Gap Analysis Report
Phase I and Phase II

Gap Analysis Report - Phase I

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Abstract:

This document describes results of the first phase of the gap analysis of existing datasets and observation systems within the Black Sea catchment aiming to assess their correspondence to the enviroGRIDS project and end-users needs and level of compatibility with the INSPIRE and GEO standards of interoperability. The document contains large cross-tables showing correspondences of the available datasets and observation systems with the end-user needs and GEO Societal Benefit Areas. The document provides recommendations to the enviroGRIDS project on some solutions to fill the identified gaps.

Executive Summary

The enviroGRIDS project aims to gather, store, distribute, analyze, visualize and disseminate crucial information on the environment of the Black Sea catchment in order to increase the capacity of decision-makers and other interested stakeholders to use it for development of most relevant management options. It will build a state of the art Grid-enabled Spatial Data Infrastructure (G-SDI) that will become a component of the Global Earth Observation System of Systems (GEOSS) targeting the needs of the Commission on the Protection of the Black Sea Against Pollution (short name: Black Sea Commission or BSC) and the International Commission for the Protection of the Danube River (ICPDR).

The aim of the gap analysis is to identify the list of existing datasets and observation systems within the Black Sea catchment and to assess their level of compatibility with the INSPIRE and GEO standards of interoperability. The gap analysis will allow identifying areas where further efforts are needed to reinforce existing observation systems in this region.

The gap analysis was undertaken by BSC PS and ICPDR with contribution of all project partners. Generalized requirements to the data and observation systems have been formulated on the base of end-user needs (primarily BSC, ICPDR)   as well as the project requirements.

An online Questionnaire for gap analysis has been developed in order to get information from project partners, to the best of their knowledge, about available datasets and observation systems at different scales, from local and national to regional and global. In total, information about 162 datasets and 30 observations systems covering the Black Sea catchment has been received. This information was supplemented with an extensive Internet search. All collected information was analyzed in order to produce cross-tables showing the availability of identified datasets and observation systems for the end-user needs and for GEO Societal Benefit Areas (SBA).

The analysis of the identified datasets and observation systems against the project requirements revealed spatial and temporal gaps in data coverage, gaps in observation systems, problems with data accessibility, compatibility and interoperability. Some recommendations to the enviroGRIDS project on filling the identified gaps have been elaborated, including proposals on involving new partners and collaboration with related projects.

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Introduction

Scope and purpose of the Task 2.1

The purpose of the Task 2.1 Gap Analysis is to establish a list of existing environmental and non-environmental datasets and observation systems within the Black Sea catchment and to assess their correspondence to the project needs and level of compatibility with the INSPIRE and GEOSS standards of interoperability.

The gap analysis is carried out under the supervision of BSC PS and ICPDR with involvement of all enviroGRIDS partners in order to get a picture of the state of development of Earth Observation Systems and Spatial Data Infrastructures in the different countries within the Black Sea catchment. The recommendations derived from the gap analysis aim at complementing the existing information systems of the ICPDR and BSC.

The aim of the gap analysis is also to identify projects and new partners that could contribute to address priority gaps in the activities and observation systems of BSC and ICPDR. The allocated budget for this purpose should be enough to involve two or three new partners into the project consortium. Apart from this allocated budget, co-financing will be searched to allow the integration of new partners according to the results of the gap analysis. An improved collaborations with other projects is also needed (e.g. euroGEOSS, UPGRADE Black Sea Scene) as well as efforts to get the results of previous projects (e.g. Black Sea Scene, SESAME).

The enviroGRIDS project is now an official task in the work plan of the Group of Earth Observations (GEO) to set up the Global Earth Observation System of Systems (GEOSS). GEOSS is built upon, and adding value to, existing and planned Earth observation systems by connecting them to one another. The enviroGRIDS project will build capacity for assembling fragmented and often inaccessible environmental data into interoperable, contiguous and readily available data streams in the complete catchment. A large catalogue of environmental data sets (e.g. land use, hydrology, and climate) will be gathered and used to perform distributed spatially-explicit simulations to build scenarios of key environmental changes. This gap analysis is thereby one of the first steps on building the capacity on Earth Observation Systems in the Black Sea catchment.

According to the enviroGRIDS Document of Work (DoW), the gap analysis is planned in two phases with corresponding deliverables D2.6 by Month 12 and Month 24 of the project duration. The DoW does not contain exact definition of activities in each phase. Following the recommendations of the kick-off meeting (April 2009) and meeting of work packages leaders (October 2009) the scope and activities of each phase were defined as follows:

- Phase 1 should focus on identification of available data and respective observation systems for the Black Sea catchment region and their initial analysis against project and end-user needs,
- Phase 2 should deal with the analysis of compatibility of the datasets and observation systems with INSPIRE and GEO standards of interoperability, improving the initial analysis and formulating recommendations for improvement of networks of data acquisition in each region/country.

The task 2.1 will contribute to the main target of WP2 – development of the Spatial Data Infrastructure (SDI) for the Black Sea catchment region by providing information for a large catalogue of environmental data sets (e.g. land use, hydrology, and climate) to be gathered and used to perform distributed spatially-explicit simulations and to build scenarios of key environmental changes.

The vision of an SDI incorporates different databases, ranging from the local to international, into an integrated information highway that constitutes a framework, needed by a community, in order to make effective use of geospatial data.

The vision is to encourage existing observation systems in the Black Sea catchment to register their institution as a GEOSS components, their metadata, and if possible their data and processing services as well.

Scope and purpose of the deliverable D2.6

This document aims to provide an overview of user needs, available data and observation systems in the Black Sea catchment region and analysis of the gaps with respect to the project and end-user data requirements.

The different chapters of the deliverable cover the following points:
- Analysis of data requirements
- Overview of available data
- Overview of available observation systems
- Gap analysis

The analysis of the available data for the Black Sea catchment region is done on following scales: global, European, regional and country level.

Approach used for gap analysis

According to the project DoW the Task 2.1, the Gap Analysis has to be done by all partners under the supervision of BSC PS and ICPDR. First, the BSC PS and ICPDR (also being the main end-users of the enviroGRIDS project) undertook an analysis of their own data usage, availability, needs and gaps, with their vision for the required observation systems and networks.

Further, a Questionnaire for the gap analysis of Observation Systems and Spatial Data Infrastructure has been developed. The online version of the Questionnaire (see Annex I) was implemented by CCSS and made available at the http://quest.envirogrids.cz/prihlaseni.php web page. All partners have been requested to contribute to the Questionnaire by providing information about used and available data, observation systems and information networks within their areas of activity from local, national to regional scales.

In addition, project partners were requested to provide lists of their end-users and respective data needs. In order to complement the information provided by project partners an intensive Internet search for available data and OS was performed.

The collected information has been analyzed for identification of: a) user needs, b) data and OS availability, and c) gaps in data and observation systems.

Presentation of the contributors

Volodymyr Myroshnychenko

Volodymyr Myroshnychenko is the expert working in the Permanent Secretariat Commission on the Protection of the Black Sea Against Pollution (BSC PS) for the enviroGRIDS project. He has a master degree in Automated Control Systems. His subject is the management of marine data and information. After graduating from Kharkov Polytechnic Institute in Ukraine he worked in the Marine Hydrophysical Institute in Sevastopol, then in the Institute of Marine Sciences of the Middle East Technical University in Turkey. From 2005-2007, he worked as Data and Information Management Expert at the Project Coordination Unit of the Caspian Environment Programme. In the enviroGRIDS project, he is involved in the implementation of WP2.

Dan Teodor

Dan Teodor is the GIS Expert at ICPDR to assist in the development and maintenance of the ICPDR GIS system and in particular in ensuring the uploading data from representatives of the Danube countries. He joined the ICPDR from the company responsible for water management in Romania (National Administration ―Apele Romane" Bucharest, Romania) where he was responsible for the organization of GIS and data collection for the EU Water Framework Directive. In the enviroGRIDS project, he is involved on WP2 (Spatial Data Infrastructure) to perform and supervise the gap analysis (Task 2.1) and Grid-enabled Spatial Data Infrastructure (Task 2.7) to exchange data in various format and projections within the Black Sea catchment.

Alex Hoebart

Alex Hoebart is the ICPDR Technical Expert on Information Management and GIS. He is responsible for the management of the ICPDR Expert Group dealing with information management and has extensive experience in organizing and operating information systems and electronic data collection. He is also responsible for the development of the Accident Early Warning System of the ICPDR and the purchase and maintenance of hardware to secure effective storage and utilization of information within the ICPDR.

Petr Uhlir

Petr Uhlir is the software specialist, web designer and SEO specialist working in the Czech Center for Science and Society (CCSS). He graduated from the electrotechnical Faculty of the Czech Technical University in Prague, subject: software technologies and management - web and multimedia. In the enviroGRIDS project, he developed the online Questionnaire for gap analysis.

Project partners

Following project partners contributed to the gap analysis by filling the Questionnaire: AZBOS, BSC PS, CCSS, DDNI, DHMO, Geographic, IBSS, ICPDR, IGAR, ONU, TNU, UAB, UNIGE, USRIEP, and VITUKI.

Following project partners contributed into the gap analysis by providing information about their end-users and end-users needs and expectations: BSC PS, BSREC, DDNI, ICPDR, ONU, and SPSU.

Analysis of data requirements

EnviroGRIDS project data requirements

The general aim of the project is to build capacities in the Black Sea region to use new international standards to gather, store, distribute, analyze, visualize and disseminate crucial information on past, present and future states of this region, in order to assess its sustainability and vulnerability. Among main deliverables of the project there will be a Black Sea catchment Observation System for decision-makers, and an Observation System for citizens, which will provide near real time dissemination of environmental data and information as well as forecasts on various environmental aspects (floods, pollution etc).

The development of the Black Sea catchment Observation System relies heavily on the work carried out in the work packages WP2, and, particularly, WP3, WP4 and WP5, which indeed require a lot of data and information, both historical and operational.

The aim of WP3 is to develop scenarios of future changes in the region. This will be done by development of the three modules listed below and by integrating their outputs:
- Demographic change module,
- Climate change module,
- Land cover change module.

The respective data requirements of each module are presented in Table 1.

Table 1 WP3 data requirements

Data Name	Requirements
Demography	
Population	Best resolution available, including historical data for last 4 reference years since 1970
Politico-administrative	At national and subnational levels
Settlements	At national and subnational levels, vector and raster
Climate	
Geographical characteristics of the watersheds	Best resolution available
Soil characteristics	Best resolution available
Air Temperature	Climatic time series
Precipitation	Climatic time series
Land cover	
Land cover	Best resolution available, including historical data
Land use	Best resolution available, including historical data

The Soil & Water Assessment Tool (SWAT) mainly specifies the data requirements of WP4. The SWAT is a river basin scale model developed to quantify the impact of land management practices in large, complex watersheds. It performs simulations that integrate various processes such as hydrology, climate, chemical transport, soil erosion, pesticide dynamics, and agricultural management. The model can use a daily to sub-hourly time step, and can perform continuous simulation for a 1- to 100-year period. SWAT has an ArcGIS interface, which takes layers of information such as soil, land cover, elevation, and management, and calculates hydrology, erosion, and chemical transport both inland and in-stream.

Table 2 WP4 data requirements

Data Name	Requirements
SWAT	
Digital Elevation Model (DEM) map	Resolution of 90m x 90m or better.
Land use map	Resolution 1 km or better
Soil map	Best available resolution. The map should be accompanied with soil database having following parameters: - Number of soil layers up to 10 may be specified - Soil Hydrologic group (A, B, C, or D) - Maximum rooting depth (mm) - Textural class of first soil layer - Depth from soil surface to bottom of each layer (mm) - Moist bulk density (g/cm^3) - Available water capacity (mm H2O/mm soil) - Saturated hydraulic conductivity (mm/hr) - Organic carbon content (% soil weight) - Clay content (% soil weight) - Silt content (% soil weight) - Sand content (% soil weight) - Rock fragment content (% total weight) - Moist soil albedo - Soil erodibility factor, K, in USLE equation
Stream network map	Best available resolution. River names are required
Climate data	Data from as many climate stations in the region as possible including: - Location (lat, long, elevation) of the climate stations - Daily precipitation (mm) - Daily Max temperature (°C) - Daily Min temperature (°C) - Wind speed (m/s) (if available) - Relative humidity (if available) - Solar radiation (MJ/m^2/day) (if available)
Reservoir operation information	At least data from larger reservoirs that including: - Year and month the reservoir became operational - Reservoir surface area when the reservoir is filled to the emergency spillway (ha) - Volume of water needed to fill the reservoir to the emergency spillway (10^4 m3) - Reservoir surface area when the reservoir is filled to the principal spillway (ha) - Volume of water needed to fill the reservoir to the principal spillway (10^4 m3) - Initial reservoir volume - Initial sediment concentration in the reservoir (mg/L) - Equilibrium sediment concentration in the reservoir (mg/L) \ - Hydraulic conductivity of the reservoir bottom (mm/hr) - Daily reservoir outflow (m^3/s)
Inlets	- Lat and long for any inlet to the watershed - Daily data for any inlet (optional)
Agricultural management data	- Planting and harvest date - Fertilization information (when, where, how much) - Tillage operation (method, date) - Irrigation (source, date, amount)

	- Grazing - Tile drains (exits or not, if yes, at what depth) - Pesticide application - Crop rotation
Water management	- Water transfer information - Water use from shallow and deep aquifer, river, and ponds
River discharge data at hydrometric stations	Data from as many stations as possible are required including: - Lat and Long of the stations - The river names where the stations are located - Daily river discharge (m^3/s) - River water quality data (see below)
Crop yield data	- Annual yield for major crops in the region
Water quality at hydrometric stations	- Sediment load transported by the river (daily, or monthly) (tn), or River sediment concentration (mg/l) - Nitrate load transported by the river (kg N) - Phosphorus load transported by the river (kg P) - Dissolved oxygen transported by the river (kg O_2) - Algal biomass transported by river (kg) - Other chemicals such as: NH4, NO2, Mineral P, organic P, Organic N, CBOD
Point sources	- Input from waste water treatment plants (Lat-Long location and quantity and quality of discharged water) - Springs (Lat-Long location, quantity and quality)
Urban data	- Information on the build-up/wash-off of solids in urban areas
Other	
Population density	Best available resolution
Live stock density	Best available resolution

The WP5 involves the analysis of the impacts of the climate, land use and demographic scenarios on river catchment processes, primarily water quality and quantity. Based on the analysis the impacts of all these changes will be assessed on selected Societal Benefit Areas (SBA) in the present and the future. The emphasis will be on impacts on ecosystems, biodiversity, agriculture, health, energy and disasters early warning. The respective data requirements are presented in Table 3.

Table 3 WP5 data requirements

Data Name	Requirements
Biodiversity	
Historical biodiversity data	
Invasive alien species	
Indicator species	
Remote sensing images	
Ecosystems	
Plankton	Long term historical data
Atmospheric anomalies	Long term data on North Atlantic Oscillation (NAO) to study linkage with plankton community changes
Bioproductivity of natural ecosystems	
High and medium spatial resolution satellite images	Multispectral - in order to extract land use, land cover and vegetation types information
Agriculture	Data on national and subnational level
DEM	
Land use and land use changes	
Climate	
Soil	

Fertilizers	
Pesticides	
Irrigation, water use	
Management	
Crop yield	
Economic data	
Energy	
Solar and wind measurements	In Turkey and Bulgaria
Health	
Water quantity and water quality change data	Output of WP3 and WP4
Remote sensing data on vegetation cover, landscape structure, and water bodies	Time series – output of T2.4
Disasters Early warning	
Meteorological and hydrological data	
Flood information	Forecast and historical information for Risk Assessment
Fire information	Historical data on fires in Crimean forests
Invasive alien species	

Note: the integrated assessment of environmental impacts on agricultural production in the Black Sea catchment will be done with the help of GEPIC model, which is compatible to the SWAT model, therefore data requirements for Agriculture SBA in WP5 are overlapped with those of WP4.

End users data requirements

BSC data requirements

The enviroGRIDS project end-users are identified as follows:
- International organizations dealing with environmental issues in the region;
- National authorities responsible for themes of enviroGRIDS;
- Local authorities
- Scientists

From the first category of international organizations listed above, the Black Sea Commission (BSC) and the International Commission for the Protection of the Danube River (ICPDR) are considered as the main end-users of the project.

The mission of the BSC is the implementation of the Convention on the Protection of the Black Sea Against Pollution (Bucharest Convention, 1992), its Protocols and Strategic Action Plan (SAP) for the rehabilitation and protection of the Black Sea, which was updated in 2009.

The primary geographical scope of the Bucharest Convention is the Black Sea. In addition, the SAP covers pollution sources from coastal area and stipulates Black Sea coastal states to make effort to implement relevant provisions of the SAP at the Black Sea basin (catchment) level. The new Protocol on the Protection of the Marine Environment of the Black Sea from Land-Based Sources and Activities, pending for ratification by Black Sea states, also applies to pollution emissions originating from land-based point and diffuse sources, which reach the marine environment through rivers or other watercourses; inputs of polluting substances transported through the atmosphere; and activities that may directly or indirectly affect the marine environment or coastal areas. Considering the above, the whole Black Sea catchment is in area of interest of BSC with respect to implementation of its mission.

The activities of BSC are addressed to the following major transboundary problems:
- Eutrophication/Nutrient Enrichment;
- Chemical Pollution, including Oil;
- Changes in Marine Living Resources, Overfishing;
- Biodiversity Changes/Habitats Loss, including Alien Species Introduction;

- Climate Change.

In order to carry out the activities on a regular basis BSC has established following Advisory Groups (AG):
- AG on pollution monitoring and assessment (PMA);
- AG on control of pollution from land based sources (LBS);
- AG on development of common methodologies for integrated coastal zone management (ICZM);
- AG on environmental safety aspects of shipping (ESAS);
- AG on conservation of biological diversity (CBD);
- AG on environmental aspects of the management of fisheries and other marine living resources (FOMLR); and
- AG on information and data exchange (IDE).

AGs of BSC have Focal Points in each Black Sea country, which are responsible for collection of data and information in area of their responsibility and reporting them on an annual basis to the Commission via its Permanent Secretariat (BSC PS). The reported data and information, which are obtained in the framework of the Black Sea Integrated Monitoring and Assessment Programme (BSIMAP), are used for periodical assessment of the State of Environment (SoE) of the Black Sea (annually and every 5 years for changes and trends); Transboundary Diagnostic Analysis (every 5 years) and assessment of SAP implementation (every 5 years).

The data requirements of the BSC are summarized in the Table 4.

Table 4 BSC data requirements

Data Name	Requirements
Eutrophication/Nutrient Enrichment	
Nutrients loads from point and diffuse sources	River discharges Municipal discharges (coastal zone) Industrial sources (coastal zone) Atmospheric deposition to the Black Sea
Nutrients, oxygen in sea water	
Data on algal bloom	
Secchi disk data	
Chemical Pollution	
Pollution loads from point and diffuse sources	River discharges Municipal discharges (coastal zone) Industrial sources (coastal zone) Atmospheric deposition to the Black Sea
Concentration of pollutants in sea water, sediments, and biota	Parameters defined in BSIMAP
Oil spills	Data of satellite and aerial surveillance, information on accidents, SAR images of oil pollution
Data for modeling of oil spill propagation	Meteorological data, SST, altimetry, wind, sea wind, currents with best available resolution
Changes in Marine Living Resources	
Stocks of commercially important fish species	
Catches and by-catches	
Aquaculture production	
Fishing fleet capacity	
Biodiversity Changes/Habitats Loss	

Phytoplankton, zooplankton, benthos	
Indicator species	
Invasive alien species	
Habitats population dynamics data	
Habitats mapping	
Land cover change	Black Sea coastal zone
Coastline change	
Climate Change	
SST	
Chlorophyll (*in-situ* and remote sensing)	
Sea level and its anomalies from altimetry data	
Data of oceanographic observations in open sea	
Data from automatic buoys (e.g. Argo)	

ICPDR data requirements

The International Commission for the Protection of the Danube River (ICPDR) works to ensure the sustainable and equitable use of watershed freshwater resources in the Danube River Basin. The work of the ICPDR is based on the Danube River Protection Convention, the major legal instrument for cooperation and transboundary water management in the Danube River Basin.

The International Commission for the Protection of the Danube River (ICPDR) is a transnational body, which has been established to implement the Danube River Protection Convention. The ICPDR is formally comprised by the Delegations of all Contracting Parties to the Danube River Protection Convention, but has also established a framework for other organizations to join.

In 2000, the ICPDR has also been nominated the platform for the implementation of the transboundary aspects of the EU Water Framework Directive (WFD). The work for the successful implementation of the EU WFD is therefore high on the political agenda of the countries of the Danube river basin district.

Today national delegates, representatives from highest ministerial levels, technical experts, and members of the civil society and of the scientific community cooperate in the ICPDR to ensure the sustainable and equitable use of waters in the Danube River Basin.

Since its creation in 1998, the ICPDR has effectively promoted policy agreements and the setting of joint priorities and strategies for improving the state of the Danube and its tributaries. This includes improving the tools used to manage environmental issues in the Danube basin, such as:
- the Accident Emergency Warning System,
- the Trans-National Monitoring Network for water quality, and
- the information system for the Danube (Danubis),
- DanubeGIS.

The goals of the ICPDR:
- Safeguarding the Danube's Water resources for future generation,
- Naturally balanced waters free from excess nutrients,
- No more risk from toxic chemicals,
- Healthy and sustainable river systems,
- Damage-free floods.

The different bodies of the ICPDR are:
- Ordinary Meeting Group: taking the political decisions,
- Standing Working Group: providing political guidance,

- Technical Expert Groups: preparing the technical background documents.

Technical Expert Groups are the backbone of the operation and the success of the ICPDR. They are formed by national experts from the Contracting Parties and representatives of the observer organizations. Seven Expert Groups deal with a variety of issues - from policy measures to reduce water pollution to the implementation of the EU Water Framework Directive.

All technical work within the ICPDR is carried out by the Expert Groups. These Expert Groups are essential to the operation of the ICPDR, and rely upon the inputs and contributions of national experts from the Contracting Parties and from the Observers. In 2008, four Expert Groups dealt with technical issues, while three ad-hoc Expert Groups addressed specific questions and support the respective Expert Groups and/or other ICPDR bodies on request.

Expert Group on River Basin Management

The Expert Group on River Basin Management (RBM EG) defined and prepared tasks related to the implementation of the EU Water Framework Directive in the Danube River Basin, the Roof Report 2004 and coordinating the development of the Danube River Basin Management Plan by 2009 is currently finalizing.

Pressures and Measures Expert Group

The Pressures and Measures Expert Group (PM EG) identifies the causes of pressures and promotes measures to address them. Harmonizing the work of the ICPDR with the EU directives (e.g. UWWT Directive, Nitrates Directive, IPPC Directive) is another issue. The current priority of this Expert Group is to develop the Joint Programme of Measures, which is part of the Danube River Basin Management Plan. This Expert Group also works with pollution prevention and precautionary controls, including inventories of potential accident risk spots and old contaminated sites in areas liable to flooding.

Monitoring and Assessment Expert Group

The Monitoring and Assessment Expert Group (MA EG) is responsible for issues concerning water quality assessment and classification, including the operation of the Trans-National Monitoring Network and Analytical Quality Control. The operation of the Accident and Emergency Warning System, and the communication of alarm/warning messages in the event of accidents are also managed by the MA EG. During 2001 and 2007, this expert group also carried out the Joint Danube Surveys.

Expert Group on Flood Protection

The Expert Group on Flood Protection (FLOOD EG) has been responsible for developing the Action Programme for Sustainable Flood Protection in the Danube River Basin and is currently overseeing its implementation at the national level.

Information Management and GIS Expert Group

Under the Information Management and Geographical Information System Expert Group (IM + GIS EG) the series of maps of the Danube River Basin and the Strategic Plan for a Danube River Basin GIS have been developed. The Expert Group supports all activities related to the operation of the information system.

Public Participation Expert Group

The task of the Public Participation Expert Group (PP EG) is to support and provide input to ICPDR activities regarding communication and participation issues.

Strategic Expert Group

The ad hoc Strategic Expert Group (ad hoc S EG) addresses administrative and legal matters arising from the implementation of the DRPC.

The Expert Groups have the possibility to form TASK GROUPS, if specific tasks involving specific experience arise. Task Groups involve experts from the group and/or additional experts. Task Groups have specific mandates and their work is usually time limited.

The **Danube-Black Sea Joint Technical Working Group** co-ordinates the work of the ICPDR and the International Commission for the Protection of the Black Sea, particularly aiming to reduce nutrient inputs into the Black Sea.

The proposal of data requirements between BSC and ICPDR are summarized in the Table 5.

Table 5 ICPDR proposal of data requirements

Data Name	Requirements
Nutrient concentrations in the water column	
Secchi depth	
Turbidity	
Chlorophyll-a	
Macro-algae (indicative species) presence/absence	
Oxygen content	
Phytoplankton	key groups in numbers, biomass, and average volume of cells
Zooplankton	biomass/percentage of key groups, number of Noctiluca
Macro-zoobenthos	biomass, percentage of key groups
Pollutants – inorganic and organic	
Water level	
Climatic information	temperature, precipitation
Atmospheric deposition	
Land properties and resources	
Groundwater parameters	
Marine biology parameters	

Project partners data requirements

Total 22 project partners (from 27) contributed to the filling of the Questionnaire. Ten partners provided all requested information, while others provided information partially. Three partners informed that within their areas of activities they are not dealing with data collection or analysis and therefore do not possess/use any datasets. Even so, the amount of different data types used, collected or operated by the partners is impressive. The data of key interest include:

- GIS data (various themes such as river network, roads, settlements, forest cover, social & healthcare, infrastructure, soils, etc.);
- Demographical data (population, population structure by sex, population structure by age, birth rates, mortality rates, natural population increase, divorces, migrations etc.);
- High-resolution DEM data;
- Socio-economic data;
- Agriculture data (structure of arable land, land improvement systems, livestock density, management practice, number of farmers in ecological agriculture etc.);
- Land cover, land use and changes, dynamics of landscapes, detailed land use maps (indicating different types of infrastructure);
- Forestry;
- Vegetation, vegetation index;
- Soil (detail characteristics, temperature, moisture) ;
- Aerial survey and orthophoto imagery (B&W, color, infrared);
- Satellite remote sensing data;
- Protected areas data;
- Land biodiversity data (birds, reptiles, mammals, insects, plant communities);
- Marine biological and biodiversity data (phyto- and zooplankton, ichtiofauna, macroinvertable, etc.);

- River biology data (Chlorophyll-a, phyto- and zooplankton, macro-algae , macro-zoobenthos, fish);
- Records of alien species;
- Fish catches;
- Meteorological data, gridded rainfall maps (for flood events);
- Hydrological data, data on river discharge, reservoir operation, water transfer, sediment load, components of water balance, i.e. rainfall, runoff;
- Oceanographic data (physical, chemical, optical) ;
- Sea water quality data (nutrients, organic and inorganic pollutants);
- River water quality (nutrient concentrations in the water column, pollutants, oxygen)
- Data on pollution loads from various point sources;
- Atmospheric pollution;
- Shipping activities and offshore installations, accidents in the sea (including oil spills);
- Natural and technological hazards;
- Climatic parameters, CO_2, greenhouse gases;
- Energy potential;
- Geological data.

Among data of potential interest most often partners indicated:
- Data related to pollution including pollutants in atmosphere and their deposition, emission balances, pollutants in river and sea waters, nutrient concentrations, data on water quality, hydrochemistry, pollution effects on biodiversity (8 partners);
- Data on hydrology including data on watershed, hydrochemistry, water level and groundwater (8 partners);
- Climate change parameters such as GHG, temperature, precipitation, sea level, distribution of snow and ice cover, effects on biodiversity etc. (7 partners);
- Data on land cover, land use and soil (4 partners);
- Marine biology parameters such as plankton, ichthyofauna, macroinvertebrates (2 partners);
- Various GIS data (2 partners)

Other data of potential interest include aerial surveys, lidar data; data on road navigation system, renewable energy sources, ecology, geology, meteorology, flora and fauna, anthropogenic pressure, marine protected areas, population distribution, vessel traffic, and marine litter.

All listed above data types can be considered as those, which are required, by project partners and their end-users regardless of whether they are collected by partners themselves or obtained through national / international observation systems, services or networks.

Generalized data requirements

The amount of different data types required by the project and project end-users is very large. Moreover, requirements to spatial and temporal resolution of each kind of data are also very diverse, so gaps analysis with respect to each data type would be time consuming and impracticable.

Hereby we undertook attempt to generalize data requirements by identifying those of them which are most important for the project and its end-users. The generalized data requirements are presented in Table 6.

Table 6 Generalized enviroGRIDS data requirements

Data theme / category	Resolution	
	Spatial	**Temporal**
GIS satisfying project requirements and user needs, i.e. including detailed watersheds, protected areas, land use etc.	At least 1:200000	Most recent
DEM	30m	Most recent
Land cover /use	1km, 300m, 100m	since 1990
Soil	1km	
Population	Administrative data downscaled at 1km	since 1990
Meteorology (in situ)	All existing stations in Black Sea catchment	Daily
Meteorology (remote sensing)	0.25°	Daily
Hydrology	All existing stations in Black Sea catchment	Daily
Oceanography (in situ)	Stations in coastal waters of Black Sea countries and in open sea	Quarterly
Oceanography (remote sensing)	Whole Black Sea	Daily
Pollutants discharges	All industrial and municipal sources in Black Sea catchment	Monthly
Pollutants emissions	Per enterprises or administrative units	monthly
Pollutants in water, sediments and biota	Black Sea	According to monitoring program (e.g.: 1/year for sediments and biota, 4/year for water column)
River water quality	All existing stations in Black Sea catchment	monthly
Sea water quality	Stations in coastal waters of Black Sea countries and open sea	quarterly
Climatic data (climatic stations)	All existing stations in Black Sea catchment	Daily
Climatic data (remote sensing)	Best available (1x1km)	monthly, daily (depending on data)
River biology	Best available	quarterly
Marine biology	Best available	quarterly
Biodiversity	Best available	quarterly
Invasive species		
Agriculture	Administrative units	yearly
Disasters	Best available	permanent monitoring

Available datasets

In the Questionnaire project partners reported 162 datasets as collected and/or operated by them, and 32 datasets as used or related to the work of partners' organizations. Table 8 presents initial statistic of reported datasets:

Table 8 Number of reported datasets by project partners

	AZBOS	BSC PS	CCSS	DDNI	DHMO	Geographic	IBSS	ICPDR	IGAR	ONU	TNU	UAB	UNIGE	USRIEP	VITUKI	Total
Own or operated datasets	16	8	3	6	14	32	3	8	32	4	2	25	4	4	1	162
Used datasets	2	5	3		1	6	1	5	6				2	1		32

The reported datasets are very heterogeneous in terms of data themes, spatial and temporal coverage and resolution, data formats and access methods. The datasets were grouped on global, European, regional (Black Sea and Danube) and country scales. The list of datasets of global and European scales was further extended with the help of an Internet search.

For each scale a cross-table was produced that allows to get a view of data availability per scale "extent" and to identify which data and/or observation system could answer the needs of BSC, ICPDR, SWAT, and GEOSS Societal Benefits Areas (SBA). Metadata catalogs, reported by partners, were not included in the cross-tables because they do not contain actual data, however they are recommended for further data discovery.

The legend for cells in the cross-tables presented further in this chapter is as follows:

  A: Accessible – data from this dataset can be accessed and used for non-commercial purposes;

  E: Exist –data exist but access to data is restricted or charged;

  U: Useful – data from the dataset are useful for cross-linked category, however to learn on data accessibility it is necessary to look at other cells in the same row whether they contain **A** or **E.**

  NA: Not Applicable – the cross-linked dataset is not applicable to current end-user needs category, for example, Georgians national datasets are not applicable to end-user needs of ICPDR

  Empty cell: it means that linkage between dataset and end-user needs category does not exist or not identified.

For convenience of the gap analysis the datasets of the same data theme belonging to the same partner were aggregated and presented in cross-tables as single items. This procedure was applied, for example, to numerous biodiversity datasets of AZBOS (aggregated into ―AZBOS biodiversity database"), meteorological datasets of DHMO (aggregated to ―Hydro-meteorological database of DHMO"), hazards datasets of IGAR (aggregated into ―Hazards Database"), satellite imagery datasets of Geographic, etc.

