Beijing, University of Geosciences,
October 25, 2015

# Early Warning and Crises Management in Big Data Era: Geoinformatics Challenges

**Milan KONECNY**

**Former President of ICA and ISDE**

**Chairman of ICA Commission for Cartography on EW&CM**

**Masaryk University, Brno,**

**Czech Republic**


0
500 km
Reykjavík
ÍSLAND
AÇORES (P)
MADEIRA (P)
CANARIAS (E)
GUADELOUPE (F)
MARTINIQUE (F)
RÉUNION (F)
Paramaribo
SURINAME
GUYANE (F)
BRASIL
SVERIGE
SUOMI
FINLAND
NORGE
Oslo
Stockholm
Helsinki
Helsingfors
Tallinn
EESTI
Rīga
LATVIJA
Moskva
RUSSIJA
UNITED KINGDOM
IRELAND
ÉIRE
Dublin
Baile Átha Cliath
DANMARK
København
LIETUVA
Vilnius
R.
Minsk
BELARUS'
NEDERLAND
Amsterdam
London
Berlin
QAZAQSTAN
Warszawa
BELGIË
Brussel
Bruxelles
BELGIQUE
DEUTSCHLAND
POLSKA
LUXEMBOURG
Luxembourg
Kyïv
Praha
ČESKÁ REPUBLIKA
Paris
UKRAÏNA
SLOVENSKO
FRANCE
Wien
Bratislava
SCHWEIZ
Bern
LIECHTENSTEIN
MOLDOVA
Chişinău
Budapest
ÖSTERREICH
SUISSE
SVIZZERA
MAGYARORSZÁG
SLOVENIJA
Ljubljana
ROMÂNIA
Zagreb
HRVATSKA
SAKARTVELO
Tbilisi
AZƏRBAYCAN
BOSNA I HERCEGOVINA
Beograd
Bucureşti
HAÏASTAN
Yerevan
MONACO
Sarajevo
SRBIJA I CRNA GORA
PORTUGAL
ANDORRA
SAN MARINO
BÂLGARIJA
Sofija
Madrid
ITALIA
IRAN
Lisboa
ESPAÑA
Skopje
PORANEŠNA JUGOSLOVENSKA REPUBLIKA MAKEDONIJA
Roma
Tiranë
Ankara
SHQIPËRIA
TÜRKIYE
ΕΛΛΑΔΑ-ELLADA
Αθήναι
Athinai
Alger
IRAQ
Rabat
Tunis
SOURIYA
ΚΥΠΡΟΣ
KYPROS
KIBRIS
Λευκωσία
Lefkosia
Lefkoşa
EL MAGHREB
EL DJAZÂIR
TOUNIS
Valletta
MALTA
LIBNAN
Beyrouth
Dimashq


Czech Rep.

Main catchment areas of the Czech Republic:
Labe (Elbe) - Vltava (Moldau) - Morava - Odra (Oder)

# CONTENT

1. Actual impulses from U.N. CDRR
2. Humanitarian Challenges
3. Big Data Concepts and Policies: USA and EU
4. Where we are now?
   - SDI Concepts (INSPIRE, COPERNICUS)
   - Digital Earth
   - Spatially-Enabled Society
5. Geo Info Strategies
6. Selected Potentials of Cartography and Geoinformatics
7. Videos Tsunami Fukushima, Huricane Katrina,New Orleans
8. Integrated Research on Disaster Risk (IRDR)
9. Big Data in Cartography/Geoinformatics

The impacts of natural hazards continue to increase around the world;
the frequency of recorded disasters affecting communities significantly **rose from about 100 per decade in the period 1900-1940, to 650 per decade in the 1960s and 2000 per decade in the 1980s, and reached almost 2800 per decade in the 1990s.**

Hundreds of thousands of people are killed and millions injured, affected or displaced each year because of disasters, and the amount of property damage has been doubling about every seven years over the past 40 years.

2005-2015: the well-being and safety of persons, communities and countries as a whole have been affected by disasters.

Over **700 thousand** people have lost their lives, **over 1.4 million have been injured**

and approximately **23 million have been made homeless** as a result of disasters.

Overall, more than **1.5 billion people have been affected by disasters in various ways**, with women, children and people in vulnerable situations disproportionately affected.

**The total economic loss was more than $1.3 trillion**. In addition, between 2008 and 2012, **144 million people were displaced by disasters.**

**Third World Conference on Disaster Reduction (DRR), Sendai, Japan**

***Mr. Liguo LI, minister of Civil Affairs, P.R. China, March 14, Sendai, Japan:***

Hyogo protocol 2005- 2015

„China has adopted the **concept of comprehensive disaster reduction** by linking the disasters with socio-economic development, adapting to climate change and building disaster reduction into rural and urban development, placing people at the central consideration.“

1) National comprehensive **disaster planning**, there are realized targets such keeping the share of direct disaster looses under 1.5% of total GDP annualy and **disaster relief** accessible for affected people within 12 hours after disaster as well as others.

2) There is established disaster prevention and reductionn **system and legislation network**, disaster reduction committee – central and provincial levels – 30 laws and rules – working reduction **mechanism** established.

3) **Nature Disaster Monitoring**, early warning system further improved (meteo-hydro-, earthquake, geological, ocean, forest fire, and pest and disease issues)

**5) Disaster education and advocacy system** has been established (6723 communities granted the special accreditation)

6) **International cooperation** (UN, regional activities and cooperation)

**Chinese contribution to World Disaster Reduction after 2015:**

1. Continue to implement **comprehensive disaster reduction strategy** and include the disaster risk reduction and adaptation of climatic change into national and local sustainable development process.

2. Formulate and implement „thirteen-five-year-planning for comprehensive disaster prevention and reduction based on **chinese's national conditions** and disaster risks.

3. Give full play of **experts and schollars** to strenghten the scientific approaches in disaster prevention and reduction.

4. Enhance the **structural construction** against nature disasters to further uplift of prevention level and increase people’s awareness about disaster prevention and reduction.

# 1.3 The Current Situation of Chinese Disaster Reduction - The available operational systems

**The 12 Twelve Integrated Observation Systems**

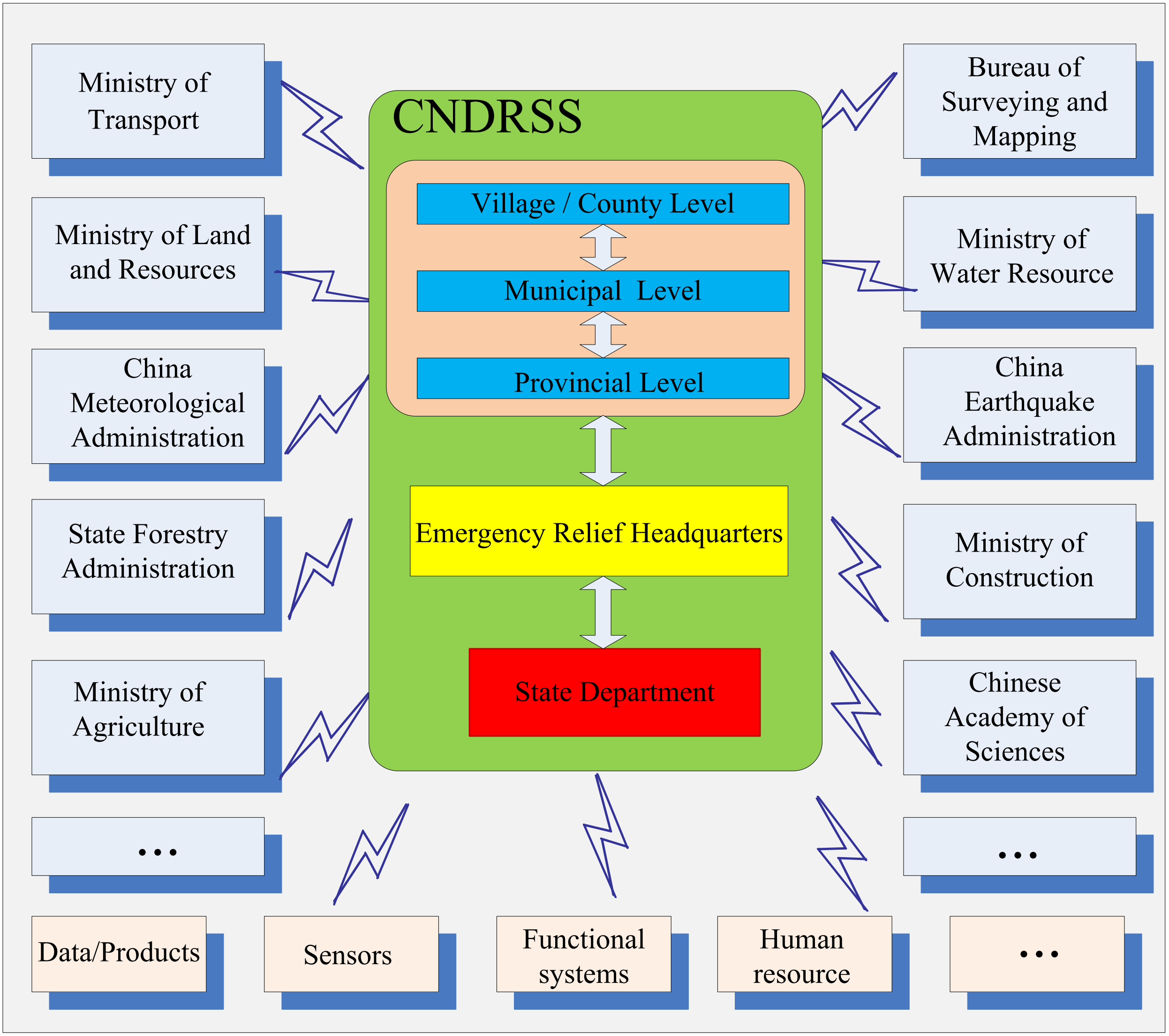
- Comprehensive Information on Disaster & Obs.System
- Integrated agricultural observing system
- Integrated hydrological monitoring system
- Integrated land observing system
- Integrated observing system in cities/townships
- Integrated meteorological monitoring systems
- Seismological &Geophysical monitoring system
- Integrated environment monitoring system
- Integrated forest &Ecological monitoring system
- Basic ocean monitoring system
- Integrated surveying and mapping information platform
- Scientific research-oriented monitoring system

# 1.3 The Current Situation of Chinese Disaster Reduction - The Existing problems

- Sensors, data and information cannot be shared and integrated sufficiently
- "Rich of data, barren of information, lack of knowledge"
- Collaboration among different ministries/institutions is insufficient.
- Stable and efficient channel for disaster information transmission among stricken areas, related ministries and headquarters cannot be guaranteed.

**We need to integrate multiple disaster related systems among different ministries/institutions by federated databases and interoperability and to use the sensor web to integrate airborne, space borne and in-situ observations through a web service.**

# 1.4 Integration of Multiple Systems is the Resolution - The Task of CNDRSS




- Sensor web available for real-time or near real-time use.
- Full and open exchange of data, service and other resources;
- Effective mechanism and platform for the collaboration of various ministries;
- Timely and rapid delivery of disaster data and information;

# 2. Humanitarian Challenges

Developing field

Surviving many people with various problems

Strong Chinese role

Organizational approaches: NGOs, princip of neutrality v. politically coloured help

Scientifically:

***Similar and close cooperation with Early Warning and Disaster Management***

# 3. Big Data Concepts and Policies : USA and EU

**Obama Administration Releases Historic Open Data Rules to Enhance Government Efficiency and Fuel Economic Growth**

- groundbreaking new steps to make information generated and stored by the Federal Government more open and accessible to innovators and the public, to fuel entrepreneurship and economic growth while increasing government transparency and efficiency.

President Obama said:

“One of the things we’re doing to fuel more private sector **innovation and discovery** is to make vast amounts of America’s data open and easy to access for the first time in history. **And talented entrepreneurs are doing some pretty amazing things with it.”**

“Starting today, we’re making even more **government data available online**, which will help launch even more new startups. And we’re making it easier for people to find the data and use it, so that entrepreneurs can build products and services we haven’t even imagined yet.”

## European Union

Big Data is an emerging field where innovative technology offers alternatives to resolve the inherent problems that appear **when working with huge amounts of data, providing new ways to reuse and extract value from information.**

**Three main dimensions characterize Big Data: huge variety of data format, often time-sensitive and large.**

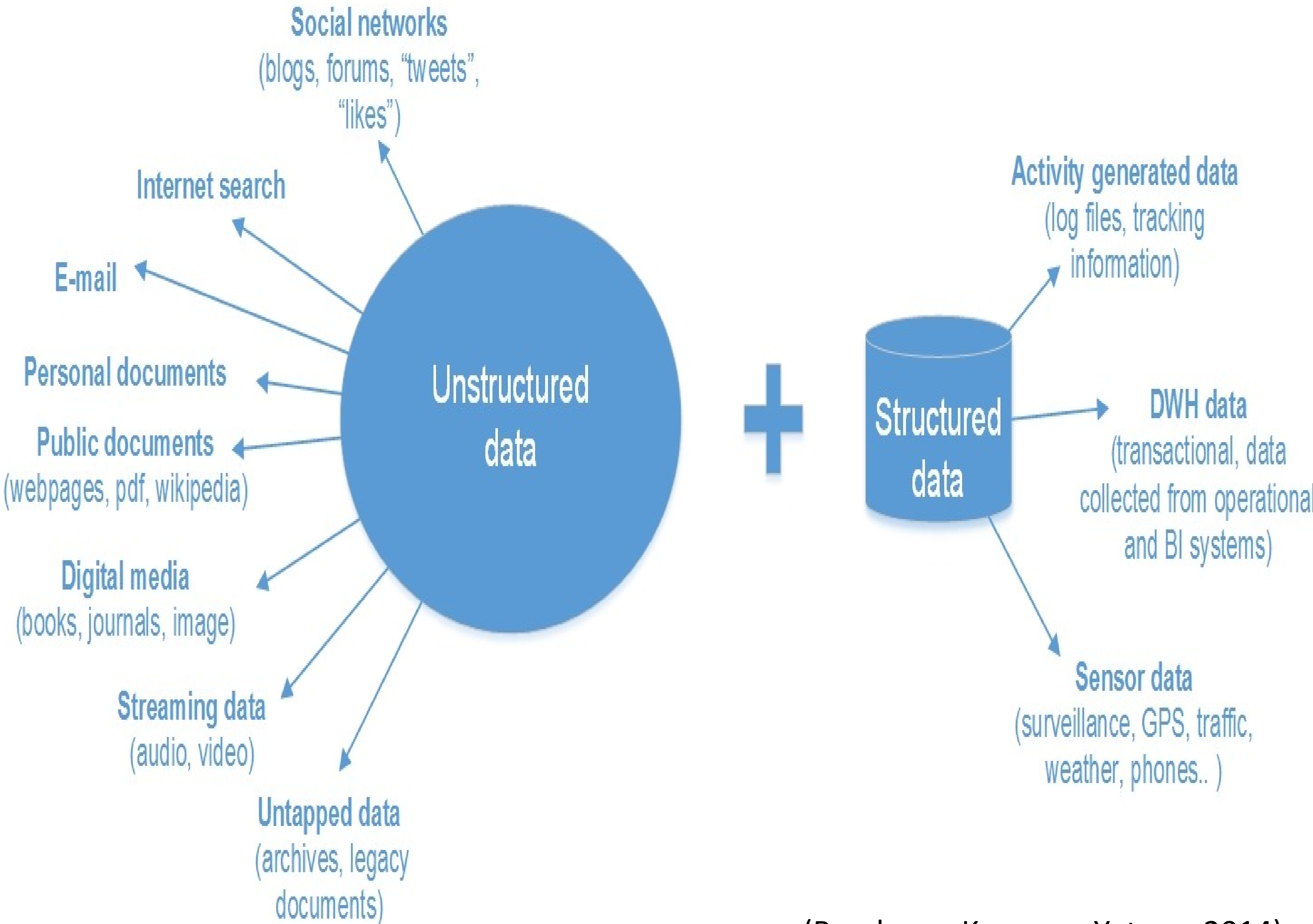
Big Data offers tremendous untapped potential value for many sectors but no specific intelligent-large-data-handling/brokering industrial sector exists.

# 1. Big Data: buzz word or reality?

Information superhighway,

SDI´s,

System of Systems concepts (GEO, GEOSS,..)




(Bandrova, Konecny, Yotova, 2014)

# BD: Definitions

Zucker, S., (2014) :

“a popular **term** used to describe the exponential growth and availability of data, both structured and unstructured” .

″**There is no rigorous definition of big data**. Initially the idea was that the volume of information had grown so large that the quantity being examined no longer fit into the memory that computers use for processing, so engineers needed to revamp the tools they used for analyzing it all” (Mayer-Schönberger V., Cukier K., 2013).

