
CISN Display User's Guide

Real-time Earthquake and Tsunami Hazards Alert System by the California Integrated Seismic Network (CISN)

CGS / USGS / OES / Caltech / UCB

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Funding Sources and Development Partners

The CISN Display was developed as a cooperative project of the California Integrated Seismic Network (CISN), whose members include the California Geological Survey (CGS); the United States Geological Survey (USGS); the California Governor’s Office of Emergency Services (OES); the California Institute of Technology, Seismological Laboratory; and the University of California, Berkeley, Seismological Laboratory. Leadership was provided by Caltech and the USGS in Pasadena. Funding for the project comes from OES, USGS, Federal Emergency Management Agency/OES Hazards Mitigation and Emergency Management Performance Grant Programs, and the National Tsunami Hazard Mitigation Program of the National Oceanographic and Atmospheric Administration (NOAA). Additional in-kind support was provided by Instrumental Software Technologies Incorporated (ISTI), developers of custom software solution for remote sensing applications. The CISN Display was developed under contract with ISTI.

For technical assistance, or other questions regarding the CISN Display please visit the help pages at www.cisn.org/software/cisndisplay.html, or contact one of the CISN member organizations and ask for their CISN Display helpdesk representative.

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Hugo Rico Jr. - CISN Display Project Lead

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1.0 CISN Display User's Guide

This user's guide covers the CISN Display (version 1.2) software program designed to run on a workstation for delivery of vital earthquake hazards information. Sections of this document also cover the QuakeWatch¹ Server and its use with the CISN Display client application. As further enhancements and updates are made to the CISN Display and QuakeWatch server software, this document will change to reflect the application's new utilities. For up to date information please contact your organizational CISN Display support representative, or visit the www.cisn.org/software/cisndisplay.html info pages to download the latest documentation, access publicly available GIS layers, sign up with the CISN Display list-server, and view CISN news releases regarding the software.

1.1 User's Guide Intended Audiences

Much of this document is intended for emergency managers, 24/7 center dispatchers, news reporters and other key decision makers; consumer of critical information who help formulate a rapid and organized response to an earthquake or tsunami emergency. However, many aspects of the User's Guide are better suited for network administrators and information systems specialists who manage and maintain software programs. In particular section 3.0 that describes the client software installation and setup, as well as section 4.0 that details the Internet access and networking requirements necessary for the client to receive event messages are especially relevant to your IT department. In many cases the participation of these specialists will be key to the successful implementation of the CISN Display for earthquake information gathering purposes. Thus it is essential that users requesting this service involve their IT departments early in the program integration process, to determine if there will be any special requests that must be submitted to management personnel, and to minimize confusion so that internal policy issues can be addressed in a timely manner.

1. The back-end server software, offered as a supplement to all critical users, which feeds earthquake data to CISN Display clients. The QuakeWatch server can offer small and large agencies/companies more flexibility, enhanced security, and increase user-capacity of CISN Display users within their organization.

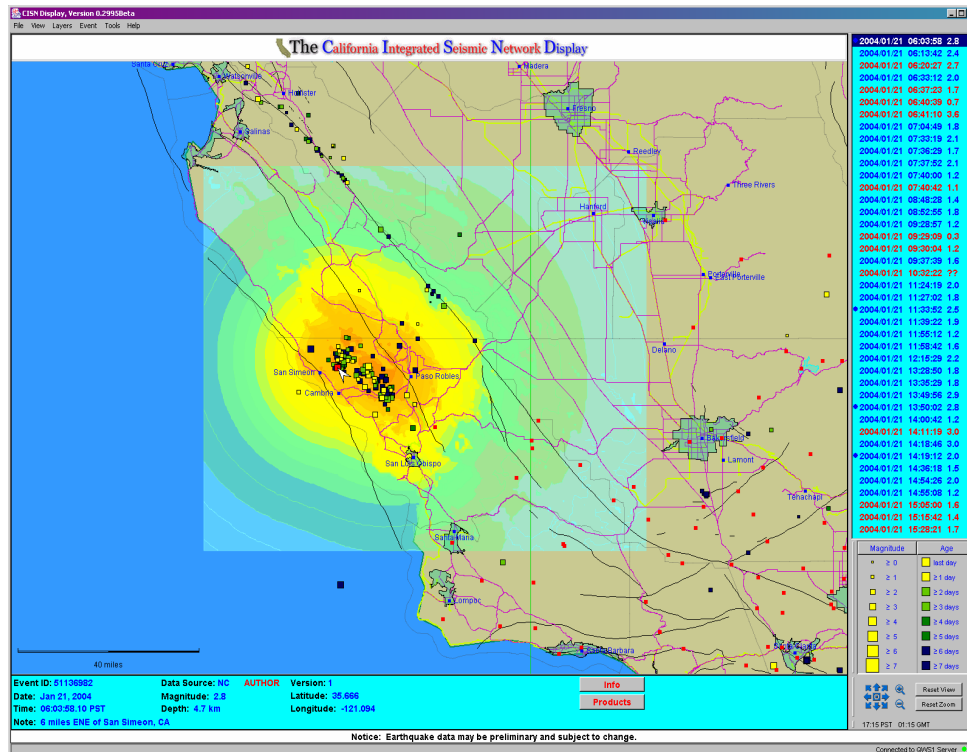


Figure 1: CISN Display with San Simeon M6.5 (2003/12/22) ShakeMap overlay.

1.2 Project Summary

Welcome to the CISN Display/QuakeWatch earthquake information system: *a next-generation, earthquake/tsunami alert and hazards notification system for the modern emergency operations center.* The California Integrated Seismic Network, and other partners, have collaborated to develop this next-generation display and alert system that promises to deliver vital decision-making information to the 24/7 responders statewide and beyond. This application will replace the CUBE/REDI system, as the principle means of delivering graphical earthquake alerts to critical users tasked with an earthquake response role. Following a significant earthquake the CISN Display will notify users, in near real-time, of seismicity as well as other Web-based hazards information. This program is expected to provide emergency managers, life-line operators and media organizations with the information and tools necessary to effectively deploy limited personnel and resources in support of recovery efforts following a major earthquake. This project helps fulfill a CISN mission, to disseminate earthquake information in support of public safety, emergency response and loss mitigation. The program suite includes a client GUI known as the CISN Display, a server module identified as the QuakeWatch Server, and a CORBA messaging middleware supporting an XML message schema. Together, these components form an alert and information system that is fast, reliable, and geared for future growth.

1.2.1 Real-Time Earthquake Display

Primary to the CISN Display's operation is its active monitoring of near real-time seismicity, and other geo-hazards information published on the Web. The application can be configured to display

seismicity of local, regional, and global events, based on user's needs. Newly received messages and updates of earthquake events are immediately posted to the program's display. Virtually all functions previously available in CUBE/REDI have been replicated in the CISN Display. However, the new system also boasts a number of upgrades that enhance its functionality as well as its reliability and robustness. New improvements include stateful connectivity, server fail-over capability, data persistence, platform independence, a highly configurable graphical-interface and modular software architecture. All these design improvements combine to form the basis of a highly scalable client, and introduce a new level of situation awareness no previously available from a single piece of software.

1.2.2 Gateway to Other Earthquake Products

A second, but equally important function of the CISN Display is its service as a Web-portal to all relevant earthquake hazards information produced after a large earthquake. Such Web-based products currently available for delivery are ShakeMap, HAZUS input files, Felt Reports (CIIM pages), Focal Mechanisms, Waveform data, Aftershock Forecasts, Tsunami Warning messages and more. URLs to these and other Internet products are automatically created on the CISN Display and made available so users have quick access to crucial decision-making information. ShakeMap, which displays the pattern of ground shaking, can be selected to appear in a separate browser window as soon as it becomes available on the Web. This portal aspect of the CISN Display, will facilitate the rapid distribution of additional online tools and services that are useful to emergency managers.

1.2.3 GIS Mapping Capabilities

In an effort to provide critical users a means of performing initial assessments of potentially damaged infrastructures, a GIS mapping engine has been integrated into the CISN Display. Thanks to the OpenMap project CISN Display interface is able to plot many available formats of GIS vector-layers. This feature allows users to make quick and reasonable assessments of potentially damaged infrastructure, when viewed alongside earthquake hazards information such as ShakeMap. In addition to geo-political boundaries such as state and county lines, users may import GIS graphics representing roadways, airports, railroads, bridges and other public lifelines vulnerable to earthquake damage. This mapping feature allows each organization to customize the application to their operation's needs. Another added GIS capability is the ability of the CISN Display to automatically download and plot ShakeMap shape files directly onto the display map. This is the same source-data used to generate the Web-based ShakeMap.

1.2.4 Additional Benefits

One of the many additional benefits to come from CISN Display's development is its ability to extend its utility beyond California. The transport layer, Quake Data Distribution System (QDDS), allows the application to receive notification of national as well as worldwide earthquakes. This uniquely allows the CISN Display to perform as a comprehensive geo-hazards alarming tool, which also supports a configurable user interface. As a result, the CISN Display is easily adapted to seismic networks across the US, by including notifications outside the CISN's region.

1.3 Development Partners

The CISN Display was developed as a cooperative project of the California Integrated Seismic Network (CISN). The CISN members include the California Geological Survey (CGS); the United States Geological Survey (USGS); the California Governor's Office of Emergency Services (OES); the California Institute of Technology, Seismological Laboratory; and the University of California, Berkeley, Seismological Laboratory. Funding for the project is provided by OES, USGS, FEMA/OES Hazards Mitigation and Emergency Management Performance Grant Programs, and the National Tsunami Hazard Mitigation Program of the National Oceanographic and Atmospheric Administration (NOAA). In-kind support was also provided by Instrumental Software Technologies Incorporated (ISTI), developers of remote-monitoring, custom software solutions, and CISN Display. For more information regarding CISN Display or the CISN cooperative project please visit the support documentation pages at <http://www.cisn.org/software/cisndisplay.html>, or contact one of the CISN member organizations providing CISN Display help-desk support.

2.0 CISN Display Registration and Account Creation

To access the CISN Display’s messaging service users will need to register their organizations and then create account logins for access to the client software. The registration schema and account creation steps are explained below in detail, but if users wish to short-cut to the registration process they can do so by accessing the Quick Start guide at: http://www.cisn.org/software/data/DOCS/CD_QuickStart.pdf. This document reduces the process to its minimal parts as well as the download and installation of the CISN Display software. Users comfortable installing their own software and familiar with their operating systems should have no trouble completing these steps.

2.1 Registration Process

Due to the limited availability of system resources to operate the QuakeWatch messaging service not everyone will have access to the CISN Display application. To ensure that the intended critical user audience has access to the CISN Display and the information it provides, organizations will be required to successfully complete a registration process and generate user accounts. The registration entails the use of an online form to **create an organization profile, validate email accounts, appointment of a local-administrator, and ultimately creation individual user accounts.**

In practical terms, this process attempts to restrict the use of the CISN Display to organizations with a legitimate emergency-response role, or news gathering/reporting activities. However, the registration process is not an attempt to restrict information from the general public. General interest users seeking current and archival earthquake information for the US and around the world are encouraged to visit one of the many publicly available Web pages hosted by the CISN, USGS or NOAA²

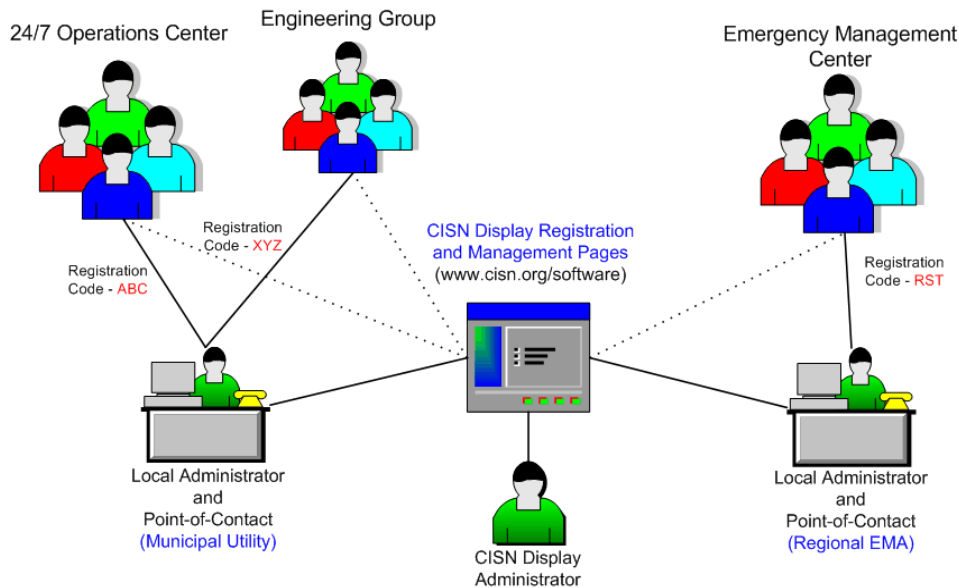


Figure 2: Illustration of the relationship between a central CISN Display Administrator, Local Organizational Admins and end-users; and their connection to the CISN Display Management pages.

2. Accurate sources for earthquake and tsunami information are: www.cisn.org, quake.wr.usgs.gov, earthquake.usgs.gov, www.anss.gov, neic.usgs.gov and wcatwc.arh.noaa.gov/tsunamiwatcher.htm.

2.1.1 The Local Administrator

The registration process employs a hierarchical structure (fig. 2) to facilitate the management of potentially thousands of individual user accounts nationwide and around the world. If a central CISN Display administrator was required to approve all individual user requests for accounts, this task would likely become overwhelming for a small number of people. However, by only needing to approve local-administrators for large organizations, and delegating the approval of individual organizational accounts to the local-Admins, this task becomes much more manageable for all involved. CISN central administrators can then spend their time targeting other organizations tasked with an emergency response roles, or maintenance of critical infrastructure vital for public safety; and local-Admins can distribute the CISN Display software to 24/7 center operators, and other key personnel within their group.

Thus this schema attempts to maximize the use of “local administrators” to manage user accounts at the department/organization level. Local admins will be responsible for issuing and managing of organizational user accounts, requesting new registration codes for creation of additional account, and assisting with rudimentary technical support at the local level. The local administrator should approve CISN Display accounts in support of the organization’s mission during an earthquake emergency response, and per a local access policy. To a large extent local admins will be the main point-of-contact for local CISN Display users, and the only point-of-contact a central CISN Display administrator will generally deal with.

Depending on the organization’s needs, the level of local-administrator responsibility will vary from one organization to another. In many cases local admins will only need to manage a few accounts to satisfy organizational requirements. In other instances these admins may have to issue dozens of accounts, to multiple departments, and situated at off-site locations. Some local administrators may also be asked to maintain a local relay-QuakeWatch server to increase user capacity throughout the enterprise. Whatever the requirements, these criteria will be established by each organization and their needs for access to the earthquake information CISN Display provides.

Likely candidates for the CISN Display local administrator may represent a variety of backgrounds. Some local-Admins may be emergency center dispatchers who monitor the Display daily. Other admins might be proficient GIS specialist or helpdesk personnel. And still others may be engineering personnel responsible for facility operations and other infrastructure. In every case, local administration duties and will be the prerogative of each organization.

2.1.2 Registration Criteria

To access and operate the CISN Display and QuakeWatch server software, users must successfully complete registration process as illustrated in the simplified graphic in figure 3, on the CISN Display management pages. The CISN Display management page is available through <http://www.cisn.org/software/cisndisplay.html> where interested users may learn more about the software, and its utilities. A much more detailed registration-flow diagram is available at www.cisn.org/software/data/DOCS/CD_Registration_Login_Flow_v7.gif.

System resources to support the CISN Display message service are limited, thus to ensure that the intended critical users will have access to earthquake alerts, organizations will be required to meet a minimum criteria described in the CISN's access policy document: http://www.cisn.org/software/access_policy.html. Applicants requesting access to the service will be approved per this published policy. Hence, the purpose of the registration process is to target key public agencies tasked with an emergency response role after an earthquake. Additionally, operators responsible for maintaining critical infrastructure, lifeline services and new gathering and reporting activities will also be targeted for the service. Since a rapid response from these key agencies can have a profound effect on the public safety, the CISN hopes to maximize their limited resources by supporting these key constituents.

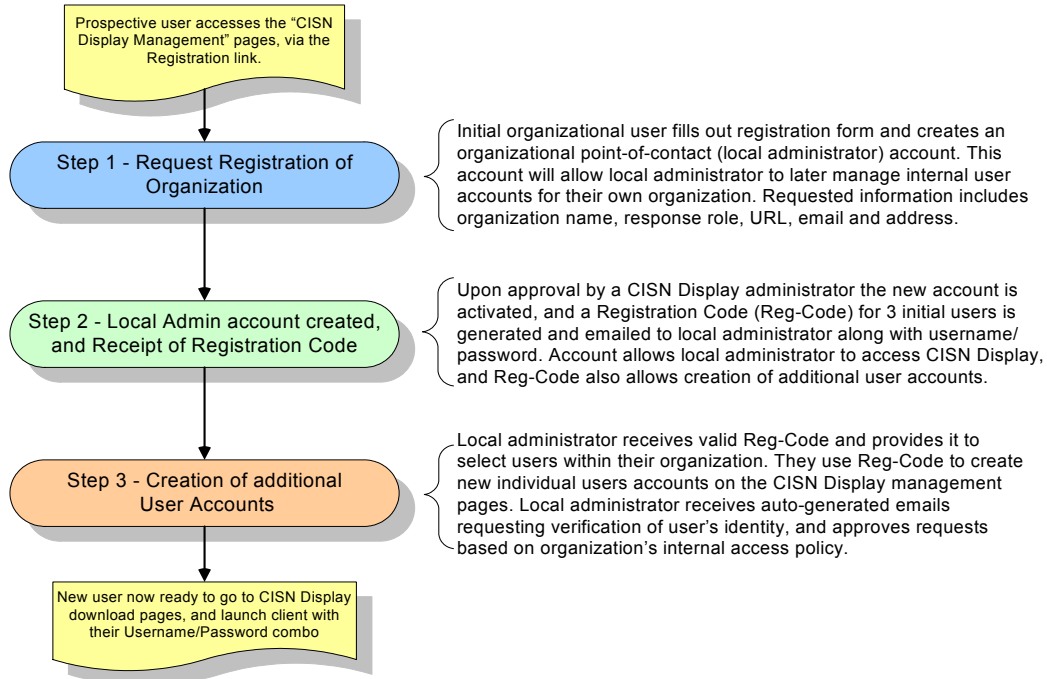


Figure 3: Basic registration process to create a CISN Display account.

The following outline lists steps necessary to gain access to the CISN Display download pages, and constitute an active user account to log into the QuakeWatch messaging servers. They entail:

- Identification of a local administrator - By default when someone requests to register an organization, the person initiating the request becomes the local-Admin. Note: this duty may later be passed on to another organizational user by editing the local-Admin's account profile.
- Approval of the registration request, and subsequent receipt of a "registration code" good for three initial users
- Finally the use of this "registration code" to create individual user accounts for access to the CISN Display/QuakeWatch software, and log into CISN Display client.

Having confirmed that their organization has not already registered, a prospective user should go to the CISN Display home page at <http://www.cisn.org/software/cisndisplay.html>, and click on the "Request a New Account" hyperlink where new organization creation begins (fig. 4). While only the "red" colored fields in this form are mandatory, all users are encouraged to complete the form; this will expedite the approval process and reduce the need for a correspondence between CISN Display admins and the requesting party.

For a "Quick Start" guide to navigating through the registration process, user may go to the following URL: http://www.cisn.org/software/data/DOCS/CD_QuickStart.pdf.

The screenshot shows a web browser window with the URL <http://www.cisn.org/software/login/createOrg.php>. The page title is "CISN Display Management" and the main heading is "Create Organization". There are links for "[Main Menu]" and "[Login]".

The form is divided into two sections:

- Organization information:**
 - Organization Name: State Agency
 - Url: www.state-ema.gov
 - Primary Classification: Emergency Management Agency
 - Secondary Classification: Homeland Security
- Point of contact information:**
 - First Name: John
 - Last Name: Doe
 - Email: JohnD@state.ema.gov
 - Phone: 333 5555-2222
 - Address 1: 1200 Main St.
 - Address 2: (empty)
 - City: City Name
 - State: California
 - Zip: 99999
 - Country: USA

At the bottom of the form are "Create" and "Cancel" buttons. A note at the bottom of the page states: "Note: Registration requests will be approved based on accurate and relevant information as it relates to their response role in earthquake emergencies. Failure to do so may result in a 'denial' or 'revocation' of account privileges. Additionally, abuse of account privileges, such as blatant distribution of username/password logins for general public access will also be grounds for account revocation. If a requesting user's emergency response role, or affiliation with a critical user organization cannot be verified, they may be contacted by a CISN Display account administrator for to confirm their job responsibilities. The potential user will have a period of no more than 5 working days to respond and provide pertinent information as it relates to their function in earthquake emergencies."

