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ANALYSIS OF EARTHQUAKE RECORDINGS OBTAINED FROM THE SEAFLOOR EARTHQUAKE MEASUREMENT SYSTEM (SEMS) INSTRUMENTS DEPLOYED OFF THE COAST OF SOUTHERN CALIFORNIA

by

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INTRODUCTION

Under the management and funding of the Minerals Management Service, seismometers have been installed on the ocean floor at various sites off of the coast of southern California. The program is called SEMS, for Seafloor Earthquake Measurement System. The purpose of the program is to characterize the nature of ground shaking from earthquakes for use in the design of offshore platforms used in petroleum drilling and production. I was asked to provide seismological analysis of the data obtained from the various SEMS sites, which I started to do in mid 1992. This report is the documentation of work that I have done on the project.

The following is a brief listing of the tasks accomplished; later sections of the report give full details of the work.

- *Data Processing:* This involved writing computer programs for reformatting data into standard file formats, correcting some of the data for an inappropriate low-cut filter, plotting time series and Fourier spectra, determining low-cut filter frequencies, applying these filters, and computing velocity and displacement traces, as well as response spectra.

- *Data Interpretation:* Because of the lack of onshore data for distances comparable to those from the source to the SEMS sites, the empirical interpretation of the data focused on the ratio of response spectra for the vertical and horizontal components (V/H) as a function of period. Comparisons to the few available ratios and to the ratios derived from regression analysis of strong motion data clearly shows the offshore ground motions to have anomalously low ratios for short period response. The differences between the average onshore and offshore ratios become smaller as period increases, but still persist at periods as long as 2 sec. A preliminary study suggest that the differences at the longer periods are more a function of the average shear-wave velocities under the site than to whether the site is offshore or onshore. An anomalous V/H does not indicate whether the anomaly is in the vertical or the horizontal components. To study this I plotted the response spectra for a particular period as a function of distance from the earthquake (for the one earthquake with available onshore data at proper distances and azimuth); predictions from the regression analysis of strong motion data were also included in the plots. These plots indicate that the anomalous V/H at short periods is due to very low values for the vertical component, a conclusion reached by Sleefe (1990) by plotting peak accelerations from on- and offshore records.

- *Comparison of Observed and Theoretical V/H:* Owing to the sparsity of SEMS data available to me in the early stages of the project, I spent considerable effort on theoretical calculations of wave propagation in earth models simulating the offshore environment. This involved deriving velocity models, learning to run the wave propagation codes, doing the runs, writing programs to reformat the data, and making and analyzing plots of the results. Comparisons of observed and theoretical V/H for Fourier spectral amplitudes are in good agreement. The theoretical calculations also allowed parameter studies to aid in understanding the significance of various aspects of the earth model on the ground motions. In particular, I found that the water layer made almost no difference to the horizontal components of the motion, although it did influence the vertical components of the S wave at frequencies related to the depth of water (around 6 Hz for depths of 60 to 70 m); the effect is negligible for periods near the resonant period of the platforms. This is not to say that the water is not an important factor, for it does allow relatively low shear-wave velocities to exist over wide regions. There are onshore locations with comparably low velocities, but they are sometimes fairly restricted in spatial extent.

- *Long-Period Waves in Basins:* The SEMS unit offshore from Long Beach recorded excellent late arriving waves from the $\mathbf{M} = 5.6$ Upland earthquake that occurred in 1990. The path from the source to the station traversed the Los Angeles basin, and these waves are quite similar to those passing through the basin from larger earthquakes. I used the $\mathbf{M} = 5.6$ recordings as a Green's function and predicted the motions from larger earthquakes using various source scaling relations. The results emphasize the potential importance to seismic design of these long period waves from large earthquakes.

- *Construct Time Series for Studies of the Seismic Response of Offshore Platforms:* This study was done at the request of Charles Smith of MMS to aid him in his analysis of the structural response of offshore platforms. The motions were computed for a site close to the source, using full wavefield calculations to account for wave propagation along the path and near the site and a stochastic source model to account for source complexities.

This report has sections on each of the tasks discussed above. Unannotated listings of the various working directories for the project are included in the appendix, along with listings of the Fortran programs written for the project.

The results clearly show that the offshore motions have very low vertical motions compared to those from an "average" onshore site, particularly at short periods. To decide whether this is fundamentally due to the presence of the water layer or is simply a result of wave propagation in the low velocity sediments beneath the sea floor requires more extensive analysis of onshore recordings from sites underlain by shear-wave velocities comparable to those beneath the offshore sites. Adequate data to do this were not available during the course of this study, so the study is incomplete in this regard. Just recently I have learned of a number of onshore recordings of the 1990 Upland earthquake that should be very useful for the onshore/offshore comparison discussed above. Studies of these data will be completed as time permits, but any such studies are clearly beyond the scope of the funding provided for this project.

The seafloor environment and the water column exert a strong influence on vertical motions at relatively high frequencies (frequencies near that of the fundamental P-wave resonance in the water column, which is about 5.5 Hz for 70m of water) and undoubtedly lead to large differences between onshore and offshore motions. It is easy to get caught up in trying to elucidate and understand these effects, but the importance of these high frequency, "mud-line" motions to the seismic response of offshore platforms may be very limited. I have tried to avoid concentrating on these high-frequency motions.

SHORT HISTORY OF SEMS

The data analyzed in this report were obtained from instrumentation installed on the sea floor by the Seafloor Earthquake Measuring System (SEMS) project. The objective of this system was to obtain ground shaking data on the sea floor that could be used to evaluate the design of offshore oil platforms. The SEMS instrument development, deployment, and data recovery were carried out by Sandia National Laboratory, with funding from the Minerals Management Service. A history of the SEMS is contained in Reece *et al.* (1981), Ryerson (1981), Sleefe and Engi (1987), Sleefe (1990), Smith (1990), Smith (1991), and Smith (1994). I will give only a brief synopsis of the SEMS project.

The SEMS was developed in a number of stages, although all used digital recording. These are usually referred to as SEMS I, SEMS II, SEMS III, and SEMS IV (in this report I refer to them using standard numbers rather than Roman numerals.... thus, SEMS1, SEMS2, SEMS3, and SEMS4), or more briefly, S1, S2, S3, and S4). I have analyzed data from SEMS1, SEMS2, and SEMS4. Here is a brief summary of each stage of the project.

SEMS1: A 3-axis accelerometer was embedded several meters below the sea floor, and the output from the accelerometer was fed to a self-contained instrument package resting on the sea floor. This package digitized the input at a rate of 100 samples per sec and stored the data on board. Data recovery was via an acoustic uplink to a ship deployed specifically for data recovery. The SEMS was installed at several offshore locations and at one onshore location. I have analyzed data from the onshore location (S1VC) and a nearby offshore location (S1HN) near platform Henry in the Santa Barbara channel (See Tables 1 and 2 for station information, Tables 3 and 4 for earthquake information, and Table 5 for the sites that recorded each earthquake, as well as earthquake-to-station distances).

SEMS2: The system was redesigned to have a longer system life, and was deployed near platforms Elly and Ellen, off of Long Beach. In other respects the system was similar to that of SEMS1 (a triggered system with data storage in a unit on the seafloor, using an acoustic uplink for data retrieval). I use the notation "S2LB" for this system. I have analyzed data for two earthquakes occuring in 1986, the North

Palm Springs and the Oceanside earthquakes.

SEMS3: The system was again redesigned, using better batteries, electronics, and triggering algorithm. The result was a longer-life, more sensitive system with fewer false triggers. A major improvement was in using data from horizontal as well as the vertical component in the triggering algorithm (the SEMS1 and SEMS2 units used only vertical component, which, as I will show, generally has anomalously low amplitudes of motion). The system was deployed at two locations, one near the SEMS2 package off of Long Beach (S3EE), and another off of Point Pedernales, near platform Irene (S3IR). This latter site used a datalogger on board the platform, connected via a cable to the sensor, which was embedded in the seafloor. Apparently the hole did not slump in, and this, combined with cable drag due to strong currents, limited the usefulness of this installation. The only data from a SEMS3 unit used in this report is that from the 1990 Upland earthquake recorded on S3EE (the recordings for this event, however, are very high quality and useful; their durations and signal-to-noise ratios permitted the recording of late arriving long-period surface waves). Unfortunately, recordings of the 1992 Landers earthquake and aftershocks were lost because the seafloor data acquisition system had been dragged away, apparently by a fisherman's net. This is very unfortunate, because that earthquake is the largest to have struck southern California since 1952. The long-period motions of most concern to platform design were very strong for that earthquake, and as a result they were well recorded on conventional strong-motion instruments onshore, thus providing an excellent set of onshore motions against which to check the offshore motions (this has been a problem with most of the SEMS recordings: the earthquakes were far enough away and of low enough magnitude that conventional onshore strong-motion recorders either did not trigger or did not record signals that could yield reliable long-period information; in contrast, the SEMS unit can faithfully record these weak motions). It has just come to my attention (August, 1997) that the Upland earthquake was well recorded by the USC strong-motion network, although it does not appear that the accelerographs recorded for a long enough duration to obtain the largest amplitude, late arriving long-period motions that control the response of long-period oscillators. The records should be useful in understanding the differences in response spectra at shorter periods. Although the data are clearly of relevance, analysis of these data are beyond the scope of the funding provided for this project. In addition, the time involved in obtaining these data would significantly delay the completion of this report (which is long overdue anyway).

SEMS4: To address the problem of data recovery from stand-alone sea-floor installations, it was decided to deploy a new system – SEMS4 – using a commercial 24-bit datalogger on a platform, with a cable connecting the sensors to the datalogger. The dataloggers also have dialup capability, making it possible to interrogate the units remotely. The loggers are being run at 20 samples per sec. The sensors are force balance accelerometers almost flat to acceleration between 0.4 and 1500 Hz (the response at 1 Hz is nominally down by 3 db relative to the 100 Hz response); the low frequency rolloffs starts at about 0.4 Hz (see notes in Table 2). Three systems have been deployed, near platforms Eureka (S4EU), Grace (S4GR), and Irene (S4IR). Records of earthquakes in 1995 and 1997, recorded by S4GR and S4IR, are analyzed in this report (to my knowledge, no data have been obtained from S4EU).

It is my understanding that the SEMS4 instruments have been turned over to the California Strong-Motion Program of the California Division of Mines and Geology, who will operate the stations and collect and disseminate the data.

AVAILABLE DATA AND DATA PROCESSING

Summary of Data Used

The data used in this report included the largest events recorded on the SEMS units. The stations from which data were obtained are listed in Table 1 and Table 2. Table 1 contains a short summary of basic information for each station, while Table 2 contains various notes that I made while working on the project. The earthquakes used are summarized in Table 3 and 4. As for the station information, the first of the two tables contains basic information for each earthquake, while the second table (Table 4) contains working notes for each event, including references for the earthquake magnitude and focal mechanism. Table 5 is a convenient summary of which stations recorded which earthquakes. The entries in the table are epicentral distances. A map showing the locations of the recording stations and the earthquakes is given in Figure 1. Several important items regarding the data available for this study can be gleaned from Table 5:

- With one exception, each earthquake was recorded on only one of the offshore SEMS stations. The exception is the first Simi Valley, 1997, aftershock of the 1994 Northridge earthquake. This event was recorded on two SEMS4 stations: S4GR and S4IR. (Note that the SF71 event provided data at two onshore sites but not at any offshore sites; I have included this event in Table 5 because later I compare these data to the S3EE recording of the Upland, 1990, earthquake.) The lack of multiple offshore recordings for a given event limits, to an extent, the interpretation of the data.

- A more important limitation than the lack of multiple offshore recordings is the relative scarcity of onshore data at sites near the offshore sites (by near, I mean along the same general azimuth from the earthquake to the SEMS site, and at distances as close to the SEMS site as the coastal configuration allows; for the earthquakes listed in Table 3 there are usually numerous recordings of ground motion, but at epicentral distances much smaller than the epicentral distances to the SEMS stations). As Tables 3 and 5 show, most of the SEMS records were obtained from moderate size earthquakes at distances in excess of 70 km. The standard analog, onshore accelerographs do not have the sensitivity to provide digitizable data at these distance for the earthquakes recorded on the SEMS sites. The only earthquake for which I was able to obtain onshore and offshore data is the Santa Barbara Island, 1981, earthquake, which was recorded on 3 onshore stations, one of which was a SEMS unit installed onshore, near Vic Trace Reservoir. The other two recordings, SC38 and SC51, were obtained on standard analog accelerometers maintained by the University of Southern California (USC). Only recently have onshore instruments with performance characteristics comparable to those of the SEMS units been installed in the southern California region (the SEMS units were ahead of their time!). As mentioned earlier, I recently found out that numerous onshore analog recordings of the Upland, 1990, earthquake are available. A cursory perusal of a preliminary digitization of these data (using a 300 dpi scanner) indicates that the data will be useful for some aspects of this study. Unfortunately, the instruments did not record for a long enough time to capture the long-period basin waves that are of particular importance to platform response. The data need to be digitized using a scanner with higher resolution. Not knowing when the new digitization will be available, nor what other demands will be placed on my time, I decided to write this report before obtaining these newly digitized data.

- Several sites recorded different earthquakes, thus allowing a check on the stability of the ratio of motions on the vertical and horizontal components. These sites include S2EE, with 2 recordings, S4GR, with 3 recordings, and S4IR, with 2 recordings. In addition, sites S2EE and S3EE were close to one another, so if counted as one site, 3 recordings are available for these sites.

Other data than those listed in Table 5 have been recorded by the SEMS units. To my knowledge, there have been smaller earthquakes than those used in this study (e.g., Reece *et al.*, 1981, discuss data from a magnitude 3.2 earthquake recorded at S1HN and S1VC), but none of these data have been made available to me. In addition to the SEMS stations, several platforms have been instrumented by the oil company responsible for the platform, and apparently data from these installations have been obtained. For example, Chen *et al.* (1989) and Mason *et al.* (1989) discuss records on and beneath platform Grace obtained from the 1987 Whittier Narrows earthquake (this event was not recorded on any SEMS stations). Several of the recordings were obtained at depths down to about 100 m below the platform; finite element calculations show that these records are little influenced by the platform and therefore can be considered to be free-field records. These data should be very useful in understanding the response of the site to ground shaking.

Processing of Data

The processing involved several steps:

- *Reformatting the data into a common format:* I chose the SMC file format used for the strong-motion data produced and disseminated by the U.S. Geological Survey. This format is described in the documentation accompanying the program BAP (Basic Accelerogram Processing) by Converse (1992). The file format of the data provided to me was different for the various generations of SEMS, and therefore I had to write different Fortran programs to reformat each data set. As part of the process of reformatting SEMS4 data, I found that the whole extent of the data could not be used because of artificial steps at the front and back of the time series. I reformatted the data as provided, plotted the time series, and then extracted the good portion of the data (which was almost all of the data; the offsets only affect the beginning and end). The file names I have used for the basic time series data sometimes have "smc" as a file extension, and other times I have used the standard notation used by Seekins *et al.* (1992) in their compilation of strong motion data. For example, *247p51s1.hne* is the *e* horizontal component at station *s1hn* for the 1981 Santa Barbara Island earthquake. Note that because of file length limitations in DOS, the four character station code is split by the period (*s1hn* becomes *s1.hn*). The first three characters of the file name (*247*) give the Julian day of the earthquake and the next 3 characters (*p51*) are a code related to the origin time of the event.

- *Determining Low-Cut Filter Parameters:* The first thing I did after reformatting the data was to compute and plot whole-record Fourier spectral amplitudes. Looking at these gave me some indication of what cut-off frequencies (f_c) to use in the processing. This is a subjective process, but various trials with different frequency cut offs showed me that the response spectra are only affected for periods longer than about $0.5/f_c$ (Figure 2). The frequency cut offs used in this report are given in Table 6. In this report I have generally used response spectra for period less than or equal to 2.0 sec. With the exception of the two S2EE recordings, the choice of f_c should not affect the response spectra used in this report (as Figure 2 shows, the response spectra at $T = 2$ sec for the two S2EE recordings are somewhat affected by the cut-off frequency).

- *Integrate the Filtered Time Series to Produce Velocity and Displacement Time Series and 5% Damped Pseudovelocity Response Spectra (PSV):* I used the program BAP to filter and integrate the time series. Three-component plots of the acceleration, velocity, and displacement time series for all records used in this report are contained in Appendix A. Plots of individual response spectra and Fourier spectra are not included in this report.

DATA INTERPRETATION

Preliminary Interpretation

Visually, the accelerograms recorded on the SEMS units look much like those from onshore sites. As an example, Figure 3 shows three components of motion for the 1990 Upland earthquake; because the units have pre-event buffers, the initial P-wave motion has been captured (unlike the records from analog accelerographs), and the P wave is followed by a clear S arrival, which is followed by a slowly decaying coda or tail. The vertical component is small relative to horizontal components, but it is possible to find onshore records with comparable relations between the components.

The acceleration, velocity, and displacement time series for the 1990 Upland SEMS recording are shown in Figure 4, 5, and 6. The acceleration traces are largest near the beginning of the record, and they decay to small motions at the time of arrival of the large amplitude long-period waves. The outstanding feature of these figures are the late arriving, long-period ($\approx$ 6 sec) motions on all three components. These motions are not unexpected, for the travel path (Figure 1) traverses the Los Angeles basin, and the waves resemble the surface waves that have been observed to propagate in the basin. In seismological terms, the peak accelerations are probably carried by body waves, while the long-period arrivals are surface waves.

The motions in the displacement traces are low amplitude (peak displacement of about 1 cm). The amplitudes of the motions are below the noise threshold of normal analog strong-motion instruments, and it is natural to question whether the motions faithfully reproduce the ground motion or whether they are nothing but long-period noise. A qualitative check on the motions is to compare plots of the time series with those from other, larger events recorded at sites for which the waves have traveled comparable distances through the Los Angeles basin. I have done this for two recordings of the 1971 San Fernando earthquake (M = 6.6), recorded at Costa Mesa (CM) and Palos Verdes (PV). According to Hanks (1975), there is no question that the long-period motions for these earthquakes are signal and not noise. The stations, earthquake location, and paths are shown in Figure 1. Comparative plots of acceleration, velocity, and displacement are shown in Figures 7, 8, and 9 (I have chosen the horizontal component from each record that best matches the various records). I have lined up the records on the S arrival for the SEMS record and on the beginning of the record for the onshore records (it appears that the onshore records were triggered shortly after the S arrival; the late triggering will have little affect on the late arriving waves). The comparison shows the records to be in good qualitative agreement: the displacements increase in time, with the largest displacements occurring 45 to 60 sec after the initial S arrival. The peak displacements are carried by waves with periods near 5 sec. Exact agreement of the waveforms for the various recordings is not expected; the earthquakes were different in magnitude and in travel path. The source duration for the Upland quake was probably shorter than the period of dominant displacement motion (making the record a good Green's function...more on this later), but this is not the case for the San Fernando recordings, for which the source duration and period of dominant displacements is comparable. The comparisons in Figures 7, 8, and 9 give confidence that the SEMS long period motions are signal, not noise.

As an aside, I note that recorded durations from instruments triggered on acceleration levels (such as the ubiquitous analog strong-motion accelerographs) might be too short to capture the peak displacements (in fact, it is not clear that the peak motions have in fact been captured on the traces shown in Figure 9; this may be particularly so for the CM recording). If the duration of recording following the initial trigger is set to less than about 60 sec, then it is possible that the largest displacements will not be recorded.

Ratio of Vertical to Horizontal Spectral Amplitudes

Because the earthquakes recorded at the SEMS sites were generally not recorded at nearby onshore sites, it is difficult to make a direct assessment of the agreement between onshore and offshore motions (ground motions depend on many variables, such as earthquake size and style of faulting, distance from the source, propagation path, and local site geology; a comparison of only a few recordings is worthless unless adequate corrections can be made to remove these influences on the amplitudes of the motions). The ratio of vertical to horizontal motions (V/H), however, might be expected to remove all but the effect of local geology, at least to first order. By comparing ratios it would then be possible to compare a few onshore and offshore recordings to see if they were comparable or not. I have done that here. I have also compared the ratios from offshore recordings with those predicted from regression analyses based on hundreds of onshore recordings from many earthquakes; this provides a measure of comparison that represents the average ratio for a typical site and earthquake of a specified magnitude and distance. In addition, I have compared the average V/H for offshore SEMS sites to the V/H from a few onshore recordings for which the shear-wave velocities beneath the recording sites are similar to the velocities I estimate to exist beneath the SEMS offshore sites.

I have studied both ratios of Fourier spectra and ratios of response spectra. The Fourier spectra are more directly related to site transfer functions, but the response spectra have the advantage of having relations available from the analysis of numerous onshore recordings, which provide a well-founded mean expectation for onshore recordings.

This method of analysis, but using H/V rather than V/H, has been applied by a number of seismologists to extract information about site response (Field and Jacob, 1995, and references therein; Atakan and Havskov, 1996). This method is often referred to as "Nakamura's method", after the application by Nakamura (1989) to obtaining site response by using microseismic noise. The basic assumption that makes this method work for extracting site response is that the vertical component motion is little affected by the sediments; as I will show later, this is a poor assumption at frequencies near the resonant frequency of P-waves in the water column, and therefore the method may not work well for offshore recordings. In addition, site response obtained using H/V are sometimes in agreement with those from other methods only at frequencies near the fundamental mode of the soil response (assuming the soil layers have a clearly defined resonance), and then only in the frequency of resonance but not in the amplitude of the response. For these reasons, I have not used the ratios as a means for estimating site response.

Effect of record duration on PSV: As mentioned earlier, it is not clear that the recorded motions have captured all of the long-period motion. I have studied this by computing response spectra for one of the horizontal traces of the S3EE recording of the Upland 1990 earthquake, using progressively shorter durations of the time series. Figure 10 shows the set of time series for acceleration, and Figures 11 and 12 show the velocity and displacement time series. The terminology "T40" (and similarly, "Tcut = 40"), etc., refers to the length of time series before padding with zeros at the front and back of the record; this zero padding is done by the processing program BAP to reduce the effect of the tails of the noncausal filters used in the processing. The displayed time series include the zero pads. The velocity time series (Figure 11) suggests that intermediate periods (around 1 sec) will be captured on all but the T40 record. In contrast, the displacement time series suggests that the long period motions late in the record will be missing from all but the T90, T80, and possibly the T70 records. A quantitative assessment of this is given in Figure 13, which shows response spectra computed for the set of traces shown in Figure 10. From this comparison it can be seen that for periods longer than about 2 sec, durations longer than the T60 duration are required to capture the complete oscillator response. If late arriving basin waves are present (such as control the response for periods greater than 4 secs), durations equal to or exceeding the T80 duration are required. Many analog onshore strong-motion accelerographs do not record for a long enough duration to capture these basin waves, particularly at the large distances for which the basin waves are well formed (and for which the peak accelerations, which control the triggering of the film recorder, are small).

The difference in the response around 6 sec between the Tcut = 70 and the Tcut = 80 and 90 time series is a bit surprising, for it seems from the displacement traces in Figure 12 that the T70 trace captured at least one cycle of the large amplitude late-arriving energy (note that the peak displacement for T70 is similar to that of T80 and T90, but the response spectra at 6 sec differ by more than a factor of 2). To see why this is so, I show in Figure 14 the input accelerations and 6 sec oscillator response for T70, T80, and T90 (note that each trace in the figure is scaled individually). This comparison clearly shows that the T70 record did not capture the long period response.

The results above show that long-period response is sensitive to record duration. This might be a problem with some of the SEMS records. (The long period response for some of the SEMS units is also problematical because I judge that noise dominates the motions; see the cut-off frequencies in see Table 6). The question then arises as to what periods to use in the analysis. Since I am particularly interested in V/H, I show in Figure 15 the V/H ratios for the various record durations. From this it seems that response spectral ratios should be OK for periods less than about 2.0 sec (the biggest difference shows up for the Tcut = 40 trace, but I judge that most of the SEMS recordings have longer effective durations). This cutoff means that long-period basin waves, such as those in the SEMS recording of the 1990 Upland earthquake, will not be included in the analysis.

V/H from recorded ground motions: With this preliminary work out of the way, I now present the results of forming ratios of vertical to horizontal ground motion. I first show results from recordings of the 1981 Santa Barbara Island earthquake, which was recorded on an offshore station and several onshore stations (Figure 1). The ratios of 5% damped response spectra and Fourier amplitude spectra are shown in Figures 16 and 17, respectively. In these figures the geometric average of the two horizontal components has been used for the denominator. In both plots it is clear that the offshore recording (S1HN) has a much different V/H than for the onshore recordings. The difference is largest at short periods and tends to decrease at long periods. An explanation for this behavior in terms of wave propagation is given later.

Several events were recorded at the same station (Table 5). It is interesting to compare

V/H for the multiple earthquakes at a given site to assess the stability of the ratio. Similar ratios for different events might suggest that the ratio is strongly controlled by local site conditions, particularly if the events are different magnitude and have different travel paths to the site. Figures 18, 19, and 20 show such comparisons for three sites: S2EE, S4GR, and S4IR. In general the ratios at a given site are similar to one another. There is also a general trend shared by all sites for the ratio to increase with period, although individual sites have distinct characteristics (in particular, compare S2EE to S4IR).

I compare ratios of response spectra at all offshore sites in Figure 21 and ratios of Fourier spectra for earthquakes through 1990 in Figure 22. These figures show considerable scatter, which the preceding figures suggest is largely due to site-to-site variations in the ratio of vertical to horizontal motion. The differences are larger for short periods than for long periods, which is what I expect in view of possible lateral variations in shear-wave velocity, as well as the influence of the water column on the higher frequency vertical motions. The ratios are similar enough in overall trend, however, to justify computing an average V/H as a function of period for purposes of comparing with average onshore relations. In the next section I compare the average offshore response spectral ratios to regression-based average onshore spectra. Later in the report I compare the ratios of Fourier amplitude spectra to theoretical predictions.

Comparison of V/H from offshore SEMS and from onshore regression analyses: Two recent sets of regression analyses were used to provide onshore ratios of vertical and horizontal components. These are Abrahamson and Silva (1997) and Campbell (1997). The Abrahamson and Silva relations, hereafter referred to as "AS97", were derived from data recorded at distances as large as 200 km; in contrast, the Campbell relations ("C97") only used data for distances less than or equal to 60 km. Both AS97 and C97 give equations for the vertical and horizontal components separately; I formed V/H from the individual components predictions. The regression-based predictions are a function of style of faulting, site condition, magnitude, and distance. For C97 I used a basement depth of 2.0 km. I first show some figures illustrating the variation expected for some of these quantities. In all cases I show results for "soil" sites. By this is meant the average soil site represented by the collection of strong-motion stations. Many of these stations are on stiff soil, and the analysis of velocities from boreholes, many of which are colocated with strong-motion stations, finds that the average shear-wave velocity in the upper 30 m (V_{30}) for a typical soil site is 310 m/s (Boore and Joyner, 1997). As I show later, the shear-wave velocities beneath the SEMS offshore sites are probably lower than at a typical onshore soil site, with $V_{30} \approx 220\,\mathrm{m/sec}$.

Figures 23 and 24 give the ratios for AS97 for a suite of distances and $\mathbf{M} = 5.0$ (Figure 23) and $\mathbf{M} = 6.0$ (Figure 24). (Recall that most of the SEMS recordings are for magnitudes between 4.7 and 6.1 and distances from 66 to 309 km). It is clear that V/H can have considerable distance variability, depending on oscillator period and magnitude. Figure 25 compares V/H for magnitudes 5 and 6 and a suite of fault types. This figure shows that fault type is not an important factor for V/H. Figure 26 is similar to Figure 25, but it uses the C97 regression results. In this case, C97 does not distinguish between reverse (Mech 1.0) and oblique (Mech 0.5) faults. As for AS97, Figure 26 shows that fault type is not an important factor. A comparison of V/H for AS97 and C97 is shown in Figure 27 for two magnitudes (5 and 6) and the greatest distance for which the C97 results are valid (60 km). The differences between the results are a crude estimate of the epistemic uncertainty due to lack of data, as well as different assumptions regarding databases and regression procedures.

I turn now to comparisons with the SEMS results. Figure 28 shows ratios from the SEMS and USC recordings for the 1981 Santa Barbara Island earthquake and the regression-based ratios. In this case the regression-based ratios are in much better agreement with the onshore ratios than with the offshore ratio. I judge that with the possible exception of SC38, the onshore sites are underlain by materials with higher shear-wave velocities than is the offshore site (SC38 is described to be on dune sand in Anderson *et al.* (1981), whereas S1VC and SC51 are on marine terrace deposits), and therefore I would expect the spectral ratios for the onshore sites to be more similar to the ratios from regression-based results than for the offshore site.

Figure 29 shows a comparison between the regression-based onshore results and the average of the SEMS offshore results (using two types of averaging— arithmetic and geometric). In view of the distance dependence of V/H shown earlier, it may be argued that I should make the comparisons on an event-by-event basis. This would lead to more figures than necessary, and the basic conclusions can be derived from a comparison with the average ratio. In so doing I use a distance for AS97 of 120 km, which is close to the geometric mean distance of 113 km for the events used in forming the ratio. The regression-based results for C97 were evaluated at the greatest distance– 60 km– for which his equations are valid. Included in the comparison in Figure 29 are results from analyses of specific earthquakes (Loma Prieta 1989 and Northridge 1994), as well as results from the SMART1 array in Taiwan. In general, the onshore results are above the SEMS offshore results, and the difference is largest at short periods.

The large difference between average onshore sites and the SEMS offshore recordings at short periods is consistent with the findings of Sleefe (1990), who made scatter plots of peak accelerations, with horizontal components on one axis and vertical components on the other. Using different symbols for offshore and onshore recordings, he clearly found two populations separated in the same sense as I found for response spectra and Fourier spectra. In addition, Smith (1990) found that V/H for peak acceleration and peak velocity from offshore sites was smaller than for onshore sites, again in qualitative agreement with the findings from the spectral ratios.

At longer periods a difference between AS97 and C97 and the SEMS results still persists, but the difference is much smaller than at short periods. The C97 results are closer to the SEMS results than are the AS97 predictions, but recall that the C97 results are for $D = 60$; the AS97 distance dependence produced an increase of V/H with distance, which if true for C97 would lead to larger values for $D > 60\,\text{km}$, and therefore the C97 ratios would be more discordant with SEMS ratios than shown in the figure. Although the AS97 and C97 ratios are higher than the SEMS ratios at all periods, it may be significant that the SMART1 results produce somewhat lower values of V/H than the SEMS values for periods in excess of about 0.6 sec (and if the distance dependence shown in Figures 23 and 24 holds for the SMART1 data, then applying a distance correction to go from the ratios at 50 km to the average distance from the earthquakes to the SEMS recordings would likely result in SMART1 ratios being in good agreement with the SEMS ratios). The SMART1 site is underlain by low velocity materials and as shown in the comparison of shear-wave velocities in Figure 30, may be a closer analog to the average SEMS offshore site than the average soil class represented by the other regression results. (The estimation of the offshore SEMS velocities is discussed in more detail later in the text.)

Comparison of V/H from offshore SEMS and from selected onshore recordings: The relatively good agreement at longer periods between the spectral ratios from the offshore SEMS recordings and the recordings on the SMART1 array, as well as the agreement in velocities, suggests that at longer periods the comparison between offshore and onshore ground motions is more a function of the sediments underlying the sites than it is on the presence or absence of a layer of water above a site. In other words, a hypothesis can be made that the ground motions will be the same if the depth dependence of the shear-wave velocities is the same, regardless of whether the site is an offshore or an onshore site. An obvious test of this hypothesis is to compare V/H for offshore and onshore sites underlain with similar velocities. I have made a limited test of this hypothesis. Figure 30 compares velocities estimated at offshore SEMS sites and velocities from several onshore sites: the LSST site within the SMART1 array, two sites near the edge of San Francisco Bay, and a site in the Imperial Valley. Three-component acceleration time series for recordings at the latter three sites are given in Figure 31, along with the offshore recordings of the 1990 Upland earthquake at S3EE. The general character of the time series is similar, but the S3EE recordings has smaller vertical accelerations relative to the horizontal accelerations. A more precise comparison of the motions is given by the ratios of response spectra, as given in Figure 32 (Figure 32 also contains the regression-based results discussed earlier). It is clear that the spectral ratios at longer periods from onshore sites can be lower than from offshore sites; the apparent bias between the offshore and onshore ratios at longer periods noted in Figure 29 may be due to the fact that the onshore regression-based ratios are from soil sites underlain by shear-wave velocities higher on average than those under the offshore sites. Figure 32 gives some support for the hypothesis that the comparison of the ground motions at longer periods is most strongly controlled by the underlying shear-wave velocities. The figure also emphasizes the dramatic difference between offshore and onshore ground motions at shorter periods.

Peak motions as a function of distance: The previous figures show a clear difference in V/H at short periods between the offshore and onshore recordings. Is this due to onshore vs. offshore differences in the vertical or the horizontal components, or both? To investigate this, I plotted response spectral amplitudes for a few selected periods as a function of distance from the earthquake. I considered only the 1981 Santa Barbara Island data, for which both onshore and offshore data are available. Plots for the horizontal components are given in Figures 33 through 37 and for the vertical components in Figures 38 through 42. Included on these plots are the regression-based results of AS97 and C97. From these plots, it is clear that the offshore vertical component is always smaller than the SEMS and USC onshore vertical components (after accounting for the attenuation with distance);

the difference is greatest at short periods. The same is not always true for the horizontal components. This comparison is strong evidence that the very low values of V/H at short periods are due to small values of V, rather than large values of H. A similar conclusion was drawn by Smith (1994), who plotted peak accelerations against distance for vertical and horizontal components.

The comparison of the SEMS results with regression-based results in Figures 33 through 42 is less useful; for longer periods both offshore and onshore V and H are below the regression-based results. From this comparison with the empirical results I conclude that it would be meaningless to base a conclusion regarding differences between onshore and offshore motions on a comparison of only an offshore recording with the regression-based results; onshore and offshore motions from the same event are needed.

COMPARISON OF V/H FROM SEMS RECORDINGS AND FROM THEORY

It is instructive to compare the observed ratios of vertical and horizontal motions with theoretical computations. Such a comparison helps in understanding the physical mechanism leading to the particular observed ratios and can be used to assess the motions expected in cases for which data are not available.

Velocity Model

The first step in the procedure is to derive velocities as a function of depth below a typical site (sufficient information was not available to do a site-by-site evaluation; in view of the overall agreement in the spectral ratios for all of the SEMS sites, this should not be an important limitation. Site-specific velocity structures, however, undoubtedly explain some of the site-to-site variations.) I could find no direct measurements of the velocity, and therefore I had to estimate the velocity from available information and from analogs to other onshore sites for which velocity information is available.

I chose to break up the model into three layers: water, 0.1 km of soft sediments, and underlying crust. I did the calculations using various combinations of these three components to understand the influence of each.

Water layer: I used a water depth of 60 m, which is appropriate for a number of the SEMS sites that I studied (see Table 1).

Shallow sediments: I obtained lithologic data and standard penetration data for three borings near SEMS station S3EE. The logs indicate that the most of the sites are underlain by sands and silts, with some clay present (the deeper sites may be subject to less current scouring and may be underlain by more clay— logs near platform Eureka near S4EU indicate this to be the case). T. Fumal of the USGS estimated shear-wave velocity from this information, based on his experience with correlations between SPT and shear-wave velocities (e.g., Fumal, 1978). His estimates are labeled "hole 261-1", "hole 261-3", and "hole 262-1" in Figure 43. Also included on this plot are shear-wave velocities from Hamilton (1976a) for ocean-bottom sediments, velocities determined by L. Dorman (written communication, 1997) for a site offshore of southern California, near Camp Pendleton, and velocities for several sites off the coast of Norway for which the water depths are comparable to those for the SEMS stations (Rognlien, 1987). Based on these velocities for ocean-bottom sites on continental shelves, I derived a model of velocities in the upper 100 m; these velocities are shown in the figure.

It is instructive to see how the offshore velocities in Figure 43 compare to those from onshore boreholes close to Long Beach. Figure 44 shows a map of USGS boreholes in the vicinity, and Figure 45 shows the velocities, along with the SEMS model. The velocities separate into two groups, which the map indicates are well correlated with the age of the near-surface sediments: with one exception (BH16), the lower velocities correspond to Holocene sediments, while the higher velocities correspond to the Pleistocene sediments, which are older (for those sites with Holocene sediments at the surface, BH44 is unusual in that the low-velocity Holocene sediments are underlain by much higher-velocity shales). The adopted SEMS model is in good agreement with the Holocene velocities.

Another comparison of the SEMS model was previously given in Figure 30, in which the onshore velocities come from farther afield: the Imperial Valley, sites near San Francisco Bay underlain by clay, and Taiwan. The adopted SEMS model has higher velocities near the surface than the clay sites, and is in reasonable agreement with the Imperial Valley velocities.

The message conveyed by Figures 30 and 45 is that onshore sites do exist with velocities similar to those that I have adopted for the offshore sites. It is probably too simplistic to lump sites into simple "offshore" and "onshore" categories. One difference between onshore and offshore sites, however, might be that the subsea depositional environment may lead to less site-to-site variation in the shear-wave velocities near the Earth's surface.

Crust: The travel time through the upper 100 m of the adopted SEMS model is 0.37 sec. This corresponds to a quarter wavelength period of 1.5 sec. Because I want to do computations out to at least 5.0 sec, it is necessary to specify the velocity structure at deeper depths. At the time I was doing the theoretical modeling, I was guided by my work in 1986 for velocities in "rock" in California (Boore, 1986), and I simply placed the soil model discussed above on this rock model, with slight modifications. Since then I have become aware of other models that may be more appropriate for the crustal velocities below the sediments (e.g., Magistrale *et al.*, 1996; Boore and Joyner, 1997), and I would use these velocities if I were to redo the theoretical calculations. It should be kept in mind, however, that the calculations will be strongly controlled by the top 100 m of sediments for frequencies greater than about 0.7 Hz, so limitations of the underlying velocities will not invalidate the theoretical results at these higher frequencies— nor will they invalidate the comparisons I make with models with and without the water layer. As I show later, however, the calculations on a rock site alone, stripped of the low velocity sediments, are suspect, particularly at high frequencies. Various velocity profiles are shown in Figures 46 and 47, for depths of 1 and 5 km, respectively. The models include velocities from the Magistrale *et al.* (1996) model for the Los Angeles basin. This model provides velocity-depth profiles for any site in the region; at my request, H. Magistrale provided velocities for sites corresponding to onshore borehole BH50 at Seal Beach, the onshore strong-motion station Costa Mesa, and offshore SEMS site S3EE (the locations of these sites are plotted on the map in Figure 44). Also included in Figures 46 and 47 are profiles from Swanger's study of offshore ground motions (Swanger, 1981), the model used by Hauksson and Jones (1988) in their study of the 1986 Oceanside earthquake, a model from D. O'Connell (written commun., 1995) for the western Transverse Ranges, and Boore and Joyner's (1997) velocities for "California" rock. The SEMS model that I adopted has a much steeper gradient near the surface than the other models. If I were doing the theoretical calculations again, I would use the Magistrale *et al.* (1996) model for S3EE.

The model I used in the calculations is given in Table 7 and is plotted in Figure 48.

Also included in Table 7 are the attenuations used in the calculations. I will show results of calculations for three different velocity models derived from the basic model given in Table 7: 1) the complete model, including the water layer; 2) the model with the water layer removed; and 3) the model stripped of the water layer and the upper 0.1 km of sediments.

Results of Theoretical Analysis

To do the theoretical modeling, I used program HSPEC91 by R. Herrmann. This versatile program uses wavenumber integration to compute the complete wavefield in an earth represented by a stack of laterally-uniform, constant-velocity layers. My procedure was to generate synthetic seismograms for a specified type of faulting for the earth model of interest, and then to treat the synthetic seismogram as I would an observed seismogram. In most case I computed the Fourier amplitude spectrum of the S-wave portion of the seismogram, although in a few cases I studied the P-wave portion. The focal depth used in the model was 10 km. The surface waves resulting from this depth will not be as energetic as the basin waves, which are probably generated by conversion of body waves at basin edges. For this reason, I do not claim that the theoretical modeling includes basin waves. This is consistent with the possible lack of basin waves in the V/H ratios computed from the data (because of the limited duration for some of the SEMS recordings or the presence of noise at long periods).

Effect of water layer: It is instructive to use the theoretical calculations to investigate the expected effect of the water layer. Because shear waves do not propagate through the water layer, the response of vertically incident shear waves should be the same with and without the water layer. For non-vertically incident SV waves, however, conversion of SV to P will occur at the water–soil interface, and the P waves will resonate within the water layer. The converted upgoing P wave will reflect from the ocean surface and travel back down. Some of it will be reflected from the ocean bottom, and some will be converted into downgoing SV waves. A similar process will occur for incident P waves. The wave propagation code HSPEC91 accounts for all of these interactions; it does not assume incidence of a particular type of plane wave; rather, it computes the motion at a given horizontal distance from a point source for a specified type of faulting embedded in the layered structure.

I show in Figure 49 the ratio of horizontal and vertical S motions at the seafloor for the model with a water layer and at the surface of the model obtained by stripping off the water layer. This figure predicts that the water layer exerts almost no influence on the horizontal S wave motions. The effect of the water layer does show up on the vertical component of the S wave, as a strong reduction in vertical motion at a particular frequency — an antiresonance. Saying "S wave" is somewhat misleading, for the wavetrain starting around the time of the initial S wave can have P-wave energy, obtained from conversion of S-wave motion to P-wave motion at interfaces. It is probably this conversion of S-wave motion into P-wave motion at the seafloor which is leading to the reduction in vertical motions compared to the case with no water layer (Bureau, 1986, also did calculations that yielded a reduction in vertical motion for an ocean-bottom site). The frequency at which the reduction in S energy is greatest is the fundamental resonance mode for P waves trapped in the water layer, as discussed below. This water-layer effect on the vertical component of the S wave will lead to different theoretical V/H ratios for onshore and offshore sites underlain by the same materials, but the difference will only be pronounced for frequencies greater than about one-half the water-layer resonance frequency.

As mentioned above, the water layer will have its most pronounced effect on motions dominated by P waves. Crouse and Quilter (1991) give a simple theory in which they predict the ratio of P-wave motion at the seafloor relative to motion without the overlaying water layer. The largest effect should be at frequencies corresponding to resonance in the water layer. At resonance, a phase change at the water–seafloor interface leads to destructive interference and a relative node in the P-wave motion. Only the fundamental mode is in the frequency range of our data, at least for all but the deepest site, for which I do not have data. The resonant frequency is given by $f_P = C/(4H)$, where C is the velocity of P waves in water (1500 m/s) and H is the water thickness. For a depth of 60 m (200 ft) this gives $f_P = 6.25\,\text{Hz}$. I used HSPEC91 to check the model of Crouse and Quilter. The results are shown in Figure 50, from which it can be seen that their simple theory is in good agreement with the calculations. Based on the these results, the water layer itself will not affect sea-floor motions for frequencies lower than about $0.5f_P$. For platforms near the SEMS stations providing the data analyzed in this report, I would not expect the water layer itself to influence directly waves with frequencies less than about 3 Hz. Of course, as the water depth increases the resonant frequency moves to smaller values (but I assume that so does the resonant frequency of a platform), so that for the deepest SEMS site (S4EU) I expect frequencies of 1.7 Hz and higher to be affected by resonance in the water layer. No data are available for S4EU.

Effect of soil layer: Figure 51 shows the ratio of Fourier amplitude spectra of S-wave motions for the soil+rock and the rock only models, along with the empirically determined soil amplifications from Boore *et al.* (1993, 1994, 1997) for horizontal-component response spectra. Results for both horizontal and vertical motions are shown. Clearly, the soil layer has a pronounced affect on the motions for the horizontal component. It also shows that the predicted onshore soil amplifications are similar to those observed empirically, and that those amplifications can be substantial at periods as long as 2 sec. The reduction of the soil site response at higher frequencies is due to the attenuation in the soil layers, which more than compensates for the amplification in the layers (and remember, these are linear calculations; nonlinear response might induce more damping of the motions at frequencies of several Hz).

Effect of deeper layers: Simulations focused on the effect of the deeper layers were not made, but some comments can be made based on the results in Figure 51. The large peak in the vertical component ratio is most likely due to a reduction in motion in the rock only motion, resulting from the strong gradient in the rock velocities near the surface. For calculations on rock sites (no low-velocity sediments on top), this steep gradient causes high-frequency waves to refract more toward vertical than for low-frequency waves. The frequency effect can be explained in terms of ray propagation, for which the angle of incidence near the surface depends on an effective shear-wave velocity, which is the shear-wave velocity averaged over some fraction of a wavelength. The effective velocity for high frequencies will be lower than for low frequencies, and therefore there will be a stronger refraction toward vertical for the high-frequency motions. The refraction will lead to very small vertical S-wave motions and a pronounced dip in the V/H ratio. As mentioned earlier, I am not satisfied with the velocity models used for the deeper layers, and if the computations were to be repeated I would use a model with a less extreme gradient.

As discussed before, for several reasons the periods emphasized in this report are shorter than several seconds. Variations in the deeper parts of the model may have an important effect at longer periods. For example, Swanger and Boore (1978) emphasize the importance of deeper layers for motions with periods of several seconds or longer; they used a model with a less rapid gradient than in the SEMS model (see the model labeled

"Swanger" in Figure 47), which will give a larger amplification at long periods than will the SEMS model.

Comparison of observed and theoretical spectral ratios: I now turn to comparisons of ratios of vertical- and horizontal-component S-wave Fourier amplitude spectra. Figure 52 show the observed and theoretical ratios for the offshore site, and Figure 53 shows the same for the onshore sites. The comparison for the offshore site is quite good, but the predicted onshore ratio has a strong dip starting at about 2.5 Hz not seen in the observed ratios. As discussed earlier, this dip is a consequence of the steep gradient in my assumed rock profile.

SCALING OBSERVED SEMS RECORDS TO SIMULATE MOTIONS FROM LARGE EARTHQUAKES

As shown before, the S3EE record of the 1990 Upland earthquake has long-period late arriving energy similar to that on records from the larger 1971 San Fernando earthquake. This section explores the use of the S3EE record in constructing the motions that would be expected at the site for an earthquake larger than the 1990 Upland earthquake. The procedure for doing this is outlined in Figure 54. The basis of the procedure is to multiply the Fourier spectrum of the recording by the ratio of source spectra for the target earthquake and an earthquake with magnitude equal to the observed earthquake. The earthquake providing the observed motion I call the "basis" event. (The smaller event is often called a "Green function", but in the formal use of the term, this would imply that the source was an impulse and all of the complexity in the record was due to wave propagation. This may be true for frequencies lower than about one-half the corner frequency of the basis event, but for higher frequencies some of the complexity in the recorded motion will be due to source complexity. For this reason I avoid the use of the term "Green function"). I assume that the target event is larger than the basis event. The ratio of source spectra accounts for differences in the amplitude spectrum; differences in duration need also to be considered. I do this by constructing a sequence of Gaussian random numbers with duration equal to the difference in duration between the larger target event and the basis event. As described in Figure 54, this time series is used as a filter to extend the duration of the basis event. The program used to generate the scaled-up time series is *BIGEQ.FOR*. Two assumptions are made in this analysis: 1) the materials remain linear, even for strong shaking, and 2) all of the path effects are captured by the basis event (this might not be true for an extended rupture, for which energy for different parts of the rupture would not be traveling along the same path).

Any suitable source-scaling relation can be used in this procedure; I use two in this study: the single-corner-frequency Brune source and the regression-based source scaling of Atkinson and Silva (1997). I found that the equations for the source spectra in Atkinson and Silva (1997) did not fit their regression-based results in the same paper. For this reason I modified their equations to produce a better fit to their regression results.

Atkinson and Silva (1997) studied Fourier amplitude spectra from strong-motion recordings of California earthquakes. Using regression analysis, they determined parameters describing the attenuation of the motion with distance, a site factor for each site, and "source" spectra for each earthquake. The "source" spectra are actually the spectra at the ground surface, corrected for the site factors and the attenuation with distance to a reference distance of 1 km and averaged over all recordings for each earthquake. They then fit a quadratic equation in moment magnitude to the corrected spectra. The coefficients are determined frequency-by-frequency, and are given at the bottom of the Appendix in Atkinson and Silva (1997). I refer to these corrected spectra as the regression-based source spectra. These spectra imply a magnitude dependent diminution parameter κ and stress parameter $\Delta\sigma$. This is most clearly seen in Figures 55 and 56, in which the ratio of Fourier amplitude spectra for two magnitudes is plotted against frequency. For a single-corner-frequency Brune model, the ratio of two spectra at frequencies well above the corner frequency of each spectra is given by

$$\ln S_1/S_2 = \frac{1}{2}(\ln 10)(\mathbf{M}_1 - \mathbf{M}_2) + \frac{2}{3}\ln(\Delta\sigma_1/\Delta\sigma_2) - \pi(\kappa_1 - \kappa_2)f. \quad (1)$$

For equal diminution parameters κ, there should be no frequency dependence for the spectral ratio at high frequencies. Figures 55 and 56 show that there is a frequency dependence. Fitting a straight line to the high frequency part of the spectra gives the equation

$$\ln S_1/S_2 = c + sf \quad (2)$$

from which

$$(\kappa_1 - \kappa_2) = -s/\pi \quad (3)$$

and

$$\ln \Delta\sigma_1/\Delta\sigma_2 = 1.5[c - 0.5(\ln 10)(\mathbf{M}_1 - \mathbf{M}_2)]. \quad (4)$$

From Figure 55, where $\mathbf{M}_1 = 6.5$ and $\mathbf{M}_2 = 5.5$ this gives $\Delta\sigma_1/\Delta\sigma_2 = 0.69$ and $(\kappa_1 - \kappa_2) = 0.008$. From Figure 56, where $\mathbf{M}_1 = 7.5$ and $\mathbf{M}_2 = 5.5$ this gives $\Delta\sigma_1/\Delta\sigma_2 = 0.29$ and $(\kappa_1 - \kappa_2) = 0.01$. The nonconstant stress parameter will lead to a significant change in predicted ground motions relative to those predicted using a constant stress parameter, particularly at high frequencies.

The nonconstant stress parameter implied by the Atkinson and Silva (1997) results is clearly shown in Figure 57, in which ratios of Fourier spectra for a suite of single-corner-frequency models (with stress parameters of 25, 50, 100, and 200 bars) are compared to the regression-based source spectra. If the stress parameter were constant, the ratio should be 10 at high frequencies; the regression-based source spectra have a ratio between 3 and 4 at high frequency.

For predictions of ground motion using the stochastic model, it is useful to derive a functional form that gives the source spectra as a function of frequency, after removing both the amplification due to velocity changes along the propagation path and the diminution due to κ. Atkinson and Silva (1997) have done that, assuming the following function for the acceleration source spectrum:

$$A_0(f) = C(2\pi f)^2 M_0\{(1-\epsilon)/[1+(f/f_A)^2] + \epsilon/[1+(f/f_B)^2]\}. \tag{5}$$

The corner frequencies and ϵ determined by Atkinson and Silva (1997) are

$$\log f_A = 2.181 - 0.496\,\mathbf{M}, \tag{6}$$

$$\log f_B = 1.778 - 0.302\,\mathbf{M}, \tag{7}$$

and

$$\log \epsilon = 2.764 - 0.623\,\mathbf{M}. \tag{8}$$

I found that this formulation does not quite fit their regression-based source spectra and I have derived an improved version. One indication of the misfit is shown in Figure 57 (the dashed line is based on equation 5). I have altered their equation for ϵ somewhat to obtain a better fit. The new equation is

$$\log \epsilon = 3.440 - 0.746\,\mathbf{M}. \tag{8'}$$

The fit to ratios of Fourier amplitude for magnitudes of 6.5 to 5.5 and 7.5 to 5.5 are shown in Figures 58 and 59, respectively. I have used the altered equation for ϵ in scaling up the time series and in making predictions of response spectra.

The acceleration time series that results from scaling the observed motion at S3EE for the M = 5.6 earthquake to what would have been observed at the same site and the same distance for a **M** = 7.5 earthquake are shown in Figure 60. The velocity and displacement time series obtained from the acceleration trace are shown in Figures 61 and 62. In each figure the basis motion is given at the bottom and the scaled-up motions for the two source scalings are given in the upper two traces. Note the large long-period motions late in the scaled-up motions. This enhanced long-period motion relative to the high-frequency motion at the beginning of the traces is a consequence of source scaling: because of the shift in corner frequencies to lower frequency as the moment increases, the long-period motions have a stronger dependence on moment than do the high-frequency motions, leading to the observed difference in relative frequency content. The difference is less pronounced for the Atkinson and Silva scaling; this is a result of the "sag" in their spectra relative to the single-corner-frequency Brune spectra.

The relative differences in frequency content are easier to see in the response spectra of the motions. These are shown in Figure 63 for the Brune scaling and Figure 64 for the Atkinson and Silva scaling. If the scaled motion is shifted vertically to match the basis motion at short periods, it is clear that the scaled motion is much richer in long periods than the basis motions. (The response spectra shown in Figures 63 and 64 are the geometric means of the individual horizontal components; the individual spectra and the mean for the basis and the Brune scaling are shown in Figure 65, where it is clear that the individual horizontal components are similar to the mean horizontal component. This is not to say that rotating the two components into radial and transverse components would not reveal physically significant differences in the ground motions. I have chosen not to rotate the components for several reasons: the component azimuths were not available for all stations; lateral refraction over long travel paths can introduce P and SV motion onto the transverse component, and vice versa; and the regression results and stochastic model simulations are in terms of the random horizontal component, which is given by the geometric mean of the two horizontal components).

Figures 63 and 64 also contain comparisons with PSV computed in two ways: 1) from equations based on the regression analysis of many onshore strong-motion recordings, and 2) from simulations using the stochastic model (Boore, 1983, 1996) and the source scaling models used in the figures.

The parameters used in the stochastic-model simulations are given in Tables 8 and 9, which are copies of the input files used by SMSIM (Boore, 1996), the program used to compute the motions. The motions are intended to represent response spectra for an average soil site (which has $V_{30} = 310\,\mathrm{m/s}$). To generate PSV values on a generic soil site, I used different approaches for the Brune and the Atkinson and Silva (1997) scaling.

Brune scaling: I generated response spectra using Boore and Joyner's (1997) amplifications for a generic rock site (with $V_{30} = 620\,\mathrm{m/s}$) and *simbasg.dat* as an input file for SMSIM. I then applied rock → soil conversions within program *BIGEQ.FOR*. The conversions used the site factors of Boore *et al.* (1994), assuming constant values of the conversion for periods outside the 0.1 to 1.0 sec range (using the Boore *et al.* factors at 0.1 sec for $T < 0.1\,\mathrm{sec}$ and at 1.0 sec for $T > 1.0\,\mathrm{sec}$). Note that the assumption for $T > 1.0\mathrm{sec}$ may be conservative, for the conversion factor at $T = 1.0\mathrm{sec}$ is greater than unity (the actual conversion factor will approach unity for long periods). Note that the Boore *et al.* factors are for response spectra, not Fourier spectra as in Atkinson and Silva (1997).

Atkinson and Silva (1997) scaling: The response spectra were generated using soil amplification factors in the SMSIM calculations. The amplifications were derived in program *AS96_CD.FOR* by multiplying the rock amplifications of Boore (1986) by the rock → soil amplifications of Atkinson and Silva (1997). The resulting amplifications are given in *sim_as.dat* (Table 9). No additional modifications were made within program *BIGEQ.FOR*. (The reason for including the rock amplifications is that the Atkinson and Silva (1997) source model was derived by removing the rock amplifications of Boore (1986), so I had to reapply the amplifications; their soil amplifications are relative to rock motions at the Earth's surface.)

The comparisons in Figures 63 and 64 tell a number of things. Note first the relatively good agreement between the PSV from the SEMS unit on the ocean floor and the regression-based results for periods from about 0.2 to 2 sec. This suggests that the horizontal-component SEMS motions are not strongly influenced by the presence of the water layer. The next thing to note is the relatively good comparison between the simulated and regression-based motions, particularly for the Brune source model (Figure 63). The regression-based relations do not extend to periods as long as those that dominate the S3EE recording, and the good fit at shorter periods gives credibility to using the simulations as a means of extrapolating the regression-based results to longer periods. The good comparison between regression-based and simulated motions suggests that the long period simulations can be considered to be representative of the typical onshore soil site. Focusing on the long periods, observe the large discrepancy for $\mathbf{M} = 5.6$ between the observed motion and the predicted motions at long periods. It is this mismatch that carries over to the motions for the **M**7.5 earthquake and produces the large motions for that earthquake at long periods. The mismatch is a result of the presence of basin waves on the SEMS record for the smaller earthquake. This emphasizes the importance of basin waves in producing large ground motions at the periods of interest to platform design. Finally, comparing Figures 63 and 64 indicates that both the Brune and Atkinson and Silva (1997) source scalings predict motions in relatively good agreement with the regression-based results for the smaller earthquake for periods less than about 1.0 sec. For the larger earthquake, however, the Brune scaling is in much better agreement with the regression-based results than is the Atkinson and Silva (1997) scaling. This is worrisome, because the Atkinson and Silva (1997) results are based on analysis of Fourier spectra from a dataset similar to that used to obtain the regression-based PSV. I am not sure how to explain this discrepancy; more work is clearly needed.

CONSTRUCTION OF TIME SERIES FOR STUDIES OF THE SEISMIC RESPONSE OF OFFSHORE PLATFORMS

At the request of Charles Smith, I constructed three-component time series for a $\mathbf{M} = 7.5$ earthquake at 10 km epicentral distance and 10 km depth. The motions were computed for several fault orientations and for two sites: site A, a firm-soil onshore site, and site B, an offshore site.

Velocity Models

The velocity models were developed in conjunction with C. Smith; they are plotted in Figures 66 and 67 (same model, but different depths plotted). The figure also includes the SEMS model I used in the theoretical calculations discussed in a previous section. The water layer for the offshore models has not been shown. The SEMS model below 0.1 km has been used beneath both the site A and site B models.

Method

As no SEMS data were available to me for these short distances, I could not use the scaling approach discussed in the previous section. Instead, I used full wavefield calculations to obtain the impulse response for the layered earth model, and I convolved the time series with stochastic-model motions. Synthetic time series for a point source in a layered media were calculated using the frequency-wavenumber integration method, as contained in Robert Herrmann's program HSPEC91. These time series are for a simple source with a source time function given by a slightly smoothed step change in slip on the fault. The time series were convolved with the motions obtained using the stochastic model (Boore, 1996) for a magnitude 7.5 earthquake in a whole space. In other words, the stochastic model accounted for the source complexity and the frequency-wavenumber model accounted for the wave propagation. The procedure is illustrated in Figures 68, 69, and 70 for the tranverse, radial, and vertical components of motion at site A, respectively. The top trace in the figures is the same in each case and is the result of the whole-space stochastic model, the middle trace in each figure is the impulse response for the layered earth model, and the bottom trace in each figure is the desired ground motion, obtained by convolving the upper two traces (after accounting for some scaling factors). The details of the convolution are given in computer program *MakeTS.FOR*. The time series are computed at 40 samples per sec (0.025 sec sampling interval), but because of the long HSPEC91 run times required for high-frequency simulations, a cutoff was used such that motions above about 5 Hz have been artificially reduced in amplitude; the motions should be unaffected for lower frequencies.

Note that most of the duration and complexity of the synthesized records is due to the source and not to the layered structure. This would not be true for greater epicentral distances. Also note that the basin waves discussed earlier will not be included in the simulations at the close distance in this exercise (10 km epicentral distance).

Results

Figures 71 through 74 show three-component time series for both sites and for two fault orientations. The faults are a vertical strikeslip and a 45-degree reverse fault. For the vertical fault, the motions were rotated into transverse (T), radial (R), and vertical (Z); for the inclined fault the orientations are north (N), east (E), and vertical (Z). Site A (onshore) motions are shown in Figures 71 and 72; site B (offshore) motions are shown in Figures 73 and 74. In all cases ground accelerations in units of cm/s are shown. Note that the fault mechanisms leads to substantial differences in amplitudes of motion, particularly for the transverse and vertical components; this is a direct result of radiation pattern. Note also that the ratio of vertical to horizontal motion is smaller for the offshore model (site B) than it is for the onshore model, in keeping with regression-based results discussed earlier in this report, in the data analysis section.

CONCLUSIONS AND DISCUSSION

The Seafloor Earthquake Measuring System (SEMS) is a multiphase instrumentation effort that has been in existence for almost two decades. The SEMS stations are excellent instruments and have produced high-quality data for a number of events. Unfortunately, onshore strong-motion instruments have not generally been of the same high-caliber as the SEMS units, and therefore few data are available from which direct comparisons can be made of onshore and offshore motions from the same earthquake recorded at similar distances and for similar site conditions. For this reason, the analysis of the SEMS data have had to use a combination of somewhat indirect observational studies and theoretical calculations to answer the fundamental question: Are the earthquake ground motions at the seafloor so different from onshore motions that the more numerous onshore recordings cannot be used for platform design?

The answer to the fundamental question is "It depends." It depends on the component of motion and the frequency of ground shaking. The ratio of vertical-to-horizontal motions (V/H) is clearly much smaller than for onshore recordings at relatively high frequencies (above about 3 Hz). Studies of the vertical and horizontal motions separately suggest that the anomaly lies with the vertical motions. For lower frequencies the results of this study suggest that both components of the seafloor motions are similar to those from onshore recordings at sites underlain by geologic materials similar to those beneath the seafloor sites.

Theoretical studies show that the reduction of vertical motions can be produced by interactions of S-waves in the solid materials below the seafloor and P-waves in the water layer. This interaction is most important at the resonant frequencies of vertically propagating acoustic waves in the water layer. A reduced vertical component can also be produced by refraction of an incoming wave toward the vertical, such as will occur for shear-wave velocities that decrease towards the Earth's surface. V/H computed from a few onshore sites with shear-wave velocity versus depth similar to that estimated to be beneath the SEMS offshore stations are much different at high frequencies than the ratios from the SEMS stations, suggesting that simple upward-refraction plays a small role in the difference between onshore and offshore motions at the higher frequencies.

The water layer indirectly influences motions by allowing low-velocity sediments to exist over a widespread area, and by increasing the pore pressure in the sediments, which will reduce the velocity in sands and silts.

It is easy to get caught up in the complexities at high frequencies, which reflect the water layer as well as very local shear-wave velocities. Although some parts of the platform system are sensitive to high-frequency, vertical-component waves (e.g., Smith, 1994; Brady, 1993), the motions are mudline motions and are far from the horizontal resonance frequencies of the platform. More important for design and analysis of platforms may be periods of motion longer than one second.

Particularly useful recordings for the study of long-period motions were made at a SEMS site offshore of Long Beach. Comparisons of response spectra obtained from the SEMS instruments with onshore regression-based spectra and theoretical calculations, as well as time-domain comparisons with onshore waves that have traveled through the Los Angeles basin, suggest that the seafloor motions at the SEMS site are significantly influenced by late arriving, large amplitude surface waves ("basin waves") at long periods. These waves may be more important for platform analysis and design than the higher frequency waves which are influenced by the water layer. In this sense, the travel path may be more important than the local site conditions.

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Table 1. Station information (see Table 2 for notes)

Code	Lat	Long	WaterDepth(m)	Nearest Platform
S1HN	34.3367	-119.5600	50	Henry
S1VC	34.4033	-119.7150	onshore	located at Vic Trace Reservoir
SC38	33.8233	-118.3567	onshore	
SC51	34.0233	-118.7867	onshore	
S2EE	33.5867	-118.1233	73	Elly/Ellen
S3EE	33.5700	-118.1300	64	Elly/Ellen
S3IR	34.6117	-120.7317	76	Irene
S4EU	33.5617	-118.1167	217	Eureka
S4GR	34.1800	-119.4700	99	Grace
S4IR	34.6117	-120.7300	76	Irene
CM	33.6400	-117.9300	onshore	located in Costa Mesa
PV	33.8017	-118.3867	onshore	located in Palos Verdes

Table 2. Notes concerning instrument and recording characteristics, SEMS project

A. S1HN - near platform Henry
   1. SEMS I
   2. closest platform: Henry
   3. 34.3367, -119.5600, -165 ft (-50.3m)
   4. sensor, FBA: embedded, nominal 5 ft (Sleefe, phone conv, 12/18/92)
   5. 100 samples per sec, 16 bit
   6. on board filtering: processing: bandpassed filtered 0.05 -- 20 Hz (3 db points).
   7. recorded Santa Barbara Island, 1981 quake
   8. data rotated into N and E
   9. references: Sleefe, OTC 6336 paper (Table 1 has system specs), letter of 5/4/92, hanging file folders
   10. SMC files:
      a) SB81: 247p51s1.hnn, *.hne, *.hnv

B. S1VC
   1. concurrent with SEMS I, onshore at Vic Trace reservoir, on Lavigia Hill.
   2. closest platform: Henry
   3. 34.4033, -119.7150, +459 ft (139.9 m)
   4. sensor: FBA (?); transducer buried, connected to SEMS unit (judging from photos in the folder)
   5. 100 sps, 16 bit
   6. on board filtering: bandpassed filtered 0.05 -- 20 Hz (3 db points).
   7. recorded Santa Barbara Island, 1981 quake
   8. data rotated into N and E
   9. references: Sleefe, OTC 6336 paper (Table 1 has system specs), letter of 5/4/92, hanging file folders
   10. SMC files:
      a) SB81: 247p51s1.vcn, *.vce, *.vcv
   11. site geology: Qm-Pu (early Pleistocene--late Pliocene marine sediments and terrace marine deposits), from plotting location on 1:250,000 Los Angeles geologic map. The site is most likely class B, with velocities near 400 m/s.

C. SC38
   1. Univ. of Southern California strong motion station
   2.
   3. 33.8233, -118.3567
   4. instrument: SMA1 analog accelerograph
   5. 50 sps
   6.
   7. recorded SBI81
   8.
   9. references: Anderson et al. (1981)
   10. SMC files:
      a) SBI81: 247p51sc.38x, *.38y, *.38v
   11. site geology: dune sand (Anderson et al., 1981, p. 34). From USGS boreholes with "dune sand" in th description I compute V30 = 316 m/s for an average "dune sand" site.

D. SC51
   1. University of California strong motion station
   2.
   3. 34.0233, -118.7867
   4. instrument: SMA1 analog accelerograph
   5. 50 sps
   6.
   7. recorded SBI81

8.
9. references: Anderson et al. (1981)
10. SMC files:
    a) SBI81: 247p51s1.51x, *.51y, *.51v
11. site geology: Pleistocene marine and marine terrace deposits (Anderson et al., 1981, p. 36). This probably has V30 near 400 m/s.

E. S2EE - near platforms Elly and Ellen
1. SEMS II
2. closest platform: Elly/Ellen (2 platforms close together) (A recording of 1986 events was also obtained at the mudline at Shell's platform Eureka... see hanging file folder)
3. 33.5867, -118.1233 (from notes and hanging file folder, based on Loran C), -240 ft (73.2 m)
4. sensor, FBA: embedded, nominal 5 ft (Sleefe, phone conv, 12/18/92)
5. 100 sps, 16 bit
6. on board filtering: 0.05 to 20 Hz (3 db down); in addition: as provided the data had a low freq cutoff, 1 Hz (3db down), 6 db per octave (inadvertent). I have removed this filter.
7. recorded 1986 N. Palm Springs and Oceanside events. x-component has electronic noise, but the noise can be removed by filtering.
8. x: 144 degrees; y: 234 degrees (scaled from a figure G. Sleefe included in his letter of May 4, 1992, but I found notes from G. Sleefe in a hanging file that has penciled in directions at 180 degrees, so I should probebly state that the orientation is uncertain).
9. references: Sleefe's OTC paper and 5/4/92 letter. Also Sandia report 2604 ("Design of the Shell Porject Seafloor Earthquake Measurement System (SEMS)") and hanging file folders.
10. SMC files: Npalm- 189j20lb.iix,y,z; Ocnsid- 194n47lb.iix,y,z
    a) NP86: 189j20s2.lbx, *.lby, *.lbz
    b) NP86 (1 Hz lc fltr rmvd): nps86x.cor, nps86y.cor, nps86z.cor
    c) OS86: 194n47s2.lbx, *.lby, *.lbz
    d) OS86 (1 Hz lc fltr rmvd): ocn86x.cor, ocn86y.cor, ocn86z.cor

F. S3EE - near platforms Elly and Ellen
1. SEMS III
2. closest platform: Elly/Ellen
3. 33.5700, -118.1300, -210 ft (64.0 m)
4. sensor, FBA: embedded, not sure of embedment depth (probably nominal 5 ft, as for the others)
5. 100 sps, 16 bit
6. on board filtering: 0.05 -- 20 Hz (3 db points)
7. recorded 1990 Upland earthquake
8. magnetometer data not processed to determine orientation of x and y components
9. references: Sleefe's 5/4/92 letter and hanging file folders.
10. SMC files:
    a) 059x43s3.lbx, *.lby, *.lbz

G. S3IR - near platform Irene (off of Pt. Pedernales)
1. SEMS III (sensor output cabled to platform)
2. closest platform: Irene
3. 34.6117, -120.7310, -249 ft (J. Ehasz, handwritten note dated 2/15/96) (75.9 m)
4. sensor, FBA: 8 ft. in hole, about 500 ft from platform. The hole did not fill in, and there were problems with orientation changing, extraneous noise. The assumption is that the cable was dragging.
5. probably same sensor constants as S3LB
6.
7. I do not think this recorded any quakes (but I am not sure).

8.
9. references: my notes, made in conversation with G. Sleefe before Spring 93
10. SMC files:

H. S4EU - near platform Eureka
1. SEMS IV (sensor output cabled to platform, uses Quanterra datalogger)
2. closest platform: Eureka
3. 33.5625(or .5617), -118.1175 (or .1167), -713 ft (from J. Ehasz's handwritten notes dated 2/15/96) (217.3 m)
4. sensor, FBA: embedded, I do not know the details.
5. 20 sps, 24 bit
6. FBA, low freq roll off nominally seems to start about 0.4 Hz (a phone call with James Matthews at Endevco indicates that it could be down 3 db by 0.1 Hz relative to 100 Hz), but flat from 0.4 to 1500 Hz
7. recorded
8. component orientations:
9. references: Notes from J. Ehasz
10. SMC files:

I. S4GR - near platform Grace
1. SEMS IV (sensor output cabled to platform, uses Quanterra datalogger)
2. closest platform: Grace
3. 34.1794, -119.4696, -324 ft (from handwritten note from J. Ehasz, dated 2/15/96) (98.8 m)
4. sensor, FBA: embedded, I do not know the details.
5. 20 sps, 24 bit
6. FBA, low freq roll off nominally seems to start about 0.4 Hz (a phone call with James Matthews at Endevco indicates that it could be down 3 db by 0.1 Hz relative to 100 Hz), but flat from 0.4 to 1500 Hz
7. recorded 1997 Calico and Simi Valley quakes (A&B)
8. x: 206.6 degrees; y: 296.6 degrees (from J. Ehasz notes received in late April or early May, 1997:
   a) BHE: az = 296.6 (call it "y")
   b) BHN: az = 206.6 (call it "x")
   c) BHZ: tilt = 6.6 degrees
9. references: Notes from J. Ehasz
10. SMC files:
   a) CL97: 077p24gr.acx, *.acy, *.acz
   b) S97A: 116k37gr.acx, *.acy, *.acz
   c) S97B: 117l09gr.acx, *.acy, *.acz

J. S4IR - near platform Irene
1. SEMS IV (sensor output cabled to platform, uses Quanterra datalogger)
2. closest platform: Irene
3. 34.6117, -120.7310, -249 ft (J. Ehasz, handwritten note dated 2/15/96) (75.9 m)
4. sensor, FBA: embedded, I do not know the details.
5. 20 sps, 24 bit
6. FBA, low freq roll off nominally seems to start about 0.4 Hz (a phone call with James Matthews at Endevco indicates that it could be down 3 db by 0.1 Hz relative to 100 Hz), but flat from 0.4 to 1500 Hz
7. recorded 1995 Ridgecrest quake of 9/20/95 and Simi Valley 97A
8. x: 7.3 degrees; y: 97.3 degrees (from J. Ehasz notes... note that *.BHN was oriented 97.3, *.BHE was oriented 7.3.. I originally named the SMC files with N and E as the last letter of the extension, but this could be confusing since what was N was really E, etc. For this rerason I renamed the files with X and Y as the last letters of the

```
   extension.)
9. references: Notes from J. Ehasz
10. SMC files:
   a) RC95: 263x27ir.enx, *.eny, *.enz
   b) S97A: 116k37ir.enx, *.eny, *.enz
```

Table 3. Earthquake information (see Table 4 for notes and references)

EqID	EqName	yy/mm/dd	hh:mm	EpcntrLat	EpcntrLong	M
SB81	Santa Barbara Island	81/09/04	15:50	33.66	-119.10	5.95
NP86	North Palm Springs	86/07/08	09:20	34.00	-116.61	6.10
OS86	Oceanside	86/07/13	13:47	32.97	-117.87	5.84
UP90	Upland	90/02/28	23:43	34.14	-117.70	5.63
RC95	Ridgecrest	95/09/20	23:27	35.76	-117.64	5.56
CL97	Calico	97/03/18	15:24	34.97	-116.82	4.85
S97A	Simi Valley	97/04/26	10:37	34.37	-118.67	4.81
S97B	Simi Valley	97/04/27	11:09	34.38	-118.64	4.72
SF71	San Fernando	71/02/09	14:01	34.40	-118.39	6.6

Table 4. Notes on Earthquake Parameters

****

•. Rake angle definitions (using Aki and Richards, p. 106, convention):

```
ra > 0.0 :  reverse slip
ra < 0.0 : normal slip
ra 0 to 90 and 0 to -90: left lateral slip
ra 90 to 180 and -90 to -180: right lateral slip
```

For our purposes, anything within 30 degrees of 0 or 180 degrees is strike slip. This can be written as:

```
if (abs(ra) .ge. 150.0 .or. abs(ra) .le. 30.0) then
   strikeslip = .true.
endif
```

•. 1971/02/09 San Fernando:
1. rake: oblique thrust. A number of different studies have been done, with point and extended ruptures. Here is a brief, incomplete review: Whitcomb (ra=64; Whitcomb, J. H. (1971). Fault-plane solutions of the February 9, 1971, San Fernando earthquake and some aftershocks, \usgspp {\it 733}, 30--32.); Langston (ra=76, lower segment and ra=90 on upper segment; Langston, C. A. (1978). The February 9, 1971 San Fernando earthquake: A study of source finiteness in teleseismic body waves, \bssa {\bf 68}, 1--29.); Heaton (same ra as Langston; Heaton, T. H. (1982). The 1971 San Fernando earthquake: A double event?, \bssa {\bf 72}, 2037--2062.). I will assign ra=76.

•. 1981/09/04 Santa Barbara Island:
1. references:
   a) Bent & Helmberger (BSSA 81, 399)
   b) Corbett & Piper (EOS 1981, 62)
   c) Ekstrom & Dzienwonski (BSSA 75, 23-39)
   d) Anderson (BSSA 74, 995)
2. epicenter: 33.663, -119.100
3. mechanism:
   a) Bent and Helmberger give 180 degrees.   This is consistent with the focal mechanism in Anderson, taken from Corbett and Piper Ekstrom & Dzienwonski.
   b) s,d,r: 311, 90, 180; 41, 90, 0 (Harvard CMT)
4. moment:
   a) Anderson (BSSA 74, 995): M0=1.5e24 from spectra of S waves recorded on strong-motion stations. The value is M0=2.3e24 if a shear velocity of 3.2 km/s is used.
   b) Bent and Helmberger (BSSA 81, 399): M0=1.2e25 from long-period regional data (M=6.02)
   c) Ekstrom & Dziewonski (BSSA 75, 23-39): M0 = 7.17e24 (constrained, the preferred solution. Unconstrained is 7.49e24, almost the same). (M=5.87)
   d) note the large discrepancy between the estimates (and, as usual, the strong-motion records give a lower moment). Taking mean of E&D and B&H gives M=5.95 (June 11, 1996).

•. 1986/07/08 North Palm Springs:
1. references:
   a) Savage, J.C. etal (19xx, manuscript). Deformation from 1973 through 1991 in the epicentral area of the 1992 Landers, California, earthquake (M_s = 7.5), manuscript.

```
    b) Jones etal (1986, BSSA 76, 1830)
    c) Mori & Frankel (1990, BSSA 80, 278)
    d) Nicholson (1992, USGS Final Report)
    e) Nicholson & Lees (1992, GRL 19, 1)
    f) Pacheco & Nabelek (1988, BSSA 78, 1907)
    g) Hartzell (1989, JGR 94, 7515)
    h) Mendoza & Hartzell (1988, BSSA 78, 1092)
    i) Seismological Notes (1987, BSSA 77, 1085)
    j) Harvard: http://www.seismology.harvard.edu/CMTsearch.html
 2. epicenter: 34.000, -116.608
 3. mechanism:
    a) SA: 316; DA: 44; RA: 159 (USGS CMT, from Seismol. Notes).
    b) s,d,r: 294, 37, 156 (Harvard CMT)
    c) others: started off as strike slip, updip motion increased
       later.  I will provisionally give it 150 degrees for rake.
 4. moment:
    a) 2.3e25 (USGS CMT, Seismological Notes).
    b) 1.34e25 (Harvard CMT, from WEB site on 8/15/97)
    c) 1.7e25 (teleseismic P waves, Mendoza & Hartzell).
    d) 1.8e25 (strong motion, Hartzell)
    e) 1.6e25 (strong motion, empirical Greens functions, Hartzell)
    f) 0.97e25 (P and SH teleseismic, Pacheco & Nabelek)
    g) 0.69e25 (geodetic, Savage etal)
    h) geom. avg. MO = 1.56e25 (M=6.10) (excluding Savage et al:
       not as well constrained)
 5. boundary:
    I was guided by the aftershock pattern, using the plots in
    Pacheco & Nabelek.  This is generally consistent with
    Hartzell slip distribution (Fig. 13, JGR 1989, 7515).

*. 1986/07/13 Oceanside earthquake:
 1. references:
    a) Pacheco & Nabelek (1988, BSSA 78, 1907)
    b) Harvard: http://www.seismology.harvard.edu/CMTsearch.html
 2. epicenter: 32.968, -117.872
 3. mechanism:
    a) Pacheco & Nabelek:
    b) Harvard CMT: s,d,r=126,37,106; s,d,r=287,55,78
 4. moment:
    a) Pacheco & Nabelek: MO = 6.5 e24
    b) Harvard CMT:       MO = 6.54e24
    c) geom. avg. MO = 6.52e24 (M=5.84)
 5. 25 June 1992: Obtained hypocentral information from
    USGS-Caltech (SPIGOT), and plotted it with potential strong
    motion sites (using pub1:[boore.maps]ocnsid86.qmap).  The
    event is offshore, with a C location, and apparently none of
    the SMA1 data have been digitized.  Because of this, the
    event should be deleted from EQS_IN.

*. 1990/02/28 Upland:
 1. references:
    a) Dreger & Helmberger, BSSA 81, 1129--1144.
    b) Harvard: http://www.seismology.harvard.edu/CMTsearch.html
 2. epicenter: 34.138, -117.703
 3. mechanism:
    a) s,d,r: 216, 77, 5.0 degrees (Dreger and Helmberger, BSSA 81,
       1129-1144).
    b) s,d,r: 307, 73, 169; 40, 80, 17 (Harvard CMT)
 4. moment:
    a) Dreger & Helmberger: MO = 2.5e24 (M=5.57)
    b) Harvard CMT:         MO = 3.97e24 (5.70)
    c) geom. avg. MO = 3.15e24 (M=5.63)
 5. rupture surface- I might base it on the aftershocks shown in
    Fig. 2 of Dreger and Helmberger.  Probably better is
    Hauksson and Jones (JGR 96, 8143-8165).
```

```
▪. 1995/09/20: Ridgecrest
   1. references:
      a) Berkeley: www.seismo.berkeley.edu/~mike/solutions.new
      b) Harvard: http://www.seismology.harvard.edu/CMTsearch.html
   2. epicenter: 35.760, -117.638
   3. mechanism:
      a) s,d,r: 247, 77, 23; 152, 68, 166 (Berkeley)
      b) s,d,r: 243, 81, -5; 334, 85, -171 (Harvard CMT)
   4. moment:
      a) MO = 2.30e24 (M=5.54) (Berkeley)
      b) MO = 2.56e24 (M=5.57) (Harvard CMT)
      c) geom. avg. MO = 2.427e24 (M=5.56)
▪. 1997/03/18: Calico (also known as Barstow)
   1. references:
      a) Berkeley: www.seismo.berkeley.edu/~mike/solutions.new
      b) USGS-PAS: http://www-socal.wr.usgs.gov/pga/...
   2. epicenter: 34.969, -116.823 (USGS-PAS)
   3. moment:
      a) MO = 2.10e23 (M=4.85) (Berkeley)
   4. mechanism:
      a) s,d,r: 242, 88, -2; 332, 88, -178 (Berkeley)

▪. 1997/04/26: Simi Valley A
   1. references:
      a) Berkeley: www.seismo.berkeley.edu/~mike/solutions.new
      b) USGS-PAS: http://www-socal.wr.usgs.gov/pga/...
   2. epicenter: 34.370, -118.669 (USGS-PAS)
   3. mechanism:
      a) s,d,r: 97, 58, 61; 323, 42, 128
   4. moment:
      a) MO = 1.84e23 (M=4.81) (Berkeley)

▪. 1997/04/27: Simi Valley B
   1. references:
      a) Berkeley: www.seismo.berkeley.edu/~mike/solutions.new
      b) USGS-PAS: http://www-socal.wr.usgs.gov/pga/...
   2. epicenter: 34.382, -118.643 (USGS-PAS)
   3. mechanism:
      a) s,d,r: 74, 74, 66; 312, 29, 145
   4. moment:
      a) MO = 1.37e23 (M=4.72) (Berkeley)
```

Table 5. Epicentral distances, in km, between earthquakes used in this report and stations recording the earthquakes. SF71 is the San Fernando earthquake; while not recorded on a SEMS unit, the onshore records are used in a comparison with offshore records from other earthquakes.

sta	SB81	NP86	OS86	UP90	RC95	CL97	S97A	S97B	SF71
S1HN	86.0								
S1VC	99.9								
SC38	71.1								
SC51	49.4								
S2EE		147.5	72.5						
S3EE				74.4					
S3IR									
S4EU									
S4GR						258.1	76.7	79.3	
S4IR					309.1		191.2		
CM									94.6
PV									66.4

Table 6. Lowcut filter frequencies used in making the plots of velocity and displacement time series.

EqCode	StaCode	LC freq
SB81	S1HN	0.2
SB81	S1VC	0.2
SB81	SC38	0.2
SB81	SC51	0.2
NP86	S2EE	0.5
OS86	S2EE	0.5
UP90	S3EE	0.1
RC95	S4IR	0.2
CL97	S4GR	0.1
S97A	S4GR	0.1
S97A	S4IR	0.1
S97B	S4GR	0.1

Table 7. Velocity model used in theoretical wave calculations at offshore sites (the first line is the water layer; the depth measurement in the second column starts at the seafloor).

Thickness	Depth(km)	VP(km/s)^1	VS(km/s)^2	RHO(gm/cc)^3	1/QP^4	1/QS^5
0.060		1.50	0.0	1.0	0.0	0.0
0.012	0.0	1.55	0.18	1.5	0.006	0.063
0.028	0.012	1.65	0.25	2.0	0.006	0.063
0.03	0.04	1.75	0.3	2.0	0.006	0.063
0.03	0.07	1.8	0.32	2.0	0.006	0.063
0.04	0.1	2.7	1.0	2.0	0.004	0.01
0.04	0.14	3.67	1.56	2.2	0.002	0.005
0.04	0.18	3.92	1.78	2.4	0.0013	0.003
0.14	0.22	4.4	2.17	2.5	0.0009	0.002
0.17	0.36	4.86	2.6	2.6	0.0009	0.002
0.85	0.53	4.98	2.75	2.6	0.0009	0.002
0.72	1.38	5.0	2.89	2.6	0.0009	0.002
3.5	2.1	5.3	3.06	2.7	0.0009	0.002
2.5	5.6	6.02	3.48	2.7	0.0009	0.002
8	8.1	6.33	3.65	2.8	0.0009	0.002
4	16.1	6.38	3.68	2.9	0.0004	0.001
4	20.1	6.47	3.74	2.9	0.0004	0.001
5	24.1	7.8	4.5	3.1	0.0004	0.001

1: Guided by Table A-1b in Hamilton (1976b) for silty clay, clayey silt, by Fumal (1978) plot of Poisson's ratio vs. shear wave velocity, and by Hauksson and Jones (1988) for deeper values.
2: Guided by shear wave velocities determined from standard penetration values at several sites (see text).
3: Guided by Table A-1b in Hamilton (1976b), Fig. 16 in Fumal (1978), Porcella (1984), and Swanger (1981).
4: Guided by empirical values and equation 13 in Hamilton (1976c).
5: From Liu et al. (1994) for shallow values; deeper values guided by values in Helmberger and McNally (1980) and equation 13 in Hamilton (1976c).

Table 8. Input parameters for simulations using single corner frequency source model with stress parameter = 70 bars and Atkinson and Silva (1997) geometrical spreading and Q. The structure of the input parameter file is that used by Boore (1996).

```
Coastal California model, with Atkinson & Silva geometrical spreading
rho, beta, prtitn, radpat, fs:
    2.8 3.5 0.707 0.55 2.0
spectral shape: source number (1=Single Corner;2=Joyner;3=A93;4=custom),
                pf, pd (1-corner spectrum = 1/(1+(f/fc)**pf)**pd; 0.0 otherwise)
                (usual model: pf=2.0,pd=1.0; Butterworth: pf=4.0,pd=0.5)
                (Note: power of high freq decay --> pf*pd)
    1 2.0 1.0
spectral scaling: stressc, dlsdm, fbdfa, amagc
                (stress=stressc*10.0**(dlsdm*(amag-amagc))
                (fbdfa, amagc for Joyner model, usually 4.0, 7.0)
                (not used for source 3, but placeholders still needed)
    70.0 0.0 4.0 7.0
gsprd: nsegs, (rlow(i), slope(i))  (Set rlow(1) = 1.0)
    3
      1.0 -1.0
      50.0 0.0
      170.0 -0.5
q: fr1, Qr1, s1, ft1, ft2, fr2, qr2, s2
    1.0 204.0 0.56 1.0 1.0 1.0 204.0 0.56
source duration: weights of 1/fa, 1/fb
    1.0 0.0
path duration: nknots, (rdur(i), dur(i), slope of last segment)
    1
      0.0 0.0
    0.05
site amplification: namps, (famp(i), amp(i))
    11
    0.01          1.00
    0.09          1.10
    0.16          1.18
    0.51          1.42
    0.84          1.58
    1.25          1.74
    2.26          2.06
    3.17          2.25
    6.05          2.58
    16.6          3.13
    61.2          4.00
site diminution parameters: fm, akappa
    100.0 0.035
low-cut filter parameters: fcut, norder
    0.0 2
rv integration params: zup, eps_int (integration accuracy), amp_cutoff (for fup)
    10.0 0.00001  0.001
window params: indxwind(0=box,1=exp), taper(<1), twdtmotion, eps_wind, eta_wind
    1 0.05 1.0 0.2 0.05
timing stuff: tsimdur, dt, tshift, seed, nruns
    40.0  0.005 7.0 123.0 100
remove dc from random series before transforming to freq. domain (0=no;1=yes)?
    0
```

Table 9. Input parameters for simulations using modified Atkinson and Silva (1997) scaling. The structure of the input parameter file is that used by Boore (1996).

```
Atkinson and Silva 96 model for soil sites
rho, beta, prtitn, radpat, fs:
    2.7 3.2 0.707 0.55 2.0
spectral shape: source number (1=Single Corner;2=Joyner;3=A93;4=custom),
                pf, pd (1-corner spectrum = 1/(1+(f/fc)**pf)**pd; 0.0 otherwise)
                (usual model: pf=2.0,pd=1.0; Butterworth: pf=4.0,pd=0.5)
                (Note: power of high freq decay --> pf*pd)
    4 2.0 1.0
spectral scaling: stressc, dlsdm, fbdfa, amagc
                (stress=stressc*10.0**(dlsdm*(amag-amagc))
                (fbdfa, amagc for Joyner model, usually 4.0, 7.0)
                (not used for source 3, but placeholders still needed)
    70.0 0.0 4.0 7.0
gsprd: nsegs, (rlow(i), slope(i))  (Set rlow(1) = 1.0)
    3
      1.0 -1.0
      50.0 0.0
      170.0 -0.5
q: fr1, Qr1, s1, ft1, ft2, fr2, qr2, s2
    1.0 204.0 0.56 1.0 1.0 1.0 204.0 0.56
source duration: weights of 1/fa, 1/fb
    1.0 0.0
path duration: nknots, (rdur(i), dur(i), slope of last segment)
    1
      0.0 0.0
    0.05
site amplification: namps, (famp(i), amp(i))
    15
    0.01 1.00
    0.10 1.408
    0.20 1.473
    0.28 1.690
    0.40 1.710
    0.56 1.775
    0.79 1.784
    1.10 1.959
    1.60 2.272
    2.20 2.392
    3.20 2.578
    4.50 2.438
    6.30 2.173
    8.90 2.029
   12.60 1.849
site diminution parameters: fm, akappa
    100.0 0.035
low-cut filter parameters: fcut, norder
    0.0 2
rv integration params: zup, eps_int (integration accuracy), amp_cutoff (for fup)
    10.0 0.00001  0.001
window params: indxwind(0=box,1=exp), taper(<1), twdtmotion, eps_wind, eta_wind
    1 0.05 1.0 0.2 0.05
timing stuff: tsimdur, dt, tshift, seed, nruns
    40.0  0.005 7.0 123.0 100
remove dc from random series before transforming to freq. domain (0=no;1=yes)?
    0
```

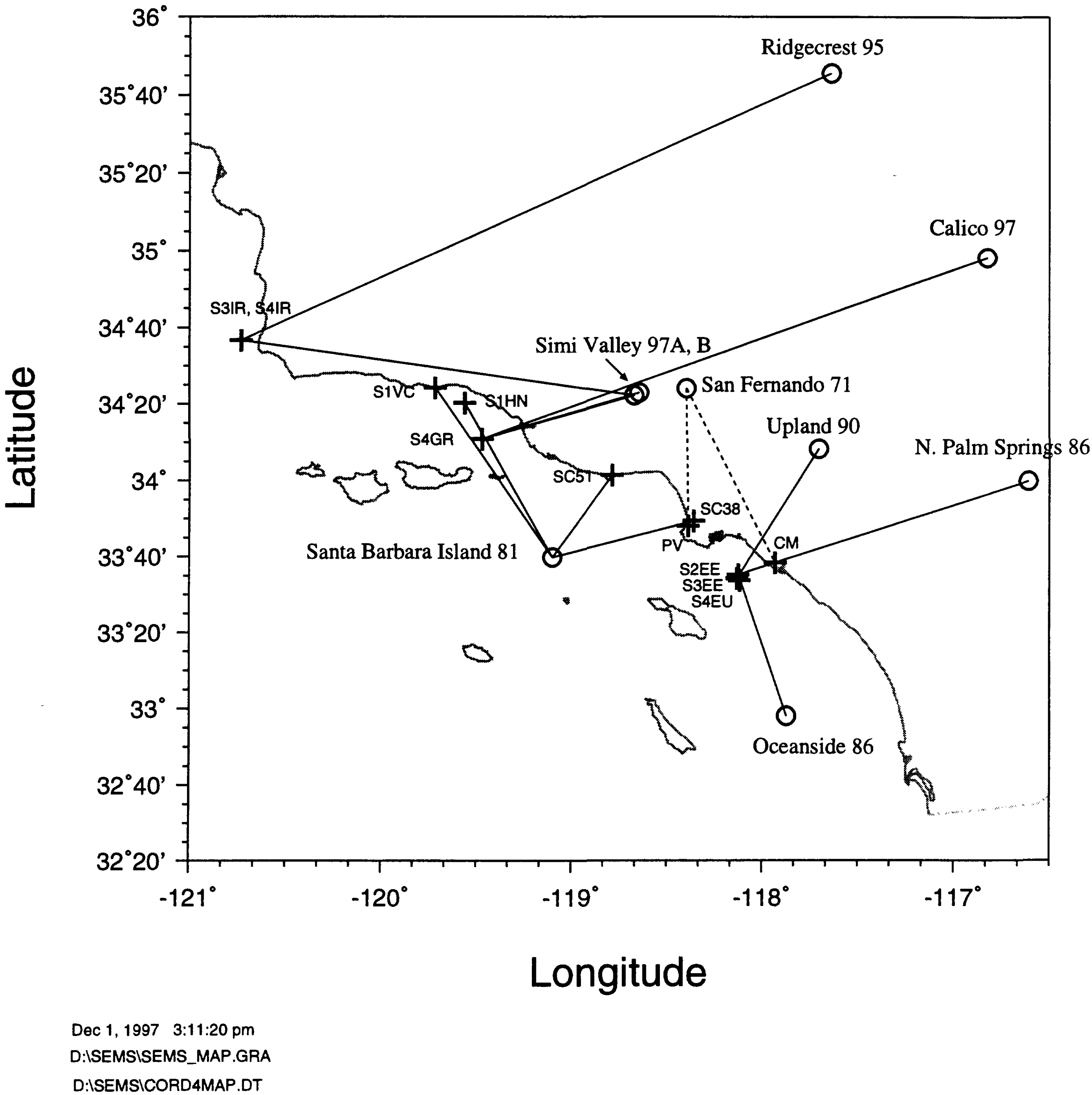
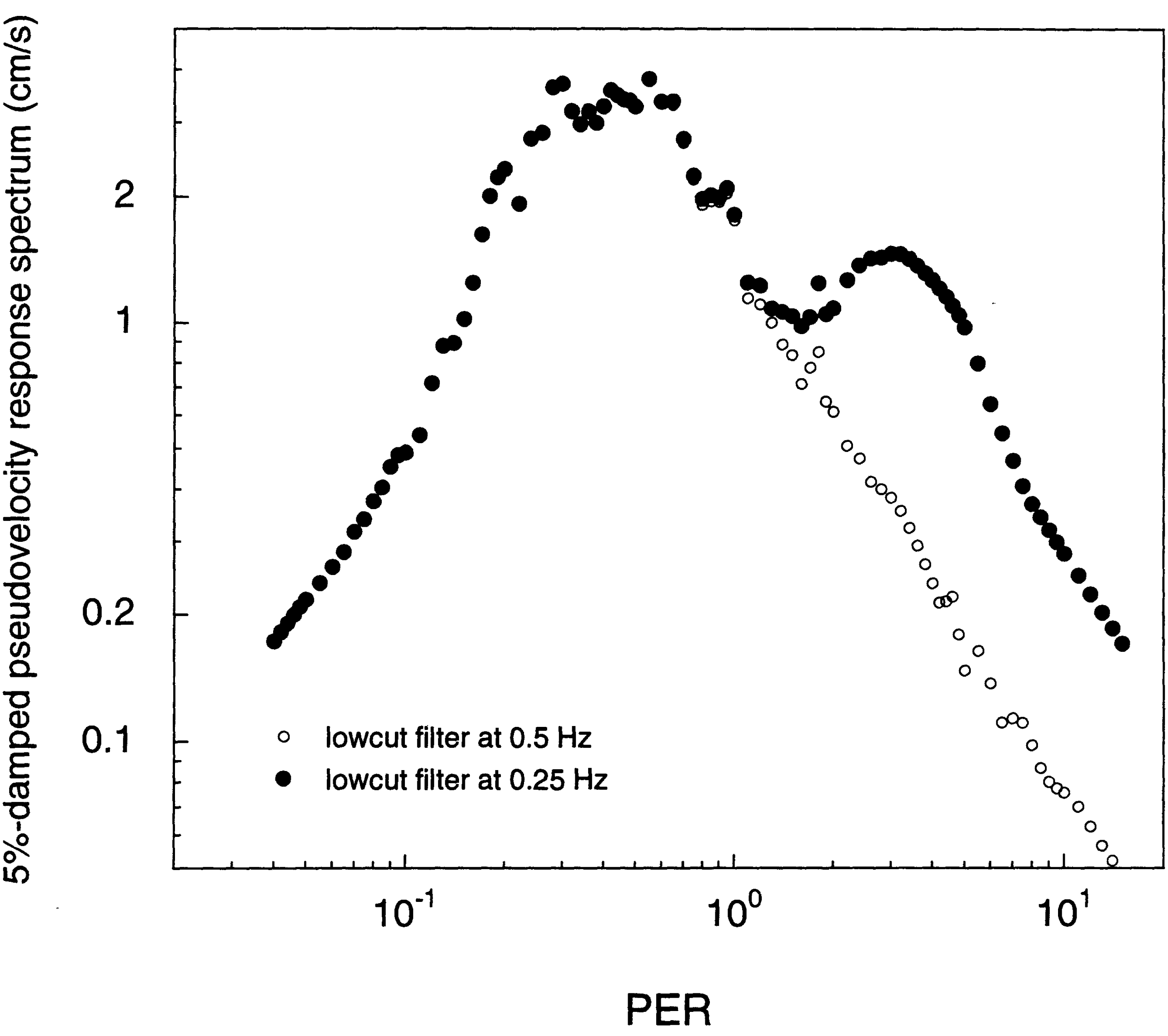


Figure 1. Map of southern California. Lines connect events (open circles) and stations (pluses) providing data for the corresponding event. The dashed lines show paths for two recordings of the 1971 San Fernando earthquake; these paths cross the Los Angeles basin, as does the path from the Upland 1990 earthquake to SEMS site S3EE. Waveforms of these two events are compared in this report. Although providing no data, station S4EU is shown for completeness.



Oct 31, 1997 2:58:36 pm
D:\SEMS\NPALM86\LCP5P25X.GRA
D:\SEMS\NPALM86\LC_P5P25.DT

Figure 2. 5%-damped response spectra for a horizontal component of the 1986 North Palm Springs earthquake recorded at SEMS site S2EE, showing the effect of the low-frequency cutoff.

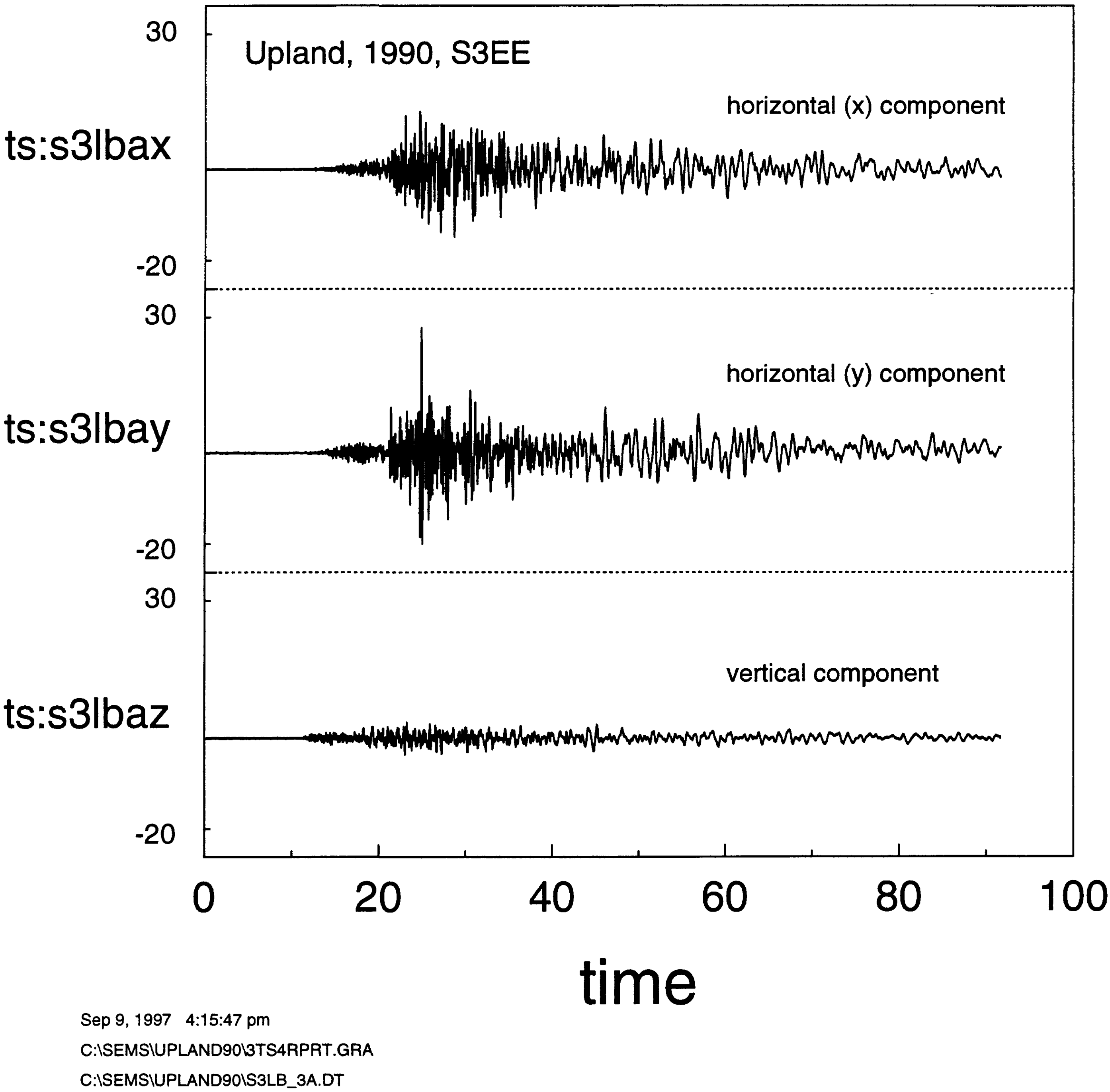


Figure 3. Three-component accelerograms, in cm/sec^2, of the Upland 1990 earthquake recorded at SEMS station S3EE. The time series are similar to those recorded onshore, with a clear portion of strong S-wave arrivals following the initial P-waves. Two interesting characteristics are the small amplitude of the vertical motion relative to the horizontal motions and the long-period energy arriving after the portion of strongest ground acceleration.

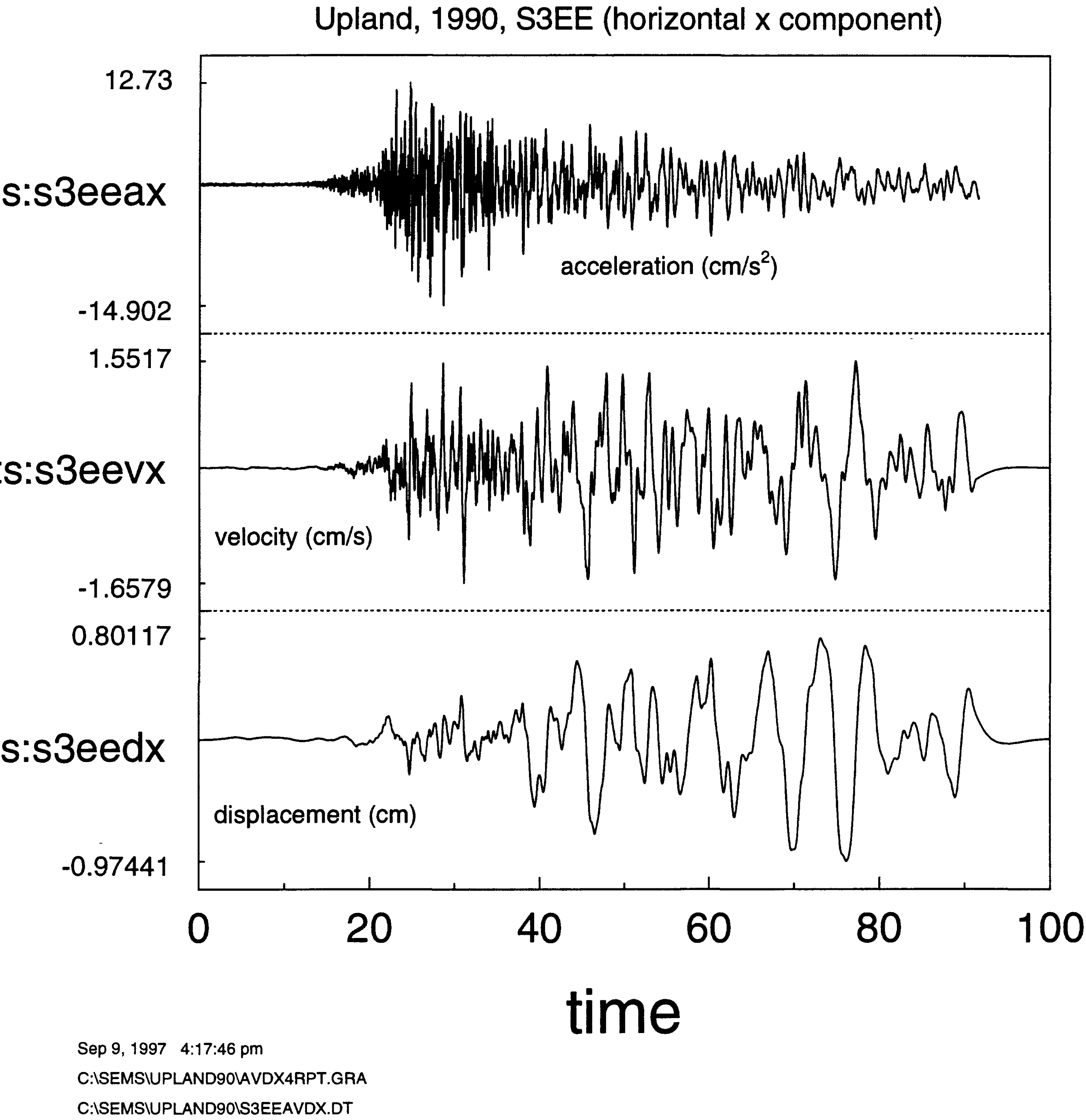


Figure 4. Acceleration (cm/sec^2), velocity (cm/sec), and displacement (cm) time series for the horizontal x component of the S3EE recording of the 1990 Upland earthquake. Note the dominance of late arriving 5 to 6 sec waves on the displacement trace, something not emphasized in the accelerogram.

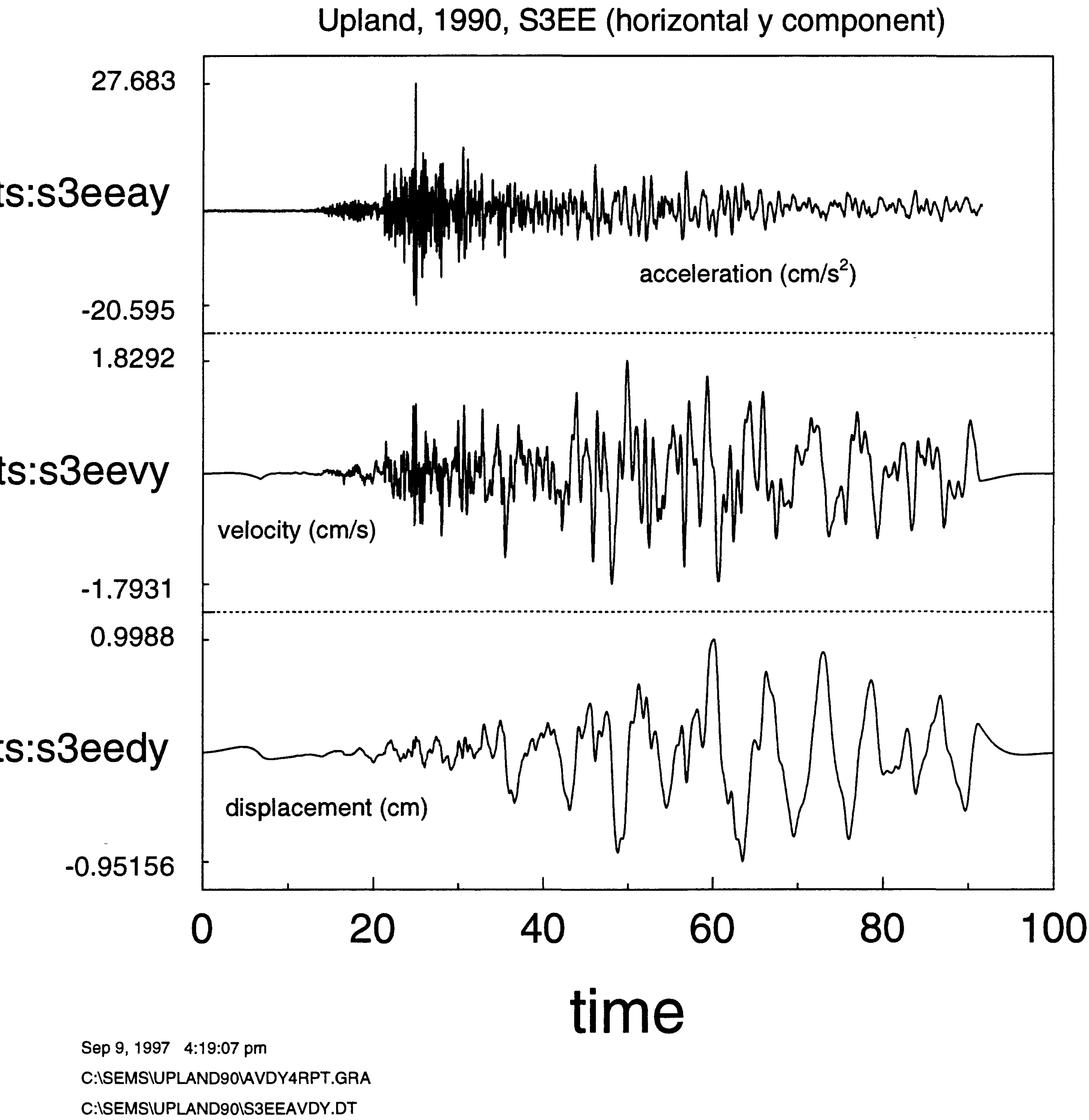


Figure 5. Acceleration (cm/sec^2), velocity (cm/sec), and displacement (cm) time series for the horizontal y component of the S3EE recording of the 1990 Upland earthquake. Note the dominance of late arriving 5 to 6 sec waves on the displacement trace, something not emphasized in the accelerogram.

