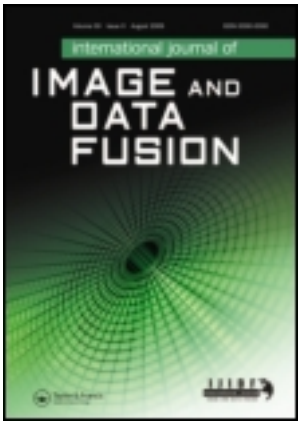


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# Report on International Conference on Geo-spatial Solutions for Emergency Management 2009

Zhong Lu [a]

[a] US Geological Survey, Vancouver, Washington, USA

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# Report on International Conference on Geo-spatial Solutions for Emergency Management 2009

Zhong Lu*

*US Geological Survey, Vancouver, Washington, USA*

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## 1. Introduction

The International Conference on Geo-spatial Solutions for Emergency Management (GSEM2009) was held in Beijing from 14 to 19 September 2009. Co-chaired by Prof J.X. Zhang and Prof Z.L. Li, GSEM2009 was conducted in conjunction with the celebration of the 50th anniversary of the Chinese Academy of Surveying and Mapping (CASM). The conference was organised by CASM, together with six International Society of Photogrammetry and Remote Sensing (ISPRS) working groups (VII/6, IV/VIII, II/1, IV/8, IV/4 and VIII/1). GSEM2009 provided an excellent platform to exchange and explore the latest developments in photogrammetry, remote sensing and spatial information sciences for emergency management, including technical developments of image and data fusion, prediction and early warning of major natural disasters based on '3S' technology, rapid acquisition and processing of remote sensing data for disaster information extraction/interpretation and services, disaster emergency cartography and service, emergency geo-spatial information data management, development and application of new sensors, research and development of new GIS products and geodesy and satellite navigation in disaster monitoring. From 150 abstracts, the scientific program committee carefully selected 63 papers as oral presentations and 13 papers for poster sessions. This report provides an overview of presentations made during GSEM2009. Further information can be obtained from Proceedings of GSEM2009, ISPRS Volume XXXVIII (Part 7/C4) edited by J.X. Zhang and others.

## 2. Image and data fusion and quality assurance

Image and data fusion aims at the integration of multi-sensor, multi-temporal, multi-resolution and multi-platform image data, together with geo-spatial data, GIS, *in situ* and other statistical data sets for improved information extraction with increased


*Email: lu@usgs.gov

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reliability. M. Ehlers outlined the objective of image fusion and provided an overview on image fusion algorithms and different quantitative-statistical methods to evaluate fusion products. Y. Zhang's talk focused on automated image fusion methods developed by The University of New Brunswick (UNB) including various UNB-Pansharp techniques and the fusion of synthetic aperture radar (SAR) and multi-spectral images of different resolution. A. Stein presented a multi-temporal image mining technique by integrating the stereology method that quantifies objects in the 3-dimensional (3D) space–time domain from 2-dimensional (2D) observed objects and the map algebra which quantifies the rate of change of phenomena. C. Liu and Y.L. Zhang presented an improved mean-shift algorithm to extract 3D features from LIDAR data fused with aerial imagery. W.Z. Shi discussed issues related to quality control for spatial data, including (a) measuring the quality of spatial data, (b) developing methods to correct captured spatial data and (c) providing improved solutions for generating higher quality spatial data. J.L. van Genderen introduced a new international journal focused on image and data fusion, entitled '*International Journal of Image and Data Fusion*', which will provide a single source of information for all aspects of image and data fusion methodologies, developments, techniques and applications. The journal focuses on the theory, methodology and applications of image and data fusion and encourages submission on a broad range of topics such as concept studies, new fusion techniques at different processing levels, image and data fusion architectures, algorithms and novel applications.



## 3. Acquisition, processing and interpretation of remote sensing data for disasters

D.R. Li's keynote speech summarised the current and future remote sensing satellites from China and their role in emergency response and hazard mitigation. A. Grun's keynote presentation outlined the principal issues for the development of image-based systems for damage and loss estimation in emergency response. W. Wagner's keynote presentation pointed that the challenge in transition from research to operation lies in the scientific algorithms for processing higher level data products and the required information technology (IT) infrastructure, and recommended to put more effort on algorithm research and IT infrastructure development to speedup the operational use of remote sensing applications. O. Baysal and G.Q. Zhou's keynote speech introduced a mathematical model for designing and implementing a versatile UAV-based multi-sensor data fusion for time-critical disaster response and application. G.Q. Zhou also presented the architecture of a future intelligent earth observing system (FIEOS) and event-driven earth observation concepts to improve the temporal, spectral and spatial coverage of disaster-affected areas, with a focus on the application of the FIEOS and the event-driven observation to increase the efficiency of monitoring and mitigating natural disasters. P. Reinartz presented the functionality of German Aerospace Center's (DLR) Center for Satellite Based Crisis Information (ZKI), which is to combine the existing DLR technical and scientific resources and expertise on both rapid airborne and spaceborne mapping for effective and coordinated crisis management. L. Zhang and others presented an efficient ortho-rectified image generation procedure that includes automatic matching between adjacent aerial photos, tie point matching with existing ortho-rectified photos with the aid of DEM and automatic block-adjustment ortho-rectification. Z.J. Liu and others presented a semi-automatic road extraction algorithm by combining one-class SVM

classifier, regional adjacency graph and template matching. H.T. Li and others presented the architecture and implementation of a cluster-based high-performance parallel processing system for HJ-1 satellite data to improve the efficiency of data processing. X.G. Ning introduced a digital photogrammetric method for lunar mapping based on images captured by the Chang'e-1 lunar mission.