# BIG DATA

A REVOLUTION THAT WILL TRANSFORM HOW WE LIVE, WORK, AND THINK

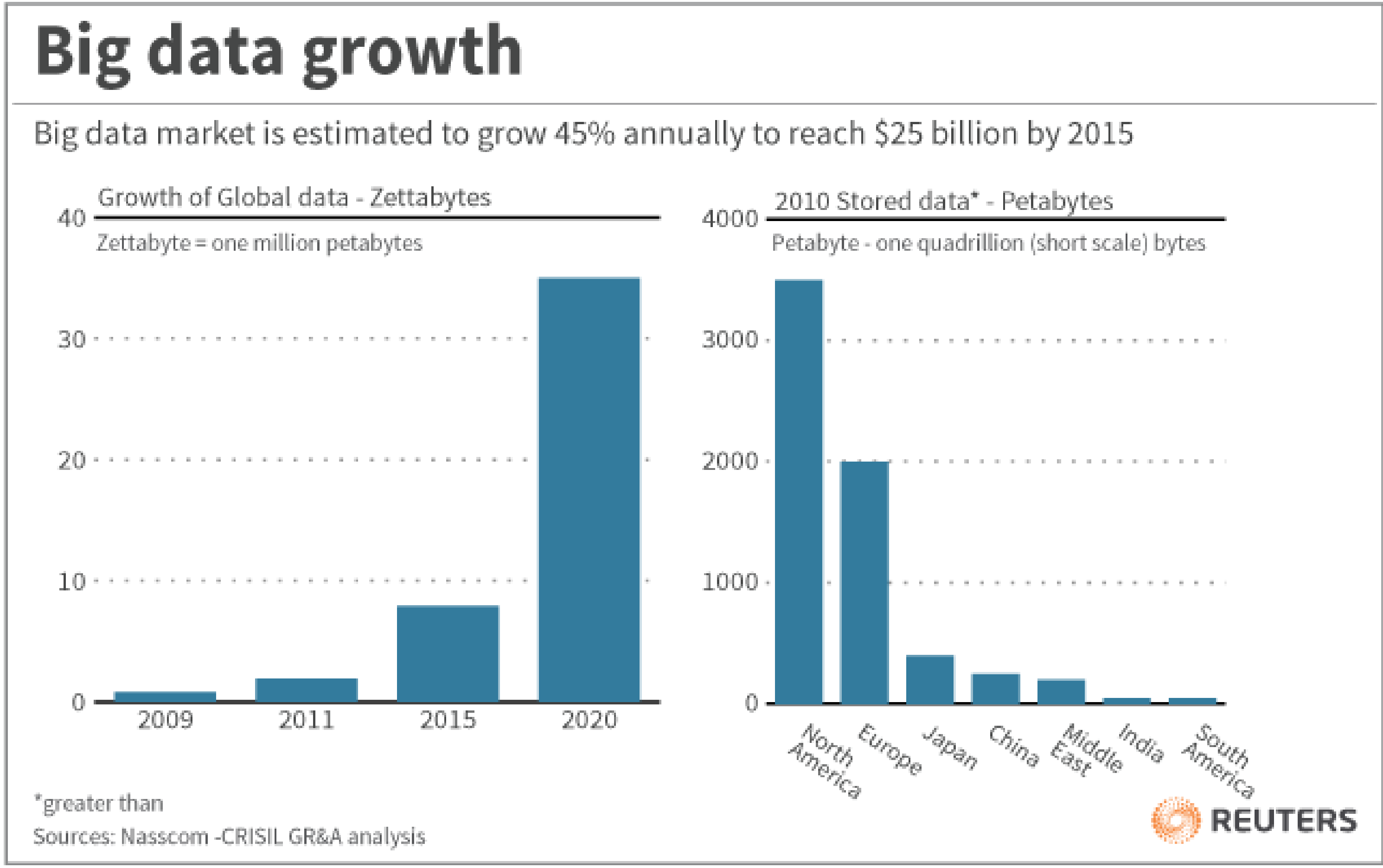
# 大数据时代

## 生活、工作与思维的大变革

Today ***era of terabytes or petabytes*** and this trend leads to new challenges in geoinformatics and cartography for gathering, storing, analyzing and visualizing the spatial information and data.

It will not happen first time in the history of cartography that it is one of few ***visualizing disciplines*** to use BD for correct analyzing of huge amount of data and their presentation and visualization on different levels of preciseness according to wishes of ***potential users.***

# Introduction



Reuters graphic/Catherine Trevethan 05/10/12

- **The increasing amount of data encourages the creation of new methodologies for data processing and the development of digital technologies**
- **New potentials and possibilities to the evolution of cartographic visualization and its applications**
- **In 2010, the volume of digital content on the planet exceeded 1 ZB**

“Big Data” BD:

It is the **ability of society to harness information in novel ways to produce useful insights or goods** and services of significant value .

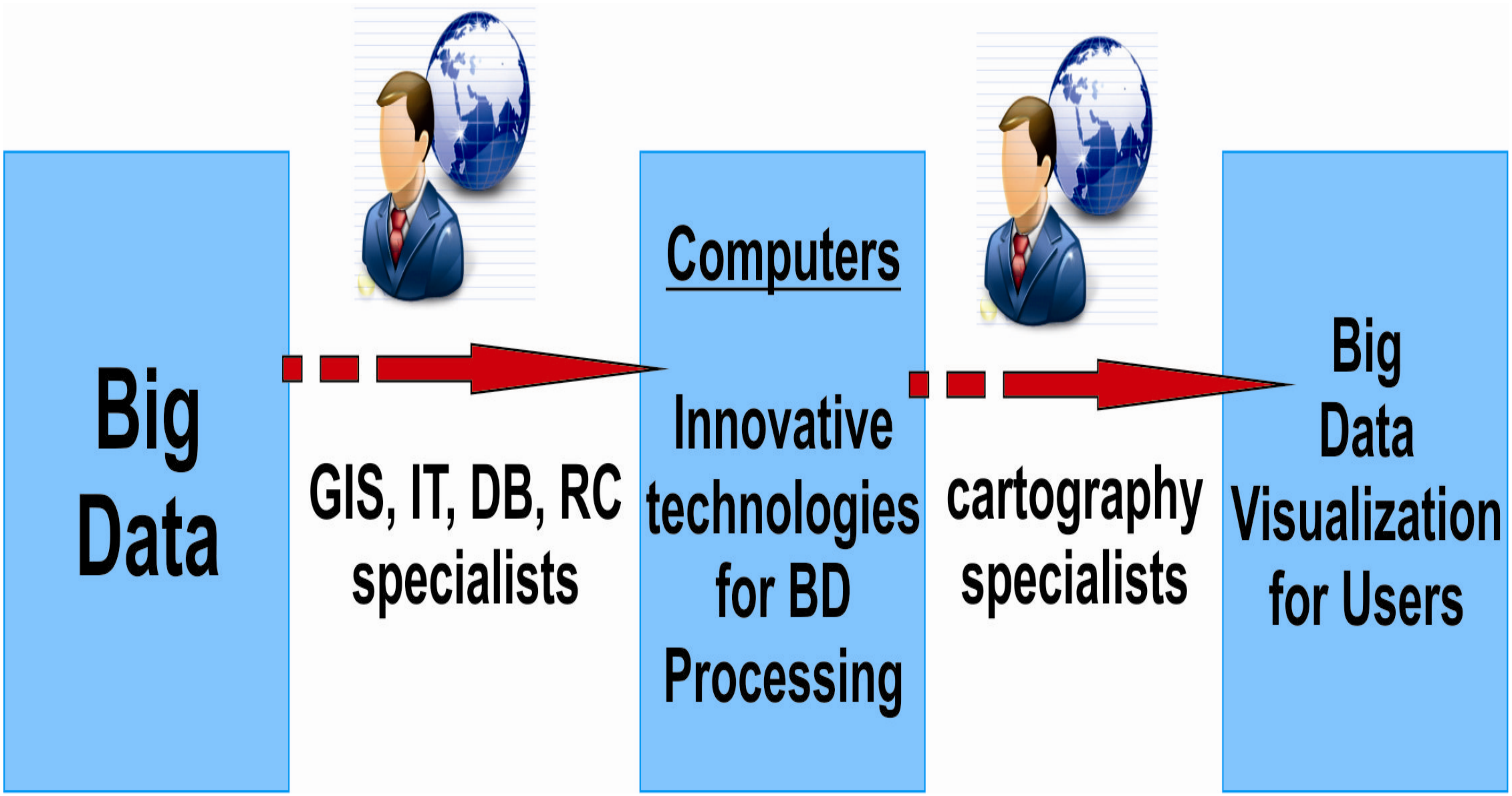
The **bridge between BD and the society cannot be done only by the existing technologies and computers.**

The presence of professionals should be more active in the process of transforming BD in useable variant to users and society.

**BD needs to establish teams with people coming from branches which did not work together to now.**

Design new complex approaches.

Geographers (physical and human and economical ones), cartographers and geoinformatics + RS want to add their knowledge to enhance such linkages and **develop paradigma for and supportive approaches of higher level usage of BD** in everyday decision making, solving problems and improvement of life of inhabitants.




**The Professional Places in BD Era** (Bandrova, Konecny, Yotova, 2014)

**Characteristics of Big Data**
(by IT industry)

**Volume** of BD means the quantity of data; as well size of data which is more than this one defined a structured data base.
**Velocity** of BD means the speed of generation of data.
or frequency of data delivery.

(thermometers, microphones, video cameras, sensor and Web data gathering in real time and data volumes get big in a hurry).

**Variety** of BD means different category of data in different formats and purpose of analyzing and using.
Here we can include all data coming from sensors, digitalization, mobile applications, Web, data bases, photos, videos, audios, sms, automations and others. This characteristics show us the next step of processing: storage, standardizing, classification and analyzing of this structured or unstructured data.

**Variability** of BD means the time of generating the data.

**Complexity** of BD means multiple resources generating data
From cartographic point of view, we can add also Accuracy, Dimensionality, Quality and Interactivity of BD.

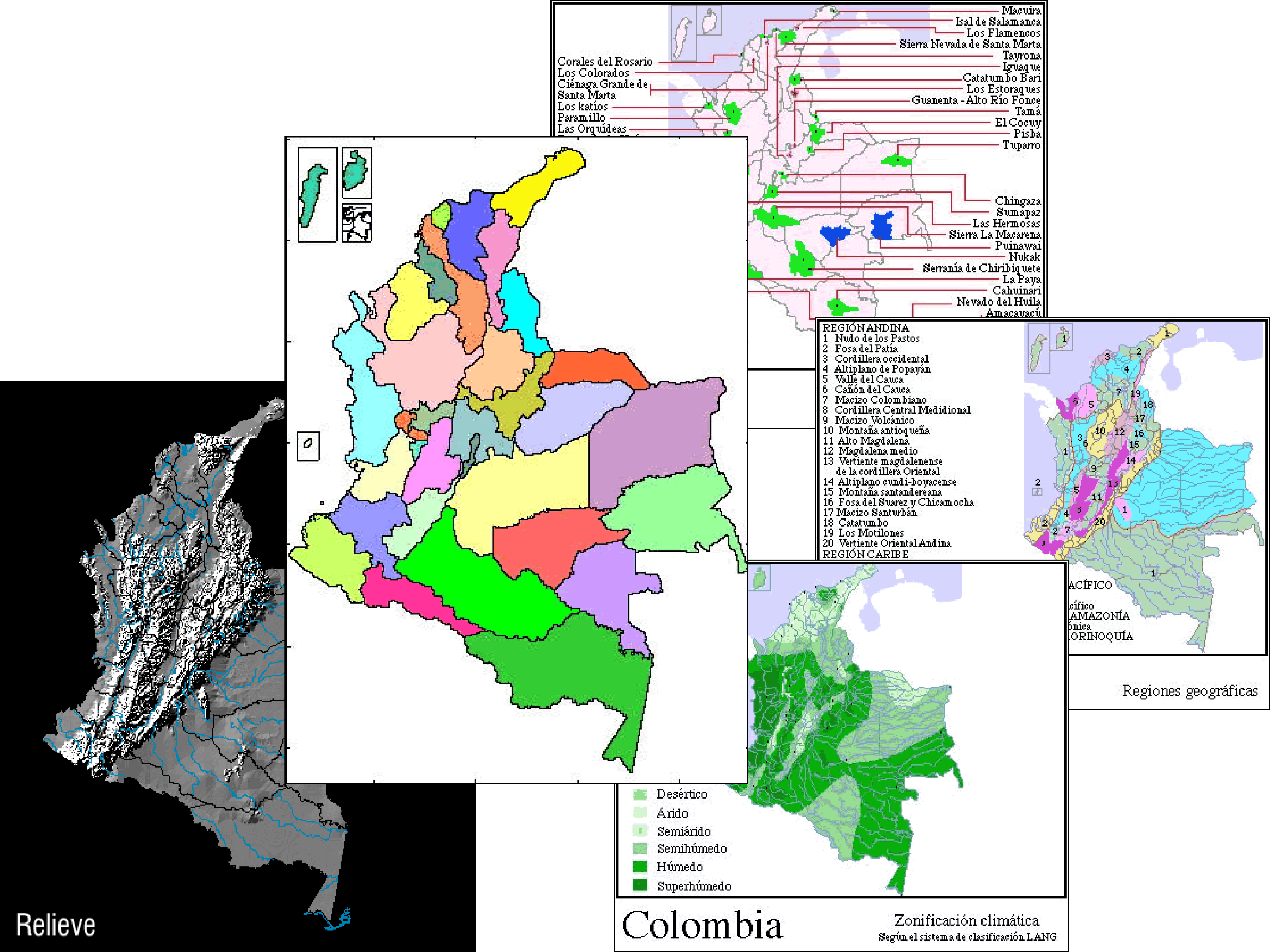
**Accuracy** means the degree of correct information and data which can be projected or referred to a coordinate system;
**Dimensionality** means a measure of spatial, time and characteristics extents of the information represented to the map. We will achieve 2D, 3D, 4D to multi-dimensional map;

**Quality** means a high level of value of the gathered information and data;

**Interactivity** means the level of allowance of user activity.

# 2. Where we are now?

- Global Mapping
- UN-GGIM
- GMES and INSPIRE: step ahead than GOOGLE, offering data (not only showing)
- GEO, GEOSS
- Digital Earth (Annoni and JRC)
- Concepts and strategies (Spatial-Enabled Society,
- e-Government, ….)
- VGI, VGE…..



Macuira
Isla de Salamanca
Los Flamencos
Sierra Nevada de Santa Marta
Tayrona
Iguaque
Corales del Rosario
Los Colorados
Ciénaga Grande de Santa Marta
Los katios
Paramillo
Las Orquídeas
Catatumbo Barí
Los Estoraques
Guanentá - Alto Río Fonce
Tamá
El Cocuy
Pisba
Tuparro
Chingaza
Sumapaz
Las Hermosas
Sierra La Macarena
Puinawai
Nukak
Serranía de Chiribiquete
La Paya
Cahuinarí
Nevado del Huila
Amacayacú
REGIÓN ANDINA
1 Nudo de los Pastos
2 Fosa del Patía
3 Cordillera occidental
4 Altiplano de Popayán
5 Valle del Cauca
6 Cañón del Cauca
7 Macizo Colombiano
8 Cordillera Central Medidional
9 Macizo Volcánico
10 Montaña antioqueña
11 Alto Magdalena
12 Magdalena medio
13 Vertiente magdalenense de la cordillera Oriental
14 Altiplano cundi-boyacense
15 Montaña santandereana
16 Fosa del Suarez y Chicamocha
17 Macizo Santurbán
18 Catatumbo
19 Los Motilones
20 Vertiente Oriental Andina
REGIÓN CARIBE
AMAZONÍA
ORINOQUÍA
Regiones geográficas
Desértico
Árido
Semiárido
Semihúmedo
Húmedo
Superhúmedo
Colombia
Zonificación climática
Según el sistema de clasificación LANG
Relieve

# 3. Spatial Data Infrastructure  Concepts

# UN-GGIM

**AIMS AND OBJECTIVES**

The United Nations initiative on Global Geospatial Information Management (UN-GGIM) aims at playing a leading role in setting the agenda for the development of global geospatial information and to promote its **use to address key global challenges**. It provides a forum to liaise and coordinate among Member States, and between Member States and international organizations.

# UN GGIM

Doha, Qatar, in 2013:

"... **National geospatial information infrastructure** in each country **should be based on internationally recognized standards**, which will integrate, manage and deliver geospatial information for timely, legitimate and authoritative decision-making and policy should be based on location, including disasters and humanitarian needs;

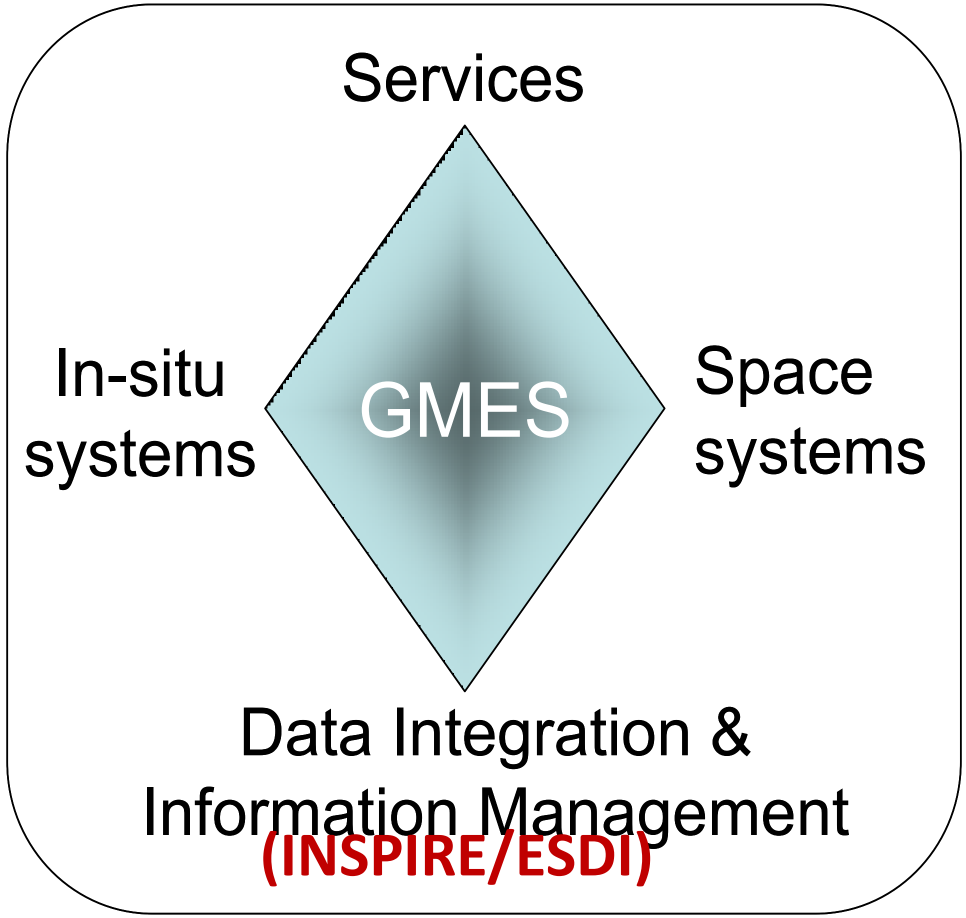
Copernicus

Europe's eyes on Earth

Former GMES – Global Monitoring of Environment and Security)

