ISSN: 1857-9000
EISSN: 1857-9019
UDC: 528:004

Geo-SEE

INTERNATIONAL
SCIENTIFIC JOURNAL

Micro Macro & Mezzo Geo Information

June, 2017

IMPACT FACTOR (2013): 0.386
(2014): 0.615
(2015): 0.722

INTERNATIONAL SCIENTIFIC JOURNAL

ISSN: 1857-9000 (printed version)
EISSN: 1857-9019 (electronic version)
UDC: 528:004
Impact Factor (2015): 0.722

June, 2017

Publisher:
Geo-SEE Institute, Skopje, Macedonia www.geo-see.org

CONTENTS:

ARCHIVE:

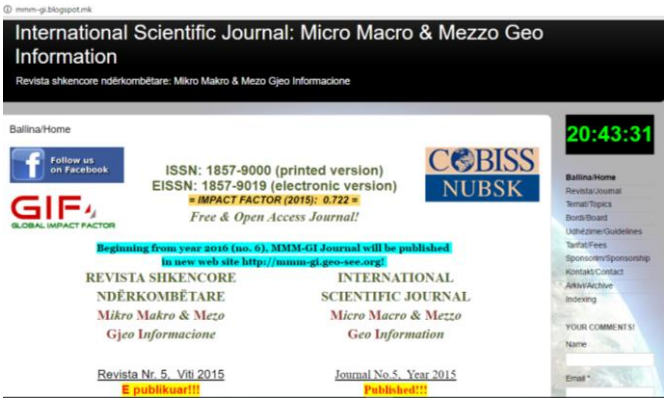
http://mmm-gi.geo-see.org

Free & Open Access Journal!

Publisher: Geo-SEE Institute

https://www.facebook.com/ISJ.MMM.GI

http://mmm-gi.geo-see.org



http://mmm-gi.blogspot.mk

INDEXING:

http://mmm-gi.geo-see.org

South-East European Research Institute on Geo Sciences
"Geo-SEE Institute"
adress: str. Djon Kenedi, 25/1-d3; 1000 Skopje, Macedonia.
tel: + 389 2 6140-453; gsm: + 389 75 712-998
info.geosee@gmail.com, www.geo-see.org

Publisher: Geo-SEE Institute

ISSN: 1857-9000, EISSN: 1857-9019

MAPPING NATURAL DISASTERS FOR PREVENTING THEIR CONSEQUENCES (REVIEW ARTICLE)

Denitsa SAVOVA[1]

UDC: 504.4:528.8/.9
351.78:35.077.3

SUMMARY

The necessity of exploring the territories affected by disasters requires the use of different maps at all four stages of the disaster management cycle. This paper presents the importance and use of cartography products in natural disaster management (DM) in its phases: mitigation, preparation, response and recovery. Natural disasters are briefly described in order to outline the need for different cartographic representations depending on their specific features. Approved and new methods of mapping natural disasters are examined and classified. A new classification is proposed following their use before, during and after the catastrophic event. Since the climate in Bulgaria presupposes an increased risk for forest fires, they have been studied in detail. Good practices in forest fire management worldwide are considered on the basis of which some future work in this respect could be planned.

Key words: natural disaster, mapping natural disasters, disaster management, forest fire.

1. INTRODUCTION

Disasters happen almost daily somewhere around the world. Some of them are natural, others are the result of human activities and in most cases, no matter what type of disaster occurs, they catch the society off guard. During the last decades climate change is considered to be a major cause for natural disasters, enhanced by the consequences of vast urbanization worldwide. Although the advanced technologies and science have improved disaster prediction over recent years, natural disasters still cause enormous damages: human fatalities, economical losses and ecosystem degradations. According to Intergovernmental Panel on Climate Change, improvement and

[1] **Denitsa Savova**, savovadenitsa@gmail.com, University of Architecture, Civil Engineering and Geodesy (UACEG), Sofia
Address: 1 Hristo Smirnenski Blvd, 1046 Sofia, Bulgaria

strengthening of the measures for coping with these events is still needed in the future (IPCC 2012).

The European Environmental Agency published a technical report which discusses the occurrence of natural disasters in Europe and their social and environmental impacts for the period 1998 - 2009. This document summarizes statistics, proposals for measures and policies for reducing the impacts of the most frequent disaster events in Europe. Statistics show that they caused nearly 100 000 deaths and affected the lives of more than 11 million people in Europe for that period (EEA 2010). Since post-disaster relief became a necessary but insufficient measure, disaster management policy has been oriented more to the mitigation and preparedness processes. To reduce the impacts of disaster events in Europe, experts started to use an approach which includes the four stages of disaster management cycle, namely, the Integrated Risk Management (IRM) involving actions for mitigation, preparedness, response and recovery.

Cartography and the related disciplines, Geo-information Systems and 3D Modeling, are an inseparable part of the disaster management cycle in which their products are successfully used at every stage. Marinova (2010) points out the use of cartography in disaster management:

- Before the catastrophic event: for assessment and preparedness;
- During the catastrophic event: for protection;
- After the catastrophic event: for recovery actions.

A variety of maps provide important and specially selected data for different groups of users: experts and non-experts, adults and children, rescuers and victims. Bandrova and Konecny (2006) suggested that the future maps used in disaster management should be more schematic and created especially for the user's needs. Mobile and electronic technologies should also be involved in the mapping process. The variety of cartographic products used for preparations before the disaster, for decision making during the rescue operations and damage assessment after the event are necessary and irreplaceable tools in disaster management.

To analyse in detail the meaning of cartography during such crises, the types of natural disasters are reviewed. This review aims to present the natural disasters in a global perspective and according to the climate and locality, narrowing them down to a continental and local level. Focusing on the most frequent natural crisis events for Bulgaria, various methods of cartographic representation are examined and a generalized classification is made. The available map products for disaster management are briefly reviewed. Special attention is paid to forest fire incidents, considering good practices in management in which the diverse use of maps improves the processes: preparation, decision making, emergency rescue, etc.

2. TYPES OF NATURAL DISASTERS

EM-DAT stands for International Disaster Database which is developed and maintained by the Centre for Research on the Epidemiology of Disasters (CRED). This database provides standardized data compilation and is known as the international source of free disaster data for decision-making, vulnerability and post-disaster damage assessments etc. (EM-DAT 2015a). In 2007 EM-DAT and Munich RE implemented a new common and comprehensive classification of disaster events which later on was accepted and established by other institutions - Swiss RE, Asian Disaster Reduction Center and United Nations Development Programme. Until then the lack of standardized classification and terminology led to poor interoperability between the different databases Therefore, the main aim of the new classification was to be recognizable and applicable internationally. This classification (fig.1) divides the disaster cases into two main groups: natural and technological. Natural disasters form six groups: Biological, Geophysical, Meteorological, Hydrological, Climatological and Extra-terrestrial. The classification is narrowed down to sub-types and sub-sub types of disaster events according to the triggering hazard (Wirtz et al. 2009).

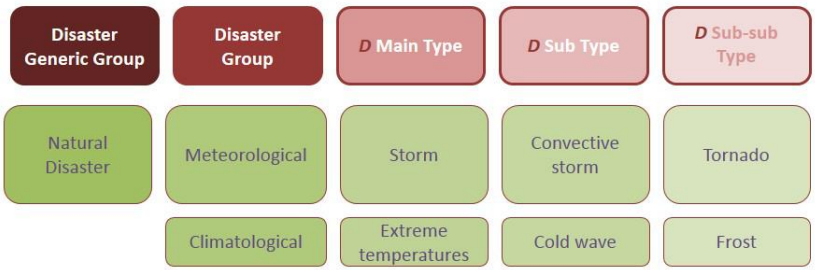


Fig. 1 An example of one row of the EM-DAT classification.

IDRD (Integrated Research of Disaster Risk) developed another classification of the natural disasters which is specially designed to serve to multiple types of loss databases. Despite the proposed structure contains the basic features of EM-DAT's, it has peculiarities. In this classification the disaster types are subdivided into families, main events and perils (fig.2). However, the families in this case are similar to the types of EM-DAT's and the main type of disaster corresponds to the main events, the disaster sub-types and sub-sub types here are combined at one level, i.e. perils. In the proposed framework perils are not strongly distinguished and this is the

reason to consider that classification as ore flexible than EM-DAT's classification. The connections "perils - main events" are one-to-many which requires that the perils should be related according to the particular case. These improvements in the IDRD classification affect not so much the global level as the national and sub-national level loss databases (IRDR 2014).
n this paper the EM-DAT classification will be assumed to be a generic classification.

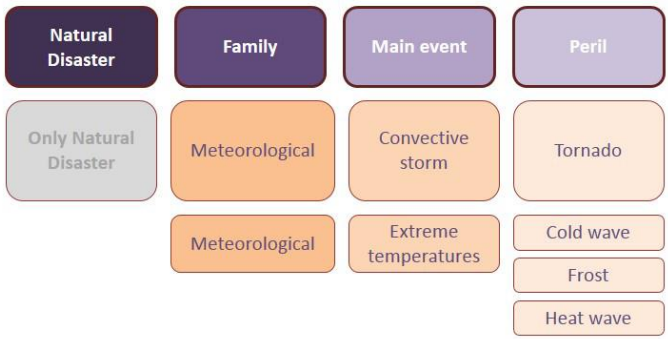


Fig. 2 An example of one row of the IDRD classification.

Conditions such as location, weather and tectonic plates are strongly related to the types of disaster and their occurrence. Reasonable disaster management requires focusing on the hazards on local level in order to take proper measures for mitigation, preparedness, response and recovery. Disaster events should be examined in the world statistics but the more reduced a disaster classification is, the closer the concrete problem solutions are. If an examination of the types of natural disasters is made locally in Europe, the worldwide classification of EM-DAT, consisting of over 28 sub types and sub-sub types, will be reduced to 8 major natural disaster events. If the examination is narrowed down to Bulgaria, two of Europe's most frequent disasters will drop out of the picture (fig. 3).
According to EM-DAT statistics of major natural disaster events in Europe for the period of 2004 to 2014, the most frequent natural disaster is flood followed by storms. However, frequency should be not considered separately from casualties and economical losses. During that period extreme weather events caused over 63 000 fatalities and next on the list are floods with over 1 000 (EM-DAT 2015b). Although significant earthquakes do not occur so often, the devastating consequences for the population and the economy list them among the most catastrophic events.

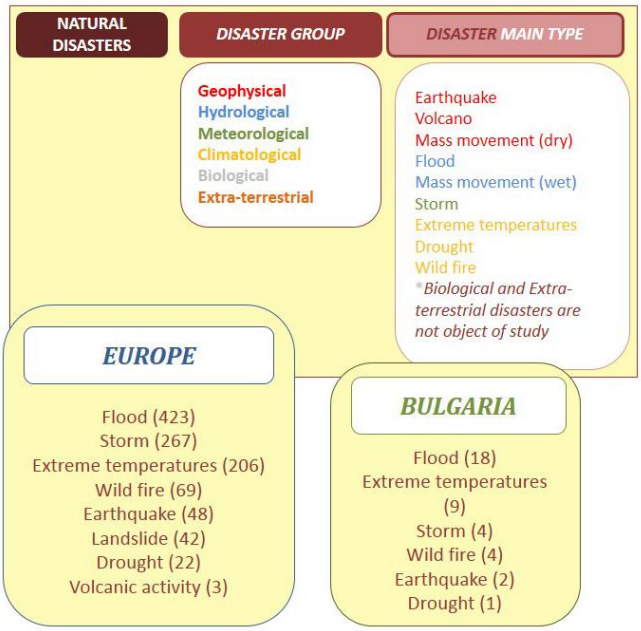


Fig. 3 Reducing the disaster classification according to locality.

Natural disasters often occur in Bulgaria, the most devastating ones being floods, storms, landslides, earthquakes and forest fires. Every summer the hot temperatures and the human neglect are the reasons for the initiation of forest fires which spread over hectares, damaging habitats and causing environmental degradation. For the ten-year period (2005 - 2015) 29 disaster events were registered in EM-DAT's database. In terms of numbers, 159 people lost their lives (EM-DAT 2015b). This amount of casualties cannot be underestimated having in mind that the population of the country is around 7 million. Only in 2014 four floods hit different regions causing human fatalities, collapsed houses and huge economic losses. In 2015 snowstorms blocked part of the country leaving thousands of people without food, medicines and electricity for days on end. The heavy snowfalls combined with rains caused floods and initiated landslides and rockfalls, blocking roads. Obviously, there is an urgent need for improving the disaster management actions in Bulgaria and especially in the pre-disaster and disaster phase in order to reduce the hazard of such events. Special attention should be paid to the huge set of mapping methods applied worldwide, which, if used properly, can improve the processes in the four stages of disaster management cycle.

3. METHODS OF MAPPING NATURAL DISASTERS

In this paper section a classification of the cartographic methods which are commonly used in the disaster management is made (fig. 4). The methods are categorized to four main groups. Three of them are following the recent technological trends: Remote Sensing (RS), GIS Analyses and 3D modeling and the other is the group of traditional cartography methods which are still not fully replaced by the modern and also provide map products for DM. The classification is based on the differentiation of the methods, according to their use in the stages of the disaster event. The four stages of the disaster management cycle requires different cartographic methods which are applied before, during and after the catastrophic event.

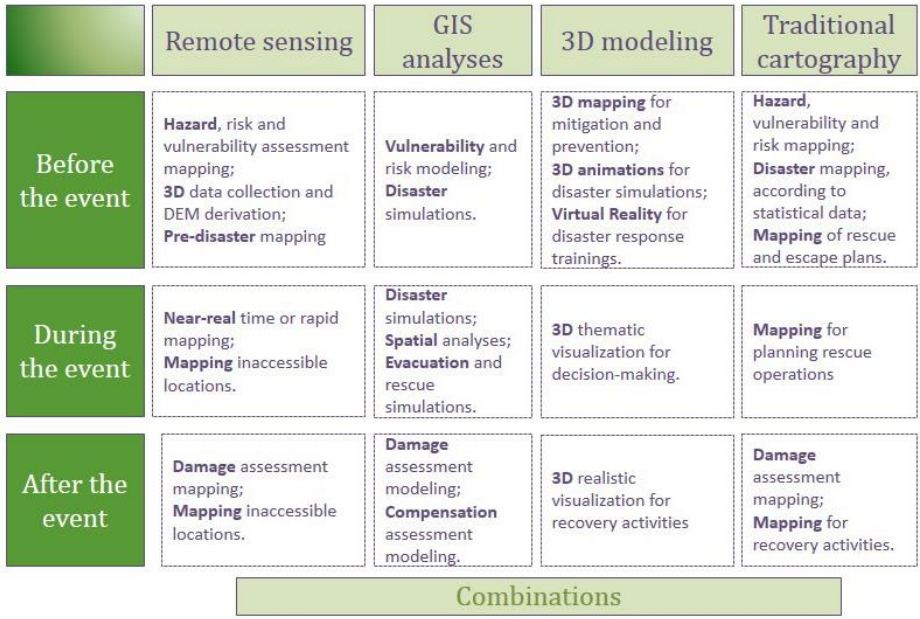


Fig. 4 Methods of mapping natural disasters, according to their use in the different stages of the catastrophic event.

3.1. Remote Sensing

Remote Sensing (RS) is irreplaceable tool in the DM, because of its ability to provide spatial data for huge areas in a short time anywhere around the world. Moreover the Remote Sensing equipment provides data via various technologies which cover the specific needs of specific data, according to the event. Many examples can be given in order to approve the huge

contribution of RS in crises management: from imagery interpretation for monitoring and risk mapping to rapid mapping during the disaster, RS provides large range of detailed data needed for reasonable disaster management.

Remote Sensing provides the opportunity of rapid mapping or mapping soon after the disaster hits. This method of rapid cartography is crucial part of decision-making processes for emergency and rescue operations. Buehler and Kellenberger (2007) present framework of rapid mapping in order to improve and optimize the process of the International Charter: an organization, which provide a unified space data to the affected by disasters (International Charter, 2015). Kerle et.al (2008) make a detailed review of the airborne sensor data and its use in different disaster scenarios.

Although Remote Sensing do not have all the functionalities of GIS and 3D modeling, it provides huge variety of data which is successfully applied as a base for further analyses via these methods. RS is a good example of showing the existing interconnection and cooperation between the different methods for disaster mapping. Dorn et.al (2014) effectively combines OpenStreetMap vector data, LIDAR point cloud, orthophotos, land use and land cover data to create flood simulations in GIS environment for a study area in Austria.

3.2. GIS analyses

The Geographic Information Systems already have a high value in public service for more than 20 years and they are still being constantly improved to meet the users' needs. The opportunities they provide are turning them into invaluable method for disaster mapping. GIS could be applied equally well before, during and after the disaster emergency.

In the phases of mitigation and preparedness the GIS methods are used mostly for risk assessment and disaster simulations. The environment of GIS does not constrict the opportunities and the diversity of parameters which can be used for problem solving in the disaster management. One of its most common uses in the first two phases of the disaster management cycle is the flood modeling. Two different study cases shows similar approaches over the coping with the disastrous flood events. Liu and et.al (2005) and Kia et.al (2012) study the potential impact of the changing from rural to urban land use to the watersheds and assess the risk of floods based on parameters such as canopy, soil surface, soil, rainfall quantity and groundwater. As oppose the work of Dorn et.al (2014) mentioned already, is more focused on studying the meaning of inundation area, water depth and flood intensity over the flooded area. Another good example of risk modeling is the forest fire risk assessment. This is deployed in details in Chapter 4.

During the disaster GIS methods provide fast and crucial information important for the decision-making process. Their huge role lays on the strength of the spatial analyses and the real-time data collection. Cases of poisonous gas leaking, explosions, terrorist attacks, forest fires and floods can be easily followed and kept under control. The tools, such as finding the shortest or the fastest route, calculation of the affected area and the number of the citizens who must be evacuated, contribute for smarter and better response in cases of emergency. The use of variable parameters, such as real-time traffic information, helps for better planning and faster decisions when there is a time limit and people are in danger.

Nowadays people are turning to social media to get current information and updates over important topics and news. One of the last innovations in GIS is to include the social sharing as a powerful instrument for collecting real-time data by tracking the posts of users reporting their close experience with the disaster event. The products are constantly updating interactive maps available on-line. For instance an examples of a real-time social media mapping is the Esri's map of Napa earthquake based on the websites: Twitter and YouTube (Kerr, 2014). Velev and Zlateva (2012) point out that receiving data is not the only use of social media in the disaster management. According to their work these networks are also available for broadcasting real-time information to the affected people and can be used for optimization of the recovery activities and immediate relief efforts.

Last but not least GIS analyses are suitable method for damage and relief assessment. In the fourth stage of the disaster management cycle - the evaluation of the affected people, buildings and infrastructure can be followed by a classification according to parameters which ease the processes of the recovery actions. Depending on the tasks assigned by the specialists to the GIS products, the recovery stage can be separated on two types: short-term and long-term recovery (Johnson, 2000). The short-term includes damage assessment, shelter accommodation, medical help, etc. and the long-term recovery is focused on restoring the normal life flow. The last one may take a couple of months up to few years.

3.3. 3D Modeling

One of the best features of the 3D modeling is that the products are more intuitive and the information that they represent is perceived in much easier way from the user than the 2D maps. The 3D models do not require special education and preliminary training which makes them suitable for any age. These qualities expand the opportunities for simulations and trainings with educational purpose: an essential part of the preparedness phase. However the 3D maps should not be considered as universal maps. Like every other

cartographic product they should be user-oriented and should be prepared in consideration of requirements depending on the specific theme. According to Bandrova et.al (2012) there are still some unresolved issues with the creation of 3D maps for disaster management. Great amount of data and time is still needed to build an accurate and user-oriented 3D map. The other problem that is examined is the lack of standardization which leads to non-compliance with the main requirements for cartographic products such as map symbology, data classification, etc. With no doubt the 3D modeling products can be successfully used in the disaster management but the time consuming preparation limits their availability in emergency cases. In time of disaster the 3D models or the 3D maps has to be already created in order to be used for urgent decision-making. The quality of the decisions which will be made by this method during disaster, will depend on the content and the Level of Detail of the model. Attention have to be paid over the quality of the data and the suitability for resolving the task. During the recovery activities the 3D modeling can take a huge role in order to assist the reconstruction of buildings and infrastructure.

The fast developing computer graphics and cognitive science moved the 3D modeling to the next level – Virtual Reality. This have made the virtual reality trainings for disaster response one of the most effective tools for teaching people the best response practices. Virtual Reality gives the user not only the experience of real 3D environment but also the opportunity to take decisions and to be responsible for them. Hsu et.al (2013) examine different VR-training for disaster response applications in order to show all the advantages and disadvantages compared with the traditional class and web trainings. The slightly different type of reality: the Augmented Reality (AR), which according to Milgram at al. (1994) is placed somewhere between reality and virtuality, is also taking its place in the disaster response education programs (Savova 2016). The interesting mixture between virtual and real gives a fun and easily perceptual way for disaster representations for children.

3.4. Traditional cartographic methods

The traditional cartographic methods are the oldest ones and lay the foundations for the new technologies like GIS and 3D Modeling. Over the years the development of the technologies has slightly displaced the creation of the traditional paper map and not only for disaster management but overall. Nevertheless it is still in use for all of the tasks the other methods resolve – risk mapping, damage mapping, mapping for recovery activities, etc. The traditional cartographic methods are popular for representing a historical data for studied area. This kind of data representation is in great

help with the activities before a disaster event occur. Based on the historical data and the map representation, conclusions can be made and further preparedness measurements could be taken. Although the GIS methods are the fastest for deriving analytical results and pre-prepared decisions, it has to be admitted that in case of disaster emergency, people are not turning to them at first place. One of the first things the children learn at school is, in case of disaster, to look and follow the evacuation and escape plans in the building, which are products of the traditional mapping methods. The paper map is one of the crucial tools for presenting the disasters and the consequences from them to children and students in educational programs.

4. FOREST FIRES: A CASE STUDY IN MAPPING NATURAL DISASTERS

Around the world, forest fires have detrimental impacts on economies, human safety and health. The damages which they inflict on the environment and society are comparable to the severity of other natural disasters. Forests can be compared with the skeleton of the soil, therefore the healthy forest keeps from other disasters as floods, avalanches, landslides. Recent example of their importance is the huge flood in June 2014 (Varna, Bulgaria) caused 11 fatalities which is considered to be triggered by illegal deforestation. Another important role is the role of windshield. To go deeper in the problem forests should not be considered only as a vegetation canopy but as a living ecosystem with easily disturbing dynamics and a habitat of countless types of species. Responsible forest protection and forest fire management, inseparable part of which is designing valuable and useful maps, must be applied in order to reduce the impacts of these natural disturbances.

4.1. Fire risk assessment

Fire risk prevention and early warning systems for fire detection are crucial for territories like the Mediterranean region where high fire danger conditions: high temperatures, drought, low relative humidity and presence of wind, contribute for fire ignition and fast fire spread. Bulgaria's closeness to the Mediterranean is a prerequisite for an increased risk of forest fires as well as forest is over 30% of its area. These are enough reasons this problem in Bulgaria to be topical and not to be underestimated. Good practices worldwide should be examined and applied in order to improve the management methods and processes in the country.

Crucial part of the fire risk assessment is the determination of the variables which can possibly contribute to fire ignition and spreading. The implementation of these variables in modern cartography and GIS as risk and phenomena modeling gives the opportunity of producing large range of map products usable before, during and after the catastrophic event. Chuvieco et.al (2005) examined the variables and proposed a method of fire risk assessment: Wildland Fire Danger assessment or WFDA which distinguish two components: ignition danger and propagation danger. The method aims to integrate the most important factors connected with fire ignition and spreading into one danger index (fig. 5). Krisp et.al (2005) focused their study on improving fire and rescue services in urban areas, proposing a method of explorative spatial analyses based on population density and incidents occurrence mapping. In other research Chuvieco and Justise (2010) examined in detail the human factors and the relationship between humans and forest fires. Another research studied the connection between the informal settlements in South Africa and the increased fire occurrence (Smith, 2005). Camaro et.al (2013) present another classification of fire risk factors, according to their time variability which divides them on two main groups - long-term and short-term.

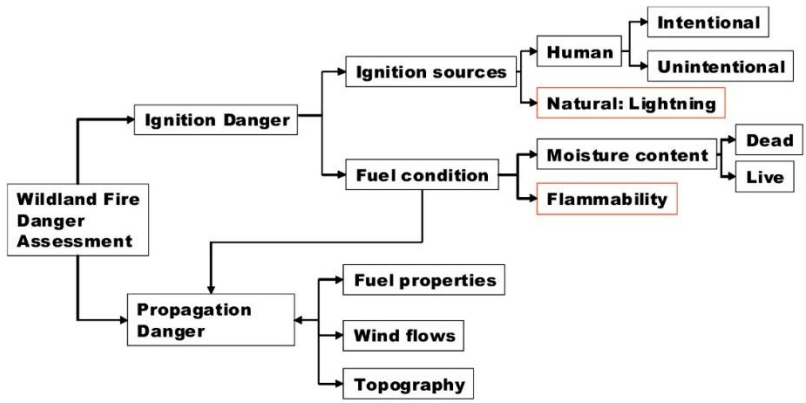


Fig. 5. Structure and components of the Wildland Fire Danger assessment (WFDA) (Chuvieco, 2005)

4.2. Methods of mapping forest fires - risk mapping and forest fire behaviour modeling

Despite of the type of disaster, risk and vulnerability mapping are constituent part of the mitigation stage. Risk mapping is a method which studies the spatial distribution of fire risk. The method requires mathematical

integration of many variables to one or several risk indexes which interpolation is made and represented on different map products.

The obvious advance of using GIS and Remote Sensing in disaster management of forest fires, explains the many examples of applicable risk models and maps. For a case study in Garhwal Himalayan region (Chandra, 2005) a technology, combining GIS and Remote Sensing is proposed. The method is used for identifying and different fire risk zones and it is based on the mapping of factors such as forest density and type, aspects, slopes, elevation (extracted from Digital Elevation Model), drainage and human factors, especially remoteness from settlements and roads. Every parameter is assessed with fire risk value. Each value is assigned with weight factor and takes part in the equation of the complex index - Fire Risk Zonation Index.

Guettouche et.al (2011) proposed another methodology of calculating risk and vulnerability indexes. The main difference between this and the previous example is that in this case the climate conditions are considered including three separate indexes, describing the weather factor: climate drought index, index of continentality and index of dry wind. The last stage of the process is combining hazard and vulnerability data for calculation of fire risk degree.

Another technology of mapping forest fires is based on analyses of fire spreading under various conditions. The phenomena is object of study for decades and there are existing forest fire spread models which describe and predict its behavior, according to factors such as fuel features, wind and slope etc. Rothermel's (1972) and Albini's (1976) are still preferred for analyses and calculations. They are also used as base for further developed models such as FARSITE (Finney 1998), etc. The recent years, topical theme is the implementation of such models in GIS environment. The integration between the theory of forest fire behaviour and the opportunities that GIS gives for spatial analyses has evidently improved the processes in the disaster management of such events. Prediction of the spread speed and direction, according to external factors such as wind, fuel type, slope and aspects, etc. takes crucial part not only in the evacuation and rescue but also in a fire fighting operations.

Condorelli and Mussumeci (2009) implement in GIS Rothermel's fire spread model for two regions in Sicily. The implementation is performed with several GRID themes, each of which represents an interpolation of variable in Rothermel's equation. As a result a new GRID is obtained, every cell of which represents the potential spreading speed of the fire front in meters/minutes. This GRID they use for further analyses of the time of spreading and identification of the most probable path of the forest fire. The study of Kanga et.al (2014) presents the successful application of FARSITE and remote-sensing imagery in forest fire risk assessment. In this case the

research is focused on using fire spread model for identification of potential fire ignitions, according to fuel, weather and other conditions.