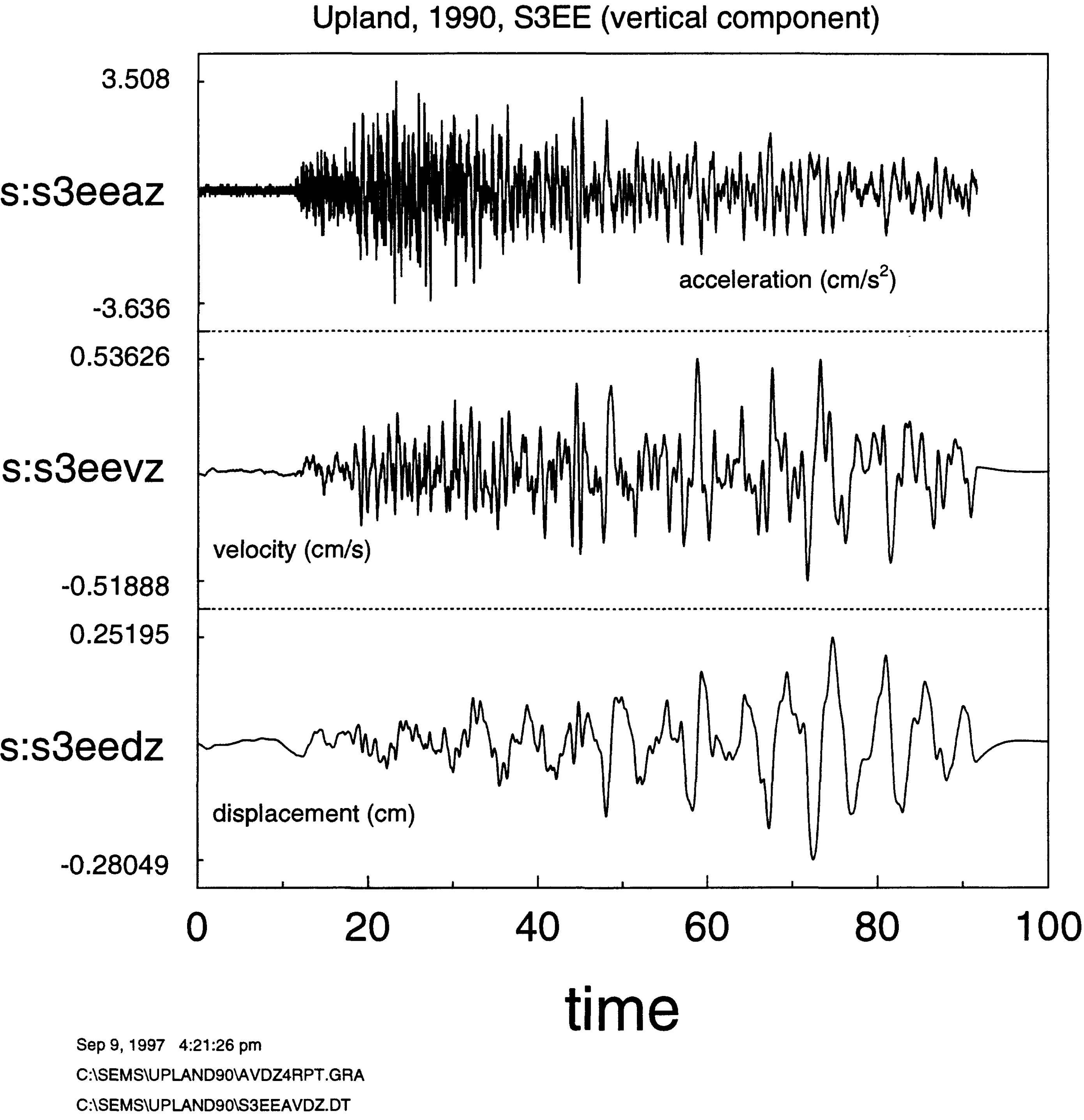


Figure 6. Acceleration (cm/sec^2), velocity (cm/sec), and displacement (cm) time series for the vertical component of the S3EE recording of the 1990 Upland earthquake. Note the dominance of late arriving 5 to 6 sec waves on the displacement trace, something not emphasized in the accelerogram. Furthermore, note the similarity of the waveforms to those of the horizontal components, something difficult to see in the true amplitude scaling in Figure 3.

Figure 7. Horizontal-component accelerations (cm/sec^2) from the 1990 Upland earthquake recorded offshore at S3EE (top trace) and from the larger 1971 San Fernando earthquake recorded at Palos Verdes and Costa Mesa (middle and bottom traces, respectively). The two 1971 recordings apparently triggered on the S wave, but comparison with the 1990 recording suggests that most of the S energy has been captured. It is unlikely that the response spectra will be affected by the short duration of missing S energy, particularly at the longer periods of most interest in this report. The durations of the accelerograms represent the complete recording, after which the triggered instruments turned off. It is likely that the long-period energy continued for a longer duration.

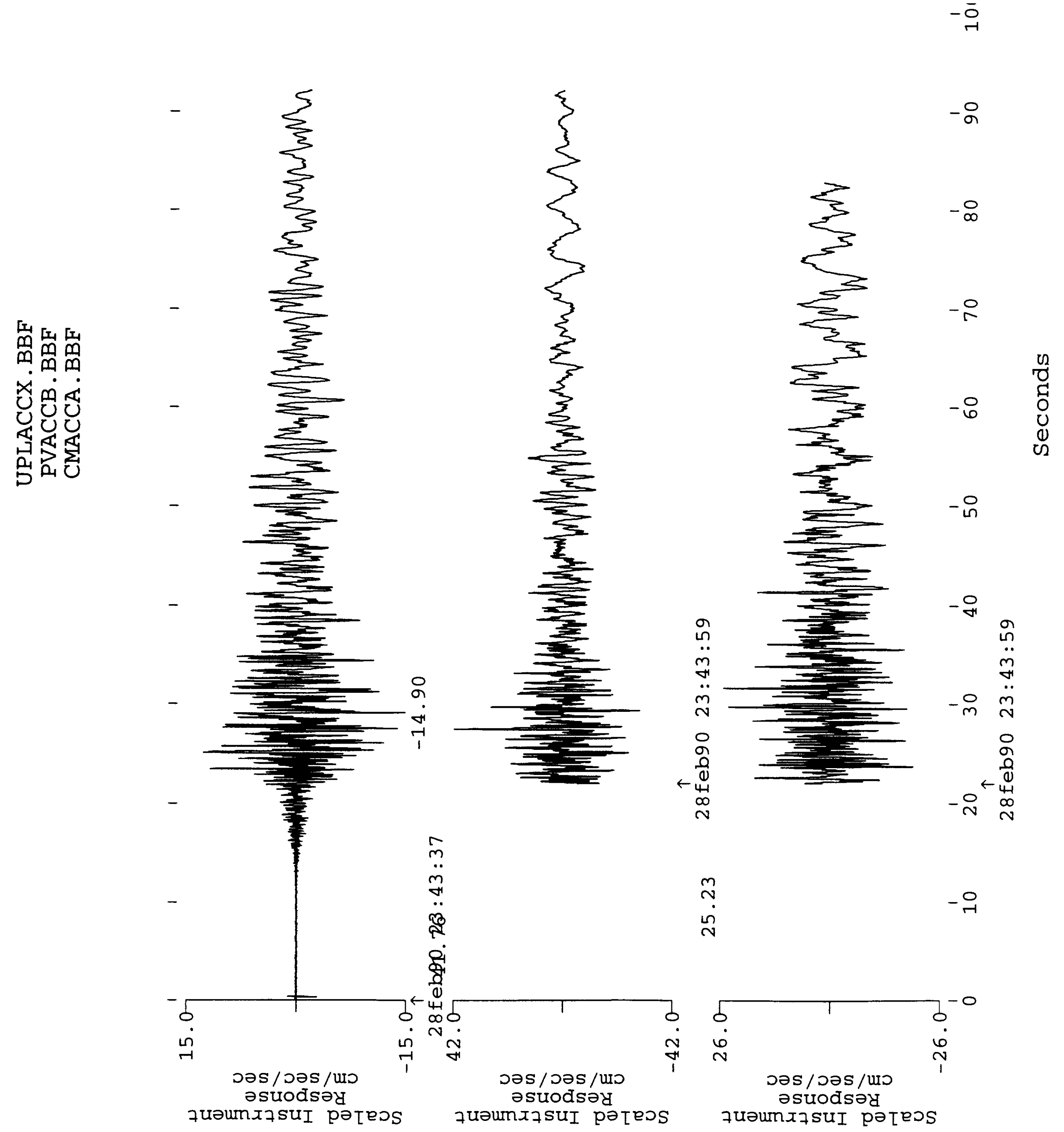


Figure 8. Horizontal-component velocities (*cm/sec*) from the 1990 Upland earthquake recorded offshore at S3EE (top trace) and from the larger 1971 San Fernando earthquake recorded at Palos Verdes and Costa Mesa (middle and bottom traces, respectively).

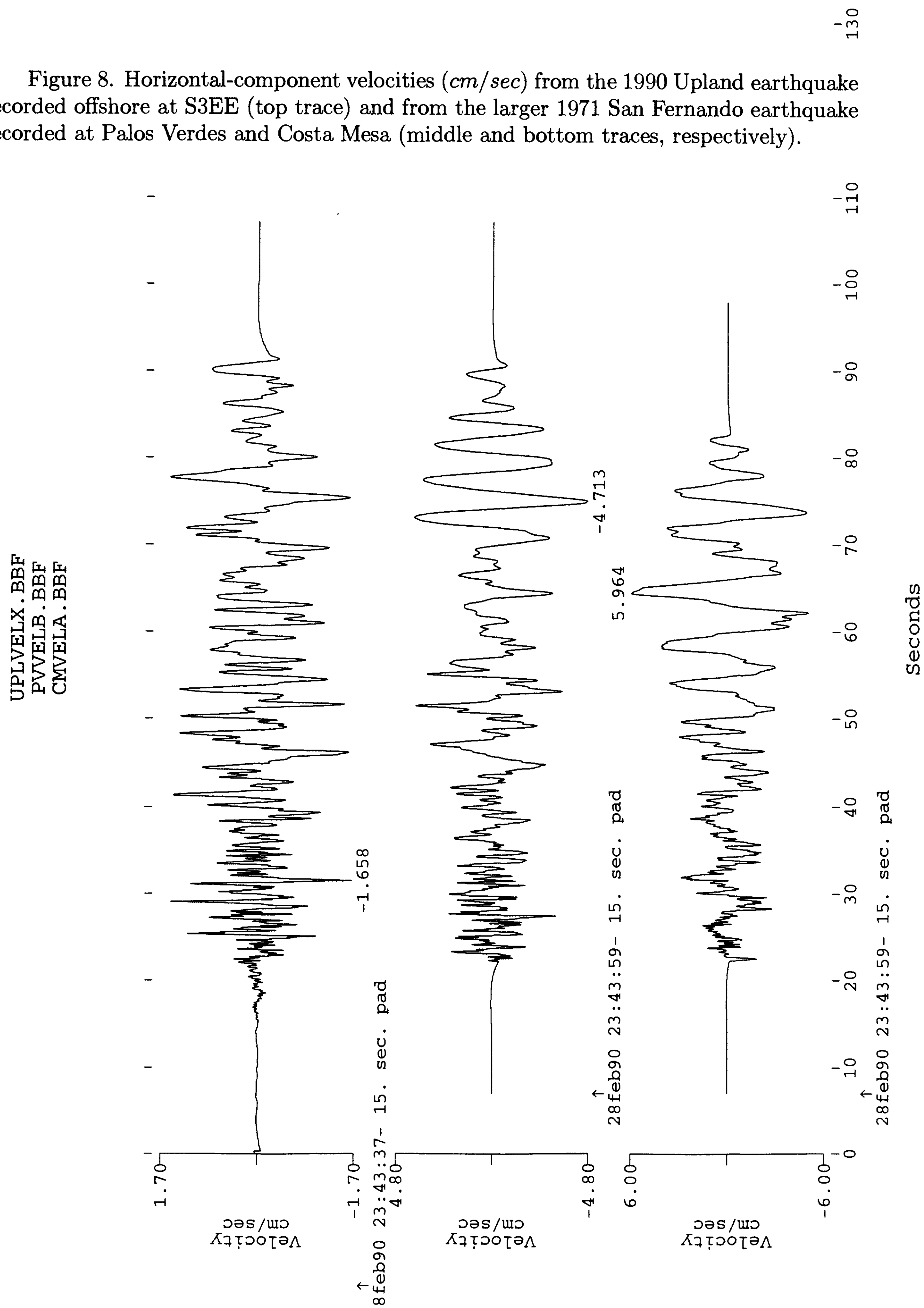


Figure 9. Horizontal-component displacements (*cm*) of lowcut filtered accelerations from the 1990 Upland earthquake recorded offshore at S3EE (top trace) and from the larger 1971 San Fernando earthquake recorded at Palos Verdes and Costa Mesa (middle and bottom traces, respectively). Note the overall similarity in the waveforms, despite the factor of up to 5 disparity in peak amplitudes. As noted in Figure 7, it is likely that the long-period motions continued for a longer duration than shown.

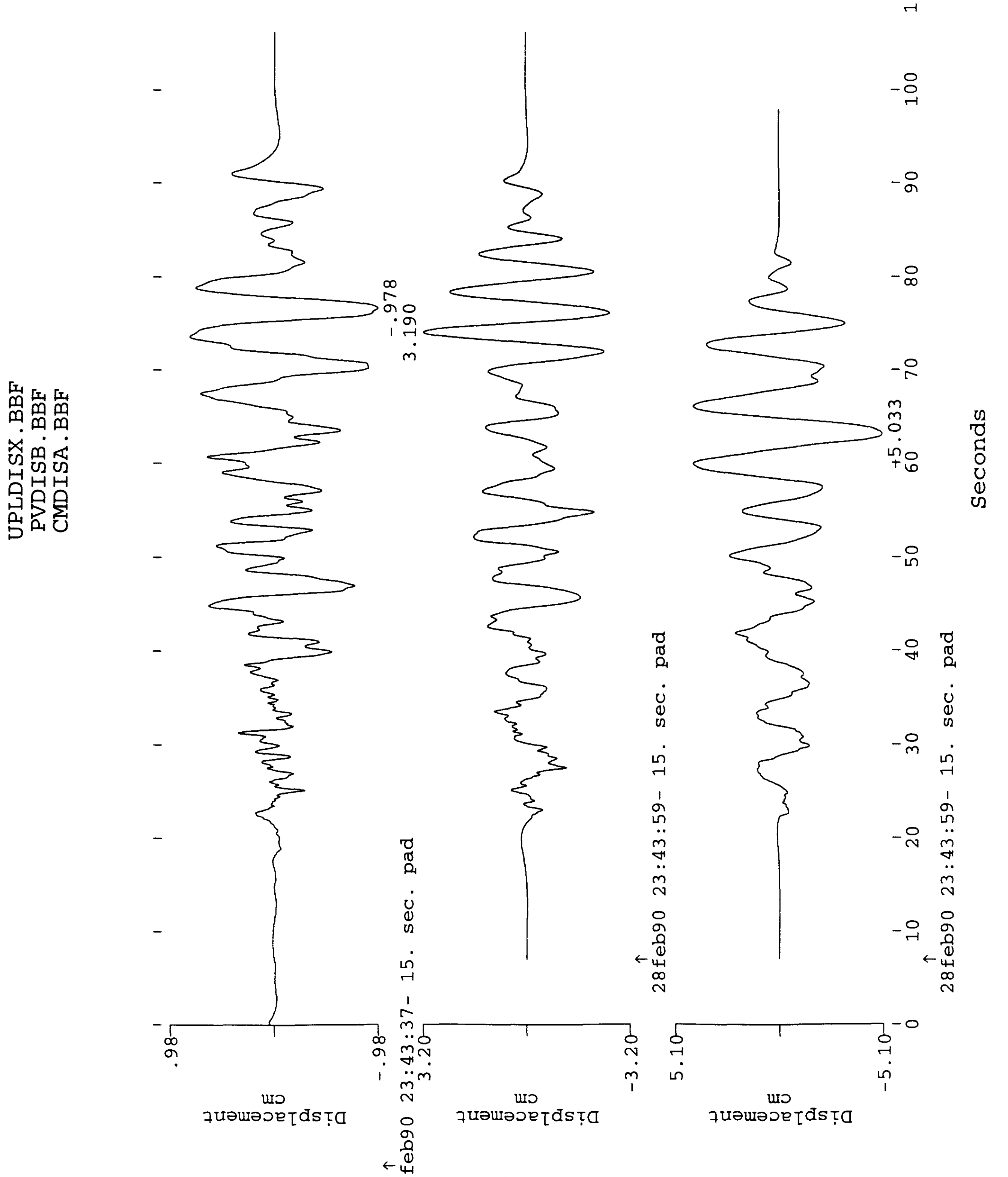


Figure 10. Accelerograms (cm/sec^2) shown for various cutoff times (and lowcut filtered at 0.1 Hz). These accelerograms were used in a study of the effect of the cutoff time on the computed response spectra (i.e., how important is the late arriving motion that may have been lost due to the limited recording duration of the triggered accelerographs?).

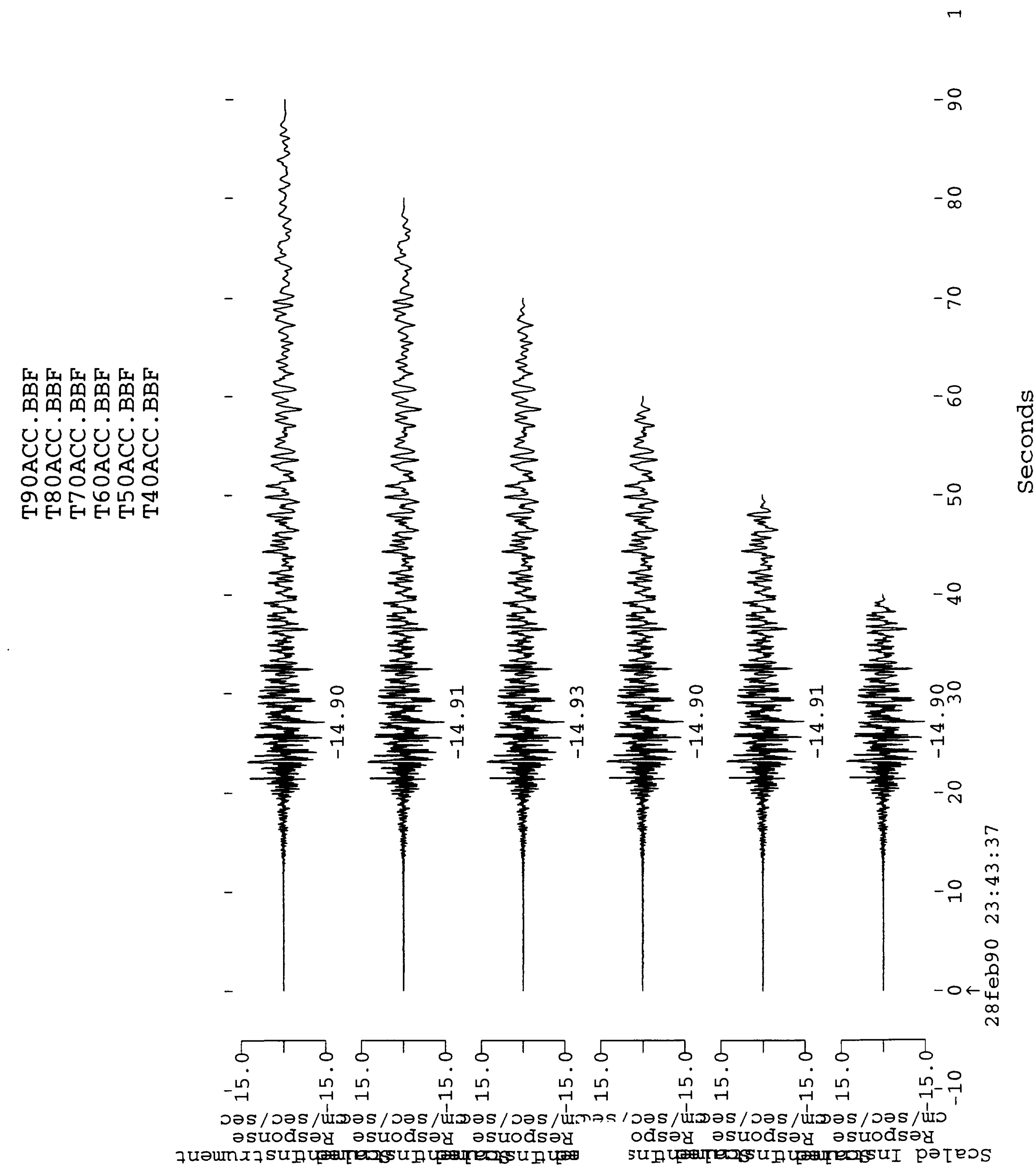


Figure 11. Velocity time series (*cm/sec*) computed from the accelerograms shown in Figure 10. Note that intermediate-period energy (with a period of one to several seconds) will be captured on all but the shortest duration record.

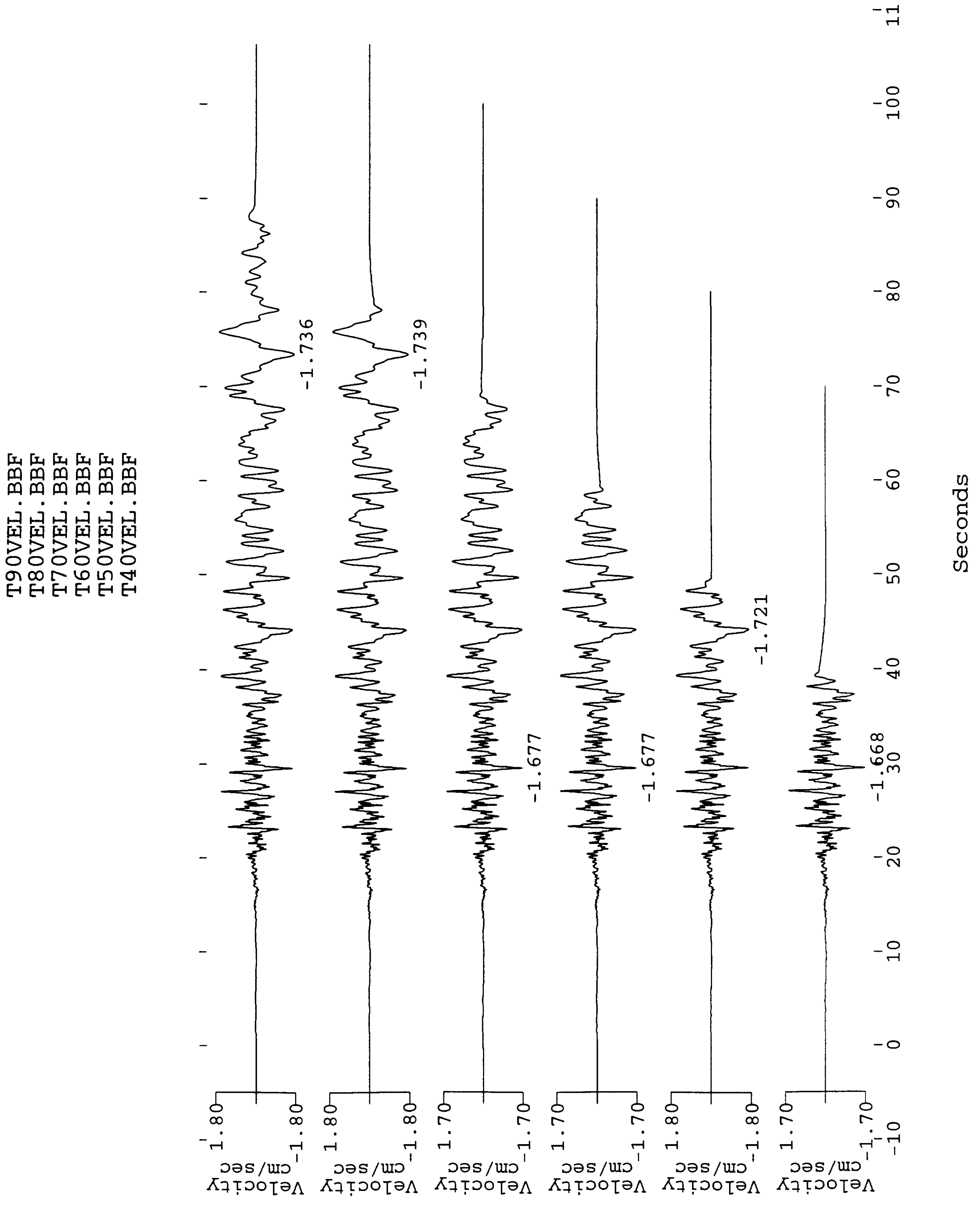
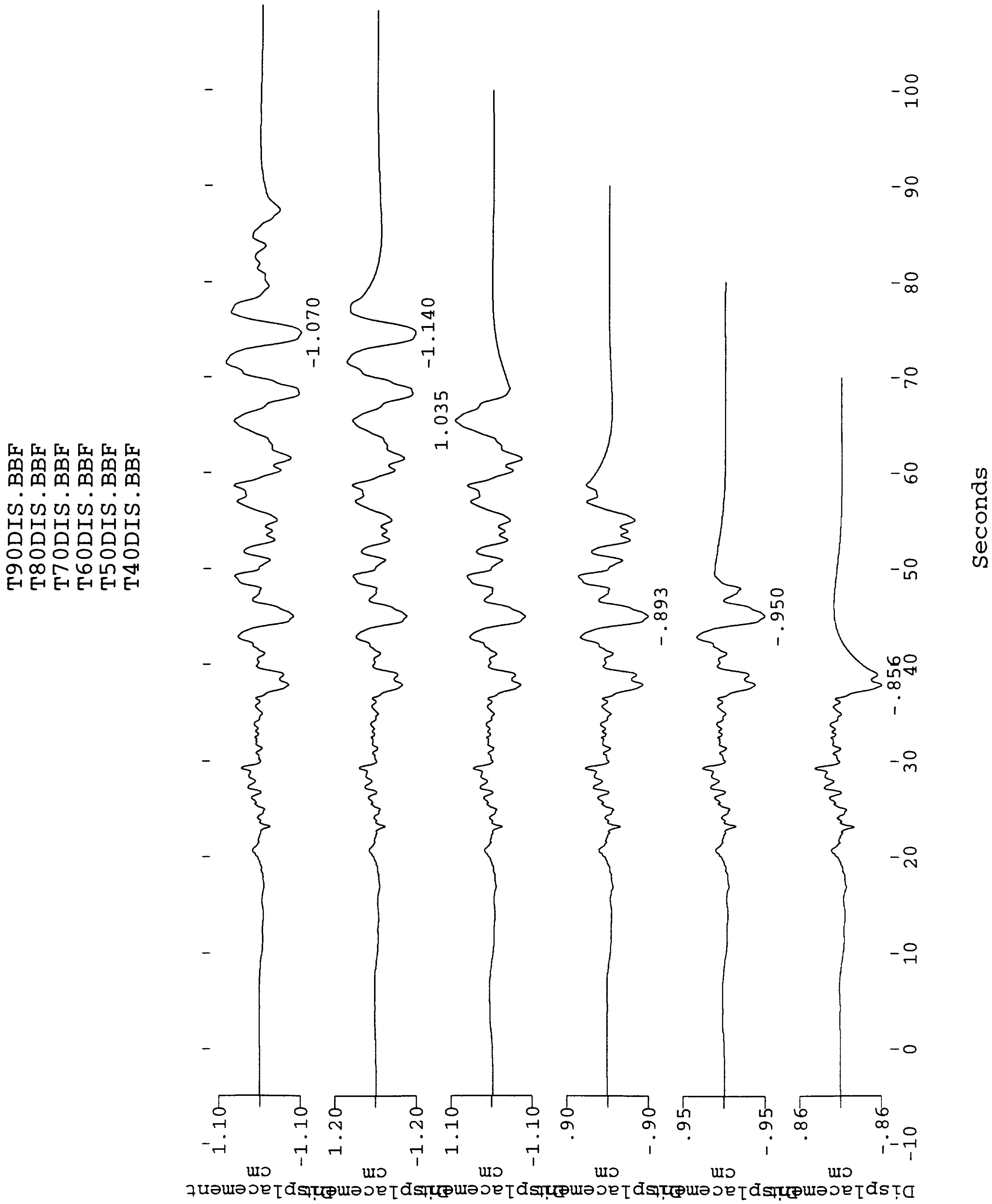


Figure 12. Displacement time series (cm) computed from the accelerograms shown in Figure 10. The 6–7 sec waves are only captured by the two longest records.



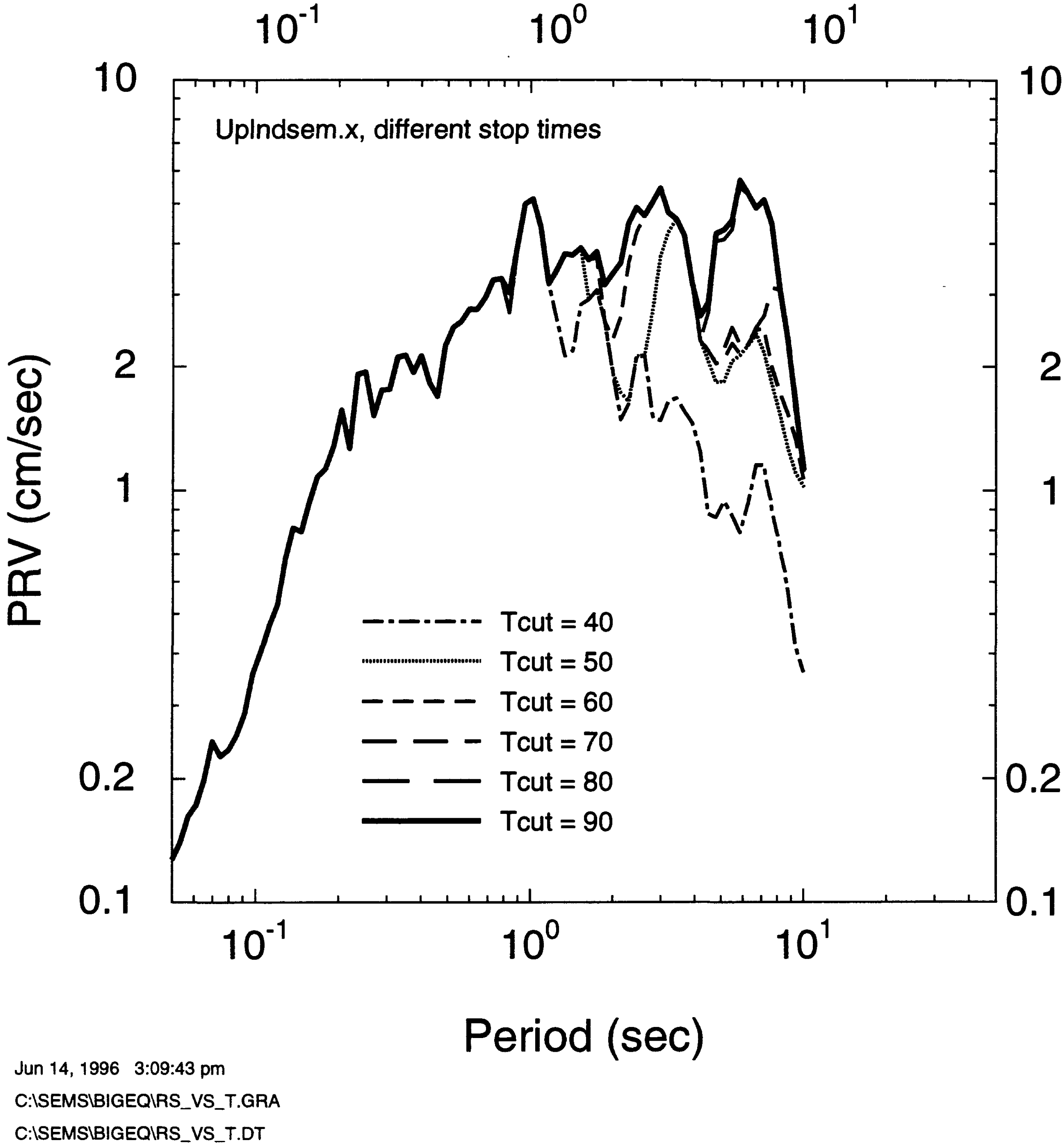


Figure 13. 5%-damped response spectra for the accelerograms shown in Figure 10, showing the effect of eliminating the late arriving long-period energy if the instrument stops recording at a certain time. Note that only the T80 and T90 accelerograms capture the 6-7 sec waves.

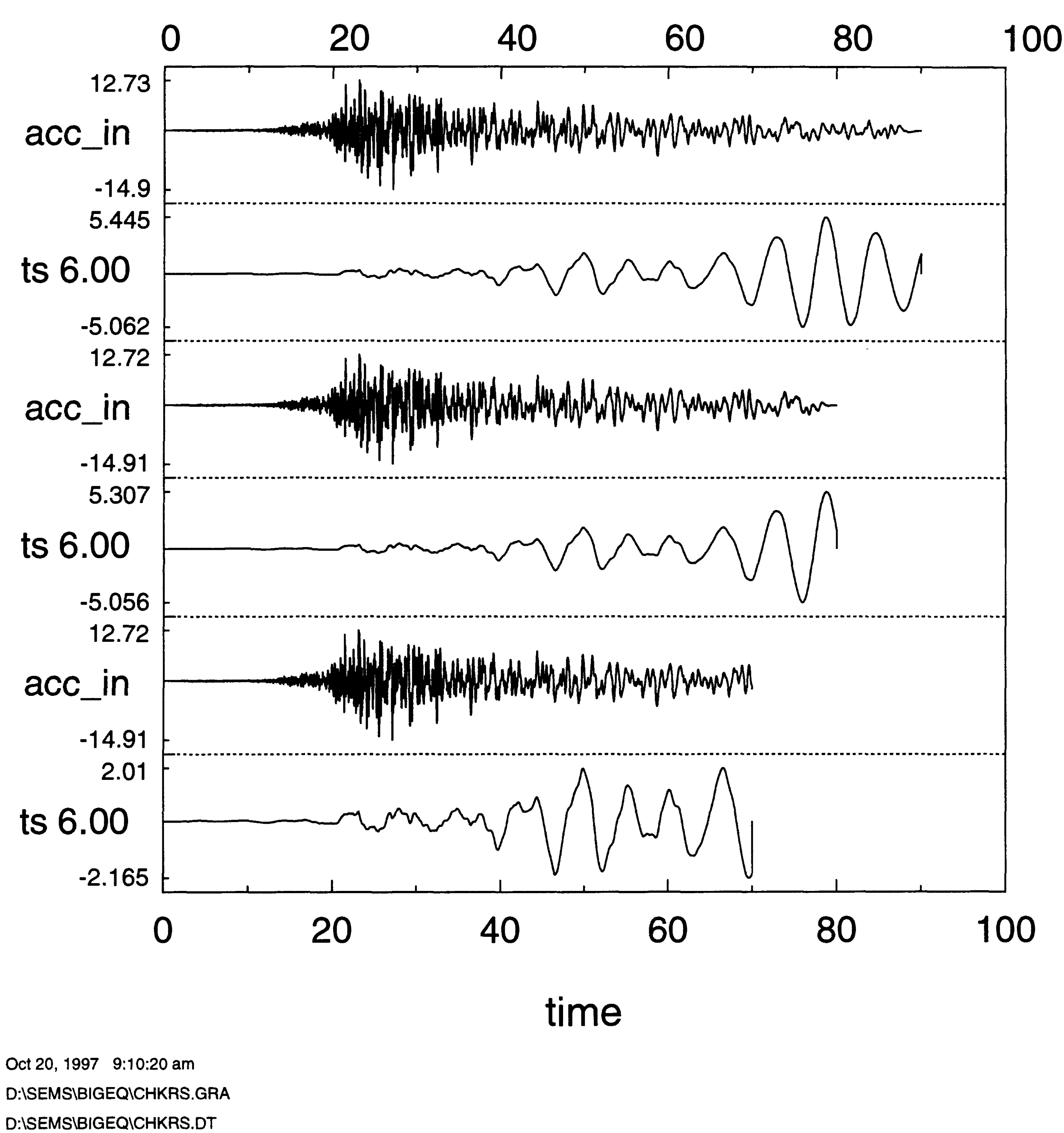


Figure 14. The accelerogram and corresponding response of a 5%-damped, 6 sec oscillator for accelerogram cutoffs of 90, 80, and 70 seconds. Unlike the 70 second accelerogram, the accelerograms with 80 and 90 second cutoffs have captured enough of the 6 second response to give the same response spectral amplitudes (Figure 13).

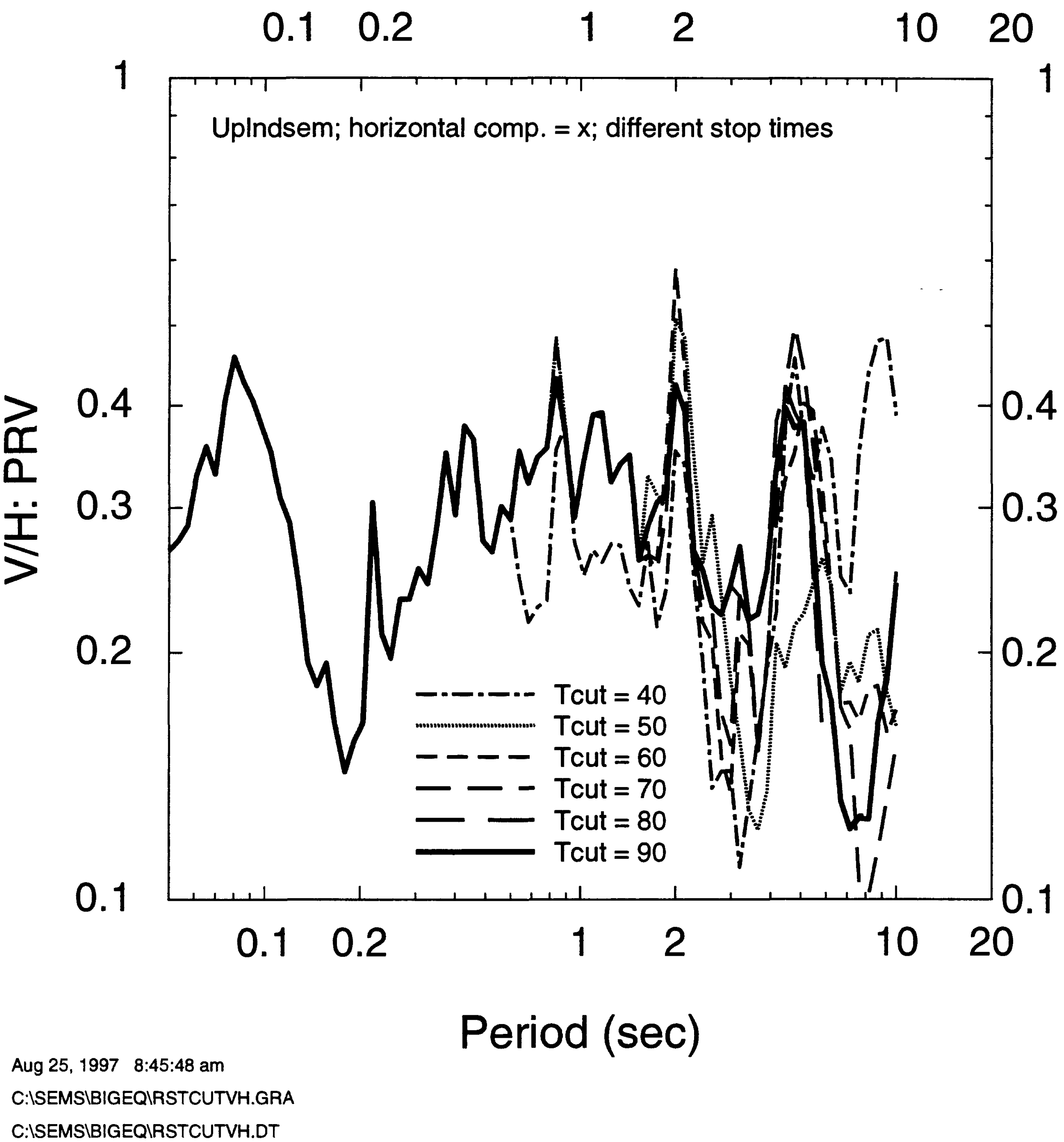


Figure 15. V/H ratio of 5%-damped response spectra computed from accelerograms with different cutoff times.

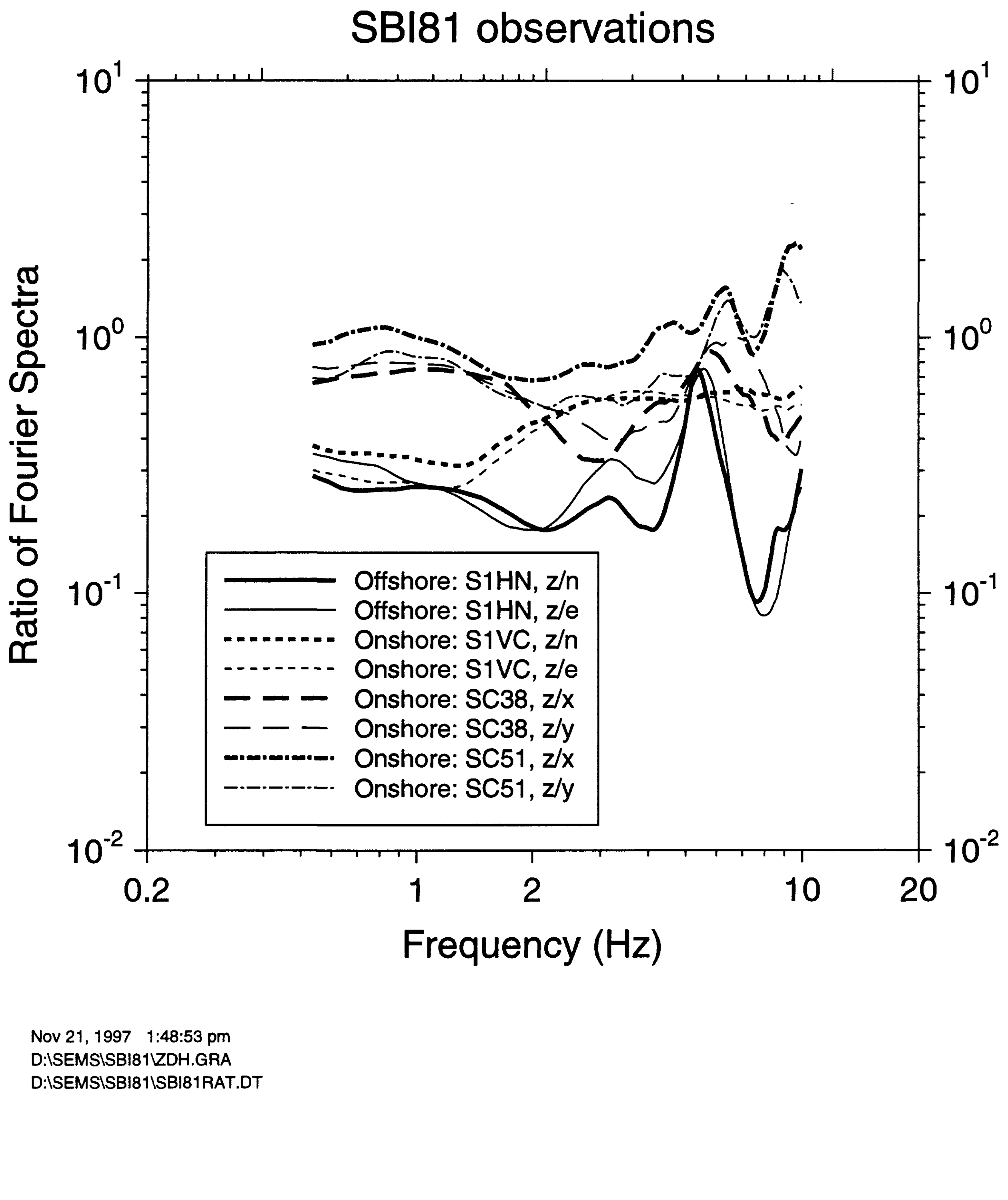


Figure 16. Comparison of V/H ratios of 5%-damped response spectra for recordings of the 1981 Santa Barbara Island earthquake at offshore and onshore sites. The ratio for the offshore site (S1HN) is much lower at short periods than are the ratios from the onshore sites.

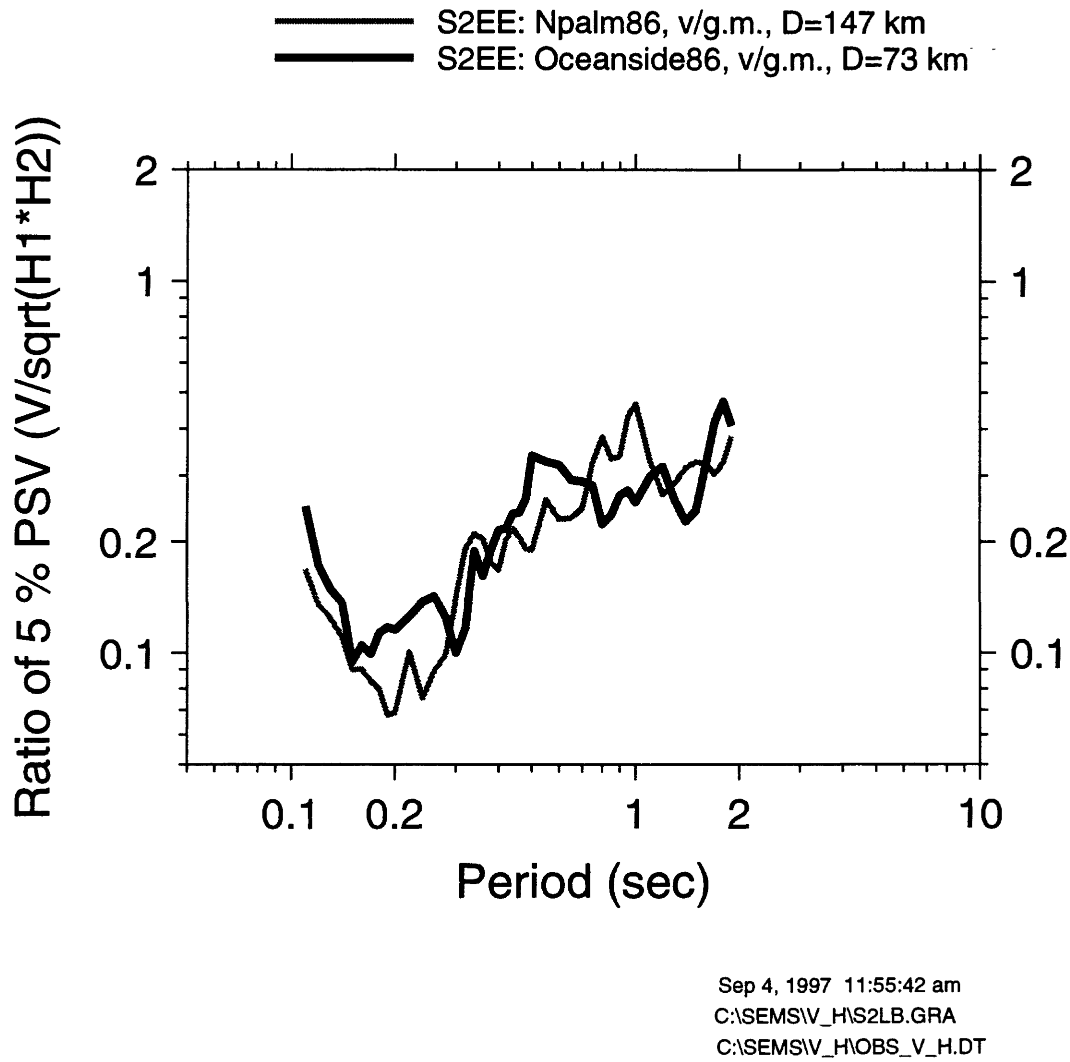


Figure 18. Comparison of V/H ratios of 5%-damped response spectra for recordings at the SEMS site S2EE. Notice the similarity of the ratios for the two events recorded at the same site.

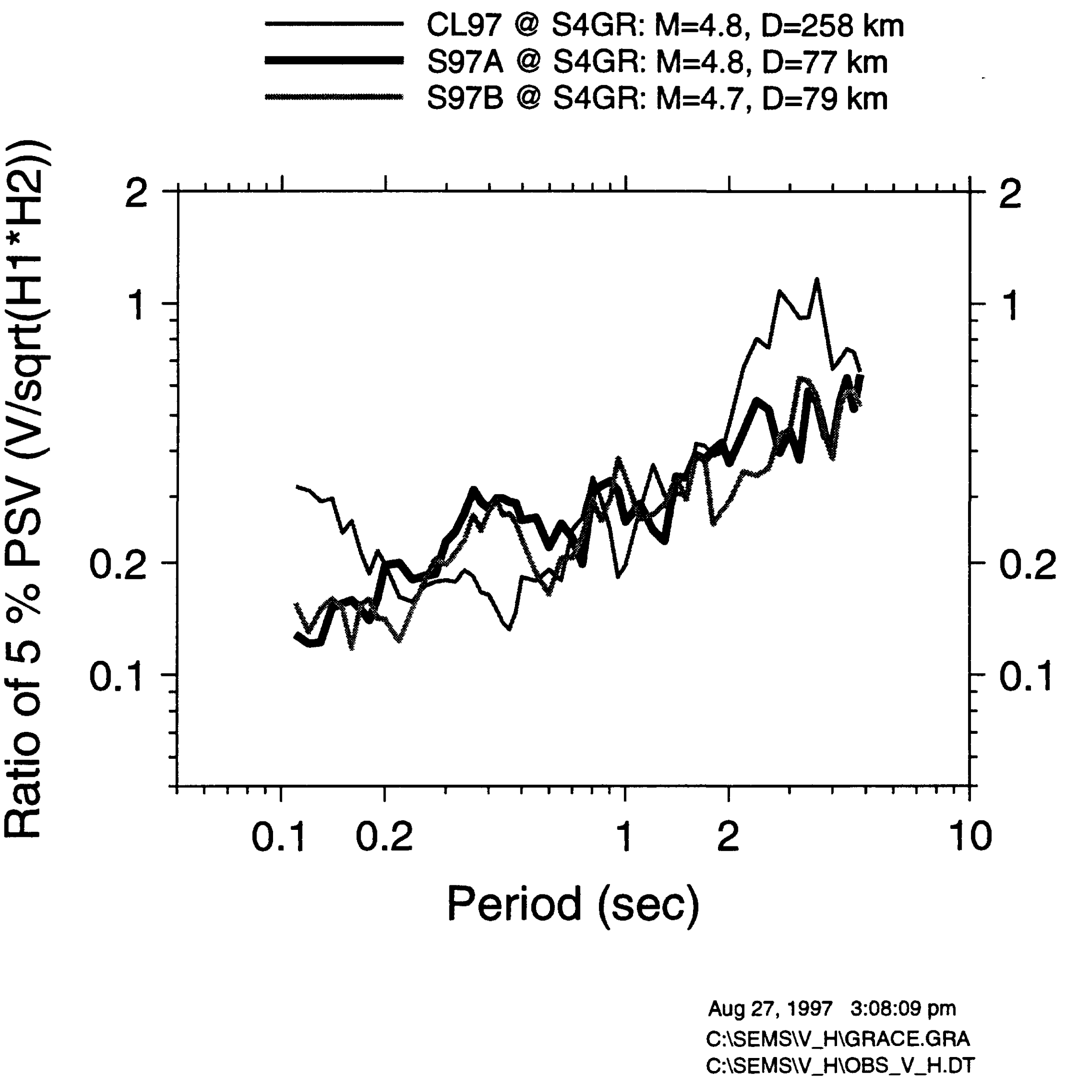


Figure 19. Comparison of V/H ratios of 5%-damped response spectra for recordings at the SEMS site S4GR. Notice the similarity of the ratios for the events recorded at the same site, particularly for the two Simi Valley earthquakes, which were located close to one another.

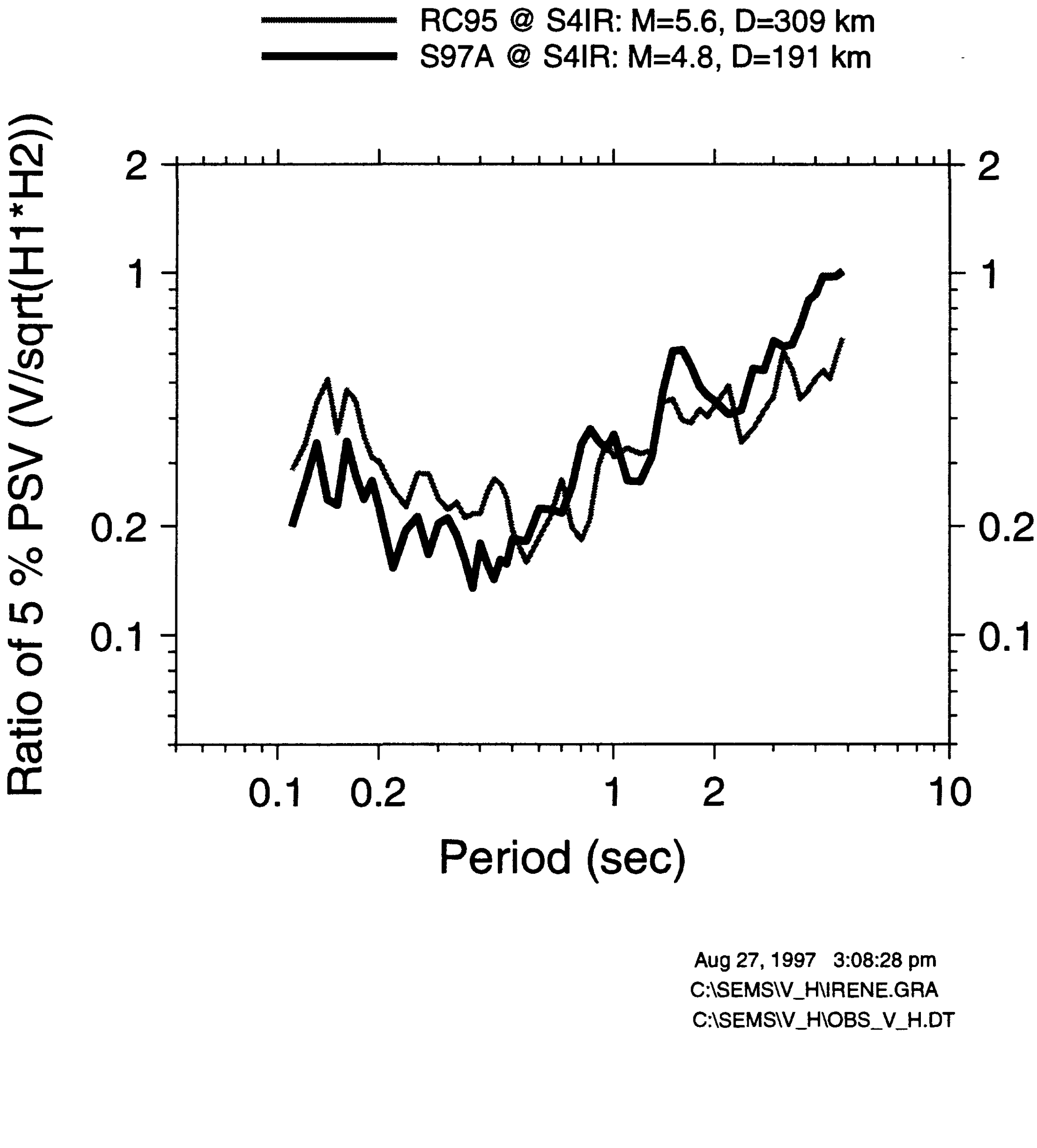


Figure 20. Comparison of V/H ratios of 5%-damped response spectra for recordings at the SEMS site S4IR. Notice the similarity of the ratios for the two events recorded at the same site.

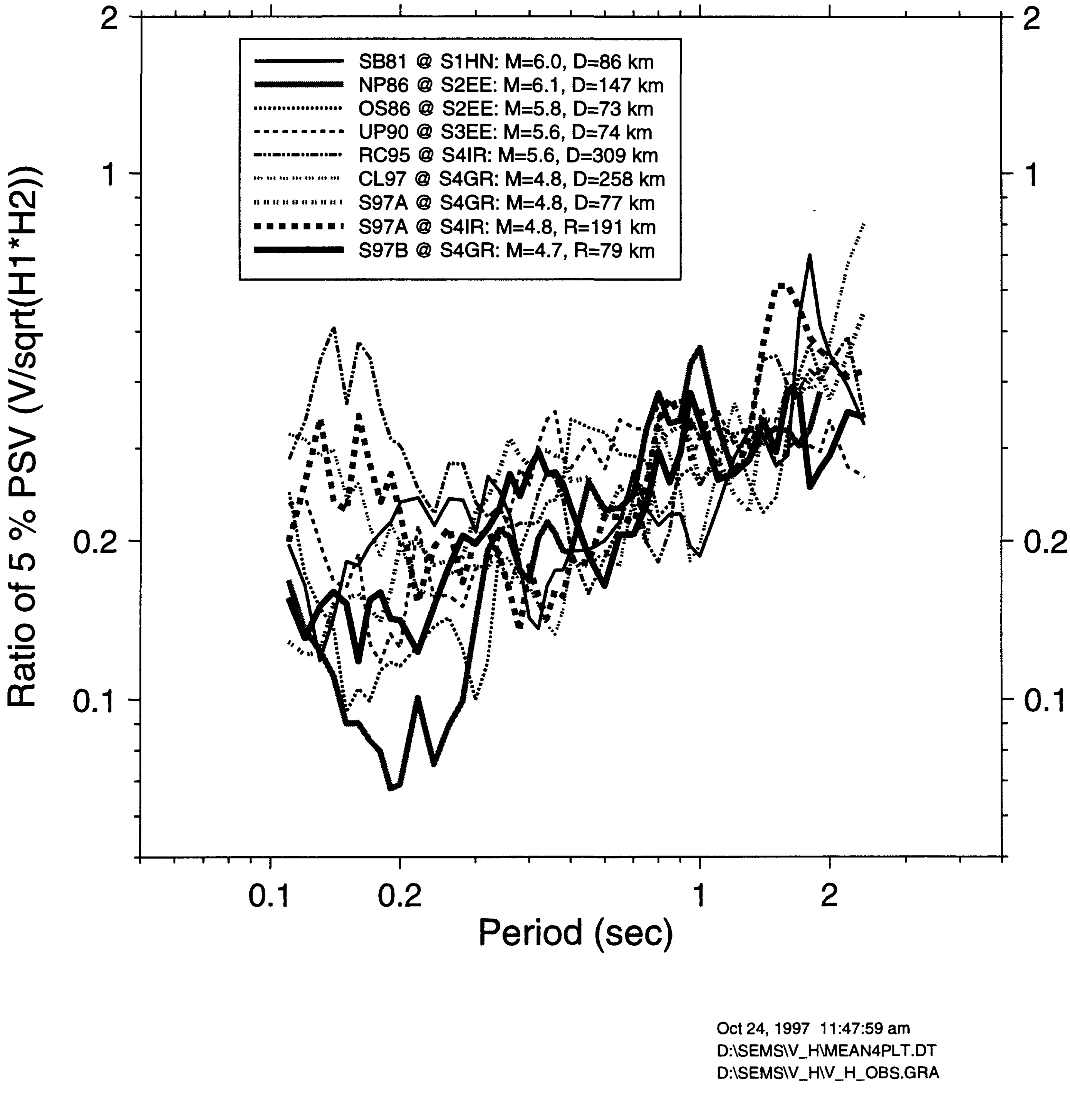


Figure 21. Comparison of V/H ratios of 5%-damped response spectra for recordings at all of the offshore SEMS sites considered in this report. In view of the widespread distribution of the stations, the ratios are remarkably similar, particularly for the longer periods. Theoretical calculations suggest that the spread in the ratios at short periods may be due to site-to-site variations in water depth and near-surface geological properties.

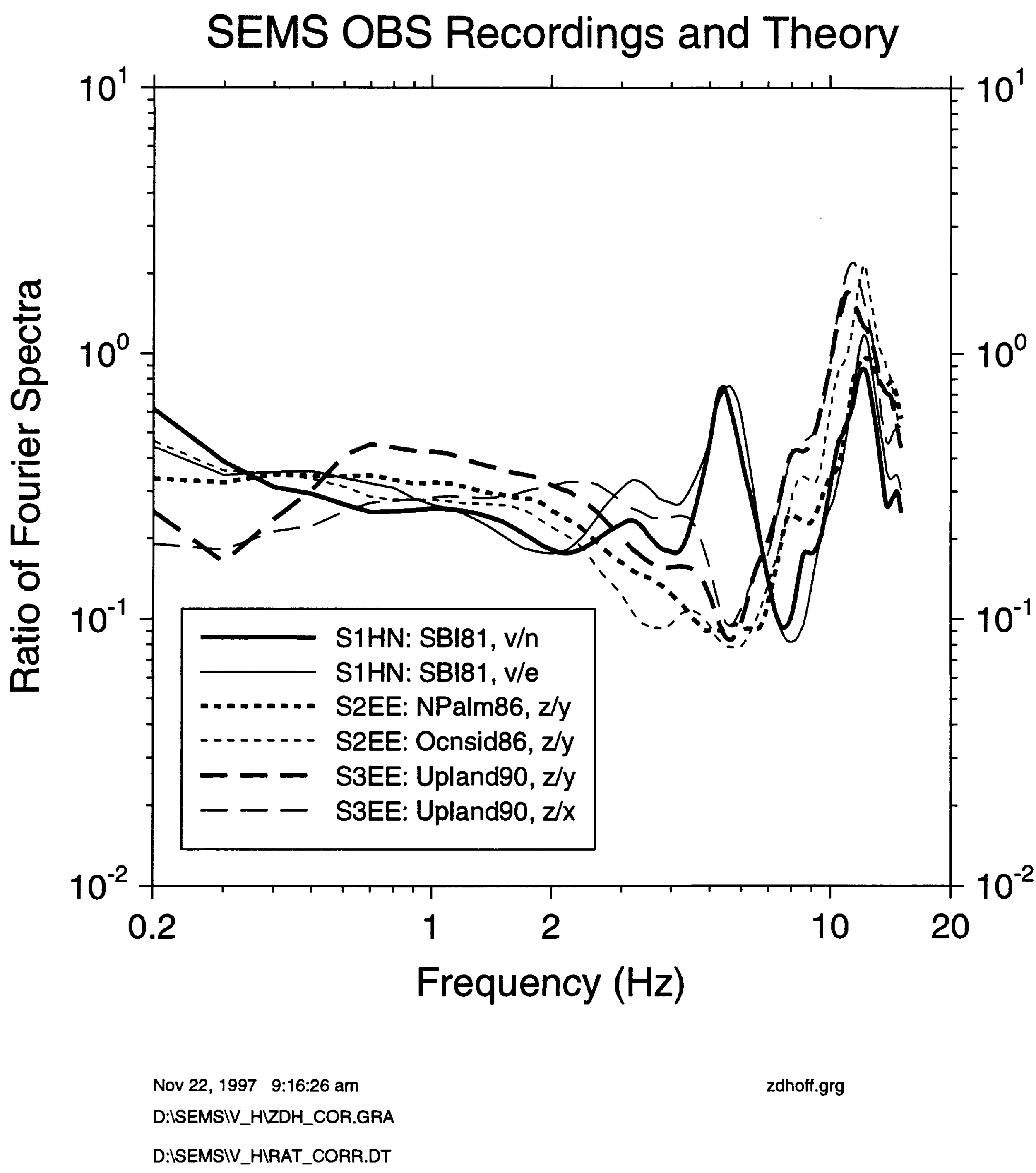


Figure 22. Comparison of V/H ratios of Fourier amplitude spectra for the offshore SEMS recordings through 1990. As in the ratio of response spectra, the ratios are very similar at low frequencies and show some divergence at high frequencies.

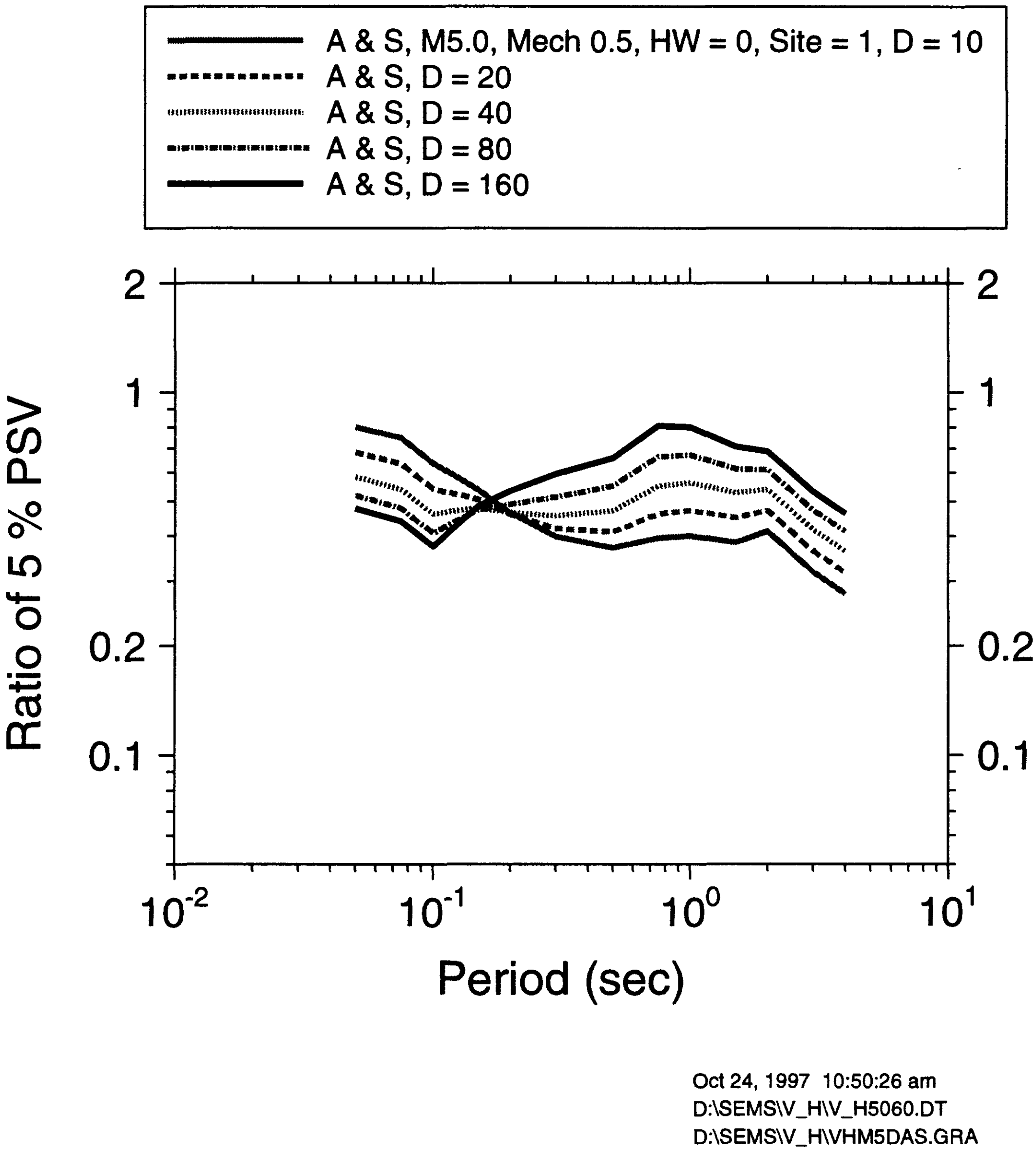


Figure 23. V/H ratios of 5%-damped response spectra from Abrahamson and Silva's (1997) regression results for $\mathbf{M} = 5.0$, oblique slip faulting, soil site, and distances from 10 to 160 km.

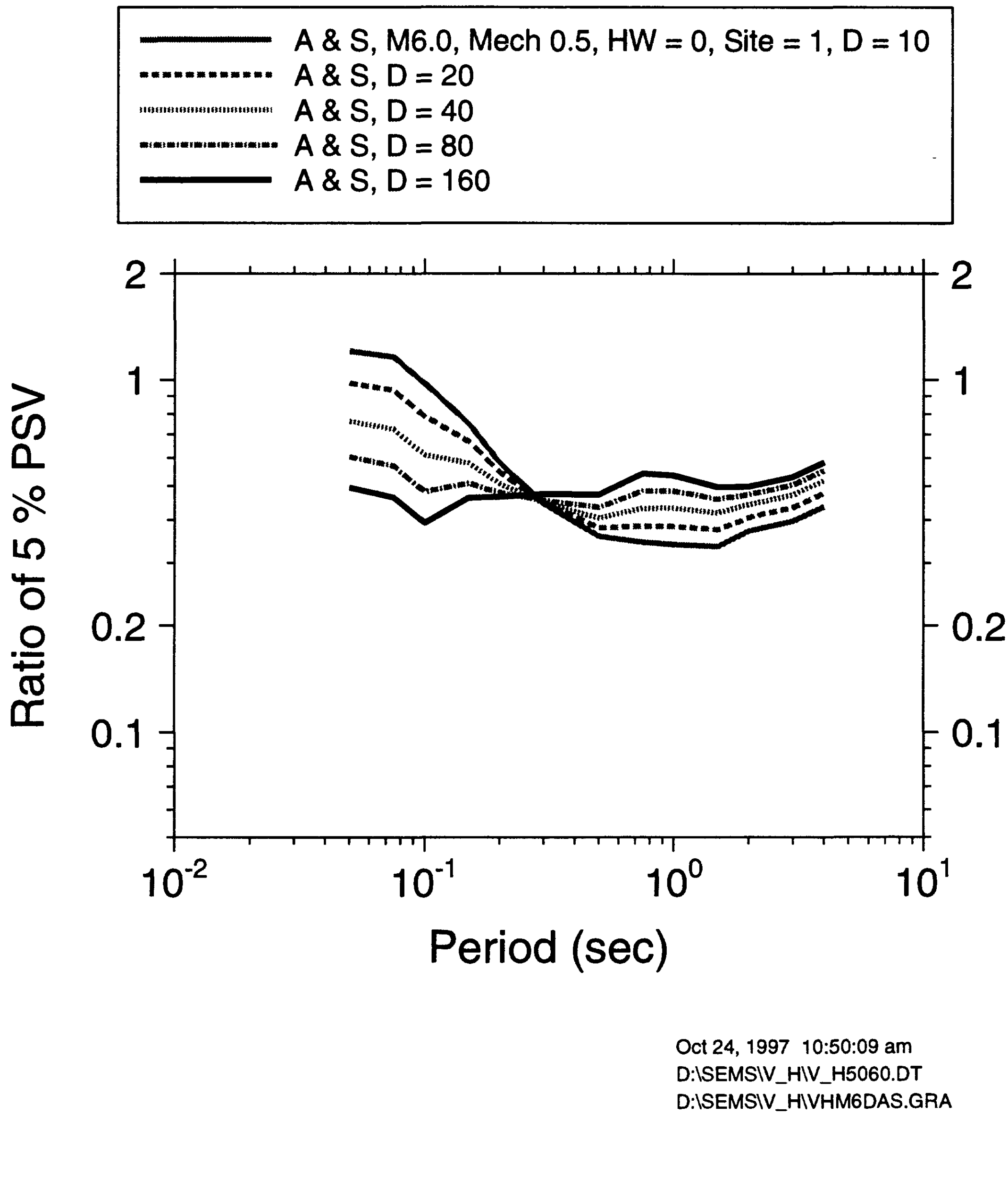


Figure 24. V/H ratios of 5%-damped response spectra from Abrahamson and Silva's (1997) regression results for $\mathbf{M} = 6.0$, oblique slip faulting, soil site, and distances from 10 to 160 km.

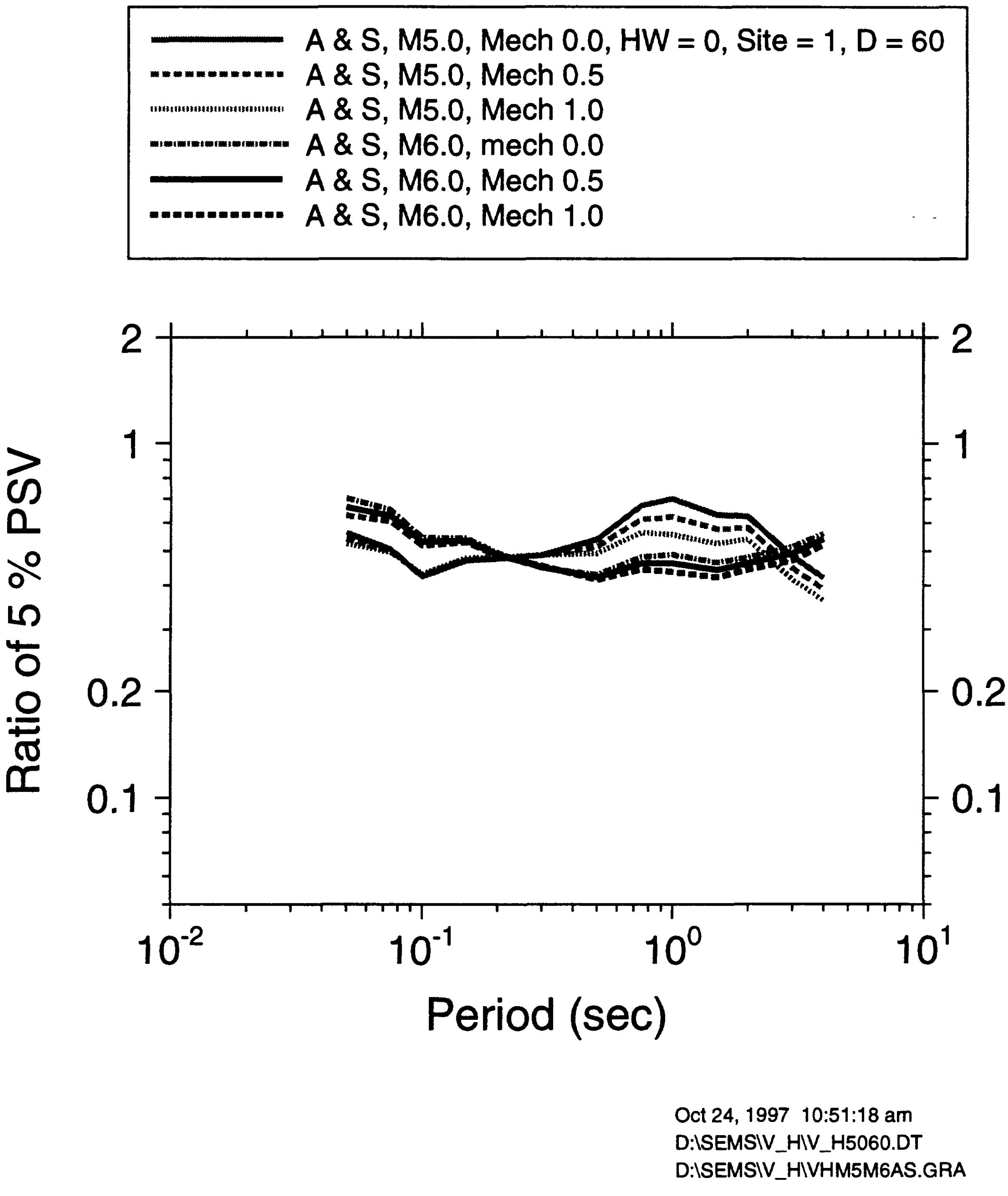


Figure 25. V/H ratios of 5%-damped response spectra from Abrahamson and Silva's (1997) regression results for **M** 5 and 6, strikeslip (Mech = 0.0), oblique slip faulting (Mech = 0.5), and reverse slip faulting (Mech = 1.0), a soil site, and a distance of 60 km.

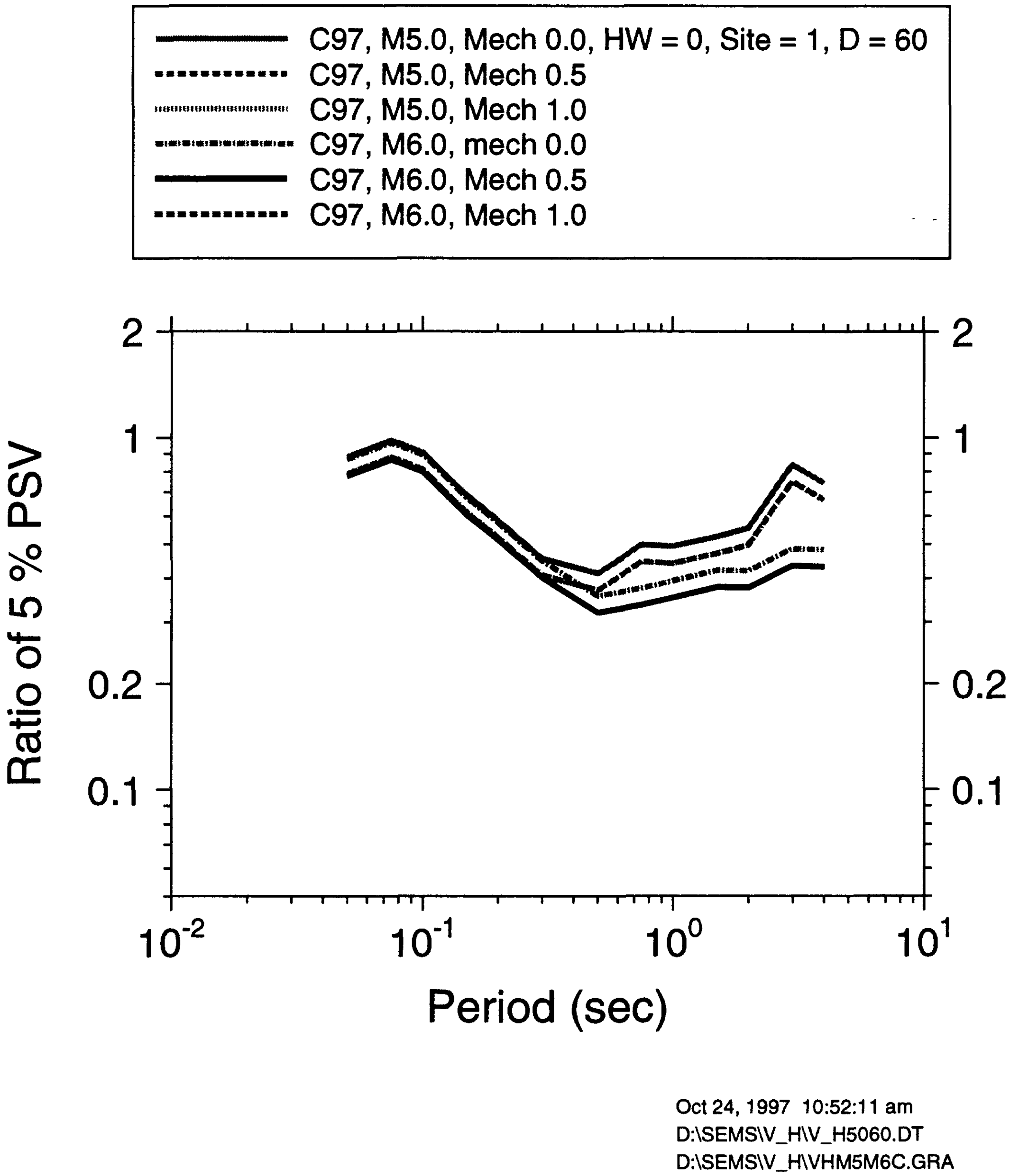


Figure 26. V/H ratios of 5%-damped response spectra from Campbell's (1997) regression results for **M** 5 and 6, strikeslip (Mech = 0.0), oblique slip faulting (Mech = 0.5), and reverse slip faulting (Mech = 1.0), a soil site, and a distance of 60 km.

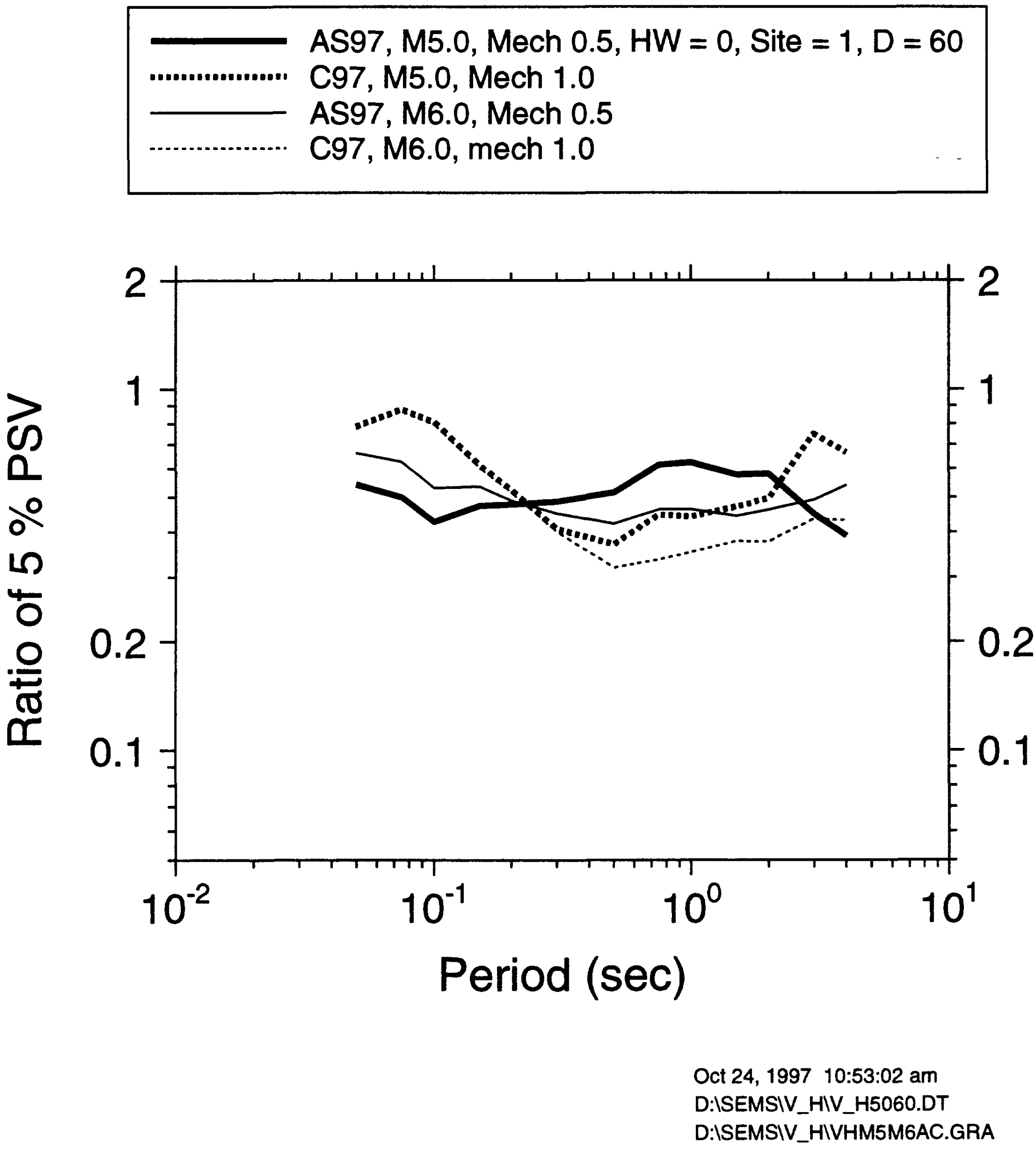


Figure 27. V/H ratios of 5%-damped response spectra from Abrahamson and Silva's (1997) and Campbell's (1997) regression results for **M** 5 and 6, oblique slip faulting (Mech = 0.5), and reverse slip faulting (Mech = 1.0), a soil site, and a distance of 60 km.

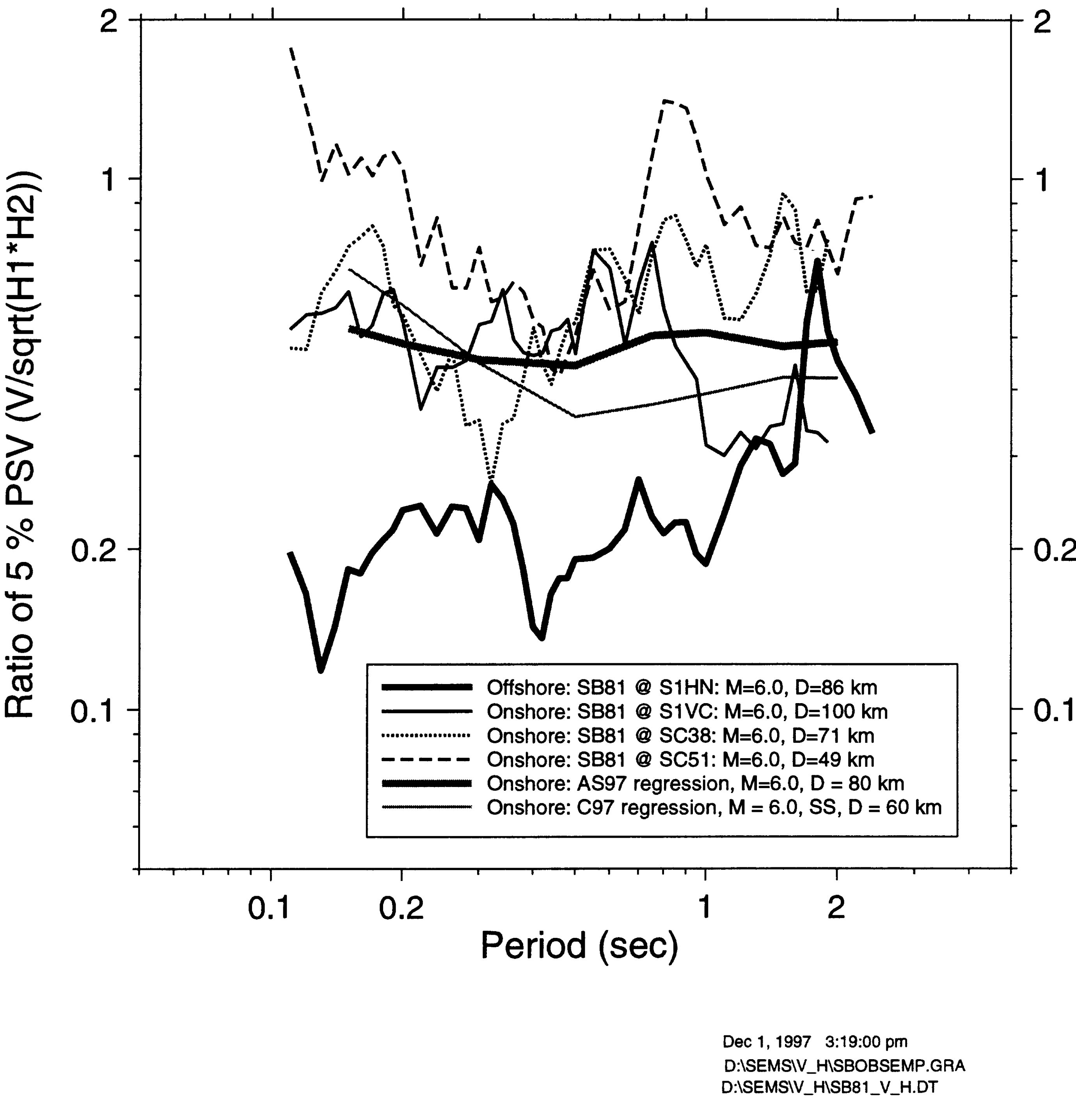


Figure 28. V/H ratios of 5%-damped response spectra for offshore and onshore recordings of the 1981 Santa Barbara Island earthquake, compared with the regression results of Abrahamson and Silva (1997) ($AS97$) and Campbell (1997) ($C97$).

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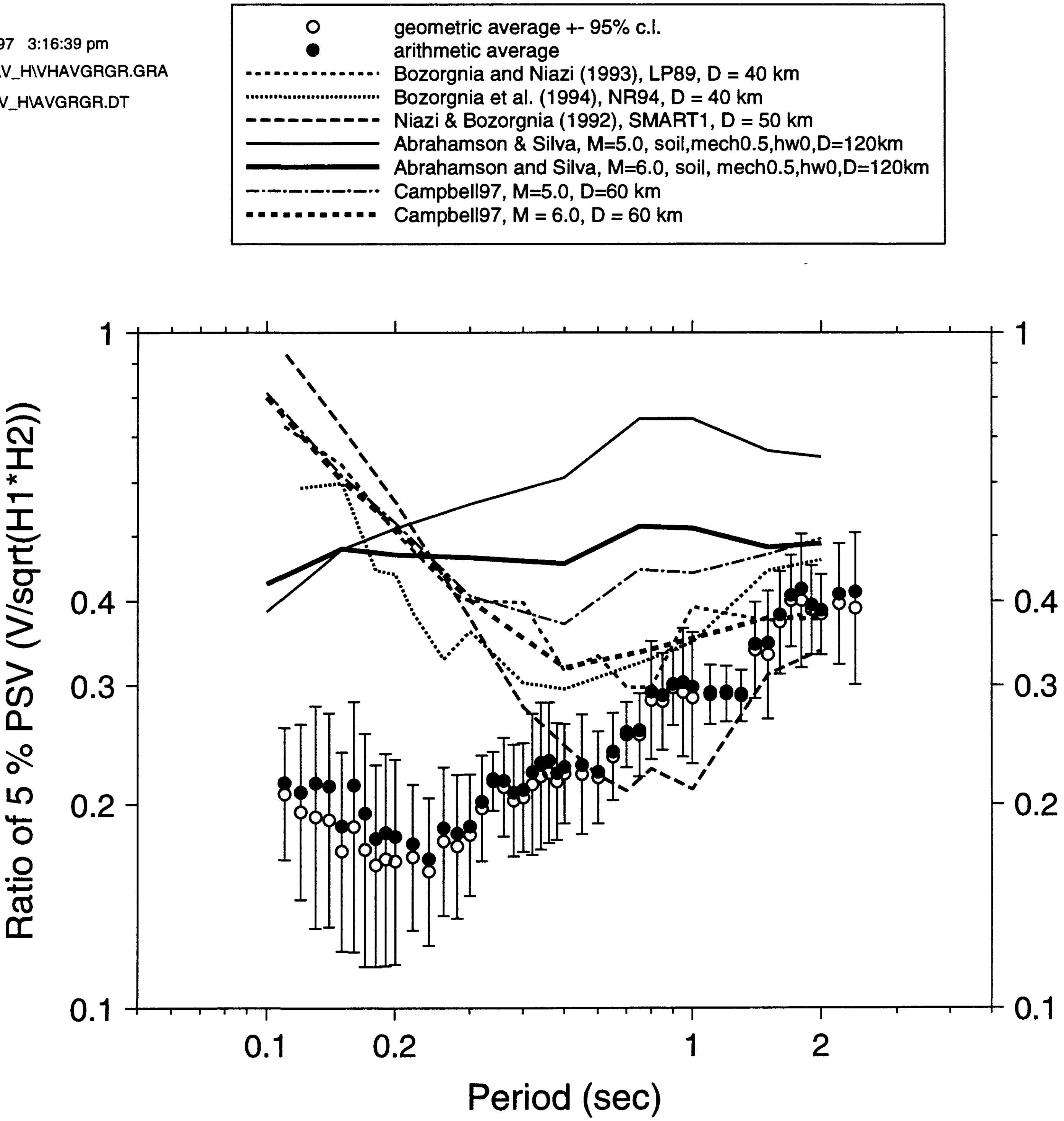

Figure 29. Observed offshore V/H ratios of 5%-damped response spectra compared with onshore ratios from regression analyses. The results for the Loma Prieta and Northridge earthquakes are indicated in the legend by "LP89" and "NR94", respectively. The Bozorgnia *et al.* (1994) results for the Northridge earthquake differ slightly from those in the final published study (Bozorgnia *et al.*, 1995).

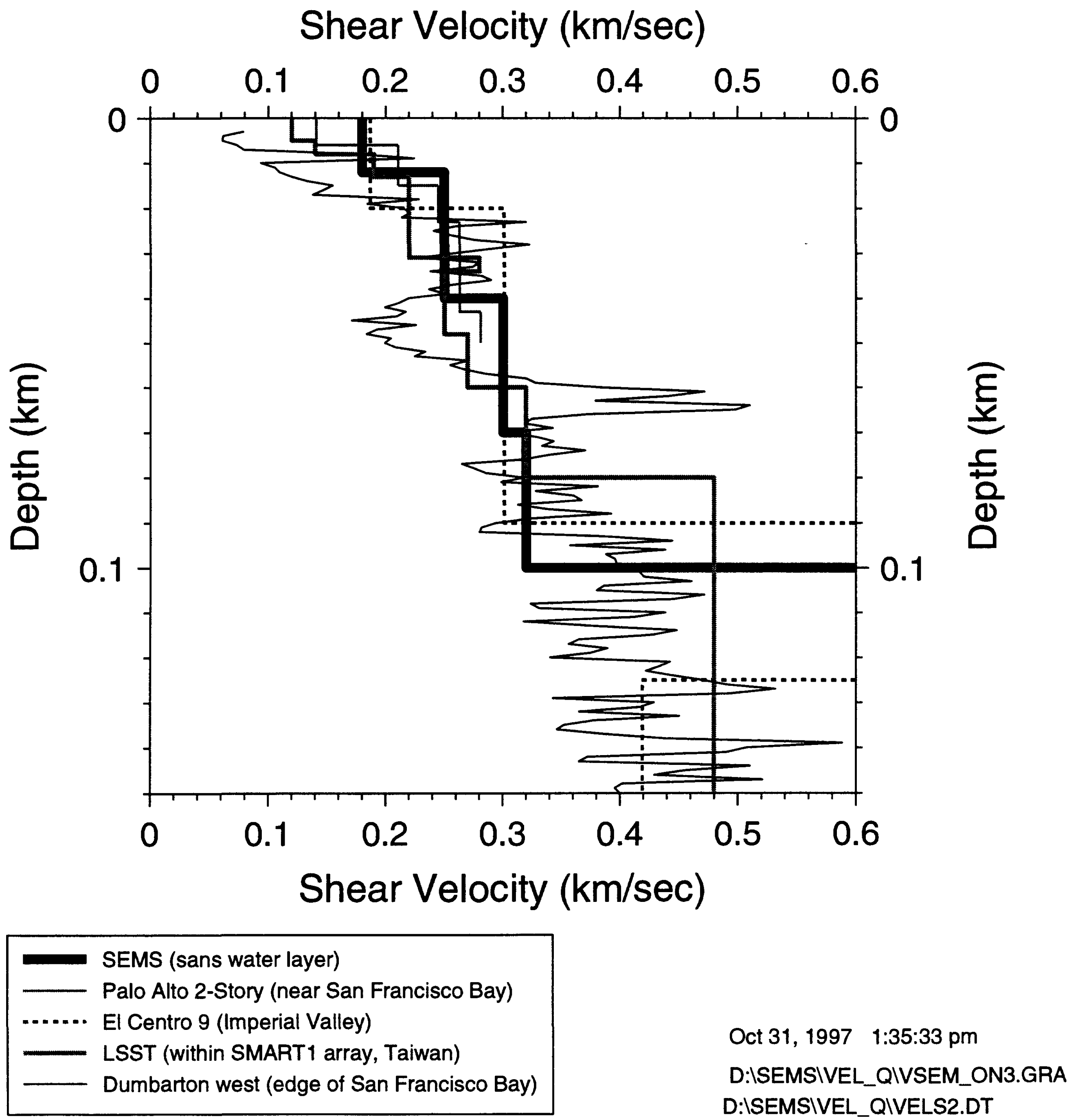

Figure 30. Shear-wave velocity estimated for an average offshore SEMS site and measured at several onshore sites for which the velocities are comparable to the estimated SEMS velocity.

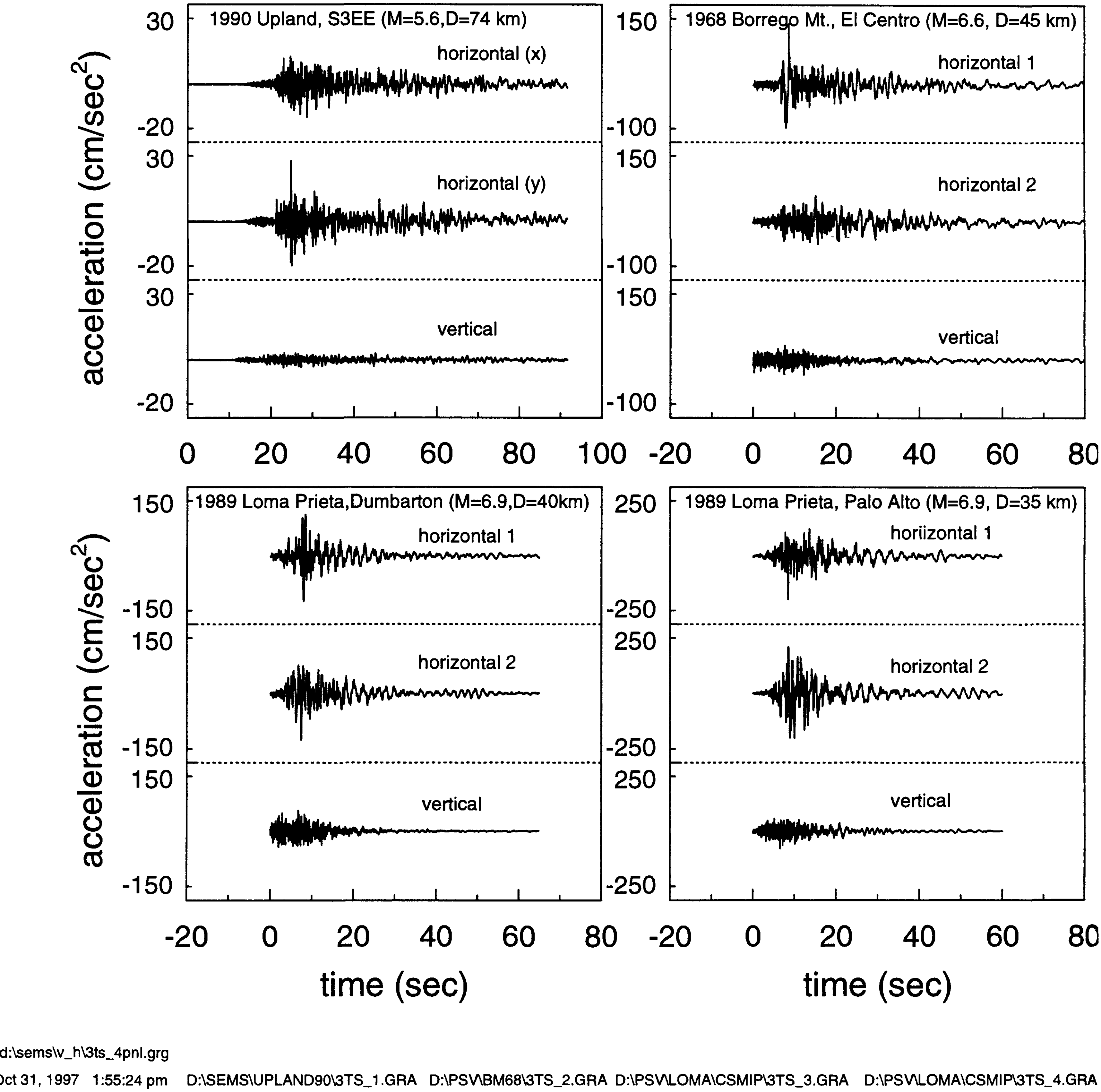

Figure 31. Three-component accelerograms for a SEMS recording (1990 Upland earthquake at S3EE) and three recordings made at onshore sites underlain by shear-wave velocities similar to those estimated to be beneath the SEMS sites.

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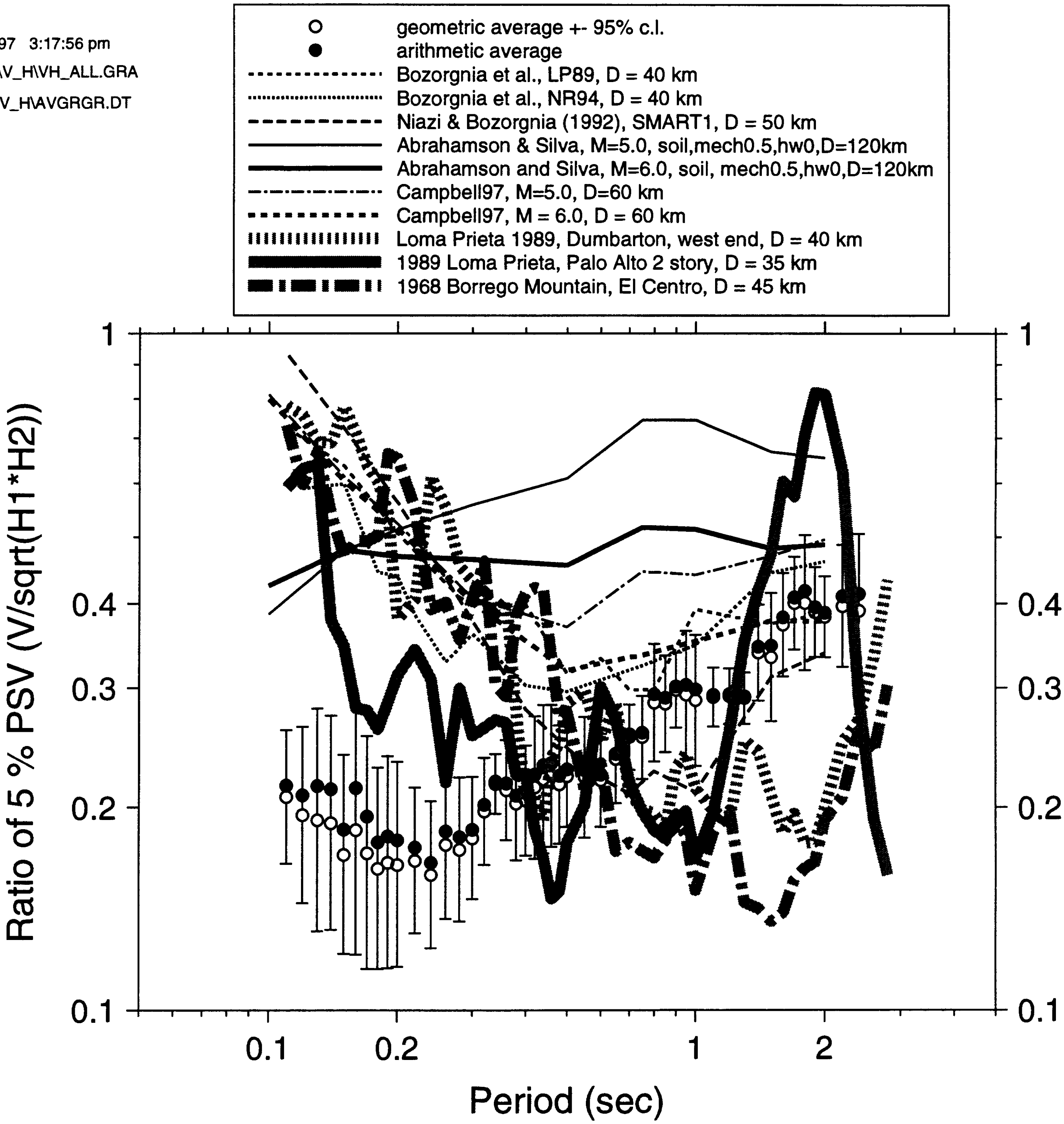

Figure 32. V/H ratios. This is the same as Figure 29, with the addition of V/H from three onshore sites underlain by velocities similar to those estimated to lie beneath the SEMS site. The ratios for these three sites are shown by the wide, grey lines (the bottom three in the legend).

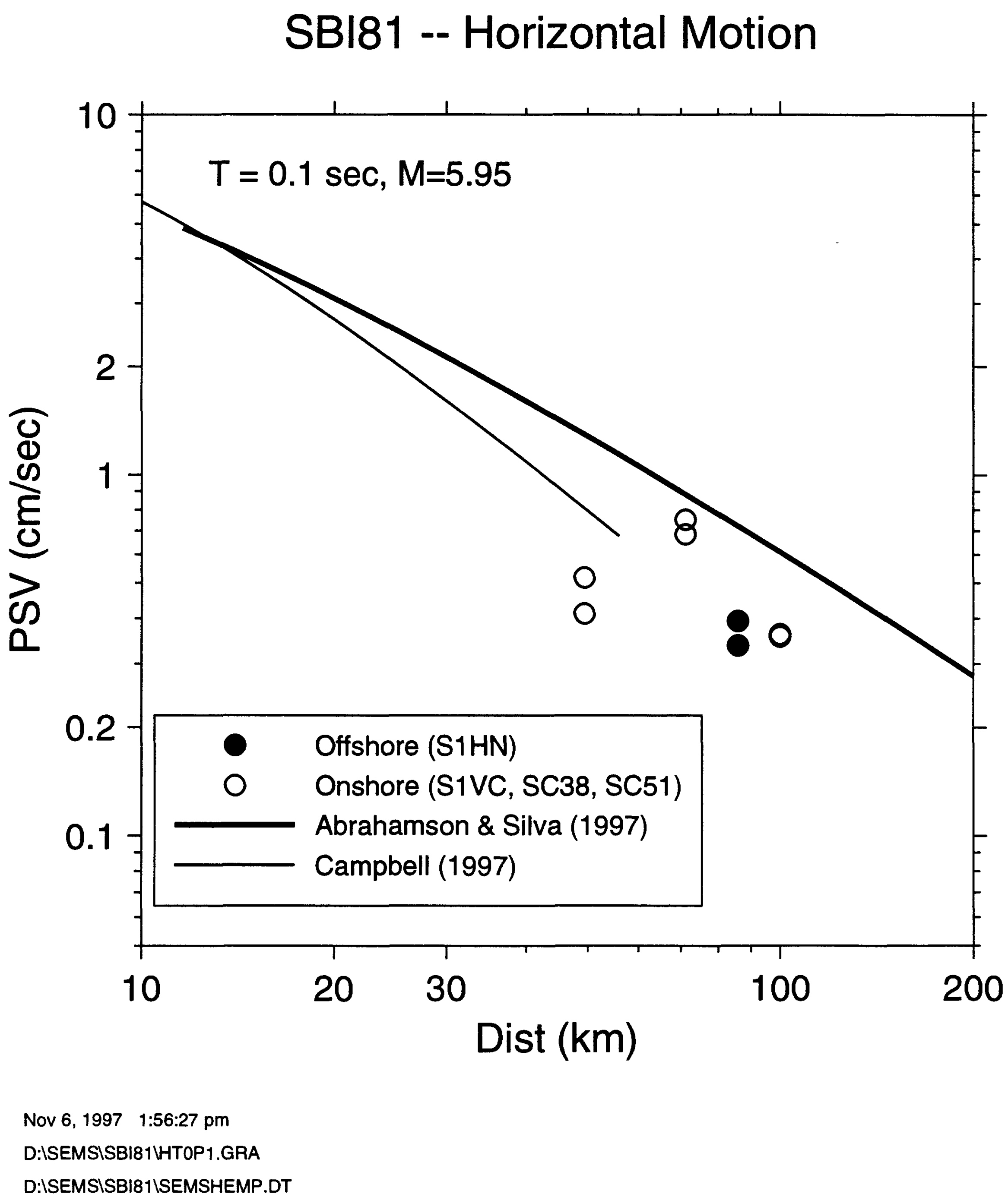

Figure 33. Horizontal-component, 5%-damped pseudo-velocity response spectra for 0.1 sec oscillator period as a function of epicentral distance for the 1981 Santa Barbara Island earthquake, compared with predictions from regression analyses.

