ODYSSEA

Creating products and knowledge for the Mediterranean

ΔΗΜΟΚΡΙΤΕΙΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΡΑΚΗΣ
DEMOCRITUS UNIVERSITY OF THRACE

ODYSSEA – REPORTING ON WP PROGRESS
III. OBSERVATORIES

RV1 Review Meeting, 13 February 2019, REA, Brussels

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DEMOCRITUS UNIVERSITY OF THRACE

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What is an Observatory ?

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- An Observatory is **a facility providing observations** (Wikipedia).
- Ocean observatories are **platforms for studying the ocean** and its fundamental processes in real time, while returning continuous streams of data and imagery back to shore-based researchers.
- They include **suites of instruments and sensors**, power supplies, computer command and storage capability, and Internet connections or other advanced communications systems. (Woods Hole).
- A few Ocean Observatories and observing systems are already in operation or under construction, while several larger ones are now being planned by universities and research institutions in conjunction with NSF's Ocean Observatories Initiative (OOI), the NOAA-led Integrated and sustained Ocean Observation System (IOOS), and other international programs.

What is an ODYSSEA Observatory ?

ODYSSEA

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 ODYSSEA Platform
- Customize the dashboard of ODYSSEA 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 'sale' services and products to marine and maritime users through ODYSSEA platform

The Observatories

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- ✓ Integrate and Operate a network of 9 observing and forecasting systems covering coastal and shelf zone environments,
- ✓ Diverse systems from Ecologically-vulnerable systems (MPAs) to systems with increased human pressure,
- ✓ Combine monitoring and modeling activities,
- ✓ Produce new datasets with increased spatial and temporal resolution, stored, manipulated, made accessible through the ODYSSEA platform.

The Scope of ODYSSEA Observatories

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The establishment and operation of ODYSSEA Observatories, will

(a) Improve the spatial and temporal resolution of existing data;

(b) Enhance existing knowledge along the North African and Middle Eastern coastline;

(c) Develop, test and demonstrate novel monitoring systems for data collection;

(d) Collect new marine parameters in line with EU policies;

(e) Involve directly and train local/regional end-users in data collection and model results assessment; and

(f) Provide operational modelling results to serve multiple end-users needs.

ODYSSEA Observatories ToR

Report 2.1 provides:

- the basic Terms of Reference for ODYSSEA Observatories operation;
- the geographical boundaries of each Observatory;
- establishes the spatial and temporal resolution and initial archived datasets and graphs retrieved from existing platforms;
- defines the procedures to map and contact end-users;
- analyses the infrastructure required;
- explains the operations requested; and
- determines the processes and models to be applied, the time needed for model runs and the flow of data from and towards the platform.

ODYSSEA Model Observatories

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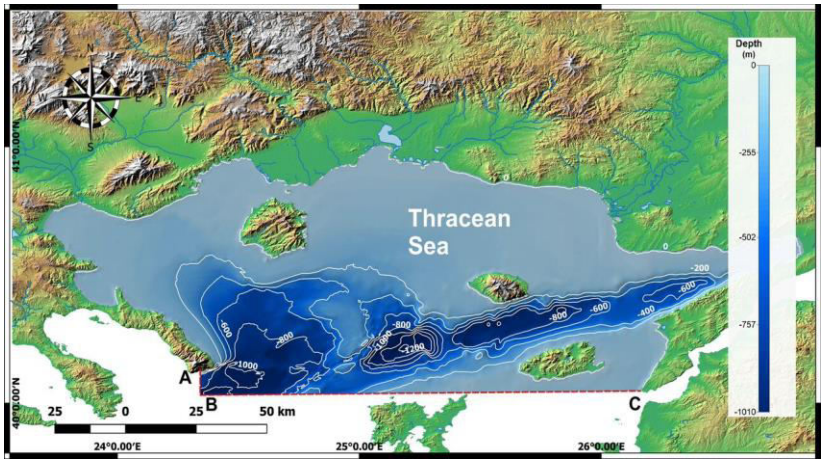
Area	Country
Thracian Sea	Greece
Gulf of Gökova	Turkey
Valencia coastline	Spain
North Adriatic Sea	Italy
Arzew Bay/ Stora Gulf	Algeria
Gulf of Gabes	Tunisia
Al-Hoceima	Morocco
Israel coastline	Israel
Nile zone of influence	Egypt

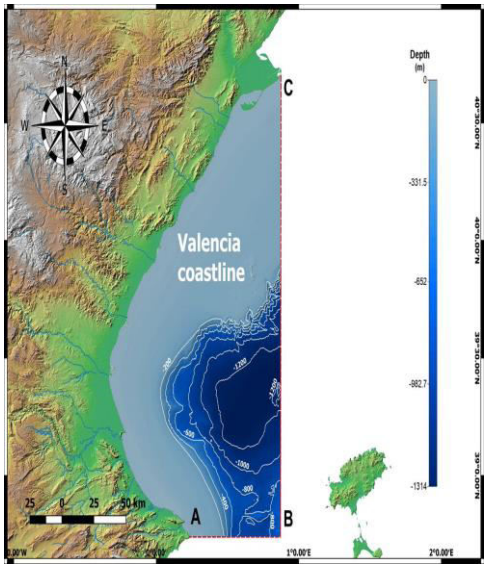
ODYSSEA Observatories factsheets

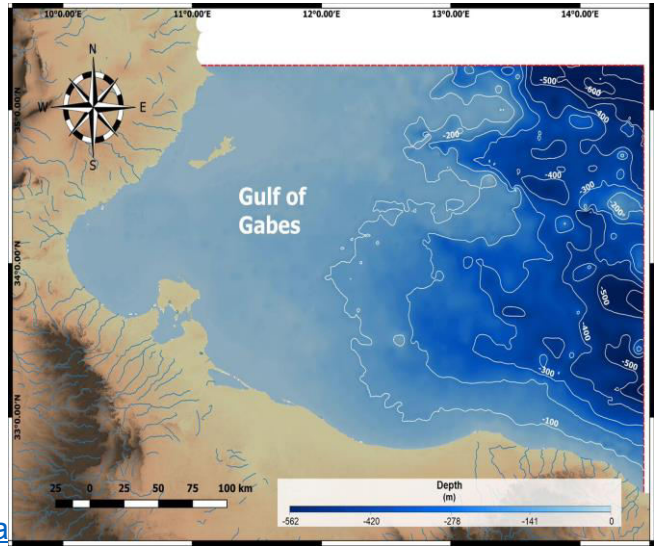
Observatory Name	National Park of Al-Hoceima (PNAH) Observatory
Country	Morocco
Geographic Area	The National Park of Al Hoceima is located on the Mediterranean Moroccan coast, 150 km east from the Gibraltar Strait, in proximity to the city of Al Hoceima and has a 47 km long coastline.
Oceanographic Interest	The area is affected by the surface Atlantic water jet-like flow through the Strait, moving eastward with strong currents and complex dynamics. Alboran basin topography induces anticyclonic gyres. Al-Hoceima is affected by the western Alboran Gyre (WAG) the combination of strong tidal currents at the entrance of the Strait, noticeable winds, mostly strong regional westerlies and easterlies regimes, and the existence of re-circulations at both margins of the jet.
Ecosystem Importance	The PNAH is an unusual biotope consists of caves, islets and rocks which host one of the most original biodiversity in the Mediterranean, like rare or threatened species from small invertebrates (giant limpet) to large marine mammals monk seal and dolphins. Also a very rich avifauna Osprey, Bonelli's Eagle, Audouins, and mixed fish abundance atlantics and Mediterranean Sea, and more than 500 types of algae.
Human Activity	The PNAH appears to be exposed to different human pressures that affect rare species survival and threaten local biodiversity. Direct effects of such threats, especially those resulting from illegal fishing practices such as dynamite fishing and poisoning, have strong implications for the entire marine biodiversity of PNAH.
Main Citations	[38-41]
End-User Groups	Port authority, fish farms, mussel farms, marine protected area management body.
Partner responsible	AGIR