CONCLUSIONS

The society is advancing slow but steady in the process of reducing the losses, both human and material, results of the uncontrollable disaster occurrence. The cartography and the interconnected disciplines have an important role in the disaster management activities by giving suitable data representation, spatial solutions and pre-prepared decisions in a short time or in other cases for detailed 3D environment mapping used for simulation and disaster recovery trainings. In order to use these methods reliably a special attention should be paid to the classification of the disaster types. For better management actions the worldwide list of disaster types should be narrowed down according to the specifications of the area on which they are applied. The disaster management in Bulgaria should note the good practices from the other parts of the world and should consider implementing them in order to improve the actions taken in such emergencies to minimize the casualties and the damages in our country.

REFERENCES

1) Albini, F.A. (1976) Estimating wildfire behavior and effects. General Technical Report INT-30. USDA Forest Service. Intermountain Forest and Range Experiment Station, Ogden, UT, 92p.
2) Bandrova, T., Konecny, M. (2006). Mapping of Nature Risks and Disasters for Educational Purposes, KiG – 6, 12 -16 June
3) Bandrova, T., Zlatanova, S., Konecny, M. (2012). Three-dimensional maps for disaster management. *ISPRS Annals of Photogrammetry, Remote Sensing and Spatial Information Sciences*, *I-4*(September), 245–250. http://doi.org/10.5194/isprsannals-I-4-245-2012
4) Buehler, Y. A., & Kellenberger, T. W. (2007). Development of processing chains for rapid mapping with satellite data. In J. Li, S. Zlatanova, & A. Fabbri (Eds.), *Geomatics solutions for disaster management. Berlin, 49-60* (pp. 49–60). Berlin, Germany: Springer. Retrieved from http://www.zora.uzh.ch
5) Camaro, W., Steffenino, S., Vigna, R., (2013). Fire risk mapping and fire detection and monitoring. p. 62- p.77. The Value of Geoinformation for Disaster and Risk Management (VALID). Altan, O., Backhaus, R.et.al. Joint Board of Geospatial Information Socie- ties (JB GIS).
6) Chandra, S., 2005, Application of Remote Sensing and GIS technology in Forest Fire Risk Modeling and Management of Forest Fires: A Case Study in the Garhwal Himalayan Region, p.1239 - p.1255. In *Geo-information for Disaster Management*, Van Oosterom (P.), Zlatanova, S., Fendel, E. (Eds.) Springer.
7) Chuvieco, E., Camia, A., Bianchini, G., Margalef, T., Koutsias, N., & Martínez, J.

(2005). Using remote sensing and GIS for global assessment of fire danger. *XXII International Cartographic Conference*, (July), 11–16. Retrieved from http://cartesia.org/geodoc/icc2005/pdf/oral/TEMA29/Session\n1/EMILIO\nCHUVIECO.pdf

8) Chuvieco, E., Justise, C. (2010) Relations Between Human Factors and Global Fire Activity. p. 187 – p. 199. In *Advances in Earth Observation of Global Change*. Chapter 14. Chuvieco, E., Li, J., Yang, X. (Eds.). Springer Netherlands.
9) Condorelli, A., Mussumeci, A. (2009) GIS Procedure to Forecast and Manage Woodland Fires. *In* Geographic Information and Cartography for Risk and Crisis Management. M. Konecny, S. Zlatanova, & T. L. Bandrova (Eds.). Springer Berlin.
10) Dorn, H., Vetter, M., & Höfle, B. (2014). GIS-based roughness derivation for flood simulations: A comparison of orthophotos, LiDAR and Crowdsourced Geodata. *Remote Sensing*, *6*(2), 1739–1759. http://doi.org/10.3390/rs6021739
11) EM-DAT (2015a): About, http://www.emdat.be/about, Available on 28.04.15
12) EM-DAT (2015b): Search, http://www.emdat.be/advanced_search/index.html. Available on 06.05.15
13) European Environment Agency. (2010). *Mapping the impacts of natural hazards and technological accidents in Europe. An overview of the last decade*. *Technical report No 132010*. http://doi.org/10.2800/62638
14) Finney MA (1998) FARSITE: Fire Area Simulator Model development and evaluation. Research Paper RMRS-RP-4. USDA Forest Service. Rocky Mountain Research Station, Ogden, UT, 47p.
15) Guettouche, M. S., Derias, A., Boutiba, M., & Boudella, A. (2011). A Fire Risk Modelling and Spatialization by GIS. *Journal of Geographic Infromation System*, *3*(July), 254–265. http://doi.org/10.4236/jgis.2011.33022
16) Hsu, E. B., Li, Y., Bayram, J. D., Levinson, D., Yang, S., & Monahan, C. (2013). State of Virtual Reality Based Disaster Preparedness and Response Training. *PLOS Currents Disasters*, 1–6. Retrieved from http://currents.plos.org/disasters/article/state-of-virtual-reality-vr-based-disaster-preparedness-and-response-training/
17) International Charter: Space & Major disasters. https://www.disasterscharter.org/web/guest/about-the-charter. Available on 03.05.2015.
18) *Integrated Research on Disaster Risk*. (2014). *Peril Classification and Hazard GLossary (IDRD DATA Publication №1)*. Beijing. http://doi.org/10.1017/CBO9781107415324.004
19) IPCC. (2012). *Managing the risks of extreme events and disasters to advance climate change adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change.* (C. B. Field, V. Barros, T. F. Stocker, Q. Dahe, D. J. Dokken, G.-K. Plattner, … P. M. Midgley, Eds.). New York, USA: Cambridge University Press. Retrieved from https://www.ipcc.ch/pdf/special-reports/srex/SREX_Full_Report.pdf
20) Johnson, R. (2000). *GIS Technology for Disasters and Emergency Management*. *An ESRI White Paper*. Esri. Retrieved from http://www.geo.umass.edu/courses/geo250/disastermgmt.pdf
21) Kanga, S., Sharma, L., Pandey, P. C., & Nathawat, M. S. (2014). Gis Modeling Approach for Forest Fire. In *International Journal of Advancement in Remote Sensing, GIS and Geography* (Vol. 2, pp. 30–44). http://doi.org/2321-835
22) Kerle, N., Heuel, S., & Pfeifer, N. (2008). Real-time data collection and information generation using airborne sensors. *Geospatial Infomation Technology for Emergency Response*, 43–74. Retrieved from http://books.google.com/books?hl=en&lr=&id=m-2RMTpe7WEC&oi=fnd&pg=PA43&dq=Real-time+data+collection+and+information+generation+using+airborne+sensors&ots=m1PiVLK80N&sig=a6xepeVeEf4miDyYSxfqBg4uUIc

23) Kerr, D. (2014) Napa earthquake as mapped by social media posts, https://www.cnet.com/news/napa-earthquake-is-mapped-by-social-media-posts/. Available on 15.01.2017
24) Kia, M. B., Pirasteh, S., Pradhan, B., Mahmud, A. R., Sulaiman, W. N. A., & Moradi, A. (2012). An artificial neural network model for flood simulation using GIS: Johor River Basin, Malaysia. *Environmental Earth Sciences*, *67*(1), 251–264. http://doi.org/10.1007/s12665-011-1504-z
25) Krisp, J., Virrantaus K. and Jolma A. (2005). Using explorative Spatial Analyses to improve Fire and Rescue Services, p. 1283 - p.1297. In *Geo-information for Disaster Management*, Van Oosterom (P.), Zlatanova, S., Fendel, E. (Eds.) Springer.
26) Liu, Y. B., De Smedt, F., Hoffmann, L., & Pfister, L. (2005). Assessing land use impacts on flood processes in complex terrain by using GIS and modeling approach. *Environmental Modeling & Assessment*, *9*(4), 227–235. http://doi.org/10.1007/s10666-005-0306-7
27) Marinova, S. (2010). Cross-Border Mapping for Disaster Management. In *3rd INTERNATIONAL CONFERENCE ON CARTOGRAPHY AND GIS, Proceedings*. Nessebar, Bulgaria.
28) Milgram, P., Takemura, H., Utsumi, A., & Kishino, F. (1994). Mixed Reality (MR) Reality-Virtuality (RV) Continuum. *Systems Research*, *2351*(Telemanipulator and Telepresence Technologies), 282–292. http://doi.org/10.1.1.83.6861
29) Rothermel, R.C. (1972) A mathematical model for predicting fire spread in wildland fuels. General Technical Report INT-115. USDA Forest Service. Intermountain Forest and Range Experiment Station.
30) Savova, D. (2016). AR Sandbox in Educational Programs for Disaster Response. In T. Bandrova & M. Konecny (Eds.), *6th International Conference on Cartography and GIS Proceedings, Vol. 1 and Vol. 2* (pp. 13–17). Sofia, Bulgaria: Bulgarian Cartographic Association. http://doi.org/1314-0604
31) Smith, H. M. (2005) The Relationship between Settlement Density and Informal Settlement Fires: Case Study of Imizamo Yethu, Hout Bay and Joe Slovo, Cape Town Metropolis. p.1333 - p.1357. In *Geo-information for Disaster Management*, Van Oosterom (P.), Zlatanova, S., Fendel, E. (Eds.) Springer.
32) Velev, D., & Zlateva, P. (2012). Use of Social Media in Natural Disaster Management. In *International Proceedings of Economics Development and Research*. Singapore: IACSIT Press. Retrieved from http://www.ipedr.com/vol39/009-ICITE2012-B00019.pdf
33) Wirtz, A., Below, R., & Guha-Sapir, D. (2009). Working paper Disaster Category Classification and peril Terminology for Operational Purposes. Context, (October), 1–20.

ENERGY TRANSECT MODELING AND SUSTAINABLE URBAN CELLS APPROACH: HARMONIZING THE URBAN AND GREEN TISSUES

Tigran HAAS[1] and Elisabetta TROGLIO[2]

UDC: 711.4:502.131.1

SUMMARY

The global city of the 21st century faces major challenges & crises, including social and economic stratification, wasteful consumption of resources, transportation congestion, and environmental degradation with the omnipresence of global climate change. Our cities, communities and neighborhoods are undergoing also rapid transformation and retrofits in terms of energy efficiency and climatic adaptations almost to the point of drastic environmental determinism. The discussion in this paper explores ways for raising quality of life and the standard of living in a new modern era by creating better and more viable places to live through sustainable urbanism approaches. The assertion is that the Green (Sustainable) Urbanism approaches offer an environmentally sound way to plan and design more ecologically stable communities. Sustainable Urban Cells within the idea of the Urban Energy Transect is presented here as a new quantitative and qualitative modeling approach and analytical methodology in working with planning of sustainable urban communities, compatible with other analytical tools such as Space Syntax and other GIS tools. The empirical Swedish case introduced shows how a better understanding of an integrated system of zoning in a complex community urban setting can contribute to clearer planning and energy efficiency of buildings. The questions we raise are: How can we combat and reconcile urban growth with sustainable use of resources for future generations to thrive? Where and how urbanism comes into the picture? and what role "sustainable" urban forms can play and have in light of these events? These and some other issues are tackled in this paper whose conclusions point to the predilection that beyond being a system of classification, the cell and the transect model we present in this paper has also the potential to become a complementary instrument for planning and design for better places to live.

[1] **Tigran HAAS**, tigran.haas@abe.kth.se, KTH – Royal Institute of Technology Department of Urban Planning and Environment, Urban and regional studies division (SOM), Address: Drottning Kristinas väg 30, Stockholm 11428, Sweden, Tel. +46.8.790.8504

[2] **Elisabetta Troglio**, elisabetta.trogliotigran.haas@abe.kth.se, KTH – Royal Institute of Technology Department of Urban Planning and Environment, Urban and regional studies division (SOM), Address: Drottning Kristinas väg 30, Stockholm 11428, Sweden, Tel. +46.8.790.9246

Key words: sustainable urban planning, morphology, transect, energy, land use.

1. ENERGY ISSUES AND NOWADAYS CHALLENGES IN URBAN AREAS

Our cities, villages, communities and neighborhoods stand at an important turning point - critical nexus of the most pressing issues of our time: rapid population growth and massive urbanization, energy inefficiency and scarcity, unbalanced resource consumption, growing air and water pollution, global and micro climate change, social exclusion and economic decline, unsustainable development of built environment at all scales and the relentless destruction of natural habitats which all degrades the quality of life (Calthorpe and Fulton, 2001 and Haas 2008). Sustainable urbanism, green urbanism, and smart growth are some of the theoretical and practical concepts developed to counteract these processes and steer the development to sustainable forms. As Peter Calthorpe (2011) points out, cities are not fixed elements and constantly remake themselves by demolish and rebuild all the time, which is a very important part of urbanism. This process is at the basis of the resilience of the urban fabric, an element that potentially can be continuously renewed and redone. However, a greater sensitivity to history and historic-cultural resources has to be part of urbanism to couple it with new designs that can offer alternative energy supplies, conservation and sustainability of the urban fabric on the long run.

Conservation, both in terms of the environment and in terms of culture and history; human scale, which translates into creating pedestrian environments that work; and diversity, which means you have to create mixed use communities for a full range of people are the three principles expressed by Peter Calthorpe when discussing the resilient city of the future.

The principles closely relates with the two key concepts in contemporary discussion of raising quality of life: those of livability and sustainability. Even though livability and sustainability may operate on different levels, scales, and contexts both can achieve similar outcomes. Both livability and sustainability support economic development and environmentally sustainable travel options, and address social equity issues and human health (Rue and Rooney et al., 2011).

Sustainable urbanism and community livability seem to present themselves as a viable platform of seeing and realizing integrated urban design projects. As

the Victoria Transport Policy Institute recognizes "Community Livability refers to the environmental and social quality of an area as perceived by residents, employees, customers and visitors". This includes safety and health (traffic safety, personal security, and public health), local environmental conditions (cleanliness, noise, dust, air quality, and water quality), the quality of social interactions (neighborliness, fairness, respect, community identity and pride), opportunities for recreation and entertainment, aesthetics, and existence of unique cultural and environmental resources (e.g., historic structures, mature trees, traditional architectural styles) (VTPI, 2013).
Sustainable Urbanism has three basic aspects: environmental, social, and economic. An urban form which is environmentally sustainable enables its inhabitants to adopt a more ecologically aware, lower carbon lifestyle; in social terms, sustainable urbanism involves an appropriate mix of dwellings of different tenures, sizes and types, and a variety of spaces and buildings for recreational and community activities, as well as for service providers and commercial enterprises; and in economic terms, sustainable developments contain business activities and opportunities capable of providing jobs for many of their inhabitants across the social and economic spectra (Prince's Foundation for the Built Environment, 2007; Haas, 2008; Steuteville and Langdon, 2009).

All the discourse on resilient cities contributes to put the focus on the key element of the community – the neighborhood and housing as being a main node for the carrying capacity of sustainable transformations and consolidation, one founded around the human aspects of form and traditional, timeless practices of good city building. By looking at the physical environment that sustain the communities, block, and neighborhood city network design has a large influence in balancing the urban energy demand and production through adaptation to local climatic conditions and identification of the most suitable morpho-typological structures (Ratti et al., 2004). A coherent organization of the city and its functional mix can largely contribute in reducing energy needs (Jenks and Burton, 2000) for the production of goods and services, mobility, indoor climate control, and decrease of local energy peaks.
Our cities need to achieve a higher integration between urban and energy design (Droege, 2006), adopting cycle approaches to energy and materials within the larger framework of resilience concepts to optimize local resources and social-urban environments (Walker and Salt, 2006).

2. RAISING URBAN ENERGY QUALITY THROUGH DESIGN

The areas of urban design, urban and regional planning and the control of urban and regional development present still a great deficiency, especially in relation to neighborhood development and the housing sector. As for the energetic reorganization of city regions, the approaches oriented to the creation of compact, de-centralized housing spaces, the complex economical handling of resources or the minimization of auto-dependency – are practical requirements in future urban developments to create a truly unique model of integrated cities (Calthorpe and Fulton, 2001; Beatley, Newman and Boyer, 2009). Sustainable Urbanism, a phrase that is used widely and in combination with ecological and green connotations, is a rather new and complete framework for interdisciplinary planning and design of contemporary cities, neighborhoods and settlements. It explores in a more holistic manner sustainability and urban design in a rapidly urbanizing world, by focusing on the processes that shape the form and function of our built environment: infrastructures, land developments, built landscapes, social networks, systems of governance and economics, and facilities that collectively make up metropolitan regions (Farr, 2007; Haas, 2008; Newman, Beatley and Boyer, 2009).

The applied sustainable urbanism – to whom this paper refers to – focuses on identifying small-scale catalytic interventions that can be applied to urbanized locations, which in aggregate leads to an overall shift towards sustainable neighborhoods, districts, and regions (Newman and Jennings, 2008). In its fullest meaning, Sustainable Urbanism is made up of the following key concepts: building and growing more densely and compactly; creating walkable mixed use urban environments that permit and encourage walking and bicycling; investments in public transit and transportation; creating closed-loop urban eco-metabolism and a self-sustaining agricultural system - local production of foods, goods and materials (food, building, materials); and investment in and commitment to sustainable, renewable, and passive technologies integrated into the built form (e.g. solar, wind, biomass, etc.) as well as solar design to reduce the need of artificial light and heat (Congress for the New Urbanism, 1999 and 2013; Farr, 2007; Newman and Beatley, 2008, Talen, 2013).
Doug Farr, in his Sustainable Urbanism: Urban Design with Nature (2008) sums this up in five value points of urban design, resilience & sustainability:

- Increasing sustainability through density and compactness;
- Integrating transportation means, patterns, and land use;

- Creating sustainable neighborhoods, including housing, car-free areas, locally-owned stores, walkable neighborhoods, and universal accessibility;
- The health and environmental benefits of linking humans to nature, including walk-to open spaces, neighborhood storm water systems, waste treatment, and food production (permaculture);
- High performance buildings and district energy systems;

Furthermore, many kinds of 'values' can be considered – economic, environmental, social or even cultural, as the fourth pillar of sustainability. Viable urban design, or good urban design as some authors refer to (Haas, 2012), can offer significant benefits to the community by providing high quality public realm based on the principles mixed use-density, now integrated with the energy efficiency principle. The achievement of more resilient urban structure can be obtained via integrated decision-making, but it is also based on the capacity of buildings, neighborhoods, spaces, and communities to adapt to changing needs.

3. URBAN DESIGN IN AN ENERGY PERSPECTIVE

Urban development – size of cities and spatial distribution – has on an historical perspective been strongly influenced by the availability of resources, where complex social and economic systems emerged and found their strength in the control and storage of resource flows, with energy – solar, biomass, animal, and human – playing a key role (Basalla, 1980 and Smil, 1994). The historical relation between urban growth, economic development, and impact on nature (biomass exploitation) has been recognized long-since as "[Ancient writers observed that] forests always recede as civilizations develop and grow […] conversely, when a society declines, forests tend to regenerate" (Perlin, 2005). With the advent of the fossil fuels society previous growth limits have been removed and the structures of cities changed to the so-called "oil city model" (De Pascali, 2008), where low cost largely available energy sources radically modified urban relations and morphology towards dispersed and highly specialized organizations (Burchell and Listokin, 1982). The design of cities and settlements without resource restrain, originally seen as sight of progress, is now undergoing strong critiques due to its long-run unsustainable and undesirable model. As human settlements have moved from a concentrated use of scattered energy resources (biomass, wind, water, animal/human) to a scattered use of concentrated resources (fossil), our next step is to again adapt our urban environments to the local conditions,

combining urban form with available renewable energies, thus creating global cities based on local resources (Troglio, Martschenko, Haas, 2012). As cities update their urban structures by inner growth there is the occasion to adapt morphologies to the new low-carbon and resilient needs. Despite a large amount of former industrial areas have been released during the last 15-20 years after the structural economic changes, many European cities have not fully explored the opportunity to update their structures towards sustainability urban forms. Nevertheless, infill and inner-growth redevelopment processes are still on-going and constitute fundamental occasions to rethink the urban environment – based on the local social-economic and geo-morphologic characteristics - and the connections with the regional environment.

Energy saving from counteracting or increasing the heat island effect, when cooling or warming need is prevailing respectively, can have substantial effects on the energy demand at the urban scale and significantly improve the indoor and outdoor well-being. Combination of green and blue elements, choice of construction materials (albedo characteristics, permeability, etc.), and urban morphology have proven effective in several project. As example, in the SolarCity district in Linz (Austria) or in the Western Harbor development in Malmö (Sweden) the heat island effect has been maximize to reduce energy losses (heat) during the winter months.

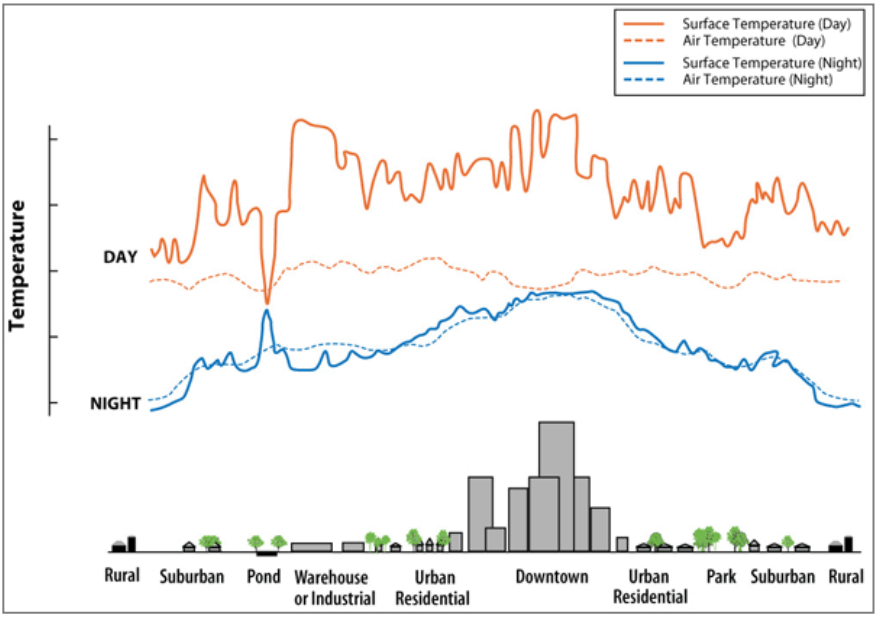


Figure 1: Scheme of the Heat Island Effect profile according with urban morphology; the temperatures shown refers to a late summer afternoon (EPA modified from Voogt, 2002)

Similarly, the siting, spacing and building shape can greatly affect the amount of potential solar gain and wind effect. Depending on the local environment, buildings and urban form can be designed for optimizing sunlight – passive solar gain – or increase the production of energy by improving roof quality for photovoltaic panels. Largely debated, the exploitation of wind power in urban areas finds still scarce integration in building or neighborhood design. Nevertheless, with increasing dependence on alternative power sources, interest and installation costs should drop significantly to make urban-based wind power generation a viable option (Grant et al., 2008). Beside the energy production factor, wind power can be passively exploited to improve indoor-outdoor micro-climate and air quality.

The adaptation of the urban morphology to respond to local climatic and geo-morphological conditions and the identification of energy conserving strategies, as this paper argues, should thus be explored before recommending high-tech solutions. Understanding the connections between different urban morphologies and their energetic outcomes can be difficult due to the multiple and complex interrelations of human and natural elements. To facilitate this process and support the actors involved in policy and design development towards more sustainable and resilient cities, we have further developed the transect concept to integrate energy issues. Also an important issue remains of how does energy performance enhancement inform urban design decision making to achieve outcomes of system resiliency? (Yang, 2015).

4. THE ENERGY TRANSECT

To reach sustainability goals urban planning and design choices need to be interrelated. Issues of reduced car use, energy efficiency, increased density, and mixed-use development become pertinent and cross connected (Farr, 2007 and Haas, 2012). When focusing on the complexity of our environment, more flexible methods and classifications should be used, providing a better understanding of the interlinks to citizens, planners and developers and helping create more livable places. As evaluation and assessment system for design, the Transect categorization is an empowering tool for communities to create and maintain sustainable places (Emerson, 2007, Low, 2010, and Thadani 2011). The transect model uses both a descriptive approach and a categorization system to identify and divide different land use into a sequence of human habitats from rural to urban zones (Coyle, 2011). Each habitat has a specific character and unique attributes, yet is also part of a network of other habitats that form a sustainable, cohesive system spatially, environmentally,

traffic and energy wise. In general, the Transect recognizes six zones, each of which can be adapted to local goals and character: 1) Rural Preserve, 2) Rural Reserve, 3) Sub-Urban, 4) General Urban, 5) Urban Center, and 6) Urban Core (Duany, 2002 and Thadani, 2011). Each zone addresses critical planning elements such as land use, roads, infrastructure, development, open space, energy, wastewater, and vegetation (Duany and Talen, 2002, Duany, 2002, Bohl and Plater-Zyberk, 2006).
Whether working on a new development or existing urban patterns, interconnected design aspects need to be included. The transect diagram can then be a useful device for explaining the intertwined components of coherent urban patterns in the adaptation towards sustainable principles (Troglio, Martschenko, Haas, 2012).

The role of energy in urban morphology is here analysed by starting from the minimum size component of the city; the typologies. In a simplified – thus reliable – analysis, the heat energy performances of buildings are related to form/dimension, age, and siting. The first parameter – which includes concepts of compactness and complexity of the building form (Olgyay, 1973) – describes the heat exchange relations between a structure and the surrounding environment. The second parameter shows the role of materials, technology and energy regulations as historical prospective, while the third one refers to the spatial configuration of buildings and their mutual relations.

In Table 1 are reported the estimated heat energy demand data from sample buildings in Uppsala (Sweden), a medium sized north European city. A representative city transect has been chosen to include the most representative morpho-typological configurations. As the data shows, both form (typology) and materials (technology) have a clear influence on heat energy reduction, and even clearer is the role of compact morphologies. Although technologies play an important part, the form effect is noticeably readable, with low mass / complex shaped buildings (i.e. detached houses) consuming twice the resources compared to more compact ones (i.e. towers or courtyard buildings).

Year built	Courtyard blocks	Low slab buildings		High slab buildings		Low tower buildings		Tower buildings		Row houses	Detached houses
	Close	Open	Close	Open	Close	Open	Close	Open	Close	Mid-Close	Open
1910-1930	167	235	179	166	143	295	243	195	156	N/A	288
1931-1975	143	215	189	142	127	208	174	147	120	221	307
1976-1995	72	113	107	72	67	94	78	71	63	98	123
1997-2007	59	68	65	66	62	107	100	50	48	90	126

kWh/Sq m/year
255-310
220-254
185-219
150-184
115-149
80-114
66-79
<65

Table 1: Estimated average annual heat energy demand (kWh/Sq m/year) based on building form and urban morphology in Uppsala, Sweden (Source: Troglio, 2012)

Identifying the role played by age, technology and building form constitutes only the starting point of the analysis and design of a sustainable city. To describe the relations between different urban morphologies and their energy and environmental performances – and thus the interactions between buildings, open spaces and the urban grid, we have juxtaposed five major analysis issues to the transect model.

The "Energy Transect" is developed as supporting design tool for the analysis of urban areas and the definition of sustainable and holistic visions for settlements, applicable at different scale and contexts. The identified five categories of analysis – morphology, land use, mobility, urban natural areas and block energy characteristics – define a first toolkit for reading and understanding the connections between urban morphologies and their main impacts on energy. The different cells (morphologies) define our units of analysis, which allow a constant overview of the existing relationships and provide a guide to the design process. By using the cell categorization, the understanding and control of the existing local and global interactions is increased.

