SeisFinder

SeisFinder is a matlab function that provides a Graphical User Interface into a FISSURES Server to obtain seismograms and associated station/channel information (Figure 1) from FARM and SPYDER, jointly know as POND. These are disk archives of seismograms that are organized by earthquake, typically containing 1 hour data from each earthquake with magnitude greater than 5.8 or 5.6 if the earthquake is deeper than 100km.
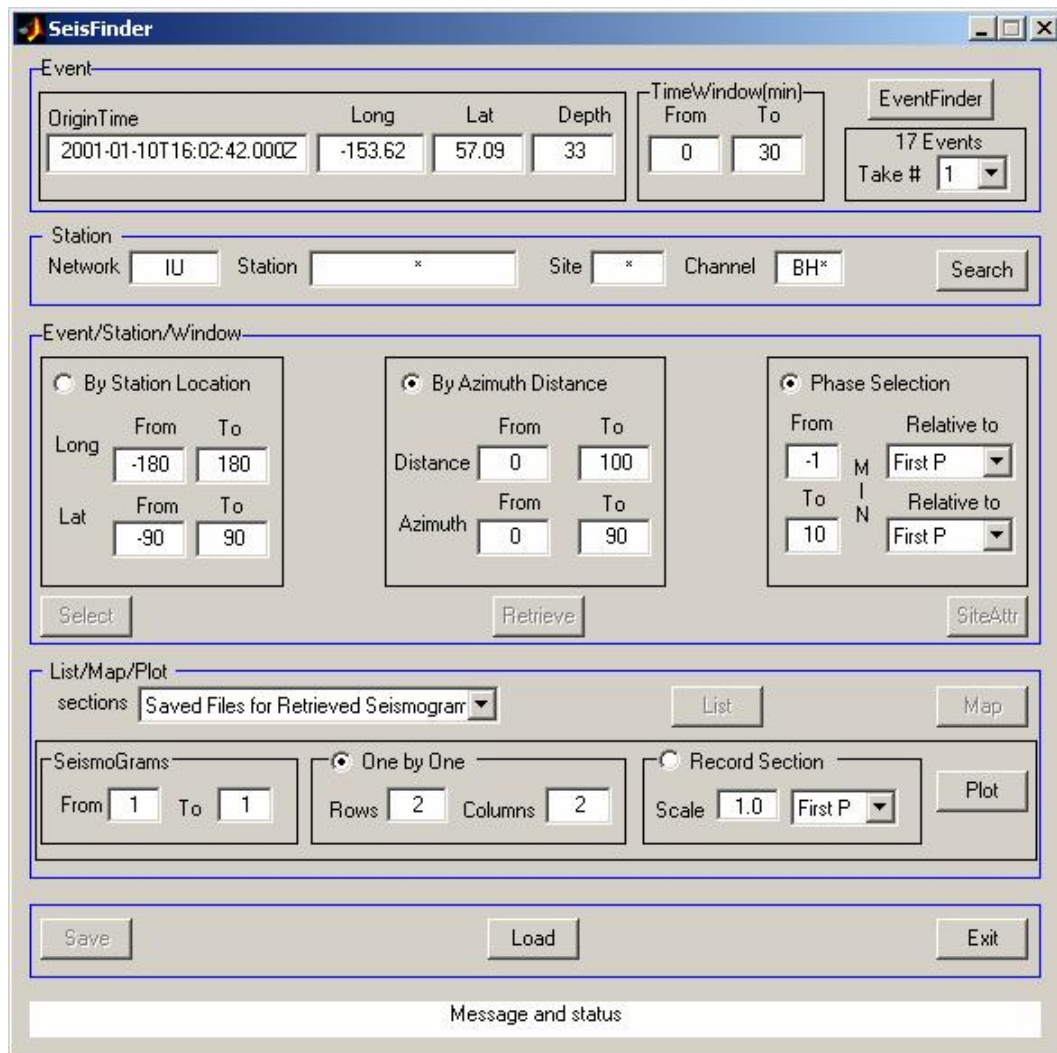

