



SEISMOLOGY
RESEARCH
CENTRE

eqServer

WEB BASED EARTHQUAKE DATA MANAGEMENT SYSTEM

PRODUCT USER MANUAL



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Overview

eqServer is a system for managing remote earthquake, blast and vibration monitoring instrumentation networks and data. It can be installed on a dedicated Ubuntu PC connected to your local network, or it can be provided as a cloud-hosted service. In either configuration, the user interface is via a standard web browser, allowing you to view real-time data, historical data by station or by sub-network, and monitor the state-of-health of an instrumentation network.

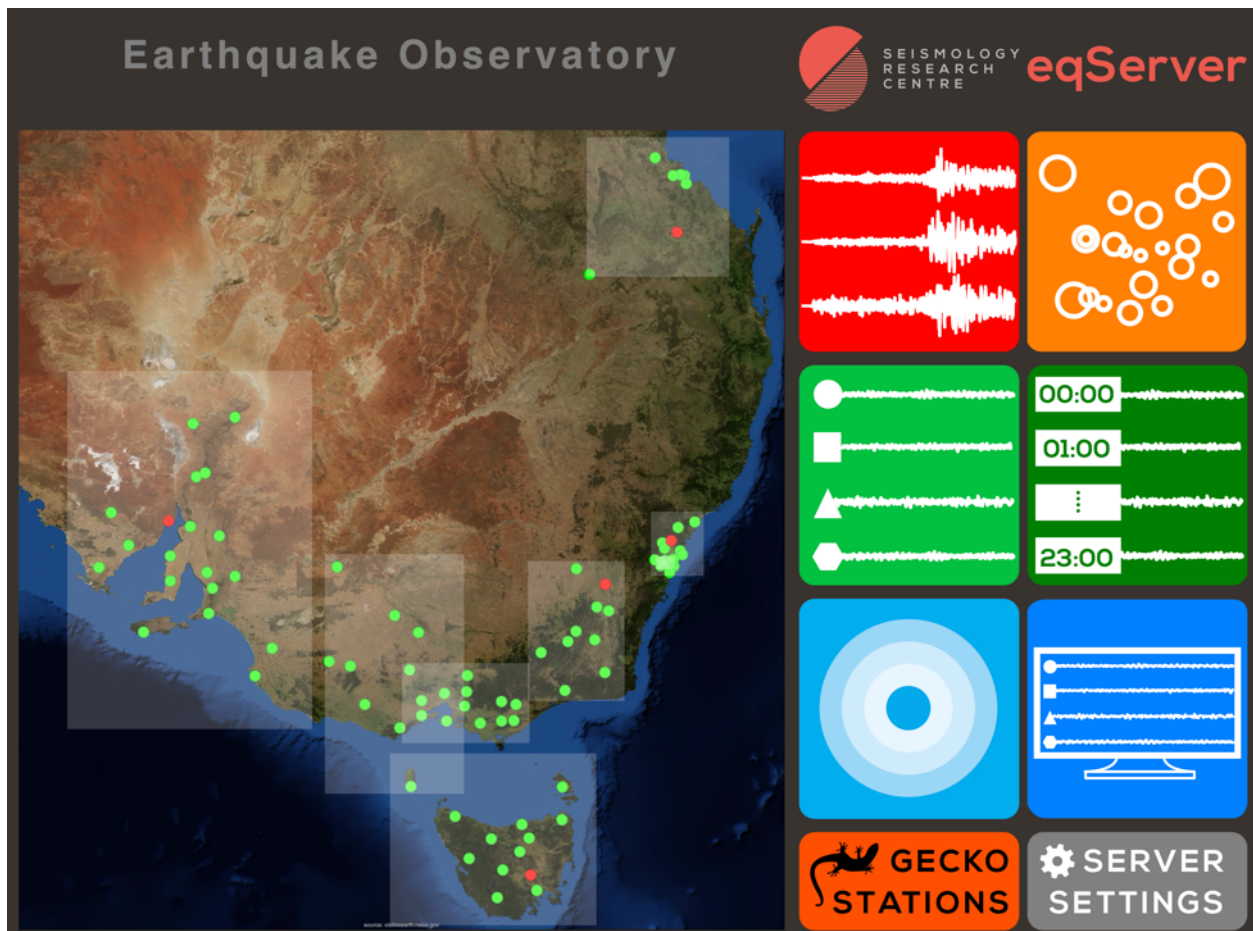
eqServer is also an automatic event detection system that will associate activity at several stations and attempt to calculate the location and magnitude of the event, also generating an email notification. This event data can be accessed through eqServer and by using our Quick Quake iPhone and iPad app.

An SQL database stores all of the station information, map place names, and automatic event location information. By using our free **Waves** application (for Windows, macOS and Ubuntu), you can upload earthquake solutions to the eqServer database.

eqServer was designed for use with Kelunji seismographs that include meta-data rich seismic waveform files in PC-SUDS or MiniSEED format (the latter with separate station meta-data files), but eqServer can also accept some other data formats. If the data file can be opened with **Waves** seismic data viewer, eqServer can read time series data.

eqServer also includes a facility to draw data from SeedLink servers – a data sharing protocol used by some data acquisition systems and by organisations such as IRIS. eqServer can also act as a SeedLink server to share live data with SeedLink clients (e.g. our free **Streams** application - also for Windows, macOS and Ubuntu).

The Home Screen



When you first log in to eqServer you will be presented with a home screen with a map.

To the right of the map are icons to access the main functions of eqServer (from top left):

- **Wave Finder:** extract a time-block of merged waveform data from the archive
- **Event Finder:** extract lists of earthquakes from the SQL database. Output lists in various formats, including plain text or KML for replay in Google Earth
- **One Hour:** browse one hour of data from multiple stations – either all stations, or groups of stations as defined by sub-network definitions
- **One Day:** 24 hours of data from a single station – a modern day drum recorder
- **Event Reports:** automatically generated bulletins based on triggered data associations. Events can be accessed by the iOS Quick Quake app
- **Live Data:** the last hour from all stations, auto-updated, suits a 16:9 display TV
- **Gecko Stations:** view and edit settings for all connected Gecko seismographs
- **Server Settings:** configuration the settings of the eqServer system

Settings

The settings page is used when initially setting up eqServer and to modify notification settings, display settings, data sources and other parameters. If you edit any settings in the grey boxes with the red title bars, click the Save button in that box before changing other settings.

Additional settings screens are accessible from the coloured buttons on the left of the page.

Server Title

This is the title that will appear above the map on the home screen.

FDSN Code

If your observatory has a two-letter FDSN code, enter it here.

Data Age (hours)

The map on the home screen shows the location of the stations that you have selected to send data to eqServer. Two symbols are available to categorise stations, each with different time frames to colourise the symbols to indicate the age of the latest data to arrive.

The value between the green and yellow symbols indicates the number of hours since data was last received from a station before the symbol turns yellow, and the value between the yellow and red symbols is the number of hours without data before the station goes red.

The symbols can be used to categorise your stations in various ways. At the SRC earthquake observatory, we typically use circles to indicate data from stations that are sending in data continuously, and triangles for stations that only send in triggered event data. Alternatively you may wish to use the circle and triangle to categorise stations as cellular versus satellite telemetry, broadband versus short-period sensors, strong motion versus weak motion stations, structural monitoring versus free field instruments, etc.

Auto Location

eqServer will automatically locate earthquakes to a fixed depth. Enter the typical earthquake depth (in kilometres) for your region in the field provided. It will also use one of many earth model files. A generic one that can be used worldwide is "JBMod" which uses the Jeffreys-Bullen time travel tables as the one-dimensional earth model. Please contact the SRC if you would like a custom layered P and S wave travel time model created specifically for your region.

Email Alerts

Mail Settings

Your sub-networks can analyse incoming data for events, which will generate event bulletins and email notifications. eqServer needs to send email through a mail server. Enter your SMTP mail server address, sender email and password (if required) into the appropriate fields, ensuring your mail server accepts connections from the network upon which your eqServer is located.

The **Notification Window** setting allows you to avoid many repeat messages for a single event that triggers many sub-networks. After sending out an alert, eqServer will wait a fixed time period before sending out a summary of which subnetworks have triggered since the last message, which by default is set to 300 seconds.

Recipients

You can define any number of email recipients for event notifications. There are three styles of notification message: SMS, Email, and Message. The SMS format is compact and designed for feature-phones. The Email is a long form report with lots of calculation details with a link to the online report. The Message format is a compacted SMS for smart phones that just lists the time, location and magnitude, along with a link to the latest online report.

Enter the recipient's email address, using the comment field for your own purposes. If you don't want to receive alerts for events that are older than some number of hours, tick the "No Old" box for that user and specify the number of hours. This is useful to avoid notifications from automatic relocations of events when data from stations that have been offline for some time come back online.

The rest of this line shows all of the defined sub-networks. Tick the box under each sub-network to enable notifications to that recipient for alerts generated by those sub-networks.

Click the green "+" icon to add another recipient.

Forward Incoming Files to Another FTP Site

As data arrives into the eqServer inbox, it is analysed to determine if it is a triggered event waveform file or simply a continuous data stream. They are then handled by separate routines within eqServer.

A copy of these two types of files can then be forwarded onto an external FTP site (perhaps another eqServer, or a backup data repository). Enter the destination FTP site credentials and tick "All" to send data from all incoming stations to the destination, or enter the station codes of the data files that you wish to forward to another FTP site, with each code (case sensitive) separated by a space.

Click the green "+" icon to add additional FTP destinations.