Starting from the transect zones described by the New Urbanism, we have identified and analyzed five recurrent urban patterns on the contemporary city: city core, dense city, modernist 1980's-2000's, special districts and suburban areas. Each urban pattern represents not only a different stage of the city's evolution, but also different approaches to energy and environment, embodied in the morphologies and the concepts that generated them.

The first area of analysis, morphology, is conceived as a traditional Transect, highlighting the main conceptual characteristics of the urban patterns, section, and relations between buildings, open spaces, and greenery (Figure 2).

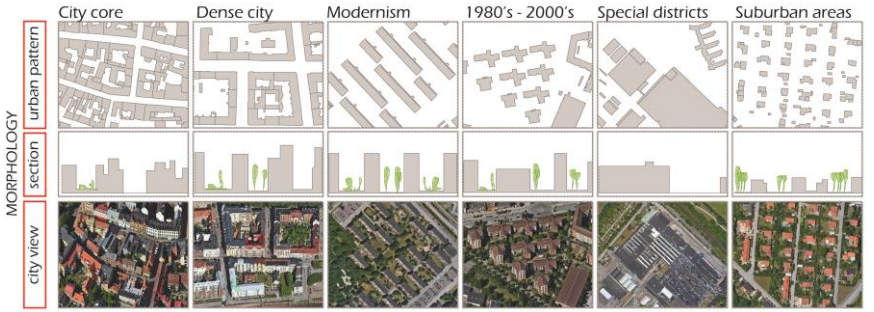


Figure 2: Different morphologies included in the transect, from the dense central areas to the scattered suburban developments (Troglio, Martschenko, Haas, 2012)

Land use (Figure 3) aims to describe the size, mix, and spatial distribution of functions in the different patterns and the related role for energy peaks control and feasibility for distributed energy resources (Holden and Norland, 2005), as well as support for sound social life and activities (ESCTC, 1994). These schemes highlight the complexity of the distribution patterns and ease the comparison between different systems. Thanks to the inclusion of the land cover factor, built density and footprint effects on heat island effect (Oke, 1982) and run off phenomena (Fiumi and Rossi, 2007) are highlighted.

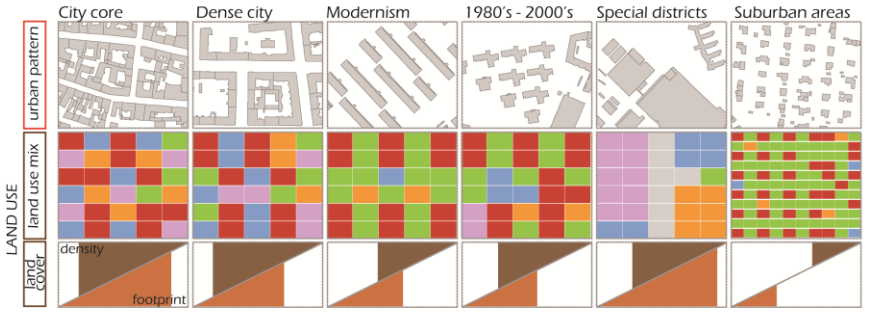


Figure 3: Visualization of the land use mix, parcel sizes, and land cover mostly recurrent in the different morphologies (Troglio, Martschenko, Haas, 2012)

The proportion of the different transportation modes is outlined in Figure 4. Common characteristic and trend in numerous European dense city cores is a high walkability and public transport service, while cars are often kept away to improve quality of life and public spaces, and to control pollution. On the contrary, suburban areas have shown difficulties in supporting walkability and collective transport due to the disperse pattern and predominant mono-

functionality (Newman and Kenworthy, 1999). Though morphology influences transport choices, social-economic characteristics of the population strongly affect the modal split, and need thus to be considered in the policy system to produce effective car usage reduction (Dieleman et al., 2002).

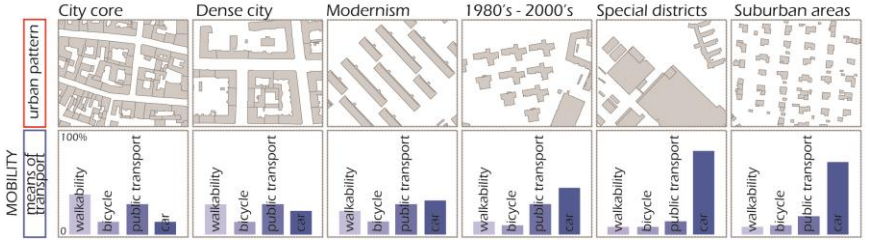


Figure 4: Modal split can be analyzed for each morphology, evaluating the sustainability potential of different configurations and posing the basis for cross-connection networks within the city (Troglio, Martschenko, Haas, 2012)

Energy performances and microclimate of urban settlements can be influenced by type and extension of green and blue elements as they affect transpiration, heat exchange, air flows, and pollution. Figure 5 describe the recurrent patterns that characterize each morphology, aiming to summarize the three main features – quality, size, and compactness/network – that mostly determine a decrease in the used energy and improve the microclimate.

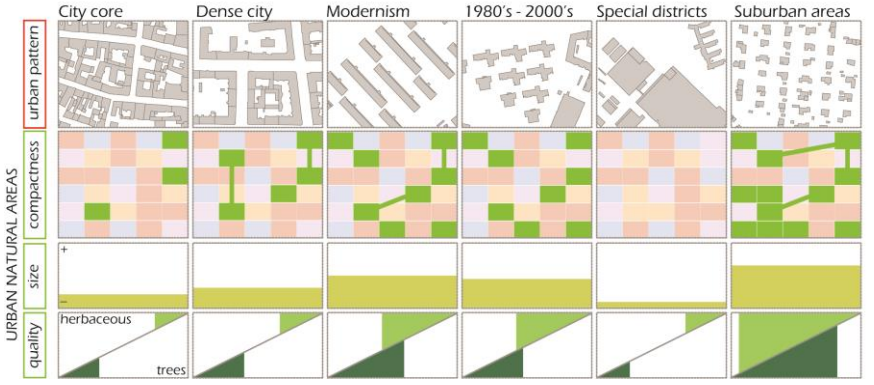


Figure 5: Visualization of green areas in urban settlements by connectivity, size and quality (Troglio, Martschenko, Haas, 2012)

By identifying compactness, extension and quality of urban natural areas in relation with morphology it is possible to set a clear framework for actions that maximize the benefits of an interconnected net of green areas. Trees and

gardens, as well as green roofs, contribute to reduce the summer heat (thus reducing the need of cooling) by controlling the microclimate (Arnfield, 2003, Akbari et al., 1992), protect from winds (Givoni, 1998), reduce the air pollutants (Ratti et al., 2005), and prevent run-off effects and floods (Girling and Kellett, 2005). Nevertheless, it has to be noticed that lawns, despite their contribution in increasing permeable surfaces and reducing the risk of floods, have inferior value than trees, as energy and water consumption for their maintenance is high and the ecological and energy balance effect low.

As prior discussed, if considered as single elements, buildings' energy performances can be easily estimated and categorized by looking at form, surface complexity, and materials. Since constructions are not separated by the urban context in which they lay and interact, the energy performances of cities are strongly influenced by their specific evolution, depending thus not only on the characteristics of the single elements (the buildings), but also on the urban grid – the morphology – and the adopted retrofit / upgrades policies. Figure 6 exemplifies, starting from the results obtained for the city of Uppsala, the average block characteristics of European cities and the influence on energy performances. City centers are often characterized by older buildings, high density, and compactness of the built environment which correspond to low solar radiation, characteristics that progressively change towards the outskirts and suburban areas.

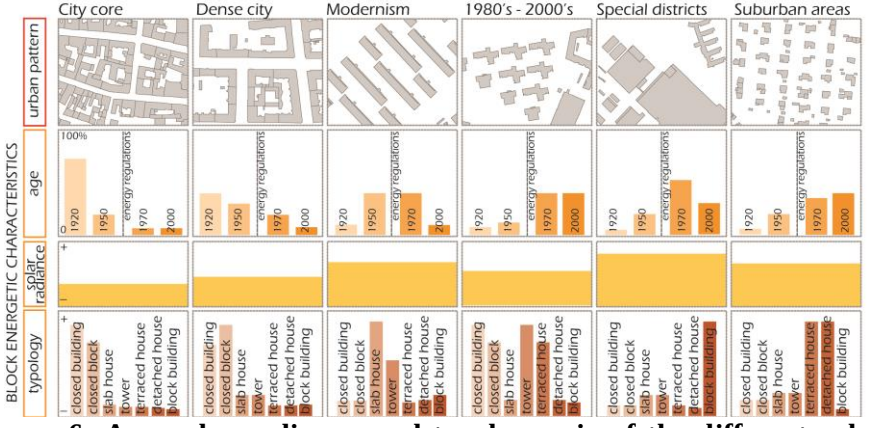


Figure 6: Age, solar radiance, and typology mix of the different urban morphologies can greatly influence the overall energetic performances (Troglio, Martschenko, Haas, 2012)

CONCLUSIONS

Cities are not static and they constantly change and evolve in new directions. Any new development is a challenge to the current situation, as it can transform the status quo in unprecedented ways (Madanipour, 2006). In neighborhoods, housing and real estate markets, we see this transformation evolving in all kinds of emergent ways, not least of sustainability. Achieving true sustainability and resilience as a way of raising the quality of life through urban design will not happen without the promotion of energy efficiency in each neighborhood and housing area. Furthermore the issues of maintenance, management and refurbishment the housing stock and housing affordability are paramount and go hand in hand with the renewed interest and need for social and low-cost housing. Overall in sustainable urban development, raising the quality of life through livability will be carried on the way we treat resilience vis-a-vis to climate change and the way we decide increase density and efficiency of urban areas – making them truly smart, lean, green and livable cities based on sustainable urbanism principles (Lehmann, 2016 and Lehmann and Bay, 2017)

Understanding and visualizing the energy characteristics of urban morphologies by adopting a transect approach contributes to focus the attention on the need of interdisciplinary planning to fully understand and exploit the potentials of urban areas to reach a more sustainable development (Farr, 2007). By adopting Sustainable Urbanism as theoretical background, the energy transect aims to contribute in the planning, design, and management of cities and districts by helping the processes that shape forms and functions of the built environment.

Internal organization of a city and relations with its region are important elements to be analyzed in their mutual connections to create the necessary environmental and socio-economic conditions (Nijkamp and Perrels, 1994) which support urban services and functions (Hardoy et al., 1992). The synergy of physical urban form, transportation patterns, natural resources, and land use, together with their socio-economic aspects became crucial for creating livable cities and communities, elements of a sustainable metropolitan-regional city network (Haas, 2012 and Haas, 2016). The value of using an energy transect become particularly important to explain the components of coherent urban patterns and improving their energy performances, to define density and human access to nature as well as design and energy saving schemes, new parameters to overlay with the city morphology (Farr, 2007).

REFERENCES

1. Akbari, H. S., Davis, S., Dorsano, S. (1992), Cooling Our Communities: A Guidebook on Tree Planting and Lightcolored Surfacing, US Environmental Protection Agency Guidebook, Washington, DC.
2. Madanipour A. (2006): Roles and Challenges of Urban Design, Journal of Urban Design, 11:2, 173-193
3. Arnfield, A. J. (2003), Two decades of urban climate research: a review of turbulence, exchanges of energy and water, and the urban heat island. International Journal of Climatology, 23, pp. 1–26.
4. Basalla, G. (1980), Energy and Civilization, in Science, Technology and the Human Prospect, Chauncey Starr ed., Pergamon Press.
5. Beatley, Newman and Boyer, 2009, Resilient Cities: Responding to Peak Oil and Climate Change. Island Press. Washington D.C.
6. Bohl, C., Plater-Zyberk, E., (eds) (2006), Building Community Across the Transect. Places, 18(1).
7. Burchell, R., Listokin, D. (1982), Energy and Land use, Center for Urban Policy Research, Rutgens, The State University of New Jersey.
8. Calthorpe, P. 2011, Urbanism in the Age of Climate Change, Island Press, Washington D.C.
9. Calthorpe, P. and Fulton, W. 2001, The Regional City. Island Press, Washington D.C.
10. CNU - CONGRESS FOR THE NEW URBANISM, 1999, Charter of The New Urbanism. McGraw-Hill Professional: New York.
11. Coyle, S. J. (2011), Sustainable and Resilient Communities: A Comprehensive Action Plan for Towns, Cities and Regions, NY Wiley.
12. De Pascali, P. (2008), Città ed energia. La valenza energetica dell'organizzazione insediativa, Franco Angeli, Milano.
13. Dieleman, F.M., Dijst, M., Burghouwt, G. (2002), Urban Form and Travel Behaviour: Micro-level Household Attributes and Residential Context. Urban Studies, 39(3), pp. 507–527.

14. Droege, P. (2006), The Renewable City: A comprehensive guide to an urban revolution, Wiley: New York.
15. Duany, A. (2002), Transect Planning. Journal of the American Planning Association, 68(3), American Planning Association, pp. 245-266.
16. Duany, A., Talen, E., (eds.) (2002), Special Issue: The Transect. Journal of Urban Design, 7(3).
17. Emerson, C. (2007), The SmartCode Solution to Sprawl, Washington DC Environmental Law Institute.
18. ESCTC - The European Sustainable Cities & Towns Campaign (1994), Charter of European Cities & Towns Towards Sustainability – The Aalborg Charter, European Conference on Sustainable Cities & Towns, Aalborg, Denmark, 27 May.
19. Farr, D. (2007), Sustainable Urbanism: Urban Design with Nature, Wiley.
20. Fiumi, L., Rossi S. (2007), Dalla cartografia storica al telerilevamento: la città di Roma, Edizione CNR – Pagine, Roma.
21. Frey, H. (1999), Designing the city: towards a more sustainable urban form, E & FN Spon: London.
22. Girling, C., Kellett, R. (2005), Skinny Streets and Green Neighborhoods: Design for Environment and Community, Island Press.
23. Givoni, B. (1998), Climate considerations in building and urban design, Van Nostrand Reinhold: New York.
24. Grant, A., Johnstone, C., Kelly, N. (2008), Urban wind energy conversion: the potential of ducted turbines, 2008, Online http://strathprints.strath.ac.uk/5672/1/strathprints005672.pdf
25. Haas, T. (ed.) 2008, New Urbanism & Beyond: Designing Cities for the Future, Rizzoli: New York.
26. Haas, T. (ed.) (2012), Sustainable Urbanism & Beyond: Rethinking Cities for the Future, NY Rizzoli.
27. Haas, T. (2016) Beyond the sustainable urban design roadmaps, Journal of Urban Design Vol. 21 , Iss. 1,2016
28. Hardoy, J. E., Mitlin, D., Satterthwaite, D. (1992), Environmental problems in Third World cities, Earthscan: London.
29. Jenks, M., Burton, E. (2000), Achieving sustainable urban form, London, Spoon press, New York.

30. Krumdieck, S., Page, S., Dantas, A. (2010), Urban from and long-term fuel supply decline: A method to investigate the peak oil risks to essential activities. Transportation research Part a, 44, Elsevier, pp. 306 – 322.
31. Lehmann, S. (2016) Sustainable urbanism: towards a framework for quality and optimal density? Future Cities and Environment, Springer (2016) December 2016, 2:8
32. Lehmann, S. and Bay, P. (2017) Growing compact: urban form, density and sustainability, Routledge: London
33. Low, T.E. (2010), Light Imprint Handbook: Integrating Sustainability and Community Design, Civic by Design, Charlotte NC.
34. Newman, P and Jennings, I. (2008). Cities as Sustainable Ecosystems: Principles and Practices. Island Press. Washington D.C.
35. Newman, P.W.G., Kenworthy, J.R. (1999), Sustainability and Cities: Overcoming Automobile Dependence, Island Press: Washington, D.C., USA.
36. Nijkamp P., Perrels A. (1994), Sustainable cities in Europe: a comparative analysis of urban energy environmental policies, Earthscan: London.
37. Oke, T. R. (1982), The energetic basis of the urban heat island. Quarterly Journal of the Royal Meteorological Society, 108, pp. 1–24.
38. Olgyay, V. (1973), Design with climate: bioclimatic approach to architectural regionalism, Princeton University Press, Princeton.
39. Perlin, J. (2005), A forest journey. The story of wood and civilization, The Countryman Press: Woodstock, Vermont.
40. Ratti, C., Baker, N., Steemers, K. (2004), Energy Consumption and Urban Texture. Energy and Buildings, 37, pp. 762-776.
41. Ratti, C., Di Sabatino, S., Britter, R. (2005), Urban texture analysis with image processing techniques: winds and dispersion. Theoretical and Applied Climatology, Springer-Verlag.
42. RUE, H., ROONEY, K., DOCK, S., ANGE, K., TWADDELL, H., & PONCY, A. (2011). The role of FHWA programs in livability. Retrieved from http://www.fhwa.dot.gov/livability/state_of_the_practice_summary/research2011.pdf; June 16, 2013.

43. Smil, V. (1994), Energy in World History, Westview Press.
44. Steuteville, R. and Langdon, P. 2009, New Urbanism: Best Practices Guide, Fourth Edition. New Urban Publications: Ithaca.
45. Talen, E. (2013) Charter of the New Urbanism, Congress for the New Urbanism, McGraw-Hill Professional: New York
46. Thadani, D. (2011), The Language of Towns & Cities, Rizzoli.
47. The Prince's Foundation For The Built Environment, 2007, Valuing Sustainable Urbanism (Commissioned by The Prince's Foundation for the Built Environment from Savills plc. A Report Measuring & Valuing New Approaches to Residentially Led Mixed Use Growth, London UK).
48. E. Troglio, T. Martschenko, T. Haas (2012), THE ENERGY TRANSECT. Including sustainability issues in the urban morphology analyses, WIT Transactions on the Ecology and the Environment (ISSN: 1746-448X, Digital ISSN 1743-3541).
49. Troglio E. (2012), Urban typologies and heat energy demand. Uppsala case study, Report financed through the J. Gust. Richert stiftelse - Sweco, October 2012.
50. Troglio, E., Doni, M., Haas, T. (2011), Urban typologies and heat energy demand. A case-study in the Italian context, 51st European Congress of the Regional Science Association International, Barcelona, Spain, August 30 - September 3.
51. Voogt, J. A. (2002), Urban heat island. Encyclopedia of Global Environmental Change, ed. Douglas, I., John Wiley & Sons, New York, pp. 660–666.
52. VTPI, 2013. Victoria Transport Policy Institute [http://www.vtpi.org/ http://www.vtpi.org/tdm/ - Retrieved February 2013]
53. Walker B, Salt D. (2006), Resilience thinking. Sustainable Ecosystems and People in Changing World, Island press
54. Yang, Y.P.P. (2015) Energy Resilient Urban Form: A Design Perspective, Energy Procedia
55. Volume 75, August 2015, Pages 2922-2927 Elsevier

ISSN: 1857-9000, EISSN: 1857-9019

THE EFFECTIVNESS OF DE-EUROSIATION MEASURES IN WESTERN BALKANS COUNTRIES

Violeta MADZOVA[1] and Luljeta SADIKU[2]

UDC: 336.7.055.4(4-672EU:497-15)

330.362(4-672EU:497-15)

SUMMARY

The geographical proximity of the euro area as well as the close trade and financial relationship with Eurozone countries , accelerated the wide acceptance of Euro parallel with domestic national currency in all Balkan countries , while Montenegro and Kosovo accepted euro as their official tender. However , the turbulences in the Eurozone, brought many challenges to highly euroised Western Balkan countries including vulnerability of the financial system to sudden changes in capital flows, weakening the central banks' effectiveness in the conduct of their monetary policy in providing macroeconomic and financial stability.

Thus, the WBC monetary authorities were forced to introduce certain macro-prudential measures, to initiated the process the reversible process of de-euroisation. The aim of this paper is to analyze the effectiveness of the measures for de-euroisation, introduced by the authorities in three West Balkans countries , Macedonia, Serbia and Albania through measuring the effect of the interest rates spreads on both loans and deposits in local currencies and those expressed or indexed in euro.

Key words: de-euroisation, macroeconomic stability, macro-prudential measures, fostering local currency .

1. INTRODUCTION

The euroisation of the Western Balkan countries was encouraged by the progress in financial markets integration, harmonisation oflegislation and increasing free movement of capital and labour, as well as promote financial deepening and integration with international markets. Therefore, moderate level of euroisation would probably be welcomed and brought some positive

[1]Assoc. Prof. Violeta MADZOVA , v.madjova@ibu.edu.mk,
International Balkan University - Skopje
[2]Ass. Prof. Luljeta SADIKU , l.sadiku@imu,edu.mk ,
International Balkan University - Skopje

effects to many emerging or developing economies , but it should definitely be lower than the levels currently observed in the Western Balkan countries , having the euroisation rate over 40% as a constant trend . The recent sovereign debt crisis and negative impact which was made on the EMU members put forward a question of euro survival and some of the Western Balkan countries started the process of so called de-euroisation.

2. THE EUROSIATION'S SIDE EFFECTS

Although there are empirical evidences about the positive impact of euroisation the small, developing or emerging economies , there are also analysis that prove that there are potentially serious macroeconomic and financial stability drawbacks related to high level of euroisation. This is in particular essential for the monetary authorities being in charge for maintaining price and financial stability in their economies.

Challenges include the vulnerability of the financial system to sudden changes in capital flows and the associated potential for nominal exchange rate volatility, the weakening of the central bank's effectiveness in the conduct of monetary policy and of its function as a lender of last resort, as well as constraints in the choice of an appropriate monetary and exchange rate regime.
The recent studies (made at the beginning of the European sovereign debt crisis) stated that the massive euroisation reduces the effectiveness of monetary policy and makes the transmission of monetary impulses to the real economy more complex than would otherwise be the case. In particular, the central bank has less room to influence macroeconomic variables as the monetary transmission mechanism via interest rates is weakened (García-Escribano, 2010; Acosta-Ormaechea and Coble, 2011).
In the case of asymmetric shocks, monetary and exchange rate policy cannot (or only to a limited extent) react as a shock absorber, as policymakers do not have the same level of control over monetary aggregates and the exchange rate leverage may be limited by the "fear of floating".
Even more, analyzing the consequences of the recent Global financial crisis ,Chitu (2012) found that unofficial dollarization (as well as euroisation) was an amplifying contributor to the economic downturn of 2007-2009 in emerging market economies. In highly euroised economies many policymakers were in favorof maintaining fixed exchange rate, which helps to further reinforce the status quo position in the economies.
The most severe drawback of euroisation is the potential effect it might have on the banks' balance sheets in the event of adverse exchange rate developments, either directly (through currency mismatches and net open

foreign exchange positions) or indirectly through unhedged borrowers. In the latter case currency risks are transformed into solvency risks. As noted by De Nicoló et al. (2003), the indirect solvency risk, which remains for banks even when the foreign exchange exposure of both sides of the balance sheet is matched, may be associated with an increased risk of deposit withdrawals that can lead to bank runs in response to or in anticipation of devaluation. In a similar vein, currency mismatches of corporates, households and the public sector can have severe destabilising effects not only for the banking sector but for the wider economy as a whole (Galindo and Leiderman, 2005).
All this implies that the central bank cannot fulfill its stabilizing role as a safeguard against the liquidity problems of a single institute or threats to the system as a whole.

In case of the West Balkans countries , there is the evidence of several drawbacks of eurosiation on WBC economies in terms of certain shocks of economic development and sustainability indicators, vulnerability of WBC' financial systems to sudden changes in capital flows , higher risk for nominal exchange rate volatility as well as weakening of the central bank's effectiveness in conducting the monetary policy and its function as a lender of last resort.

3. THE PROCESS OF DE-EUROISATION IN WESTERN BALKAN COUNTRIES

The sovereign debt crisis, change the attitude of the monetary authorities , banks and private entities in the Western Balkans countries to be more cautious regarding the extensive use of euro in their financial transactions , savings and credit activities. This stressed the necessity of reversible process of so called de-euroisation and therefore fostering wider use of their local currencies. Namely, over the past 5-6 yeas these countries have deployed some of the macro prudential measures to moderate or even stop the trend of eurosiation. Different regulatory measures towards de-euroisation have had different impact on de-euroisation process in different WBC due to many factors that naturally support euroisation (such as memories of macroeconomic turbulences, high inflation rates and low credibility of monetary authorities).

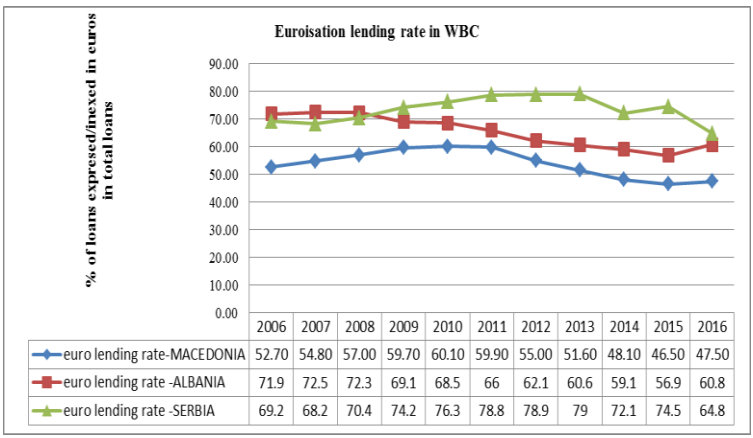
In this regard the analysis of de-euroisation process have been made in three Western Balkan countries-Macedonia, Albania and Serbia, having specifics related to the foreign curency regimes, macroeconomic stability as well as

the different prudent measures that have been depolyed by the monetary authorities over the observed period.

Namely, Macedonia as the smallest economy is employing fixed foreign exchange regime peged to euro, the other two (muchbigger) ones, (Albania and Serbia) have managed float foreign exchange regime. Further , Serbia has showen comparatively high and volatile inflation rates as well as high external and fiscal imbalances compared to the other two, while Macedonia till 2015 has been emproving the business enviroment , which has been worstened in the recent period (2016 and on) , due to political crisis. Albania is still facing with the problem of low credibility in institutions and debendence of remitances from abroad , which are directly supporting euroisation, and the monetary authorities are less comitted (in related to other two countries) in introducing more radical measures towards de-euroisation.

More explicitly, the level of de-euroisation analyzed through the level of lending euroisation(% of loans expressed or indexed in euro in total loans to non-financial corporations and households) and level of deposit euroisation(% of euro deposits in total deposits from non-financial corporations and households) in the period 2006-2016 is presented in Figure 1 and Figure 2.

Figure1 :Euroisation lending rate in WBC



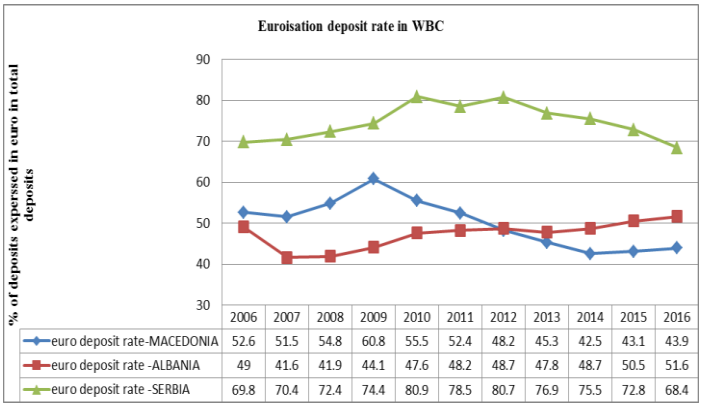
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
euro lending rate-MACEDONIA	52.70	54.80	57.00	59.70	60.10	59.90	55.00	51.60	48.10	46.50	47.50
euro lending rate -ALBANIA	71.9	72.5	72.3	69.1	68.5	66	62.1	60.6	59.1	56.9	60.8
euro lending rate -SERBIA	69.2	68.2	70.4	74.2	76.3	78.8	78.9	79	72.1	74.5	64.8

Source: WBC Central Banks Annual Reports (created by the author)

Analyzing the level of lending and deposit euroisation in the banking sectors of the observed Western Balkan countries, the most evident drop of euro denominated deposits and loans is registered in Macedonian banking sector , decreasing its deposit share from over 60% to 43% , while the share

of euro denominated and indexed loans decreased from over 70% to 47% at the end of 2016.

