

Demonstrator for the Black Sea Marine Environmental Management Support System based on Telematics (Black Sea Web)

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The Black Sea is an almost closed sea being bordered by countries with intensive agriculture and several harbors without or with very limited wastewater treating capacities. The water pollution arising from this has a very important negative impact on the marine environment of the Black Sea. Active measures have to be taken by the Black Sea countries, to improve the polluted state of the Black Sea Ecosystem. The Strategic action plan for saving the Black Sea [1] cannot be realized without a (near) real time information and data on the several ecological aspects of the Black Sea marine environment. It is also necessary for future Black Sea Observation and Forecasting system [2].

Detailed discussions with marine (environmental) scientists from Romania, the Russian Federation and Ukraine resulted in the opinion that data-availability as well as data-access and integrated marine environmental management of the Black Sea Region may be improved by application of innovative practice tools and management systems from EC-countries.

A Black Sea Web site on the Internet could provide such management tool and help the decision-makers in their tasks to implement an adequate integrated marine environmental management of the Black Sea Region.

The Black Sea Web Project, a joint-project between local partners from Ukraine, the Russian

Federation and Romania and EC-partners from the Netherlands and Denmark, focuses on strengthening of environmental management for the Black Sea Region. Within the framework of the Project, a Demonstrator for a Black Sea Marine Environmental Management Support System, based on Telematics (Black Sea Web) will be developed and evaluated. This Demonstrator might provide a model for future expansion of the system among all countries bounded on the Black Sea. Also it will contribute to the further development of the Black Sea Region state-of-the-art on Informatics and Telematics. The Project started at September 1, 1998. Duration of the Project is 1.5 year.

The innovative design of the to be developed Demonstrator for a Black Sea Web, is that the data source holders have access into each other data and information, on an independent basis. However, the data source holders will keep control of their own data. Within this concept, several databases, which are physically and geographically separated, can be accessed remotely for data retrieval and data transfer from a Black Sea Web Interface.

The central element in the system is a Central Meta Directory, describing what information is available at what location. This directory (catalogue) will be built in the Black Sea Web Interface, largely based upon GIS for geographical interfacing. The Central Meta Directory will be installed as a World Wide Web server.

To host the Black Sea Web web-site a dedicated domain being registered and activated at the MARIS server infrastructure: <http://www.blackseaweb.net/>. First draft version of the Project Web-site has been now accessible. It already includes a lot of useful information on the Black Sea environment and studies.

Objectives of the Black Sea Web Project

Development of an innovative management tool based on Telematics, which will help local and regional (governmental) organizations and bodies around the Black Sea to implement integrated marine environmental management, including:

- Description of what information is available at what location, and Provision of Information Technology (IT-) Systems (Internet techniques) with automated procedures to access the actual information.
- The innovative design of a Demonstrator for the Black Sea Marine Environmental Management Support System (Black Sea Web) to have access into each others data of organizations dealing with marine environmental data of the Black Sea, on an independent base and

maintaining the control of their own data. This concept results in several connected databases, which are physically separated, but appear as one.

- Providing the capability for the implementation of different types of integrated environmental management information, through the use of a Central Meta Directory.

- The (Innovative) Design of a Central Meta Directory (CMD) as a central element of the system, considering the guidelines of the Catalogue of Data Sources of the European Environment Agency. The CMD describes what information is available at what location and will be installed as a World Wide Web Server (WWW). CMD will be supported by applications based on a Geographical Information System (GIS) for geographical interfacing. From the CMD and GIS users can search for relevant data and information. The system will provide automated procedures and telematic solutions (by the Internet) to access the actual distributed databases and to locate and bring out the required data. The distributed database model will be based upon CORBA-software architecture, the telematics/transport model upon Internet techniques. The Demonstrator will focus on two separate databases, maintained and managed by different partners from different countries along the Black Sea: (1) the Black Sea database of Marine Hydrophysical Institute in the Ukraine, containing physical and geo-chemical data on the marine Black Sea environment; (2) the database of the Romanian Marine Geology and Geology Institute containing geological and geo-ecological data.

