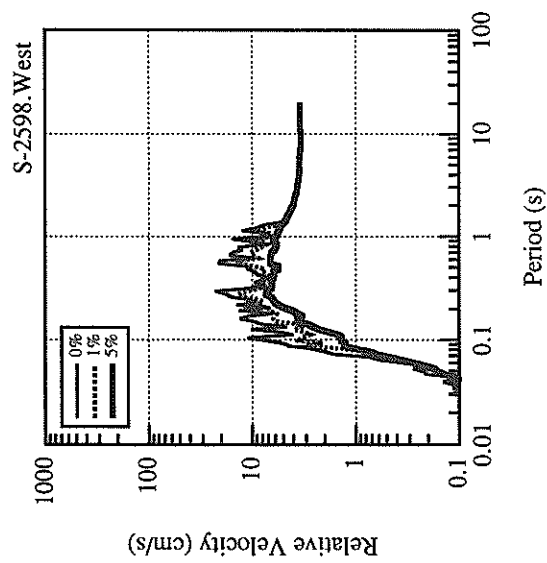
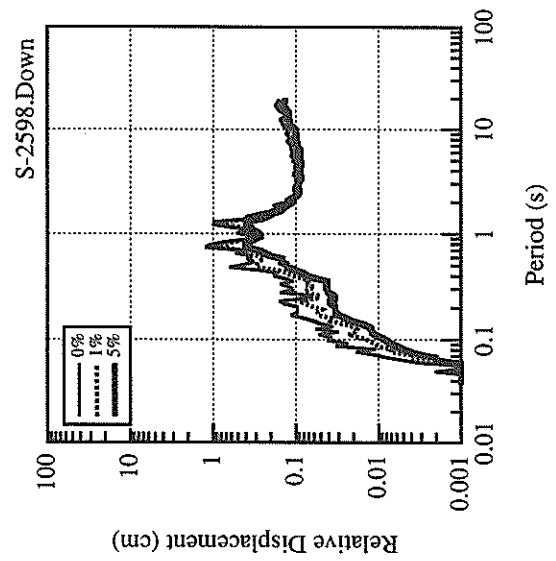
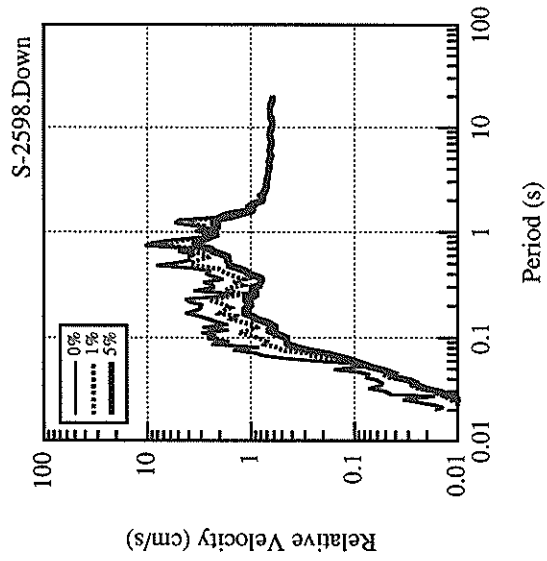
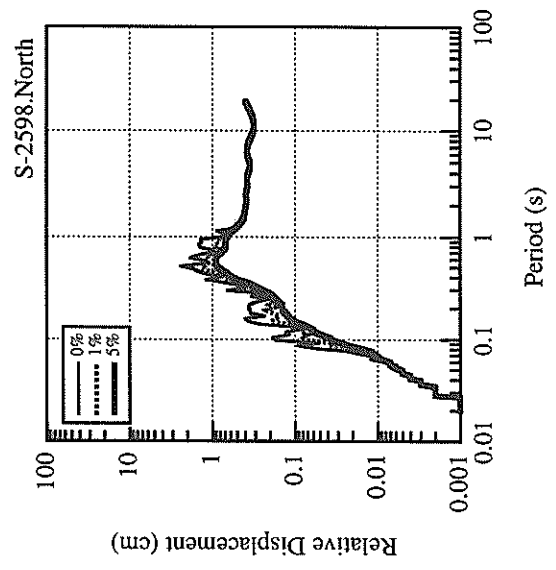
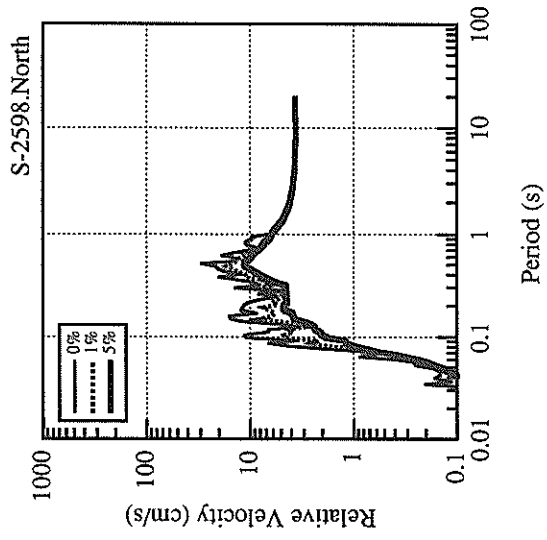
\* RESULTANT OF HORIZONTAL COMPONENTS



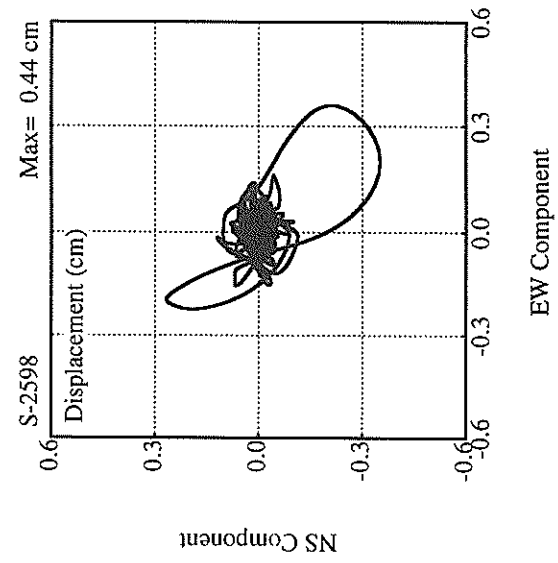
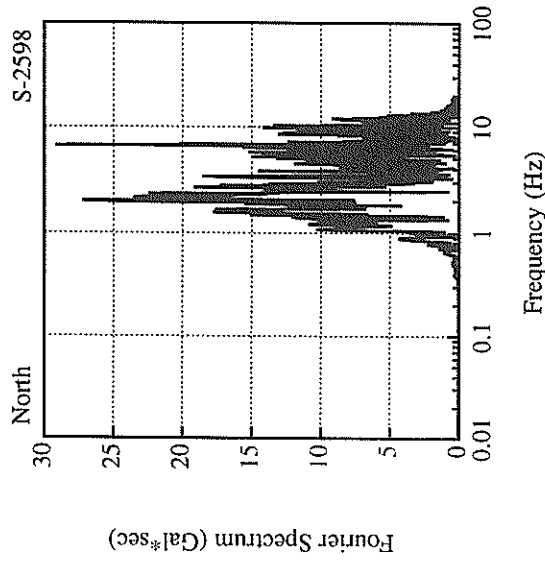
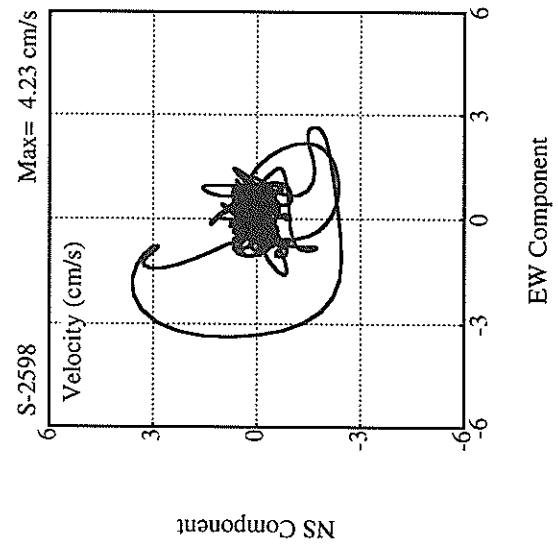
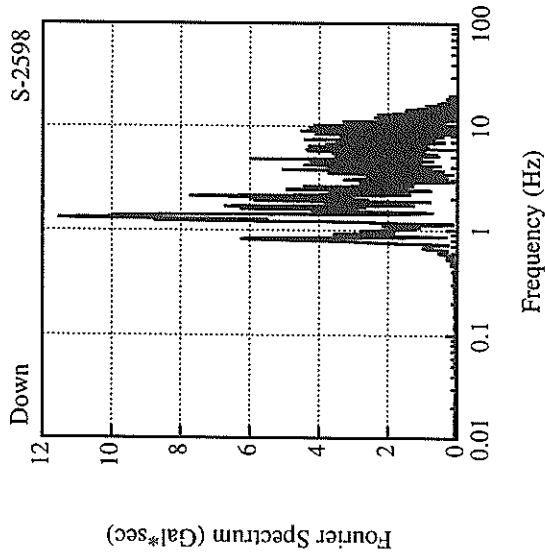
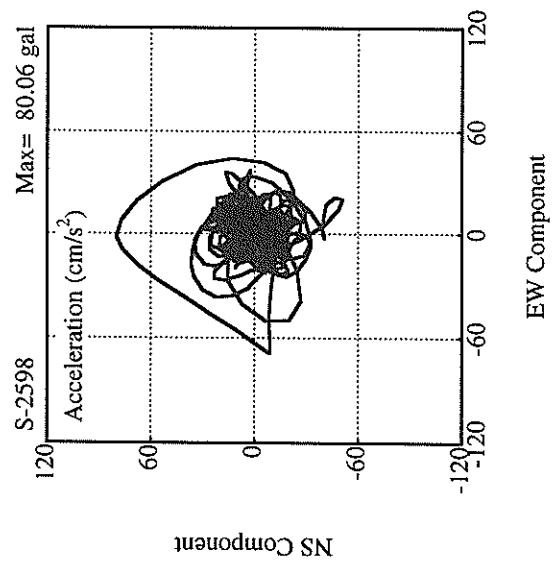
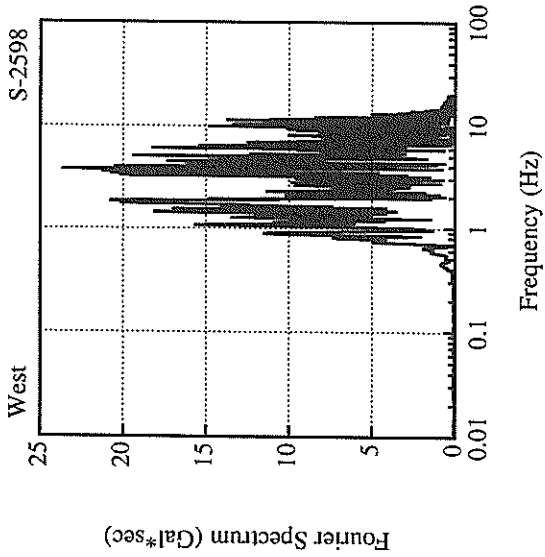












RECORD NUMBER : F-730  
 STATION : MIYAKO-G

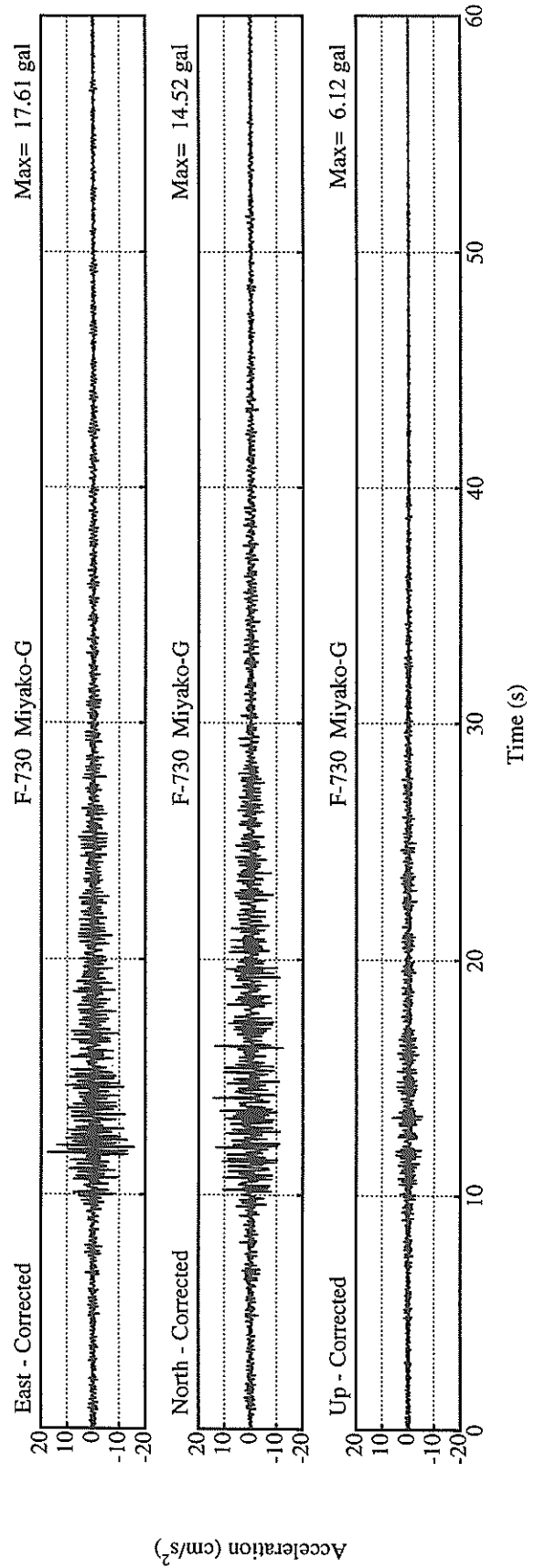
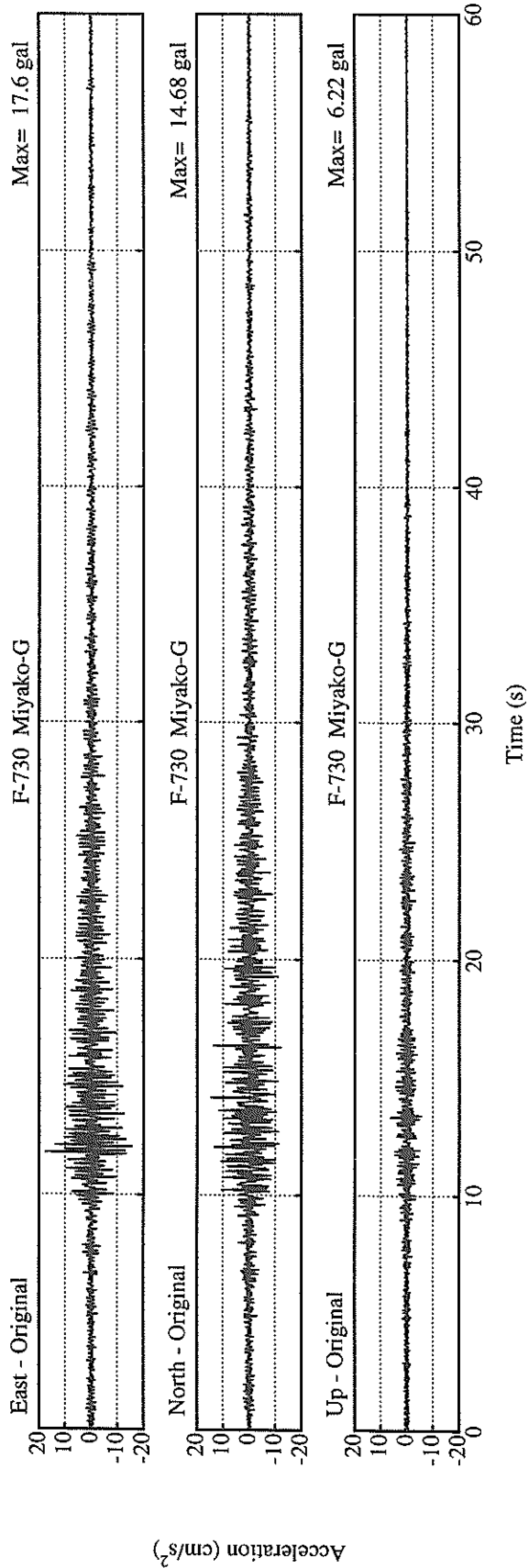
EARTHQUAKE DATA

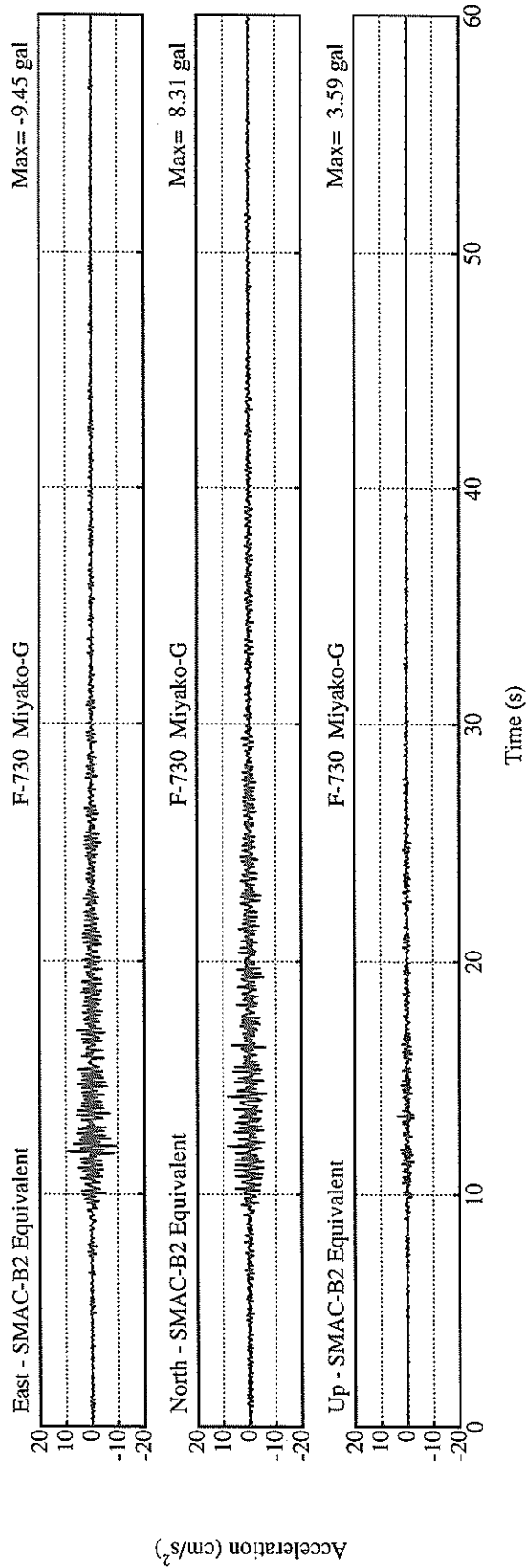
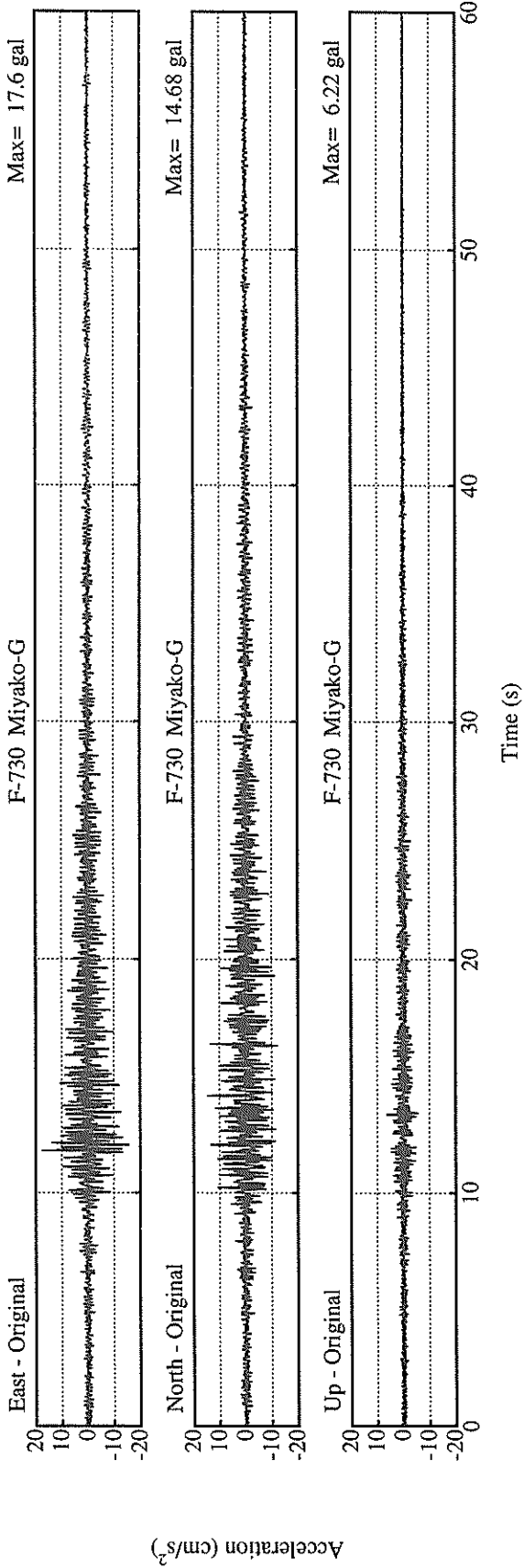
\*\*\*\*\*  
 DATE AND TIME 0:29 DEC.30,1994  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION E OFF AOMORI PREF  
 LATITUDE 40°43.8' N  
 LONGITUDE 142°11.0' E  
 DEPTH 52.5KM  
 JMA MAGNITUDE 5.6  
 \*\*\*\*\*

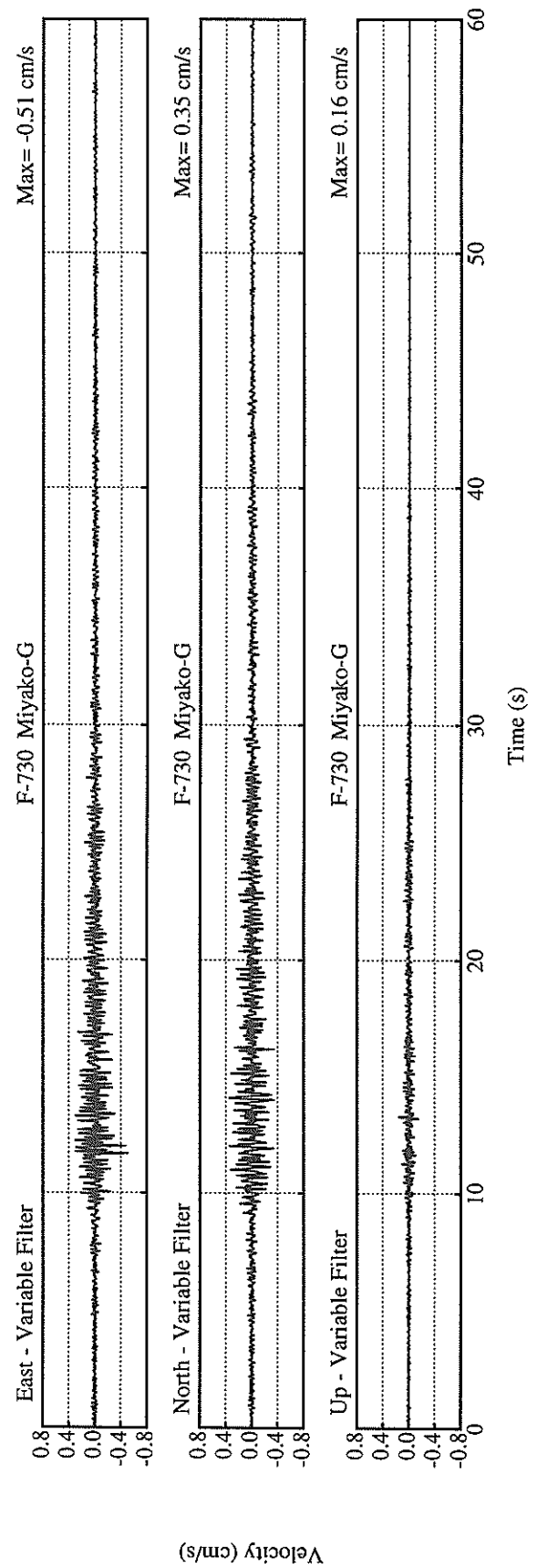
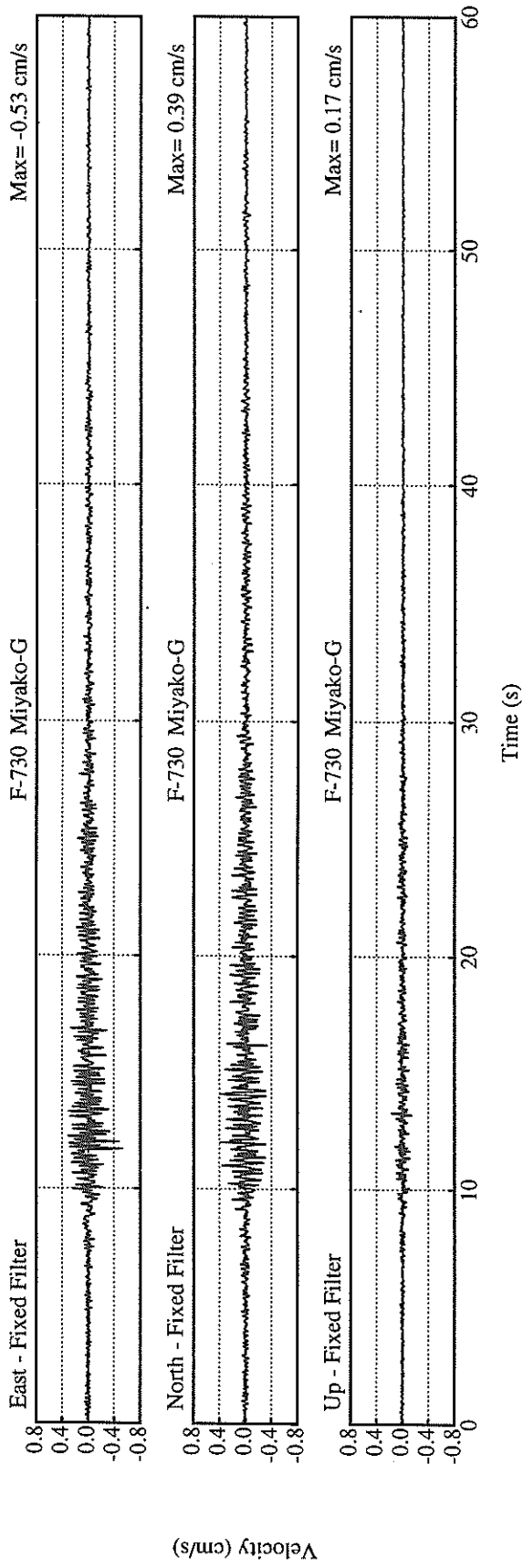
PEAK VALUES OF COMPONENTS

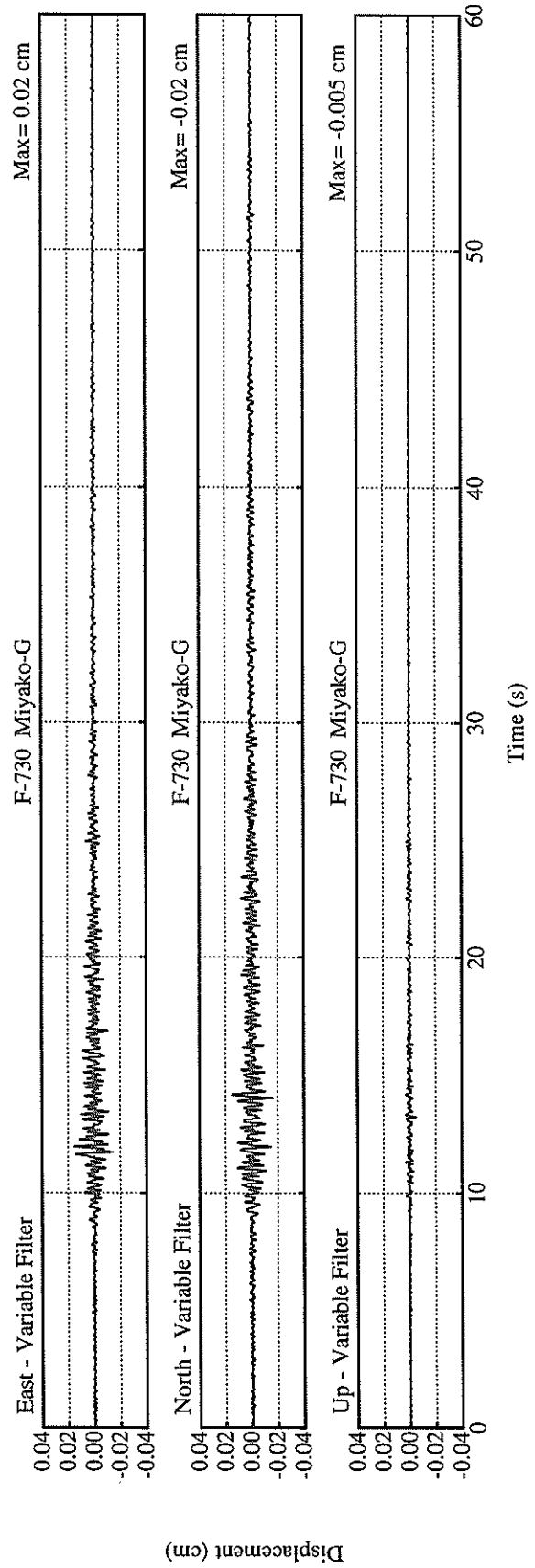
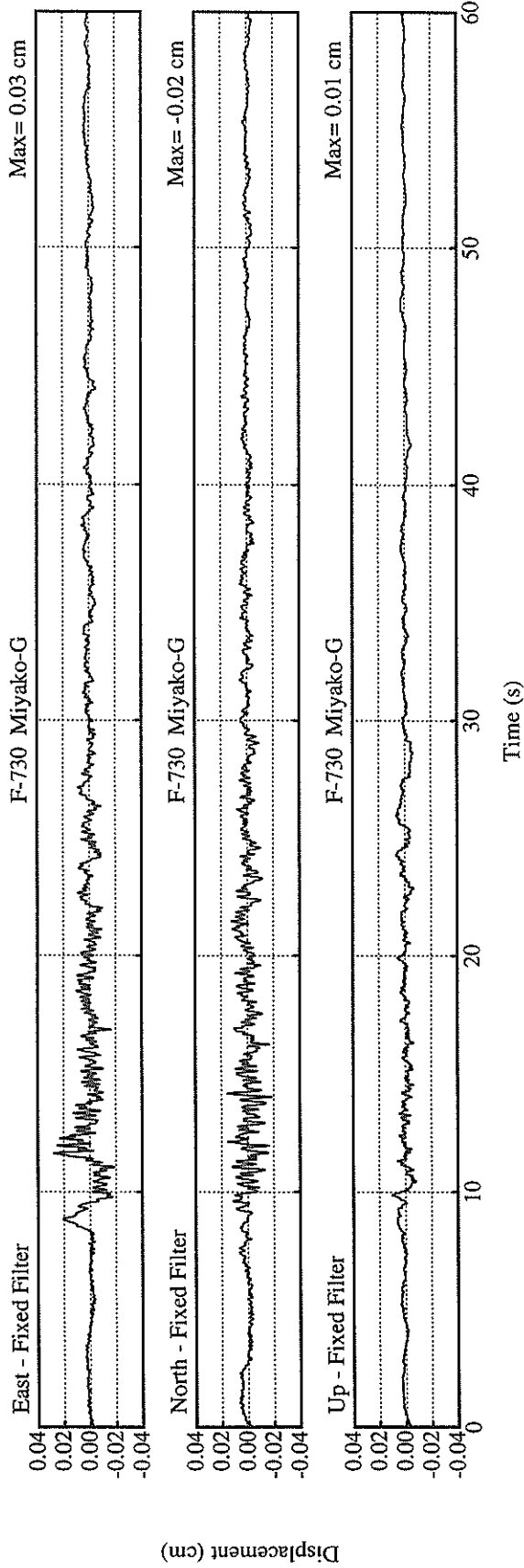
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	1.550	1.489	2.282	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	8.3	9.4	3.6	12.6
ORIGINAL	14.7	17.6	6.2	20.7
CORRECTED	14.5	17.6	6.1	20.6
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	0.39	0.53	0.17	0.61
VARIABLE FILTER	0.35	0.51	0.16	0.58
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.02	0.03	0.01	0.03
VARIABLE FILTER	0.02	0.02	0.00	0.02

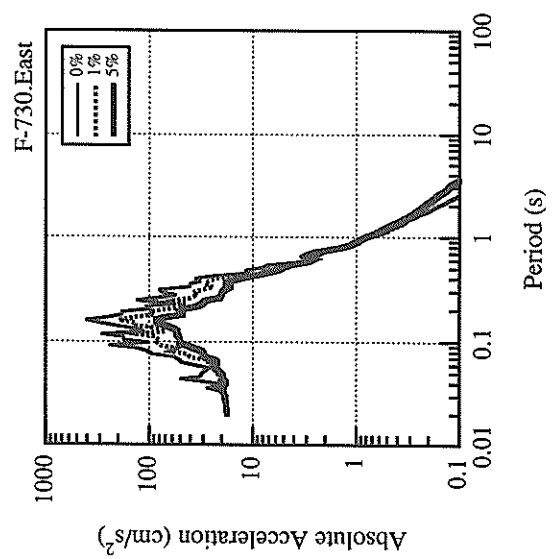
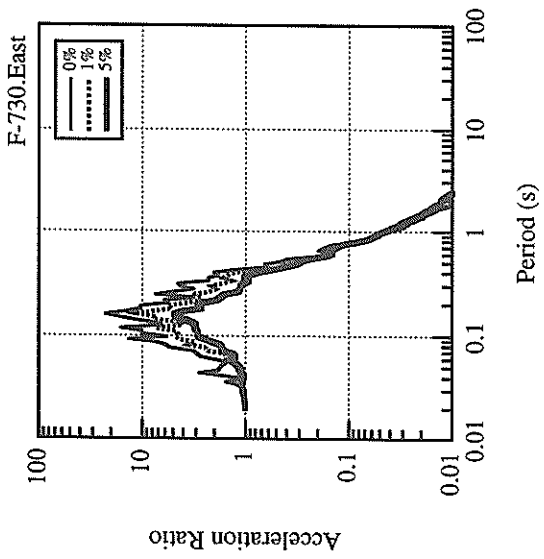
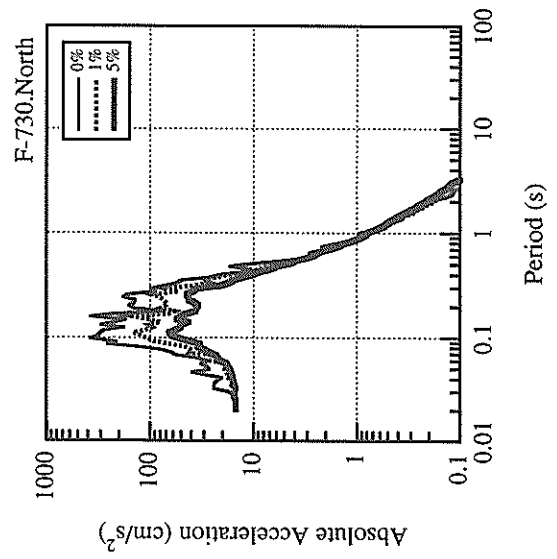
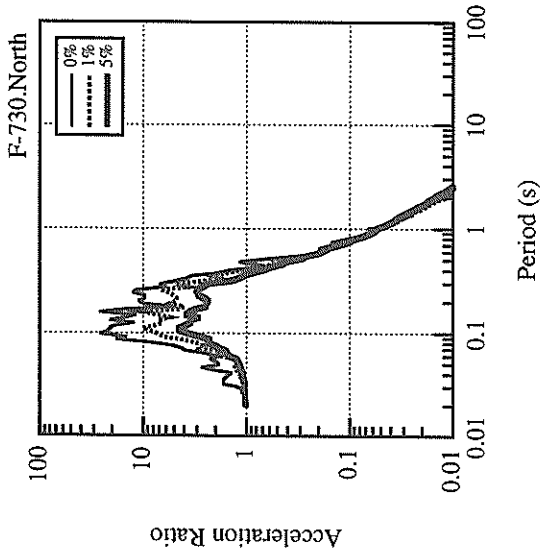
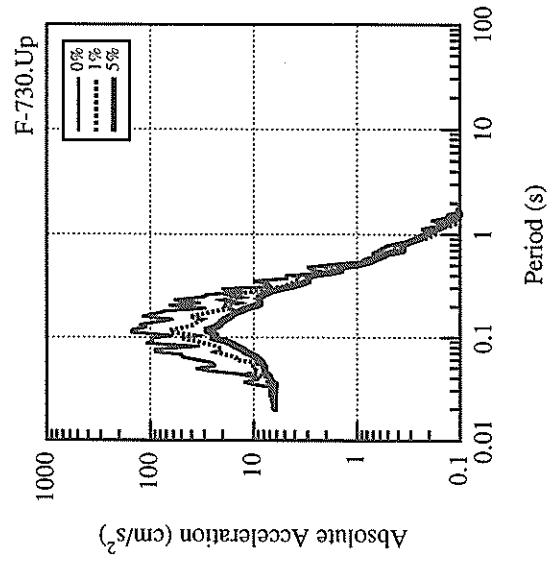
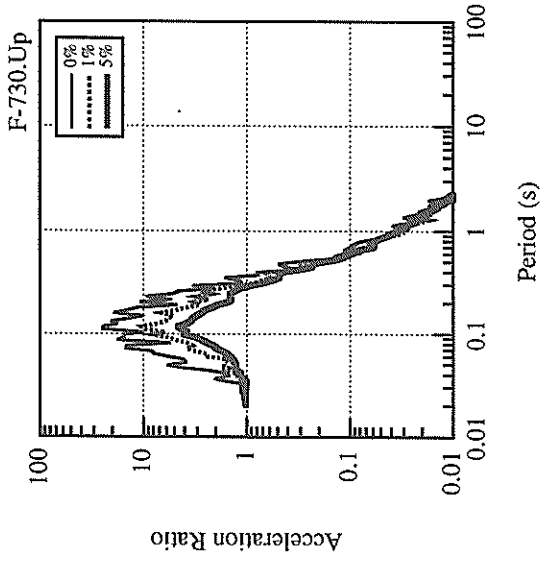
\* RESULTANT OF HORIZONTAL COMPONENTS

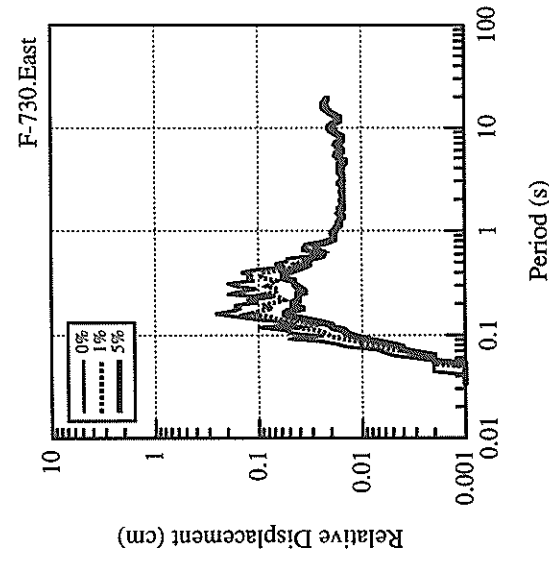
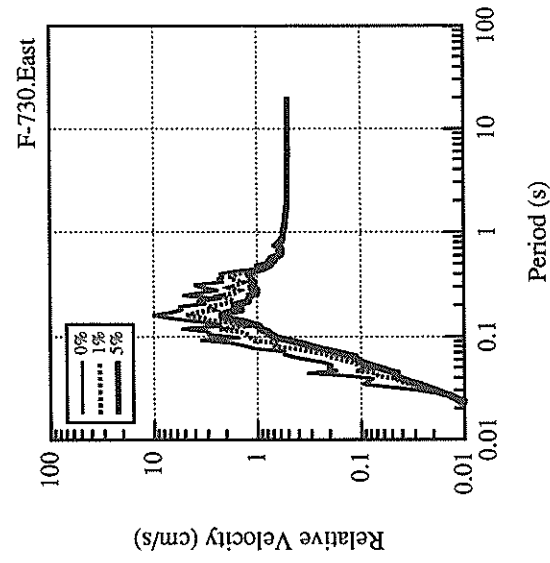
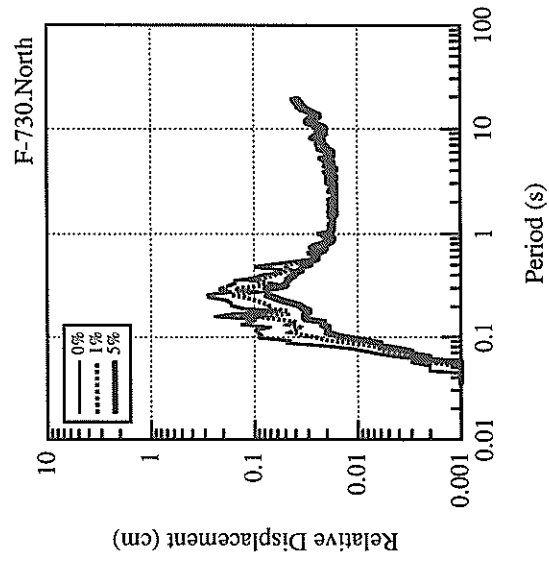
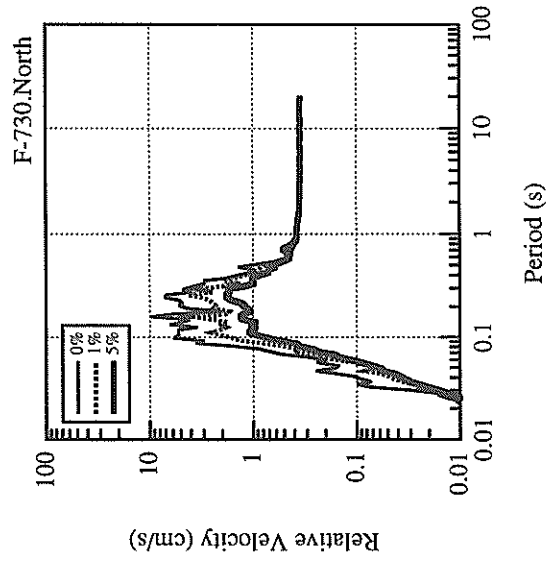
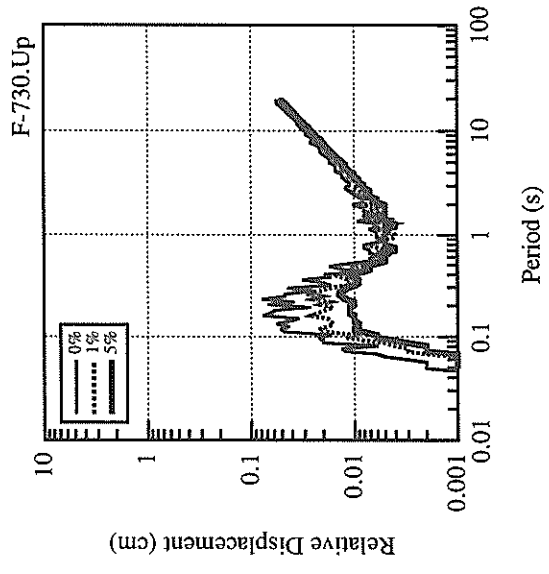
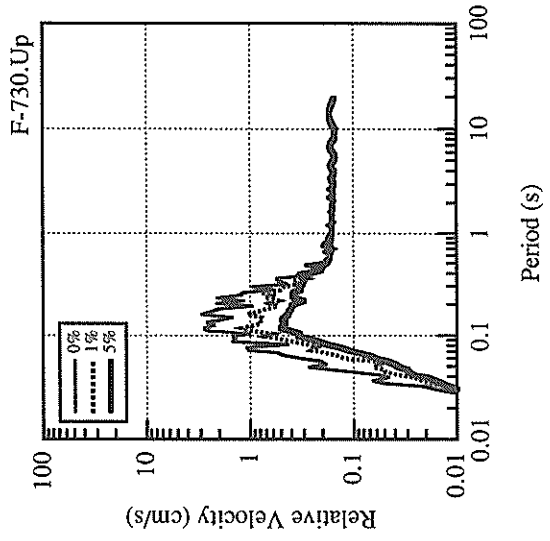




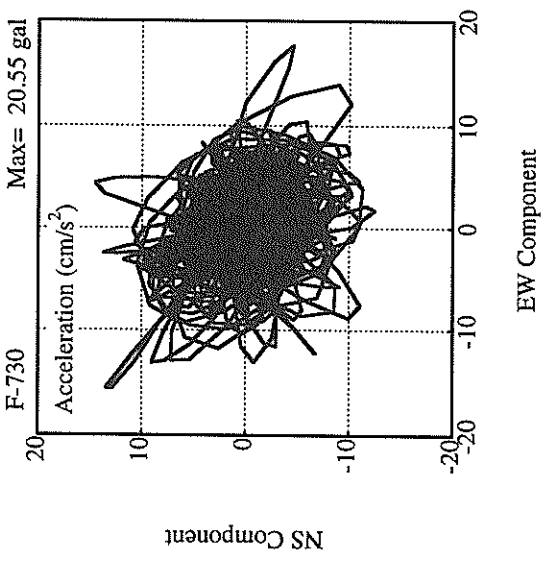
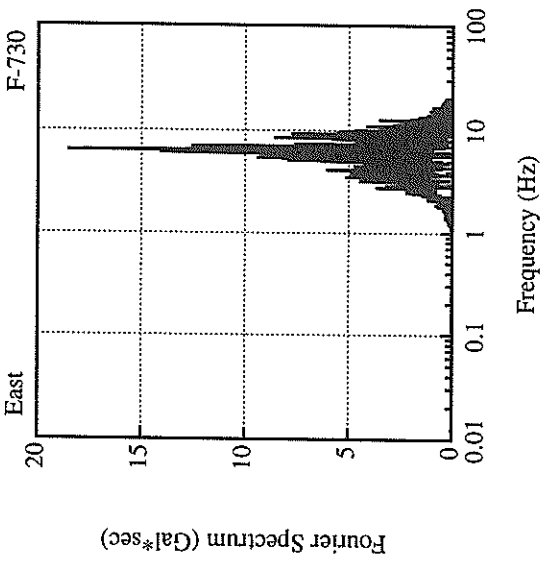
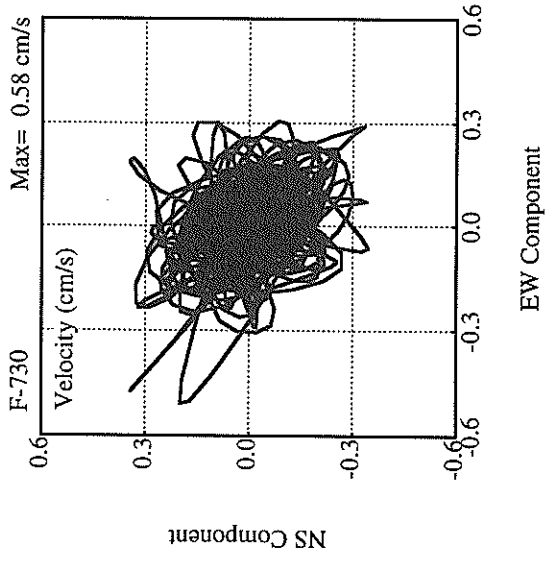
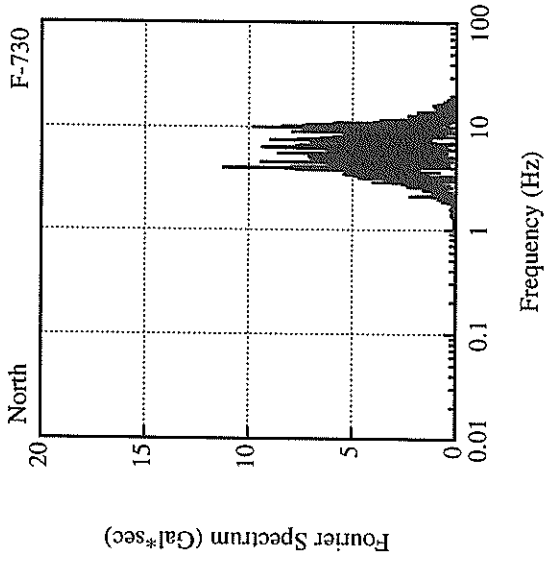
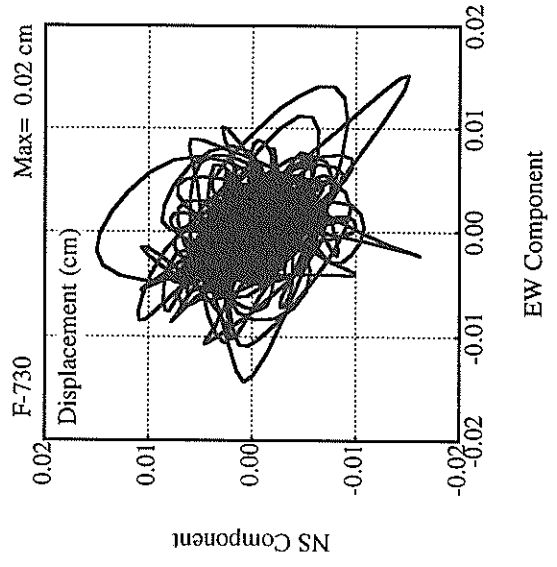
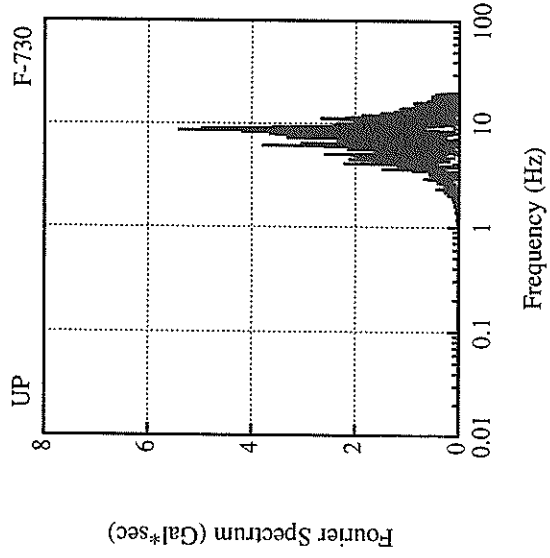












Strong-Motion Earthquake Observation Results  
of the after Shock at 07:37:37, January 7, 1995

STRONG-MOTION EARTHQUAKE OBSERVATION RESULTS

07:37 JAN. 7, 1995

HE OFF IWATE PREF

EPICENTER : 40 13.2'N 142 18.5'E

DEPTH : 47.8KM MAGNITUDE : 7.2

JWA INTENSITIES

V : HACHINOHE, MORIOKA

IV : OFUNATO, MIYAKO, NUTSU,

AOMORI

III : SENDAI, ISHINOWAKI, AKITA,

SHINJO, SAKATA, FUKUSHIMA,

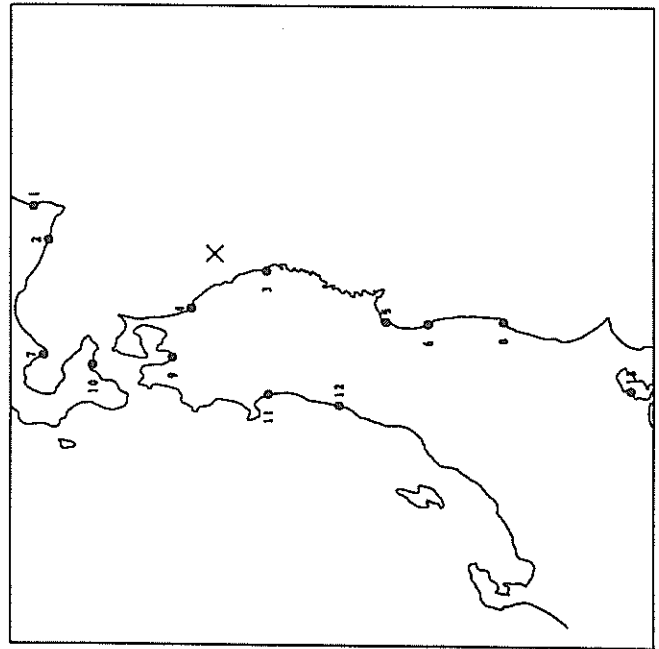
URAKAWA, HIROO, HAKODATE,

TOMAKOMAI, OBIHIRO,

KUSHIRO, OTARU, KAKIOKA,

ONAHAMA

STATION	CONDITION	RECORD NUMBER	MAX. ACC. (MS) (EW) (UD)	MAX. ACC. (GAL)	DIST. (KM)
1 TOKACHI-M	ON GROUND	M-1549	13 12 6	6	245
2 URAKAWA-S	ON GROUND	S-2608	11 12 6	6	219
3 MIYAKO-G	ON GROUND	F-734	212 192 60	60	70
4 HACHINOHE-JI-S	ON GROUND	S-2606	243 281 76	76	78
5 SHIOGAWA-KOJYO-S	ON GROUND	S-2612	31 24 14	14	238
5 SENDAI-HB	IN GROUND	M-1550	5 7 4	4	242
6 SOHA-S	ON GROUND	S-2610	11 12 5	5	290
7 MURORAH-G	ON GROUND	F-701	25 31 9	9	261
8 ONAHAMA-JI-S	ON GROUND	S-2605	4 8 3	3	383
9 AOHORI-G	ON GROUND	F-713	42 35 27	27	147
10 HAKODATE-FR	ON STRUC.	F-894	23 20 7	7	218
10 HAKODATE-F	ON GROUND	F-891	15 18 8	8	218
10 HAKODATE-PB	IN GROUND	F-888	9 9 6	6	218
11 AKITA-G	ON GROUND	F-905	12 8 3	3	197
11 AKITA-GB	IN GROUND	F-904	9 8 3	3	197
12 SAKATA-S	ON GROUND	S-2609	6 6 2	2	256
13 KAWASAKI-FR	ON STRUC.	F-986	7 1 2	2	569
13 KAWASAKI-F	ON GROUND	F-985	6 8 2	2	569
13 KAWASAKI-FB	IN GROUND	F-984	2 1 1	1	569



Results of Preliminary Analyses  
of the After Shock at 07:37:37, January 7, 1995

RECORD NUMBER : S-2606  
 STATION : HACHINOHE-JI-S

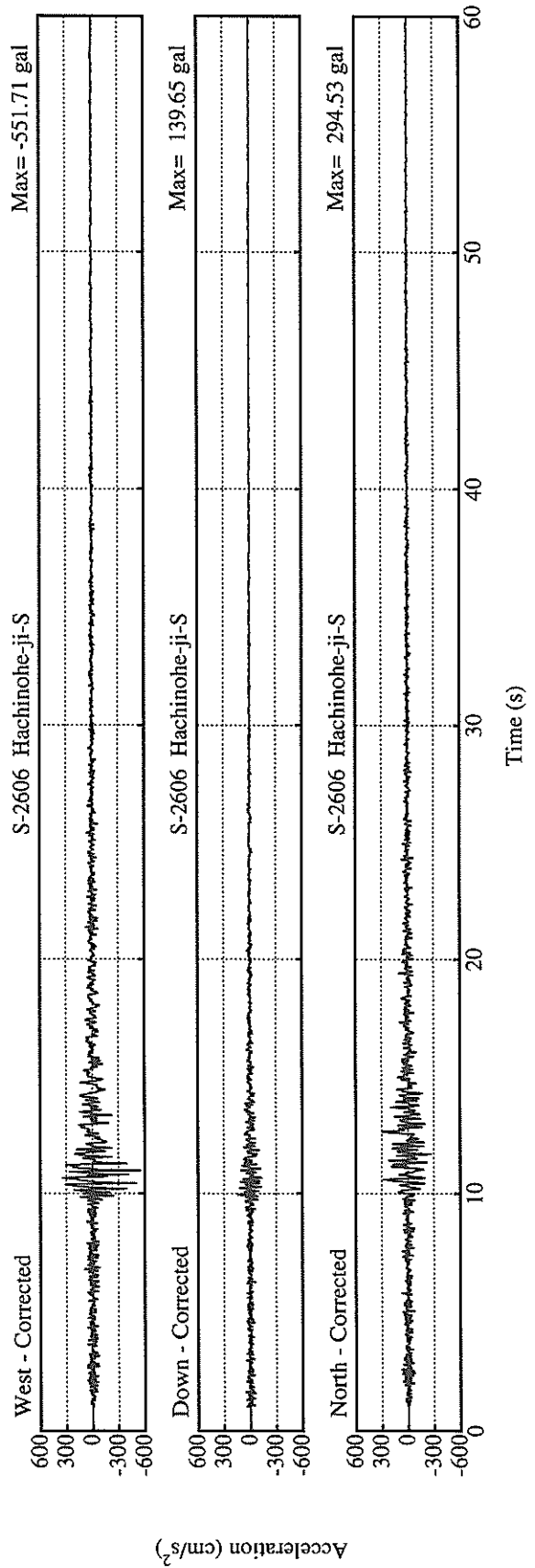
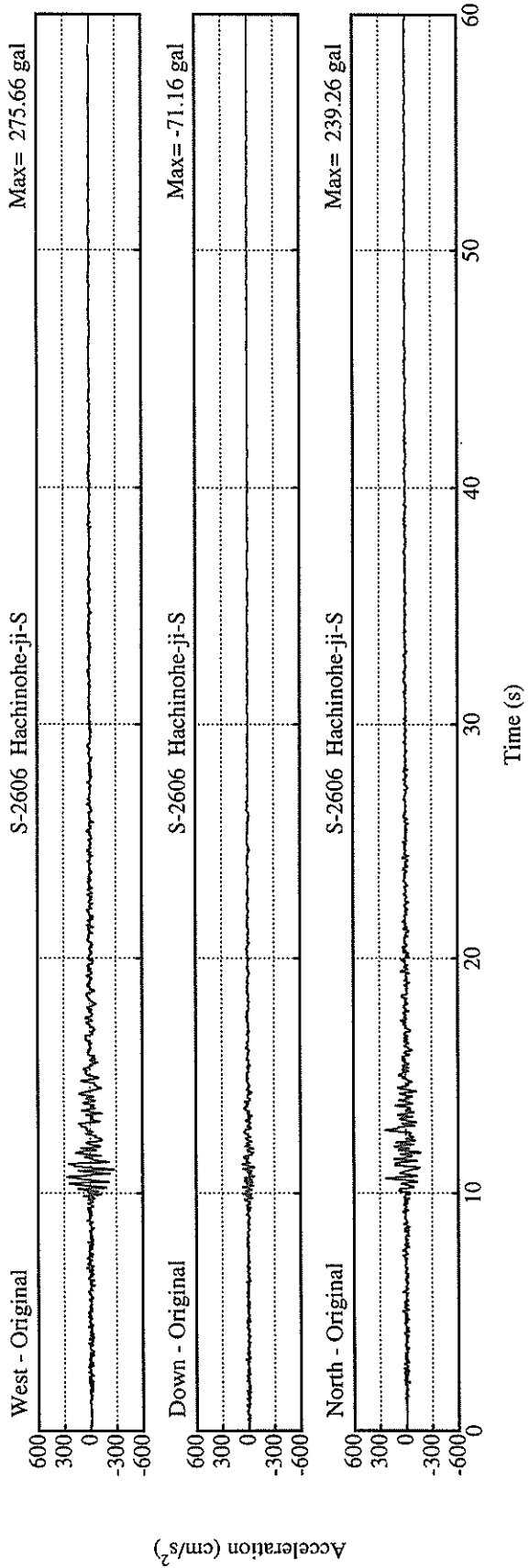
EARTHQUAKE DATA

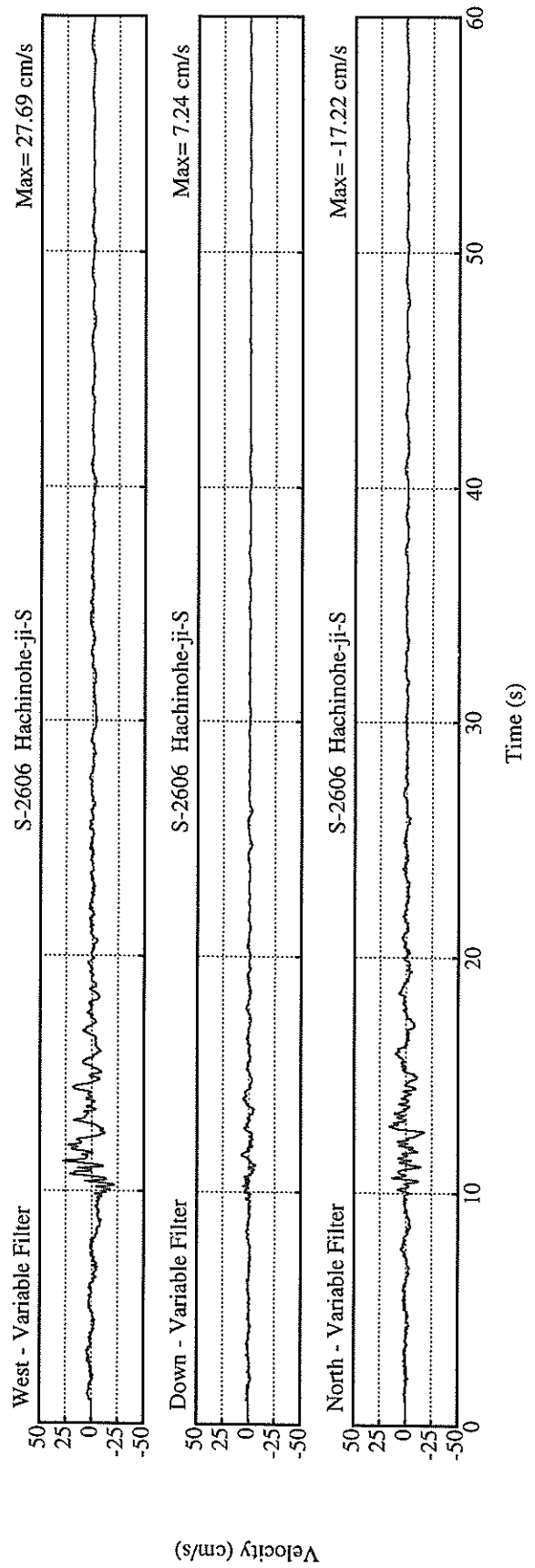
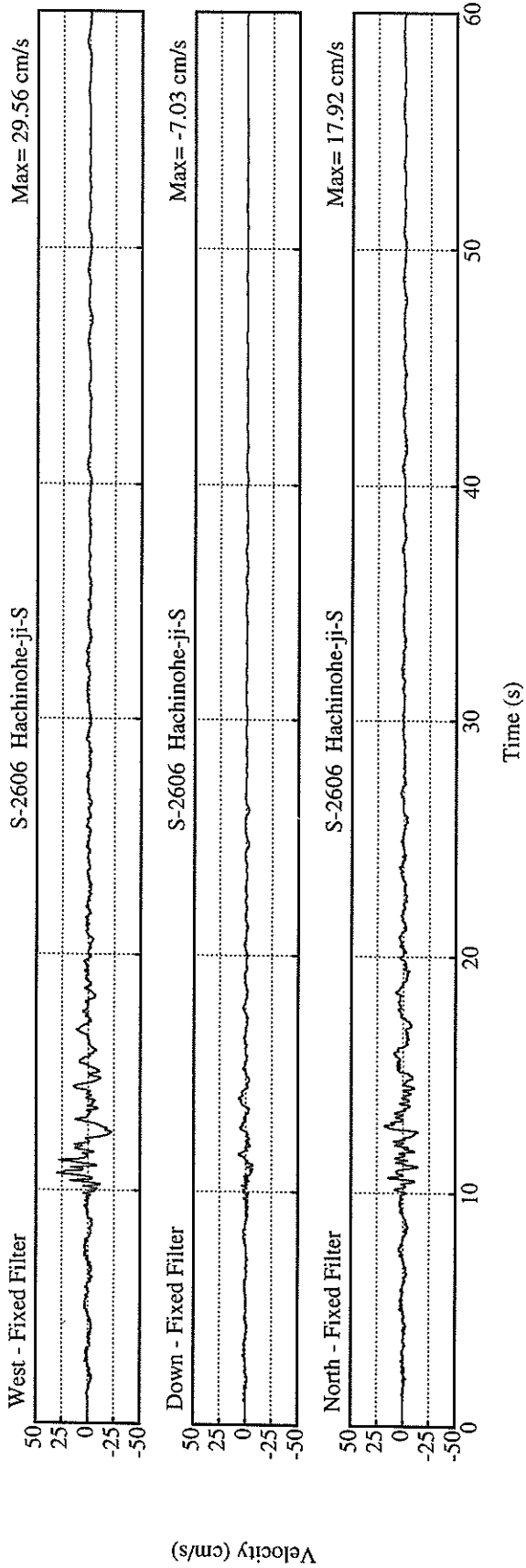
\*\*\*\*\*  
 DATE AND TIME 7:37 JAN. 7,1995  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION NE OFF IWATE PREF  
 LATITUDE 40°13.2' N  
 LONGITUDE 142°18.5' E  
 DEPTH 47.8KM  
 JMA MAGNITUDE 7.2  
 \*\*\*\*\*