# COPERNICUS

## Global Monitoring for Environment and Security

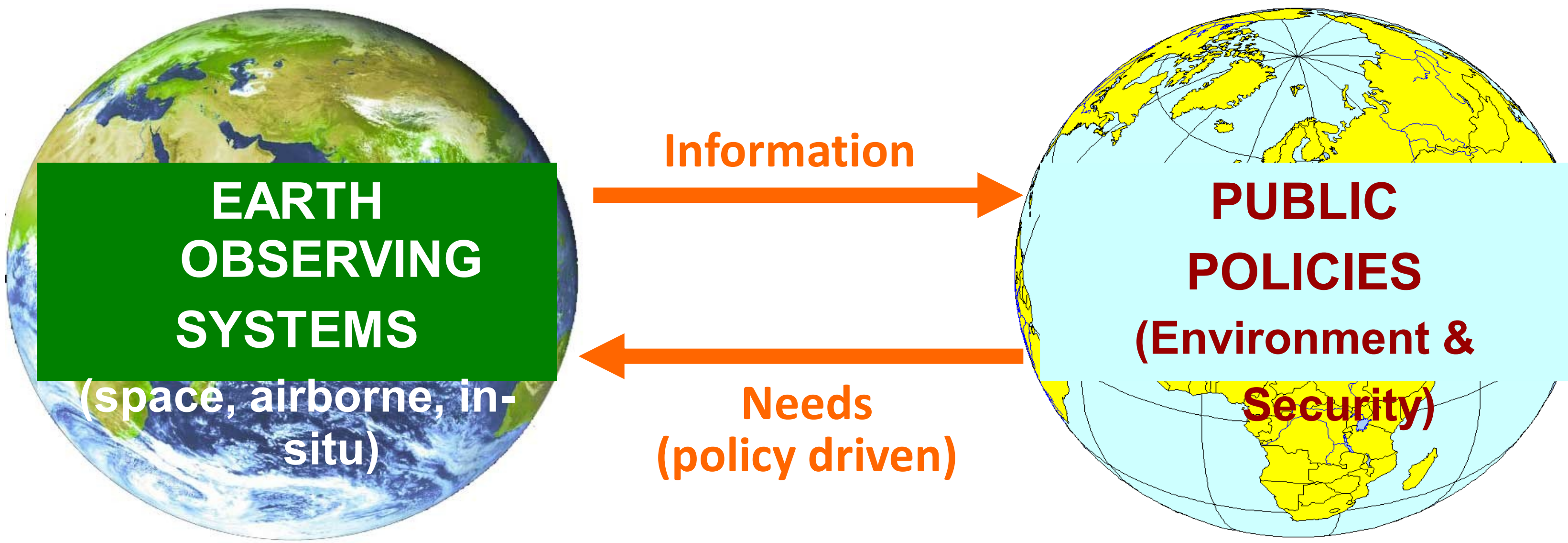


***The Copernicus Emergency Management Service*** *supports actors dealing with* ***natural disasters, man-made emergency situations, and humanitarian crises as well as those involved in preparedness and recovery activities.***

***The service improves people's safety*** *and helps to prevent loss of lives and/ or property by improving the effectiveness of preparedness, prevention, disaster risk reduction and resilience activities, in particular through the provision of early warning services for floods and fires.*

# Overall GMES objectives

to provide information services to policy-makers and other users




**Space Agencies**
**In-situ Observing systems**
**Scientific Community**
**EO Value Adding Industry**

**National Governments and Agencies**
**European Union Institutions**
**Inter-Governmental Organisations (IGOs)**
**Non Governmental Organisations (NGOs)**

Virginia PUZZOLO, EC DG Enterprise-GMES Burreau, Prague Symposium, 2009

The Copernicus programme **supports** the **protection of the environment and the efforts of Civil Protection and civil security, and contributes to European participation in global initiatives.**

Copernicus offers **six different service lines**:

Emergency Management, Atmosphere Monitoring, Marine Environment Monitoring, Land Monitoring, Climate Change, and services for Security applications.

The Copernicus Emergency Management Service (EMS) provides actors

with ***timely and accurate geo-spatial information*** derived from satellite-based remote sensing complemented by available *in situ* (non-space) or open source data.

As an EU service, the EMS's ***first priority*** is responding to national or cross-border disasters in Europe and large-scale disasters outside of the EU.

**The Copernicus Emergency Management Service (EMS) has two main components:**

- ***Early Warning,*** EW component strengthens the preparedness of national and local authorities for floods and forest fires, and

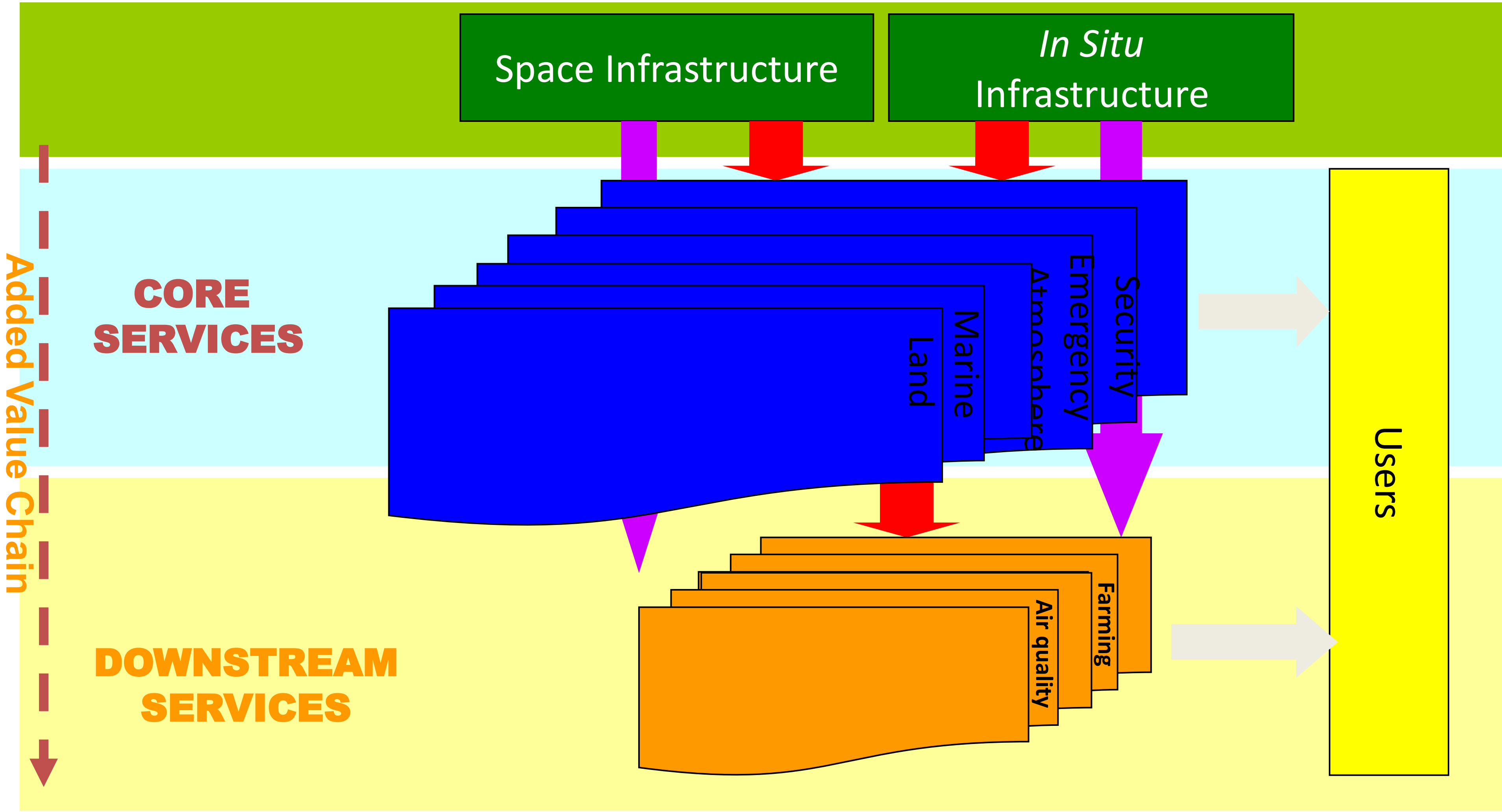
- ***Mapping***, as well as a dedicated component for the validation of the mapping products.

**The EMS Mapping Service**

is provided in ***two modules***:

- **Rapid Mapping,** for rapid service delivery during the response phase of crises, and
- **Risk & Recovery Mapping**, which is designed for pre- or post-crisis situations in support of recovery, disaster risk reduction, prevention, and preparedness activities.

# Overall architecture



- On demand
- Standardised
- Hours-days

REFERENCE MAPS
DELINEATION MAPS
GRADING MAPS
VALIDATION


**RISK AND RECOVERY MAPPING**

- On demand
- Tailored to user needs
- Weeks-months

REFERENCE MAPS
PRE-DISASTER SITUATION MAPS
REFERENCE MAPS
POST-DISASTER SITUATION MAPS
VALIDATION

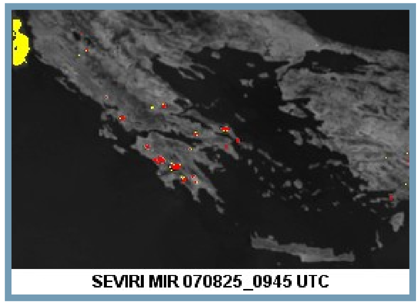
**EARLY WARNING**

- Floods: EFAS
- Forest Fires: EFFIS

CONTINOUS ALERTS

# Four main types of products:

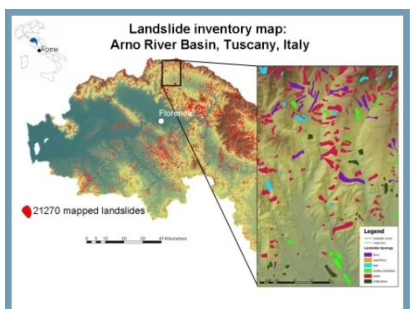
**Early warning**




**Reference maps**


**Assessment maps**

**Thematic maps**




**For headquarters,**
**decision-makers**
**and in-field operatives**
**In Europe and worldwide**

# ERCS 1st priority

**Rapid mapping** on demand in case of humanitarian crises, natural disasters, and man-made emergency situations within & outside Europe

- **Reference maps** available within 6 hours over crisis area
- **Damage assessment maps** available within 24 hours & daily updated
- **Situation maps and forecasts** of evolution of situations within the few days-weeks after crisis

INSPIRE

Infrastructure for Spatial Information in Europe

**Annex I**

1. Coordinate reference systems
2. Geographical grid systems
3. Geographical names
4. Administrative units
5. Transport networks
6. Hydrography
7. Protected sites

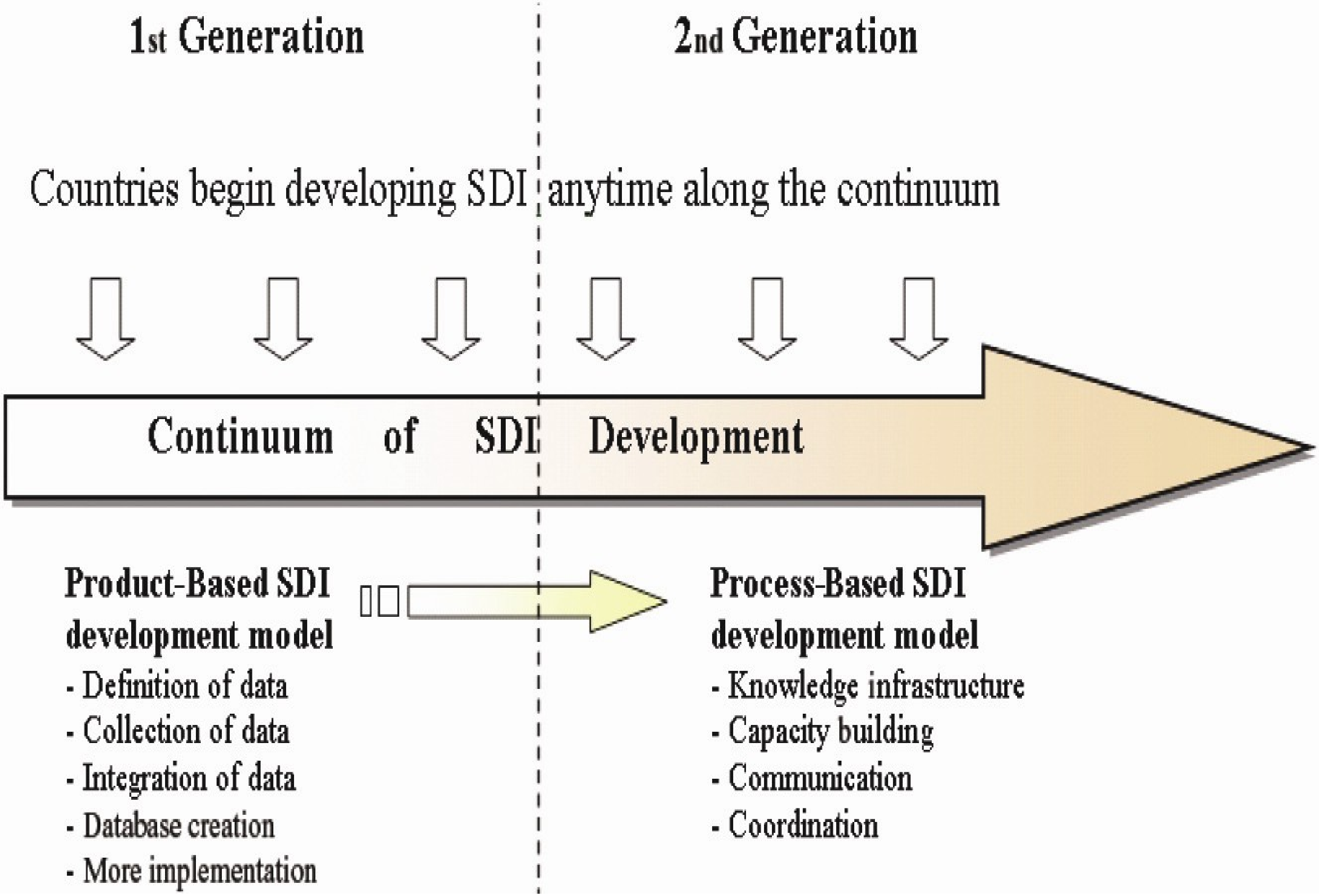
**Annex II**

1. Elevation
2. Addresses
3. Cadastral parcels
4. Land cover
5. Orthoimagery
6. Geology

*Harmonised spatial data specifications more stringent for Annex I and II than for Annex III*

**Annex III**

1. Statistical units
2. Buildings
3. Soil
4. Land use
5. Human health and safety
6. Utility and governmental services
7. Environmental monitoring facilities
8. Production and industrial facilities
9. Agricultural and aquaculture facilities
10. Population distribution – demography
11. Area management/restriction /regulation zones & reporting units
12. Natural risk zones
13. Atmospheric conditions
14. Meteorological geographical features
15. Oceanographic geographical features
16. Sea regions
17. Bio-geographical regions
18. Habitats and biotopes
19. Species distribution
20. Energy resources
21. Mineral resources

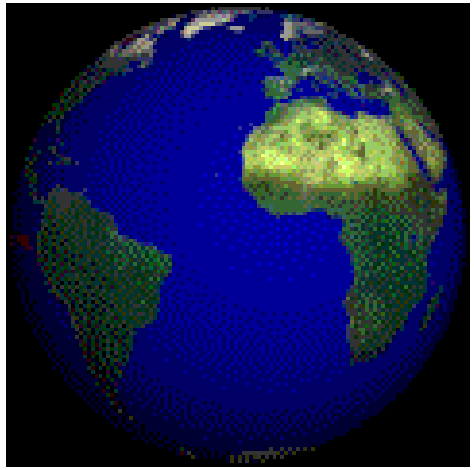



*Relationship between the first and second generations of SDIs.*
*(by Williamson Rajabifard, Binns, 2007, reprinted from Rajabifard at al.2006 with permission of the International Journal of GIS)*