Forward MiniSEED files to IRIS

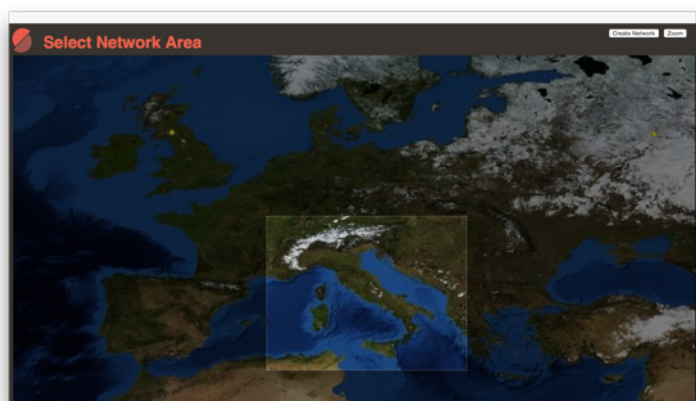
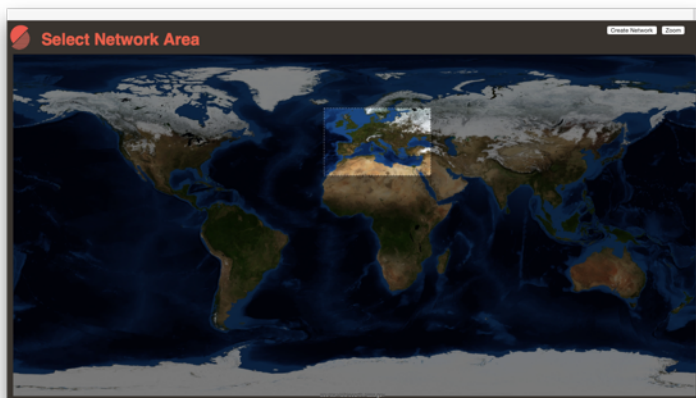
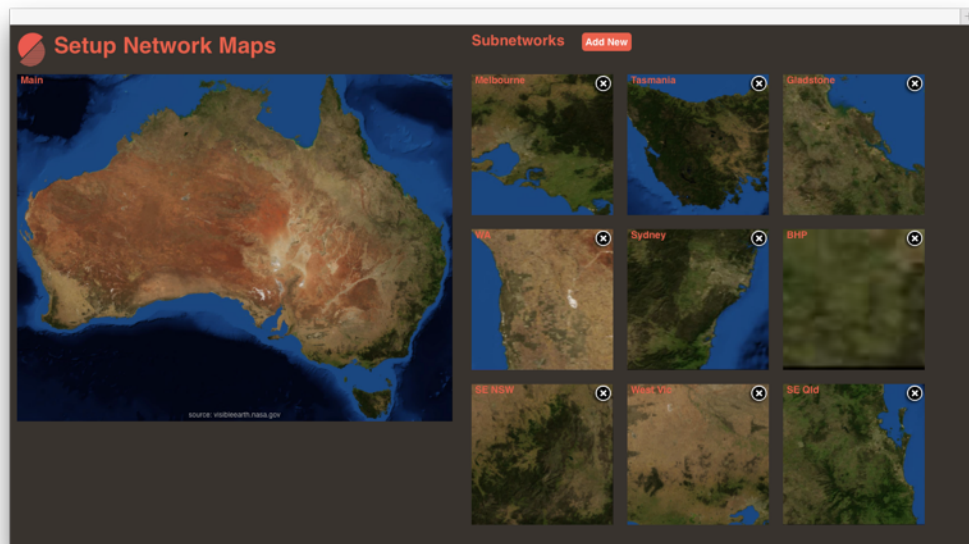
If you are using IRIS as a long term archive for your data, eqServer can forward your data to their server's port assigned to your account upon registration with IRIS. Contact IRIS for more information on setting up your earthquake observatory on their system, which will require an FDSN code. Go to <https://ds.iris.edu/ds/> for more information.

Live Data Image

The TV display image linked from the home page by default shows the last hour of data, with the image updated every 30 seconds. You can reduce the period of data displayed down to as little as 5 minutes, and increase or decrease the image refresh rate.

Main Map & Networks

The home page of eqServer shows you the Main map as defined on the first of the eqServer settings sub-pages. This map area encompasses all of the stations from which you expect to receive data. The current Main map is shown on the left side of the screen, and any sub-networks you have defined within this main map are shown on the right side of the screen.

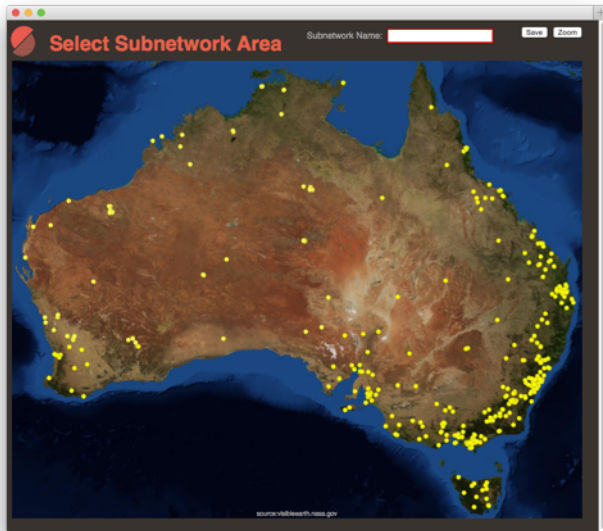


To define a new **Main map**, click anywhere on the current Main map image and you will be presented with a map of the world. Click and drag a box to define an area on the map. This function may not be available on touch-based input devices such as smart phones and tablets.

You can now click on “Create Network” to use this as your Main map, or click on “Zoom” to load a more detailed map of the highlighted area so that you can select more accurate map boundaries. If you have zoomed in you can continue to zoom, or create your network map.

Add a Sub-network

Once you have defined your Main map, you can start to define your **Subnetworks** so that you can generate automatic earthquake locations by station association. You may only wish to have a single sub-network to start with, and you can add more later as your network expands. Click on the "Add New" button next to the Subnetworks title.



Your Main map will now load, showing yellow dots wherever there is a **Station** defined in the database to help guide your sub-network boundaries.

You must type in a **Subnetwork Name** before proceeding. You can then drag a box on the map to define the boundary or zoom as you did for the Main map.

When you are happy with your selection, click Save to proceed to the detailed settings for your sub-network.

 A screenshot of the "Tasmania" sub-network configuration screen. The left side shows a map of Tasmania with grey dots representing stations. The right side contains configuration options:

- Name:** Tasmania (with a "Save Changes" button)
- Event Association:**
 - Time frame to associate triggers together (seconds): 30
 - Minimum number of bias-weighted triggers to Alarm: 3
 - Before notification, wait for more triggers (seconds): 10
- Stations:** Select a Network ID (All)
- Display Settings:** A table of station parameters.
- Trigger Settings:** A table of trigger parameters.

Display Settings				Trigger Settings							
Site	Frequency	Bias	Trig	STA	LTA	Thres	Frequency	Channel			
AUTAR	1.0 to 20.0	1.0	<input type="checkbox"/>	2.0	30.0	3.0	5.0	to 20.0			
AULHS	1.0 to 20.0	1.0	<input type="checkbox"/>	2.0	30.0	3.0	5.0	to 20.0			
AUPKL	1.0 to 20.0	1.0	<input type="checkbox"/>	2.0	30.0	3.0	5.0	to 20.0			
AUBRN	1.0 to 20.0	1.0	<input type="checkbox"/>	2.0	30.0	3.0	5.0	to 20.0			
DEAL	1.0 to 20.0	1.0	<input type="checkbox"/>	2.0	30.0	3.0	5.0	to 20.0			
HOGN	1.0 to 20.0	1.0	<input type="checkbox"/>	2.0	30.0	3.0	5.0	to 20.0			
FNT	1.0 to 20.0	1.0	<input type="checkbox"/>	2.0	30.0	3.0	5.0	to 20.0			
TAU	1.0 to 20.0	1.0	<input type="checkbox"/>	2.0	30.0	3.0	5.0	to 20.0			
MOO	1.0 to 20.0	1.0	<input checked="" type="checkbox"/>	2.0	30.0	3.0	5.0	to 20.0			
SAV	1.0 to 20.0	1.0	<input type="checkbox"/>	2.0	30.0	3.0	5.0	to 20.0			
CORO	1.0 to 20.0	1.0	<input checked="" type="checkbox"/>	2.0	30.0	3.0	5.0	to 20.0			
GEES	1.0 to 20.0	1.0	<input type="checkbox"/>	2.0	30.0	3.0	5.0	to 20.0			
GLAD	1.0 to 20.0	1.0	<input checked="" type="checkbox"/>	2.0	30.0	3.0	5.0	to 20.0			
SCOT	1.0 to 20.0	1.0	<input checked="" type="checkbox"/>	2.0	30.0	3.0	5.0	to 20.0			

All of the stations that are in the database that fall within the sub-network boundary will be shown on the map as grey dots, and in a list on the right side of the screen. As you mouse-over the stations in the list they will be highlighted in the map, and vice versa. Click on a station on the map (or tick the box in the list) to add it to your sub-network. You can filter the list of stations displayed based on their Network ID using the drop-down menu at the top of the list. You can also click on the circle symbol in the list to change it to a triangle symbol so that it uses the alternate data age symbol on the state-of-health map.

Display Settings

When you view data using the **One Hour** display function for this sub-network, you can choose to filter the data to a particular frequency band to make certain types of earthquake appear more clearly. The waveform display automatically scales the data so that the peak-to-peak signal for the hour is just visible, but for broadband sensors this amplitude can be quite high over a long period, so it may be difficult to see small or local earthquakes. If you are using broadband sensors but you wish to clearly see local earthquakes on One Hour, we recommend setting the Frequency range as 2 to 20 Hz.

Bias

When defining the number of stations that need to trigger within a particular time window to declare an event, you may wish to bias a station to have a greater or lesser impact on the event association routine. If a station is particularly quiet and only ever triggers on "real" events, you may wish to give it a weighting of 1.5 or 2.0, but if a station is particularly susceptible to local noise you may wish to set the bias to 0.3 or 0.5.

Trigger Settings

If you have stations only sending continuous data into eqServer (e.g. from a SeedLink stream or a Kelunji Gecko) you may wish to run an algorithm over the data to trigger on earthquakes. If the station is a continuous stream, tick the "Trig" box and set STA/LTA, Threshold, and Frequency pass band settings to set the trigger sensitivity. There is a detailed explanation of STA/LTA triggering routine in the Waves user manual.

Event Association

To declare an "Event", eqServer is looking for multiple triggers to occur within a timeframe. The size of this time window will depend on the size of your network and earthquake wave travel times, but as a rule of thumb you can set it as 10 seconds for every degree across your network.

The minimum number of stations that is usually required to reasonably attempt an earthquake location is 3, but if you have a high density of stations you may wish to increase this to a higher number to reduce false triggers. The Bias of the station (defined earlier) will contribute to this Alarm threshold.

After declaring an Event, you may want eqServer to wait for some time before calculating the location and magnitude to allow data from additional stations to come in. This wait time is defined in seconds and is set in the last settings field in the Event Association section.

Remember to click on the **"Save Changes"** button at the top right corner of the page to save your sub-network settings.