## 4. Radar remote sensing for natural hazards

Radar technology has provided an all-weather tool for an emergency response. Z. Lu provided an overview of the unique capability of interferometric synthetic aperture radar (InSAR) techniques and the critical role of InSAR in monitoring and characterising natural hazards. G.M. Huang presented DEM, digital orthophoto map and digital line graphic generation with SAR imagery for The Western China Mapping project, where DEM generation is accomplished by the combination of stereophotogrammetry of ascending and descending stereo pairs and InSAR techniques. X.L. Ding and others presented a triple difference (phase differential operations between SAR acquisitions, between nearby PS points and between differential interferograms) model for persistent scatterer InSAR, including a new 1D phase unwrapping algorithm that takes into account the minima of the combined perpendicular baseline and the time interval in a time series. Y.H. Zhang and others presented urban subsidence mapping with advanced InSAR techniques including the interferometric point target analysis method and the small baseline subset technique. A. Sowter discussed differential InSAR observations in difficult terrain such as the region of the May 2008 Wenchuan earthquake, and how to utilise partially coherent InSAR images to understand earthquake process.

## 5. Geodesy and satellite navigation in the disaster monitoring

C. Rizos' keynote speech described the characteristics of modern geodesy including GSP/GNSS, satellite laser ranging, very long baseline interferometry, Doppler Orbitography by radiopositioning integrated on satellites and InSAR and showed how these evolving geodetic tools have been utilised to address the societal needs for improved geo-hazard warning and disaster response. A. Dodson and others presented the latest developments in precise point position (PPP) for geo-hazards monitoring, including an effective algorithm to reduce the initial PPP convergence time and fast re-convergence and a solution to resolve PPP integer ambiguity. J.F. Miao and others presented an adaptive and robust Kalman filter to improve GPS phase tracking precision through automatically adjusting the mis-modelling of the dynamic process and reducing the effects of larger measurement errors under low signal-to-ratio environments. R.Z. Chen and others presented a seamless indoor/outdoor positioning algorithm based on multiple sensors including a GNSS receiver and MEMS sensors and multiple wireless networks consisting of the WLAN and BT networks. Y.H. Cai and others provided an overview of a geodetic compass navigation satellite system receiver which could achieve results similar to dual-frequency GPS observation. J.C. Wu and others presented GPS measurements and the analysis of crust deformation before and after the 2008 M8 earthquake in Wenchuan, China, and discussed the earthquake cycle in the Longmengshan fault zone.

## 6. Research and development of GIS, cartography and emergency geo-spatial information data management and policy

J.Y. Chen's keynote presentation discussed lessons learned from the M8 Wenchuan (Sichuan, China) earthquake in May 2008. J. Chen outlined the pivotal role of spatial data infrastructure (SDI) in a rapid response system of disaster and crisis management and recommended future development of SDI in establishing a real-time geo-spatial information platform for disaster and crisis management, enhancing the ability of imagery data acquisition and processing, and developing early warning systems for natural disasters. W. Kainz discussed some issues related to a geo-data policy and infrastructure that should facilitate provision and sharing of GIS software and relevant information under any circumstance. X.M. Tang presented the procedure of spatio-temporal object handling and introduced a space–time association method to integrate time-series spatial objects into databases with unified definitions. Z.L. Lin evaluated the effectiveness of area cartogram for visualising spatial data, and found that pseudocartogram is the most preferred technique and Dorling cartogram the least preferred cartogram for visualisation of spatial data. M. Konecny described the role of context cartography in early warning and emergency management. J.P. Liu and others introduced the function, characteristics and application of the government geographic information service platform in administration, decision-making and emergency support. Y.J. Wang and others discussed some key issues related to the application of geo-spatial information techniques such as GIS, virtual reality and radio frequency identification technology in intelligent monitoring, analysis, visualisation, personnel localisation and search and rescue. I.M.M. Molenaar presented the state-of-the-art of geo-information and its societal benefits. C.M. Li outlined the theory and practice of common platform of Cyber City. T. Wang presented an algorithm for extracting the optical skeleton network of polygons through hierarchical analysis by incorporating length, angularity and area of associated skeleton segment. X.Y. Chen summarised a new spatial statistical theory – spatial error propagation law – that deals with the relative statistical distribution of measurement-based spatial data.

## 7. Development of '3S' technology and geo-spatial solution for disaster management

The development of '3S' for disaster management has been dramatic in the past decade. B. Harch outlined methodologies and approaches for integrated systems monitoring and modelling that can be used to provide reliable inferences for landscape level risk assessment. B. Hofmann-Wellenhof introduced an innovative system that integrates positioning, navigation, geo-information and communication techniques for optimised search and rescue missions to enhance the survival chances of the injured persons in mountainous regions. S. Zlatanova summarised various aspects of utilising 3D geo-information for emergency response. A. Peled stressed that remote sensing is the most affordable and efficient solution for monitoring, analysing and managing hazards and emergency events. P. Cleary and others presented recent development on modelling realistic 3D dam collapse and landslide events based on the smoothed particle hydrodynamics method.