# Earth Observation Capacity for Environmental Mapping in Bulgaria

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**Abstract.** This paper will present the status, opportunities and perspectives of Earth Observation capacity for Environmental mapping in Bulgaria, with special emphasis on its importance and possibilities provided by participation in the international observation systems, for the purpose of climatic changes and environment quality monitoring. The assessment of the capacity is based on the individual geographical, historical and economical trends in Republic of Bulgaria. This report reflects the achievements of Bulgaria's participation in the project OBSERVE/FP7 Program.

**Keywords:** Earth Observation, Environment, Mapping, OBSERVE

## 1. Introduction

Earth Observation (EO) starts for almost every country in the world, including Bulgaria, with the creation of the basic national cartographic inventory and the respective maps of Land Use in small and medium scales. The starting dates for the use of Photogrammetry in Map making procedures are placed just before and after the 2nd World War while it is important to remark that in some cases, Remote Sensing Satellite imagery was acquired to help the production of the modern base maps of the whole state. There is not a global policy to use Earth Observation applications for environmental decision making. Although in Bulgaria there are some steps to raise the awareness on environmental issues are attempted. Earth Observation applications can provide great help towards this approach since they can: provide base maps to support the design of infrastructure projects taking into account restrictions for the protection of the Environment; protect the Environment by monitoring sensitive areas of great natural beauty and importance; guide the state to develop financial growth using pollution free or environment friendly strategies; lead to development fostering, the prevention of forest fires, earthquakes and other natural disasters. Based on different inputs of the project for Bulgaria, the roadmap and strategy plan has been prepared as an important result of the project. The short term and medium term actions have been proposed:

Consider and evaluate ways to participate in international standards bodies and activities in the EO domain (e.g. OGC working groups, GEOSS Architecture Implementation Pilot); Extend the initiative of a common GEO forum for networking and application exchange from the national to the Balkan region; Further expand dissemination and stakeholder involvement; Further promotion of GEOSS data sharing facilities. Organize permanent training courses and workshops in Bulgaria. Increase cooperation between the Universities in the region (student and teacher exchange; organization of specialized courses, etc.).·Strive for increasing funding for scientific research in the EO field. Promote GEOSS as a common data platform in the region for data producers, providers and end-users that will allow the sharing and exchange of EO data. Encourage national bodies to perform market researches on the end-users needs (at the national and regional level) aiming at getting objective information on real needs and achieving a qualitative collaboration between the end-user, EO producers and providers. The report identifies the problems of the Earth Observation mapping of the environment in Bulgaria and indicates the possible ways to solve them.

## 2. A BRIEF HISTORICAL OVERVIEW ON EARTH OBSERVATION ACTIVITIES IN BULGARIA

The foundation of the cartographic and topographic activities in Bulgaria was laid during the Russian-Turkish war (in 1877-1878). At that period the Russian specialists did the first cartographic, astronomical and geodetic measurements. A 1:42K mensural method was applied and some city maps and fortification plans were performed.

On December 3rd 1891 the Fourth Regular National Assembly accepted "The Law for Organization of the Bulgarian Armed Forces". Based on that law, prince Ferdinand issued his edict №170/ Dec. 27 1891 for Establishment of Military Topographic Section. Its main purpose was to finalize the works performed by the Russian Topographic Corp as well as teaching new Bulgarian topographers.

On January 17th 1906 the section was ranked as a separate institution and was renamed to Military Cartographic Institute (MCI) associated to the Ministry of the War.

### 2.1. Historical Dates

In 1919 MCI was renamed to Geographic Institute (GI), obtaining status of a separate department at the Ministry of the War.

In 1952 GI was renamed to Central Military Cartographic Base (CMCB).

In 1953 CMCB was moved to the town of Troyan.

In 1980 CMCB was renamed to Military Cartographic Institute (MCI).

