ISSN: 1857-9000, EISSN: 1857-9019

DEVELOPING OF THE ALBANIAN GLOBAL MAP DATASET; CASE STUDY: VECTOR LAYERS

Milot LUBISHTANI[1] and **Bashkim IDRIZI**[2]

UDC: 528.9:004.9(496.5)

SUMMARY

International Steering Committee for Global Mapping (ISCGM) is an organization located at Authority for geospatial information of Japan in Tsukuba, established in year 1996, composed by representatives of geospatial information authorities of respective countries and by the experts in this field, in order to promote the Global Mapping Project, as well to develop global geospatial information needed to solve global-scale issues, to provide them widely, and to promote the use of global information in cooperation with the respective countries (iscgm.org, September 2016).

Being the whole world is divided into different continents and countries that follows various institutions, which develops the geospatial data with the same or different standards; it is thought that the global geospatial data to have same standards, so they can be used to be exchanged in order to reach the analysis of a problem; more easily and at a low cost.

The main purpose of this project is global data collection of geospatial data from all states and interested organizations to develop and to have easy access to digital geographic information at global level of scale 1:1.000.000 for vector, as well 30" spatial resolution for raster data. This is useful to equip the implementation of international/global agreements and conventions for environment protection, for supervision of major phenomena of the environment and encourage economic growth. Global Map also contributes in development of spatial data in global level (GSDI-Global Spatial Data Infrastructure).

The Republic of Albania, within the project for the compilation of the global map dataset is represented by the State Authority for Geospatial Information (ASIG), as the responsible institution for Albanian cartography at the national level. Preparation of Albanian GM dataset has been proceed in academic level within the geodesy department of the Polytechnic University of Tirana, with aim to support, help and improve the Albanian cartography. Existing topographic maps in scale 1:25.000,

[1] **MSc. Milot LUBISHTANI,** milot.lubishtani1@hotmail.com
PhD candidate at Polytechnic University of Tirana; Faculty of Civil Engineering; Geodesy department.
GSM +377 44 720210: Slatine e Poshtme; Viti; Republic of Kosova.

[2] **Assoc.Prof.Dr. Bashkim IDRIZI,** bashkim.idrizi@yahoo.com
"Mother Teresa" University – Skopje; Geodesy and Geoinformatics department; www.unt.edu.mk
GSM.: +38975712-998, Dzon Kenedi, Str.25/4-20; 1010 Skopje-Chair; Macedonia.

ortho photo images from year 2007, satellite data, as well as the official data from governmental institutions has been utilized as source data.
In this paper, in details is shown the whole process of data compilation, quality and outputs of Albanian Global Map vector dataset.

Key words: Global mapping, Albania, ISCGM, Global Map, vector data, transportations, population centers, boundaries, drainage.

1. INTRODUCTION

Global Map is a set of digital maps that accurately cover the whole globe to express the status of global environment. It is developed through the cooperation of National Geospatial Information Authorities (NGIAs) in the world. An initiative to develop Global Map under international cooperation, the Global Mapping Project, was advocated in 1992 by the Ministry of Construction, Japan.
Non-contemporary standards of International World Map in a scale of 1:1,000,000 dating from 1891, the development of digital technology, the need for recognition of global geospatial data, and using updated datasets, in 1992 in Rio de Janeiro in Brazil was proposal for establishing of Global Map (GM) in scale 1:1,000,000. (Maruyama H., 2005)
GM database contains four vector layers (population centers, transportations, drainage and boundaries) at scale 1:1.000.000 and four raster layers (land cover, land use, vegetation and elevation) with spatial resolution of 30" (arc seconds of longitude and latitude).
State Authority for Geospatial Information (ASIG) and geodesy department of the Polytechnic University of Tirana, through the PhD thesis of Milot Lubishtani supervised by prof.dr. Bashkim Idrizi, has developed the vector and raster datasets for Albanian GM version 2, which have been released on 14th of July 2016 in www.iscgm.org.

2. GLOBAL MAPPING

Global Map is an international project, which states, namely the state agencies dealing with geospatial-qualified data to apply for membership on a voluntary basis, by applying established standards for membership.
Global mapping project is an International collaborative initiative, through the voluntary participation of national mapping organizations of the world, aiming to globally develop a homogeneous geographic data set at the ground resolution of 1km for raster data and vector data in scale 1:1.000.000, and to establish concrete partnership among governments, private sectors, data

providers and users to share information and knowledge for a sound decision-making.