- Facilitate the search for and access to specific environmental data by several, well-developed navigation systems.

- Develop an innovative Marine Environmental Management Support System, which can be used for a wide variety of environmental topics and management levels.

- Increase the velocity and quantity of environmental data and information, available through the use of the Black Sea Web.

Partners of the Black Sea Web Project

The Marine Information Service (MARIS, Netherlands) - Project co-ordinator

MARIS is an industrial company (engineering office), whose main business interests are marine information services & data brokerage, consultancy, development and implementation of Marine Data & Information management systems and services, project development and management, development and management of Internet Web sites and applications and electronic publishing.

MARIS has still strong links with the government and performs many projects and tasks for governmental services. One of these tasks is that MARIS function as focal point for oceanographic and marine data, information and expertise for the Netherlands, maintaining various meta-databases on data resources, organisation addresses, marine research projects etc.

MARIS is also a member of the network of National Oceanographic Data Centres in Europe that act in the framework of the Intergovernmental Oceanographic Commission (IOC). By this and many other contacts MARIS has a strong international network of oceanographic data & information sources and is also well experienced in oceanographic data & information management and dissemination.

A key issue for MARIS is that it supports organisations to bridge the existing gap between internal data & information resources at one side and the user market at the other side. MARIS supports the development and implementation of the marketing strategy as well as engineer's effective information tools and systems to streamline dissemination and exploitation.

Information management systems are mostly developed in projects for governmental departments, such as the Ministry of Transport, Public Works & Water Management, and international bodies, such as the EC and UNEP, and for bilateral co-operation between the Netherlands and Eastern European countries.

Information services comprise among others the exploitation of factual databases and Web sites, targeted at economic users of the sea, such as the offshore oil & gas industry and dredging industry. Web-sites are set-up as thematic electronic markets and are targeted at the primary information/service providers in the specific theme. MARIS supports or manages the overall set-up and strategy for the site development and develops the individual home pages for participating organisations. These comprise governmental departments, regional government, research institutes, branch associations and private industries, such as publishers.

MARIS role within the Black Sea Web Project is: Project Management / Development of the Meta Directories / Co-ordination of Development of the Demonstrator Black Sea Web / User Consultation.

The Moscow State University (MSU, Russia)

The MSU is founded in 1755 and has a long-standing tradition of academic excellence. Today it is considered to be one of the most important scientific and educational centres in Russia. At present there are more than 8600 professors, lecturers and research associates working at MSU. More than 26000 undergraduate students at MSU.

and about 5000 are working on their PhD projects. MSU has among others more than 100 laboratories, computer centre, botanical gardens, etc.

MSU role within the Black Sea Web Project is: Development of the Application Layer / Development of the Central Meta Directory and Meta Directories / Implementation, Testing and Promotion.

The Marine Hydrophysical Institute Sevastopol (MHI, Ukraine)

MHI of the National Academy of Sciences of Ukraine was founded in 1929, when a stationary hydrophysical station was established in Katsiveli (Crimea) on shore of the Black Sea. In 1948, Marine Hydrophysical Institute affiliated to the USSR Academy of Sciences was set up in Moscow, on the basis of the Black Sea hydrophysical station (Katsiveli) and Marine hydrophysical laboratory (Moscow). In 1961, MHI was reaffiliated to the Ukrainian Academy of Sciences, and in 1963, was transferred to Sevastopol. About 200 researchers work in the MHI, amongst which 26 are professors and 120 persons are PhDs.

MHI has 14 scientific departments including Department of the Marine Information Systems and Technologies with the Data Base Laboratory (DBL), which participates in this Project.

Main Tasks of the DBL include:

- Development of the scientific basis, algorithms and software for the oceanographic data quality control, processing, and database management systems.

- Creation, loading and maintenance of the regional, special and interdisciplinary oceanographic databases. Among others, Laboratory maintain the Black Sea data base of the MHI and has a big experience in work with the Black Sea data.

Jointly with MARIS (Netherlands), it participated in the creation of the Black Sea Information System. Laboratory participates/participated in these current international programs related to the Black Sea:

- Cooperative Marine Science Program for the Black Sea, CoMSBlack, (IOC).