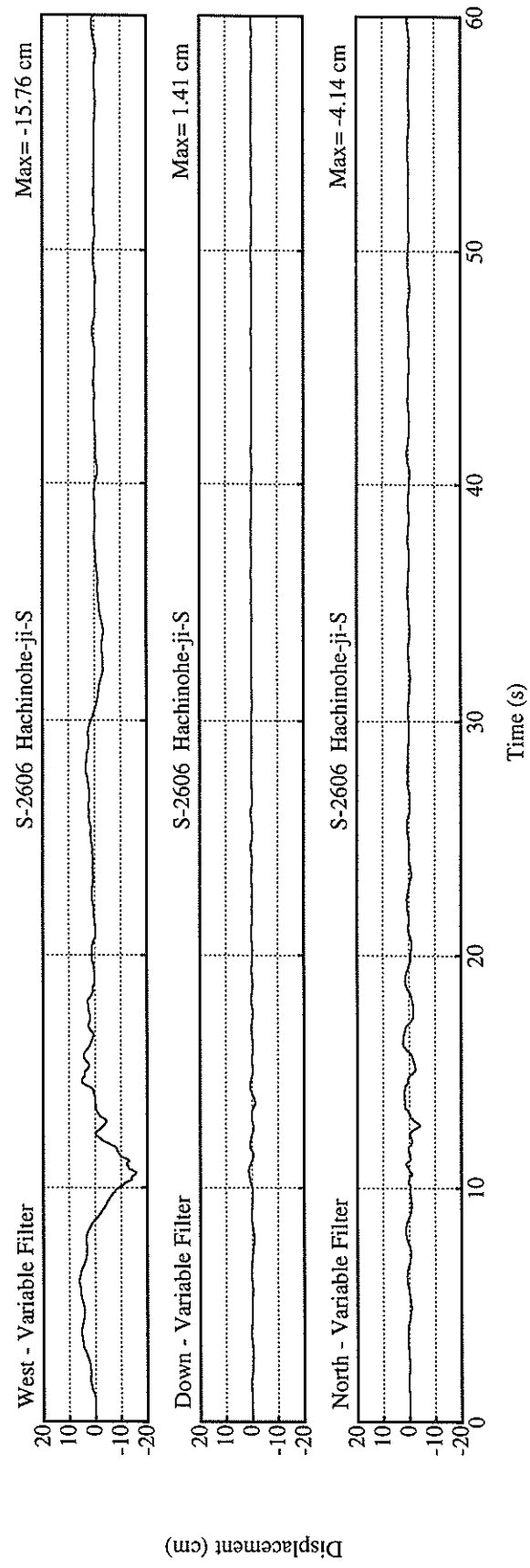
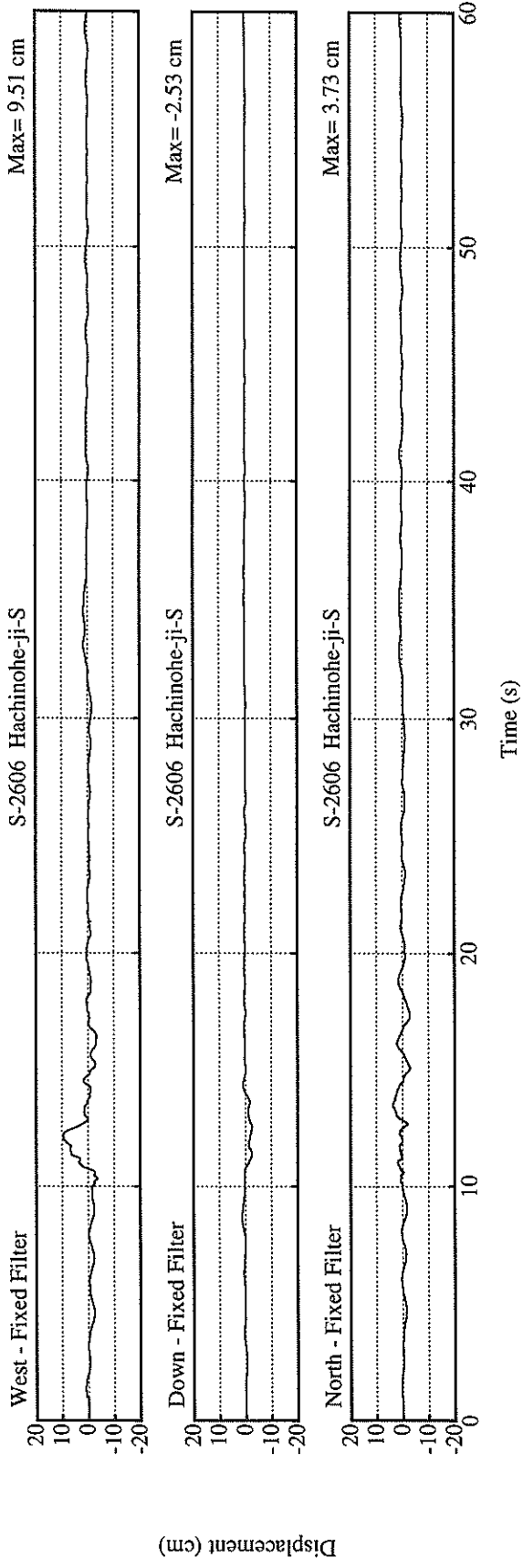
PEAK VALUES OF COMPONENTS

	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.157	0.073	0.194	
MAXIMUM ACCELERATION (GAL)				
ORIGINAL	239.3	275.7	71.2	296.4
CORRECTED	294.5	551.7	139.7	558.0
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	17.92	29.56	7.03	30.35
VARIABLE FILTER	17.22	27.69	7.24	27.69
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	3.73	9.51	2.53	9.56
VARIABLE FILTER	4.14	15.76	1.41	15.79

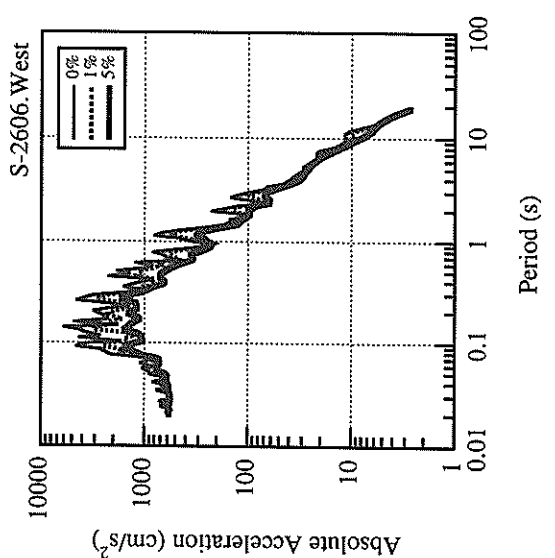
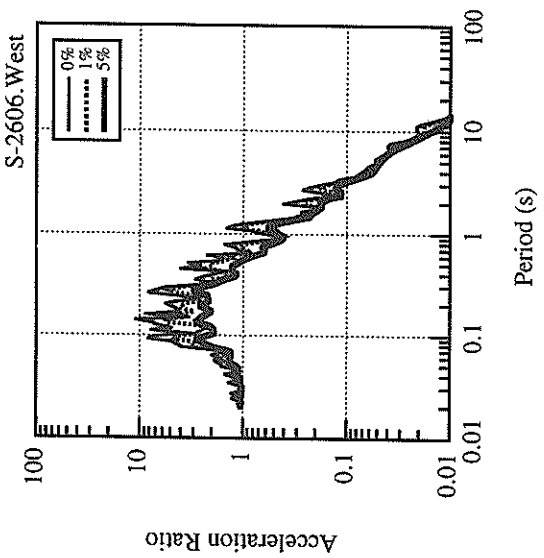
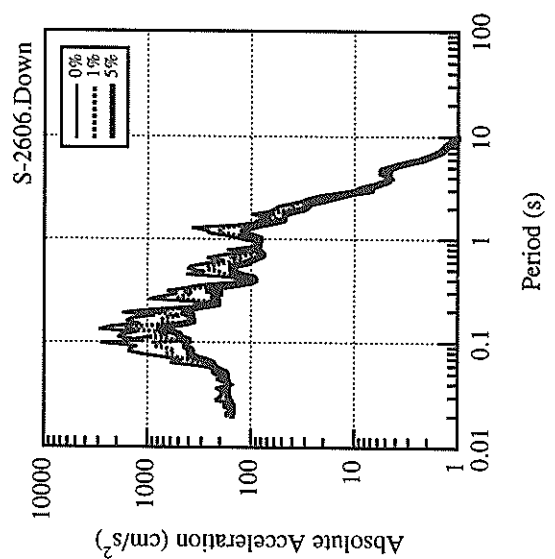
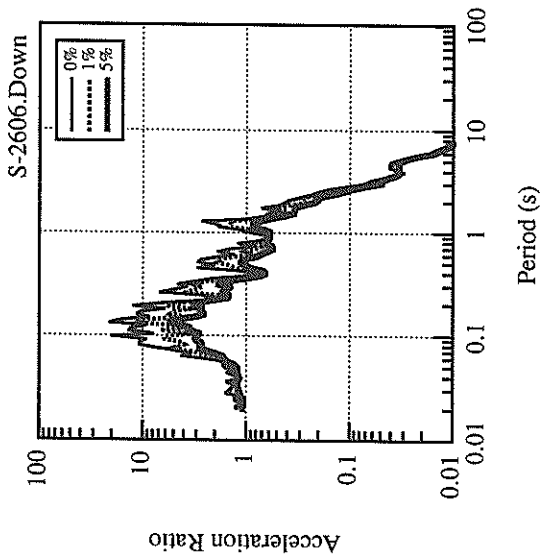
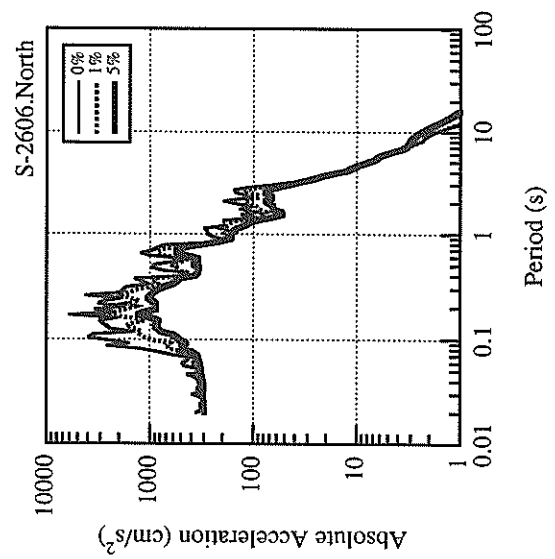
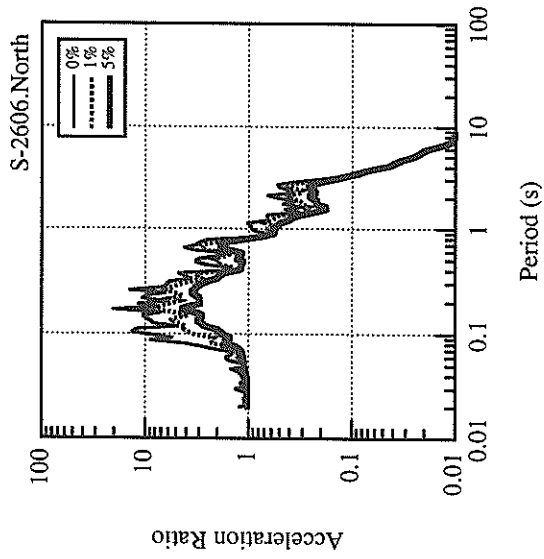
\* RESULTANT OF HORIZONTAL COMPONENTS

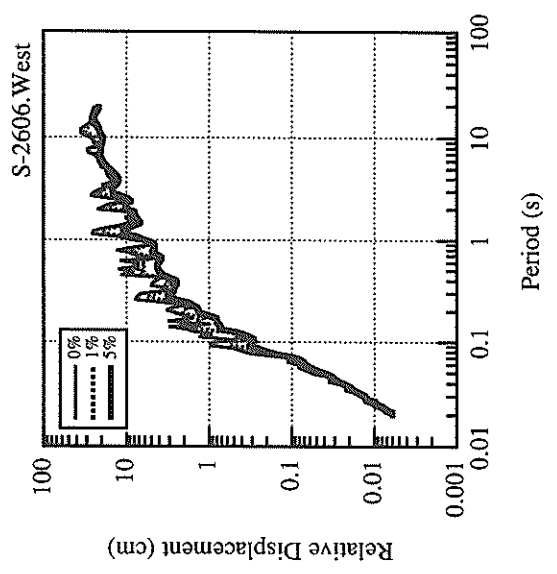
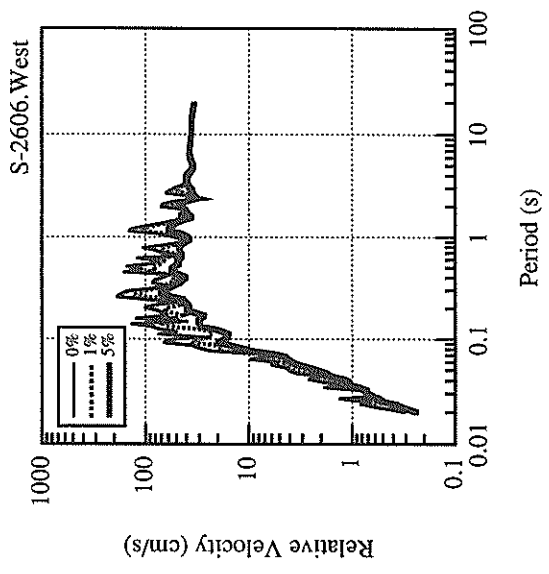
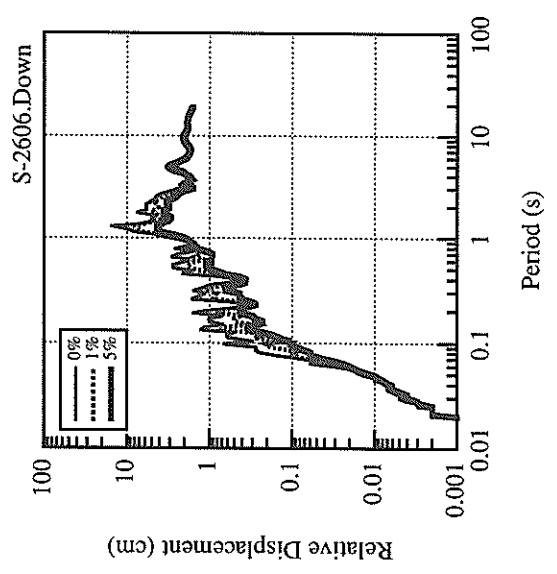
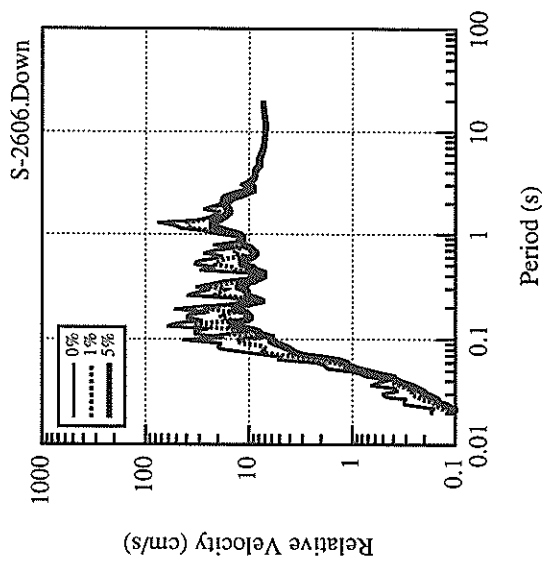
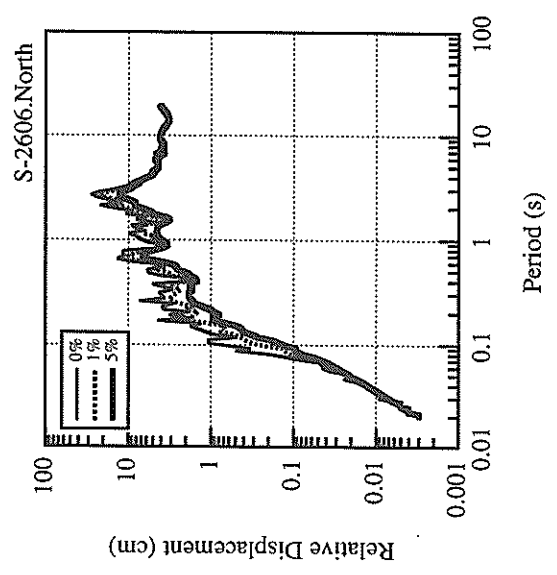
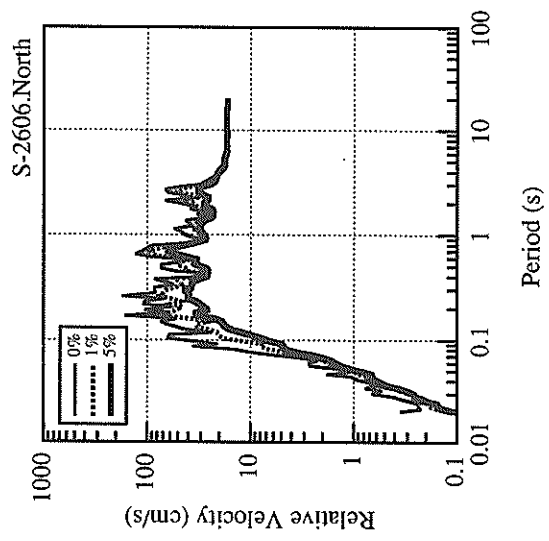


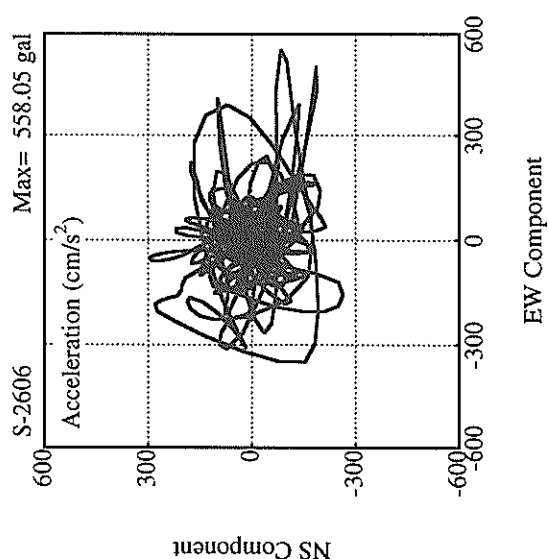
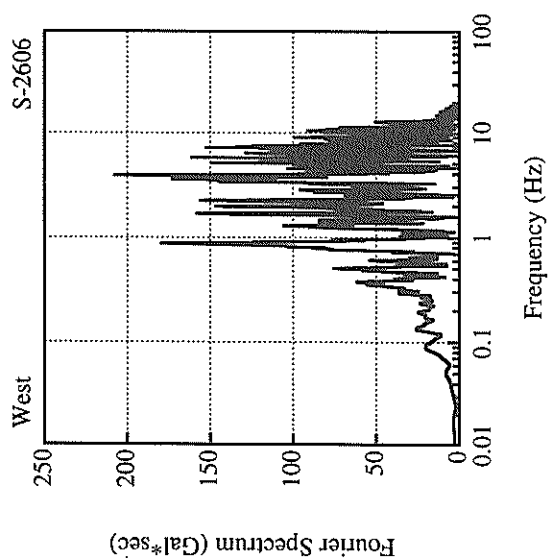
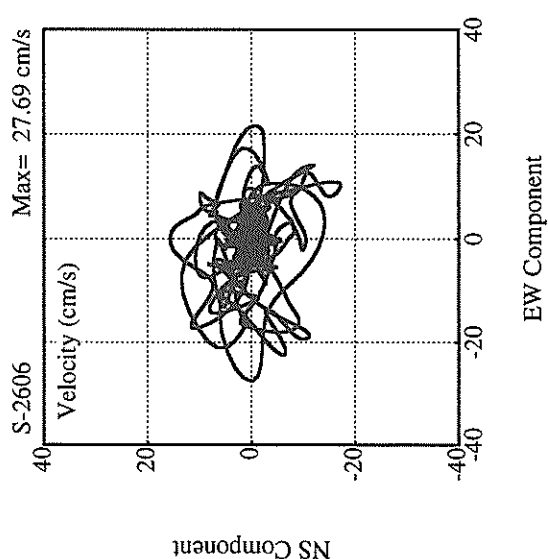
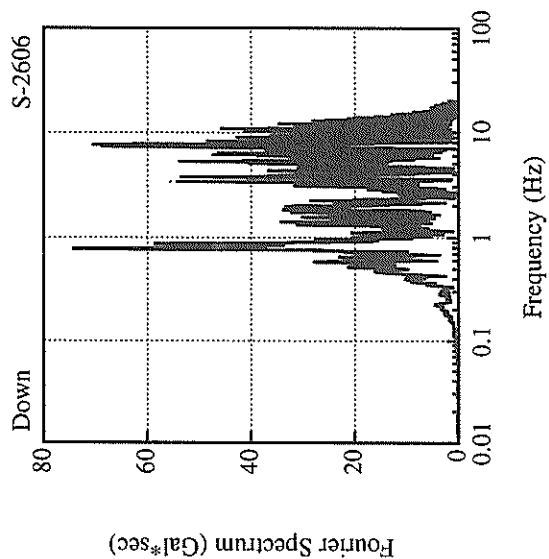
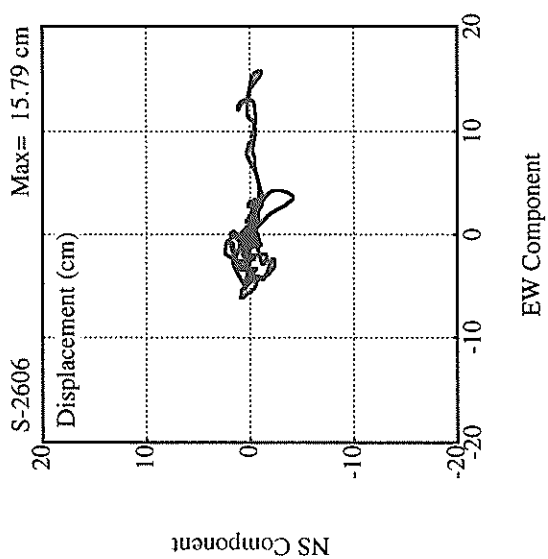
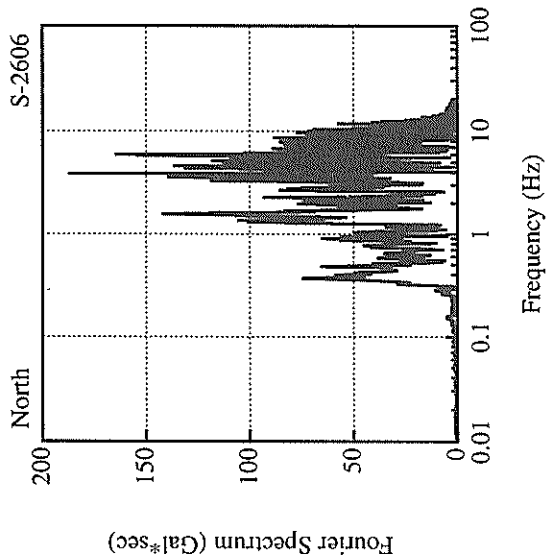












RECORD NUMBER : S-2608  
 STATION : URAKAWA-S

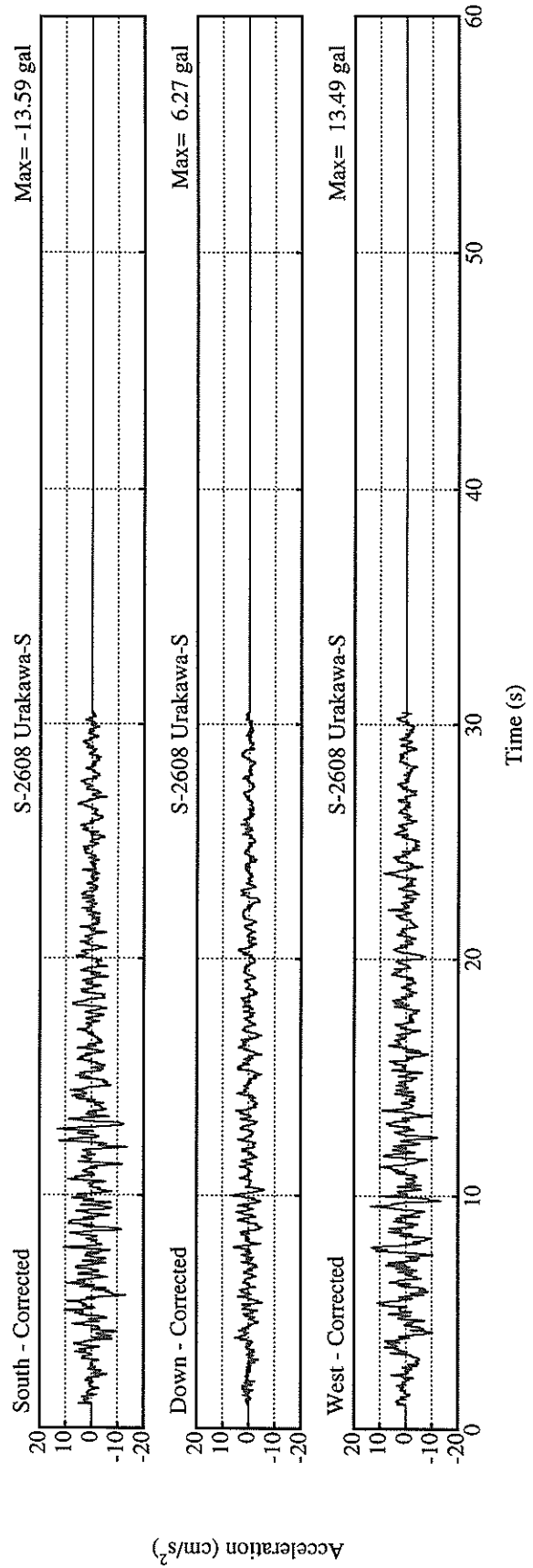
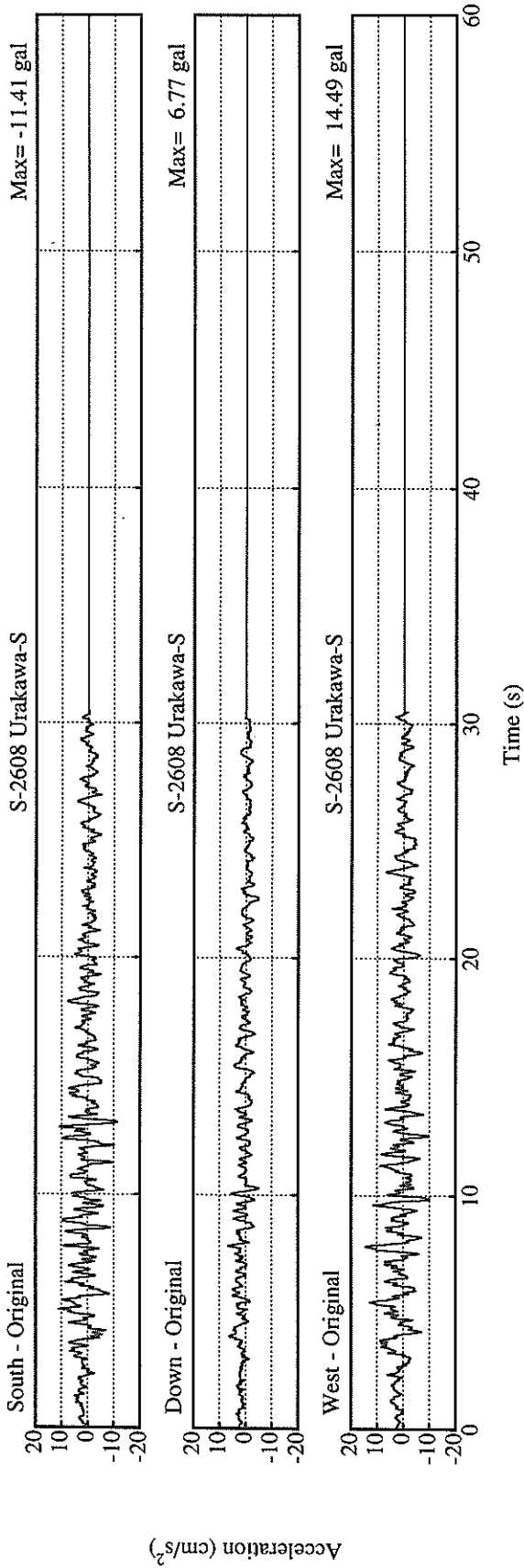
EARTHQUAKE DATA

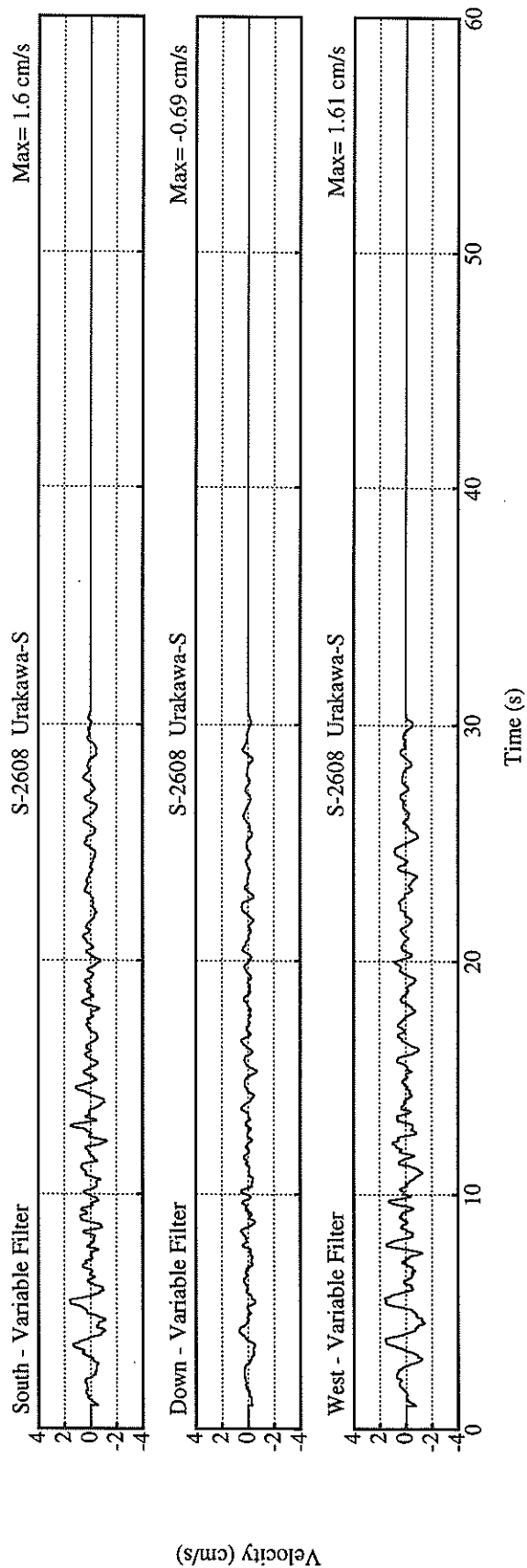
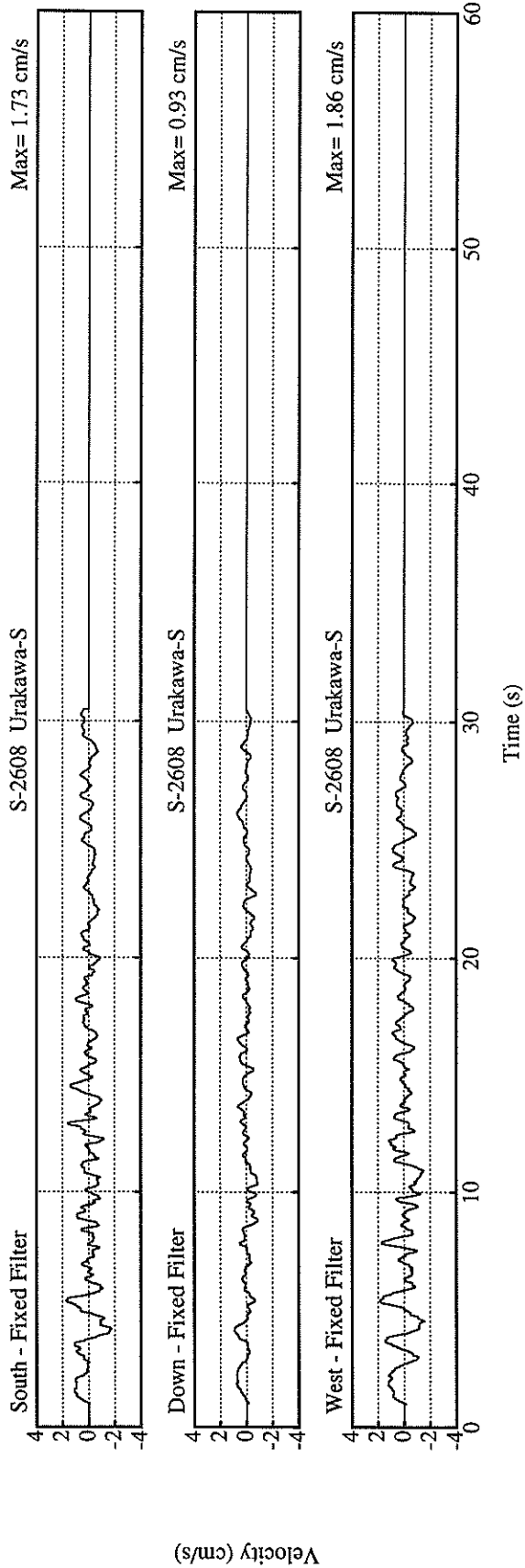
\*\*\*\*\*  
 DATE AND TIME 7:37 JAN. 7,1995  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION NE OFF IWATE PREF  
 LATITUDE 40°13.2' N  
 LONGITUDE 142°18.5' E  
 DEPTH 47.8KM  
 JMA MAGNITUDE 7.2  
 \*\*\*\*\*

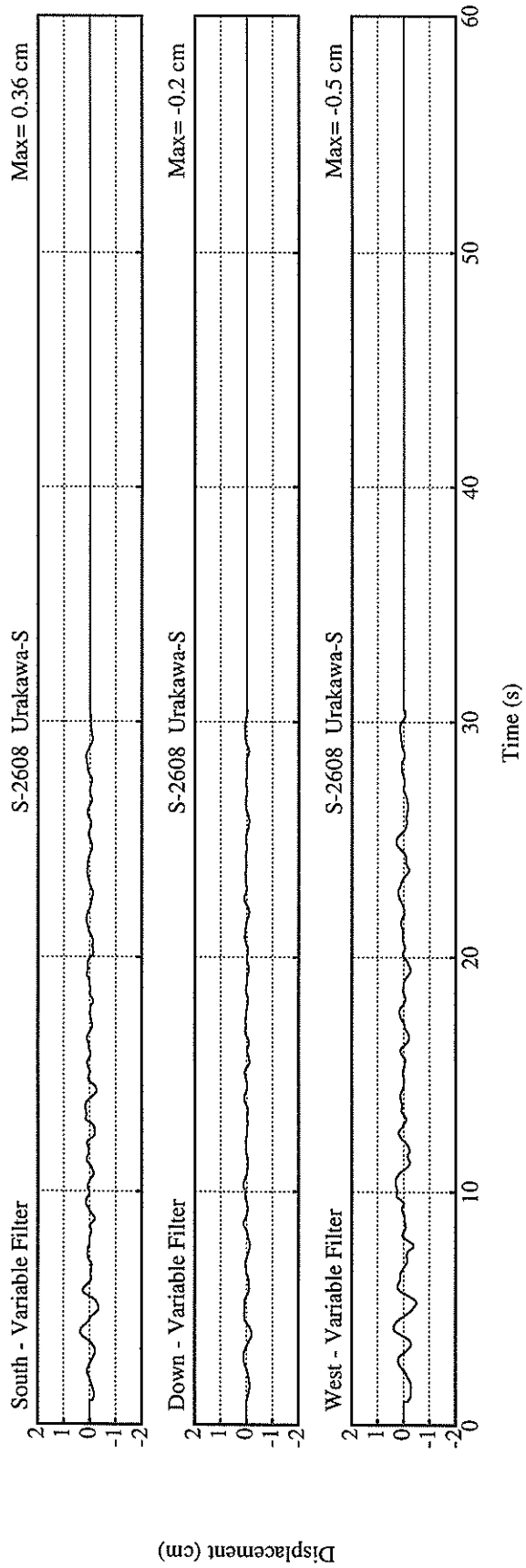
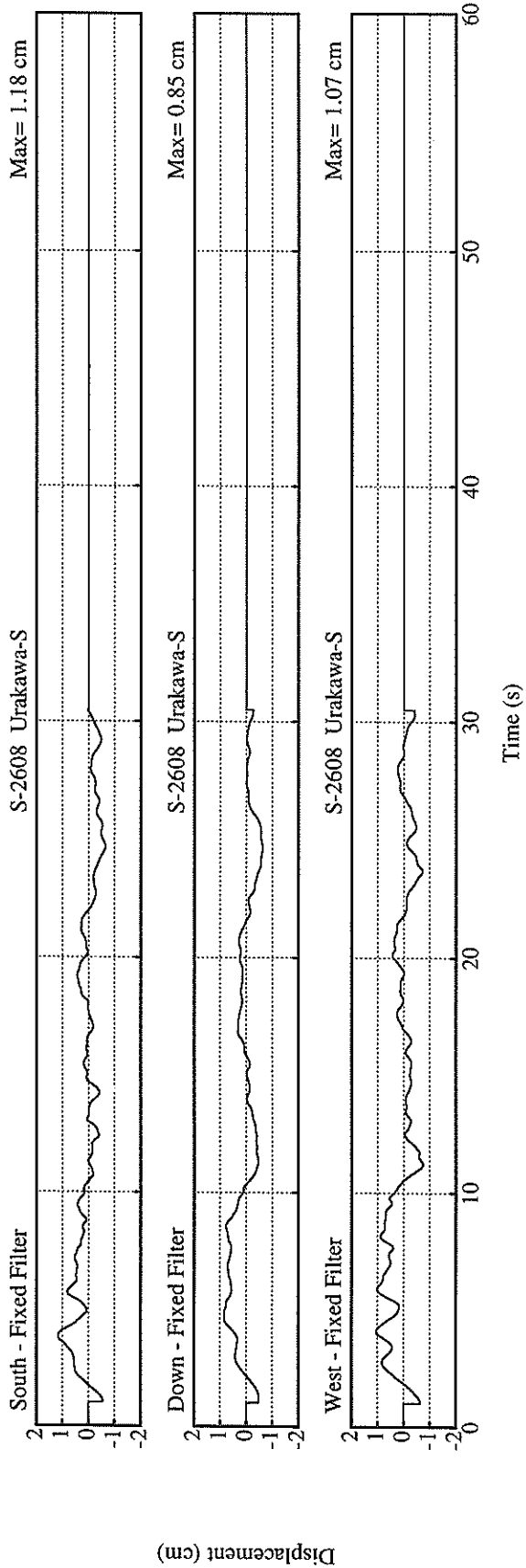
PEAK VALUES OF COMPONENTS

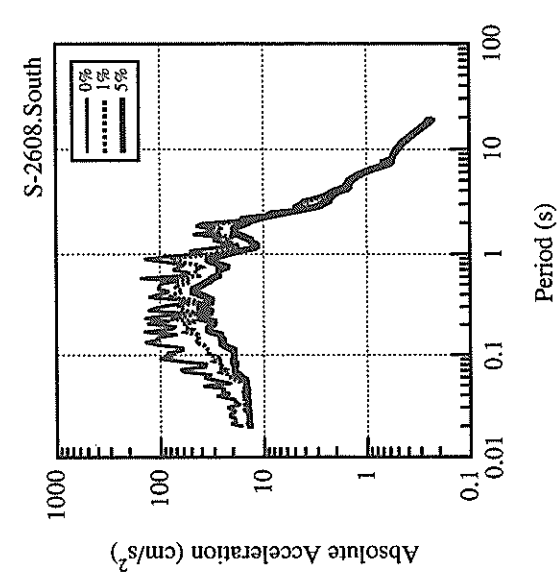
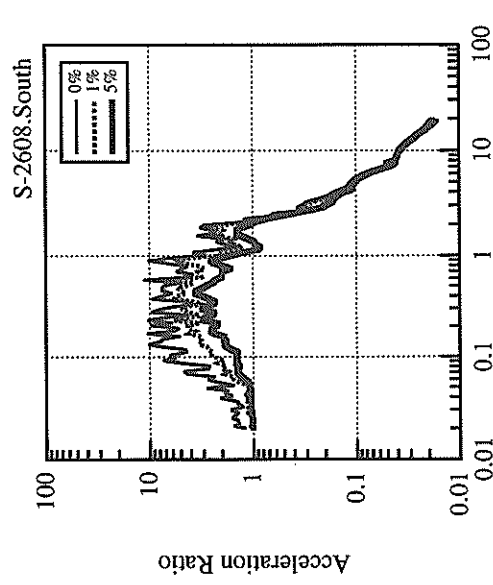
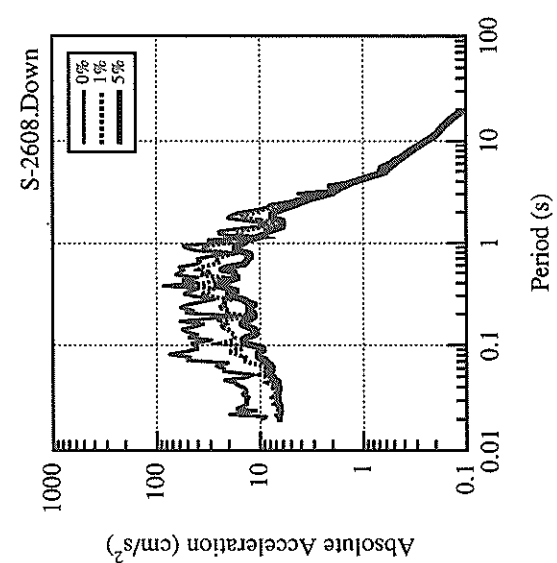
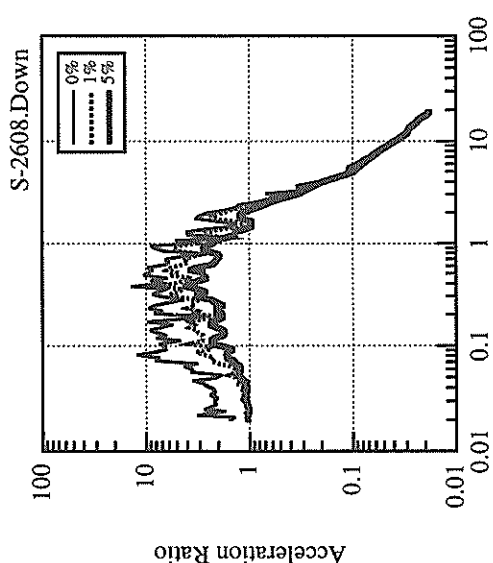
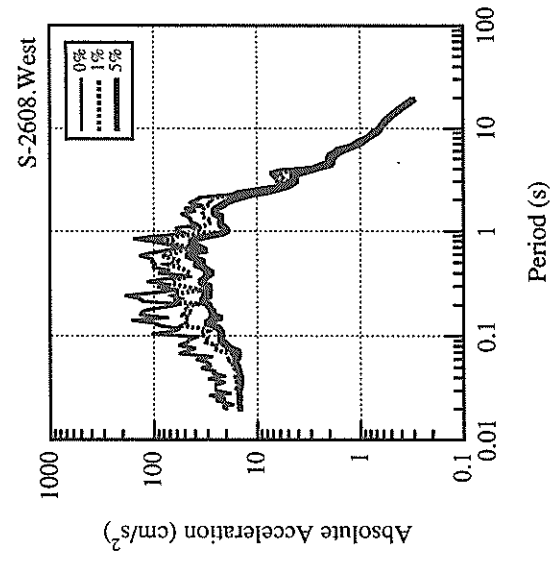
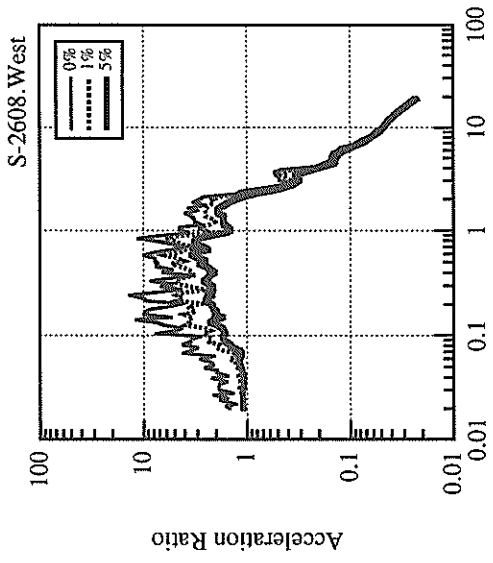
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.315	0.218	0.291	
MAXIMUM ACCELERATION (GAL)				
ORIGINAL	11.4	14.5	6.8	16.6
CORRECTED	13.6	13.5	6.3	16.1
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	1.73	1.86	0.93	2.53
VARIABLE FILTER	1.60	1.61	0.69	2.22
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	1.18	1.07	0.85	1.51
VARIABLE FILTER	0.36	0.50	0.20	0.56

\* RESULTANT OF HORIZONTAL COMPONENTS

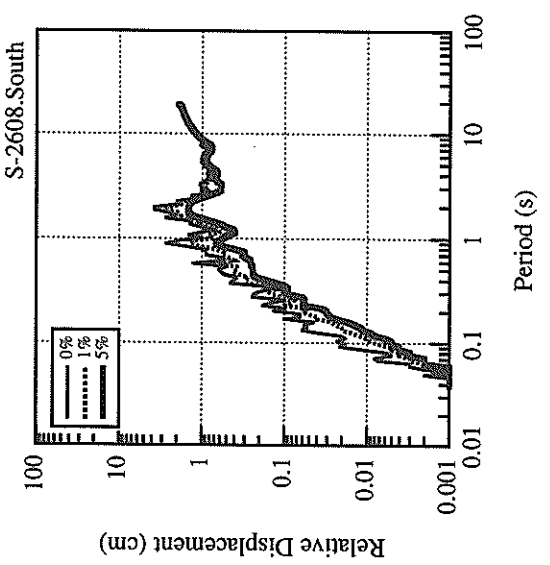
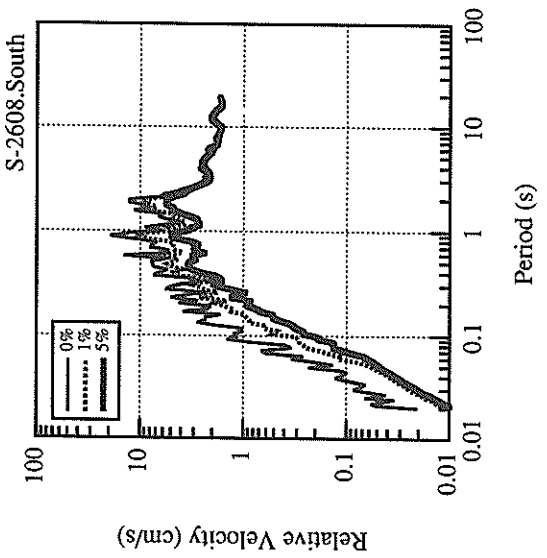
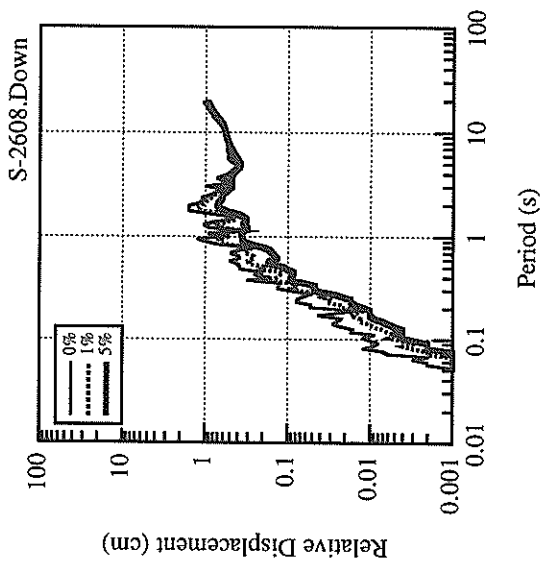
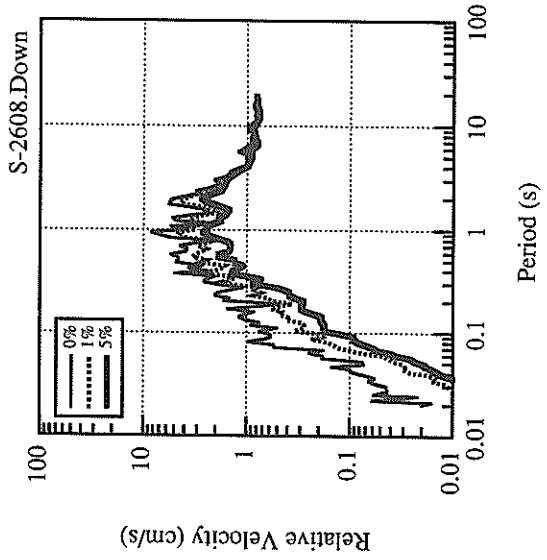
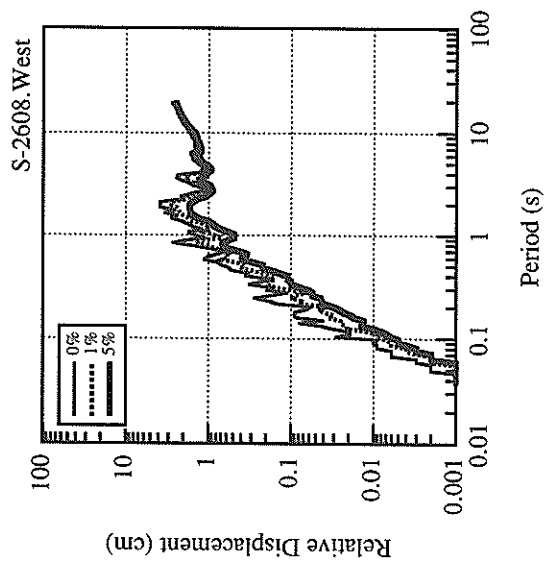
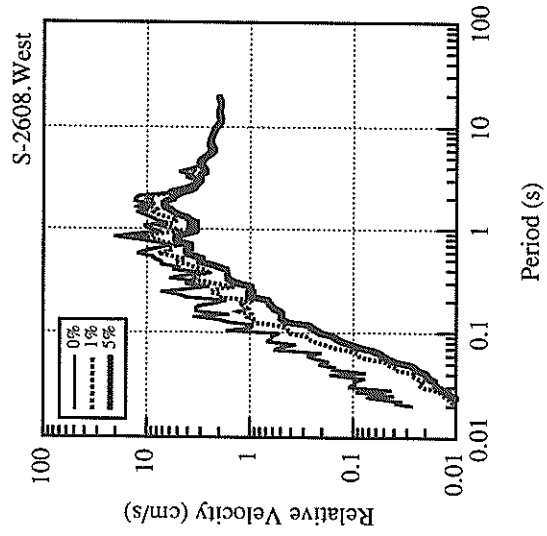


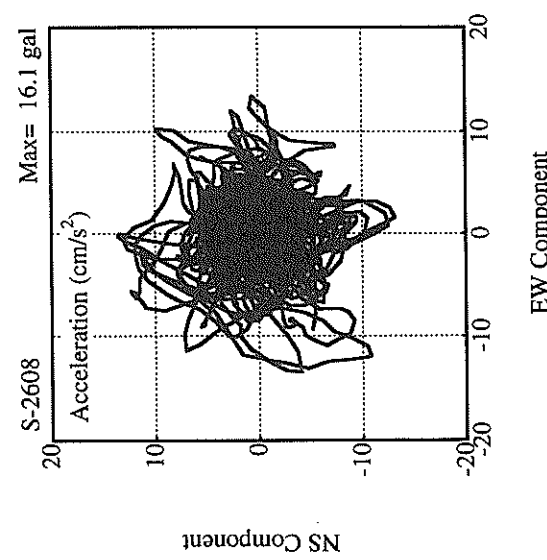
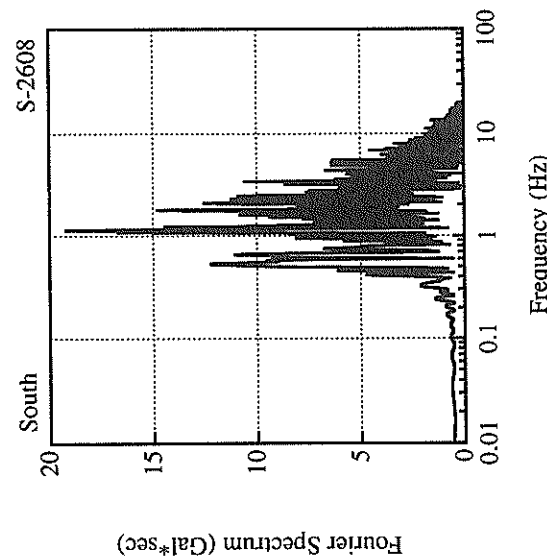
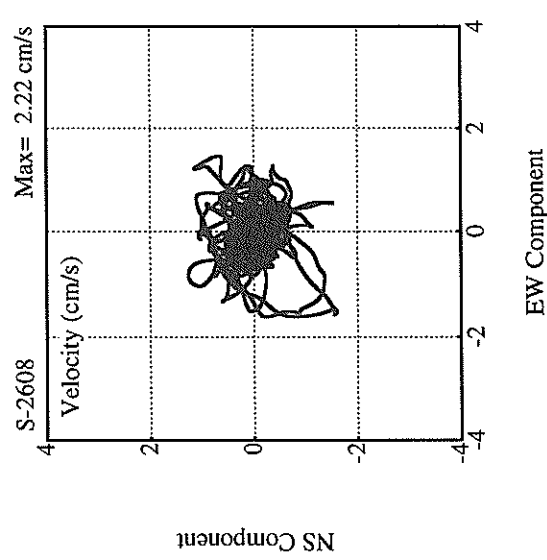
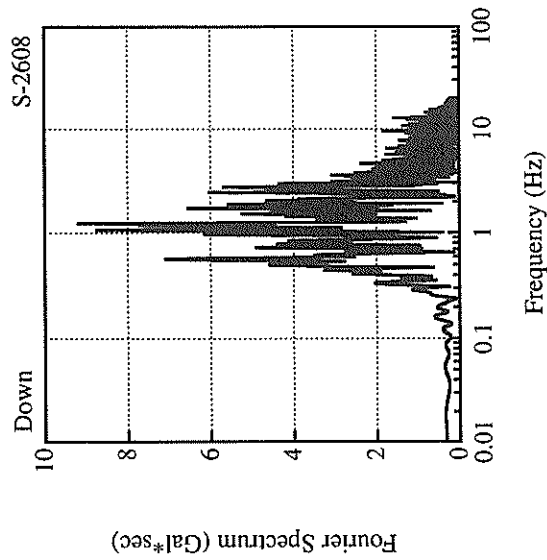
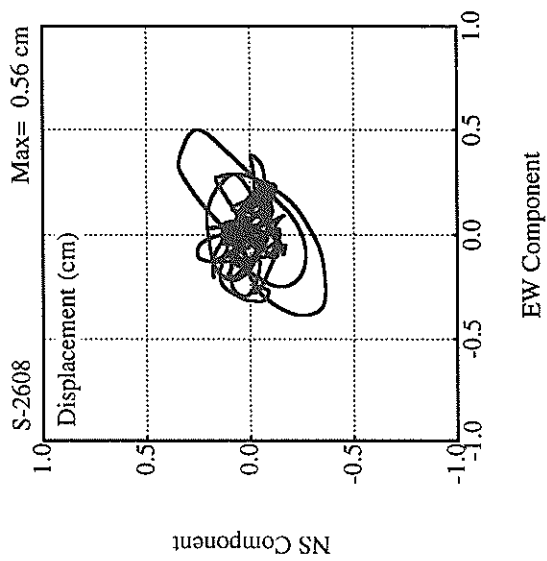
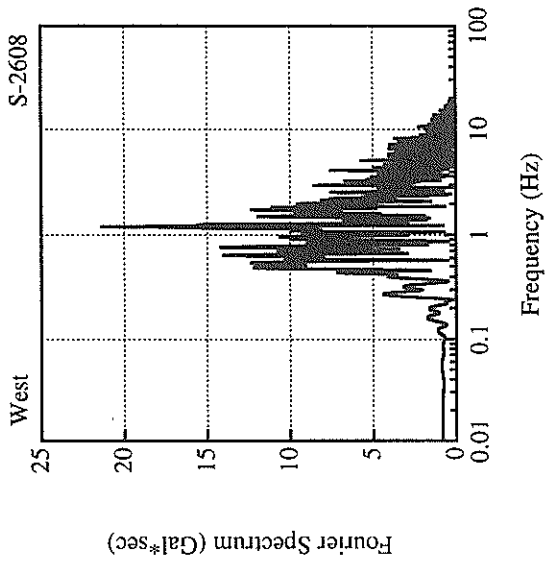












RECORD NUMBER : S-2610

STATION : SOMA-S

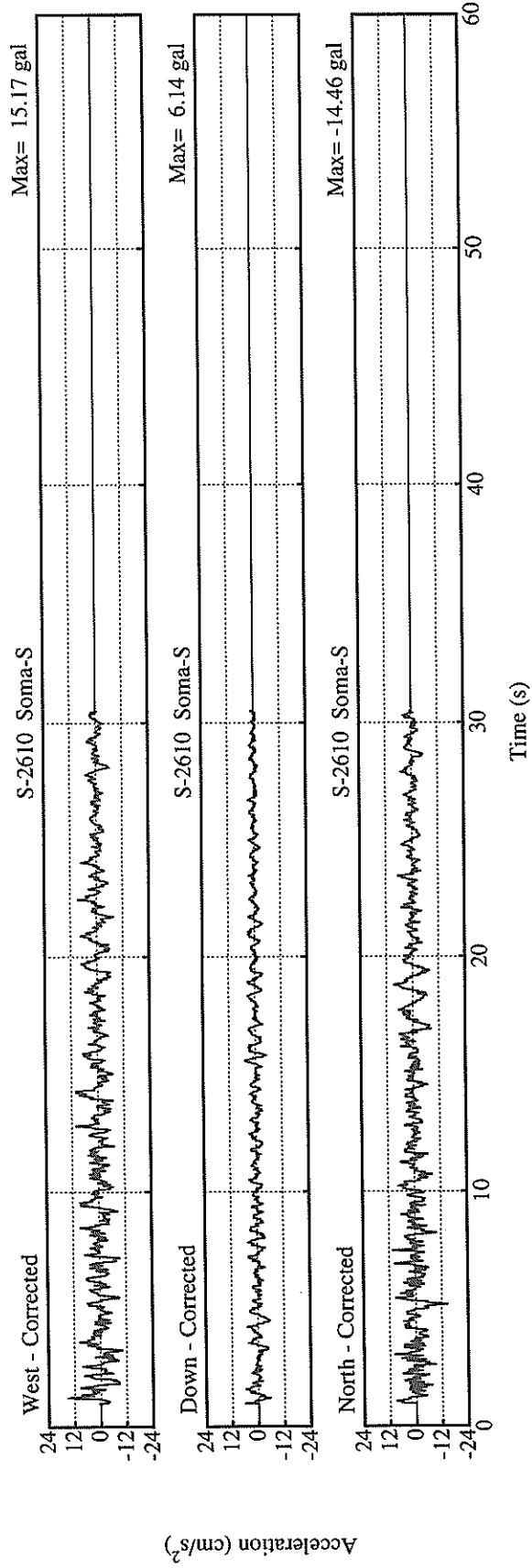
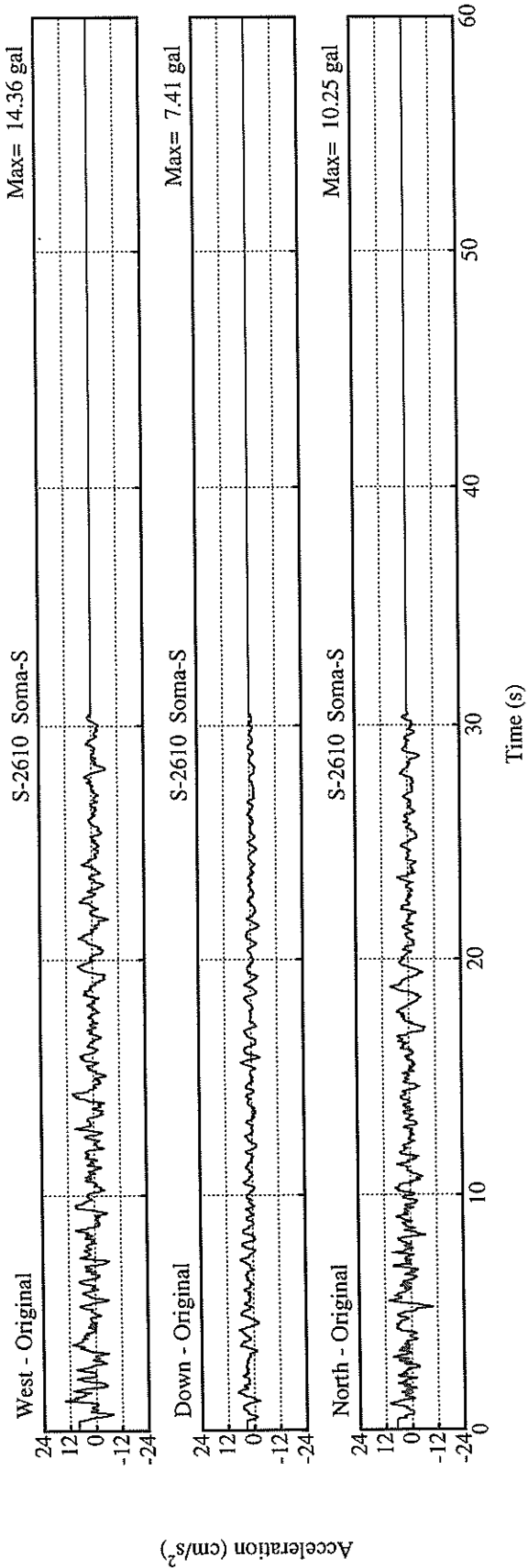
EARTHQUAKE DATA

