Research and capacity building

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Content

- Use of geo-information in Disaster Management
- Recommendations for R&D (Gi4DM traces)
- A look in the future

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Painting by Egbert Lievensz van der Poel, 1654
collection Stedelijk Museum Het Prinsenhof, Delft

Gunpowder explosion, Delft
12 October 1654

- Warehouse in the city
- 80.000-90.000 pound exploded
- 200 houses not found back, hundreds more destroyed
- 100 fatal casualties (some reports 1000)
- Blast could be heart up to Texel (> 100km North)

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Flood Disaster
1st February 1953

Flood Disaster
1st February 1953

- hurricane-force northwester wind & high spring tides
- 1800 people drowned
- 72.000 evacuated
- thousands of farm animals lost
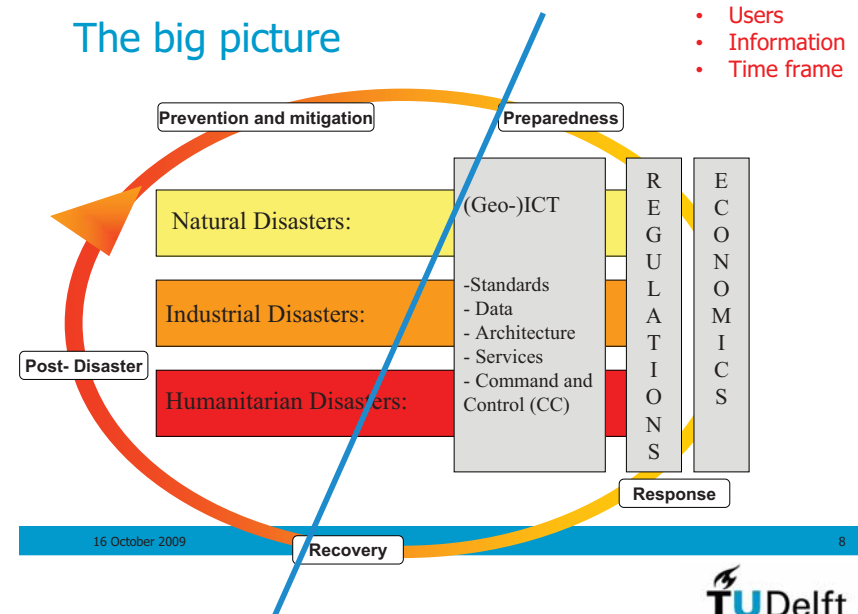- 150,000 hectares of land inundated

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People learn …

- Some examples from the recent NL past:
  - sea flooding Zeeland 1956 → Delta-works
  - river flooding Betuwe 1995 → New program for river management and improved dikes
  - firework disaster Enschede 2000 → More strict regulations and checking of regulations

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The big picture

- Users
- Information
- Time frame

Prevention and mitigation

Preparedness

Natural Disasters:

Industrial Disasters:

Humanitarian Disasters:

(Geo-)ICT

-Standards
- Data
- Architecture
- Services
- Command and Control (CC)

