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Integrating Official and Crowdsourced Geographic Information Following Disasters

Crowdsourcing geographic information via the Internet is not new to USGS. Since 1999, the USGS Earthquake Hazards Program has been generating Community Internet Intensity Maps (CIIMs) using geographic data submitted to the *Did You Feel It?* website. This open call to the public affected by an earthquake is a notable example of how USGS facilitates the sharing of critical geographic information by members of the public not only to provide valuable data for earthquake research at USGS, but also to provide immediate situational awareness for emergency management stakeholders. CIIM is one of the early instances of "crowdsourcing" that was consciously developed long before the coining of this term by Jeff Howe in 2006.

New opportunities and challenges are arising as members of the public use pervasive information and communication technologies (ICTs) including social media and social networking sites (e.g., Twitter, Facebook, and user-generated maps) to help in the immediate aftermath of major disasters. CIIM exhibits how citizens can act as voluntary sensors and contribute valuable geographic information to the scientific documentation of natural hazards like earthquakes. This research project will investigate recent examples of crowdsourcing geographic data after the 2010 Haiti earthquake and the 2011 Japan and New Zealand earthquakes to inform the design and development of future USGS products, like CIIM and The National Map.

At the 2010 International Conference on Crisis Mapping (ICCM), Patrick Meier stated, "The Crisis Mappers Google Group played a pivotal role in the hours, days and weeks following the earthquake in Haiti." Members of this virtual network shared time-sensitive geographic information, such as post-impact satellite imagery and locations of health care facilities, using open source mapping and collaborative networking technologies. Approximately 2,000 volunteers—including people from the Haitian diaspora in nearly 40 countries who shared their local geographic knowledge of Haiti—worked with the Crisis Mappers Network to geocode crisis reports coming out of Haiti. But in what ways did these new social networking technologies play a "pivotal role" in mapping Haiti to better manage the disaster? What kinds of official and crowdsourced geographic information were shared, and in what ways were they seamlessly integrated together? What lessons can be learned from the mapping activities that emerged after the Haiti, Japan and New Zealand earthquakes? How might these lessons inform the design and development of future USGS products and services, especially in the hazards domain?

To answer these questions, current trends in social media and networking technologies need to be assessed to better anticipate future uses and users of USGS products. The notion of "user" is changing especially in the context of the Geospatial Web; users are increasingly contributing valuable geographic information in addition to consuming geospatial data from a much wider variety of sources. Many of the mapping efforts that took place after the Haiti earthquake were facilitated by the use of social media and other networking technologies.

The USGS Earthquake Hazards Program has already begun to investigate how to harness crowdsourced geospatial data from social media sites like Twitter to rapidly characterize earthquake effects. Paul Earle and Michelle Guy developed a prototype software application that collects tweets containing the word "earthquake" and uses spatial data mining techniques to map and summarize short personal accounts that are reported within seconds after an earthquake strikes. This type of crowdsourced geographic information can be a useful supplement to instrument-based estimates of quake location and magnitude. However, further research is needed to determine how to strategically use networked technologies to communicate hazards information, as well as how crowdsourced data can best augment the quantitative data traditionally collected by USGS.

This research will consist of systematically investigating the official and crowdsourced mapping activities that took place after the recent historic earthquakes to understand what kind of cross-agency collaborations formed and how geographic data from government agencies, satellite imagery companies, volunteer technical communities, disaster-affected populations, and the general public were integrated together to better facilitate emergency response efforts. Additionally, I will investigate how real-time geographic data from social media sites (e.g., Twitter and Facebook) can augment USGS maps like CIIM. The research findings will provide implications for how to design and develop future USGS products and services like The National Map to better facilitate emergency response efforts. These findings will also inform how to best integrate official and crowdsourced geographic information to provide timely and accurate maps to emergency responders and the public as well as help USGS strengthen cross-agency collaborations with emergency management agencies.