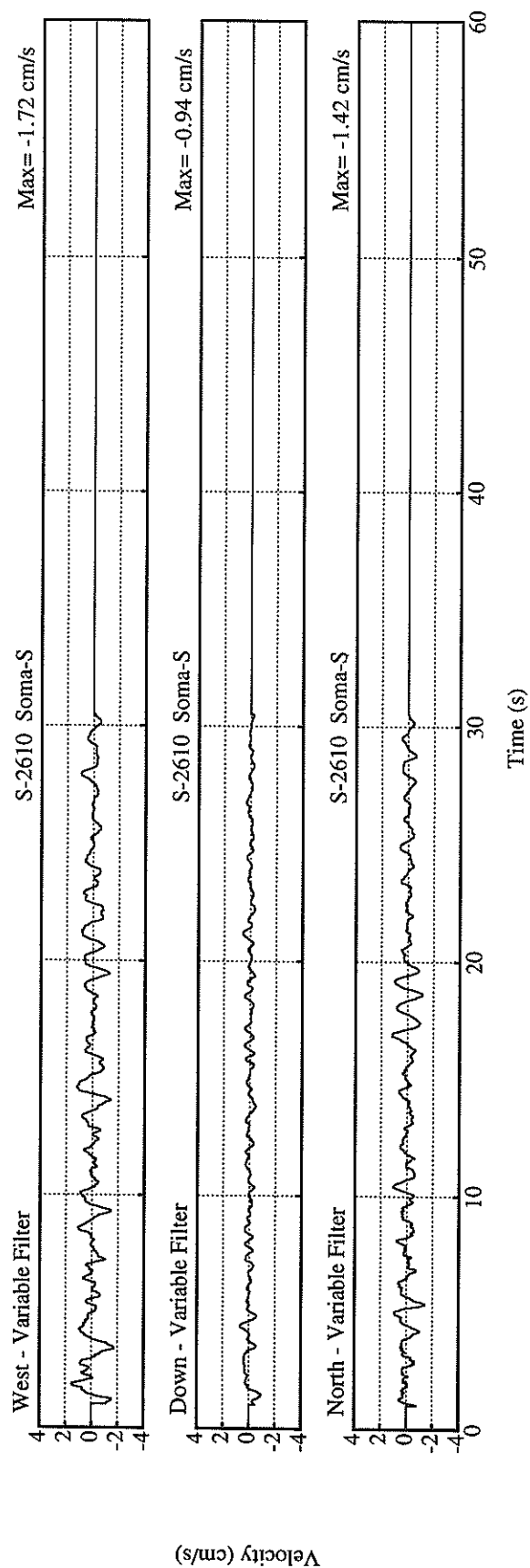
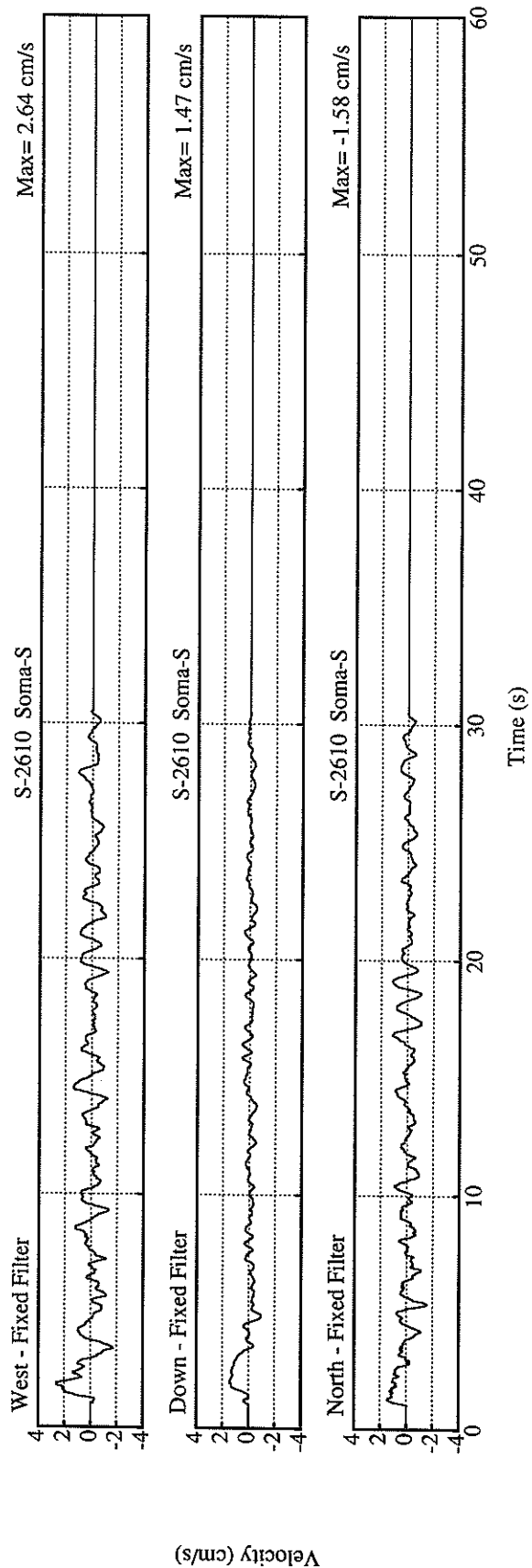
\*\*\*\*\*  
DATE AND TIME 7:37 JAN. 7,1995  
LOCATION OF HYPOCENTER  
EPICENTRAL REGION NE OFF IWATE PREF  
LATITUDE 40°13.2' N  
LONGITUDE 142°18.5' E  
DEPTH 47.8KM  
JMA MAGNITUDE 7.2  
\*\*\*\*\*

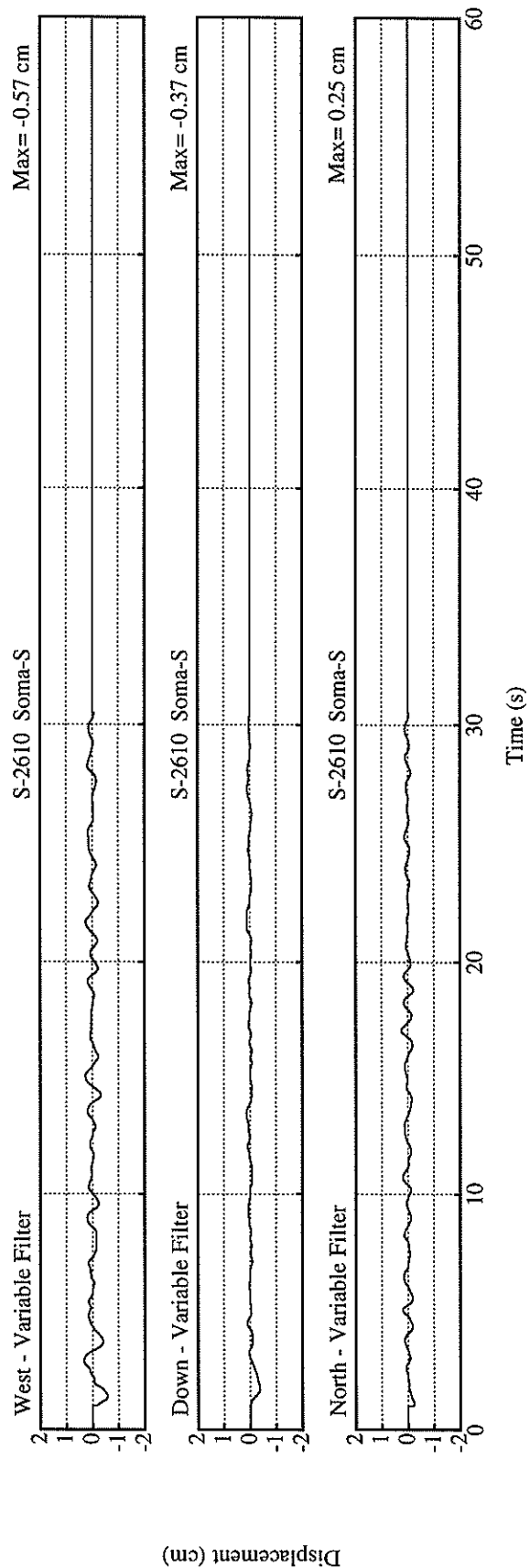
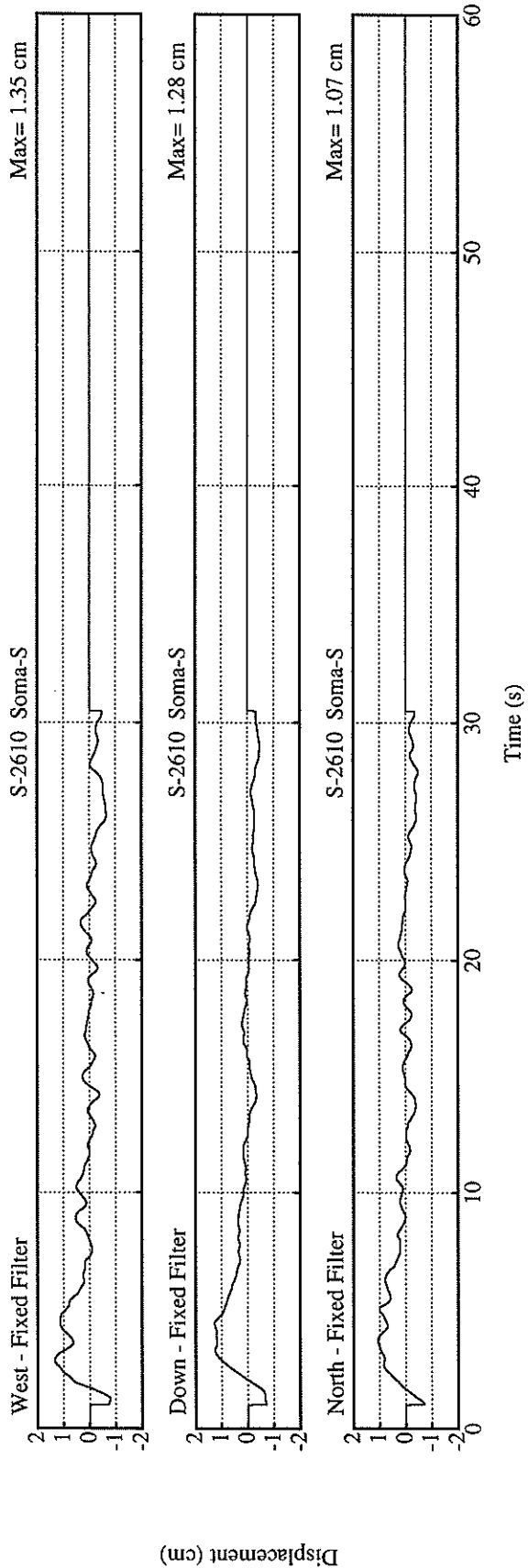
PEAK VALUES OF COMPONENTS

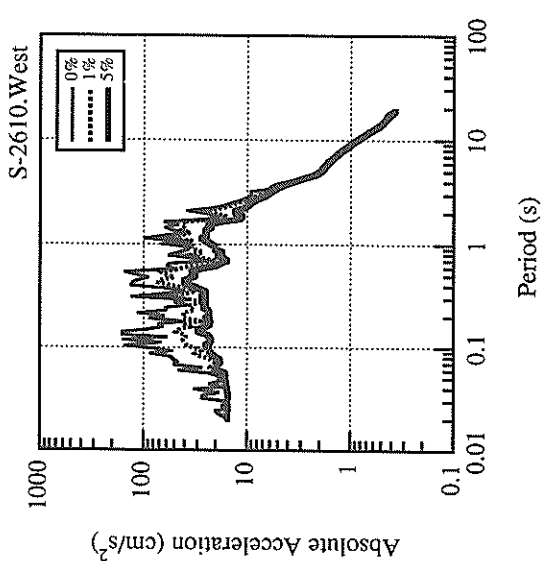
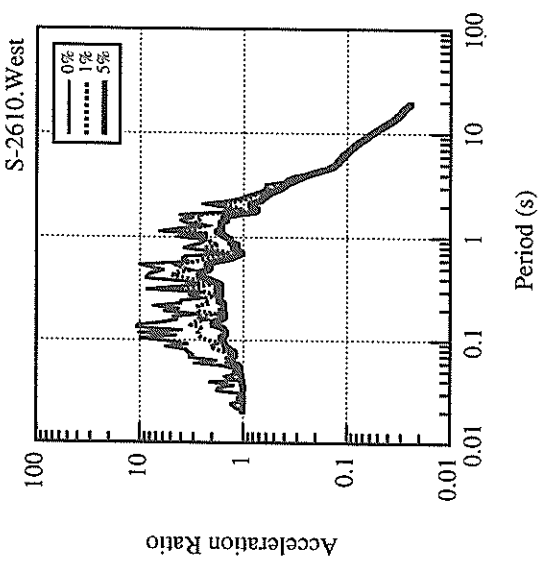
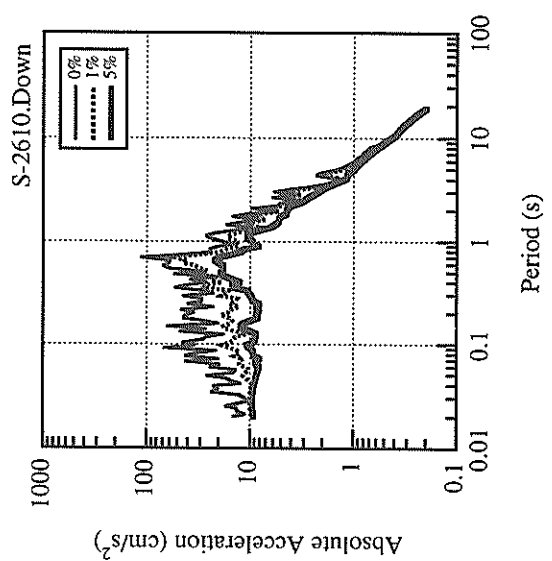
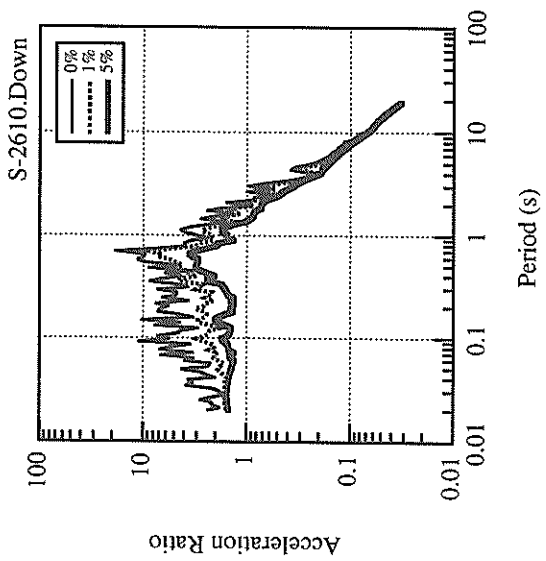
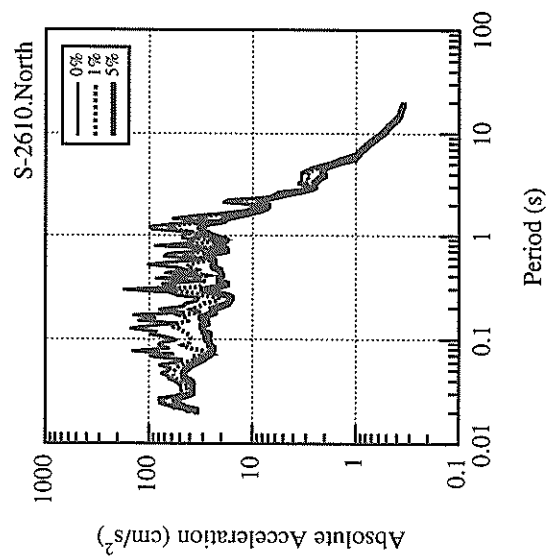
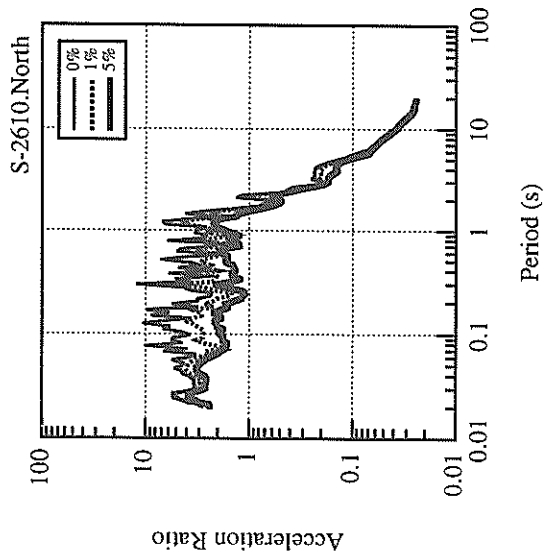
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.303	0.242	0.218	
MAXIMUM ACCELERATION (GAL)				
ORIGINAL	10.2	14.4	7.4	14.4
CORRECTED	14.5	15.2	6.1	15.4
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	1.58	2.64	1.47	2.80
VARIABLE FILTER	1.42	1.72	0.94	1.74
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	1.07	1.35	1.28	1.58
VARIABLE FILTER	0.25	0.57	0.37	0.58

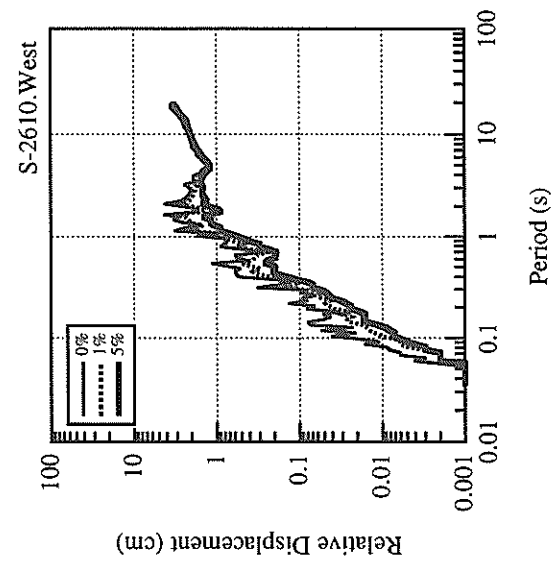
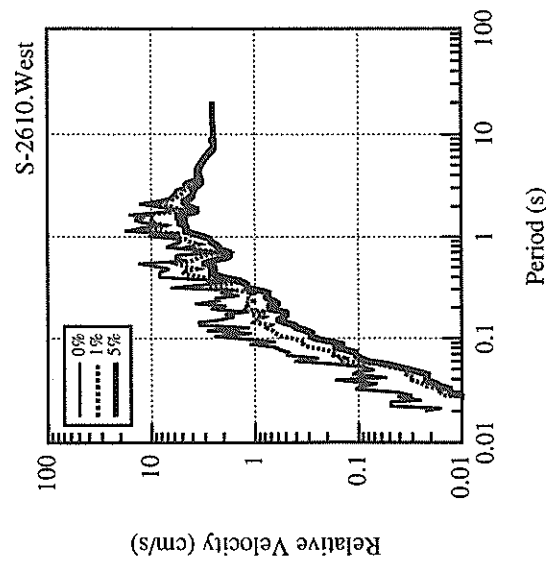
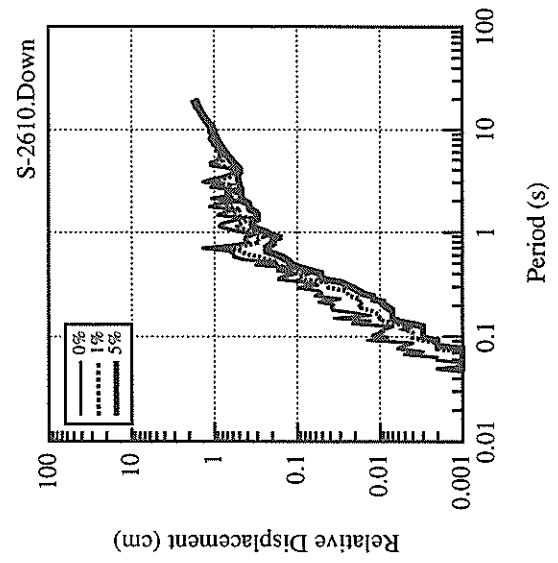
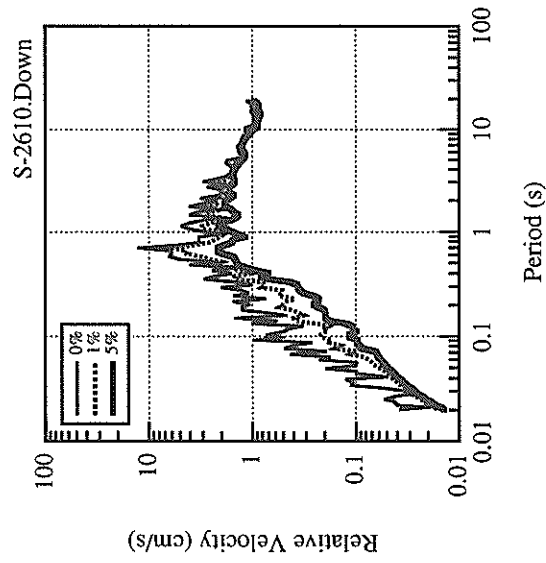
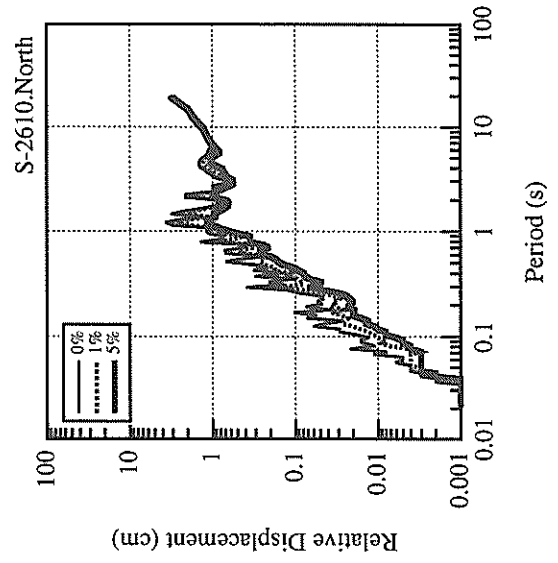
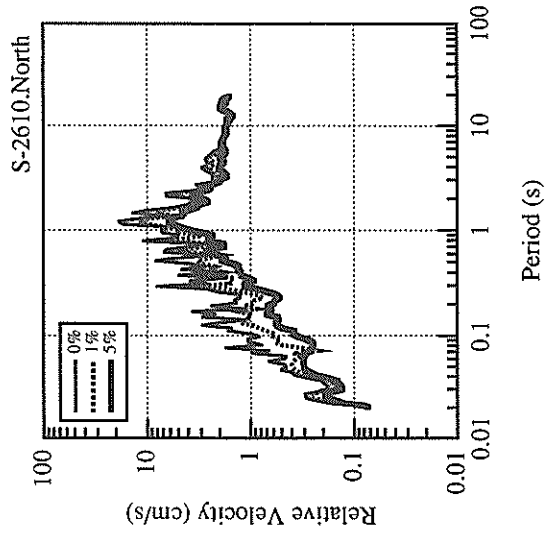
\* RESULTANT OF HORIZONTAL COMPONENTS



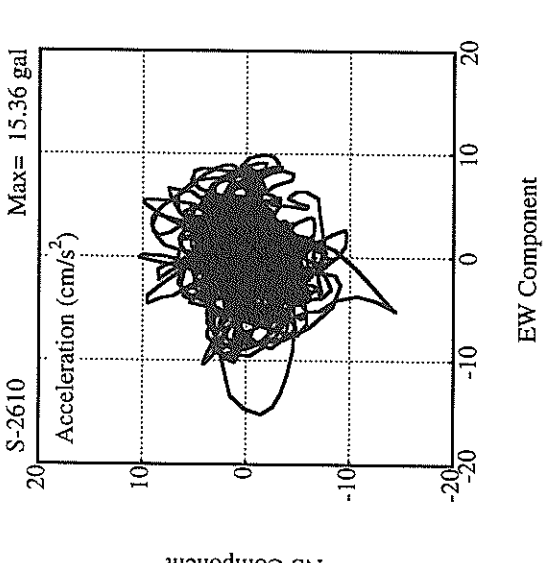
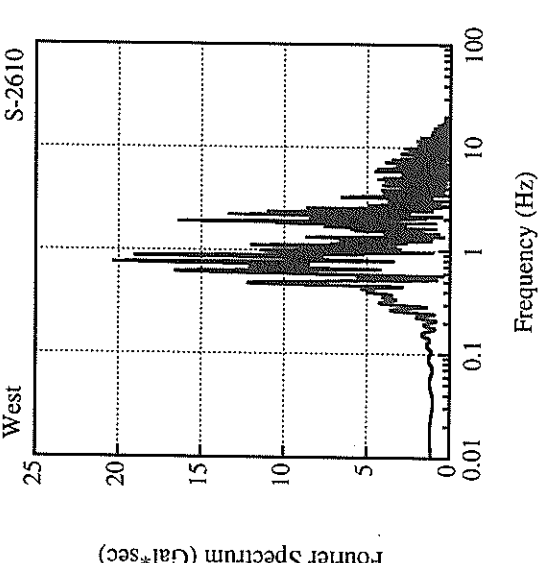
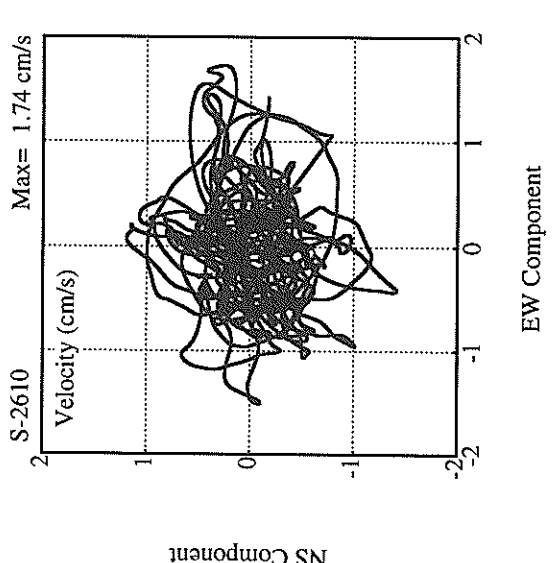
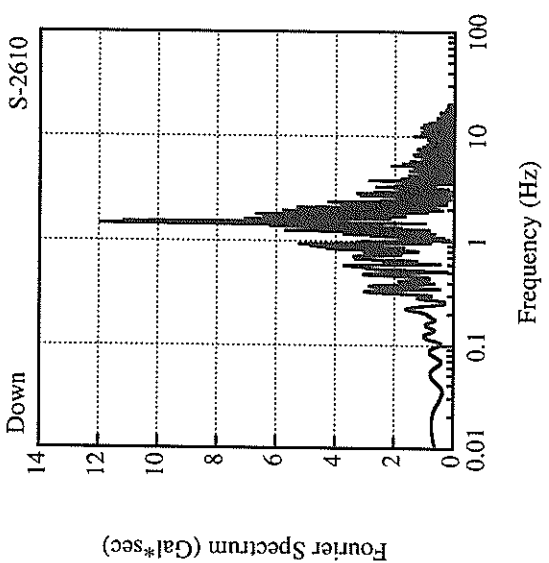
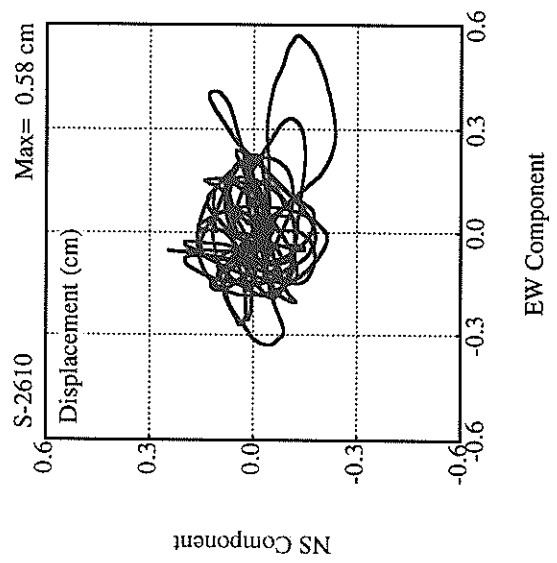
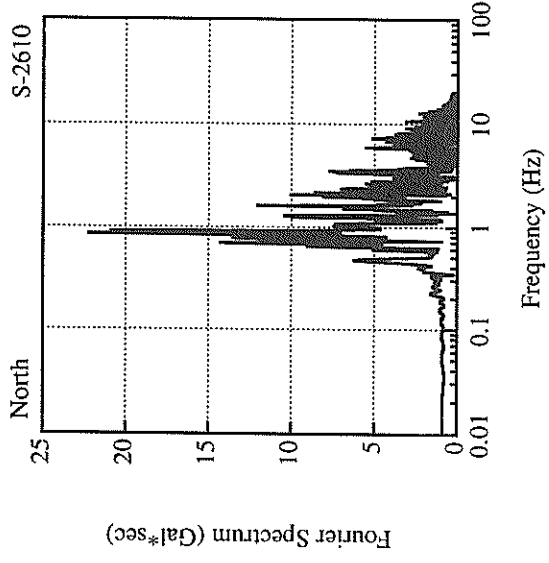












RECORD NUMBER : S-2612  
 STATION : SHIOGAMA-KOJYO-S

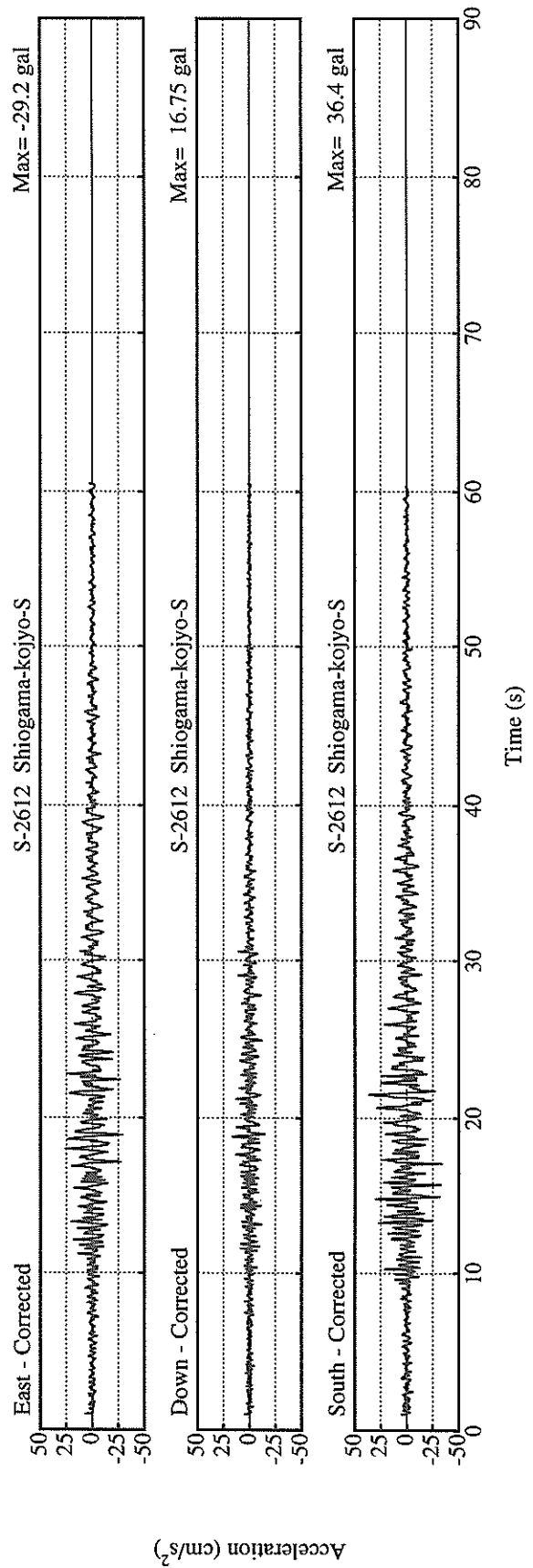
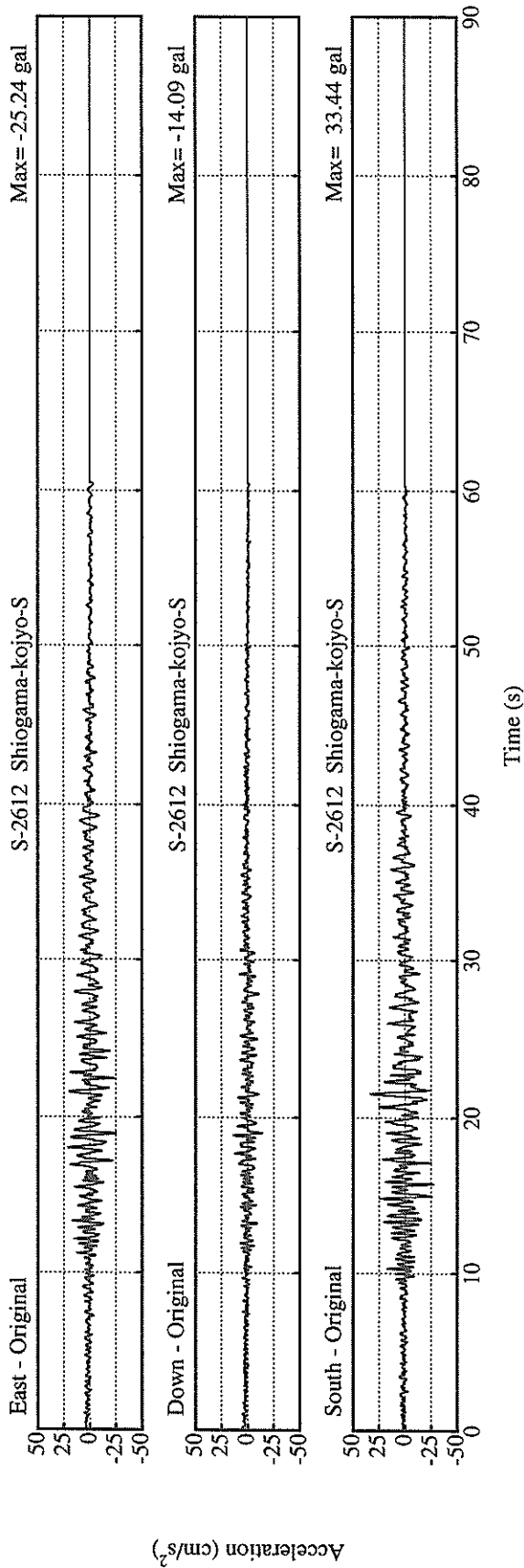
EARTHQUAKE DATA

