



Rio de Janeiro State University
lecture , May 8, 2006 Rio de Janeiro,
Brasil

Contemporary Cartography and Geoinformatics

Milan KONECNY

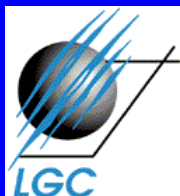
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International Cartographic Association

www.icaci.org

Commissions of ICA

- *Commission on Cartography and Children*
- Commission on Education and Training
- Commission on Gender and Cartography
- Commission on Generalisation and Multiple Representation
- Commission on the History of Cartography
- Commission on Incremental Updating and Versioning

- Commission on Management and Economics of Map Production
- Commission on Mapping from Satellite Imagery
- Commission on Map Projections
- Commission on Maps and Graphics for the Blind and the Partially Sighted
- Commission on Maps and the Internet
- Commission on Marine Cartography
- Commission on Mountain Cartography

- Commission on National and Regional Atlases
- Commission on Planetary Cartography
- Commission on Spatial Data Standards
- Commission on Theoretical Cartography
- Commission on Ubiquitous Mapping
- Commission on Visualization and Virtual Environments

- Working Group on Mapping Africa for Africa
- Working Group on Spatial Data Uncertainty and Map Quality
- WG on Use and User issues
- WG on Geospatial analysis
- WG on historical geometrical analysis
- Publications Committee

ICA and ESRI

Children Map the World

*Selections from the Barbara Petchenik
Children's World Map Competition*



Jacqueline M. Anderson, Jeet Atwal, Patrick Wiegand, and Alberta Auringer Wood, editors

1. Information/Knowledge-based Society
2. European Challenges
3. Position of Cartography (geotechnology)
4. GMES and INSPIRE
5. State of the Art of Cartography
6. SDI and Cartography
7. Geospatial Information & the Knowledge Economy
8. Early Warning, Disaster management and cartography: Nobody is Perfect?

„Information Society” is the term that is used to capture the increasing contemporary influence of information and communication technologies (ICTs).

Knowledge-based society enhances content of the processes based on data, information and knowledge.

Information Society

Sustainable Information Society

The linkage between sustainability
and information society development
is still poorly understood.

2. European Challenges

“i2010 – A European Information Society for growth and employment”

COM(2005) 229 final

COMMUNICATION FROM THE COMMISSION
TO THE COUNCIL, THE
EUROPEAN PARLIAMENT, THE EUROPEAN
ECONOMIC AND SOCIAL
COMMITTEE AND THE COMMITTEE OF THE
REGIONS

Brussels, 31.05.2005

(Text with EEA relevance)

i2010 Content:

A single European information space

Inclusion, better public services and quality of life

Conclusion: i2010 within the new Lisbon governance cycle

0 500 km



Connecting the UK: the Digital Strategy

Cabinet Office

Prime Minister's Strategy Unit

March 2005

UK Approach

Contents

Section 1: A 'digitally rich' UK – progress to date

Section 2: The 'digital divide': problems with low take-up

Section 3: Why should the Government intervene to promote take-up?

Section 4: How can we close the digital divide and become a world leader in digital excellence?

- ***Raising our game: Making the UK a world leader in digital excellence***

Action 1: Transform learning with ICT

Action 2: Set up a “Digital Challenge” for LAs

Action 3: Make the UK the safest place to use the Internet

Action 4: Promote the creation of innovative broadband content

- ***Constructing a robust strategy to achieve our vision***

Action 5: Set out a strategy for transformation of delivery of public services

Action 6: Ofcom's strategy should consider improving competition and take-up in the broadband market

- ***Tackling social exclusion & bridging the digital divide***

Action 7: Improve accessibility to technology for the digitally excluded and ease of use for the disabled

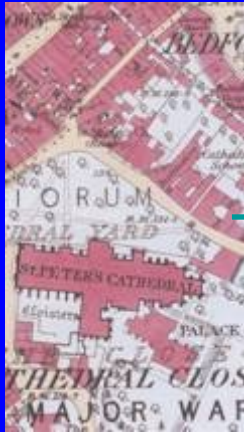
Action 8: Review the digital divide in 2008

OS MasterMap:

a definitive digital map of Great Britain, providing detailed geographic information for a wide range of business and government purposes.

OS MasterMap underpins a huge range of commercial services used by millions of people every day.

Changing models of geographic information



Paper map



Digital data file



Spatial database

Layers of OS MasterMap



Topography

Addresses

Integrated
Transport
Network

Imagery

Tony Blair, Patricia Hewitt:

..... We now have a world-leading position in digital TV.... the most extensive – and one of the most competitive broadband markets in the G7.

Virtually all households in the UK are within easy-reach of a UK online centre where they can access the internet in a safe, secure and supportive environment.

We cannot...think the job is done. We must harness the power of ICT to modernise public services so they are as personalised, efficient and responsive as the most successful companies.

We must be in the forefront of new technologies to remain globally competitive.

And most important of all, we must make sure the whole of society can experience the benefits of the internet.

Too many people still don't enjoy the advantages of that ICT offers. We are committed to ending the digital divide for families with children by the end.

Strategy to make the UK a world leader in digital excellence and the first nation to close the digital divide.

**How is reacting and what will do
cartographic and geoinformatics
community?**

GI in IT?

3. Position of Cartography (Geotechnology)

Mapping opportunities

Nature, January 2004

Scientists who can combine geographic information systems with satellite data are in demand in a variety of disciplines.

In start of 2004, the US Department of Labor identified **geotechnology as one of the three most important emerging and evolving fields**, along with nanotechnology and biotechnology.

The demand for geospatial skills is growing worldwide, but the job prospects reflect a country's geography, mapping history and even political agenda.

Cartography

in

SDI WORLD

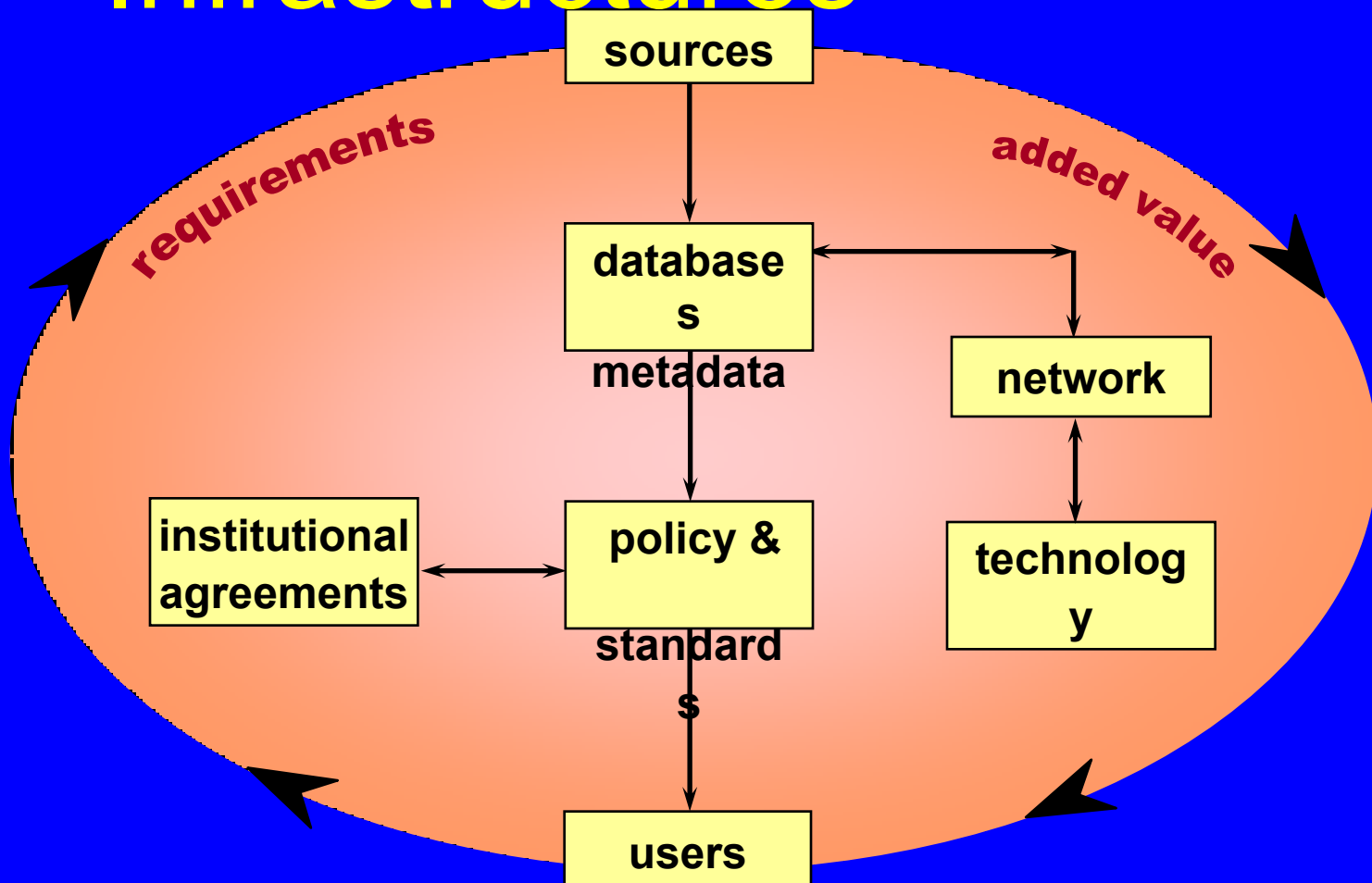
The term *Spatial Data Infrastructure (SDI)* is used to encapsulate the technologies, policies, institutional arrangements, financial and human resources that facilitate the availability, access and effective usage of geographic data. Start: Clinton 1994.

The SDI provides the means for *discovery, access and application* of spatial data for policy-makers, planners and managers, citizens and their organizations.

SDI technologies consist of *a set of data services* that provide geographic data and their attributes.

Services and data are documented with *meta-data* which that subsequently offer the means *to discover, visualise and evaluate the data through the Web*. Additionally, methods are provided to access the data. Applications are built to solve specific needs on the data service layer.

Spatial Data Infrastructures



Santiago Borrero (PAIGH SG): importance of *non-technical variables* in SDI building in Developing Nations.

“Culturally speaking, particularly, there is a problem of attitude and a history of isolation, ill-defined ideas, language barriers, and financial challenges. In every country SDI will reflect local social and economic conditions, cultural aspects and elements related to national identity“.

4. GMES and INSPIRE

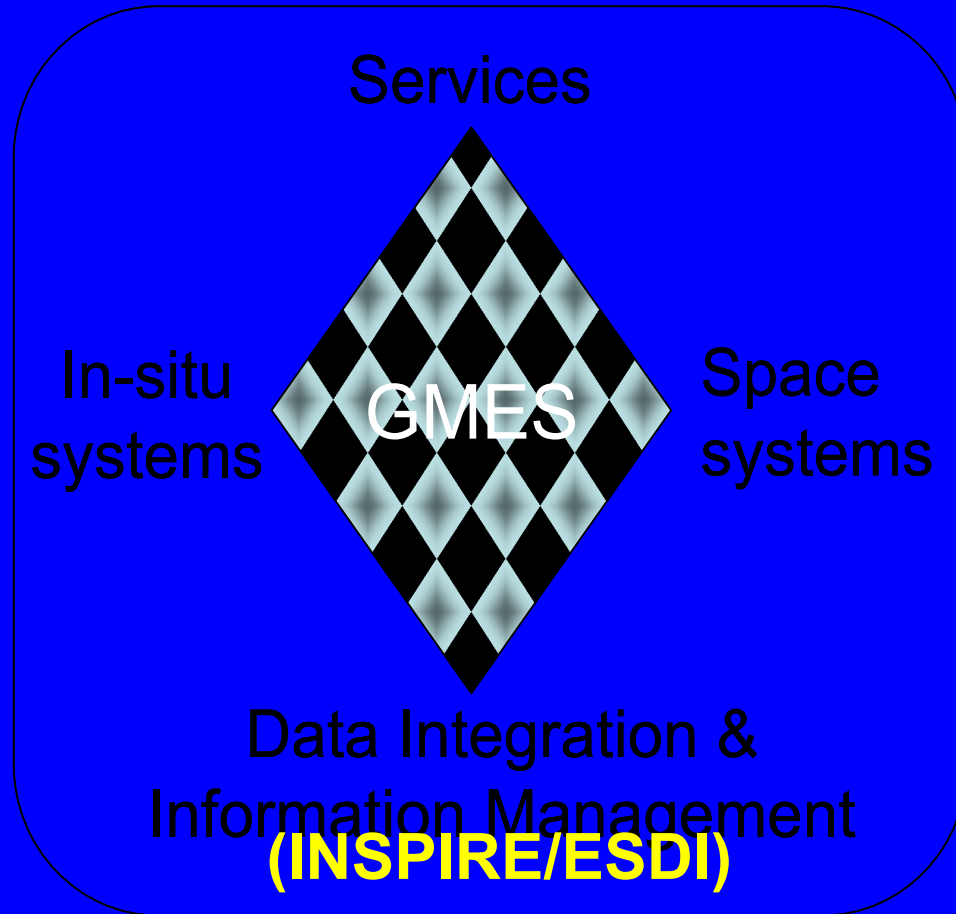
Global Monitoring for Environment and Security (GMES)

seeks to bring together the needs of society related to the issue of environment and security with the advanced technical and operational capability offered by terrestrial and space born observation systems.

