OVERVIEW ON GLOBAL MAP AS CONTRIBUTOR OF GSDI

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ABSTRAKT

Global mapping is an international collaborative initiative through voluntary participation of national mapping organizations of the world, aiming to develop globally homogeneous geographic data set at the ground resolution of 1km, and to establish concrete partnership among governments, NGOs, private sectors, data providers and users to share information and knowledge for 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.

Nowadays in the web site of ISCGM are available four GM datasets, named as GM V0, GM VX, GM V1/V2 (national and regional version) and GM V1 (global version), by following the ISO/TC 211 standards for geographic information. The GM specification consist the standards of GM V1/V2 and GM V1, both of them as most popular and most utilized GM data. GM V1 (global version) is available within the Google Earth also.

The research for utilization of GM data resulted with some limitations in wide utilization for spatial analyses in international level. Problems detected as data overlapping, gaps, spatial discontinuity of data, non-homogeneous accuracy of whole data, utilization of UNK as value for unknown data ext., make GM dataset with limited utilization for wide spatial analyses. The lack of cartographic key (cartographic symbols), lack of cartographic/graphic representation, and absence of defined map projection prove that global map oneself does not contain the basic elements characterize a map, but it is just GIS database.

Results from the research are in accordance with paragraph 6 of the GM specification 2, where suggestions from GM users are required, hoping that they will be taken into account in the next revision of GM specification.

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1. INTRODUCTION

Global Mapping is a process/project for the development of spatial database for the surface of the Earth that corresponds to the scale 1:1.000.000 for vector data and 30" spatial resolution for raster data, consistent with the specifications adopted by the International Steering Committee for Global Mapping (ISCGM). GM has accomplished through cooperation between national agencies for Cartography (National Mapping Organizations - NMO) as country participants in the project. The main purpose of this global project is to gather intelligence from all countries interested organizations to develop and easy access to spatial data in digital form at the global level.

Collaboration between participants in different levels is essential to sound decision - making for sustainable economic development of society and environment. This will be used for implementation of global/international conventions and agreements for environment protection, to oversee major phenomena of the environment and encourage economic growth within a sustainable context. GM also contributes to the development of global spatial data infrastructure (GSDI - Global Spatial Data Infrastructure) and to global observation systems on Earth (GEOSS - Global Earth observation system of systems).

The GM data primarily is aimed for:

- Monitoring and early warning systems for natural disasters;
- Monitoring and management of natural resources;
- Assessment of the trends of environment changes;
- Local, national and multinational physical development planning; and
- Informed decision-making of policy makers with a strategic database.

GM with steady of data quality and standards can be used as tool for monitoring of the environmental status in regional and global level. Utilization of GM data enables analysis of the data pertaining to everyday life in different situations. GM data might have limited use in national and local level. They are necessary to monitor global, regional and international issues, as well as national issues if the country has a large area. Some potential applications of GM data are given bellow:

- Global Environmental Assessments (Ozone, Intergovernmental panel on climate change IPCC, Global Climate Models etc.)
- Global/Regional/National perspective and contextual information
- Developing ecosystem, drainage basins framework for environmental assessment
- Quantifying trans boundary issues
- Rapid response capability/early warning
- Environmental priority setting, analytical studies over large areas.

For these reasons, international organizations and institutions around the globe provide and share Global Map information about the state of the globe and its changes. The "Earth Summit" - the United Nations Conference on Environment and Development (UNCED) - in Rio in June 1992 addressed the issue of information access. The report of this session includes mention of the need for global mapping, stressing the importance of public access to information and international cooperation in making it available. It is therefore essential that we have access to the most accurate and up-to-date maps of important environmental features, if we are to properly understand our global

environment. At present, available maps of the entire globe originate from various sources and therefore their accuracy is inconsistent, mainly because of irregularities in source material, lack of up-to-date data, gaps in the data, etc. Insufficient circulations of existing map information and a concern for national security have also reduced the availability of maps at a global scale.

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

- all data of Earth to be in one place,
- with the same attributes,
- in the same format,
- in the same coordinate system,
- in the same scale, and
- with similar accuracy.

The process of GM developing is directly supported by the United Nations, from which in 1998 was put down the letter addressed to all National mapping organizations around the world with invitation for participating in the project.

"Initiatives and partnerships for global mapping," were strongly encouraged in the Johannesburg Plan of Implementation following the World Summit on Sustainable Development in 2002. The Global Map project was subsequently registered as an initiative following this summit with the goal of completing global coverage by the year 2007 (GM specification 2, 2009).

2. GLOBAL MAP DATA

Spatial features of global map dataset are organized into thematic layers in either vector or raster formats with each layer containing logically related geographic information. Global Map contains four kinds of datasets:

- Global Map V.0
- Global Map V.X
- Global Map V1/V2 (national and regional version) and
- Global Map V1 (global version).

