

# The COASTAL CRETE downscaled forecasting system

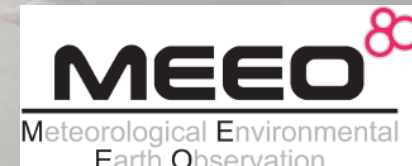
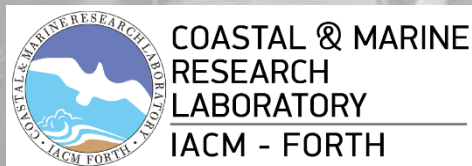
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Marco Folegani<sup>3</sup>, George Galanis<sup>4</sup>**

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Coastal & Marine Research Laboratory

<sup>2</sup> ORION Joint Research and Development Center, Cyprus

<sup>3</sup> Meteorological and Environmental Earth Observation – MEEO S.r.l., Italy

<sup>4</sup> Mathematical Modeling and Applications Laboratory, Section of Mathematics, Hellenic Naval Academy, Greece



# COASTAL CRETE

## at a glance



- ✓ A high-resolution operational forecasting system for the coastal area of Crete
- ✓ Implements advanced numerical hydrodynamic and sea state models nested in CMEMS Med MFC
- ✓ Provides, on a daily basis, 5-days hourly forecasts of currents, sea temperature, salinity, wave characteristics
- ✓ Downscaled high-resolution COASTAL CRETE forecasts are used in maritime safety and coastal management & monitoring



On demand simulation of different response actions in case of a pollution accident.



Early warnings and alerts (e.g. warn me when the waves are higher than 5 meters from north).



# COASTAL CRETE

## The partners



❖ **CMRL** conducts basic research and provide research and consultancy services to the private and public sectors in the field of marine monitoring & forecasting.

❖ **MEEO** is devoted to the development and implementation of products and services for the public and private sector based on remote sensing of the Earth-Atmosphere system.

❖ **ORION** works towards for the development of operational information systems and forecasting of environmental phenomena in the Eastern Med Sea.

❖ **CMRL** (est. 2006, Hellas):  
N.A. Kampanis, K. Spanoudaki,  
G. Alexandrakis, G.V. Kozyrakis

❖ **MEEO** (est. 2004, Italy): M.  
Folegani, D. Barboni, M. L.  
Quarta

❖ **ORION** (est. 2014, Cyprus):  
G. Zodiatis, R. Lardner, E. Zhuk,  
M. Nikolaidis

# COASTAL CRETE

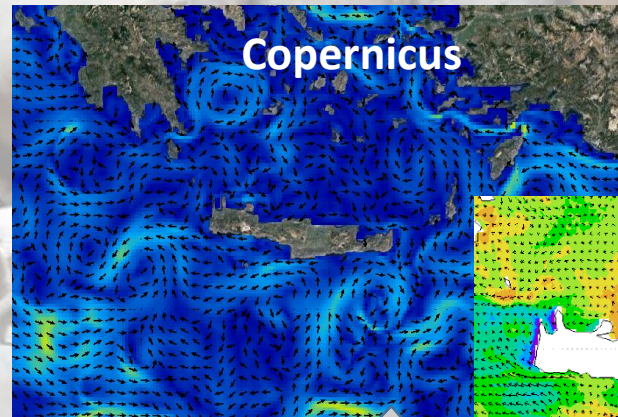
## context and description



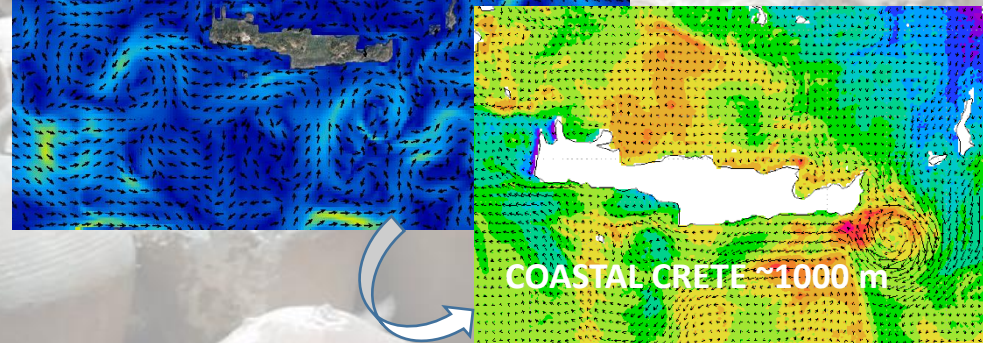
EMODNET Bathymetry &  
local measurements