- NATO TU-Black Sea Program. Ecosystem Modeling as a management Tool for the Black Sea. (Science for Stability Program, NATO).

- Black Sea Environmental Program, BSEP, (GEF).

- Black Sea Ecosystem Processes and Forecasting/Operational Database Management System - Sfp ODBMS Black Sea Project (NATO, Science for Peace Program).

MHI role within the Black Sea Web Project is: Development of the Remote Data Access / Development of the Central Meta Directory / User

Consultation/Testing of System / Implementation, Testing and Promotion. MHI team also includes V. Mamaev (recently works at the Woods Hole Group, USA), who has great experience in the Black Sea environment and its problems and will also be involved in Implementation and Promotion.

The National Institute for Marine Geology and Geo-ecology (GeoEcoMar, Romania)

GeoEcoMar is a governmental research-development institute, controlled and co-ordinated by the Ministry of Research and Technology of Romania. Presently GeoEcoMar has 105 scientific and technical employees.

The main activities are oriented as follows:

- Marine and fluvial geo-ecological studies regarding ecosystems of the macro-geo-system Danube, Danube Delta, Coastal Zone and Black Sea, as well as the environmental impact of hydro-technical works.

- Geological-geophysical survey of the Black Sea, mainly the Romanian Continental Shelf.

- Studies of paleo-ecology, studies of the environmental and geological impacts of the climate and sea level changes.

- Land-sea interactions in the coastal zone and its integrated management.

- Studies, technical assistance and consulting for littoral and offshore marine engineering, industrial and environmental impact studies.

GeoEcoMar has carried out projects like «European River-Ocean System (EROS-2000)», financed by the EC (PHARE and PECO projects), and «The Global Environmental Facility (GEF) Project for Environmental Management of the Black Sea,» supported by the World Bank, UNDP, UNEP and UNESCO.

GeoEcoMar role within the Black Sea Web Project is: Development of the Remote Data Access / Development of the Central Meta Directory / User Consultation / Testing of the System / Implementation, Testing and Promotion.

TERMA Elektronik A/S (Denmark)

TERMA Elektronik A/S is a software house and systems integrator, founded in 1978. Headquartered in Birkerød, Denmark, the company operates a worldwide organisation with subsidiaries and branch offices in Europe, the US and the Pacific Rim. TERMA is a leading supplier of software systems for project involving large amounts of mission-critical information within: space, airlines, financial, manufacturing and other industries.

TERMA is Denmark's largest space company and has been active in the space domain since the company's formation. The space activities of TERMA have traditionally been a source of innovation and technology development, which

the rest of the company has been able to exploit in other market areas. TERMA was awarded the contract to manage the development and production of Denmark's first satellite and this satellite, Ørsted, is devoted to several Earth observing tasks.

The Space Division of TERMA has further developed a series of areas of expertise including applications of satellite data for Earth observation. This emphasises the use of IT-systems to support the acquisition and processing of data from space borne instruments.

TERMA's relevant background for the Black Sea Web Project is composed of specific experience in the application and management of remote sensing and in situ data for coastal zone and oceanographic applications, and in providing the necessary systems to compose the infrastructure for such data processing/application schemes.

TERMA role within the Black Sea Web Project is: Development of the Remote Data Access / Development of the Central Meta Directory / Implementation, Testing and Promotion.

The Netherlands Institute for Applied Geosciences (NITG, Netherlands)

NITG is the Netherlands Centre for information, services and consultancy in geological matters. It is a government agency within the Ministry of Economic Affairs and serves government, industry and society.

The main fields of activity in the Netherlands and abroad relate to land use projects in lowland and coastal areas, ground water resources and environmental matters, applied marine and coastal geology, mineral resources (governmental as well as industrial advisor), and various geological and aggregate resource mapping programmes. An important part of these activities concerns the development as well as application of Data-Access, Data-Management and GIS-based Data-Applications.

NITG role within the Black Sea Web Project is: Development of the Application Layer (Presentation Tools) / User Consultation / Testing of System.