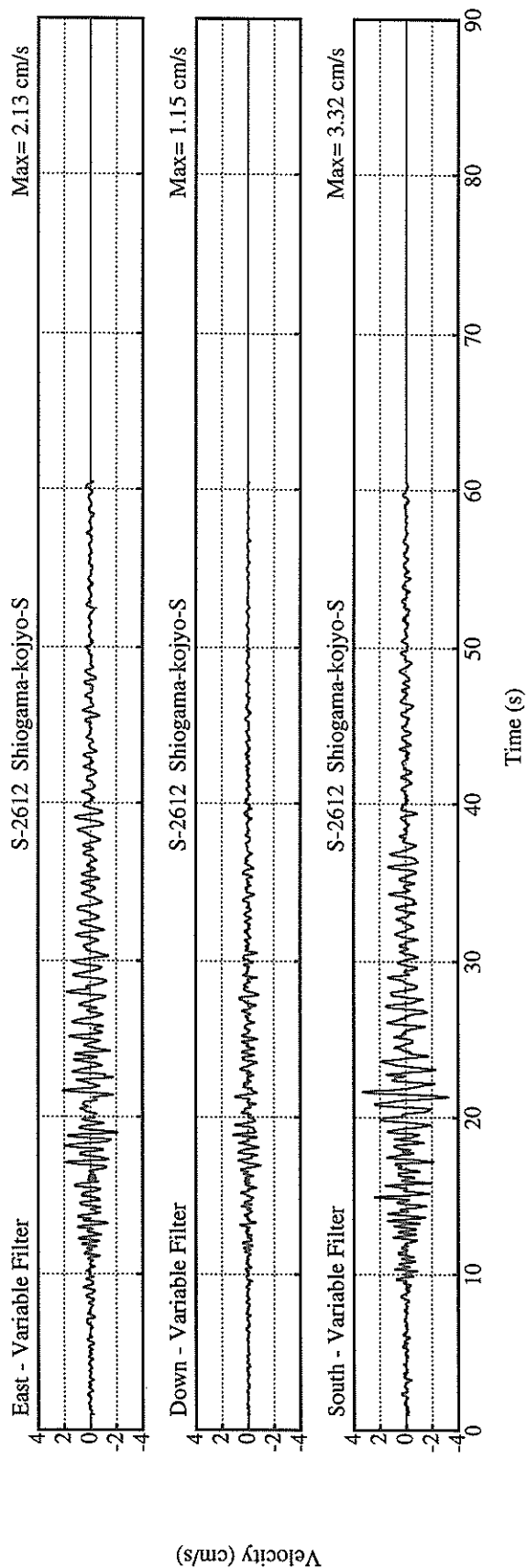
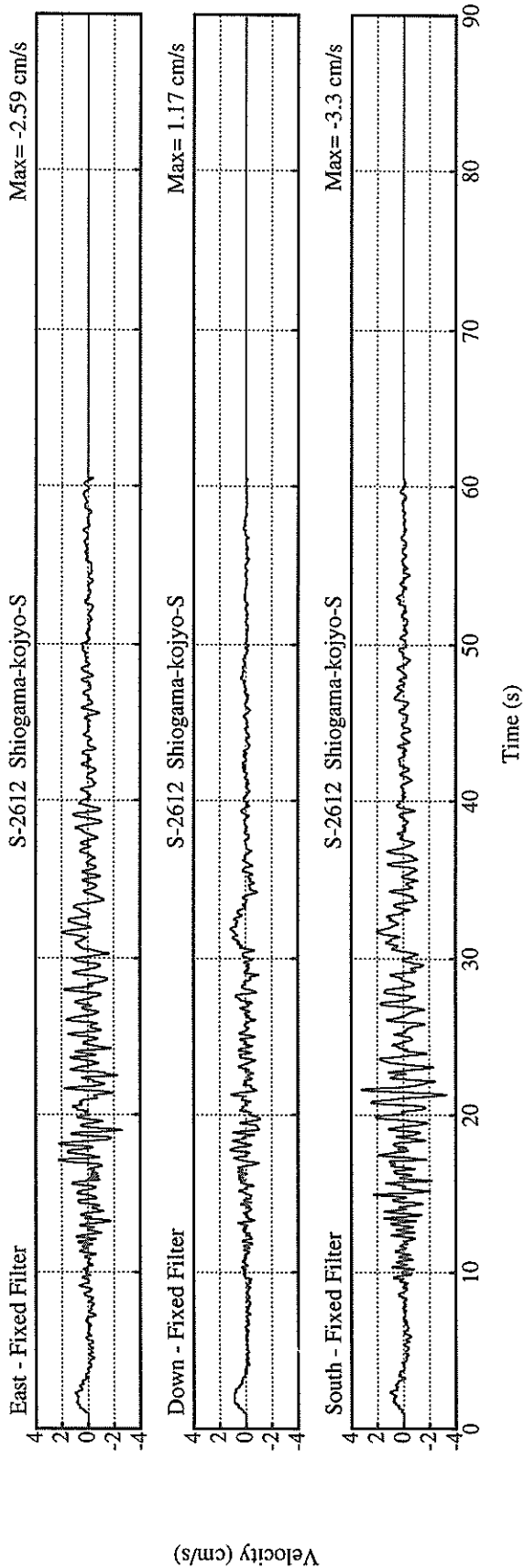
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*****
DATE AND TIME          7:37 JAN. 7,1995
LOCATION OF HYPOCENTER
  EPICENTRAL REGION    NE OFF IWATE PEF
  LATITUDE              40°13.2' N
  LONGITUDE             142°18.5' E
  DEPTH                 47.8KM
  JMA MAGNITUDE        7.2
*****
```

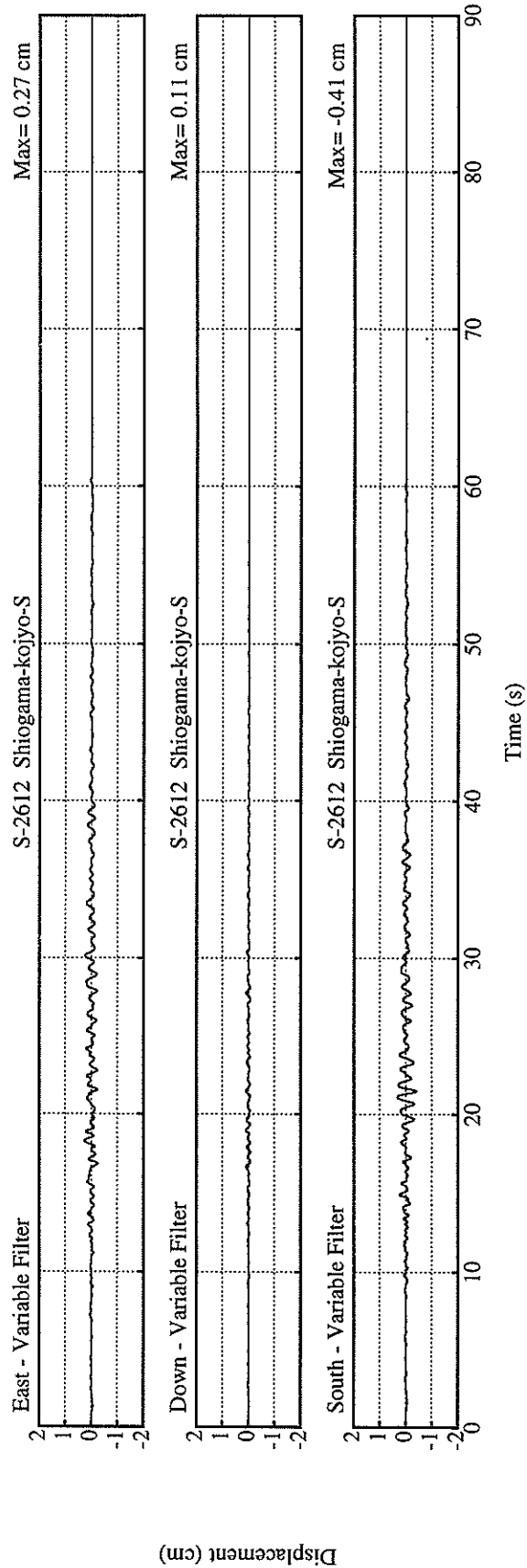
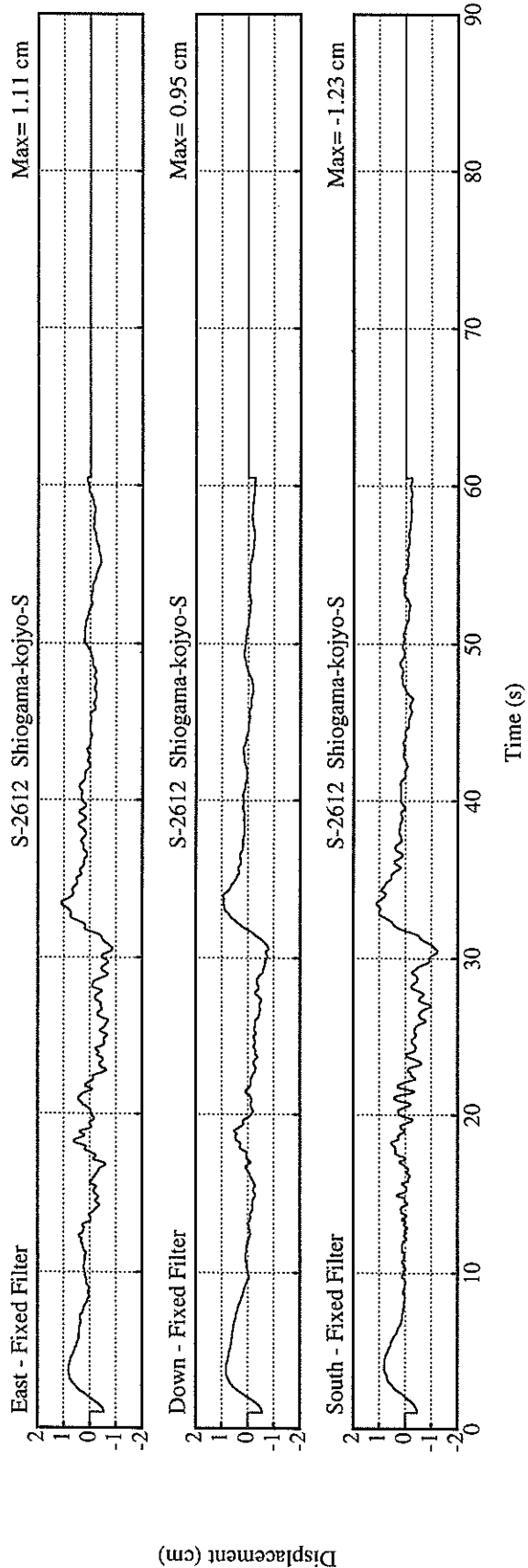
PEAK VALUES OF COMPONENTS

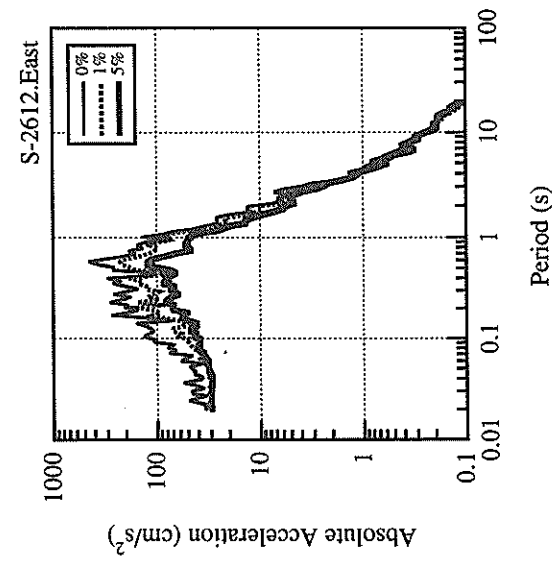
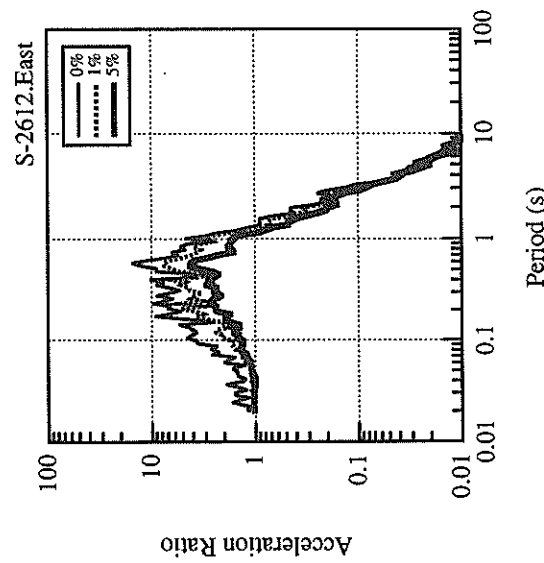
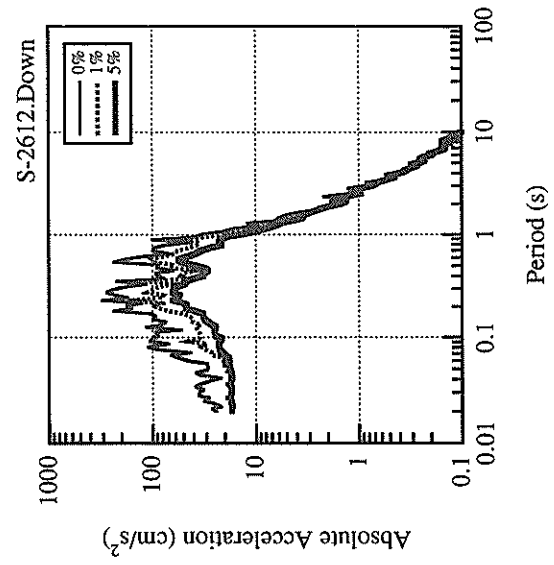
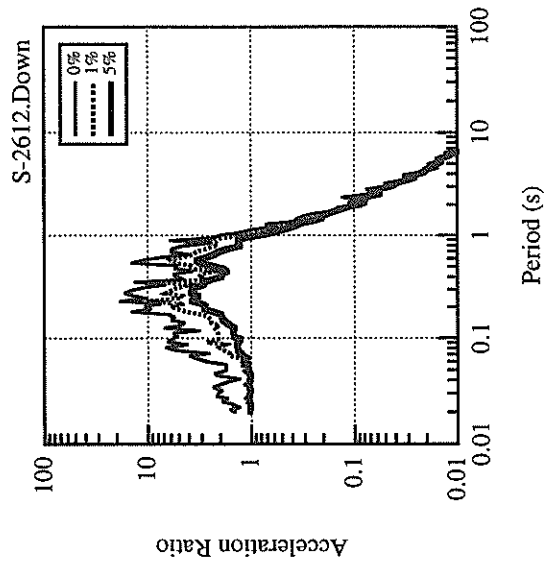
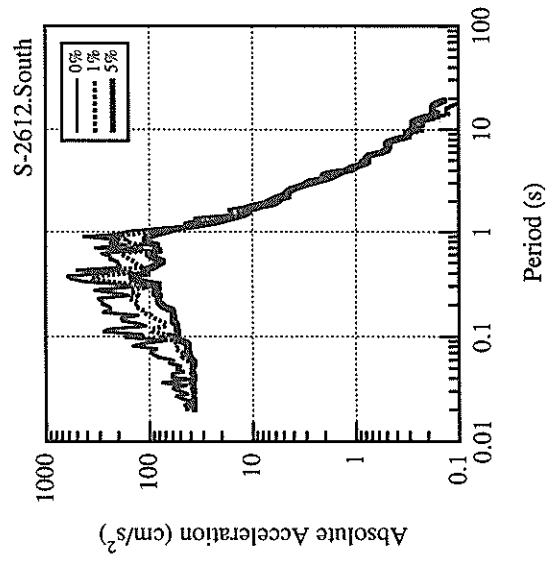
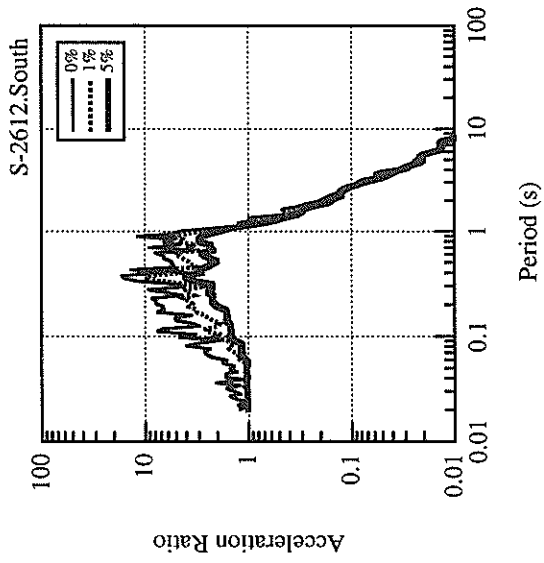
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.377	0.402	0.609	
MAXIMUM ACCELERATION (GAL)				
ORIGINAL	33.4	25.2	14.1	37.2
CORRECTED	36.4	29.2	16.7	41.0
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	3.30	2.59	1.17	3.54
VARIABLE FILTER	3.32	2.13	1.15	3.84
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	1.23	1.11	0.95	1.57
VARIABLE FILTER	0.41	0.27	0.11	0.46

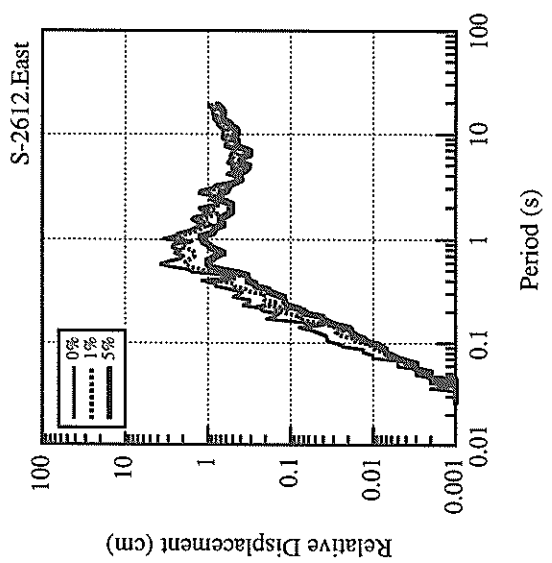
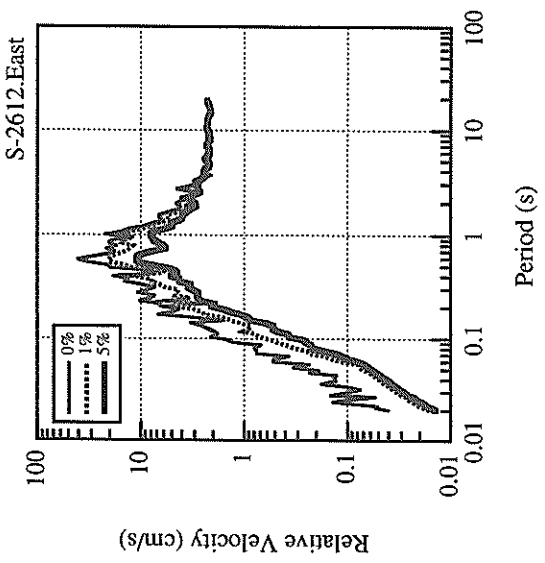
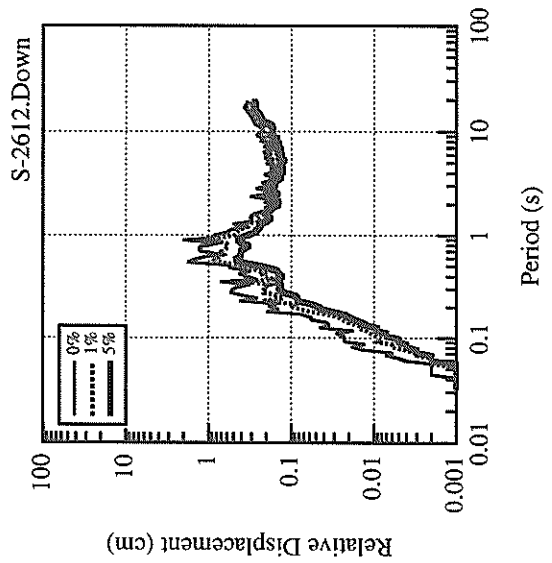
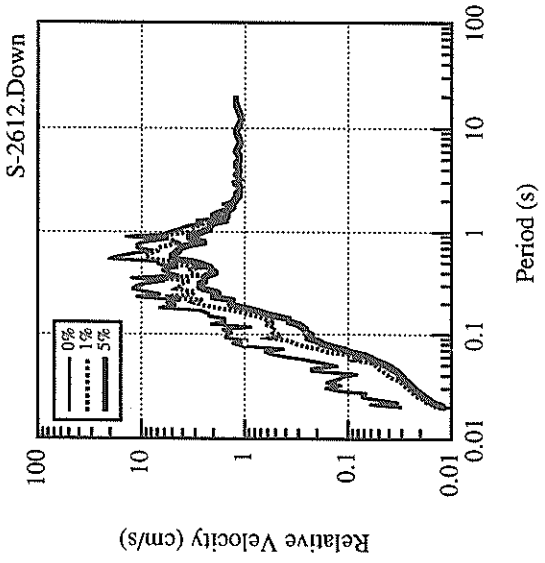
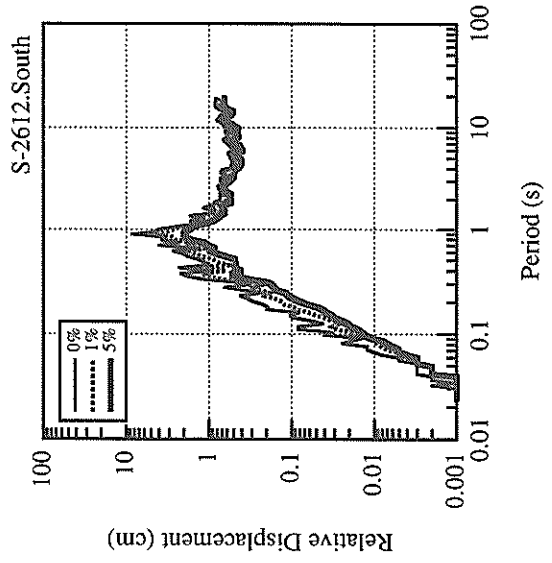
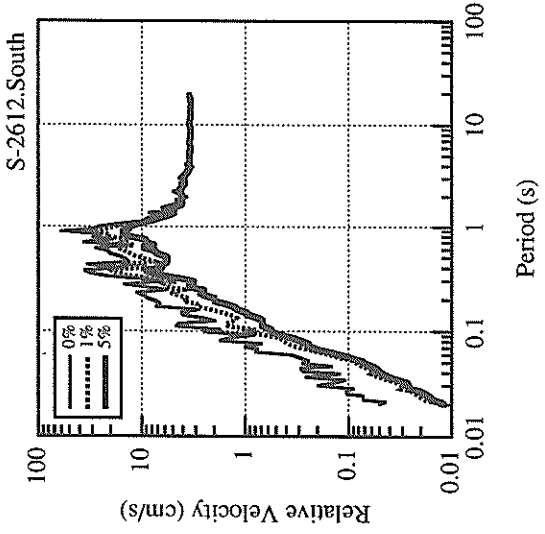
\* RESULTANT OF HORIZONTAL COMPONENTS

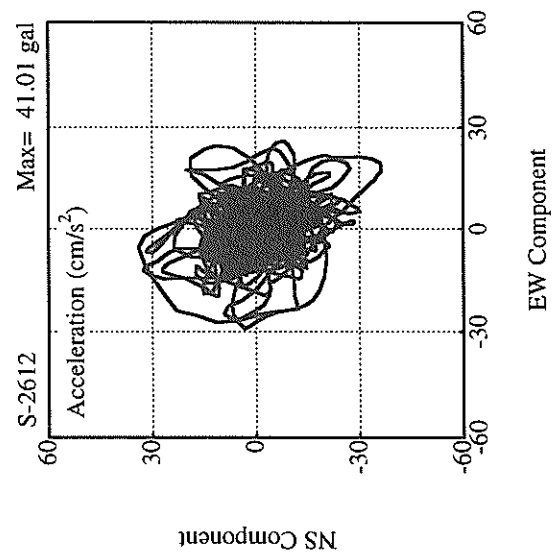
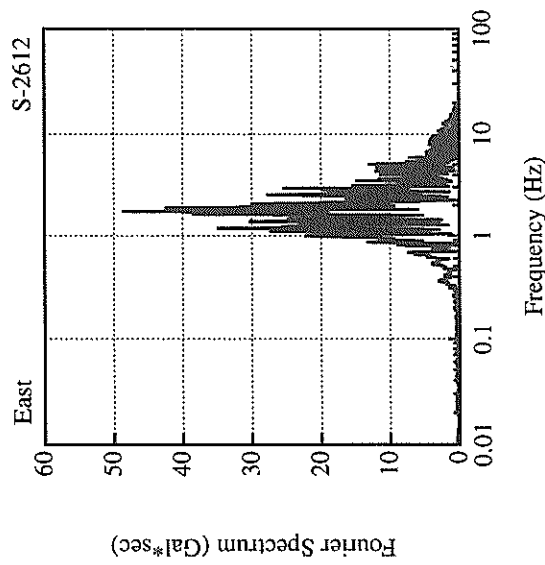
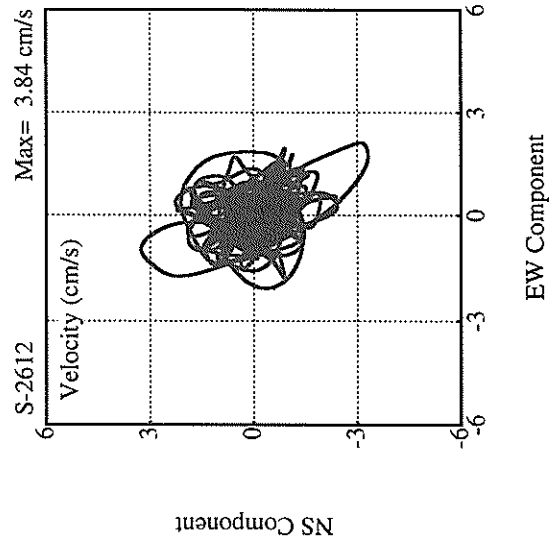
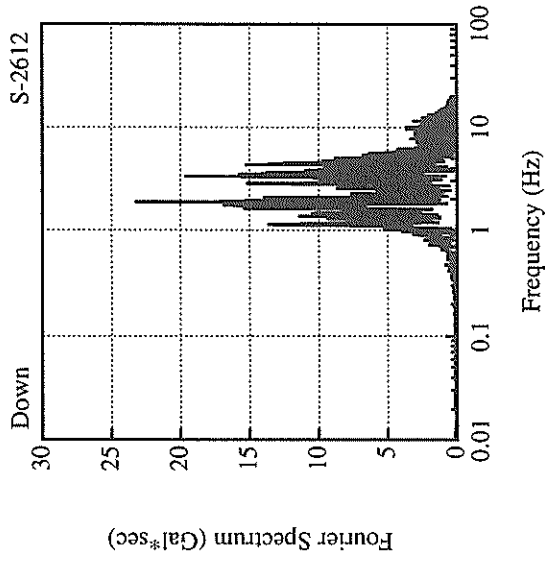
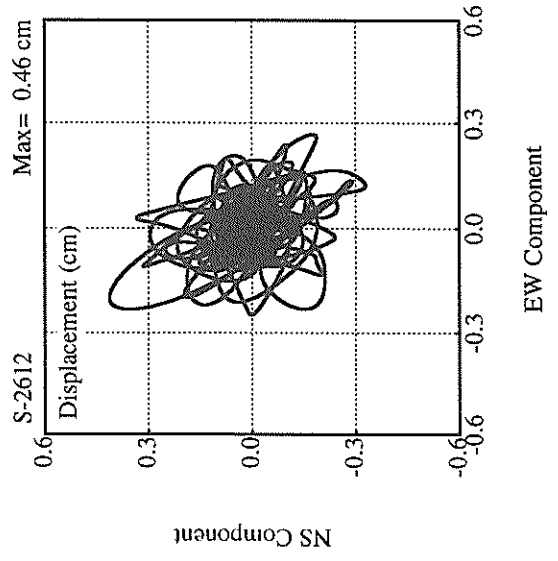
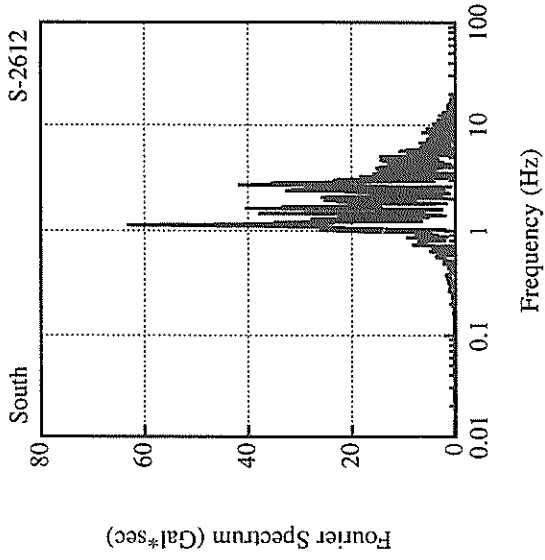














RECORD NUMBER : F-701  
 STATION : MURORAN-G

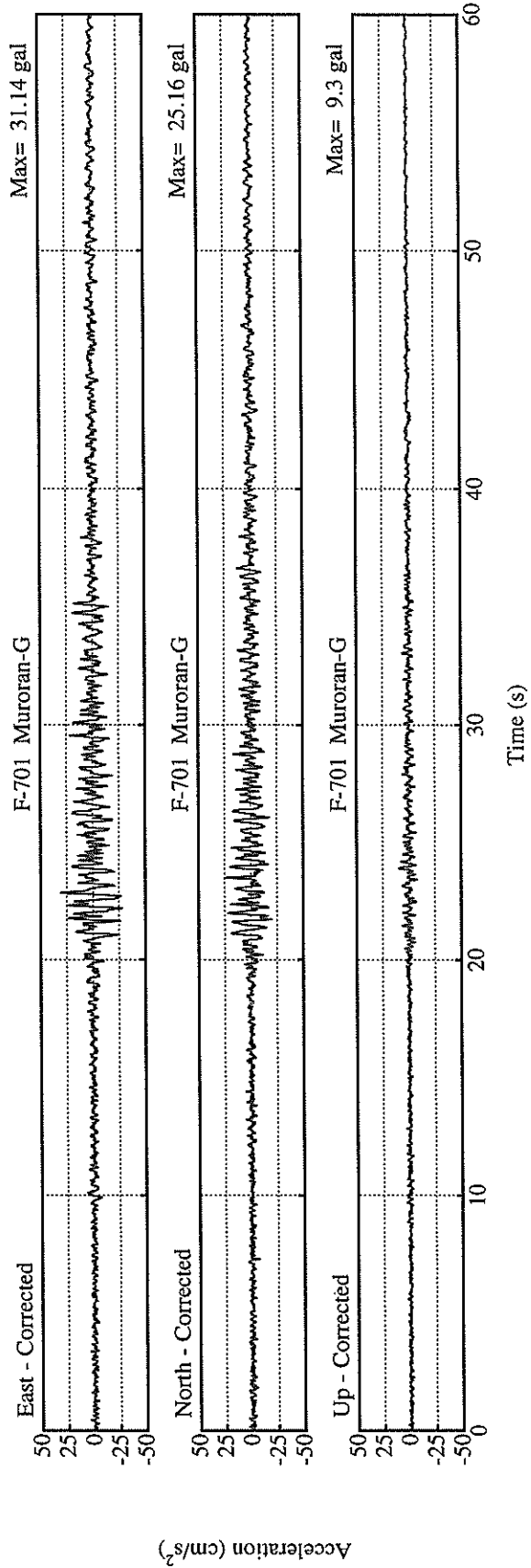
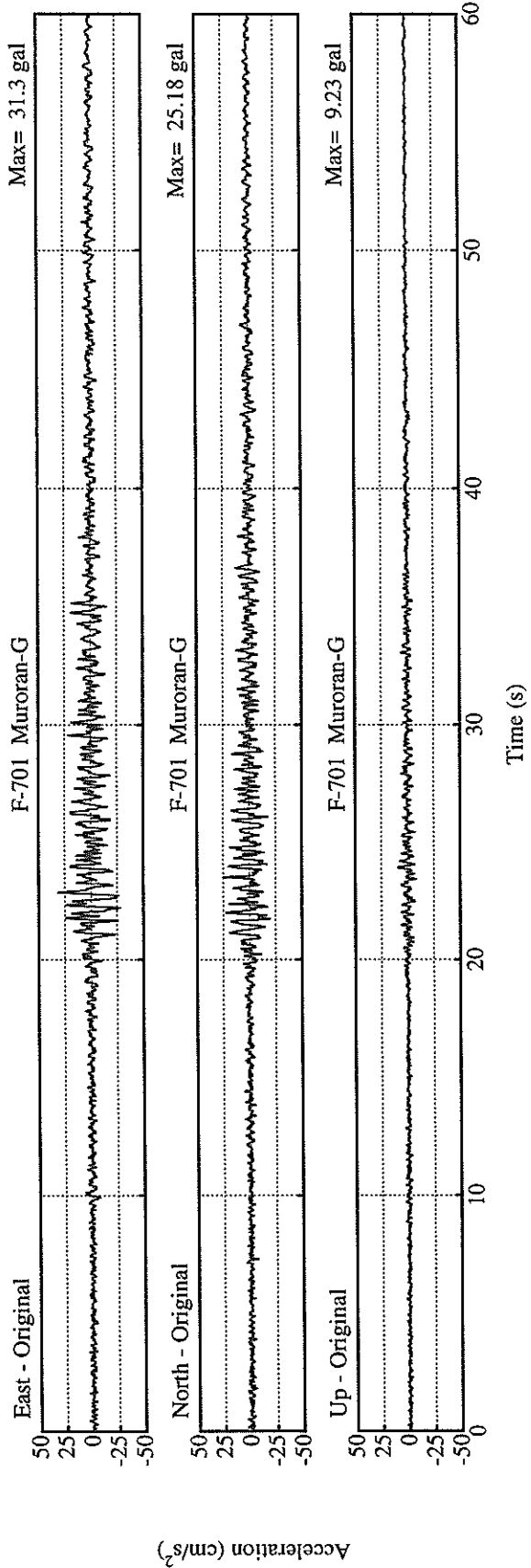
EARTHQUAKE DATA

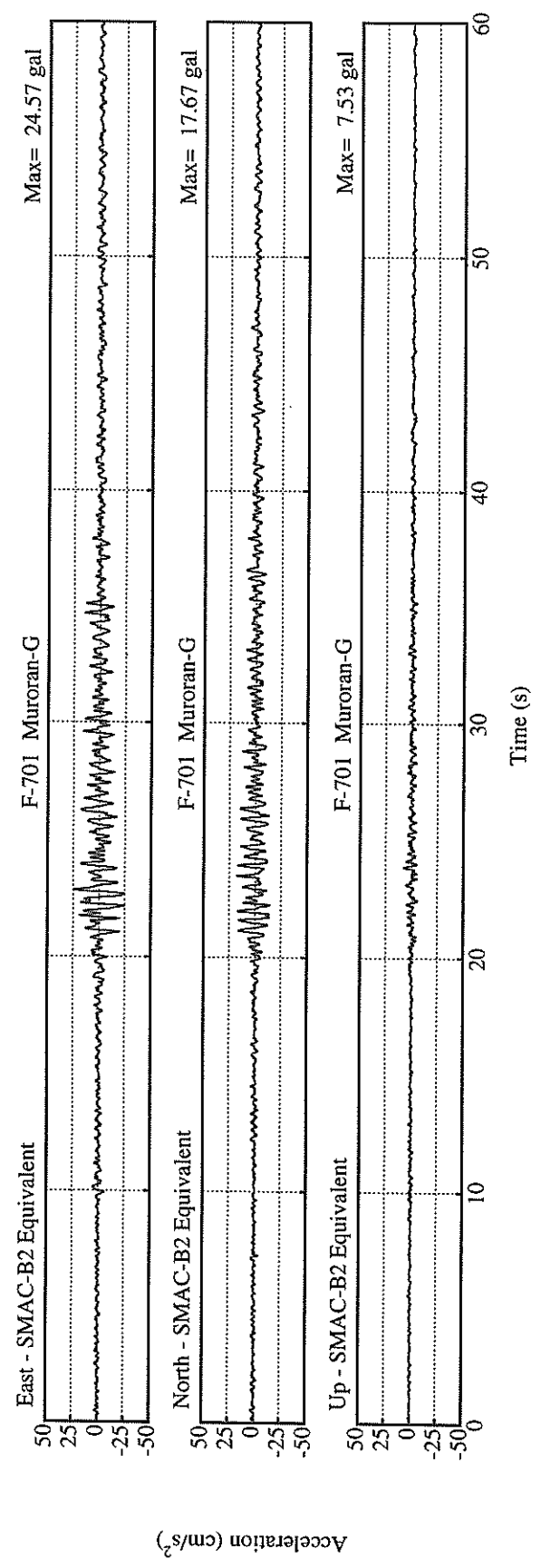
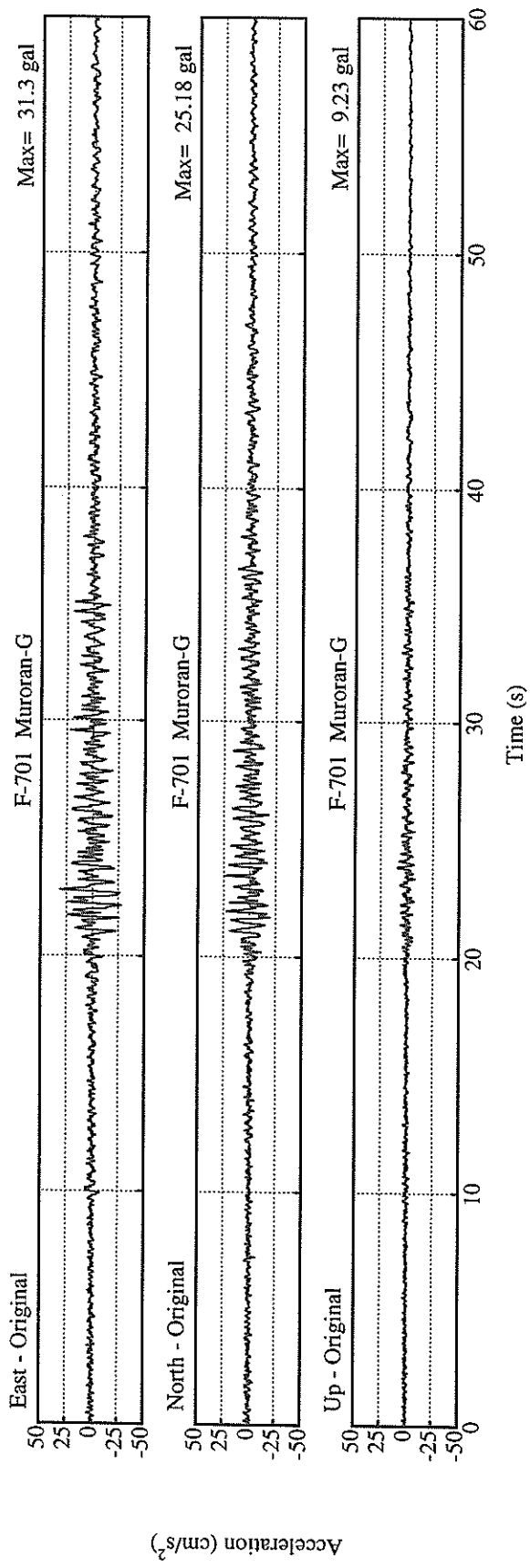
\*\*\*\*\*  
 DATE AND TIME 7:37 JAN. 7,1995  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION NE OFF IWATE PREF  
 LATITUDE 40°13.2' N  
 LONGITUDE 142°18.5' E  
 DEPTH 47.8KM  
 JMA MAGNITUDE 7.2  
 \*\*\*\*\*

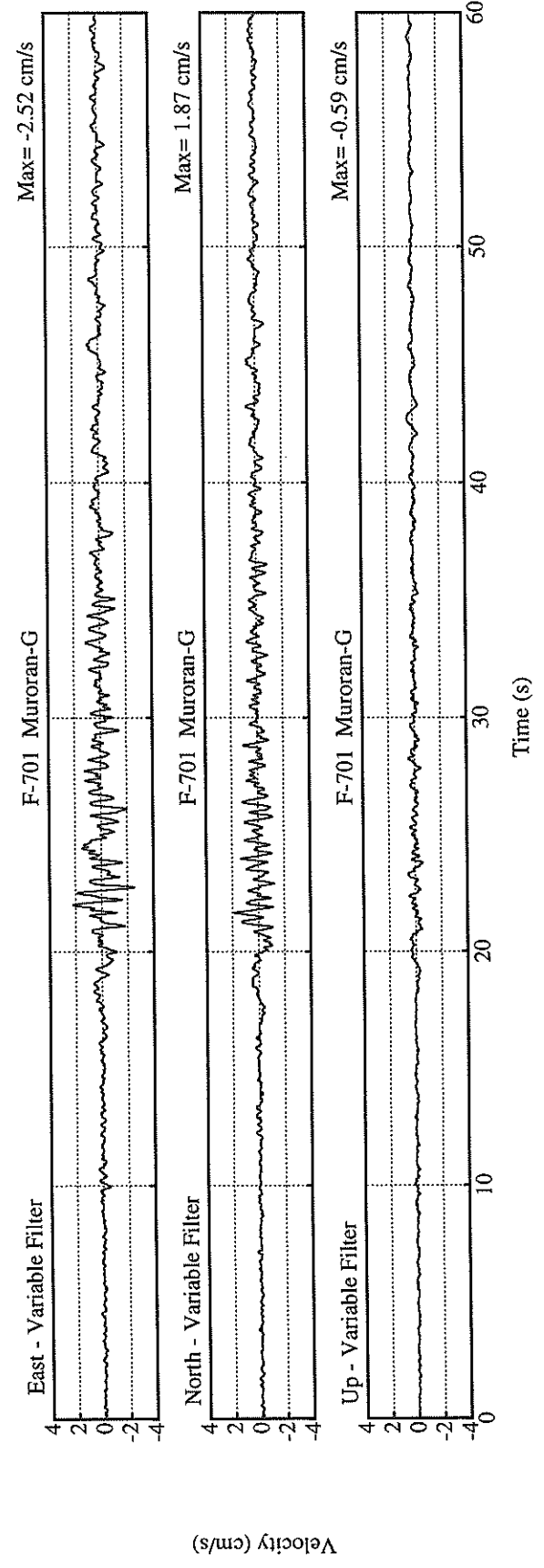
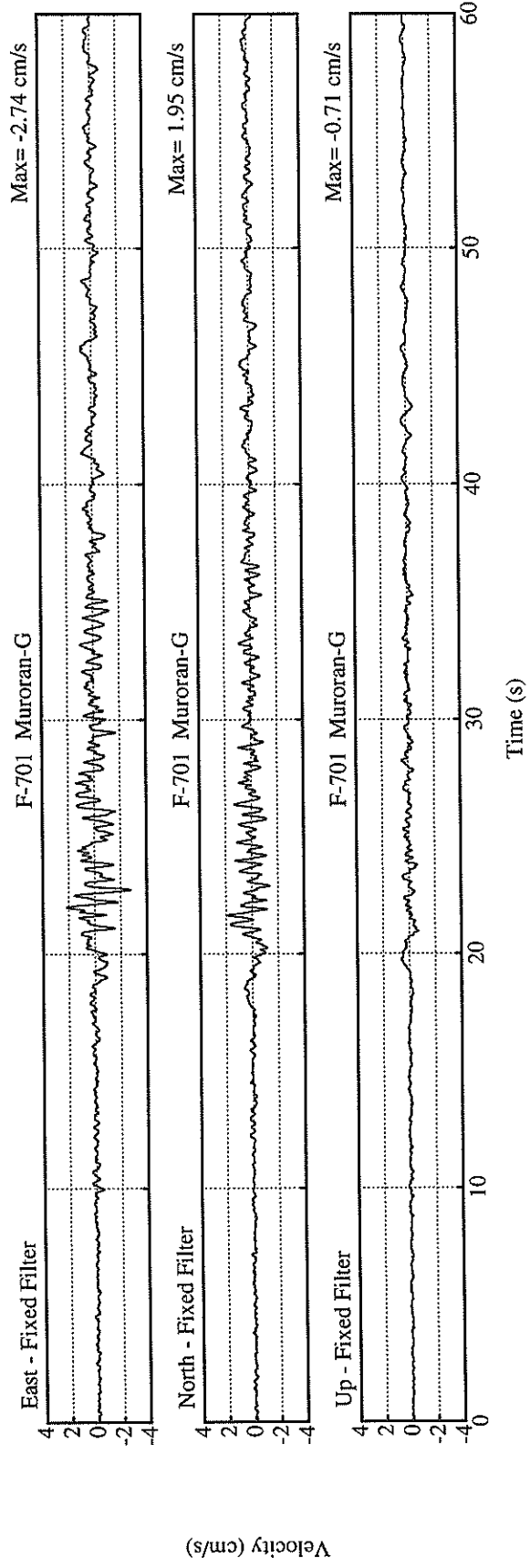
PEAK VALUES OF COMPONENTS

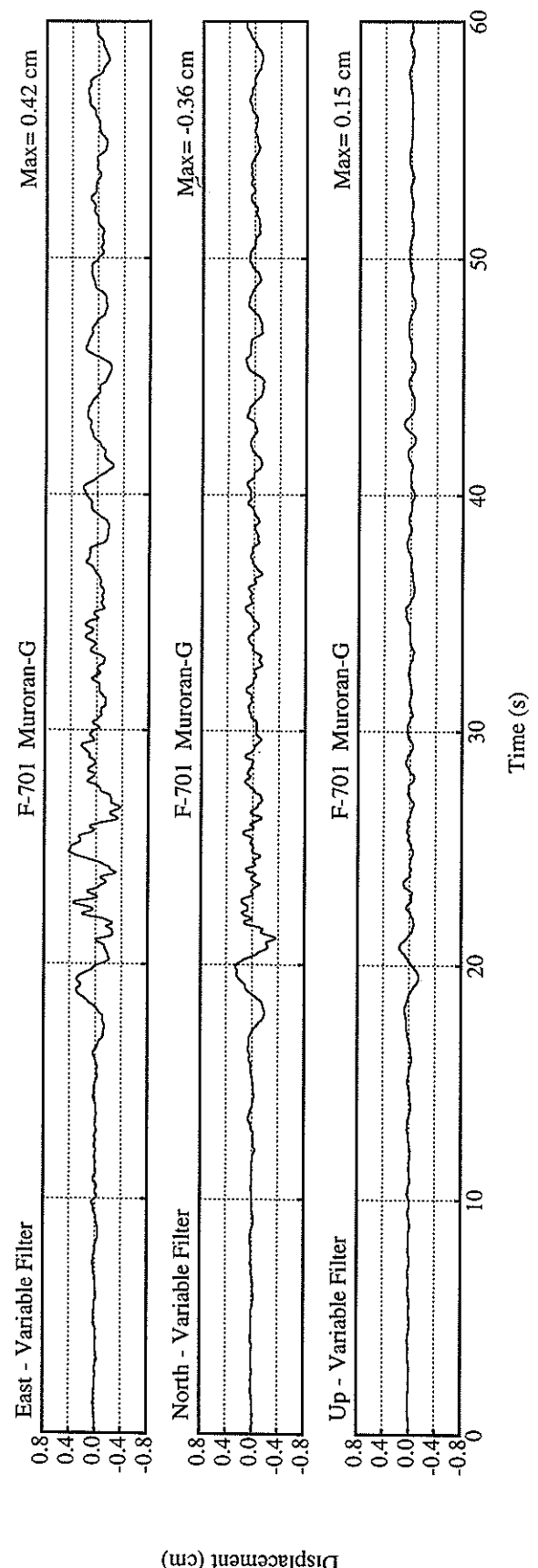
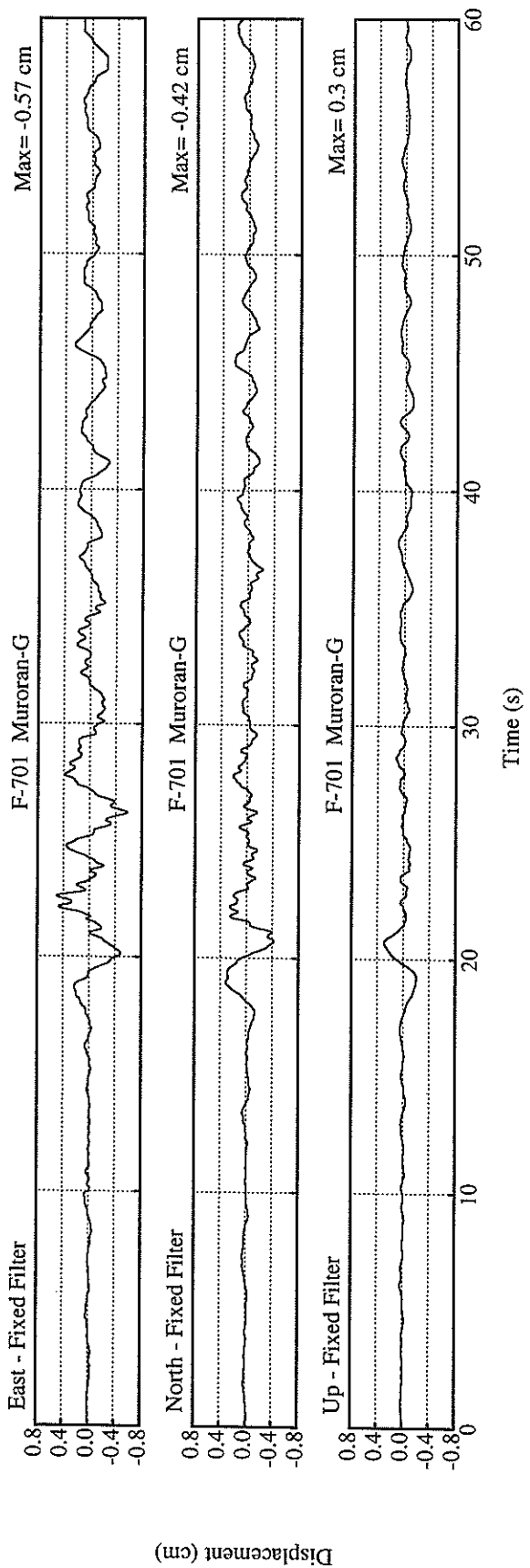
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.207	0.170	0.256	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	17.7	24.6	7.5	26.6
ORIGINAL	25.2	31.3	9.2	33.4
CORRECTED	25.2	31.1	9.3	33.2
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	1.95	2.74	0.71	2.77
VARIABLE FILTER	1.87	2.52	0.59	2.52
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.42	0.58	0.30	0.59
VARIABLE FILTER	0.36	0.42	0.15	0.42

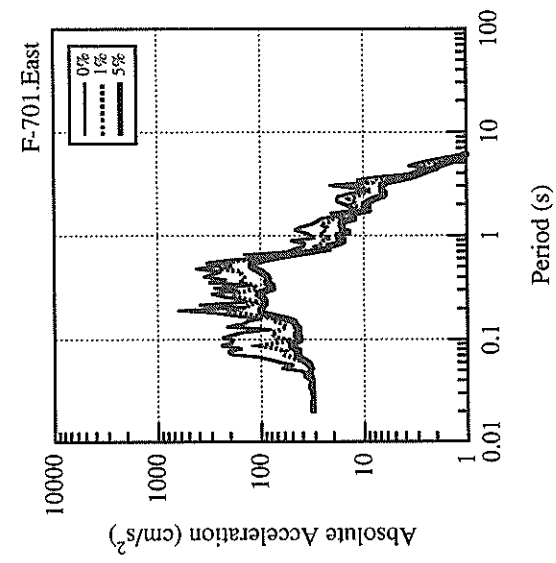
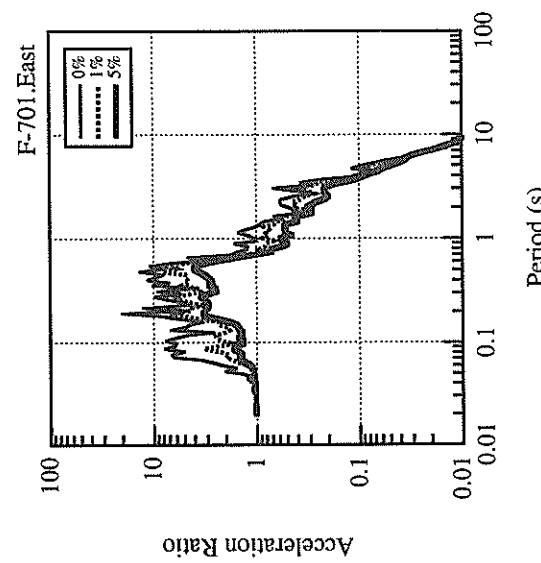
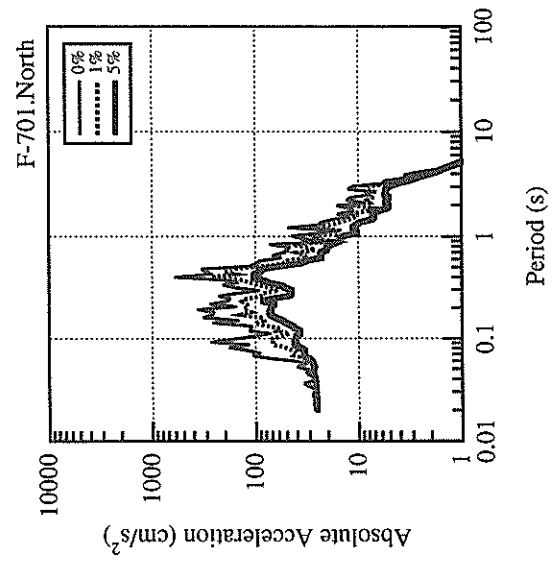
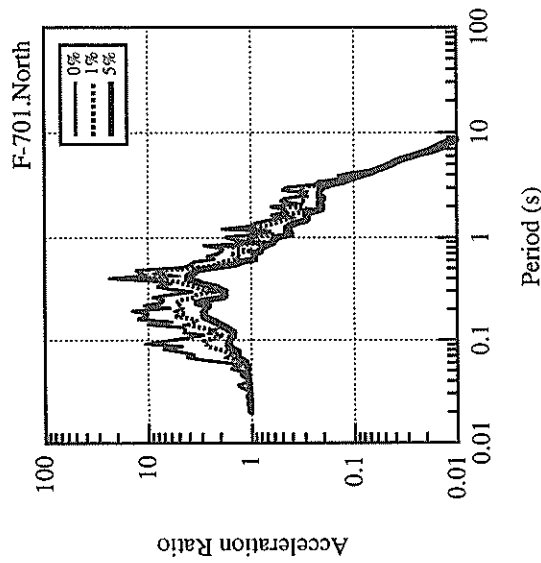
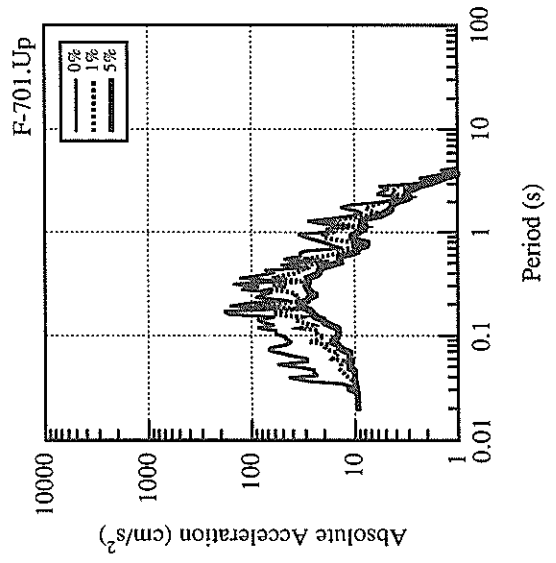
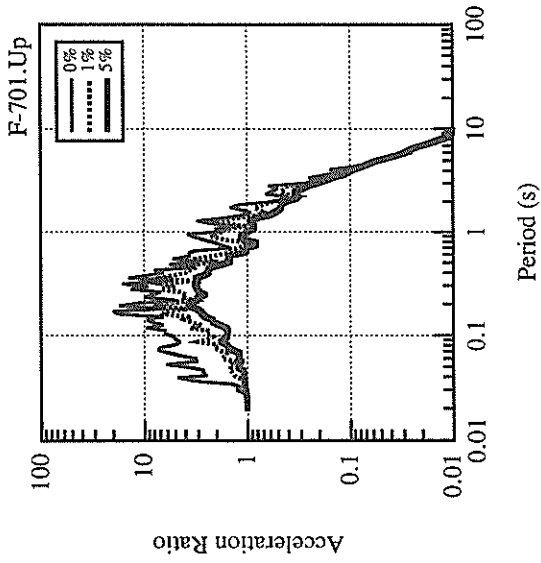
\* RESULTANT OF HORIZONTAL COMPONENTS

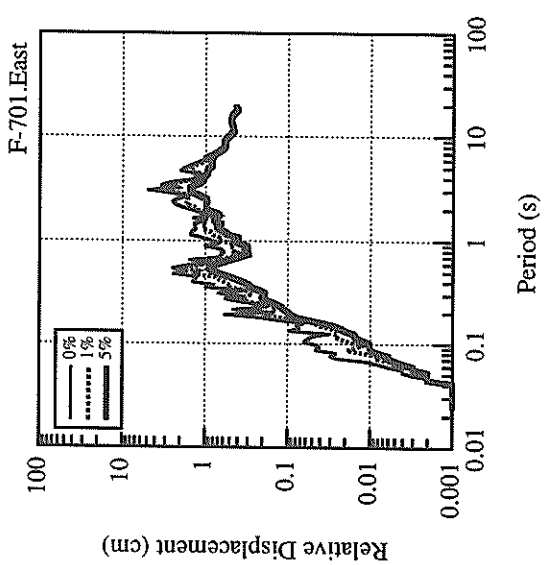
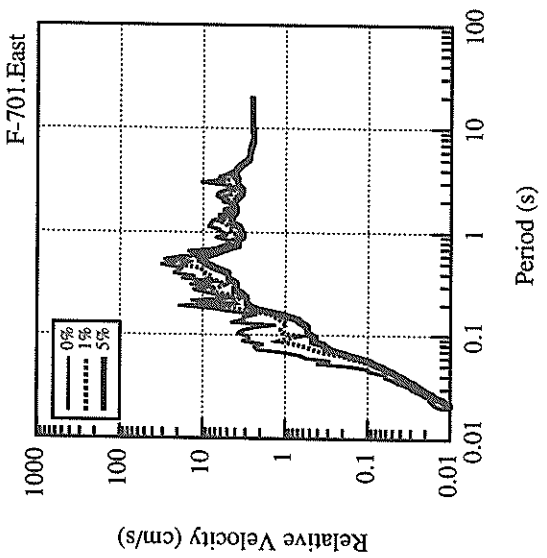
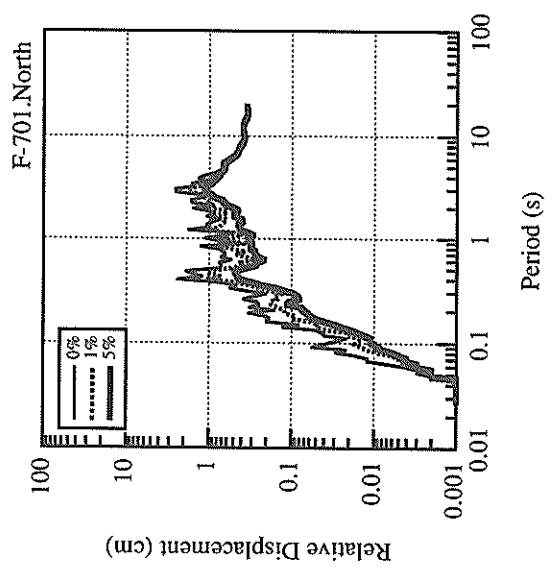
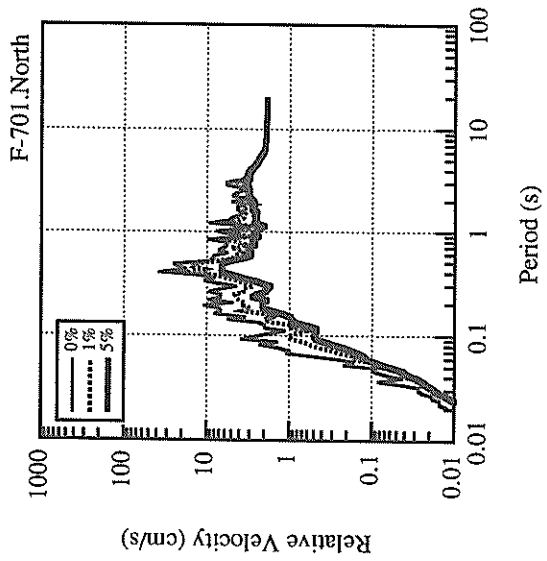
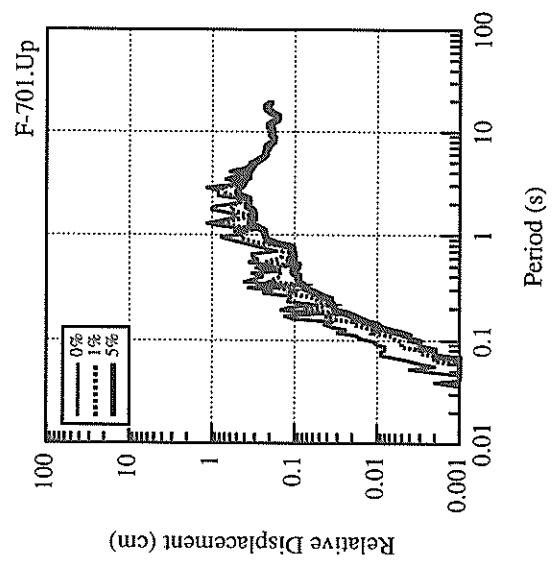
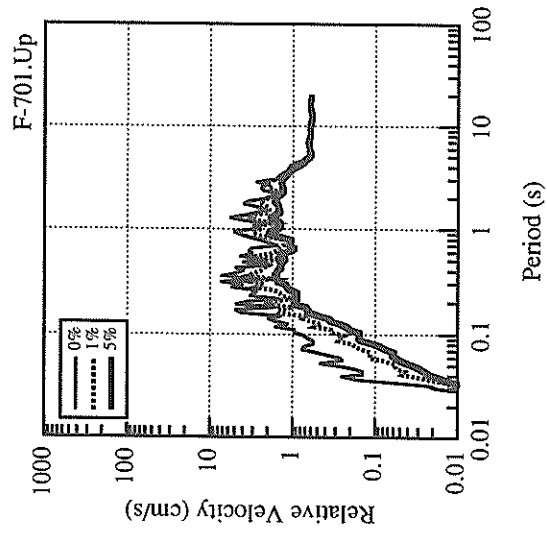


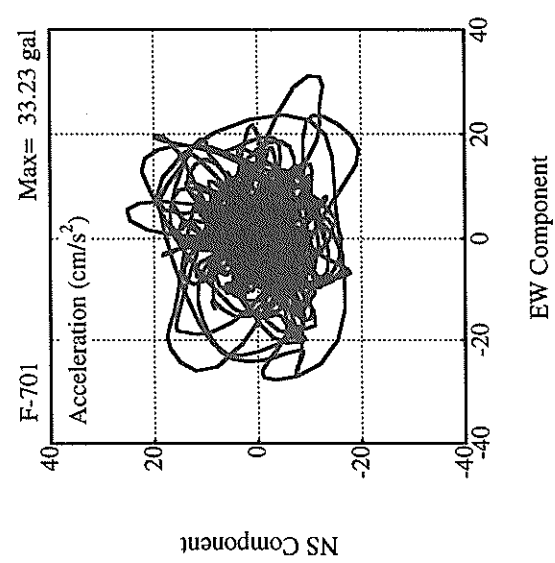