The primary objective of Global Mapping project is to contribute to the sustainable development through the provision of base framework geographic dataset, which is necessary to understand the current situation and changes of environment of the world.

The purpose of the Global Map is; to accurately describe the present status of the global environment in international cooperation of respective National Mapping Organizations (NMOs) of the world, aimed for:

- Monitoring and early warning systems for natural disasters;
- Developing ecosystem, drainage basins framework for environmental assessment;
- Monitoring and management of natural resources;
- Quantifying the Trans boundary issues;
- Assessment of the trends of environment changes;
- Rapid response capability/early warning;
- Local, national and multinational physical development planning;
- Environmental priority setting, analytical studies over large areas and
- Informed for decision-making of policy makers with a strategic database (Idrizi B., et all, 2010).

Increasing demands and the needs to be qualified data geospatial and their use for achieving a result set and necessary and cost as little as possible, many European countries and the Balkans have handed over the data as geospatial on the global map with a scale of 1 1.000.000 and as such as Macedonia in 2006, Romania in 2009, Bulgaria in 2009, Kosovo in 2011 and Albania in 2016.

Despite the maps prepared in local/national standards, GM dataset enable (Idrizi, 2006):

- All data of the Earth to be in one place;
- With the same data structure;
- In the same format;
- In the same coordinate system;
- In the same scale; and
- With similar accuracy.

The main objective of this global project is to bring all nations and concerned organizations together to collaboratively develop and provide easy and open access to worldwide geographic information at a global scale. The use of these dataset:

– will facilitate the implementation of global agreements and conventions for environmental protections;

- will support the monitoring of major environmental phenomena; and
- will encourage economic growth within the context of sustainable development.

Joining the world community of surveying and mapping organizations will facilitate the acquisition of the latest information and knowledge of digital geographic data development and service; it would also facilitate to raise the status of the organization by active participation in international activities and the contribution to sustainable development which is the final goal of Global Mapping Project (figure 1).

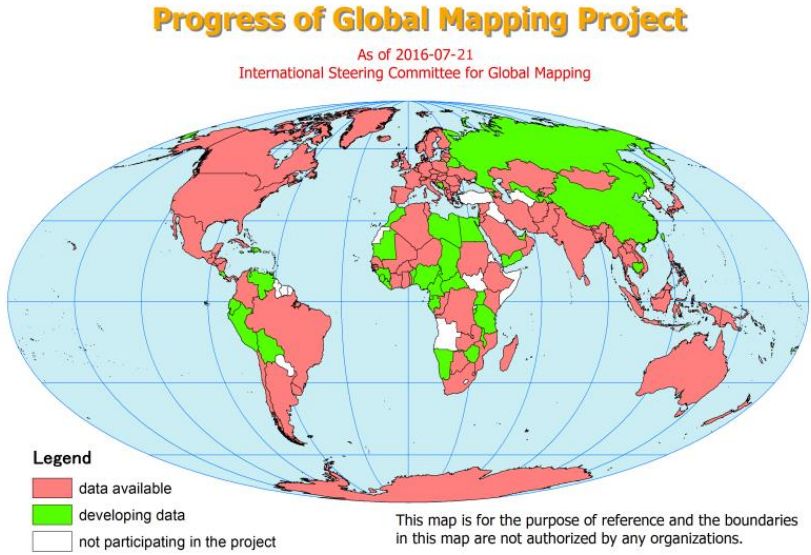


Figure 1. Progress of Global Mapping project (21.07.2016, www.iscgm.org)

