THE 9TH INTERNATIONAL WORKSHOP ON REMOTE SENSING FOR DISASTER RESPONSE
Stanford University, California
September 15-16, 2011

WORKSHOP SUMMARY AND RESOLUTIONS

Workshop Summary

The following observations were recorded over the two-day period:

1) The 9th International Workshop on Remote Sensing for Disaster Response which was held at Stanford University between September 15 – 16 2011 was one of the most successful workshops to date in this series; Over 40 participants from five countries (U.S., Japan, New Zealand, UK and the Netherlands) delivered 25 presentations on a broad set of topics dealing with recent worldwide earthquakes, tsunami effects, earthquake effects, hurricane effects, wildfires, damage detection methodologies, building inventory development, and new and emerging technologies for disaster response. In addition, because of the devastating effects caused by the 2011 Tohoku, Japan earthquake, a special session was organized to learn from this event. A common conclusion from this session was that remote sensing played an important role in rapid delineation of tsunami run-up areas and in quantifying the amount of debris generated by this devastating event.

2) Prior to this workshop, a one-day Symposium on Remote Sensing for Disaster Response was held in order to discuss the future directions of remote sensing technologies in rapid information extraction for disaster response. Close to 90 participants attended this symposium including first responders, government agencies, data providers, academia, researchers, and industry. Six presentations were given focusing on NASA technologies for disaster management, commercial imagery for rapid response, navigating the transition from imagery to information, towards an information supply chain, towards the operation use of remote sensing for disaster response, and a wish list for rapid disaster mappers and analysts. In addition, a lively panel discussion followed where members of the audience interacted with the panel experts on a variety of topics, including availability and release of imagery, and priorities for future research.

3) A continued thrust for damage studies is using remotely-sensed images/data for the purpose of developing damage or fragility models. This was especially evident in several studies of tsunami and hurricane damage (2004 Hurricane Katrina, 2004 Indian Ocean earthquake, and 2011 Tohoku, Japan earthquake) where probabilistic models relating building damage to inundation height, wave velocity, and hydrodynamic pressure were produced from empirical data from these events.
4) The use of remotely-sensed data in measuring, monitoring and evaluating post-disaster recovery was also highlighted (i.e., Hurricanes Charley and Katrina in the U.S.). High-resolution imagery datasets offer a unique opportunity for tracking the progress of recovery and rebuilding after a major disaster. This ability is important in assessing whether recovery is progressing as planned. A major thrust of this research remains defining metrics that adequately represent recovery progress.

5) Remotely-sensed data are now being used to characterize the built environment; great interest was observed in methods that can be applied to large urban areas in a semi-automated way. It was noted that a major international effort sponsored by the Global Earthquake Model Foundation is focusing on the development of 1) Inventory Data Capture Tools (IDCT) using remotely-sensed data, and 2) a global exposure database for buildings at a coarse level. In addition, special tools for building inventory development being used by the insurance industry were discussed (Stanford University).

6) Crowdsourcing technologies generated a good deal of discussion during the workshop – timing, sustaining participation beyond peak interest in the immediate aftermath, sharing results with contributors were all topics discussed during this workshop. This is a rich topic for discussion for future workshops.

7) It was noted that supplementing remotely-sensed damage assessments with ground survey information is critical in ensuring a full and accurate understanding of the damage caused an event. Furthermore, integration of both datasets helps to quantify the level of uncertainty associated with the final damage assessment results.

8) There were many examples of where remote sensing damage methodologies developed from one hazard type could be successfully applied to other hazard types, e.g., storm surge to tsunami, or vice-a-versa. The participants of the workshop identified several synergies across hazard types, specifically delineating debris line from storm surge, tsunami or flood was mentioned in this workshop.

9) Other research topics included: 1) advances in building inventory development, 2) integration of imagery datasets of different resolutions, 3) disaster preparedness and integration with modeling, 4) earthquakes effects, advances in analytical techniques, and disaster recovery, and 5) use of UAVs for post-disaster reconnaissance surveys.

10) A brief review of last year’s workshop in Tokyo, Japan revealed that demonstrable progress has been made on almost all resolutions. Initial resolutions are underlined.