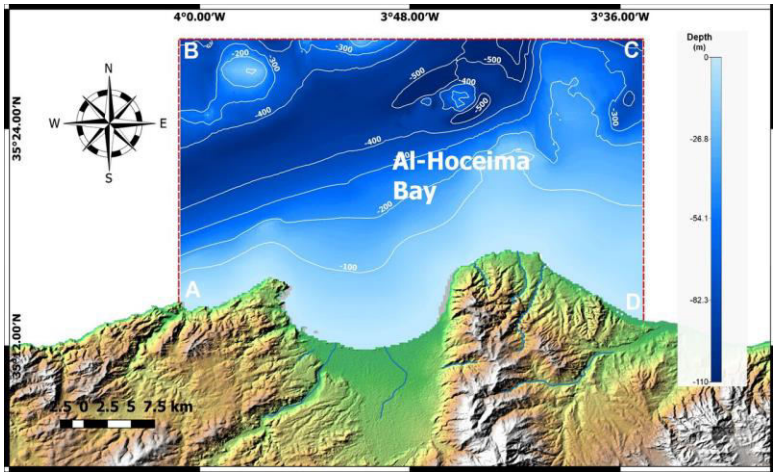
Spatial Boundaries of Observatories

ODYSSEA









Use of ODYSSEA Platform in each Observatory

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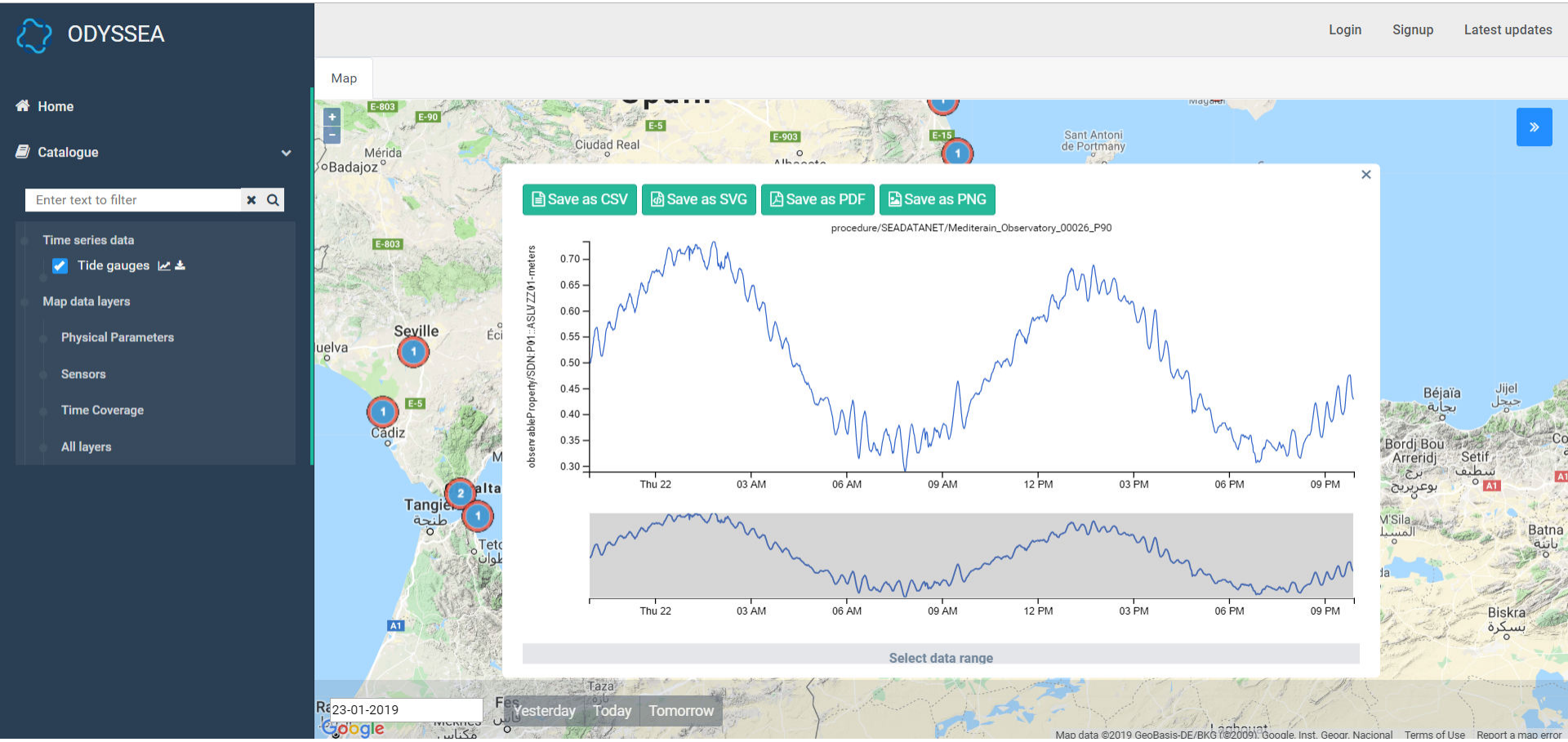
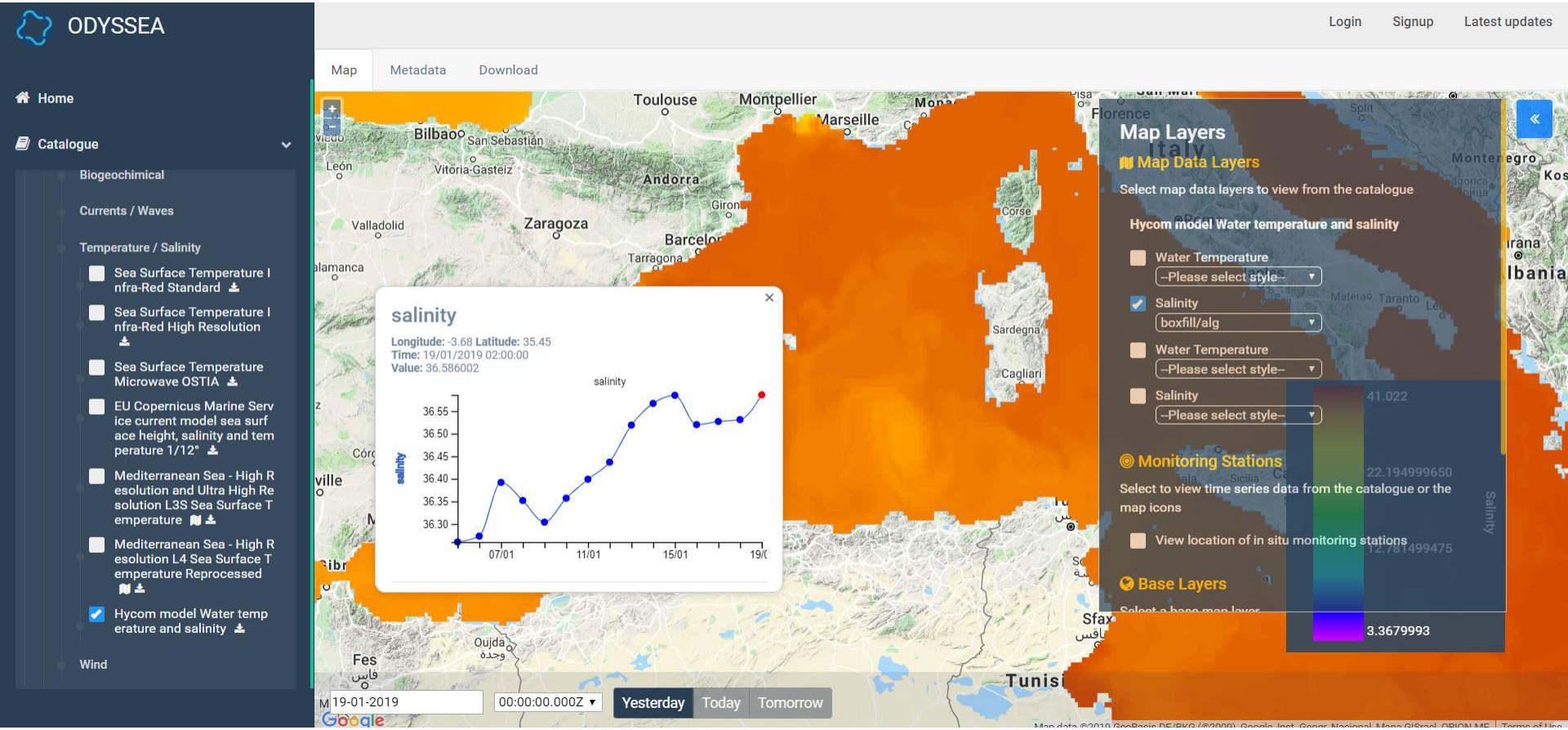
Tidal Sea Level Variability – Mediterranean Sea



Use of ODYSSEA Platform in each Observatory

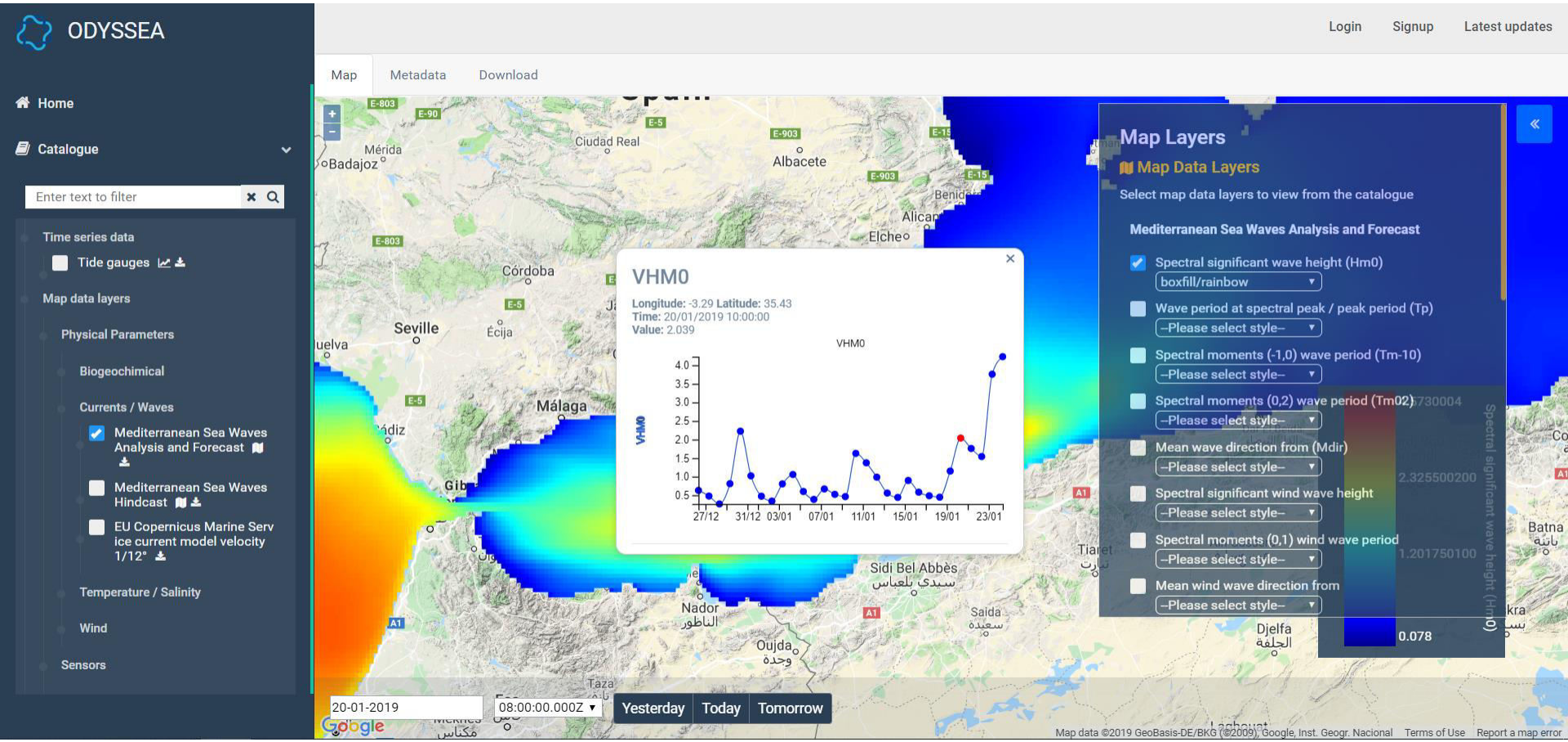
ODYSSEA

Sea Surface Salinity – Mediterranean Sea



ODYSSEA Platform

Waves, Significant Wave Height – Mediterranean Sea



ODYSSEA Platform

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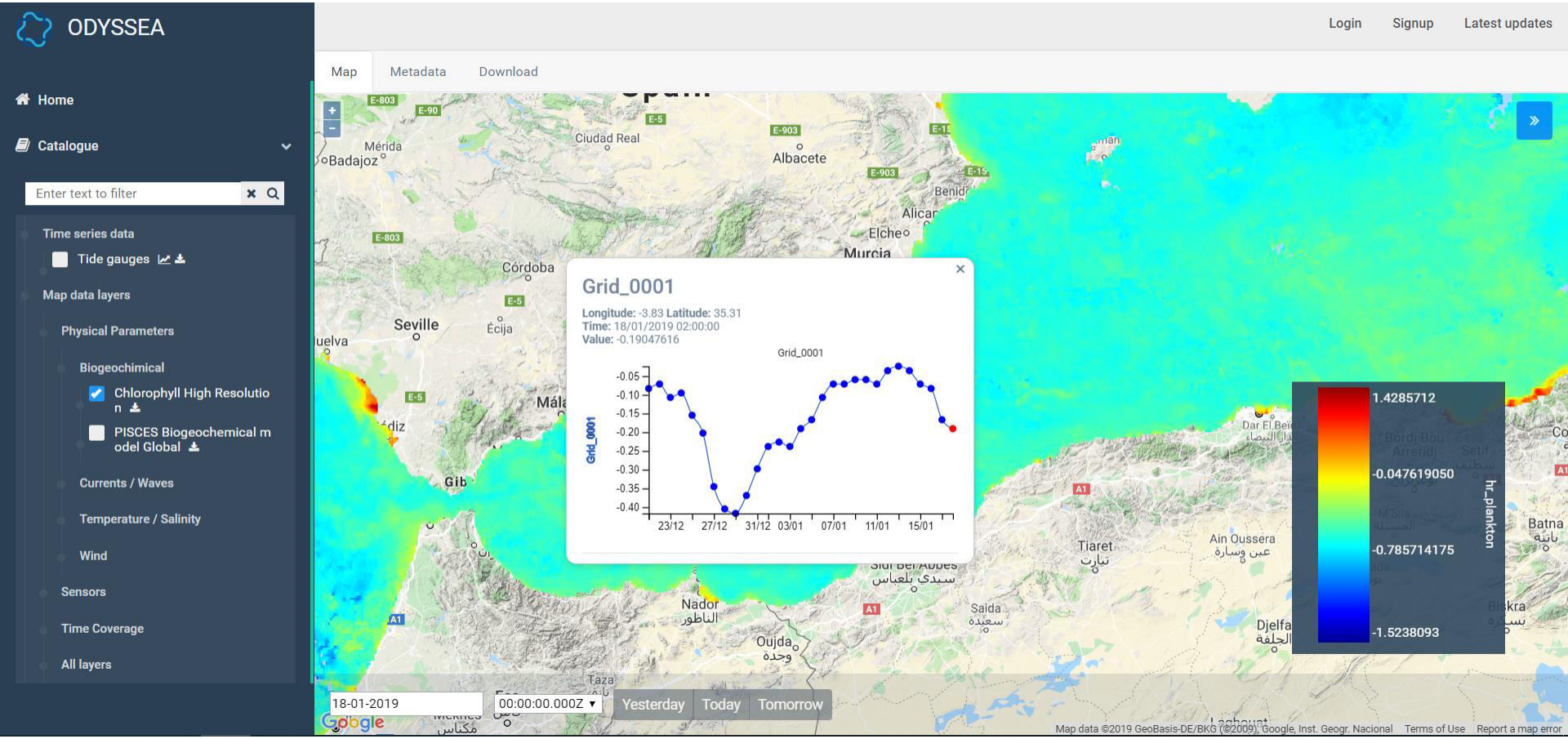
Chlorophyll-a, Concentration (mg/m^3) – Mediterranean Sea



Collaboration with end-users

ODYSSEA

ENERGEAN
OIL & GAS

To: ODYSSEA Project
Democritus University of Thace
Xanthi, 67100 Greece

Attn: Mr. G. Sylaios

Marousi, 07 of September 2018

Subject: **Collaboration with ODYSSEA**

Dear Mr. Sylaios,

We accept your proposal for participating in ODYSSEA Project and collaborating in operating a station of real-time oceanographic data installed in our offshore installation of South Kavala.