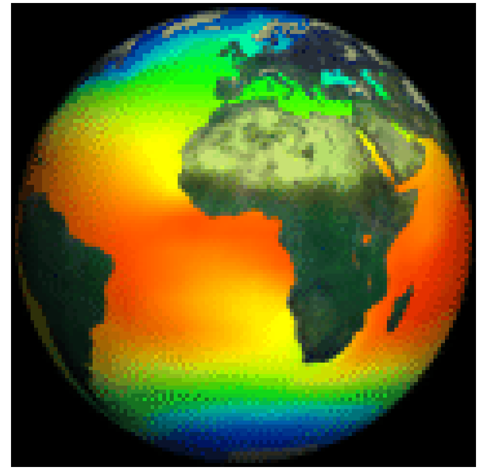
# DIGITAL EARTH

# Understanding Digital Earth

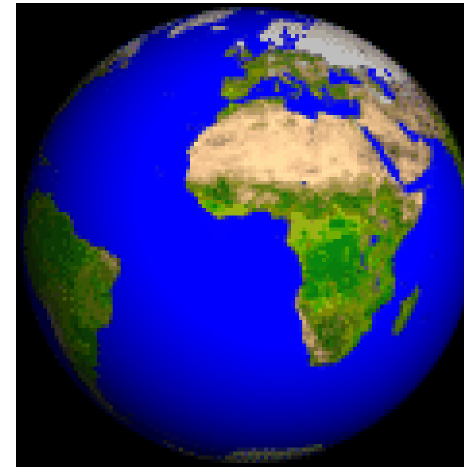
Cloud



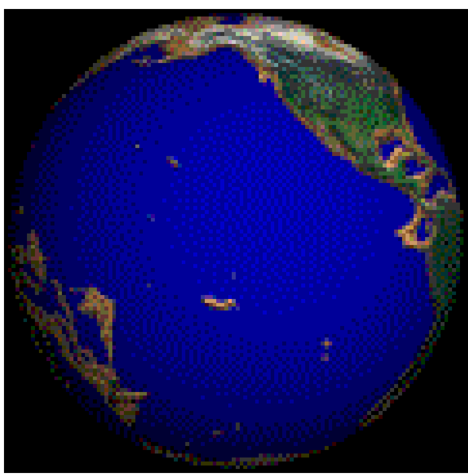
El Nino



Sea water temperature



Vegetation



Earth Surface

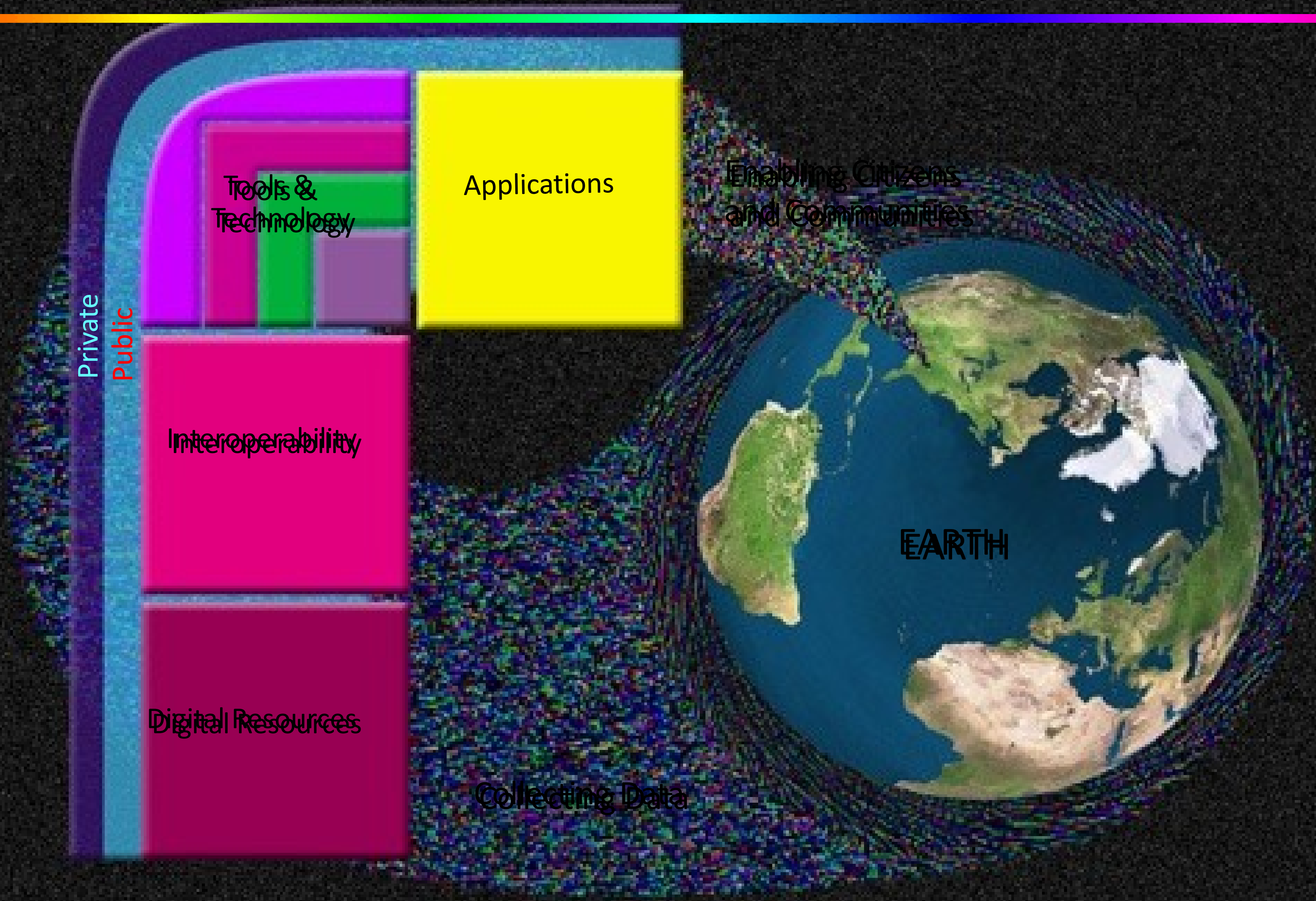
Earthquake

Volcano

Plate Boundary

(http://www.nasm.si.edu/EarthToday)

# Understanding Digital Earth



**Spatially-Enabled Society**

Rajabifard, Williamson, …..

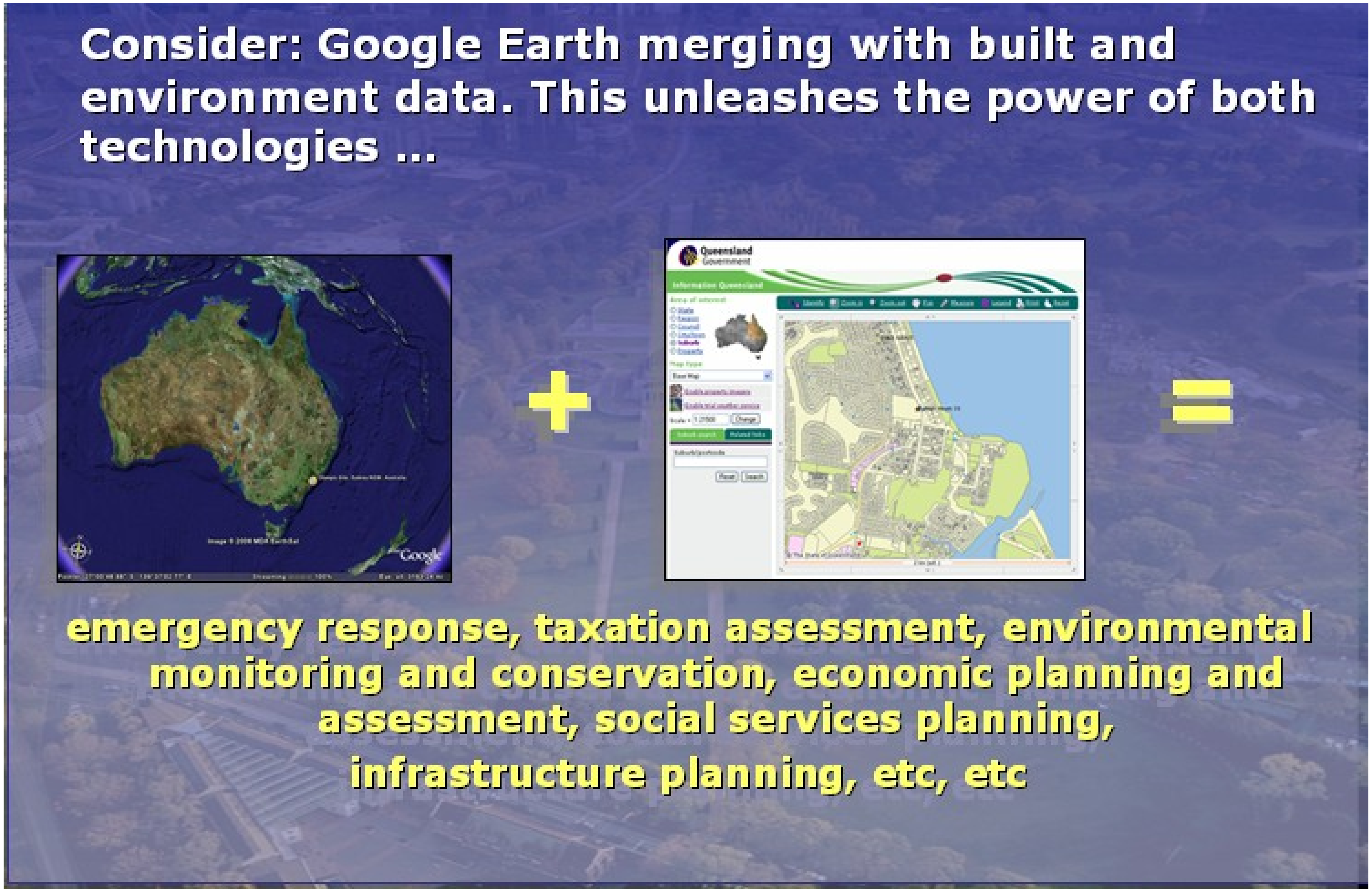
# Australian Government, Ministerial Online and Communications Council

*8 September, 2006*

"…spatially-enabled government is an exciting area for government. Spatially-enabled government uses place or location to manage and integrate government services and enhance business opportunities."

*The Hon Gary Nairn MP, Special Minister for State, Australian Government*

**The answer**: Provide the systems and people use them!!!



# Three visions to support spatially enabled government as part of e-government

- A land management vision: incorporating spatially enabled land administration
- A spatial data infrastructure (SDI) vision: SDI as an enabling platform
- A vision for a spatially enabled society

***Governments are spatially enabled when -***

Location is used to organise their information

*and*

Location and spatial information are common goods available to citizens and businesses to encourage creativity and product development.

# Challenges and Issues for spatially enabled society

- SDI to facilitate spatially enabled government as part of an e-government strategy
- SDI to facilitate integration of natural and built environment datasets
- Development of SDI vision, mission and road map – where are we heading?
- Role of government, private and academic sectors
- Capacity building

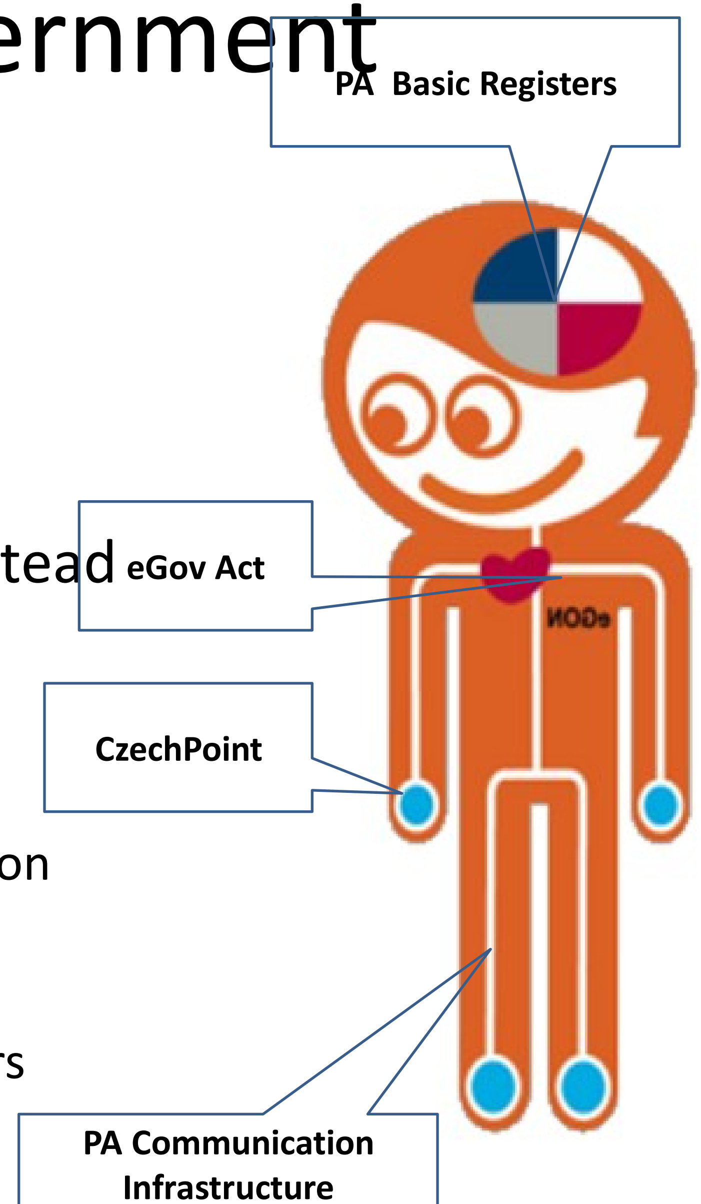
# Conclusion

- SDI is a new and evolving concept
- SDI development is multi-disciplinary with policy, legal, institutional and technical dimensions
- SDI will be a *virtual environment* supported by an *enabling platform* - spatially enabling society and government within an e-government environment
- Innovations in use of information will involve private and government sectors.
- Research is central to SDI development

# 5. What is it Geo Info Strategy and why we need it?

# Czech eGovernment

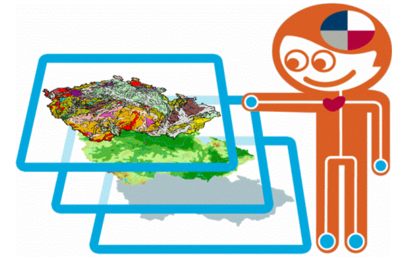
- smart public administration
  - better laws
  - functional authorities
  - professional public servants
  - effective information technologies
- „the document has to circulate instead of the citizen“
- four measures
  1. Czech Point
  2. Public Administration Communication Infrastructure
  3. eGovernment Act (2008)
  4. Public Administration Basic Registers (2012)



# PA Basic Registers System

- Act No. 111/2009 Coll., on basic registers
- 4 basic registers of public administration
  - Register of Inhabitants (MoI)
  - Register of Corporations (Czech Statistical Office)
  - 
  - 
    and Real Estates (Czech Office for Surveying, Mapping and Cadastre)
- Basic Registers Information System (MoI)
- ORG (The Office for Personal Data Protection)
- fully operational in July 2012

INTEGROVANÝ OPERAČNÍ PROGRAM
EVROPSKÁ UNIE
EVROPSKÝ FOND PRO REGIONÁLNÍ ROZVOJ
ŠANCE PRO VÁŠ ROZVOJ



# RUIAN

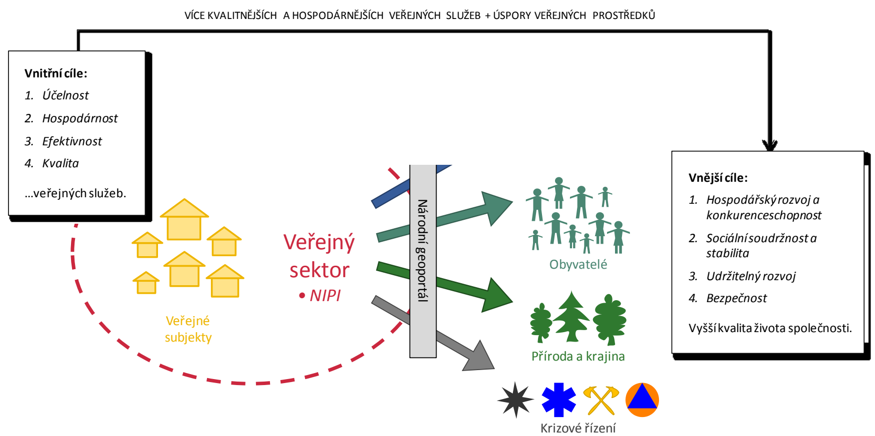
- Basic Register of Territorial Identification, Addresses and Real Estates (RUIAN)
- content of RUIAN
  - administration units (country, regions, …cadastral units, parcels, buildings)
  - entities of land administration (municipality districts, streets, …)
  - addresses
  - location data (centroids of parcels, buildings, …)
  - other data (building features, …)

- no personal data
- the crucial pillar of the Czech NSDI
- **administrated** by Czech Office for Surveying, Mapping and Cadaster (COSMC)
- **edited by** Municipal and Building Authorities, Czech Statistical Office (CSO) and Local Cadastral Authorities

# GeoInfoStrategy

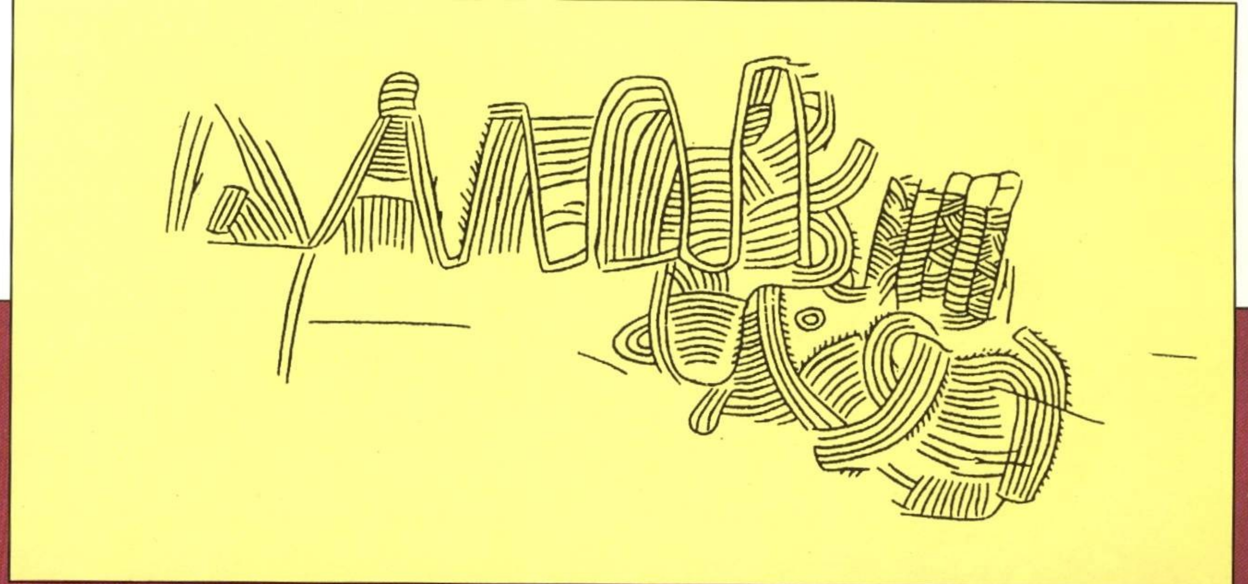
- Czech Government
  - approved the proposal of working out of the *„Strategy of spatial information infrastructure development in the Czech Republic up to 2020“* (GeoInfoStrategy) by Resolution No. 837 on the 14th November 2012
  - ordered to submit the GeoInfoStrategy draft for approval to the end of February 2014
  - ordered to cooperate to all central state administration bodies
  - recommend to cooperate to regions and cities

