SWARM

Seismic Wave Analysis and Real-time Monitor:

User Manual and Reference Guide

Version 2.6.4

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# Introduction

## About

SWARM, Seismic Wave Analysis and Real-time Monitor, is a Java application designed

to display and analyze seismic waveforms in real-time. SWARM is a functional replacement to the traditional helicorder, but also has many other tools for visualizing wave forms, such as frequency spectra plots and spectrograms. Other features include ability to obtain station metadata for plotting on map, and support for IRIS DMC connections. Recent additions include ability to view NEIC events and do basic picks.

SWARM was developed at the Alaska Volcano Observatory (AVO) in 2004 and is still used at various volcano observatories around the world. The latest version of SWARM can be obtained from <https://volcanoes.usgs.gov/software/swarm/download.php>.

# Getting Started

## System Requirements

SWARM is platform independent (will run on any operating system) but requires a graphical display and a Java Virtual Machine 1.6 or greater. Due to the large volume of data and complex calculations performed it is recommended to run on SWARM with modern specifications for memory and processing speed. The less memory and processing speed the computer has, the more likely that SWARM’s performance is affected when pulling and analyzing large data sets. Minimum screen display of 1024 x 768 is also recommended. Maximizing the application window to full screen size will provide the best user experience.

## Installing SWARM

To install SWARM, unzip the download swarn-x.y.z-bin.zip file downloaded from the [USGS SWARM website](https://volcanoes.usgs.gov/software/swarm/download.php). In Windows, your unzipped swarm-x.y.z directory will look like this:



Figure 1 Swarm Directory Contents

## Running SWARM

On Windows, double clicking on swarm\_console.bat will open the SWARM user interface. If nothing happens, you can run the application from a command (or DOS) prompt to see if there are any errors that can be used for troubleshooting. On Linux or Mac operating systems, you will need to execute swarm.sh from the terminal (command-line).

# Data Sources and Channels

## Introduction

After starting SWARM, a panel will be visible on the left side of the main screen. This is the Data Source Chooser and Channel Selector. It’s possible to adjust the size of the two panels by adjusting the split line in the center, either by dragging with the mouse or clicking on one of the small arrows.

The Data Source Chooser, the top half of the panel, is used to select the source of the waveform or helicorder data. The box contains the list of all available data sources, both ones that have been used before and new ones that are created.

The Channel Selector, the bottom half of the panel, is used to select a channel, either

the waveform or the helicorder. Once a data source is selected, the Channel Selector will

be populated with the available channels. The contents of both theWaves and Helicorders

lists depend on the data available from the selected data source.

Figure 2Data source chooser and the channel selector

## General Usage

SWARM is preconfigured with AVO Winston Wave Server. To add another data source click on the ‘New data source’ icon C:\Users\Diana\git\swarm\src\main\resources\images\new_server.gif. Existing data sources can be modified by clicking on the ‘Edit data source’ icon C:\Users\Diana\git\swarm\src\main\resources\images\edit_server.gif. The next icon  will let you collapse the data source trees. To remove an existing data source, select the data source to delete and click on ‘Remove data source’ icon C:\Users\Diana\git\swarm\src\main\resources\images\new_delete.gif. A data source can be refreshed by clicking on it and selecting the ‘Refresh data source’ icon C:\Users\Diana\git\swarm\src\main\resources\images\refresh.gif.

The C:\Users\Diana\git\swarm\src\main\resources\images\closeview.gif icon in the upper right lets the user dismiss the whole data source chooser window if more space is desired. To get it back, type CTRL-D or go to the Window menu and select Data Chooser.

The icons associated with the different data sources have the following meaning:

* C:\Users\Diana\git\swarm\src\main\resources\images\server.gif A data server that the user manually added with the ‘New data source’ option.
* C:\Users\Diana\git\swarm\src\main\resources\images\locked_server.gif A data server that is in the DataSources.config file. The small padlock denotes that it is not possible to edit or delete it from SWARM.
* A data server that is broken; e.g. not responding.



