



International Multidisciplinary Scientific GeoConference SGEM

International Multidisciplinary Scientific GeoConference
17th - 26h June 2014 Albena, Bulgaria

“CERTAIN RESULTS OF THE REMOTE SENSING TECHNIQUES APPLICATIONS FOR THE COASTAL ENVIRONMENT QUALITY MONITORING AND ROMANIAN ICZM PROCESS IMPLEMENTATION

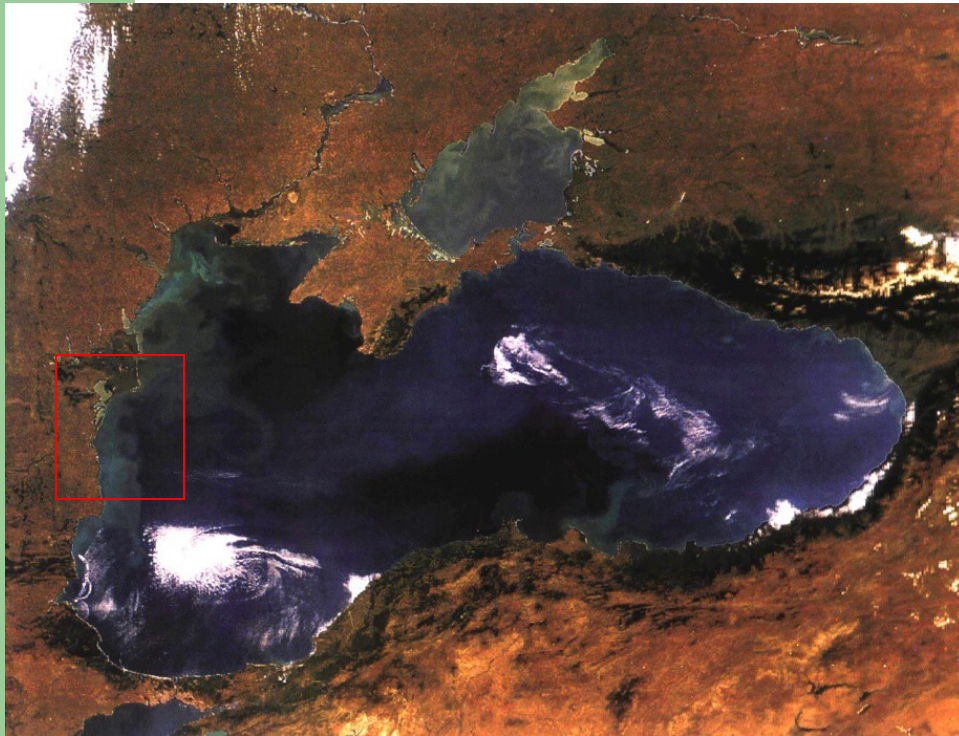
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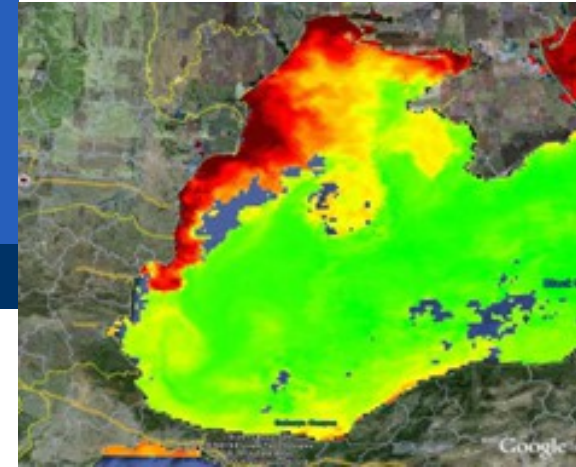
1. Introduction – Regional General Data



BLACK SEA BASIN

- **Total area: 4.2×10^5 km²**
- **Total water volume: 547,015 km³**
- **Maximum depth: 2,212 m**
- **Drainage basin: > 2 million km²**
- **Shoreline length: > 4,100 km**
- **Population: > 160 million people**
- **Riparian countries: 6 (Bulgaria, Georgia, Romania, Russian Federation, Turkey, Ukraine)**

NW Black Sea Basin

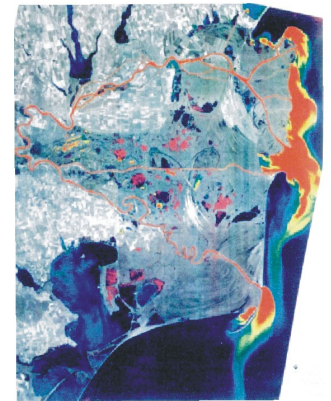


Romanian Shelf Waters (<200m)

- Highly dynamic system
- Most productive area of the Black Sea
 - strongly influenced by the Danube's discharges
 - climatic processes
- High temporal variability of optimal blooming conditions

Open Waters

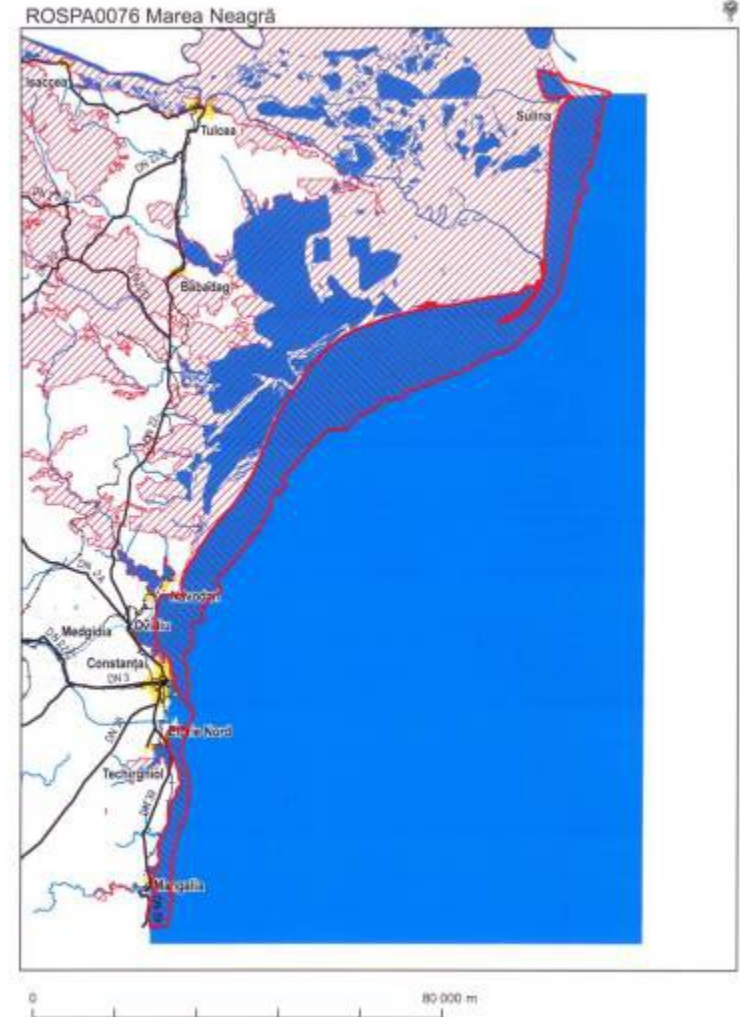
- Less productive system
- Less temporal variability of favorable blooming conditions
- Production mainly influenced by climatic processes which govern stratification, upwelling and water masses circulation¹



1. McQUATTERS-GOLLOP, A., MEE, D., L., RAITSOS, D., E., SHAPIRO, D., I., 2008, Non-linearities, regime shifts and recovery: The recent influence of climate of Black Sea chlorophyll, *Journal of Marine Systems*, 74, 649-658

MARINE PROTECTED AREAS

1 SITE UNDER BIRDS DIRECTIVE



ROSCI009 Danube Delta – marine zone (overlapping on the marine zone of the MDR - 103.000 ha)

ROSCI0237 Methanogenic Structures from Sfantu Gheorghe (covering 6.000 ha)

ROSCI0197 Submerged Beach from Eforie (140 ha)

ROSCI0273 Marine Zone from Cape Tuzla (1.790 ha)

ROSCI0094 Mangalia Underwater Sulphur Springs (360 ha)

ROSCI0066 Vama Veche – 2 Mai marine zone: (overlapping on Marine Reserve, 5.000 ha)

6 SITES UNDER HABITATS DIRECTIVE

Romanian Coast Hydrology/Hydrodynamics

- Waves regime

(N. Valcev 2005)

