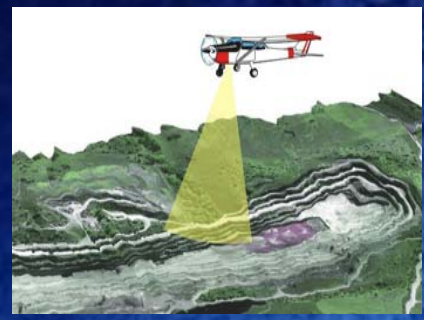
Geo-information for Disaster Management

With
Special Emphasis on Earthquakes

MODERN METHODS of Earth Observation

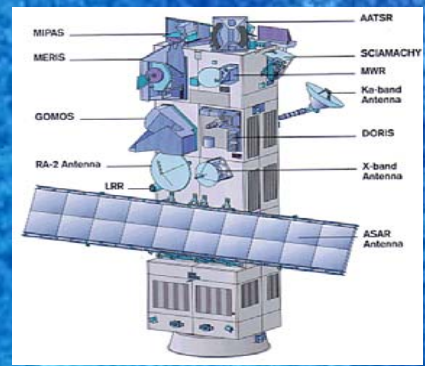
EARTH OBSEVTATION

METHODS



Photogrammetry

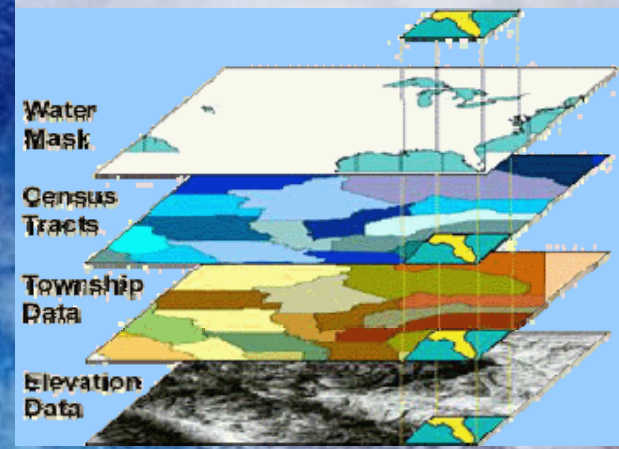
Remote Sensing



PRODUCTS

- Topographic Maps,
- Terrain models,
- Orthophotos,…….
- Or
- GIS Data for management

Like Water management (Watershed)



Steps of Disaster Management in an Earthquake

(adapted from Yilmaz Aslantürk)

Before	During	After
Optimal allocation of available resources for risk reduction	Damage reduction/control	Rehabilitation of infrastructure functionality
- strengthening - rebuilding	Emergency help and rescue	Condition assess-ment and updating
in regard to possible earthquakes	Aftershock hazards	Optimal allocation of ressources for rebuilding and strengthening

1. Step of Disaster Management for an Earthquake

(adapted from Yilmaz Aslantürk)

Before

Optimal allocation of available resources for risk reduction

- strengthening
- rebuilding

in regard to possible earthquakes

Prediction-

Early Warning

During

Damage reduction/control

Emergency help and rescue

Aftershock hazards

After

Rehabilitation of infrastructure functionality

Condition assess-ment and updating

Optimal allocation of ressources for rebuilding and strengthening

Figure 1: Triangle network of GPS station

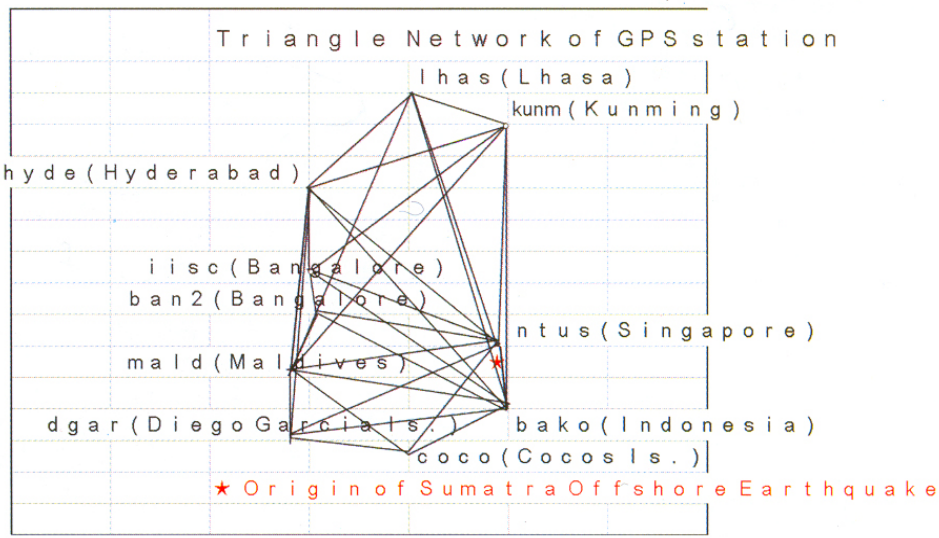


Figure 5: Location of GPS stations and boundary of plates

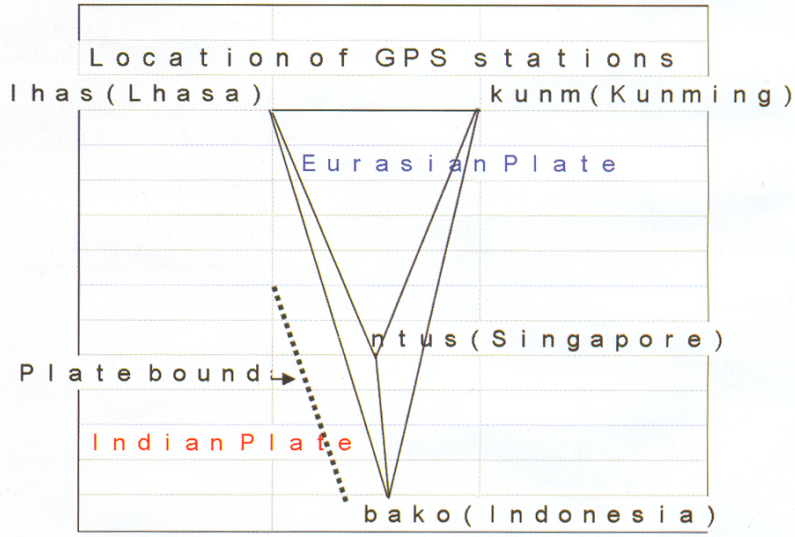
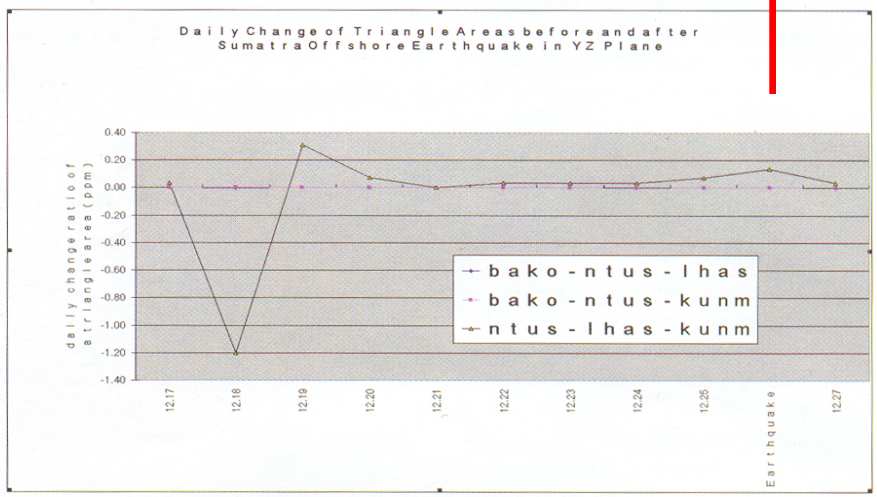


Figure 4: Daily change of triangle area in y-z plane

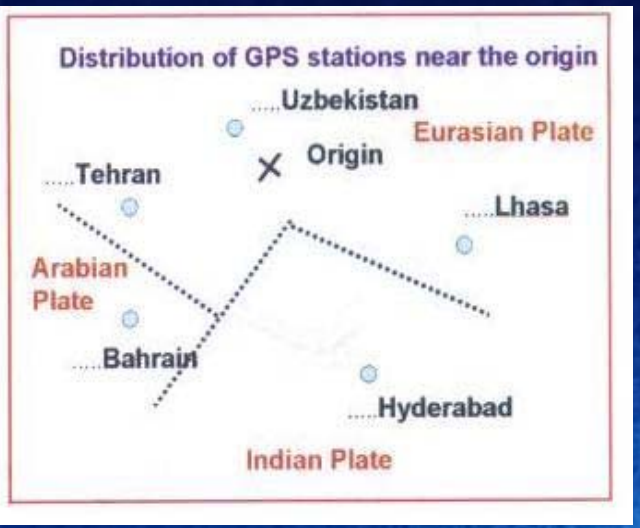


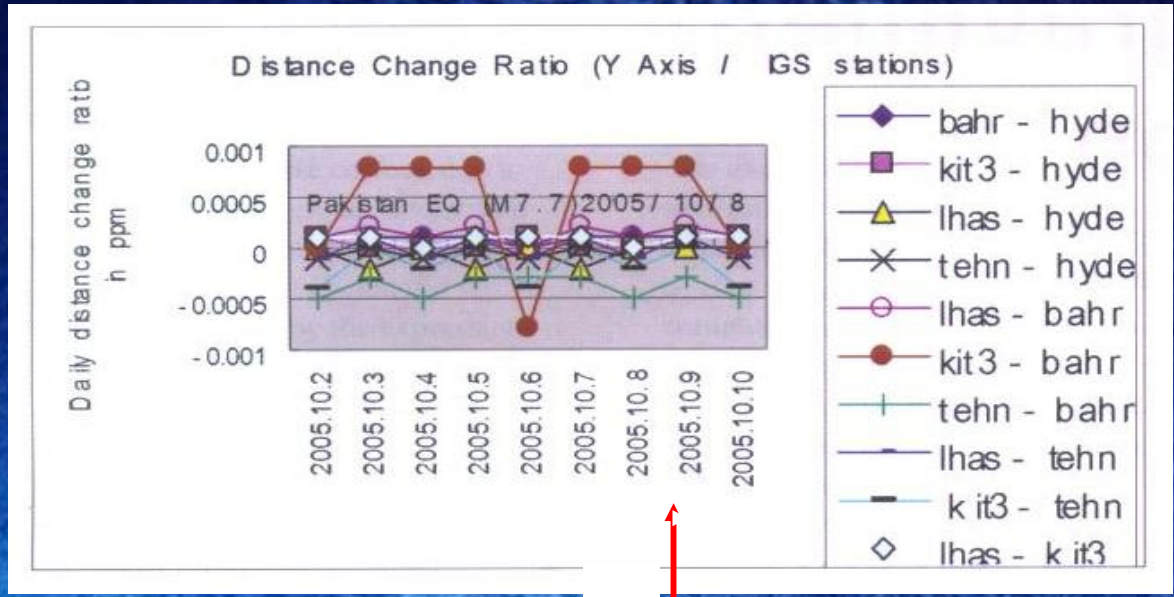
Shunji Murai; Harumi Araki;

Was Early Warning of Sumatra Earthquake possible?