The project will provide useful information to our marine operations and to multiple maritime sector end-users. Energean continuously supports the local community in multiple levels and recognizes that this project will provide valuable information to them.

Please proceed with drafting a detailed Collaboration Agreement.

For Energean Oil & Gas S.A.,

Dimitris Gontikas
Managing Director

Collaboration with end-users

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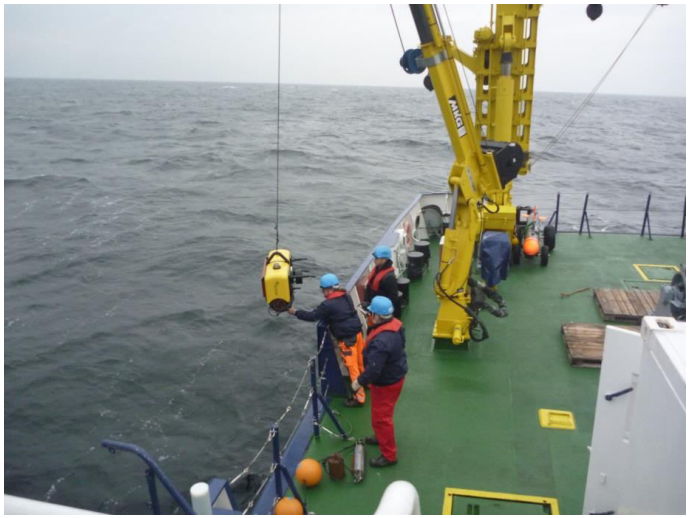
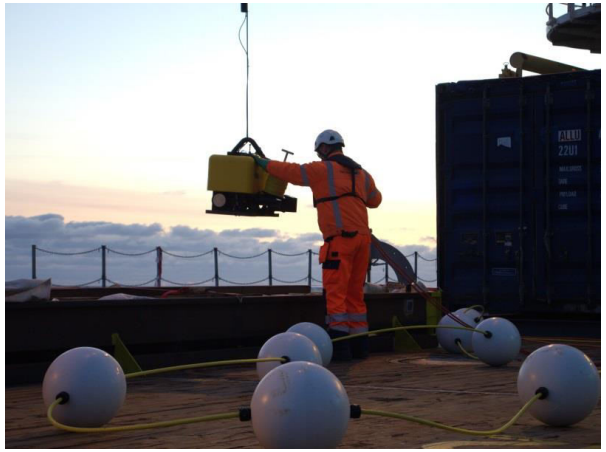
Turkey: Marine Protected Zone Organization
Israel: Offshore Fish farm
Egypt: Abu Quir Fishermen Association
Tunisia: National Hydrographic Service
Algeria: National Space Agency
Morocco: National Forestry and Water Agency
Valencia: Valencia Port Authority
North Adriatic: Italian Environmental Agency for MSFD/WFD implementation

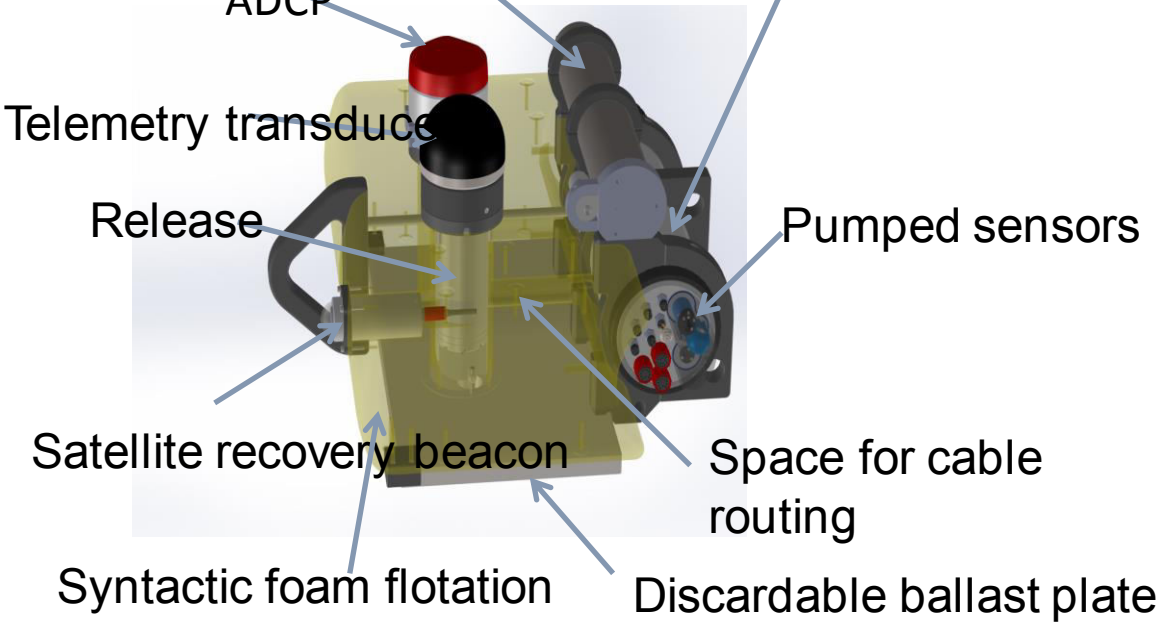
Static Monitoring Systems for ODYSSEA Observatories

ODYSSEA





Static Monitoring Systems for ODYSSEA Observatories



– Sensors

- Temperature
- Salinity, pH
- Pressure
- Dissolved Oxygen
- Hydrophone to record marine mammals
- Submarine camera to record fish
- Currents
- Microplastics sensor

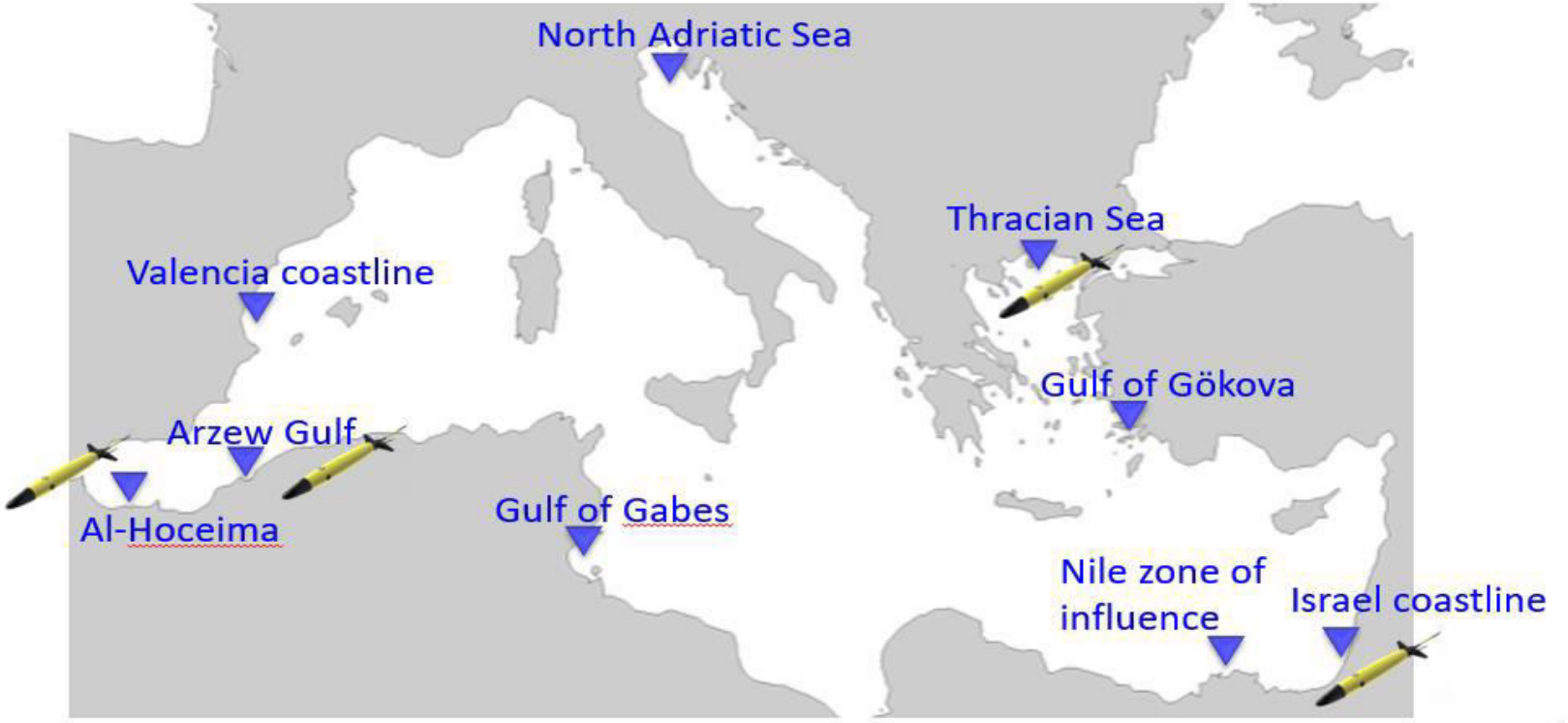
Mobile Monitoring Systems for ODYSSEA Observatories

- 2 SEAEXPLORER GLIDERS

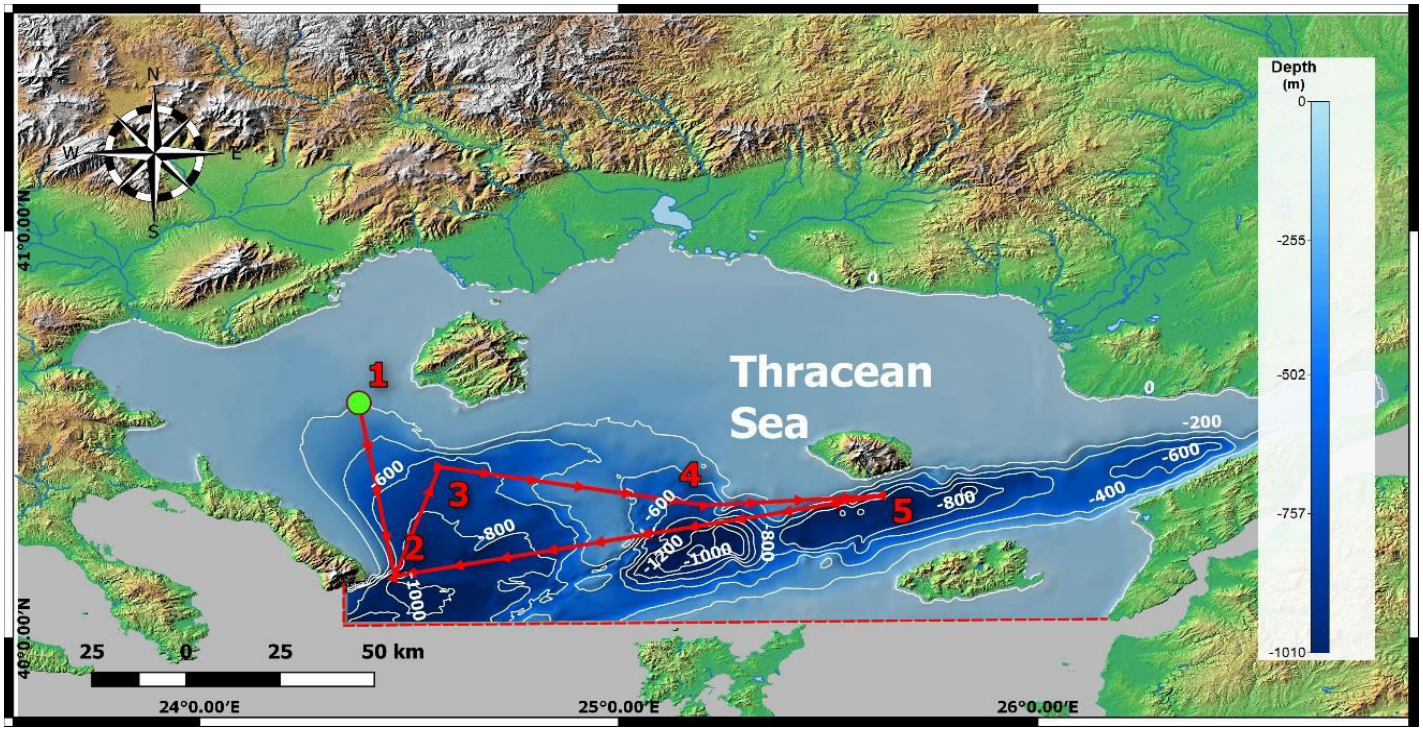
- 3 sensor payloads:
  - ❖ Payload 1
    - ✓ Temperature, salinity, pH, dissolved oxygen, chlorophyll-a, turbidity, CDOM
  - ❖ Payload 2
    - ✓ Passive Acoustic Monitoring (PAM)
  - ❖ Payload 3
    - ✓ Temperature, salinity, microplastics