Figure 4: Create Organization page; “Step 1” in registering a new organization on the CISN Display management site. Red fields indicate required entries, however requests will be more readily processed when all field are filled.

2.2 Managing Your Account

Management of CISN Display accounts is available to both organizational “local-admins” and “individual users”. After receiving a username/passwords most people will need to perform little maintenance to their user accounts,

but when changes are needed the account maintenance page below will allow users to edit their profile, or administer the accounts of users within their organization (fig. 5).

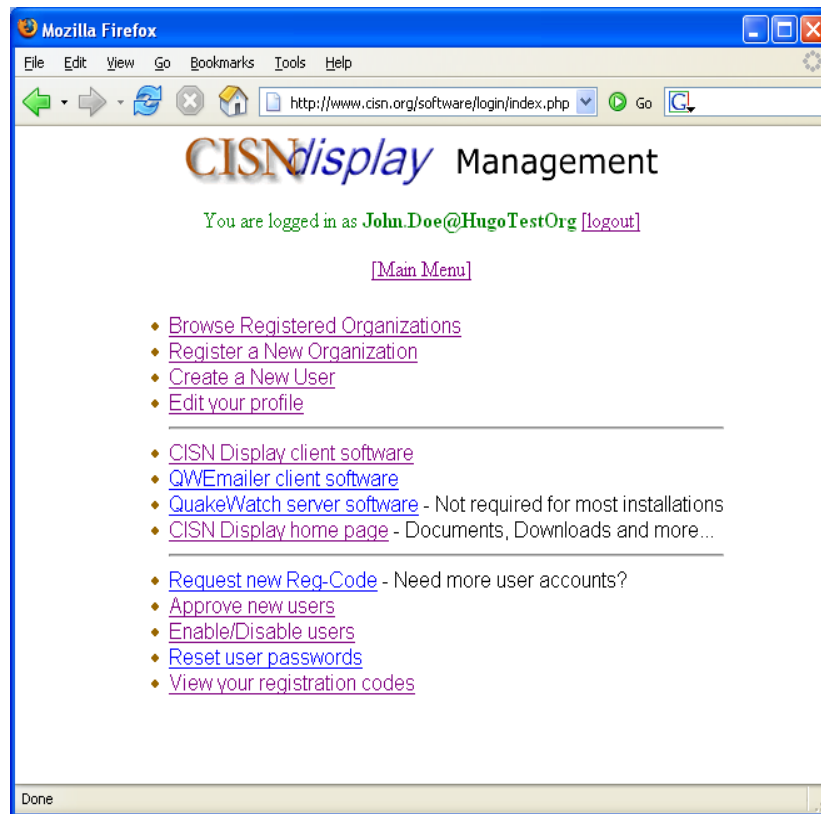


Figure 5: “Local Administrator” page useful for downloading software, edit personal profile, and management of local-user accounts. Basic user-accounts can access all but the bottom four links.

Currently, users are able to change the following settings to their user accounts:

- ***Username/Password Login***
- ***First and Last name***
- ***E-mail***
- ***Contact Phone Number***
- ***Address***
- ***City Name***
- ***State***
- ***Country***

These options and others are offered to users since they may find themselves moving within their organization, and their contact information changing along the way. Also, the ability to change a first/last name allows users to pass on their login accounts to another co-worker, in the event they leave their company or give up their CISN Display job responsibilities.

The only restrictions to editing a user’s profile information are: 1) users may not use a “login” name already in the database, and 2) a user’s e-mail address must also be a unique value³. Duplicate e-mail addresses may not be used

3. By default the user’s email address is used as the account login. Thus duplicate email addresses would cause a conflict in the database schema.

CISN Display Registration and Account Creation

Recovering Your “Account Password”

for multiple user accounts. There are server-side scripts that will check these parameters against what is in the database, and alert the user if they need to re-enter alternate values.

2.3 Recovering Your “Account Password”

In the unlikely event a user forgets their login password, the CISN Display account management pages provides a tool to retrieve a new password. To reset their password, current registered users simply need to go to the login page at: <http://www.cisn.org/software/login/index.php?login=yes>, and just below the standard login box there is a second field where a user may enter their email address (fig. 6). Once the email address is entered, hit “Submit” and the user should promptly receive their new login information sent to their email inbox. If a user should happen to have more than one user account, associated with different email addresses, they will need to ensure they have submitted the correct email address.

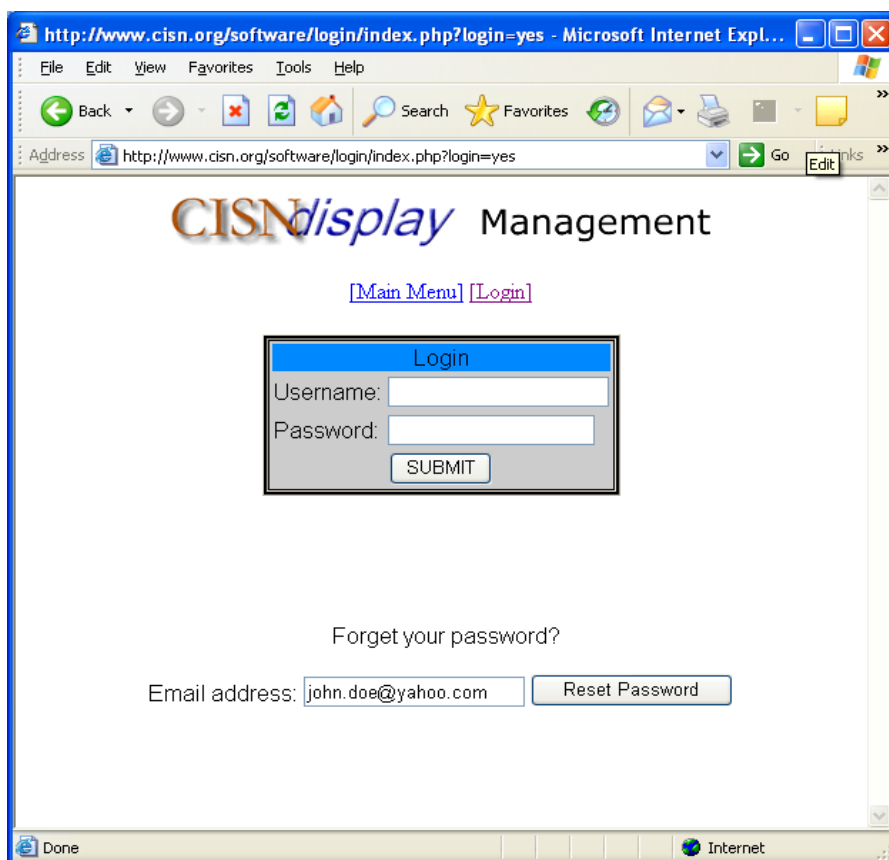


Figure 6: Password recovery field below standard login window; users will receive reset password in their email.

3.0 CISN Display Installation and Configuration

This section pertains to the installation and setup of the CISN Display client software. If users do not feel comfortable performing any of these steps they should contact your local systems administrator for assistance. However individuals familiar with their operating system, and with sufficient administrative privileges should also be able to follow these installation steps.

The CISN Display is supplied with an installer package that loads the executable program, default configuration files, select GIS layers, and support documentation. Being written in Java, and using a platform-independent installer the CISN Display can run on a variety of computer operating systems including Windows, OS X, Linux and Sun Microsystems' Solaris. However, not all platforms and hardware configurations have been tested to date. To help ensure software compatibility, make sure your computer has a recent Java runtime environment installed (1.4.X or later). Users can get the latest Java by going to <http://java.com/en/index.jsp>, and selecting the download link (its free). Doing so will auto-detect the computer's operating system and offer the user the correct Java installation. Users should note that installation of new software sometime requires administrative privileges on the host machine. If any part of the installation process generates a dialog box with an error message, contact your local administrator for assistance.

3.1 CISN Display Installation Requirements

Listed below are the **minimum**, recommended items needed to install and operate the CISN Display on an WinTel-based platform. As previously noted the software will run on many hardware configurations, so these specifications should be used as a baseline reference.

- *Java Runtime Environment (JRE) 1.4.X or higher (available from at <http://java.com/en/index.jsp>)*
- *Pentium-III, 1GHz CPU speed or higher, and 384 Mb RAM or more*
- *Monitor with resolution 1024 x 768 pixels or higher*
- *IP Address (private or public)*
- *Access to Internet on ports 39977/39988 (TCP) without a protocol filtering device*
- *And a username/password account from the CISN Display Management pages*
- *CISN Display software: visit the www.cisn.org/software/cisndisplay.html*

While the CISN Display application will operate on lower-performance hardware than specified above, users may experience significant delays in processing and displaying of data onto the screen. ***Organizations should carefully consider the relatively small investment needed to operate and maintain a reliable CISN Display machine, verses the consequences associated with a delayed and uninformed response resulting from not having accurate and actionable information following a damaging earthquake/tsunami.***

3.2 A Note to CISN Display Beta-testers

If you or your organization were part of the 2-year CISN Display beta-test program then a special precaution must be taken when installing the new v1.0 or newer software. If you do not have a earlier beta-version of the CISN Display installed then proceed to section 3.2.

CISN Display configuration files from earlier beta-clients are not compatible with the configurable settings now available in the production release of the current CISN Display software. Thus if a user installs the current software release over an existing beta-version, the user may receive a error during the installation process, or they may not have access to all the features available in the latest CISN Display release.

To avoid this possible conflict, users need to simply delete the current default /CISN_Display directory (removing its contents will also work), or install the new client release in a separate directory. Either option will do, so long as old files are not combined with new ones. Note: future releases/updates to the CISN Display will no suffer from

this problem, unless dramatic changes are made to the program. In any event users will be notified if such a change occurs.

3.3 Installation Procedures

Once the Java Runtime Environment is installed and a user account has been created, the next step is to install the CISN Display software. There are two ways to do this, one is to initiate the auto-installation process online, and the other is to download the appropriate compressed file to the host machine and run the installer manually. With a valid CISN Display account, the software is available through the CD management pages available at: <http://www.cisn.org/software/login/index.php?login=yes> pages (username/password required).

At the CISN Display installation screen, select the Interactive cross-platform installer link; this will take you to a Web page similar to figure 13. If your Web browser accepts Java applets (most do) then a grey installer bar will appear under the CISN Display Management title; clicking on the grey bar is the preferred method. Otherwise you may choose to download the compressed (zip) file for your operating system to a local directory, and then execute the self-extracting folder. In both cases, users should follow the directions as outlined in the installation wizard. In general, the default installation settings should be fine, but if you are unsure see you local systems administrator for assistance.



Figure 7: CISN Display download page. The auto-installer grey bar appears near the top of the page.

During the installation process, the wizard will present a series of five windows, which the user must click through or acknowledge. At the end, the installation-shield will read **Done** in the lower-right corner indicating that the process is now complete (fig. 8).

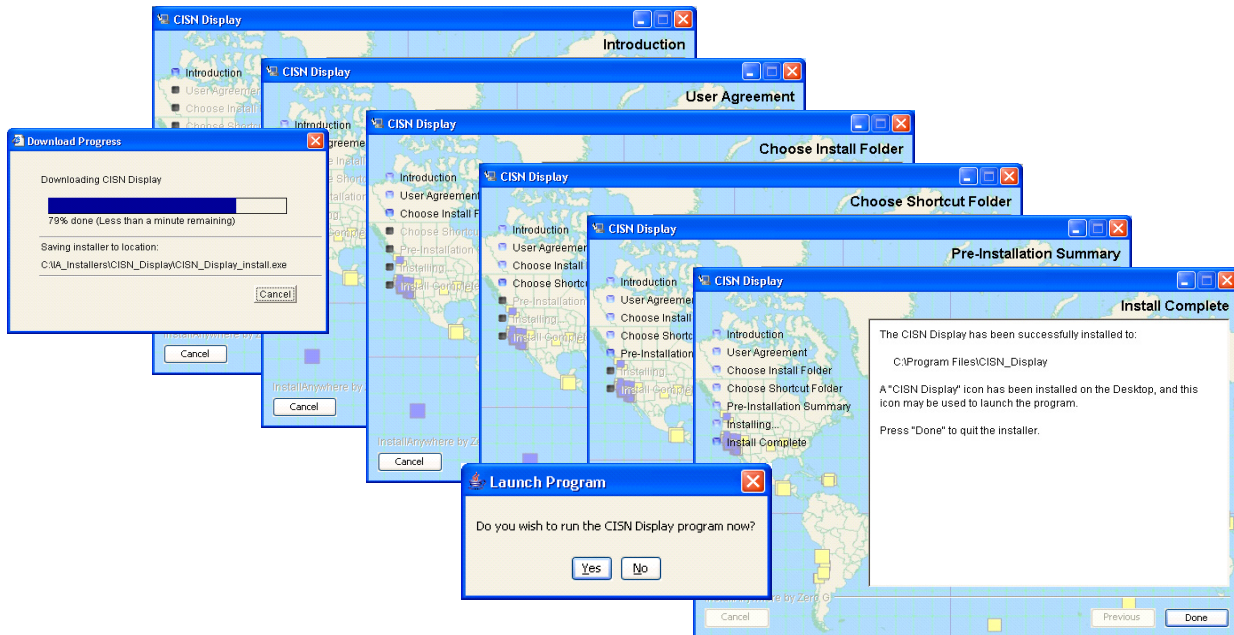


Figure 8: CISN Display download and installation-shield windows. Read instructions for proper installation

3.4 Creating a CISN Display Shortcut in Windows

Once installation of the software is complete, users are encouraged to create a desktop shortcut for easy access to the program executable. In Windows this can be done by clicking on Start button in the lower-left corner and selecting **Programs > CISN Display**, and then mousing over the CISN Display button (fig. 15). By right-clicking on this button users can option “**Send To**” and click on “**Desktop (create shortcut)**”; creating an icon on the desktop.

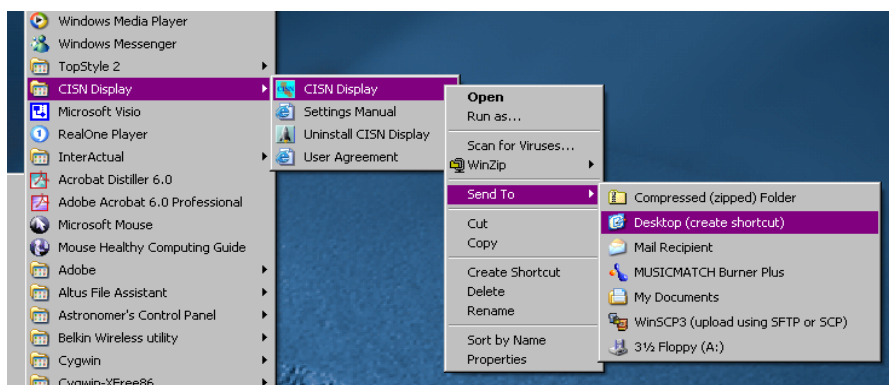


Figure 9: Creating a CISN Display shortcut for the Windows desktop.

3.5 Windows Auto Start-up Configuration for CISN Display

These steps outline the changes needed to add the CISN Display executable to the Windows operating system start-up procedures. The steps are general in nature, and may not work with all installations of the Windows OS. Furthermore, flawed changes to your systems registry may affect the proper operation of other programs, or the operating system itself. For these reasons, if you do not feel comfortable making such system modifications, you should contact your local systems administrator for help.

- **To launch the registry editor (fig.10) type "regedit" at the command prompt in a DOS-shell window**
- **In the Registry Editor window find the key:**
[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Run] (fig.16)

Note: if this is not the correct registry key, then perhaps your system uses:
[HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Run] or one of the other system registry keys.

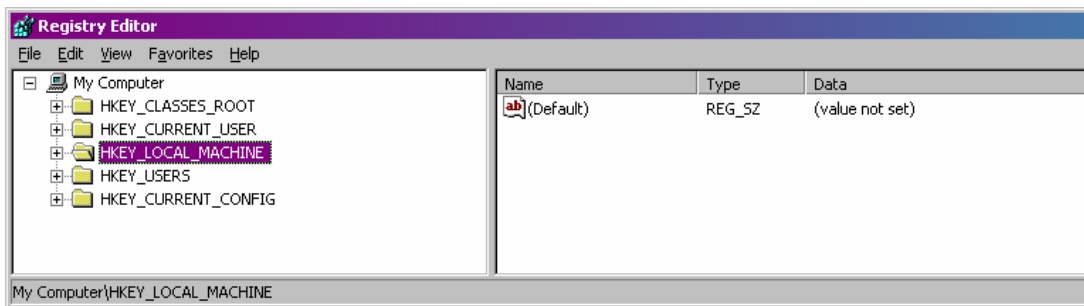


Figure 10: Registry Editor for Windows operating system; begin by locating the **HKEY_LOCAL_MACHINE**.

- **For the CISN Display, or any other program that you want to start automatically, create a new string value using a descriptive name, and set the value of the string to the program executable pathway (fig. 17).**

For example, to automatically start the CISN Display, add a new entry by selecting from the menu bar **Edit | New | String Value**. In the "Name" column, provide the registry a descriptive name, and hit enter. Once the new name is appearing in the program's window, double click on the newly entered descriptive name and a Edit String window should appear (Fig. 17); here enter the program executable's full path name, such as: C:\Program Files\CISN_Display\QWClient.exe.

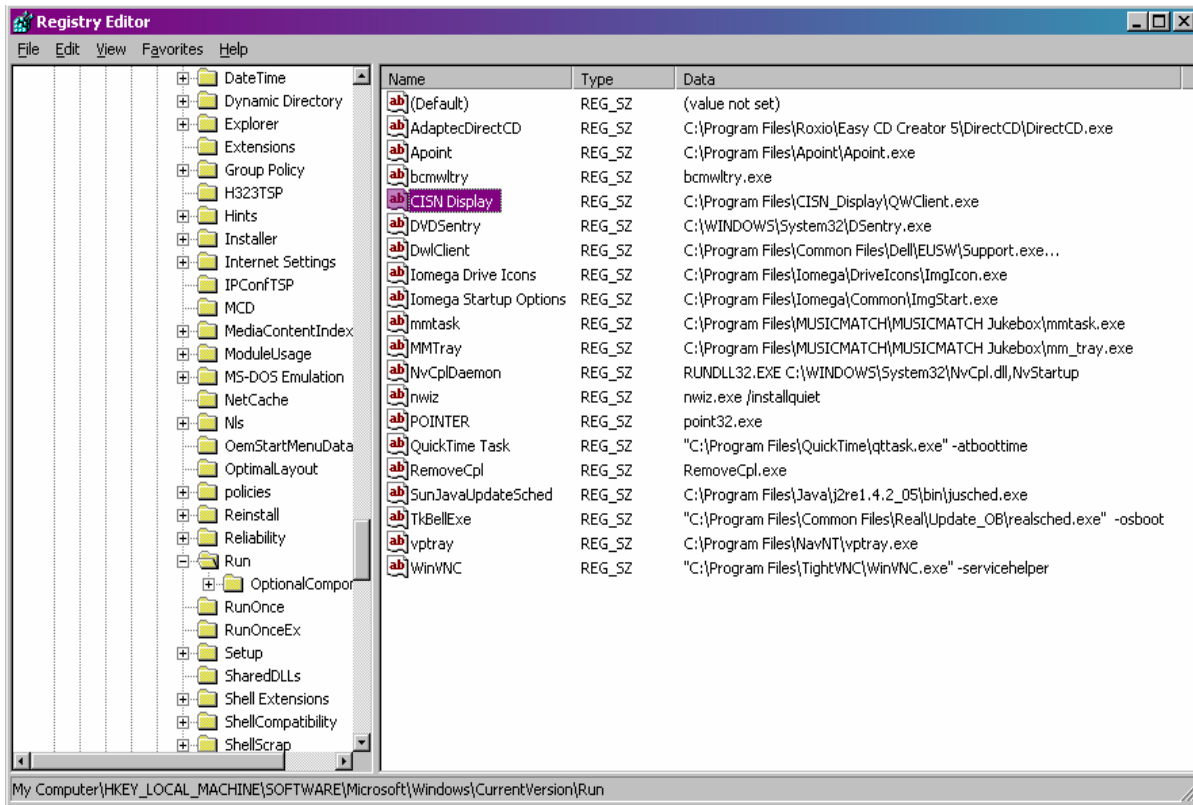


Figure 11: Registry Editor Window with the new CISN_Display entry, and full pathname for the executable.