* C:\Users\Diana\git\swarm\src\main\resources\images\wave_folder.gif Data channels available after opening a wave in a file (e.g. SEED, SAC format) from the File menu.

Double clicking on a data source will cause a channel tree to appear, listing the available channels. Double clicking on a channel will bring up a helicorder. Alternatively, it’s possible to select a channel (or channels, with CTRL- or Shift-click on Windows) and press one of the five buttons at the bottom of the data chooser:

* C:\Users\Diana\git\swarm\src\main\resources\images\helicorder.gif Opens helicorder views
* C:\Users\Diana\git\swarm\src\main\resources\images\clipboard.gif Puts waves on the clipboard
* C:\Users\Diana\git\swarm\src\main\resources\images\monitor.gif Puts waves on the real-time monitor
* C:\Users\Diana\git\swarm\src\main\resources\images\wave.gif Opens waves in the real-time view window
*  Opens RSAM viewer
* C:\Users\Diana\git\swarm\src\main\resources\images\earth.gif Shows channels on a map

## Data Source Types

Clicking on the ‘New data source’ icon will open a New Data Source dialog window. Currently supported data source types for SWARM are Winston Wave Server, Earthworm Wave Server, FDSN WS, and SeekLink Server.

### Winston Wave Server

Winston is a Java-based seismic wave server developed by USGS that provides data and plots to clients. It can be obtained from <https://volcanoes.usgs.gov/software/winston/>. Connection to Earthworm requires the IP address or host name of the server, port number, and communication time out in seconds.



Figure 3 Adding new Winston data source

### Earthworm Wave Server

Earthworm is an open-source software system used globally for regional local network seismology. Earthworm Wave Server is essentially the wave\_serverV module of the Earthworm system. Connection to Earthworm requires the IP address or host name of the server, port number, and communication time out in seconds.



Figure 4 Adding new Earthworm data source

### FDSN Web Services

International Federation of Digital Seismograph Networks (FDSN) provides RESTful web service interfaces for accessing wave data. See <https://www.fdsn.org/webservices/> for more information on the FDSN web services.

To add an FDSN web service data source, enter in the dataselect and station URL. A list of available web services can be found at <https://www.fdsn.org/webservices/datacenters/>. Then click on the Update button to get a list of Networks to choose from. You may choose to filter the data further with station, channel, and location information.



Figure 5 Adding new FDSN data source

### SeedLink Server

SeedLink protocol transmits data packets in 512-byte Mini-SEED records. IRIS Data Management Center (DMC) hosts a public accessible SeedLink server. More information on SeedLink and IRIS DMC’s server can be found at http://ds.iris.edu/ds/nodes/dmc/services/seedlink/. To connect to a SeedLink server enter in the IP address or host name, and the port.



Figure 6 Adding a new SeedLink data source

## DataSource.config

Locking a data source may be desirable in cases where multiple people may run SWARM from the same location (e.g. from network drive). In such cases the data source can be specified in a file called DataSource.config under the Swarm directory. Below is an example of DataSource.config contents.

server=CVO Winston;wws:130.118.152.47:16022:15000:1

server=AVO Winston;wws:pubavo1.wr.usgs.gov:16022:10000:1

Data sources specified in DataSource.config cannot be edited or deleted by users.

# Helicorder Views

## Introduction

One of SWARM’s primary functions is to display helicorders and allow user interactions with it. The helicorder below is displaying channel PN7A SHZ AV from AVO Winston data source. Helicorders derived from an active source, like a Wave Server or Winston connection, will automatically update when new data are available.



Figure 7 Helicorder view

## Wave Inset Panel

Clicking on the helicorder opens a wave panel for a magnified view of the area highlighted in yellow. See section on Wave Views for more information on wave view settings and types.

## Status Bar

The status bar at the bottom will display information about the wave when in Wave, Spectra, or Spectrogram view in inset panel.