SeedLink Feeds

Seedlink Settings

☒ Enabled **Restart Seedlink** **Save Changes**

☒ Add stations to "Automatic Network"
☐ Add stations to subnetworks

Host: 192.104.43.82 **Get Stations**

Host: rtserve.iris.washington.edu **Get Stations**

Host: rtserve.beg.utexas.edu **Get Stations**

Host: rtserve.resif.fr **Get Stations**

Host: auspass.edu.au **Get Stations**

192.104.43.82 Networks:

AM AU YW

☐ Show Enabled

Station	Channels
Network AM	
R9928	<input type="checkbox"/> All <input type="checkbox"/> EHZ <input type="checkbox"/> ENE <input type="checkbox"/> ENN
RDB0C	<input type="checkbox"/> All <input type="checkbox"/> EHE <input type="checkbox"/> EHN <input checked="" type="checkbox"/> EHZ
Network AU	
ARMA	<input type="checkbox"/> All <input type="checkbox"/> BHE <input type="checkbox"/> BHN <input type="checkbox"/> BHZ
ARPS	<input type="checkbox"/> All <input checked="" type="checkbox"/> BHE <input checked="" type="checkbox"/> BHN <input checked="" type="checkbox"/> BHZ
AS01	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS02	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS03	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS04	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS05	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS06	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS07	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS08	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS09	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS10	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS11	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS12	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS13	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS14	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS15	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS16	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS17	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS18	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS19	<input type="checkbox"/> All <input type="checkbox"/> SHZ
AS31	<input type="checkbox"/> All <input type="checkbox"/> BHE <input type="checkbox"/> BHN <input type="checkbox"/> BHZ
AXCOZ	<input type="checkbox"/> All <input type="checkbox"/> HHE <input type="checkbox"/> HHN <input type="checkbox"/> HHZ
BBOO	<input type="checkbox"/> All <input checked="" type="checkbox"/> BHE <input checked="" type="checkbox"/> BHN <input checked="" type="checkbox"/> BHZ
BCON	<input type="checkbox"/> All <input type="checkbox"/> BHE <input type="checkbox"/> BHN <input type="checkbox"/> BHZ
BLDU	<input type="checkbox"/> All <input type="checkbox"/> BHE <input type="checkbox"/> BHN <input type="checkbox"/> BHZ
BN2S	<input type="checkbox"/> All <input type="checkbox"/> SHE <input type="checkbox"/> SHN <input type="checkbox"/> SHZ <input type="checkbox"/> LCQ
BRAT	<input type="checkbox"/> All <input type="checkbox"/> SHE <input type="checkbox"/> SHN <input type="checkbox"/> SHZ <input type="checkbox"/> LCQ
BTL02	<input type="checkbox"/> All <input type="checkbox"/> BHE <input type="checkbox"/> BHN <input type="checkbox"/> BHZ <input type="checkbox"/> LCQ
BTL04	<input type="checkbox"/> All <input type="checkbox"/> BHE <input type="checkbox"/> BHN <input type="checkbox"/> BHZ <input type="checkbox"/> LCQ
BTL05	<input type="checkbox"/> All <input type="checkbox"/> BHE <input type="checkbox"/> BHN <input type="checkbox"/> BHZ <input type="checkbox"/> LCQ
BTL06	<input type="checkbox"/> All <input type="checkbox"/> BHE <input type="checkbox"/> BHN <input type="checkbox"/> BHZ <input type="checkbox"/> LCQ

To use eqServer as an automatic earthquake location and notification system using data from external SeedLink sources, enter the address of the server or seismograph and click "Get Stations".

A list of Networks hosted on this SeedLink source will be displayed. Click on one or more

networks to display the list of available stations and channels for the network, then tick the checkbox for every station or channel that you wish to subscribe to. Scroll to the bottom of the screen and click the **"Save"** button and within a few minutes you will start receiving data from the stations.

Hosts that have active links from remote data feeds will have a chain link icon next to the "Get Stations" button. There may be hundreds

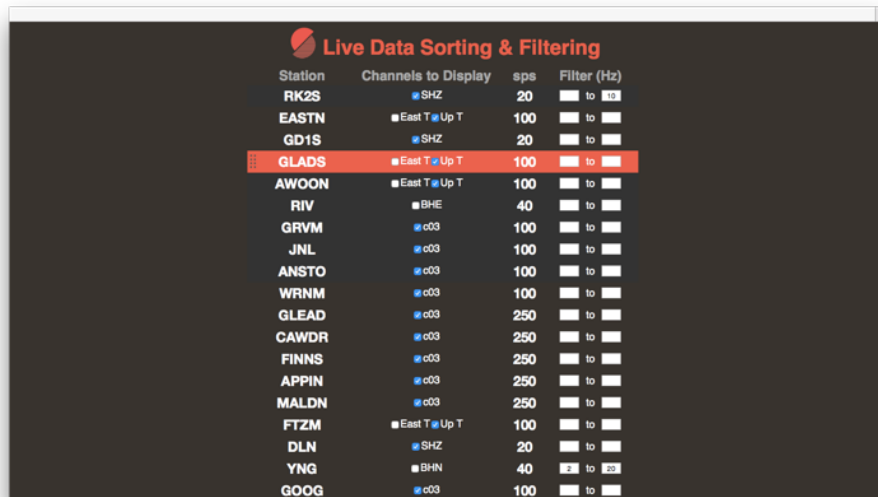
of stations in a network, so to show only those that you have selected, tick the "Show Enabled" box that appears below the Network list.

Add more SeedLink hosts using the green **+** button below the list, and the red **x** to delete any unwanted hosts.

For IRIS-registered stations, eqServer will attempt to download the station.xml data to place them on the map and properly scale the ground motion amplitude.

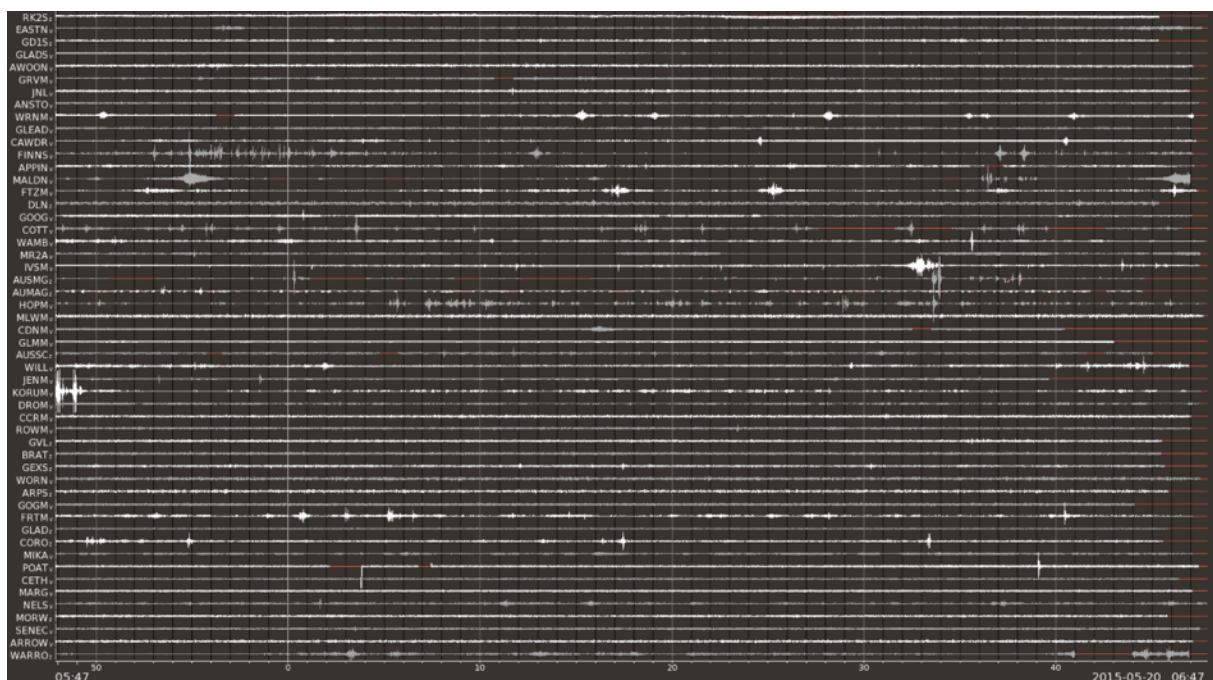
Waveform Display Settings

Here you can define which channels of incoming data are shown on the Live Data (TV-style) display. You can manually sort the order that the stations are displayed, and you can also define the frequency range displayed so that high amplitude low frequency signals from long period sensors don't obscure small high frequency local earthquake signals.



To change the order of the stations, place your cursor over a station and it will become highlighted. Click and drag the dots to the left of the station name up or down in the list to set the display order. Untick any channels that you do not wish to display, and set the frequency pass band of the data to be displayed on the Live Data screen.

Scroll to the top or bottom of the screen and click the **"Save"** button and within a few minutes your Live Data screen will refresh with the updated display settings.



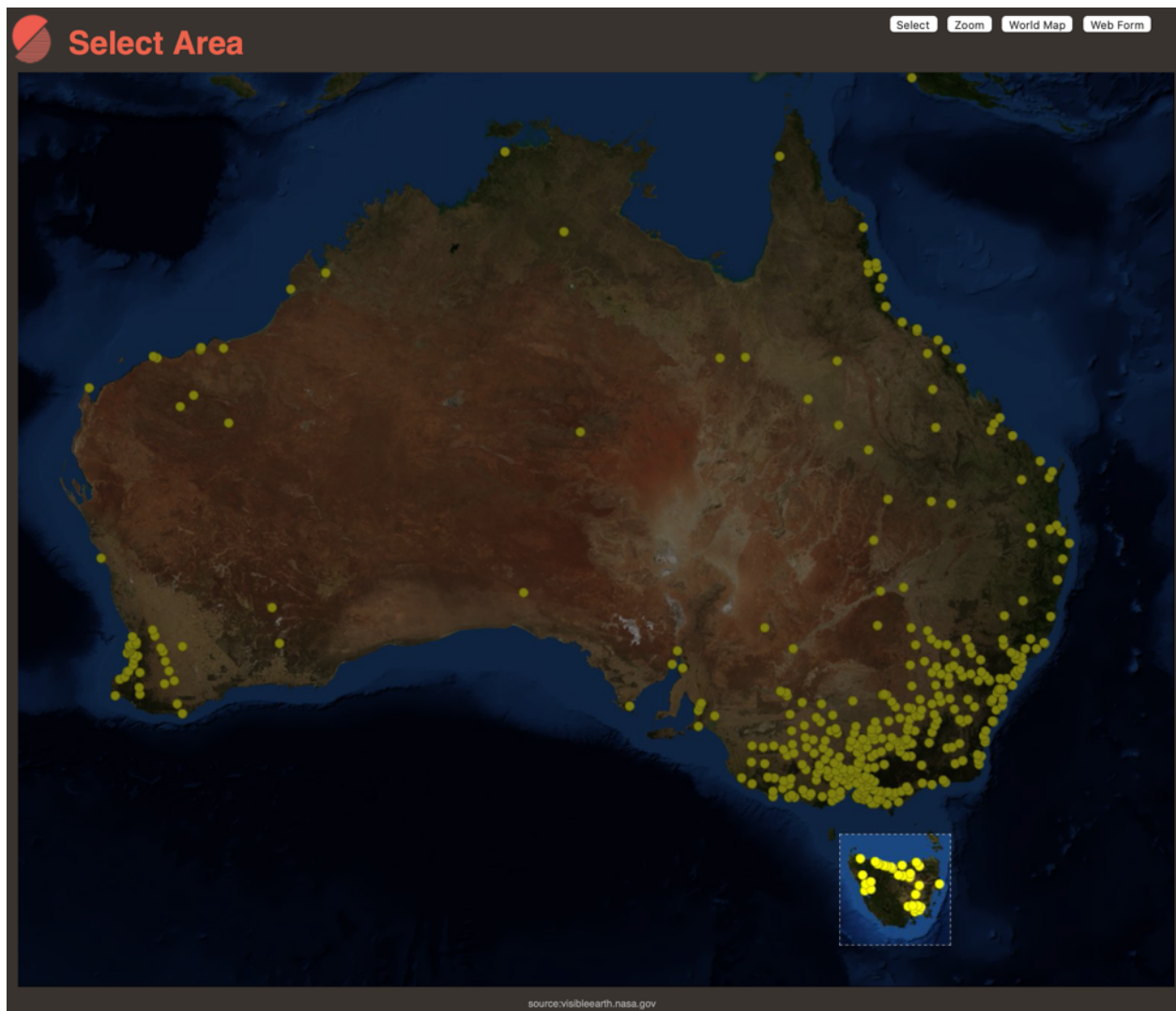
Place Names

The default eqServer SQL database is populated with a list of place names (cities, towns, lakes, etc) but you will probably need to add more detail for your map regions. You can export a list of place names, add a new place, edit a place name, or delete places from the database.