Coordinates, July 2005, p. 8-11

GEODETIC MEASUREMENTS AS A MEANS OF EARLY WARNING





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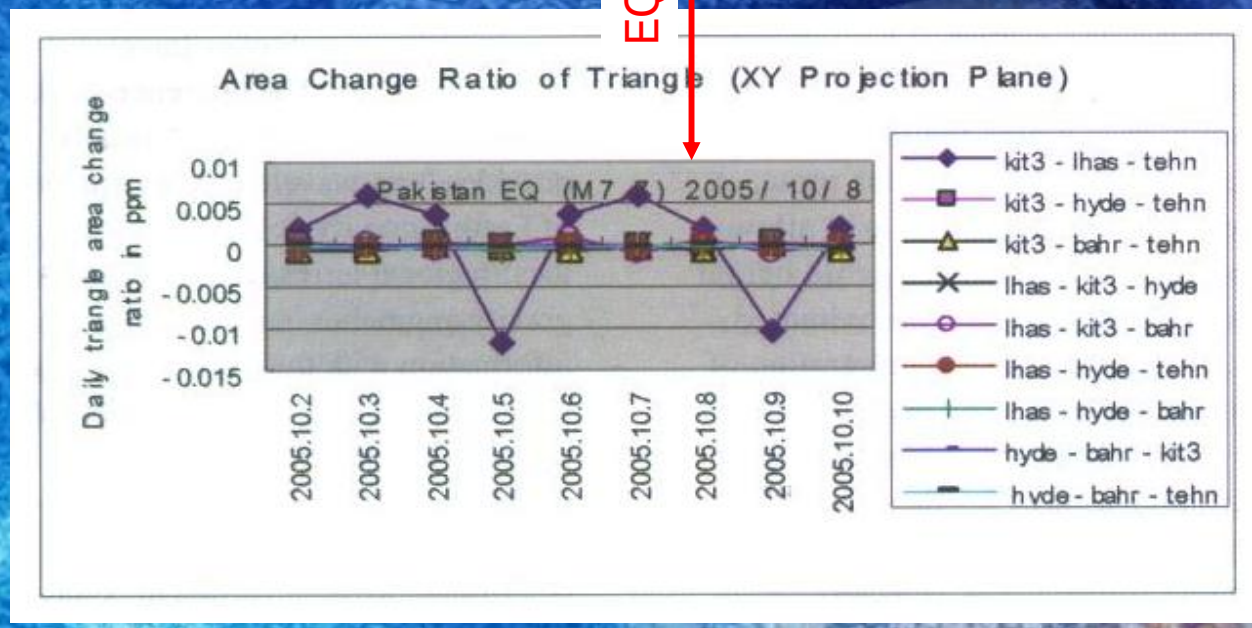
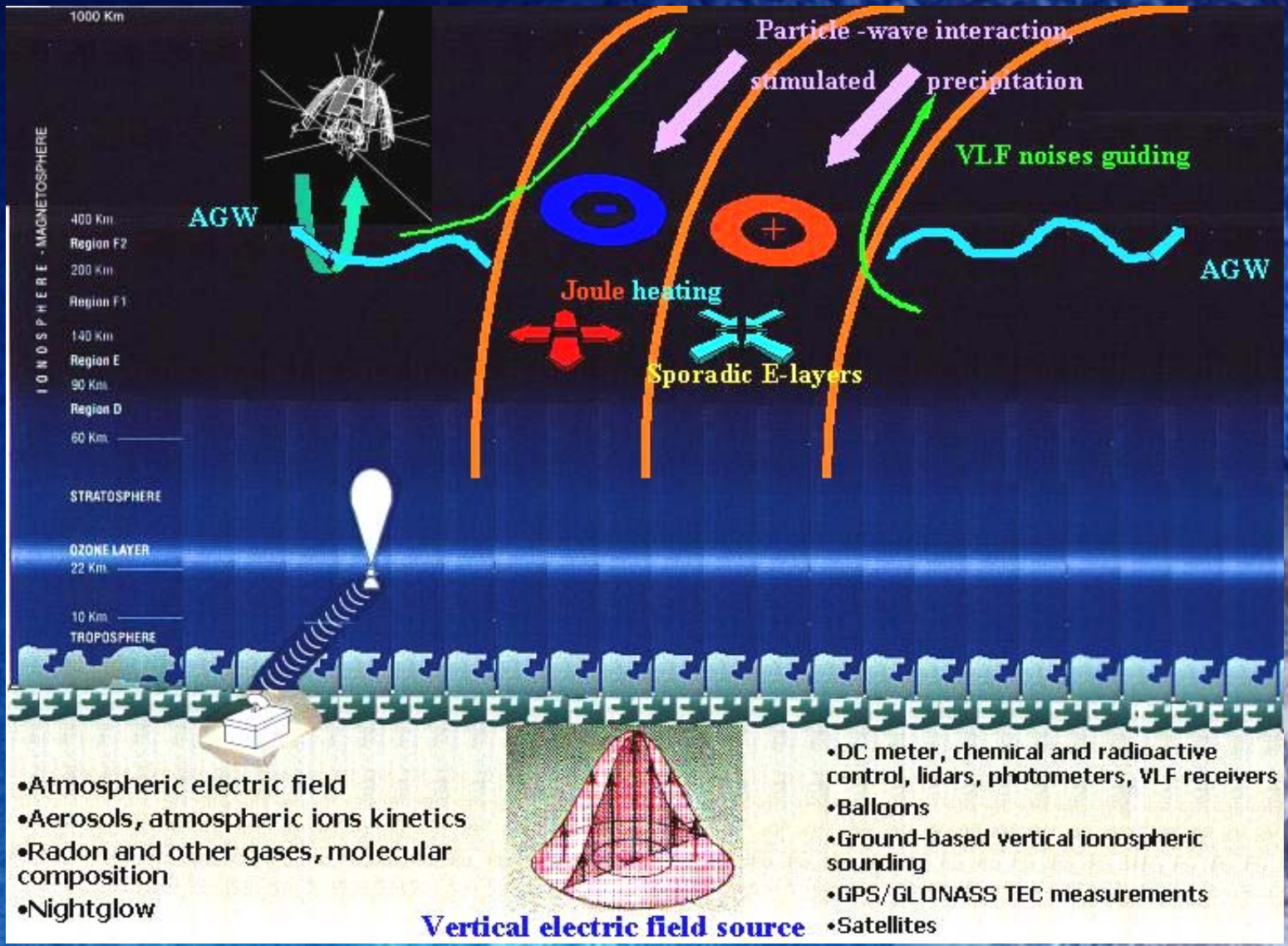


Shunji Murai; Harumi Araki;

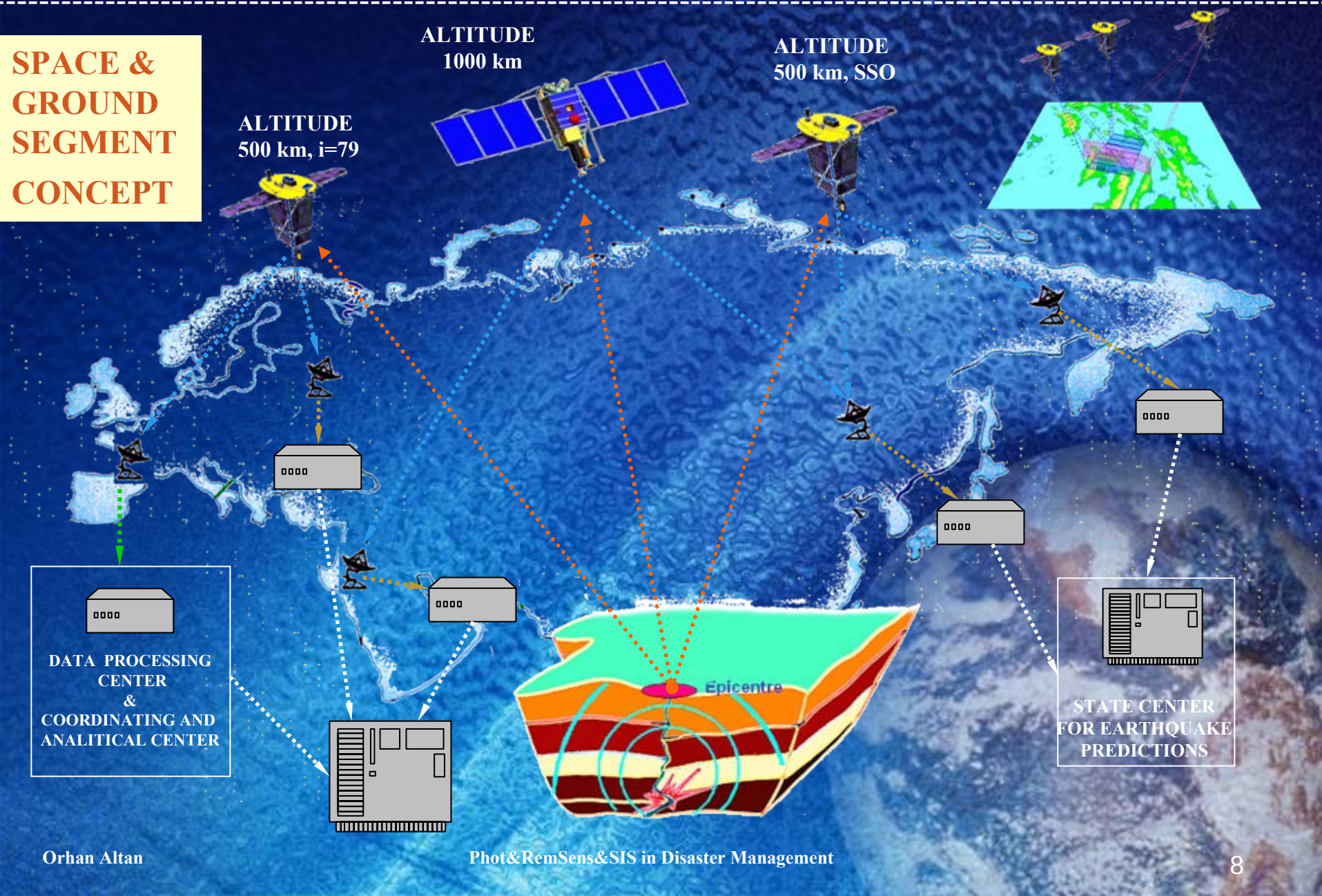
Was there any pre-signal of Pakistan earthquake?

