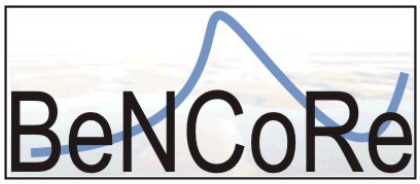

Second BeNCoRe Conference:

Geographic Information Systems in Coastal and Marine Research and Management

- Opportunities and new perspectives for Coastal and Marine Research -

Leuven,
30 May 2008

Conference organisation

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Preface

BeNCoRe, the Belgian Network for Coastal Research, has been established under ENCORA, a EU funded network of both national and thematic networks. The main goal is to “connect” the more than 100 Belgian research institutes, 40 companies and NGO’s and about 16 administrations which are involved in, or have responsibilities for coastal and marine management and research. BeNCoRe aims at stimulating and facilitating knowledge exchange between network participants both at national and European level. Most important bottlenecks to be addressed are fragmentation of the coastal communities, communication between science, practice and policy within and between the different regions and lack of multidisciplinary approaches.

During the First BeNCoRe Conference in 2007 a state of the art was presented on ten coastal thematic issues related to Coastal Engineering and Observation Techniques, the Natural System, Integrated Coastal Zone Management and Marine and Coastal Spatial Planning. The discussions have produced an important input from BeNCoRe into the Green Paper on Maritime Policy, which has been published in the mean time.

We have the pleasure to welcome you to the second BeNCoRe Conference, which deals with different aspects, developments and applications of Geographical Information Systems (GIS), which are becoming indispensable tools in Coastal and marine Research and Management. This technology is being used across different disciplines for storing, managing, visualizing or integrating geographical data and information. The Second BeNCoRe Conference provides the opportunity to discuss future developments and new perspectives in the field of Coastal and Marine GIS. Case studies related to submarine mapping systems, Coastal remote sensing techniques and the development of Coastal and Marine Atlases will be presented.

The follow-up of ENCORA will most probably be the creation of a European Coastal Platform, with basically the same objectives as ENCORA, and in particular to better inform policy makers and the public about coastal issues,

to create greater awareness of future threats and to communicate the need for restoring coastal and marine resilience

Whether there ever will be a third BeNCoRe Conference will depend on the continuation of BeNCoRe after ENCORA and the EU financing will end (end of 2008). Efforts are made to obtain support from the the Belgian Federal Science policy, but nothing is secure yet.

The large number of attendees today is the very proof that BeNCoRe is useful and necessary.

We wish you an interesting and rewarding conference day.

Simon Claus
Coordination Officer BeNCoRe

Jean Berlamont
Chairman of BeNCoRe

Programme

09.00-09.30: Registration and coffee

09.30-9.45: Mr. Simon Claus (Flanders Marine Institute – VLIZ)
Introduction; the BeNCoRe Network

Session 1: Geographic Information Systems in Coastal and Marine Research; current situation, technical challenges and future developments (Chair Prof Dr. Jean Berlamont, Hydraulics Laboratory, K.U. Leuven)

09.45.10.15: Prof Dr. Philippe De Maeyer (Geography Department, Ghent University)
Geographic and Mapping Information Systems: A historical overview, new developments and challenges for Belgian Coastal and Marine Research

10.15-10.45: Prof Dr. David Green (Aberdeen Institute for Coastal Science and Management, University of Aberdeen, UK)
Marine and Coastal Geographic Information Systems – a European Perspective

10.45-11.15: Coffee

Session 2: Relevant European directives, frameworks and legislations related to Coastal and Marine Geographic Information Systems (Chair Ir. Miguel Berteloot, Agency for Maritime and Coastal Services, Coastal Division)

11.15-11.45: Ir. Ingrid Vanden Berghe (National Geographic Institute)
The Infrastructure for Spatial Information in Europe (INSPIRE) Directive: Implications and Opportunities for Coastal and Marine Research

11.45-12.15: Dr. Wendy Bonne (Federal Public Service, Marine Environment)
Policy as an end-user of Geographic Information Systems and importance of Geographic Systems as a reporting tool

12.15-13.15: Lunch

Session 3: Case Studies in Coastal and Marine Research (Chair Prof Dr. Philippe Dubois, Marine Biology Unit - BIOMAR, Université libre de Bruxelles)

13.15-13.35: Dr. Kevin Ruddick (Management Unit of the North Sea Mathematical Models-MUMM)
Optical teledetection of Coastal Waters

13.35-13.55: Dr. Bart Deronde (Flemish Institute for Technological Research–VITO)
Airborne remote sensing as a tool to study coastal sediment dynamics

13.55-14.15: Drs. Els Verfaillie (Renard Centre of Marine Geology, Ghent University)
Mapping European Seabed Habitats, the MESH project as a case study

14.15-14.45: Ir. Frederic Wauters (ESRI Belux/Eurosense)
Applications of 3D Geographic Information System of the North Sea and the Scheldt Estuary