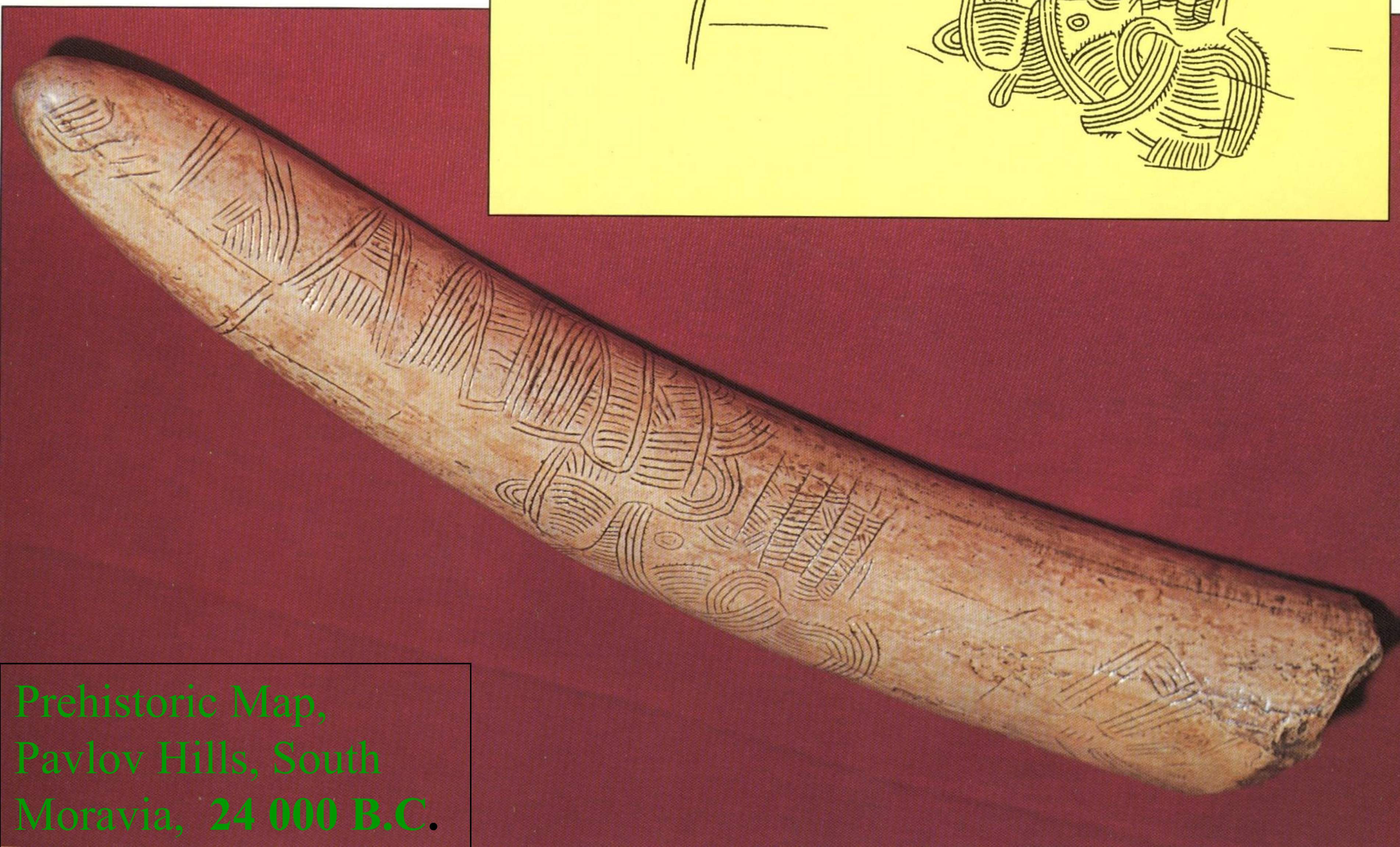
# GeoInfoStrategy Main Goals




- to set up effective coordination and integration of public bodies and commercial sector activities in the field of spatial data
- to help to set up conditions for
  - major improvement of eGovernment services regarding spatial data
  - reduction of costs of public administration
  - enhancing of the overall competitiveness of the Czech economy

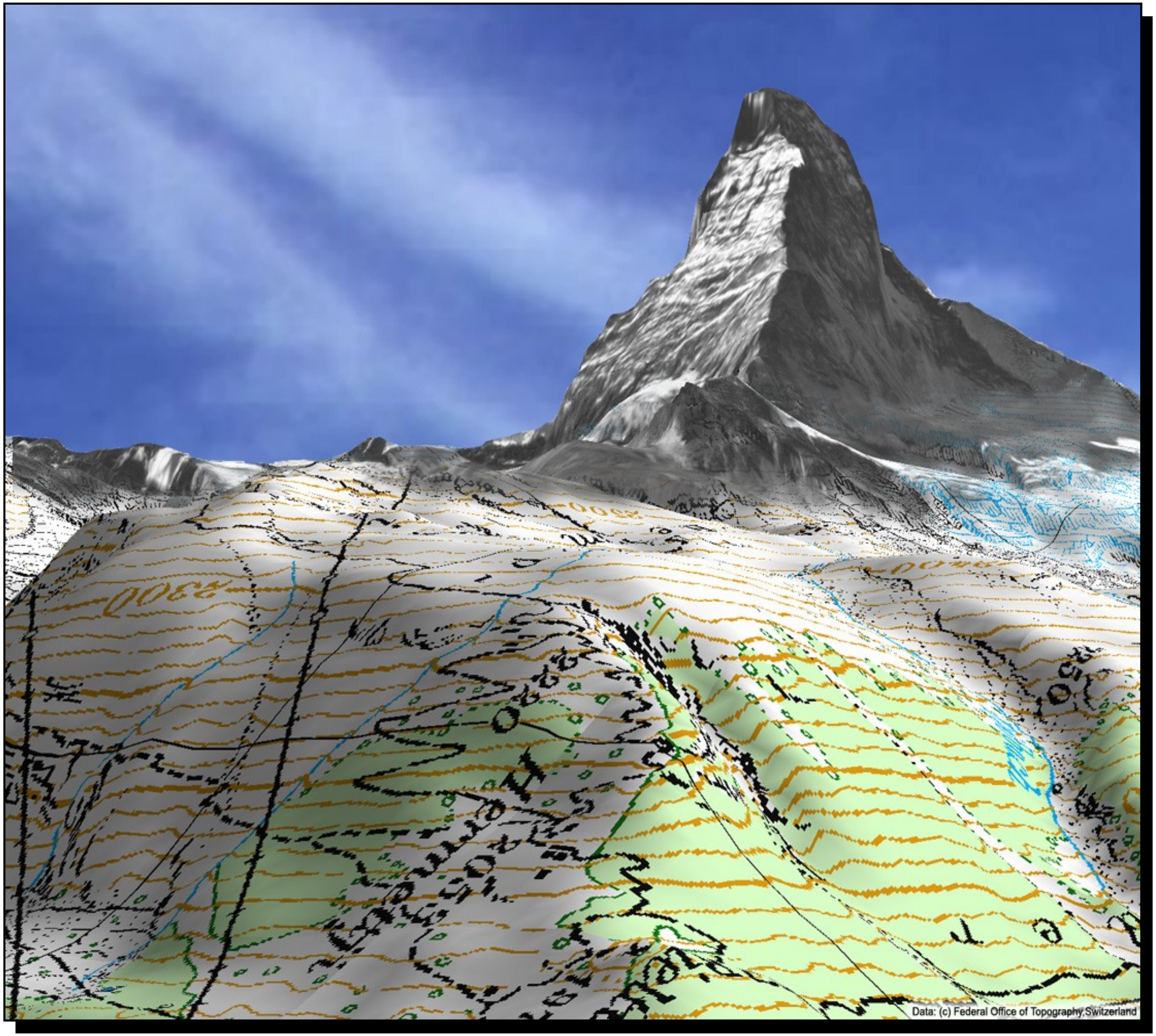
# 6. Selected Potentials of Cartography and Geoinformatics



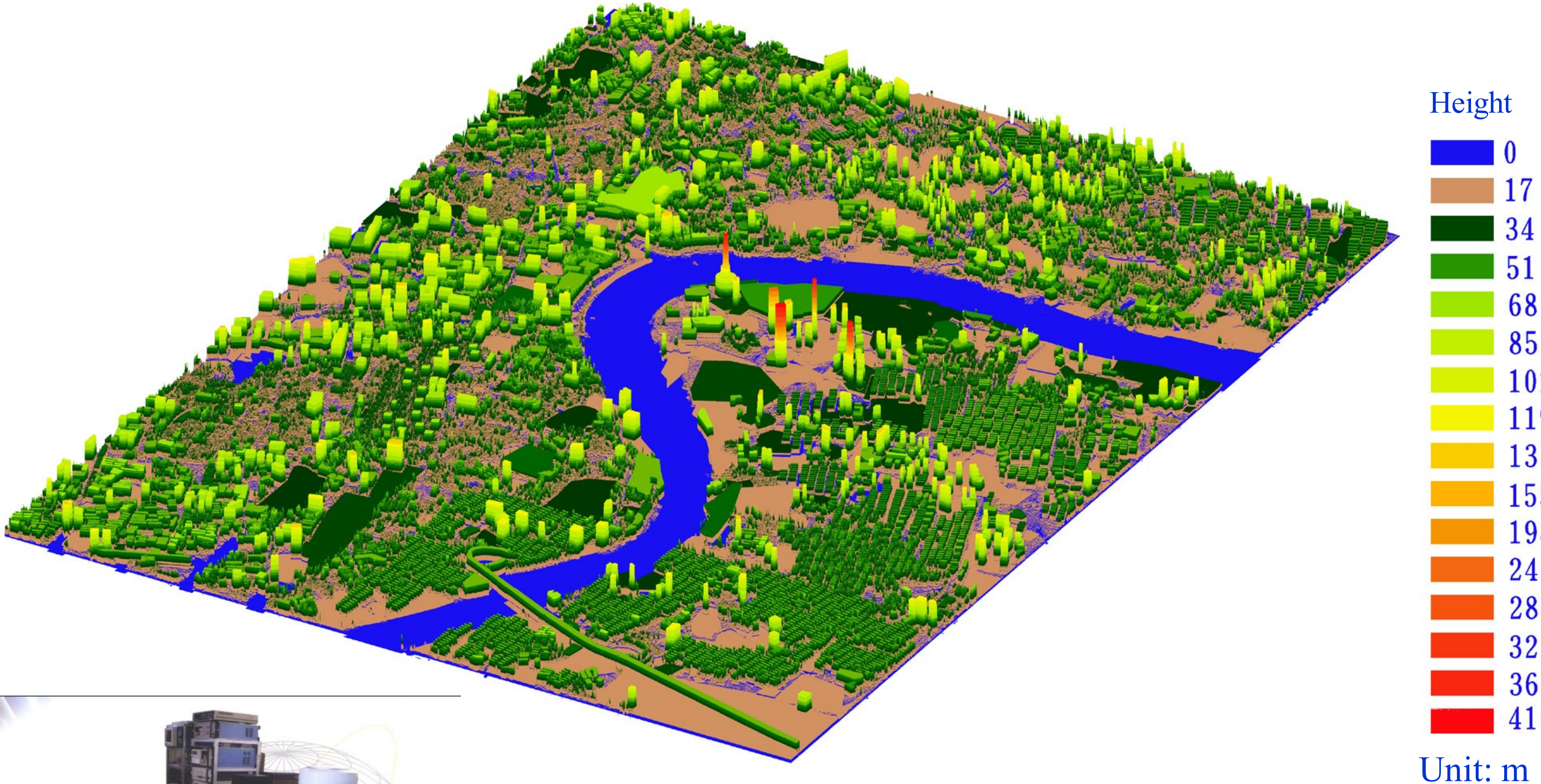


Prehistoric Map, Pavlov Hills, South Moravia, **24 000 B.C**.


Deblin
Czebin
Räecžkowitz
Koržim
Bytesschka
Posoritz
Reičzan
Eickhorn
B.Wewerzj
Lischna
Spilberg
Brinn
B.Brno
Schla:
panitz
Kralitz
Rositz
Ssip
Sokolnitz
Strutz
B.Traubsko
Schelschitz
Modritz
Oslowany
Rzgran
B.Reybrad
Gihlawa flu.
Brschitz
Mohelno
Bog:
kowicze
Ewanczitz
Preles
B.Prawlow
Ruchowan
Kaunitz
Selowitz
B. Židlochowitz
Kruml'ow