**First Line**

The top line of the status bar always has information on the entire wave displayed:

* Start time in UTC
* End time in UTC
* Number of samples (duration in seconds)
* Sample rate
* Minimum amplitude (does not account for bias)
* Maximum amplitude (does not account for bias)

Example: 

**Second Line**

If the panel is in time series view (Wave and Spectrogram), it will display the time on the x-axis that the mouse is hovering over in local and UTC time. Other information shown:

* Y-axis value if in Wave view; e.g.:
* Frequency and Power in Spectra view; e.g.: 
* Frequency in Spectrogram view; e.g.: 

## Helicorder Toolbar

Below are the functions available in the toolbar above the helicorder. Hovering over an icon will also provide a tooltip indicating the function of the button and the hot keys, if available.

* C:\Users\Diana\git\swarm\src\main\resources\images\pin.gif Helicorder always on top
* C:\Users\Diana\git\swarm\src\main\resources\images\settings.gif Helicorder view settings
* C:\Users\Diana\git\swarm\src\main\resources\images\left.gif Scroll back time (A or left arrow)
* C:\Users\Diana\git\swarm\src\main\resources\images\right.gif Scroll forward time (Z or right arrow)
* C:\Users\Diana\git\swarm\src\main\resources\images\xminus.gif Compress X-axis (Alt and left arrow)
* C:\Users\Diana\git\swarm\src\main\resources\images\xplus.gif Expand X-axis (Alt and right arrow)
* C:\Users\Diana\git\swarm\src\main\resources\images\yminus.gif Compress Y-axis (Alt and down arrow)
* C:\Users\Diana\git\swarm\src\main\resources\images\yplus.gif Expand Y-axis (Alt and up arrow)
* C:\Users\Diana\git\swarm\src\main\resources\images\zoomplus.gif Decrease zoom time window (+)
* C:\Users\Diana\git\swarm\src\main\resources\images\zoomminus.gif Increase zoom time window (-)
* C:\Users\Diana\git\swarm\src\main\resources\images\wavesettings.gif Wave view settings (?)
* C:\Users\Diana\git\swarm\src\main\resources\images\wave.gif Wave view (W or ,)
* C:\Users\Diana\git\swarm\src\main\resources\images\spectra.gif Spectra view (S or .)
* C:\Users\Diana\git\swarm\src\main\resources\images\spectrogram.png Spectrogram view (G or /)
* C:\Users\Diana\git\swarm\src\main\resources\images\particle_motion.gif Particle motion view (M or ‘)
* C:\Users\Diana\git\swarm\src\main\resources\images\clipboard.gif Copy inset to clipboard (C or Ctrl-C)
* C:\Users\Diana\git\swarm\src\main\resources\images\delete.gifRemove inset wave (Delete or Esc)
* C:\Users\Diana\git\swarm\src\main\resources\images\camera.gif Save helicorder image (P)
* C:\Users\Diana\git\swarm\src\main\resources\images\wavezoom.gif Toggle between adjusting helicorder scale and clip

### Helicorder View Settings

There are two main ways in which the user can interact with the a helicorder view: manipulating the helicorder view itself or zooming in and looking at the underlying waveform. All of the settings for the helicorder view can be manipulated in the helicorder view settings dialog which can be opened by clicking on the C:\Users\Diana\git\swarm\src\main\resources\images\settings.gif button.

Figure 8 Helicorder View Settings

#### Axes

* *X* is the number of minutes to display along the bottom of the helicorder. Default is 15 minutes.
* *Y* is the total time in hours to display on the helicorder. Default is 12 hours.
* View time setting allows user to set the time at the bottom of the helicorder. Default is ‘Now’, or current time. The format for specifying the bottom view time is YYYYMMDD or, if more resolution is needed, YYMMDDHHMMSS.

#### Zoom

* *Zoom* determines the amount of time, in seconds, on either side of the mouse cursor to zoom.
* Also available is a button to display the Wave View Settings Dialog.