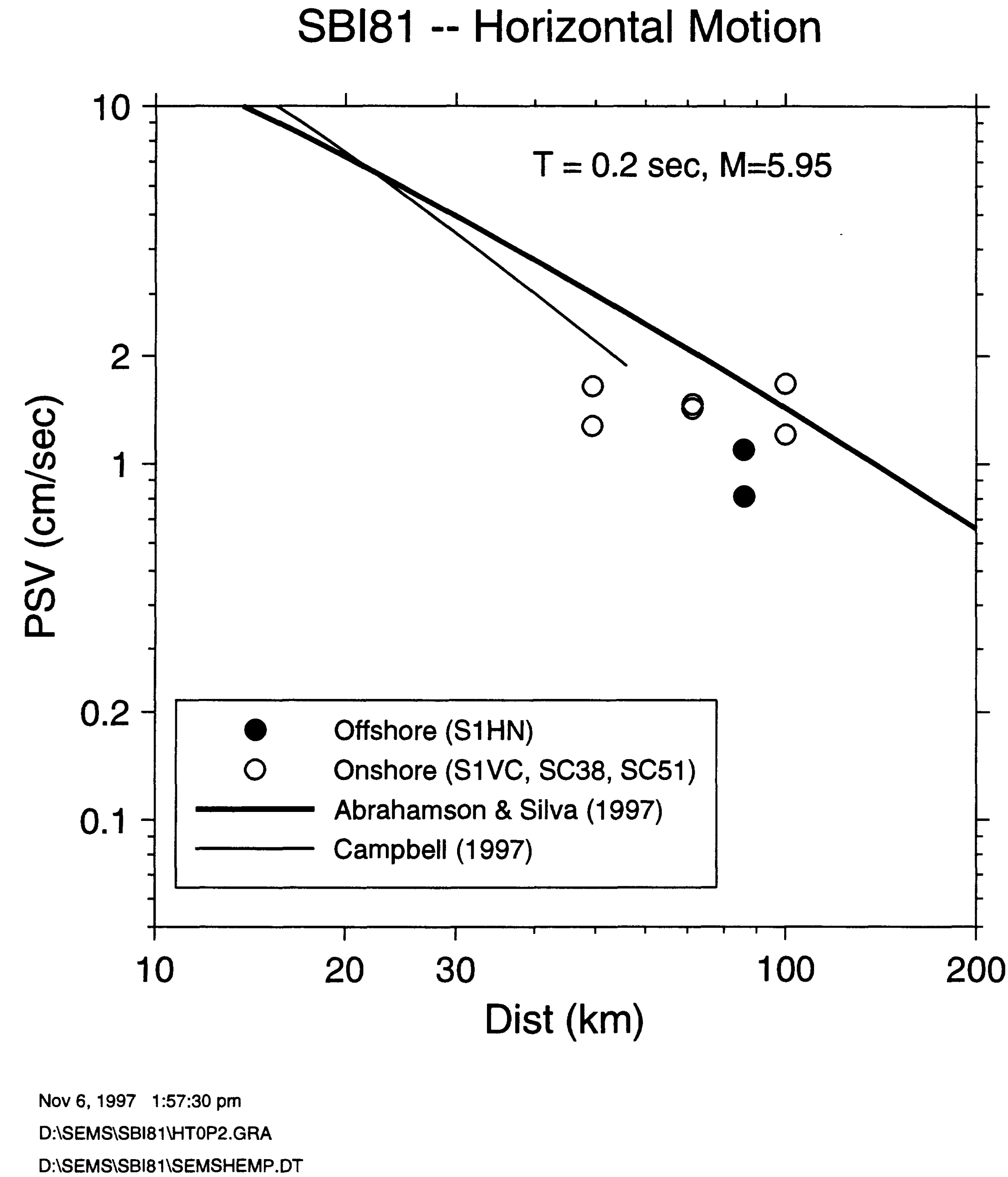

Figure 34. Horizontal-component, 5%-damped pseudo-velocity response spectra for 0.2 sec oscillator period as a function of epicentral distance for the 1981 Santa Barbara Island earthquake, compared with predictions from regression analyses.

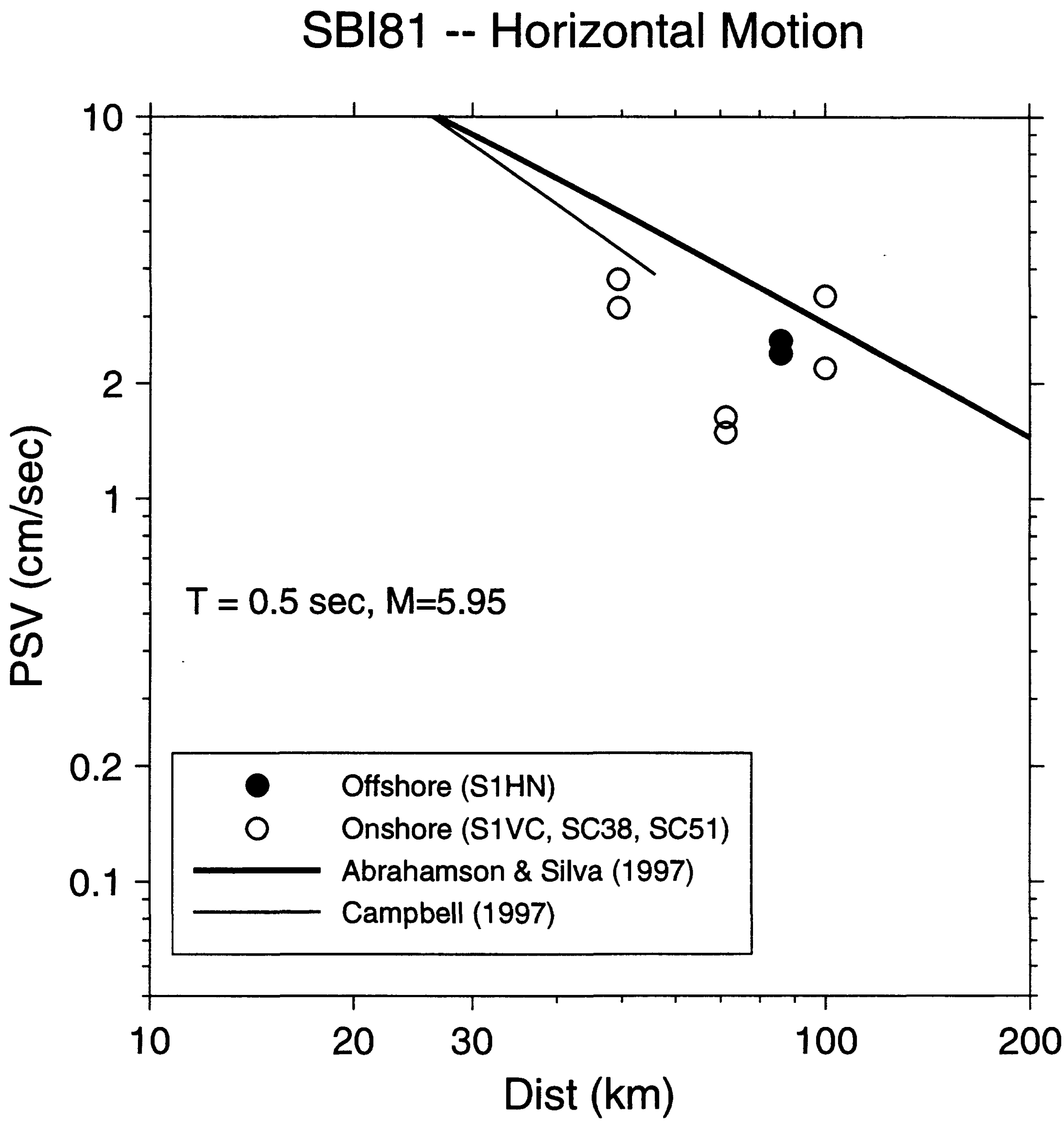

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Figure 35. Horizontal-component, 5%-damped pseudo-velocity response spectra for 0.5 sec oscillator period as a function of epicentral distance for the 1981 Santa Barbara Island earthquake, compared with predictions from regression analyses.

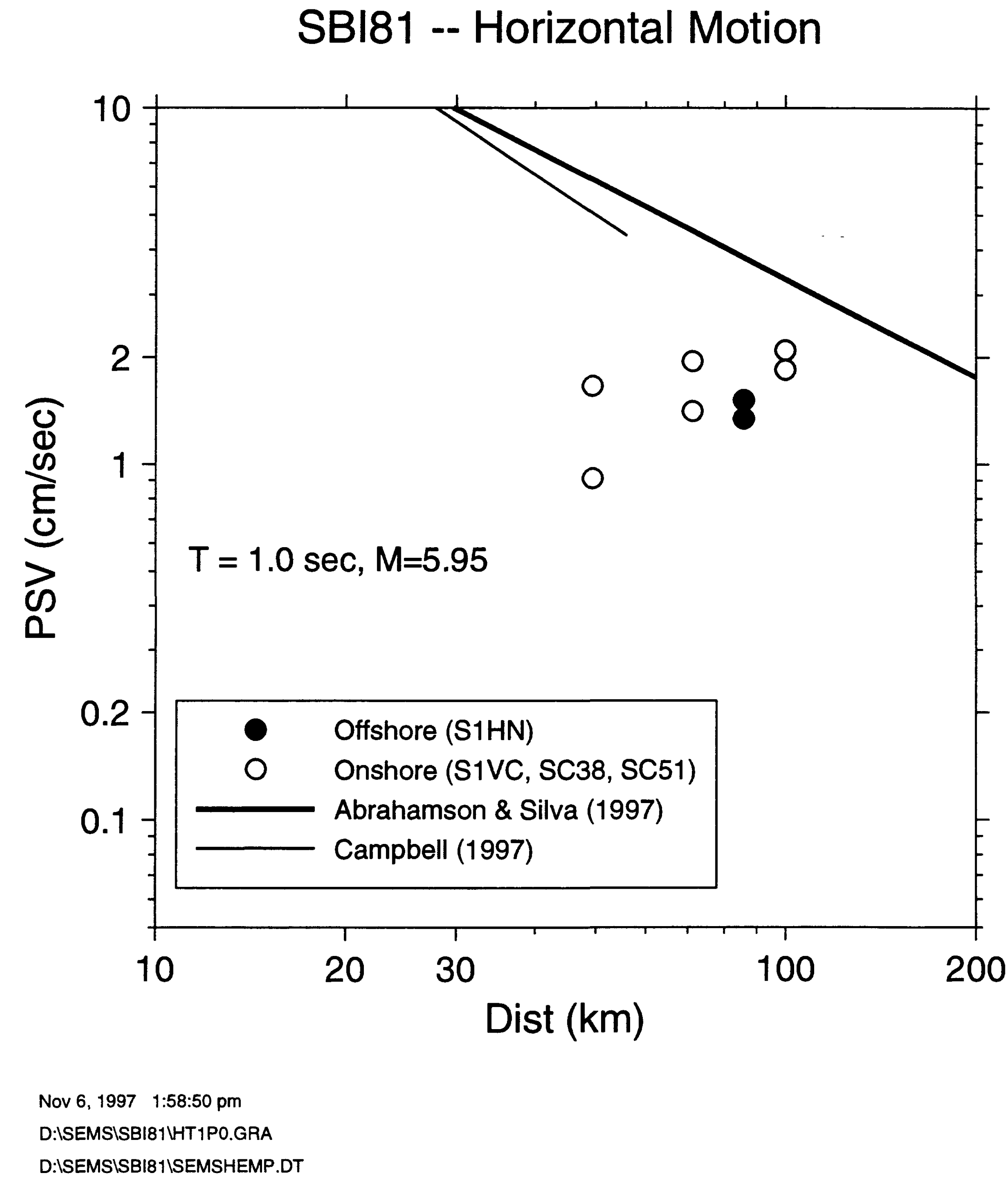

Figure 36. Horizontal-component, 5%-damped pseudo-velocity response spectra for 1.0 sec oscillator period as a function of epicentral distance for the 1981 Santa Barbara Island earthquake, compared with predictions from regression analyses.

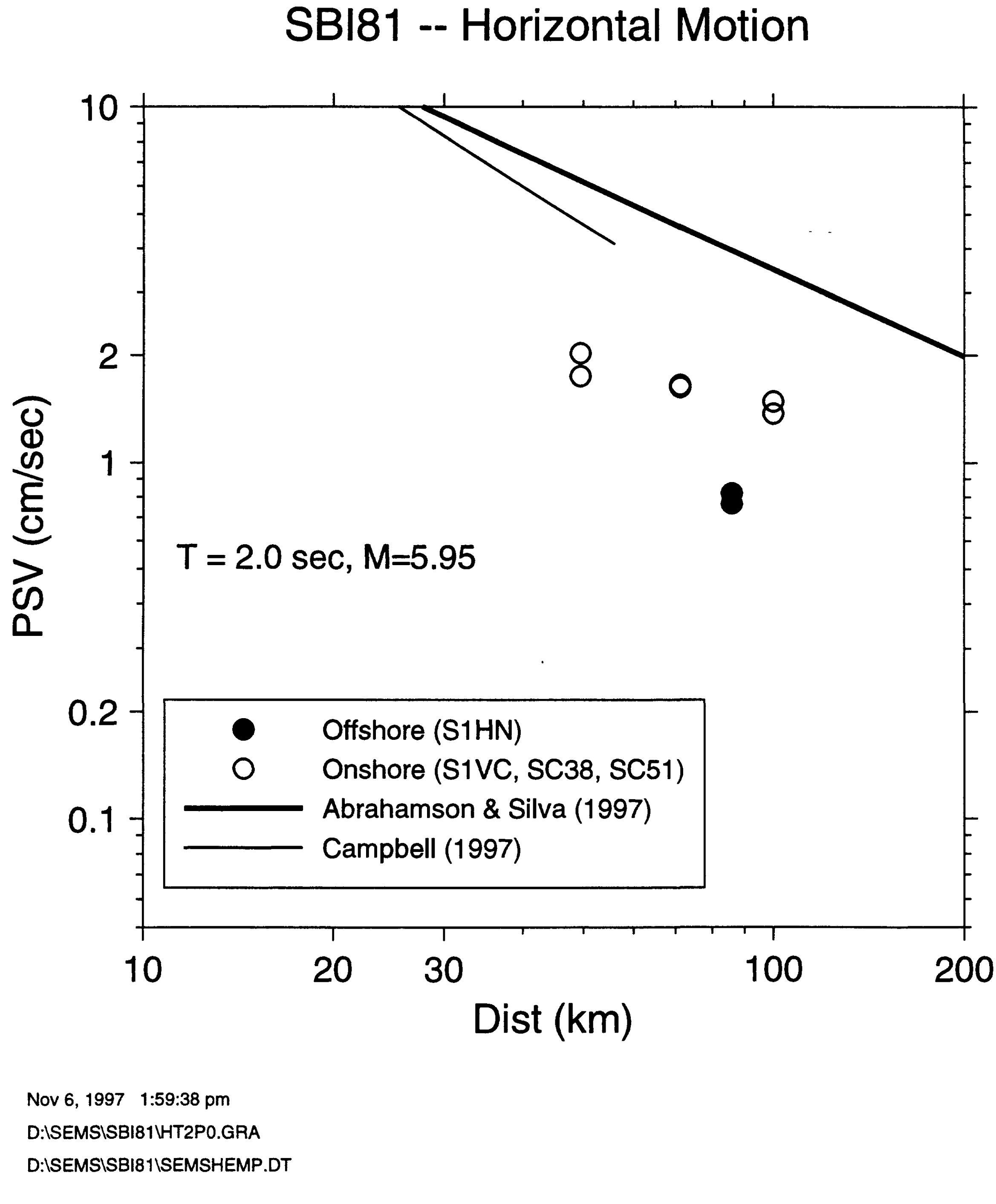

Figure 37. Horizontal-component, 5%-damped pseudo-velocity response spectra for 2.0 sec oscillator period as a function of epicentral distance for the 1981 Santa Barbara Island earthquake, compared with predictions from regression analyses.

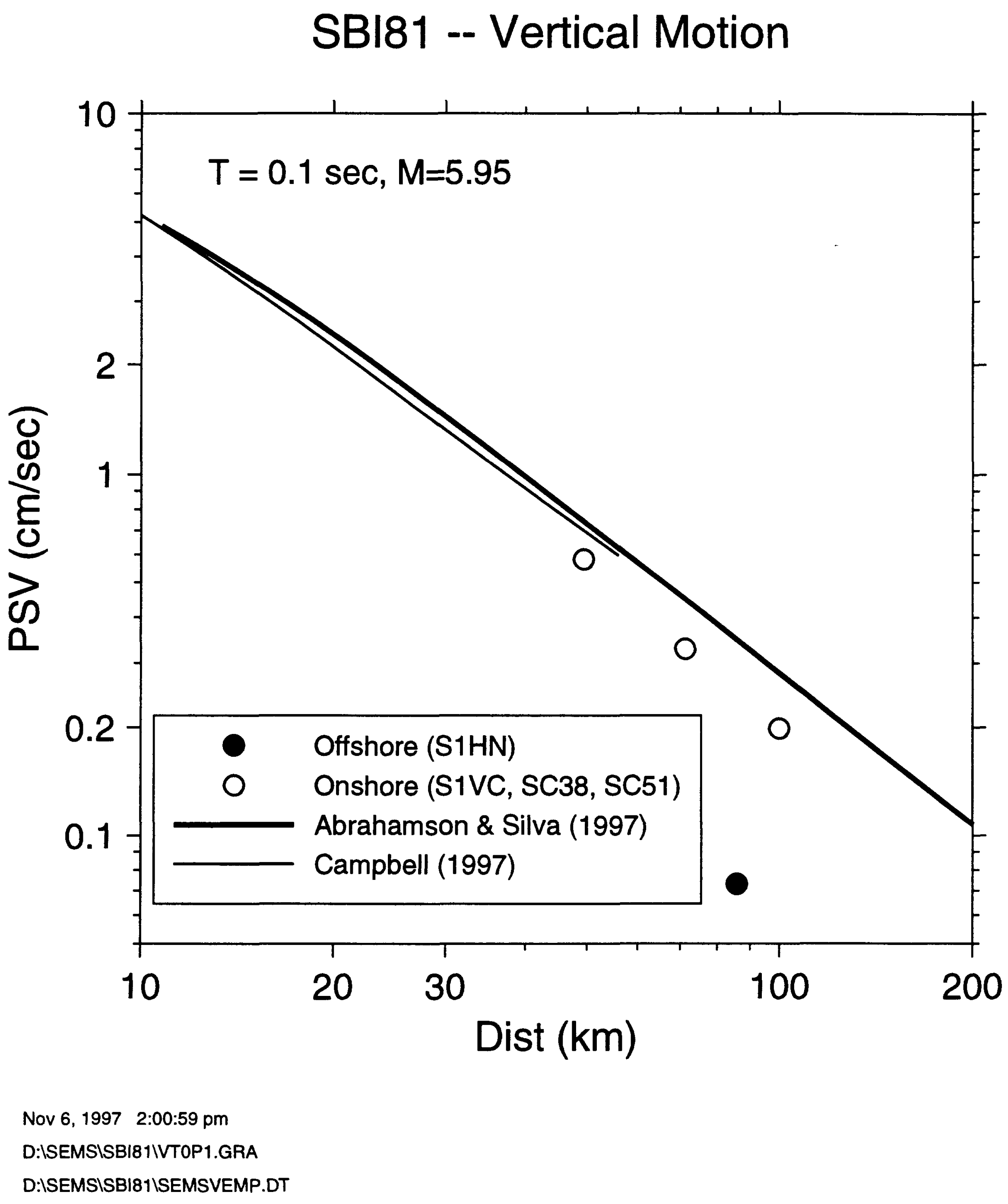

Figure 38. Vertical-component, 5%-damped pseudo-velocity response spectra for 0.1 sec oscillator period as a function of epicentral distance for the 1981 Santa Barbara Island earthquake, compared with predictions from regression analyses.

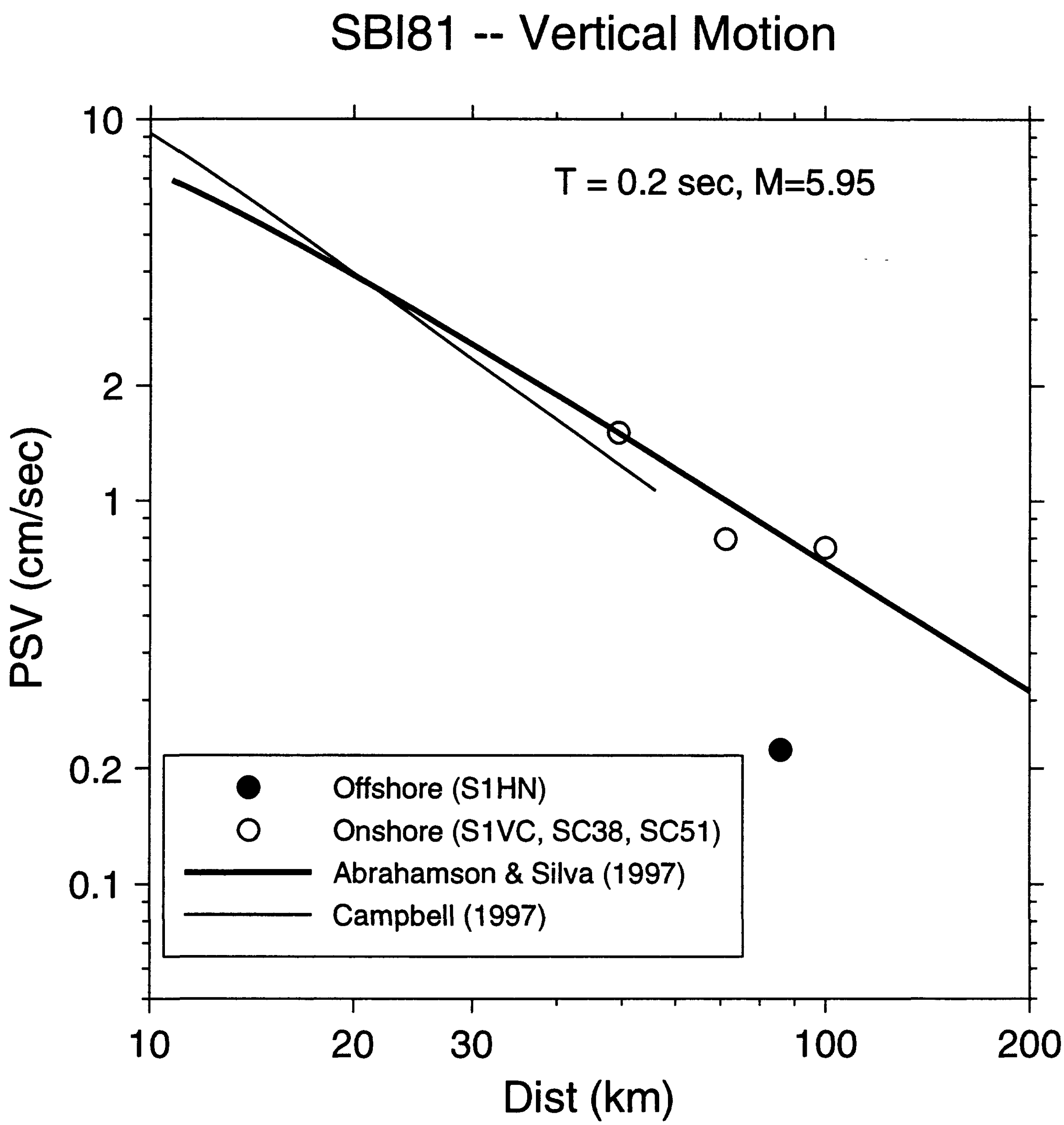

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Figure 39. Vertical-component, 5%-damped pseudo-velocity response spectra for 0.2 sec oscillator period as a function of epicentral distance for the 1981 Santa Barbara Island earthquake, compared with predictions from regression analyses.

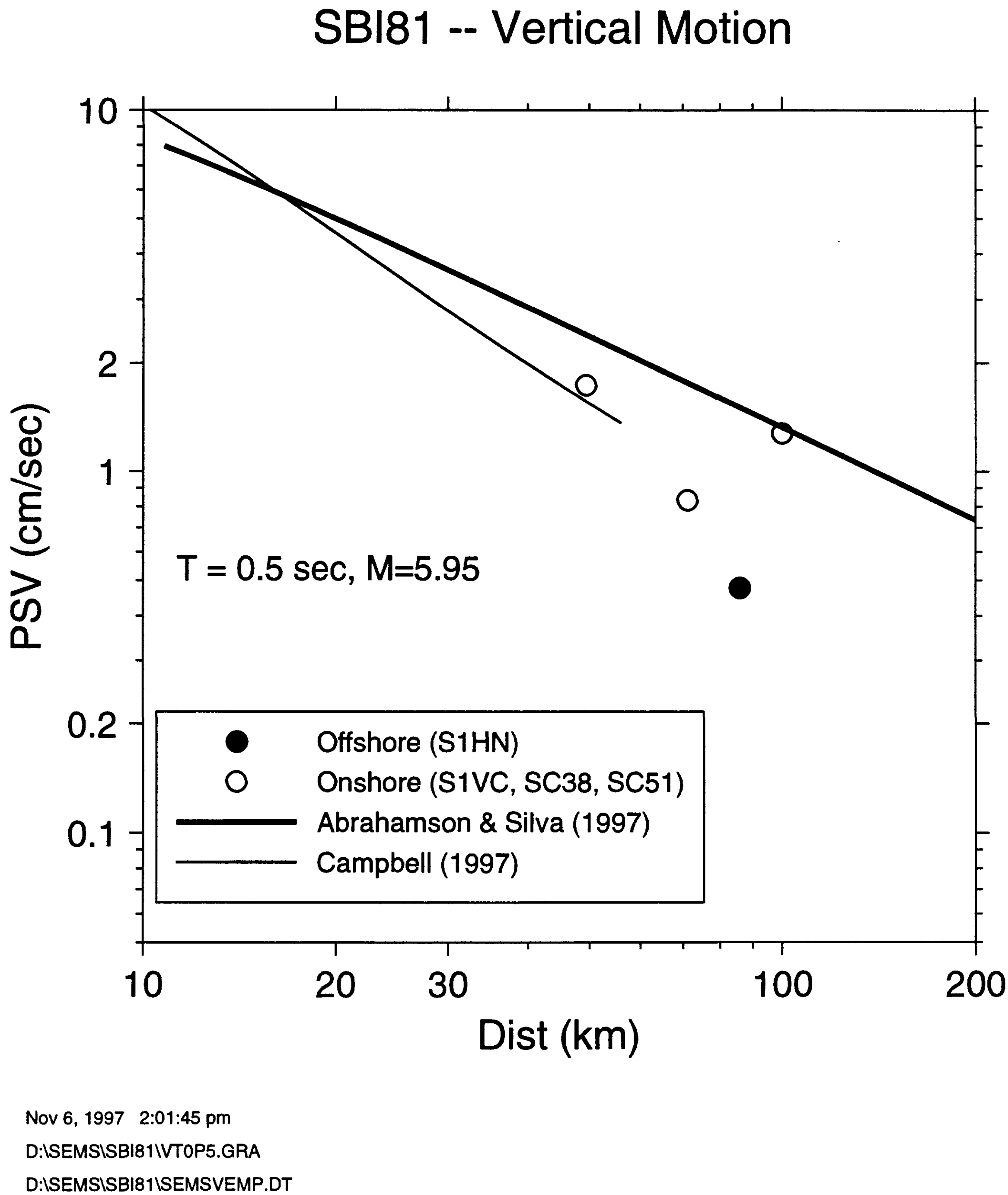

Figure 40. Vertical-component, 5%-damped pseudo-velocity response spectra for 0.5 sec oscillator period as a function of epicentral distance for the 1981 Santa Barbara Island earthquake, compared with predictions from regression analyses.

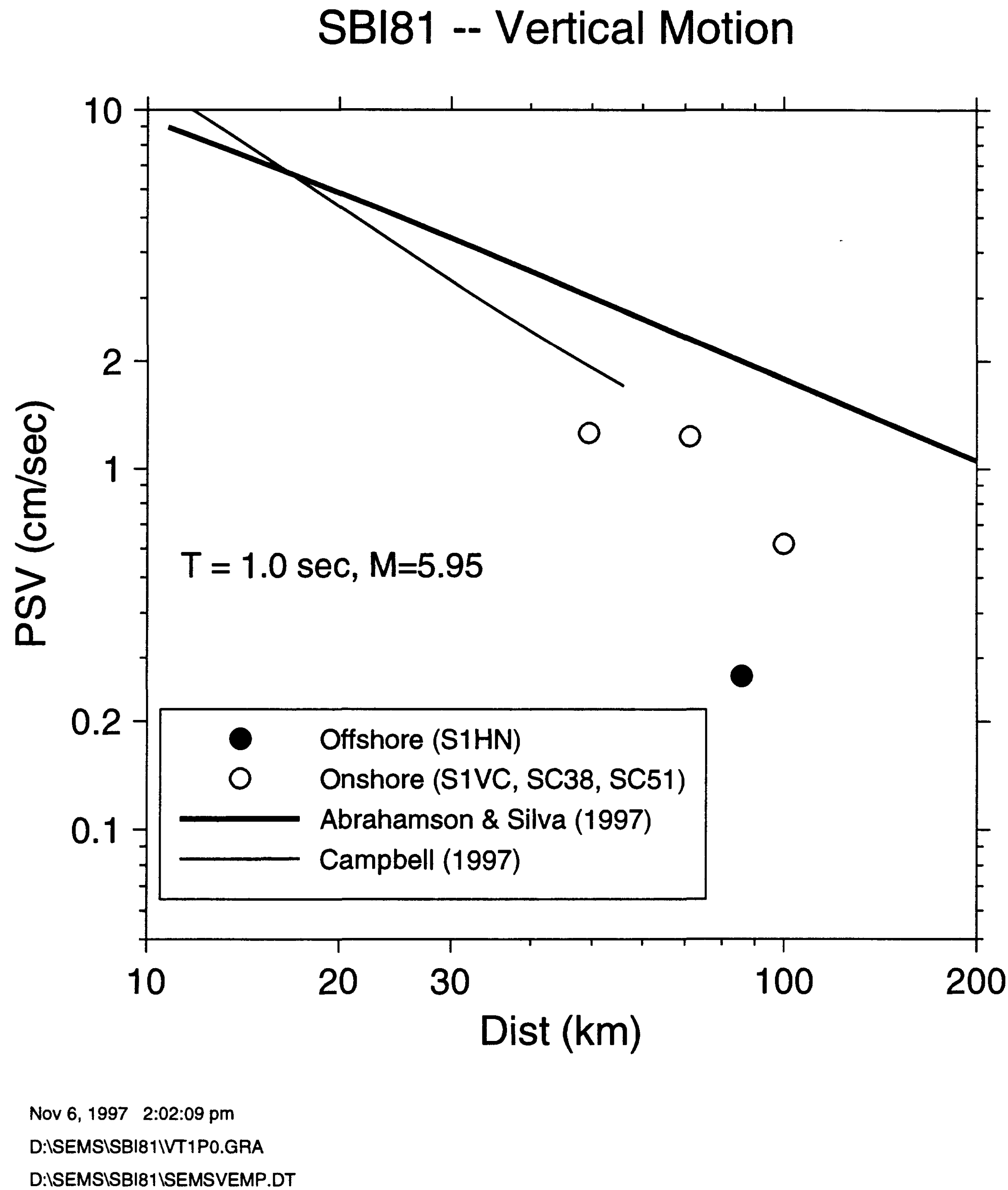

Figure 41. Vertical-component, 5%-damped pseudo-velocity response spectra for 1.0 sec oscillator period as a function of epicentral distance for the 1981 Santa Barbara Island earthquake, compared with predictions from regression analyses.

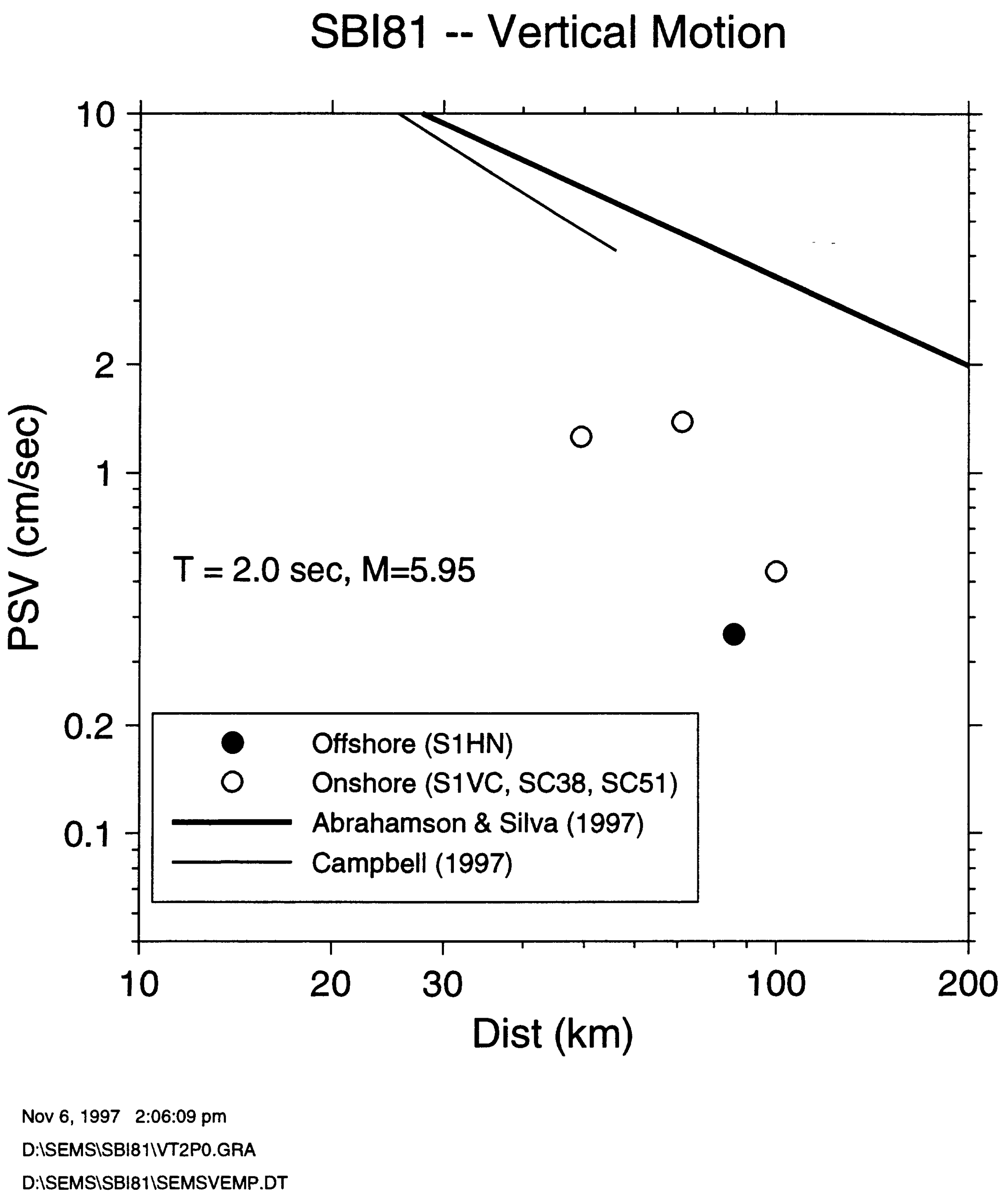

Figure 42. Vertical-component, 5%-damped pseudo-velocity response spectra for 2.0 sec oscillator period as a function of epicentral distance for the 1981 Santa Barbara Island earthquake, compared with predictions from regression analyses.

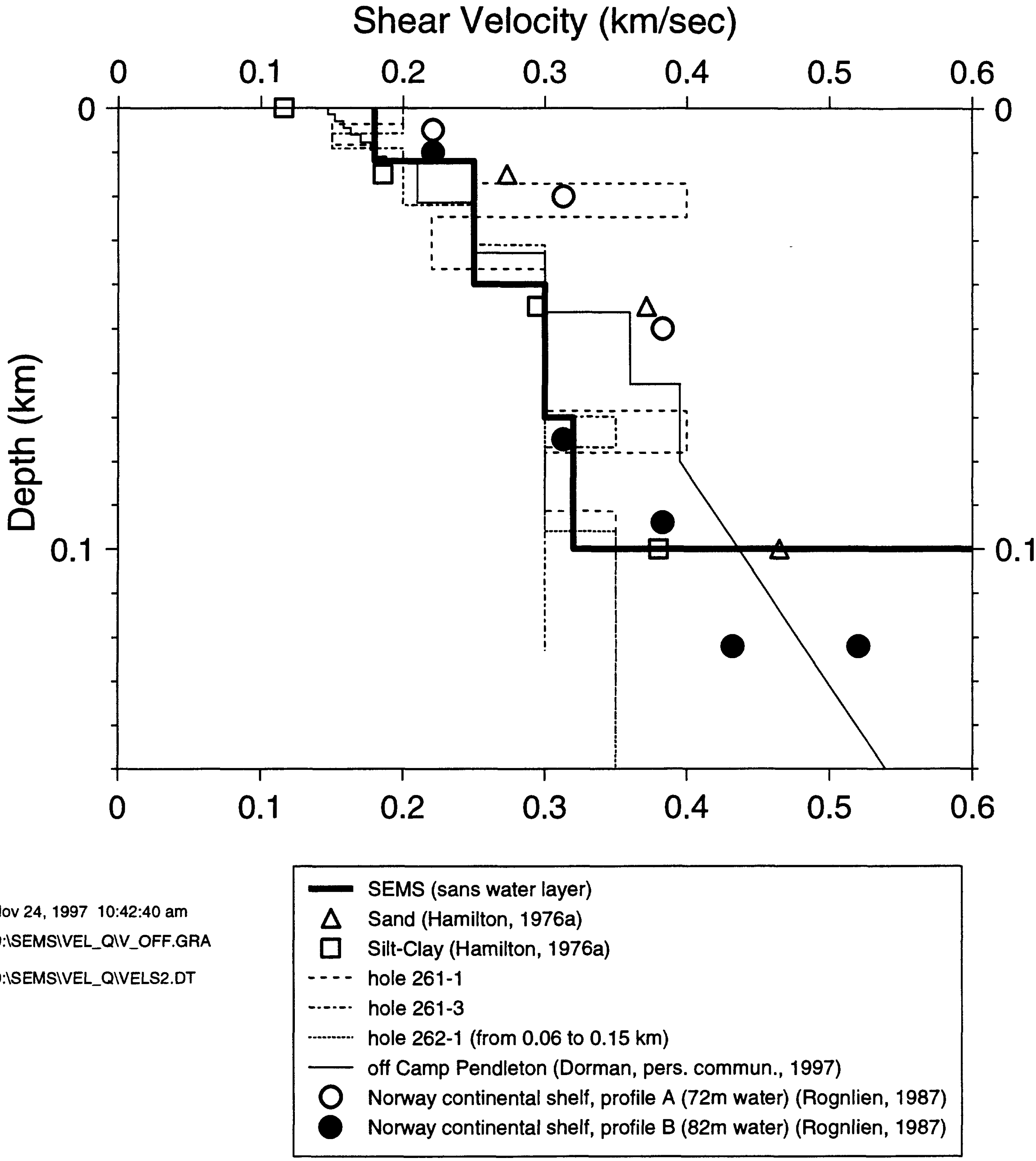

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Figure 43. Shear-wave velocity to 0.15 km from offshore sites and adopted SEMS velocity. The velocities for holes 261-1, 261-3, and 262-1 were estimated from standard penetration values near SEMS site S2EE. The velocities for Norwegian sites are point values for a series of representative depths; the actual profiles are characterized by linear velocity gradients with depth.

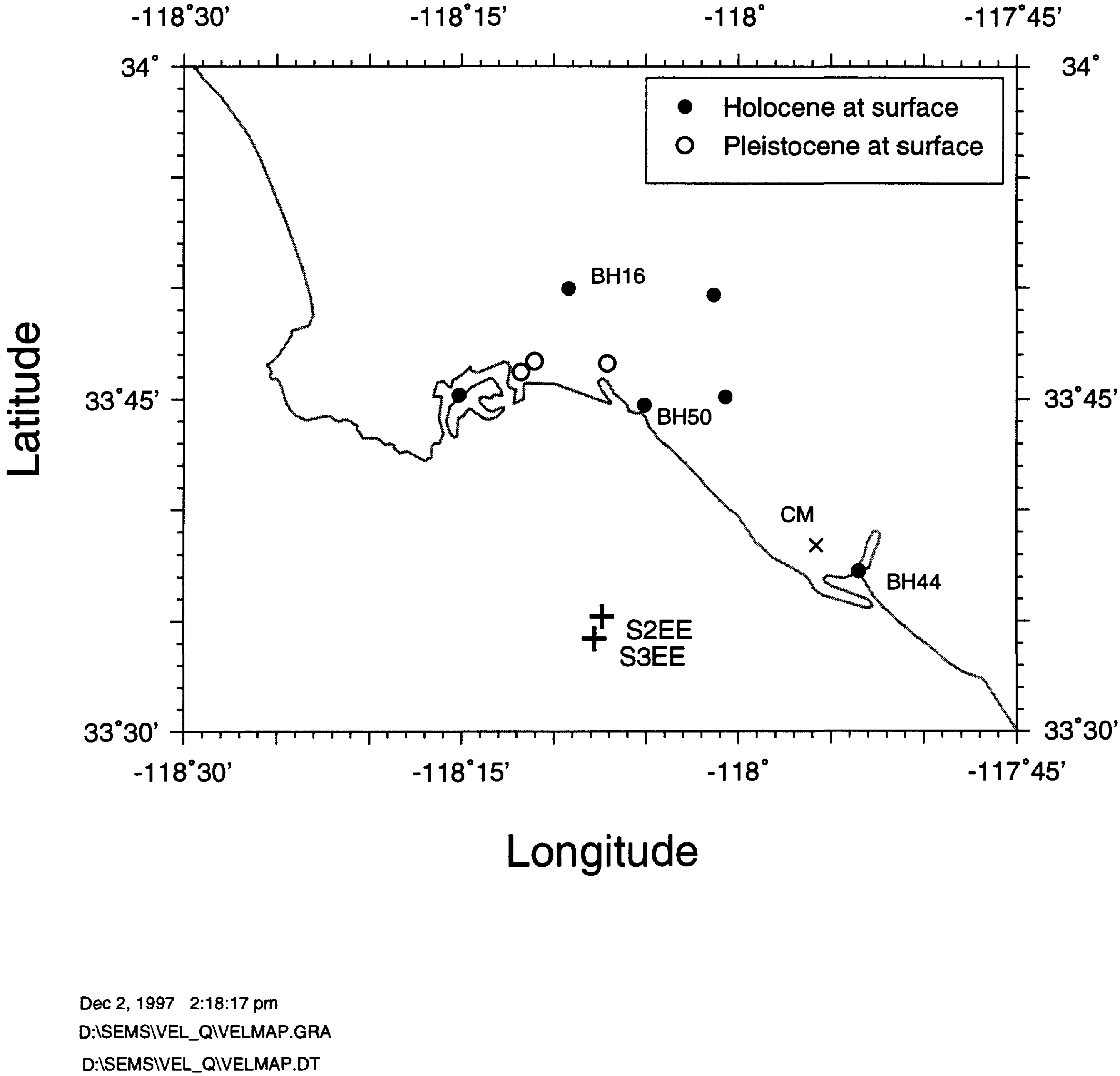

Figure 44. Map of borehole sites (circles) near the SEMS sites offshore of Long Beach (pluses). Boreholes BH16, BH44, and BH50 are discussed in the text; "CM" is the strong-motion station at Costa Mesa (see also Figure 1).

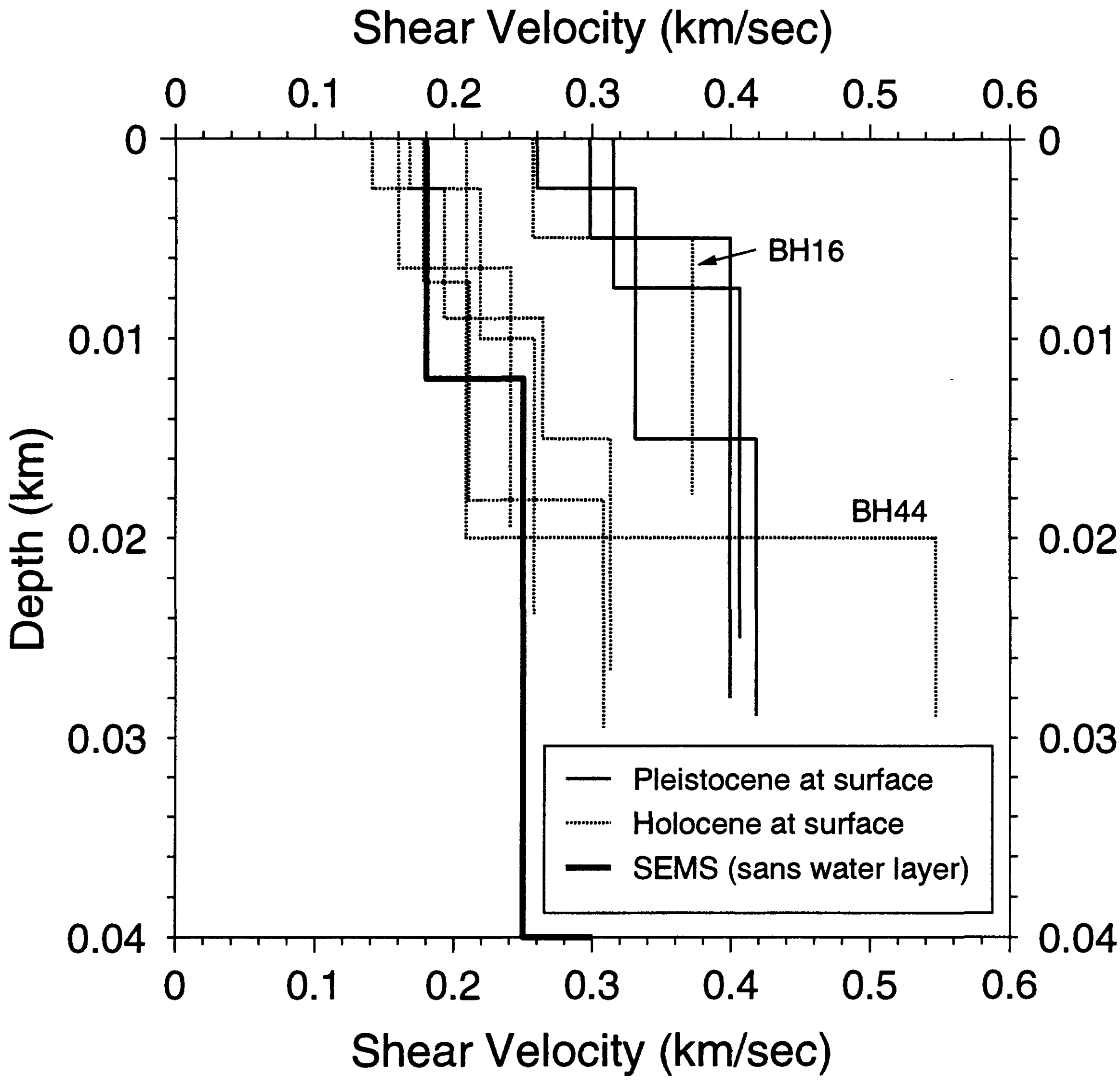

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Figure 45. Shear-wave velocity to 0.04 km from borehole sites near Long Beach and velocity profile adopted for theoretical calculations at the SEMS sites.

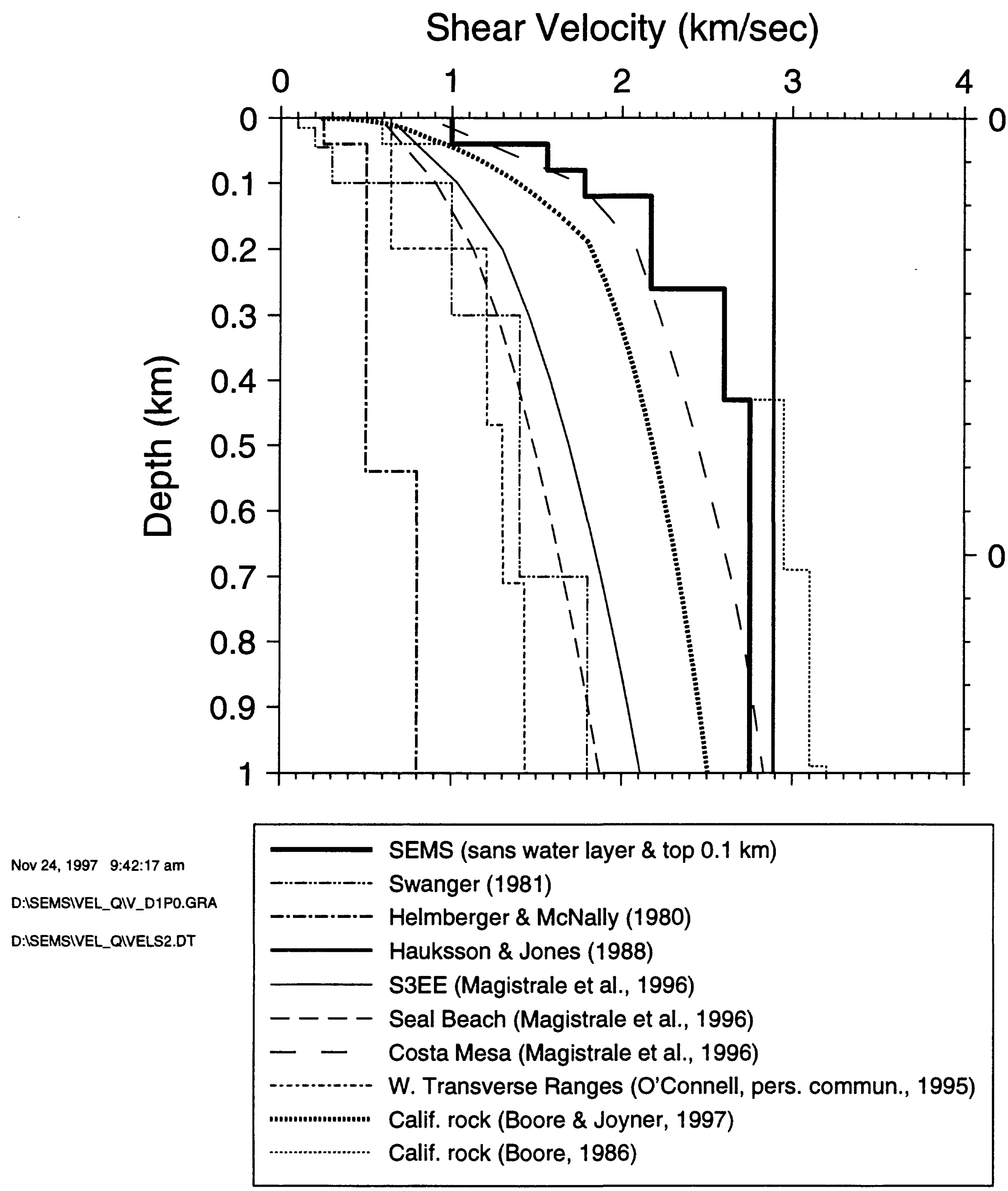

Figure 46. Shear-wave velocity to 1.0 km from several sources, compared to the adopted SEMS model, stripped of the water layer and the material in the first 0.1 km beneath the seafloor. The Hauksson and Jones values were derived from their P-wave velocities, assuming a Poisson's ratio of 0.25.

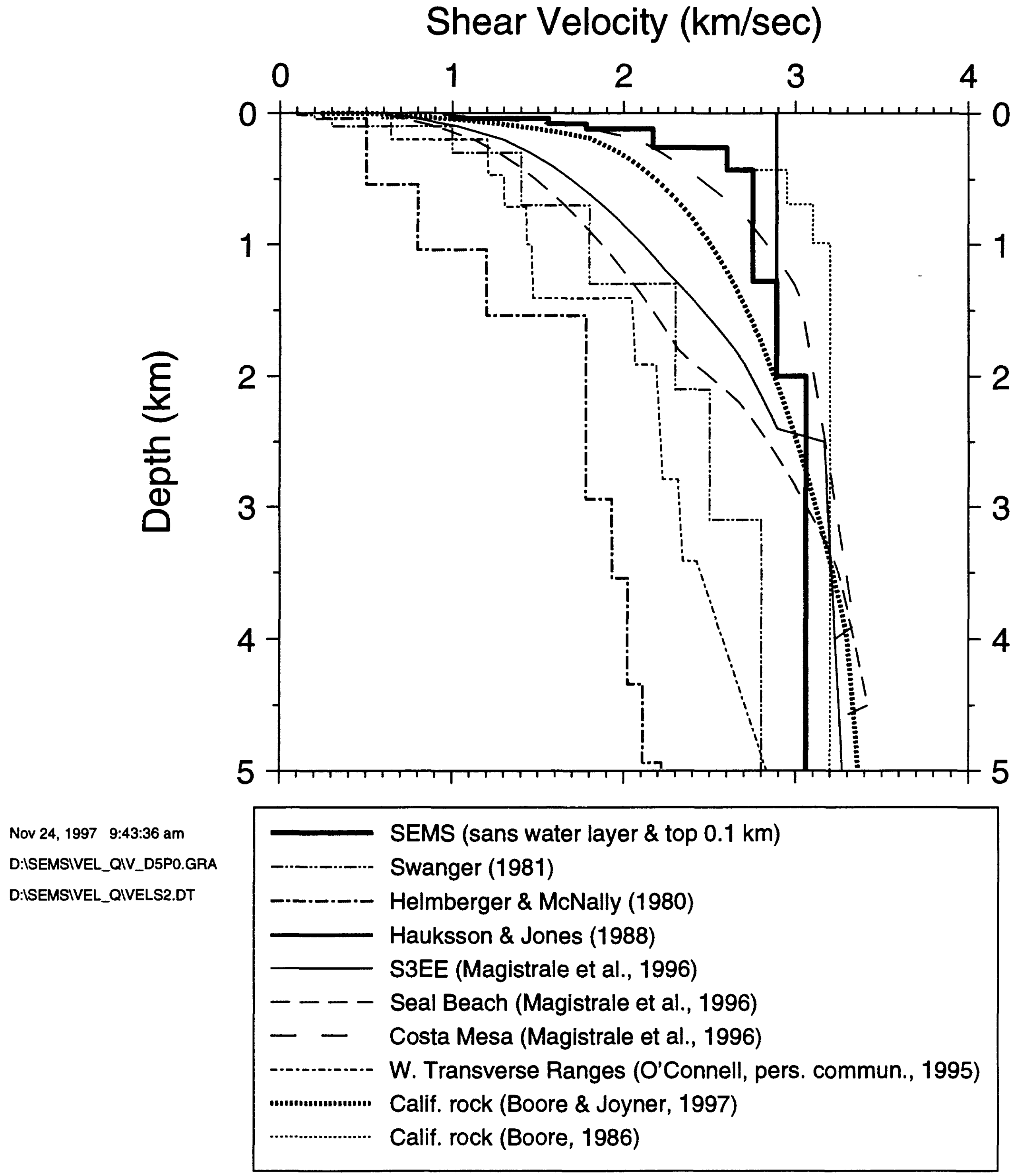

Figure 47. Shear-wave velocity to 5.0 km from several sources, compared to the adopted SEMS model, stripped of the water layer and the material in the first 0.1 km beneath the seafloor. The Hauksson and Jones values were derived from their P-wave velocities, assuming a Poisson's ratio of 0.25.

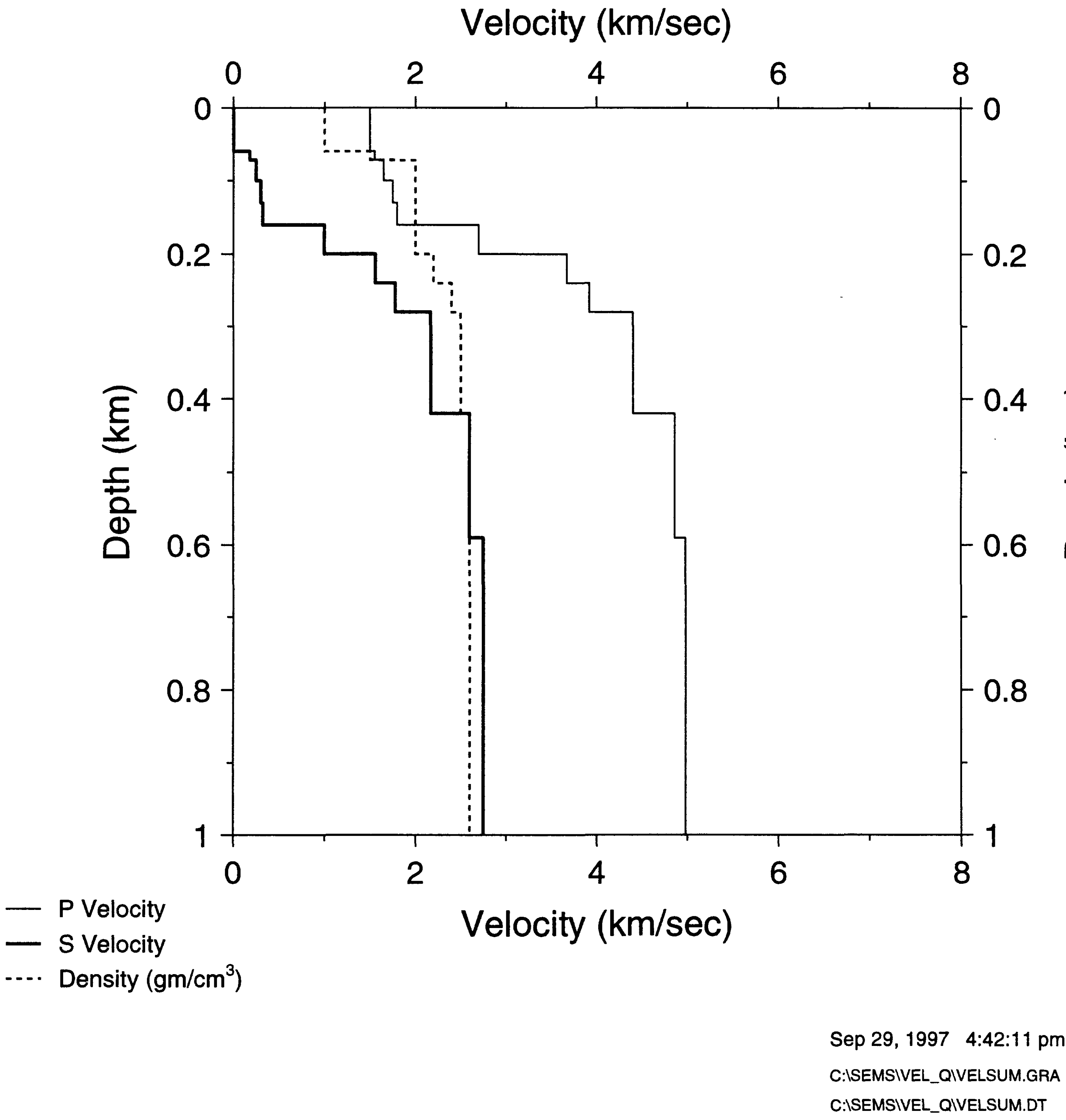

Figure 48. SEMS shear and compressional wave velocity and density used in the theoretical wave propagation calculations.

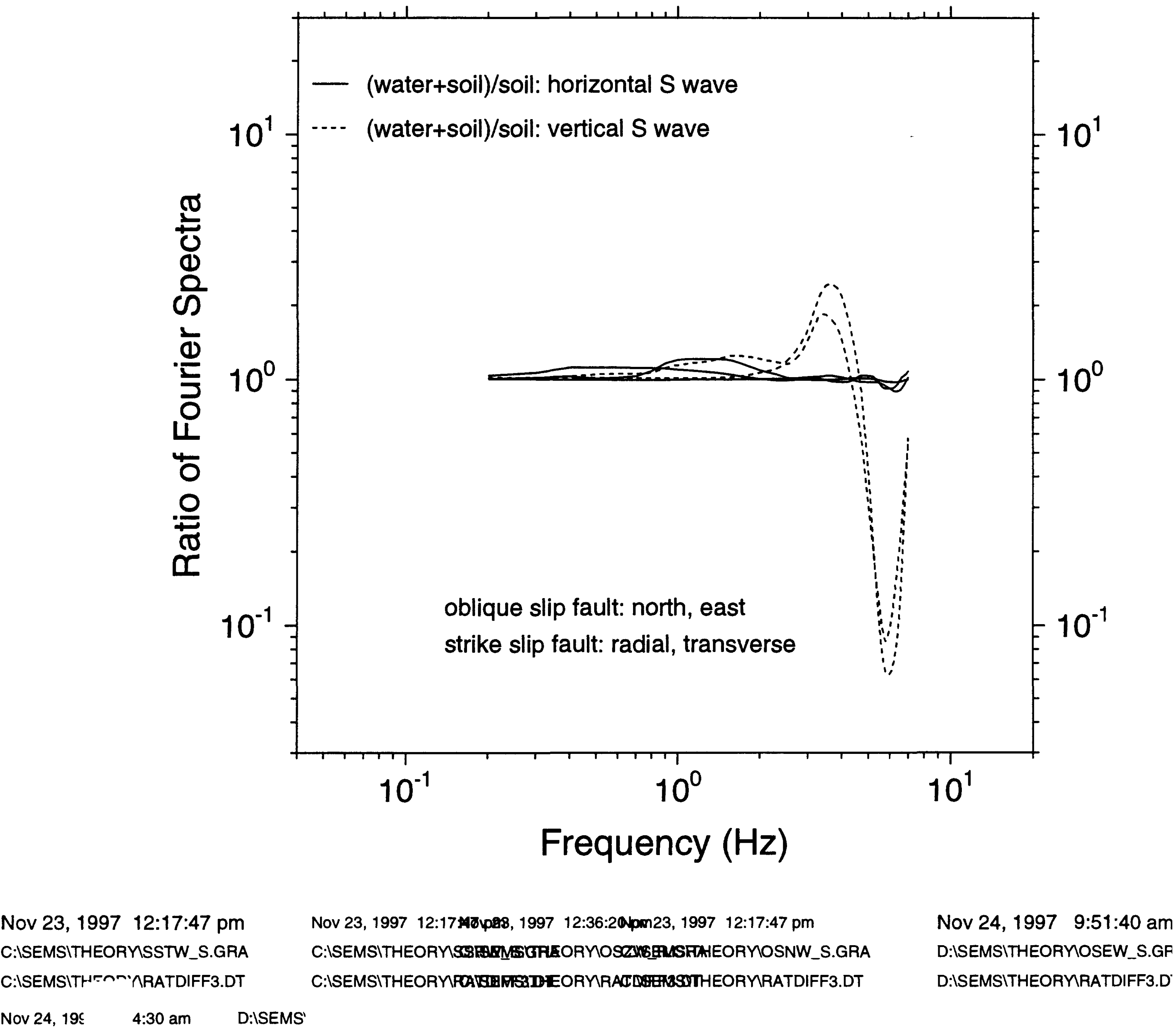

Figure 49. Ratios of Fourier spectra for the S-wave portion of horizontal-component (solid lines) and vertical-component (dashed lines) synthetic seismograms computed for various velocity models and fault orientations (because the results are so similar, the different orientations are not specifically identified). Shown are the ratio of spectra for models with and without the water layer. The figure shows that the water layer only has influence on the vertical-component motions. For the ocean bottom situation and the water depths of most relevance to the SEMS recordings analyzed in this report (about 70m; see Table 1), the effect of the water layer is only important for frequencies higher than about 2.5 Hz.

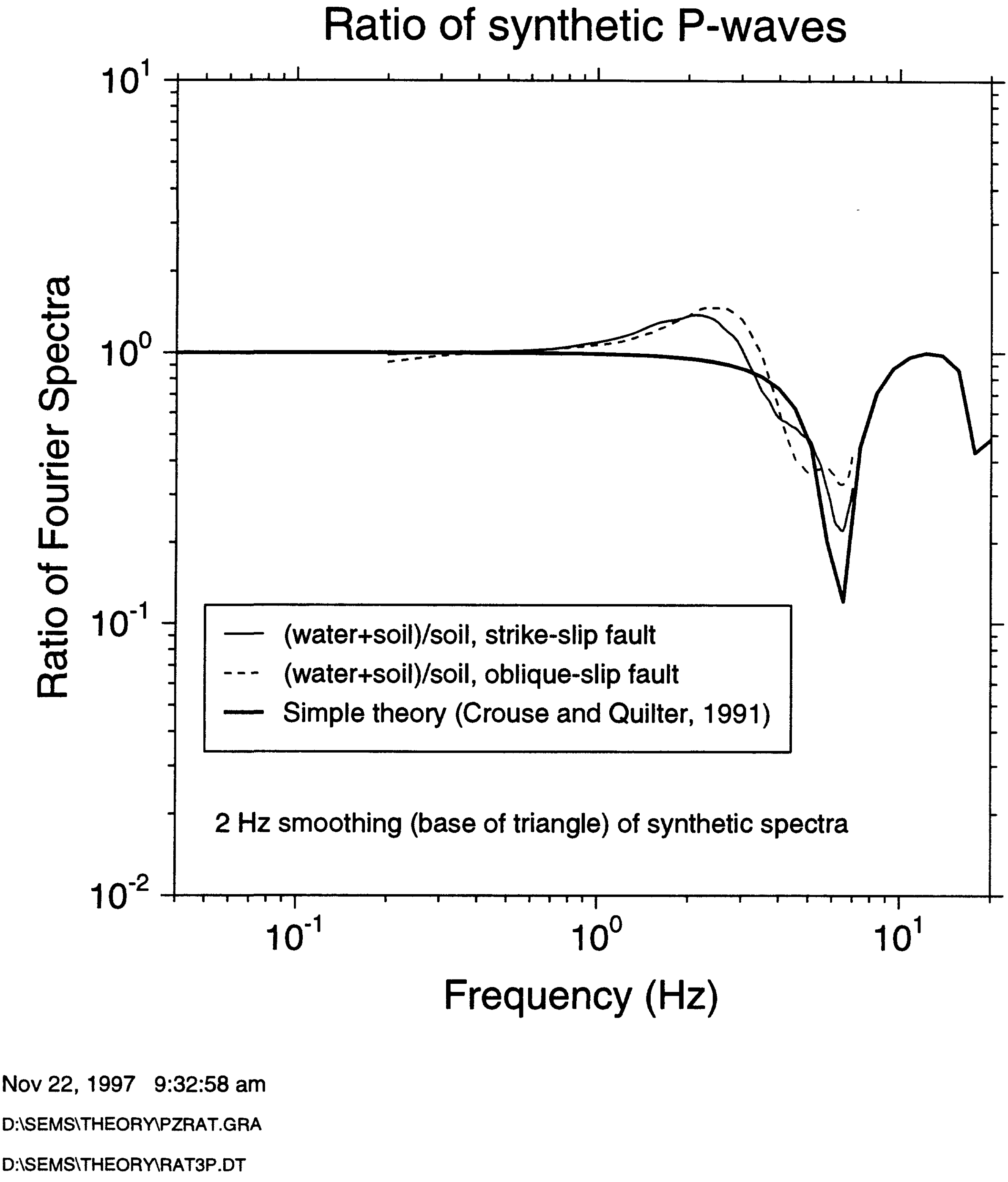

Figure 50. Ratios of Fourier spectra for the P-wave portion of vertical-component synthetic seismograms computed for various velocity models and fault orientations. Also shown is the prediction from a simple model of a P-wave vertically incident on a water layer overlying an elastic halfspace (Crouse and Quilter, 1991).

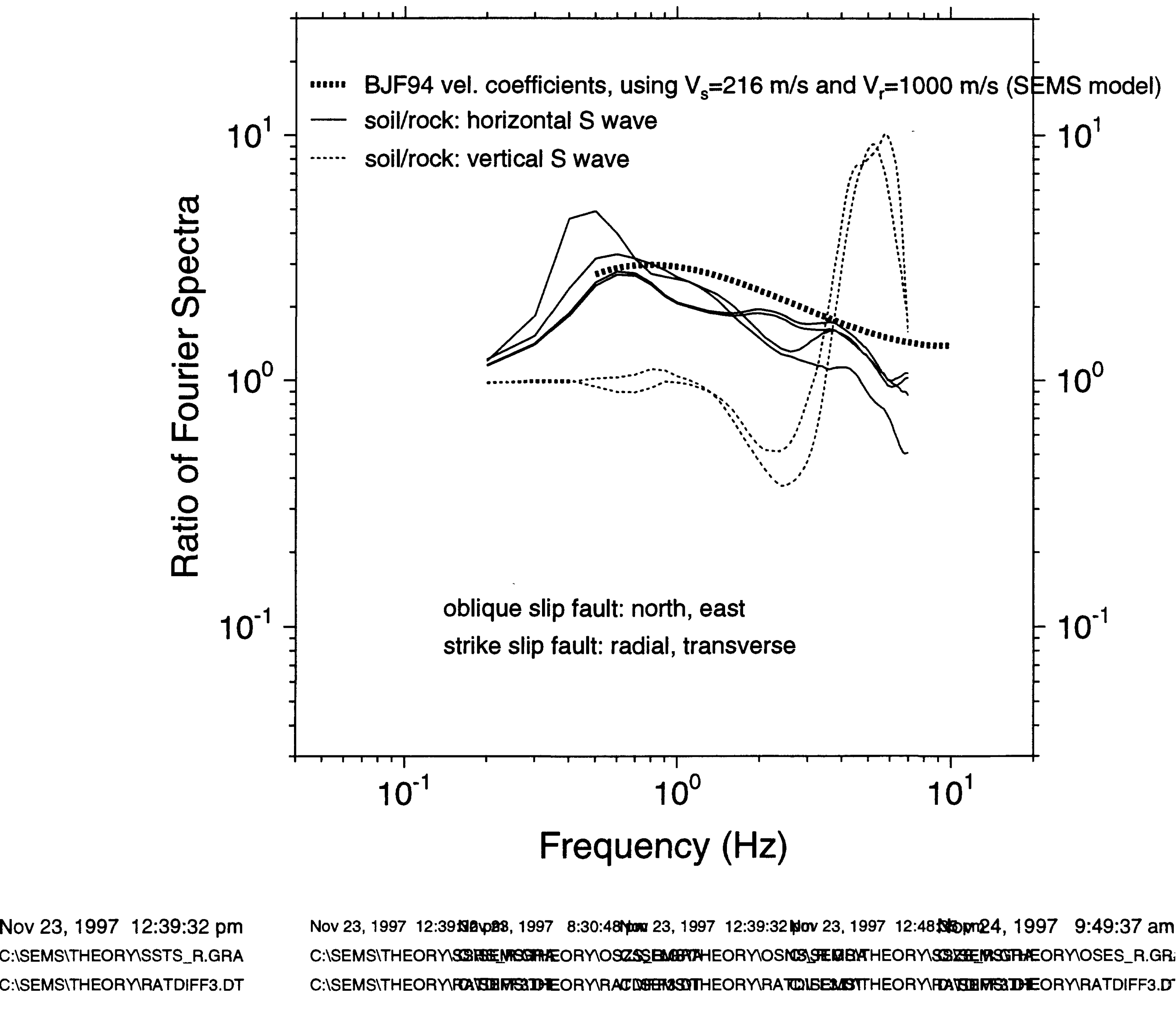

Figure 51. Ratios of Fourier spectra for the S-wave portion of horizontal-component (solid lines) and vertical-component (dashed lines) synthetic seismograms computed for various velocity models and fault orientations (because the results are so similar, the different orientations are not specifically identified). Shown are the ratio of spectra for models with and without the upper 0.1 km of sediments ("soil" and "rock"). The heavy dashed line is the soil-to-rock coefficients for horizontal-component response spectra found by Boore *et al.* (1994) from regression analysis.

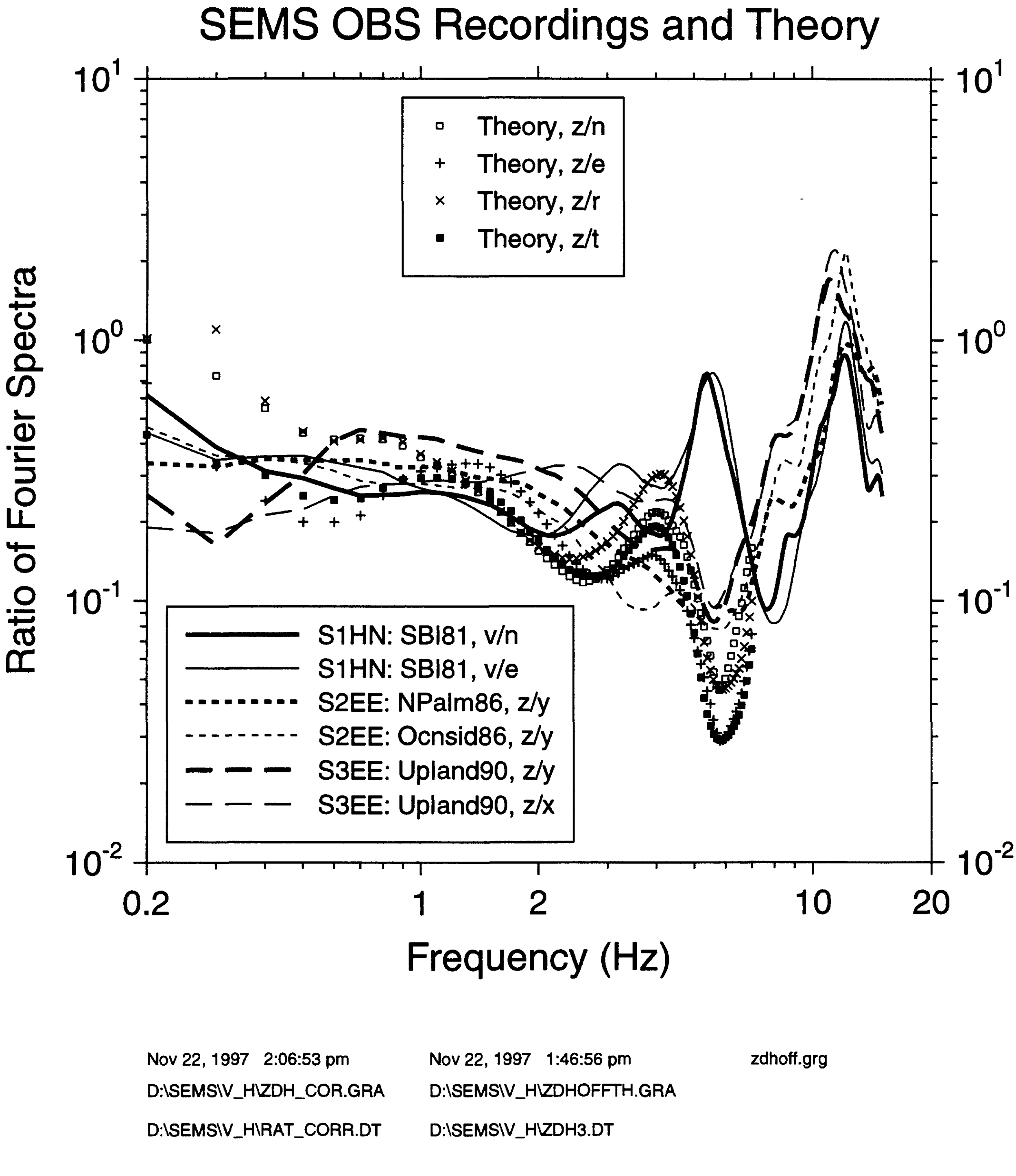

Figure 52. V/H ratios of Fourier amplitude spectra of the S-wave portion of offshore recordings, compared to theoretical predictions.

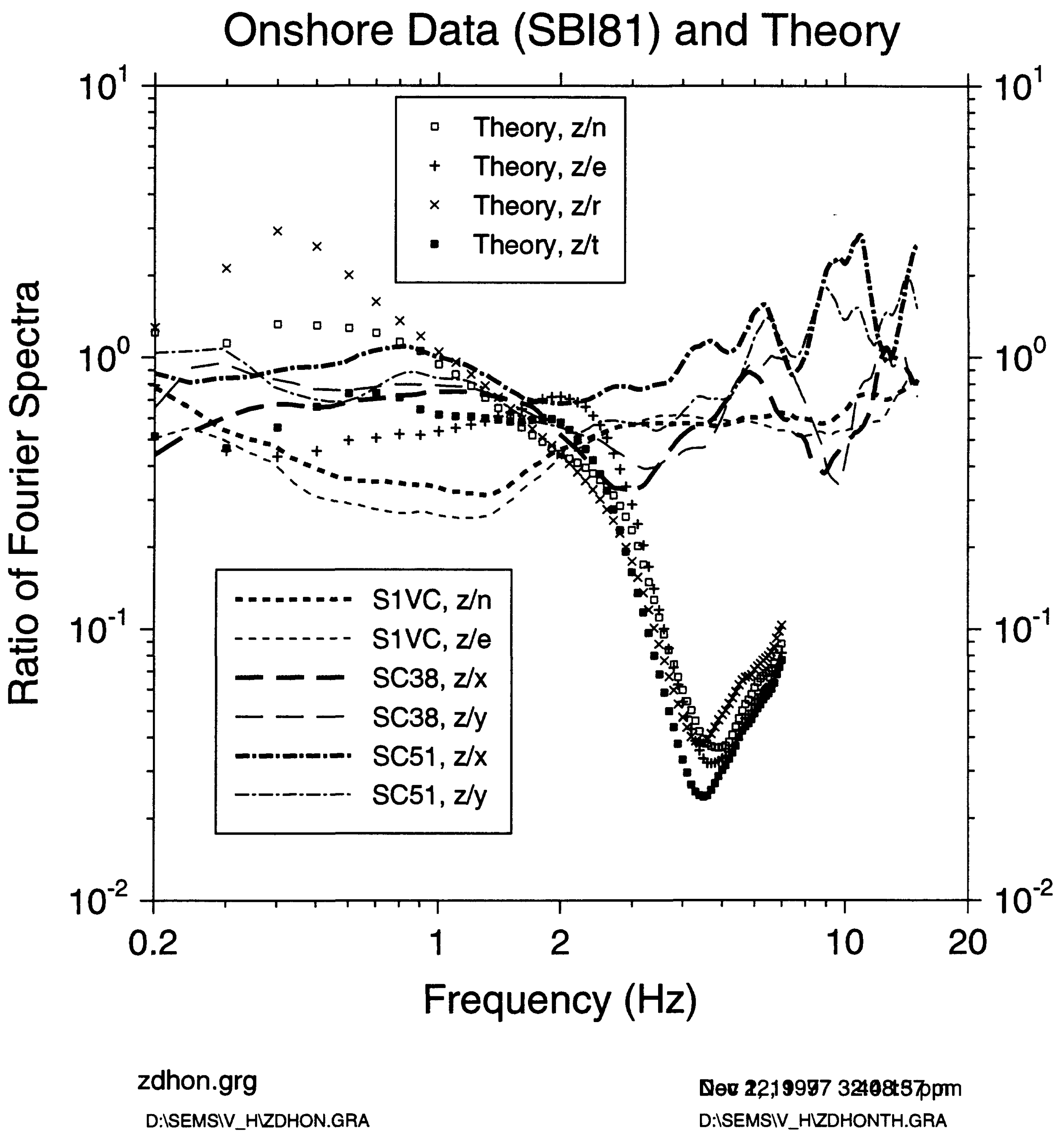

Figure 53. V/H ratios of Fourier amplitude spectra of the S-wave portion of onshore recordings, compared to theoretical predictions. As discussed in the text, the model used for the theoretical computations should be changed; it is based on a old assessment of the velocity gradient beneath a generic rock site (Boore, 1986). More recent studies (Boore and Joyner, 1997) suggest that the gradient in this model is too steep, leading to a strong reduction in high-frequency vertical component motion, and consequently a strong dip in the ratio of V/H. Furthermore, the appropriate velocity model beneath the near-surface sediments for these onshore sites should probably be different than for a generic rock site.

Constructing the ground shaking for a large earthquake from the recording of a smaller earthquake

- Construct duration filter (Gaussian random numbers with duration equal to difference in source duration of large and small earthquakes)

- Multiply spectrum of duration filter by source spectral ratios

- Multiply product above by the spectrum of the small earthquake

- Inverse transform to obtain time series of large event.

- Compute velocity, displacement, and response spectra

Figure 54. Basis of scaling method.

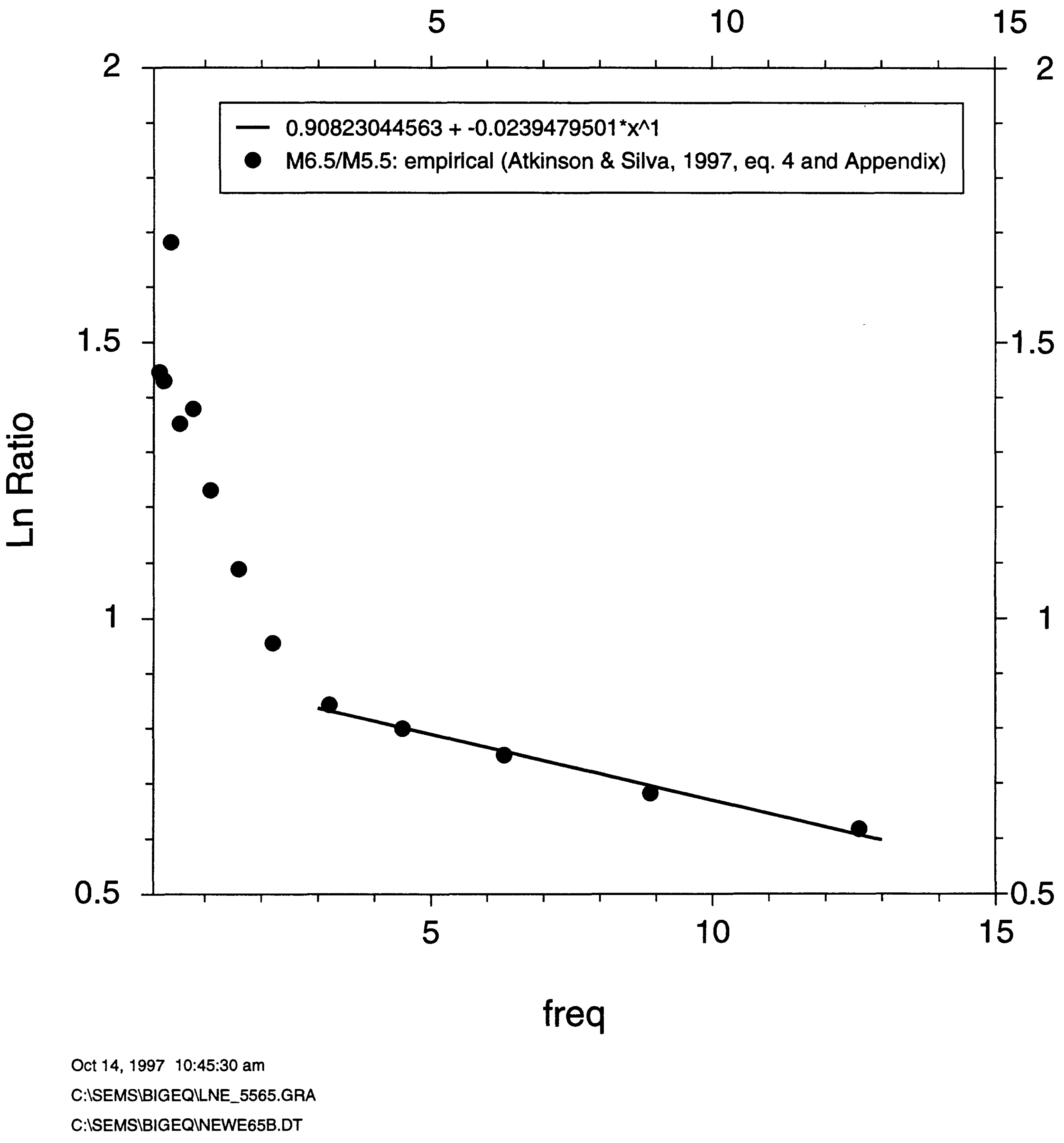

Figure 55. The symbols are the ratio of "source" spectra from Atkinson and Silva (1997) for moment magnitudes 6.5 and 5.5, $\ln A_{6.5}/A_{5.5}$, plotted against frequency using semilog scales. The line is a regression fit to the symbols over the range of frequencies indicated by the extent of the line. The slope and intercept of the line give information about the difference in κ values and equivalent stress parameters for the two earthquakes (see text).

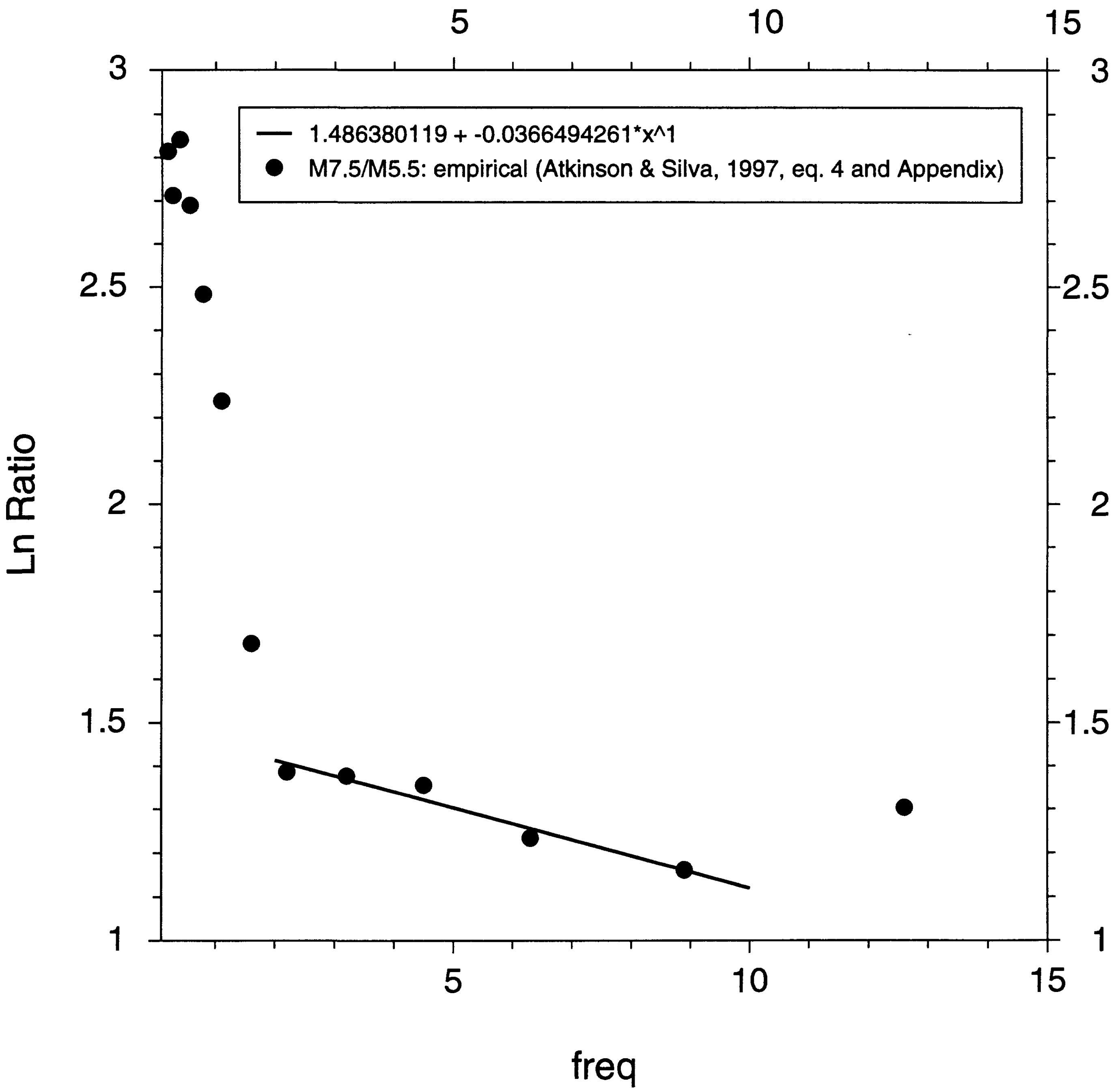

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Figure 56. The symbols are the ratio of "source" spectra from Atkinson and Silva (1997) regression analysis of Fourier spectral amplitudes from strong motion data in California, for moment magnitudes 7.5 and 5.5, $\ln A_{7.5}/A_{5.5}$, plotted against frequency using semilog scales. The line is a regression fit to the symbols over the range of frequencies indicated by the extent of the line. The slope and intercept of the line give information about the difference in κ values and equivalent stress parameters for the two earthquakes (see text).

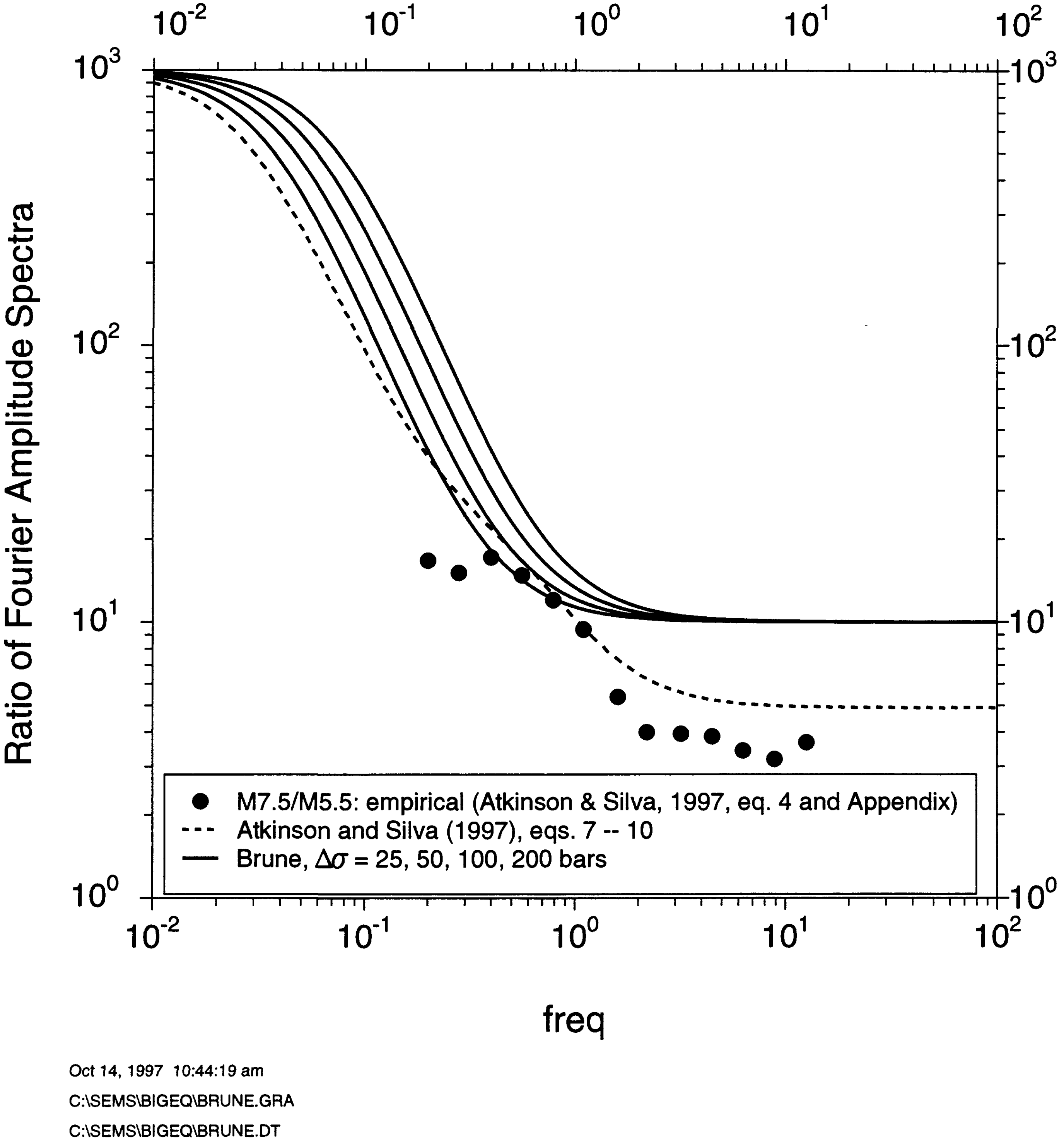


Figure 57. Ratio of "source" spectra from Atkinson and Silva (1997) vs. frequency, plotted using log–log scales (symbols). The dashed line is the ratio of amplitudes predicted from the equations in Atkinson and Silva for earthquakes with moment magnitudes of 7.5 and 5.5. The mismatch is an indication of the need to modify the Atkinson and Silva equations, as is done in the text. The solid curves are the ratios expected for a single-corner-frequency, constant-stress-parameter model, which is clearly ruled out by the Atkinson and Silva derived source spectra.

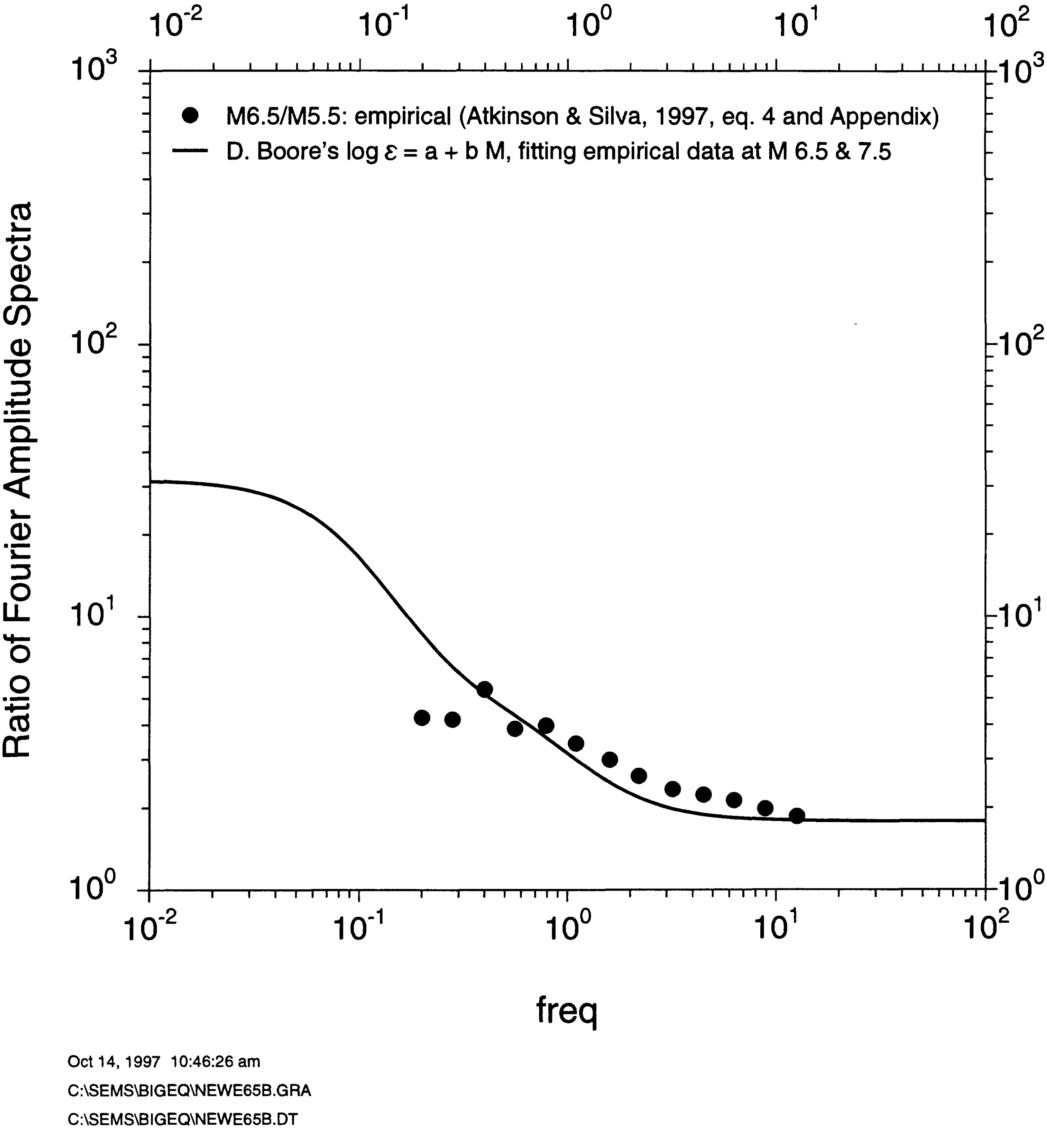


Figure 58. Ratio of "source" spectra from Atkinson and Silva (1997) vs. frequency, plotted using log–log scales (symbols). The solid line is the ratio of amplitudes predicted from my modification to the equations in Atkinson and Silva for earthquakes with moment magnitudes of 6.5 and 5.5.

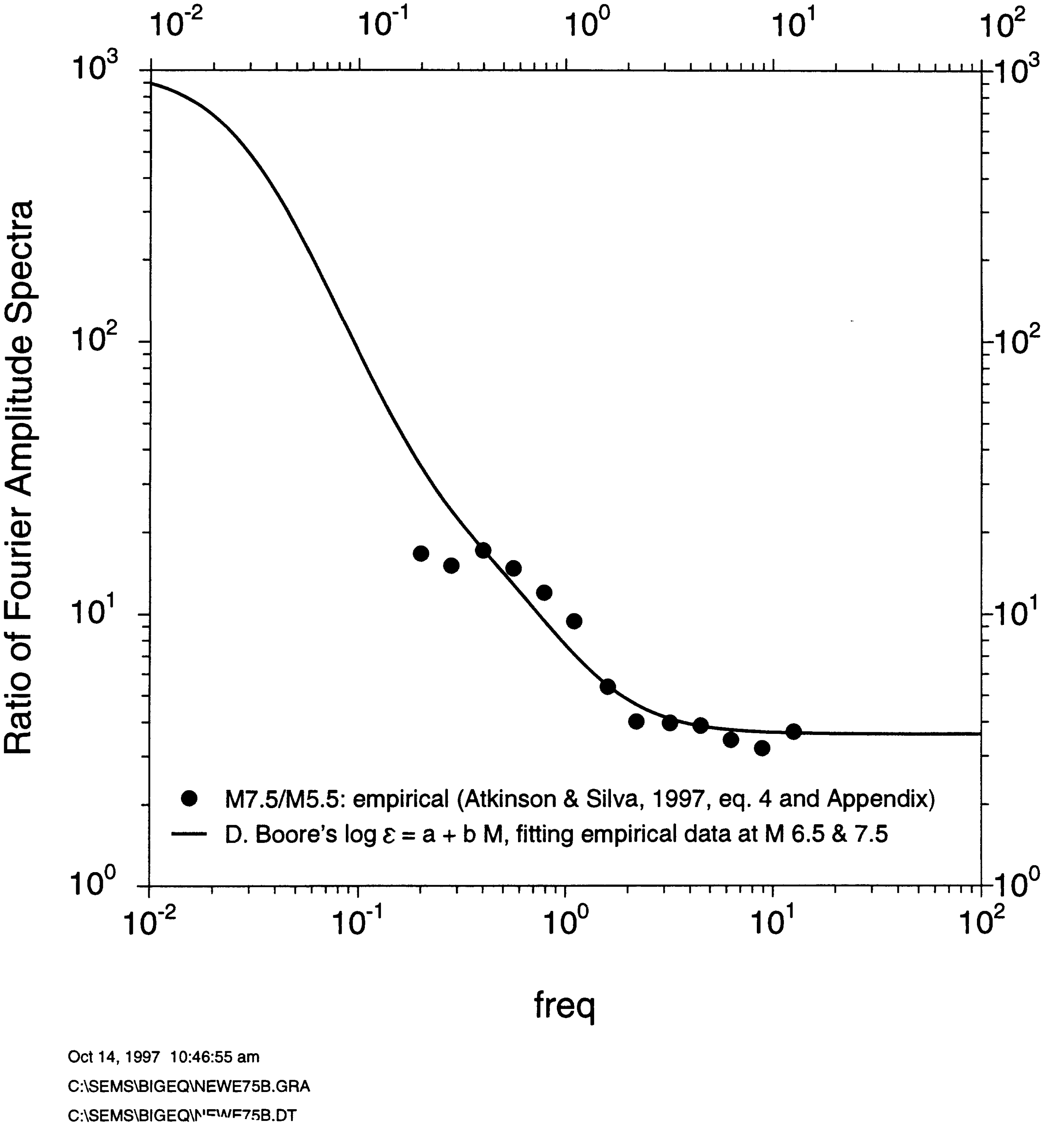


Figure 59. Ratio of "source" spectra from Atkinson and Silva (1997) vs. frequency, plotted using log–log scales (symbols). The solid line is the ratio of amplitudes predicted from my modification to the equations in Atkinson and Silva for earthquakes with moment magnitudes of 7.5 and 5.5.

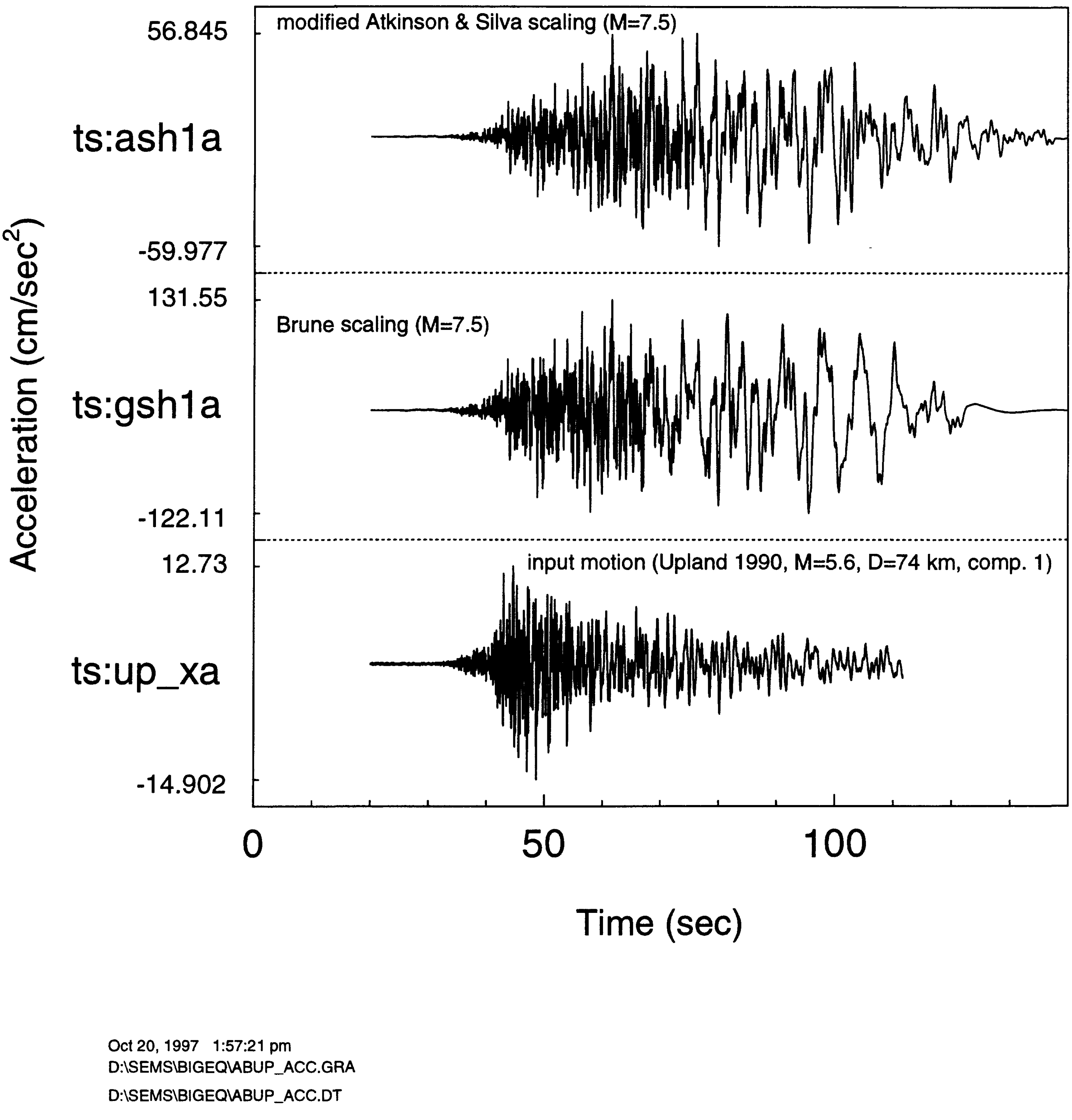


Figure 60. Scaling of horizontal-component acceleration recorded for a **M** = 5.6 earthquake at SEMS site S3EE up to an earthquake with **M** = 7.5. The bottom trace is the recorded motion, and upper two traces are the motions for the larger earthquake, based on the indicated source-scaling models.

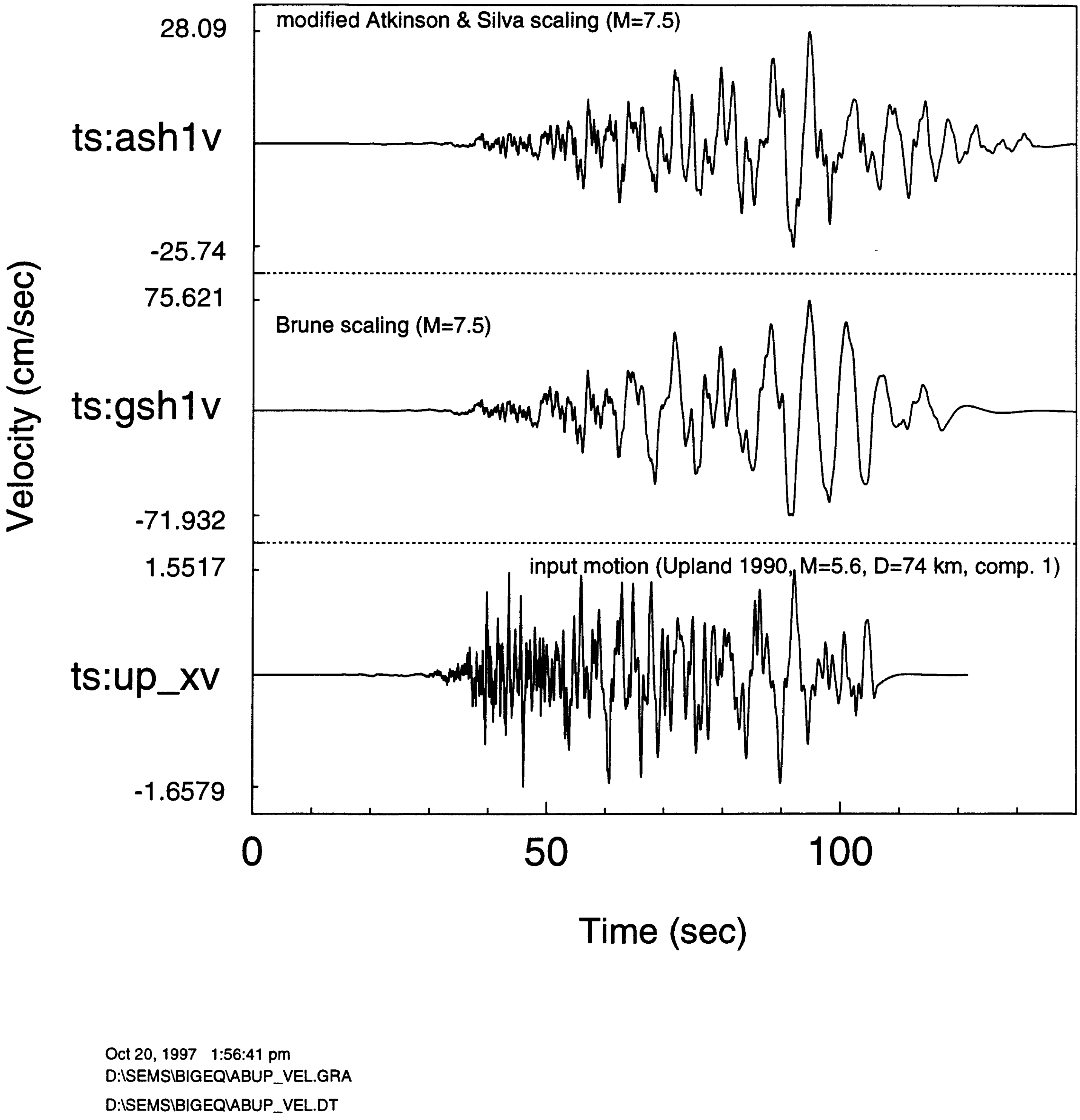


Figure 61. Scaling of horizontal-component velocity time series for a $\mathbf{M} = 5.6$ earthquake at SEMS site S3EE up to an earthquake with $\mathbf{M} = 7.5$. The bottom trace is derived from the recorded motion, and upper two traces are the motions for the larger earthquake, based on the indicated source-scaling models. These time series were obtained by integrating the acceleration time series in Figure 60.