Figure 2:Euroisation deposit rate in WBC



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
euro deposit rate-MACEDONIA	52.6	51.5	54.8	60.8	55.5	52.4	48.2	45.3	42.5	43.1	43.9
euro deposit rate -ALBANIA	49	41.6	41.9	44.1	47.6	48.2	48.7	47.8	48.7	50.5	51.6
euro deposit rate -SERBIA	69.8	70.4	72.4	74.4	80.9	78.5	80.7	76.9	75.5	72.8	68.4

Source: WBC Central Banks Annual Reports (created by the author)

The banking sector in Serbia faces extensive euroisation, reaching portion of about 80% of euro deposits in total banks' deposits in 2012 and 79% euro indexed loans in 2013 . However , since then , trend of de-euroisation is noticeable at both lending and deposit side and due to improved macroeconomic indicators as well as to the measures from de-euroisation strategy , the level of euroisation dropped below 70% in 2016. Albania there is the evidence of de-euroisation process on the lending side till 2015 , with slight increase of euroisation in 2016. However there is stable or even slight, but constant increase of euroisation on the deposit side., It might be concluded that Macedonia as a country with fixed exchange rate regime seem to score somewhat better in terms of de-euroisation than the two other countries with floating exchange rate arrangement. The Macedonian authorities argue that the local currency fixed to euro inspires the confidence of depositors in the local currency and its relative value in euro, which on the other side , might create a false sense of security for borrowers in foreign currency .

The stable macroeconomic environment needed to be supported by effective regulatory and prudential measures which can serve as a catalyst for increasing the use of the domestic currency in each of the observed countries.

4. DE-EUROISATION MEASURES IN WESTERN BALKAN COUNTRIES

The observed Western Balkan countries (Macedonia, Albania and Serbia) have been relatively active in implementing regulatory and prudential de-eurosiation measures, which were mostly aimed to discourage foreign exchange lending rather than to create incentives for saving in domestic currency, while only Serbia introduced more comprahensive de-euroisation (or "dinarisation") strategy in March 2012.

Some of the prudential measures mainly served to enhance financial stability , but as well to reduce euroisation, to minimise risks stemming from foreign exchange lending and to incentivise local currency savings.

Prudential measures taken in the region include ceilings on foreign exchange exposure, higher reserve requirements for foreign exchange denominated liabilities, liquidity requirements for foreign exchange denominated assets as well as provisioning requirements.

In that respect , in the period 2009-2015 , Macedonian authorities continiously introduced more favorable reserve requirement on local currency liabilities, which envisaged that reserve requirement of 8%, for deposits in denars, while deposits indexed to foreign currency to 20%, and deposits denominated in foreign currency to 15% (previously all were subject to 10%). Furthermore, as of September 2015 , the reserve requirement ratio on banks' liabilities to households in local currency with a contractual maturity of above one year is equal to 0%.

In recent two years (2015 and 2016) the Serbian authorities required reserves rates are different by currency and by maturity of liabilities included in the required reserves base. Thus, rates for domestic currency liabilities are 5% (maturity up to two years) and 0% (maturity over two years), while the corresponding rates for foreign exchange liabilities are 23% and 16% (20% and 13% as of February 2016), respectively.Albanian authorities envisage , tighter provisioning requirements for foreign exchange loans.In that respect , loans in foreign currency granted for nonfinancial entities outside the country bear a risk coefficient of 150% for the purpose of calculating the risk weighted capital of the bank (since 2010). Any increase in net investments with non-resident financial institutions or securities bears a risk coefficient of 100% (2013). While the lower or no reserve requirements for liabilities in local currency is in favor of both lending and deposit de-euroisation, the

provisioning requirements for loans in euro is only in favor of lending de-euroisation.

Thus , the limited effect of de-euroisation on deposit side versus more evident on lending side is quite understandable.

5. EMPIRICAL FINDINGS OF DE-EUROISATION MEASURES EFFECTIVNESS IN WESTERN BALKAN COUNTRIES

The above mentioed regulatory measures enables the banks in the region to inrease their lending volume , as well as to decrease the interest rate on loans expresed in local currency . However , there is the evidence that the reduction of the interest rate differential between lending in euro and in domestic currency contribute further to the process of de-euroisation. This is the case particularly in Albania and Macedonia where the reduction of the interest rate differential was accompanied by a decrease in euro lending. The simmilar effect with pospond effect is noticable in Serbia too, as the prudent mesures from denarisation strategy started to show more evident effects in 2016 .The impact of the differences in domestic and foreign exchange lending rates on the level of euroisation will be demostrated, using the model of panel regression as well as trend anlysis in three observedWestern Balkans countries.

To examine if the decreasing spread between the domestic and foreign exchange lending rates contribute to the process of de-euroisation (particulary at the loan side), it is examined the influence of the mentioned spread on the level of lending euroisation (i.e % loans expressed or indexed in euro in total loans to non financial institutions.

For that purpose OLS approach is aplied , where as dependent variable is considered lending euroisation level(EURL) , while as the independent variable is included interest rate gap (IRG), as a difference between lending interest rate for loans expressed in national currency (IRDC) and the interest rate for loans expressed or indexed in euro (IREUR).
In the empirical analysis are used the annual data series which covers the period 2006-2016. The main sources of data are the reports and other official publication of the observed WB countries' Central Banks and State Statistical Offices.
E**conometric Model** represents the random effects of panel regression model as follows :

$$\ln\text{EURL}_i = \beta_0 + \beta_1 lnIRG_i + \varepsilon_i$$

where EURL is the level of lending euroisation in time i; β_0 is the constant; while IRG is the interets gap (differential) between lending interest rate for loans expressed in national currency and the interest rate for loans expressed or indexed in euro. With 'ε' is presented the error term, or stochastic factor that is supposed to be with zero conditional mean and constant variance, ie $E(\varepsilon_i) = 0$ for each period i. All the data are transformed into logarithms. (Table1)

