



CISN Shake/Alert

Towards a Prototype Earthquake Early Warning System for California

UserDisplay – Operations Guide

Version 2.3

Contents:

1. Disclaimer
2. Background
3. Download and Installation
4. Menu
5. Alert Information
6. Contact Information

1. **Disclaimer:**

The CISN ShakeAlert system, which includes the UserDisplay, is a system under development. We are continuously enhancing the software, including improving the robustness and speed of alert messages. Do not share this software with others.

Disclaimer of Earthquake Information

The preliminary earthquake data provided by the CISN ShakeAlert system are computer generated, and are subject to change. Earthquake records are subsequently reviewed by seismologists. In the acceptance process, details of the information about the event are likely to change, possibly significantly. These include changes to magnitude, location and origin time; or the earthquake information may be deleted as being a false event. The data are not intended to, nor do they provide early warning or a prediction of future seismic activity. All efforts have been made to provide accurate information, but reliance on or interpretation of earthquake data from a single source is not advised. Consumers of the earthquake messages are strongly cautioned to consider carefully and use common sense in any decisions relating to personal or public safety, and the conduct of business that involves substantial financial or operational consequences.

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2. Background

Since 2007 scientists from Caltech, UC Berkeley, ETH Zurich, USC/SCEC and USGS have been working on the development and implementation of a prototype earthquake early warning (EEW) system for California (<http://www.cisn.org/eew/>). CISN ShakeAlert combines the outputs from three independently running algorithms, Tauc-Pd Onsite, Virtual Seismologist, and ElarmS. CISN ShakeAlert provides a continuum of earthquake alert information, including rapid estimates of magnitudes, locations, and expected seismic intensities. To notify users and to rapidly and simply display alert information, we have developed a Java Application that runs on a user's computer and receives xml-messages from the ShakeAlert system. This UserDisplay shows the user's location and the estimated epicenter of the earthquake. As time elapses from the detection and notification of an event, the current locations of the P- and S-wave fronts are also shown, as well as the estimated magnitude, the predicted intensity of shaking at the user's site and the remaining time until this shaking is expected to start. The UserDisplay pops-up automatically once an alert message is received that exceeds the minimum thresholds for magnitude, intensity and probability that the user has specified. Xml-messages received by the UserDisplay are locally stored on the user's computer and can be replayed. To ensure robust communication, the UserDisplay receives and displays heartbeats coming from the three algorithms and the DecisionModule of the ShakeAlert system.

We are making the UserDisplay available to a limited group of users as part of our testing of the EEW algorithms and software. During the testing, software modules may fail and we expect the system to be off-line some of the time. Thus, it will not be reliable and should not be used to make important decisions. We request that users do not distribute the UserDisplay software to others, as they will not be informed about the progress of the EEW testing and/or may not understand the current limitations of the EEW prototype system. We also ask users of the prototype system not to talk to the news media or judge the system performance, because they may not have enough information to explain unexpected system performance. If EEW testing is a success, the USGS plans to raise funds to build an actual EEW system that will be available to the public, and everybody can receive alerts.

3. Download and Installation

The latest version of the CISN ShakeAlert UserDisplay program can be downloaded from the CISN web site: <http://www.cisn.org/eeew/software/userdisplay/>. To download and to run the program, users must request a username and password. Requests should be directed to either

Prof. Thomas Heaton (Caltech) heaton@caltech.edu, or
Prof. Richard Allen (UC Berkeley) rallen@berkeley.edu

Windows users should download *.msi. Users of other platforms should download *.zip. **Do not share your username and password with others.**

The CISN ShakeAlert UserDisplay is a platform-independent Java Application. The program has been successfully tested on Windows 7, Windows Vista, Windows XP, Linux and Mac OS X. The program requires Java version 1.6 or higher. Please follow the instructions of the installation manager. You must grant the UserDisplay access through your firewall to be able to receive alert messages from the ShakeAlert system.

Once the program is fully installed, you should find a shortcut for the UserDisplay on your desktop. Double-click on the icon and enter your username and password to start your CISN ShakeAlert UserDisplay. Do not forget to turn on the volume of your PC to be able to hear the siren and voice announcements, when an alert message is received.