The GM V.0 is based in Vmap level 0 data, Global Land Cover Characterization (GLCC), and GTOPO 30 elevation data set. All listed datasets are existing global geographic datasets, without any validation of any NMO. It contains four raster layers (vegetation, land cover, land use and elevation), all of them in TIFF and BIL raster formats, except elevation which is only in BIL raster format.

The GM V.X is based in existing global geographic datasets, as the previous one (GM V0), tentatively developed with expectance to be improved in GM V1/V2.

The GM V1/V2 national and regional version is most popular and most utilized global map dataset, produced by National Mapping Organizations of respective countries under their responsibility, without any responsibility assume of ISCGM for the contents of these data. In addition to the official VPF/GML and BIL formats, Shape and TIFF formats are available for the Global Map V.1/V.2 (National and Regional version) also. It contains eight layers, four vector layers (populations centers, drainage, transportations and boundaries) represented in VPF, Shape and/or GML formats, and four raster (elevation, land cover, land use and vegetation) layers in TIFF and/or BIL format.

The GM V1 global version was developed as additional raster data aimed to replace existing raster layers (land cover, land use and vegetation) in future GM V2. The data were created by using MODIS data observed in 2003 (TERRA Satellite). It contains

two raster layers, Land cover and Vegetation (Percent tree cover), all of them available on BIL and TIFF formats, with the same spatial resolution as raster data of national and regional version. They are uploaded and available in Google Earth also (figure 1).

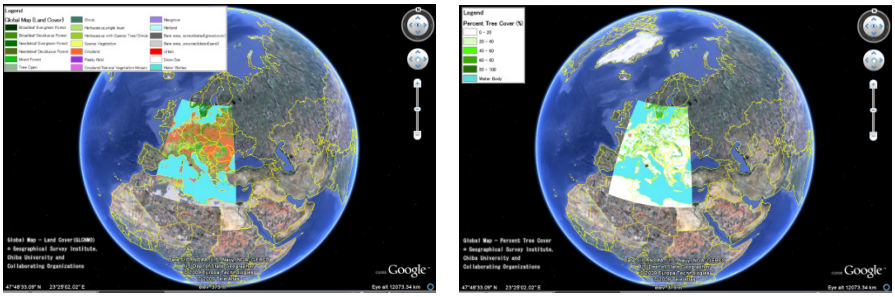

Figure 1. Global map V1 (global version) in Google Earth

2.1. Global Map V1/V2 – national and regional version

The global map V1/V2 national and regional version, is most utilized and known version of global map, in which all participant NMOs give their efforts for its developing. This global map dataset includes both types of data, vector and raster data, provided by NMOs based on their level of participation. The list of layers is given in the next table 1.

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

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

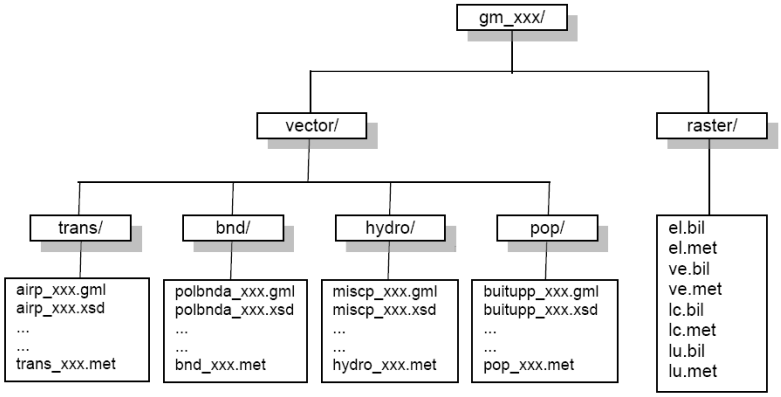

Figure 2. Global Map V1/V2 data set - national/regional version

2.1.1. Vector data of GM V1/V2 – national and regional version

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. GM vector data stored as edges and faces are individually structured, which means that GM vector data is partly topologically structured. The intense of GM vector data is to keep the logical consistency of data, and non duplicate features.
The structure of GM vector data is adapted to ISO/TC 211 standards. Vector layers and the associated feature types are shown in the following table 2 (GM specification 2, 2009).

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

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

The vector data of Global Map V1/V2 (national and regional version) can be downloaded in VPF (Vector Product Format), SHAPE and GML (Geography Markup Language) formats. VPF is a standard format, structure, and organization for large geographic databases that are based on a geo-relational data model, combinatorial topology and set theory, and are intended for direct use (Idrizi, 2007a). Because the utilization of VPF files is so limited by the existing GIS software's, on October 10th 2008 the existing GM vector data (national/regional version) has been published in SHAPE format also, which is more simple and user-friendly format. On October 25th 2009, the GML (standardized in ISO19136) format has replaced former VPF as the

official distribution format of GM data, which provides a standard format for transferring digital geographic data (Idrizi, Nikolli, Hyseni, 2010).
The file names of shape and GML data are different. The names of shape files consists the identifying letters of layer, and in the end of name letter of geometrical type of data (p for point, l for line and a for polygons), given in next table 3. The names od vector data stored in GML format have a file name of the form wwww_xxx_y.zzz or wwww_xxx.zzz where:

- wwww - identifies the abbreviation of the feature shown in table 2,
- xxx - identifies the country code from ISO 3166 Nation Code,
- y - shows the Unique ID if a territory is divided in two or more tiles, and
- zzz - is the extension identifying the data (gml).