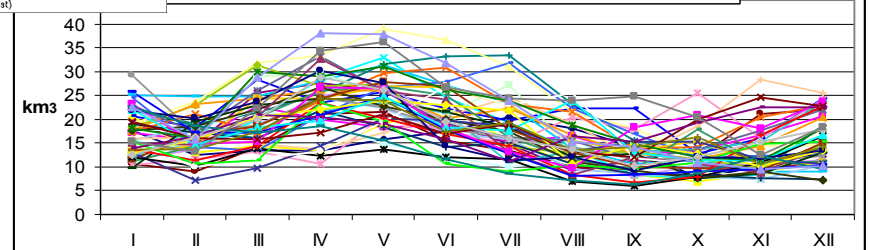
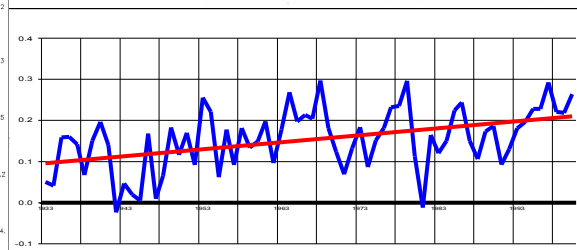
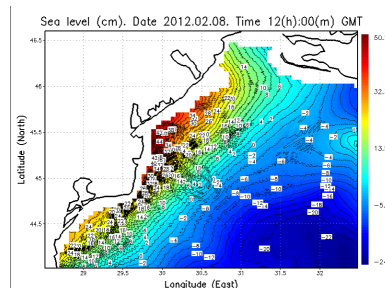
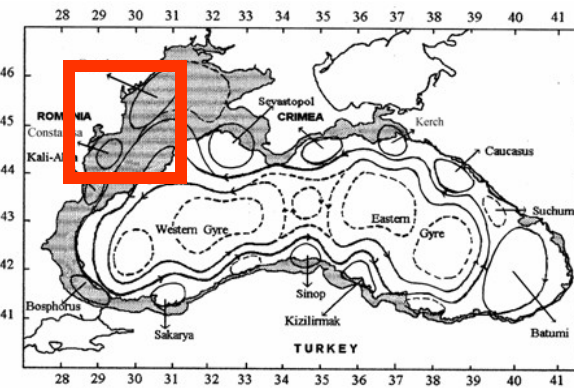
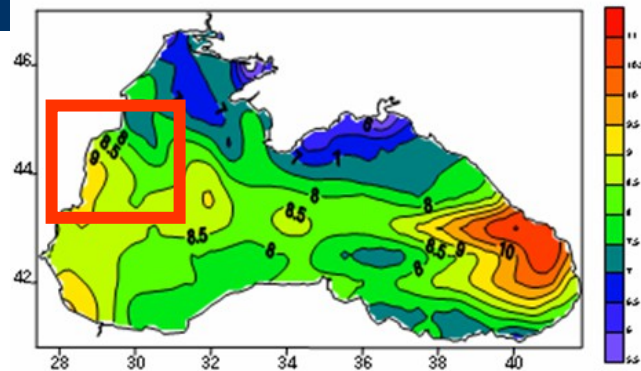
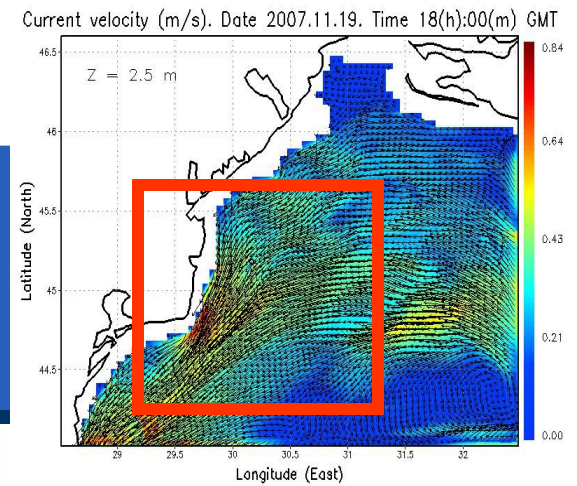
- Currents regime

(<http://www.rmri.ro/RMRI/Forecasts/ForecastsRO.php>)

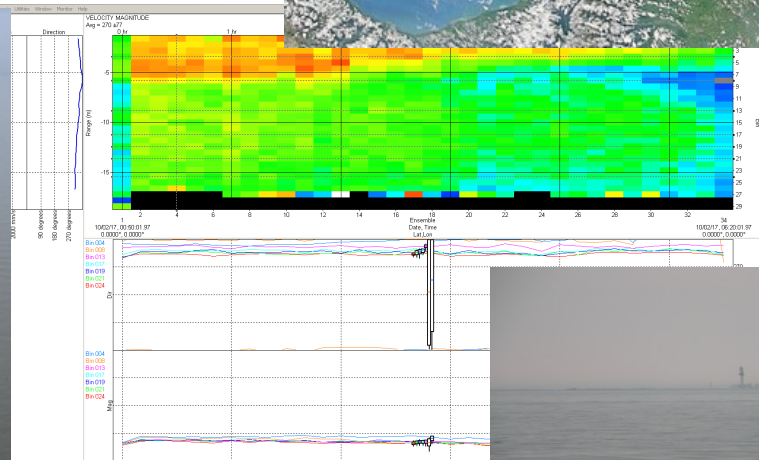
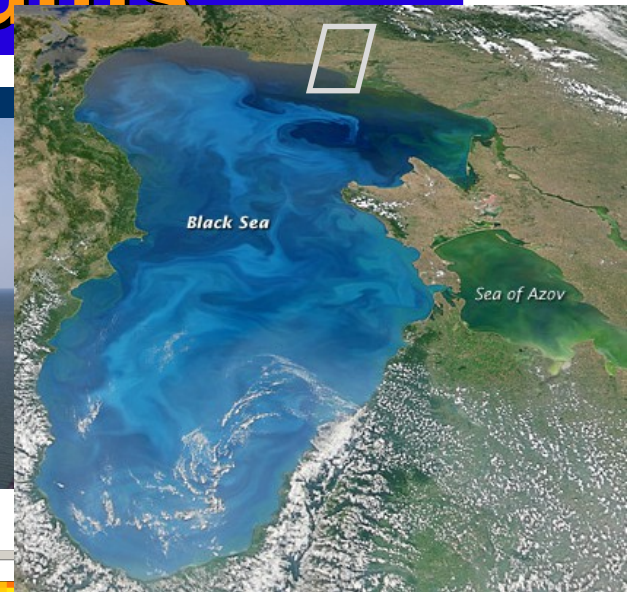
- Sea-level variability

(Eurogoos-IOC site)

- Danube river discharge



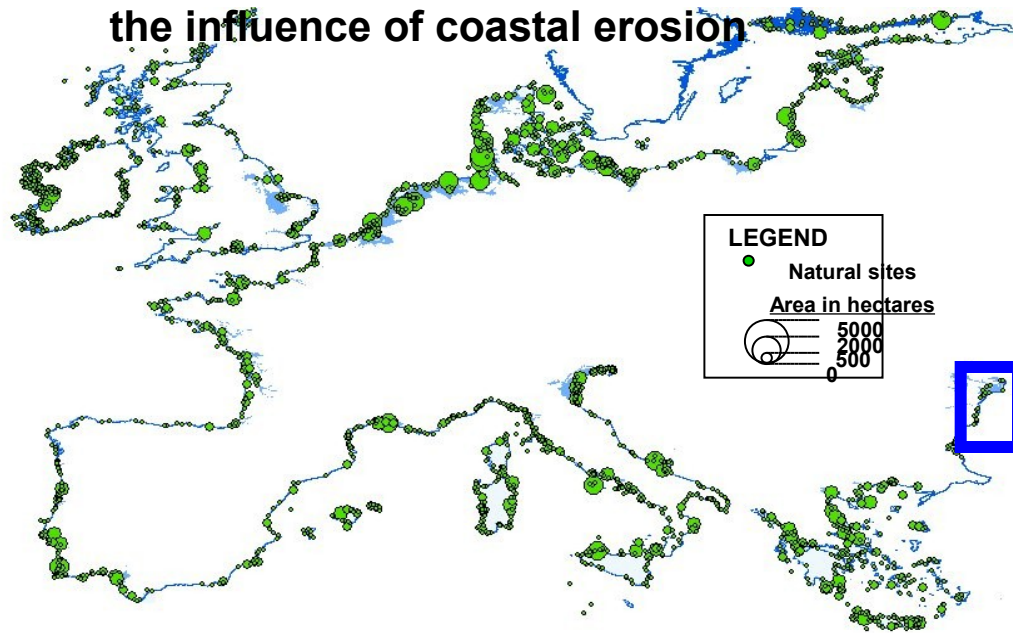
Water fronts in front of Danube Mouths



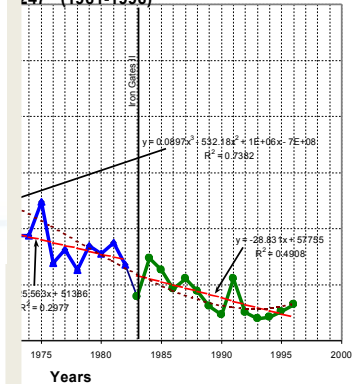
Danube Delta Coast

Human Intervention affecting Geomorphology

Natural sites with high ecological value under the influence of coastal erosion



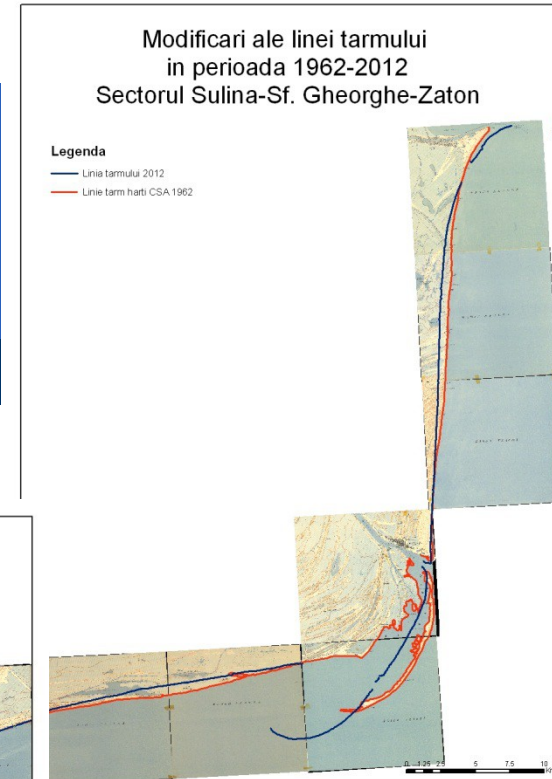
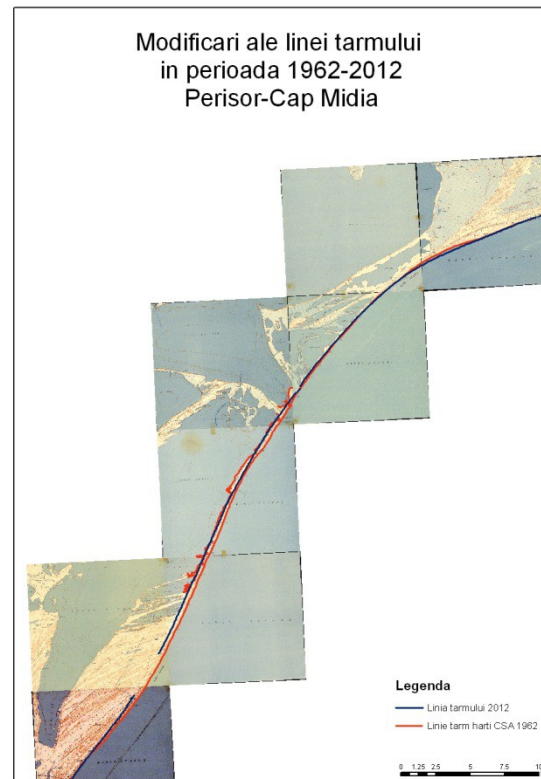
Discharge at Vadu Oii hydrographic station - 247 (1961-1996)