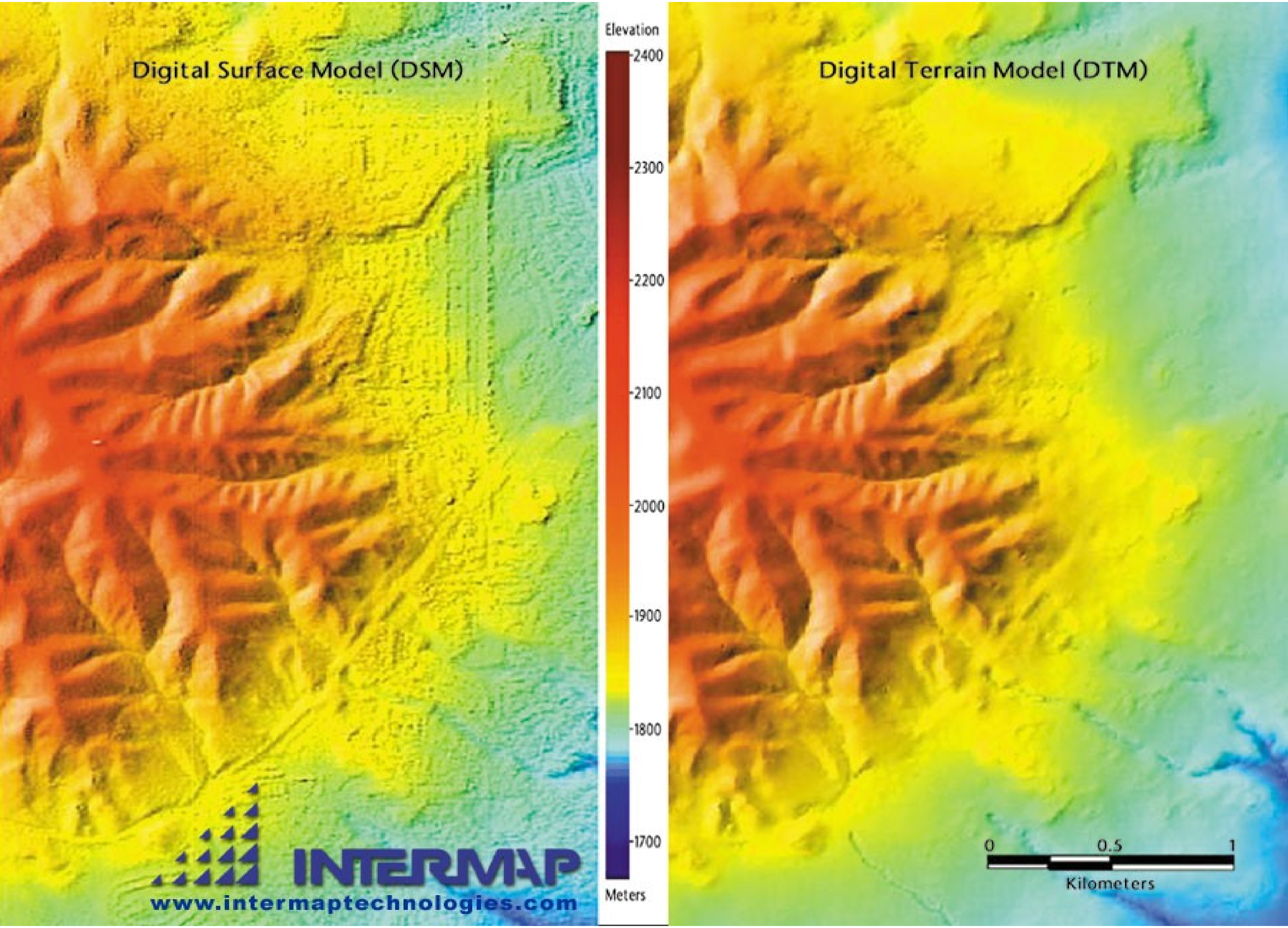

Data: (c) Federal Office of Topography,Switzerland

# 3-D Image of Pudong Area, Shanghai

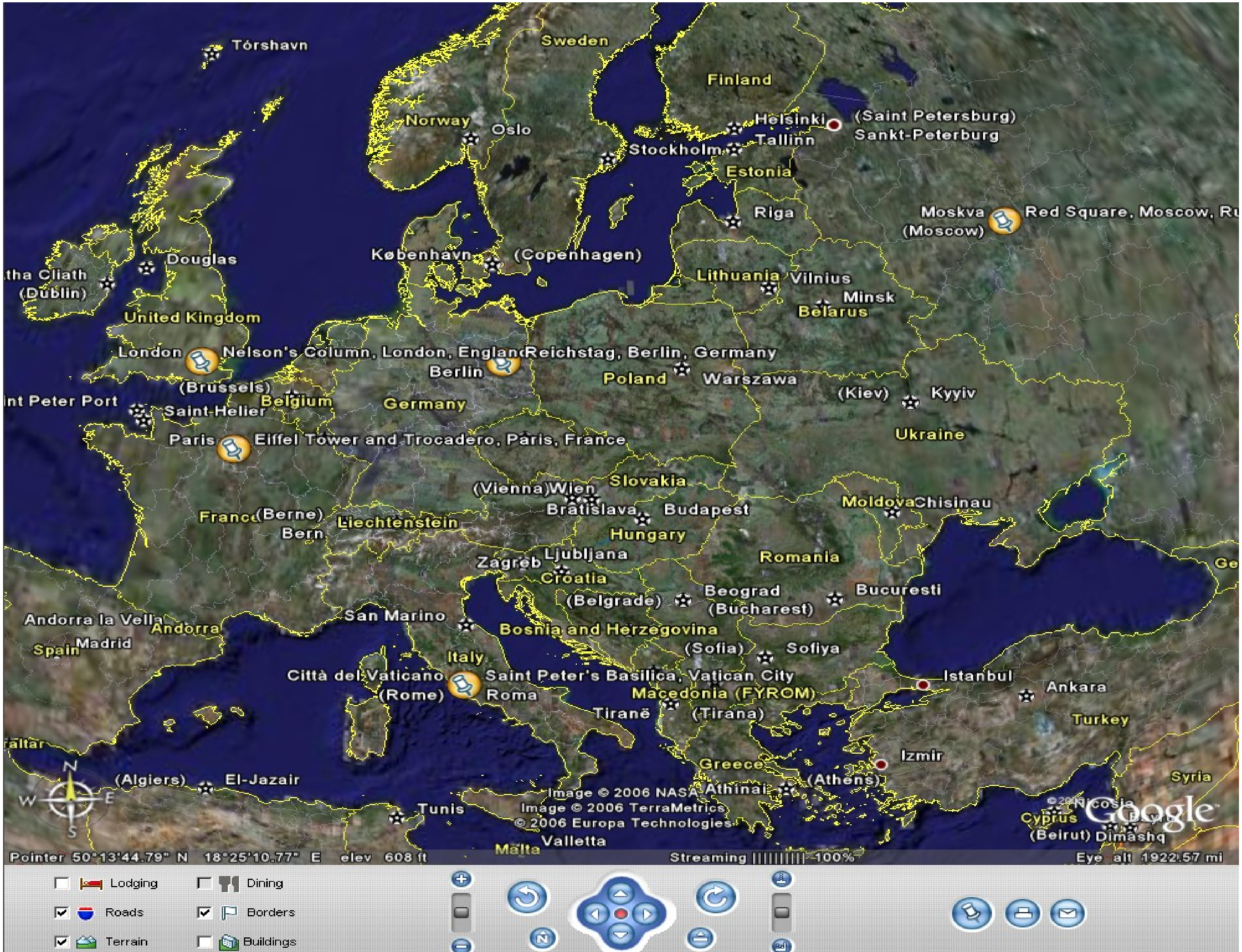


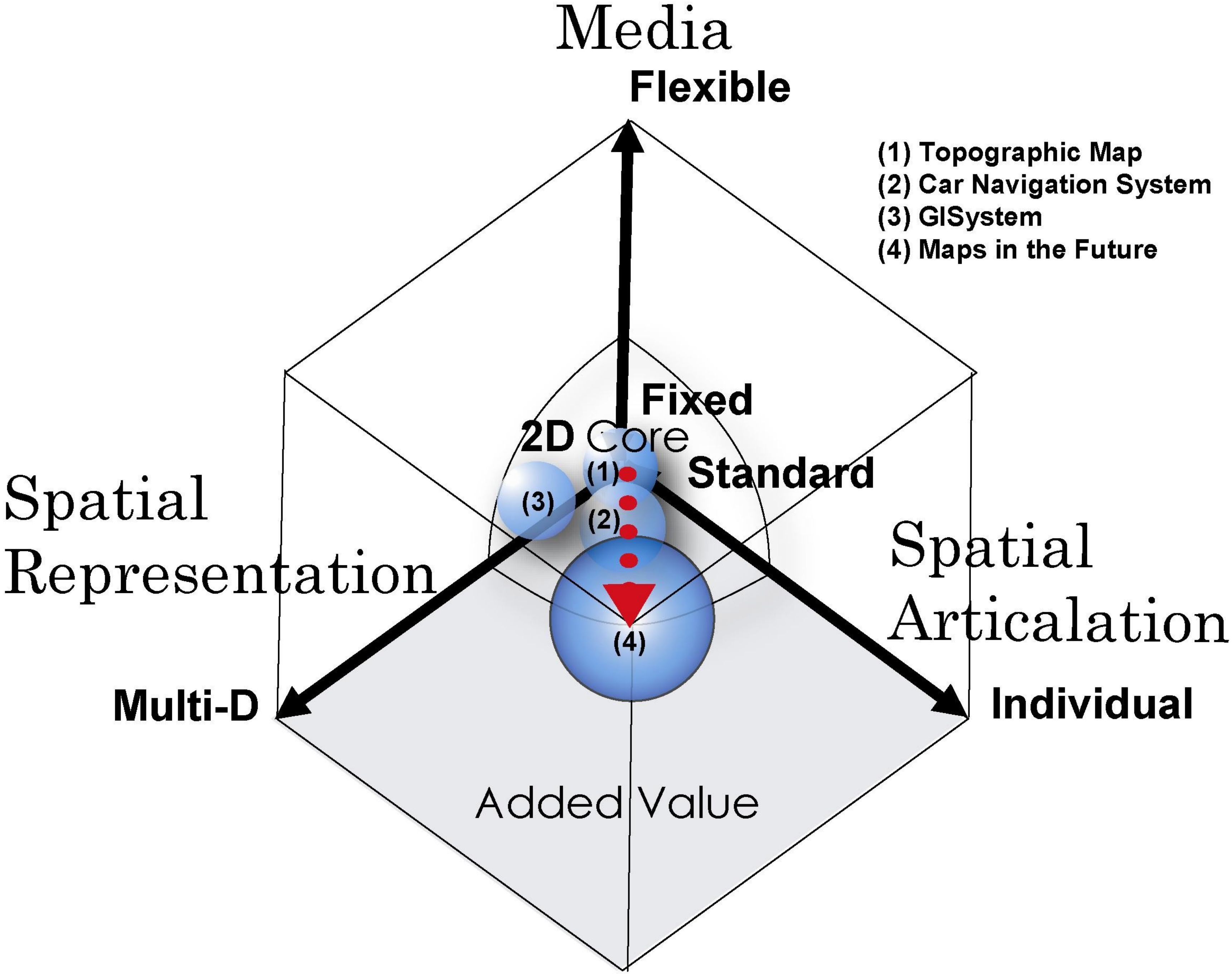


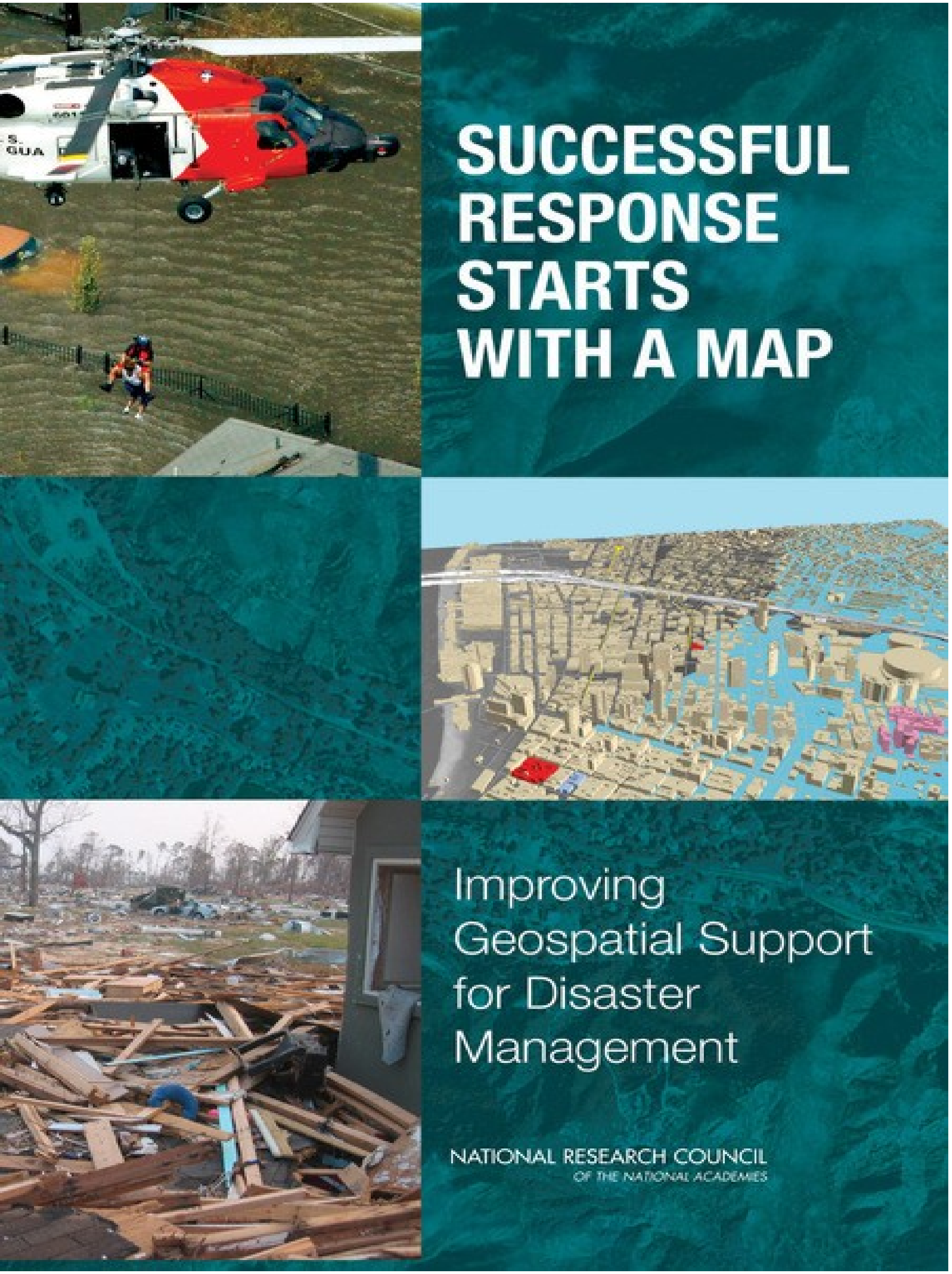
Elevation Map of Buildings Produced from 3-D Imager


Digital Surface Model (DSM)
Digital Terrain Model (DTM)
Elevation
2400
2300
2200
2100
2000
1900
1800
1700
Meters
0
0.5
1
Kilometers
INTERMAP
www.intermaptechnologies.com

# Easy navigation




Media
Flexible
(1) Topographic Map
(2) Car Navigation System
(3) GISystem
(4) Maps in the Future
Fixed
2D Core
Standard
(1)
(3)
(2)
Spatial Representation
Spatial Articalation
(4)
Multi-D
Individual
Added Value




**Successful Response Starts with a Map: Improving Geospatial Support for Disaster Management, NRC (2007)**

# HFA

# Hyogo Framework for Action 2005-2015:

## Building the Resilience of Nations and Communities to Disasters

## People-Centred Early Warning Systems

The objective : - to empower individuals and communities threatened by hazards **to act in sufficient time and in an appropriate manner**

so as **to reduce** the possibility of personal injury, loss of life, damage to property and the environment and of livelihoods.

To be effective, ***early warning systems must be people-centred and must integrate four elements*** :

1. knowledge of the risks faced;

2. technical monitoring and warning service;

3. dissemination of meaningful warnings to those at risk; and

4. public awareness and preparedness to act.

Failure in any one of these elements can mean failure of the whole early warning system.

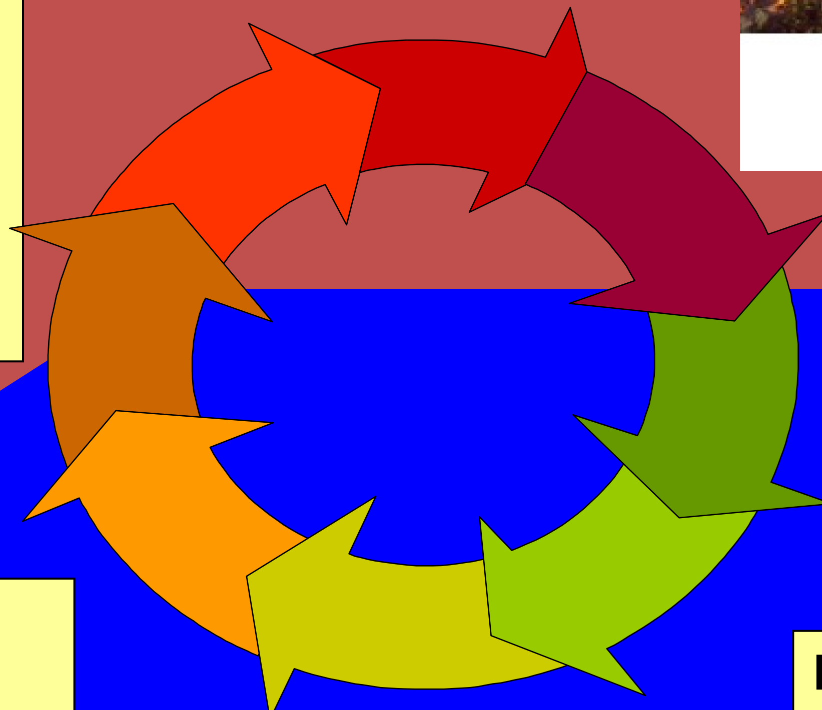
# Disaster Management Cycle


**Prevention and Mitigation**

- Hazard prediction and modeling
- Risk assessment and mapping
- Spatial Planning
- Structural & non structural measures
- Public Awareness & Education..

**Preparedness**

- Scenarios development
- Emergency Planning
- Training



**Alert**

- Real time monitoring & forecasting
- Early warning
- Secure &dependable telecom
- Scenario identification
- all media alarm

**Response**

- Dispatching of resources
- Emergency telecom
- Situational awareness
- Command control coordination
- Information dissemination
- Emergency healthcare

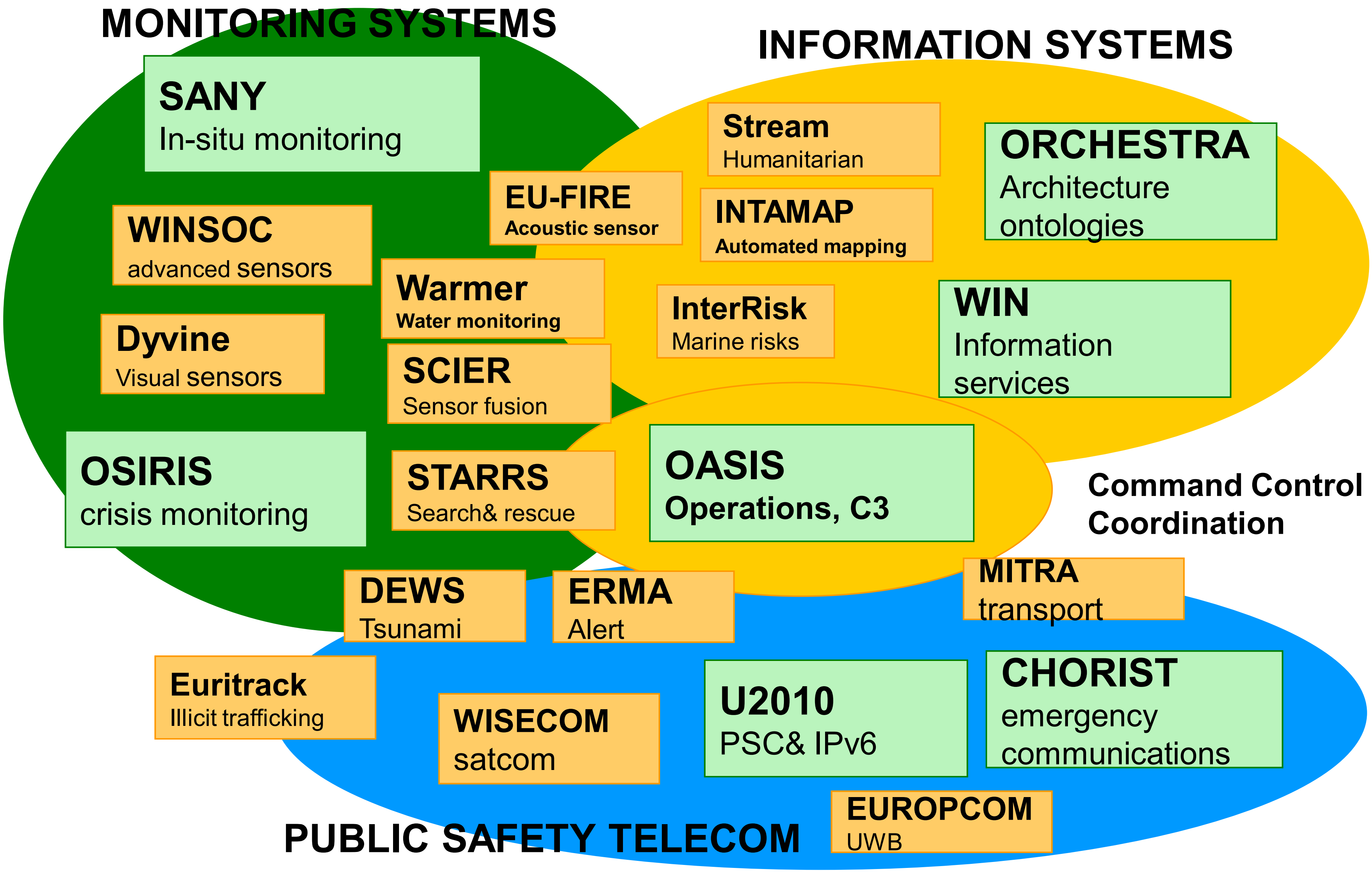
**Recovery**

- Early damage assessment
- Re-establishing life-lines transport &communication infrastructure

**Post Disaster**

- Lessons learnt
- Scenario update
- Socio-economic and environmental impact assessment
- Spatial (re)planning

# Disaster risk reduction projects



- VIDEO Tsunami

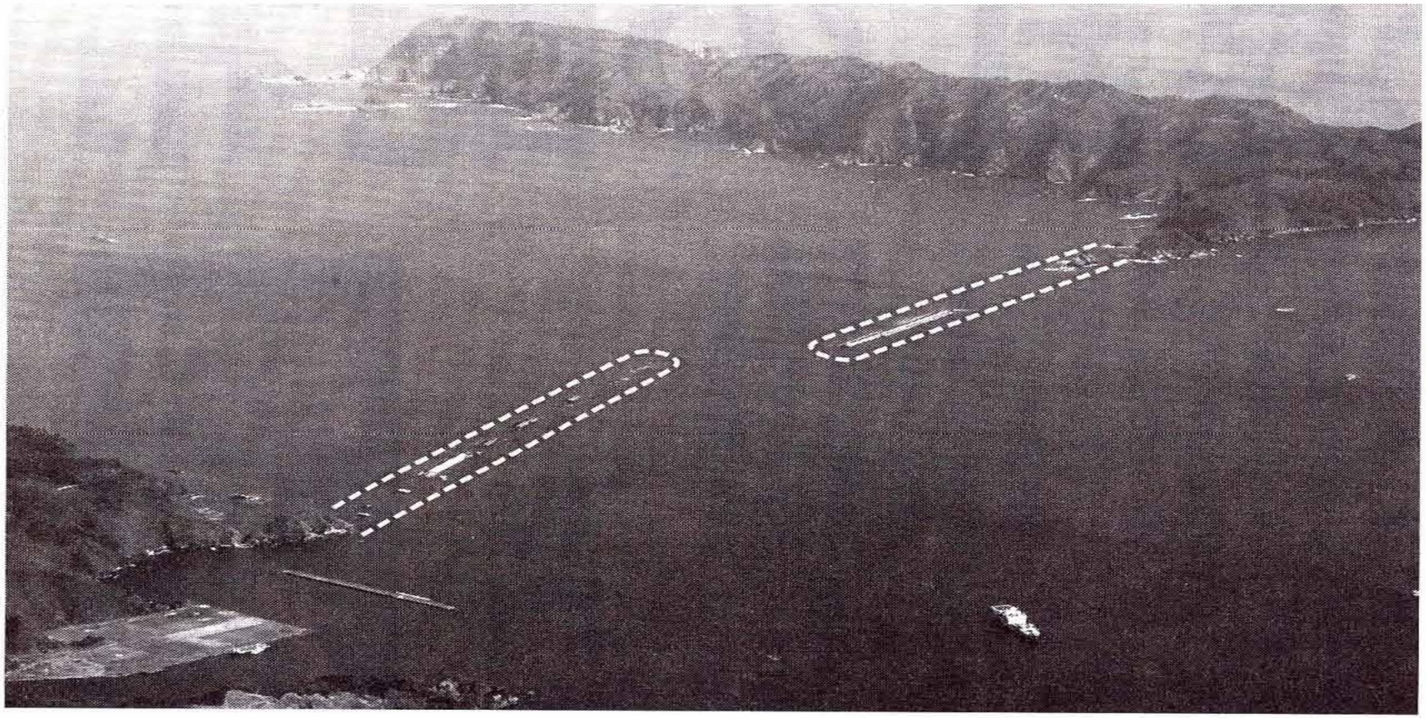
Kamaishi City, Iwate Prefecture constructed huge breakwaters 2km long, 20m thick, 8m above sea level and 65m deep, which have been registered as the deepest breakwaters in the Guinness World Records (see Fig.4a and 4b).

