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November 15, 1989

To: All members of the seismological community

From: R. A. Phinney

Nearly six years after the first workshop for a new global digital network, and four years after the start of NSF funding, IRIS has reached an important milestone. The IRIS seismological facilities have completed design and development, and are now becoming available for use by the research community. This includes:

- 21 very broad band digital seismic stations are now returning data for the GSN.
- The Data Management Center archive is now in place, and continuous data from the GSN is available for users to request.
- The first 45 Passcal instruments are now available for use in the Passcal Maintenance Center.

In this Newsletter, you will find information on how to plug in to the facilities and services of IRIS. In the months to come, IRIS will be issuing a Handbook, with "manual pages" giving detailed information on a broad range of topics.

These accomplishments are the legacy of the four years which Stewart Smith served as President, and of his vision and persistence in mantaining the momentum of the program in the face of significant difficulties. They also represent the fruits of dedicated effort by Rhett Butler, the GSN Program Manager, Jim Fowler, the Passcal Chief Engineer, and Tim Ahern, the Program Manager for the Data Management Center.

In 1989, the DARPA-funded Eurasian Seismic Studies Program, a joint effort with the USGS, assumed a role as a major IRIS effort, with a budget equal to that which we receive from NSF for our baseline programs. It has resulted in the addition of five GSN stations in the Soviet Union, and will see two more stations in 1990, as well as the installation of telemetered digital arrays.

The October 17 Loma Prieta earthquake provided IRIS with an opportunity to evaluate the utility of the new Passcal instruments for rapid response deployment. A team from the Passcal maintenance center at Lamont, headed by David Simpson, worked with the support of the USGS in Menlo Park, and in collaboration of seismologists from U.C. Santa Cruz and U. C. Santa Barbara to acquire a major high resolutuion digital aftershock data set. In collaboration with the National Earthquake Engineering Research Center group at Lamont, the team also acquired some very interesting site-response data with tight arrays of instruments.

IRIS planning for the next five years focuses on obtaining funding for the growth of the IRIS facilities to the levels projected in the 1984 Program Plan, and approved by the National Science Board. The time is now ripe for the acquisition of the network and array facilities which have been developed, to approach the goals of 100 GSN stations and 1000 Passcal instruments. A history of near-zero funding growth in the NSF, however, projects to 15 years or more before these facilities can come up to strength. Much of our effort will be going into looking for creative ways to rectify this situation.

I call your attention to the announcement for the IRIS Workshop, to be held this year at Hilton Head, South Carolina on 5-8 March 1990. It will be a chance to explore the opportunities for significant advances in seismological capabilities which we have with the new lines of instrumentation.

please post

Second Annual

IRIS WORKSHOP

Global and Portable Seismographic Networks

March 5-7, 1990
Hilton Head Island, South Carolina

The second annual IRIS workshop for reporting on new facilities, ongoing projects, and future plans will be held at the Hyatt Regency Hilton Head, Hilton Head Island, South Carolina. This science review and planning workshop is sponsored by the National Science Foundation and the Incorporated Research Institutions for Seismology.

Topics of discussion: Topics of discussion will include

- results of studies using Global Seismic Network data
- results of PASSCAL imaging projects
- workshop on techniques for studying reflectors in the crust and mantle
- the joint US-USSR Eurasian Seismic Studies Program
- results of data analysis from the Loma Prieta earthquake
- the continental transect project
- plans for future large-scale experiments

Plus other matters related to the use of the global and portable networks being developed by IRIS under NSF sponsorship.

Demonstrations: "Hands-on" demonstrations will illustrate:

- how to retrieve global digital data from the IRIS Data Management Center at the Institute of Geophysics of the University of Texas, Austin.
- how to access digital data from dial-up Global Seismographic Network stations
- how to use the PASSCAL portable seismographic systems and seismic processing software

Travel Support: IRIS will sponsor one participant from each member institution, as well as invited speakers and standing committee members.

Those desiring to attend must notify IRIS by January 1, 1990.

Those interested in presenting a paper, contact IRIS or :

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Activities at the IRIS Data Management Center

by Tim Ahern
Program Manager
IRIS Data Management Systems
October 27, 1989

Good NEWS !!! The IRIS Data Mangement Center is open for business. The past year has seen a good deal of progress within the IRIS Data Management Systems program. Let me give you a summary of some of the more significant accomplishments of the Data Management Systems Program within IRIS.

Although the DMS program has been quite active in the PASSCAL program in the past, this past year has seen us concentrate on the problem of archiving data from Global Seismic Network stations located around the world. Activities this year in support of the PASSCAL program include the distribution of SierraSEIS to ten different IRIS universities and the assembly of a second PASSCAL field computer. These field computers have now been deployed in California, Nevada, Texas, North Dakota and Greenland. Further activity in this area is being handled by the PASSCAL Instrument Center at Lamont. PASSCAL datasets are available through the IRIS Data Management Center in Austin, TX, but at present our capability is limited to distribution of data by dataset. PASSCAL data sets from the Ouachita Experiment and the Basin and Range project are available. Additionally PASSCAL data is available as part of the Joint Verification Experiments that occurred in the fall of 1988.

With the cooperation of the Global Seismic Network (GSN), the DMS has developed a geographically distributed system where various activities take place at different locations around the country. The DMS and GSN programs have worked closely in the development of the system. At the present time there are three primary locations at which activity is taking place. In San Diego, California the IRIS/IDA Data Collection Center is responsible for the operation of four permanent stations in the Soviet Union at Arti (ARU), Garm (GAR), Kislovodsk (KIV), and Obninsk (OBN). Additionally the IRIS/IDA DCC operates stations at Pinon Flats, California (PFO), Nana, Peru (NNA), Eskdalemuir, Scotland (ESK) and Easter Island (RPN). The IRIS/IDA DCC collects the data from these eight stations, performs quality control on the data, reformats the data from station format to the Standard for Exchange of Earthquake Data (SEED) format and then forwards the data to the IRIS/USGS DCC in Albuquerque, New Mexico.

The IRIS/USGS DCC is responsible for the operation and collection of data from many digital networks. These networks include

Seismic Research Observatory (SRO)
Abbreviated Seismic Research Observatory (ASRO)
Digital World-Wide Standard Seismograph Network (DWWSSN)
China Digital Seismograph Network (CDSN)

Additionally IRIS stations presently located at Harvard (HRV), Pasadena (PAS), Cathedral Caves, Missouri (CCM), Kipapa, Hawaii (KIP), and Albuquerque (ANMO) send their data to the IRIS/USGS for reformatting and quality control. The IRIS/USGS DCC merges data from networks they are responsible for with the SEED volumes from the IRIS/IDA DCC and forwards these tapes to the IRIS Data Management Center (DMC) in Austin.

THE INTERIM DATA MANAGEMENT SYSTEM

The University of Texas Institute for Geophysics developed a method of accessing data under contract with IRIS. This system is now functioning and is capable of servicing user requests for data. A brief summary of the Interim System may help you better understand how an IRIS user can access data from the IRIS Data Management Center.

In Austin, the SEED volumes from the two DCCs are split into two distinct portions. The SEED header information is separated from the waveforms. The header information contains significant information about all of the stations and channels including such things as geographic coordinates, network affiliations, response functions and any problems observed at the stations. This header information is stored on a main IRIS computer located at the Center for High Performance Computing in Austin, Texas. The actual waveforms are much more voluminous than is the header information and can not be stored on conventional disk systems. The main IRIS computer is connected to an IBM 4381 mass storage system via a Hyperchannel interface. Waveform data are first stored in a disk file on the main IRIS SUN 3/280 computer, a TCP/IP connection is made to the IBM mainframe and the waveform files are transferred to the IBM system using the standard File Transfer Protocol (FTP) method many of you are familiar with.

As the Header information is appended to files on the SUN and waveform data are transferred to the IBM, a Holdings file is updated on the SUN 3/280 reflecting the fact that more data are available for access by IRIS users. This file contains a summary of which data are available in the DMC archive and information about what time periods the data cover, station and channel names for the data, sample rates, waveform sizes in bytes and various other items.

At present the INTERIM SYSTEM in Austin has data from most stations in the network for the time period January 1, 1989 to about 60 days behind real time. In the near future this time delay will be reduced to less than one week after quality control takes place. This means that data from some stations will be available two to three weeks after real time. Data flow between the two DCCs and the IRIS DMC is just beginning but by next summer we hope to have all data from the various networks available from January 1, 1988 through approximately one month before present.

REQUESTING DATA FROM THE DMC

Beginning in December, 1989, IRIS users will be able to interactively request data from the archives in Austin. The user interface software has been developed by Lamont Doherty Geological Observatory. A user with access to NSFNET or with a modem can use the interface software to specify station time windows for which data are desired.

The user interface uses CURSES software that allows any system with the ability to emulate a VT100 terminal the ability to generate data requests. The software named "RETRIEVE" can run on a local SUN computer or by logging in to irisdmc, a computer at the IRIS Data Management Center.

When one logs into the IRIS DMC computer "irisdmc" or starts the RETRIEVE program locally, they are presented a series of menus. The main menu is presented below.

```
                    MAIN MENU
              Iris Interim Data Management Center

1.   Enter Address Parameters
2.   Enter Search Parameters
3.   Search DMC Holding File (Create Request File)
4.   View Request File
5.   Mail Request File to DMC Staff
6.   Help
7.   Quit

Enter your selection:

ESC-select ^X-exit ^U-up <RETURN>-down ?-help
```

Normally a user selects items in order starting with item 1 and ending with item 5. The address menu is presented if option 1 is selected.

```
                    ADDRESS PARAMETERS MENU
                  Iris Interim Data Management Center
                       [Enter Address Parameters]

User Name                   Tim Ahern
Institution Name            IRIS
Mail Address                8701 Mopac Blvd. Suite 205 Austin, TX 78759
E-mail Address              tim@iris.edu

(Area Code) Phone No        (512) 471-0404
[(Fax  Code) Phone No ]     (512) 471-8844
[ Ftp Guest Host Name ]     iris (192.35.78.1)
[ Ftp Guest User Name ]     guest
[ Ftp Guest Password ]      xxxxxx
[ Directory Pathname ]      /usr/users/tim/
[ Comments ]                none
[ Output Medium ]           1

   type 0 - Exabyte Cartridge Tape (default)
   type 1 - 1/2" 9-track Tape, 6250 bpi
   type 2 - 1/2" 9-track Tape, 1600 bpi
   type 3 - 1/4" cartridge
   type 4 - electronic transmission

^T-input type checking ^X-main menu ^U-up <RETURN>-down ?-help
```

After entering the address parameters and performing the Type Check with the ^T option, one normally returns to the main menu with ^X. (Note the ^ indicates pressing the "Control" Key while simultaneously pressing the other indicated key). The address information menu is where the Data Management Center can determine your name and output medium. Normally transfers would be by 1/2" tape and would be sent by US Mail. If you would like to arrange other methods of shipping, please contact the DMC at (512)471-0403 and talk with Becky Wofford.

Main Menu option 2 is where you can define the particular station time window for which you desire data. Fields within the Search Parameters Menu can be entered using UNIX regular expressions. This means that several special characters are permitted. These regular expressions include:

Symbol	Meaning	
^	match characters at the beginning of a field	
$	match characters at the end of a field	
[chars]	match any characters in chars	
[^chars]	match any characters not in chars	
[a-z]	match any character a through z, or other range	
*	match zero or more characters	

Although there are additional regular expressions, these will probably be the ones you use the most. A simple example will serve to illustrate how useful regular expressions can be to assist you in defining your station time

window.

For example say you wish to recover data from all SRO and ASRO stations in the data archive. Naming conventions for these stations require that they end in an "O". Furthermore assume that you only want long period data but you are aware that these channels may be named LPN, LPE, LPZ, LHN, LHE, or LHZ. You can enter "O$" (match any station that ends in O) for the station field and "L.." for the channel name to match all channels with an L followed by two characters. This could be changed to "L.Z" if you only wanted the long period vertical channels.

```
STATION/TIME WINDOW SPECIFICATION
      Iris Interim Data Management Center
           [Enter Search Parameters]

Station                    (str  5)   O$ BJI HIA KMI
Channel                    (str  3)   L..
Source                     (str  2)

Start year                 (int  4)   1989
Start month                (int  2)   5
Start day                  (int  2)   13
Start hour                 (int  2)   12
Start minute               (int  2)   17
Start second               (float )   34.2

End year                   (int  4)   1989
End month                  (int  2)   5
End day                    (int  2)   17
End hour                   (int  2)   20
End minute                 (int  2)   17
End second                 (float )   45

^T-input type checking ^X-main menu ^U-up <RETURN>-down ?-help
```

The window above represents a request for all long period data from the SRO/ASRO stations plus stations BJI, HIA and KMI. The time period is from 12:17:34.2 May 13, 1989 until 20:17:45 May 17, 1989.

Main menu option 3 is invoked after defining the station/time window select panels (there can be more than one). Selection of menu option 3 results in the display of the select panel with some address information. When ^E is selected, a connection is made between the machine upon which you are running RETRIEVE and the main IRIS DMC database computer system in Austin. A summary Holdings file is searched for entries that match the station time window indicated in the select panel. All seismograms in the DMC archive that match the parameters you specify add a line to a REQUEST file that is built for you automatically. The REQUEST file is returned from the DMC database computer to your local machine and a line such as

```
>> Total 150 records matched. Request File 89_1020_1339_59 created
```

is returned telling you how many seismograms were found that match your request. This process can take several minutes. Selecting main menu option 4 allows you to view the individual lines in the request file and unwanted entries can be deleted. When you are satisfied with the nature of the specific entries in the request file you can make a request for data from the DMC by selecting main menu option 5. RETRIEVE will first tell you

how large your request will be

Total size of request is 25836 kilobytes

and if you select the ^E option the request will be mailed electronically to DMC staff. Your request will normally be filled within 24 hours and shipped by US Mail or if other arrangements have been previously made by the agreed upon manner.

Although the INTERIM SYSTEM only allows access to archived data through station time windows, we feel that it is easy to use and allows all IRIS users rapid access to IRIS data in a straightforward manner.

THE PROTOTYPE DATA MANAGEMENT SYSTEM

At the same time as the Interim System is being released to the general IRIS community, staff at the IRIS Data Management Center are developing a more sophisticated and flexible prototype database management system. Although access to data through station time windows was thought to be the most basic type of data request IRIS users would make, we also realize that a more sophisticated way of customizing the data request issued by a user is necessary.

Sue Schoch is the Senior Database Programmer at the IRIS Data Management Center in Austin. Sue is developing a network database management system using db_Vista, a commercially available system. This system is presently operational and can already assist a user in formulating a more sophisticated request for data than the Interim System. It is also an inherently faster method of accessing data.

The prototype database management system will not be available for use by the general IRIS user until sometime later in 1990. A brief description of the system may be useful. The prototype system accepts the same input SEED volumes from the two DCCs as does the interim system. Instead of using a simple Holdings file, the prototype system extracts the various SEED header information and stores it in a network database. The system uses a concept of a HUB record that serves as a starting point for all seismograms recorded on a given day at a particular station and for a given channel. These HUB records have pointers that associate the relevant SEED headers with that HUB record. All information that is contained on the input SEED volumes is stored within the database management system in a way that an IRIS user can display it or use any particular field as part of a search. Fields such as station code, channel name, sample rate, network affiliation, response information, station locations are just a few of the fields that can be accessed. For a more complete description of the information available in the Prototype Database Management System consult the appropriate SEED documents.

For instance if an IRIS user wished to retrieve data from all stations that were within a specified latitude and longitude range, the prototype system would allow that type of search. If an IRIS user wished to recover data from all stations that recorded a specific event but at specific distances, the prototype system would support that type of request. If one then wished to only include events that had a magnitude greater than some threshold that request would also be supported.

The number of different requests an IRIS user may make is extremely large. It is true to say that all fields within the input SEED data volumes can be used as search parameters. The prototype system uses Structured Query Language (SQL) to perform these searches. This is a standard database access language where complicated queries are phrased in a more English like manner. For instance a statement such as

```
select station, channel, jday, start_time, end_time from seismograms where station in ("PAS", "HRV", "AFI");
```

would result in a summary of all starting and ending times for seismograms in the archive for stations PAS, HRV and AFI. This would result in a huge output listing. To reduce the number of matched records, one could further limit this search by adding a range for the julian day (jday) field.

After a user identifies a specific set of seismograms using SQL, they may then generate a request file and receive data in much the same manner as with the Interim System.

Ultimately, the DMC will provide tools for both the experienced SQL user and for the novice. In the case of the novice interface, no details about fields or SQL syntax will be required. The user will be able to specify their data request in primarily seismological terms.

GOPHER - NEARLY REAL TIME ACCESS TO DATA FROM IRIS STATIONS

The IRIS Data Management Center issued a contract to the University of Washington to develop a system whereby IRIS stations equipped with high speed dial up modems could be automatically accessed and data transferred to the DMC in Austin. This system is now fully operational.

The IRIS DMC receives special alert bulletins from the National Earthquake Information Center in Golden, Colorado. These bulletins are received through electronic mail. When an alert is received, a portion of the GOPHER system starts running on a computer at the Data Mangement Center. Based on magnitude of the event, and distance between the various stations and the event, GOPHER will select which stations should be called and exactly what data windows should be retrieved. The amount of data that is retrieved is a compromise between seismological needs and practical considerations related to the length of time that is required to transfer the large amounts of data involved.

Once the data have been automatically transferred to the DMC, an event location file is updated and users may access the seismograms. To do this the user uses the portion of GOPHER dubbed GOPHER-VIEW. This is a menu driven system that is simple to use. Normally an event is selected, the traces are normally viewed using Tektronix 4014 emulation and if desired, traces can be transferred using FTP or XMODEM transfer protocols.

The data in the GOPHER database is normally available within three hours after significant events. In the case of the Santa Cruz earthquake, some of the data were actually available within one hour of the earthquake but the entire dataset was not in place until about 3 hours after the event. Although the system was not designed to accommodate hundreds of users within a short period of time, it actually serviced more than 120 accesses during the 24 hours following the Santa Cruz earthquake.