3. Geomorphological changes 1962-2012

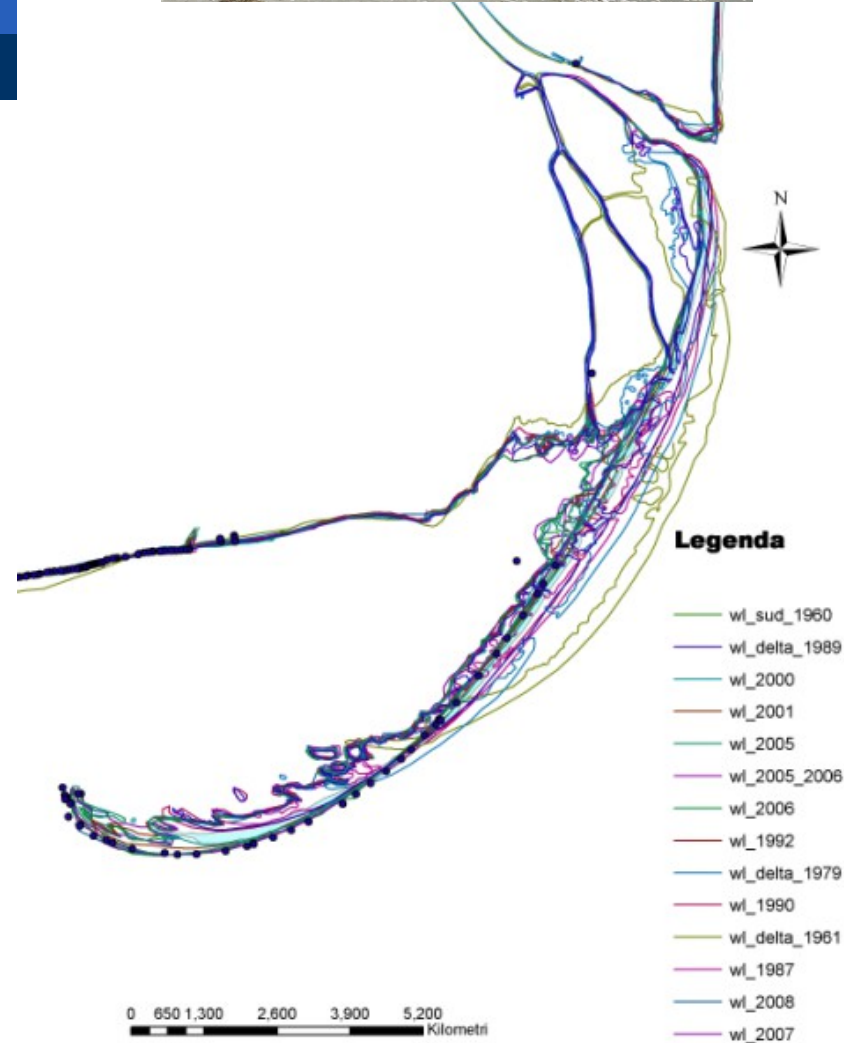
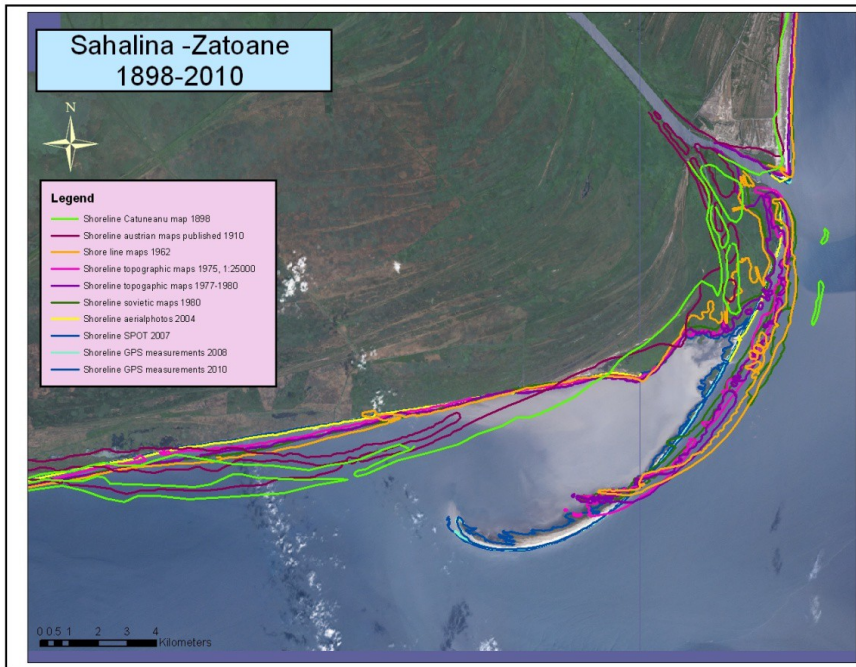
Shoreline retreat, it were affect the norther littoral in more that 70%,

- land losses cumuled for all coast a surface more than 2600 ha (between average values of 45 - 55 ha/an).
- accretions registered less than 350 ha (7 ha/an),
- erosion/deposition being of 7.5% (2300 ha loss)



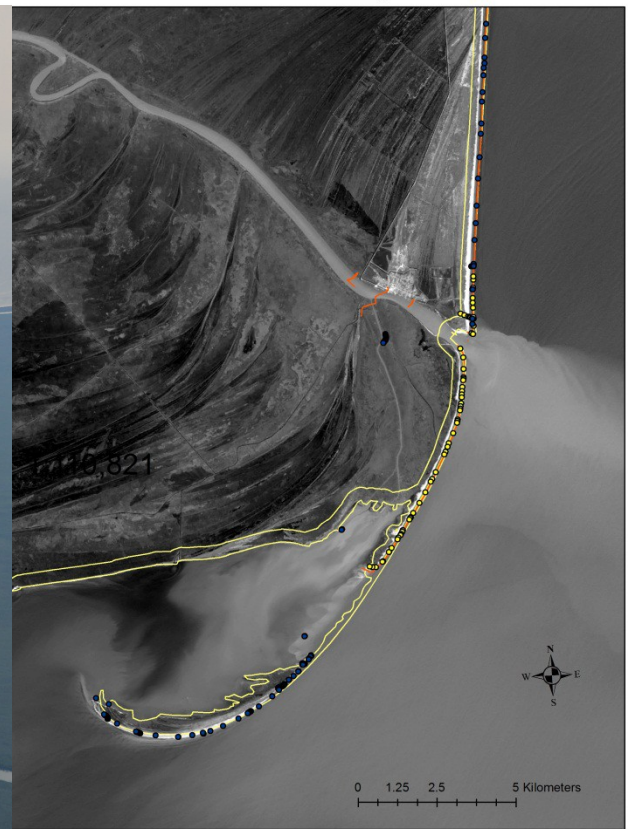
Method(s): map vectorization, and GPS Measurements

Shoreline Mapping



Sahalin Island: sand spit surface variability

Sahalin Island - may 2013



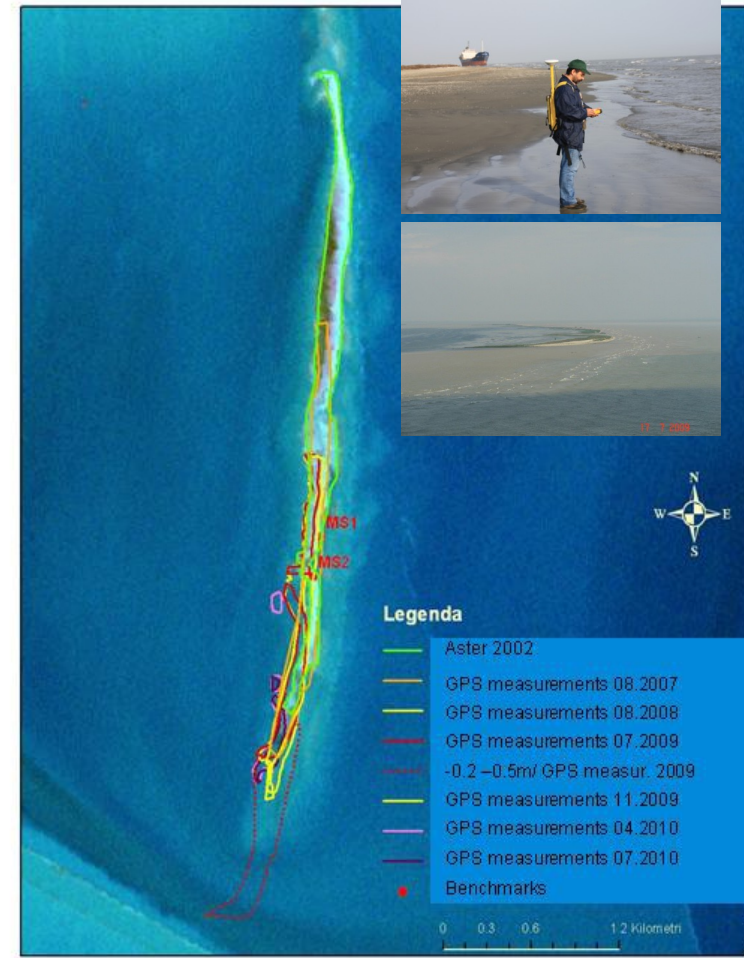
Musura Bay

Shoreline Mapping

Shoreline position: aerial photography, historical maps, satellite images, recent GPS measurements: 2005 - 2011