GMES relevant policy areas:

- *Sustainable Development*
- *European Research Area*
- *Global Climate Change*
- *European Strategy for Space*
- *Common Defence and Security Policy*

Global Monitoring for Environment and Security





INSPIRE

Infrastructure for Spatial Information in Europe

The INSPIRE concept:

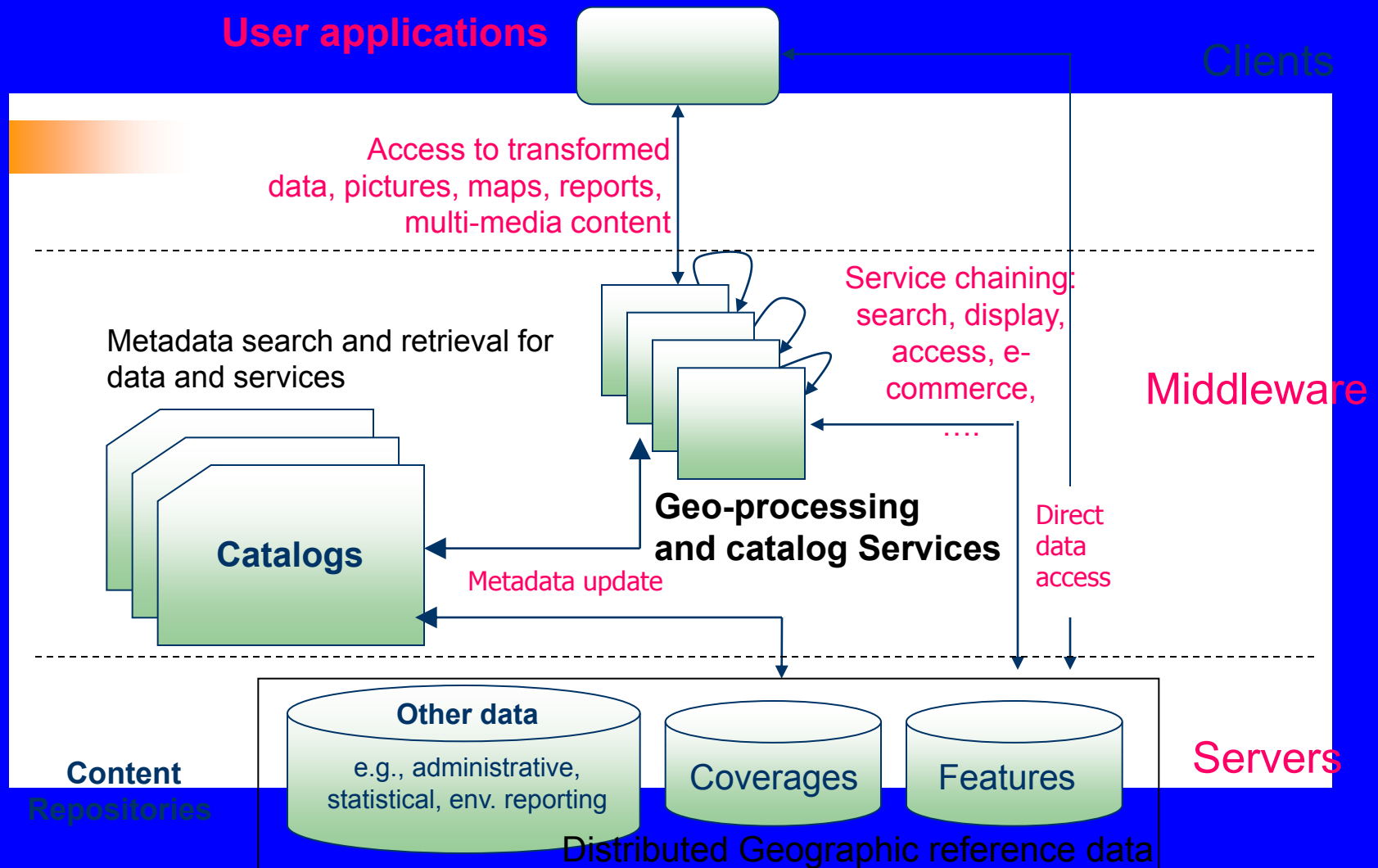
Availability

Accessibility

Legislation rules.

Current status

Architecture model



After the Digital Earth Reference Model

INSPIRE Scope: 17 Themes-1

- **1. Geographical location**
- **2. Administrative units**
- **3. Properties, buildings and addresses**
- **4. Elevation**
- **5. Geo-physical environment**
- **6. Land surface/land cover**
- **7. Transport**
- **8. Utilities and facilities**
- **9. Society and population**
- **10. Spatial planning/ Area regulation**

INSPIRE Scope: 17 Themes-2

- **11. Air and climate**
- **12. Water/
hydrography**
- **13. Ocean and seas**
- **14. Biota/biodiversity**
- **15. Natural resources**
- **16. Natural and technological risks and natural disasters**
- **17. Areas under anthropogenic stress**

GEOSS and GNSS Activities

G-8 Conference 2003 in Evian:

the Ad hoc „**Group on Earth Observation**“ (**GEO**) were created with intention to design Global Earth Observation System of Systems (**GEOSS**).

Earth Observation Summit 2005 in Brussels **decided about permanent GEO** activities (based at WMO, Geneva, Switzerland).

The 10 Years Implementation Plan, so called - **10YIP was adopted.**

Purpose of GEOSS (ref. 1st EOS in 2003)

1. to achieve comprehensive, coordinated, and sustained Earth observations for the benefit of humankind.

2. to improve

- **monitoring** of the **state** of the Earth,
- increased **understanding** of **dynamic Earth processes**,
- enhanced **prediction** of the Earth system, and
- further implementation of international environmental treaty obligations.

Nine Societal Benefit Areas of GEOSS have been formulated

- **Disasters**
- **Health**
- **Energy**
- **Climate**
- **Water**
- **Weather**
- **Ecosystems**
- **Agriculture**
- **Biodiversity**

GLOBAL SPATIAL DATA PROJECTS

Global Mapping

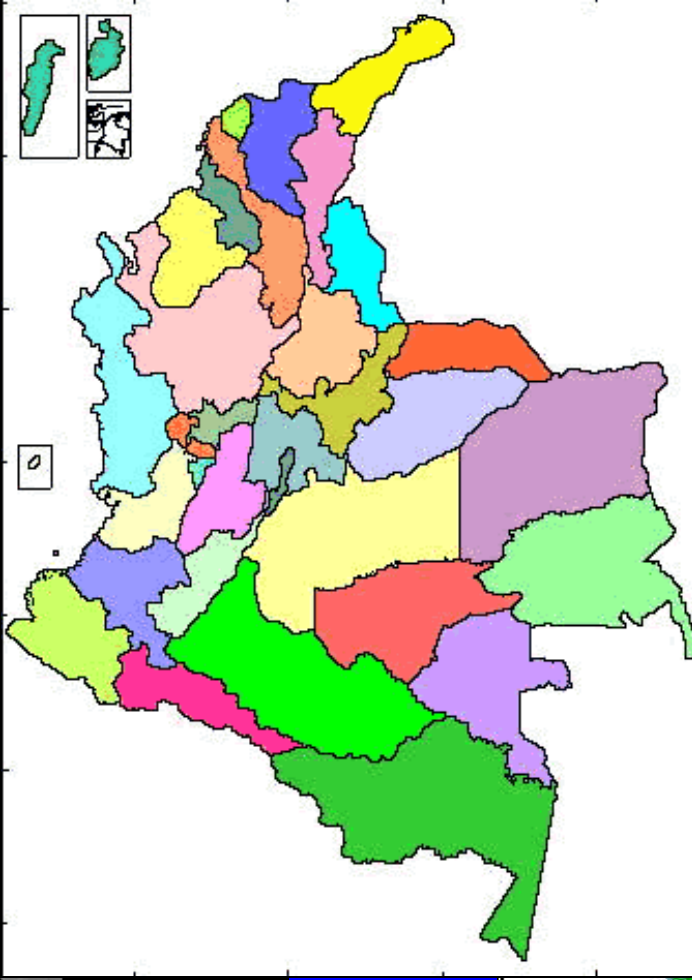
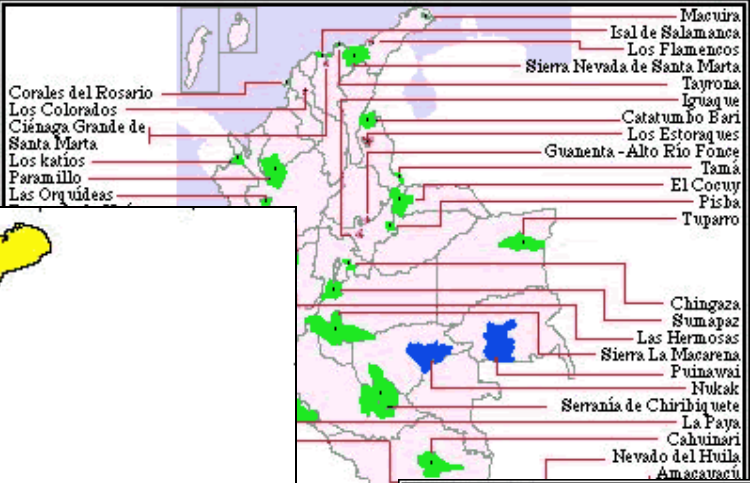
Global Spatial Data Infrastructure (GSDI)

Digital Earth

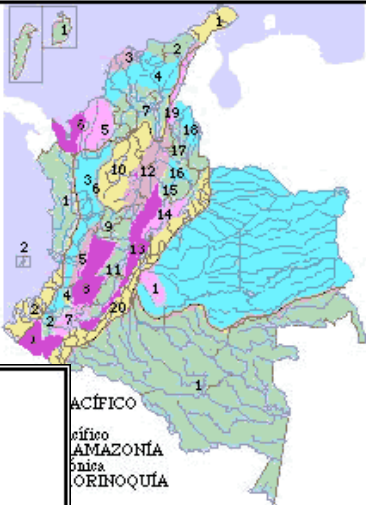
U. N. Geographic Data Base

GI for Sustainable Development (GISD)
(OGC)

GNSS (EOS, GEOS, GEOSS), FAO..



- REGIÓN ANDINA**
- Huila de los Pastos
 - Fosa del Patia
 - Cordillera occidental
 - Altiplano de Popayán
 - Valle del Cauca
 - Cañón del Cauca
 - Macizo Colombiano
 - Cordillera Central Medional
 - Macizo Volcánico
 - Montaña antioqueña
 - Alto Magdalena
 - Magdalena medio
 - Vertiente magdalense de la cordillera Oriental
 - Altiplano cundi-boyacense
 - Montaña santandereana
 - Fosa del Suarez y Chicamocha
 - Macizo Santurbán
 - Catatumbo
 - Los Mottlones
 - Vertiente Oriental Andina
- REGIÓN CARIBE**