REGULATIONS

ECONOMICS

Post- Disaster

Response

Recovery

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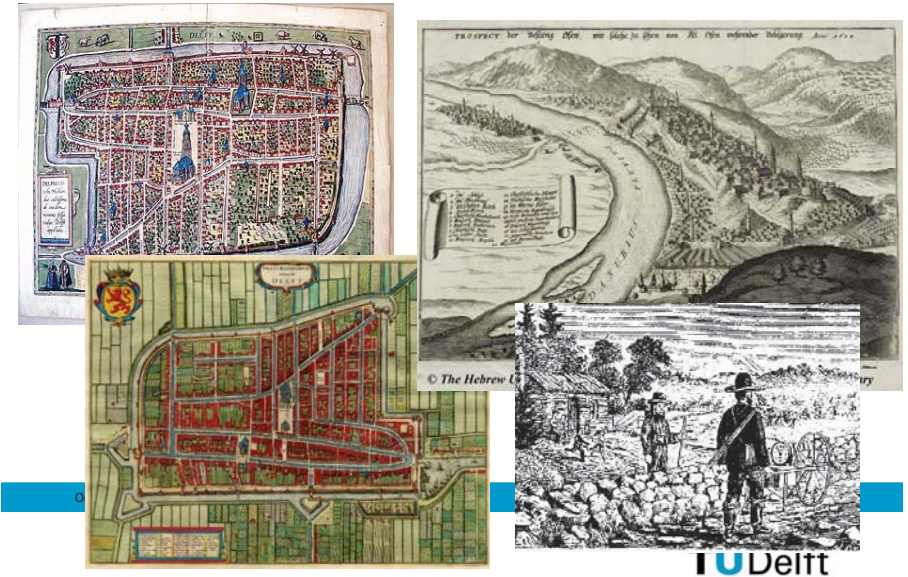## Geo-information is a small but very critical part

- Provides situational awareness 'what/who is where'
- Allows for context-aware 'what info to whom'
- Better visualisation (2D/3D)
- Mixed indoor (CAD) and outdoor (GIS) information
- Enables analysis (routes, flooding prediction,…)
- Provides clear communication interface 'the map'
- Up to date information; monitoring by satellite sensors
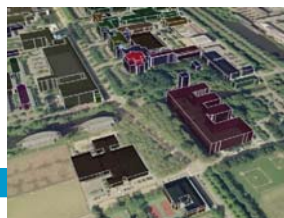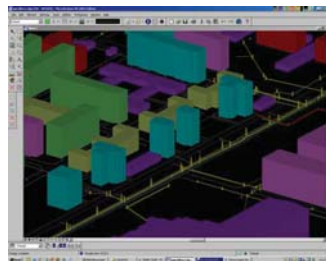- Positioning and navigation (GPS, Galileo)
- Location based services (LBS)

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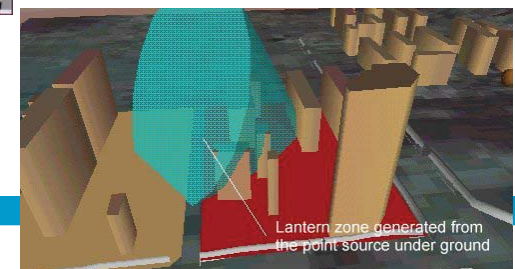## Before we had the maps

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3D visualisation

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3D analysis

Lantern zone generated from the point source under ground

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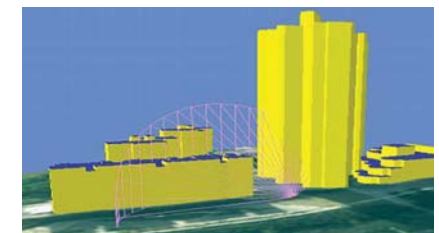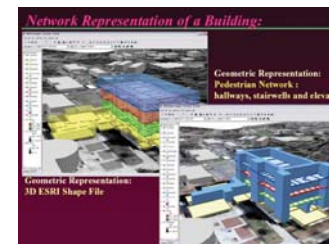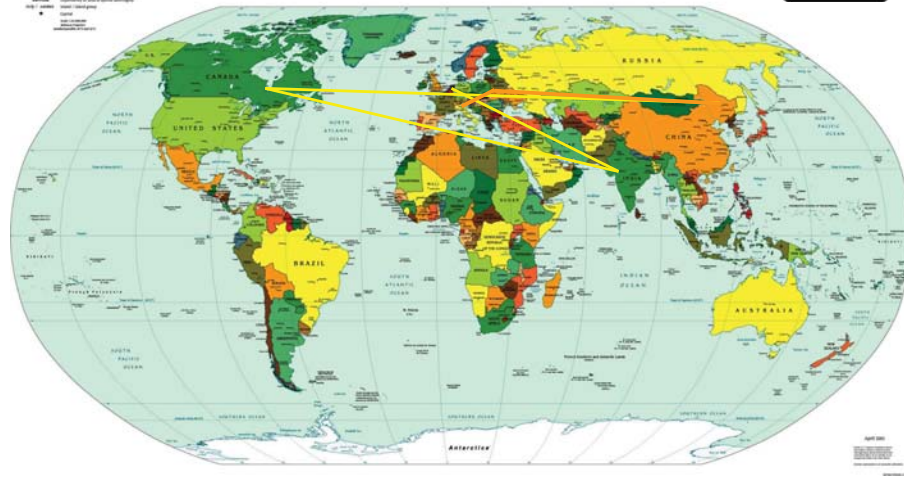
Gi4DM: Series Symposia across the continents **TU**Delft