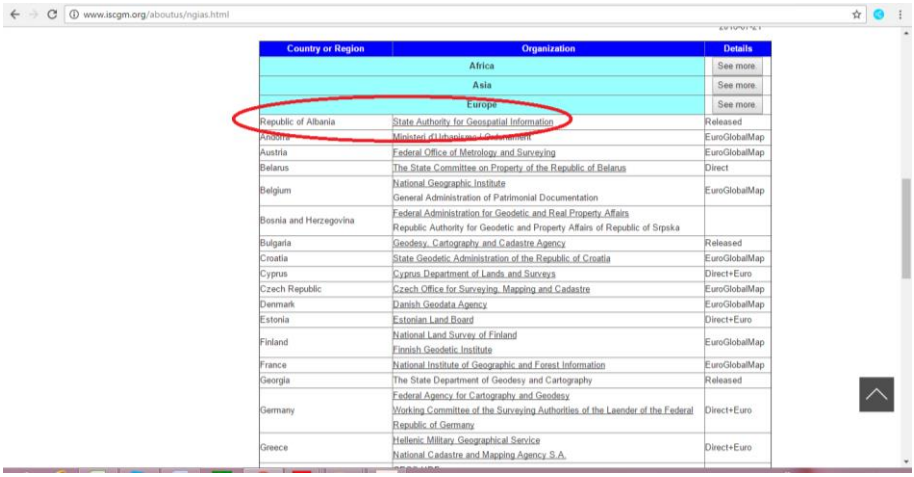
Global Map is fundamental digital geospatial information being developed to cover the whole land of the globe. It is an effort central to the Global Mapping Project. Global Map data have been developed under the cooperation of National Geospatial Information Authorities (NGIAs) of respective countries and regions (Kishimoto N.,2010).
The ISCGM takes the central role in conducting the Global Mapping Project to develop and provide Global Map data set with the following characteristics (Idrizi B., et All, 2011):

- Geospatial information developed and authorized by NGIAs of respective countries and regions around the world;
- Fundamental geospatial information covering the whole land of the globe;
- Data are updated in every five years as a target cycle;

- Freely available for download, and in case of non-commercial purposes, in principle, anyone can use the data freely; and
- Digital geospatial information composed of eight layers being developed with consistent specifications.

3. GLOBAL MAP DATA OF ALBANIA

The Global Mapping project is for noncommercial purposes, while the participation in it is voluntary. Eligible for participation are only the national mapping organizations, which are the governmental responsible institutions for mapping and spatial data developing on national level.
Involvement by an organization in the project in generally is categorized in three levels, i.e. as Level A, B and C.
Level A means that institution will prepare the data set of own country and other countries, the *Level B* mean that institution will prepare the data set of own country, and the *Level C* mean that institution will give all necessary data, preparation will be done by ISCGM.
The Republic of Albania participates in global mapping project since 30.06.2016 in *Level B*, through State Authority for Geospatial Information (ASIG) as national mapping and spatial data infrastructure organization (figure 2). Republic of Albania is last country that has participated in GM project, before the dissolution of ISCGM and the termination of the Global Mapping Project on August 2016!



Country or Region	Organization	Details
Africa		See more
Asia		See more
Europe		See more
Republic of Albania	State Authority for Geospatial Information	Released
Andorra	Ministeri d'Urbanisme i Ordenament	EuroGlobalMap
Austria	Federal Office of Metrology and Surveying	EuroGlobalMap
Belarus	The State Committee on Property of the Republic of Belarus	Direct
Belgium	National Geographic Institute General Administration of Patrimonial Documentation	EuroGlobalMap
Bosnia and Herzegovina	Federal Administration for Geodetic and Real Property Affairs Republic Authority for Geodetic and Property Affairs of Republic of Srpska	
Bulgaria	Geodesy, Cartography and Cadastre Agency	Released
Croatia	State Geodetic Administration of the Republic of Croatia	EuroGlobalMap
Cyprus	Cyprus Department of Lands and Surveys	Direct+Euro
Czech Republic	Czech Office for Surveying, Mapping and Cadastre	EuroGlobalMap
Denmark	Danish Geodata Agency	EuroGlobalMap
Estonia	Estonian Land Board	Direct+Euro
Finland	National Land Survey of Finland Finnish Geodetic Institute	EuroGlobalMap
France	National Institute of Geographic and Forest Information	EuroGlobalMap
Georgia	The State Department of Geodesy and Cartography	Released
Germany	Federal Agency for Cartography and Geodesy Working Committee of the Surveying Authorities of the Laender of the Federal Republic of Germany	Direct+Euro
Greece	Hellenic Military Geographical Service National Cadastre and Mapping Agency S.A.	Direct+Euro

Figure 2. List of participants in GM project (www.iscgm.org, 30.06.2016)

Developing of Albanian GM dataset has been conducted in a closed cooperation between the State Authority for Geospatial Information (ASIG) and geodesy department of the Polytechnic University of Tirana, through the PhD thesis of Milot Lubishtani in a field of establishing Albanian GSDI with case study on developing of Albanian Global Map dataset. Working team of ASIG has been leaded by Milot Lubishtani from the university site (as PhD candidate) and supervised by Prof.Dr. Bashkim Idrizi (from the university site also), together with mapping and GIS experts of ASIG, and direct technical support from the team of experts from ISCGM-Japan.
Albanian Global Map V2, consists both, the vector and raster layers, totally 8 layers, which have been released on 14th of July 2016 in www.iscgm.org, as free downloadable for non-commercial use.

