

MAPPING STANDARDS PRINCIPLES AND PROPOSALS FOR DISASTER MANAGEMENT

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Introduction

- The method of visualization:
users receive clear perception of their characters,
volume and size, and conditions.
- Cartography is offering new types of maps based
on spatial databases.
- Today we are talking about ubiquitous mapping,
mapping for everywhere, every time and
everything.

Introduction

INTERNATIONAL CARTOGRAPHIC ASSOCIATION CARTOGRAPHY AND GEOINFORMATICS FOR EARLY WARNING

MOBILE AND ADAPTIVE CARTOGRAPHY

Mobile and adaptive cartography is a new paradigm in cartography. It is based on the use of mobile devices and adaptive maps that can be customized to the user's needs and the environment. This approach allows for the creation of maps that are more useful and more accessible to a wider range of users.



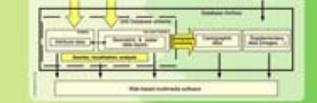
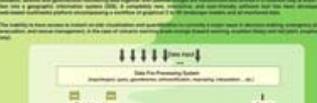
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CARTOGRAPHIC AND SCIENTIFIC VISUALIZATION



SPATIAL DATA SERVICES

Geowarn - Geospatial Warning Systems



CARTOGRAPHIC DATA SOURCES

Cartographic data sources are the various sources of data used to create maps. These sources include satellite imagery, aerial photography, and ground-based surveys. Each source has its own strengths and weaknesses, and the choice of source depends on the specific needs of the map.



- Improvement of maps created by newest information and communication technologies as a “channel of information” for decision makers but as well as inhabitants

- Poster presentation for the United Nations EW III



Definitions of natural risks and disasters

- *Natural hazards*
- *Risk = Hazards x Vulnerability*
- *Disaster*

Definitions of natural risks and disasters

- Why do cartographers need these definitions?
 - multi-aspects of mapping objects, phenomena, processes and their results;
 - in the definitions natural hazards are classified, - all kinds of disasters are shown as well as their influence on human society;
 - reasons and characteristics of mapping features.
- Cartographers' tasks are their classification, modeling and visualization if appropriate data is available. These tasks would be much less difficult if there were some standards.

Visualization

- In adaptable cartography we have to take into account variability of extent of displayed area related to differences in displays of used equipment (e.g. PDA vs. 19" LCD monitor).
- Related to extent is **scale**, transformed to the term **level of detail**.
- ***The aim is to adjust map to the user's cognitive abilities and shorten time necessary to extract required information from the map.***

3D Map



ACTIVITY

- solved problem
- spatial extent
- importance of events

USER

- education
- experience
- culture
- preferences

Content
Level of details
Symbols

TECHNOLOGY

- data usage
- transfer speed
- level of interactivness

SITUATION

- place
- time
- orientation
- natural conditions

Role of cartography in crisis management

- Many questions asked during management of a crisis situation begin with the word
 - **WHERE** – **WHERE** did something happen,
 - **WHERE** are the rescue units,
 - **WHERE** are the sources of danger,
 - **WHERE** should the threatened people be relocated, etc.

It is clear, that an answer to these questions is a map. The role of cartography in crisis management is therefore clear – **simplify and well-arrange required spatial data**. That makes the decision-making process quicker and better and leads to minimization of damage.

Natural risks and disasters represented in the maps

- Natural risks and disasters are presented on maps using different kinds of visualization. They are represented also on maps in different scales and territories from maps of the world to the largest-scaled maps of cities and municipal districts.

Classification

- To be mapped, the all phenomena, processes and objects of interest should be classified.
- “definitions and categorization of disasters vary according to geosectors, the geographical and social settings in which they are located” [Parasuraman S., Unnikrishnan P., 2006]:
 - two categories: **major** (earthquake, flood, drought, cyclone) and
 - **minor** (heat wave, cold wave, landslide, avalanche, tornadoes hailstorm).
- Other authors give classification of disasters as:
 1. **Natural**, 2. **Fire**, 3. **Water** 4. **Animate creatures**