Figure 1. SeisFinder GUI

It generates four outputs. The first is event: an array containing information about a selected event. The second is seiswav: a cell array containing retrieved seismograms. The third is seisatt: a structure array saved attributions of retrieved seismograms. The fifth is channelinfo: a structure array kept channel information

Overview:

The GUI is divided into 5 sections that must be executed in order:

1) Event: Select an Event, and a time window with respect to the origin time

2) Station: Select a set of Networks, Stations, Sites and Channels. Search returns the number of station/channels that contain data within the selected time window.

3) Event/Station/Window: Refine station/channel selection using a geographic region for station location and/or distance and azimuth limits relative to the event location. Choose time windows relative to a selected seismic phase. Select determines how many seismograms match the request for the intersection of time windows in Window and Event. Retrieve retrieves the seismograms and associated station/channel information. List pops up one window to show all retrieved seismograms. Map draws locations of sites whose seismograms have been retrieved.

4) List/Map/Plot: Select seismograms to plot and plot one seismogram at a time or plot all of them in a record section.

5) Save/Load/Exit: Save all data into one file or Exit.

Event

This GUI is event driven and works on one event at a time. You may either enter an event's origin time and location by hand, or by using the EventFinder button. The format for the origin time is: 2003-10-21T18:55:56.101Z. The units for longitude and latitude are degrees while depth is in km. TimeWindow specifies the desired time window (minutes) for seismograms relative to the origin time.

The EventFinder button opens a second GUI allowing the user to select one of more events (see documentation for **EventFinder**). Use the POND catalog to restrict your search to events that contain seismograms in FARM or SPYDER. You must Search, Retrieve and List events. From the list, highlight the event (or events) you wish to pursue using the mouse, and select the EventFinder/Exit button.

After returning from EventFinder, the SeisFinder GUI shows the first selected event on the left. A pop-up-menu on the right displays an index into the retrieved events. Select the appropriate index to display a desired event on the left. All further operations in SeisFinder key off the selected event.

Station

A recording package is uniquely defined by its Network Code, Station Name, Site Code and Channel Name. In this section the user limits the search based on these four fields. Wild cards (*) are allowed in each field. Case is ignored. The Station filed can contain multiple entries separated by white space. All other fields must contain exactly one entry. The Search button searches for all the network/station/site/channels that match the selected values and contain waveforms in the POND

in the selected time window. It returns the number of channels that were found. For the selected channels, station coordinates (latitude and longitude) are retrieved.

Event/Station/Window

Select: choose available seismograms. Search button can tell user the number of available seismograms for one event and given parameters. In the Select frame, user can choose seismograms by either station location or by azimuth distance. Their units are all degrees. User can also use phase selection to ask seismograms for particular phases. "From" box and "To" box both have a unit of minutes. Negative value means before a selected phase, positive means after a selected phase. For example, if the "From" time is -1, "Relative to" phase is P; "To" time is 10, "Relative to" phase is S. This means a time window from 60 seconds before phase P to 600 seconds after phase S. Here, phase "First P" means phases p, P, Pdiff, PKIKP. "First S" means phases s, S, SKS, SKIKS.

Seismograms are stored as SYPDER and as FARM with considerable redundancy. Currently data center puts all FARM data and SYPDER data only for seismograms is not available in the FARM.

When press Select button, the GUI will show the number of available seismograms and how many seismograms have been selected in the bottom message bar.

User can always re-select seismograms. There is no need to run from EventFinder to Select again.