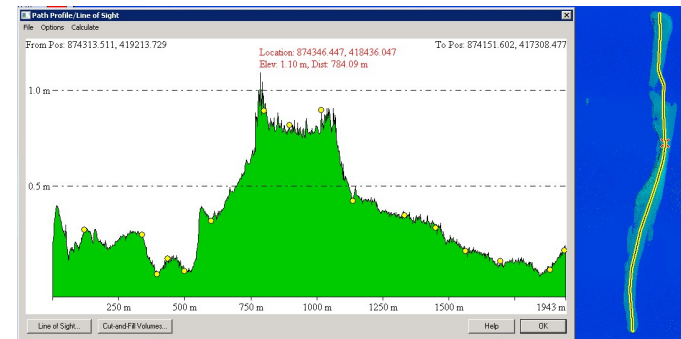
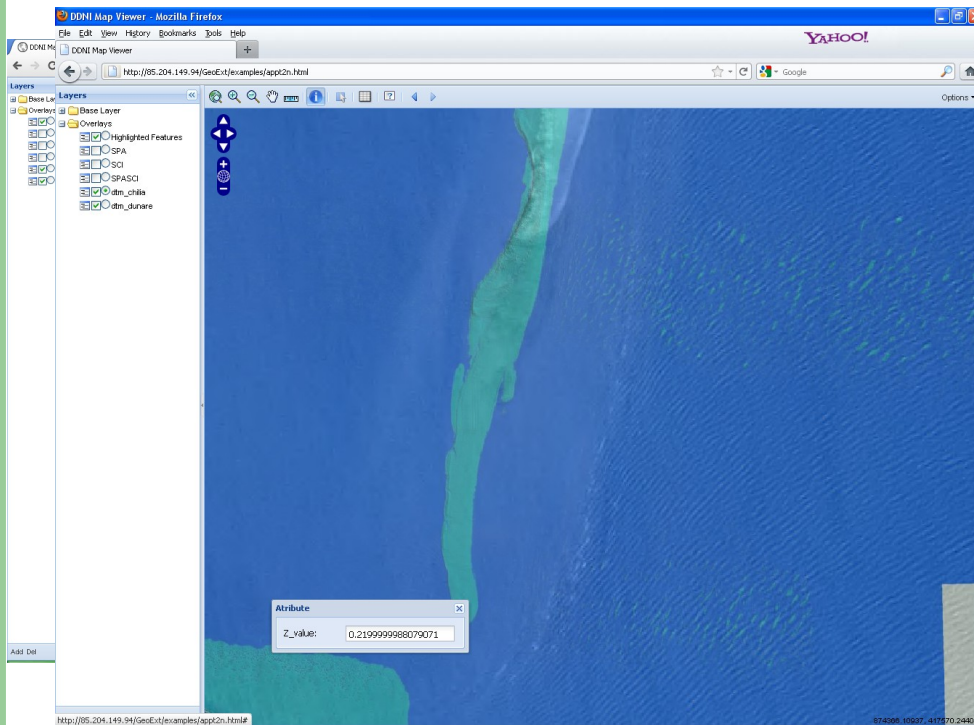


Island Musura Bay
Shoreline 2002-2010



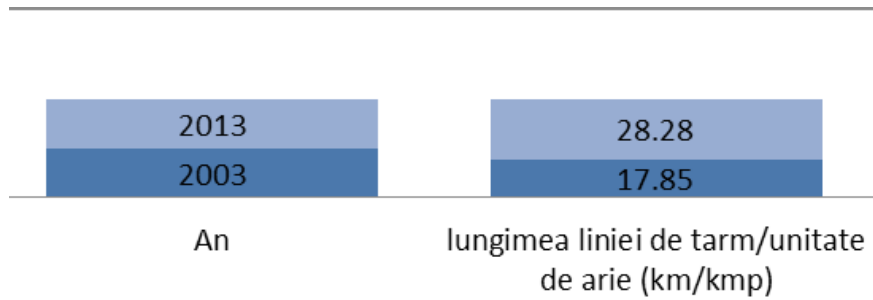
Musura Bay: sand spit geomorphology

- DTM obtained by LIDAR measurements





An	aria (S)	perimetru (P)	lungimea liniei de tarm/unitate de arie (km/kmp)
2003	0.50	8.84	17.85
2013	0.29	8.19	28.28



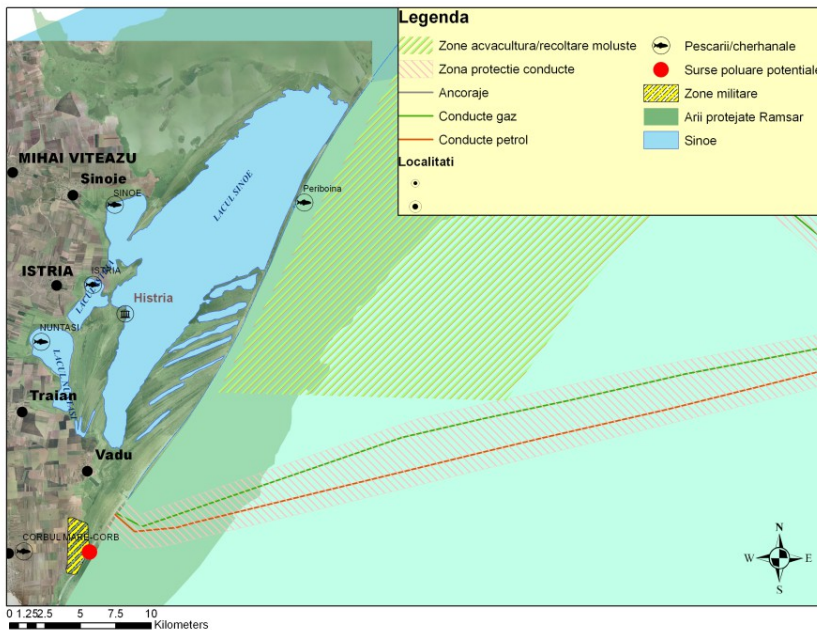
An	Aria (Ha)	Perimetru (P) (Km)	Indice P/A (km/kmp)	Observations
2007	16.2	3.8	23.15	Vectorizare
2010	17.7	4.1	22.99	masuratori GPS
2011	11.7	3.5	30.20	masuratori GPS
2012	10.9	3.4	31.09	masuratori GPS
2013	9.5	2.2	22.96	masuratori GPS

4. Ecological Aspects



Ecological Impact

Similarities with Sinoe Lagoon - Protected Reserves and special zones (for Conservation Bird and Habitat Directives) PART OF DDNBR SINCE 1993



Sinoe Lagoon was ecologically unbalanced, and its aquatic environment was degraded due to the inlets closing through hydrotechnical constructions

MPAs



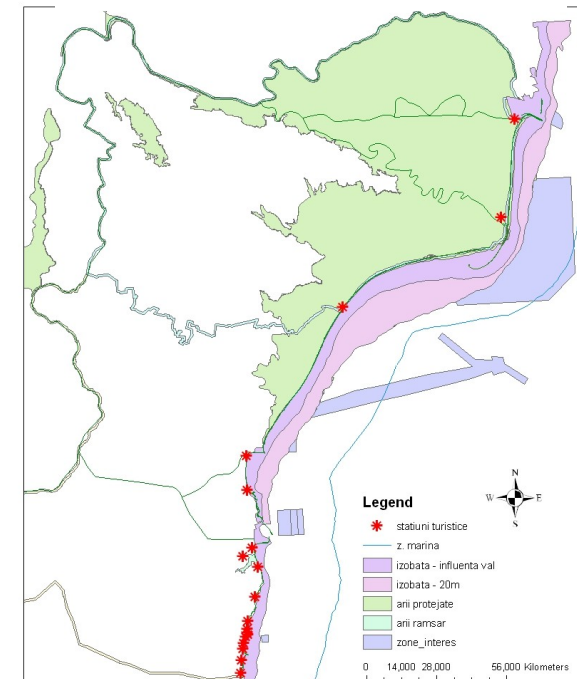
Changing habitats: lagoon => lake

5. Ecosystem vs. Local Development/ICZM implementations

Ongoing Projects in the Danube Delta Area:

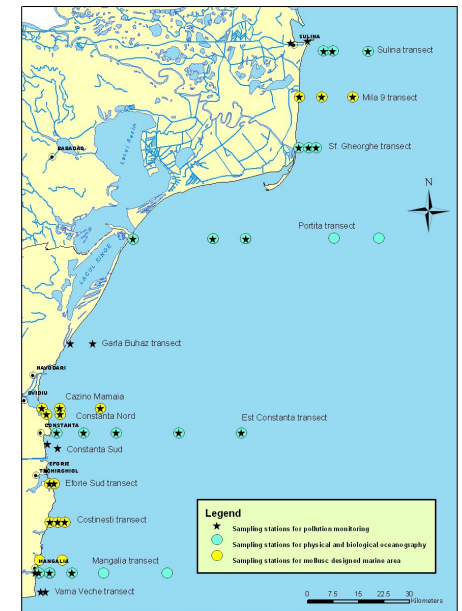
- Implementation of the Masteplan for coastal protection/Halcrow 2011
- Danube Delta Master Plan
- Law projects: **Musura Bay Dredging**
- **Sulina – spatial planning**
- **Razim-Sinoe Complex – ecological rehabilitation**

Romanian Coastal Zone



SUPPORT of the MARINE INTEGRATED MONITORING (SUB)SYSTEMS:

1. Marine pollution monitoring ;
2. Shellfish water monitoring;
3. Monitoring and control of dangerous substances in dredged sediments from ports and maritime shipping channels;
4. Monitoring of ballast waters;
5. Monitoring of coastal erosion;
6. Monitoring of the biological diversity, including marine mammals populations and marine habitats in the protected areas;
7. Monitoring of dolphins' accidental catches and stranding;
8. Monitoring of the bathing waters and beaches quality (collaboration with Sanitary Directorate);
9. Monitoring of extreme marine phenomena (extreme surges, tsunamis);
10. Monitoring of accidental oil pollution (when needed).



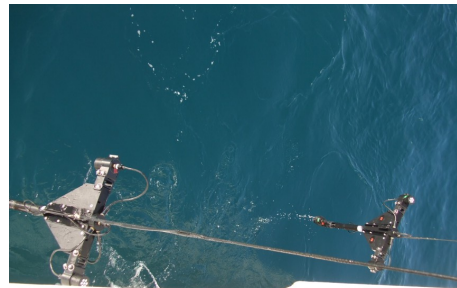
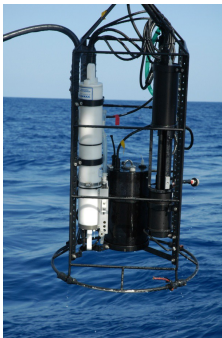
Marine Integrated Monitoring System