- **Once the full pathname is entered, select OK in the Edit String window (fig.18)**
- **Now close the Registry Editor, and you should test your new configuration by rebooting your computer. The CISN Display should automatically start once the user logs into the desktop environment.**

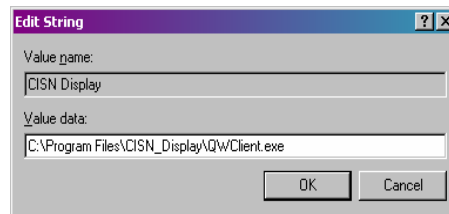


Figure 12: Edit String window used to enter full pathname of CISN Display executable.

CISN Display Installation and Configuration

Windows Auto Start-up Configuration for CISN Display

4.0 CISN Display Network Access

Some chapters of the CISN Display User's Guide may be technical in nature and require a general understanding of common networking protocols and software architectures. This section is one of them as it pertains to the networking requirements necessary for the CISN Display to access the QuakeWatch messaging servers.

After having obtained a username/password, and completed installation of the JAVA runtime-environment and CISN Display software, the next logical step is to launch the program, login using your new user account, and begin customizing your local user settings. However, if within a minute or so the CISN Display application does not start prompt you for a username/password or displays an error message, chances are the client encountered some difficulty reaching one of the four public-QuakeWatch servers on the Internet⁴. In this case, the user would be well advised to confirm that local perimeter-security polices will not restrict the CISN Display application's access to one of the available QuakeWatch servers. For some institutions this may be quickly resolved, but for others it might represent a hurdle that could require significant time and effort to modify the organizational firewall access rules.

4.1 Network Access in the Enterprise

While front-line dispatchers, emergency managers, critical users and other consumers of the earthquake data will benefit from reading this *networking* section, much of it can only be put into practice by system administrators and network security specialists that manage the organizational firewall. In any case, it is the end-user's responsibility to alert their organizational administrators of any special networking arrangements that may be required if the CISN Display cannot initiate a connection to a QuakeWatch Server. In these situations, consumers of the earthquake data should be prepared to make a case to their upper management, for the allotment of the personnel time, and resources necessary to allow the needed network access for the CISN Display. The CISN Display earthquake alert application has the real potential to deliver earthquake hazards information to emergency managers and other key decision-makers following the aftermath of a damaging earthquake. These benefits can easily offset the costs, time and effort required to implement the CISN Display service within the enterprise. Thus, after reviewing the networking requirements contained here, users should contact their local administrators with this information if they feel these special arrangements will be necessary within their organization.

The following sections describe examples users can employ to connect their CISN Display to one of the available QuakeWatch servers. The options include configurations that require no additional hardware or software (other than the default client setup), to arrangements that call for additional local servers and changes to the firewall access policy. Network security concerns and resistance to firewall modifications will vary from one organization to another, thus its up to each user group to determine which option best suits their needs. Any hardware additions, or firewall modifications will no doubt require close coordination with the organizational IT department responsible for Internet access. For this reason CISN Display users should keep IT personnel apprised of all plans to access the public QuakeWatch servers, no matter what option they choose, so that they become aware of the nature of CISN Display program and the vital emergency-response information it provides.

4. There may be other reasons for the client software not connecting to the server, or even failing to launch at all; they include an improperly installed JAVA environment or the lack of any public Internet access on the local machine. In any case CISN Display will attempt to provide an "error" message that could be helpful when reporting the problem to your networking personnel or CISN Display support staff.

4.2 Client to Server Connections

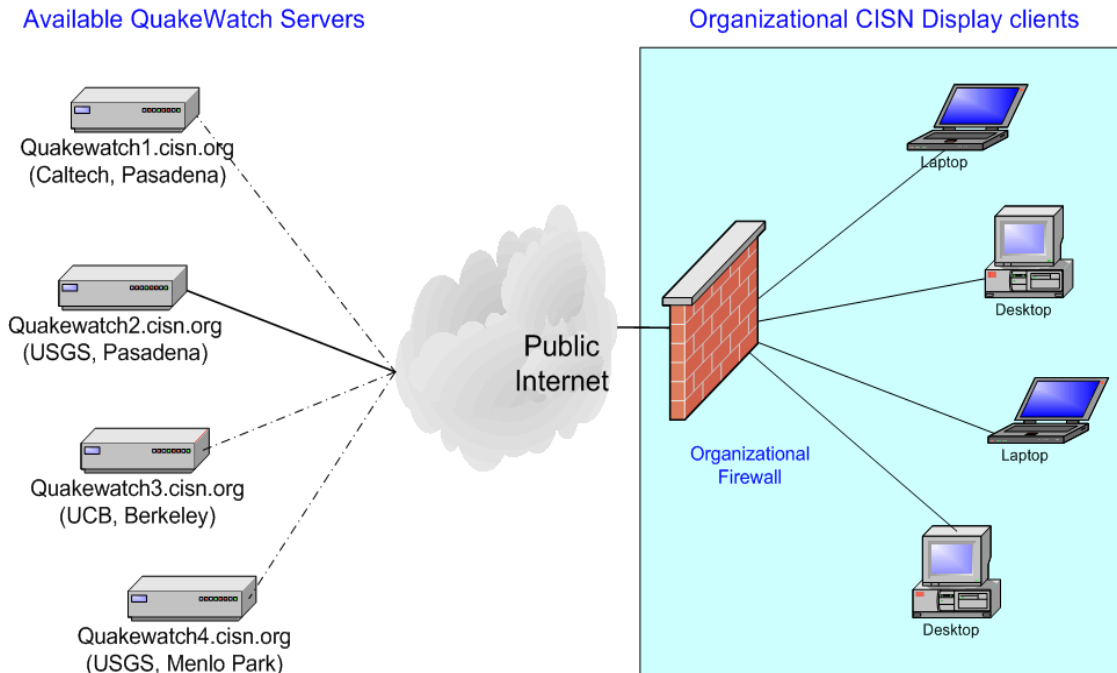


Figure 13: The standard client-to-server connection uses IP ports 39977/39988 (TCP) to connect to the QWServers. In some cases special provisions must be made to the organizational firewall to allow for this two-way traffic to pass.

4.2.1 Client-to-Server Communications Using CORBA

Communications between the CISN Display and the QWServers is handled by the *Common Object Request Broker Architecture*⁵ (CORBA) messaging-middleware. CORBA is a robust and reliable, application-layer protocol that is currently in wide use for online banking applications, the financial industry, telephone switch networks, and power utilities to name a few. The CISN Display's implementation of the CORBA protocol affords a distinct advantage over HTTP, in that it may provide a stateful⁶ connection between two nodes. This benefit allows the CISN Display to employ a server-failover strategy if it detects its connection has been dropped, thus contributing to the application's enhanced redundancy and reliability.

During initial testing of the CISN Display ports 80 & 443 were originally chosen for client-to-server communications since they are commonly open to many Web applications. However, due to the prevalent use of Web-proxies on these ports, we learned that the CORBA will not work with these filtering devices. Web-proxies are only intended to handle HTTP Web traffic and not other communication protocols such as FTP, Telnet or CORBA. For these reasons ports 39977/39988 (not associated with any other application) were randomly chosen and are now being employed for client-to-server communications. Users should learn if these ports are available (open) on their network from their local administrators, and if there are any *firewall modification requests* needed for submission to access undefined ports above 1024.

5. To learn more about CORBA and its development community see java.sun.com/developer/onlineTraining/corba/corba.html or www.omg.org/gettingstarted/corbafaq.htm

6. Stateful connections allow a client to know its state to the server, and notify the user of changes in status.

4.2.1.1 Details of Client-to-Server Handshake

When a CISN Display machine initiates a connection to one of several available QuakeWatch server (QWServer), the following set of calls-and-responses take place:

1. The client makes a TCP connection to the server machine at port 39977
 - used to authenticate the client with the server, after which the server provides the client a unique event-channel ID to reconnect with the server when it is passed to port 39988
2. The client then makes a TCP connection to the server machine at port 39988
 - used by the client to implement a CORBA-event-channel between it and the server and listen for earthquake event messages (via a bi-directional IIOP); additionally it will use this same channel to recover any missed messages it may have missed if it was down or unable to connect for a given period of time
3. The client does a status-check call back once-a-minute to the server machine at port 39977
 - In the event one of these status checks fail, the client will first attempt to reconnect to its current server host. If a successive number of attempts fails, it will read from its configuration file the next available QuakeWatch server and attempt to connect to it. It will continue this pattern until it is successful, or if it exhaust the list, it will retry connecting to the servers with ever increasing time periods between tries... as specified in the **Settings** | **Connection** | **Max connection-retry wait (minutes)** field

The synopsis of this communications exchange between the client and the server is that any CISN Display connecting to one of the public QWServers will require two-way TCP access on ports 39977/39988. Additionally, ports 80/443 may also need to be opened to this client machine if the workstation will also be used to access HTTP-based products such as *ShakeMap*, *Felt Reports*, *Tsunami Alerts*, *Damage Estimates* and other useful reports issued on the Web after an earthquake.

Lastly, the messaging middleware can handle standard DHCP⁷ as well as NAT⁸ addressing, which are in wide use throughout most organizations. However, the middleware's ability to deal with these protocols may still not be enough to resolve all networking-policy concerns where security is especially tight. For such circumstances the information contained in the following sections may prove helpful in devising an alternate plan to allow CISN Display network access.

4.2.2 Option 1: Standard Client-to-Server Connection

The standard CISN Display connection (fig. 13) requires no special configuration other than the software, and the system requirements previously mentioned (Sec. 3.1). This connection type assumes that ports 39977/39988 are open to the CISN Display and server, and that a protocol filtering device does not sit between the client and server on the public Internet. The list of available QuakeWatch servers, numeric IP addresses, and their physical locations is as follows:

QuakeWatch1.cisn.org - 131.215.68.52 - Caltech, Pasadena CA

QuakeWatch2.cisn.org - 131.215.68.53 - USGS, Pasadena CA

QuakeWatch3.cisn.org - 169.229.197.16 - UC Berkeley, Berkeley CA

QuakeWatch4.cisn.org - 130.118.61.55 - USGS, Menlo Park CA

7. Dynamic host configuration protocol, used to temporarily assign IP addresses to computer on a local network. Often employed to maximize the use of IP addresses within a local network.

8. Network address translation; Often used to mask a computer's private IP address to the outside world.

Users and firewall managers alike can at anytime verify the IP addresses of any QuakeWatch server by doing an `nslookup`⁹ of the server name. Anyone of the above machine names may be entered in the *Server host address* field found in the Connection Settings window on the CISN Display (fig. 14).

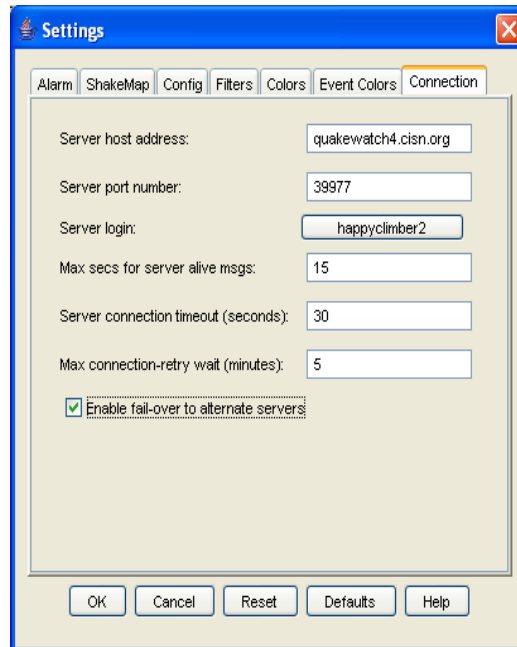


Figure 14: Connection tab for a standard CISN Display connection on port 39977 to a QuakeWatch server.

4.2.3 Option 2: Relay-QuakeWatch Server

The set up of a relay-QuakeWatch server may provide some organizations with a viable option for receiving the CISN Display messaging service (fig. 15). The relay QuakeWatch server software offers users two advantages over a standard connection: 1) it allows organizations to freely expand the number of CISN Display users within their enterprise; 2) it allows the organization to exercise greater security and control over local access to the CISN Display messaging service.

The relay-QuakeWatch (relay-QW) server software affords nearly the same functionality as the public QuakeWatch servers hosted by the CISN, but in a modified configuration for easier setup and operation. In practical terms, the relay-QW server creates one connection to a public QW server on the Internet, thus requiring only a single-set of open ports in the firewall. However, it may be able to host dozens, even hundreds of local CISN Display connections behind the firewall. So instead of connecting to a public QW server, the internal CISN Display clients on the private LAN connect to the relay-QW server to receive their earthquake notifications (fig. 14). In the standard arrangement, each client must initiate its own port opening through the firewall to the public server. Thus the relay server option can enhance network security by limiting the number of client-initiated connections to the public QuakeWatch servers, and empower local administrators over how the service is used.

An added benefit of the relay QW Server is that internal users connecting to it will not need to login with the typical username/password combination. Because of limited resources to support every potential client, public QuakeWatch servers enforce logins to authenticate users, but on a private network there is no inherent requirement to request a username/password because network access is already restricted. Here, only internal

9. *Nslookup* is a computer utility to look up and find IP address information of computers on the internet.

users can connect to these local relay-QW servers. Using this model, the number of organizational users is then only limited to the available hardware resources an organization is willing to commit to the project.

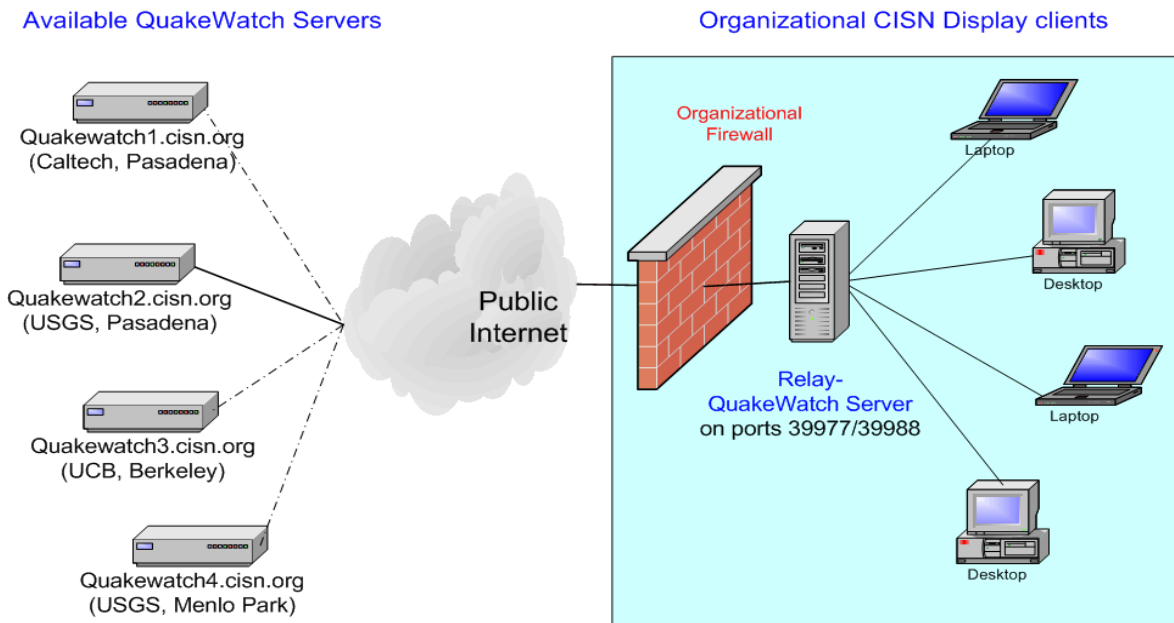


Figure 15: Alternate client-to-server connection using a relay-QuakeWatch server. This option allows local-administrators to aggregate client connections to a single node, and increase user capacity within the enterprise.

4.2.4 Option 3: Relay-QuakeWatch Server on the DMZ

Another suitable use for the relay-QuakeWatch software that will significantly enhance a networks security is to place the server on the DMZ (fig. 16). Placing the relay-server on the DMZ may ease security concerns of a compromised local machine attacking clients on the organizational LAN. By providing a second layer of network security, internal users receive the messaging service they desire, and at the same time limit the exposure of CISN Display clients to attack from a malicious source. Furthermore, there is the additional benefit of being able to scale the number of internal CISN Display users an organization wishes to host. Interested parties are welcomed to download and install software for operation at their facilities. Section 5 covers installation and configuration of the relay-QuakeWatch server software within private organizations. The relay-server software, as well as the QW server manual are available at: <http://www.cisn.org/software/QWServer/index.html>.

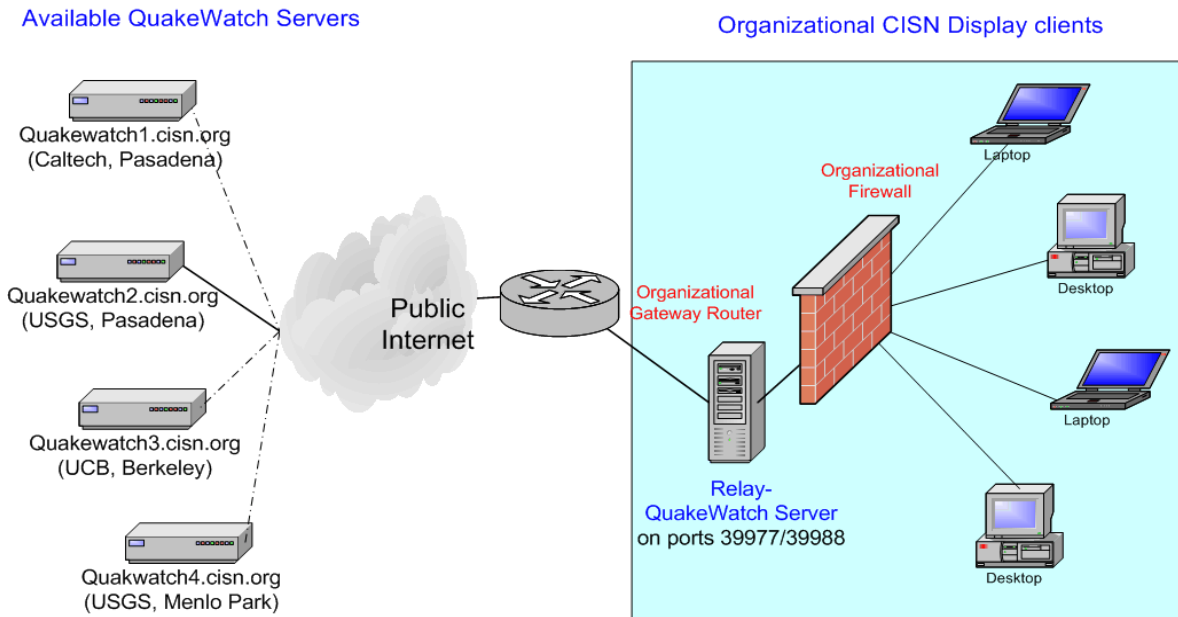


Figure 16: Alternate client-to-server connection using the relay-QuakeWatch server deployed on a DMZ. Provides an optimal level of security and flexibility, while increasing the number of user's an organization can provide.

4.2.5 Option 4: Separate Internet Connection to QW Servers

Finally, for organizations where security policies discourage the modification of firewall access rules, and do not provide any alternatives for connecting to the public QW Servers, users may have to resort to a separate network connection to the Internet. Possibilities include the use of a dial-up phone line, a DSL connection, and in some instances a satellite link or other wireless option (fig. 17). Whichever option is chosen is up to each organization; one CISN Display client connection is better than none. In any case, all of the preceding examples have been tested and satisfy nominal bandwidth requirements of the messaging service. Additionally, these options may also work for organizations where firewall modification requests are permitted, but may take several months to receive approval. In the interim users may use one of these alternates to connect to the Internet independent of the local network.