Retrieve: obtain selected seismograms. Due to not enough memory, if the number of selected seismograms is too big, it's better to divide it into sections. Each section user can retrieve one part of all selected seismograms and save retrieved information into one file. So when Retrieve is clicked, it pops up one window to ask user to input a filename and the number of seismograms each section would have (Figure 2). For example, in the pop-up window, the filename user inputs is "nn", the number of seismograms for each section is 100, and all selected seismograms user wants to retrieve is 950. Then there would be 10 sections. In each section, the retrieved information including the selected event, seismograms, attributions of seismograms, and channel information is saved into one file whose name starts with "nn". After retrieving is done, there should be a set of files in working directory, such as "nn_1.mat", "nn_2.mat", "nn_3.mat", and etc. One needs to pay attention here that the number of retrieved seismograms in each

section has not to be the exact number user inputs. For the above example, perhaps in one section, 150 seismograms, not exact 100 seismograms, have been retrieved.
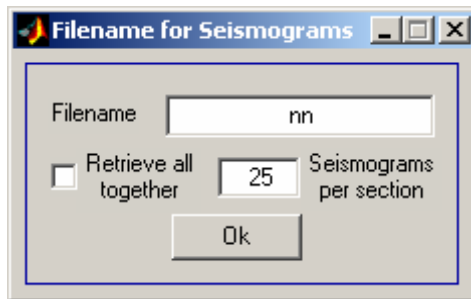
Figure 2. Pop-up window for filename and the number of seismograms in each section.

Now user has several sections. In the post-retrieving process (List/Map/Plot), user needs to select which section will be listed, mapped and plotted. If all sections are merged into one file which can be done by pressing Save button, the post-process can deal with all retrieved information.

List: show all retrieved seismograms in one section (Figure 3). It pops up another window. The first line of the window shows information about selected event, such as event origin time, longitude, latitude, and depth. The second line is all possible fields of retrieved seismogram attributions. User can highlight them to update contents in listbox. The first line in the listbox shows the fields user selects. Other lines show information about the retrieved seismograms. One line is for one seismogram. User can use mouse to select seismograms to show positions of their sites on map and draw figures. Return button returns to the SeisFinder GUI with index of selected seismograms.

Map: draw locations of sites for selected seismograms in one section and draw location of the selected event on map (Figure 4). Sites are shown by smaller red circles. Two lines display site information. The first line shows relative time of a seismogram to the event's origin time, and azimuth distance and azimuth between the site and the selected event in format of "T:time D:distance A:azimuth". The second line shows station information in form of "ID-networkCode.stationCode. siteCode". For the selected seismograms that are next to each other and their channels have same coordinates, only site information is shown on map. The selected event is show by a big color circle. Different color represents different hypocenter depth. The first line for the event is the occurrence date of earthquake while the second line is the occurrence time. If no seismograms are selected in listbox, sites of all retrieved seismograms are shown on map. Maps are drawn using m_map, matlab code written and freely distributed by Richard Pawlowicz (http://www.eos.ubc.ca:/ ~rich).