Table 1 : Regression output for period 2006-2016

```
Random-effects GLS regression                   Number of obs      =        33
Group variable: country                         Number of groups   =         3
R-sq:  within  = 0.4851                         Obs per group: min =        11
       between = 0.9995                                        avg =      11.0
       overall = 0.8418                                        max =        11
                                                Wald chi2(1)       =    164.92
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
------------------------------------------------------------------------------
  log_udkvok |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      log_kg |   .1791797   .0139524    12.84   0.000     .1518336    .2065259
       _cons |   3.939903   .0196634   200.37   0.000     3.901364    3.978443
-------------+----------------------------------------------------------------
     sigma_u |          0
     sigma_e |   .0614038
         rho |          0   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Analyzing the results, the focus is made on the z-statistics, which tests the significance of the coefficient of the interets gap (differential) between lending interest rate for loans expressed in national currency and the interest rate for loans expressed or indexed in euro(IRG).

This estimation present the IRG value of 12.84 which is much higher than the critical value of 2.

Thus it can be concluded that there is a positive and highly significant impact on decreasing lending euroisation rate .

The similar findings can be confirmed by observing the p-value.

Being (< 0.01) indicates the high level of significance (and therefore rejection of the null hypothesis of non significance). In other words, a predictor that has a low p-value is likely to be a meaningful addition to our model because changes in the predictor's value are related to changes in the response variable. Furthermore, the coefficient of independent variable IRG is 0.179, which indicate that 1% change of interest gap will imply 0.179% change of euroisation.

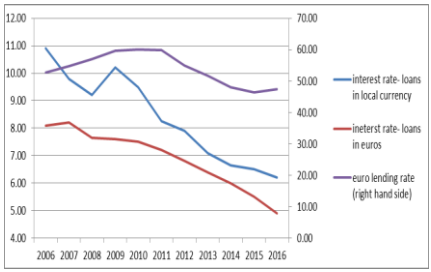
From the model, it can be also analyzed the R-squared, between and overall R2 (as a statistical measure of how close the data are to the fitted regression line). According to the results the overall R-squared is 0.84, implying that 84% of variations of the lending euroization rate , could be explained by the changes of differential) between lending interest rate for loans expressed in

national currency and the interest rate for loans expressed or indexed in euro (IRG).

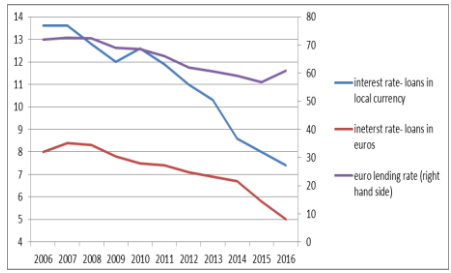
The strong corelation and impact of differences in domestic and foreign exchange lending rates on the level of euroisation with each of the observed Western Balkan countries can be confirmed through trend analysis presented on the following graphs :

Graph 3: Banks' lending rates in euro and domestic currency loan

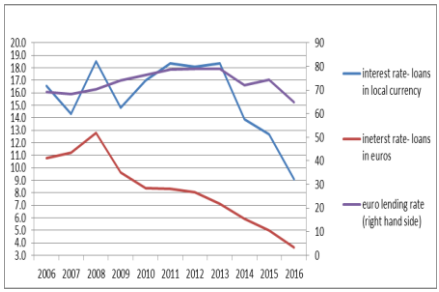
Macedonia



Albania



Serbia



Source: Central Banks reports –created by the author

The graphs clearly present that the country with constanly highest euroisation (Serbia) has the bigest diferences in domestic and foreign exchange lending rates. However the dicrease of the spread of the mentioned lending rates in recent year , resulted with decreasing the level of euroisation. On the other hand ,Macedonia is the country which has the biggest results in the process of de-euroisation andin the same time , the smallest diferences in domestic and foreign exchange lending rates. The same correlation implies for Albania.

6. CONCLUSIONS

Although the evidence and literature findings suggest that macroeconomic stabilization of the West Balkans countries bring euroisation rates down, the process of de-euroisation need to be accompanied with respective regulatory and prudential measures. The observed Western Balkan countries have introduced certain regulatory and prudential measures, especially aimed at lowering foreign exchange lending. While clear causalities between measures taken and a reduction in the eurosiation rates are difficult to establish, some conclusions can be drawn. In this paper it is demonstrated clear evidence that the reduction of the interest rate differential between lending in euro and in domestic currency contribute further to the process of de-euroisation

REFERENCES

1. Acosta-Ormaechea, S. and Coble, D. (2011), "Monetary Transmission in Dollarized and Non-Dollarized Economies,IMF Working Paper, No. 11/87.
2. Basso, H., Calvo-Gonzalez, O. and Jugila, M. (2007), "Financial Dollarization: The Role of Banks and Interest Rates", ECB WP, No 748.
3. Bratkowski, A., Rostowski, J.. 'The EU attitude to unilateral euroization: Misunderstandings, real concerns and suboptimal admission (2012)
4. Cabral I., Dierick F., esala J. "Banking integration in the euro area" 2002.
5. Chitu, L, "Was unofficial dollarisation/euroisation an amplifier of the 'Great Recession' in emerging economies?", ECB WP, No. 1473, 2012
6. Calvo, G. and Reinhart, C. (2002), "Fear of floating", *The Quartely Journal of Economics*, Vol. 117, No. 2, pp. 379-408.
7. De Nicoló, G., Honohan, P. and Ize, A. "Dollarization of the Banking System: Good or Bad?", WB Working Paper, No. 3116. (2011),
8. Lucia Országhová " Euroisation in the Western Balkans (Part III)"-EU Enlargement ed. 23, 2/2015
9. Roland Back at all "Financial stability challenges for EU acceding and candidate countries "Occasional paper series, No 136, Sept. 2012 .
10. ECB (2015), " Financial stability challenges in EU candidate and potential candidate countries", International Relations Committee Expert Group of the ESCB, ECB Occasional Paper, No 164.
11. Luca, A. and Petrova, I. (2008), "What Drives Credit Dollarization in Transition Economies?", Journal of Banking and Finance, Vol. 32, No. 5, pp. 858–869.

12. Mueller, H. (1999), "From Dollarisation to Euroisation - The Future of the Euro as an International Substitution Currency", *Intereconomics*, Vol. 34 (November/December), pp. 286-296.
13. Tkalec, M. (2013), "The Determinants of Deposit Euroization in the European Post-transition Countries: Evidence from Threshold VECM", ONB, Q1/2013.
14. Ulrich Windischbauer "Strengthening the role of local currencies in EU candidate and potential candidate countries " ECB Occasional Paper Series , No 170 / April 2016

PRACTICAL IMPLEMENTATION OF THE MIHAJLOVIČ METHOD IN THE "MANTOVO" DAM

Veton HAMZA[1]

UDC: 627.8.04:624.04]:528.063(497.7)

SUMMARY

In complex engineering objects such as dams, bridges, viaducts and other objects, deformations occur on them over time as a result of the external factors and the size of the objects themselves. In order to avoid potential disasters, these objects in certain time periods are supervised for potential deformations. There are a range of different methods of deformation analysis through which displacement of objects is determined. In this research a practical application of the *Method of Mihajlovič* is applied for determination of horizontal deformations of the *"Mantovo"* dam with the aim of analyzing the conducted results. In practical implementation two epochs of measurements are used, the first epoch from the year 1978 and the second epoch from the year 2008. From the conducted calculations it is confirmed that this methodology has its disadvantages in determination of the stable points that also affect the determination of the points that are located in the dam itself. This issue is overcome by setting more stable points when developing the network, these points should not be dislocated over time, but of course in natural environments this is difficult to achieve. The inability of determining the stable points is a major drawback that limits the practical implementation of this methodology.

Key words: geodetic network, deformations, stable points, epochs of measurements, deformation analyses.

1. DESCRIPTION OF THE DAM

The *"Mantovo"* dam was built in the late seventies of the last century. It is located in the southeastern part of the Republic of Macedonia, precisely in the Kiva Lakavica River. This accumulation has a capacity of 490 million m^3 water and is mostly used for agricultural needs in the region. It is an embankment dam, and has the following characteristics (Samarov, 2010):

[1] **Ass.MSc**.**Veton HAMZA**, veton.hamza@unt.edu.mk,veton_hamza@hotmail.com, University Mother Teresa- Skopje, Geodesy and Geoinformatics Department, Adress: Negotino - Gostivar. FYROM, Tel +389 72 755 215

- the construction height (49.0 m)
- the slope of downstream side (1:2)
- the slope of upstream side (1:1.75)
- the length of dam's crest (138 m)
- the maximal width of the base (161.38 m).

The view of the dam on the accumulated side is shown in Fig.1 while the view on the side where geodetic points are placed is shown in Fig.2.

Fig.1. The view on the accumulation

Fig.2. Downstream side of dam

2. PREVIOUS MEASUREMENTS FOR AUSCULTATION OF THE DAM

During the construction of the dam a geodetic network was developed that was used for construction needs and then for performing auscultation. For determination of the altitude deformations a high network is used that consists of five benchmarks placed far from the dam that actually are the basic benchmarks, while also a part of the high geodetic network are the 15 geodetic points placed in the dam itself (Fig.5).

The horizontal network is composed of 26 geodetic points, which include 20 points arranged in three rows with a mutual distance of 22 m and 6 basic points that make up the basic part of the geodetic network from which the measurements were conducted (Fig.3). The points of the basic network are placed in the concrete pillars that also have devices for forced centering (Fig.4). For determination of the horizontal deformations, horizontal angles from the stations *I,II,III,IV,V* and *VI* to the points that are located on the dam are measured. The measurements are conducted in four series with the

theodolite *Wild T3* with the precision of *1"*. The measured angles are controlled if they have rough errors with the *"Data Snooping"* method (Baarda, 1986).

The first epoch of measurement is done after the construction of the dam in the year 1978 and within this period the local coordinative system is also defined, and based on the measurements the approximate coordinates are determined. After the first epoch a couple epochs of measurements for osculation of the dam are done. In this research as the second epoch of measurements are the conducted measurements in the year 2008.

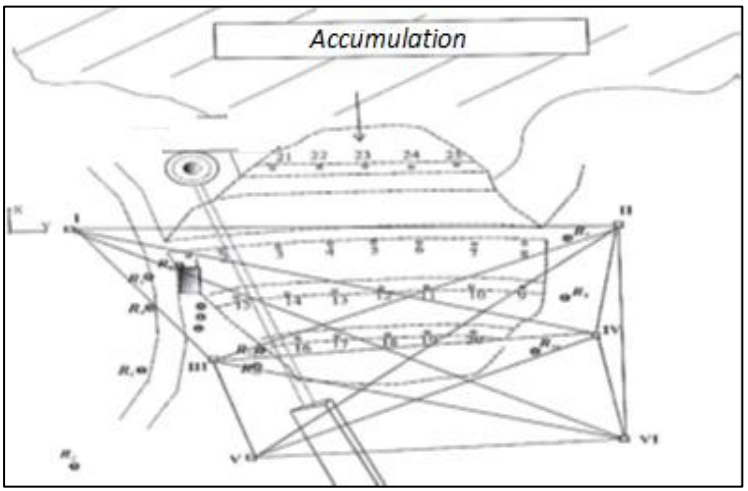


Fig.3.Geodetic network in the "Mantovo" dam

Fig.4.Points of the basic network

Fig.5.Geodetic points

3. METHODS FOR OSCULTATION

Nowadays different models for determining the deformation on the objects are used; among the safest methods are the method of *Pelzer, Caspary, Delft, Karlsruhe* etc. With the *Pelzer* method when equalizing the network the next conditions are required: $v^T pv=min$ and $x^T x=min$ (Mihajlovič and Aleksič, 1994). This method has a lot of similarities with the method of *Caspary* which also foresees the same conditions when equalizing the network (Caspary, 2000).
The method of Mihajlovič differs from these methods because it foresees the use of conventional datum of the geodetic network, while with other methods the datum is optimal according to the S-transformations (Baarda, 1981). This methodology in practical application tends to give uncertain results, and in the Republic of Macedonia it is not used for the osculation of the dams and other complex objects. In the research this methodology of osculation on the *"Mantovo"* dam is applied, while the main goal is the analysis of the conducted results.

4. THE METHOD OF MIHAJLOVIČ

The method of Mihajlovič is classified in the group of conventional methods of deformation analyses, which unlike other methods requires the fulfillment of the next condition ($v^T pv=min.$) during the equalization of the geodetic network. This method is based on the stability of the coordinate system, if the points that define the coordinate system are not dislocated in the period between the two epochs, then the difference of the coordinates from the second and the first epoch will represent the deformations of the points. If the points that define the coordinate system are dislocated then the unstable points will undergo a displacement caused by the outside factors and instability of the coordinate system.
This methodology is based on two statistical tests, one of which refers to the difference of lengths and the second to the difference of the azimuth angles. In the beginning all of the azimuth angles and lengths of the sides are calculated using the formula that includes all combinations (Mihajlovič and Aleksič, 1994):

$$r = \frac{n(n-1)}{2} \qquad ....(1)$$

where:

r -number of sides of the network
n -number of points of the network

After defining the number of the sides, afterwards it is determined in which sides the differences of lengths obtained from first and the second epoch have a value around zero, and this is done with the next hypothesis (Mihajlovič and Aleksič 1994):

$$H_o = M[\Delta S_i] = 0 \quad \text{....(2)}$$

$$H_A = M[\Delta S_i] \neq 0 \quad \text{....(3)}$$

This hypothesis is checked through the statistical test (Mihajlovič and Aleksič, 1994):

$$t_i = \frac{\Delta S_i}{\sigma_{\Delta Si}} = \frac{\Delta S_i}{\sigma\sqrt{Q_{\Delta Si}}} \quad \text{....(4)}$$

In case of:

1. $t_i < t_{\alpha/2}$ the statistical test has a normal central dispersion and the first hypothesis is accepted (Form. 2).
2. $t_i > t_{\alpha/2}$ the statistical test has a normal eccentric dispersion and the alternative hypothesis is accepted (Form. 3).

The statistical test shows that the lengths in which the value of the statistical test is colored with red (the last column t_i) the first hypothesis applies (Tab.1), when solving practical cases the statistical test for lengths can also be performed through the next test (Mihajlovič and Aleksič, 1994):

$$|\Delta S_i| \leq 3\sigma_{\Delta Si} \quad \text{....(5)}$$

This condition is attained by the lengths shown in column ΔS_i marked with red color, as it can be seen from Table.1 this condition fulfills a large number of sides. From the Table1 it can be seen that we have two groups of points in which the difference of the azimuth angles are gathered around a particular value. One group consists of points *I,II, III* and *VI*, while in the other group we have the points *II,IV* and *V*. All these points can be declared

as conditionally stable points. From these results it cannot be decided to which group of points should the test for azimuth angles apply, that is why the test is applied for both groups of points. Whether conditionally stable points are really stable will be confirmed through the difference of the azimuth angles, and the following hypothesis (Mihajlovič and Aleksič 1994):

$$H_o = M[\Delta\varphi_i] = 0 \quad \text{....(6)}$$

$$H_A = M[\Delta\varphi_i] \neq 0 \quad \text{....(7)}$$

This hypothesis is checked through the statistical test (Mihajlovič and Aleksič, 1994):

$$t_i = \frac{|\Delta\varphi_i|}{\sigma_{\Delta\varphi i}} = \frac{\varphi_i - \overline{\varphi}}{\sigma\sqrt{Q_{\Delta\varphi i}}} \quad \text{....(8)}$$

In case of:

1. $t_i < t_{\alpha/2}$ the statistical test has a normal central dispersion and the first hypothesis is accepted (Form. 6).
2. $t_i > t_{\alpha/2}$ the statistical test has a normal eccentric dispersion and the alternative hypothesis is accepted (Form. 7).

From the obtained values it is defined that the statistical test of azimuths applies to both groups of points, whereas the dilemma that appears is which group of points should be pronounced as stable. This issue is not easy to solve. The stable points impact the determination of the deformations of the points that are located in the dam itself, which is why the inability to define the stable points results in the impossibility of determining the deformations on the other geodetic points located on the dam.

The solution to this matter is to have stable points and their number should be higher than the number of the points that are declared as conditionally stable points (Mihajlovič and Aleksič, 1994). This means that when projecting the network, points need to be set in such a way in which we will be certain that they will not shift over time, which regarding the natural conditions is almost impossible.

Table1.The difference of the azimuth angles and the lengths between the second and the first epoch.

TiTj		First epoch				Second epoch				Difference			Test	
		νio			Sio	νio			Sio	Δνi	ΔSi	σΔSi	3σΔSi	ti
		°	'	''	(m)	°	'	''	(m)	''	(mm)	(mm)	(mm)	
I	II	90	0	0.00	188.6219	90	0	0.00	188.6219	0.0	0.0	1.3	3.9	0.0
I	III	156	29	47.15	101.0799	156	29	42.73	101.0847	4.4	-4.8	1.1	3.2	-4.53
I	IV	114	50	2.09	215.7883	114	50	0.32	215.7925	1.8	-4.2	1.6	4.7	-2.71
I	V	159	46	50.45	161.4455	159	46	46.09	161.4532	4.4	-7.7	1.4	4.2	-5.56
I	VI	127	35	53.73	250.3703	127	35	53.35	250.3781	0.4	-7.8	1.9	5.6	-4.17
II	III	237	59	40.89	174.8948	237	59	34.93	174.8933	6.0	1.4	1.3	3.9	1.10
II	IV	175	26	59.94	90.9153	175	26	49.52	90.9158	10.4	-0.5	1.0	3.0	-0.46
II	V	221	14	33.06	201.4781	221	14	24.46	201.4788	8.6	-0.7	1.6	4.8	-0.42
II	VI	176	20	54.53	153.0669	176	20	46.22	153.0717	8.3	-4.8	1.4	4.3	-3.38
III	IV	89	14	21.32	155.5366	89	14	16.80	155.5373	4.5	-0.8	1.2	3.7	-0.62
III	V	165	14	43.18	60.8079	165	14	38.87	60.8109	4.3	-2.9	0.9	2.6	-3.44
III	VI	110	48	24.29	169.0863	110	48	24.17	169.0890	0.1	-2.7	1.4	4.3	-1.89
IV	V	246	30	26.79	152.6926	246	30	18.75	152.6939	8.0	-1.2	1.3	3.8	-0.97
IV	VI	177	39	44.21	62.1791	177	39	38.69	62.1835	5.5	-4.4	0.9	2.6	-5.06
V	VI	90	30	22.18	142.5781	90	30	19.77	142.5786	2.4	-0.6	1.2	3.7	-0.47

5. CONCLUSION

The method of Mihajovič in contrast to other conventional methods of deformation analyses has shorter calculations for determining the stability of the geodetic points. The same is based on the stability of the coordinate system while the dislocation of the coordinate system is a result of the points through which the same is defined (Mihajlovič and Aleksič, 1994).

From practical application of this method in the *"Mantovo"* dam it is concluded that with the same it cannot be defined which points remained stable in the period between the two epochs of measurements, while the method of Pelzer gives certain results when using the same measurements (Ajro, 2014).

In our case the differences of the azimuth angles are gathered around two values, the first group, same as the second group, meets the requirements in order to be declared as stable points based on the statistical test of this methodology. Knowing that the calculation of deformations of other points depends on the stable points, the same are not calculated because it cannot be confirmed which of the points are stable. This issue is overcome if, when

projecting, the network stable points are placed in such way that we will be certain that they will remain stable and will not shift. Taking into account the natural conditions the stability of the points cannot be guaranteed. The number of the stable points for which we are certain that they are not displaced should be higher than the number of the points for which we have a dilemma whether they are stable.

Knowing that the number of the points that need to be declared as stable (conditionally stable) is not always the same complicates the solution of the issue even more. If this issue is solved, then as stable points are declared those points in which the difference of the azimuths angles will be gathered more around a particular value within the measuring accuracy. This solution is debatable for the sole fact that the network already exists and placing new points would induce a series of additional measurements, analyses and costs.

The inability of defining the stable points and the deformation of the dam in practical application is a major disadvantage of this methodology that limits its implementation even though the calculations are shorter compared to others conventional methods of deformation analyses.

REFERENCES

1. Ajro, R., (2014): *Komparacija na sovremeni metodi za ispituvanje na sigurnosta na kontrolnite geodetski mreži*, Univerzitet "Sv.Kiril i Metodi" , Gradežen Fakultet, Skopje.
2. Baarda, W., (1968): *A Testing Procedure for Use in Geodetic Networks*, Netherlands Geodetic Commission, Delft. Publications on Geodesy.
3. Baarda, W., (1981): *S-Transformations and Criterion Matrices*. Netherlands Geodetic Commission, Delft. Publications on Geodesy, New Series, Vol. 5, No. 1.
4. Caspary, W. F., (2000): *Concepts of Network and Deformation Analysis*. Monograph 11, School of Surveying, The University of New South Wales, UNSW SYDNEY NSW 2052, AUSTRALIA.
5. Mihajlovič, K., Aleksič, K., (1994): *Deformaciona analiza geodetski hmreža*,Građevinski Fakultet Univerzitet u Beogradu, Institut za geodeziju, Beograd.
6. Samarov,I.,(2010): *Metodologija za utvrduvanje na sootvetnost na geodetski mreži za specijalni nameni,* Univerzitet "Sv.Kiril i Metodi" ,Gradežen Fakultet, Skopje.

Other publications!

In regards to the publication of the two scientific papers:

Trajanovski, S., Budzakoska-Gjoreska, B., Trajanovska, S., Zdraveski, K. and Loshkoska, T. (2016). IBI INDEX APPLICATION IN ASSESSMENT OF THE ECOLOGICAL STATUS OF LAKE OHRID TRIBUTARIES. *International Scientific Journal: Micro Macro & Mezzo Geo Information*, (6), pp.108-120.

Zdraveski, K., Petri, L., Trajanovski, S., Beqiraj, S. and Loshkoska, T. (2016). FIRST CONTINGENT VALUATION OF LAKE OHRID BIODIVERSITY. *International Scientific Journal: Micro Macro & Mezzo Geo Information*, (6), pp.62-74.

we would like hereby to apologize for the accidental omission of expressing our gratitude to the Funding Mechanism for publication of the papers:

Acknowledgment

The study was funded by the Financial Mechanism of the European Economic Area (2009-2014), Programme BG03 Biodiversity and Ecosystem Services, ESENIAS-TOOLS Project , D-33-51/30.06.2015.

Dr. Sasho Trajanovski

MSc. Konstantin Zdraveski

GLOSSARY OF TERMS BY OGC [1]

http://www.opengeospatial.org/ogc/glossary (May, 2017)

OVERVIEW

The OGC works in the complex and specialized area of software engineering that concerns itself with the attributes and geometries of features and phenomena on or near the Earth's surface, and with the many kinds of digital processing employed to make this data useful. To enable efficient and precise communication, every specialty, including this one, has its own special terms and special definitions of ordinary words. Facilitating agreement on definitions of geospatial technology terms - for the sake of "semantic interoperability" - is appropriately part of OGC's mission.
As geospatial technology comes into wider use through OpenGIS Specifications that enable its integration into the rest of the information technology world, there is a growing need for a definitive ("normative") geospatial technology industry glossary. To create this glossary, we have drawn from a number of sources and from our familiarity with the language and agreed terms of the OGC Technical Committee. This is a living document, an open source document whose content will change as the technology and technology agreements evolve. We invite you to send your comments and suggestions to Glossary at editor@opengeospatial.org.

Abbreviations and Acronyms Used in the OGC

3DIM DWG – 3d Information Management Domain Working Group
AECOO – Architecture, Engineering, Construction, Owner and Operator
AGILE – Association of Geographic Information Laboratories in Europe
ANSI – American National Standards Institute
Arch DWG – Architecture Domain Working Group
ARML – Augmented Reality Markup Language
AS – Abstract Specification
ASCII – American Standard Code for Information Interchange
AUTH ie – Authentication Interoperability Experiment
BMP – Bitmap. A Microsoft Windows image format
BP – Best Practice
CADD or CAD – Computer-aided design and drafting
Cat DWG – OGC Catalog Domain Working Group

[1] Authorized publication by the Open Geospatial Consortium (editor@opengeospatial.org)

Cat SWG – OGC Catalog Revision Standards Working Group
CEN – Comite Europeen de Normalisation (European Committee for Standardization)
CGDI – Canadian Geospatial Data Infrastructure
CIPI – A 2002 OGC Interoperability Initiative focused on critical infrastructure protection
CITE – OGC Compliance and Interoperability Testing Initiative, the OGC's Compliance Testing Program.
CityGML – OGC City Geography Markup Language (CityGML) Encoding Standard
COM – Common Object Model, a Microsoft paradigm to connect components
CORBA – Common Object Request Broker Architecture
CRS – Coordinate Reference System. Also CRS Domain Working Group.
CS – OGC Catalogue Service Interface Standard
CSW – OGC Catalog Service Interface Standard for the Web
CT – OGC Coordinate Transformation Encoding Standard
CT SWG – OGC Coordinate Transformation Standards Working Group
CTL – Compliance Test Language
CUAHSI – Consortium of Universities for the Advancement of Hydrologic Science
D&I DWG – Defense and Intelligence Domain Working Group
DBF – Data Base File, the Dbase file format
DBMS – Data Base Management System
DCE – Distributed Computing Environment
DCP – Distributed Computing Platform
DEM – Digital Elevation Model
DEMTS – Digital and Electronic Maps Transfer Standard (Russia)
DGIWG – Digital Geospatial Information Working Group
DGN – DesiGN file, the Microstation drawing format
DIGEST – Digital Geographic Exchange Standard
DLG – Digital Line Graph
DLM – Digital Landscape Model
DP – Discussion Paper
DQ DWG – Data Quality Domain Working Group
DS DWG – Decision Support Domain Working Group
DTM – Digital Terrain Model
DWG – Domain Working Group
DXF – Drawing eXchange Format (AutoCAD exchange format)
EA – Enterprise Architecture
EASIG – Enterprise Architecture Special Interest Group
ebRIM – OASIS ebXML (OASIS Electronic Business using eXtensible Markup Language) Registry Information Model. See OGC Catalog ebRIM Application Profile: Earth Observation Products.
ebXML RegRep SWG – OGC Standards Working Group developing an an extension to the OASIS ebXML RegRep standard
EC08 Pilot – Empire Challenge 08 Pilot Project

EDM DWG – Emergency & Disaster Management Domain Working Group
EEA – European Environment Agency
EO – Earth Observation
EO2heaven – Earth Observation and Environmental Modelling for the Mitigation of Health Risks
EOSDIS – Earth Observing System Data and Information System
EPSG – European Petroleum Survey GroupEuroSDR European Spatial Data Research Network
ESDI – European Spatial Data Information Infrastructure
ESS DWG - Earth System Science Domain Working Group
EUROGI – European Umbrella Organisation for Geographic Information
FE or FES – OGC Filter Encoding Standard
GeoAPI – OGC GeoAPI Interface Standard (a Java application programming interface)
GeoRM DWG – Geospatial Rights Management Domain Working Group
GeoSPARQL SWG – GeoSPARQL Standards Working Group (SPARQL is a recursive acronym for the W3C's "SPARQL Protocol And RDF Query Language")
GEOSS Pilot – Global Earth Observation System of Systems Pilot Project
Geosync SWG – GeoSynchronization 1.0 Standards Working Group
GeoXACML – OGC Geospatial eXtensible Access Control Markup Language Standard
GETIS – Geoprocessing networks in a European Territorial Interoperability Study
GITA – Geospatial Information & Technology Association
GLS SWG – Geographic Linkage Service 1.0 Standards Working Group
GML – OGC Geography Markup Language Encoding Standard
GML in JPEG 2000 – OGC standard that defines how GML is used in JPEG 2000 images
GMLJP2 1.1 SWG – GML in JPEG 2000 Standards Working Group
GO – Geospatial Objects (a retired OGC standard)
GPC/GIS – GPC Global Information Solutions
GPS – Global Positioning System
GRSS – IEEE Geoscience and Remote Sensing Society
GSDI – Global Spatial Data Infrastructure
GSDI Association – Global Spatial Data infrastructure (GSDI) Association
GServRestSWG – GeoServices REST (REpresentational State Transfer) Standards Working Group
HDF – Hierarchical Data Format
HTI – Human Technology Interface
ICS – Information Communities and Semantics
ICT – Information and Communications Technology
IE – Interoperability Experiment
IE3D Portrayal – 3D Portrayal Interoperability Experiment
IEC – ISO IEC JTC 1/SC 24/WG 8 - Computer graphics, image processing and environmental presentation
IEEE GRSS – IEEE Geoscience and Remote Sensing Society

IEEE Technical Committee 9 (Sensor Web)
iEMSs – International Modeling & Software Society Secretariat
IES – Imagery Exploitation Working Group IETF – Internet Engineering Task Force
IETF – Internet Engineering Task Force
IJIS Institute – Integrated Justice Information Systems (IJIS) Institute
ILAF – OGC Iberian and Latin-American Forum
IndoorGML – common schema framework for interoperability between indoor and outdoor navigation applications, being drafted by the OGC IndoorGML Standards Working Group
IP – Depending on context, either Intellectual Property or Interoperability Program
IPR - Intellectual Property Rights
IPTeam – Interoperability Program Team
IS – Implementation Standard
ISO – International Organization for Standardization
ISO IEC JTC 1/SC 24/WG 8 – Computer graphics, image processing and environmental presentation
ISO Technical Committee 204 – Intelligent transport systems
ISO Technical Committee 211 (ISO TC/211) – Geographic information/Geomatics
ISOC – Internet Society
ISPRS – International Society for Photogrammetry and Remote Sensing
ITU – International Telecommunication Union
JAG – Joint Advisory Committee between OGC and ISO TC 211
JPEG – Joint Photographics Group
KML – OGC KML Encoding Standard (formerly Keyhole Markup Language)
LBS – Location Based Services
LEAPS DWG - Law Enforcement and Public Safety Domain Working Group
LOS – Location Organizer Folder
LS DWG – Location Services Domain Working Group
MCP – OGC Marketing & Communications Program
Met Ocean DWG – Meteorology & Oceanography Domain Working Group
MISMO – Mortgage Information Standards Maintenance Organization
MLS DWG - Mobile Location Services Domian Working Group - merger of Mass Market and Location Services DWGs
MMI – OGC`s Multi-Hazard Mapping Initiative (MMI) Phase I (2001)
MPP – OGC`s Military Pilot Project (MPP) (2001)
NCOIC – Net Centric Operations Infrastructure Committee
NetCDF – OGC Network Common Data Form (NetCDF) Core Encoding Standard version 1.0 comprises earlier NetCDF Classic and 64–bit Offset Format standards from UCAR/Unidata.
NGO – Non-Governmental Organization
NIBS – National Institute for Building Standards
NIST – National Institute of Standards and Technology
NMA – National Mapping Agency
NRE – Natural Resources and Environment

NSDI – National Spatial Data Infrastructure
NTF – Neutral Transfer Format (in UK)
O&M – OGC Observations and Measurements Encoding Standard
OAB – OGC Architecture Board
OASIS – Organization for the Advancement of Structured Information Standards
OCAP – OGC Outreach and Community Adoption (now OGC Marketing and Communications)
OGC – Open Geospatial Consortium
OGC Reference Model – a complete set of the OGC's reference models
OGC–A – OGC Austral–Asia
OGC–E – OGC Europe
OGF – Open Grid Forum
OI Demo
OLE/COM – Object Linking and Embedding/Common Object Model (Microsoft)
OLS – OGC Location Services
OMA – Open Mobile Alliance
OMG – Object Management Group
OO – Object Oriented
Open GeoSMS – OGC standard providing an extended Short Messaging Service (SMS) encoding and interface for communicating location content
OpenLS – OGC Open Location Services Interface Standard
OSF – Ordering Services Framework for Earth Observation Products
ORM – OGC Reference Model
OSCRE – Open Standards Consortium for Real Estate
OSDM – Office of Spatial Data Management (Australia)
OSGEO – Open Source Geospatial Foundation
OWS – OGC Web Services
OWSCommon1.2SWG – OWS Common 1.2 SWG
OWScontextSWG – OWS Context SWG
OWSC – OGC Web Services Common
P&P – Policies and Procedures
PC – Planning Committee
PNG – Portable Network Graphic
PubSub SWG – OGC Standards Working Group defining a standard that clearly defines a standard way to enable publish/subscribe functionality for OGC Web Services
PUCK – OGC standard defining a protocol for RS232 and Ethernet connected instruments
RCM – Risk and Crisis Management
RESTful – REpresentational State Transfer programming style
RFC – Request for Comment
RFI – Request for Information
RFP – Request for Proposals (or Participation)
RFT – Request for Technology

RM-ODP – Reference Model for Open Distributed Processing
RPC – Remote Procedure Call
RTD – Research and Technology Development (Europe)
SAA Pilot – Special Activity Airspace Pilot
SANY – Sensors Anywhere Consortium
SCOTS – Standards based Commercial Off-The-Shelf software
SDI – Spatial Data Infrastructure
SDTS – Spatial Data Transfer Standard
SE – Symbology Encoding
SensorML – OGC Sensor Model Language Encoding Standard
SF – Simple Features
SF CORBA – Simple Features CORBA
SF OLE/COM – Simple Features OLE/COM
SFS – OGC Simple Features – SQL Encoding Standard
SIF – Standard Interchange Format
SIG – Special Interest Group
SLD – OGC SLDSE SWG – Styled Layer Descriptor and Symbology Encoding 1.2 Standards Working Group
SLD – Styled Layer Descriptor
SMAC – OGC Strategic Member Advisory Committee
SME – Small or Medium Sized Enterprise
SOA – Services Oriented Architecture
SOAP – Simple Object Access Protocol
SOS – OGC Sensor Observation Service Interface Standard
SP – Standards Program
SPS – OGC Sensor Planning Service Interface Standard
SQL – Structured Query Language
SLD – Styled Layer Descriptor Encoding Standard
TIFF – Tagged Image File Format
SVG – Styled Vector Graphics
SWE – OGC Sensor Web Enablement activity
SWE Common – Sensor Web Enablement Common Data Model
SWG – Standards Working Group
TC – Technical Committee
TC P&P – Technical Committee Policies and Procedures
TDWG – Taxonomic Data Working Group
TEAM Engine – Test, Evaluation, And Measurement Engine
TIGER – Topologically Integrated Geographic Encoding and Reference file (US)
TJS – OGC Georeferenced Table Joining Service Encoding Standard
TML – OGC Transducer Markup Language Encoding Standard (retired)
UCAR – University Corporation for Atmospheric Research / National Center for Atmospheric Research (NCAR)
UDDI – Universal Description, Discovery, and Integration
UML – Unified Modeling Language

Univ DWG – University Domain Working GroupVPF – Vector Product Format (US)
USGIF – US Geospatial Intelligence Foundation
VR – Virtual Reality
W3C – World Wide Web Consortium
WaterML 2.0 – OGC Water Markup Language Encoding Standard
WCPS – OGC Web Coverage Processing Service Interface Standard
WCS – OGC Web Coverage Service Interface Standard
WCTS – OGC Web Coordinate Transformation Service Interface Standard
Web3D ConsortiumWfMC – Workflow Management Coalition
WFS – OGC Web Feature Service Interface Standard
WG – Working Group
WMC – OGC Web Map Context Encoding Standard
WMO – World Meteorological Organization
WMS – OGC Web Map Service Interface Standard
WMT – Web Mapping Testbed
WMTS – OGC Web Map Tile Service Interface Standard
WPS – OGC Web Processing Service Interface Standard
WS – Web Services
WSC – OGC Web Service Common Interface Standard
WSDL – Web Services Definition Language
XIMA – XML for Imagery and Map Annotations
XML – eXtensible Markup Language
XSLT – eXtensible Style Sheet Transformation

Glossary of Terms - A

Abstract Data Type
The basic information construct used by the GeoMobility Server and associated Core Services. Consists of well-known data types and structures for location information. Defined as application schemas that are encoded in XML for Location Services (XLS).
accuracy
Source: OpenGIS Guide
The degree to which information on a map or in a digital database matches true or accepted values. Accuracy pertains to the quality of data and the number of errors contained in a dataset or map. In discussing a GIS database, it is possible to consider horizontal and vertical accuracy with respect to geographic position, as well as attribute, conceptual, and logical accuracy. The effect of inaccuracy and error on a GIS solution is the subject of sensitivity analysis. Accuracy, or error, is distinguished from precision, which concerns the level of measurement or detail of data in a database.

agent
Source: OpenGIS Guide
A kind of intermediary service which acts on behalf of another service (service provider or requester) according to rules established upon its invocation. Also known as an `intelligent agent.`
Annual Technical Baseline Target
The Annual Technical Baseline Target is the subset of the elements of the Technical Plan that are scheduled to be completed within any given calendar year.
ANSI
An abbreviation for American National Standards Institute. ANSI standards have been established for many elements of computer systems to aid research and development. The existence of standards allows designers to develop general solutions to common problems.
applet
A small application, with limited functionality, designed to operate in a componentware and/or middleware environment. Large, multifunctional, `monolithic` applications can be, and in the future often will be, broken into single-function applets that interoperate with other applets, and that can be assembled, perhaps only temporarily, into a user`s work environment. Java applets, for example, are typically downloaded via the Internet into your computer`s program memory, where they accomplish their task (such as `let the user zoom on this geodata`) and then `evaporate`.
application
Source: OpenGIS Guide
The use of capabilities, including hardware, software and data, provided by an information system specific to the satisfaction of a set of user requirements. See Geographic Application and Geoprocessing Application.
application assembly
Assemble single application from components
application developer
Source: OpenGIS Guide
A software programmer who creates applications, usually by integrating a variety of pre-existing elements such as application programming interfaces and software and hardware platforms.
application domain models
Application-oriented models that characterize information and service resources within a domain. They are often based upon a General Model and must always be consistent with the Abstract Model. The two subclasses are: Data Domain Models and Process Domain Models.
application integration
Integrate multiple applications to support a cross function business process
application platform
Source: OpenGIS Guide

The collection of hardware and software components that provide the infrastructure services used by application programs. APIs make the specific characteristics of the platform transparent and accessible to the application.

application profile

Source: ISO 19101, ISO 19106

A set of one or more base standards and - where applicable - the identification of chosen clauses, classes, subsets, options and parameters of those base standards that are necessary for accomplishing a particular function.

Application Programming Interface (API)

An interface definition that permits invoking services from application programs without knowing details of their internal implementation.

Application Programming Interface (API)

An interface definition that permits invoking services from application programs without knowing details of their internal implementation.

application schema

A set of conceptual schema for data required by one or more applications. An application schema contains selected parts of the base schemas presented in the ORM Information Viewpoint. Designers of application schemas may extend or restrict the types defined in the base schemas to define appropriate types for an application domain. Application schemas are information models for a specific information community.

application services

OWS Services operating on user devices or servers that have network connectivity. Users use Application Services to access Registry, Portrayal, Processing and Data Services. Application Services commonly, but not necessarily, provide user-oriented displays of geospatial content and support user interaction at the user terminal.

application software

Source: OpenGIS Guide

The computing elements supporting users` particular needs. Frequently includes data, documentation, and training, as well as programs.

architectural framework

Source: OpenGIS Guide

Identifies key interfaces and services, and provides a context for identifying and resolving policy, management and strategic technical issues. Constrains implementation by focusing on interfaces, but does not dictate design or specific technical solutions.

architecture