Coordinates, April 2006, p. 6-7

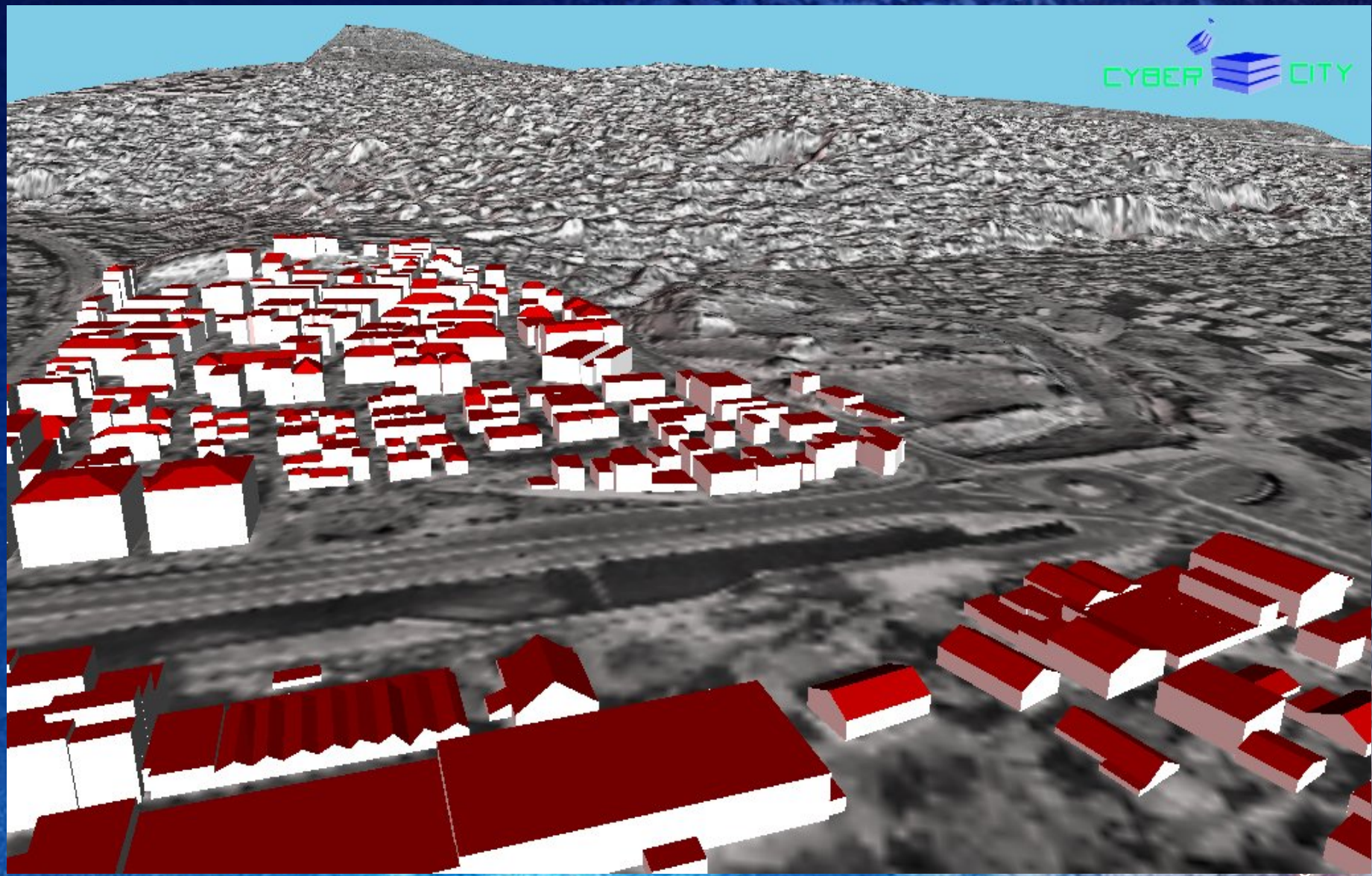
Seismo-ionospheric coupling model schematic presentation



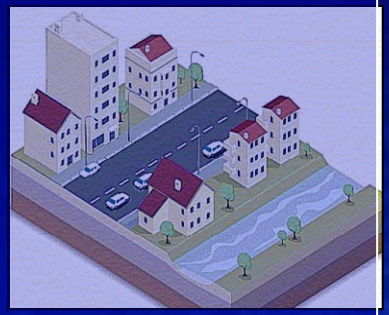
Seismo-ionospheric coupling model schematic presentation

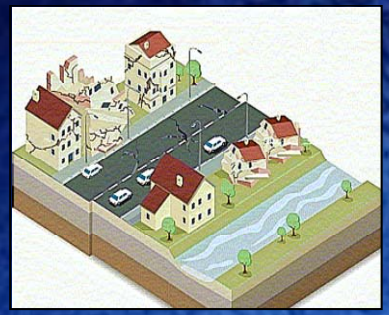


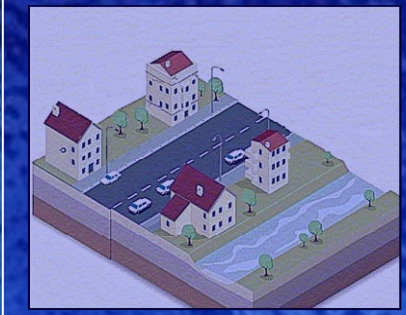
İzmir IKONOS



2. Step of Disaster Management for an Earthquake







(adapted from Yilmaz Aslantürk)

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

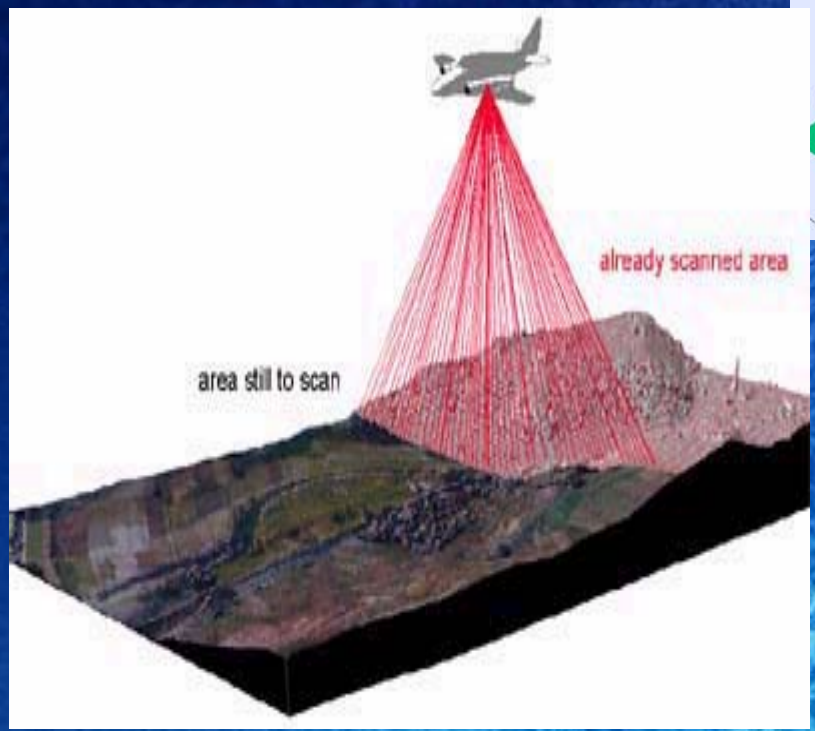
Rehabilitation of infrastructure functionality

Condition assess-ment and updating

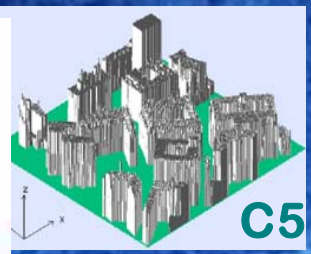
Optimal allocation of ressources for rebuilding and strengthening

Small Scale

Laserscan



Height Data



Building Data

A B C D E

construction types
occupancy classes
pre-event height data

Z1/B6

+

- ➔ damages to single buildings
- ➔ number of casualties
  - ➔ need for personnel and rescue equipment
  - ➔ amount of debris to be removed

Damage detection using airborne laser scanning

Small Scale

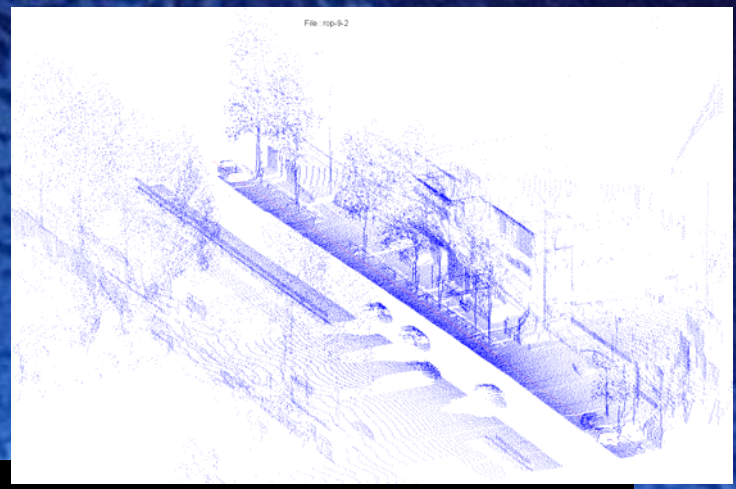
Damage detection using helicopters and video cameras