#### Clipping

* *Show clip*
* *Audible clipping*
* *Alert frequency*

#### Other

* *Refresh* is the number of seconds between attempts to refresh the helicorder with the latest data. The default value is 15.
* *Scroll size* is the number of helicorder rows to scroll up or down on user scroll requests with mouse-wheel or scroll bar buttons.
* *Force center* forces each helicorder sample to be centered on its current line. This effectively eliminates all drift and is useful for broadband stations with lots of low frequency energy. This feature is to be used with caution though: it can make an obviously false signal look like an earthquake.
* *Auto-scale* toggles helicorder auto-scaling on and off. When auto-scaling is on an attempt is made to produce a “pleasant” looking helicorder. If this fails, or if more control over the appearance of the helicorder is wanted, set the One bar range.
* *One bar range* is the number of counts on either side of zero that make up one bar. For example, if there is a seismometer that reports counts between -3600 and 3600 and a bar range of 1200 is selected, a full-range waveform will take 3 bars, overlapping one above and one below. This is best understood through experimentation.
* *Clip threshold* allow user to set a counts threshold after which the trace will be shown in red.

# Wave Views

## Introduction

Wave views are one of the fundamental data views in SWARM. There are four wave view types: standard wave view, spectra, spectrogram, and particle motion. Any time a wave view is seen in SWARM there are settings associated with that individual view. For example, a wave view pasted into the clipboard from somewhere else has its own view settings.

## Wave View Settings Dialog

The Wave View Settings allow users to change how to look at the plots. The settings can be edited by clicking on the wave view settings icon C:\Users\Diana\git\swarm\src\main\resources\images\wavesettings.gif or pressing the ? key.



Figure 9 Wave View Settings dialog window

### View

The general display mode can be set under the View section. Options are Wave, Spectra, Spectrogram, or Particle Motion.

#### Wave

W or , will also toggle Wave view mode.



Figure 10 Wave view

In certain windows (e.g. Helicorder View, Clipboard), users can zoom in on a wave by left clicking and dragging over the portion of the wave you want to see. The selected section will highlight in yellow prior to zooming in.

When in Helicorder View, if Duration Magnitude option is enabled (see Options under File menu) users can left click on the wave panel to create two green markers. Once marked, the status bar at the bottom will display the duration time and magnitude at the end of the first line. Example:



If the wave panel is subsequently copied to the Clipboard, the duration markers become Coda markers for use in Pick Mode.

#### Spectra

S or . will also toggle Spectra view mode.



Figure 11 Spectra view

#### Spectrogram

G or / will also toggle Spectrogram view mode.



Figure 12 Spectrogram view

#### Particle Motion

M or ‘ will also toggle Particle Motion view mode.



Figure 13 Particle Motion view

The particle motion view will plot the amplitude of one component against the amplitude of another component from the same station. The plot begins as red at start time and gradually turns to blue at end time. The gray number next to each plot indicates the limit of the x and y axis. This view is supported only for the traditional orientation codes (Z N E) and only in certain windows (e.g. Helicorder View, Clipboard).

### Wave Options

* *Remove bias* will remove the mean value from the wave if on. It is enabled by default.
* *Use calibrations*
* *Min. Amplitude* is the y-axis minimum limit.
* *Max. Amplitude* is the y-axis maximum limit.
* *Auto scale* will scale the y-axis automatically if selected. The y-axis will be set to contain the minimum and maximum values attained by the wave in the shown time interval.
* *Manual scale*, if selected,will set the y-axis to the user specified Min. Amplitude and Max. Amplitude settings.
* *Persistant rescale*, if checked,

### Spectra Options

* *Log Power*, if checked, will set the power axis to log mode.
* *Log frequency*, if checked, will set the frequency axis to log mode.