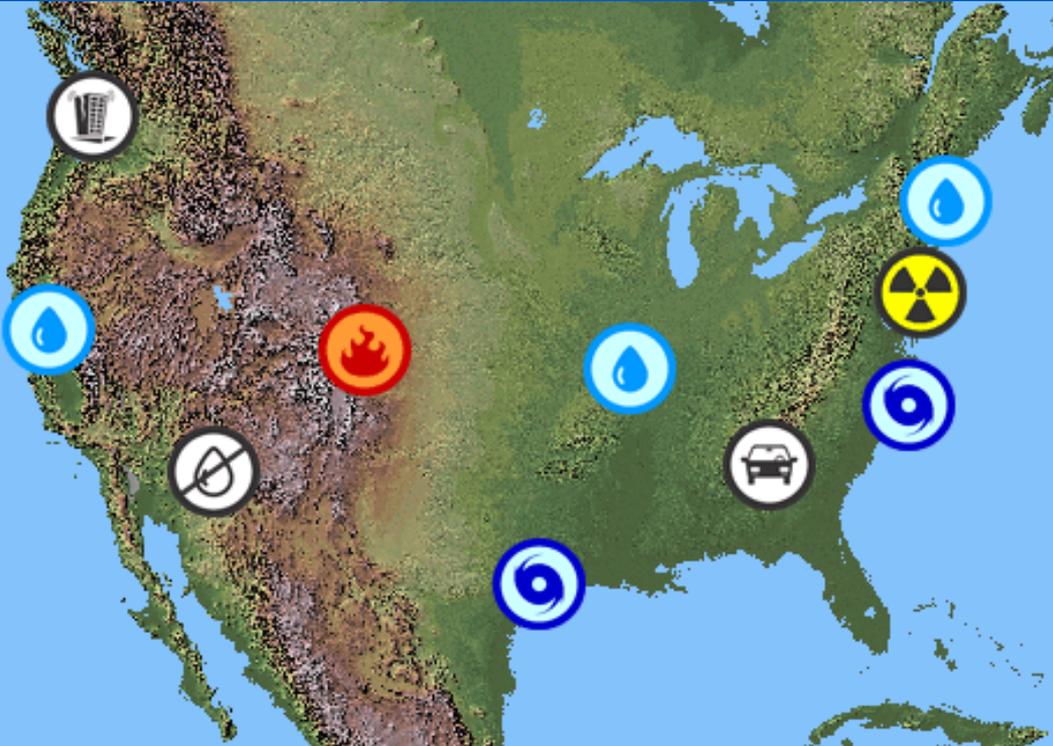
Natural hazards and risks	Disasters	Characteristics
1000. Geological	1010. earthquake, 1020. volcanic eruption, 1030. landslide, 1040. erosion	1011 magnitude, 1012 structure location, 1013 date, 1014 built area 1015 construction
2000. Hydrometeorological	2010. landslide, 2020. erosion, 2030. hurricane, 2040. tornado, 2050. storm, 2060. flood, 2070. high water, 2080. wind-driven water, 2090. tidal wave, 2100. drought, 2110. hailstorm 2120. blizzard, 2130. avalanche, 2140. wild-land fire	<i>intensity, frequency, duration, area of extent, speed of onset, spatial dispersion and temporal spacing</i>
3000. Biological and social	3010. famine, 3020. pestilence, 3030. fire, 3040. oil spills, 3050. explosion, 3060. building collapse, 3070. transportation wreck, 3080. erosion	<i>intensity, frequency, duration, area of extent, speed of onset, spatial dispersion and temporal spacing</i>

Mapping



- We can find many maps in the theme “natural hazards, risks and disasters”.
- From cartographic point of view, there are no standards and no order in object and phenomena visualization.