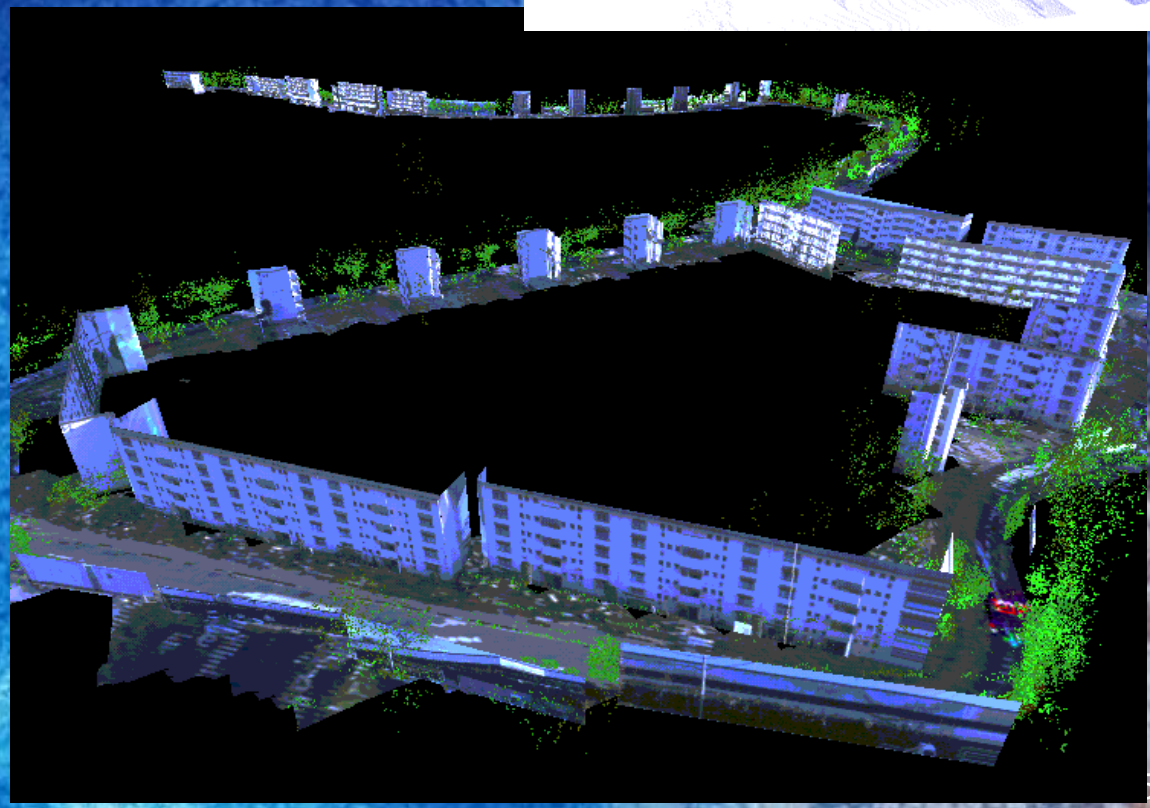
Monitoring in Large Scale

Vehicle-borne Laser Mapping System (VLMS)

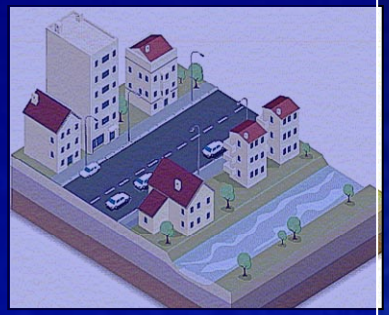
Monitoring in Large Scale

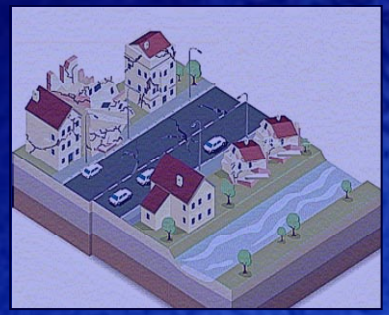
Vehicle-borne Laser Mapping System (VLMS)

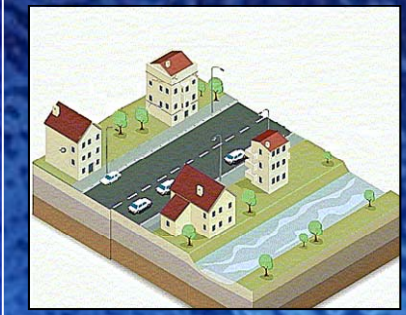




1. Step of Disaster Management for an Earthquake







(adapted from Yilmaz Aslantürk)

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Conventional Seismic Performance Assessment Methods

Estimate the **Maximum** Values of Response Parameters → Evaluate the Seismic Performance of the Building

Advantage:

- Damage is usually well correlated with the maximum response values.

Disadvantage:

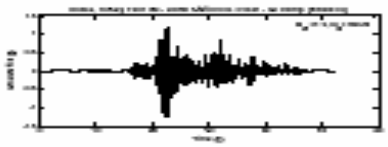
- After an earthquake, most of the time, maximum response values can only be roughly estimated.

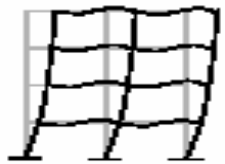
Performance Assessment using Residual Displacements

A **Seismic Performance Assessment Method** for buildings based on **residual displacements** will be developed.

Post-Earthquake Assessment

Damaged Building





Reconnaissance Survey

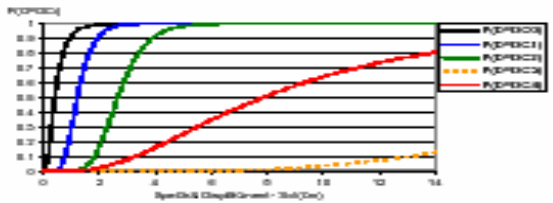
Recorded Ground Motion

FEM Model

Measured Residual Displacements

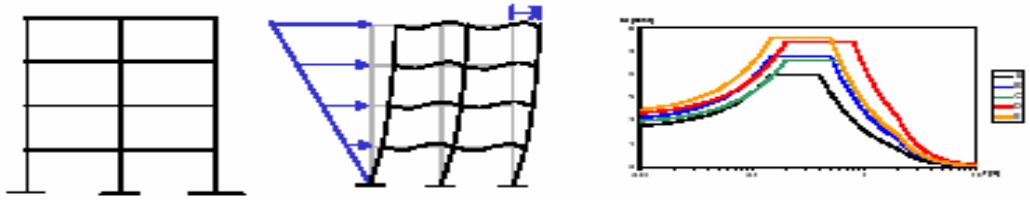
Estimates of Maximum Displacements

Post-Earthquake Vulnerability



Performance Assessment using Residual Displacements

Performance-based Design of a New Structure



FE Model | **PSH Model**

Seismic Performance

Estimates of Residual Displacements ← Estimates of Maximum Displacements

Provide essential information about the the post-earthquake:
- **Reparability/Usability**
- **Vulnerability**