4. Menu

There are menus along the top and bottom of the CISN ShakeAlert UserDisplay. At the top, the following icons and options appear from left to right:



Program exit



Program status:

green: The communication between the ShakeAlert system and your UserDisplay is healthy. You will be able to receive alert messages.

grey: There are either internal problems with the ShakeAlert system or problems in the communication between the ShakeAlert system and your UserDisplay. The communication may still be healthy and you may receive alert messages.

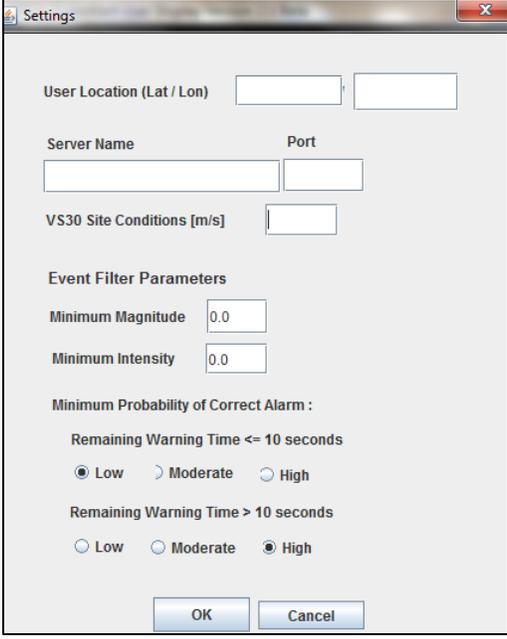
yellow: The ShakeAlert system is only partially operational. You are likely to receive alert messages.

red: There is a problem either in the communication between the ShakeAlert system and your UserDisplay or the ShakeAlert system is down (e.g., for maintenance). You will not receive alert messages.

Settings

Program settings:

The Settings window (Figure 1) allows you to enter user-specific parameters.



The screenshot shows a 'Settings' dialog box with the following fields and options:

- User Location (Lat / Lon):** Two text input boxes for latitude and longitude.
- Server Name:** A text input box.
- Port:** A text input box.
- Vs30 Site Conditions [m/s]:** A text input box.
- Event Filter Parameters:**
 - Minimum Magnitude:** A text input box with the value '0.0'.
 - Minimum Intensity:** A text input box with the value '0.0'.
- Minimum Probability of Correct Alarm:**
 - Remaining Warning Time <= 10 seconds:** Radio buttons for Low (selected), Moderate, and High.
 - Remaining Warning Time > 10 seconds:** Radio buttons for Low, Moderate, and High (selected).
- Buttons:** 'OK' and 'Cancel' buttons at the bottom.

Figure 1. Program Settings.

- **User Location (Lat/Lon):** enter the latitude and longitude of your location; you can use <http://geocoder.us/> or other websites to determine the latitude and longitude of your US address
- **Server name & port:** do not change these fields unless requested
- **Vs30 site conditions [m/s]:** enter the Vs30 value (average S-wave velocity of the uppermost 30 m) at your location. This value is important for estimating the seismic intensity at your site. Enter “0” if you do not know the Vs30 value at your site. The program will automatically determine a Vs30 value from a lookup table using the latitude and longitude you entered.
- **Event Filter Parameters:** You can specify three threshold parameters, which must all be exceeded before an event message received by the UserDisplay will be displayed as an alert. Thus, the parameters you set here will control the number of alert messages you will receive.
 - **Minimum Magnitude:** enter the minimum magnitude of events for which you will receive alerts. Take care in setting this value. The UserDisplay will receive messages for events with magnitudes as small as “1.0” or even smaller. These events cannot be felt by humans, but can be used to test the alert system. If you set the minimum magnitude too high (e.g. “5.5”), you may not see any alerts in the following weeks or months. We encourage you to try different magnitude thresholds. Start, perhaps, with a small value, like “2.0”, and increase the magnitude to “3.0” or “4.5” after a few days when you have become familiar with the UserDisplay.