There are two ways to edit place names – via map view or web form.

Map View

In the same way that you navigate the maps to set up subnetworks, zoom in to an area of the map. The yellow dots on the map show the position of places defined as a “Large Town”, which is the 3rd of 7 default place size definitions: National Capital, Regional Capital, Large Town, Small Town, Miscellaneous, Reservoir, and Mining.



Once you hit the “Select” button it will take you to the place editor, or click the “Web Form” button in the top right corner of the screen to use the alternate interface.

The next screen will show you all places listed in the area, but you can filter the display by using the drop-down menu at the top of the list.

To edit any existing entries, click into the text fields and modify accordingly.

To add an additional place, click on the map. A new row will be added to the bottom of the list with the latitude and longitude of the map position clicked. Edit the name, region, country, size, latitude and longitude as required, then Save Changes.

Places

Select a place size

Name	Region	Country	Size	Latitude	Longitude
Strahan	Tasmania	Australia	3	-42.1564	145.32001
Queenstown	Tasmania	Australia	3	-42.0862	145.547
Zeehan	Tasmania	Australia	3	-41.8829	145.327
Rosebery	Tasmania	Australia	3	-41.7788	145.537
Savage River	Tasmania	Australia	3	-41.5088	145.21001
Latrobe	Tasmania	Australia	3	-41.2398	146.41299
Devonport	Tasmania	Australia	3	-41.1805	146.34599
Ulverstone	Tasmania	Australia	3	-41.1624	146.168
Penguin	Tasmania	Australia	3	-41.1141	146.061
Burnie	Tasmania	Australia	3	-41.0635	145.892
Somerses	Tasmania	Australia	3	-41.0496	145.82001
Wynyard	Tasmania	Australia	3	-40.9844	145.714
Smithton	Tasmania	Australia	3	-40.8482	145.117
Strathgordon	Tasmania	Australia	4	-42.766	146.054
Tarraleah	Tasmania	Australia	4	-42.302	146.444
Derwent Bridge	Tasmania	Australia	4	-42.136	146.229
Tullah	Tasmania	Australia	4	-41.734	145.619
Mole Creek	Tasmania	Australia	4	-41.557	146.40199
Sheffield	Tasmania	Australia	4	-41.383	146.32401
Marrawah	Tasmania	Australia	4	-40.91	145.69
Maatsuyker Island	Tasmania	Australia	5	-43.65	146.27
De Witt Island	Tasmania	Australia	5	-43.572	146.52299
Port Davey	Tasmania	Australia	5	-43.337	145.916
Federation Peak	Tasmania	Australia	5	-43.267	146.45
Low Rocky Point	Tasmania	Australia	5	-42.99	145.49001
Point Hibbs	Tasmania	Australia	5	-42.61	145.25999
Frenchmans Cap	Tasmania	Australia	5	-42.271	145.83
Bronte Park	TAS	Australia	5	-42.136	146.493
Cradle Mountain	Tasmania	Australia	5	-41.685	145.95
Sandy Cape	Tasmania	Australia	5	-41.42	144.74001
Mount Bertha	Tasmania	Australia	5	-41.284	145.22
West Point	Tasmania	Australia	5	-40.94	144.61
Robbins Island	Tasmania	Australia	5	-40.68	144.92999
Cape Grim	Tasmania	Australia	5	-40.675	144.685
Hunter Island	Tasmania	Australia	5	-40.52	144.75
Three Hummock Island	Tasmania	Australia	5	-40.43	144.88
Scotts Peak	Tasmania	Australia	6	-43	146.27
Lake Gordon	Tasmania	Australia	6	-42.73	146.21001
Macquarie Harbour	Tasmania	Australia	6	-42.3	145.36
Reece Dam	Tasmania	Australia	6	-41.725	145.12399
Cethana Dam	Tasmania	Australia	6	-41.4825	146.132
Rennison Bell Mine	Tasmania	Australia	7	-41.795	145.442
Railton Cement Quarry	Tasmania	Australia	7	-41.3246	146.40601
Name				-41.438	145.802

[Save Changes](#)

Web Form

The web form presents place name database editing and queries in a table.

The screenshot shows a web form titled "Places" with a dark background. It contains four main sections, each with a colored header and a table of input fields:

- List (Red Header):** Contains fields for "List places between :", "and :", "where :", "Leave blank for 'all'", "Name contains :", "Region contains :", "Country contains :", and "Minimum Size :". A "List" button is on the right.
- Add (Yellow Header):** Contains fields for "Add New Place :", "Lat", "Long", "Name", "Region", "Country", and "Minimum Size :". An "Add" button is on the right.
- Edit (Orange Header):** Contains fields for "Edit Site where:", "Leave blank for 'all'", "Name contains :", "Region contains :", and "Country contains :". An "Edit" button is on the right.
- Delete (Green Header):** Contains fields for "Delete Site where:", "Enter complete Name, Region & Country Deleted immediately.", "Name is :", "Region is :", and "Country is :". A "Delete" button is on the right.

The first (red) section will produce a list of place names from the database. You can set the boundaries of the extraction using latitudes and longitudes, or where the entry contains a particular word in the name, region, or country. Places have a defined "size" hierarchy, and the list can be set to only show places above a certain size. A page will load after you click the "List" button. You can select all, copy and paste the results into a document.

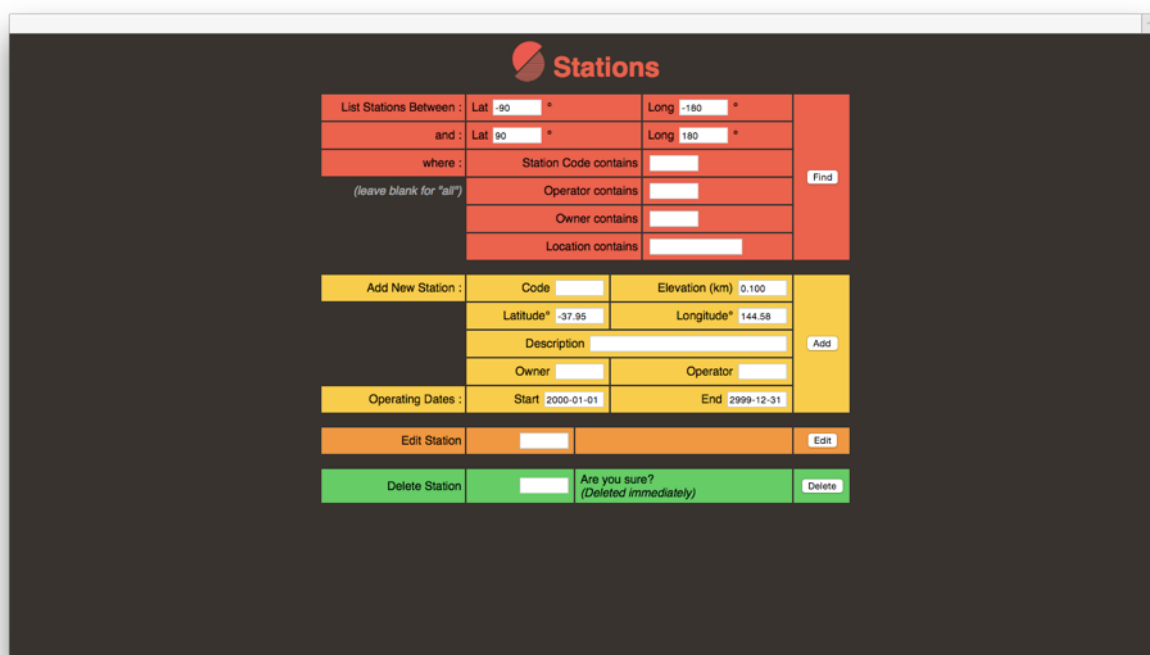
To add a new place name to the database, define its coordinates, name, region, country and category in the yellow section, then click on the "Add" button.

If you wish to edit an existing place, in the orange section type partial text into as many fields as possible to target the intended result. If there are additional entries that match your search field you will see the message "more than 1 row selected", so check that the visible result is the correct entry.

The final green section allows you to delete an entry from the place name database. Enter the name, region and country as it appears in the List result and click "Delete". This will remove the entry, so check your entry to be certain before clicking the button.

Station Database

We use the term "Stations" to define an earthquake monitoring location, which are sometimes referred to by seismologists and geophysicists as "sites" or "seismographs" or "nodes". The default database may contain some stations, which you can view and edit in much the same way as the Place Names web form.



The screenshot shows a web form titled "Stations" with a red header. The form is divided into several sections:

- Search Section (Red):** Contains fields for "List Stations Between : Lat" (with a range from -90 to 90), "Long" (with a range from -180 to 180), and "where :". The "where" section includes checkboxes for "Station Code contains", "Operator contains", "Owner contains", and "Location contains". A "Find" button is on the right.
- Add New Station Section (Yellow):** Includes fields for "Code", "Elevation (km)" (0.100), "Latitude" (-37.95), "Longitude" (144.58), "Description", "Owner", and "Operator". An "Add" button is on the right.
- Operating Dates Section (Yellow):** Includes fields for "Start" (2000-01-01) and "End" (2999-12-31).
- Edit Station Section (Orange):** Includes a field for the station code and an "Edit" button.
- Delete Station Section (Green):** Includes a field for the station code, a confirmation message "Are you sure? (Deleted immediately)", and a "Delete" button.

You can produce a list of stations using latitude and longitude boundaries, station codes and other parameters. Partial text matching will produce results, e.g. using "aust" to search a location description will also list stations described using the terms Australia, Austria, and names such as Faust.

The station code is code of up to five characters made up of letters (typically upper case) and numbers only. The **latitude**, **longitude** and **elevation** are self-explanatory, and the **description** is a human readable text field to help you find stations using relevant keywords. The **owner** of a site may be different to the **operator** of the site, and these are usually short codes that usually relate to the international network code, such a GB for the British Geological Survey or AU for Geoscience Australia.