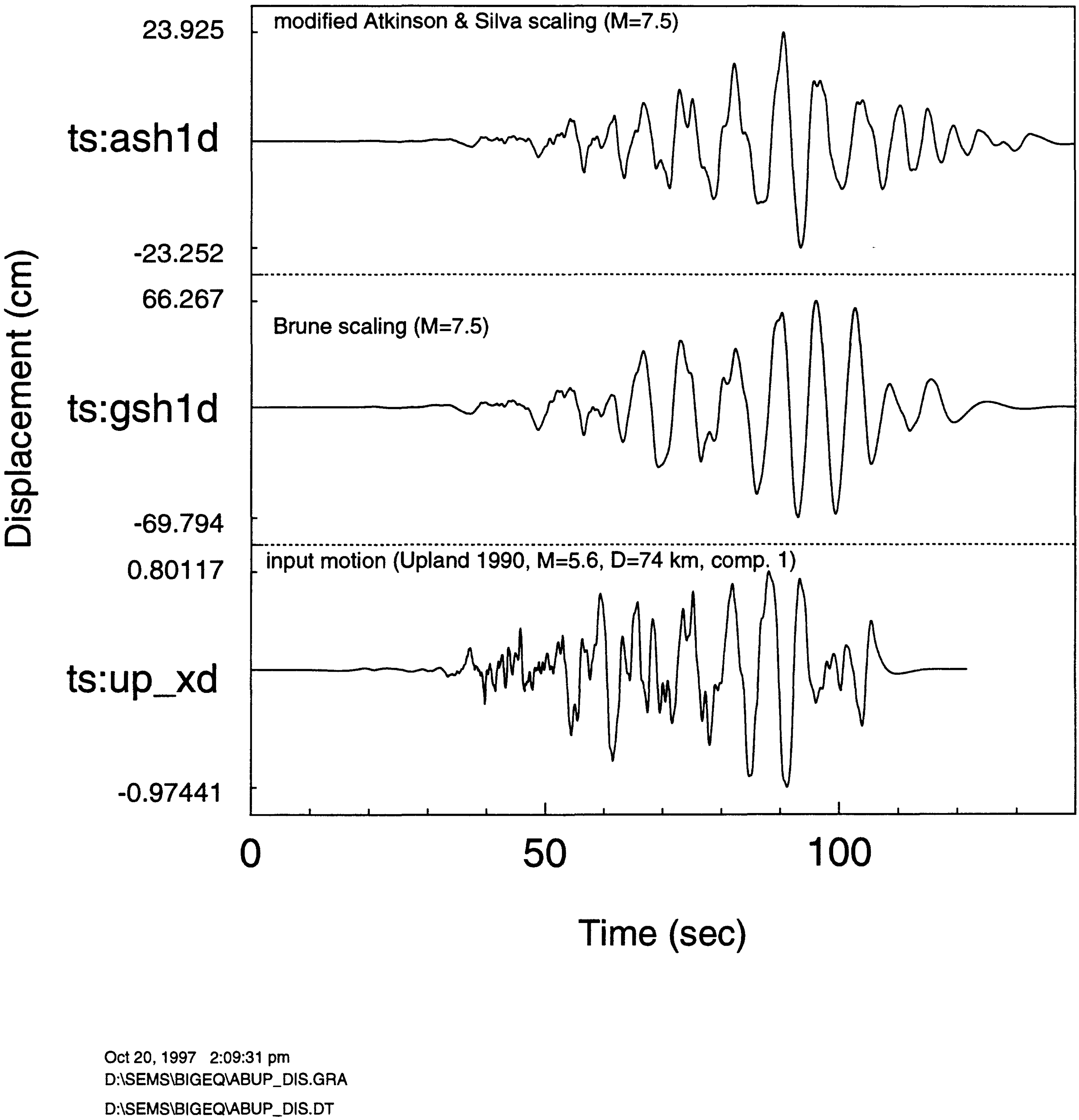


Figure 62. Scaling of horizontal-component displacement time series for a $\mathbf{M} = 5.6$ earthquake at SEMS site S3EE up to an earthquake with $\mathbf{M} = 7.5$. The bottom trace is derived from the recorded motion, and upper two traces are the motions for the larger earthquake, based on the indicated source-scaling models. These time series were obtained by integrating the velocity time series in Figure 61.

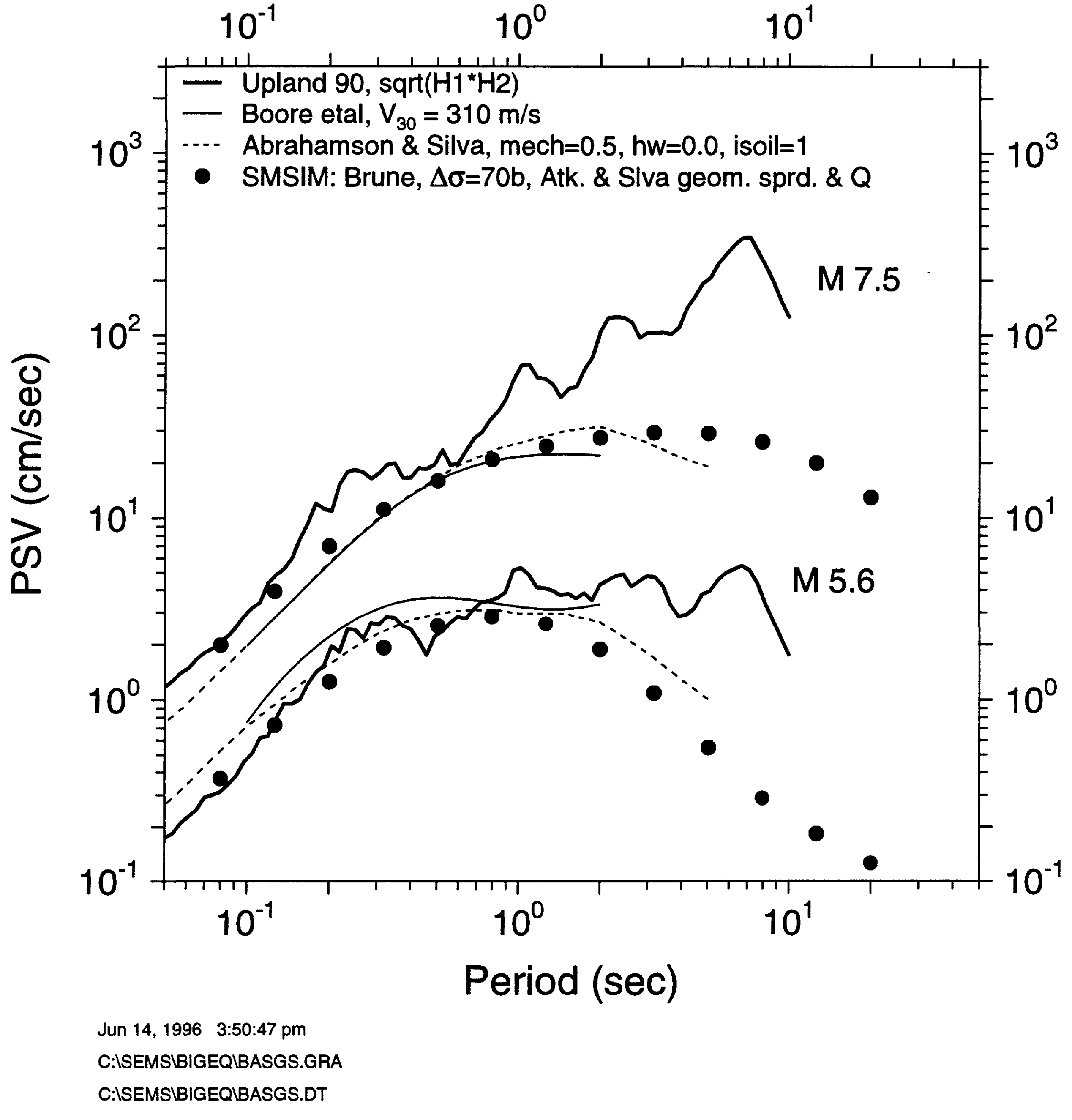


Figure 63. 5%-damped, pseudo-velocity response spectra (*PSV*) for the basis earthquake (**M** = 5.6) and the target earthquake (**M** = 7.5) (heavy solid lines). The *PSV* for the target event has been derived from the basis event assuming single-corner-frequency scaling with a stress parameter of 70 bars. Also shown are the predictions from two regression analyses (light solid and dashed lines) and from stochastic-model simulations (solid circles).

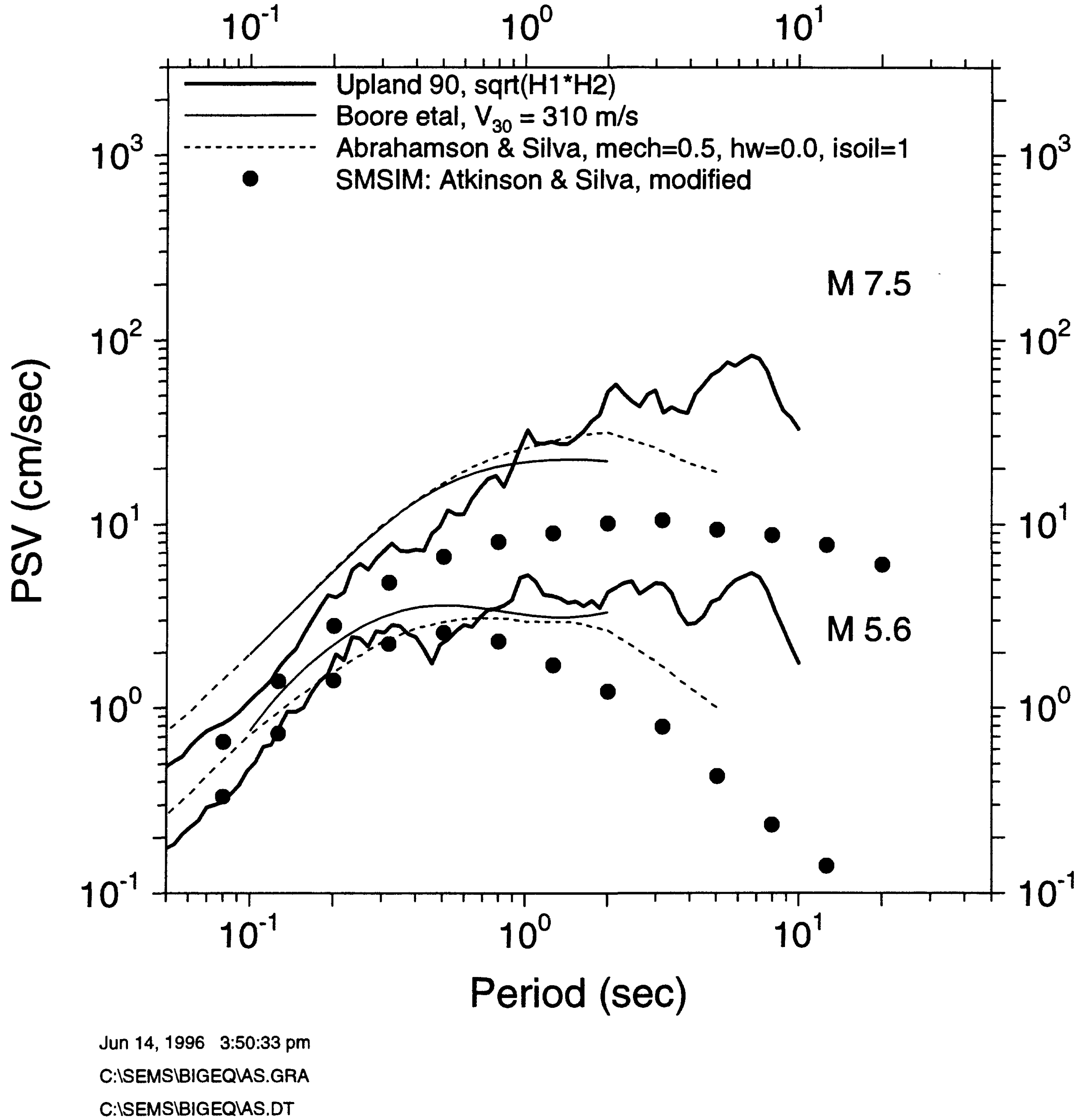


Figure 64. 5%-damped, pseudo-velocity response spectra (*PSV*) for the basis earthquake ($\mathbf{M} = 5.6$) and the target earthquake ($\mathbf{M} = 7.5$) (heavy solid lines). The *PSV* for the target event has been derived from the basis event assuming modified Atkinson and Silva source scaling. Also shown are the predictions from two regression analyses (light solid and dashed lines) and from stochastic-model simulations (solid circles).

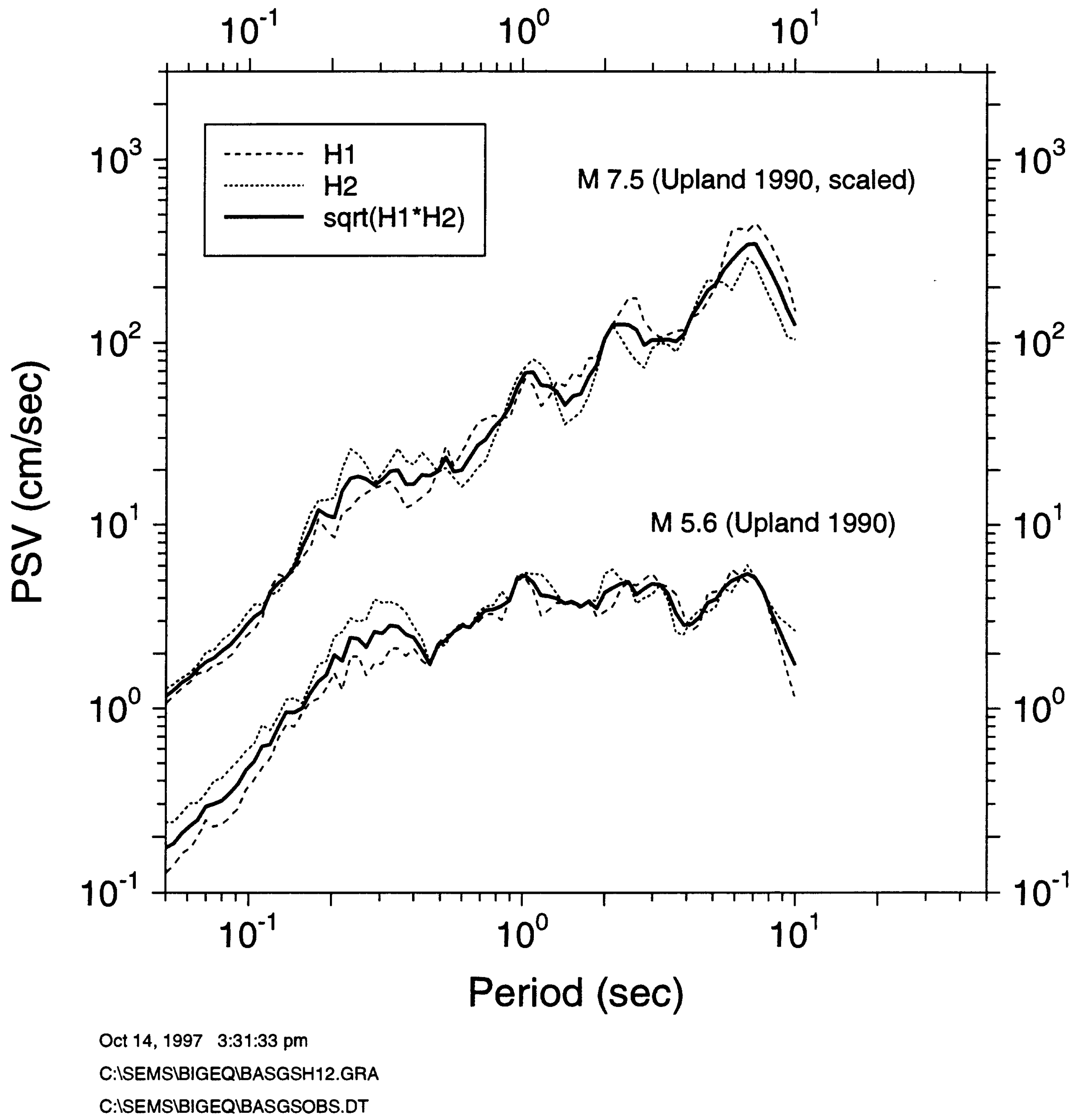


Figure 65. This figure demonstrates the insensitivity of the scaled results to the component of horizontal motion. As in Figure 63, the *PSV* for the target event has been derived from the basis event assuming single-corner-frequency scaling with a stress parameter of 70 bars. The solid line is the geometric mean of the two horizontal components (dashed lines).

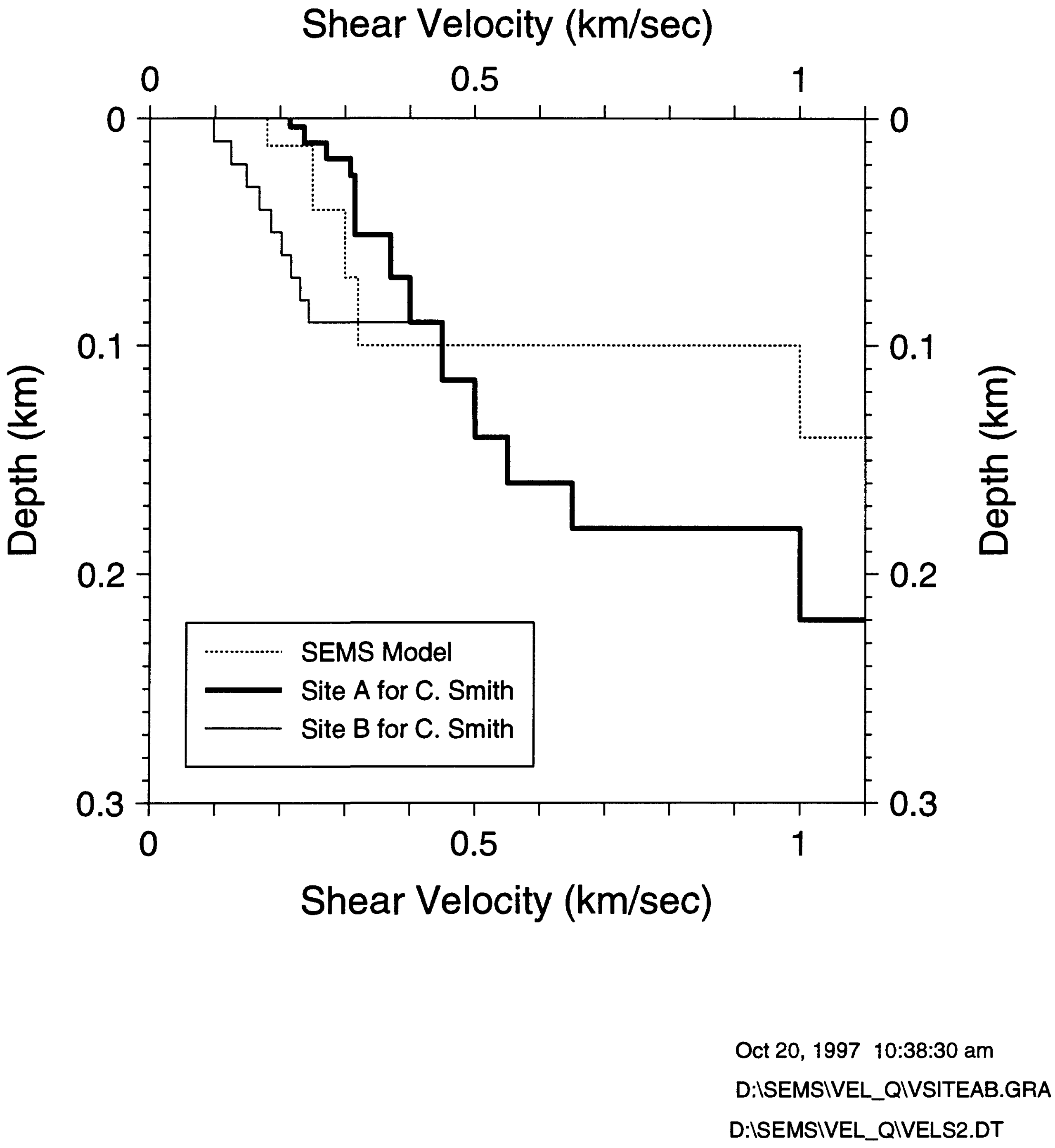


Figure 66. Shear-wave velocity for the two sites for which synthetic motions were generated for use in platform response studies by C. Smith, plotted to a depth of 0.3 km. Also shown is the SEMS model used in modeling V/H.

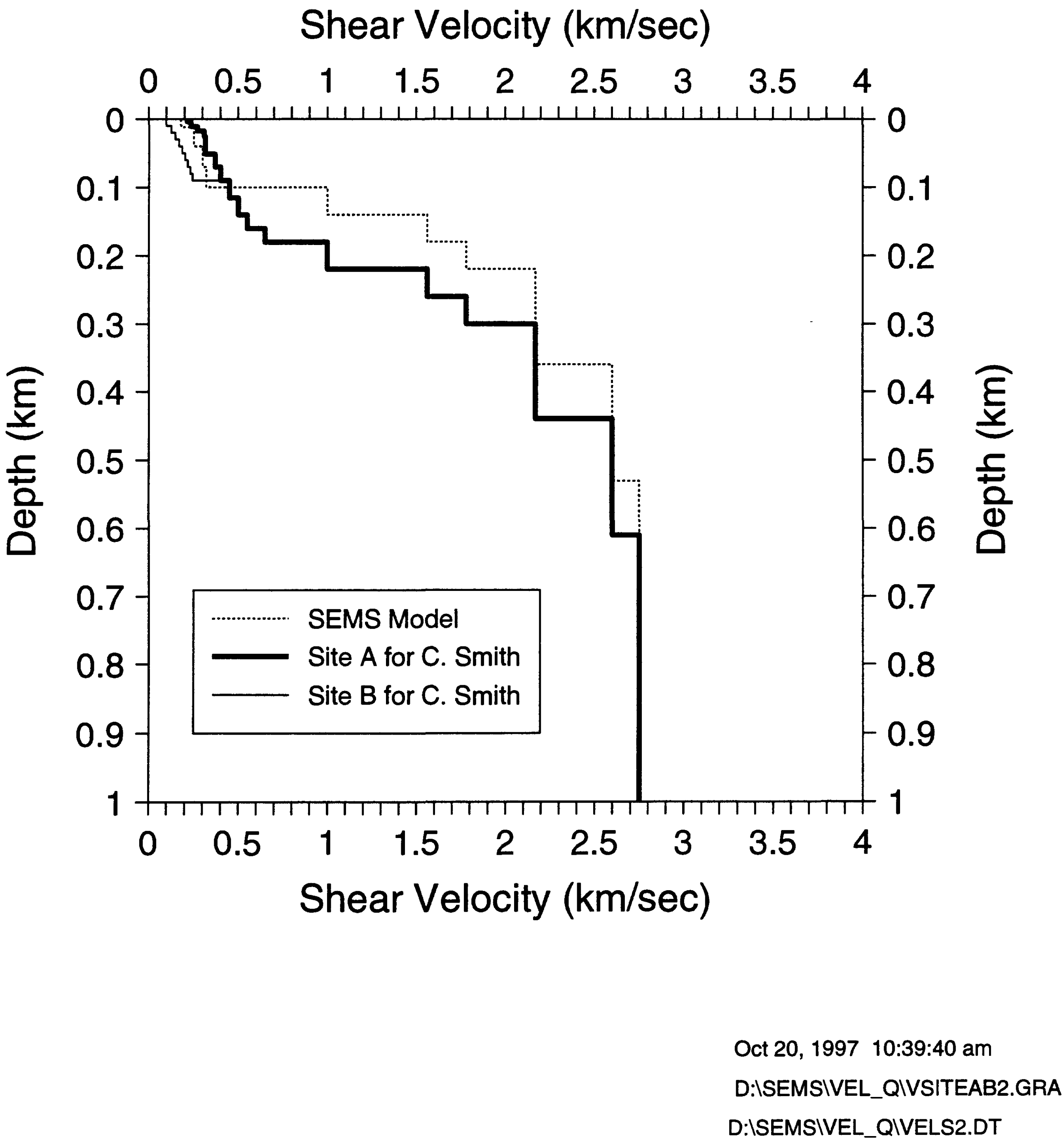


Figure 67. Shear-wave velocity for the two sites for which synthetic motions were generated for use in platform response studies by C. Smith, plotted to a depth of 1.0 km. Also shown is the SEMS model used in modeling V/H.

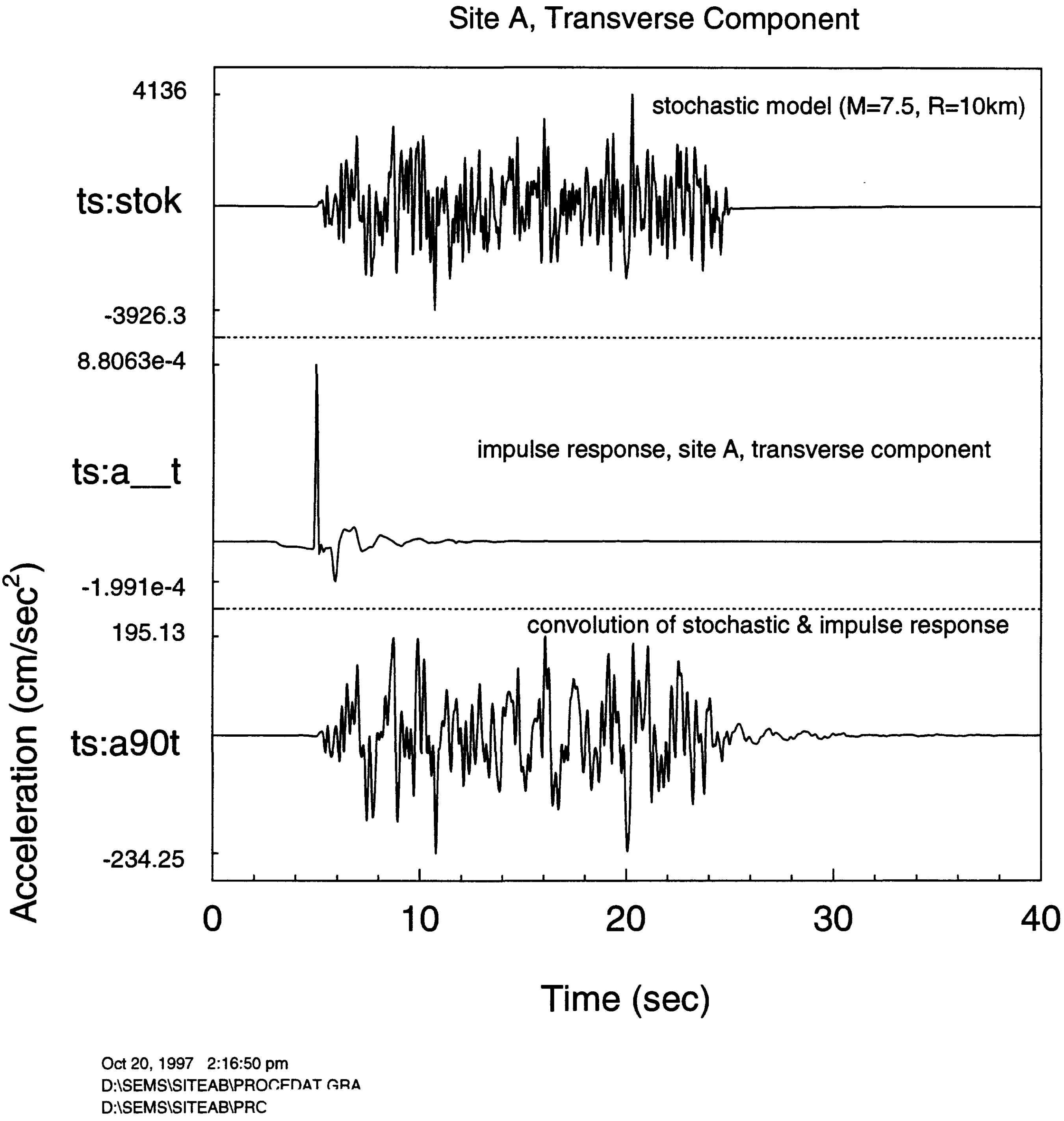


Figure 68. Illustrating the procedure for generating the design motions. The top trace shows the output of the stochastic model (Boore, 1996) for a moment magnitude of 7.5 and a distance of 10 km. The complexity in the time series is assumed to be due to source complexity. The middle trace is the impulse response of the layered velocity model, computed using full-wave synthetics (using program HSPEC91, written by R. Herrmann). This time series accounts for site-specific geological complexity (at least that part that can be modeled by a stack of laterally uniform layers). The bottom trace is the final result, obtained by convolving the top two traces. This ground motion corresponds to the transverse component at site A.

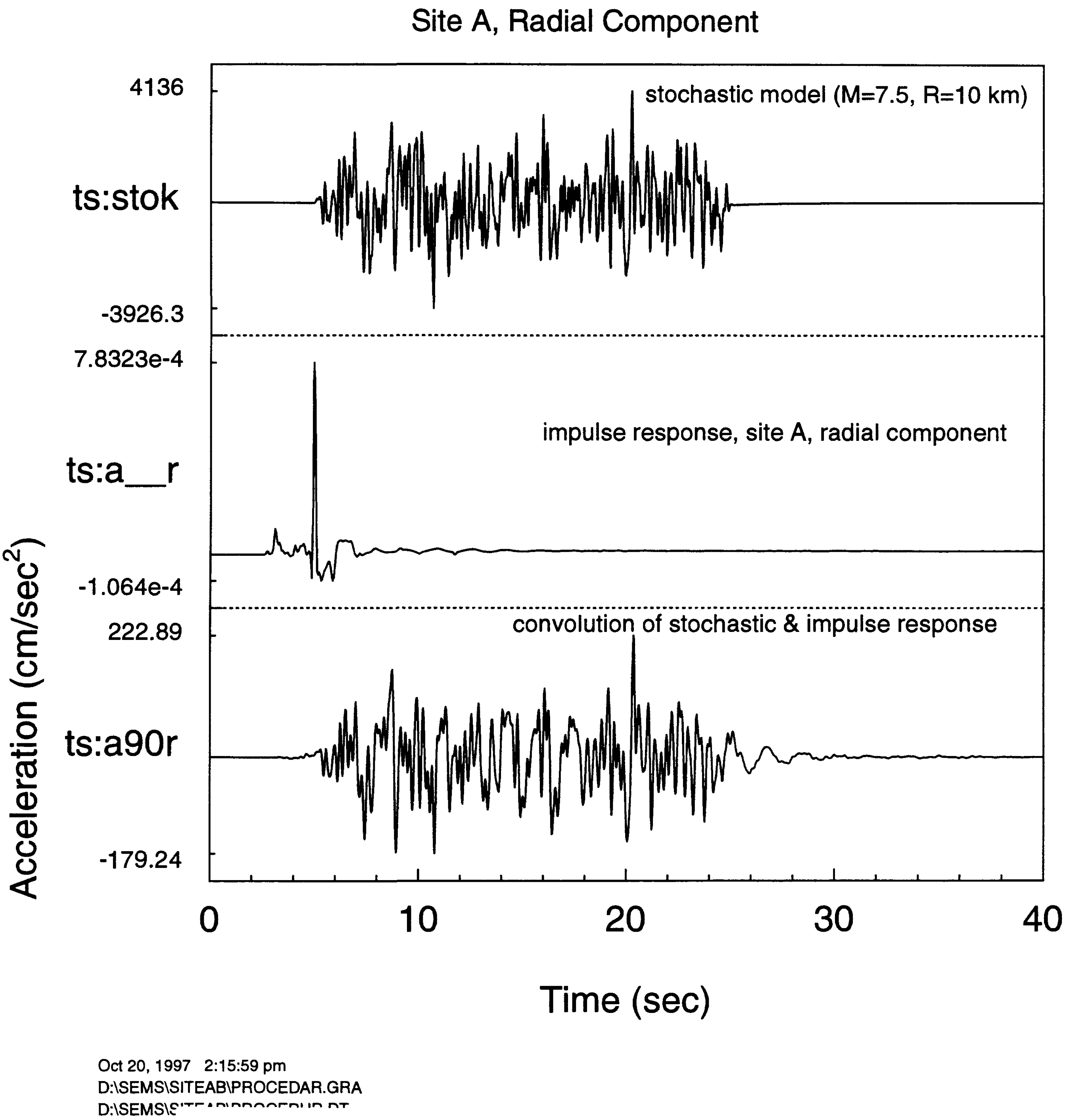


Figure 69. Illustrating the procedure for generating the design motions. The top trace shows the output of the stochastic model (Boore, 1996) for a moment magnitude of 7.5 and a distance of 10 km. The complexity in the time series is assumed to be due to source complexity. The middle trace is the impulse response of the layered velocity model, computed using full-wave synthetics (using program HSPEC91, written by R. Herrmann). This time series accounts for site-specific geological complexity (at least that part that can be modeled by a stack of laterally uniform layers). The bottom trace is the final result, obtained by convolving the top two traces. This ground motion corresponds to the radial component at site A.

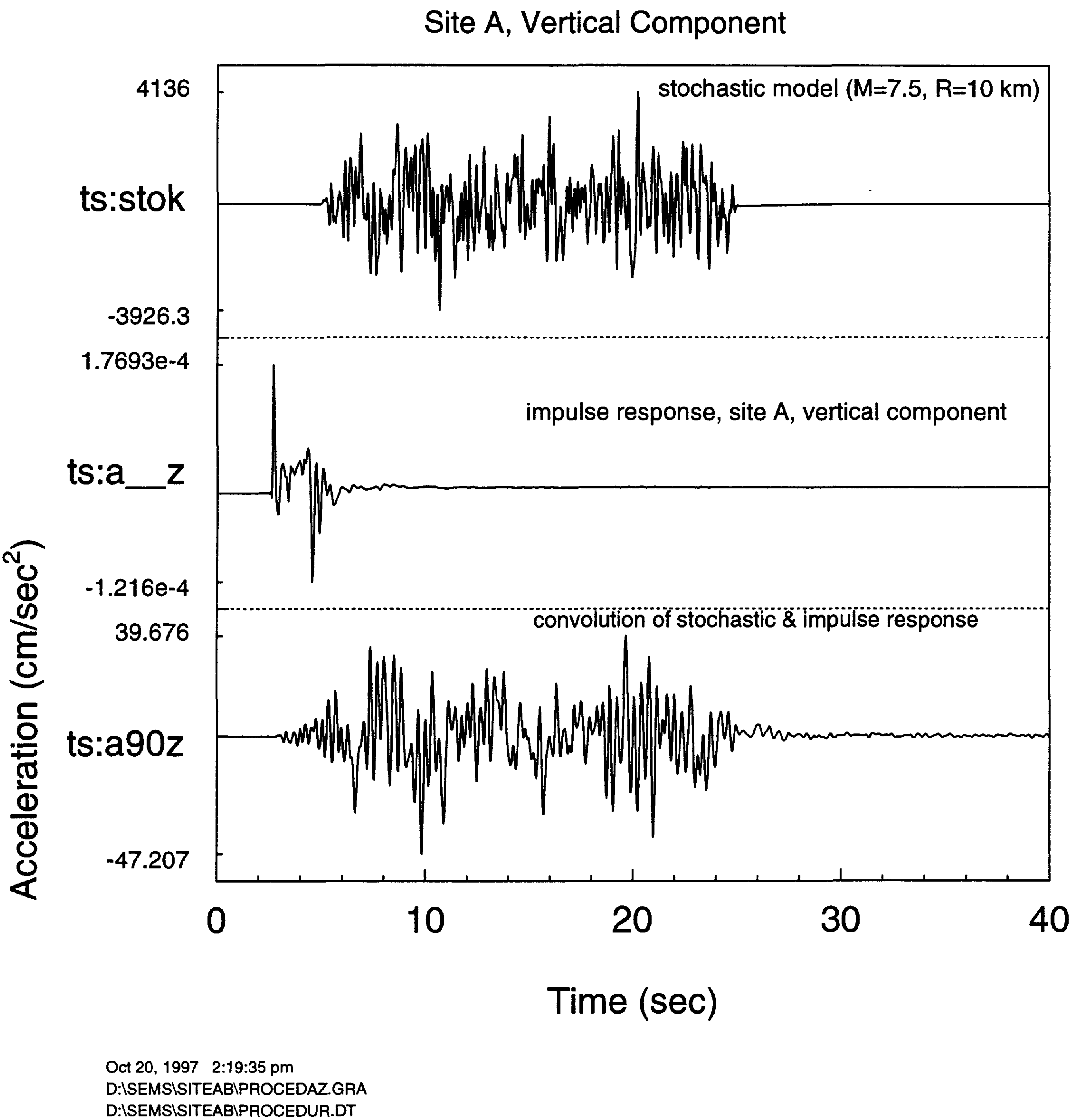


Figure 70. Illustrating the procedure for generating the design motions. The top trace shows the output of the stochastic model (Boore, 1996) for a moment magnitude of 7.5 and a distance of 10 km. The complexity in the time series is assumed to be due to source complexity. The middle trace is the impulse response of the layered velocity model, computed using full-wave synthetics (using program HSPEC91, written by R. Herrmann). This time series accounts for site-specific geological complexity (at least that part that can be modeled by a stack of laterally uniform layers). The bottom trace is the final result, obtained by convolving the top two traces. This ground motion corresponds to the vertical component at site A.

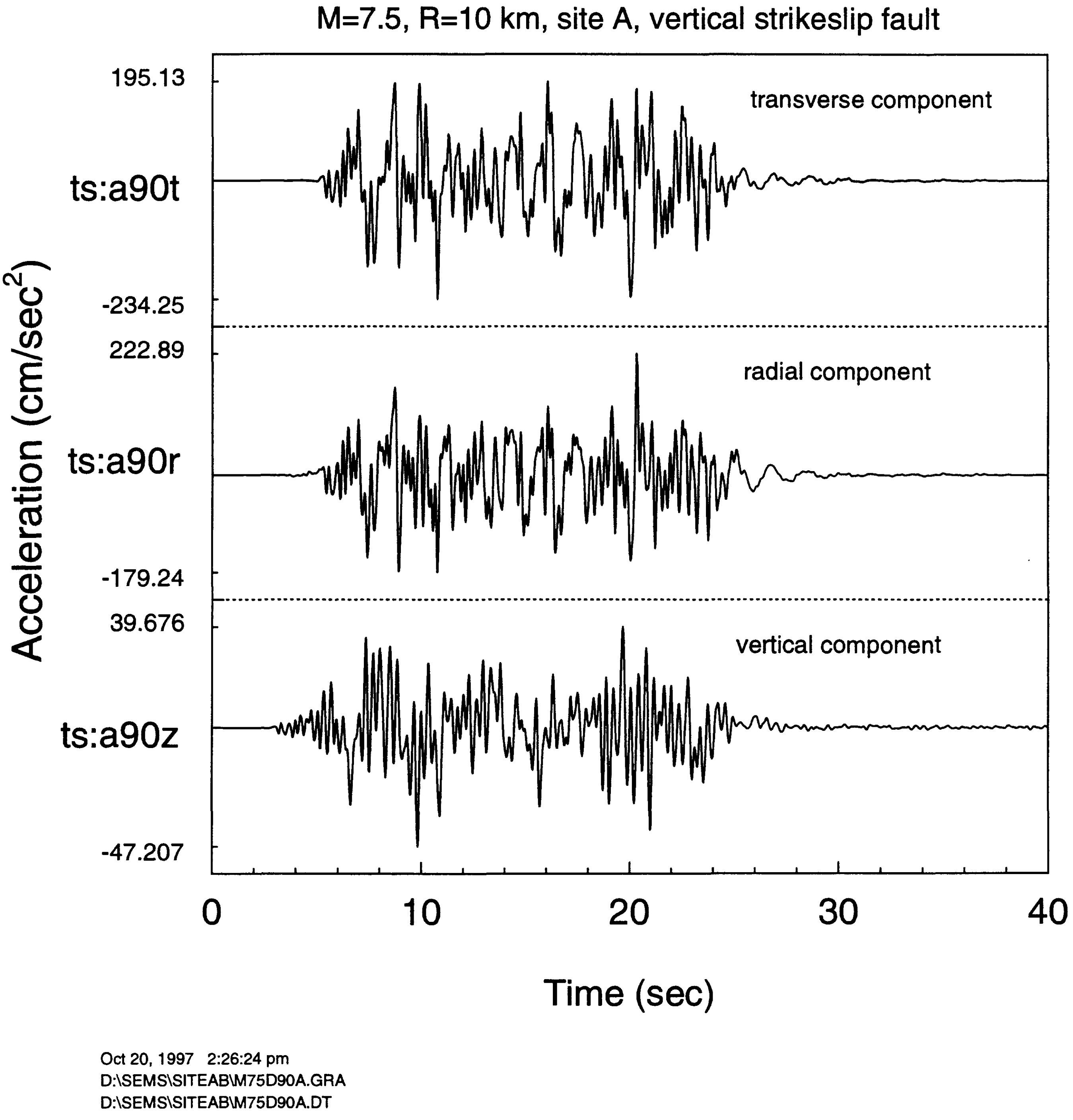


Figure 71. The three-component simulated motion at site A for a vertical strikeslip fault, at 10 km from a $\mathbf{M} = 7.5$ earthquake.

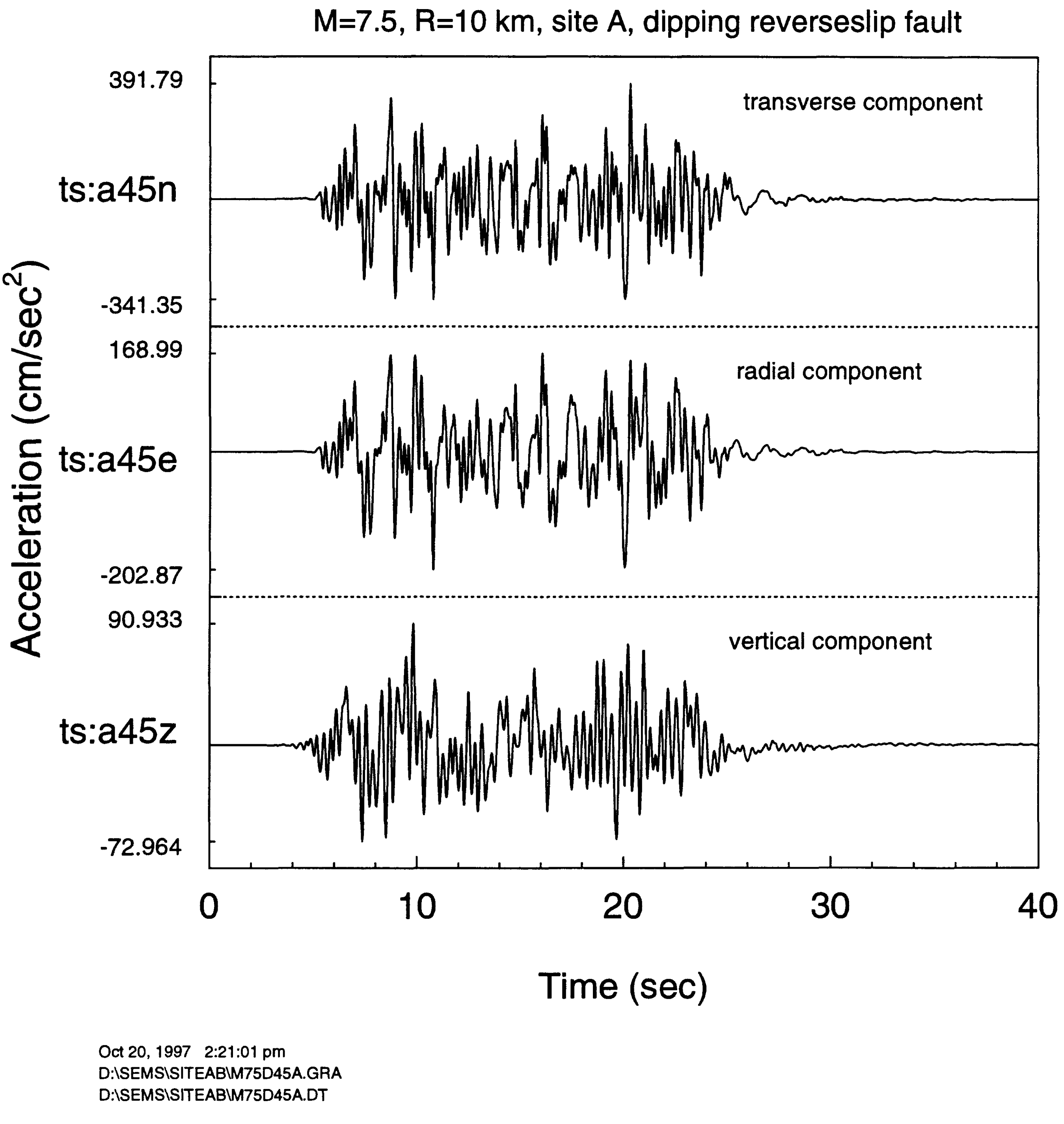


Figure 72. The three-component simulated motion at site A, 10 km from a $\mathbf{M} = 7.5$ earthquake on a 45 degree reverseslip fault.

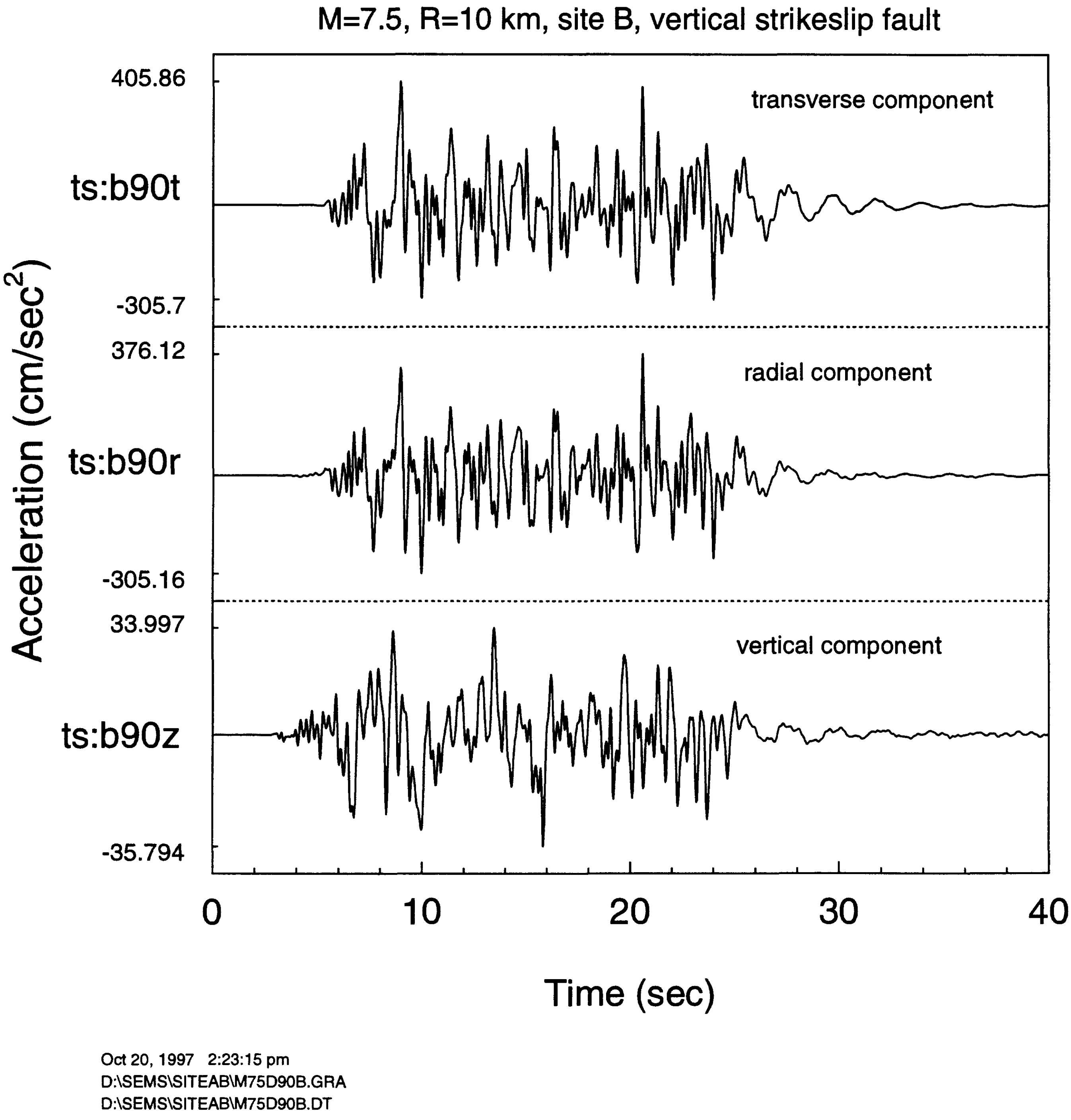


Figure 73. The three-component simulated motion at site B for a vertical strikeslip fault, at 10 km from a $\mathbf{M} = 7.5$ earthquake.

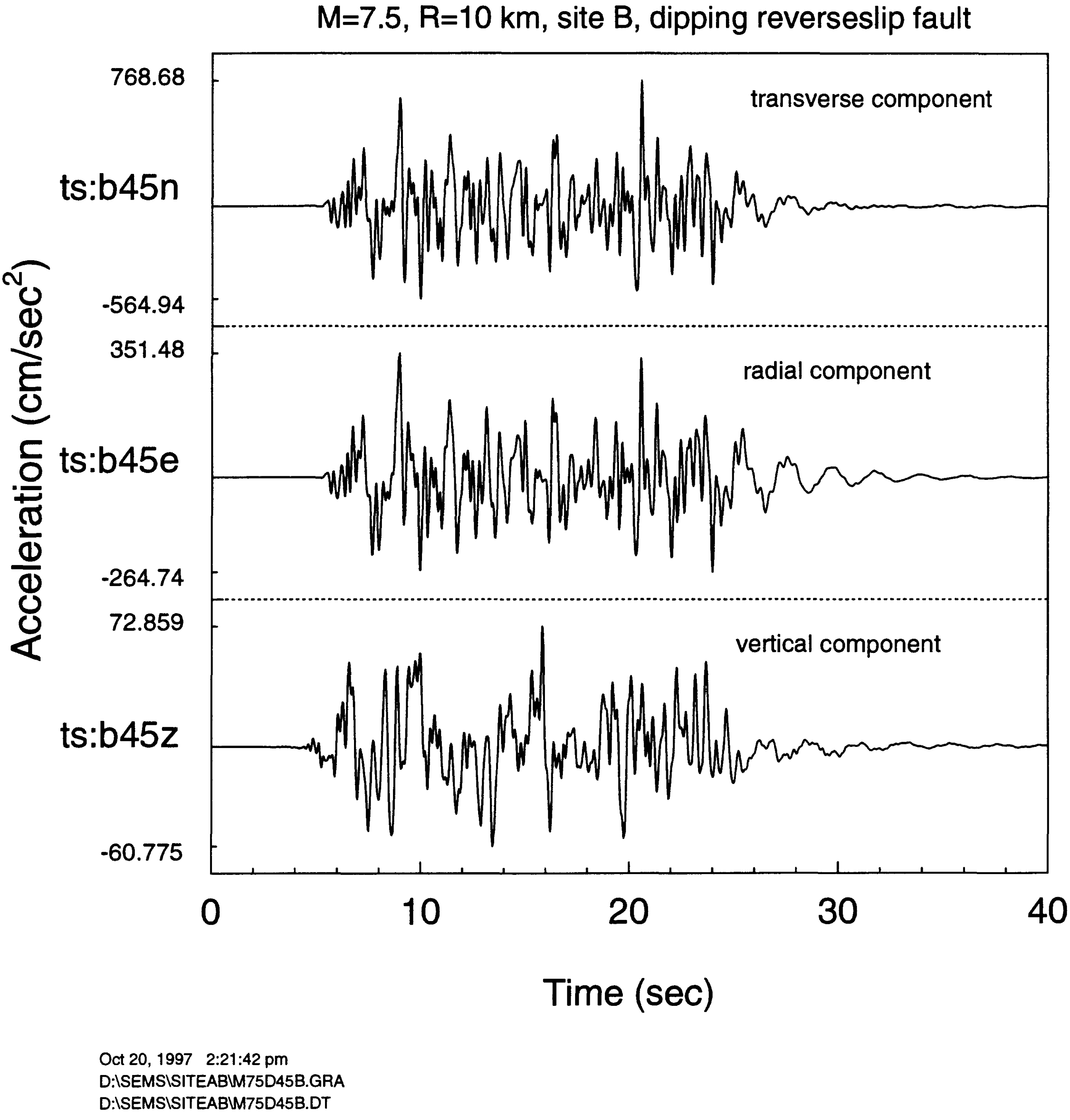
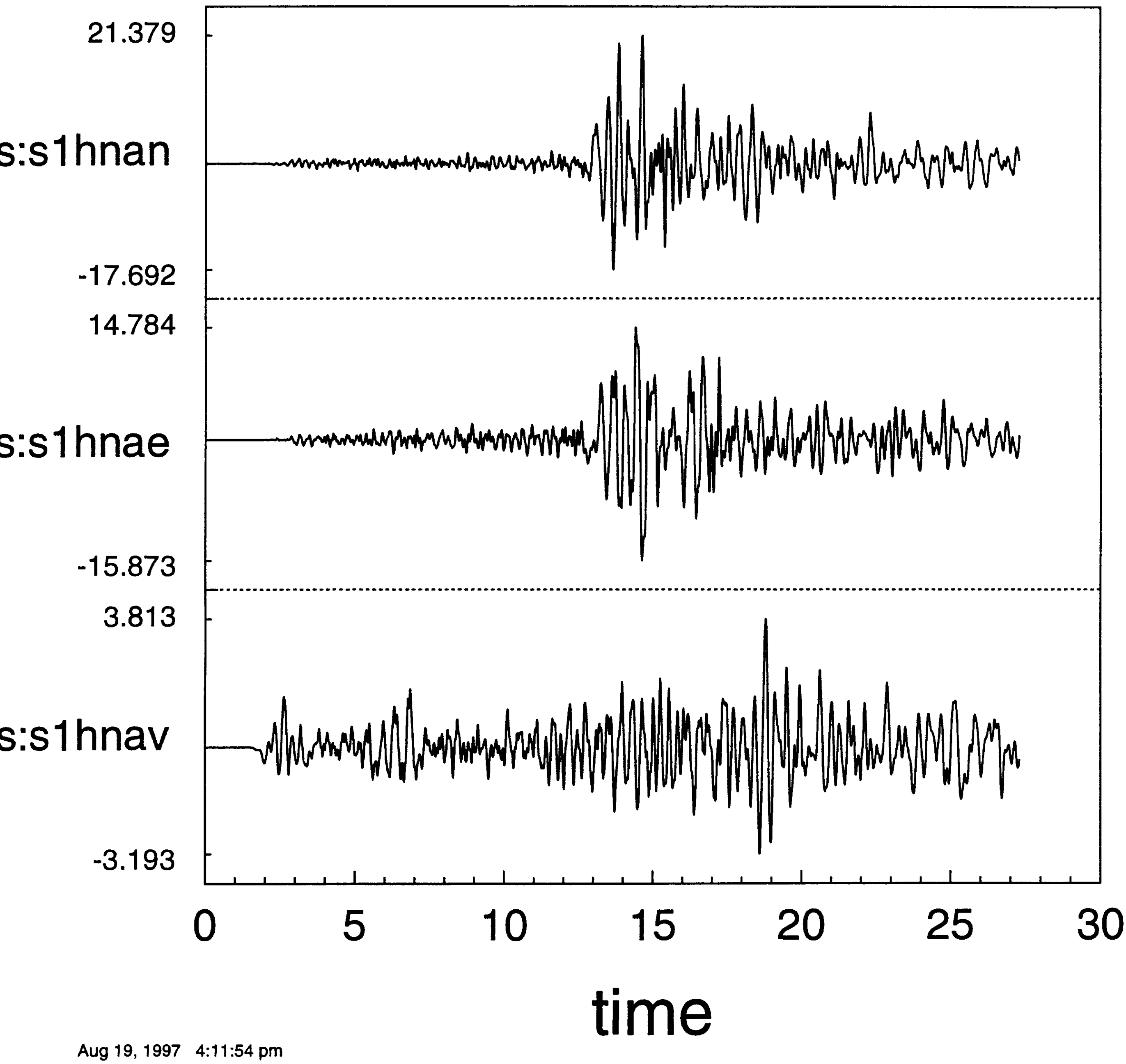


Figure 74. The three-component simulated motion at site B, 10 km from a $\mathbf{M} = 7.5$ earthquake on a 45 degree reverseslip fault.

APPENDIX A – PLOTS OF SEMS DATA

The following figures contain plots of acceleration, velocity, and displacement for all of the SEMS recordings. Each figure shows the three components of motion for a given recording, and consecutive figures show acceleration, velocity and displacement for each recording. The identification of each recording can be obtained from the small comment in the lower left of each figure. For example, "C:\SEMS\SBI81\S1HN_3A.DT" is a plot of the three components of acceleration at station S1HN. Somewhat less obvious are the names for the recordings of the two 1997 Simi Valley earthquakes. In this case, "C:\SEMS\SIMI97A\S97AI_3A.DT" are the three-component accelerograms at S4IR. It is best to refer to Table 5 to help in deciphering the names. Note that in some cases "LB" has been used as part of a station name; this is the same as station "EE".



Aug 19, 1997 4:11:54 pm
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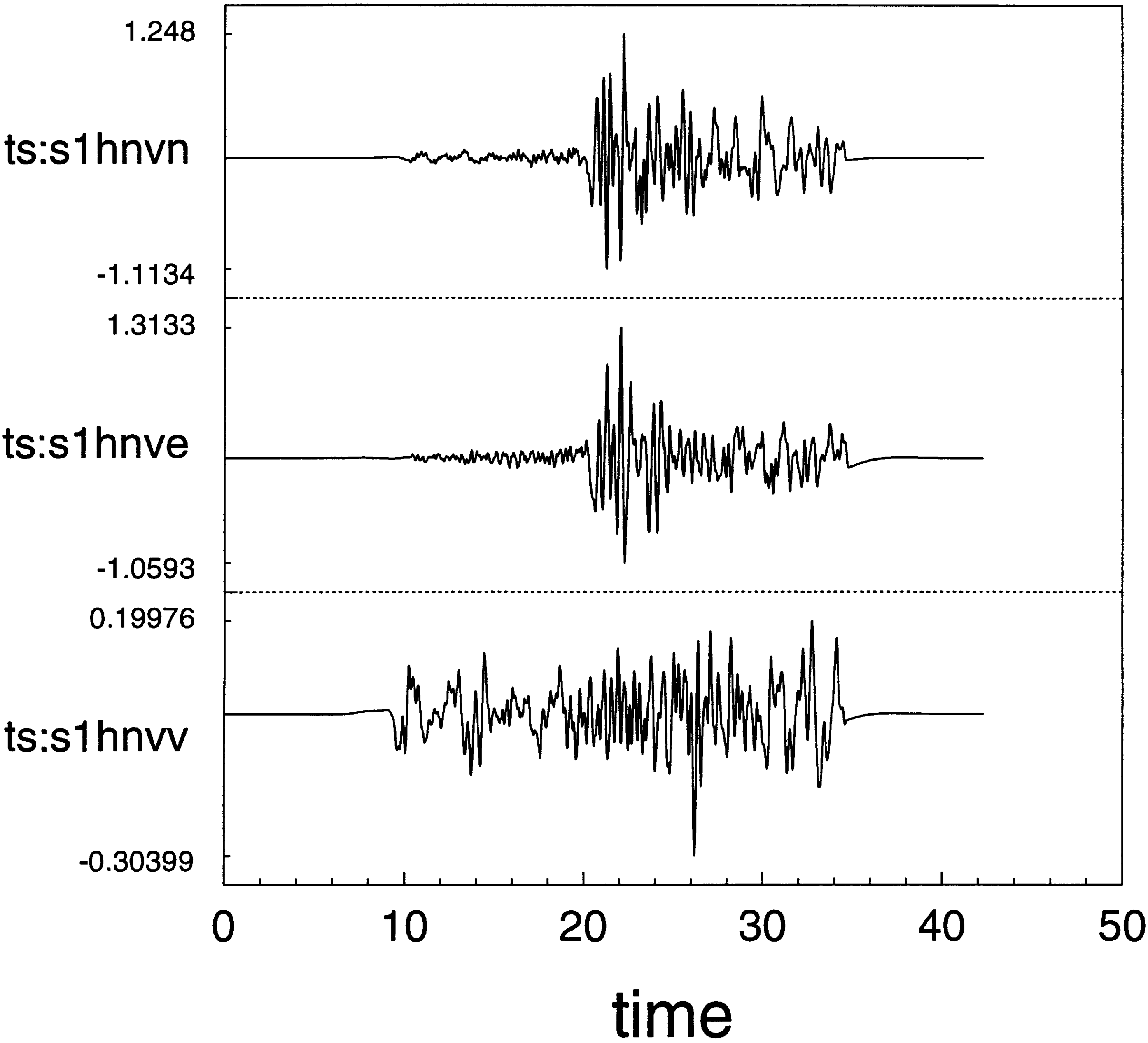

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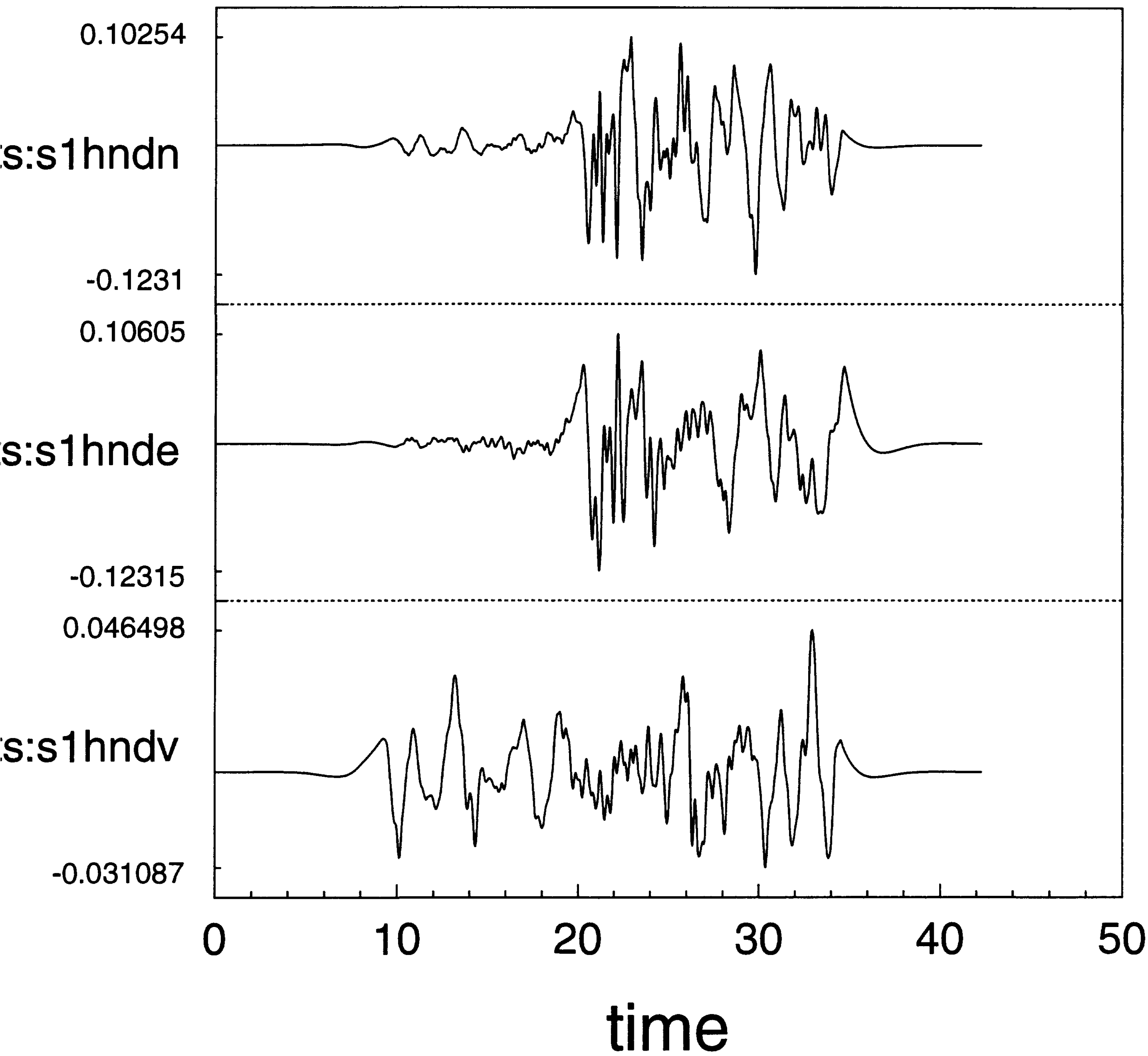

Aug 19, 1997 4:12:49 pm

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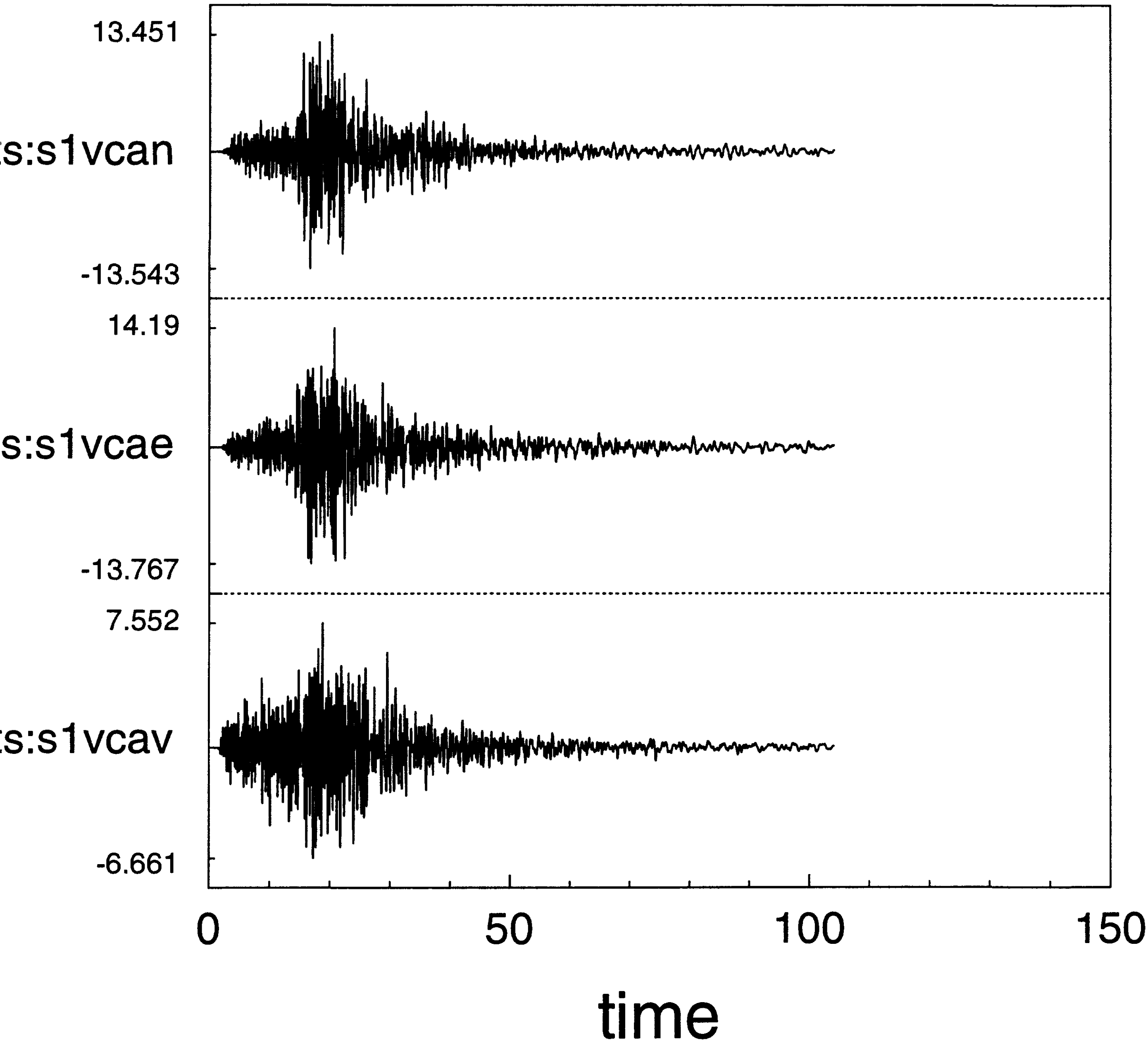

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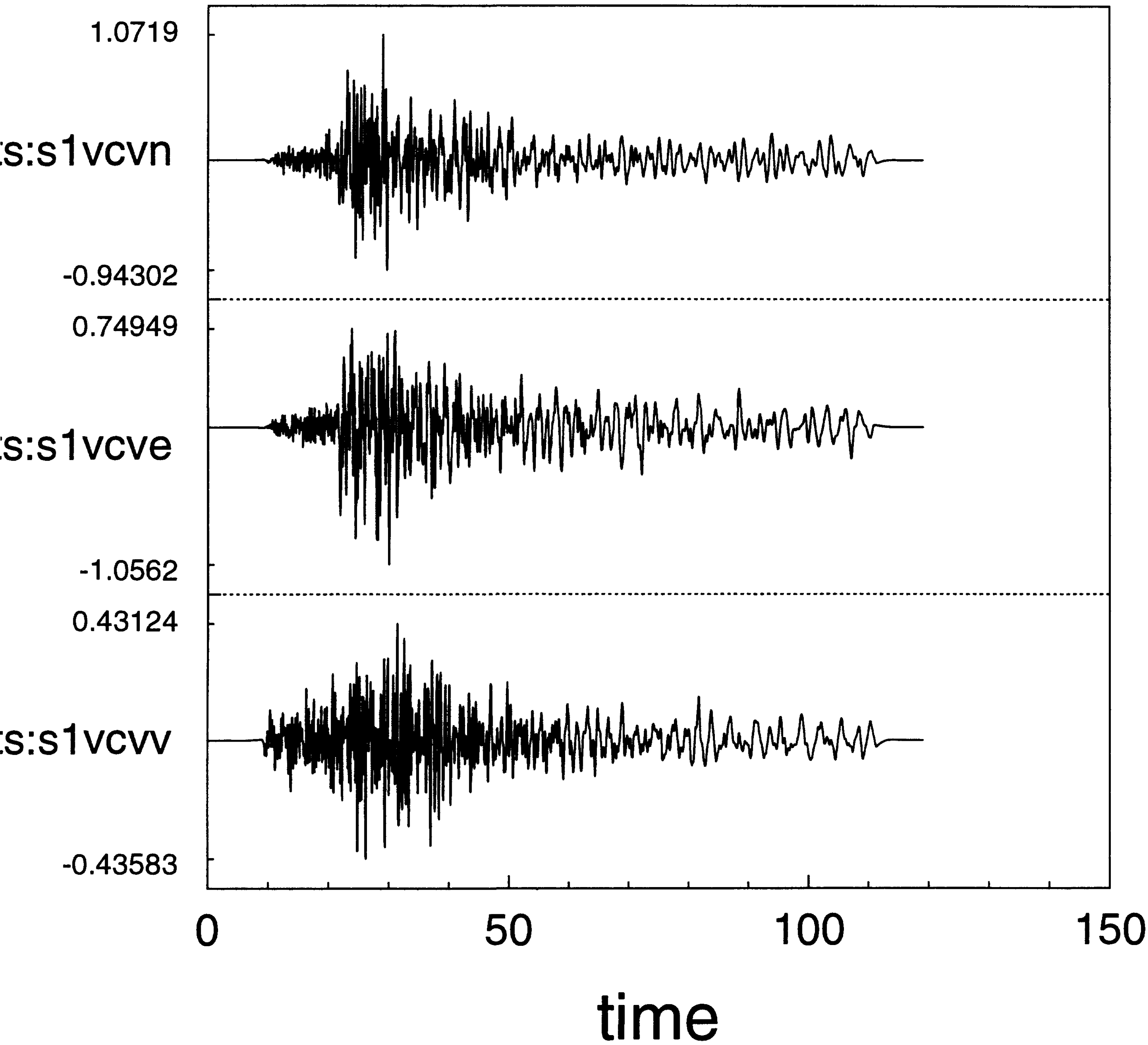

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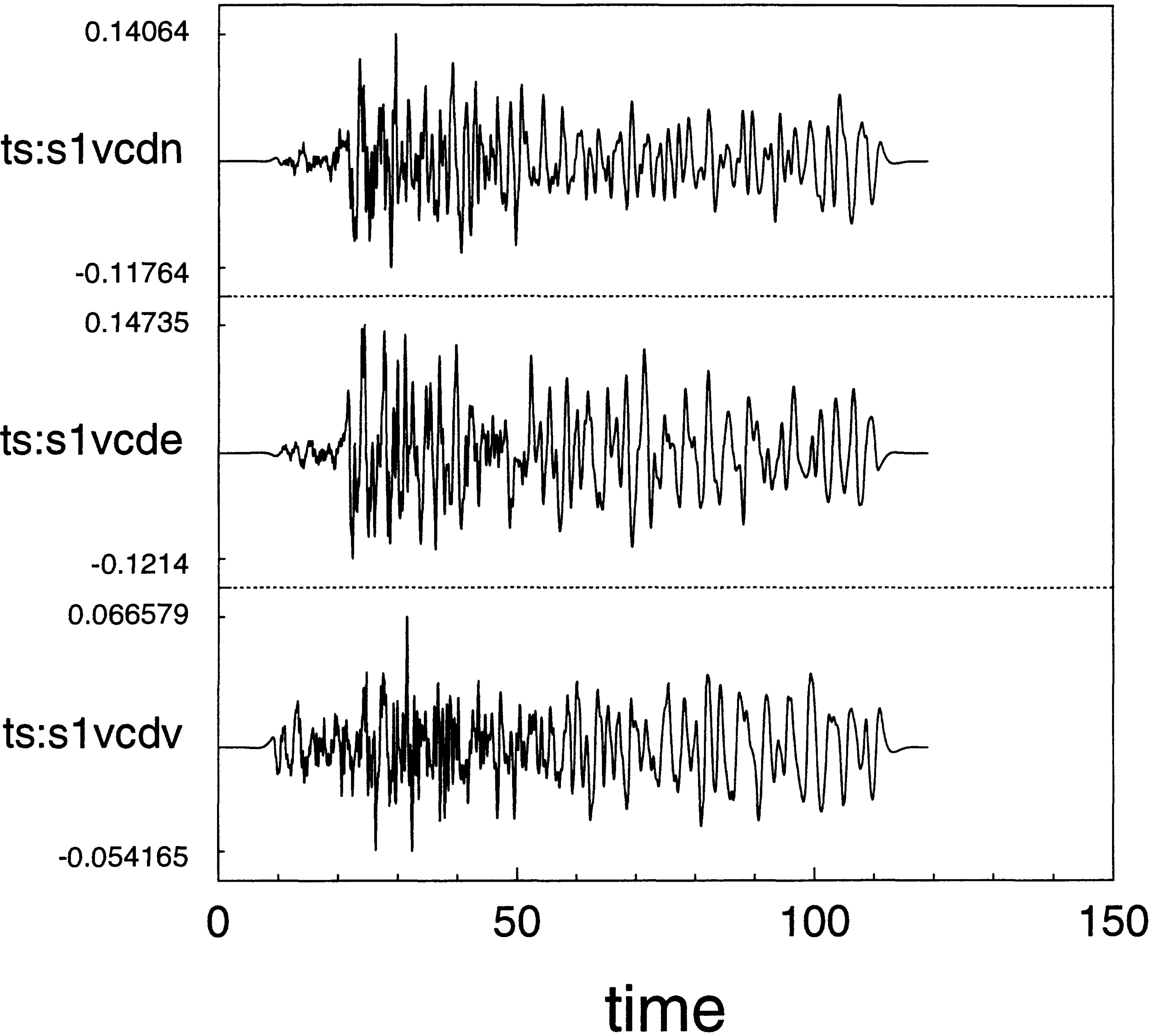

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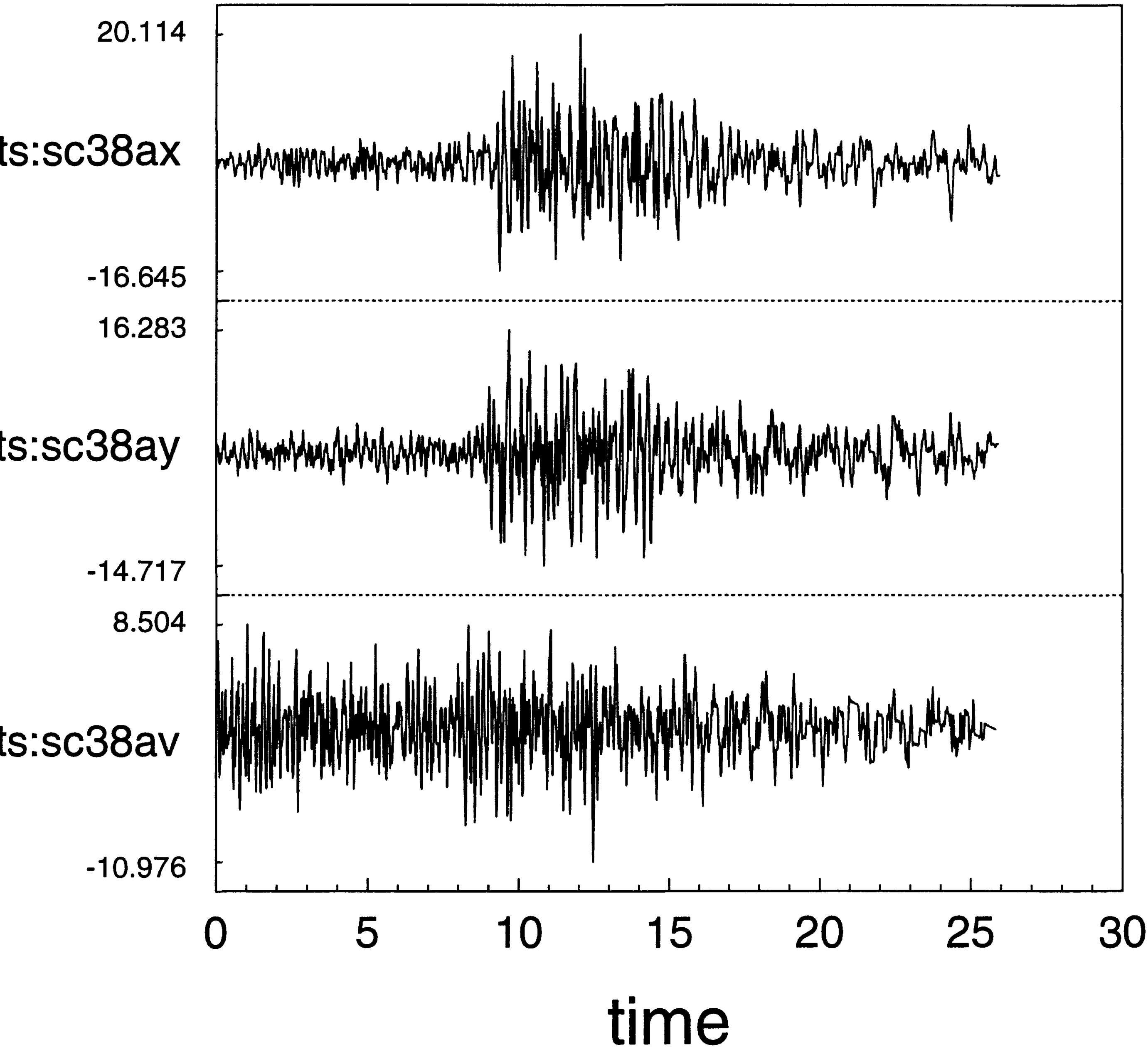

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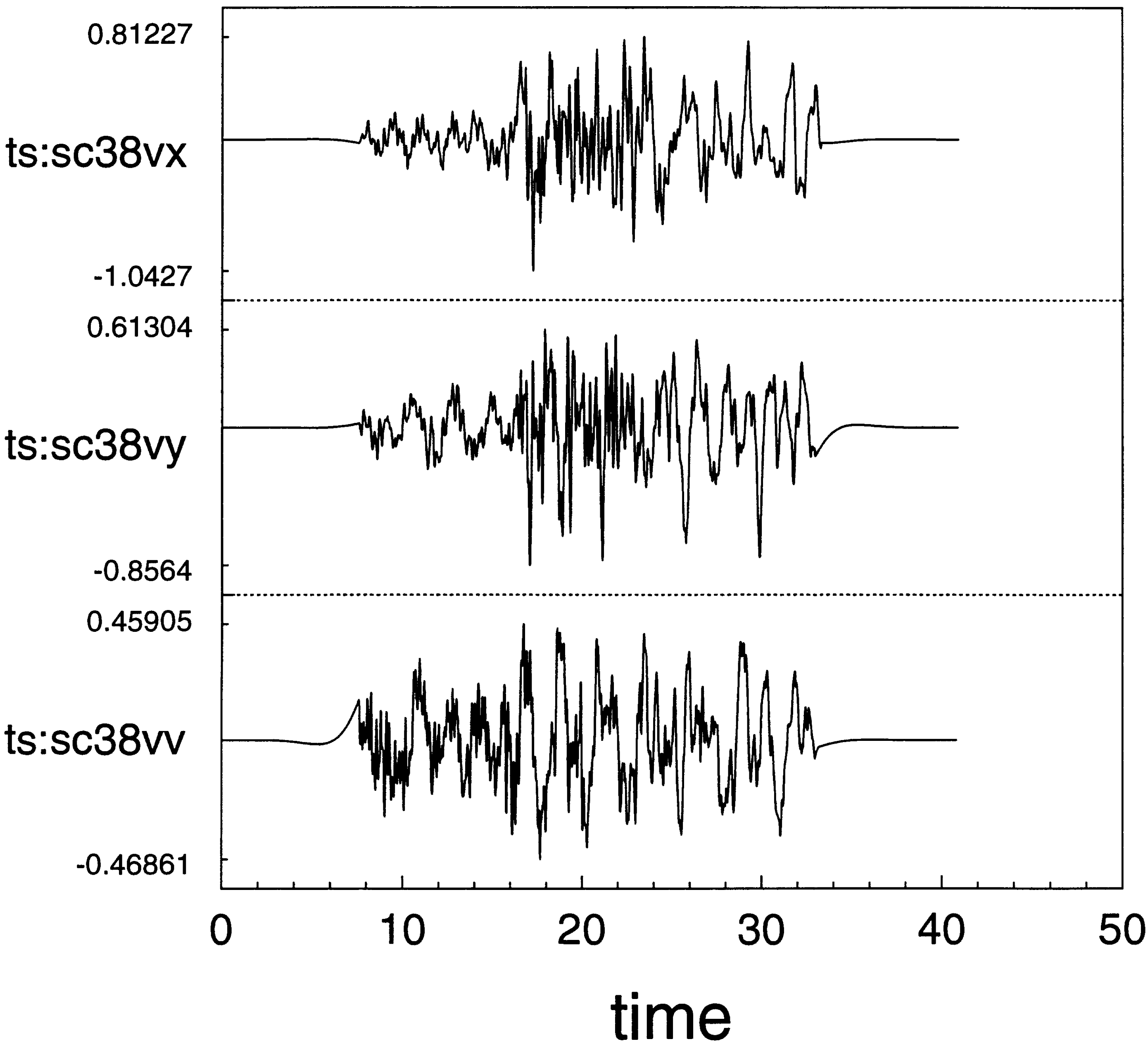

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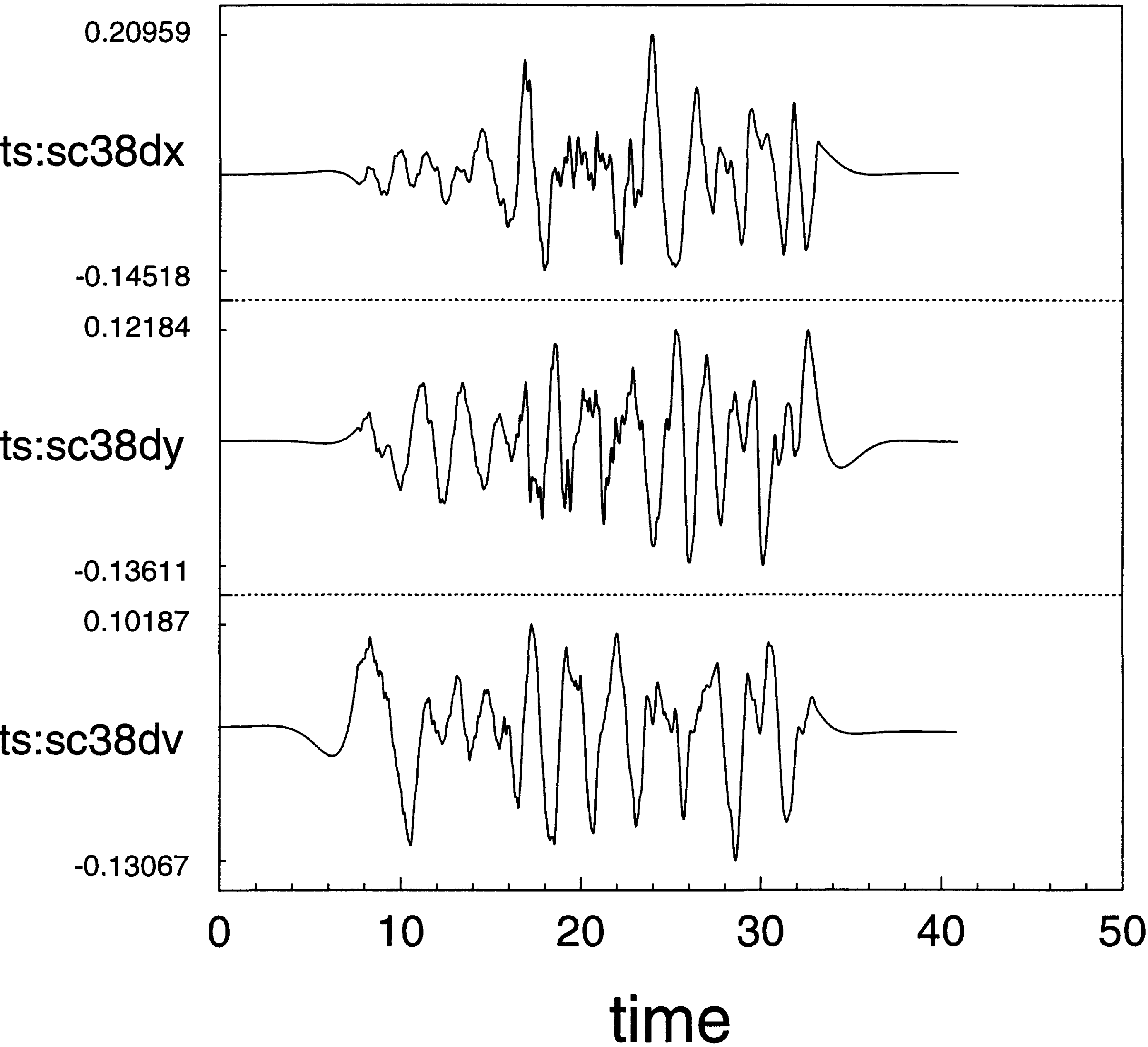

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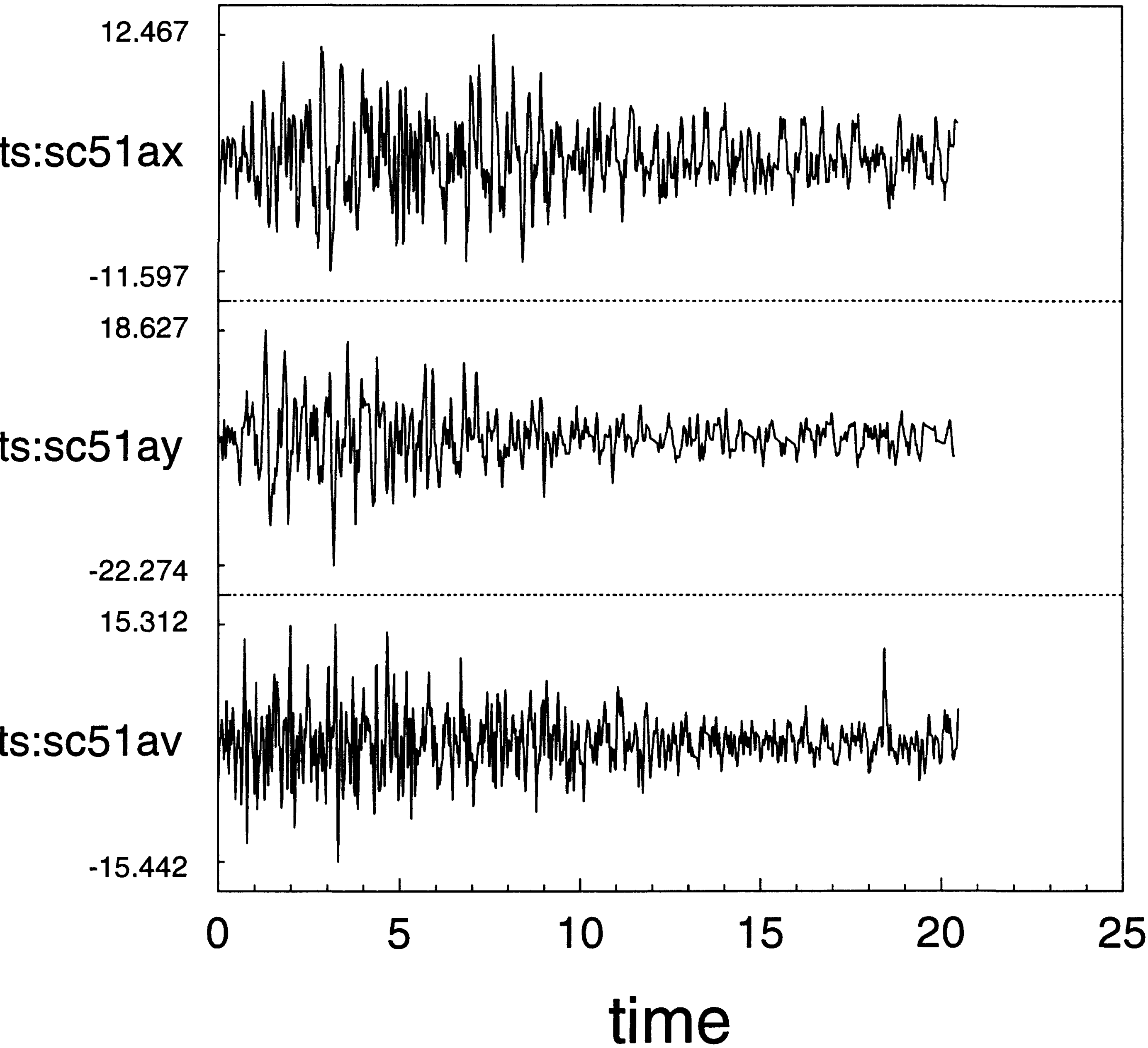

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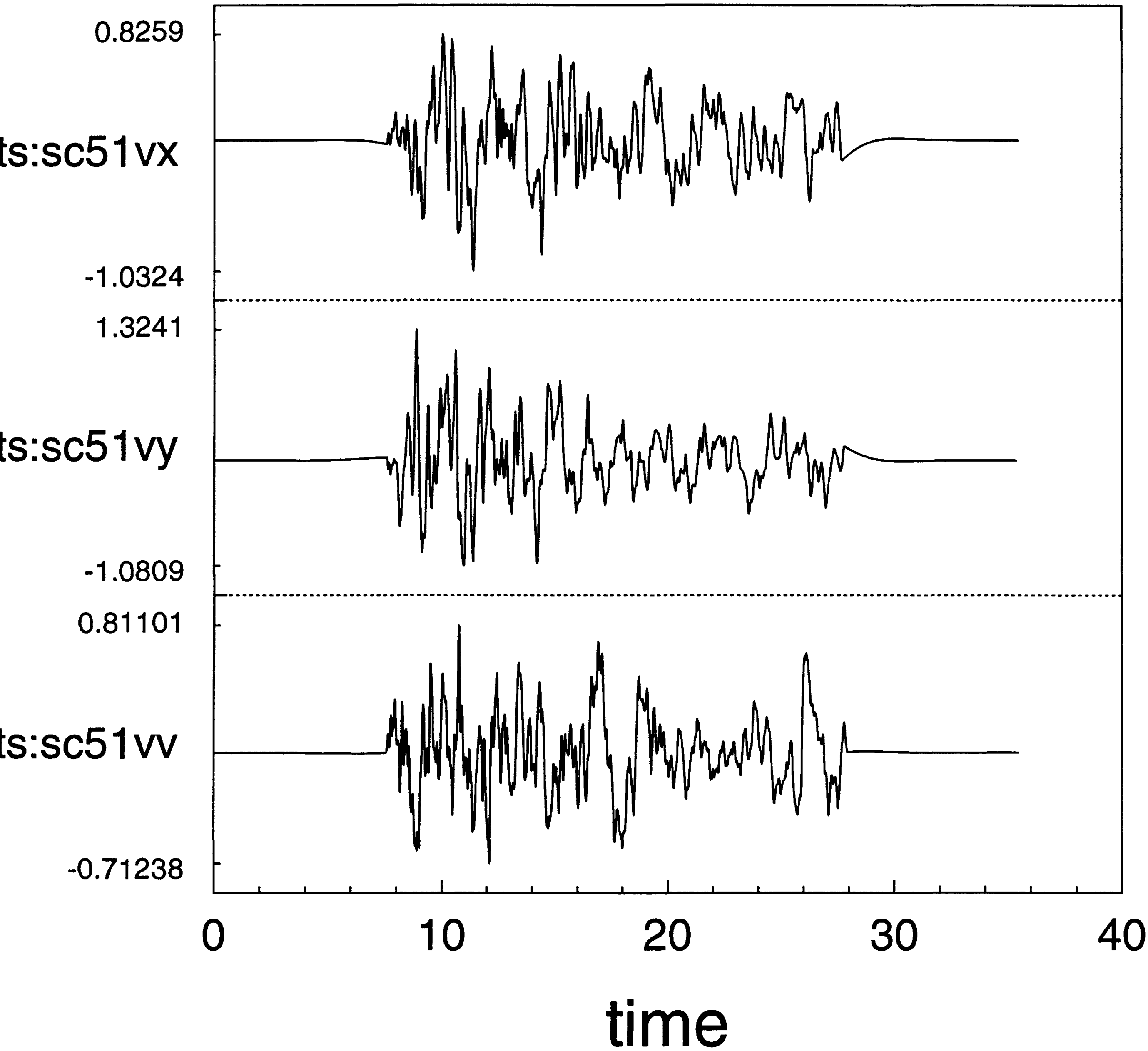

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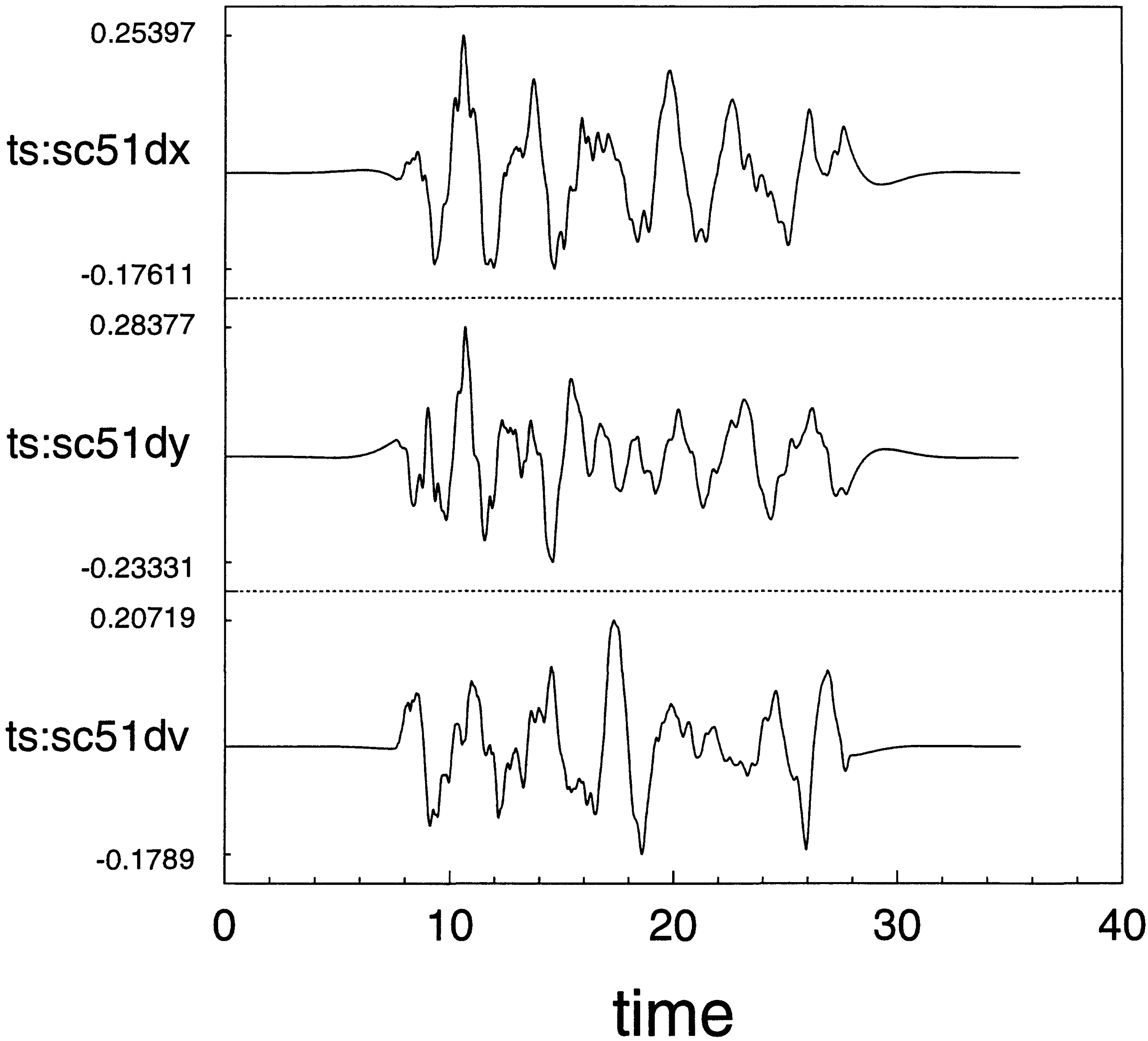

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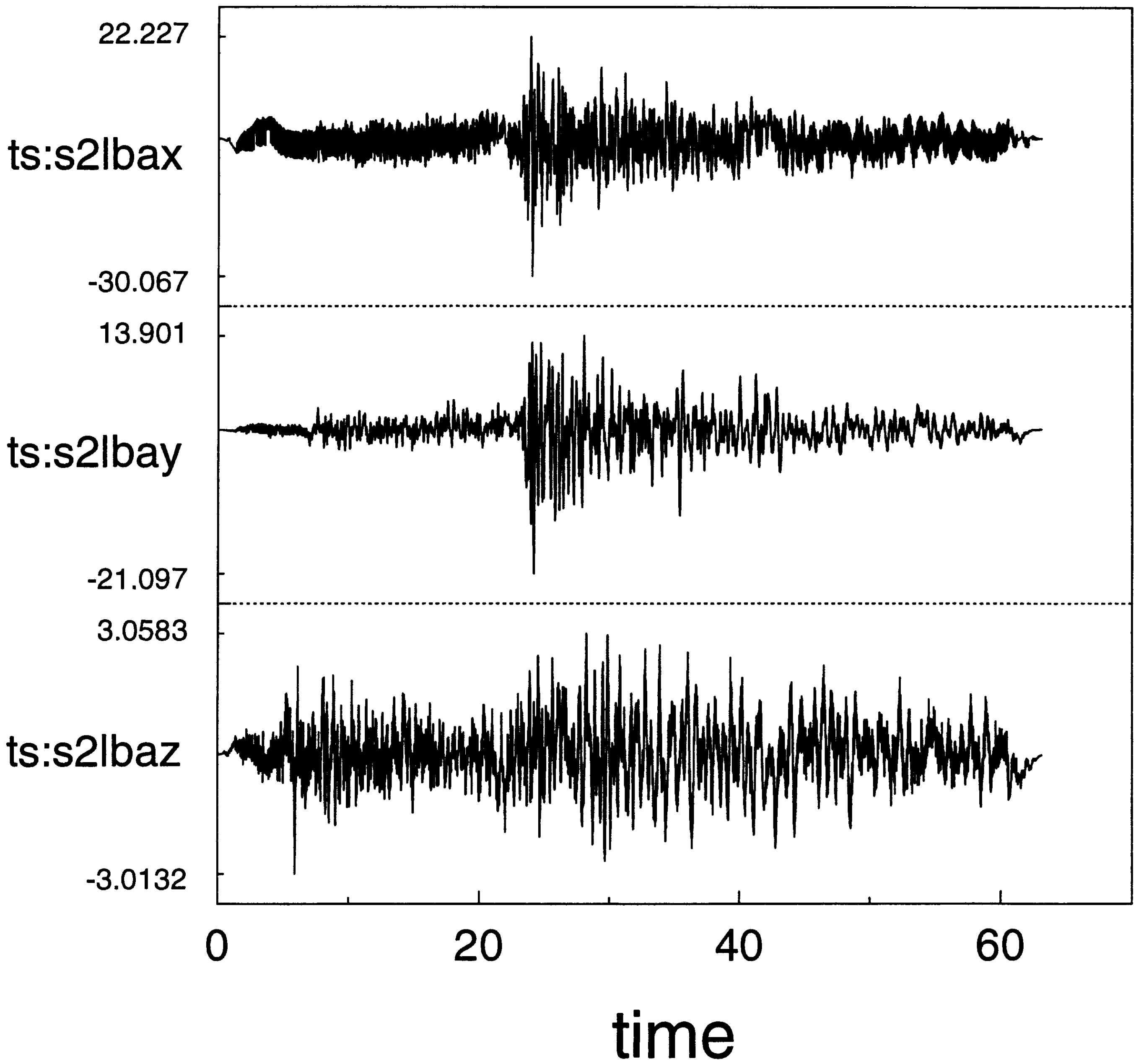

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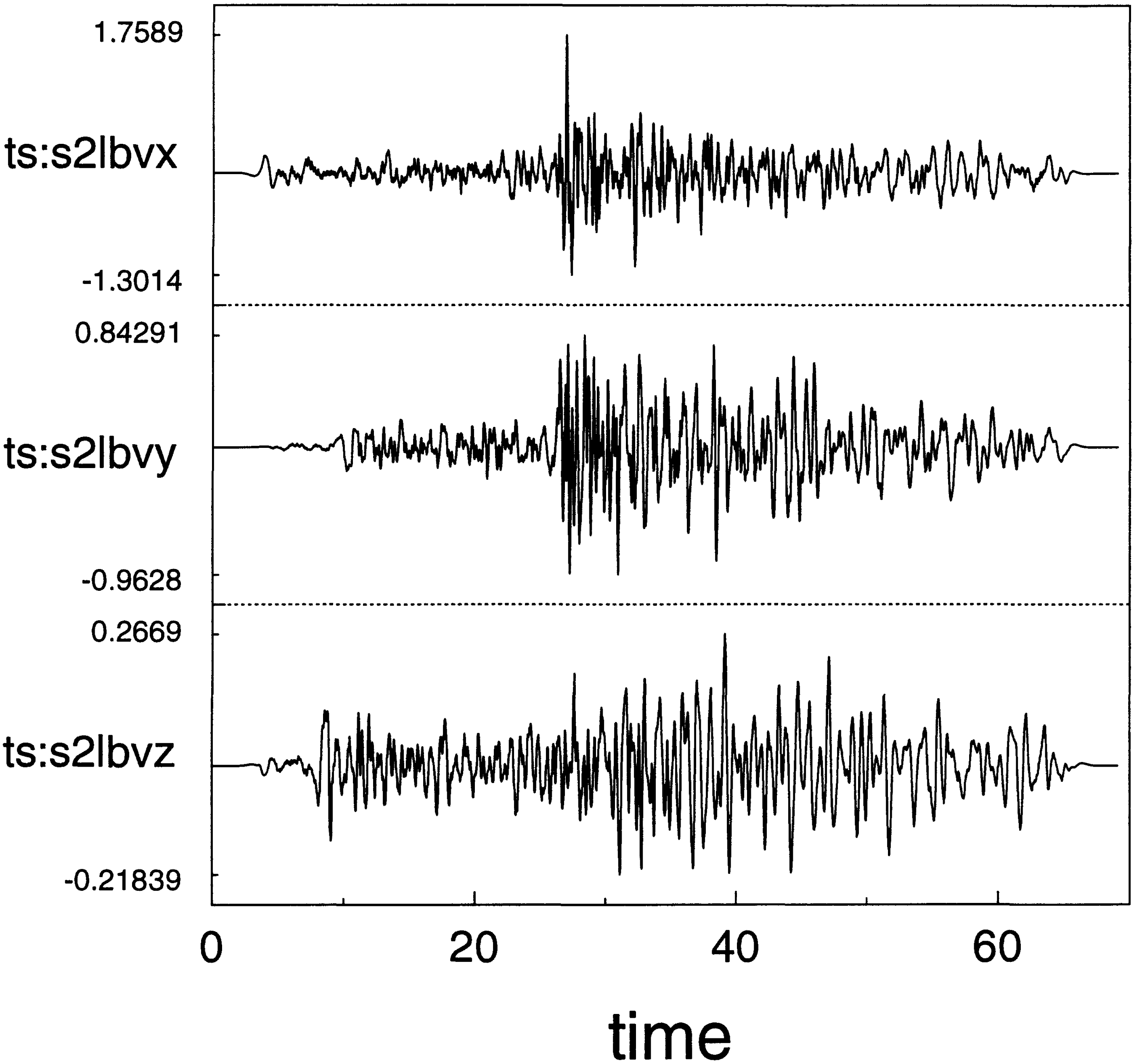

