GEO-CRADLE
Regional Workshop in Romania

"Constanta Space Technologies Competence Centre Dedicated to the Romanian Marine and Coastal Regions Sustainable Development"

Acronym: COSMOMAR

Speaker Name:

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National Institute for Marine Research and Development "Grigore Antipa"

May 9th 2017, Magurele

National Institute of Research and Development for Earth's Physics (NIRDEP)

Coordinating organization: **National Institute for Marine Research and Development "Grigore Antipa", Constanta, Romania**

(NIMRD "Grigore Antipa")

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Collaborators organization(s):

UOC, S.C. ET Innovative Solutions S.R.L., INCDDD, UB-FG, UDJG

Collaborators (name and contact address)

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Short description of the project

The Project is proposing to develop an Competence Center having three main components/domains of activity.

The main component of the project COSMOMAR is to develop a multidisciplinary remote sensing center for the RS/marine&coastal surveillance center as a main tool of ICZM implementation (governance/decision making towards marine&coastal environmental conservation and protection) on the Romanian coastal zone.

The second component of the COSMOMAR center consists in the development of a dedicated facility for assuring clean room conditions for the development of devices and experimental set ups for spatial applications, related to advanced fuel cells and electrochemical devices for outer space missions, biotechnological research projects dedicated to the identification of new properties, processes and materials using the biological, biochemical, and biophysical reactions in low gravity conditions.

The third component of the proposed center consists in capacity building and organizational development: the selection, training and certification of experts and consultants to assist the companies from the region specialized in manufacturing or EOS services for integration in the programs coordinated by ROSA or ESA.

Objectives

1. **Development of a research infrastructure facilitating the cooperations and networking within coastal stakeholders, on Remote Sensing and Space applicability research projects;**

2. **Competences development and capacity building which will enhance the consultancy and expertise towards accesing research programs at ESA s excellence standards;**

3. **Dissemination of the knowledge and opportunities in the spatial research domain, trough an interactive website designed as an informational node for coastal stakeholders as well for private enteprisses from the reagion;**

4. **Promotion of an innovative, original research results, products and technologies realized in the space industry by the regional institutions and firms, (as well the knowledge and technology transfer to them), twoards them integration in ESA projects and programs.**

5. **Encouraging young people from high schools and universities to address the knowledge in the field of space, as well to promote career planning in space research, environmental education and awareness.**

6. **The development of a dedicated facility for assuring clean room conditions for the development of devices and experimental set ups for spatial applications as advanced fuel cells and electrochemical devices for outer space missions, biotechnological research projects dedicated to the identification**

Human resources involved

Interdisciplinary team formed by:

5 physicists

7 engineers

2 geographers

1 biologist

Collaborators, representing four institutions from Constanta, Galati, Tulcea and Bucharest:

UOC, S.C. ET Innovative Solutions S.R.L., INCDDD Tulcea, UB-FG, UDJG,

two retired specialists

mean age: 48 years

Start date of the project / End date of the project: **11.2013 / 11.2018 (60months)**

Work plan of the project

Work Packeges

WP1: Project Management

WP2: COSMOMAR infrastructure development

WP3: Human resource development

WP4: Pilot projects developments in the Competence center framework

WP5: RS technologies and its applications for consultancy capacities enhancement, educational and dissemination activities

Milestones

M1 = WP1+WP2

M2 = WP1+WP2+WP3+ WP5

M3 = WP1+WP3+WP4+WP5

Tasks/Phases and milestones.

Task/Phases	Person-month	2014				2015				2016		2017			2018		
T1	50																
T2	65																
T3	63																
					M1				M2		M3			M2			M3
					I Progress Report →				II Progress Report →		III Fina Report →			Progress Report →			III Fina Report →

Implementation status of the project

2013: WP1, WP2

- **Design of the data and information flow**

- **Differentiating the function of the project participants / setting tasks and needs of staff and equipment to ensure the operational capacities of the competence center and Equipment acquisition**

2014, 2015, 2016, 2017, 2018: WP 1, WP2, WP3, WP5

- **Design and implementation of databases and related information flow of the competence center - COSMOMAR**

- **Grounding Studies on the development of activities related pilot projects, development of institutional cooperation activities.**

- **Testing equipment /pilot projects starting**

- **Assimilation coastal surveillance technology**

- **Infrastructure construction/arrangements, equipment installation and operators training, and connection to European NODC s network activities, dissemination and knowledge transfer**

Finishing the informatic infrastructure building /5 - rooms renovation and extension of Cosmomar's operational capacity by supplying of in situ measurements equipment and one powerful server

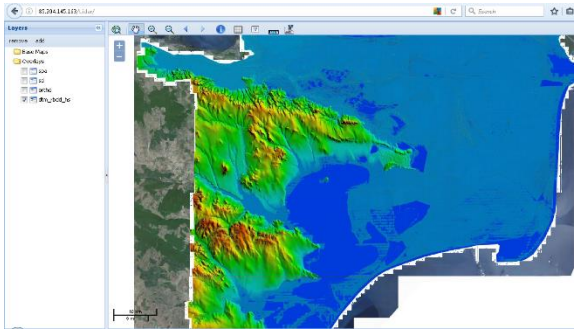
2017 and 2018 - in preparation : SUMMER /WINTER SCHOOL in UAVs applications

(for seniors researchers)

- Results

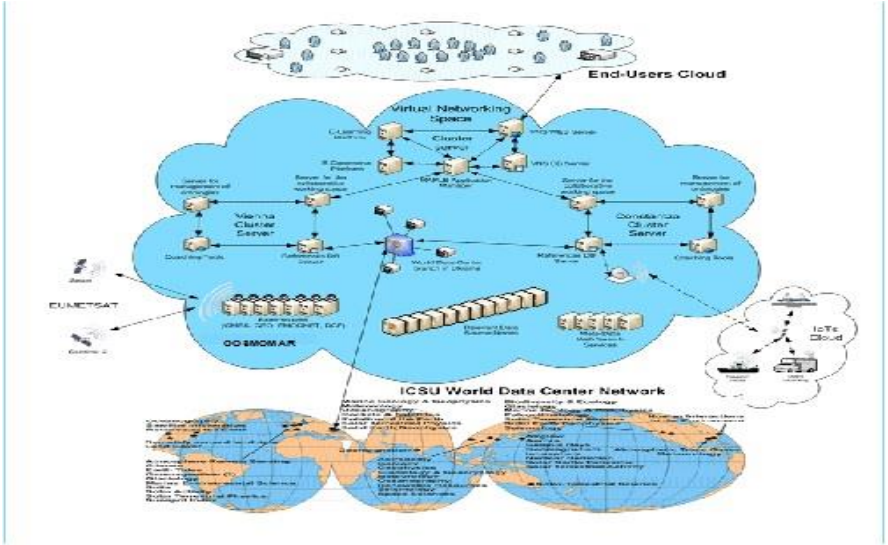
- **Implementing/Testing equipment ans informatic system&data portal / pilot studies finishing**

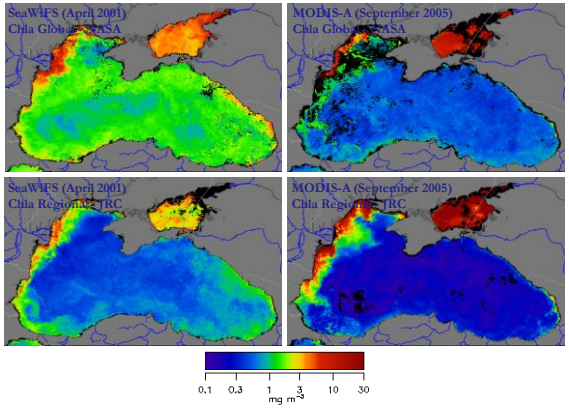
- **Connection with RO-NODC and activities / connection with EOS services provided by COPERNICUS/ESA within a marine forecast system based on MOHID Model**



- Finishing of the internet connection of the Center

www.cosmomar.ro
http://eism.geo-spatial.ro/cosmomar
http://85.204.145.163/Lidar/ (temporar address)



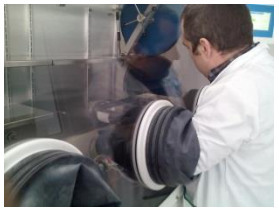


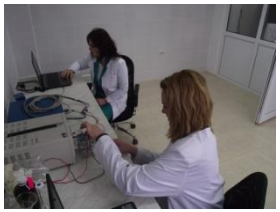
(Technology Readiness Level - present which is the TRL intended to be achieved till the end of the project; TRL4 to expected 5

Pilot Projects

started within COSMOMAR Compeetnce Center

1. Development of fuel cells based on urea and robust MEAs (Membrane Electrode Assemblies), helping to improve our knowledge in microbial fuel cell technology that will have several applications in the space sector.