14.45-15.15: Coffee

Session 4: Geographic Information Systems as a tool to present and organize Coastal and Marine Information (Chair Dr. Rudy Herman – Ministry of Flanders, Department Economy, Science and Innovation)

15.15-15.30: Miss Kathy Belpaeme (Coordinaton Centre for ICZM)
The Belgian Coastal Atlas: moving from a classical static to an interactive data driven atlas

15.30-16.00: Dr Wouter Rommens (UNESCO/IOC Project Office for IODE)
How marine data can be presented at a global scale: the African Marine Atlas as a case study

16.00-16.30: Mr. Andrus Meiner (European Environmental Agency, EEA)
Publication of the Blue Book on an Integrated Maritime Policy for the European Union. The concept of Marine Spatial Planning and how to organize Coastal and Marine Information at the European Scale

16.30-16.45: Discussion, synthesis and conclusions

16.45-18.45: Reception

General Introduction

Simon Claus & Jean Berlamont

Introduction to the Network

BeNCoRe, the Belgian Network for Coastal Research, is a national network gathering 36 institutes on coastal and marine research. BeNCoRe aims at stimulating and facilitating the knowledge exchange between network participants both at the National and the European level. Improving the communication between science, practice and policy, decreasing the fragmentation of the coastal communities and improving the multidisciplinary approaches are the main goals of the network.

The Network was established in February 2006 under the umbrella of the European Network for Coastal Research (ENCORA-FP6-2004-Global-3-518120) in which 13 National Networks were created. The BeNCoRe Network is managed by a BeNCoRe Bureau (including representatives of the scientific community from the different regions and policymakers) and a permanently staffed secretariat hosted in Oostende at the Innovocean Site under the same roof as the Flanders Marine Institute, the Coordination Centre for ICZM, the UNESCO/IOC Project Office for IODE and the Marine Board of the European Science Foundation. By signing the BeNCoRe Memorandum of Understanding, 36 Belgian Marine and Coastal Research Institutes and/or Administrations (Fig I) expressed their intention to co-operate within BeNCoRe for the development and exchange of information, knowledge and experience in support of European and National policies on Coastal and Marine Research. The key contact persons of the Network are the ten Network Ambassadors.

Main activities of the Belgian Network For Coastal Research are:

- Organising conferences and meetings for dissemination and exchange of knowledge (BeNCoRe Conferences). These meetings act as open Fora to present Coastal and Marine research activities in Belgium and pan-

European. They aim at improving the communication between marine science, practice and policy.

- Stimulating and facilitating mobility and temporary exchange of young researchers and practitioners across disciplinary boundaries. At this moment 15 BeNCoRe Short Term Grants (maximum of 750 Euro) were attributed to coastal researchers and practitioners to attend ICZM and Coastal Research related workshops and conferences organised across Europe. The deadline of the next call for application is the 05th of June 2008.

- Offering trainee opportunities or temporary positions to young researchers and practitioners from other partner institutions. At this moment 2 BeNCoRe Long Term Grants (maximum of 2000 Euro) were attributed facilitating the international training of a young coastal or marine researcher.

Other activities include intertwining ongoing projects, providing access to data and information sources and harmonising information systems and practices.

Fig I: Partner Institutes of the Belgian Network for Coastal Research

The BeNCoRe Conferences…

The First BeNCoRe Conference took place the 26th of April 2007 in Leuven. It provided for the first time a platform to the BeNCoRe partners to meet and exchange ideas on the future of coastal and marine research in Belgium. During this one-day conference the BeNCoRe Network Ambassadors provided a Belgian State of the Art on ten coastal thematic issues. These were discussed during four sessions that additionally focused on issues raised in the Green Paper on a future European Maritime Policy. This Green Paper set the first step towards the establishment of an all-embracing EU Maritime Policy aiming at developing a thriving maritime economy in an environmentally sustainable manner. It covered, among others, maritime transport, industry, coastal and marine research, coastal regions, offshore energy, fisheries, socio-economic cohesion and the marine environment. Outcomes and suggestions from this First BeNCoRe Conference were communicated to the Green Paper on Maritime Policy.

We are now one year later and the Green Paper resulted in the publication of a Blue Book in which the Commission proposes an Integrated Maritime Policy for the European Union, based on the recognition that all matters relating to Europe's oceans and seas are interlinked, and that sea-related policies must develop in a joined-up way. In order to achieve this, the Commission commits itself to 1) take steps in 2008 towards the creation of a European Marine Observation and Data Network in order to improve access to high quality data 2) promote the multi-dimensional mapping of Member States‘ waters and 3) launch a European Atlas of the Seas as an educational tool and as a means of highlighting the common maritime heritage.

Sound Geographic Information Systems (GIS) will be indispensable tools to achieve these latter two activities. Therefore we focus during the Second BeNCoRe Conference on Geographic Information Systems in Coastal and marine Research and Management and provide the opportunity to discuss

future developments and new perspectives in the field of Coastal and Marine GIS.