Global scale

Dataset name	Category	BSC priority transboundary problems					ICPDR	Project / SWAT	GEOSS SBAs									Resolution	Web link
		Eutrophication	*Chemical pollution*	*Changes in marine living resources*	*Biodiversity changes*	*Climate change*			*Disasters*	*Health*	*Energy*	*Climate*	*Water*	*Weather*	*Ecosystems*	*Agriculture*	*Biodiversity*		
ESRI maps	GIS	A	A		U	A		E	E	E	E	U	E	U	E	E	E	various	http://www.esri.com/
UNIGE GIS datasets	GIS	E	E		E	E		E	E	E	E	U	E	U	E	E	E	various	
VMap0	GIS	A	A		U	A		A	U	U	U	U	U	U	U	U	U	1:1000000	http://www.mapability.com/info/vmap0_index.html
VMap1	GIS	E	E		U	A		E										1:250000	http://www.mapability.com/info/vmap1_index.html
GRUMP	Population	A	U		U	U		A	A	A	A	A	A		A	A	U	30"	http://sedac.ciesin.columbia.edu/gpw/
GPW	Population	A	U		U	U		A	A	A	A	A	A		A	A	U		http://sedac.ciesin.columbia.edu/gpw/
LandScan	Population	A	U		U	U		A	A	A	A	A	A		A	A	U	30"	http://www.ornl.gov/sci/landscan/index.html
ASTER GDEM	DEM	A	A					A	A		A	U	A		A	A	U	30m	http://www.ersdac.or.jp/GDEM/E/2.html
SRTM DEM	DEM	A	A					A	A		A	U	A		A	A	U	90m	http://www2.jpl.nasa.gov/srtm/
Globcover	Land cover	A	A		A	A		A	A	A		A	A		A	A	A	300m	http://ionia1.esrin.esa.int/index.asp
MODIS Land Cover Type product	Land cover	A	A		A	A		A	A	A		A	A		A	A	A	500m	https://lpdaac.usgs.gov/lpdaac/products/modis_products_table
DSMW v. 3.5	Soil	E	E		U	U		E	E	E		U	E		E	E	U	1:5000000	http://www.fao.org/ag/agl/lwdms.stm

Dataset name	Category	BSC priority transboundary problems					ICPDR	Project / SWAT	GEOSS SBAs									Resolution	Web link
		Eutrophication	*Chemical pollution*	*Changes in marine living resources*	*Biodiversity changes*	*Climate change*			*Disasters*	*Health*	*Energy*	*Climate*	*Water*	*Weather*	*Ecosystems*	*Agriculture*	*Biodiversity*		
HWSD v 1.1	Soil	A	A		U	U		A	A	A		U	A		A	A	U	1km	http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/index.html?sb=1
ERS/MetOp Soil Moisture	Soil	A	A		U	U		A	A	A		U	A		A	A	U	50km	http://www.ipf.tuwien.ac.at/radar/index.php?go=ascat
Global Runoff Database	Hydrology	A	A			A		A	A	U	A	A	A	A	U	U		at stations	http://www.bafg.de/cln_016/nn_294146/GRDC/EN/Home/homepage__node.html?__nnn=true
Hydroweb	Hydrology	A	A			A		A	A	U	A	A	A	A	U	U		major water bodies and wetlands	http://www.legos.obs-mip.fr/en/soa/hydrologie/hydroweb/
GPCP Precipitation	Meteorology	A	A			A		A	A	A	A	A	A	A	A	A	U	1°	http://precip.gsfc.nasa.gov/
TMPA (precipitation)	Meteorology	A	A			A		A	A	A	A	A	A	A	A	A	U	0.25°	
TRMM (rainfall)	Meteorology	A	A			A		A	A	A	A	A	A	A	A	A	U	0.25°	http://trmm.gsfc.nasa.gov/data_dir/data.html
Global Rainfall Map	Meteorology	A	A			A		A	A	A	A	A	A	A	A	A	U	0.1°	http://sharaku.eorc.jaxa.jp/GSMaP/
WorldClim (precipitation, T°)	Climate	A	A			A		A	A	A	A	A	A	A	A	A	U	1km	http://www.worldclim.org/
CRU TS 2.1 (precipitation, T°, vapor pressure,	Climate time series	A	A			A		A	A	A	A	A	A	A	A	A	U	1km	http://www.cru.uea.ac.uk/cru/data/hrg/timm/grid/CRU_TS_2_1.html

Dataset name	Category	BSC priority transboundary problems					ICPDR	Project / SWAT	GEOSS SBAs									Resolution	Web link
		Eutrophication	Chemical pollution	Changes in marine living resources	Biodiversity changes	Climate change			Disasters	Health	Energy	Climate	Water	Weather	Ecosystems	Agriculture	Biodiversity		
cloud cover)																			
Climate of the World (T°, wind, pressure, precipitation etc)	Climate stations data	A	A			A		A	A	A	A	A	A	A	A	A	U	stations	http://www.ncdc.noaa.gov/oa/wdc/index.php
SST	Ocean	A	U	U	U	A			A			A	A	A	A		U	1km+	numerous web sites
Ocean color data (Chl)	Ocean	A	U	A	A	A			A	A		A	A	A	A		U	1km+	http://oceancolor.gsfc.nasa.gov/
Ocean surface wind	Ocean	A	A			A			A		A	A	A	A				25km	http://manati.orbit.nesdis.noaa.gov/ascat/
Sea Level anomalies	Ocean	U	U	A	A	A			A		A	A	A	A	A	A	A		http://www.aviso.oceanobs.com/en/data/products/sea-surface-height-products/global/index.html
UNEP Geo Data Portal	various themes	U	U	U	U	U			A	A	A	A	A	A	A	A	A	1km+ / Country	http://geodata.grid.unep.ch/webservices/
International Energy Agency (IEA) energy statistics	Energy								E		E	E						Country	http://data.iea.org/ieastore/statslisting.asp
PREVIEW Global Risk Data Platform	Disasters	A	A	A	A	A			A	A	A	A	A	A	A	A	A	events	http://preview.grid.unep.ch/

EU/European scale

Dataset name	Category	BSC priority transboundary problems					ICPDR	Project / SWAT	GEOSS SBAs									Resolution	Web link
		Eutrophication	Chemical pollution	Changes in marine living resources	Biodiversity changes	Climate change			Disasters	Health	Energy	Climate	Water	Weather	Ecosystems	Agriculture	Biodiversity		
EuroGlobalMap	GIS	E	E		U	E		E	E	E	E	U	E	U	E	U	E	1:1000000	http://www.eurogeographics.org/content/products-services-eurodem
EuroRegionalMap	GIS	E	E		U	E		E	E	E	E	U	E	U	E	U	E	1:250000	http://www.eurogeographics.org/products-and-services/euroregionalmap
EuroBoundaryMap v4.0	GIS	E	E		U	E		E	E	E	E	U	E	U	E	U	E	1:100000	http://www.eurogeographics.org/products-and-services/euroboundarymap
EuroDEM	DEM	A	A						A	A		A	U	A		A	A	U	60m	http://www.eurogeographics.org/content/products-services-eurodem
CLC1990 raster	Land cover	U	U		U	A		A	A	U		A	A		A	A	U	100m	http://www.eea.europa.eu/data-and-maps/data/corine-land-cover-clc1990-100-m-version-12-2009
CLC2000 vector	Land cover	U	U		U	A		A	A	U		A	A		A	A	U	100m	http://www.eea.europa.eu/data-and-maps/data/corine-land-cover-2000-clc2000-seamless-vector-database-1

Dataset name	Category	BSC priority transboundary problems					ICPDR	Project / SWAT	GEOSS SBAs									Resolution	Web link
		Eutrophication	*Chemical pollution*	*Changes in marine living resources*	*Biodiversity changes*	*Climate change*			*Disasters*	*Health*	*Energy*	*Climate*	*Water*	*Weather*	*Ecosystems*	*Agriculture*	*Biodiversity*		
CLC2000 raster	Land cover	U	U		U	A		A	A	U		A	A		A	A	U	100m	http://www.eea.europa.eu/data-and-maps/data/corine-land-cover-2000-clc2000-100-m-version-12-2009
CLC2006 raster	Land cover	U	U		U	A		A	A	U		A	A		A	A	U	100m	http://www.eea.europa.eu/data-and-maps/data/corine-land-cover-2006-clc2006-100-m-version-12-2009
Population density disaggregated with Corine land cover 2000	Population	A	U		U	U		A	A	A	A	A	A		A	A	U	100m	http://www.eea.europa.eu/data-and-maps/data/population-density-disaggregated-with-corine-land-cover-2000-2
ESBD V.2	Soil	A	A		U	U		A	A	A		U	A		A	A	U	1:1000000	http://eusoils.jrc.ec.europa.eu/ESDB_Archive/ESDBv2/index.htm
ESBD V.2 raster	Soil	A	A		U	U		A	A	A		U	A		A	A	U	1km	http://eusoils.jrc.ec.europa.eu/ESDB_Archive/ESDB_data_1k_raster_intro/ESDB_1k_raster_data_intro.html
Degree of soil sealing	Soil	A	A		U	U		A	A	A		U	A		A	A	U	100m	http://www.eea.europa.eu/data-and-maps/data/eea-fast-track-service-precursor-on-land-monitoring-degree-of-soil-sealing-100m
EEA Waterbase	Water quality	A	A	U	U	U		A	U	A		U	A		A	A	U	rivers, water bodies, coastal waters	several datasets at http://www.eea.europa.eu/data-and-maps/data/

Dataset name	Category	BSC priority transboundary problems					ICPDR	Project / SWAT	GEOSS SBAs									Resolution	Web link
		Eutrophication	Chemical pollution	Changes in marine living resources	Biodiversity changes	Climate change			Disasters	Health	Energy	Climate	Water	Weather	Ecosystems	Agriculture	Biodiversity		
Sediment discharges	Water quality	A	A	U	U	U			U	A		U	A		U	A	A	at stations	http://www.eea.europa.eu/data-and-maps/data/sediment-discharges
Airbase	Air quality	A	A		U	U			A	A		U			U	A	U	at stations	http://www.eea.europa.eu/data-and-maps/data/airbase-the-european-air-quality-database-1
EMEP grids reprojected by EEA (emissions)	Air quality	A	A		U	U			A	A		U			U	A	U	50km	http://www.eea.europa.eu/data-and-maps/data/emep-grids-reprojected-by-eea
Air pollutants (emissions)	Air quality	A	A		U	U			A	A		U			U	A	U	country	numerous data sources at http://www.eea.europa.eu/
Greenhouse gases emissions	Air quality, climate	A	A		U	A			A	A		A			A			country	numerous data sources at http://www.eea.europa.eu/
Eurostat Statistics Database	Socio-economic	A	A	A	U	U			A	A	A	U	A		A	A	U	country/ major provinces	http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database
Nature 2000	Protected areas			A	A	U			A	A		U	A		A	A	A		http://www.eea.europa.eu/data-and-maps/data/natura-2000
Nationally designated areas	Protected areas			A	A	U			A	A		U	A		A	A	A	100m	http://www.eea.europa.eu/data-and-maps/data/nationally-designated-areas-national-cdda-4

Dataset name	Category	BSC priority transboundary problems					ICPDR	Project / SWAT	GEOSS SBAs									Resolution	Web link
		Eutrophication	Chemical pollution	Changes in marine living resources	Biodiversity changes	Climate change			Disasters	Health	Energy	Climate	Water	Weather	Ecosystems	Agriculture	Biodiversity		
REABIC database	Ecosystem, invasive species			A	A	U			A			U	A		A		A		http://www.reabic.net/map_europe.html
GRID-Europa Datasets -GNV	Climate, soils, vegetation, water, socio-economic, population, GIS	A	A	A	A	A		A	A	A	A	A	A	A	A	A	A	various	http://www.grid.unep.ch/data/data.php
E-PRTR	pollutant emissions to air, water and land	A	A	U	U	A	A	A	A	A	A	A	A		U	A	U	country	http://prtr.ec.europa.eu/

Regional scale

Black Sea

Dataset name	Category	BSC priority transboundary problems					ICPDR	Project / SWAT	GEOSS SBAs									Resolution	Web link
		Eutrophication	*Chemical pollution*	*Changes in marine living resources*	*Biodiversity changes*	*Climate change*			*Disasters*	*Health*	*Energy*	*Climate*	*Water*	*Weather*	*Ecosystems*	*Agriculture*	*Biodiversity*		
Black Sea Information System (BSIS)	Water quality, ecosystem, ICZM	A	A	A	A	U		E	U	E		U	E		E		E	stations / country	mailto:secretariat@blacksea-commission.org
Black Sea Surveys data	Sea water quality	A	A	A	A	U			A	A		U	A		A		A	stations	mailto:secretariat@blacksea-commission.org
Black Sea TDA GIS	GIS	U	U	A	A	U			A	A		U	A		A		A	1:100000, 1:200000	mailto:secretariat@blacksea-commission.org
NATO TU-Black Sea database	Ecosystem	A	A	A	A	U			U	A		U	A		A		A	stations	http://sfp1.ims.metu.edu.tr/ODBMSDB/
Black Sea Oceanographic Database	Ecosystem	E	E	A	A	U			U	A		U	A		A		A	stations	For CD apply to IMS METU http://www.ims.metu.edu.tr/
Mnemiopsis leidyi Database	Ecosystem, biodiversity			A	A	U			A			U	A		A		A	stations	http://ps-blacksea-commission.ath.cx/MLDB/
Black Sea SLA	Sea level anomalies	U	U	U	A	A			A	A	A	A	A		A		A	1/8°	http://www.aviso.oceanobs.com/en/data/products/sea-surface-height-products/regional/m-sla-black-sea/index.html

															Web link
Climatic Maps (T°, Salinity, Density, O2, H2S)	Climate	A	A	U	U	A		U	U	A	A	U		U	http://www.ims.metu.edu.tr/SeaDataNet/indexclimat.asp?doc=inSituProductDescription.htm
Satellite Averaged Maps (SST, Chl)	Climate	A	A	U	U	A		U	U	A	A	U		U	http://www.ims.metu.edu.tr/SeaDataNet/indexsat.asp?doc=satelliteProductDescription.htm

Danube

Dataset name	*Category*	BSC priority transboundary problems					*ICPDR*	*Project / SWAT*	GEOSS SBAs									*Resolution*	*Web link*
		Eutrophication	*Chemical pollution*	*Changes in marine living resources*	*Biodiversity changes*	*Climate change*			*Disasters*	*Health*	*Energy*	*Climate*	*Water*	*Weather*	*Ecosystems*	*Agriculture*	*Biodiversity*		
DanubeGIS	GIS	U	U		U	U	A	E										different scales	http://www.danubegis.org/
TNMN database	Water quality, hydrology	E	E			U	A	E											www.icpdr.org/wq-db
Bucharest Declaration database	Water quality	E	E			U	A	E											www.icpdr.org/danubis
Danube Surveys database	Water quality	E	E			U	A	E											www.icpdr.org/danubis
Emissions Inventory	Water pollution	E	E			U	A	E											www.icpdr.org/danubis
Investment Projects database	Socio-economic						A	E											www.icpdr.org/projects-db
DRBMP Economic analysis	Socio-economic						A	E											

Country scale

Georgia

Dataset name	Category	BSC priority transboundary problems					ICPDR	Project / SWAT	GEOSS SBAs									Resolution	Web link
		Eutrophication	Chemical pollution	Changes in marine living resources	Biodiversity changes	Climate change			Disasters	Health	Energy	Climate	Water	Weather	Ecosystems	Agriculture	Biodiversity		
GIS Basemap	GIS	U	U		U	U	NA		E	E	E	E	E		E	E	E	1:50000+	
Topographic DB	GIS	U	U		U	U	NA		E	E	E	E	E		E	E	E	1:50000+	
Municipal DB (Tbilisi, district)	GIS	U	U		U	U	NA		E	E	E	E	E		E	E	E		
Population data	Population	U	U		U	U	NA	E	E	E	E	E	E		E	E	U		http://napr.gov.ge/index.php?m=222
DEM	DEM	E	E		U	U	NA	E	E		E	U	E		E	E	U		
Forestry	Land use	U	U		U	U	NA	E	E	E		E	E		E	E	E		
Land Cadastre	Land use	U	U		U	U	NA	E	E	E		E	E		E	E	E		
Geology	GIS						NA		E	E	E	E	E		E	E	E	1:500000	
Soil	Soil	E	E		U	U	NA	E	E	E		U	E		E	E	U		
Healthcare facilities database	Socio-economic						NA			E									
Disasters management database	Disasters	U	U		U		NA		E	E		U	E		E	E	U		

Dataset name	Category	BSC priority transboundary problems					ICPDR	Project / SWAT	GEOSS SBAs									Resolution	Web link
		Eutrophication	*Chemical pollution*	*Changes in marine living resources*	*Biodiversity changes*	*Climate change*			*Disasters*	*Health*	*Energy*	*Climate*	*Water*	*Weather*	*Ecosystems*	*Agriculture*	*Biodiversity*		
Orthophotos	Imagery	U			U		NA		E	U			U		E	E	U		
Aerial imagery	Imagery	U			U		NA		E	U			U		E	E	U	1:8000	
Satellite imagery (IKONOS, IRS, KATE, Landsat, Resurs, Aster, KVR)	Imagery	U			U	U	NA		E	U		E	E		E	E	U	1m+	
Rioni River database	Water quality	E	E	U	U	U	NA	E	U	E		U	E		E	E	U		

Romania

Dataset name	Category	BSC priority transboundary problems					ICPDR	Project / SWAT	GEOSS SBAs									Resolution	Web link
		Eutrophication	*Chemical pollution*	*Changes in marine living resources*	*Biodiversity changes*	*Climate change*			*Disasters*	*Health*	*Energy*	*Climate*	*Water*	*Weather*	*Ecosystems*	*Agriculture*	*Biodiversity*		
Administrative	GIS	U	U		U	U			E	E	E	E	E		E	E	E		http://www.mmediu.ro/
Demographic Dataset	Population	A	U		U	U		A	A	A	A	A	A		A	A	U	NUTS3, NUTS5	
Agriculture Dataset	Land use, socio-economic	A	A		U	U		A	U	U		U	A		A	A	U	NUTS3, NUTS5	
Soil	Soil	E	E		U	U		E	E	E		U	E		E	E	U		http://www.mmediu.ro/
Romanian river register	GIS, hydrology	E	E		U	U		E	E	E	E	E	E		E	E	E		http://www.mmediu.ro/
Hydrological datasets	Hydrology	E	E		U	U		E	E	E	E	E	E		E	E	E		
Meteorological datasets	Meteorology	U	U		U	U		E	E	E	E	E	E		E	E	E		
Natura 2000	GIS, Protected areas			E	E	U		E	E	E		U	E		E	E	E		http://www.mmediu.ro/
Danube delta vegetation map	Land cover	E	E		E	E		E	E	E		E	E		E	E	E		http://www.mmediu.ro/
Climatic Dataset	Climate	A	A			A		A	A	A	A	A	A	A	A	A	U		

Dataset name	Category	BSC priority transboundary problems					ICPDR	Project / SWAT	GEOSS SBAs									Resolution	Web link
		Eutrophication	*Chemical pollution*	*Changes in marine living resources*	*Biodiversity changes*	*Climate change*			*Disasters*	*Health*	*Energy*	*Climate*	*Water*	*Weather*	*Ecosystems*	*Agriculture*	*Biodiversity*		
Hazards Database of IGAR (natural, technologic)	Disasters	E	E	E	E	E		E	E	E	E	E	E	E	E	E	E		
NIMRD database	Marine living resources, hydrology, hydrochemistry, biology			E	E	U						U			E		E		
Administrative	GIS	U	U		U	U			E	E	E	E	E		E	E	E		http://www.mmediu.ro/
Demographic Dataset	Population	A	U		U	U		A	A	A	A	A	A		A	A	U	NUTS3, NUTS5	

Ukraine

Dataset name	Category	BSC priority transboundary problems					ICPDR	Project / SWAT	GEOSS SBAs									Resolution	Web link
		Eutrophication	Chemical pollution	Changes in marine living resources	Biodiversity changes	Climate change			Disasters	Health	Energy	Climate	Water	Weather	Ecosystems	Agriculture	Biodiversity		
AZBOS biodiversity database	Biodiversity			E	E	U						U			E		E	Actual observations	http://ornitology.narod.ru/english/index.html
Hydrochemical data of the Sea of Azov basin	Water quality	U	U					E	U				E					Actual observations	http://ornitology.narod.ru/english/index.html
Socio-economic data	Socio-economic	E	E		U	U		E	E	E	E	U	E		U	E	U	Per administrative units	http://niiep.kharkov.ua/eng/index.php
Point pollution sources	Water quality	E	E	U	U			E	U	E			E		U		U	points	http://niiep.kharkov.ua/eng/index.php
2TP-vodkhoz	Water quality	E	E	U	U			E	U	E			E		U	E	U		
Pollution load with rivers to the Black Sea	Water quality	E	E	U	U			E	U	E			E		U	E	U	points	http://niiep.kharkov.ua/eng/index.php
Zooplankton in the Sevastopol Bay	Biodiversity			E	E	E		A	U	E		E	E		E		E	at stations	http://www.ibss.org.ua/Default.aspx?tabid=508

Dataset name	Category	BSC priority transboundary problems					ICPDR	Project / SWAT	GEOSS SBAs									Resolution	Web link
		Eutrophication	Chemical pollution	Changes in marine living resources	Biodiversity changes	Climate change			Disasters	Health	Energy	Climate	Water	Weather	Ecosystems	Agriculture	Biodiversity		
IBSS Data and Metadata Access Portal	Marine biology, oceanography	E	E	E	E	E		E	U	E		E	E		E		E	at stations	http://data.ibss.org.ua/
Hydro-meteorological database of DHMO	Hydrology, meteorology	E	E			E		E	E	E	E	E	E	E	U	E		actual measurements	
Water quality database of ONU	Water quality	E	E	U	U			E	U	E			E		U	E	U	actual measurements	http://www.onu.edu.ua/?type=en&action=monitoring_center
Greenhouse gases and aerosols at st. Petrodoloskoye	Air quality	E	E			E		E		E		E						at stations	http://www.onu.edu.ua/?type=en&action=monitoring_center
Natural reserves of Crimea	Protected areas			E	E	U		E	E	E		U	E		E	E	E		http://www.ccssu.crimea.ua/tnu/eng/structure/geo_fac/geoecology/index.html

Hungary

Dataset name	Category	BSC priority transboundary problems					ICPDR	Project / SWAT	GEOSS SBAs									Resolution	Web link
		Eutrophication	*Chemical pollution*	*Changes in marine living resources*	*Biodiversity changes*	*Climate change*			*Disasters*	*Health*	*Energy*	*Climate*	*Water*	*Weather*	*Ecosystems*	*Agriculture*	*Biodiversity*		
OPADAT	Hydrology, meteorology	U	U			U			E		E	E	E	E	E	E	E	stations	http://www.hydroinfo.hu

Annex II contains details of the datasets that are presented in the cross-tables.

Available observation systems, networks and services

Project partners indicated about 30 observations systems and networks through the Questionnaires. Data of Earth observation systems (EOS, i.e. satellite based observation systems) are used by 14 organization, mostly for research purposes (11) as well as in operational mode (UAB, meteo-organizations).

Ten organizations participate in different data exchange networks of different scales:
- Global: 2 (WMO GTS, IODE)
- European: 3 (EIONET, Atmospheric pollution in framework of NEU FP6 project, European Research and Stakeholder Network on Aquatic Invasive Species)
- Regional: 5 (ICPDR network, Danube Commission for Navigation, Black Sea Scientific Network)

Project partners submit information into the following data centers: ICPDR, BSC PS, UNIGE-GRID, and national hydro-meteorological centers.

As in case of datasets, the observation systems were grouped on global, European, regional (Black Sea and Danube) and country scales. The list of observation systems from Questionnaires was further extended with the help of the Internet search (mainly this relates to EOS of global scale).

Most of the existing observation systems are multipurpose, i.e. one observation system can produce different data types. Vice versa, data of the same type can be produced by different observation systems. Considering the fact that end-users usually define their need through requirements to data rather than to observation systems, it was decided to analyze the observation systems with respect to the data, which they are able to produce.

The format of produced cross-tables for observation systems of global, European and regional scales is similar to that one for datasets and aims to indicate ability of observation systems to meet needs of BSC, ICPDR, project (SWAT), and GEOSS Societal Benefits Areas. The last table (section 0) related to the country scale provides list of identified national observation networks, services and/or respective national agencies.

Global observation systems

Category	Observation system (instrument) / network	BSC priority transboundary problems					ICPDR	Project / SWAT	GEOSS SBAs								
		Eutrophication	Chemical pollution	Changes in marine living resources	Biodiversity changes	Climate change			Disasters	Health	Energy	Climate	Water	Weather	Ecosystems	Agriculture	Biodiversity
Satellite based																	
Land cover, vegetation	Landsat, Terra, Aqua, SPOT	U	U		A	U	A	U	U	U	U	U	U		A	A	A
Soil moisture	METOP	A	A				A	A					A			A	
Surface temperature	NOAA	A	U	A	U	A			A			A	A	A	A	A	U
Atmosphere	Terra, Aqua	U	U			A			A	A	A	A	A	A		A	
Elevations	Terra (ASTER)	A	A					A	A		A	U	A		A	A	U
Sea color, Chl, algal blooms	Aqua (MODIS, EOS (MERIS)	A	A	U	U	A			A	A		A	A		U		U
Weather	Meteo satellites, Terra, Aqua, TRMM	A	A			A		A									
Oil spills	RADARSAT, ERS (SAR)	E	E	U	U				E	E			E		U		U
Hi-resolution imagery	SPOT, IKONOS, IRS etc	U	U	U	E				E	E			E		E	E	E
Sea Level Heights	Jason, Envisat	U	U			A			A		A	A	A	A			
Sea wind	METOP (ASCAT)	U	U			A			A		A	A	A	A			
Disasters (flood, forest fire)	ERS, Terra, Aqua	U	U	U	U	E		E	E			E	E	E	U	E	U
Rainfall	TRMM	U	U			A		A	A		A	A	A	A	U	A	U

Category	Observation system (instrument) / network	BSC priority transboundary problems					ICPDR	Project / SWAT	GEOSS SBAs								
		Eutrophication	*Chemical pollution*	*Changes in marine living resources*	*Biodiversity changes*	*Climate change*			*Disasters*	*Health*	*Energy*	*Climate*	*Water*	*Weather*	*Ecosystems*	*Agriculture*	*Biodiversity*
Integrated																	
Weather, climate, hydrology	WMO Global Observing System (GOS) comprises observing facilities on land, at sea, in the air and in outer space, owned and operated by the Member countries of WMO.	U	U	U	U	E		E	E		E	E	E	E	U	E	U
State of the oceans	Global Ocean Observing System (GOOS) comprising of satellites, ARGO floats, autonomous data buoys, Voluntary Observing Ships (VOS), Global Sea-Level Observing System (GLOSS) to observe atmospheric and oceanographic conditions.	U	U			A			A		E	A	A	A	U		
Data exchange																	
Weather, climate, hydrology	WMO GTS (Global Telecommunication System)	E	E			E		E	E		E	E	E	E		E	
Oceanography	International Oceanographic Data Exchange (IODE) of IOC UNESCO	A	A	A	A	A			A			A	A	A	A		A

The details of satellite based observation systems can be found in the project deliverable D2.4 ―EnviroGRIDS remote sensing data use and integration guideline".

OS of European scale

Category	Observation system (instrument)	Eutrophication	Chemical pollution	Changes in marine living resources	Biodiversity changes	Climate change	ICPDR	Project / SWAT	Disasters	Health	Energy	Climate	Water	Weather	Ecosystems	Agriculture	Biodiversity
		BSC priority transboundary problems							**GEOSS SBAs**								
Satellite based data products	Satellites of European Space Agency (ESA)	E	E	U	U	E		E	E		E	E	E	E	E	E	E
	GENESI-DR project data repositories	A	U	U	U	A		A	A			A	A	A	U	A	U
Various data products	Joint Research Centre (JRC)	E	E	E	E	E	A	E	E		E	E	E	E	E	E	E
Weather, meteorology	European Centre for Medium-Range Weather Forecasts (ECMWF)	U	U			A		E	A		A	A	A	A	U	A	U
Flooding	European Floods Alert System (EFAS)	U	U			U	A	E	E			E	E	E	E	E	U
Water	Water Information System for Europe (WISE)	U	U	U	U	U	A	A	A	A	A	A	A	A	A	U	U
River discharges	European Terrestrial Network for River Discharge (ETN-R)	E	E			E		E	E		E	E	E	E	E	E	
Invasive species	European Research Network on Aquatic Invasive Species (ERNAIS)			A	A			A					A		A		A
Protected areas	NATURE 2000			A	A			A							A		A
Environment	European Environmental Information and Observation Network (Eionet)	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
	European Environmental Agency	A	A		A		A	A		A			A		A	A	A
Climate	European Network of greenhouse gases					A			A		A						
Pollution	POPs European Monet network		E						E								

OS of regional scale

Black Sea OS / networks / programs

Category	Observation system / network / program	BSC priority transboundary problems					ICPDR	Project / SWAT	GEOSS SBAs								
		Eutrophication	*Chemical pollution*	*Changes in marine living resources*	*Biodiversity changes*	*Climate change*			*Disasters*	*Health*	*Energy*	*Climate*	*Water*	*Weather*	*Ecosystems*	*Agriculture*	*Biodiversity*
State of the sea	Black Sea Global Ocean Observing System (Black Sea GOOS); MyOcean and ECOOP projects	A	A			A	NA		A			A	A	A			
Sea level anomalies	AVISO Black Sea	A	A			A	NA					A	A				
SST, Chl	NOAA and Aqua satellites data processed at local data center (Marine Hydrophysical Institute, Ukraine)	A	A	U	U	A	NA		A			A	A	A	U		U
Weather	Marine Hydrophysical Institute, Ukraine	A	A			A	NA		A			A		A			
Oceanography	Black Sea Oceanographic Data and Information Network (ODIN Black Sea)	A	A	A	A	A	NA					A	A		A		A
State of environment and ecosystem	Black Sea Integrated Monitoring and Assessment Programme (BSIMAP) implemented by Black Sea countries	A	A	A	A	A	A					A	A		A		A
	Black Sea Scientific Network (Black Sea Scene project)	A	A	A	A	A	A										

enviroGRIDS – FP7 European project

Building Capacity for a Black Sea catchment

Observation and Assessment supporting Sustainable Development

Danube basin OS / networks / programs

Category	Observation system (instrument)	Eutrophication	Chemical pollution	Changes in marine living resources	Biodiversity changes	Climate change	ICPDR	Project / SWAT	Disasters	Health	Energy	Climate	Water	Weather	Ecosystems	Agriculture	Biodiversity
Hydrology, water quality	Transnational Monitoring Network (TNMN)	U	U				A	E	E	E	E	E	E	U	E	E	E
Hydrology, hydrometeorology	Danube Commission for Navigation	U	U				E	E	E		E	E	E	U	U	E	U
Accidental Pollution	Accident Emergency Warning System (AEWS)	E	E	E	E		A	E	E	E			E	E	E	E	E

National observation system / services / responsible agencies

Data category	Country					
	Bulgaria	*Georgia*	*Romania*	*Russia*	*Turkey*	*Ukraine*
Land cover / use			Research Institute for Soil Science and Agrochemistry	Ministry of Regional Development, Administration of Krasnodar Kray (Black Sea coastal zone)	Ministry of Environment and Forestry, Ministry of Agriculture and Rural Affairs, Environmental Protection Agency for Special Areas (EPASA), municipalities, Statistics, Ministry of Tourism, Ministry of Industry and Trade	State Committee on Land Resources, National Space Agency of Ukraine
Soil	Ministry of Agriculture	Ministry of Regional Development and Infrastructure	Research Institute for Soil Science and Agrochemistry	Ministry of Agriculture, Ministry of Regional Development, Administration of Krasnodar Kray (Black Sea coastal zone)	Ministry of Environment and Forestry, Ministry of Agriculture and Rural Affairs, Environmental Protection Agency for Special Areas (EPASA)	State Committee on Land Resources, Ministry of Agrarian Policy of Ukraine
Hydrology	National Institute of Meteorology and Hydrology, Bulgarian Academy of Sciences	Ministry of Environment protection and Natural Resources	National Water Administration, National Institute of Hydrology and Water Management	Roshydromet, Rosprirodnadzor, Federal Water Resources Agency	Ministry of Environment and Forestry, Electrical Affairs Survey Authority	State Hydrometeorological Service
Water quality	Minister of Environment and Water	Ministry of Environment protection and Natural Resources	National Water Administration	Roshydromet, Rosprirodnadzor, Federal Water Resources Agency	Ministry of Environment and Forestry, Ministry of Agriculture and Rural Affairs	State Hydrometeorological Service, Ministry for Environmental Protection of Ukraine

Data category	Country					
	Bulgaria	*Georgia*	*Romania*	*Russia*	*Turkey*	*Ukraine*
Pollutants	Minister of Environment and Water	Ministry of Environment protection and Natural Resources	National Water Administration, Ministry of the Environment	Rostehnadzor, Rosprirodnadzor	Ministry of Environment and Forestry, Ministry of Health	Ministry for Environmental Protection of Ukraine
Weather, climate	National Institute of Meteorology and Hydrology, Bulgarian Academy of Sciences	Ministry of Environment protection and Natural Resources	National Meteorological Administration	State Meteorological Service	State Meteorological Service	State Hydrometeorological Service, Ministry for Environmental Protection of Ukraine
Disasters		Ministry of Environment protection and Natural Resources	National Meteorological Administration	Roshydromet, Ministry of Emergency Situations	State Meteorological Service	Ministry of Ukraine of Emergencies and Affairs of Population Protection from the Consequences of Chornobyl Catastrophe
Biodiversity	Bulgarian Academy of Sciences	Ministry of Environment protection and Natural Resources	National Institute for Marine Research and Development	Russian Academy of Sciences	Ministry of Environment and Forestry	National Academy of Sciences of Ukraine, Ministry of Education and Science of Ukraine

Gap analysis

Analysis of gaps in data

The datasets reported by project partners cover all 9 GEOSS Societal Benefits Areas. The initial statistic (before grouping) of relevance of the reported datasets to SBAs is presented in Table 9. The GEOSS SBAs in this table are sorted according to their relevance frequency. Statistic shows that most of the datasets are related to the Water, Ecosystems, and Climate SBAs, while least covered SBAs are Energy, Weather and SBAs. Considering that Energy and Health are among selected GEOSS benefit areas to be dealt by enviroGRIDS project, and that Weather data are crucial for SWAT model and Disasters SBA (also one of the selected SBAs) the limited amount of available data for these 3 SBAs is identified as a gap.

The gaps in data related to the Energy SBA at national level is confirmed by BSREC, which informs about lack of data for the characteristic of wind at various heights needed for investigation of energy potential of wind. The collection of such information needs investments in metering devices, software and computer systems and cannot be done soon.

Table 9 Relevance of partner's datasets to GEOSS SBAs

Datasets	GEOSS SBAs								
	Water	*Ecosystems*	*Climate*	*Agriculture*	*Disasters*	*Biodiversity*	*Energy*	*Weather*	*Health*
Collected / operated by partners	61	57	50	50	47	41	33	21	21
Used by partners	15	13	12	10	8	10	7	3	6

The methods of access to data are various: direct Internet links, ftp, e-mail, CD. The datasets of country scale are usually not accessible online and have to be requested via e-mail from data holders. The variety of formats for data storage, as well as absence of online access to the data hamper the data exchange and appear to be a significant gap for the datasets at country scale.

In the Questionnaire project partners reported national datasets only for four countries: Georgia, Hungary, Romania and Ukraine, whereas Black Sea catchment is situated on the territory of 23 countries. Thus, there is a large spatial gap in data coverage at country scale. This gap is partly covered by available regional and European scale datasets containing data from Danube basin countries, however for the rest of the Black Sea catchment the problem persists.

With respect to the river basins of the Black Sea Catchment:
- Danube river basin has the best data coverage. Data are available on all scales: global, European, regional and national;
- The large river basins of Ukraine (Dnepr, Dniester, Bug) seem to have rather acceptable data coverage, however due to lack of access to data it is difficult to assess their completeness;
- For the large river basins of Russia (Don, Kuban) and Turkey (Kizilirmak, Yesilirmak) (see Figure 1) project partners did not report any dataset. This is identified as a significant gap in data, particularly taking into account that these river basins are important for the project end-users and decision-makers: they cover large territories populated by millions of people and have important socio-economic value for these countries.

Figure 1: River basins in the Black Sea catchment with least data availability for the project

The analysis of data availability with respect to the project and end-users needs is presented in the Table 10. The analysis is done against most important for enviroGRIDS data themes and categories, requirements to which were defined earlier in Chapter 0 (see Table 6).

The legend to the Table 10:

> **A**: Accessible;
> **E**: Exist, but access to data is limiter / restricted;
> **M**: Missing**.**

Some cells of the table, usually related to country scale, contain two marks, for example ―A/M‖. It means that data are available partly, e.g. data exist for EU countries and are missing for non-EU countries of the Black Sea Catchment.