In 2000 MCI was renamed to Central Military Cartographic Base (CMCB).
In 2007 CMCB was renamed to Military Geographic Centre (MGC).
In 1919 a General plan for creating the National Geodetic Network was endorsed and geodetic activities began. It included creating First- and Second order points. Geodetic points were built till 1924 and geodetic measurements finished in 1929. The estimation of the network finished in 1934.
Later on, the network was developed up to Dobrudja and South Thrakiya regions and increased to 6500 geodetic points.
In 1926 two self-writing tide-gauges started in Burgas and Varna and creation of the Main Leveling Network began.
Earth-photogrammetry method was first applied in 1930. Three working groups were formed then.
Another topographic imagery method – aerial imagery - was applied at that period, too. In 1942 it became the main method for performing topographic imagery.
Creation of 1:40K map started in 1899. The map was based on the Russian map of the same scale. It was one-color map with Bulgarian labels and symbols.
Using the above maps, 50K and 126K color maps were created and printed in 1905 as well as 200K map of the Balkan Peninsula.
From the beginning to 1919 its main purposes were to improve existing maps and their publishing in various scales.
During the wars (1912-1918) the main activities of the Institute were to supply the troops with cartographic data.
In order to satisfy the growing demand of maps, a plan for developing large scale (25K, contour interval - 10 m) imagery method was started. The actual work began in 1932. About 62% of the territory was processed till 1944. The remaining part was finished in 1952.

## 2.2. Current Status of Earth Observation Activities

Two state organizations have a dominant role for National Geographic Information Infrastructure:

The Military Geographic Service, responsible for the survey of the country at scale 1:25.000 and producing topographic maps at scales 1:25.000, 1:50.000, 1:100.000, 1:200.0000, 1:500.000 and 1:1.000.000. It also maintains the State Geodetic Network.

The Geodesy, Cartography and Cadastre Agency is responsible for the provision of large scale topographic maps (scale 1:10.000 and 1:5.000) and the cadastre. It maintains the State Levelling Network.

A new approach was developed called the “Sustainable Development Concept related to National Spatial Data Infrastructure” which was approved by the Bulgarian government in 2004 (Decree of the Council of Ministers 761).

Key topics in this concept are building partnerships, interoperability and integration. The approach is interdisciplinary and is focusing on the environmental sector. The above mentioned decision of the Council of Ministers aims reach unified national data for the territory, resources and population. A national plan is under development to reach this objective.

In 2008, the Council of Ministers adopted a Resolution to approve the Action Plan for the implementation of the INSPIRE directive and a Resolution to nominate the State Agency for Information Technology and Communications (SAITC) as the institution responsible for the implementation of INSPIRE. At the end of 2009 due to administration restructuring, SAITS joined the Ministry of Transport, Information Technology and Communications. The National Assembly passed the Spatial Data Access Act on February 24, 2010.

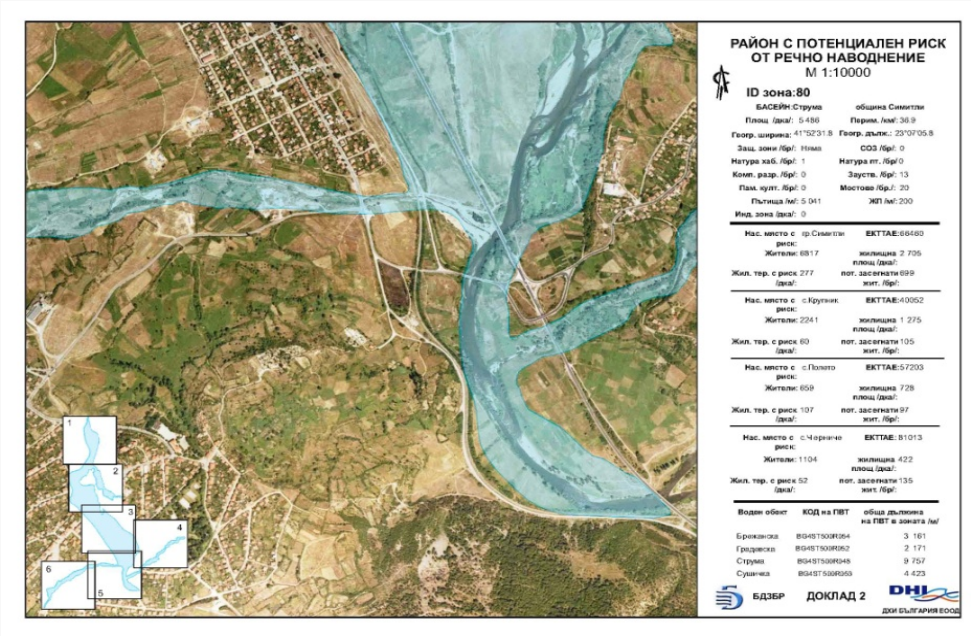


**Figure 1.** Example of map developed for estimation of flood risk.

## 2.3. Gap analysis on EO in Bulgaria

Many activities within the Observe projects have been focused to collect information and investigate the current situation on EO in Bulgaria.