The list of IRIS stations that currently support dial up access and from which GOPHER normally retrieves data includes:

Harvard, Massachusetts
Pasadena, California
Albuquerque, New Mexico
Cathedral Caves, Missouri
Kipapa, Hawaii

In the very near future, Corvalis, Oregon and Matsushiro, Japan will be added to the list of IRIS stations that will be accessed.

Data will normally reside in the GOPHER database until the same data are archived using the Interim or Prototype Database Management Systems. At that time, they will be removed from the GOPHER database. Users can then request the same data through the normal method described earlier in this article.

GOPHER has already been shown to be a very valuable tool. I encourage you to become familiar with it and use it frequently. GOPHER makes IRIS data available within hours of an event and the data are accessible over the Internet in an easy to use manner rather than directly connecting with each IRIS station.

THE ELECTRONIC BULLETIN BOARD

The IRIS Data Management Center maintains an electronic bulletin board in Austin, TX. This system allows an

IRIS user to access current information about the DMS program, data holdings, data products and various other items of interest.

This is a convenient method for any user to request specific data sets that have been preassembled by DMC staff or to request programs that are available through the Data Management Center.

The Electronic Bulletin Board has been used extensively by much of the IRIS community and has been shown to work well. It is presently averaging between one and two accesses per day and has operated trouble free since its installation in May, 1989.

I encourage everyone to access the bulletin board by connecting through the Internet using an

rlogin irisdmc -l bulletin (password is board)

The bulletin board runs in a restricted environment and you will be limited to looking at the various items posted on the various portions of the bulletin board or to leaving notes using the note facility.

The system is self explanatory, but a separate article is available upon request. Notify the DMC if you wish to have a copy sent to you.

DATA PRODUCTS

From time to time, earthquakes with a widespread interest in the IRIS community will occur. The DMC internally produces a data product that should meet the needs of most users for these events. The existence of Data Products is indicated in the Electronic Bulletin Board under the "assembled data sets" item in the main menu.

At the present time, data products have been assembled for the Armenian earthquake of December 7, 1988 and the Macquarie Ridge earthquake of May 23, 1989. When data are available for the Santa Cruz event of October 18, 1989 the DMC will assemble the appropriate data also.

IRIS users should try to make a habit of accessing the Electronic Bulletin Board periodically to determine when new data products are available. Of course whenever a user needs a customized data set for their own research needs, the RETRIEVE software can be used.

I hope this brief summary gives you some idea of the various services that the IRIS DMC in Austin, TX provides you. We have already received some very positive comments from some of the IRIS community and will always be available to help you acquire the data you need to perform your research. If any of the IRIS Data Management Center staff can help you please feel free to contact us. We are located at

IRIS Data Management Center
c/o University of Texas Institute for Geophysics
Suite 205
8701 Mopac Blvd.
Austin, Texas 78759

Members of the IRIS DMC staff include:

Becky Wofford	Systems Administrator	(512)471-0403
Sue Schoch	Senior Database Programmer	(512)471-0405
Tim Ahern	Program Manager	(512)471-0404

I.R.I.S. 'GOPHER' Users Manual
by Steve Malone, U. of Washington
June 1, 1989

Gopher is a system for the IRIS Data Management Center (DMC) to automatically up-load selected trace data by high-speed modem from IRIS GSN stations and to provide easy access to these data via the Internet, or dial-up login to the seismological community. The following is a description of this software which is now running in Beta-test stage at the DMC in Austin as well as at the University of Washington. Please send comments or suggestions via E-mail to either: *steve@geops.geo.washington.edu* or on KOSMOS to: *SMALONE*, or by regular US mail to: Steve Malone, Geophysics AK-50, University of Washington, Seattle WA 98195.

PURPOSE

IRIS GSN seismic stations record broad-band high-dynamic range seismic data continuously and store these data on magnetic tape. After quality control these tapes are shipped to the DMC in Austin, Texas where the data are stored in SEED format in a mass-store system. The whole process to acquire all the data for one earthquake may take several months. In the mean time there may be interest in some large or significant earthquake for which the data are in transit and not available. The *GOPHER* project makes available to the community selected sections of trace data from IRIS GSN stations which can be accessed by dial-up telephone within a day of the occurrence of a significant earthquake. These data can be easily reviewed by interested researchers from their home institution via connections over the NSF-Internet or dial-up login session to the DMC. Selected portions of these data may be down-loaded to a researcher's own computer via *ftp* over the Internet or *Xmodem* over dial-up lines. There are two main parts of *GOPHER*. The guts of the system is the automatic up-loading part, appropriately called *gopher-guts*. The normal user does not access this part of *gopher*, though the details of how it all works are covered later in this document. The part which the remote user connects to is *gopher-view*

USER INTERFACE (Gopher-view)

Interactive access to *GOPHER* may be gained over the Internet with

rlogin irisdmc.ig.utexas.edu -l gopher

or by dial-up at (512)471-6496 a Telebit Trailblazer modem. The password for GOPHER is "guts". The internet address of irisdmc is 128.83.149.25. The user interface for *gopher* presents a series of questions and then a main menu from which the user can make choices. The advanced user (with the proper password) may escape from the query script and use standard UNIX commands to examine and/or retrieve data. A *HELP* choice allows the use of standard UNIX manual entries to document the user accessible utilities. There is also a DMC maintained bulletin board which contains the latest information and status of IRIS stations and a summary of new important data holdings. Refer to the appropriate IRIS manual describing the use of the Electronic Bulletin Board.

Gopher-view Main Menu

On login the user's identity is requested asking for his/her name, phone number, E-mail address and/or postal mailing address. (The name is required.) The type of terminal being used is next requested. If a tek-tube emulator is being used, you may tell it the ascii equivalent, such as 'vt100', or 'h19'. If later you want a graphic display it will then ask for the type of graphics device you are on (ie

tek4010, or tek4014). A temporary directory will be set up for you which will contain all the data you have requested in your requested format. If data is already in this directory (perhaps from a previous session) you will be asked if you want it removed. The main gopher-view menu will then be presented.

The main menu choices are the following:

1) Review event list and select one of interest by paging through the catalog.

2) Review list of stations and components recording selected event.

3) Review trace data using SAC and a standard set of display parameters. You must be on a graphics terminal (Tek-4014 emulator, X-window server, or the SUN system console). Experienced SAC users may use SAC directly to customize their review session.

4) Define data extraction format type, (ie SAC-BINARY, AH-BINARY...), generate a data extraction list, and place the desired data in the desired format in your private sub-directory.

5) Set up and get specific information on how to down-load the data to your own machine. Do an *ftp* down load directly.

6) Get general documentation or manual information about various programs used by *GOPHER* including this document.

7) Leave the *Gopher-view* script with a standard UNIX shell (for experienced UNIX users with a password).

8) Exit *Gopher-view* with a chance to send requests, complaints, or information to the DMC staff.

Any one of these menu items may be chosen by typing its number and <return>. At any time typing a 'q' <return> will back out of the current menu or exit *gopher*. The typical sequence to review and extract data would be the following:

After logging in one might review the current catalog with menu choice #1. You will be given the chance to type the number of the event in which you are interested. This will now be the event of interest until changed by another use of menu choice #1. You may see which components of which stations recorded this event by using menu choice #2. Menu choice #3 will start the program *SAC* (Seismic Analysis Code) and use a fixed script to display sections of data for the current event. You will be told which components are available and asked to type a 'y' if you want to see them. You must be on a graphics device for this to work. After reviewing all the data available for an earthquake you might use menu choice #4 to select which traces and the format for the data you want to retrieve. Currently you may only retrieve complete traces. There is no way to get just part of a trace. You might then use menu choice #5 to explain exactly what to do to down load your selected data to your machine.

Data Formats

The seismic trace data is stored in a subdirectory whose name is a ten digit number corresponding to the origin time of the earthquake (ie: 8902231422 for 14:22 UTC on Feb 23, 1989). Each trace data file within this subdirectory has a name constructed from the seismic station code, component code and data rate (ie: pas.z.lp for Pasadena vertical long-period). Thus each significant earthquake will have its own subdirectory containing the trace data from all reachable IRIS GSN stations. This trace data is in SAC binary format. A master catalog contains the event name (Origin date-time) and the NEIC alert message (location, magnitude...) for each event. This catalog is used to review what data are available in main menu choice #1.

The trace data files can be converted from SAC-BINARY to several other formats in preparation for down-loading to a user's local computer. These formats are: SAC-ASCII (best for use to machines running SAC like VAXes but which do not use the IEEE binary data representation, AH-BINARY (for machines running the Lamont 'AH' seismic display software), and AH-ASCII (for similar machines but for some reason binary transfer does not work well).

Directory Structure

	bin	executables	
	man	documents	
	tmp	**user_name1**	user trace data
		user_name2...	user trace data
~**gopher**			
	view	interactive scripts	
	mlink	gopher-guts code and source	
	data	**event1**	trace data files
		event2...	trace data files

DATA UP-LOAD (Gopher-guts)

Arrangements have been made with the National Earthquake Information Center (NEIC) to E-mail to the DMC, over the internet, an event summary statement (alert message) as soon as they have located a significant earthquake. This is usually done within 12 hours of the event. The alert message is sent directly to the *gopher-guts* software at the DMC which will use the summary information to determine what data to up-load. *Gopher-guts* uses the earthquake location and magnitude to compute a selection time window for each operating IRIS station. The current algorithm is as follows:
Given the earthquake magnitude, M and its distance, D (degrees) and P-wave arrival time, T (GMT-time) for each IRIS station.

```
if(M > 5.0 and D < 10) or if( M > 6.0)
or if( 10 < D < 50 and (M - 5.0 -(D -10)* 0.025) > 0) then
   get data for this station:
   if( D < 10 ) then
        get 6.5 minutes of VBB only, starting 0.5 minute before T
   else if( D > 10 ) then
        get 3 minutes of VBB starting 1 minute before T
        and get L minutes of LP starting 1 minute before T
             where: L (min) = 4 + 0.6 * D
```

The above parameters may be adjusted to get more or less data after we gain more experience.

Each IRIS GSN station is automatically called in turn using a 9600 baud error-correcting modem and the appropriate data windows are up-loaded in SAC ASCII format. Error conditions such as station not answering, dropped connection or garbled data are recognized and logged. Up to 3 dial-up retries separated by 5 minutes will be done before giving up. *Gopher-guts* sends a mail message to the operator for every alert message received summarizing this event and any problems encountered.

Limitations

The *GOPHER* system is not intended to be used for the review and extraction of large data volumes; but, rather as a simple way of accessing limited amounts of important data in a timely manner. The large research project should use the complete data set that will be available from SEED format archives some months after recording. Station calibration, data quality, station outage, or other such information will probably not be available from the *GOPHER* system. We anticipate that *GOPHER* acquired data will stay resident in the DMC for only as long as until the SEED format archive is complete.

IRIS DATA MANAGEMENT CENTER
8701 Mopac Blvd. Suite 205
Austin, TX 78759
Tel. (512) 471-0403, 0404 or 0405

DMC ELECTRONIC BULLETIN BOARD

Due to the wide geographic distribution of the IRIS membership, the Data Management Center is establishing an electronic bulletin board to assist in the transfer of information from IRIS to our membership. Although this bulletin board is specifically being established to allow users to determine which data sets are presently at the Data Management Center, information of a general nature will also be maintained.

The bulletin board can be accessed either through the Internet or through a modem attached to a Data Management Center SUN workstation in Austin, Texas. At the present time the bulletin board is accessible through the Internet by remotely logging in to

irisdmc.ig.utexas.edu (128.83.149.25)

Dial in capability to the bulletin board is available by dialing (512)471-6496. This is a Telebit Trailblazer Plus modem.

To login use userid "bulletin" with password "board". From a remote SUN you can issue the following command

rlogin irisdmc.ig.utexas.edu -l bulletin or
rlogin 128.83.149.25 -l bulletin

You will be logged into an account with limited capabilities but you will be able to view posted bulletins maintained by the Data Management Center and leave messages for DMC staff.

When you login to irisdmc as bulletin, you will be presented a self-explanatory menu. It allows you to view one of several bulletin boards containing different types of information, or it allows you to send notes to the IRIS DMC staff.

READING BULLETIN BOARDS

An interested party can view any of the existing bulletin boards by typing the appropriate key in the main menu. This results in the selected bulletin board being displayed. The bulletin boards are displayed one page at a time using the UNIX "more" function. A space bar presents the next page of the menu and a carriage return moves the bulletin one line.

The format of the main menu may change in the future, but at the present time it provides access to the following bulletins:

1. CURRENT DATA HOLDINGS

This bulletin board summarizes the existing data that have been transferred from the Albuquerque Seismic Lab to the IRIS Data Management Center. These data have been quality controlled at either the Data Collection Center (DCC) in Albuquerque (IRIS/USGS DCC) or the Data Collection Center at UCSD (IRIS/IDA DCC). The display graphically indicates if data have been archived (x) and therefore are available for you to make a request, the data have arrived at the DMC but have not yet been archived (.) or if the DMC has not yet received any data for a given day ( ).

2. ASSEMBLED DATA SETS

Periodically, the DMC will preassemble certain data sets, in the anticipation that these data will be of general interest to the community. Examples of these types of data sets are the Joint Verification Experiment (JVE) for both the 1988 Nevada nuclear test and the 1988 Soviet test. Datasets for the Armenian Earthquake of December 7, 1988 and the Macquarie Island earthquake of May 23, 1989 have also been produced.

Distribution of PASSCAL datasets will also be identified as entries on this bulletin board.

3. GENERAL INFORMATION

This bulletin board will contain information of a general nature. It might be used to store current information about the GSN and PASSCAL programs, announce upcoming workshops, or other important information.

4. PROGRAMS AVAILABLE

In addition to data, the Data Management Center supports the distribution of programs that can be used for analysis and processing of seismic data. This bulletin board will document such programs and indicate the distribution channel. Examples in this category include the distribution of SierraSEIS, SAC and AH. In the future, programs generated by individual members can be highlighted here.

5. IRIS TELEPHONE NUMBERS

This bulletin board documents several relevant phone numbers for IRIS and the DATA MANAGEMENT CENTER.

6. USER GENERATED BULLETINS

This bulletin board is intended to allow individual users to post items they feel may be of interest to other users. This bulletin board will be maintained by the DMC staff to control the size and usefulness of the bulletin board. It is not intended to replace existing public bulletin boards. Users may request that certain items be posted on this bulletin board by sending a note to DMC staff using the "note" facility described in the next section.

7. DETERMINING WHICH STATIONS AND CHANNELS ARE AVAILABLE

A determination of all stations and channels that are in the archive is available using this option. This listing contains the various stations and channels for which the DMC has archived seismograms. Keep in mind that just because a specific station/channel may appear in this list, data may not be available for that station/channel on the day you may desire. The interim system only allows you to determine the availability for a specific station/channel/time window by using the user interface to the INTERIM Database Management System described in the RETRIEVE manual.

8. ON-LINE MANUALS

The Electronic Bulletin Board has several manuals available on-line. Selecting this option presents another menu. This second menu allows you to view several manuals describing programs and systems of interest to the IRIS membership. At the present time three manuals are available;

1) RETRIEVE, software to access the DMC data archive,

2) GOPHER, A system that allows data from recent earthquakes to be displayed and if desired transferred to your own computer system, and

3) this Electronic Bulletin Board manual.

The manuals are displayed using the UNIX "more" facility. Pressing the return key will advance the display one line at a time and pressing the space bar will advance the display one page at a time.

SENDING MESSAGES TO DMC OPERATIONS STAFF

Viewing bulletin boards is useful in itself, but it is anticipated that users may wish to request additional information, make data requests for special data sets, or provide comments to IRIS, the DMC, or other party. For this reason the ELECTRONIC BULLETIN BOARD provides the user a mechanism to leave notes for operations staff.

When in the main menu, selection of the "n" menu option allows the user to post a note to DMC staff. This facility will prompt the note sender for their name, institution, address, electronic mailing address and other pertinent information. The sender of the note will then be allowed to enter several lines of information. The note entry is terminated by typing "CNTL-d" (Pressing the control key and the "d" key at the same time).

Please note that the user can only edit information on a given note line until the carriage return is pressed. The sender of the note can not alter a line of the note after a carriage return is pressed and cannot alter or view any of the note after the "cntl-d".

Users cannot view the notes that other users have sent to DMC staff. Only IRIS staff can view these notes. So don't worry about misspelled words or notes that don't make much sense. Simply resend the note to the DMC if you feel it is necessary.

==========

The IRIS DATA MANAGEMENT CENTER exists for your benefit. We feel that the ELECTRONIC BULLETIN BOARD will greatly improve the communication between IRIS and its members. Your suggestions and recommendations will be listened to. If you would like to talk directly to staff at the IRIS Data Management Center please contact any of the following members of the DMC staff.