### Spectrogram Options

* *Auto scale*
* *Manual scale*
* *Min. frequency* specifies the x-axis minimum in Spectra view and the y-axis minimum limit in Spectrogram view.
* *Max. frequency* specifies the x-axis minimum in Spectra view and the y-axis maximum limit in Spectrogram view. While SWARM will allow the maximum frequency to be set to any positive value greater than the minimum frequency, this value will adjust automatically if it is greater than the Nyquist frequency of the wave being manipulated.
* *Overlap (%)* determines the amount of overlap in consecutive FFTs. Legal values are between 0 and 95. The higher this value is set the smoother the FFT will look. However, artifacts can occur when excessive overlap is used.
* *Window size*
* *FFT points* is the number of samples to be used in each FFT. Adjusting this value affects the dimensions of each pixel of the spectrogram. Increasing the number of samples increases the vertical resolution while decreasing the horizontal resolution. Decreasing the number of samples increases the horizontal resolution while decreasing the vertical resolution.
* *Power range*

### Butterworth Filter

* *Enabled* checkbox will turn Butterworth filtering on and off.
* *Low pass* filter passes over the low frequencies and filters the high frequencies. When enabled, only the Max. frequency box will be editable since this is the corner frequency of the low pass filter.
* *High pass* filter passes over the high frequencies and filters the low frequencies. When enabled, only the Min. frequency box will be editable since this is the corner frequency of the high pass filter.
* *Band pass* filter passes over a band of frequencies and filters frequencies higher and lower than the band as defined by the Min. frequency and Max. frequency settings.
* *Zero phase shift* option runs the specified filter both forward and backward. This eliminates any phase shift effects due to the filter at the expense of effectively doubling the filter order.
* *Min. frequency* specifies the lower bound to filter on.
* *Max. frequency* specifies the upper bound to filter on.
* *Order* slider bar sets the order of the filter as even values between 2 and 8, inclusive. In general, the higher the order the steeper the cutoff at the corner frequencies.

# Wave Clipboard

The Wave Clipboard holds as many simultaneous wave views as desired. This allows users, for example, to compare arrival times across many stations, look at the same waveform with three different filters, or compare different events from one station.

The user interface consists of a clipboard toolbar at the top and then as many stacked

clipboard wave views as desired, each with its own toolbar. It’s also possible to zoom into any portion of a wave by left clicking and dragging over the portion to zoom in on (the transparent yellow block is showing the act of zooming). The status bar at the bottom displays information about the wave. The panel shaded blue is the *selected* wave for the purposes of the clipboard toolbar.



Figure 14 Wave Clipboard

## Clipboard Toolbar

Below are the functions available in the clipboard toolbar. Hovering over an icon will also provide a tooltip indicating the function of the button and the hot keys, if available.