The Second BeNCoRe Conference is organised in fours sessions. The first session gives a general overview of Geographic Information Systems used in Coastal and Marine Research, presented by Prof. Dr. Philippe De Maeyer and Prof Dr. David R. Green. Prof Dr. Philippe De Maeyer is the head of the Cartography and Geographic Information Systems research unit of the Ghent University. His research focuses, among others, on historical cartography and Coastal geomorphology. Prof Dr. David R. Green is the president of the European Union of Coastal Conservation – The Coastal Union (EUCC) and deputy chair of the International Cartographic Association. He is an international expert on Coastal and Marine Geo-Information Systems. His presentation will focus on the developments in Coastal and Marine GIS on a European scale.

The second session tackles the link between Geographic Information Systems and European directives related to the Coastal and Marine environment. Background information on the INSIRE directive, establishing an Infrastructure for Spatial Information in the European Community, is presented by Ir. Ingrid Vanden Berghe, General Administrator of the National Geographic Institute. This directive creates a general framework for spatial data infrastructure covering metadata, spatial data sets and agreements and procedures on data sharing. Ir. Vanden Berghe focuses on the opportunities and challenges of this new directive for Coastal and Marine Researchers in Belgium. Dr. Wendy Bonne from the Federal Public Service, Marine Environment presents how Geographic and mapping information systems can or could be used by policy makers for reporting purposes (i.e. Water Framework directive or the Maritime Strategy directive).

Four case studies on Geographic Information Systems, both from the scientific community and from the private sector, are presented during the third session. Dr Kevin Ruddick from the Management Unit of the North Sea

Mathematical Models presents Optical teledetection of Coastal waters. Dr. Bart Deronde presents Airborne remote sensing as a tool to study coastal sediment dynamics. The ambitious European MESH project which aimed at mapping the European Seabed habitats is presented by Drs. Els Verfaillie. Finally Ir. Frederic Wauters from ESRI Belux presents a 3D GIS system of the bathymetry of the North Sea and the Scheldt Estuary.

The last session focuses on the current development of Coastal and Marine Atlases as a tool to organize data and information at the national and international level. Miss Kathy Belpaeme, the head of the Coordination Centre on Integrated Coastal Zone Management presents the Belgian Costal Atlas. Dr Wouter Rommens from the International Oceanographic Data and Information Exchange (IODE) of the Intergovernmental Oceanographic Commission (IOC - UNESCO) presents the African Marine Atlas as a case study of a continental Marine Atlas. Mr. Andrus Meiner from the European Environmental Agency closes the conference, presenting the current status of the Blue Book and the vision of the European Environmental Agency on how to deal with the organization of Coastal and Marine Information at a European scale – possibly through the creation of a network of Coastal and Marine Atlases.

Additionally, about 20 research posters and 6 promotion stands on Coastal and Marine GIS form the scientific community, different administrations and the private sector will be presented during lunch and coffee in the main conference hall.

Session 1: Geographic Information Systems in Coastal and Marine Research; current situation, technical challenges and future developments

Chair: Prof Dr. Jean Berlamont, Hydraulics Laboratory, K.U. Leuven

Geographic and Mapping Information Systems: A historical overview, new developments and challenges for Belgian Coastal and Marine Research

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Geographic Information Systems (GIS) are systems of computer hardware, software and procedures, designed to support the capture, management, manipulation, analysis, modelling and display of spatially referenced data for solving complex planning and management problems (FICCDC, 1988). Since a decade GIS has been widely used in marine and coastal research. Nevertheless, in the foregoing twenty years computer hardware and software was already available for geographic applications (in the limited sense of planimetric and bathymetric positioning) and for modeling purposes. Those location computer applications were mainly 'home-made' tools developed by centers as MUMM and some academic laboratories.

Also in 1980's people saw the separate development of raster and vector-GIS. The first as a technique closely linked to matrix maps, remote sensing and computer cartography (see e.g. the work of Tomlin) and the second as an outcome of the integration of DBMS and advanced CAD-techniques using more complex topologies.

A second generation of GIS in the 1990's introduced developments in topological structures, and an integration of vector and raster tools; the same period saw the development of a lot of extensions on the basic tools and, later on, larger facilities for customization and developing new applications. The implementation of more complex topologies and new algorithms today has been made possible by larger memories and faster computers.

Parallel with the development in the 1990's of more powerful techniques of data collection of the marine surface and of the sub-bottom, new topological models were described in vector GIS, especially for geographical surfaces, such as TINs (triangular irregular networks). But the new challenges in GIS are now to switch from 2D and 2.5D to real 3D data structures and algorithms. In a raster oriented GIS pixels become in 3D voxels and in vector GIS TINs become 3D TENs, (tetrahedral networks) using tetrahedrons as building blocks for 3D volumes instead of triangular surfaces generating a 2.5D surface.