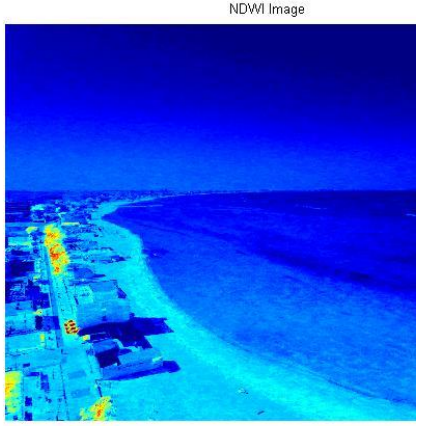


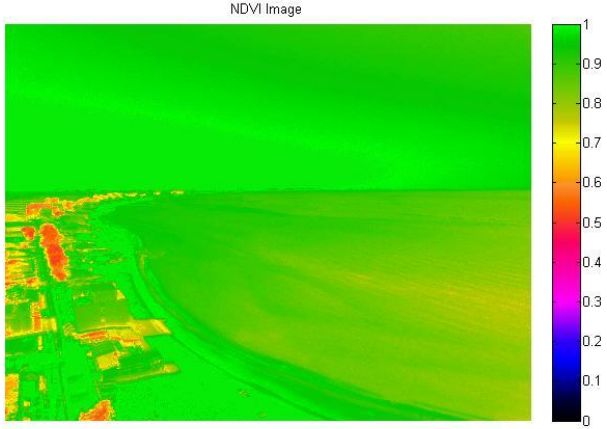


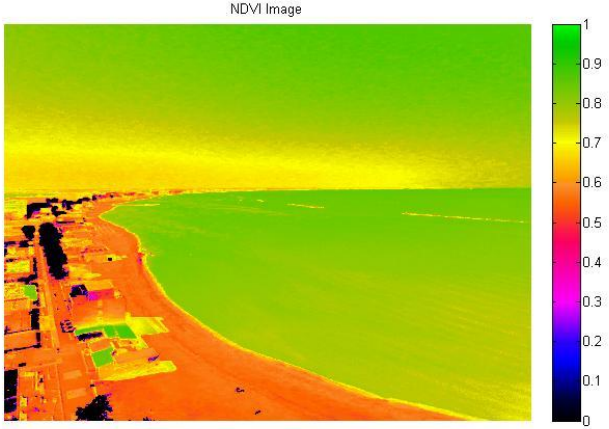
2. Development of facilities of "clean room" necessary to develop the devices and procedures for space applications.

3. Center Initialization related to the selection, training and testing of technologies monitorig/coastal surveillance remote sensing using AUVs/drones, in order to implement ICZM and MSP EU strategies

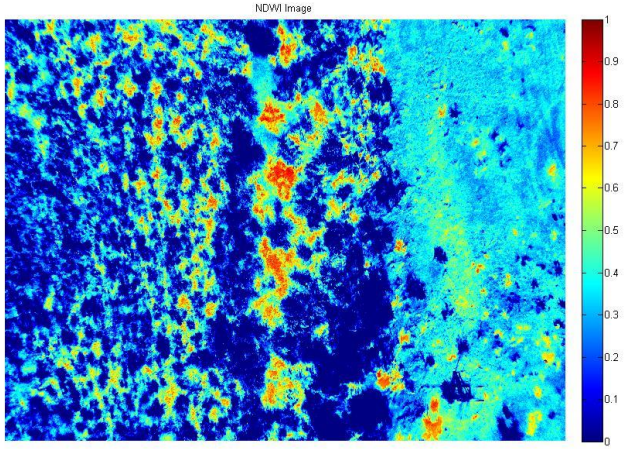
Aerial Spectroscopy: Coastal Vegetation and WQ studies

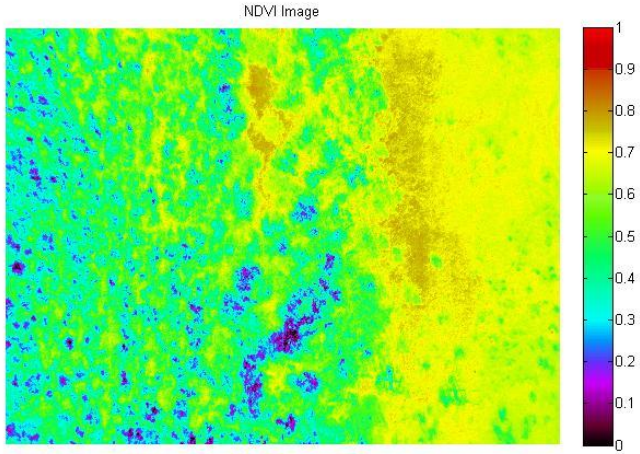


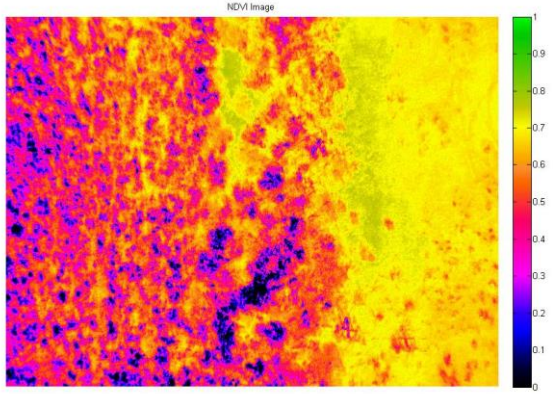


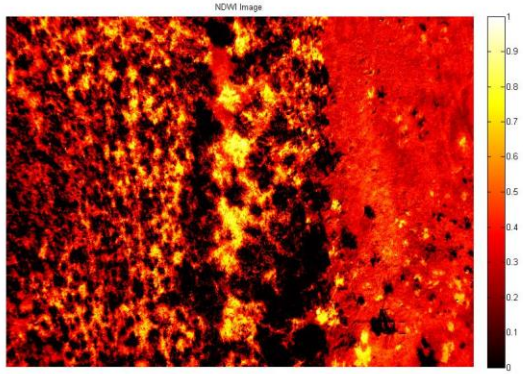


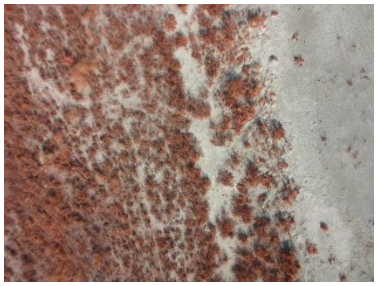
Coastal vegetation/macro-algae investigations by UAVs mapping and data analysis