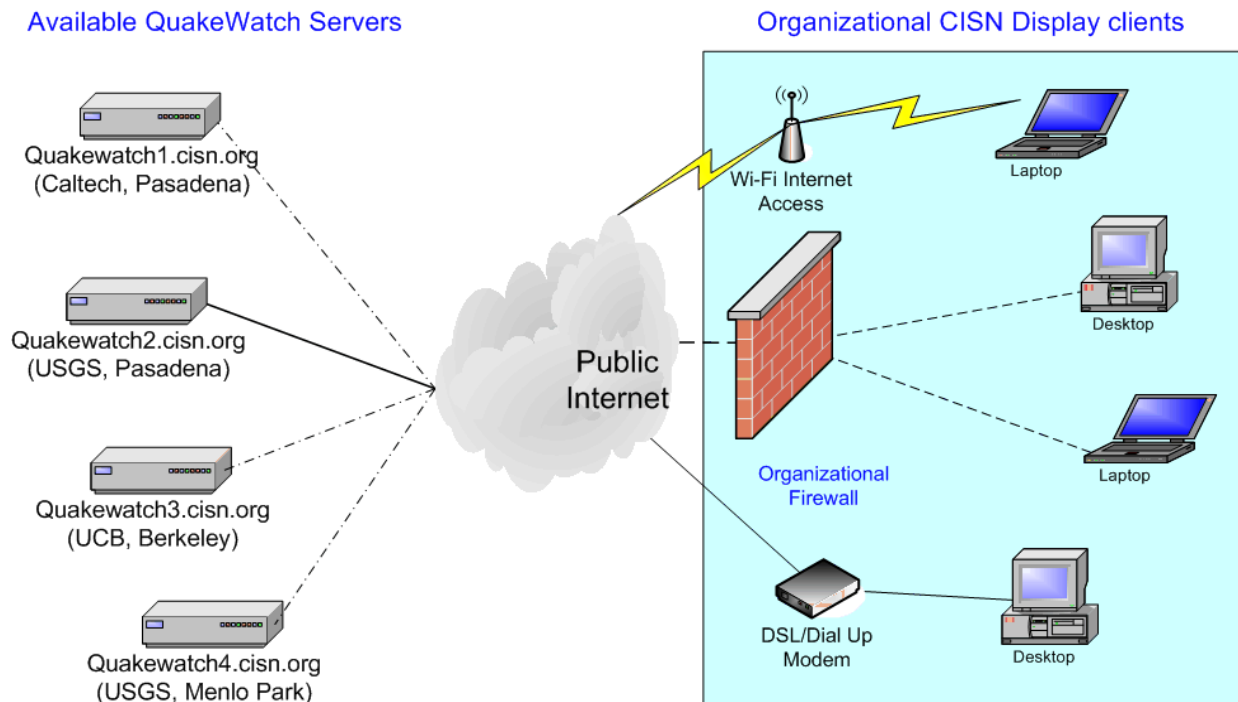


Figure 17: Alternative client-to-server connection that employees a link to the QuakeWatch servers independent from the organizational LAN. This schema should settle any concerns over compromising local network security.

CISN Display Network Access

Client to Server Connections

5.0 Relay-QuakeWatch Server Installation and Setup

Since organizational users will be relying on this service for critical earthquake and tsunami information, installation and configuration of the relay-QuakeWatch server software should be performed by a systems administrator or other IT specialist to ensure proper setup. Additionally, dedicated robust and reliable server software should be assigned for this task to guarantee that the service will be able to handle however many internal clients are expected to connect to it for a given earthquake emergency.

The software provided for this service is the same as the server software operated by the CISN to host the public-QuakeWatch servers. There are only two real differences between a public-QuakeWatch server and relay-QuakeWatch server operated by a private organization to serve local clients. The differences are that relay-QWServer connects to one of the public-QWServers for its earthquake/tsunami messages rather than a private QDDS hub operated by a regional seismic network. The other distinction is that the relay-QuakeWatch server does not need to run and maintain a user-account database to authenticate CISN Display users. By default all clients connecting to a relay-QWServer should be local and trusted machines, so there's no need to place unnecessary login restrictions to these users. However, if organizations wish to make local CISN Display clients provide a username/password login, they may enable this feature in the server configuration file¹⁰.

5.1 Installing a relay-QuakeWatch Server

The following steps should provide adequate guidance for the installation and configuration of the relay-QuakeWatch server. However, if your installation will differ from the standard setup below, or you have questions regarding certain optional flags in the configuration file, reference the complete QuakeWatch Server manual available online at: www.cisn.org/software/QWServer/QWServer.html.

- *Download and unzip the QWServer software from the following site, to the machine that will host the messaging service.*

`http://www.cisn.org/software/QWServer/`

- *Once unzipped the following files will need to be modified for local use: `~/conf/QWServerConfig.xml` and `~/conf/ServerLoginInfo.dat`. In the case of `ServerLoginInfo.dat`, you will probably need to create this text file.*

Included is an example of both file types. Note: the `ServerLoginInfo.dat` file contains the username and password allowing a relay-QWServer can authenticate with a public-QWServer.

***** Start 'QWServerConfig.xml' File *****

```
<QWServerConfig>
```

```
<Settings>
```

```
  # ID for this QuakeWatch server; name will appear in lower R/H corner:
  serverIdName = "CA OES, QuakeWatch Server (Mather, CA)"
  # Name of console output redirect file:
  consoleRedirectFileName = "log/QWServerConsole.txt"
  # Name of the log file:
```

¹⁰. Please note that database software is not provided if an organization selects this option. It will be up to each organization to provide and maintain their own user database.

Relay-QuakeWatch Server Installation and Setup

Installing a relay-QuakeWatch Server

```
serverLogFileName = "log/QWServer.log"
  # Level of log messages sent to the log file:
serverLogFileLevel = "Debug"
  # Level of log messages sent to the console:
serverConsoleLevel = "Warning"
  # Maximum age for log files (days, 0=infinite):
logFilesMaxAgeInDays = 30
  # Port number spec for this server:
serverPortNum = 39977
  # Port # spec for notification service:
notifSvcPortNum = 39988
  # alternate server IDs list: only use if you're providing other QWServers
altServerIdsList = ""
  # maximum message size (0 = no limit):
maximumMessageSize = 65536
  # true = use numeric IPs instead of host names:
#   publishNumericIPFlag = false
  # The path name given to clients to check for client updates
clientVersionsInfoFile =
"http://www.cisn.org/software/QWClient/ClientVersionsInfo.xml"
  #
</Settings>
<QWFeederMod
  Name = "QWRelay"
  Class = "com.isti.quakewatch.server.QWRelayFeeder"
  LogFileName = "log/QWRelayFeeder.log"
  LogFileLevel = "Debug"
  ConsoleLevel = "Warning">
  <QWFeederSettings>
    # host address of server for QWRelay feeder:
serverHostAddress = "quakewatch1.cisn.org"
    # port number of server for QWRelay feeder: Generally not configurable
serverPortNumber = 39977
    # Name of the server login file containing username/password to public
QWServer: You'll have to specify your own login info.
loginInfoFileName = "conf/ServerLoginInfo.dat"
```



```
# max event from server age (days):
maxServerEventAgeDays = 3.0

# list of alternate servers for client fail-over; only use this if
2nd server is setup:
#   alternateServersList = "2nd QWServer Host:39977"
#   # true = enable fail-over reconnect to alternate servers:
altServersEnabledFlag = false
#   # true = allow only default alternate servers:
keepDefaultAltServersFlag = false

</QWFeederSettings>
</QWFeederMod>
</QWServerConfig>
***** End 'QWServerConfig.xml' File *****
```

With only one login account dozens... even hundreds of internal users may gain access to the QuakeWatch messaging service via the single relay. To take advantage of this feature, create a "ServerLoginInfo.dat" file and place it in the ~/conf folder in the default QuakeWatch Server directory. Your login information should look something like this:

```
***** Start 'ServerLoginInfo.dat' File *****
username = "yourUsername"
password = "yourPassword"
***** End 'ServerLoginInfo.dat' File *****
```

- *Execute the "runAll.bat" batch file (for Windows machines) to launch both the "Notification Service", which receives event messages from one of the public QWServers, and the "QuakeWatch Server" messaging service to allow local CISN Display clients to connect to the organizational relay-QWServer.*

As with the standard CISN Display client, you will need to ensure that ports 39977/39988 are accessible to both the relay-QWServer connecting to the public Internet, as well as to the internal CISN Display clients connecting locally to your relay.

- *Edit your CISN Display's "Server Host Address" (Settings > Connection) field to your relay-QuakeWatch Server's machine name, or simply its IP address if its not DNS'd locally.*

Since you are not connecting to a public QuakeWatch server, you can disable the "Enable fail-over to alternate servers" option in the "Connection" window.

Relay-QuakeWatch Server Installation and Setup

Installing a relay-QuakeWatch Server

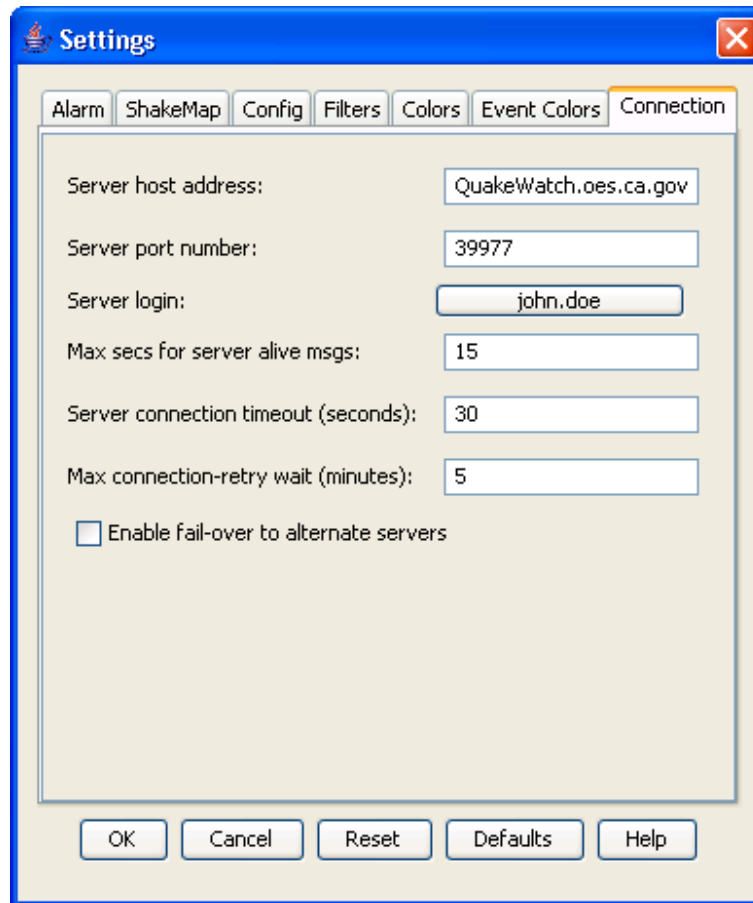


Figure 18: CISN Display “Connection” tab; in particular listing a local relay-QWServer’s host name.

If all pieces of the puzzle are set up correctly your local CISN Display clients should be able to connect to your relay-QWServer without the need for a username/password login. Also, when you check your “connection status” indicator in the lower right-hand corner, you should see the name you assigned to your local relay-QWServer.

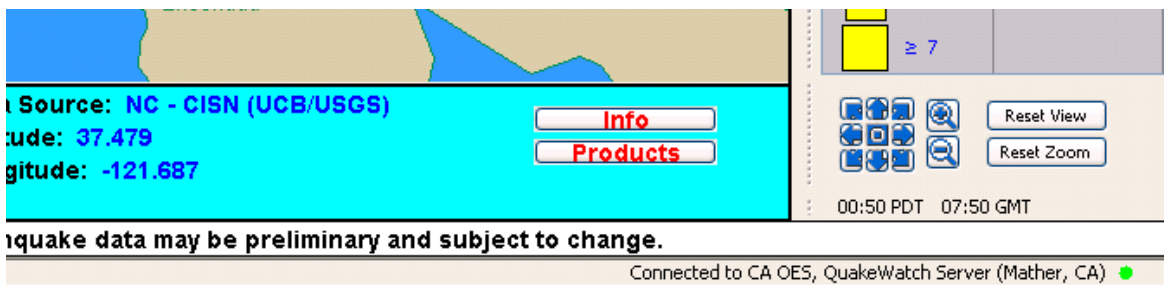


Figure 19: Lower right-corner of CISN Display window, illustrating the name of an organizational relay-QWServer.

Note: the `serverIdName="name"` field can be modified to anything you like; this is the name that will appear in the lower right-hand corner of your client’s connection status indicator.

6.0 CISN Display Startup and Configuration

6.1 Running the Application

Having completed installation of the latest version of CISN Display, and created an applicable desk-top shortcut, users should launch the program, read through the legal disclaimers and select the desired display format, CUBE/REDI or Simpson Map¹¹. Once the application is open to the worldwide map, users should ensure they are indeed connected to one of the available QuakeWatch server machines. This is indicated by a green status light in the lower right-hand corner of the display window, with an alias of the server's name (fig. 21). If numerous failures to initialize a connection to the server do occur, they will be followed by a dialog box indicating a communications malfunction, or some other possible error. In such instances check all physical network connections, and ensure the computer has a valid IP address with direct access to the Internet, and it is not being blocked by the local firewall.

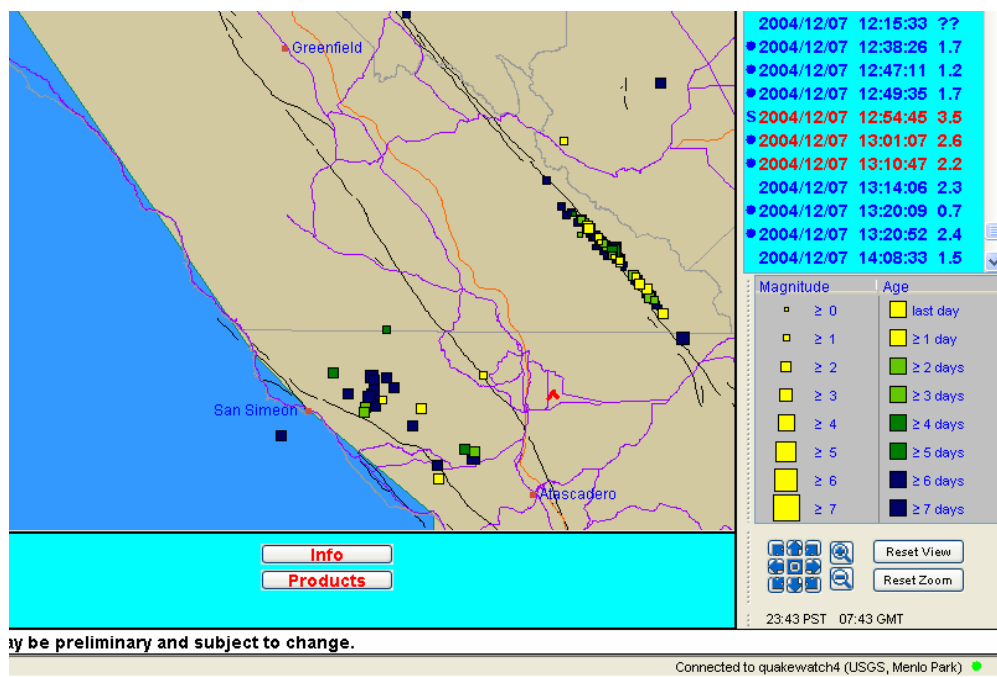


Figure 20: Lower-right corner of window displays connection status, as well as which sever the client is connected to.

The first time the CISN Display connects to the QuakeWatch server, it will attempt to download any missed earthquake messages going back up to two weeks. These event messages will be retrieved and stored locally on the hard drive, and made available for viewing even if the client-to-server connection is later lost. The ability to recover from short to extended data gaps resulting from a failed QuakeWatch server, network interruptions or a loss of power affecting local machines, is an essential feature of the CISN Display client's persistence strategy.

11. The CUBE/REDI format is native to the DOS based application common to many 24/7 operations centers in California, and the Simpson Map format is native to the "Recent Earthquake" pages available through the regional USGS Web pages. These formats determine the color schema used for the epicenters as they age over time, and may easily be changed later by going to the **Tools > Settings > Event Colors** tab.

6.2 Modifying Client Settings

Users will discover that the CISN Display upon establishing a connection, it immediately begins receiving messages from the QuakeWatch server and notifies users with up-to-the-minute earthquake activity. However, users should realize that the default settings of the CISN Display are generic, and not optimal for any particular region. Thus users should modify their default map-view, as well as the reset-button zoom and view parameters (lower-right corner of Fig 22) to a geographic region of interest. Guidelines that might influence the users choice of CISN Display settings may include tolerance level to alarms for smaller, non-damaging earthquakes, or the need for GIS ShakeMap files by the organizational mapping group. In short, the CISN Display’s configuration should be dictated by an organization’s working environment and their needs for information during an earthquake emergency.

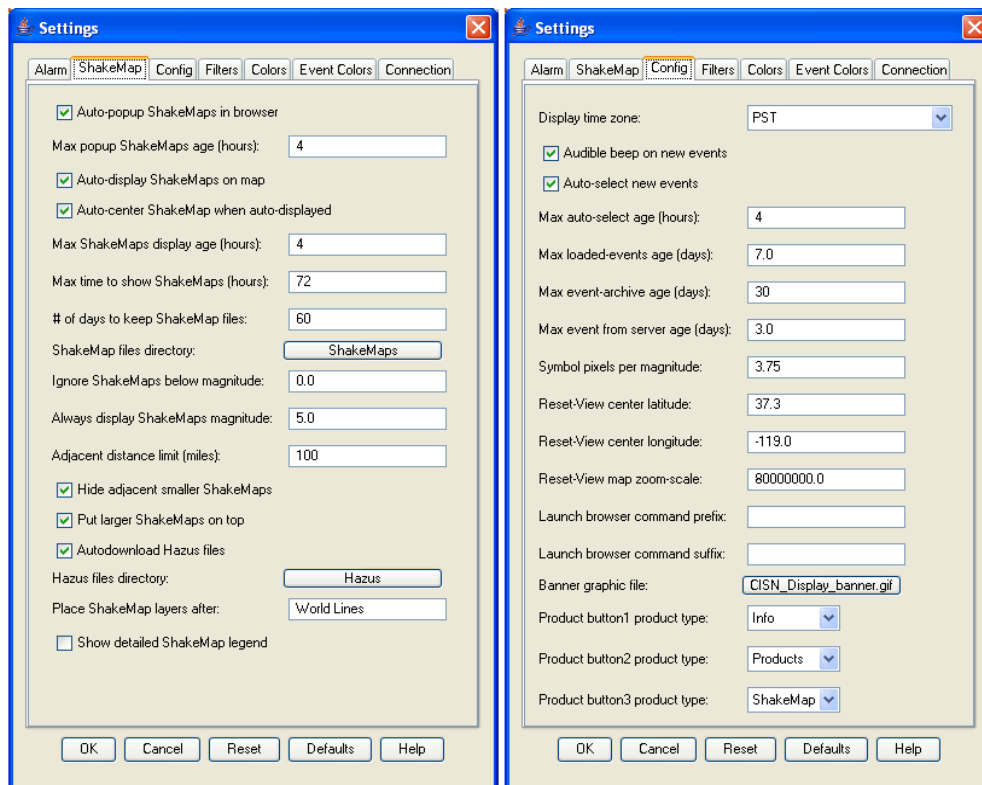


Figure 21: “Settings” window featuring the “ShakeMap” and “:Config” tabs; all other tabs are accessible here as well.

6.2.1 Event-Triggered Settings

In general event-triggered parameters normally come into play for moderate to large magnitude earthquakes. They include features that alert the user (visually and audibly) of earthquake events above a given magnitude,

and other behaviors that are triggered when online products, such as ShakeMap, are produced. Listed below are some of the optional parameters all users should consider when configuring their CISN Display settings:

- *Alarm Magnitude threshold - #value*
- *Audible Alarming - On/Off*
- *Visual Alarming - On/Off*
- *Auto-Pop-up ShakeMap Website - On/Off*
- *Auto-Display ShakeMap on Interface - On/Off*
- *Auto-Center ShakeMap on Interface - On/Off*
- *Hide smaller adjacent ShakeMaps - On/Off*
- *Put larger ShakeMap on top - On/Off*
- *Auto-download HAZUS input files - On/Off*
- *and more...*

The above parameters may be accessed and configured from the menu bar by clicking Settings > Alarm and ShakeMap tabs. A full listing of these and other configurable parameters is posted in Appendix A of this document. Both the Manual and Appendix contain definitions describing the of affect each parameter has, and its proper implementation in the CISN Display configuration file.