Known to be well correlated with the attained damage

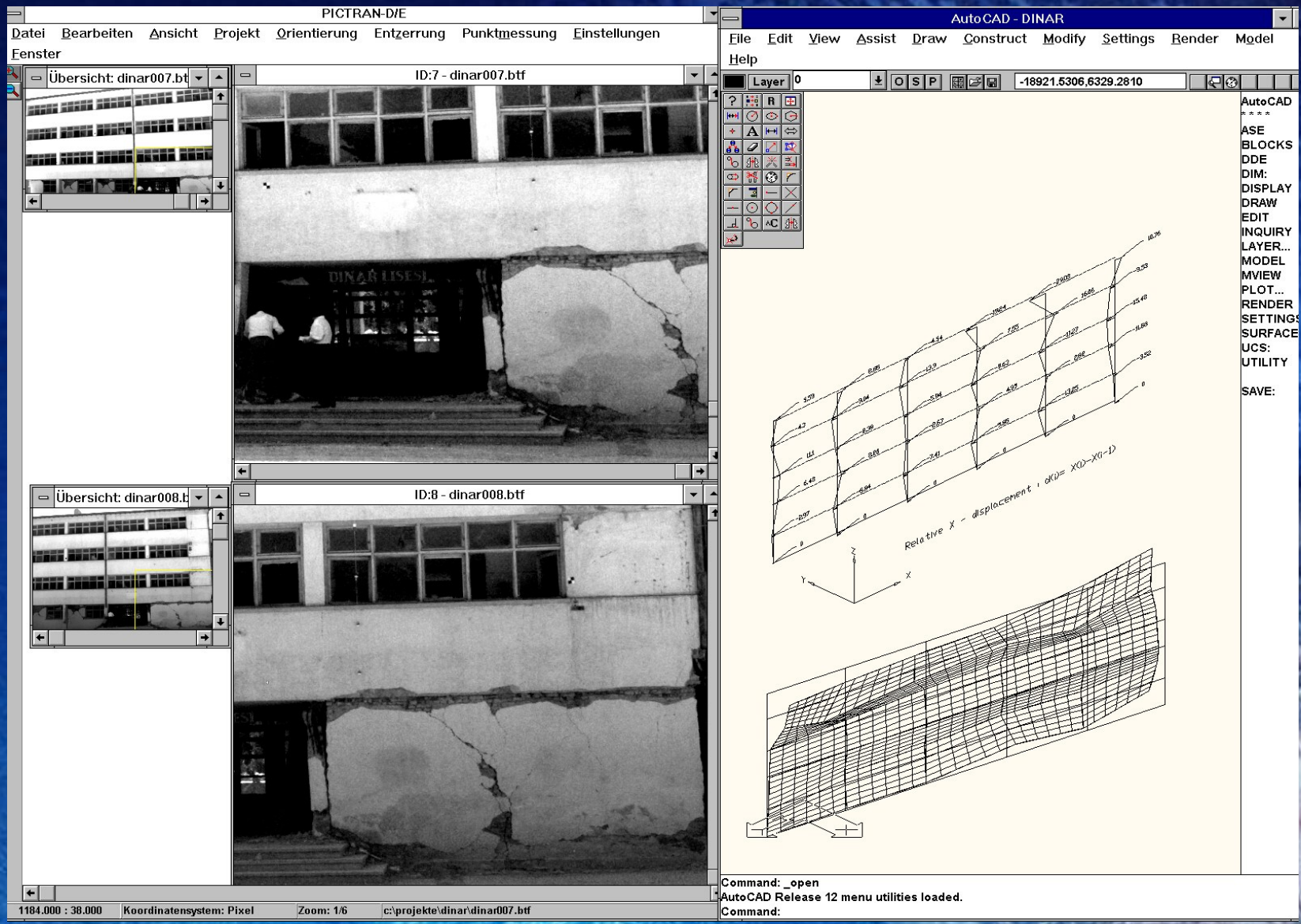
MERCI

An Important Question

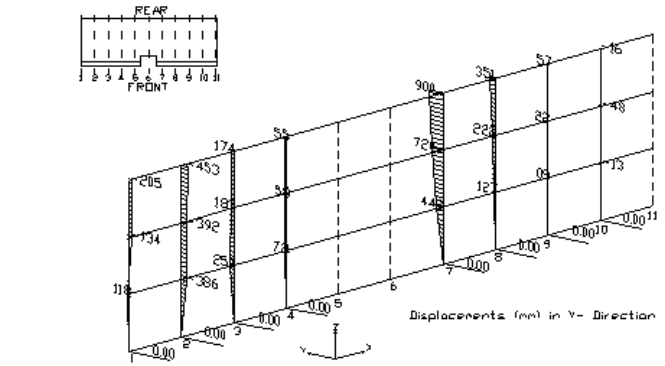
Before making elaborate statistical analyses on the residual displacements one needs to answer the following question:

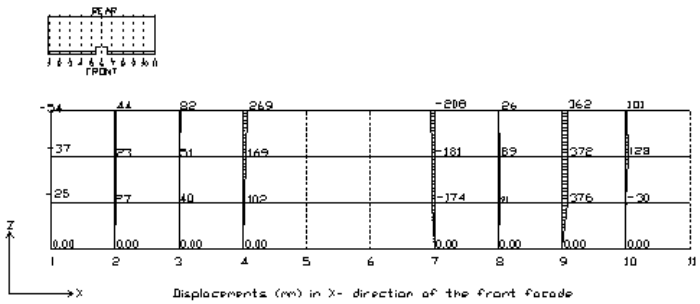
- How accurate can the available analysis tools simulate the seismic response of reinforced concrete structures in terms of residual displacements?

Displacement Measurements



Displacement Measurements





Ministry of Public Works and Settlement

Government of Republic of Turkey

Specification for Structures to be Built in Disaster Areas

- The *storey drift*, Δ_i , of any column or structural wall shall be determined by **Eq.(6.19)** as the difference of displacements between the two consecutive stories.

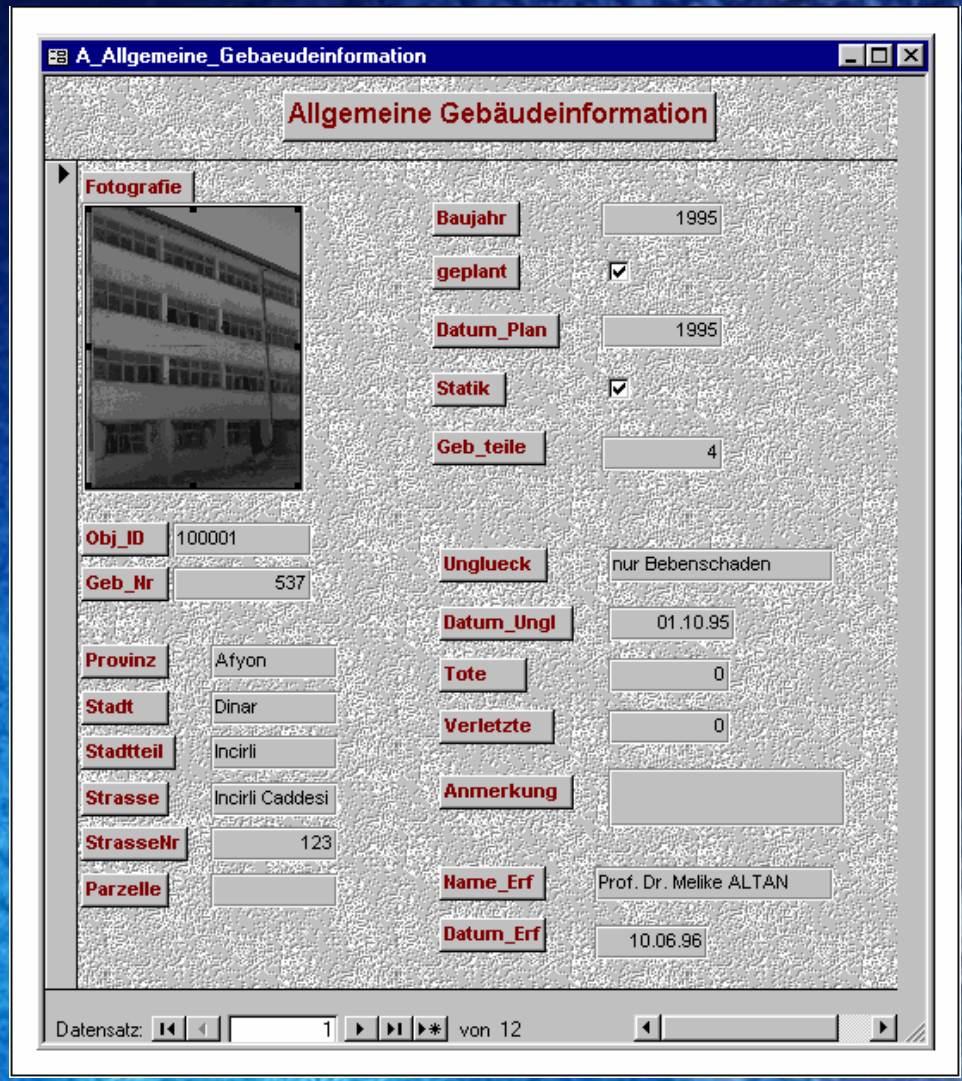
$$\Delta_i = d_i - d_{i-1} \qquad (6.19)$$

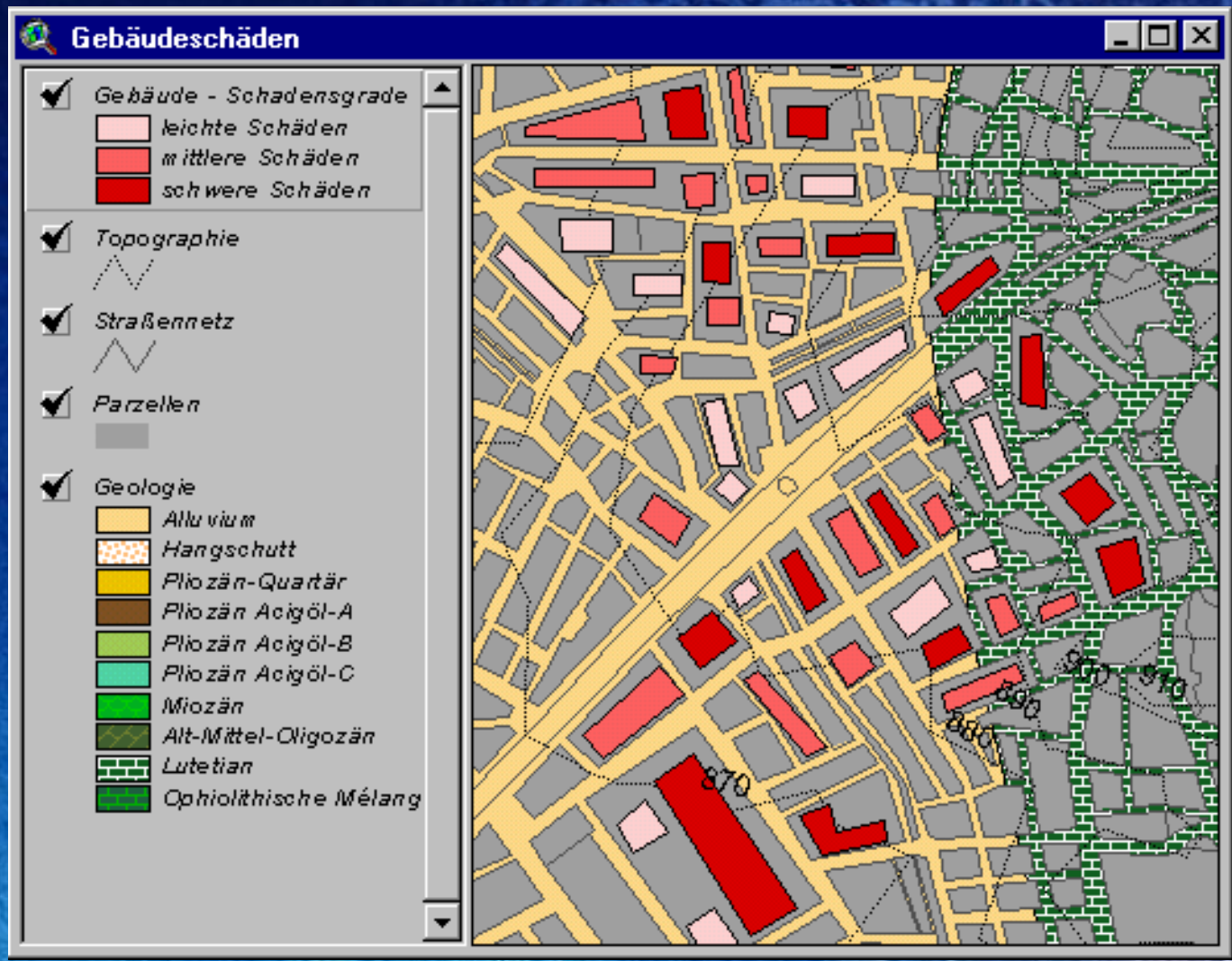
- The maximum value of storey drifts within a storey, $(\Delta_i)_{max}$, calculated by **Eq.(6.19)** for columns and structural walls of the i'th storey of a building for each earthquake direction shall satisfy the unfavourable one of the conditions given by **Eqs.(6.20)**