Mobile Monitoring Systems for ODYSSEA Observatories

ODYSSEA



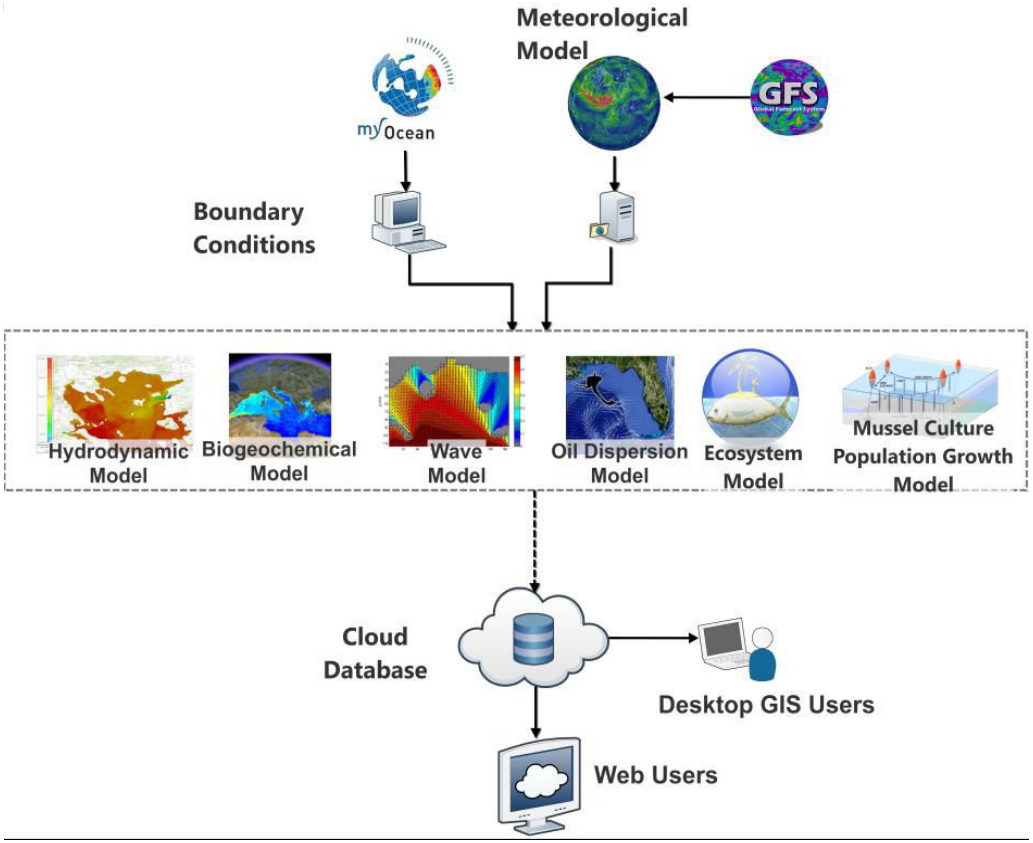
Mobile Monitoring Systems for ODYSSEA Observatories



The Models

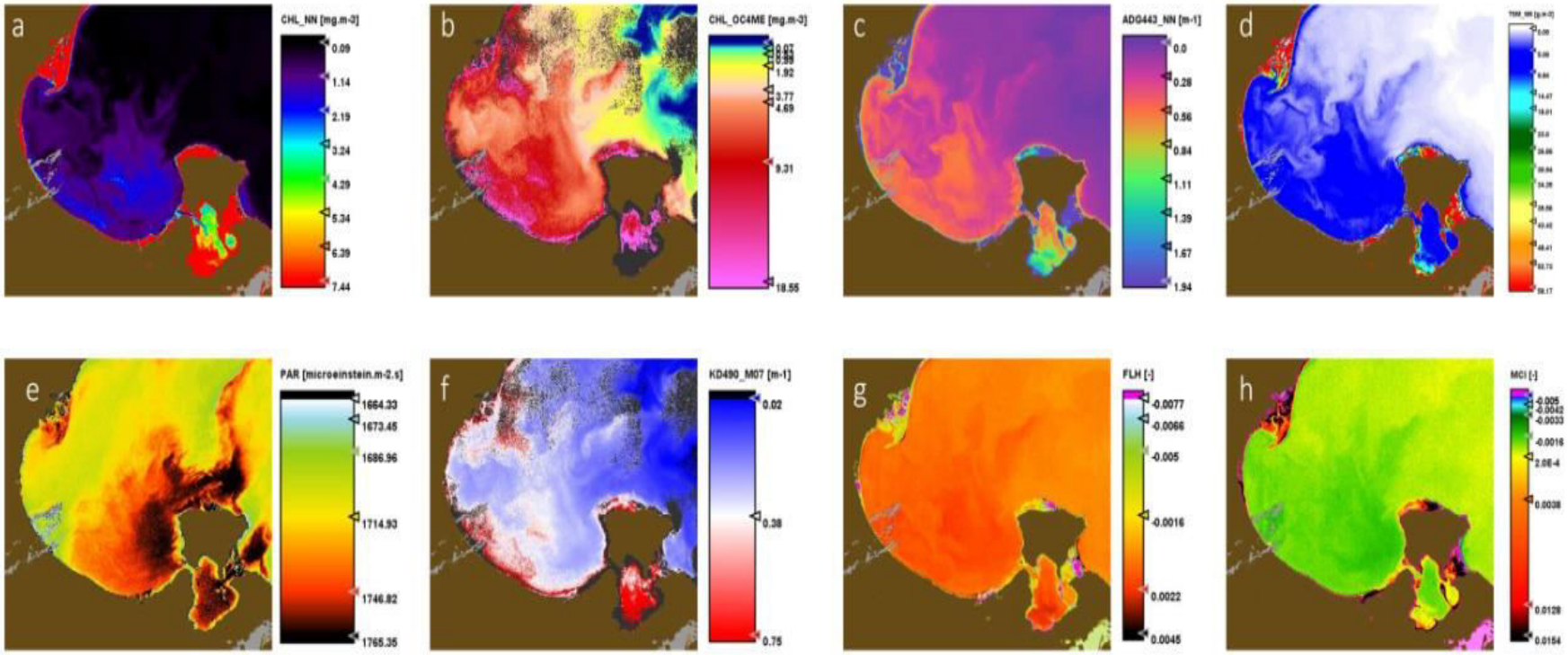
- ✓ A prototype 'chain' of operational models will be developed,
- ✓ Link models to existing databases,
- ✓ Provide short- and long-term prognostic results,
- ✓ Manage risks and emergencies in coastal and offshore areas,
- ✓ Meet the requirements of various end-user groups,
- ✓ Report on parameters never previously reported,

Models: Meteorological (WRF), 3Dhydrodynamic (Delft3D), Wave (SWAN), Oil spill (MEDSLICK-II), Water quality (DELWAQ), Ecosystem models (Ecopath with Ecosim), Fish and Mussel/oyster culture population growth



Remote Sensing

ODYSSEA



Sentinel-3 Level2 spatial distributions of a) chlorophyll-a conc (mg m^{-3}) Oc4me algorithm, b) chlorophyll-a conc (mg m^{-3}) chlnn neural network algorithm, c) absorption of CDOM at 443 nm (m^{-1}), d) TSM concentration (gm^{-3}), e) PAR in the spectral range 400-700 nm (µEinstein m^{-2} s^{-1}), f) diffuse attenuation coefficient at 490 nm (m^{-1}), g) fluorescence line height and h) max chlorophyll index at Gulf of Gabes.

Capacity Building

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Networking, Training and Capacity Building in N. African countries

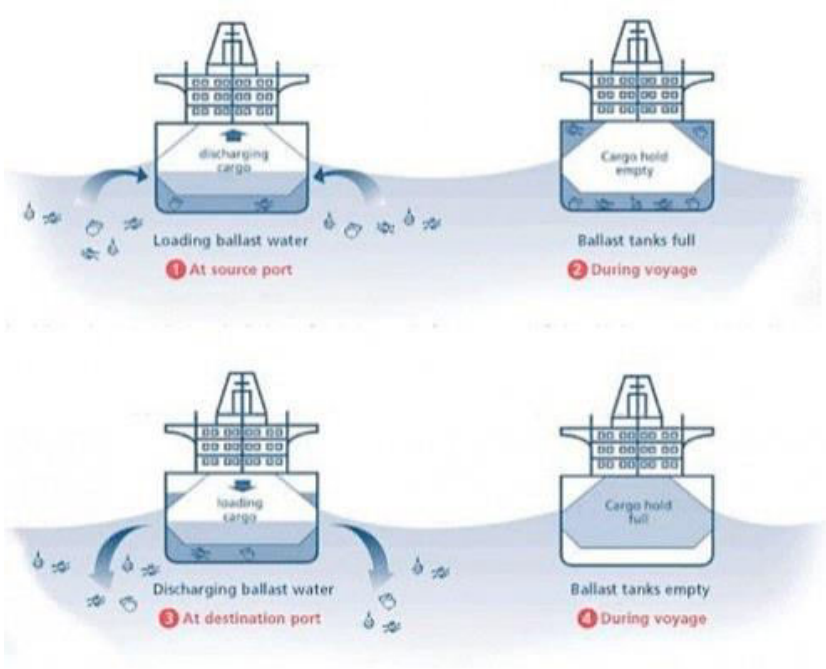
Organize workshops to train future managers and operators of ODYSSEA Observatories;

Organize personnel exchanges;

Improve the professional skills and competences of those working and being trained to work in the blue economy.

Deviations from DoA

Valencia Observatory: IMPLEMENTATION OF THE BALLAST WATER CONVENTION IN THE FRAMEWORK OF BARCELONA CONVENTION



Pic Source: NOAA: International Maritime Organization

Deviations from DoA

ODYSSEA

Why Valenciaport

Valenciaport is a **leading Mediterranean port** in terms of commercial traffic, mostly containerised cargo, due to its dynamic area of influence and an extensive network connecting it to major world ports. Valenciaport is the best and most efficient option for maritime trade in southern Europe, with **connections to over 1000 ports throughout the world**

The Aim

The aim is to **provide a tool for monitoring and implementing several EU and International policies** as explained later, as well as, to conduct an harmonised implementation of the Ballast Water Convention in the Mediterranean basin. The data collected will provide relevant information to researchers and public authorities for **assessing and controlling the impact of alien invasive species (AIS)** in local ecosystems.

Deviations from DoA

ODYSSEA

WP2/9

1. Analysis of data available and requested
2. Cooperation and coordination between ports, environmental agencies and maritime administrations

ODYSSEA scope includes sampling of 3 sampling points located inside the port of Valencia.

1. Analysis of organisms in the water column:
   - Pathogenic bacteria: Vibrio cholerae, intestinal enterococci and E.coli.
   - Phytoplankton.
   - Zooplankton.

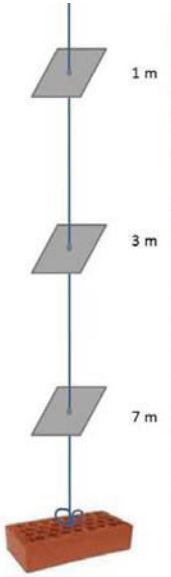
2. Analysis of benthic organisms (from the bottom):
   - Infauna (soft substrate organisms).
   - Epifauna (organisms that live on the bottom).
   - Fouling organisms.