Table 3. Names of shape files of GM V1/V2 (national and regional version) and features within them

Shapefile	Features
transp.shp	Airport, Rail yard
transl.shp	Railroad, Road, Trails and tracks line, Structures (bridge, tunnel, ferry route)
bndp.shp	Political boundary
bndl.shp	Political boundary line, Coast line
bnda.shp	Political boundary, Ocean/Sea
hydrop.shp	Miscellaneous (Dam/Weir, Island, Spring/Water-hole)
hydrol.shp	Aqueduct/Canal/Flume/Penstock, Water course
hydroa.shp	Inland water
popp.shp	Builtup area, Miscellaneous population
popa.shp	Builtup area

Table 4. Excample of names of gml files of GM V1/V2 (national and regional version)

Name of GML files	Description
builtupa_mkd_1.gml	When country is divided in two ore more tiles
builtupa_mkd.gml	When the whole country is within one tile

2.1.2. Raster data of GM V1/V2 – national and regional version

The raster data grid cells are organized and accessed by rows and columns with the cell size (spatial resolution) 30”x30”, with the origin on the north-west corner of the tile. Its area represented by a square grid cell is computed from the length of its side called spatial resolution. The attribute of each cell represent a characteristic that is dominant nearby the center point of cell. The characteristics of the raster layers of Global Map data will be shown in the following text.
Elevation Layer – contain the vertical distance between the surface of the earth and the mean sea level that the nation has defined. The elevation layer is in a Band Interleaved Line (BIL) format with 16-bit elevation value and 30” horizontal grid spacing. The values of elevation are represented in meters, in which the codes -9999 are areas masked with the sea.

Land Cover Layer - Land cover is the observed (bio) physical cover on the earth's surface (Di Gregorio and Jansen, 1998). In Global Map specification the codes of Land Cover Characteristics of GM V1/V2 national/regional version is adopted for International Geosphere-Biosphere Programme (IGBP). IGBP has 17 Land Cover classes.
Land Use Layer - Land Use is a series of operations on land, carried out by humans, with the intention of obtaining products and/or benefits through using land resources (de Bie 2000). For Land Use legend, simplified GLLC with 9 classes is adopted. There is a proposal to drop this layer from the next version 2 of GM national/regional as this being almost derived from Land Cover data.
Vegetation Layer - For Vegetation layer, a modified water legend with 20 classes is adopted. Changing of this layer based on percent tree cover for GM V1 global version is proposed also.

Table 5. Types of raster data of GM V1/V2 national and regional version

Land Cover		**Land Use**		**Vegetation**	
Description	***Code***	***Description***	***Code***	***Description***	***Code***
Evergreen Needleleaf Forest	1	Forest	10	Tropical rainforest	10
Evergreen Broadleaf Forest	2	Mixture	20	Hydrotropic forest	20
Deciduous Needleleaf Forest	3	Grassland/shrub	30	Grassland in tropical or sub-tropical zone	30
Deciduous Broadleaf Forest	4	Agricultural area	40	Semi desert in tropical or sub-tropical zone	40
Mixed Forest	5	Wetland	50	Desert in tropical or sub-tropical zone	50
Closed Shrublands	6	Barren area	60	Evergreen thick-leaved forest	60
Open Shrublands	7	Built-up area	70	Evergreen broad-leaved forest	70
Woody Savannas	8	Drainage/water	80	Deciduous broad-leaved forest	80
Savannas	9	Ocean	90	Grassland in temperate zone	90
Grasslands	10			Semi-desert in temperate zone	100
Permanent Wetlands	11			Desert in temperate zone	110
Croplands	12			Northern coniferous forest	120
Urban and Built-Up	13			Tundra	130
Cropland/Natural Vegetation Mosaic	14			Water body	140
Snow and Ice	15			Ice and snow	150
Barren or Sparsely Vegetated	16			Wetland	210
Water Bodies	17			Mixed forest	220
				Mixed land	230
				Non natural	240
				Unclassified	250

Global Map raster data is in simple binary raster format without the embedded header – BIL (Band Interleaved by Line) format, pixel information stores band by band for each

line, or row, of the image. Vegetation, Land Cover and Land Use are in 8 bit unsigned data and the elevation data in 16 bit signed in Motorola (big-endian) byte order.
On October 10th 2008 the existing GM raster data (national/regional version) has been published in TIFF format also, which is more simple and user-friendly format.
All layers are identified with two letters, which explain the name of layer (table 6). The file names have the form ww_xxx.zzz where

- ww identifies the theme,
- xxx identifies the country code which is defined at ISO 3166 Nation Code, and
- zzz is the extension identifying the data (bil or tiff) or the header (hdr).