- Desértico
- Árido
- Semiárido
- Semihúmedo
- Húmedo
- Superhúmedo

Colombia

Zonificación climática
Según el sistema de clasificación LANG

Relieve

Regiones geográficas

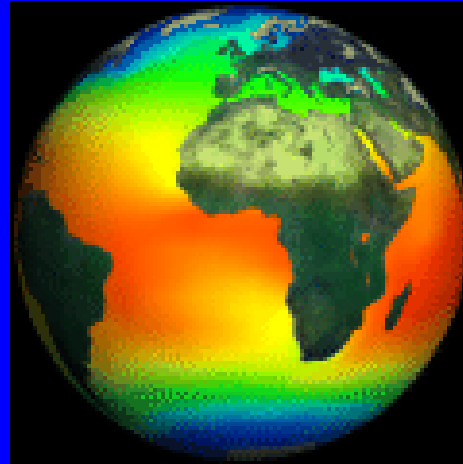
Understanding Digital Earth



Cloud



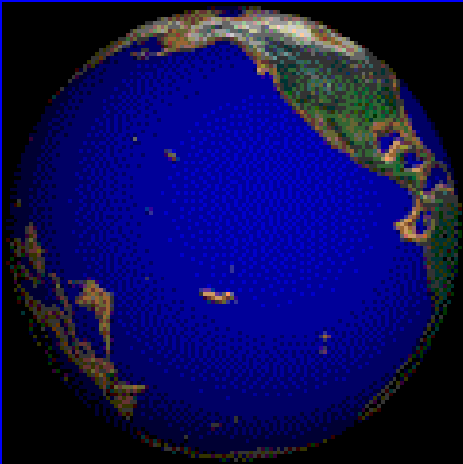
El Nino



Sea water temperature



Vegetation



Earth Surface



Earthquake



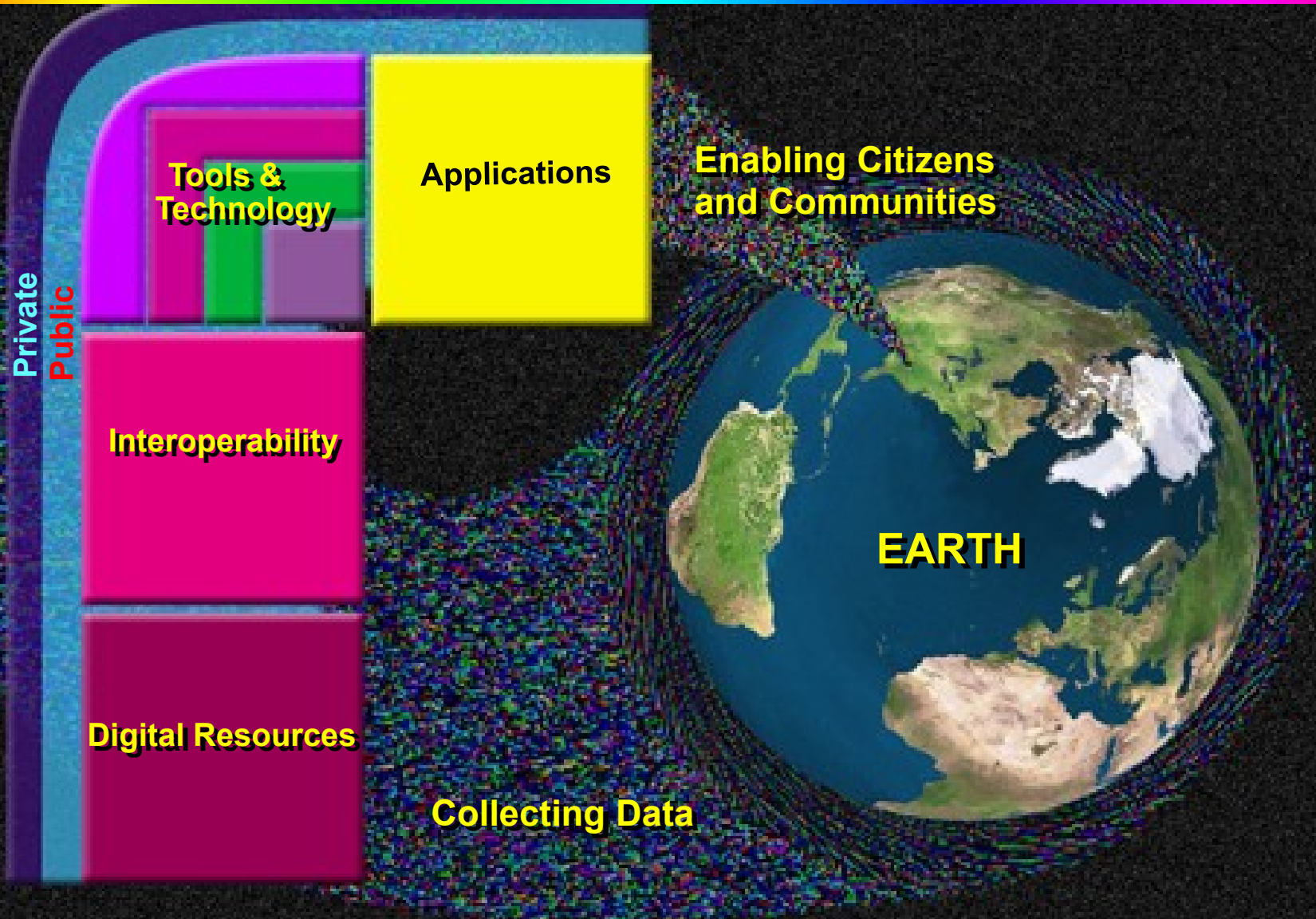
Volcano



Plate Boundary

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

Understanding Digital Earth



(White paper by NASA Digital Earth office, 2000)

U.N. department of Outer Space in Vienna:

GNSS (Global Spatial and Navigation Systems) – harmonization of data and information from NAVSTAR, GALILEO, GLONASS and other systems for everyday users needs.

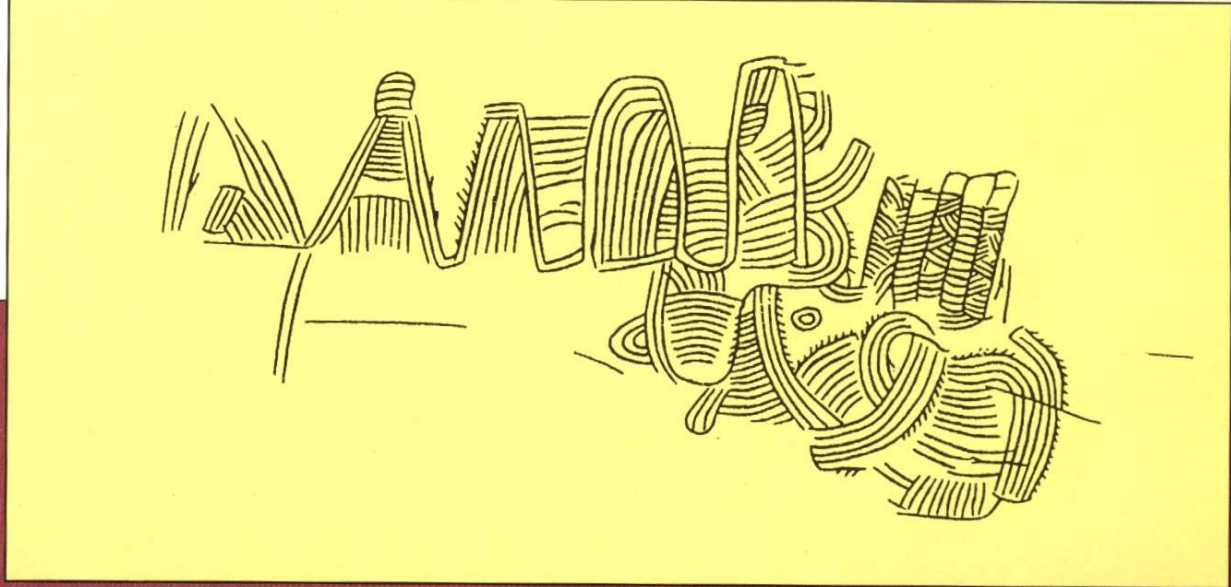
LBS



5. State of the Art of Cartography

Cartography needed

Cartography offer its help



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



Deblin

Casbijn

Raczka

Habrowa

Byteschka

Korzum

Posortz

aschowitz

Reizan

Eickhorn
B. Wewersj

Lischna

Kralitz

Rositz

Sip

Spilberg

Brinn
B. Brno

Schla:
panitz

Sokolnitz

Oslowany

Strutz
B. Traubsko

Modritz

Teln

Giblawitz

Au.