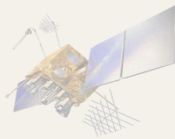
Support of RS projects

« MyOcean », a project for ocean monitoring and forecasting in Europe

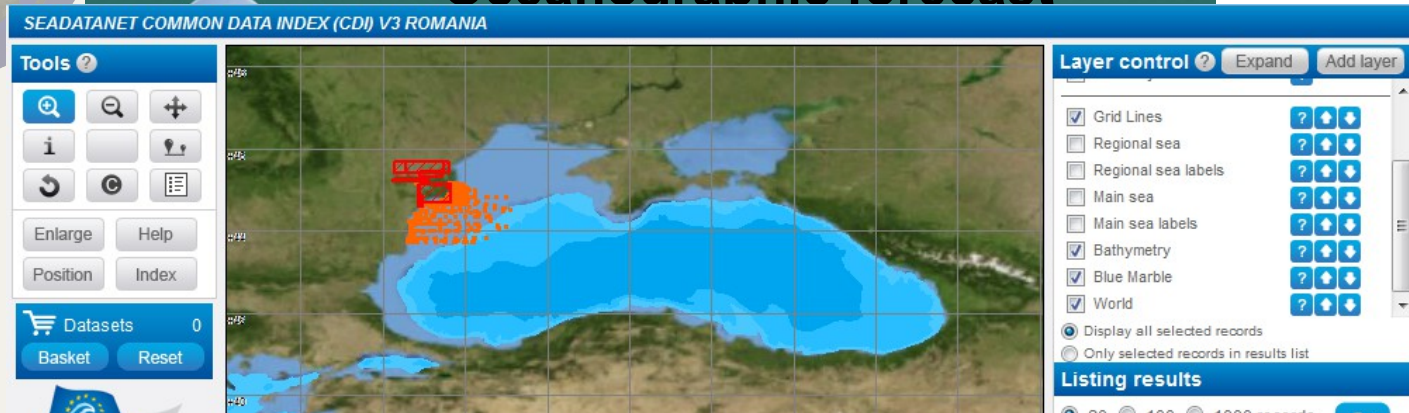
“Bio-Optical Characterization of the Black Sea for Remote Sensing Applications“ (Bio-Optical) NATO SfP project # 982678

“Ocean colour – Application for the Western Black Sea”
(ROSA/ESA support) Period of development: 2010 – 2013



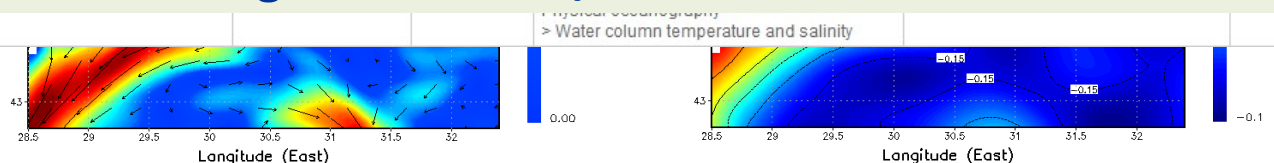


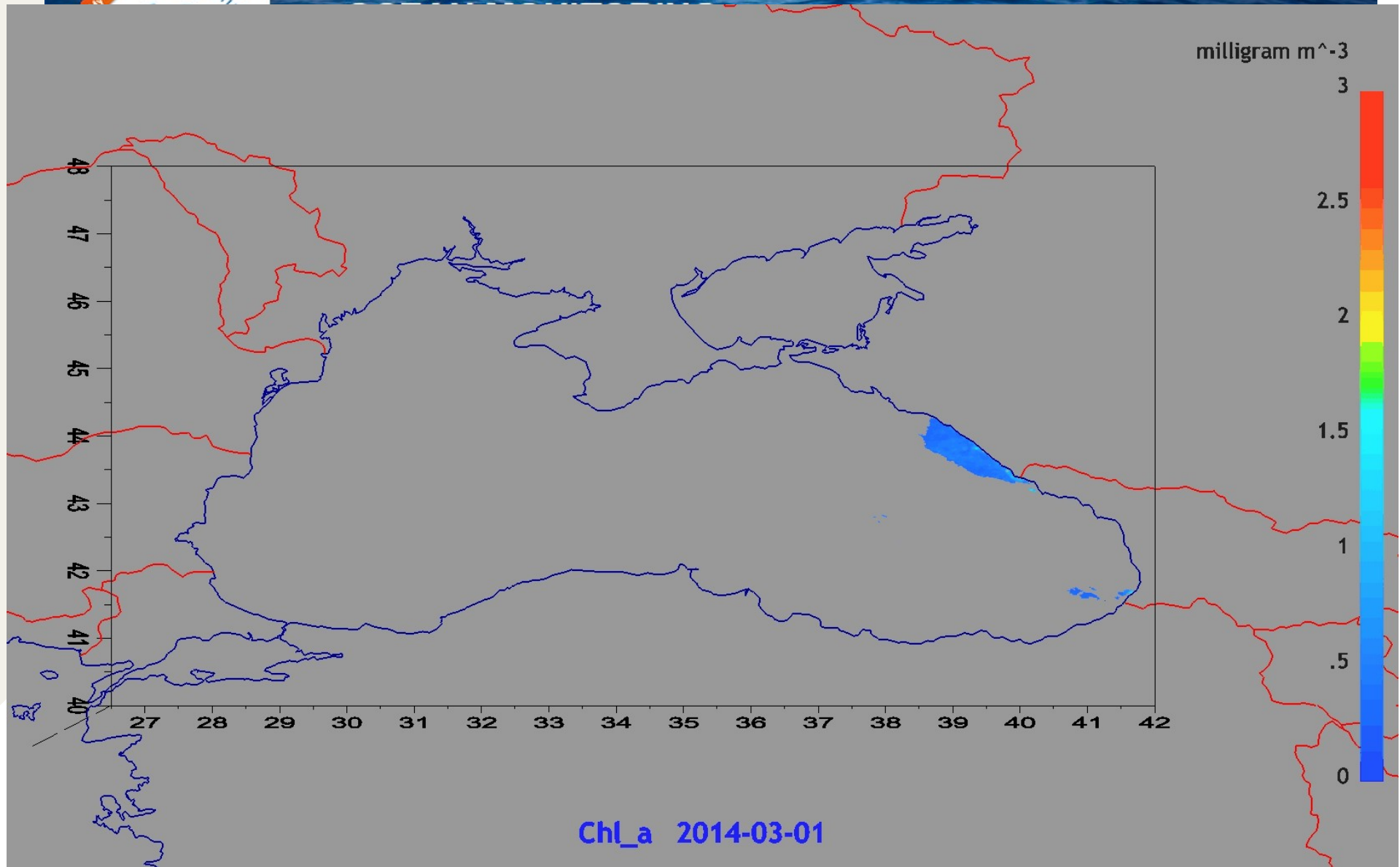
Oceanographic database Oceanographic forecast



Strategic Objectives:

- To collate oceanographic data, archive, store it and maximize its utilization;
- To enhance the availability of high quality oceanographic data for a wide group of users;
- To promote data exchange on national/international level.





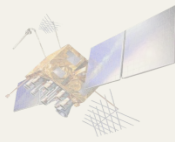
Chl_a 2014-03-01



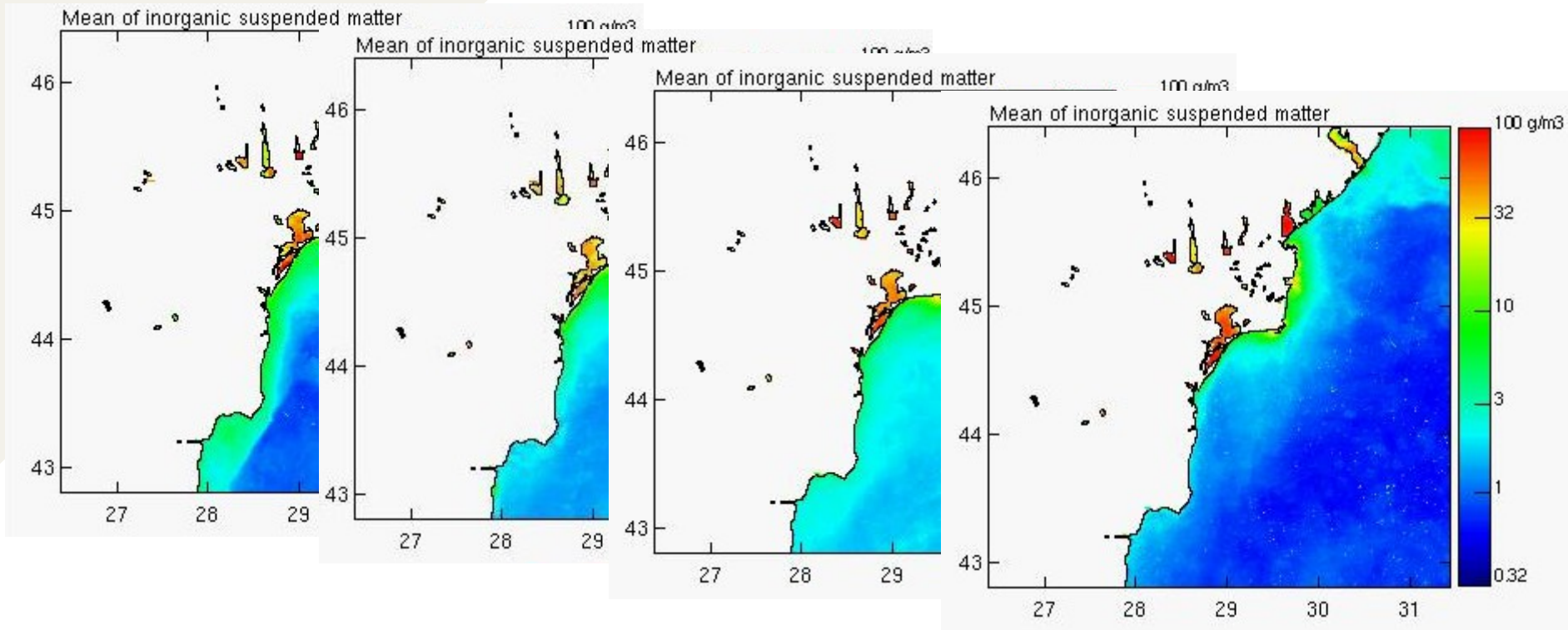
Download the latest MyOcean catalogue 
» download PDF