Table 6. Identifiers of raster layers within GM V1/V2 (national/regional version)

Identifier	***Theme***
el	Elevation
lc	Land Cover
lu	Land Use
ve	Vegetation

2.2. Global Map V1 – global version

The Global Version is developed by using satellite imagery with cooperation between participating NMOs and supporting stakeholders, which covers only the vegetation and land cover layers. The ground truth data are collected by Center for Environmental Remote Sensing (CEReS), Chiba University in cooperation with National Mapping Organizations (NMO).
Cell size for raster data is the same as national/regional version, 30 arc-seconds by 30 arc-seconds with the origin being the north-west corner of the tile. The data format of global map V1 global version is the same as national/regional version also.
File names of global version of raster data have a form wwyy.zzz, where:

- ww - indentifies the theme,
- yy - identifies the file number, and
- zzz - is the extension identifying the data (bil) or the header (hdr).

2.2.1. Land cover – global version

MODIS data of 2003 with 1km tile (10 deg. by 10deg.) from United States Geological Survey (USGS) have been used as the source satellite data for developing the Land cover – global version. Classification of land cover data was made in two ways: one was global classification and the other was national/regional classification. The main classification method was decision tree method applied to MODIS data.
Land cover global version dataset contain 20 land cover classes, and another additional class with code 255 which represent the areas without data (table 7). In table 7 are represented the comparison between the Land cover classes in national/regional with 17 and global version with 20 classes (Tateishi, 2005).
One of the reasons of creating of Land cover global version with 20 classes is the intention to drop the land use layer from the next version 2 of GM national/regional, because it's being derived from Land Cover data.

Table 7. Comparison between classes of Land cover global and national/regional versions

Land cover global version	Land cover – national and regional version
1. Broadleaf Evergreen Forest	2. Evergreen Broadleaf Forests
2. Broadleaf Deciduous Forest	4. Deciduous Broadleaf Forests
3. Needleleaf Evergeen Forest	1. Evergreen Needleleaf Forests
4. Needleleaf Deciduous Forest	3. Deciduous Needleleaf Forests
5. Mixed Forest	5. Mixed Forests
6. Tree Open	8. Woody Savannas 9. Savanna
7. Shrub	6. Closed Shrublands 7. Open Shrublands
8. Herbaceous, single layer	10. Grasslands
9. Herbaceous with Sparse and Tree/Shrub	
10. Sparse Herbaceous/Shrub	16. Barren
11. Cropland (herbaceous crops except rice)	12. Croplands
12. Rice, paddy	
13. Cropland/Natural Vegetation Mosaic	14. Cropland/Natural Vegetation Mosaics
14. Tree-Water (Brackish to Saline)	11. Permanent Wetlands
15. Wetland	
16. Bare area, consolidated (gravel, rock)	16. Barren
17. Bare area, unconsolidated (sand)	
18. Urban	13. Urban and Built-up
19. Snow/Ice	15. Snow and Ice
20. Water Bodies	17. Water Bodies

2.2.2. Vegetation (percent tree cover) – global version

Vegetation (percent tree cover) layer of global version is developed by using the MODIS data of 2003, which has been used for global estimation of percent tree cover data. The decision tree method was applied for estimation of percent tree cover.
The data within this layer contains an integer value from 0 to 100 which describes the percent of coverage with trees, except the cells with value 254 which represent the areas masked as water bodies, and cells with value 255 which represent the areas without data.
The percent tree cover data can be effectively used to discriminate forest and "tree open" during the process of land cover classification.

2.3. Mathematical elements of Global Map

The reference coordinate system of Global Map is ITRF94, and its longitudes and latitudes are defined in GRS80 Ellipsoid, stored in decimal degrees to a minimum of three decimal points as geographic coordinates with southern and western hemispheres having a negative sign for latitude and longitude. Since the difference between ITRF94+GRS80 and WGS84 is negligible in spatial resolution and scale of Global Map, WGS84 can be used also.

The positional accuracy of spatial data based on the composite errors from three sources: which are the positional accuracy of source material, errors due to conversion

processes, and errors due to the data processing. For horizontal accuracy, 90% of points need to be within ±2km of their actual location, and in the case of data obtained from satellite images, the maximum error is less than or equal to 0.5km. In other site vertical accuracy is notionally ±150m for 90% of points.

GM data is in use of GEOREF tiling naming system, which does not allow overlaps or gaps between the tiles, with the the reference for their southwest corner. It uses two pairs of letters. The first pair of letters represents the coarsest, 15° by 15° standard GEOREF division, and represents the first coordinate pair identifying the tile name. The second pair of letters represents the 1° by 1° standard GEOREF divisions, and represents the second coordinate pair of the tile name.
In the other site, the tiling system of GM V1 global version uses the dividing system of 30° x 30° starting from the equator and the Greenwich meridian (Idrizi, 2007b).