Schelschitz

Ragran
B. Reyhrad

Mohelno

Ewancitz

Btschitz

Dog:
kowitz

Lauty
B. Blac

Ruchowan

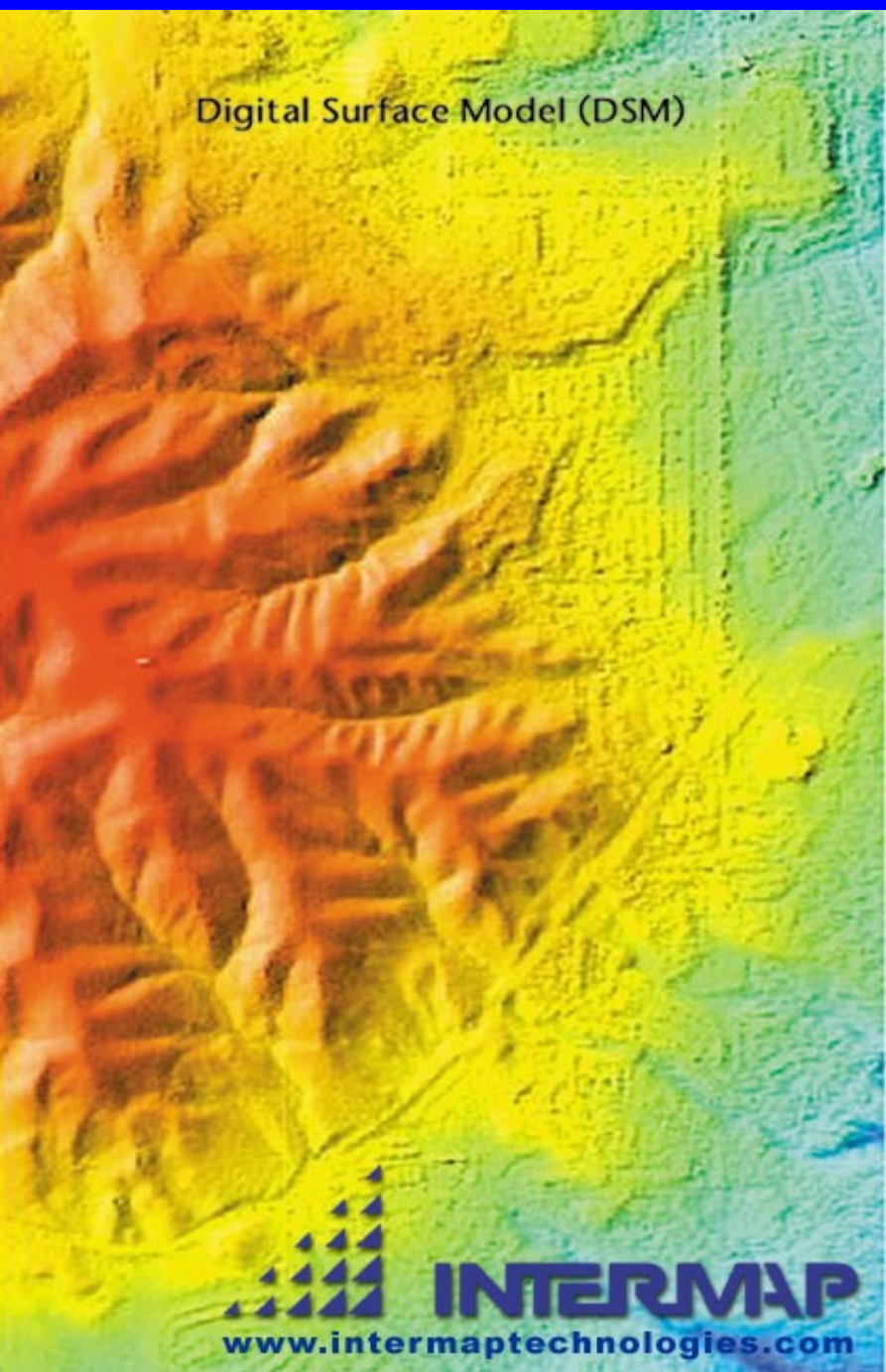
Preles
B. Prawlow

Kaunitz

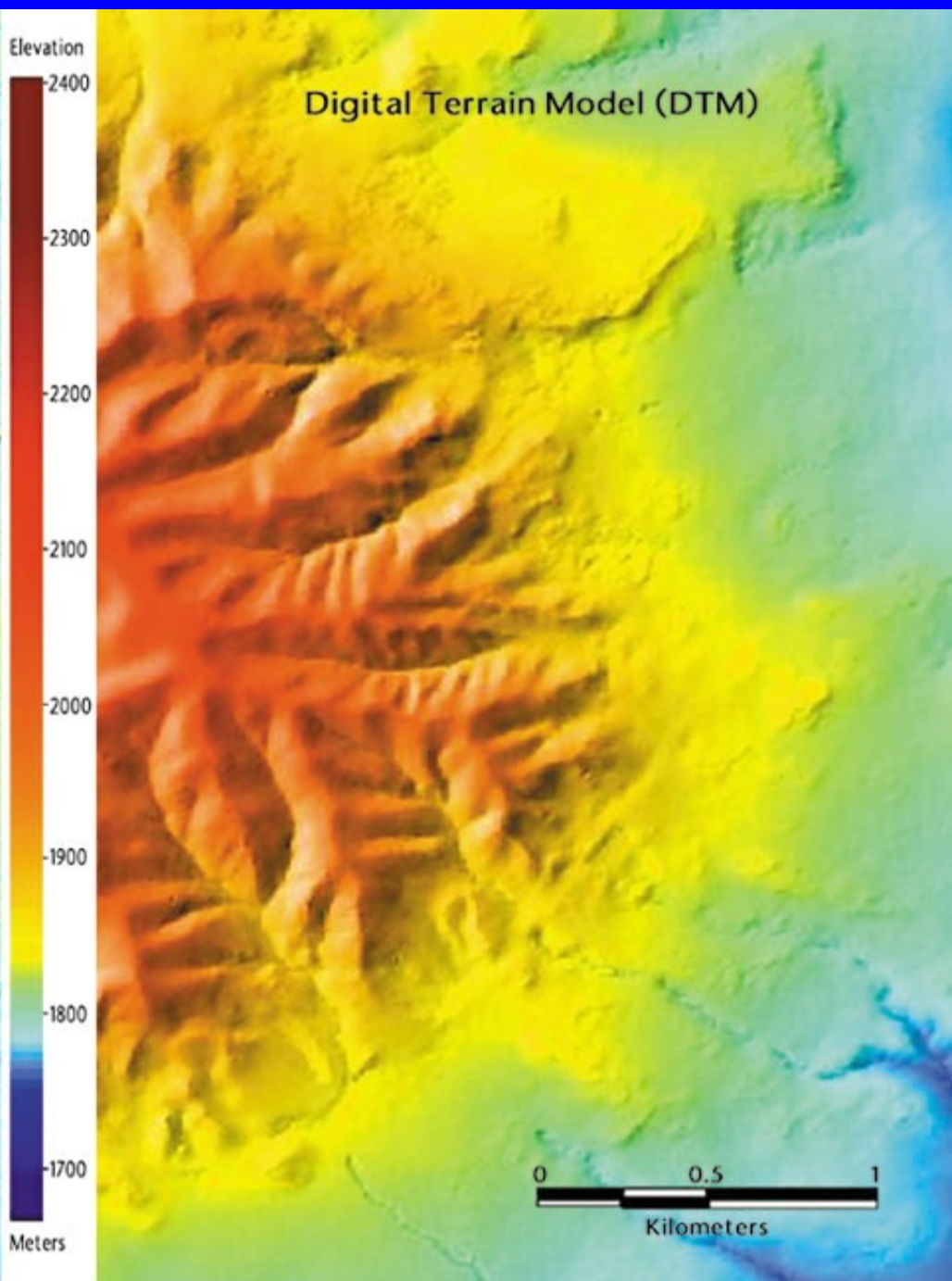
Selowitz
B. Zidlochowitz

Krumlow

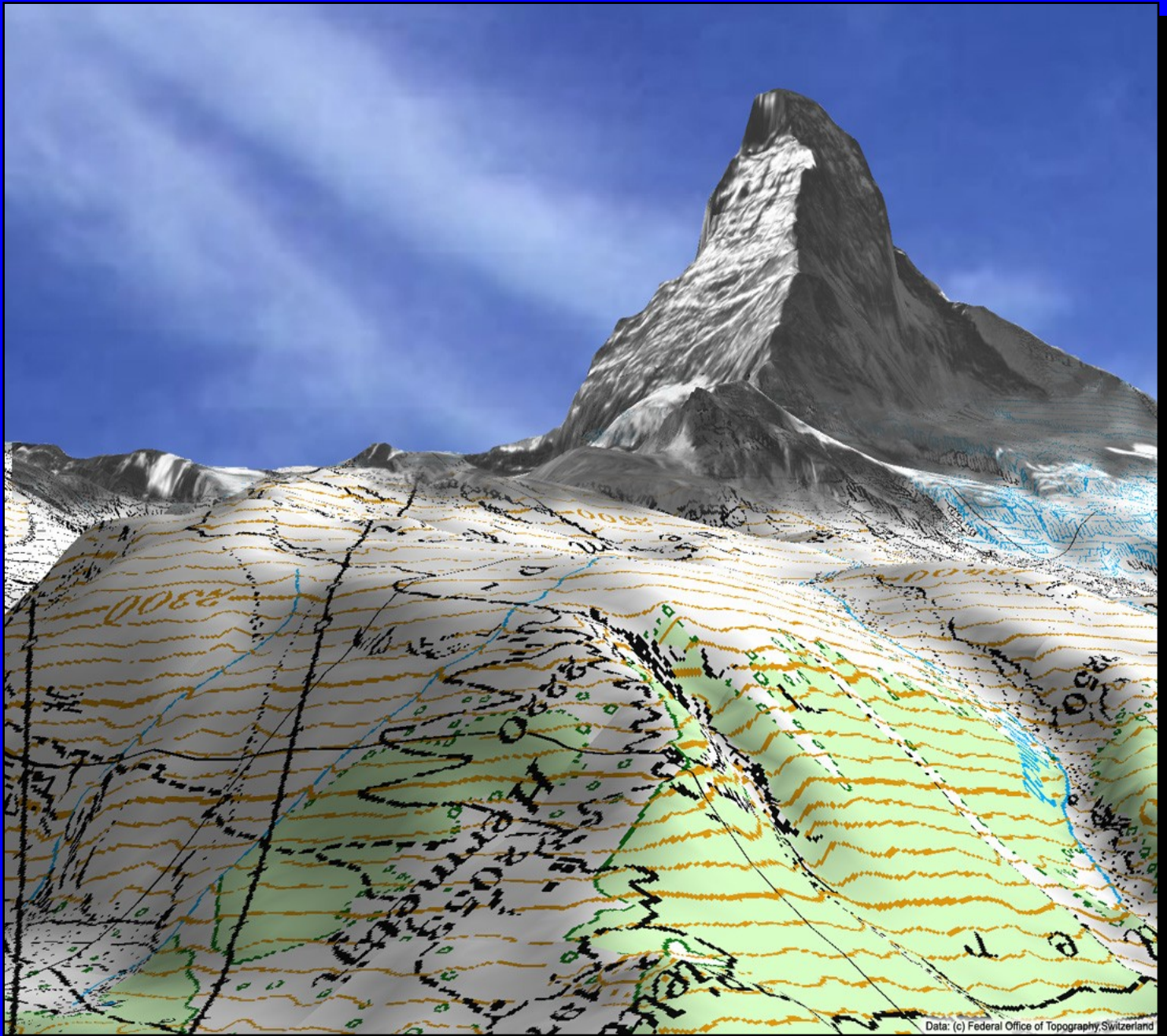
Digital Surface Model (DSM)



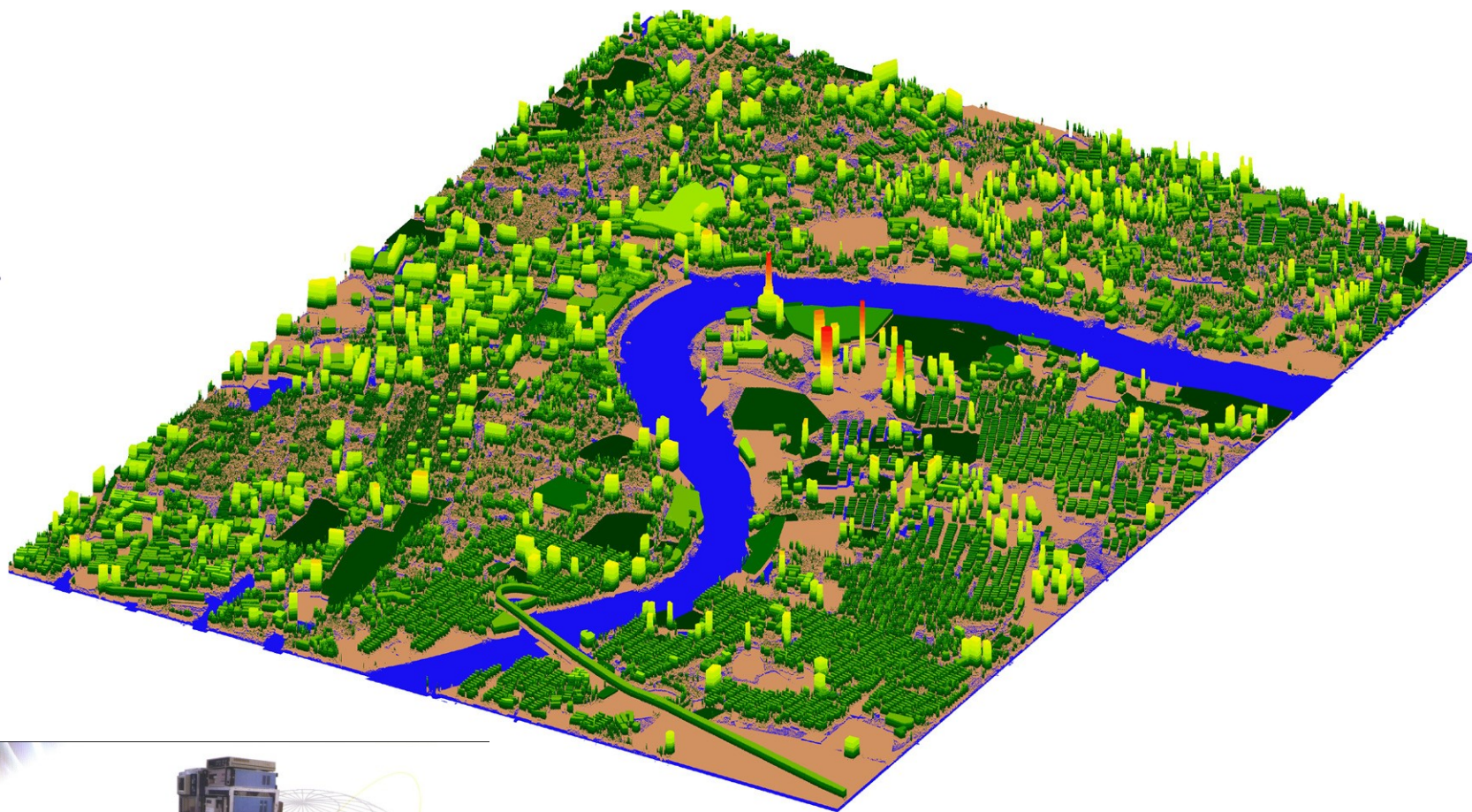
Digital Terrain Model (DTM)



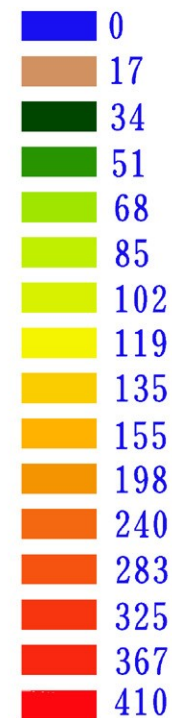
Elevation
-2400
-2300
-2200
-2100
-2000
-1900
-1800
-1700
Meters



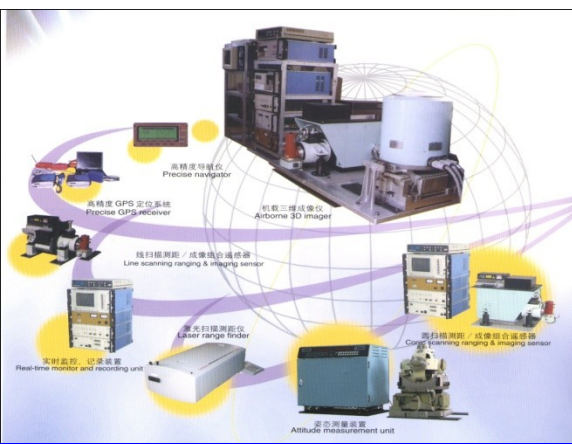
3-D Image of Pudong Area, Shanghai



Height



Unit: m



Elevation Map of Buildings Produced from 3-D Imager

It is *not enough* to build a nice technical infrastructure without teaching the population how to use the maps (analog or digital one).

We have to provide:

-the concepts with which the population is able *to deal* with geospatial information,

-to provide maps from which the population is able *to derive* the information they need: information that is *up-to date and tailor* made for solving the problems.

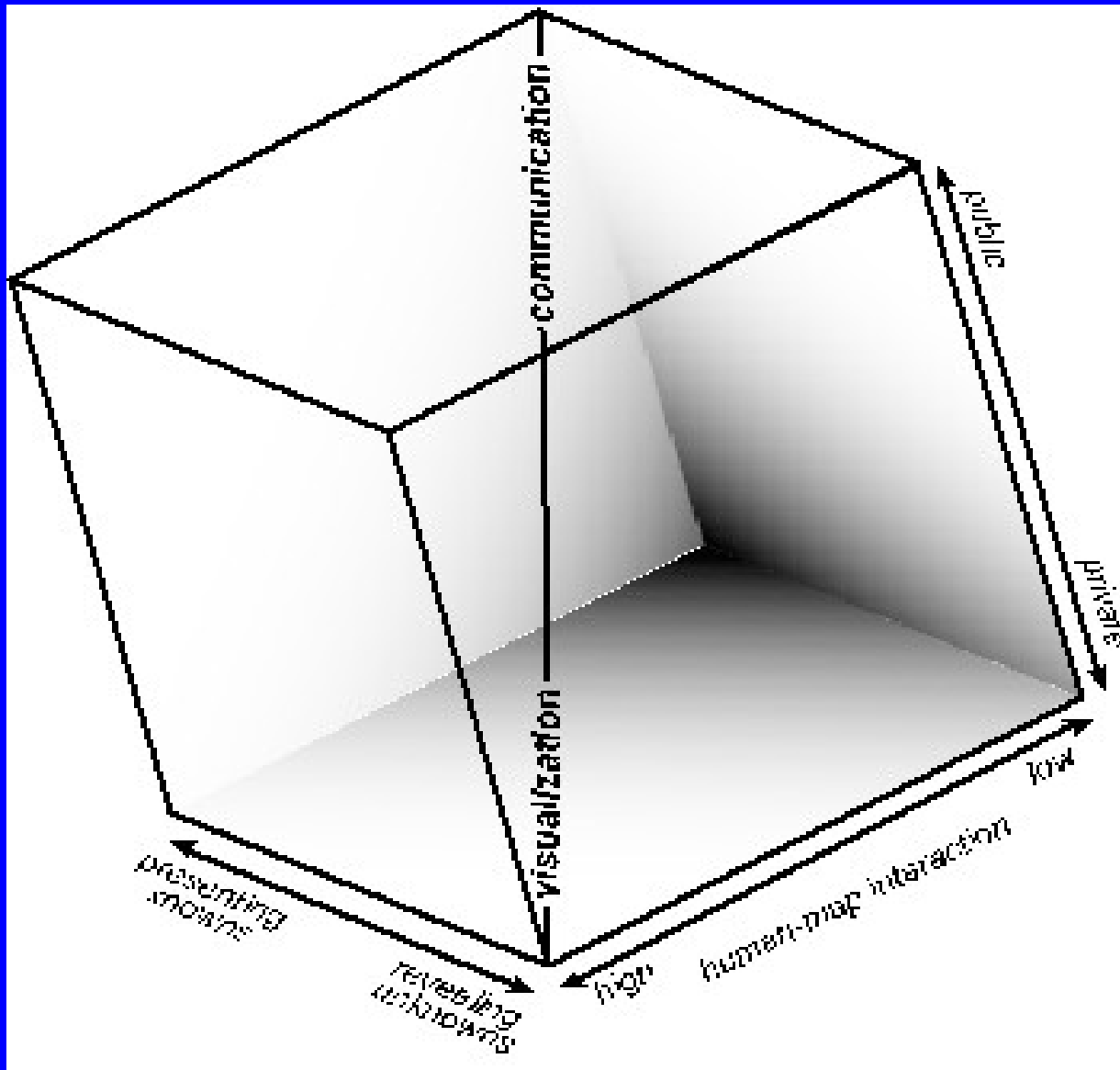
Cartography is originally an instinctive science, which nowadays enters a new, revolutionary period of its development.