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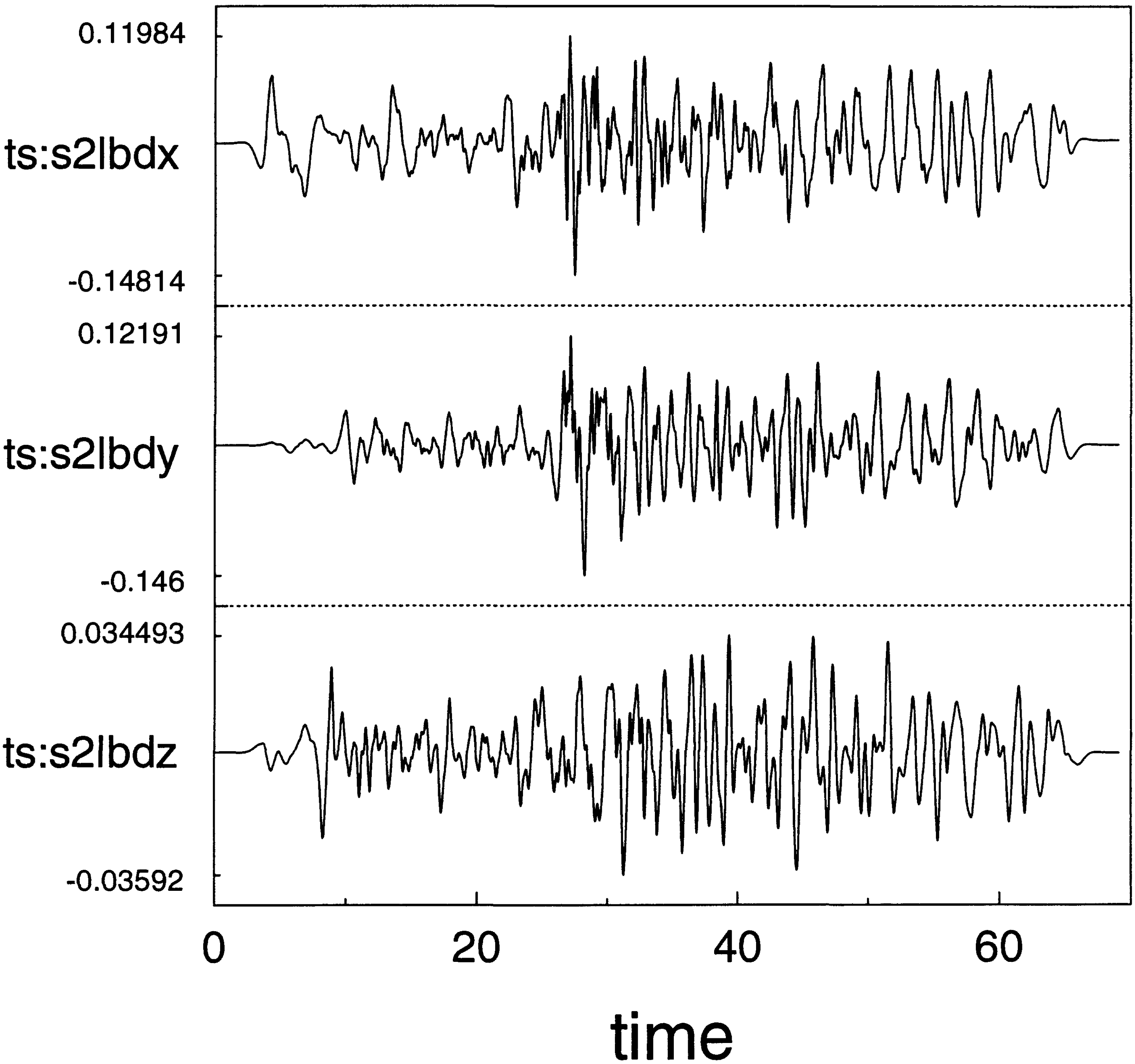

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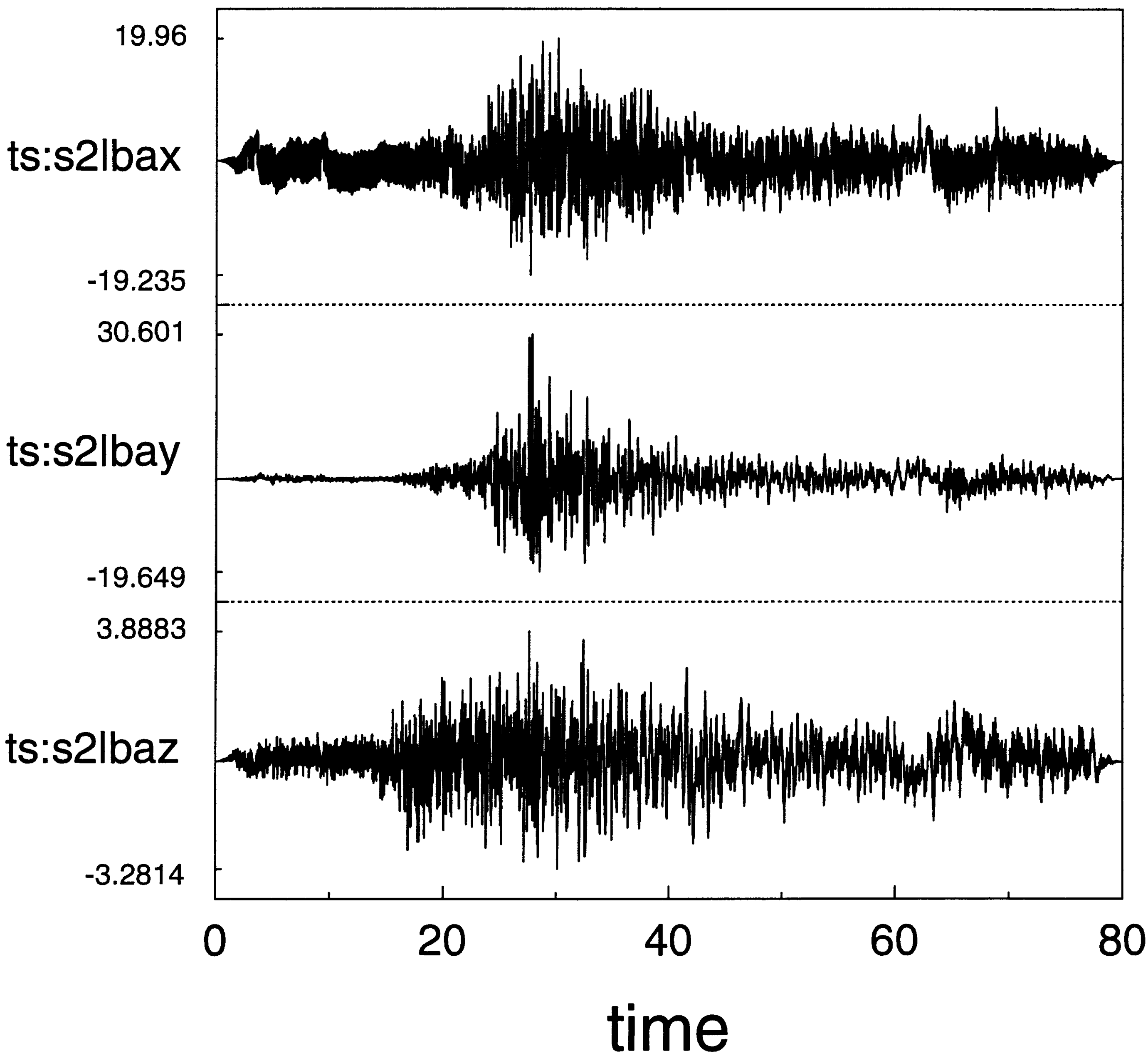

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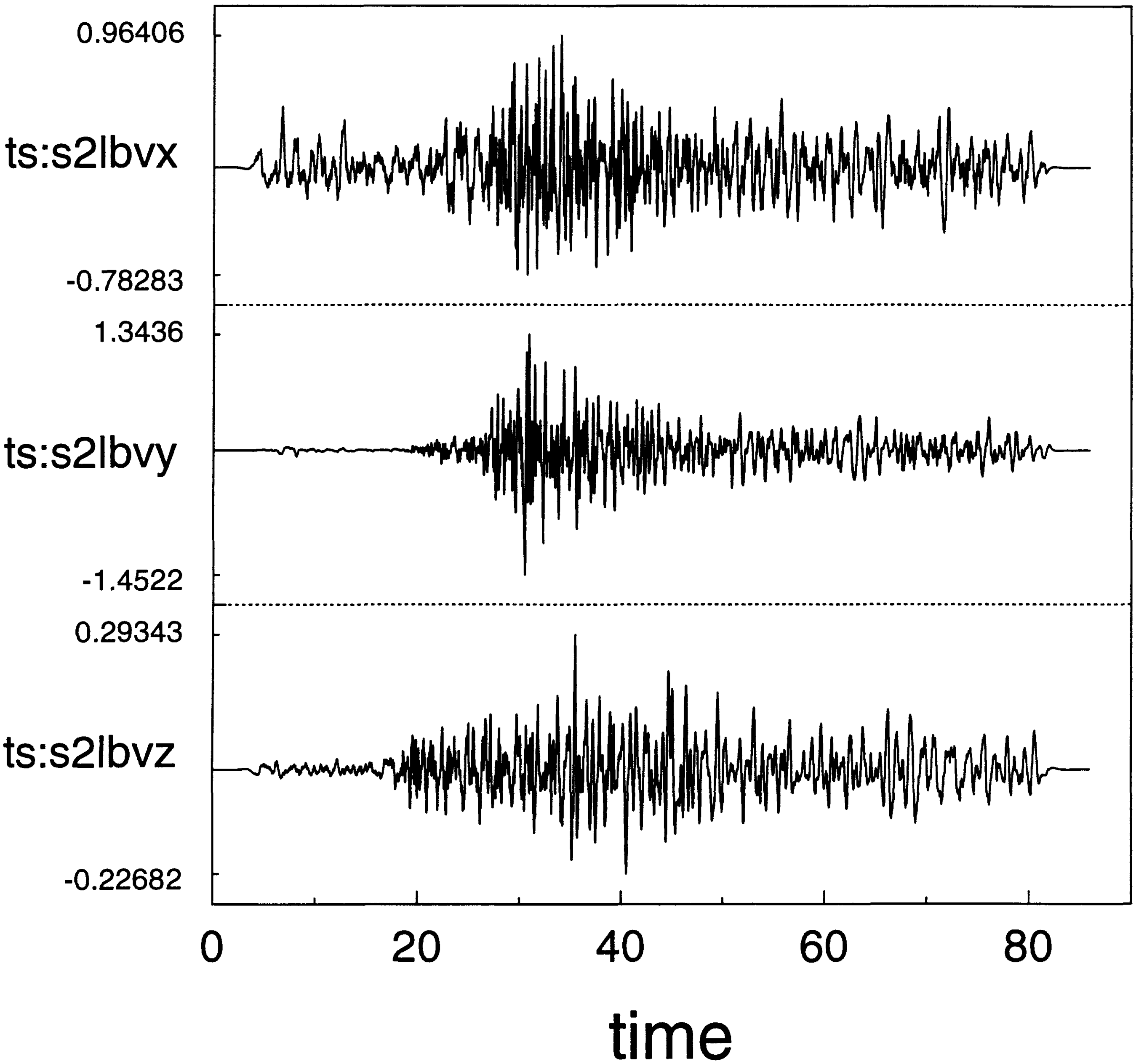

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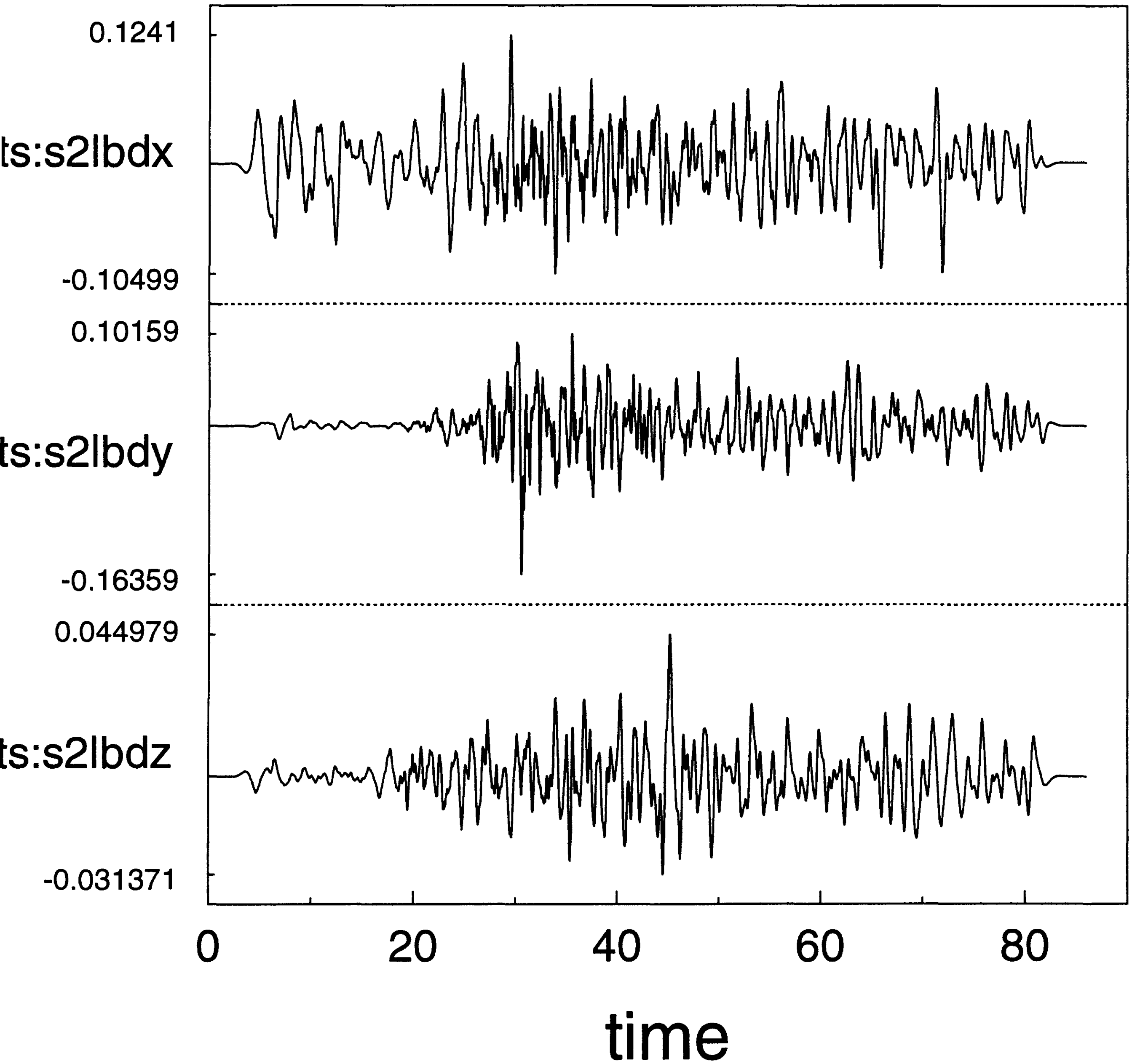

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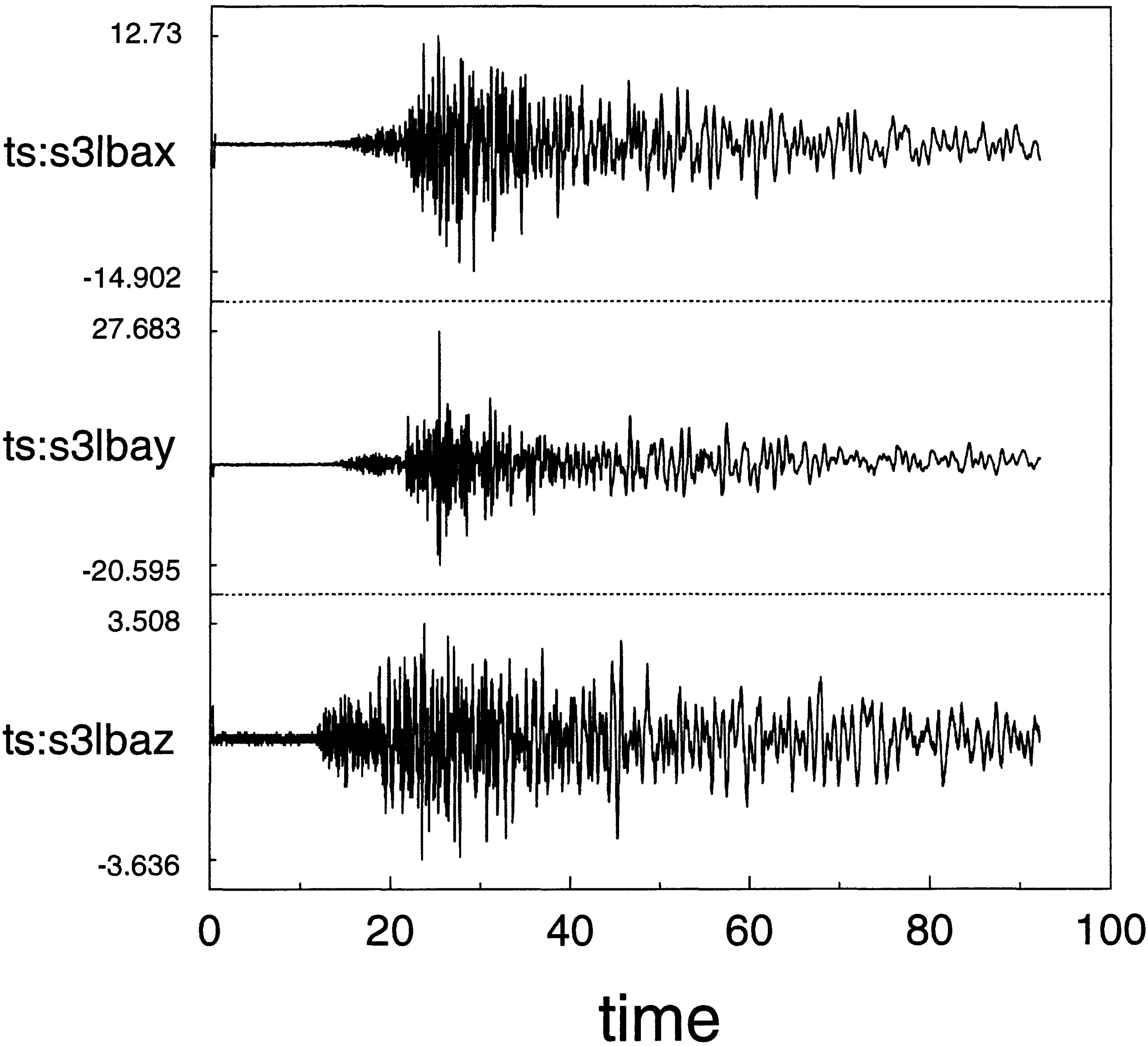

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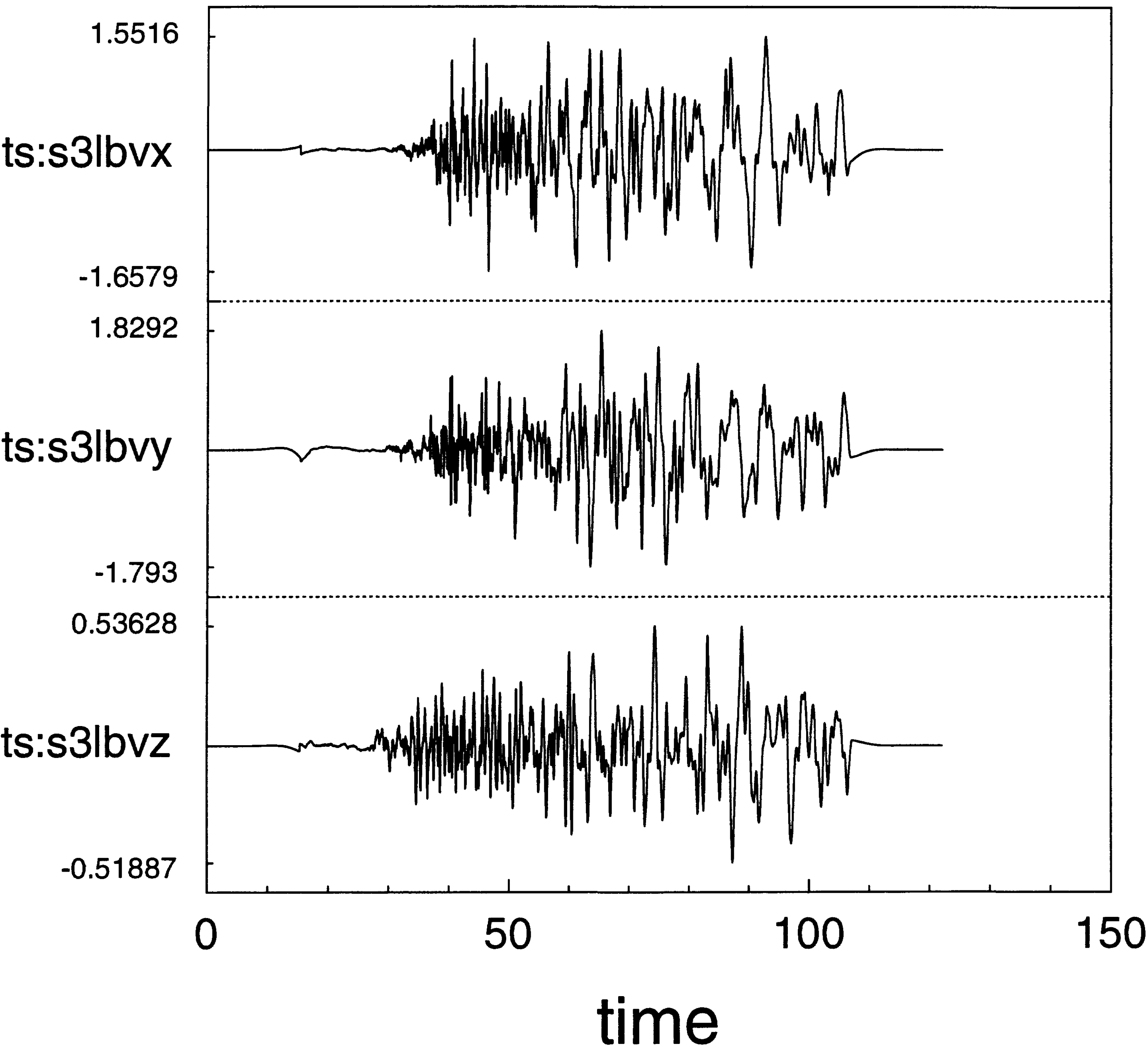

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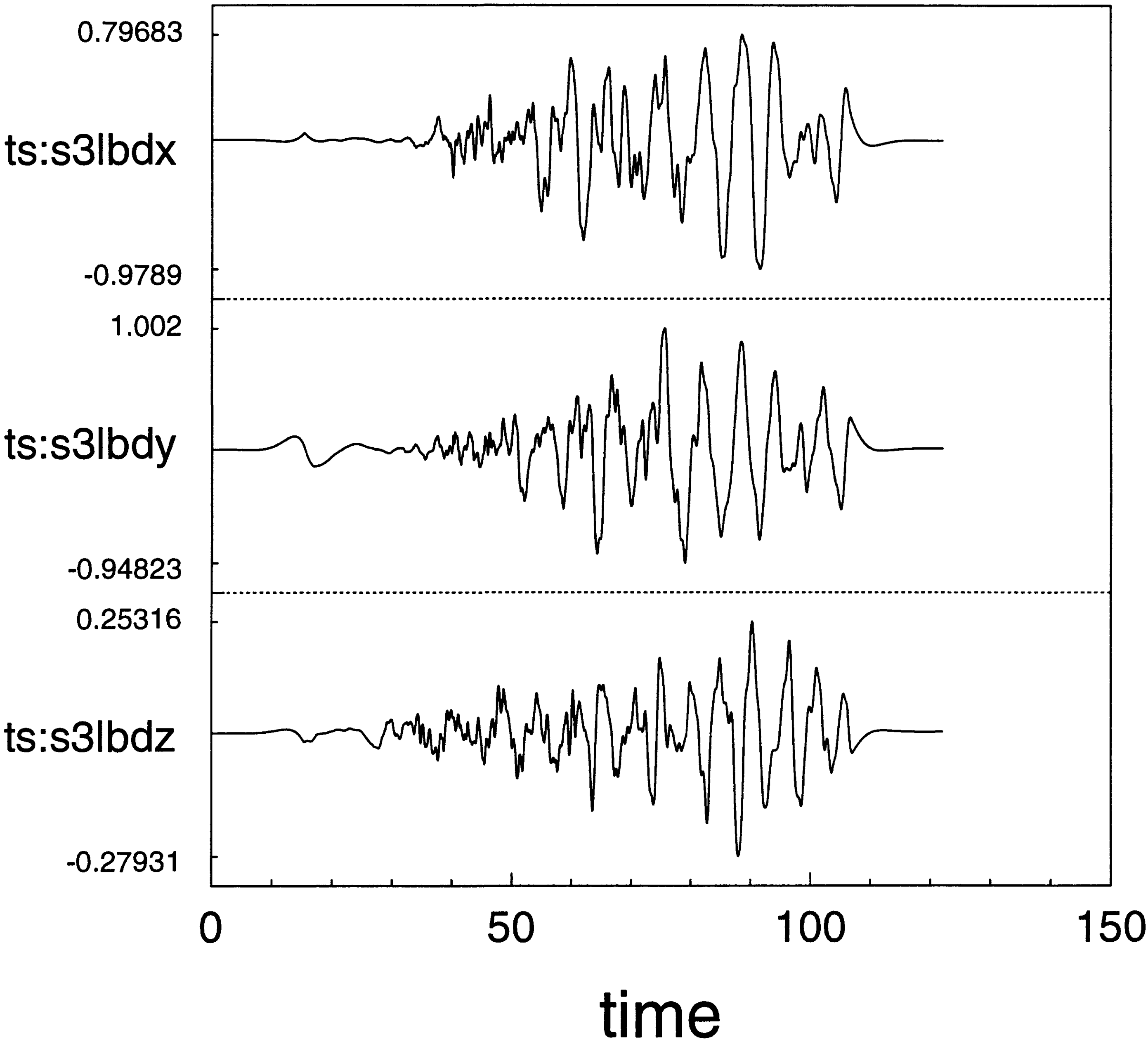

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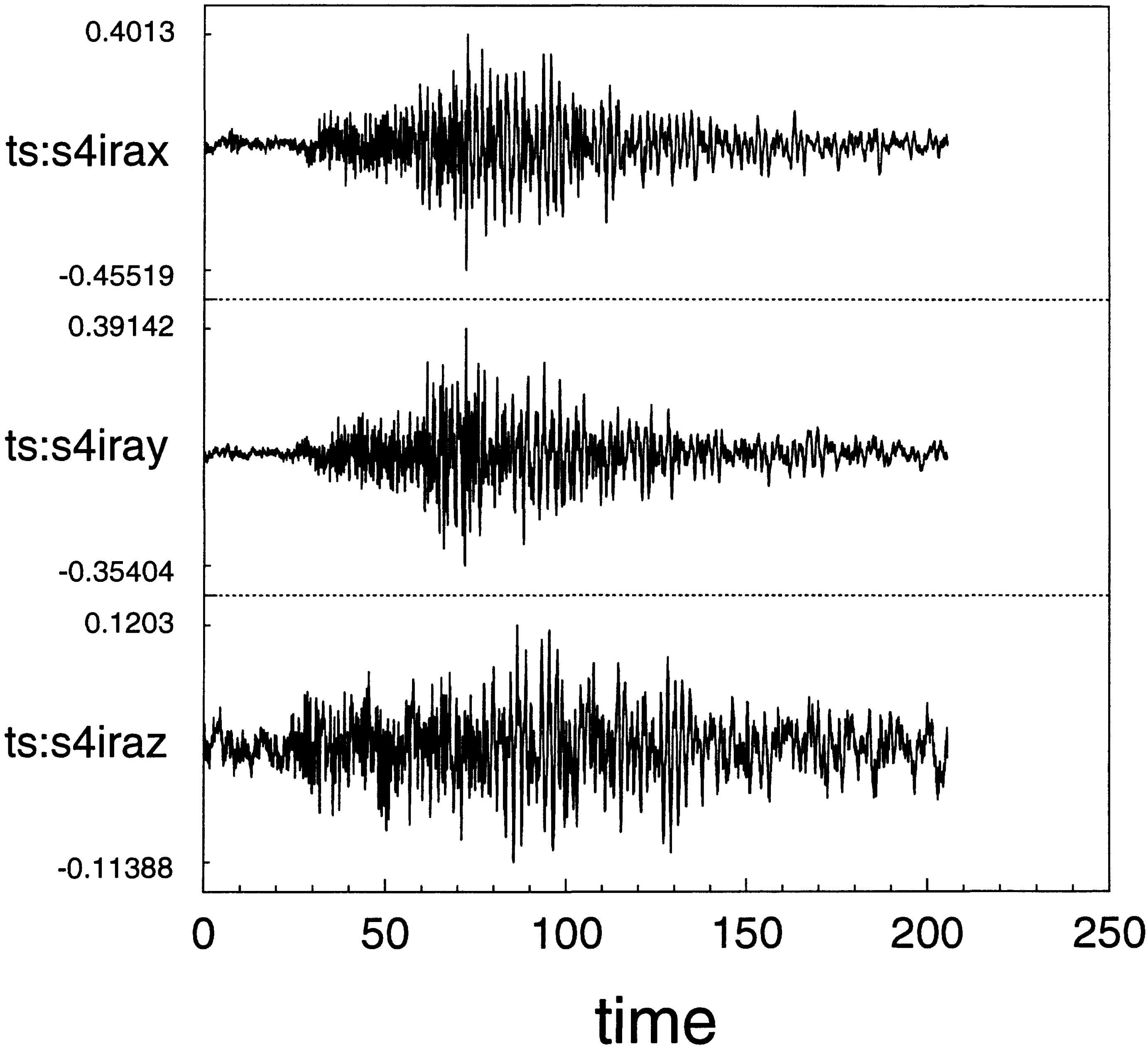

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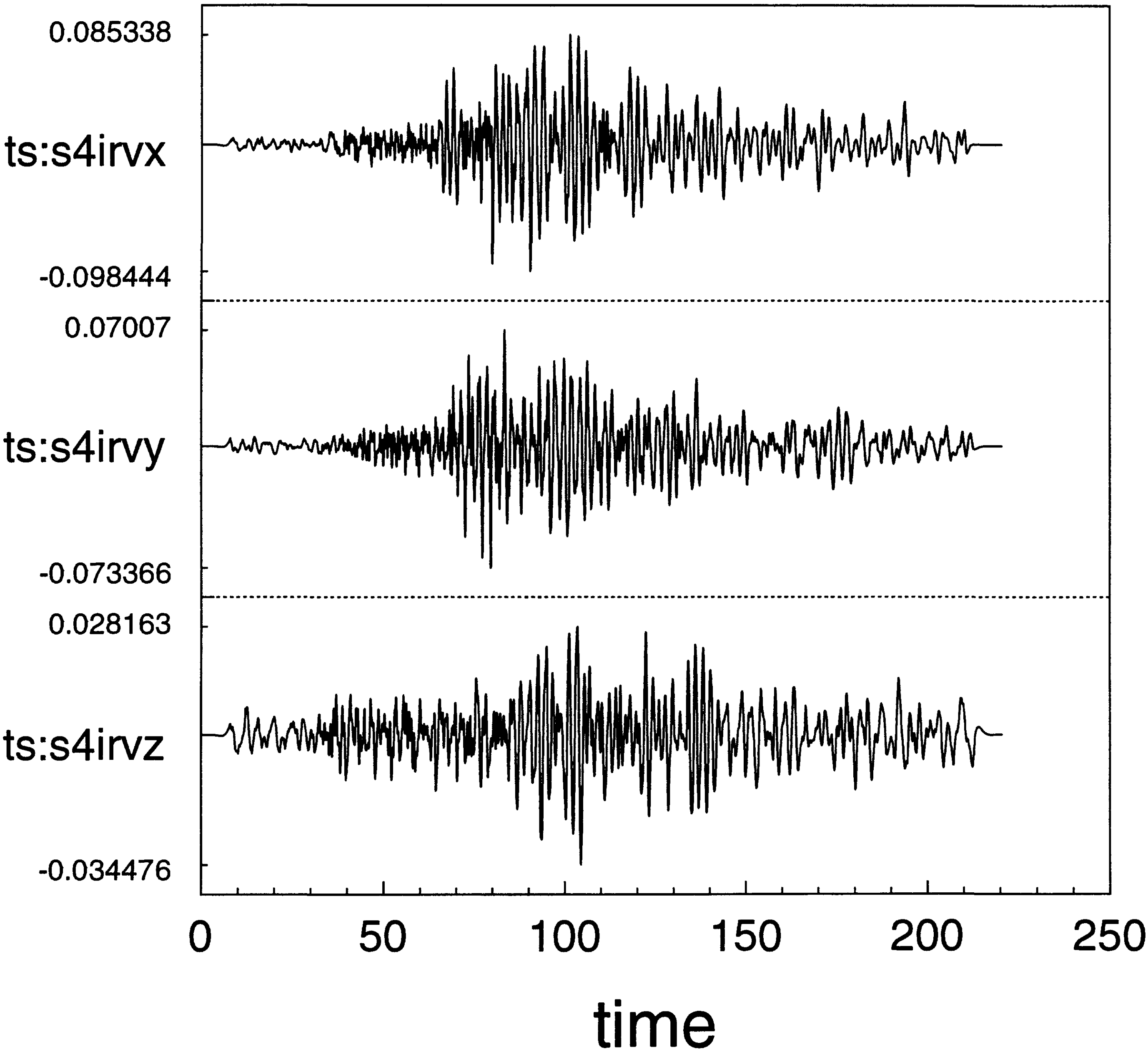

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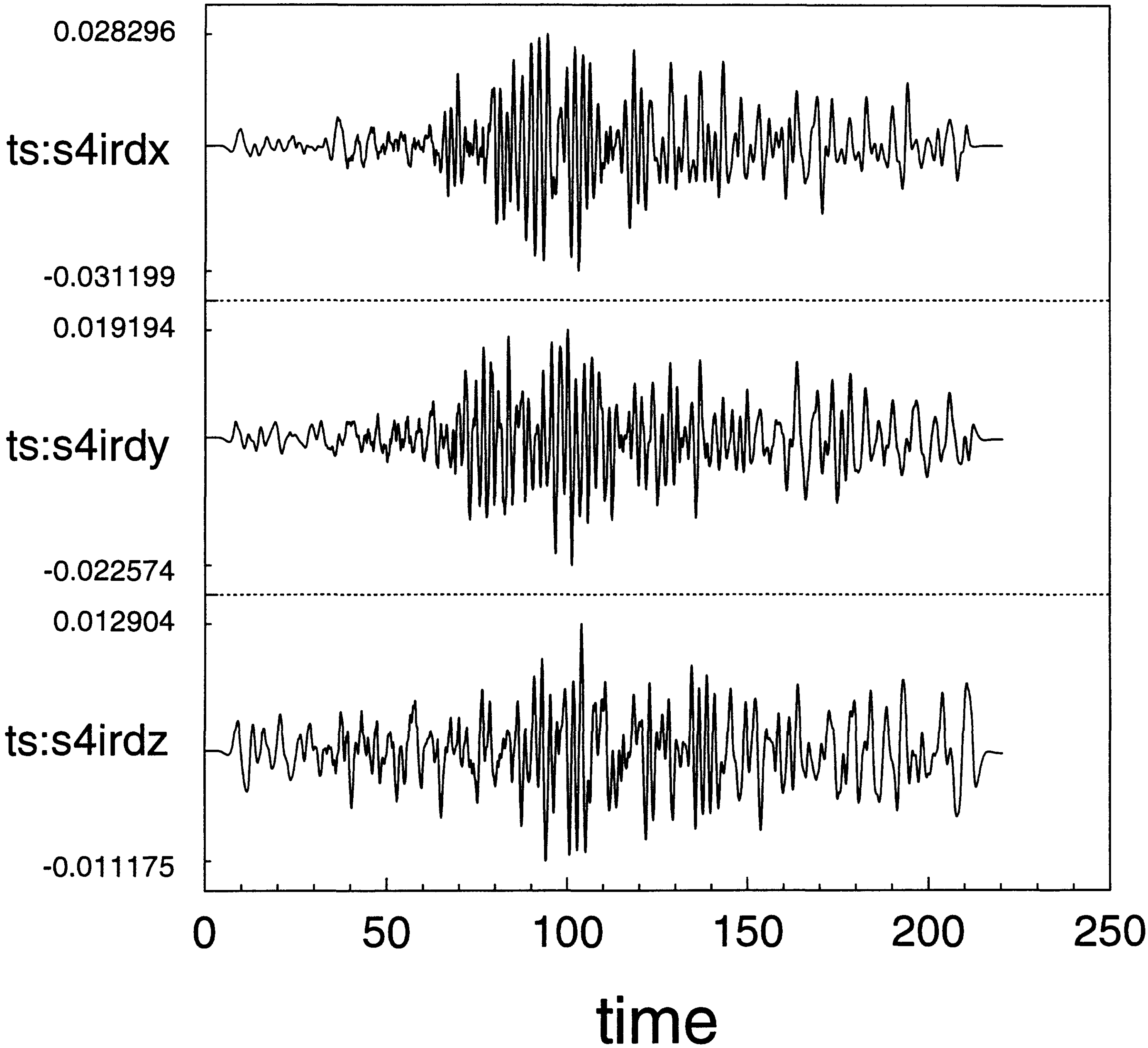

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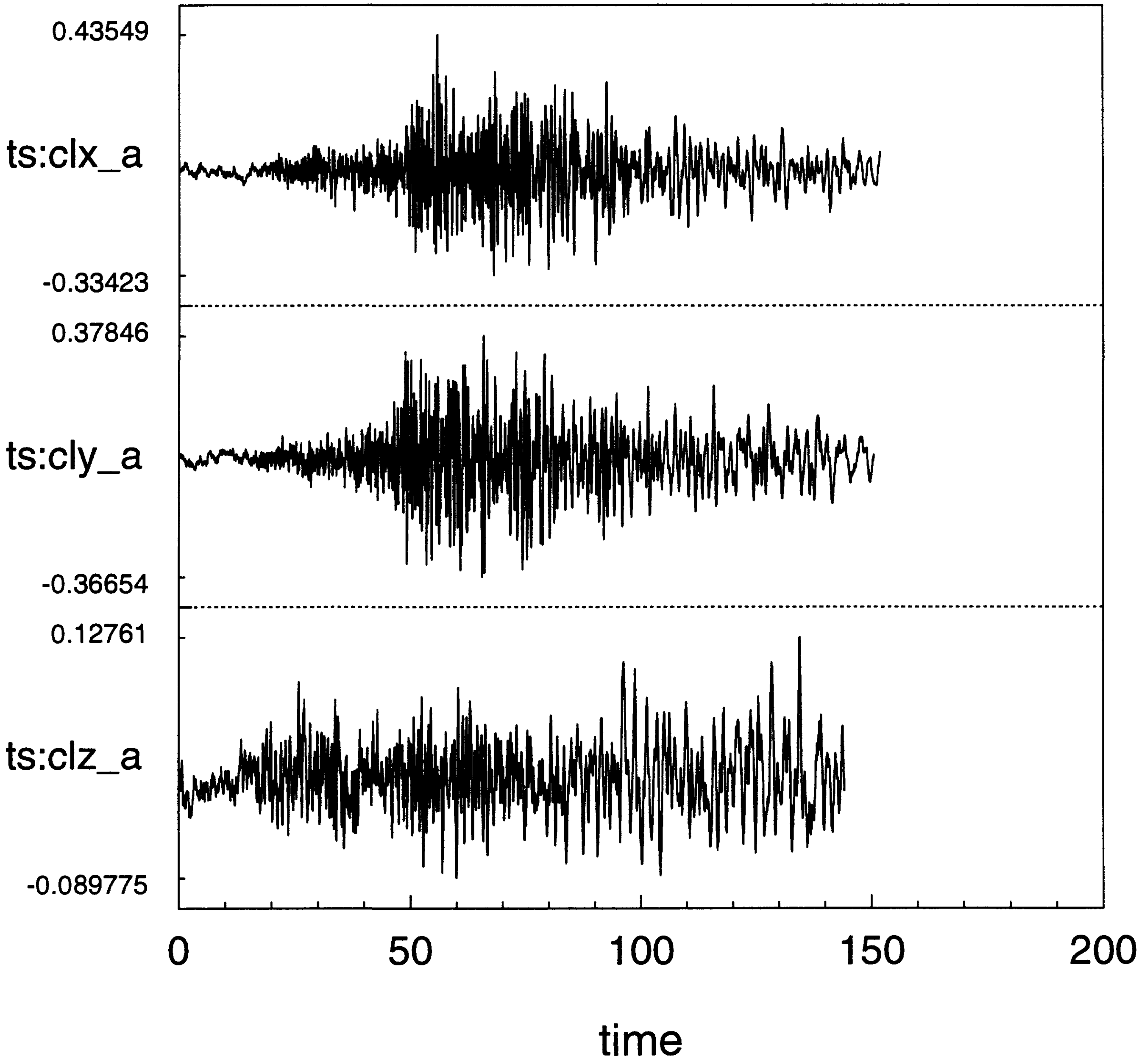

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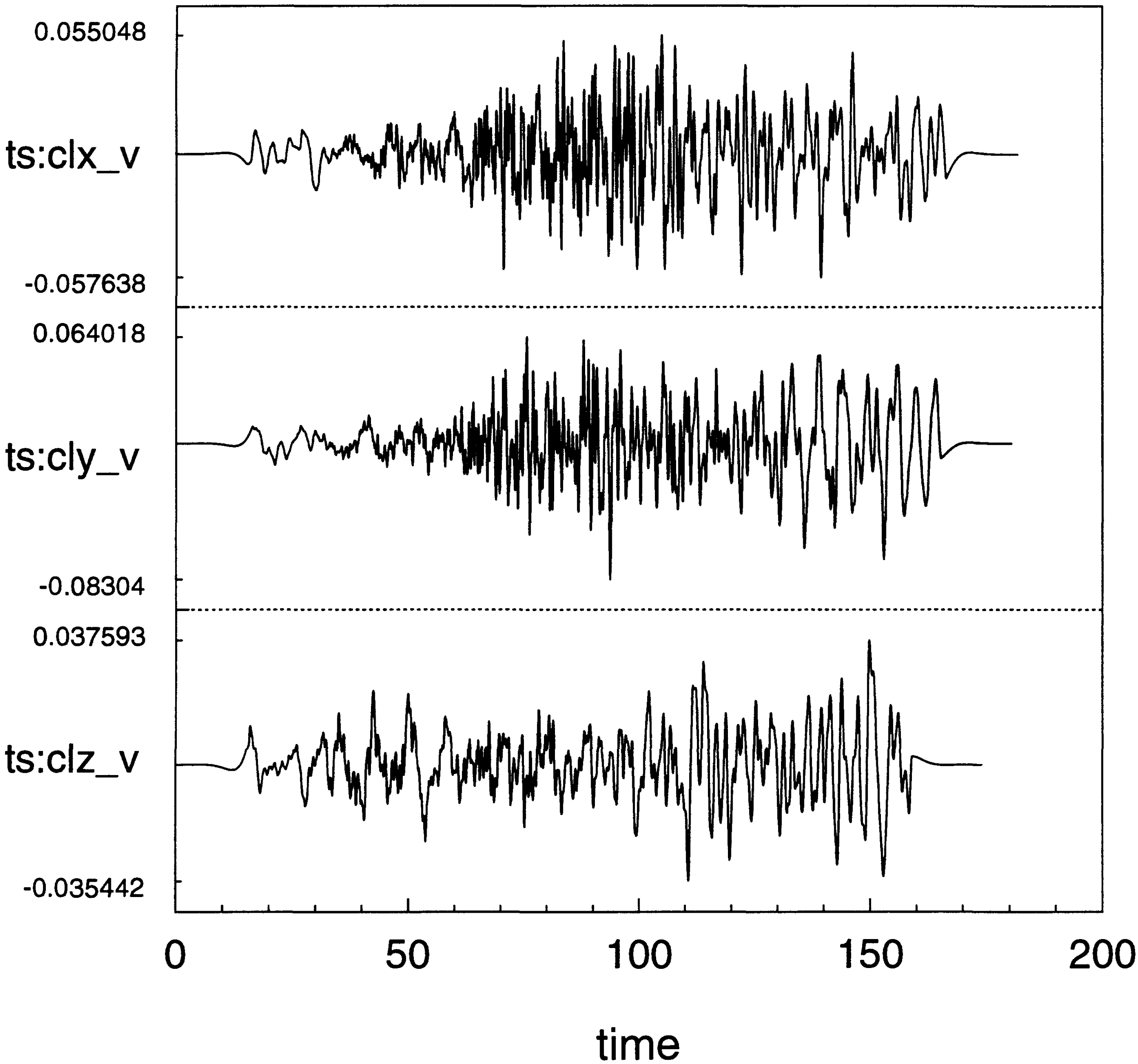

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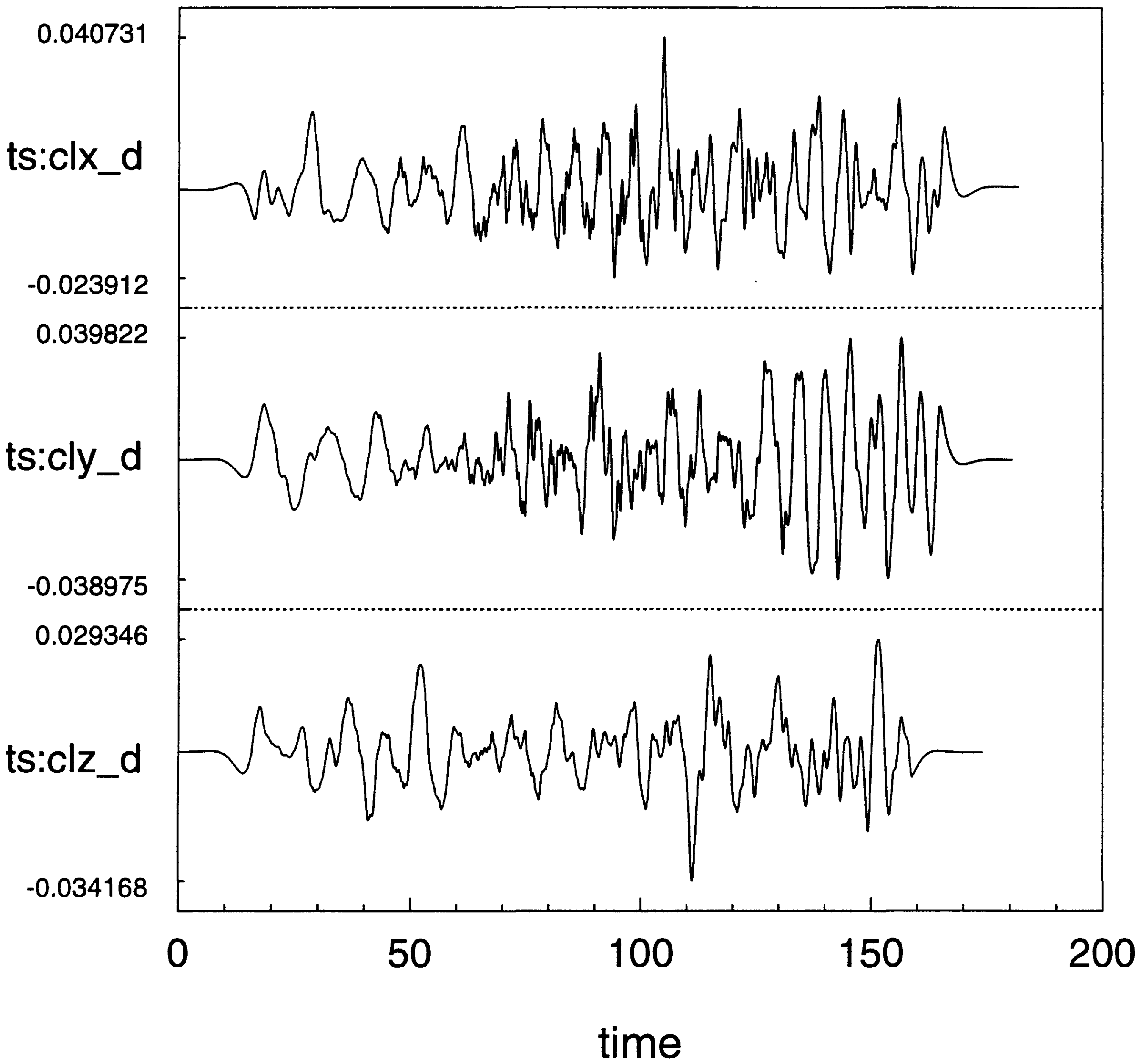

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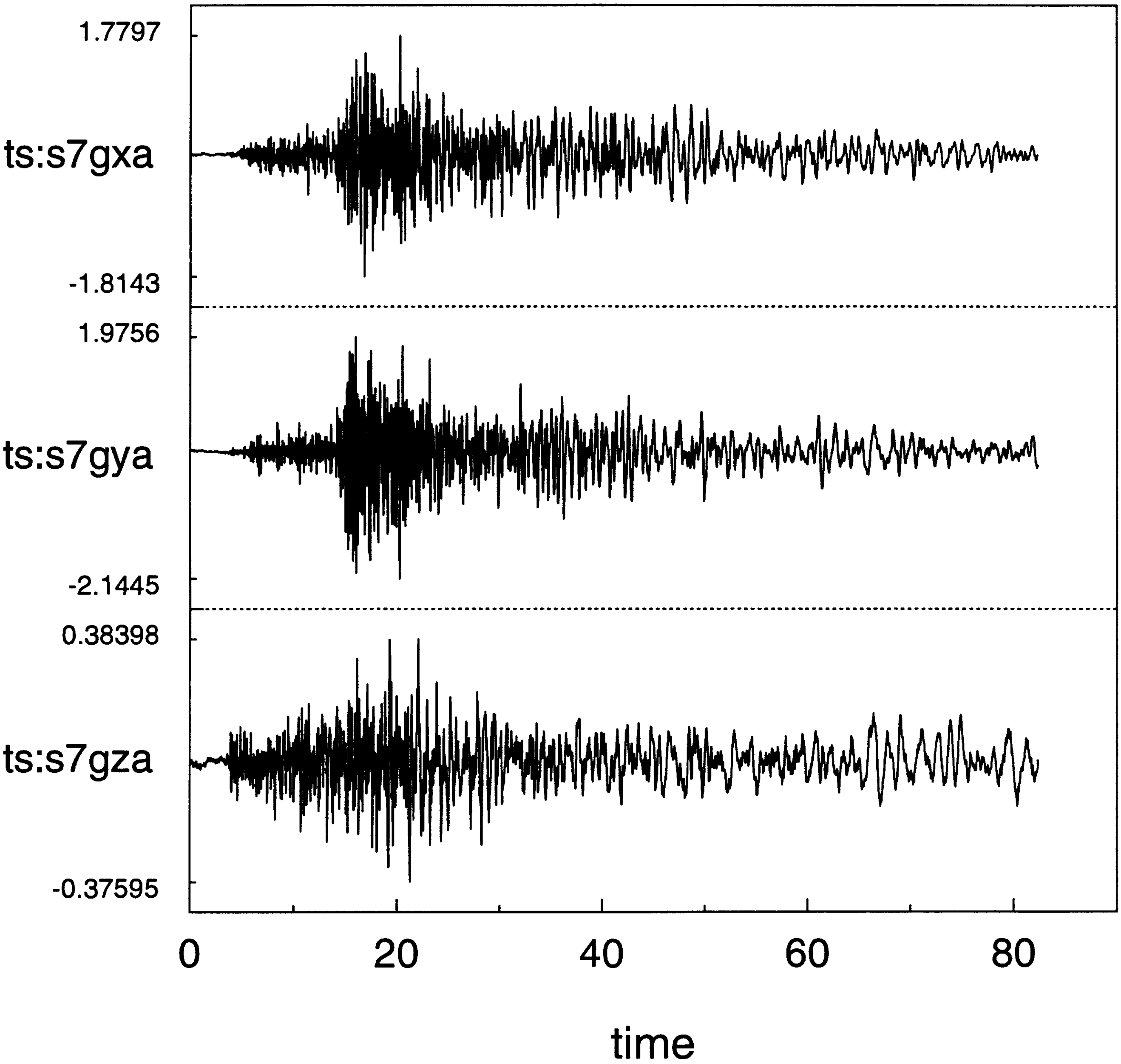

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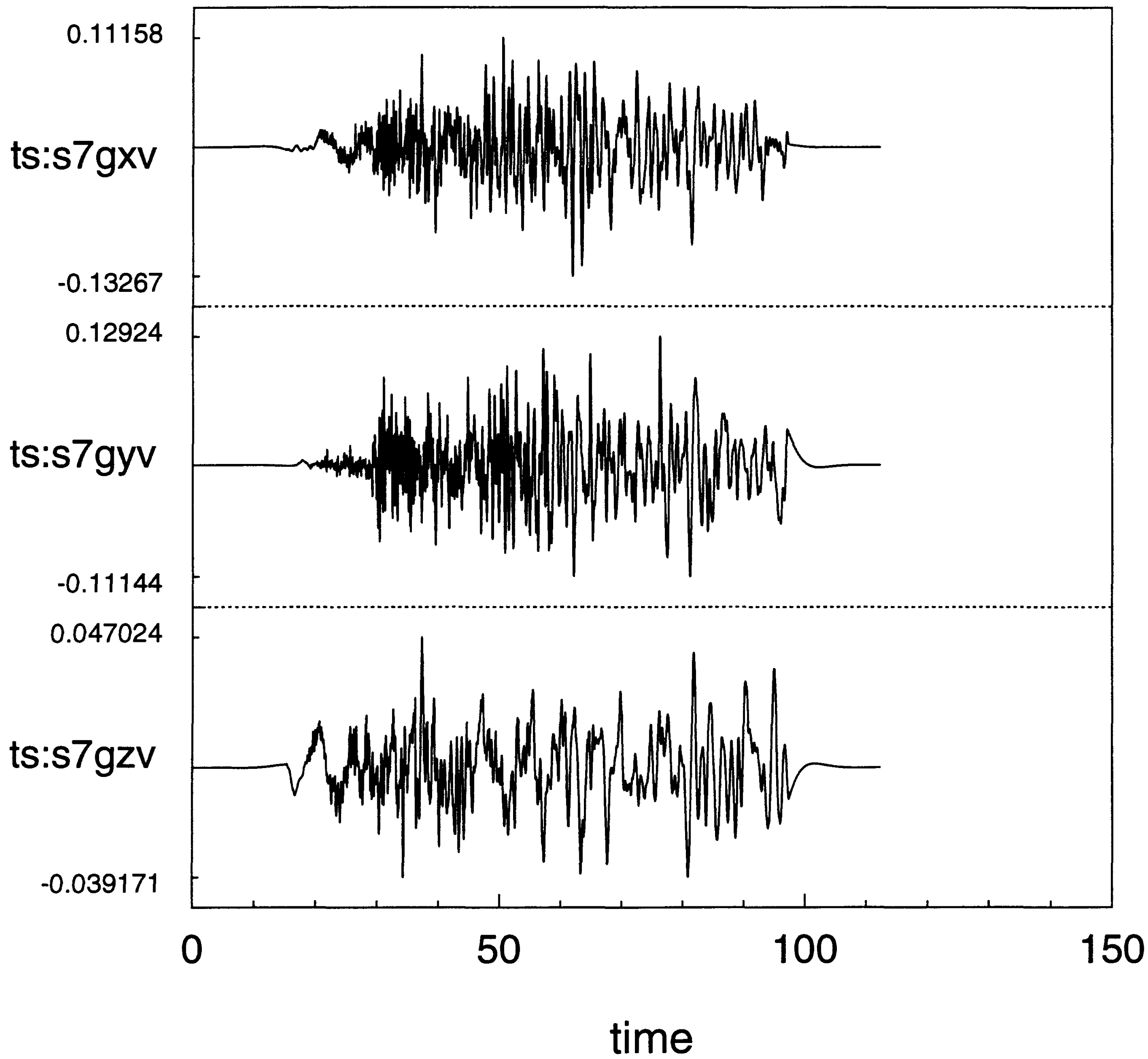

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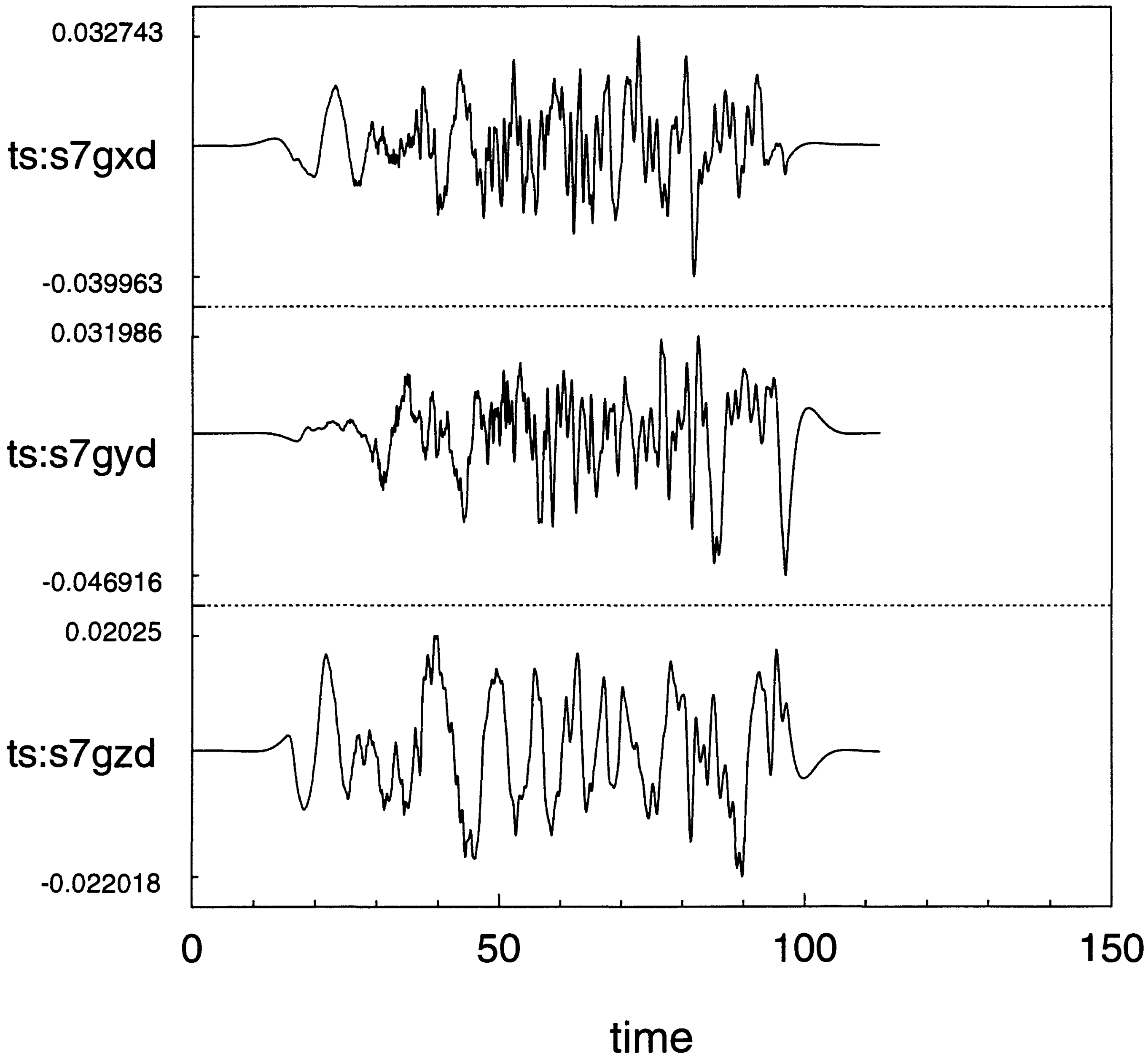

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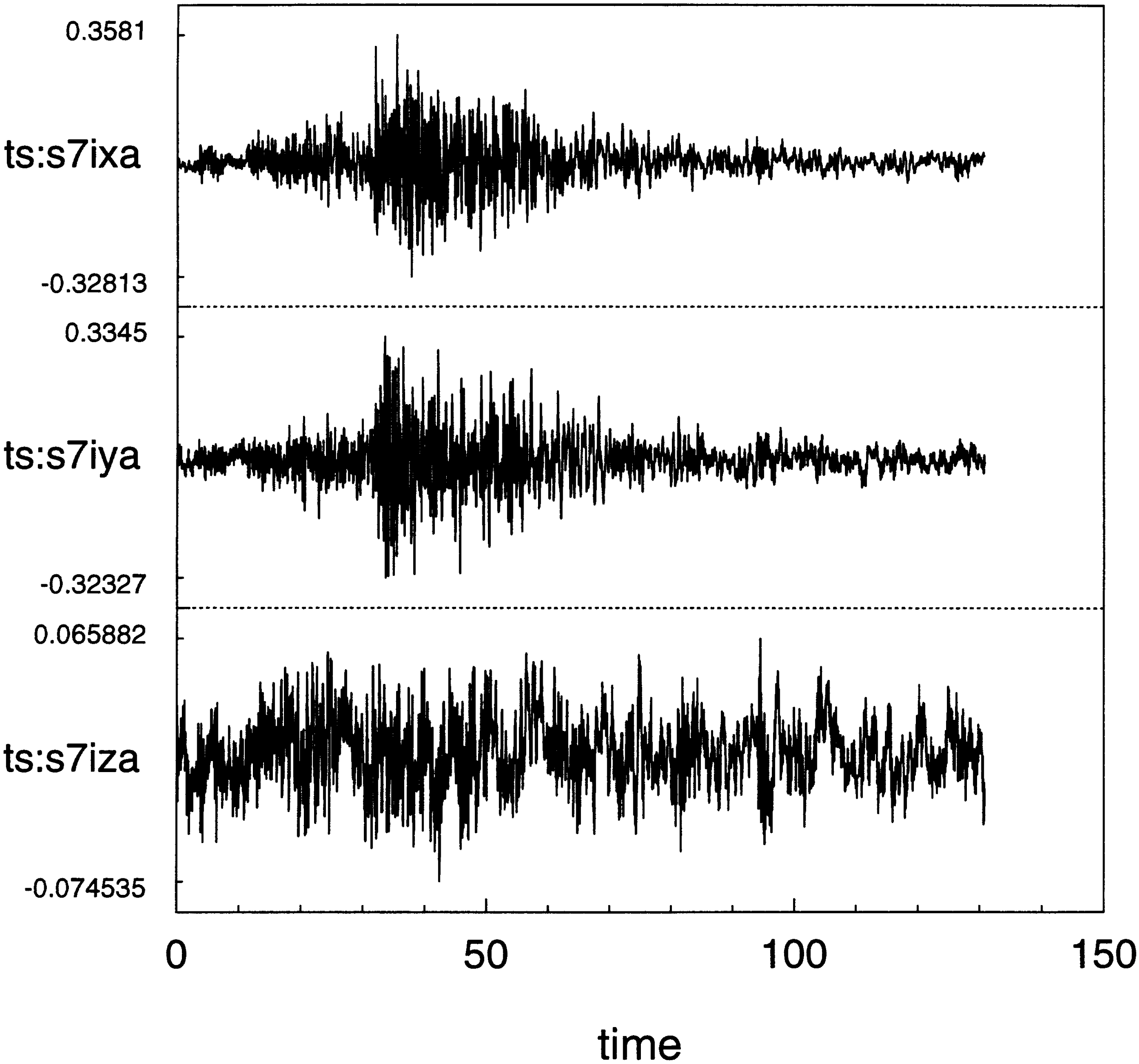
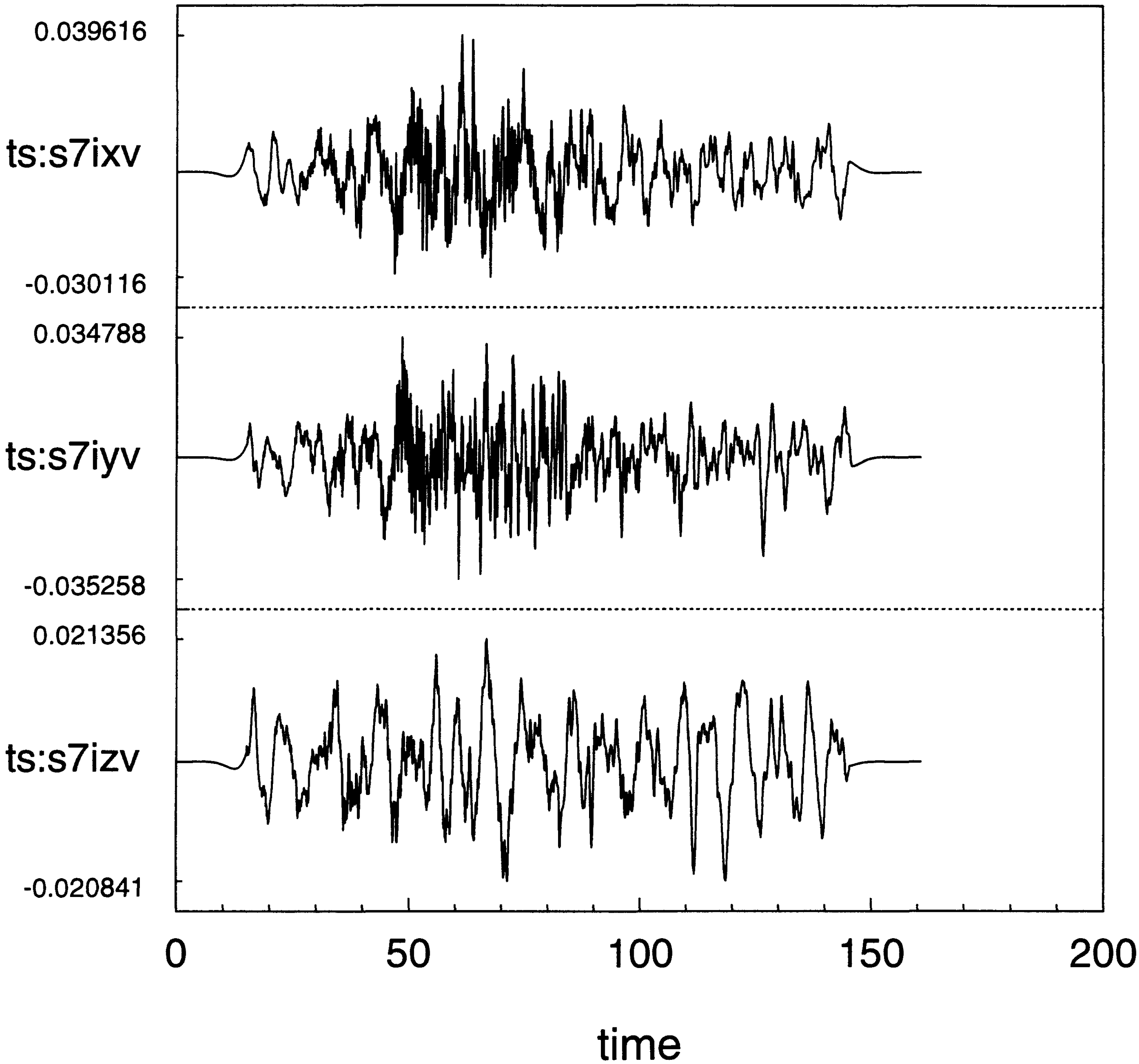
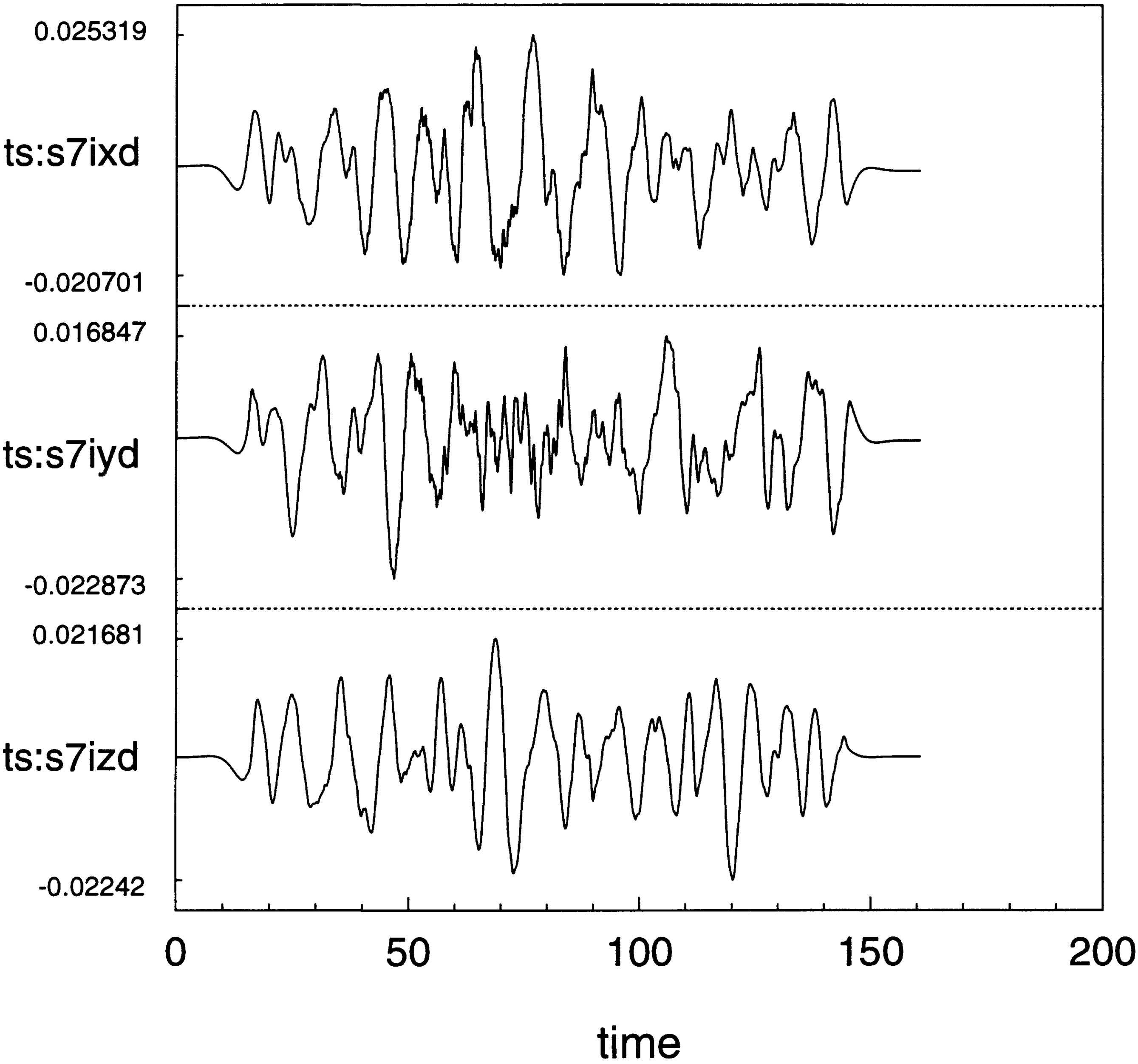


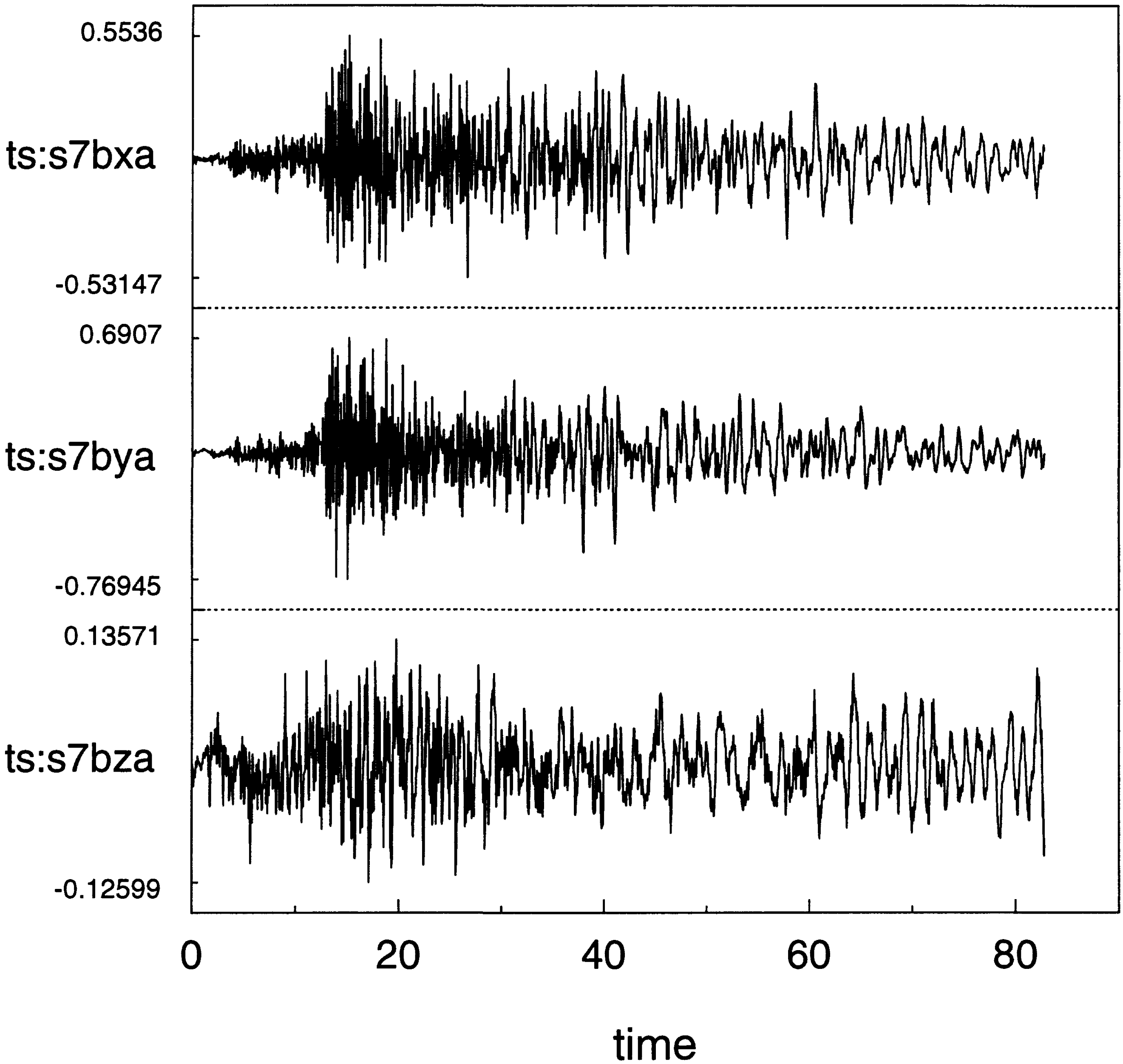
Jul 18, 1997 1:19:25 pm
C:\SEMS\SIMI97A\S97A_3AI.GRA
C:\SEMS\SIMI97A\S7AI_3A.DT



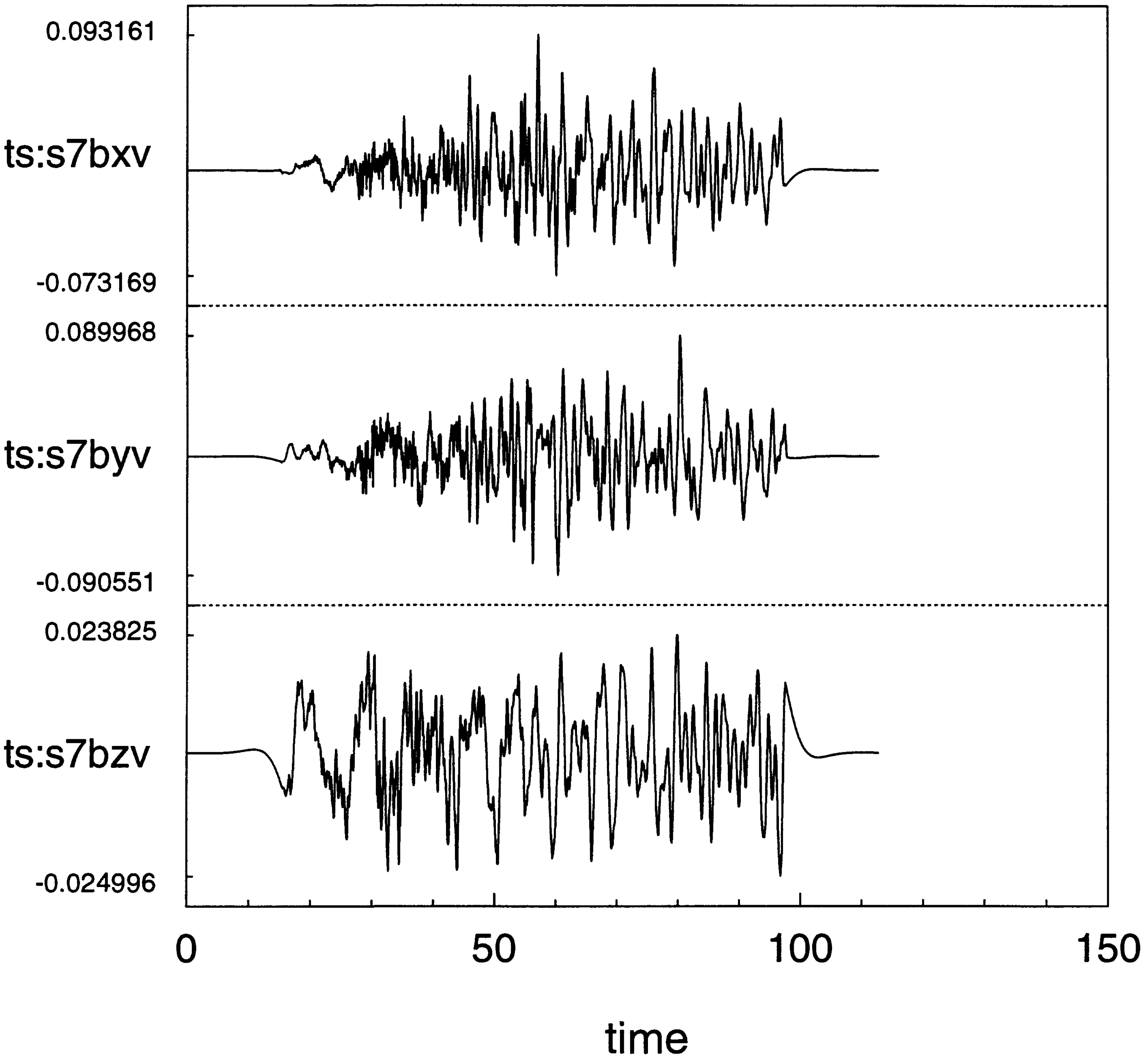
Jul 18, 1997 1:22:59 pm
C:\SEMS\SIMI97A\S97A_3VI.GRA
C:\SEMS\SIMI97A\S7AI_3V.DT



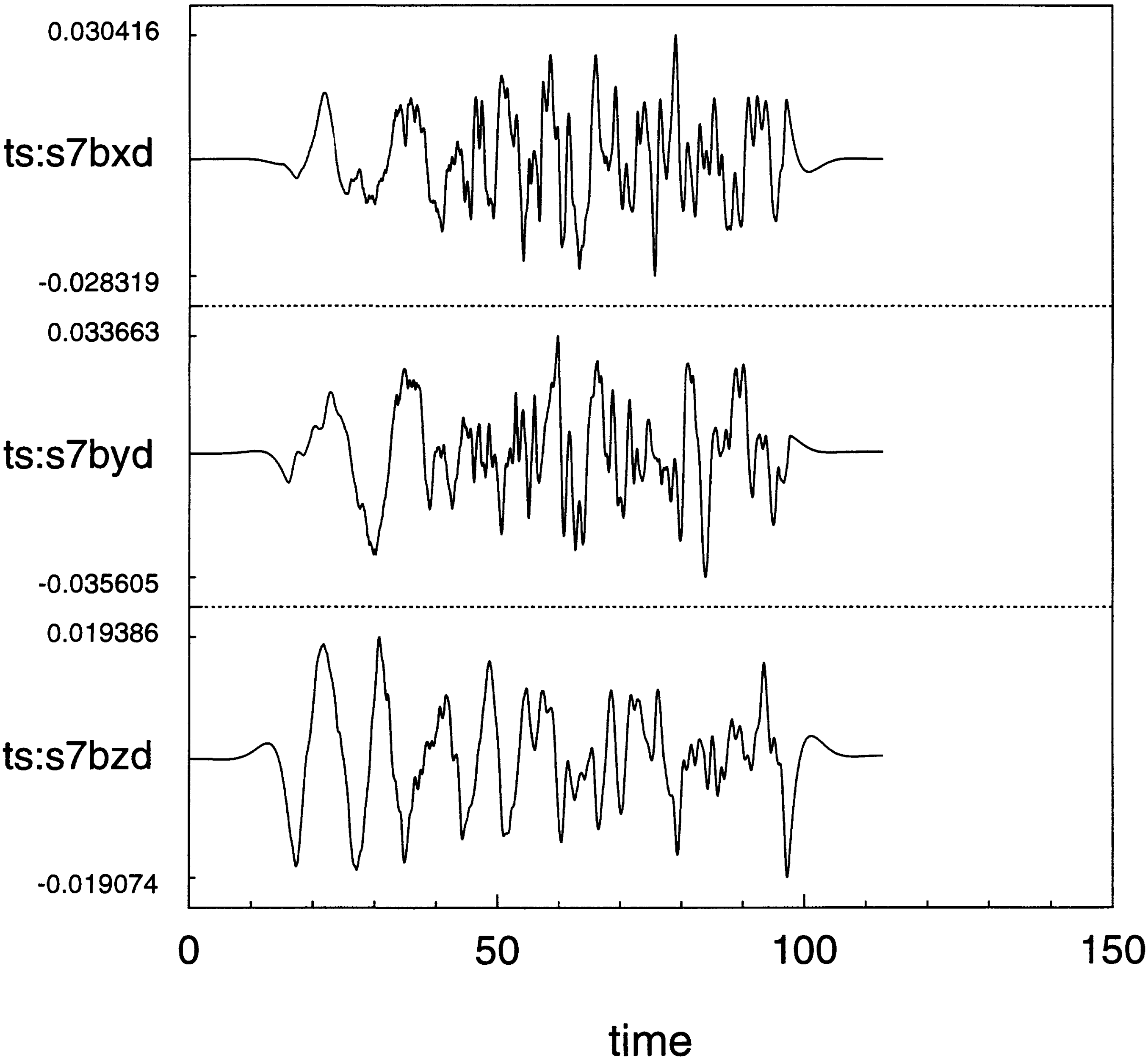
Jul 18, 1997 1:20:45 pm
C:\SEMS\SIMI97A\S97A_3DI.GRA
C:\SEMS\SIMI97A\S7AI_3D.DT



Jul 18, 1997 1:24:02 pm
C:\SEMS\SIMI97B\S97B_3A.GRA
C:\SEMS\SIMI97B\S97B_3A.DT



Jul 18, 1997 1:25:03 pm
C:\SEMS\SIMI97B\S97B_3V.GRA
C:\SEMS\SIMI97B\S97B_3V.DT



Jul 18, 1997 1:24:21 pm
C:\SEMS\SIMI97B\S97B_3D.GRA
C:\SEMS\SIMI97B\S97B_3D.DT

APPENDIX B – LISTINGS OF DIRECTORY CONTENTS

The following pages contain listings of the contents of the various directories used in this project. The first 2 pages contain the contents of the root directory (\SEMS) and the following pages are the contents of the subdirectories, arranged alphabetically.

```
 Volume in drive D has no label
 Volume Serial Number is D845-2F2F
 Directory of D:\sems

DIR      LST             0  11-11-97  9:07a DIR.LST
SEMS_MAP GRA        23,188  11-10-97  4:54p SEMS_MAP.GRA
SMITT197 LTR         2,432  11-10-97  9:06a SMITT197.LTR
SEMS95   ASC        26,848  11-07-97  2:19p SEMS95.ASC
STAINFO  ASC         8,513  11-05-97  3:55p STAINFO.ASC
STAINFO  PCO        10,706  11-05-97  3:55p STAINFO.PCO
STAINFO  BAK        10,418  11-05-97  3:37p STAINFO.BAK
TEMP     ASC         1,742  11-05-97 12:51p TEMP.ASC
PAPERS   ASC        10,567  11-04-97 10:39a PAPERS.ASC
PAPERS   PCO        11,212  11-03-97  8:50a PAPERS.PCO
PAPERS   BAK        11,212  11-03-97  8:45a PAPERS.BAK
REPORT   ASC        16,298  10-30-97  9:46p REPORT.ASC
REPORT   PCO        18,480  10-30-97  9:46p REPORT.PCO
REPORT   BAK        18,456  10-30-97  9:16p REPORT.BAK
SEMS97A  ASC        30,849  10-30-97  9:07p SEMS97A.ASC
SEMS97A  PCO        30,276  10-30-97  9:07p SEMS97A.PCO
SEMS97A  BAK        29,700  10-29-97  9:23p SEMS97A.BAK
ZIPS         <DIR>          10-16-97  4:22p zips
BIGEQ        <DIR>          10-16-97  4:22p bigeq
NPALM86      <DIR>          10-16-97  4:22p npalm86
OCNSID86     <DIR>          10-16-97  4:22p ocnsid86
RC95         <DIR>          10-16-97  4:22p rc95
SBI81        <DIR>          10-16-97  4:22p sbi81
SITEAB       <DIR>          10-16-97  4:22p siteab
THEORY       <DIR>          10-16-97  4:22p theory
UPLAND90     <DIR>          10-16-97  4:22p upland90
VEL_Q        <DIR>          10-16-97  4:21p vel_q
REPORT       <DIR>          10-16-97  4:21p report
AVD          <DIR>          10-16-97  4:21p avd
V_H          <DIR>          10-16-97  4:21p v_h
CALICO97     <DIR>          10-16-97  4:21p calico97
SIMI97A      <DIR>          10-16-97  4:21p simi97a
SIMI97B      <DIR>          10-16-97  4:21p simi97b
.            <DIR>          10-16-97  4:21p .
..           <DIR>          10-16-97  4:21p ..
SEMS96A  ASC        14,753  10-14-97  3:42p SEMS96A.ASC
V_D1P0   GRA        23,305  09-13-97  2:11p V_D1P0.GRA
ACTION   PCO         3,724  09-09-97  2:52p ACTION.PCO
ACTION   BAK         3,658  09-09-97 10:13a ACTION.BAK
SITEAB   ASC         1,567  08-26-97  2:06p SITEAB.ASC
MMSPRPSL ASC         1,130  08-26-97  2:05p MMSPRPSL.ASC
MMS      ASC         1,125  08-26-97  2:05p MMS.ASC
SEMS     ASC        26,524  08-26-97  2:05p SEMS.ASC
SEMSHIST ASC        25,443  08-26-97  2:05p SEMSHIST.ASC
ACTION   ASC         3,062  08-26-97  2:04p ACTION.ASC
NEIC_EPI TBL        26,478  08-22-97 10:51a NEIC_EPI.TBL
7062500              2,427  08-14-97  8:01p 7062500
DST4RPT  TBL           762  08-12-97  9:28a DST4RPT.TBL
SEMS_D   TBL           910  08-12-97  9:08a SEMS_D.TBL
SEMS_AZ  TBL           910  08-12-97  9:08a SEMS_AZ.TBL
SEMS_BAZ TBL           910  08-12-97  9:08a SEMS_BAZ.TBL
DEBUG    OUT        17,064  08-12-97  9:03a DEBUG.OUT
EQ_LOC   PRN           298  08-12-97  8:46a EQ_LOC.PRN
STA_LOC  PRN           388  08-12-97  8:45a STA_LOC.PRN
DISTANCE IN            332  08-11-97  5:31p DISTANCE.IN
SEMSLOC  WQ1         3,249  08-11-97  4:46p SEMSLOC.WQ1
EQSLOC   WQ1         3,058  08-11-97  4:45p EQSLOC.WQ1
SEMS96A  PCO        14,516  08-09-97 10:38a SEMS96A.PCO
SEMSHIST PCO        25,033  08-09-97 10:35a SEMSHIST.PCO
SEMSHIST BAK        25,033  08-09-97 10:34a SEMSHIST.BAK
SEMS     PCO        28,016  08-09-97 10:31a SEMS.PCO
SEMS     BAK        28,016  08-09-97 10:27a SEMS.BAK
SMIT0797 LTR         8,704  07-21-97  2:24p SMIT0797.LTR
CORD4MAP DT          2,304  07-19-97  5:50p CORD4MAP.DT
CORD4MAP WQ1         5,107  07-19-97  5:49p CORD4MAP.WQ1
EQS      LOC           226  07-19-97  8:27a EQS.LOC
SEMSLOC  DT            640  07-18-97 10:39p SEMSLOC.DT
MAIN     HYP         1,156  07-18-97  7:22p MAIN.HYP
MMS      PCO         1,939  07-16-97  6:37p MMS.PCO
MMSPRPSL PCO         1,944  07-16-97  6:36p MMSPRPSL.PCO
SITEAB   PCO         2,393  07-16-97  6:36p SITEAB.PCO
SEMS95   PCO        26,301  07-16-97  6:35p SEMS95.PCO
SEMS96A  BAK        14,360  07-16-97  6:30p SEMS96A.BAK
PCO      LST        10,136  07-16-97  2:34p PCO.LST
DREGR624 EML         3,018  06-24-97  2:43p DREGR624.EML
REFORMAT EXE        33,922  05-16-97  4:50p REFORMAT.EXE
REFORMAT LST         3,322  05-16-97  4:50p REFORMAT.LST
REFORMAT OBJ         2,366  05-16-97  4:50p REFORMAT.OBJ
REFORMAT FOR         1,247  05-16-97  4:50p REFORMAT.FOR
SEMS     LOC           323  05-12-97  4:39p SEMS.LOC
BIGEQ    VAX         3,103  04-29-97  8:51a BIGEQ.VAX
NPALM86  VAX         3,273  04-29-97  8:50a NPALM86.VAX
OCNSID86 VAX         1,591  04-29-97  8:49a OCNSID86.VAX
SBI81    VAX         5,455  04-29-97  8:48a SBI81.VAX
SITEAB   VAX         6,800  04-29-97  8:46a SITEAB.VAX
THEORY   VAX        19,233  04-29-97  8:45a THEORY.VAX
UPLAND90 VAX         2,264  04-29-97  8:40a UPLAND90.VAX
DRMN0117 PS          6,865  01-24-97  9:50a DRMN0117.PS
DORMAN   PS          6,867  01-23-97  1:26p DORMAN.PS
DORMAN1  EML         6,866  01-21-97  2:23p DORMAN1.EML
TEMP     EPS        23,882  01-21-97  2:23p TEMP.EPS
DRMNTXT  EML         1,926  01-21-97  2:21p DRMNTXT.EML
DRMN0117 EML         9,397  01-17-97  2:35p DRMN0117.EML
TXT10    TEX            15  01-07-97 12:34p TXT10.TEX
C2D0106A EML         1,135  01-07-97 12:09p C2D0106A.EML
D2C0106A EML         2,947  01-07-97 12:09p D2C0106A.EML
D2DORMAN EML         2,462  12-19-96  3:42p D2DORMAN.EML
SMIT0996 LTR         2,304  09-13-96 12:37p SMIT0996.LTR
STA4BENZ TXT           253  09-13-96  9:18a STA4BENZ.TXT
EQS4BENZ TXT           200  06-28-96  5:01p EQS4BENZ.TXT
RFRM4MAP OBJ         1,869  06-28-96  5:01p RFRM4MAP.OBJ
RFRM4MAP EXE        33,342  06-28-96  5:01p RFRM4MAP.EXE
RFRM4MAP FOR         1,588  06-28-96  5:00p RFRM4MAP.FOR
RFRM4MAP LST         3,866  06-28-96  4:49p RFRM4MAP.LST
SEMS95   BAK        26,301  06-15-96 11:35p SEMS95.BAK
SML2BIG  WPW         2,801  06-13-96  4:39p SML2BIG.WPW
SHAKA596 LTR         3,072  05-07-96  3:25p SHAKA596.LTR
ZDHOFF   GRG            90  09-06-95  7:19p ZDHOFF.GRG
ZDH_COR  GRA        23,241  09-06-95  7:19p ZDH_COR.GRA
ZDHOFFTH DRA        10,006  09-06-95  7:17p ZDHOFFTH.DRA
ZDHOFFTH GRA        23,189  09-06-95  7:17p ZDHOFFTH.GRA
ZDH_COR  DRA        18,877  09-06-95  7:17p ZDH_COR.DRA
RAT_CORR DT          6,784  09-06-95  6:53p RAT_CORR.DT
RAT_CORR COL        12,020  09-06-95  6:53p RAT_CORR.COL
RAT_CORR SUM         3,556  09-06-95  6:48p RAT_CORR.SUM
RAT_CORR IN            590  09-06-95  6:48p RAT_CORR.IN
CORR4LC  EXE       267,910  09-06-95  9:46a CORR4LC.EXE
CORR4LC  FOR         8,436  09-06-95  9:46a CORR4LC.FOR
IMP_RESP GRA        23,059  09-05-95  3:13p IMP_RESP.GRA
IMP_RESP DT         75,392  09-05-95  3:13p IMP_RESP.DT
IMP_RESP OUT       192,538  09-05-95  3:11p IMP_RESP.OUT
IMP_RESP EXE       134,930  09-05-95  3:11p IMP_RESP.EXE
IMP_RESP FOR         3,957  09-05-95  3:11p IMP_RESP.FOR
H_V                    977  08-28-95  5:25p H_V
ABRAH895 LTR         2,048  08-17-95  7:22p ABRAH895.LTR
SMITH394 LTR         1,280  03-29-94  1:05p SMITH394.LTR
GSADD                1,412  03-01-94  2:25p GSADD
```

```
SITEAB   BAK       2,377  01-28-94  8:59p SITEAB.BAK
SMIT1193 LTR       4,864  11-19-93  3:54p SMIT1193.LTR
SLEE1193 LTR       1,792  11-19-93  2:27p SLEE1193.LTR
BPRUN    MSG       4,813  03-26-93 10:10a BPRUN.MSG
UNTITLED GRA       8,148  03-25-93 11:17a UNTITLED.GRA
UNTITLED GRG          87  03-25-93 11:17a UNTITLED.GRG
ZDHONTH  DRA       9,860  03-25-93 10:54a ZDHONTH.DRA
ZDHALLEV DRA      18,748  03-24-93  2:48p ZDHALLEV.DRA
ZDHALLEV GRA       8,167  03-24-93  2:47p ZDHALLEV.GRA
ZDHONTH  GRA       8,108  03-24-93  2:47p ZDHONTH.GRA
ZDHON    DRA      40,505  03-24-93  2:37p ZDHON.DRA
ZDHON    GRA       8,145  03-24-93  2:37p ZDHON.GRA
ZDHON    GRG          87  03-24-93  2:32p ZDHON.GRG
SBI81RAT DT       28,544  03-24-93  2:24p SBI81RAT.DT
ZDHTHRY  DRA       9,823  03-24-93  2:11p ZDHTHRY.DRA
ZDH3     DT        7,680  03-24-93  1:53p ZDH3.DT
UNTITLED DRA      18,832  02-06-93  8:08a UNTITLED.DRA
ZDHALLEV DT        6,784  02-06-93  7:52a ZDHALLEV.DT
ZDHALLEV COL      38,550  02-05-93  3:26p ZDHALLEV.COL
BAPERROR ZIP      20,890  12-16-92 10:54p BAPERROR.ZIP
MMSPRPSL BAK       1,915  06-22-92  4:32p MMSPRPSL.BAK
SLEEF692 LTR       1,664  06-19-92  4:52p SLEEF692.LTR
SLEEF592 LTR       2,688  05-11-92  4:53p SLEEF592.LTR
SLEEF492 LTR       1,792  04-28-92 12:13p SLEEF492.LTR
SMITH492 LTR       2,304  04-28-92 11:51a SMITH492.LTR
GETTR292 LTR       1,792  02-14-92  2:22p GETTR292.LTR
STEPH292 LTR       1,664  02-14-92  2:20p STEPH292.LTR
MMS      TEX      19,462  06-14-91 12:20p MMS.TEX
MMS      BAK       1,915  06-13-91  8:33p MMS.BAK
GSCLOSE              256  03-27-85  4:53p GSCLOSE
       139 file(s)     1,934,221 bytes
        18 dir(s)  1,738,604,544 bytes free
```

```
 Volume in drive D has no label
 Volume Serial Number is D845-2F2F
 Directory of D:\sems\avd

AVD      LST             0  11-11-97  9:22a avd.lst
.             <DIR>         10-16-97  4:21p .
..            <DIR>         10-16-97  4:21p ..
DIR      LST           410  07-29-97  2:13p DIR.LST
BU       BAT            14  08-27-96  5:09p BU.BAT
AVD_BBF  BAT         1,254  06-10-96  5:50p AVD_BBF.BAT
         4 file(s)           1,678 bytes
         2 dir(s)   1,738,276,864 bytes free
```

```
Volume in drive D has no label
Volume Serial Number is D845-2F2F
Directory of D:\sems\bigeq

BIGEQ    LST            0  11-11-97  9:12a bigeq.lst
ABUP_DIS GRA       23,137  10-20-97  2:13p ABUP_DIS.GRA
ABUP_DIS DT       585,600  10-20-97  1:59p ABUP_DIS.DT
ABUP_ACC GRA       23,146  10-20-97  1:58p ABUP_ACC.GRA
ABUP_VEL GRA       23,137  10-20-97  1:57p ABUP_VEL.GRA
ABUP_VEL DT       585,600  10-20-97  1:54p ABUP_VEL.DT
ABUP_DIS ASC      992,384  10-20-97  1:51p ABUP_DIS.ASC
ABUP_VEL ASC      992,384  10-20-97  1:51p ABUP_VEL.ASC
ABUP_ACC DT       597,760  10-20-97  1:11p ABUP_ACC.DT
GSH1DIS  SMC      368,204  10-20-97  1:04p gsh1dis.smc
GSH1VEL  SMC      368,204  10-20-97  1:04p gsh1vel.smc
ASH1DIS  SMC      368,204  10-20-97  1:03p ash1dis.smc
ASH1VEL  SMC      368,204  10-20-97  1:03p ash1vel.smc
BPRUN    MSG        1,123  10-20-97 12:36p BPRUN.MSG
BPPLOTS  APS       19,314  10-20-97 12:36p BPPLOTS.APS
ABUP_DIS IN            97  10-20-97 12:34p abup_dis.in
ABUP_VEL IN            97  10-20-97 12:33p abup_vel.in
ABUP_ACC ASC      868,384  10-20-97 12:31p ABUP_ACC.ASC
GSH1ACC  SMC      337,454  10-20-97 12:29p gsh1acc.smc
ASH1ACC  SMC      337,454  10-20-97 12:28p ash1acc.smc
ABUP_ACC IN            97  10-20-97 12:15p ABUP_ACC.IN
BBF2SMC  BAT          552  10-20-97 11:44a BBF2SMC.BAT
DIR      LST       16,184  10-20-97 11:28a DIR.LST
BASGSH12 GRA       23,243  10-20-97 11:27a BASGSH12.GRA
BASGS    GRA       23,278  10-20-97 11:26a BASGS.GRA
AS       GRA       23,250  10-20-97 11:26a AS.GRA
CHKRS    GRA       22,987  10-20-97  9:10a CHKRS.GRA
.              <DIR>       10-16-97  4:22p .
..             <DIR>       10-16-97  4:22p ..
SIMBASGS TBL        2,125  10-14-97  4:02p simbasgs.tbl
SIM_AS   TBL        1,981  10-14-97  3:59p sim_as.tbl
TEMP     FIL          171  10-14-97  3:59p TEMP.FIL
LNE_5575 GRA       23,151  10-14-97 10:50a LNE_5575.GRA
NEWE75B  GRA       23,284  10-14-97 10:48a NEWE75B.GRA
NEWE65B  GRA       23,284  10-14-97 10:46a NEWE65B.GRA
LNE_5565 GRA       23,153  10-14-97 10:45a LNE_5565.GRA
BRUNE    GRA       23,165  10-14-97 10:45a BRUNE.GRA
M55M75   GRA       23,149  10-13-97  9:32p M55M75.GRA
NEWE75B  DT         4,096  10-13-97  9:31p NEWE75B.DT
M55M65   GRA       23,150  10-13-97  9:25p M55M65.GRA
DT       LST        1,989  10-04-97  8:47p DT.LST
CHKRS    DT       823,552  09-09-97  6:30p CHKRS.DT
CHKRST90 SUM          633  09-09-97  6:27p CHKRST90.SUM
CHKRST80 SUM          633  09-09-97  6:26p CHKRST80.SUM
CHKRST70 SUM          633  09-09-97  6:26p CHKRST70.SUM
CHKRST90 FIL           92  09-09-97  6:25p CHKRST90.FIL
CHKRST80 FIL           92  09-09-97  6:25p CHKRST80.FIL
CHKRST70 FIL           92  09-09-97  6:25p CHKRST70.FIL
RSTCUTVH GRA       23,119  08-25-97  8:47a RSTCUTVH.GRA
RSTCUTVH DT        10,496  08-24-97  9:05p RSTCUTVH.DT
RS_VS_TV DT         3,840  08-24-97  9:02p RS_VS_TV.DT
RS_VS_T  DT         3,840  08-24-97  9:02p RS_VS_T.DT
RS_VS_T  COL        6,402  08-24-97  9:01p RS_VS_T.COL
RS_VS_TV COL        6,402  08-24-97  9:01p RS_VS_TV.COL
RS_VS_TV SUM        2,037  08-24-97  8:32a RS_VS_TV.SUM
T90V     SMC       94,426  08-24-97  8:32a T90V.SMC
T60V     SMC       63,676  08-24-97  8:32a T60V.SMC
T70V     SMC       73,926  08-24-97  8:32a T70V.SMC
T80V     SMC       84,176  08-24-97  8:32a T80V.SMC
T40V     SMC       43,176  08-24-97  8:32a T40V.SMC
T50V     SMC       53,426  08-24-97  8:32a T50V.SMC
RS_VS_TV FIL          367  08-24-97  8:30a RS_VS_TV.FIL
M65M75   GRA       23,101  11-12-96  3:24p M65M75.GRA
M65M75   DT         4,096  11-12-96  3:12p M65M75.DT
M55M65   DT         4,096  11-12-96  3:08p M55M65.DT
M65M75   ASC        7,221  11-12-96  3:04p M65M75.ASC
M55M65   ASC        7,221  11-12-96  3:02p M55M65.ASC
BIGEQ    FOR       14,148  07-15-96 11:00a BIGEQ.FOR
HARLEY   PS        46,850  07-02-96 10:50a HARLEY.PS
BU       BAT           90  06-28-96 11:38a BU.BAT
RS_VS_T  EXE      158,848  06-28-96 11:36a RS_VS_T.EXE
CL       OUT        1,331  06-28-96 11:36a CL.OUT
RS_VS_T  FOR        4,187  06-28-96 11:36a RS_VS_T.FOR
CHK_RS   EXE      274,381  06-28-96 10:16a CHK_RS.EXE
CHK_RS   FOR        6,188  06-28-96 10:15a CHK_RS.FOR
CHKRS_CL BAT           60  06-28-96 10:13a CHKRS_CL.BAT
CHK_PRV  GRA       23,099  06-28-96  8:46a CHK_PRV.GRA
T90BAPRS DT         4,864  06-28-96  8:40a T90BAPRS.DT
T80BAPRS DT         4,864  06-28-96  8:40a T80BAPRS.DT
T70BAPRS DT         4,864  06-28-96  8:39a T70BAPRS.DT
T60BAPRS DT         4,864  06-28-96  8:39a T60BAPRS.DT
T50BAPRS DT         4,864  06-28-96  8:39a T50BAPRS.DT
T40BAPRS DT         4,864  06-28-96  8:38a T40BAPRS.DT
T90BAPRS RS1        7,496  06-28-96  8:36a T90BAPRS.RS1
T80BAPRS RS1        7,496  06-28-96  8:36a T80BAPRS.RS1
T70BAPRS RS1        7,496  06-28-96  8:36a T70BAPRS.RS1
T60BAPRS RS1        7,496  06-28-96  8:36a T60BAPRS.RS1
T50BAPRS RS1        7,496  06-28-96  8:36a T50BAPRS.RS1
T40BAPRS RS1        7,496  06-28-96  8:35a T40BAPRS.RS1
CHK_PRV  BAT          770  06-28-96  8:34a CHK_PRV.BAT
T40T90_D APS      122,135  06-14-96  3:18p T40T90_D.APS
T40T90_V APS      148,102  06-14-96  3:18p T40T90_V.APS
T40T90_A APS      206,250  06-14-96  3:17p T40T90_A.APS
T40T90_P BAT          420  06-14-96  3:17p T40T90_P.BAT
RS_VS_T  GRA       23,099  06-14-96  3:11p RS_VS_T.GRA
H2DIS    APS      142,564  06-12-96 11:12a H2DIS.APS
H1DIS    APS      131,678  06-12-96 11:12a H1DIS.APS
H2VEL    APS      160,918  06-12-96 11:12a H2VEL.APS
H1VEL    APS      152,545  06-12-96 11:12a H1VEL.APS
H2ACC    APS      210,214  06-12-96 11:12a H2ACC.APS
H1ACC    APS      210,584  06-12-96 11:12a H1ACC.APS
PLT_TS   BAT          810  06-12-96 11:11a PLT_TS.BAT
PLT      BRP          164  06-12-96  8:28a PLT.BRP
MSG_DEL  BAT          106  06-12-96  8:10a MSG_DEL.BAT
BBF2     FIL          117  06-12-96  8:03a BBF2.FIL
BBF1     FIL          111  06-12-96  8:03a BBF1.FIL
APS_DEL  BAT          106  06-12-96  7:57a APS_DEL.BAT
MSG      FIL           76  06-12-96  7:55a MSG.FIL
BH2AVD   APS      136,794  06-12-96  7:54a BH2AVD.APS
BH2AVD   MSG        4,724  06-12-96  7:54a BH2AVD.MSG
BH2VEL   BBF      144,896  06-12-96  7:54a BH2VEL.BBF
BH2DIS   BBF      144,896  06-12-96  7:54a BH2DIS.BBF
BH2ACC   BBF      132,608  06-12-96  7:54a BH2ACC.BBF
BH1AVD   APS      129,781  06-12-96  7:54a BH1AVD.APS
BH1AVD   MSG        4,636  06-12-96  7:54a BH1AVD.MSG
BH1DIS   BBF      144,896  06-12-96  7:54a BH1DIS.BBF
BH1VEL   BBF      144,896  06-12-96  7:54a BH1VEL.BBF
BH1ACC   BBF      132,608  06-12-96  7:54a BH1ACC.BBF
GSH2AVD  APS      136,797  06-12-96  7:54a GSH2AVD.APS
GSH2AVD  MSG        4,728  06-12-96  7:54a GSH2AVD.MSG
GSH2DIS  BBF      144,896  06-12-96  7:54a GSH2DIS.BBF
GSH2ACC  BBF      132,608  06-12-96  7:54a GSH2ACC.BBF
GSH2VEL  BBF      144,896  06-12-96  7:54a GSH2VEL.BBF
GSH1AVD  APS      129,784  06-12-96  7:54a GSH1AVD.APS
GSH1AVD  MSG        4,640  06-12-96  7:53a GSH1AVD.MSG
GSH1DIS  BBF      144,896  06-12-96  7:53a GSH1DIS.BBF
GSH1ACC  BBF      132,608  06-12-96  7:53a GSH1ACC.BBF
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GSH1VEL	BBF	144,896	06-12-96	7:53a	GSH1VEL.BBF
ASH2AVD	APS	150,162	06-12-96	7:53a	ASH2AVD.APS
ASH2AVD	MSG	4,725	06-12-96	7:53a	ASH2AVD.MSG
ASH2ACC	BBF	132,608	06-12-96	7:53a	ASH2ACC.BBF
ASH2VEL	BBF	144,896	06-12-96	7:53a	ASH2VEL.BBF
ASH2DIS	BBF	144,896	06-12-96	7:53a	ASH2DIS.BBF
ASH1AVD	APS	141,546	06-12-96	7:53a	ASH1AVD.APS
ASH1AVD	MSG	4,725	06-12-96	7:53a	ASH1AVD.MSG
ASH1ACC	BBF	132,608	06-12-96	7:53a	ASH1ACC.BBF
ASH1VEL	BBF	144,896	06-12-96	7:53a	ASH1VEL.BBF
ASH1DIS	BBF	144,896	06-12-96	7:53a	ASH1DIS.BBF
AVD2BBF	BAT	1,994	06-12-96	7:53a	AVD2BBF.BAT
BBF	FIL	462	06-11-96	10:09p	BBF.FIL
BH2VELX	BBF	144,896	06-11-96	9:57p	BH2VELX.BBF
BH2DISX	BBF	144,896	06-11-96	9:57p	BH2DISX.BBF
BH2ACCX	BBF	132,608	06-11-96	9:57p	BH2ACCX.BBF
BH1DISX	BBF	144,896	06-11-96	9:57p	BH1DISX.BBF
BH1ACCX	BBF	132,608	06-11-96	9:57p	BH1ACCX.BBF
BH1VELX	BBF	144,896	06-11-96	9:57p	BH1VELX.BBF
GSH2ACCX	BBF	132,608	06-11-96	9:57p	GSH2ACCX.BBF
GSH2VELX	BBF	144,896	06-11-96	9:57p	GSH2VELX.BBF
GSH2DISX	BBF	144,896	06-11-96	9:57p	GSH2DISX.BBF
GSH1ACCX	BBF	132,608	06-11-96	9:57p	GSH1ACCX.BBF
GSH1VELX	BBF	144,896	06-11-96	9:57p	GSH1VELX.BBF
GSH1DISX	BBF	144,896	06-11-96	9:57p	GSH1DISX.BBF
ASH2ACCX	BBF	132,608	06-11-96	9:57p	ASH2ACCX.BBF
ASH2VELX	BBF	144,896	06-11-96	9:57p	ASH2VELX.BBF
ASH2DISX	BBF	144,896	06-11-96	9:57p	ASH2DISX.BBF
ASH1ACCX	BBF	132,608	06-11-96	9:57p	ASH1ACCX.BBF
ASH1VELX	BBF	144,896	06-11-96	9:57p	ASH1VELX.BBF
ASH1DISX	BBF	144,896	06-11-96	9:57p	ASH1DISX.BBF
BASGS_H1	SMC	338,037	06-11-96	9:56p	BASGS_H1.SMC
BASGS_H2	SMC	338,037	06-11-96	9:56p	BASGS_H2.SMC
B_H2	SMC	338,037	06-11-96	9:55p	B_H2.SMC
B_H1	SMC	338,037	06-11-96	9:55p	B_H1.SMC
AS_H2	SMC	338,037	06-11-96	9:54p	AS_H2.SMC
AS_H1	SMC	338,037	06-11-96	9:53p	AS_H1.SMC
T40ACC	BBF	17,920	06-10-96	5:50p	T40ACC.BBF
T40VEL	BBF	41,984	06-10-96	5:50p	T40VEL.BBF
T40DIS	BBF	41,984	06-10-96	5:50p	T40DIS.BBF
T50DIS	BBF	45,568	06-10-96	5:50p	T50DIS.BBF
T50ACC	BBF	22,016	06-10-96	5:50p	T50ACC.BBF
T50VEL	BBF	45,568	06-10-96	5:50p	T50VEL.BBF
T60ACC	BBF	25,600	06-10-96	5:50p	T60ACC.BBF
T60VEL	BBF	49,664	06-10-96	5:50p	T60VEL.BBF
T60DIS	BBF	49,664	06-10-96	5:50p	T60DIS.BBF
T70ACC	BBF	29,696	06-10-96	5:50p	T70ACC.BBF
T70VEL	BBF	53,760	06-10-96	5:50p	T70VEL.BBF
T70DIS	BBF	53,760	06-10-96	5:50p	T70DIS.BBF
T80ACC	BBF	33,792	06-10-96	5:50p	T80ACC.BBF
T80VEL	BBF	57,856	06-10-96	5:50p	T80VEL.BBF
T80DIS	BBF	57,856	06-10-96	5:50p	T80DIS.BBF
T90ACC	BBF	37,888	06-10-96	5:50p	T90ACC.BBF
T90VEL	BBF	61,952	06-10-96	5:50p	T90VEL.BBF
T90DIS	BBF	61,952	06-10-96	5:50p	T90DIS.BBF
AVD_BBF	BAT	1,254	06-10-96	5:50p	AVD_BBF.BAT
TEMP	BAT	54	06-10-96	4:55p	TEMP.BAT
CLEAN	BAT	640	06-10-96	2:46p	CLEAN.BAT
RS_VS_T	SUM	2,037	06-10-96	2:08p	RS_VS_T.SUM
T90	SMC	94,426	06-10-96	2:08p	T90.SMC
T70	SMC	73,926	06-10-96	2:08p	T70.SMC
T80	SMC	84,176	06-10-96	2:08p	T80.SMC
T50	SMC	53,426	06-10-96	2:08p	T50.SMC
T60	SMC	63,676	06-10-96	2:08p	T60.SMC
T40	SMC	43,176	06-10-96	2:08p	T40.SMC
B	GRA	23,263	06-10-96	2:07p	B.GRA

B	DT	8,320	06-10-96	1:53p	B.DT
BSIM	DT	640	06-10-96	1:52p	BSIM.DT
BOBS	DT	3,840	06-10-96	1:52p	BOBS.DT
AS	DT	8,320	06-10-96	1:49p	AS.DT
ASSIM	DT	640	06-10-96	1:48p	ASSIM.DT
ASOBS	DT	3,840	06-10-96	1:48p	ASOBS.DT
BJF	COL	735	06-10-96	1:47p	BJF.COL
ABR_SLVA	COL	1,015	06-10-96	1:47p	ABR_SLVA.COL
AS	SUM	3,316	06-10-96	1:47p	AS.SUM
ASOBS	COL	6,399	06-10-96	1:47p	ASOBS.COL
ASSIM	COL	490	06-10-96	1:47p	ASSIM.COL
AS	FIL	807	06-10-96	1:47p	AS.FIL
SIM_AS	SUM	6,091	06-10-96	1:46p	SIM_AS.SUM
AS75	SIM	812	06-10-96	1:46p	AS75.SIM
AS56	SIM	812	06-10-96	1:46p	AS56.SIM
B	FIL	801	06-10-96	1:33p	B.FIL
B	SUM	3,784	06-10-96	1:19p	B.SUM
BOBS	COL	6,399	06-10-96	1:19p	BOBS.COL
BSIM	COL	490	06-10-96	1:19p	BSIM.COL
BASGS	SUM	3,784	06-10-96	1:11p	BASGS.SUM
BASGSSIM	COL	490	06-10-96	1:11p	BASGSSIM.COL
BASGSOBS	COL	6,399	06-10-96	1:11p	BASGSOBS.COL
BASGS	FIL	861	06-10-96	1:11p	BASGS.FIL
BIGEQ	EXE	1,413,150	06-10-96	1:07p	BIGEQ.EXE
BASGS	DT	8,320	06-10-96	12:39p	BASGS.DT
BASGSSIM	DT	640	06-10-96	12:37p	BASGSSIM.DT
ABR_SLVA	DT	896	06-10-96	12:37p	ABR_SLVA.DT
BJF	DT	768	06-10-96	12:37p	BJF.DT
BASGSOBS	DT	3,840	06-10-96	12:37p	BASGSOBS.DT
SIMBASGS	SUM	5,963	06-10-96	12:20p	SIMBASGS.SUM
BASGS75	SIM	812	06-10-96	12:20p	BASGS75.SIM
BASGS56	SIM	812	06-10-96	12:20p	BASGS56.SIM
SIMBASGS	DAT	1,858	06-10-96	12:16p	SIMBASGS.DAT
RS_VS_T	FIL	357	06-09-96	4:12p	RS_VS_T.FIL
RS_T_CL	BAT	62	06-09-96	3:53p	RS_T_CL.BAT
BIGEQCL	BAT	58	06-08-96	5:43p	BIGEQCL.BAT
SIM_AS	DAT	1,808	06-07-96	10:49a	SIM_AS.DAT
AS96_CDA	GRA	23,062	06-07-96	10:28a	AS96_CDA.GRA
AS96_CDA	DT	640	06-07-96	10:24a	AS96_CDA.DT
AS96_CDA	DAT	390	06-07-96	10:21a	AS96_CDA.DAT
AS96_CD	EXE	38,418	06-07-96	10:21a	AS96_CD.EXE
AS96_CD	FOR	2,785	06-07-96	10:20a	AS96_CD.FOR
AMP_AS96	DAT	620	06-07-96	10:05a	AMP_AS96.DAT
AMP_AS96	DT	768	06-07-96	8:20a	AMP_AS96.DT
AMP_AS96	WQ1	4,025	06-07-96	8:18a	AMP_AS96.WQ1
SIM_B	SUM	5,899	06-06-96	8:08a	SIM_B.SUM
B75	SIM	812	06-06-96	8:08a	B75.SIM
B56	SIM	812	06-06-96	8:08a	B56.SIM
SIM_B	DAT	1,775	06-05-96	10:43p	SIM_B.DAT
NEWE75B	ASC	7,221	06-04-96	9:42p	NEWE75B.ASC
NEWE65B	DT	4,096	06-04-96	9:40p	NEWE65B.DT
NEWE65B	ASC	7,221	06-04-96	9:39p	NEWE65B.ASC
FIT_AS	EXE	46,932	06-04-96	9:39p	FIT_AS.EXE
FIT_AS	FOR	10,054	06-04-96	9:39p	FIT_AS.FOR
FIT	GRA	23,201	06-04-96	9:38p	FIT.GRA
NEWE65	DT	4,096	06-04-96	9:34p	NEWE65.DT
NEWE75	DT	4,096	06-04-96	9:33p	NEWE75.DT
NEWE65	ASC	7,221	06-04-96	9:31p	NEWE65.ASC
NEWE75	ASC	7,221	06-04-96	9:30p	NEWE75.ASC
M175	604	1,040	06-04-96	10:58a	M175.604
M171	604	8,249	06-04-96	10:58a	M171.604
M168	604	3,439	06-04-96	10:57a	M168.604
GAILRVW	LTR	7,040	06-04-96	10:45a	GAILRVW.LTR
NEWE75_4	DT	4,096	06-03-96	8:15p	NEWE75_4.DT
NEWE75_4	ASC	7,221	06-03-96	8:14p	NEWE75_4.ASC
NEWE75_3	DT	4,096	06-03-96	8:11p	NEWE75_3.DT

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NEWE75_3 ASC         7,221  06-03-96  8:11p NEWE75_3.ASC
NEWE75_2 DT          4,096  06-03-96  8:07p NEWE75_2.DT
NEWE75_2 ASC         7,221  06-03-96  8:06p NEWE75_2.ASC
NEW_E75  DT          4,096  06-03-96  7:59p NEW_E75.DT
NEW_E75  ASC         7,221  06-03-96  7:57p NEW_E75.ASC
JOYMC8   DT          5,888  06-03-96  2:32p JOYMC8.DT
JOYMC7   DT          5,888  06-03-96  2:31p JOYMC7.DT
JOYMC6   DT          5,888  06-03-96  2:31p JOYMC6.DT
JOYMC8   ASC        10,749  06-03-96  2:31p JOYMC8.ASC
JOYMC7   ASC        10,749  06-03-96  2:31p JOYMC7.ASC
JOYMC6   ASC        10,749  06-03-96  2:30p JOYMC6.ASC
BRUNE    DT          5,888  06-03-96  2:27p BRUNE.DT
BRUNE    ASC        10,749  06-03-96  2:23p BRUNE.ASC
GAIL696A LTR         3,840  06-03-96  1:39p GAIL696A.LTR
GET_K    GRA        23,096  06-03-96 12:50p GET_K.GRA
TEMP     DT          4,096  06-03-96 12:43p TEMP.DT
TEMP     ASC         7,221  06-03-96 12:25p TEMP.ASC
PSVM75   DAT         1,574  05-29-96  3:53p PSVM75.DAT
PSVM56   DAT         1,574  05-29-96  3:53p PSVM56.DAT
CHKLIST  MS             27  04-27-95  9:43a CHKLIST.MS
GSCLOSE                640  06-30-94  3:45p GSCLOSE
GSADD                1,536  03-25-94  9:53a GSADD
SA_M5675 GRA         8,150  12-01-93  2:34p SA_M5675.GRA
UNTITLED GRA         8,150  12-01-93  2:33p UNTITLED.GRA
PSVM5675 GRA         8,144  12-01-93  2:33p PSVM5675.GRA
PSVM5675 DT         19,200  12-01-93  2:30p PSVM5675.DT
PSVM5675 WQ1        53,040  12-01-93  2:30p PSVM5675.WQ1
UNTITLED DT         19,200  12-01-93  2:11p UNTITLED.DT
PSVM56   OUT         3,003  12-01-93 11:21a PSVM56.OUT
PSVM75   OUT         3,003  12-01-93 11:07a PSVM75.OUT
BPRESPON TXT         7,107  11-29-93 12:59p BPRESPON.TXT
AVDPSV   BAT           420  11-29-93 12:57p AVDPSV.BAT
SAT12049 GRA         8,213  11-26-93 11:01a SAT12049.GRA
UNTITLED DRA        11,017  11-26-93 11:00a UNTITLED.DRA
M75T49   PSV         7,107  11-25-93 11:19p M75T49.PSV
M75T120  PSV         7,107  11-25-93 11:10p M75T120.PSV
M75T49   SMC        51,403  11-25-93 10:58p M75T49.SMC
M75T120  SMC       124,495  11-25-93 10:50p M75T120.SMC
BIGM66   SMC       338,036  11-23-93  5:58p BIGM66.SMC
PSVM75   TXT         7,107  11-23-93  3:03p PSVM75.TXT
BIGM75   SMC       338,036  11-23-93  2:59p BIGM75.SMC
BIGEQ    SAV        18,531  11-23-93  2:56p BIGEQ.SAV
PSVM56   TXT         7,107  11-23-93 12:57p PSVM56.TXT
BJFM75   COL         1,974  11-23-93 12:52p BJFM75.COL
BJFM56   COL         1,974  11-23-93 12:52p BJFM56.COL
PSVM75PH TXT         7,107  11-23-93 12:12p PSVM75PH.TXT
BIGM75PH SMC       338,036  11-23-93 12:10p BIGM75PH.SMC
SMALL    SMC        95,958  11-16-93  6:12p SMALL.SMC
       305 file(s)    23,155,719 bytes
         2 dir(s)  1,738,571,776 bytes free
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 Volume in drive D has no label
 Volume Serial Number is D845-2F2F
 Directory of D:\sems\calico97

CALICO97 LST             0  11-11-97   9:23a calico97.lst
.            <DIR>          10-16-97   4:21p .
..           <DIR>          10-16-97   4:21p ..
DIR      LST         2,937  08-21-97   9:43p DIR.LST
CL97_3D  GRA        23,003  07-18-97   8:39a CL97_3D.GRA
CL97_3V  DT        133,504  07-18-97   8:39a CL97_3V.DT
CL97_3D  DT        133,504  07-18-97   8:38a CL97_3D.DT
CL97_3A  DT        111,616  07-18-97   8:38a CL97_3A.DT
CL97_3A  ASC       188,802  07-18-97   8:37a CL97_3A.ASC
CL97_3V  ASC       226,002  07-18-97   8:37a CL97_3V.ASC
CL97_3D  ASC       226,002  07-18-97   8:37a CL97_3D.ASC
CL97ZAVD MSG         5,503  07-18-97   8:36a CL97ZAVD.MSG
CL97ZDIS SMC        37,303  07-18-97   8:36a CL97ZDIS.SMC
CL97ZACC SMC        31,153  07-18-97   8:36a CL97ZACC.SMC
CL97ZVEL SMC        37,303  07-18-97   8:36a CL97ZVEL.SMC
CL97YAVD MSG         5,503  07-18-97   8:36a CL97YAVD.MSG
CL97YVEL SMC        38,615  07-18-97   8:36a CL97YVEL.SMC
CL97YDIS SMC        38,615  07-18-97   8:36a CL97YDIS.SMC
CL97XAVD MSG         5,503  07-18-97   8:36a CL97XAVD.MSG
CL97XVEL SMC        38,891  07-18-97   8:36a CL97XVEL.SMC
CL97YACC SMC        32,465  07-18-97   8:36a CL97YACC.SMC
CL97XDIS SMC        38,891  07-18-97   8:36a CL97XDIS.SMC
CL97XACC SMC        32,741  07-18-97   8:36a CL97XACC.SMC
AVD      BAT           801  07-18-97   7:07a AVD.BAT
CL97_3V  GRA        23,003  07-17-97   6:25p CL97_3V.GRA
CL97_3D  IN             94  07-17-97   6:23p CL97_3D.IN
CL97_3V  IN             94  07-17-97   6:22p CL97_3V.IN
CL97_3A  GRA        23,003  07-17-97   6:22p CL97_3A.GRA
CL97_3A  IN             94  07-17-97   6:12p CL97_3A.IN
CL97_3TS GRA        23,005  07-17-97   6:03p CL97_3TS.GRA
CL97_3TS DT        111,616  07-17-97   5:56p CL97_3TS.DT
CL97_3TS ASC       188,802  07-17-97   5:53p CL97_3TS.ASC
CL97_3TS IN             95  07-17-97   4:08p CL97_3TS.IN
RSZ_10   MSG         5,522  05-15-97   1:47p RSZ_10.MSG
RSZ_10   RS1         7,492  05-15-97   1:47p RSZ_10.RS1
RSY_10   MSG         5,522  05-15-97   1:47p RSY_10.MSG
RSY_10   RS1         7,492  05-15-97   1:47p RSY_10.RS1
RSX_10   MSG         5,522  05-15-97   1:47p RSX_10.MSG
RSX_10   RS1         7,492  05-15-97   1:47p RSX_10.RS1
RS       BAT           663  05-15-97   1:45p RS.BAT
CALCO97Z MSG         6,436  05-13-97   4:21p CALCO97Z.MSG
CALCO97Y MSG         6,436  05-13-97   4:21p CALCO97Y.MSG
CALCO97X MSG         6,436  05-13-97   4:21p CALCO97X.MSG
AVD_FAS  BAT           516  05-13-97   4:21p AVD_FAS.BAT
CALCO97  BRP            40  05-13-97   3:10p CALCO97.BRP
077P24GR ACZ        31,056  05-13-97   2:48p 077P24GR.ACZ
077P24GR ACY        32,368  05-13-97   2:47p 077P24GR.ACY
077P24GR ACX        32,644  05-13-97   2:47p 077P24GR.ACX
CALCO97Z IN            561  05-13-97   2:47p CALCO97Z.IN
CALCO97Y IN            563  05-13-97   2:46p CALCO97Y.IN
CALCO97X IN            562  05-13-97   2:46p CALCO97X.IN
CALCO97  GRA        23,005  05-13-97   2:18p CALCO97.GRA
CALCO97Z DT         56,320  05-13-97   1:44p CALCO97Z.DT
CALCO97N DT         56,320  05-13-97   1:44p CALCO97N.DT
CALCO97E DT         56,320  05-13-97   1:44p CALCO97E.DT
CALCO97Z ASC       100,864  05-13-97   1:23p CALCO97Z.ASC
CALCO97N ASC       100,864  05-13-97   1:23p CALCO97N.ASC
CALCO97E ASC       100,864  05-13-97   1:22p CALCO97E.ASC
03181534 BHZ        15,015  05-13-97   1:21p 03181534.BHZ
03181534 BHN        12,170  05-13-97   1:21p 03181534.BHN
03181534 BHE        15,402  05-13-97   1:20p 03181534.BHE
CALICO   EML         3,097  05-12-97   5:56p CALICO.EML
        60 file(s)      2,456,027 bytes
         2 dir(s)   1,738,375,168 bytes free
```