# Fig.4a The Deepest Water Break against Tsunami in Kamaishi Bay. Iwate Prefecture


©Google

Sunji Murai, 2011

# Fig.4b Destructed Water Break in Kamaishi Bay By Tsunami



世界最深の防波堤 無残

**We should have learnt the lessons that *'hardware'* including very high breakwaters, cannot save people but**

**we need to use *'software'* including procedures for providing early warning and evacuation systems.**

Video

Prezentace Red Cross and Red Crescent

Nepal

- VIDEO

- New Orleans

# Fig.3.1 Key Disaster-Related Functions by Level of Government and Phase-A

TABLE 3.1 Key Disaster-Related Functions by Level of Government and Phase

| Level | Mitigation | Preparedness | Response | Recovery |
|---|---|---|---|---|
| **Federal** | • Supports research of hazard causes<br>• Develops means to modify the causes of or vulnerability to hazards<br>• Reviews and approves state mitigation projects<br>• Provides training and technical expertise<br>• Directs flood control program<br>• Directs hazard prediction and mapping initiatives<br>• Provides hazard mitigation grants<br>• Provides funds to individuals for small projects to prevent losses<br>• Funds coastal land-use planning<br>• Creates geospatial data model<br>• Provides federal flood insurance<br>• Invests in development of new technologies | • Provides training and professional development programs<br>• Provides public education<br>• Coordinates warning system<br>• Formulates, implements, and evaluates emergency management policy<br>• Conducts inspection and assessment programs<br>• Reviews, coordinates, and conducts federal, state, and regional exercises<br>• Assesses and coordinates disaster plans<br>• Provides grants for disaster planning, equipment, and training<br>• Operates the national operations center<br>• Specifies required response capabilities<br>• Facilitates information sharing<br>• Coordinates incident response planning<br>• Synthesized intelligence<br>• Generates threat assessments<br>• Inventories critical infrastructure<br>• Stockpiles equipment and supplies | • Collects data about the disaster<br>• Creates and disseminates common operating picture<br>• Assesses damage<br>• President may declare disaster or emergency<br>• Implements the National Response Plan and activates Emergency Support Functions<br>• Designates principal federal official<br>• Establishes Joint Field Offices to coordinate support<br>• Provides atmospheric modeling<br>• Can mobilize the military<br>• Validates and makes recommendations in response to threat assessments<br>• Provides food, water, temporary power, and technical assistance | • Restores economic stability<br>• Provides crisis counseling<br>• Provides legal assistance<br>• Provides technical assistance, debris removal, communications, and public transportation, if requested<br>• Provides temporary housing assistance, individual and family grants, funds to repair facilities, and disaster unemployment assistance<br>• Provide loans for repair of homes, businesses, farms<br>• Provides tax relief |
| **State** | • Conducts hazard identification<br>• Conducts land-use planning<br>• Develops, adopts, and enforces land-use standards<br>• Regulates growth<br>• Solicits mitigation projects and establishes funding priorities<br>• Establishes legal basis for local ordinances<br>• Regulates construction<br>• Provides aid to localities | • Conducts risk and exposure assessment<br>• Monitors and surveys potential hazards<br>• Creates resource inventory<br>• Conducts disaster planning<br>• Coordinates plans of localities, facilitates interagency policy coordination<br>• Stockpiles equipment and supplies<br>• Conducts capability assessment<br>• Provides public education<br>• Conducts training and exercises<br>• Provides technical expertise to localities<br>• Obtains grant funding to support preparedness activities | • Mobilizes National Guard<br>• Provides food, water, clothing, and shelter<br>• Conducts damage assessment<br>• Disseminates public information<br>• Restores essential infrastructure<br>• Executes state emergency plan<br>• May request FEMA to assess damage<br>• May seek presidential declaration<br>• Runs EOC<br>• Coordinates resources across jurisdictions<br>• Funds mutual aid to other states<br>• Provides aid to localities<br>• Assists with evacuation | • Conducts debris removal<br>• Restores public services and facilities<br>• Restores infrastructure<br>• Restores economic stability<br>• Renews economic development<br>• Restores governmental self-sufficiency<br>• Prepares hazard mitigation plan<br>• May request federal agencies to perform short-term tasks<br>• Administers federal assistance<br>• Provides technical assistance to localities<br>• Provides relief funds to localities |

*continued*

TABLE 3.2 Continued

| | Requirements | Current Capabilities | Gaps |
|---|---|---|---|
| Recovery | • Ability to provide information to public about rebuilding and regrowth<br>• Ability to track resource locations and status, and the locations and activities of service providers<br>• Access to response geospatial database for transition of response to recovery<br>• Geospatial tools for land-use planning<br>• Identification and analysis of optimal landfill, shelter, long-term housing sites, disaster recovery centers, and recovery team staging areas<br>• Integrated monitoring system for recovery operations at the parcel level<br>• Maps of how population shifts as a result of disaster—age is an important attribute<br>• New information required to issue building permits<br>• Remote-sensing acquisitions to monitor recovery progress on a regional basis<br>• User-friendly decision support tools to systematically evaluate short- and long-term demands such as allocation of resources, capacity shortfalls, and status of restoration | • Optimal location analysis using image data, geographic data, and spatial modeling<br>• COTS GIS tools for spatial analysis of optimal siting and land-use planning (e.g., landfill, shelter)<br>• Commercial or government-provided remote-sensing acquisitions to monitor recovery progress on a regional basis<br>• Land-cover or land-use classification, change detection, and mapping using COTS image analysis tools<br>• Correlation of individual-level data across data sets<br>• Multiple overlay and spatial relationships and comparison<br>• Standard COTS GIS products for mapping and spatial analysis (but data may not be available) | • Fleet tracking or location-based service to tag field activity with a handheld device; used by private sector (e.g., FedEx) but not by FEMA<br>• Dynamic models that incorporate real-time geographic data of response activity within a GIS for full understanding of resource use and changing need<br>• Coordinated, detailed information on post-incident population movement<br>• Simple geocoding capabilities that allows nontechnical staff to provide coordinates for search and rescue operations |

NOTE: COTS = commercial, off the shelf; ORNL = Oak Ridge National Laboratory; SOP = Standard Operating Procedure.

# 7. INTEGRATED RESEARCH ON DISASTER RISK (IRDR) IS A DECADE-LONG RESEARCH PROGRAMME

**Guided by ICSU's Science Plan for Integrated Research on Disaster Risk, IRDR**

***"envisages an integrated approach to natural and human-induced environmental hazards through a combination of natural, socio-economic, health and engineering sciences, including***

***socio-economic analysis, understanding the role of communications, and public and political***

***responses to reduce the risk."***

# SCIENTISTS AND DECISION MAKERS

*Our knowledge and understanding of natural hazards has grown dramatically.*

*Scientists can more accurately characterise the possible magnitude of hazard events and better estimate the probability of their occurrence at specific magnitudes. Forecasting capacity has also dramatically improved, especially for weather-related events.*

*Far more is now known about the social dimensions of disasters, for instance human exposure and vulnerability (and lack of resistance and resilience) to natural hazards and places where poverty and multiple stresses shape the character and distribution of losses.*

# IRDR SCIENCE PLAN

*…has observed that there is a shortfall in current research on how science is used to shape social and political decision-making in the context of hazards and disasters. It noted*
*that addressing this problem would require an approach that would*
***integrate expertise in research and policy-making***
*across all hazards, disciplines, geographic regions and political institutional frameworks.*

# ICSU, ISSC, UNISDR and Co-Sponsors

## *IRDR Programme*

*… a global, trans-disciplinary research programme to address the major challenges of natural and human-induced environmental hazards.*
*The complexity of the task is such that it requires the full integration of research expertise from the natural, socio-economic, health and engineering sciences,*
*encompassing also areas of inquiry and practice such as policy-making, the role of communications, and public and political perceptions of and responses to risk.*

**The IRDR program is guided by three research objectives:**

***1. Characterising hazards, vulnerability and risk.***
***2. Understanding decision-making in complex and changing risk contexts.***
***3. Reducing risk and curbing losses through knowledge-based actions.***

***Three cross-cutting themes** support IRDR's work towards these objectives:*

*1. Capacity building, including mapping capacity for disaster reduction and building self-sustaining*
*capacity at various levels and for different hazards.*

*2. Development and compilation of case studies and demonstration projects.*

*3. Assessment, data management, and monitoring of hazards, risks and disasters.*

# The IRDR Strategic Goals, 2013-2017

*The Strategic Plan has expressed the ambitions of the programmes in six strategic goals.*

**Goal 1: Promoting integrated research.**
**Goal 2: Characterizing hazards, vulnerability and risk.**
**Goal 3: Understanding decision-making.**
**Goal 4: Reducing risk and curbing losses.**
**Goal 5: Networking and partnership-building.**
**Goal 6: Supporting the science and policy dialogue.**

**GOAL 2**
**….. Address the gaps in knowledge, methodologies and types of information that prevent the effective application of science to avert disasters and reduce risk.**

***Disaster Loss Data (DATA)***

**DATA aims to establish an overall framework for disaster loss data for all providers, to establish**
**nodes and networks for databases, and to conduct sensitivity testing among databases to ensure**
**some level of comparability.**

**GOAL 2**

**Extension 1**

**Example-1:**

**Hazards and Vulnerability Research Institute (HVRI), University of South Carolina, USA, meeting:**

**to modified IRDR peril classification schema to serve multiple types of databases—global, national and sub-national—in order to make loss information more comparable despite different goals and objectives of individual databases. The working group will test the classification system on each of its members' databases.**

# GOAL 2

## EXTENSION2

**Example – 2:**

**the Asian Disaster Reduction Center (ADRC) in Japan to**

**continue work on the GLobal IDEntifier Number (GLIDE) system, an identification system that enables linking events that have multiple impact areas;**

**and concurred with the new definitions proposed in a joint Centre for Research on the Epidemiology of Disasters (CRED) and United Nations Development Programme (UNDP) draft Human Impact Indicators document.**

# *GOAL 3*
# Understanding decision-making

***…. in the context of risk management – what it is and how it can be improved; identify relevant decision-making systems and their interactions; understand decision-making in the context of environmental hazards and help improve the quality of decision-making practices.***

**Risk Interpretation and Action (RIA): main objective is to build a community of practice on risk perception, communication and decision-making that focuses on the question of how people make decisions in the face of risk.**

# GOAL 4

## *REDUCING RISK AND CURBING LOSSES*

***Develop a methodology for implementing comprehensive, long-term***

***vulnerability assessments and effective approaches to risk reduction, by also bringing together insights gained under Goals 2 and 3.***

**Forensic Investigations of Disasters (FORIN):**

***has produced a template that aims to guide the discovery of root***

***causes of disasters through in-depth investigations that go beyond the typical reports and case studies conducted after disaster events.***

# Connecting Science, Policy and Practice – Goal 5 and Goal 6

**GOAL 5:**
**Networking and partnership-building**
***Develop, strengthen and collaborate within the IRDR network at global, regional and national levels***

**GOAL 6:**
**Supporting the science and policy dialogue**
***Enhance the utilisation of research findings.***

# AND BIG DATA?

Loss of data versus BIG DATA

Need of understandable data versus non-understandable

Structured DB versus Non-Structured DB:
Volunteer Geographic Information, inclusion of inhabitants

New kinds of Data Presentations and Visualisations

New promising applications in other fields: Mr. Steve Jobs, Apple,
Crime Mapping, USA

# 7. Potentials of cartography: context and adaptive cartography

The subject-matter of adaptive cartography is **automatic creation of correct geodata visualization with regard to situation, purpose and the user.**

Adaptive maps are still maps in the conventional sense – they are correct and well-readable medium for transfer of spatial information. The user controls map modifications ***indirectly via modification of context***.

# Traditional vs. adaptive map

- Traditional map
  - Static
  - Universal
  - As much information as possible (level of legibility)
  - Demand on high level of user knowledge
- Adaptive map
  - As little information as needed for interpretation
  - No redundancy of information
  - Individual

# EMERGENCY CONTEXT

**EVENT**

FLOOD
CAR ACCIDENT
FOREST FIRE

*WHAT*

**TASK**

PREDICTION

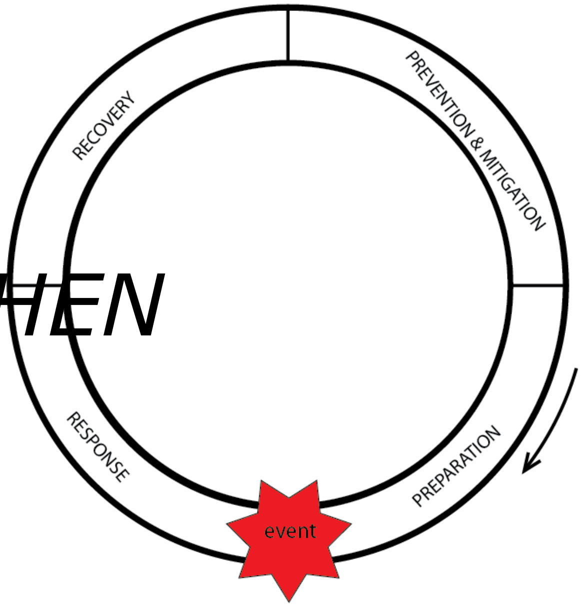
TECHNICAL SUPPORT

RESCUE

ORGANIZATION

INFORMATION

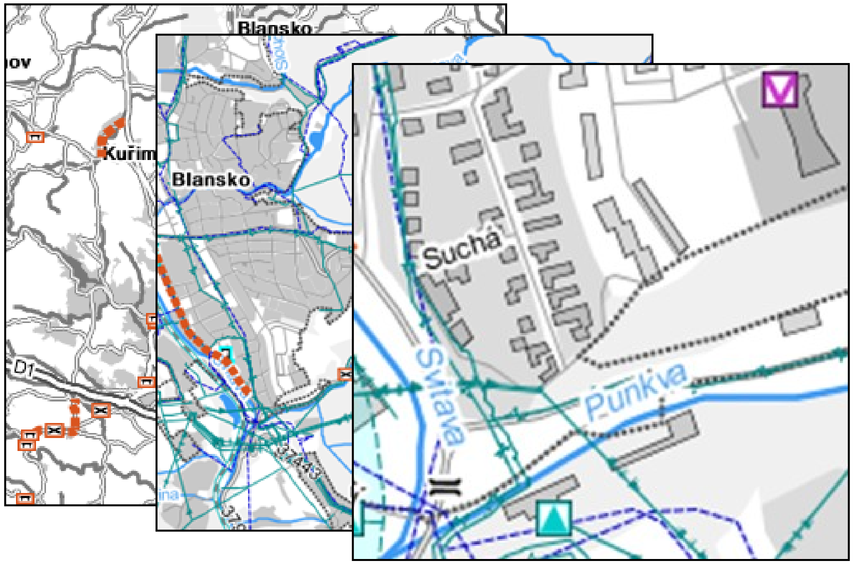
**STAGE**




*WHEN*

**OPERATION RANGE**

REGION-DISTRICT-MUNICIPALITY-LOCAL




*WHERE*

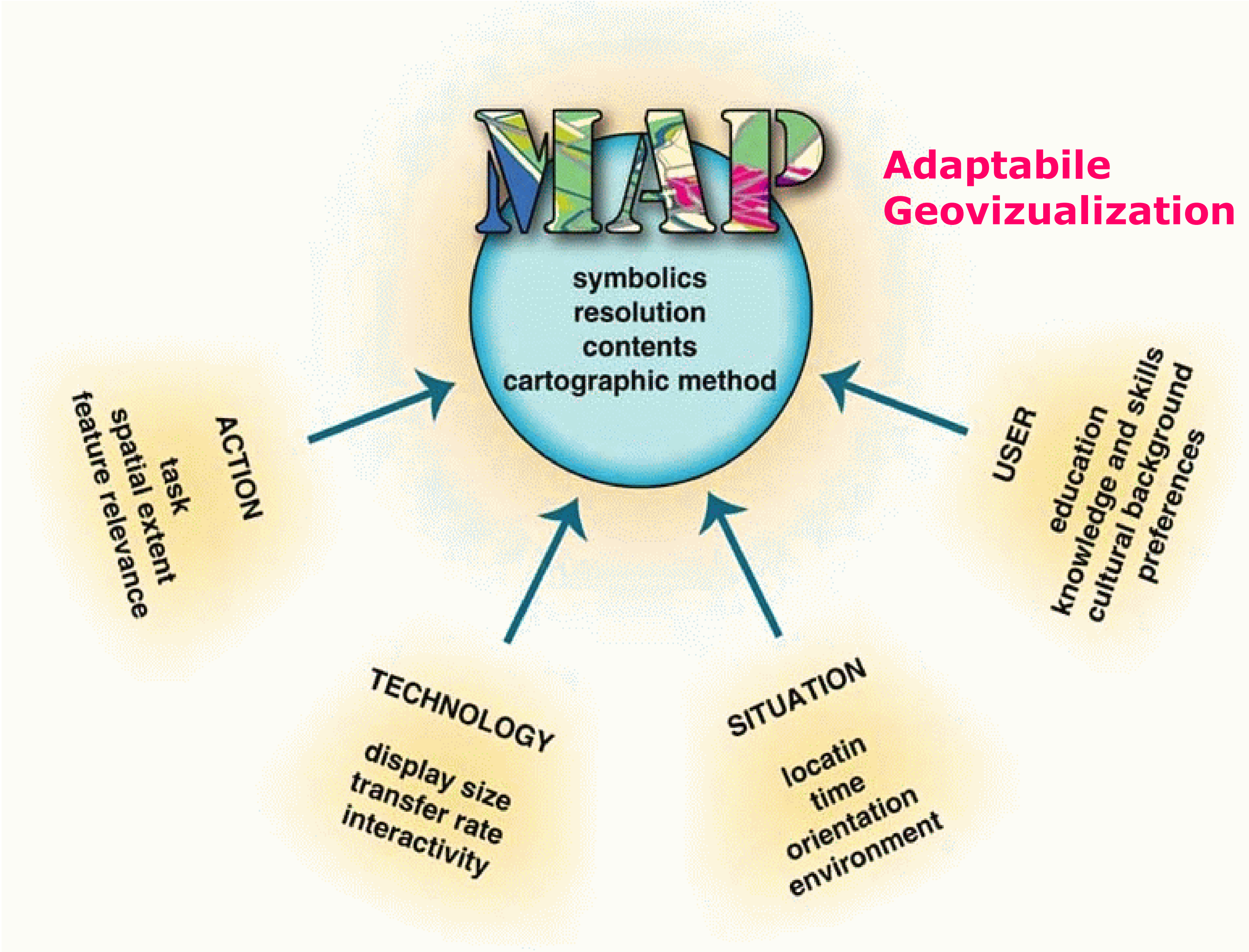



*Figure: Examples of changes in visualization according to change of context (Friedmanová, Konečný and Staněk 2006)*