In a modern approach, mapping is understood as the ability to create a knowledge frame of an environment in space.

*The creation of maps and the use of maps,
have evolved separately for centuries.*

A new generation of electronic maps and atlases, mainly on the Internet, resulted in the definition of multimedia cartography.

Multimedia, global communication systems, and global publishing offer possibilities for the production of dynamic and interactive visualizations, which utilize mainly virtual environments (developed originally for the computer games industry).



The Map use cube showing four forms of visualization for exploration.
Analysis and Presentation A.M. MacEachren)

Intelligent access to databases and interactive user support can be used not only for the location of suitable maps on the Internet, but also for map creation and modification according to *specific and individual requirements.*

Instead of just *using maps* created by someone else in advance, these new research technologies allow individuals

to use cartography *interactively, on the basis of individual user's requirement*, to study and present spatial information.

Four most dynamic streams

in cartography:

1. Cartographic visualization (ICA Commission on Visualization and Virtual Environments).

2. Ubiquitous mapping

3. Internet maps

4. Map Use

Cyber Cartography???

Geographical Information is going mobile



Differences between GIS and Maps (Morita).

GIS means data input, database building, data analysis and data output for spatial information.

Mapping includes not only map making, but also map use and map communication, as it considers the interaction between map, spatial image and the real world.

GIS is system function oriented, whereas

Map is human-oriented, including spatial cognition, decision making and communication.

Media Flexible

- (1) Topographic Map
- (2) Car Navigation System
- (3) GISystem
- (4) Maps in the Future

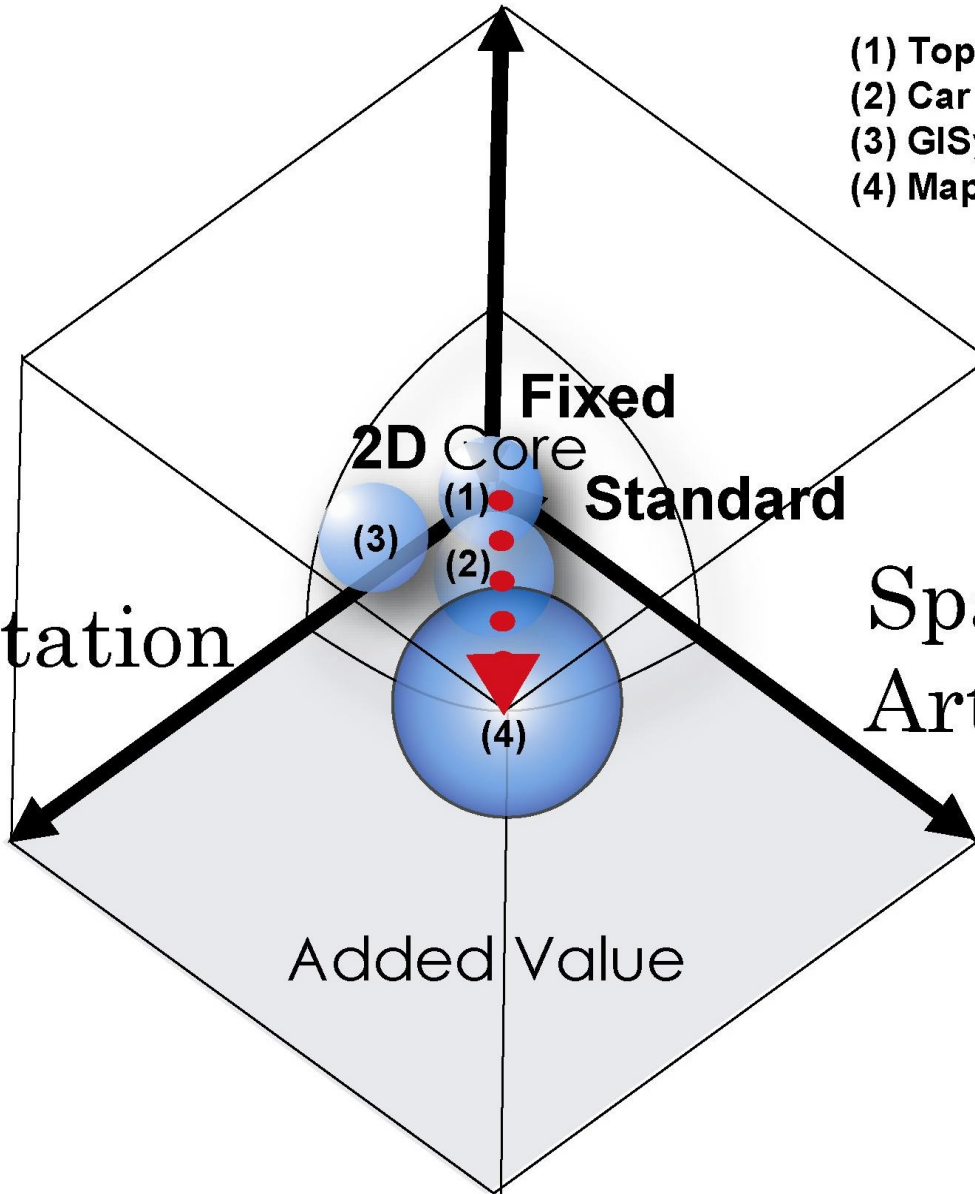
Spatial Representation

Spatial Articulation

Multi-D

Individual

Added Value



Fixed Standard
2D Core

Where SDIs end, cartography begins?

Geographer Ptolemy first developed the idea of atlases: how to subdivide the world into 26 parts, how to portray the world in its entity and in parts. We are still using his ideas of subdividing the world, in parts from north to south and from west to east.

Ortelius Atlas

Mercator Atlas



*Spectandum dedit Ortelius mortalib. orbem,
Orbi spectandum Gallus Ortelium. P. P. P.*



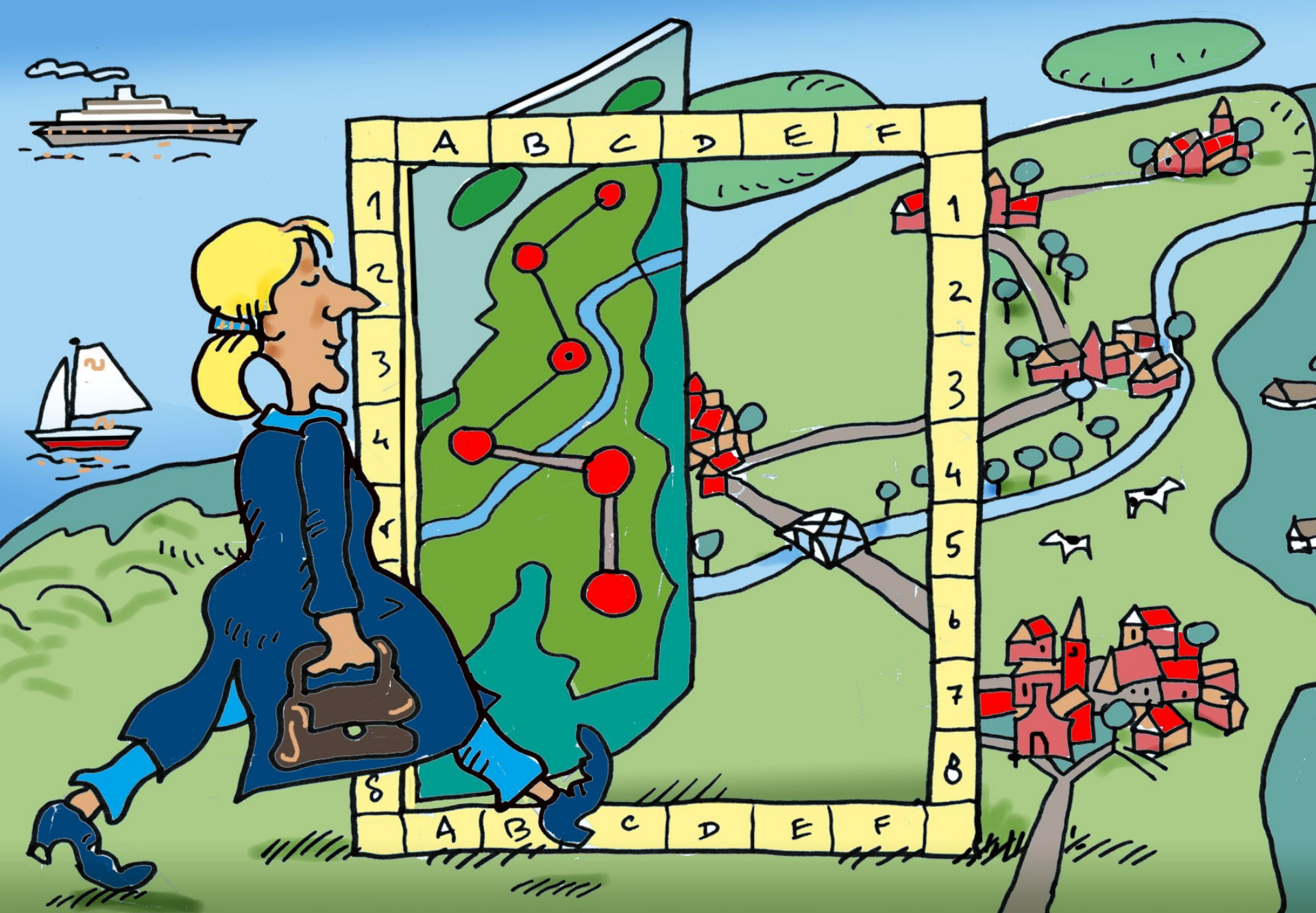
Opus nunc tertio ab ipso Auctore recognitum, multisque locis castigatum, & quamplurimis
nouis Tabulis atque Commentarijs auctum.

We are refining these ideas;

In another geodata revolution, in the 19th century, we used national atlases;

The next geodata revolution at the end of the 20th century led us to digital atlases.

But still we keep these cartographic ideas of making sense of the world.



7. Early Warning, Disaster management and cartography: Nobody is Perfect?

Without guaranteed access (in sensu lato meaning) to the geospatial data and information also

the cartographical ambitions to be part of the game will be hard to reach. So there is much at stake for us cartographers as well.









Praha – Vltava river



PRAHA – capital of Czech Rep.

57 districts

- Area 496 km²
- Amount of Inhabitants 1,16 mil

KOBE - Hyogo Declaration:

it was recognized that a **culture** of disaster prevention and resilience,

and associated pre-disaster strategies, must be fostered at all levels, ranging from the individual to the international levels. Human societies have to live with the risk of hazards posed by nature.

Examples of the atlas concept – atlases as ways of storage of geospatial information we have learned to deal with – are for instance *emergency-atlases*.

Here in the first place atlases allow us access to the area involved, the atlas *opens the door to that area, and allows also people faraway to understand its problems*.

Maps are prepared and elaborated knowledge!!!!

Bill CLINTON, EW III Conference, Bonn,
March 27 urges:

„Risk Reduction Become a Global Priority“

„Hazards are not disasters by definition. Hazards only become disasters when lives and livelihoods are swept away. Making communities safer – by better managing the risks of natural hazards – must become a global priority“.

Clinton continues-1:

We need implementation of well known but under-applied measures to reduce risk.

E.g. encouraging the practice of *Hazard Mapping* to identify areas of extreme vulnerability, better enforcement of uniform building codes to prompt safer construction, the expansion of access to insurance to help survivors recover and education to increase awareness.

Clinton continues-2:

„We know that Early Warning Systems are the keystone to an effective risk reduction strategy....

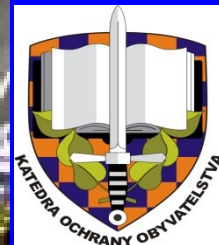
....recognizes the tremendous contribution of scientifically advanced monitoring systems and noted that highly sophisticated technology is meaningless if the signal does not reach a community already informed on how to protect itself once the sirens are heard“