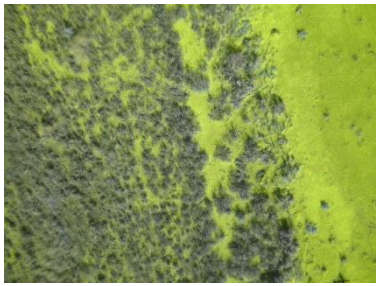


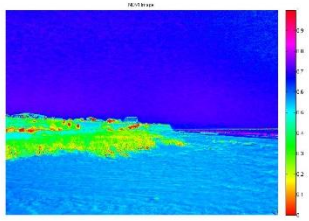




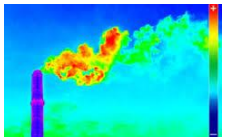


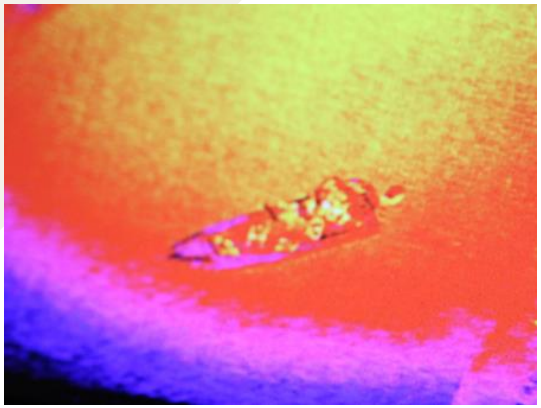


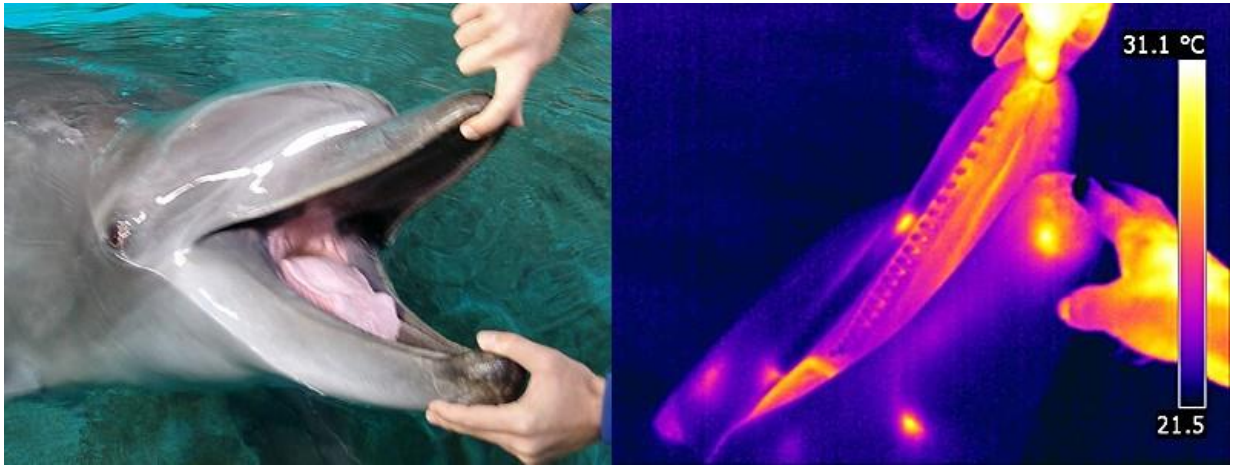




Thermal imaging by UAVs mapping and data analysis





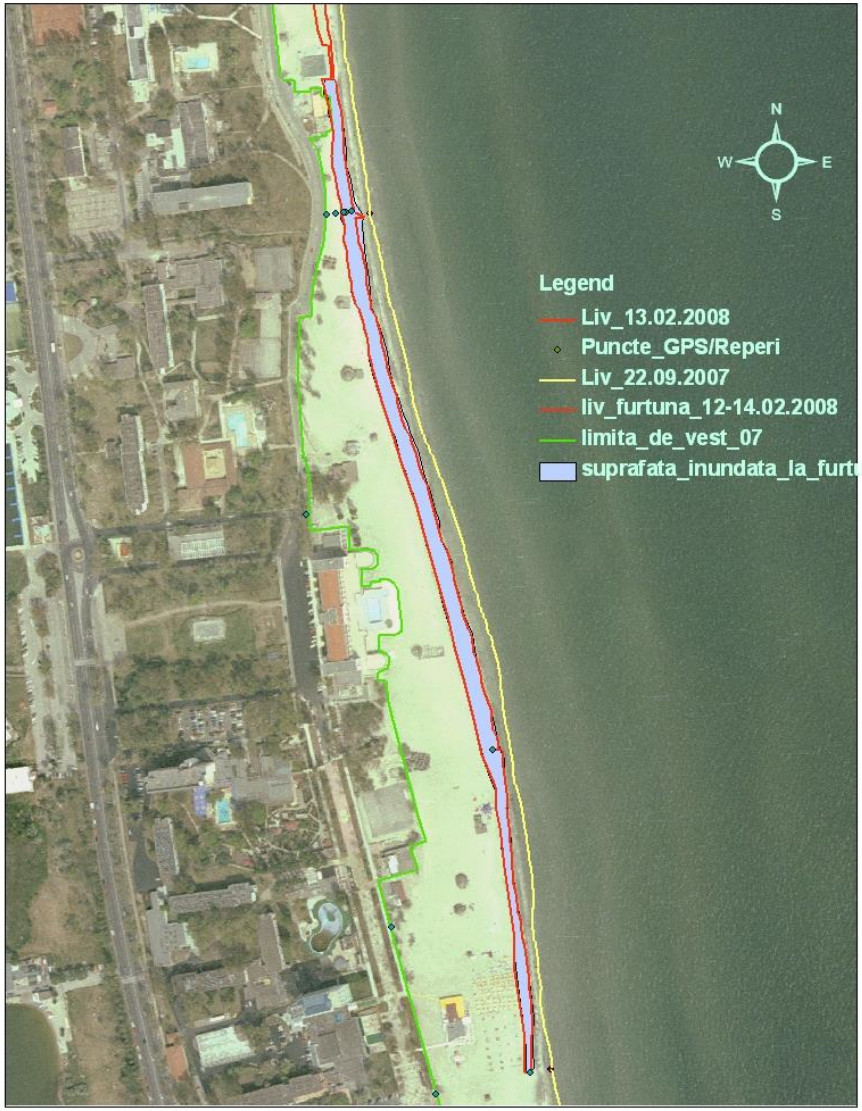


Mapping of the wave run-up marks after storm (for set-backs delineations)

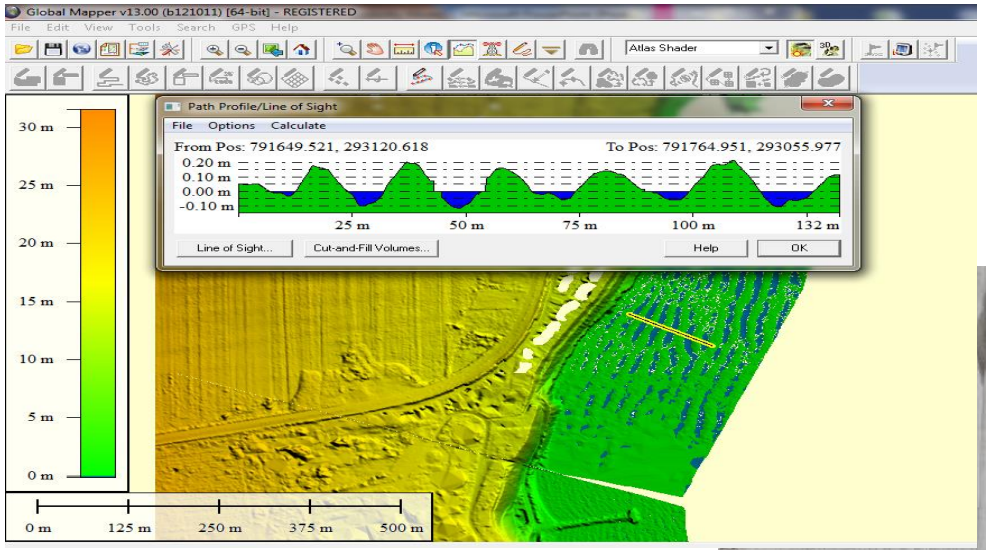
COASTAL DELINEATION STUDIES:

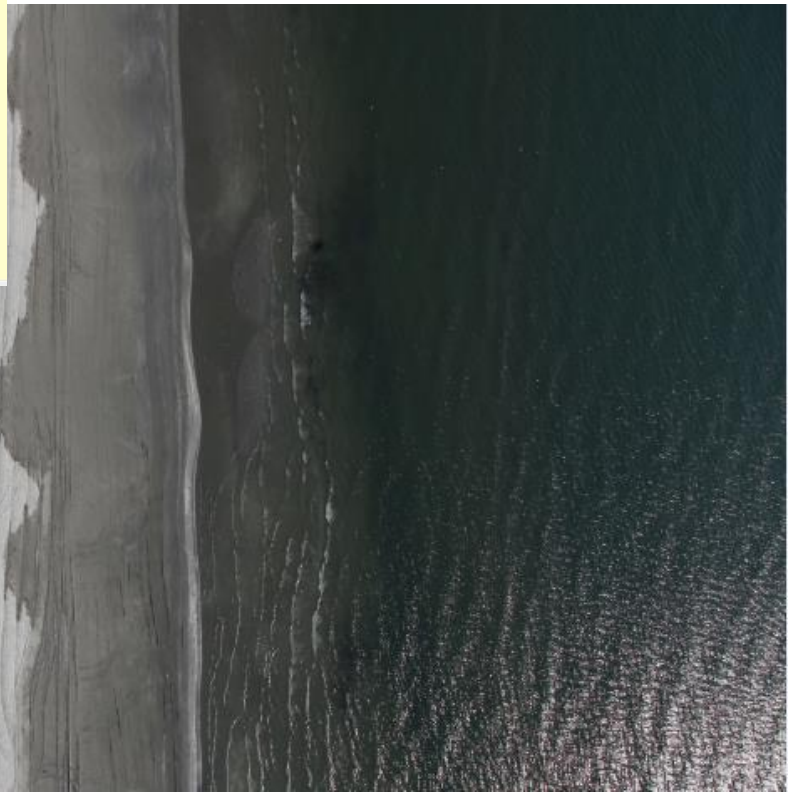
boundaries issues/setbacks

GIS Support for Experimental research on the wave run-up



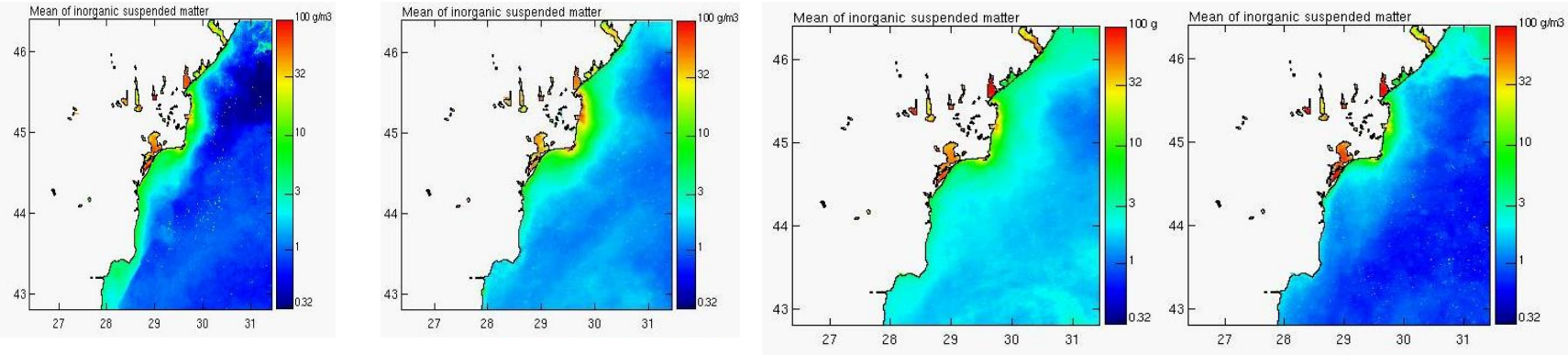
WAVES FIELDS INVESTIATION based on : sun-glitter vs. LIDAR





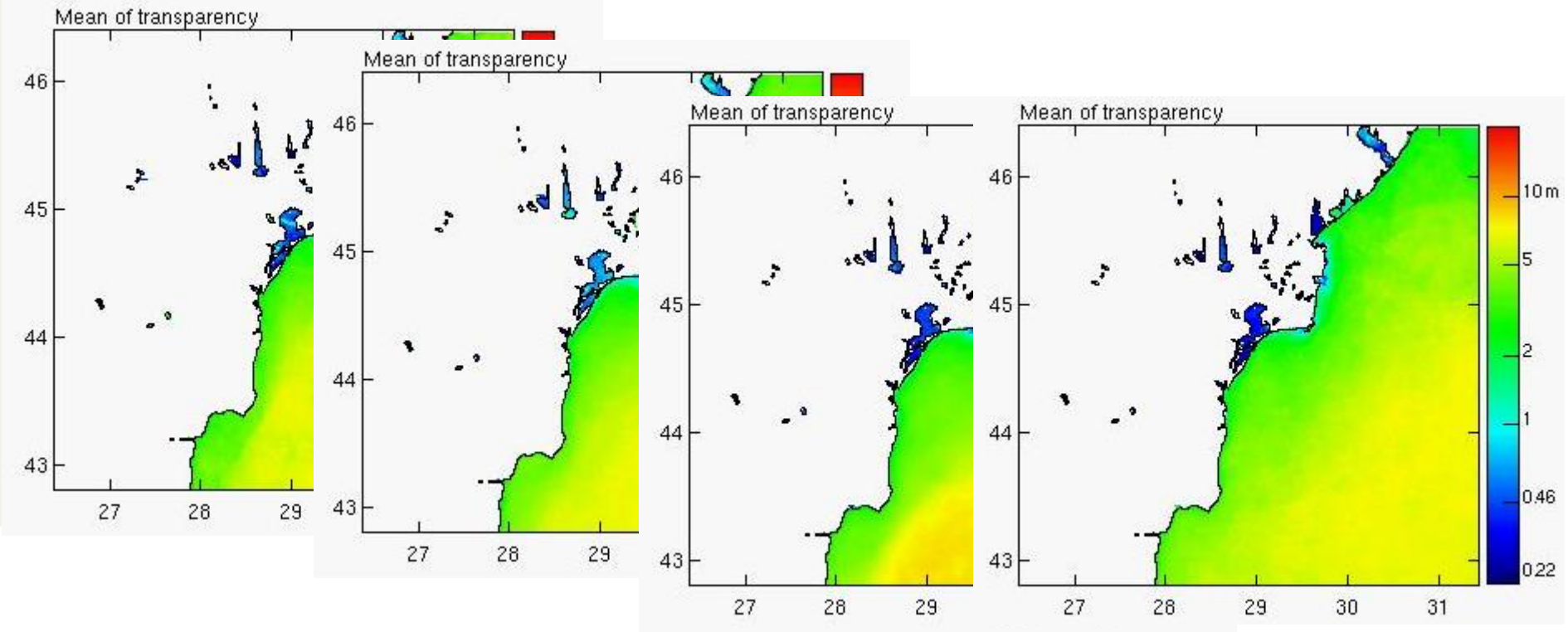
Season distribution of WQ Parameters based on Modis Aqua data