* C:\Users\Diana\git\swarm\src\main\resources\images\wave_folder.gif Open a saved wave
* C:\Users\Diana\git\swarm\src\main\resources\images\save.gif Save selected wave
* C:\Users\Diana\git\swarm\src\main\resources\images\saveall.gif Save all waves
* C:\Users\Diana\git\swarm\src\main\resources\images\helicorderlink.gif Synchronize times with helicorder wave
* C:\Users\Diana\git\swarm\src\main\resources\images\date.gif Synchronize times with selected wave
* C:\Users\Diana\git\swarm\src\main\resources\images\geosort.gif Sort waves by nearest to selected wave
* C:\Users\Diana\git\swarm\src\main\resources\images\resize.gif Set clipboard wave size
* C:\Users\Diana\git\swarm\src\main\resources\images\deleteall.gif Remove all waves from clipboard
* C:\Users\Diana\git\swarm\src\main\resources\images\camera.gif Save clipboard image (P)
* C:\Users\Diana\git\swarm\src\main\resources\images\pick.pngPick Mode
* C:\Users\Diana\git\swarm\src\main\resources\images\left.gif Scroll back time (A or left arrow)
* C:\Users\Diana\git\swarm\src\main\resources\images\right.gif Scroll forward time (Z or right arrow)
* C:\Users\Diana\git\swarm\src\main\resources\images\gototime.gif Go to time (Ctrl-G)
* C:\Users\Diana\git\swarm\src\main\resources\images\xminus.gif Shrink sample time 20% (Alt left arrowor+)
* C:\Users\Diana\git\swarm\src\main\resources\images\xplus.gif Expand sample time 20% (Alt right arrowor-)
* C:\Users\Diana\git\swarm\src\main\resources\images\timeback.gif Last time setting (Backspace)
* C:\Users\Diana\git\swarm\src\main\resources\images\wavesettings.gif Wave view settings (?)
* C:\Users\Diana\git\swarm\src\main\resources\images\wave.gif Wave view (W or ,)
* C:\Users\Diana\git\swarm\src\main\resources\images\spectra.gif Spectra view (S or .)
* C:\Users\Diana\git\swarm\src\main\resources\images\spectrogram.png Spectrogram view (G or /)
* C:\Users\Diana\git\swarm\src\main\resources\images\particle_motion.gif Particle motion view (M or ‘)
* C:\Users\Diana\git\swarm\src\main\resources\images\clipboard.gif Place another copy of wave on clipboard (C or Ctrl-C)
* C:\Users\Diana\git\swarm\src\main\resources\images\up.gifMove wave(s) up in clipboard (Up arrow)
* C:\Users\Diana\git\swarm\src\main\resources\images\down.gifMove wave(s) down in clipboard (Down arrow)
* C:\Users\Diana\git\swarm\src\main\resources\images\delete.gifRemove wave from clipboard (Delete or Esc)

## Status Bar

The status bar at the bottom will display information about the wave when in Wave, Spectra, or Spectrogram view.

**First Line**

The top line of the status bar always has information on the entire wave displayed:

* Start time in UTC
* End time in UTC
* Number of samples (duration in seconds)
* Sample rate
* Minimum amplitude (does not account for bias)
* Maximum amplitude (does not account for bias)

Example: 

**Second Line**

If the panel is in time series view (Wave and Spectrogram), it will display the time on the x-axis that the mouse is hovering over in local and UTC time. Other information shown:

* Y-axis value if in Wave view; e.g.:
* Frequency and Power in Spectra view; e.g.: 
* Frequency in Spectrogram view; e.g.: 

**Third Line**

If the clipboard is in Pick Mode, the third line will display:

* S-P duration and distance, if P and S phases are picked.
* Coda duration and magnitude, if coda start and end are picked.

Example: 

# Real-time Monitor



Figure 15 Real-time Monitor

# Real-time Wave Viewer

Clicking on C:\Users\Diana\git\swarm\src\main\resources\images\wave.gif at the bottom of the Data Chooser window will open real-time wave viewer. The white area to the right shows the lag between now and the last available data at the time of refresh (which occurs every two seconds.) It is possible to switch between views of 15, 30, 60, 120 (default), 180, 240, or 300 seconds. The time displayed is UTC.



Figure 16 Real-time Wave Viewer

# RSAM

Clicking on  at the bottom of the Data Chooser window will open the RSAM viewer. The buttons at the top let you choose between values view and counts view.

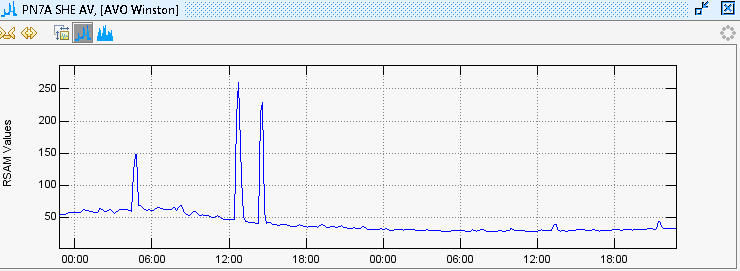


Figure 17 RSAM values view



Figure 18 RSAM counts view

# Map Interface

## Introduction

The map shows station locations on geographically projected background imagery. Imagery can be, for example, shaded DEMS, satellite imagery, aerial photos, coastlines, etc. By default a basic world map taken from NASA Blue Marble imagery is provided. Custom imagery can be added provided that unprojected, geo-registered image files are available. See map packs for more information. The map interface can be opened by checking on the Window -> Map menu item or pressing Ctrl-M.