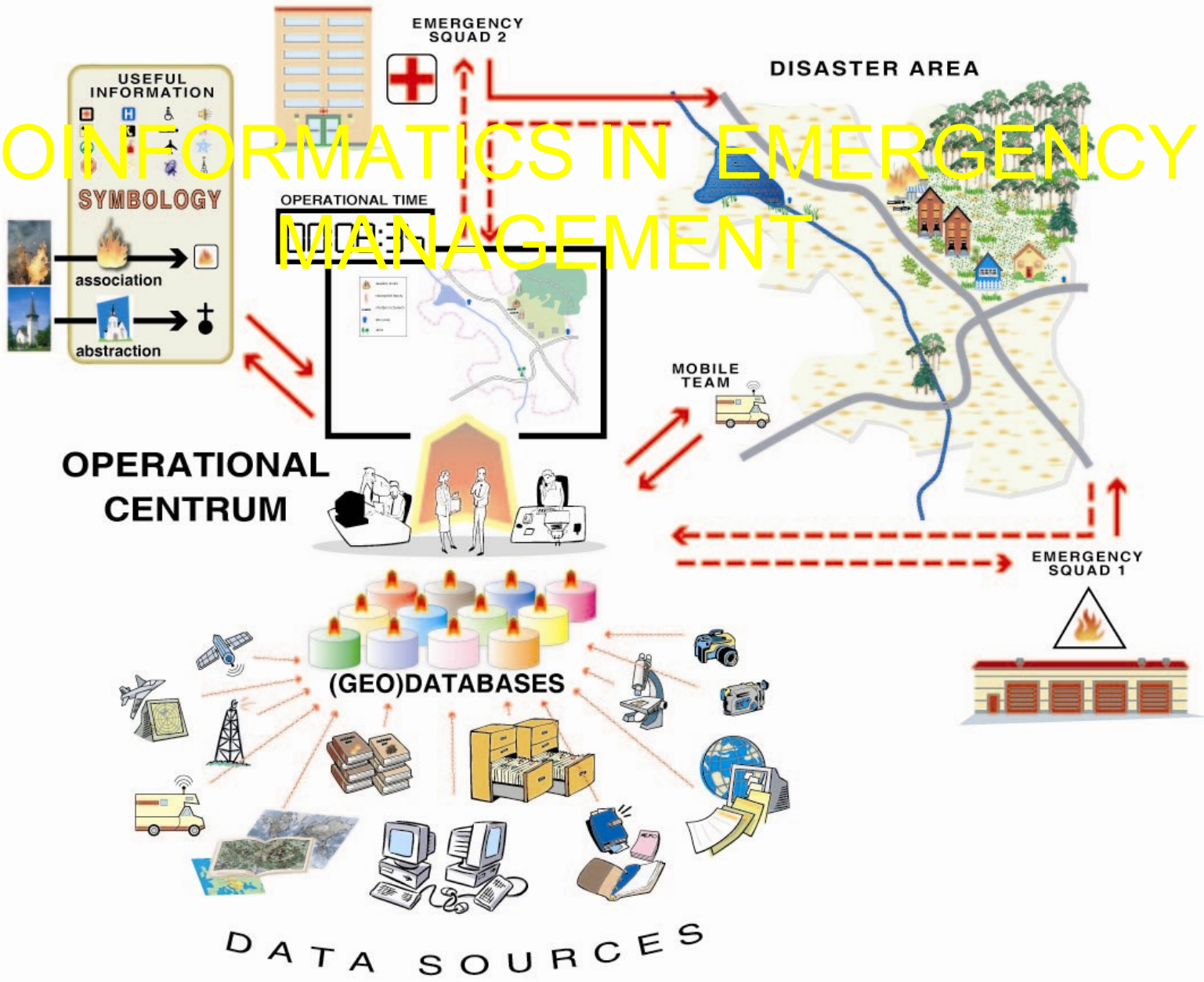
Flooding in Shrewsbury



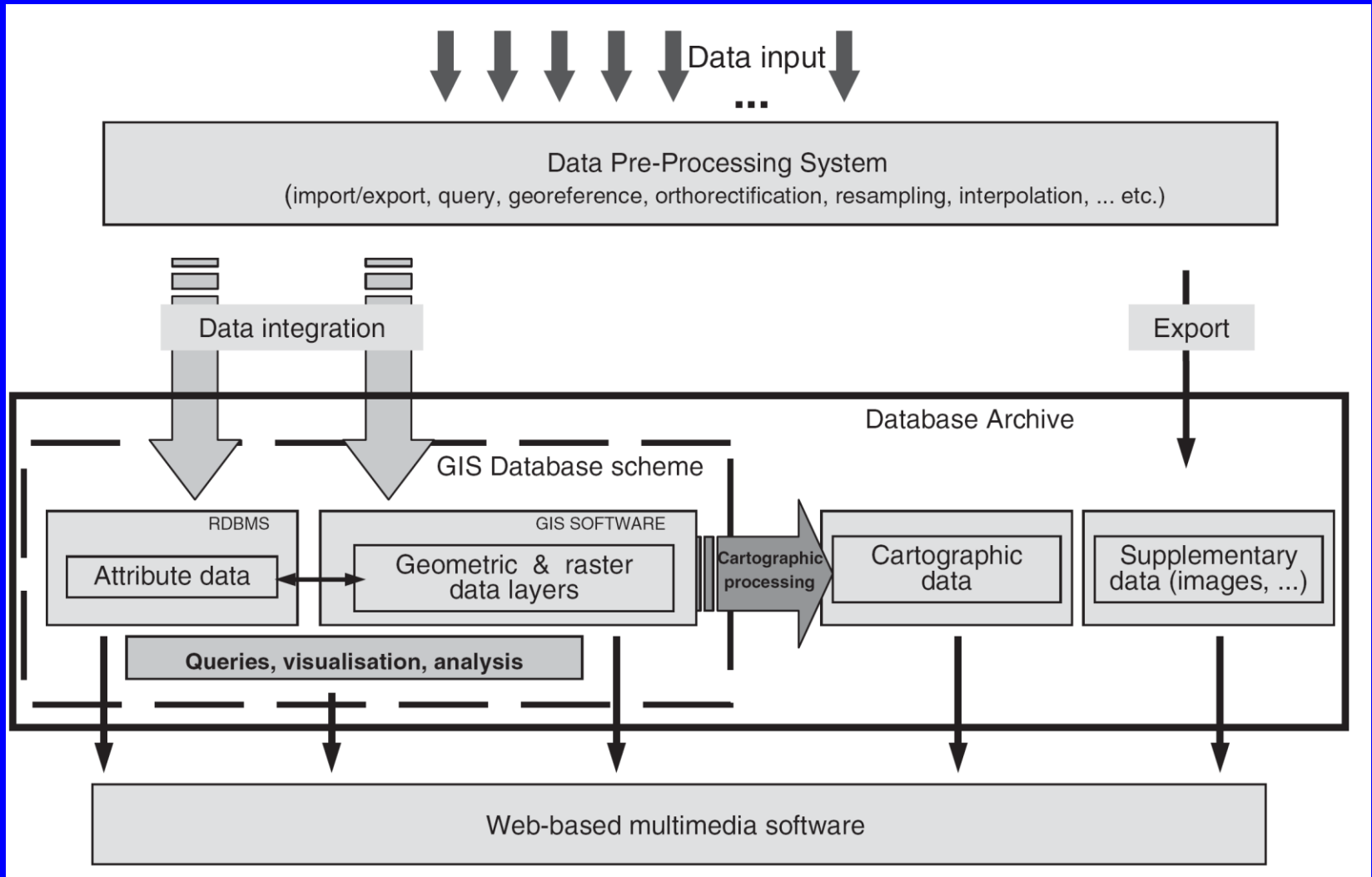




GEOINFORMATICS IN EMERGENCY MANAGEMENT

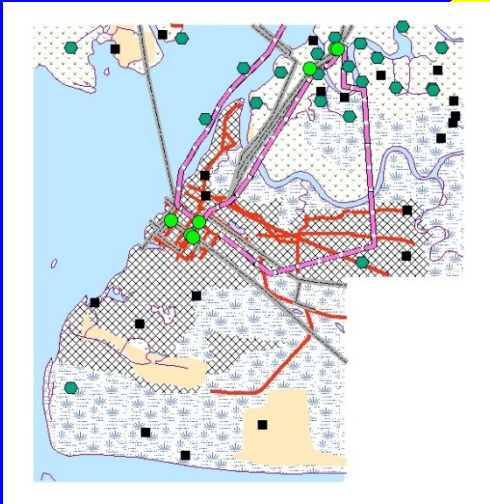


Geowarn - Geospatial Warning Systems

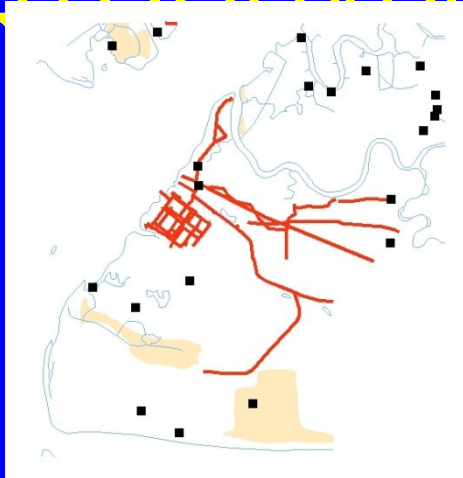


MOBILE AND ADAPTIVE

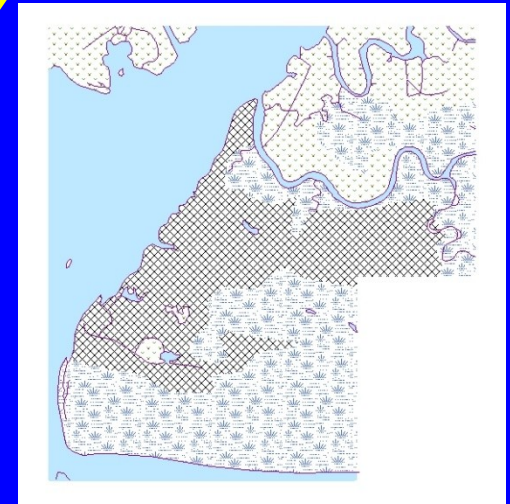
CARTOGRAPHY



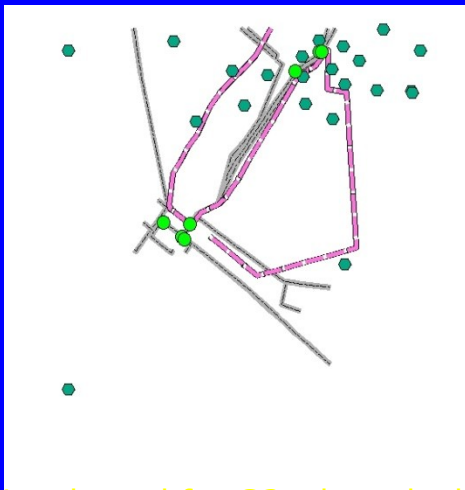
1: no adaptation: full dataset



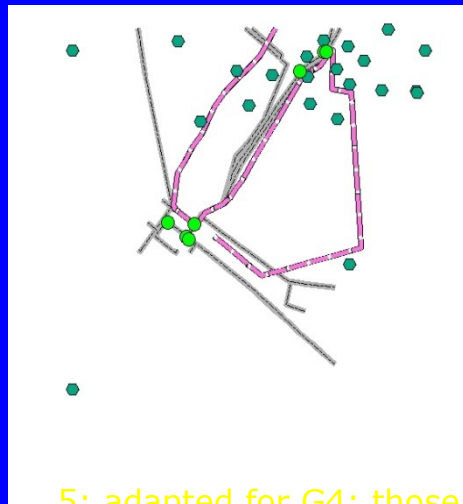
2: adapted for G1: those in charge of human evacuation



3: adapted for G2: those looking to protect biological sites



4: adapted for G3: those looking to recover some of the spilled oil



5: adapted for G4: those in charge of repairing the leak to the oil pipeline

Key

- " communities
 - (oil manifolds
 - % oil wells
 - gas pipeline
 - oil pipeline
 - roads
 - rivers
 - major towns
- inland habitat**
- <all other values>
 - Fresh Water Swamp, 3
 - Mangrove Forest, 4
 - Rainfed Deltaic Forest, 6
 - Urban Areas, 9
 - Water Bodies, 7

MOBILE AND ADAPTIVE CARTOGRAPHY

Cartography in Current Emergency management:

- Analogue maps or static digital sources.
- No real time cartographic support in emergency situation.
- Insufficient cartographic legibility for particular emergency situation.
- Maps for user needed (not user for maps)=personalisation of cartographic output.

MOBILE AND ADAPTIVE CARTOGRAPHY

Adaptability of Cartographic Representation

1. User level—operational units, dispatching units and stakeholders need different scales, themes and map extent, but over the same data.
2. User background—different educational and map use bias.
3. Theme importance – different features in map content and variable significance with changing emergency situation.

MOBILE AND ADAPTIVE CARTOGRAPHY

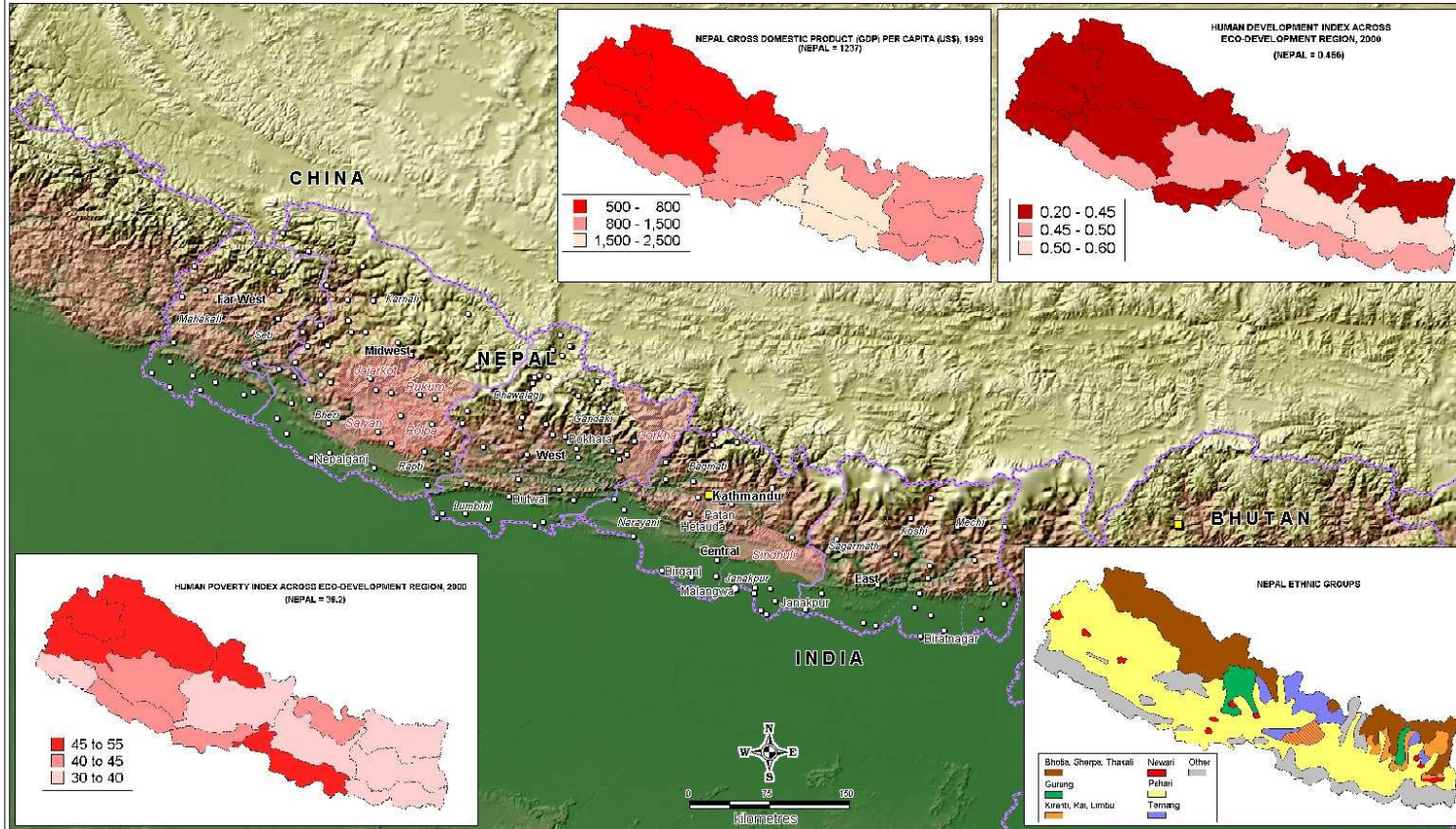
Adaptability of Cartographic Representation

4. New phenomena – new features reflecting the emergency status need to be inserted into map consistently.
5. Interaction device and environment – various electronic visualization devices are used and they are also in interaction with environment which is influencing visibility and amount of information used.