- MODIS Sea Surface Temperature
- MODIS Remote Sensing Reflectance
- MODIS Sub-surface Chlorophyll-a Concentration
- MODIS Diffuse Attenuation at 490 nm
- MODIS Particulate Organic Carbon
- MODIS Particulate Inorganic Carbon
- MODIS Fluorescence Line Height (FLH)
- MODIS Instantaneous Photosynthetically Available Radiation
- MODIS Daily Mean Photosynthetically Available Radiation



Inorganic suspended matter

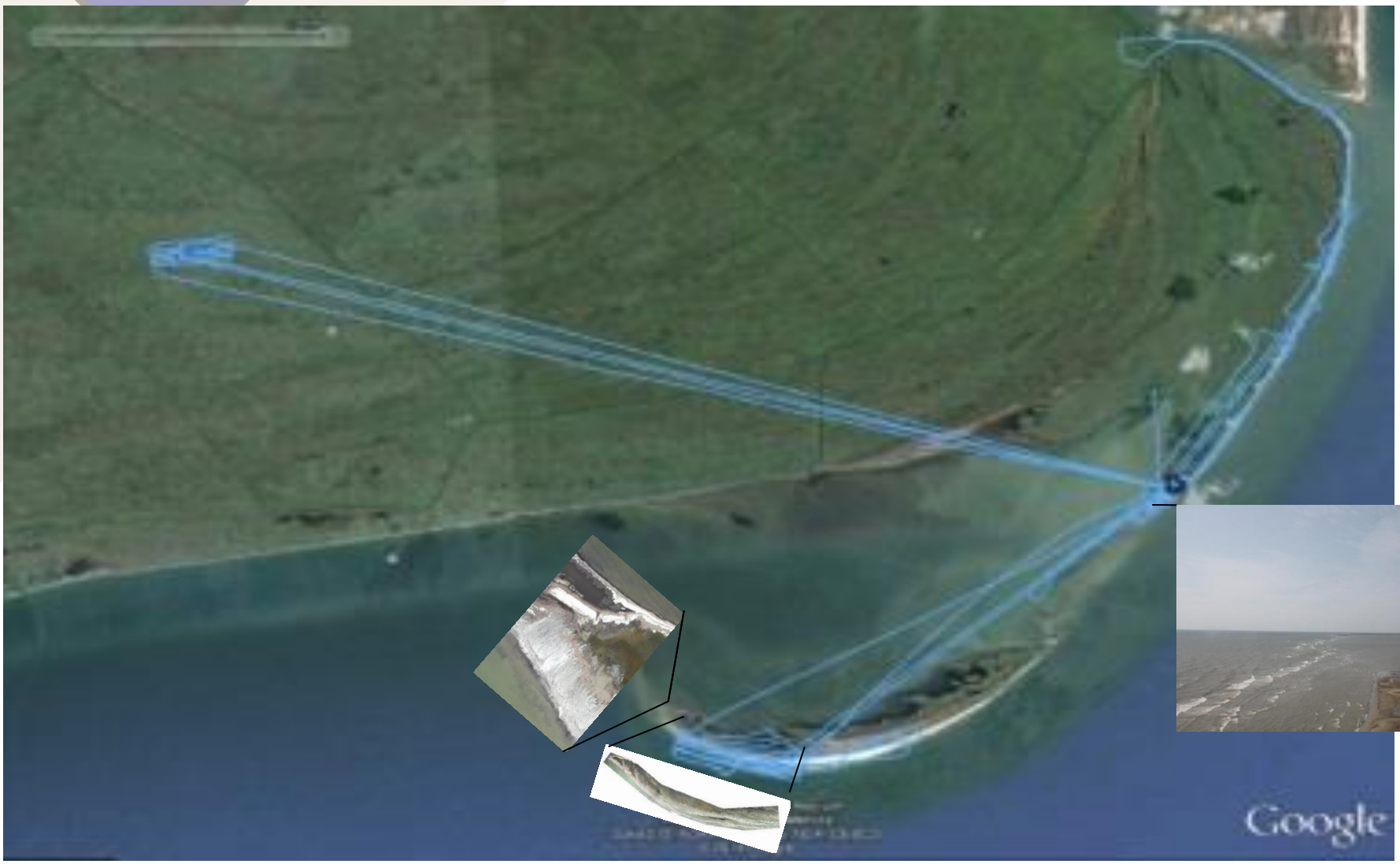
Seasonal distribution of WQ Parameters

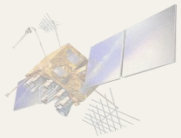


Transparency

Coastal survey using AUV / Octo_copter (12kg)