Table 10 Availability of datasets for enviroGRIDS project and end-users

Data theme / category	Resolution		Availability for project at different scales				Comment
	Spatial	Temporal	Global	European	Regional	National	
GIS satisfying project requirements and end-user needs, i.e. including detailed watersheds, protected areas, land use etc.	At least 1:200000	Most recent	M	M	E	E/M	The required GIS of regional scale exist in BSC PS and ICPDR, however they do not cover whole Black Sea Catchment, and their usage is restricted. The national GIS should exist in the countries, however only one such GIS was reported in Questionnaire with restricted access. We assume that GIS in other countries are either restricted or missing.
DEM	30m	Most recent	A	-	-	-	Global dataset meets requirements.
Land cover /use	1km	since 1990	M	A/M	A/M	A/M	European datasets meet requirements but covers only EU countries. Global and European datasets are not compatible. National datasets from non EU countries were not reported. UAB is working on GlobCorine at 300m resolution covering all Black Sea catchment.
Soil	1km		A	A	-	-	Global and European datasets meet requirements. European dataset is derived from Soil Geographical Database of Eurasia available at scale 1:1,000,000. National datasets may have better resolution (two such datasets were reported), however the issue of their compatibility has to be studied.
Population	100m	since 1990	M	A/M	M	E	European datasets meet requirements but covers only EU countries.
Meteorology (in situ)	All existing stations in Black Sea catchment	Daily	E	E	E	E	Data on all scales exist but are rather not accessible. The freely accessible global dataset contains very few data from the Black Sea Catchment.
Meteorology (remote sensing)	0.25°	Daily	A	-	-	-	Global dataset meets requirements.
Hydrology	All existing stations in Black Sea	Daily	E	E	E	E	Data on all scales exist but are rather not accessible. The freely accessible global dataset contains

Data theme / category	Resolution		Availability for project at different scales				Comment
	Spatial	Temporal	Global	European	Regional	National	
	catchment						very few data from the Black Sea Catchment.
Oceanography (in situ)	Stations in coastal waters of Black Sea countries and in open sea	Quarterly	M	M	M	M/A	The frequency of observations at all scales is not enough (except some countries, such as Romania)
Oceanography (remote sensing)	Whole Black Sea	Daily	A	-	A	-	Global and regional datasets meet requirements.
Pollutants discharges	All industrial and municipal sources in Black Sea catchment	monthly	M	M	E	E	Data of regional scale are available.
Pollutants emissions	Per enterprises or administrative units	monthly	M	M	M	E	Spatial resolution of data on global, European and regional level is not enough (data are reported either per country). National data usually exist but are not accessible.
Pollutants deposition from atmosphere	Coastal zone	monthly	M	M	M	M	The network of stations measuring athmospheric deposition in coastal zone is poor.
Pollutants in sea water, sediments and biota	Black Sea	According to monitoring program	M	M	E/M	E/M	Data exist with gaps, particularly with respect to pollutants in sediments and biota.
River water quality	All existing stations in Black Sea catchment	monthly	M	E/M	E/M	E/M	Data are not freely accessible. Data at some stations do not meet frequency requirements.
Sea water quality	Stations in coastal waters of Black Sea countries and open sea	quarterly	M	M	M	M	The frequency of observations at all scales is not enough (except some countries, such as Romania)
Climatic data (climatic stations)	All existing stations in Black Sea catchment	Daily	E	E	E	E	Data on all scales exist but are rather not accessible. The freely accessible global dataset contains very few data from the Black Sea

Data theme / category	Resolution		Availability for project at different scales				Comment
	Spatial	Temporal	Global	European	Regional	National	
							Catchment.
Climatic data (remote sensing)	Best available (1x1km)	monthly, daily (depending on data)	A	-	A	-	Global and regional datasets meet requirements.
River biology	Best available	quarterly	M	M	E	E/M	Data may not meet temporal requirements.
Marine biology	Best available	quarterly	M	M	M	A/M	Data do not meet temporal requirements in most cases.
Biodiversity	Best available	quarterly	M	M	E/M	E/M	Data do not meet temporal requirements in most cases.
Invasive species			M	E/M	M	E/M	The European network ERNAIS poorly covers Black Sea Catchment
Agriculture	Administrative units	yearly	M	M	E	E	Data of required spatial resolution are not freely accessible.
Disasters	Best available	permanent monitoring	E	E	E	E	Data exist but may be not accessible to the project particularly at country scale.

The analysis of available data confirmed assumption that for most categories required data exist at least at one of the scales: global, European, regional or national. The analysis also confirmed that the accessibility of data is one of the main problems. The data of global and European scale are mostly free, while access to the data on regional and national level is usually limited or restricted. For such data categories as climatic, hydro-meteorological, agricultural, and pollutants discharges data of required spatial and temporal resolution are not accessible, which is considered as a significant gap, because these data are crucial for running and calibrating the SWAT model.

The most problematic data categories are:
- Pollutants deposition from atmosphere,
- Oceanography (in situ),
- Sea water quality
- Marine biology and biodiversity.

For these categories, the data of required spatial and, particularly, temporal resolution are missing. All these data categories are among the priority data needs of the Black Sea Commission.

Analysis of gaps in observation systems

The list of available observation systems provided in Chapter 0 clearly demonstrates that satellite based platforms and instruments are becoming a main tool for Earth observation. The success of Earth observation systems (EOS) first of all is predetermined by such factors as operability, uniqueness of obtained information, possibility to cover by measurements large territories at once, possibility to obtain information on remote areas, and relatively low cost of remote sensing observations in comparison with other methods. These factors are especially important in case of oceanic and sea

observation, which experience a lack of research resources as due to huge areas to be covered as due to high costs of observations.

However, due to limitations of remote sensing methods the applicability of satellite based Earth observation systems is mainly related to the Earth surface and atmosphere. For example, EOS is not able to measure concentration of pollutants in river and sea waters; identify changes in biodiversity; obtain exact values of crop yields. On the other hand, for the listed above examples, EOS can help to trace propagation of pollution in the sea; assess potential changes in biodiversity due to land cover change; provide estimate of year's yield on the base of climate and rainfall data. Thus, the maximum benefit can be achieved when resources of the Earth observation systems from space are combined with the resources of traditional observation systems, networks and services. EnviroGRIDS projects aims at reaching this objective by coordinating the development of a Black Sea catchment Observation System.

The available observations systems were analyzed regarding their ability to satisfy the project and end-users data requirement. Based on the fact, that all required data types exist in the Black Sea catchment, we conclude that respective observation systems, networks and services also exist. The identified gaps in data may result from different factors such as imperfection of respective observation systems, scarcity of monitoring networks, weakness of data exchange mechanisms and services. However, the results of the gap analysis of the available datasets clearly indicate that in most cases the real problem is the limited or restricted access to data produced by observation systems rather than gaps in observation systems. The relevant problems are also not developed ownership of datasets and lost datasets after projects are completed.

With respect to the most problematic data categories identified in the previous chapter, we conclude that they result from the gaps in observation systems, i.e. the capacity of monitoring networks / services for following data types:
- pollutants deposition from atmosphere,
- oceanography (in situ),
- sea water quality, and
- marine biology and biodiversity

does not correspond to end-user requirements.

The datasets, produced with the help of Earth observation systems operated by ESA, in most cases have data coverage limited to the territory of EU, while the Black Sea catchment extends significantly to the territories of non-EU countries. Due to the problem of data compatibility, the application of high resolution qualitative ESA EOS data for the project needs can be limited, instead the project may need to use the global datasets of lower quality. So this limitation of ESA EOS datasets in geographical coverage is considered as a gap.

The main component of the future Black Sea catchment Observation System will be the Spatial Data Infrastructure (SDI), which will allow integrate different types of data required by the project and end-users within the GEO and INSPIRE framework. Thus, the issue of the correspondence of observation systems to INSPIRE and GEO interoperability standards is getting high importance. The situation at the global, European and regional scale is quite satisfactory. This follows from the fact that there are already many datasets at these scales registered in the GEOSS portal, but this is likely not to be the case for data at the country scale, though we could not prove this due to lack of information.

SDI can clearly help improve the situation of data and metadata exchange among partners and beyond. The project decided therefore to concentrate its capacity building efforts through courses dedicated to high-level decision makers capable of changing national data policies in one hand, and to technicians capable of setting new local SDI needed to register existing data and metadata flows into GEOSS and INPSIRE.

EnviroGRIDS will improve metadata flows by encouraging data holders of the Black Sea to register their information through the CCSS URM platform, which itself will be able to harvest GEOSS and INSPIRE catalogs of metadata. The Catalogue Service for the Web (CWS) standard will be used for metadata flows.
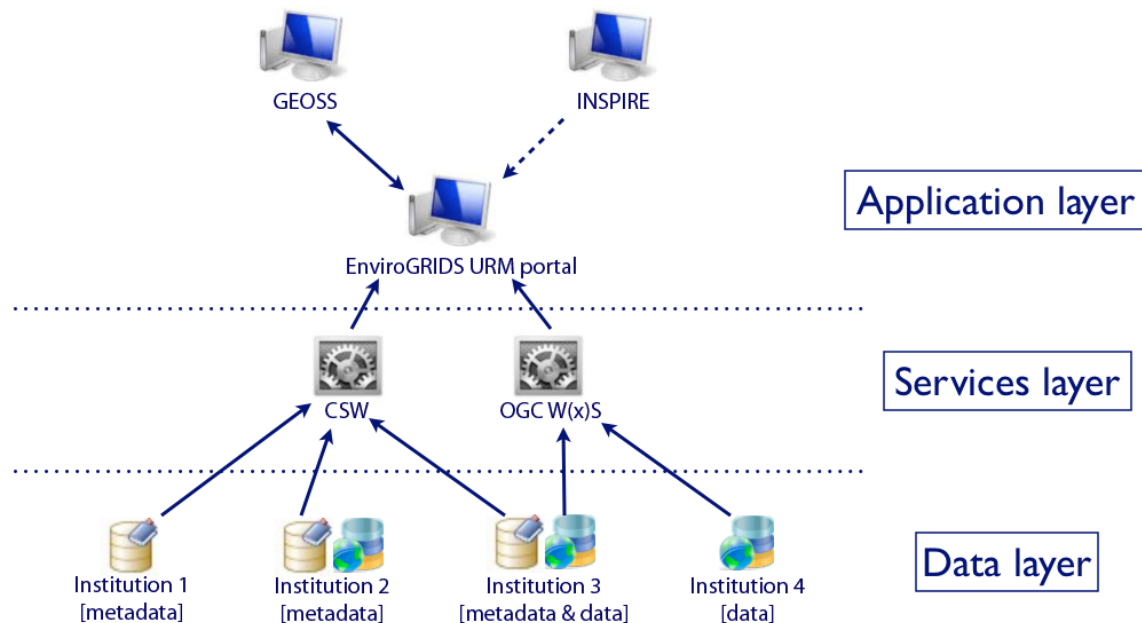
Figure 2: General architecture of the envrioGRIDS SDI (Giuliani et al. 2009)

All partners of the project will also be strongly encouraged to make some or all of their data available through different web services:

- Web Mapping Services (WMS) transform spatial data into dynamic maps created on request as images that are published on the Internet without making the raw data available

- Web Feature Service (WFS) allow to share vector data itself with all its geometric features and related attributes

- Web Coverage Services (WCS) allows a client to access raster datasets as a matrix of cells in continuous space organized in rows and columns where each cells contains a value. Thus WCS provide access to different types of gridded data such as Digital Elevation Model (DEM), remote sensing imagery, etc...

EnviroGRIDS will develop a web-based clearinghouse to quickly visualize all existing web services in the region.

Recommendations

The issue of data accessibility is of primary importance. Even access to the project partners data in many cases is limited or restricted (see Annex II). It is recommended to elaborate appropriate data policy, which envisages different types of data access licenses and encourages free data access and exchange for non-commercial purposes. Then projects partners – data-holders have to share their data for the project under the data policy, further encouraging other stakeholders to do the same.

During the first phase of gap analysis project could not get information about available national datasets for the most of the Black Sea catchment countries. This gap has to be covered during the second phase, and it is recommended that not only BSC PS and ICPDR but also partners from the respective countries should take part in discovering available datasets and identification national agencies responsible for data acquisition.

The metadata catalogs and portals are key gateways to discover data. Following portals are recommended for further discovery of datasets relevant to the project and end-users data needs: GEOSS portal, portals of EEA, Eurostat, etc, as well as metadata catalogues reported by CCSS:
- Czech UNSDI GeoPortal (http://portal.unsdi.cz)
- One Geology Metadata (http://one.geology.cz)
- Spatial planning portal (http://portal.plan4all.eu)

Unlike in Danube countries, the gaps in data availability for large areas of the Black Sea catchment within Russia, Georgia and Turkey cannot be covered from datasets available at large scales. In order to cover this gap it is recommended to identify and to incorporate in the project new partners from these countries. New partners have to either be holders of the required data or be able to facilitate access to missing data as well as to participate in other enviroGRIDS activities such as development of SDI, assessment of impact on GEOSS SBAs.

Potential partner in Russia can be the Scientific Research Institute of Applied Ecology, Krasnodar, dealing with ecological problems of the Russian Black Sea coastal zone. However, this institute does not possess data for large catchment area of Azov Sea (rivers Don, Kuban), so its possibility to facilitate access to the respective data should be further investigated.

In Turkey, the potential partners can be found within the Ministry of Environment and Forestry or within the Scientific and Technological Research Council of Turkey (TÜBITAK). The Ministry of Environment and Forestry, for example, holds data collected recently for preparation of an Integrated Water Resources Management (IWRM) plan for the Yesilirmak river basin. Considering that Yesilirmak river is one of the largest Turkish rivers in the Black Sea Catchment, these can be very useful for the project needs, particularly for application of the SWAT model for this river basin.

Cooperation with other relevant project and initiatives is effective instrument for facilitation of data exchange and covering data gaps. EnviroGRIDS projects has already concluded MoU with GENESI-DR project to get access to satellite data and with PEGASO project in combine efforts in obtaining data for coastal zone of the Black Sea. Further, it is recommended to set up cooperation with FP7 UPGRADE Black Sea Scene project, which aims to extend the existing research infrastructure for the Black Sea and improve data exchange and use. It is also recommended to support initiative on creation and further cooperate with the European Topic Centre for Spatial information and Analysis (ETC SIA), which will carry out works on harmonization and completion of European spatial datasets.

With respect to the further gap analysis works following activities are recommended:
- Analysis of compatibility of the datasets and observation systems with INSPIRE and GEO standards of interoperability,
- Identifying national observation systems, services, and responsible agencies (Section 0) in all countries of the Black Sea catchment in order to elaborate recommendation on filling data gaps at country level,
- Enhancing the initial analysis and formulating the recommendations for improvement of networks of data acquisition in each region/country,
- Publishing information on available datasets at the enviroGRIDS portal (http://www.envirogrids.net/) and at URM enviroGRIDS Catalogue

(http://www.envirogrids.cz/), which will be the entry-point to discover data and metadata within enviroGRIDS.

Conclusion

The first phase of the gap analysis was focused on identification of available data and respective observation systems for the Black Sea catchment region and their initial analysis against project and end-user needs. The work was performed by BSC PS and ICPDR with contribution of the project partners.

The large amount of datasets relevant to the project and end-users data need has been identified at different scales from national to regional, European and global. At the same time, it was found that access to data in many cases is limited or restricted, particularly at national level, so the data accessibility appears to be the main problem preventing effective data usage.

Gap analysis revealed large spatial and temporal gaps in data coverage. The recommendations to the enviroGRIDS project on filling some gaps have been proposed. However, elaboration of recommendations for filling gaps at country level requires additional information to be collected. This task will be performed during the second phase.

With respect to the data and observation systems needs of the main end-users, gap analysis found out the following:

- **BSC**:
  - There are significant gaps in availability of marine environment data from water column, sediments and biota resulted from gaps in corresponding observation / monitoring systems. It is unlikely that these gaps can be covered within the enviroGRIDS, since the project is focused mainly on the catchment area rather than on the Black Sea water body.
  - There are gaps in data on pollution loads to the Black Sea from land based sources, including rivers,
  - Observation system to monitor pollutants deposition from atmosphere is missing.

- **ICPDR**:
  - Most of required data are available at the regional (Danube) or European scales,
  - There are gaps on availability of data on pollutants deposition from atmosphere.

- **SWAT**:
  - Some of required data (DEM, land cover, soil, population) are available at regional to global scales, however,
  - Data from climate and river station are rather scarce and have to be complemented with national data;
  - Access to the data on pollution discharges and water quality, particularly in non-EU counties, is limited or restricted;
  - The spatial resolution of crop yield data from open sources of global scale may be not satisfactory, while access to more detailed national agriculture data is limited or restricted.

The analysis of available datasets revealed the problem of data compatibility at different scales. For example, global and European datasets for land cover are not compatible in terms of land cover categories. Similar problem exist between datasets of country scale and other scales. Resolving this problem may require significant efforts, particularly when it is necessary to combine in one application data from different scales.

Combining data from different scales is directly linked to the issue of correspondence of datasets and observation systems to INSPIRE and GEO interoperability standards. The fact, that most of reported national datasets are not accessible through internet and do not have relevant metadata available, points to absence of such correspondence. The enviroGRIDS project has to facilitate bringing project partners' data to the interoperability standards.

In framework of the gap analysis project partners were also asked whether they were using grid technologies. So far, only four partners– UTC, CSR4, UAB and UNIGE- are using these technologies, which means both that application of grid technologies is underdeveloped in the Black Sea catchment

region and also that this technology is still relatively recent and not much developed for geosciences in general.

In conclusions, the aim of the enviroGRIDS project to build capacity on Earth Observation Systems through improved data collection, management, storage, analyses and dissemination is more than ever a necessity in the Black Sea catchment. The next three years of the project will be crucial to show best practices on SDI development, on data and metadata portals, and on useful applications for citizens and decision makers. The beauty, interest and unique identity of the Black Sea region well disserve a state-of-the-art system to preserve its value and assess its vulnerability to global changes. Let the enviroGRIDS project convince now a maximum of data owners that sharing their data is good for the Black Sea and for themselves, because they will become more visible nationally and internationally by joining the effort of the Global Earth Observation System of Systems.

References

Lehmann A. et al. 2008. EnviroGRIDS - Building Capacity for a Black Sea Catchment Observation and Assessment System supporting Sustainable Development. Annex 1 – Description of Work.

Giuliani G. et al. 2009. EnviroGRIDS interoperability guideline. Deliverable D2.1

Allenbach K. et al. 2009. EnviroGRIDS remote sensing data use and integration guideline. Deliverable D2.4

Strategic Action Plan for the Rehabilitation and Protection of the Black Sea. Istanbul, Turkey, 30 - 31 October 1996

Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea. Sofia, Bulgaria, 17 April 2009

Regional Gap Analysis of the Black Sea Strategic Action Plan. Final Report. 2007

Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE). 25.4.2007 Official Journal of the European Union L 108/1

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Water Framework Directive – WFD). OJ L 327, 22.12.2000, p. 1–73

Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive -MSFD). OJ L 164/19, 25.6.2008

The Global Earth Observation System of Systems (GEOSS) 10-Year Implementation Plan. 16 February 2005

Winchell, M., Srinivasan, R., Di Luzio, M.,Arnold J.G 2007. ArcSWAT interface for SWAT2005: User's guide.

Abbreviations and Acronyms

BSC	Black Sea Commission (short name for the Commission on the Protection of the Black Sea Against Pollution)
DEM	Digital Elevation Model
DoW	―Description of Work" project document
EEA	European Environmental Agency
EOS	Earth Observation System
ESA	European Space Agency
FAO	Food and Agriculture Organization
GENESI-DR	Ground European Network for Earth Science Interoperations – Digital Repositories
GEO	Group on Earth Observation
GEOSS	Global Earth Observation System of Systems
GHG	Greenhouse gases
GIS	Geographic Information System
GRID	technology for sharing computer power and data storage capacity over the Internet
IAS	Invasive alien species
INSPIRE	Infrastructure for Spatial Information in Europe
NUTS	Nomenclature of Statistical Territorial Units of Eurostat
OS	Observation System
SBA	Societal Benefit Area
SST	Sea Surface Temperature
SWAT	Soil & Water Assessment Tool
TDA	Transboundary Diagnostic Analysis
UN	United Nations
URM	Uniform Resource Management
WFD	Water Framework Directive
WMO	World Meteorological Organization
WP	Work Package

Abbreviations for project partners' organizations:

ARXIT	Arx iT SA, Switzerland
AZBOS	Melitopol State Pedagogical University, Ukraine
BSC PS	Permanent Secretariat of the Commission on the Protection of the Black Sea Against Pollution, Istanbul, Turkey
BSREC	The Black Sea Regional Energy Centre, Bulgaria
CCSS	Czech Centre for Science and Society, Republic Czech
CERN	European Organization for Nuclear research, Switzerland
CRS4	Center for Advanced Studies, Research and Development in Sardinia, Italy

DDNI	Danube Delta National Research Institute for Research and Development, Romania
DHMO	Danube Hydrometeorological Observatory, Ukraine
EAWAG	Swiss Federal Institute for Aquatic Science and Technology, Switzerland
Geographic	GIS and RS Consulting Centre, Georgia
IBSS	Institute of Biology of the Southern Seas, Ukraine
ICPDR	International Commmission for the Protection of the Danube River, Vienna, Austria
IGAR	The Institute of Geography of the Romanian Academy, Romania
IHE	UNESCO Institute for Hydrological Education, Delft, The Netherlands
INHGA	The National Institute of Hydrology and Water Management, Romania
ITU	Istanbul Technical University – Geodesy and Photogrammetry Department & Environmental Engineering Department
NIMH	National Institute of Meteorology and Hydrology, Sofia, Bulgaria
ONU	Odessa National I.I. Mechnikov University, Ukraine
SORESMA	Soresma, Belgium
SPSU	St. Petersburg State University, Russian Federation
TNU	V.I. Vernadsky Taurida National University, Simferopol, Ukraine
UAB	University of Barcelona, European Topic Centre Land Use and Spatial Information, Spain
UNIGE	University of Geneva, Switzerland
USRIEP	Ukrainian Scientific and Research Institute of Ecological Problems, Ukraine
UTC	Technical University of Cluj-Napoca, Romania
VITUKI	Environmental Protection and Water Management Research Institute, Budapest, Hungary

Annex I.   Questionnaire for the gap analysis of Observation Systems

Web address: http://quest.envirogrids.cz/prihlaseni.php

Questionnaire

for the gap analysis of Observation Systems and Spatial Data Infrastructure

- **Organization**
- **Databases/datasets operated/collected by organization**
- **Databases/datasets used by or related to the work of organization**

Organization

Name:

Department:

Main area of work/interest:

Contact person:

E-Mail Address:

Data of key interest:

Further data of potential interest:

Is your organization a member of observation network(s) or OS(s)?:

○   NO

○   YES

Please specify the name(s) of the network(s)/system and its level (local, national, regional).:

Is your organization using Earth Observation data?:

○   NO

○   YES

Which is the main application area for your EO data?:

Which is the mode of EO data use (operational, research)?:

How do you access to EO data?:

Is your organization using data from other OS?:

○   NO

○   YES

Please specify the name(s) of the OS and its level (local, national, regional).:

Which is the main application area of these data?:

Which is the mode of OS data use (operational, research)?:

How do you access to OS data?:

Is your organization using GRID technology?:

○ NO

○ YES

What is the main application area of GRID technology in your organization?:

Is your organization a member of a data/information exchange network?:

○ NO

○ YES

Please specify the name(s) of network(s) and its level (local, national, regional).:

Does any Joint Information Analysis Center exist, which collects all data and-information from different agencies in area of activities of your organization?:

○ NO

○ YES

Please specify the name(s) of the Center:

[Save and continue]

Databases/datasets operated/collected by organization

Name of database	Types of data	Link	Geographical scope	Time period (from - to)	Frequency	Downloadable	Free or user rights	Web services URL	Remarks	GEOSS SB areas

Databases/datasets used by or related to the work of organization

Name of database	Types of data	Link	Geographical scope	Time period (from - to)	Frequency	Downloadable	Free or user rights	Web services URL	Remarks	GEOSS SB areas

Annex II.   Details of available datasets

1. Global scale

UNIGE GIS datasets

- **Brief description**: various GIS datasets containing information on boundaries, population, watersheds, DEM (SRTM), etc. It is planned to incorporate these datasets in enviroGRIDS SDI to be developed.
- **Released**: update frequency varies depending on data type
- **Period:** various
- **Resolution:** various
- **Areas of application:** environment management
- **Accessibility**: depends on data type
- **Format:** shape files
- **Reported by:** UNIGE

VMap0

- **Link:** http://www.mapability.com/info/vmap0_index.html
- **Brief description:** Vector Map (VMap) Level 0 is an updated and improved version of the National Imagery and Mapping Agency's (NIMA) Digital Chart of the World (DCW®). The VMap Level 0 database provides worldwide coverage of vector-based geospatial data. It consists of geographic, attribute, and textual data stored on CD-ROM or as downloaded files. VMap Level 0 includes major road and rail networks, hydrologic drainage systems, utility networks (cross-country pipelines and communication lines), major airports, elevation contours, coastlines, international boundaries and populated places.
- **Released**: ? (based on 1993 DCW data)
- **Resolution:** 1:1,000,000
- **Areas of application:** socio-economic analysis, spatial planning, resource management, facilities management; land management
- **Accessibility**: free
- **Format:** vector (shape files)
- **Download link:** http://www.mapability.com/info/vmap0_download.html

VMap1

- **Link:** http://www.mapability.com/info/vmap1_index.html
- **Brief description:** Vector Map (VMap) Level 1 provides medium resolution worldwide coverage of vector-based geospatial data. Data content includes 10 thematic layers: boundaries and coastlines; elevation and contour lines; road and rail networks; hydrography; utility networks; vegetation cover; and so on. These themes are arranged in over 100 vector layers of information, with mass numbers of features, attributes, and geographic names appropriate to their respective scales. The VMAP1 data is divided into a rather complex global mosaic of 234 geographic zones, however at the present time only 57 of them are released to public. The Black Sea catchment area is not released yet.
- **Released**: 2004
- **Resolution:** 1:250,000

- **Areas of application:** socio-economic analysis, spatial planning, resource management, facilities management; land management
- **Accessibility**: free
- **Format:** vector (shape files)
- **Download link:** http://www.mapability.com/info/vmap1_download.html

GRUMP

- **Link:** http://sedac.ciesin.columbia.edu/gpw/
- **Brief description:** Global Rural-Urban Mapping Project (GRUMP) builds on GPWv3 by incorporating urban and rural information, allowing new insights into urban population distribution and the global extents of human settlements.
- **Released in 2005**
- **Period:** 1990 – 2000 (estimate) with 5 years step
- **Resolution:** 30"
- **Areas of application:** research, policy making, and communications
- **Accessibility:** free.
- **Format:** .bil, grid, ascii
- **Download link:** http://sedac.ciesin.columbia.edu/gpw/global.jsp

GPW

- **Link:** http://sedac.ciesin.columbia.edu/gpw/
- **Brief description:** Gridded Population of the World, version 3 (GPWv3) depicts the distribution of human population across the globe and includes population estimates to 2015.
- **Released in 2003**
- **Period:** 1990 – 2015 (estimate) with 5 years step
- **Resolution:** 2.5' (in reality 4-100km depending on administrative units)
- **Areas of application:** research, policy making, and communications
- **Accessibility:** free.
- **Format:** .bil, grid, ascii
- **Download link:** http://sedac.ciesin.columbia.edu/gpw/global.jsp

LandScan

- **Link:** http://www.ornl.gov/sci/landscan/index.html
- **Brief description:** The LandScanTM Dataset comprises a worldwide population database compiled on a 30" X 30" latitude/longitude grid. Census counts (at sub-national level) were apportioned to each grid cell based on likelihood coefficients, which are based on proximity to roads, slope, land cover, nighttime lights, and other information. LandScan has been developed as part of the Oak Ridge National Laboratory (ORNL) Global Population Project for estimating ambient populations at risk.
- **Release**: 2008
- **Period:** annually, with each new release superseding the previous
- **Resolution:** 30"
- **Areas of application:** research, policy making, communications
- **Accessibility:** free for research and education (registration is required).
- **Format:** .ESRI grid

ASTER G-DEM

- **Link:** http://www.ersdac.or.jp/GDEM/E/2.html
- **Brief description:** Global DEM for all the land area covered by ASTER.
- **Released in 2009**
- **Resolution:** 1" = ~30m
- **Areas of application:**
    - Automated calculation of slope direction and angle, catchment area, faults, etc.
    - flood risk areas can be estimated
    - Hydrology (water resource management)
    - Energy (oil resource exploration)
- **Accessibility:** GDEM data will be provided free of charge to the users who utilize in 9 GEOSS societal benefit areas.
- **Format:** GeoTIFF
- **Download link:** http://www.gdem.aster.ersdac.or.jp/
- **Reported by:** UAB

SRTM3 V2.1

- **Link:** http://www2.jpl.nasa.gov/srtm/
- **Brief description:** Shuttle Radar Topography Mission (SRTM) 2000 obtained elevation data on a near-global scale to generate the most complete high-resolution digital topographic database of Earth.
- **Released in 2009**
- **Resolution:** 3" = ~90m
- **Areas of application:**
    - Automated calculation of slope direction and angle, catchment area, faults, etc.
    - flood risk areas can be estimated
    - Hydrology (water resource management)
    - Energy (oil resource exploration)
- **Accessibility:** free.
- **Format:** SRTM
- **Download link:** http://dds.cr.usgs.gov/srtm/version2_1/

GLOBCOVER

- **Link:** http://ionia1.esrin.esa.int/index.asp
- **Brief description:** global land cover maps on base of observations from the 300m MERIS sensor on board the ENVISAT satellite mission, including
    - 10 bi-monthly reflectances composites for period December 2004 - June 2006
    - 1 annual reflectance composite for year 2005
  22 land cover classes are defined with the UN Land Cover Classification System (LCCS).
- **Released in 2009** (Version 2.2)
- **Period:** see above
- **Resolution:** 300m
- **Areas of application:**
    - Deforestation/decertification monitoring
    - Habitats monitoring

- o etc
- **Accessibility:** free for scientific purposes.
- **Format:** HDF
- **Download link:** ftp://us-ext-nas.eo.esa.int/regional

MODIS Land Cover Type

- **Link:** https://lpdaac.usgs.gov/lpdaac/products/modis_products_table
- **Brief description:** The MODIS Land Cover Type product contains multiple classification schemes, which describe land cover properties derived from observations spanning a year's input of Terra and Aqua data. The primary land cover scheme identifies 17 land cover classes defined by the International Geosphere Biosphere Programme (IGBP), which includes 11 natural vegetation classes, 3 developed and mosaicked land classes, and three non-vegetated land classes.
- **Released**: updated yearly
- **Period:** 2001-2007
- **Resolution:** 500m
- **Areas of application:**
  - o Land cover change monitoring
  - o Deforestation/decertification monitoring
  - o Habitats monitoring
  - o etc
- **Accessibility:** free for scientific purposes, (acknowledgement of source is required)
- **Format:** HDF-EOS
- **Download link**: https://wist.echo.nasa.gov/api/

DSMW v. 3.6

- **Link:** http://www.fao.org/ag/agl/lwdms.stm
- **Brief description**: the Digitized Soil Map of the World Including Derived Soil Properties (version 3.6) is based on the FAO/UNESCO Soil map of the world. The CD-ROM contains two types of files, DSMW map sheets and derived soil properties files with images derived from the Soil map of the World. DMSW consists of the data from 10 map sheets: Africa, North America, Central America, South America, Europe, Central and Northeast Asia, Near East, Far East, Southeast Asia, and Australia. The maps are available in four formats: two vector formats (ARC/INFO Native and Export) and two raster formats (ERDAS and IDRISI). The derived soil properties files include programs that interpret the maps in terms of parameters such as pH, organic carbon content, C/N ratio, clay mineralogy, soil depth, soil and terrain stability for specific crop production, soil moisture storage capacity and soil drainage class
- **Released**: 2003
- **Period:**
- **Resolution:** 1:5,000,000
- **Areas of application:** agriculture, water resources management
- **Accessibility**: on request (for low cost)
- **Format:** raster, ArcInfo

HWSD v. 1.1

- **Link:** http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/index.html?sb=1

- **Brief description**: the Harmonized World Soil Database (HSWD) v. 1.0 was compiled on the base of four source databases: the European Soil Database (ESDB), the 1:1 million soil map of China, various regional SOTER databases (SOTWIS Database), and the Soil Map of the World. The HWSD is composed of a GIS raster image file linked to an attribute database in Microsoft Access format. While these two components are separate data files, they can be linked through a commercial GIS system. The HWSD attribute database provides information on the soil unit composition for each of the 15773 soil mapping units. The database shows the composition of each soil mapping unit, and standardized soil parameters for top- and subsoil.
- **Released**: 2009
- **Period:**
- **Resolution:** 1km raster. The spatial resolution of the SMUs varies by region depending on the source data. The best resolution represents approximately a 1:1 million map scale and can be found in China, the territory covered by ESDB (Europe and Russia), and Eastern and Southern Africa, which is included in the SOTWIS database. The DSMW (FAO-74) represents a 1:5 million map scale.
- **Areas of application**: agriculture, water resources management
- **Accessibility:** free
- **Format:** raster

ERS/MetOp Soil Moisture

- **Link:** http://www.ipf.tuwien.ac.at/radar/index.php?go=ascat
- **Brief description**: Global, coarse-resolution soil moisture data (25-50 km) are derived from backscatter measurements acquired with scatterometers onboard the satellites ERS-1 and ERS-2 (1991 to present) and the three MetOp satellites (2006-2020). Two different product types are derived:
  - Level 2 products representing the soil moisture content within a thin soil surface layer (< 2 cm) during the time of overflight of the satellite (SSM),
  - Level 3 products representing the water content in the soil profile, regularly sampled in space and time (SWI).
- **Released**:
- **Period**: 1991-2007
- **Resolution:** 50km
- **Areas of application:** agriculture, water resources management
- **Accessibility:** on request
- **Format:** binary
- **Reported by:** UNIGE

Global Runoff Database

- **Link:** http://www.bafg.de/cln_016/nn_294146/GRDC/EN/Home/homepage__node.html?__nnn=true
- **Brief description:** Global Runoff Database contains time series of daily and/or monthly river discharge data of more than 7300 stations from 156 countries, comprising around 280,000 station-years with an average time series length of about 38 years. The earliest data are from the year 1807, the most recent from the year 2008. The database is updated as soon as data are supplied by the national hydrological services, our primary data providers.