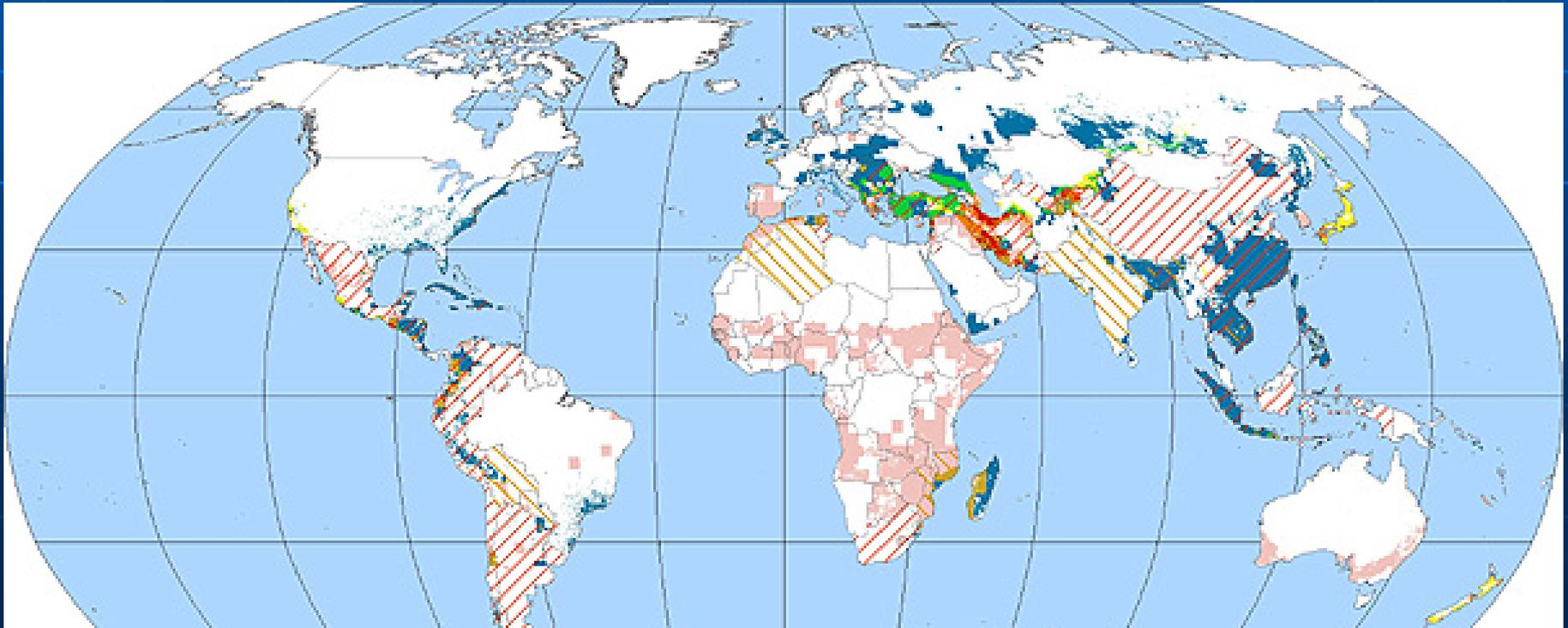
Mapping



- The cartographers used point (pictorial), line and area symbols.
- The color systems are also different.
- The users could direct attention to map legend and understand the map contents.

Mapping

- But if we use the same presentation for visualization of these phenomena on mobile or computer screen in a critical situation, it will be very difficult to direct user's attention to legend.
- Because of this we need standardization of visualization: colors, symbol system and cartographic way of presentations.



Symbol system

- The utilization and standardization of a symbol system for mapping natural hazards, risks and disasters requires a detailed research on the international level.
- It could be started by classification of represented objects and phenomena and clarification of the color system presentation.
- Many authors and organization propose standards for symbols systems representing natural hazards and risk processes, as well as disasters. All of them are represented as national standards or they are active in different branches of science and practice.

Safety Symbols



DISPOSAL ALERT

This symbol appears when care must be taken to dispose of materials properly.



ANIMAL SAFETY

This symbol appears whenever live animals are studied and the safety of the animals and the students must be ensured.



BIOLOGICAL HAZARD

This symbol appears when there is danger involving bacteria, fungi, or protists.



RADIOACTIVE SAFETY

This symbol appears when radioactive materials are used.



OPEN FLAME ALERT

This symbol appears when use of an open flame could cause a fire or an explosion.



CLOTHING PROTECTION SAFETY

This symbol appears when substances used could stain or burn clothing.



THERMAL SAFETY

This symbol appears as a reminder to use caution when handling hot objects.



FIRE SAFETY

This symbol appears when care should be taken around open flames.



SHARP OBJECT SAFETY

This symbol appears when a danger of cuts or punctures caused by the use of sharp objects exists.



EXPLOSION SAFETY

This symbol appears when the misuse of chemicals could cause an explosion.