- The workshop participants supported the idea of changing the meeting venue from a workshop setting to a conference setting. The goal would be to involve more end-users in the proceedings and to expand the focus to other natural disasters. As a step towards this goal, the organizers of the Stanford Workshop organized a special symposium on Remote Sensing for Disaster Response which was attended by close to 90 participants.
An invitation from the Cambridge University Press to publish a book on Remote Sensing and its Impact on Disaster Planning, Response and Recovery was received in 2010. However, because of the occurrence of two devastating earthquakes in 2011 (2011 Christchurch, New Zealand, and the 2011 Tohoku, Japan earthquake), planning for this book was been put on hold. In its place, however, were several special publications on the Haiti earthquake which occurred in 2010. Many of the workshop participants had papers published in *Earthquake Spectra* and *Photogrammetric Engineering & Remote Sensing* on the 2010 Haiti earthquake.

The availability of a worldwide, very-high resolution (VHR) aerial imagery dataset. Little progress has been made here. Imagery remains expensive although “partnering” to purchase data remains an option.

As a group, emphasize the importance of ground truth or survey data in validating the efficacy of remote sensing analyses, especially to affected countries or regions that have collected such data. The Christchurch GEO-CAN “experiment” – which is ongoing – is helping to address this issue. This work will supplement previous work on the Haiti earthquake.

The notion of standardized damage scales for buildings, lifelines and the environment based primarily on using remote sensing data is still considered a high priority by the workshop participants. A small step was taken to decide on a common scale after the 2010 Haiti earthquake. A recommendation was made to use the European Macroseismic Scale (98). Also, through a partnership between the World Bank, UNOSAT and JRC, a set of Standardized Operating Procedures (SOP) have been developed for classifying earthquake damage.

Expanding the emphasis of the workshop beyond just earthquakes was noted by participants. Hazards discussed in the Stanford workshop included earthquakes, tsunamis, landslides, hurricanes, floods and wildfires.

A priority for the next workshop continues to be to reach out to regions that have not been actively engaged with this workshop, e.g., Latin America, Africa, and other Asian countries. Work is still needed in this area. One challenge is to find funding to support travel for participants from these areas.

Copies of all papers and presentations will be put up on the Tokyo Institute of Technology workshop website. Access to this website will also be possible through the MCEER website so that the general research community can also have access to the products from this year’s workshop as well as previous workshops. This has been done.

**Workshop Resolutions**

The following resolutions were agreed upon by all workshop participants:

1) The **10th International Workshop on Remote Sensing for Disaster Management** will be held at Tohoku University, Sendai, Japan, on September 15-
In addition to the two-day workshop, a post-workshop study tour of the Tohoku region is planned.

2) The workshop participants felt strongly that standards, guidelines, metrics, protocols, taxonomies for the areas must be developed:
   a. Developing building inventories
   b. Damage assessment and standards for damage maps
   c. Representing uncertainty/confidence
   d. Recovery monitoring, evaluation and mapping/visualizing
   e. Crowdsourcing
   f. Data sharing
   g. Potentially identify sponsors/partners/publication outlets for standards and protocols that are developed.

3) There was strong support for promoting multi-peril analysis – working across techniques, methods, and data sources to establish multi-hazard patterns/findings. (Example: storm surge and tsunami findings – potentially a joint paper looking at fragility and structural vulnerability included).

4) Ensure that (at least) one session at every workshop is focused on and organized by stakeholders/end-users/practitioner partners (response and recovery phases of the disaster cycle).

5) The workshop participants wanted to identify and develop more effective ways of sharing data, protocols, test and case study data, as well as findings. Diverse, rich and extensive datasets exist. Sharing this information will minimize duplication and leverage findings and advances. A repository of collective works that is multi-event, multi-hazard, multi-method, multi-data hub is highly encouraged. This resolution will facilitate resolutions #2 and #3, perhaps through the NEES hub or GEONode (GFDRR).

6) Engage in aggressive outreach to expand the geographic representation of workshop participants. Specifically: Central and South America and Africa. Exploring travel funding for key investigators to future workshops is likely linked to accomplishing this goal. The World Bank could be an initial partner to approach. Outreach to involve individual points of contact with research peers in the region as well as funding links and sharing our web available conference proceedings. The participants encouraged that a task committee be formed to take the lead on expanding our network into under-represented regions.

7) Explore the options and viability of a conference venue rather than a workshop. Over the next year group might explore the advantages/disadvantages and a strategy for success. Perhaps a combination of our workshop with a symposium is a working model for future years. Networking key here moving forward. A potential model could be a workshop with a conference every fourth year with designated time and space for discussion and thinking among workshop
participants. Taskforce to lead this effort and to have quarterly reports to promote sustained attention and consideration.

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