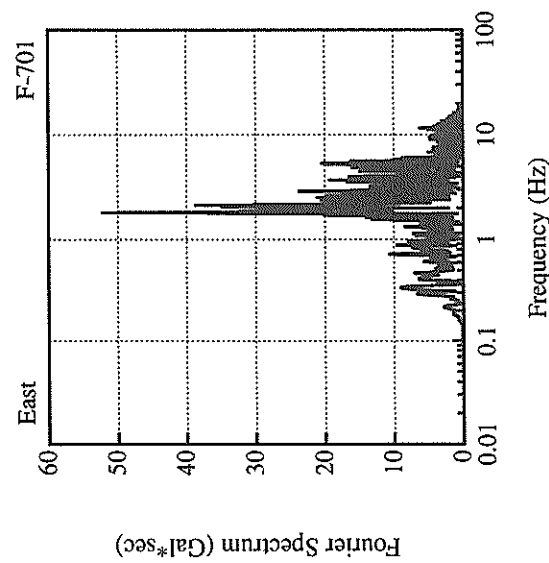
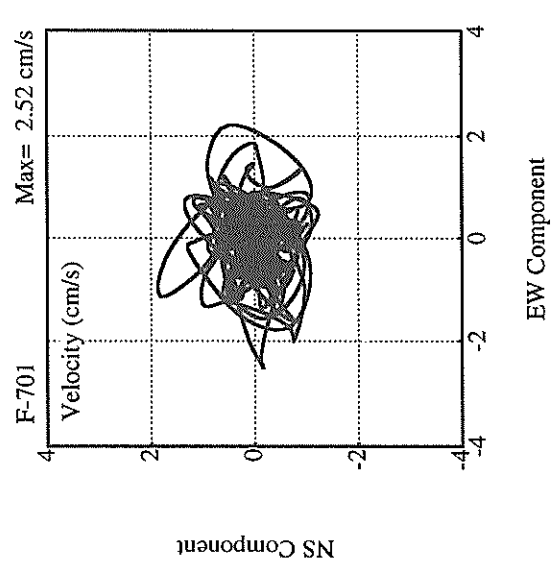
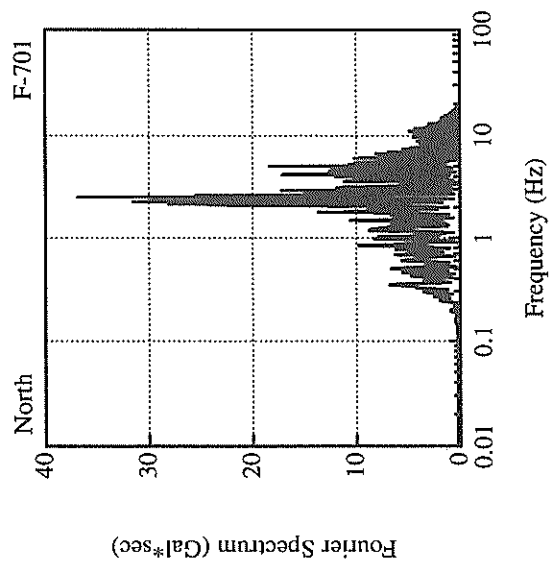
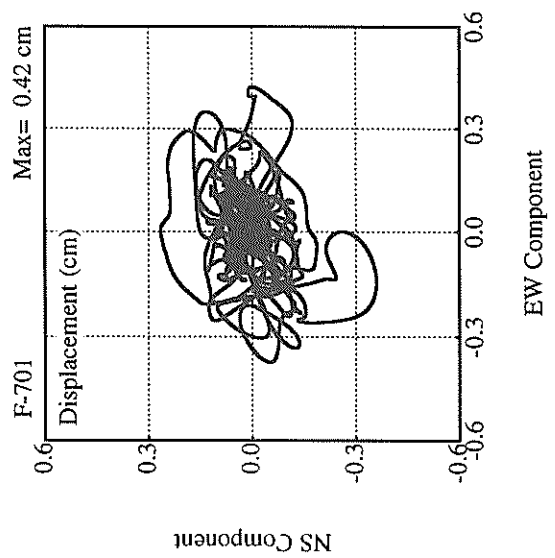
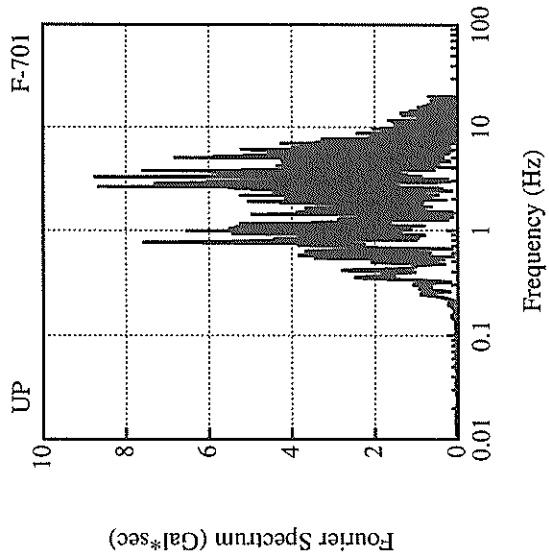














RECORD NUMBER : F-713  
 STATION : AOMORI-G

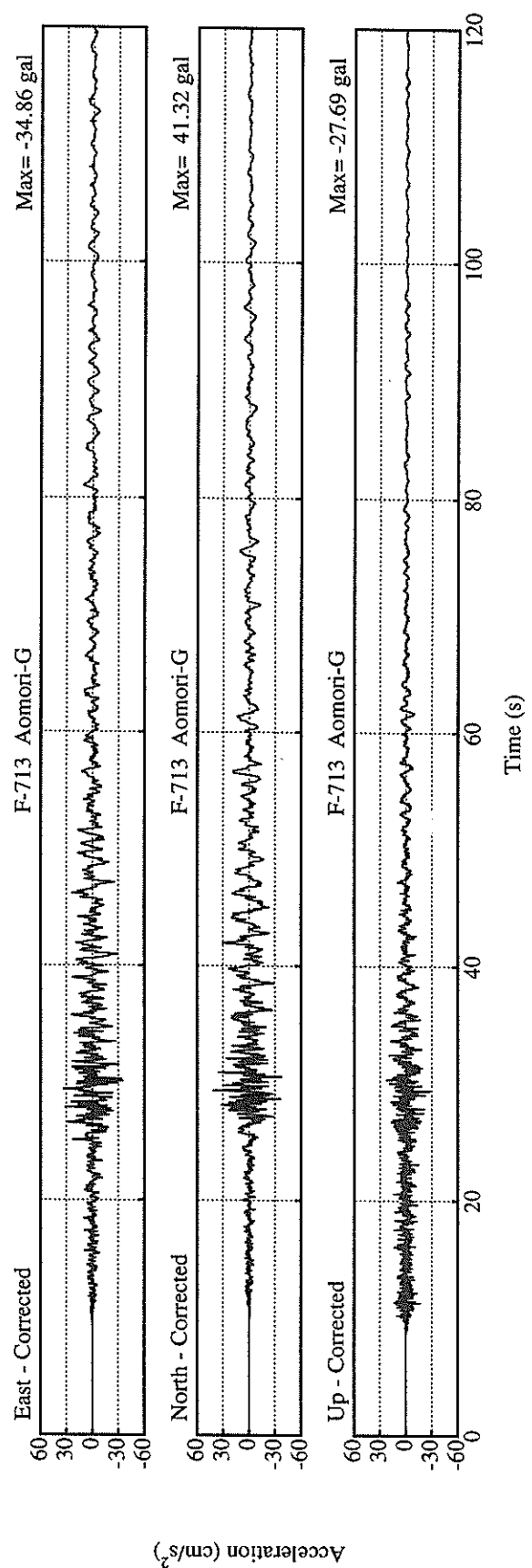
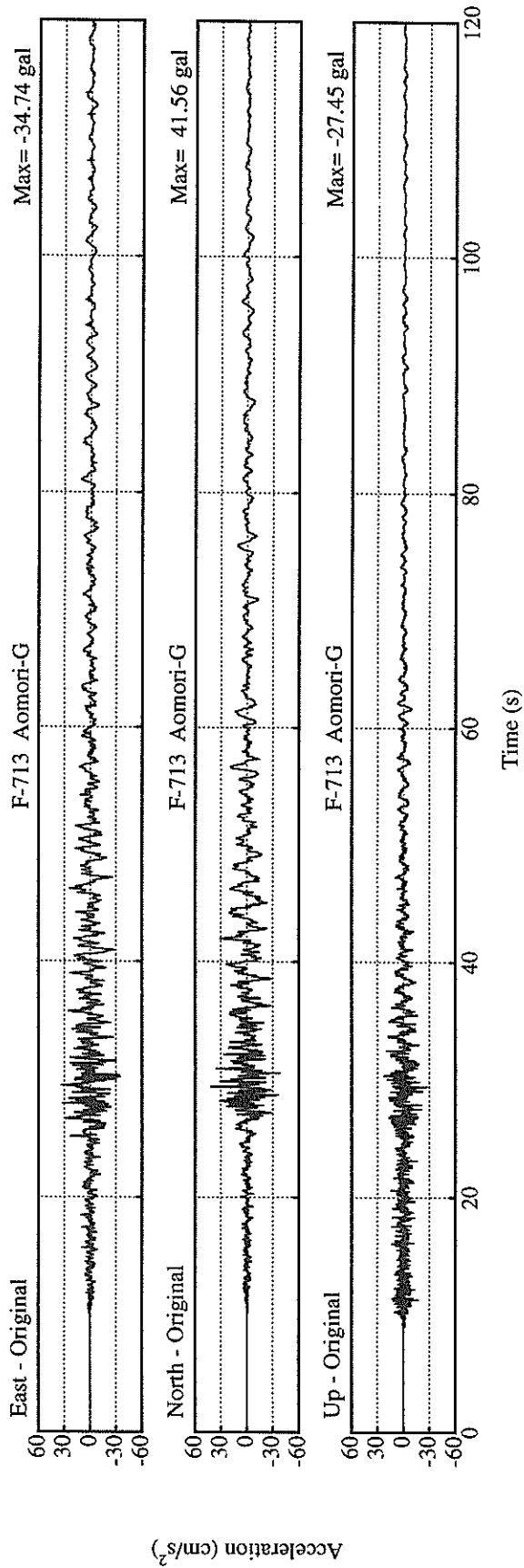
EARTHQUAKE DATA

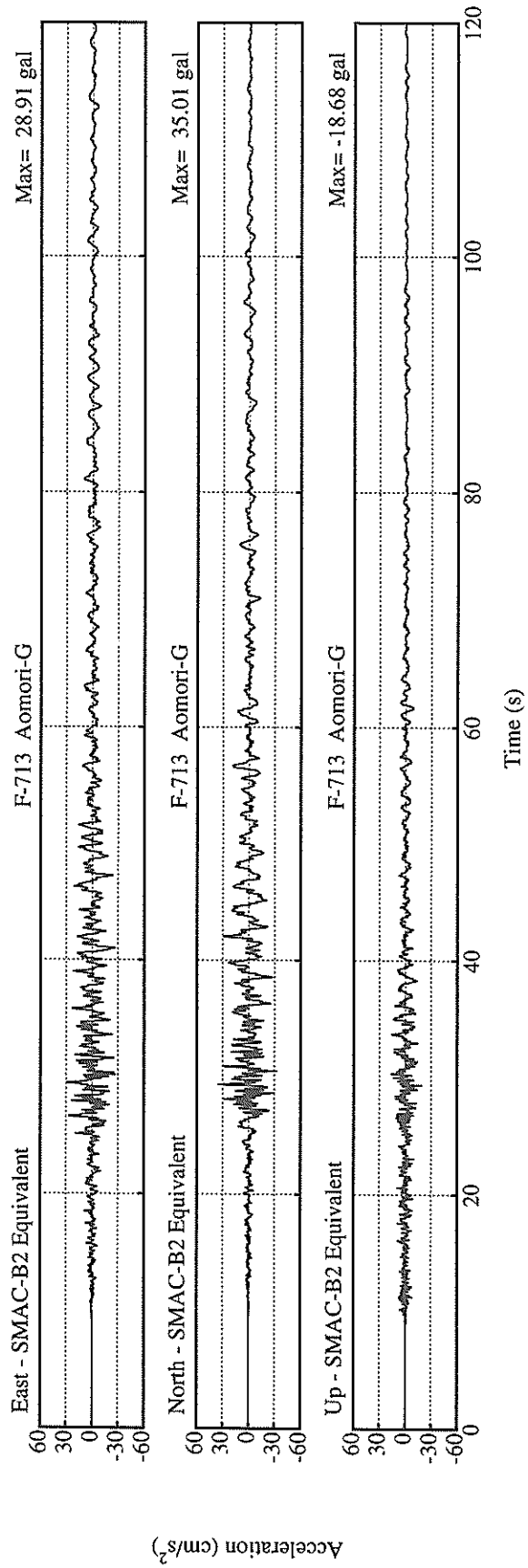
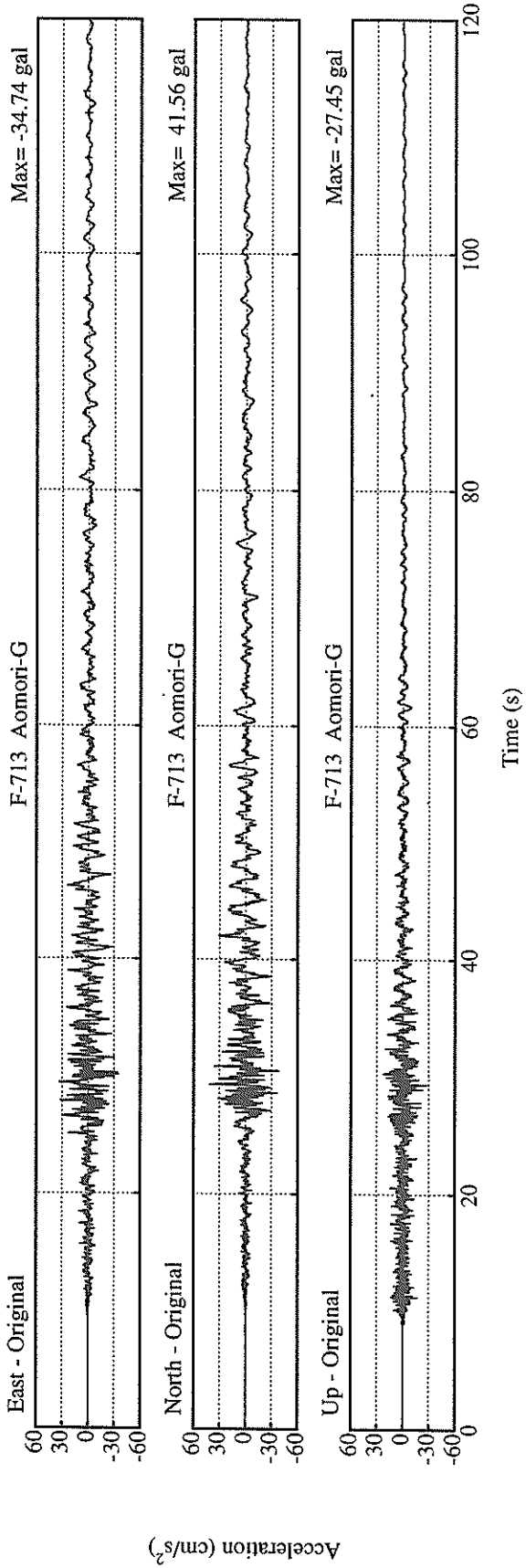
\*\*\*\*\*  
 DATE AND TIME 7:37 JAN. 7,1995  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION NE OFF IWATE PREF  
 LATITUDE 40°13.2' N  
 LONGITUDE 142°18.5' E  
 DEPTH 47.8KM  
 JMA MAGNITUDE 7.2  
 \*\*\*\*\*

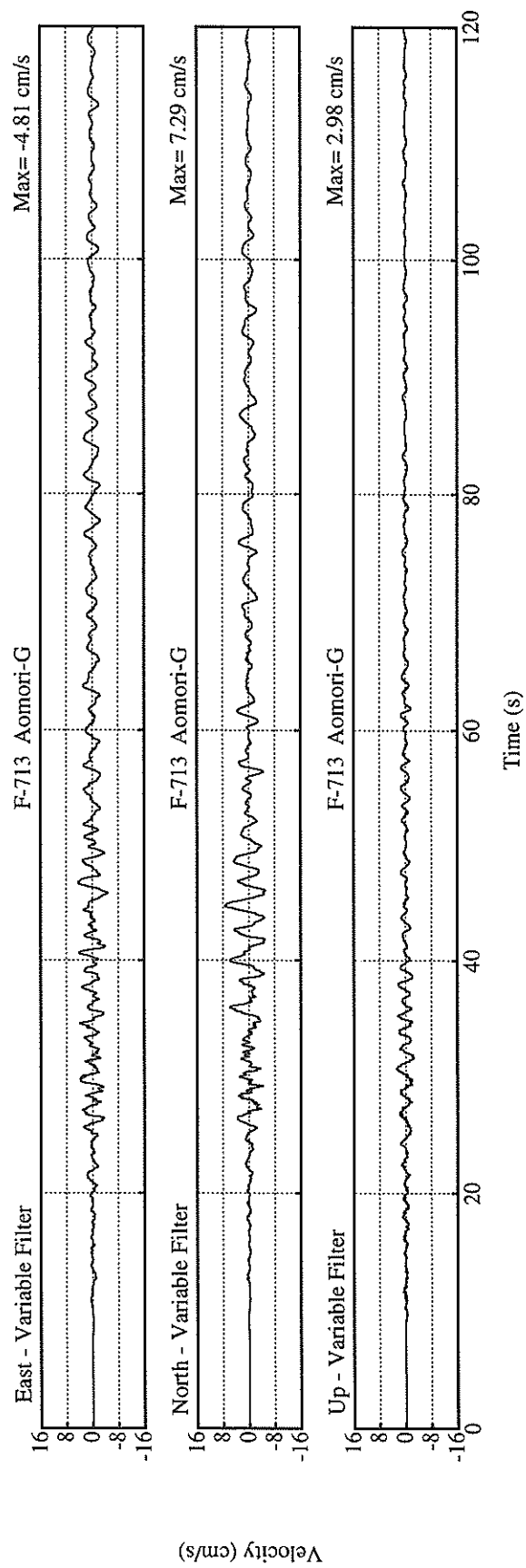
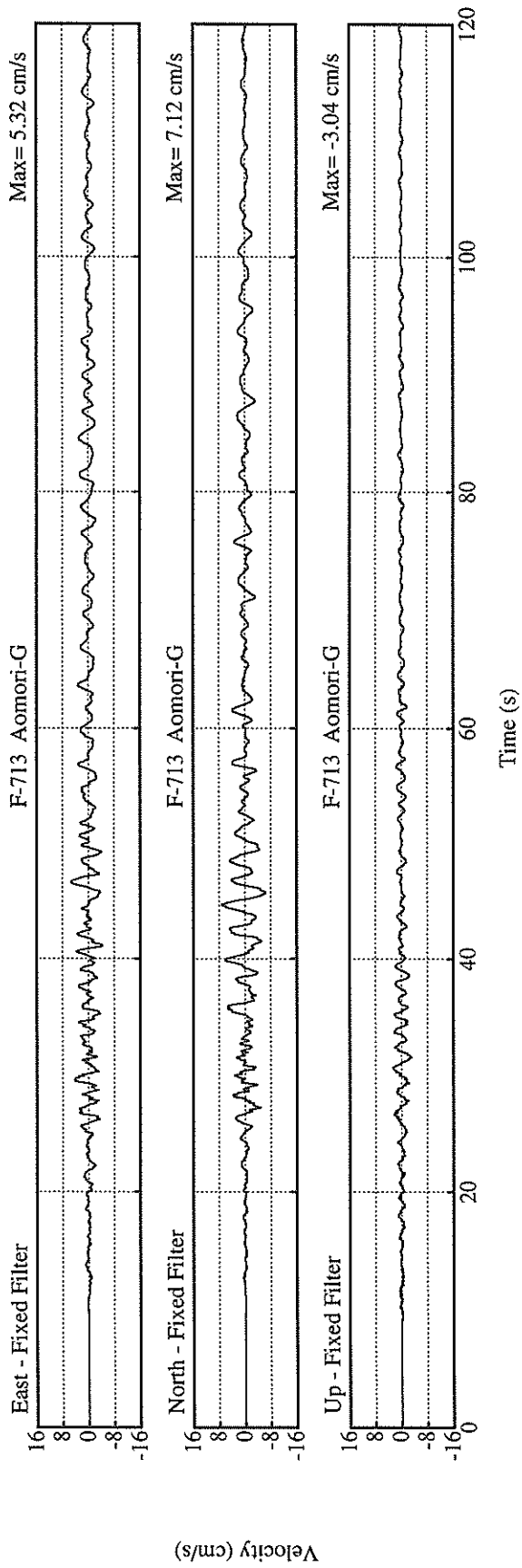
PEAK VALUES OF COMPONENTS

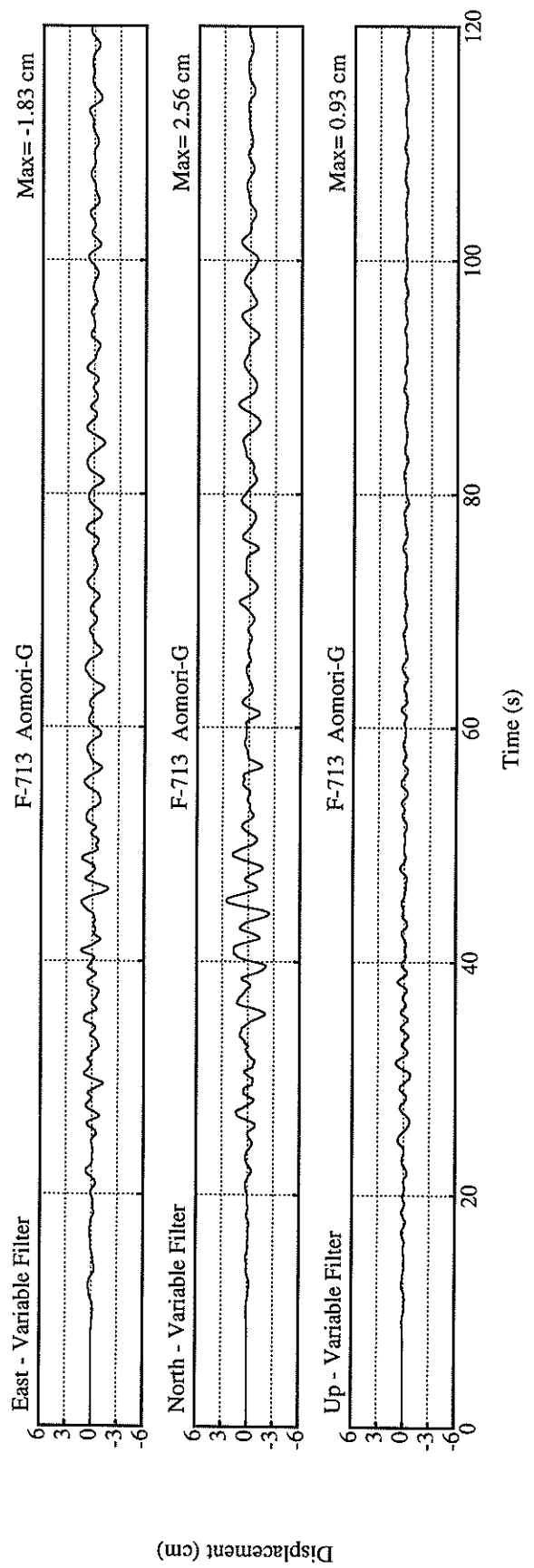
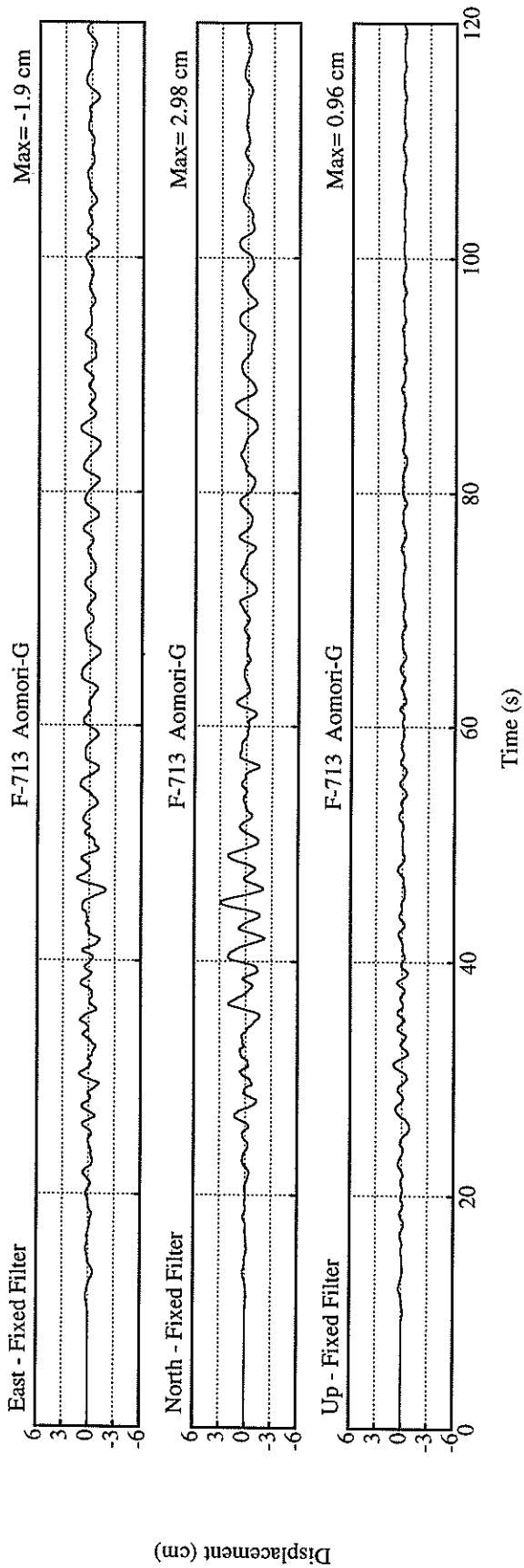
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.128	0.134	0.146	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	35.0	28.9	18.7	37.3
ORIGINAL	41.6	34.7	27.4	42.6
CORRECTED	41.3	34.9	27.7	42.4
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	7.12	5.32	3.04	7.41
VARIABLE FILTER	7.29	4.81	2.98	7.40
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	2.98	1.90	0.96	3.05
VARIABLE FILTER	2.56	1.83	0.93	2.79

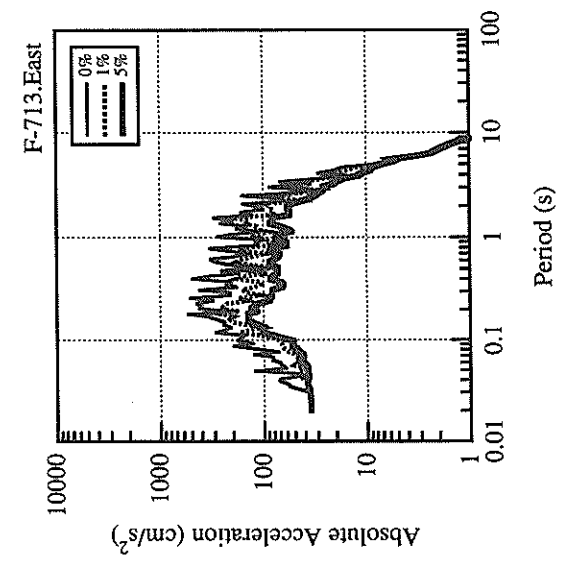
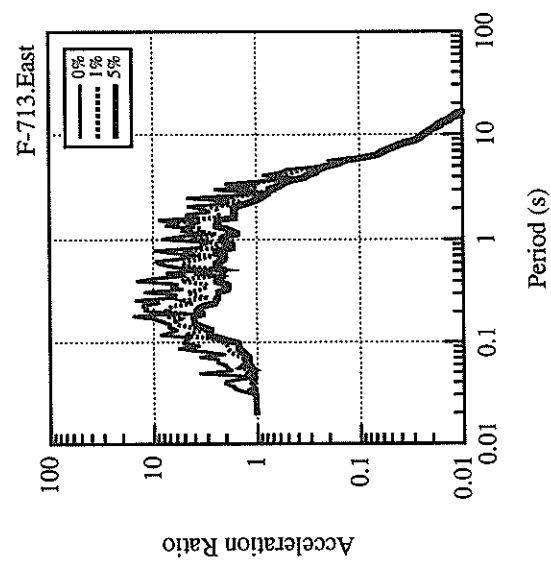
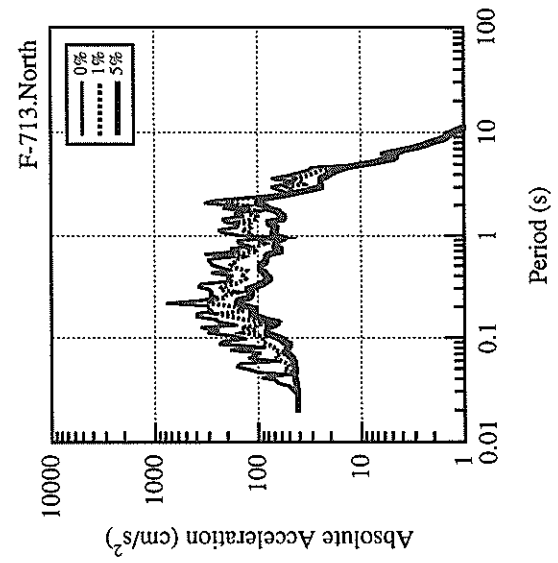
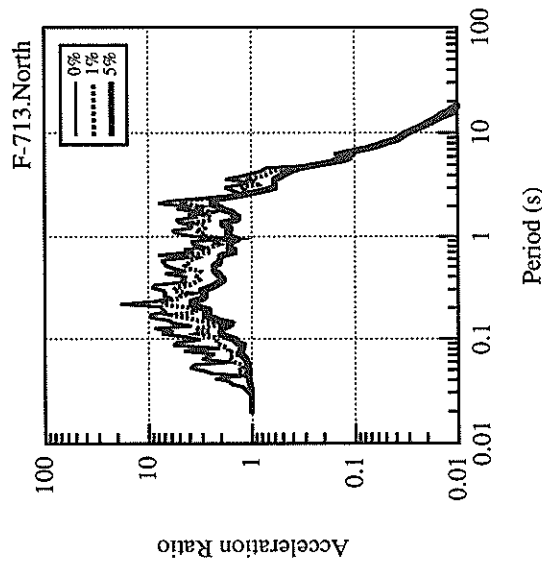
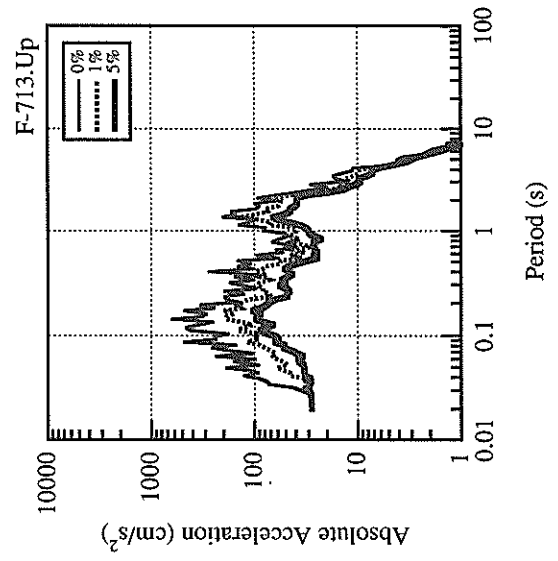
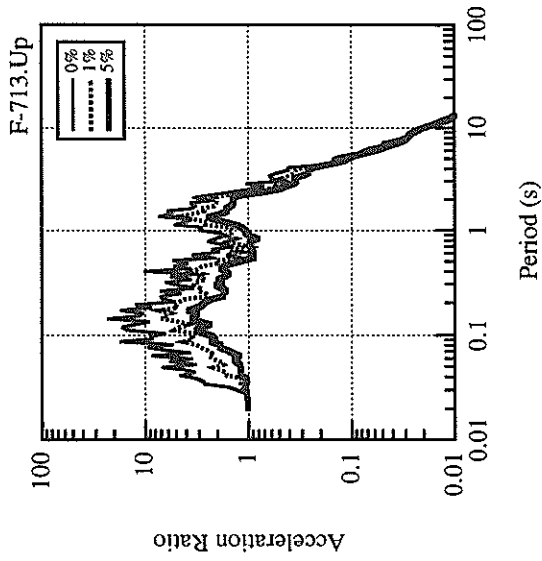
\* RESULTANT OF HORIZONTAL COMPONENTS

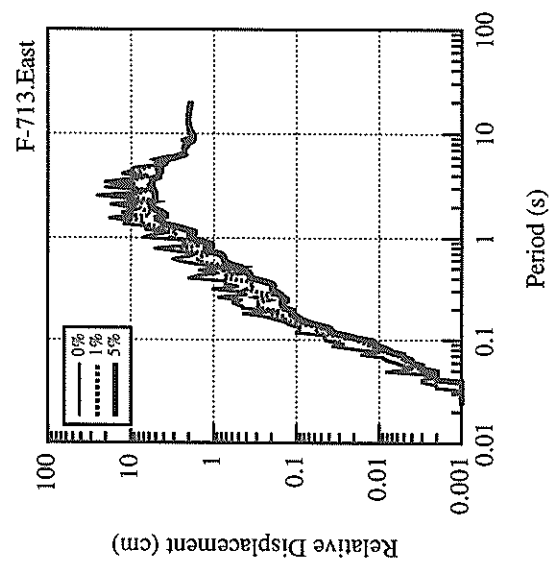
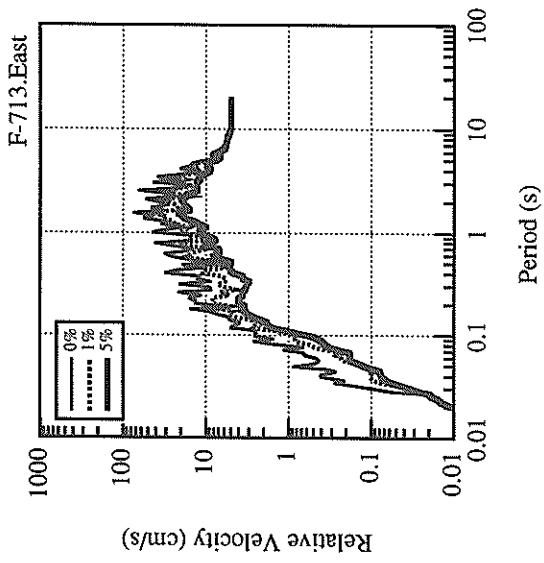
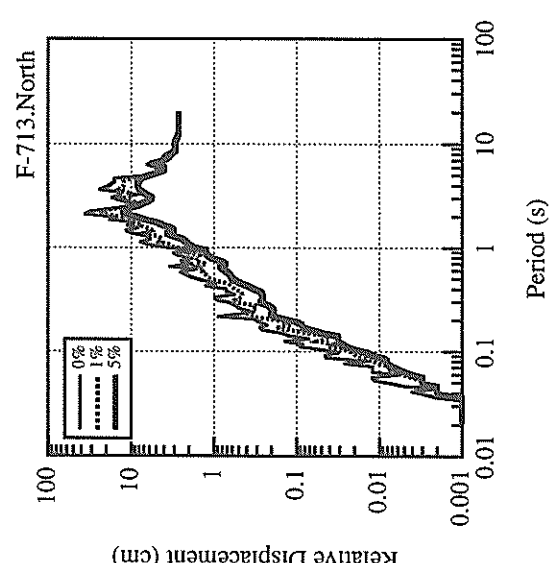
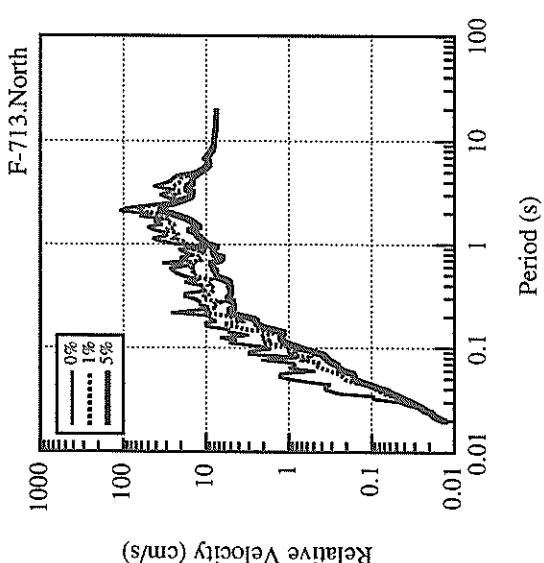
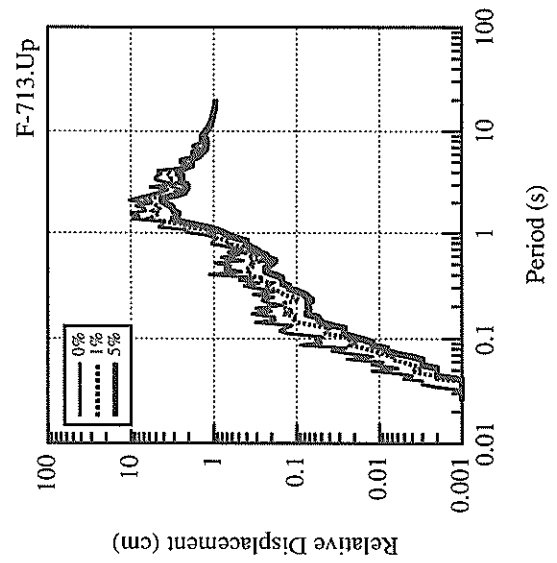
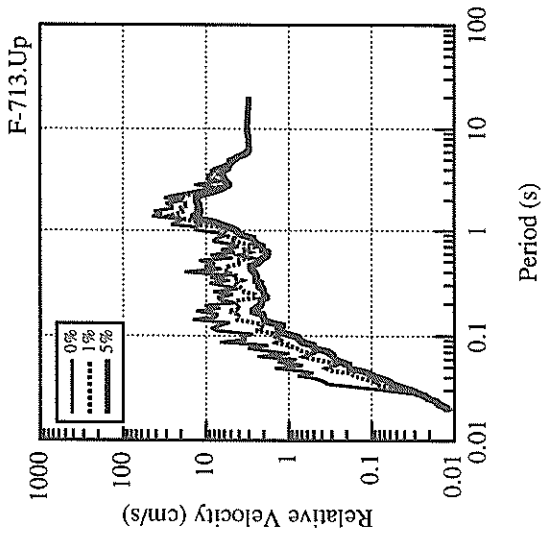


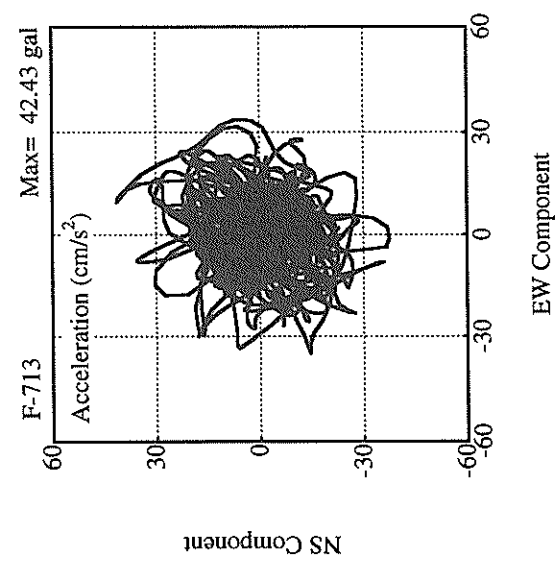
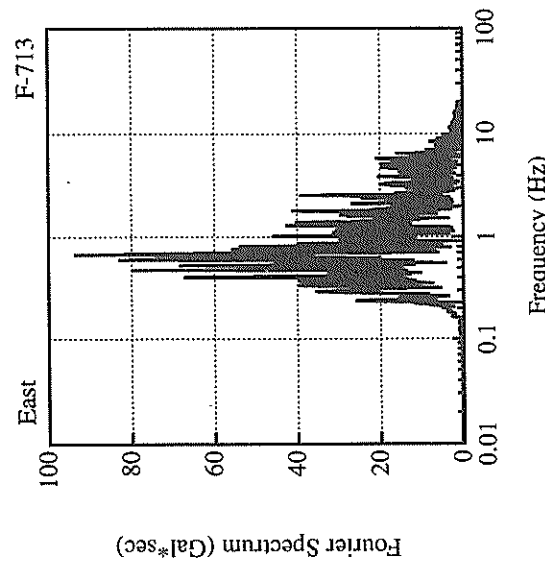
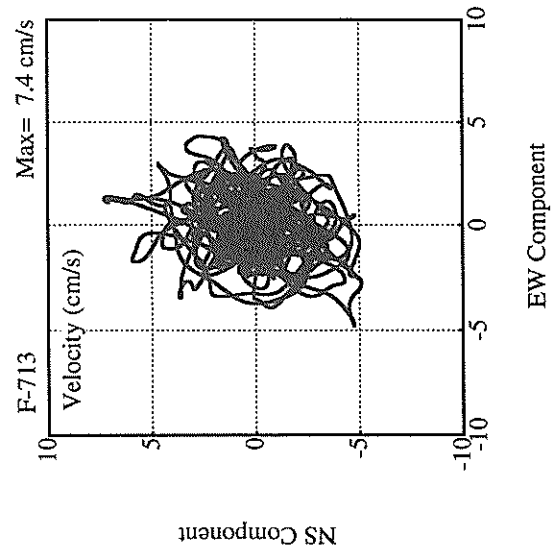
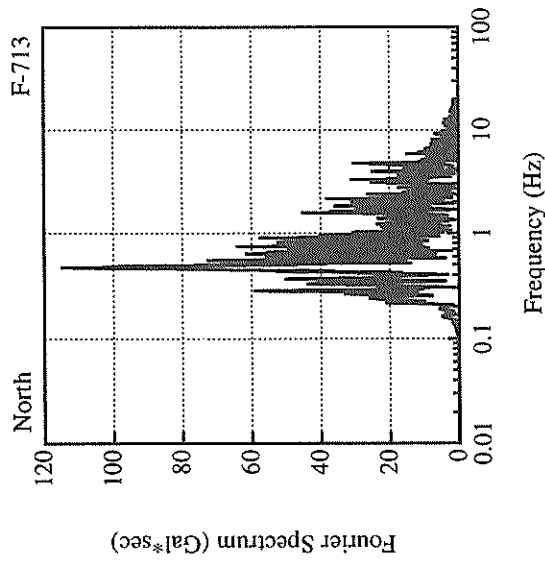
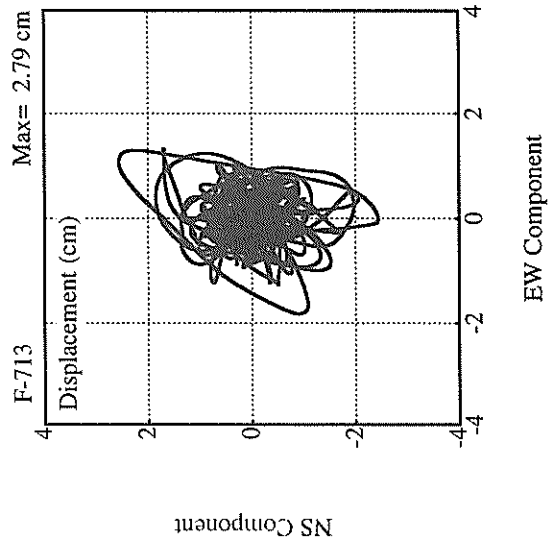
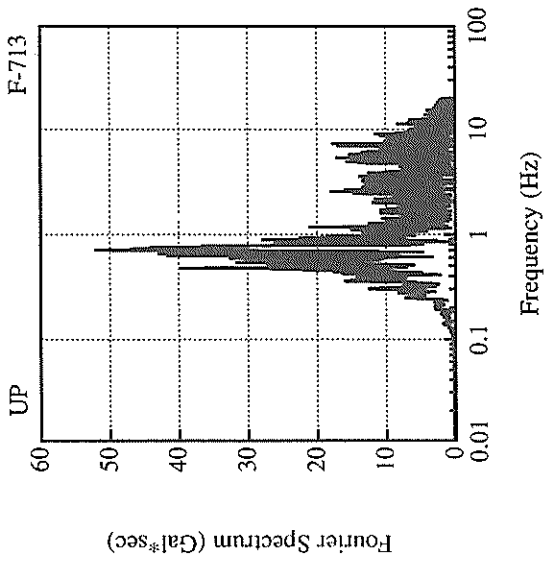














RECORD NUMBER : F-734  
 STATION : MIYAKO-G

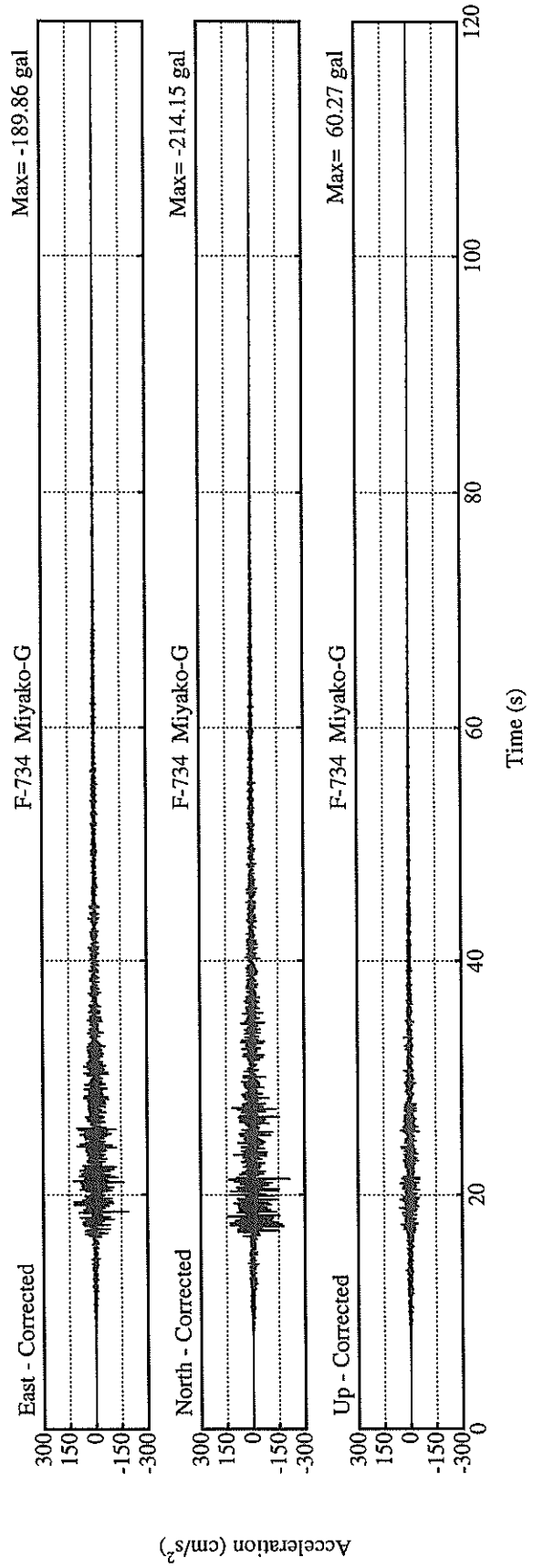
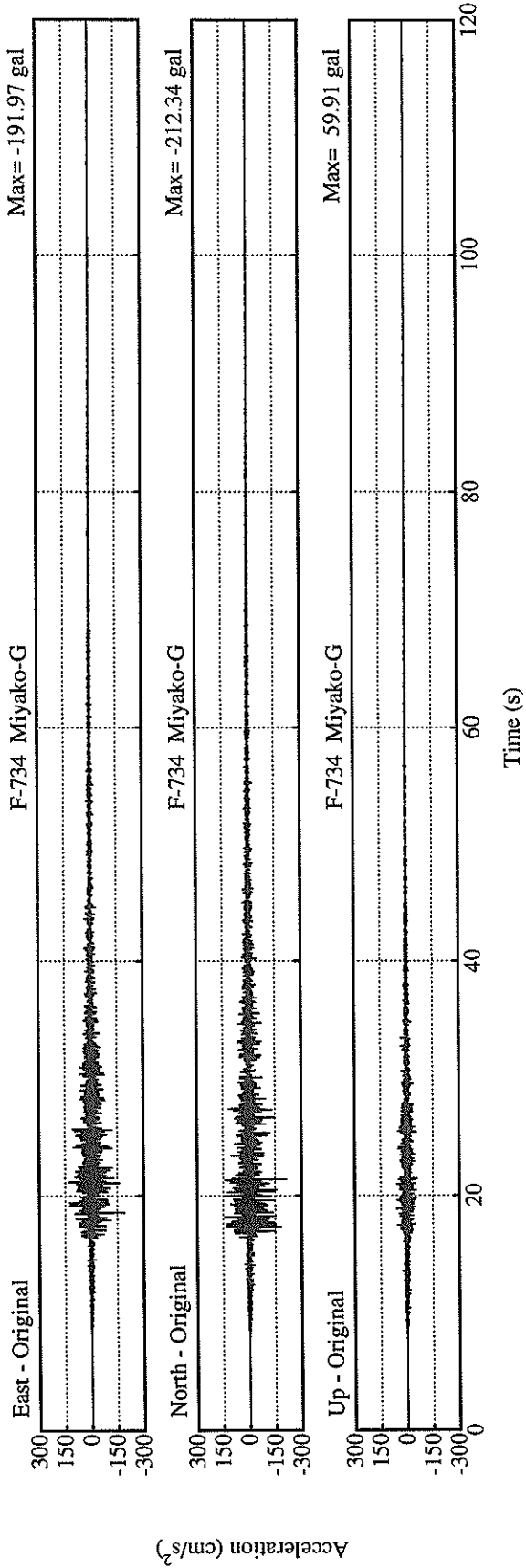
EARTHQUAKE DATA

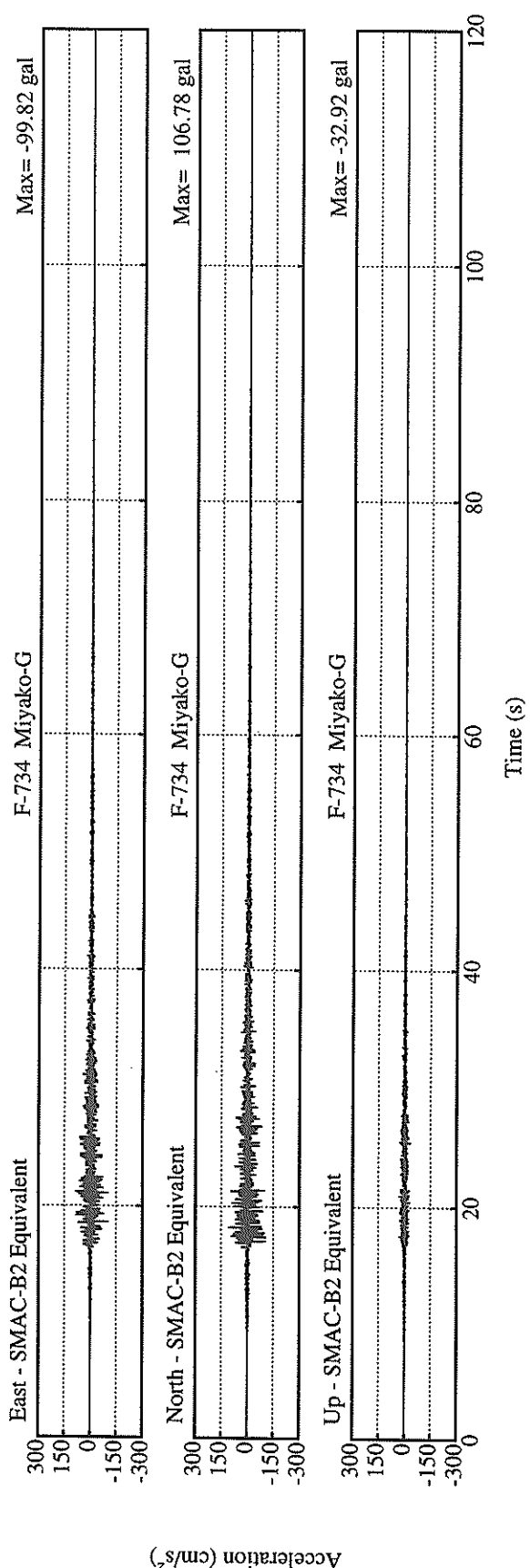
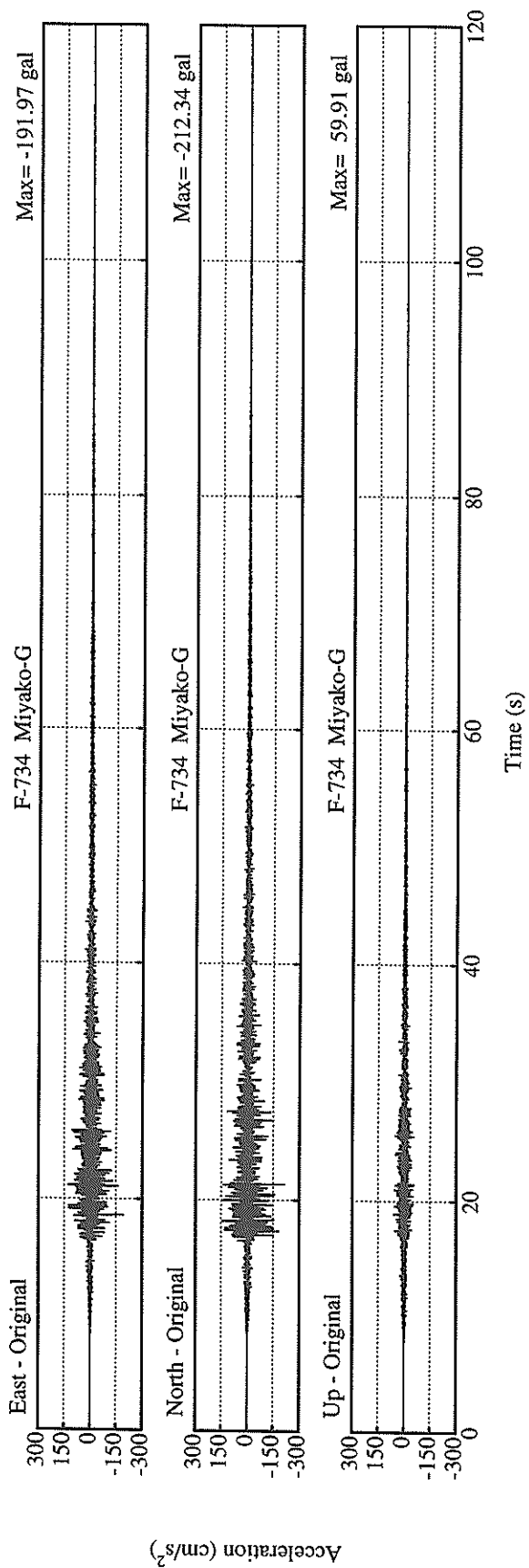
\*\*\*\*\*  
 DATE AND TIME 7:37 JAN. 7,1995  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION NE OFF IWATE PEF  
 LATITUDE 40°13.2' N  
 LONGITUDE 142°18.5' E  
 DEPTH 47.8KM  
 JMA MAGNITUDE 7.2  
 \*\*\*\*\*

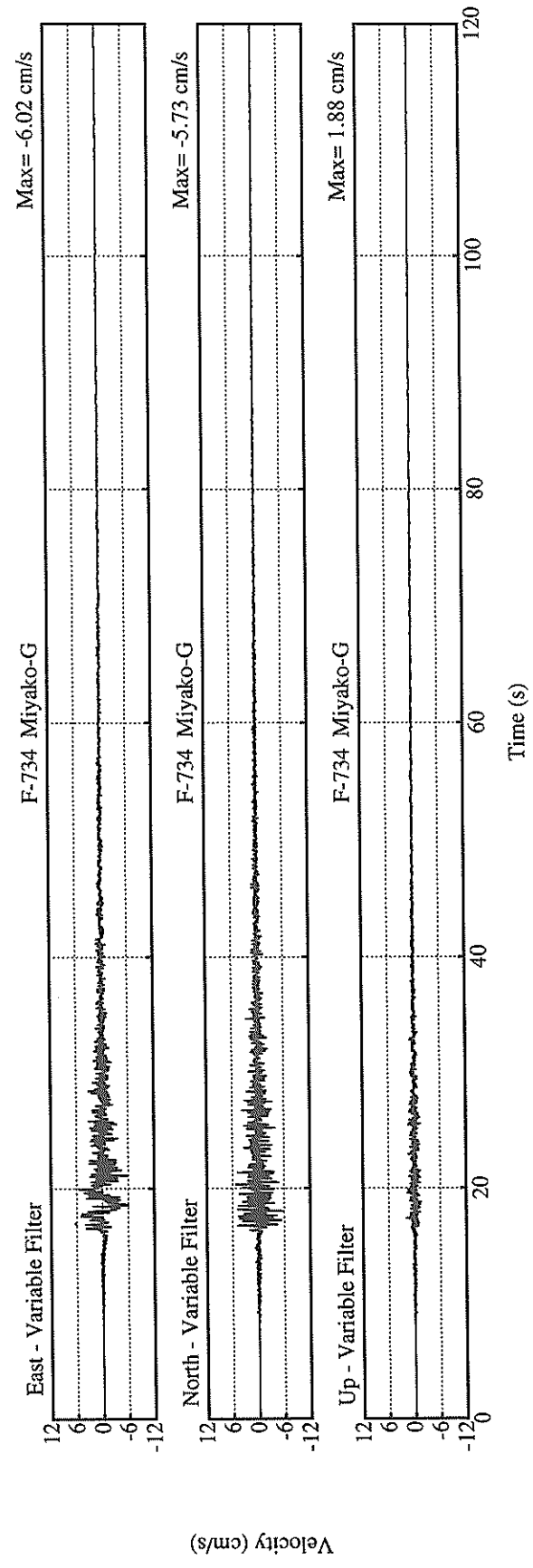
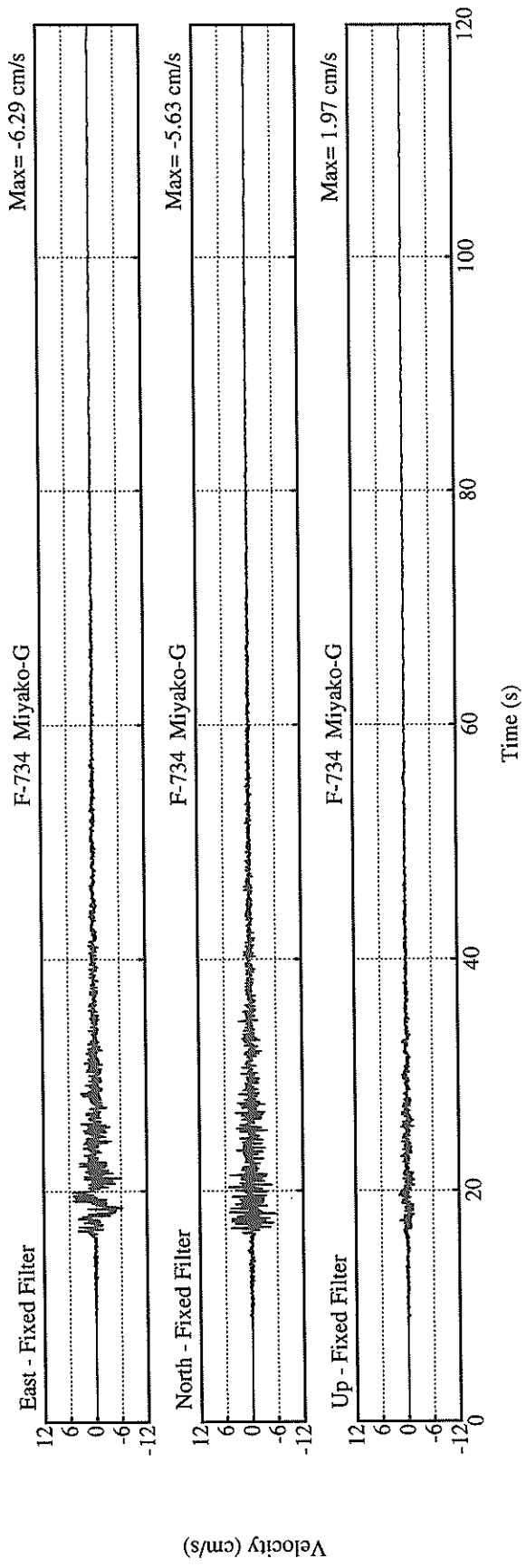
PEAK VALUES OF COMPONENTS

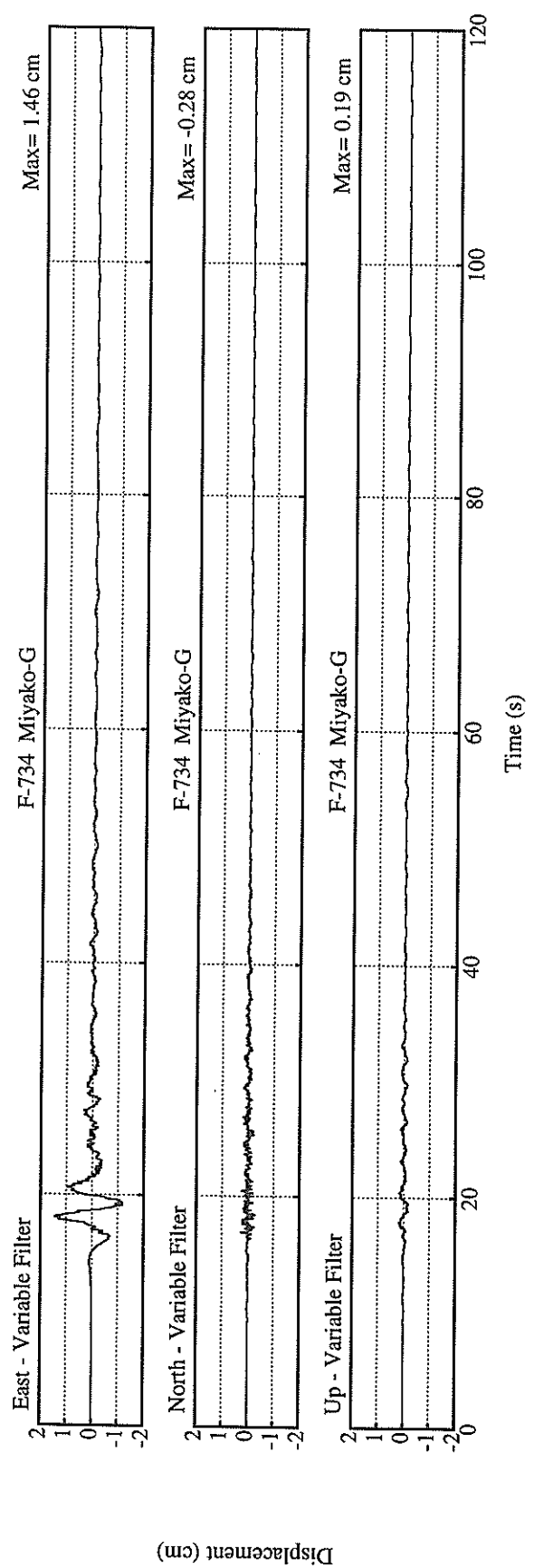
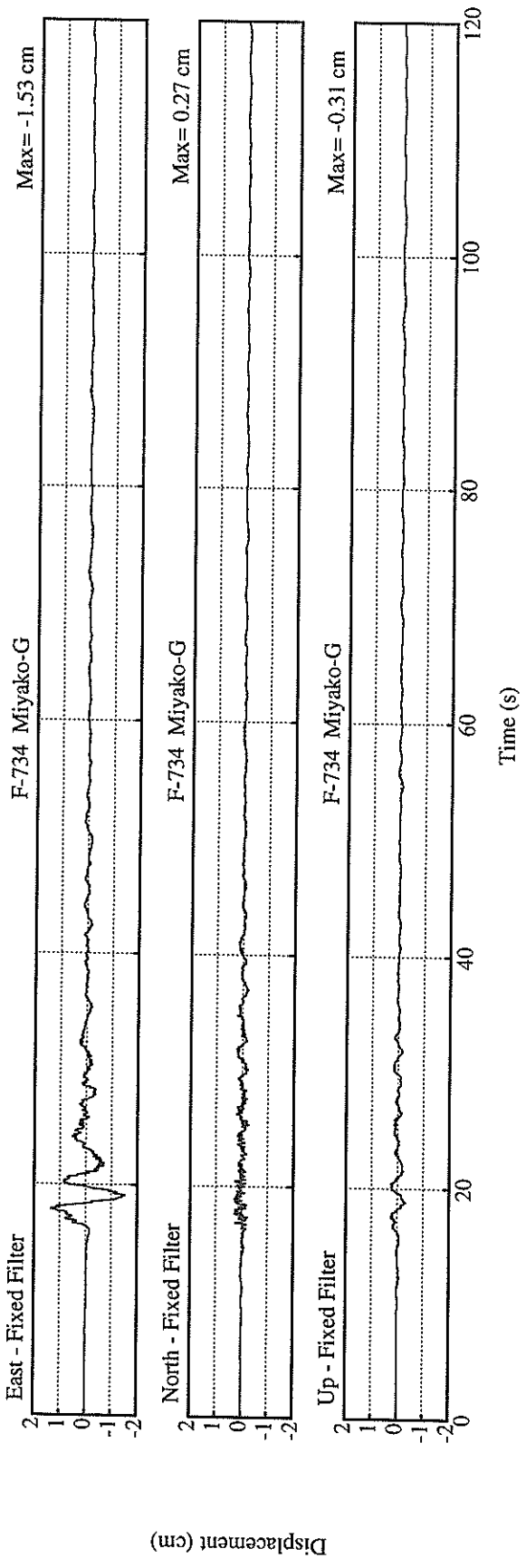
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.305	0.152	0.280	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	106.8	99.8	32.9	121.0
ORIGINAL	212.3	192.0	59.9	236.5
CORRECTED	214.1	189.9	60.3	233.4
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	5.63	6.29	1.97	6.67
VARIABLE FILTER	5.73	6.02	1.88	6.36
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.27	1.53	0.31	1.54
VARIABLE FILTER	0.28	1.46	0.19	1.47

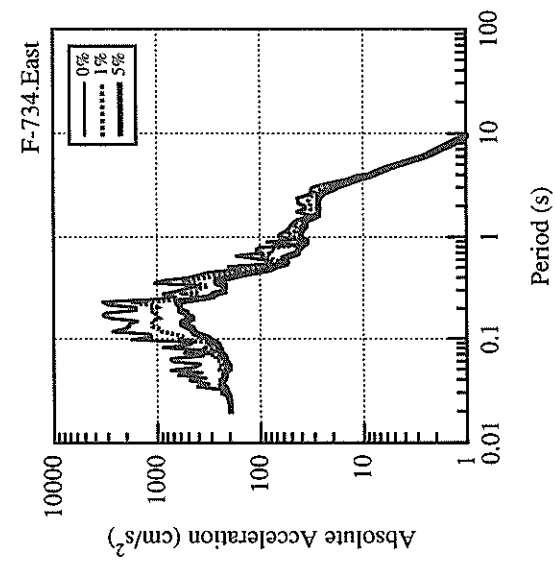
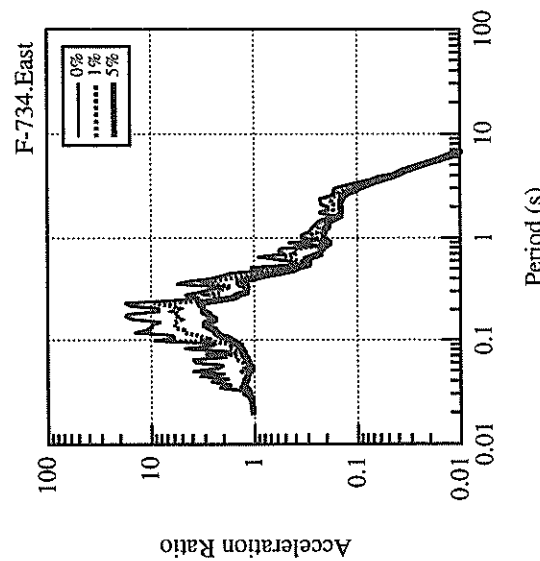
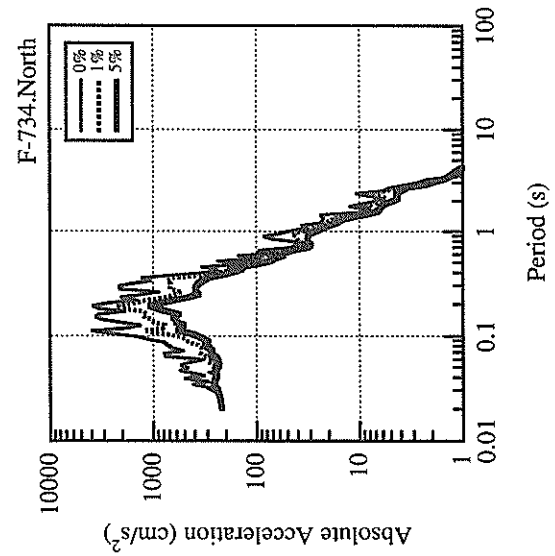
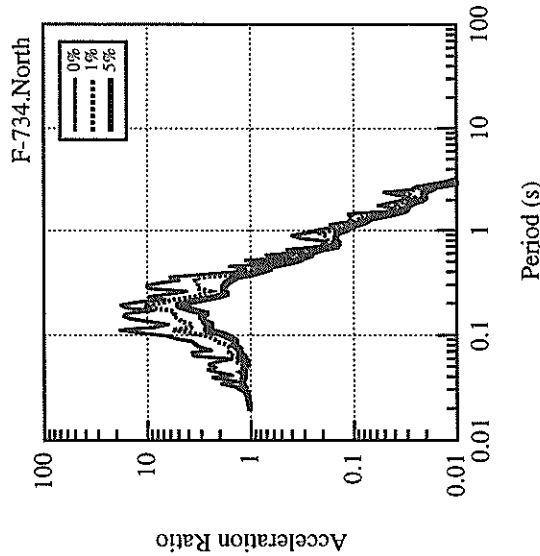
