Development of the CISN Earthquake Early Warning Web Site: Establishing a Basis for Comparison of Algorithms

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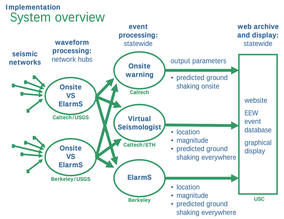
Motivation:



As multiple CISN (and other) EEW algorithms are developed, tools and techniques for comparing the performance of these algorithms are needed. To address this need, we have developed a beta-version web site.

Basic Web Site Requirements:

1. Define a common EEW warning algorigthm results "reporting" format for CISN EEW Algorithms.
2. Define a delivery mechanism for EEW results from networks to the web site as a collection point.
3. Build a secure web site that provides access to EEW algorithm results to authorized users.
4. Store EEW Algorithm Results into a relational database.
5. Provide Search Capabilities to find EEW Results
6. Plot EEW algorithm performance results as time series as basis for comparison.

Data Exchange Formats:

To enable performance comparisons, all algorithms should report equivalent information. We defined the two "data exchange formats" in which algorithms report their performance during events. These Data Exchange formats are XML-based time series formats and are posted on the CISN EEW Web site:

```
-<cisn_eew_data xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.w3schools.com EEW_TS_0.6.0.xsd"
xmlns="http://www.w3schools.com" major="0" minor="0" bugfix="0">
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    <report_id>smi://ucberkeley/elarms/10001</report_id>
    <data_source major="1" minor="0" bugfix="0">
      <data_source_id>ssi://ucberkeley/seismo.uach.edu/elarms</data_source_id>
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    </data_source>
    <network_data_source>
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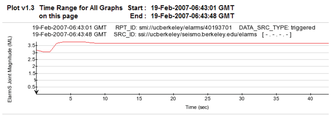


Data Delivery and Storage Mechanism:

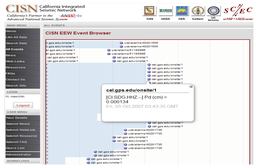
The CISN EEW web site functions as a collection point for CISN EEW algorithm performance results. Each of the real-time algorithms transfer their EEW warning results to the central site using a secure copy protocol developed by CISN. The results are transfer in the CISN EEW Data Exchange format.

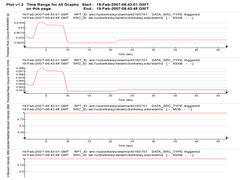
The EEW web site software loads the reports into a open-source database to facilitate search and discovery.

Data delivery to CISN EEW Web site is not real-time. The reports are transfered after event processing is completed.

Current Capabilities

The CISN EEW Web site currently provides access to EEW algorithm results via: (a) time, data-type, and source-based searches, (b) Event browsing, and (c) Comparison plots of EEW algorithm performance time-series.





http://www.scec.org/eew - Login Required

Time Reporting:

We have identified a need to report multiple time stamps on EEW reports. Both of types of times stamps are of signficance to performance evaluations:

1. Time (data) (Td) – Td is the maximum (largest) time in any of the data used to produce the warning. So Td for an onsite algorithm is the end of the time window during which the TauP was calculated.

2. Time (available) (Ta) – Ta is the earliest wall-clock time at which the warning can be made available to users by a system running an algorithm. Ta is the "transmit" or "release" time of a warning. Ta depends on telemetry time, processing time, and other elements. Ta is the "release time" from the parts of the system that are algorithm specific. Ta = Td + telemetry delay + processing delay.

Currently, the CISN EEW algorithms report Td to the web site and we must update the reporting format to capture Ta.

Performance Evaluation

Our initial time-series comparisons will be augmented with performance evaluations for amplitudes, magnitudes, and locations. The proposed performance matrix will capture time-based performance of algorithms for these types of information as well as information on capture valid alarms, false alarms, and accuracy of reports during alarm.

		3 sec after 1st P detection	10 sec after 1st P detection	30 sec after 1st P detection	X sec after 1st P detection
Compare predicted vs observed PGA, PGV	At stations w/ P Detection	LX*	LX*	LX*	LX*
	$R_{epi} \leq 10$km	LX	LX	LX	LX
	$10\text{km} \leq R_{epi} < 50$km	LX	LX	LX	LX
	$50\text{km} \leq R_{epi} < 150$km	LX	LX	LX	LX
Magnitude		LM	LM	LM	LM
Location		Lloc	Lloc	Lloc	Lloc

with:
Lx and Lx* predicted amplitude likelihood score,
LM a predicted magnitude likelihood score, and
Lloc a predicted location likelihood score.

Planned Developments:

The following enhancements are currently under development on the EEW web site:

(1) Add reporting of located earthquakes for comparison between EEW algorithms reports and located events.
(2) Update data exchange format so that both Td (time of data used) and Ta (time EEW results are available).
(3) Map-based display of events and EEW algorithms results.
(4) Augment existing time series comparisons with table-based Performance Evaluation reports described earlier.
(5) Identify and transition to an existing data exchange format (QuakeML?, SEED?) so maintenance of data formats is done by larger data management organizations.
(6) Transfer addtional "supplemental" information from CISN EEW algorithms (e.g. Maps) procuded by real-time algorithms to web site for display.