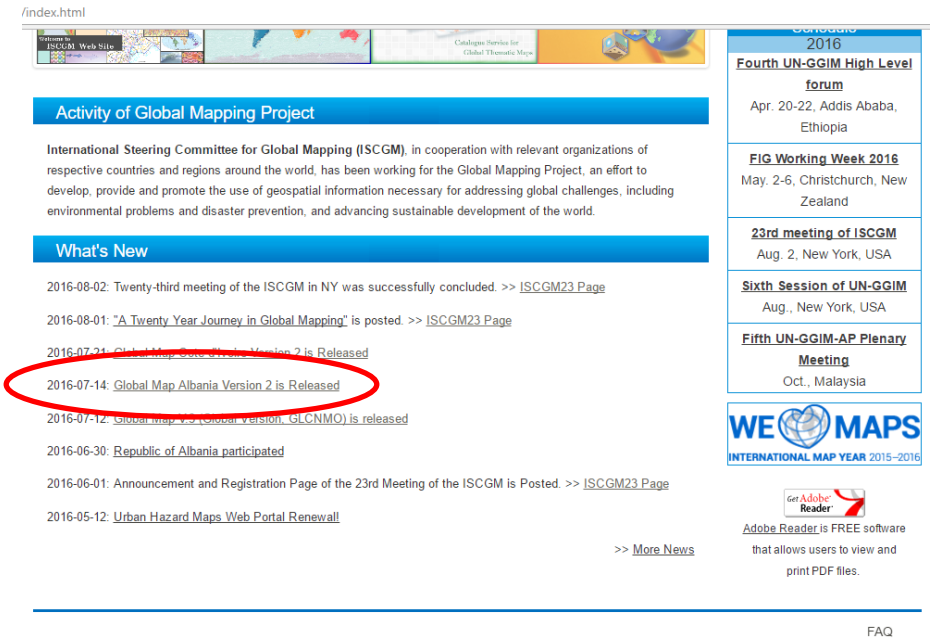


Figure 3. Extract of ISCGM web site (www.iscgm.org, 30.06.2016)

3.1. Data source for Global Map of Albania

Official data from responsible governmental institutions for supplying the current and updated data sets that have been used:

- State Authority for Geospatial Information (ASIG);
- Institute of transportation;
- Albanian Institute of Statistics (INSTAT);

- Military Geographical Institute of Albania;
- Ministry of the Urban Development.

In order to harmonize the input data with the GM V2.2 specification, all received data have been transformed, converted, harmonized and generalized, as well reprocessed in a cases of satellite images. In a next table and figure, the list of developed layers and the directory structure of Albanian GM dataset according to GM V2.2 specification for national/regional version are given.

Vector Layers	Raster Layers
Boundaries	Land Cover
Drainage	Land Use
Trasportation	Elevation
Population Centers	Vegetation

Table 1. Global Map V1/V2 data set layers - national/regional version

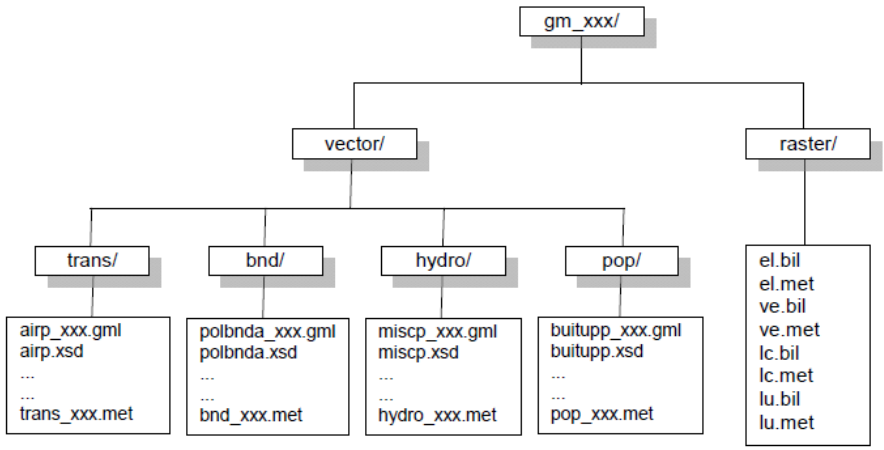


Figure 4. Directory Structure (Global Map Specifications Version 2.2)

3.2. Global Map vector data of Albania

The features of the vector data are represented by the three basic spatial objects: points, edges (lines) and faces (polygons), allocated a category number for linking the geometrical with attribute data. Next table (2) shows the list of developed vector layers, feature names, geometrical types, inclusion (optional or mandatory) and abbreviation of layers names.