In the 2000's the use of remote map serving using intranet and internet is a reality. Constraints on an integrated use of different datasets spread over the internet are more to be attributed to administrative and legal restrictions than to real technical problems. Further developments in GIS would be the use of a real 3th and later on 4th dimension, the involvement of expert and knowledge systems in GIS and integration with other techniques such as VR. Introduction of 3D GIS instead of 2.5D and expert and knowledge features in geographical information science and systems are also in marine and coastal research the challenges for the upcoming decade.

Marine and Coastal Geographic Information Systems–A European Perspective

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The potential to monitor, map, and model the environment at a wide variety of different spatial and temporal scales has been greatly enhanced in recent years by the growing availability of remote sensing, Geographical Information Systems (GIS), Global Positioning Systems (GPS), and a range of rapidly evolving utilities and computer technologies. Most recently mobile field data collection and GIS have also become possible with the availability of smaller and more powerful low-cost handheld hardware devices and software. The Internet has also provided access to multiple digital datasets from disparate sources, through online databases, maps and imagery (e.g. Google Earth) for researchers, specialist applications, and the general public. Widely available and affordable computer software now also provides opportunities to store, process, integrate and analyse large volumes of geographical data in many forms using GIS and digital image processing on a desktop computer, a mobile device, and even utilising online interfaces to databases and image catalogues. Powerful programming languages provide the basis to develop overlay and process-based models, many of which utilise spatial data derived from image analysis or field-based data collection, and can easily be interfaced with GIS as the basis for further data integration and analysis, or visualisation. With the growing availability of multidimensional data there has also arisen the need for software to visualise the information either for exploratory purposes or as a means to communicate the results of an analysis to a wider audience, such as the coastal stakeholder, or even to aid in the field.

With the growing interest in managing the World's coastal zones, increasingly a topic of concern - as a direct result of issues of climate change and sea level rise as well as incidents surrounding coastal storms, flood inundation,

and coastal disasters resulting from hurricanes and tsunami - the geospatial technologies are finding an increasing number of practical applications. These range from research-based academic studies to develop our knowledge and understanding of coastal processes, to essential environmental monitoring exercises, accessibility to data and information and stakeholder involvement and participation in coastal management problems, particularly where there is a need for a range of practical tools.

Around the World an increasing amount of time and money is now also being invested in studying the coastal environment, much of it through projects that seek to bring together the scientific community, the policy maker, and the public to facilitate sustainable management of the coastal zone. Whilst such technologies have largely been the domain of the specialist in the past, these are now becoming more widely available and more useful to a greater range of people from the researcher to the practitioner.

Remote sensing has also long provided a means to gather current environmental data and information about the coast, often using airborne cameras e.g. aerial photography, but with renewed interest more recently using specialist airborne sensors such as the CASI and Lidar, the latter offering both terrestrial heighting and underwater capability for bathymetry. Numerous acoustic sensors also provide remote sensing capabilities at greater depths. Satellite remote sensing offers numerous additional and already well known capabilities such as synoptic coverage and repeatability. However, increasingly better spatial, spectral, and temporal resolutions are also yielding new sources of information.

This presentation seeks to provide a brief snapshot of some of the developments surrounding the growing use of the geospatial technologies in the spatial and temporal study and management of coastal environments. Although it can only offer a very brief insight into the many different ways in which a wide range of geospatial technologies have been and are being used, it will touch upon some of the most important areas of current developments and uses, offering insight into the importance of data and information as a

means to help gain a better knowledge and understanding of coastal environment, the interface between the land and the sea and the goal of sustainable and integrated coastal zone management (ICZM). The presentation will be illustrated with a number of examples.

Session 2: Relevant European directives, frameworks and legislations related to Coastal and Marine Geographic Information Systems

Chair: *Ir. Miguel Berteloot, Agency for Maritime and Coastal Services, Coastal Division*

The Infrastructure for Spatial Information in Europe (INSPIRE) Directive: Implications and Opportunities for Coastal and Marine Research

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The INSPIRE directive[1] was published in the Official Journal of the European Union on 25th April 2007. This directive aims to create the legal basis for a European Spatial Data Infrastructure. In such a spatial data infrastructure geographical data, metadata[2] , geographical services and a set of rules and regulations on the functioning and the coordination of the infrastructure are provided. The directive lays down general rules aimed at the establishment of the Infrastructure for Spatial Information in the European Community (hereinafter referred to as Inspire), for the purposes of Community environmental policies and policies or activities which may have an impact on the environment. The directive does not impose the collection of new data, but tries to create an environment where data is collected only once, but used many times. The scope of the directive is quite wide, reaching from geographic reference data such as the coordinate system, the transportation network, land use, to thematic information linked to the environment, including many themes relevant for the marine and coastal areas.

The MS have until the 15th May 2009 to comply with the directive which creates a legal framework for establishing an Infrastructure for Spatial Information in the European Community. In Belgium a cooperation agreement between the Federal state, the regions and the communities is on its way.

INSPIRE will be implemented through 'Implementing Rules' for metadata, data specifications (interoperability), network services, data sharing and monitoring and reporting. The time frame for implementing these sets of rules

1 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

2 Metadata provide information describing a set of data or a service

varies for the different themes, coming quickly for reference data such as transport networks, and foreseen in a medium time frame for many environmental data.