FUME SAFETY

This symbol appears when chemicals or chemical reactions could cause dangerous fumes.



EYE SAFETY

This symbol appears when a danger to the eyes exists. Safety goggles should be worn when this symbol appears.



ELECTRICAL SAFETY

This symbol appears when care should be taken when using electrical equipment.



POISON SAFETY

This symbol appears when poisonous substances are used.



PLANT SAFETY

This symbol appears when poisonous plants or plants with thorns are handled.



CHEMICAL SAFETY

This symbol appears when chemicals used can cause burns or are poisonous if absorbed through the skin.

Symbol system

This symbol system has very wide explanations in the legend.

Symbol system

Damage Operational Symbology Reference

Use this page to cross-reference the Damage Operational symbols with their definitions.

Symbol Types	Symbols	Symbol Terms and Definitions
1.) Incident (No Levels)		Incident (No Levels) - Not Applicable
2.) Natural Event (No Levels)		Natural Event (No Levels) - Not Applicable
3.) Operation (Level 1)		Operation (Level 1) - Fully operational/open.
4.) Operation (Level 2)		Operation (Level 2) - Operational, but filled to capacity or otherwise closed.
5.) Operation (Level 3)		Operation (Level 3) - Operational, but partially damaged or partially incapacitated.
6.) Operation (Level 4)		Operation (Level 4) - Destroyed or Totally incapacitated.
7.) Infrastructure (Level 1)		Infrastructure (Level 1) - Fully operational/open.
8.) Infrastructure (Level 2)		Infrastructure (Level 2) - Operational, but filled to capacity or otherwise closed.
9.) Infrastructure (Level 3)		Infrastructure (Level 3) - Operational, but partially damaged or partially incapacitated.
10.) Infrastructure (Level 4)		Infrastructure (Level 4) - Destroyed or Totally incapacitated.

It is specialized for emergency situations.

Symbol system

Emergency Facilities - 1

Facilities	Signet Signal Symbol	GIS Unit EM	ESRI Forestry	Clickart	Zapf Dingbats	Japan: Pictogram	Symbol Source Book	O '72	SP
Medical									

Facilities	Nova Scotia	NPS	O '64	O '68	Pg	Port	S/TA	TC	UIC	WO '72	X '67	X '70
Medical												

Facilities	Military	METT- TC	Cameo	EMIS OES	Dingbats	ADV	ATA	BAA	D/FW	D.O.T. '74	European Road	IATA	ICAO
Medical													

Proposal for symbol system standards in hazards mapping
 ([<http://science.valleyheights.org/safety.jpg>], by Dymon, Ute J.

Symbol system

- The cartographic symbols should have clear and short definition to be used in a map legend.
- The next very important characteristic of them is to be situated on a map and the last one is that they should give quality and quantity information about represented object, phenomena or process to users.

Symbol system

The symbols should be created to comply with the following conditions:

- easy for reading and understandable;
- simple graphic construction;
- association with presented phenomenon, process, object;
- color system presentation in CMYK or RGB
- independence on software system.

Symbol system

Symbols should

- cross cultural barriers as much as possible;
- relate to each other in a hierarchical or tiered structure;
- be based on common cartographic standards and perceptual research;
- display effectively in both low- and high-resolution computer displays.

Symbol system

Such designed symbol system, conforming to all mentioned rules and requirements, should also correspond to mapped area, scale, map dimensions and way of visualization, as well as user's requirements.

Colors

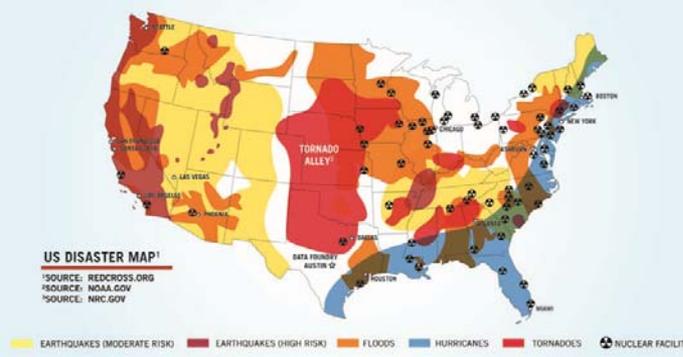
- Color standardization could be defined using computer definitions of colors for paper presentations in **CMYK** color system and for screen presentation in **RGB** color system.