Tim Ahern	Program Manager	(512)471-0404
Becky Wofford	Systems Administrator	(512)471-0403
Sue Schoch	Senior Database Programmer	(512)471-0405

The address of the IRIS Data Management Center is

IRIS Data Management Center
c/o University of Texas Institute for Geophysics
Suite 205
8701 Mopac Blvd.
Austin, Texas 78759

BULLETIN BOARD MENUS

MAIN MENU

```
irisdmc

Welcome to the IRIS DATA MANAGEMENT CENTER Electronic Bulletin Board


Enter 'a' for ASSEMBLED data sets
      'c' for CURRENT data holdings
      'g' for GENERAL information
      'h' for HELP information
      'i' for IRIS telephone numbers and addresses
      'm' for consult on-line MANUALS
      'n' for NOTE writing to DMC staff
      'p' for PROGRAMS available
      's' for a list of Stations and channels available
      'q' to  QUIT

* Space bar scrolls bulletins one page at a time, CR one line at a time


(Enter your selection) []
```

ASSEMBLED DATA SETS

```
shell tool - /bin/csh
The IRIS Data Management Center has the following data sets assembled:
   see "PROGRAMS AVAILABLE" for information on SEED and SAC formats

JVE1    Joint Verification Experiment - Nevada Test Site
        Date of Test --- 88/08/17
        Status - ready for shipment
        Format - SAC binary

JVE2    Joint Verification Experiment - Soviet Test
        Date of Test --- 88/09/14
        Status - ready for shipment
        Format - SAC binary

ARM     Armenian Earthquake Dataset
        December 7, 1988 --- Ms = 6.8
        Status - ready for shipment
        Format - SEED

MCQ     Macquarie Island Earthquake
        May 23, 1989 --- Ms = 8.3
        Status - ready for shipment
        Format - SEED


PASSCAL Ouachita Experiment
        Status --- Data at DMC, reformatting required

PASSCAL Basin and Range Experiment
        Status --- Data at DMC, reformatting required

To request a copy of a special dataset use "note" facility

  Press return to continue[]
```

CURRENT HOLDINGS

```
irisdmc

CURRENT DATA HOLDINGS AT THE IRIS DMC

x= archived and available for user requests
.= data received but not yet archived

a blank indicates data have not been received

A summary of the current stations/channels available through the
IRIS DMC can be viewed by selecting the "s" option from the main
Electronic Bulletin Board Menu.

------------------------------------------------------------------

                                1989

                            DAY OF MONTH

                                1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 3 3
    1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1

Jan x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x
Feb x x x x x x x x x x x x x x x x x x x x x x x x x x x
Mar x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x
Apr x x x x x x x x x x x x x x x x x x x x x x x x x x x x x
May x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x
Jun x x x x x x x x x x x x x x x x x x x x x x x x x x x
Jul     x x x x x x x x
Aug           . . . . . . . . . . . . . . . .
Sep
Oct
Nov
Dec
```

GENERAL INFORMATION

```
shelltool - /bin/csh
The IRIS Data Management Center is being developed in two stages.
An INTERIM system will be available in September, 1989. This sys-
tem will allow simple access to IRIS/USGS datasets by specifica-
tion of station/channel/time windows for which data are desired.
This INTERIM system has been developed by personnel from the
University of Texas and Lamont Doherty Geological Observatory.
An on-line manual is available that describes the user interface
software (RETRIEVE) written by Lamont. Consult the manuals by
selecting "m" from the main menu.

The INTERIM system is presently able to service user requests.
If you have a specific data requirement contact Tim Ahern at the
DMC and he will assist you.

The University of Washington has developed a system named GOPHER.
This system automatically dials up IRIS stations when "signifi-
cant" events occur. The system automatically retrieves data and
places it on line at the Data Management Center. Documentation
for GOPHER is available through the on-line manuals. It is func-
tioning at this time. GOPHER can be accessed by logging in to
this computer system (irisdmc) as user gopher with password
"guts".

The PROTOTYPE system is being developed concurrently by IRIS
staff. This system will be operational in the fall but will not
be available to the general user at that time. The prototype sys-
tem can presently read SEED formatted data, extracting parametric
information and inserting it into a database management system.
This system will allow the user to make fairly complex queries of
the database and generate requests for data.

The PROTOTYPE system will initially allow access to the database
through station and time windows much like the INTERIM system.
However the PROTOTYPE system will allow far more powerful selec-
tion capability, allowing seismogram selection to be based on any
--More--(66%)
```

HELP INFORMATION

```
irisdmc
Welcome to the IRIS DATA MANAGEMENT CENTER Electronic Bulletin Board

This bulletin board contains information in several different areas:

        1) Current data holdings
           Lists GDSN/IRIS data available through user defined windows
        2) Assembled data sets
           Pre-assembled DMC Products for datasets with general appeal
        3) General information
        4) On-Line Manuals
           Electronic Bulletin Board, RETRIEVE and GOPHER
        5) Programs available
        6) DMC & IRIS phone numbers and addresses

Additionally you can leave notes to the operator by selecting the "n"
or "Note" option from the menu.

* Space bar scrolls bulletins one page at a time, CR one line at a time

One leaves the bulletin board by entering a "q" for quit and this
will automatically log you off the system.

  Press return to continue
```

IRIS CONTACTS

```
irisdmc

IRIS HQ          (703)524-6222   1616 N. Ft Myer Drive  Suite 1440
                                 Arlington, VA  22209
IRIS DMC         (512)471-8484   8701 Mopac Blvd  Suite 258
                                 Austin, TX  78759

NSFNET address                   iris.iris.edu          192.35.78.1
-------------------------------------------------------------------------
NAME             TITLE           PHONE                  EMAIL

Bob Phinney      President       (703)524-6222          phinney@iris.edu

Jim Fowler       PASSCAL Chief   (703)524-6222          jim@iris.edu
                 Engineer
Rhett Butler     Program Manager (703)524-6222          rhett@iris.edu
                 GSN
Tim Ahern        Program Manager (512)471-8484          tim@iris.edu
                 DMC
Liz McDowell     Manager of      (703)524-6222          liz@iris.edu
                 Administration
Sue Schoch       Senior Database (512)471-8485          sue@iris.edu
                 Programmer
Becky Wofford    Systems         (512)471-8483          becky@iris.edu
                 Administrator
Deanna Mann      Administrative  (703)524-6222          dee@iris.edu
                 Assistant
Greg             Director of     (703)524-6222          greg@iris.edu
Van der Vink     Planning

  Press return to continue
```

ON-LINE MANUALS

```
shelltool - /bin/csh


The following manuals are available on line

 Enter 'b' --- Electronic Bulletin Board
       'g' --- GOPHER manual
       'r' --- RETRIEVE manual
       'q' to QUIT

 * Space bar scrolls bulletins one page at a time, CR one line at a ti

 (Enter your selection)
```

NOTE GENERATION

```
iris@mc

 Please enter your name
Becky Wofford
 Enter your institution
IRIS DMC
 What is your mailing address... street, city, state, zip
8701 Mo-Pac Blvd, Suite 285, Austin, TX  78759
 What is your email address such as name@iris.css.gov
becky@iris.iris.edu
 Enter your note to the Data Management Center
 enter CONTROL-d when finished

You may use as many lines as you need for your comments.
Your note will only be viewable by the DMC staff.

 D
 Your note has been recorded and the Data Management Center
 will respond as required

 Your comments are appreciated

  Press return to continue
```

PROGRAMS AVAILABLE

```
iris@mc

                    ---------------------------------
                                 IRIS DMC
                      PROGRAMS READY FOR DISTRIBUTION
                    ---------------------------------


AH              AdHoc by Lamont Doherty Geological Observatory available
                for SUN 3 workstations from Lamont.


Field           Field Computer Software that translates data from all
Computer        PASSCAL instruments to SEGY format available from IRIS
                for SUN 3 and SUN 4 workstations.

RDSEED          A program that converts SEED format data tapes into SAC
                binary data traces.

SAC             Seismic Analysis Code produced by Lawrence Livermore Labs
                available for several computers including the SUN 3 and
                SUN 4 workstations and Vax computers.
                        version 10.4C for SUN
                        version 9.14  for Vax

SierraSEIS      Industry Standard Reflection Seismic Processing System

                  - Cost = $4000 for SierraSEIS BASIC for IRIS members
                  - Extensions are additional
                  - Maintenance is paid by IRIS

FORMAT          Several programs exist to convert data formats.  Supported
CONVERSION      formats include GDSN, SAC, AH, SEGY and SEED.  Consult IRIS
for
PROGRAMS        the availability of specific programs and other formats.

  Press return to continue
```

STATION-CHANNEL LIST

```
iris@mc
The IRIS DATA MANAGEMENT CENTER presently has
data from the following stations.

The channels reporting are indicated on subsequent lines
-----------------------------------------------------------
AFI
      BBE   BBN   BBZ   LPE   LPN   LPZ   SPZ

ANMO
      LPE   LPN   LPZ   SPE   SPN   SPZ

ANTO
      LPE   LPN   LPZ   SPZ

BJI
      BBE   BBN   BBZ   LPE   LPN   LPZ
      SPE   SPN   SPZ   VPE   VPN   VPZ

CHTO
      LPE   LPN   LPZ   SPE   SPN   SPZ

CMB
      IPE   IPN   IPZ   LPE   LPN   LPZ   SPZ

COL
      BBE   BBN   BBZ   LPE   LPN   LPZ   SPZ

CTAO
      LPE   LPN   LPZ   SPE   SPN   SPZ

GAC
      LPE   LPN   LPZ

GDH
      IPE   IPN   IPZ   LPE   LPN   LPZ   SPZ

GRFO
      LPE   LPN   LPZ   SPZ
--More--(39%)
```

IRIS Global Seismographic Network

The IRIS Global Seismographic Network (GSN) now includes 21 stations with high-performance, very broad band (VBB) seismometers. Data from these stations are now being archived at the IRIS Data Management Center (DMC), and are available for use by the research community through DMC services.

Goals

The primary goal of IRIS GSN is to install a network of over 100 state-of-the-art digital seismic stations uniformly distributed over the Earth. The secondary goal of the GSN is to provide for near real-time telemetry of data from the Network to IRIS.

Design Goals

State-of-the-art seismometers: Very-broad-band, high dynamic range vault and borehole sensors; optional high frequency and low gain seismic sensors and other geophysical sensors where appropriate.

State-of-the-art data loggers: Data digitized continuously at 20 sps with 24-bit resolution on broad band channels, at least 16-bit resolution on optional triggered seismometer channels and other auxiliary channels; satellite clock timing; separability of data acquisition and data processing modules via a telemetry link; telephone dial-up access to the data at the site; satellite telemetry and host data access ports; high density data storage media; standard data format; DAC outputs to helicorders and plotting devices; modular system design with a clear upgrade path.

State-of-the-art data collection and quality assurance: The IRIS Data Collection Centers (DCCs) require a cluster of modern computer workstations networked together to handle the volume of data from the GSN (over 1 TERAbyte/year when fully operational). Computer software to manage the DCCs is based upon 15 years experience with handling digital seismic data, and is continually being improved to meet the demands of the GSN.

Data, Archive, and Access

All GSN continuous and triggered data is archived at the IRIS Data Management Center (DMC). Appropriate GSN data is also available on the USGS Event CD-ROMs. Selected GSN stations currently have telephone dial-up capability, and data from these sites may be retrieved by seismologists using a personal computer and modem.

The design standard for continuous very-broad-band (VBB) data is a sample rate of 20 sps. IRIS DWWSSN sites currently sample continuously at 1 sps with triggered 20 sps data. Several IRIS/IDA sites currently sample continuously at 5 sps with triggered 20 sps data. When these sites are upgraded with newer data loggers, all of these sites will meet the continuous 20 sps standard.

High frequency and strong motion channels are currently sampled at 100 sps in a triggered mode. Newer versions of the IRIS data loggers have the capability to digitize at 200 sps.

Several channels available on the IRIS systems are derived channels. These include the LP (1 sps) channels derived from the VBB channels, the VLP (0.1 sps) derived from the LP channels, and the ULP (0.01 sps) channels from the VLP.

IRIS GSN also supports Project IDA - the global network of LaCoste-Romberg gravimeters. The IDA Network continues to provide fundamental data on spheroidal free oscillations of the Earth.

Federation of Broad Band Digital Seismographic Networks

The FDSN is a loose confederation of digital seismographic networks. IRIS was a founding member of the FDSN in 1986. The initial member countries of the Federation were: Australia, Canada, China, France, Germany, Japan and USA (IRIS and USGS); in addition, ORFEUS - an organization of 15 west European countries - also joined as a member. Subsequently, Great Britain, Italy, and the Soviet Union have joined the FDSN. The principal objectives of the Federation are: 1) establishment of common instrumentation standards;

2) timely exchange of data recorded by the member networks; and 3) coordination of siting plans. The principle accomplishment of the Federation to date is the establishment of an international format for seismic data exchange - SEED (Standard for Exchange of Earthquake Data). Within the spirit of coordination of siting plans, IRIS records the GEOSCOPE Streckeisen seismometers at KIP, Kipapa as a GEOSCOPE/IRIS data stream.

Elements of the GSN

The 100+ station network of design goal seismic stations is many years away. We are primarily funding limited. With the resources available IRIS is evolving toward the design goal network through a combination of upgrading old sites and installations at new sites, and in partnership with both the U.S. Geological Survey and IRIS Universities - in particular, the U.C.S.D. IDA group. The primary emphasis in this evolution has been toward the installation of Streckeisen STS-1 VBB seismometers, upgraded KS36000 (SRO) seismometers, and high-quality high frequency seismometers. Toward this end, twenty-one sites have now have state-of-the-art seismometers. Following this dedication toward deploying the most modern seismometers, IRIS GSN has been developing its design goal data logger while at the same time deploying modern data loggers with outstanding capabilities that can be upgraded to design goals.

The IRIS GSN is comprised of 3 program elements. IRIS works in partnership with the U.S. Geological Survey through a Memorandum of Understanding to upgrade and expand the current Global Digital Seismographic Network (GDSN) with IRIS design goal equipment. This IRIS/USGS element of the GSN is centered at the network maintenance and data collection center operated by the Albuquerque Seismological Laboratory (ASL) in New Mexico. IRIS works with the University of California, San Diego in supporting Project IDA, and through upgrading and expanding the IDA Network with Streckeisen seismometers. This IRIS/IDA element of the GSN is centered at the Institute for Geophysics and Planetary Physics in La Jolla, California where network maintenance and data collection centers are operated. The third element of the IRIS GSN is the IRIS University Network of independent stations which contribute to the GSN within the United States. Several IRIS member universities either through their own resources or through matching funds with IRIS have established seismic stations meeting IRIS GSN design goals. These independent stations contribute data to the IRIS DMC and maintain telephone dial-up access to data directly from the station.

Data Flow

All IRIS stations currently record their data on magnetic tape. The recording interval varies from several days to two weeks. The recorded tapes are promptly shipped to a Data Collection Center (DCC) for quality assurance and validation. IRIS/USGS and IRIS University stations send their data to the IRIS/ASL DCC. IRIS/IDA stations are processed at the IRIS/IDA DCC. Data from IRIS stations in the Soviet Union are first collected and copied at a DCC near Moscow before being forwarded by World Data Center B to the appropriate DCC in the United States. After quality assurance and validation at the DCC the data are promptly forwarded to the IRIS DMC to be archived for immediate access by the seismological community. All IRIS/IDA data is made available to the IRIS/USGS DCC, which continues to produce Network Volumes. All GSN data is forwarded by the IRIS/USGS DCC to the National Earthquake Information Center for the production of the USGS Event CD-ROMs.

IRIS Global Seismographic Stations

AFI Afiamalu, Apia, Western Samoa

Host	Apia Observatory
Location	13.9093°S 171.7773°W
Data Logger	DWWSSN (16-bit)
Seismometers	Streckeisen STS-1 VBB Continuous:1 sps Triggered: 20sps
Data Collection Center	Albuquerque Seismological Laboratory
Affiliation	IRIS/USGS Network

ALE Alert, Canada

Host	Geological Survey of Canada
Location	82.4833°N 62.4000°W
Data Logger	REF TEK IRIS-3 (16-bit)
Seismometers	Streckeisen STS-1 VBB Continuous: 20 sps high gain Triggered: 20 sps low gain LaCoste-Romberg accelerometer Continuous: 0.1 sps; 1 sample/minute
Data Collection Center	IRIS/IDA
Affiliation	IRIS/IDA Network

ANMO Albuquerque, New Mexico

Host	United States Geological Survey
Location	34.9462°N 106.4567°W
Data Logger	Martin Marietta IRIS-1 (24-bit & 16-bit)
Seismometers	Geotech KS36000-I Continuous: 20; 1; 0.1; 0.01 sps Geotech GS-13 Triggered: 100 sps
Data Collection Center	Albuquerque Seismological Laboratory
Dial-up Number	1-505-846-0384
Affiliation	IRIS/USGS Network

ARU Arti, U.S.S.R.

Host	Inst. Physics Earth, Academy of Sciences
Location	56.40°N 58.60°E
Data Logger	REF TEK IRIS-3 (16-bit)
Seismometers	Streckeisen STS-1 VBB Continuous: 20 sps high gain Triggered: 20 sps low gain
Data Collection Center	IRIS/IDA
Affiliation	IRIS/IDA Network

CCM Cathedral Caves, Missouri

Host	St. Louis University
Location	38.0557°N 91.2446°W
Data Logger	Martin Marietta IRIS-1 (24-bit & 16-bit)
Seismometers	Streckeisen STS-1 VBB Continuous: 20; 1; 0.1; 0.01 sps Geotech GS-13 Triggered: 100 sps
Data Collection Center	Albuquerque Seismological Laboratory
Dial-up Number	1-314-245-6555
Affiliation	IRIS University Network

COL College, Alaska

Host	United States Geological Survey
Location	13.9093°S 171.7773°W
Data Logger	DWWSSN (16-bit)
Seismometers	Streckeisen STS-1 VBB
	Continuous:1 sps
	Triggered: 20sps
Data Collection Center	Albuquerque Seismological Laboratory
Affiliation	IRIS/USGS Network

COR Corvallis, Oregon

Host	Oregon State University
Location	44.5857°N 123.3032°W
Data Logger	Quanterra IRIS-1 (24-bit)
Seismometers	Streckeisen STS-1 VBB
	Continuous: 20; 1; 0.1; 0.01 sps
Data Collection Center	Albuquerque Seismological Laboratory
Dial-up Number	1-503-737-0853
Affiliation	IRIS University Network

CTAO Charters Towers, Australia

Host	University of Queensland
Location	20.0883°S 146.2544°W
Data Logger	ASRO (16-bit gain ranged)
Seismometers	Streckeisen STS-1 VBB
	Continuous: 1 sps
	Triggered: 10 sps
Data Collection Center	Albuquerque Seismological Laboratory
Affiliation	IRIS/USGS Network

ESK Eskdalemuir, Scotland

Host	British Geological Survey
Location	55.3167°N 3.2050°W
Data Logger	IDA Mark 3 (16-bit)
Seismometers	Streckeisen STS-1 VBB
	Continuous: 5; 0.1 sps high gain
	Triggered: 5; 0.1 sps low gain
	Triggered: 20 sps high and low gain
	LaCoste-Romberg accelerometer
	Continuous: 0.1 sps; 1 sample/minute
Data Collection Center	IRIS/IDA
Affiliation	IRIS/IDA Network

GAR Garm, U.S.S.R.