An abstract technical description of a system or collection of systems. Modern software architectures employ interoperability interfaces to enable enterprises and whole industries to establish coherent, flexible, integrated information flows that can be implemented with heterogeneous but intercommunicating software systems. The OpenGIS Specification defines the interoperability interfaces that make it possible to include geographic information in these information flows.

Conceptually based, architecture does not contain the level of detail needed for construction.

area of interest

A user defined area (represented by a bounding box, circle or polygon). Often used as a filter in a query.

ASCII

Source: OpenGIS Guide

An abbreviation for American Standard Code for Information Interchange. The ASCII format provides computer systems with a common language for exchanging information. Although most GIS software system make use of proprietary binary codes, almost all systems have import-export capabilities for translating between ASCII and binary formats.

asynchronous

Calling application does not require immediate response to request before proceeding

attribute data

Source: OpenGIS Guide

Descriptive information about features or elements of a database. For a database feature like census tract, attributes might include many demographic facts including total population, average income, and age. In statistical parlance, an attribute is a `variable,` whereas the database feature represents an `observation` of the variable.

Glossary of Terms - B

backward and forward compatibility

Interoperability with earlier and la

base document

The working draft of the OpenGIS Specification, maintained by the Chairman of the OGC Technical Committee, which is the repository for working papers that have been submitted by Committee members.

base maps, data, or layers

Spatial data sets that provide the background upon which more specific thematic data is overlaid and analyzed. As inputs into a GIS, the term base map is usually applied to those sources of information about relatively permanent features including topography, soil data, geology, cadastral divisions, and political divisions. Within a GIS database, such information may become part of a land base to which other information is indexed and referenced.

base standard

An approved International Standard, Technical Report, CCITT Recommendation or National Standard.

bind

In the context of OGC Web Services, Bind refers to Web service components connecting and executing through interfaces

BMP
Bitmap. A Microsoft Windows image format.
bounding box
a set of 2, 4, 6 or 8 numbers indicating the upper and lower bounds of an interval (1D), rectangle (2D), parallelpiped (3D), or hypercube along each axis of a given CRS
broker
A kind of intermediary service whose responsibility is only to bring other services together (typically a service requester and a service provider) and has no responsibility for satisfactory completion of the `contract` established between the requester and provider.
business object
An identifiable business concept such as customer or order.
business process
See process domain model.

Glossary of Terms - C

CAD or CADD
Computer-aided design and drafting. CAD systems are used to create maps and plans and are closely related to GIS systems. Although most CAD systems lack certain features essential to GIS analysis, such as the power to manage different spatial coordinate systems and database capabilities, many CAD systems have been developed into full GIS with the addition of necessary functions.
cadastral survey
The means by which private and public land is defined, divided, traced, and recorded. The term derives from the French cadastre, a register of the survey of lands and is, in effect, the public record of the extent, value, and ownership of land for purposes of taxation. Cartesian Coordinates are a system of positional reference in which location is measured along two or three orthogonal (perpendicular) axes. Every location can be defined uniquely by its X, Y, and Z coordinates. Locations in the coordinate system can be established using any unit of measurement such as meters, feet, or miles.
Call for Communities
An OGC invitation to local, state, or national government agencies; transnational organizations; academic groups; or private sector companies involved in geospatial technologies to participate in a series of hands-on, collaborative engineering efforts (Pilot Projects) to test the effectiveness of new standards which support Web-based sharing and use of geospatial information.
capabilities document service profile
The result of invoking the "Get Capabilities" operation on a service is a message containing a "capabilities document" describing the service. Provides a high-level description of a service instance and its provider. Includes: a human readable description of the service, a specification of the functionalities that are provided by

the service and a set of functional attributes that provide additional information and requirements about the service.

Capabilities XML

Service-level metadata describing the operations and content available at a service

Cartesian coordinates

Coordinates that differ from latitude-longitude coordinates in that the latter comprise a spherical (rather than planar) reference system.

catalog

A collection of entries, each of which describes and points to a feature collection. Catalogs include indexed listings of feature collections, their contents, their coverages, and other metadata. Registers the existence, location, and description of feature collections held by an Information Community. Catalogs provide the capability to add and delete entries. At a minimum Catalog will include the name for the feature collection and the locational handle that specifies where this data may be found. The means by which an Information Community advertises its holdings to members of the Information Community and to the rest of the world. Each catalog is unique to its Information Community.

catalog services

One thing that the OpenGIS Abstract Specification defines is a standard set of services to support on-line catalogs of geodata and geoprocessing capabilities accessible to users in networked environments. Currently, your Web browser can ask a Web indexing service such as Lycos or Alta Vista to report Web sites that contain certain text strings or combinations of text strings. OpenGIS conformant catalog services will enable our Web browser (or other software) to report Web sites (or perhaps non-Web network resources) that contain certain data themes for certain geographic areas for certain time frames. These services will also be able to report geoprocessing resources available on remote servers. Of course, you may not be the one doing the asking. Car computers, for example, will automatically use catalog services to obtain current information about road and traffic conditions.

CEN

Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm

European Committee for Normalization: makes standards for Europe, cooperates with ISO to avoid competition. http://www.cenorm.be/

centroid

The term given to the center of an area, region, or polygon. In the case of irregularly shaped polygons, the centroid is derived mathematically and is weighted to approximate a sort of `center of gravity.` Centroids are important in GIS because these discrete X-Y locations are often used to index or reference the polygon within which they are located. Sometimes attribute information is `attached,` `hung,` or `hooked` to the centroid location.

CIPI

CIPI is an OGC Interoperability Initiative to help organizations publish, discover, access, exchange, and maintain vital geo-spatial information and online geoprocessing services required to support critical infrastructure protection.

CITE

The OGC Conformance & Interoperability Testing & Evaluation Initiative (CITE) is an OGC Interoperability Initiative designed to test and evaluate OGC Interfaces and products that implement them. The CITE Initiative has three focus areas related to the establishment of a successful and robust OGC Conformance and Interoperability Test and Evaluation Program: * Planning and Feasibility Study, * Conformance Engine, Scripts and Guidelines, and * CITE Portal and Reference Implementations.

classification scheme

An arrangement or division of objects into groups based on characteristics that the objects have in common, e.g., origin, composition, structure, application, function, etc. It is a set of concepts, organized in some specified structure, limited in content by a scope, and designed for assigning objects to classes (concepts) defined within it ISO 11179. It helps to organize the contents of a registry and supports more meaningful queries.

clearinghouse

Source: GETIS glossary

"In general a clearinghouse provides a central access point for value-added topical guides which identify, describe, and evaluate Internet-based information resources. In our case a clearinghouse is a decentralized system of servers located on the Internet which contain field-level descriptions of available digital spatial data. This descriptive information, known as metadata, are collected in a standard format to facilitate query and consistent presentation across multiple participating sites. A clearinghouse uses readily available Web technology for the client side and uses standards for the query, search, and presentation of search results to the Web client. A clearinghouse provides information about who is providing which authorized geoinformation for which application."

client

A software component that can invoke an operation performed by a server.

client/server

The network computing revolution (which includes the distributed geoprocessing revolution) is based on software entities (clients) that tell other software entities (servers) to do things for them. Software clients say, `Send me this specific data from your database!` or `Tell me what Internet address contains this information!` or `Take this data and do a correlation operation on it!` In a simple sense, your word processor is a client when you click on `Save` and the word processor instructs the operating system (acting as a server) to save your file to disk. Interoperability interfaces make it possible for diverse computers to request things of each other over networks and get predictable responses.

COM

"Component Object Model, the Microsoft (MS) paradigm to connect components. MS has implemented the base technology for COM on the NT platform. Software AG has ported these on MVS and UNIX. A COM-object defines its interfaces. Components from different machines can be combined using DCOM ."

Common Object Request Broker Architecture (CORBA)
The basic distributed object scheme developed by the Object Management Group (OMG), a consortium similar to OGC but focused on object technology instead of distributed geoprocessing. Object Request Brokers (ORBs) help clients find servers.
Communications Service Interface (CSI)
The interface by which an application platform accesses external entities which provide data transport services. The service provided is data transport among application platforms.
component
In the context of distributed computing, a component is a software program unit that performs one or more functions and that communicates and interoperates with other components through common interfaces.
componentware
Software that exists in relatively small modules with standard interfaces. Components can be combined easily to create tailored applications that are easier to maintain and upgrade than `monolithic` applications that provide the same functionality. Another benefit is that components from different vendors can be used together to provide flexible, economic solutions. componentware can be defined as software products constructed using object technology.
composite curve
Sequence of Curves such that each curve (except the first) starts at the end point of the previous curve in the sequence. (see OGC Abstract Specification (Topic 1) clause 7.3.10.4)
composite map
Two or more maps with the same geographic extent and coordinate reference system can be accurately layered to produce a composite map.
computational viewpoint
Viewpoint in RM-ODP concerned with the functional decomposition of the system into a set of services that interact at interfaces. This viewpoint captures the details of these components and interfaces without regard to distribution. (See the ORM for further definition.)
computer architecture
The functional composition of a system and its components, the interfaces between components, and interfaces with the external environment, including users and other systems.
computer environment
The general term describing the people, hardware, software, and databases comprising a single computer system or several network-connected computer systems, and the associated standards.
conceptual architecture
A diagram and accompanying text that provides a model of how a system works
conceptual schema
Base schema. Formal description of the model of any geospatial information. Application schemas are built from conceptual schemas.

Conformance Test Suite and Guidelines
The set of materials, defined under the OGC Conformance Testing Program document (available at http://www.opengeospatial.org/compliance), required to test an implementation for conformance to a specification. (Conformance Test Suite and Guidelines refer to OpenGIS Implementation Specifications.) A software vendor whose software implements interfaces based on OGC`s standards can claim that a product "implements" particular OpenGIS Specifications. If the product has passed a conformance test for a particular OpenGIS Specification, the vendor can claim that their product conforms to that version of a specification and they can use OGC`s trademarks to assure buyers of the veracity of those claims.

connectivity
A topological property relating to how geographical features are attached to one another functionally, spatially, or logically. In a water distribution system, connectivity would refer to the way pipes, valves, and reservoirs are attached, implying that water could be `traced` from its source in the network, from connection to connection, to any given final point. Functional, spatial, and logical connectivity are examples of relationships that can be represented and analyzed in a GIS database.

container
Association role between topology primitives and those of co-deminsion -2 or greater. (see OGC Abstract Specification (Topic 1) clause 7.3.10.4)

content standard
A standard data model

conversion
The process of transferring data derived from existing records and maps to a digital database. Conversion is a major input problem and can consume the greatest share of time in a GIS project.

coordinate conversion
A mathematical operation on coordinates that does not include a change of datum. The best-known example of a coordinate conversion is a map projection. The parameters describing coordinate conversions are defined rather than empirically derived.

coordinate reference system (CRS)
A coordinate system that has a reference to the Earth. Consists of a coordinate system and a datum.

coordinate system
Composed of a set of coordinate axes with a known metric. The concept 'metric of a coordinate space' consists of the set of mathematical rules that defines the relationships between the coordinate values and the invariant spatial quantities between points; for example, the mathematical rules (formulae) required for calculating angles and distances between points from coordinate values and vice versa.

coordinate transformation
Source: GETIS glossary

A mathematical operation on coordinates that includes a change of datum. The parameters of a coordinate transformation are empirically derived from a dataset containing the coordinates of a series of points in both coordinate reference systems. This computational process is usually "over determined", allowing derivation of error (or accuracy) estimates for the transformation. Also, the stochastic nature of the parameters may result in multiple (different) instantiations of the same coordinate transformation.

coordinates

A tuple of ordered scalar values that define the position of a single point feature in a coordinate reference system. The tuple is composed of one, two or three 'ordinates'. The ordinates must be mutually independent and their number must be equal to the dimension of the coordinate space; for example, a tuple of coordinates may not contain two heights.

CORBA

"Common Object Request Broker Architecture: CORBA is an architecture and specification for creating, distributing, and managing distributed program objects in a network. It allows programs at different locations and developed by different vendors to communicate in a network through an `interface broker.` CORBA was developed under the auspices of the OMG (Object Management Group) and has been sanctioned by both ISO and X/Open as the standard architecture for distributed objects (also known as components)."

core technology

The set of Implementation Specifications resulting from the Technology Development process that are based on the Abstract Specification.

coverage

Source: The OpenGIS® Abstract Specification Topic 6: Schema for coverage geometry and functions, Version 7 .

A feature that associates positions within a bounded space (its spatiotemporal domain) to feature attribute values (its range). GIS coverages (including the special case of Earth images) are two- (and sometimes higher-) dimensional metaphors for phenomena found on or near a portion of the Earth's surface. A coverage can consist of a set of features or Feature Collections. Earth images are seen as Grid Coverages that contain features whose geometries are of type "set of cells" or "set of pixels" (surfaces).

coverage domain model

The definition of a domain-specific application schema for a well-known geospatial coverage. For example: DTED.

Coverage Model

Source: The OpenGIS® Abstract Specification Topic 6: The Coverage Type and its Subtypes Version 6. http://www.opengis.org/techno/abstract/00-106.pdf

The basic model for how earth information may be represented as raster or grid coverages (e.g., an image or digital terrain model).

critical infrastructure
Critical infrastructure encompasses large-scale systems in a range of sectors - energy, tele-communications, transportation, public health services, banking, government, public safety etc. These systems are essential to maintaining society.
curve
1-deminsional geometric primitive, representing the continuous image of a line (see OGC Abstract Specification (Topic 1) clause 6.3.16)
curve segment
1-deminsional geometric object used to represent a continuous component of a curve using homogeneous interpolation and definition methods. (see OGC Abstract Specification (Topic 1) clause 6.3.17)

Glossary of Terms - D

Data Catalog Model
Source: The OpenGIS® Abstract Specification Topic 6: The Coverage Type and its Subtypes Version 6. http://www.opengis.org/techno/abstract/00-106.pdf
The general model for representing online data catalogs that pertain to enterprise data stores.
data clearinghouse
Source: ISO 19115
Collection of institutions providing digital data, which can be searched through a single interface using a common metadata standard.
data coordination
Organizations that seek to share GI working to reach consensus on common data models.
data domain
Source: GETIS glossary
Set of feature collections that is commonly used in a specific discipline or application. An example of a data domain is {roads, houses, rivers} or on another abstraction level {transport, buildings}
data infrastructure
Source: GETIS glossary
See SDI
data level
Source: ISO 19101
Stratum within a set of layered levels in which data is recorded that conforms to definitions of types found at the application model level
data model
Source: AGI glossary. http://www.geo.ed.ac.uk/agidict/welcome.html
"An abstraction of the real world which incorporates only those properties thought to be relevant to the application at hand. The data model would normally define specific groups of entities, and their attributes and the relationships between these

entities. A data model is independent of a computer system and its associated data structures. A map is one example of an analogue data model."

data quality

Source: AGI glossary. http://www.geo.ed.ac.uk/agidict/welcome.html

"Indications of the degree to which data satisfies stated or implied needs. This includes information about lineage, completeness, currency, logical consistency and accuracy of the data"

data schema

Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm

Formal description of a data model

data semantics

Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm

The meaning of data: in the GI sector this includes the identification of related object classes embedded in different abstractions

data services

OSF services that provide access to collections of data in repositories and databases. Resources accessible by Data Services can generally be referenced by a name (identity, address, etc). Given a name, Data Services can then find the resource. Examples include: Feature Access Services (FAS), Coverage Access Services (CAS) and Sensor Collection Service (SCS).

data transfer

Source: OpenGIS Guide

"In the geoprocessing world, this refers to converting geodata from one (usually proprietary) data format to another. The OpenGIS Specification is not a data transfer standard. Instead, it (in most cases) specifies interfaces by which software systems can exchange information about features, geometry, spatial referencing, and geoprocessing operations. It enables remote GIS systems, for example, to behave like extensions of your local computing environment. "

data transfer standard

A (usually vector) data format designed to be a "lowest common denominator" for multiple data formats, to enable data to be used by different GIS systems.

data update cycle

Source: GETIS glossary

Data update interval

dataset series

Source: ISO 19115; ISO 19113; ISO 19114

Collection of datasets sharing the same product specification

datum

Defines the origin, orientation and scale of the coordinate system and ties it to the earth, ensuring that the abstract mathematical concept 'coordinate system' can be applied to the practical problem of describing positions of features on or near the earth's surface by means of coordinates.

DBF

Data Base File - the dBase file format

DBMS
Database management system. DBMS sometimes refers to the software that contains and organizes the data, and sometimes refers to an organizational plan for the use of information within a single project, or within one unit or the whole of an organization.
DCP
Distributed Computing Platform
de facto standard
Source: OpenGIS Guide
"A standard that has been informally adopted, often because a particular vendor was first to market with a product that became widely adopted. MS-DOS and Microsoft Windows are examples. "
de jure standard
Source: OpenGIS Guide
"An official standard created in a formal `juried` process, such as the International Organization for Standards Technical Committee 211 (ISO TC/211), which is working on problems similar to those addressed by the OpenGIS Specification, but at a higher, more abstract level."
DEM
Digital elevation model, a data exchange format developed by the United States Geological Survey for geographical and topographical data.
DEMTS
Digital and Electronic Maps Transfer Standard. Interchange of digital maps. Russian state standard GOST R*50828-95Â
DGN
DesiGN file, the Microstation drawing format
Dictionary Model
Source: The OpenGIS® Abstract Specification Topic 6: The Coverage Type and its Subtypes Version 6. http://www.opengis.org/techno/abstract/00-106.pdf
The general model for representing online dictionaries that pertain to well-known types of classification schemes and dictionaries.
DIGEST
(Digital Geographic Exchange Standard) Standard that supports images and gridded data in alignment with the ISO/IEC 1/SC 24 BIIF standard. DIGEST Annex D, known as the Image Interchange Format, is an encapsulation of the NATO Secondary Imagery Format (NSIF), which allows for the standard exchange of image, graphic and text data.
Digital Cartographic Model
Source: http://www.eurogeographics.org/Projects/GDDD/GDDD/lists/products.htm#52
"Simple digital maps having a 'flat' data structure, e.g. digitized maps. Digital Cartographic Models (DCMs) are suitable for display and plots purposes. In the context of GIS the DCM may be used as background information. The geometric form of the DCM is vector"

Digital Elevation Model
Source: http://www.eurogeographics.org/Projects/GDDD/GDDD/lists/products.htm#52
"The Digital Elevation Model (DEM) only contains elevation data. Normally, the height data are arranged in a matrix. Also, vector based contour lines and spot elevations are considered as DEM. "
Digital Landscape Model
Source: http://www.eurogeographics.org/Projects/GDDD/GDDD/lists/products.htm#52
"A Digital Landscape Model (DLM) is an object orientated topographic database. The data structure facilitates spatial analysis and linkage of geographic objects to external data. The geometric form of the DLM is vector. The DLM often contains explicit or implicit topological information. The objects, their attributes and the relations between the objects are referred to in terms of real world entities. "
digital orthoimages
Orthorectified images produced using photogrammetric techniques to orthorectify scans of aerial photos and paper maps.
digitize
The process of converting information into the digital codes stored and processed by computers. In geographic applications, digitizing usually means tracing map features into a computer using a digitizing tablet, graphics tablet, mouse, or keyboard cursor.
DIPR
See Draft Interoperability Program Report.
Directory Model
The general model for representing online, well-known types of directories (e.g. Yellow Pages).
directory service
A network-accessible service that provides access to an online directory (e.g. Yellow Pages) to find the location of a specific or nearest place, product or service.
discipline
A particular area of study, such as forestry, hydrology, disaster management, etc. Disciplines often show overlaps in their study topics, data domains and application domains
Discussion Paper
A document containing discussion of some technology or specification area prepared by a SIG or WG for release for the public. Discussion Papers are not the official position of the OGC and contain a statement to that effect.
Distributed Computing Environment (DCE)
DCP being developed by the Open Software Foundation (OSF).
Distributed Computing Platform (DCP)
The foundation technology that enables access to and exploitation of physically distributed information and services. Examples include CORBA, COM/OLE, SQL,

Java, and Internet services from the World Wide Web Consortium (W3C) such as HTTP, SOAP and XML.

diversity

The ability of a system or components of a system to support multiple behaviors, functions, and data types.

DLG

Digital line graph, a form of digital map developed by the United States Geological Survey. DLGs supply users with the digital version of information printed on USGS topographical quadrangle maps.

domain

System context: A class of systems that have similar requirements and capabilities. Application context: The body of knowledge defining the range and scope of an application in terms of elements, rules and behaviors.

Draft Interoperability Program Report (DIPR)

A DIPR is an informational report written by participants from an Interoperability Program Initiative. DIPR documents may be submitted to the OGC TC for review and comment. Depending on the desired outcome, the document type should be either "Information-Only" or "Draft Discussion Paper". The former, obviously, is intended for information only and is not to be considered for public release. The latter, is intended for consideration for public release as a Discussion Paper. A DIPR does not represent the official position of the OGC nor is it an adopted OGC specification.

DTM

Digital terrain model, a method of transforming elevation data into a contoured surface of a three-dimensional display.

DXF

"Drawing eXchange Format", an AutoCad export file. Drawing interchange format, a file exchange format developed by Autodesk Inc. for its AutoCAD drafting software. DXF files are ASCII records of all objects in a drawing file. DXF is used by GIS systems for exchanging map files.

dynamic segmentation

Points along a line that vary in value, e.g. pavement thickness along a road centerline.

Glossary of Terms - E

Earth model

An approach to abstracting the Earth. The data model for the Earth.

edge

1-dimensional topology primitive (see OGC Abstract Specification (Topic 1) clause 7.3.14)

EEA

European Environment Agency

encapsulation
In object-oriented programming, data can be encapsulated in an object, which means all access to the data and manipulation of the data occurs through the object`s methods. Legacy software or data can be encapsulated by giving it an interface that is compatible with object software.
engineering viewpoint
RM-ODP viewpoint that relates a system`s purposes, content, and functions to specific components linked by a communications network. This viewpoint is concerned primarily with the interaction between distinct computational objects: its chief concerns are communication, computing systems, software processes and the clustering of computational functions at physical nodes of a communications network. The engineering viewpoint also provides terms for assessing the "transparency" of a system of networked components - that is, how well each piece works without detailed knowledge of the computational infrastructure. The engineering viewpoint can be described in terms of UML collaboration diagrams and deployment diagrams.
enterprise
In the context of computing, an enterprise is a large organization whose many offices, agencies, workers and partners must be able to communicate and share information effectively and efficiently.
enterprise application
Software that automates a business process that spans many business units
enterprise viewpoint
Describes the business or organizational perspective, context, purpose, scope and policies governing a distributed information system. The ORM enterprise viewpoint highlights geospatial location as a fundamental information ingredient and provides a representative value chain of geospatial information within an enterprise or an information community. The ORM enterprise viewpoint includes the major requirements on OGC technology as derived from the described value chain.
EO
Earth observation, i.e., remote sensing.
EOSDIS/HDF
HDF-EOS is an extension of NCSA (National Center for Supercomputing Applications) Hierarchical Data Format. HDF-EOS adds mechanisms for storing geo-referencing and temporal information, data organization, and metadata storage. HDF-EOS contains Grid, Point and Swath structures.
ESDI
Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm
European Spatial Data Information Infrastructure http://www.ec-gis.org/inspire/
ESPRIT
Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm
The Research programme of the European Union until 1998 http://www.cordis.lu/esprit/home.html

ETeMII
Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm
European Territorial Management Information Infrastructure: a Fifth Framework project supporting consensus-building on Data issues. http://www.ec-gis.org/etemii
Ethernet
A type of local-area network used for high-speed communication among computers.
EUROGI
Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm
European Umbrella Organisation for Geographic Information: members are national associations (e.g. The Association for Geographic Information in the UK) and related pan-European sector bodies. http://www.eurogi.org/
exemplar implementation
An operational, conformant implementation of an implementation specification that is made available for public use for testing purposes (Exemplar Implementations refer to OpenGIS Implementation Specifications.)
extensibility
The ability for a system or components of a system to expand by assimilating new data, software or hardware components.
extrinsic resource
A registered resource associated with a repository item for which the content model is not defined by the RIM. It may be located in a repository not managed by a Registration Authority, and its content may be represented by any Internet Media Type (e.g. application/pdf, image/svg+xml).

Glossary of Terms - F

face
2-dimensional topology primitive (see OGC Abstract Specification (Topic 1) clause 7.3.16)
feasibility study
In OGC, a research effort directed at understanding emerging technology areas for the purposes of planning OGC Interoperability Initiatives.
feature
Source: The OpenGIS® Abstract Specification Topic 6: The Coverage Type and its Subtypes Version 6. http://www.opengis.org/techno/abstract/00-106.pdf
The starting point for modeling of geographic information. Abstraction of a real world phenomenon. "A digital representation of a real world entity or an abstraction of the real world. It has a spatial domain, a temporal domain, or a spatial/temporal domain as one of its attributes. Examples of features include almost anything that can be placed in time and space, including desks, buildings, cities, trees, forest stands, ecosystems, delivery vehicles, snow removal routes, oil wells, oil pipelines, oil spill, and so on. Features are usually managed in groups as

feature collections. The terms feature and object are often used synonymously. The terms feature, feature collection and coverage are defined in line with OpenGIS."

feature catalog

Source: ISO 19101; ISO 19110

Catalog containing definitions and descriptions of the feature types, feature attributes, and feature relationships occurring in one or more sets of geographic data, together with any feature operations that may be applied

feature collection

Source: OpenGIS Guide

A special category of feature that represents a collection of features that have common metadata and formal relationships. "A set of related features managed as a group. Feature collections can be identified at different abstraction levels, i.e. high abstraction level, e.g. "topography" and low abstraction level, e.g. "roads" The terms feature, feature collection and coverage are defined in line with OpenGIS 5."

feature domain model

The definition (typing framework and properties) of a domain-specific application schema for a well-known class of geospatial features, in vector form (i.e., points, lines and polygons). For example: Transportation, Hydrographic, Electric Utility, etc.

federated database

Separate databases that are structured, perhaps with middleware or special database access software, in such a way that they can be queried as a single database.

find

In the context of OGC Web Services, clients, which might be applications or thin clients on users` computers or which might be other services, find data and services based on what is published in online registries and catalogs. (See Publish.)

framework

An information architecture. In terms of software design, a reusable software template, or skeleton, from which key enabling and supporting services can be selected, configured and integrated with application code.

framework data

In the US, "framework data" or "the Framework" refers to a national collaborative effort to create a widely available source of basic geographic data. It provides the most common data themes geographic data users need, as well as an environment to support the development and use of these data. The framework's key aspects are * seven themes of digital geographic data that are commonly used; (Orthoimagery, Elevation, Transportation, Hydrography, Cadastral, Geodetic Control and Government Units) * procedures, technology, and guidelines that provide for integration, sharing, and use of these data; and * institutional relationships and business practices that encourage the maintenance and use of data. (http://geo-one-stop.gov/participate/status.html)

Glossary of Terms - G

gateway service
The Open Location Services (OLS) initiative introduced gateway services, which link location application services (accessed via the Internet or the Web) with mobile wireless-IP platforms, in support of small form factor mobile terminals.
gazetteer
Source: http://www.eurogeographics.org/Projects/GDDD/GDDD/lists/products.htm#52
A catalogue of toponyms (place names) assigned with geographic references. A gazetteer service retrieves the geometries for one or more features, given their associated well-known feature identifiers (text strings).
gazetteer model
The general model for representing online, well-known types of gazetteers.
general feature model
Metamodel of feature types. A feature may have properties that may be operations, attributes or associations. Any feature may have a number of attributes, some of which may be geometric and spatial. A feature is not defined in terms of a single geometry, but rather as a conceptually meaningful object within a particular domain of discourse, one or more of whose properties may be geometric.
general models
Source: The OpenGIS® Abstract Specification Topic 6: The Coverage Type and its Subtypes Version 6. http://www.opengis.org/techno/abstract/00-106.pdf
General Models Define the basic models for how geospatial information is to be characterized and encoded. To date, OGC has defined several types of General Models: (Simple) Feature Model, Coverage Model, Observation Model, Registry Model, Service Model, Data Catalog Model, Dictionary Model, Directory Model, and Gazetteer Model.
geocoder
Transforms a description of a feature location, such as a place name, street address or postal code, into a normalized description of the location, which includes a coordinate geometry.
geocoder Service
Geocoding is the process of linking words, terms and codes found in a text string to their applicable geospatial features, with known positions (i.e., usually a point with x, y coordinates but more generally any geometry), e.g. converting a street address to a geographic location. The Geocoder Service Interface allows for a request providing an address or set of addresses and returns them along with the corresponding geometry (usually a point relative to a requested spatial reference system.) The request is "sent" to a Geocoder Service, which processes the request and returns the resulting geographic feature representing position.

geocoding
Geocoding refers to the assignment of alphanumeric codes or coordinates to geographically reference data provided in a textual format. Examples are the two letter country codes and coordinates computed from addresses.
geodata
Digital data that represent the geographical location and characteristics of natural or man-made features, phenomena and boundaries of the Earth. Geodata represent abstractions of real-world entities, such as roads, buildings, vehicles, lakes, forests and countries. Geodata refers to such data in any format, including raster, vector, point, text, video, database records, etc.
geographic application
Applications which pertain to the Earth and Earth phenomena, with known spatial and temporal reference systems. Expressed in a human context versus computer context.
geographic data
See geospatial data.
geographic feature
Feature associated with a location relative to the Earth. The starting point for modeling of geographic information. A feature is an abstraction of a real world phenomenon. A geographic feature is a feature associated with a location relative to the Earth. A digital representation of the real world can be thought of as a set of features. Geographic features occur at two levels: feature instances and feature types. At the instance level, a geographic feature is represented as a discrete phenomenon that is associated with its geographic and temporal coordinates. These individual feature instances are grouped into classes with common characteristics - feature types.
geographic model
A model of the real world that recognizes an integrated family of spatial features
Geographic Objects
The vision for the Geographic Objects Initiative is to define platform-independent and implementation-neutral interface models of specific geographic services or component objects.
geographic reference system
A 3D reference coordinate system with well-defined origin and orientation of the coordinate axes. A mathematical system.
Geography Markup Language (GML)
OGC`s XML-based language for describing and encoding geospatial information. An application of XML, a specification developed by members of the Open GIS Consortium. http://www.opengis.org/techno/specs/00-029/GML.html ". GML is an XML encoding for spatial data. In a sense, it is a schema-writing language for spatial information.