Targeted User Market

Based on the foregoing, the Demonstrator for a Black Sea Web will be targeted on the following groups of (end-) users:

- Public Organisations involved into environmental policy making and management of the Black Sea Region including National and Regional governments, (Trans-) National Governmental Bodies and Organisations, including UNEP, Private and Public

(Environmental) Research Institutes and Associations.

- Black Sea NGO's.
- Society.

Involvement of the End-Users Potential

At the start of the project, a so-called Electronic Sounding Board Group has been established, with representatives from the partner's organization, national and regional governmental offices/departments involved with environmental policy development and decision making, governmental and private research institutes involved into researches on behalf of:

- Environmental policy development,
- Environmental interest groups, and if possible national representatives of transnational (governmental) bodies and organizations.

The Electronic Sounding Board Group communicates by means the Electronic Sounding Board Module, developed as part of the Black Sea Web on the Internet.

By establishment of the Sounding Board Groupie at the start of the project, from the first project stage the process of acceptance for the Black Sea Web can start. In this manner potential end-users will be involved from a very early stage of the project.

In general, within the Electronic Sounding Board Group, the following subjects will be discussed:

- Definition of structure and scope of the meta-data for the Demonstrator and Final Black Sea Web, to be realized after finishing of the project
- Possible provision of basic meta-data references (joining the Black Sea Web)
- Linking of existing web-sites to the Black Sea Web
- Definition of maintenance and up-date procedures
- Definition of cooperation agreements for further management and operation of the Black Sea Web
- Requirements for the process of acceptance within the countries involved
- Possible involvement of other interesting parties
- Contributions to the dissemination of the Black Sea Web

The Electronic Sounding Board Groupie will act as a consultative as well as a potential end-users group for guiding the development of the Demonstrator for a Black Sea Web, and on the mid term of the Final Black Sea Web.

In September 1999 the first draft prototype of the System Architecture will be shown on the

Black Sea Web. From that moment, the possible end-users can obtain a good (visual) insight into:

- what is actually the system
- the possibilities of the system
- the performance of the system
- the required contributions for access and availability of data
- the related benefits for the end-users.

Structure and Modules of the Public Web-site

The Black Sea Web web-site will feature a series of modules, being developed and implemented during the project. First of all, a design and layout are made for the home-page and a second page at a test site. This layout and design are applied to all envisaged modules. The design is also based on an effective navigation for users. The following modules are applied:

Project information

Background information on the project, its objectives and a work plan. Information, short profiles, and contacts details of the project partners. Where possible, links are integrated to the partner web-sites.

Meta-directories

First version of the Black Sea Information System (BlackSIS) has been defined and developed by MARIS and Delft Hydraulics from the Netherlands and the Marine Hydrophysical Institute from Ukraine in close cooperation with the Programme Co-ordination Unit of the GEF Black Sea Environmental Programme (BSEP) in 1996. As a part of the Black Sea Web project, MHI and MARIS integrates main catalogues of BlackSIS in the Black Sea Web web-site and a direct query interface is developed and implemented. The following meta-directories are included:

- Scientists
- Organisations
- Bibliography
- Research Projects
- Marine Environmental Datasets

Thematic Maps

Within the framework of the Black Sea Environmental Programme, an extensive digital atlas was developed in 1995 by the MSU consisting of a wide variety of thematic maps related to the Black Sea. As a part of the Black Sea Web project, a selection of these thematic maps are integrated in the Black Sea Web web-site including legends. The references are made to the Digital Atlas product and how to obtain this full CD-ROM package. The following thematic maps are included in the Project Web-site as the GIF files supplied with the legends:

- Tectonic map of Black Sea (geology)
- Average circulation in the Black Sea
- Surface temperature (seasons)
- Surface salinity (seasons)
- Average hydrogen sulphide (H₂S). Location of upper-boundary zone in the 20's and the 80's
- Precipitation (animation)
- Black Sea wetlands, plus pop-up screens with attribute information
- Distribution and migration of anchovy fish

Dynamic Map of the Black Sea

To present the Black Sea countries and their main geographic features, a dynamic map of the Black Sea will be developed by MSU at the MSU server. Users will be able to query the map and zoom in for further details. The map will include layers of the following features:

- Base Map of Black Sea (1: 2 M)
- Base Map of Black Sea countries with 7 layers: city names, roads, railroads, boundaries, rivers - main rivers, bathymetry (6 isobaths), standard grid

The functionality will include overlays, zoom (enlarging) function, legends, and co-ordinates position indication. The link to the MSU server from the Black Sea Web server will be implemented as a frame-link.