6.2.2 Regional Settings

Earthquake information is received for every part of the world as reported by regional seismic networks across the US, and the NEIC. However, organizations and agencies with well-defined jurisdictions should employ region-specific settings to help them focus on their areas of responsibility. These settings can help filter out non-relevant information from networks outside their state, or multi-state area. A properly configured set of parameters will help draw an organization's attention to earthquakes that may be damaging within their jurisdiction or service area. A listing of these and other parameters are:

- *Time Zone selection*
- *Minimum event latitude displayed - Lat value*
- *Maximum event latitude displayed - Lat value*
- *Minimum event longitude displayed - Long value*
- *Minimum event longitude displayed - Long value*
- *Keep events from these data sources - network code*
- *Drop events from these data sources - network code*
- *Reset-button View lat/long values - Lat/Long value*
- *Reset-button Zoom scale value - scale value*
- *and more...*

In particular users should pay close attention to the ***Min event latitude displayed, Max event latitude displayed, Min event longitude displayed*** and the ***Min event longitude displayed parameters***. These optional settings have the effect of creating a filter window where only earthquake events, whose epicenters fall within the box created by the lat/long values, are displayed on the map interface. Thus for example if an organization were only interested in earthquake messages for the greater Alaska region, they would enter an appropriate set of lat/long coordinates to filter out event messages from other seismic networks not reporting for this area (fig 23). Note: the numeric values used for the filter window should reflect the Maximum/Minimum parameters; for instance when selecting an set of lat/long coordinates recall that -170.0 is a smaller value than say -130.0, and thus should be entered in their Minimum... instead of the Maximum... field. Not following this convention may result in a filters keeping out event information of interest, and letting through messages from outside your area.

A mention is warranted about the ***Keep events from these data sources*** and ***Drop events from these data sources*** fields. These fields can also be used to filter events displayed on the CISN Display interface. Rather than using explicit geographic coordinates to keep certain events out, this filter functions by specifying either

which network events are allowed to pass through, or which network events are excluded from the local earthquake list. These filter parameters require knowledge of the network codes for each regional seismic network and the area covered by each network. Some network codes encompass only a portion of the state, some cover the entire state, and still other networks span a multi-state region. Hence, in practice these parameters may be a little more cumbersome to implement than the geographic set, and thus are not recommended for the typical user unfamiliar with the extent of regional network boundaries. A full listing of the currently available seismic network codes is listed in Appendix B of this document, along with the polygon coordinates defining their respective boundaries. Most of the Regional Settings may be accessed and configured from the **menu bar** by clicking the **Settings > Config** and **Filters** tabs.

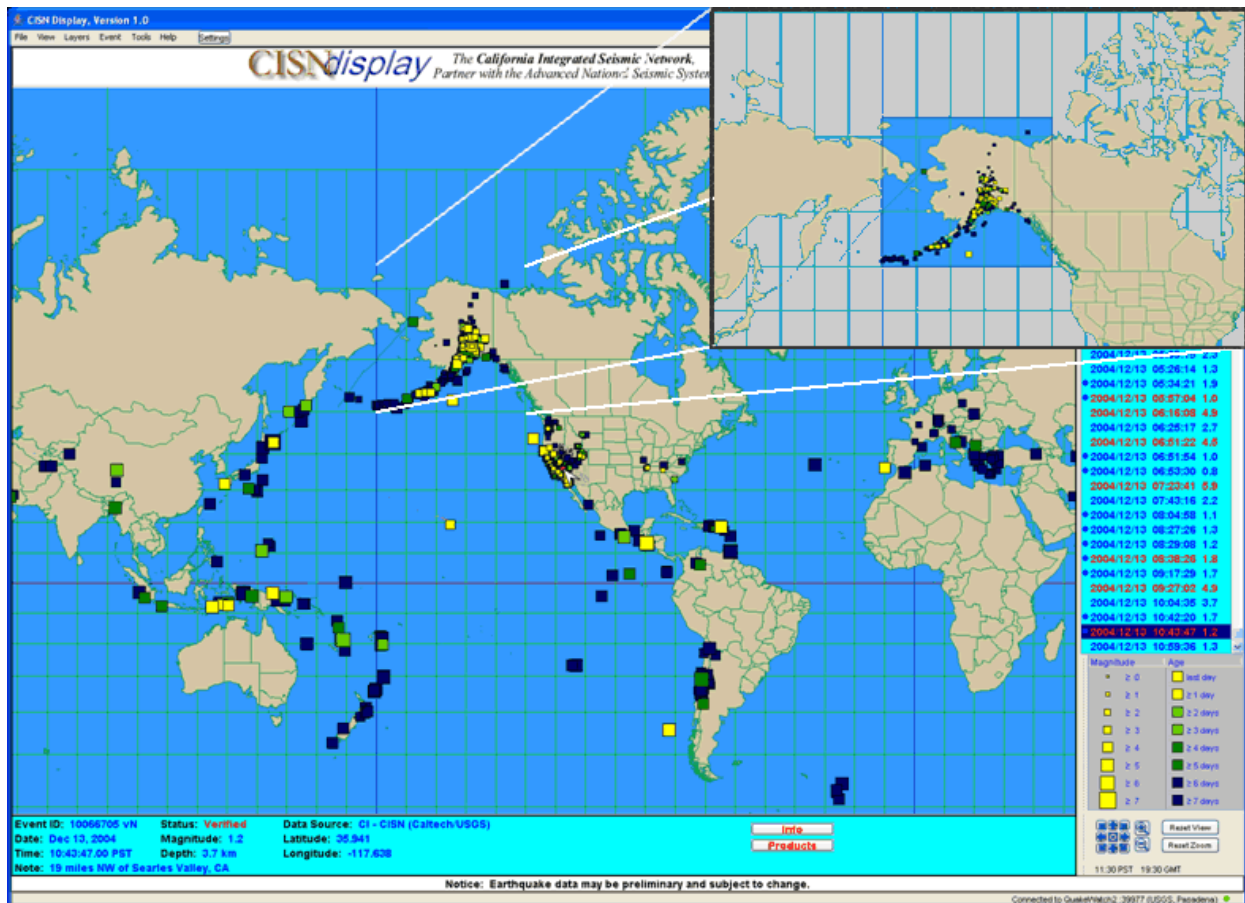


Figure 22: Applying filter parameters, whether they are geographic coordinates or seismic network codes, removes events outside these regions, and only displays events inside the specified values. Here coordinates forming a box around the greater Alaska region were chosen; the shaded-grey area surrounding Alaska was added for effect.

6.2.3 Global Settings

Global Settings are another collection of configurable features that are in effect for all earthquake events received. They typically affect generic behaviors of how the client behaves and displays event information. Examples of these parameters may determine how many days worth of earthquake are displayed on the map (7 days worth is the default value), or whether to audibly beep and re-center the map when new events are

received, or what product buttons should appear when Web pages are created for larger earthquakes. The following is a listing of some of the parameters users may adjust:

- Audible beep on new events - On/Off
- Auto-select new events - On/Off
- Max loaded-events age (days) - # days
- Maximum event age displayed (days) - # days
- Banner Graphic file - filename
- Product button1 product type - product-name
- Product button2 product type - product-name
- Product button3 product type - product-name
- And more...

Many of these Global Settings may be accessed and configured from the menu bar by clicking the **Settings** > **Config** tab. A full listing of these and as well as all other configurable parameters is posted in **Appendix A** of this document. Both the Manual and Appendix contain definitions describing the affect each parameter has, and its proper implementation in the client configuration file.

6.2.4 Changing Interface Colors

Changing the interface colors affects the text and background color of items such as the map legend, the information panel, and the epicenter colors. Motives for modifying the interface and map colors go beyond cosmetic reasons; in many instances screen colors can vary widely between traditional CRT monitors and flat-panel LCD screens. Also, many organizations with 24/7 emergency operations centers often project their CISN Display applications onto wall screen displays for general viewing. This application may have the effect of washing out the intensity of the colors, and making the information more difficult to read. Thus, color changes can enhance the program's usability and effectiveness in the work environment.

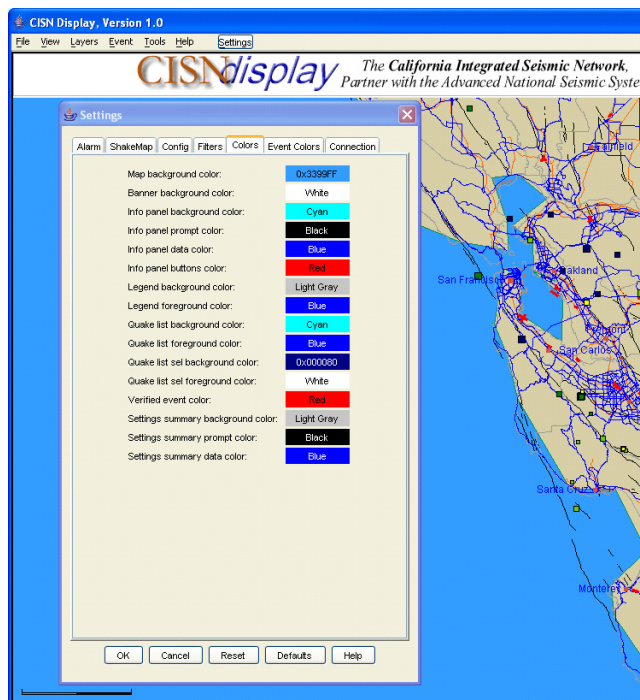


Figure 23: Colors and Event Colors tabs accessible from settings window.

The color editing window can be found on the menu bar under the **Settings > Colors** and **Event Colors** tabs (fig. 24). Users will note that entire epicenter colors-schemas can be modified at the **Event Colors** tab by selecting either the CUBE/REDI or Simpson Map color options. To edit an individual color, users can select a colored button to the right of the item descriptor (fig. 24). This opens a color editing window with several tabs, (fig.25) with options for standard or custom colors. When done editing, click “OK” to effect the color change on the display. The modifications will be saved when the CISN Display software is shutdown. Note that selecting the “Reset” or “Default” buttons will only affect the selected window tab; other settings will not be affected.



Figure 24: The “Select Color” editing windows for modifying individual layer colors.

6.3 Editing Map Layers

At the heart of the CISN Display's graphical interface is a GIS mapping engine. The OpenMap GIS program is capable of plotting many common GIS vector-formats, thus allowing users to customize their interface to meet their organizational needs. For instance assets such as roads, railways or power plants may be plotted on the display to help emergency managers and lifeline operators evaluate their critical infrastructure with respect to seismic hazards such as ShakeMap ground-shaking data.

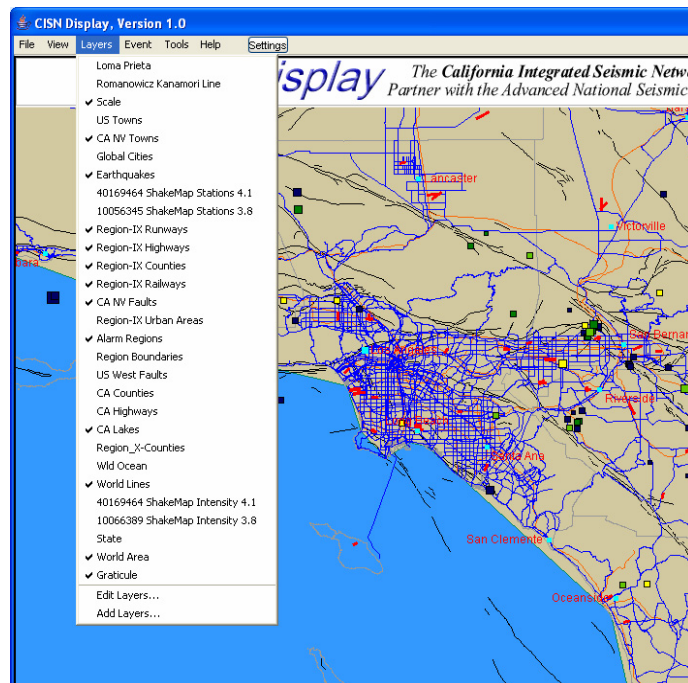


Figure 25: Layers drop-down menu.

This same GIS engine also provides a user interface to edit existing map-layer colors and attributes, and to add or remove layers as needed. These features are all accessed from the menu bar in the Layers drop-down window (fig. 26). The drop-down menu represents all the GIS layers available for display. A check-mark to the left of the layer name indicates an active map layer; deselecting the check mark removes it from the map but leaves it in the layer's list for later viewing. This drop-down window is also the entry point for adding, editing or the deleting of GIS layers. To edit an existing layer, select the Edit Layers option and a Layers window appears again listing all active and non-active layers present (fig 26). An "illuminated" light bulb indicates an active layer on the map. Similarly to the Layers drop-down list, turning off a light bulb will deactivate the layer on the map, but leave it available for later viewing.

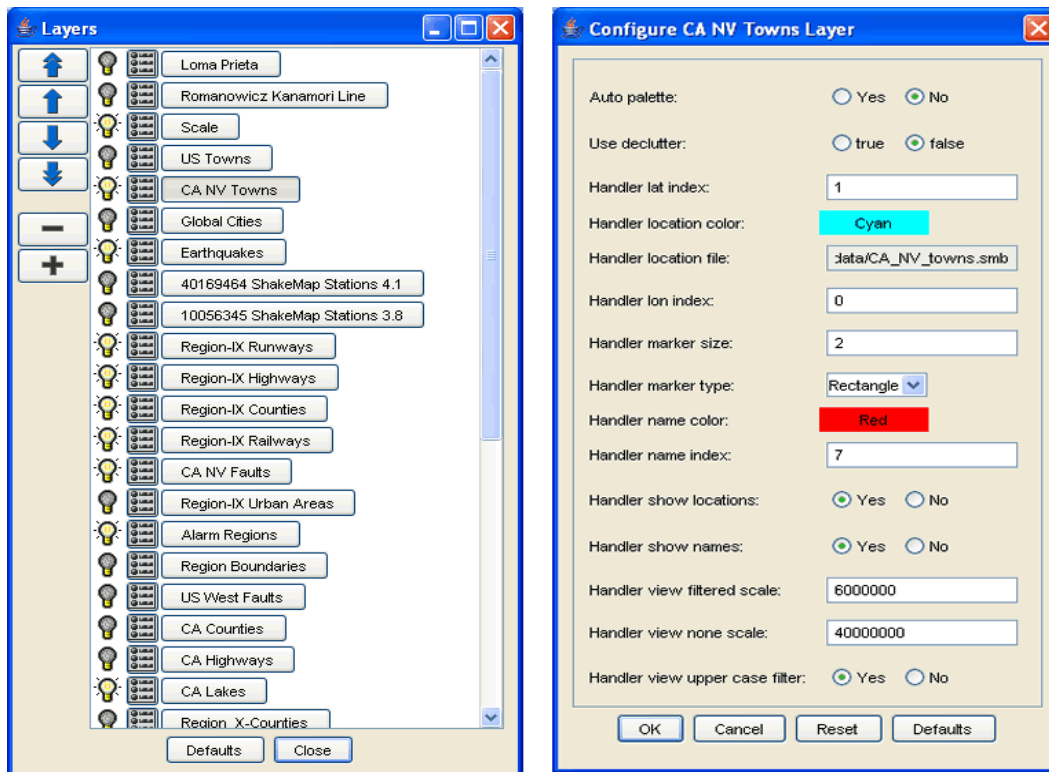


Figure 26: a) Layers editing window and b) Color and Attribute configuration widow for selected layer.

Users should note that the vertical arrangement of names in the Layers window represents their relative hierarchy on the display map. For instance the “CA NV Towns” layer appears above the “Earthquakes” layer (fig. 27a). This means that the mapping engine will always draw the text-names and their handler above that of the “Earthquake” epicenters. This may be desirable since a larger earthquake can produce many hundreds of aftershocks in a short period of time. A tight cluster of epicenters on the map could make it difficult to read the city names or other infrastructure information if the epicenters were on top. To modify the stratum order, highlight the desired layer and click on the “up” or “down” arrows to move the layer one step at a time. To push the layer all the way to the “top” or “bottom”, click on one of the double-arrow buttons. This will move the selected layer to either extreme; thereafter incremental adjustments to the layers rank can be made by using the “single” up or down arrows.

6.3.1 Changing Layer Colors

Editing the map-layer colors is done through the “Layers” window (fig. 27a) accessible through the Layers drop-down menu. To edit a map layer, select the square icon between the layer’s light bulb and name descriptor. A second window opens with a variety of buttons for “Line”, “Fill” as well as “Text” colors (fig. 27b). These configuration windows will vary slightly depending on the editable attributes of each map layer. Selecting one of the colored buttons will open up yet another color editing window; similar to those previously shown for editing interface colors (fig. 25). Users can then modify the selected color for each layer as they did for the interface colors earlier.

6.3.2 Adding a New Layer

Returning to the “Layers” drop-down menu (fig. 26), users may choose to add new map layers to the CISN Display. These layers may represent public facilities such as roads, schools or hospitals, as well as private structural inventories. Once added these additional layers can be edited just the same as other layers that come included with the CISN Display. The following steps assume that additional layer files are available for uploading, and the GIS formats are compatible with the OpenMap software.

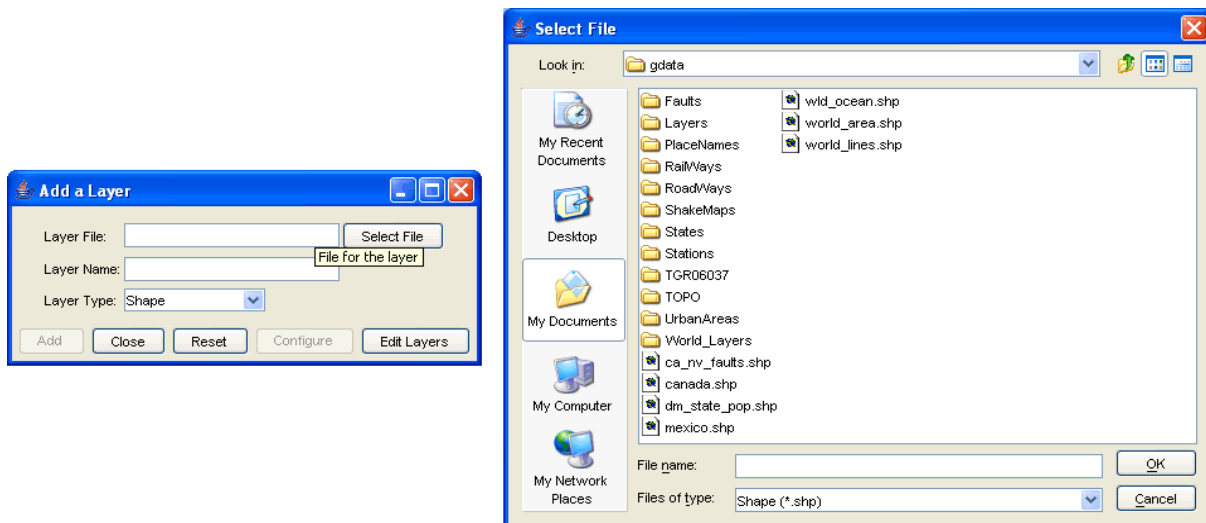


Figure 27: a) “Add a Layer” and b) “Select file” windows.

To add a new layer, select “Add Layers” from the drop-down menu (fig. 26). An “Add a Layer” box appears; from here click the “Select File” button. This opens a local directory window to the folders in the default CISN_Display file (fig. 28b). At this point the user should locate a desired GIS layer in a local folder, and select it for uploading to the CISN Display. To simplify the uploading of new layers, users may consider storing all GIS files centrally in “gdata” directory, or some other folder within the CISN_Display default home directory. Having selected the GIS file, the user may change the layer name or leave it as is. Once the layer has been chosen, the user may also have to choose the “layer type” if it has not already been selected. Having done this, the user should click “Add” to see the layer appear on the display map. Here too, users can choose to edit a layer by selecting the “Edit Layers” button, and the “Layer” editing window will appear (fig. 28 a).