The **start dates** are useful for historical records, and **end dates** are used to ensure only current stations are plotted on the maps when setting up sub-networks.

To edit or delete station, enter the exact station code, proceeding with caution when deleting a station as the action is immediate and non-reversible.

Live Data



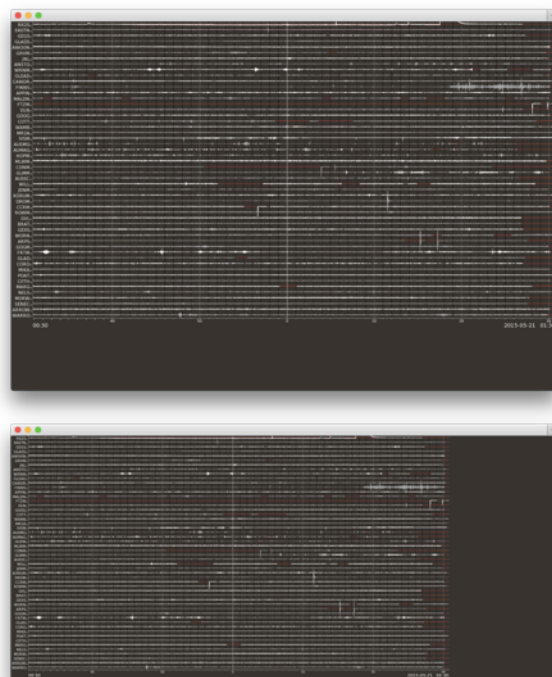
The Live Data display web page displays a high-resolution image of up to the last hour of data received by eqServer. The image is suited to widescreen television displays that have a screen ratio of 16:9, but the image is automatically scaled so that it fits to the browser window resolution.

If your browser window is wider or taller than this ratio you will see a gap at the right or bottom of the image.

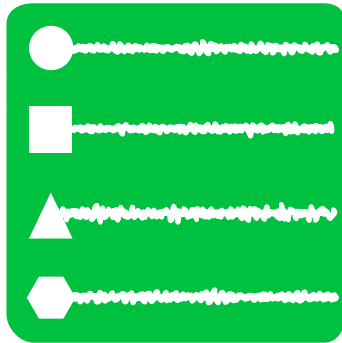
Most web browsers have a full screen or presentation mode that will hide the navigation and tool bars so that your screen will only show your seismic data. The Google Chrome browser has a very clean presentation mode that is well suited for showing this page on an LCD television display.

The web page automatically refreshes at the interval defined in Server Settings.

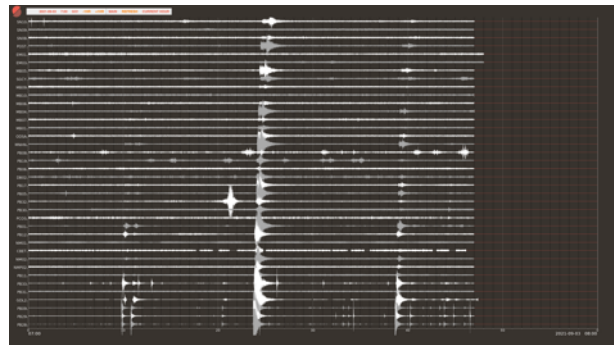
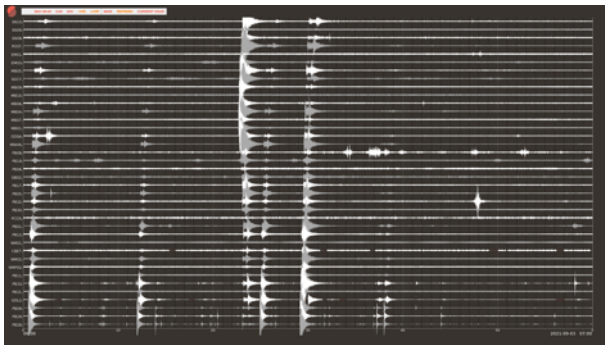
Beware of image burn-in on certain screens (e.g. plasma, OLED)



One Hour

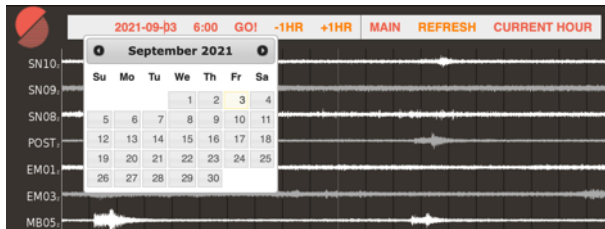


The One Hour display works in a similar way to Live Data in that it shows data from many stations for a one-hour period. The difference is that you can browse back in time in one-hour blocks, and you can view subsets of data as defined by your sub-networks. When you first click on the One Hour icon you will be the last whole hour for stations on your main map (below left). To a sub-network for the same period, mouse over "MAIN" in the toolbar and select the sub-network you wish to view.



You can click on "CURRENT HOUR" in the tool bar to show the waveforms for the current hour (above right) which may be only partially completed as each page starts on the hour.

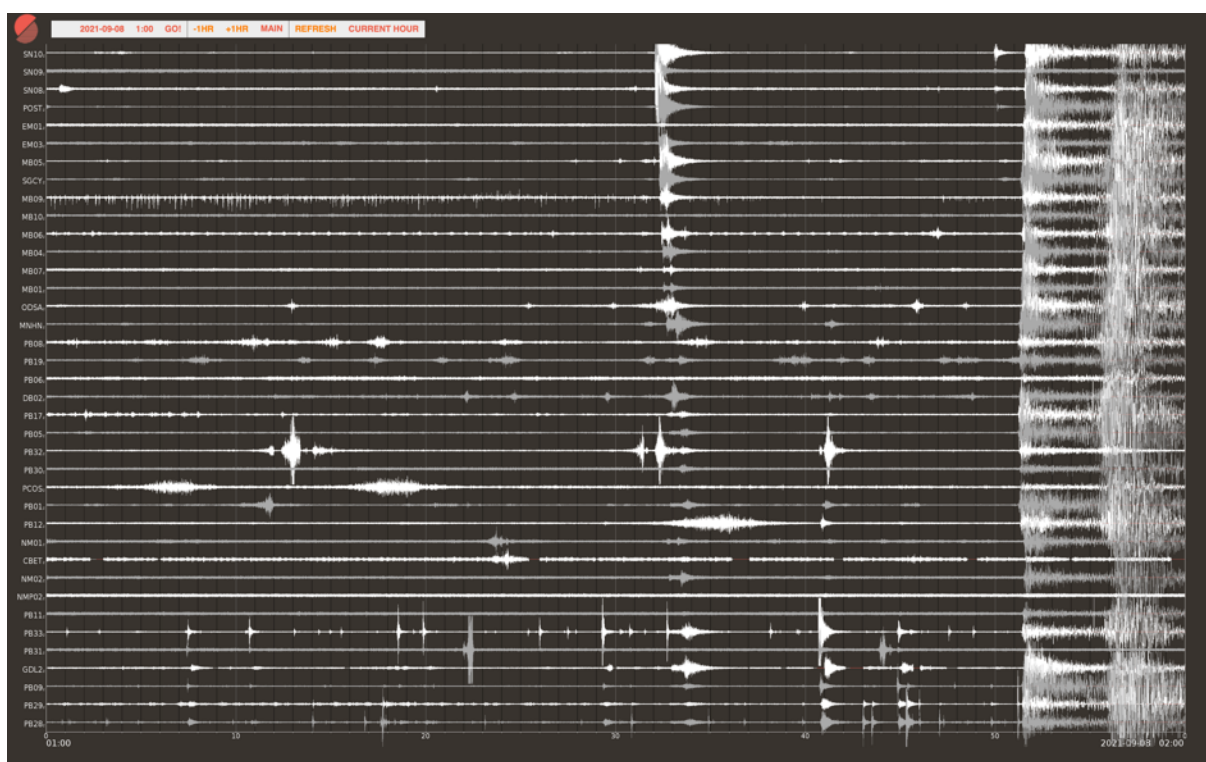
To skip of other dates and times, use the toolbar at the top of the screen:



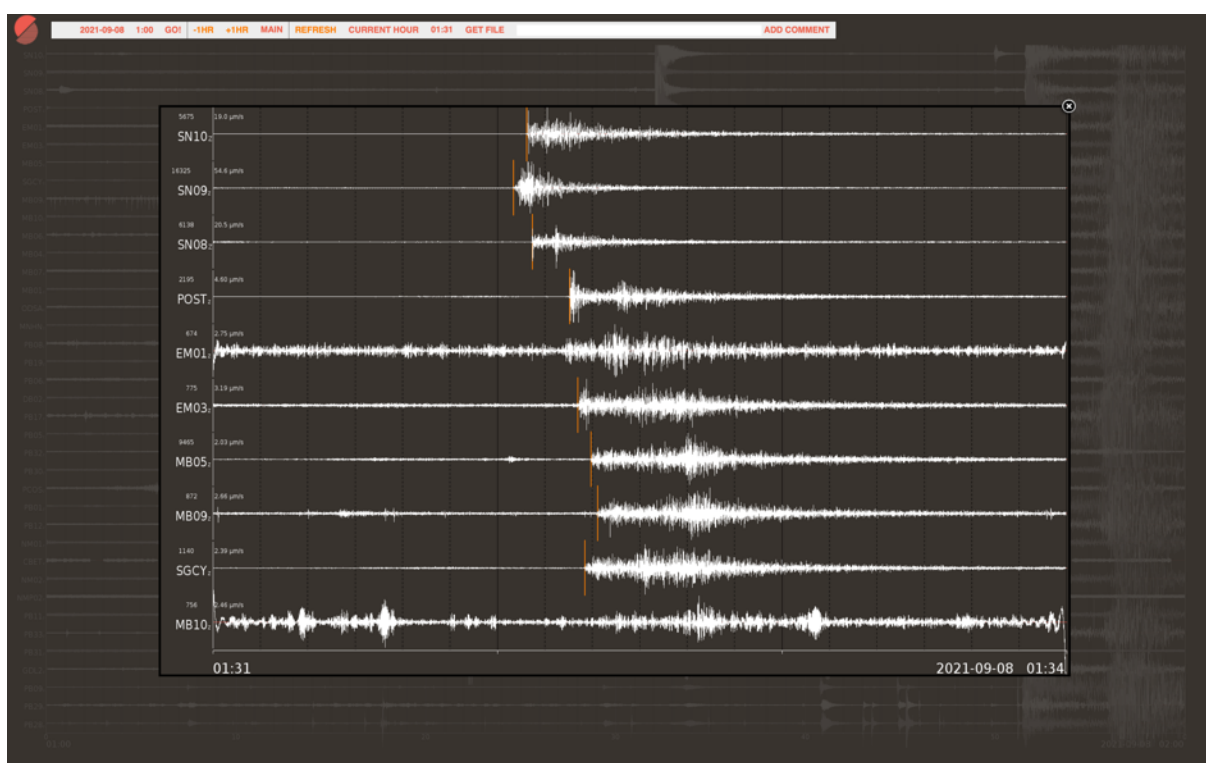
The red Seismology Research Centre "S" logo in the top left corner will always take you back to the home page. Use the "-1HR" and "+1HR" buttons to step through other hourly images, or you can select a date and time

from the menus then click the "GO!" button to jump to a particular hour.