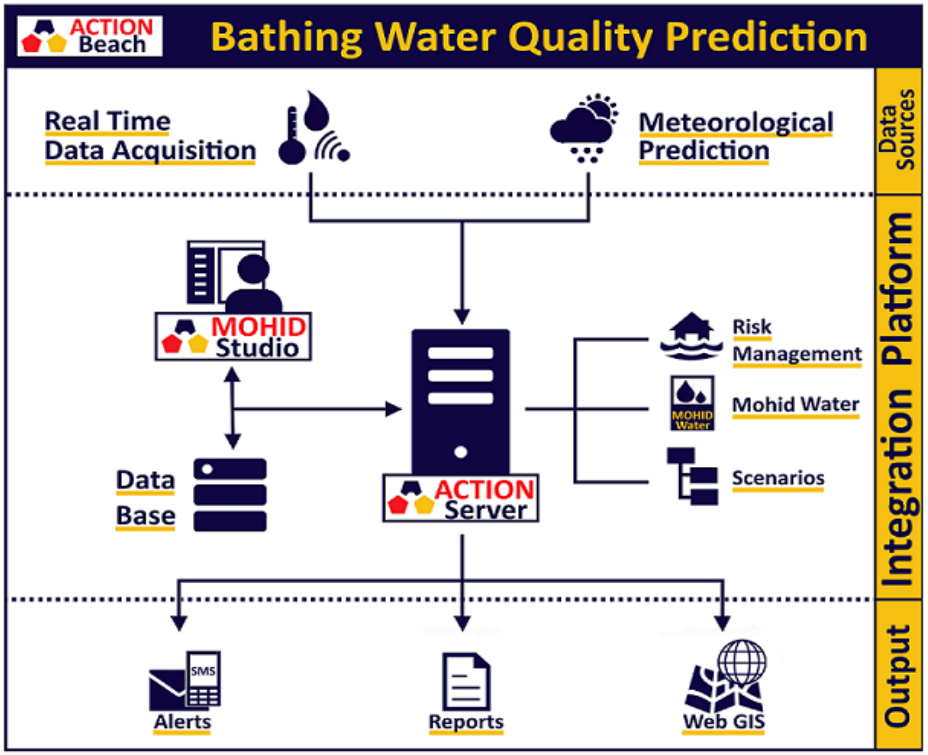
high resolution of orto-mozaics and DTM

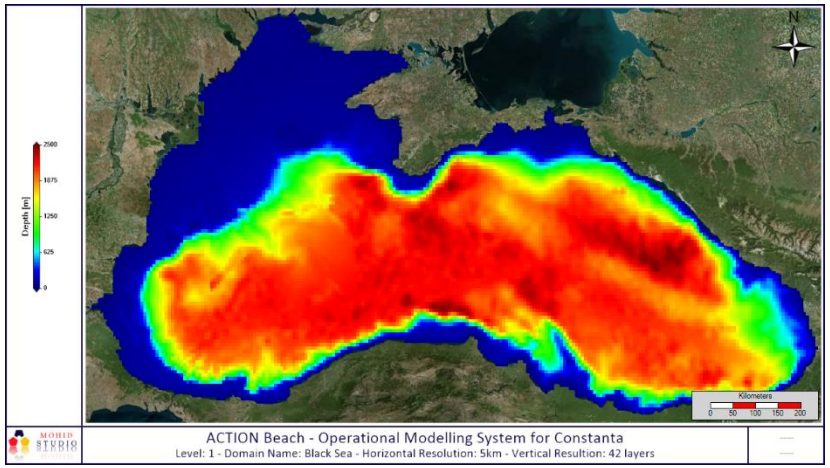


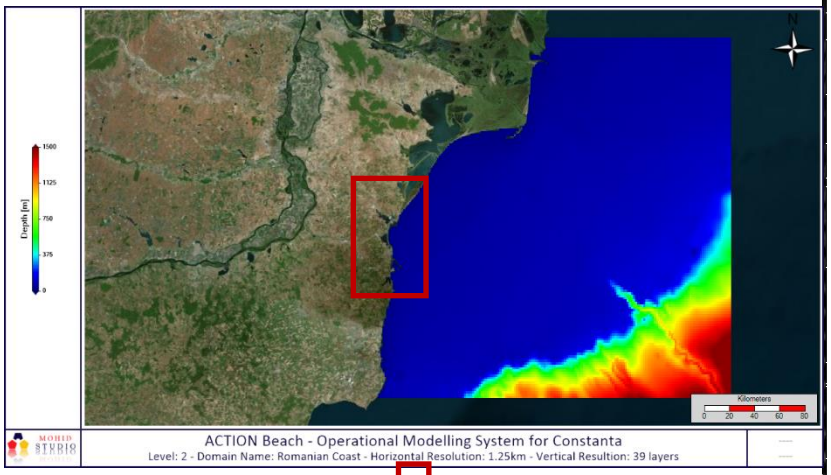


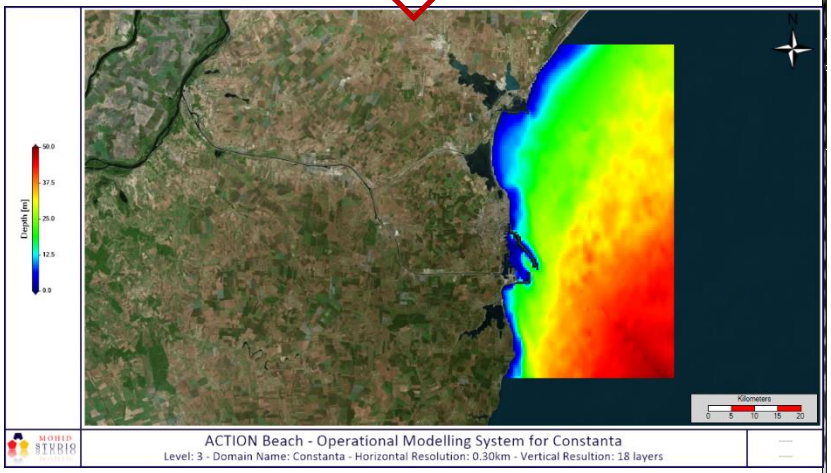
Hydrodynamic forecast system using Copernicus and GFS data

Hydrodynamic model – Approach





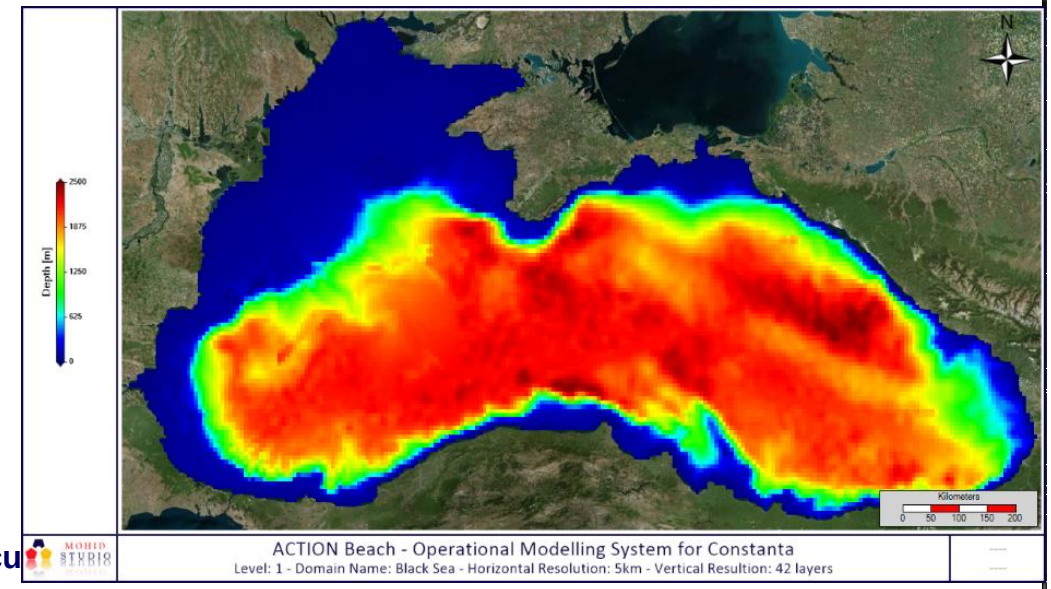




- **Level 1 - Black Sea**
- **Level 2 – Romanian Coast**
- **Level 3 - Constanta**

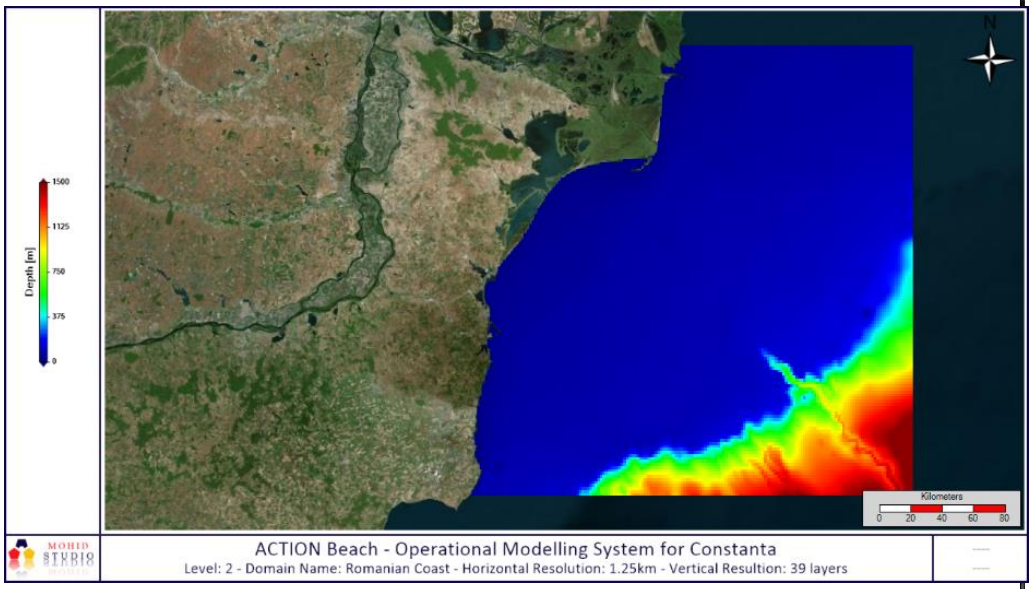
Hydrodynamic model – Level 1

- Level 1 - Black Sea
- Grid
  - Horizontal Resolution 5.0 km
  - 42 Vertical Layers (Cartesian)
- Hydrodynamics Forcing
  - Wind
  - Discharges
- Initial Conditions
  - Temperature & Salinity (Copernicu
- Boundary Conditions
  - Wind (GFS)
  - Heat Fluxes (GFS)
  - Discharges
    - Danube (3x)
    - Dnieper
    - Strait of Kerch (Don and Kuban)
    - Bosphorus (Surface and Bottom)



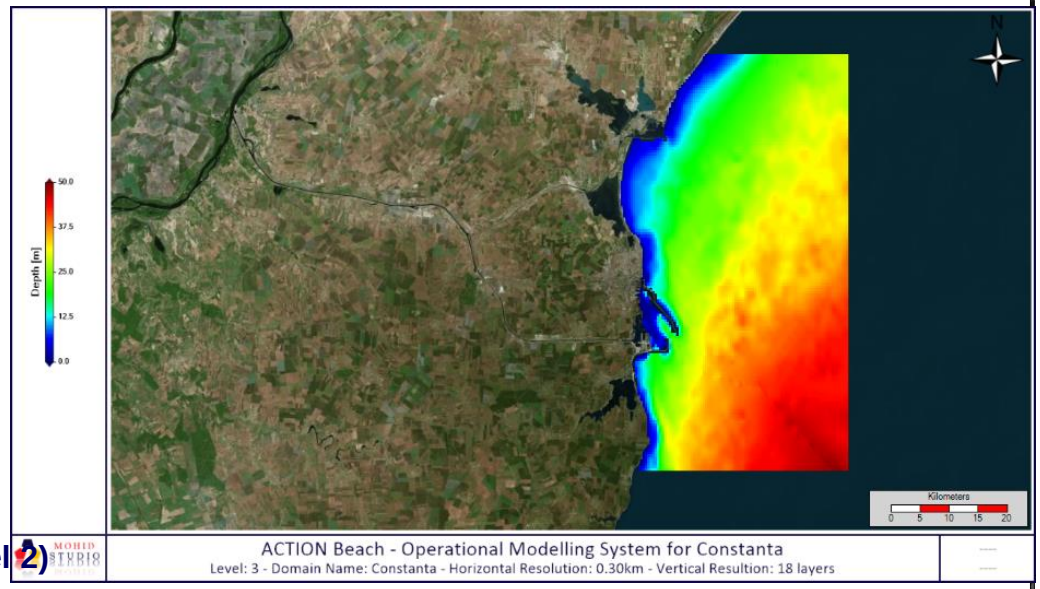
Hydrodynamic model – Level 2

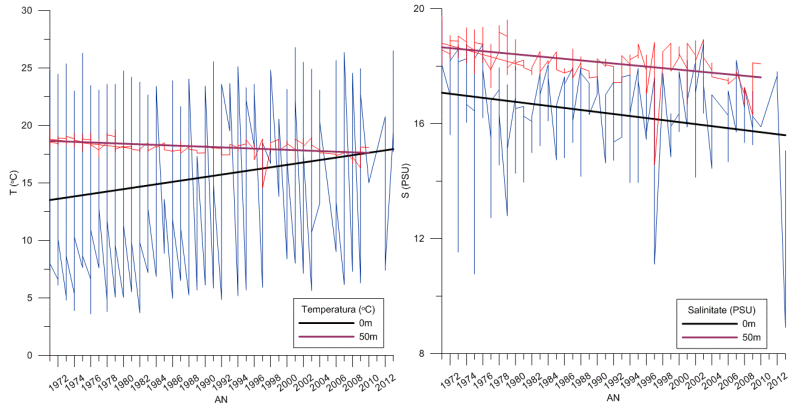
- **Level 2 - Romanian Coast**
- **Grid**
  - **Horizontal Resolution 1.25 km**
  - **39 Vertical Layers (Cartesian)**
- **Hydrodynamics Forcing**
  - **Wind**
  - **Discharges**
- **Initial Conditions**
  - **From Black Sea Model (Level 1)**
- **Boundary Conditions**
  - **Wind (GFS)**
  - **Heat Fluxes (GFS)**
  - **Discharges**
    - **Danube (3x)**
  - **Black Sea Model (Open Boundary)**