- **Released:** updated yearly.
- **Period:** 1807 – 2008 (estimate)
- **Resolution:** hydrological stations
- **Areas of application:** research
- **Accessibility:** free for non-commercial uses under the conditions of GRDC's data policy.
- **Format:** ASCII
- **Data link:** http://www.bafg.de/cln_016/nn_294146/GRDC/EN/02__Services/01__RiverDischarge/riverdischarge__node.html?__nnn=true
- **Note**: in GEOSS
- **Reported by:** UNIGE

Hydroweb

- **Link:** http://www.legos.obs-mip.fr/en/soa/hydrologie/hydroweb/
- **Brief description:** Lakes, rivers and wetlands water levels from satellite altimetry
- **Released:**
- **Period: since** 1992 -
- **Resolution:** major lakes, reservoirs and rivers
- **Areas of application:** water, research
- **Accessibility:** free
- **Format:** ASCII

GPCP One -Degree Daily Precipitation Data Set

- **Link:** http://precip.gsfc.nasa.gov/
- **Brief description:** The Global Precipitation Climatology Project One-Degree Daily Precipitation Data Set (1DD Data Set) provides daily, global 1x1-deg gridded fields of precipitation totals for October 1996 through the delayed present. The 1DD draws upon several different data sources covering different areas of the globe. Every attempt has been made to make the complete record homogeneous, given the different available input sources.
- **Released:** 2009.
- **Period: since** 1996 - present
- **Resolution:** 1°x1°
- **Areas of application:** weather, climate change, water
- **Accessibility:** free
- **Format:** binary grid
- **Data link**: http://www1.ncdc.noaa.gov/pub/data/gpcp/1dd-v1.1

TMPA

- **Link:** http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=TRMM_3B42RT
- **Brief description:** The Tropical Rainfall Measuring Mission (TRMM) Multi-Satellite Precipitation Analysis (TMPA) provides a calibration-based sequential scheme for combining precipitation estimates from multiple satellites. TMPA is available both after and in real time.
- **Released:**
- **Period**: since 1998

- **Coverage**: latitude band 50°N–S
- **Resolution**: 0.25°?
- **Areas of application:** weather, water, climate change
- **Accessibility**: free
- **Format:**
- **Data link**: http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=TRMM_3B42RT

Global Rainfall Map

- **Link:** http://sharaku.eorc.jaxa.jp/GSMaP/
- **Brief description:** Global Rainfall Map by JAXA/EORC GSMaP Near Realtime System provides hourly global rainfall maps in near real time (about four hours after late from observation) as well as corresponding NRT rainfall data and Daily Accumulated Rainfall.
- **Released:** 2008
- **Period: since** 2008 - present
- **Resolution:** 0.1° (0.25 for Daily Accumulated Rainfall)
- **Areas of application:** weather, climate change, water
- **Accessibility:** free
- **Format:** binary grid/ ASCII
- **Data link:** GSMaP_NRT data are freely available from password protected ftp server. Please contact trmm_real@jaxa.jp to get data.

WorldClim

- **Link:** http://www.worldclim.org/
- **Brief description:** WorldClim is a set of global climate layers (climate grids) with a spatial resolution of a square kilometer. They can be used for mapping and spatial modeling in a GIS or other computer programs. The climate elements considered were monthly precipitation and mean, minimum, and maximum temperature.
- **Released:** 2005
- **Period:** since 1950 – 2000
- **Resolution:** 1km
- **Areas of application:** weather, climate change
- **Accessibility:** free
- **Format:** ESRI grids
- **Data link:** http://www.worldclim.org/download
- **Reported by:** UNIGE

CRU TS 2.1

- **Link:** http://www.cru.uea.ac.uk/cru/data/hrg/timm/grid/CRU_TS_2_1.html
- **Brief description:** The CRU TS 2.1 dataset comprises 1224 monthly grids of observed climate, for the period 1901-2002, and covering the global land surface at 0.5 degree resolution. There are nine climate variables available: daily mean, minimum and maximum temperature, diurnal temperature range, precipitation, wet day frequency, frost day frequency, vapor pressure and cloud cover.
- **Released:** 2004
- **Period:** since 1901 – 2002
- **Resolution:** 0.5°
- **Areas of application:** weather, climate change

- **Accessibility:** free for scientific purposes
- **Format:** ASCII
- **Data link:** http://www.cru.uea.ac.uk/cru/data/hrg/cru_ts_2.10/data_all/
- **Reported by:** UNIGE

Climate of the World

- **Link:** http://www.ncdc.noaa.gov/oa/wdc/index.php
- **Brief description:**
  The global surface summary of day product is produced by the National Climatic Data Center (NCDC) in Asheville, NC. The input data used in building these daily summaries are the Integrated Surface Data (ISD), which includes global data obtained from the USAF Climatology Center, located in the Federal Climate Complex with NCDC. The latest daily summary data are normally available 1-2 days after the date-time of the observations used in the daily summaries. The online data files begin with 1929, and are now at the Version 7 software level. Over 9000 stations' data are typically available.
  The daily elements included in the dataset (as available from each station) are:
    o Mean temperature (.1 Fahrenheit)
    o Mean dew point (.1 Fahrenheit)
    o Mean sea level pressure (.1 mb)
    o Mean station pressure (.1 mb)
    o Mean visibility (.1 miles)
    o Mean wind speed (.1 knots)
    o Maximum sustained wind speed (.1 knots)
    o Maximum wind gust (.1 knots)
    o Maximum temperature (.1 Fahrenheit)
    o Minimum temperature (.1 Fahrenheit)
    o Precipitation amount (.01 inches)
    o Snow depth (.1 inches)
    o Indicator for occurrence of:
      ▪ Fog
      ▪ Rain or Drizzle
      ▪ Snow or Ice Pellets
      ▪ Hail
      ▪ Thunder
      ▪ Tornado/Funnel Cloud
  Number of stations per country in 2010:
    o Bulgaria - 37
    o Georgia - 12
    o Romania - 14
    o Russia - ~15 in Black Sea catchment
    o Turkey - ~30 in Black Sea catchment
    o Ukraine - 21
  Monthly issues contains monthly mean temperature, pressure, precipitation, vapor pressure, and sunshine for approximately 2,000 surface data collection stations worldwide and monthly mean upper air temperatures, dew point depressions, and wind Velocities for approximately 500 observing sites. This is the final quality controlled copy and generally has a 4 - 6 month time lag.
- **Released:** 2006
- **Period:** since 1929 – present (surface summary of day product)
- **Resolution:** Stations
- **Areas of application:** weather, climate change
- **Accessibility:** free/conditional (see website)

- **Format:** ASCII
- **Data link:** ftp://ftp.ncdc.noaa.gov/pub/data/gsod/ (or use web interface to select data).

SST

- **Link:** numerous web sites, e.g. http://oceancolor.gsfc.nasa.gov/; http://www.ghrsst.org/index.htm.
- **Brief description:**
- **Released**: updated daily
- **Period:**
- **Resolution:**
- **Areas of application:** weather, climate change
- **Accessibility:**
- **Format:**
- **Data link:**

OceanColor

- **Link:** http://oceancolor.gsfc.nasa.gov/
- **Brief description:**
- **Released**: updated daily
- **Period:**
- **Resolution:**
- **Areas of application:** Bioproductivity, climate change
- **Accessibility:**
- **Format:**
- **Data link:**

Ocean Surface Vector Winds

- **Link:** http://manati.orbit.nesdis.noaa.gov/ascat/
- **Brief description:**
- **Released**: updated daily
- **Period:**
- **Resolution:**
- **Areas of application:** weather, currents
- **Accessibility:**
- **Format:**
- **Data link:**

Sea Level Anomalies

- **Link:** http://www.aviso.oceanobs.com/en/data/products/sea-surface-height-products/global/index.html
- **Brief description:**
- **Released**:
- **Period**: 1992 -
- **Resolution:** 20' gridded from along track data
- **Areas of application:** climate change, currents
- **Accessibility**: free
- **Format:**

- **Data link:**

UNEP Geo Data Portal

- **Link:** http://geodata.grid.unep.ch/
- **Brief description:** The GEO Data Portal is the authoritative source for data sets used by UNEP and its partners in the Global Environment Outlook (GEO) report and other integrated environment assessments. Its online database holds more than 500 different variables, as national, subregional, regional and global statistics or as geospatial data sets (maps), covering themes like Freshwater, Population, Forests, Emissions, Climate, Disasters, Health and GDP.
- **Released**: updated yearly
- **Period:** 1950 -2050
- **Resolution:** 1km+, per country / per region (depending on data type)
- **Areas of application:** weather, climate change
- **Accessibility:** free/conditional (see website)
- **Format:** ASCII
- **Data link:** http://geodata.grid.unep.ch/webservices/
- **Reported by:** UNIGE

PREVIEW Global Risk Data Platform

- **Link:** http://preview.grid.unep.ch/
- **Brief description:** The PREVIEW Global Risk Data Platform is a multiple agencies effort to share spatial data information on global risk from natural hazards. Users can visualize, download or extract data on past hazardous events, human & economical hazard exposure and risk from natural hazards. It covers tropical cyclones and related storm surges, drought, earthquakes, biomass fires, floods, landslides, tsunamis and volcanic eruptions.
- **Released**: updated yearly
- **Period:** 1975-2008
- **Resolution:** events
- **Areas of application:** disasters management
- **Accessibility:** free
- **Format:** shape files, ASCII
- **Data link:** http://preview.grid.unep.ch/index.php?preview=data&lang=eng
- **Reported by:** UNIGE

2. EU/European scale

EuroGlobalMap

- **Link**: http://www.eurogeographics.org/content/products-services-eurodem
- **Brief description**: EuroGlobalMap is a topographic dataset at the scale 1:1 Million and it covers 32 countries. It contains 6 themes (including a total of 23 feature classes):
  - o Administrative boundaries
  - o Hydrography
  - o Transport
  - o Settlements
  - o Elevation
  - o Geographical names Product Formats
- **Released**: 2010
- **Resolution**: 1:1,000,000.
- **Coverage**: Austria, Belgium, Luxembourg, Croatia, Czech Republic, Cyprus, Denmark including Greenland, Faroe Islands, Estonia, Finland, France, Germany, Great Britain, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, Moldova, Northern Ireland, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Andorra, Sweden, Switzerland, The Netherlands, Ukraine.
- **Areas of application:** geo-market analysis, socio-economic analysis, demographic analysis, asset management, geo-referencing cross-border data.
- **Accessibility:** licensed (license costs from € 150 per country)
- **Format:** Shape files (ETRS 89)

EuroRegionalMap

- **Link**: http://www.eurogeographics.org/products-and-services/euroregionalmap
- **Brief description**: EuroRegionalMap contains following themes: administrative boundaries, hydrography, transport, settlements, vegetation, named locations, miscellaneous (monuments, power lines, towers etc).
- **Released**: 2009
- **Resolution:** 1:250,000
- **Coverage**: EU 27 (besides Bulgaria), plus Iceland, Norway, Switzerland, Lichtenstein, Faeroe Islands and the Republic of Moldova
- **Areas of application:** marketing planning, service provision and retail site location, environmental analysis, vehicle routing, map backdrop against which to display specific information.
- **Accessibility:** licensed (license cost vary from € 25,000 to € 137,000)
- **Format:** raster or triangular irregular network (ERTS 89)

EuroBoundaryMap v4.0

- **Link**: http://www.eurogeographics.org/products-and-services/euroboundarymap
- **Brief description**: EuroBoundaryMap v4.0 is a seamless geo database at the scale 1:100 000. It contains geometry, names and codes of administrative and statistical units.
- **Released**: 2009

- **Resolution:** 1:100,000
- **Coverage**: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark (incl. Faroe Islands and Greenland), Estonia, Finland, France (incl. French Guiana, Guadeloupe, Martinique, Reunion and Monaco), Germany, Great Britain, Greece, Hungary, Iceland, Ireland, Italy (incl. San Marino and Vatican City), Kosovo, Latvia, Lithuania, Luxembourg, Malta, Moldova, Northern Ireland, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain (incl. Andorra and Gibraltar), Sweden, Switzerland (incl. Liechtenstein), The Netherlands, Ukraine
- **Areas of application:** geo-market analysis, socio-economic analysis, demographic analysis, asset management, geo-referencing cross-border data.
- **Accessibility:** licensed (license cost from € 200 per country)
- **Format:** Shape files (ETRS 89)

EuroDEM

- **Link**: http://www.eurogeographics.org/content/products-services-eurodem
- **Brief description**: EuroDEM v1.0 is a digital representation of the ground surface topography of Europe. It describes the distribution of terrain or 'bare earth' heights. This does not include 'first surface' elevations such as vegetation and manmade structures.
- **Released**: 2010
- **Resolution:** ~60m. Vertical accuracy of 8 to 10 meters.
- **Coverage**: EU 27, the four EFTA countries (Iceland, Liechtenstein, Norway and Switzerland) as well as Croatia, Kosovo, Bosnia & Herzegovina, Serbia, Montenegro, Macedonia, Moldova and the Kaliningrad area.
- **Areas of application:** Automated calculation of slope direction and angle, catchment area, faults, etc.; flood risk areas can be estimated, hydrology (water resource management)
- **Accessibility:** licensed (license cost vary from € 30,000 to € 750,000)
- **Format:** raster or triangular irregular network (ETRS 89)

Corine land cover (CLC1990) 100 m - version 12/2009 (EU without Scandinavia and Britain)

- **Link:** http://www.eea.europa.eu/data-and-maps/data/corine-land-cover-clc1990-100-m-version-12-2009
- **Brief description:** Raster data on land cover for the CLC1990 inventory
- **Released in 2009**
- **Resolution:** 100m
- **Coverage:** Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Montenegro, Netherlands, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain
- **Areas of application:** land cover change monitoring, land use, nature conservation, urban planning, deforestation/decertification monitoring, habitats monitoring
- **Accessibility:** free of charge provided the source is acknowledged
- **Format**: GeoTiff
- **Download link**: http://www.eea.europa.eu/data-and-maps/data/corine-land-cover-clc1990-100-m-version-12-2009
- **Reported by:** UAB

Corine Land Cover 2000 seamless vector database (EU)

- **Link:** http://www.eea.europa.eu/data-and-maps/data/corine-land-cover-2000-clc2000-seamless-vector-database-1
- **Brief description:** Corine land cover 2000 is the year 2000 update of the first CLC database which was finalised in the early 1990s as part of the European Commission programme to COoRdinate INformation on the Environment (Corine)
- **Released in Oct 2009**
- **Resolution:** ~100m
- **Coverage:** EU27, Albania, Bosnia and Herzegovina, Croatia, Iceland, Macedonia, the former Yugoslavian Republic of, Montenegro, Norway, Serbia
- **Areas of application:** land cover change monitoring, land use, nature conservation, urban planning, deforestation/decertification monitoring, habitats monitoring
- **Accessibility:** free of charge provided the source is acknowledged
- **Format**: shape files
- **Download link**: http://www.eea.europa.eu/data-and-maps/data/corine-land-cover-2000-clc2000-seamless-vector-database-1
- **Reported by:** UAB

Corine land cover 2000 (CLC2000) 100 m - version 12/2009 (EU)

- **Link:** http://www.eea.europa.eu/data-and-maps/data/corine-land-cover-2000-clc2000-100-m-version-12-2009
- **Brief description:** Raster data on land cover for the CLC2000 inventory
- **Released in 2009**
- **Resolution:** 100m
- **Coverage:** EU27, Albania, Bosnia and Herzegovina, Croatia, Iceland, Liechtenstein, Macedonia, the former Yugoslavian Republic of, Montenegro, Norway, San Marino, Serbia
- **Areas of application:** land cover change monitoring, land use, nature conservation, urban planning, deforestation/decertification monitoring, habitats monitoring
- **Accessibility:** free of charge provided the source is acknowledged
- **Format:** GeoTiff
- **Download link:** http://www.eea.europa.eu/data-and-maps/data/corine-land-cover-2000-clc2000-100-m-version-12-2009
- **Reported by:** UAB

Corine land cover 2006 (CLC2006) 100 m - version 12/2009

- **Link:** http://www.eea.europa.eu/data-and-maps/data/corine-land-cover-2006-clc2006-100-m-version-12-2009
- **Brief description:** Raster data on land cover for the CLC2006 inventory. Coverage: Albania, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, France, Hungary, Iceland, Ireland, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, the former Yugoslavian Republic of, Montenegro, Netherlands, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia.
- **Released in 2009**
- **Resolution:** 100m
- **Areas of application:** land cover change monitoring, land use, nature conservation, urban planning, deforestation/decertification monitoring, habitats monitoring
- **Accessibility:** free of charge provided the source is acknowledged

- **Format:** GeoTiff
- **Download link:** http://www.eea.europa.eu/data-and-maps/data/corine-land-cover-2006-clc2006-100-m-version-12-2009
- **Reported by:** UAB

Population density disaggregated with Corine land cover 2000

- **Link:** http://www.eea.europa.eu/data-and-maps/data/population-density-disaggregated-with-corine-land-cover-2000-2
- **Brief description:** Raster data on land cover for the CLC2006 inventory. Coverage: EU27 + Croatia + Liechtenstein.
- **Released in 2009**
- **Resolution:** 100m
- **Areas of application:** demographic analysis
- **Accessibility:** free of charge provided the source is acknowledged
- **Format:** GeoTiff
- **Download link:** http://www.eea.europa.eu/data-and-maps/data/population-density-disaggregated-with-corine-land-cover-2000-2

ESDB v2.0

- **Link:** http://eusoils.jrc.ec.europa.eu/ESDB_Archive/ESDBv2/index.htm
- **Brief description:** European Soil Database v2.0, consisting of four components: the Soil Geographical Database of Eurasia at scale 1:1,000,000 (SGDBE), a PedoTransfer Rules Database (PTRDB), the Soil Profile Analytical Database of Europa (SPADBE) and documentation of the Database of Hydraulic Properties of European Soils (HYPRES). The database contains a list of Soil Typological Units (STU). Besides the soil names they represent, these units are described by variables (attributes) specifying the nature and properties of the soils: for example the texture, the water regime, the stoniness, etc.
- **Coverage:** Europe except Georgia and Turkey
- **Released**: 2006
- **Resolution:** 1:1,000,000
- **Areas of application:** agriculture, land use, resource management
- **Accessibility:** free of charge upon registration
- **Format:** shape files
- **Download link**: http://eusoils.jrc.ec.europa.eu/ESDB_Archive/ESDB_Data_Distribution/ESDB_data.html

ESDB v2.0 Raster version

- **Link:** http://eusoils.jrc.ec.europa.eu/ESDB_Archive/ESDB_data_1k_raster_intro/ESDB_1k_raster_data_intro.html
- **Brief description:** derived from ESDB v. 2.0
- **Coverage:** EU27
- **Released**: 2006
- **Resolution:** 1x1km
- **Areas of application:**
- **Accessibility:** free of charge upon registration

- **Format:** shape files
- **Download link**:
  http://eusoils.jrc.ec.europa.eu/ESDB_Archive/ESDB_Data_Distribution/ESDB_data.html

EEA Fast Track Service Precursor on Land Monitoring - Degree of soil sealing 100m

- **Link:** http://www.eea.europa.eu/data-and-maps/data/eea-fast-track-service-precursor-on-land-monitoring-degree-of-soil-sealing-100m
- **Brief description:** Raster data set of built-up and non built-up areas including continuous degree of soil sealing ranging from 0 - 100% in aggregated spatial resolution (100 x 100 m). Coverage: EU27, Albania, Bosnia and Herzegovina, Croatia, Macedonia, the former Yugoslavian Republic of, Montenegro, Serbia, Turkey.
- **Released:** 2009
- **Resolution:** 100m
- **Areas of application:** resource management
- **Accessibility:** free of charge provided the source is acknowledged
- **Format:** GeoTiff?
- **Download link:** http://www.eea.europa.eu/data-and-maps/data/eea-fast-track-service-precursor-on-land-monitoring-degree-of-soil-sealing-100m

Waterbase – Rivers

- **Link:** http://www.eea.europa.eu/data-and-maps/data/waterbase-rivers-5
- **Brief description:** Waterbase contains timely, reliable and policy-relevant data collected from EEA member countries through the WISE-SoE data collection (formerly known as Eurowaternet and Eionet-Water) process. This dataset contains annual data on hazardous substances in rivers.
- **Coverage:** EU15, Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, the former Yugoslavian Republic of, Poland, Romania, Serbia, Slovakia, Slovenia, Turkey.
- **Released:** 2009 (1962-2007)
- **Resolution:** by station/WaterbaseID
- **Areas of application:** water, resource management
- **Accessibility:** free of charge provided the source is acknowledged
- **Format:** .mdb
- **Download link:** http://www.eea.europa.eu/data-and-maps/data/waterbase-rivers-5
- **Reported by:** UAB

Waterbase – Lakes

- **Link:** http://www.eea.europa.eu/data-and-maps/data/waterbase-rivers-5
- **Brief description:** Waterbase contains timely, reliable and policy-relevant data collected from EEA member countries through the WISE-SoE data collection (formerly known as Eurowaternet and Eionet-Water) process. This dataset contains seasonal and annual data on water quality and raw data of hazardous substances in lakes.
- **Coverage:** Albania, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Macedonia, the former Yugoslavian Republic of, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Serbia and

Montenegro, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom.

- **Released:** 2009 (1931-1939, 1949-2007)
- **Resolution:** by station/WaterbaseID
- **Areas of application:** water, resource management
- **Accessibility:** free of charge provided the source is acknowledged
- **Format:** .mdb
- **Reported by:** UAB

Waterbase - Transitional, coastal and marine waters

- **Link:** http://www.eea.europa.eu/data-and-maps/data/waterbase-transitional-coastal-and-marine-waters-5
- **Brief description:** Waterbase contains timely, reliable and policy-relevant data collected from EEA member countries through the WISE-SoE data collection (formerly known as Eurowaternet and Eionet-Water) process. This dataset contains annual data on discharges to Transitional, coastal and marine waters, inputs (loads) and hazardous substances in water, biota and sediments.
- **Coverage:** Albania, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden, Turkey, United Kingdom.
- **Released:** 2009 (1978-2007)
- **Resolution:** by country
- **Areas of application:** water, resource management
- **Accessibility:** free of charge provided the source is acknowledged
- **Format:** .mdb
- **Reported by:** UAB

Waterbase - Groundwater

- **Link:** http://www.eea.europa.eu/data-and-maps/data/waterbase-groundwater-5
- **Brief description:** Waterbase contains timely, reliable and policy-relevant data collected from EEA member countries through the WISE-SoE data collection (formerly known as Eurowaternet and Eionet-Water) process. This dataset contains annual data on bodies and quality.
- **Coverage:** EU27, Albania, Bosnia and Herzegovina, Macedonia, the former Yugoslavian Republic of, Montenegro, Serbia, Serbia and Montenegro, Turkey.
- **Released:** 2009 (1960-2007)
- **Resolution:** by country
- **Areas of application:** water, resource management
- **Accessibility:** free of charge provided the source is acknowledged
- **Format:** .mdb
- **Reported by:** UAB

Sediment discharges from European rivers

- **Link:** http://www.eea.europa.eu/data-and-maps/data/sediment-discharges
- **Brief description:** This dataset is composed of 3 layers: 1) GISCO watersheds, 2) Total Suspended Solid (TSS) delivery downstream within the sea and 3) Sediment flow from quality stations.

- **Coverage:** EU15, Bosnia and Herzegovina, Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Liechtenstein, Lithuania, Malta, Norway, Poland, Romania, Slovakia.
- **Released:** 2005
- **Resolution:** at stations
- **Areas of application:** spatial planning, habitat management
- **Accessibility:** free of charge provided the source is acknowledged
- **Format:** shape files

AirBase - The European air quality database

- **Link:** http://www.eea.europa.eu/data-and-maps/data/airbase-the-european-air-quality-database-1
- **Brief description:** AirBase is the air quality information system maintained by the EEA through the European topic centre on Air and Climate Change. It contains air quality data delivered annually under 97/101/EC Council Decision establishing a reciprocal exchange of information and data from networks and individual stations measuring ambient air pollution within the Member States (EoI Decision).
- **Coverage:** EU27, Andorra, Bosnia and Herzegovina, Croatia, Macedonia, the former Yugoslavian Republic of, Montenegro, Serbia, Turkey.
- **Released:** 2009 (1969-2007)
- **Resolution:** by station
- **Areas of application:** health, environment protection
- **Accessibility:** free of charge provided the source is acknowledged
- **Format:** .mdb

Interpolated air quality data

- **Link:** http://www.eea.europa.eu/data-and-maps/data/interpolated-air-quality-data-1
- **Brief description:** The maps are derived from the measurement data at the stations in AirBase in combination with modeled output from EMEP and with other parameters. These maps are assessment tools for use at the European scale. They may show results which differ from assessments made at national scale.
- **Coverage:** EU27, Albania, Bosnia and Herzegovina, Croatia, Montenegro, Serbia.
- **Released:** 2008 (2004-2005)
- **Resolution:** ~50km
- **Areas of application:** health, environment protection
- **Accessibility:** free of charge provided the source is acknowledged
- **Format:** .shp
- **Reported by:** UAB

EEA aggregated and gap filled air pollutant data

- **Link:** http://www.eea.europa.eu/data-and-maps/data/eea-aggregated-and-gap-filled-air-emission-data-3
- **Coverage**: EU27, Croatia, Macedonia, the former Yugoslavian Republic of, Serbia, Turkey.
- **Released:** 2009 (period 1990-2007)
- **Resolution:** per country
- **Areas of application:** health, environment protection
- **Accessibility:** free of charge provided the source is acknowledged

- **Format:** .mdb
- **Download link:** http://www.eea.europa.eu/data-and-maps/data/eea-aggregated-and-gap-filled-air-emission-data-3

EMEP grids reprojected by EEA
- **Link:** http://www.eea.europa.eu/data-and-maps/data/emep-grids-reprojected-by-eea
- **Brief description:** EEA has reprojected the grid used by EMEP for analyses on air emissions (150*150 km2 and 50*50 km2 grids covering Europe).
- **Coverage:** EU27, Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Croatia, Georgia, Kazakhstan, Moldova, Republic of, Monaco, Montenegro, Russian Federation, San Marino, Serbia, Turkey, Ukraine.
- **Released:** 2005
- **Resolution:** 150km, 50km
- **Areas of application:** health, environment protection
- **Accessibility:** free of charge provided the source is acknowledged
- **Format:** .shp

National Emission Ceilings (NEC) Directive Inventory
- **Link:** http://www.eea.europa.eu/data-and-maps/data/national-emission-ceilings-nec-directive-inventory-4
- **Brief description:** Data on emissions of air pollutants (NH3, NMVOC, NOX, SO2) reported annually by MSs to the EC (with copies to EEA) under Directive 2001/81/EC.
- **Coverage:** EU27.
- **Released:** 2009 (period 1990-2007)
- **Resolution:** per country
- **Areas of application:** health, environment protection
- **Accessibility:** free of charge provided the source is acknowledged
- **Format:** .mdb
- **Reported by:** UAB

National emissions reported to the Convention on Long-range Transboundary Air Pollution (LRTAP Convention)
- **Link:** http://www.eea.europa.eu/data-and-maps/data/national-emissions-reported-to-the-convention-on-long-range-transboundary-air-pollution-lrtap-convention-3
- **Brief description:** Data on emissions of air pollutants submitted to the LRTAP Convention and copied to EEA and ETC/ACC. Coverage: EU27, Croatia, Macedonia, the former Yugoslavian Republic of, Montenegro, Norway, Serbia, Switzerland.
- **Released:** 2009 (period 1980-2007)
- **Resolution:** per country
- **Areas of application:** environment protection, climate change
- **Accessibility:** free of charge provided the source is acknowledged
- **Format:** .mdb
- **Download link:** http://www.eea.europa.eu/data-and-maps/data/national-emissions-reported-to-the-convention-on-long-range-transboundary-air-pollution-lrtap-convention-3

National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism

- **Link:** http://www.eea.europa.eu/data-and-maps/data/national-emissions-reported-to-the-unfccc-and-to-the-eu-greenhouse-gas-monitoring-mechanism-3
- **Brief description:** Data on greenhouse gas emissions and removals, sent by countries to UNFCCC and the EU Greenhouse Gas Monitoring Mechanism (EU Member States). Coverage: EU27, Croatia, Turkey.
- **Released:** 2009 (1985-2007)
- **Resolution:** by country
- **Areas of application:** environment protection, climate change
- **Accessibility:** free of charge provided the source is acknowledged
- **Format:** .mdb
- **Download link:** http://www.eea.europa.eu/data-and-maps/data/national-emissions-reported-to-the-unfccc-and-to-the-eu-greenhouse-gas-monitoring-mechanism-3

National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism

- **Link:** http://www.eea.europa.eu/data-and-maps/data/national-emissions-reported-to-the-unfccc-and-to-the-eu-greenhouse-gas-monitoring-mechanism-3
- **Brief description:** Data on greenhouse gas emissions and removals, sent by countries to UNFCCC and the EU Greenhouse Gas Monitoring Mechanism (EU Member States). Coverage: EU27, Croatia, Turkey.
- **Released:** 2009 (1985-2007)
- **Resolution:** by country
- **Areas of application:** environment protection, climate change
- **Accessibility:** free of charge provided the source is acknowledged
- **Format:** .mdb
- **Download link:** http://www.eea.europa.eu/data-and-maps/data/national-emissions-reported-to-the-unfccc-and-to-the-eu-greenhouse-gas-monitoring-mechanism-3

Eurostat Statistics Database

- **Link:** http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database
- **Brief description:** Detailed statistics on the EU and candidate countries on following themes:
  - General and regional statistics
  - Economy and finance
  - Population and social conditions
  - Industry, trade and services
  - Agriculture, forestry and fisheries
  - External Trade
  - Transport
  - Environment and energy
  - Science and technology
- **Coverage:** EU and candidate countries.
- **Resolution:** country/major country regions

- **Areas of application:** comprehensive analysis of countries development, trends, etc.
- **Accessibility:** aggregated data freely accessible while microdata (data, which contain information about individual statistical units) are confidential. Access to anonymised microdata available at Eurostat only for scientific purposes.
- **Format:** ASCII

Nature 2000

- **Link:** http://www.eea.europa.eu/data-and-maps/data/natura-2000
- **Brief description:** Natura 2000 is the key instrument to protect biodiversity in the European Union. It is an ecological network of protected areas, set up to ensure the survival of Europe's most valuable species and habitats. Natura 2000 is based on the 1979 Birds Directive and the 1992 Habitats Directive. The spatial data (borders of sites) submitted by each Member State is integrated into a spatial database and, after validation with a specifically developed GIS tool, linked to the descriptive data.
- **Coverage:** Belgium, Bulgaria, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden.
- **Resolution:**
- **Areas of application**: biodiversity, habitats monitoring, ecosystem
- **Accessibility**: free
- **Format:** GIS, mdb

Nationally designated areas (National - CDDA)

- **Link:** http://www.eea.europa.eu/data-and-maps/data/nationally-designated-areas-national-cdda-4
- **Brief description:** The European inventory of nationally designated areas holds information about protected sites and about the national legislative instruments, which directly or indirectly create protected areas. Coverage: EU27, Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Croatia, Georgia, Kazakhstan, Kyrgyzstan, Macedonia, the former Yugoslavian Republic of, Moldova, Republic of, Monaco, Montenegro, Russian Federation, Serbia, Tajikistan, Turkey, Turkmenistan, Ukraine, Uzbekistan (Black Sea catchment is totally covered).
- **Released:** 2009 (previous versions 2002-2008)
- **Resolution:** ~100m
- **Areas of application:** biodiversity, habitats monitoring, , ecosystem
- **Accessibility:** free of charge provided the source is acknowledged
- **Format:** .shp
- **Download link:** http://www.eea.europa.eu/data-and-maps/data/nationally-designated-areas-national-cdda-4

REABIC database

- **Link:** http://www.reabic.net/map_europe.html
- **Brief description:** The Regional Euro-Asian Biological Invasions Centre (REABIC) database provides on-line information on biological invasions.
- **Released:** 2001
- **Resolution**: actual observations
- **Areas of application:** ecosystem, biodiversity
- **Accessibility:** free (detailed information on request)

- **Format:**

GRID-Europa Datasets -GNV

- **Link:** http://www.grid.unep.ch/data/data.php
- **Brief description**: Historical GRID data collection on climate, soils, vegetation, water, socio-economic, human population, boundaries, etc
- **Released**: update frequency varies depending on data type
- **Period:** various
- **Resolution:** various
- **Areas of application:** environment management
- **Accessibility:** 80 % free
- **Format:** shape files, ASCII
- **Data link:** http://www.grid.unep.ch/data/data.php
- **Reported by:** UNIGE

3. Regional scale

3.1. Black Sea

Black Sea Information System (BSIS)

- **Link:** http://www.blacksea-commission.org/_bsis-description.asp
- **Brief description:** The Black Sea Information System (BSIS) contains nationally reported data and serves to the informational needs of the Black Sea Commission (BSC) and its Black Sea Integrated Monitoring and Assessment Programme (BSIMAP). The main purpose of the BSIS and BSIMAP is to provide reliable and consolidated data for 'state of the environment' reporting, 'impact assessments' of major pollutant sources, 'transboundary diagnostic analysis', SAP implementation reports. The BSIS contains data on:
    - o Sea water quality (about 40 determinants at more than 100 monitoring stations located mainly in the Black Sea coastal area - since 2001);
    - o Sediments quality (about 25 determinants at more than 30 stations located mainly in the Black Sea coastal area – since 1998)
    - o Pollution from Land Based Sources including river, industrial and municipal discharges (about 20 determinants– since 2001);
    - o Fish catches (~70 species) and stocks (assessment for ~20 species – since 1990);
- **Released:** 2005, updated annually
- **Time period:** 1990 - present
- **Resolution:** points
- **Coverage:** Black Sea (mainly coastal zone)
- **Areas of application:** assessment of environment, ecosystem studies
- **Accessibility:** restricted
- **Format:** ASCII (csv)
- **Data source link**: mailto:secretariat@blacksea-commission.org
- **Reported by:** BSC PS

Black Sea Surveys data

- **Brief description:** The research cruises dataset contains data collected in the cruises organized by the Black Sea Ecosystem Recovery project (BSERP) in 2003 -2006 in framework of its Research Programme. The cruises were carried out by international scientific teams at Bulgarian R/V Akademik (3 cruises) and Ukrainian R/V Vladimir Parshin (1 cruise). The Research Cruises dataset is multidisciplinary, containing data in areas of physical and chemical oceanography, marine biology, meteorology, sediment quality etc.
- **Released:** 2003-2006
- **Time period:** 1990 - present
- **Resolution:** stations
- **Coverage**: Western Black Sea
- **Areas of application:** investigation changes in the Black Sea ecosystem
- **Accessibility:** free
- **Format:** ASCII (reports, data files)
- **Data source link**: mailto:secretariat@blacksea-commission.org

Black Sea TDA GIS

- **Brief description:** Transboundary Diagnostic Analysis (TDA) GIS includes borders, cities, districts, roads, water bodies, protected areas, elevations, EEZ, land cover, hot spots, monitoring stations, municipal sources, etc.
- **Released:** 2007
- **Time period:**
- **Resolution**: 1:200 000
- **Coverage**: Black Sea + 500 km around
- **Areas of application:** TDA, regional analysis
- **Accessibility:** free/restricted (depending on data type)
- **Format:** shape files
- **Data source link**: mailto:secretariat@blacksea-commission.org
- **Reported by:** BSC PS