What was said in 2005

'they what to sell us GIS'
'GIS is a tool, it does not solve everything by itself'
'there is difference between 'small' disasters and 'big' disasters'
'we have to educate disaster managers'
'geo-ICT has to learn from disasters'
'technologically everything is possible'
'the problem is organization and communication between partners'
'we succeeded because we are working together'
'our geo-information dates 1973'
'response phase cannot be isolated from prevention'
'data integration should be based on ontology and semantics'
'data are available after 3 days' vs. 'data were available after 3 hours'
'we have to stay close to the users'
'not all the people can work with total station but everybody can measure with
    steal type'
'can it be extended in 3D?'
...

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What was said in 2006

'right information vs. any information'
'we have to educate disaster managers'
'geo-scientists have to understand the users – user centered design'
'users feedback is critical … on accuracy, quality, etc.'
'web-based information is important'
'there problems with policy and organizational aspects'
'technologically everything is possible'
'near-real time satellite-based fire information system is needed'
'the internet connection to Africa is very slow, most data transport is between
    NA and Europe'
'LIDAR-based DEM for costal vulnerability mapping'
'cyclones are still not accurately predicted'
'knowledge-based, context-aware'

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2009 … Capacity building
ISPRS, ICA, OGC, EC

- Integration and analysis of heterogeneous data
- Spatial Data Infrastructures
- 3D/4D Data representation and Context-aware

Round Table at the Joint ICA CEWCM and 4th Gi4DM, Prague, January 2009: Orhan Altan, Soleil
    Beaulieu, Wolfgang Kainz, Gottfried Konecny, Milan Konecny Paulo Menezes, Virginia Puzzolo,
    Mark Reichard, Kristi Virrantaus and Sisi Zlatanova

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Information facts

- Increased importance of cooperating, sharing of information between institutions responsible for emergency response at national and international level;

- Enormous amount of data that emergency responders have to perceive as well as the fact that they are not geo-specialists and work within extreme circumstances.

- Availability of data repositories, as geographically organised web-based Digital Earth representations and dynamic image databases linked to global knowledge archives.

- Increased awareness of, and demands for geospatial information by governments, industries, academia and society.

Technology facts

- Increased research in semantic/ontology aspects of geo-information science for supporting machine geo-processing;

- Remarkable advances in software and hardware for processing, management, visualisation, visual analysis and simulation of natural phenomena on land, in the ocean and in the atmospheric;

- Emergence of Virtual Environments such as Google Earth, Visual Earth, Second Life and serious games, providing high level of interaction and immersion with virtual or real environments

- Increased international activities for standardisation of service, system architectures and geospatial information (e.g. OGC) and the various successful demonstrations of data integration fro emergency response.

Progress in use of geo-information

- Enormous potential of geospatial databases in emergencies;

- Maturing the level of harmonisation and sharing of data in order to take full advantage of information for decision-makers;

- Understanding the need for real-time data integration, constant access to data (7/365), ensuring secure interfaces.

- Developments on national and international levels related to harmonisation of geospatial data and building spatial data infrastructures such as GMES and INSPIRE in Europe, and Digital Earth initiatives;

Recommendations 1/4

- To understand the advanced concepts of many sciences dealing e.g. presentation of information (cartography, man-machine interaction, computer graphics), human behaviour (psychology), etc. in order to successfully apply these concepts in data representation in emergency situations

- To study the manner of work and communication in case of crisis in order to develop context-aware visualization and analysis.