Country information

For each Black Sea country, a profile is included by MARIS with descriptive information on economy, population, industry, demographics, etc. from different sources. A lot of basis information can be found in the CIA yearbook.

Environmental projects, programs and links

For the Black Sea, a range of environmental projects and programmes has been executed and are still underway. Overview of these projects and programmes has been made, with abstracts and possible environmental links for further information. These overviews are integrated in the Black Sea Web web-site.

Recent Black Sea Publications

A reference lists of recent and relevant Black Sea publications are produced and included in the Black Sea Web web-site.

Satellite images

MHI maintains an extensive archive of recent NOAA SST satellite images. A selection of these images is included in the web-site and reference is made where additional images and further information can be obtained. The satellite images are accessible by means of a list with names, legends and thumbnail pictures. Clicking on thumbnails will give the full image.

Electronic sounding board

To get feedback upon the Black Sea Web development, a relevant group of users is invited to join the Electronic Sounding Board. They are invited to comment and to give suggestions for the further development of BSW by means of an open discussion platform. The web-site will feature the names of the Sounding Board members, a questionnaire and comments and suggestions will be published.

Spider

MARIS will implement a spider option to perform free searches on the BSW server and later on the network of related servers of Project Partners and possible other selected servers.

Remote Data Access Demonstrator

An important module of the Black Sea Web project and web-site will be a demonstrator for remote access of distributed datasets. This module will be co-ordinated by TERMA and be developed in co-operation with local data-holders MHI and GeoEcoMar. The main principles will be:

- MHI manages a local dataset on their server-space: 3 cruises with about 200 stations with data on Oceanography and Chemistry, North part of the Black Sea for 1991-1993.
- GeoEcoMar manages a local dataset on their new server: 10 full stations over last 5 years with data on Mineralogy, Chemistry of Sediments and Grain Size in the Rumanian sector of the Black Sea plus some cruises in the West sector of the Black Sea.
- These datasets (database tables) are samples for the demonstrator and will be publicly accessible by the Remote Data Access module.
- On top of these datasets each (MHI and GeoEcoMar) manages a meta-data layer with documentation on the individual dataset records. The meta-databases will also contain additional meta-data for other dataset records that are not directly accessible, but can be released in agreement with MHI and/or GeoEcoMar.
- TERMA will develop a Remote Data Access module that consists of a Uniform Central Query Form to specify queries to the

individual partner databases and to retrieve the related datasets. Therefore a Search Engine program has to be developed including a so-called Guidance Catalogue Server. This Guidance Catalogue in fact contains conversion rules and tables between the Uniform Query Form and the individual distributed meta-databases. The Remote Data Access modules will be installed on the TERMA server and be linked to BSW by a frame-link.

- The Query Interface for the Remote Data Access makes use of alphanumerical SQL query commands to search the databases and to present the meta-records. The interface can be extended with a Geographical Interface for searching within a certain box area and for presenting the locations of selected data. This mapping module will be developed by MSU as a Java Applet with the following basic vector map: Coastlines of Black Sea and Bathymetry of Black Sea. Zooming option, selection within box co-ordinates and presentation of positions of results will be available. The challenge is a very compact program including vector map-data that the user will load once and can use locally to zoom in effectively.

It is seen as very important that the data centres should not convert their data to a common format but rather continue to use their existing format.

The conceptual design for the Remote Data Access Module is described in more details in the separate paper of these proceedings.

Acknowledgments

This work is supported by the EC INCO-Copernicus grant No 977005 «Demonstrator for a Black Sea Marine Environmental Management Support System, based on Telematics.»

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