$$(\Delta_i)_{max} / h_i \leq 0.0035 \qquad (6.20a)$$

$$(\Delta_i)_{max} / h_i \leq 0.02 / R \qquad (6.20b)$$

Acsess Database



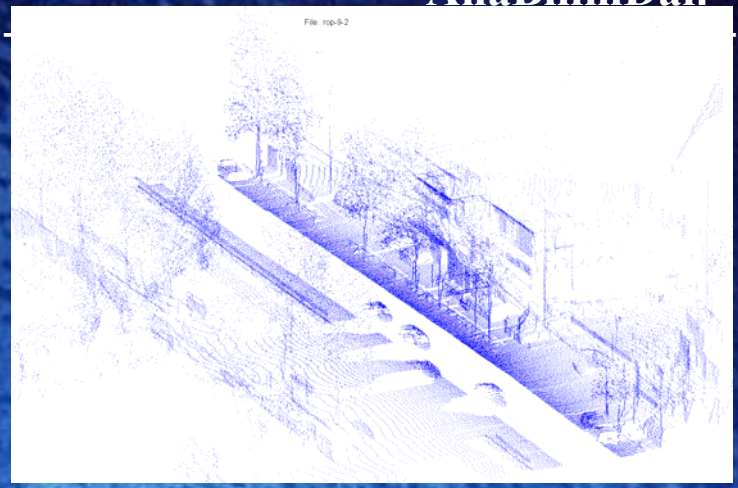

Gebäudeschäden
Gebäude - Schadensgrade
leichte Schäden
mittlere Schäden
schwere Schäden
Topographie
Straßennetz
Parzellen
Geologie
Alluvium
Hangschutt
Pliozän-Quartär
Pliozän Acigöl-A
Pliozän Acigöl-B
Pliozän Acigöl-C
Miozän
Alt-Mittel-Oligozän
Lutetian
Ophiolithische Mélang
870
880
890
900
910

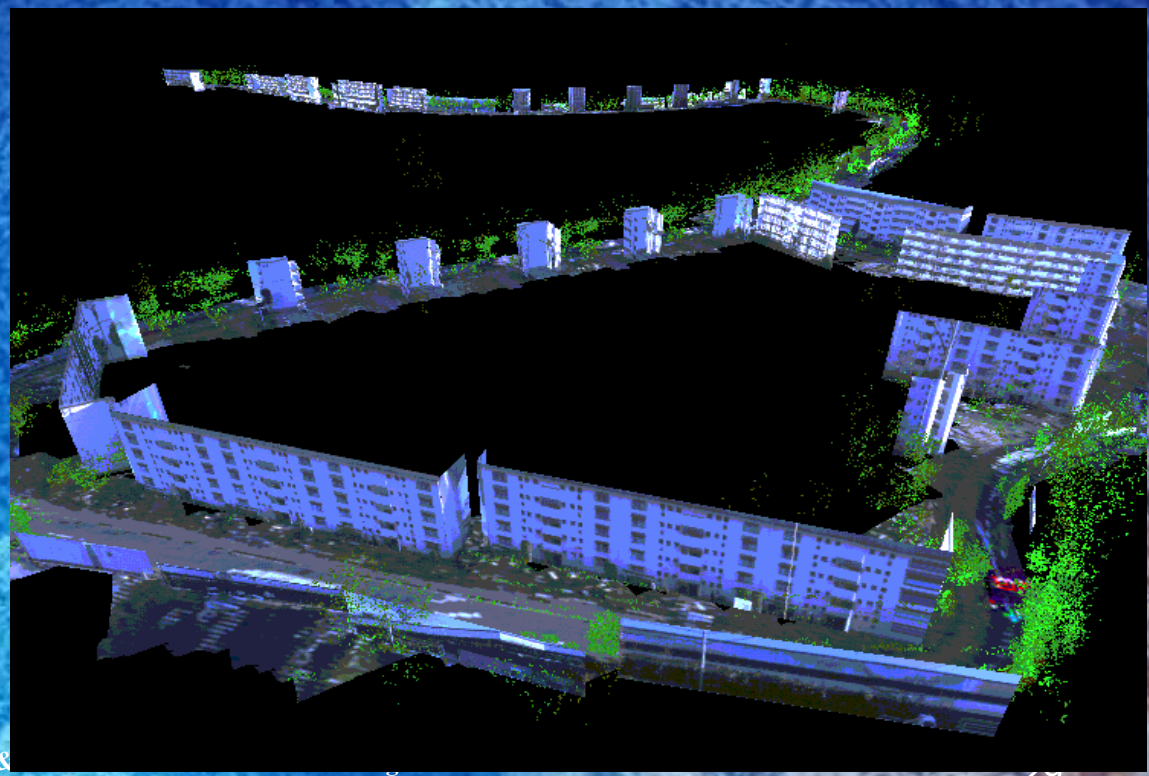
Large Scale

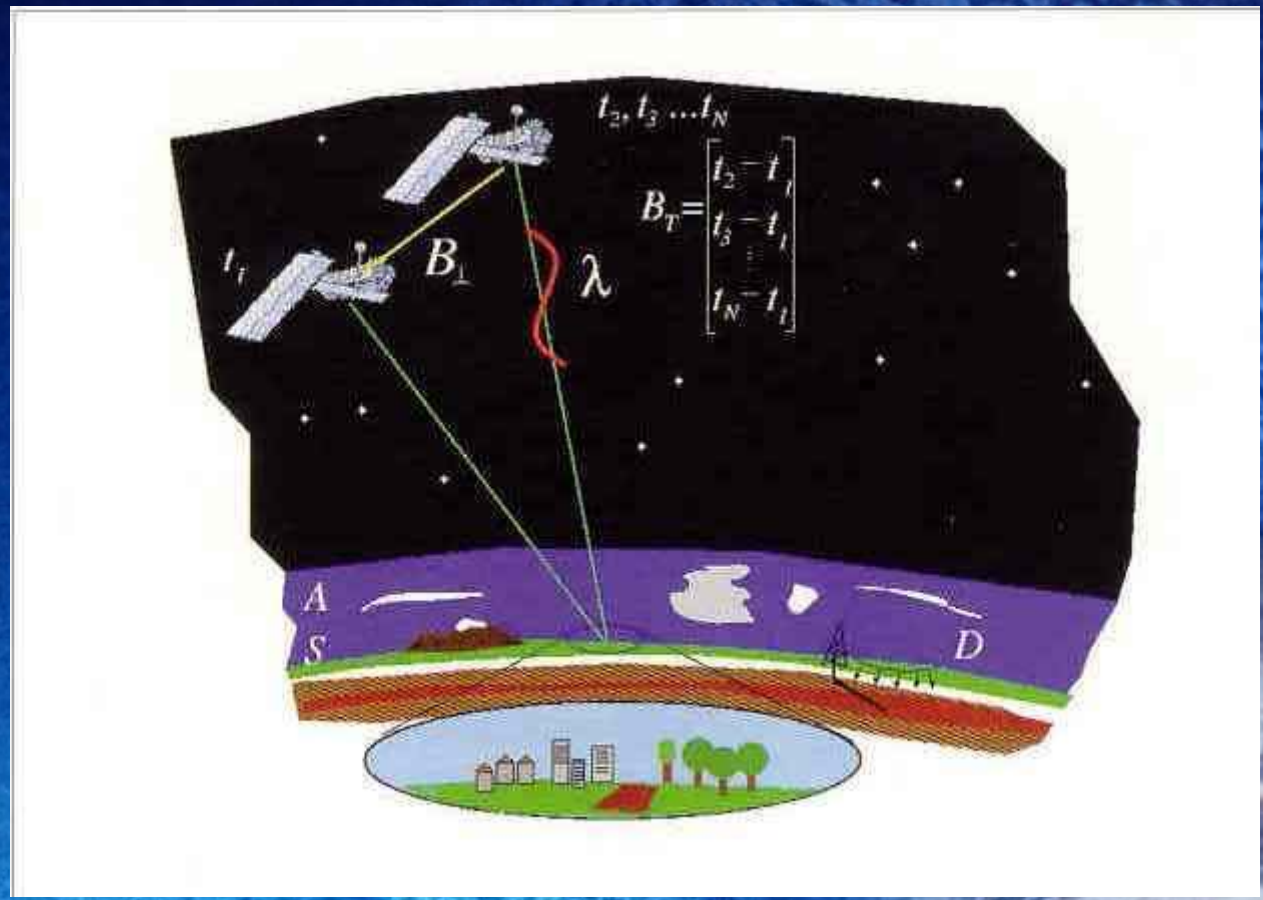
Vehicle-borne Laser Mapping System (VLMS)

Large Scale

Vehicle-borne Laser Mapping System (VLMS)