Hydrodynamic model – Level 3

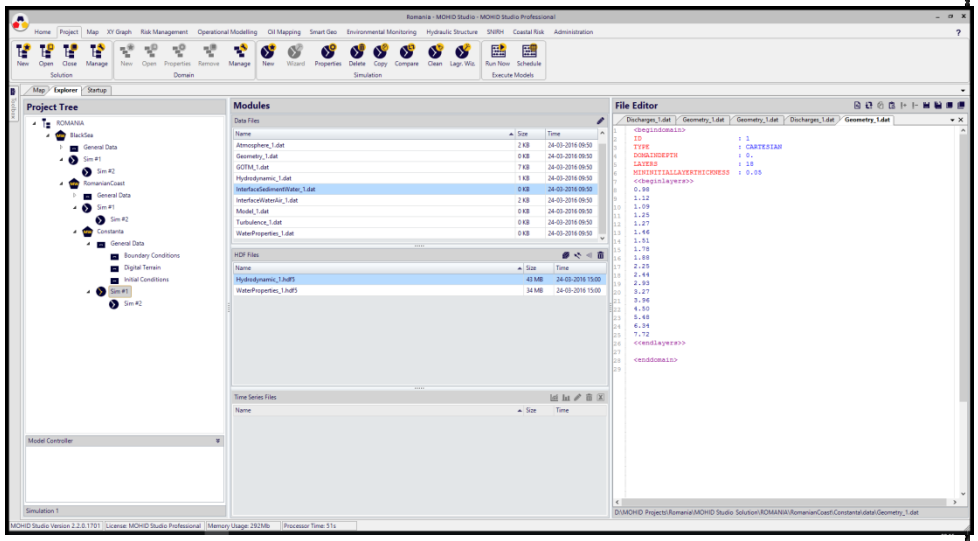
- **Level 3 - Constanta Coast**
- **Grid**
  - **Horizontal Resolution 0.3 km**
  - **18 Vertical Layers (Cartesian)**
- **Hydrodynamics Forcing**
  - **Wind**
  - **Discharges**
- **Initial Conditions**
  - **From Romania Coast Model (Level 2)**
- **Boundary Conditions**
  - **Wind (GFS)**
  - **Heat Fluxes (GFS)**
  - **Romanian Coast Model (Open Boundary)**





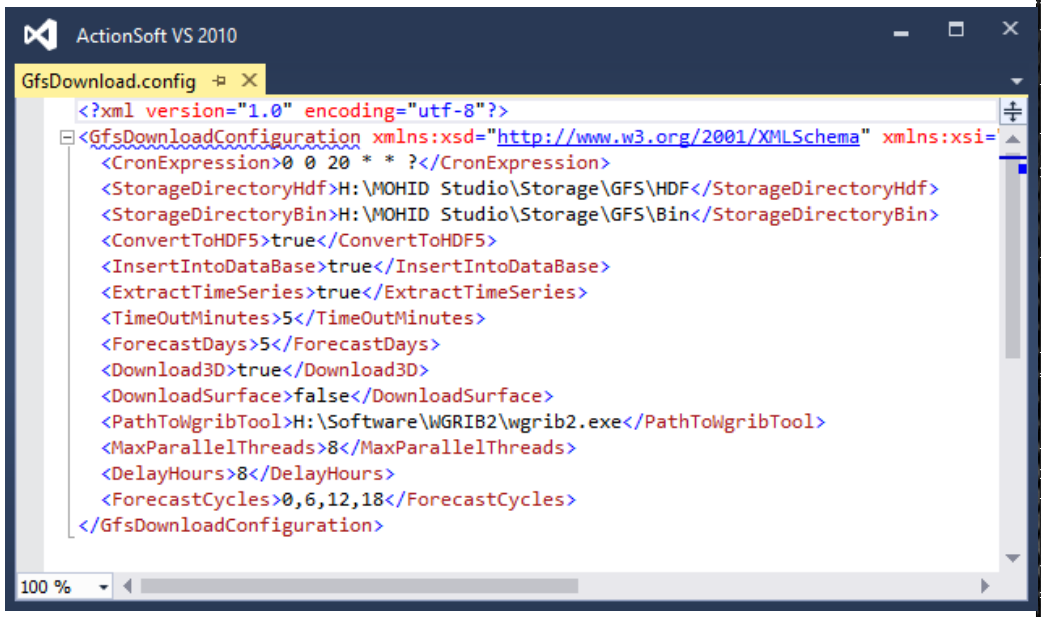
Hydrodynamic model - Configuration

- **Model Configuration Inside MOHID Studio**
  - **Workspace “Black Sea”**
- **Each Domain as 2 Simulation Templates**
  - **Sim #1 (cold start)**
  - **Sim #2 (hot start)**
- **Scheduling**
  - **Model Run every Night at 0h10**
  - **Cold Start**
    - **5 days Spinup**
    - **3 days Forecast**
  - **Hot Start**
    - **3 days Forecast**
- **Results**
  - **All Results are stored as HDF Files**
  - **Index in Database for further processing**



Boundary Conditions - GFS

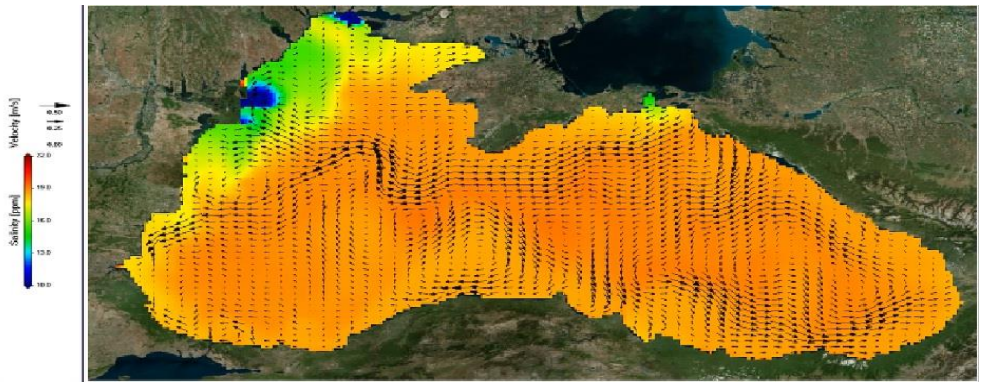
- **GFS**
  - air temperature
  - Solar radiation
  - Cloud cover
  - relative humidity
  - wind Velocity
- **Scheduling**
  - Every Day at 20h00
  - Forecast of 5 days
- **Results**
  - All Results are stored as HDF Files
  - Index in Database for further processing