These images are generated on demand and stored in a buffer. If you believe additional data has been sent in since the image was last rendered, click the "Refresh" button to re-render the image from the currently-available waveform data.

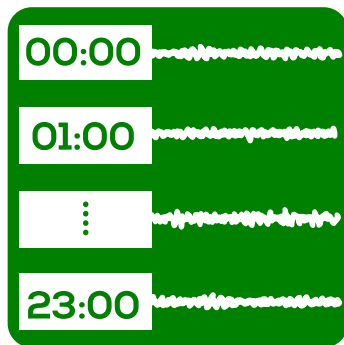


If you see a signal of interest (e.g. above, the local earthquake in the middle of the hour), you can click on any time/channel and a window will pop up a three-minute zoomed image of the data from that station, and from nearby stations (e.g. below).



You can then click on the "Get File" button in the toolbar to download the full resolution waveform files to your computer. You can also add a tag to the time on the event by typing a text description in the toolbar field, then clicking on "Add Comment". This text will appear in the top right of this hour's One Hour page for future reference.

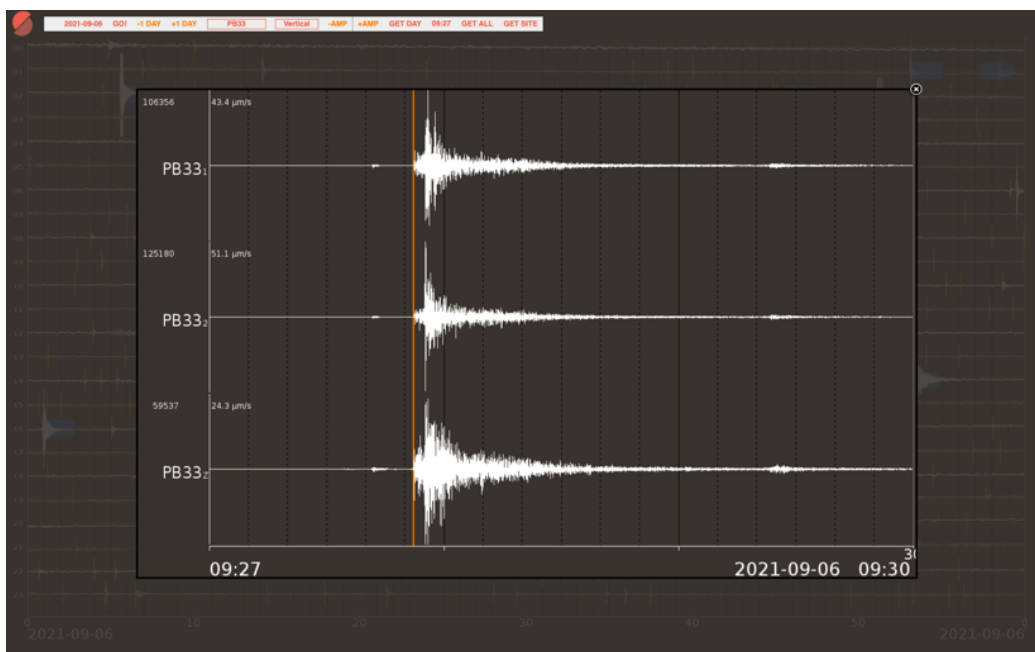
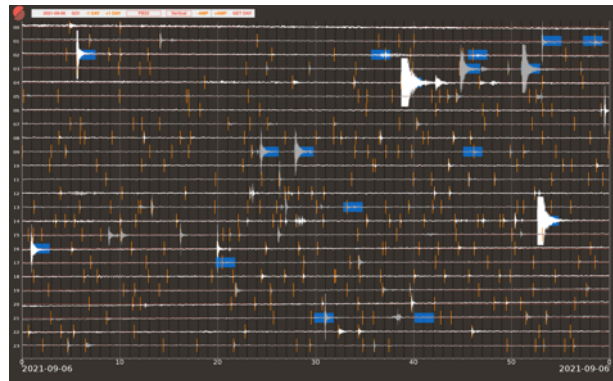
One Day



The One Day display works in a similar way to One Hour. It still shows one hour of data per line, but it shows 24 lines of data from a single station. The image is scaled to fit the available screen area in your web browser. The control panel at the top of the screen is slightly different to One Day as you now use the “plus” and “minus” buttons to step through days rather than hours, and you can select from a list of stations (and channels).

The signal amplitude is scaled based on the average signal level from the first hour of data. If you need more or less amplitude resolution, click on -AMP and +AMP in the toolbar. You can download the entire day of data from this station by clicking “GET DAY” in the toolbar.

The blue markers throughout the day indicate eqServer’s automatic event detections on that day, which may or may not involve the station you are viewing. If the station you are viewing triggered during that day you will see a red vertical line at the trigger time.



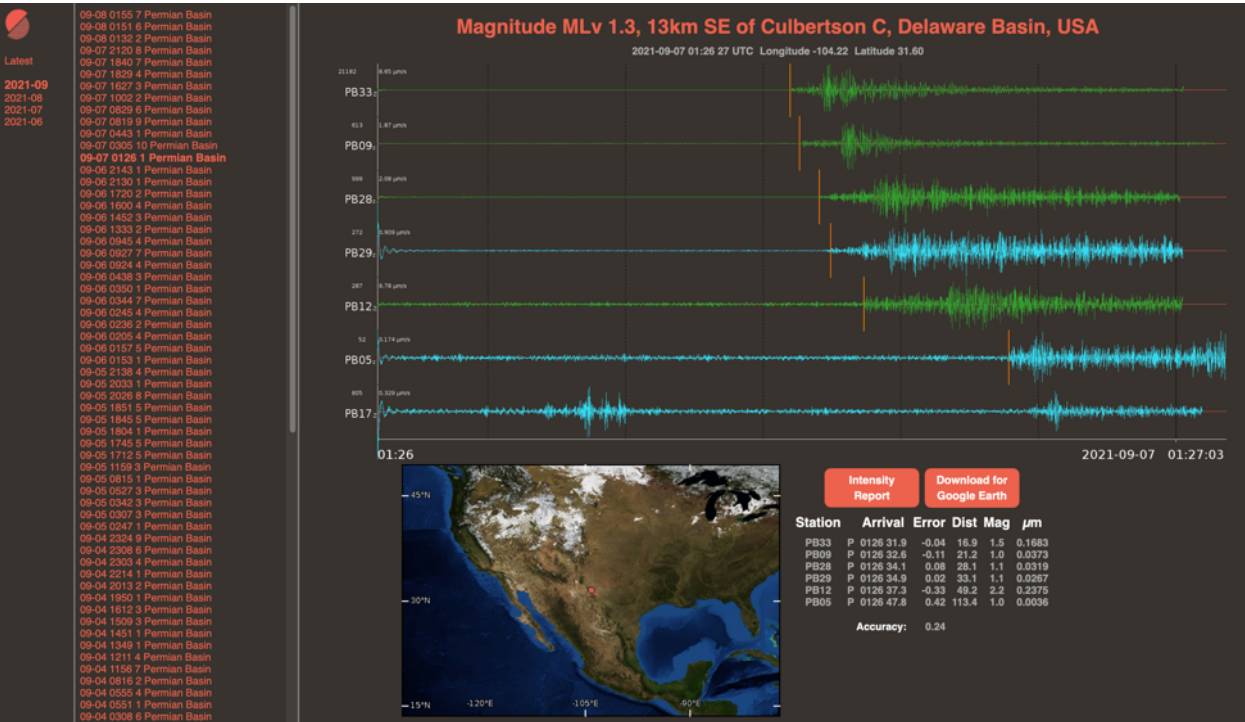
As with One Hour, you can click on an event of interest and see a pop-up window showing three minutes of data from that station. Additional file download options will appear in the toolbar – “GET ALL” will get waveforms from all stations for that time period, and “GET SITE” will just download the waveforms from that station.

Event Reports



One of the main features of eqServer is its ability to automatically detect earthquakes and send out a notification of the estimated location and magnitude. When an event is declared, a bulletin is generated showing the waveforms, a map of the estimated location, and a summary of the data related to the solution.

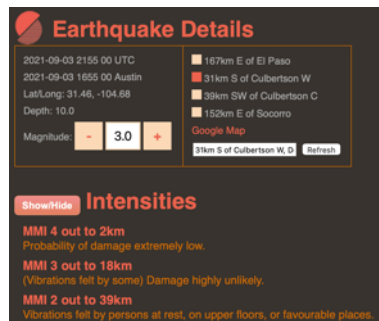
On the left of the screen you will see a list of past months. Click on a month to open a second column that shows a list of automatic event bulletins, in reverse chronological order, suffixed by the name of the sub-network that created the bulletin. Click on a bulletin to load it into the main window to the right.



The estimated magnitude and location of the event is at the top of the screen, followed by the date, time, latitude and longitude of the solution. Below this is an image of the waveforms used in the solution. By clicking on the waveform image you will be taken to the Wave Finder screen, with the date, time, and stations to download preloaded into the relevant fields. You can adjust these as required, which will be discussed later.

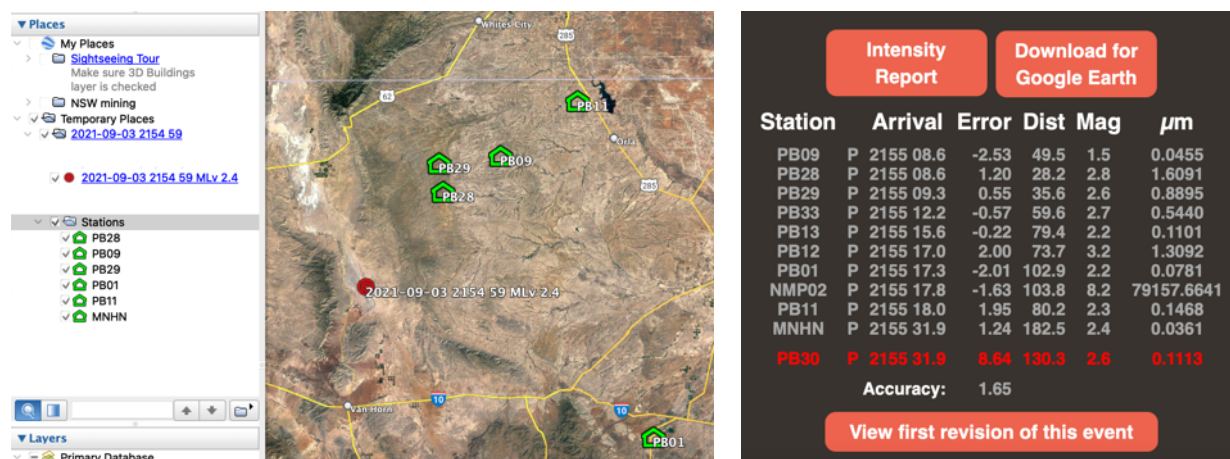
Below the waveforms is a map showing a circle where the automatic solution places the event, with dotted lines connecting it to the location of the stations used in the solution. Clicking on the map will open a new browser window for Google Maps with a pin dropped at the estimated location of the event.