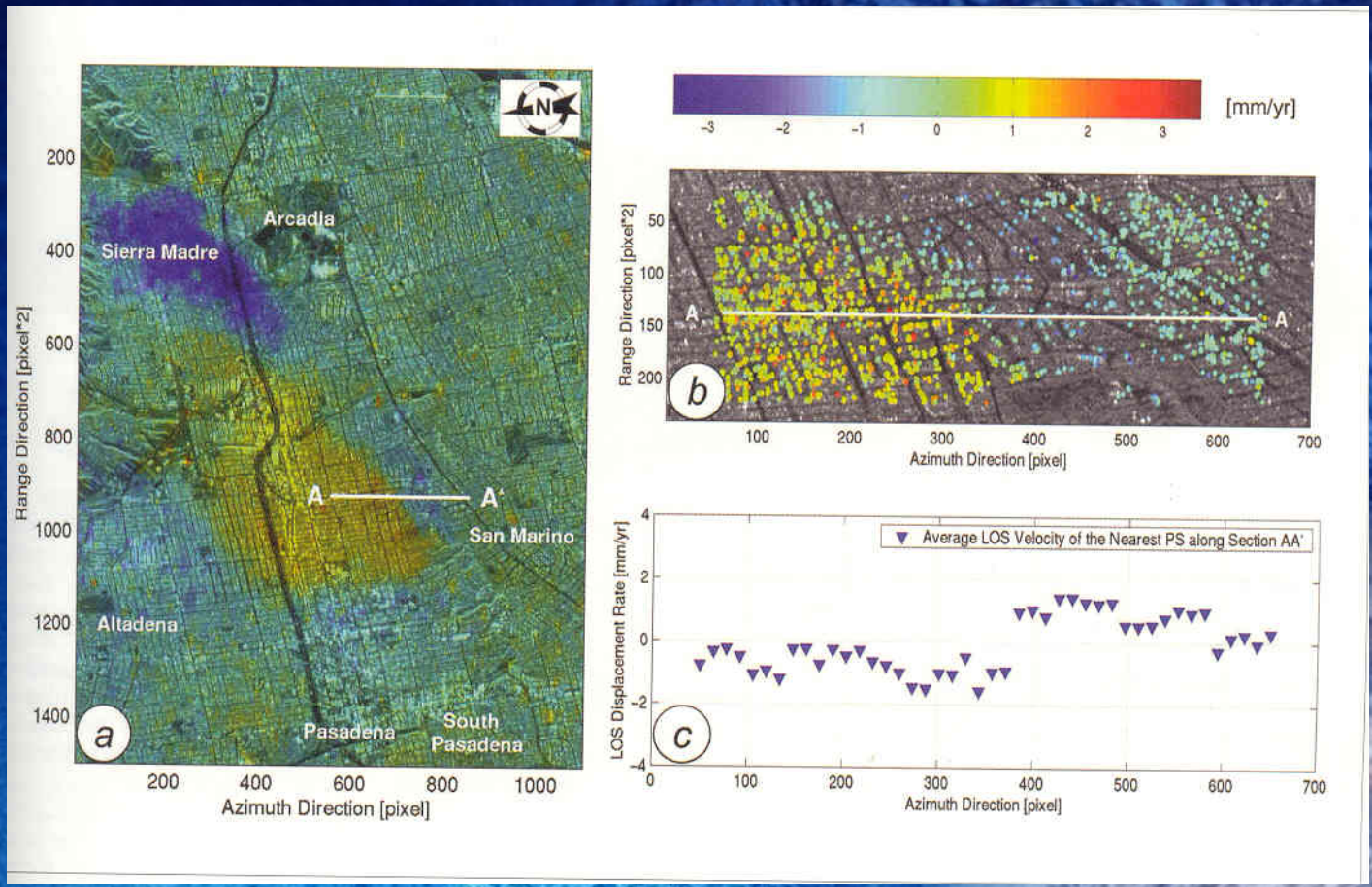




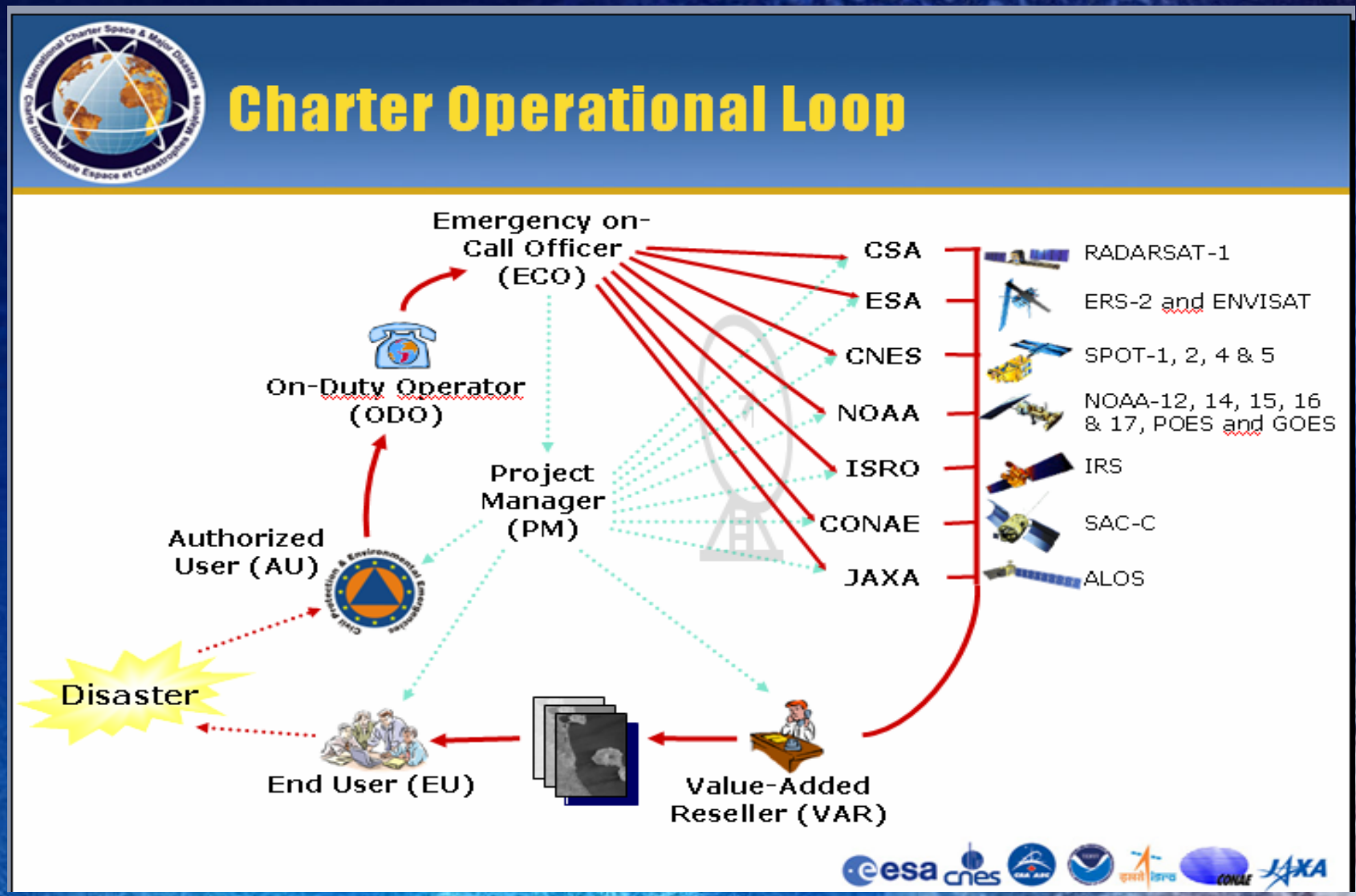


Deformation Monitoring by Satellite Radar Interferometry R. F. Hansen, GIM, 09.2002 p 52-57

Schlussfolgerung

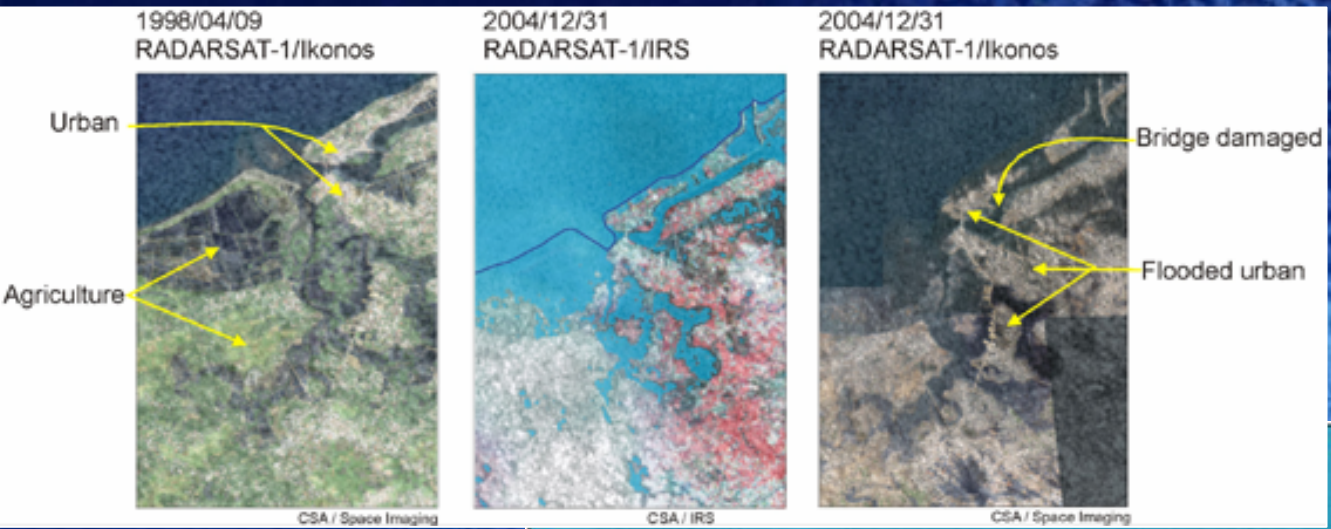


Deformation Monitoring by Satellite Radar Interferometry R. F. Hansen, GIM, 09.2002 p 52-57

