

Creating products and knowledge for the Mediterranean



ΔΗΜΟΚΡΙΤΕΙΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΡΑΚΗΣ ΟF THRACE

AN OVERVIEW OF ODYSSEA PROJECT

PLATFORM VALIDATION AND CAPACITY DEVELOPMENT WORKSHOP : HYDRODYNAMICAL AND WATER QUALITY MODELING BASED ON THE MARINOMICA PLATFORM Wednesday-Thursday 14- 15 July 2021

> Prof. Georgios SYLAIOS Democritus University of Thrace gsylaios@env.duth.gr



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727277

What is ODYSSEA



ODYSSEA is a Mediterranean-focused research project funded by EU Research and Innovation Program Horizon 2020

- 28 partners from 14 countries (6 non-EU)
- 8.398 Meuros budget
- 54 months duration
- Starting date 1st June 2017
- Ending date 30th November 2021
- 932 PMs in total
- 118 researchers involved
- 7 Advisory Board Members

Horizon 2020



Horizon 2020 is the biggest EU Research and Innovation program ever with nearly €80 billion of funding available over 7 years (2014 to 2020) – in addition to the private investment that this money will attract.

Achievements: scientific breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market.

The EU Blue Growth Strategy DYSSEA

- Long term strategy to support sustainable growth in the MARINE and MARITIME sectors as a whole.
- Leads to achieving the Europe 2020 Strategy for Smart, Inclusive and Sustainable Growth.
- Recognizes that seas and oceans have great potential for innovation and growth.
- Considers the blue economy as a driver for Europe's welfare and prosperity.
- KEY ISSUES: Jobs and Sustainability

Marine Open Data





Data to Information





Water Temperature is 28°C

If Water Temperature is higher than 26°C for more than 5 days then 'HEAT STRESS" High probability of fish mortality

Data to Information





Mediterranean Challenges



Vulnerable ecosystems Overexploitation Pollution Climate change Extreme events Limited coastal protection



Images taken from UNEP/MAP MedQSR 2017



ODYSSEA is a user-centred project aiming to make Mediterranean marine data easily accessible and operational to multiple end-users, by

- harmonizing existing Earth Observing systems,
- upgrading operational oceanographic capacities,
- supporting EU policy implementation,
- improving interoperability in monitoring,
- fostering blue growth jobs creation, and
- opening participation to non-EU member states.

ODYSSEA Pillars







ODYSSEA as a platform

ODYSSEA is a system bridging the gap between operational oceanography capacities and the need for information on marine conditions from the community of end-users.

ODYSSEA's ambition is to develop an interoperable, fully-integrated and cost-effective multiplatform network of observing and forecasting systems across the Mediterranean basin, addressing both the open sea and the coastal zone.





The Marinomica platform



Marinomics could be a new interdisciplinary scientific topic involving the provision of digital marine data services from sensors development, models implementation, integrative platforms, Big Data collection and processing, product development, cost analysis, marketing, testing user satisfaction, etc.

Therefore, Marinomics is a multidisciplinary scientific topic adopting the novel approaches of Earth Big Data to provide Services within the concept of Blue Economy and Growth. Marinomics aims to improve decision-making and operations in the multitude of users operating at sea, protect the marine environment and support marine and maritime sustainable development.



The Marinomica platform



odysseaplatform.eu |@odysseaplatform



The Marinomica platform

Surface Salinity



odysseaplatform.eu |@odysseaplatform

9 ODYSSEA Observatories



Establish ODYSSEA Observatories to fill-in data gaps & increase spatial and temporal resolution

- A. North Aegean/Thracian Sea (Greece/Turkey),
- B. Gulf of Gökova (Turkey),
- C. Valencia's regional coastline (Spain),
- D. Northern Adriatic Sea basin,
- E. Arzew Bay/Stora Gulf (Algeria)
- F. Gulf of Gabes and Monastir-Kuriat Islands (Tunisia),
- G. MPA National Park Al-Hoceima (Morocco),
- H. Israel's coastline and
- I. Nile River of Freshwater Influence (Egypt).

What is an ODYSSEA Observatory ?



They are pilot facilities referring to an **ODYSSEA local partner** with the aim to:

- Identify, contact and inform potential users and stakeholders needing marine data;
- Promote and train scientists and users on Marinomica Platform
- Customize the dashboard of Marinomica Platform according to users' needs
- Have trained staff to operate numerical models for local forecasts on sea conditions
- Have trained staff to operate and maintain at least a sensor at sea located at the facility of an end-user
- Have special interest to 'sell' services and products to marine and maritime users through Marinomica platform

Marinomica Platform and ODYSSEA Observatories







The Models

- A prototype 'chain' of operational models will be developed,
- ✓ Link models to existing databases,
- ✓ Provide short- and long-term prognostic results,
- ✓ Manage risks and emergencies in coastal and offshore areas,
- ✓ Meet the requirements of various end-user groups,
- Report on parameters never previously reported,
- Models: 3D hydrodynamic (Delft3D), Wave (SWAN), Oil spill (MEDSLICK-II), Water quality (DELWAQ), Ecosystem models (Ecopath with Ecosim), Fish and Mussel/oyster culture population growth





The Models – Present Status





Mobile Monitoring Systems

- 2 SEAEXPLORER GLIDERS
- 3 sensor payloads:
 - ✤ Payload 1
 - Temperature, salinity, pH, dissolved oxygen, chlorophyll-a, turbidity, CDOM
 - Payload 2
 - ✓ Passive Acoustic Monitoring (PAM)
 - Payload 3
 - ✓ Temperature, salinity, microplastics







Mobile Monitoring Systems



Status Gliders Two CTD glider missions have been completed successfully in Thracian Sea

One PAM glider mission is currently in operation

One CTD + MPS glider mission in Morocco is prepared



Fixed Monitoring Systems





DUTH deployed a surface system near a mussel farm in Olympiada DUTH in collaboration with Energean Oil & Gas deployed a MSL Lander near an oil platform in N. Aegean Sea







We dealt with the problem of detecting seagrass presence/absence and distinguishing seagrass families in the Mediterranean via supervised learning methods. We merged datasets on seagrass presence and other external environmental variables, we develop suitable training data, enhanced by seagrass absence data algorithmically produced based on certain hypotheses

Fig. 10. Distribution of Salinity-December values per seagrass family.