Host	Inst. Physics Earth, Academy of Sciences
Location	39.00°N 70.32°E
Data Logger	REF TEK IRIS-3 (16-bit)
Seismometers	Streckeisen STS-1 VBB
	Continuous: 20 sps high gain
	Triggered: 20 sps low gain
Data Collection Center	IRIS/IDA
Affiliation	IRIS/IDA Network

HRV Harvard, Massachusetts

Host	Harvard University
Location	42.5072°N 71.5625°W
Data Logger	Harvard Prototype IRIS-1 (24-bit)
Seismometers	Streckeisen STS-1 VBB
	Continuous: 20; 1; 0.1; 0.01 sps
Data Collection Center	Albuquerque Seismological Laboratory

	Dial-up Number	1-508-456-3099
	Affiliation	IRIS University Network
IRK	Irkutsk, U.S.S.R.	
	Host	Inst. Physics Earth, Academy of Sciences
	Location	52.27°N 104.31°E
	Data Logger	REF TEK IRIS-3 (16-bit)
	Seismometers	Streckeisen STS-1 VBB
		Continuous: 20 sps high gain
		Triggered: 20 sps low gain
	Data Collection Center	IRIS/IDA
	Affiliation	IRIS/IDA Network
KEV	Kevo, Finland	
	Host	University of Helsinki
	Location	69.7553°N 27.0067°E
	Data Logger	DWWSSN (16-bit)
	Seismometers	Streckeisen STS-1 VBB
		Continuous:1 sps
		Triggered: 20sps
	Data Collection Center	Albuquerque Seismological Laboratory
	Affiliation	IRIS/USGS Network
KIP	Kipapa, Oahu, Hawaii	
	Host	Pacific Tsunami Warning Center
	Location	21.4233°N 158.0150°W
	Data Logger	Martin Marietta IRIS-1 (24-bit & 16-bit)
	Seismometers	Streckeisen STS-1 VBB
		Continuous: 20; 1; 0.1; 0.01 sps
		Geotech GS-13
		Triggered: 100 sps
	Data Collection Center	Albuquerque Seismological Laboratory
	Dial-up Number	1-808-671-0268
	Affiliations	IRIS/USGS & GEOSCOPE Networks
KIV	Kislovodsk, U.S.S.R.	
	Host	Inst. Physics Earth, Academy of Sciences
	Location	42.95°N 42.68°E
	Data Logger	REF TEK IRIS-3 (16-bit)
	Seismometers	Streckeisen STS-1 VBB
		Continuous: 20 sps high gain
		Triggered: 20 sps low gain
	Data Collection Center	IRIS/IDA
	Affiliation	IRIS/IDA Network
NNA	Ñaña, Peru	
	Host	Instituto Geofisico del Peru
	Location	11.9875°S 76.8422°W
	Data Logger	IDA Mark 3 (16-bit)
	Seismometers	Streckeisen STS-1 VBB
		Continuous: 5; 0.1 sps high gain
		Triggered: 5; 0.1 sps low gain
		Triggered: 20 sps high and low gain
		LaCoste-Romberg accelerometer
		Continuous: 0.1 sps; 1 sample/minute
	Data Collection Center	IRIS/IDA
	Dial-up Number	to be implemented
	Affiliation	IRIS/IDA Network

OBN Obninsk, U.S.S.R.

Host	Inst. Physics Earth, Academy of Sciences
Location	56.10°N 36.60°E
Data Logger	REF TEK IRIS-3 (16-bit)
Seismometers	Streckeisen STS-1 VBB
	Continuous: 20 sps high gain
	Triggered: 20 sps low gain
Data Collection Center	IRIS/IDA
Affiliation	IRIS/IDA Network

PAS Pasadena, California

Host	Caltech/USC/USGS
Location	34.1483°N 118.1717°W
Data Logger	Quanterra IRIS-1 (24-bit & 16-bit)
Seismometers	Streckeisen STS-1 VBB
	Continuous: 20; 1; 0.1; 0.01 sps
	Kinemetrics FBA-23
	Triggered: 100 sps
Data Collection Center	Albuquerque Seismological Laboratory
Dial-up Number	1-818-795-6415
Affiliations	IRIS University Network & USGS

PFO Piñon Flat, California

Host	University of California, San Diego
Location	33.6092°N 116.4553°W
Data Logger	IDA Mark 3 (16-bit)
Seismometers	Streckeisen STS-1 VBB
	Continuous: 5; 0.1 sps high gain
	Triggered: 5; 0.1 sps low gain
	Triggered: 20 sps high and low gain
	LaCoste-Romberg accelerometer
	Continuous: 0.1 sps; 1 sample/minute
Data Collection Center	IRIS/IDA
Affiliation	IRIS/IDA Network

RPN Rapa Nui, Easter Island

Host	Universidad de Chile
Location	27.1581°S 109.4344°W
Data Logger	IDA Mark 3 (16-bit)
Seismometers	Streckeisen STS-1 VBB
	Continuous: 5; 0.1 sps high gain
	Triggered: 5; 0.1 sps low gain
	Triggered: 20 sps high and low gain
	LaCoste-Romberg accelerometer
	Continuous: 0.1 sps; 1 sample/minute
Data Collection Center	IRIS/IDA
Affiliation	IRIS/IDA Network

TOL Toledo, Spain

Host	Instituto Geografico Nacional
Location	39.8814°N 4.0486°W
Data Logger	DWWSSN (16-bit)
Seismometers	Streckeisen STS-1 VBB
	Continuous:1 sps
	Triggered: 20sps
Data Collection Center	Albuquerque Seismological Laboratory
Affiliation	IRIS/USGS Network

PASSCAL INSTRUMENT PROGRAM

by J Fowler

The Instrumentation Program passed a milestone this summer. We were able to move from the mode of testing prototype instruments that of supporting scientific experiments in the field. Since the beginning of May we have supported three major experiments with instrumentation and furnished additional support to a fourth experiment. This change in operation has not been without its difficulties, however, with each deployment we have expanded our capabilities and we are well on our way to being able to quickly and efficiently handle deployments of a moderate number of instruments in the field.

In addition to the support provided in the projects below, we are now making plans for the projects to be supported next year. This schedule will be finalized during the next month and should be available by AGU time.

ARCHEAN-PROTEROZOIC TRANSITION PROJECT

This was a teleseismic experiment conducted over a four month period (15 June to 15 October) to characterize the variations in crust and upper mantle structure along a 2000 km traverse in North America. This traverse spans two major geologic transitions: from the Archean Western Superior Province of the Canadian Shield to the Proterozoic Trans-Hudson, and then to the Archean Wyoming Craton. Twenty-two portable three-component seismic stations were deployed in a line from western Ontario to Wyoming with spacing ranging from 50 to 100 km. The array passed through two permanent RSTN stations, RSON and RSSD, which were recording long and intermediate period channels through much of the experiment. Twelve of the instruments were University of Wisconsin data loggers with three-component 1 Hz sensors operating in a triggered mode, the other ten stations were the PASSCAL prototype instruments with intermediate period seismometers (Kinemetrics 5s and Guralp CMG3) recording continuously at 10 samples per second.

Of the large suite of teleseismic events recorded, more than 30 had well recorded S waves. In addition, two NTS blasts were recorded by many of the instruments, providing an excellent profile over the distance range 10-25 °. Three types of studies will be undertaken with this data set. 1) Variations in mantle anisotropy as determined by shear-wave splitting in S, ScS and SKS, 2) variations in the properties of crustal reflectors, the moho, and upper mantle discontinuities using boundary interaction phases, and 3) variations in travel times in all major phases to gain high resolution information on lateral variations in P and S velocity.

The principal investigators in this experiment are from the Carnegie Institution of Washington and the University of Wisconsin-Madison. Additional project support came from the Ontario Geologic Survey, the Geologic Survey of Canada and the University of North Dakota.

GREENLAND REFLECTION/REFRACTION PROJECT

This was the first experiment supported through the PASSCAL Instrument Center at Lamont. Twenty of the new PASSCAL Instruments equipped with disk drives and Omega clocks were utilized during this program.

The Greenland project was principally a marine recording project conducted by the University of Wyoming with support from the Bergen University and the University of Copenhagen. The objective of the program was to utilize marine air gun source from the University of Bergen's seismic ship Haakon Mosby to record reflections from the crust and moho. The study area centered near Godthab on the southwest Greenland coast contains some of the Earth's oldest rocks along with two Archean and one Proterozoic crustal sutures.

The principal line in this project was a marine CDP line about 500 km long parallel to the coast. In this line the PASSCAL instruments were deployed at fixed intervals along the coast to provide wide angle three component reflection data to increase the interpretability of the CDP data recorded with the streamer.

Additional lines were shot in fjords along the coast. In this case the streamer was not used and the PASSCAL instruments recorded low fold CDP and refraction profiles utilizing the air guns from the ship as a source.

In all cases the small size of the instruments made it possible to deploy them from a helicopter or a small boat. The instruments used the Omega clock to keep synchronized to the ships clock and the disks allowed the instruments to record 150 Mbytes (or six days) before servicing. This kept deployment costs to a minimum in this difficult field area. The field computer provided the ability to look at the profiles before the experiment was completed to insure that the recording parameters were optimized for this location.

The PASSCAL instruments recorded about 1000 km of three component wide angle reflection and refraction data with an effective trace spacing of about 100 meters. This represents one of the most complete sets of data on the lower crust and moho in the world.

LOMA PRIETA EARTHQUAKE DEPLOYMENT

The PASSCAL instruments were used in the Loma Prieta aftershock deployment. For a full report on this activity see the article in this Newsletter.

PACE

In addition to the program sponsored above, PASSCAL helped support the PACE Experiment in Arizona. The SGR's jointly supported by Stanford, the USGS and IRIS were operated by Stanford and the USGS while the five EDA instruments owned by PASSCAL were operated by the University of Texas-El Paso and Texas A&M University.

Instrumentation

All of the new REF TEK instruments ordered by PASSCAL this year have now been delivered. As of today the Passcal program has the instrumentataion at the PASSCAL Instrument Center:

10 Prototype PASSCAL instruments,

10 Disk drives for the prototype instruments,

35 Production instruments,

6 Auxiliary recording systems,

20 Disk drive units for the production instruments,

70 3-channel cables,

70 3-component L-22 2 Hz sensors,

5 3_component L-4 1 Hz sensors,

10 3-component S-13 1 Hz sensors,

2 SUN 3/160 field computers,

2 SUN 3/50 field computers,

6 Epson hand held terminals, and

miscellaneous support equipment such as antennas, external clocks, tool kits, etc.

Stanford/USGS/PASSCAL SGR - III Facility Success
by Walter Mooney

The SGR - III (Seismic Group Recorder) seismographs acquired by Stanford University and operated in partnership by Stanford and the USGS/Menlo Park were modified over the summer of 1989 to include the capability for pre-programmed turn-on. This modification involved the addition of a micro-processor board and a chronometer. PASSCAL shared one-third of the cost of this modification with Stanford and the USGS. Amoco donated the SGR's to Stanford in 1988.

The modified instruments were first used in the field Sept. 19-21 during the PACE (Pacific-to-Arizona Crustal Experiment) project near Flagstaff, Arizona. Dr. Jill McCarthy of the USGS/Menlo Park was the project chief for this investigation that involved over 80 participants from numerous academic and government institutions. The modified SGR's achieved a success rate of over 90% on their maiden deployment across the Basin-Range/Colorado Plateau Transition Zone; and a newly-acquired IBM-386 PC based SGR cartridge-tape transcriber produced immediate record sections from the field tapes.

The SGR facility is available for use by PASSCAL institutions on a cost basis. At present there is no permanent field party chief or repair staff; these would have to be provided by the user (on contract with a seismic acquisition company that is familiar with SGR's). Further information on use of the SGR's can be obtained through IRIS headquarters.

GOPHER CAPTURES SANTA CRUZ EVENT

by Tim Ahern, IRIS
Fumiko Tajima, University of Texas Institute for Geophysics

October 27, 1989

The Santa Cruz event of October 18, 1989 represented the first time the IRIS Data Management Center's GOPHER system was used to recover data after an event of national significance. The system performed extremely well.

The alert bulletin from the NEIC that triggers GOPHER, was not received until about 1 hour and 45 minutes after the earthquake. Of the five IRIS stations that are equipped with dial-up capability, only stations ANMO, HRV and PAS were able to be accessed for the event. Station KIP in Hawaii had suffered an outage due to lightening several days before and station CCM had equipment problems that prevented dial-up access but the data were recorded on magnetic tape.

GOPHER recovered data for time windows for the long period and broadband channels. All data were recovered and available for use by IRIS users only three hours after the event, one hour and fifteen minutes after receipt of the alert bulletin.

The GOPHER system was accessed approximately 100 times within the first 24 hours after the earthquake with several individuals transferring data back to their home institutions for further analysis. Only two users that we are aware of reported difficulties with the GOPHER system. Several IRIS institutions were able to display IRIS data on local television stations.

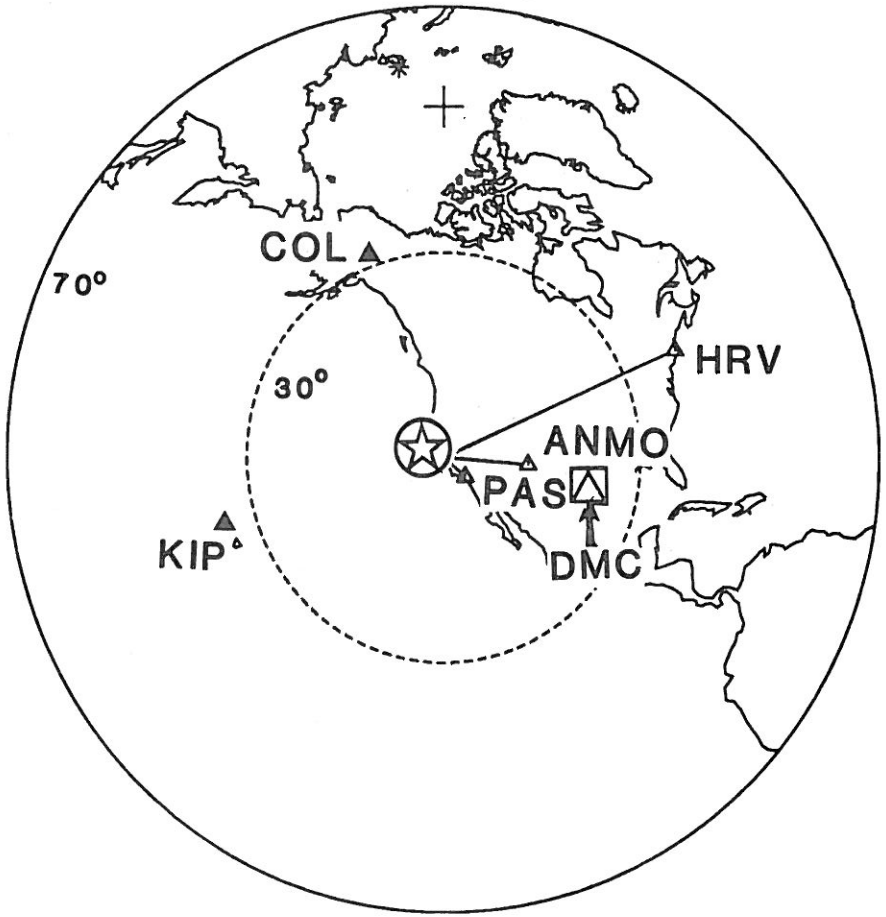
Several days after the event, the IRIS/IDA DCC in San Diego transferred data from station PFO (Pinion Flat) to the DMC. The IRIS DMC has included those seismograms within the GOPHER database also. These channels use a different naming convention where channel 04 is the vertical component, channel 05 is the north-south component and channel 06 is the east-west component. It is these designators that you will find on the plot when viewing PFO data.

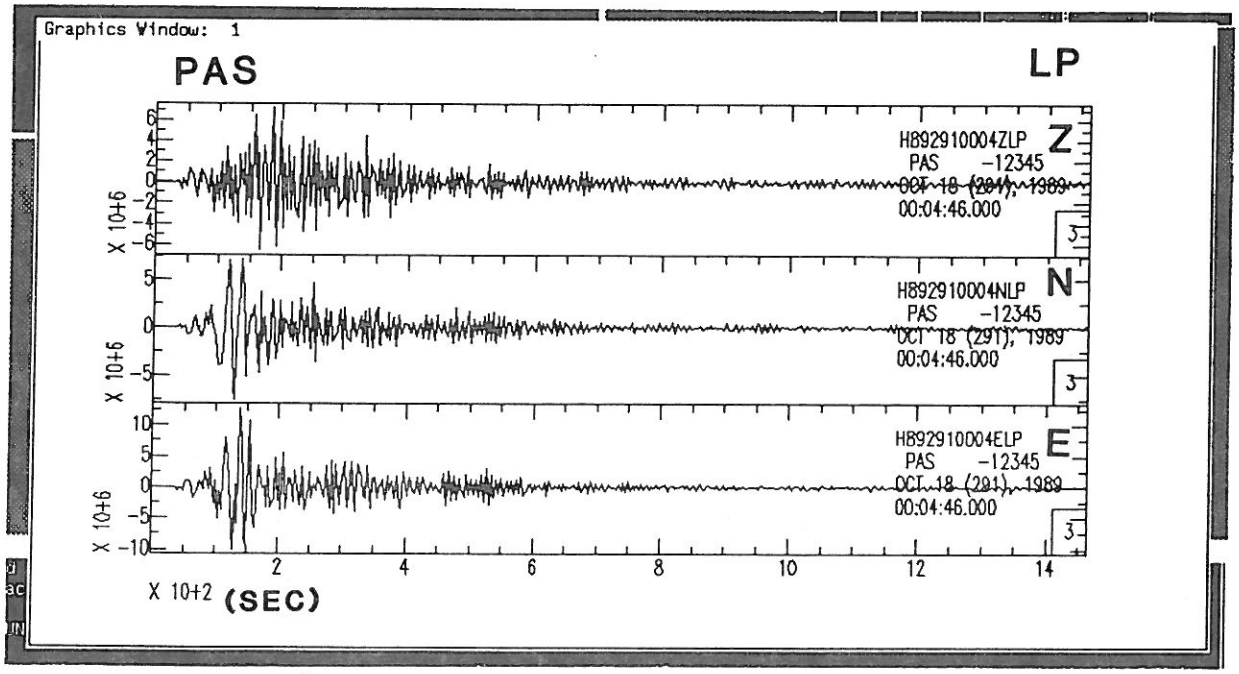
Fumiko Tajima has used the GOPHER system to generate the following displays from the Santa Cruz event. She has identified several different phases for both the long period and broadband data channels. The following four pages show the relative locations and distances of stations PAS, ANMO and HRV from the event as well as the long period and broadband seismograms.