- To develop systems, which can be used in daily work and not only in case of crisis.

- To develop and support all graphic device displays and interfaces.

Recommendations 2/4

- Accelerate the developments of SDI in Europe and worldwide

- Involve countries of Central and East Europe, Asia, Africa and Central and South America in the standardisation activities

- Develop models for efficient management of dynamic information (being critical for emergency response) and corresponding indexing and retrieval methos with emphasis of the quality of the models (and not only data quality) ;

- To enhance coordination of international efforts within INSPIRE, GMES and Digital Earth and standardisation organisations as ISO and OGC towards the standardisation of geospatial information;

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Recommendations 3/4

- To speed-up research on adaptive representation of data in crisis situation considering the context of the user and the current environment.

- To intensify developments in standardized symbology for emergency responders

- To extend research in 3D representations as being more intuitive and towards the integration of dynamic phenomena (such as flood noise, wind, air pollution and oils spill);

- To continue research on visual analytics and corresponding models for dynamic 3D/4D visualization, interaction and simulation to support monitoring of natural phenomena.
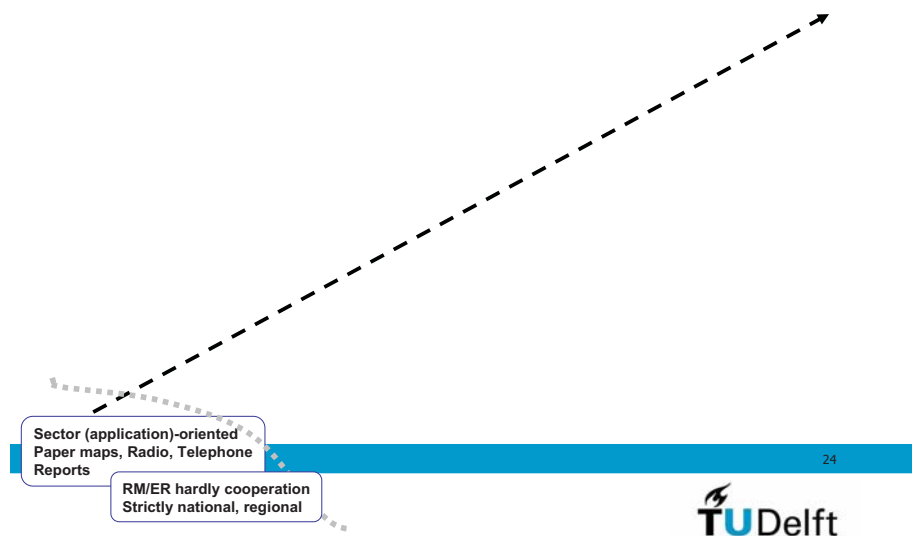
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Recommendations 4/4

- To strengthen the research on integration and harmonisation of different geo-data by considering a larger scope of domains such as construction (AEC/BIM), meteorological/atmospheric, geological, biological, ocean/marine, etc.

- To increase research on common integrated 3D data models (e.g. such as CityGML for management and exchange of heterogeneous static and dynamic data.

- To further develop client-server, location-based, Net-centric, distributed and federated architectures for geospatial services and analysis to support the work in Command and Control Centres;

- To intensify research on user-centred applications for both field and desktop applications