## Displaying Station on Map

The map can also be opened by clicking on the  button at the bottom of the Data Chooser to display the selected stations or network. For example, selecting the All group under AVO Winston data source and then clicking on the map button will display the Aleutian arc along with transparent station markers. To avoid clutter not all stations are displayed at this scale. The number of hidden channels is displayed in the lower left of the map panel.

## Map Toolbars

Map related functions:

* C:\Users\Diana\git\swarm\src\main\resources\images\settings.gif Map Options - or map settings
* C:\Users\Diana\git\swarm\src\main\resources\images\label_all.gif Change label settings - toggles between showing some, all, or none of the station labels
* C:\Users\Diana\git\swarm\src\main\resources\images\earth.gif Zoom out to full scale (home)
* C:\Users\Diana\git\swarm\src\main\resources\images\drag.gif Drag map (D) – left click and hold to pan the map
* C:\Users\Diana\git\swarm\src\main\resources\images\dragbox.gif Zoom into box (B) – left click and hold to draw a box to zoom in on
* C:\Users\Diana\git\swarm\src\main\resources\images\ruler.gif Measure distances (M)
* C:\Users\Diana\git\swarm\src\main\resources\images\zoomplus.gif Zoom in (+)
* C:\Users\Diana\git\swarm\src\main\resources\images\zoomminus.gif Zoom out (-)
* C:\Users\Diana\git\swarm\src\main\resources\images\geoback.gif Last map view (Ctrl-Backspace)

Wave related functions:

* C:\Users\Diana\git\swarm\src\main\resources\images\date.gif Real-time mode
* C:\Users\Diana\git\swarm\src\main\resources\images\helicorderlink.gif Synchronize times with helicorder wave
* C:\Users\Diana\git\swarm\src\main\resources\images\left.gif Scroll back time 20% (A or left arrow)
* C:\Users\Diana\git\swarm\src\main\resources\images\right.gif Scroll forward time 20% (Z or right arrow)
* C:\Users\Diana\git\swarm\src\main\resources\images\gototime.gif Go to time (Ctrl-G)
* C:\Users\Diana\git\swarm\src\main\resources\images\xminus.gif Shrink time axis (Alt left arrow)
* C:\Users\Diana\git\swarm\src\main\resources\images\xplus.gif Expand time axis (Alt right arrow)
* C:\Users\Diana\git\swarm\src\main\resources\images\timeback.gif Last time settings (Backspace)
* C:\Users\Diana\git\swarm\src\main\resources\images\wavesettings.gif Wave view settings (?)
* C:\Users\Diana\git\swarm\src\main\resources\images\wave.gif Wave view (W or ,)
* C:\Users\Diana\git\swarm\src\main\resources\images\spectra.gif Spectra view (S or .)
* C:\Users\Diana\git\swarm\src\main\resources\images\spectrogram.png Spectrogram view (G or /)
* C:\Users\Diana\git\swarm\src\main\resources\images\particle_motion.gif Particle motion view (M or ‘)
* C:\Users\Diana\git\swarm\src\main\resources\images\clipboard.gif Copy inset to clipboard (C or Ctrl-C)
* C:\Users\Diana\git\swarm\src\main\resources\images\camera.gif Save map image (P)

## Map Settings

Clicking on C:\Users\Diana\git\swarm\src\main\resources\images\settings.gif will open the Map Settings dialog. You can enter in the longitude and latitude to center on, and the map scale to display. Other options



### Displaying NEIC Events

To display events from the National Earthquake Information Center (NEIC), choose an option from NEIC Event Summary. See Events section for more information.