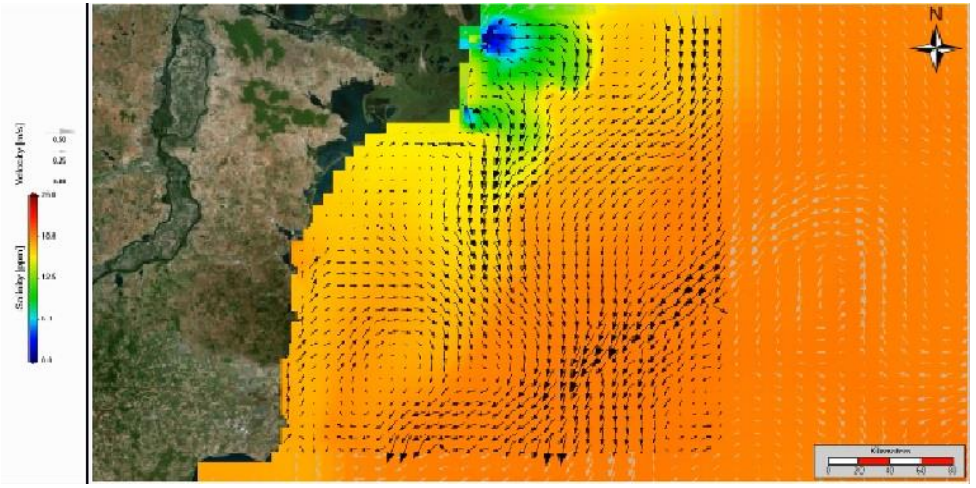
Initial Conditions - Copernicus

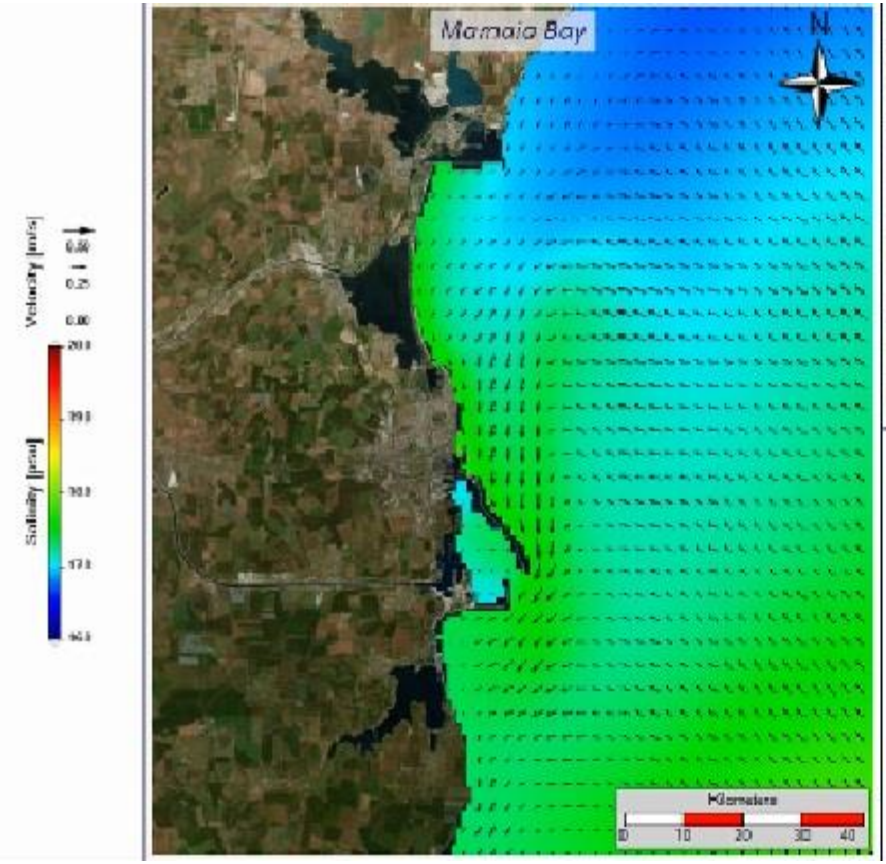
- **Copernicus**
  - **salinity**
  - **temperature**
- **Scheduling**
  - **Before any Cold Start**
- **Results**
  - **Converted to MOHID Specific Input Files**

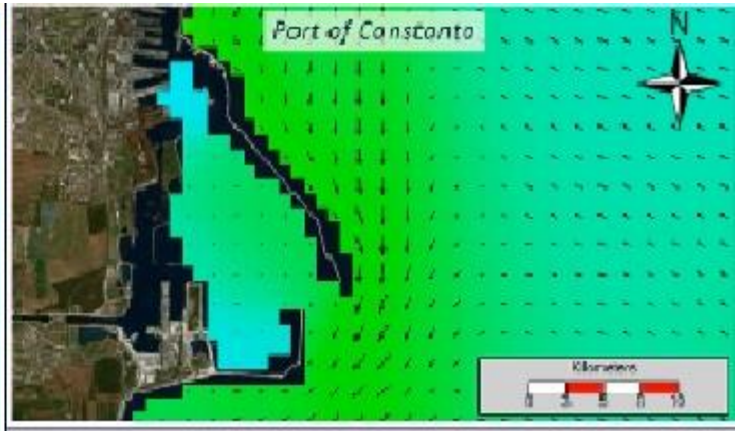
Results – Currents and Salinity

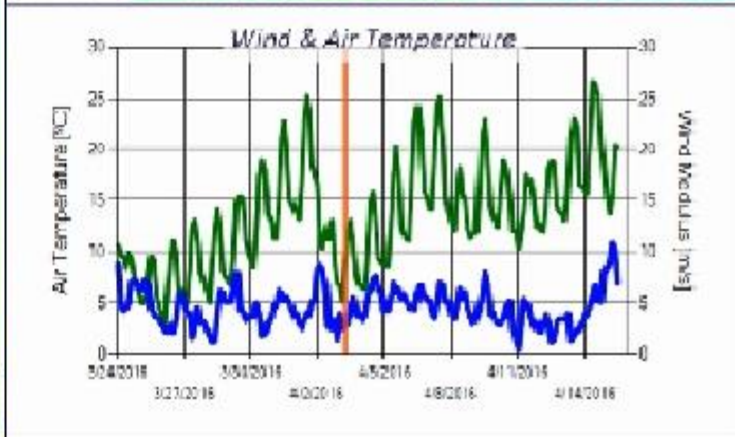


Results – Nesting









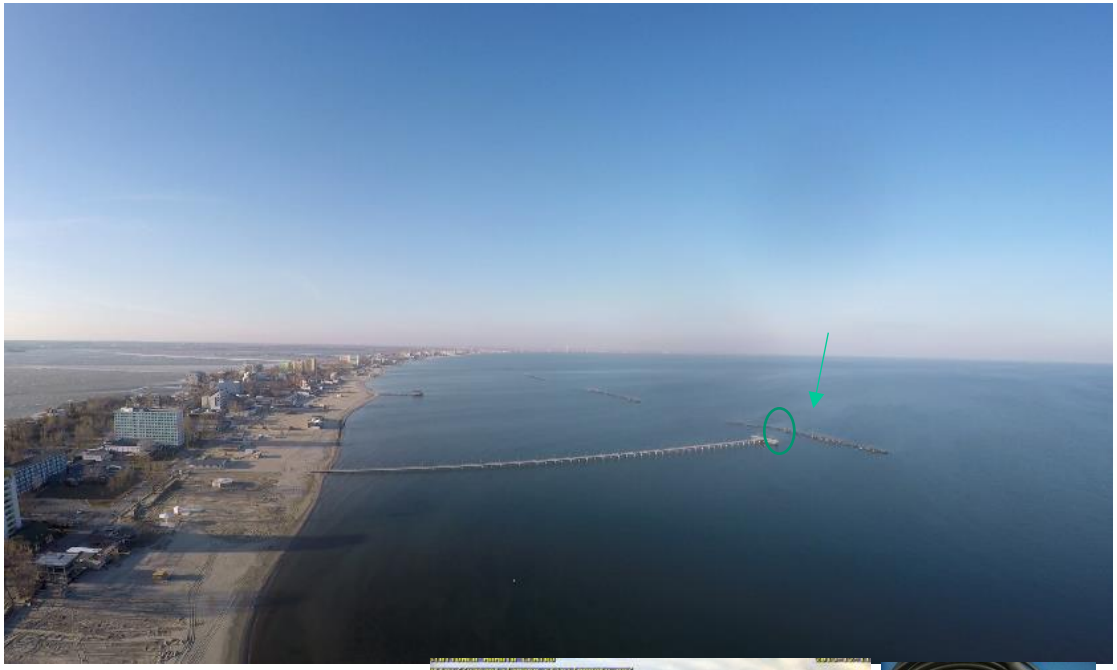
Ongoing project of Cosmomar: ISWIM integrated Service for Water Quality Monitoring in Mamaia bay

31-UU-DO-CMEMS-DEM1 - Lot 11

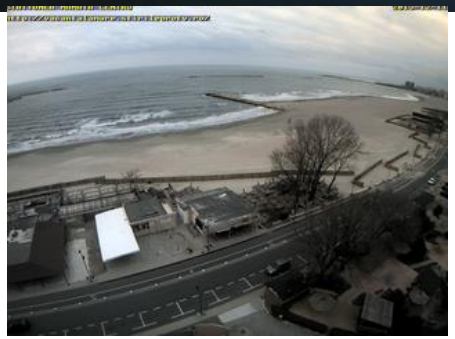
PROMOTION OF DEMONSTRATIONS OF CMEMS DOWNSTREAM SERVICES

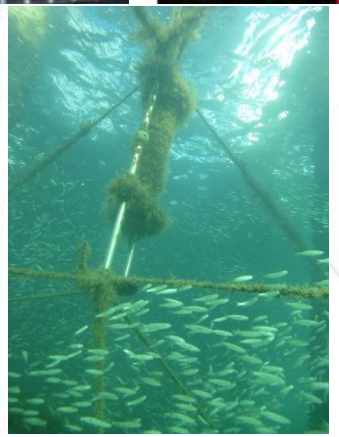
- **In-situ data (buoys, meteorological stations, webcams)**

http://www.rmri.ro/Home/Products.MamaiaStation.html?lang=en





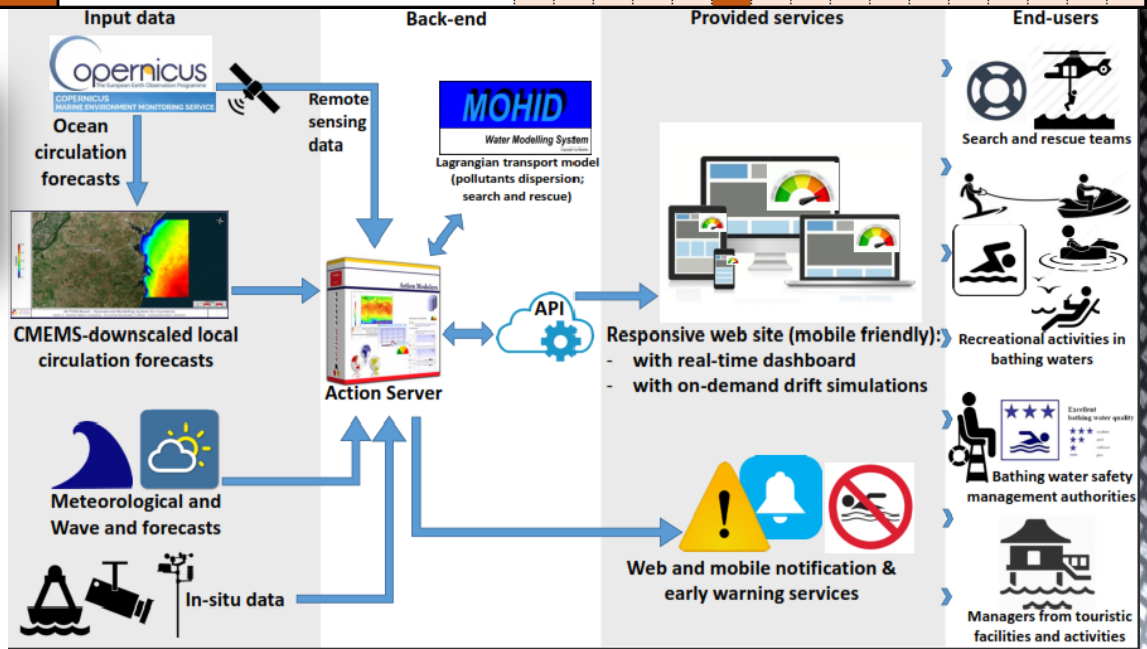



iSWIM - integrated Service for Water Quality Monitoring in Mamaia bay

- **4 Activities**
  - **Activity 1: Coordination and Management**
  - **Activity 2: Management of Water quality forecasts and in-situ data**
  - **Activity 3: Website for data visualization, drift simulations & model validation**
  - **Activity 4: Communication**