- The politicians have to be aware of the need for these developments ('research is done for social benefit')
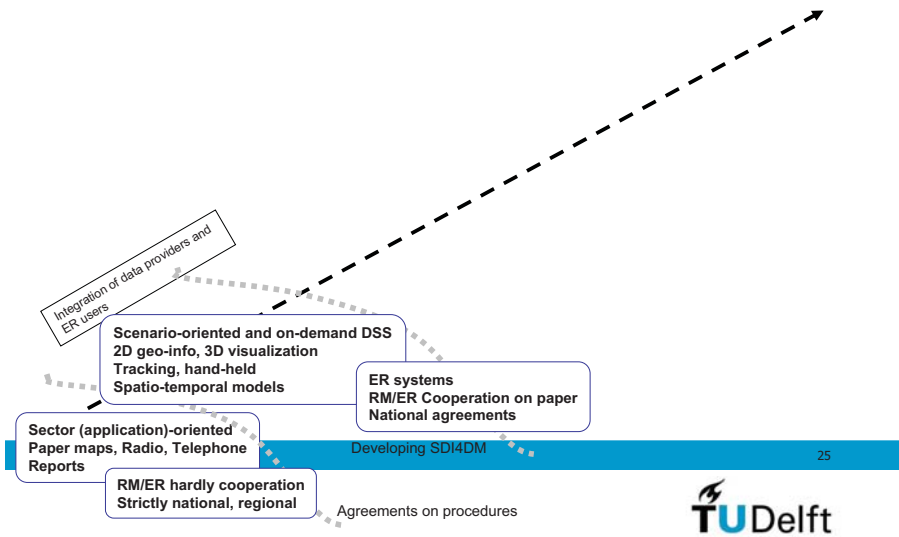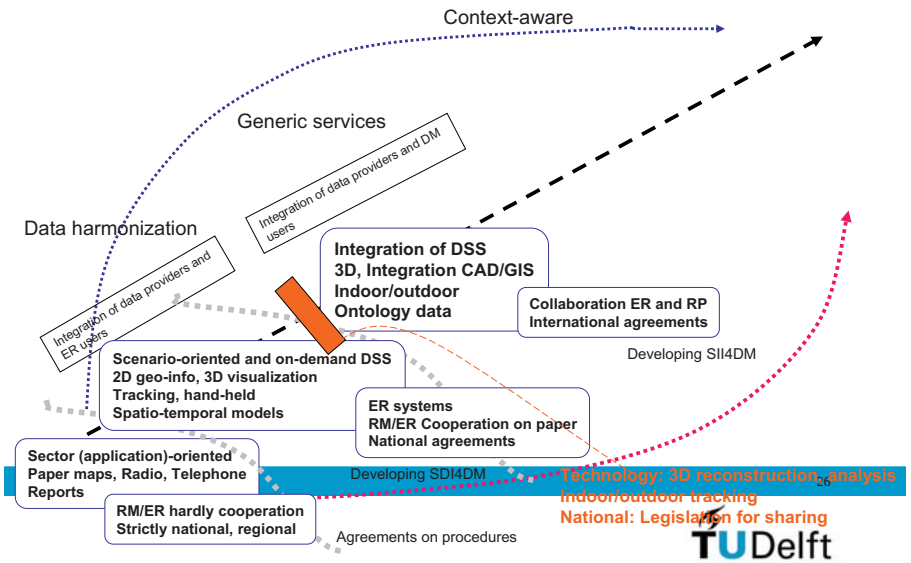
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Before

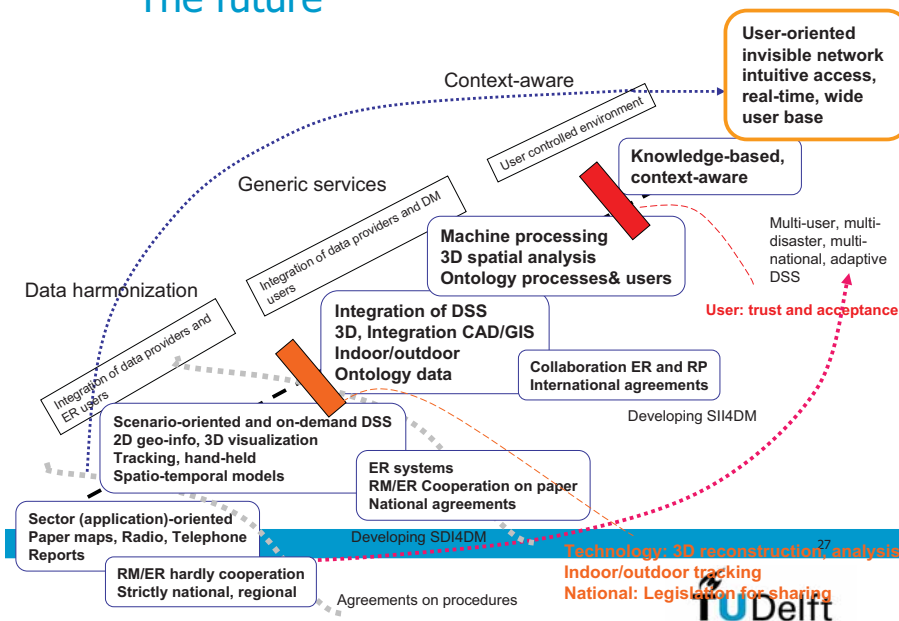Sector (application)-oriented
Paper maps, Radio, Telephone
Reports