Layer	Feature Name	Feature Type	Inclusion	Abbreviation
Transportation	Airport	point	optional	airp
	Railroad Station	point	optional	rstatp
	Port	point	optional	portp
	Railroad	edge	mandatory	raill
	Road	edge	mandatory	roadl
	Trails and Tracks Line	edge	mandatory	traill
	Ferry route	edge	optional	ferryl
Boundaries	Political Boundary	point	mandatory	polbndp
	Coast Line	edge	mandatory	coastl
	Political Boundary Line	edge	mandatory	polbndl
	Political Boundary Area	face	mandatory	polbnda
Drainage (Hydrography)	Miscellaneous (Dam/Weir/Island/Spring /Water-Hole)	point	optional	miscp
	Miscellaneous (Dam/Weir)	edge	optional	miscl
	Aqueduct/Canal/Flume/ Penstock	edge	optional	aquel
	Water Course	edge	mandatory	riverl
	Inland Water	face	mandatory	inwatera
Population Centres	Built-up area	point	optional	builtupp
	Built-up area	face	optional	builtupa

Table 2. Feature class, name, type and inclusion of vector layers

3.2.1. Transportation layer of Albanian Global Map

There are seven national developed Global Map layers of Albanian dataset:
- *Airports*, which include digital cartographic data with attributes for the airports of the Albania, represented as points;
- *Ports*, which include digital cartographic data with attributes for the airports of the Albania, represented as points;
- *Ferry Routes*, which includes digital cartographic data with attributes for the ferries of the Albania, represented as lines;
- *Railroad*, which stations include digital cartographic data with attributes for the railroad stations of the Albania, represented as points;
- *Railroads*, which include digital cartographic data with attributes for the railroads of the Albania, represented as lines;
- *Trails and tracks line*, which includes digital cartographic data with attributes for the railroads of the Albania, represented as lines;
- *Roads*, which include digital cartographic data with attributes for the roads of the Albania, represented as lines.

Based on results, derived from the analyses and processing of transportation network in Albania; all highways, railroads, roads of first and second order, some local roads and Tirana airport, have been included within the transportations layer of Albania's GM. In total have been included 302km Highway, 421km Primary route, 3362km Secondary route, 11583km others and 483km Rail road's, as shown in figure 5.

3.2.2. Population centers layer of Albanian Global Map

There are two national developed Global Map layers of Albanian dataset:
- *Build up areas*, which include digital cartographic data with attributes for the main cities of Albania, represented as polygons;
- *Build up areas*, which include digital cartographic data with attributes for the smaller cities and main settlements of Albania, represented as pints.

Based on results, derived from analyses and processing population centers data in Albania within the layer of population centers of Albanian GM, in total have been included 208 population centers, i.e.61 cities and 147 settlements, shown in figure 6.