NATO TU-Black Sea database

- **Link:** http://sfp1.ims.metu.edu.tr/
- **Brief description:** Black Sea inter-disciplinary multivariable historical database was created in framework of the NATO TU-Black Sea project in 1994-1997 and is maintained in framework of the NATO SfP ODBMS Black Sea Projects. It includes all main physical, chemical and biological variables for the entire Black Sea basin. Database covers the most crucial period in the history of the Black Sea ecosystem starting from the "background" situation in 1960 till the drastic changes occurred in 90s. All data included into the database were quality checked by qualified groups of regional experts, well acquainted with the Black Sea data. Each value of physical, chemical and bio-optical data is accompanied with the quality flag.
- **Released:** 2002
- **Time period:** 1956-2001
- **Resolution:** stations
- **Coverage:** Black Sea
- **Areas of application:** ecosystem studies and assessment
- **Accessibility:** free
- **Format:** ASCII (csv)
- **Data source link:** http://sfp1.ims.metu.edu.tr/ODBMSDB/
- **Reported by:** BSC PS

Black Sea Oceanographic Database (BSOD)

- **Brief description:** The Black Sea Oceanographic Database (BSOD) was compiled on the base of the NATO TU-Black Sea database and MEDAR-MEDATLAS. The BSOD includes main physical, chemical and biological variables for the entire Black Sea basin (148 variables). The database includes data obtained at 74,532 oceanographic stations.
  For more information contact: Sukru Besiktepe, Director of IMS METU, sukru@ims.metu.edu.tr.
- **Released:** 2005
- **Time period:** 1890 - 2003
- **Resolution:** stations
- **Coverage:** Black Sea
- **Areas of application:** ecosystem studies and assessment

- **Accessibility:** free, provided by request by Institute of Marine Sciences, Middle East Technical University (www.ims.metu.edu.tr)
- Format: Paradox Database distributed on CD
- **Reported by:** BSC PS

Mnemiopsis leidyi Database

- **Link**: http://ps-blacksea-commission.ath.cx/MLDB/
- **Brief description:** The Mnemiopsis leidyi Database (MLDB) contains data on abundance and biomass of ctenophore Mnemiopsis leidyi collected in the Black Sea. The invasive ctenophore Mnemiopsis leidyi (Agassiz, 1865) was first found in the Black Sea in early 1980-s. This species created the tremendous ecosystem damage and big economic losses in the region in the late 1980-s, 1990-s. It was recognized as one of the main ecological problems for the Black Sea ecosystem.
- **Released:** 2008, updated regularly
- **Time period:** 1991 - 2009
- **Resolution:** stations
- **Coverage:** Black Sea
- **Areas of application:** ecosystem studies and assessment, biodiversity
- **Accessibility:** free for data older 5 years, conditional for recent data
- **Format:** MS SQL database, ASCII
- **Reported by:** BSC PS

3.2. Danube

DanubeGIS
- **Link:** http://www.danubegis.org/
- **Brief description**: 38 datasets collected for Danube RBM Plan 2009: SWB, GWB, HYMO, borders, cities, etc.
- **Released:** 2007
- **Time period:** 2009
- **Resolution:** various
- **Coverage:** Danube river basin
- **Areas of application:** environment management, spatial analysis and planning
- **Accessibility:** maps are freely accessible, data are restricted
- **Format:** shape files
- **Reported by:** ICPDR

TNMN database
- **Link:** www.icpdr.org/wq-db
- **Brief description:** TransNational Monitoring Network database contains data on river water quality and hydrology (average flow). Water quality data on about 50 determinants at about 40 monitoring stations located in the Danube River itself and 37 monitoring stations in tributaries are collected monthly. Flow data for load assessment are collected at 10 locations on the Danube River itself and 9 locations on the tributaries are collected daily.
- **Released:** 2000
- **Time period:** 1996 – 2006, updated every year
- **Resolution:** network of monitoring stations
- **Coverage:** Danube River Basin
- **Areas of application:** ecosystem studies and assessment
- **Accessibility:** free, registration required
- **Format:**
- **Data source link:**
- **Reported by:** ICPDR

Bucharest Declaration database
- **Link:** www.icpdr.org/danubis
- **Brief description:** Water quality data on about 48 determinants from 13 stations for flow and 11 for water quality located in the Danube River (monthly).
- **Released:** 2000
- **Time period:** 1992 – 1998
- **Resolution:** network of monitoring stations
- **Coverage:** Danube River Basin
- **Areas of application:** ecosystem studies and assessment
- **Accessibility:** free, registration required
- **Format:**
- **Data source link:**
- **Reported by:** ICPDR

Danube Surveys database

- **Link:** www.icpdr.org/danubis
- **Brief description:** Contains data on river water quality and river biology collected in following surveys: JDS1, JDS2, Aquaterra Danube Survey , Investigation of Tisza River.
- **Released:** every six years
- **Time period:** 2001, 2007
- **Coverage:** Danube river and some tributaries
- **Areas of application:** ecosystem studies and assessment
- **Accessibility:** free, registration required
- **Format:**
- **Data source link:**
- **Reported by:** ICPDR

Emissions Inventory

- **Link:** www.icpdr.org/danubis
- **Brief description:** Contains data on municipal and industrial discharges.
- **Released:** 2000
- **Time period: 1**997, 2000, 2002, 2005/2006
- **Coverage:** Danube river basin
- **Areas of application:** ecosystem studies and assessment
- **Accessibility:** free, registration required (partly)
- **Format:**
- **Data source link:**
- **Reported by:** ICPDR

Investment Projects database

- **Link:** www.icpdr.org/projects-db
- **Brief description:** Project investments and financing.
- **Released:** 2002
- **Time period:** 2002, 2004, 2006
- **Coverage:** Danube river basin
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:**
- **Reported by:** ICPDR

DRBMP Economic analysis

- **Link:**
- **Brief description:** Economic indicators: GDP, water pricing, etc.
- **Released:**
- **Time period:** 2009
- **Coverage:** Danube river basin
- **Areas of application:** economic analysis
- **Accessibility:** free, registration required
- **Format:**

- **Data source link:**
- **Reported by:** ICPDR

4. Country scale

4.1. Georgia

GIS Basemap
- **Link:**
- **Brief description:** Basemap dataset with roads/streets, buildings, communications, relief, infrastructure, administrative units, hydrography, etc.
- **Released: c**ontinuously updated
- **Time period:** 1999-2009
- **Resolution:**
- **Coverage:** All Georgia's municipalities (complete coverage with some intermittent gaps)
- **Areas of application:** socio-economic analysis, spatial planning, resource management, facilities management; land management
- **Accessibility:** restricted
- **Format:** shape files
- **Data source link:** mailto:office@geographic.ge
- **Reported by:** Geographic

Topographic DB
- **Link:**
- **Brief description:** Vector datasets based on the former soviet topographic quadrangle maps, updated with the RS. UTM (WGS 1984) & GK (Pulkovo 1942): borders, settlements, districts, transportation, hydro network, land cover, elevation, relief, communications.
- **Released: c**ontinuously updated
- **Time period:** 1980-2009
- **Resolution:** 1:50,000, 1:100,000, 1:200,000
- **Coverage:** all country
- **Areas of application:** socio-economic analysis, spatial planning, resource management, facilities management; land management
- **Accessibility:** restricted
- **Format:** vector
- **Data source link:** mailto:office@geographic.ge
- **Reported by:** Geographic

Topographic maps
- **Link:**
- **Brief description**: Raster, scanned & geo-referenced sheets (GKS42)
- **Released:** project based, irregular
- **Time period:** 1999
- **Resolution**: 1:10,000, 1:25,000, 1:100,000
- **Coverage**: all country
- **Areas of application:** socio-economic analysis, spatial planning, resource management, facilities management; land management
- **Accessibility:** restricted

- **Format:**
- **Data source link:** mailto:office@geographic.ge
- **Reported by:** Geographic

Tbilisi municipal GDB

- **Link:** http://napr.gov.ge/index.php?m=222
- **Brief description**: basemap dataset with streets, buildings, communications, relief, DEM, Infrastructure, administrative units, hydrography, etc.
- **Released: c**ontinuously updated
- **Time period:** 1999-2006
- **Resolution:**
- **Coverage**: Tbilisi
- **Areas of application:** socio-economic analysis, spatial planning, resource management, facilities management; land management
- **Accessibility**: restricted
- **Format:**
- **Data source link:** mailto:office@geographic.ge
- **Reported by:** Geographic

Population data

- **Link:** http://napr.gov.ge/index.php?m=222
- **Brief description**: population, birth rate, mortality rate, Infant death by age and sex, Marriages and divorces, Life expectancy at birth etc.
- **Released: c**ontinuously updated
- **Time period:** 2002
- **Resolution:**
- **Coverage**: whole country
- **Areas of application:** demographic analysis
- **Accessibility**: restricted
- **Format:** bundled with spatial dataset
- **Data source link:** mailto:office@geographic.ge
- **Reported by:** Geographic

DEM

- **Link:**
- **Brief description**: raster, geo-referenced (WGS84, UTM, Zone 38N)
- **Released:** project based, irregular
- **Time period:** 1999
- **Resolution**: 10m
- **Coverage**: all country
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:office@geographic.ge

Land cadastre

- **Link:** http://napr.gov.ge/index.php?m=222

- **Brief description:** database includes parcel information, buildings, hydro network, communications, infrastructure, etc.
- **Released: c**ontinuously updated
- **Time period:** 1996-2009
- **Resolution:**
- **Coverage**: Georgia, Tbilisi, Poti
- **Areas of application:**
- **Accessibility**: data are restricted
- **Format:**
- **Reported by:** Geographic

Forestry

- **Link:**
- **Brief description:** Forest inventory datasets
- **Released:** project based, irregular
- **Time period:** 2004-2006, 2008
- **Resolution:**
- **Coverage:** Adjara, Tsageri, Lentekhi, Tsalenjikha, Chkhorotsku
- **Areas of application:** forest management
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:office@geographic.ge
- **Reported by:** Geographic

Geology

- **Link:**
- **Brief description:** Engineering geology data
- **Released:**
- **Time period:** 2004
- **Resolution:** 1:500,000
- **Coverage:** all country
- **Areas of application:**
- **Accessibility:** restricted
- **Format:** vector
- **Data source link:** mailto:office@geographic.ge
- **Reported by:** Geographic

Soil

- **Link:**
- **Brief description**: soil type data collected under the KfW funded Land Cadastral Project (1999-2007).
- **Released:**
- **Time period**: 2002-2004
- **Resolution:** 1:5,000 and 1:10,000
- **Coverage:** all country
- **Areas of application:**
- **Accessibility:** restricted

- **Format:** vector
- **Data source link:** mailto:office@geographic.ge
- **Reported by:** Geographic

Healthcare facilities database

- **Link:**
- **Brief description**: combination of vector, raster and tabular data
- **Released:**
- **Time period**: 2003-2006
- **Resolution:**
- **Coverage:** all country
- **Areas of application:** optimizing the rehabilitation of healthcare facilities commissioned by the Ministry of Health and Labour
- **Accessibility:** restricted
- **Format:** vector
- **Data source link:** mailto:office@geographic.ge
- **Reported by:** Geographic

Disasters management database

- **Link:**
- **Brief description**: vector and tabular datasets, including population, transport, public buildings
- **Released:**
- **Time period**: 1999
- **Resolution:**
- **Coverage:** all country
- **Areas of application:** disaster preparedness, analysis of natural catastrophic events such as floods, landslides, mudflows, etc.
- **Accessibility:** restricted
- **Format:** vector
- **Data source link:** mailto:office@geographic.ge
- **Reported by:** Geographic

Orthophotos

- **Link:**
- **Brief description:** Raster, Spectral Characteristic: Panchromatic (WGS84, UTM, Zones 37N, 38N). Survey done with frame camera, ADS40.
- **Released:** project based, irregular
- **Time period:** 2000-2007
- **Resolution**: Ground Sample Distance (GSD): 0.1 – 1m
- **Coverage: i**nternal mountainous areas of Georgia, Tbilisi, Bakuriani, Adjara, Kazreti, Oni, Ambrolauri, Tsageri, Lenteckhi
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:office@geographic.ge
- **Reported by:** Geographic

Aerial imagery

- **Link:**
- **Brief description:** Raw data, Spectral Characteristic: Panchromatic, RGB & Near-infrared. Survey done with ADS40.
- **Released:** project based, irregular
- **Time period:** 2006-2007
- **Resolution**: 1:8,000, 1:30,000
- **Coverage: i**nternal mountainous areas of Georgia, Tbilisi, Batumi
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:office@geographic.ge
- **Reported by:** Geographic

Satellite imagery

- **Link:**
- **Brief description**: raster color and panchromatic geo-referenced (WGS84, UTM, Zones 37N, 38N) images from IKONOS, IRS, KATE, Landsat, Resurs, SPOT, ASTER, KVR
- **Released:** project based, irregular
- **Time period:** 1987-2006
- **Resolution**: Ground Sample Distance (GSD): 1m – 140m (depending on platform type)
- **Coverage**: different cities and regions including coastal area
- **Areas of application:**
- **Accessibility:** restricted
- **Format:** geo-referenced raster
- **Data source link:** mailto:office@geographic.ge
- **Reported by:** Geographic

Rioni River database

- **Link:**
- **Brief description**: historical pollution, hydrological and climate data of variable quality
- **Released:**
- **Time period:**
- **Resolution**:
- **Coverage**: Rioni river basin
- **Areas of application:**
- **Accessibility:**
- **Format:**
- **Data source link:** mailto:office@geographic.ge
- **Reported by:** Geographic

Database of NEA

- **Link:** http://www.nea.gov.ge/index.php?lang_id=ENG&sec_id=224
- **Brief description**: Department of Hydrometeorology of National Environmental Agency (NEA) in the frames of its competence provides all interested physical persons and legal entities with the following chargeable data and services:

- o Regime (Historical) Data
  - ▪ Meteorological information of the current day, received from observational network (air temperature, atmospheric pressure, wind direction and speed, atmospheric processes);
  - ▪ Daily information from the hydrological posts (water level and relevant discharge);
  - ▪ Information regarding conditions of Sioni water reservoir;
  - ▪ Metadata on meteorological stations and posts;
- o Climatic Data: all types of certain climatic characteristics (air soil temperature, air humidity, atmospheric precipitations, snow cover, wind, cloudiness, fog, thunder storms, hail, snow-storm, solar radiation and radiation balance, solar lightning) for meteorological posts and stations;
  - o Agro-meteorological Data
- **Released**: regularly updated
- **Time period:**
- **Resolution**: stations
- **Coverage**: country
- **Areas of application:**
- **Accessibility**: chargeable
- **Format:**

4.2. Romania

Administrative

- **Link:** www.mmediu.ro
- **Brief description:**
- **Released:**
- **Time period:** 2000 - 2005
- **Resolution:**
- **Areas of application:**
- **Accessibility:** conditional
- **Format:** vector
- **Download link:**
- **Reported by:** DDNI

Demographic Dataset

- **Link**
- **Brief description:** the database available at Institute of Geography of the Romanian Academy (IGAR) contains data on:
  - o Population density
  - o Population structure by nationality
  - o Demographic size of localities
  - o Population structure by religion
  - o Birth rates
  - o Mortality rates
- **Released:**
- **Time period:** 1990, 1992,2000, 2002, 2007 (depending on data type)
- **Resolution:** NUTS3, NUTS5
- **Coverage**: Romania
- **Areas of application:**
- **Accessibility**: free
- **Format:**
- **Download link:** mailto:igar@geoinst.ro
- **Reported by:** IGAR

Agriculture Dataset

- **Link**
- **Brief description:** the database available at Institute of Geography of the Romanian Academy (IGAR) contains data on:
  - o Land cover/Land use categories
  - o Agricultural exploitations (by number, size class, land use categories, etc)
  - o Agricultural branch production
  - o Cultivated area, by main in crop
  - o Crop production, for main crop
  - o Average yield, for main crop
  - o Livestock
  - o Animal production

- o   Park of tractors and of main agricultural machinery
- o   Chemical and natural fertilizers used in agriculture
- **Released:**
- **Time period:** 1990 – 2007 (depending on data type and resolution)
- **Resolution:** NUTS3, NUTS5
- **Coverage**: Romania
- **Areas of application:**
- **Accessibility**: free
- **Format:**
- **Download link:** mailto:igar@geoinst.ro
- **Reported by:** IGAR

Soils

- **Link:** www.mmediu.ro
- **Brief description:**
- **Released:**
- **Time period:** 1990 - 2005
- **Resolution:**
- **Areas of application:**
- **Accessibility:** conditional
- **Format:** vector
- **Download link:**
- **Reported by:** DDNI

Romanian river register

- **Link:** www.mmediu.ro
- **Brief description:**
- **Released:**
- **Time period:** 2000 - 2008
- **Resolution:**
- **Areas of application:**
- **Accessibility:** conditional
- **Format:** vector
- **Download link:**
- **Reported by:** DDNI

Natura 2000

- **Link:** http://www.natura2000.ro/
- **Brief description:** biodiversity
- **Released:**
- **Time period:** 2000 - 2009
- **Resolution:**
- **Areas of application:**
- **Accessibility:** conditional
- **Format:** shape files
- **Download link:**
- **Reported by:** DDNI

Danube delta vegetation map

- **Link:** www.indd.tim.ro
- **Brief description:**
- **Released:**
- **Time period:** 1993, 2003
- **Resolution:**
- **Coverage**: Danube delta
- **Areas of application:**
- **Accessibility:** conditional
- **Format:** vector
- **Download link:**
- **Reported by:** DDNI

Climatic Dataset

- **Link**
- **Brief description:** the database available at Institute of Geography of the Romanian Academy (IGAR) contains data on:
  - o Sunshine time
  - o Duration of frost period on soil surface
  - o Relative moisture
  - o Number of snow-layer days/month
  - o Air temperature, monthly and annual means
  - o Absolute extreme temperatures
  - o Monthly and annual precipitations amounts
  - o Absolute maximum and mean quantities of precipitation/24 hours
  - o Annual frequency of atmospheric calm and the dominant winds

  Annual and monthly averages are obtained on the base of historical data available since 1886.
- **Released:**
- **Time period:** depends on data type
- **Resolution:** ?
- **Coverage**: Romania
- **Areas of application:**
- **Accessibility**: free
- **Format:**
- **Download link:** mailto:igar@geoinst.ro
- **Reported by:** IGAR

Hazards Dataset

- **Link**
- **Brief description:** the dataset available at Institute of Geography of the Romanian Academy (IGAR) contains information on vulnerability to natural, climatic and technological hazards such as :
  - o Landslides susceptibility
  - o Vulnerability to floods
  - o Extreme dates of air freeze occurrence and maximum soil freezing depth
  - o Areas vulnerable to the action of freeze and hoar; rime; sleet and snow-broth; ice deposits; snowstorm; high winds; intensity to summer rains; fog and acid rains

- o Seveso III units
- o Mining exploitations
- **Released:** 2009
- **Time period:** 2009
- **Resolution:** ?
- **Coverage**: Romania
- **Areas of application:**
- **Accessibility**: free
- **Format:**
- **Download link:** mailto:igar@geoinst.ro
- **Reported by:** IGAR

NIMRD database

- **Link**
- **Brief description:** the database of the National Institute for Marine Research and Development (NIMRD) "Grigore Antipa" Constanta, Romania contains data on:
  - o Catch and landings
  - o Fishing effort
  - o Catch structure on fish species
  - o Spawning and recruitment intensity
  - o Fish stock biomass
  - o Biological parameters
- **Released:** updated annually
- **Time period:** since 1950 for first three data types listed above, since 1992 for others
- **Resolution:**
- **Coverage**: Black Sea
- **Areas of application:** Preparation of the periodic report on the State of Environment of the Black Sea, scientific advice on stocks of Community interest
- **Accessibility**: restricted
- **Format:**
- **Download link:** mailto:office@alpha.rmri.ro

4.3. Ukraine

Wintering of Otis tarda

- **Link:**
- **Brief description:** birds .
- **Released:** updated 1-3 times per year
- **Time period:** 1998-2007
- **Resolution:**
- **Coverage:** arid steppe zone of Ukraine
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:anthropoides@mail.ru
- **Reported by:** AZBOS

The structure of fish populations

- **Link:**
- **Brief description:** fish
- **Released:** updated 1-4 times per year
- **Time period:** 1996-2009
- **Resolution:**
- **Coverage:** Azov sea basin
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:demvik@bigmir.net
- **Reported by:** AZBOS

Number and distribution of fish by water bodies

- **Link:**
- **Brief description:** fish
- **Released:** updated 1-4 times per year
- **Time period:** 1996-2009
- **Resolution:**
- **Coverage:** Azov sea basin
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:demvik@bigmir.net
- **Reported by:** AZBOS

The structure of fish catches

- **Link:**
- **Brief description:** fish
- **Released:** updated 1-4 times per year
- **Time period:** 1996-2009

- **Resolution:**
- **Coverage:** Azov sea basin
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:demvik@bigmir.net
- **Reported by:** AZBOS

Data of breeding birds

- **Link:**
- **Brief description:** birds
- **Released:** updated yearly
- **Time period:** 1976-2009
- **Resolution:**
- **Coverage:** Azov-Black Sea Region of Ukraine
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:azov.black.station@gmail.com
- **Reported by:** AZBOS

Wintering birds in wetland of South of Ukraine

- **Link:**
- **Brief description:** birds
- **Released:** updated yearly
- **Time period:** 1976-2009
- **Resolution:**
- **Coverage:** Azov-Black Sea Region of Ukraine
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:azov.black.station@gmail.com
- **Reported by:** AZBOS

Data of migration birds

- **Link:**
- **Brief description:** birds
- **Released:** updated yearly
- **Time period:** 1976-2009
- **Resolution:**
- **Coverage:** Azov-Black Sea Region of Ukraine
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:azov.black.station@gmail.com
- **Reported by:** AZBOS

Number and distribution of bird in different season

- **Link:**
- **Brief description:** birds
- **Released:** updated yearly
- **Time period:** 1976-2009
- **Resolution:**
- **Coverage:** Azov-Black Sea Region of Ukraine
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:azov.black.station@gmail.com
- **Reported by:** AZBOS

Morphology of reptiles

- **Link:**
- **Brief description:** reptiles
- **Released:** updated yearly
- **Time period:** 1991-2009
- **Resolution:**
- **Coverage:** Azov-Black Sea Region of Ukraine
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:yu_karmishev@rambler.ru
- **Reported by:** AZBOS

The fertility of reptiles

- **Link:**
- **Brief description:** reptiles
- **Released:** updated yearly
- **Time period:** 1991-2009
- **Resolution:**
- **Coverage:** Azov-Black Sea Region of Ukraine
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:yu_karmishev@rambler.ru
- **Reported by:** AZBOS

Number and distribution of reptiles

- **Link:**
- **Brief description:** reptiles
- **Released:** updated yearly
- **Time period:** 1991-2009
- **Resolution:**
- **Coverage:** Azov-Black Sea Region of Ukraine
- **Areas of application:**

- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:yu_karmishev@rambler.ru
- **Reported by:** AZBOS

The number and distribution of Lepidoptera; Noctuidae on the south of Ukraine

- **Link:**
- **Brief description:** insects
- **Released:** updated yearly
- **Time period:** 1994-2009
- **Resolution:**
- **Coverage:** Zaporozhzhya region, Odessa region, Crimea
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:sereban.melit@mail.ru
- **Reported by:** AZBOS

The species compositions, number and distribution of Macrolepidoptera in Zaporozhzhya region

- **Link:**
- **Brief description:** insects
- **Released:** updated yearly
- **Time period:** 1994-2009
- **Resolution:**
- **Coverage:** Zaporozhzhya region, Ukraine
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:sereban.melit@mail.ru
- **Reported by:** AZBOS

Rare species of insect of Zaporozhzhya region

- **Link:**
- **Brief description:** insects
- **Released:** updated yearly
- **Time period:** 1994-2009
- **Resolution:**
- **Coverage:** Zaporozhzhya region, Ukraine
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:sereban.melit@mail.ru
- **Reported by:** AZBOS

The number and distribution of mammals

- **Link:**
- **Brief description:** mammals

- **Released:** updated yearly
- **Time period:** 1990-2009
- **Resolution:**
- **Coverage:** Dniester region
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:rogenkonikolaj@gmail.com
- **Reported by:** AZBOS

Hydrochemical data of Azov Sea Basin

- **Link:**
- **Brief description:** hydrochemical data
- **Released:** updated 1-4 times per year
- **Time period:** 1996-2009
- **Resolution:**
- **Coverage:** Azov sea basin
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** mailto:demvik@bigmir.net
- **Reported by:** USRIEP

Socio-economic data

- **Link:**
- **Brief description:** average annual data on population, agriculture, industries, etc.
- **Released:** updated yearly
- **Time period:** 1996-2007
- **Resolution:**
- **Coverage:** Black / Azov Sea basin
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:**
- **Reported by:** USRIEP

Point pollution sources - municipal WWTP

- **Link:**
- **Brief description:** average annual chemical
- **Released:** updated yearly
- **Time period:** 1996-2007
- **Resolution:**
- **Coverage:** Black Sea
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:**

- **Reported by:** USRIEP

Point pollution sources - industrial WWTP

- **Link:**
- **Brief description:** average annual chemical
- **Released:** updated yearly
- **Time period:** 1996-2007
- **Resolution:**
- **Coverage:** Black Sea
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:**
- **Reported by:** USRIEP

Pollution load with rivers to the Black Sea

- **Link:**
- **Brief description:** average annual chemical
- **Released:** updated yearly
- **Time period:** 1995-2007
- **Resolution:**
- **Coverage:** Black Sea coast
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link:** USRIEP
- **Reported by:** USRIEP

Zooplankton in the Sevastopol Bay

- **Link:** http://www.ibss.org.ua/Default.aspx?tabid=508
- **Brief description:** zooplankton data
- **Released:** updated once per 2 weeks
- **Time period:** 2002-2009
- **Resolution:**
- **Coverage:** Sevastopol Bay
- **Areas of application:**
- **Accessibility:** conditional
- **Format:**
- **Data source link:** mailto:info@ibss.org.ua
- **Reported by:** IBSS

IBSS Data and Metadata Access Portal

- **Link:** http://data.ibss.org.ua/
- **Brief description:** hydrobiological data (zooplankton, phytoplankton, hydrophysical and hydrochemical parameters) collected in scientific expeditions of IBSS
- **Released:**
- **Time period:** 1958-2009
- **Resolution:**

- **Coverage:** World Ocean, including Black Sea
- **Areas of application:**
- **Accessibility:** metadata are free, data are mainly restricted
- **Format:**
- **Data source link:** mailto:info@ibss.org.ua
- **Reported by:** IBSS

Hydro-meteorological database of DHMO

- **Brief description:** water levels, water temperature, measured water discharge, H/Q water discharge, water turbidity, suspended sediments, air temperature, precipitation, evaporation, wind velocity and direction, soil temperature, water quality, air quality, radioactivity
- **Released:** updated daily
- **Time period:** mainly since 1960-present (water levels and temperature – since 1921, water quality – monthly since 1970, air quality – since 1990, radioactivity – since 1980)
- **Resolution**: actual measurements
- **Coverage:** Black Sea Basin - Lower Danube Region
- **Areas of application:**
- **Accessibility:** restricted
- **Format:** ASCII
- **Data source link:** mailto:dhmo@izm.odessa.ukrtel.net
- **Reported by:** DHMO

Water quality database of ONU

- **Link:** http://www.onu.edu.ua/?type=en&action=monitoring_center
- **Brief description:** water quality data in:
    - coastal zone of Zmiinyi is. (2002-2009, every ten days)
    - lower Dnister river (2002-2009, yearly)
    - Lower Danube lakes: Yalpug, Katlabuck, Kartal, Kitai, Kagul (2002-2004, yearly).
- **Released:**
- **Time period:**
- **Resolution:**
- **Coverage:** NW coastal zone of Black Sea
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link**: mailto:medinets@te.net.ua
- **Reported by:** ONU

Greenhouse gases and aerosols at st. Petrodoloskoye

- **Link:**
- **Brief description:** concentrations of Greenhouse gases and aerosols obtained in framework of NEU project.
- **Released:**
- **Time period:** 2006 – 2009, biweekly
- **Resolution:**

- **Coverage:** st. Petrodoloskoye
- **Areas of application:**
- **Accessibility:** restricted
- **Format:**
- **Data source link**: mailto:medinets@te.net.ua
- **Reported by:** ONU

Natural reserves of Crimea

- **Link:**
- **Brief description**: The database includes a set of detailed descriptions and maps of protected landscapes on the territory of Crimea.
- **Released:**
- **Time period:** 2000 – 2009, updated annually
- **Resolution:**
- **Coverage:** Crimea
- **Areas of application:**
- **Accessibility:** restricted
- **Format:** text, maps
- **Data source link**:
- **Reported by:** TNU

4.4. Hungary

OPADAT

- **Link:** http://www.hydroinfo.hu
- **Brief description:** hydrological data and meteorological data
- **Released**: continuously updated
- **Time period**: 1983 -
- **Resolution:**
- **Coverage**: country
- **Areas of application:**
- **Accessibility:** on request
- **Format:**
- **Reported by:** VITUKI

Gap Analysis Report - Phase II

Title	:	EnviroGRIDS Gap Analysis 2
Creator	:	Dan Adrian Teodor (ICPDR)
Creation date	:	17.01.2011
Date of last revision	:	28.03.2011
Subject	:	Observation systems, GEOSS, INSPIRE
Status	:	On going
Type	:	Word document
Description	:	This document is focus on Observation Systems and on level of implementation of GEOSS and/or INSPIRE within the Black Sea catchment.
Contributor(s)	:	Gregory Giuliani, Volodymyr Myroshnychenko
Rights	:	Restricted to project partners (including the Commission Services)
Identifier	:	enviroGRIDS_D26_2.doc
Language	:	English
Relation	:	EnviroGRIDS data storage guideline (enviroGRIDS_D22),
		EnviroGRIDS sensor data use and integration guideline (enviroGRIDS_D23), EnviroGRIDS remote sensing data use and integration guideline (enviroGRIDS_D24), Grid infrastructure sustainability for environmental sciences (enviroGRIDS_D25), EnviroGRIDS Gap Analysis 1 (enviroGRIDS_D26_Gap_Analysis)

1. Abstract:

This document show an overview about what is INSPIRE and GEOSS, which are the recruitments of INSPIRE and GEOSS, and how EnviroGRIDS project is linked to both INSPIRE and GEOSS.

Executive Summary

The aim of the EU FP7 EnviroGRIDS project is to build capacities in the Black Sea region to use new international standards to gather, store, distribute, analyze, visualize and disseminate crucial information on past, present and future states of this region, in order to assess its sustainability and vulnerability. To achieve its objectives, EnviroGRIDS will build a Grid-enabled Spatial Data Infrastructure (GSDI) becoming one of the integral systems in the Global Earth Observation System of Systems (GEOSS), and compatible with the new EU directive on Infrastructure for Spatial Information in the European Union (INSPIRE), as well as UNSDI developments.

The present deliverable tries to give a good overview about INSPIRE and GEOSS.

The aim of the document is to convince the partners to share and integrate geographical data and metadata in a more efficient way and without restrictions, if possible.

INTRODUCTION

1.1 Scope and purpose of the Task 2.1: Gap Analysis 2

The purpose of the Task 2.1 Gap Analysis is to establish a list of existing environmental and non-environmental datasets and observation systems within the Black Sea catchment and to assess their correspondence to the project needs and level of compatibility with the INSPIRE and GEOSS standards of interoperability.

The Gap Analysis will allow identifying areas where most efforts are needed to reinforce existing Observation Systems in this region and is carried out under the supervision of BSC PS and ICPDR with involvement of all enviroGRIDS partners in order to get a picture of the state of development of Earth Observation Systems and Spatial Data Infrastructures in the different countries within the Black Sea catchment.

The aim of the gap analysis is also to identify projects and new partners that could contribute to address priority gaps in the activities and observation systems of BSC and ICPDR. The allocated budget for this purpose should be enough to involve two or three new partners into the project consortium. Apart from this allocated budget, co-financing will be searched to allow the integration of new partners according to the results of the gap analysis. An improved collaborations with other projects is also needed (e.g. euroGEOSS, UPGRADE Black Sea Scene) as well as efforts to get the results of previous projects (e.g. Black Sea Scene, SESAME).

The enviroGRIDS project is now an official task in the work plan of the Group of Earth Observations (GEO) to set up the Global Earth Observation System of Systems (GEOSS). GEOSS is built upon, and adding value to, existing and planned Earth observation systems by connecting them to one another. The enviroGRIDS project will build capacity for assembling fragmented and often inaccessible environmental data into interoperable, contiguous and readily available data streams in the complete catchment. A large catalogue of environmental data sets (e.g. land use, hydrology, and climate) will be gathered and used to perform distributed spatially-explicit simulations to build scenarios of key environmental changes. This gap analysis is one of the first steps on building the capacity on Earth Observation Systems in the Black Sea catchment in terms of bringing together Environmental institutes and Organizations, National data centres, Governmental agencies, etc. in order to impulse building policies, programmes and managerial structures in governments and organizations and to enhance the understanding of the value of EO data and products.

According to the enviroGRIDS Document of Work (DoW), the Gap Analysis is planned in two phases with corresponding deliverables D2.6 by Month 12 and Month 24 of the project duration. First phase was finalized in April 2010 with focus on identification of available data and observation systems for the Black Sea catchment region and their initial analysis against project and end-user needs. The second phase (current) will focus with the analysis of compatibility of the datasets and observation systems with INSPIRE and GEO standards of interoperability, improving the initial analysis and formulating recommendations for improvement of networks of data acquisition in each region/country.

The task 2.1 will contribute to the main target of WP2 – development of the Spatial Data Infrastructure (SDI) for the Black Sea catchment region by providing information for a large catalogue of environmental data sets (e.g. land use, hydrology, and climate) to be gathered and used to perform distributed spatially-explicit simulations and to build scenarios of key environmental changes.

The vision of an SDI incorporates different databases, ranging from the local to international, into an integrated information highway that constitutes a framework, needed by a community, in order to make effective use of geospatial data and to encourage existing observation systems in the Black Sea catchment to register their institution as a GEOSS components, their metadata, and if possible their data and processing services as well.

1.2 Scope and purpose of Deliverable 2.6.2

This document aims to provide an overview about what are INSPIRE and GEOSS, which are their requirements and the implementation status in the Black Sea catchment region and analysis of the gaps with respect to the project and end-user data requirements.

There are 2 main chapters of the deliverable which cover the following points:

- INSPIRE Directive (chapter 2)
- GEO/GEOSS (chapter 3)

Each chapter contains detailed information about the above-mentioned topics, including their requirements, status of implementation and recommendations.

This report is strongly linked with:

       D2.2: EnviroGRIDS data storage guideline
       D2.3: EnviroGRIDS sensor data use and integration guideline,
       D2.4: EnviroGRIDS remote sensing data use and integration guideline,
       D2.5: Grid infrastructure sustainability for environmental sciences,
       D2.6: EnviroGRIDS Gap Analysis 1.

This report will contribute to the main target of WP2 – development of the Spatial Data Infrastructure (SDI) for the Black Sea catchment region by providing information for a large catalogue of environmental data sets, observation systems and metadata and to assess level of compatibility with the INSPIRE and GEO standards of interoperability.