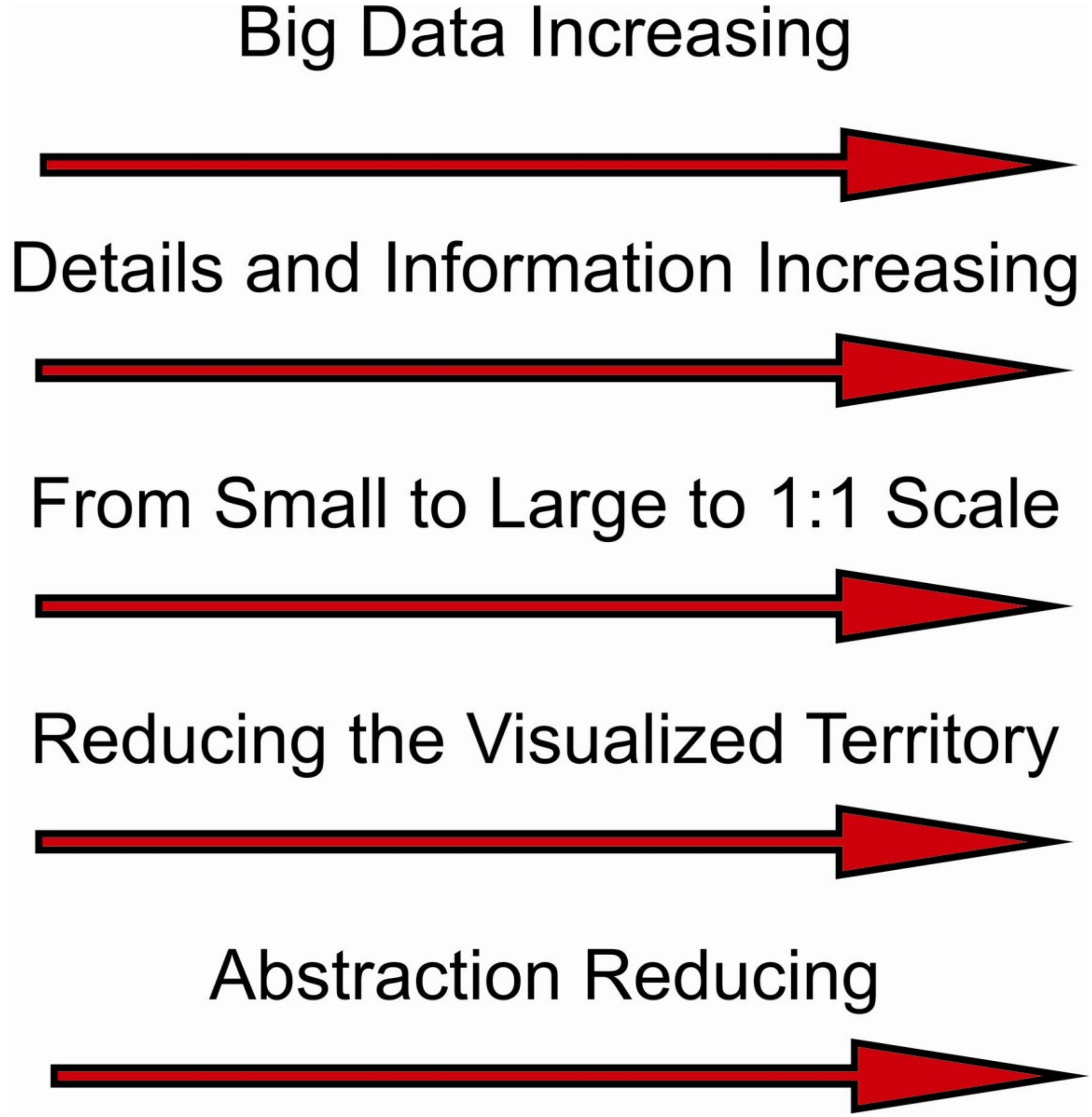
# Cartography  and Geoinformatcs tasks:

**Big Data and Map Scale:** 3D cyber models; 1:1 scales?

**Big Data and Map Dimensionality:** 2D, 3D, 4D,....?

Guerley, 2013:  „the map is a multi-dimensional rendering of any type of information, representing the relationships of objects (by statistical methods for “small” data. Now Big Data, but statistics are still missing.

# BD AND MAP SCALE




(Bandrova, Konecny, Yotova, 2014)

**BD Generalization:** The modern GIS - automatic generalization in special cartographic cases.

In the case of Big Data it will be big challenge for all GI specialists.

We cannot leave generalizations principles we just have to create new ones in new environment and new situations.

Cartography cannot deal with all kinds of data of the BD environment and cannot provide all the solutions of BD processing and management.

Cartography can handle only a part of the data and extract valuable information from it.

- Data must be spatially distributed: The power of cartography is in its capacity of describing quality and quantity characteristics of objects, their positioning and relations.

- Data must be classified. The majority of BD is semi- or non-classified. To map the data, we need clear classification first.
- Data must have quality and / or quantity characteristics. Cartography visualizes objects’ and phenomena’s characteristics and provides to readers their distribution. Modern cartography capabilities like multidimensional representation and animation allow us to represent much more data characteristics than before.
- Data of interest must be generalized. Many data in semi- or non- classified format can represent an interest for cartography.

**PERSPECTIVES**

To look from the BD perspective we see that cartography will continue its development in some kind of equilibrium between sciences, technology and art.

This equilibrium is more valid than before, because combination of new scientific approaches based on ICT in cartography provides many possibilities for map creation and inclusion of art not only make maps attractive but also enables new and imaginative forms in which maps could be shown and naturally understood.

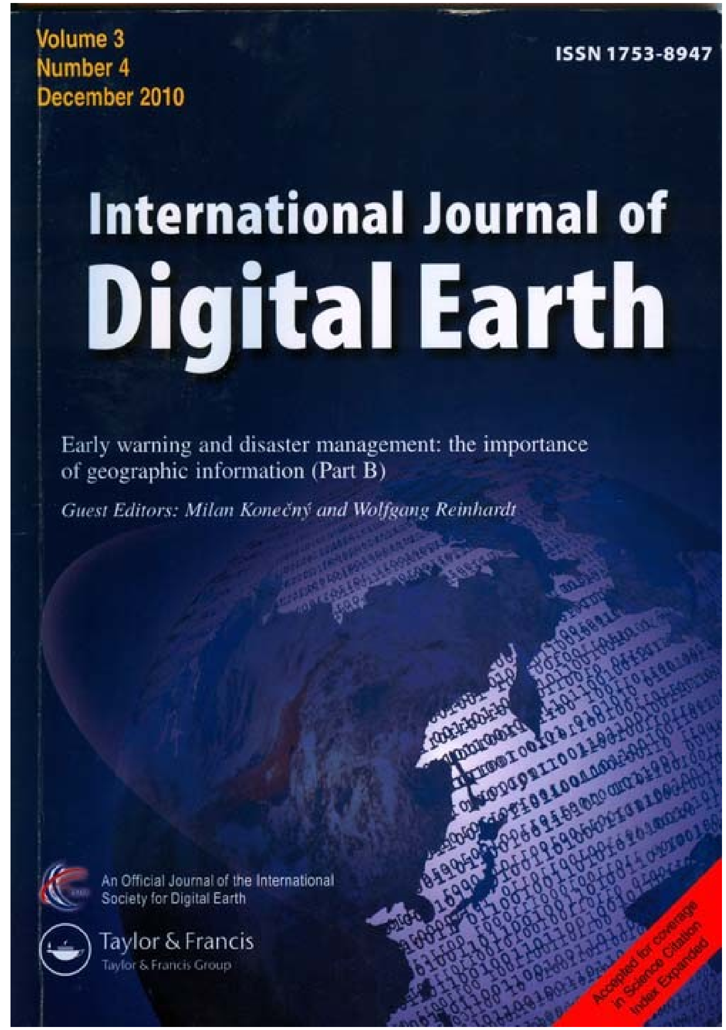
In the era of BD, it is very important for cartography to take advantage of the development of the ICT.

The distance between cartographers and the world's leading information providers like Google, Open Streat Maps, Facebook and Twitter have to be reduced through clear involvement of cartography roles and rules in solution delivery.

As experts, we are happy of the new possibilities presented by ICT, but still we cannot hide the fact that much chaotically transmitted information is not correct and can lead to misinterpretation by the users.

# Publications

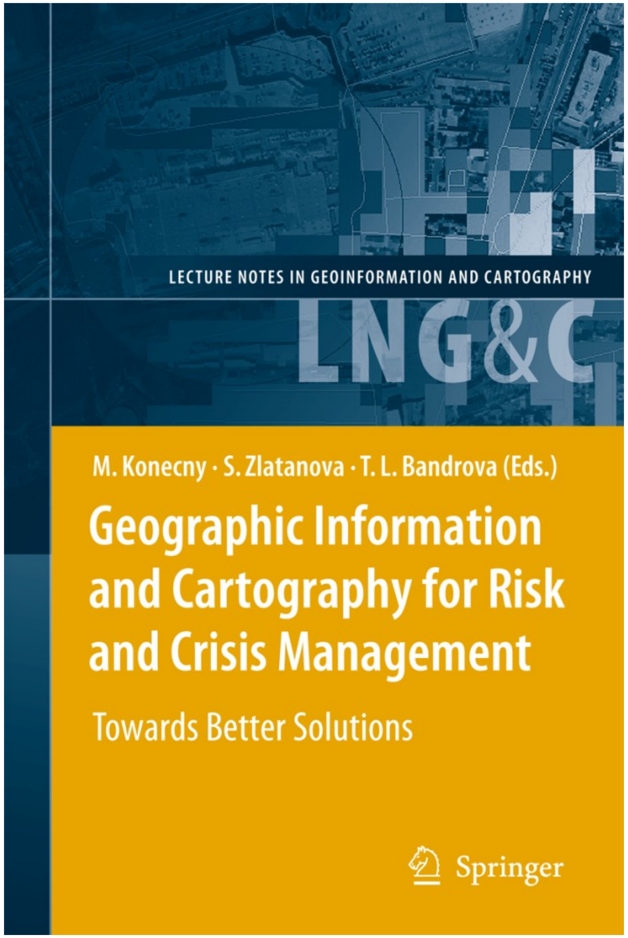
Editing of specialized double issues for EW and CM in International Journal on Digital Earth




Result:

Growth of IF from 0.853 to 1.222

# Geographic Information and Cartography for Risk and Crisis Management




From publishing on March 25 2010, Geographic Information and Cartography for Risk and Crisis Management have been **3161** requests for chapter uploading. Statistics of last two years:

| Yea | Amount of uploadings |
|---|---|
| 2011 | 1261 |
| 2010 | 1900 |

## Publications

The best papers will be proposed for publication in a Book titled:

# Thematic Cartography for Society

Publisher: Springer

Book topics:

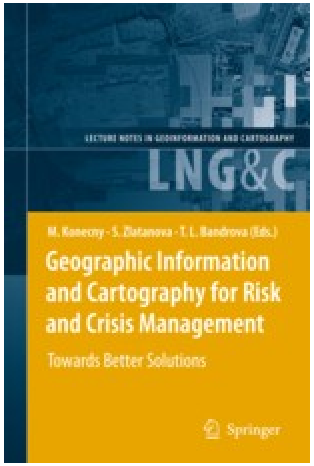
- *User-friendly Internet Cartography*
- *User-oriented Map Design and Production*
- *Context-oriented Cartographic Visualization*
- *Map interfaces for Volunteered Geographic Information*
- *Sensing Technologies and their integration with Maps*
- *Cartography in Education*

On-line publication

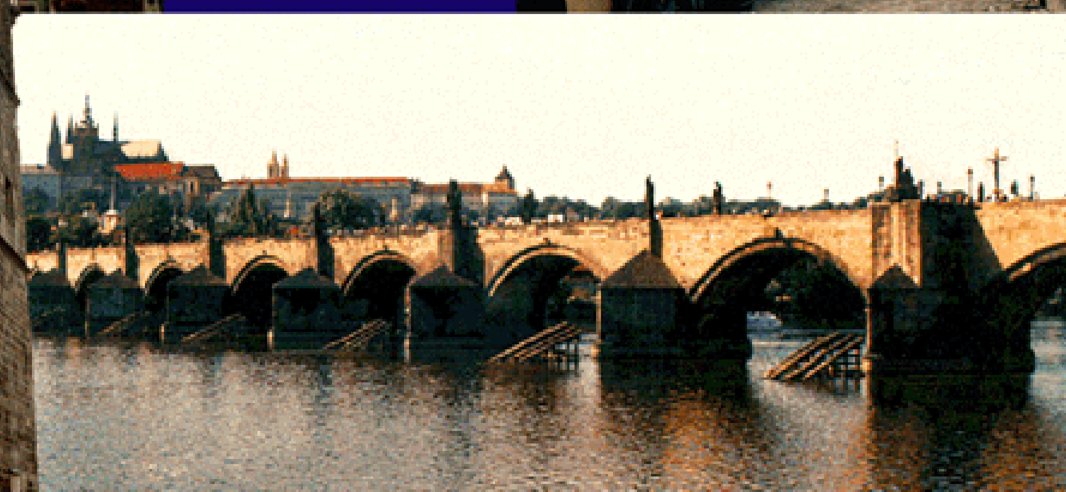
CD Publication, ISSN

Abstract/ paper submission Deadline:

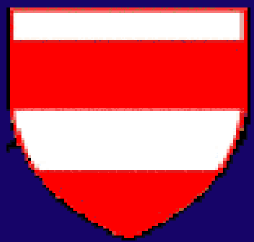
10. January 2014

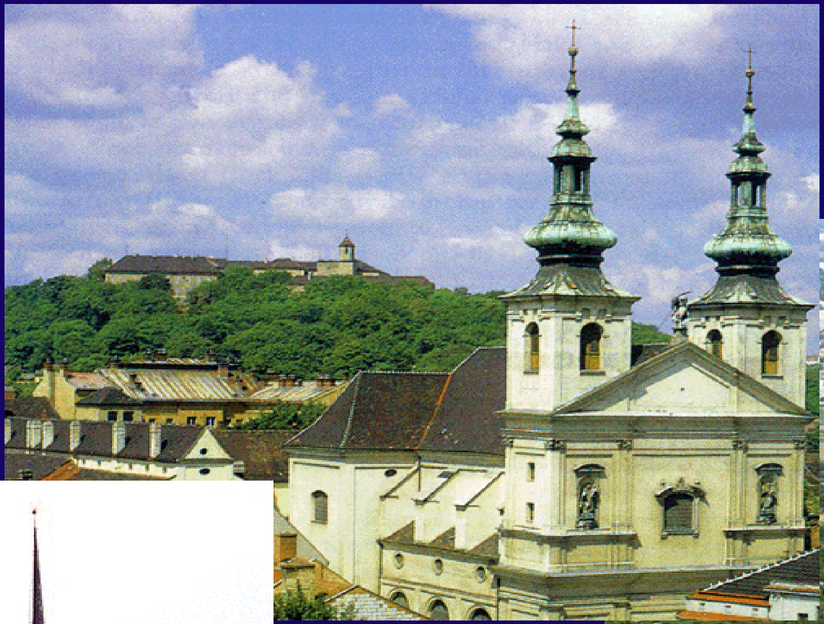


# PRAGUE



# BRNO





# ***Xie, Xie!!!!!***

***Bardzo Dziekuje***

*Chvala*

*THANK  YOU*

*Muchas Gracias*

*Terima KasimO Brigada*

***Kammsa Hamida***

***Aligator***

***SHUKRAN***

*BLAGODARJA*

***DĚKUJI ( in Czech)***