Colors

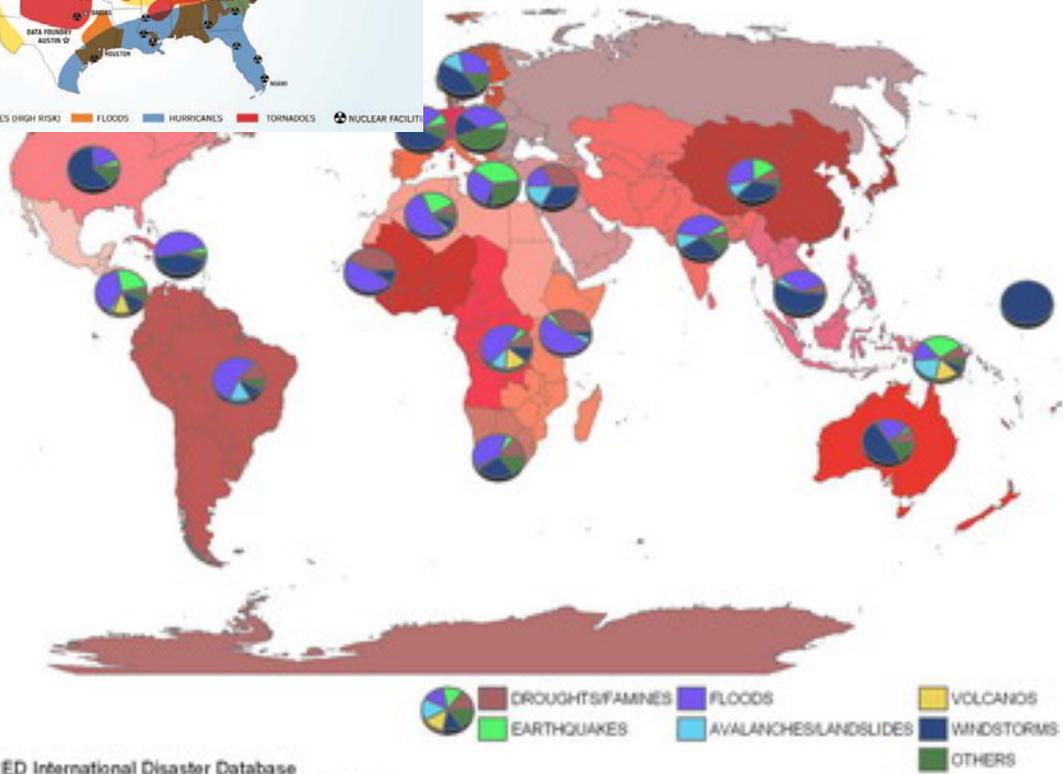
Emergency	Type of Alarm levels
Green	No alarm
Yellow	Vigilance
Orange	Pre-Alarm
Red	Alarm

Colors/Color systems	RGB – screen	CMYK – paper
Green	R = 0 G = 153 B = 61	C = 90 M = 0 Y = 100 K = 0
Yellow	R = 255 G = 245 B = 30	C = 0 M = 0 Y = 100 K = 0
Orange	R = 231 G = 120 B = 23	C = 0 M = 60 Y = 100 K = 0
Red	R = 218 G = 37 B = 29	C = 0 M = 100 Y = 90 K = 0

- Working with paper and screen visualized cartographic products we could propose the standard colors. They are defined in the Table.
- Using the same logic in color presentation we could define color presentation of different main disasters for map of the world or some region.



United Nations Sub-Regions:
2003



EM-DAT: THE OFDA/CRED International Disaster Database
www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium

the main disasters (draughts, earthquakes, floods, volcanoes, windstorms, avalanches and others) are mapped on a map of the world.

They are summarized for Sub-Regions, defined by the UN.

The same diagrams can show situations in the world or regions by country or in a country by districts.