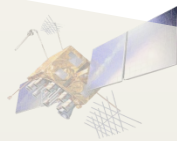
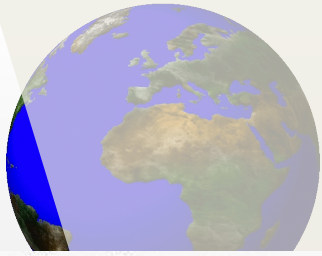
Access TUII catalogue online
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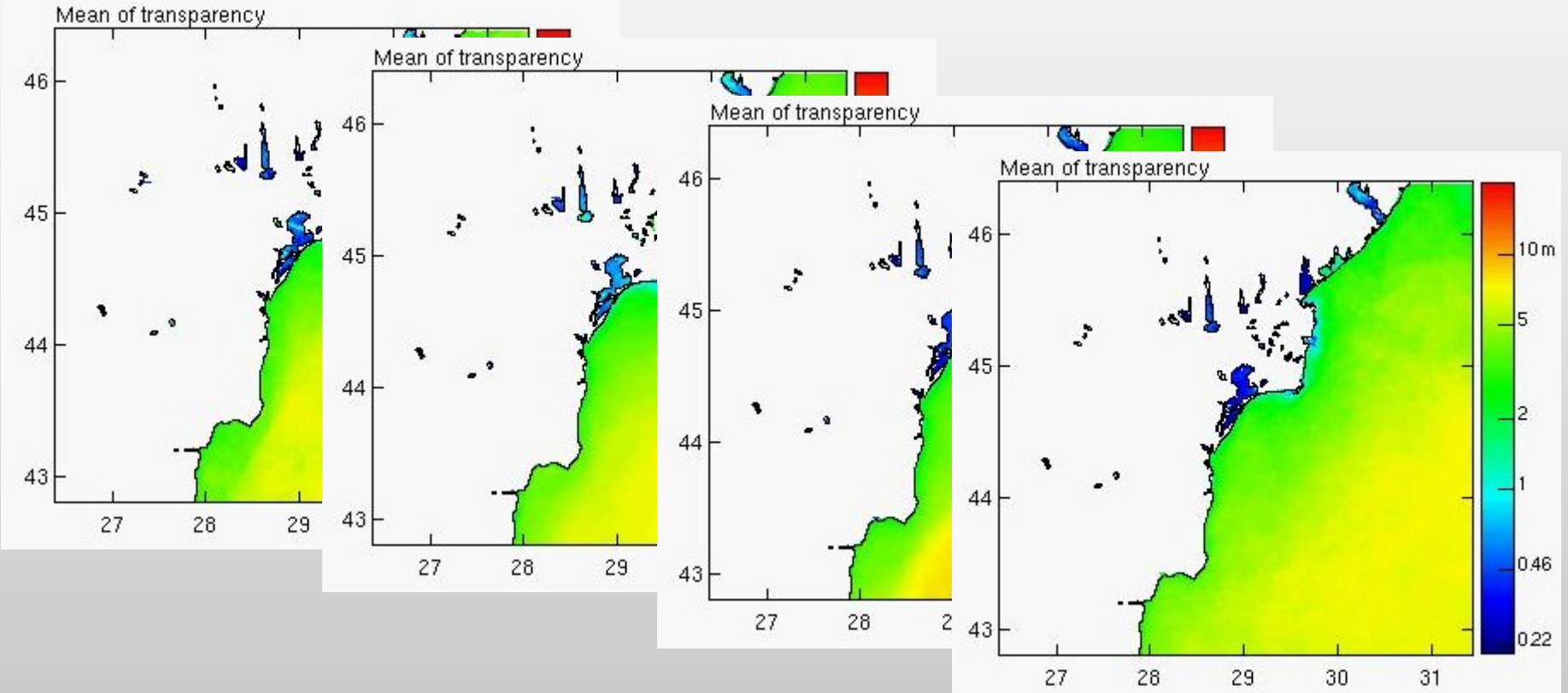
Seasonal distribution of WQ Parameters



Mean inorganic suspended matter



Seasonal distribution of WQ Parameters



Transparency

Algorithms developments – 2012 by JRC, Ispra, within NATO SfPS project “Ocean color”

Rationale and Justification

Current limitation in the operational use of satellite ocean color data in the Black Sea and in other marginal seas is the *lack of regional bio-optical algorithms linking the satellite signal to the specific water quality indicators.*

Main aim: the development of specific regional bio-optical algorithms on the basis of comprehensive data sets of statistically *representative in situ measurements.*

Multi Layer Perceptron (MLP) neural networks algorithm

This section summarizes the specific application of Multi Layer Perceptron (MLP) neural networks developed to derive Chlorophyll-a concentration C_{hl-a} , absorption of the yellow substance at 412 nm $a_{ys}(412)$ and concentration of the total suspended matter TSM from remote sensing reflectance R_{RS} spectral values for the Western Black Sea (D' Alimonte et al. 2011)

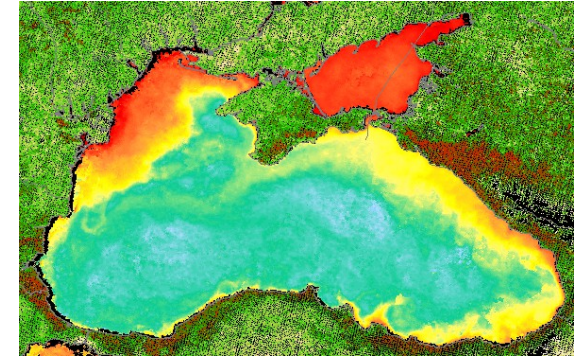
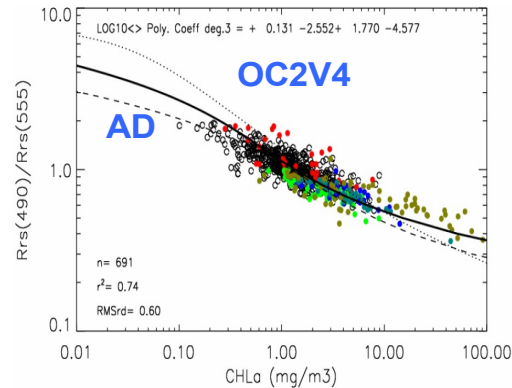
The applicability of *regional* bio-optical algorithms has been verified with the Medium Resolution Imaging Spectrometer (MERIS) remote sensing reflectance R_{RS} (see Kajiyama et al. 2012)

Specific objectives

Creation of an in situ data set of optical properties (inherent and apparent) and concentration of constituents

Development of optical - algorithms for the determination of optically significant seawater constituents

Generation of satellite ocean - color products of the Black Sea freely accessible through web interface



The project realization

- operating an autonomous above-water radiometer on Gloria Oil platform in front of the Romanian coast/Danube Delta Biosphere Reserve
 - producing data for the continuous assessment of the atmospheric correction process of current satellite ocean colors sensors
 - part of the international AERONET-OC network.
 - long-term operation: NIMRD with the support of the JRC > ensuring real-time data, available from the AERONET-OC data base and also from the ESA MERMAID server.

In situ Data collection

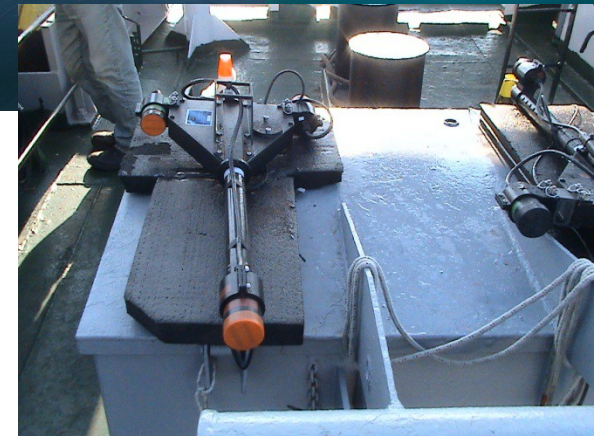
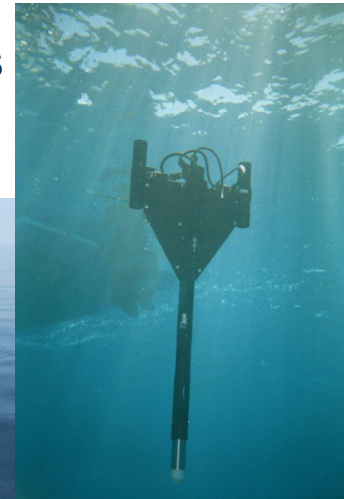
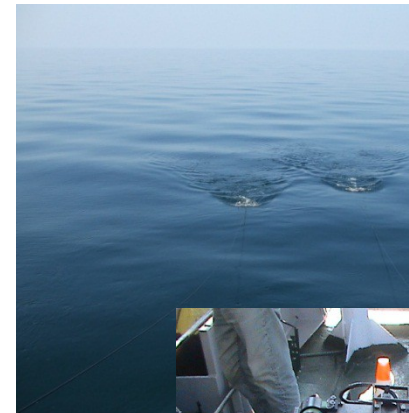
- within the framework of the series of oceanographic cruises: measurements of *apparent and inherent optical properties of seawater*, in addition to the concentration of optically significant constituents

- with the autonomous above-water radiometer on a continuous basis: the remote sensing reflectance and the aerosol optical thickness

AOP: the remote sensing reflectance and the diffuse attenuation coefficient (all determined through in-water radiometric profiling).

IOP: the absorption, scattering and back-scattering coefficients (determined through in-water profiling).

Concentrations of specific seawater suspended constituents include those of pigments and total suspended matter (determined from laboratory analysis of water samples).