geometric object
A combination of a coordinate geometry and a coordinate reference system. In general, a geometric object is a set of geometric points.

GeoMobility Server
The open service platform comprising the Core Services developed under the OGC OpenLS initiatives.

geoparser service
Geoparsing refers to the capability to process a textual document and identify key words and phrases that have a spatial context. A Geoparsing Interface implementing this specification works in the context of two bodies of information: a reserved vocabulary (usually of place names, such as a gazetteer) and a text source (e.g., a newspaper, or voice track.) The Geoparser Service returns all occurrences of the use (in the text source) of any word in the reserved vocabulary. Each occasion establishes a geolink between the source and the location associated with the reserved word.

geoprocessing
Use of computers to acquire, analyze, store, display, and distribute information about geographic features. This includes GIS and systems for remote sensing (Earth imaging), facilities management, automated mapping, cartography, navigation, and location services.

geoprocessing applications
Computer applications which model, interpret and use Earth information. The implementation of a Geographic Application on a computer. The terms `geoprocessing,` `geomatics,` and `geotechnology` mean approximately the same thing, though some groups make minor distinctions among them.

georectified gridded data
A cell in a georectified gridded data can be uniquely geolocated, given the cell spacing, grid origin and orientation. Ungeorectified gridded data are irregularly spaced in any geographic/map projection coordinate system. Therefore, the location of one cell in an ungeorectified gridded data cannot be determined based on another cell's location. One approach to rectifying imagery utilizes a sensor description.

georeference
Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm
Description of a location relative to the Earth

geospatial
Referring to location relative to the Earth's surface. "Geospatial" is more precise in many GI contexts than "geographic," because geospatial information is often used in ways that do not involve a graphic representation, or map, of the information.

geospatial data
Location properties related to any terrestrial feature or phenomena. Location properties may include any information about the location or area of, and relationships among, and descriptive information about geographic features and phenomena. This includes remotely sensed data, vector map data, addresses, coordinates, etc. Note that "geospatial data" is more precise in many contexts than "geographic data," because geospatial data is often used in ways that do not involve a graphic representation, or map, created from the data.

Geospatial Fusion Services
Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm
Non-map information - text, video, audio, digital photographs, mpeg movies, sensor data, word processing documents, etc. - often refers to place. Geospatial Fusion Services enable the "fusing" of information such as addresses, place names, coordinates, pinpoints on photographs, and descriptive directions into one information management framework that supports search, discovery, and sharing of spatial information stored in non-map formats.
geospatial information
Information about entities and phenomena that includes their location with respect to the Earth`s surface. Frequently used as a synonym to geodata, but technically, geodata are "dry" digitally represented facts or recorded observations which on their own have no meaning. They become information when interpreted and put in context by humans.
geospatial portal
A Web site that provides a view into a universe of spatial content and activity through a variety of links to other sites, communication and collaboration tools, and special features geared toward the community served by the portal. As an open Web resource, a geospatial portal should connect through open interfaces to data and services with similar interfaces. Catalogs and registries that conform to OpenGIS Specifications play an important role in geospatial portals.
GeoTIFF
Data interchange standard for raster geographic images. An extension of the TIFF format to support a geodetically sound raster data georeferencing capability. The aim of GeoTIFF is to allow a means for tying a raster image to a known model space or map projection, and for describing those projections. The geographic content supported in GeoTIFF tag structure includes its cartographic projection, datum, ground pixel dimension, and other geographic variables.
GFS Testbed
OGC`s GFS Testbed yielded a set of candidate standard specifications for open interfaces and protocols that begin to support "geospatial fusion."
GIF
Graphic Interchange Format An image format commonly used on the Web
GII
National Information Infrastructure. The world`s entire collection of public and private digital information, physical networks and network software, computers, and knowledge about how to use them.
GIS
Source: AGI glossary. http://www.geo.ed.ac.uk/agidict/welcome.html
"Geographic Information System. A computer system for capturing, storing, checking, integrating, manipulating, analyzing and displaying data related to positions on the Earth`s surface. " Both vector and raster GISs are available.
GIS application
Source: OpenGIS Guide

"The use of capabilities, including hardware, software and data, provided by a Geographic Information System specific to the satisfaction of a set of user requirements. Example of a GIS application: Spatial decision support system application for district planning purposes."

GISD-ICP

The Geospatial Information for Sustainable Development Initial Capability Pilot (GISD-ICP) is the first of a series of projects to help make geographic information more accessible and useful to decision makers working on sustainable development problems.

Global Spatial Data Infrastructure (GSDI)

A set of policies, standards, practices, technologies, and relationships to facilitate the flow of geographic data and information at all levels across government, academic, and private sectors globally. A linking of National Spatial Data Infrastructures. See www.gsdi.org.

Globe

Source: Wikipedia

A globe is a three-dimensional scale model of Earth (terrestrial globe or geographical globe) or other celestial body such as a planet or moon. While models can be made of objects with arbitrary or irregular shapes, the term globe is used only for models of objects that are approximately spherical.

GML

Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm

"Geographic Mark-up Language: an application of XML, a specification developed by members of the Open GIS Consortium.
http://www.opengis.org/techno/specs/00-029/GML.html ". GML is an XML encoding for spatial data. In a sense, it is a schema-writing language for spatial information.

GML Application Schema

An XML Schema written according to the GML 3 rules for Application Schemas, which defines a vocabulary of geographic objects for a particular domain of discourse

GPS

Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm

Global Positioning System: (1) a network of satellites that interact with special receivers to position the receiver relative to the Earth. (2) describing the generic approach to using a network of satellites to deliver a positioning service.Â Although GPS can be used to determine location very precisely (within centimeters given the correct controls and proper use, it does not solve all the problems of location determination in GIS databases.

Glossary of Terms - H

handle
An index entry or unique name in software that identifies a catalog entry or other resource so that it can be found and utilized by another software facility.
harmonization
With respect to standards: activities undertaken by communities of experts to align standards. For example, to define common metadata and application schema from legacy sources, harmonization will consider: -- Architecture - multiple viewpoints that capture high level requirements, use cases, scenarios, information flows and computational flows. -- Data modelling - definition and UML encoding of feature type, attribute type, data type, coding, dependency mapping -- Schema modelling - UML mapping and encoding to GML, mapping of profiles to one another, and delineation to service types -- Iteration and development - build a little, see if it works, build more- -- Delivery to standards organizations for approval.
hierarchical database
A database that stores related information in terms of pre-defined categorical relationships in a `tree-like` fashion. Information is traced from a major group, to a subgroup, and to further subgroups. Much like tracing a family tree, data can be traced through parents along paths through the hierarchy. Users must keep track of the hierarchical structure in order to make use of the data. The relational database provides an alternative means of organizing datasets.
http
Hypertext Transfer Protocol, the World Wide Web protocol for moving hypertext (HTML) files across the Internet. OGC has defined a suite of Web Service interfaces that have explicit bindings for HTTP. Specifically, there are two HTTP bindings for invoking operations of a service (i.e., Sending a message): GET and POST.
human technology environment
The environment within which people interact with information technology, typically a mouse and windowing system.
human technology interface (HTI)
The interface across which people interact with information technology. The service provided through this interface is access to the information infrastructure and to other people.
hydrography
The charting and description of bodies of water.

Glossary of Terms - I

image metadata
XML encoding used to describe all types of images handled by OpenGIS Framework services. Image Metadata is used for publishing and discovery of types of original

and derived images, image identifications, dates, spatial extents and other information that could be used to find and retrieve images from an archive.

imagery

A common way of collecting information associated with a coverage, by which the value of a continuous phenomenon is usually sampled at regular but discrete locations, i.e. pixels.

implementation

A software package that conforms to a standard or specification. A specific instance of a more generally defined system.

implementation profile

An Implementation Profile contains an interoperable set of implementation technologies. The languages and associated technologies that a functioning enterprise depends upon are part of the Implementation Profiles for an environment. In addition to modeling languages, Implementation Profiles contain inter-process communication protocols and other dependent infrastructure technologies that the framework employs.

implementation specification

Guidance for software engineers that is so specific that any two independent software implementations of the specification can "plug and play" for each other.

implementation view

Part of Information Viewpoint that captures how information must be represented within a working enterprise (i.e., how it is encoded for runtime use).

information appliance

End-user equipment having input and display (or auditory) capabilities for communication with other users or service providers in the NII.

Information Community

Source: The OpenGIS® Abstract Specification Topic 6: The Coverage Type and its Subtypes Version 6. A collection of people (a government agency or group of agencies, a profession, a group of researchers in the same discipline, corporate partners cooperating on a project, etc.) who, at least part of the time, share a common digital geographic information language and common spatial feature definitions. See Topic 14, Semantics and Information Communities.

Information Storage Interface (ISI)

The interface across which information technology interacts with external storage media. The service provided through this interface is persistent storage of data, where the physical storage media is often removable.

integrated client

A software application that provides a unified environment for visualizing, analyzing, and editing geospatial data from a wide variety of sources.

interface

A named set of operations that characterize the behavior of an entity. An implementation of operations including the syntax of the interaction for a given distributed computing technology. A shared boundary between two functional entities. An established ordering of parameters (with specific names and data

types) and instructions (with specific names and functions) that enables one software component to exchange data and instructions with another software component.

intermediary

A service that provides functions by which to interconnect, adapt and facilitate services offered by other parties, components or environments. Common forms of intermediaries include agent, broker, mediator and trader services.

interoperability

Source: OpenGIS Guide

Capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units ISO 2382-1. "The ability for a system or components of a system to provide information portability and interapplication, cooperative process control. Interoperability, in the context of the OpenGIS Specification, is software components operating reciprocally (working with each other) to overcome tedious batch conversion tasks, import/export obstacles, and distributed resource access barriers imposed by heterogeneous processing environments and heterogeneous data. "

Interoperability Program

The OGC Interoperability Program is a global, collaborative, hands-on engineering and testing program designed to deliver proven candidate specifications into the OGC Specification Development Program and to exercise and test existing OGC Implementation Specifications in domain specific situations.

Interoperability Program Report (IPR)

An IPR is provided by an Interoperability Program Initiative to the TC. IPR documents may be submitted to the OGC TC for review and comment. Depending on the desired outcome, the document type should be either "Information-Only", "Draft Discussion Paper", "Draft Recommendation Paper", or "RFC Proposal". The first, obviously, is intended for information only and is not to be considered for public release. The second approach is intended for consideration for public release as a Discussion Paper. The third is intended for consideration for public release as a Recommendation Paper. The last is intended for consideration as an RFC proposal (and must be submitted under the TC Policies and Procedures for RFCs). An IPR is not a publicly available document. An IPR will be provided to the TC in the correct IPR template format. An IPR does not represent the official position of the OGC nor of the OGC Technical Committee.

intrinsic resource

A registered resource for which the content model and normative representation are defined by the Registry Information Model (RIM).

IPR

See Interoperability Program Report.

ISO

International Organization for Standardization

ISO 19108, GI - Temporal Schema
See http://www.statkart.no/isotc211/scope.htm#19108 for a brief description.
ISO 19118, GI - Encoding,
See http://www.statart.no/isotc211/scope.htm#19118 for a brief description.
ISO/CD 19107.3, GI - Spatial Schema
See http://www.statkrt.no/isotc211/scope.htm#19107 for a brief description.
ISO/CD 19115 (ISO TC 211 N 1024, 201-01-30) GI - Metadata
See http://www.statkart.no/isotc211/scope.htm#19115 for a brief description.
ISO/CD 19119 (ISO TC 211 N 1044, 2001-01-29) GI - Services
See http://www.statkart.no/isotc211/scope.htm#19119 for a brief description.
isolated
Association role between topography primitives and those of co-deminsion 2 or greater. (see OGC Abstract Specification (Topic 1) clause 7.3.10.4)

Glossary of Terms - J

JAVA
A platform independent programming language developed by SunSoft. Any computer with the Java server software installed can run Java client applets that arrive over a network.
JPG (JPEG)
JPEG (Joint Photographic Experts Group) Image format for continuous tone pictures: JPEG makes use of continuous-tone digital images much more economical by drastically reducing the volume required for storage and the bandwidth required for transmission.

Glossary of Terms - K

key data sets
Source: GETIS glossary
Data sources essential for a specific application.

Glossary of Terms - L

LAN
Local Area Network. A system for connecting computers so they can communicate with one another.
Landsat
A particular system of US satellites that scan the earth at a variety of wavelengths. The satellites return information that can be used to inventory and analyze a variety of natural and human resources.

language independent
Describes a standard or specification which is not specified in terms of a specific programming language, but is implementable in a variety of languages.
layered map visualization
Pictoral representation of geographic data
LBS
Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm
See Location Based Services
legacy system
In computing terms, a legacy System includes software or database components inherited from a previous computing model which do not fit into an open system environment without some modification. In the case of the OpenGIS Specification, legacy systems are modified to include OpenGIS-conformant interfaces.
line string
A set of coordinate points and the lines that join them.
Location Based Services (LBS)
Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm
Location Based Services (or "Location Services") deliver information about location to people who are using wireless, position-aware devices such as cell phones and PDAs. A wireless-IP service that uses geographic information to serve a mobile user. Any application service that exploits the position of a mobile terminal.
Location Dependent Services
Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm
"Services in which the location of the client, server or both form an integral part of the service "
Location Organizer Folder (LOF)
The general, multi-source information container model for handling sets of inter-related spatiotemporal information, including images, maps, features, cables, and any other information elements (e.g., audio, video, etc).
location service
Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm
A service that provides the location of a moving or fixed device
Long-Term Technical Baseline Target
The Long-Term Technical Baseline Target is the subset of the elements of the Technical Plan that are scheduled to be completed greater than two calendar years into the future.
loosely-coupled service
A service that can be used to operate on multiple, unspecified datasets. Calling application has no structural dependency on the interface of called application. Call is not made in same technology as the interface of the called application.
LZW
Lempel-Zif-Welch: a popular data compression technique developed in 1977 by J. Ziv and A Lempel. Unisys researcher Terry Welch later created an enhanced version of these methods, and Unisys holds a patent on the algorithm. It is widely used in

many hardware and software products, including V.42bis modems, GIF and TIFF files and PostScript Level 2.

Glossary of Terms - M

map
A two-dimensional visual portrayal of geospatial data. A map is not the data itself.
map projection
A coordinate conversion from a geodetic coordinate system to a planar surface, converting geodetic latitude and longitude to plane (map) coordinates. The result is a two-dimensional coordinate system called a projected coordinate reference system.
map scale
The relationship between distance on a map and the corresponding distance on the earth`s surface. Map scale is often recorded as a representative fraction such as 1:1,000,000 (1 unit on the map represents a million units on the earth`s surface) or 1:24,000 (1 unit on the map represents 24,000 units on the earth`s surface). The terms `large` and `small` refer to the relative magnitude of the representative fraction. Since 1/1,000,000 is a smaller fraction than 1/24,000, the former is said to be a smaller scale. Small scales are often used to map large areas because each map unit covers a larger earth distance. Large-scale maps are employed for detailed maps of smaller areas.
measurement
An observation event whose value property is a value of some natural phenomenon. A measurement usually refers to the measuring device and procedure used to determine the value, such as a sensor or observer, analytical procedure, simulation or other numerical process. A measurement feature binds the result to the (spatiotemporal) location where the measurement was made.
message broker
Hubs designed to route and manage message traffic between various applications. May include transformation for incompatible messages.
metadata
Source: ISO 19115; KOGIS Switzerland; Co-ordination for GIS in the federal administration of Switzerland
"Data about data or a service. Metadata is the documentation of data. In human-readable form, it has primarily been used as information to enable the manager or user to understand, compare and interchange the content of the described data set. In the Web Services context, XML-encoded (machine-readable and human-readable) metadata stored in catalogs and registries enables services to use those catalogs and registries to find data and services.
metadata dataset
Source: ISO 19101
Metadata describing a specific dataset

metadata entity
Source: ISO 19115
Group of metadata elements and other metadata entities describing the same aspect of data. Note 1: A metadata entity may contain one or more metadata entities. Note 2: A metadata entity is equivalent to a class in UML terminology
metadata schema
Source: ISO 19101
Coceptual schema describing metadata Note: ISO 19115 describes a standard for metadata schema.
metadata section
Source: ISO 19115
Subset of metadata that defines a collection of related metadata entities and elements.
metadata translator
Software based on the OpenGIS Specification that will be configured by two diverse Information Communities to enable automated data integration or sharing to the degree that their metadata schema overlap.
Mid-Term Technical Baseline Target
The Mid-Term Technical Baseline Target is the subset of the elements of the Technical Plan that are scheduled to be completed between one and two calendar years into the future.
middleware
Software in a distributed computing environment that mediates between clients and servers.
MMI
OGC`s Multi-Hazard Mapping Initiative (MMI) Phase I (2001) was a pilot project sponsored by the US Federal Emergency Management Agency (FEMA) that established a limited operational framework of interoperable services to illustrate the advantages of using products with OGC interfaces to access, fuse and visualize critical spatial information in support of FEMA multi-hazard mitigation, response and recovery functions.
modeling languages
Well-known "languages" to encode the semantics, syntax and schema of geospatial and geoprocessing-related information resources. They apply to all Application Domain Models and Runtime (Model) Components.
MPP
OGC`s Military Pilot Project (MPP) (2001) was a collaborative effort that tested the interoperability of commercial geoprocessing products in the defense and intelligence (DI) domain.

Glossary of Terms - N

National Mapping Agencies
National government agencies, such as the UK's Ordnance Survey, France`s Institut Geographique National (IGN) and the US's US Geological Survey and Federal Geographic Data Committee, that are chartered to provide national mapping products and services.
National Spatial Data Infrastructure (NSDI)
Information Infrastructure elements that make digital geographic information a part of everyone's digital information environment: data content and metadata standards; national Framework (base) data; metadata to help inventory, advertise, and intelligently search geographic data sets; a clearinghouse that allows for catalog searches across multiple geodata servers on the Internet; commercial geoprocessing products that interoperate through interfaces that conform to interoperability interface specifications; and partnerships to advance data sharing and NSDI development.
navigation service
An enhanced version of the Route Service, which is a network-accessible service that determines travel routes and navigation information between two or more points.
NGO
Non-governmental organization
NII
National Information Infrastructure. A nation`s entire collection of public and private digital information, physical networks and network software, computers, and knowledge about how to use them.
NMA
National Mapping Agency
node
0-dimensional topology primitive (see OGC Abstract Specification (Topic 1) clause 7.3.12)
NTF
Neutral Transfer Format. Interchange of geographic information within UK

Glossary of Terms - O

object
Data and processing functions packaged into a small, discrete, interoperable module. Also, in a specific OGC context, an XML document element of a type derived from AbstractGMLType

Object Oriented (OO)
Software in which data and processing functions are packaged into small, discrete, interoperable modules, offering advantages such as portability and easy maintainability.
object technology
Software scheme in which data and processing functions are packaged into small, discrete, interoperable modules, offering advantages such as portability and easy maintainability.
observation domain model
The definition of a specific observation type in accordance with the general observation model.
Observation Model
The general model for representing observations of earth phenomena; general observation model for describing well-known observations.
OGC
Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm Open GIS Consortium, Inc. http://www.opengis.org
OGC Interoperability Program
The OGC Interoperability Program provides an industry consensus process to develop, test, demonstrate, and promote the use of standard interfaces and protocols that enable interoperable geoprocessing. The Interoperability Program organizes and manages Interoperability Initiatives, including Testbeds, Pilot Projects, Planning Studies, Insertion Projects, and Feasibility Studies. Technical documents, training materials, test suites, reference implementations and other resources developed in these initiatives become available for use by members and the public on the OGCNetwork.
OGC Network
An OGC web site (http://www.ogcnetwork.org/) that provides a Directory of OGC services, fora, mail lists, specifications, discussion papers, Collaborative Test Environment services, and other OGC-related resources.
OGC Specification Program
In the OGC Specification Program, the OGC Technical Committee reviews specifications for interfaces and encodings developed either in the Interoperability Program by groups of members, or through an internal proposals process. The Technical Committee and Planning Committee then approve these as OpenGISÂ® Specifications for release to the public.
OGC Technical Baseline
See Technical Baseline.
OGC Technical Committee
The OGC Technical Committee is the primary operational unit of the OpenGIS specification development and adoption process. It is comprised of the technical representatives of all OGC member organizations and is charged with creating OpenGIS Specifications and maintaining the OGC Abstract Specification. The Technical Committee does the bulk of its work through its Working Groups (WGs).

OGCE
Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm
Open GIS Consortium (Europe) Limited: a business supporting OGC in Europe. http://www.opengis.co.uk

OLE/COM
Object Linking and Embedding/Common Object Model. A DCP developed by Microsoft.

online
A state (referring to equipment such as computers, plotters, printers, and digitizers) of being turned on and actively communicating with a computer or computer network.

open interface
An interface that implements a standard specification developed in an open consensus process. (See interface.)

Open Location Services
Open Location Services (OpenLS) is a multi-phase project which is focused on defining and building the "core" Location Based Services (LBS) standards and information framework for LBS application services in close coordination with other related industry standards groups.

open platform
In the past, the term platform denoted any specific hardware and operating system combination, such as the Windows/Intel platform. It now used more generally describes an application programming interface (API) or set of APIs that provide access to computing power, database, GIS or other services hidden "underneath" those APIs. The acronym "API" is generally giving way to "interface" in programmer-speak. No single vendor provides an open platform unless all the exposed interfaces are open interfaces as defined above. An open platform needs to be like the IT industry`s Web Services platform, which is still, as of August, 2003, largely unencumbered by proprietary restrictions and is the product of a non-exclusive consensus process.

open source
It is important not to confuse "open source" with "open standards." They are entirely different. The special licenses that govern use and sale of such software exist not to ensure profits to the software`s owner, but to ensure that the software`s source code remains in the public domain (free to all), though companies are allowed to sell products that include some or all of the source code. Open source software is usually developed not by single company but by a distributed team of developers, typically an informal ad hoc group of volunteers.

open specification
A specification that promotes interoperability through its public availability to developers, who use it to develop software or hardware compatible with the common resource described in the specification. Open specifications are generally consistent with related standards and are updated to conform with new standards

and new technologies. They may be developed and maintained, as in the case of OpenGIS Specifications, by a public open consensus process.

open standards

An "open standard" is one that: 1. Is created in an open, international, participatory industry process 2. Is freely distributed and openly accessible 3. Does not discriminate against persons or groups 5. Ensures that the specification and the license must be technology neutral: Its use must not be predicated on any proprietary technology or style of interface.

open system

Open systems are systems that interoperate through open interfaces, protocols etc. developed and maintained in an inclusive, open consensus process. Open systems promote application portability, scalability, interoperability, diversity, manageability, extensibility, compatibility with legacy components, and user portability.

open system environment

A computer environment specified by a set of standards and profiles for interfaces, services, and formats for an open system.

OpenGIS Abstract Specification

A document that captures the OGC member consensus on a computing technology independent specification for interfaces, protocols or schemas for interoperable geoprocessing. The Abstract Specification is that part of the OpenGIS Specification created by the OGC Technical Committee to provide a high level description of the functionality to be provided in OpenGIS Implementation Specifications.

OpenGIS Implementation Specification

A document containing a computing platform dependent specification for application program interfaces, protocols etc. OpenGIS Implementation Specifications contain detailed software specifications for implementing standard interfaces, protocols etc. on particular distributed computing platforms such as the Web, SQL, OLE/COM and CORBA.

OpenGIS Reference Model (ORM)

The ORM is a document, part of the OGC Technical Baseline, that provides an overall conceptual framework for building geospatial processing into distributed systems in an incremental and interoperable manner.

OpenGIS Specification

An open software standard developed and adopted in OGC`s open consensus process that enables interoperable geoprocessing, which includes: real-time data sharing and process execution between GIS systems from different vendors; interoperation between dissimilar types of geoprocessing systems (GIS, Earth imaging, surveying and mapping, navigation, etc.); and efficient discovery of and access to remote geodata and geoprocessing resources in distributed computing environments.

OpenGIS, Open GIS and open GIS

OGC registered the trademark "Open GIS" and OpenGIS" in countries around the world to assert the importance of open standards in geoprocessing and to protect

these standards with a legal brand. The phrase "open GIS" (with a small "o") is also a trademark of OGC, with the same meaning as "Open GIS," though "open GIS" is not a registered trademark.

OpenLS

See Open Location Services.

OpenLS Core Services

The basic services that comprise the open service platform (GeoMobility Server) defined under OpenLS.

operation

A single step performed by a computer in the execution of a program, or, in the context of object-oriented programming: Specification of an interaction that can be requested from an object to effect behavior. ISO 19119

ORM

OpenGIS Reference Model

orthophoto map

Source: http://www.eurogeographics.org/Projects/GDDD/GDDD/lists/products.htm#52

Digital or digitized aerial photographs in which the pixels are geometrically rectified and given geographical references. The data structure is raster. An orthophoto map may include details of topography and names.

orthorectification

Use of photogrammetric techniques to adjust and correct distortions in mages.

OWS

OGC Web Services.

OWS Service Framework

(OSF) Identifies services, interfaces and exchange protocols that can be utilized by any application. OpenGIS Services are implementations of services that conform to OpenGIS Implementation Specifications. Compliant applications, called OpenGIS Applications, can then "plug into" the framework to join the operational environment.

Glossary of Terms - P

PDF

Portable Document Format. An Adobe file format readable with free software (Acrobat Reader)

photogrammetry

Use of aerial photographs to produce planimetric and topographic maps of the earth`s surface and of features of the built environment. Effective photogrammetry makes use of ground control by which aerial photographs are carefully compared and registered to the locations and characteristics of features identified in ground-level surveys.

pilot project
In the context of the OGC Interoperability Program, a project to introduce new technology products into an operational environment to discover the effectiveness of these products and the new approaches they enable, and to provide feedback into the Specification Program.
Planning Committee
The OGC Planning Committee identifies market opportunities for interoperability and uses this information to document and maintain a "Technology Roadmap" that sets forth the plan, schedule and rationale for OGC activities.
planning study
In OGC: Strategic study that assesses opportunities to expand and sustain an organization's interoperability capacity.
platform
Another term for computer hardware, including microcomputers, workstations, and mainframe computers, or for underlying software, like an operating system, that provides services to layered software.
platform independent
Depends on context, but in general, when discussing software, platform independence means the software can be run on any computer or operating system or distributed computing platform.
PNG
Portable Network Graphic. A format for Web graphics
point of interest
A location (with a fixed position) where one can find a place, product or service, typically identified by name rather than by address and characterized by type, which may be used as a reference point or a target in a location based service request, e.g., as the destination of a route.
point to grid interpolation
Source: GETIS glossary
The conversion from a geospatial data set that represents a surface with points and their attributes (e.g. terrain heights) to a grid (raster) data structure that represents the same surface. The estimation of attribute values of the surface at an unsampled point in the grid is based on the known attribute values of surrounding points in the point dataset.
polygon
Source: AGI glossary. http://www.geo.ed.ac.uk/agidict/welcome.html
A feature used to represent areas. A polygon is defined by the lines that make up its boundary and a point inside its boundary for identification. Polygons have attributes that describe the geographic feature they represent.
polygon overlay
Source: AGI glossary. http://www.geo.ed.ac.uk/agidict/welcome.html
"The process of superimposing two or more polygons, through registration to a common co-ordinate system. Such an overlay procedure determines the spatial

coincidence of two sets of polygon features and creates a new set of polygons based upon overlay operating."

portal

A Web site that provides a view into a universe of content and activity through a variety of links to other sites, communication and collaboration tools, and special features geared toward the community served by the portal.

portrayal

The presentation of information to humans, e.g., a map. In the context of the Web, portrayal refers to how data is presented for the user. Map portrayal, for example, is concerned with shape and color of symbols representing features, rules for displaying text labels, rules for showing/not showing symbols based on zoom extent, etc.

Portrayal Service

Defines a standard interface for producing visual pictures from coverage data. CPS extends the WMS interface and uses the Styled Layer Descriptor (SLD) language to support rendering of WCS coverages. provide visualization of geospatial information. Portrayal Services are components that, given one or more inputs, produce rendered outputs (e.g., cartographically portrayed maps, perspective views of terrain, annotated images, views of dynamically changing features in space and time, etc.). Examples include: Map Portrayal Services (MPS), Coverage Portrayal Services (CPS) and Mobile Presentation Services.

precision

Refers to the level of measurement and exactness of description in a GIS database. Precise locational data may measure position to a fraction of a unit. Precise attribute information may specify the characteristics of features in great detail. It is important to realize, however, that precise data - no matter how carefully measured - may be inaccurate. Surveyors may make mistakes or data may be entered into the database incorrectly. Therefore, a distinction is made between precision and accuracy.

presentation (map portrayal) service

A network-accessible service that portrays a map made up of a base map derived from any geospatial data and a set of ADT's as overlays.

process domain model

Data model that characterizes well-known, domain-specific business processes. These models capture business rules, policies, tasks, and procedures in the form of processing chains. Microsoft, IBM and others are collaborating on a standard methodology for online workflow and service chaining. When this standard stabilizes and emerges, organizations will start testing this technology and adapt it in a wide range of workflows. When that happens, many Process Domain Models will result.

processing services

OWS Services that operate on geospatial data and provide 'value-add' services for applications. They can transform, combine, or create data. Processing Services can be tightly or loosely coupled with other services, such as Data and Portrayal

Services. Processing Services can be sequenced into a 'chain' of services to perform specialized processing in support of information production workflows and decision support. Examples include: Coordinate Transformation Services (CTS), Geocoder Services, Route Determination Services etc.

profile
A collection of standards, with parameters, options, classes, or subsets, necessary for building a complete computer system, application, or function. An implementation case of a more general standard or set of standards.

property
A facet or attribute or an object referenced by a name.

protocol
A set of semantic and syntactic rules that determine the behavior of entities that interact.

prototyping
In the context of the OGC Interoperability Program, prototyping refers to developing a new candidate standard interface, protocol, schema etc. for the purpose of learning about it and guiding future OpenGIS Specification development.