Disasters/ Color systems	RGB - screen			CMYK - paper			
draught	R = 255	G = 250	B = 60	C = 0	M = 0	Y = 80	K = 0
earthquake	R = 0	G = 155	B = 80	C = 90	M = 0	Y = 90	K = 0
flood	R = 90	G = 90	B = 160	C = 70	M = 70	Y = 0	K = 0
volcano	R = 220	G = 35	B = 45	C = 0	M = 100	Y = 90	K = 0
windstorm	R = 35	G = 41	B = 122	C = 100	M = 90	Y = 0	K = 0
avalanche	R = 0	G = 125	B = 195	C = 100	M = 20	Y = 0	K = 0
draught - area	R = 255	G = 250	B = 150	C = 0	M = 0	Y = 40	K = 0
earthquake – area	R = 100	G = 185	B = 95	C = 50	M = 0	Y = 80	K = 0
flood – area	R = 140	G = 130	B = 180	C = 40	M = 40	Y = 0	K = 0
volcano- area	R = 230	G = 110	B = 105	C = 0	M = 65	Y = 50	K = 0
windstorm – area	R = 160	G = 170	B = 200	C = 30	M = 20	Y = 0	K = 0
avalanche – area	R = 90	G = 190	B = 240	C = 50	M = 0	Y = 0	K = 0

Standardization in coloring for symbol systems and maps is a long process and it could continue in many directions.

The work here is only a first step and shows the way of the process.

Every color system could be improved to be more clear and readable for users. The human vision also could be researched in the direction of how people react of different colors in emergency situations.

Conclusion remarks and directions for future work

- The tasks of all organizations caring for natural risks and disasters are to reduce them and – when they occur – ensure safety of human lives.
- The ICA and many cartographers work in this field of mapping phenomena connected with natural risks and disasters. The way for data capture, collection, classification and visualization is proposed and many different ways for management with cartographic presented data are known.

Conclusion remarks and directions for future work

- All efforts could be direct to the international standardization process: it could be started from data standards in some aspects:
 - data classification;
 - data content;
 - **data symbology or presentation;**
 - data transfer;
 - data usability [Batuk, F. et al].

Conclusion remarks and directions for future work

The process standards could be considered in the following directions:

- general (specific) data transfer procedures;
- existing data access procedures;
- **classification methodology;**
- data collection;
- storage procedures;
- presentation standards;
- data analyzing procedures;
- data integration;
- quality control and quality assurance.

Conclusion remarks and directions for future work

In the report we proposed a methodology of a standard in two of the mentioned directions: **symbol system and color representation**

and the second one –

data classification in natural risks and disasters mapping.

The research could be continued in the International Commission of Standardization of different International organizations. Specialists in different branches of geo-science are needed to achieve final results of presented problems.



5th International Conference on Cartography and GIS

&

Seminar with EU cooperation on Early Warning
and Disaster Management

15.-21. 06. 2014
Riviera, Varna, BULGARIA

INVITATION

Topics

Conference

- Cartography Concepts in BigData Environment
 - GIS Technologies and Related Disciplines
 - Web Cartography and Digital Atlases
 - Map Design and Production
 - Cartographic Visualization
 - Volunteer Geographic Information
 - Virtual Geographic Environment
 - Cartography and GIS in Education; GPS Technologies

Contemporary problems using geodetic coordinate systems and map projections

Geospatial data acquisition by remote sensing technologies for cartographic purposes

 - GIS for Geology and Natural Sciences

Seminar with EU Cooperation on Early Warning & Crisis Management

- European Concepts for CM and EW
- Visualization of Geodata and Geoinformation in CM and EW
 - User Needs and Context Mapping
- From Discovery to Full Interoperability in CM and EW
 - SDI and CM: INSPIRE Influence
- "Speaking the Same Language - Semantic Aspects of CM"
 - Sensor Mapping for EW and CM



Publications

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

Thematic Cartography for Society

Publisher: **Springer**

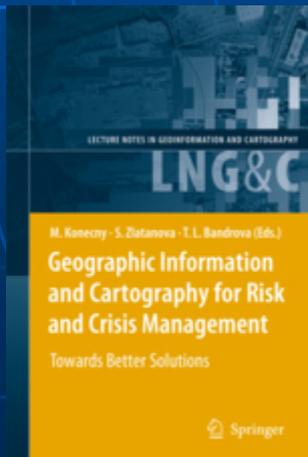
Book topics:

- *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**





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www.cartography-gis.com

Благодаря за вниманието!
Děkuji Vám!
Thank you very much!

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