2.4. Metadata of Global Map

Metadata is data about the contents, quality, condition and other characteristics of the data, which also describes the lineage, process and accuracy of the data set. The contents of global map metadata follow the ISO 19115 standard of metadata, described in English language and supplied separately for each layer, by using ISO 19139 for encoding.
A metadata files of GM data accompanies each layer of the data set separately, as XML file with utf8, named after the relevant theme and have the extension "*.met" in the form: wwww_xxx.zzz where:

- wwww - identifies the abbreviation (table 2),
- xxx - identifies the country based on ISO 3166 Nation Code, and
- zzz - is the extension 'met'.

2.5. Downloading and copyright for usage of Global Map data

Downloading of Global Map data is available for non-commercial use, via internet and free of charge, for all registered users. GM data can be downloaded through the "Global Map download service" in the GM web site www.iscgm.org as:

- all national and regional version in VPF and BIL formats,
- all national and regional version in SHAPE and TIFF formats,
- land cover data of global version in BIL format,
- percent tree cover data of global version in BIL format, and
- only one selected layer of national and regional version in VPF or BIL format.

This data basically is for non-commercial use only! If anybody intends to use the Global Map data for commercial purpose, it is necessary to get permission from responsible institution of its country, according to defined data policy by each NMO's. Any unauthorized use of these data for any commercial purposes is in violation of international copyright laws and strictly forbidden.

In the next figure 3 is given the scheme of standards for data developing defined in global map specifications.

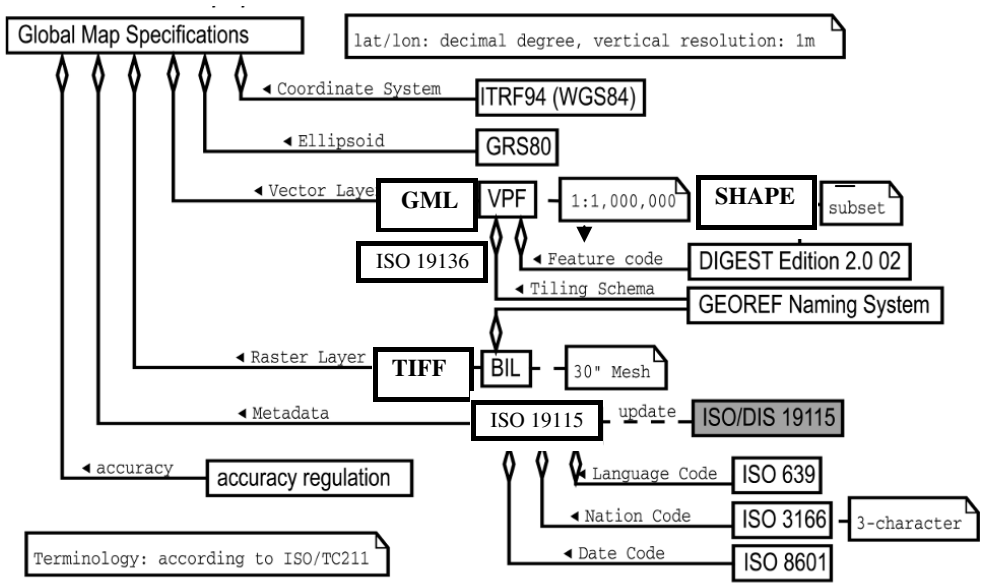

Figure 3. Scheme of Global Map data

3. PARTICIPATION

Based on fact that the GM project is for noncommercial purposes, participation in it is voluntary. Eligible for participation has only the national mapping organizations, which are the governmental responsible institutions for mapping and spatial data developing on national level, and probably they should have source of information of core geographical data as a result of their original duty.

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.

Currently, 180 countries and regions have participated in global mapping project, from which 75 countries (table 8) have already released their data and they are available for downloading in the web site of ISCGM. From the European countries who almost participate in the EuroGLobalMap project powered by EuroGeographics, 23 of them participate in the GM through the EuroGlobalMap, and 12 others participate directly and through EuroGlobalMap. The progress on developing of GM data is given in the figure 4, and the dynamic of releasing of GM data from year 2000 till May 2010 is given in figure 5.

