Role of Geospatial Professionals in Risk and Disaster Management and Preventing Natural Catastrophes

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What is Changing? CRED report

The Centre for Research on the Epidemiology of Disasters (CRED) was established in 1973.


Since then, CRED has increased its international network substantially and collaborates closely with numerous UN agencies, inter-governmental and governmental institutions, non-governmental organizations, research institutes and universities.
The Plate of Africa, the Arabic Peninsula and the Anatolian Plate

Earthquake Frequencies
Tectonic Plates

Tectonic Plate movements, McClusky et al. (1999)

Before
- Optimal allocation of available resources for risk reduction
- Strengthening
- Rebuilding
in regard to possible earthquakes

During
- Damage reduction/control
- Emergency help and rescue
- Aftershock hazards

After
- Rehabilitation of infrastructure functionality
- Condition assessment and updating
- Optimal allocation of resources for rebuilding and strengthening

(adapted from Yilmaz Aslantürk)

Steps of Disaster Management in Earthquake
Before

Optimal allocation of available resources for risk reduction
- strengthening
- rebuilding
in regard to possible earthquakes

During

Damage reduction/control
Emergency help and rescue
Aftershock hazards

After

Rehabilitation of infrastructure functionality
Condition assessment and updating
Optimal allocation of resources for rebuilding and strengthening

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GEODETIC MEASUREMENTS AS A MEANS OF EARLY WARNING

Shunji Murai; Harumi Araki;
Was Early Warning of Sumatra Earthquake possible? Coordinates, July 2005, p. 8-11
Wenchuan earthquake was consisted of eight earthquakes with 7.1-7.6 grade (Yuntai Chen, et al., 2008), which were multi-point continuous fracture motion along middle fault of Longmen mountain in several ten seconds.

- The first earthquake center was located at the intersection of middle fault of Longmen mountain with NE direction, fault of Min river with NNE direction and Jintang arc structure with nearly EW direction.
GEODETIC MEASUREMENTS AS A MEANS OF EARLY WARNING

Figure 3. Change of X direction distance at three base lines

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Figure 4. Normalized Change of Distances of three Baselines (WN-LS and KN-LS showed over 3 sigma)

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Earthquake in L’Aquila
Earthquake in L’Aquila

ITALY MUZZLED SCIENTIST WHO PREDICTED QUAKE

By Quinta Jilani

An Italian scientist predicted a major earthquake around L’Aquila weeks before disaster struck the city on Monday, killing more than 90 people, but was reported to authorities for spreading panic.

Giovanni Guidi, a radio scientist, said that an earthquake was about to happen in the mountainous region after studying a pattern of seismic activity. He warned officials but was told to stop spreading rumors.

The government has now imposed a warning, by seismologist Giacomo Guidi, about the possibility of earthquakes in the region, about 180 km (100 miles) west of Rome.

Vanes with loudspeakers drove around the town a month ago telling locals to evacuate their houses after Guidi, from the National Institute of Geophysics, predicted a large quake was on the way, prompting the mayor’s anger.

Guidi, who based his forecast on concentrations of radon gas around apparently active areas, was reported to police for "spreading panic" and...
SPACE & GROUND SEGMENT CONCEPT

DATA PROCESSING CENTER & COORDINATING AND ANALYTICAL CENTER

ALTITUDE 500 km, i=79

ALTITUDE 1000 km

ALTITUDE 500 km, SSO

STATE CENTER FOR EARTHQUAKE PREDICTIONS

FIG Working Week 09, Eilat

RISK PREPAREDNESS

A. Garagon et.al.; CONSTRUCTING A WEB-BASED GIS FOR EARTHQUAKE MONITORING IN TURKEY; FIG Working Week 2005, Cairo

F. Batuk et.al.; The New Zoning Approach for Earthquake Risk Approach; GI4DM, Delft, 2005

FIG Working Week 09, Eilat
Before
- Optimal allocation of available resources for risk reduction
- Strengthening: rebuilding
- In regard to possible earthquakes

During
- Damage reduction/control
- Emergency help and rescue
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After
- Rehabilitation of infrastructure functionality
- Condition assessment and updating
- Optimal allocation of resources for rebuilding and strengthening

Laserscan
C5
![damages to single buildings](image1)
![number of casualties](image2)
- need for personnel and rescue equipment
- amount of debris to be removed

Height Data
Construction types
Occupancy classes
Pre-event height data

Building Data
Z1/86

Small Scale

Damage detection using airborne laser scanning
Damage detection using helicopters and video cameras