Figure 3 List all retrieved seismograms

Plot

Plot: draw seismograms. There are two types of figures user can draw seismograms. The first one is one by one. It requires user input how many seismograms will be drawn in one figure and the total number of seismograms need drawing. If one figure can not plot all seismograms, user can press any key to draw rest of seismograms until plotting is over (Figure 5).
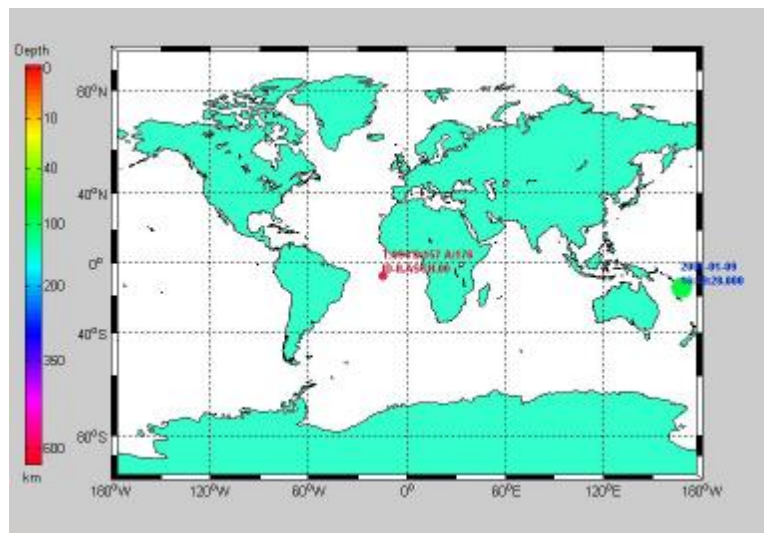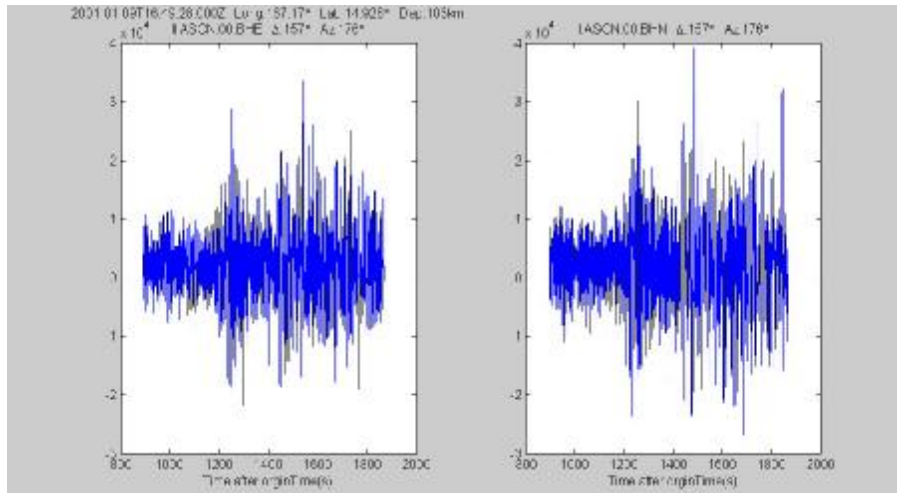

Figure 4 Plot selected sites and selected event on map

Figure 5. One by One plotting. Event information is at the top of the first figure, such as event's originTime, location, depth. On the top of each seismogram shows network, station, site, channel associated with it, and its azimuth distance from the event. For example, "II.ASCN.00.BHZ Δ: 157º Az: 176º" means: Network = II, Station = ASCN, Site = 00, Channel = BHZ, Distance = 157º with an azimuth of 176º

The second one is plotting all seismograms in one figure with selected phases in the same figure (Figure 6). User needs to input a scale and a phase or phases that will be drawn in this figure.

If user has used List button to select seismograms, only the selected can be plotted. If user has used List button, but has not selected any seismograms, all retrieved seismograms can be plotted.

Save/Load/Exit

Save: merge all retrieved sections into one bigger section and save it into one file user has input in Retrieve. After it's done, user has one additional file to select in List/Map/Plot . For the above example, the file is "nn.mat". Then user can list, map, and plot all retrieved information. Notice here, only if user thinks there would be no memory problem to merge all sections together, this button can be clicked.

If user just wants to plot figures of retrieved MatSeismograms before, just click Load button, **SeisFinder** will ask user to input filename, for example, "nn_1". Then "nn_1.mat" can be loaded into this GUI. User can use the loaded file to do post-retrieving processing (List/Map/Plot) with out selecting section first.

All input parameters and selected events are kept in cookie.mat. When user wants to obtain seismograms for other events, there is no need to run EventFinder and type in parameters again.

If user run **EventFinder** GUI alone before and has retrieved events, and wants to retrieve seismograms for these events, just saves these events in cookie.mat and runs **SeisFinder**. **SeisFinder** will load these events. The name of the retrieved events should be "events".

Figure 6. Record section plotting