Western States Seismic Policy Council
2012 National Awards in Excellence

Award in Excellence for Use of New Technology

Administering Agency:	United States Geological Survey (USGS) – National Earthquake Information Center
Program Name:	ShakeMap and Suite of Accompanying Programs
Contact:	Dr. David Wald, Supervising Research Geophysicist
Address:	Box 25046, DFC,MS 966, Denver, CO 80225-0046
Telephone:	303-273-8441
Email:	wald@usgs.gov

Program Summary

ShakeMap, ShakeCast, the Prompt Assessment of Global Earthquakes for Response (PAGER) and the Community Internet Intensity Map ("Did you feel it?") are products developed by Dr. David Wald and his team at the United States Geological Survey (USGS) National Earthquake Information Center. These products have greatly enhanced the capacity of emergency management agencies worldwide to rapidly assess the scope of possible impacts of earthquakes in terms of damage and population exposure, mitigate earthquake hazards, and test response plans with valid scientifically-grounded earthquake scenarios. The innovative uses of new scientific developments, mapping techniques and loss estimation technologies have made these products the most important improvements in earthquake emergency response and management capability in the last 30 years.

In March of 1997, the first ShakeMap was produced for a small southern California earthquake. Based on ground motion parameters captured by the Southern California Seismic Network, the map revealed the distribution of ground motion as acceleration, velocity and, most important to emergency managers, intensity. The map displays ground motion as color-coded areas with red and orange indicating strong and potentially damaging motion; green and blue indicate relatively minor non-damaging motion. From this modest beginning, the ShakeMap technology was extended to the nation as a whole and, ultimately, to global earthquakes. The ShakeMap is automatically produced and posted on the Internet within a few minutes of an earthquake occurrence, then reviewed, verified and updated by a seismologist. It is utilized by emergency managers to determine the overall scope of impact, identify the areas of probable damage and direct response activities. These activities include search and rescue, medical emergency services, damage assessment and the location of staging areas for resource allocation and deployment. ShakeMaps have also been developed for scenario earthquakes that may occur or have occurred historically. These scenarios have facilitated the mitigation of hazards in communities with known earthquake risks and have been the basis for conducting exercises to test emergency response plans.

ShakeCast is an application of ShakeMap that allows specific users (e.g. utility and lifeline operators) to receive notification of shaking levels at user-selected facilities. Using the velocity and spectral acceleration parameters in ShakeMap, ShakeCast is used by the California Department of Transportation (Caltrans) to prioritize inspection of highway bridges and corridors following the occurrence of a significant earthquake. For events greater than magnitude 4.0, ShakeCast automatically determines the shaking value at the locations of more than 12,700 bridges and facilities, compares the values with the damage

threshold pre-established for each facility, and distributes emails to designated responders within 15 minutes of the event.

The Prompt Assessment of Global Earthquakes for Response (PAGER) is an extension of ShakeMap to provide fatality and economic loss impact estimates for earthquakes worldwide. Fatality and economic loss estimates are scaled as alerts ranging from Green (zero or minimal loss of life and property damage) to Red indicating that fatalities could exceed one thousand and losses could reach or exceed one billion dollars. Yellow and Orange alerts are intermediate categories. PAGER was an important factor in notifying local and international response and relief agencies of the catastrophic earthquakes in Haiti and Chile in 2010, and New Zealand and Japan in 2011.

Taking advantage of the vast numbers of Internet users, the Community Internet Intensity Map invites those who feel an earthquake to complete a brief questionnaire on the “Did you feel it?” web site; responses are aggregated by Zip or Postal Codes and arrayed on a map, color coded by intensity. This map not only provides an opportunity for the public to participate in analyzing an earthquake and promoting a better understanding of earthquakes, it also provides scientists and emergency managers with valuable information about impacts, particularly in areas that are sparsely instrumented or have no seismic network coverage at all.

In developing these products, David Wald and his team have given the emergency management community vital tools that have provided early detection of earthquakes which require immediate response and have provided rapid information on what the impacts of these events are likely to be. Before ShakeMap and its derivative products, emergency managers relied on “windshield surveys” and the media for information about earthquake impacts, an inefficient, time consuming and error-prone method. ShakeMap scenarios have provided accurate scientifically-grounded events that have been the basis for mitigation plans and driven exercises to test emergency response plans for public and private sector organizations. For catastrophic international earthquake disasters, particularly in underdeveloped nations, PAGER now alerts international aid agencies of the need for immediate assistance, avoiding days or weeks of delays. These products have also increased public understanding of earthquakes and allowed non-scientists to participate in the analysis of an earthquake.