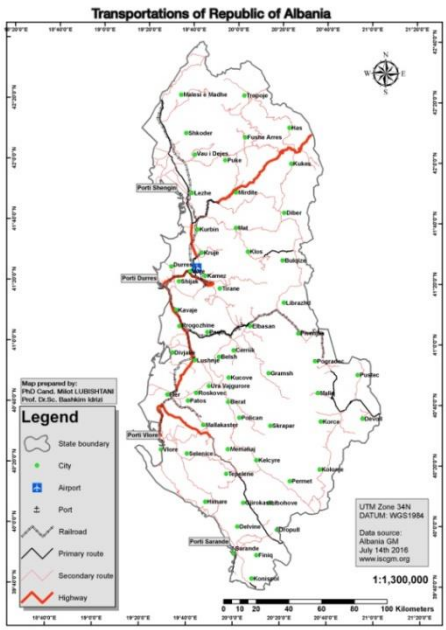


Figure 5. Transportation layer

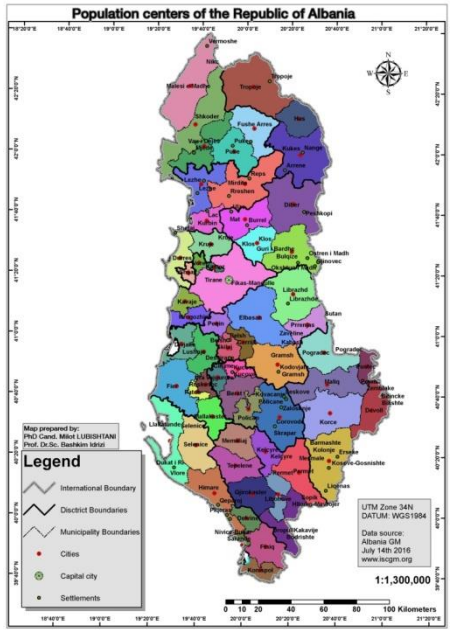


Figure 6. Population centers layer

3.2.3. Drainage (hydrographic) layer of Albanian Global Map

There are four national developed Global Map layers of Albanian dataset:
- *Miscellaneous,* which includes the digital cartographic data with attributes for the dams, weirs, islands, springs, and water-holes of the Albania, represented as points;
- *Aquels,* which include digital cartographic data with attributes for the aqueducts, canals, flumes, and penstocks of the Albania, represented as lines;
- *Rivers,* which includes digital cartographic data with attributes for the watercourse of the Albania, represented as lines;
- *Inland water,* which stations include digital cartographic data with attributes for the lakes of the Albania, represented as polygon.

Within the drainage (hydrographic) layer of Albania's GM data, based on results derived from analyses of hydrography of Albania, 41 rivers, 477 lakes and 896 reservoir have been include, which can be shown in figure 7.

3.2.4. Boundaries layer of Albanian Global Map

There are three national developed Global Map layers of Albanian dataset:
- *Coast line,* which includes digital cartographic data with attributes for the coast line of the Albanian seas, represented as lines;
- *Political boundary line,* which includes the digital cartographic data with attributes for the national and administrative boundaries (in two levels, as district and municipality) of the Albania, represented as lines;
- *Political boundary area,* which include digital cartographic data with attributes for the areas (polygons) of districts and municipalities (based on current legislation) of the Albania, represented as polygons;

Finally, based on results emerging from analyses of boundaries of Albania in national and local level, within the boundary layer have been added national boundary line, district boundaries and all municipality boundaries, shown in figure 8.
These map layers are part of our collection of fundamental digital cartographic data in vector format at scale 1:1,000,000. In terms of vector geometry, the lines, points, and polygons in these map layers are identical to National Map boundaries map layers. The difference is in the attributes assigned to boundaries features. The Global Map edition includes just the data fields and attribute values in the Global Map Specifications Version 2.2. Whole dataset is downloadable through www.iscgm.org/gmd (figure 9).