1.3 Contributors to the Deliverable

Dan Teodor:

Is the GIS Expert at ICPDR to assist in the development and maintenance of the ICPDR GIS system and in particular in ensuring the uploading data from representatives of the Danube countries. He joined the ICPDR from the company responsible for water management in Romania (National Administration ―Aele Romane" Bucharest, Romania) where he was responsible for the organization of GIS and data collection for the EU Water Framework Directive. In the enviroGRIDS project, he is involved on WP2 (Spatial Data Infrastructure) to perform and supervise the gap analysis (Task 2.1) and Grid-enabled Spatial Data Infrastructure (Task 2.7) to exchange data in various format and projections within the Black Sea catchment

Gregory Giuliani:

After obtaining a degree in Earth Sciences, he went on to complete a master in Environmental Sciences, specializing in remote sensing and GIS. He previously worked as a GIS Consultant for the World Health Organization, as a University tutor in remote sensing and GIS and as a GIS Developer in a local Swiss GIS company. He works at UNEP/GRID-Europe since 2001 and is the focal point for Spatial Data Infrastructure (SDI). In 2008, he also started to collaborate closely with the enviroSPACE laboratory where he begins a PhD thesis and works also for the FP7 ACQWA project. In enviroGRIDS, he is involved as WP2 leader where his objective is to coordinate SDI and Grid technology researches.

Volodymyr Myroshnychenko:

Is the expert working in the Permanent Secretariat Commission on the Protection of the Black Sea Against Pollution (BSC PS) for the enviroGRIDS project. He has a master degree in Automated Control Systems. His subject is the management of marine data and information. After graduating from Kharkov Polytechnic Institute in Ukraine he worked in the Marine Hydrophysical Institute in Sevastopol, then in the Institute of Marine Sciences of the Middle East Technical University in Turkey. From 2005-2007, he worked as Data and Information Management Expert at the Project Coordination Unit of the Caspian Environment Programme. In the enviroGRIDS project, he is involved in the implementation of WP2.

2. INSPIRE - Infrastructure for Spatial Information in the European Community

INSPIRE is a Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing the Infrastructure for Spatial Information in the European Community. INSPIRE addresses mainly such policy and activities that may have direct or indirect impact on environment; there are also implications and overlaps with other activities, policies and initiatives with complementary objectives. The Directive does not require collecting of new spatial data; it foresees that data should be collected only once and then stored, made available and maintained at the most appropriate level; the infrastructure should ensure the possibility of combining data from different sources in a consistent way and sharing them among users and applications.

The INSPIRE Directive is a legal act (Directive 2007/2/EC) of the Council of the European Union and the European Parliament setting up an Infrastructure for Spatial Information in Europe based on infrastructures for spatial information established and operated by the 27 Member States of the European Union (EU). For the readers not familiar with the institutional setup of the European Union, it is worth pointing out that the EU is not a federal state but a union of 27 sovereign Member States that agree through a series of international treaties (the latest being the Lisbon Treaty of 2009) to the policy areas in which they wish to share responsibilities and resources (e.g., agricultural, environmental, and regional policies) and those that remain instead the exclusive domain of the national governments (e.g., defense and immigration).

The European Directive on ―Infrastructure for Spatial Information in the European Community‖ (INSPIRE) is a major milestone for the use of Geographical Information in Europe, and is a central contribution to environmental policy and sustainable development.

The Directive is a legal agreement that encourages European countries to have: up-to-date metadata using identified themes lists and numbers of attributes, interoperability for dataset and services, facilitation of network access and sharing of data.

The purpose of INSPIRE is to support environmental policy and overcome major barriers still affecting the availability and accessibility of relevant data. These barriers include:
- Inconsistencies in spatial data collection, where spatial data is often missing or incomplete or, alternatively, the same data is collected twice by different organizations
- Lack or incomplete documentation of available spatial data
- Lack of compatibility among spatial datasets that cannot, therefore, be combined with others
- Incompatible SDI initiatives within a Member State that often function only in isolation
- Cultural, institutional, financial, and legal barriers preventing or delaying the sharing of existing spatial data

2.1 About INSPIRE

The INSPIRE directive came into force on 15 May 2007 and will be implemented in various stages, with full implementation required by 2019. The INSPIRE directive aims to create a European Union (EU) spatial data infrastructure. This will enable the sharing of environmental spatial information among public sector organizations and better facilitate public access to spatial information across Europe.

To ensure that the spatial data infrastructures of the Member States are compatible and usable in a Community and transboundary context, the Directive requires that common Implementing Rules (IR) are adopted in a number of specific areas (Metadata, Data Specifications, Network Services, Data and Service Sharing and Monitoring and Reporting). These IRs are adopted as Commission Decisions or Regulations, and are binding in their entirety. The Commission is assisted in the process of adopting such rules by a regulatory committee composed of representatives of the Member States and chaired by a representative of the Commission.

INSPIRE is based on the infrastructures for spatial information established and operated by the Member States of the European Union. The Directive addresses **34 spatial data themes** (*see Table 1 and Annex A – INSPIRE themes*) needed for environmental applications, with key components

specified through technical implementing rules. This makes INSPIRE a unique example of a legislative –regional" approach.

Table 1: Spatial data themes addressed by INSPIRE

Annex I
1 Coordinate reference systems
2 Geographical grid systems
3 Geographical names
4 Administrative units
5 Addresses
6 Cadastral parcels
7 Transport networks
8 Hydrography
9 Protected sites
Annex II
1 Elevation
2 Land cover
3 Orthoimagery
4 Geology
Annex III
1 Statistical units
2 Buildings
3 Soil
4 Land use
5 Human health and safety
6 Utility and governmental services
7 Environmental monitoring Facilities
8 Production and industrial facilities
9 Agricultural and aquaculture facilities
10 Population distribution and demography
11 Area management/restriction/regulation zones & reporting units
12 Natural risk zones
13 Atmospheric conditions
14 Meteorological geographical features
15 Oceanographic geographical features
16 Sea regions
17 Bio-geographical regions
18 Habitats and biotopes
19 Species distribution
20 Energy Resources
21 Mineral Resources

The legal framework of INSPIRE has two main levels. First one is the INSPIRE Directive itself, which sets the objectives to be achieved and asks the Member States to pass their own national legislation establishing their SDIs. This mechanism of European plus national legislation allows each country to define its own way to achieve the objectives agreed upon, taking into account its own institutional characteristics and history of development. The second one is the establishment of a EU geo-portal operated by the European Commission to which the infrastructures of the Member States have to connect.

2.2 Requirements of INSPIRE

This section describes what is the INSPIRE and what are its principles and requirements. The main source of information are INSPIRE documents. INSPIRE lays down general rules to establish an infrastructure for spatial information in Europe for the purposes of Community environmental policies, and policies or activities which may have an impact on the compliant systems.

The **Implementation Phase** (2009-2019) should cover the implementation of the Implementing Rules by Member States and monitoring of the implementation through reporting according to the road map of the INSPIRE.

The Implementing Rules (IR) are for the following INSPIRE elements:

• Metadata – INSPIRE metadata profiles for spatial datasets, spatial datasets series and for services are outlined through set of metadata elements. It includes the minimum set of metadata elements necessary to comply with the INSPIRE Directive. It should ensure that all geospatial information resources and data produced and made available by Member States and their constituent organizations are catalogued in a standard way to support a consistent means of discovery, understanding and access across the Community.

Figure 1: INSPIRE Metadata Editor

• Data Specifications – Data Specifications pertain to the content of a basic set of data themes that each Member State is required to maintain and also the technological standards for communication of those data themes for use. The set of spatial data themes is listed in Annexes I, II and III to the INSPIRE Directive. These rules will enable full data use and interoperability across the INSPIRE network.

• Network Services – Member States are required to establish and operate a network of services for the spatial data sets and services. In order to ensure the compatibility and usability of such services on the Community level, it is necessary to lay down the technical specifications and minimum performance criteria for those services with regard to the themes listed in Annexes I, II and III to the INSPIRE Directive (*see Table 1*). In order to ensure that public authorities and the third parties are given the

technical possibility to link their spatial data sets and services to the Network Services, it is necessary to lay down the appropriate requirements for those services (including services that enable discovery, viewing, downloading and data transformation).

• Data and Service Sharing - The INSPIRE Directive requires the development of implementing rules to regulate the provision of access to spatial data sets and services from Member States to the institutions and bodies of the Community.
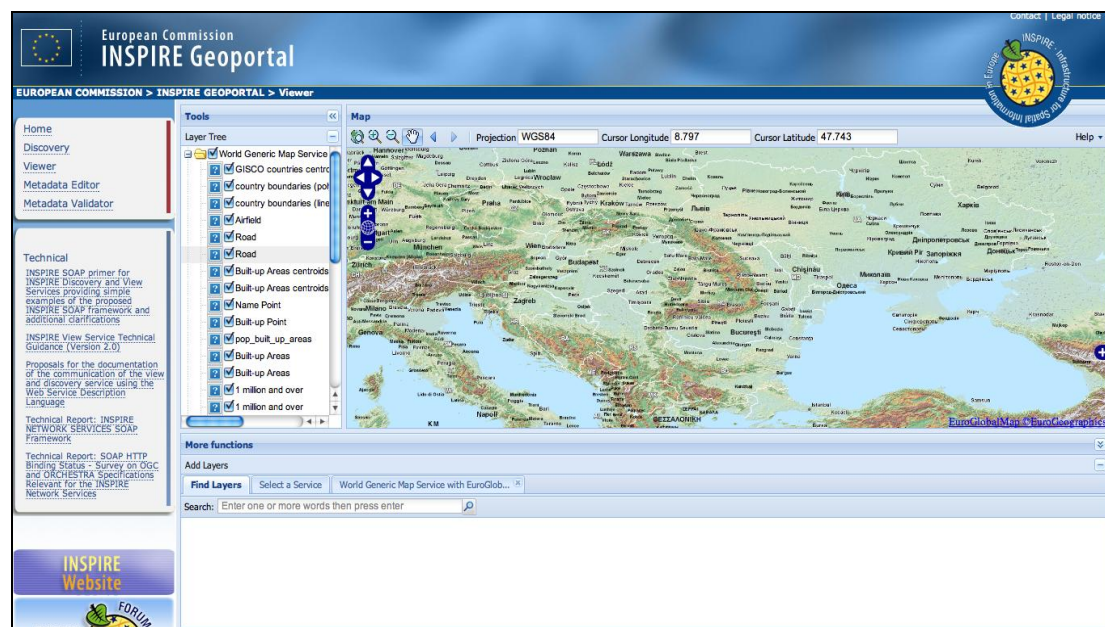

Figure 2: INSPIRE Geoportal Viewer

2.3 Guidelines and good practice documents

In parallel with the definition of the formal Regulation, the guidelines have been developed. They are intended to serve as a document helping Member States to implement the Regulation on INSPIRE Data and Service Sharing, and also contain non binding instruments, such as model contracts, and illustrate related concepts such as framework agreements. A second supporting document provides examples of good practice related to sharing within and between Member States. A list of central issues has been established and for every topic criteria for good practice have been defined. Topics covered are e.g. transparency, framework agreements, coordination, charging mechanisms, public access etc.).

In order to have a solid basis for decision making related to the implementation of the INSPIRE Directive and to the future evolution of INSPIRE, continuous monitoring of the implementation of the Directive and regular reporting are taking place. Quantitative indicators for assessing the progress of SDI implementation in the EU Member States and the structure of qualitative reports are outlined.

Monitoring and reporting have to cover the four main fields of INSPIRE Directive: metadata, spatial data sets and services, network services, data sharing. Monitoring follows a quantitative approach and takes place every year, while reporting covers more qualitative aspects and takes place every 3 years.

Implementing rules on monitoring and reporting

Article 21 of INSPIRE Directive defines the basic principles for monitoring and reporting and specifies that detailed rules for the implementation of this Article will be adopted by the Commission.

Implementing rules regarding INSPIRE monitoring and reporting received the positive opinion of the INSPIRE Committee in December 2008 and have been adopted as COMMISSION DECISION regarding INSPIRE monitoring and reporting on the 5th of June 2009. All linguistic versions of this Decision have been published on the Official Journal of the EU no. L148/2009, dated 11/6/2009.

The first monitoring and reporting was done on 15th of May 2010. The implementing rules for monitoring and reporting consist of two parts, one for monitoring and one for reporting.

Monitoring follows a quantitative approach and is based on a list of spatial data sets and services of the Member States. The list should cover already conformant data sets and services as well as those that still have to be brought into conformity. This list should basically reflect the Member State's plans for the implementation of INSPIRE. Based on the information collected for all the items of the list, indicators can be calculated to evaluate:

- Existence of metadata for spatial data sets and services
- Conformity of metadata for spatial data sets and services with the implementing rules on metadata
- Geographical coverage of spatial data sets
- Conformity of spatial data sets with the data specifications and of their metadata with the implementing rules on metadata
- Accessibility of metadata for spatial data sets and services through discovery services
- Accessibility of spatial data sets through view and download services
- Use of network services
- Conformity of network services to the implementing rules on network services.

Reporting follows a qualitative approach. Member states will provide information on five main areas:

- Coordination and quality assurance, including information on the Member State contact point and the coordination structure, as well as a description and evaluation of the quality assurance procedure, including measures taken to improve it
- Contribution to the functioning and coordination of the infrastructure, including an overview of the stakeholders and of their roles, the measures taken to facilitate sharing and a description on how they cooperate
- Use of the infrastructure for spatial information, in general and by public authorities in particular; examples of cross border use and efforts made to improve it
- Data sharing arrangements between public authorities of the Member State, between public authorities and Community institutions and bodies as well as barriers to sharing
- Cost and benefit aspects, that is an estimate of the costs related to INSPIRE Directive and examples of the observed benefits.

2.4 enviroGRIDS and INSPIRE

EnviroGRIDS @ Black Sea Catchment aims at building capacities in the Black Sea region to use new international standards to gather, store, distribute, analyze, visualize and disseminate crucial information on past, present and future states of this region, in order to assess its sustainability and vulnerability. To achieve its objectives, EnviroGRIDS will build an ultra-modern Grid enabled Spatial Data Infrastructure (GSDI) that will become one component in the Global Earth Observation System of Systems (GEOSS), compatible with the new EU directive on Infrastructure for Spatial Information in the European Union (INSPIRE) (*Figure 3*).

One of the main objective of enviroGRIDS is to build capacities in the implementation of new standards and frameworks (INSPIRE, GEOSS, OGC).
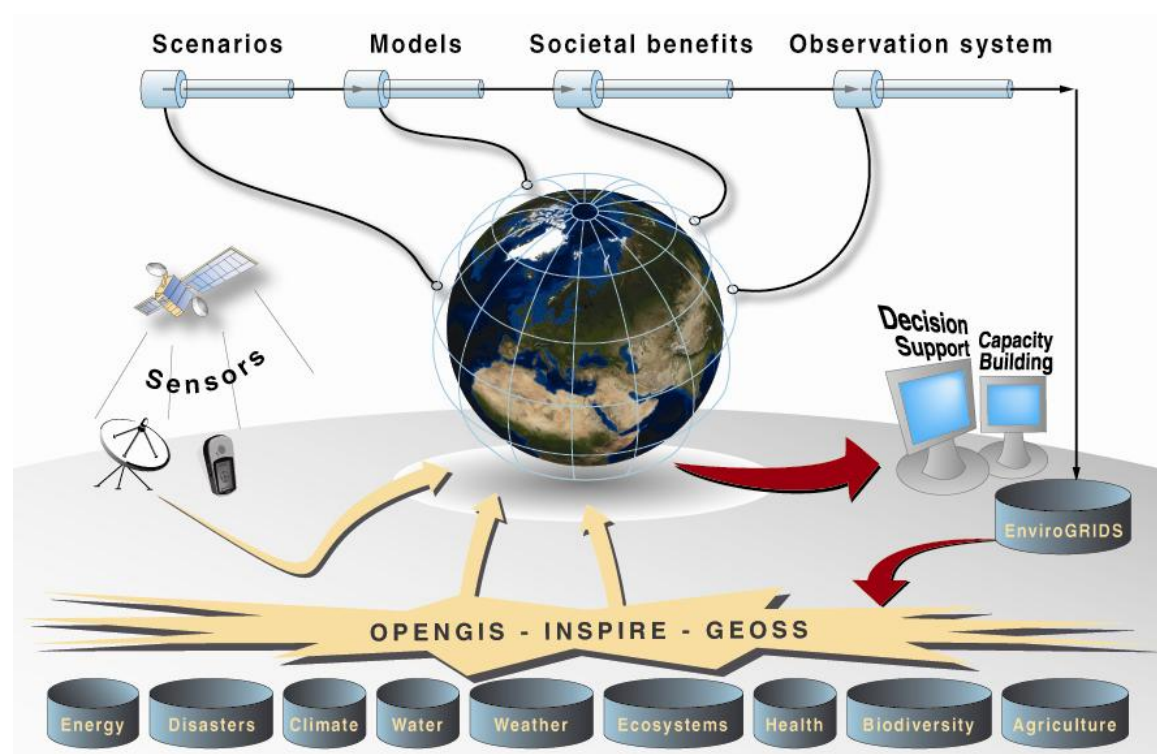
Figure 3: enviroGRIDS Concept

From a technological point of view, EnviroGRIDS will serve as benchmark to the INSPIRE. EnviroGRIDS will help INSPIRE to reach its audience of policy-makers, planners and managers at European, national and local levels, as well as the citizens and their organizations.

2.5 INSPIRE State of Play Reports 2010

This section will provide information from the Black See Catchment countries regarding existing/available data, metadata, observation systems and SDI at different scales for INSPIRE as they were reported in State of Play Reports 2010.

Austria

In Austria, SDI-related initiatives in the public sphere are taken at the regional rather than at the national level. The federal government is responsible for coordinating the SDI activities of the states.

The National Mapping (and Cadastral) Agency (Bundesamt fur Eich-un Vermessungswesen, BEV), which is chairing the federal coordinating body on GI, is taking the lead with respect to coordination of SDI-related initiatives.

Data for themes of the INSPIRE annexes

BEV is producing topographic GI at European, national, regional and local scale levels:

> 1:2,000,000 raster A-Map
>
> 1:500,000 vector, raster KM500V, KM500R
>
> 1:200,000 raster KM200R
>
> 1:250,000 vector KM250V
>
> 1:50,000 vector, raster KM50R, KM50V (partly)
>
> 1:25,000 vector, raster V BMN
>
> 1:25,000 vector, raster UTM

        1:1.000 raster, vector OP, DKM, DLM

        1:2,000 raster, vector OP, DKM, DLM

        1:5,000 raster, vector OP, DKM, DLM

        1:10,000 raster, vector OP, DLM

Other data available:

        Corine Landcover (u)

        Contaminated Sites (u)

        Geographic data relevant for 2000/60/EU (BMLFUW supported by u)

        Geographic data relevant for soil (Provincial Government Authorities and u)

        Geographic data relevant for agriculture (BMLFUW supported by AMA)

        Geographic data on conservation areas (Provincial Government Authorities)

The Ministry of Life (Lebensministerium) and its partners are responsible for more than 100 spatial datasets including hydrography (Annex I), geo-references image data (Annex II), soil, bio-geographical regions, natural risk zones (Annex III). Data are collected also through the WFD initiative, the Environmental Information Act, the Aarhus Convention and the Integrated Administration and Control System.

Umweltbudsamt provides a number of environmental (and other) data via its portal (http://www.oerok-atlas.at/). Data and maps about Air pollutants, NATURA 2000 sites, Water quality, Nature conservation, etc can be found.

A list of all the available maps and products can be found at:

http://www.bev.gv.at/portal/page?_pageid=713,1569819&_dad=portal&_schema=PORTAL

The themes included in Geoland.at are available at:

http://www.geoland.at/geoland2/%28bfcka2unnegnvx55wwynk42t%29/themenliste.aspx

With respect to three INSPIRE annexes addressing the 34 spatial data themes Austria is providing discovery and view services mainly for Annex I and II while a number of them can be also downloaded. All metadata are based on ISO and the main provider is BEV. The datasets are provided in a variety of scales and resolution according to their usage. A complete list will be presented in the updated report including the information provided by the country in 2010.

Metadata

There are metadata available for a significant part of the reference data and core thematic data produced and maintained by BEV. Metadata also exist for certain data at provincial and federal levels, alongside a complete metadata set for land registration.

Geoland.at offers free access to important Geodata/Metadata and it is the first step of the implementation of strategic objectives defined by Austrian Geodata politics. At the site, www.geoland.at, there is a link to metadata for each of the 9 federal states (http://www.geoland.at/index.php?option=com_content&task=view&id=16&Itemid=48).

The 9 federal states although have different portals to provide their metadata; they can be found and accessed via the www.geoland.at portal. Metadata implementation is coordinated within each of the data producing organizations, not among them.

Network Services

The Internet portal www.geoland.at provides central access to metadata, maps, mapping services and contacts of all Austrian provinces. Up to 200 different Web mapping applications are used.

The portal www.geoland.at offers free access to geodata and it is the first step of the implementation of the strategic objectives defined by Austrian Geodata politics. Users have possibility to view the geodata

of all 9 federal states of Austria by using an Internet Browser. Moreover, they can search for places and coordinates, can zoom in and out and it is possible to print the selected maps.

Some of the data layers can also be accessed via WMS thereby users can use these layers in other GIS-Applications.

Moreover, www.geoland.at offers a GPS transformation service. Data can be transformed from WGS84 into all coordinate systems used in Austria. The service is based on the open SOURCE library "proj4", while all computations take place with genuine date transition.

The data can be uploaded in different input formats (ASCII, CSV, GPX) and a visual control with WMS is possible.

At http://www.bev.gv.at/index.html, BEV provides some metadata about all its data products together with limited visualization functionality.

Via the website of BEV (www.bev.gv.at) and straight via www.austrianmap.at the Austrian Map Online service is available. This particular service allows to graphically browse the raster versions of topographic maps at scales of 1:50.000, 1:200.000, 1:500.000 and 1:2.000.000 to locate named places. The application is developed using Java 1.1. The website does not state the date at which the service has become operational.

The website of Land-, forst und wasserwirtschaftliches Rechenzentrum http://egis.lfrz.at/ contains several maps, ArcIMS web mapping and WMS. Most of them related to environmental data like soils, bio-geographical regions, waste management, flooding areas, but also aerial photos, etc. These services were developed in the framework of the eGIS project. LFRZ is storing the necessary data respecting the existing legal framework (so no connection to data where they are, e.g. orthophotos). The maps and services target not only own staff, but the public as well.

SDI

The main usage of the SDI focuses on the public use of data from the 9 federal states. Via the various interactive maps the states assist decision making and provide useful geographical and environmental information to the public authorities and citizens.

Bulgaria

In Bulgaria the SDI activities are coordinated by two agencies: the State Agency for Information Technology and Communications (SAITC) and the Agency for Sustainable Development and Eurointegration (ASDE). The objective is to coordinate activities from ministries, regional and local authorities, specific agencies, and organize collaboration with the private sector.

Data for themes of the INSPIRE annexes

Topographic maps are being digitized for the whole country. The series at scale 1:5.000 and 1:10.000 are the responsibility of the AGCC. The series at scale 1:25.000 and smaller are the responsibility of the Military Topographic Service of the Ministry of Defence (1:25.000, 1:50.000, 1:100.000, 1:200.000 and 1:500.000);

The cadastre databases are developed by the AGCC: the agricultural and forest cadastre are digitized for the whole territory in scale 1:5.000 and 1:10.000. The urban cadastre is for approximately 10%. This is a large-scale database (between 1:1.000 and 1:500). The agriculture data currently held by the Land Commissions is of varying quality. Major problems occur where rural data and municipal data are combined. The cost of converting the Land Commission data and entering it into the new information system will be paid under the Registry and Cadastre project. The Agency of Geodesy, Cartography and Cadastre and the Ministry of Agriculture and Forestry (MAF) will be recipients of that data.

Two types of Digital Elevation Models are available for the whole country: based on the topographic maps in scale 1:50.000, and using Shuttle Radar Topography Mission – SRTM.

In addition, a geological database is available as well in digital format for the whole country (created by Ministry of Environment and Water): 1:500.000, 1:100.000 and 1:25.000 for areas with high geological potential. There are several other digital geological maps (uranium deposits, ground

magnetic maps).

Data on Administrative units are provided by the Agency of Geodesy, Cartography and Cadastre.

CORINE Land Cover data at scale 1:100.000 exists for the whole territory.

City plans for some settlements are available in the Municipalities and in the regional offices of AGCC.

Metadata

Metadata exists only for a very small part of the data that has been digitized. From 281 reported data sets only 10% have metadata.

Network Services

On-line services and catalogue services for metadata are not available.

The website http://www.domino.bg/ was created by the private company DOMINO SLTD. Its activity is oriented towards the development and implementation of multimedia products and technologies, web development, publishing of cartographic products, business catalogues, etc. DOMINO has developed the official websites of 75 Bulgarian municipalities and maintains them. DOMINO made maps of cities of Bulgaria, detailed road maps of Bulgaria, maps of the Bulgarian resorts, etc. Everything is accessible through its website.

In 1998 DATECS GIS Centre company developed its own technology for presenting maps in Internet and for a long period of time www.sof-info.com and www.bul-info.com services were one of the most visited Bulgarian web pages. Both of them were suspended for some time, but this service is available since 2003 at www.bgmaps.com. For some types of the information search functions are implemented (place names).

Everyone can add - free of charge – his own URL link to the web page www.bgmaps.com. The service ―virtual server‖ is paid and it offers a map made by bgmaps.com appearing via a link in one's webpage and is showing the location of one's company. A get link capability is also available via the bgmaps.com.Moreover, a blog has been added to the website (http://blog.bgmaps.com/) in Bulgarian where the recent updates are mentioned.

The newly launched web site www.Emaps.bg is a web site for online geo services and maps. The www.Emaps.bg provides online geo services, dynamic relief map for the territory of Bulgaria, detailed maps for the territory of more than 20 cities and resorts in Bulgaria as well as contacts and location of thousands of useful places for tourism, business and living. The site offers to its users the tools to find addresses in the cities and the unique service to find routes in the cities.

A portal for spatial data on the Trans European Transport Corridors is developed as a joint action of SAITC and ASDE. Currently no information on its status is available, while some thematic maps are present at http://bsdi.asde-bg.org/proj/lccs.php (only in Bulgarian).

The cadastre provides a service to translate geographical names from Cyrillic to Latin and vice versa (http://www.geomatics-bg.com/transliterate.php).Furthermore, an on-line service and information system of reference of land registers- (www.icadastre.bg) is available.

On the http://smes.asde-bg.org/bedstvia.phtml website a number of map services exist (only in Bulgarian) providing information of Floods, Earthquakes, Forest Fires, 3D models and Disasters and accidents. Specifically, a map service (http://smes.asde-bg.org/index2.php) offers relevant, continuously expanded thematic information for a variety of risks from natural disasters in GIS format, maintained by SAITC, ASDE and ReSAC (Remote Sensing Application Center).

SDI

The development of the Bulgarian SDI is project oriented and focuses on environmental applications.

The use of digital spatial data is mainly focused on land registry and cadastre applications. There exist several projects, many of them funded by the international donor community. This could be the basis for a wider future use of GI in the areas of agriculture, transport, tourism, etc. There are also several projects in the area of environment: projects to monitor the water quality of cross-country rivers like the Arda, Mesta and Struma (Bulgaria-Greece). In addition, there are some projects applying GI & GIS

in utilities, construction and telecommunications.

Czech Republic

In Czech Republic, The Czech Environmental Information Agency, CENIA is responsible for the implementation of INSPIRE.

Data for themes of the INSPIRE annexes

Czech Republic provides maps in different scales and resolution acc. Key providers are Ministry of Environment (MoE), Czech Office for Surveying, Mapping and Cadastre (COSMC), Czech Statistical Office (CZSO), Geodis Brno a.s. and others.

COSMC provides state map series at:

> State Map 1: 5000
>
> Raster base map CR 1 10 000
>
> Raster Base Map CR 1: 25 000
>
> Raster base map CR 1: 50 000
>
> Raster base map   R 1: 200 000
>
> Raster Map of the Czech Republic 1:500.000
>
> Raster Map of the Czech Republic 1:1.000.000

Administrative and Cadastral Boundaries are available at 1:10.000 and 1:50.000 scale.

Reference geographic data (ZABAGED) created by COSMC are at an equivalent scale of 1:10.000. ZABAGED is currently providing the map sheets also as vector and mdb files (in GML or SHP format). Data are given in S-JTSK, WGS84/UTM or in S-42/1983 coordinate system and vertical reference system for Balt compensation.

The available map products of COSMC can be found at:

http://www.cuzk.cz/Dokument.aspx?PRARESKOD=10&MENUID=10009&AKCE=DOC:30-ZU_GEOPODKLADY

In addition, the DMU (Digital Map of the Territory) has been created by the Army Topographic Institute at scale of 1:25.000. This datasets is extensively used in military, environmental and risk management applications. This dataset has been based on WGS84-based S-42 coordinate system allowing continuous work when exceeding Czech borders.

Metadata

Metadata are produced for most of the reference and core thematic data. The MoE Metadata portal enables searching and browsing the metadata of geodata and web map services from resort organizations and other organizations in Czech Republic. It is based on catalogue service defined by Open Geospatial Consortium and supports ISO 19115, 19119, 19139 standards.

The on-line MIDAS-metadata catalogue contains metadata of more than 3.000 geodatasets. Metainformation system MIS covers about 1000 environmental data sources. These both used standards respects the Dublin core metadata recommendations.

Metadata are produced for a significant fraction of geodatasets of the themes of the INSPIRE annexes. The 2010 MR reveals that for the reported datasets of INSPIRE (94%, 100% and 80% of the data sets have metadata for annex I, II and III respectively). The MoE Metadata portal enables searching and browsing the metadata of geodata and web map services from resort organizations and other organizations in Czech Republic.

Network Services

The main geographic information metadata service is MIDAS, developed by CAGI. MIDAS is an on-line (http://www.cagi.cz/midas) catalogue of geodata of the public administration. It allows an

overview of existing data for the GIS community and is a tool for system analysis (coordinating requirements, removing duplicities, possible data sharing etc.). It is freely accessible and provides complete set of records for download.

Environmental metainformation system MIS (http://mis.cenia.cz/) has a well established user base and provides metadata of numerous organisations such as COSMS. More than that MIS has been linked to MS-NPSA (http://geoportal.cenia.cz) and Environmental Portal (http://portal.env.cz) allowing portal visitors to access data description of the maps shown.

The websites of COSMC (EN and CZ) and CZSO (EN and CZ) provide descriptions of the available data products of these institutions at www.cuzk.cz and www.czso.cz.

The portal of geohazards provides map applications, which allow access the geoscientific data from geodatabases and the Digital Archive of the Czech Geological Society (CGS). The CGS Map Sever was started in the 2003 and is based on ESRI technology – ArcIMS map server and ArcSDE spatial database (http://www.geology.cz/extranet-eng/geodata/mapserver).

Geocodes and names of administrative and other territorial units, streets and buildings (gazetteers) are available on www.mpsv.cz (Ministry of Social Affairs) and/or on www.mmr.cz (Ministry of Regional Development).

SDI

The main geographic information metadata service is MIDAS, developed by CAGI. (http://www.cagi.cz/midas). MIDAS system is freely accessible and provides complete set of records for download. CENIA provides several web mapping services with basic administrative, topographic and environmental data. The geoportal enables authorised users to upload new data sets.

Germany

The GeoPortal.Bund (http://www.geoportal.bund.de) is functioning as a central point of entry for GI in Germany, provided by the German Federal administration. It is linked to the geoportals of the federal states, as well as to thematic databases and services. The Federal Agency for Cartography and Geodesy (BKG) is responsible for the development and operation of the GeoPortal.Bund.

Data for themes of the INSPIRE annexes

The product line ATKIS® (Authoritative Topographic-Cartographic Information System) includes digital landscape models, digital topographic maps and digital terrain models. All products listed here are stored and – if possible – harmonized centrally at the Geo Data Centre of the Federal Agency of Cartography and Geodesy.

Digital Landscape Models (DLM)

The DLMs describe the topographic features of the landscape and the relief of the earth's surface in vector format.

The databases contain the following six themes: settlements, transport, vegetation, hydrography, relief and other areas (e.g. islands, national parks, etc.). Each theme contains one or more data layers. The following landscape models are available:

Basic-DLM (compiled from the scale range 1:5.000 – 1:25.000, horizontal accuracy ± 3 m)

DLM 50 (partly ready, in responsibility of the federal states)

DLM 250 (resolution 1:250.000, ± 125 m)

DLM 1000 (content of 1:500.000, ± 250 – 500 m)

With the help of appropriate GIS-software, the DLM can be visualized as simple map graphics.

Digital Topographic Maps (DTM)

The following DTMs with different scales are provided by the German state survey for nationally standardised topographic description of the territory of the Federal Republic of Germany with geo-referenced Digital Topographic Maps (DTM):

Digital Topographic map 1:10 000 DTM10

Digital Topographic map 1:25 000 DTM25

Digital Topographic map 1:50 000 DTM50

Digital Topographic map 1:100 000 DTM100

Digital Topographic map 1:250 000 DTM250

Digital Topographic map 1:1.000 000 DTM1000

The following digital terrain models (DTM) of different qualities are being set up in the course of the ATKIS®-project by the German state survey for the standardised description of the relief of the territory of the Federal Republic of Germany:

Digital terrain model 2 - DTM2

Digital terrain model 5 - DTM5

Digital terrain model 25 - DTM25

Digital terrain model 50 - DTM50

Digital terrain model Germany - DTM-G

Digital terrain model 250 - DTM250

Digital terrain model 1000 - DTM1000

Metadata

Consistent metadata are produced for a significant part of the reference and core thematic data. With more and more geo-services becoming available, production of service metadata has started.

There are fourteen distributed metadata information systems with more than 35000 datasets connected to Geodatenkatalog. They describe geodata regarding biota and environment, basic data, air, water, statistics, infrastructure, geology, farming, etc. Geodatenkatalog has access to all UDK catalogues in Germany via PortalU® catalogue interface.

The catalogue of data sources integrated in PortalU® is based on the UDK metadata model that was developed for the environmental ministries and agencies (on the federal and federal state level) in Germany and Austria. In Germany, the UDK catalogues maintained by federal and federal state environmental authorities can be accessed through the central Internet portal (http://www.portalu.de).

Network Services

A list of 123 services is available   at http://141.74.33.52/ngdb-liste/produkte_all_print.aspx. The list provides discovery and view services of national cover datasets in various formats and scales.

The ATKIS® data can be obtained via Internet at http://www.geodatenzentrum.de.

The on-line access for core thematic data of environmental administrations is realized by the German Environmental Information Portal PortalU® (www.portalu.de).

SDI

A major development is observed towards local SDI implementation.

A number of examples exist such as the portal of the county of Bernkastel-Wittlich in Rhineland-Palatinate state. (http://www.geoportal.rlp.de/portal/en/).

TIM-online is an Internet-Application provided by the Federal State of North- Rhine Westphalia in order to display the reference data of the Surveying and Cadastre Service via Web Map Services (http://www.tim-online.nrw.de).