Parameters monitored *in situ* and remote sensing

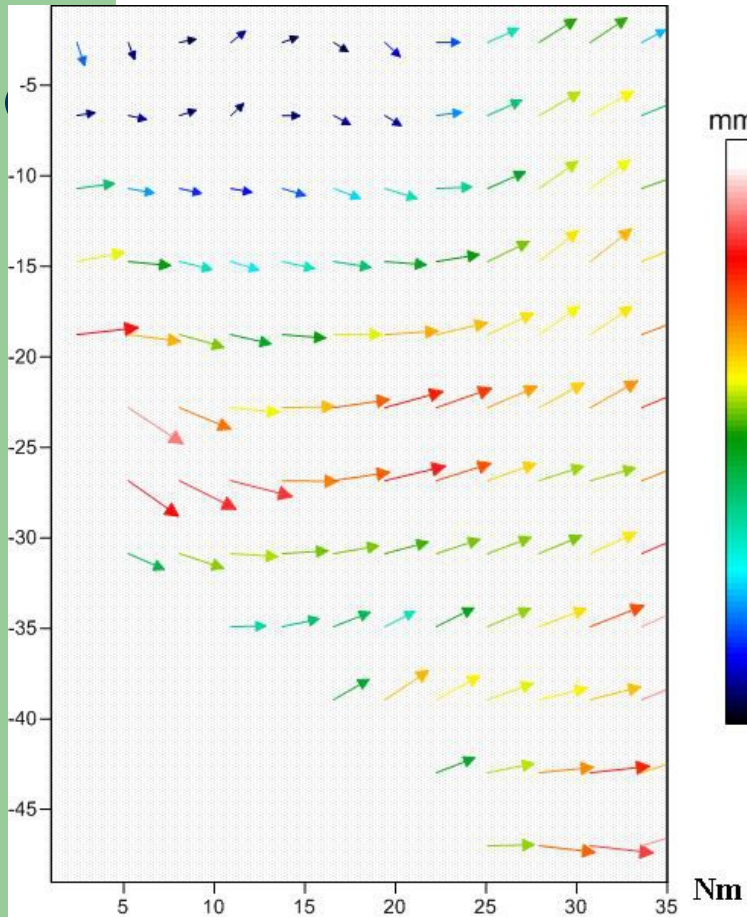
□ Chlorophyll *a*

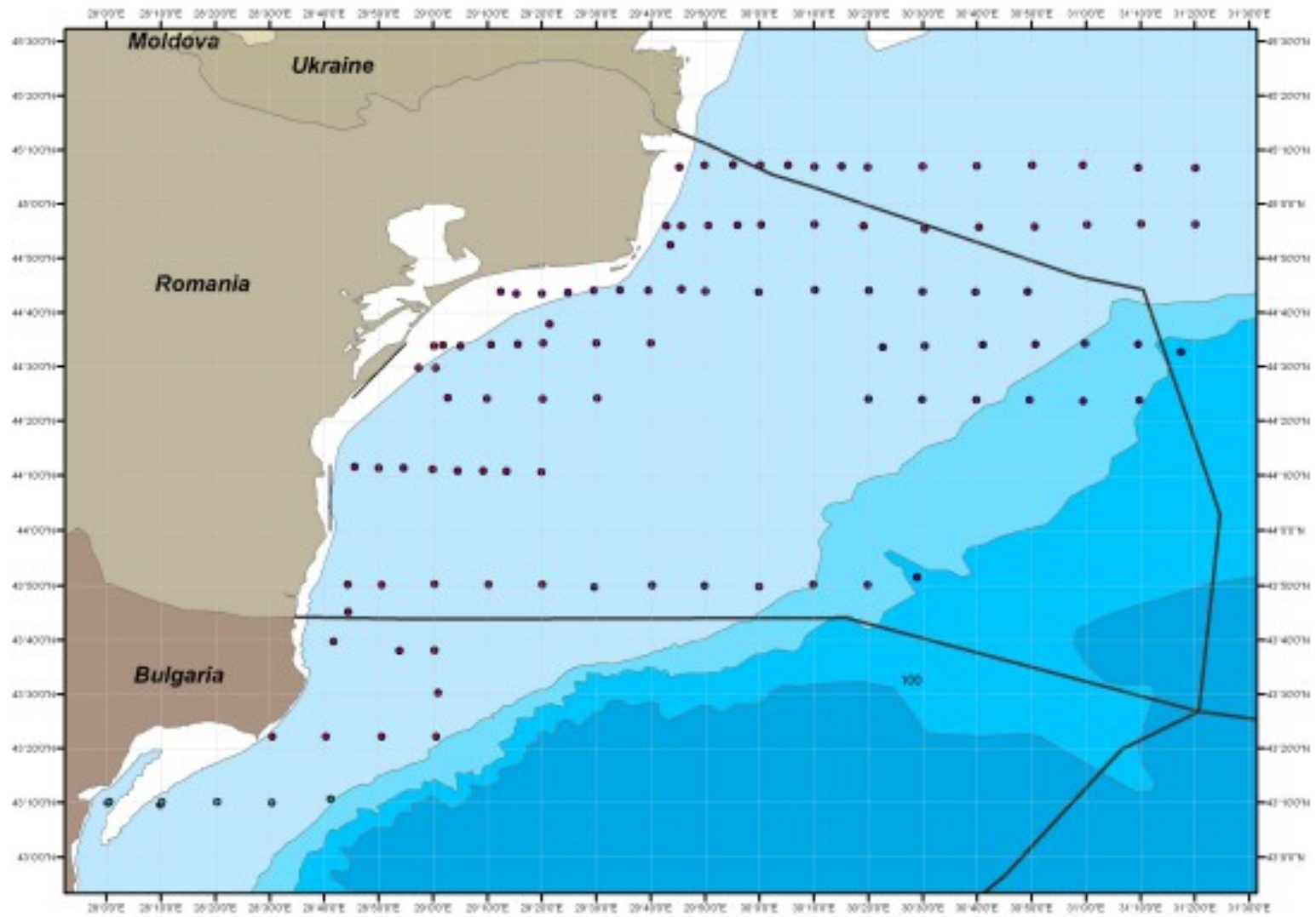
- commonly used parameter for the estimation of phytoplankton biomass and primary production
- included in the list of indicators of eutrophication within WFD
- proposed indicator related to “Direct effects of nutrient enrichment” criteria (Descriptor 5) in the MSFD

□ Transparency

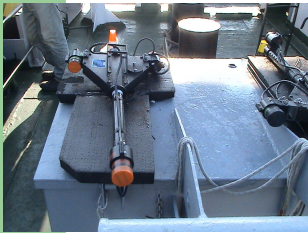
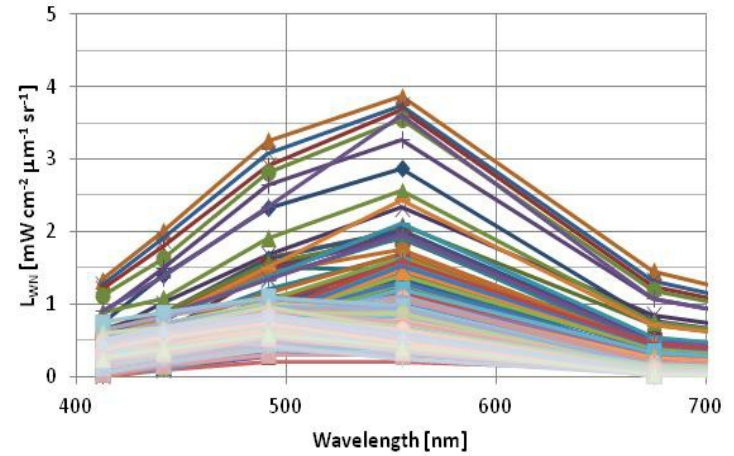
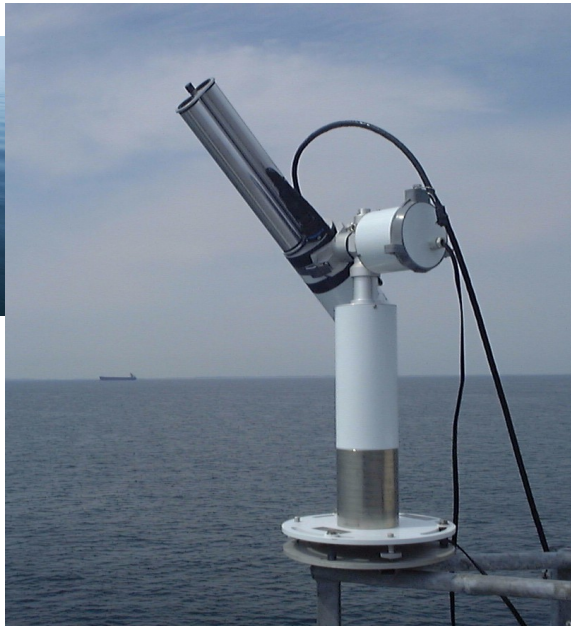
- strongly related to the amount, size, composition of suspended material (sediments and organic material)
- Transparency related to increase in suspended algae is proposed as MSFD’s indicator (Descriptor 5)

Academik Cruise - September 2012





Gloria AeroNet-OC site - in order to sustain the continuous data acquisition - transmission, 6 expeditions for system maintenance were sustained, including wet sensor maintenance and battery changes and adding an extra solar-panel, as well.



Gloria AeroNet-OC site

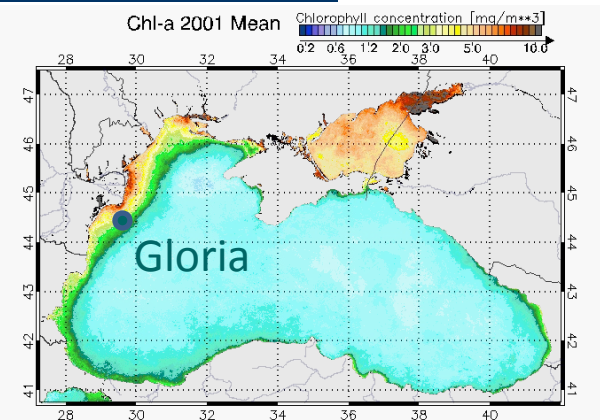
SeaPRISM



Gloria Platform



Complex Logistics



Site: Gloria

Location: Black Sea

Water type: Case-2 (sed. dom.)

Water depth: 50 m (height: 30 m)

Distance: ~20 nm

Period: 2010-present



Data from the SeaPrism Radiometer

aeronet.gsfc.nasa.gov/cgi-bin/type_one_station_seaprim_new?site=Gloria&nachal=2&level=1&place_code=10

Google

+ SYSTEM DESCRIPTION

AERONET DATA ACCESS

DATA SYNERGY TOOL

+ Data Display

AEROSOL OPTICAL DEPTH

+ Data Display

+ Download Tool

+ Download All Sites

+ Climatology Tables

+ Climatology Maps

+ V2 L2 Data Availability

AEROSOL INVERSIONS

+ Data Display

+ Download Tool

+ Download All Sites

SOLAR FLUX

+ Data Display

OCEAN COLOR

+ Data Display

CLOUD MODE

+ Data Display

AERONET Site Lists

+ Text Format

+ Google Earth Format

+ All Lists

Choose Display Options:

AERONET-OC Data Type: Lwn (with f/Q correction)

Lwn Level: Level 1.0 Level 1.5

Data Format: All points Daily averages

SELECT CHARTS FOR LARGER IMAGES

Choose year :	2010	2011	2012	2013	2014
Choose month of 2014 :	JAN	FEB	MAR		

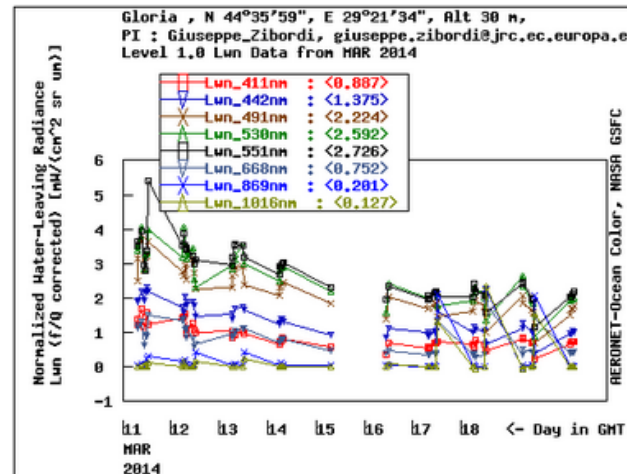
Related Product Availability for Gloria (select each day below):