publish
In the context of OGC Web Services, just as non-spatial Web pages "publish" their contents - make them discoverable - through HTML, metadata, geodata and geoprocessing services servers publish their contents and capabilities through XML metadata contained in feature type registries, feature instance catalogs, and service registries.

publish, find, bind
In the context of Web Services, publish means to advertise data and services to a broker (such as registry, catalog or clearinghouse). A service provider contacts the service broker to publish (or unpublish) a service. A service provider typically publishes to the broker metadata describing its capabilities and network address. Find is used by service requestors to locate specific service types or instances. Service requestors describe the kinds of services they're looking for to the broker and the broker responds by delivering results that match the request. Service requestors typically use metadata published to the broker to find service providers of interest. Bind results after a service requestor and a service provider successfully negotiate so the requestor can access and invoke services of the provider. A service requestor typically uses service metadata provided by the broker to bind to a service provider. The service requestor can either use a proxy generator to generate the code that can bind to the service, or can use the service description to manually implement the binding before accessing that service.

Glossary of Terms - Q

qualified name
Source: ISO 19118

Name that is prefixed with its naming context. Example: The qualified name for the road no attribute in class Road defined in the roadmap schema is Roadmap Road road_no.

Glossary of Terms - R

raster
Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm
The representation of spatial data as a matrix of valued cells. Originally, a raster was a scan line in an electronic display such as a television or computer monitor. In geoprocessing, raster refers to a digital representation of the extent of geographic data sets using "grid cells" in a matrix. A raster display builds an image from pixels, small square picture elements of coarse or fine resolution. A raster database maintains a "picture" of reality in which each cell records some sort of information averaged over the cell`s area. The size of the grid cell may range from centimeters to kilometers. Many satellites transmit raster images of the earth`s surface. Reflectance of sunlight at a certain wavelength is measured for each cell in an image.
real-time
Refers generally to systems that respond (almost) immediately or synchronously to external events.
Recommendation Paper
An OGC document containing discussion of some technology or specification area, prepared by a Working Group for release to the public. Recommendation Papers are the official position of the OGC and thus represent an endorsement of the content of the paper.
reference data
European term for a collaborative effort to create a widely available source of basic geographic data, providing national or European coverage of a set of common digital geographic data such as Elevation, Transportation, Hydrography, Cadastral, Geodetic Control, Governmental Units, etc. (Similar to "framework data" in the U.S.)
Reference Implementation
An operational, conformant implementation of an implementation specification, together with available source code, that is made available for public use for testing and development purposes. (a Reference Implementation refers to one or more OpenGIS Implementation Specifications.)
reference model
Provides the complete scientific and engineering contextual framework for a technology area. Includes the underlying elements, rules and behaviors.
register of geodetic points
Source: http://www.eurogeographics.org/Projects/GDDD/GDDD/lists/products.htm#52

"A catalogue of geodetic control points, e.g. trigonometric points and leveling benchmarks."

register of land

Source: http://www.eurogeographics.org/Projects/GDDD/GDDD/lists/products.htm#52

"A general term used for the designation of registers for ownership of land, e.g. cadastre and registers of territorial rights."

Registry Model

The general model for online registries. Sensor Model - The general model for sensor phenomena; the general sensor model for describing well-known sensors.

registry object

Every registered resource is a registry object. Dataset metadata and service metadata are examples of registry objects. All metadata and data types are regarded as registry objects.

registry services

OWS Services that provide a common mechanism to classify, register, describe, search, maintain and access information about resources available on a network. Resources are network addressable instances of typed data or services.

Relational Data Base

Stores data in such a way that it can be added to, and used independently of, all other data stored in the database. Users can query a relational database without knowing how the information has been organized. Although relational databases have the advantages of ease-of-use and analytical flexibility, their weakness can be slower retrieval speed. SQL (structured query language) is an interface to a relational database.

Remote Procedure Call (RPC)

An API for remote (across the network) execution of detailed functions.

remote sensing

Acquisition of raster images of the Earth, often involving spectral frequencies other than the visible band, by devices typically carried on airborne or satellite platforms. Sometimes refers also to image analysis of these images.

reporting group

Source: ISO 19113; ISO 19109

Data with common characteristics forming a subset of a dataset. Note 1: Common characteristics can include belonging to an identified feature type, feature attribute or feature relationship; sharing of data collection criteria; sharing original source; or being within a specified geographic or temporal extent. Note 2: A reporting group can be as small as a feature instance, an attribute value, or a single feature relationship.

request

Invocation of an operation by a client

Request for Comment (RFC)

In the context of OpenGIS Specification Development, an explicit request to the industry for comments concerning a particular technology that an OGC Technical

Committee Working Group or Interoperability Initiative is considering for development or adoption as an OpenGIS Specification.

Request for Information (RFI)

In the context of OpenGIS Specification Development, a general request to the industry to submit information to one of the OGC Technical Committee Working Groups.

Request for Proposals (RFP)

In the context of OpenGIS Interoperability Program, an explicit request to the industry to submit proposals for work to be performed as part of an Interoperability Initiative.

response

Result of an operation returned from a server to a client

reverse geocoder service

A network-accessible service that transforms a given position into a normalized description of a feature location (Address with Point), where the address may be defined as a street address, intersection address, place name or postal code

RM-ODP

Reference Model for Open Distributed Processing (ISO/IEC 10746). In RM-ODP, Architecture is defined as a set of components, connections, and topologies defined through a series of views: enterprise, information, computation, engineering and technology.

route service

A network-accessible service that determines travel routes and navigation information between two or more points.

RTD

Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm
Research and Technology Development: a term used in the European IST program.

Glossary of Terms - S

SAIF

Spatial Archive and Interchange FormatÂ

scalability

The ability to change the component configuration of a system to fit desired application contexts.

scanned map

Source: http://www.eurogeographics.org/Projects/GDDD/GDDD/lists/products.htm#52
Analogue maps digitized by scanning. The data structure of scanned maps is raster.

schema

A structured framework. A metadata schema specifies the order and types and labels of information elements describing a geodata set.

SCOTS
Standards based commercial off-the-shelf software. ("Off the shelf" means that the product is commercially available, without any need for customization.)
SDI (GDI)
Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm
"(Geo)Spatial Data Infrastructure: a comprehensive package of consensus and initiatives required to enable complete provision of data, access and privacy within the territory of the designated infrastructure."
SDO
Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm
Standards Development Organization: any international organization that develops standards for the whole community. Includes de jure SDOs and standards consortia.
SDTS
Spatial Data Transfer Standard. A standard vector format developed by the US Federal Geographic Data Committee.
semantic translator
A collection of mappings between a target Information Community`s data model and a source Information Community`s data model, generally held and maintained by the target Information Community, though both Information Communities may participate in configuring it. Usually expressed in terms of metadata, features, attributes and rules that permit information integration to occur when a feature collection is imported to the target Information Community from a source Information Community.
Sensor Collection Service (SCS)
Provides a web-enabled interface to a sensor, collection of sensors or sensor proxy. The Sensor Collection Service provides a standard interface for clients to collect and access sensor observations and manipulate them in different ways. SCS instances are collection points on the web for disparate types and instances of sensors. SCS instances deliver sensor observation values (e.g., temperature, ppm, chemical type) in response to queries form HTTP clients.
sensor domain model
The definition of a specific sensor type in accordance with the general sensor model.
Sensor Model Language
(SML) OGC`s XML-based language for describing and encoding sensors (in situ, satellite and airborne).
sensor web
A networked collection of sensors that can be remotely read and perhaps also controlled.
Sensor Web Enablement
OGC`s initiative to develop standards that support linking of environmental sensors to the World Wide Web. A Sensor Collection Service (SCS) server gathers readings from in-situ environmental sensors via a private network (cellular, microwave,

etc.), and provides summaries or interpretations of those readings to SCS clients over the Web.

service

A computation performed by a software entity on one side of an interface in response to a request made by a software entity on the other side of the interface. A collection of operations, accessible through an interface, that allows a user to evoke a behavior of value to the user. ISO - 19119

service chain

A sequence of services where, for each adjacent pair of services, occurrence of the first action is necessary for the occurrence of the second action ISO 19119.

service interface

Source: ISO 19101

Shared boundary between an automated system or human being and another automated system or human being

service metadata

The most basic operation all OGC services must provide is the ability to describe themselves. This "Get Capabilities" operation, yielding a capabilities document, is common to all OWS1 services. An XML vocabulary comprised of several parts for describing different aspects of a service. The first unit describes the service interface in sufficient detail so that an automated process can read the description and invoke an operation that the service advertises. A second unit describes the data content of the service (or the data it operates on) in a way that enables service requestors to dynamically compose requests for service.

Service Model

The general model for online services.

service request

A request by a client of an operation from a service.

SHAPE

An ESRI published spatial data format.

SIF

Standard interchange format. SIF is a format which allows data to be transferred among dissimilar computer systems. SQL stands for Structured Query Language, a relational database.

Simple Feature Model

The general, descriptive model for how earth features may be represented as vector objects (i.e., points, lines and polygons).

SME

Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm

Small or Medium Sized Enterprise (1-500 employed persons)

SOAP

Source: http://www.softwareag.com/xml/about/glossary.htm

"Simple Object Access Protocol, a method invented by Microsoft to use RPC over the internet via HTTP calls. SOAP is now published as an W3C Note and implemented, among others, as part of the Apache XML Project." SOAP is a

protocol specification that defines a uniform way of passing XML-encoded data. It also defines a way to perform remote procedure calls (RPCs) using HTTP as the underlying communication protocol. Development of SOAP is in the care of the W3C`s XML Protocols Working Group.

spatial reference system

Source: The OpenGIS® Abstract Specification Topic 2: "Spatial Referencing by Coordinates" http://www.opengis.org/techno/abstract/02-102.pdf

As defined in the OpenGIS Abstract Specification Topic 2 and ISO 19111. Position on or near the Earth's surface can be described by spatial reference systems. These are of two basic types: those using coordinates; and those based on geographic identifiers (for example postal addresses, administrative areas). Spatial referencing by geographic identifiers is defined in ISO 19112, Geographic information - "Spatial referencing by geographic identifiers." The subject matter of The OpenGIS® Abstract Specification Topic 2: "Spatial Referencing by Coordinates" is spatial referencing by coordinates.

Spatial Web

The Spatial Web is the spatially enabled World Wide Web. It is also the set of Web-resident open geospatial resources -- data, schemas and services - that enable people to publish, find and use Web-resident geospatial information off all kinds.

specification

A document written by a consortium, vendor, or user that specifies a technological area with a well-defined scope, primarily for use by developers as a guide to implementation. A specification is not necessarily a formal standard.

Specification Program

The OGC Specification Program provides an industry consensus process to plan, review and officially adopt OpenGIS Specifications for interfaces and protocols that enable interoperable geoprocessing services, data, and applications. The OGC bodies involved in the Specification Program are the Technical Committee, Planning Committee, and Strategic Member Advisory Committee.

SQL

Source: http://www.softwareag.com/xml/about/glossary.htm

Structured Query Language. "SQL is a standard interactive and programming language for getting information from and updating a database. Although SQL is both an ANSI and an ISO standard, many database products support SQL with proprietary extensions to the standard language"

standard

A document that specifies a technological area with a well-defined scope, usually by a formal standardization body and process.

State Plane Coordinate System (SPC)

A locational reference system developed in the U.S. in the 1930s which provides positional descriptions accurate to 1 foot in 10,000. The SPC system divides the United States into 125 zones (5 cover Texas) and employs both Lambert conformal and Transverse Mercator projections (depending upon a state`s size and shape). Within any given SPC zone, X-Y coordinates are given in eastings and northings. A

central meridian passes each zone and is given a false easting of 2 million feet. A false northing of 0 feet is established below the southern limit of each zone.

stove pipe or stove piped

Colloquial term describing systems that are 'islands of automation,' that do not interoperate with other systems. Data in at the bottom, data out at the top, no sharing of data or services laterally.

Strategic Member Advisory Committee (SMAC)

The SMAC is granted authority to operate by the OGC by-laws. The SMAC has as a primary responsibility to recommend areas of strategic opportunity for Consortium operations and to recommend resource strategies in support of Consortium programs to the Board of Directors, Consortium staff and the Membership.

structured code

Refers to software designed such that a small central program makes calls to subroutines organized in external libraries: as opposed to the `spaghetti` code of large monolithic programs with integral functions and subroutines. This approach enables libraries called application programming interfaces (APIs) to provide a standard set of `hooks` by which a program can cooperate with other programs.

Style

Styles provide the mapping from feature types and feature properties and constraints to parameterized symbols used in drawing maps

Styled Layer Descriptors (SLD)

A map-styling language for producing georeferenced maps with user-defined styling

stylesheet

Source: http://www.softwareag.com/xml/about/glossary.htm

"A program written in a stylesheet language for converting and/or presenting HTML, SGML, or XML documents. Stylesheet languages are e.g. CSS for HTML (and CSS2 for XML too), XSL for XML and FOSI and DSSSL for both SGML and XML."

sub-assembly

Collection of components. E.g. Customer Management contains many software components including Party, Location, Post Code look-up, and assign new ID number.

surface

2-deminsional geometric primitive, locally representing a continuous image of a region of a plane. (see OGC Abstract Specification (Topic 1) clause 6.3.17)

Surface Configuration Model

Defines the geometric characteristics of the Earth`s surface, exclusive of features which fall upon the surface; defined in terms of elevation, shape, roughness, slope, and aspect, with the later properties possibly derived from elevation.

SVG

"Scalable Vector Graphics, a language for describing two-dimensional vector and mixed vector/raster graphics in XML. SVG graphic types include text and XSLT can transform XML documents into SVG output. Thus SVG is a possible replacement for XSL FO. SVG tools are provided by IBM, CSIRO and Adobe." SVG is a standard

application programming interface (API) for displaying graphics encoded in XML. SVG is used for presentation of GML data.

symbol

Symbols are bundles of predefined graphical parameters and predefined fixed graphic "images".

symbology

Methodology for describing symbols and mapping of the schema to an application schema. Portrayal requires symbology.

synchronous

Calling application requires response to request before proceeding.

System Internal Interface (SII)

An interface between components within an application platform.

Glossary of Terms - T

TC/211

Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm

Technical Committee within ISO for Geographic Information/ Geomatics standards

Technical Baseline

The OGC Technical Baseline, at any point in time, is the set of all Adopted Specifications plus all other technical documents that have been approved by the OGC Technical and Planning Committees, including the OpenGIS Reference Model, OpenGIS Abstract Specifications, Recommendation Papers, and Discussion Papers.

Technical Committee

In the OGC Specification Program, the OGC Technical Committee reviews specifications for interfaces and encodings developed either in the Interoperability Program by groups of members, or through an internal proposals process. The Technical Committee and Planning Committee then approve these as "adopted" OpenGISÂ® Specifications for release to the public. The OGC Technical Committee is comprised of the technical representatives of all OGC member organizations. The Technical Committee does the bulk of its work through its Working Groups.

Technical Plan

The OGC Technical Plan, at any point in time, is the set of planned modifications and additions to the Technical Baseline that could occur over a given time horizon. This includes both the specification documents as well as the Supporting Material.

Technology Insertion Project

In OGC: Collaborative project focusing on expanding an organization's interoperability capacity by laying the infrastructure (groundwork) for open implementations.

technology viewpoint

RM-ODP viewpoint concerned with the underlying infrastructure in a distributed system. It describes the hardware and software components used in a distributed system. The infrastructure, which may be provided by a Distributed Computing

Platform (DCP), allows objects to interoperate across computer networks, hardware platforms, operating systems and programming languages.

temporal reference system

The temporal reference system package in the ORM provides elements for describing temporal reference systems, e.g., calendars and clocks.

testbed

In the context of OGC's Interoperability Program, a testbed is a collaborative activity in which sponsors provide interoperability requirements and financial support and technology providers team to develop prototype interoperability interfaces, protocols etc. that meet those requirements. The testbed concludes with a public demonstration, and the prototype-derived specifications are submitted to the OGC Technical Committee for review and approval.

thematic map

A map showing, by color or pattern, the distribution of a single phenomenon

thick clients

Clients that handle much of the necessary computation and data/metadata management themselves; and rather than invoking the processing services of other components, they obtain their inputs through low-level data-access requests.

thin clients

Clients that rely on invoking the services of other components (servers, middleware) for most of the computation they need to function in the system; they also rely on other components to manage most of the data and metadata they use.

TIFF

Tagged Image File Format. A graphic file format developed by Aldus and Microsoft.

TIGER

Topologically integrated geographic encoding and referencing file. This is a type of digital map developed by the U.S. Bureau of the Census to support the 1990 population census. Census maps in TIGER format succeed the previous DIME format. TIGER files are available for every county in the United States and for the millions of census blocks in urban areas. Although the accuracy of TIGER files varies from county to county, partly for reasons beyond the control of the Bureau, they are likely to improve in coming decades. The TIGER files are a particularly important resource for many urban GIS. The Census Bureau is moving to provide TIGER data in GML.

tightly coupled data and service

An instance of a service associated with a specific instance of a dataset.

tightly-coupled

Calling application must have detailed knowledge of interfaces of called application. Call is likely made in same technology, and using same call structure.

tool

A software component, sometimes called an application object, which can act as either a service provider or service requester within an application platform.

topographic map

Source: AGI glossary. http://www.geo.ed.ac.uk/agidict/welcome.html

"A map whose principal purpose is to portray the features of the earth`s surface. These features might include the cultural landscape, but normally refer to the terrain and its relief."

topology

Properties of geometric forms that remain invariant when the forms are deformed or transformed by bending, stretching, and shrinking. Among the topological properties of concern in GIS are connectivity, order, and neighborhood. One productive use of topology is to accelerate computational geometry. Geometric calculations such as containment (point-in-polygon), adjacency, boundary, and network tracking are computationally intensive. For this reason, combinatorial structures known as topological complexes are constructed to convert computational geometry algorithms into combinatorial algorithms. Another purpose is, within the geographic information domain, to relate feature instances independently of their geometry.

trader

A kind of intermediary service which acquires services from one or more providers for `resale` to a service requester. The trader service insulates requester and provider services from having to interact directly with one another. The trader is responsible to the requester for all aspects of the requested service.

transfer protocol

Source: ISO 19118

Common set of rules for defining interactions between distributed systems.

translation

The process of converting data or commands from one computer format to another, or from one computer language to another.

transparency

The ability of systems or components of systems to hide the details of their implementations from other client or server systems or components of systems.

tuple

An ordered set. Such a set of coordinates that define a point.

Glossary of Terms - U

UDDI

Source: http://www.softwareag.com/xml/about/glossary.htm

"Universal Description, Discovery, and Integration, a standard for a platform-independent, open framework for describing services on the Internet, suggested by, among others, IBM, Ariba and Microsoft, September 6, 2000. UDDI is intended mainly for B2B enhancement and is based on the W3C`s XML standard and, especially on SOAP". UDDI provides a mechanism for clients to dynamically find other Web services. A UDDI registry is similar to a CORBA trader, or it can be thought of as a DNS service for business applications. A UDDI registry has two kinds of clients: businesses that want to publish a service (and its usage interfaces), and

clients who want to obtain services of a certain kind and bind programmatically to them.

use case scenario

Source: GETIS glossary

A possible sequence of real world events used as a test case for specifying or testing information systems designed to help manage such events.

user domain

Source: GETIS glossary

"User group with common interests in activities in a specific discipline, parts of a discipline or a type of GIS application, e.g. local government, fire brigades, etc."

user portability

The ability of a user to move from one system to another without having to relearn everything necessary to use such as system.

UTM Coordinate System (Universal Tranverse Mercator)

A planar locational reference system which provides positional descriptions accurate to 1 meter in 2,500 across the entire earth`s surface except the poles. Based on the Universal Transverse Mercator map projection. At the poles, the Universal Polar Stereographic projection is used. The UTM system divides the earth`s surface into a grid in which each cell, excluding overlap with its neighbors, is 6 degrees east to west, and 8 degrees north to south (with the exception of the row from 72-84 degrees north latitude). For any position in the UTM grid, X-Y coordinates can be determined in eastings and northings. Eastings are in meters with respect to a central meridian drawn through the center of each grid zone (and given an arbitrary easting of 500,000 meters). In the northern hemisphere, northings are read in meters from the equator (0 meters). In the southern hemisphere, the equator is given the false northing of 10 million meters.

Glossary of Terms - V

validation

The process of testing an application or system to ensure that it conforms to a specification.

vector

A representation of the spatial extent of geographic features using geometric elements (such as point, curve, and surface) in a coordinate space.

vector displays and databases

Databases that build all geographic features from point, that is, from discrete X-Y locations. Lines are constructed from strings of points, and polygons (regions) are built from lines which close.

vector methods

In geoprocessing, methods of representing geographic features from points, lines, and polygons, as opposed to raster techniques which record geographic features within a matrix of grid cells. The choice between vector and raster GIS has much to do with the application being considered since both methods have strengths and

weaknesses. Many current GIS permit transformation between vector and raster input and output.

view

SQL `Select`, Statement, used to provide temporary information about a given table(s) of a Database Management System without actually creating a subset or new table.

viewpoint

Form of abstraction achieved using a selected set of architectural concepts and structuring rules, in order to focus on particular concerns within a system. ISO-10746-2 In an RM-ODP based description of a multi-tier, multi-network architecture, the Enterprise, Information, and Computation viewpoints describe a system in terms of its purposes, its content, and its functions.

virtual reality (VR)

Refers generally to interactive multimedia environments that present users with a sensory experience similar in some ways to our experience of the real world.

VPF

Vector Product Format. A published vector format used by the US Department of Defense.

Glossary of Terms - W

W3C

World Wide Web Consortium. The organization that manages standards for the Worldwide Web.

Web Coverage Service (WCS)

Supports the networked interchange of geospatial data as "coverages" containing values or properties of geographic locations. Unlike the Web Map Service, which returns static maps (server-rendered as pictures), the Web Coverage Service provides access to intact (unrendered) geospatial information.

Web Feature Service (WFS)

OpenGIS Specification that supports INSERT, UPDATE, DELETE, QUERY and DISCOVERY of geographic features. WFS delivers GML representations of simple geospatial features in response to queries from HTTP clients. Clients access geographic feature data through WFS by submitting a request for just those features that are needed for an application.

Web mapping

Dynamic query, access, processing, combination and portrayal of different types of spatial information over the Web.

Web Mapping Service (WMS)

OpenGIS Specification that standardizes the way in which Web clients request maps. Clients request maps from a WMS instance in terms of named layers and provide parameters such as the size of the returned map as well as the spatial reference system to be used in drawing the map.

Web Mapping Testbeds (WMT) Phases 1 and 2
The groundbreaking Web Mapping Testbed Phase 1 (WMT 1), which ran from June, 1999 to October, 1999, yielded candidate interface specifications for Web mapping that were subsequently approved by OGC`s Technical Committee and Planning Committee. The Web Mapping Testbed Phase 2 (WMT 2), which ran from June, 2000 to March, 2001 expanded on this foundation with extensions to those specifications and a set of new draft specifications

Web Registry Service
The Web Registry Service is a software component that supports the run-time discovery and evaluation of resources such as services, datasets, and application schemes.

Web Service Flow Language (WSFL)
Available at: www.oasis-open.org/cover/wsfl.html

Web Services
"Web services are self-contained, self-describing, modular applications that can be published, located, and invoked across the Web. Web services perform functions that can be anything from simple requests to complicated business processes. Once a Web service is deployed, other applications (and other Web services) can discover and invoke the deployed service."

Web Services Definition Language (WSDL)
Available at: http://www.w3.org/TR/wsdl

Web Services Description Language (WSDL)
The language for describing and encoding services. The Web Services Description Language (WSDL) is a draft specification from W3C to describe networked services in terms of what they can do, where they reside on the network and how to invoke them.

Well-Known Binary Representation for Geometry (WKBGeometry)
Data format that provides a portable representation of a Geometry value as a contiguous stream of bytes. Obtained by serializing a geometric object as a sequence of numeric types drawn from the set {Unsigned Integer, Double} and then serializing each numeric type as a sequence of bytes using one of two well defined, standard, binary representations for numeric types (NDR, XDR).

Well-Known Text Representation of Spatial Reference Systems
Format that provides a standard textual representation for spatial reference system information. The definitions of the well-known text representations are modeled after the POSC/EPSG coordinate data.

WFS
See Web Feature Service.

WMS
See Web Map Service

WMS Context
XML document that unambiguously describes the state or "context" of a WMS client states that accounts for a specific grouping of one or more maps from one or

more map servers can be described in a portable, platform-independent format for storage in a repository of for transmission between WMS clients

Working Group (WG)

In OGC, a group of individuals composed of members of the Technical Committee and invited guests, working to solve some particular problem or problems in a particular arena of interoperable geoprocessing. A particular use of the Working Group structure is to generate Requests for Information or Requests for Proposal, and to evaluate responses.

WRS

See Web Registry Service.

WSDL

Web Services Description Language

WWW

Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm

"World Wide Web: a collection of protocols, based on IP, and infrastructure that enable efficient, user-friendly publishing, discovery and access to digital information."

Glossary of Terms - X

XIMA

XML for Imagery and Map Annotations, OGC Discussion Paper 01-018: 29.XML Linking Language (XLink), Version 1.0, DeRose, S., Maler, E., Orchard, D., available at: http://www.w3.org/TR/xlink/

XML

Source: PreANVIL Glossary http://www.anvil.eu.com/find/Glossary-english.htm

XML (eXtensible Markup Language) is the predominant form for interoperable, self-describing data/content, in combination with XML schema definition language. See http://www.w3.org/XML/. XML has its roots in SGML, the Standard Generalized Markup Language (an ISO standard). The development of XML came about because of perceived limitations in HTML when used as a tool for publishing complex documents on the Web. http://www.w3.org.

XML for Imagery and Map Annotations (XIMA)

The means to encode annotations on imagery, maps, and other geospatial data.

XML for Location Services (XLS)

The encoding method for OpenLS-based Abstract Data Types.

XSLT

"(eXtensible Stylesheet Language Transformation) A language used to convert an XML document into another XML document or into HTML, PDF or some other format."

INTERNATIONAL SCIENTIFIC JOURNAL
Micro Macro & Mezzo
Geo Information

ISSN: 1857-9000; EISSN: 1857-9019
UDC: 528:004
Impact Factor (2015): 0.722

http://mmm-gi.geo-see.org

– *International scientific journal with international professional editorial board;*
– *Registered in National and university library "St. Clement of Ohrid" – Skopje with ISSN numbers for printed and electronic versions;*
– *Indexed in many international databases for calculating of Impact Factor*
– *All papers are indexed separately with own UDC number.*
– *Reviewing: double blind peer review.*
– *Periodical journal, with two volumes within one year;*
– *Type of articles: scientific papers, professional papers, overviews, interviews, reviews, in memoriam, news for professional-scientific events and literature;*
– *Number of pages: maximum 15 pages per paper;*
– *Publication: hard copy version in 200copies, as well free & open accessible electronic version in journal web site;*
– *Language of articles: English.*
– *Publication Ethics & Malpractice Statement (PEMs) rules (http://publicationethics.org/files/u2/New_Code.pdf*

TOPICS: Surveying, Geophysics, Cartography, Geography, Geostatistics, Toponomastic, Geology, Geomorphology, Geodynamics, Geopolitics, Hydrology, Demography, GIS, SDI, Cadaster, Topography, Geoinformatics, Remote sensing, Photogrammetry, Mining, Forestry, Soils, Climatology, Environment, Spatial and urban planning, Ecology, Geo-spatial data, other geo sciences.

FEES:
Paper up to 5 pages: 50euro
Paper up to 10 pages: 100euro
Paper up to 15 pages: 150euro

SPONSORSHIP
Last cover page: 300euro
Full page: 150euro
Half page: 100euro
Logo and web adress: 50euro

Free & Open Access Journal!

Publisher: Geo-SEE Institute

DETAILS FOR INTERNATIONAL PAYMENTS

Bank name	Komercijalna Banka AD Skopje Branch office: Chair, Skopje
Bank address	Str.Ferid Bajram, 48 1000 Skopje Macedonia (FYRoM)
SWIFT	KOBSMK2X
Beneficiary – account holder	Geo-SEE Institute (South East European Research Institute on Geo Sciences)
Beneficiary address	Str Djon Kenedi, 25/1-d3 1000 Skopje Macedonia
IBAN	MK07300701003027046
Remittance information	For paper publishing in journal MMM-GI.
Details of charges	OUR (Full amount for international bank transfer should be covered by the author/s of paper/s)

DETAILS FOR NATIONAL PAYMENTS

Образец	ПП10 за физички лица; ПП30 за правни лица.
Назив и седиште на примач	Гео-СЕЕ Институте, Ул.Џон Кенеди, 25/1-д3, 1010 Скопје-Чаир
Трансакциска сметка на примач	300-0000036339-47
Банка на примач	Комерцијална Банка АД Скопје
Шифра	930
Цел на дознака	Научен труд за објавување во списание

SUBMISSION FORMAT OF PAPERS

http://mmm-gi.geo-see.org/guidelines

Format: As defined by the template (Template_Paper.docx). One line space between the text and heading title, two line spacing between text and heading title, and one line space between text and subheading/sub-subheading title.

Size: up to 15 pages, and up to 15MB.

Language: English

Title: Font 12pt, Times New Roman, with capital letters, bold, in center, and single spacing. The title needs to be written in second line (one space line 12pt).

Name of the author/s: Font 11pt, Times New Roman, name with first capital letter, surname with all capital letters, bold, in center, after surname add footnote with number, single spacing, all authors in one line. Between title and name of the author, leave one line spacing with 11pt.

Affiliations: To be written in the footnote, single spacing, font 8pt Times New Roman, in the order: degrees, Name, SURNAME (all in bold), e-mail address, new line and four space characters, institution, web address, new line and six space characters, telephone, gsm and fax numbers, new line and four space characters, address. No line spacing between footnotes.

Abstract title: With upper case letters, bold, font 11pt, Times New Roman, left text, without space in the beginning of the line, single spacing. Between title of abstract and name of the authors, two line spacing with 10pt.

Text of abstract: Font 10pt, Times New Roman, justified, single spacing, without space in the beginning of the line. The text of abstract should contain maximum 300 words (counted by "word count-no spaces"). Between the title and text of abstract, leave one line space with 9pt.

Key words: Font 11pt, Times New Roman, justified, single spacing, without space in the beginning of the line. Between the key words and text of abstract, one line spacing with 9pt.

Headings: With upper case letters, bold, font 11pt, Times New Roman, left text, without space in the beginning of the line, single spacing and numbered.

Subheadings: Bold, font 11pt, Times New Roman, left text, without space in the beginning of the line, single spacing and numbered according to number of heading.

Sub-subheadings: With bold and italic characters, font 11pt, Times New Roman, left text, without space in the beginning of the line, single spacing and numbered according to number of subheading.

Text of paper: Font 11pt, Times New Roman, justified, single spacing, without space in the beginning of the line. The text should include the Introduction as a first and Conclusions as a last chapter.

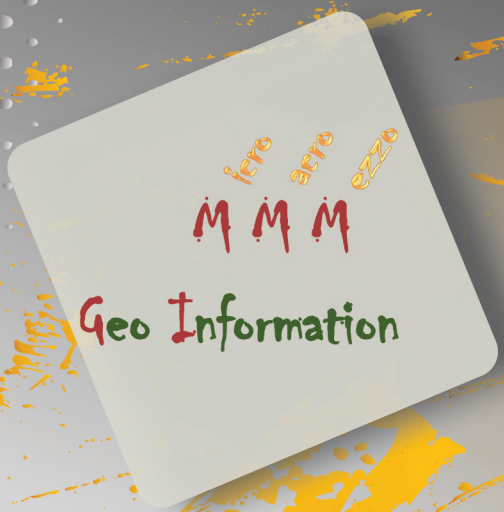
Tables: Head of the table, above the table, with font 10pt, Times New Roman, italic. Tables should be numbered consecutively throughout the paper. Table to be in center, with font 10pt, Times New Roman, single spacing. Between title of table and table, one line spacing with 10pt. All tables must be cited in text.

Figures/maps: Figures-maps should be numbered consecutively throughout the paper. After figure/map, its title must be written, with font 10pt, Times New Roman, italic. Between title of figure/map and figure/map, leave one line space with 10pt. All figures/maps must be cited in text.

Symbols and special characters: Use the SI (Systeme Internationale) units and symbols.

References: The Harvard referencing system is to be used. Footnotes should not be used.

Publication Ethics & Malpractice Statement *(PEMs) rules*
http://publicationethics.org/files/u2/New_Code.pdf



http://mmm-gi.geo-see.org