- **Minimum Intensity:** enter the minimum seismic intensity (MMI scale) to be expected at your location for which you want alerts. The scale, shown on the lower left of the UserDisplay screen, ranges from “1” (not felt) to “10” (extreme shaking). Bear in mind that you will not receive alert messages, if you choose the threshold too high. Start with a small value (e.g. “1.0”) and increase it (e.g. to “5.0”) after a few days.
- **Minimum Probability of Correct Alarm (PCA):** although we are making the CISN ShakeAlert system as robust as possible, we cannot exclude that any particular alert message is wrong. False alerts can result from many different causes, such as instrument failure, noise, or very strong teleseismic (distant) earthquakes. CISN ShakeAlert will often “know” that a certain alert message may be incorrect (e.g. if an “event” is detected by only one or two sensors, but other stations do not trigger) and is capable of providing an estimate of the “Probability of Correct Alarm” (PCA). The PCA has values between “0.0” and “1.0” meaning the alert was most likely incorrect or correct, respectively. For simplicity, we have introduced three PCA levels: “low” ($0 \leq \text{PCA} < 0.4$), “moderate” ($0.4 \leq \text{PCA} \leq 0.7$) and “high” ($0.7 \leq \text{PCA} \leq 1.0$). Often, the PCA will increase or decrease as time passes after an earthquake is detected. If an earthquake occurs close to your location and you may thus experience strong shaking soon (i.e. the warning time is ≤ 10 seconds), you may want to receive all alert messages regardless of their probability. If the earthquake, however, is relatively far away (i.e. the warning time is > 10 seconds), you may want to wait longer and allow the PCA to increase, to make sure that the alert is correct. We therefore recommend specifying a small PCA value (“low” or “moderate”) for close events, and a high PCA threshold for distant events (“high”).

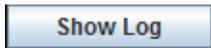
Press “OK” once you have entered your parameters. The information will be saved and the values immediately applied.

Play Event

Play Event:

Xml-messages from the ShakeAlert system that have been received by the UserDisplay will be stored on your computer in the “**history**” folder. When you click on “Play Event” button, an open-file dialog appears. You may click on one of the subfolders (the name of these subfolders indicates the ShakeAlert eventID; note that this id is different from the CISN event id that is used in ShakeMap) and replay an event by double-clicking on the file with the “.ew” extension. The event will not be displayed, if the threshold parameters in “Settings” are not exceeded, or if the warning time is zero or negative.

You can find some example earthquakes in the “**examples**” folder.

**Show Log:**

The log-file lists information for alert messages that have been received. From left to right the file shows: (1) the time when the alert message was received, (2) message type (“NEW”, “UPDATE” or “DELETE”), (3) eventID, (4) version (up-date) number, (5) estimated magnitude, (6) estimated event origin time (i.e. when the earthquake occurred/started), (7) estimated earthquake location (lat/lon/depth), (8) estimated seismic intensity (MMI) at your location, (9) Probability of Correct Alarm (PCA), and (10) the (rounded) remaining time (in seconds) until shaking is expected to begin at your location.

**Volume control (mute):**

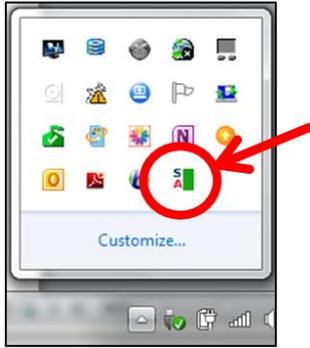
Check this box to mute the volume of your UserDisplay. **You will not hear the siren and voice announcement as long as this box is checked!**

**Minimize/maximize and close the UserDisplay window:**

Note, that even if you close the window using the “Close Window” button, the UserDisplay will still be running. (Use the “Exit” button on the left of the display to terminate the program.) The UserDisplay will pop-up automatically when an alert message is received that exceeds the settings you have chosen.

Right-click on the ShakeAlert icon in the system tray and select “Show” to reopen the UserDisplay window manually (see below).

**Map navigation, zoom in/out**



System tray icon:

Right-click the ShakeAlert icon in the Windows system tray (at the lower right corner of your Windows screen) to “Exit” or “Show” your UserDisplay. The color of the icon shows the UserDisplay status (see “Program status” on page 4 of this guide for explanation of color code).