Many of the INSPIRE themes are related to the coastal and marine research. Of course the reference data of annexes 1 and 2 of the directive are useful material also for coastal and marine research, but a strong support from this research community will be needed to provide data that are required in the annexe 3 themes such as *oceanographic geographical features* (the physical conditions of oceans (currents, salinity, wave heights, etc.)) *Sea regions* (the physical conditions of seas and saline water bodies divided into regions and sub-regions with common characteristics) or *Habitats and biotopes* and *species distribution* of marine and coastal species.

The directive will in this way certainly influence the scientific community on Coastal and Marine research, in its role as a data providing community to the Belgian and European public authorities, but also the infrastructure will probably induce a more open, integrated and efficient access to geographical data throughout Europe, for the citizen and thus also for the researcher.

Policy as an end-user of Geographic Information Systems and importance of Geographic Systems as a reporting tool

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Effective management in the marine environment is a complex issue due to its pronounced transboundary nature and physical and biological characteristics that are hidden in its waters and only observable by humans through sophisticated techniques. Spatial variability can be high, not only in its natural characteristics but also in the human activities taking place. Geo-referenced data are an indispensable tool to try to understand and manage the marine environment. Numerous obvious examples can be given, such as the follow up of sand extraction activities, analysed from black-box systems on board, to track the route where sand has been extracted from the sea bottom. A long tradition exists of reporting initiatives on the marine environment in an international context, using GIS. Countries with marine interests and the European institutions have established relevant marine environmental data sharing arrangements, using GIS, in the context of: regional sea conventions and the International Council for the Exploration of the Sea (ICES); the European Environment Agency for state of the environment reporting (formalized through the Eionet); international data systems for operational purposes (meteorology, oceanography, surveillance of activities) and research applications, for instance the International Oceanographic Commission (IOC) in the UNESCO context; Global Monitoring for Environment and Security (GMES) that is a joint programme between the European Commission and the European Space Agency (ESA); and the Environmental Marine Information System (EMIS) web site of the Joint Research Centre (JRC). The latter makes detailed spatial and temporal marine environmental information, derived from research, available on a pan-European scale, including various physical and biological key variables and environmental indices, and can be further developed for viewing bottom

mapping products, three dimensional model outputs, high resolution spatial information and point observations, and even animations. Contracting Parties of the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention 1992) are required to undertake and publish at regular intervals joint assessments of the quality status of the marine environment and of its development, to provide a basis for necessary measures to protect the maritime area, and to evaluate the effectiveness of measures taken. Currently at the EU level, existing water legislation (in particular the Water Framework Directive) covers aspects of seawater quality in coastal and transitional waters. The required reporting features, including GIS, are in development in the current version of the Water Information System for Europe (WISE) that was launched in March 2007. WISE is the water-related component of the environmental data reporting under INSPIRE and will gradually be developed further to become a main, harmonized, tool for water-related data and information at the European scale, including formal compliance reporting under EU water policy between Member States and the Commission and water-related data used by European and international organizations in their State of the Environment assessments. WISE-Marine will extend WISE to serve as a common reporting platform for the marine environment community under the EU Marine Strategy Framework Directive. It is currently proposed that new reporting requirements of the Marine environmental Strategy should be supported by reference data sets (relevant maps, i.e. relevant geo-referenced background information). In addition, adding oil spill surveys from EMSA could be accomplished in an early phase.

Reporting using geo-referenced systems is very demanding, but the importance and the demand of reporting requiring GIS will only increase. Transparency and awareness is needed among the policy and scientific community on which products are most relevant and important. Through cooperation only, the burden can be shared by exchanging contributions useful for science and policy.

Session 3: Case Studies in Coastal and Marine Research

Chair : Prof Dr. Philippe Dubois, Marine Biology Unit - BIOMAR, Université libre de Bruxelles

Optical Remote Sensing of Coastal Waters

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Optical remote sensing is now an important source of information on coastal water quality. Medium resolution polar-orbiting sensors such as MODIS-AQUA and ENVISAT-MERIS provide daily maps of chlorophyll a and total suspended matter concentrations and sea surface temperature at 1km resolution in near real-time (within hours). In cloud-free periods, the spatial and temporal coverage far exceeds the possibilities of in situ measurement techniques. Time series information back to 2003 (or back to 1997 with SeaWiFS) can also be retrieved for these parameters, allowing assessment of interannual variability of the ecosystem. Usage of this data has seen corresponding growth both in the marine science and the environmental management communities.

In this presentation the possibilities and limitations of optical remote sensing will be described with a focus on usability of data for applications such as (harmful) algae bloom detection, eutrophication assessment, ecosystem model forcing and validation and sediment transport. Challenges relating to data quality will be addressed and future perspectives will be outlined and illustrated using results from ongoing research in the BELCOLOUR and RECOLOUR projects.