CISN Display Startup and Configuration
Editing Map Layers

7.0 CISN Display Operation

In its layout and functionality the CISN Display will look familiar to many people accustomed to the CUBE/REDI interface. It features a similar **map window** with geographic coastline-detail and the familiar earthquake epicenters. It also showcases an **earthquake event list**, and the **detail information panel** for easy access and identification of earthquake data. However, this is where many of the similarities end as well. The new interface also introduces a number of features that will require some explanation, familiarity and experimenting by the user to fully understand.

7.1 Theory of Operation

The CISN Display client program receives earthquake information multicast by regional seismic network operators across the US, the NEIC for worldwide and large events, and NOAA for tsunami alerts to a common transport layer¹² that the QuakeWatch servers are listen to. The QuakeWatch servers receive these earthquake and tsunami messages and relay them to the CISN Display clients. Upon receipt the client program displays the earthquake information on the map, arrange the data in chronological order in the “Earthquake Event List” and “Detail Information Panel” windows; sets off audio and visual alarms when configured to do so; and saves the earthquake information in an ASCII text file on the local hard drive in a storage folder.

For each earthquake message received the CISN Display client performs the following actions:

1. In the **Map Window** plots the earthquake location, and highlights the event summary line in the **Earthquake Event List**, and if configured, will automatically recenter the map on the epicenter lat/long coordinates with a geometric square representative of the earthquake magnitude.
2. In the **Detail Information Panel** displays the event identifier, version number, date, time, magnitude, longitude, latitude, depth, reporting seismic network, a descriptive text referencing a nearby city, and verification status indicating if it has been reviewed by a duty seismologist.
3. If the event magnitude is above a pre-configured threshold, the **Map Window** will flash repeatedly and audibly alarm if the computer is equipped with speakers.
4. If an ‘add on’ messages is received for a particular event, which generally provide URLs to product messages generated available on the Internet, a hyperlink will be created in the **Detail Information Panel** in an area underneath the “Info” button.
5. If an event large enough to generates a ShakeMap occurs, and the program has been preconfigured to do so, the client software will automatically download and display the ShakeMap shapefiles to the **Map Window** and overlay them beneath the earthquake epicenters.
6. Updates to initial earthquake messages will trigger the “Status” title in the **Detail Information Panel** to read “Verified” in red, and also change the event summary line in the earthquake event list to red.

In all other respects, updates are treated in the same manner as steps 1-5 above. The only exception might be that audio and visual alarms may not be triggered, even if they are above the preconfigured threshold, if the information received is more than four hours past the event origin time. For all other subsequent events, steps 1-6 will be repeated for each additional event received by the client.

Throughout the process, information regarding the client’s connection status to one of the available QuakeWatch servers (hosted by CISN member organizations) is displayed in the **Status Bar**’s right-hand corner. Changes in the connection status will prompt the status indicator to change colors (green=good, yellow=not reported in more than 30 seconds, red=has not reported after 10 or more attempts to reconnect), and a failure to connect to any of the

12. The current transport layer is QDDS (Quake Data Distribution System) developed and supported by the USGS. However this middleware is slated to be replaced by EIDS late 2005 to early 2006. This effort is being lead by the UC Berkeley Seismo Lab in cooperation with the CISN partners.

CISN Display Operation

Theory of Operation

available QuakeWatch servers will cause a error window to pop-up, pointing to a likely network problem with the client. The **Status Bar** is automated display component and is always one when the client is running.

7.2 Understanding the Interface Layout

Interface Layout Summary

- **A - Menu Bar:** Shows text titles for all the application options and configurable settings.
- **B - Title Bar:** Features a configurable “banner graphic”, where users may select from a pre-packaged list of regional banners, or create their own for uploading.
- **C - Earthquake-Event List:** It list time-ordered earthquakes, locally archived on the host machine under: *C:\Program Files\CISN_Display\storage* (default), or user-specified directory.
- **D - Map Window:** Features a GIS-viewing interface (OpenMap) capable of displaying vector-based GIS layers. Prominent in this window are a world map, major world/US city names, earthquake epicenters, major roadways, a focus-pointer, and many other user-configurable layers.
- **E - Map Legend:** Depicts and earthquake epicenter age, and magnitude; enabled/disabled by user.
- **F - Detail Information Panel:** Displays detailed information for the earthquake highlighted in the earthquake event list.
- **G - Navigation Tool Area:** Tools available to user to navigate around the Map Window, and reset the Map Window to default view and magnification. This area also houses the Time Display, featuring system time in GMT, as well as other user configurable time zone.
- **H - Warning Notice:** Brief notice to user, reminding them that earthquake information provided may be preliminary and subject to change.
- **I - Settings Summary:** Displays a select group of configurable parameters from the “Settings Window”.
- **J - Status Bar:** On left-hand side, displays latitude and longitude readout, wherever mouse cross-hairs hover over map; on right-hand side displays connection status *QuakeWatch Server*.

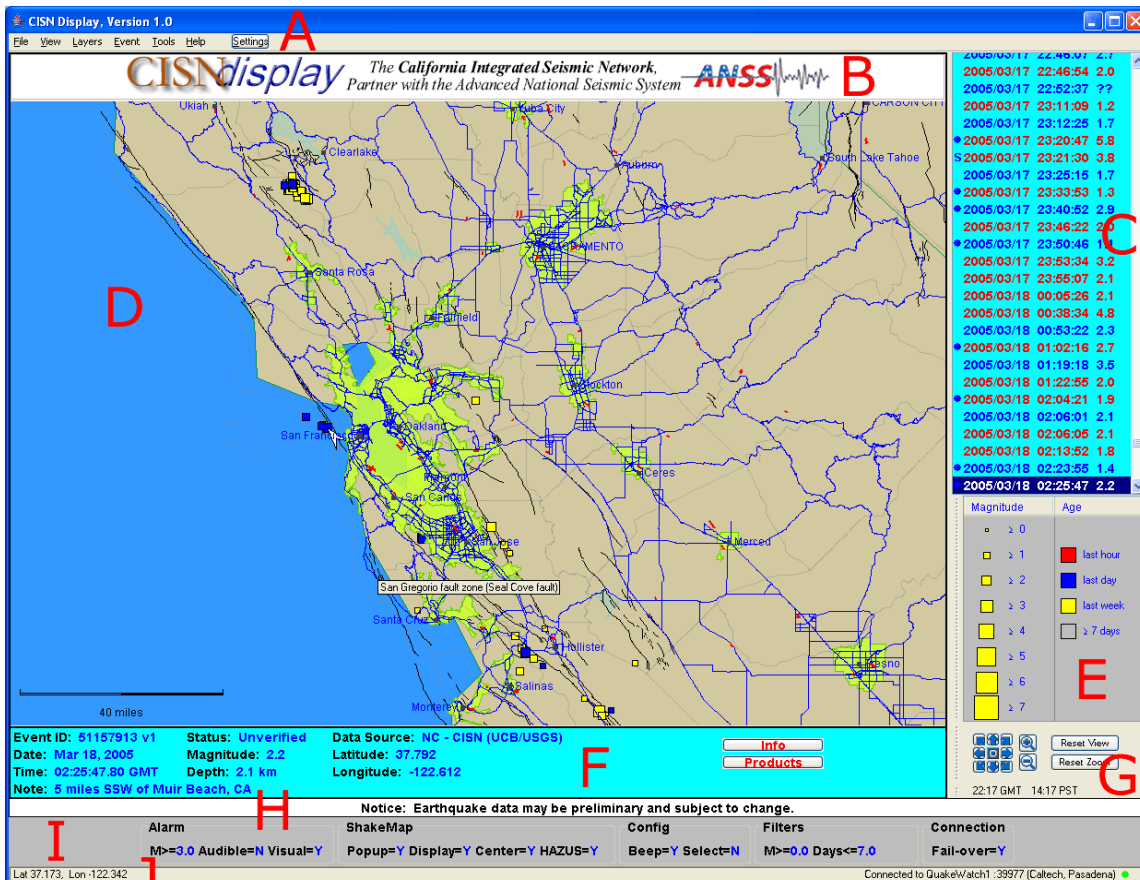


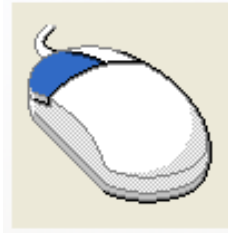
Figure 28: CISN Display layout features a configurable map, and a number of configurable layouts and behaviors.

7.3 Mouse-Click Functions

The CISN Display offers users a number of built-in behaviors and functionality with both left and right mouse-clicks. These behaviors may vary slightly from one operating system, to another, and may not be available where the hardware does not support right-click operations. For such users keyboard shortcuts are provided, where depressing a correct combination of keys will replicate the right-click mouse functionality. Keyboard shortcuts for many left and right mouse-clicks can be accessed from the **Menu Bar** drop-down screens.

In some cases, specifically for **MAC** OS users where there is no built in right-mouse button, these actions may be triggered by clicking the MAC “Apple” button, and a single-click combination.

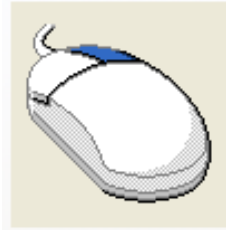
7.3.1 Left-Click Mouse Actions



For the given “interface area” below, performing a single mouse left-click will do all the following, unless otherwise specified (if an area of the interface is not listed then a mouse click has no effect):

1. **Menu Bar** - Produces the drop-down options menu.
2. **earthquake event list** - Single Click: Highlights the “earthquake summary line”, and displays the full information in the **Detail Information Panel**; Double Click: In addition to the single-click action, will also center and display the earthquake epicenter on the **Map Window**.
3. **Map Window** - Centers the map on the geographic point, when the mouse was clicked.
4. **Map Legend** - Clicking the lightly-shaded grey bar on the left side of the window, and dragging it, will pull the **Map Legend** and drag it anywhere on the screen the user wishes.
5. **Detailed Information Panel** - Clicking on the “Info” button opens a window featuring parametric information used to evaluate the event-message; clicking on the “Products” button opens a window featuring all URLs available for a particular event; clicking on a “Product Specific” button opens a Web browser to an individual Web page hosting information regarding that product. Exiting the legend will close the window and automatically make it reappear in its default location.
6. **Navigation Tool Area** - Clicking on one of the “navigation arrows”, moves the geographic map in that direction; clicking at the center of the “navigation arrows” recenters the map at a configurable lat/long coordinate set; clicking on the “Reset Zoom” resets the zoom (or scale-view) resolution to a preset parameter; “Reset View” recenters the view to the configurable lat/long coordinate set, and zoom resolution parameter. Clicking the lightly-shaded grey bar on the left side of the window, and dragging it, will pull either the **Navigation Tool** or the **Time Display** and drag it anywhere on the screen the user wishes.
7. **Settings Summary** - Clicking on one of the “settings” area, opens the “Settings Summary” window with the respective tab selected for quick editing.

7.3.2 Right-Click Mouse Actions



For the given “interface area” below, performing a single mouse right-click will do all the following, unless otherwise specified (if an area of the interface is not listed then a mouse click has no effect):

1. **Menu Bar** - Produces the drop-down options menu.
2. **earthquake event list** - Clicking over a particular event summary line produces a standard options menu for that event that list:
 - Show Products
 - Show Information
 - Close All Information
 - Center Map On Event
 - Display ShakeMap on Map
 - Remove ShakeMap from Map
3. **Map Window** - Selects the earthquake epicenter, nearest the mouse cross-hairs on the map; displays event information in the **Detailed Information Panel** (creates products buttons and hyperlinks if applicable); and highlights the event summary line in the **earthquake event list**.
4. **Detailed Information Panel** - Clicking anywhere in this area panel (except where the “Info” and “Product” buttons are) produces a standard options menu for that event:
 - Show Products
 - Show Information
 - Close All Information
 - Center Map On Event
 - Display ShakeMap on Map
 - Remove ShakeMap from Map
5. **Navigation Tool Area** - Clicking on one or more of the “Time Displays”, will reveal a menu with three current options:
 - Show Seconds
 - Show 24 Hour
 - Show “Regional” Time
6. **Settings Summary** - Clicking on one of the “settings” area, opens the “Settings Summary” window with the respective tab selected for quick editing.

CISN Display Operation
Mouse-Click Functions

8.0 CISN Display Functions & Features

The CISN Display program combines tools previously available only through multiple applications from different sources. The project aims to provide emergency managers and other critical users, a host of useful features helping them to quickly receive and analyze earthquake and tsunami data, and related hazards information from many sources. The following sections attempt to describe the major components that make up the CISN Display's program suite, and delivery of both basic magnitude/location information, and other more comprehensive products published to the Web.

At the foundation of this software package are the auto-generated earthquake messages providing basic, but rapid location, magnitude and date/time reports on a graphical map. Following these messages are URLs distributed to CISN Display, to Web-based products, giving the software a portal aspect that allows users to access many other sources of data. These hyperlinks take users to the home sites of many product generators¹³ where additional information related to the earthquake may be gleaned. Finally, the CISN Display client also serves as a mapping engine, capable of plotting many common formats of GIS layers. This feature is especially useful for the overlaying of ground-shaking intensities provided by ShakeMap. These ground-motion data, coupled with other infrastructure information displayed on the map, combine to form a comprehensive picture of the earthquake's damaging effects.

8.1 Real-time Earthquake Monitoring

Primary to the CISN Display's operation is its active monitoring of near real-time seismicity and earthquake hazards information. Once connected to a QuakeWatch server, the CISN Display begins to monitor seismic data messages, and posts these updates as they are received. This feature requires no interaction from the user, aside from the initial client setup and configuration performed in Section 4.2. Other functions may be activated by the user to sound an audible beep as well as centering each epicenter on the map every time an earthquake message arrives (section 5.2.3). Additionally, an alarm threshold may be configured to trigger a group of audible beeps, as well as a visual flash, for earthquakes above a given magnitude threshold. These options may be configured through **Tools > Setting > Alarm** (section 4.2.1).

8.2 Product Gateway to Web-based URLs

What distinguishes the CISN Display from other GIS enabled, earthquake information tools is its use of the QDDS add-on message, and the Web products these links provide. These messages allow the client to automatically associate specific earthquakes to products and services produced by CISN member organizations, and made available on the Web. These URLs appear on the CISN Display client as soon as the products become available (fig. 29), providing decision makers with quick access to earthquake information on the Internet. A residual benefit to using the QDDS add-on feature on the CISN Display is that it can provide users with national as well as worldwide earthquake information. Since other seismic regions as well as NEIC use QDDS to distribute earthquake information, users may be updated on seismic activity in Alaska, the Pacific Northwest, the East Coast and the New Madrid central US region.

13. Product generators can be anyone from a group of state or federal agencies such as the USGS, NOAA, or state-run EMA's; to research universities that assist in the operation of seismic networks nationwide.

CISN Display Functions & Features

Automated Display and Download of Shakemap

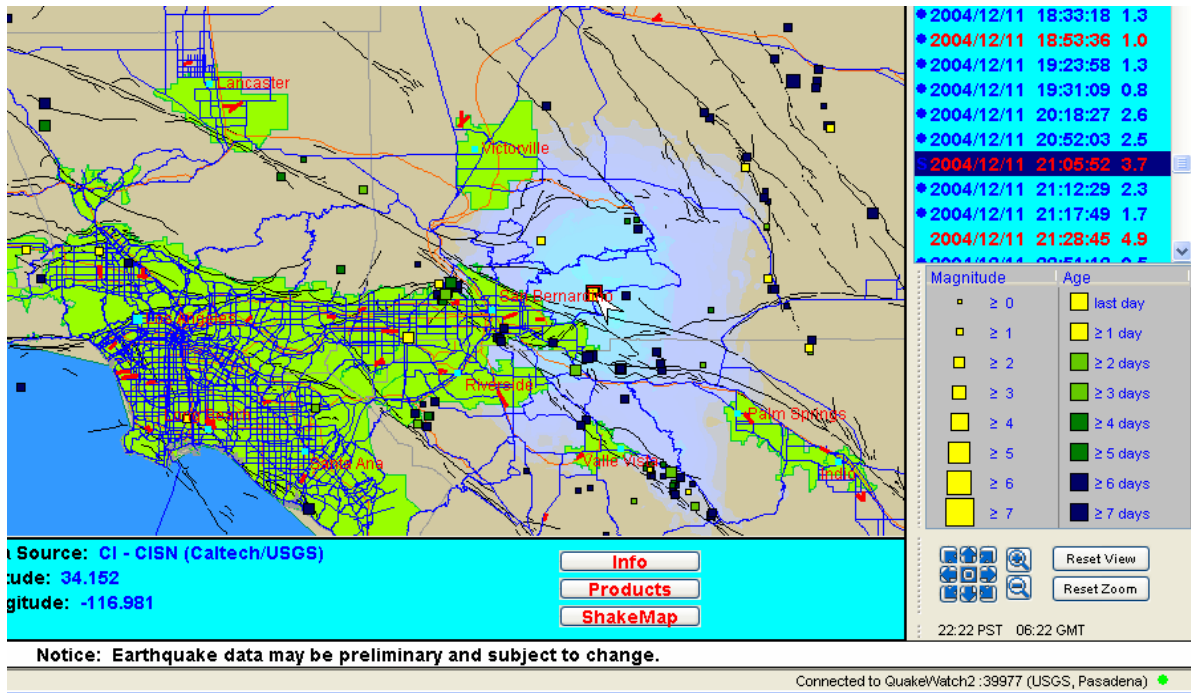


Figure 29: URLs appear by clicking on the “Products” buttons, for earthquake events that feature a “dot” or an “S” in the right-hand earthquake column. Automated events appear in Blue, human-verified events appear in Red in the list.

Current data available on the CISN Display are:

- ShakeMap JPEGs, shape files, HAZUS input files and ShakeMap station-lists
- Digital Waveforms (northern and southern CA)
- Community Internet Intensity Maps (CIIM), or 'Felt Reports'
- First Motion Mechanisms/Moment Tensor Solutions
- Aftershock Forecasts/Earthquake Commentaries
- Tsunami Warning Messages

8.3 Automated Display and Download of Shakemap

A unique and useful feature of the CISN Display is the automated download and display of ShakeMap shapefiles and station-lists overlays onto the map interface. The ShakeMap overlays are treated as GIS files and can be modified like other map layers in section 5.2.5. When ShakeMap information is joined with other map layers depicting critical infrastructure and urban census information, they combine to form a complete picture of the earthquake's aftermath. This level of situational detail can provide decision makers with the key information necessary to allocate limited personnel and resources in response and recovery efforts, and restoration of public lifelines after a major earthquake.

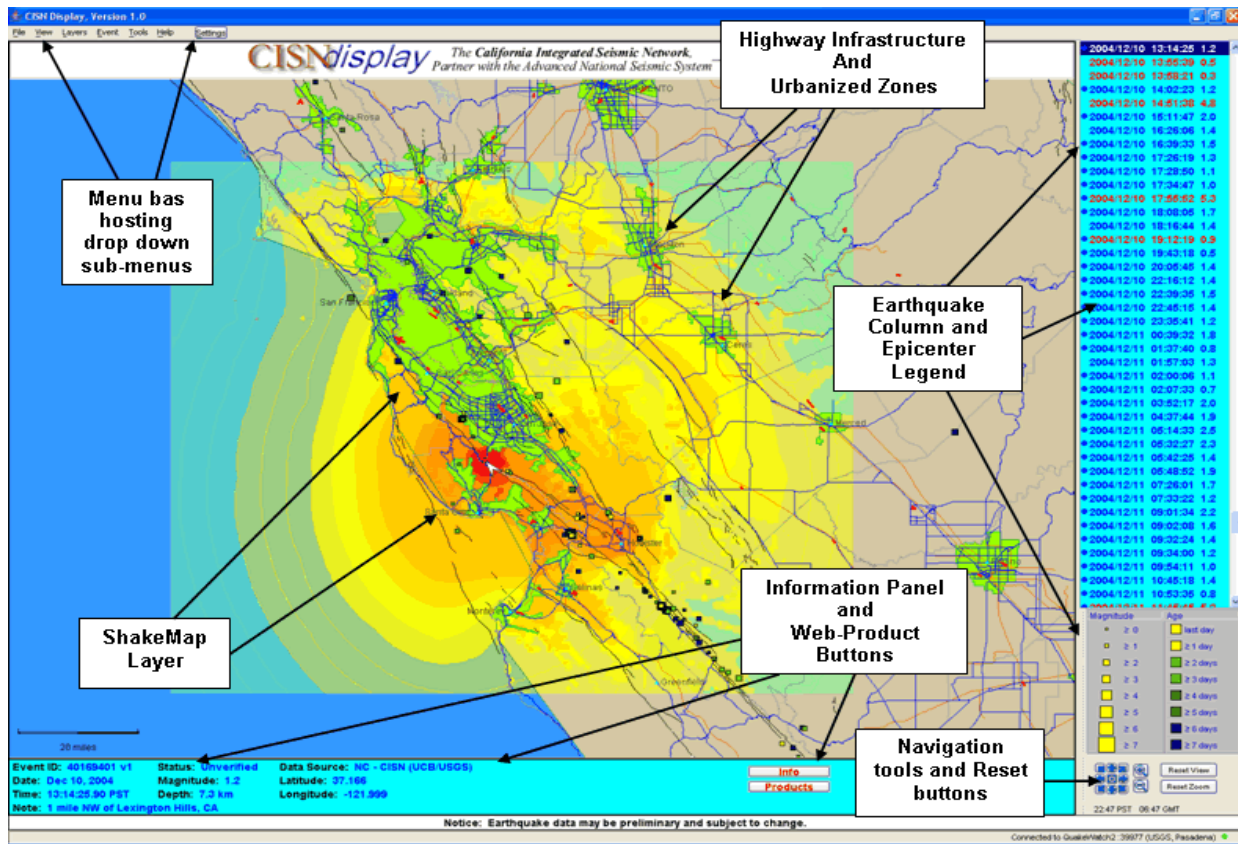


Figure 30: CISN Display with Loma Prieta's 1989 M6.9 ShakeMap overlay. Plotted on the map are active layers of faults, major roadways, population centers, county boundaries, and city centers with maximum measured intensity overlay.