3. Sampling frequency:
   - Quarterly for water.
   - Annual for benthic organisms.

NOTE: Water quality data will be provided by the Port Authority of Valencia

Deviations from DoA

TASK	MONTHS											
	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
Sampling of organisms in the water column	■			■			■			■		
Sampling of organisms in the water column and benthos							■					
Analysis of organisms in the water column	■	■		■	■		■	■		■	■	
Analysis of benthic organisms							■	■	■	■		
Partial report (water organisms only)		■			■			■				
Final report												■



The 9 ODYSSEA Observatories Operational Modelling

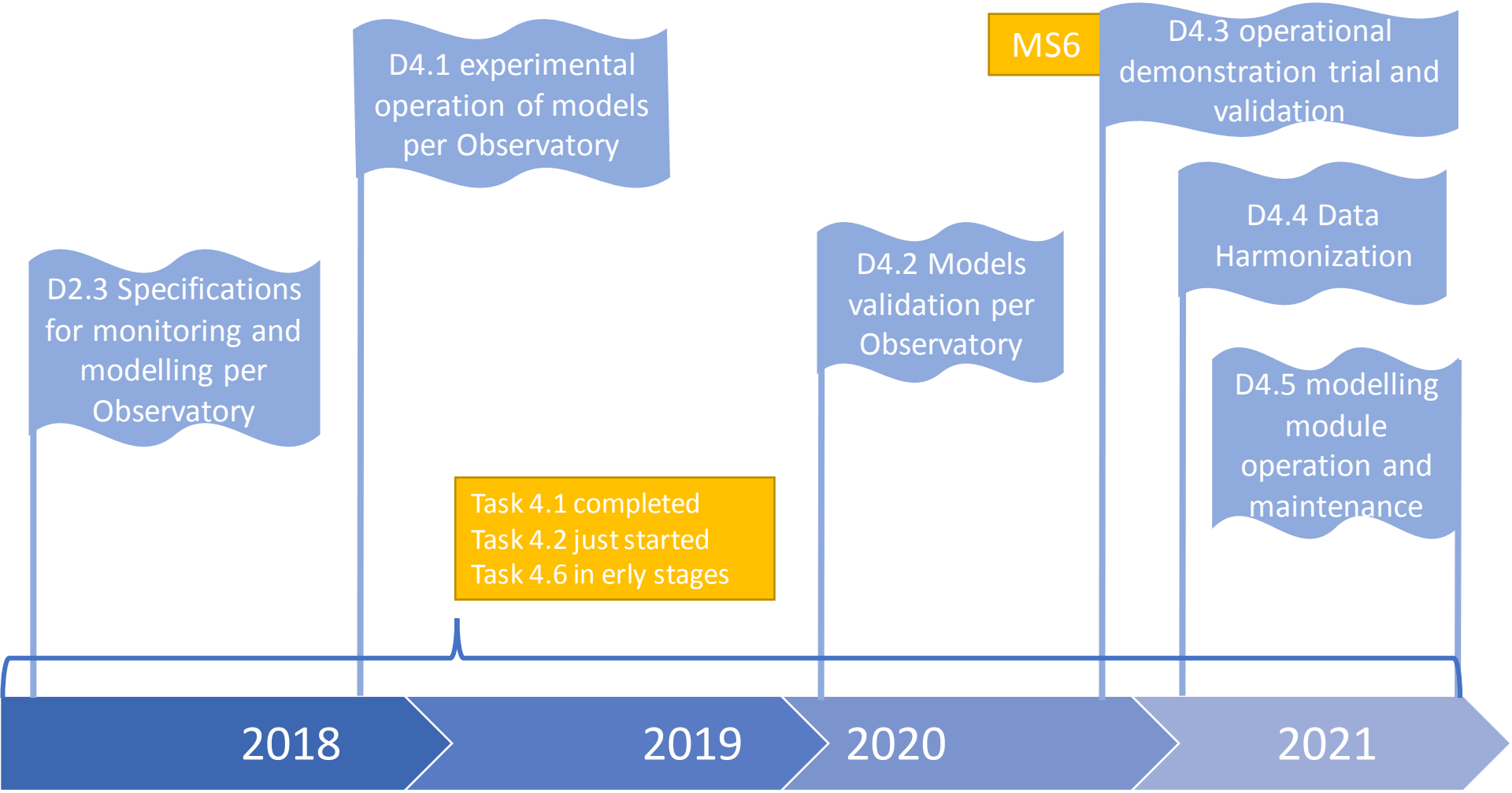
ODYSSEA

The scope of the modelling module of ODYSSEA observatories is to:

(a) Provide short and long-term forecasts to serve multiple end-users needs;
(b) Manage risks and emergencies in coastal and offshore areas
(c) Improve the spatial and temporal resolution of existing data;
(d) Enhance existing knowledge along the North African and Middle Eastern coastline;
(e) Produce new datasets in line with EU policies;
(e) Train Observatory personnel in operating and maintaining the local platform.

Modelling Module Roadmap: Deliverables and milestones

ODYSSEA

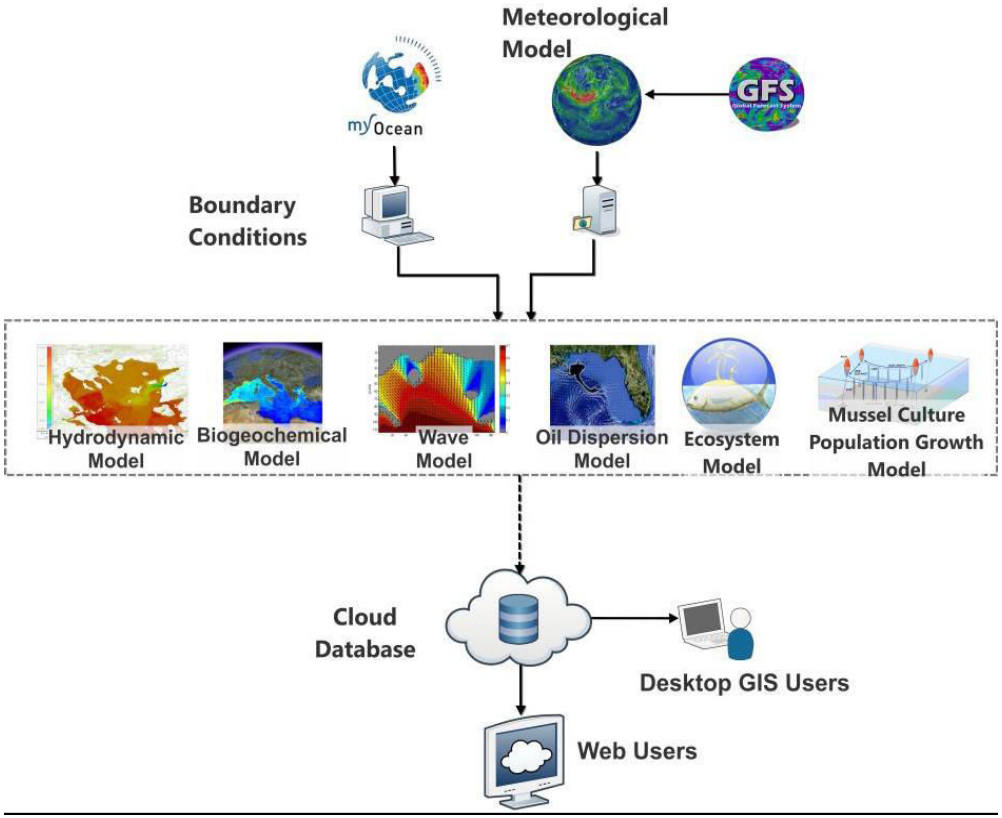


Progress: Task 4.1

ODYSSEA

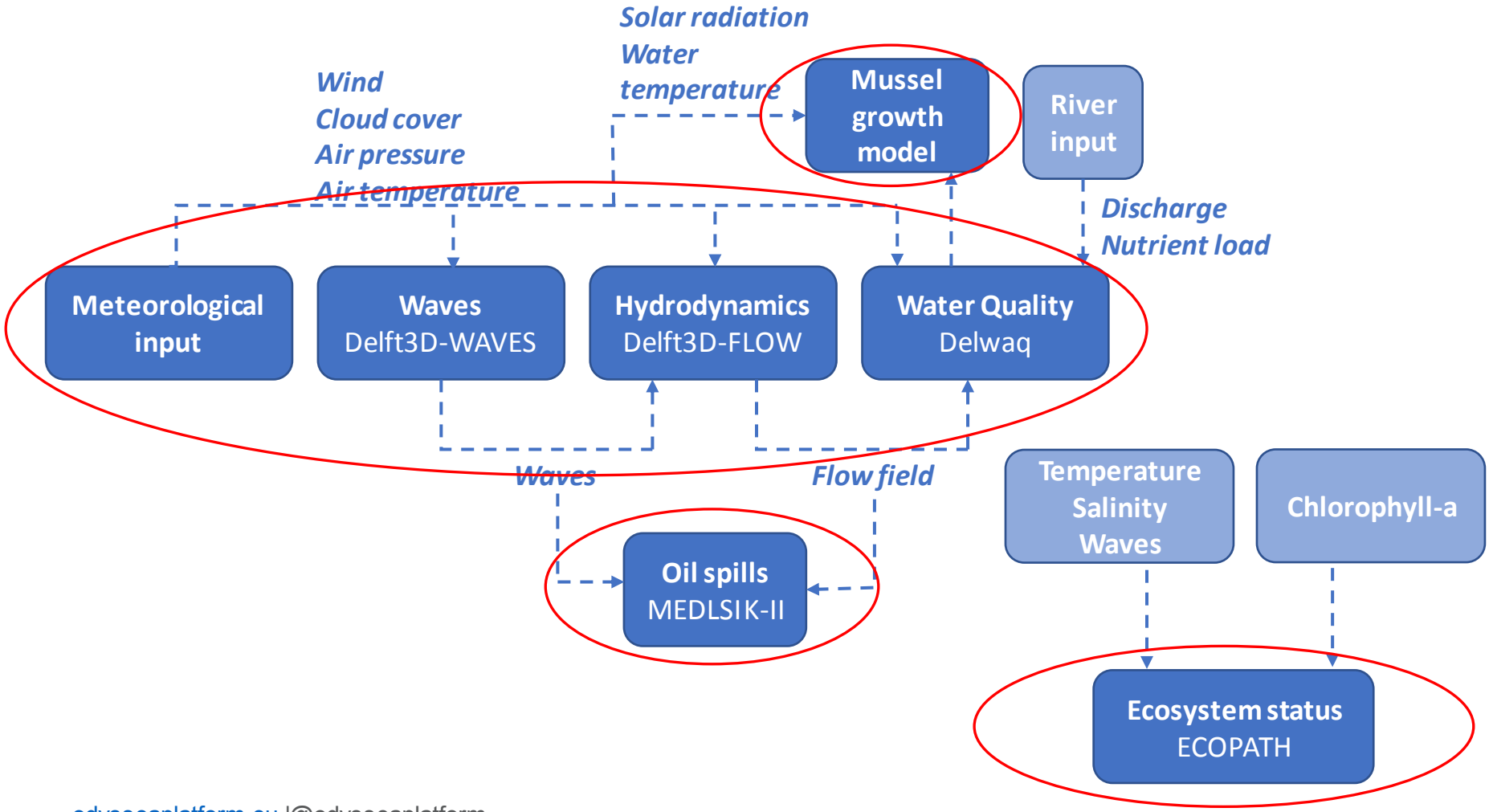
Objective: Set-up and experimental operation of models at Observatories

- ✓ models' coupling & interface
- ✓ establish iternal data flows
- ✓ Link to external databases and local sensors (for initial & boundary conditions, cal/val)
- ✓ Set-up a service chain
- ✓ Planned developments/modifications to models used for Observatories



Progress: Task 4.1

ODYSSEA

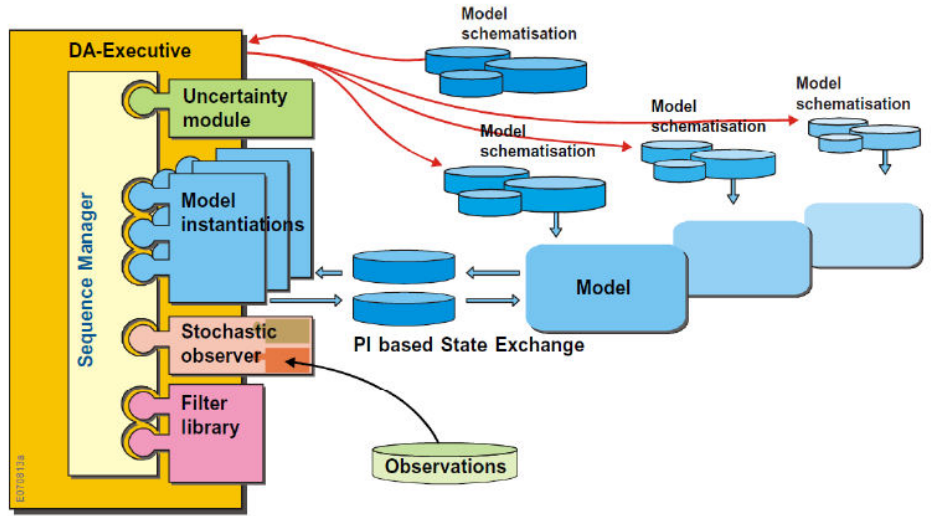


Progress: Task 4.1

ODYSSEA

Available interface tools for models' operationalization:

- ✓ Import of initial and boundary conditions
- ✓ Couple, sequence, run models in an automated manner
- ✓ Integrate data from local sensors and external databases
- ✓ Process and assimilate results
- ✓ Interface with ODYSSEA platform



- Imformation flow from FEWS AQUASAFE to ODYSSEA platform and differences
- Data – model – odyssea platfrom - users

Progress: Task 4.1

ODYSSEA

Training for Technical Staff and managers of ODYSSEA Observatories on Delft3D, Delft-FEWS and AQUASAFE

ODYSSEA workshop, 5-9 March 2018, Crete (FORTH)

Progress: Task 4.1

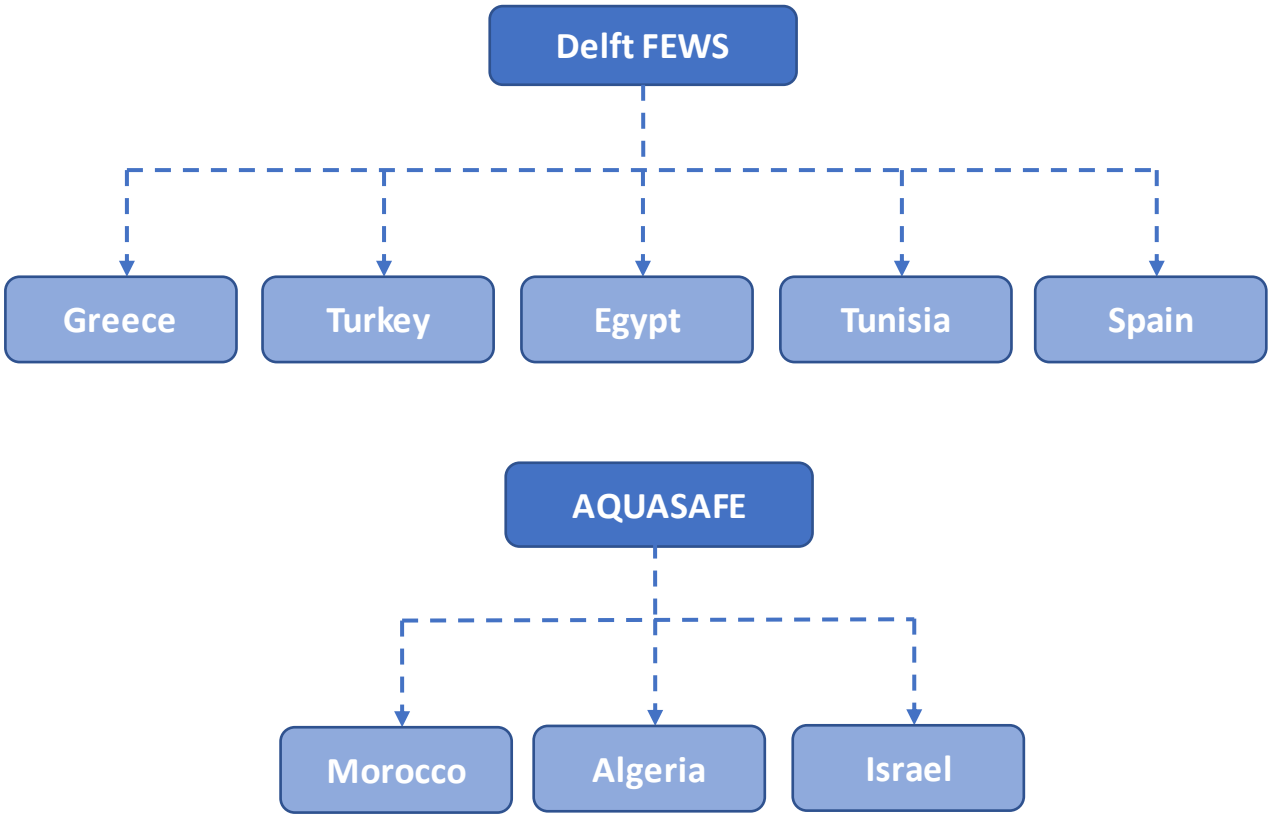
ODYSSEA

Comparative analysis of available interface tools (Delft-FEWS & AQUASAFE) for Thracian Sea based on a set of pre-established criteria

- **General criteria:** operationalization capacity, robustness, user-friendliness, computer capacity required – computational time & effort, number of models the system can handle and their stepping and sequence, possibilities for expansion and flexibility (e.g. subsequent linking of additional models), ease to configure and adapt to users' needs.
- **Pre-processing capacity:** data import and links to external data sources, data assimilation options/capabilities, ease of link to new sensors.
- **Post-processing capacity:** visualization options, data analysis, reporting, setting up automatic alarms and warnings.
- **Publication capacity:** availability of web-publishing services.

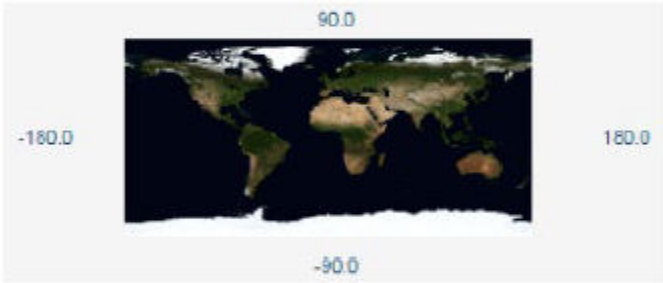
Progress: Task 4.1

ODYSSEA

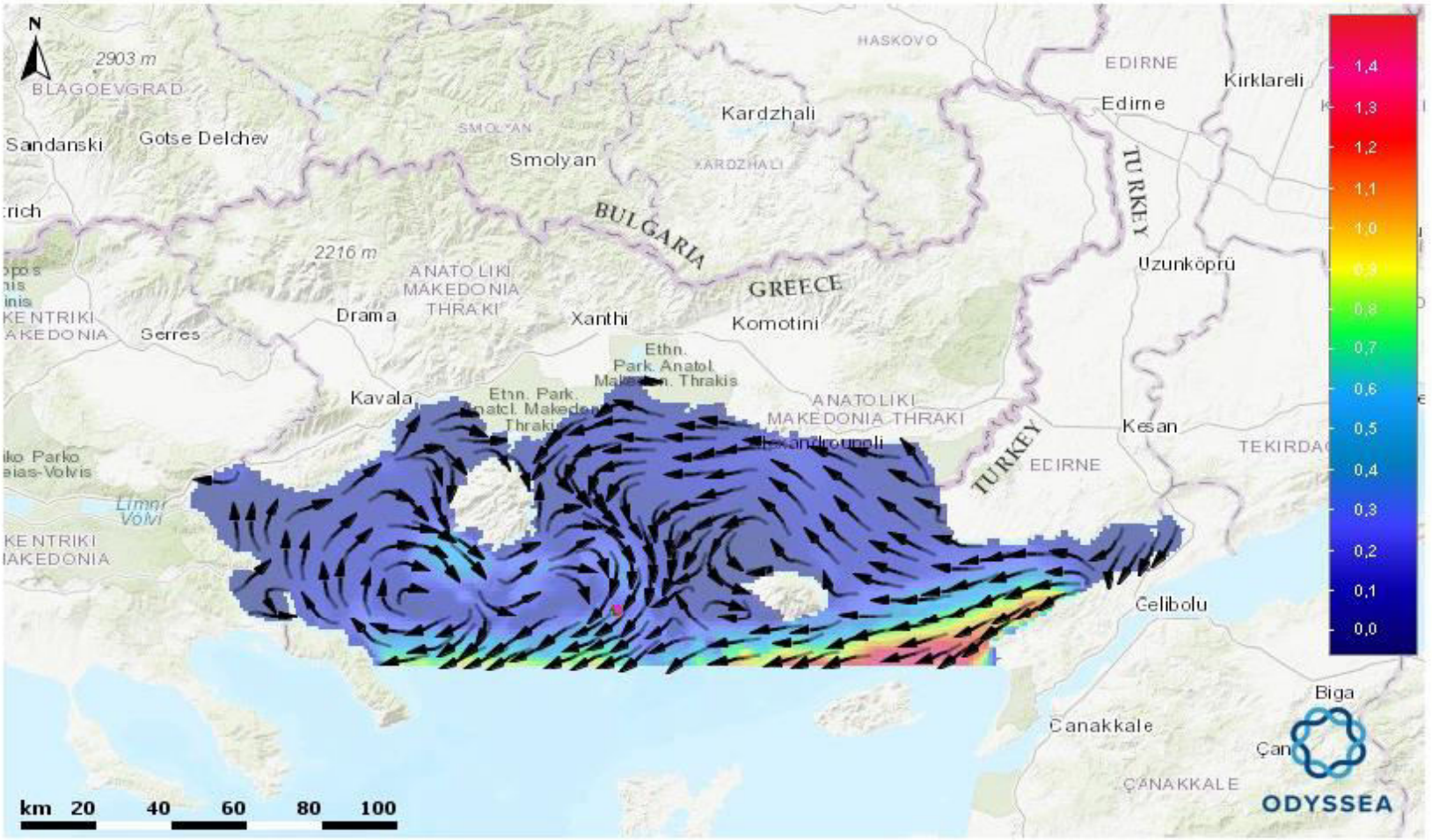


- Northern Adriatic Sea results + explanation on models

Progress: Task 4.1

Data Information	
Provider	National Centres for Environmental Prediction (NCEP)
Product identifier	gfs.tCCz.pgrb2.0p50.fFFF, gfs.tCCz.pgrb2.0p25.fFFF
Downloaded Variables	wind velocity X (ms^{-1}), wind velocity Y (ms^{-1}), atmospheric pressure (Pa), solar radiation (Wm^{-2}), air temperature (ºC), relative humidity (%), precipitation (mm), wind modulus (ms^{-1}), wind direction (º), wind gust (ms^{-1}), cloud cover, downward long wave radiation (Wm^{-2})
Geographical coverage	
Areas	Global-ocean
Spatial resolution	0.25 degree
Vertical coverage	Values at 10 meters high
Temporal resolution	Hourly
Temporal coverage	From 2015-02-14 T00:00:00Z, still going
Update frequency	Four times a day