Airborne remote sensing as a tool to study coastal sediment dynamics

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Recent indications and model predictions leave little room for argument that the sea level worldwide is rising and that the rising will continue and will even be accelerated in the next decades. The rising of the sea level goes hand in hand with climate changes that are expected to cause more storminess along the Western European coastline. Even without an intensified storminess and an accelerated sea level rise, the Western European coastline and more in particular the Belgian shoreline, needs permanent attention as this shoreline is highly prone to erosion.

Two state-of-the-art remote sensing techniques have been explored to monitor the Belgian shoreline in the period 2000 – 2006. Airborne LIDAR or laserscanning is a well-known technique that allows to make accurate Digital Terrain Models (DTMs) of the shoreface. Successive DTM's were used to calculate the amount of sediment that was eroded or deposited. As a novel technique, airborne hyperspectral remote sensing was applied to classify the sediment of the beach and sea-bordering dunes in seven sand type classes, applying a statistical classifier based on Linear Discriminant Analysis (LDA). The combination of LDA with a careful selection of spectral bands, transformed into wavelet coefficients (cf. feature selection), resulted in an overall classification accuracy of 82%.

While the LIDAR data served to calculate the amount of sediment eroded or deposited, the classified hyperspectral data served to interpret the sand dynamics and more specifically to define the sediment transport directions. The classes were used as a tracer for the sediment transport. The methodology was applied in five distinct coastal units, most of them limited by harbour dams or harbour channels, which allowed to treat each unit as a more

or less closed system. In summary, it could be concluded that for the period 2000 – 2006 the beach was in most places stable (i.e., less that 25 cm accretion or erosion) or erosive. The beaches which were most affected by erosion are mainly situated along the Middle and East Coast, among which the beaches of Knokke-Zoute, the Duinse Polders, and a large area around De Haan featured the most severe erosive. The only accretional beaches were found in Zeebrugge, Sint-Laureins and the centre of Koksijde. However, each of these accretional beaches could be linked to human interventions. The overall natural tendency of the beach was erosive. In contrast to the beach, the sea-bordering dunes grew in many places or remained stable. Only at the Middle Coast, between Westende and Oostende, the sea-bordering dunes were erosive. The study period is known as a relatively mild period at the southern North Sea shore lacking severe northwester storms. No major events occasioning beach erosion occurred, and the accretion noted for the sea-bordering dunes may well be a beneficial effect of these conditions. Most dune growth was measured at nourished beaches, showing that in the study period the beach nourishments executed proved to be efficient as coastal protection.

Mapping European Seabed Habitats, the MESH project as a case study

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The MESH project ("Developing a Framework for Mapping European Seabed Habitats" – 2003-2007) involved twelve partners from five north-west European countries (Ireland, UK, Netherlands, Belgium and France). It was led by the UK's Joint Nature Conservation Committee (JNCC) and was financed by the EC's Interreg IIIb Programme for north-west Europe.

The general aim of the project was to "establish a framework for mapping the marine habitats of north-west Europe, through the development of internationally agreed protocols and guidelines for seabed habitat mapping, and the generation of the first compiled marine habitat maps for the north-west Europe Interreg IIIb area."

The role of GIS in this project was crucial, as it served as a tool to manage and analyse marine habitat mapping data following European standards. MESH has gathered metadata, following the ISO19115 standard, which are available for potential users through an online Metadata Catalogue (www.searchMESH.net/metadata). Moreover, the collated seabed mapping data are available through the MESH webGIS (www.searchMESH.net/webGIS), presenting interactive maps of seabed habitats for north-west Europe. The webGIS allows users to zoom to areas of interest, control which layers are shown and query attributes of the data. The Metadata Catalogue is integrated within the MESH webGIS. A search in the catalogue allows the user to open a map showing the selected study, and a spatial search in the MESH webGIS can locate available metadata for the selected area. MESH developed specific GIS data exchange formats (DEFs),

defining the characteristics of data to be exchanged between parties, clearly stating the recipient's requirements.

The Belgian GIS contribution to MESH was mainly related to the standardisation of existing and new habitat mapping data and metadata to the MESH standards and the translation of the habitat maps towards the EUNIS classification (European Nature Information System, i.e. a pan-European habitat classification system). A lot of effort was put into the production of high quality maps of the Belgian part of the North Sea: sedimentological maps and habitat suitability maps of macrobentic communities and specific species. Moreover, the methodology for marine landscape mapping was optimised using statistically sound techniques.

One of the important international policy drivers for the MESH project is the Marine Strategy Directive (2007). The European Commission and European Environment Agency are considering ways to build upon MESH to develop seabed maps across European seas to contribute to the Marine Strategy and the European Atlas of the Seas proposal from the Marine Strategy. Initial ideas include harmonising the maps from north-west Europe (the MESH area) and the Baltic Sea (from the Interreg BALANCE project) and expanding the broadscale mapping to the Mediterranean Sea.