# Events

## Importing Events

Events can be imported into Swarm by enabling NEIC Event Summary option in Map Settings (see section 10.4.1.) Events in QuakeML file formats can also be imported from the File -> Import Event menu.

## Map Display

Events displayed on the map are represented by unlabeled circles as markers. The size and color of the marker is based on how recent the event is, and its magnitude. The larger the magnitude, the larger the marker. Below table shows the colors associated with the age of event.

|  |  |
| --- | --- |
| Event Age | Color |
| < 1 hour | Red |
| 1 hour or more but < 1 day | Orange |
| 1 day or more but < 1 week | Yellow |
| 1 week or more | White |

Hovering over the marker will turn the color green and display basic information about the event.



Figure 19 Example of hover over event

Clicking on the marker will open the Event Frame.

## Event View

The event view can be opened by clicking on an event marker on the map. The top of the event window will display basic information about the event; such as the description, origin date, event type, hypocenter, etc. The bottom part of the event window will display the wave views of the picks associated with each arrival within the event. Pick times are marked by a green line and label tag indicating the magnitude, onset, and phase of the pick. The gray area to either side of the pick mark represents uncertainty. The toolbar above the picks contain buttons that perform functions similar to that found in other views. The buttons related to waves are enabled only after a wave is selected.

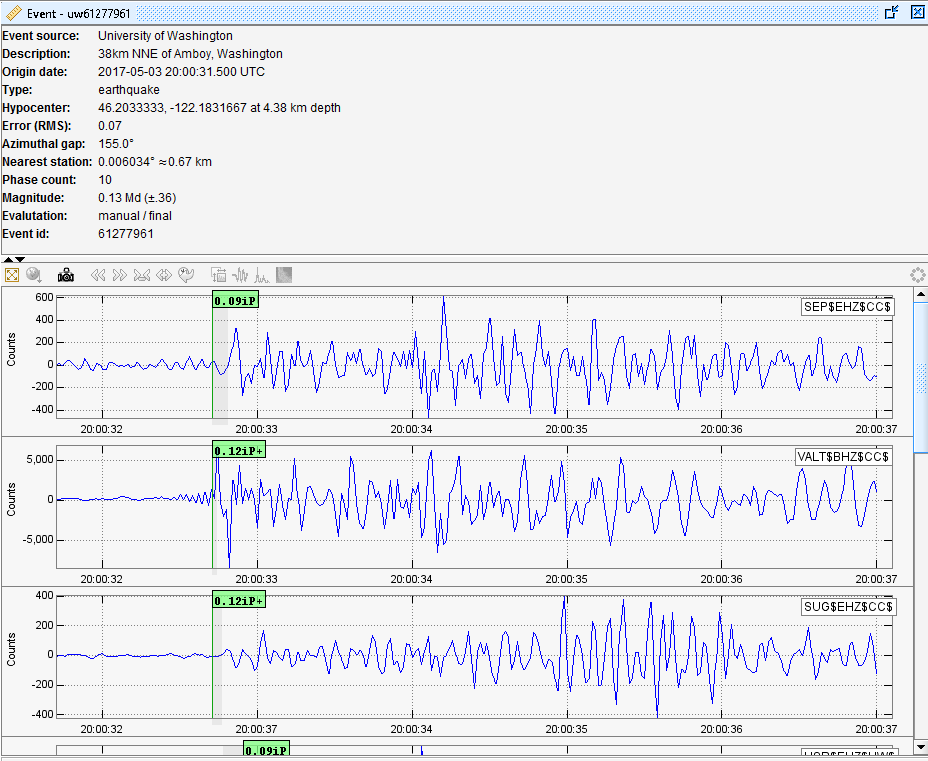


Figure 20 Event Frame

# Kiosk Mode

# Layouts

# Menu Reference