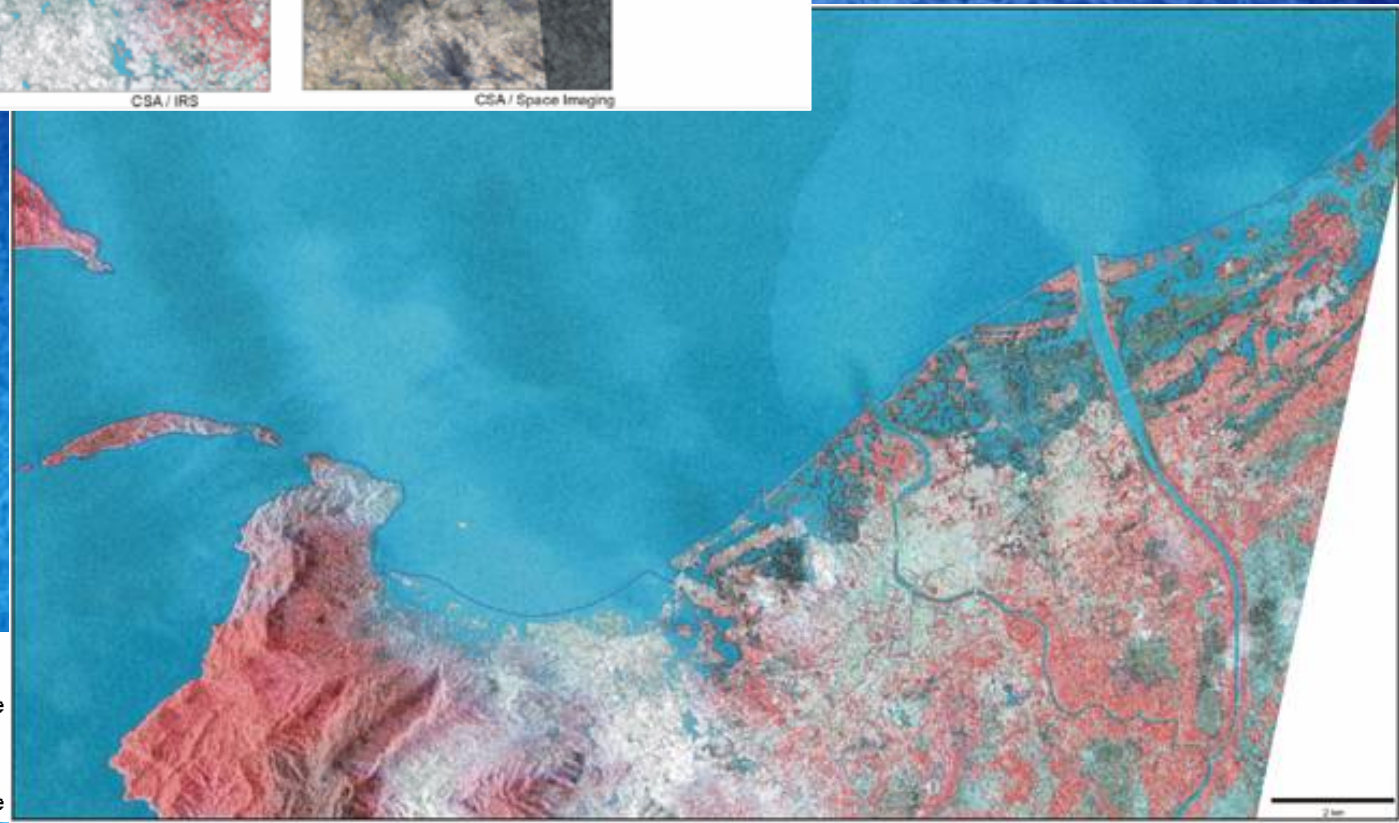


International Charter for Disaster Management

Charter Products

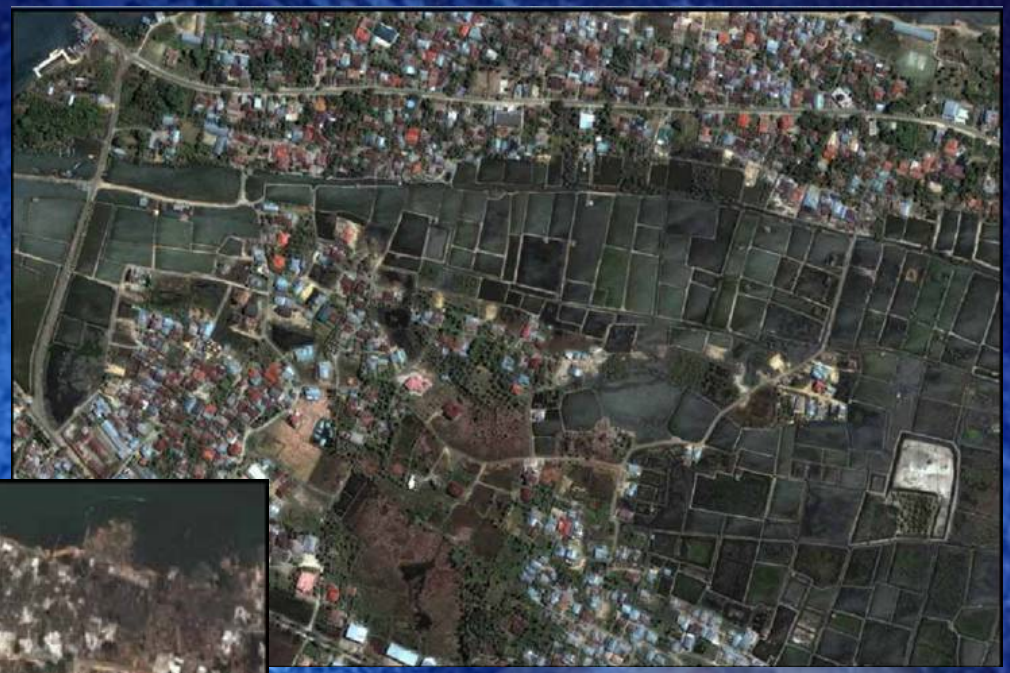


Banda Aceh, Northern Sumatra



Orhan Altan

Charter Products



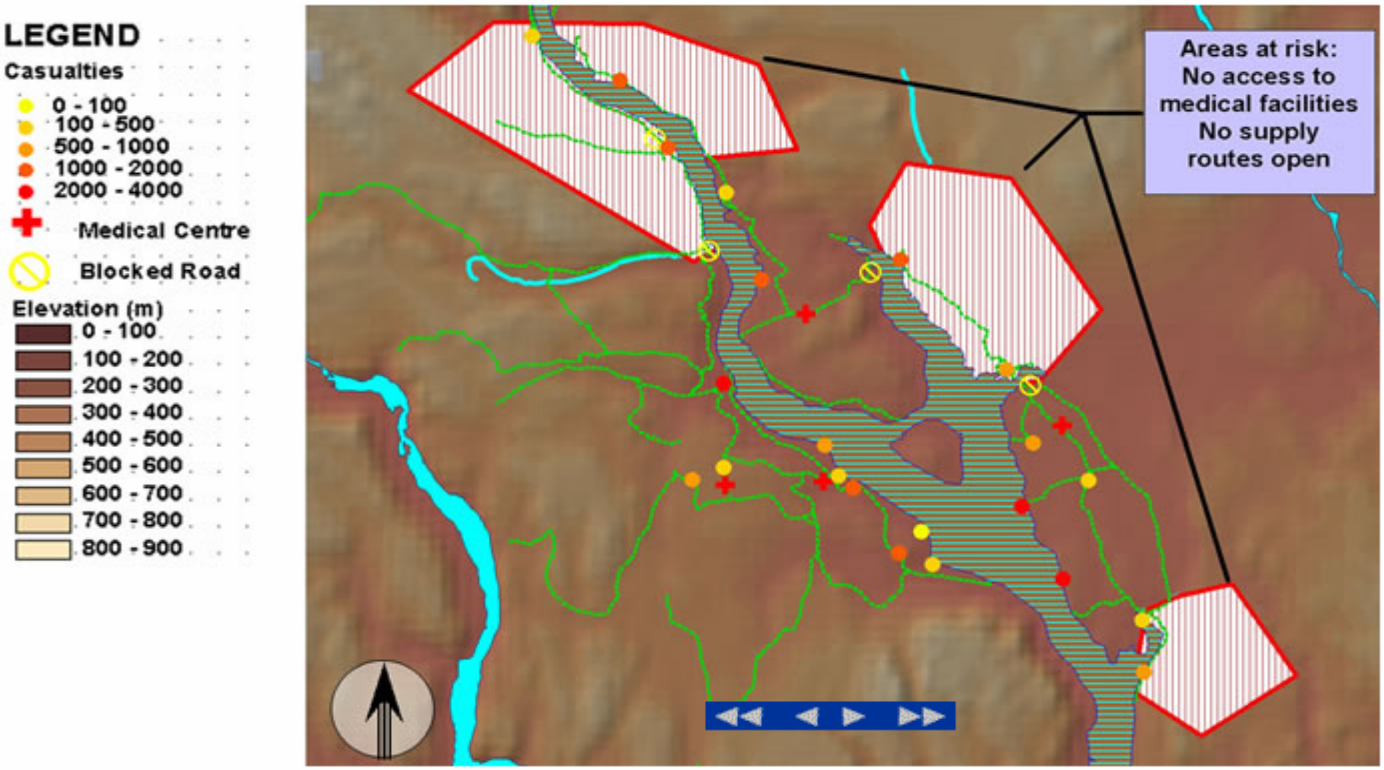
Post tsunami QuickBird image, 28-Dec-04

Pre tsunami QuickBird image, 23-Jun-04

High Resolution QuickBird image of the devastated area

Summary of the mapping, surveillance and communications technology used by MapAction. © 2004 MapAction.

Stage 5: Data is analysed rapidly at the field base using GIS software. Paper maps are issued to partner aid agencies on the scene as required, showing the required layers of information. Overview maps are uploaded to the web via satellite modem, for access by disaster response agencies internationally.

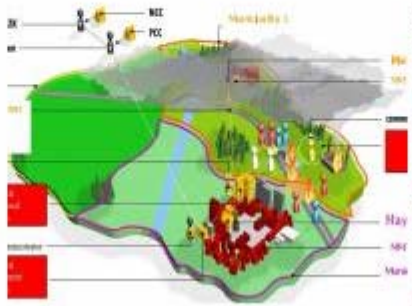


End of Presentation, return to: Capability Page | Home Page

ISPRS AND DISASTER MANAGEMENT

isprs
Information from Imagery

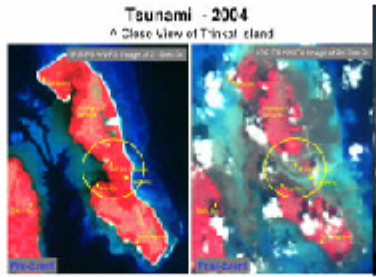
International Society for Photogrammetry and Remote Sensing
Commission IV - Geo-Databases and Digital Mapping
Working Group IV/8 - Spatial Data Integration for Emergency Services, 2004 - 2008



isprs
information from imagery

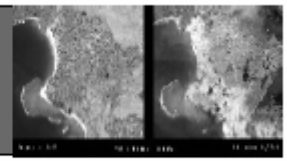
International Society for Photogrammetry and Remote Sensing
Commission VIII - Remote Sensing Applications and Policies

Working Group VIII / 2 - HAZARDS, DISASTERS AND PUBLIC HEALTH, 2004-2008


DIMISCO and ISPRS

Ad Hoc Expert Group on the Possibility of Creating a Disaster Management International Space Coordination Entity



"Study on the possibility of creating an international entity to provide for coordination and the means of realistically optimizing the effectiveness of space-based services for use in disaster management" - A/AC.105/C.1/L.285

ISPRS is an Active Member of this Ad Hoc Expert Group

GROUP ON EARTH OBSERVATIONS

GEO and GEOSS…

- **GEO is an Intergovernmental Group**
  - 60 Nations
  - European Commission
  - 43 Participating Organizations
- **With a Single Objective: GEOSS**
  - To establish a global, coordinated, comprehensive
  - and sustained system of Earth observing systems

A PROPOSAL FOR COORDINATION

Do not forget your culture, inheritance and tradition

Orhan Altan

Pho

Do not forget your culture, inheritance and tradition


the END