Within the GDI-3D a number of applications have been developed:

OpenStreetMap-3D: www.OSM-3D.org combining free and user generated data from OpenStreetMap with SRTM DEM - currently for entire Germany

NorthRhine-Westphalia-3D: www.nrw-3d.de - all (over 6 Million) LOD1 buildings from GeoBasis.NRW in GDI-3D;

Heidelberg-3D: www.heidelberg-3d.de - official data combined with textured high resolution building models of Heidelberg.

Last but not least, various German organisations and administrative divisions are participating in the X-Border-GDI (http://www.x-border-gdi.org/en/) project. The aim of the project is to develop and implement a structure for the supply of cross-border geographic information in North Rhine-Westphalia and the Netherlands.

Hungary

The Ministry of Environment and Water[1] was assigned as national contact point for INSPIRE, namely the National Environmental Spatial Information Coordination Committee (NESICC). The key executive player in the elaboration of the NSDI is the Institute of Geodesy, Cartography and Remote Sensing (FÖMI). FÖMI is operating a website which aims at providing access to metadata, some geodatasets and some other spatial data services.

Data for themes of the INSPIRE annexes

Maps and spatial data are produced for the following major scale and resolution levels:

Scale 1:500 Resolution10 cm

Scale 1:1.000 (old 1:1.440 also used) Resolution 20 cm

Scale 1:2.000 (old 1:2880 also used) Resolution 40 cm

Scale 1:4.000 Resolution 80 cm

Scale 1:10.000 Resolution 2m

Scale 1:50.000 and smaller Resolution 10 m and less

Furthermore there are digital orthophotos of Hungary (corresponding to scale 1:10 000). The country has been fully covered by analogue aerial photographs and rasterised orthophotos two times: in 2000 and in 2005. Starting from year 2007 instead of analogue a new digital cameras are applied for aerial data acquisition. Ground resolution of the digital images is 50 cm/pixel. Full coverage was made in four parts of the Hungary (2007,2008, 2009, and 2010).

Cadastre: the whole area of Hungary is covered by analogue cadastral basic maps in scale 1:1.000, 1:2.000, 1:4.000 depending on data density.

Topography: as basic data, the digital topographic maps at scales of 1:10.000, 1:50.000 and 1:100.000 are serviceable, together with the related digital terrain models and various datasets, obtained from the traditional data acquisition methods.

Regarding the three INSPIRE annexes addressing the 34 spatial data themes, Hungary is providing discovery and view services (FÖMI, MoE, MoD, VKKI, TAKI, OBKI) for most of them in a number of scales and resolutions while a number of them can be also downloaded.

Metadata

Metadata are produced for a significant fraction of geodatasets of the themes of the INSPIRE annexes.

A metadata catalogue is available at the Institute of Geodesy, Cartography and Remote Sensing. It is organized according to the DAT-standard (Digital Base Map), based on ISO TC211 and CEN TC 287.

Another catalogue has been set up at the Geological Institute of Hungary: METATER. It contains metadata of the framework basic data; the territorial information system data; and the geological thematic data. The DUBLIN-core set of metadata was used.

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[1] The tasks and responsibilities of the former Ministry of Environment and Water have been taken over by the Ministry of Rural Development.

The Dept. of Cartography and Geoinformatics of the Budapest University provides metadata description information via its webpage (http://lazarus.elte.hu/gis/gisindex.htm) on the National GIS database, the database of Hungarian administrative boundaries and the Central Hydrological Database.

Network Services

Network services are provided by the Institute of Geodesy, Cartography and Remote Sensing via http://www.fomi.hu/portal/index.php/kezdoldal (English version at http://www.fomi.hu/portal/index.php/home). The aim of FÖMI's web site is to support a wide spectrum of customers with land related data and information services. Other web services exist as well (see http://www.kvvm.hu; http://www.fvm.hu; http://magyarorszag.hu).

SDI

The www.fomi.hu site is set up to provide to citizens and institutions services such as precise scanning and geocoding, data transformations, thematic mapping, professional plotting etc. Several applications exist in the fields of agriculture and land (Land Parcel Information System, vineyard register, land consolidation, crop monitoring, ...) and environment (disaster mitigation, agro-environment, ...). The Land Information Services on the Web provided by FOMI are available at: http://fish.fomi.hu/termekekhonlap/angol/.

Romania

In Romania the ANCPI (National Agency for Cadastre and Real) is coordinating GI activities (http://geoportal.ancpi.ro/geoportal).

Data for themes of the INSPIRE annexes

The following digital data are produced by the Institute of Cadastre, Geodesy, Photogrammetry and Cartography (IFGFC), which is the operational branch of the ANCPI:

- The digital map of Romania at scale 1:500.000 including the following layers: planimetric elements such as railways, road-network, settlements, administrative boundaries and place names; hydrography such as main rivers, lakes, the Black Sea and Danube Delta; elevation at an interval of 100 meters (from which also a DTM has been derived)

- The topographic map database at scale 1:50.000. It has more spatial and semantic details as compared to the previous map, but not all the elements were digitized. It is not clear which layers are not in the database. The original maps from which they are scanned are at scale 1:25.000

- There are orthophotos for the whole territory (42 districts). In 12 districts they are used to update the digital database at scale 1:50.000.

Users can get information about the available data at http://www.ancpi.ro/harti/digitale.html and http://www.ancpi.ro/harti/analogice.html for digital and paper maps.

Other databases are developed within the framework of particular projects. Some examples are:

- Digital database of Bucharest at scale 1:2.000 (1997);
- Real estate cadastre for the City of Constanta at scale 1:500;
- Agricultural cadastre for the district of Fundulea at scale 1:2.000;
- Real estate cadastre for the municipality of Craiova at scale 1:1.000.

Metadata

Metadata production and management is currently not implemented and Dublin Core Metadata is not applicable.

A catalogue is planned for ANCPI data. The envisaged standard is not known.

Network Services

Only some viewing services are available like Natura 2000 portal (http://www.natura2000.ro/) developed by ROSA composed of a data-loading interface, an information access interface, a database and security rules. The objective is to give officers of the Ministry of Environment easy access to the data.

SDI

There are some specific user applications, but they are never country wide (rather project oriented) and mainly focused on management and inventory of spatial data. Potential end-users use indirectly the data in the form of printouts of maps.

Slovak Republic

In the Slovak Republic, the Geodesy, Cartography and Cadastre Authority (GCCA) of the Slovak Republic has a mandate to work towards an NSDI for reference and core thematic data.

Data for themes of the INSPIRE annexes

The state map series are divided into the basic state map series and the thematic state map series. The GCCA is responsible for compilation, updating, and editing of the basic state map series and some thematic state map series.

The ministry of defense produces:

Analogue products

Standard products

- Topographic map 1:50,000 with reprinted UTM Grid
- Topographic map 1:200,000 with reprinted UTM Grid
- Unified topographic map 1:50,000 (UM50, Series M779)
- Topographic map 1:25,000 (WGS 84), (in preparation)
- Topographic map 1:100,000 (WGS 84), (in preparation)
- Topographic map 1:500,000 (WGS 84), (in preparation)
- Topographic map 1:1,000,000 (WGS 84)
- JOG – Joint Operations Graphic – Ground 1:250,000 (Series 1501 - Ground)

Aeronautical charts

- JOG – Joint Operations Graphic – Air 1:250,000 (Series 1501 - Air),
- TFC(L) – Transit Flying Chart (Low Level) 2nd Series 1:250,000,
- Aeronautical chart 1:500,000
- Aerial chart TPC – Tactical Pilotage Chart (Topographic Institute(TI) is only a provider)
- Aerial chart ONC – Operational Navigation Chart (TI is only a provider)

Orthophoto maps of Military Training Area (MTA)

- Orthophoto maps of MTA   e   1:25,000
- Orthophoto maps of MTA Záhorie 1:25,000
- Atlas of orthophoto maps MTA   e   1:10,000
- Atlas of orthophoto maps MTA Záhorie 1:10,000
- Atlas of orthophoto maps MTA Turecký vrch 1:10,000
- Atlas of orthophoto maps MTA Kamenica nad Cirochou 1:10,000

Digital products

- VMAP Level1 –The Vector Smart Map Level 1 is a vector geographic database of the territory of the Slovak Republic at a scale of 1:250,000

- DTM version 3 – Digital Terrain Model version 3. DTM is continuous model of terrain generated from vectorized contour lines. Vertical Accuracy of DTM is estimated in interval ±5m. Model was generated with TOPOGRID module of ArcInfo and it is hydrological correct.

- CGD –Central Geospatial Database is a global set of information about the territory of the Slovak Republic in digital form.

Geodetic products

- Map of geodetic data, (in preparation)

- Catalogue of coordinates of the Sun and the Polaris

- Catalogue of levelling points

Other products

- MGI-Military Geographic Information. The Military Geographic Information is designated for preparation of members of the Slovak Armed Forces deployed in foreign missions

- Aerial photographs

- Military Topographic Map (MTM).

The Topographic Institute has prepared a new edition of the new Military Topographic Map (MTM) processed in NATO standards, in new index and trim sizes of map sheets. The basic data source for production of MTM at scale of 1:25,000, 1:50,000 and 1:100,000 is utilization of the Central Geospatial Database. The basic sources for production of MTM at scale of 1:500,000 are JOG 1:250,000 (series 1501) and for production of MTM at scale of 1:1mil the basic data source is VMap Level 0.

The Basic Map of the Slovak Republic 1:10 000 has been made by updating the 1:10.000 topographic map published before 1971 in S-42. In its compilation, current aerial photos were used. The first edition was published in the period 1972-1986. From 1987, systematic revision of the map series has been done using aerial photos in a differentiated cycle depending on the territory significance.

- The raster sets of the Basic Map of the Slovak Republic 1:10.000 was made by scanning the map print base of planimetry, lettering, hydrography, canopy and altimetry from 2,820 map sheets of the territory of the Slovak Republic and in the year 2000 has been updated. Brand new maps are made by visualization of GIS data of the PD GIS.

- The Basic Map of the Slovak Republic 1:25.000 has been derived from the Basic map of the Slovak Republic 1:10.000. The content of the map was generalized during the cartographic processing. The first edition of the map started in 1973.

- The Basic Map of the Slovak Republic 1:50.000 has been made by cartographic re-editing of the previous map series published in S-42. The first edition issued in 1970-1971 covered the whole territory of the Slovak Republic.

- The Seamless Vector Map 50 (SVM50) was completed as the spatial object-oriented database, which was created by vectorizing the scanned print bases of all 134 map sheets of the Basic map 1:50 000 in the Arc/Info environment. Individual features have been separated into 52 levels. In the year 2000, the layers of the boundaries of territory-administrative and territory-technical units were updated. Data is stored in nine basic thematic layers with lettering, type and attribute. Eight basic thematic layers are created in vector form. The item of lettering is attached in raster format. The http://www.geoportal.sk/gp/index_en.html website displays SVM50 layers: forests, contours, water areas and streams, roads of all classes, built-up areas, boundaries of territorial

units (cadastral districts, municipalities, districts, regions and others).

- The Basic Map of the Slovak Republic 1:100.000 is a downscaled version of the Basic map of the Slovak Republic 1:50 000. The first edition published in 1983 -1990.The map Revision is carried out according to requirements.

- The Basic Map of the Slovak Republic 1:200.000 is a map derived from the Basic Map of the Slovak Republic 1:50.000. The first edition was published in 1971 - 1972, and by 1997 two all-area revisions had been made.

Within the group of medium-scale maps, there are also the maps of territorial units, published on the basis of chosen basic maps. They comprise of:

- The District Map of the Slovak Republic edited and published on the basis of the Basic Map of the Slovak Republic 1:50.000;

- The Region Map of the Slovak Republic 1:200.000 edited and published on the basis of the Basic Map of the Slovak Republic 1:200.000.

- MSR 10 - the Map of the administrative division of the Slovak Republic. It was created from the map print base of the Basic Map of the Slovak Republic 1:10.000. Vectorisation has been done in the GeoScan environment. The vector map is in line with the current administrative units of the Slovak Republic.

Small-scale Maps & Geodatasets:

- The Basic Map of the Slovak Republic 1:500.000 and the Basic map of the Slovak Republic 1:1.000.000. Both maps are published as a 6-colour print;

- The territorial and administrative division of the State is projected on the administrative maps at scales of 1:250.000, 1:400.000 and 1:500.000 and the maps of the administrative division of the Slovak Republic at scales of 1:400.000 and 1:1.000.000.

The high quality forestry maps - forest stand maps in scale 1:10.000, and updated simultaneously with the forest management plan renewal every ten years, form the basis of Slovak forestry mapping. They contain basic geographical data, terrain lines, detailed recognition of forest road network and footpaths and further important data relevant to forestry practice. Contour (uncolored) forestry maps serve as a basis for the creation of various special forestry maps.

Regarding the INSPIRE data themes requirements, there has been launched a survey for INSPIRE data themes availability.

At the enviroportal (http://enviroportal.sk/) there are 115 different themes of information with about 154337 metadata. All 34 INSPIRE themes are available.

Moreover, the Water Research Institute (WRI) provides comprehensive service and maintenance in the development and delivery of digital (GIS) or analogue (printed) map services. Water maps of Slovakia at scale 1: 50,000 can be purchased at WRI map service

Metadata

Metadata are available for most of the available data. The Slovak Republic is preparing for adoption of the standard ISO 19115 Geographic Information - Data description for Metadata.

The Metainformation system (http://geo.enviroportal.sk/sluzby/metaudaje) is built under the INSPIRE directive, namely as INSPIRE metadata profile and is based on ISO 19115, 19139 standards.

The Metadata catalogue of the National Spatial Data Infrastructure (NSDI) Project (http://geonet.sk/main_en.htm) also gives information on SDI stakeholders and offers applications for integration and distribution of interoperable geographical information resources. A user can also register at this web site.

Other metadata links:

EnviroInfo: http://enviroinfo.enviroportal.sk

Cadastral Portal: http://www.katasterportal.sk

EnviroGeoPortal: http://geo.enviroportal.sk

Network Services

The Geoportal GCCA is on-line available (http://www.geoportal.sk/). The GCCA Geoportal contains meta-information about documents, databases, vector spatial data and raster spatial data. Some of the reference and core thematic data and their metadata can be found there.

The main metadata service for the Environmental sector in Slovak Republic is Catalogue of Data Sources CDS developed by Slovak Environmental Agency SEA. CDS is on-line available (http://www.iszp.sk/katalog/index.html). The Slovak Environmental CDS contains meta-information about documents, projects, databases, vector spatial data and raster spatial data.

The geoportal (http://geonet.sk/main_en.htm) created by the NSDI project offers a set of elements, which provide the functionality for the interoperability of geographical information sources.

There are WMS and WFS services. The WMS, WFS map services were implemented within the frame of the project based on Open Geospatial Consortium, Inc. (OGC) specification.

WMS services:
1. Overview data of Slovak Republic
   http://mapserver.geonet.sk/WMSKLIENT/mapy/SPH/wms.asp
2. Sample service of ZBGIS of ZVOLEN surroundings
   http://mapserver.geonet.sk/WMSZVOLEN/wms.asp
3. Sample service of rasters of ZVOLEN surroundings
   http://mapserver.geonet.sk/WMSZVOLENRAS/wms.asp

SDI

Example of usage published web map services can be found on tourist server ―Hiking.sk" (http://mapy.hiking.sk/index.php?ref=menu).

Slovenia

In Slovenia the Survey and Mapping Authority of the Republic of Slovenia (SMA), operating under the Ministry of Environment and Spatial Planning (MESP), has a de facto mandate to coordinate the elaboration of the NSDI.

Data for themes of the INSPIRE annexes

The SMA covers all scale levels for its analogue and digital data products.

A vector database of topographic data of homogeneous accuracy and details appropriate for the 1:5000 scale is divided by objects into four areas (buildings, traffic, land cover, hydrography). The whole territory is also covered with topographic maps: basic (scale 1:5.000), national (scales 1:25.000 and 1:50.000), which are available in analogue and digital form. National general maps (scales from 1:250.000 to 1: 1.000.000) are available in printed form, digital vector form and raster form (Ažman and Petek, 2009).

Regarding the three INSPIRE annexes addressing the 34 spatial data themes, Slovenia is providing discovery and view services for some of them (SMA, the Environmental Agency of the Republic of Slovenia EARS) including metadata while a number spatial data themes can be also downloaded.

Metadata

The Slovenian Metadata system is called the Central Evidence of Spatial Metadata (CESM) and is developed and maintained within the former GeoInformation Centre of the SMA.

Metadata are available for all the geodatasets managed by the SMA and for datasets provided by other partners of the SDI (private and other). The CESM is a list of existing digital spatial data in Slovenia where users can see the metadata (http://prostor.gov.si/cepp/). The metadata contains all necessary information about content, purpose, usage, quality, distribution and all other information to select and use the datasets. The metadata allow users to discover and explore datasets. However, we had not the

opportunity to explore the metadata themselves, therefore we do not know whether all datasets are described completely.

Network Services

The Survey and Mapping Authority developed a model of user services that will include at the end: the metadata catalogue, the information layers, a series of services and meta- information on the services, a data ordering mechanism and related pricing policy. Although at the moment there is no official INSPIRE geo-portal in Slovenia, it is planned to be established as a single entry point to data and services, for INSPIRE and NSDI. Currently the portal of SMA (http://e-prostor.gov.si/) serves for this purpose.

The WFS http://gis.arso.gov.si/wfs_web/faces/WFSLayersList.jspx of EARS allows to export spatial data in Shp or GML format (version 2.0). A number of other services are listed at http://gis.arso.gov.si/ (Slovenian).

SDI

Besides already mentioned access services to the databases of the SMA, some applications are developed or are under development. Other on-line services are:

> www.geabios.com
> www.geopedia.si
> www.geoprostor.net

The EARS portal http://e-prostor.gov.si/ provides central access to numerous metadata, maps, and also to viewing and download services.

Turkey

Currently, the Military Mapping Agency is the main data producer, has the most visible internet presence offering limited metadata for its own products.

Cadastral and other large scale geodata are produced by the (civil) General Directorate of Land Registry and Cadastre.

Data for themes of the INSPIRE annexes

GCM produces topographic maps and related digital raster and vector products at scales 1:25.000, 1:50.000, 1:100.000, 1:250.000, 1:500.000 and 1:1.000.000.

Large Scaled Maps, 1/5000 and larger, are produced by LRCD and State Provincial Bank. Other public institutions and municipalities also produce maps serving their own needs, depending on their responsibilities and rights legalized by the laws.

The GCM website announces following digital geodatasets:

> 1:25.000 Scale Digital Elevation Maps (YUKPAF25)
>
> 1:250.000 Scale Digital Elevation Maps (YUKPAF250)
>
> 1:25.000 Scale Raster Maps (RHEG25)
>
> 1:50.000 Scale Raster Maps (RHEG50)
>
> 1:100.000 Scale Raster Maps (RHEG100)
>
> 1:250.000 Scale Raster Maps (RHEG250)
>
> 1:500.000 Scale Raster Maps (RHEG500)
>
> 1:1.000.000 Scale Raster Maps (RHEG1000)
>
> 3" x 3" Digital Terrain Data (DTED1)
>
> 1" x 1" Digital Terrain Data (DTED2

The 1:25.000 scale digital elevation maps contain the contour lines (5 meters interval), elevation points and their heights as derived from the 1:25.000 topographic maps. The spatial coverage is not clear

(populating database is about to start).

The 1" x 1" Digital Terrain Dataset comprises the terrain elevations defined by points in intervals of 1" latitude and 1" longitude, as derived from the contour lines and elevation spots at the 1:25.000 topographic map. Again the spatial coverage is not specified.

According to GISEE (2004), few geodatasets have complete national coverage.

Topographic Database at scale 1:25.000 (CGM): vector data collection seem to be completed and available for sale among other products at: http://www.hgk.msb.gov.tr/urunler/satis.asp.

The Mineral Research & Exploration General Directorate (MTA), established in 1935 with the aim of conducting scientific and technological research on mineral exploration provides a number of Geology, Geophysics, and Mineral maps (http://www.mta.gov.tr/v1.0/english/maps.php).

The Ministry of Environment and Forest has the responsibility for co-ordinating the studies conducted with relation to the Environment Chapter of EU legislation. The ministry has its own GIS department (http://gis.cevreorman.gov.tr/sayfalar/ana_sayfa.html).

A number of web map services and datasets are available in the ministry geo-portal (http://geodata.cob.gov.tr/geodata/index.aspx) providing water data, meteorological data, data on forests and preserved areas.

Metadata

The GCM website http://www.hgk.msb.gov.tr/urunler/satis.asp provides a description of the offered analogue and digital products.

According to GISEE (2004), metadata are available for a significant part of the major geodatasets. These are however mostly not according to some standard. Few are available on-line.

Network Services

The GCM website provides a description of the offered analogue and digital products. GISEE mentions this web site as the most comprehensive geo-portal in Turkey.

A number of portals exist, mainly dispersed to its institutions while most of them deal with environmental data. The Ministry of Environment and Forest and its department of Information Technology, provide a GIS geodata services (in Turkish) at http://gis.cevreorman.gov.tr/sayfalar/ana_sayfa.html. A number of data layers are available as well as the GIS map functionalities such as zoom in/out, info, crop, take a snapshot etc.

The ministry also provides the http://www.yildizdagiprojesi.cevreorman.gov.tr/cob2/denemetestpage.aspx portal and the http://agmcas.cevreorman.gov.tr/COB/MainPageFW/index2.aspx?HideMenus=1 archive (for registered users).

SDI

The Project on establishing the "National Geographic Information Infrastructure" started for the common purpose of collection, presentation and use of geographic information. It is coordinated by the State Planning Organization under the responsibility of the Ministry of Public Works and Settlement, with participation of the General Directorate of Land Registry and Cadastre and relevant government agencies such as TurkSat.

Under the Project, the responsible public institutions and organizations submit their geographic information and specified content for establishing common infrastructure of geographic information systems at the national level applying the appropriate technological solutions and exchange standards.

By this Project, the Turkey's Geographic Information Infrastructure is being prepared in accordance with the international standards of the INSPIRE Directive.

2.6 Recommendations

A set of recommendations for methodology, non-technical and technical approach are mentioned in **the 2010 update summary report**.

2.6.1 Recommendations from approach & methodology point of view

•From the perspective of the development and implementation of INSPIRE and the NSDI, the involvement of the relevant stakeholders is of utmost importance. It is clear that some countries still have difficulties in detecting and/or actively involving the right organizations, whether they are data custodian or not. This is especially true for organizations responsible for data sets from annex III. But in more general, the local level is still far from being integrated in the INSPIRE implementation. This will need particular attention in the coming years. It is therefore worthwhile to use and support initiatives that are focusing on this sub-national level.

•In more general terms, much more could be made of the pressing need that exists for a more systematic approach at the European level towards evaluation research in the field of SDIs as a whole. At the moment there are besides the INSPIRE MR, and the State of Play studies a number of ad hoc projects such eSDI-Net+, EURADIN and the EuroSDR Atlas project that cover aspects of INSPIRE implementation, but as this report shows very clearly a much more integrated approach to evaluation by independent bodies is required to assess all aspects of INSPIRE & NSDI implementation, and to make the best use of the resources that are available.

2.6.2 Recommendations from Non technological point of view

From the experience of different stakeholders and countries it is deemed to be very important that countries and individual technological stakeholders become active members of (some of) the standardization organizations like OGC and the ISO & CEN committees. Even if specific efforts are required for doing so, the experience that is being build-up throughout these activities, is helping the country/stakeholders to implement INSPIRE and the NSDI more easily. And in general, this work helps the stakeholders, as well as the countries to apply this experience in other sectors as well.

•There is an overall need to work on capacity building, to create better awareness, and to train more experts to support the often complex tasks of INSPIRE and NSDI implementation. This need has been echoed during the workshop in Krakow and during the INSPIRE conference as well. There might be specific educational initiatives: e.g. the organization of a good INSPIRE e- learning offer at the European level focusing on different types of people; e.g. the exchange of experts among NSDI. Existing European educational/training programs could be used for this. Also specific initiatives could be taken by different universities, private companies and other stakeholders, or by the NSDI themselves. Existing initiatives might be streamlined in order to bring a more consistent training offer.

•Many countries are lacking a good strategic document and implementation plan. However it is deemed that this is necessary to achieve the envisaged results, i.e. to have a high quality NSDI to support multiple needs. Several countries have such plans: from very simple ones (e.g. LI) to more elaborated plans (e.g. NL, DE). It is proposed to have the existing ones together in a central repository, e.g. on the INSPIRE website, and eventually to translate some documents that are currently only in the national language. This could help countries that do not have (yet) such plans.

•Sustainable funding seems to be an important issue as well. While it is probably not feasible to have an overall funding program for INSPIRE at the European level, the more systematic usage of existing budget lines or the creation of specific activity lines in existing programs would be a good solution (combined with mobilization of own funds and business models in the respective countries). The experience of the eContentPlus projects which helped (and still help) funding a lot of the data harmonization projects has proven to be an effective way of working and has made important contributions to the INSPIRE implementation, also in separate countries. A similar approach could be followed for other parts of the infrastructure development.

2.6.3 Recommendations from technological point of view

•It seems that the usage of registries for supporting (and as part of) the infrastructure is very powerful. It is advisable to develop certain registries as part of the European infrastructure. It could also be used, as is done already in Germany, to organize the conformity and performance testing of the infrastructure with a very close link to INSPIRE M&R. Currently very little is known about conformity and performance, but with INSPIRE and NSDI becoming more developed and more mature, and with hopefully more and more users, these aspects will become critical. It is proposed to organize a separate

workshop on this issue in order to bring together the first experiences in this area and to allow other countries to learn on how to tackle this issue.

•Development of metadata must be further improved since it is critical for the whole infrastructure. Especially the metadata for services is still in its initial stage and deserves particular attention. It is suggested to promote the existing metadata editing tools EUOSME[2] (http://www.inspire-geoportal.eu/InspireEditor/, Figure 1) that can help to create metadata in an easier and conformant way. For enviroGRIDS partners the Metadata editor Micka at enviroGRIDS geoportal http://www.envirogrids.cz is also recommended.

• There are more and more network services available in the individual countries, or even at the sub-national level. However, it is not so clear how they perform and whether they are conformant. It is proposed to initiate a small project to do some of this testing. Part can be done within this State of Play study, but certainly not systematic. So another initiative could be envisaged. Also the use and usability of the infrastructure could be analyzed by analyzing how services are used and are usable or not within existing business processes. Issues of portrayal, granularity of services and chaining of services are becoming more important from that perspective. Again, the State of Play can help to collect (part of) this information, but certainly not systematic.

•Over the last few years, and confirmed by the country reports, many efforts have been done on the issue of harmonization and interoperability of spatial data. Several European projects have been carried out or are still continuing. Those experiences should be more systematically documented in view of selecting good practices and problems that were overcome. Questions like: ―wich harmonization strategy to follow", ―transformation or re- engineering", etc. are important questions which have been (only partially) answered or will be tackled in many ongoing European and national projects. CEN/TC 287 is already working on a Technical Report to do this type of systematization. This work could be supported and extended, and it should certainly be promoted.

•Many countries are focusing on the development of a (national) geoportal. Aspects of usability should be taken more actively into account, involving ‚real' users that can test prototypes. A nice geoportal (door) without a good catalogue and services behind it (content) has only limited usability. So focus should be on the latter and on the way it is presented.

One interesting suggestion for those countries which are using commercial products, especially ESRI, world leader of GIS software, is to use ArcGIS software with his module called ArcCatalog, which in the current version 10 include a specialized tool dedicated to INSPIRE Metadata.

ESRI's objective is to provide INSPIRE constituents at all levels with a comprehensive, integrated technology base for ensuring successful and INSPIRE-compliant participation in the EU geospatial information-sharing community.

ESRI's approach for accomplishing this is to present a complete technical solution that can be configured and implemented in its entirety for new INSPIRE-compliant systems or that can provide components for integration into existing systems as necessary.

ESRI now offers solution for INSPIRE by combining ESRI's proven ArcGIS geographic information and SDI platform technologies with complementary ArcGIS software-based technologies developed by ESRI partners in Europe.

The ESRI collaborative solution has been constructed to meet and exceed INSPIRE requirements. Core capabilities that are addressed by this collaborative solution include the capability to author geospatial data and metadata, serve network services (view, download, and discovery services), and use geospatial services and data—all in an INSPIRE-compliant form. Additional distinguishing capabilities offered by this solution include the capability to secure access to geospatial services (and the content and applications they serve), create and apply license models for accessing geospatial services, define quality-of-service rules for geospatial services, and monitor the status and availability of geospatial services.

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[2] The European Open Source Metadata Editor (EUOSME) is a web application to create INSPIRE-compliant metadata in any of 22 European languages.

In addition to the technology itself, ESRI and its European partners in each EU Member State offer services to implement the particular solution technologies needed—in the particular configuration needed—to make each INSPIRE constituent successful.

3. GEO/GEOSS

The Group on Earth Observations (GEO) is coordinating efforts to build a Global Earth Observation System of Systems, or GEOSS.

GEO was launched in response to calls for action by the 2002 World Summit on Sustainable Development and by the G8 (Group of Eight) leading industrialized countries. These high-level meetings recognized that international collaboration is essential for exploiting the growing potential of Earth observations to support decision making in an increasingly complex and environmentally stressed world.

GEO is a voluntary partnership of governments and international organizations. It provides a framework within which these partners can develop new projects and coordinate their strategies and investments. As of March 2011, GEO's Members include 86 Governments and the European Commission. In addition, 61 intergovernmental, international, and regional organizations with a mandate in Earth observation or related issues have been recognized as Participating Organizations.

GEO is constructing GEOSS on the basis of a **10-Year Implementation Plan** for the period 2005 to 2015. The Plan defines a vision statement for GEOSS, its purpose and scope, expected benefits, and the nine ―Societal Benefit Areas" of **disasters, health, energy, climate, water, weather, ecosystems, agriculture and biodiversity**.

3.1 About GEO/GEOSS

The Global Earth Observation System of Systems will provide decision-support tools to a wide variety of users. As with the Internet, GEOSS will be a global and flexible network of content providers allowing decision makers to access an extraordinary range of information at their desk.

The vision for GEOSS is to realize a future wherein decisions and actions for the benefit of humankind are informed by coordinated, comprehensive and sustained Earth observations and information.

This ‗system of systems will proactively link together existing and planned observing systems around the world and support the development of new systems where gaps currently exist. It will promote common technical standards so that data from the thousands of different instruments can be combined into coherent data sets. The ‗GEOPortal' offers a single Internet access point for users seeking data, imagery and analytical software packages relevant to all parts of the globe. It connects users to existing data bases and portals and provides reliable, up-to-date and user friendly information – vital for the work of decision makers, planners and emergency managers. For users with limited or no access to the Internet, similar information is available via the ‗GEONETCast' network of telecommunication satellites.

The purpose of GEOSS is to achieve comprehensive, coordinated and sustained observations of the Earth system, in order to improve monitoring of the state of the Earth, increase understanding of Earth processes, and enhance prediction of the behavior of the Earth system. GEOSS will meet the need for timely, quality long-term global information as a basis for sound decision making, and will enhance delivery of benefits to society in the following initial areas:
- Reducing loss of life and property from natural and human-induced disasters;
- Understanding environmental factors affecting human health and well-being;
- Improving management of energy resources;
- Understanding, assessing, predicting, mitigating, and adapting to climate variability and change;
- Improving water resource management through better understanding of the water cycle;
- Improving weather information, forecasting, and warning;
- Improving the management and protection of terrestrial, coastal, and marine ecosystems;
- Supporting sustainable agriculture and combating desertification;
- Understanding, monitoring, and conserving biodiversity.

The Global Earth Observation System of Systems is simultaneously addressing nine areas of critical importance to people and society. It aims to empower the international community to protect itself against natural and human-induced disasters, understand the environmental sources of health hazards,

manage energy resources, respond to climate change and its impacts, safeguard water resources, improve weather forecasts, manage ecosystems, promote sustainable agriculture and conserve biodiversity. GEOSS coordinates a multitude of complex and interrelated issues simultaneously. This cross-cutting approach avoids unnecessary duplication, encourages synergies between systems and ensures substantial economic, societal and environmental benefits.

As was already mentioned GEOSS components are nine ―Societal Benefit Areas" of **disasters, health, energy, climate, water, weather, ecosystems, agriculture** and **biodiversity**.

Figure 4: The Global Earth Observation System of Systems

3.1.1 Disasters

The aim of this theme is to reduce loss of life and property from natural and human-induced disasters. Here are included earthquakes, tsunamis, wild fires, floods, hurricanes and volcanoes – the list of disasters that can kill and injure people and destroy property is a lengthy one.

When disaster strikes, rapid access to data on land and ocean conditions, maps of transport links and hospitals, weather forecasts, and information on socio-economic variables can save uncounted lives.

The Global Earth Observation System of Systems is integrate Earth observations with other information to help planners reduce vulnerability, strengthen preparedness and early-warning measures and, after disaster strikes, rebuild housing and infrastructure in ways that limit future risks.

GEOSS is also helping to reduce risk over the long term by providing a better understanding of the relationship between natural disasters and climate change. Climate forecasts must become an integral part of sustainable development planning and of strategies for adaptation and risk management.

Disaster-induced losses can be reduced through observations relating to hazards such as: wildland fires, volcanic eruptions, earthquakes, tsunamis, subsidence, landslides, avalanches, ice, floods, extreme weather, and pollution events. GEOSS implementation will bring a more timely dissemination of information through better coordinated systems for monitoring, predicting, risk assessment, early warning, mitigating, and responding to hazards at local, national, regional, and global levels.

3.1.2 Health

Changes in the natural environment can compromise human health. Droughts may lead to malnutrition and life-threatening forest fires. Dust storms and smog often cause respiratory illnesses. Algal blooms contaminate seafood. Climate change and extreme weather events are associated with a wide range of health risks. Emerging infectious diseases such as HIV/AIDS and Lyme appear to be linked to land-use changes that have opened up previously hidden pathways for disease transmission.

The Group on Earth Observations is working with the Health community to improve the flow of user-friendly environmental data. Comprehensive data sets support prevention, early warning, research, health-care planning and delivery, and timely public alerts.

Gathered and distributed through the Global Earth Observation System of Systems, these Earth observation data contribute to improving our understanding of how the environment affects human health and well-being. Key variables include airborne, marine, and water pollutants; stratospheric ozone depletion; land-use change; persistent organic pollutants; food security and nutrition; noise levels; weather-related stresses and disease vectors; and many others.

For example, remote-sensing observations of weather, land and ocean parameters can now be used to predict outbreaks or trends in infectious diseases such as meningitis, malaria and cholera. Such data need to be readily available to public health workers in a format that they can use.

Health issues with Earth-observation needs include: airborne, marine, and water pollution; stratospheric ozone depletion; persistent organic pollutants; nutrition; and monitoring weather-related disease vectors. GEOSS will improve the flow of appropriate environmental data and health statistics to the health community, promoting a focus on prevention and contributing to continued improvements in human health worldwide.

3.1.3 Energy

Exploiting the full potential of energy resources is of critical importance to all countries. This trillion-dollar economic sector includes coal, oil and gas as well as renewable energy sources such as solar, wind and hydropower.