Activity	Deliverable/Milestone	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	18
1	D.1.1 Mock-up of the web page dedicated to the services																
	D1.2 A full descriptive report																
2	D2.1 Daily release of high resolution operational local forecasts																
	D2.2 Report with implementation details and validation aspects																
3	M3.1 End-user surveys related with beta-testing																
	D3.1 Release of the iSWIM mobile-friendly webpage																
4	M4.1 Organization of small local roadshow																
	D4.1 Communication plan																
	D4.2 iSWIM logo																
	D4.3 iSWIM leaflet																
	D4.4 iSWIM poster / rollout																
	D4.5 A hyperlink, pointing to a dedicated web page																
	D4.6 A report with the annual statistics on users of the service presented																
	D4.7 A letter will be sent to the official representatives of Copernicus programme designated by the Member States																
	D4.8 "Use case" form																



COLLABORATION ON SATELITE DATA PROCESSING

On geological survey of mining sites, old dumps, tailings and por

EFTAS Remote Sensing Transfer of Technology based in Münster i

of Germany's leading service providers for:

Aerial photo interpretation/Satellite image analysis

Digital Photogrammetry/Geographic Information Systems

Training/Consulting and system maintenance

Remote Sensing, i.e. the acquisition and analysis of aerial photos

and satellite images is EFTAS core business. Since setting-up the

business in 1988 as one of the first of its kind in Germany the aim was to extract the maximum image information not only from aerial

photos but also from satellite images. EFTAS offers not only the acquisition of data according to your needs, but also the implementation of custom-made management software. In the form of Geographic Information Systems they are tailored for the management, analysis and visualization of remote sensing data and other geodata.

CONSULTANCY and COLLABORATION ON MONITORING OF THE WATER RESOURCES IN THE DANUBE AND BLACK SEA REGION

- **EARTH DATA OBSERVATION CENTER FOR WATER RESOURCE MONITORING** operates a virtualised, distributed earth observation (EO) data centre, providing collaborative IT infrastructure for archiving, processing, and distributing EO data.

- COSMOMAR has initiated collaboration with EODC on Sentinel-1 and Sentinel – 2 Level 2A on-demand processing and value-added products.

- EODC partner and service provider BOKU maintains a **Sentinel-2 metadata catalogue for EODC archive exploration**. It allows queries for product, granules and image information.

- The data processing chain exploits the ESA Sen2Cor algorithm (currently version 2.2.1). Additional layers produced by this algorithm are available for download such as **Aerosol Optical Thickness, Water Vapor, Scene Classification Maps and Quality Indicators.** Products are available in JPEG 2000 format, at three different spatial resolutions (60, 20 and 10 m).

More details you can find at: https://www.eodc.eu/mission/

COSMOMAR BUSINESS ECOSYSTEM
- MEDGreen Cluster-

The purpose of Cluster MEDGreen is to facilitate and promote cooperation between enterprises, businesses research and educational institutions and other organizations, in order to contribute and support activities for the development of innovative products and services that are competitive both on the national and international markets, with high added value and to generate jobs and opportunities for the sustainable development of Medgidia city and the surrounding areas.

Main fields of activities

The development and implementation of projects financed with European and national funds, in order to develop and achieve cluster progress for the entities involved;

The promotion and development of public-private partnerships in the association's areas of interest;

To ensure dissemination of information on technological progress and continuous professional training for the cluster's members;

To conduct lobbying actions around governmental institutions in orfer for them to adopt the proper legislation for the fields where the cluster is active;

Support and promotion for the establishment of megaclusters (clusters of clusters) and networks of successful companies in the European Union;

Support and promotion of research activities and innovation for the economic agents in the area, facilitating the transfer of policies, management procedures and advanced technology.

More details about Cluster MEDGReen can be found at: www.medgreen.eu

RO-CEO
Romanian Cluster
for Earth Observation

- ROCEO Romanian Cluster for EO -

The main goal of RO-CEO project is to establish the Romanian Cluster for Earth Observation, by mobilizing the most relevant capacities and expertise in the field, which are available in Romania now.

The main roles of the Romanian Cluster for Earth Observation :

•to promote (to ESA and other space-relevant organizations) the specific interests and relevant capacities at national level, and attract more investments and contracts for the Romanian institutions;

•to improve the provision of services to end-users by joining complementary skills and expertise;

•to ensure the sustainability of the EO sector in Romania by enabling EO market development.

We intend to build on existing capacities and achieve a critical mass of organizations joining the RO-CEO cluster and boosting the development of EO activities in Romania, as well as promoting the use of EO data in different sectors of the economy.

As such, before starting the clustering process, we need to:

•identify and valorize relevant competences and infrastructures able to contribute to ESA's Earth Observation missions (science feeders, hardware and software developers, service and data providers);

•improve the networking capacity, collaboration and joint initiatives of the Romanian players in Earth Observation;

•develop a coherent and practical agenda to foster and support inter and intra-sectorial cooperation in the field of Earth Observation.

More details about ROCEO can be found at: www.ro-ceo.ro

COUNSELING AND ADVISORING FOR POTENTIAL ESA CONTRACTORS

The were identifie the following companies that will be counseled to register in the ESA Potential contractors, under EMITS Invitation To Tender System (http://emits.sso.esa.int/emits/owa/emits.main) to be eligible for participation under ESA Open Invitations To Tender:

IT Technology: GMB Computers started its activity in 1991, to promote New Technology were the ingredients which, together with perseverance and professionalism lead to the existence, today, of a strong, healthy, professional and trustworthy company.

Electronics and automatization: Monsson Alma is the largest Monsson Group company, which has developed and constructed wind projects in Romania since 2004. With more than 10 years of experience, with 500 MW projects already in operation, Monsson Alma offers a unique opportunity to invest and operate wind farms on the Romanian wind energy market, one of the most attractive markets world-wide.

Industrial manufacturing: Microplasma is a well-known privately-owned enterprise established in 1992 with a rich experience in metal manufacturing industry. Microplasma is nowadays a leading industrial enterprise among top similar Romanian competitors.

Lessons learned

To avoid the risk of not achieving the project objectives has been developed since the project proposal stage of the project implementation strategy. Risks associated with project development and coordination activities are related to risk management activities / vulnerabilities in project implementation, the plan contingency measures, consideration of possible corrections in connection with project management and the associated quality assurance system

Providing risk management is done by:

- Control the timing of activities and the performance stages
- Cost Management
- Quality Management
- Resource Management (with great attention paid to human resources available in the areas of expertise to the project)
- Communication of results / difficulties in the Project activities: drone changing use regime–> **new law for AUVs (for 2kg equipment)**, new assurance policy requirements (compulsory), which encompass new costs/ changing of equipment/differentiating commercial activities than scientific activities

COSMOMAR's contribution to the goal of the STAR Program

The project involves the implementation of modern equipment, technologies and automated methods for measuring in situ coastal processes / nearshore and offshore, as well as new approaches to process / validate of RS data, as well analysis and assimilation into the modeling system incomplex multi-level interaction, with the support spatial analysis software, RS / GIS.

Implementation of remote sensing techniques in the study of specific coastal processes :

it will be monitored at the synoptic/local coastal scales the hydro -bio- geo-morphological processes, under the double aspect of the direct interaction of hydrological and bio-geo -morphological, and indirectly, in relation with the impact on CZ socio-economic activities, aiming at effective management of risk, based on remote sensing data, especially on the vulnerable areas / economic interest , tourist / fishing / and navigation .

Thus Project results can be transferred to potential beneficiaries / stakeholders in the Romanian coastal zone as scientific support decision making on the selection of protection and conservation solutions

Beneficiaries and potential outcomes associated application in the economy:

Local authorities , the National Council of the Coastal Zone (CNZC) Ministry of Environment and Forests (MEF) , the Ministry of Regional Development and Tourism , Ministry of Transport, Universities / Research Institutes , Environmental Protection Agency , Administration / Kings State : APC , ANR , NARW / ABADL , DHM , ONGs.

Context and contribution to ESA Programs

At the stage of development, COSMOMAR is accessing the ESA programs / activities in connection with COPERNICUS/ESA (EO and forecast systems), by pursuing development objectives of the project, aiming to precise monitoring of the coastal environment, based mainly on satellite data validation through comparison with in situ measurements, and respectively achievements toward the development of local bio-optical algorithms for RS image processing, and the development of the operational mapping and classification of water masses according to their bio-optical properties in accordance with the protocols MODIS AQUA, and near-future, SENTINEL 3.

Conclusions

Although it has a broad spectrum of RS & space technologies development activities through its components, the COSMOMAR Competence Center is functional/ materialized as entity within the NIMRD Constanta. CCTS is developed through its extending project activities/new and existent work capacity and research infrastructure, and also by the its data and information flows/exchange that will be extended both internally and externally, through cooperative web platform of the RoNODC

Thank you for your attention!