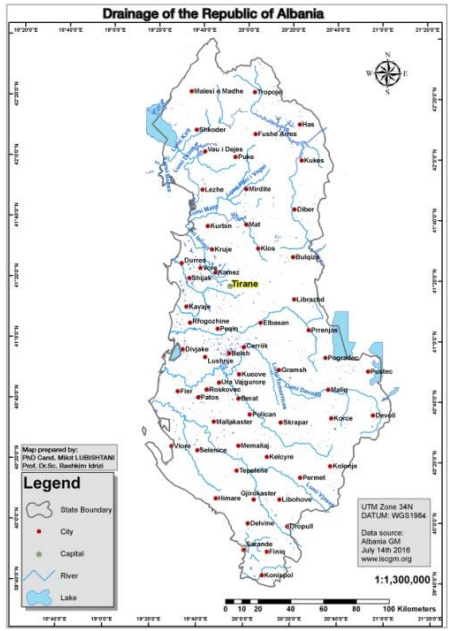


Figure 7. Drainage layer

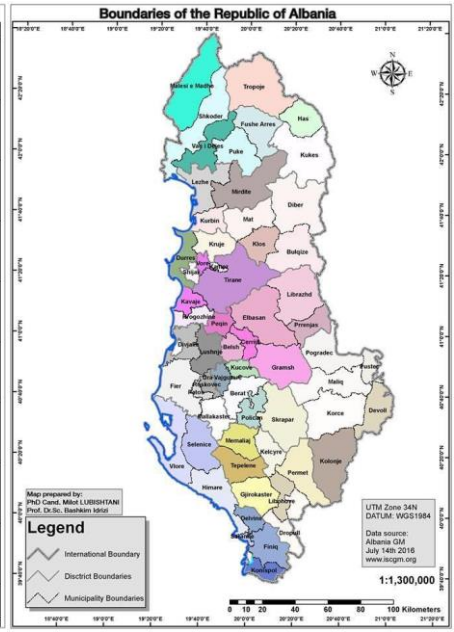


Figure 8. Boundaries layer

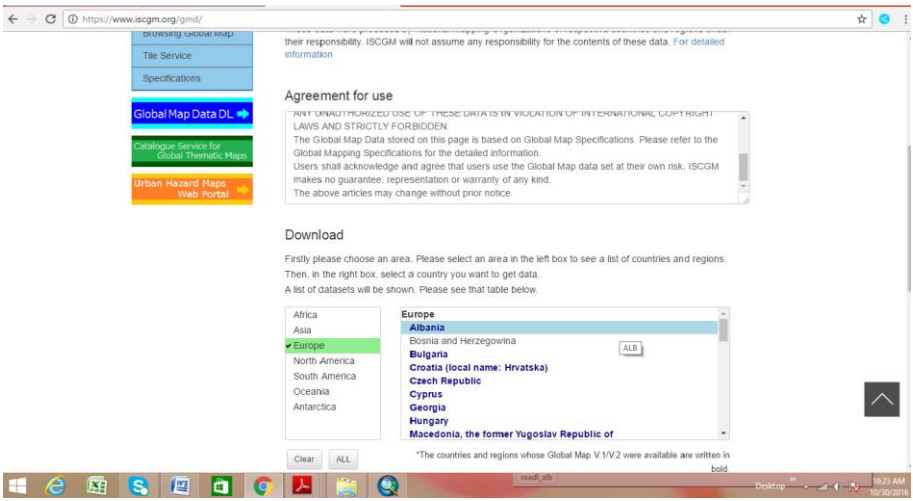


Figure 9. Web page for free download (https://www.iscgm.org/gmd)

3.3. Metadata of Global Map vector data of Albania

Metadata is "data that provides information about other data". Three distinct types of metadata exist:

- Structural metadata;
- Descriptive metadata and
- Administrative metadata.

Metadata is data about the quality, condition, contents and other characteristics of the data, which also describes the lineage, process and accuracy of the data set.

Global Map Metadata Profile is based on ISO 19115 core metadata elements and other profiles to provide information about Global Map data.

Metadata package is a subset of metadata that define the related metadata entities and elements. In next table, extract from Albanian Global Map metadata is given:

	Boundary	**Drainage**	**Population Center**	**Transportation**
Country	Albania	Albania	Albania	Albania
Version	2.2	2.2	2.2	2.2
Metadata	Boundary	Drainage	Population Center	Transportation
Organisation Name	ASIG (State Authority for Geospatial Information)	ASIG (State Authority for Geospatial Information)	ASIG (State Authority for Geospatial Information)	ASIG (State Authority for Geospatial Information)
Voice	+355672138519	+355672138519	+355672138519	+355672138519
Delivery Point	Str."Papa Gjon Pali Ⅱ",Godina e Inovacionit, kati Ⅲ-te	Str."Papa Gjon Pali Ⅱ",Godina e Inovacionit, kati Ⅲ-te	Str."Papa Gjon Pali Ⅱ",Godina e Inovacionit, kati Ⅲ-te	Str."Papa Gjon Pali Ⅱ",Godina e Inovacionit, kati Ⅲ-te
City	Tirana	Tirana	Tirana	Tirana
Administrative Area	Tirana	Tirana	Tirana	Tirana
Country	Albania	Albania	Albania	Albania
Electronic Mail Address	dcm@bnetd.ci	dcm@bnetd.ci	dcm@bnetd.ci	dcm@bnetd.ci
Online	www.bnetd.ci	www.bnetd.ci	www.bnetd.ci	www.bnetd.ci