It is important to remember that all IRIS GOPHER users would have been able to view the same seismograms within three hours after the Santa Cruz event.

We feel that GOPHER is an extremely important addition to the services the IRIS Data Management Center can provide you. We encourage you to become familiar with the system and use it frequently.

GOPHER FOR SANTA CRUZ EQK

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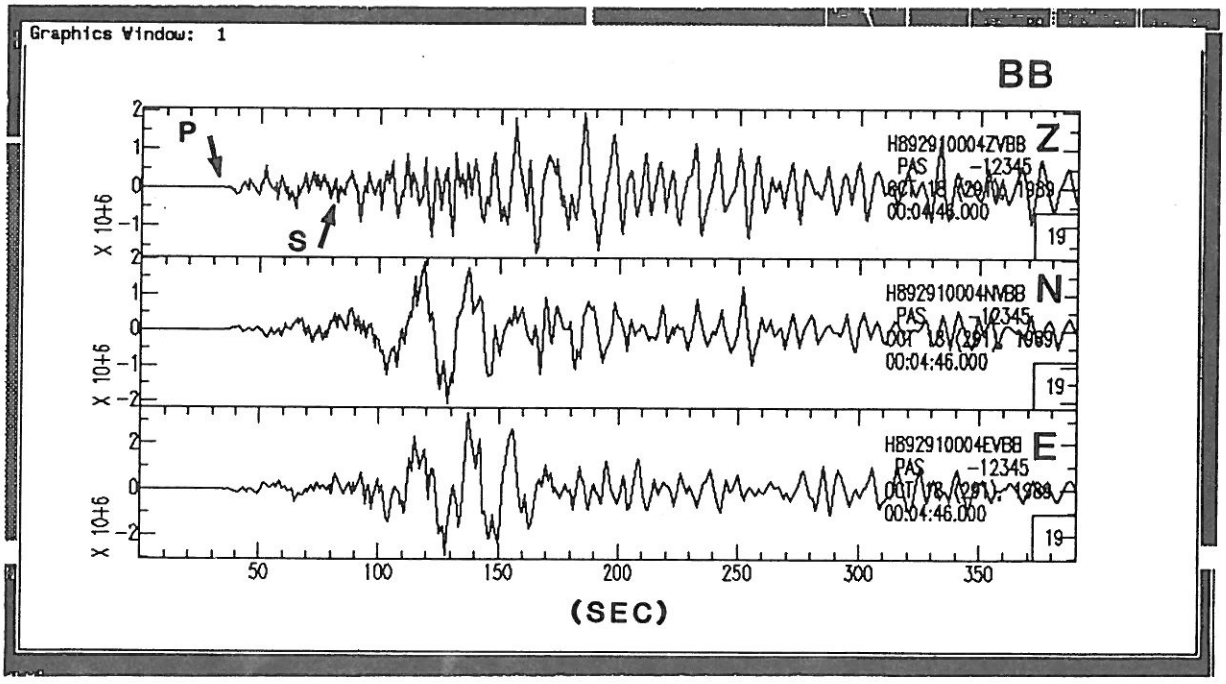
E
X 10+6
X 10+2 (SEC)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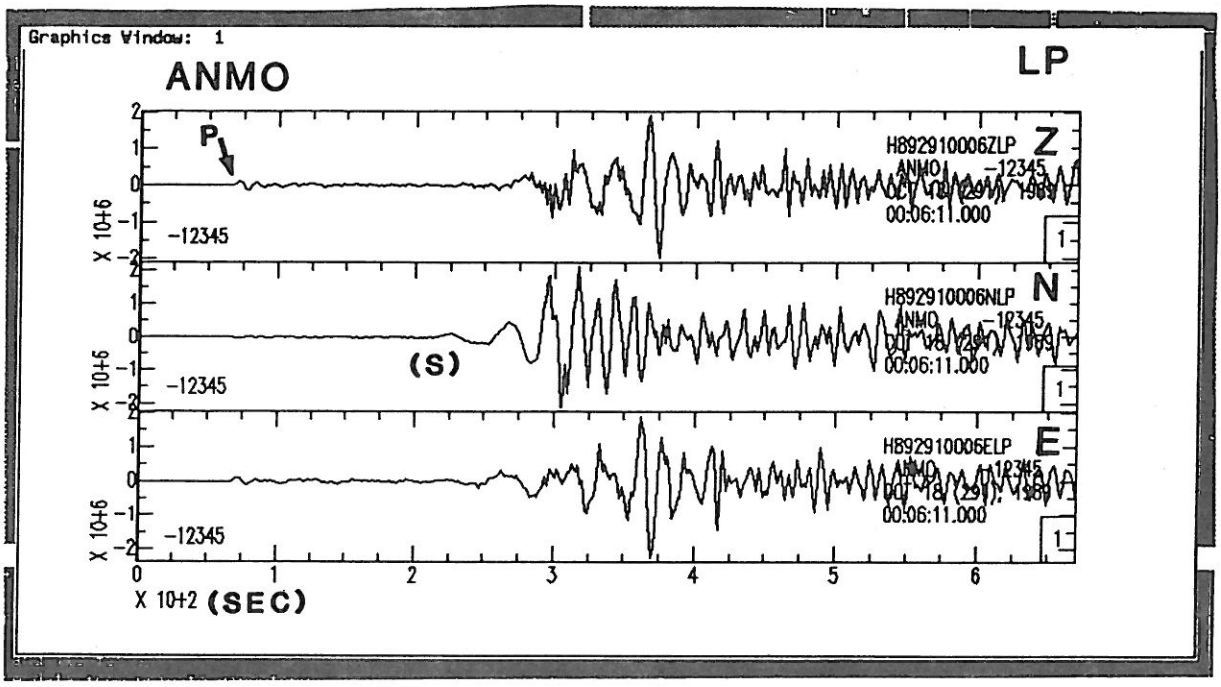
E
X 10+6
(SEC)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(S)
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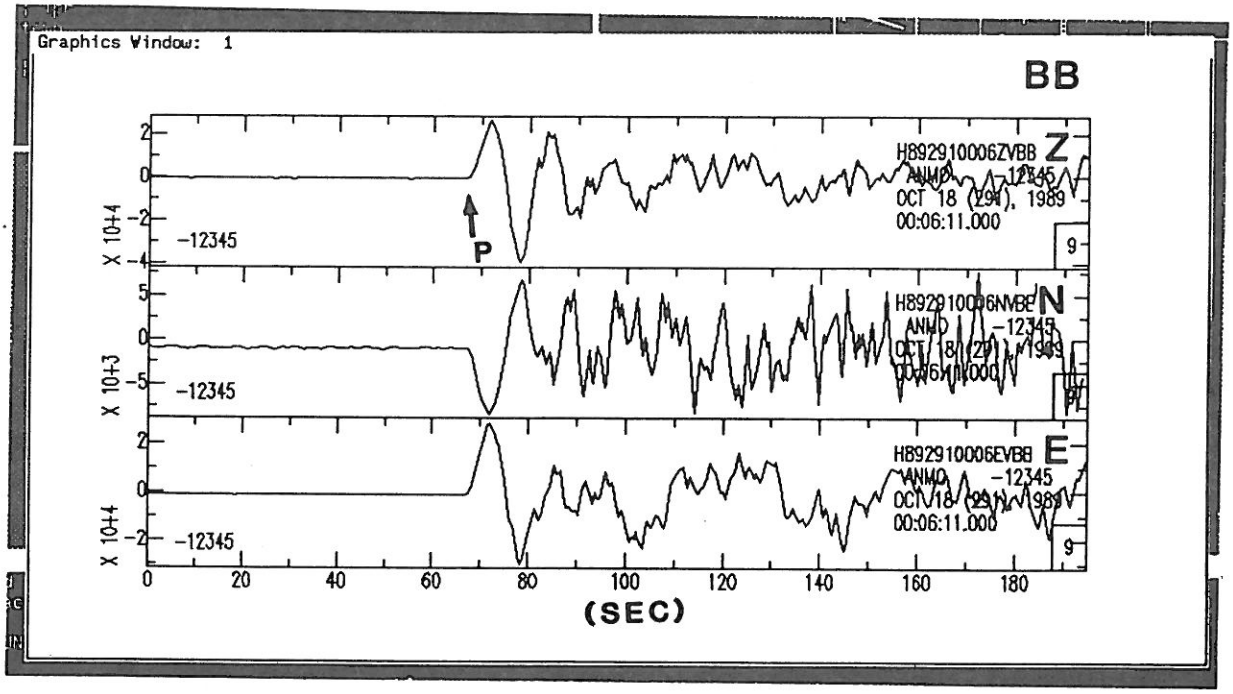
X 10+6
X 10+2 (SEC)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OCT 18 (291), 1989
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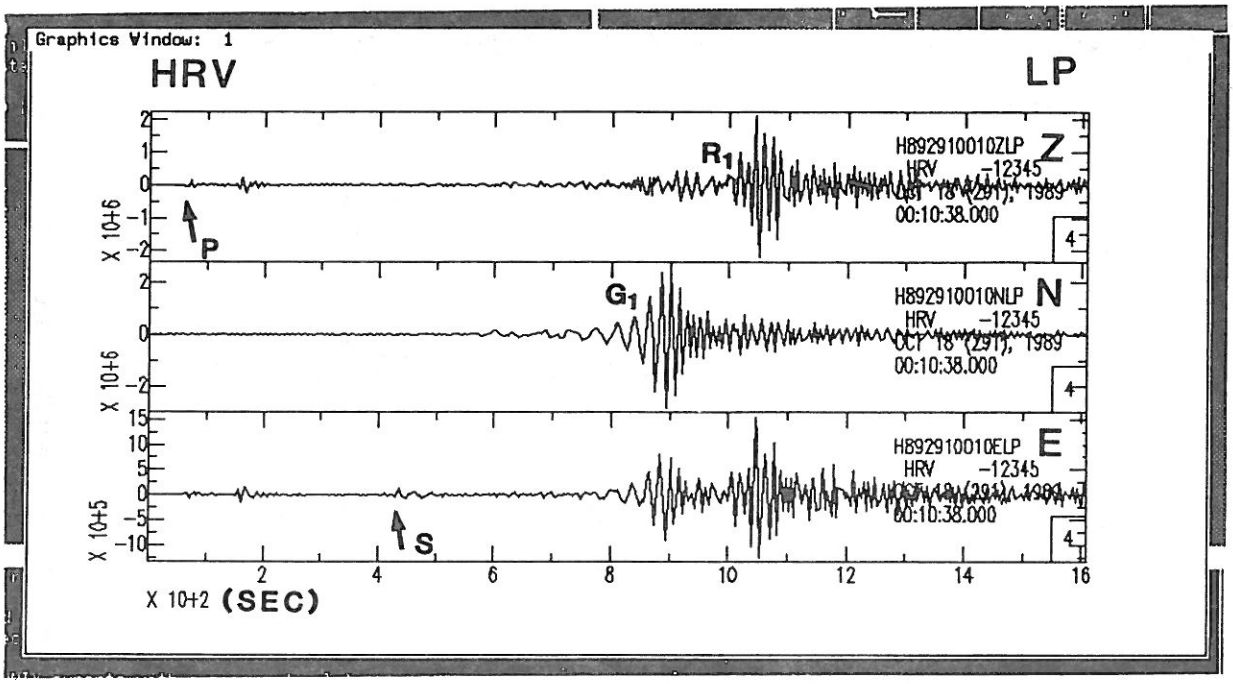
X 10+4
X 10+3
(SEC)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E
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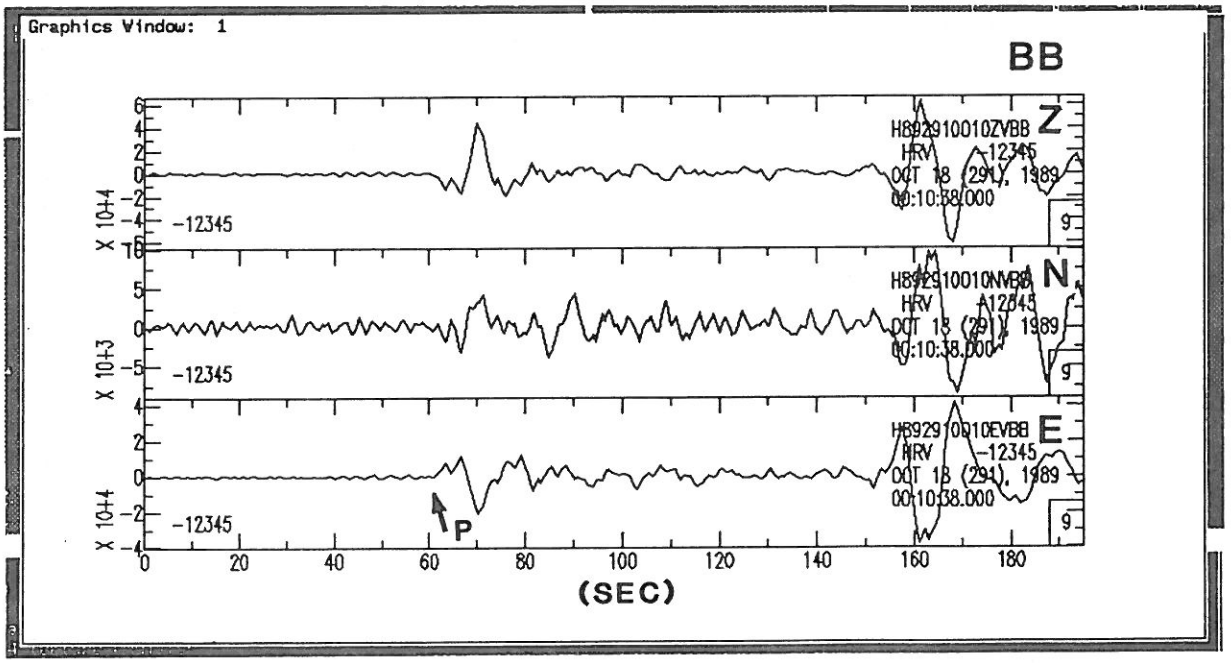
X 10+5
X 10+2 (SEC)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(SEC)

Report on the Initial PASSCAL Deployments During the Loma Prieta Aftershock Sequence

David Simpson
Art Lerner-Lam
Doug Johnson
Lamont-Doherty Geological Observatory

Preface (submitted by Jim Fowler)

The PASSCAL instrumentation arrived back at the Instrument Center from the Greenland experiment at 4:00 PM on Tuesday October 17, 1989. At 8:04 PM the magnitude 7.1 Loma Prieta earthquake occurred. A major element of IRIS future planning for these instruments is their availability and readiness for rapid-response to a major earthquake. Therefore, IRIS decided that Lamont would lead an initial effort to respond to the earthquake utilizing resources from PASSCAL as well as the National Center for Earthquake Engineering Research. Lamont was asked to respond because of their experience in other aftershock studies and because they had a technical staff which had familiarity with the instruments. After this initial deployment, personnel from the University of California-Santa Cruz and the University of California-Santa Barbara were trained and continued the deployment for several weeks.

The deployment at Loma Prieta would not have been possible without the logistical and communications support provided by the U. S. Geological Survey in Menlo Park during the critical early phases of the work.

Summary

The Loma Prieta earthquake provided an opportunity to give the PASSCAL instruments an unanticipated test in an aftershock study. In addition to having one of the most significant sociological impacts since San Fernando, the Loma Prieta event will have one of the best instrumented aftershock sequences in the history of seismic observation. Initial mapping of the rupture zone by aftershock distributions and observations of aftershock waveforms indicate that these data should provide constraints on a number of critical issues regarding the structure of the San Andreas Fault Zone with depth, spatial distribution of moment release and the relation to fault zone geometry and geology, and the capricious patterns of damage observed in the Santa Cruz Mountains and the populated areas to the North. Loma Prieta also signifies a turning point in long and intermediate term prediction studies, and public support of basic research on the earthquake process. As coordinators of the PASSCAL field effort, we consider the PASSCAL deployment to be an overall success and are confident that the IRIS data will constitute a significant seismological component of the Loma Prieta data set. These data should be of great interest to a broad constituency in the IRIS community and further demonstrate the IRIS commitment to seismological issues of pressing national concern.

Deployment and Initial Results

A map of the station sites is shown in Figure 1. The deployments can be broken down into five general areas:

- A study of the response of the sediments and bay fill in West Oakland, in cooperation with NCEER, near the collapse of the Cypress structure on the Nimitz Freeway (I-880). Five instruments for one week.
- A tight directional array (200 m spacing) in Sunnyvale to study excitation of surface waves at the boundaries of alluvial basins. Four instruments with 5-sec seismometers for five days.
- A detailed study of the aftershock zone, concentrating on the northern half. Ten instruments for the first week, expanded southward to include 20 instruments in the second week. 2-Hz three-component L22 sensors.

- Small tripartite arrays in the aftershock zone, set up by UCSC, starting around November 5th and located on some of the sites used during the first two weeks.
- Short linear arrays in the southern part of the aftershock zone, set up by UCSB, using six instruments starting November 5.

At least sixteen large events were recorded on the West Oakland array, and Sue Hough already has some significant results showing strong amplification of ground motion (up to 8x) on mud sites at frequencies close to the natural resonances of the Cypress structure. There is substantial interest in these data among engineering seismologists and structural and forensic engineers, as well as the general public.

Figures 2, 3, and 4 show Calnet seismicity, the two-week aftershock deployment, and an overlay. The three cross-sections in Figure 4 are shown in Figures 5, 6, and 7. There are three apparent clusters of aftershock activity at the northern end of the rupture at intermediate depths (about 10 km), and at shallow depths near the intersection of the Sargent Fault with the SAF. The cross fault array at AA' (Figure 5) lies almost directly above the northernmost cluster, delineating the northernmost end of the rupture, and provides good path coverage through the hanging wall. It is thought by Lindh, McNally, Sykes, Scholz, and others that there is still unrelieved accumulated slip on this part of the Santa Cruz Mountains segment. Stations further south were designed to get reasonably complete coverage of shallow focal spheres to examine (1) the interaction of the Sargent Fault with the SAF, and (2) the apparent end of the rupture some 3-5 km below the surface.