CISN Display Functions & Features
Automated Display and Download of Shakemap

9.0 Appendix A - Detailed Client Settings

9.1 Setting Dialog Window

Clicking on the “**Settings**” item in the “**Tools**” menu brings up the “**Settings**” dialog window. The window contains several “**tabbed**” panels, one of which may be selected at a time. These tabs and their items are described in the sections below.

At the bottom of the window are the following buttons:

OK: Accepts and saves all the changes made (on all the tabs) since the window was displayed.

Cancel: Discards all the changes made since the window was displayed.

Reset: Discards any changes made on the current tab and restores all the items on the current tab to the values they had when the window was displayed.

Defaults: Discards any changes made on the current tab and sets all items on the current tab to their factory-default values (the values they had when the program was first installed).

Help: Displays the Settings Manual documentation, with the screen positioned on the section of the manual that describes the items on the current tab.

9.2 “Alarm” Tab

The items on this tab configure the operation of the audible and visible alarms that are triggered in response to seismic events that meet the alarm criteria. Note that “alarm regions” may be configured via the “Tools | Alarm Regions” menu item; see the “Alarm Regions” Dialog Window section for details. The following items define the “global” alarm settings.

Enable audible alarms: When this checkbox item is selected, a sound will be played when an event alarm is triggered. The alarm duration and frequency items described below will effect how long and how often the alarm sound is played.

Enable visual alarms: When this checkbox item is selected, the program's display screen will flash when an event alarm is triggered. The alarm duration and frequency items described below will effect how long and how often the screen is flashed.

Minimum magnitude for alarm: Sets the minimum-magnitude criteria value for the alarm. The magnitude of an earthquake event must be at this value or greater for the alarm to be triggered. This is a floating-point value. Note that all of the alarm criteria items must be satisfied for the alarm to be triggered.

Minimum depth for alarm: Sets the minimum-depth criteria value for the alarm, in kilometers. The depth of an earthquake event must be at this value or higher for the alarm to be triggered. This is a floating-point value. Note that all of the alarm criteria items must be satisfied for the alarm to be triggered.

Maximum depth for alarm: Sets the maximum-depth criteria value for the alarm, in kilometers. If this value is greater than zero then the depth of an earthquake event must be at this value or lower for the

alarm to be triggered. If this value is zero then this alarm criteria item will be disabled. This is a floating-point value. Note that all of the alarm criteria items must be satisfied for the alarm to be triggered.

Maximum event age (hours): Sets the maximum-event-age criteria value for the alarm. If this value is greater than zero then the number of hours passed since the event-time of an earthquake event must be at this value or lower for the alarm to be triggered. If this value is zero then this alarm criteria will be disabled, allowing events of any age to trigger the alarm. Note that all of the alarm criteria items must be satisfied for the alarm to be triggered.

Only verified events trigger alarm: When this checkbox item is selected, only “verified” events (those that have been reviewed) will be allowed to trigger the alarm.

Alarm duration (seconds): Sets the number of seconds that the alarm sound will be played and the screen flashed. Setting this item to zero will configure the alarm to be played once.

Alarm frequency (seconds): Sets the number of seconds that will pass between the repeated playing of the alarm sound and flashing of the screen. Setting this item to zero will configure the alarm to be played once.

After the alarm has been triggered, it may be shut off manually by using the “Tools | Stop Alarm” menu item or by pressing the “Esc” key. The alarm may be tested by using the “Tools | Trigger Alarm” menu item or by pressing “A” while holding the “Alt” key.

9.3 “ShakeMap” Tab

The items on this tab configure how ShakeMap are downloaded and displayed.

Auto-popup ShakeMaps in browser: Selecting this checkbox enables the automatic display of newly-arrived ShakeMaps in a popped-up web-browser window.

Max popup ShakeMaps age (hours): Sets the maximum age (in hours) for ShakeMaps to be automatically displayed in a popped-up web-browser window. The age is measured from the time that the ShakeMap-product message was generated on the server. Setting this item to zero will allow ShakeMaps of any age to be automatically displayed in a popped-up web-browser window.

Auto-display ShakeMaps on map: Selecting this checkbox enables the automatic download and display of ShakeMaps onto the map display.

Auto-center ShakeMap when auto-displayed: When this checkbox is selected and a ShakeMap is automatically displayed on the map, the map will be centered onto the event associated with the ShakeMap.

Max ShakeMaps display age (hours): Sets the maximum age (in hours) for ShakeMaps to be automatically displayed onto the map. The age is measured from the time that the ShakeMap-product message was generated on the server. Setting this item to zero will allow ShakeMaps of any age to be automatically displayed onto the map.

Max time to show ShakeMaps (hours): Sets the maximum age (in hours) that a ShakeMap will be shown on the map before being automatically removed. The age is measured from the time that the ShakeMap is downloaded and displayed on the map. Setting this item to zero will disable the automatic removal of ShakeMaps from the map.

of days to keep ShakeMap files: Sets the number of days that downloaded ShakeMap files will be kept. ShakeMap files older than the specified number of days will be automatically deleted. These files are downloaded whenever a ShakeMap is displayed on the map, and they are kept in the directory specified by the "ShakeMap files directory" setting. The age of the files is measured from the time that the ShakeMap was displayed. Setting this item to zero will disable the automatic removal of ShakeMap files (never delete).

ShakeMap files directory: Sets the name of the subdirectory used to store downloaded ShakeMap data files.

Ignore ShakeMaps below magnitude: ShakeMaps associated with events whose magnitude is below this value will never be automatically downloaded and displayed onto the map display.

Always display ShakeMaps magnitude: ShakeMaps associated with events whose magnitude is at or above this value will always be automatically downloaded and displayed onto the map display (as long as the ShakeMap is not older than the "Max ShakeMaps display age" setting). See the "Rules for Automatic Download and Display of ShakeMaps" section below for more information on how this setting is used.

Adjacent distance limit: When the distance between two ShakeMaps is less than or equal to this value then the two ShakeMaps are considered to be "adjacent" or "in the same area". The distance is measured between the locations of ShakeMaps' associated events. See the "Rules for Automatic Download and Display of ShakeMaps" section below for more information on how this setting is used.

Hide adjacent smaller ShakeMaps: When this checkbox is selected, smaller ShakeMaps that are adjacent to larger ShakeMaps will (in many cases) be hidden. When this happens, the hidden ShakeMap will still have an entry under the "Layers" menu. See the "Rules for Automatic Download and Display of ShakeMaps" section below for more information on how this setting is used.

Put larger ShakeMaps on top: If this checkbox is selected then when a new ShakeMap is added, the new ShakeMap is placed below any currently-loaded ShakeMaps whose "magnitude" is greater than the new ShakeMap. (The "magnitude" of the ShakeMap is the magnitude of its associated event.) If this checkbox is not selected then new ShakeMaps are placed above all currently-loaded ShakeMaps. Note that the relative positions of the ShakeMap layers may also be moved via the "Layers | Edit Layers" menu item.

Autodownload HAZUS files: If this checkbox is selected then when a new ShakeMap is available, if the magnitude of the event associated with the ShakeMap is greater than or equal to 5.0 the program will attempt to download the set of "HAZUS" data files for the event. If the files are available and the download is successful then the files will be placed into the subdirectory defined by the "Hazus files directory" settings.

Hazus files directory: Sets the name of the subdirectory used to store downloaded HAZUS data files.

Place ShakeMap layers after: Sets the name of the layer after which ShakeMap layers should be placed. When a new ShakeMap is displayed it is placed after the specified layer, allowing it and all the layers above it to be viewed on top of the ShakeMap. Note that the relative positions of the ShakeMap layers may also be moved via the "Layers | Edit Layers" menu item.

Show detailed ShakeMap legend: When this checkbox is selected, the "detailed" version of the ShakeMap legend (shown via the "View | Show ShakeMap Legend" menu item) is used; otherwise the "basic" version of the legend is used.

9.4 Rules for Automatic Download and Display of ShakeMaps:

The tag names below are used in the rule-descriptions that follow:

displayShakeMapsMag: “Always display ShakeMaps magnitude”

adjacentShakeMapDist: “Adjacent distance limit”

hideAdjShakeMapsFlag: “Hide adjacent smaller ShakeMaps”

1. When a new ShakeMap is available, if 'hideAdjShakeMapsFlag'==false then the new ShakeMap is automatically downloaded & displayed and no other ShakeMaps are modified. Otherwise:
2. If no other ShakeMaps are located within 'adjacentShakeMapDist' miles of the new ShakeMap's location then the new ShakeMap is automatically downloaded & displayed. (The distance between ShakeMaps is measured between the locations of ShakeMaps' associated events.) Otherwise:
3. If the new ShakeMap has a magnitude at or above the 'displayShakeMapsMag' value or is the highest-magnitude ShakeMap in the area then the new ShakeMap is automatically downloaded & displayed. (Being equal to the highest-magnitude ShakeMap is treated the same as being the highest.) After that, any of the smaller ShakeMaps in the area with a magnitude smaller than the 'displayShakeMapsMag' value are hidden (but their layers remain in the “Layers” menu).
4. If the new ShakeMap has a magnitude below the 'displayShakeMapsMag' value and is not the highest-magnitude ShakeMap in the area then the new ShakeMap is downloaded and placed into the “Layers” menu but it is not displayed on the map. (Being equal to the highest-magnitude ShakeMap is treated the same as being the highest.)

4.1 “Config” Tab

The items on this tab define a set of general configuration parameters.

Display time zone: This combo-box selects the time zone used on the display.

Audible beep on new events: When this checkbox is selected, a “beep” will be sounded when a new earthquake event arrives.

Auto-select new events: When this checkbox is selected and a new earthquake event arrives with an event-time newer than the “Max auto-select age” value then the newly-arrived event will become the selected event, with the map centered on it.

Max auto-select age (hours): Sets the maximum age (in hours) for newly-arrived events to be auto-selected. The age is measured from the event-time for the event. Setting this item to zero will allow all newly-arrived events to be auto-selected.

Max loaded-events age (days): Sets the maximum age (in days) for earthquake events that are held in the program's memory. Events older than this age will be removed from the display. (The events may

still be available in the program's local archive.) The age is measured from the event-time for the events and is specified as a floating-point value (which must be greater than zero).

Max event-archive age (days): Sets the maximum age (in days) for earthquake-event messages that are held in the program's local (file-based) archive. Event messages older than this age will be removed from the archive. The age is measured from the time that the event messages were generated on the server and is specified as an integer value (which must be greater than zero).

Max event from server age (days): Sets the maximum age (in days) for earthquake-event messages that are fetched from the server. The age is measured from the time that the event messages were generated on the server and is specified as a floating-point value. Setting this item to zero will disable the fetching of messages from the server. Note that event messages generated on the server after the time specified by this maximum-age limit may reference earthquake events that occurred before the time specified by this maximum-age limit.

Symbol pixels per magnitude: Configures the size of the earthquake-event symbols shown on the map as a floating-point ratio of screen pixels to earthquake-event magnitude.

Maximum symbol magnitude: Establishes a maximum magnitude for earthquake-event symbols shown on the map such that no event symbol will be larger than the symbol for this magnitude value.

Reset-View center latitude: Sets the latitude value (in decimal degrees) used by the "Reset View" button and view-menu item.

Reset-View center longitude: Sets the longitude value (in decimal degrees) used by the "Reset View" button and view-menu item.

Reset-View map zoom-scale: Sets the map zoom-scale value used by the "Reset View" and "Reset Zoom" buttons and view-menu items.

Launch browser command prefix: Sets the prefix string for the operating system command used to launch a web browser. Leaving the two "Launch browser command" items blank will configure the program to automatically determine the proper operating system command to use, which works well on most systems.

Launch browser command suffix: Sets the suffix string for the operating system command used to launch a web browser. Leaving the two "Launch browser command" items blank will configure the program to automatically determine the proper operating system command to use, which works well on most systems.

Banner graphic file: Clicking on this button will display a file-chooser browser that may be used to modify the graphic for the banner shown above the map. This graphic is also used as the "splash screen" displayed while the program is loading. The name of the current banner-graphic file is displayed on the button.

Product button1 product type: This combo-box may be used to select the function performed by the top "product" button that appears on the event information panel shown below the map. Available selections include "Info" (to configure the button to bring up an event information window) and "Products" (to configure the button to bring up a menu showing available event products, if any are available). The other available selections correspond to various product types that may be associated with events. When the button is configured for one of these product types and the product is available for the event displayed in the information panel, the button will appear.

Product button2 product type: This combo-box may be used to select the function performed by the middle “product” button that appears on the event information panel shown below the map. See the description for “Product button1 product type” for more information.

Product button3 product type: This combo-box may be used to select the function performed by the bottom “product” button that appears on the event information panel shown below the map. See the description for “Product button1 product type” for more information.

4.2 “Filters” Tab

The items on this tab define the earthquake-event filter that is used to select which events are shown on the program's display. For an earthquake event to be shown, it must satisfy all of the enabled filter items.

Minimum event magnitude displayed: Only earthquake events with a magnitude of this value or greater will be displayed.

Maximum event age displayed (days): Only earthquake events that are newer than this age (in days) will be displayed. The age is measured from the event-time for the event and is specified as a floating-point value. Setting this item to zero will disable it (allowing events of any age to be displayed).

Keep events from these data sources: This item may contain a comma-separated list of data-source specifiers (i.e. “CI, NC”). If this item is not blank then only earthquake events with matching data-source specifiers will be displayed, and this item will override the “Drop events from these data sources” item. If this item is blank then earthquake events from all data sources will be displayed (except those dropped via the “Drop events from these data sources” item). The data-source specifiers are not case-sensitive.

Drop events from these data sources: This item may contain a comma-separated list of data-source specifiers (i.e. “CI, NC”). If this item is not blank and the “Keep events from these data sources” item is blank then earthquake events with matching data-source specifiers will not be displayed. If this item is blank then it will have no effect on filtering. The data-source specifiers are not case-sensitive.

Minimum event latitude displayed: Earthquake events with a latitude less than this item's value will not be displayed. The value is specified in decimal degrees. If both this and the “Maximum event latitude displayed” item are zero then earthquake events of any latitude will be displayed.

Maximum event latitude displayed: Earthquake events with a latitude greater than this item's value will not be displayed. The value is specified in decimal degrees. If both this and the “Minimum event latitude displayed” item are zero then earthquake events of any latitude will be displayed.

Minimum event longitude displayed: Earthquake events with a longitude less than this item's value will not be displayed. The value is specified in decimal degrees. If both this and the “Maximum event longitude displayed” item are zero then earthquake events of any longitude will be displayed.

Maximum event longitude displayed: Earthquake events with a longitude greater than this item's value will not be displayed. The value is specified in decimal degrees. If both this and the “Minimum event longitude displayed” item are zero then earthquake events of any longitude will be displayed.

4.3 "Colors" Tab

The items on this tab define the colors used on the program's display. Each color item has a "color" button labeled with the name or numeric-hex value for the color. When a "color" button is pressed, it brings up a "Select Color" dialog window that may be used to select a color using various methods. In addition to the red, green and blue attributes of the color, its "alpha" value may also be set, where an "alpha" value of 0 means fully transparent and an "alpha" value of 255 means fully opaque. Note that lowering the "alpha" value below 255 on any of the "background" color items is not recommended, as this may cause intermittent "ghosting" effects on the display.

Map background color: The map background color, shown as the "water" areas on the map.

Banner background color: The background color for the program "banner" graphic shown above the map.

Info panel background color: The background color for the event information panel shown below the map.

Info panel prompt color: The color for the "prompt" text items on the event information panel shown below the map. (For example, "Event ID".)

Info panel data color: The color for the "data" text items on the event information panel shown below the map. (For example, the event-ID value.)

Info panel buttons color: The color for the text-labels on the buttons on the event information panel shown below the map.

Legend background color: The background color for the map legend.

Legend foreground color: The color for the text on the map legend.

Quake list background color: The background color for non-selected events on the earthquake-event list shown to the right of the map.

Quake list foreground color: The text color for non-selected, non-verified events on earthquake-event list shown to the right of the map.

Quake list sel background color: The background color for the currently-selected event on the earthquake-event list shown to the right of the map.

Quake list sel foreground color: The text color for the currently-selected (non-verified) event on the earthquake-event list shown to the right of the map.

Verified event color: The text color for verified events on earthquake-event list shown to the right of the map.

Settings summary background color: The background color for the optional settings-summary panel shown at the bottom of the display. This panel may be shown or hidden via the "View | Show Settings Summary" menu item.

Settings summary prompt color: The color for the "prompt" text items on the optional settings-summary panel shown at the bottom of the display. This panel may be shown or hidden via the "View | Show Settings Summary" menu item.

Settings summary data color: The color for the “data” text items on the optional settings-summary panel shown at the bottom of the display. This panel may be shown or hidden via the “View | Show Settings Summary” menu item.

4.4 “Event Colors” Tab

Event age \geq 0 hours color: The color for event symbols on the map that represent events that are less than one hour old.

Event age \geq 1 hour color: The color for event symbols on the map that represent events that are at least one hour old but less than one day old.

Event age \geq 1 day color: The color for event symbols on the map that represent events that are at least one day old but less than two days old.

Event age \geq 2 days color: The color for event symbols on the map that represent events that are at least two days old but less than three days old.

Event age \geq 3 days color: The color for event symbols on the map that represent events that are at least three days old but less than four days old.

Event age \geq 4 days color: The color for event symbols on the map that represent events that are at least four days old but less than five days old.

Event age \geq 5 days color: The color for event symbols on the map that represent events that are at least five days old but less than six days old.

Event age \geq 6 days color: The color for event symbols on the map that represent events that are at least six days old but less than seven days old.

Event age \geq 7 days color: The color for event symbols on the map that represent events that are at least seven days old.

Selected symbol color: The color for the event symbol on the map corresponding to the currently-selected event. Setting the “alpha” value for this color to zero will leave the symbol for the currently-selected event unchanged.

CUBE/REDI color scheme: Selecting this radio-button will set the “Event age” and “Selected symbol color” items to the factory-default values for the CUBE/REDI color scheme.

Simpson-map color scheme: Selecting this radio-button will set the “Event age” and “Selected symbol color” items to the factory-default values for the Simpson-map color scheme.

4.5 “Connection” Tab

The items on this tab define the parameters used for the connection to the server.

Server host address: Sets the host-address value for the server. The value may be in name (i.e. “www.caltech.edu”) or numeric-IP (i.e. “131.215.220.4”) form. If the server-host-address value is empty and the “Enable fail-over to alternate servers” checkbox is selected then one of the alternate servers will be chosen at random and used as the server.

Server port number: Sets the port-number value for the server.