Resource				
Date Type	001	001	001	001
Abstract	Global Map Albania - Boundary is one of the layers of Global Map Albania. It consists of Political Boundary Line, Political Boundary Area features and Coast line.	Global Map Albania - Drainage is one of the layers of Global Map Albania. It consists of Water Course, Inland Water features, Miscellaneous and Aquaduct.	Global Map Albania - Population Center is one of the layers of Global Map Albania. It consists of Built-up Point and Built-up Area feature.	Global Map Albania - Transportation is one of the layers of Global Map Albania. It consists of Airport, Port, Railroad, Railstation and Road features.
Purpose	The Global Map is a basic framework database designed to support Geographic Information Systems applications, especially for examination of global environmental issues.	The Global Map is a basic framework database designed to support Geographic Information Systems applications, especially for examination of global environmental issues.	The Global Map is a basic framework database designed to support Geographic Information Systems applications, especially for examination of global environmental issues.	The Global Map is a basic framework database designed to support Geographic Information Systems applications, especially for examination of global environmental issues.
Credit	©ASIG	©ASIG	©ASIG	©ASIG
Use Limitation	Refer to data policy	Refer to data policy	Refer to data policy	Refer to data policy
Statement	The Global Map Albania version 2 Boundary layer was developed based on Global Map Specifications	The Global Map Albania version 2 Drainage layer was developed based on Global Map Specifications	The Global Map Albania version 2 Population Center layer was developed based on Global Map	The Global Map Albania version 2 Transportation layer was developed based on Global Map Specifications

	version 2.2. The data source was a Digital Map 1:25000 and Orthophoto, topographic map made in 1985 and orthophoto made in 2008.	version 2.2. The data source was a 1Digital Map 1:25000 and Orthophoto, topographic map made in 1985 and orthophoto made in 2008.	Specifications version 2.2. The data source was Digital Map 1:25000 and Orthophoto, topographic map made in 1985 and orthophoto made in 2008.	version 2.2. The data source was a Digital Map 1:25000 and Orthophoto, topographic map made in 1985 and orthophoto made in 2008.

Table 3. Extract from Albanian GM METADATA V2.2.

4. CONCLUSIONS

By its' efforts, ISCGM has managed to implicate Global Map as part of the "Implementation Plan" of the World Summit on Sustainable Development (World Summit on Sustainable Development - WSSD) held in Johannesburg (August-September, 2002). At that meeting it was decided that the project's compilation of Global Map completed by the end of 2007, as well as GM's data be updated each five years.

All European countries have joined the GM except countries like Montenegro, Belarus and Bosnia and Herzegovina. Albania is the last country participated to the project, as well last European country has been released its GM dataset. Releasing the Albanian GM dataset, will fill a big gap of Balkan Peninsula, due to non-participating of two countries!

Climate change is a process by which facing the world in these days, and automatically create a need that we geospatial data global of which can manage a various emergencies such as natural disasters, floods, earthquakes, mudslides, volcanoes etc. As more states to be part of GM, as more geospatial data we have, the easier it will be the management of emergencies. By including Albanian GM dataset in Global Map, direct contribution on regional environmental analyses will be enabled.

With the Global Map dataset being in digital form, it lends itself to various data manipulation and for modeling real life situations. Global Map dataset may have limited uses at national and local scales, however Global Map dataset is needed to address global, regional, and trans-boundary and in many cases national concerns. Therefore, the Albanian GM dataset as latest updated data set will support all type of spatial analyses.

Albanian Global Map data set can be downloaded from the web site www.iscgm.org, intended for non-commercial use (research, academia, students etc.). In a case of need for usage for commercial purposes, interested institution must obtain permission from the ASIG, otherwise, each unauthorized use for commercial purposes is in conflict with the law on copyright and related rights which is prohibited and punishable.
From September 2016, based on the letter of approval from ASIG, the Albanian GM data set has been migrated to the United Nations Geospatial Information Section (UNGIS), due to decision for transfer of GM data to UNGIS database, which has been formalized on August 2016, at New York, during the final (23rd) meeting of ISCGM.

5. REFERENCES

1. Maruyama H., Sasaki H., and Okatani T. (2005): Global Mapping – Global Geo-information for Sustainable Development. GSI. Tsukuba, Japan.
2. Kishimoto N. (2005): Global Map specifications; handout; Geographical Survey Institute; Tsukuba – Japan.
3. Idrizi B. (2006): Developing of globaly homogeneous geographic dataset through the global mapping project. Kartografija i geoinformacije; Zagreb; Croatia.
4. Idrizi B., Nikolli P., Hyseni D. (2010): Kosova in Global Map; 3rd ICCGIS conference - Proceedings; Bulgaria.
5. Idrizi B. , Meha M., Nikolli P. Kabashi I. (2011): Data quality of Global Map and some possibilities/limitations for its wide utilization for global issues; FIG COM 3. www.fig.net
6. ISCGM (2012): Global map specification 2.2. www.iscgm.org
7. http://www.iscgm.org (September 2016)