RM/ER hardly cooperation
Strictly national, regional

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Now…

Integration of data providers and ER users

Scenario-oriented and on-demand DSS
2D geo-info, 3D visualization
Tracking, hand-held
Spatio-temporal models

ER systems
RM/ER Cooperation on paper
National agreements

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Developing SDI4DM

Agreements on procedures

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The near future

Context-aware

Generic services

Data harmonization

Integration of data providers and DM users

Integration of data providers and ER users

Integration of DSS
3D, Integration CAD/GIS
Indoor/outdoor
Ontology data

Collaboration ER and RP
International agreements

Developing SII4DM

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Agreements on procedures

Technology: 3D reconstruction, analysis
Indoor/outdoor tracking
National: Legislation for sharing

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The future

User-oriented
invisible network
intuitive access,
real-time, wide
user base

Context-aware

User controlled environment

Knowledge-based,
context-aware

Generic services

Integration of data providers and DM users

Machine processing
3D spatial analysis
Ontology processes& users

Multi-user, multi-
disaster, multi-
national, adaptive
DSS

Data harmonization

User: trust and acceptance

Integration of data providers and ER users

Integration of DSS
3D, Integration CAD/GIS
Indoor/outdoor
Ontology data

Collaboration ER and RP
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Developing SII4DM

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The first bottleneck … 3D!

- 3D data models: indoor structures, multi-resolution, temporal, possibilities to switch between geometry, topology, graph
- 3D complex representations
- 3D analysis : 3D buffering, 3D overlap
- 3D navigation: 'intelligent algorithms'
- Semantics
- 3D intuitive interfaces for various devices (mobile, augmented reality)
- 3D decision-support systems
- 3D positioning (indoor/outdoor)
- Communication of 3D (compression techniques, bandwidth, wireless)
- Alert systems working in 3D
- …

The second bottleneck ... user trust

- Incident Management
- HAZMAT reporting
- Plume model
- Emergency alert
- Surveillance video
- Chem/weather sensors
- Citizen call center
- .....

- BIM/AEC/GIS
- 3D visualization
- AVL-GPS
- Document management
- Thermal imagery
- Work order management
- Health tracking
- .....

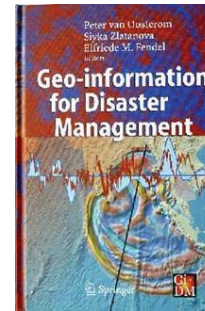**Can we completely rely on the machines ... although programmed by humans?**

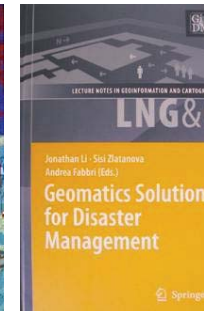## Thank you for your attention

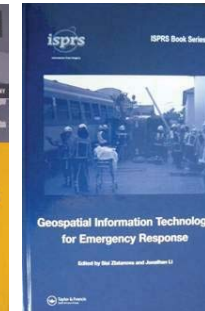2005   2007   2008   2008