- Show Back Trajectory Analyses - Availability - Disclaimer
 - MPLNET Images - Availability - More Information
 - Show TERRA-MODIS | AQUA-MODIS Rapid Response Images - Availability - More Information
- GIOVANNI AQUA-MODIS 9km Ocean Images GIOVANNI SeaWiFS 9km Ocean Images

Not Available Not Available

Choose day of MAR 2014											
1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31					

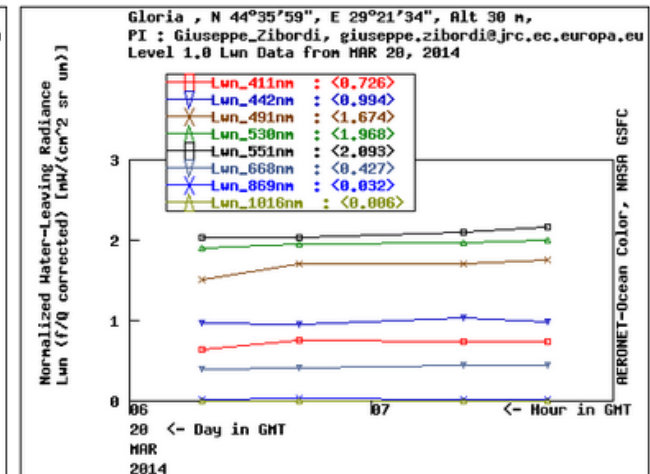
Lwn Level 1.0 data from MAR of 2014



AERONET-OC DOWNLOAD

- Lwn Level 1.0
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- Download all: Lwn Level 1.0
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Lwn Level 1.0 data from MAR 20 of 2014

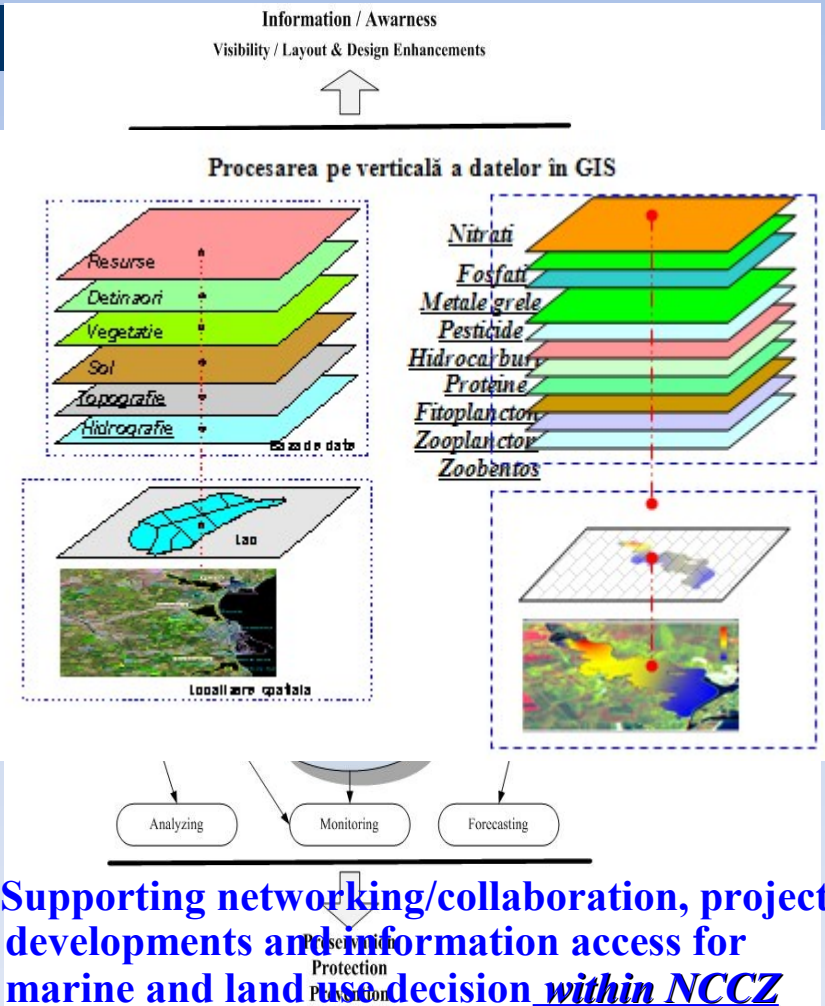


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Support activities for implementation: On-going national actions/projects

1. ECOMAGIS: IMPLEMENTATION OF A COMPLEX GEOGRAPHIC INFORMATIC SYSTEM FOR ECOSYSTEM-BASED MANAGEMENT, THROUGH INTEGRATED MONITORING AND ASSESSMENT OF THE BIOCOENOSIS STATUS AND ITS EVOLUTION TRENDS IN A FAST CHANGING ENVIRONMENT AT THE ROMANIAN COASTAL ZONE OF THE BLACK SEA considered as a continuation at a superior level of the PN2-32164/2008 project IMAGIS "Complex system for the application of the GIS and remote sensing techniques to support the environmental quality monitoring and ICZM process implementation in the Romanian coastal zone".



WEB-GIS COMPONENT

The WEB-GIS component fulfils requirements of presenting relevant information in the scope of the project and raise awareness of professional partners/public regarding the evolution of marine and coastal environment indicators.

System Functionalities:

Spatial Data Access: WMS: Interactive, complex information within simple format

Documents and Processes Management: pdf for

Support Information System for Analysis and S

and European data portal : SDN, BSFS, etc.

These functionalities allow achieving the following objectives:

1-GIS

- Identify vulnerable and high risk areas
- Description of time evolution of monitored a
- Management of protected areas

2- Documents and Processes Management:

- Real - time data processing
- Data Analysis/ Auditing / Validation /
- Redundant information reduction

3- Analysis and simulation system:

- Reports/Statistics
- Notifications/Alerts

Monitorizare habitat

Vegetatie anuala de-a lungul tarmului


Descriere habitat
Nisip marin de origine biogena, in general grosier; dune joase de cca 0,5-1 m inaltime; acoperire mica sau medie a vegetatiei (30-60%), stratificare redusa.

Localizare habitat
De-a lungul tarmului in RBDD.

Specii habitat **Specii invazive** **Stare habitat** **Factorii de risc** **Fotografii** **Descriere zona**

Zona de monitorizare in care a fost identificat habitatele este Zona Sulina - Sf. Gheorghe. Zona se afla in regiunea biogeografica pontica.
Se intrestceataza cu urmatoarele situri protejate:
- ROSCI0065 - Delta Dunarii
- ROSCI0066- Delta Dunarii - zona marina
- ROSPA0031 - Delta Dunarii si Complexu Razim Sinoe
- ROSPA0076 - Marea Neagra
- Rezervatia nationala Vatafu Lunguletu

Zona de monitorizare Sulina - Sfantu Gheorghe



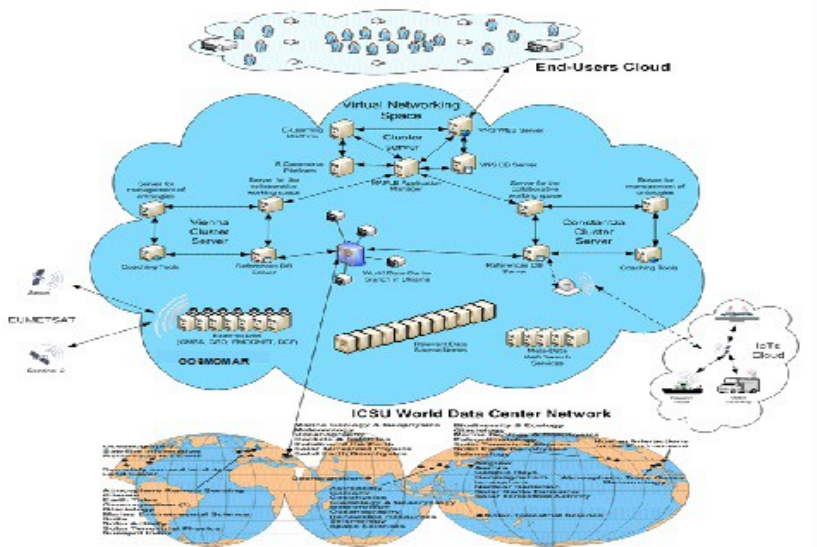
Legenda

	Zona de monitorizare Sulina - Sfantu Gheorghe		Arii protejate SPA ROSPA031		Arii protejate SCI ROSCI0065
	Rezervatii nationale		ROSPA076		ROSCI0066
	Regiuni biogeografice				ROSCI0068

“Constanta Space Technologies Competence Centre Dedicated to the Romanian Marine and Coastal Regions Sustainable Development”
Acronym: COSMOMAR

(Programme for Research-Development-Innovation for Space Technology and Advanced Research - STAR)

- Testing equipment / start the pilot studies
- Connection with RO-NODC and activities / services provided by COPERNICUS



- start of the Centre
 Arrangement/construction/renovation

Using of AUVs







Conclusions

- Romanian coastal area is confronting with a significant issues toward European WFD/ICZM/MSPD's Implementation and also:
- Implementation of the national coastal law/ICZM rules and regulations

Erosion control

- In the near future, the implementation of the conservation-rehabilitation measures outlined by the Masterplan for the erosion control/dredging activities

WQ – monitoring

- Developing a monitoring-modeling-management systems/tools for WQ control
- ❑ improved data validation
- extended coverage area for *in-situ* measurements through common cruises (future collaboration with other institutions)

collect discrete samples (spatial and temporal) – when is possible

- ❑ better use of GIS&RS products: web application support/WMS
- better dissemination (more papers based on these data)
- use data in more national and international projects
- use data in other research areas (i.e. fisheries, marine ecology)
- assimilation of technology of processing and delivery

Conclusion – cont.

- The CZ's ecological & physical condition: not optimal for the ecological integration, and it is crucial to consider the ecosystem based practices for Romanian BSCZ
- **Implementation of WEB-GIS** to support CZ/ICZM policies has great socio-economic importance for coastal stakeholders and contributes to the CZ protection and management, as well for the coastal delimitation/delineation policy and also contributes to the sustainable development of the CZ

7. Acknowledgments

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**THANK YOU FOR YOUR
ATTENTION !**