To the right of the map are two buttons and a table with the trigger time and amplitude data from each station. Red text means the data has been deferred from the solution. The **Accuracy** number indicates how well the solution fits with the earth model used and is the standard deviation of the error of the arrivals in seconds. A good solution has a standard deviation of less than 1 second across the arrivals.



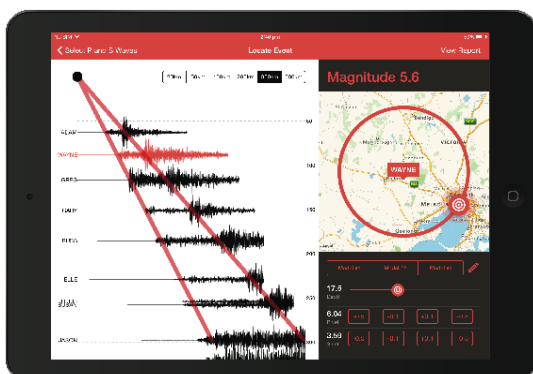
The **Intensity Report** button shows a brief summary of the distances to nearby locations (from your Places database) as well as an estimate of the Modified Mercalli Intensity at various distances based on the depth and magnitude. This uses an attenuation function that applies for southeast Australia, so this estimate should only be used as a rough guide for regions with different ground motion attenuation.

The other button initiates the creation of a KML file to **Download for Google Earth** which you can open with the Google Earth desktop application. By default only the earthquake will be shown as a red epicentre target, but the stations can be turned on in the Places folder.



If there have been several revisions of the automatic solution, you will be looking at the latest version. To view the first revision of the event (which may better match the information received in the notification), click on the button below the data table.

Quick Quake for iOS



These automatic event bulletins are the source of data for our free Quick Quake app for iPhone and iPad. The app connects to your eqServer to browse recent and past bulletins. You can refine automatic solutions by marking a P & S arrival on a single station and moving the earthquake until it roughly fits the expected wave travel times.

For more information visit www.src.com.au/software/quick-quake/

Wave Finder



Wave Finder enables you to extract waveform files from the archive, based on time and location. Wave Finder can be accessed from the Event Reports by clicking on the waveform preview image, or by clicking on the red waveform icon on the home page.

Opening Wave Finder from the home screen will populate the red fields with the current UTC date and time, which will be the start time of the data extraction. Edit these as required to set the start time of the data extraction. The yellow section defines the number of minutes of data to extract from the start time, and you can optionally only extract the vertical channels of data if you have limited download speed. The maximum extraction is 1440 minutes (i.e. one day).

Wave Finder

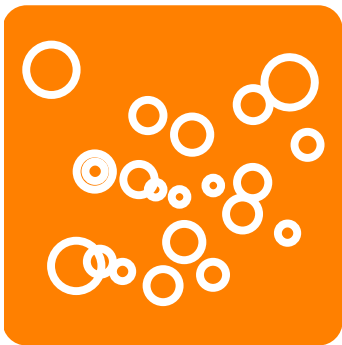
Date	2021-09-10
Time	0338 (hhmm)
Duration	3 minutes <input type="checkbox"/> Only Vertical
Get data from	All Stations
Specific Stations	CBET DB02 EM01 EM03 MB01 MB02 MB04 MB05 MB06 MB07 MB08 MB09 MB10 MNHN NM01 NMP02 ODSA PB01 PB02 PB05 PB06 PB07 PB08 PB09 PB11 PB12 PB13 PB17 PB18 PB19 PB28 PB29 PB30 PB31 PB32 PB33 PECS POST SGCY SN08 SN09 SN10
Stations near this station	Radius: 300 km Site:
Stations near this location	Radius: 300 km Latitude: -37.000 Longitude: 144.000
File format	SUDS <input checked="" type="radio"/> Miniseed <input type="radio"/>

Get Waveform Get Image View Image

The orange section tells eqServer which stations to include in the data extraction. You can get data from: all available stations; specific stations (by typing in their station codes, separated by spaces, or by clicking on a sub-network button to auto-fill the station codes); from all stations within a certain distance of a particular station code; or from all stations within a certain distance of a particular latitude/longitude.

The last section deals with the data format. If you are using Waves to view the waveform files, we recommend using the SUDS format so that any available meta data is automatically applied in Waves. You can alternatively extract the data in MiniSEED format, which is also readable by Waves. Click on the "Get Waveform" button to download the file, or simply preview or download an image of the files using the other buttons.

Event Finder



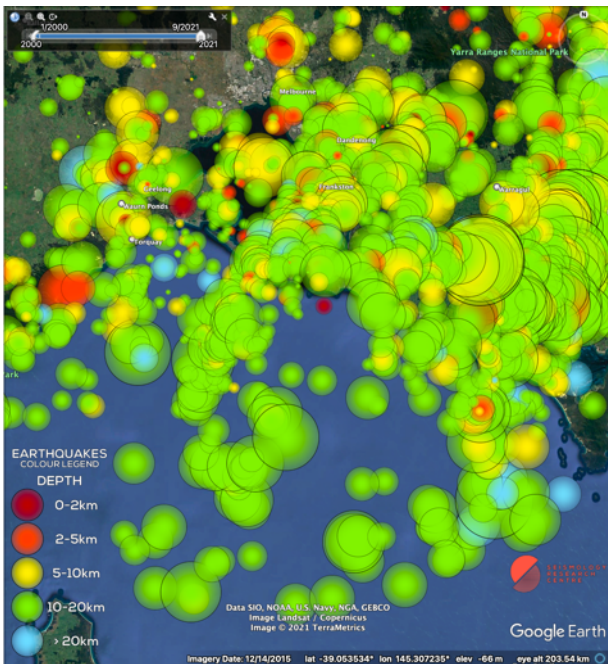
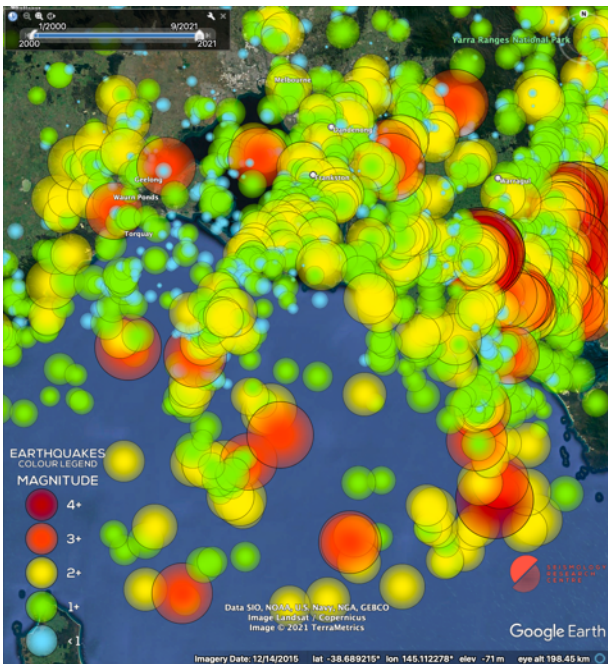
Event Finder allows you to extract a list of events from the database. The form is self-explanatory, defining date and distance ranges for the query.

Six search filter options are available based on the

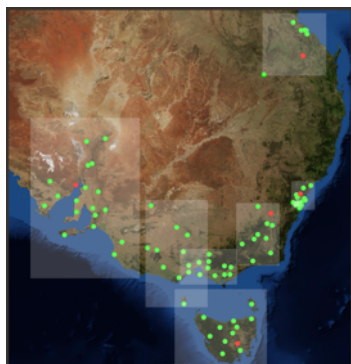
various parameters stored in the database by the location application, whether generated by eqServer’s automatic algorithm, or by our interactive data analysis applications eqFocus or Waves (v4.1 or later).

The green section at the bottom of the form defines the format of the data extracted from the event database. The standard format is a fixed width text-based output, with other text formats for various third-party applications.

There is an option to generate a Google Earth .kml file based on the event list. This creates a time-stamped list of events that can be animated over time in Google Earth. Each event appears as a dot on the map, with the dot’s colour based on magnitude (below, left) or depth (below, right); the dot’s size based on scaled magnitude or fixed to a certain scaled size; and the dot’s depth either locked to the ground level or offset into the sky so that planes of event activity can be seen above where they occurred (Google Earth will obscure dots that are underground).

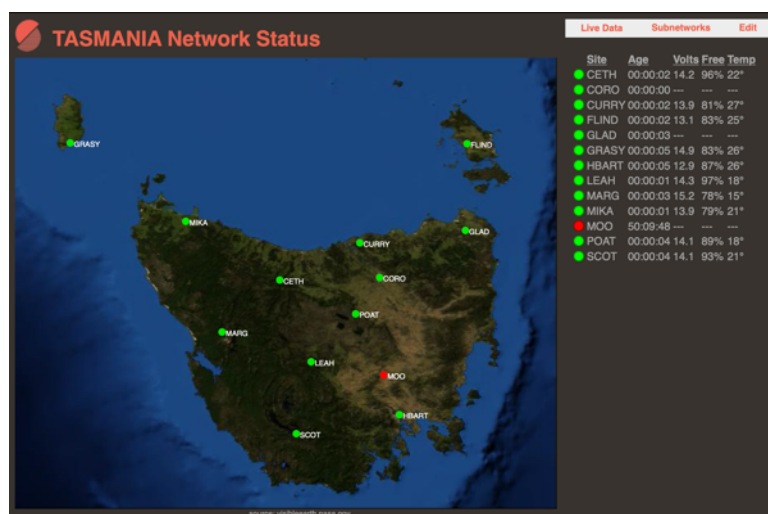


Network Status Maps



Your sub-networks are drawn as transparent boxes over the main map on the home screen. Within each of these areas will be markers showing the location of your stations, and their data age as green, yellow, or red circles or triangles.

For a more detailed view of your station status, click on a sub-network area to bring up the Network Status summary page for that sub-network.



Don't worry if your areas overlap and your click brings up the wrong map – you can change to another sub-network from the list of **Subnetworks** that appears at the top of the page.

The toolbar at the top of the screen also contains a link to **Live Data**, which displays the current One Hour page for this sub-network. This page does not

automatically refresh, but can be manually updated using your browser controls.

The other menu item allows you to **Edit** the detailed **Settings** for the sub-network (i.e. which stations appear on the map, display and trigger settings, event association settings), edit the **Map**, or add upload a **Custom Map** image. The latter options allow you to define the boundaries of the map, retaining the settings (stations, display, etc) for the stations that remain within the boundaries of the map.