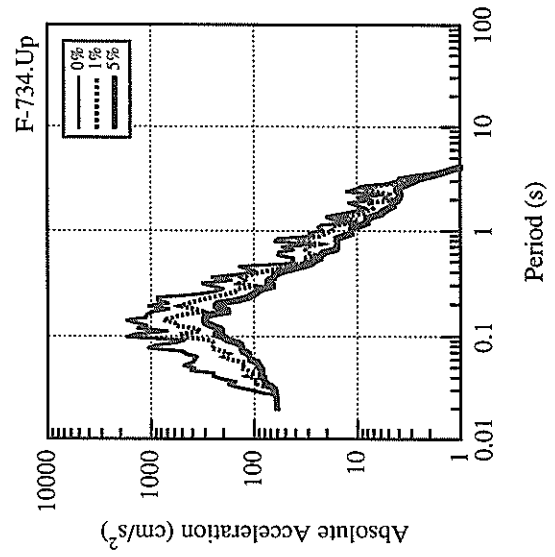
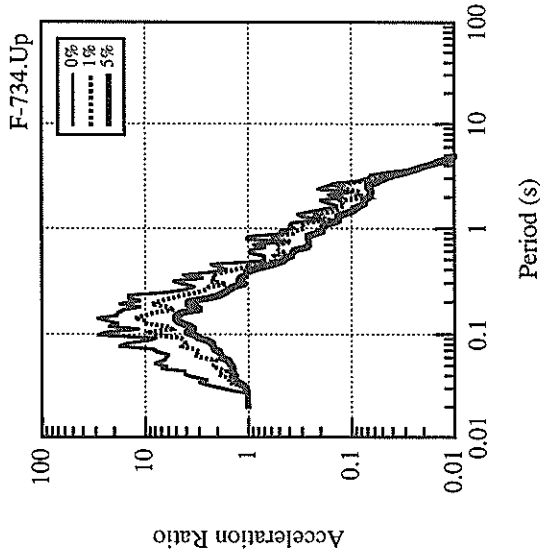
\* RESULTANT OF HORIZONTAL COMPONENTS

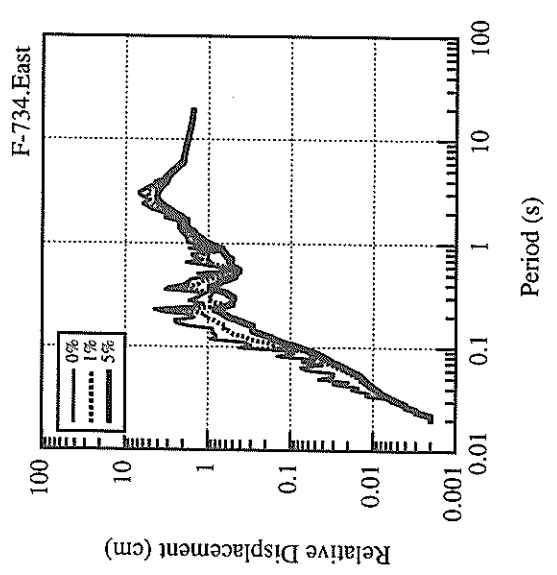
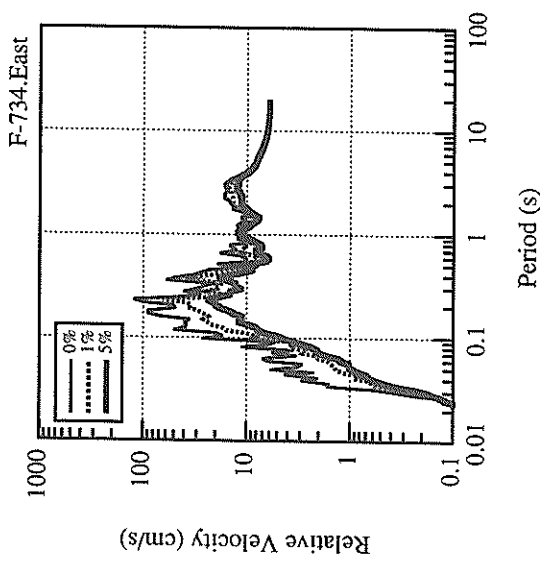
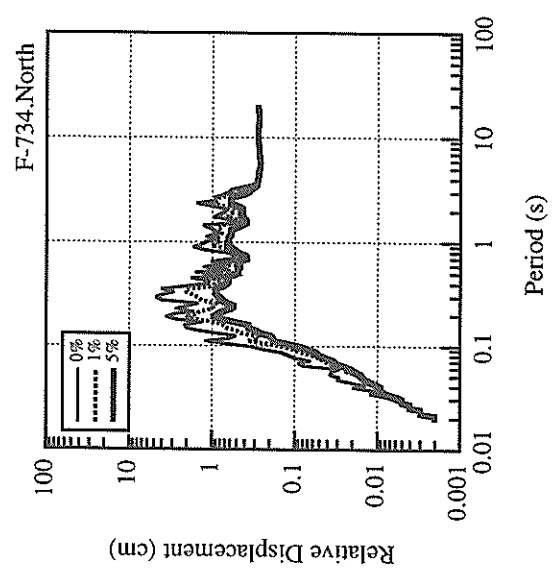
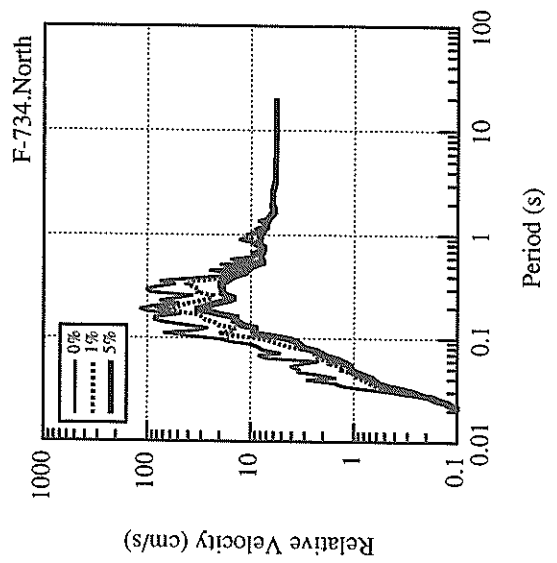
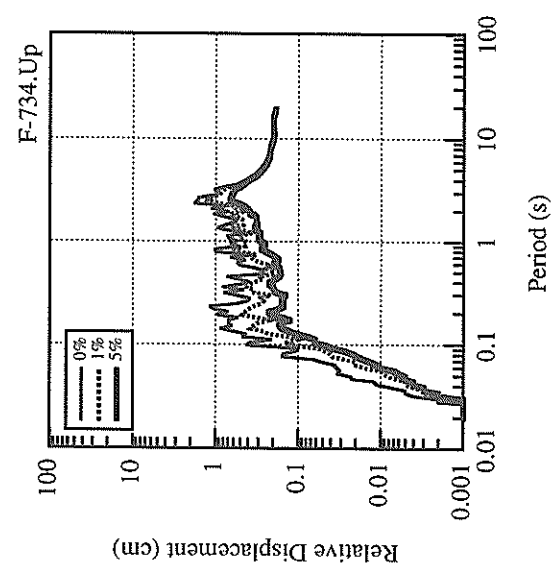
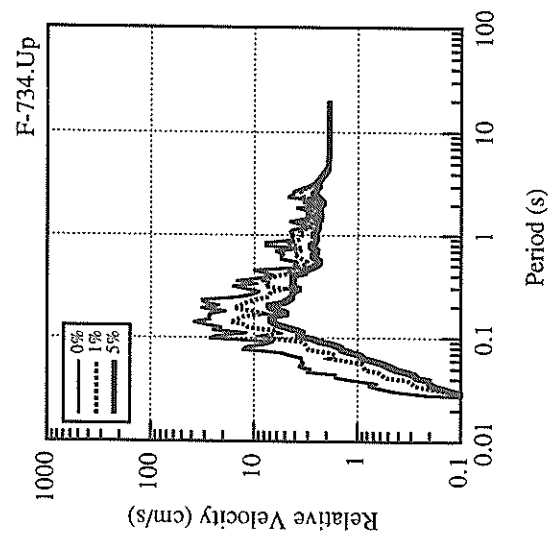


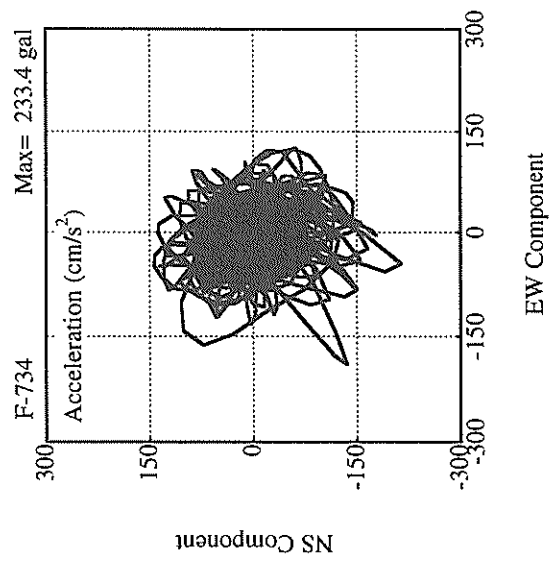
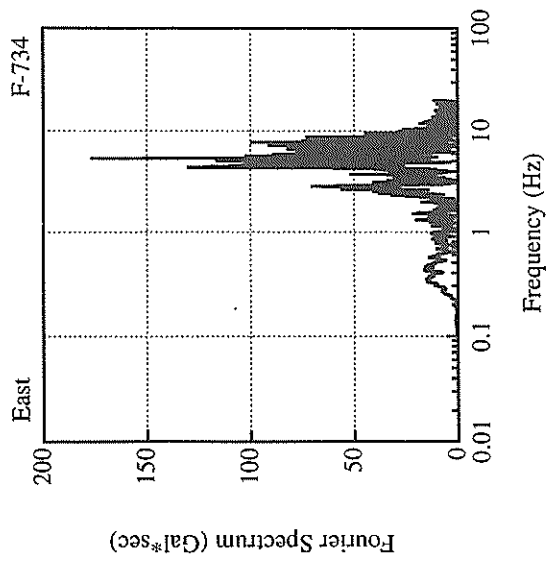
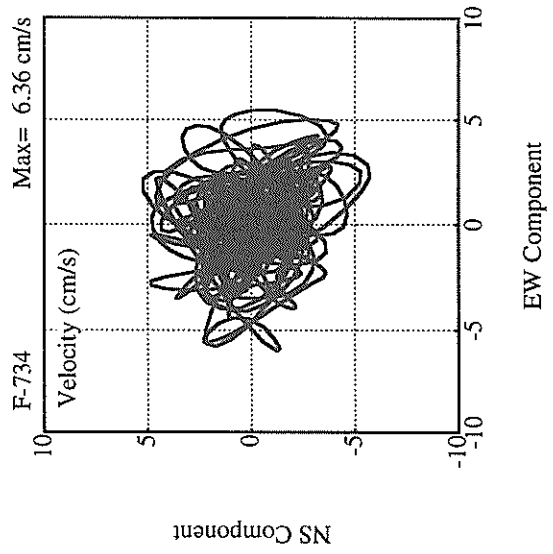
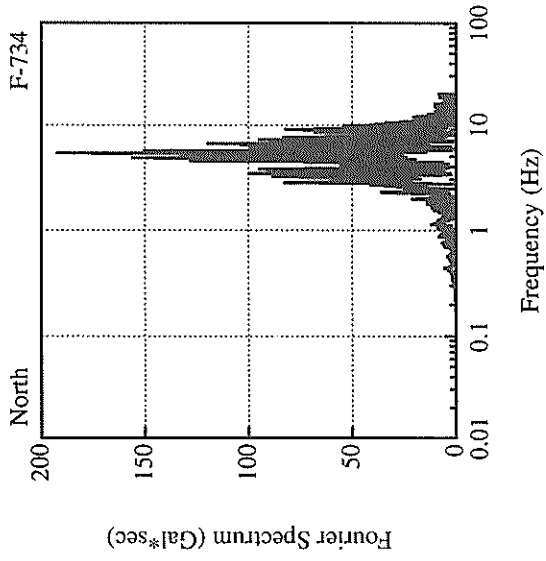
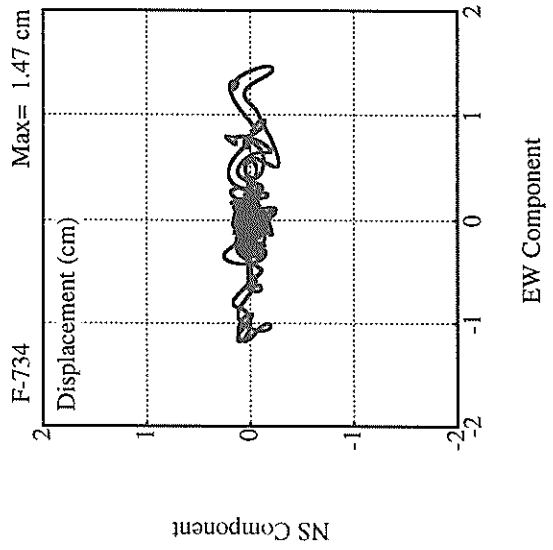
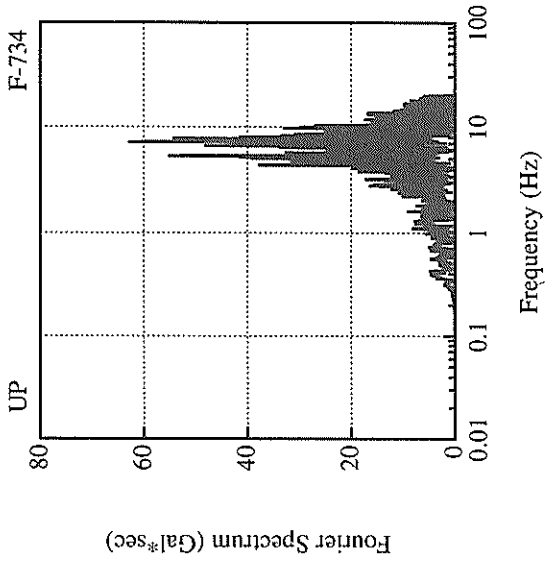














RECORD NUMBER : F-888  
 STATION : HAKODATE-FB

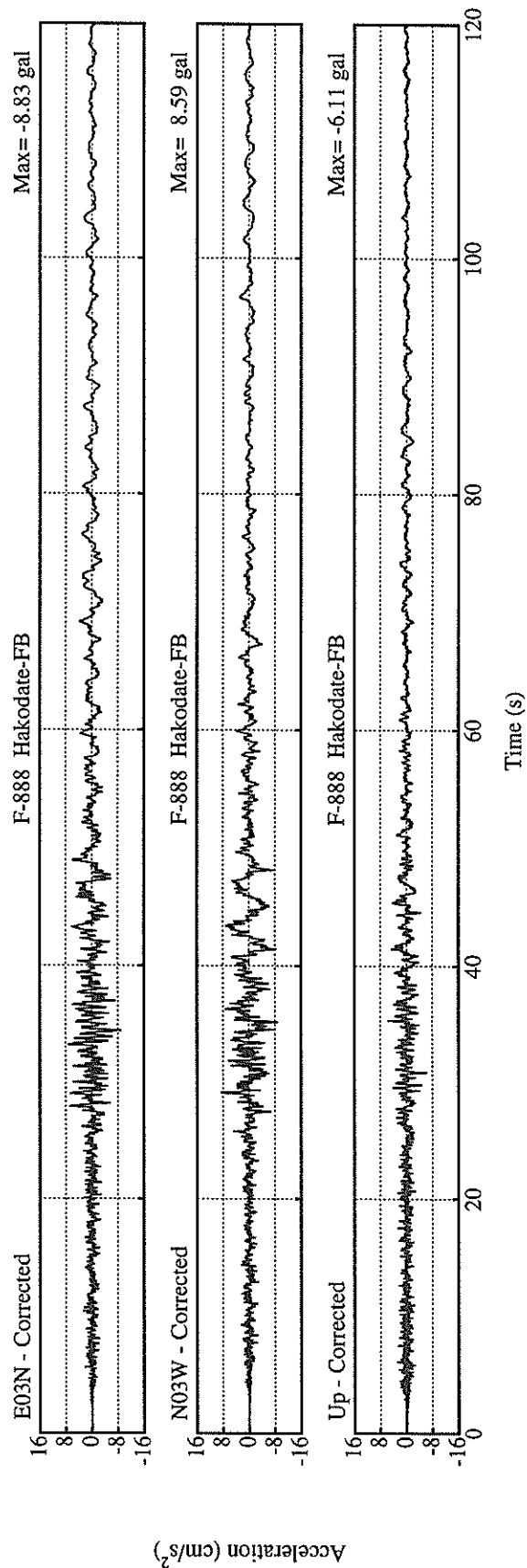
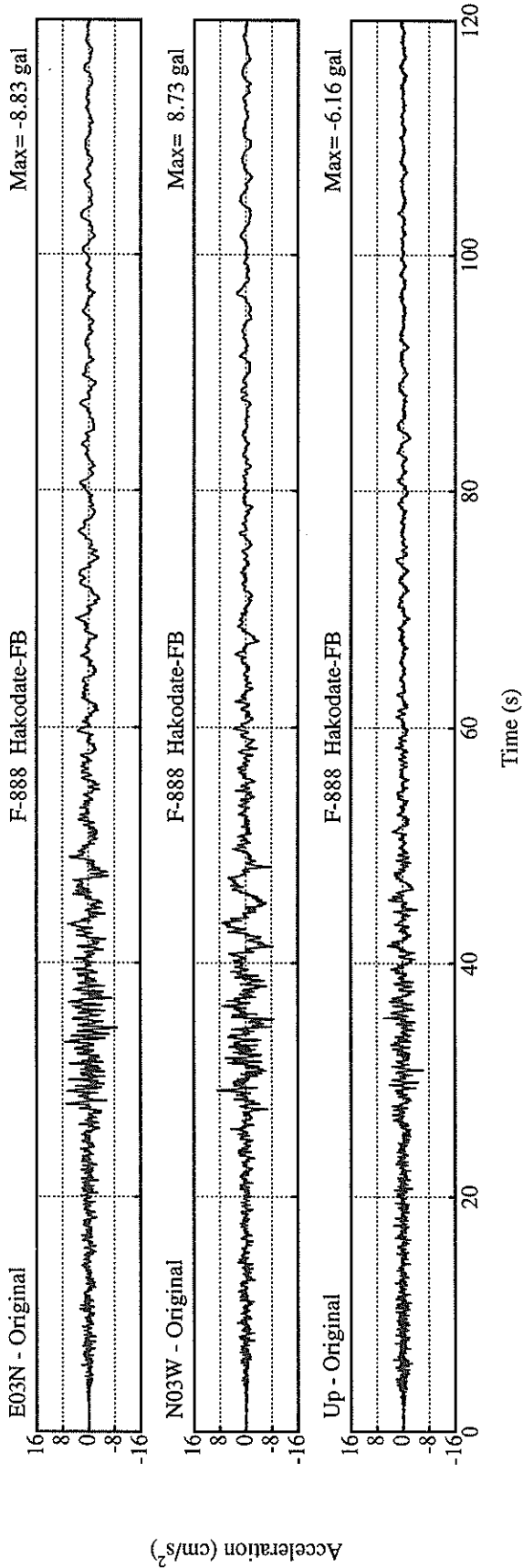
EARTHQUAKE DATA

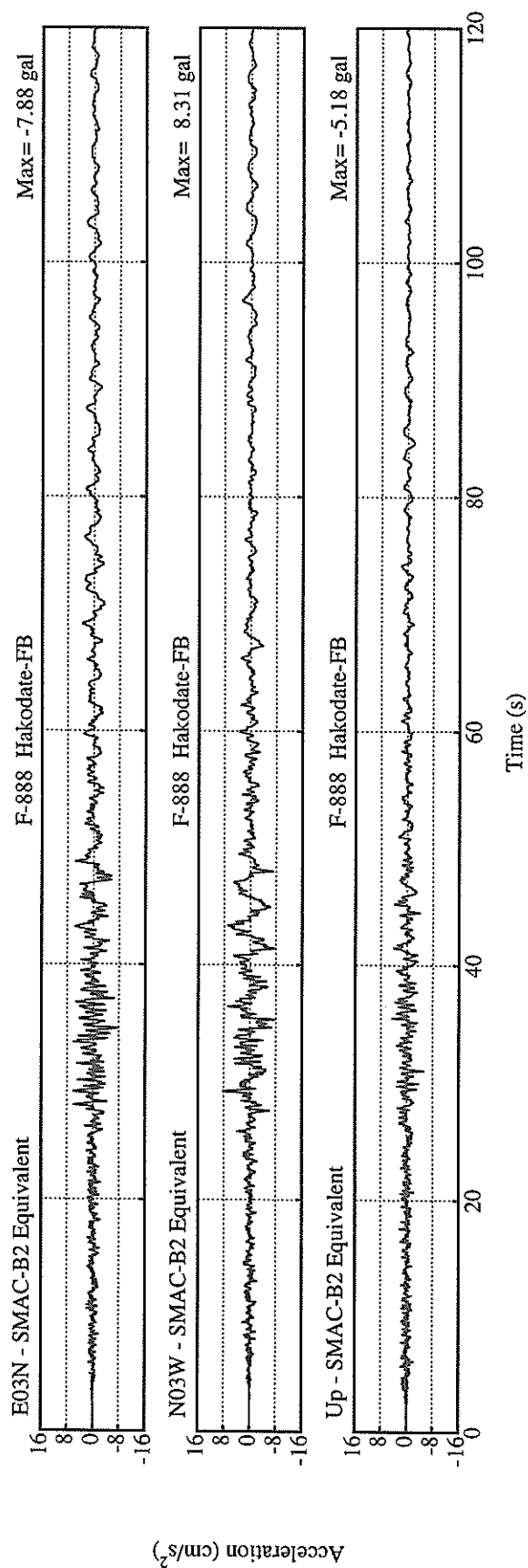
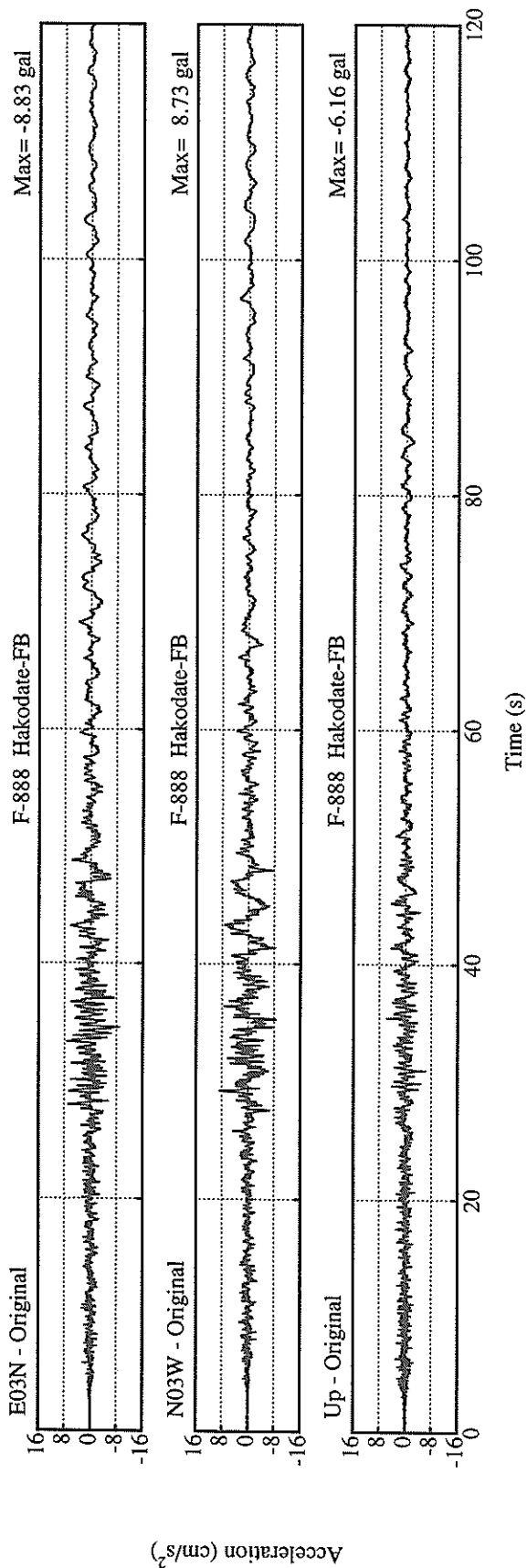
\*\*\*\*\*  
 DATE AND TIME 7:37 JAN. 7,1995  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION NE OFF IWATE PREF  
 LATITUDE 40° 13.2' N  
 LONGITUDE 142° 18.5' E  
 DEPTH 47.8KM  
 JMA MAGNITUDE 7.2  
 \*\*\*\*\*

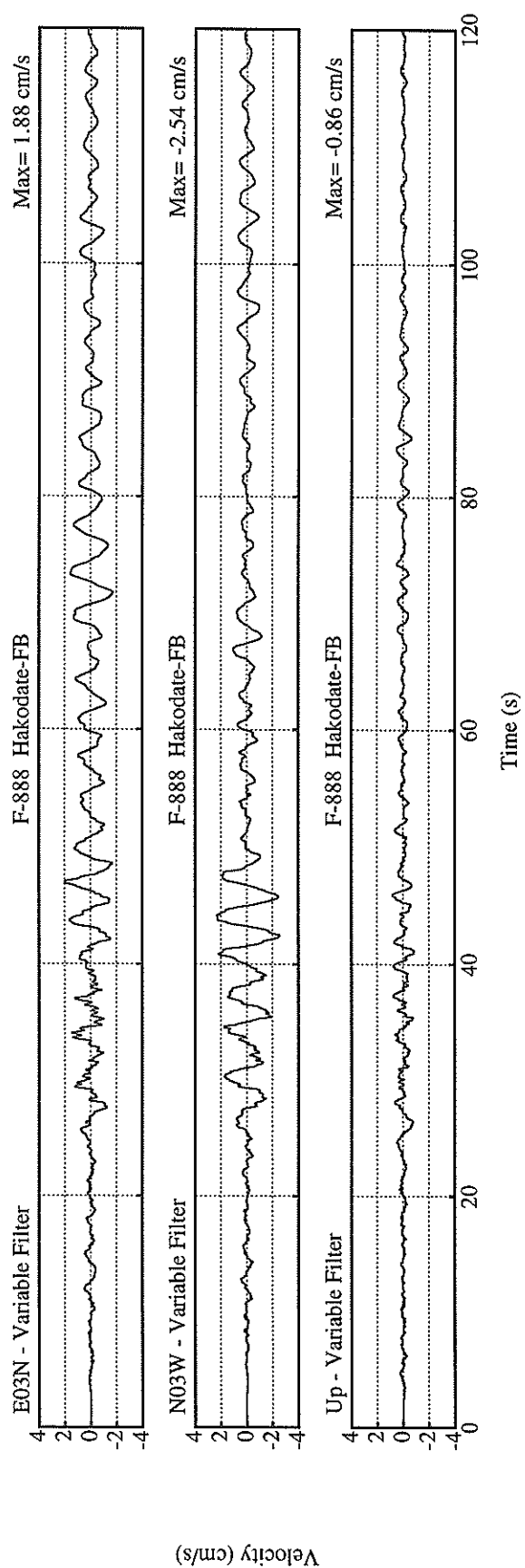
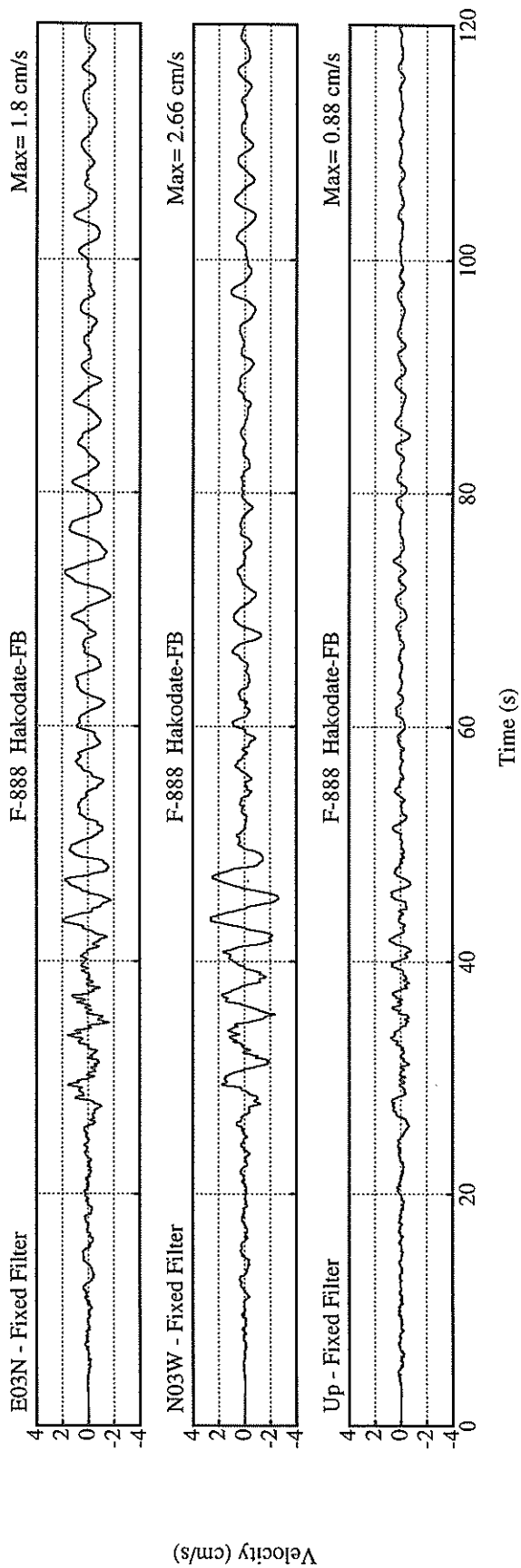
PEAK VALUES OF COMPONENTS

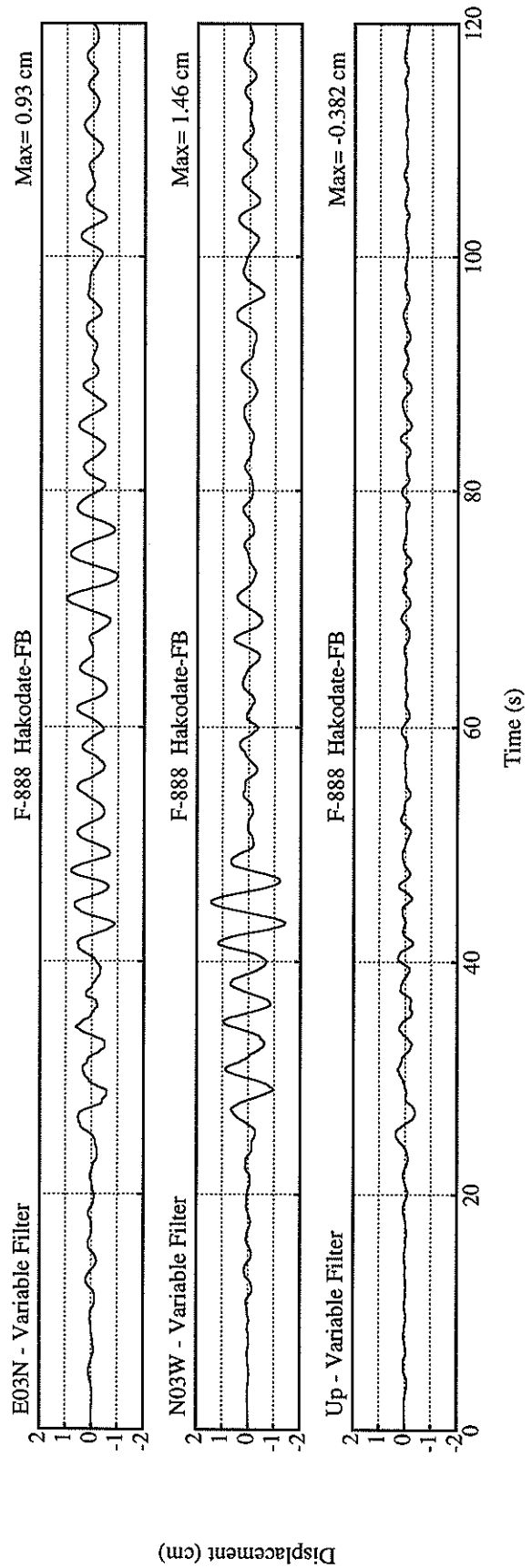
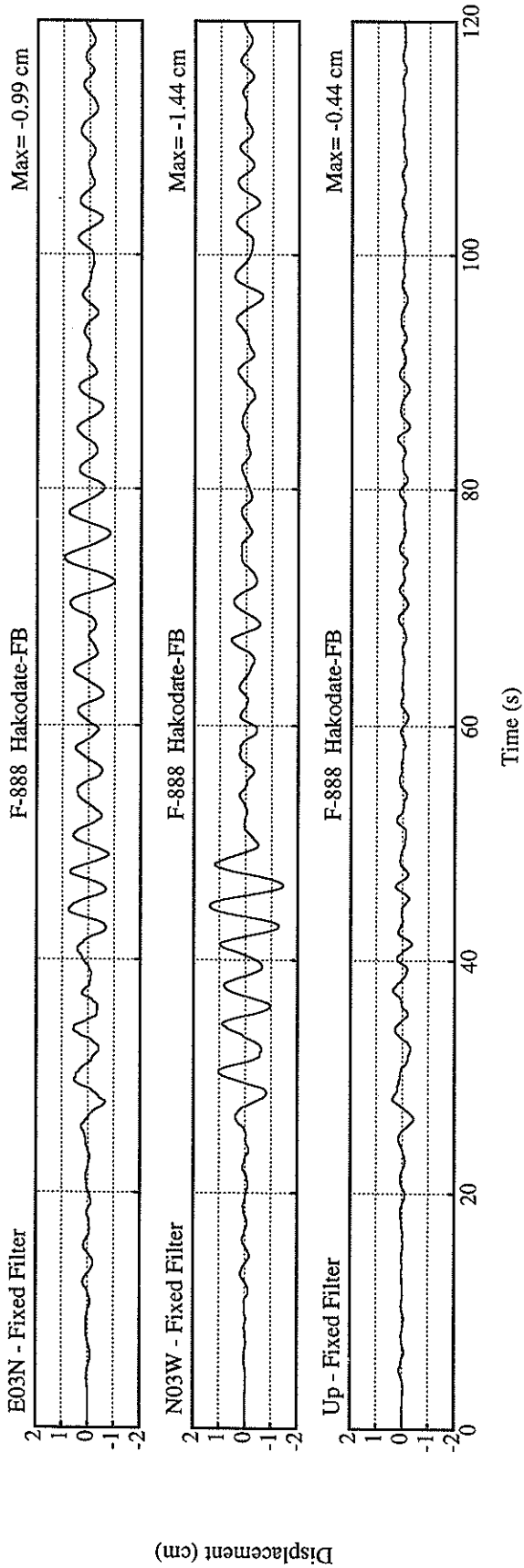
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.128	0.116	0.122	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	8.3	7.9	5.2	9.5
ORIGINAL	8.7	8.8	6.2	10.3
CORRECTED	8.6	8.8	6.1	10.1
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	2.66	1.80	0.88	3.17
VARIABLE FILTER	2.54	1.88	0.86	2.78
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	1.44	0.99	0.44	1.54
VARIABLE FILTER	1.46	0.93	0.38	1.62

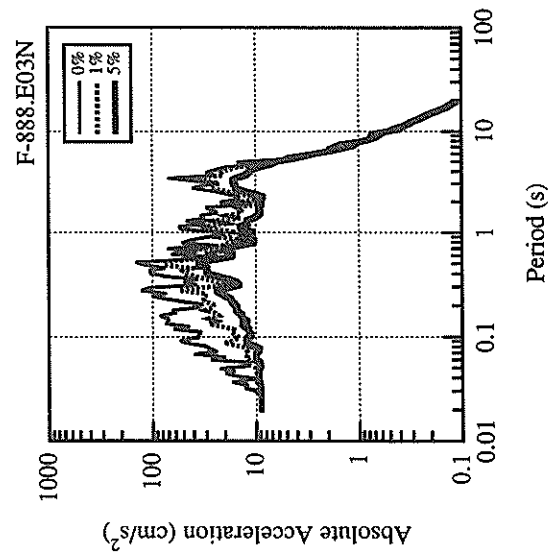
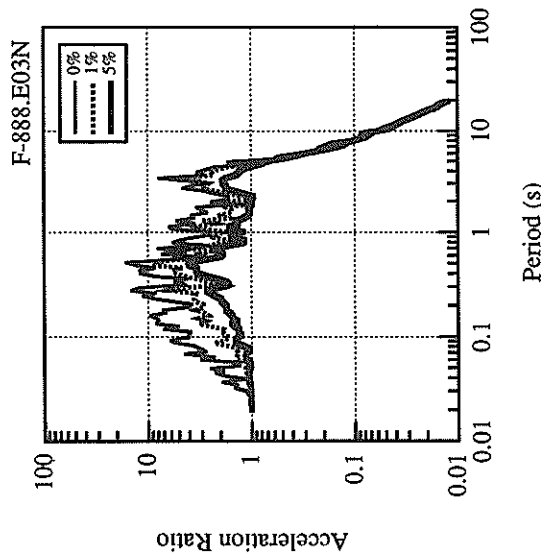
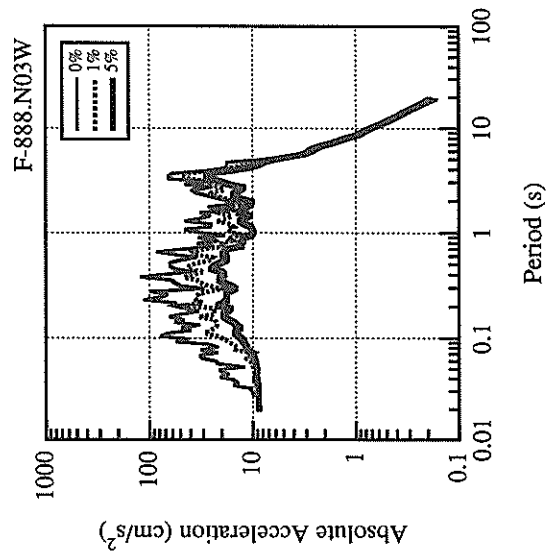
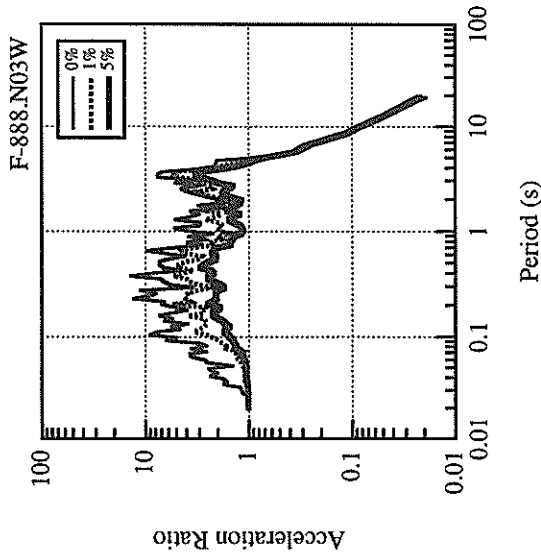
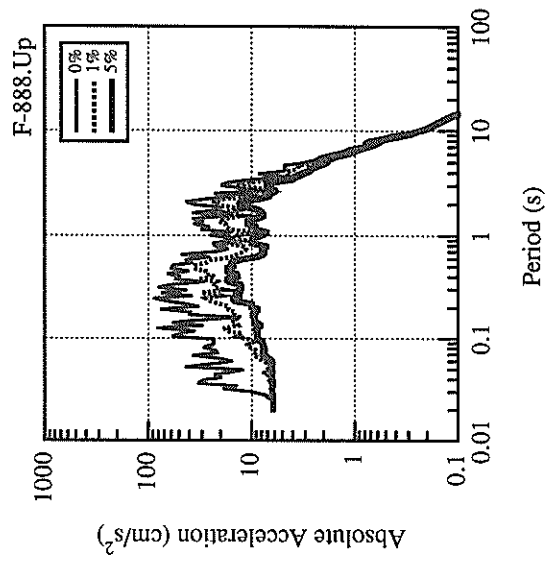
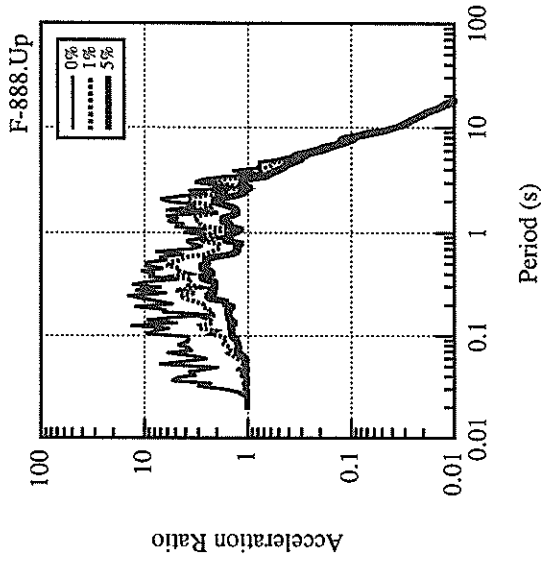
\* RESULTANT OF HORIZONTAL COMPONENTS

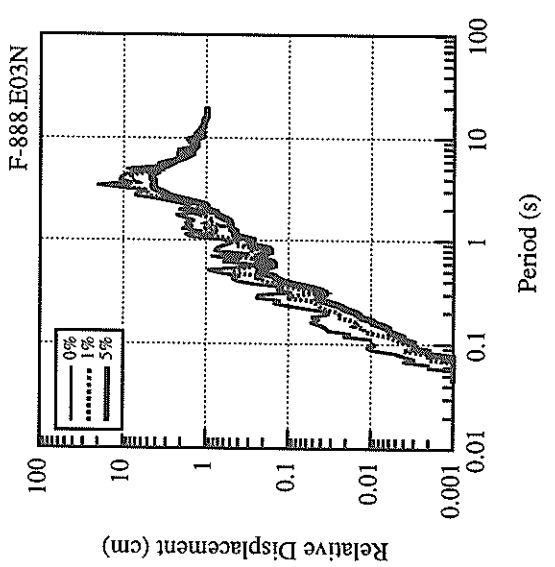
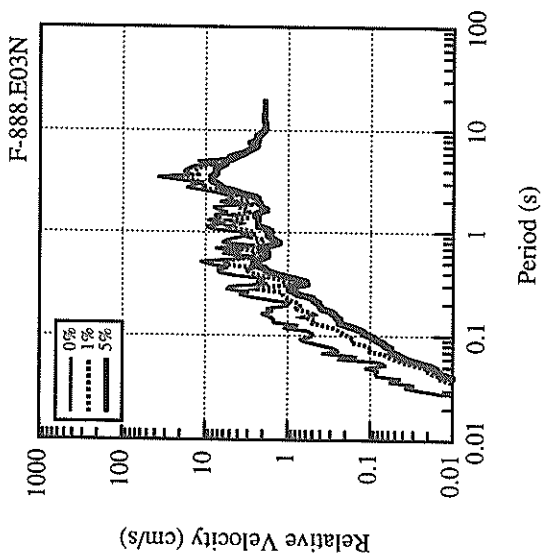
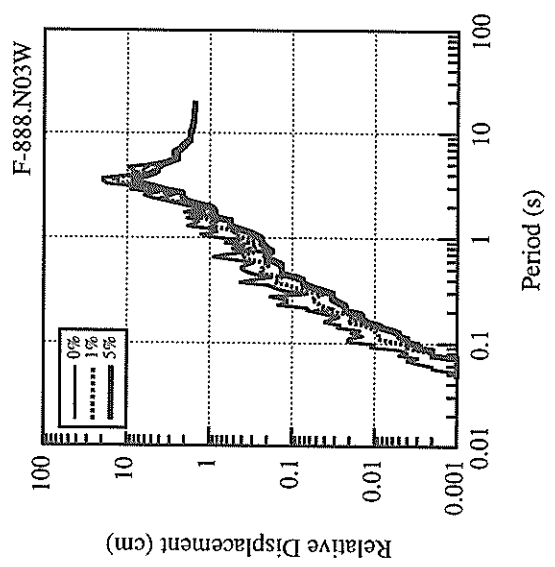
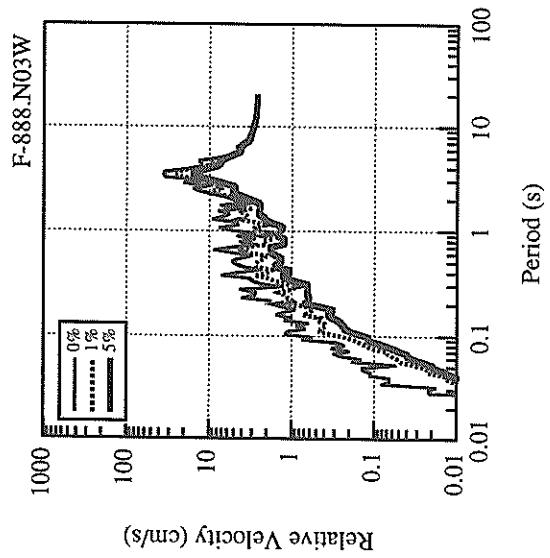
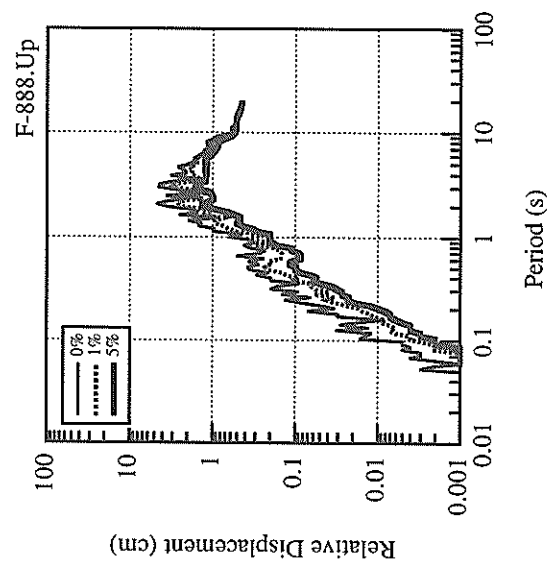
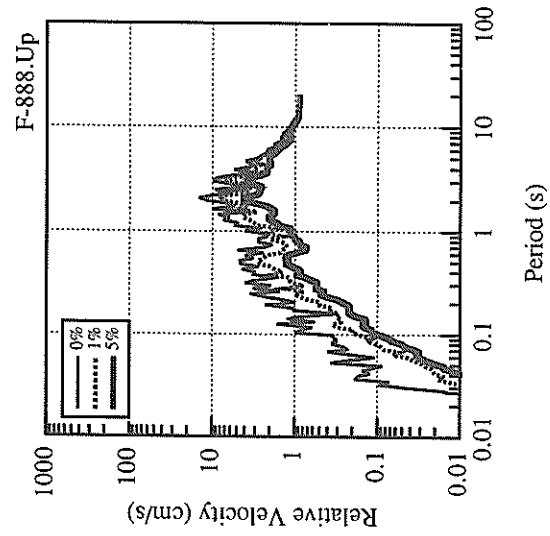


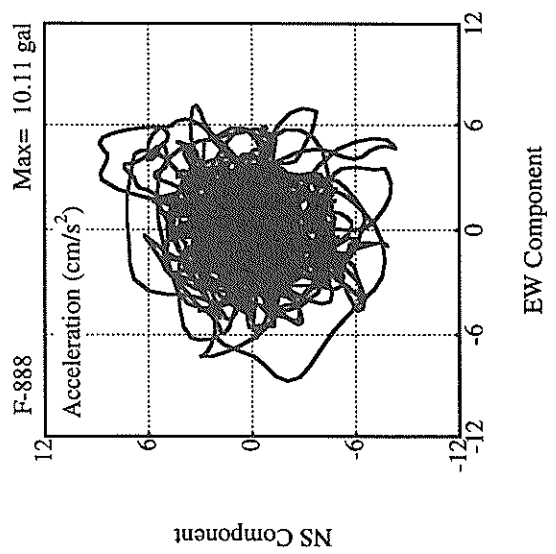
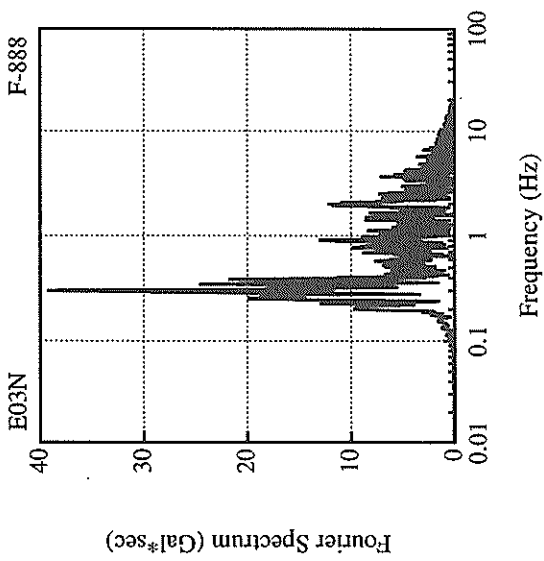
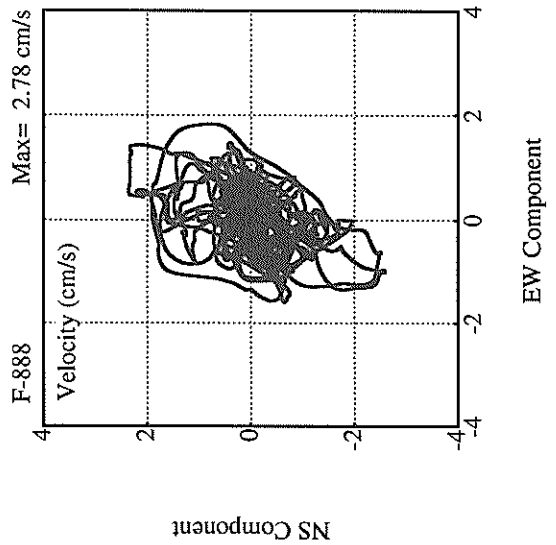
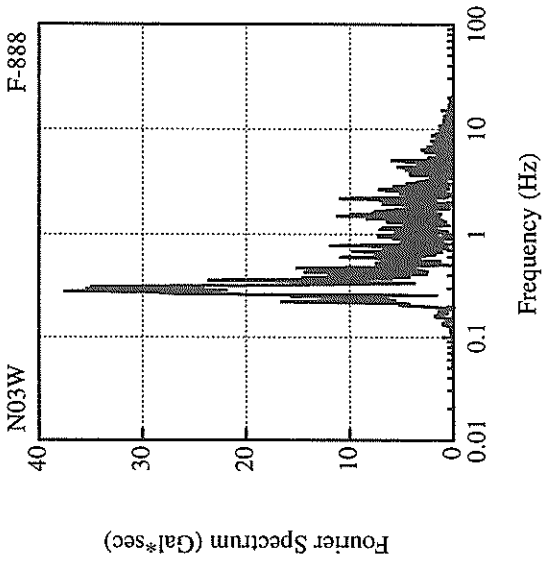
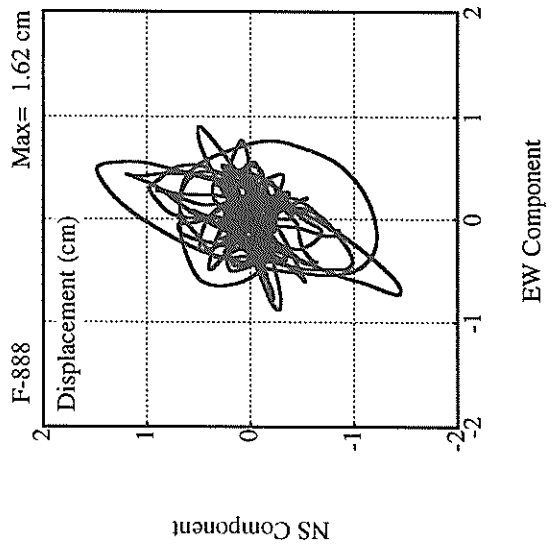
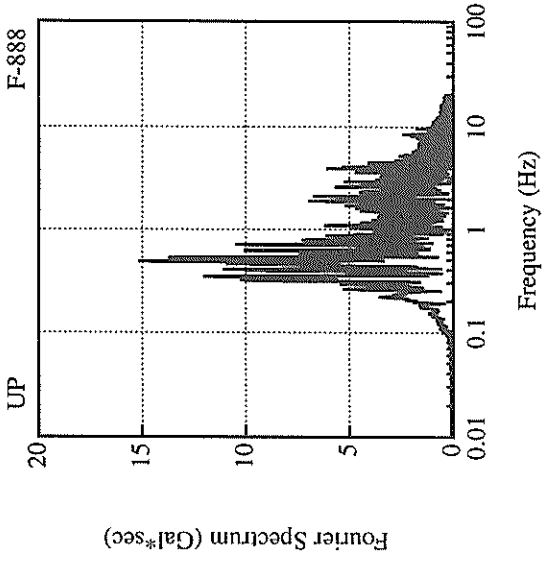














RECORD NUMBER : F-891  
 STATION : HAKODATE-F

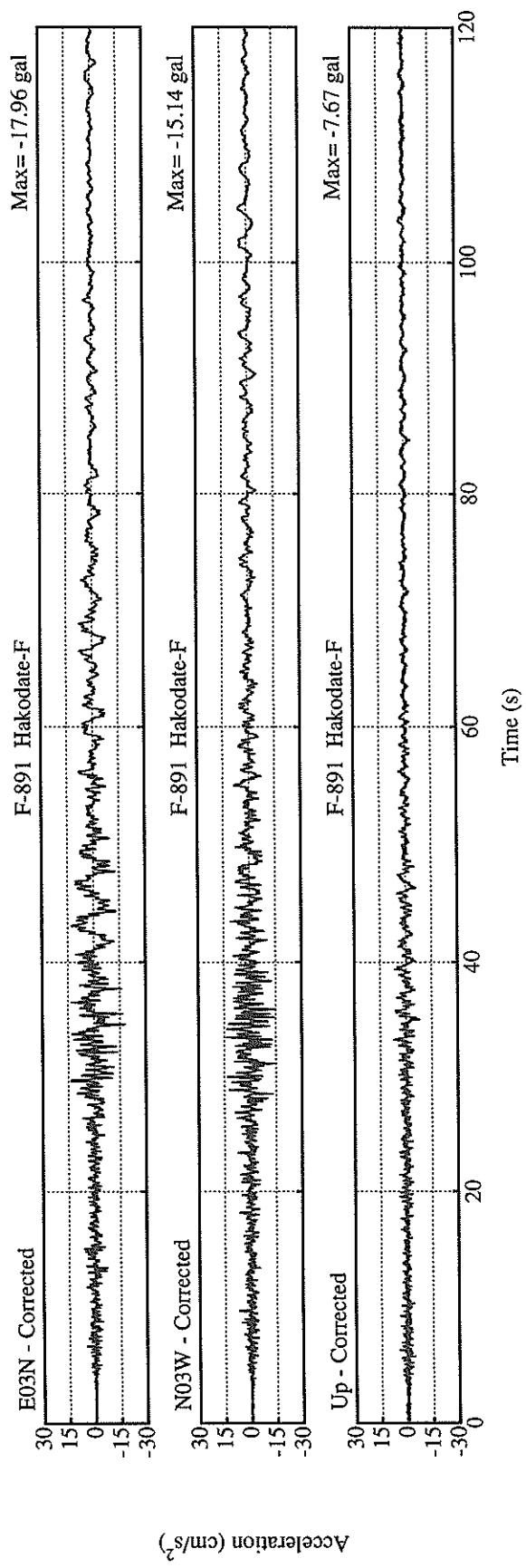
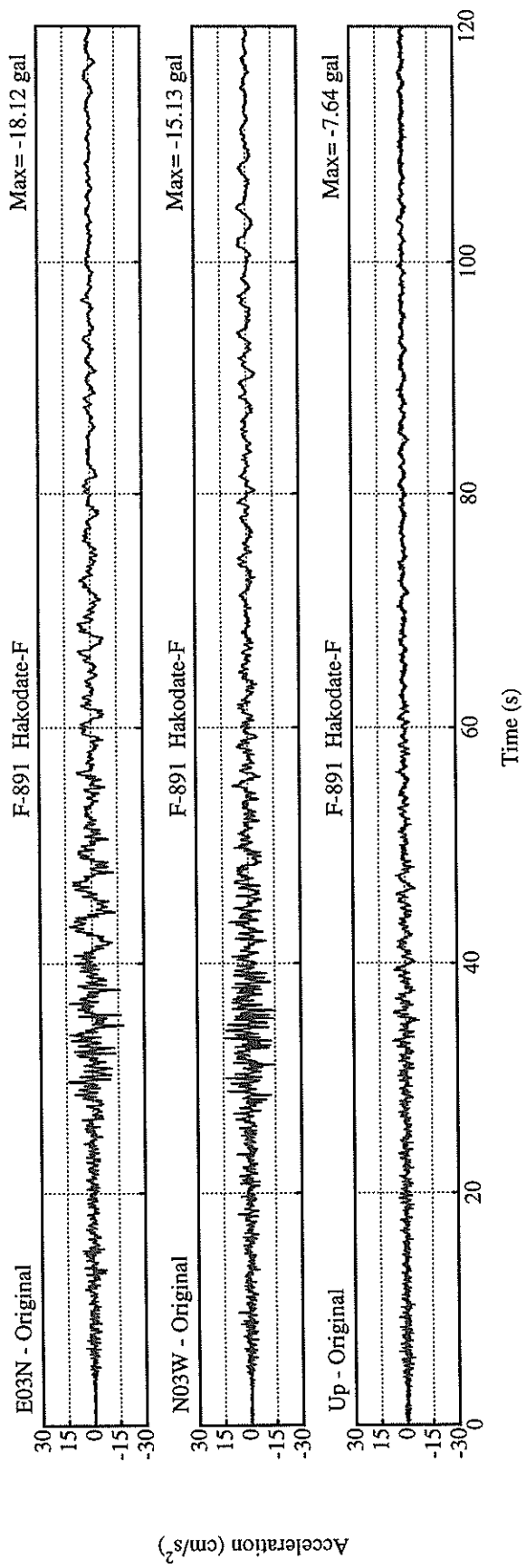
EARTHQUAKE DATA

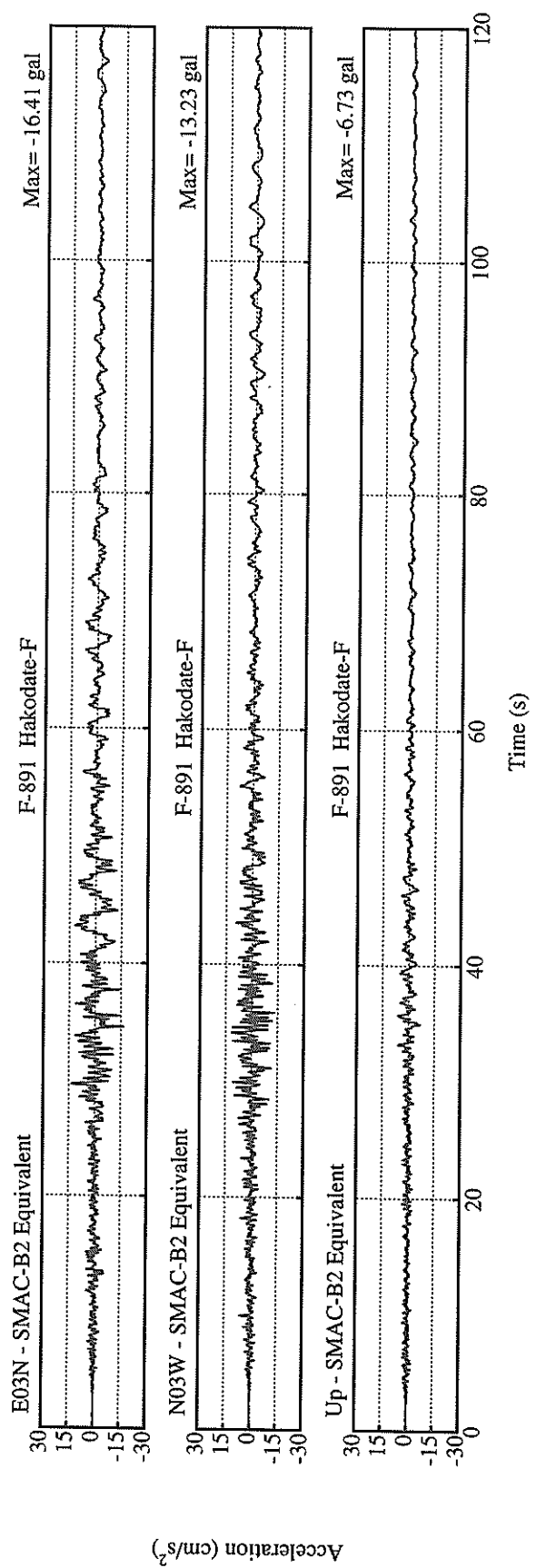
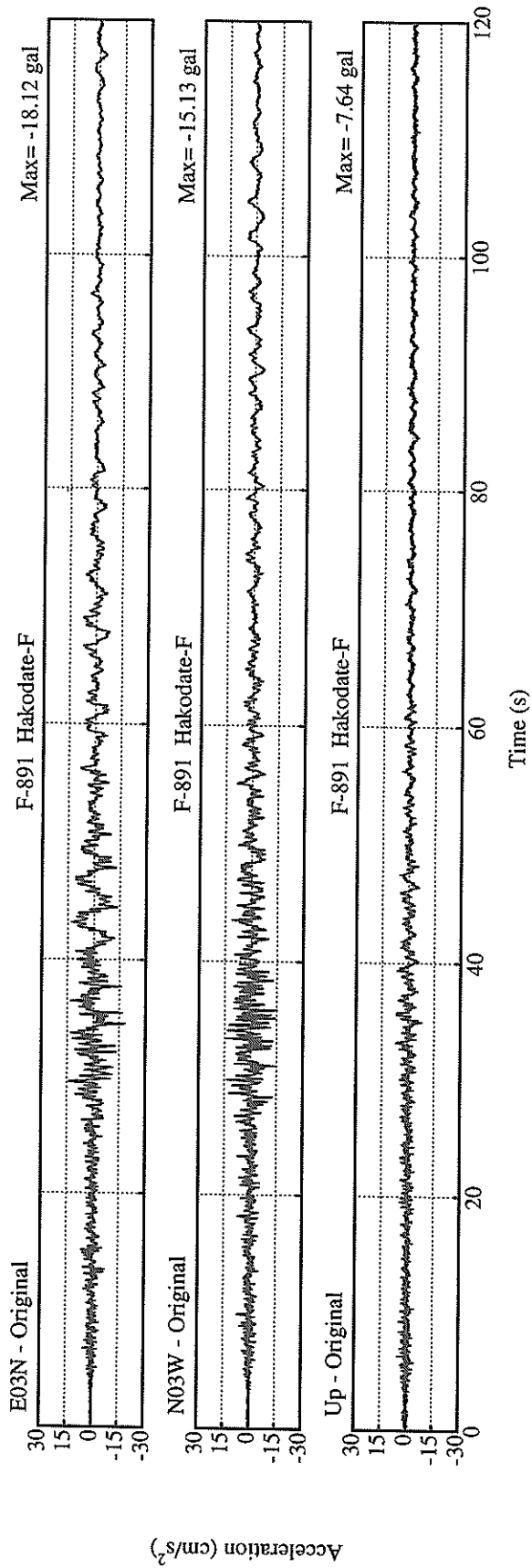
\*\*\*\*\*  
 DATE AND TIME 7:37 JAN. 7, 1995  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION NE OFF IWATE PREF  
 LATITUDE 40° 13.2' N  
 LONGITUDE 142° 18.5' E  
 DEPTH 47.8KM  
 JMA MAGNITUDE 7.2  
 \*\*\*\*\*

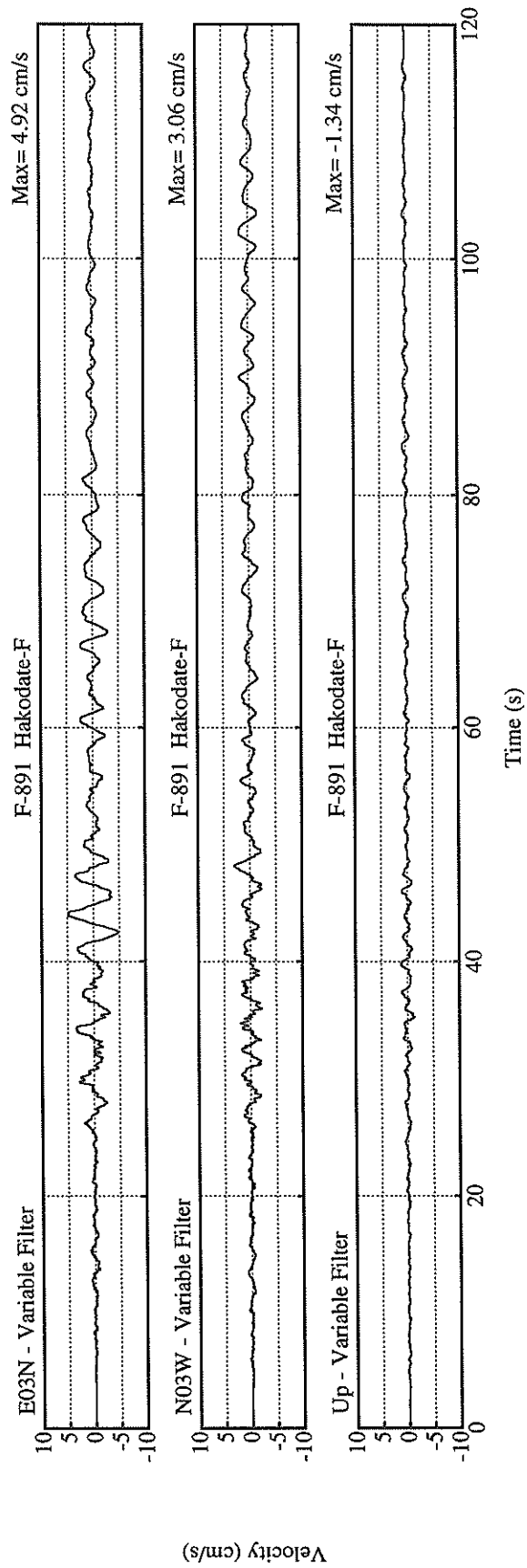
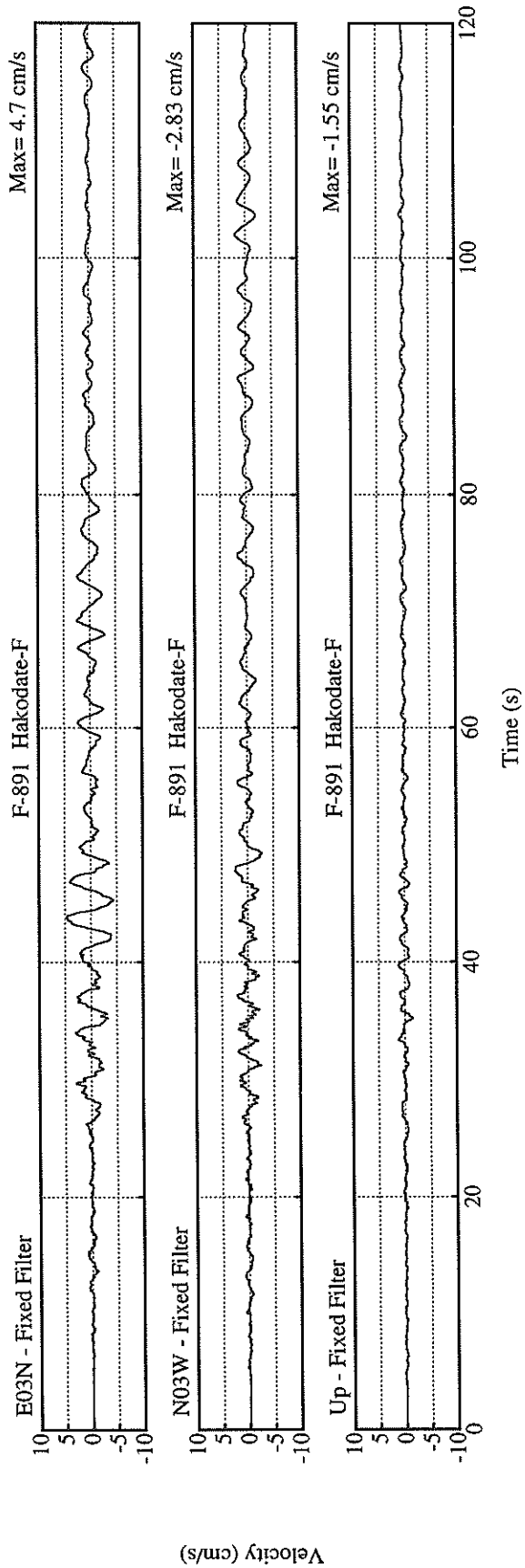
PEAK VALUES OF COMPONENTS

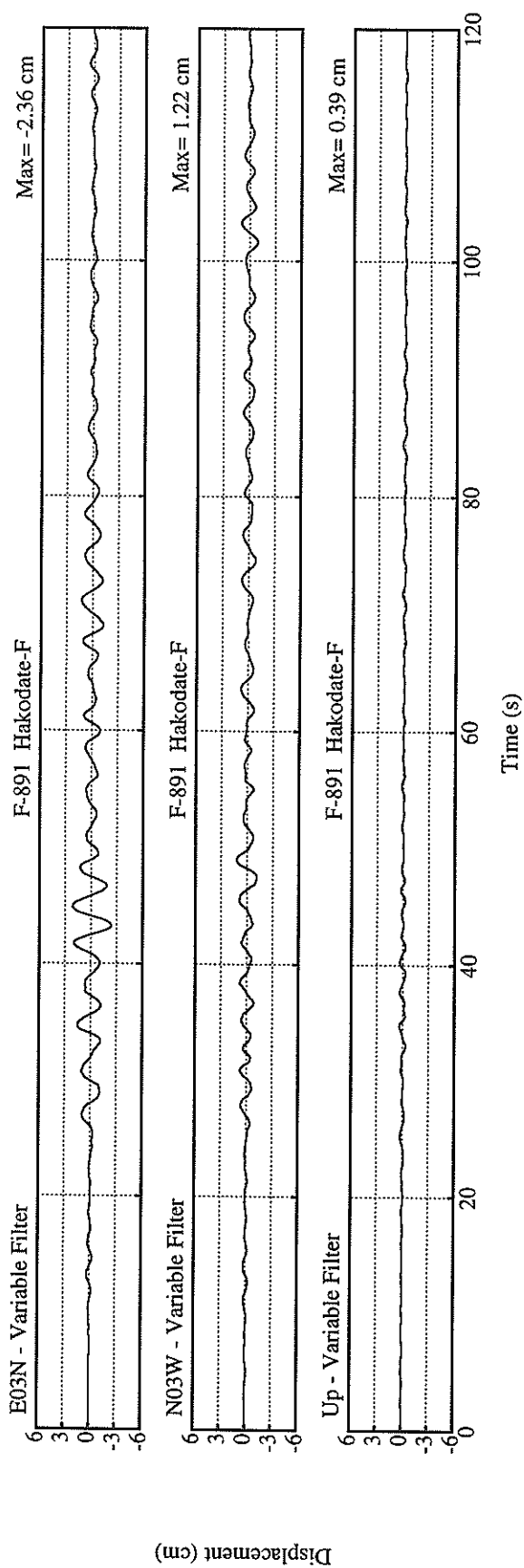
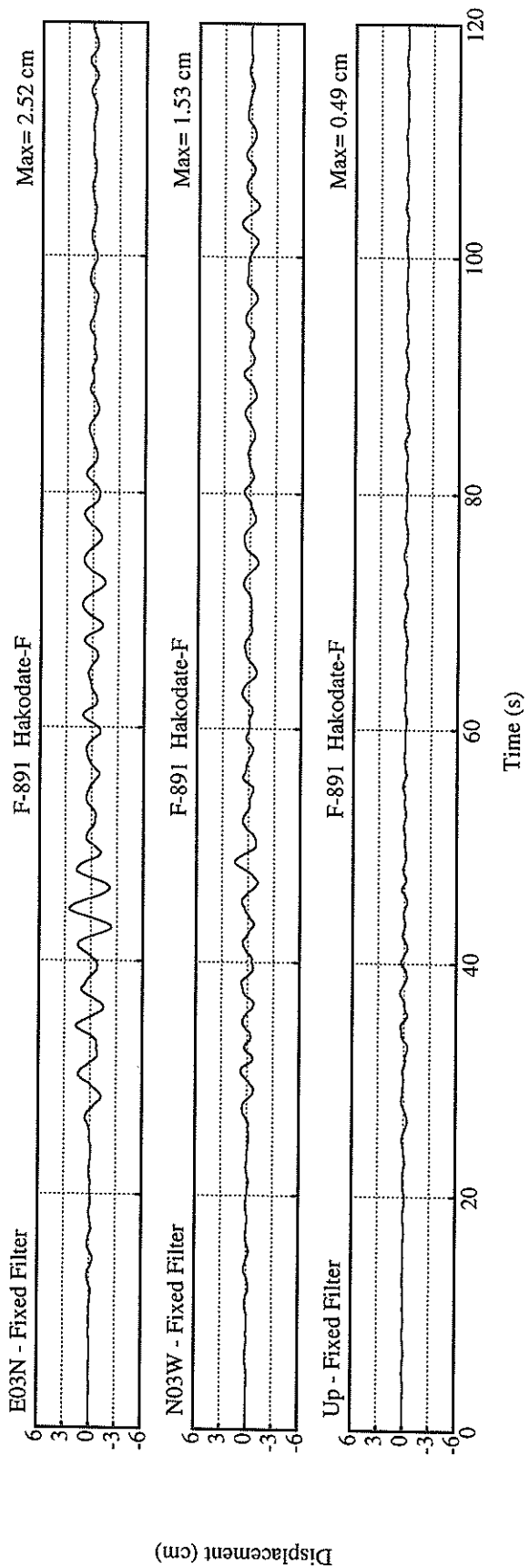
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.140	0.134	0.195	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	13.2	16.4	6.7	18.6
ORIGINAL	15.1	18.1	7.6	20.9