Key concerns for both governments and the private sector include reliable access to energy, the efficient management of energy resources, improved technologies for stabilizing or reducing greenhouse gas emissions, and the need to report energy emissions levels to the UN Climate Change Convention and other bodies.

The Global Earth Observation System of Systems is helping governments and companies to manage energy resources more effectively. GEOSS provides the information they need for evaluating the potential for producing renewable energy and assessing the risks and potential of carbon capture and storage systems designed to reduce greenhouse gas emissions.

GEOSS also provides data and information for monitoring and forecasting fluctuations in hydropower, solar, ocean and wind energy sources; assessing and predicting the environmental impacts of energy exploration, extraction, transportation and consumption; reducing weather-related and other risks to energy infrastructure; matching energy supply and demand; and informing other aspects of energy-policy planning in both developing and developed countries.

GEOSS outcomes in the energy area will support: environmentally responsible and equitable energy management; better matching of energy supply and demand; reduction of risks to energy infrastructure; more accurate inventories of greenhouse gases and pollutants; and a better understanding of renewable energy potential.

3.1.4 Climate

The issue of climate change has moved to the top of the global political agenda. However, many aspects of the global climate system are still not fully understood. Key uncertainties involve clouds, sea-level rise, the carbon cycle and the impact of sulfates and other human-caused aerosols. Solving these uncertainties will assist governments to adopt more effective policies for mitigating, and adapting to, climate change.

The Group on Earth Observations is a strong advocate for sustained and coordinated climate observing systems. It is supporting an ambitious and multidisciplinary effort to strengthen the ability of governments to minimize and adapt to the societal and environmental impacts of climate variability and change

The climate has impacts in each of the other eight societal benefit areas. Coping with climate change and variability demands good scientific understanding based on sufficient and reliable observations.

GEOSS outcomes will enhance the capacity to model, mitigate, and adapt to climate change and variability. Better understanding of the climate and its impacts on the Earth system, including its human and economic aspects, will contribute to improved climate prediction and facilitate sustainable development while avoiding dangerous perturbations to the climate system.

3.1.5 Water

Water-related issues addressed by GEOSS will include: precipitation; soil moisture; streamflow; lake and reservoir levels; snow cover; glaciers and ice; evaporation and transpiration; groundwater; and water quality and water use. GEOSS implementation will improve integrated water-resource management by bringing together observations, prediction, and decision-support systems and by creating better linkages to climate and other data. In situ networks and the automation of data collection will be consolidated, and the capacity to collect and use hydrological observations will be built where it is lacking.

Freshwater is vital for households, agriculture, and industry, and ever larger quantities will be needed for burgeoning human populations over the coming decades. Unfortunately, current observation systems cannot adequately monitor long-term changes and transfers in the global water system and their implications for people, the climate, and biodiversity.

The amount of freshwater available for human consumption and for ecosystem services is affected by many variables. The Global Earth Observation System of Systems seeks to track these variables by filling in existing information gaps about water resources, integrating data sets from various monitoring systems, developing better forecasting models, and disseminating the results to a wider range of decision makers.

A key next step for the GEOSS will be to combine water-level data from satellite-based radar altimeters with data from ground-level, in-situ monitors. This will improve the ability of water managers to map the water cycles of major rivers.

The Group on Earth Observations is also standardizing metadata and improving the accuracy of data and predictions. It aims to establish global prediction models and then develop national-level models and finally river-basin or catchment-level models. These models will eventually become interoperable, creating a —system of systems" that will facilitate the global exchange of observation data and forecasting information.

3.1.6 Weather

Weather monitoring and prediction is the most operationally advanced discipline in the field of Earth observation. National meteorological and hydrological services have been sharing data and information for over 100 years and producing extensive national and global databases on wind, rain, temperature and other key weather variables.

The resulting global network of weather monitoring instruments, databases and forecasting models is already making a critical contribution to the emerging Global Earth Observation System of Systems.

GEOSS is integrating international weather data with the growing number of Earth observation data sets now emerging in such fields as biodiversity, health, energy, and water management.

To achieve this goal, the Group on Earth Observations is developing common data formats and boosting collaboration amongst experts in a wide range of scientific and socio-economic disciplines.

The end result will be to greatly expand the range of uses to which weather information and forecasts can be put. This will lead to enormous societal and economic benefits.

The weather observations encompassed by GEOSS are based on the requirements for timely short-and medium-term forecasts. GEOSS can help fill critical gaps in the observation of, for example, wind and humidity profiles, precipitation, and data collection over ocean areas; extend the use of dynamic sampling methods globally; improve the initialization of forecasts; and increase the capacity in developing countries to deliver essential observations and use forecast products. Every country will have the severe-weather-event information needed to mitigate loss of life and reduce property damage. Access to weather data for the other societal benefit areas will be facilitated.

3.1.7 Ecosystems

Terrestrial, coastal and marine ecosystems provide essential socio-economic and environmental benefits. Ecosystems the world over, however, are under tremendous stress from rapid land-use change, pollution and the overexploitation of natural resources.

Unfortunately, current Earth observation systems for monitoring forests, wetlands, deserts and other ecosystems suffer from numerous gaps and weaknesses. As a result, these systems cannot adequately support efforts to revive, protect or manage ecosystems.

The Group on Earth Observations seeks to strengthen ecosystem monitoring through the Global Earth Observation System of Systems. GEOSS is establishing an expanded and coordinated network of land, ocean and coastal monitoring systems that will produce information of the required breadth and depth.

In particular, GEO is improving spatial information on ecosystem conditions and trends. This will enable researchers to classify ecosystems and delineate their boundaries, including the geographic limits of protected areas. GEO is also generating and integrating a wide variety of ecosystem data and creating high-resolution maps so that decision makers can monitor ecosystem services such as flood control and sustainable timber harvests. Other priorities include improving the monitoring and assessment of desertification and coordinating global, regional and national forest monitoring programs.

Observations are needed on the area, condition, and natural-resource stock levels of ecosystems such as forests, rangelands, and oceans. GEOSS implementation will seek to ensure that methodologies and observations are available on a global basis to detect and predict changes in ecosystem condition and to define resource potentials and limits. Ecosystem observations will be better harmonized and shared, spatial and topical gaps will be filled, and in situ data will be better integrated with space-based observations. Continuity of observations for monitoring wild fisheries, the carbon and nitrogen cycles, canopy properties, ocean color, and temperature will be set in place.

3.1.8 Agriculture

This theme include: crop production; livestock, aquaculture and fishery statistics; food security and drought projections; nutrient balances; farming systems; land use and land-cover change; and changes in the extent and severity of land degradation and desertification.

GEOSS implementation will address the continuity of critical data, such as high-resolution observation data from satellites. A truly global mapping and information service, integrating spatially explicit socio-economic data with agricultural, forest, and aquaculture data will be feasible, with applications in poverty and food monitoring, international planning, and sustainable development.

Food supplies depend on trends in the natural environment, including weather and climate, freshwater supplies, soil moisture and other variables.

At the same time, agriculture has a major impact on the environment. Unless they are sustainably managed, farms and pastures can cause erosion, desertification, chemicals pollution and water shortages. Similarly, fishing can deplete fish stocks and damage coastal ecosystems. These risks need to be monitored and managed.

The Group on Earth Observations is constructing the Global Earth Observation System of Systems to help farmers, fishers and policymakers maximize productivity and food security while preserving ecosystems and biodiversity.

GEO also aims to support the sustainable management of agriculture by disseminating weather forecasts, early warnings of storms and other extreme events, water pollution, long-term forecasts of likely climate change impacts, and information on water supplies.

These and other data are being integrated so that they can be used in models for simulating and predicting agricultural trends. Related activities include mapping the changing distribution of croplands around the world, advancing the accuracy of measurements of biomass (the total amount of living material in a given habitat or population), reporting agricultural statistics in a more timely manner, and improving forecasts of shortfalls in crop production and food supplies.

3.1.9 Biodiversity

Issues in this area include the condition and extent of ecosystems, distribution and status of species, and genetic diversity in key populations. Implementing GEOSS will unify many disparate biodiversity-observing systems and create a platform to integrate biodiversity data with other types of information. Taxonomic and spatial gaps will be filled, and the pace of information collection and dissemination will be increased. Biological diversity encompasses all of the Earth's plants, animals and micro-organisms; the genetic variation within each species; and the diverse ecosystems in which living things –including human beings – form communities and interact with one another and with the air, water, and soil around them.

The conservation and sustainable use of the world's biological resources is central to promoting sustainable development. The Global Earth Observation System of Systems supports these goals by improving the quality and quantity of biodiversity information and analysis.

GEOSS is linking together the world's many stand-alone biodiversity monitoring systems and connecting them to other Earth observation networks that generate relevant data, such as climate and pollution indicators.

It also helps to fill in gaps in taxonomic and biological information, generate updated assessments of global biodiversity trends, track the spread and retreat of invasive alien species, and monitor how biodiversity responds to climate change.

3.2 Requirements of GEOSS

Systems intended to become GEOSS Components can only be contributed by GEO Members or Participating Organizations, and each of them must have endorsed the GEOSS 10-Year Implementation Plan.

Technical requirements on contributed systems from a systems architecture and data management perspective are known as ―interoperability arrangements". At minimum, any new GEOSS Component is understood to be bound by the GEOSS interoperability arrangements as documented at the time it was contributed.

The success of GEOSS will depend on data and information providers accepting and implementing a set of interoperability arrangements, including technical specifications for collecting, processing, storing, and disseminating shared data, metadata, and products. GEOSS interoperability is on non-proprietary standards, with preference to formal international standards. Interoperability is on interfaces, defining only how system components interface with each other and thereby minimizing any impact on affected systems other than where such affected systems have interfaces to the shared architecture.

GEOSS interoperability arrangements are to be based on the view of complex systems as assemblies of components that interoperate primarily by passing structured messages over network communication services. By expressing interface interoperability specifications as standard service definitions, GEOSS system interfaces assure verifiable and scalable interoperability, whether among components within a complex system or among discrete systems.

In the system of systems adopted by GEO, virtually all the operational infrastructure is provided through contributions by GEO Members and Participating Organizations. This includes certain components that are common across the whole of GEOSS. For instance, the GEOSS Clearinghouse provides registry services with: a description of each of the formally contributed components of GEOSS; metadata about the various data and information holdings in each of the contributed components; technical specifications for using the services exposed by the contributed components; and, descriptions of key interoperability standards in use across the contributed components of GEOSS.

The process of contributing a system to become a part of GEOSS begins by registering it as a ‗GEOSS Component' through the online registration form. If the system has public service interfaces, these also should be registered. The contributed system and service interfaces are then catalogued by the GEOSS Clearinghouse for discovery and access.

3.2.1 GEOSS Common Infrastructure

The GEOSS Common Infrastructure allows the user of Earth observations to access, search and use the data, information, tools and services available through the Global Earth Observation System of Systems. The infrastructure consists of four main elements:

- The GEO Portal - http://www.geoportal.org/web/guest/geo_home provides the direct web interface through which the user accesses GEOSS and searches for information and services.
- The GEOSS Clearinghouse is the engine that drives the entire system. It connects directly to the various GEOSS components and services, collects and searches their information and distributes data and services via the Portal to the user.
- The GEOSS Components and Services Registry is similar to a library catalogue. All of the governments and organizations that contribute components and services to GEOSS provide essential details about the name, contents, and management of their contribution. This assists the Clearinghouse, and ultimately the user, to identify the GEOSS resources that may be of interest.
- The GEOSS Standards and Interoperability Registry enables contributors to GEOSS to configure their systems so that they can share information with other systems. This Registry is vital to the ability of GEOSS to function as a true system of systems and to provide integrated and cross-cutting information and services. Contributors can also share ideas and proposals informally via the associated Standards and Interoperability Forum.
- The Best Practices Wiki provides the GEOSS community with a means to propose, discuss and converge upon best practices in all fields of earth observation.
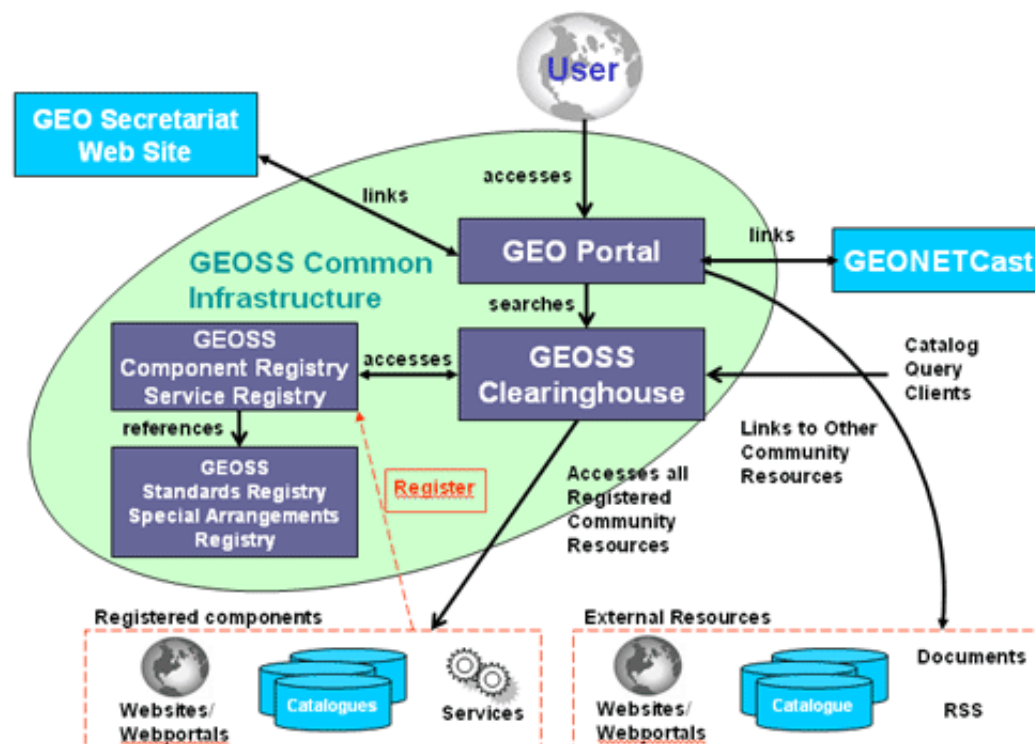
Figure 5: GEOSS Common Infrastructure

3.2.2 GEOSS Data Sharing Principles

The 3 main principles of this requirements are:

- There will be full and open exchange of data, metadata, and products shared within GEOSS, recognizing relevant international instruments and national policies and legislation;
- All shared data, metadata, and products will be made available with minimum time delay and at minimum cost;
- All shared data, metadata, and products being free of charge or no more than cost of reproduction will be encouraged for research and education.

3.2.3 GEOSS Data Management

Identify and implement recommendations for best practices of Earth Observation data and information life cycle management. Improve data discovery, availability, near real-time access and traceability including data tagging for citation tracking.

- GEOSS Quality Assurance Strategy
- Data, Metadata and Products Harmonisation
- Long Term Preservation of Earth Observation Data

3.2.3 Data Integration and Analysis

Coordinate data management approaches for data modeling and information products. Enable users to define processes to efficiently generate information products through modeling and analyses and utilize large volumes of data from heterogeneous data sources.

- Data Integration and Analysis Systems
- Ensemble-Technique Forecasting Demonstrations - facilitate the development of demonstration projects promoting the use of ensemble-based techniques in disciplines other

than weather forecasting.

- Global Geodetic Reference Frames - Ensure the availability of accurate, homogeneous, long-term, stable, global geodetic reference frames as a mandatory framework and the metrological basis for Earth observation. Identify steps towards such consistent high-accuracy global geodetic reference frames for Earth observation and the observing systems contributing to GEOSS. Promote the use of common or interoperable reference frames within GEOSS.
- Atmospheric Model Evaluation Network - demonstrate the use of web services to compare global and regional atmospheric models (including atmospheric chemistry/air quality models). Apply to a variety of Earth observations from distributed archives using standardized approaches to evaluate and improve model performance.

3.3.4 Global Data Sets

Provide a suite of global datasets based on improved and validated data sources. Initiate regular analysis and reporting. Facilitate interoperability among data sets using the framework, structure and methodologies of the GEO Architecture. Register the global data sets in the GEOSS registries and where new approaches are developed; contribute new best practices and interoperability arrangements to the GEOSS registries.

- Global Land Cover - Provide a suite of global land cover datasets, initially based on improved and validated moderate resolution land cover maps and eventually including land-cover change at high resolution. This activity will benefit directly from the establishment of the Land Surface Imaging virtual constellation.
- Global Meteorological and Environmental Data - Implement the Chinese Meteorological Satellite Program for global weather and environmental monitoring. This Program will (i) provide users worldwide with low-resolution multiple-source observation data; (ii) develop integrated multi-source satellite retrieval products shared with users; and (iii) enhance capabilities to acquire and apply Chinese meteorological satellite data and products.
- Digital Geological Map Data - Make existing geological map data web-accessible. Transfer know-how to the developing world. Accelerate the progress of an emerging geoscience data interchange standard. Use OneGeology to raise the public profile and understanding of geoscience. One hundred and two nations and thirteen international bodies participate in the OneGeology Project.
- Global DEM - Facilitate interoperability among Digital Elevation Model (DEM) data sets with the goal of producing a global, coordinated and integrated DEM. This DEM database should be embedded into a consistent, high accuracy, and long term stable geodetic reference frame for Earth observation.
- Global Soil Data - Support the development of a global soil information system building upon the work of ongoing and completed projects. The system will incorporate data from global, regional and national soil data projects into a coherent system using a common dictionary – to support implementation of major multilateral environmental agreements (e.g. UNFCCC, UNCCD and CBD) and provide harmonized and policy-relevant information to users at the global, regional and national level. The system will deliver web-based services on soil information.
- Global Road and Human Settlements Mapping on GEO Grid - Develop a global road and human settlements map on GEO Grid. Related activities will include: (i) System development of GEO Grid towards sharing, developing and distributing data; (ii) Research & development for producing relevant data using satellite images; and (iii) Collection, maintenance, and evaluation of relevant remote sensing and GIS data.

3.3 enviroGRIDS and GEO/GEOSS

The aim of the EU FP7 EnviroGRIDS project is to build capacities in the Black Sea region to use new international standards to gather, store, distribute, analyze, visualize and disseminate crucial information on past, present and future states of this region, in order to assess its sustainability and vulnerability. To achieve its objectives, EnviroGRIDS will build a Grid-enabled Spatial Data Infrastructure (gSDI) becoming one of the integral systems in the Global Earth Observation System of Systems.

The scientific aim of the EnviroGRIDS @ Black Sea Catchment project is to start building an Observation System that will address several GEO Societal Benefit Areas within a changing climate framework. This system will incorporate a shared information system that operates on the boundary of scientific/technical partners, stakeholders and the public.

It will contain an early warning system able to inform in advance decision-makers and the public about risks to human health, biodiversity and ecosystems integrity, agriculture production or energy supply caused by climatic, demographic and land cover changes on a 50-year time horizon.

To achieve and support the EnviroGRIDS vision and objectives, the work package 2 will focus its attention on the creation of a Grid enabled Spatial Data Infrastructure (gSDI) so that the data necessary for the assessment of GEO Societal Benefit Areas, as well as the data produced within the project can be gathered and stored in an organized form and accessible in an interoperable way on the Grid infrastructure and distributed across the Grid in order to provide a high performance and reliable access through standardized interfaces.

The main goal of the EnviroGRIDS project is to build capacities in the Black Sea region especially regarding data sharing and related technologies (web services, metadata catalogues, etc.) allowing data providers to register their data into GEOSS. The success of the project could and/or will be measured on how many new contributors of the region will register their services into the GEOSS Common Infrastructure.

EnviroGRIDS will apply the following GEOSS data sharing principles:
- There will be full and open exchange of data, metadata, and products shared within GEOSS, recognizing relevant international instruments and national policies and legislation.
- All shared data, metadata, and products will be made available with minimum time delay and at minimum cost.
- All shared data, metadata, and products free of charge or no more than cost of reproduction will be encouraged for research and education.

EnviroGRIDS metadata and data standards will also be coordinated and aligned with GEOSS standards, which are currently under development. Note that EnviroGRIDS is now an official task named "Vulnerability of Sea Basin" (EC-09-02c) in the GEO work plan 2009-2011 under the Area "Ecosystems" and the overarching task "Ecosystem vulnerability to Global Change".

The enviroGRIDS geoportal http://www.envirogrids.cz has been officially launched in February 2011. It uses principles of web services, Uniform Resource Management (URM), social network sites, semantic web. It integrates different technologies like GIS, multimedia, and virtual reality. The EnviroGRIDS portal implements functionalities to query the different metadata catalogue as well as showing the different geospatial data. It includes following components:
- GeoServer
- Geohosting
- Visualisation client HSLayers
- Catalogue client
- Metadata editor Micka
- Metadata extractor
- SimpleCMS Content management system

The EnviroGRIDS URM geoportal is registered into the GEOSS Common Infrastructure and in consequence, all the metadata and data available in the URM portal will also be accessible through the GEOSS geoportal. Finally, the EnviroGRIDS geoportal will have the possibility to query and access data of GEOSS and INSPIRE geoportals.

3.4 Black Sea catchment in GEOSS

The availability of the information and data services and resources for the Black Sea catchment countries is presented in the Table 2. The availability of resources for all countries from the Black Sea catchment is very similar, because most of the GEOSS resources are either of global character (as it follows from the name of the system), such as ASTER GDEM, ESRI GEO Portal, or the resources are

delivered by EU providers assuring coverage of the whole territory of Europe, e.g. Corine Land Cover, CleanSeaNet, AirBase.

Table 2: Available resources for Black Sea catchment in GEOSS

Country	Information Services										Capacity Building	Showcase of datasets		International Initiatives
	Early warning	Monitoring Services	Analysing Services	Mapping Services	Assessment Services	Alert Systems	Geospatial Web Services	Data processing	Data Provision	Total		Layers	Maps	
Austria	7	62	23	40	22	15	68	8	196	367	9	12	2	17
Belarus	7	61	23	39	21	14	63	8	197	363	9	12	1	18
Bosnia and Herzegovina	7	58	23	38	21	14	63	8	195	360	9	12	1	17
Bulgaria	7	59	23	39	21	14	62	8	193	358	9	12	1	17
Croatia	7	58	23	38	21	14	63	8	195	360	9	12	1	17
Czech Republic	7	62	23	40	22	15	68	8	196	367	9	12	2	17
Georgia	7	59	23	38	20	14	62	8	193	358	8	12	1	18
Germany	7	62	23	40	22	15	71	8	196	370	9	12	2	17
Hungary	7	58	23	38	21	14	63	8	195	360	9	12	1	17
Moldova	7	58	23	38	21	14	62	8	194	358	9	12	0	17
Montenegro	5	38	23	36	13	13	55	8	172	307	8	12	0	18
Romania	7	58	23	38	21	14	62	8	194	358	9	12	0	17
Russian Federation	7	67	24	42	22	15	76	9	217	399	10	13	5	18
Serbia	5	38	23	36	13	13	55	8	172	307	8	12	0	18
Slovakia	7	59	23	39	21	14	63	8	195	359	9	12	0	17
Slovenia	7	58	23	38	21	14	63	8	195	360	9	12	1	17
Switzerland	5	40	23	36	13	13	55	8	173	310	8	12	1	18
Turkey	8	61	25	41	21	14	61	8	193	364	10	13	1	20
Ukraine	7	61	23	39	21	14	63	8	198	364	9	12	1	18
Europe	8	66	25	43	22	15	75	8	203	390	10	13	4	20
Global	10	77	29	50	23	18	95	10	248	466	12	23	14	20

On the one hand, the availability of resources for Black Sea catchment seems to be good but on the other hand, the number of information and data resources originating from the Black Sea catchment

countries (Table 3) is rather small. Moreover, for Romania, Russian Federation and Ukraine one of the resources is the contribution of the enviroGRIDS project.

Table 3: GEOSS resources originating from the Black Sea catchment countries

Country	Austria	Germany	Romania	Russian Federation	Switzerland	Ukraine
GEOSS resources	3	18	1	3	1	3

The lack of regional and local resources hampers introducing appropriate tools and instruments supporting decision-making processes in GEOSS societal benefit areas on respective levels. The enviroGRIDS project is aimed to reduce this misbalance between global and regional data for the Black Sea catchment area.

3.5 Recommendations

The societal benefits of Earth observations cannot be achieved without data sharing.

The main recommendations are:

- To open exchange of data, metadata, and products
- Shared data, metadata, and products shall be made available with minimum time delay and at minimum cost
- All shared data, metadata, and products free of charge or no more than cost of reproduction will be encouraged for research and education
- Use enviroGRIDS URM geoportal for registering partner's informational (OGC web) services, data and/or metadata thus bring them into GEOSS

ANNEXES

A. INSPIRE themes

Annex 1

1. Coordinate reference systems

Systems for uniquely referencing spatial information in space as a set of coordinates (x, y, z) and/or latitude and longitude and height, based on a geodetic horizontal and vertical datum.

2. Geographical grid systems

Harmonized multi-resolution grid with a common point of origin and standardized location and size of grid cells.

3. Geographical names

Names of areas, regions, localities, cities, suburbs, towns or settlements, or any geographical or topographical feature of public or historical interest.

4. Administrative units

Units of administration, dividing areas where Member States have and/or exercise jurisdictional rights, for local, regional and national governance, separated by administrative boundaries.

5. Addresses

Location of properties based on address identifiers, usually by road name, house number, postal code.

6. Cadastral parcels

Areas defined by cadastral registers or equivalent.

7. Transport networks

Road, rail, air and water transport networks and related infrastructure. Includes links between different networks.

8. Hydrography

Hydrographic elements, including marine areas and all other water bodies and items related to them, including river basins and sub-basins.

9. Protected sites

Area designated or managed within a framework of international, Community and Member States' legislation to achieve specific conservation objectives.

Annex 2

1. *Elevation*

Digital elevation models for land, ice and ocean surface. Includes terrestrial elevation, bathymetry and shoreline.

2. *Land cover*

Physical and biological cover of the earth's surface including artificial surfaces, agricultural areas, forests, (semi-) natural areas, wetlands, water bodies.

3. *Orthoimagery*

Geo-referenced image data of the Earth's surface, from either satellite or airborne sensors.

4. *Geology*

Geology characterized according to composition and structure. Includes bedrock, aquifers and geomorphology.

Annex 3

1. *Statistical units*

Units for dissemination or use of statistical information.

2. *Buildings*

Geographical location of buildings.

3. *Soil*

Soils and subsoil characterized according to depth, texture, structure and content of par ticles and organic material, stoniness, erosion, where appropriate mean slope and anticipated water storage capacity.

4. *Land use*

Territory characterized according to its current and future planned functional dimension or socioeconomic purpose (e.g. residential, industrial, commercial, agricultural, forestry, recreational).

5. *Human health and safety*

Geographical distribution of dominance of pathologies (allergies, cancers, respiratory diseases, etc.), information indicating the effect on health (biomarkers, decline of fertility, epidemics) or well-being of humans (fatigue, stress, etc.) linked directly (air pollution, chemicals, depletion of the ozone layer, noise, etc.) or indirectly (food, genetically modified organisms, etc.) to the quality of the environment.

6. *Utility and governmental services*

Includes utility facilities such as sewage, waste management, energy supply and water supply, administrative and social governmental services such as public administrations, civil protection sites, schools and hospitals.

7. *Environmental monitoring facilities*

Location and operation of environmental monitoring facilities includes observation and measurement of emissions, of the state of environmental media and of other ecosystem parameters (biodiversity, ecological conditions of vegetation, etc.) by or on behalf of public authorities.

8. *Production and industrial facilities*

Industrial production sites, including installations covered by Council Directive 96/61/EC of 24

September 1996 concerning integrated pollution prevention and control and water abstraction facilities, mining, storage sites.

9. *Agricultural and aquaculture facilities*

Farming equipment and production facilities (including irrigation systems, greenhouses and stables).

10. *Population distribution — demography*

Geographical distribution of people, including population characteristics and activity levels, aggregated by grid, region, administrative unit or other analytical unit.

11. *Area management/restriction/regulation zones and reporting units*

Areas managed, regulated or used for reporting at international, European, national, regional and local levels. Includes dumping sites, restricted areas around drinking water sources, nitrate-vulnerable zones, regulated fair ways at sea or large inland waters, areas for the dumping of waste, noise restriction zones, prospecting and mining permit areas, river basin districts, relevant reporting units and coastal zone management areas.

12. *Natural risk zones*

Vulnerable areas characterized according to natural hazards (all atmospheric, hydrologic, seismic, volcanic and wildfire phenomena that, because of their location, severity, and frequency, have the potential to seriously affect society), e.g. floods, landslides and subsidence, avalanches, forest fires,

earthquakes, volcanic eruptions.

13. *Atmospheric conditions*

Physical conditions in the atmosphere. Includes spatial data based on measurements, on models or on a combination thereof and includes measurement locations.

14. *Meteorological geographical features*

Weather conditions and their measurements; precipitation, temperature, evapotranspiration, wind speed and direction.

15. *Oceanographic geographical features*

Physical conditions of oceans (currents, salinity, wave heights, etc.).

16. *Sea regions*

Physical conditions of seas and saline water bodies divided into regions and sub-regions with common characteristics.

17. *Bio-geographical regions*

Areas of relatively homogeneous ecological conditions with common characteristics.

18. *Habitats and biotopes*

Geographical areas characterized by specific ecological conditions, processes, structure, and (life support) functions that physically support the organisms that live there. Includes terrestr ial and aquatic areas distinguished by geographical, abiotic and biotic features, whether entirely natural or semi-natural.

19. *Species distribution*

Geographical distribution of occurrence of animal and plant species aggregated by grid, region, administrative unit or other analytical unit.

20. *Energy resources*

Energy resources including hydrocarbons, hydropower, bio-energy, solar, wind, etc., where relevant including depth/height information on the extent of the resource.

21. *Mineral resources*

Mineral resources including metal ores, industrial minerals etc.

B. List of SDI addresses/contacts

Austria

Name	Web address	Organizational mailing address	Over-all contact person: tel./fax/e-mail
AGEO – Austrian Umbrella Organization for Geographic Information	http://www.ageo.at/		Contact: DI Gerda Schennach Bürgerstrasse 34, A-6010 Innsbruck email: gerda.schennach@bev.gv.at Tel: +43 / 512 / 588948-60 Fax: +43 / 512 / 588948-61
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General Directorate of Cadastre and Land Registry (GDCLR)	http://www.tkgm.gov.tr/tkgm/index.php	Dikmen Yolu No:14 (06100) Bakanlıklar / Ankara	Phone:+90 312 413 60 00
Ministry of Public Works and Settlement (MPWS)	http://www.bayindirlik.gov.tr/		
SAGRES (SAtellite Ground REceiving Station) under Istanbul Technical University (ITU).	www.itu.edu.tr.		
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REFERENCES

GEO website http://www.earthobservations.org/

INSPIRE Directive portal http://inspire.jrc.ec.europa.eu/index.cfm

INSPIRE & NSDI SoP. D4.1 Summary report regarding the results of the European Assessment of 34 NSDI (first year) September 2010
http://inspire.jrc.ec.europa.eu/reports/stateofplay2009/INSPIRE%20NSDI%20SoP%20-%20Summary%20Report%202010%20-%20v4%204.pdf

Charvat K., Alberts M., Horakova S., 2009. INSPIRE, GMES and GEOSS Activities, Methods and Tools towards a Single Information Space in Europe for the Environment

Craglia M. 2010. Building INSPIRE: The Spatial Data Infrastructure for Europe, ArcNews, Spring 2010, ESRI Press, Redland, California, USA

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Water Framework Directive – WFD). OJ L 327, 22.12.2000, p. 1–73

European Commission (2007) Directive 2007/2/EC of the European Parliament and the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community(INSPIRE), 14p
http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2007:108:SOM:EN:HTML

GEO (2009 - 2011) The Global Earth Observation System of Systems (GEOSS) GEO 2009-2011 WORK PLAN
http://www.earthobservations.org/documents/work%20plan/geo_wp0911_rev3_101208.pdf

GEO (2005) Global Earth Observation System of Systems 10-Year Implementation Plan Reference Document, 209p
http://www.earthobservations.org/documents/10-Year%20Plan%20Reference%20Document.pdf

GEO (2005) The Global Earth Observation System of Systems (GEOSS) 10-Year Implementation Plan, 11p
http://www.earthobservations.org/documents/10-Year%20Implementation%20Plan.pdf

GEO (2006) GEO Capacity Building Strategy, 13p.
http://www.earthobservations.org/documents/committees/cbc/capacity_building_strategy.pdf

GEO (2007) The Full Picture, 143p.
http://www.earthobservations.org/documents/the_full_picture.pdf

GEO (2008) White Paper on the GEOSS Data Sharing Principles, 93p.
http://www.earthobservations.org/documents/dsp/Draft%20White%20Paper%20for%20GEOSS%20Data%20Sharing%20Policies_27Sept08.pdf

Giuliani G. et al. 2009. EnviroGRIDS interoperability guideline. Deliverable D2.1

Lehmann A. et al. 2008. EnviroGRIDS. Building Capacity for a Black Sea Catchment Observation and Assessment System supporting Sustainable Development. Annex 1 – Description of Work

Masser I. 2010. Building European Spatial Data Infrastructure, ESRI Press, Redland, California, USA

Open Geospatial Consortium (2005) The Importance of Going ―Open‖, OGC White Paper, 8p.
http://portal.opengeospatial.org/files/?artifact_id=6211&version=2&format=pdf

Open Geospatial Consortium (2004) The Havoc of Non-Interoperability, OGC White Paper, 7p.
http://portal.opengeospatial.org/files/?artifact_id=5097&version=3&format=pdf

Open Geospatial Consortium (2004) Integrating Geospatial Standards and Standards Strategies Into Business Process, OGC White Paper, 7p.
http://portal.opengeospatial.org/files/?artifact_id=5098&version=2&format=pdf

Open Geospatial Consortium (2004) The Spatial Web, OGC White Paper, 8p.
http://portal.opengeospatial.org/files/?artifact_id=3859&version=2&format=pdf

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ABBREVIATIONS & ACRONYMS

BSC PS	Black Sea Commission Permanent Secretariat
CGM	Computer Graphics Metafile
DoW	Document of Work
EC	European Commission
EO	Earth Observation
ESRI	Environmental Systems Research Institute – GIS software development and services company
GEO	Group of Earth Observation
GEOSS	Global Earth Observation System of Systems
GI	Geographical Information
GIS	Geographical Information System
GISEE	GIS Technology and Market in South Eastern Europe study
GSDI	Grid enabled Spatial Data Infrastructure
ICPDR	International Commission for the Protection of the Danube River
INSPIRE	Infrastructure for Spatial Information in the European Union
MR	Monitoring and Reporting
NSDI	National Spatial Data Infrastructure
OGS	Open Geospatial
SDI	Spatial Data Infrastructure
URM	Uniform Resource Management
WP	Work Package