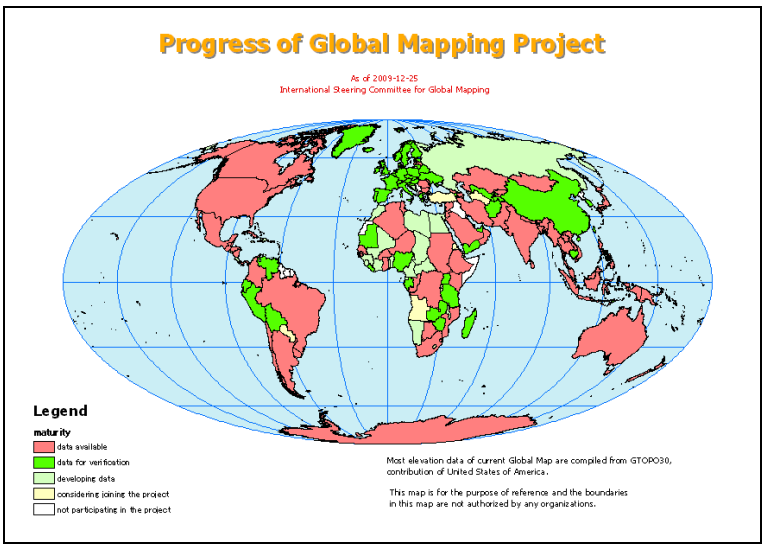

Figure 4. Progress of Global Mapping

Table 8. List of countries

Year of publishing	Country/region	Year of publishing	Country/region
2000	Japan	2007	Saudi Arabia
2000	Lao People's Democratic Republic	2007	Algeria
2000	Nepal	2007	Lebanon
2000	Thailand	2007	Sudan
2000	Sri Lanka	2007	Brazil
2000	Philippines	2007	India
2001	Colombia	2007	Indonesia
2001	Australia	2007	Niger
2001	Bangladesh	2007	Uruguay
2001	Mongolia	2007	Dominica
2002	Panama	2008	Mozambique
2002	Kenya	2008	Georgia
2003	Botswana	2008	China, Hong Kong SAR
2003	Burkina Faso	2008	Romania
2003	Kazakhstan	2008	Chile
2003	Kyrgyz	2008	Palestine
2003	Mexico	2008	Brunei Darussalam
2003	Myanmar	2008	Pakistan
2004	Swaziland	2008	Papua New Guinea
2004	Samoa	2008	Oman
2005	Iran	2008	Belize
2006	The Former Yugoslav Republic of Macedonia	2008	Dem.Rep. of Congo
2006	Latvia	2008	Honduras
2006	Tristan da Cunha	2008	Saint Lucia
2006	Argentina	2008	Nicaragua
2006	Antarctica	2008	Ethiopia
2006	Jordan	2008	Senegal

2006	Japan (version 1.1)	2008	Congo
2007	Bangladesh (version 1.1)	2008	Guinea-Bissau
2007	Ghana	2008	St. Vincent and the Grenadines
2007	Viet Nam	2008	Republic of Moldova
2007	Malaysia	2008	United States of Amerika
2007	South Africa	2008	Bhutan
2007	Bahrain	2008	Syrian Arab Republic
2007	Canada	2008	Azerbaijan
2007	Singapore	2008	Tunisia
2007	New Zealand	2009	Mauritius
2007	Cuba	2009	Bulgaria
2007	Guatemala	2010	Bulgaria (version 2)

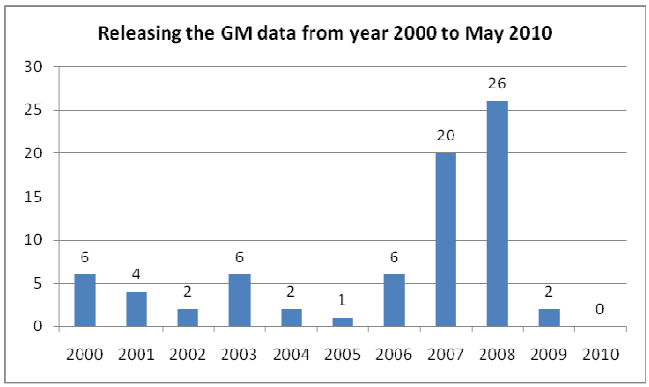

Figure 5. Progress of releasing the Global Map data (2000-May 2010)

From the upper list it is so clear that Macedonia is the first European country who has published its own GM data. Other European countries which have already released their GM data are Latvia, Republic of Moldova, Romania and Bulgaria. The data of the other 35 European countries which participate through EuroGlobalMap are under the verification, countries filled with green color in figure 4.
Beside the 180 participants, other 10 countries/regions are in the list of considering countries/regions: Ascension Island, Bahamas, Djibouti, Eritrea, Lesotho, Paraguay, Qatar, Rwanda, Turkey and Turkmenistan, which considers as potential participants of Global Mapping project in a Global Map V1/V2 national and regional version, represented by their NMO's.

4. SOME ISSUES TO BE CONSIDERED FOR THE FUTURE OF GLOBAL MAP

The idea for developing the global map was lunched as a result of unsuccessful completing the IMW (International Map of the World in scale 1:1.000.000) and contemporary trends that imposed information technology in the last decade of last century for preparing the digital maps. Based on this idea, global map has had to replace the IMW with a new map in digital form with the homogeneous standards for entire globe. But if we take a look to the structure of global map since the beginning till today,

namely its standards listed in its specifications, it is so clearly that global mapping is not designed as a standard map, but it represents the GIS database format with specific defined standards. The lack of cartographic key (cartographic symbols), the lack of cartographic/graphic representation, and absence of defined map projection are the main arguments which prove that global map it isn't map but it is GIS database, i.e. global map oneself does not contain the basic elements that characterize a map. Based on these details, comes the expression mapping element which should be subject for GM revising in the next period by orienting the project in this regard.