The next several figures show examples of waveforms recorded for a m=2.1 aftershock. Figures 8, 9, and 10 show closeups of the waveforms. We are particularly excited by the well-recorded shear waves. The bandwidth of the data provides clear illustrations of differences in frequency content not only between stations, but between P and S (Figures 8 and 9). Figure 10 shows the NS component recorded at three stations (WVRD, LOMP, and GOOD). All three sites are North of the San Andreas, but LOMP and GOOD are located along the trace of the Sargent Fault. The seismograms are plotted at true relative amplitude (the instruments are flat to velocity above 2 Hz). The correlation of low amplitudes with the Sargent Fault trace clearly bears further investigation.

Figures 11, 12, and 13 show record sections plotted at true relative amplitude. Figures 14, 15, and 16 are the same seismograms with auto-scaling. (This is an incomplete set of data to avoid overplotting.) Note differences in frequency content for stations at similar distances but different azimuths, and differences in relative P/S amplitude ratios and surface wave excitation. Contrary to conventional wisdom, these seismograms show a richness of spectral behavior that becomes accessible through increased bandwidth and three-component recording. We have seen clear compressional energy corners well above 20 Hz in some of the data.

Figure 17 shows the three-component recording of an event almost directly below DBWN. The shear arrival on component 2 (NS) appears to lag the arrival on the vertical and EW components by about 0.1 s. We rotated the horizontals in 5° increments to examine this apparent shear-wave splitting, and have found that the slow polarization strikes about N35°E (Figure 18). The amount of splitting, about 0.1s, if averaged along the travel path, implies about 3-5% anisotropy in the upper 10 km of the hanging wall. The direction of the slow polarization is in agreement with maximum stress striking roughly normal to the SAF, which is expected if the SAF is weakly resistant to shear.

Many thousands of events (over 20,000 separate triggers as of November 12) have been recorded, and Santa Cruz intends to operate the instruments in the aftershock zone at least until November 21. We have started the event association process based on the USGS Calnet catalogs. We expect that 10 or more events will be available for distribution to interested IRIS institutions this week. While many weeks' worth of work are required to complete the association (including locating events not detected by Calnet), it is clear that we are dealing with volumes of data more in line with multichannel seismics than with teleseismic studies. We describe below our suggestions for distribution of the entire data set.

Data Distribution

We feel it is important that the entire data set collected in this experiment (including the components now being run by UCSC and UCSB) be distributed to the IRIS community as soon as possible. We intend to follow a phased approach:

- Event association for several (~10) large aftershocks, distribution of raw waveforms with nominal instrument responses, caveats on known timing and instrument problems.
- Further association to USGS catalog, instrument calibration (phase and amplitude), timing corrections.
- Further association, unassociated waveforms, further timing and instrument problems corrected.

The first phase can be fully completed in time for the AGU and the data can be made available to interested members at that time. The second and third phases of the distribution will be dependent upon IRIS receiving additional support.

Instrumentation Issues

This was the first use of the PASSCAL instruments in an aftershock study. Overall, the instruments were a great success and have certainly proven their usefulness in this type of deployment. They are extremely easy to use in the field with a few hours of training. The flexibility in defining data streams allows for use in a variety of different types of deployments, and is a significant feature. We should bear in mind, however, that these instruments are "diamonds in the rough", and there were still problems with hardware and software experienced in the field.

While considerable software development is required, the two SUN computers we used for a field computer system proved invaluable in the initial processing of data.

Understandably, a number of areas for improvement were recognized. A summary the areas that we feel are the most important will be given the the manufacturers and the relevant IRIS committees.

Personnel

Larry Shengold and Bob Busby (Regional Instrument Center) were in the field at critical times. David Lentrichia and Richard Boaz (RIC) provided software and hardware support from Lamont, often communicating via internet. We are especially proud of and grateful for the contributions these people have made to the instrumentation program in general and this experiment in particular.

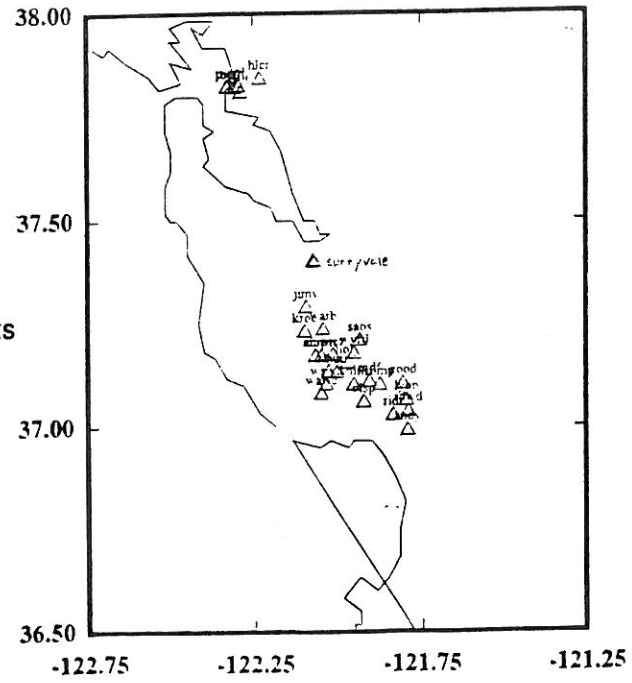

Figure 1 Initial Deployment of PASSCAL Instruments

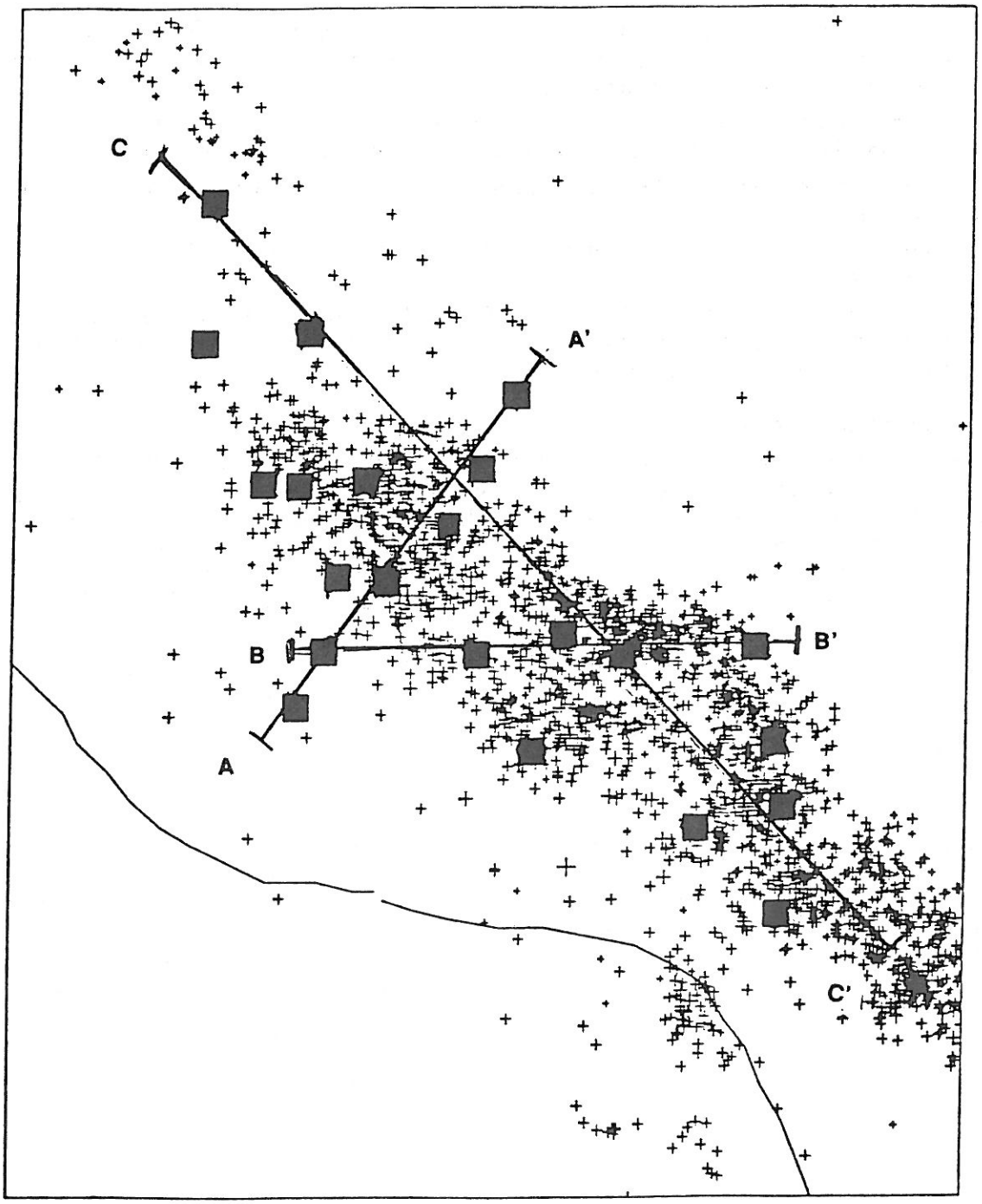

Figure 2 Two-week Aftershock Deployment with Calnet Seismicity

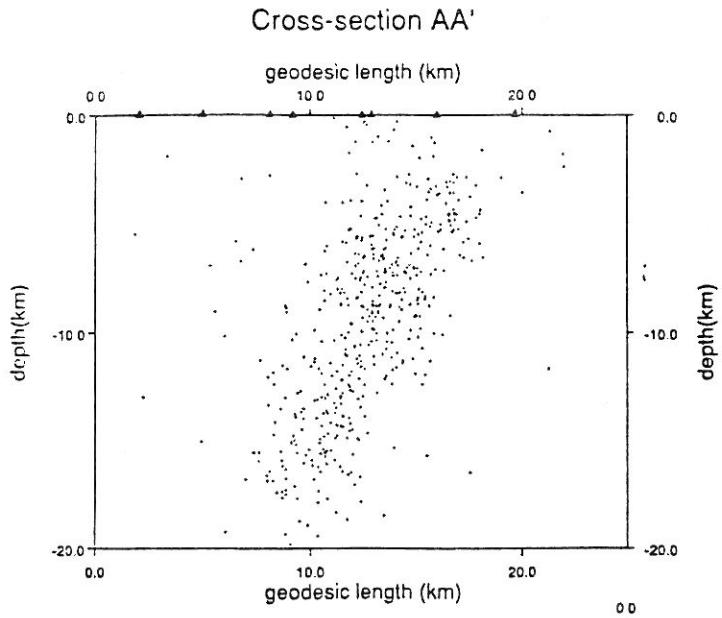

Figure 3

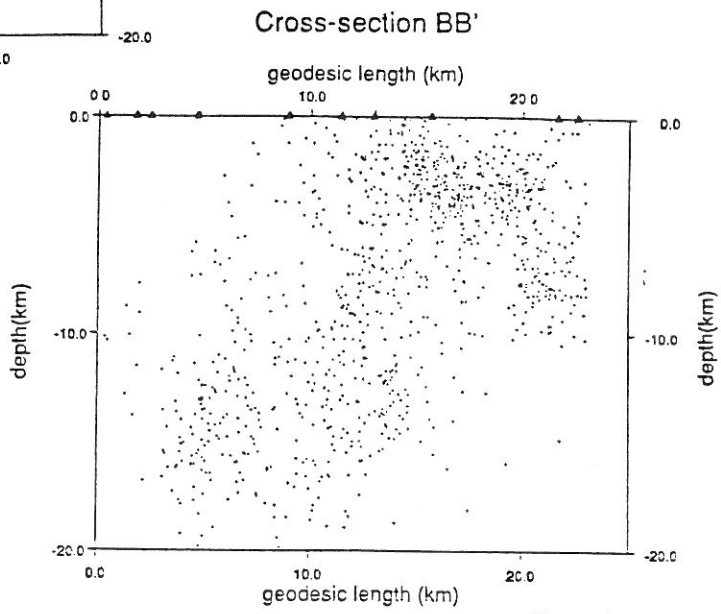

Figure 4

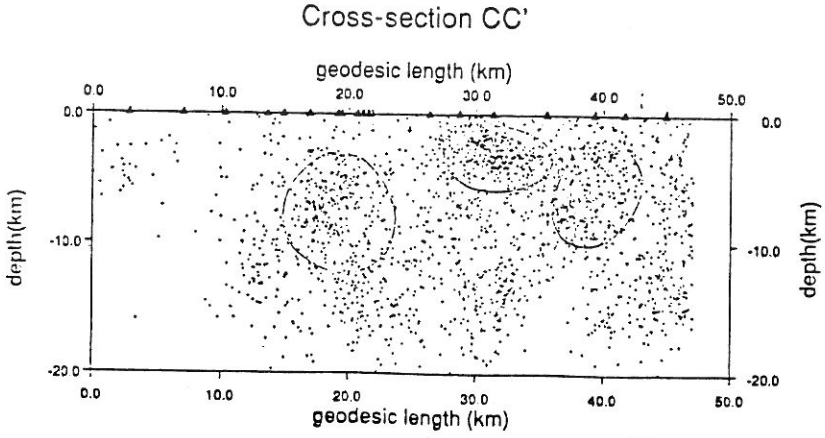

Figure 5

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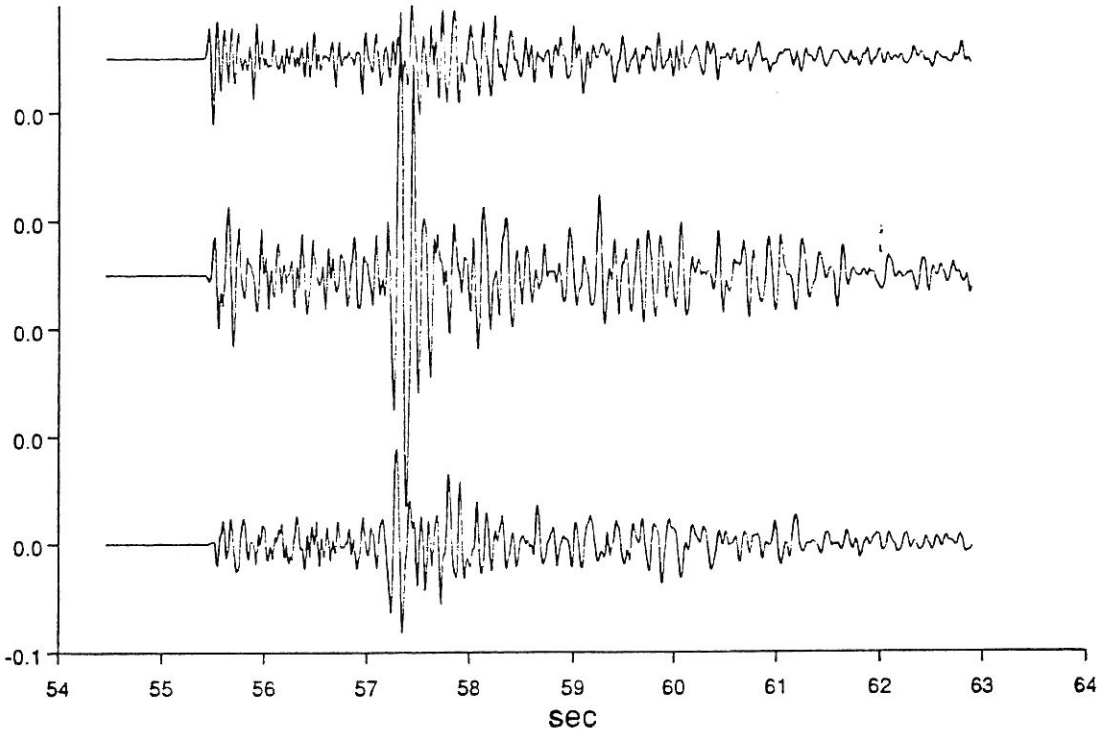