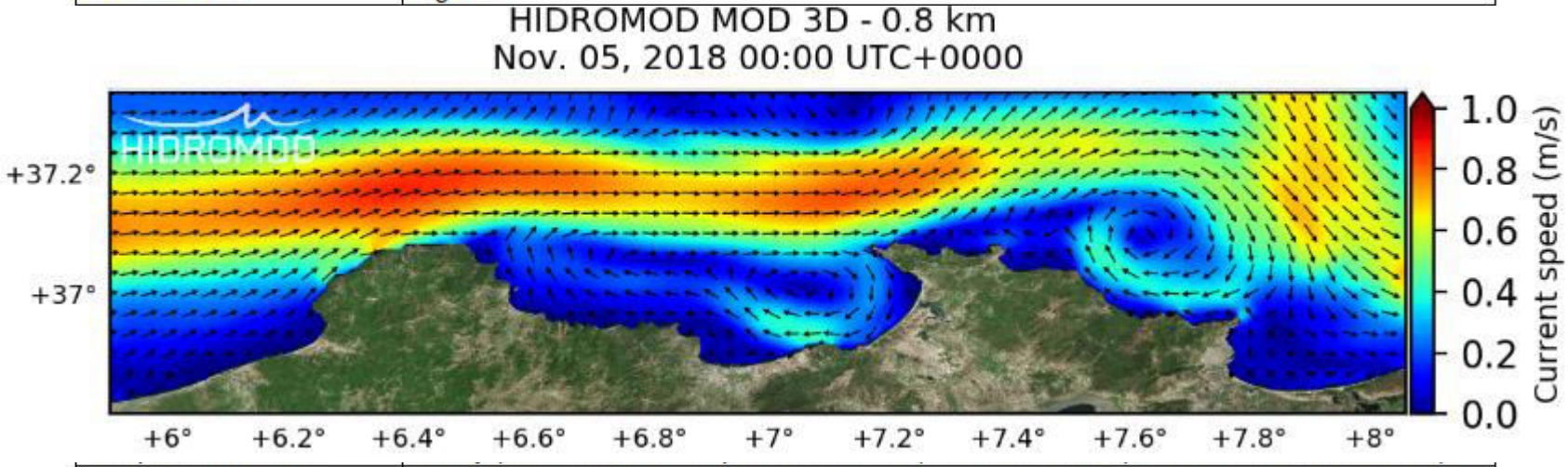
Progress: Task 4.1



Progress: Task 4.1

ODYSSEA

Data Information	
Model identifier	Algeria_Model
Domain Name	Algeria

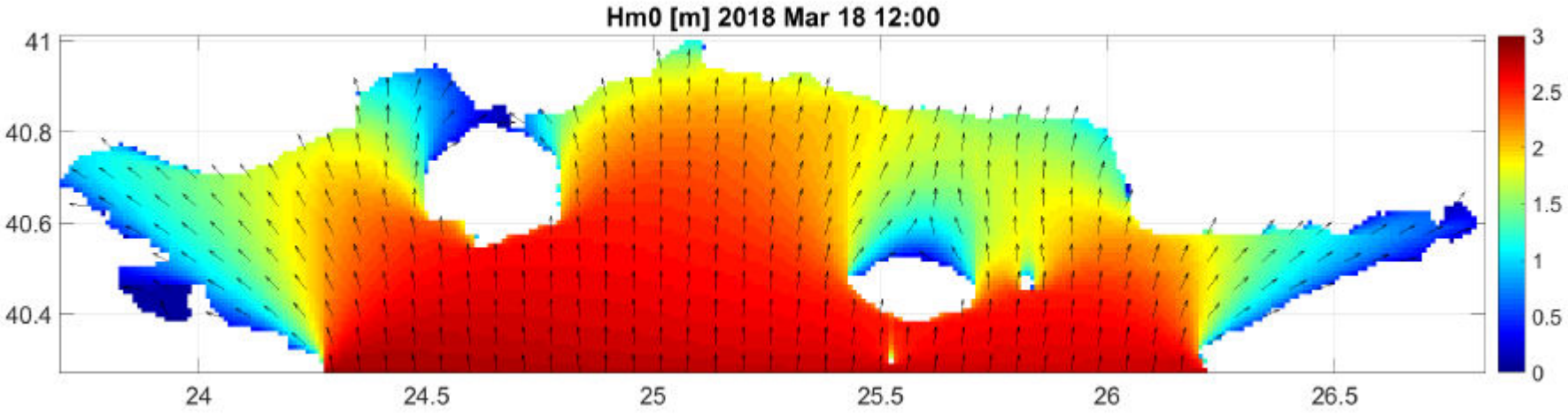


Temporal coverage	Under configuration
Local Stations	Collo, Skida Port and Stora
Vertical coverage	From -2855 to 0 m
Hindcast	1 day
Forecast	2 days

Progress: Task 4.1

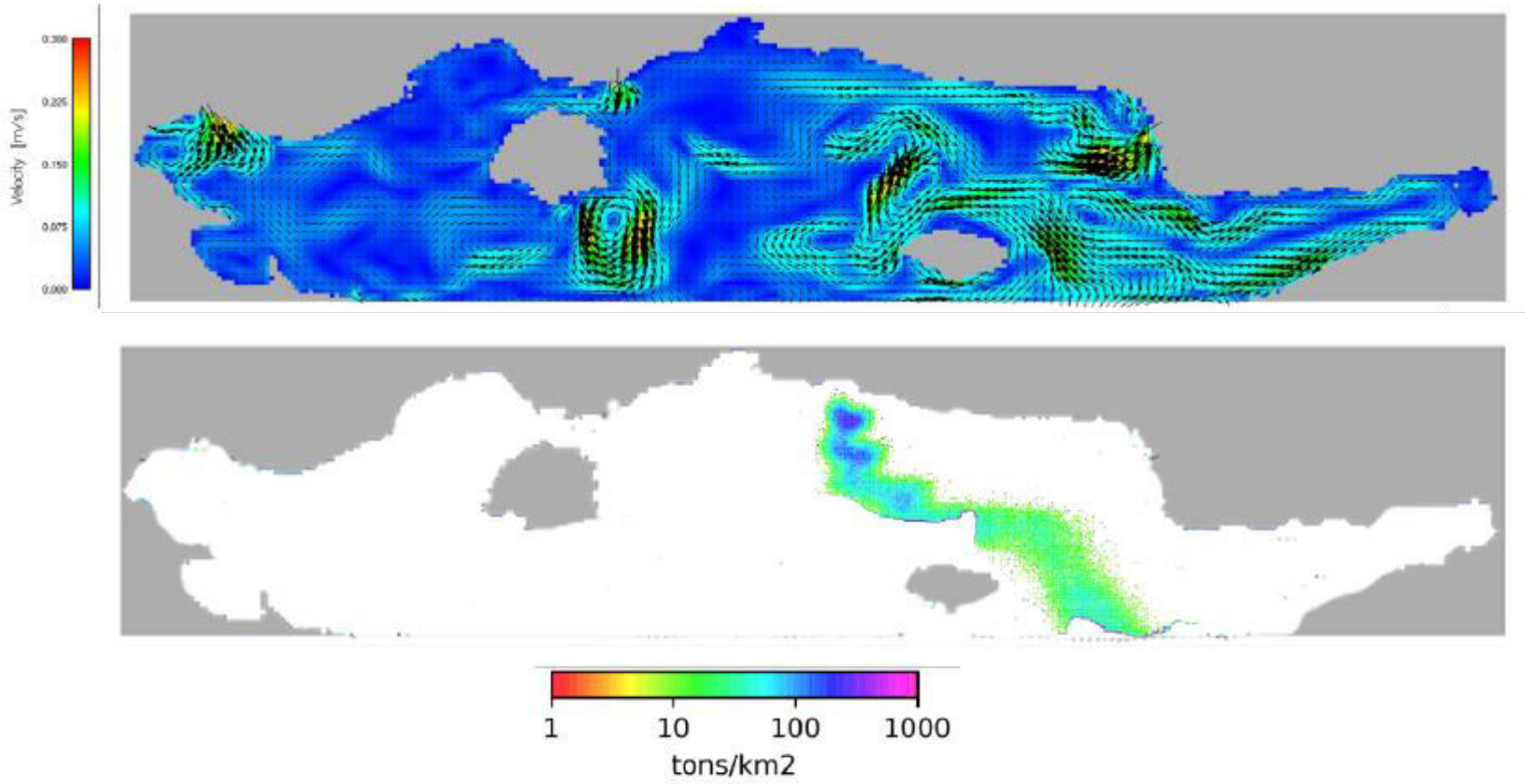
ODYSSEA

Pilot runs of SWAN, MEDSLIK-II, ECOPATH & mussel growth models



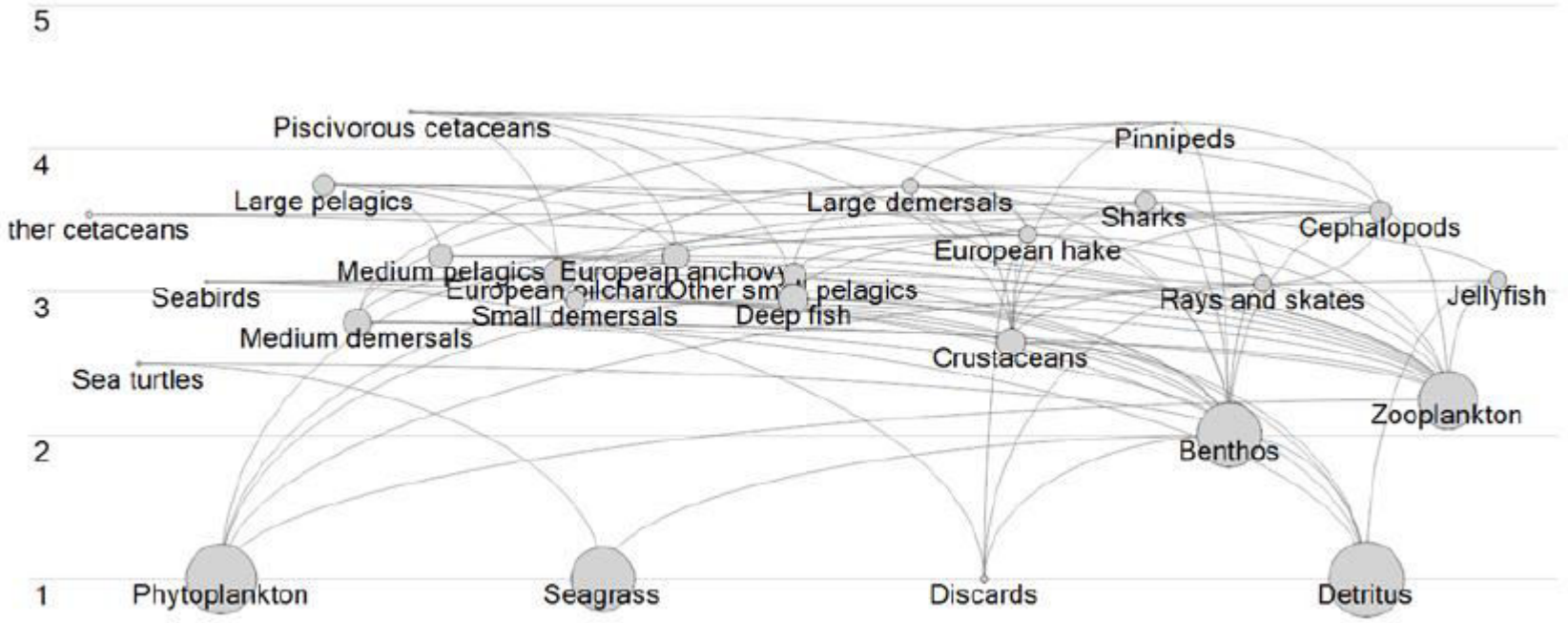
Indicative model outputs for significant wave height from SWAN for Thracian Sea

Progress: Task 4.1



Indicative model outputs for sea surface slick concentration from MEDSLIK-II for Thracian Sea

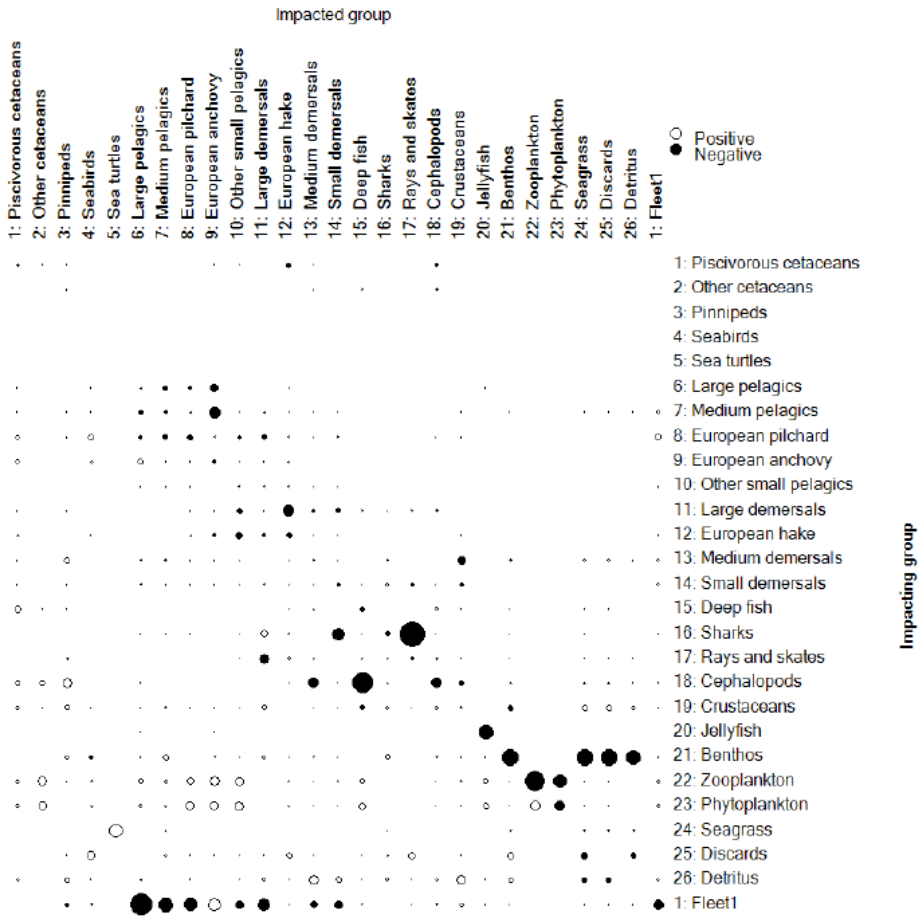
Progress: Task 4.1



FLOW DIAGRAM OF THE FIRST TEST MODEL FOR THE MEDITERRANEAN MOROCCO OBSERVATORY, ORGANISED BY THE TROPHIC LEVELS OF 26 FUNCTIONAL GROUPS