Our efforts for utilization the GM data from different countries for mapping and spatial analyses resulted that data of each countries within itself follows all the standards set global mapping project, but in a case of preparing a map of two neighboring countries by using GM data as well in a case of spatial analysis of a wider geographical region consists by two or more countries, using of global map data is quite limited. Example which prove the above two deficiencies are shown in the next figure 6, example along the borderline between Bulgaria and Romania. In the figure clearly is shown that in some places have overlapping and in some gaps between the two border lines released by Bulgaria and Romania. Besides the overlaps and gaps, between two databases there is no spatial continuity of objects of the road network, railway, rivers, lakes, coastline, etc. Absence of spatial continuity condition and appearance of overlaps and gaps prevents the utilization of this database for spatial analysis of hydrography, transportations, the coastal line, state boundary, etc. Such situation is a result of several factors as:

- Utilization of source data with different scale, accuracy and entireness;
- Utilization of source data with different period of collecting and non up-to-date data,
- Utilization of tendentiously data,
- Accuracy of the transformation of coordinate system,
- Data generalization,
- Lack of bilateral agreements between neighboring states to the border line,
- Various conflicts between neighboring countries for boundary line,
- Non-recognition of States between themselves, etc.

Above mentioned problems are of different natures from the technical up to the political, accumulated in many decades-centuries, which cannot be overcome so easily.

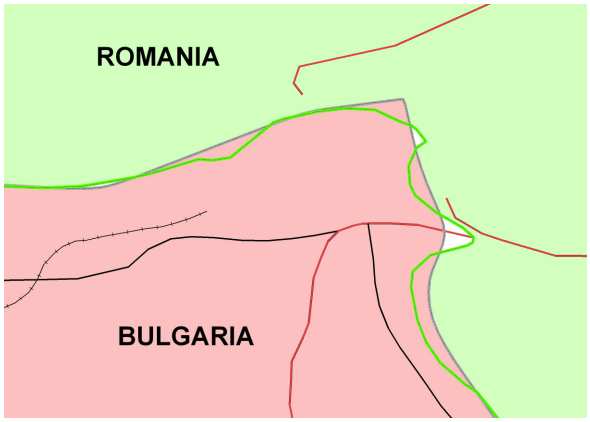

Figure 6. Part of GM data along the borderline between Bulgaria and Romania

Regarding to the accuracy, the GM specification allows GM data to have a different accuracy depending on the source materials (for 90% of points ±2km, and ±0.5km if the data comes from satellite images), where the difference can be up to four times. This accuracy in some way allows overlaps, gaps, and non spatial continuity of data not only between different countries, but the data within a country and between different layers. This allows to each participant to use different sources with different quality for different areas of their countries and for different layers. If we convert dimensions of both errors, they are 2mm to 0.5mm in map, which are values much larger than the standards for mapping in scale 1:1.000.000.

Non-homogeneous accuracy is one of the generators of overlaps, gaps and non spatial continuity, which in other site means that GM dataset is a database without strong topology. Topology of GM as defined in its specification "Vector data in the Global Map will be partially topologically structured. Features stored as edges and faces will be individually structured", does not allow full spatial joint between objects in different layers and objects between two data bases.

Of big importance is the relation between the data of raster and vector layers, for which such as example we have analyzed the overlapping of lakes, seas and oceans with DEM (digital elevation model). The differences are much larger than projected accuracy (0.5km to 2km) and resolution of the DEM (1km), as can be seen in overlapped situation between the coastline of the Black Sea and DEM, shown in figure 7.

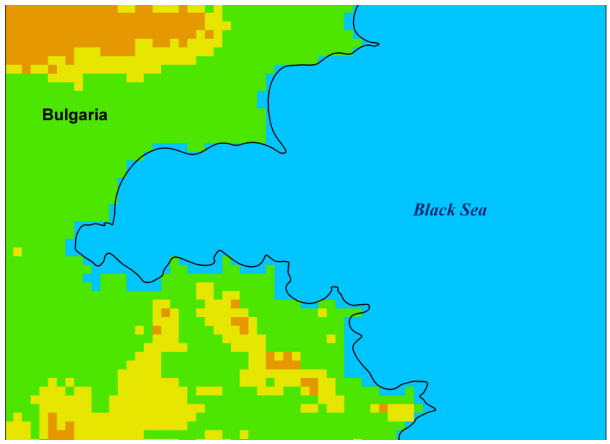

Figure 7. Differences between the coastline and DEM

From the analysis on global map, utilization of UNK attribute about the unknown data for us is somewhat unreasonable. This conclusion comes from the fact that participants for developing the GM database for own countries are NMO's, which according to legal obligations on their countries they should possess native spatial data and their accompanying attributes. On the existing GM data available for download, we found a large number of data with this attribute. Probably the NMO's have used the given opportunity by the GM specification, and not really that their institution or other country institutions don't have information they possess.

All the above suggestions can be treated as a point for which appropriate solutions must be found in the next version of GM, in accordance with paragraph 6 of the specification where suggestions of GM users are required.

