

# **FINAL TECHNICAL REPORT**

## **Sixth International Workshop on Remote Sensing for Disaster Response**

**EUCENTRE, Pavia, Italy  
September 11-12, 2008**

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**Group Photo of Workshop Participants**

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## Acknowledgments

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## Workshop Summary

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

- 1) The 6<sup>th</sup> International Workshop on Remote Sensing for Disaster Management Applications held at the EUCENTRE in Pavia, Italy on September 11-12, 2008, was one of the most successful workshops to date in this series; Close to 30 participants from eight different countries delivered 24 presentations on a broad set of topics dealing with the International Charter, damage assessment, response, and recovery, hazard assessment, user needs and challenges, and advanced monitoring and warning technologies, including those for tsunamis.
- 2) A brief review of last year's workshop in Washington D.C. revealed that demonstrable progress has been made on almost all resolutions:
  - Next workshop to be held in Pavia with a focus on Remote Sensing in a Multi-hazard, Globalized World – close to 30 experts from 8 different countries (Italy, Iran, Netherlands, Japan, UK, France, Canada and U.S.) discussed a variety of topics that encompass remote sensing and disaster management including earthquake, flood, hurricane, tsunami and environmental issues.
  - A journal article in EERI Spectra that identifies the basic requirements of a remote sensing damage scale – EERI Spectra authored by Rathje and Adams was published this year.
  - A common (benchmark) data set (beyond the Bam, Iran earthquake) to compare, validate and assess techniques potentially useful for disaster response applications and research - A multi-national effort involving the Earthquake Engineering Research Institute (EERI), the Multidisciplinary Center for Earthquake Engineering Research (MCEER), the University College of London, and the EFIT is currently focusing on the creation of a Virtual Disaster Viewer (VDV) that will allow wide spread access to before and after-satellite imagery for the purpose of performing large-scale aerial damage surveys.
  - Include members of the disaster management community in the next workshop – several talks were presented in the Pavia workshop that discussed ongoing work by researchers on how satellite imagery can be used to more effectively support the International Charter.

- 3) Examples of damage or hazard assessment using remotely-sensed technologies were provided for: 1) earthquake, 2) flooding, 3) storm surge, 4) landslide, including debris flow and avalanche 5) tsunami, 6) wildfire; 7) tornado; 8) hurricane
- 4) The workshop participants provided input to a USGS-funded study to assess the use of data provided by the Charter. The discussion focused on the opportunities and problems for researchers in accessing Charter data as well as the mechanisms and politics involved when engaging with the functional units of the Charter. Some of the comments made by the participants were:
  - Information obtained from Charter data can be used to guide field teams for deployment.
  - The research community could be helpful to the Charter by evaluating and validating the value added products stemming from Charter data.
  - During the years following the disaster events, the research community could provide a valuable service by performing quality assessments on Charter products.
  - The research community performs a wide range of activities and could perform a service by helping to train potential ‘users’ on how they could benefit from the Charter.
  - The research community could benefit from access to Charter data because they could use the data to extend their models to include disaster-affected areas for which the Charter has been activated.

The workshop participants are also providing input via a questionnaire that was distributed. Some outcomes of the discussion and input from the questionnaire will be presented to the Charter Board through as part of the results of the project funded by the USGS. The questions posed to the participants were:

- What has been your involvement with the Charter?
  - What do you perceive to be the successes and failures of the Charter?
  - Are you interested in interacting with the Charter, given current barriers and data policies?
  - How could you use the data if you were given access?
  - Why should the Charter involve the research community?
  - If the Charter data became more accessible to researchers, how do you propose that the researchers should report back to the Charter’s Executive Secretariat?
  - What do you see as the main problem for you in relating to the Charter?
- 5) A number of papers were presented this year that attempted to quantify the accuracy of remote-sensing-based damage results. As a benchmark, ground-truth data from in-field surveys were used to quantify the accuracy of damage state assignments using methodologies based on remote sensing technologies. There is a general consensus that remote sensing techniques provide reliable estimates of no damage or extreme damage but do a poor job in measuring low to moderate damage states. Part of the reason for this is that in order to evaluate these lower damage states, it may be necessary to view effects from off-nadir images; images that are not generally used or collected for damage assessment. Possible solutions might include fusion with other data (e.g., ground survey data; application of aerial images, and effects that may be related collateral damage or impact).