CARTOGRAPHIC AND SCIENTIFIC VISUALIZATION

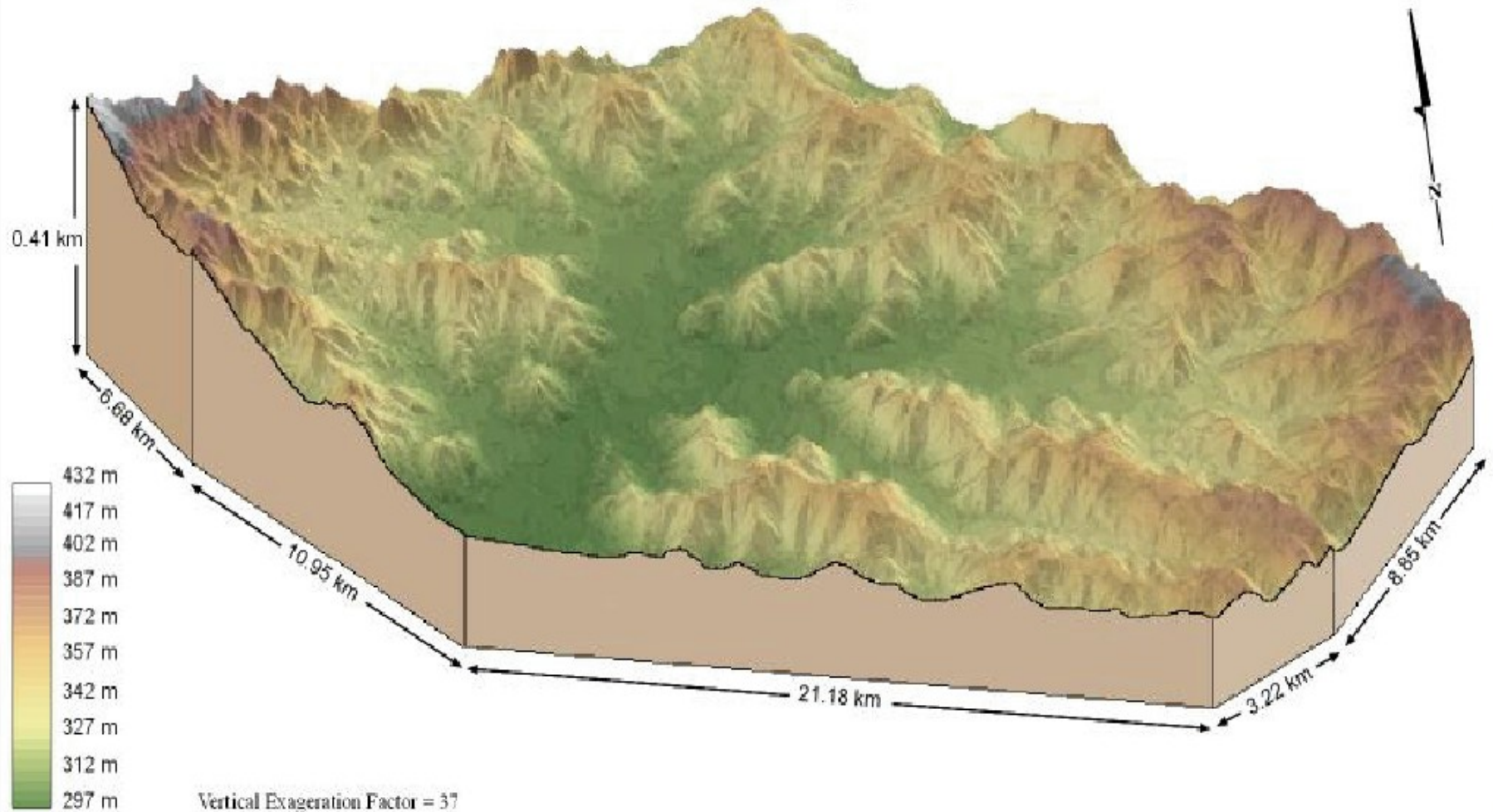
NEPAL

Conflict and poverty

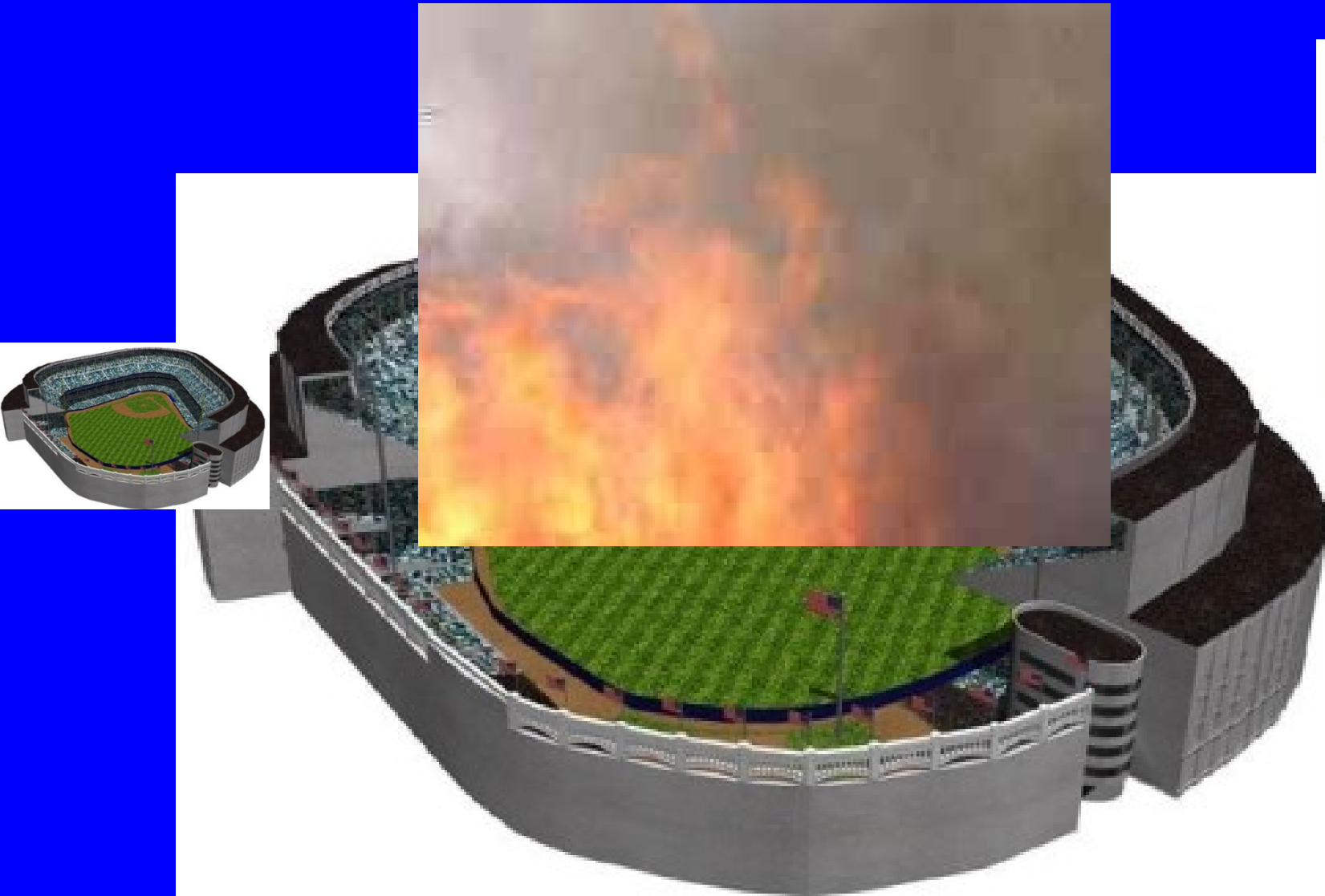
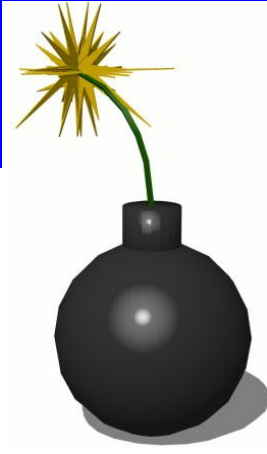


CARTOGRAPHIC AND SCIENTIFIC VISUALIZATION

Lake Toolibin Catchment Digital Elevation Model



Příklady nasazení



Ilustrační foto – mini AVAX





miniAVAX

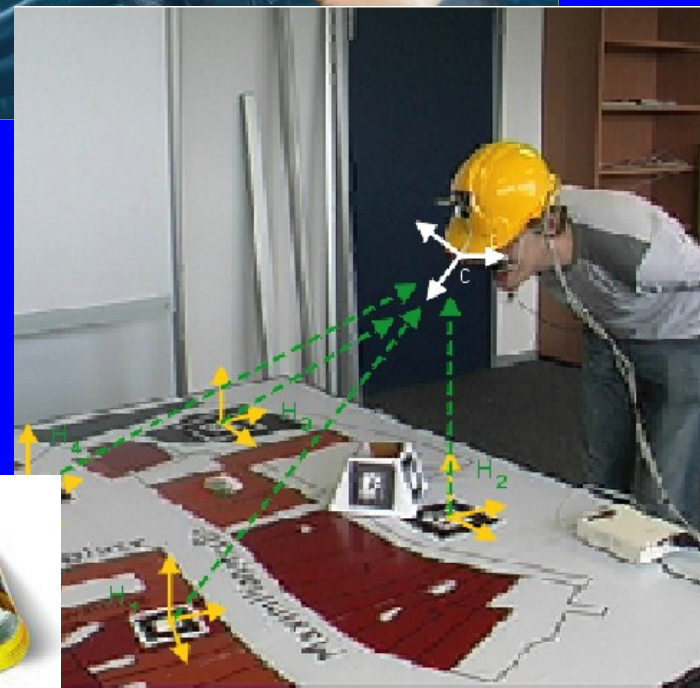
- Monitoring
- Scanning
- Application
- Retranslation



