

## The Twitter Earthquake Detector

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It can take many minutes for an earthquake to be scientifically reported, but social networks can reduce this time to seconds. The U.S. Geological Survey, which has responsibility in the U.S. for earthquake detection and reporting, is building a prototype to take advantage of social Internet technology to speed up early reporting of earthquake activity. It is parsing tweets sent by Twitter users to find out about earthquakes in the seconds after the tremors begin. It calls this new system the Twitter Earthquake Detector (TED).

### U.S. Geological Service

Driven by the need to inventory the vast lands acquired by the United States after the Louisiana Purchase and the Mexican-American War, the United States Geological Survey (USGS) was created in 1879.<sup>1</sup> It was charged with the “classification of the public lands and examination of the geological structure, mineral resources, and products of the national domain.”



A bureau of the U.S. Department of the Interior, the USGS is a scientific agency with no regulatory responsibility. USGS scientists study the landscape of the United States, its natural resources, and the natural hazards that threaten it. The USGS supports four major scientific disciplines – biology, geography, geology, and hydrology.

Its Earthquake Hazards Program monitors earthquake activity worldwide. The Colorado-based Earthquake Information Center detects the location and magnitude of global earthquakes and informs authorities, emergency responders, the media, and the public, both domestic and worldwide, about significant earthquake activity.

### Twitter

Twitter is a very popular worldwide microblogging service<sup>2</sup> that allows its users to send text-message “tweets” comprising up to 140 characters. The receipt of tweets can be limited to the “followers” of the sender, or they may be open tweets available to all.

### The Twitter Earthquake Detector

It can take several minutes for the USGS to receive sufficient data about an earthquake from its seismic networks to justify notification to authorities and to the public. This time can be as little as two or three minutes in earthquake-prone California and almost a half hour if the earthquake occurs in a remote area with sparse seismic instrument coverage.

<sup>1</sup> [United States Geological Survey](#), *Wikipedia*.

<sup>2</sup> [Twitter](#), *Wikipedia*.

However, even as the tremors are occurring, the Twitter network is alive with first-hand accounts of the shaking. These tweets can get through even if voice communication channels are overloaded.

The USGS has recognized that tweets are a valuable source of information, unscientific though they may be, and is experimenting with adding first-hand accounts of shaking to its suite of seismically-derived information. It has initiated a prototype project that automatically monitors open tweets for words like “earthquake,” “tremor,” and “shake” in all languages, focusing on those that identify a location. It calls this project the Twitter Earthquake Detector.<sup>3</sup>

The USGS can summarize and map pertinent tweets to get an early indication of suspected earthquake activity. The mapping rapidly determines the area of an earthquake that has been felt by people, and this data can subsequently be linked to the scientifically-derived seismic information. The USGS attaches a summary of the cities where tweets originated and the text of the first several tweets to its earthquake alerts that provide the measured location and magnitude of the earthquake. In this sense, tweet information augments but does not replace scientific information.



Map of tweets following the magnitude 3.7 Pleasanton, California, earthquake on October 14, 2009

A major ongoing effort is improving the filtering of tweets. For instance, the USGS must be able to filter out tweets concerning Dairy Queen’s Oreo Brownie Earthquake dessert. Fraudulent or malicious tweets must be discarded. Locations may not be unique, such as Ontario. Is this Ontario, California, or Ontario, Canada? Location information is much improved for tweets sent by GPS-enabled mobile devices, an enhancement that Twitter is working on in conjunction with the USGS. These tweets can give locations accurate to within city blocks.

## Summary

The USGS has realized that social networking can produce more than simply “short bursts of inconsequential information.” Immediate responses by observers over a social network can be mined to provide early reports of many disasters, from earthquakes, fires and accidents to

<sup>3</sup> [U.S. Geological Survey: Twitter Earthquake Detector](#), *Department of the Interior Recovery Investments. Science for a Changing World, Twitter Case Study: The United States Geological Survey.*

terrorist attacks. All it takes is a little software (it's probably more accurate to say "a lot of software").