CORRECTED	15.1	18.0	7.7	20.8
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	2.83	4.70	1.55	4.79
VARIABLE FILTER	3.06	4.92	1.34	4.96
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	1.53	2.52	0.49	2.55
VARIABLE FILTER	1.22	2.36	0.39	2.42

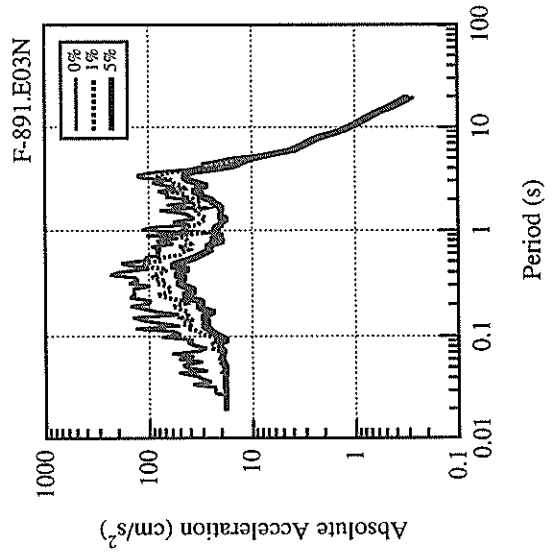
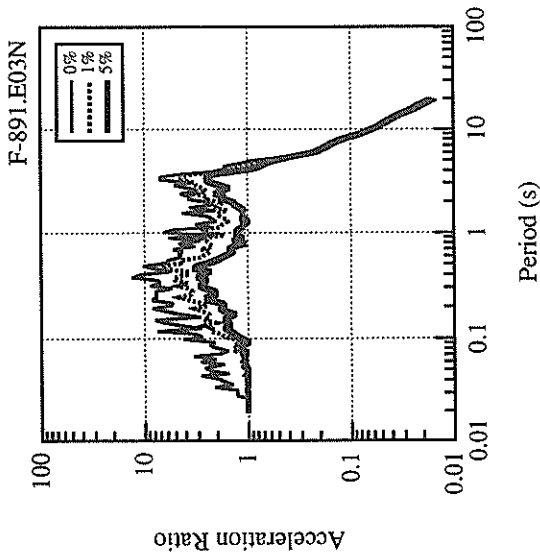
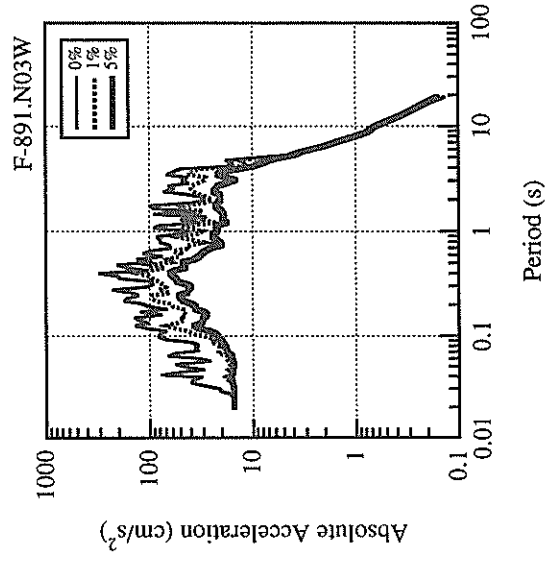
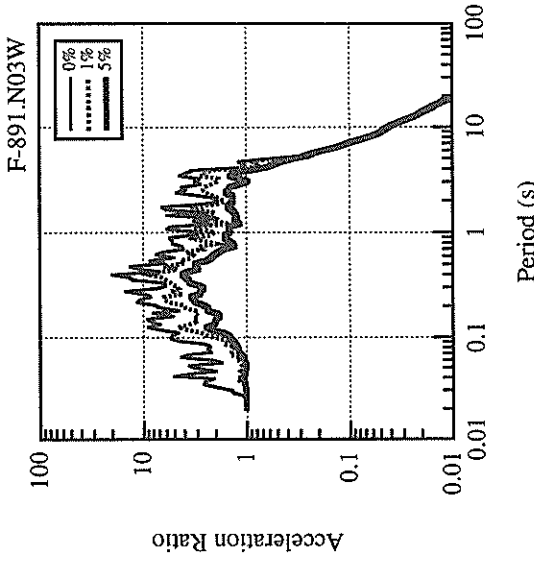
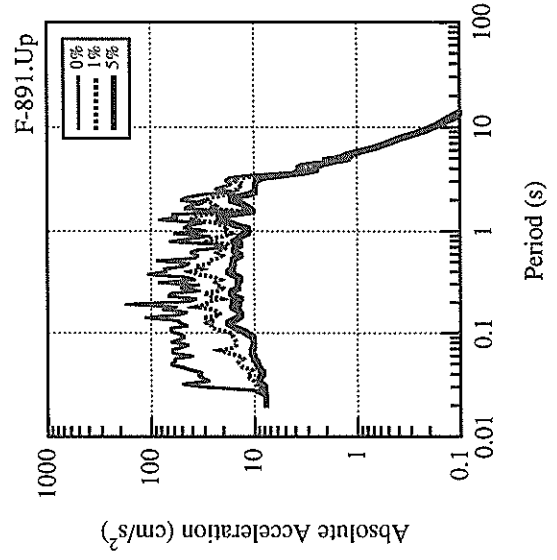
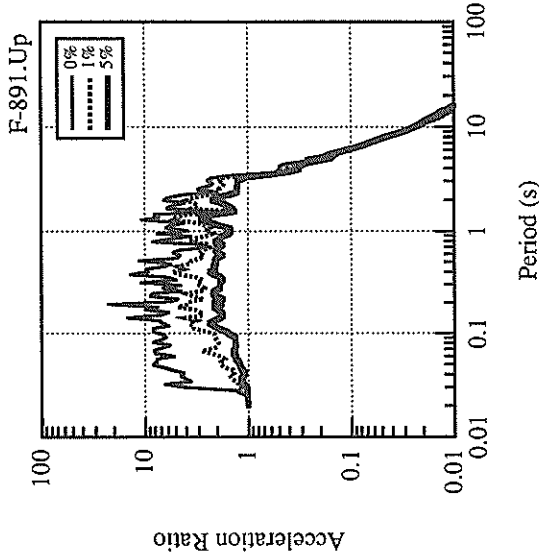
\* RESULTANT OF HORIZONTAL COMPONENTS

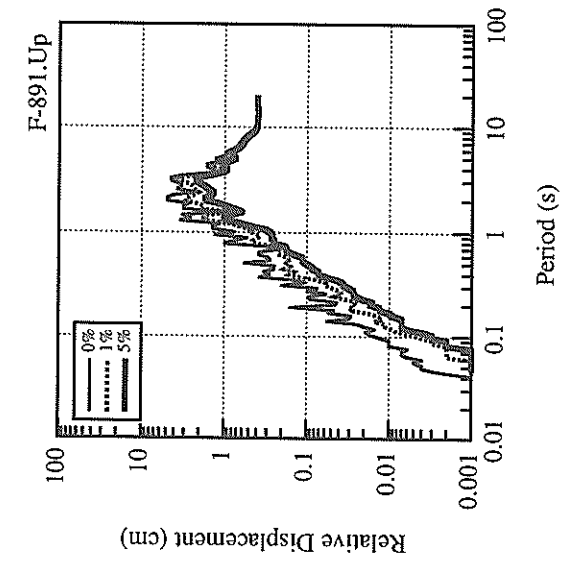
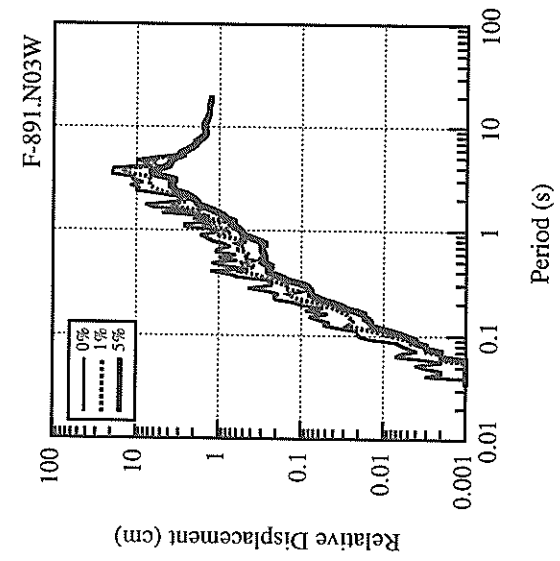
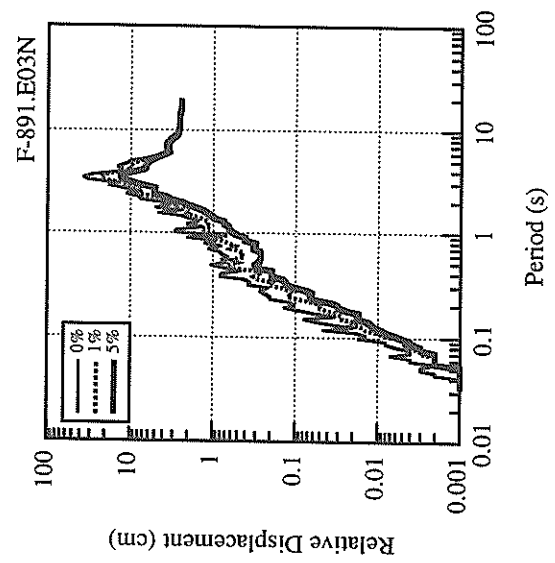
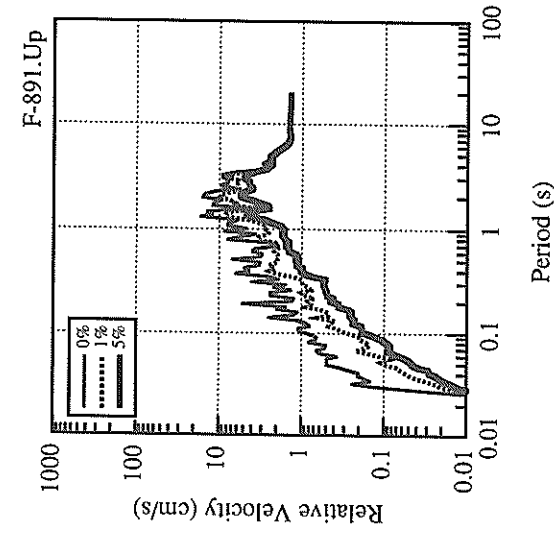
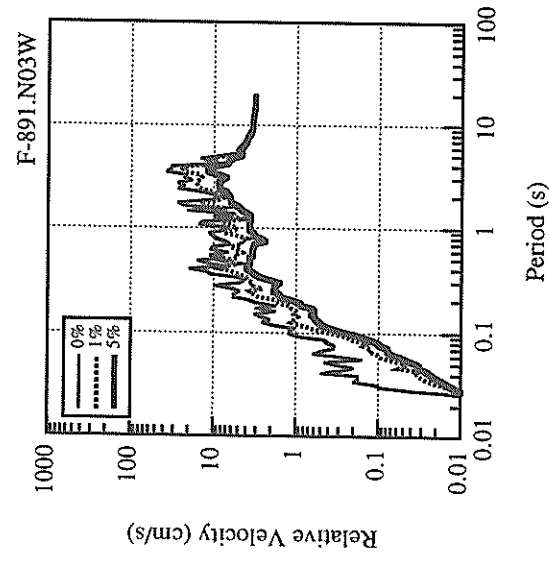
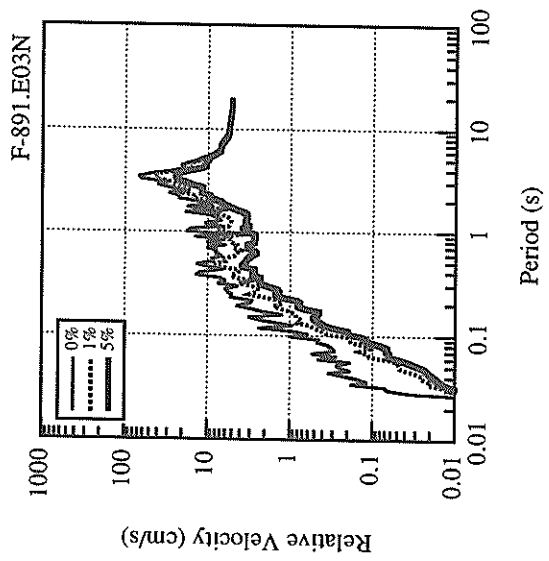


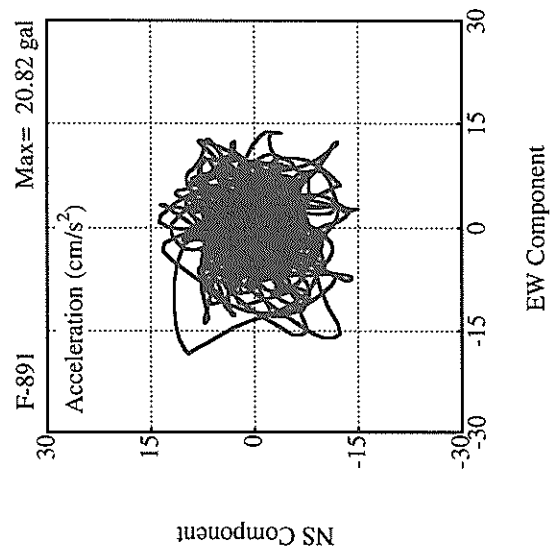
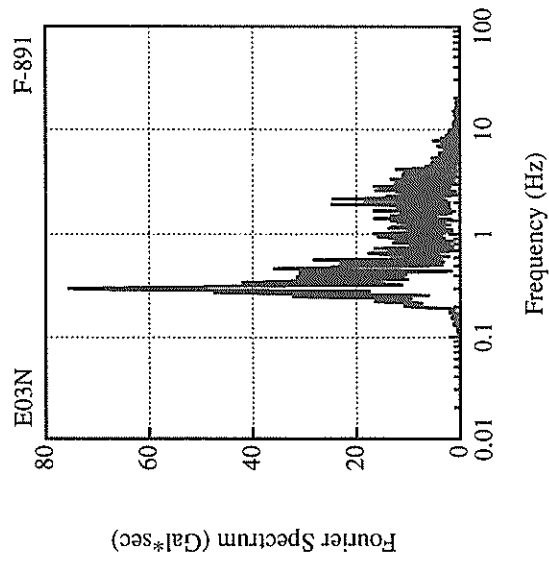
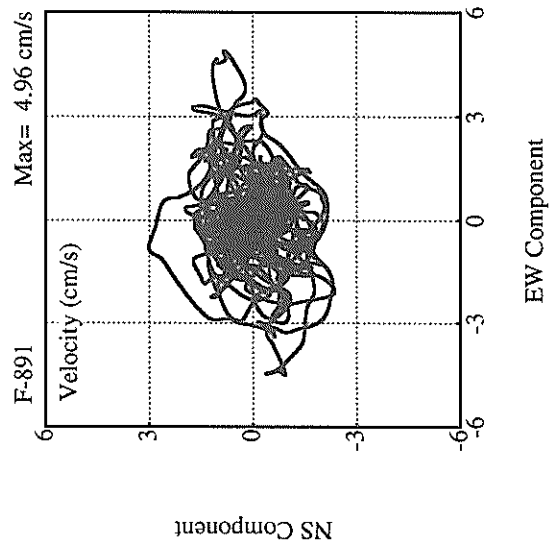
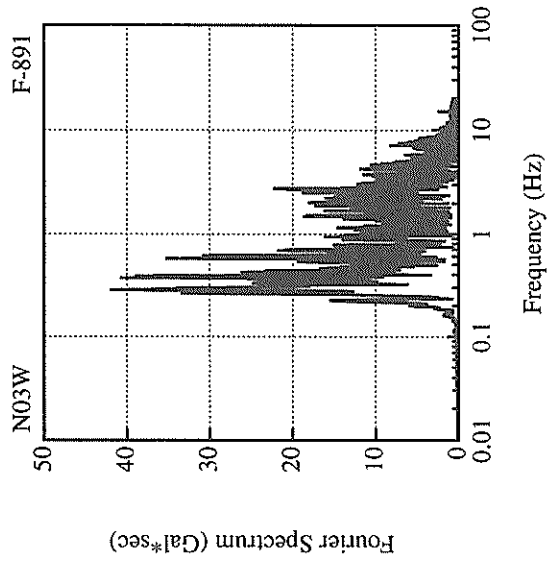
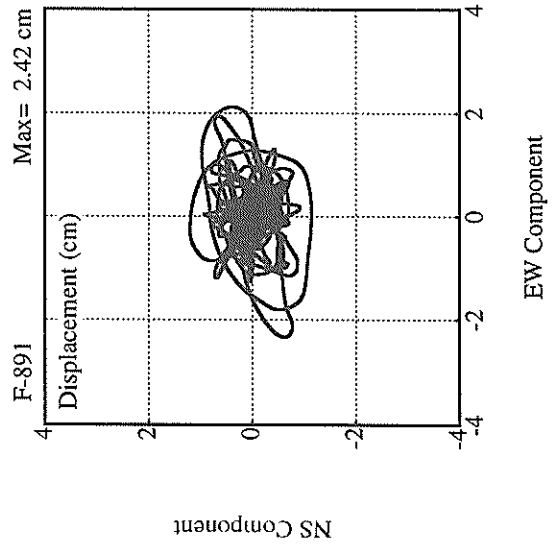
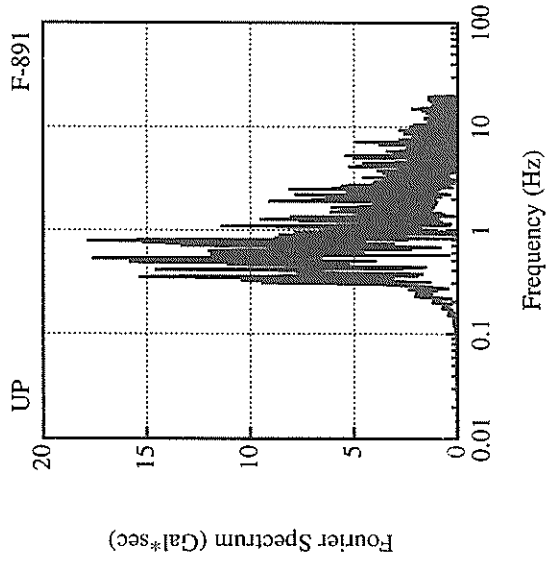














RECORD NUMBER : F-904  
 STATION : AKITA-GB

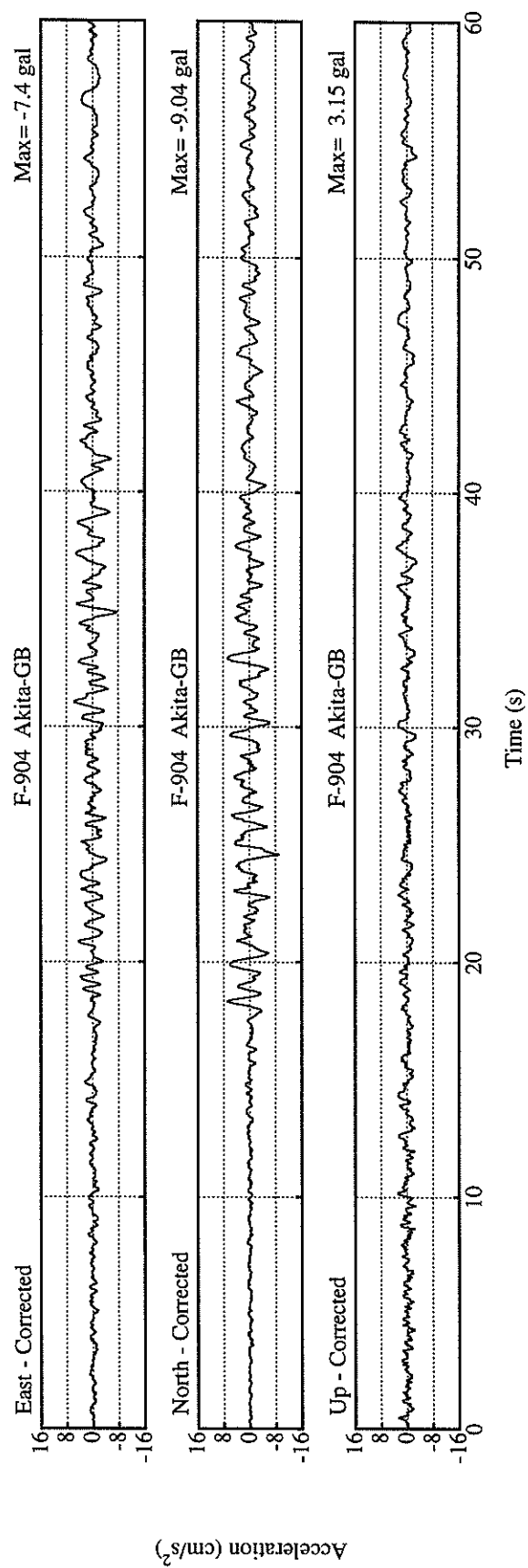
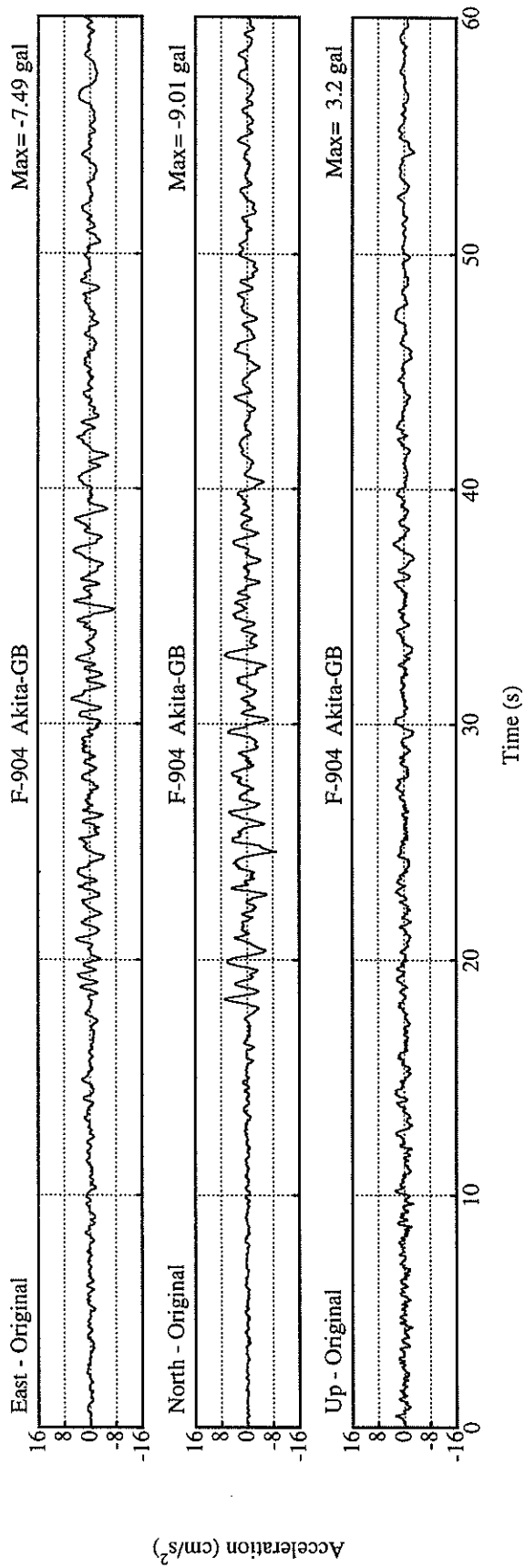
EARTHQUAKE DATA

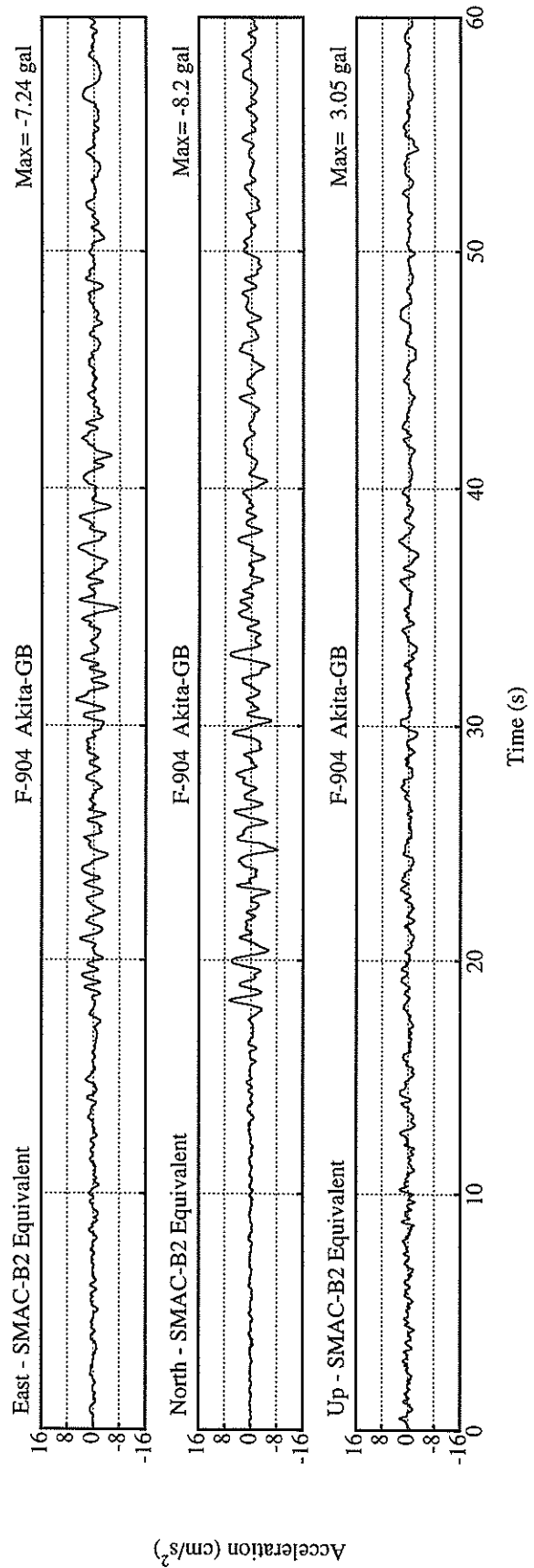
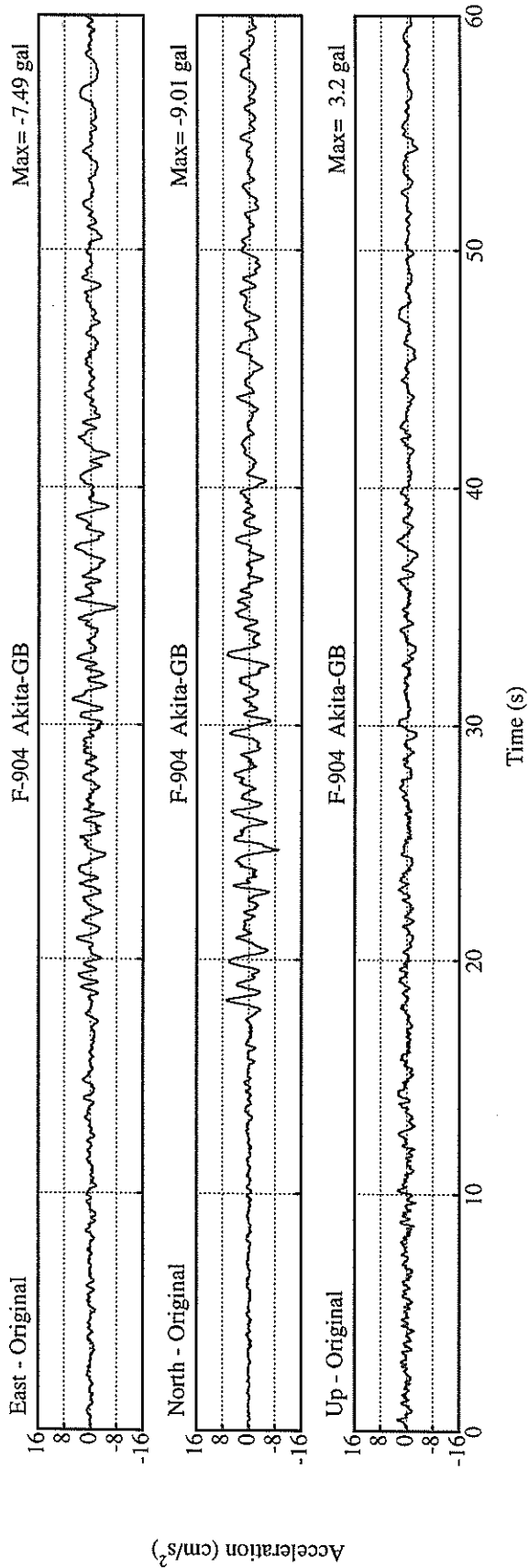
\*\*\*\*\*  
 DATE AND TIME 7:37 JAN. 7,1995  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION NE OFF IWATE PREF  
 LATITUDE 40°13.2' N  
 LONGITUDE 142°18.5' E  
 DEPTH 47.8KM  
 JMA MAGNITUDE 7.2  
 \*\*\*\*\*

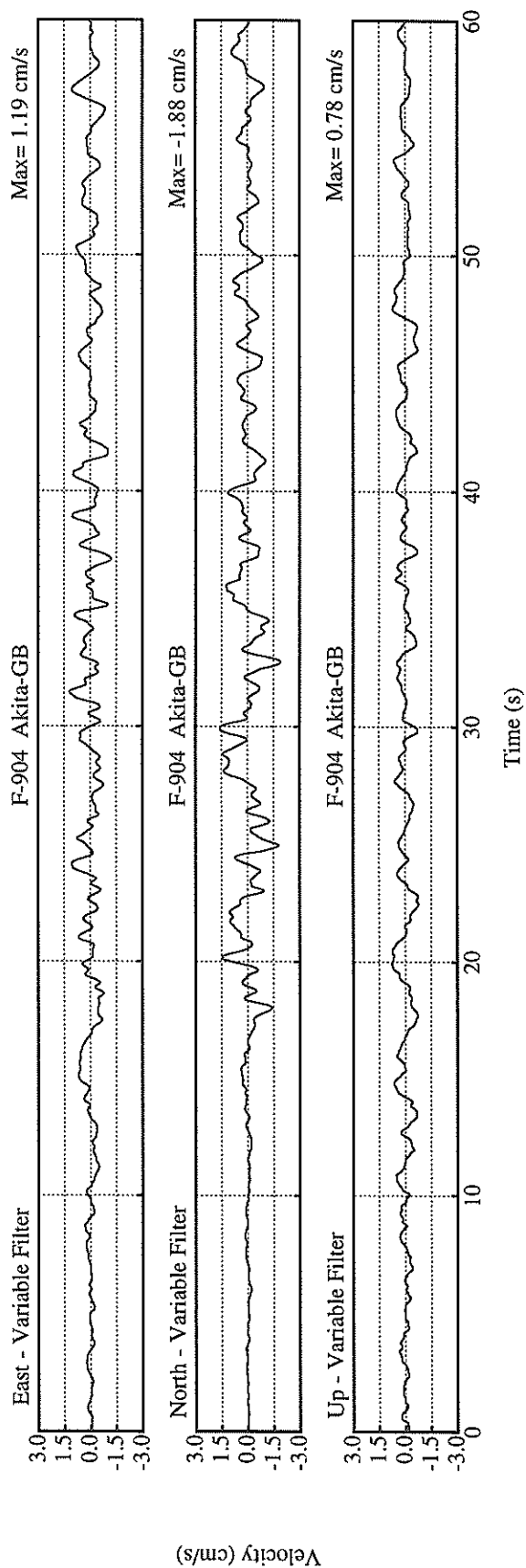
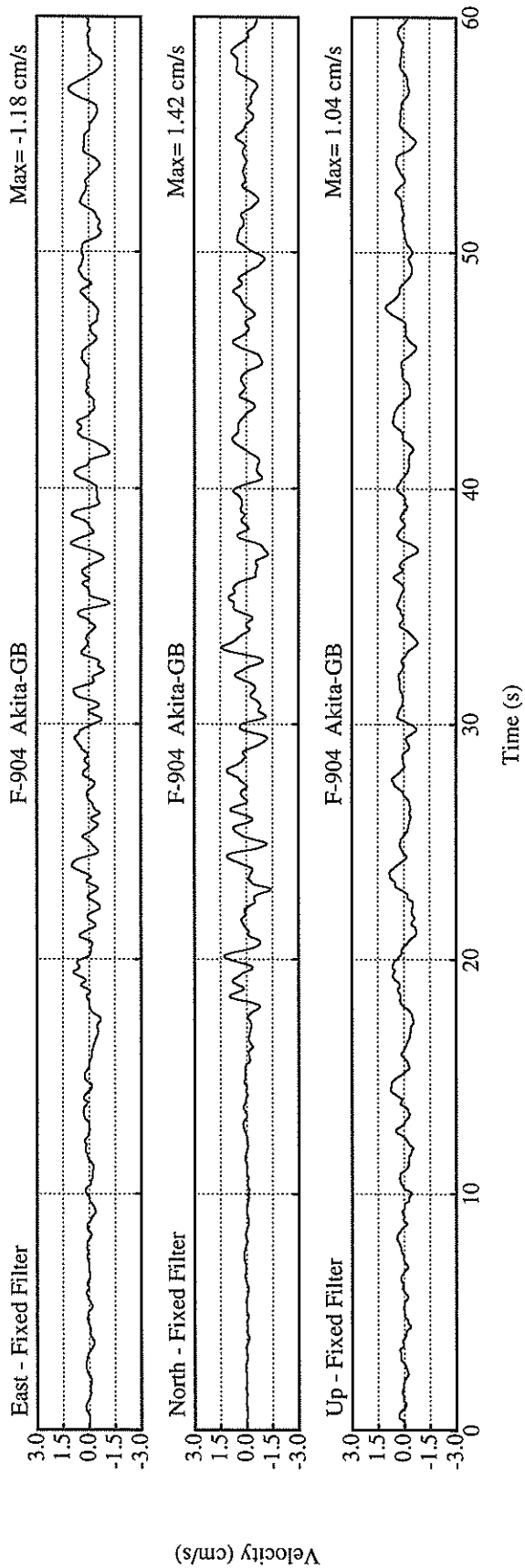
PEAK VALUES OF COMPONENTS

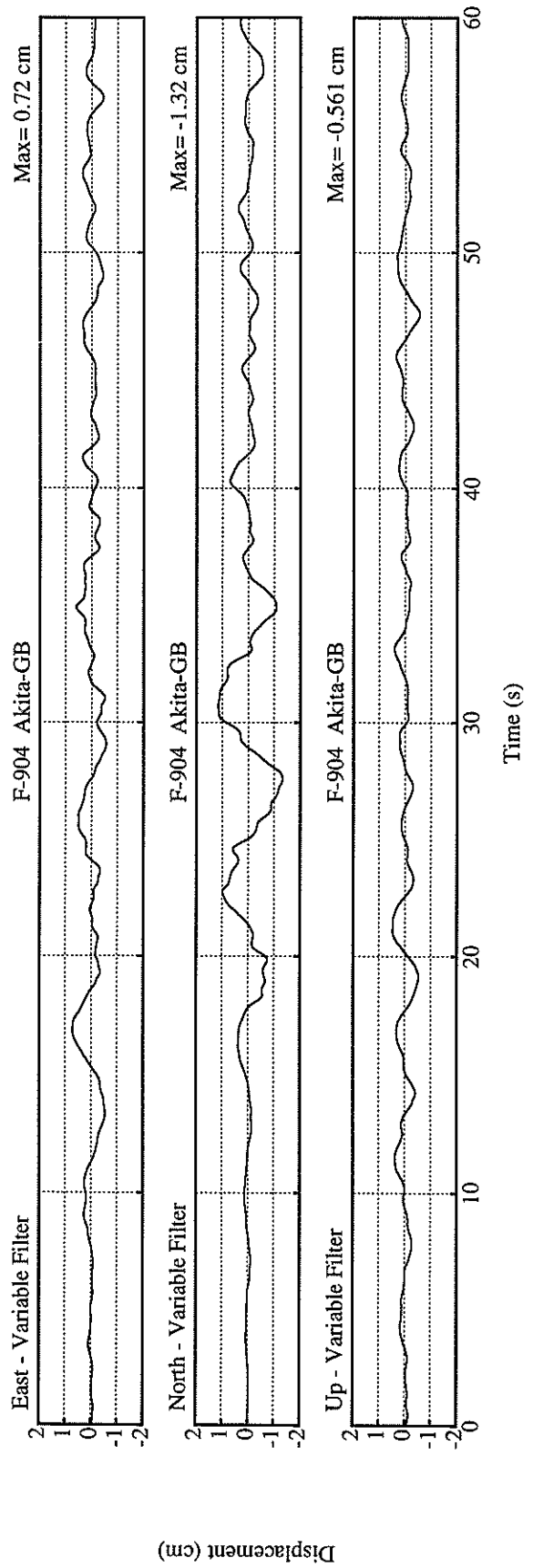
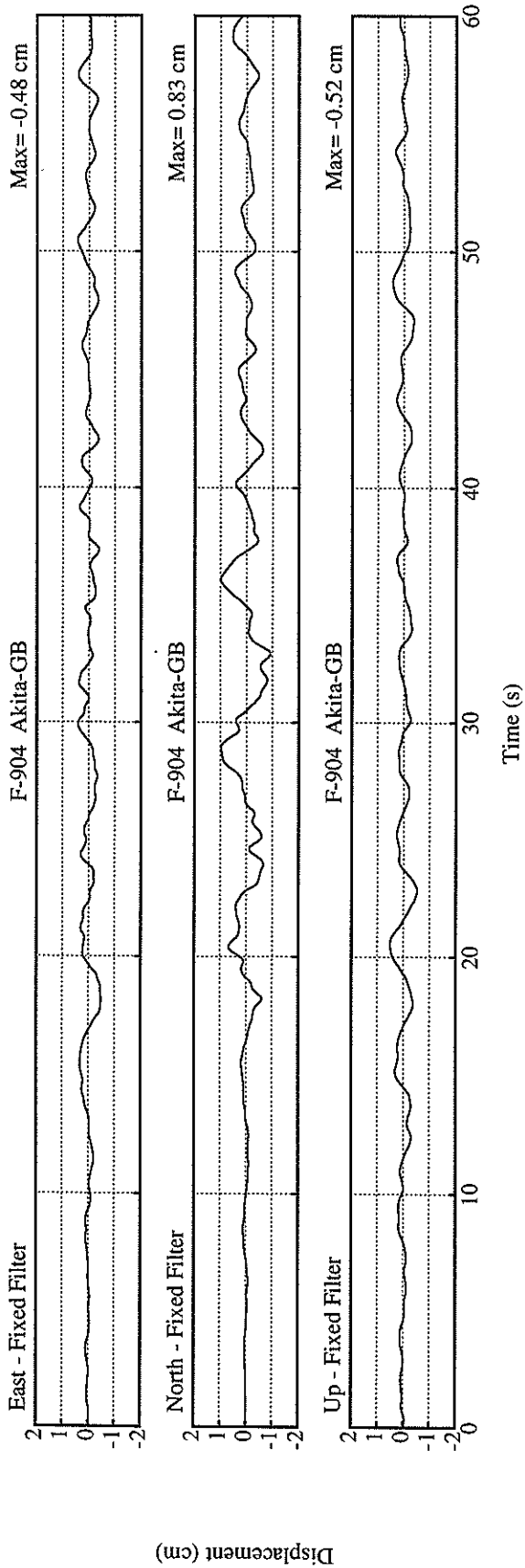
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.073	0.079	0.097	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	8.2	7.2	3.1	8.2
ORIGINAL	9.0	7.5	3.2	9.0
CORRECTED	9.0	7.4	3.1	9.0
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	1.42	1.18	1.04	1.48
VARIABLE FILTER	1.88	1.19	0.78	1.91
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.83	0.48	0.52	0.85
VARIABLE FILTER	1.32	0.72	0.56	1.32

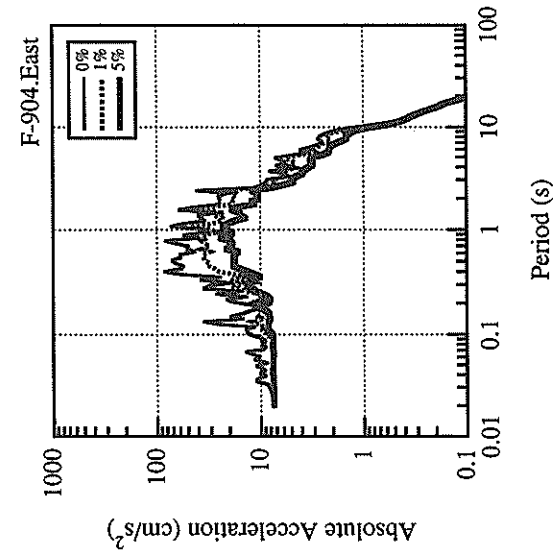
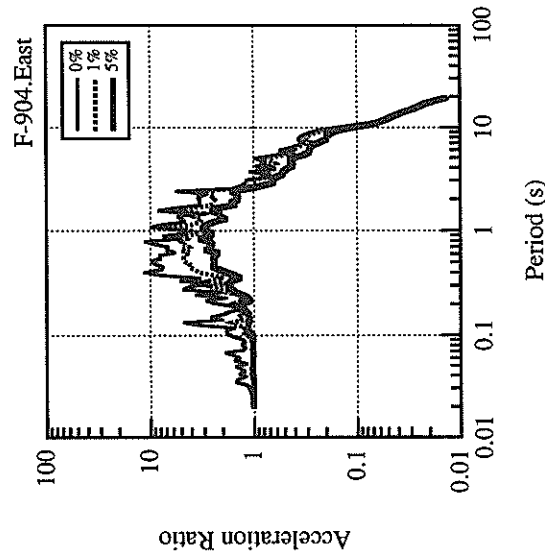
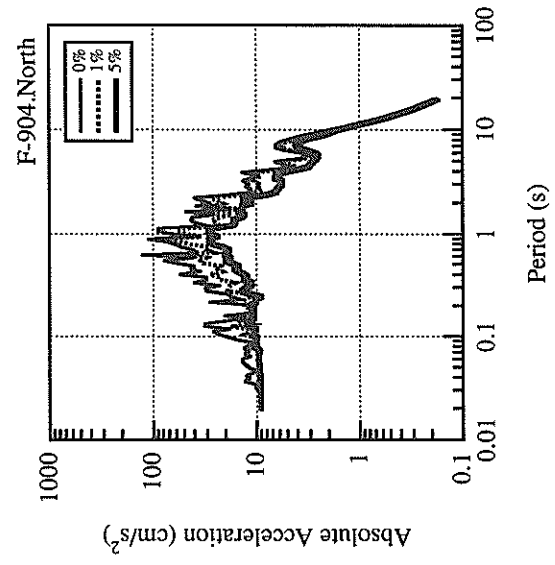
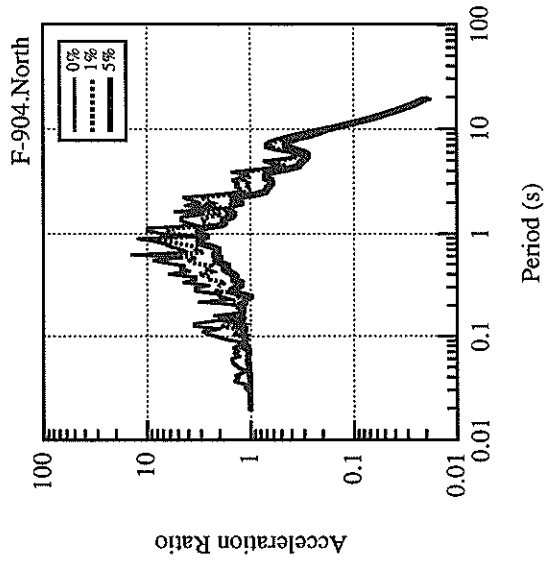
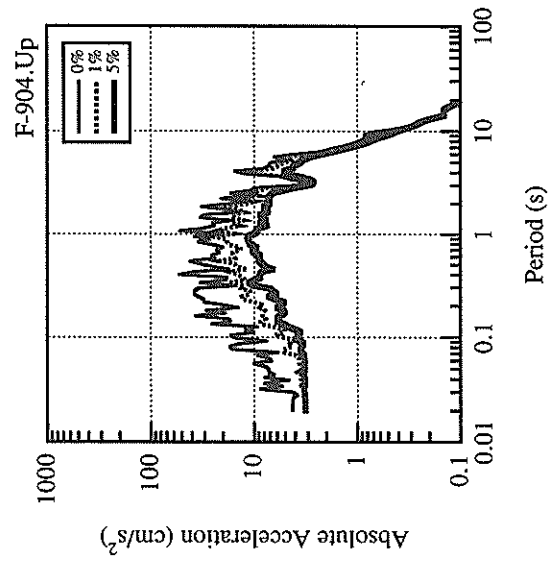
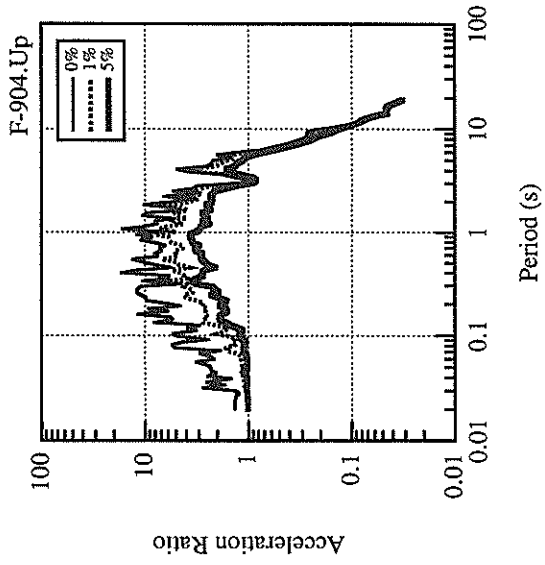
\* RESULTANT OF HORIZONTAL COMPONENTS

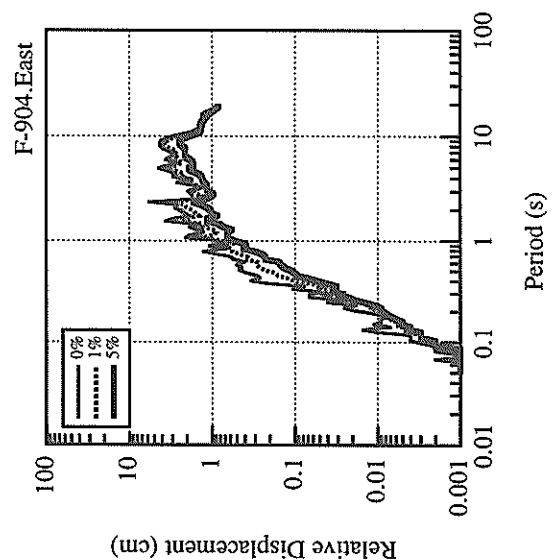
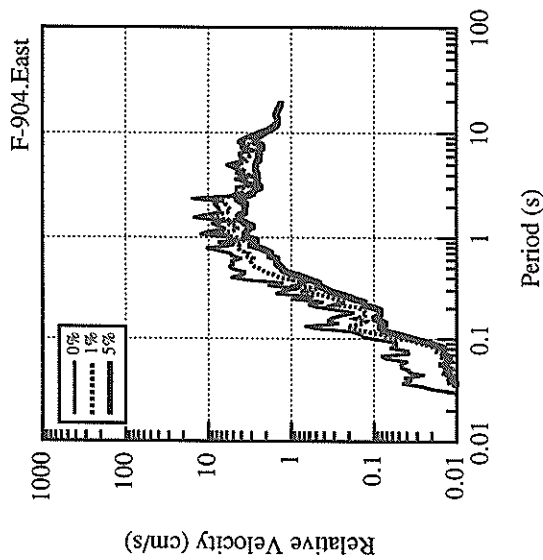
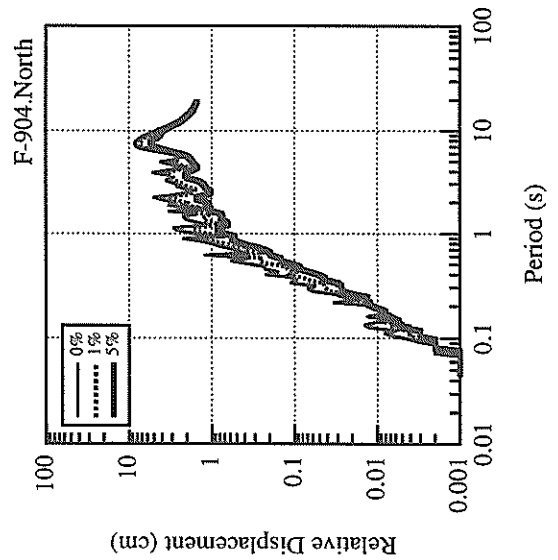
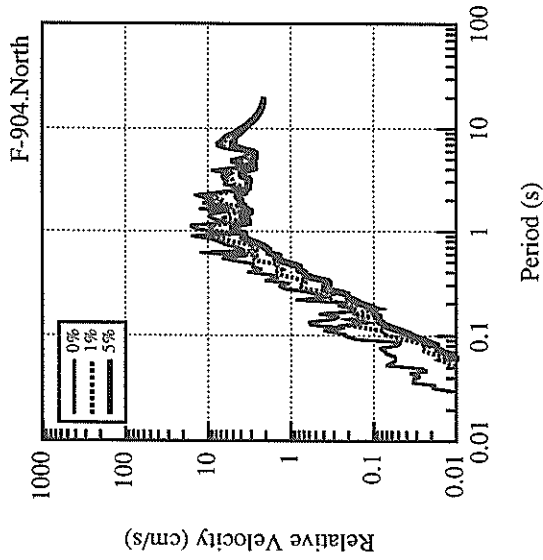
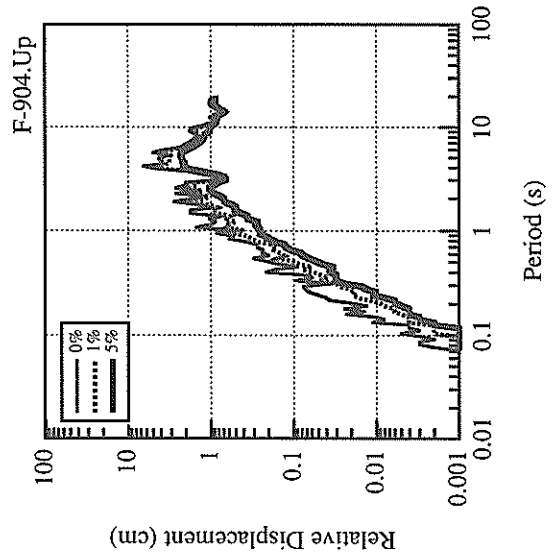
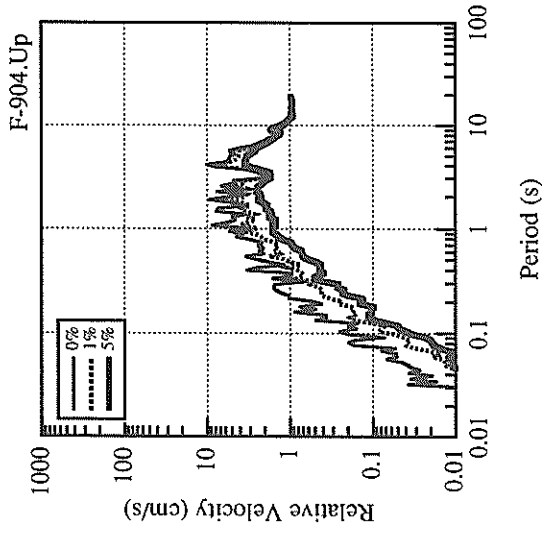


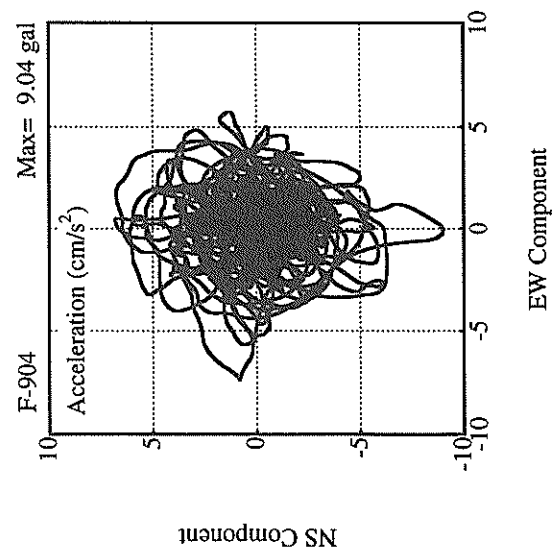
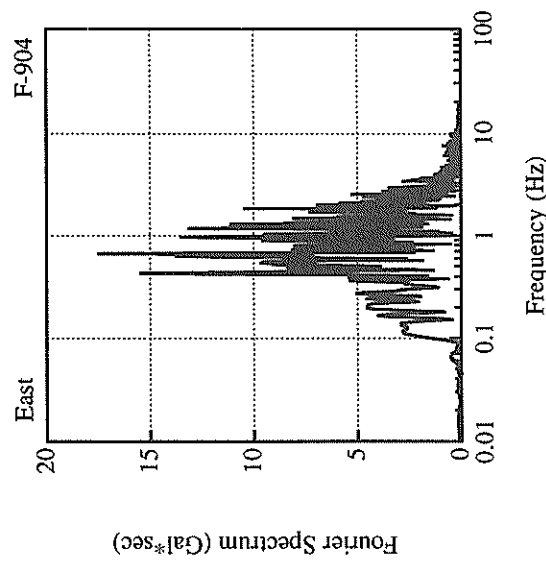
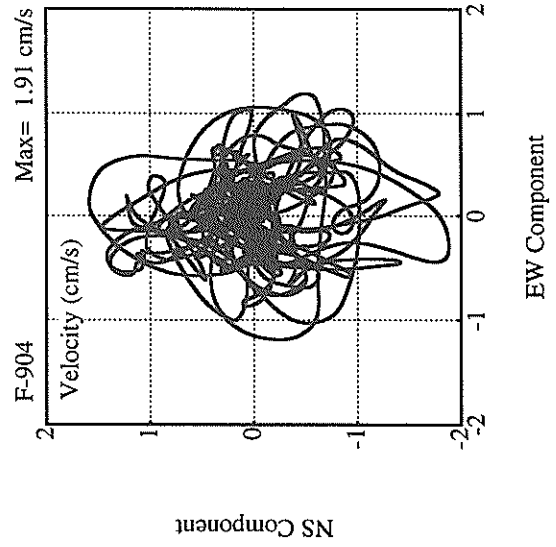
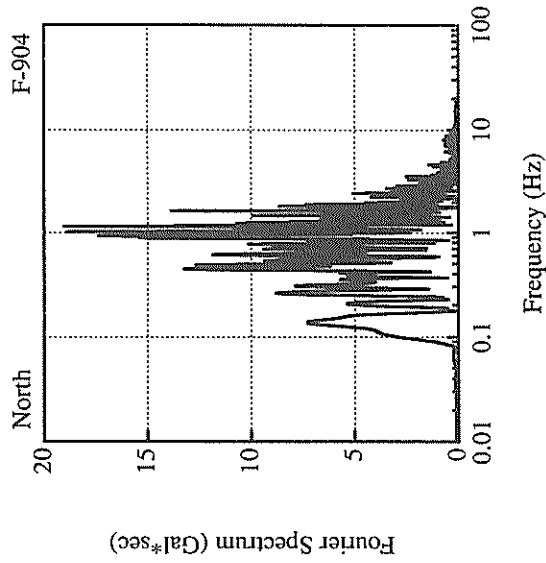
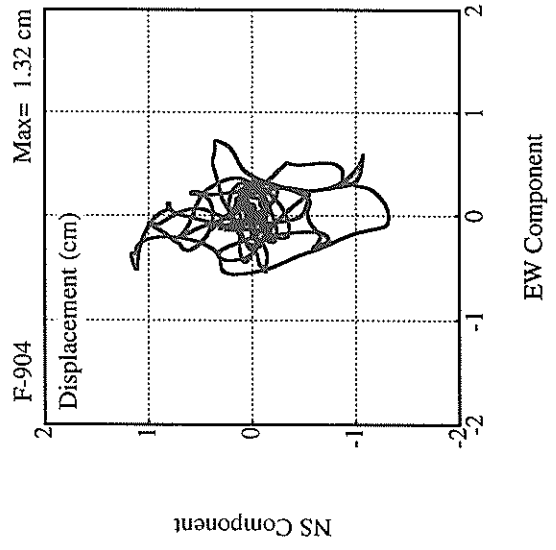
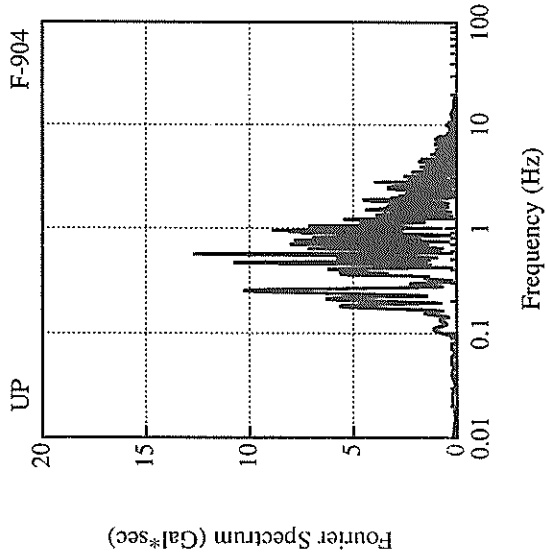














RECORD NUMBER : F-905  
 STATION : AKITA-G

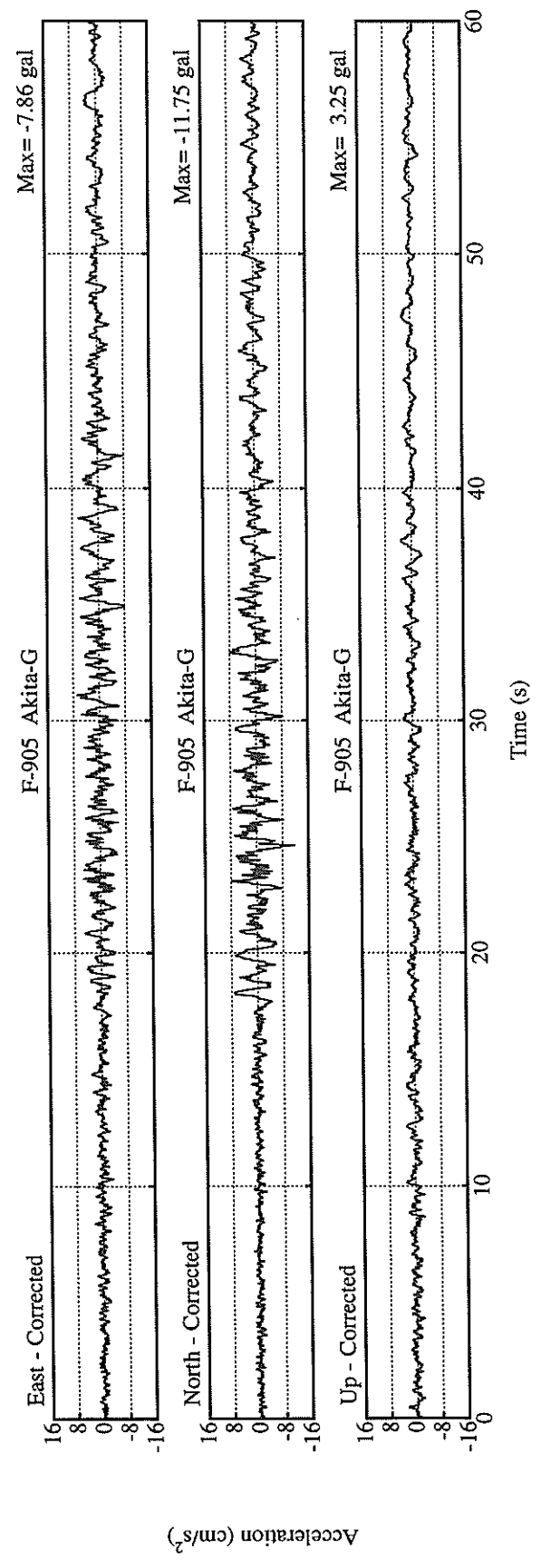
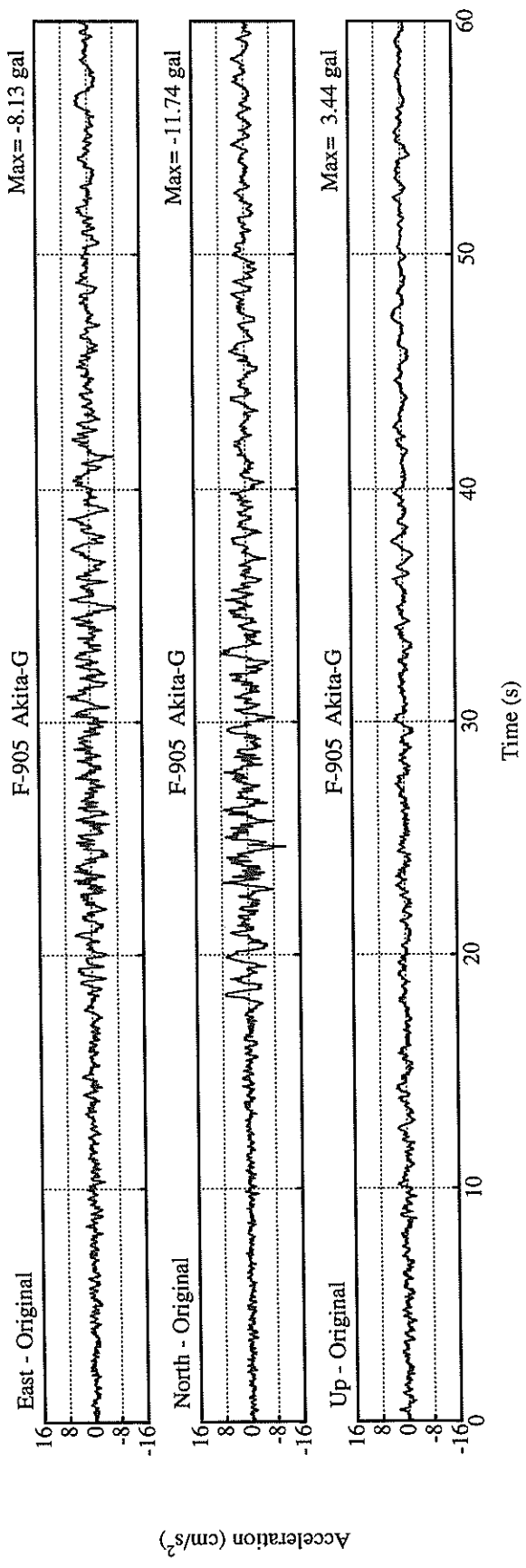
EARTHQUAKE DATA

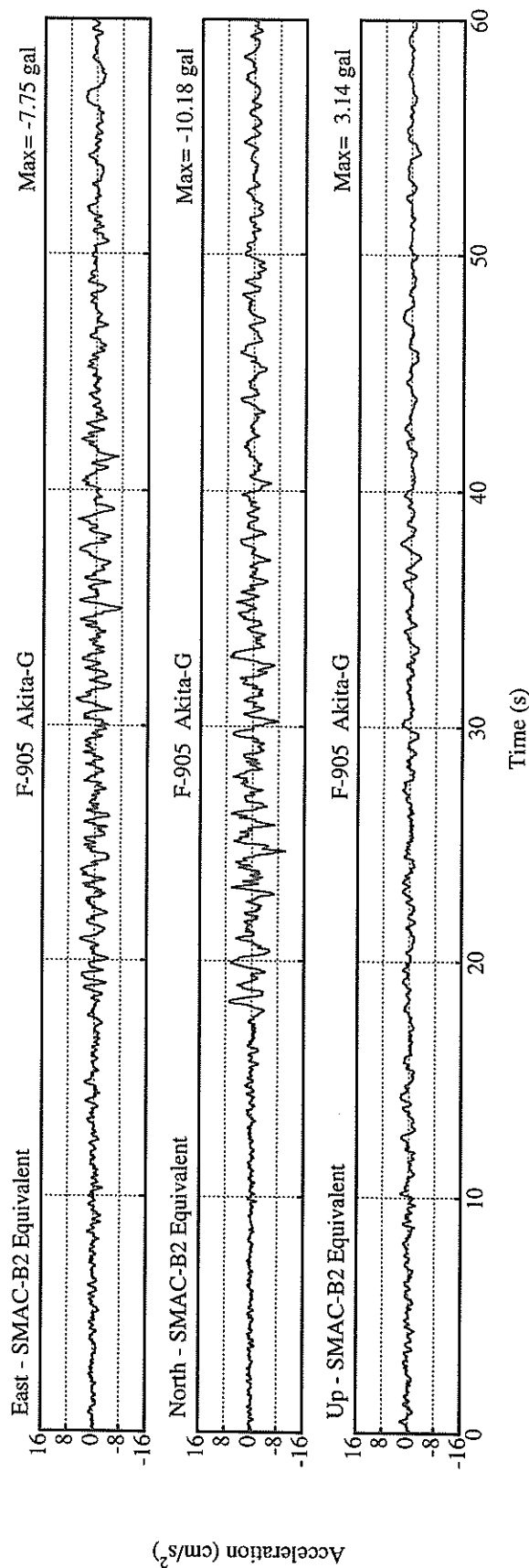
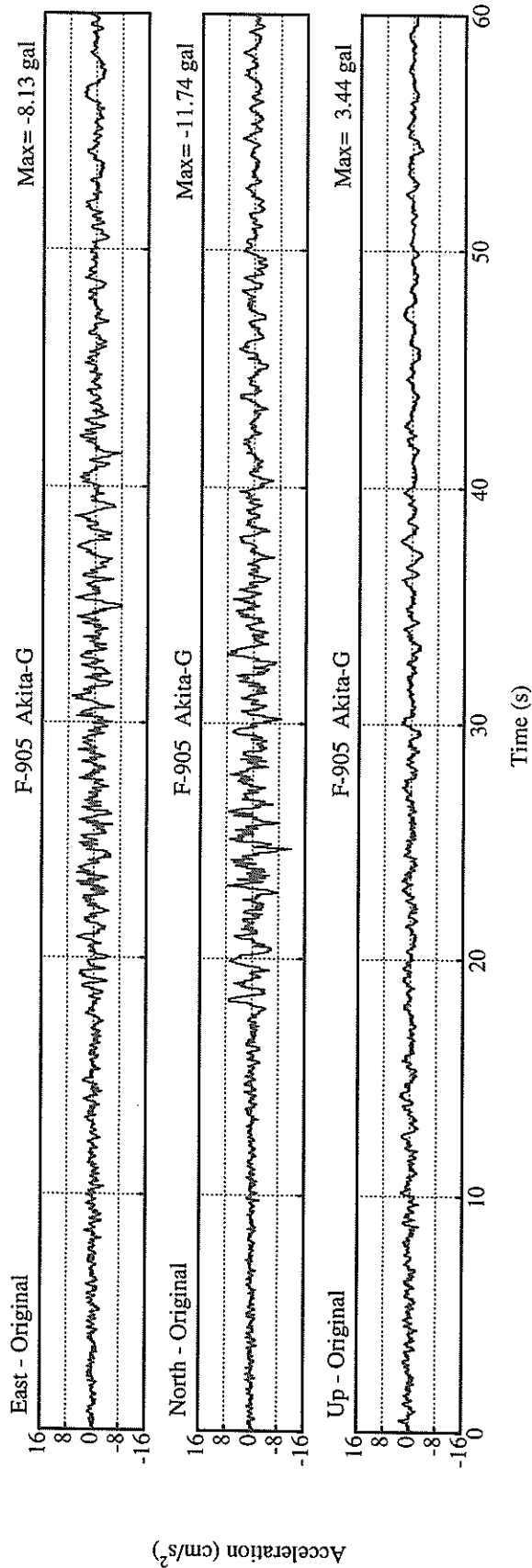
\*\*\*\*\*  
 DATE AND TIME 7:37 JAN. 7,1995  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION NE OFF IWATE PEF  
 LATITUDE 40°13.2' N  
 LONGITUDE 142°18.5' E  
 DEPTH 47.8KM  
 JMA MAGNITUDE 7.2  