Progress: Task 4.1

ODYSSEA



MIXED TROPHIC IMPACT ANALYSIS OF THE FIRST TEST MODEL FOR THE MEDITERRANEAN MOROCCO OBSERVATORY

Progress: Task 4.1

ODYSSEA

Deliverable 4.1: Experimental operation of models per Observatory submitted on time

ODYSSEA

Operating a network of integrated observatory systems in the Mediterranean Sea

Project Deliverable Report

Deliverable Number: 4.1

Deliverable Title: Experimental operation of models per Observatory

Author(s): Georgios Sylaios, Adelio Silva, Nikolaos Kokkos, Konstantinos Zachopoulos, Katerina Spanoudaki, Menno de Ridder, Caroline Gautier, Lorinc Meszaros, Marco Zavatarelli, Athanasios Tsikliras, George Tserpes

Work Package Number: 4

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Table of Contents

Difficulties, delays and corrective actions

ODYSSEA

- ✓ Some delays were experienced as Delft-FEWS was a tool not previously applied as an interface to downscale CMEMS modeling products, and thus significant effort was required in terms of algorithmic development, to make the system compatible and capable to read and download the CMEMS NETCDF files at daily basis
- ✓ Significant efforts required to gather local data (biomass, catches) from Observatories where ECOPATH with ECOSIM will be implemented (Morocco, Egypt, Turkey)
- ✓ Corrective actions: Increase efforts to complete the modeling chain at all Observatories→ SWAN is already implemented through FEWS for Thracian Sea and can be duplicated for remaining Observatories

Next steps

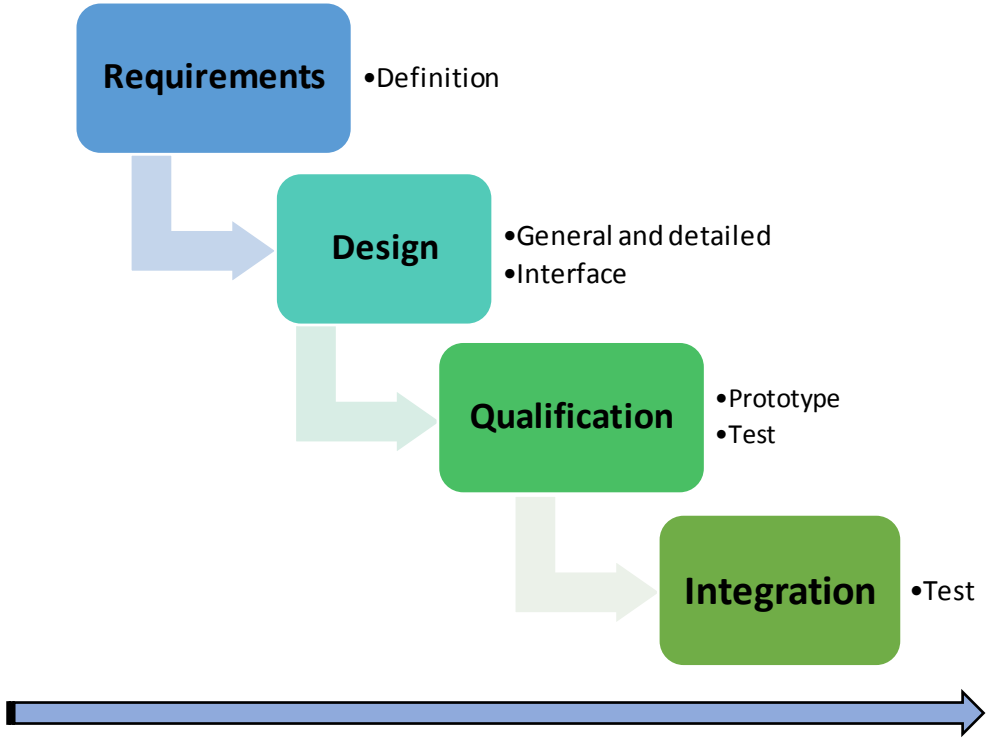
ODYSSEA

- Workshop on SWAN and Delwaq…
- Tasks 4.2 & 4.3: Models testing and calibration in each Observatory, Models validation in each Observatory
- Implementation began during the last month of RP1
  - Testing, calibration & validation activities for models at each Observatory
  - Ad-hoc metrics defined, data analysis and visualization options facilitated by Delft-FEWS & AQUASAFE platforms
  - Performance of models evaluated in hindcast mode (calibration) using available historical data both satellite and in-situ (for sea surface temperature, salinity, currents, Chl-a, species biomass data, fisheries catches etc.)
  - Example data sets from CMEMS:
    - SST_MED_SST_L4_NRT_OBSERVATIONS_010_004,
    - INSITU_MED_NRT_OBSERVATIONS_013_035,
    - SEALEVEL_MED_PHY_L4_NRT_OBSERVATIONS_008_050
  - Metrics passed to Task 4.3 for validations tests (forecasts experiments)
  - D4.2 on month 36 (RP2), including activities of Tasks 4.2 & 4.3

Observatories – regarding equipment

New equipment were created or adapted and built for ODYSSEA (sensors, gliders, suface platform, landers)

During the WP5 monthly meetings, we exchanged technical information in order to bribg ibivatives solutions to odyssea equipment



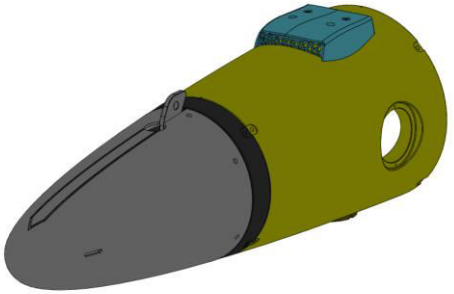
Equipement built

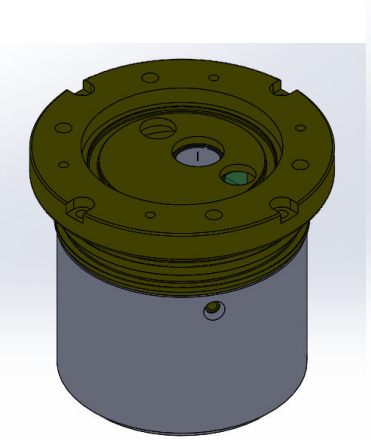
Landers and surface platforms from Develogic

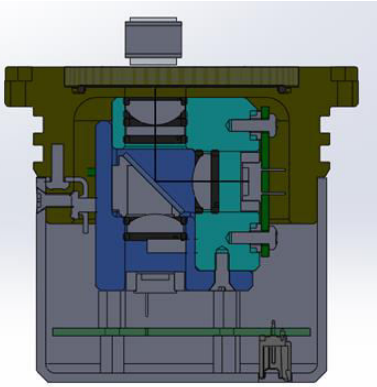
SeaExplorer Gliders from Alseamar

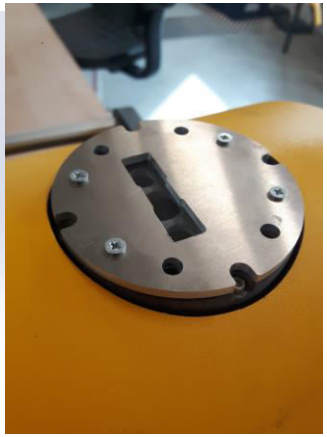
WP5 – µPlastic sensor for gliders

- The Microplastic sensor was fully redisigned during the 1st RP of ODYSSEA in order to be integradable on gliders, surface platform and landers.
- This resulted in 2 different designs. The sensors are currently being integrated on platforms.



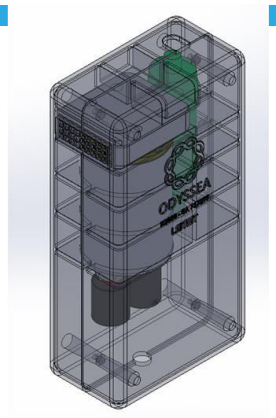
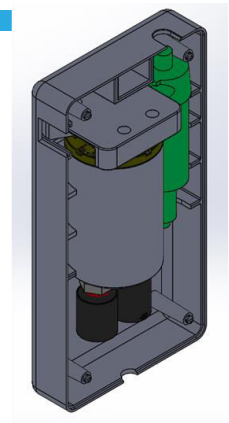






WP5 – µPlastic sensor for other platforms

- The Microplastic sensor was fully redisign during the 1st RP of ODYSSEA in order to be integrable on gliders, surface platform and landers.
- This resulted in 2 different designs. The sensors are currently being integrated on platforms.
- This design comes within a box equipped with a pump

Problem occured and solutions

ODYSSEA

- The development of a new sensor is very complex.
- This sensor was supposed to dive to 1000 meters but the windows cracked
- The window material is currently changed and new tests are ongoing.

Observatories : regarding persons and training

ODYSSEA

- Training is planned for the 8th to 12th of April 2019

Objectives

- Learn how a SeaExplorer glider works in order to be able to prepare and operate the glider for scientific missions.
- Know-how :
  - Equipment functioning
  - Equipment preparation
  - Mission preparation
  - Deployment / Piloting / Recovery
  - Maintenance

Program

Day 1 : SeaExplorer Overview
- Presentation, round table
- Glider Principle and system breakdown
- Vehicle description
- Payload description
- Review of the day, Questions & Answers session (Q&A)

Day 2 : Getting the instrument ready
- Ballasting
- Magnetic compass calibration
- Presentation of the day: piloting
- Review of the day, Q&A session

Day 3 : Mission Preparation
- Mission's files preparation
- Glider simulation
- Getting ready to go at sea
- Review of the day, Q&A session

Day 4 : *At-sea Operations*
- Safety at sea
- Deployment
- Field exercises
- Recovery
- Review of the day, Q&A session

Day 5 : Piloting & *Maintenance*
- Piloting
- Working on the dataset
- Maintenance
- Additional operations
- Review of the day, Q&A session

Deviation from DOA

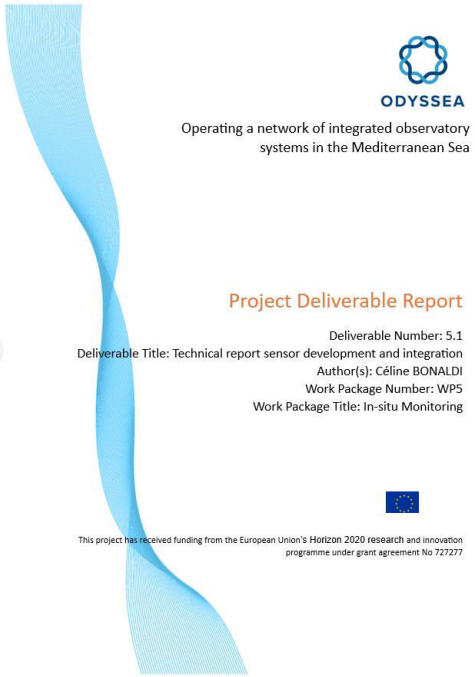
ODYSSEA

- The training and first missions will occurs beginning of April which is 5 months later than in the DOA.
    - Difficulties to have the permission to bring equipment in foreign countries and to install them at sea.
    - Difficulties to create and install new sensors on platform (example of windows cracked)
- However it would have been difficult to start all the deployments of instruments in winter time.

Deliverable and miles stones achieved

- D5.1 delivered on time

« Technical report sensor development and integration »



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