Informing Sustainable Fishery Exploitation



Observatory	Catch	Troph	FiB	EcoInd	Overall
1. North Aegean/Thracian Sea				-	
2. Gulf of Gökova				-	
3. Valencia's regional coastline				-	
4. Northern Adriatic Sea				-	
5. Gulf of Arzew/Stora Bay				-	
6. Gulf of Gabes				-	
7. Israel Coastal				-	
8. National Park of Al-Hoceima					
9. Nile river region					

Comparison of the ecosystem status of all observatories concerning catch based indicators (Catch), trophic level (Troph), Fishing-in-Balance index (FiB) and ecoindicators from EwE ecosystem models (EcoInd) and overall performance (Green: good; Orange: intermediate; Red: bad)

odysseaplatform.eu |@odysseaplatform

Revealing Fish Species Distribution Dynamics



Apply AI and ML tools for Species Distribution Models



odysseaplatform.eu |@odysseaplatform



Habitat Mapping

29.75"N

25"E

11"E

10.5'E

28°E



61

25°E

IT'E

19.5"E

78°E

High resolution produced habitat maps depicting the probability of occurrence in the whole Mediterranean Sean for the eight commercial fish species

Bio-acoustics for Marine Mammals







Integrating MPS in glider





Integrating MPS in Surface Systems and Landers





Surface system







MPS pack

Lander

odysseaplatform.eu |@odysseaplatform

Historic Shoreline extraction



Semi-Automatic Classification Plugin (SCP) for QGIS



Landsat Image - Band 5



Classified Image (Land - Sea)



Raster to Vector





Extracted Shoreline

Coastal Erosion in Al-Hoceima Observatory





Wind Resource Assessment





Study area map and CMEMS grid discretization

The 6-hourly data of wind speed (eastings and northings) measured 10 m above sea level with a spatial resolution of 0.25° × 0.25° were retrieved from the Copernicus Marine Environmental Monitoring Service (CMEMS).



Density plots histograms of CMEMS wind speed data against wind data from on-site stations in Lemnos Airport

odysseaplatform.eu |@odysseaplatform

Wind Resource Assessment





Wind frequency roses at hub height over the study area.



odysseaplatform.eu |@odysseaplatform

Spatial distribution of the Weibull probability density function parameters at the hub level over the study area.

Wind Resource Assessment



Total annual wind energy content (in kWh/m²) at hub level, per directional bin, for all sub-areas.

Sub-Areas/	West Thracian	Central Thracian Sea	East Thracian	Lemnos	Dardanelles	Siggitikos/Mt Athos
Directional Diris	364		Jea	Tateau		Atilos
N	82	62	80	73	59	91
NNE	214	389	775	887	973	436
NE	435	664	1,256	2,256	2,206	1,308
ENE	222	238	262	353	252	556
E	60	47	30	42	32	96
ESE	60	15	9	19	14	45
SE	18	30	12	27	21	33
SSE	23	23	25	72	58	62
S	69	112	183	358	395	168
SSW	27	87	227	235	272	89
SW	42	26	52	56	61	40
WSW	14	14	21	29	22	34
W	9	8	6	13	7	21
WNW	16	9	5	10	7	24
NW	29	14	8	17	11	40
NNW	36	37	13	15	9	47
all	1,354	1,774	2,964	4,455	4,398	3,091

CC Impacts on Coastal Zone





Assessing Extreme Wave Energy Incident to Coast





Estimated Wave Energy from wind along the study shoreline for the South-Eastern bearing (135°) (Return Level: 25 years, Period: 2006-2030)

Estimated Wave Energy from wind along the Paggaion Municipality shoreline for the South-Eastern bearing (135°) (Return Level: 100 years, Period: 2060-2090).

ODYSSEA End-User Workshops



ODYSSEA partners developed activities to exchange experiences and collaborate with other European projects and initiatives in the Mediterranean Sea (e.g. <u>ENI SEIS II</u>, Maestrale, LAkHsMI, CLAIM, EuroSea, HiSea, COSPAR Panel for Capacity Building)



ODYSSEA Summer Schools ODYSSEA



odysseaplatform.eu

2nd ODYSSEA Summer School Oceanography and Fisheries in the Mediterranean Patitiri Village, Alonissos, Greece 2-6 September 2019



View of the main harbor (Patitiri Village) of Alonissos Island, Greece

Co-organized through ODYSSEA Project by:

School of Biology Department of Environmental Engineering Aristotle University of Thessaloniki Democritus University of Thrace



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 727277



ODYSSEA Training on the Platform





ODYSSEA

ODYSSEA's Main Message

ODYSSEA is a research project to create novel knowledge, services and products for the Mediterranean with a bottom-up approach (from local/regional to broad and general) to cover end-user needs from diverse marine and maritime sectors



Creating products and knowledge for the Mediterranean



THANK-YOU

Prof. Georgios SYLAIOS

Democritus University of Thrace

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727277

odysseaplatform.eu |@odysseaplatform