Figure 6 Station OLSP

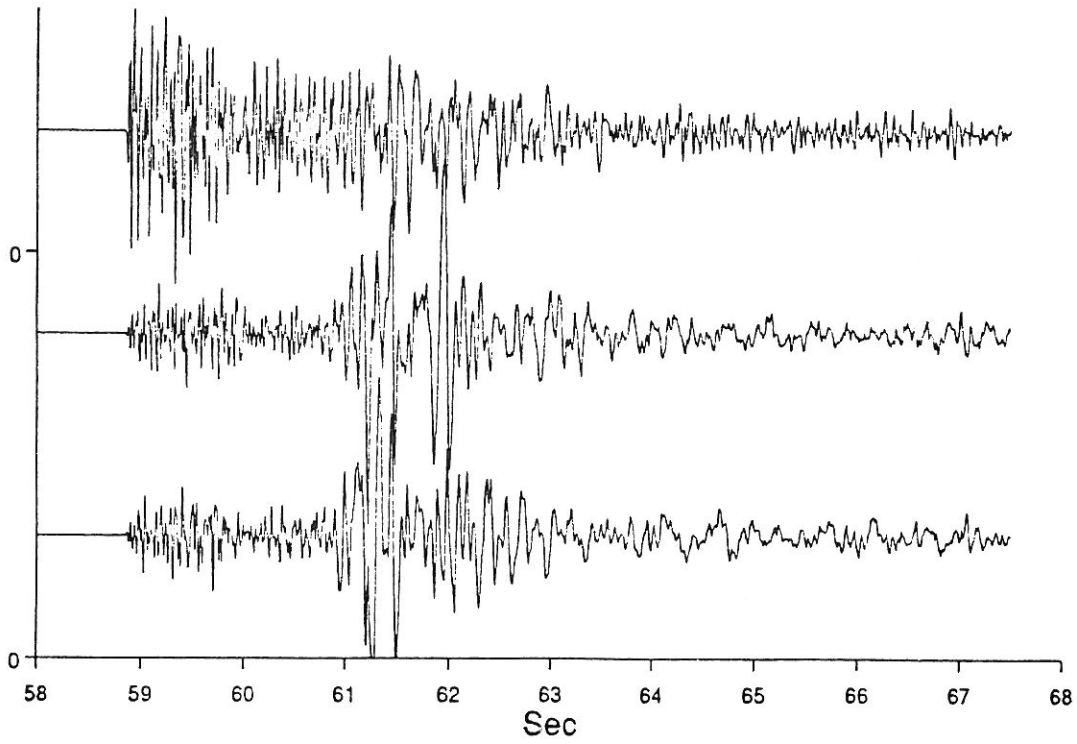

Figure 7 Station GOOD

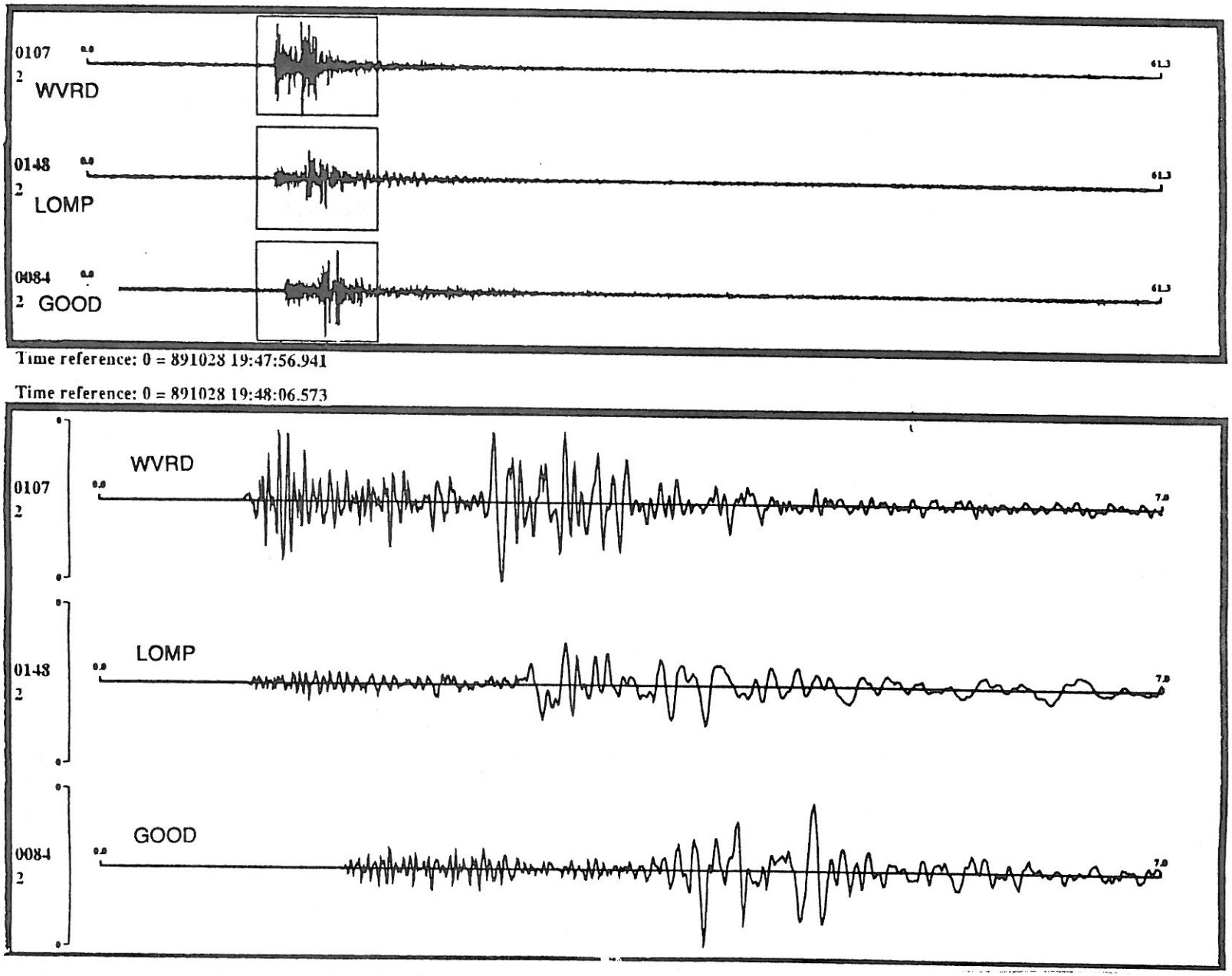

Figure 8 North-South Components from Three Stations

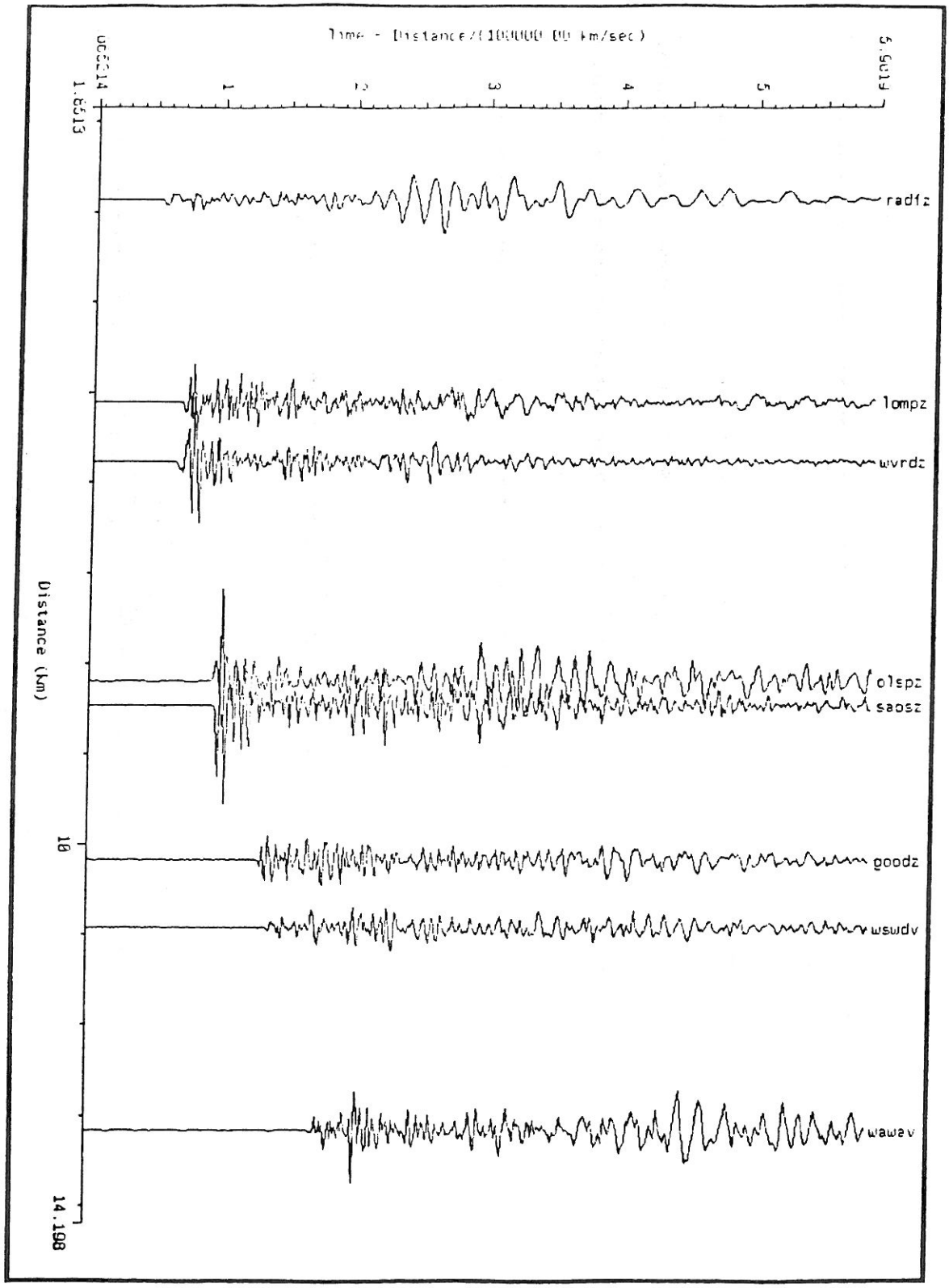

Figure 9 Vertical Components

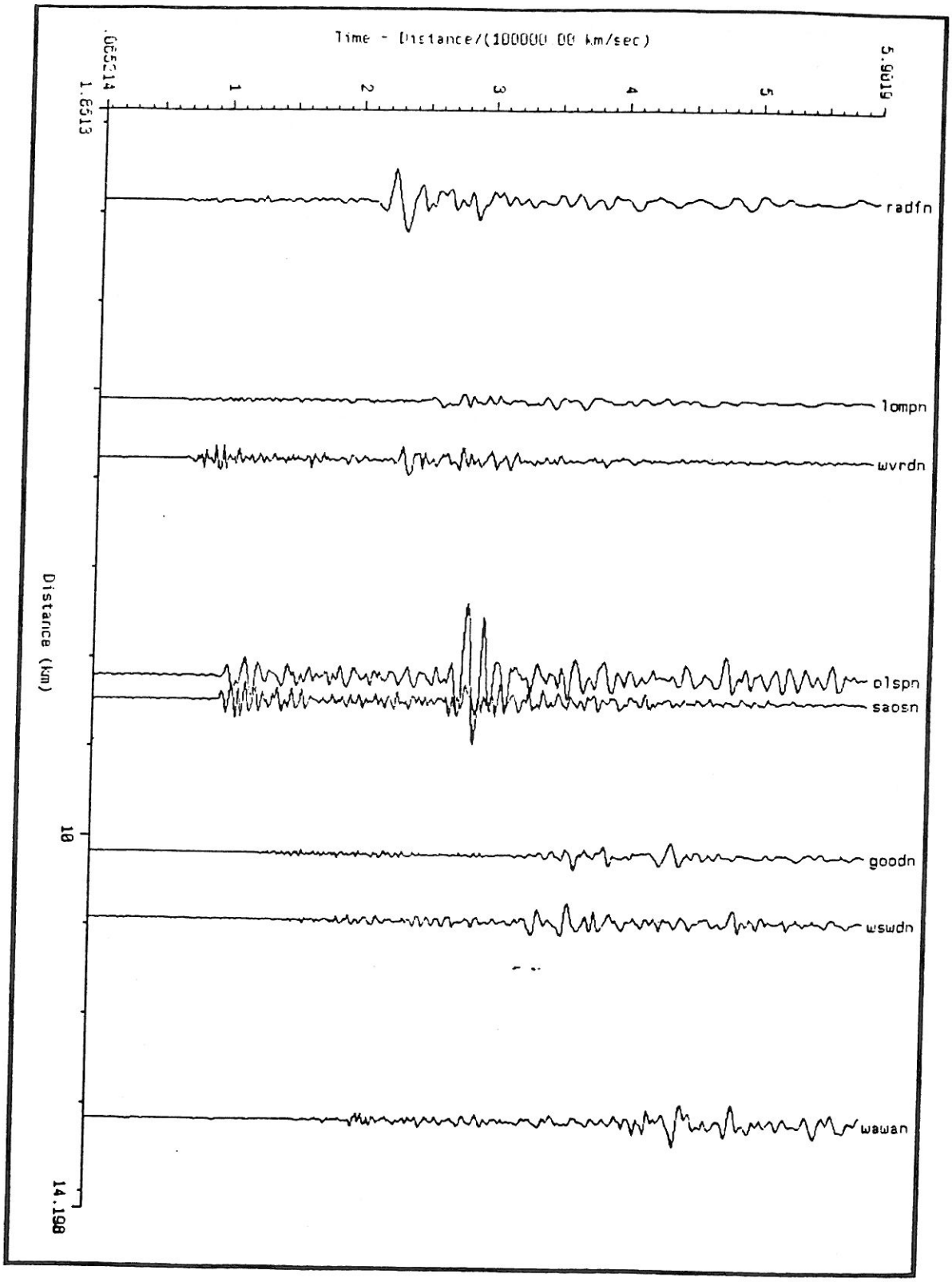

Figure 10 North-South Components

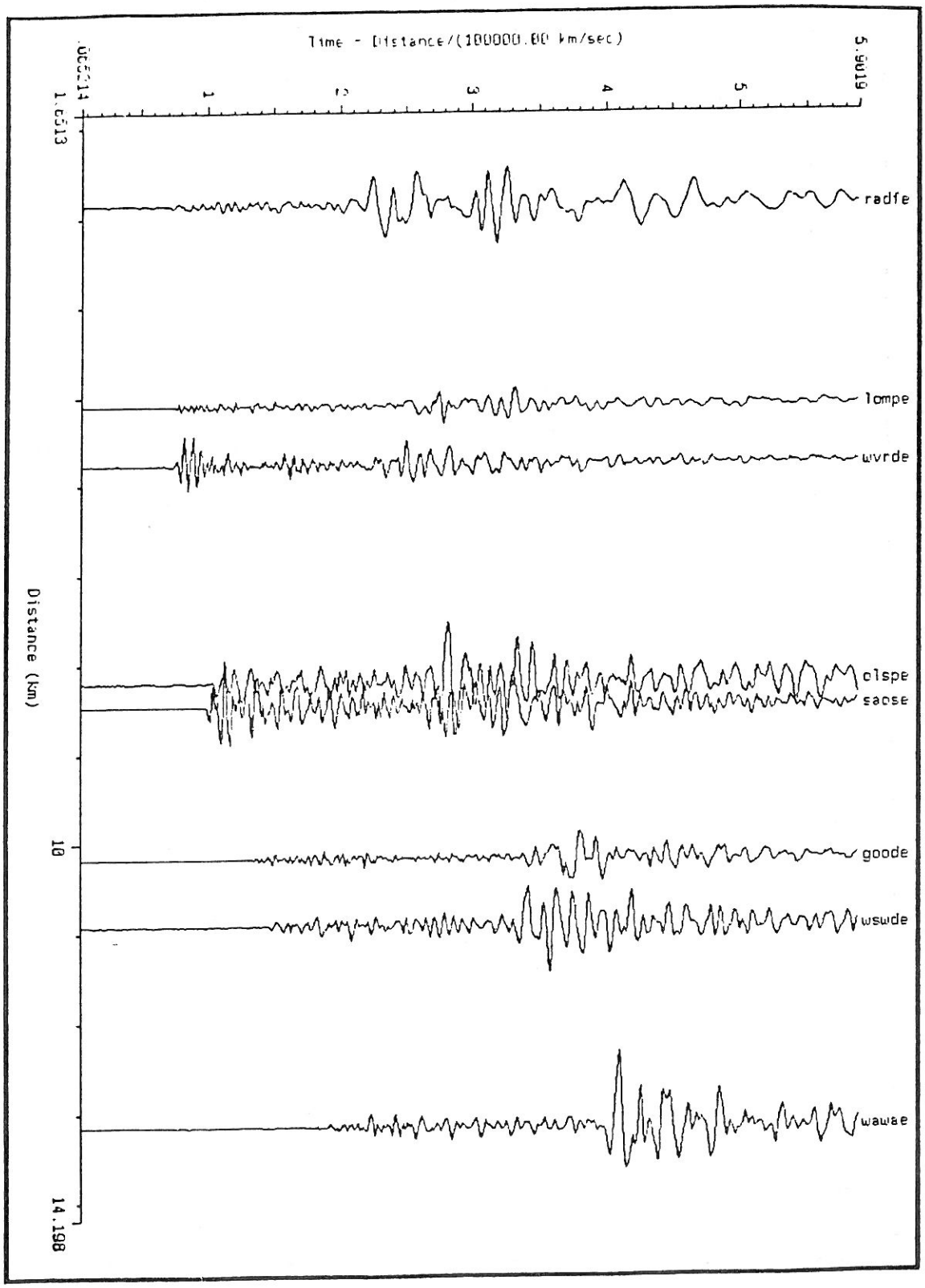

Figure 11 East-West Components

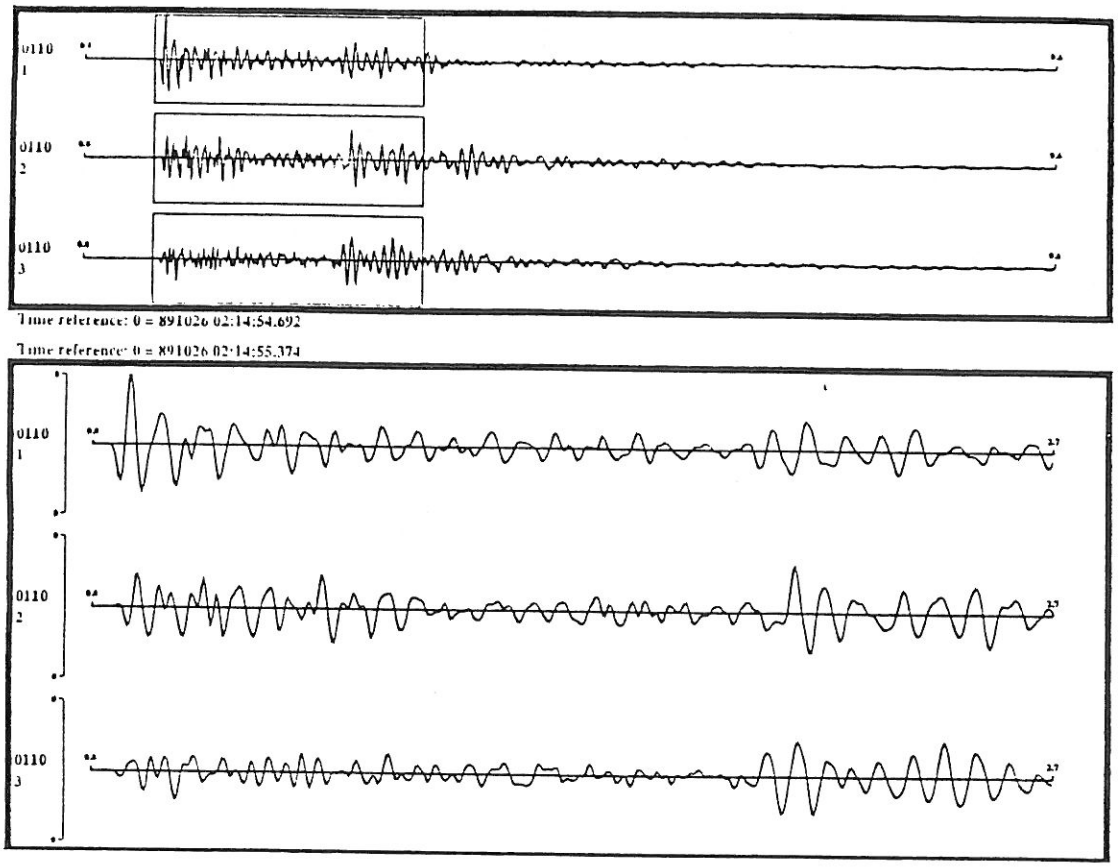

Figure 12 Event from Below Station DBWN

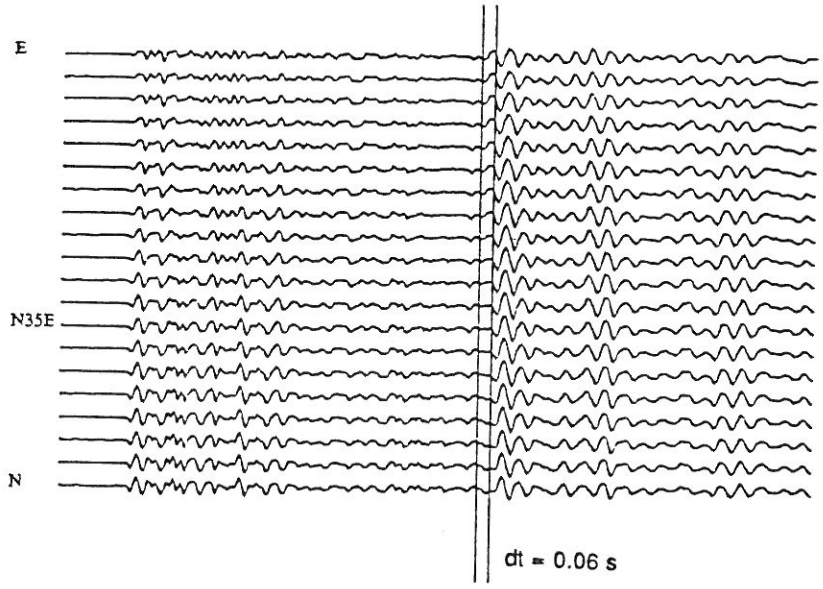

Figure 13 Rotation of Horizontal Components in 5° Increments

Studies in West Greenland Using the New PASSCAL Instruments
by Scott Smithson, Marvin Speece, and Micheal Humphreys