- 6) There is a suggestion that existing damage scales (EMS) are not set up well for incorporating remotely-sensed data, e.g., cannot represent moderate levels of damage well. In light of these problems, it may be imperative to consider a new damage scale that is primarily based on remotely-sensed data.
- 7) Remotely-sensed data are now being used to characterize the built environment; an example was provided for an industrial facility, i.e., tank farms.
- 8) There were many examples of where remote sensing damage methodologies developed from one hazard type were successfully applied to other hazard types, e.g., storm surge to tsunami.
- 9) There were several studies that examined the use of remote sensing technologies for monitoring the recovery activities (and rates) after major disasters. A gap that currently exists is the lack of standardized metrics to measure the progress of recovery.
- 10) The notion of fusing synthetic aperture radar (SAR) with high-resolution optical data was a common theme in several studies (quantifying seismic hazard levels, delineating flood inundation areas, characterizing building damage.)
- 11) There was a question that suggested researchers are not working close enough with end users to develop products that precisely meet the needs of these users. During this discussion, the notion of standard products (e.g., damage maps based on using remotely-sensed data of a certain resolution produced in a specific format, without field validation) or standard delivery timelines (e.g., immediate – within 2 days; early – within a week, etc.) Having such definitions and criteria would help to drive the development of products and would also help in the communication of product details to end users.
- 12) Several excellent examples of the use of low and moderate-resolution data were provided for monitoring flood effects, landslides and wildfires. A major benefit in adopting moderate-level datasets is the larger area of coverage that is possible and more frequently repeat times.
- 13) GPS monitoring buoys for tsunami when combined with simulation techniques provide an important tool for estimating tsunami heights along the coast as well as in the ocean.
- 14) Ground-based survey data key in calibrating new damage states associated with Enhanced Fujita Tornado scale. These ground-based data were collected using high-resolution video where photos were extracted (VIEWS system).
- 15) Workshop participants were given a tour of earthquake testing facilities at EUCENTRE.

## **Workshop Resolutions**

The following resolutions were agreed upon by all workshop participants:

- 1) The 7<sup>th</sup> International Workshop on Remote Sensing for Disaster Management Applications Remote Sensing for the Disaster Cycle: Preparedness, Response, and Recovery will be held at the University of Texas at Austin in October 2009

This workshop is the 7<sup>th</sup> in a series that brings together remote sensing analysts, disaster researchers, and emergency managers to exchange ideas and research results related to the use of remote sensing in disaster management. Interested topics include the integration of remote sensing into:

- 1) Risk assessment
  - 2) Analytical modeling of disaster impact
  - 3) Rapid response
  - 4) Long-term scientific studies
  - 5) Recovery efforts
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- 2) All workshop participants are encouraged to provide input into the use of remote sensing technologies for the International Charter. A questionnaire has been developed and completed forms should be provided back to Adina Gillespie by September 20, 2008. In addition, feedback on VDV (Sichuan EQ) results is encouraged by those who participate in this effort.
  - 3) The development of a damage scale based primarily remotely-sensing data for buildings, lifelines and the environment is still considered a high-priority topic by the workshop participants.
  - 4) The notion of using off-nadir imagery (e.g., Pictometry) to help detect low to moderate damage states was considered a priority area by the workshop participants.
  - 5) The notion of standard data products (e.g., level 1 damage map for buildings using high-resolution optical data with field validation) and standard product delivery timelines deserves further consideration.
  - 6) A proposal in special issue of a peer-reviewed journal on the topic of “Remote Sensing for Disaster Management Applications” will be prepared and the relevant call for paper will be distributed to workshop participants and interested colleagues. It is recognized that a more refined focus for this issue will help to distinguish this paper from others that may have a more general focus. Workshop participants are encouraged to recommend appropriate journals for a special issue on Remote Sensing and Disaster Management. Paolo Gamba will take the lead on this latter task.
  - 7) A priority for the next workshop should be to reach out to regions that have not been actively engaged with this workshop, e.g., Latin America, Africa.
  - 8) Within a two-day workshop platform, encourage more sessions/opportunities to interact with each to explore and perhaps collectively comment on possible directions and solutions.
  - 9) Copies of all papers and presentations will be put up on the workshop website managed by the Remote Sensing Group of the University of Pavia so that the general research community can also have access to the products from this year’s workshop.

## **Workshop Proceedings**

Workshop papers, presentations and a list of participants are available at the University of Pavia’s website at [http://tlc.unipv.it/6\\_RSDMA/](http://tlc.unipv.it/6_RSDMA/)