 \*\*\*\*\*

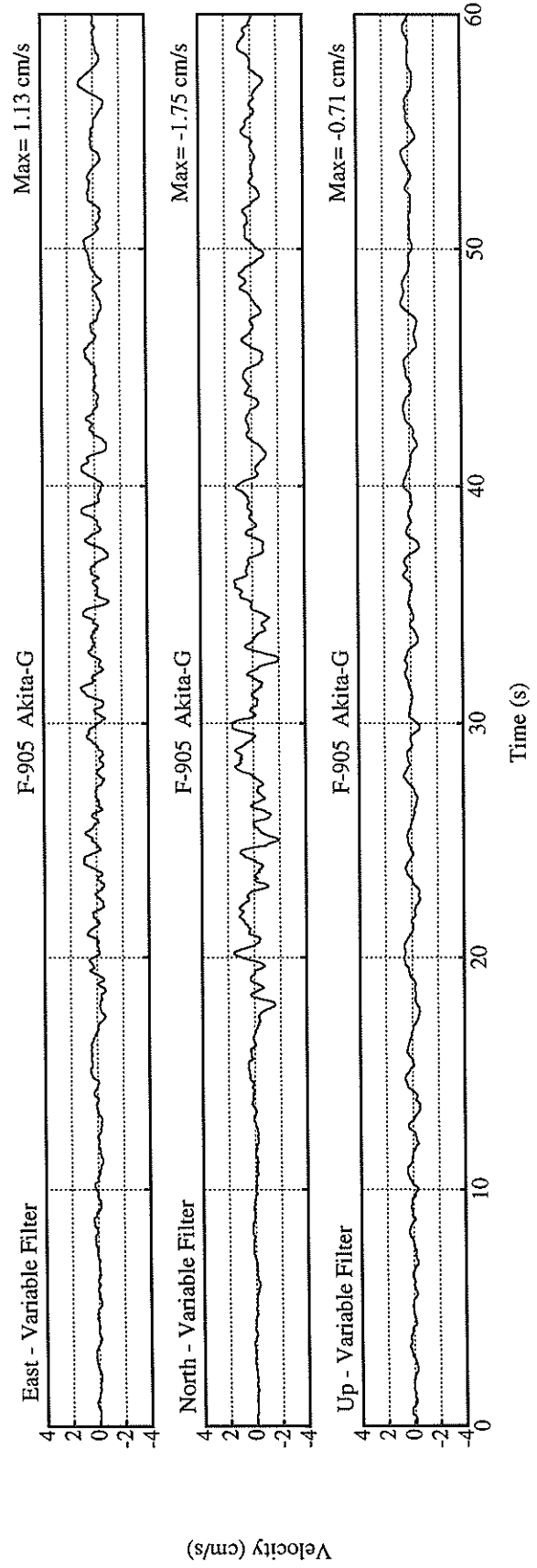
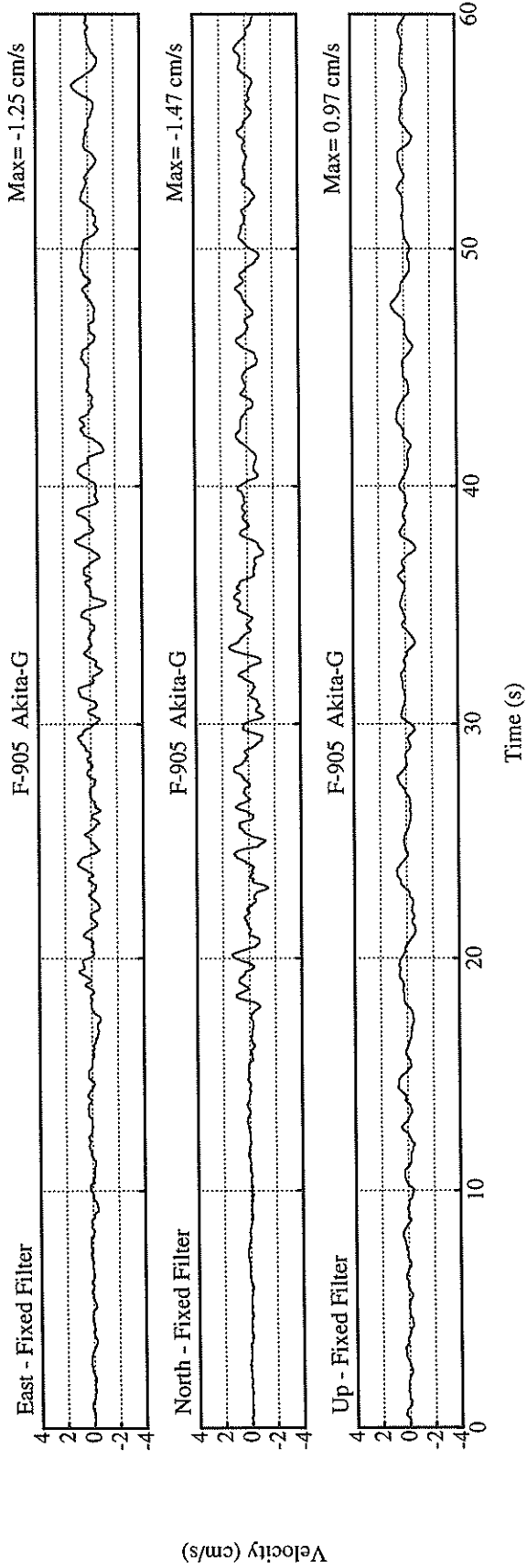
PEAK VALUES OF COMPONENTS

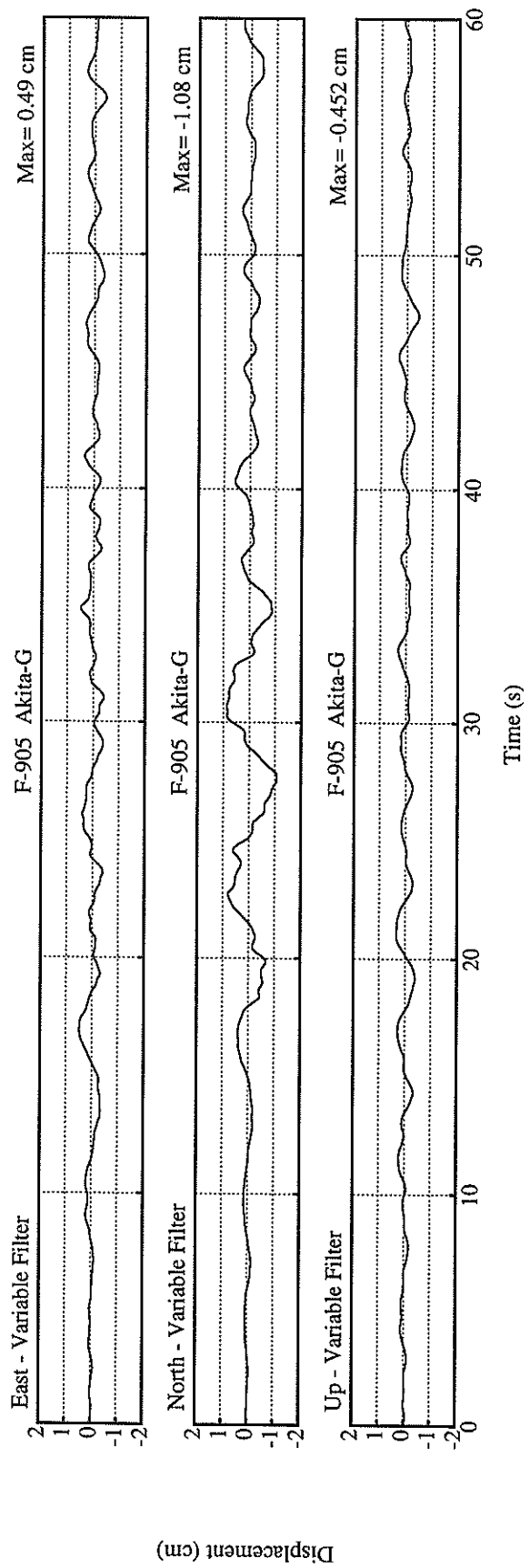
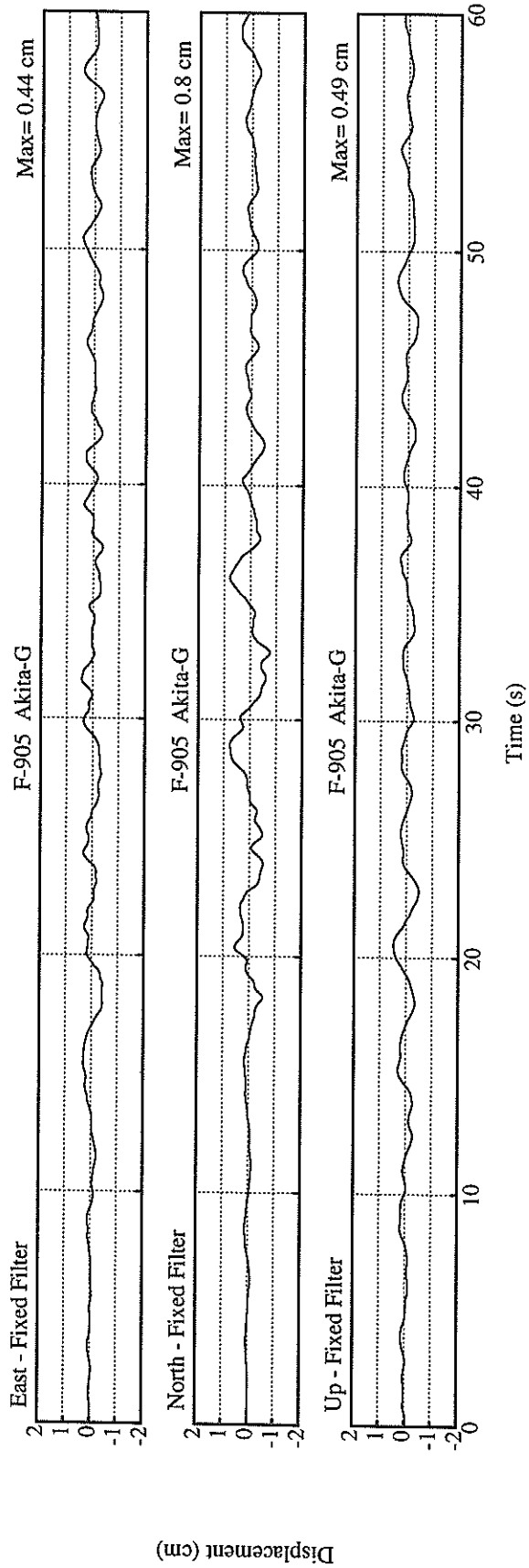
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.091	0.109	0.140	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	10.2	7.7	3.1	10.2
ORIGINAL	11.7	8.1	3.4	11.8
CORRECTED	11.8	7.9	3.3	11.8
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	1.47	1.25	0.97	1.51
VARIABLE FILTER	1.76	1.13	0.71	1.77
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.80	0.44	0.49	0.83
VARIABLE FILTER	1.08	0.49	0.45	1.08

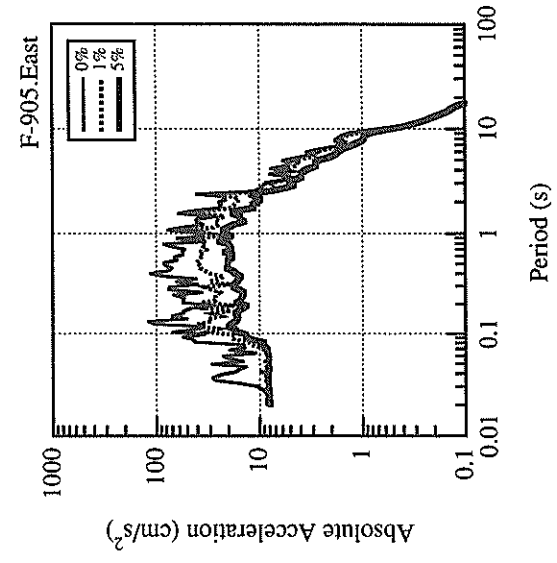
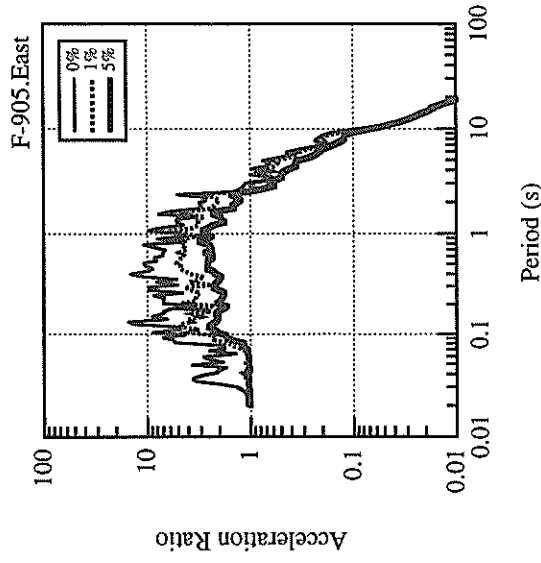
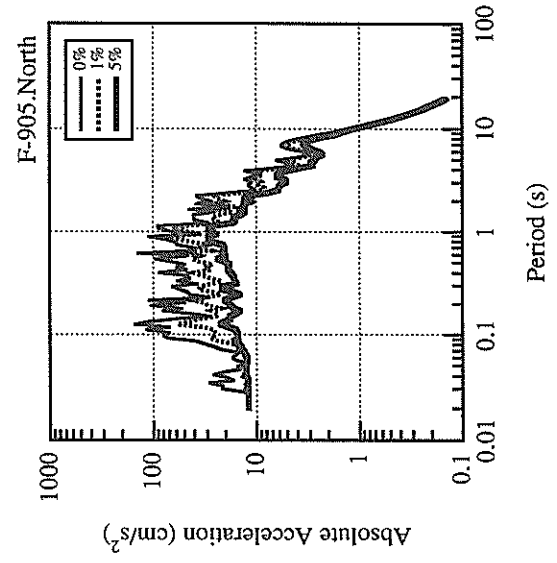
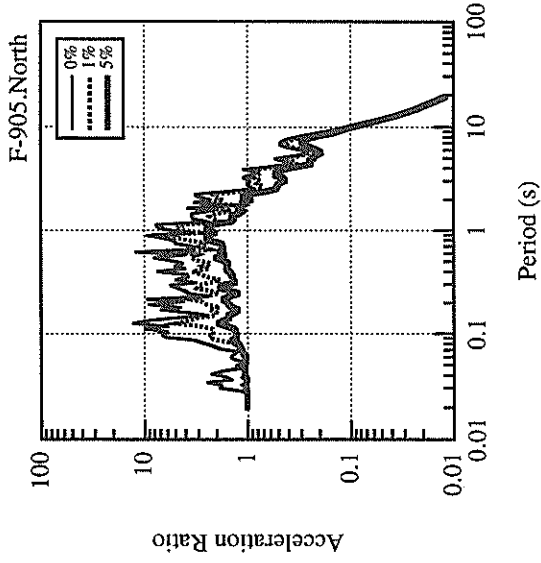
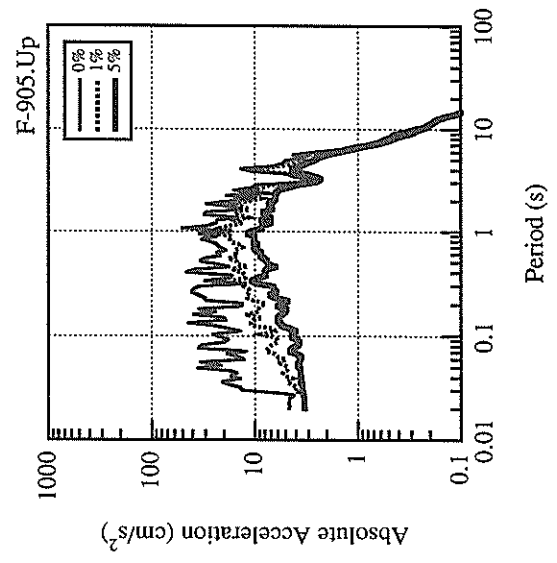
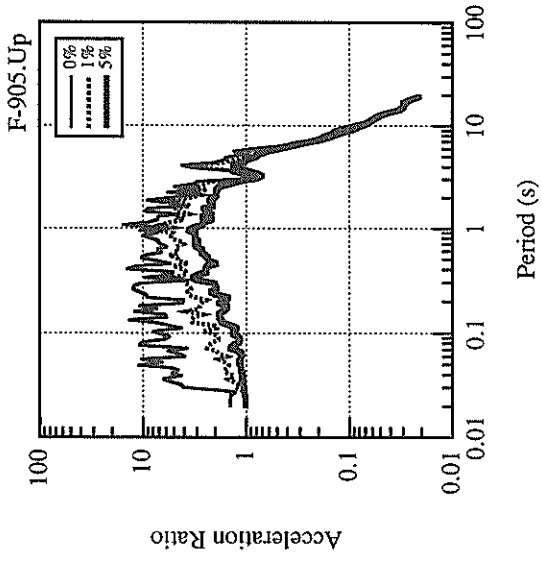
\* RESULTANT OF HORIZONTAL COMPONENTS

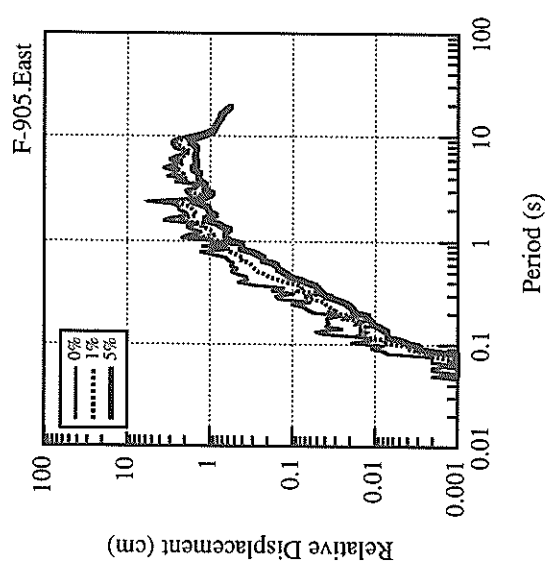
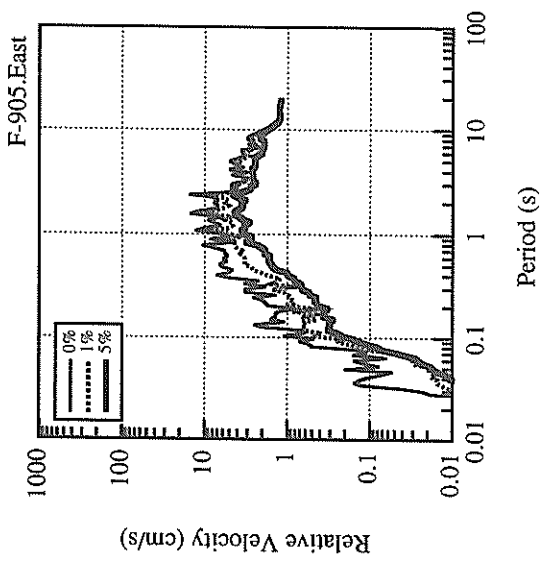
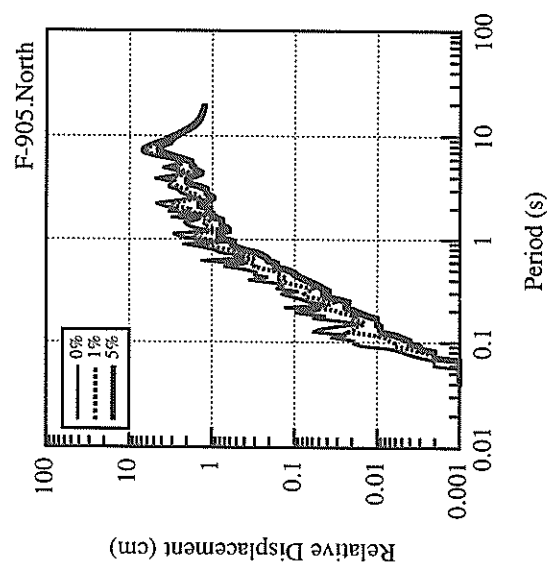
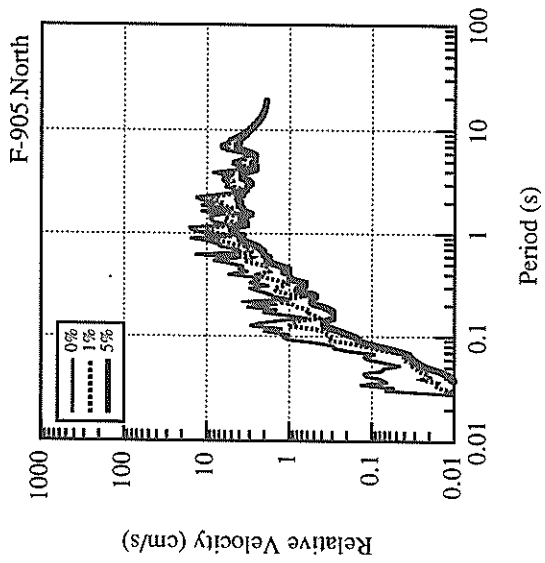
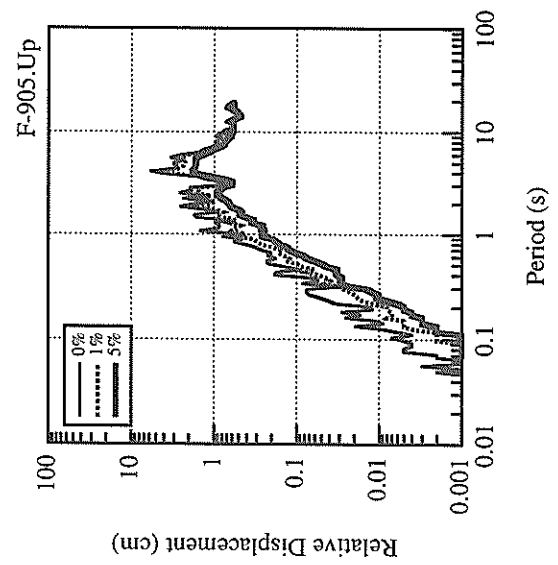
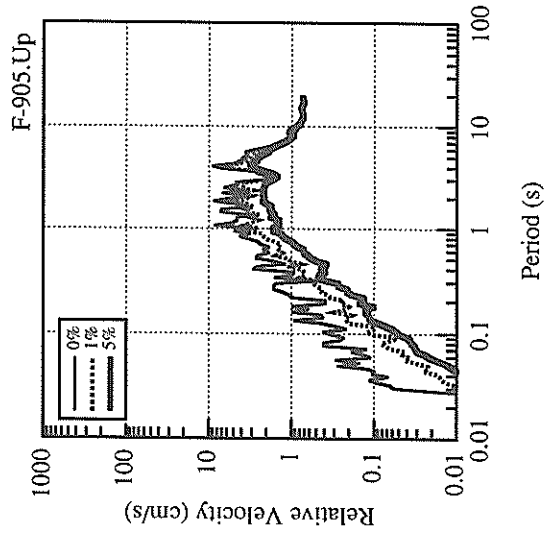


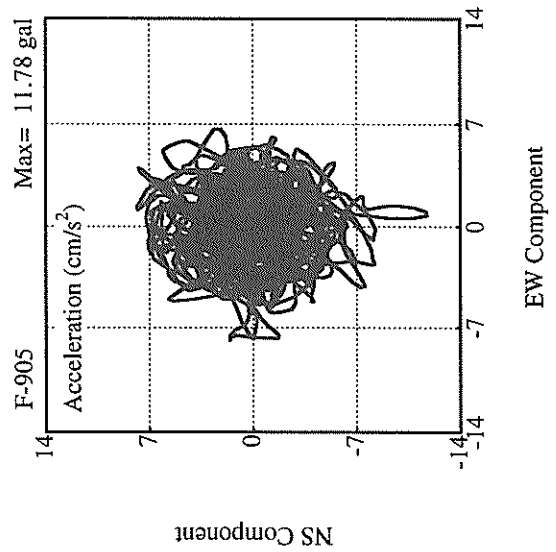
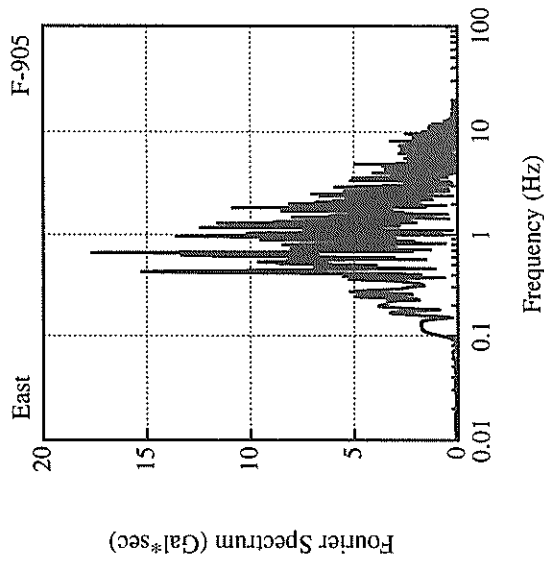
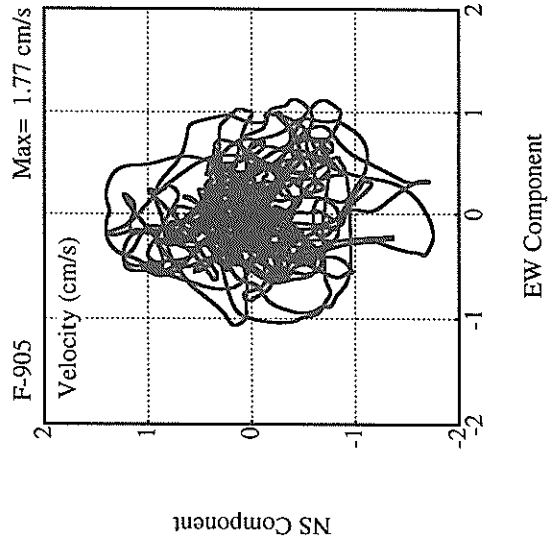
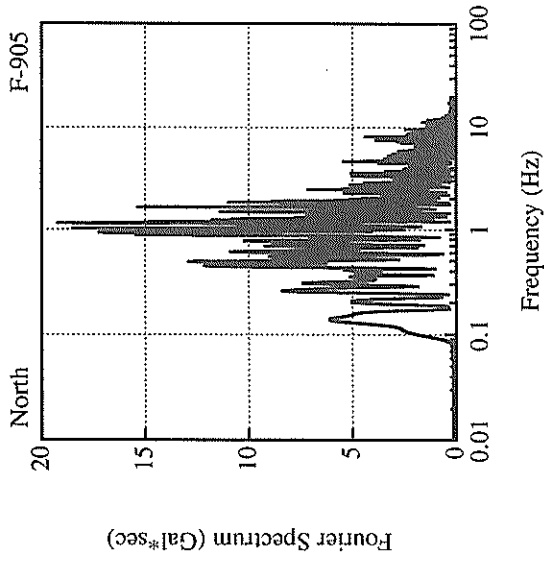
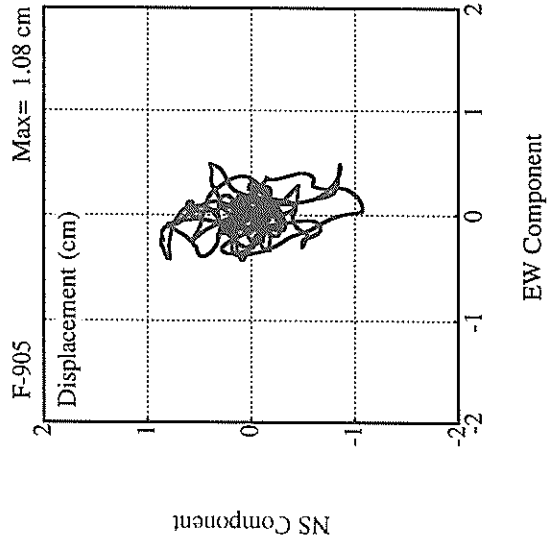
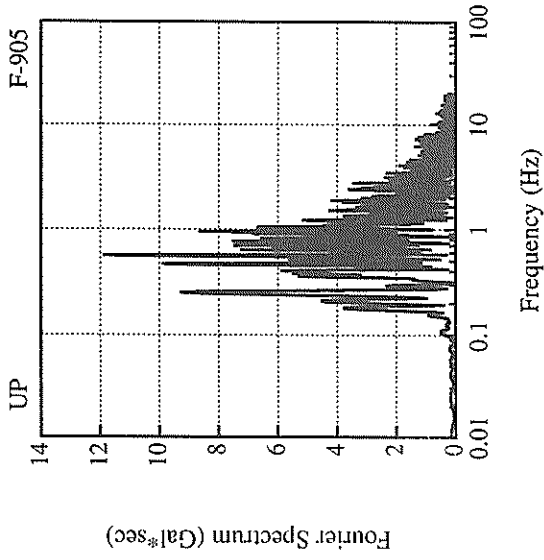














RECORD NUMBER : F-985  
 STATION : KAWASAKI-F

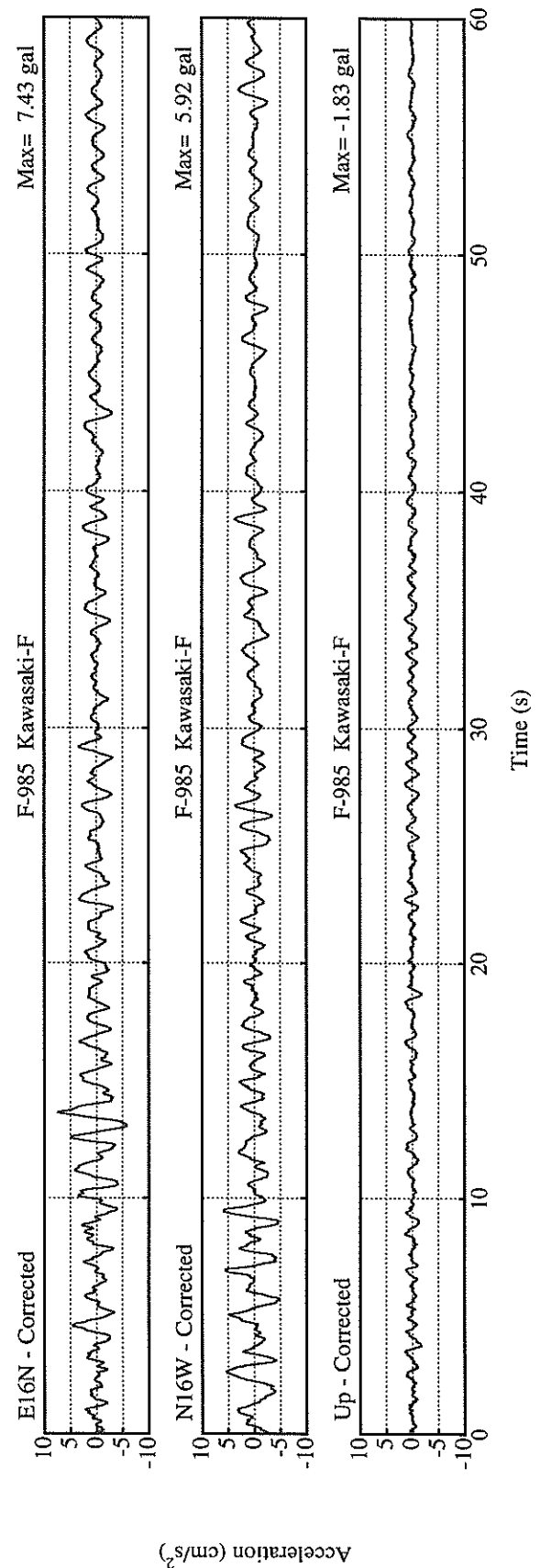
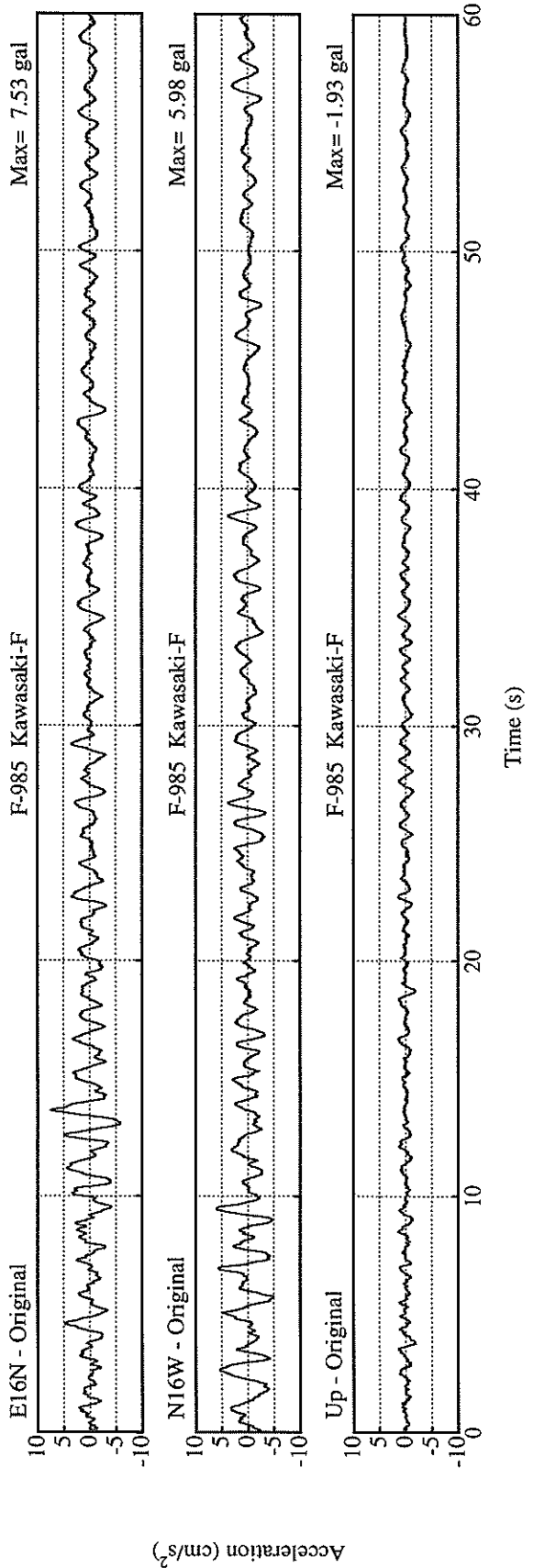
EARTHQUAKE DATA

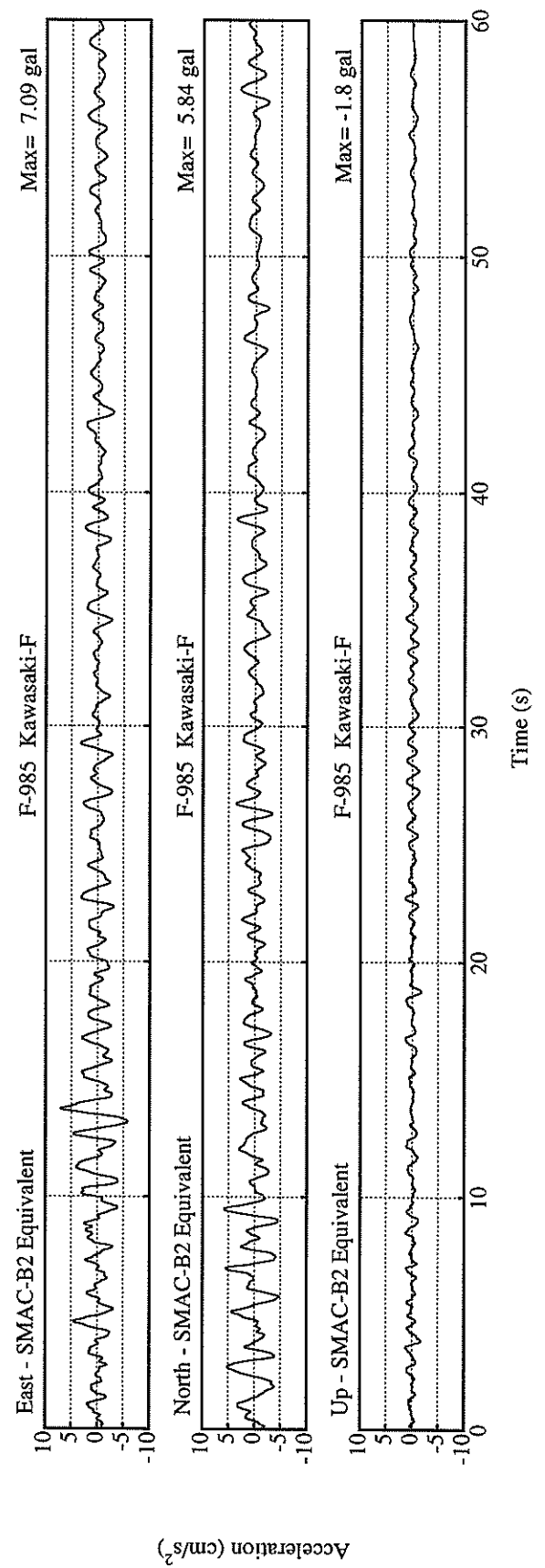
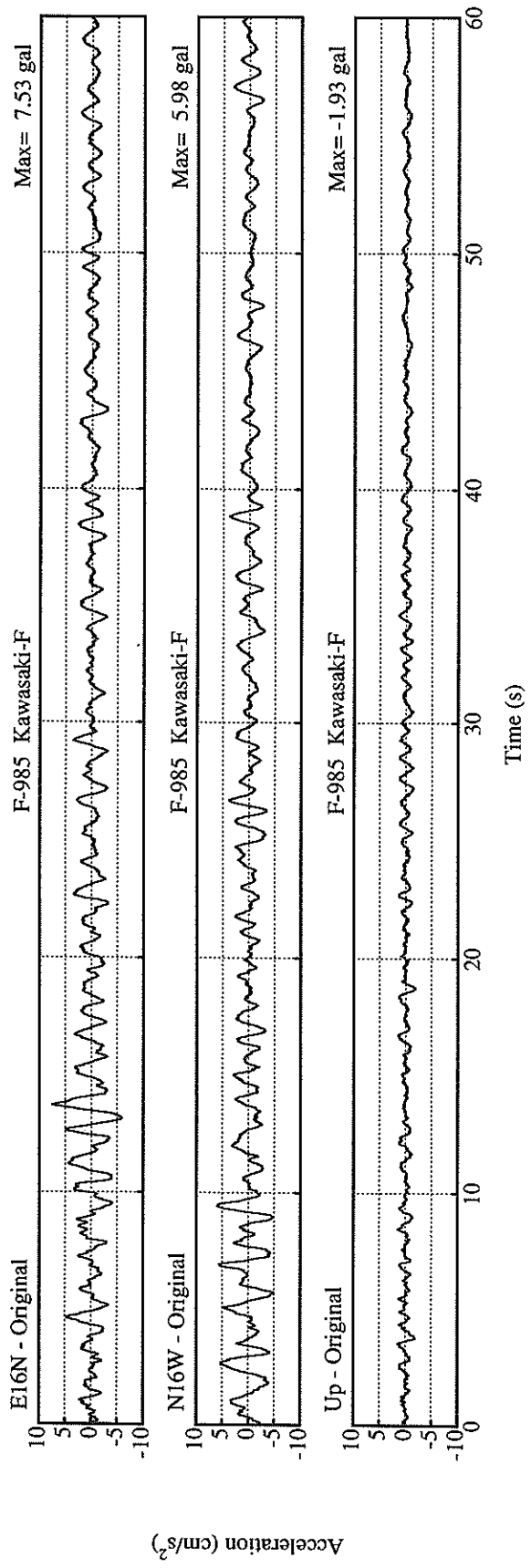
\*\*\*\*\*  
 DATE AND TIME 7:37 JAN. 7,1995  
 LOCATION OF HYPOCENTER  
 EPICENTRAL REGION NE OFF IWATE PREF  
 LATITUDE 40°13.2' N  
 LONGITUDE 142°18.5' E  
 DEPTH 47.8KM  
 JMA MAGNITUDE 7.2  
 \*\*\*\*\*

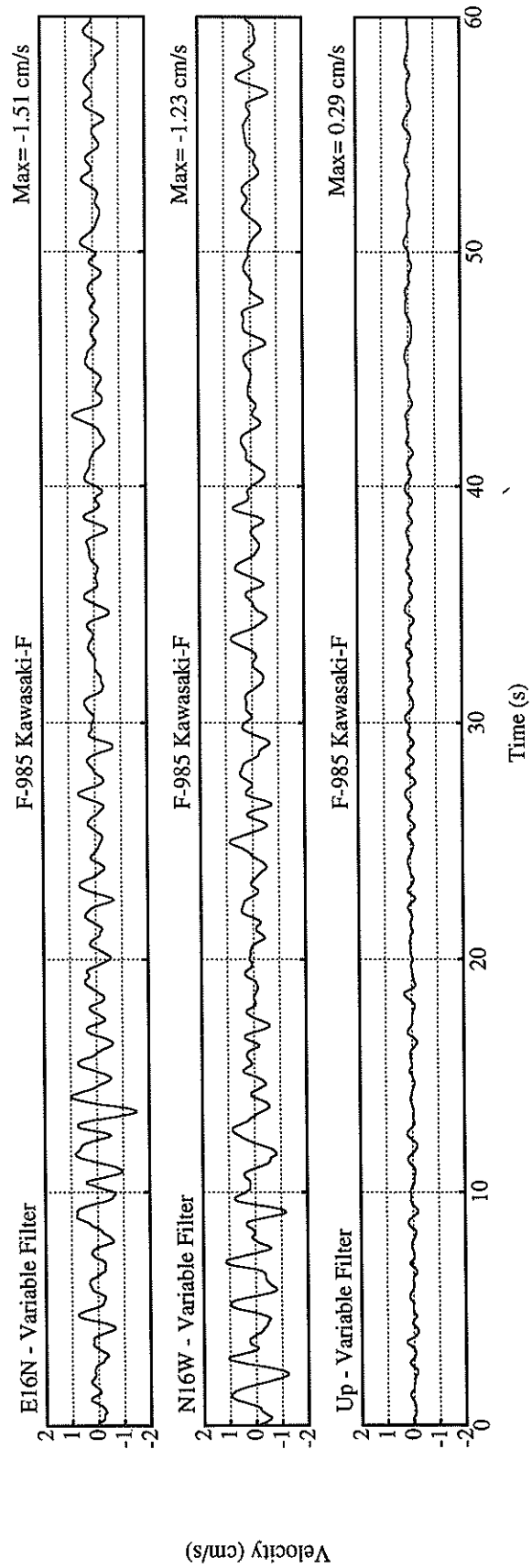
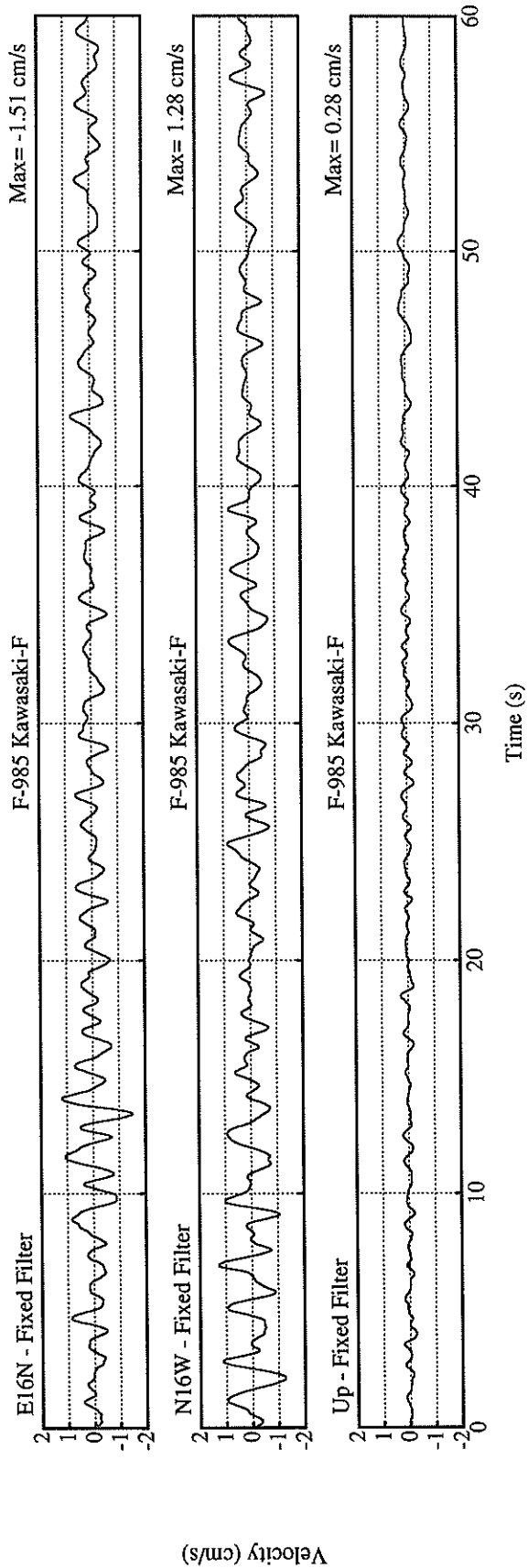
PEAK VALUES OF COMPONENTS

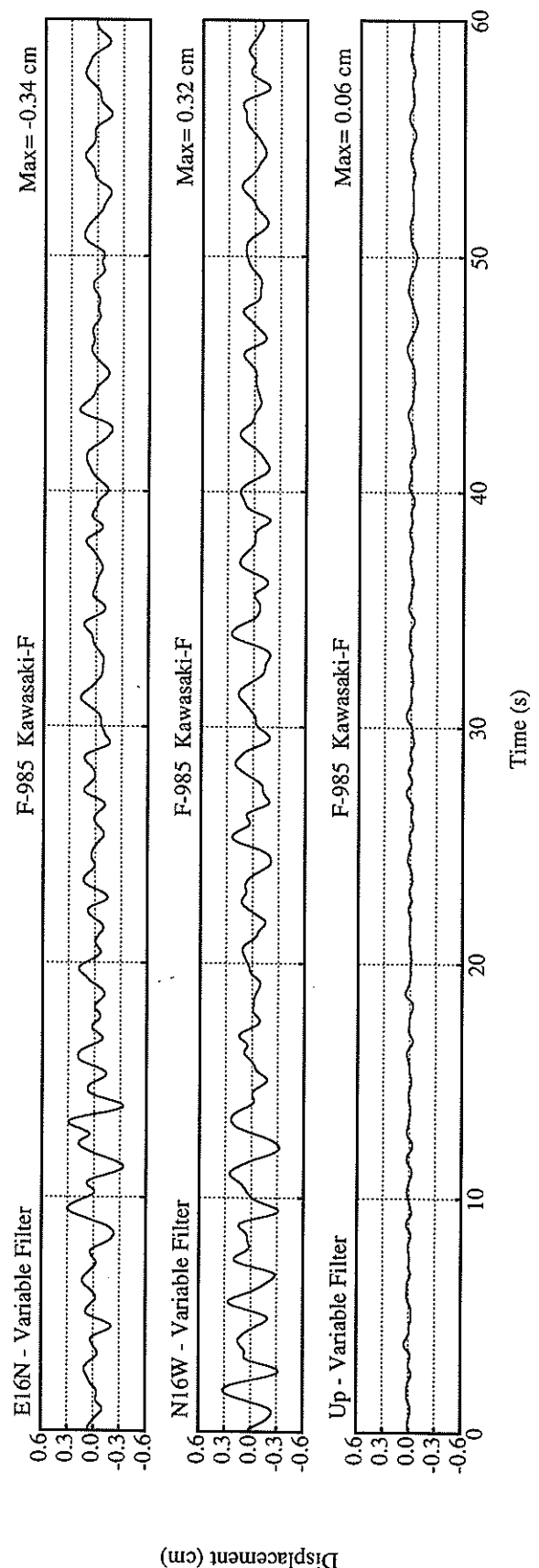
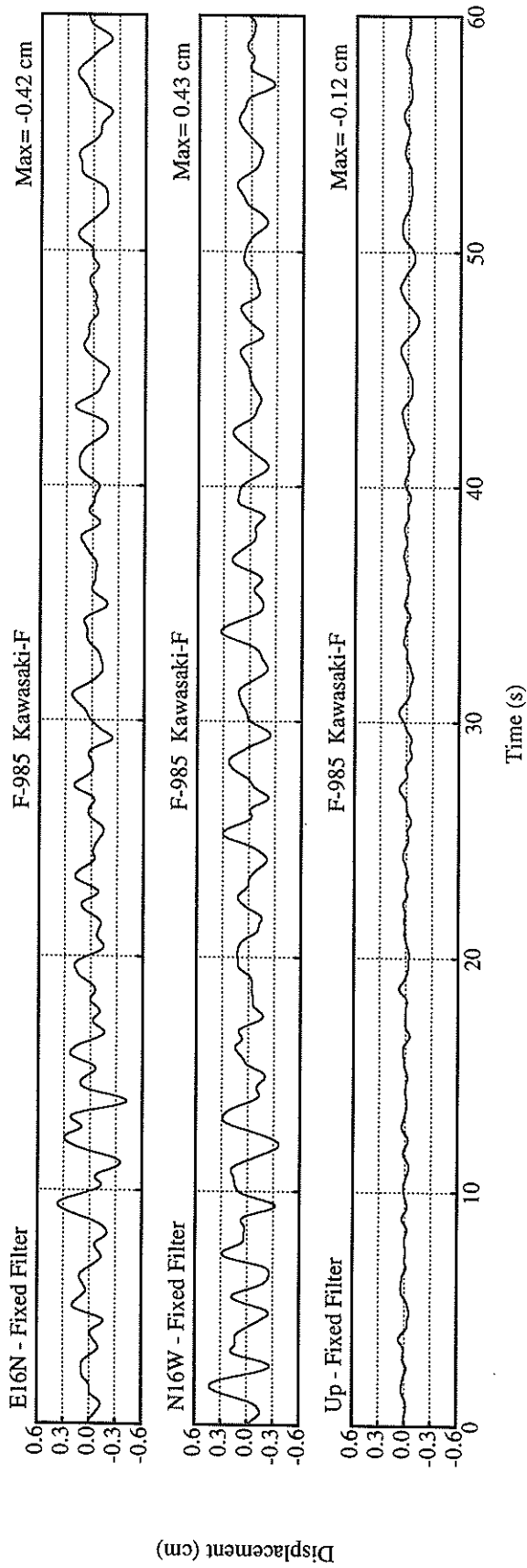
	N S	E W	U D	HORIZONTAL*
PARAMETER OF THE VARIABLE FILTER				
FC (HZ)	0.207	0.207	0.323	
MAXIMUM ACCELERATION (GAL)				
SMAC-B2 EQUIVALENT	5.8	7.1	1.8	7.1
ORIGINAL	6.0	7.5	1.9	7.5
CORRECTED	5.9	7.4	1.8	7.4
MAXIMUM VELOCITY (CM/SEC)				
FIXED FILTER	1.28	1.51	0.28	1.59
VARIABLE FILTER	1.23	1.51	0.29	1.54
MAXIMUM DISPLACEMENT (CM)				
FIXED FILTER	0.43	0.42	0.12	0.49
VARIABLE FILTER	0.32	0.34	0.06	0.43

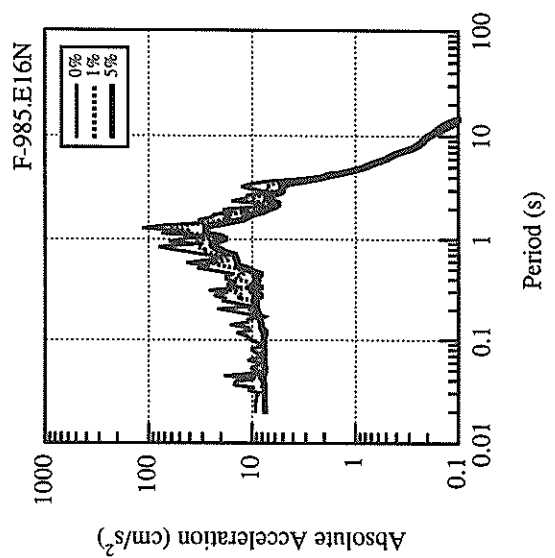
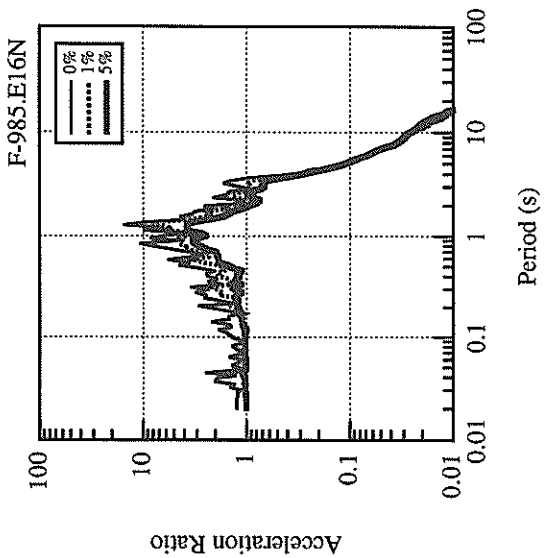
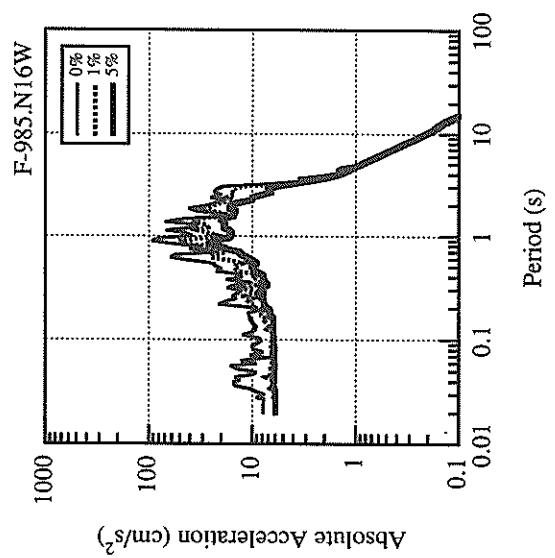
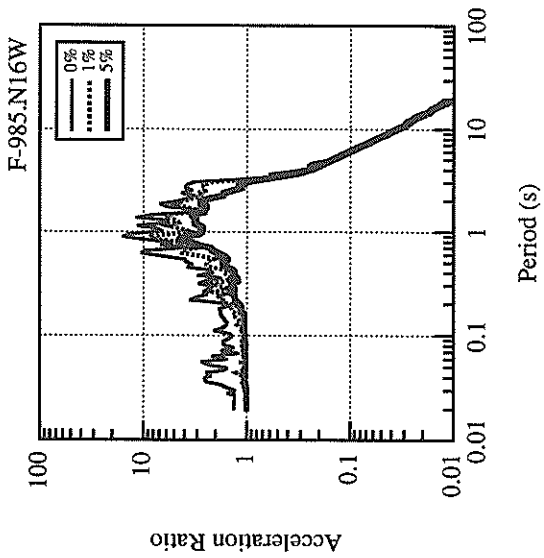
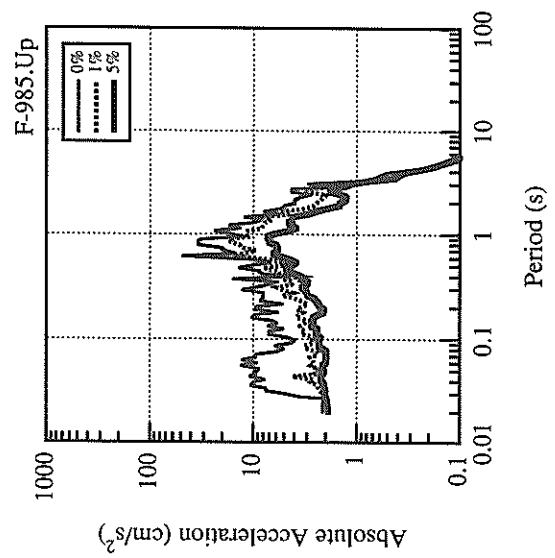
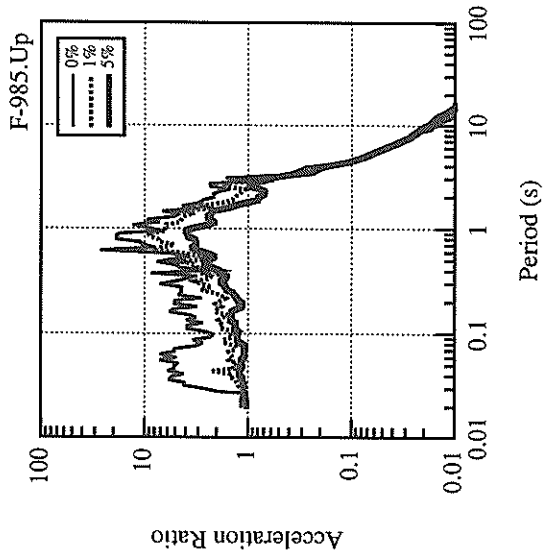
\* RESULTANT OF HORIZONTAL COMPONENTS

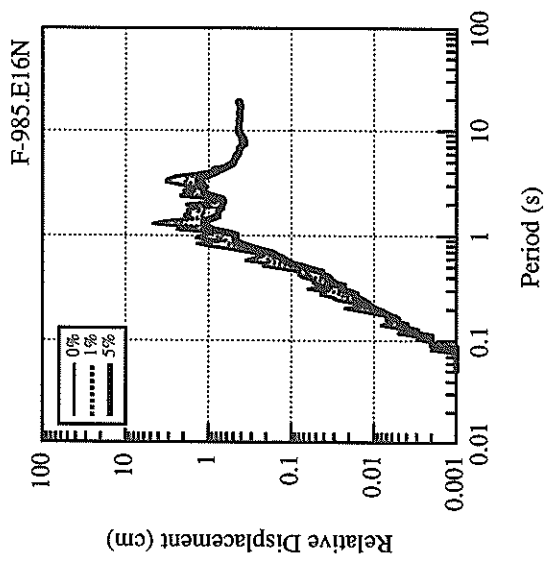
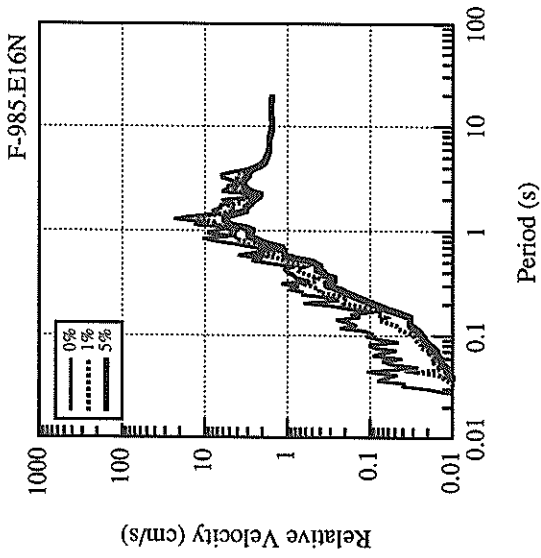
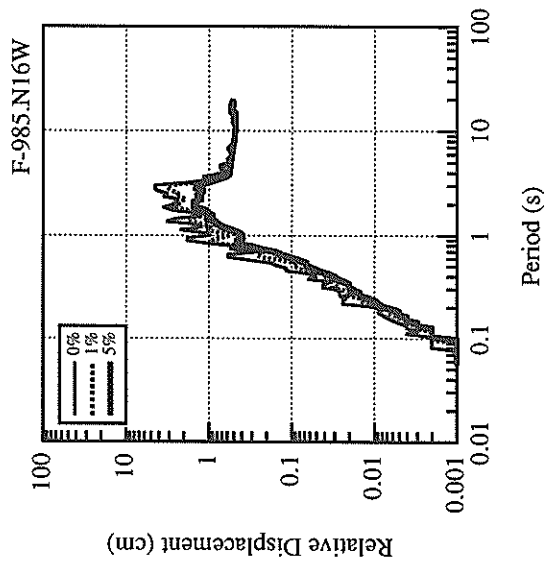
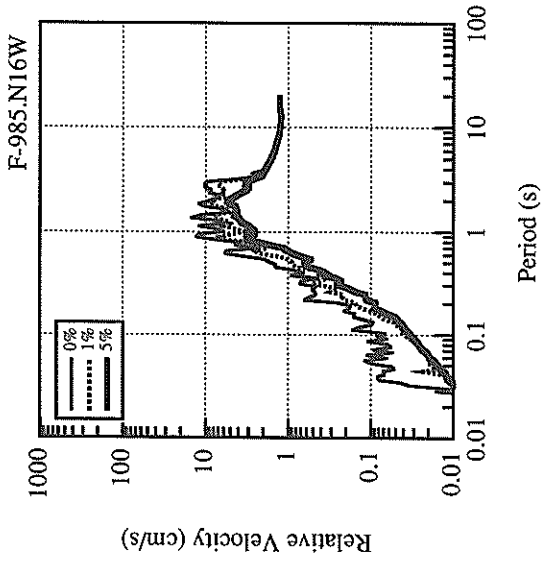
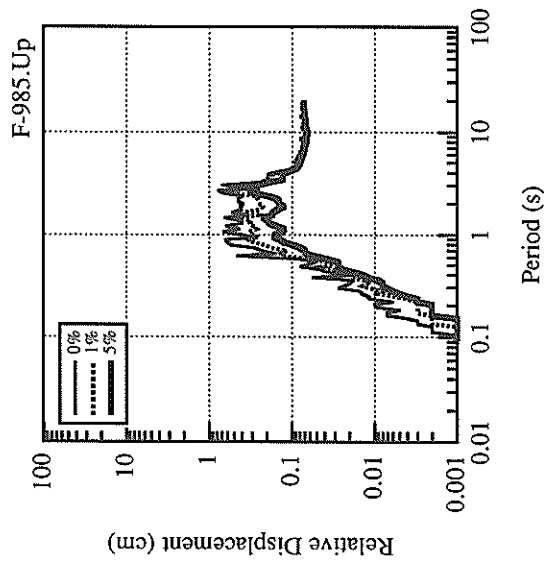
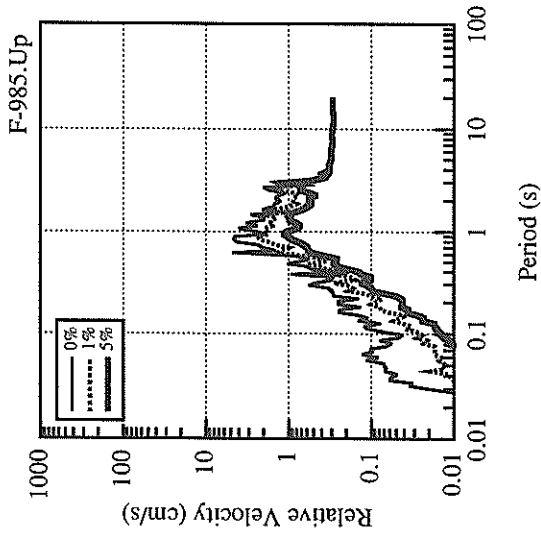


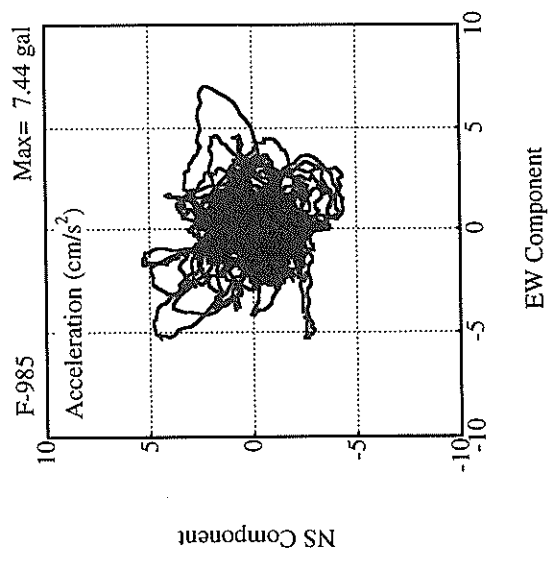
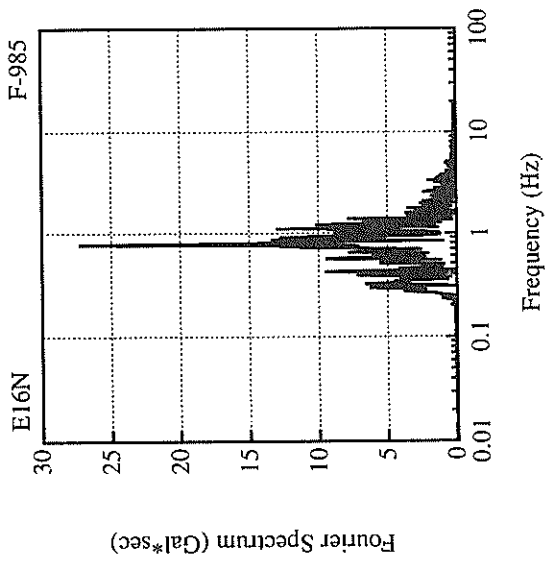
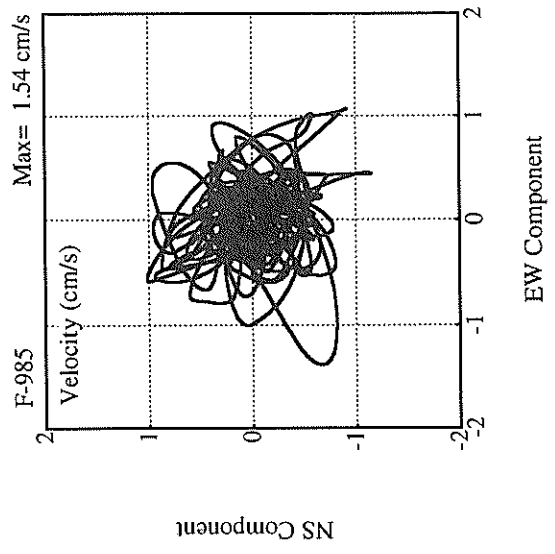
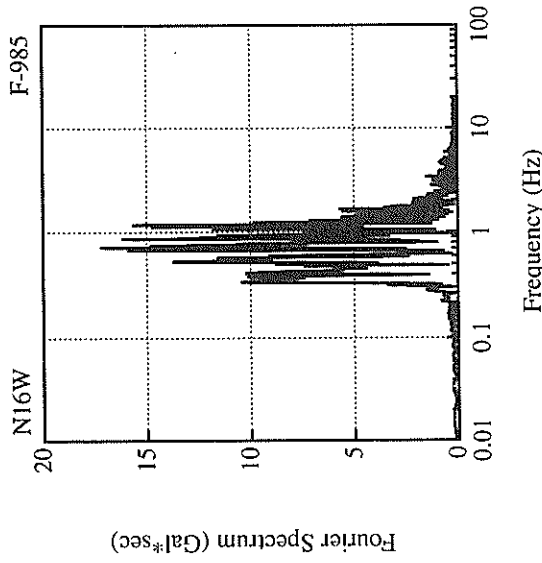
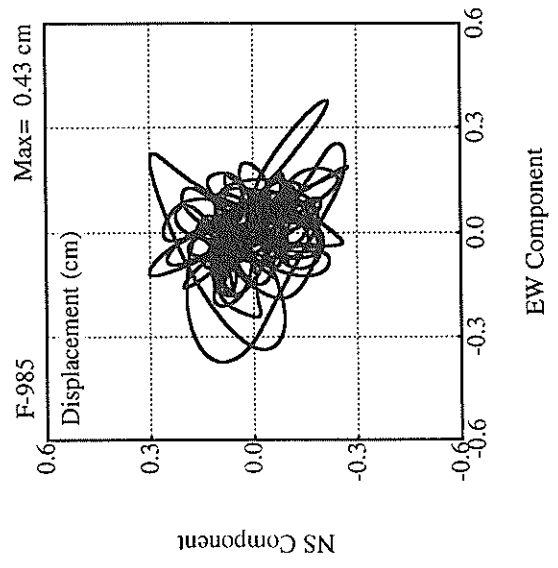
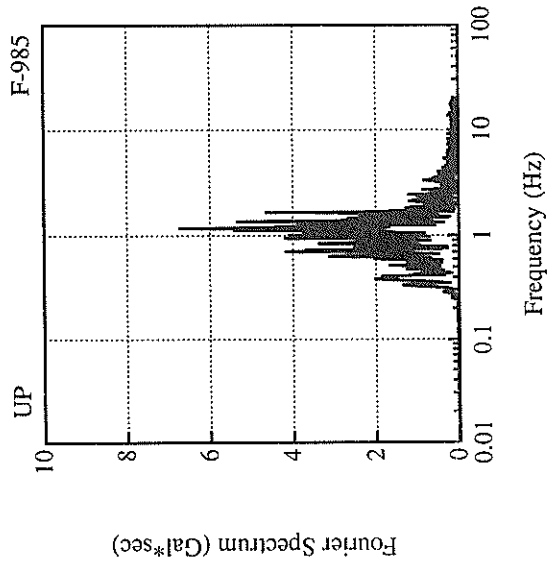














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