A large cooperative project was mounted in September 1989 to carry out geophysical studies of the Earth's oldest crust in West Greenland. Targets include possible oceanic crust under oldest supercrustal rocks, granulite terranes, the ancient Moho, and three crustal sutures. Geophysical studies consist of gravity, CDP reflection, and wide-angle reflection studies that combine recording on land and sea using 6000 cu in airguns from the University of Bergen's research vessel. The new PASSCAL instruments were used for the first time with a controlled source for three-component recording in three different deployments on land. Deployment was by small boat and helicopter. Fjords were used for access of up to 100 km inland. PASSCAL 2 hz three-component seismometers were tested against 7.5 hz geophones and provided better results. The PASSCAL field computer was used to check data quality as the data were recorded and to provide real-time feedback into the experiment. The marine airguns were fired at one-minute intervals to generate 120 km-long common receiver gathers with trace spacing of 105 m. P-waves and S-waves converted off the water bottom were recorded out to more than 100 km on the PASSCAL instruments. Combined land and marine recording, utilizing the great flexibility of the PASSCAL instruments, resulted in a relatively dense network consisting of hundreds of kilometers of fan CDP and wide-angle profiles parallel to both strike and dip as well. Strong Moho P- and S-wave reflections were recorded on many profiles at long offsets, and events at travel times greater than 70 s were noted at offsets around 180 km.

Comments on the PASSCAL instruments:

1. The PASSCAL instruments are extremely flexible. This flexibility was most useful for a data acquisition program in a difficult area like Greenland. The system is ideally suited for rough terrain and/or helicopter equipment dispersal and set-up. They are relatively lightweight and the small size of the basic units is good.

2. This flexibility also means that the instruments are rather slow to set up. Programming is quite easy (although slow and with chances for operator errors). The monitor function on the programmer is good but not easy to interpret and can't be used while gathering data. User may insert comments into memory for recall later -- this is a very handy note-taking feature. Communications with the DAS from the programmer is slow and unreliable. There needs to be a PC interface available from the DAS to allow for monitoring and trouble-shooting.

3. The fact that they include Omega clocks is a real plus -- if they get reliable that would be excellent. Resolve timing and Omega problems. Omega antennas are difficult to erect in field conditions and bulky to transport.

4. Instruments seem to be relatively weatherproof. This is difficult to do. The normal system batteries would be OK for short experiments, but insufficient for long projects employing the disk (SCSI) drives. The inter-unit cabling is arranged so it can't be connected incorrectly (although there can be several cables). Connectors are very good

quality (although they may be jammed or cross-threaded.)

5. The PASSCAL 2 hz seismometers seemed to produce better results than 10 hz geophones for crustal reflection work although they also had more low-frequency noise. The selected system geophones (L-22/Mark) are handy to use although heavy. The bases are easy to deal with.

6. The SCSI disk has such great capacity that it considerably increases the flexibility of the instruments. Unfortunately, this disk also has an unacceptably high failure rate at present. Better integration of the DAS and SCSI is needed for transport and installation. Communications from the DAS and SCSI is poor and needs improvement to increase reliability of DAS downloads. General tape (Exabyte) downloads off the SCSI are still unreliable and the Exabyte reliability is low.

7. The instrument package was somewhat unreliable -- but not considering its stage of development. It needs to be de-bugged.

8. The instruments operated in wind, rain, and snow at temperatures typically around -4°C.

9. Jim Fowler and Larry Shengold did a fine job of instructing on instrument operation, maintaining instruments and playing-out data.

10. An on-site field computer is a Godsend.

11. If these instruments are to be deployed regularly, Jim and Larry will need more help.

12. The cable and breast reel to deploy 6 sensors in line (500 m) is cumbersome but necessary. Geophone cables should have a mating connector on the far end of the cable to mate with the 3-D phone (in addition to the 3 takeouts at the far end.)

13. The instruments are not well suited for crustal reflection recording because of inadequate gain (≤8k) and lack of gain ranging. If the system is to remain a fixed gain type recording system the A/D converter needs to be improved.

An Ocean-bottom Piggyback of the EDGE Chesapeake Bay Transect

by

W. Steven Holbrook and G. Michael Purdy

The Woods Hole Oceanographic Institution has been funded by NSF to conduct a wide-angle reflection/refraction piggyback of the upcoming EDGE Chesapeake Bay multichannel seismic reflection transect. The transect, scheduled for spring or summer 1990, will consist of three profiles, two perpendicular and one parallel to the coast (Figure 1). We plan to deploy nine ocean-bottom hydrophones along two of the EDGE profiles to record seismic signals from the airgun array source at offsets up to 250 km. The resulting ray coverage should enable a detailed delineation of the deep velocity structure of the continent/ocean transition.

Add-on experiments such as this, both on land and at sea, have proven to be a cost-effective way of expanding the seismological information recorded in a field survey. A wide-angle piggyback of the EDGE survey will provide a means of determining deep velocity structure and imaging the basement and Moho beneath the thick sediments seaward of the basement hinge zone, where reflection surveys historically have had difficulty obtaining deep images. In addition, our experiment will test for the presence of a high-velocity (7.3 km/s) rift-stage crustal layer; such a layer has been discovered farther south on the U.S. East Coast and on the eastern North Atlantic margin and has been postulated to be the manifestation of voluminous basaltic volcanism during the transition from continental rifting to sea-floor spreading.

We also hope to coordinate, in cooperation with the U.S. Geological Survey, an onshore extension of our piggyback using land seismometers. The landward extension of the profile along USGS reflection profile I-64 will provide important information on the structure of the rifted continental crust and its transition to rift-stage crust.

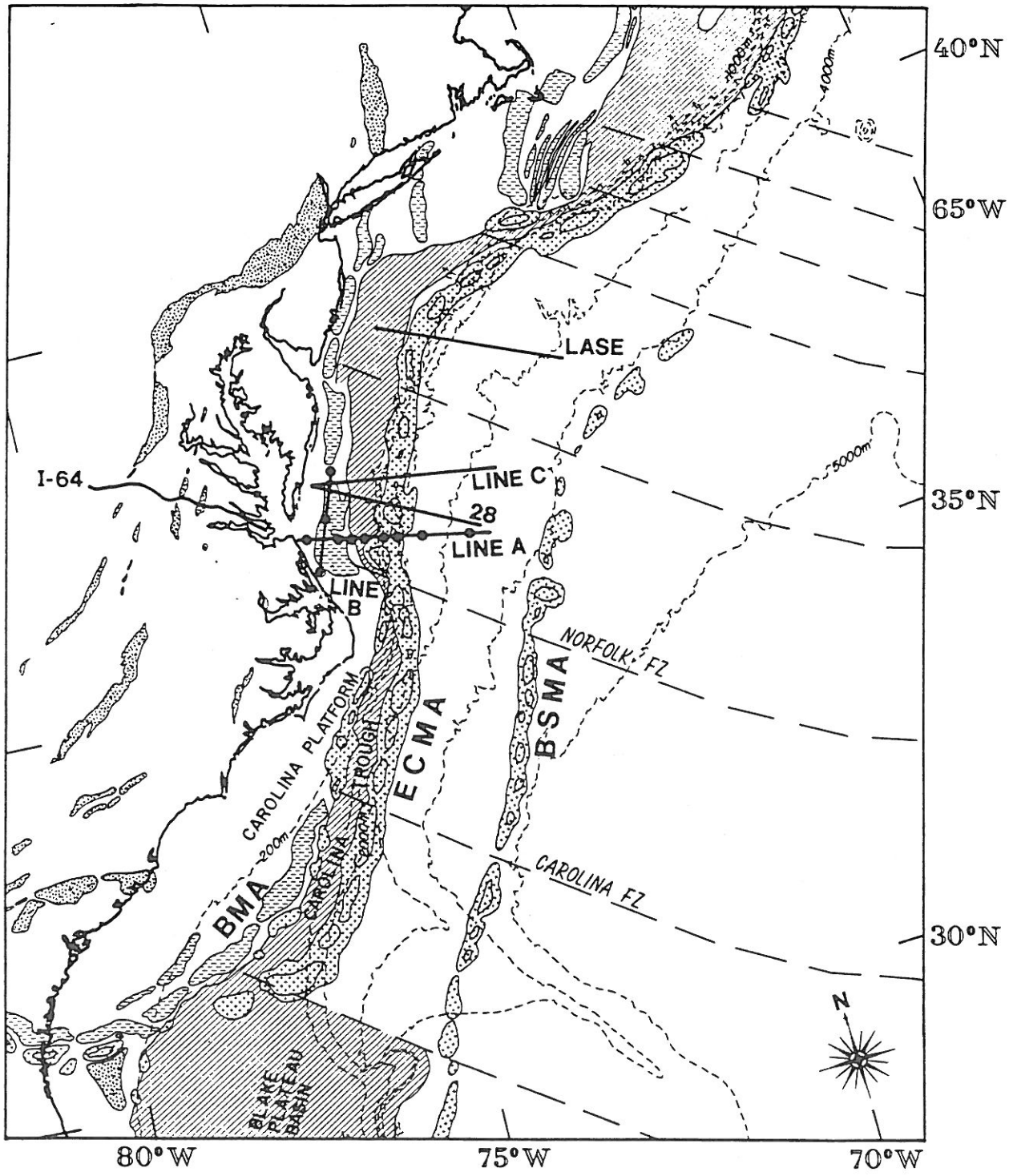
40°N
65°W
35°N
30°N
80°W
75°W
70°W
LASE
I-64
LINE C
28
LINE A
LINE B
NORFOLK FZ
CAROLINA FZ
CAROLINA PLATFORM
CAROLINA TROUGH
BLAKE PLATEAU BASIN
BMA
ECMA
BSMA
200m
2000m
4000m
5000m
N

Figure 1

TACT BROOKS RANGE SEISMIC EXPERIMENT, 1990

by Alan Levander and Walter Mooney

A major seismic experiment will be conducted in the Brooks Range of northern Alaska during June and July, 1990, by Rice University and the U. S. Geological Survey. Stanford University, the Geological Survey of Canada (GSC), and the University of Alaska at Fairbanks will also be participating in the experiment. The investigation will consist of a detailed seismic refraction and roll-along reflection study using SGR's (Seismic Group Recorders) from Stanford and loaned by industry, EDA (lunchbox) recorders from the GSC, FM-cassette recorders from the USGS, and the new PASSCAL instruments. The survey will utilize 500-900 seismic recording channels, and about twenty shots fired across the Brooks Range. Field operations are expected to take 6-8 weeks, including 3-4 weeks of recording. This study will constitute the final land segment of the Trans-Alaska Crustal Transect (TACT); future seismic data may be recorded in an offshore/onshore configuration across the North Slope.

To date TACT has collected more than 1,300 km of land and marine reflection data, 2,500 km of land refraction/wide-angle reflection data, gravity, rock physical properties, aeromagnetic, MT, and geologic data. Two special sections will be published in JGR reporting TACT results. Results of recent TACT investigations, including geologic studies in the Brooks Range, will be presented at the December AGU meeting in San Francisco. Contact Robert Page, USGS/Menlo Park (415-329-4742), for more information.

Rice University currently has positions available on the 14-person university field crew. In addition to a modest salary, airfare and expenses in Alaska are provided. A cooperative attitude, a willingness to work long hours, good driving skills, and a robust constitution are essential. Experience in seismic field work, and with electronics and firearms is helpful but not required. Interested parties should contact Alan Levander or Stuart Henrys at Rice for more information.

AN INFORMAL EXPERIMENT INFORMATION SESSION WILL BE HELD AT THE FALL AGU MEETING. The time and place will be posted on bulletin boards in the conference hall. Addresses at Rice are:

PO Box 1892
Rice University
Dept. of Geology & Geophysics
Houston, TX 77251

E-mail: alan@geophysics.rice.edu (may change in December)

WHITE SANDS MISSILE RANGE TO NTS PROFILE
by Walter Mooney

The University of Texas - El Paso (UTEP) group working with Los Alamos is slowly but surely collecting recordings along a 1000 km long profile extending from NTS to White Sands Missile Range (WSMR) in south-central New Mexico. Appropriate NTS shots are fired several times each year, although these shots are often difficult to catch due to last minute delays. Every year or two, large chemical shots are fired at WSMR, and one was successfully recorded this past summer. So far, the profile includes NTS shots recorded from the Colorado Plateau in eastern Arizona across the Rio Grange Rift, to the Great Plains of the Texas Panhandle. The WSMR shots have been recorded from the source to eastern Arizona.

NYNEX (New York/New England Seismic Experiment)
by Walter Mooney

A seismic refraction/wide angle reflection experiment was conducted in September of 1986 by the USGS, Air Force Geophysics Lab and the Geological Survey of Canada in the northeastern US and southern Ontario. Dr. James H. Luetgert and Dr. John Cipar served as the project chiefs on this investigation, which attracted piggy-back recording by numerous groups including Lamont-Doherty, SUNY-Binghamton, Boston College/Weston Observatory, Roundout Associates, and Yale University. Twenty shotpoints were fired along a 650 km east-west profile extending from central Maine across the Appalachians and the Adirondack massif into the Grenville-age craton. Instrument spacing of 750 to 1000 meters provided a detailed look at the Appalachian-Adirondack transition. The profile was occupied by three successive deployments of over 300 instruments. Two of the shotpoints were fired for each deployment to give continuous coverage over 650 km with offsets exceeding 380 km. Data collected by the three groups has been merged into shot gathers in SEGY format and initial structural models are being produced. Data analysis is well underway and results will be reported at the December AGU meeting.

KENYA RIFT INTERNATIONAL SEISMIC PROJECT (KRISP) 1989-1990

by Walter Mooney

Field work has begun for the KRISP teleseismic and refraction/wide-angle reflection project in Kenya. Following a one year delay in obtaining a research permit, site surveying for the teleseismic and refraction profiles got underway in August, 1989. The passive recording of teleseismic P- and S-wave began in October to continue for about 5 months. The active-source experiment will be conducted during the period January 16 - February 17, 1990. Over 100 three-component seismographs will be used for the teleseismic study, and 200 SGR's and 20 other portables will be used for the active experiment. The passive and active experiments will be the most ambitious every attempted in Africa, and will constitute a world-class seismic study of the deep structure and tectonics of the East-African Rift.

The KRISP project is cooperative with several Kenyan universities and governmental agencies. Funding has been provided by NSF, the EEC, and the German Research Foundation (DFG). Non-Kenyan participants include scientists from the USA, Germany, UK, Ireland, Denmark, France, and Italy. Claus Prodehl (Karlsruhe, W. Germany), Aftab Khan (Leicester, UK.), and American co-P.I.'s George Thompson, Randy Keller, Larry Braile, and Walter Mooney are coordinating the active experiment. Paul Davis (UCLA) and Bob Meyer (Wisconsin) lead the American teleseismic teams, which will be joined by teams lead by Uli Auchauer (Karlsruhe), Alfred Hirn (Paris), and Peter Macquire (Leicester). Karl Fuchs (Karlsruhe) has provided additional KRISP project leadership.

Results from the KRISP 89-90 experiment will be reported in the USA at the December AGU.

IRIS E-mail Directory
by Rick Williams

Last modified 21 November 1989

To get the most recent version of this list, use the command "finger rick@utkux1.utk.edu" or send a mail message either to "rick@utkux1.utk.edu" or to "rick@utkvx.bitnet"

An astrisk (*) preceeding a name means that I was unable to send mail to the address given, but others may be able to use it. A carat (^) preceeding a name means that individual is a member of the anisotropy interest group assembled by Joe Dellinger. Contact Joe for details. The letter (j) before a name indicates a Japanese seismologist from the list compiled by Kioyshi Suyehiro with additions by Kazuki Koketsu. The letter (o) before a name means the address is old, and did not work the last time I tried it.

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