Server Login: Clicking on this button will display a Login-Information window that may be used to enter or modify the username and password used to validate the connection to the server. This window is also displayed when the program fails to connect because the username/password combination is not accepted by the server. For login username/password help, contact your system administrator or the CISN Display helpdesk representative at one of the CISN member organizations.

Max secs for server alive msgs: Sets the maximum number of seconds that this program will wait for a server "alive" message before determining that the message has been missed. The server will transmit one "alive" message every ten seconds. When server "alive" messages have been missed and the number of seconds elapsed since the last-received server "alive" message exceeds the "Server connection timeout" value, the program will attempt to reestablish its connection to the server. Setting this item to zero will disable alive-message checking.

Server connection timeout (seconds): Sets the number of seconds that this program will wait, after server "alive" messages have been missed, before attempting to reestablish its connection to the server. Setting this item to zero will configure the program to never attempt to reestablish its server connection.

Max connection-retry wait (minutes): Sets the maximum number of minutes that this program will wait between consecutive attempts to reestablish its connection to its server (or alternate servers). After each consecutive failed connection attempt, the amount of wait-time before the next attempt will be doubled (which helps to reduce network traffic during lengthy outages). This item establishes a maximum wait-time.

Enable fail-over to alternate servers: When this checkbox item is selected and a connection to the current server cannot be established, a connection to an alternate server will be attempted. This program maintains a list of alternate servers in its configuration, and also fetches a new list each time it connects to a server.

4.6 "Alarm Regions" Dialog Window

Clicking on the "Alarm Regions" item in the "Tools" menu brings up the "Alarm Regions" dialog window, which may be used to specify regions of interest for deciding which events will trigger alarms. For a given alarm region, a minimum-magnitude value may be specified that applies only within that region and is used instead of the "global" minimum-magnitude value. The events must still pass all the other (non-magnitude) "global" alarm-criteria settings (configured via the "Alarm" Tab) in order to trigger an alarm.

To make an alarm region more "sensitive" than the area outside of the region, the "global" minimum-magnitude may be set to a value that is much higher than the minimum-magnitude value for the region.

Note: Events first need to pass the "filter" settings (configured via the "Filters" Tab) to be able to trigger alarms.

The polygons and circles that make up the regions reside in a map layer named "Alarm Regions", which is listed in the "Layers" menu. When this map layer is enabled, the polygons and circles are shown on the map. They may be hidden by unsetting the "Alarm Regions" entry in the "Layers" menu. When adding or editing alarm regions it is recommended that the "Alarm Regions" layer be enabled. Whether or not it is enabled has no effect on how the alarms are triggered.

Appendix A - Detailed Client Settings

“Add/Edit Circle/Polygon Region” Dialog Window

The “Alarm Regions” dialog window displays a list of entries, one for each currently-configured region. An entry may be selected by clicking on it, and the following right-side buttons are available:

Add Circle: Brings up the “Add Circle Region” dialog window, which may be used to define a region using a point and a radius. See the “Add/Edit Circle/Polygon Region” Dialog Window section below.

Add Poly: Brings up the “Add Polygon Region” dialog window, which may be used to define a region using a polygon. See the “Add/Edit Circle/Polygon Region” Dialog Window section below.

Edit: Brings up the “Edit Circle Region” dialog window if a circle alarm region is selected or the “Edit Polygon Region” dialog if a polygon alarm region is selected. See the “Add/Edit Circle/Polygon Region” Dialog Window section below.

Remove: Removes the currently selected alarm region(s). Several regions may be selected and removed at one time.

At the bottom of the dialog window are the following buttons:

Close: Closes the dialog window.

Help: Displays the Settings Manual documentation, with the screen positioned on the section of the manual that describes this dialog window.

4.7 “Add/Edit Circle/Polygon Region” Dialog Window

Clicking on one of the right-side “add” or “edit” buttons on the “Alarm Regions” dialog window will bring up a dialog window that may be used to add or edit an alarm region. This dialog window is located at the top-right portion of the screen, and while it is displayed, alarm regions may be defined by clicking on the map. After each mouse click, the corresponding numeric values will be entered into the “Region data” field on the dialog window.

The following items are available:

Name of region: An optional name for the region.

Minimum magnitude for alarm: Sets the minimum-magnitude alarm criteria value for the region. The magnitude of an earthquake event must be at this value or greater for the alarm to be triggered. This is a floating-point value. If this setting is blank or zero then the “global” minimum-magnitude value (configured via the “Alarm” Tab) will be used.

Region data: The geographical data values for the region. The values may be entered in manually or by clicking on points on the map display.

For **circle regions**, the data values consist of a latitude, longitude and radius (in miles) with the following format: “(lat lon) radius”. A circle region may be defined by two mouse clicks on the map display, with the first one specifying the center and the second one specifying the radius of the circle. When clicking on the map to define a circle region, any existing region-data values will be replaced.

For **polygon regions**, the data values consist of 3 or more latitude/longitude points with the following format: “(lat lon)”, with each point-entry on a separate line. The polygon region may be defined by clicking points on the map display. The latitude-longitude values for each clicked-on point will be added after any current values. When clicking points to define a polygon, the shape does not need to be “closed” because a line will automatically be assumed between the first and last points.

At the bottom of the window are the following buttons:

OK: Accepts and saves all the changes made since the dialog window was displayed.

Cancel: Discards all the changes made since the dialog window was displayed.

Help: Displays the Settings Manual documentation, with the screen positioned on the section of the manual that describes this dialog.

4.8 Libraries

The following open-source libraries are used by this program:

OpenMap <http://openmap.bbn.com>

OpenORB <http://openorb.sourceforge.net>

JDOM <http://www.jdom.org>

Sources <http://xml.apache.org>

See the files in “doc/libidos” in the installation directory of this program for the licensing information for these libraries.

Appendix A - Detailed Client Settings
Libraries

10.0 Appendix B - Authoritative Regions

10.1 Lat/Long Geographic Coordinates

Each reporting network is assigned an authoritative region and network code, represented by a closed polygon (given as latitude and longitude pairs). The following maps shows the boundaries of the authoritative regions for the contributing networks. The symbols on the maps show the seismic station locations of the respective networks. Any region not assigned to a regional network is by default assigned to NEIC.

Regional Seismic Networks, and their Polygon Boundaries:

AK: Alaska Regional Network

71.0000 -140.0000
57.0000 -140.0000
55.0000 -156.0000
59.0000 -164.0000
63.0000 -169.0000
71.0000 -169.0000

CI: Southern California Seismic Network

35.8000 -116.4000
34.0815 -114.4717
32.0000 -114.3333
32.0000 -120.5000
34.5000 -121.2500
37.2167 -118.0167
36.6847 -117.7930
35.8000 -116.4000

HV: Hawaii Volcano Observatory Network

18.8333 -155.0000
19.5000 -154.7500
20.0000 -154.9167
20.2500 -155.2500
20.3333 -155.9167
20.0000 -156.5000
19.1667 -156.1667
18.7500 -155.6667
18.8333 -155.0000

MB: Montana Seismic Network

Appendix B - Authoritative Regions

Lat/Long Geographic Coordinates

45.1667 -109.5000
45.1667 -111.3333
44.5000 -111.3333
44.5000 -113.0000
47.9500 -116.0500
48.5000 -115.0000
48.5000 -113.0000
46.0000 -109.5000
45.1667 -109.5000

NC: Northern California Seismic Networks

34.5000 -121.2500
37.2167 -118.0167
37.7500 -118.2500
37.7500 -119.5000
39.5000 -120.7500
42.0000 -121.4167
42.0000 -122.7000
43.0000 -125.0000
40.0000 -125.5000
34.5000 -121.2500

LD: Lamont Doherty Seismographic Network

46.5000 -72.5000
45.4000 -72.5000
40.5000 -73.5000
38.0000 -73.0000
38.0000 -75.4000
38.0000 -76.3000
38.3500 -77.2500
39.0000 -77.2500
39.5000 -80.5000
43.5000 -80.5000
46.5000 -75.0000
46.5000 -72.5000

NM: New Madrid Seismic Network

37.6270 -86.6797
36.6270 -88.6203
34.0273 -88.4165
34.0000 -93.5000
38.0000 -93.5000
40.0000 -91.5000
40.0000 -85.0000
38.8000 -85.0000

37.6270 -86.6797

NN: Nevada Seismic Network

35.3000 -114.6000
35.8000 -116.4000
36.6847 -117.7930
37.7500 -118.2500
37.7500 -119.5000
39.5000 -120.7500
40.5000 -120.5000
41.5000 -119.2000
41.3000 -118.3000
40.0000 -116.0000
37.5000 -114.3000
35.3000 -114.6000

PR: Puerto Rico Seismic Network

17.0000 -69.0000
17.0000 -63.5000
20.0000 -63.5000
20.0000 -69.0000
17.0000 -69.0000

SE: SouthEast US Seismic Network

36.6270 -88.6203
37.6702 -86.6797
37.2553 -82.1907
39.0 -81.0000
39.0 -77.2500
38.3500 -77.2500
38.0000 -76.3000
38.0000 -75.4000
35.9530 -75.5817
32.2235 -79.6552
30.7383 -81.0937
26.9808 -79.8295
24.7603 -80.2632
24.9113 -81.4730
30.0472 -85.2255
33.4813 -85.8910
34.0273 -88.4165
36.6270 -88.6203

UU: Utah Seismograph Network

36.7500 -108.7500

Appendix B - Authoritative Regions

Lat/Long Geographic Coordinates

36.7500 -114.2500
42.5000 -114.2500
42.5000 -108.7500
36.7500 -108.7500

UW: Pacific Northwest Seismic Network

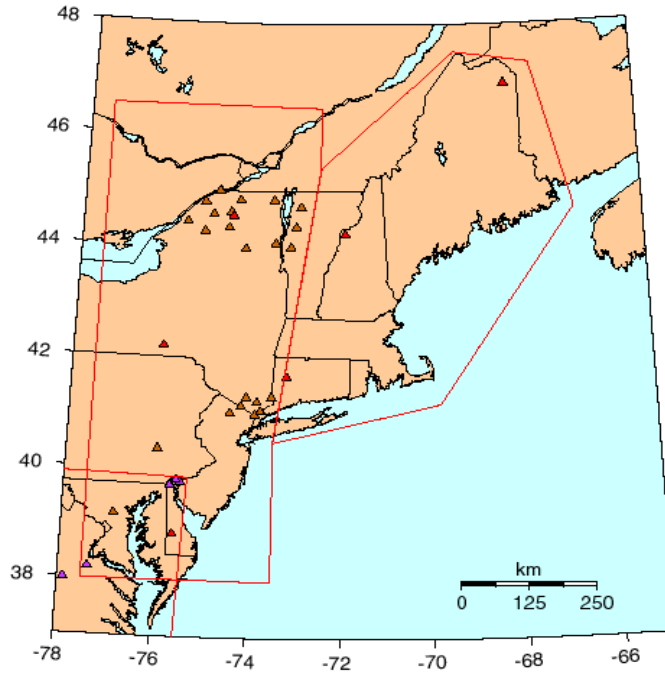
43.0200 -125.0000
42.0000 -122.7000
42.0000 -121.0000
45.9000 -117.8000
46.0000 -117.8000
47.0000 -116.9000
48.8000 -117.0000
48.9800 -121.2000
48.9500 -123.3000
48.3000 -123.4000
48.5000 -125.0000
44.5000 -124.6000
43.0000 -125.0000
43.0200 -125.0000

WY: Yellowstone WY Seismic Network

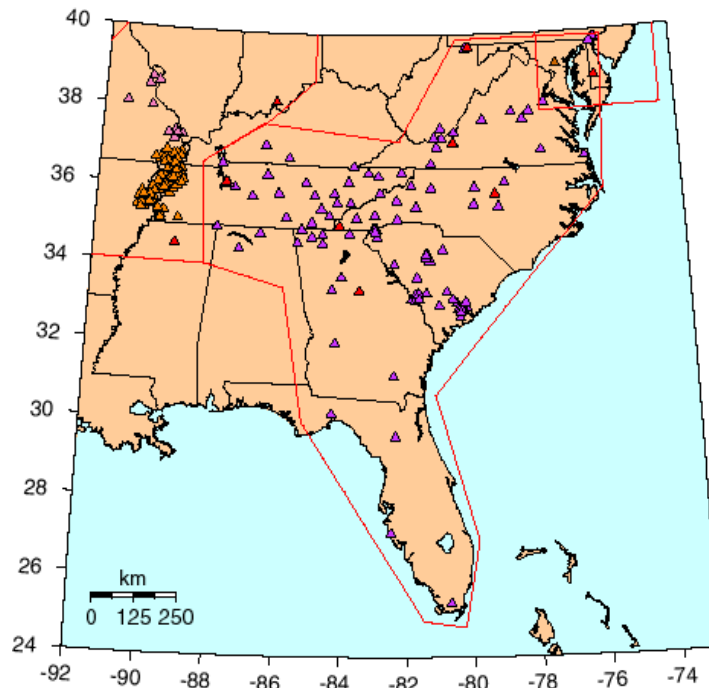
44.0000 -109.7500
44.0000 -111.3333
45.1667 -111.3333
45.1667 -109.7500
44.0000 -109.7500

10.2 Regional US Seismic Network Maps

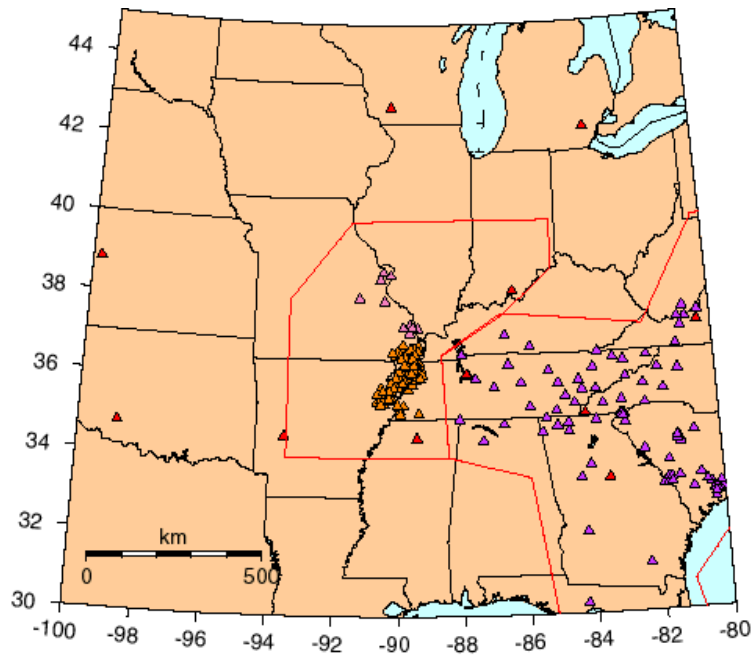
Northeast US



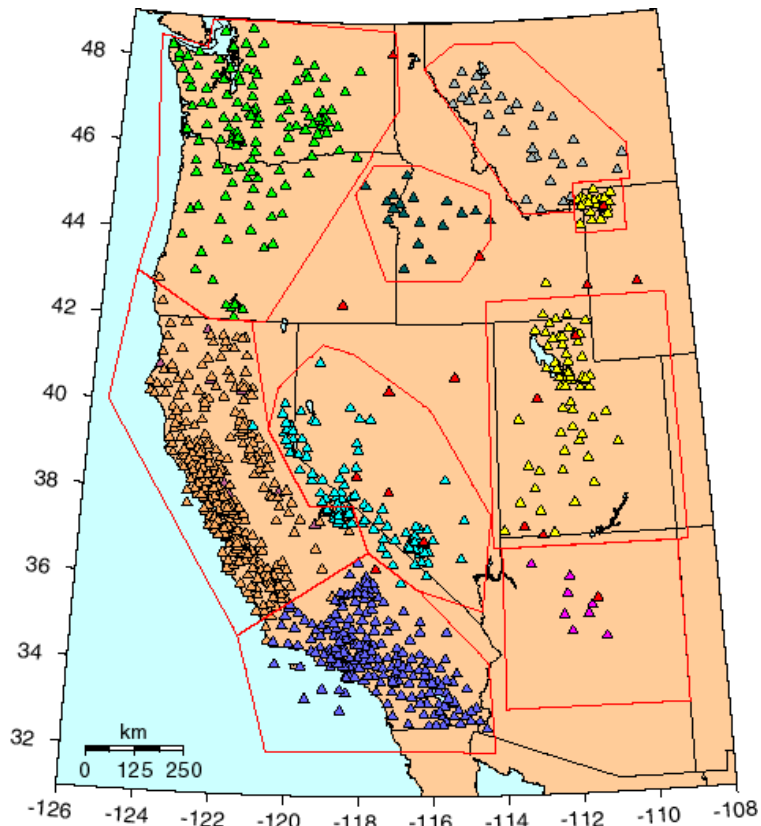
Southeast US



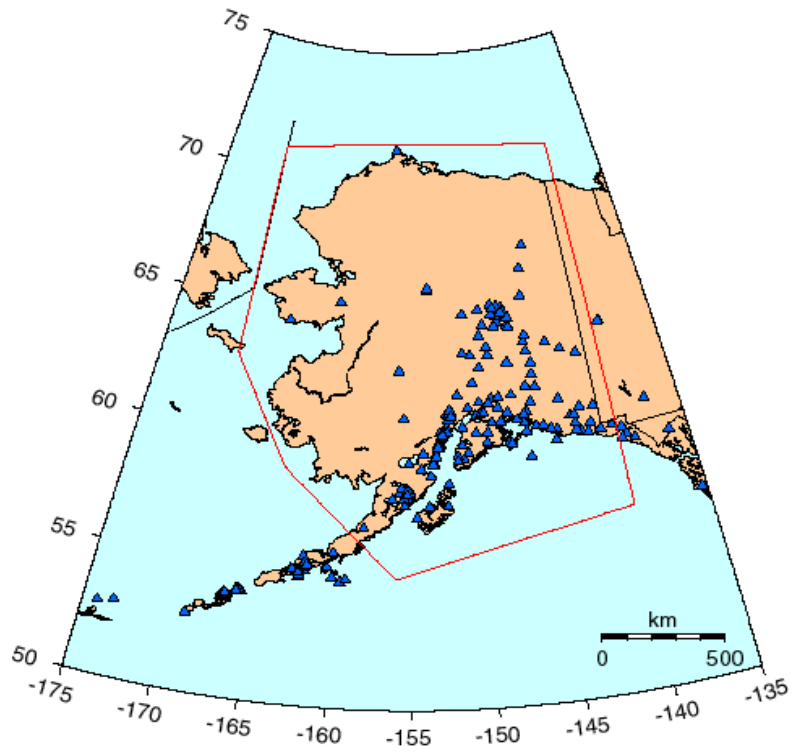
New Madrid region (Central US)



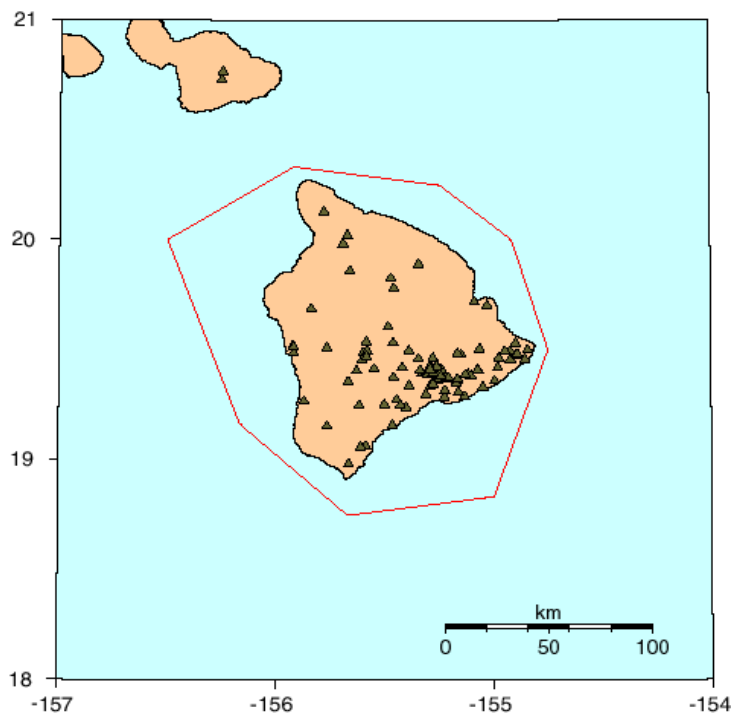
Western US



Alaska



Hawaii



Puerto Rico