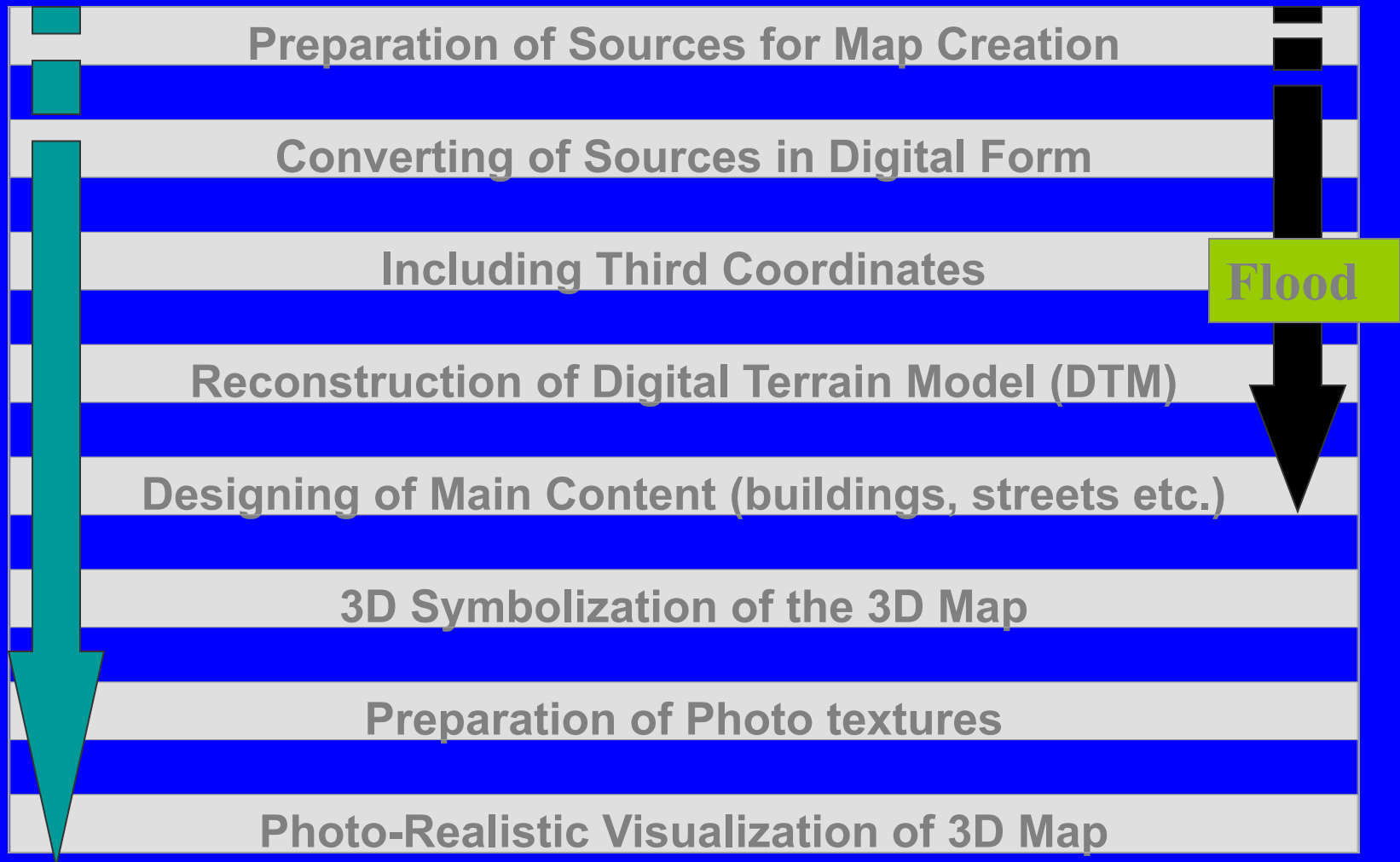
EMOFF
SmartTerminal



MOBILE CARTOGRAPHY DEVICES

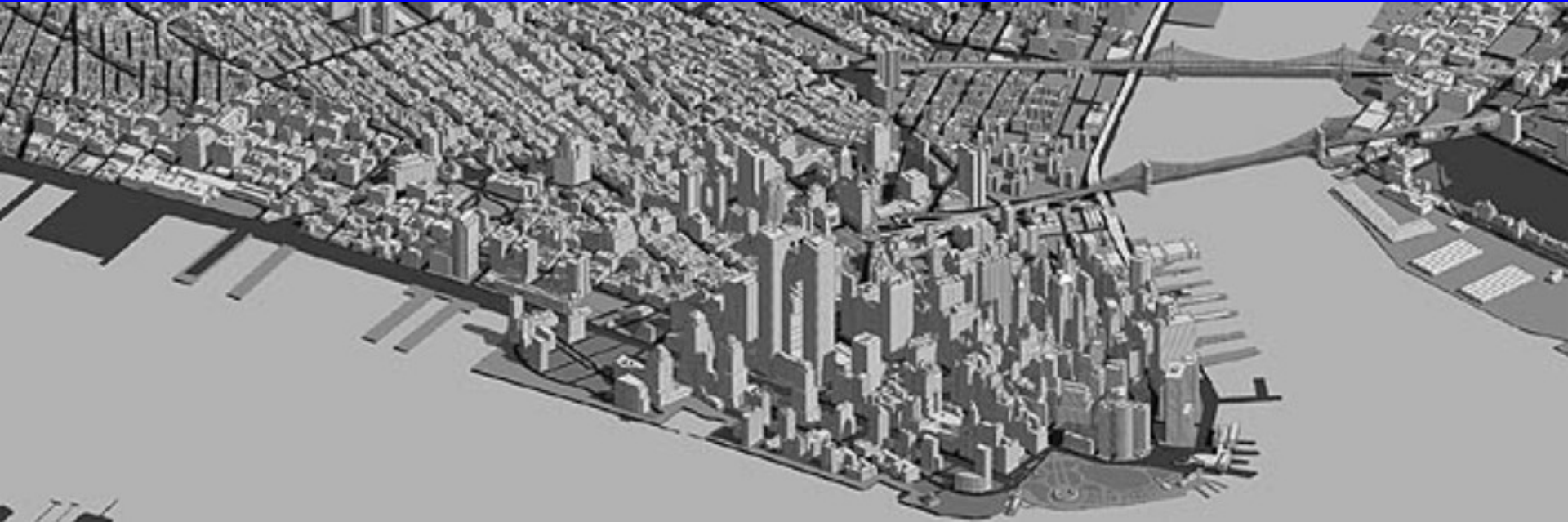


A technology for designing of 3D maps



3D Main content - in flood mapping

- large topographic or landscape objects – relief bodies
 - roads
 - buildings



Secondary content

- traffic signs
- facilities
- transport elements
- information signs
- trees
- geodetic points



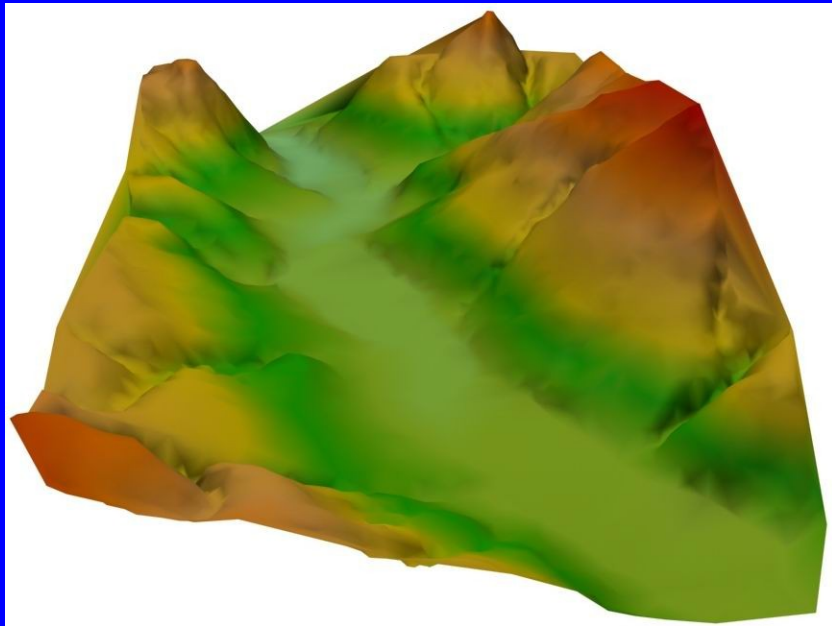
3D map “a street in Vienna”, created by ICG, TU Graz and 3D symbols created by T. Bandrova

Additional content



- **quality and quantity information about objects**
– fence, roof, street, parcel
- **created as a textural database**

Sources for 3D map



- paper topographic or cadastral maps
- photogrammetric or surveying data
- digital 2D map
- topographic information, measurements, architecture drawings etc.
- digital or paper photos
- 3D symbol system

VIEW from OUTSIDE

Kobe:

GSDI potential and the Global Mapping potential are not enough visible, at least in conference documents.

QUESTIONS:

Is it some kind of *ignorance* or simply the fact that *we are insufficiently able to offer our results* in a way which will be a part of the culture of disaster prevention and resilience, and associated pre-disaster strategy (using the words of Hyogo Declaration)?

Are we still *too much concerned with the technological aspects* and not enough with developing approaches towards *people* who needs all of our data for their everyday life, but also need to get them in a form they *can understand*?

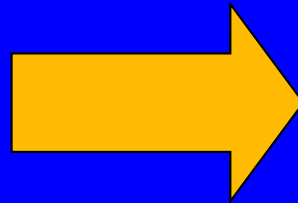
Unfortunately, lessons from recent disaster management show that the decision makers that needed the geospatial information *did not have access to it in time, nor in a form* they were taught to deal with.

What is Expected from us
by our Students and potential
Customers?

5. Geospatial Information & the Knowledge Economy

Contributions

**Geospatial
Information**



**The
Knowledge
Economy**

Contributions of GI to the Knowledge Economy

Criteria Contribution

Knowledge Jobs

High tech employment in remote sensing, mapping and surveying hardware; software development; IT consulting; application development; geospatial data collection; and project/program management.

Globalization

Companies in Europe, North America and Australia are partnering with IT and mapping firms in India, China and elsewhere to take advantage of a highly qualified workforce prepared to work at very competitive rates of pay.

Contributions of GI to the Knowledge Economy

Criteria Contribution

Economic Dynamism and Competition

SDI evolution encourages creation and growth of new high-technology companies:

Stage 1 and Stage 2 -- New hardware, software and data collection firms to support government mapping and data collection projects.

Stage 3 -- Focus shifts to IT consulting firms as interest increases in data maintenance, enterprise GIS; data distribution and interoperable systems.

Stage 4 -- Emphasis on applications development, specializ. data collection, LB services.

Contributions of GI to the Knowledge Economy

Criteria Contribution

Transformation to a Digital Economy

Real property information component now driving applications in **E-Government**.

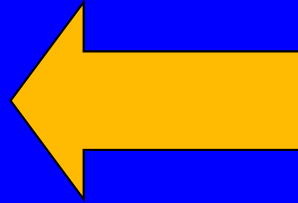
Data related to address-matched road networks driving applications in **Location-Based Services and E-Commerce**.

Technological Innovation Capacity

New capital investments and returns from intellectual property tend to be focused on geospatial firms involved in hardware / software development, location-based services, and situations where the firm has a monopoly on management and distribution of key datasets.

Contributions

**Geospatial
Information**



**The
Knowledge
Economy**

Generation Title	Born between...	Characteristic	Comments
GI Generation	1901 - 1924	Civic	Responded to social crisis (WW2); Focussed on common good, community, and “rebuilding the world”.
Silent Generation	1925 - 1942	Adaptive	Flexible; sensitive to diversity (told by parents during WW2 ‘Stay out of the way, we’re busy’).
Baby-Boomers	1943 - 1960	Idealistic	Spiritual awakening; Beginnings of global awareness; Aiming to ‘carry things forward’
Generation X	1961 - 1981	Reactive	Cynical, pragmatic, questioning
Millennials	1981 - 2000?	Civic	Optimistic, success-oriented, conservative

- from work by Neil Howe and William Strauss

The “Millennial Students” now moving into the Workplace

- Based on the research of Neil Howe and William Strauss.
- Newest books –*Millennials Rising – the Next Great Generation* and *Millennials Go to College: Strategies for a New Generation on Campus*
- *“The Millennials say they want to use technology. They want to use the web as a means to access information and one another. They want to work on solving problems that matter and they want to do this in collaborative teams.”*

Implications to Future Geospatial Services?

Must be...

- Quick
- Anonymous
- Authoritative
- Delivered “Just-in-Time” (“Use it and lose it”)
- Easy to share on-line with friends and colleagues.

Geospatial Information & the Knowledge Economy

- Are current SDI services oriented to continue affecting Knowledge Economy Indicators?
- Will the “look and feel” of SDI services change as expectations of Millennial Generation begin to dominate the market?
- What indicators will determine the success or failure of SDI over the next 10 years?
- Roles of Government as SDI evolves?

NATURE again....:

AN EXPANDING MARKET

All indications are that the US\$5-billion worldwide geospatial market will grow to \$30 billion by 2005 - a dramatic increase that is sure to create new jobs.

NASA says that 26% of its most highly trained geotech staff are due to retire in the next decade, and the National Imagery and Mapping Agency is expected to need 7,000 people trained in GIS in the next three years.

Next ICC

Moscow 2007

Next after Next

Chile 2009



XXIII International Cartographic Conference

4-10 August Moscow 2007, Russia

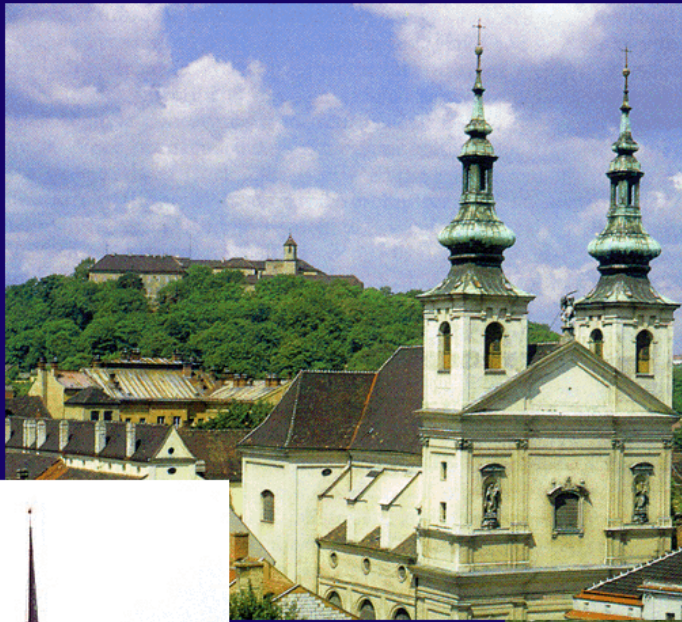
Cartography for everyone and for you

PRAGUE





BRNO





PALAVA

**UNESCO
BIOSPHERE
RESERVE**



Obrigado

SHUKRAN

Aligator

Xie, Xie

THANK YOU

VERY

MUCH !!!!!

DĚKUJI (in Czech)