Applications of 3D Geographic Information System of the North Sea and the Scheldt Estuary

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At present the multitude of remote sensing techniques that are used in the marine environment are very broad. These techniques vary from photogrammetric data, topographic lidar, bathymetric lidar, multibeam, …

One general aspect that at present is a constant factor when working with these kind of data-sets is the multitude (as well in kind of data and in Mbytes) of data that is obtained and needs to be filtered and managed. This alone already demands specific tools and methods to handle the multitude of data.

The experience present within EUROSENSE and ESRI BeLux combines as well the way in which the data itself is handled to prepare it in a useful form and the tools available to analyse these data in an efficient way.

The ESRI software (ArcGIS, Arc SDE, …) are developed to create a general concept for visualisation and analysis of 3-dimensonal data. Within this system 3D data can easily be presented as surfaces (DTM, DHM, terrain data) but also 3D cross-sections can be made based on queries.

This creates the possibility to combine different data-sets and perform multi-criteria analysis on as well the points, the TIN's as the surfaces.

The applications of this software are unlimited : presentation of sediment surfaces and volumes, 3D temperature analysis.

The implementation of a 4th dimension (e.g. time-series) can also be analysed and implemented. This could be the example for : algae dynamics, fish densities, current analysis or the presentation of Marine morphology.

Session 4: Geographic Information Systems as a tool to present and organize Coastal and Marine Information

Chair: Dr. Rudy Herman – Ministry of Flanders, Department Economy, Science and Innovation

The Belgian Coastal Atlas: moving from a classical static to an interactive data driven atlas

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In October 2004 the Coordination Centre on Integrated Coastal Zone Management (ICZM) published the Flemish/Belgian atlas. It took on the challenge of combining scientifically sound material and an attractive looking publication for a wide audience. The on-line version of the Belgian Coastal Atlas (www.kustatlas.be) was launched on 16 November 2005. The site gives information about several themes and activities on the Belgian coast, such as coastal defence, environment and nature, tourism, industry and business, fisheries and agriculture and cultural heritage.

The development of the atlas tackles the concern of the European Commission, who mentioned in the recent communication on a Maritime Policy for Europe that “much information is available about Europe's Oceans and about maritime activities, but there is a lack of published material bringing it all together in a form that would allow the general public, those interested in the sea, and young people at school to get to know the maritime world.”

Over recent years, in various countries worldwide, there has been significant development of national and regional coastal atlases based on web-applications and Geographic Information Systems (GIS). These internet-based resources are of great value to decision makers, scientists and the general public with an interest in coastal issues.
In 2007 important policy decisions and developments took place in Europe regarding the management of coastal, marine and maritime resources. After 2 years of negotiations, the European Union agreed upon a marine environmental law (Marine Strategy Framework Directive, MSFD), which aims at achieving ‘good environmental status’ in the marine environment by 2020.

Furthermore, in October 2007 the communication “An Integrated Maritime Policy for the European Union” (COM (2007) 575 final) was published by the European Commission.
This communication highlights the importance of atlases and the Commission has decided to launch a European Atlas of the Seas in 2009 as an educational tool and as a means of underlining Europe’s common maritime heritage. The development of an integrated tool should make the holistic nature of the maritime environment visible and should contribute to raising a generation of citizens and stakeholders for whom an integrated approach to maritime policy is self-evident. The development of an EU Atlas of the Seas should demonstrate the relevance of setting up an integrated data network, and the importance of the cross-sectoral accessibility of such data.

The Belgian on-line coastal currently offers quite limited possibilities for interactivity. Layers can be switched on and off, data can be downloaded in several formats, but the Coordination centre on ICZM wants to do much more than that. Linking the atlas to sustainability indicators, including Google earth applications and enhancing the interactivity of the maps is on the agenda for 2009-2010.

With the improvement of the on-line Belgian Coastal Atlas the Coordination Centre will connect to the developments at European and International scale. Being member of the International Coastal Atlases Network (ICAN) and actively participation in international atlas workshops will assist this.

How marine data can be presented at a global scale: the African Marine Atlas as a case study*

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The African Marine Atlas is a digital web atlas of marine and coastal geo-data arranged under five themes: atmosphere, hydrosphere, biosphere, geosphere, human environment and basemap themes. Under the Ocean Data and Information Network for Africa (ODINAFRICA), funded by the Intergovernmental Oceanographic Commission of UNESCO (IOC of UNESCO), twelve coastal African countries and two international programmes collaborated to develop the atlas. Launched in February 2007, the atlas project had several objectives. It sought to increase access to public-domain data for African scientists, resource managers and decision-makers; to develop capacity for marine data management in Africa, and to increase collaboration between data managers and projects collecting or disseminating African marine & coastal data.

The atlas was developed by a team of 16 African scientists with Geographic Information Systems skills and currently incorporates over 800 continental-scale public domain data sets on the marine and coastal environments. Two web portals offer different products, one being a static website which acts as a clearinghouse for the full complement of data in the atlas, and a second (http://www.africanmarineatlas.net) which is the dynamic web atlas prototype.