COASTAL CRETE high-resolution ( $1/120^\circ$ )  
hydrodynamic model: forecasts of currents,  
SSH, T, S

Copernicus Med MFC initial  
& boundary conditions



ECMWF surface forcing &  
local meteorological data



EO SST, Sea level anomaly  
Mooring time series

COASTAL CRETE wave model (the latest  
ECMWF WAM CY46R1 parallel version)  
series of nested models of increasing  
resolution -  $1/120^\circ$  to  $\sim 250$  m -

Marine  
variables

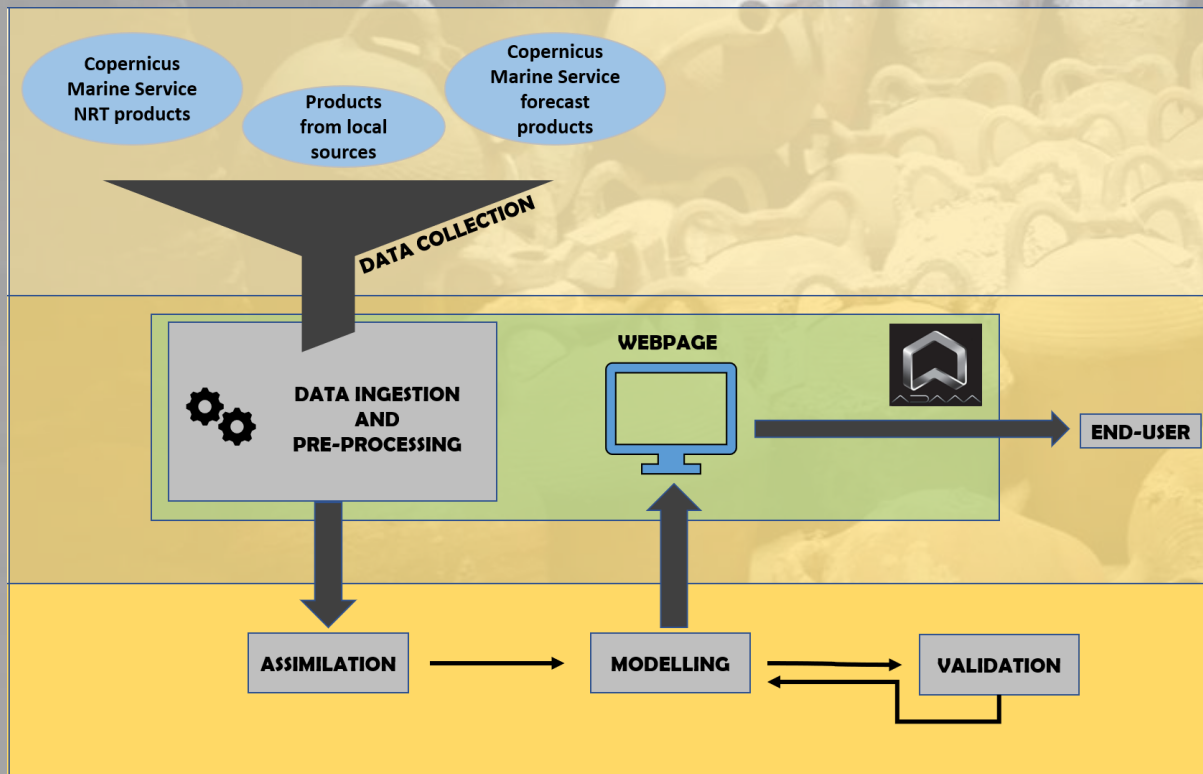
Maps,  
information  
services,  
warning & alerts