5. CONCLUSIONS

From the above text it can be concluded that global mapping project is a project that had a tendency to replace IMW with a digital map of whole globe with homogeneous standards. Ten years after first publication of the dataset of Japan, the progress of GM results with less than 50% released datasets of the participating countries and over 10 non participating countries in the project. Despite the recommendation letter of the United Nations in 1998 and the Johannesburg Plan of Implementation following the World Summit on Sustainable Development in 2002, to date is not reached with completing of global map.

Global Map mainly characterized by national/regional and global versions, both of them downloadable from the website of ISCGM. Beside them there are also two other global datasets named as V0 and VX, which nowadays do not represent attractive database for wider usage. Global map V1/V2 national and regional version consist raster and vector data, despite other versions that contains only raster data. Intention of the global map version two is to change the raster data structure, by replacing layers of land cover, vegetation and land use of GM V1/V2 (national and regional version) with land cover and percent tree cover layers of GM V1 (global version). Beside the essential changes in raster layers, in the vector data only the format of the VPF has been replaced with GML, as well as the metadata standards have been change into ISO 19115.

In order to approach the global map data to a larger number of users, GM data of national and regional version V1/V2 can be downloaded in shape and TIFF formats, as more appropriate formats and much wider use, despite the standard GM formats VPF for vector and BILL for raster data. Setting global map data of global version V1 in Google Earth tends to approach the data to users of various levels.

Global mapping basically is aimed to develop globally homogeneous geographic data set, for better managing with the environment in global level, as well as to contribute the development of GSDI and to GEOSS. Theoretically utilization of global map data should give opportunity to make spatial analyses in regional, continental, intercontinental and global levels, by downloading all needed data from one place – web site. According to our research on the usage of GM data at international level, some problems which make very limited its wide utilization have been recognized. The problems as overlapping, gaps, spatial discontinuity of data, big differences in accuracy, unknown data attributes, non topologically structured data ext., have to be new challenges of global mapping project for the better future of global map. We hope that all above mentioned issues to be considered for the future of global map, will be accepted with open hands by the ISCGM and GM working groups, as positive and fruitful suggestions for changes/corrections of Global Mapping specification.

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7. BIOGRAPHICAL NOTES OF THE AUTHORS

Bashkim IDRIZI, was born on 14.07.1974 in Skopje, Macedonia. He graduated in geodesy department of the Polytechnic University of Tirana-Albania in 1999year. In 2004, hot the degree of master of sciences (MSc) in Ss.Cyril and Methodius University-Skopje. In 2005 he had a specialization for Global Mapping in Geographical-Survey Institute (GSI) of Japan in Tsukuba-Japan. On year 2007, he held the degree of Doctor of sciences (PhD) in Geodesy department of Ss.Cyril and Methodius University–Skopje. He worked in State Authority for Geodetic Works from May 1999 until January 2008. From October 2003 up to January 2008, he worked as a outsourcing lecturer in State University of Tetova. From February 2008, he works as a cartography& GIS Professor at the State University of Tetova–Tetova. He continu with working as outsourcing lecturer in geodesy department of the University of Prishtina-Kosova. He is the author of three cartography university books, and 56 papers published and presented in national and international scientific conferences related to geodesy, cartography, GIS & remote sensing.

Murat Meha is a University Professor and Deputy Head of the state Border Demarcation Commission. He has been teaching at the University of Prishtina - Kosovo since 1988. He has also taught for ten years at Tetova University (FYR of Macedonia). He worked for five years as Manager of SEO Ferronikeli, for three years as a CEO of Kosova Cadastre Agency, in different funded EAR projects, USAID project, KTA etc. His teaching and research concern survey, cadastre, Land Administration and Land management. and related educational and capacity building activities. He is currently the member of Kosova Surveyor Association. Main publications of Mr Meha are on survey, cadastre, Land

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Pal NIKOLLI. Graduated at the Geodesy branch of Engineering Faculty, Tirana University. In 1987 has been nominated lecturer in the Geodesy Department of Tirana University. In 1994 has been graduated Doctor of Sciences in cartography field. During this period, have taught the following subjects: "Cartography" (for Geodesy and Geography students) and "Geodesy" (for Civil engineering & Geology students). Actually he is lecturer and tutor of the following subjects: "Elements of Cartography" (for Geography students), GIS (for Geography students, diploma of first and second degree) "Interpretation of Arial Photographs" (for Geography students, diploma of first degree), "Satellite Images" (for geography students, diploma of second degree) "Thematic Cartography" (for Geography students, diploma of second degree) and "Topography-GIS (for the Geophysics students, diploma of second degree). Mr. Nikolli is the author and co-author 8 textbooks (Elements of Cartography and Topography, Elements of Cartography, Geographic Information Systems, Processing of satellite images, Cartography, etc), 3 monographs (History of Albanian Cartography, Mirdita on Geo-Cartographic view, etc), more than 40 scientific papers inside and outside of the country, more 40 scientific & popular papers, etc. Has participated in several post graduation courses of cartography and GIS outside of the country (1994, 2000 - Italy), etc.

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