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 Volume in drive D has no label
 Volume Serial Number is D845-2F2F
 Directory of D:\sems\npalm86

NPALM86  LST            0  11-11-97   9:13a npalm86.lst
LCP5P25X GRA       23,099  10-31-97   3:00p LCP5P25X.GRA
LCP5P25Z GRA       23,006  10-30-97   9:28a LCP5P25Z.GRA
LCP5P25Y GRA       23,006  10-30-97   9:26a LCP5P25Y.GRA
LC_P5P25 DT         7,168  10-30-97   9:25a LC_P5P25.DT
RSLC5XYZ DT         3,712  10-30-97   9:24a RSLC5XYZ.DT
NPSLC5Z  DT         1,536  10-30-97   9:23a NPSLC5Z.DT
NPSLC5Y  DT         1,536  10-30-97   9:22a NPSLC5Y.DT
NPSLC5X  DT         1,536  10-30-97   9:22a NPSLC5X.DT
NPSLC5Z  RS1        7,493  10-30-97   9:21a npslc5z.rs1
NPSLC5Y  RS1        7,493  10-30-97   9:21a npslc5y.rs1
NPSLC5X  RS1        7,493  10-30-97   9:20a npslc5x.rs1
NPSLC5Z  MSG        6,766  10-30-97   9:20a npslc5z.msg
NPSLC5X  MSG        6,677  10-30-97   9:20a npslc5x.msg
NPSLC5Y  MSG        6,766  10-30-97   9:20a npslc5y.msg
LC0P5    BAT          622  10-30-97   9:19a lc0p5.bat
RSL25XYZ DT         3,712  10-30-97   9:06a RSL25XYZ.DT
NPSLC25Y DT         1,536  10-30-97   9:04a NPSLC25Y.DT
NPSLC25X DT         1,536  10-30-97   9:04a NPSLC25X.DT
NPSLC25Z DT         1,536  10-30-97   9:03a NPSLC25Z.DT
NPSLC25Z RS1        7,494  10-30-97   9:02a npslc25z.rs1
NPSLC25Y RS1        7,494  10-30-97   9:02a npslc25y.rs1
NPSLC25X RS1        7,496  10-30-97   9:01a npslc25x.rs1
NPSLC25Y MSG        6,767  10-30-97   8:57a npslc25y.msg
NPSLC25Z MSG        6,767  10-30-97   8:57a npslc25z.msg
NPSLC25X MSG        6,678  10-30-97   8:57a npslc25x.msg
LC0P25   BAT          637  10-30-97   8:51a lc0p25.bat
.            <DIR>         10-16-97   4:22p .
..           <DIR>         10-16-97   4:22p ..
DIR      LST        3,971  08-21-97   9:41p DIR.LST
3TS      GRA       22,995  08-17-97  10:55p 3TS.GRA
S2LB_3V  DT       253,312  08-17-97  10:54p S2LB_3V.DT
S2LB_3D  DT       253,312  08-17-97  10:54p S2LB_3D.DT
S2LB_3A  DT       231,296  08-17-97  10:54p S2LB_3A.DT
S2LB_3D  ASC      429,052  08-17-97  10:53p S2LB_3D.ASC
S2LB_3V  ASC      429,052  08-17-97  10:53p S2LB_3V.ASC
S2LB_3A  ASC      391,852  08-17-97  10:53p S2LB_3A.ASC
S2LB_3D  IN            97  08-17-97  10:53p S2LB_3D.IN
S2LB_3V  IN            97  08-17-97  10:52p S2LB_3V.IN
S2LB_3A  IN            97  08-17-97  10:51p S2LB_3A.IN
S2LBAVDZ MSG        5,499  08-17-97  10:48p S2LBAVDZ.MSG
S2LB__AZ SMC       66,311  08-17-97  10:48p S2LB__AZ.SMC
S2LB__VZ SMC       72,461  08-17-97  10:48p S2LB__VZ.SMC
S2LB__DZ SMC       72,461  08-17-97  10:48p S2LB__DZ.SMC
S2LBAVDY MSG        5,499  08-17-97  10:48p S2LBAVDY.MSG
S2LB__AY SMC       66,311  08-17-97  10:48p S2LB__AY.SMC
S2LB__VY SMC       72,461  08-17-97  10:48p S2LB__VY.SMC
S2LB__DY SMC       72,461  08-17-97  10:48p S2LB__DY.SMC
S2LB__VX SMC       72,461  08-17-97  10:48p S2LB__VX.SMC
S2LB__DX SMC       72,461  08-17-97  10:48p S2LB__DX.SMC
S2LBAVDX MSG        5,499  08-17-97  10:48p S2LBAVDX.MSG
S2LB__AX SMC       66,311  08-17-97  10:48p S2LB__AX.SMC
AVD_SMC  BAT          807  08-17-97  10:48p AVD_SMC.BAT
189J20S2 LBZ       66,795  08-14-97  11:11a 189J20S2.LBZ
189J20S2 LBY       66,797  08-14-97  11:11a 189J20S2.LBY
189J20S2 LBX       66,825  08-14-97  11:10a 189J20S2.LBX
COMMENT  TXT          600  09-13-96   2:14p COMMENT.TXT
HDR      TXT        1,933  09-13-96   1:56p HDR.TXT
BU       BAT           16  08-27-96   5:04p BU.BAT
NPS2AVDZ MSG        4,724  06-12-96   6:12p NPS2AVDZ.MSG
NPS2AVDY MSG        4,724  06-12-96   6:11p NPS2AVDY.MSG
NPS2AVDX MSG        4,636  06-12-96   6:11p NPS2AVDX.MSG
AVD_BBF2 BAT        1,047  06-12-96   6:11p AVD_BBF2.BAT
TEMP     BAT          343  06-12-96   6:06p TEMP.BAT
NPSAVDZ  MSG        4,726  06-11-96   4:21p NPSAVDZ.MSG
NPSAVDY  MSG        4,726  06-11-96   4:21p NPSAVDY.MSG
NPSAVDX  MSG        4,638  06-11-96   4:21p NPSAVDX.MSG
AVD_BBF  BAT        1,011  06-11-96   4:21p AVD_BBF.BAT
NP86XYZ  DT         3,712  05-09-96   4:12p NP86XYZ.DT
NP86ZCOR DT         1,536  05-09-96   4:10p NP86ZCOR.DT
NP86YCOR DT         1,536  05-09-96   4:06p NP86YCOR.DT
NP86XCOR DT         1,536  05-09-96   4:06p NP86XCOR.DT
NP86ZCOR RS1        7,496  05-09-96  11:32a NP86ZCOR.RS1
NP86YCOR RS1        7,496  05-09-96  11:32a NP86YCOR.RS1
NP86XCOR RS1        7,496  05-09-96  11:31a NP86XCOR.RS1
NP86ZCOR MSG        6,764  05-09-96  11:30a NP86ZCOR.MSG
NP86YCOR MSG        6,764  05-09-96  11:29a NP86YCOR.MSG
NP86XCOR MSG        6,764  05-09-96  11:29a NP86XCOR.MSG
ACC2RS1  BAT          378  05-09-96  11:29a ACC2RS1.BAT
NPALM86  BRP          106  05-09-96  11:24a NPALM86.BRP
COR_Z    MSG        1,927  09-06-95   2:04p COR_Z.MSG
189_Z    MSG        1,929  09-06-95   2:04p 189_Z.MSG
COR_Y    MSG        1,927  09-06-95   2:04p COR_Y.MSG
189_Y    MSG        1,929  09-06-95   2:04p 189_Y.MSG
COR_X    MSG        1,927  09-06-95   2:04p COR_X.MSG
189_X    MSG        1,929  09-06-95   2:04p 189_X.MSG
CORR4LC  BAT          568  09-06-95   2:03p CORR4LC.BAT
NPS86Y   COR       66,849  09-06-95   2:01p NPS86Y.COR
NPS86Z   COR       66,849  09-06-95   2:01p NPS86Z.COR
NPS86X   COR       66,849  09-06-95   2:01p NPS86X.COR
CORR4LC  IN            80  09-05-95   5:03p CORR4LC.IN
NPSPVYZ  GRA       23,229  08-17-95   6:47p NPSPVYZ.GRA
NPSPVYZ  DT         4,352  08-17-95   6:44p NPSPVYZ.DT
NPSPSVZ  DT         4,864  08-17-95   6:37p NPSPSVZ.DT
NPSPSVY  DT         4,864  08-17-95   6:37p NPSPSVY.DT
NPSPSVZ  RS1        7,497  08-17-95   6:36p NPSPSVZ.RS1
NPSPSVY  RS1        7,497  08-17-95   6:35p NPSPSVY.RS1
NPSPSVZ  MSG        6,774  08-17-95   6:35p NPSPSVZ.MSG
NPSPSVY  MSG        6,774  08-17-95   6:35p NPSPSVY.MSG
ACC_LC   BAT          317  08-17-95   5:33p ACC_LC.BAT
CDROM    REC        8,944  02-24-93   1:53p CDROM.REC
BPRESPON TXT          892  12-05-92  10:59p BPRESPON.TXT
BPRUN    MSG        5,894  12-05-92  10:59p BPRUN.MSG
NPALM86  BAT           31  12-05-92  10:36p NPALM86.BAT
FIL      FIL        8,944  12-02-92   9:20a FIL.FIL
NPALMZ   IN           510  12-01-92  12:39p NPALMZ.IN
NPALMY   IN           512  12-01-92  12:38p NPALMY.IN
NPALMX   IN           511  12-01-92  12:36p NPALMX.IN
JUL0886  Z        221,260  07-08-88   9:44a JUL0886.Z
JUL0886  Y        221,260  07-08-88   9:44a JUL0886.Y
JUL0886  X        221,260  07-08-88   9:44a JUL0886.X
       109 file(s)      4,099,772 bytes
         2 dir(s)   1,738,539,008 bytes free
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 Volume in drive D has no label
 Volume Serial Number is D845-2F2F
 Directory of D:\sems\ocnsid86

OCNSID86 LST             0  11-11-97   9:14a ocnsid86.lst
LCP5P25Z GRA        23,009  10-30-97   2:04p LCP5P25Z.GRA
LCP5P25Y GRA        23,009  10-30-97   2:03p LCP5P25Y.GRA
LCP5P25X GRA        23,009  10-30-97   2:02p LCP5P25X.GRA
LC_P5P25 DT          7,168  10-30-97   2:01p LC_P5P25.DT
OCNLC25Z DT          1,536  10-30-97   1:59p OCNLC25Z.DT
OCNLC25Y DT          1,536  10-30-97   1:58p OCNLC25Y.DT
OCNLC25X DT          1,536  10-30-97   1:58p OCNLC25X.DT
OCNLC5X  DT          1,536  10-30-97   1:58p OCNLC5X.DT
OCNLC5Y  DT          1,536  10-30-97   1:57p OCNLC5Y.DT
OCNLC5Z  DT          1,536  10-30-97   1:57p OCNLC5Z.DT
OCNLC25Z RS1         7,493  10-30-97   1:55p ocnlc25z.rs1
OCNLC25Y RS1         7,493  10-30-97   1:55p ocnlc25y.rs1
OCNLC25X RS1         7,493  10-30-97   1:55p ocnlc25x.rs1
OCNLC5Z  RS1         7,493  10-30-97   1:54p ocnlc5z.rs1
OCNLC5Y  RS1         7,493  10-30-97   1:54p ocnlc5y.rs1
OCNLC5X  RS1         7,493  10-30-97   1:54p ocnlc5x.rs1
OCNLC25Y MSG         6,678  10-30-97   1:53p ocnlc25y.msg
OCNLC25Z MSG         6,767  10-30-97   1:53p ocnlc25z.msg
OCNLC25X MSG         6,679  10-30-97   1:53p ocnlc25x.msg
OCNLC5Y  MSG         6,677  10-30-97   1:53p ocnlc5y.msg
OCNLC5Z  MSG         6,766  10-30-97   1:53p ocnlc5z.msg
OCNLC5X  MSG         6,678  10-30-97   1:53p ocnlc5x.msg
LCOP5    BAT           622  10-30-97   1:50p lc0p5.bat
LCOP25   BAT           637  10-30-97   1:50p lc0p25.bat
.              <DIR>        10-16-97   4:22p .
..             <DIR>        10-16-97   4:22p ..
DIR      LST         3,702  08-21-97   9:41p DIR.LST
3TS      GRA        22,998  08-17-97  11:28p 3TS.GRA
S2LB_3V  DT        315,008  08-17-97  11:08p S2LB_3V.DT
S2LB_3D  DT        315,008  08-17-97  11:08p S2LB_3D.DT
S2LB_3A  DT        292,992  08-17-97  11:08p S2LB_3A.DT
S2LB_3D  ASC       533,584  08-17-97  11:07p S2LB_3D.ASC
S2LB_3V  ASC       533,584  08-17-97  11:07p S2LB_3V.ASC
S2LB_3A  ASC       496,384  08-17-97  11:07p S2LB_3A.ASC
S2LBAVDZ MSG         5,499  08-17-97  11:07p S2LBAVDZ.MSG
S2LB__AZ SMC        83,591  08-17-97  11:07p S2LB__AZ.SMC
S2LB__VZ SMC        89,741  08-17-97  11:07p S2LB__VZ.SMC
S2LB__DZ SMC        89,741  08-17-97  11:07p S2LB__DZ.SMC
S2LBAVDY MSG         5,499  08-17-97  11:07p S2LBAVDY.MSG
S2LB__AY SMC        83,591  08-17-97  11:07p S2LB__AY.SMC
S2LB__VY SMC        89,741  08-17-97  11:07p S2LB__VY.SMC
S2LB__DY SMC        89,741  08-17-97  11:07p S2LB__DY.SMC
S2LB__AX SMC        83,591  08-17-97  11:07p S2LB__AX.SMC
S2LB__VX SMC        89,741  08-17-97  11:07p S2LB__VX.SMC
S2LB__DX SMC        89,741  08-17-97  11:07p S2LB__DX.SMC
S2LBAVDX MSG         5,499  08-17-97  11:07p S2LBAVDX.MSG
AVD_SMC  BAT           807  08-17-97  11:06p AVD_SMC.BAT
S2LB_3D  IN             97  08-17-97  10:53p S2LB_3D.IN
S2LB_3V  IN             97  08-17-97  10:52p S2LB_3V.IN
S2LB_3A  IN             97  08-17-97  10:51p S2LB_3A.IN
194N47S2 LBZ        84,067  08-14-97  11:27a 194N47S2.LBZ
194N47S2 LBY        84,069  08-14-97  11:27a 194N47S2.LBY
194N47S2 LBX        84,095  08-14-97  11:26a 194N47S2.LBX
HDR      TXT         2,094  09-13-96   2:20p HDR.TXT
COMMENT  TXT           574  09-13-96   2:17p COMMENT.TXT
BU       BAT            19  08-27-96   5:04p BU.BAT
OCN2AVDZ MSG         4,732  06-12-96   6:18p OCN2AVDZ.MSG
OCN2AVDY MSG         4,732  06-12-96   6:18p OCN2AVDY.MSG
OCN2AVDX MSG         4,732  06-12-96   6:18p OCN2AVDX.MSG
AVD_BBF2 BAT         1,047  06-12-96   6:18p AVD_BBF2.BAT
OCNAVDZ  MSG         4,726  06-11-96   4:39p OCNAVDZ.MSG
OCNAVDY  MSG         4,726  06-11-96   4:39p OCNAVDY.MSG
OCNAVDX  MSG         4,726  06-11-96   4:39p OCNAVDX.MSG
AVD_BBF  BAT         1,011  06-11-96   4:39p AVD_BBF.BAT
OS86ZCOR RS1         7,496  05-11-96   6:21p OS86ZCOR.RS1
OS86XCOR RS1         7,496  05-11-96   6:21p OS86XCOR.RS1
OS86YCOR RS1         7,496  05-11-96   6:21p OS86YCOR.RS1
OS86ZCOR MSG         6,764  05-11-96   6:12p OS86ZCOR.MSG
OS86YCOR MSG         6,764  05-11-96   6:12p OS86YCOR.MSG
OS86XCOR MSG         6,764  05-11-96   6:12p OS86XCOR.MSG
OCN86    BRP           106  05-11-96   6:11p OCN86.BRP
ACC2RS1  BAT           372  05-11-96   6:10p ACC2RS1.BAT
COR_Z    MSG         1,927  09-06-95  10:04a COR_Z.MSG
194_Z    MSG         1,929  09-06-95  10:04a 194_Z.MSG
COR_Y    MSG         1,927  09-06-95  10:04a COR_Y.MSG
194_Y    MSG         1,929  09-06-95  10:04a 194_Y.MSG
COR_X    MSG         1,927  09-06-95  10:03a COR_X.MSG
194_X    MSG         1,929  09-06-95  10:03a 194_X.MSG
CORR4LC  BAT           568  09-06-95  10:03a CORR4LC.BAT
OCN86Z   COR        84,129  09-06-95   9:57a OCN86Z.COR
OCN86X   COR        84,129  09-06-95   9:57a OCN86X.COR
OCN86Y   COR        84,129  09-06-95   9:57a OCN86Y.COR
CORR4LC  IN             80  09-06-95   9:57a CORR4LC.IN
BPRUN    MSG         1,803  09-05-95   7:20p BPRUN.MSG
OCNPVYZ  GRA        23,223  08-17-95   7:02p OCNPVYZ.GRA
OCNPVYZ  DT          4,352  08-17-95   7:00p OCNPVYZ.DT
OCNPSVZ  DT          4,864  08-17-95   6:58p OCNPSVZ.DT
OCNPSVY  DT          4,864  08-17-95   6:58p OCNPSVY.DT
OCNPSVZ  RS1         7,497  08-17-95   6:57p OCNPSVZ.RS1
OCNPSVY  RS1         7,497  08-17-95   6:57p OCNPSVY.RS1
OCNPSVZ  MSG         6,774  08-17-95   6:57p OCNPSVZ.MSG
OCNPSVY  MSG         6,685  08-17-95   6:57p OCNPSVY.MSG
OCNSID86 BRP           105  08-17-95   6:35p OCNSID86.BRP
OCNSID3C PS        115,618  01-12-94   1:19p OCNSID3C.PS
OCNSIDZ  IN            503  12-01-92  12:53p OCNSIDZ.IN
OCNSIDY  IN            505  12-01-92  12:53p OCNSIDY.IN
OCNSIDX  IN            504  12-01-92  12:52p OCNSIDX.IN
DAVE     PLT           146  06-24-92   4:28p DAVE.PLT
DAVE     DCK           160  06-24-92   4:28p DAVE.DCK
JUL1386  Y         280,271  07-08-88  10:33a JUL1386.Y
JUL1386  X         280,271  07-08-88  10:33a JUL1386.X
JUL1386  Z         280,271  07-08-88  10:33a JUL1386.Z
       101 file(s)      5,111,071 bytes
         2 dir(s)   1,738,506,240 bytes free
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OCNSID86.LST 11-11-97 9:14a

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 Volume in drive D has no label
 Volume Serial Number is D845-2F2F
 Directory of D:\sems\rc95

RC95     LST             0  11-11-97   9:15a RC95.LST
RFRMRC95 FOR         1,208  11-11-97   9:04a rfrmrc95.for
.            <DIR>          10-16-97   4:22p .
..           <DIR>          10-16-97   4:22p ..
DIR      LST         4,058  08-21-97   9:42p DIR.LST
3TS      GRA        22,986  08-20-97   4:40p 3TS.GRA
S4IR_3V  DT        161,792  08-20-97   4:32p S4IR_3V.DT
S4IR_3D  DT        161,792  08-20-97   4:32p S4IR_3D.DT
S4IR_3A  DT        150,784  08-20-97   4:31p S4IR_3A.DT
S4IR_3D  ASC       273,928  08-20-97   4:30p S4IR_3D.ASC
S4IR_3V  ASC       273,928  08-20-97   4:30p S4IR_3V.ASC
S4IR_3A  ASC       255,328  08-20-97   4:29p S4IR_3A.ASC
S4IR_3D  IN             97  08-20-97   4:29p S4IR_3D.IN
S4IR_3V  IN             97  08-20-97   4:29p S4IR_3V.IN
S4IR_3A  IN             97  08-20-97   4:29p S4IR_3A.IN
S4IRAVDZ MSG         5,505  08-20-97   4:28p S4IRAVDZ.MSG
S4IR__AZ SMC        43,739  08-20-97   4:28p S4IR__AZ.SMC
S4IR__VZ SMC        46,815  08-20-97   4:28p S4IR__VZ.SMC
S4IR__DZ SMC        46,815  08-20-97   4:28p S4IR__DZ.SMC
S4IRAVDY MSG         5,505  08-20-97   4:28p S4IRAVDY.MSG
S4IR__AY SMC        43,739  08-20-97   4:28p S4IR__AY.SMC
S4IR__VY SMC        46,815  08-20-97   4:28p S4IR__VY.SMC
S4IR__DY SMC        46,815  08-20-97   4:28p S4IR__DY.SMC
S4IRAVDX MSG         5,505  08-20-97   4:28p S4IRAVDX.MSG
S4IR__AX SMC        43,739  08-20-97   4:28p S4IR__AX.SMC
S4IR__VX SMC        46,815  08-20-97   4:28p S4IR__VX.SMC
S4IR__DX SMC        46,815  08-20-97   4:28p S4IR__DX.SMC
AVD_SMC  BAT           813  08-20-97   4:28p AVD_SMC.BAT
RSZ_20   MSG         5,524  08-20-97   4:01p RSZ_20.MSG
RSZ_20   RS1         7,492  08-20-97   4:01p RSZ_20.RS1
RSY_20   MSG         5,524  08-20-97   4:01p RSY_20.MSG
RSY_20   RS1         7,492  08-20-97   4:01p RSY_20.RS1
RSX_20   MSG         5,524  08-20-97   4:01p RSX_20.MSG
RSX_20   RS1         7,492  08-20-97   4:01p RSX_20.RS1
RS_LCOP2 BAT           663  08-20-97   4:01p RS_LCOP2.BAT
RSZ_10   MSG         5,522  05-15-97   4:23p RSZ_10.MSG
RSZ_10   RS1         7,492  05-15-97   4:23p RSZ_10.RS1
RSY_10   MSG         5,522  05-15-97   4:23p RSY_10.MSG
RSY_10   RS1         7,492  05-15-97   4:23p RSY_10.RS1
RSX_10   MSG         5,522  05-15-97   4:23p RSX_10.MSG
RSX_10   RS1         7,492  05-15-97   4:23p RSX_10.RS1
263X27S4 IRZ        43,642  05-15-97   2:19p 263X27S4.IRZ
263X27S4 IRY        43,642  05-15-97   2:19p 263X27S4.IRY
RC95Z    IN            563  05-15-97   2:19p RC95Z.IN
RC95Y    IN            565  05-15-97   2:18p RC95Y.IN
263X27S4 IRX        43,642  05-15-97   2:16p 263X27S4.IRX
RS       BAT           663  05-15-97   2:13p RS.BAT
COMMENT  TXT           432  09-13-96  12:59p COMMENT.TXT
TEMP     FIL         1,862  09-12-96   9:09p TEMP.FIL
RC95X    IN            564  09-12-96   8:43p RC95X.IN
BU       BAT            15  08-27-96   5:05p BU.BAT
RC95_TS2 BAT           309  06-18-96  10:14a RC95_TS2.BAT
RC95FSZ  MSG         1,929  06-18-96  10:05a RC95FSZ.MSG
RC95FSE  MSG         1,929  06-18-96  10:05a RC95FSE.MSG
RC95FSN  MSG         1,929  06-18-96  10:05a RC95FSN.MSG
RC95_FS  BAT           378  06-18-96  10:04a RC95_FS.BAT
RC2AVDZ  MSG         4,730  06-12-96   6:43p RC2AVDZ.MSG
RC2AVDE  MSG         4,730  06-12-96   6:43p RC2AVDE.MSG
RC2AVDN  MSG         4,730  06-12-96   6:43p RC2AVDN.MSG
AVD_BBF2 BAT         1,017  06-12-96   6:43p AVD_BBF2.BAT
RCAVDZ   MSG         4,728  06-12-96   6:37p RCAVDZ.MSG
RCAVDE   MSG         4,728  06-12-96   6:37p RCAVDE.MSG
RCAVDN   MSG         4,728  06-12-96   6:37p RCAVDN.MSG
AVD_BBF  BAT           978  06-12-96   6:37p AVD_BBF.BAT
RC95Z    RS1         7,497  05-11-96   6:29p RC95Z.RS1
RC95RVH  GRA        23,079  05-07-96   1:37p RC95RVH.GRA
RC95RVH  DT         15,104  05-07-96   1:19p RC95RVH.DT
RC95Z    DT          4,864  05-07-96   1:17p RC95Z.DT
RC95N    DT          4,864  05-07-96   1:17p RC95N.DT
RC95E    DT          4,864  05-07-96   1:16p RC95E.DT
RC95N    RS1         7,497  05-07-96   1:15p RC95N.RS1
RC95E    RS1         7,497  05-07-96   1:15p RC95E.RS1
RC95Z    MSG         9,411  05-07-96   1:12p RC95Z.MSG
RC95E    MSG         9,411  05-07-96   1:12p RC95E.MSG
RC95N    MSG         9,411  05-07-96   1:12p RC95N.MSG
AVD_RS   BAT           635  05-07-96   1:12p AVD_RS.BAT
RC95     BRP            69  05-07-96  11:14a RC95.BRP
RC95E    IN            558  05-07-96   8:20a RC95E.IN
RC95N    IN            559  05-07-96   8:20a RC95N.IN
RDGE_BHZ ASC       155,380  11-02-95   1:04p RDGE_BHZ.ASC
RDGE_BHE ASC       155,380  11-02-95   1:04p RDGE_BHE.ASC
RDGE_BHN ASC       155,380  11-02-95  12:47p RDGE_BHN.ASC
REFORMAT EXE        33,922  11-02-95  12:46p REFORMAT.EXE
09202330 BHZ        22,161  10-26-95   4:15p 09202330.BHZ
09202330 BHN        23,685  10-26-95   4:15p 09202330.BHN
09202330 BHE        23,466  10-26-95   4:15p 09202330.BHE
        84 file(s)      2,661,410 bytes
         2 dir(s)   1,738,506,240 bytes free
```

```
 Volume in drive D has no label
 Volume Serial Number is D845-2F2F
 Directory of D:\sems\report

REPORT   LST             0  11-11-97  9:20a report.lst
SIMBASGS TBL         2,120  11-10-97  4:46p simbasgs.tbl
SEMS_VEL TBL         1,399  11-10-97  4:43p sems_vel.tbl
LC       TBL           489  11-10-97  4:38p LC.TBL
DST4RPT  TBL           757  11-10-97  4:37p DST4RPT.TBL
EQ4APND  TBL         7,455  11-10-97  4:36p EQ4APND.TBL
STA      TBL           892  11-10-97  4:16p STA.TBL
EQ       TBL           857  11-10-97  4:16p EQ.TBL
TEX      LOG        11,203  11-10-97  1:34p Tex.log
TEX      DVI       152,392  11-10-97  1:34p Tex.dvi
AKNOW    TEX           842  11-10-97  9:43a Aknow.tex
THEORY   TEX        13,887  11-10-97  9:40a Theory.tex
FIGS     TEX        24,907  11-10-97  9:37a Figs.tex
DATA     TEX        32,623  11-10-97  9:37a Data.tex
SCALING  TEX        13,647  11-10-97  9:34a Scaling.tex
SITEAB   TEX         4,246  11-10-97  9:26a SITEAB.TEX
DATA     BAK        32,632  11-10-97  9:18a Data.BAK
REFSSEMS TEX         7,664  11-10-97  9:14a refssems.tex
TTL_TOC  TEX         3,697  11-10-97  9:07a ttl_toc.TEX
JENS1102 EML         1,090  11-10-97  7:24a JENS1102.EML
FIGS     BAK        24,906  11-09-97  8:14a FIGS.BAK
TEX      TEX           481  11-08-97 10:55a Tex.tex
THEORY   BAK        13,886  11-08-97  9:51a Theory.BAK
CONCLUDE TEX         4,028  11-07-97 10:18p CONCLUDE.TEX
HIST     TEX         6,579  11-07-97 10:15p Hist.tex
INTRO    TEX         7,574  11-07-97  9:58p Intro.tex
TEMP     ASC         3,621  11-07-97  2:21p temp.asc
DIR      LST           911  11-06-97  8:35a dir.lst
TABLE2   ASC         8,495  11-05-97  3:58p table2.asc
SAND_VEL TXT           907  11-05-97  3:40p sand_vel.txt
TEMP     TEX            99  11-04-97  8:49p TEMP.TEX
SCALING  BAK        12,384  10-16-97  9:20p Scaling.BAK
INTRO    BAK         7,255  10-16-97  9:12p INTRO.BAK
HIST     BAK         6,494  10-16-97  9:11p HIST.BAK
INTRO    LOG           378  10-16-97  4:50p INTRO.LOG
DATA     LOG           377  10-16-97  4:43p Data.log
.              <DIR>        10-16-97  4:21p .
..             <DIR>        10-16-97  4:21p ..
SIM_AS   TBL         1,981  10-14-97  3:59p sim_as.tbl
TEMP0    ASC         6,945  10-14-97  3:45p temp0.asc
SCALING  TXT         6,016  09-27-97 10:49a SCALING.TXT
STA4APND TBL         7,847  09-04-97 12:17p STA4APND.TBL
SMITH797 ASC         7,936  09-03-97 10:07p SMITH797.ASC
HIST     TXT         1,702  08-21-97  6:20p HIST.TXT
        42 file(s)      443,601 bytes
         2 dir(s)  1,738,309,632 bytes free
```

```
Volume in drive D has no label
Volume Serial Number is D845-2F2F
Directory of D:\sems\sbi81

SBI81    LST          0  11-11-97  9:16a sbi81.lst
VT1P0    GRA     23,319  11-06-97  2:09p VT1P0.GRA
VT2P0    GRA     23,319  11-06-97  2:06p VT2P0.GRA
VTOP5    GRA     23,319  11-06-97  2:01p VTOP5.GRA
VTOP2    GRA     23,319  11-06-97  2:01p VTOP2.GRA
VTOP1    GRA     23,319  11-06-97  2:01p VTOP1.GRA
HT2P0    GRA     23,321  11-06-97  2:00p HT2P0.GRA
HT1P0    GRA     23,321  11-06-97  1:59p HT1P0.GRA
HTOP5    GRA     23,321  11-06-97  1:58p HTOP5.GRA
HTOP2    GRA     23,321  11-06-97  1:57p HTOP2.GRA
HTOP1    GRA     23,321  11-06-97  1:56p HTOP1.GRA
ZDH      GRA     23,343  10-20-97  9:20a ZDH.GRA
.              <DIR>     10-16-97  4:22p .
..             <DIR>     10-16-97  4:22p ..
DIR      LST     12,924  09-01-97 10:24p DIR.LST
SC51PSVV MSG      5,499  09-01-97  6:21p SC51PSVV.MSG
SC51PSVV RS1      7,492  09-01-97  6:21p SC51PSVV.RS1
SC51PSVX MSG      5,499  09-01-97  6:21p SC51PSVX.MSG
SC51PSVY MSG      5,499  09-01-97  6:21p SC51PSVY.MSG
SC51PSVX RS1      7,492  09-01-97  6:21p SC51PSVX.RS1
SC51PSVY RS1      7,492  09-01-97  6:21p SC51PSVY.RS1
SC38PSVV MSG      5,499  09-01-97  6:21p SC38PSVV.MSG
SC38PSVV RS1      7,492  09-01-97  6:21p SC38PSVV.RS1
SC38PSVY MSG      5,499  09-01-97  6:21p SC38PSVY.MSG
SC38PSVY RS1      7,492  09-01-97  6:21p SC38PSVY.RS1
SC38PSVX MSG      5,499  09-01-97  6:21p SC38PSVX.MSG
SC38PSVX RS1      7,492  09-01-97  6:21p SC38PSVX.RS1
S1VCPSVV MSG      6,770  09-01-97  6:21p S1VCPSVV.MSG
S1VCPSVV RS1      7,492  09-01-97  6:21p S1VCPSVV.RS1
S1VCPSVE MSG      6,681  09-01-97  6:21p S1VCPSVE.MSG
S1VCPSVE RS1      7,492  09-01-97  6:21p S1VCPSVE.RS1
S1VCPSVN MSG      6,770  09-01-97  6:21p S1VCPSVN.MSG
S1VCPSVN RS1      7,492  09-01-97  6:21p S1VCPSVN.RS1
ACC2RS1  BAT      1,725  09-01-97  6:21p ACC2RS1.BAT
SEMSVEMP DT      13,568  08-31-97  4:01p SEMSVEMP.DT
SEMSHEMP DT      13,568  08-31-97  3:44p SEMSHEMP.DT
VHALLTSS DT       9,600  08-31-97  3:43p VHALLTSS.DT
VHT2POSS DT       2,176  08-31-97  3:40p VHT2POSS.DT
VHT1POSS DT       2,176  08-31-97  3:40p VHT1POSS.DT
VHTOP5SS DT       2,176  08-31-97  3:40p VHTOP5SS.DT
VHTOP2SS DT       2,176  08-31-97  3:40p VHTOP2SS.DT
VHTOP1SS DT       2,176  08-31-97  3:40p VHTOP1SS.DT
VHT2POSS ASC      3,529  08-31-97  3:39p VHT2POSS.ASC
VHT1POSS ASC      3,529  08-31-97  3:39p VHT1POSS.ASC
VHTOP5SS ASC      3,529  08-31-97  3:39p VHTOP5SS.ASC
VHTOP2SS ASC      3,529  08-31-97  3:39p VHTOP2SS.ASC
VHTOP1SS ASC      3,529  08-31-97  3:39p VHTOP1SS.ASC
VH_EMP_D IN         954  08-30-97 10:59p VH_EMP_D.IN
PSVV1P0  GRA     23,416  08-27-97  9:59p PSVV1P0.GRA
SC51_3V  DT      65,408  08-17-97 11:03a SC51_3V.DT
SC51_3D  DT      65,408  08-17-97 11:03a SC51_3D.DT
SC51_3A  DT      37,888  08-17-97 11:03a SC51_3A.DT
SC38_3V  DT      75,392  08-17-97 11:02a SC38_3V.DT
SC38_3D  DT      75,392  08-17-97 11:02a SC38_3D.DT
SC38_3A  DT      48,000  08-17-97 11:02a SC38_3A.DT
S1VC_3V  DT     435,968  08-17-97 11:02a S1VC_3V.DT
S1VC_3D  DT     435,968  08-17-97 11:01a S1VC_3D.DT
S1VC_3A  DT     381,184  08-17-97 11:01a S1VC_3A.DT
S1HN_3V  DT     155,136  08-17-97 11:01a S1HN_3V.DT
S1HN_3D  DT     155,136  08-17-97 11:01a S1HN_3D.DT
S1HN_3A  DT     100,224  08-17-97 11:00a S1HN_3A.DT
SC51_3D  ASC    110,434  08-17-97 10:59a SC51_3D.ASC
SC51_3V  ASC    110,434  08-17-97 10:59a SC51_3V.ASC
SC51_3A  ASC     63,934  08-17-97 10:59a SC51_3A.ASC
SC38_3D  ASC    127,422  08-17-97 10:59a SC38_3D.ASC
SC38_3V  ASC    127,422  08-17-97 10:58a SC38_3V.ASC
SC38_3A  ASC     80,922  08-17-97 10:58a SC38_3A.ASC
S1VC_3D  ASC    738,804  08-17-97 10:58a S1VC_3D.ASC
S1VC_3V  ASC    738,804  08-17-97 10:58a S1VC_3V.ASC
S1VC_3A  ASC    645,804  08-17-97 10:58a S1VC_3A.ASC
S1HN_3D  ASC    262,644  08-17-97 10:58a S1HN_3D.ASC
S1HN_3V  ASC    262,644  08-17-97 10:57a S1HN_3V.ASC
S1HN_3A  ASC    169,644  08-17-97 10:57a S1HN_3A.ASC
SC51AVDV MSG      5,505  08-16-97  7:05p SC51AVDV.MSG
SC51__AV SMC     12,099  08-16-97  7:05p SC51__AV.SMC
SC51__VV SMC     19,785  08-16-97  7:05p SC51__VV.SMC
SC51__DV SMC     19,785  08-16-97  7:05p SC51__DV.SMC
SC51AVDX MSG      5,505  08-16-97  7:05p SC51AVDX.MSG
SC51__AX SMC     12,087  08-16-97  7:05p SC51__AX.SMC
SC51__VX SMC     19,775  08-16-97  7:05p SC51__VX.SMC
SC51__DX SMC     19,775  08-16-97  7:05p SC51__DX.SMC
SC51AVDY MSG      5,505  08-16-97  7:05p SC51AVDY.MSG
SC51__AY SMC     12,047  08-16-97  7:05p SC51__AY.SMC
SC51__VY SMC     19,735  08-16-97  7:05p SC51__VY.SMC
SC51__DY SMC     19,735  08-16-97  7:05p SC51__DY.SMC
SC38AVDV MSG      5,505  08-16-97  7:05p SC38AVDV.MSG
SC38__AV SMC     14,845  08-16-97  7:05p SC38__AV.SMC
SC38__VV SMC     22,533  08-16-97  7:05p SC38__VV.SMC
SC38__DV SMC     22,533  08-16-97  7:05p SC38__DV.SMC
SC38AVDX MSG      5,505  08-16-97  7:05p SC38AVDX.MSG
SC38__VX SMC     22,595  08-16-97  7:05p SC38__VX.SMC
SC38__DX SMC     22,595  08-16-97  7:05p SC38__DX.SMC
SC38AVDY MSG      5,505  08-16-97  7:05p SC38AVDY.MSG
SC38__AY SMC     14,887  08-16-97  7:05p SC38__AY.SMC
SC38__VY SMC     22,573  08-16-97  7:05p SC38__VY.SMC
SC38__DY SMC     22,573  08-16-97  7:05p SC38__DY.SMC
SC38__AX SMC     14,907  08-16-97  7:05p SC38__AX.SMC
S1VCAVDV MSG      5,505  08-16-97  7:05p S1VCAVDV.MSG
S1VC__VV SMC    124,007  08-16-97  7:05p S1VC__VV.SMC
S1VC__DV SMC    124,007  08-16-97  7:05p S1VC__DV.SMC
S1VC__AV SMC    108,633  08-16-97  7:05p S1VC__AV.SMC
S1VCAVDN MSG      5,505  08-16-97  7:05p S1VCAVDN.MSG
S1VC__AN SMC    108,633  08-16-97  7:05p S1VC__AN.SMC
S1VC__VN SMC    124,007  08-16-97  7:05p S1VC__VN.SMC
S1VC__DN SMC    124,007  08-16-97  7:05p S1VC__DN.SMC
S1VCAVDE MSG      5,416  08-16-97  7:05p S1VCAVDE.MSG
S1VC__AE SMC    108,633  08-16-97  7:05p S1VC__AE.SMC
S1VC__VE SMC    124,007  08-16-97  7:05p S1VC__VE.SMC
S1VC__DE SMC    124,007  08-16-97  7:05p S1VC__DE.SMC
S1HNAVDV MSG      5,505  08-16-97  7:05p S1HNAVDV.MSG
S1HN__AV SMC     29,913  08-16-97  7:05p S1HN__AV.SMC
S1HN__VV SMC     45,287  08-16-97  7:05p S1HN__VV.SMC
S1HN__DV SMC     45,287  08-16-97  7:05p S1HN__DV.SMC
S1HNAVDN MSG      5,505  08-16-97  7:05p S1HNAVDN.MSG
S1HN__AN SMC     29,913  08-16-97  7:05p S1HN__AN.SMC
S1HN__VN SMC     45,287  08-16-97  7:05p S1HN__VN.SMC
S1HN__DN SMC     45,287  08-16-97  7:05p S1HN__DN.SMC
S1HNAVDE MSG      5,505  08-16-97  7:05p S1HNAVDE.MSG
S1HN__AE SMC     29,913  08-16-97  7:05p S1HN__AE.SMC
S1HN__VE SMC     45,287  08-16-97  7:05p S1HN__VE.SMC
S1HN__DE SMC     45,287  08-16-97  7:05p S1HN__DE.SMC
AVD_SMC  BAT      3,252  08-16-97  7:04p AVD_SMC.BAT
3TS_     GRA     22,989  08-16-97  5:59p 3TS_.GRA
S1VC_3D  IN          97  08-16-97  5:16p S1VC_3D.IN
S1VC_3V  IN          97  08-16-97  5:16p S1VC_3V.IN
S1VC_3A  IN          97  08-16-97  5:16p S1VC_3A.IN
S1HN_3D  IN          97  08-16-97  5:14p S1HN_3D.IN
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S1HN_3V	IN	97	08-16-97	5:14p	S1HN_3V.IN
S1HN_3A	IN	97	08-16-97	5:13p	S1HN_3A.IN
SC38_3D	IN	97	08-16-97	5:11p	SC38_3D.IN
SC38_3V	IN	97	08-16-97	5:11p	SC38_3V.IN
SC38_3A	IN	97	08-16-97	5:11p	SC38_3A.IN
SC51_3D	IN	97	08-16-97	5:10p	SC51_3D.IN
SC51_3V	IN	97	08-16-97	5:09p	SC51_3V.IN
SC51_3A	IN	97	08-16-97	5:07p	SC51_3A.IN
247P51SC	51Y	11,975	08-16-97	4:48p	247P51SC.51Y
247P51SC	51X	12,015	08-16-97	4:48p	247P51SC.51X
247P51SC	51V	12,027	08-16-97	4:48p	247P51SC.51V
247P51SC	38Y	14,815	08-16-97	4:47p	247P51SC.38Y
247P51SC	38X	14,835	08-16-97	4:47p	247P51SC.38X
247P51SC	38V	14,773	08-16-97	4:47p	247P51SC.38V
247P51S1	HNV	29,801	08-16-97	4:46p	247P51S1.HNV
247P51S1	HNE	29,802	08-16-97	4:46p	247P51S1.HNE
247P51S1	HNN	29,802	08-16-97	4:46p	247P51S1.HNN
247P51S1	VCE	108,470	08-16-97	4:43p	247P51S1.VCE
247P51S1	VCV	108,468	08-16-97	4:43p	247P51S1.VCV
247P51S1	VCN	108,469	08-16-97	4:42p	247P51S1.VCN
SMC	LST	1,537	08-16-97	4:15p	SMC.LST
SC51AVDN	MSG	301	08-14-97	9:58a	SC51AVDN.MSG
SC51AVDE	MSG	301	08-14-97	9:58a	SC51AVDE.MSG
SC38AVDN	MSG	301	08-14-97	9:58a	SC38AVDN.MSG
SC38AVDE	MSG	301	08-14-97	9:58a	SC38AVDE.MSG
RNAME2	BAT	362	08-14-97	9:08a	RNAME2.BAT
COMMENT	TXT	60	09-13-96	2:08p	COMMENT.TXT
HDR	TXT	1,680	09-13-96	1:42p	HDR.TXT
BU	BAT	22	09-13-96	1:32p	BU.BAT
VICAVDV	MSG	4,638	06-10-96	7:40p	VICAVDV.MSG
VICAVDE	MSG	4,638	06-10-96	7:40p	VICAVDE.MSG
VICAVDN	MSG	4,727	06-10-96	7:39p	VICAVDN.MSG
HENAVDV	MSG	4,727	06-10-96	7:39p	HENAVDV.MSG
HENAVDE	MSG	4,727	06-10-96	7:39p	HENAVDE.MSG
HENAVDN	MSG	4,638	06-10-96	7:39p	HENAVDN.MSG
AVD_BBF	BAT	2,026	06-10-96	7:39p	AVD_BBF.BAT
HENPSVV	RS1	7,497	05-11-96	6:39p	HENPSVV.RS1
BOZ_F7	GRA	23,208	08-28-95	5:24p	BOZ_F7.GRA
BOZ_F56	GRA	23,209	08-28-95	5:09p	BOZ_F56.GRA
HENPVTRV	GRA	23,212	08-17-95	7:06p	HENPVTRV.GRA
HENPVNEV	GRA	23,212	08-17-95	6:51p	HENPVNEV.GRA
BPRUN	MSG	5,158	08-17-95	5:34p	BPRUN.MSG
ACC_LC	BAT	317	08-17-95	5:33p	ACC_LC.BAT
HENPVNEV	DT	5,376	08-17-95	4:50p	HENPVNEV.DT
HENPSVE	DT	4,864	08-17-95	4:28p	HENPSVE.DT
HENPSVN	DT	4,864	08-17-95	4:27p	HENPSVN.DT
HENPSVE	RS1	7,497	08-17-95	4:26p	HENPSVE.RS1
HENPSVN	RS1	7,497	08-17-95	4:26p	HENPSVN.RS1
HENPSVE	MSG	6,769	08-17-95	4:10p	HENPSVE.MSG
HENPSVN	MSG	6,769	08-17-95	4:10p	HENPSVN.MSG
HENPSVV	DT	4,864	08-17-95	3:37p	HENPSVV.DT
HENPSVV	MSG	6,769	08-17-95	3:32p	HENPSVV.MSG
HENPSVV	RS2	7,214	08-17-95	3:23p	HENPSVV.RS2
ACC2RS2	BAT	574	08-17-95	3:21p	ACC2RS2.BAT
TSPL	BAT	160	08-16-95	2:12p	TSPL.BAT
SMC2BBF	BAT	220	08-16-95	2:11p	SMC2BBF.BAT
S51VELV	MSG	2,959	08-16-95	1:48p	S51VELV.MSG
S38VELV	MSG	2,959	08-16-95	1:48p	S38VELV.MSG
VICVELV	MSG	6,659	08-16-95	1:47p	VICVELV.MSG
HENVELV	MSG	6,659	08-16-95	1:47p	HENVELV.MSG
ACC2VELV	BAT	612	08-16-95	1:47p	ACC2VELV.BAT
UNTITLED	GRA	8,283	03-28-94	3:29p	UNTITLED.GRA
PSVP1P5	GRA	8,284	11-16-93	4:36p	PSVP1P5.GRA
PSVP0P75	GRA	8,283	11-16-93	4:32p	PSVP0P75.GRA
PSVP0P4	GRA	8,282	11-16-93	4:28p	PSVP0P4.GRA
PSVP0P2	GRA	8,281	11-16-93	4:25p	PSVP0P2.GRA

PSVP0P15	GRA	8,287	11-16-93	4:20p	PSVP0P15.GRA
PSVP0P1	GRA	8,286	11-16-93	4:17p	PSVP0P1.GRA
UNTITLED	DT	1,280	11-16-93	4:16p	UNTITLED.DT
BU_SBI81	BAT	38	02-09-93	1:18p	BU_SBI81.BAT
PSVP2P0	GRA	8,251	02-09-93	1:15p	PSVP2P0.GRA
PSVP1P0	GRA	8,251	02-09-93	1:05p	PSVP1P0.GRA
PSVP0P5	GRA	8,251	02-09-93	1:03p	PSVP0P5.GRA
PSVP0P3	GRA	8,251	02-09-93	1:02p	PSVP0P3.GRA
UNTITLED	DRA	6,098	02-06-93	9:05p	UNTITLED.DRA
PSVHOR	DT	1,280	02-06-93	8:21p	PSVHOR.DT
PSVHOR	COL	1,575	02-06-93	7:59p	PSVHOR.COL
PSVVERT	DT	896	02-06-93	7:59p	PSVVERT.DT
PSVVERT	COL	875	02-06-93	7:55p	PSVVERT.COL
PSVHOR	IN	142	02-06-93	7:32p	PSVHOR.IN
PSVVERT	IN	72	02-06-93	7:31p	PSVVERT.IN
S51PSVY	TXT	1,409	02-04-93	10:51p	S51PSVY.TXT
S51PSVX	TXT	1,409	02-04-93	10:51p	S51PSVX.TXT
S51PSVV	TXT	1,409	02-04-93	10:51p	S51PSVV.TXT
S38PSVY	TXT	1,409	02-04-93	10:51p	S38PSVY.TXT
S38PSVX	TXT	1,409	02-04-93	10:50p	S38PSVX.TXT
S38PSVV	TXT	1,409	02-04-93	10:50p	S38PSVV.TXT
VICPSVV	TXT	1,354	02-04-93	10:50p	VICPSVV.TXT
VICPSVE	TXT	1,354	02-04-93	10:48p	VICPSVE.TXT
VICPSVN	TXT	1,354	02-04-93	10:47p	VICPSVN.TXT
HENPSVV	TXT	1,354	02-04-93	10:41p	HENPSVV.TXT
HENPSVE	TXT	1,354	02-04-93	10:41p	HENPSVE.TXT
HENPSVN	TXT	1,354	02-04-93	10:40p	HENPSVN.TXT
USC	BAT	438	02-04-93	10:39p	USC.BAT
VICTOR	BAT	228	02-04-93	10:38p	VICTOR.BAT
HENRY	BAT	225	02-04-93	10:37p	HENRY.BAT
USC	BRP	175	02-04-93	10:34p	USC.BRP
VICTOR	BRP	169	02-04-93	10:34p	VICTOR.BRP
HENRY	BRP	168	02-04-93	10:33p	HENRY.BRP
RATIO	OUT	4,656	02-04-93	2:32p	RATIO.OUT
SBI81RAT	DT	28,544	02-04-93	2:26p	SBI81RAT.DT
SBI81RAT	COL	53,474	02-04-93	2:21p	SBI81RAT.COL
PRINTAPS	BAT	168	12-21-92	1:40p	PRINTAPS.BAT
S38V	MSG	2,616	12-21-92	1:36p	S38V.MSG
S38Y	MSG	2,616	12-21-92	1:36p	S38Y.MSG
S38X	MSG	2,616	12-21-92	1:36p	S38X.MSG
S51V	MSG	2,616	12-21-92	1:36p	S51V.MSG
S51Y	MSG	2,616	12-21-92	1:36p	S51Y.MSG
S51X	MSG	2,362	12-21-92	1:36p	S51X.MSG
HENV	MSG	2,616	12-21-92	1:36p	HENV.MSG
HENE	MSG	2,616	12-21-92	1:36p	HENE.MSG
SBI81	BAT	728	12-21-92	1:36p	SBI81.BAT
RECSECV	BAT	212	12-18-92	5:57p	RECSECV.BAT
ACC2VEL	BAT	1,332	12-18-92	5:53p	ACC2VEL.BAT
APRL1292	MEM	427	12-18-92	12:18p	APRL1292.MEM
RNAME	BAT	360	12-18-92	11:30a	RNAME.BAT
S38ACCY	SMC	14,790	12-07-92	7:59p	S38ACCY.SMC
S38ACCX	SMC	14,810	12-07-92	7:59p	S38ACCX.SMC
S38ACCV	SMC	14,748	12-07-92	7:58p	S38ACCV.SMC
USCR2H2	IN	524	12-07-92	7:55p	USCR2H2.IN
USCR2H1	IN	523	12-07-92	7:54p	USCR2H1.IN
USCR2V	IN	520	12-07-92	7:52p	USCR2V.IN
USCR2	V	16,556	12-07-92	7:47p	USCR2.V
USCR2	H2	16,598	12-07-92	7:46p	USCR2.H2
USCR2	H1	16,616	12-07-92	7:44p	USCR2.H1
S51ACCY	SMC	11,950	12-07-92	6:38p	S51ACCY.SMC
S51ACCX	SMC	11,990	12-07-92	6:38p	S51ACCX.SMC
S51ACCV	SMC	12,002	12-07-92	6:38p	S51ACCV.SMC
USCR7H2	IN	521	12-07-92	6:38p	USCR7H2.IN
USCR7H1	IN	520	12-07-92	6:37p	USCR7H1.IN
USCR7V	IN	517	12-07-92	6:37p	USCR7V.IN
USCR7	H2	13,754	12-07-92	6:00p	USCR7.H2

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USCR7    H1        13,794  12-07-92  5:59p USCR7.H1
USCR7    V         13,804  12-07-92  5:57p USCR7.V
SBI81    BRP          148  12-06-92  3:40p SBI81.BRP
SBIVIC   Z        108,288  12-06-92  3:27p SBIVIC.Z
SBIVIC   X        108,288  12-06-92  3:27p SBIVIC.X
SBIVIC   Y        108,288  12-06-92  3:26p SBIVIC.Y
VICTRV   IN           516  12-06-92  3:24p VICTRV.IN
VICTRE   IN           518  12-06-92  3:23p VICTRE.IN
VICTRN   IN           517  12-06-92  3:23p VICTRN.IN
SBIHEN   Z         29,478  11-30-92  9:20p SBIHEN.Z
SBIHEN   X         29,478  11-30-92  9:20p SBIHEN.X
HENRYV   IN           514  11-30-92  9:12p HENRYV.IN
HENRYE   IN           516  11-30-92  9:11p HENRYE.IN
SBIHEN   Y         29,478  11-30-92  9:08p SBIHEN.Y
HENRYN   IN           515  11-30-92  8:54p HENRYN.IN
SAMPLE   IN           502  10-21-92  1:01p SAMPLE.IN
CONVERT  FOR        2,410  01-06-87  2:51p CONVERT.FOR
R7                104,634  04-18-86  7:36a R7
R6                 61,530  04-18-86  7:36a R6
R5                 90,906  04-18-86  7:35a R5
R4                 61,446  04-18-86  7:35a R4
R3                 58,128  04-18-86  7:34a R3
R2                129,864  04-18-86  7:34a R2
R1                 60,614  04-18-86  7:32a R1
       281 file(s)      9,923,375 bytes
         2 dir(s)   1,738,473,472 bytes free
```

```
 Volume in drive D has no label
 Volume Serial Number is D845-2F2F
 Directory of D:\sems\simi97a

SIMI97A  LST             0  11-11-97  9:24a simi97a.lst
.            <DIR>          10-16-97  4:21p .
..           <DIR>          10-16-97  4:21p ..
DIR      LST         5,231  08-21-97  9:43p DIR.LST
S97A_3DI GRA        23,001  07-17-97  9:44p S97A_3DI.GRA
S97A_3VI GRA        23,001  07-17-97  9:43p S97A_3VI.GRA
S97A_3AI GRA        23,001  07-17-97  9:43p S97A_3AI.GRA
S97A_3DG GRA        23,001  07-17-97  9:42p S97A_3DG.GRA
S97A_3VG GRA        23,001  07-17-97  9:42p S97A_3VG.GRA
S97A_3AG GRA        23,001  07-17-97  9:41p S97A_3AG.GRA
S7AI_3V  DT        118,144  07-17-97  9:40p S7AI_3V.DT
S7AI_3D  DT        118,144  07-17-97  9:40p S7AI_3D.DT
S7AI_3A  DT         96,128  07-17-97  9:40p S7AI_3A.DT
S7AG_3V  DT        329,216  07-17-97  9:40p S7AG_3V.DT
S7AG_3D  DT        329,216  07-17-97  9:40p S7AG_3D.DT
S7AG_3A  DT        241,408  07-17-97  9:39p S7AG_3A.DT
S7AG_3D  ASC       557,702  07-17-97  9:37p S7AG_3D.ASC
S7AG_3V  ASC       557,702  07-17-97  9:37p S7AG_3V.ASC
S7AG_3A  ASC       408,902  07-17-97  9:37p S7AG_3A.ASC
S7AI_3D  ASC       199,838  07-17-97  9:37p S7AI_3D.ASC
S7AI_3V  ASC       199,838  07-17-97  9:36p S7AI_3V.ASC
S7AI_3A  ASC       162,638  07-17-97  9:35p S7AI_3A.ASC
S97A_3TG GRA        23,002  07-17-97  9:34p S97A_3TG.GRA
S97A_3TG DT        241,408  07-17-97  9:33p S97A_3TG.DT
S97A_3TI GRA        23,002  07-17-97  9:33p S97A_3TI.GRA
S97A_3TI DT         96,128  07-17-97  9:32p S97A_3TI.DT
S7AGZAVD MSG         5,503  07-17-97  9:26p S7AGZAVD.MSG
S7AGZVEL SMC        93,729  07-17-97  9:26p S7AGZVEL.SMC
S7AGZDIS SMC        93,729  07-17-97  9:26p S7AGZDIS.SMC
S7AGYAVD MSG         5,503  07-17-97  9:26p S7AGYAVD.MSG
S7AGYVEL SMC        93,729  07-17-97  9:26p S7AGYVEL.SMC
S7AGYDIS SMC        93,729  07-17-97  9:26p S7AGYDIS.SMC
S7AGZACC SMC        69,129  07-17-97  9:26p S7AGZACC.SMC
S7AGXAVD MSG         5,415  07-17-97  9:26p S7AGXAVD.MSG
S7AGXDIS SMC        93,729  07-17-97  9:26p S7AGXDIS.SMC
S7AGYACC SMC        69,129  07-17-97  9:26p S7AGYACC.SMC
S7AGXACC SMC        69,129  07-17-97  9:26p S7AGXACC.SMC
S7AGXVEL SMC        93,729  07-17-97  9:26p S7AGXVEL.SMC
S7AIYAVD MSG         5,415  07-17-97  9:26p S7AIYAVD.MSG
S7AIYDIS SMC        34,567  07-17-97  9:26p S7AIYDIS.SMC
S7AIZAVD MSG         5,414  07-17-97  9:26p S7AIZAVD.MSG
S7AIZACC SMC        28,417  07-17-97  9:26p S7AIZACC.SMC
S7AIZVEL SMC        34,567  07-17-97  9:26p S7AIZVEL.SMC
S7AIZDIS SMC        34,567  07-17-97  9:26p S7AIZDIS.SMC
S7AIXAVD MSG         5,414  07-17-97  9:26p S7AIXAVD.MSG
S7AIXVEL SMC        34,567  07-17-97  9:26p S7AIXVEL.SMC
S7AIXDIS SMC        34,567  07-17-97  9:26p S7AIXDIS.SMC
S7AIYACC SMC        28,417  07-17-97  9:26p S7AIYACC.SMC
S7AIYVEL SMC        34,567  07-17-97  9:26p S7AIYVEL.SMC
S7AIXACC SMC        28,417  07-17-97  9:26p S7AIXACC.SMC
S97A_3TG ASC       408,902  07-17-97  9:25p S97A_3TG.ASC
S97A_3TI ASC       162,638  07-17-97  9:25p S97A_3TI.ASC
AVD      BAT         1,602  07-17-97  9:24p AVD.BAT
S97A_3DG IN             94  07-17-97  9:19p S97A_3DG.IN
S97A_3DI IN             94  07-17-97  9:19p S97A_3DI.IN
S97A_3VG IN             94  07-17-97  9:19p S97A_3VG.IN
S97A_3VI IN             94  07-17-97  9:18p S97A_3VI.IN
S97A_3TG IN             95  07-17-97  9:16p S97A_3TG.IN
S97A_3TI IN             95  07-17-97  9:15p S97A_3TI.IN
S97A_3AG IN             94  07-17-97  9:14p S97A_3AG.IN
S97A_3AI IN             94  07-17-97  9:12p S97A_3AI.IN
RSIRZ_10 MSG         5,433  05-16-97  8:07p RSIRZ_10.MSG
RSIRZ_10 RS1         7,492  05-16-97  8:07p RSIRZ_10.RS1
RSIRY_10 MSG         5,434  05-16-97  8:07p RSIRY_10.MSG
RSIRY_10 RS1         7,492  05-16-97  8:07p RSIRY_10.RS1
RSIRX_10 MSG         5,433  05-16-97  8:07p RSIRX_10.MSG
RSIRX_10 RS1         7,492  05-16-97  8:07p RSIRX_10.RS1
RSGRZ_10 MSG         5,522  05-16-97  8:07p RSGRZ_10.MSG
RSGRZ_10 RS1         7,492  05-16-97  8:07p RSGRZ_10.RS1
RSGRY_10 MSG         5,522  05-16-97  8:07p RSGRY_10.MSG
RSGRY_10 RS1         7,492  05-16-97  8:07p RSGRY_10.RS1
RSGRX_10 MSG         5,434  05-16-97  8:07p RSGRX_10.MSG
RSGRX_10 RS1         7,492  05-16-97  8:07p RSGRX_10.RS1
RS       BAT         1,398  05-16-97  8:07p RS.BAT
SV97AIRZ MSG         6,341  05-16-97  7:57p SV97AIRZ.MSG
SV97AIRY MSG         6,342  05-16-97  7:57p SV97AIRY.MSG
SV97AIRX MSG         6,341  05-16-97  7:57p SV97AIRX.MSG
SV97AGRZ MSG         6,430  05-16-97  7:57p SV97AGRZ.MSG
SV97AGRY MSG         6,430  05-16-97  7:57p SV97AGRY.MSG
SV97AGRX MSG         6,342  05-16-97  7:57p SV97AGRX.MSG
AVD_FAS  BAT         1,026  05-16-97  7:57p AVD_FAS.BAT
116K37IR ENZ        28,320  05-16-97  7:54p 116K37IR.ENZ
116K37IR ENY        28,320  05-16-97  7:53p 116K37IR.ENY
116K37IR ENX        28,320  05-16-97  7:53p 116K37IR.ENX
SV97AIRZ IN            561  05-16-97  7:52p SV97AIRZ.IN
SV97AIRY IN            563  05-16-97  7:52p SV97AIRY.IN
SV97AIRX IN            562  05-16-97  7:51p SV97AIRX.IN
116K37GR ACZ        69,032  05-16-97  5:09p 116K37GR.ACZ
116K37GR ACY        69,032  05-16-97  5:08p 116K37GR.ACY
116K37GR ACX        69,032  05-16-97  5:08p 116K37GR.ACX
SV97AGRX IN            566  05-16-97  5:07p SV97AGRX.IN
SV97AGRY IN            566  05-16-97  5:07p SV97AGRY.IN
SV97AGRZ IN            563  05-16-97  5:07p SV97AGRZ.IN
SIMI97A  GRA        23,002  05-16-97  5:00p SIMI97A.GRA
SV97AIRZ DT         48,256  05-16-97  4:56p SV97AIRZ.DT
SV97AIRN DT         48,256  05-16-97  4:56p SV97AIRN.DT
SV97AIRE DT         48,256  05-16-97  4:56p SV97AIRE.DT
SV97AGRZ DT        120,960  05-16-97  4:56p SV97AGRZ.DT
SV97AGRN DT        120,960  05-16-97  4:56p SV97AGRN.DT
SV97AGRE DT        120,960  05-16-97  4:55p SV97AGRE.DT
SV97AGRE ASC       217,552  05-16-97  4:52p SV97AGRE.ASC
SV97AGRZ ASC       217,552  05-16-97  4:51p SV97AGRZ.ASC
SV97AGRN ASC       217,552  05-16-97  4:51p SV97AGRN.ASC
SV97AIRE ASC        86,476  05-16-97  4:45p SV97AIRE.ASC
SV97AIRN ASC        86,476  05-16-97  4:45p SV97AIRN.ASC
SV97AIRZ ASC        86,476  05-16-97  4:44p SV97AIRZ.ASC
04261043 BHZ        13,495  05-13-97  5:22p 04261043.BHZ
04261043 BHN        13,435  05-13-97  5:22p 04261043.BHN
04261043 BHE        13,440  05-13-97  5:22p 04261043.BHE
04261047 HHN        29,670  05-13-97  5:19p 04261047.HHN
04261047 HHZ        40,608  05-13-97  5:19p 04261047.HHZ
04261047 HHE        33,211  05-13-97  5:19p 04261047.HHE
SIMI26   EML         3,044  05-12-97  5:57p SIMI26.EML
       111 file(s)      7,518,081 bytes
         2 dir(s)   1,738,342,400 bytes free
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 Volume in drive D has no label
 Volume Serial Number is D845-2F2F
 Directory of D:\sems\simi97b

SIMI97B  LST             0  11-11-97   9:25a simi97b.lst
.              <DIR>        10-16-97   4:21p .
..             <DIR>        10-16-97   4:21p ..
DIR      LST         2,936  08-21-97   9:44p DIR.LST
S97B_3D  GRA        23,000  07-18-97   8:51a S97B_3D.GRA
S97B_3V  GRA        23,000  07-18-97   8:51a S97B_3V.GRA
S97B_3A  GRA        23,000  07-18-97   8:50a S97B_3A.GRA
S97B_3TS GRA        23,002  07-18-97   8:50a S97B_3TS.GRA
S97B_3V  DT         82,944  07-18-97   8:49a S97B_3V.DT
S97B_3TS DT         61,056  07-18-97   8:49a S97B_3TS.DT
S97B_3D  DT         82,944  07-18-97   8:49a S97B_3D.DT
S97B_3A  DT         61,056  07-18-97   8:49a S97B_3A.DT
S97B_3D  ASC       140,318  07-18-97   8:47a S97B_3D.ASC
S97B_3V  ASC       140,318  07-18-97   8:47a S97B_3V.ASC
S97B_3A  ASC       103,118  07-18-97   8:47a S97B_3A.ASC
S97B_3TS ASC       103,118  07-18-97   8:47a S97B_3TS.ASC
S97B_3D  IN             94  07-18-97   8:46a S97B_3D.IN
S97B_3V  IN             94  07-18-97   8:46a S97B_3V.IN
S97B_3A  IN             94  07-18-97   8:45a S97B_3A.IN
S97B_3TS IN             95  07-18-97   8:43a S97B_3TS.IN
S97BZAVD MSG         5,503  07-18-97   8:41a S97BZAVD.MSG
S97BZACC SMC        18,577  07-18-97   8:41a S97BZACC.SMC
S97BZVEL SMC        24,727  07-18-97   8:41a S97BZVEL.SMC
S97BZDIS SMC        24,727  07-18-97   8:41a S97BZDIS.SMC
S97BYAVD MSG         5,415  07-18-97   8:41a S97BYAVD.MSG
S97BYACC SMC        18,577  07-18-97   8:41a S97BYACC.SMC
S97BYVEL SMC        24,727  07-18-97   8:41a S97BYVEL.SMC
S97BYDIS SMC        24,727  07-18-97   8:41a S97BYDIS.SMC
S97BXAVD MSG         5,503  07-18-97   8:41a S97BXAVD.MSG
S97BXACC SMC        18,577  07-18-97   8:41a S97BXACC.SMC
S97BXVEL SMC        24,727  07-18-97   8:41a S97BXVEL.SMC
S97BXDIS SMC        24,727  07-18-97   8:41a S97BXDIS.SMC
AVD      BAT           804  07-18-97   7:10a AVD.BAT
RSZ_10   MSG         5,522  05-15-97   7:52p RSZ_10.MSG
RSZ_10   RS1         7,492  05-15-97   7:52p RSZ_10.RS1
RSY_10   MSG         5,434  05-15-97   7:52p RSY_10.MSG
RSY_10   RS1         7,492  05-15-97   7:52p RSY_10.RS1
RSX_10   MSG         5,522  05-15-97   7:52p RSX_10.MSG
RSX_10   RS1         7,492  05-15-97   7:52p RSX_10.RS1
117L09GR ACZ        18,480  05-15-97   7:51p 117L09GR.ACZ
SIMI_B_Z IN            563  05-15-97   7:50p SIMI_B_Z.IN
RS       BAT           663  05-15-97   7:37p RS.BAT
SIMI97BZ MSG         6,432  05-14-97   3:30p SIMI97BZ.MSG
SIMI97BY MSG         6,344  05-14-97   3:30p SIMI97BY.MSG
SIMI97BX MSG         6,432  05-14-97   3:30p SIMI97BX.MSG
AVD_FAS  BAT           516  05-14-97   3:19p AVD_FAS.BAT
117L09GR ACY        18,480  05-14-97   2:09p 117L09GR.ACY
117L09GR ACX        18,480  05-14-97   2:09p 117L09GR.ACX
SIMI_B_X IN            566  05-14-97   2:07p SIMI_B_X.IN
SIMI_B_Y IN            566  05-14-97   2:07p SIMI_B_Y.IN
SIMI97B  GRA        23,002  05-14-97   2:00p SIMI97B.GRA
SIMI97BZ DT         30,720  05-14-97   1:54p SIMI97BZ.DT
SIMI97BN DT         30,720  05-14-97   1:54p SIMI97BN.DT
SIMI97BE DT         30,720  05-14-97   1:54p SIMI97BE.DT
SIMI97BZ ASC        54,796  05-14-97   1:53p SIMI97BZ.ASC
SIMI97BE ASC        54,796  05-14-97   1:53p SIMI97BE.ASC
SIMI97BN ASC        54,796  05-14-97   1:53p SIMI97BN.ASC
SIMI27   EML         3,055  05-12-97   5:59p SIMI27.EML
04271119 BHN         7,113  05-06-97   9:05a 04271119.BHN
04271119 BHZ        10,258  05-06-97   9:05a 04271119.BHZ
04271119 BHE         8,524  05-06-97   9:05a 04271119.BHE
AVD_RS   BAT           635  05-07-96   1:12p AVD_RS.BAT
        60 file(s)      1,517,116 bytes
         2 dir(s)   1,738,309,632 bytes free
```

```
 Volume in drive D has no label
 Volume Serial Number is D845-2F2F
 Directory of D:\sems\siteab

SITEAB   LST          0  11-11-97   9:17a siteab.lst
M75D90A  GRA     23,136  10-20-97   2:29p M75D90A.GRA
M75D90B  GRA     23,136  10-20-97   2:26p M75D90B.GRA
M75D45B  GRA     23,136  10-20-97   2:21p M75D45B.GRA
M75D45A  GRA     23,136  10-20-97   2:21p M75D45A.GRA
PROCEDAZ GRA     23,188  10-20-97   2:20p PROCEDAZ.GRA
PROCEDAT GRA     23,191  10-20-97   2:17p PROCEDAT.GRA
PROCEDAR GRA     23,184  10-20-97   2:16p PROCEDAR.GRA
SMITH194 LTR      4,992  10-19-97   9:09p SMITH194.LTR
PROCEDUR DT     375,040  10-18-97   3:47p PROCEDUR.DT
PROCEDUR GRA     23,004  10-18-97   3:40p PROCEDUR.GRA
SITEB    GRA     22,998  10-18-97   3:34p SITEB.GRA
SITEB    DT      75,392  10-18-97   3:32p SITEB.DT
SITEB    ASC    127,360  10-18-97   3:32p SITEB.ASC
SITEB    IN          68  10-18-97   3:32p siteb.in
M75R1    GRA     22,998  10-18-97  11:59a M75R1.GRA
SITEA    GRA     22,998  10-18-97  11:58a SITEA.GRA
SITEA    DT      75,392  10-18-97  11:50a SITEA.DT
M75D90B  DT     102,912  10-18-97  11:50a M75D90B.DT
M75D90A  DT     102,912  10-18-97  11:49a M75D90A.DT
M75D45B  DT     102,912  10-18-97  11:49a M75D45B.DT
M75D45A  DT     102,912  10-18-97  11:49a M75D45A.DT
M75D45B  ASC    174,046  10-18-97  11:44a M75D45B.ASC
M75D45A  ASC    174,046  10-18-97  11:44a M75D45A.ASC
M75D90A  ASC    174,046  10-18-97  11:44a M75D90A.ASC
M75D90B  ASC    174,046  10-18-97  11:44a M75D90B.ASC
M75D90B  IN          76  10-18-97  11:44a m75d90b.in
M75D90A  IN          76  10-18-97  11:43a m75d90a.in
M75D45B  IN          76  10-18-97  11:42a m75d45b.in
M75D45A  IN          76  10-18-97  11:41a M75D45A.IN
SITEA    ASC    127,360  10-18-97  11:38a SITEA.ASC
SITEA    IN          68  10-18-97  11:37a SITEA.IN
M75R1    DT      50,432  10-18-97  11:35a M75R1.DT
M75R1    ASC     90,282  10-18-97  11:34a M75R1.ASC
STOKE    IN          29  10-18-97  11:34a STOKE.IN
SMC      LST      2,627  10-18-97  11:04a smc.lst
VAX          <DIR>       10-18-97   8:37a VAX
.            <DIR>       10-16-97   4:22p .
..           <DIR>       10-16-97   4:22p ..
DIR      LST      3,790  08-23-97   9:30a DIR.LST
BU       BAT         17  08-27-96   5:07p BU.BAT
CHKLIST  MS          81  04-27-95   9:43a CHKLIST.MS
GSADD             1,412  03-01-94   2:25p GSADD
BPRUN    MSG      1,933  01-31-94  12:25p BPRUN.MSG
BPPLOTS  APS     40,322  01-31-94  12:25p BPPLOTS.APS
GETFAS   BAT        746  01-31-94  12:21p GETFAS.BAT
MAKETS   OUT      1,242  01-29-94  10:11p MAKETS.OUT
M75D90BZ SMC     30,168  01-29-94  10:11p M75D90BZ.SMC
M75D90BT SMC     30,168  01-29-94  10:11p M75D90BT.SMC
M75D90BR SMC     30,168  01-29-94  10:11p M75D90BR.SMC
M75D90AZ SMC     30,168  01-29-94  10:11p M75D90AZ.SMC
M75D90AT SMC     30,168  01-29-94  10:10p M75D90AT.SMC
M75D90AR SMC     30,168  01-29-94  10:10p M75D90AR.SMC
M75R1BZ  SMC     30,168  01-28-94   9:04p M75R1BZ.SMC
D45BZ    SMC     30,168  01-28-94   9:04p D45BZ.SMC
M75D45BZ SMC     30,168  01-28-94   9:04p M75D45BZ.SMC
M75R1BN  SMC     30,168  01-28-94   9:04p M75R1BN.SMC
D45BN    SMC     30,168  01-28-94   9:04p D45BN.SMC
M75D45BN SMC     30,168  01-28-94   9:04p M75D45BN.SMC
M75R1BE  SMC     30,168  01-28-94   9:04p M75R1BE.SMC
D45BE    SMC     30,168  01-28-94   9:04p D45BE.SMC
M75D45BE SMC     30,168  01-28-94   9:04p M75D45BE.SMC
M75R1AZ  SMC     30,168  01-28-94   9:04p M75R1AZ.SMC
M75D45AZ SMC     30,168  01-28-94   9:04p M75D45AZ.SMC
D45AZ    SMC     30,168  01-28-94   9:04p D45AZ.SMC
M75R1AN  SMC     30,168  01-28-94   9:03p M75R1AN.SMC
D45AN    SMC     30,168  01-28-94   9:03p D45AN.SMC
M75D45AN SMC     30,168  01-28-94   9:03p M75D45AN.SMC
M75R1AE  SMC     30,168  01-28-94   9:03p M75R1AE.SMC
D45AE    SMC     30,168  01-28-94   9:03p D45AE.SMC
M75D45AE SMC     30,168  01-28-94   9:03p M75D45AE.SMC
D45      FIL         76  01-28-94   9:01p D45.FIL
D45SBZ   SMC     22,576  01-28-94   2:54p D45SBZ.SMC
D45SBN   SMC     22,576  01-28-94   2:54p D45SBN.SMC
D45SBE   SMC     22,576  01-28-94   2:54p D45SBE.SMC
D45SAZ   SMC     22,576  01-28-94   2:54p D45SAZ.SMC
D45SAN   SMC     22,576  01-28-94   2:54p D45SAN.SMC
D45SAE   SMC     22,576  01-28-94   2:54p D45SAE.SMC
D45SA    3CP     99,761  01-28-94   2:29p D45SA.3CP
D45SB    3CP     99,761  01-28-94   2:28p D45SB.3CP
D45SB    PS      45,014  01-28-94   2:27p D45SB.PS
D45SA    PS      44,909  01-28-94   2:23p D45SA.PS
M75R1BT  SMC     30,168  01-28-94  12:03p M75R1BT.SMC
M75R1BR  SMC     30,168  01-28-94  12:03p M75R1BR.SMC
M75R1AT  SMC     30,168  01-28-94  12:03p M75R1AT.SMC
M75R1AR  SMC     30,168  01-28-94  12:03p M75R1AR.SMC
MECH91   FIL         76  01-28-94  10:46a MECH91.FIL
MAKETS   EXE    564,554  01-27-94   4:00p MAKETS.EXE
MAKETS   FOR     16,945  01-27-94   4:00p MAKETS.FOR
M75R1    SMC     43,440  01-26-94   8:29p M75R1.SMC
M75R1    TSR    226,813  01-26-94   8:28p M75R1.TSR
TDSM2SMC EXE    125,106  01-26-94   8:22p TDSM2SMC.EXE
TDSM2SMC FOR      3,835  01-26-94   8:21p TDSM2SMC.FOR
TEMP     SPC     98,328  01-26-94   5:40p TEMP.SPC
CSPECT   TMP    122,880  01-26-94   5:40p CSPECT.TMP
M75R1SE  SMC     43,440  01-26-94   5:06p M75R1SE.SMC
TEST     FIL         17  01-26-94   5:05p TEST.FIL
IMPULSE  SMC     43,440  01-26-94   5:04p IMPULSE.SMC
IMPULSE  EXE     71,642  01-26-94   5:04p IMPULSE.EXE
IMPULSE  FOR      2,737  01-26-94   5:03p IMPULSE.FOR
WRITESMC FOR      2,105  01-26-94   4:50p WRITESMC.FOR
TEMP     TSR     90,112  01-26-94  11:01a TEMP.TSR
SITEBZ   SMC     22,576  01-25-94   5:09p SITEBZ.SMC
SITEBT   SMC     22,576  01-25-94   5:09p SITEBT.SMC
SITEBR   SMC     22,576  01-25-94   5:09p SITEBR.SMC
SITEAZ   SMC     22,576  01-25-94   5:09p SITEAZ.SMC
SITEAT   SMC     22,576  01-25-94   5:09p SITEAT.SMC
SITEAR   SMC     22,576  01-25-94   5:09p SITEAR.SMC
SITEB    3CP     99,761  01-25-94   9:41a SITEB.3CP
SITEA    3CP     99,761  01-23-94   4:15p SITEA.3CP
MCH91XBB FOR      2,948  01-14-94   3:47p MCH91XBB.FOR
SITEB    DAT      1,257  01-14-94  12:35p SITEB.DAT
SITEA    DAT      1,140  01-14-94  11:18a SITEA.DAT
FRMSTFAB DAT        667  01-14-94  10:56a FRMSTFAB.DAT
NOMUD    DAT        693  01-14-94  10:49a NOMUD.DAT
GSCLOSE             256  03-27-85   4:53p GSCLOSE
        113 file(s)      5,407,916 bytes
          3 dir(s)   1,738,440,704 bytes free
```

SITEAB.LST 11-11-97 9:17a

```
 Volume in drive D has no label
 Volume Serial Number is D845-2F2F
 Directory of D:\sems\theory

THEORY   LST          0  11-11-97  9:18a theory.lst
.             <DIR>      10-16-97  4:22p .
..            <DIR>      10-16-97  4:22p ..
DIR      LST      1,583  07-29-97  2:20p DIR.LST
BU       BAT         17  08-27-96  5:07p BU.BAT
SSZSMOO  DRA      8,036  09-01-95  4:14p SSZSMOO.DRA
WTR_S_RV GRG        103  08-16-95  6:55p WTR_S_RV.GRG
SSZSMOO  GRA     23,246  08-16-95  6:55p SSZSMOO.GRA
OSZSMOO  DRA      7,792  08-16-95  6:47p OSZSMOO.DRA
OSZSMOO  GRA     23,173  08-16-95  6:47p OSZSMOO.GRA
OSESMOO  DRA      8,875  08-16-95  6:25p OSESMOO.DRA
SSTSMOO  DRA      7,792  08-16-95  6:25p SSTSMOO.DRA
PZRAT    GRA     23,456  08-16-95  6:25p PZRAT.GRA
WTR_S_R  GRG        189  08-16-95  6:22p WTR_S_R.GRG
OSESMOO  GRA     23,412  08-16-95  6:22p OSESMOO.GRA
OSNSMOO  DRA      7,785  08-16-95  5:58p OSNSMOO.DRA
OSNSMOO  GRA     23,166  08-16-95  5:58p OSNSMOO.GRA
SSRSMOO  DRA      7,770  08-16-95  5:52p SSRSMOO.DRA
SSRSMOO  GRA     23,173  08-16-95  5:52p SSRSMOO.GRA
SSTSMOO  GRA     23,173  08-16-95  5:51p SSTSMOO.GRA
MCH91_BB FOR      2,948  01-24-94  8:45p MCH91_BB.FOR
RATDIFF3 DT       6,016  02-15-93  2:21p RATDIFF3.DT
RATRAT   GRA      8,183  02-15-93 12:40p RATRAT.GRA
ZDHALL   GRA      8,140  02-15-93 12:36p ZDHALL.GRA
ZDH3     DT       7,680  02-15-93 12:35p ZDH3.DT
RAT3P    DT       2,560  02-15-93 12:24p RAT3P.DT
ZDH3     COL     10,380  02-15-93 12:23p ZDH3.COL
FAS3S    COL     14,560  02-15-93 12:23p FAS3S.COL
FAS3P    COL      5,568  02-15-93 12:23p FAS3P.COL
RATDIFF3 COL     10,380  02-15-93 12:22p RATDIFF3.COL
RAT3P    COL      3,956  02-15-93 12:22p RAT3P.COL
ZDHALL3  GRA      8,141  02-14-93  5:05p ZDHALL3.GRA
        30 file(s)        301,253 bytes
         2 dir(s)   1,738,407,936 bytes free
```

```
 Volume in drive D has no label
 Volume Serial Number is D845-2F2F
 Directory of D:\sems\upland90

UPLAND90 LST             0  11-11-97   9:19a upland90.lst
3TS_1    GRA        23,119  10-31-97   1:58p 3TS_1.GRA
3TS_1    DRA       383,432  10-31-97   1:41p 3TS_1.DRA
3TS4RPRT GRA        23,110  10-28-97   9:42p 3TS4RPRT.GRA
DIR      LST         6,945  10-20-97  11:28a DIR.LST
.            <DIR>          10-16-97   4:22p .
..           <DIR>          10-16-97   4:22p ..
M2D0909A EML         4,268  09-09-97   4:24p M2D0909A.EML
AVDZ4RPT GRA        23,100  09-09-97   4:22p AVDZ4RPT.GRA
AVDY4RPT GRA        23,103  09-09-97   4:21p AVDY4RPT.GRA
AVDX4RPT GRA        23,104  09-09-97   4:18p AVDX4RPT.GRA
CM71_ACC DT        446,080  09-09-97   3:17p CM71_ACC.DT
CM71_ACC ASC       755,978  09-09-97   3:16p CM71_ACC.ASC
CM71_ACC IN             83  09-09-97   3:15p CM71_ACC.IN
S3CMPV_A IN            100  09-09-97   3:12p S3CMPV_A.IN
S3EEAVDZ DT        445,440  09-09-97   3:00p S3EEAVDZ.DT
S3EEAVDY DT        445,440  09-09-97   2:57p S3EEAVDY.DT
S3EEAVDX DT        445,440  09-09-97   2:53p S3EEAVDX.DT
S3EEAVDZ ASC       754,800  09-09-97   2:06p S3EEAVDZ.ASC
S3EEAVDY ASC       754,800  09-09-97   2:06p S3EEAVDY.ASC
S3EEAVDX ASC       754,800  09-09-97   2:06p S3EEAVDX.ASC
S3EEAVDZ IN             98  09-09-97   2:05p S3EEAVDZ.IN
S3EEAVDY IN             98  09-09-97   2:04p S3EEAVDY.IN
S3EEAVDX IN             98  09-09-97   2:04p S3EEAVDX.IN
S3LB_3V  DT        445,440  09-09-97  11:47a S3LB_3V.DT
S3LB_3D  DT        445,440  09-09-97  11:47a S3LB_3D.DT
S3LB_3A  DT        335,744  09-09-97  11:46a S3LB_3A.DT
S3LB_3D  ASC       754,800  09-09-97  11:46a S3LB_3D.ASC
S3LB_3V  ASC       754,800  09-09-97  11:45a S3LB_3V.ASC
S3LB_3A  ASC       568,800  09-09-97  11:45a S3LB_3A.ASC
S3LBAVDZ MSG         5,503  09-09-97  11:44a S3LBAVDZ.MSG
S3LB__VZ SMC       127,134  09-09-97  11:44a S3LB__VZ.SMC
S3LB__DZ SMC       127,134  09-09-97  11:44a S3LB__DZ.SMC
S3LB__AZ SMC        96,384  09-09-97  11:44a S3LB__AZ.SMC
S3LBAVDY MSG         5,503  09-09-97  11:44a S3LBAVDY.MSG
S3LB__AY SMC        96,548  09-09-97  11:44a S3LB__AY.SMC
S3LB__VY SMC       127,298  09-09-97  11:44a S3LB__VY.SMC
S3LB__DY SMC       127,298  09-09-97  11:44a S3LB__DY.SMC
S3LB__VX SMC       127,298  09-09-97  11:44a S3LB__VX.SMC
S3LB__DX SMC       127,298  09-09-97  11:44a S3LB__DX.SMC
S3LBAVDX MSG         5,414  09-09-97  11:44a S3LBAVDX.MSG
S3LB__AX SMC        96,548  09-09-97  11:44a S3LB__AX.SMC
059X43S3 LBZ        96,010  09-09-97  11:24a 059X43S3.LBZ
059X43S3 LBY        96,111  09-09-97  11:23a 059X43S3.LBY
059X43S3 LBX        96,111  09-09-97  11:21a 059X43S3.LBX
D2M0905A EML         1,368  09-05-97   1:29p D2M0905A.EML
M2D0904A EML         2,718  09-04-97   1:12p M2D0904A.EML
3TS      GRA        22,998  08-20-97   9:39a 3TS.GRA
S3LB_3D  IN             97  08-20-97   9:11a S3LB_3D.IN
S3LB_3V  IN             97  08-20-97   9:11a S3LB_3V.IN
S3LB_3A  IN             97  08-20-97   9:11a S3LB_3A.IN
AVD_SMC  BAT           813  08-20-97   9:08a AVD_SMC.BAT
059X43S3 ZBK        96,450  08-14-97  11:32a 059X43S3.ZBK
059X43S3 YBK        96,551  08-14-97  11:32a 059X43S3.YBK
059X43S3 XBK        96,551  08-14-97  11:31a 059X43S3.XBK
HDR      TXT         2,087  09-13-96   2:33p HDR.TXT
COMMENT  TXT           491  09-13-96   2:26p COMMENT.TXT
71_DEL   BAT           324  06-15-96  12:13p 71_DEL.BAT
BBF      FIL         1,587  06-12-96   5:12p BBF.FIL
BBF_DEL  BAT           324  06-12-96   5:11p BBF_DEL.BAT
SMC_     FIL           462  06-12-96   5:04p SMC_FIL
APS      FIL         1,272  06-12-96   5:04p APS.FIL
PLT_TS   BAT           876  06-12-96   4:53p PLT_TS.BAT
PVAVDC   MSG         4,723  06-12-96   4:43p PVAVDC.MSG
PVAVDB   MSG         4,723  06-12-96   4:42p PVAVDB.MSG
PVAVDA   MSG         4,723  06-12-96   4:42p PVAVDA.MSG
CMAVDC   MSG         4,723  06-12-96   4:42p CMAVDC.MSG
CMAVDB   MSG         4,723  06-12-96   4:42p CMAVDB.MSG
CMAVDA   MSG         4,723  06-12-96   4:42p CMAVDA.MSG
CMC      SMC       126,509  06-12-96   2:20p CMC.SMC
CMB      SMC       126,662  06-12-96   2:20p CMB.SMC
CMA      SMC       126,426  06-12-96   2:19p CMA.SMC
PVC      SMC       145,687  06-12-96   2:14p PVC.SMC
PVB      SMC       145,654  06-12-96   2:14p PVB.SMC
PVA      SMC       145,634  06-12-96   2:14p PVA.SMC
SF_BBF   BAT         1,928  06-12-96   1:45p SF_BBF.BAT
BU_      BAT            33  06-11-96   5:43p BU_BAT
TEMP     FIL         4,917  06-11-96   5:35p TEMP.FIL
UPLAVDZ  MSG         4,726  06-11-96   5:24p UPLAVDZ.MSG
UPLAVDY  MSG         4,637  06-11-96   5:24p UPLAVDY.MSG
UPLAVDX  MSG         4,726  06-11-96   5:24p UPLAVDX.MSG
AVD_BBF  BAT         3,171  06-11-96   5:23p AVD_BBF.BAT
UP_71AVD BAT         1,333  05-31-96   6:00p UP_71AVD.BAT
UPLPVXYZ GRA        23,223  08-17-95   6:52p UPLPVXYZ.GRA
BPRUN    MSG         3,858  08-17-95   6:26p BPRUN.MSG
ACC_LC   BAT            72  08-17-95   6:26p ACC_LC.BAT
UPLPVXYZ DT          5,376  08-17-95   6:19p UPLPVXYZ.DT
UPLPSVZ  DT          4,864  08-17-95   6:16p UPLPSVZ.DT
UPLPSVY  DT          4,864  08-17-95   6:16p UPLPSVY.DT
UPLPSVX  DT          4,864  08-17-95   6:15p UPLPSVX.DT
UPLPSVZ  RS1         7,497  08-17-95   6:15p UPLPSVZ.RS1
UPLPSVY  RS1         7,497  08-17-95   6:15p UPLPSVY.RS1
UPLPSVX  RS1         7,497  08-17-95   6:15p UPLPSVX.RS1
UPLPSVZ  MSG         5,495  08-17-95   6:14p UPLPSVZ.MSG
UPLPSVY  MSG         5,495  08-17-95   6:14p UPLPSVY.MSG
UPLPSVX  MSG         5,495  08-17-95   6:13p UPLPSVX.MSG
ACC2RS1  BAT           531  08-17-95   6:06p ACC2RS1.BAT
UPDISZ   MSG         4,715  11-15-93  12:31p UPDISZ.MSG
UPDISY   MSG         4,626  11-15-93  12:31p UPDISY.MSG
UPDISX   MSG         4,715  11-15-93  12:31p UPDISX.MSG
UPLAND90 BRP           150  12-05-92  11:19p UPLAND90.BRP
UPLAND90 BAT            32  12-05-92  11:17p UPLAND90.BAT
UPLANDY  IN            506  12-02-92  10:46a UPLANDY.IN
UPLANDX  IN            505  12-02-92  10:45a UPLANDX.IN
UPLANDZ  IN            504  12-02-92  10:45a UPLANDZ.IN
UPLND90  DT          7,976  06-22-92   2:49p UPLND90.DT
UPLND90  NXO           317  06-22-92   2:49p UPLND90.NXO
FILES    TMP            12  06-22-92   2:49p FILES.TMP
UPLND90  003        32,768  06-22-92   2:47p UPLND90.003
UPLND90  001        32,768  06-22-92   2:47p UPLND90.001
UPLND90  002        32,768  06-22-92   2:47p UPLND90.002
UPLND228 90Y       110,593  06-22-92   1:07p UPLND228.90Y
UPLND228 90X       110,593  06-22-92   1:07p UPLND228.90X
UPLND228 90Z       110,593  06-22-92   1:06p UPLND228.90Z
FEB2803  Y          36,865  03-05-90   9:36a FEB2803.Y
FEB2803  Z          36,864  03-05-90   7:59a FEB2803.Z
FEB2803  X          36,864  03-05-90   7:59a FEB2803.X
FEB2802  Z          36,864  03-05-90   7:58a FEB2802.Z
FEB2802  X          36,864  03-05-90   7:58a FEB2802.X
FEB2802  Y          36,864  03-05-90   7:58a FEB2802.Y
FEB2801  Z          36,864  03-05-90   7:57a FEB2801.Z
FEB2801  X          36,864  03-05-90   7:57a FEB2801.X
FEB2801  Y          36,864  03-05-90   7:57a FEB2801.Y
       121 file(s)     12,044,142 bytes
         2 dir(s)   1,738,375,168 bytes free
```