One of the critical points for the Balkan countries is how to create a future environment of cooperation between many partners and on various levels where large and small companies from many countries are involved in joint projects. Experience gained in projects supported by the EU paves the way

towards future models of cooperation and will help to identify new products and market niches for these products. Future cooperation between Balkan partners becomes much easier if experience from initial projects is already available. Another aspect to consider is the embedding of partners from the Balkan partners in globally international projects and research programs.
We summarize and present here only some most relevant and realistic challenges that can be addressed to the EO community as well as decision makers and politicians in the region.


**Figure 2.** Maps for the monitoring of snow cover and snow melting process.

In addition, the partners of the Observe from the Balkan region have defined the following key priorities and future trends, referring to the recognized regional priorities:

***The main identified problems are:***

- Absence of a common body for coordination and cooperation. Lack of harmonization of activities of EO players across the Balkan. Lack of jurisdiction over the establishment of regional Balkan EO sysem on a high political level.
- Need for financial means for establishing regional EO system (who/how).

- Lack of recognition of national interests in some participating countries.

***The expected or desired key characteristics of the EO data in the future are:***

- Easier access and exchange of various EO data.
- Data standardization.
- Uniform metadata system available to users.
- Improvement of management in hazardous or disastrous situations.
- Less expensive data for the end-users.
- Access to all data in one place.
- Efficient on-line services on the data quality and quality control.
- Emphasis on the data quality and quality control approaches.

## 3. Conclusion

In the field of EO activities, the critical point found for the Balkan countries is how to create a future environment of cooperation between different partners and at various levels where companies of different scale from many countries would be involved in joint projects. Experience gained in projects supported by the EU paves the way towards the future models of cooperation and will help to identify new products and market niches for these products and services. Future cooperation between Balkan partners becomes much easier if experience from initial projects is already available. In this sense, the OBSERVE project has significantly contributed through developing a network and capacity building in the region. Many activities within the OBSERVE projects have been focused to collect information and investigate the current state of affairs in the field of the EO in the Balkan region. The analysis of this very detailed data shows that there are inevitable differences between the contributing countries due to historical, political and other reasons. On the other hand, we can found many common trends as well striving after some common goals and actions of the EO in the region.

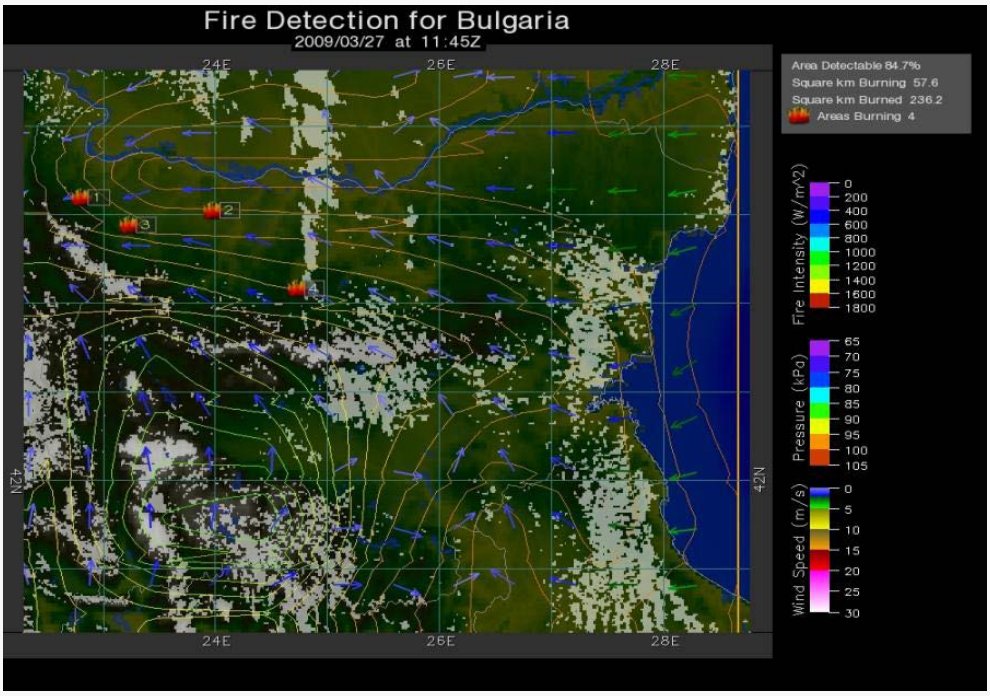


**Figure 3.** A map for Fire Detection produced by a Satellite- Based Automatic Fire Detection and Analysis Tool

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