Health Graphs

If the seismographs that are sending data into eqServer are also sending station health data, such as battery voltage, temperature, and memory storage remaining (a standard feature of SRC-developed Kelunji seismographs) then this data is displayed in a table on the right of the screen. Data from SeedLink servers do not have this meta data and will appear blank. The age of the data is calculated by eqServer.

Stations that send in health data may include GPS synchronisation information – if there is an issue with the GPS a message of “no sync” will be displayed, but this message will also appear if no time synchronisation information is available, as will be the case for SeedLink data. In this case we assume the data is time synchronised.

This meta data is being stored in the eqServer database and can provide a useful historical health record for each station. Click on the station marker in the list or on the map to bring up the last 7 days of station data.



Mains-powered stations will usually show a steady voltage, whereas solar panel powered stations (as in the example above) will vary depending on solar exposure. Equipment installed in vaults will have stable temperatures, whereas more exposed installations will vary with ambient temperatures. Draw a box on a graph to zoom into the selected area. Revert to the full view using the orange button in the top right of the screen. Use the expand/close control in the top right of each window to maximise your view.

Select other stations from the toolbar and enter a different number of days to review from the current date, or from a particular date for this number of days. Long term trends can be useful in diagnosing issues such as solar panel damage or degradation, extreme temperature effects, memory issues, changes in cellular data reception, etc.

The "Live Data" link in the tool bar will take you to the 24-hour data view for that station.

This station status data can be downloaded as a text file using the link in the toolbar.

Gecko Stations

If you have SRC-made Gecko seismographs sending data to your eqServer, you can edit their settings and update their firmware through the eqServer web interface. Click on the orange & black button on the bottom of the eqServer home screen to see a list of Gecko stations.

Gecko Hub Stations

Restart

Code	Serial No.	Firmware	Settings	Fetch Data	Queue Downloads
CDF01	02000616	6.4.4635	Edit	Get 0000 to 0002	Date: 2021-09-14
CDF02	02000562	6.4.4635	Edit	Get 0000 to 0002	From: 0000 UTC
CHPP0	02000152	6.3.4630 Update	Edit	Get 0000 to 0002	Duration 2 : Minutes
CHPP1	02000173	6.3.4630 Update	Edit	Get 0000 to 0002	
REJE0	02000629	6.3.4630 Update	Edit	Get 0000 to 0002	
REJE1	02000158	6.3.4630 Update	Edit	Get 0000 to 0002	
WSHO0	02000174	6.3.4630 Update	Edit	Get 0000 to 0002	
WSHO1	02000132	6.3.4630 Update	Edit	Get 0000 to 0002	

Upload Rasbora.bin file

Current build: 4635

Choose file

Upload

Offline Stations

Any Gecko stations that have been recently connected but are currently offline will be listed below station table. The amount of elapsed time since they were last online is also displayed.

Code	Serial No.	Firmware	Settings	Fetch Data	Queue Downloads
SHORT	02000341	6.8.4657	Edit	Get 0000 to 0002	<div>Date: 2021-09-14</div> <div>From: 0000 UTC</div> <div>Duration 2 : Minutes</div>
TOOL	02000589	6.7.4645 Update	Edit	Get 0000 to 0002	
Offline					
		Last Online			
GECKO	02000634	20 hours ago			
Upload Rasbora.bin file					
Current build: 4657					
Upload Choose File no file selected					

Updating Gecko Firmware

At the bottom of this page there is a form that allows you to upload the latest Gecko firmware (Rasbora.bin) to your eqServer so that it can be uploaded to remote Gecko units at your convenience. The current build number of Rasbora.bin that resides on the server is shown in this form's title. Download the latest firmware from [ESS Earth Sciences](#) and choose this file to upload to eqServer. Any Gecko stations that are eligible to be updated to this version will now have an "Update" button next to their existing firmware version.

Clicking on the station code will take you to the health graphs page for that station. Clicking on the "Edit" button in the "Settings" column will show you a web page with all of the settings and controls that you can remotely control for that Gecko.

Edit: Gecko Remote Control

The Gecko seismic data logger is designed to initiate a connection with a remote data server: either eqServer running at a data centre; or Streams running on a PC – in either case operating on computers with a fixed IP address or domain name. Once connected, a Gecko can be remotely controlled to change settings or take certain actions.

The screenshot displays the 'TOOL' web interface for editing Gecko settings. The browser address bar shows 'Not Secure - vip.kelunji.net'. The interface is divided into several panels:

- Settings:** Includes 'Station Codes' (Station Code: TOOL, Network Code: , Location ID - 3D: 00), 'Signal' (Sample Rate: 100 sps, Input Amplifier: x8, Channels to Store: E N Z SUM), 'Telemetry' (Stream Continuous & Triggers, Triggers Only, Channels to Stream: E N Z SUM), and 'Alarm Outputs' (Alarm #1: Off, Alarm #2: Off, Normally: Open, Alarm Duration: 120).
- Sensor:** Titled '3D Sensor' with a 'Change' link. Fields include Sensor Serial No: 12345, Name: ESS LFA-HR, Type: Acceleration, Sensitivity: V/g, Channel E: 15, Channel N: 15, Channel Z: 15, Drift Compensation: Off, Cal Enable: None, Cal Duration: 4 seconds, Cal Type: Sine (L), Cal Sine Freq: 5 Hz, SIG+ Mode: Normal, SIG- Mode: Normal, and DC Offset: Normal.
- Trigger and Alarm:** Contains 'Level Triggering - High' (Enable: Off, Sensor to Check: 3D 1D, Trigger Level: 5.00 % / 0.00833 g) and 'Level Triggering - Low' (Enable: Off, Sensor to Check: 3D 1D, Trigger Level: 5.0 % / 0.00833 g). It also has 'STA/LTA Triggering' (STA/LTA Triggering: Off, Threshold: 3.00, STA Window Size: 2.00, LTA Window Size: 30.00, Filters: Off, Channels to Check: 3D) and 'System Alerts' (Low Voltage: 11.9, High Temperature: 55).
- Sensor Controls:** Features buttons for 'Mass', 'Unlock', 'Lock', 'Centre', and 'Initiate', along with a 'Calibration Sequence' button.
- Advanced Controls:** Includes a 'WARNING!' section with text: 'Using these control will initiate actions that may cause a break in the communication link with the Gecko, and may result in loss of data. Proceed with caution.' and a 'Show' button.

A 'Save' button is located at the bottom center of the interface.

All Gecko settings apart from the communication configuration (which could potentially break the link between the Gecko and the server) are exposed in a single page for you to modify. See the Gecko user manual for a full explanation of the function of each setting. If you have a 4-channel Gecko with both 3D and 1D sensor inputs, the 1D sensor editor will appear below the 3D sensor section.

If the sensor connected to your Gecko requires mass control, these signals can be initiated using the buttons under the "Sensor Control" table. Similarly, if your sensor has a calibration circuit, the calibration signal generation can be initiated using that button.

Advanced Controls

A number of actions that can affect your Gecko's ability to record data are hidden behind a warning. As stated: "Using these control will initiate actions that may cause a break in the communication link with the Gecko, and may result in loss of data. Proceed with caution."

Note that formatting the SD card can take several minutes.

Offset correction will take the average of the sensor signal over two seconds and remove that offset from the signal. This can aid with data compression if there is a large offset in your sensor signal. Sensor Power control is only available on Gecko digitisers produced from late 2020.

Advanced Controls

WARNING!

Using these control will initiate actions that may cause a break in the communication link with the Gecko, and may result in loss of data. Proceed with caution.

Reboot Firmware

Reboot

Restarts operating system. Reboot takes approximately 10 seconds. Communication link may be interrupted for a longer period.

Format SD card

Format

All data on the SD card will be lost. Can take several minutes to complete.

Offset Correction

Zero

Clear

Zero to remove the offset from each channel.

Clear correction for raw data including offset.

Local Alarm

Clear Alarm

Stops alarms if manual override required.

Log Level

Info

Update

Sensor Power

Off

On

Fetching Data from Gecko Stations

Gecko stations can be configured to stream continuous data to eqServer, or to stay connected and only send data when an earthquake is detected, or to stay connected and only send data that is manually requested by eqServer users. This manual data request can also be used to backfill any gaps in data that might have been caused by a break in data telemetry.

Data in a Gecko is continuously stored on an SD card in one-minute long MiniSEED files. eqServer can be asked to request a number of these minute-files from a station. Enter the start date/time and the duration of data you want the Gecko to send to eqServer using the "Queue Downloads" form. The time period will appear in a button in the station table in the Fetch Data column. Click on the button to request data from that Gecko. These minute-file requests will be added to a queue.

Code	Serial No.	Firmware	Settings	Fetch Data	Queue Downloads
CDF01	02000616	6.4.4635	Edit	Get 0000 to 0002	Date: 2021-09-14 From: 0000 UTC Duration: 2 : Minutes
CDF02	02000562	6.4.4635	Edit	Get 0000 to 0002	
CHPP0	02000152	6.3.4630 Update	Edit	Get 0000 to 0002	
CHPP1	02000173	6.3.4630 Update	Edit	Get 0000 to 0002	
REJE0	02000629	6.3.4630 Update	Edit	Get 0000 to 0002	
REJE1	02000158	6.3.4630 Update	Edit	Get 0000 to 0002	

Gecko Hub Stations					
Restart					
Code	Serial No.	Firmware	Settings	Fetch Data	Queue Downloads
CDF01	02000616	6.4.4635	Edit	Get 0000 to 0002	Date: 2021-09-14 From: 0000 UTC Duration: 2 : Minutes
CDF02	02000562	6.4.4635	Edit	Get 0000 to 0002	
CHPP0	02000152	6.3.4630 Update	Edit	Get 0000 to 0002	
CHPP1	02000173	6.3.4630 Update	Edit	Get 0000 to 0002	
REJE0	02000629	6.3.4630 Update	Edit	Get 0000 to 0002	
REJE1	02000158	6.3.4630 Update	Edit	Get 0000 to 0002	
WSHO0	02000174	6.3.4630 Update	Edit	Get 0000 to 0002	
WSHO1	02000132	6.3.4630 Update	Edit	Get 0000 to 0002	

Once these data files have arrived, they will be added to the general waveform archive. If you re-enter or refresh this page, a list of recently-completed download requests will be shown, with a convenient button to download each minute file. You can view and/or merge these data files using [Waves](#), our free waveform analysis application for Windows, macOS and Ubuntu

GECKO SEISMOGRAPHS & ACCELEROGRAPHS



GECKO COMPACT

**3+1 Channel
Digitisers
To Record
Any Brand
Of Sensor**



BLAST, FORCE and SMA

**Low Cost Portable
Velocity and
Acceleration
Vibration
Monitors**



**SMA-HR and -XR, TREMOR,
PRISM-SP, -MP and -LP**

**Professional
Earthquake
Seismographs
and
Accelerographs**