```
 Volume in drive D has no label
 Volume Serial Number is D845-2F2F
 Directory of D:\sems\v_h

V_H      LST            0  11-11-97  9:23a v_h.lst
ZDHON    GRA       23,230  11-06-97  2:13p ZDHON.GRA
ZDHONTH  DRA        9,602  11-06-97  2:11p ZDHONTH.DRA
ZDHONTH  GRA       23,186  11-06-97  2:11p ZDHONTH.GRA
ZDHON    DRA       40,020  11-06-97  2:11p ZDHON.DRA
VHAVGRGR GRA       24,088  10-31-97  2:57p VHAVGRGR.GRA
VH_ALL   GRA       24,086  10-31-97  2:54p VH_ALL.GRA
3TS_4PNL GRG          186  10-31-97  1:58p 3TS_4PNL.GRG
BM68EC   IN           144  10-28-97  9:03p BM68EC.IN
AVGRGR   DT        44,672  10-28-97  8:04p AVGRGR.DT
BM68ECVH DT         4,864  10-28-97  8:03p BM68ECVH.DT
BM68ECVH ASC        8,554  10-28-97  8:00p BM68ECVH.ASC
LP89D_PA GRA       23,978  10-27-97  7:49p LP89D_PA.GRA
LP89V_H  DT         9,472  10-27-97  7:44p LP89V_H.DT
PA2STRVH DT         4,864  10-27-97  7:43p PA2STRVH.DT
DUMBRTVH DT         4,864  10-27-97  7:43p DUMBRTVH.DT
DUMBRTVH ASC        8,554  10-27-97  7:41p DUMBRTVH.ASC
PA2STRVH ASC        8,554  10-27-97  7:41p PA2STRVH.ASC
DUMBARTN IN           175  10-27-97  7:40p DUMBARTN.IN
PA2STRY  IN           166  10-27-97  7:39p PA2STRY.IN
ZDH_COR  GRA       23,257  10-24-97 11:51a ZDH_COR.GRA
V_H_OBS  GRA       23,902  10-24-97 11:48a V_H_OBS.GRA
SB8T_OBS GRA       23,944  10-24-97 11:26a SB8T_OBS.GRA
SBOBSEMP GRA       23,942  10-24-97 11:25a SBOBSEMP.GRA
VHM5M6AC GRA       23,465  10-24-97 10:53a VHM5M6AC.GRA
VHM5M6C  GRA       23,462  10-24-97 10:52a VHM5M6C.GRA
VHM5M6AS GRA       23,475  10-24-97 10:51a VHM5M6AS.GRA
VHM5DAS  GRA       23,443  10-24-97 10:50a VHM5DAS.GRA
VHM6DAS  GRA       23,443  10-24-97 10:50a VHM6DAS.GRA
ZDHOFFTH DRA        8,972  10-20-97 10:02a ZDHOFFTH.DRA
ZDHOFFTH GRA       23,201  10-20-97 10:02a ZDHOFFTH.GRA
ZDH_COR  DRA       18,411  10-20-97 10:00a ZDH_COR.DRA
GR_TR    GRG           93  10-20-97  9:57a GR_TR.GRG
ZDHON    GRG           95  10-20-97  9:57a ZDHON.GRG
ZDHOFF   GRG           98  10-20-97  9:56a ZDHOFF.GRG
V_H5060  GRA       23,521  10-20-97  9:27a V_H5060.GRA
.             <DIR>        10-16-97  4:21p .
..            <DIR>        10-16-97  4:21p ..
UP90SC90 GRA       23,831  10-01-97  4:23p UP90SC90.GRA
UP90SC88 GRA       23,831  10-01-97  4:22p UP90SC88.GRA
UP90SC86 GRA       23,831  10-01-97  4:22p UP90SC86.GRA
UP90SC85 GRA       23,831  10-01-97  4:21p UP90SC85.GRA
UP90SC83 GRA       23,831  10-01-97  4:21p UP90SC83.GRA
V_HUPSC  GRA       23,770  10-01-97  4:17p V_HUPSC.GRA
MEAN4PLT DT        17,408  10-01-97  4:03p MEAN4PLT.DT
SC90_V_H DT         4,864  10-01-97  4:00p SC90_V_H.DT
SC88_V_H DT         4,864  10-01-97  4:00p SC88_V_H.DT
SC86_V_H DT         4,864  10-01-97  4:00p SC86_V_H.DT
SC85_V_H DT         4,864  10-01-97  3:59p SC85_V_H.DT
SC83_V_H DT         4,864  10-01-97  3:56p SC83_V_H.DT
SC90_V_H ASC        8,554  10-01-97  3:52p SC90_V_H.ASC
SC88_V_H ASC        8,554  10-01-97  3:52p SC88_V_H.ASC
SC86_V_H ASC        8,554  10-01-97  3:52p SC86_V_H.ASC
SC85_V_H ASC        8,554  10-01-97  3:52p SC85_V_H.ASC
SC83_V_H ASC        8,554  10-01-97  3:52p SC83_V_H.ASC
SC90_V_H IN            92  10-01-97  3:51p SC90_V_H.IN
SC88_V_H IN            92  10-01-97  3:51p SC88_V_H.IN
SC86_V_H IN            92  10-01-97  3:51p SC86_V_H.IN
SC85_V_H IN            92  10-01-97  3:51p SC85_V_H.IN
SC83_V_H IN            92  10-01-97  3:50p SC83_V_H.IN
S2LB     GRA       23,960  09-04-97 11:56a S2LB.GRA
SB81_V_H DT        25,856  09-01-97 10:51p SB81_V_H.DT
SC51_V_H DT         4,864  09-01-97 10:33p SC51_V_H.DT
SC38_V_H DT         4,864  09-01-97 10:33p SC38_V_H.DT
S1VC_V_H DT         4,864  09-01-97 10:33p S1VC_V_H.DT
SC51_V_H ASC        8,554  09-01-97 10:20p SC51_V_H.ASC
SC38_V_H ASC        8,554  09-01-97 10:20p SC38_V_H.ASC
S1VC_V_H ASC        8,554  09-01-97 10:20p S1VC_V_H.ASC
SC51_V_H IN            98  09-01-97 10:19p SC51_V_H.IN
SC38_V_H IN            98  09-01-97 10:19p SC38_V_H.IN
S1VC_V_H IN            98  09-01-97 10:18p S1VC_V_H.IN
V_H5060  DT         7,680  08-30-97  2:41p V_H5060.DT
V_HM60SS DT         1,664  08-30-97  2:38p V_HM60SS.DT
V_HM60RS DT         1,664  08-30-97  2:38p V_HM60RS.DT
V_HM60OS DT         1,664  08-30-97  2:38p V_HM60OS.DT
V_HM50SS DT         1,664  08-30-97  2:38p V_HM50SS.DT
V_HM50RS DT         1,664  08-30-97  2:38p V_HM50RS.DT
V_HM50OS DT         1,664  08-30-97  2:38p V_HM50OS.DT
V_HM50SS ASC        2,188  08-30-97  2:32p V_HM50SS.ASC
V_HM60SS ASC        2,188  08-30-97  2:32p V_HM60SS.ASC
V_HM50OS ASC        2,188  08-30-97  2:32p V_HM50OS.ASC
V_HM60OS ASC        2,188  08-30-97  2:32p V_HM60OS.ASC
V_HM50RS ASC        2,188  08-30-97  2:32p V_HM50RS.ASC
V_HM60RS ASC        2,188  08-30-97  2:32p V_HM60RS.ASC
V_H_EMP  OBJ       17,461  08-30-97  2:32p V_H_EMP.OBJ
V_H_EMP  EXE       51,390  08-30-97  2:32p V_H_EMP.EXE
V_H_EMP  FOR       23,686  08-30-97  2:31p V_H_EMP.FOR
DEBUG    OUT        4,446  08-30-97  1:39p DEBUG.OUT
V_H_EMP  IN         1,125  08-30-97  1:38p V_H_EMP.IN
CHK_V_H  ASC        2,034  08-30-97 12:55p CHK_V_H.ASC
CHK_V_H  IN           204  08-30-97 12:55p CHK_V_H.IN
CHK_V_H  DRA        6,618  08-30-97 11:56a CHK_V_H.DRA
CHK_V_H  GRA       23,520  08-30-97 11:56a CHK_V_H.GRA
CHK_V_H  DT         1,536  08-30-97 11:54a CHK_V_H.DT
V_H_M50  ASC        2,034  08-30-97 11:43a V_H_M50.ASC
V_H_M60  ASC        2,034  08-30-97 11:43a V_H_M60.ASC
TEMP     FOR          639  08-30-97  9:54a TEMP.FOR
ATTNSUBS FOR       30,547  08-29-97 10:57p ATTNSUBS.FOR
GRACE    GRA       23,957  08-22-97 11:06a GRACE.GRA
IRENE    GRA       23,967  08-22-97 11:02a IRENE.GRA
TEMP     DT        26,624  08-13-97  9:11p TEMP.DT
V_H_AVG  GRA       23,950  08-13-97  9:02p V_H_AVG.GRA
MEAN4PLT ASC       20,917  08-13-97  8:57p MEAN4PLT.ASC
MEAN4PLT EXE       44,682  08-13-97  8:57p MEAN4PLT.EXE
MEAN4PLT OBJ        8,575  08-13-97  8:57p MEAN4PLT.OBJ
MEAN4PLT FOR       10,944  08-13-97  8:55p MEAN4PLT.FOR
IRENE    DRA        7,207  08-13-97  5:36p IRENE.DRA
V_H      GRA       23,934  08-13-97  4:45p V_H.GRA
RGRS     DT        15,104  07-18-97 11:22a RGRS.DT
MEAN4PLT IN           136  07-18-97 10:21a MEAN4PLT.IN
UP90V_H  ASC        8,554  07-17-97  8:52a UP90V_H.ASC
OS86V_H  ASC        8,554  07-17-97  8:52a OS86V_H.ASC
NP86V_H  ASC        8,554  07-17-97  8:52a NP86V_H.ASC
SB81V_H  ASC        8,554  07-17-97  8:52a SB81V_H.ASC
S1HN_V_H ASC        8,554  07-17-97  8:52a S1HN_V_H.ASC
SB81     IN            94  07-17-97  8:51a SB81.IN
UP90     IN           103  07-17-97  8:51a UP90.IN
OS86     IN           106  07-17-97  8:51a OS86.IN
NP86     IN           103  07-17-97  8:51a NP86.IN
V_H      DT        56,576  07-16-97  9:34p V_H.DT
V_H      ASC      178,105  07-16-97  6:21p V_H.ASC
BOORE1   DOC       29,696  05-29-97 10:50p BOORE1.DOC
ANSARY2  EML       42,618  05-29-97 10:49p ANSARY2.EML
BOORE    MAY       15,360  05-26-97  8:47a BOORE.MAY
ANSARY   EML       22,225  05-26-97  8:46a ANSARY.EML
GRACE    DRA        8,133  05-16-97  8:29p GRACE.DRA
OBS_V_H  DT        45,824  05-16-97  8:25p OBS_V_H.DT
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SCRATCH  GRA        23,946  05-16-97  8:19p SCRATCH.GRA
SV97AIVH DT          4,864  05-16-97  8:15p SV97AIVH.DT
SV97AGVH DT          4,864  05-16-97  8:14p SV97AGVH.DT
SV97AIVH ASC         8,554  05-16-97  8:14p SV97AIVH.ASC
SV97AGVH ASC         8,554  05-16-97  8:14p SV97AGVH.ASC
S97AIR   IN            155  05-16-97  8:13p S97AIR.IN
S97AGR   IN            155  05-16-97  8:10p S97AGR.IN
V_H      PS         47,963  05-16-97  8:48a V_H.PS
SIMI_BVH DT          4,864  05-15-97  7:52p SIMI_BVH.DT
SIMI_BVH ASC         8,554  05-15-97  7:52p SIMI_BVH.ASC
S97B     IN            149  05-15-97  7:41p S97B.IN
RC95V_H  DT          4,864  05-15-97  5:12p RC95V_H.DT
CAL97V_H DT          4,864  05-15-97  5:12p CAL97V_H.DT
CAL97V_H ASC         8,554  05-15-97  5:06p CAL97V_H.ASC
CL97     IN            101  05-15-97  5:05p CL97.IN
RC95V_H  ASC         8,554  05-15-97  5:03p RC95V_H.ASC
RS2V_H   EXE        39,712  05-15-97  5:03p RS2V_H.EXE
RS2V_H   OBJ         3,235  05-15-97  5:03p RS2V_H.OBJ
RS2V_H   FOR         2,846  05-15-97  5:03p RS2V_H.FOR
RC95     IN             88  05-15-97  4:59p RC95.IN
CAL97V_H COL         8,280  05-15-97  1:51p CAL97V_H.COL
BU       BAT            14  08-27-96  5:08p BU.BAT
V_H_RGRS GRA        23,302  05-11-96  7:14p V_H_RGRS.GRA
V_H_OBS  DT         23,168  05-11-96  6:59p V_H_OBS.DT
UP90V_H  DT          4,864  05-11-96  6:47p UP90V_H.DT
SB81V_H  DT          4,864  05-11-96  6:47p SB81V_H.DT
S1HN_V_H DT          4,864  05-11-96  6:47p S1HN_V_H.DT
UP90V_H  COL         8,280  05-11-96  6:46p UP90V_H.COL
SB81V_H  COL         8,280  05-11-96  6:46p SB81V_H.COL
RC95V_H  COL         8,280  05-11-96  6:35p RC95V_H.COL
OS86V_H  DT          4,864  05-11-96  6:26p OS86V_H.DT
OS86V_H  COL         8,280  05-11-96  6:24p OS86V_H.COL
NP86V_H  DT          4,864  05-09-96 10:24p NP86V_H.DT
NP86V_H  COL         8,280  05-09-96 10:23p NP86V_H.COL
OFR      TBL        10,368  05-08-96  1:41p OFR.TBL
ASM55M65 GRA        23,522  05-08-96  1:18p ASM55M65.GRA
ASM55M65 DT          5,120  05-08-96  1:09p ASM55M65.DT
ASM55RSS DT          2,816  05-08-96  1:08p ASM55RSS.DT
ASM55RSS OUT         4,256  05-08-96  1:08p ASM55RSS.OUT
ASM65RSS OUT         4,255  05-07-96 10:55p ASM65RSS.OUT
ASM65SS  OUT         4,255  05-07-96 10:54p ASM65SS.OUT
ASM65RF  OUT         4,255  05-07-96 10:52p ASM65RF.OUT
VHBOZDST GRA        23,488  05-07-96 10:47p VHBOZDST.GRA
SEMS_V_H DT         33,408  05-07-96 10:41p SEMS_V_H.DT
V_H_RGRS DT         33,408  05-07-96 10:41p V_H_RGRS.DT
ASVHM65S DT          2,816  05-07-96 10:40p ASVHM65S.DT
ASVHM65S OUT         4,255  05-07-96 10:38p ASVHM65S.OUT
NORMV_H  EXE        47,202  05-07-96 10:38p NORMV_H.EXE
NORMV_H  FOR         5,998  05-07-96 10:38p NORMV_H.FOR
RAT_CORR DT          6,784  09-06-95  6:53p RAT_CORR.DT
RAT_CORR COL        12,020  09-06-95  6:53p RAT_CORR.COL
RAT_CORR SUM         3,556  09-06-95  6:48p RAT_CORR.SUM
RAT_CORR IN            590  09-06-95  6:48p RAT_CORR.IN
VHSEMBOZ GRA        23,395  08-31-95  2:35p VHSEMBOZ.GRA
VHBOZS1  GRA        23,415  08-31-95  2:35p VHBOZS1.GRA
VHBOZEGN GRA        23,440  08-31-95 12:00p VHBOZEGN.GRA
VHBOZNR  GRA        23,385  08-31-95 11:34a VHBOZNR.GRA
VHBOZLP  GRA        23,385  08-31-95 11:32a VHBOZLP.GRA
BOZ_SMR1 DT            896  08-31-95 10:02a BOZ_SMR1.DT
BOZ_NR94 DT          1,024  08-31-95 10:02a BOZ_NR94.DT
BOZ_LP89 DT            896  08-31-95 10:02a BOZ_LP89.DT
BOZ_LP89 COL           748  08-31-95 10:00a BOZ_LP89.COL
BOZORG   EML         4,382  08-31-95 10:00a BOZORG.EML
BOZ_SMR1 COL         1,009  08-31-95 10:00a BOZ_SMR1.COL
BOZ_NR94 COL         1,165  08-31-95  9:58a BOZ_NR94.COL
BOZOR895 LTR         2,560  08-28-95  7:34p BOZOR895.LTR
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ABRAH895 LTR         2,176  08-28-95  7:14p ABRAH895.LTR
BOZ_F7   GRA        23,205  08-28-95  6:59p BOZ_F7.GRA
BOZ_F56  GRA        23,206  08-28-95  5:37p BOZ_F56.GRA
OCNPVYZ  DT          4,352  08-17-95  7:00p OCNPVYZ.DT
NPSPVYZ  DT          4,352  08-17-95  6:44p NPSPVYZ.DT
UPLPVXYZ DT          5,376  08-17-95  6:19p UPLPVXYZ.DT
HENPVNEV DT          5,376  08-17-95  4:50p HENPVNEV.DT
GSCLOSE                640  06-30-94  3:45p GSCLOSE
GSADD                1,536  03-25-94  9:53a GSADD
ZDHALLEV DRA        18,748  03-24-93  2:48p ZDHALLEV.DRA
ZDHALLEV GRA         8,167  03-24-93  2:47p ZDHALLEV.GRA
SBI81RAT DT         28,544  03-24-93  2:24p SBI81RAT.DT
ZDHTHRY  DRA         9,823  03-24-93  2:11p ZDHTHRY.DRA
ZDH3     DT          7,680  03-24-93  1:53p ZDH3.DT
ZDHALLEV DT          6,784  02-06-93  7:52a ZDHALLEV.DT
ZDHALLEV COL        38,550  02-05-93  3:26p ZDHALLEV.COL
       207 file(s)      2,594,517 bytes
         2 dir(s)   1,738,407,936 bytes free
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 Volume in drive D has no label
 Volume Serial Number is D845-2F2F
 Directory of D:\sems\vel_q

VEL_Q    LST            0  11-11-97   9:20a vel_q.lst
V_OFF    GRA       23,472  11-07-97  10:17a V_OFF.GRA
VELS2    DT       570,240  11-07-97  10:12a VELS2.DT
VSEM_ON3 GRA       23,486  11-06-97   7:49p VSEM_ON3.GRA
VELMAP   GRA       23,259  11-06-97   1:52p VELMAP.GRA
VELMAP   DT         3,456  11-06-97   1:28p VELMAP.DT
V_D5PO   GRA       23,478  11-06-97   1:20p V_D5PO.GRA
V_D1PO   GRA       23,487  11-06-97  12:55p V_D1PO.GRA
VSEM_ON3 EPS       24,002  10-31-97   2:32p VSEM_ON3.EPS
DUMBW    DT         3,200  10-30-97   7:19p DUMBW.DT
LSST_VEL DT           768  10-27-97   1:37p LSST_VEL.DT
LSST_VEL COL          435  10-27-97   1:37p LSST_VEL.COL
WEN      TXT          733  10-27-97   8:34a wen.txt
LSST_VEL TXT          733  10-27-97   8:34a LSST_VEL.TXT
VSITEAB  GRA       23,255  10-20-97   2:30p VSITEAB.GRA
VSITEAB2 GRA       23,256  10-20-97  10:40a VSITEAB2.GRA
.            <DIR>         10-16-97   4:21p .
..           <DIR>         10-16-97   4:21p ..
VELSUM   GRA       23,279  09-29-97   4:43p VELSUM.GRA
VSEM_ON1 GRA       23,301  09-29-97   4:38p VSEM_ON1.GRA
VSEM_ON2 GRA       23,215  09-29-97   4:29p VSEM_ON2.GRA
GRA      LST        1,177  09-29-97   4:28p GRA.LST
BH_PLEIS DT           512  09-27-97   5:06p BH_PLEIS.DT
BH_HOLOC DT           640  09-27-97   5:06p BH_HOLOC.DT
BH_HOLOC COL          518  09-27-97   5:06p BH_HOLOC.COL
BH_PLEIS COL          276  09-27-97   5:06p BH_PLEIS.COL
BHCOORD  PRN          886  09-27-97   1:32p BHCOORD.PRN
SEMSVEL  TBL        2,509  09-13-97   3:00p SEMSVEL.TBL
TEMP     DT        16,128  09-13-97   2:22p TEMP.DT
SEMS     PRN          685  09-12-97  10:41p SEMS.PRN
SEMSXX   PRN        2,250  09-12-97  10:40p SEMSXX.PRN
VSEMSBAY GRA       23,287  09-12-97  10:34p VSEMSBAY.GRA
VHMSEMDO GRA       23,207  09-12-97  10:23p VHMSEMDO.GRA
VELHMSEM GRA       23,177  09-12-97  10:22p VELHMSEM.GRA
DIR      LST        2,527  07-29-97   2:22p DIR.LST
S97B_3A  IN            94  07-18-97   8:45a S97B_3A.IN
VELS2    WQ1       29,587  01-24-97   6:36p VELS2.WQ1
VELS2TMP WQ1        6,380  01-24-97   4:52p VELS2TMP.WQ1
VELS2TMP PRN        1,941  01-24-97   4:38p VELS2TMP.PRN
VELS2TMP DT         2,560  01-24-97   4:24p VELS2TMP.DT
VELS     DT         4,608  01-24-97   3:44p VELS.DT
BU       BAT           16  08-27-96   5:08p BU.BAT
CSTA_HM  ASC       21,895  11-01-95   8:28p CSTA_HM.ASC
CSTAM_HM WQ1      109,472  11-01-95   8:28p CSTAM_HM.WQ1
DENS_VS  GRA       23,163  10-30-95   7:28p DENS_VS.GRA
VELHMSEM DT        87,040  10-30-95   7:25p VELHMSEM.DT
VELS2    GRA       23,291  09-01-95   4:11p VELS2.GRA
BH_LB    TBL        1,824  09-01-95   2:29p BH_LB.TBL
XTRACT   DB         3,072  09-01-95   2:27p XTRACT.DB
REFS     EML        2,925  09-01-95  12:08p REFS.EML
DHMSEMDO GRA       23,261  08-31-95   4:41p DHMSEMDO.GRA
DAN      COL        1,264  08-31-95   4:28p DAN.COL
DAN      DT         1,536  08-31-95   4:05p DAN.DT
DAN      EML        3,351  08-31-95   3:49p DAN.EML
VELHM    EML        4,255  08-31-95   1:28p VELHM.EML
DENHMSEM GRA       23,230  08-31-95   1:04p DENHMSEM.GRA
VELS_HM  GRA       23,179  08-31-95  12:40p VELS_HM.GRA
VELSUMXW DT         2,048  08-31-95  12:38p VELSUMXW.DT
VEL_HM   DT        59,520  08-30-95   4:42p VEL_HM.DT
S3LB_HM  DT        20,096  08-30-95   4:41p S3LB_HM.DT
CSTAM_HM DT        20,096  08-30-95   4:41p CSTAM_HM.DT
BH50_HM  DT        20,096  08-30-95   4:40p BH50_HM.DT
S3LB_HM  WQ1       79,838  08-30-95   4:39p S3LB_HM.WQ1
BH50_HM  WQ1       79,898  08-30-95   4:39p BH50_HM.WQ1
DB_VEL   WQ1      236,824  08-30-95   4:31p DB_VEL.WQ1
DB_VEL             55,854  08-30-95   3:58p DB_VEL
UNTITLED GRA        7,887  01-13-94   4:05p UNTITLED.GRA
UNTITLED DT        19,200  01-13-94   4:00p UNTITLED.DT
VSITEA   GRA        7,954  01-13-94  11:31a VSITEA.GRA
UNTITLED DRA        7,211  11-24-93  11:14p UNTITLED.DRA
TEMP     STT          221  11-24-93  10:14p TEMP.STT
VELTHRY  GRA        8,027  11-16-93   4:06p VELTHRY.GRA
VELSUM   WQ1        8,727  01-21-93  10:56a VELSUM.WQ1
INVQSUM  GRA        8,002  01-21-93  10:39a INVQSUM.GRA
VELSUM   DT         2,176  01-21-93  10:34a VELSUM.DT
VELS     WQ1       13,688  01-11-93   9:13p VELS.WQ1
VELS     GRA        7,915  12-04-92  10:11a VELS.GRA
        75 file(s)      1,998,056 bytes
         2 dir(s)   1,738,342,400 bytes free
```

VEL_Q.LST 11-11-97 9:20a

Page 1 of 1

```
 Volume in drive D has no label
 Volume Serial Number is D845-2F2F
 Directory of D:\sems\zips

DIR      LST           0  11-11-97  9:10a DIR.LST
REPORT   ZIP     161,884  11-10-97  4:54p REPORT.ZIP
SEMS     ZIP     624,952  11-10-97  4:54p SEMS.ZIP
ZIPS     ZIP       2,537  11-10-97  9:08a ZIPS.ZIP
RSTR     BAT       1,568  11-10-97  9:04a RSTR.BAT
VEL_Q    ZIP     255,483  11-07-97 10:20a VEL_Q.ZIP
V_H      ZIP     739,090  11-06-97  2:13p V_H.ZIP
SBI81    ZIP   3,238,353  11-06-97  2:13p SBI81.ZIP
NPALM86  ZIP   1,308,354  10-31-97  3:02p NPALM86.ZIP
UPLAND90 ZIP   3,744,167  10-31-97  3:02p UPLAND90.ZIP
OCNSID86 ZIP   1,619,001  10-30-97  2:04p OCNSID86.ZIP
BU       PIF         967  10-27-97  4:36p Bu.PIF
SITEAB   ZIP   1,404,905  10-20-97  2:33p SITEAB.ZIP
BIGEQ    ZIP   9,588,707  10-20-97  2:33p BIGEQ.ZIP
SITEABVX ZIP     218,170  10-18-97 10:56a SITEABVX.ZIP
BU       BAT       1,056  10-18-97 10:55a BU.BAT
.            <DIR>        10-16-97  4:22p .
..           <DIR>        10-16-97  4:22p ..
CPY      BAT         134  08-23-97  3:08p CPY.BAT
THEORY   ZIP      56,260  08-23-97 10:31a THEORY.ZIP
SIMI97B  ZIP     486,627  08-21-97 10:41p SIMI97B.ZIP
SIMI97A  ZIP   2,477,747  08-21-97 10:41p SIMI97A.ZIP
CALICO97 ZIP     760,534  08-21-97 10:41p CALICO97.ZIP
RC95     ZIP     847,634  08-21-97 10:41p RC95.ZIP
AVD      ZIP         795  08-09-97 10:44a AVD.ZIP
CPY2DSK  BAT         106  05-16-97  8:41p CPY2DSK.BAT
CPY2HD   BAT         106  05-16-97  6:28p CPY2HD.BAT
TEMP     BAT         103  05-15-97  5:18p TEMP.BAT
BIGAPS   ZIP     605,649  06-28-96 11:37a BIGAPS.ZIP
BIGBBF2  ZIP   1,044,299  06-12-96  8:04a BIGBBF2.ZIP
BIGBBF1  ZIP   1,066,881  06-12-96  8:04a BIGBBF1.ZIP
BIGSMC   ZIP     719,506  06-11-96 10:02p BIGSMC.ZIP
BIGBBFT  ZIP     635,592  06-11-96  6:49p BIGBBFT.ZIP
SBIDATA  ZIP   1,178,471  06-11-96  2:17p SBIDATA.ZIP
ANDRSN81 ZIP     196,313  12-18-92  6:03p ANDRSN81.ZIP
        33 file(s)     32,985,951 bytes
         2 dir(s)   1,738,604,544 bytes free
```

APPENDIX C – LISTINGS OF FORTRAN PROGRAMS

The following pages contain listings of the Fortran programs used in this project. They are arranged alphabetically.

```
      Program AS96_CD

* Combines Boore 86 amps and AS96 amps (which are for soil relative
* to rock --- as AS96 put it, C/D relative to A/B) to give C/D amplification
* for use in SMSIM with AS96 scaling.

      real f_b86(20), f_as96(20), amp_b86(20), amp_as96(20)
      real f_out(20)

      open(unit = 10, file='\site_amp\a_b86.dat',status='unknown')
      read(10,*)
      read(10,*) nf_b86
      do i = 1, nf_b86
        read(10,*) f_b86(i), amp_b86(i)
      end do
      close(unit=10)

      open(unit = 10, file='\sems\bigeq\amp_as96.dat',
     :     status='unknown')
      read(10,*)
      read(10,*)
      read(10,*) nf_as96
      do i = 1, nf_as96
        read(10,*) f_as96(i), dum1, dum2, amp_as96(i)
      end do
      close(unit=10)

      nf = nf_as96 + 1
      f_out(1) = 0.10
      do i = 2, nf
       f_out(i) = f_as96(i-1)
      end do

      open(unit = 10, file='as96_cda.dat',status='unknown')
      write(10,'(t3,a, t14,a)') 'f_as96_cd', 'a_as96_cd'
      write(10, '(i4)') nf + 1
      write(10, '(1p2(1x,e10.3))') 0.01, 1.00
      do i = 1, nf
        f = f_out(i)
        b86 = site_amp_factor(f, nf_b86, f_b86, amp_b86)
        as96 = site_amp_factor(f, nf_as96, f_as96, amp_as96)
        write(10, '(1p2(1x,e10.3))') f, as96 * b86
      end do
      close(unit=10)

      stop
      end

*----------------- BEGIN SITE_AMP_FACTOR ----------------------------
* Dates: 06/07/95 - Written by D.M. Boore
      function site_amp_factor(f, namps, famp, amp)
      real famp(*), amp(*), site_amp_factor

      if ( f .le. famp(1) ) then
        site_amp_factor = amp(1)
      else if ( f .ge. famp(namps) ) then
        site_amp_factor = amp(namps)
      else
        call locate( famp, namps, f, j)
        site_amp_factor = amp(j)*10.0**(alog10(f/famp(j))
     :             *alog10(amp(j+1)/amp(j))
     :             /alog10(famp(j+1)/famp(j)))
       end if

       return
       end
*----------------- END SITE_AMP_FACTOR ----------------------------

* -------------------- BEGIN LOCATE --------------------------------
      SUBROUTINE locate(xx,n,x,j)

* finds j such that x is between xx(j) & xx(j+1)
* j = 0 if x <= xx(1) (note problem if x = xx(1)!)
* j = n if x > xx(n)
* xx can be increasing or decreasing

      INTEGER j,n
      REAL x,xx(n)
      INTEGER jl,jm,ju
      jl=0
      ju=n+1
10    if(ju-jl.gt.1)then
        jm=(ju+jl)/2
        if((xx(n).gt.xx(1)).eqv.(x.gt.xx(jm)))then
          jl=jm
        else
          ju=jm
        endif
      goto 10
      endif
      j=jl
      return
      END
C  (C) Copr. 1986-92 Numerical Recipes Software $!6)$-"11j.
* -------------------- END LOCATE --------------------------------
```

AS96_CD.FOR 6-7-96 10:20a

Page 1 of 1

```
      Program ASCI2SMC

*  Reads in ASCII files and reformats them
*  into SMC format (the format used on the CD-ROM)

*  For flexibility, the various header parameters are read from a file
*  in namelist format rather than being picked out of whatever headers are
*  available.

*  Dates:  11/30/92 - Started writing by D. Boore (based on SCEToSMC.FOR)
*          05/07/96 - added nstart, nstop, removedc

      real  sps, orient_h, orient_v, eqmag,
     :      eqlat, eqlong, stalat, stalong, rnull,
     :      accel(13000), freqins, dampins, rhead(50), scale2gals

      integer iyr, imon, iday, ihr, isec,
     :        inscode, ncomments, naccel, inull, idoy, ihead(48),
     :        lines2skip, nstart, nstop

      character stacode*4, fnameout*12, fnamedatain*12, fnamein*12,
     :           hour*1, eqname*20, staname*20, compname*1, dataformat*60

      logical removedc

      namelist/input/
     :        fnamedatain, lines2skip, dataformat,
     :        naccel, nstart, nstop, removedc, sps, rnull,
     :        inull, scale2gals,
     :        eqname, iyr, imon, iday, ihr, imin, isec,
     :        eqlat, eqlong, eqmag,
     :        staname, stacode, stalat, stalong,
     :        compname, orient_v, orient_h,
     :        inscode, freqins, dampins

* Open input file and read information:

      write(*, '(a\)') '  Enter name of input file:'
      read(*, '(a)') fnamein
      open(unit=10, file=fnamein, status='unknown')

* Now use namelist to read the parameters:
      read(10, NML=input)
* Echo to screen:
      write(*, NML=input)

* Close input file:
      close(unit=10)

* Calculate doy and hour character:

      hr = ihr
      call WCCHR(hr, hour, 1, icstr2)

      call DOY(iyr, imon, iday, idoy, istat)

* write results to screen:
      write(*, '(a,i2, 2a)') ' For ihr= ', ihr, ' hour= ', hour
      write(*, '(a,i4, i2, i2, a, i3)') ' For year, mon, day= ',
     :      iyr, imon, iday, ' doy= ', idoy

* Open Input file:
      open(unit=20, file=fnamedatain, status='unknown')

* Construct the output file name:
      write(fnameout(1:3), '(i3.3)') idoy
      fnameout(4:4) = hour
      write(fnameout(5:6), '(i2.2)') imin
      fnameout(7:8) = stacode(1:2)
      fnameout(9:9) = '.'
      fnameout(10:11) = stacode(3:4)
      fnameout(12:12) = compname

* Open output file:
      open(unit=30, file=fnameout, status='unknown')

* Write name to screen:
      write(*, '(2a)') ' Output file name: ', fnameout

* Write headers:

* First write the 11 lines of comments:

      write(30, '(a)') '*'
      write(30, '(a)') '*'
      write(30, '(a)') stacode
      write(30, '(5x,i4,2x,i2,2x,i2,4x,i2,i2,1x,a)')
     :                iyr, imon, iday, ihr, imin, eqname
      write(30, '(a,6x,f3.1)') 'Moment Mag=', eqmag
      write(30, '(2a,t30,a,i3,1x,a,i3)') 'station = ', staname,
     :                             'orient_h= ', int(orient_h),
     :                             'orient_v= ', int(orient_v)
      write(30, '(a,t34,a)') 'epicentral dist =','pk acc ='
      write(30, '(a, t22, a)') 'inst type=DSA', 'data source = SCE'
      write(30, '(a)') '*'
      write(30, '(a)') '*'
      write(30, '(a)') '*'

* Now write the integer header block:
* First fill with null values:
      do i = 1, 48
        ihead(i) = inull
      end do

      ihead(1) = inull
      ihead(2) = iyr
      ihead(3) = idoy
      ihead(4) = ihr
      ihead(5) = imin
      ihead(6) = isec
      ihead(11) = 3
      ihead(13) = orient_v
      ihead(14) = orient_h
      ihead(15) = inscode
      ncomments = 0
      ihead(16) = ncomments
      naccel_nu = nstop - nstart + 1
      ihead(17) = naccel_nu

      write(30, '(8I10)') (ihead(i), i=1,48)

* Now write the real header block:
* First fill with null values:
      do i = 1, 50
        rhead(i) = rnull
      end do

      rhead(1) = rnull
      rhead(2) = sps
      rhead(3) = eqlat
      rhead(4) = eqlong
```

```
      rhead(6) = eqmag
      rhead(11) = stalat
      rhead(12) = stalong
      rhead(22) = freqins
      rhead(23) = dampins

      write(30, '(5E15.7)') (rhead(i), i=1,50)

* Skip the specified number of lines:

      call skip(20, lines2skip)

* Read the acceleration values from the input file between specified index
* values, remove dc if requested, scale to cm/s^2 if needed,
* and write.

      read(20, dataformat) (accel(j), j = 1, naccel)
      do i = 1, naccel_nu
        accel(i) = accel(nstart - 1 + i)
      end do

      avg = 0.0
      if (removedc) then
        do i = 1, naccel_nu
          avg = avg + accel(i)
        end do
        avg = avg/naccel_nu
      end if

      write(30, '(8(1pe10.4e1))')
     :        (scale2gals*(accel(j)-avg), j = 1, naccel_nu)

* That should be it; close the output file and loop back for another component

      close(unit=30)
      close (unit=20)

      stop
      end

      include '\forprogs\skip.for'
      include '\forprogs\doy.for'
      include '\forprogs\wcc.for'
      include '\forprogs\wcchr.for'
```

```
      Program BIGEQ

*  Finds an elongation filter for specified magnitudes of the
*  input and target events

*  Applies the filter to a file specified at runtime

* Then calculate the extension filter (ask for filter cutoffs, Brune or Joyner
* scaling)

* Then read in a source file name, time to skip at the beginning.

*  Dates:  11/15/93 - Written by David M. Boore
*          11/23/93 - added normal random numbers, using complex spectra
*                     rather than just the phase.
*          06/07/96 - major revision

      real real_head(50)
      integer int_head(48)
      character*80 char_head(11)
      character f_cntrl*40, f_sum*40, f_sml*30, f_big*30, buf*80
      character f_obs*40, f_bjf*40, f_norm*40, f_sim*40
      character f_sim_sml*40, f_sim_big*40, buf1*80
      real msml, mbig, m0sml, m0big
      real mc, m0b_m0sml, m0b_m0big, mnrm
      complex work(65600), spect_random(65600)
      real accel(65600)
      real per_rs(100), rs_sml(100,2), rs_big(100,2)
      real per_norm(40), rs_norm_sml(40), rs_norm_big(40)
      real per_bjf(40), rs_bjf_sml(40), rs_bjf_big(40)
      real per_sim(40), rs_sim_sml(40), rs_sim_big(40)

      pi = 4.0 * atan(1.0)

      write(*,'(a\)') ' Enter name of control file:'
      f_cntrl = ' '
      read(*, '(a)') f_cntrl

      nu_cntrl = 20
      open(unit=nu_cntrl, file=f_cntrl, status='unknown')

      buf1 = ' '
      read(nu_cntrl, '(a)') buf1

      buf = ' '
      read(nu_cntrl, *) buf
      f_sum = ' '
      read(nu_cntrl, *) f_sum
      write(*,'(2a)') ' Summary file with name:', f_sum
      write(*,'(2a)') ' Header line: ', buf1

      nu_sum = 30
      open(unit=nu_sum, file=f_sum, status='unknown')
      write(nu_sum, *) buf1
      write(nu_sum, '(2a)') ' Control file: ', f_cntrl

      write(nu_sum, *) buf
      write(nu_sum, *) f_sum

      buf = ' '
      read(nu_cntrl, *) buf
      f_obs = ' '
      read(nu_cntrl, *) f_obs
      write(nu_sum, *) buf
      write(nu_sum, *) f_obs
      buf = ' '
      read(nu_cntrl, *) buf
      read(nu_cntrl, *) filt_low, filt_high, tskip, pad, tshift
      write(nu_sum, *) buf
      write(nu_sum, *) filt_low, filt_high, tskip, pad, tshift

      buf = ' '
      read(nu_cntrl, *) buf
      read(nu_cntrl, *) iseedstrt
      write(nu_sum, *) buf
      write(nu_sum, *) iseedstrt

      buf = ' '
      read(nu_cntrl, *) buf
      read(nu_cntrl, *) msml, mbig
      write(nu_sum, *) buf
      write(nu_sum, *) msml, mbig

      buf = ' '
      read(nu_cntrl, *) buf
      read(nu_cntrl, *)
     :      iscale, beta, stressc, dlsdm, mnrm, fbdfa, mc
      write(nu_sum, *) buf
      write(nu_sum, *)
     :      iscale, beta, stressc, dlsdm, mnrm, fbdfa, mc

* Compute the source corners:

      call SCALE( msml, m0sml,
     :            fasml, fbsml, m0b_m0sml, stresssml,
     :            stressc, dlsdm, mnrm, beta, fbdfa, mc, iscale)
      write(nu_sum, '(3a)')
     :          'msml, m0sml,',
     :          ' fasml, fbsml, m0b_m0sml, stresssml,',
     :          ' stressc, dlsdm, mnrm, beta, fbdfa, mc, iscale'
      write(nu_sum, '(1p14(1x,e10.3))')
     :          msml, m0sml,
     :          fasml, fbsml, m0b_m0sml, stresssml,
     :          stressc, dlsdm, mnrm, beta, fbdfa, mc, iscale

      call SCALE( mbig, m0big,
     :            fabig, fbbig, m0b_m0big, stressbig,
     :            stressc, dlsdm, mnrm, beta, fbdfa, mc, iscale)
      write(nu_sum, '(3a)')
     :          'mbig, m0big,',
     :          ' fabig, fbbig, m0b_m0big, stressbig,',
     :          ' stressc, dlsdm, mnrm, beta, fbdfa, mc, iscale'
      write(nu_sum, '(1p14(1x,e10.3))')
     :          mbig, m0big,
     :          fabig, fbbig, m0b_m0big, stressbig,
     :          stressc, dlsdm, mnrm, beta, fbdfa, mc, iscale

      buf = ' '
      read(nu_cntrl, *) buf
      write(nu_sum, *) buf
      read(nu_cntrl, *) damp, perstart, perstop, nper
      write(nu_sum, *) damp, perstart, perstop, nper
      dlogper = (alog10(perstop/perstart))/(float(nper-1))
      do i = 1, nper
        per_rs(i) = perstart*10.0**(float(i-1)*dlogper)
      end do

      buf = ' '
      read(nu_cntrl, *) buf
      read(nu_cntrl, *) ncomp
      write(*, '(a,i3)') ' ncomp = ', ncomp
```

```
      write(nu_sum, *) buf
      write(nu_sum, *) ncomp

      iseed = -iabs(iseedstrt)

      do icmp = 1, ncomp
        write(*,'(a,i3)') ' After do icmp, i = ', icmp
        buf = ' '
        read(nu_cntrl, *) buf
        write(*,'(2(1x,a))') ' After read, buf= ', buf
        write(nu_sum, *) buf
        f_sml = ' '
        read(nu_cntrl, *) f_sml
        write(nu_sum, *) f_sml
        buf = ' '
        read(nu_cntrl, *) buf
        write(nu_sum, *) buf
        f_big = ' '
        read(nu_cntrl, *) f_big
        write(nu_sum, *) f_big

* Extract the small eq acceleration trace, sample per second,
* and number of samples:

        call ReadSMC(accel, nsml, sps, tskip,
     :             99, f_sml,
     :             char_head, int_head, real_head)

        write(nu_sum, '(a, f5.1)') ' SPS = ', sps

        dt = 1.0/sps

* Check and set lengths:

        nfft = 4.0 * 2.0**
     :   (int(alog10(sps/fabig + sps*pad + nsml)/alog10(2.)) + 1)

        if (nfft .gt. 65600) then
          write (*, '(a,i5,a)') ' NFFT = ', nfft,
     :           ', larger than 65,600; choose a smaller mbig.'
          close(unit=nu_sum)
          stop
        end if

        nfilt = sps * (1.0/fabig - 1.0/fasml)

        df = 1.0/(float(nfft)*dt)

        write(nu_sum,'(a,1p2(1x,e10.3),0p3i6)')
     :      ' dt, df, nsml, nfft, nfilt= ',
     :        dt, df, nsml, nfft, nfilt

* Fill in an array with random numbers:

        do i = 1, nfft
          spect_random(i) = 0.0
*          work(i) = 0.0
        end do

        npad = sps * pad

        write(nu_sum, '(2a, i6, a, i6)')
     :    ' Fill with random numbers, for',
     :    ' indexes from ', npad, ' to ', npad+nfilt

        twind = nfilt * dt

        dum = sqrt(nfft*dt)/sqrt(twind) ! see TDSIM.FOR for this factor

        do i = npad, npad + nfilt
           spect_random(i) = dum * cmplx(gasdev(iseed), 0.0)
*           work(i) = ran1(iseed) - 0.5
        end do

* Compute the FFT:

        call fork(nfft, spect_random, -1.)
*        call fork(nfft, work, -1.)

        nfftd2 = nfft/2
        inyq = nfftd2 + 1

        write(nu_sum, '(a, 2i6)') ' nfftd2, inyq= ', nfftd2, inyq

* Get the phase:

*       do i = 2, nfftd2
*          yp = aimag(work(i))
*          xp =  real(work(i))
*          if (xp .eq. 0.0 .and. yp .eq. 0.0) then
*             write(*, '(a, i5)') ' Both xp and yp = 0, for i = ',
*    :                           i
*          end if
*          phase(i) = atan2(yp, xp)
*       end do

*       phase(1) = 0.0
*       phase(inyq) = 0.0

* Compute the FFT of the small eq:

       do i = 1, nfft
         work(i) = 0.0
       end do

* remove dc, apply taper to data segment (nsmall points long):

       call dcdt( accel, dt, nsml, 1, nsml, .true., .false.)
       call fbctpr(5, 5, accel, nsml)

       do i = 1, nsml
         work(i) = accel(i)
       end do

* Compute response spectra
      do i = 1, nper
        omega = 2.0*pi/per_rs(i)
        call rd_calc(accel,nsml,omega,damp,dt,rd)
        rs_sml(i, icmp) = omega*rd
      end do

* Compute the FFT:

       call fork(nfft, work, -1.0)

* Filter the spectrum:

       do i = 2, nfftd2
        df = 1.0/(float(nfft)*dt)
        f = float(i-1)*df
        work(i) = (m0big/m0sml)*
     :    filter(f, filt_low, filt_high)*
     :    (spect_shape(f, fabig, fbbig, 2.0, 1.0, m0b_m0big, iscale)/
```

```
      :     spect_shape(f, fasml, fbsml, 2.0, 1.0, m0b_m0sml, iscale))*
*     :        work(i) * cexp(cmplx(0.0,phase(i)))
      :   work(i) * spect_random(i) *
      :   cexp(cmplx(0.0,-2.0*pi*f*tshift))
        work(nfft+1-i) = conjg(work(i))
      end do

      work(1) = 0.0
      work(inyq) = 0.0

      call fork(nfft, work, +1.0)

      do i = 1, nfft
        accel(i) = real(work(i))
      end do

* Now write out the new time series in smc format:

* decrease nfft by 1/2 first:
      nout = nfft/2

      write(char_head(5)(17:21), '(f5.2)') mbig
      real_head(6) = mbig
      call WriteSMC(accel, nout, sps,
     :             99, f_big,
     :            char_head, int_head, real_head)

* Compute response spectra
     do i = 1, nper
       omega = 2.0*pi/per_rs(i)
       call rd_calc(accel,nout,omega,damp,dt,rd)
       rs_big(i, icmp) = omega*rd
     end do


     end do    ! loop back for a new component


* Write prv to output file:

     nu_out = 40
     open(unit=nu_out, file=f_obs, status = 'unknown')

     write(nu_out,
    : '(  t9,a,  t16,a,  t27,a,  t38,a,  t49,a,  t60,a,  t71,a)')
    :   'per',
    :          'upsmlh1', 'upsmlh2', 'upsmlgm',
    :          'upbigh1', 'upbigh2', 'upbiggm'
     do i = 1, nper
       gm_sml = sqrt(rs_sml(i,1)*rs_sml(i,2))
       gm_big = sqrt(rs_big(i,1)*rs_big(i,2))
       write(nu_out, '(1p7(1x,e10.3))')
    :  per_rs(i),
    :            (rs_sml(i,j), j = 1,2),
    :  gm_sml,
    :            (rs_big(i,j), j = 1,2),
    :  gm_big
     end do
     close(unit=nu_out)

* Compute BJF94:

     buf = ' '
     read(nu_cntrl, *) buf
     f_bjf = ' '
     read(nu_cntrl, *) f_bjf
     write(nu_sum, *) buf
     write(nu_sum, *) f_bjf

     buf = ' '
     read(nu_cntrl,*) buf
     write(nu_sum, *) buf
     read(nu_cntrl,*) ddist, v30, perstrt_bjf, perstop_bjf, nper_bjf
     write(nu_sum,*) ddist, v30, perstrt_bjf, perstop_bjf, nper_bjf

     dlogper_bjf =
    :   (alog10(perstop_bjf/perstrt_bjf))/float(nper_bjf-1)
     do i = 1, nper_bjf
       per_bjf(i) = perstrt_bjf * 10.0**(float(i-1)*dlogper_bjf)
       rs_bjf_sml(i) =
    :          10.0** psvper_f(per_bjf(i), msml, ddist, r, v30, samp)
       rs_bjf_big(i) =
    :          10.0** psvper_f(per_bjf(i), mbig, ddist, r, v30, samp)
     end do

* Write prv to output file:

     nu_out = 40
     open(unit=nu_out, file=f_bjf, status = 'unknown')

     write(nu_out,
    : '(  t5,a, t17,a, t28,a)')
    :          'per_bjf', 'bjfsml' , 'bjfbig'

     do i = 1, nper_bjf
       write(nu_out, '(1p7(1x,e10.3))')
    :  per_bjf(i), rs_bjf_sml(i), rs_bjf_big(i)
     end do
     close(unit=nu_out)

* Compute Abrahamson and Silva:

     buf = ' '
     read(nu_cntrl, *) buf
     f_norm = ' '
     read(nu_cntrl, *) f_norm
     write(nu_sum, *) buf
     write(nu_sum, *) f_norm

     buf = ' '
     read(nu_cntrl,*) buf
     write(nu_sum, *) buf
     read(nu_cntrl,*) rdist, amech, hw, isoil
     write(nu_sum,*) rdist, amech, hw, isoil

     nper_norm = 28
     do iper=1,nPer_norm
       icomp=1   ! horizontal, icomp = 2 for vertical
       call Calc_AS95b(msml, rdist, amech, isoil, hw, iPer,
    :         icomp, per_norm(iper), sa_norm )
       rs_norm_sml(iper) = 980.0 * per_norm(iper)*sa_norm/(2.0*pi)
       call Calc_AS95b(mbig, rdist, amech, isoil, hw, iPer,
    :         icomp, per_norm(iper), sa_norm )
       rs_norm_big(iper) = 980.0 * per_norm(iper)*sa_norm/(2.0*pi)
     end do

* Write prv to output file:

     nu_out = 40
     open(unit=nu_out, file=f_norm, status = 'unknown')

     write(nu_out,
```

```
      : '(  t4,a, t16,a, t27,a)')
      :          'per_norm', 'normsml' , 'normbig'

       do i = 1, nper_norm
         write(nu_out, '(1p7(1x,e10.3))')
      :  per_norm(i), rs_norm_sml(i), rs_norm_big(i)
       end do
       close(unit=nu_out)

* Read in SMSIM results, applying additional soil factor if iscale < 3

       buf = ' '
       read(nu_cntrl, *) buf
       f_sim = ' '
       read(nu_cntrl, *) f_sim
       write(nu_sum, *) buf
       write(nu_sum, *) f_sim

       buf = ' '
       read(nu_cntrl,*) buf
       write(nu_sum, *) buf
       read(nu_cntrl,*) f_sim_sml, f_sim_big, nper_sim
       write(nu_sum,*) f_sim_sml, f_sim_big, nper_sim

       nu_sim = 50
       open(unit=nu_sim, file=f_sim_sml, status = 'unknown')
       read(nu_sim, *)
       do i = 1, nper_sim
         read(nu_sim, *) per_sim(i), dum, rs_sim_sml(i)
       end do
       close(nu_sim)

       nu_sim = 50
       open(unit=nu_sim, file=f_sim_big, status = 'unknown')
       read(nu_sim, *)
       do i = 1, nper_sim
         read(nu_sim, *) per_sim(i), dum, rs_sim_big(i)
       end do
       close(nu_sim)

* Apply correction factors if iscale < 3:

       if( iscale .lt. 3) then
         do i = 1, nper_sim
           r2s = bjfr2s_f(per_sim(i))
           rs_sim_sml(i) = r2s * rs_sim_sml(i)
           rs_sim_big(i) = r2s * rs_sim_big(i)
           write(nu_sum,'(a,1p2(1x,e10.3))')
      :        ' per, r2s = ', per_sim(i), r2s
         end do
       end if

* Write prv to output file:

       nu_out = 40
       open(unit=nu_out, file=f_sim, status = 'unknown')

       write(nu_out,
      : '(  t5,a, t16,a, t27,a)')
      :          'per_sim', 'sim_sml' , 'sim_big'

       do i = 1, nper_sim
         write(nu_out, '(1p7(1x,e10.3))')
      :  per_sim(i), rs_sim_sml(i), rs_sim_big(i)
       end do
       close(unit=nu_out)

       close(unit=nu_cntrl)

       close(unit=nu_sum)


       stop
       end

       include 'c:\forprogs\smc_rw.for'
       include 'c:\forprogs\filter.for'
       include 'c:\forprogs\dcdt.for'
       include 'c:\forprogs\fbctpr.for'
       include 'c:\forprogs\fork.for'
       include 'c:\forprogs\ran1.for'
       include 'c:\forprogs\gasdev.for'
       include 'c:\forprogs\rd_calc.for'
       include 'c:\smsim\spctshap.for'
       include 'c:\smsim\scale.for'
       include 'c:\norm\code\calcas95.for'
       include 'c:\psv\progs\psvper_f.for'
       include 'c:\site_amp\bjfr2s_f.for'
```

```
      function BJFR2S_F(per)

* Returns the correction factor to apply to rock response spectra to obtain
* soil response spectra.  Based on work of 6/05/96; this is the
* ratio of the BJF94 spectra for V30=310 and V30=620 m/s, except that the
* value for per = 0.1 is used for all smaller periods and the per=1.0 value
* is used for periods longer than 1.0 sec.  Note that the latter is
* conservative; we expect the amplifications to reach unity for long enough
* periods (at least for Fourier spectra, what about for response spectra?)

* Dates: 06/05/96 - Written by D. Boore

      if(per .lt. 0.1) then
         bjfr2s_f = 10.0**cubic(0.1)
      else if (per .gt. 1.0) then
         bjfr2s_f = 10.0**cubic(1.0)
      else
         bjfr2s_f = 10.0**cubic(per)
      end if

      return
      end

      function cubic(per)
        a0 = 0.2102
        a1 = 0.0726
        a2 = -0.3142
        a3 = -0.2403
        x = alog10(per)
        cubic = a0 + a1*x + a2*x**2 + a3*x**3
      return
      end
```

```
      Program CHK_RS

*  Computes prv and prints oscillator time series
*  This program was written because I noticed a very large change in
*  PRV for Tcut = 70 vs Tcut=80, even though the displacement time series
*  both seemed to capture the long period energy (but an extra cycle for
*  Tcut=80).

*  Dates:  06/28/96 - Written by David M. Boore, using RS_VS_T.FOR and
*                     \forprogschk_rs\chk_rsts.for

      real real_head(50)
      integer int_head(48)
      character*80 char_head(11)
      character f_cntrl*40, f_sum*40, f_in*30
      character f_out*30, buf*80
      character col_head*80
      real accel(10000), ts_osc(10000,4), per_rs(4), rs(4)

      pi = 4.0 * atan(1.0)

      write(*,'(a\)') ' Enter name of control file:'
      f_cntrl = ' '
      read(*, '(a)') f_cntrl

      nu_cntrl = 20
      open(unit=nu_cntrl, file=f_cntrl, status='unknown')

      buf = ' '
      read(nu_cntrl, *) buf
      f_sum = ' '
      read(nu_cntrl, *) f_sum
      write(*,'(2a)') ' Summary file with name:', f_sum

      nu_sum = 30
      open(unit=nu_sum, file=f_sum, status='unknown')
      write(nu_sum, '(2a)') ' Control file: ', f_cntrl

      write(nu_sum, *) buf
      write(nu_sum, *) f_sum

      buf = ' '
      read(nu_cntrl, *) buf
      f_in = ' '
      read(nu_cntrl, *) f_in
      write(nu_sum, *) buf
      write(nu_sum, *) f_in

      buf = ' '
      read(nu_cntrl, *) buf
      f_out= ' '
      read(nu_cntrl, *) f_out
      write(nu_sum, *) buf
      write(nu_sum, *) f_out

      buf = ' '
      read(nu_cntrl,*) buf
      write(nu_sum, *) buf
      read(nu_cntrl,*) damp, nper
      write(nu_sum,*) damp, nper

* Extract the eq acceleration trace, samples per second,
* and number of samples:

      tskip = 0.0
      call ReadSMC(accel, n_in, sps, tskip,
     :             99, f_in,
     :             char_head, int_head, real_head)

      write(nu_sum, '(a, f5.1)') ' SPS = ', sps

      dt = 1.0/sps


      buf = ' '
      read(nu_cntrl, *) buf
      write(nu_sum, *) buf

      do i = 1, nper

        read(nu_cntrl, *) per
        write(nu_sum, *) per

* Compute response spectra
        per_rs(i) = per
        omega = 2.0*pi/per_rs(i)

        call rdcalcts(accel,n_in,omega,damp,dt,rd, ts_osc(1,i))
        rs(i) = omega*rd

      end do

* Write prv and ts_osc to output file:

      nu_out = 40
      open(unit=nu_out, file=f_out, status = 'unknown')

      col_head = ' '
      col_head(4:7) = 'time'
      col_head(13:18) = 'acc_in'
      write(*, '(a)') col_head
      do i = 1, nper
        col_head(i*11+18-6:i*11+18-5) = 'ts'
        write(col_head(i*11+18-4:i*11+18), '(f5.2)') per_rs(i)
      end do
      col_head(nper*11+18+11-2:nper*11+18+11) = 'per'
      col_head(nper*11+18+11+11-1:nper*11+18+11+11) = 'rs'

      write(nu_out, '(a)') col_head
      write(*, '(a)') col_head

      do i = 1, nper
        write(nu_out, '(1x,f6.2,1p7(1x,e10.3))')
     :  float(i-1)*dt, accel(i), (ts_osc(i,j), j=1, nper),
     :  per_rs(i), rs(i)
      end do

      do i = nper+1, n_in
        write(nu_out, '(1x,f6.2,1p7(1x,e10.3))')
     :  float(i-1)*dt, accel(i), (ts_osc(i,j), j=1, nper)
      end do

      close(unit=nu_out)

      close(unit=nu_cntrl)

      close(unit=nu_sum)


      stop
      end
```

```
      include 'c:\forprogs\smc_rw.for'
      include 'c:\forprogs\dcdt.for'
      include 'c:\forprogs\fbctpr.for'
      include 'c:\forprogs\rd_calc.for'


*----------------- BEGIN RDCALCTS ----------------------------
      subroutine rdcalcts(acc,na,omega,damp,dt,rd,ts)
* This is a modified version of "Quake.For", originally
* written by J.M. Roesset in 1971 and modified by
* Stavros A. Anagnostopoulos, Oct. 1986.  The formulation is that of
* Nigam and Jennings (BSSA, v. 59, 909-922, 1969).  This modification
* eliminates the computation of the relative velocity and absolute
* acceleration; it returns only the relative displacement.
* Dates: 05/06/95 - Modified by David M. Boore
*        04/15/96 - Changed name to RD_CALC and added comment lines
*                   indicating changed for storing the oscillator time series
*                   and computing the relative velocity and absolute
*                   acceleration
*        04/16/96 - This is RD_CALC, with the time series of the relative
*                   displacement added and the name changed

*   acc = acceleration time series
*    na = length of time series
* omega = 2*pi/per
*  damp = fractional damping (e.g., 0.05)
*    dt = time spacing of input
*    rd = relative displacement of oscillator

      dimension acc(*), ts(*)
      omt=omega*dt
      d2=1-damp*damp
      d2=sqrt(d2)
      bom=damp*omega
*       d3 = 2.*bom                   ! for aa
      omd=omega*d2
      om2=omega*omega
      omdt=omd*dt
      c1=1./om2
      c2=2.*damp/(om2*omt)
      c3=c1+c2
      c4=1./(omega*omt)
      ss=sin(omdt)
      cc=cos(omdt)
      bomt=damp*omt
      ee=exp(-bomt)
      ss=ss*ee
      cc=cc*ee
      s1=ss/omd
      s2=s1*bom
      s3=s2+cc
      a11=s3
      a12=s1
      a21=-om2*s1
      a22=cc-s2
      s4=c4*(1.-s3)
      s5=s1*c4+c2
      b11=s3*c3-s5
      b12=-c2*s3+s5-c1
      b21=-s1+s4
      b22=-s4
      rd=0.
*       rv = 0.                          ! for rv
*       aa = 0.                          ! for aa
      n1=na-1
      y=0.
      ydot=0.
      do i=1,n1
        y1=a11*y+a12*ydot+b11*acc(i)+b12*acc(i+1)
        ydot=a21*y+a22*ydot+b21*acc(i)+b22*acc(i+1)
        y=y1    ! y is the oscillator output at time corresponding to index i
        ts(i) = y
        z=abs(y)
        if (z.gt.rd) rd=z
*         z1 = abs(ydot)                 ! for rv
*         if (z1.gt.rv) rv = z1          ! for rv
*         ra = -d3*ydot -om2*y1          ! for aa
*         z2 = abs(ra)                   ! for aa
*         if (z2.gt.aa) aa = z2          ! for aa
      end do
      return
      end
*----------------- END RDCALCTS ----------------------------
```

```
      program convert
c
      character*80    heading(25)
      real            acc(20000), t(0:5)
      data            eclat / 33.726 /, eclon / 119.118 /
     .                period / 0.0012 /, damp / 0.5 /
c
      read ( 1, 901 ) heading
      write( 2, 904 ) ( heading(i), i=3,4 )
c
      read ( 1, 902 ) npoints, month, nday, nyear,
     .                 nhour, min, nsec, msec,
     .                 nsite, latdeg, latmin, latsec,
     .                        londeg, lonmin, lonsec, naxis
c
      flat = real(latdeg) + real(latmin)/60.0 + real(latsec)/3600.0
      flon = real(londeg) + real(lonmin)/60.0 + real(lonsec)/3600.0
      write( 2, 1001 ) nsite, flat, flon
c
      if( naxis .eq. 1 ) write( 2, 1002 ) 'VERT'
      if( naxis .eq. 2 ) write( 2, 1002 ) 'NORT'
      if( naxis .eq. 3 ) write( 2, 1002 ) 'EAST'
c
      write( 2, 1003 )
      write( 2, 1004 ) eclat, eclon
      write( 2, 1005 ) period, damp
      duration = real( npoints )/100.0
      write( 2, 1006 ) npoints, duration
      write( 2, 1007 )
c
      read ( 1, 903 ) ( acc(i), i=1,npoints )
c
      rms = 0.0
c
      do 10 i = 1, npoints
   10         rms = rms + acc(i)**2
c
      rms = sqrt( rms/real( npoints ) )
      write( 2, 1008 ) rms
c
      write( 2, 1009 ) month, nday, 19, nyear, nhour, min,
     .                 npoints, period, damp, duration, rms,
     .                 flat, flon, eclat, eclon
c
      t(0) = -0.01
      do 30 i = 1, npoints, 5
              do 20 j = 1,5
   20                 t(j) = t(j-1) + 0.01
              ncnt = ncnt + 1
              write( 2, 1010 ) ( t(j), acc(i+j-1), j=1,5 ), ncnt
   30         t(0) = 0.01*real( 5*ncnt - 1 )
c
      if( 5*ncnt .lt. npoints ) then
              i = 5*ncnt
              n = npoints - i
              do 40 j = 1,n
   40                 t(j) = t(j-1) + 0.01
              do 50 j = n+1, 5
                      acc(i+j) = 0.0
   50                 t(j) = 0.0
              ncnt = ncnt + 1
              write( 2, 1011 ) ( t(j), acc(i+j-1), j=1,4 ),
     .                         '      I', '      I', ncnt
      endif
c
  901 format ( a2000 )
  902 format ( 16i5 )
  903 format ( 2p10f8.0 )
  904 format ( 2(a80/) )
 1001 format ( 'STATION NO.', i6, f9.3, ' N,', f9.3, ' W' )
 1002 format ( 'COMP', 1X, a4 )
 1003 format ( 'SANTA BARABRA ISLAND EARTHQUAKE',
     .                     1X, 'OF SEPTEMBER 4, 1981-1551' )
 1004 format ( 'EPICENTER', f9.3, ' N,', f9.3, ' W' )
 1005 format ( 'INSTR PERIOD =', F6.4, '  SEC  DAMPING =', F6.3 )
 1006 format ( 'NO. OF POINTS =', I5, '   DURATION =', F7.3, ' SEC' )
 1007 format ( 'UNITS ARE SEC AND G/10' )
 1008 format ( 'RMS ACCLN OF COMPLETE RECORD =', F7.4, ' G/10' )
 1009 format ( 6i2, i5, f7.4, 7f8.3 )
 1010 format ( 10f7.3, i10 )
 1011 format ( 8f7.3, 2a7,i10 )
c
      end
```

```
      Program Corr4LC

* Corrects the SEMS 2 data recorded off of Long Beach for the low cut
* filter (a single pole filter with corner frequency at 1 Hz, such that
* the response is down 3 db at 1 Hz and falls off at 6 db/octave, according
* to a letter from Gerry Sleefe, dated May 4, 1992).
* As part of the correction I also apply another lowcut with fc = 0.1 Hz.

* Dates: 09/05/95 - Written by D. Boore

      real data(17000), real_head(50)
      integer int_head(48)
      complex work(17000), filt_lc
      character buf*80, buf_in*12, buf_out*12

* Get file with file names:
      write(*, '(a\)') ' Enter name of file with filenames: '
      buf = ' '
      read(*, '(a)') buf

      nu_in = 10
      open(unit=nu_in, file=buf, status='unknown')

* Process a record

1000  continue

      buf_in = ' '
      buf_out = ' '
      read(nu_in, '(t1,a,t14,a)') buf_in, buf_out
      if (buf_in(2:5) .eq. 'STOP' .or.
     :         buf_in(2:5) .eq. 'stop') goto 9999

      nu_data = 12
      nu_out = 14
      open(nu_data, file=buf_in, status='unknown')
      open(nu_out, file=buf_out, status='unknown')
      do i = 1, 10
        buf = ' '
        read(nu_data, '(a)') buf
        write(nu_out, '(a)') buf
      end do
        buf = ' '
        read(nu_data, '(a)') buf
        write(nu_out, '(a)')
     :     '*  Corrected for 1 pole, 1 Hz, low cut filter'
      read(nu_data, '(8i10)') (int_head(i), i = 1, 48)
      write(nu_out, '(8i10)') (int_head(i), i = 1, 48)
      read(nu_data, '(5e15.7)') (real_head(i), i = 1, 50)
      write(nu_out, '(5e15.7)') (real_head(i), i = 1, 50)
      npts = int_head(17)
      sps = real_head(2)
      dt = 1.0/sps
      read(nu_data, '(8(1pe10.4e1))') (data(i), i = 1, npts)
      close(unit=nu_data)

* Remove dc, add zeros:

      call dcdt(data, dt, npts, 1, npts, .true., .false.)

      iprcntfrtaper = 5
      ifront = iprcntfrtaper
      iback = iprcntfrtaper
      call fbctpr(ifront, iback, data, npts)
      ntotin = npts
      call zeropad2( data, npts, ntotin, npw2)

      delf = 1.0/(float(npw2)*dt)

      npw2d2 = npw2/2
      nnyq = npw2d2+1
      write(*,'(a, 3i6, f8.4)')
     :      ' npts, npw2, nnyq, dt = ', npts, npw2, nnyq, dt

      do i = 1, npw2
        work(i) = cmplx(data(i), 0.0)
      end do

      call fork(npw2,work,+1.)


*      fc = 0.0
*      fcl = 0.0
      fc = 1.0
      fcl = 0.1
      npoles = 2

      do i=2,nnyq
        f = delf*float(i-1)
        work(i) = work(i)
     :  * filt_lc(f, fcl, npoles)/filt_lc(f, fc, 1)   ! Apply l.c., avoid div 0
      end do

C...Enforce correct symmetry.
      work(nnyq) = cmplx(real(work(nnyq)),0.0)

      do i=npw2,nnyq+1,-1
        work(i) = conjg(work(npw2-i+2))
      end do

      call fork(npw2,work,-1.)

*      sfact = 1.0/(sqrt(float(npw2))*dt) ! not needed: started from time domain
      sfact = 1.0

      write(nu_out, '(8(1pe10.4e1))')
     :     (sfact*real(work(i)), i = 1, npts)

      close(unit=nu_out)

      goto 1000
9999  continue

      close(unit=nu_in)

      stop
      end

* <<<<<<<<< BEGIN FILT_LC >>>>>>>>>>>>>>>>>>>>>>>>>>>>
      complex function filt_lc(f, fc, npoles)
      complex ci
      ci = (0.0, 1.0)
      if (fc .le. 0.0) then
        filt_lc = 1.0
        return
      end if
      filt_lc = ((-ci*(f/fc))/(1.0-ci*(f/fc)))**npoles
      return
      end
* <<<<<<<<< END FILT_LC >>>>>>>>>>>>>>>>>>>>>>>>>>>>

* <<<<<<<<< BEGIN FORK >>>>>>>>>>>>>>>>>>>>>>>>>>>>
```

```
      SUBROUTINE FORK(LX,CX,SIGNI)
C FAST FOURIER                                  2/15/69
C                          LX
C    CX(K) = SQRT(1.0/LX)* SUM (CX(J)*EXP(2*PI*SIGNI*I*(J-1)*(K-1)/LX))
C                          J=1                         FOR K=1,2,...,LX
C
C  THE SCALING BETWEEN FFT AND EQUIVALENT CONTINUUM OUTPUTS
C  IS AS FOLLOWS.
C
C
C     GOING FROM TIME TO FREQUENCY:
C             F(W)=DT*SQRT(LX)*CX(K)
C
C                  WHERE W(K)=2.0*PI*(K-1)/(LX*DT)
C
C
C     GOING FROM FREQUENCY TO TIME, WHERE THE FREQUENCY
C     SPECTRUM IS GIVEN BY THE DIGITIZED CONTINUUM SPECTRUM:
C
C             F(T)=SQRT(LX)/(LX*DT)*CX(K)
C                  WHERE T(K)=(K-1)*DT
C
C
C  THE RESULT OF THE SEQUENCE...TIME TO FREQUENCY,POSSIBLE MODIFICATIONS
C  OF THE SPECTRUM (FOR FILTERING,ETC.), BACK TO TIME...
C  REQUIRES NO SCALING.
C
C
C  THIS VERSION HAS A SLIGHT MODIFICATION TO SAVE SOME TIME...
C  IT TAKES THE FACTOR 3.1415926*SIGNI/L OUTSIDE A DO LOOP (D.BOORE 12/8
C  FOLLOWING A SUGGESTION BY HENRY SWANGER).
C
      COMPLEX CX,CARG,CEXP,CW,CTEMP
      DIMENSION CX(LX)
      J=1
      SC=SQRT(1./LX)
      DO 5 I=1,LX
      IF(I.GT.J) GO TO 2
      CTEMP=CX(J)*SC
      CX(J)=CX(I)*SC
      CX(I)=CTEMP
 2    M=LX/2
 3    IF(J.LE.M) GO TO 5
      J=J-M
      M=M/2
      IF(M.GE.1) GO TO 3
 5    J=J+M
      L=1
 6    ISTEP=2*L
      TEMP=3.14159265*SIGNI/L
      DO 8 M=1,L
      CARG=(0.,1.)*TEMP*(M-1)
      CW=CEXP(CARG)
      DO 8 I=M,LX,ISTEP
      CTEMP=CW*CX(I+L)
      CX(I+L)=CX(I)-CTEMP
 8    CX(I)=CX(I)+CTEMP
      L=ISTEP
      IF(L.LT.LX) GO TO 6
 9    RETURN
      END
* <<<<<<<<< END FORK >>>>>>>>>>>>>>>>>>>>>>>>>>>>


* <<<<<<<<< BEGIN DCDT >>>>>>>>>>>>>>>>>>>>>>>>>>>
      SUBROUTINE DCDT (Y,DT,NPTS,INDX1,INDX2,LDC,LDT)
c+
c  DCDT - Fits DC or trend between indices INDX1 and INDX2.
C         Then removes DC or detrends whole trace.
c         Y is real, DT = delta t.
c         If remove DC, LDC = .TRUE.
c         IF detrend, LDT = .TRUE.
c-
      real Y(1)
      logical LDC,LDT
c
c...Fit DC and trend between indices INDX1 and INDX2.
100   NSUM = INDX2-INDX1+1
      SUMX = 0.0
      SUMX2 = 0.0
      SUMY = 0.0
      SUMXY = 0.0
      DO 200 I=INDX1,INDX2
         XSUBI = (I-1)*DT
         SUMXY = SUMXY+XSUBI*Y(I)
         SUMX = SUMX+XSUBI
         SUMX2 = SUMX2+XSUBI*XSUBI
200      SUMY = SUMY+Y(I)
C
C... Remove DC.
300   IF (LDC) THEN
        AVY = SUMY/NSUM
        DO 360 I=1,NPTS
360        Y(I) = Y(I)-AVY
        RETURN
      ENDIF
C
C... Detrend. See Draper and Smith, p. 10.
400   IF (LDT) THEN
        BXY = (SUMXY-SUMX*SUMY/NSUM)/(SUMX2-SUMX*SUMX/NSUM)
        AXY = (SUMY-BXY*SUMX)/NSUM
        QXY = DT*BXY
        DO 450 I=1,NPTS
450        Y(I) = Y(I)-(AXY+(I-1)*QXY)
        RETURN
      ENDIF
C
      STOP
      END
* <<<<<<<<< END DCDT >>>>>>>>>>>>>>>>>>>>>>>>>>>>

* <<<<<<<<< BEGIN FBCTPR >>>>>>>>>>>>>>>>>>>>>>>>>>
      subroutine FBCTPR (IFRONT,IBACK,Z,NZ)

c  Apply IFRONT% and IBACK% cosine tapers to ends of time series array Z.
c  Written by Chuck Mueller, USGS.
c  Modified by D. M. Boore on 8/31/88 to eliminate the use of ZNULL;
c  see FBCTPR_CSM for the original version.

*  Dates:  2/13/90 - if ifront or iback is zero, do not apply a taper.

      real Z(*)

      PI = 4.0*ATAN(1.0)
      LZ = NZ*(IFRONT/100.)

      if (lz .lt. 1) lz = 1

      SF = PI/LZ
      do 1 I=1,LZ
c        if (Z(I).eq.ZNULL) goto 1
         F = 0.5*(1.0-COS(SF*(I-1)))
```

```
         Z(I) = Z(I)*F
1        continue
      LZ = NZ*(IBACK/100.)

      if (lz .lt. 1) lz = 1


      SF = PI/LZ
      do 2 I=NZ,NZ-LZ+1,-1
c         if (Z(I).eq.ZNULL) goto 2
         F = 0.5*(1.0-COS(SF*(NZ-I)))
         Z(I) = Z(I)*F
2        continue

      return
      end
* <<<<<<<<< END FBCTPR >>>>>>>>>>>>>>>>>>>>>>>>>>>

* <<<<<<<<< BEGIN ZEROPAD2 >>>>>>>>>>>>>>>>>>>>>>>>>>>
      subroutine ZEROPAD2 (Y,NIN,NTOTIN,NPW2)

c Calculates NPW2, the next power-of-2 greater than NTOTIN.
c Pads time-series array Y with (NPW2-NIN) zeroes.  With this program
c the window of the data, which determines NIN, can be different
c for different time series, yet the overall length of
c the time series used in the FFT can
c be the same (determined by NTOTIN), thus guaranteeing
c that the frequencies for which FFT
c values are computed are the same.
c I assume that the user makes sure that NTOTIN .ge. NIN.
c Written by Chuck MUeller, USGS; modified by Dave Boore,
c 5/1/87.

      real Y(*)

      npw2 = 2
1     if ( npw2 .lt. ntotin) then
           npw2 = 2 * npw2
           go to 1
      endif

      do 20 I=NIN+1,NPW2
20       Y(I) = 0.0

      return
      end
* <<<<<<<<< END ZEROPAD2 >>>>>>>>>>>>>>>>>>>>>>>>>>>
```

```
c Program FASRATIO

c Computes the ratio of Fourier amplitude spectra for specified time series.
* The program reads a list of time series, and an output
* file containing the spectral ratios is written.
* A summary file is also created.  The intended use is to provide input to
* CoPlot on the PC.

* The time series to be used in the ratio are given in sequential lines, with
* a blank line between ratios

* Assumptions:

*    * number of frequency output points is less than 5000.
*    * the number of time series is 22 or less (so that recl = 255 is ok,
*        the restriction on number of time series can be easily changed by
*        changing recl in the open statements).

* Some Day List:

*    * Adjust the record length in the open statement based on
*        number of time series (2/01/93)

* Dates:  2/01/93 - Written by D. M. Boore, using TS2FAS.FOR as
*                   a guide, which in turn uses BH_SPECT.FOR (on samoa,
*                   in PUB1:[BOORE.FORTRAN]) as a template, which in turn
*                   was based on TS2FAS2ASCII.FOR.  The current program is
*                   an improved version of TS2FAS2ASCII, in that no
*                   assumptions are made about the input time series file name.
*                   It is also a simplified version because of the assumption
*                   of the same dt and df.  This allows the use of only one
*                   column in the output file for the time and frequency
*                   values.
*         2/05/93 - Used Chuck Mueller's subroutines RCC, RCF, RCI to
*                   allow the use of a file name of unspecified length.
*                   To use his programs, link to
*                   PUB2:[MUELLER.FS.GEN]CSMGENLB/LIBR.
*         2/05/93 - Include interpolation for specified df_intrp,
*                   f_intrp_low, and f_intrp_high.  This will
*                   reduce the length of the output files and
*                   will allow for different frequency spacings
*                   for each spectra.
c
c Dimension and declaration statements:

      real fas1(5000), fas2(5000), ratio(5000,22),
     :     freq_out(5000)

      integer  prcntfrtaper1, prcntfrtaper2, record_length

      character bufd*9, buft*8, reply*40, buffer*80,
     :        path_in*60, ts_name1*80, ts_name2*80,
     :        bigbuf*380, fname*80

c Initializations:

       nread  = 3
       nwrite_rat= 20
       nsummary = 7
       record_length = 255

c Date and time stamp:

      call date(bufd)
      call time(buft)

c Open I/O units:

      reply = ' '
      type 511
511   format('$Enter input file name:')
      accept 512, nch, reply
512   format( q, a)
      open(unit=nread, file=reply, status='old',
     :     readonly)


      reply = ' '
      type 515
515   format('$Enter summary file name:')
      accept 512, nch, reply
      open(unit=nsummary, file=reply, carriagecontrol='list',
     :     status='new')

      reply = ' '
      type 514
514   format('$Enter name of file for spectral ratio output:')
      accept 512, nch, reply
      open(unit=nwrite_rat, file=reply, recl= record_length,
     :     carriagecontrol='list', status='new')


* Read interpolation parameters:

      buffer = ' '

      read (nread, '(a)', end=9999) buffer

      call RCF(1, buffer, 80, df_intrp    , istat)
      call RCF(2, buffer, 80, f_intrp_low , istat)
      call RCF(3, buffer, 80, f_intrp_high, istat)

* Set up the frequency array:

      mspct = (f_intrp_high-f_intrp_low)/df_intrp + 1

      do i = 1, mspct
        freq_out(i) = float(i-1) * df_intrp + f_intrp_low
      end do

      write(nsummary, '(1x,a,f5.3,a,f6.2,a,i4)' )
     :       ' df_intrp= '     , df_intrp,
     :       ' f_intrp_high= ' , f_intrp_high,
     :       ' mspct= '        , mspct

c Read path name

      path_in = ' '

      read(nread,'(1x,a)') path_in

      write(*,'(1x,a)') 'Path='//path_in

c
c-----------------------------------------------------------------
c LOOP OVER RATIOS.
c

      nrat = 0

1000  continue
```

```
* Read 2 lines, each with a filename, start times, window length,
* percent taper at front (the back taper is assumed to be the same length),
* and the smoothing (in terms of the width of the smoothing window
* in Hz).
* A blank line separates each pair.
* Mark the end of the list with a line having "stop" starting on column 2.


* Read numerator, checking for STOP:

      buffer = ' '

      read (nread, '(a)', end=9999) buffer

      if(buffer(2:5) .eq. 'stop'
     : .or. buffer(2:5) .eq. 'STOP') go to 9999

      nrat = nrat+ 1

* Now extract the filename, start time, window length, etc:

      call RCC(1, buffer, 80, ts_name1      , nc)
      call RCF(2, buffer, 80, tstartsignal1 , istat)
      call RCF(3, buffer, 80, tlengthsignal1, istat)
      call RCI(4, buffer, 80, prcntfrtaper1 , istat)
      call RCF(5, buffer, 80, smoo1         , istat)


* Read denominator and extract fields:

      buffer = ' '

      read (nread, '(a)', end=9999) buffer

      call RCC(1, buffer, 80, ts_name2      , nc)
      call RCF(2, buffer, 80, tstartsignal2 , istat)
      call RCF(3, buffer, 80, tlengthsignal2, istat)
      call RCI(4, buffer, 80, prcntfrtaper2 , istat)
      call RCF(5, buffer, 80, smoo2         , istat)

* Remove blanks from file names (RMBLNK is in
* pub1:[agram.agramlib]agramlib/libr).

      call RMBLNK( 3, path_in , newendpi)
      call RMBLNK( 3, ts_name1, newend1)
      call RMBLNK( 3, ts_name2, newend2)

* Get the smoothed spectrum of file 1:

      fname = ' '
      fname = path_in(1:newendpi)//ts_name1(1:newend1)

      call Get_Spectrum(fname,
     :     tstartsignal1, tlengthsignal1, prcntfrtaper1, smoo1,
     :     dt, npts, npw2, df, fas1,
     :     freq_out, mspct, nsummary)


* Get the smoothed spectrum of file 2:

      fname = ' '
      fname = path_in(1:newendpi)//ts_name2(1:newend2)

      call Get_Spectrum(fname,
     :     tstartsignal2, tlengthsignal2, prcntfrtaper2, smoo2,
     :     dt, npts, npw2, df, fas2,
     :     freq_out, mspct, nsummary)

* Compute the spectral ratio

      do ifreq = 1, mspct

        if (fas2(ifreq) .eq. 0.) then
           denom = 1.0e-20
        else
           denom = fas2(ifreq)
        end if

        ratio(ifreq, nrat) = fas1(ifreq)/denom

      end do


c Loop back for another station

* First skip past the blank line (and check for a STOP)

      buffer = ' '

      read (nread, '(a)', end=9999) buffer

      if(buffer(2:5) .eq. 'stop'
     : .or. buffer(2:5) .eq. 'STOP') go to 9999

      go to 1000

9999  continue

* Close input file

      close(unit=nread)

* Write Fourier spectral ratio to a file:

*   First write the header:

      bigbuf = ' '
      bigbuf(5:8) = 'FREQ'

      do irat = 1, nrat
        iseg = 11*(irat-1)
        bigbuf(iseg+12:iseg+17) = 'RATIO '
        write(bigbuf(iseg+18:iseg+19),'(i2)') irat
      end do

      write(nwrite_rat, '(a)') bigbuf(1:record_length)


*   Now write the Fourier spectral ratios:

      do i = 1, mspct

        bigbuf = ' '

        write(bigbuf(2:8),'(f7.3)')
     :          freq_out(i)

        do irat = 1, nrat
          iseg = 11*(irat-1)
          write(bigbuf(iseg+10:iseg+19),'(1pe10.3)')
```

```
     :          ratio(i,irat)
        enddo

        write(nwrite_rat, '(a)') bigbuf(1:record_length)

      end do

* Close file containing the Fourier spectral ratios

      close(unit=nwrite_rat)

* Close summary file

      close(unit=nsummary)

      stop
      end

*########################################################
      subroutine Get_Spectrum(fname,
     :     tstartsignal, tlengthsignal,prcntfrtaper, smoo,
     :     dt, npts, npw2, df, spect_out,
     :     freq_out, mspct, nsummary)

* Note that this version of Get_Spectrum includes smoo rather than nhits
* in the argument list (nhits is an argument of the version of
* Get_Spectrum in BH_SPECT).  In all cases Get_Spectrum is bundled
* with the main program, so changes in the arguments should not lead to
* confusion.

      real spect_out(*), freq_out(*)
      real data(16400), freq(8200), spect(16400)

      integer  prcntfrtaper

      character fname*80

c Initializations:

       ndimen = 16400
       iudata = 4

      write(*,'(1x,a)') 'Processing file:'//fname

      write(*,'(2(1x,f7.3), 1x,i2,1x,f5.2)') tstartsignal,
     :               tlengthsignal, prcntfrtaper, smoo

      write (nsummary, 30) fname,
     *                       tstartsignal,tlengthsignal,
     :                       prcntfrtaper, smoo

30    format(1x,'data file= ',a/
     : 3x,'signal: start=',f7.3,' length=',f7.3,
     : ' prcnttaper= ', i2, ' smoo= ',f5.2)

* Open time series file:

      open(unit=iudata,file=fname,access='direct',status='old',
     1     readonly,recordsize=128,
     2     associatevariable=iav)

* Read the data:

      call dreadd(fname,data,ndimen,tstartsignal,tlengthsignal,
     *           dt,npts,iudata,
     *           iudbs, iav, 1, ierr)

      close(unit=iudata)

      write(nsummary,4210) dt, npts
4210  format(3x,'signal: dt=',f7.4,' npts=',i5,30('.'))

* Compute the Fourier spectra:

      call Abs_Spectra(data, dt, npts, prcntfrtaper,
     :                 spect, npw2, df)

      write(nsummary,4211) df, npw2
4211  format(3x,'spectra: df=',f7.4,' npw2=',i5,30('.'))

* Smooth the spectra

      ihwid = int( smoo/(2*df) )
      if (ihwid .lt. 1) ihwid = 1
      call SMTHS (spect, npw2, df, ihwid, 1)

* Interpolate to specified frequencies:

* First set up the frequency array for the spectra:

      nfreq = npw2/2
      do i = 1, nfreq
        freq(i) = float(i-1)*df
      end do

* Now interpolate

      do i = 1, mspct
         spect_out(i) = yintrf(freq_out(i), freq, spect, nfreq)
      end do

      return
      end
```

```
      Program Fit_AS

*  Makes column files as part of finding parameters needed to fit
*  Atkinson and Silva Fourier spectral ratios.

*  Dates:  06/01/96 - Written by David M. Boore
*          06/04/96 - Incorporate the scaling I derived

      real freq(13), x0(13), x1(13), x2(13), freq_fit(200)
      real stress(10), fbdfa(10), mcrit(10), ratio_fit(10)
      real fasml(10), fbsml(10), fabig(10), fbbig(10), eps(10)
      real fasml_as, fbsml_as, fabig_as, fbbig_as,
     :     eps_sml_as, eps_big_as

      character f_out*30, col_head(10)*5
      real msml, mbig, m0sml, m0big

      data
     :  freq/ 0.20 ,  0.28 ,  0.40 ,  0.56 ,  0.79 ,  1.1  ,
     :        1.6  ,  2.2  ,  3.2  ,  4.5  ,  6.3  ,  8.9  ,  12.6/,
     :    x0/ 1.92 ,  1.96 ,  2.10 ,  2.18 ,  2.41 ,  2.46 ,
     :        2.60 ,  2.65 ,  2.68 ,  2.66 ,  2.56 ,  2.35 ,  2.14 /,
     :    x1/ 0.628,  0.621,  0.730,  0.587,  0.599,  0.534,
     :        0.473,  0.415,  0.366,  0.347,  0.326,  0.296,  0.268/,
     :    x2/-0.017, -0.032, -0.113, -0.003, -0.060, -0.048, -0.108,
     :       -0.114, -0.067, -0.053, -0.058, -0.044,  0.015/

      pi = 4.0 * atan(1.0)
      nfreq = 13

      freq_start = 0.01
      freq_stop = 100.0
      nfreq_fit = 100
      dlogf = (alog10(freq_stop/freq_start))/(nfreq_fit - 1)
      do i = 1, nfreq_fit
        freq_fit(i) = 10.0**(alog10(freq_start)+float(i-1)*dlogf)
      end do

* First read in the magnitudes of the source and target events:

      write(*, '(a\)') ' Enter magnitude of the small event:'
      read(*, '(f5.0)') msml

      write(*, '(a\)') ' Enter magnitude of the target event:'
      read(*, '(f5.0)') mbig

      write(*, '(a\)') ' Enter type of scaling (1=Brune, 2=Joyner):'
      read(*, '(i1)') iscale

* Get source info:

      write(*, '(a\)') ' Source shear velocity:'
      read(*, '(f7.0)') beta

      write(*, '(a\)') ' Enter number of trials:'
      read(*, *) nfit

      write(*,*)
      do ifit = 1, nfit
        write(*, '(a\)') ' Enter stress parameter:'
        read(*, '(f7.0)') stress(ifit)
      end do

      if (iscale .eq. 2) then
        do ifit = 1, nfit
          write(*, '(a\)') ' Enter fbdfa:'
          read(*, '(f7.0)') fbdfa(ifit)
        end do

        do ifit = 1, nfit
          write(*, '(a\)') ' Enter mcrit:'
          read(*, '(f7.0)') mcrit(ifit)
        end do
      end if

* Compute the source corners:

      do ifit = 1, nfit
        call scale( msml, m0sml, fasml(ifit), fbsml(ifit), eps(ifit),
     :     stress(ifit), beta, fbdfa(ifit), mcrit(ifit), iscale)

        call scale( mbig, m0big, fabig(ifit), fbbig(ifit), eps(ifit),
     :     stress(ifit), beta, fbdfa(ifit), mcrit(ifit), iscale)

        write(*,*)
        write(*, '(a, i3)')  '   ifit = ', ifit
        write(*, '(a,f7.2)') '   Stress= ', stress(ifit)
        write(*, '(a,f5.2)') '   Beta= ', beta
        write(*, '(a,f5.2)') '   Mag of small eq= ', msml
        write(*, '(a,f6.2)')
     :       '   Duration of small eq= ', 1.0/fasml(ifit)
        write(*, '(a,f5.2)') '   Mag of big eq= ', mbig
        write(*, '(a,f6.2)')
     :       '   Duration of big eq  = ', 1.0/fabig(ifit)

      end do

      call scale( msml, m0sml, fasml_as,
     :     fbsml_as, eps_sml_as,
     :     dum1, beta, dum2, dum3, 3)

      call scale( mbig, m0big, fabig_as,
     :     fbbig_as, eps_big_as,
     :     dum1, beta, dum2, dum3, 3)

* Special case, use eps_big_as calculated as per 6/03/96 handwritten notes
*     if (mbig .eq. 7.5) then
*        eps_big_as = 0.00867
*        eps_big_as = 0.006
*     end if
*      eps_sml_as = 10.0**(3.628 - 0.780*msml)
*      eps_big_as = 10.0**(3.628 - 0.780*mbig)
      eps_sml_as = 10.0**(3.440 - 0.746*msml)
      eps_big_as = 10.0**(3.440 - 0.746*mbig)

* Open output file and write column headings:
      nu_out = 10

      write(*,*)
      write(*, '(a\)') ' Enter name of output file:'
      f_out = ' '
      read(*, '(a)') f_out

      open(unit = nu_out, file = f_out, status = 'unknown')
      write(nu_out, '(a, 3f7.2)') ' msmall, mbig, beta = ',
     :  msml, mbig, beta
      write(nu_out, '(a, 10(1x,f6.1))') ' stress = ',
     :  (stress(j), j = 1, nfit)
      write(nu_out, '(a, 10(1x,f6.1))') ' fbdfa  = ',
     :  (fbdfa(j), j = 1, nfit)
      write(nu_out, '(a, 10(1x,f6.1))') ' mcrit  = ',
     :  (mcrit(j), j = 1, nfit)
```

```
      write(nu_out, '(a, 1p10(1x,e10.3))') ' fasml  = ',
     :   (fasml(j), j = 1, nfit)
      write(nu_out, '(a, 1p10(1x,e10.3))') ' fbsml  = ',
     :   (fbsml(j), j = 1, nfit)
      write(nu_out, '(a, 1p10(1x,e10.3))') ' fabig  = ',
     :   (fabig(j), j = 1, nfit)
      write(nu_out, '(a, 1p10(1x,e10.3))') ' fbbig  = ',
     :   (fbbig(j), j = 1, nfit)
      write(nu_out, '(a, 1p10(1x,e10.3))') ' fasml_as  = ', fasml_as
      write(nu_out, '(a, 1p10(1x,e10.3))') ' fbsml_as  = ', fbsml_as
      write(nu_out, '(a, 1p10(1x,e10.3))') ' eps_sml_as = ',
     :                                       eps_sml_as
      write(nu_out, '(a, 1p10(1x,e10.3))') ' fabig_as  = ', fabig_as
      write(nu_out, '(a, 1p10(1x,e10.3))') ' fbbig_as  = ', fbbig_as
      write(nu_out, '(a, 1p10(1x,e10.3))') ' eps_big_as  = ',
     :                                       eps_big_as
      do j = 1, nfit
        col_head(j)(1:3) = 'col'
        write(col_head(j)(4:5), '(i2.2)') j
      end do
      write(nu_out, '(t8,a, t20,a, t28,a, t37,a, t48,a, 10(6x,a))')
     :  'freq', 'emp', 'ln_emp', 'freq_fit', 'as_eq(7)',
     :   (col_head(j), j = 1, nfit)

* Compute ratios and print:
* Separate into two ranges (empirical over a smaller range than fitted).
      do i = 1, nfreq
       f = freq(i)
       ratio_emp =
     :            10.0**(x0(i)+x1(i)*(mbig-6.0)+x2(i)*(mbig-6.0)**2)/
     :            10.0**(x0(i)+x1(i)*(msml-6.0)+x2(i)*(msml-6.0)**2)
       f_fit = freq_fit(i)
       ratio_fit_as =
     :     source(f_fit, m0big, fabig_as, fbbig_as,
     :        eps_big_as, 3)/
     :     source(f_fit, m0sml, fasml_as, fbsml_as,
     :        eps_sml_as, 3)
       do j = 1, nfit
         ratio_fit(j) =
     :     source(f_fit, m0big, fabig(j), fbbig(j), eps(j), iscale)/
     :     source(f_fit, m0sml, fasml(j), fbsml(j), eps(j), iscale)
       end do
       write(nu_out, '(1p15(1x,e10.3))')
     :   f, ratio_emp, alog(ratio_emp),
     :   f_fit, ratio_fit_as, (ratio_fit(j), j = 1, nfit)
      end do

      do i = nfreq+1, nfreq_fit
       f_fit = freq_fit(i)
       ratio_fit_as =
     :     source(f_fit, m0big, fabig_as, fbbig_as,
     :        eps_big_as, 3)/
     :     source(f_fit, m0sml, fasml_as, fbsml_as,
     :        eps_sml_as, 3)
       do j = 1, nfit
         ratio_fit(j) =
     :     source(f_fit, m0big, fabig(j), fbbig(j), eps(j), iscale)/
     :     source(f_fit, m0sml, fasml(j), fbsml(j), eps(j), iscale)
       end do
       write(nu_out, '(t11,a,t22,a,t33,a,1p12(1x,e10.3))')
     :   '.', '.', '.',
     :   f_fit, ratio_fit_as, (ratio_fit(j), j = 1, nfit)
      end do

      close(unit=nu_out)

      stop
      end

c-----------------------------------------------------

      subroutine SCALE( m, m0, fa, fb, eps, stress,
     :                  beta, fbdfa, mc, iscale)

      real m, m0, mc, m0c
c
c computes moment and corner frequencies from moment magnitude
c and stress drop.
c
      m0 = 10.0 ** ( 1.5*m + 16.05 )

      goto (10, 20, 30) iscale

10    continue      ! Brune
        fa = (4.906e+06) * beta * (stress/m0)**(1.0/3.0)
        fb = fa
        eps = 0.0
      return

20    continue      ! Joyner
        m0c = 10.0 ** ( 1.5*mc + 16.05 )
        rat = stress/m0
        dum = 4.906e+06
        if ( m0 .gt. m0c ) rat = stress/m0c
        fb = ( dum*beta ) * ( fbdfa )**(3./4.) * ( rat )**(1./3.)
        fa = ( dum*beta ) * (stress)**(1./3.) * (m0c)**(1./6.)
     *       * ( fbdfa )**(-0.25) * ( m0 )**(-0.5)
        if ( m0 .lt. m0c ) fa = fb / fbdfa
        eps = 0.0
      return

30    continue     ! Atkinson and Silva
        fa = 10.0**(2.181 - 0.496 * m)
        fb = 10.0**(1.778 - 0.302 * m)
        eps = 10.0**(2.764 - 0.623 * m)
      return

      end

c-----------------------------------------------------

      function filter(f, fl, fh)

      pi = 4.0 * atan(1.0)
      eps = 0.5
      eta = 2.0

      if (f .gt. fl .and. f .lt. fh) then
         filter = 1.0
         return
      end if

      if ( f .le. eps*fl) then
         filter = 0.0
         return
      end if

      if ( f .le. fl) then
         filter = 0.5*( 1.0+cos( pi*(f-fl)/( fl*(1.0-eps) ) ) )
         return
      end if
```

```
      if ( f .ge. eta*fh) then
         filter = 0.0
         return
      end if

      if ( f .ge. fh) then
         filter = 0.5*( 1.0+cos( pi*(f-fh)/( fh*(eta-1.0) ) ) )
         return
      endif

      return
      end

c-----------------------------------------------------------------------

      function source(f, m0, fa, fb, eps, iscale)

      real m0

      goto (601, 602, 603) iscale

* iscale=1: Brune model
601   sb = 1.0
      sa = 1.0/( 1.0 + (f/fa)**2.0 )
      goto 699

* iscale=2: Joyner model
602   sb = 1.0/ ( 1.0 + (f/fb)**2 )**0.25
      sa = 1.0/ ( 1.0 + (f/fa)**2 )**0.75
      goto 699

* iscale=3: Atkinson and Silva, WUS model
603   source = m0 * ((1.0-eps)/(1.0+(f/fa)**2) + eps/(1.0+(f/fb)**2))
      return

699   continue

      source = m0 * sa * sb

      if ( source .eq. 0.0) then
         write(*, '(a)') ' SOURCE = 0.0 !!!, for'
         write(*, '(a, f7.3, e10.3, 2f7.3, i2)')
     :   ' f, m0, fa, fb, iscale = ', f, m0, fa, fb, iscale
      end if

      return
      end
```

```
      Program Imp_Resp

* Computes impulse response for single-pole lowcut filter and its inverse.
* I did this before correcting the SEMS2 LB data (Oceanside and N. Palm
* Springs data).

* Dates: 09/05/95 - Written by D. Boore

      complex work_f(5000),work_i(5000), ci, filt_lc

      ci = (0.0, 1.0)

      pi = 4.0*atan(1.0)

      npw2 = 4096
*      npw2 = 2048
      tshft = 5.0
      fc = 1.0
      fcl = 0.1
      npoles = 2
      sps = 100.0
      dt = 1.0/sps
      delf = 1.0/(float(npw2)*dt)

      npw2d2 = npw2/2
      nnyq = npw2d2+1
c...shift impulse response TSHFT seconds to right.

      do i = 1, nnyq
        work_f(i) = 0.0
        work_i(i) = 0.0
      end do

      do i=2,nnyq
        f = delf*float(i-1)
        work_f(i) = filt_lc(f, fc, 1)        ! This is the usual statement
*         work_f(i) = filt_lc(f, fcl, npoles) ! check resp. of added l.c. filter
        work_i(i) = filt_lc(f, fcl, npoles)/work_f(i) ! Apply l.c., avoid div 0
        work_f(i) = cexp(ci*2.0*pi*f*tshft) * work_f(i)
        work_i(i) = cexp(ci*2.0*pi*f*tshft) * work_i(i)
      end do

*         work_i(1) = 1.0   ! only for check response of added l.c. filter

C...Enforce correct symmetry.
      work_f(nnyq) = cmplx(real(work_f(nnyq)),0.0)
      work_i(nnyq) = cmplx(real(work_i(nnyq)),0.0)

      do i=npw2,nnyq+1,-1
        work_f(i) = conjg(work_f(npw2-i+2))
        work_i(i) = conjg(work_i(npw2-i+2))
      end do

      call fork (npw2,work_f,-1.)
      call fork (npw2,work_i,-1.)

      sfact = 1.0/(sqrt(float(npw2))*dt)

      open(unit=10, file='imp_resp.out', status='unknown')
      write(10, '(a)') ' time, forward, inverse:'

      do i=1,npw2
        write(10, *) float(i-1) * dt, real(sfact * work_f(i)),
     :                real(sfact * work_i(i))
      end do

      close(unit=10)
      stop
      end

* <<<<<<<<< BEGIN FILT_LC >>>>>>>>>>>>>>>>>>>>>>>>>>>>
      complex function filt_lc(f, fc, npoles)
      complex ci
      ci = (0.0, 1.0)
      filt_lc = ((-ci*(f/fc))/(1.0-ci*(f/fc)))**npoles
      return
      end
* <<<<<<<<< END FILT_LC >>>>>>>>>>>>>>>>>>>>>>>>>>>>

* <<<<<<<<< BEGIN FORK >>>>>>>>>>>>>>>>>>>>>>>>>>>>
      SUBROUTINE FORK(LX,CX,SIGNI)
C FAST FOURIER                                  2/15/69
C                          LX
C    CX(K) = SQRT(1.0/LX)* SUM (CX(J)*EXP(2*PI*SIGNI*I*(J-1)*(K-1)/LX))
C                          J=1                        FOR K=1,2,...,LX
C
C  THE SCALING BETWEEN FFT AND EQUIVALENT CONTINUUM OUTPUTS
C  IS AS FOLLOWS.
C
C
C     GOING FROM TIME TO FREQUENCY:
C             F(W)=DT*SQRT(LX)*CX(K)
C
C                  WHERE W(K)=2.0*PI*(K-1)/(LX*DT)
C
C
C     GOING FROM FREQUENCY TO TIME, WHERE THE FREQUENCY
C     SPECTRUM IS GIVEN BY THE DIGITIZED CONTINUUM SPECTRUM:
C
C             F(T)=SQRT(LX)/(LX*DT)*CX(K)
C                  WHERE T(K)=(K-1)*DT
C
C
C  THE RESULT OF THE SEQUENCE...TIME TO FREQUENCY,POSSIBLE MODIFICATIONS
C  OF THE SPECTRUM (FOR FILTERING,ETC.), BACK TO TIME...
C  REQUIRES NO SCALING.
C
C
C  THIS VERSION HAS A SLIGHT MODIFICATION TO SAVE SOME TIME...
C  IT TAKES THE FACTOR 3.1415926*SIGNI/L OUTSIDE A DO LOOP (D.BOORE 12/8
C  FOLLOWING A SUGGESTION BY HENRY SWANGER).
C
      COMPLEX CX,CARG,CEXP,CW,CTEMP
      DIMENSION CX(LX)
      J=1
      SC=SQRT(1./LX)
      DO 5 I=1,LX
      IF(I.GT.J) GO TO 2
      CTEMP=CX(J)*SC
      CX(J)=CX(I)*SC
      CX(I)=CTEMP
 2    M=LX/2
 3    IF(J.LE.M) GO TO 5
      J=J-M
      M=M/2
      IF(M.GE.1) GO TO 3
 5    J=J+M
      L=1
 6    ISTEP=2*L
      TEMP=3.14159265*SIGNI/L
      DO 8 M=1,L
      CARG=(0.,1.)*TEMP*(M-1)
```

```
      CW=CEXP(CARG)
      DO 8 I=M,LX,ISTEP
      CTEMP=CW*CX(I+L)
      CX(I+L)=CX(I)-CTEMP
  8   CX(I)=CX(I)+CTEMP
      L=ISTEP
      IF(L.LT.LX) GO TO 6
 9    RETURN
      END
* <<<<<<<<< END FORK >>>>>>>>>>>>>>>>>>>>>>>>>>>>
```

```fortran
      Program Impulse

* Write an impulse in SMC format, to check the
* program MAKETS

      character fnameout*12
      dimension accel(4100)
      pi=4.0*atan(1.0)
      ivert = 90
      ihor = 30
      dt = 0.025
      naccel = 4096
      rho=2.7
      beta=3.5
      r=14
      fnameout = 'impulse.smc'

      nstrt = 5.0/dt

      fact = 1.0/(r*4.0*pi*rho*(beta)**3)
      fact = fact/dt

      do i = 1, naccel
        accel(i) = 0.0
      end do
      accel(nstrt) = fact

      call WriteSMC(fnameout, accel,
     :  dt, naccel, ivert, ihor)

      stop
      end

* #######################################################
      subroutine WriteSMC(fnameout, accel,
     :  dt, naccel, ivert, ihor)

*  Reformats a time series
*   into SMC format (the format used on the CD-ROM)

      real  rnull, accel(*), rhead(50)

      integer ncomments, naccel, inull, ihead(48)

      character fnameout*12

* Open output file:
      open(unit=30, file=fnameout, status='unknown')

* Write name to screen:
      write(*, '(2a)') ' Output file name: ', fnameout

* Write headers:

* First write the 11 lines of comments:

      write(30, '(a)') '*'
      write(30, '(a)') '*'
      write(30, '(a)') ' stacode'
      write(30, '(a)') ' date, eqname'
      write(30, '(a)') 'Moment Mag='
      write(30, '(a,t30,a,i3,1x,a,i3)') 'station = ',
     :                          'orient_h= ', ihor,
     :                          'orient_v= ', ivert
      write(30, '(a,t34,a)') 'epicentral dist =','pk acc ='
      write(30, '(a, t22, a)') 'inst type=DSA', 'data source = SCE'
      write(30, '(a)') '*'
      write(30, '(a)') '*'
      write(30, '(a)') '*'

* Now write the integer header block:
* First fill with null values:

      inull = -32768
      do i = 1, 48
        ihead(i) = inull
      end do

      ihead(1) = inull
      ihead(11) = 3
      ihead(13) = ivert
      ihead(14) = ihor
      ncomments = 0
      ihead(16) = ncomments
      ihead(17) = naccel

      write(30, '(8I10)') (ihead(i), i=1,48)

* Now write the real header block:
* First fill with null values:
      rnull = 1.7e+38
      do i = 1, 50
        rhead(i) = rnull
      end do

      rhead(1) = rnull
      sps = 1.0/dt
      rhead(2) = sps

      write(30, '(5E15.7)') (rhead(i), i=1,50)

* Write the acceleration values

      write(30, '(8(1pe10.4e1))')
     :       (accel(j), j = 1, naccel)

* That should be it; close the output file and loop back for another component

      close(unit=30)

      return
      end
* #######################################################
```

```
      Program MakeTS

*  read acceleration series from TDSIM and the
*  displacement series from HSPEC91, RHFOC91, and MECH91,
*  and combine them into a single time series (one
*  for each component).

* Dates:  01/25/94 - Written by Dave Boore

      dimension tdsim(8200)
      dimension tsrmch91(8200), tsrout(8200)

      character mech91filelist*12, mech91file*12,
     :   tdsimfile*12, outfile*12, outfile2*12
      real pi, C, rho, beta, prtitn, rtp, fs, amax, dtacc
      real dtmch91

      complex spectacc(8200), spectmch91(8200), work(8200)

      integer nptsacc, nptsmch91, ivert, ihor

      iarraybound = 8200

      pi = 4.0*atan(1.0)

* Set up an output file:
      outfile2 = 'makets.out'
      open(unit=13,file=outfile2,status='unknown')

* Work with the time series from TDSIM:

2000  continue

      write(*, '(2a\)')
     : ' Enter the filename for the TDSIM time',
     : ' series (CR to quit):'

      tdsimfile = ' '
      read(*, '(a)') tdsimfile

      write(13, '(2a)') ' TDSIM file= ', tdsimfile

      if (tdsimfile(1:1) .eq. ' ') then
         write(*, '(a)') ' Quitting, as you requested!'
         go to 999
      end if

      open(unit=10, file=tdsimfile, status='old')

      write(*, '(a)')
     : ' Specify start time of window for output: '
      read(*, '(f6.0)') twinstart
      write(*, '(a)')
     : ' Specify stop time of window for output: '
      read(*, '(f6.0)') twinstop
      write(*, '(a,2f6.1)') ' The start and stop times are: ',
     :                 twinstart, twinstop

      call skip(10,3)
      read(10,'( t5,f5.2, t16,f5.2, t29,f5.3,
     :           t39,f4.2, t47,f4.1)')
     :   rho, beta, prtitn, rtp, fs

* Compute C factor:

      C = 1.0e-20*(rtp * fs * prtitn)/(4*pi*rho*(beta**3))

* Note: the factor 1.0e-20 (including
* a factor of 1.0e5 for r, which has been taken as 1 km).
* Bob Herrmann has already included the factor in the rhfoc91
* output.  I could just ignore the factor, but to be more precise, I
* will explicitly take it into account.