5. Alert Information

When the UserDisplay receives a xml alert message from the CISN ShakeAlert system, the following information will be displayed (provided that your thresholds in “Settings” are exceeded and the remaining warning time is greater than 1 second; Figure 2):

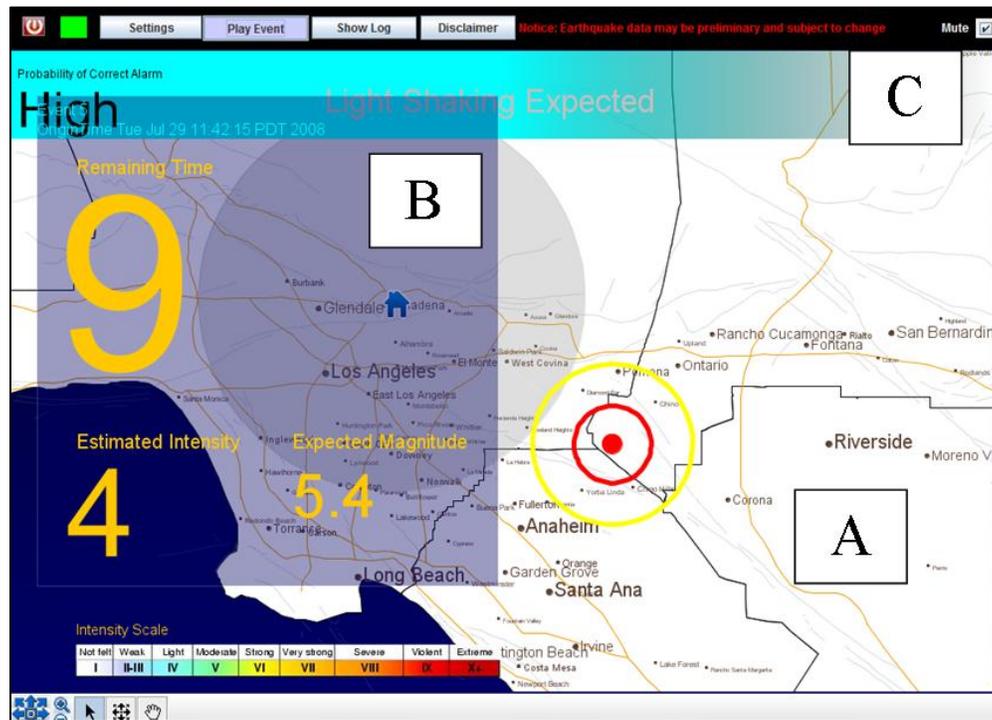


Figure 2. Screenshot of the UserDisplay.

- A. Map:** Your location is shown by a blue house, the estimated location of the earthquake by a red dot. The map is automatically centered on a point halfway between the two locations. The yellow and red circles show the estimated locations of the P- and S-wavefronts of the earthquake waves, respectively. P-waves, which travel faster than S-waves, rarely cause damage, because amplitudes are smaller and ground motions are predominantly in the vertical direction. The yellow circle, representing the P-wave front at a given time, will always be larger than the red circle (S-wave front). Damage is typically caused by S-waves. The “remaining time” is the estimated time it will take for the S-wavefront (red circle) to reach your location. For some events you will also see estimated ground motions at various sites shown by filled circles. You may notice a grey circle around your location: this approximates the current “blind zone” of the ShakeAlert system. If an earthquake occurs within this area, it is extremely unlikely that you will receive an alert message before you experience the shaking. We are working to decrease the radius of the blind zone in future versions of the ShakeAlert system.
- B. Information Panel:** The panel on the left side of the screen gives the estimated time (in seconds) remaining until shaking is expected to begin at your location, the estimated seismic intensity (MMI scale), and the expected magnitude.
- C. Top Panel:** the top panel describes the level of expected shaking at your site and gives the Probability of Correct Alarm (PCA). We have introduced three PCA levels: “low” ($0 \leq \text{PCA} < 0.4$), “moderate” ($0.4 \leq \text{PCA} \leq 0.7$) and “high” ($0.7 \leq \text{PCA} \leq 1.0$). The top panel

will also display the information “False Alert” or “Test”, if an event has been cancelled or if a test message was received.

Important: Do not forget to turn on the volume of your PC and do not check the “mute” box at the top of your UserDisplay if you want to hear alert messages (siren and voice announcement).

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6. Contact information

For questions or feedback please contact:

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Additional information on the CISN ShakeAlert project can be found at <http://www.cisn.org/eew/>. Thank you very much for your participation. We are looking forward to your feedback.