Vehicle-borne Laser Mapping System (VLMS)
Vehicle-borne Laser Mapping System (VLMS)

Monitoring in Large Scale
The storey drift, $\Delta_i$, of any column or structural wall shall be determined by Eq. (6.19) as the difference of displacements between the two consecutive stories:

$$\Delta_i = d_i - d_{i-1} \quad (6.19)$$

The maximum value of storey drifts within a story, $(\Delta_i)_{max}$, calculated by Eq. (6.19) for columns and structural walls of the $i$th story of a building for each earthquake direction shall satisfy the unfavourable one of the conditions given by Eqs. (6.20):

$$\frac{(\Delta_i)_{max}}{h_i} \leq 0.0035 \quad (6.20a)$$

$$\frac{(\Delta_i)_{max}}{h_i} \leq 0.02 / R \quad (6.20b)$$
3D-Modelling of a Structure

Visualization of Crack structures in 3D
Earthquake GIS

EQ-GIS in that area of Gölcük

Tsunami Risc Map of a 3m high wave in Istanbul’s Coasts
Wenchuan Earthquake

- The Wenchun Earthquake which China suffered on 12 May 2008 proved to be one of the catastrophic ones in the history.
- As of 11 June 2008, the Chinese State Council Information Office reported:
  - 69,146 persons killed, 17,516 missing, and 374,131 injured.

Beijing Congress

FIG Working Week 09, Eilat
ISPRS Structure

“ISPRS is a Society of National Societies and Organizations”

Founder of ISPRS

Prof. Dolezal was a Professor for Practical Geometry in Vienna, Austria with a great love for photogrammetry. In 1910 he considered the time was right for worldwide cooperation of photogrammetrists. ISPRS was founded in Vienna on 4th July 1910 ITU Vienna
ISPRS Council has decided to celebrate the Centenary with several actions;

• 4th of July 2010 a celebration date in Vienna
• To prepare and propose a new strategic plan for the Society
• To use this event outreaching our sciences and society to the outside world
Beijing Declaration

We, members of The International Society for Photogrammetry and Remote Sensing (ISPRS) and participants of the XXII ISPRS Congress in Beijing, recognize the importance of imagery to measure and monitor the natural and man-made features on planet Earth and to explore other planets of the solar system, especially after witnessing the important role of photogrammetry, remote sensing and spatial information systems in the rescue operation and damage assessment of the recent devastating natural disasters.

1. Wide application of Earth observation technologies and tools to the fields of sustainable development, climate protection, agriculture, and emergency management of disasters, cultural heritage conservation, global and environmental change monitoring, energy engineering and management, land use and land cover monitoring, food security, sustainable use of water resources, and human habitat assessment and health.

Disaster Management in ISPRS

[Image of Disaster Management in ISPRS]
Conclusions

- Geo-Information Sciences is an important tool for observing human induced and natural disasters.
- Scientific research and different applications show this is a very important tool.
- BUT!!
- How can we assure that the decision makers and governmental institutions realise this fact???

On November 4, member of the Standing Committee of the Political Bureau of the CPC Central Committee and Chinese Premier Wen Jiabao paid a visit to the Chinese Academy of Sciences (CAS), whereupon Vice Chairman of the NPC Standing Committee and CAS President Lu Yongxiang gave a warm welcome to the Premier and presented him the “Remote Sensing Atlas of Wenchuan Earthquake” as a souvenir.

FIG Working Week 09, Eilat
Aerial- Spaceborne Programs

Ministry of Land Resources
National Bureau of Surveying and Mapping
Chinese Academy of Sciences
Wuhan University

Remote Sensing Communities
Optical Camera: SWDC, ADS40, DMS etc.
Synthetic Aperture Radar

Camera & Sensors
Monitoring of Collapsed Buildings
Joint Board of Geospatial Information Societies (JB GIS) is a coalition of leading international geospatial societies. The members of the JB GIS are FIG, IAG, ICA, IHO, IMTA, ISCGM, ISPRS and GSDI.

The aim JBGIS Best Practises Booklet is to assist governments, local authorities, and other stakeholders concerned with natural hazards in potentially vulnerable areas, and outline the potential uses of the Geo-Information Technologies to governmental, institutional and operative decision makers. The Booklet is intended to cover all regions of the world and all phases of the disaster management cycle.

The “JBGIS Best Practises Booklet” to be released by a Press Conference in Vienna in July 2010.
Do not forget your culture, inheritance and tradition

LESSONS TO BE LEARNED!!
IT’S NOT THE END - to be cont.