* Get dt, npts:

      call skip(10,12)
      read(10,'( t4,f7.4, t17,i5)')  dtacc, nptsacc

      write(13, '(a,f6.3,i5)') ' dtacc, nptsacc= ', dtacc, nptsacc

* Read the time series:

      do i = 1, nptsacc
        read(10,'(f9.4,2(1x,e10.3))') time, amax, tdsim(i)
      end do

      close(unit=10)

* Remove normalization and divide by the C factor:

      do i = 1, nptsacc
        tdsim(i) = amax*(tdsim(i)-1.0)/C
      end do

* Get spectrum of the acceleration trace:


      prcntfrtapr = 5.
      sign = -1.0

      write(*, '(a)') ' Get the FFT of the TDSIM time series.........'

* First double the length of the time series:

      do i = nptsacc+1, 2*nptsacc
        tdsim(i) = tdsim(nptsacc)
      end do
      nptsacc = 2 * nptsacc

      call Complex_Spectrum(tdsim, dtacc, nptsacc, prcntfrtapr,
     :                      spectacc, npw2acc, df_acc, sign)

* Now work with the time series from HSpec91:

      write(*,'(a\)')
     :       ' Enter name of file with mech91 data:'
      mech91filelist = ' '
      read(*, '(a)') mech91filelist

      open(unit=20, file=mech91filelist, status='old')

1000  continue
      mech91file = ' '
      read(20, '(a)') mech91file
      if (mech91file(1:4) .eq. 'stop') then
         write(*, '(2a)')
     :       ' No more Mech91 files to process;',
     :       ' looping back for another TDSIM file'
         go to 2000
      end if

      write(*, '(3a)')
```

```
     :     ' Get the time series for file ', mech91file, '...'

      call GetSMC(mech91file, tsrmch91, dtmch91,
     :                nptsmch91, ivert, ihor)

* Remove the e20 factor:

      do i = 1, nptsmch91
        tsrmch91(i) = 1.0e-20*tsrmch91(i)
      end do

* Get the spectrum:
      write(*, '(a)')
     :     '    Get the FFT of the mech91 time series.........'

* First double the length of the time series:

      do i = nptsmch91+1, 2*nptsmch91
        tsrmch91(i) = tsrmch91(nptsmch91)
      end do
      nptsmch91 = 2 * nptsmch91

      prcntfrtapr = 5.
      sign = -1.0

      call Complex_Spectrum(tsrmch91, dtmch91, nptsmch91,
     :          prcntfrtapr, spectmch91,
     :          npw2mch91, df_mch91, sign)


* Multiply the parts of the spectra corresponding to
* positive frequencies.  Note that because the df is the same for
* both (or should be), I can safely multiply the two, keeping
* in mind that spectmch91 is zero for frequencies above npw2mch91/2+1.

      write(*, '(a)')
     :      ' Multiply the spectra and inverse transform....'

      npw2accd2 = npw2acc/2
      npw2mch91d2 = npw2mch91/2

      do i = 1, iarraybound
         work(i) = cmplx(0.0, 0.0)
      end do

      do i = 1, npw2mch91d2
         work(i) = spectacc(i) * spectmch91(i)
         work(npw2acc+2-i) = conjg(work(i))
* Note the use of npw2acc rather than npw2mch91... this accounts for the
* different dt's used in the two time series.
      end do

* Impose zero dc:
      work(1) = cmplx(0.0, 0.0)

* Inverse transform:
      sign = -1.0 * sign
      call fork(npw2acc, work, sign)
      fact = sqrt(npw2acc)/(npw2acc*dtacc)
      do i = 1, npw2acc
         tsrout(i) = fact* real(work(i))
      end do

*  Call a subroutine that writes an SMC file.  Make the file name from
*  mech91file name.
      outfile = ' '
      outfile = tdsimfile(1:5)//
     :  mech91file(index(mech91file,'.')-2:index(mech91file,'.'))//
     :  'smc'

* Note that now the dt and the npts are those for the longer time
* series (from tdsim):

      call WriteSMC(outfile, tsrout, twinstart, twinstop,
     :  dtacc, npw2acc, ivert, ihor)

* Write some stuff to the output file:
      write(13, '(2a)') ' Mech91 file= ', mech91file
      write(13, '(a,f5.3, a,i4)')
     :   '    dtmch91= ', dtmch91, ' nptsmch91= ', nptsmch91
      write(13, '(a, i4, a, i4)')
     :    ' ivert= ', ivert, ' ihor= ', ihor
      call mnmax(tsrmch91, 1, nptsmch91, 1, dum1, dum2)
      write(13,'(a,2e11.3)') ' amin, amax= ', dum1, dum2
      write(13, '(a, 2f7.3)') ' df_acc, df_mch91= ',
     :         df_acc, df_mch91
      write(13, '(a, 2i5)') ' npw2acc, npw2mch91= ',
     :         npw2acc, npw2mch91

      go to 1000          ! Loop back for another mech91 file
999   continue
      close(unit=13)
      stop
      end

* ####################################################
      subroutine SKIP(lunit, nlines)
        do i = 1, nlines
          read(lunit, *)
        end do
        return
      end
* ####################################################

* ####################################################
       subroutine GetSMC(mech91file, tsrmch91, dtmch91,
     :              nptsmch91, ivert, ihor)

       dimension tsrmch91(*), realdum(50)
       integer intdum(48)
       character mech91file*(*)

       open(unit=10, file=mech91file, status='old')

       call skip(10,11)

       read(10, '(8i10)') (intdum(i), i=1, 48)
       read(10, '(5e15.7)') (realdum(i), i=1,50)
       dtmch91 = 1.0/realdum(2)
       nptsmch91 = intdum(17)
       ivert = intdum(13)
       ihor = intdum(14)

       read(10, '(8(e10.4))')
     :         (tsrmch91(i), i = 1, nptsmch91)

       close(unit=10)
       return
       end
* ####################################################
```

```
* ######################################################
      subroutine WriteSMC(fnameout, accel, tstart, tstop,
     :  dt, naccel, ivert, ihor)

*  Reformats a time series
*   into SMC format (the format used on the CD-ROM)

      real  rnull, accel(*), rhead(50)

      integer ncomments, naccel, inull, ihead(48)

      character fnameout*12

* Open output file:
      open(unit=30, file=fnameout, status='unknown')

* Write name to screen:
      write(*, '(2a)') ' Output file name: ', fnameout

* Write headers:

* First write the 11 lines of comments:

      write(30, '(a)') '*'
      write(30, '(a)') '*'
      write(30, '(a)') ' stacode'
      write(30, '(a)') ' date, eqname'
      write(30, '(a)') 'Moment Mag='
      write(30, '(a,t30,a,i3,1x,a,i3)') 'station = ',
     :                         'orient_h= ', ihor,
     :                         'orient_v= ', ivert
      write(30, '(a,t34,a)') 'epicentral dist =','pk acc ='
      write(30, '(a, t22, a)') 'inst type=DSA', 'data source = SCE'
      write(30, '(a)') '*'
      write(30, '(a)') '*'
      write(30, '(a)') '*'

* Figure out indices for the output window:

      indxstart = tstart/dt + 1
      indxstop = tstop/dt + 1
      if (indxstop .gt. naccel) indxstop = naccel

      nout = indxstop - indxstart + 1


* Now write the integer header block:
* First fill with null values:

      inull = -32768
      do i = 1, 48
        ihead(i) = inull
      end do

      ihead(1) = inull
      ihead(11) = 3
      ihead(13) = ivert
      ihead(14) = ihor
      ncomments = 0
      ihead(16) = ncomments
      ihead(17) = nout

      write(30, '(8I10)') (ihead(i), i=1,48)

* Now write the real header block:
* First fill with null values:
      rnull = 1.7e+38
      do i = 1, 50
        rhead(i) = rnull
      end do

      rhead(1) = rnull
      sps = 1.0/dt
      rhead(2) = sps

      write(30, '(5E15.7)') (rhead(i), i=1,50)

* Write the acceleration values

      write(30, '(8(1pe10.4e1))')
     :        (accel(j), j = indxstart, indxstop)

* That should be it; close the output file and loop back for another component

      close(unit=30)

      return
      end
* ######################################################


* ######################################################
      subroutine mnmax(a,nstrt,nstop,ninc,amin,amax)
c
c author: D. M. Boore
c last change: 9/7/84
c
      dimension a(1)
      amax = a( nstrt)
      amin=amax
      do 10 i=nstrt,nstop,ninc
      if(a(i)-amax) 15,15,20
20    amax=a(i)
      go to 10
15    if(a(i)-amin) 25,10,10
25    amin=a(i)
10    continue
      return
      end
* ######################################################

* ######################################################
      subroutine Complex_Spectrum( datain, dt, npts,
     :    prcntfrtapr, cspect, npw2, df, sign)

c Returns the complex spectrum.
c The program applies a tapered window to the
c front and back of the time series, pads with zeros, and computes the
c spectrum.

c Written by D. M. Boore

* Dates: 10/28/92 - Created by modifying Abs_Spectra


      real DATAIN(*)
      complex CSPECT(*)
      real DATA(16400)
      complex CX(16400)

c Fill working array with input data:
```

```
      do i = 1, npts
         data(i) = datain(i)
      end do

c
c     remove dc, apply taper, pad with zeros
c
      call dcdt(data, dt, npts, 1, npts, .true., .false.)

      ifront = prcntfrtapr
      iback = prcntfrtapr
      call fbctpr (ifront, iback, data, npts)

      call zeropad2( data, npts, npts, npw2)

c sample rate and frequency spacing:

      sr = 1.0 / dt
      tlength = float(npw2)* dt
      df = 1.0/ tlength

      npw2d2 = npw2 / 2

c Fill working complex array

      do j = 1, npw2
        cx(j)=cmplx(data(j), 0.0)
      end do

c     FFT to get spectrum

      call fork(npw2,cx, sign)

* Scale properly:

      inyq = npw2d2+1

      do j =1 ,inyq
        cspect(j)=cx(j)*dt*sqrt(float(npw2))
      end do

* Make sure the value at Nyquist is real:
        cspect(inyq) = cmplx(real(cspect(inyq)),0.0)

      return
      end
* ##########################################################

* ##########################################################
      subroutine ZEROPAD2 (Y,NIN,NTOTIN,NPW2)

c Calculates NPW2, the next power-of-2 greater than NTOTIN.
c Pads time-series array Y with (NPW2-NIN) zeroes.  With this program
c the window of the data, which determines NIN, can be different
c for different time series, yet the overall length of
c the time series used in the FFT can
c be the same (determined by NTOTIN), thus guaranteeing
c that the frequencies for which FFT
c values are computed are the same.
c I assume that the user makes sure that NTOTIN .ge. NIN.
c Written by Chuck MUeller, USGS; modified by Dave Boore,
c 5/1/87.

      real Y(*)

      npw2 = 2
1     if ( npw2 .lt. ntotin) then
           npw2 = 2 * npw2
           go to 1
      endif

      do 20 I=NIN+1,NPW2
20       Y(I) = 0.0

      return
      end
* ##########################################################

* ##########################################################
      SUBROUTINE FORK(LX,CX,SIGNI)
C FAST FOURIER                                    2/15/69
C                             LX
C   CX(K) = SQRT(1.0/LX)* SUM (CX(J)*EXP(2*PI*SIGNI*I*(J-1)*(K-1)/LX))
C                             J=1                           FOR K=1,2,...,LX
C
C  THE SCALING BETWEEN FFT AND EQUIVALENT CONTINUUM OUTPUTS
C  IS AS FOLLOWS.
C
C
C     GOING FROM TIME TO FREQUENCY:
C             F(W)=DT*SQRT(LX)*CX(K)
C
C                  WHERE W(K)=2.0*PI*(K-1)/(LX*DT)
C
C
C     GOING FROM FREQUENCY TO TIME, WHERE THE FREQUENCY
C     SPECTRUM IS GIVEN BY THE DIGITIZED CONTINUUM SPECTRUM:
C
C             F(T)=SQRT(LX)/(LX*DT)*CX(K)
C                  WHERE T(K)=(K-1)*DT
C
C
C  THE RESULT OF THE SEQUENCE...TIME TO FREQUENCY,POSSIBLE MODIFICATIONS
C  OF THE SPECTRUM (FOR FILTERING,ETC.), BACK TO TIME...
C  REQUIRES NO SCALING.
C
C
C  THIS VERSION HAS A SLIGHT MODIFICATION TO SAVE SOME TIME...
C  IT TAKES THE FACTOR 3.1415926*SIGNI/L OUTSIDE A DO LOOP (D.BOORE 12/8
C  FOLLOWING A SUGGESTION BY HENRY SWANGER).
C
      COMPLEX CX,CARG,CEXP,CW,CTEMP
      DIMENSION CX(LX)
      J=1
      SC=SQRT(1./LX)
      DO 5 I=1,LX
      IF(I.GT.J) GO TO 2
      CTEMP=CX(J)*SC
      CX(J)=CX(I)*SC
      CX(I)=CTEMP
 2    M=LX/2
 3    IF(J.LE.M) GO TO 5
      J=J-M
      M=M/2
      IF(M.GE.1) GO TO 3
 5    J=J+M
      L=1
 6    ISTEP=2*L
      TEMP=3.14159265*SIGNI/L
      DO 8 M=1,L
      CARG=(0.,1.)*TEMP*(M-1)
      CW=CEXP(CARG)
```

```
      DO 8 I=M,LX,ISTEP
      CTEMP=CW*CX(I+L)
      CX(I+L)=CX(I)-CTEMP
  8   CX(I)=CX(I)+CTEMP
      L=ISTEP
      IF(L.LT.LX) GO TO 6
 9    RETURN
      END
* #######################################################

* #######################################################
      subroutine FBCTPR (IFRONT,IBACK,Z,NZ)

c  Apply IFRONT% and IBACK% cosine tapers to ends of time series array Z.
c  Written by Chuck Mueller, USGS.
c  Modified by D. M. Boore on 8/31/88 to eliminate the use of ZNULL;
c  see FBCTPR_CSM for the original version.

*  Dates:  2/13/90 - if ifront or iback is zero, do not apply a taper.

      real Z(*)

      PI = 4.0*ATAN(1.0)
      LZ = NZ*(IFRONT/100.)

      if (lz .lt. 1) lz = 1

      SF = PI/LZ
      do 1 I=1,LZ
c         if (Z(I).eq.ZNULL) goto 1
         F = 0.5*(1.0-COS(SF*(I-1)))
         Z(I) = Z(I)*F
1        continue
      LZ = NZ*(IBACK/100.)

      if (lz .lt. 1) lz = 1


      SF = PI/LZ
      do 2 I=NZ,NZ-LZ+1,-1
c         if (Z(I).eq.ZNULL) goto 2
         F = 0.5*(1.0-COS(SF*(NZ-I)))
         Z(I) = Z(I)*F
2        continue

      return
      end
* #######################################################

* #######################################################
      SUBROUTINE DCDT (Y,DT,NPTS,INDX1,INDX2,LDC,LDT)
c+
c  DCDT - Fits DC or trend between indices INDX1 and INDX2.
C         Then removes DC or detrends whole trace.
c         Y is real, DT = delta t.
c         If remove DC, LDC = .TRUE.
c         IF detrend, LDT = .TRUE.
c-
      real Y(1)
      logical LDC,LDT
c
c...Fit DC and trend between indices INDX1 and INDX2.
100   NSUM = INDX2-INDX1+1
      SUMX = 0.0
      SUMX2 = 0.0
      SUMY = 0.0
      SUMXY = 0.0
      DO 200 I=INDX1,INDX2
         XSUBI = (I-1)*DT
         SUMXY = SUMXY+XSUBI*Y(I)
         SUMX = SUMX+XSUBI
         SUMX2 = SUMX2+XSUBI*XSUBI
200      SUMY = SUMY+Y(I)
C
C... Remove DC.
300   IF (LDC) THEN
        AVY = SUMY/NSUM
        DO 360 I=1,NPTS
360        Y(I) = Y(I)-AVY
        RETURN
      ENDIF
C
C... Detrend. See Draper and Smith, p. 10.
400   IF (LDT) THEN
        BXY = (SUMXY-SUMX*SUMY/NSUM)/(SUMX2-SUMX*SUMX/NSUM)
        AXY = (SUMY-BXY*SUMX)/NSUM
        QXY = DT*BXY
        DO 450 I=1,NPTS
450        Y(I) = Y(I)-(AXY+(I-1)*QXY)
        RETURN
      ENDIF
C
      STOP
      END
* #######################################################
```

```
      program mech91vfbb

*  Reads synthetic seismogram files from Bob Herrmann's program
*  mech91 and
*  writes as VFBB files for use in Chuck Mueller's analysis
*  programs.  The program is based on a modification of HRMNVFBB.
*  Files for all distances are written, with the distance as the
*  extension.  Note that mech91 uses character*4 for "component"
*  (called "icom" in mech91), but only a single character is used.
*  I have changed the format 13 statement to pick out only the single
*  character.

*  Dates:  01/28/93 - Created.  The stem name is not necessarily a
*                     proper VFBB file name, and can be more descriptive.

      parameter (LIN=20)
      real*4 y(2048)
      character*1 component(3)
      character*4 scode, stacode*3, buf*80
      character*80 outfile, datafile, stem_outfile*9

* Get the name of the file containing the time series:

      datafile = ' '
      type 511
511   format('$Enter the name of the file containing time series:')
      accept 512, nch, datafile
512   format(q, a)

* Get the stem name for the output files:

      stem_outfile = ' '
      type 513
513   format('$Enter the stem name for the output files:')
      accept 512, nch, stem_outfile

* Use April's program to remove the blanks. The program is in
* pub1:[agram.agramlib]agramlib/libr

      call rmblnk(3, stem_outfile, newend)

*  Open the data file:

      open( unit=LIN, file=datafile, status='old', readonly)

   13 format(3e16.9,i10,e16.9/5e16.9/3e16.9,i10,3(1x,a1,2x))
   11 format(5e16.9)

c-----
c     process seismograms (3 components for each distance)
c-----

1000  continue

      read(LIN,13,end=9999)
    :   r, hr, hs, nt, ti, dt, tau, dip, strike, slip, xmom,
    :   az, baz, iexpl1, (component(i), i=1,3)

* Convert the distance 'r' into a 3 character string:

      write( stacode(1:3), '(i3.3)' ) int(r)

      do jcmp = 1, 3
```

```
       do i=1,nt
         y(i)=0.0
       end do

       read(LIN,11,end=9999) (y(i),i=1,nt)

*  Construct output file name:
       outfile = ' '
       outfile = stem_outfile(1:newend)//component(jcmp)//
    :              '.'//stacode(1:3)

       iazm = 0
       ivert = 0

       if(component(jcmp) .ne. 'Z') then
         ivert = 90
         if (component(jcmp) .eq. 'R') then
           iazm = az
         else if (component(jcmp) .eq. 'T') then
           iazm = az + 90.
         else if (component(jcmp) .eq. 'N') then
           iazm = 0.0
         else if (component(jcmp) .eq. 'E') then
           iazm = 90.0
         endif
       endif

       iavd = 2
       call write_vfbb(y, nt, dt, ivert, iazm, iavd, outfile)

      end do

      goto 1000
9999  continue
      write(6, '(a)') ' EOF encountered reading input file'
      close(unit=LIN)

      stop
      end
```

```
      Program Mean4Plt

* Read *.asc files made with rs2v_h, read V/Geom MeanH for each event/site
* and compute arithmetic and geometric means and SEOM or confidence limits.
* Write the output to a file for plotting.

* Dates: 07/18/97 - Written by D. Boore
*        08/13/97 - Added cl70 rather than cl68, and substituted the
*                   most recent version of mean_cl.for, which uses the
*                   correct t-factors

      real per(100,10), v_h(100,10), work(10), alogwork(10)
      character f_in*30, f_out*30, f_vh*30, colhead(10)*9
      logical f_in_exist

* Get name of input file:
      f_in_exist = .false.
      do while (.not. f_in_exist)
        f_in = ' '
        write(*, '(a\)')
     :    ' Enter name of file with file names (cr to quit): '
        read(*, '(a)') f_in
        if (f_in(1:4) .eq. '    ') stop
        inquire(file=f_in, exist=f_in_exist)
        if (.not. f_in_exist) then
          write(*,'(a)') ' ******* FILE DOES NOT EXIST ******* '
        end if
      end do

* Open file
      nu_in = 10
      open(unit=nu_in, file=f_in, status='unknown')

* Read output file name:
      f_out = ' '
      read(nu_in, '(a)') f_out

* Open output file:
      nu_out = 40
      open(unit=nu_out, file=f_out, status='unknown')
      write(nu_out, '(2a)') ' File with input parameters: ', f_in

* Read number of records to average:
      read(nu_in, *) nrecs

* Loop over records:

      do j = 1, nrecs

* Open file with averages
        f_vh = ' '
        read(nu_in, '(a)') f_vh
        nu_vh = 30
        open(unit=nu_vh, file=f_vh, status='unknown')
        write(nu_out, '(2a)') ' File with v/h: ', f_vh

* Extract information:
        call skip(nu_vh, 4)
        read(nu_vh, '(t80,a9)') colhead(j)
        nper = 91
        do i = 1, nper
          read(nu_vh, *) per(i, j), d1, d2, d3, d4, d5, d6, v_h(i, j)
        end do
        close(unit = nu_vh)

      end do

      close(unit = nu_in)

      write(nu_out, '(t9,a3, 9(2x,a9), 2(7x,a4,4(2x,a9)))')
     : 'per', (colhead(j), j= 1, nrecs),
     : 'aavg', 'aavg-cl70', 'aavg+cl70', 'aavg-cl95', 'aavg+cl95',
     : 'gavg', 'gavg-cl70', 'gavg+cl70', 'gavg-cl95', 'gavg+cl95'

* For each period, find averages:

      do i = 1, nper

* Set up work arrays:

        do j = 1, nrecs
* Check equality of all periods
          if(j .gt. 1) then
            do l = 1, j-1
              if (per(i,j) .ne. per(i,l)) then
                write(*,'(a)') ' ERROR: PERIODS NOT EQUAL; QUITTING!'
                stop
              end if
            end do
          end if
          work(j) = v_h(i,j)
          alogwork(j) = alog10(work(j))
        end do

* Now compute statistics:
        call mean_cl(work, 1, nrecs,
     :     aavg, std, seom, acl70, acl90, acl95, acl99)
        call mean_cl(alogwork, 1, nrecs,
     :     gavg, std, seom, gcl70, gcl90, gcl95, gcl99)

        write(nu_out, '(1p20(1x,e10.3))')
     :   per(i,1), (work(j), j=1, nrecs),
     :   aavg, aavg-acl70, aavg+acl70, aavg-acl95, aavg+acl95,
     :   10.0**gavg, 10.0**(gavg-gcl70), 10.0**(gavg+gcl70),
     :               10.0**(gavg-gcl95), 10.0**(gavg+gcl95)
      end do

      close(unit=nu_out)

      stop
      end

* --------------------- BEGIN SKIP ------------------
      subroutine SKIP(lunit, nlines)
        do i = 1, nlines
           read(lunit, *)
        end do
        return
      end
* --------------------- END SKIP ------------------

* ---------------- BEGIN Mean_CL -----------------
      subroutine mean_cl( a, nstart, nstop,
     :    mean, std, seom, cl70, cl90, cl95, cl99)

* Computes mean and measures of deviation of the array entries

* Dates: 12/04/96 - Written by D. Boore, patterned after Numerical
*                   recipes AveVar.For and Mean_Std.For
*        03/02/97 - Added check of n = 1
*        08/03/97 - Added proper 95% confidence limit factor
*        08/13/97 - Added proper t-factors and cl99.
```

```
      real mean, std
      dimension a(1)

      ave=0.0
      n = nstop - nstart + 1
      do 11 j=1,n
        ave=ave+a(j+nstart-1)
11    continue
      ave=ave/n
      var=0.0
      ep=0.0
      do 12 j=1,n
        s=a(j+nstart-1)-ave
        ep=ep+s
        var=var+s*s
12    continue
      if ( n .eq. 1) then
        var = 0.0
      else
         var=(var-ep**2/n)/(n-1)
      end if
      mean = ave
      std = sqrt(var)

      seom = std/ sqrt(float(n))

      cl70 = t_70(n-1) * seom
      cl90 = t_90(n-1) * seom
      cl95 = t_95(n-1) * seom
      cl99 = t_99(n-1) * seom

      return
      end
* ---------------- END Mean_CL -----------------

* -------------------- BEGIN t_70 --------------------------------
      function t_70(n)
* Computes t distribution factor for 15% upper tail for n degrees
* of freedom (use for 70% confidence limits).  Data values from
* Crow etal, Statistics Manual, Table 3, p. 231.

      real t(34)
      integer n_tbl(34)
      data t/
     :   1.963, 1.386, 1.250, 1.190, 1.156,
     :   1.134, 1.119, 1.108, 1.100, 1.093,
     :   1.088, 1.083, 1.079, 1.076, 1.074,
     :   1.071, 1.069, 1.067, 1.066, 1.064,
     :   1.063, 1.061, 1.060, 1.059, 1.058,
     :   1.058, 1.057, 1.056, 1.055, 1.055,
     :   1.050, 1.046, 1.041, 1.036/
      data n_tbl/
     :       1,      2,      3,      4,      5,
     :       6,      7,      8,      9,     10,
     :      11,     12,     13,     14,     15,
     :      16,     17,     18,     19,     20,
     :      21,     22,     23,     24,     25,
     :      26,     27,     28,     29,     30,
     :      40,     60,    120, 100000/

      n_loop = 33
      do i = 1, n_loop
        if (n .ge. n_tbl(i) .and. n .lt. n_tbl(i+1)) then
           indx = i
           go to 100
        end if
      end do
      indx = 34
100   continue
      if (indx .eq. 34) then
        t_70 = t(34)
      else
        t_70 = t(indx+1) + (t(indx) - t(indx+1))*
     :       (1.0/float(n)           - 1.0/float(n_tbl(indx+1)))/
     :       (1.0/float(n_tbl(indx)) - 1.0/float(n_tbl(indx+1)))
      end if

      return
      end
* -------------------- END t_70 -------------------------------

* -------------------- BEGIN t_90 --------------------------------
      function t_90(n)
* Computes t distribution factor for 5.0% upper tail for n degrees
* of freedom (use for 90% confidence limits).  Data values from
* Crow etal, Statistics Manual, Table 3, p. 231.

      real t(34)
      integer n_tbl(34)
      data t/
     :   6.314, 2.920, 2.353, 2.132, 2.015,
     :   1.943, 1.895, 1.860, 1.833, 1.812,
     :   1.796, 1.782, 1.771, 1.761, 1.753,
     :   1.746, 1.740, 1.734, 1.729, 1.725,
     :   1.721, 1.717, 1.714, 1.711, 1.708,
     :   1.706, 1.703, 1.701, 1.699, 1.697,
     :   1.684, 1.671, 1.658, 1.645/
      data n_tbl/
     :       1,      2,      3,      4,      5,
     :       6,      7,      8,      9,     10,
     :      11,     12,     13,     14,     15,
     :      16,     17,     18,     19,     20,
     :      21,     22,     23,     24,     25,
     :      26,     27,     28,     29,     30,
     :      40,     60,    120, 100000/

      n_loop = 33
      do i = 1, n_loop
        if (n .ge. n_tbl(i) .and. n .lt. n_tbl(i+1)) then
           indx = i
           go to 100
        end if
      end do
      indx = 34
100   continue
      if (indx .eq. 34) then
        t_90 = t(34)
      else
        t_90 = t(indx+1) + (t(indx) - t(indx+1))*
     :       (1.0/float(n)           - 1.0/float(n_tbl(indx+1)))/
     :       (1.0/float(n_tbl(indx)) - 1.0/float(n_tbl(indx+1)))
      end if

      return
      end
* -------------------- END t_90 -------------------------------

* -------------------- BEGIN T_95 --------------------------------
      function t_95(n)
* Computes t distribution factor for 2.5% upper tail for n degrees
* of freedom (use for 95% confidence limits).  Data values from
```

```
* Crow etal, Statistics Manual, Table 3, p. 231.

      real t(34)
      integer n_tbl(34)
      data t/
     :  12.706, 4.303, 3.182, 2.776, 2.571,
     :   2.447, 2.365, 2.306, 2.262, 2.228,
     :   2.201, 2.179, 2.160, 2.145, 2.131,
     :   2.120, 2.110, 2.101, 2.093, 2.086,
     :   2.080, 2.074, 2.069, 2.064, 2.060,
     :   2.056, 2.052, 2.048, 2.045, 2.042,
     :   2.021, 2.000, 1.980, 1.960/
      data n_tbl/
     :       1,      2,      3,      4,      5,
     :       6,      7,      8,      9,     10,
     :      11,     12,     13,     14,     15,
     :      16,     17,     18,     19,     20,
     :      21,     22,     23,     24,     25,
     :      26,     27,     28,     29,     30,
     :      40,     60,    120, 100000/

      n_loop = 33
      do i = 1, n_loop
        if (n .ge. n_tbl(i) .and. n .lt. n_tbl(i+1)) then
           indx = i
           go to 100
        end if
      end do
      indx = 34
100   continue
      if (indx .eq. 34) then
        t_95 = 1.960
      else
        t_95 = t(indx+1) + (t(indx) - t(indx+1))*
     :       (1.0/float(n)            - 1.0/float(n_tbl(indx+1)))/
     :       (1.0/float(n_tbl(indx)) - 1.0/float(n_tbl(indx+1)))
      end if

      return
      end
* -------------------- END T_95 --------------------------------

* -------------------- BEGIN t_99 --------------------------------
      function t_99(n)
* Computes t distribution factor for 0.5% upper tail for n degrees
* of freedom (use for 99% confidence limits).  Data values from
* Crow etal, Statistics Manual, Table 3, p. 231.

      real t(34)
      integer n_tbl(34)
      data t/
     :  63.657, 9.925, 5.841, 4.604, 4.032,
     :   3.707, 3.499, 3.355, 3.250, 3.169,
     :   3.106, 3.055, 3.012, 2.977, 2.947,
     :   2.921, 2.898, 2.878, 2.861, 2.845,
     :   2.831, 2.819, 2.807, 2.797, 2.787,
     :   2.779, 2.771, 2.763, 2.756, 2.750,
     :   2.704, 2.660, 2.617, 2.576/
      data n_tbl/
     :       1,      2,      3,      4,      5,
     :       6,      7,      8,      9,     10,
     :      11,     12,     13,     14,     15,
     :      16,     17,     18,     19,     20,
     :      21,     22,     23,     24,     25,
     :      26,     27,     28,     29,     30,
     :      40,     60,    120, 100000/

      n_loop = 33
      do i = 1, n_loop
        if (n .ge. n_tbl(i) .and. n .lt. n_tbl(i+1)) then
           indx = i
           go to 100
        end if
      end do
      indx = 34
100   continue
      if (indx .eq. 34) then
        t_99 = t(34)
      else
        t_99 = t(indx+1) + (t(indx) - t(indx+1))*
     :       (1.0/float(n)            - 1.0/float(n_tbl(indx+1)))/
     :       (1.0/float(n_tbl(indx)) - 1.0/float(n_tbl(indx+1)))
      end if

      return
      end
* -------------------- END t_99 --------------------------------
```

```
      program NormV_H

* Makes a file with V/H from Abrahamson and Silva regression

* Dates: 05/07/96 - Written by D. Boore, using Norm's code as a start


      real amag, dist, amech, hw, sa(2,5), period(40)

      integer isoil, iper, icomp, nper

      character f_out*30


      write(*, '(a\)') ' Enter name of output file:'
      f_out = ' '
      read(*,'(a)') f_out
      nu_out = 10
      open(unit=nu_out, file=f_out,status='unknown')

      nper = 28

      write (*,'( 2x,''Enter amag, amech, isoil, hw'')')
      read (*,*) amag, amech, isoil, hw

      write (*,'( 2x,''amag, amech, isoil, hw:'',2f6.2,i5,f6.2)')
     :            amag, amech, isoil, hw

      write (nu_out,'( 2x,
     :     ''amag, amech, isoil, hw:'',2f6.2,i5,f6.2)')
     :       amag, amech, isoil, hw


      write(nu_out, 111)
111   format (t6,'period',
     :    t16,'h-d10',t29,'v-d10',t38,'v/h-d10',
     :    t51,'h-d20',t62,'v-d20',t71,'v/h-d20',
     :    t84,'h-d40',t95,'v-d40',t104,'v/h-d40',
     :    t117,'h-d80',t128,'v-d80',t137,'v/h-d80')

      nper = 28
      do iper=1,nPer

        ndist = 4
        dstart = 10.0
        dfactor = 2.0

        dist = dstart/dfactor
        do idist = 1, ndist
          dist = dfactor*dist
          do icomp=1,2
            write(*,'(a,i3,f7.2)') ' icomp, dist = ', icomp, dist
            call Calc_AS95b ( amag, dist, amech, isoil, hw, iPer, icomp,
     :           period(iper), sa(icomp,idist) )
          enddo
        end do

        write (nu_out,'( 1p13(1x,e10.3))')
     :      period(iper),
     :      (sa(1,i), sa(2,i), sa(2,i)/sa(1,i), i = 1, ndist)

      enddo

      close(unit=nu_out)

      stop

      end



c ---------------------------------------------------------------------


      subroutine Calc_AS95b ( mag, dist, mech, soil, hw, iPer, icomp,
     :                        period, sa )


      integer icomp, i, j, k, soil, iFlag

      real theta(2,40,13), mag, dist, mech, n(2,40), c4(2,40), rockPGA

        real hw, mag1(2,40), c5(2,40), period1(40), mu

      common / AS95_Coeff / iFlag, theta, c4, c5,
     :        mag1, n


c     IF first pass, then read data files

      if (iFlag .eq. 0) then

            do i=1,2

        if ( i .eq. 1 ) then

           open (35,file='\norm\code\as95_h.dat',status='old')

                else

           open (35,file='\norm\code\as95_z.dat',status='old')

                endif

                read (35,*) nPer

                read (35,'( a1)') dummy

                do j=1,nPer

                  read (35,*) period1(j), c4(i,j),
     :               (theta(i,j,k),k=1,6),
     :               (theta(i,j,k),k=9,13), mag1(i,j),
     :                c5(i,j), n(i,j)

                enddo

                close (35)

              enddo

              iFlag = 1

        endif
```

```
c     Compute the rock PGA
      isoil1 = 0
          rockPga1 = 0.
          call CalcMu ( mag, dist, mech, isoil1, hw, iPer,
     :               rockPGA, rockpga1, icomp )


c     Compute the Sa
      call CalcMu ( mag, dist, mech, soil, hw, iPer, mu,
     :               rockpga, icomp )
      Sa = exp(mu)
          period = period1(iPer)


      return
          end


c ------------------------------------------------------------------------


      subroutine CalcMu ( mag, dist, mech, soil, hw, iPer, mu,
     :                    rockpga, icomp )
      implicit none
      integer i, j, k, soil, iFlag, icomp, iper
      real theta(2,40,13), mag, dist, mech, mu, n(2,40), c4(2,40),
     :     rockPGA
          real x1, x2, x3, x4, t1, hw, mag1(2,40), c5(2,40)
          real soilFactor, r
      common / AS95_Coeff / iFlag, theta, c4, c5,
     :         mag1, n
c     Rock model
      r = sqrt(dist**2+c4(icomp,iper)**2)
          mu = theta(icomp,iper,1) + theta(icomp,iper,12)*
     :         (8.5-mag)**(n(icomp,iper)) +
     :         theta(icomp,iper,3) * alog(r)
     :     + theta(icomp,iper,13)*(mag - mag1(icomp,iper))*alog(r)
      if ( mag .lt. mag1(icomp,iper) ) then
           mu = mu + theta(icomp,iper,2)*(mag-mag1(icomp,iper))
          else
           mu = mu + theta(icomp,iper,4)*(mag-mag1(icomp,iper))
          endif

c     mech model
      x1 = 5.8
      x2 = mag1(icomp,iper)
          if (mag .lt. x1 ) then
                mu = mu + theta(icomp,iper,5)*mech
      elseif ( mag .lt. x2 ) then
         mu = mu + theta(icomp,iper,5)*mech* (1. -
     :             (mag-x1)/(x2-x1) ) +
     :              theta(icomp,iper,6)*mech*(mag-x1)/(x2-x1)
      else
                mu = mu + theta(icomp,iper,6)*mech
          endif


c     HW model
      t1 = 0.
          if ( mag .gt. 5.5 ) then
          x1 = 4.
          x2 = 8.
          x3 = 18.
          x4 = 25.
          if ( hw .eq. 1. ) then
                if ( dist .lt. x1 ) then
                  t1 = 0.
                elseif ( dist .lt. x2 ) then
                  t1 =  (dist-x1)/(x2-x1)
            elseif ( dist .lt. x3 ) then
              t1 = 1.
            elseif ( dist .lt. x4 ) then
              t1 = 1. - (dist-x3)/(x4-x3)
            else
              t1 = 0.
                endif
```

```
          if ( mag .lt. 6.5 ) then

            t1 = t1 * (mag-5.5)

            endif

  endif

    endif

    mu = mu + t1*theta(icomp,iper,9)


c     Soil Model

      if ( soil .eq. 1 ) then

           soilFactor = theta(icomp,iper,10) +
     :                  theta(icomp,iper,11)*alog((exp(rockPGA)
     :                  + c5(icomp,iper)))

           mu = mu + soilFactor

      endif


c     Return in g


      return

      end
```

```
      Program PSV2COL

*  Reads response spectra files computed by BAP and converts
*  to a single file that can be used by COPLOT, with distance as the
*  first column.

*  Dates:  2/06/93 - Written by Dave Boore (patterned after CONVERT)

      character f_out*30, f_list*30, cdum*9,
     :          psv_file*30, filename*30(50), buffer*80, bigbuf*600

      real dist(50), psv(100, 50), period(100)

      write(*, '(a\)' ) ' Enter name of file with psv file names:'
      read(*, '(a)' ) f_list

      write(*, '(a\)' ) ' Enter name of output column file:'
      read(*, '(a)' ) f_out

      open(unit=2, file=f_out, status='unknown')
      open(unit=4, file=f_list, mode='read', status='old')

      write(*,'(1x,2a/1x,2a)')
     :             '  f_list: ', f_list,
     :             '   f_out: ', f_out

      ifile = 0

      do while (.not. eof(4) )

        ifile = ifile + 1

        buffer = ' '
        psv_file = ' '

        read (4, '(a)' ) buffer
        call RCC( 1, buffer, 80, psv_file, nc)
        call RCF( 2, buffer, 80, dist(ifile), istat)

        filename(ifile) = psv_file

        open(unit=3, file=psv_file, status='old' )

* Find the start of the data:

1892    read(3, '(3x,a9)') cdum
        if (cdum .eq. '#    PER') goto 892
        goto 1892
892     continue

* Read the values:

        ipsv = 0
        do while (.not. eof(3))
          ipsv = ipsv + 1
          read(3, '(7x,f6.3,30x,e10.3)' ) period(ipsv), psv(ipsv,ifile)
        end do

        npsv = ipsv

        close(unit=3)

* Go back for the next psv file

      end do

      nfile = ifile

* Finished reading the all the psv files

      close(unit=4)

* Write column labels:

      bigbuf = ' '

      bigbuf(23:30) = 'Filename'

      bigbuf(38:41) = 'Dist'

      do ipsv = 1, npsv
         iseg = 11 * (ipsv - 1) + 41
         bigbuf(iseg+7: iseg+9) = 'per'
         write(bigbuf(iseg+10: iseg+11), '(i2.2)') ipsv
      end do

      write(2, '(a)') bigbuf(1:iseg+11)

* Write the data:


      do ifile = 1, nfile

         bigbuf = ' '

         write(bigbuf(1:30), '(a)') filename(ifile)
         write(bigbuf(32:41), '(f10.5)') dist(ifile)

         do ipsv = 1, npsv
           iseg = 11 * (ipsv - 1) + 41
           write(bigbuf(iseg+2:iseg+11), '(1pe10.3)') psv(ipsv,ifile)
         end do

         write(2, '(a)') bigbuf(1:iseg+11)

      end do

      close(unit=2, status='keep')

      stop
      end
```

```
      Program Reformat

* Reformat Sept. 1995 Ridgecrest earthquake data
*  dates: 05/16/97 - Increased dimension of array

      character f_in*80, f_out*80, header*80

      real ain(8000), sps


      nu_in = 10
      write(*,'(a\)') ' Enter name of input file: '
      f_in = ' '
      read(*,'(a)') f_in
      open(unit=nu_in, file=f_in, status='unknown')

      nu_out = 20
      write(*,'(a\)') ' Enter name of output file: '
      f_out = ' '
      read(*,'(a)') f_out
      open(unit=nu_out, file=f_out, status='unknown')

      header = ' '
      read(nu_in, '(a)') header

      read(header,'(t29,f6.2)') sps
      read(header,'(t36,i4)') npts

      write(*,'(a,f6.2,1x,i4)') ' sps, npts = ', sps, npts

      read(nu_in,*) (ain(i),i=1,npts)

      avg = 0.0
      do i = 1, npts
        avg = avg + ain(i)
      end do
      avg = avg/npts

      write(nu_out, '(a)') header
      write(nu_out, '(t6,a,t18,a,t25,a)')
     :    'Time', 'Ain', 'Ain-Avg'

      do i = 1, npts
        write(nu_out, '(t2,f7.3,1p,t11,e10.3,t22,e10.3)')
     :     float(i-1)/sps, ain(i), ain(i)-avg
      end do

      close(unit=nu_in)
      close(unit=nu_out)

      stop
      end
```

```
      Program RfrmRC95

* Reformat Sept. 1995 Ridgecrest earthquake data

      character f_in*80, f_out*80, header*80

      real ain(5000), aout, tout, sps


      nu_in = 10
      write(*,'(a\)') ' Enter name of input file: '
      f_in = ' '
      read(*,'(a)') f_in
      open(unit=nu_in, file=f_in, status='unknown')

      nu_out = 20
      write(*,'(a\)') ' Enter name of output file: '
      f_out = ' '
      read(*,'(a)') f_out
      open(unit=nu_out, file=f_out, status='unknown')

      header = ' '
      read(nu_in, '(a)') header

      read(header,'(t29,f6.2)') sps
      read(header,'(t36,i4)') npts

      write(*,'(a,f6.2,1x,i4)') ' sps, npts = ', sps, npts

      read(nu_in,*) (ain(i),i=1,npts)

      avg = 0.0
      do i = 1, npts
        avg = avg + ain(i)
      end do
      avg = avg/npts

      write(nu_out, '(a)') header
      write(nu_out, '(t6,a,t18,a,t25,a)')
     :    'Time', 'Ain', 'Ain-Avg'

      do i = 1, npts
        write(nu_out, '(t2,f7.3,1p,t11,e10.3,t22,e10.3)')
     :      float(i-1)/sps, ain(i), ain(i)-avg
      end do

      close(unit=nu_in)
      close(unit=nu_out)

      stop
      end
```

```
      Program RFrm4Map

* Reformats files used by Qplot on the VAX to make a map
* into the format that Harley Benz needs to make a
* map.

* Dates: 06/28/96 - Written by D. Boore, hardwiring things because
*                   of time constraints, rather than making the program
*                   more general.

      character sta_c*4, buf*80

      nu_in = 10
      open(unit=nu_in,file='sems.loc', status='unknown')
      nu_out = 20
      open(unit=nu_out,file='sta4benz.txt', status='unknown')
100   continue
      read(nu_in, '(t1,a4, t6,f2.0, t10,f4.1, t15,f3.0, t20,f4.1)',
     :     end=888) sta_c, alatd, alatm, alongd, alongm
      alat = alatd + alatm/60.0
      along = -1.0*(alongd + alongm/60.0)
      write(nu_out, '(t1,a4, t7,f6.3, t14,f8.3)') sta_c, alat, along
      go to 100
888   close(unit=nu_in)
      close(unit=nu_out)

      nu_in = 10
      open(unit=nu_in,file='main.hyp', status='unknown')
      nu_out = 20
      open(unit=nu_out,file='eqs4benz.txt', status='unknown')
200   continue
      buf = ' '
      read(nu_in, '(a)', end = 999) buf
      if(buf(1:1) .eq. '|') go to 200
      read(buf, '(t15,f2.0, t18,f4.2,
     :            t22,f3.0, t26,f4.2)')
     :  alatd, alatm,
     :  alongd, alongm
      alat = alatd + alatm/60.0
      along = -1.0*(alongd + alongm/60.0)
      write(*,*) alatd, alatm, alat
      write(*,*) alongd, alongm, along

      write(nu_out, '(t6,f7.4, t16,f8.3)') alat, along
      go to 200
999   close(unit=nu_in)
      close(unit=nu_out)

      stop
      end
```

```
      Program RS_VS_T

*  Computes prv for various lengths of time series and writes files.

*  Dates:  06/09/96 - Written by David M. Boore
*          06/28/96 - Reduced dimension of accel, work

      real real_head(50)
      integer int_head(48)
      character*80 char_head(11)
      character f_cntrl*40, f_sum*40, f_in*30
      character f_ts_out*30, f_rs_out*30, buf*80
      character col_head*80
      real accel(10000), work(10000)
      real per_rs(100), rs(100,10)

      pi = 4.0 * atan(1.0)

      write(*,'(a\)') ' Enter name of control file:'
      f_cntrl = ' '
      read(*, '(a)') f_cntrl

      nu_cntrl = 20
      open(unit=nu_cntrl, file=f_cntrl, status='unknown')

      buf = ' '
      read(nu_cntrl, *) buf
      f_sum = ' '
      read(nu_cntrl, *) f_sum
      write(*,'(2a)') ' Summary file with name:', f_sum

      nu_sum = 30
      open(unit=nu_sum, file=f_sum, status='unknown')
      write(nu_sum, '(2a)') ' Control file: ', f_cntrl

      write(nu_sum, *) buf
      write(nu_sum, *) f_sum

      buf = ' '
      read(nu_cntrl, *) buf
      f_in = ' '
      read(nu_cntrl, *) f_in
      write(nu_sum, *) buf
      write(nu_sum, *) f_in

      buf = ' '
      read(nu_cntrl, *) buf
      read(nu_cntrl, *) tskip
      write(nu_sum, *) buf
      write(nu_sum, *) tskip

      buf = ' '
      read(nu_cntrl, *) buf
      f_rs_out= ' '
      read(nu_cntrl, *) f_rs_out
      write(nu_sum, *) buf
      write(nu_sum, *) f_rs_out

      buf = ' '
      read(nu_cntrl,*) buf
      write(nu_sum, *) buf
      read(nu_cntrl,*) damp, per_start, per_stop, nper
      write(nu_sum,*) damp, per_start, per_stop, nper

      buf = ' '
      read(nu_cntrl, *) buf
      read(nu_cntrl, *) nsegs
      write(nu_sum, *) buf
      write(nu_sum, *) nsegs

* Extract the eq acceleration trace, samples per second,
* and number of samples:

      call ReadSMC(accel, n_in, sps, tskip,
     :             99, f_in,
     :             char_head, int_head, real_head)

      write(nu_sum, '(a, f5.1)') ' SPS = ', sps

      dt = 1.0/sps

      do i = 1, nsegs

        buf = ' '
        read(nu_cntrl, *) buf
        read(nu_cntrl, *) tlen
        write(nu_sum, *) buf
        write(nu_sum, *) tlen

        buf = ' '
        read(nu_cntrl, *) buf
        f_ts_out= ' '
        read(nu_cntrl, *) f_ts_out
        write(nu_sum, *) buf
        write(nu_sum, *) f_ts_out

* remove dc, apply taper to data segment:
        nup = (tlen - tskip)/dt + 1
        do j = 1, nup
          work(j) = accel(j)
        end do
        call dcdt( work, dt, nup, 1, nup, .true., .false.)
        call fbctpr(5, 5, work, nup)

        int_head(17) = nup
        call WriteSMC(work, nup, sps,
     :                99, f_ts_out,
     :                char_head, int_head, real_head)

* Compute response spectra
        dlogper =
     :   (alog10(per_stop/per_start))/float(nper-1)
        do j = 1, nper
          per_rs(j) = per_start * 10.0**(float(j-1)*dlogper)
          omega = 2.0*pi/per_rs(j)

       write(*,'(a,2i3,i6,4(1x,e10.3))')
     :  'i, j, nup, per, omega, damp, dt',
     :   i, j, nup, per_rs(j), omega, damp, dt

          call rd_calc(work,nup,omega,damp,dt,rd)
          rs(j, i) = omega*rd
        end do
      end do

* Write prv to output file:

      nu_out = 40
      open(unit=nu_out, file=f_rs_out, status = 'unknown')

      col_head = ' '
      col_head(9:11) = 'per'
```

```
      write(*, '(a)') col_head
      do i = 1, nsegs
        col_head((i+1)*11-3:(i+1)*11-2) = 'rs'
        write(col_head((i+1)*11-1:(i+1)*11), '(i2.2)') i
      end do

      write(nu_out, '(a)') col_head
      write(*, '(a)') col_head

      do i = 1, nper
        write(nu_out, '(1p7(1x,e10.3))')
     :  per_rs(i), (rs(i,j), j = 1, nsegs)
      end do

      close(unit=nu_out)

      close(unit=nu_cntrl)

      close(unit=nu_sum)


      stop
      end

      include 'c:\forprogs\smc_rw.for'
      include 'c:\forprogs\dcdt.for'
      include 'c:\forprogs\fbctpr.for'
      include 'c:\forprogs\rd_calc.for'
```

```
      Program RS2V_H

* Read response spectral files and makes a new file with
* ratios of individual horizontal components and with the
* geometric mean of the components.

* Make sure first entry in f_in is the output file name
* Make sure that the names of the two horizontal components
* come before the vertical component file name.  Also
* if one H component is dead, duplcate the name of the live H component.

* Dates: 05/09/96 - Written by D. Boore
*        05/15/97 - modified to include id tag, read from the input file
*                   and to add header lines with input file names:

      real rs(100,3), per(100)
      character f_in*30, f_rs*30, colhead(3)*2
      character f_out*30, idtag*4
      logical f_in_exist

* Get input file:
      f_in_exist = .false.
      do while (.not. f_in_exist)
        f_in = ' '
        write(*, '(a\)')
     :    ' Enter name of file with file names (cr to quit): '
        read(*, '(a)') f_in
        if (f_in(1:4) .eq. '    ') stop
        inquire(file=f_in, exist=f_in_exist)
        if (.not. f_in_exist) then
          write(*,'(a)') ' ******* FILE DOES NOT EXIST ******* '
        end if
      end do

* Open file and read coefficients into an array:
      nu_in = 10
      open(unit=nu_in, file=f_in, status='unknown')

* Read idtag:
      idtag = ' '
      read(nu_in, '(a)') idtag

* Read output file name:
      f_out = ' '
      read(nu_in, '(a)') f_out

* Open output file:
      nu_out = 40
      open(unit=nu_out, file=f_out, status='unknown')
      write(nu_out, '(2a)') ' File with input parameters: ', f_in

* Read file names and spectra:
      do i = 1, 3
        f_rs = ' '
        read(nu_in, '(a)') f_rs
        write(nu_out, '(a, i2,2a)')
     :    ' File with response spectra, comp. ',i, ': ', f_rs
        nu_rs = 30
        open(unit=nu_rs, file=f_rs, status='unknown')
        call skip(nu_rs, 11)
        colhead(i) = ' '
        read(nu_rs, '(t47,a)') colhead(i)
        do j = 1, 91
          read(nu_rs, '(t8,f6.3, t45,e9.3)') per(j), rs(j,i)
        end do
        close(unit=nu_rs)
      end do

      close(unit=nu_in)

      write(nu_out, '( t5,a, t14,a, t25,a, t35,a, t47,a,
     :                t58,a, t69,a, t80,a)')
     :   'per'//idtag, colhead(1)//'-H1'//idtag,
     :    colhead(2)//'-H2'//idtag,
     :   'Gavg_H'//idtag, colhead(3)//'-H3'//idtag,
     :   'H3/HT'//idtag, 'H3/H2'//idtag, 'H3/GH'//idtag


* Form averages and ratios:
      do i = 1, 91
        gavg = sqrt(rs(i,1)*rs(i,2))
        write(nu_out, '(1p8(1x,e10.3))')
     :     per(i), rs(i,1), rs(i,2), gavg, rs(i,3),
     :     rs(i,3)/rs(i,1), rs(i,3)/rs(i,2), rs(i,3)/gavg
      end do

      close(unit = nu_out)

      stop
      end

      include '\forprogs\skip.for'
```

```
      Program SMC2ASC

* Read an input file with info for 1 to 3 smc files.  Read
* the smc file and reformat to produce a column file (actually, in
* CoPlot parlance, a wrapped ascii file).

* The basic use is to produce one file with three components that can be used
* by CoPlot to make a plot.

* Dates: 07/17/97 - Written by D. Boore
*        08/16/97 - Allow for a 6 character id tag
*                   increase # of time points to 11,000
*        08/20/97 - Named changed to SMC2ASC to be more exact (it creates
*                   a *.ASC file)
*        10/20/97 - Increased number of time points to 16,000

      real ts(16000, 3), sps(3)
      integer npts(3)
      real real_head(50)
      integer int_head(48)
      character char_head(11)*80
      character f_in*30, f_out*30, f_ts*30, idtag(3)*6,
     :  colhead(3)*11, ts_c(3)*11
      logical f_in_exist

      npts_max = 16000           ! depends on dimensions statement


* Get name of input file:
      f_in_exist = .false.
      do while (.not. f_in_exist)
        f_in = ' '
        write(*, '(a\)')
     :    ' Enter name of file with file names (cr to quit): '
        read(*, '(a)') f_in
        if (f_in(1:4) .eq. '    ') stop
        inquire(file=f_in, exist=f_in_exist)
        if (.not. f_in_exist) then
          write(*,'(a)') ' ******* FILE DOES NOT EXIST ******* '
        end if
      end do

* Open file
      nu_in = 10
      open(unit=nu_in, file=f_in, status='unknown')

* Read number of time series to process (1, 2, or 3):
      read(nu_in, *) nts

* Read output file name:
      f_out = ' '
      read(nu_in, '(a)') f_out

* Open output file:
      nu_out = 40
      open(unit=nu_out, file=f_out, status='unknown')
      write(nu_out, '(2a)') ' File with input parameters: ', f_in

* Loop over time series:

      do j = 1, nts
* Read idtag:
        idtag(j) = ' '
        read(nu_in, '(a)') idtag(j)
* Set up the column headings:
        colhead(j) = ' '
        colhead(j) = '  ts:'//idtag(j)
        write(*,'(2a)') ' colhead = ', colhead(j)
* Read file name:
        f_ts = ' '
        read(nu_in, '(a)') f_ts
        nu_ts = 30
        call ReadSMC(nu_ts, f_ts, npts_max, 0.0,
     :     ts(1,j), npts(j), sps(j), char_head, int_head, real_head)
        write(nu_out, '(2a)')
     :    ' File with time series: ',f_ts
        write(nu_out, '(3x, a, i5, 1x, f7.3)')
     :    ' npts, sps = ', npts(j), sps(j)
      end do

      close(unit=nu_in)

* Write output:

      write(nu_out, '(3(1x,3x,a4,1x,a11))')
     :    ('time', colhead(j), j = 1, nts)

* Figure out largest value of npts:
      call imnmax(npts,1,nts,1,imin,imax)
      write(*, '(a, 2(1x,i5))') ' imin, imax = ', imin, imax
      if (imax .gt. npts_max) then
        write(*, '(a,1x,i6,1x,a)') ' **** WARNING ****, imax = ',
     :    imax, ', which is greater than npts_max; QUITTING!'
        stop
      end if

      do i = 1, imax

* Account for unequal number of points:
        do j = 1, nts
          if (i .le. npts(j)) then              ! fill output string with value
            write(ts_c(j), '(1pe11.4)') ts(i,j)
* Note: best if could use blanks, but CoPlot does not import this
* correctly as wrapped ascii.  It would import properly if I made
* a column file, but I am reluctant to strip off the informative header lines
*         else                                 ! fill with blanks
*           ts_c(j) = ' '
          else                                 ! fill with very large number
            write(ts_c(j), '(1pe11.4)') 1.0e37
          end if
        end do
        write(nu_out, '(3(1x,f7.3,1x,a))')
     :    (float(i-1)/sps(j),ts_c(j), j = 1, nts)
      end do

      close(unit=nu_out)

      stop
      end

*-----------------   Begin ReadSMC   ---------------------------------

      subroutine ReadSMC(unit, file, npts_max, tskip,
     :                   y, npts, sps, char_head, int_head, real_head)

* The output arrays char_head, int_head, real_head should be dimensioned
* as follows in the calling program:

*      character char_head(11)*80
*      integer int_head(48)
*      real real_head(50)
```

```
*  Dates: 07/17/97 - Modified order of input parameters, to put input
*                    first (unit, file, tskip), followed by output.

      real real_head(*)
      integer int_head(*)
      character*80 char_head(*)
      character file*(*)
      real y(*)
      integer unit

      open(unit= unit, file=file,
     :   status='old')

      do i = 1, 11
        read(unit, '(a)') char_head(i)
      end do

      read(unit, '(8I10)') (int_head(i), i=1, 48)

      read(unit, '(5e15.7)') (real_head(i), i = 1, 50)

      sps = real_head(2)

      do i = 1, int_head(16)
        read(unit,*)
      end do

      read(unit, '(8(e10.4e1))') (y(i), i = 1, int_head(17))

* Skip into the trace:

      nskip = tskip * sps

      int_head(17) = int_head(17) - nskip
      npts = int_head(17)
      if (npts .gt. npts_max) then
        write(*, '(a, i6, a, i6, a)')
     : ' npts (', npts, ') .gt. npts_max (', npts_max, '); QUITTING!'
        stop
      end if
      do i = 1, npts
        y(i) = y( i + nskip)
      end do

      close(unit=unit)
      return
      end

*-----------------   End ReadSMC   --------------------------------

* --------------------- BEGIN IMNMAX ---------------------
      subroutine imnmax(ia,nstrt,nstop,ninc,imin,imax)
c
* Compute min, max for an integer array

c author: D. M. Boore
c last change: 7/17/97 - Written, based on mnmax.for
c
      integer ia(*)
      imax = ia( nstrt)
      imin=imax
      do 10 i=nstrt,nstop,ninc
      if(ia(i)-imax) 15,15,20
20    imax=ia(i)
      go to 10
15    if(ia(i)-imin) 25,10,10
25    imin=ia(i)
10    continue
      return
      end
* --------------------- END IMNMAX ---------------------
```

```
      Program TDSM2SMC

*  read acceleration series from TDSIM and
*  convert to SMC format.

* Dates:  01/26/94 - Written by Dave Boore

      dimension tdsim(16400)

      character filein*12, fileout*12

2000  continue

      write(*, '(2a\)')
     : ' Enter the filename for the TDSIM time',
     : ' series (CR to quit):'

      filein = ' '
      read(*, '(a)') filein

      write(*, '(2a)') ' TDSIM file= ', filein

      if (filein(1:1) .eq. ' ') then
         write(*, '(a)') ' Quitting, as you requested!'
         go to 999
      end if

      open(unit=10, file=filein, status='old')

      call skip(10,4)

* Get dt, npts:

      call skip(10,12)
      read(10,'( t4,f7.4, t17,i5)')  dt, npts

      write(*, '(a,f6.3,i5)') ' dt, npts= ', dt, npts

* Read the time series:

      do i = 1, npts
        read(10,'(f9.4,2(1x,e10.3))') time, amax, tdsim(i)
      end do

      close(unit=10)

* Remove normalization

      do i = 1, npts
        tdsim(i) = amax*(tdsim(i)-1.0)
      end do

*  Call a subroutine that writes an SMC file.  Make the file name from
*  the stem of the FILEIN name.

      fileout = ' '
      fileout = filein(1:index(filein,'.'))//
     :  'smc'

      ivert = 90
      ihor = 0

      call WriteSMC(fileout, tdsim,
     :  dt, npts, ivert, ihor)

      go to 2000         ! Loop back for another dtsim file

999   continue
      stop
      end

* ##################################################################
      subroutine SKIP(lunit, nlines)
        do i = 1, nlines
           read(lunit, *)
        end do
        return
      end
* ##################################################################


* ##################################################################
      subroutine WriteSMC(fnameout, accel,
     :  dt, naccel, ivert, ihor)

*  Reformats a time series
*  into SMC format (the format used on the CD-ROM)

      real  rnull, accel(*), rhead(50)

      integer ncomments, naccel, inull, ihead(48)

      character fnameout*12

* Open output file:
      open(unit=30, file=fnameout, status='unknown')

* Write name to screen:
      write(*, '(2a)') ' Output file name: ', fnameout

* Write headers:

* First write the 11 lines of comments:

      write(30, '(a)') '*'
      write(30, '(a)') '*'
      write(30, '(a)') ' stacode'
      write(30, '(a)') ' date, eqname'
      write(30, '(a)') 'Moment Mag='
      write(30, '(a,t30,a,i3,1x,a,i3)') 'station = ',
     :                                'orient_h= ', ihor,
     :                                'orient_v= ', ivert
      write(30, '(a,t34,a)') 'epicentral dist =','pk acc ='
      write(30, '(a, t22, a)') 'inst type=DSA', 'data source = SCE'
      write(30, '(a)') '*'
      write(30, '(a)') '*'
      write(30, '(a)') '*'

* Now write the integer header block:
* First fill with null values:

      inull = -32768
      do i = 1, 48
        ihead(i) = inull
      end do

      ihead(1) = inull
      ihead(11) = 3
      ihead(13) = ivert
      ihead(14) = ihor
      ncomments = 0
      ihead(16) = ncomments
      ihead(17) = naccel
```

```
      write(30, '(8I10)') (ihead(i), i=1,48)

* Now write the real header block:
* First fill with null values:
      rnull = 1.7e+38
      do i = 1, 50
        rhead(i) = rnull
      end do

      rhead(1) = rnull
      sps = 1.0/dt
      rhead(2) = sps

      write(30, '(5E15.7)') (rhead(i), i=1,50)

* Write the acceleration values

      write(30, '(8(1pe10.4e1))')
     :        (accel(j), j = 1, naccel)

* That should be it; close the output file and loop back for another component

      close(unit=30)

      return
      end
* ######################################################
```

```
c Program TS2FAS

c Computes the Fourier amplitude spectra for specified time series.
* The program reads a list of time series, and an output
* file containing the spectra is written.
* A summary file is also created.  The intended use is to provide input to
* CoPlot on the PC.

* Assumptions:

*    * number of frequency output points is less than 5000.
*    * the number of time series is 22 or less (so that recl = 255 is ok,
*        the restriction on number of time series can be easily changed by
*        changing recl in the open statements).
*    * With one exception, no assumption is made about equality of dt or npts
*      for each time series when computing spectra.  This is not true
*      it is for the time
*      series output file (for which the first column is the set of time
*      values, based on the dt and npts from the last time series
*      processed.  The exception for frequency is if df_intrp = 0, in which
*      case the output frequencies are the same as the fft frequencies
*      (within the bounds specified by the low and high interpolation
*      parameters), and these must be the same for each spectrum written to
*      a file, since I assume a common frequency axis (although I could
*      write separate frequency columns for each spectrum).

* Dates:  2/15/93 - Written by D. M. Boore.
*                   This is a revision of an earlier version, using
*                   FASRATIO as a guide.
*         4/07/95 - Commented out write time series, changed logic
*                   to write spectra for a group of files, indicated
*                   by a 'p' in the first column.
*                   I also replaced DREAD in GetSpectrum with READ_VFBB.
*                   In addition, I label the FAS columns with the first
*                   12 characters of the ts_name (which requires ts_name
*                   to be an array).
*         4/27/95 - Increased dimensions to 8200 from 5000
*         5/04/95 - Added columns with ln(FAS) for use in COPLOT to
*                   determine kappa.
*         5/06/95 - Made acceleration output files smaller by being
*                   smarter about record length and number of points in output.
*         6/26/95 - Increased dimensions to 16400 from 8200.
c
c Dimension and declaration statements:

      real fas(16400,22), freq_out(16400)
      real ts(16400,22), tvals(16400)

      integer  iprcntfrtaper, record_length_fas, record_length_acc

      character bufd*9, buft*8, reply*40, buffer*80,
     :        ts_name(22)*80, bigbuf*380, fname*80,
     :        f_fas*20, f_ts*20

c Initializations:

       nread  = 3
       nwrite_fas= 20
       nwrite_ts= 10
       nsummary = 7

c Date and time stamp:

      call date(bufd)
      call time(buft)

c Open I/O units:

      reply = ' '
      write(*, '(a$)') ' Enter input file name: '
      read(*, '(a)') reply
      open(unit=nread, file=reply, status='old',
     :     readonly)


      reply = ' '
      write(*, '(a$)') ' Enter summary file name: '
      read(*, '(a)') reply
      open(unit=nsummary, file=reply, carriagecontrol='list',
     :     status='new')

* Read interpolation parameters:

      buffer = ' '

      read (nread, '(a)', end=9999) buffer

      call RCF(1, buffer, 80, df_intrp    , istat) ! df_intrp=0 means use df_fft
      call RCF(2, buffer, 80, f_intrp_low , istat)
      call RCF(3, buffer, 80, f_intrp_high, istat)

* Set up the frequency array:

      if (df_intrp .eq. 0.0) then
        mspct = 0
        freq_out(1) = f_intrp_low
        freq_out(2) = f_intrp_high
      else
        mspct = (f_intrp_high-f_intrp_low)/df_intrp + 1
        do i = 1, mspct
          freq_out(i) = float(i-1) * df_intrp + f_intrp_low
        end do
      end if

      write(nsummary, '(1x,a,f5.3,a,f6.2,a,i4)' )
     :        ' df_intrp= '     , df_intrp,
     :        ' f_intrp_high= ' , f_intrp_high,
     :        ' mspct= '        , mspct


c
c------------------------------------------------------------
c LOOP OVER RECORDS
c

      nrec = 0

1000  continue

* Read a line.  If ' stop', quit.
*               If 'p ', calculate record_length, open output file, write FAS
*                  'p t' means to also write out the time series
*               If not above, read ts, computed FAS

* Read a file name, checking for STOP:
* Mark the end of the list with a line having "stop" starting on column 2.

      buffer = ' '
      read (nread, '(a)', end=9999) buffer
      if(buffer(2:5) .eq. 'stop'
     : .or. buffer(2:5) .eq. 'STOP') go to 9999
```

```
* Check for 'p':

      if(buffer(1:2) .ne. 'p ' .and.
     :   buffer(1:2) .ne. 'P ') then     ! Not finished with a group of FAS

* Extract the filename, start time, window length,
* percent taper at front (the back taper is assumed to be the same length),
* and the smoothing (in terms of the width of the smoothing window
* in Hz).

         nrec = nrec+ 1

* Now extract the filename, start time, window length, etc:

         call RCC(1, buffer, 80, ts_name(nrec), nc)
         call RCF(2, buffer, 80, tstartsignal , istat)
         call RCF(3, buffer, 80, tlengthsignal, istat)
         call RCI(4, buffer, 80, iprcntfrtaper , istat)
         call RCF(5, buffer, 80, smoo         , istat)

* Remove blanks from file names (RMBLNK is in
* pub1:[agram.agramlib]agramlib/libr).

         call RMBLNK( 3, ts_name(nrec), newend_ts)

* Get the smoothed spectrum of the file:

         fname = ' '
         fname = ts_name(nrec)(1:newend_ts)

         if (df_intrp .eq. 0.0) then
            mspct = 0
            freq_out(1) = f_intrp_low
            freq_out(2) = f_intrp_high
         end if

         call Get_Spectrum(fname,
     :       tstartsignal, tlengthsignal, iprcntfrtaper, smoo,
     :       dt, npts, npw2, df, fas(1,nrec), ts(1, nrec),
     :       freq_out, mspct, nsummary)

c Loop back for another record

         go to 1000

      else                         ! finished with a group of FAS... write the FAS

* Write the spectra  (note: see the block of commented statements at the end
* for writing the time series).

* Figure out record length, construct the file name, and open the file:

          record_length_fas = 29*nrec + 8
          record_length_acc = 13*nrec + 8

* Check for writing the time series:

          if (buffer(1:3) .eq. 'p t') then

* Write the time series to a file:


*  First fill the time value array:

            nup = npw2
            nup = npts
            do i = 1, nup
               tvals(i) = float(i-1)*dt
            end do

            f_ts = ' '
            f_ts = ts_name(nrec)(index(ts_name(nrec),']')+1:
     :             index(ts_name(nrec),';')-5)//'.acc'

         write(nsummary,'(2a)') ' write ACC into file: ', f_ts
            open(unit=nwrite_ts, file=f_ts,
     :       recl = record_length_acc,
     :       carriagecontrol='list', status='new')

*   First write the header:

            bigbuf = ' '
            bigbuf(5:8) = 'TIME'

            do irec = 1, nrec
              iseg = 13*(irec-1)
              bigbuf(iseg+10:iseg+21) =
     :          ts_name(irec)(index(ts_name(irec),']')+1:
     :          index(ts_name(irec),';')-1)
     :          //'____________'     ! Add this in case ts_name < 12 characters
            end do

            write(nwrite_ts, '(a)') bigbuf(1:record_length_acc)

*   Now write the time series:

            nup = npw2
            nup = npts
            do i = 1, nup

              bigbuf = ' '

              write(bigbuf(2:8),'(f7.3)')
     :             tvals(i)

              do irec = 1, nrec
                iseg = 13*(irec-1)
                write(bigbuf(iseg+10:iseg+21),'(1pe12.3)')
     :             ts(i,irec)
              enddo

              write(nwrite_ts, '(a)') bigbuf(1:record_length_acc)

            end do

* Close files containing time series

            close(unit=nwrite_ts)

         end if


         f_fas = ' '
         f_fas = ts_name(nrec)(index(ts_name(nrec),']')+1:
     :             index(ts_name(nrec),';')-5)//'.fas'


         write(nsummary,'(2a)') ' write FAS into file: ', f_fas
         open(unit=nwrite_fas, file=f_fas,
     :    recl = record_length_fas,
```

```
     :    carriagecontrol='list', status='new')


*   First write the header:

        bigbuf = ' '
        bigbuf(5:8) = 'FREQ'

        do irec = 1, nrec
          iseg = 29*(irec-1)
          bigbuf(iseg+10:iseg+21) =
     :      ts_name(irec)(index(ts_name(irec),']')+1:
     :      index(ts_name(irec),';')-1)
     :      //'____________'    ! Add this in case ts_name < 12 characters
          bigbuf(iseg+23:iseg+37) =
     :      'LN:'//
     :      ts_name(irec)(index(ts_name(irec),']')+1:
     :      index(ts_name(irec),';')-1)
     :      //'____________'    ! Add this in case ts_name < 12 characters
        end do

        write(nwrite_fas, '(a)') bigbuf(1:record_length_fas)


*   Now write the Fourier spectra:

        do i = 1, mspct

          bigbuf = ' '

          write(bigbuf(2:8),'(f7.3)')
     :         freq_out(i)

          do irec = 1, nrec
            iseg = 29*(irec-1)
            write(bigbuf(iseg+10:iseg+21),'(1pe12.3)')
     :         fas(i,irec)
            if( fas(i, irec) .eq. 0.0) then
               alnfas = -9999.0
            else
               alnfas = alog(fas(i, irec))
            end if
            write(bigbuf(iseg+26:iseg+37),'(1pe12.3)')
     :         alnfas
          enddo

          write(nwrite_fas, '(a)') bigbuf(1:record_length_fas)

        end do

* Close file containing the Fourier spectra

        close(unit=nwrite_fas)

* Reset nrec and loop back for another record:

        nrec = 0
        go to 1000

      end if


9999  continue

* Close input file

      close(unit=nread)

* Close summary file

      close(unit=nsummary)

      stop
      end

*##########################################################
      subroutine Get_Spectrum(fname,
     :     tstartsignal, tlengthsignal,iprcntfrtaper, smoo,
     :     dt, npts, npw2, df, spect_out, ts,
     :     freq_out, mspct, nsummary)

* Note that this version of Get_Spectrum includes smoo rather than nhits
* in the argument list (nhits is an argument of the version of
* Get_Spectrum in BH_SPECT).  In all cases Get_Spectrum is bundled
* with the main program, so changes in the arguments should not lead to
* confusion.

      real spect_out(*), freq_out(*), ts(*)
      real data(16400), freq(8200), spect(16400)

      integer  iprcntfrtaper

      character fname*80

c Initializations:

       ndimen = 16400
       iudata = 4

      write(*,'(1x,a)') 'Processing file:'//fname

      write(*,'(2(1x,f7.3), 1x,i2,1x,f5.2)') tstartsignal,
     :               tlengthsignal, iprcntfrtaper, smoo

      write (nsummary, 30) fname,
     *                      tstartsignal,tlengthsignal,
     :                      iprcntfrtaper, smoo

30    format(1x,'data file= ',a/
     : 3x,'signal: start=',f7.3,' length=',f7.3,
     : ' iprcnttaper= ', i2, ' smoo= ',f5.2)

* Open time series file:

      open(unit=iudata,file=fname,access='direct',status='old',
     1     readonly,recordsize=128,
     2     associatevariable=iav)

* Read the data:

      irdec = 1
      call read_vfbb(fname,data,ndimen,tstartsignal,tlengthsignal,
     *           irdec, dt, npts, t_fs, ierr)

      close(unit=iudata)

*      do i = 1, npts
*        ts(i) = data(i)
*      end do

      write(nsummary,4210) dt, npts
4210  format(3x,'signal: dt=',f8.6,' npts=',i5,30('.'))
```

```
      program V_H_Emp

* Makes a file with V/H from several regression relations:
*       Abrahamson and Silva (1997)
*       Campbell (1997)
*       Sadigh et al., (1993) (NO: rock only)

* Compute separate files for several magnitudes, each relation,
* soil, soft rock, rock, oblique faulting

* Dates: 08/29/97 - Written by D. Boore, using Norm Abrahamson's code as a start
*                   and Norm's subroutines as is.  Note that I changed
*                   "isoil" to "irock" for Campbell, because for AS97 soil = 1
*                   indicates soil, but for C97 what was called isoil indicated
*                   soil response when isoil = 0; this is confusing.


      real amag
      real ftype_as97, soil
      real ftype_c97, basedpth
      integer ihw
      integer irock, isoftrck, ihardrck
      real period(13)
      real dist_as97(7), v_h_as97(7)
      real dist_c97(4) , v_h_c97(4)
      character f_in*30, f_out*30, cdum*80
      logical f_in_exist

      data period / 0.05, 0.075, 0.10, 0.15, 0.20, 0.30, 0.50,
     :              0.75, 1.00 , 1.50, 2.00, 3.00, 4.00/
      data dist_as97/ 10.0, 20.0, 40.0, 60.0, 80.0, 120.0, 160.0/
      data dist_c97 / 10.0, 20.0, 40.0, 60.0/

      nper = 13
      ndist_as97 = 7
      ndist_c97 = 4

* Get name of input file:
      f_in_exist = .false.
      do while (.not. f_in_exist)
        f_in = ' '
        write(*, '(a\)')
     :    ' Enter name of file with file names (cr to quit): '
        read(*, '(a)') f_in
        if (f_in(1:4) .eq. '    ') stop
        inquire(file=f_in, exist=f_in_exist)
        if (.not. f_in_exist) then
          write(*,'(a)') ' ******* FILE DOES NOT EXIST ******* '
        end if
      end do

* Open file
      nu_in = 10
      open(unit=nu_in, file=f_in, status='unknown')


* Read input file:
      read(nu_in,*)
      read(nu_in, *) ncases

* Loop over cases:
      do icases = 1, ncases

* Read info for each case:
        read(nu_in,*)
        f_out = ' '
        read(nu_in,'(a)') f_out
        nu_out = 20
        open(unit=nu_out, file=f_out, status='unknown')

        write(nu_out, '(a)') ' Filename Output'
        write(nu_out, '(a)') f_out

        read(nu_in,*)
        read(nu_in,*) amag,
     :                ftype_as97, soil, ihw,
     :                ftype_c97, irock, isoftrck, ihardrck, basedpth

        write(nu_out, '(2a)')
     :   'amag, ftype_as97, soil, ihw, ',
     :        'ftype_c97, irock, isoftrck, ihardrck, basedpth'
        write(nu_out,'(3(1x,f3.1),1x,i1,1x,f3.1,3(1x,i1),1x,f4.1)')
     :  amag,
     :        ftype_as97, soil, ihw,
     :        ftype_c97, irock, isoftrck, ihardrck, basedpth

        write(nu_out, 111)
111     format (t8,'amag',  t17,'period',
     :    t25,'as97-d010',  t36,'as97-d020',  t47,'as97-d040',
     :    t58,'as97-d060',  t69,'as97-d080',  t80,'as97-d120',
     :    t91,'as97-d160',
     :    t103, 'c97-d010',  t114,'c97-d020',  t125,'c97-d040',
     :    t136,'c97-d060')

        do iper=1,nPer

          do idist = 1, ndist_as97
            call AS_95b_H ( amag, dist_as97(idist),
     :       ftype_as97, soil, ihw, period(iper), period_out,
     :       alnH, sigma )
            call AS_95b_V ( amag, dist_as97(idist),
     :       ftype_as97, soil, ihw, period(iper), period_out,
     :       alnV, sigma )
            v_h_as97(idist) = exp(alnV - alnH)
          end do

          do idist = 1, ndist_c97
            call Campbell_97_H ( amag, dist_c97(idist),
     :       ftype_c97, alnH, sigma, period(iper),
     :       irock, isoftRck, ihardRck, baseDpth,
     :       cdum, period_out)
            call Campbell_97_Z ( amag, dist_c97(idist),
     :       ftype_c97, alnV, sigma, period(iper),
     :       irock, isoftRck, ihardRck, baseDpth,
     :       cdum, period_out)
            v_h_c97(idist) = exp(alnV - alnH)
          end do

          write (nu_out,'( 1p13(1x,e10.3))')
     :      amag, period(iper),
     :      (v_h_as97(i), i=1,ndist_as97),
     :      ( v_h_c97(j), j=1,ndist_c97 )

        enddo    ! loop over nper

      end do    ! loop over ncases

      close(unit=nu_out)
      close(unit=nu_in)

      stop
```

```
      end

      subroutine Campbell_97_Z ( mag, d, ftype, lnY, sigma, Tref,
     1               rockFlag, softRock, hardRock, baseDepth,
     2               attenName, period1 )
c     This subroutine uses the Campbell 1997 attenuation relationship.
      parameter (MAXPER=14)
      real mag, d, ftype, lnY, sigma, baseDepth, horiz, Hsigma
      integer iper, rockFlag, softRock, hardRock, Tflag, i
      real Tref, period1, period2
      real c1(MAXPER), c2(MAXPER), c3(MAXPER), c4(MAXPER), c5(MAXPER),
     1     period(MAXPER)
      character*80 attenName, attenname1

      data period / 0.00, 0.05, 0.075, 0.10, 0.15, 0.2, 0.3,
     1              0.5, 0.75, 1.0, 1.5, 2.0, 3.0, 4.0 /
      data c1 / 0.00, -1.32, -1.21, -1.29, -1.57, -1.73, -1.98,
     1        -2.03, -1.79, -1.82, -1.81, -1.65, -1.31, -1.35/
      data c2 / 0.00, 0., 0., 0., 0., 0., 0., 0.46, 0.67, 1.13,
     1        1.52, 1.65, 1.28, 1.15 /
      data c3 / 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, -0.74,
     1        -1.23, -1.59, -1.98, -2.23, -2.39, -2.03 /
      data c4 / 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
     1      0.18,  0.57,  0.61,  1.07,  1.26 /
      data c5 / 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
     1      -0.18, -0.49, -0.63, -0.84, -1.17 /


      Tflag = 0
      do i=1,14
         if (Tref .eq. period(i)) then
            iPer = i
            Tflag = 0
            goto 12
         endif
         Tflag = 1
         iPer = 1
      enddo
 12   period1 = period (iPer)
      if (Tflag .eq. 1) then
         lnY = 0.0
         sigma = -99.0
         return
      endif

c     Set name
      if ( rockFlag .eq. 0 ) then
        attenName = 'Campbell 97 Z soil'
      elseif ( softRock .eq. 1 ) then
        attenName = 'Campbell 97 Z soft-rock'
      elseif ( hardRock .eq. 1 ) then
        attenName = 'Campbell 97 Z hard-rock'
      else
        write (*,'( 2x,''bad site flags for Campbell 97'')')
        stop 99
      endif

c     Compute horizontal
c     note since output of campbell_97_H has already been
c     converted to gals, we don't need to do it again
      call Campbell_97_H ( mag, d, ftype, horiz, Hsigma, Tref,
     1              rockFlag, softRock, hardRock, baseDepth,
     1              attenName1, period2 )

       if (period1.ne.period2) then
         write(*,'(2x,''Error in subroutine Campbell_97_Z'')')
         write(*,'(2x,''periods do not match'')')
           write (*,*) period1, period2
         stop 99
        endif

       if (iper .eq. 1) then
         lnY = horiz - 1.58 - 0.10*mag
     1       - 1.5*alog(d+0.079*exp(0.661*mag))
     2       + 1.89*alog(d+0.361*exp(0.576*mag))
     3       -0.11*ftype
         sigma = sqrt( Hsigma**2 + 0.36**2)
       else
         lnY = horiz + c1(iper) - 0.11*mag
     1         + c2(iper)*tanh(0.71*(mag-4.7))
     2         + c3(iper)*tanh(0.66*(mag-4.7))
     3         - 1.50*alog(d+0.071*exp(0.661*mag))
     4         + 1.89*alog(d+0.361*exp(0.576*mag))
     5         - 0.11*ftype + c4(iper)*
     6          tanh(0.51*basedepth)
     7         + c5(iper)*tanh(0.57*basedepth)
         sigma = sqrt( Hsigma**2 + 0.39**2)
       endif

       return
       end

c ---------------------------------------------------------------
       subroutine Campbell_97_H ( m, d, ftype, lnY, sigma, Tref,
     1               rockFlag, softRock, hardRock, baseDepth,
     2               attenName, period1 )
c      This subroutine uses the Campbell 1997 attenuation relationship.
       parameter (MAXPER=14)
       real m, d, ftype, lnY, sigma, baseDepth, fsa, r, period1
       integer iper, rockFlag, softRock, hardRock, Tflag, i
       real lnPGA97, Tref
       real c1(MAXPER), c2(MAXPER), c3(MAXPER), c4(MAXPER), c5(MAXPER),
     1     c6(MAXPER), c7(MAXPER), c8(MAXPER), period(MAXPER)
       character*80 attenName

       data period / 0.00, 0.05, 0.075, 0.10, 0.15, 0.2, 0.3,
     1               0.5, 0.75, 1.0, 1.5, 2.0, 3.0, 4.0 /
       data c1 / 0.00, 0.05, 0.27, 0.48, 0.72, 0.79, 0.77, -0.28,
     1         -1.08, -1.79, -2.65, -3.28, -4.07, -4.26 /
       data c2 / 0.00, 0., 0., 0., 0., 0., 0., 0.74, 1.23, 1.59,
     1         1.98, 2.23, 2.39, 2.03 /
       data c3 / 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.66,
     1        0.66, 0.66, 0.66, 0.66, 0.66, 0.66 /
       data c4 / 0.00, -0.0011, -0.0024, -0.0024, -0.0010, 0.0011,
     1       0.0035,  0.0068,  0.0077,  0.0085,  0.0094, 0.0100,
     2       0.0108,  0.0112 /
       data c5 / 0.00, 0.000055, 0.000095, 0.000007, -0.00027,
     1      -0.00053, -0.00072, -0.00100, -0.00100, -0.00100,
     2      -0.00100, -0.00100, -0.00100, -0.00100 /
       data c6 / 0.00, 0.20, 0.22, 0.14, -0.02, -0.18, -0.40,
     1        -0.42, -0.44, -0.38, -0.32, -0.36, -0.22, -0.30 /
       data c7 / 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.25,
     1         0.37, 0.57, 0.72, 0.83, 0.86, 1.05 /
       data c8 / 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.62,
     1         0.62, 0.62, 0.62, 0.62, 0.62, 0.62 /

       Tflag = 0
       do i=1,14
          if (Tref .eq. period(i)) then
             iPer = i
             Tflag = 0
```

```
         goto 12
      endif
      Tflag = 1
      iPer = 1
   enddo
12 period1 = period (iPer)
   if (Tflag .eq. 1) then
      lnY = 0.0
      sigma = -99.0
      return
   endif

c  Set name
   if ( rockFlag .eq. 0 ) then
     attenName = 'Campbell 97 soil'
   elseif ( softRock .eq. 1 ) then
     attenName = 'Campbell 97 soft-rock'
   elseif ( hardRock .eq. 1 ) then
     attenName = 'Campbell 97 hard-rock'
   else
     write (*,'( 2x,''bad site flags for Campbell 97'')')
     stop 99
   endif

c  Compute pga for 1997 relation
   r = sqrt( d**2 + (0.149*exp(0.647*m))**2)
   lnPGA97 = -3.512 + 0.904*m - 1.328*alog(r)
  1          + (1.125-0.112*alog(d)-0.0957*m)*ftype
  2          + (0.440-0.171*alog(d))*softRock
  3          + (0.405-0.222*alog(d))*hardRock
   if ( m .lt. 7.4 ) then
     sigma = 0.889 - 0.0691*m
   else
     sigma = 0.38
   endif
   if ( iper .eq. 1 ) then
      lnY = lnPGA97 + 6.89
      return
   endif

c  Compute Campbell 1997 SA values.
   if (baseDepth .lt. 1.0) then
      fsa = c6(iper)*(1-hardRock)*(1-basedepth)+
  1         0.5*c6(iper)*(1-basedepth)*softrock
   else
      fsa = 0.0
   endif

   lnY=lnPGA97+c1(iper)+c2(iper)*tanh(c3(iper)*(m-4.7))+
  1    (c4(iper)+c5(iper)*m)*d+0.5*c6(iper)*softRock+
  2    c6(iper)*hardRock+c7(iper)*tanh(c8(iper)*basedepth)*
  3    (1.0-hardRock)+fsa

c  Convert to gal and set sigma values.
   lnY = lnY + 6.89
   sigma = sqrt(sigma*sigma + 0.27*0.27)

   return
   end

c -------------------------------------------------------------


   subroutine AS_95b_H ( mag, dist, mech, soil, hw, Tref, period1,
  1             lnY, sigma )
```

```
   parameter (MAXPER=27)

   integer i, Tflag, hw
   real mag, dist, mech, n, c4(MAXPER), rockPGA, Tref
   real mag1, c5, period(MAXPER), mu, b1(MAXPER), b2(MAXPER)
   real lnY, sigma, soil
   real a1(MAXPER), a2, a3(MAXPER), a4, a5(MAXPER), a6(MAXPER),
  1     a9(MAXPER), a10(MAXPER), a11(MAXPER), a12(MAXPER), a13,
  2     a14(MAXPER)

   data b1 / 0.700, 0.700, 0.705, 0.713, 0.720, 0.728,
  1         0.735, 0.739, 0.746, 0.754, 0.759, 0.765, 0.772,
  2         0.780, 0.787, 0.791, 0.796, 0.799, 0.806, 0.814,
  3         0.819, 0.825, 0.840, 0.851, 0.866, 0.877, 0.885 /
   data b2 /  0.135, 0.135, 0.135, 0.135, 0.135, 0.135,
  1          0.135, 0.135, 0.135, 0.135, 0.135, 0.135, 0.135,
  2          0.135, 0.135, 0.135, 0.132, 0.130, 0.127, 0.123,
  3          0.121, 0.118, 0.110, 0.105, 0.097, 0.092, 0.087 /

   data period / 0.00, 0.03, 0.04, 0.05, 0.06, 0.075, 0.09, 0.10,
  1   0.12, 0.15, 0.17, 0.20, 0.24, 0.30, 0.36, 0.40, 0.46, 0.50,
  2        0.60 ,0.75, 0.85, 1.00, 1.50, 2.00, 3.00, 4.00,  5.00/
   data c4 / 5.60, 5.60, 5.60, 5.60, 5.60, 5.58, 5.54, 5.50, 5.39,
  1          5.27, 5.20, 5.10, 4.97, 4.80, 4.62, 4.52, 4.38, 4.30,
  2          4.12, 3.90, 3.81, 3.70, 3.55, 3.50, 3.50, 3.50, 3.50 /
   data a1 / 1.640, 1.690, 1.780, 1.870, 1.940, 2.037, 2.100, 2.160,
  1          2.272, 2.407, 2.430, 2.406, 2.293, 2.114, 1.955, 1.860,
  2          1.717, 1.615, 1.428, 1.160, 1.020, 0.828, 0.260,-0.150,
  3         -0.690, -1.130, -1.460 /
   data a3 / -1.145, -1.145, -1.145, -1.145, -1.145, -1.145, -1.145,
  1          -1.145, -1.145, -1.145, -1.135, -1.115, -1.079, -1.035,
  2          -1.005, -0.988, -0.965, -0.952, -0.922, -0.885, -0.865,
  3          -0.838, -0.772, -0.725, -0.725, -0.725, -0.725 /
   data a5 / 0.610, 0.610, 0.610, 0.610, 0.610, 0.610, 0.610, 0.610,
  1          0.610, 0.610, 0.610, 0.610, 0.610, 0.610, 0.610, 0.610,
  2          0.592, 0.581, 0.557, 0.528, 0.512, 0.490, 0.438, 0.400,
  3          0.400, 0.400, 0.400 /
   data a6 / 0.260, 0.260, 0.260, 0.260, 0.260, 0.260, 0.260, 0.260,
  1          0.260, 0.260, 0.260, 0.260, 0.232, 0.198, 0.170, 0.154,
  2          0.132, 0.119, 0.091, 0.057, 0.038, 0.013,-0.049,-0.094,
  3         -0.156, -0.200, -0.200 /
   data a9 / 0.37, 0.37, 0.37, 0.37, 0.37, 0.37, 0.37, 0.37, 0.37,
  1          0.37, 0.37, 0.37, 0.37, 0.37, 0.37, 0.37, 0.37, 0.37,
  2     0.37, 0.331, 0.309, 0.281, 0.210, 0.160, 0.089, 0.039,0.0 /
   data a10 /-0.417, -0.470, -0.555, -0.620, -0.665, -0.628, -0.609,
  1          -0.598, -0.591, -0.577, -0.522, -0.445, -0.350, -0.219,
  2          -0.123, -0.065,  0.020,  0.085,  0.194,  0.320,  0.370,
  3            0.423, 0.600, 0.610, 0.630, 0.640, 0.664 /
   data a11 /-0.230, -0.230, -0.251, -0.267, -0.280, -0.280, -0.280,
  1          -0.280, -0.280, -0.280, -0.265, -0.245, -0.223, -0.195,
  2          -0.173, -0.160, -0.136, -0.121, -0.089, -0.050, -0.028,
  3           0.000,  0.040,  0.040,  0.040,  0.040,  0.040 /
   data a12 /0.0000, 0.0143, 0.0245, 0.0280, 0.0300, 0.0300, 0.0300,
  1   0.0280, 0.0180, 0.0050, -0.0040, -0.0138, -0.0238, -0.0360,
  2  -0.0460, -0.0518, -0.0594, -0.0635, -0.0740, -0.0862,
  3  -0.0927, -0.1020, -0.1200, -0.1400, -0.1726, -0.1956, -0.2150 /
   data a14 /-0.160, -0.160, -0.160, -0.160, -0.160, -0.160, -0.160,
  1          -0.160, -0.148, -0.134, -0.126, -0.115, -0.103, -0.089,
  2          -0.077, -0.070, -0.070, -0.070, -0.070, -0.131, -0.166,
  3          -0.210, -0.321, -0.400, -0.400, -0.400, -0.400 /
   data mag1,n,a2,a4,a13,c5 / 6.4, 2.0, 0.512, -0.144, 0.17, 0.03 /

   Tflag = 0
   do i=1,27
      if (Tref .eq. period(i)) then
         iPer = i
```

```
         Tflag = 0
         goto 12
      endif
      Tflag = 1
      iper = 1
   enddo
12 period1 = period (iPer)
   if (Tflag .eq. 1) then
      lnY = 0.0
      sigma = -99.0
      return
   endif

c  Compute the rock PGA
   soil1 = 0.0
   rockPga1 = 0.
   call Calcarg_as95 (mag,dist,mech,soil1, hw, 1, rockPGA, rockpga1,
  1  a1,a2,a3, a4, a5, a6, a9, a10, a11, a12, a13, c4, c5, mag1,
  2  n,a14)

c  Compute the Sa
   call Calcarg_as95 (mag,dist, mech, soil, hw, iPer, mu, rockpga,
  1 a1,a2,a3, a4, a5, a6, a9, a10, a11, a12, a13, c4, c5, mag1,
  2 n,a14)

    lnY = mu + 6.89

C  Set Standard Error.
   if (mag .le. 5.0) then
      sigma = b1(iper)
   elseif (mag .gt. 5.0 .and. mag .lt. 7.0) then
      sigma = b1(iPer) - b2(iPer)*(mag-5.0)
   elseif (mag .ge. 7.0) then
      sigma = b1(iPer) - 2.0*b2(iPer)
   endif

   return
   end

c ------------------------------------------------------------------
   subroutine AS_95b_V ( mag, dist, mech, soil, hw, Tref, period1,
  1                      lnY, sigma )
   parameter (MAXPER=27)

   integer i, Tflag, hw
   real mag, dist, mech, n, c4(MAXPER), rockPGA, Tref
   real mag1, c5, period(MAXPER), mu, b5(MAXPER), b6(MAXPER)
   real lnY, sigma, soil
   real a1(MAXPER), a2, a3(MAXPER), a4, a5(MAXPER), a6(MAXPER),
  1    a9(MAXPER), a10(MAXPER), a11(MAXPER), a12(MAXPER), a13,
  2     a14(MAXPER)
   data b5 / 0.760, 0.760, 0.760, 0.760, 0.760, 0.760,
  1         0.760, 0.760, 0.740, 0.720, 0.700, 0.690, 0.690,
  2         0.690, 0.690, 0.690, 0.690, 0.690, 0.690, 0.690,
  3         0.690, 0.690, 0.690, 0.690, 0.720, 0.750, 0.780 /
   data b6 /  0.085, 0.085, 0.085, 0.085, 0.085, 0.085,
  1          0.085, 0.085, 0.075, 0.063, 0.056, 0.050, 0.050,
  2          0.050, 0.050, 0.050, 0.050, 0.050, 0.050, 0.050,
  3          0.050, 0.050, 0.050, 0.050, 0.050, 0.050, 0.050 /
   data period /0.00, 0.03, 0.04, 0.05, 0.06, 0.075, 0.09, 0.10,
  1     0.12, 0.15, 0.17, 0.20, 0.24, 0.30, 0.36, 0.40,  0.46, 0.50,
  2          0.60 ,0.75, 0.85, 1.00, 1.50, 2.00, 3.00, 4.00,  5.00/
   data c4 / 6.00, 6.00, 6.00, 6.00, 6.00, 6.00, 6.00, 6.00, 6.00,
  1          6.00, 5.72, 5.35, 4.93, 4.42, 4.01, 3.77, 3.45, 3.26,
  2          2.85, 2.50, 2.50, 2.50, 2.50, 2.50, 2.50, 2.50, 2.50 /
   data a1 / 1.642, 2.100, 2.420, 2.620, 2.710, 2.750, 2.730, 2.700,
  1          2.480, 2.170, 1.960, 1.648, 1.312, 0.878, 0.617, 0.478,
  2    0.271, 0.145, -0.087, -0.344, -0.469, -0.602, -0.966, -1.224,
  3          -1.581, -1.857, -2.053 /
   data a3 /-1.2520,-1.3168,-1.3700,-1.3700,-1.3700,-1.3700, -1.3700,
  1     -1.3700, -1.2986, -1.2113, -1.1623, -1.0987, -1.0274, -0.9400,
  2    -0.9004, -0.8776, -0.8472, -0.8291, -0.7896, -0.7488, -0.7451,
  3    -0.7404, -0.7285, -0.7200, -0.7200, -0.7200, -0.7200 /
   data a5 / 0.390, 0.432, 0.469, 0.496, 0.518, 0.545, 0.567, 0.580,
  1          0.580, 0.580, 0.580, 0.580, 0.580, 0.580, 0.571, 0.539,
  2          0.497, 0.471, 0.416, 0.348, 0.309, 0.260, 0.260, 0.260,
  3          0.260, 0.260, 0.260 /
   data a6 / -0.050, -0.050, -0.050, -0.050, -0.050, -0.050, -0.050,
  1  -0.050,-0.017, 0.024, 0.047, 0.076, 0.109, 0.150, 0.150, 0.150,
  2          0.150, 0.150, 0.150, 0.150, 0.150, 0.150, 0.058,-0.008,
  3          -0.100, -0.100, -0.100 /
   data a9 /0.630,0.630,0.630,0.630,0.630,0.630,0.630,0.630,0.630,
  1   0.630, 0.604, 0.571, 0.533, 0.488, 0.450, 0.428, 0.400, 0.383,
  2   0.345, 0.299, 0.273, 0.240, 0.240, 0.240, 0.240, 0.240 ,0.240/
   data a10 / -0.140, -0.140, -0.140, -0.140, -0.140, -0.129, -0.119,
  1           -0.114, -0.104, -0.093, -0.087, -0.078, -0.069, -0.057,
  2           -0.048, -0.043, -0.035, -0.031, -0.022, -0.010, -0.004,
  3            0.004,  0.025,  0.040,  0.040,  0.040,  0.040 /
   data a11 / -0.220, -0.220, -0.220, -0.220, -0.220, -0.220, -0.220,
  1           -0.220, -0.220, -0.220, -0.220, -0.220, -0.220, -0.220,
  2           -0.220, -0.220, -0.220, -0.220, -0.220, -0.220, -0.220,
  3           -0.220, -0.220, -0.220, -0.220, -0.220, -0.220 /
   data a12 /0.0000,0.0000,0.0000,-0.0002,-0.0004,-0.0007,-0.0009,
  1   -0.0010, -0.0015, -0.0022, -0.0025, -0.0030, -0.0035, -0.0042,
  2            -0.0047, -0.0050, -0.0056, -0.0060, -0.0068, -0.0083,
  3   -0.0097, -0.0115, -0.0180, -0.0240, -0.0431, -0.0565, -0.0670/
   data a14 /-0.250, -0.250, -0.250, -0.250, -0.217, -0.178, -0.145,
  1          -0.126, -0.094, -0.054, -0.031, -0.002,  0.030,  0.070,
  2           0.070,  0.070,  0.070,  0.070,  0.070, -0.001, -0.037,
  3          -0.087, -0.212, -0.300, -0.300, -0.300, -0.300 /
   data mag1,n,a2,a4,a13,c5 / 6.4, 3.0, 0.909, 0.275, 0.06, 0.3/

   Tflag = 0
   do i=1,27
      if (Tref .eq. period(i)) then
         iPer = i
         Tflag = 0
         goto 12
      endif
      Tflag = 1
   enddo
12 period1 = period (iPer)
   if (Tflag .eq. 1) then
      lnY = 0.0
      sigma = -99.0
      iPer = 1
      return
   endif

c  Compute the rock PGA
   soil1 = 0.0
   rockPga1 = 0.
   call Calcarg_as95 (mag,dist,mech,soil1, hw, 1, rockPGA, rockpga1,
  1 a1, a2, a3, a4, a5, a6, a9, a10, a11, a12, a13, c4, c5, mag1,
  2  n,a14)

c  Compute the Sa
   call Calcarg_as95 ( mag, dist, mech, soil, hw, iPer, mu, rockpga,
  1  a1,a2, a3, a4, a5, a6, a9, a10, a11, a12, a13, c4, c5, mag1,
  2   n,a14)

    lnY = mu + 6.89
```

```
c     Set Standard Error.
      if (mag .le. 5.0) then
         sigma = b5(iper)
      elseif (mag .gt. 5.0 .and. mag .lt. 7.0) then
         sigma = b5(iPer) - b6(iPer)*(mag-5.0)
      elseif (mag .ge. 7.0) then
         sigma = b5(iPer) - 2.0*b6(iPer)
      endif

      return
      end

c ----------------------------------------------------------------------

      subroutine CalcArg_as95 (mag,dist,mech,soil,hw,iPer,mu,rockpga,
     1 a1, a2, a3, a4, a5, a6, a9, a10, a11, a12, a13, c4, c5, mag1,
     2 n,a14)
      implicit none
      integer iper, hw
      real a1(1), a3(1), a5(1), a6(1), a9(1), a10(1), a11(1), a12(1),
     1     mag, dist, mech, mu, n, c4(1), rockPGA, a2, a4, a13,a14(1)
      real x1, x2, x3, x4, t1, mag1, c5
      real soilFactor, r, soil
c      write (*,'( 15f10.4)') a1(iper), a2, a3(iper), a4, a5(iper),
C     1        a6(iper), a9(iper),
c     2  a10(iper), a11(iper), a12(iper), a13, c4(iper), c5, n, mag1

c     Rock model
      r = sqrt(dist**2+c4(iper)**2)
      mu = a1(iper) + a12(iper)*(8.5-mag)**(n) + a3(iper) * alog(r)
     1     + a13*(mag - mag1)*alog(r)
      if ( mag .lt. mag1 ) then
         mu = mu + a2*(mag-mag1)
      else
         mu = mu + a4*(mag-mag1)
      endif
c      write (*,'( 10f10.4)') mag, dist, mech, mu

c     mech model
      if (mech .eq. 2.0) then
         mu = mu + a14(iper)*(mech/2.0)
      else
      x1 = 5.8
      x2 = mag1
      if (mag .lt. x1 ) then
        mu = mu + a5(iper)*mech
      elseif ( mag .lt. x2 ) then
        mu = mu + a5(iper)*mech* (1. - (mag-x1)/(x2-x1) ) +
     1        a6(iper)*mech*(mag-x1)/(x2-x1)
      else
        mu = mu + a6(iper)*mech
      endif
      endif
c      write (*,'( 10f10.4)') mag, dist, mech, mu

c     HW model
      t1 = 0.
      if ( mag .gt. 5.5 .and. hw .eq. 1 ) then
        x1 = 4.
        x2 = 8.
        x3 = 18.
        x4 = 25.
        if ( dist .lt. x1 ) then
        t1 = 0.
        elseif ( dist .lt. x2 ) then
          t1 =  (dist-x1)/(x2-x1)
        elseif ( dist .lt. x3 ) then
          t1 = 1.
        elseif ( dist .lt. x4 ) then
        t1 = 1. - (dist-x3)/(x4-x3)
        else
        t1 = 0.
        endif
        if ( mag .lt. 6.5 ) then
        t1 = t1 * (mag-5.5)
        endif
      endif
      mu = mu + t1*a9(iper)
c      write (*,'( 10f10.4)') mag, dist, mech, mu

c     Soil Model
      if ( soil .eq. 1. ) then
         soilFactor = a10(iper) + a11(iper)*alog((exp(rockPGA) + c5))
         mu = mu + soilFactor
      endif

      return
      end
```

```
* ########################################################
      subroutine WriteSMC(fnameout, accel,
     :  dt, naccel, ivert, ihor)

*  Reformats a time series
*  into SMC format (the format used on the CD-ROM)

      real  rnull, accel(*), rhead(50)

      integer ncomments, naccel, inull, ihead(48)

      character fnameout*12

* Open output file:
      open(unit=30, file=fnameout, status='unknown')

* Write name to screen:
      write(*, '(2a)') ' Output file name: ', fnameout

* Write headers:

* First write the 11 lines of comments:

      write(30, '(a)') '*'
      write(30, '(a)') '*'
      write(30, '(a)') ' stacode'
      write(30, '(a)') ' date, eqname'
      write(30, '(a)') 'Moment Mag='
      write(30, '(a,t30,a,i3,1x,a,i3)') 'station = ',
     :                               'orient_h= ', ihor,
     :                               'orient_v= ', ivert
      write(30, '(a,t34,a)') 'epicentral dist =','pk acc ='
      write(30, '(a, t22, a)') 'inst type=DSA', 'data source = SCE'
      write(30, '(a)') '*'
      write(30, '(a)') '*'
      write(30, '(a)') '*'

* Now write the integer header block:
* First fill with null values:

      inull = -32768
      do i = 1, 48
        ihead(i) = inull
      end do

      ihead(1) = inull
      ihead(11) = 3
      ihead(13) = ivert
      ihead(14) = ihor
      ncomments = 0
      ihead(16) = ncomments
      ihead(17) = naccel

      write(30, '(8I10)') (ihead(i), i=1,48)

* Now write the real header block:
* First fill with null values:
      rnull = 1.7e+38
      do i = 1, 50
        rhead(i) = rnull
      end do

      rhead(1) = rnull
      sps = 1.0/dt
      rhead(2) = sps
      write(30, '(5E15.7)') (rhead(i), i=1,50)

* Write the acceleration values

      write(30, '(8(1pe10.4e1))')
     :        (accel(j), j = 1, naccel)

* That should be it; close the output file and loop back for another component

      close(unit=30)

      return
      end
* ########################################################
```

```
* Compute the Fourier spectra:

    call Abs_Spectra(data, dt, npts, iprcntfrtaper,
   :                 spect, npw2, df)

    do i = 1, npw2
      ts(i) = data(i)
    end do

    write(nsummary,4211) df, npw2
4211 format(3x,'spectra: df=',f7.4,' npw2=',i5,30('.'))

* Smooth the spectra

    ihwid = int( smoo/(2*df) )
    if (ihwid .lt. 1) ihwid = 1
    call SMTHS (spect, npw2, df, ihwid, 1)

* Interpolate to specified frequencies:

* First set up the frequency array for the spectra:

    nfreq = npw2/2
    do i = 1, nfreq
      freq(i) = float(i-1)*df
    end do

* Now interpolate

* If mspct = 0, use fft frequencies:

    if (mspct .eq. 0) then
      fstart = freq_out(1)
      fstop = freq_out(2)
      call locate(freq, nfreq, fstart, m_start)
       m_start = m_start + 1
      call locate(freq, nfreq, fstop, m_stop)
       m_stop = m_stop - 1
      mspct = m_stop - m_start + 1
      do i = 1, mspct
        freq_out(i) = freq(i + m_start - 1)
      end do
    end if

    do i = 1, mspct
      spect_out(i) = yintrf(freq_out(i), freq, spect, nfreq)
    end do

    return
    end

    subroutine Abs_Spectra( datain, dt, npts,
   :    iprcntfrtaper, spect, npw2, df_fft)

c Returns the absolute value of the spectrum.
c The program applies a tapered window to the
c front and back of the time series, pads with zeros,  and computes the
c spectrum.

c Written by D. M. Boore

* Dates:  3/22/89 - Modified from SqrSpectFT, by removing
*                   the smoothing and interpolation.
*        11/08/89 - Pass df_fft out through the argument list.
*         4/07/95 - Declared prcntfrtaper as an integer.  I wonder

    real DATAIN(*), SPECT(*)
    real DATA(16400)
    complex CX(16400)
    integer iprcntfrtaper

c Fill working array with input data:

    do 1 i = 1, npts
    data(i) = datain(i)
1   continue

c
c   remove dc, apply taper, pad with zeros
c

    call dcdt(data, dt, npts, 1, npts, .true., .false.)

    ifront = iprcntfrtaper
    iback = iprcntfrtaper
    call fbctpr (ifront, iback, data, npts)

    call zeropad2( data, npts, npts, npw2)

c sample rate and frequency spacing:

    sr = 1.0 / dt
    df = sr/ float(npw2)
    df_fft = df

    npw2d2 = npw2 / 2

c Fill working complex array

    do 90 j = 1, npw2
      cx(j)=cmplx(data(j), 0.0)
      datain(j)=data(j)   ! To check if tapering, etc was OK
90  continue

c   FFT to get spectrum

    call fork(npw2,cx,-1.)

    do 100 j =1 ,npw2d2
      cx(j)=cx(j)*dt*sqrt(float(npw2))
      spect(j)=cabs( cx(j) )
100 continue

    return
    end
```