Techniques and practices of the atlas creation process have been captured in online available training tools to enable creation of similar products for other regions. This paper will address the process of international cooperation for the development of the atlas to date, current data infrastructures, management and capacity building tools (OceanTeacher, http://www.oceanteacher.org), and outlines proposed ideas for improved access to these data. Mechanisms for building links between the African

Marine Atlas and other Global and African data portals and programs utilizing large-scale marine data sets will be discussed.

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European coastal and marine information to support EU Integrated Maritime Policy and marine spatial planning

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The European Environment Agency (EEA), together with the EIONET, the regional seas Conventions and the European Commission, aims to streamline monitoring and reporting activities in order to support the production of policy-relevant assessments of marine environment quality with an emphasis on ecosystem-based management issues. EEA has initiated the following activities with a view to preparing the production of regular indicator-based assessments and the delivery of information services over the period 2008 to 2010 in support to new policies adopted by the European Union.

A new EU marine environmental law (Marine Strategy Framework Directive, MSFD) aims at applying an ecosystem-based approach to the management of human activities. The EEA has supported the development of the monitoring and assessment components of the MSFD (e.g. clarification of data and information needs) via its work as co-chair of the European Monitoring and Assessment (EMMA) informal Working Group.

Within the framework of Global Monitoring for Environment and Security (GMES), operational oceanography has been identified as a GMES fast track service (the Marine Core Service, MCS). The EEA provides regular indicator-based assessments of the state and trends of the European environment and participates in the MCS Implementation Group to define how the MCS can provide pan-European marine indicator and assessment products and to support the coordination of marine in-situ (non-satellite) monitoring. The EEA also participates in the group developing the European Marine Observation and Data Network (EMODNET).

The EEA is supporting the initiative by the European Commission for an Integrated Maritime Policy for the European Union[3]. The above-mentioned MSFD constitutes the environmental pillar of such a policy. The EEA, together with other EU bodies and national organisations has started identifying projects to this end (e.g. sea-bed mapping and marine habitats classification). The corresponding knowledge-based approach will be structured around and targeted at supporting maritime spatial planning, which is a fundamental tool for integrating the sustainable development of marine areas and coastal regions.

A similar development took place under the implementation of the EU ICZM Recommendation where Member states, European Commission and EEA identified core sets of indicators for sustainable development and ICZM effectiveness, which were tested by regional and national authorities. EEA is also involved in reporting on maritime transport, air emissions and oil spills. The identification and mapping of important biotopes, ecosystems and protected areas - under EU nature directives - is being gradually extended to coastal and marine areas with the view to create a coherent view of ecological networks.

Finally, reflecting on the ecosystem-based approach put forward by the Maritime policy and the Marine strategy directive, the Agency is engaged in transposing and adapting the analytical frameworks and methods used for land-based analysis to the marine/maritime space. The accumulated and validated experience on terrestrial ecosystems, through environmental accounting and spatial analysis techniques, serves as a robust basis for characterizing the marine/maritime space according its natural assets and the many and conflicting uses.

Via international cooperation and specific projects, the EEA shares the experience of these European activities to contribute to global monitoring and assessment activities, especially under GEOSS. The EEA co-chairs, for example, the UN expert group that aims to evaluate existing marine

3: COM(2007) 575 final http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0575:FIN:EN:PDF

assessments and to propose a framework for a regular reporting process on the state of the marine environment globally.

Poster Presentations

1. Inner water coastal waters and marine spatial planning: principal structure of geographical information system

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2. GIS @ VLIZ

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3. Microphytobenthos production and biomass monitoring on intertidal Mudflats using Remote Sensing

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4. Spatial database of sustainable development indicators for integrative coastal zone management to the South-Eastern Baltic

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5. Fishing effort related to a biological value of the Belgian part of the North Sea

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6. Software controlled guidance, recording and post-processing of seafloor observations made by ROV and other towed devices: The software package OFOP

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7. GIS - A powerful tool for managing the coastal environment

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8. Integrated Bottom Objects Geodatabase for Polish Marine Areas

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9. Nutrient fluxes in the Scheldt basin: an approach using a dynamic GIS

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10. Benthic biodiversity maps of the Southern Bight of the North Sea

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11. The importance of coastal and continental shelf sediments in the global carbon and nitrogen cycle: a modeling synthesis

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12. A coastal processes simulator to support coastal management under

climate change

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13. Azores Islands: The GIS role in Coastal and Marine Management

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14. GIS approach to the evolution of subtidal habitats in the Lower Sea Scheldt

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15. DINEOF univariate reconstruction of missing satellite data from the North Sea Belcolour-1 database.

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16. Utilize GIS technology toward coastline segmentation: a case study of Bulgarian coast

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17. Tidal marsh mapping as a base for predicting models of vegetation and plant species in the Scheldt estuary

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18. Belspo project QUEST4D

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19. Remote sensing in support of GIS Flanders

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20. Flood risk mapping of the North Sea Coastal Zone

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