# COASTAL CRETE

## context and description



- ✓ Copernicus Marine Service products play a key role in the operational forecasting chain providing the required initial and open boundary conditions to run the series of nested hydrodynamic and wave models



### Analysis and Forecast

- ✓ Mediterranean Sea Physics Analysis and Forecast  
[MEDSEA ANALYSIS FORECAST PHY 006 013](#)

- ✓ Mediterranean Sea Waves Analysis and Forecast  
[MEDSEA ANALYSIS FORECAST WAV 006 017](#)

### Observations

- ✓ Mediterranean Sea High Resolution and Ultra High Resolution Sea Surface Temperature Analysis  
[SST\\_MED SST L4 NRT OBSERVATIONS 010 004](#)
- ✓ Mediterranean Sea- In-Situ Near Real Time Observations  
[NSITU\\_MED NRT OBSERVATIONS 013 035](#)
- ✓ MEDITERRANEAN SEA GRIDDED L4 SEA SURFACE HEIGHTS AND DERIVED VARIABLES NRT  
[SEALEVEL\\_MED PHY L4 NRT OBSERVATIONS 008 050](#)

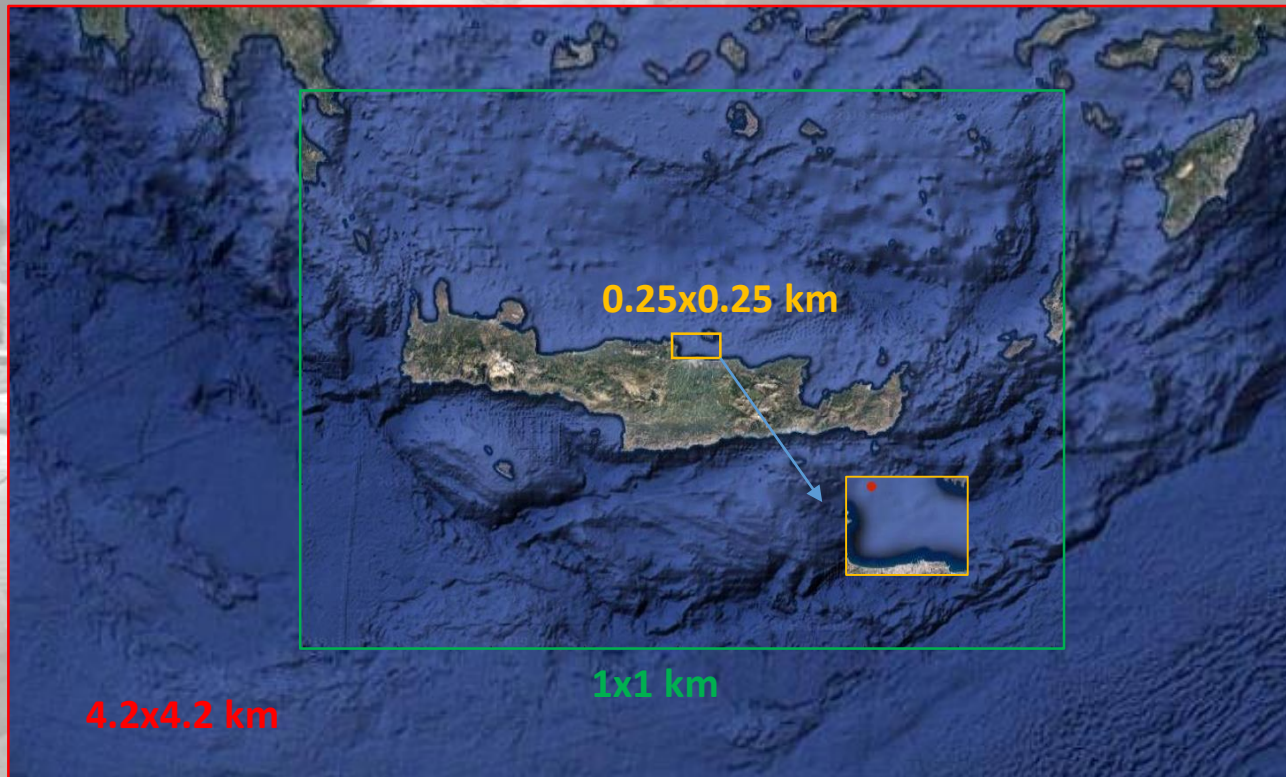


# COASTAL CRETE

## context and description



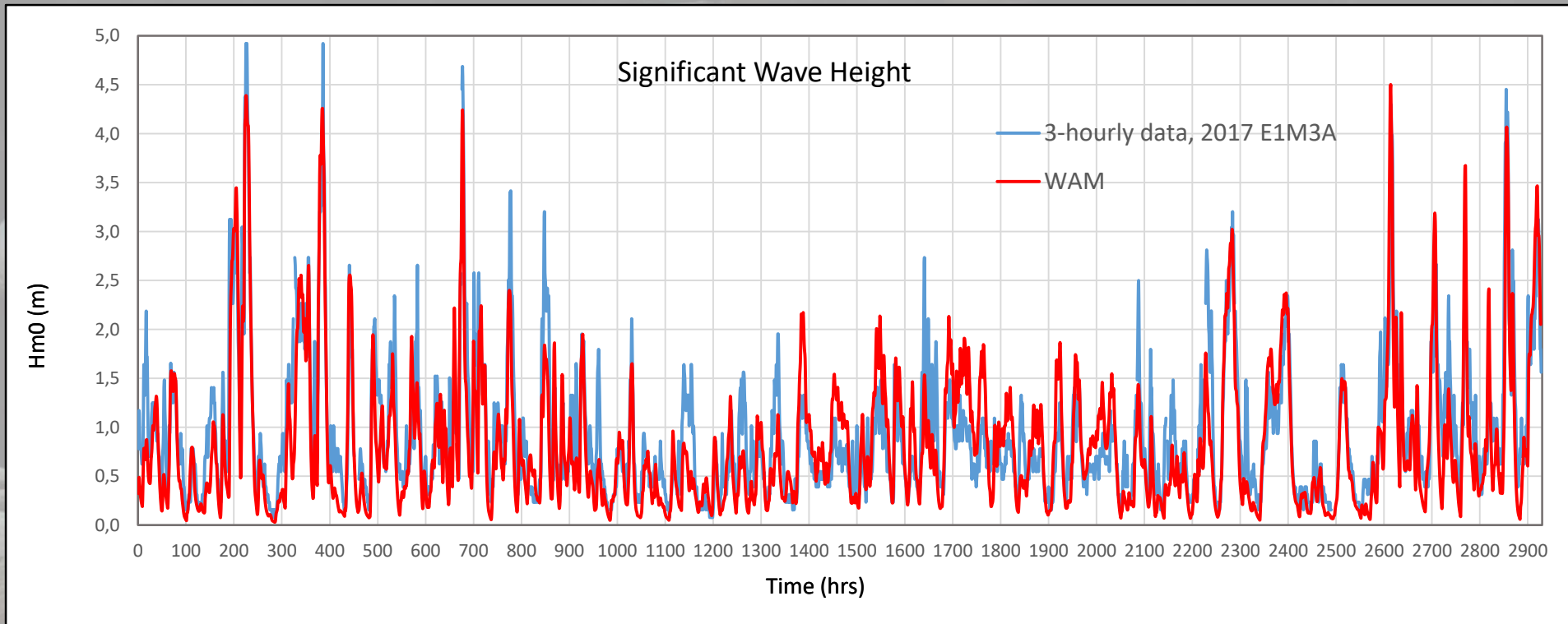
COASTAL CRETE wave model



Series of computational grids (nesting)

# COASTAL CRETE

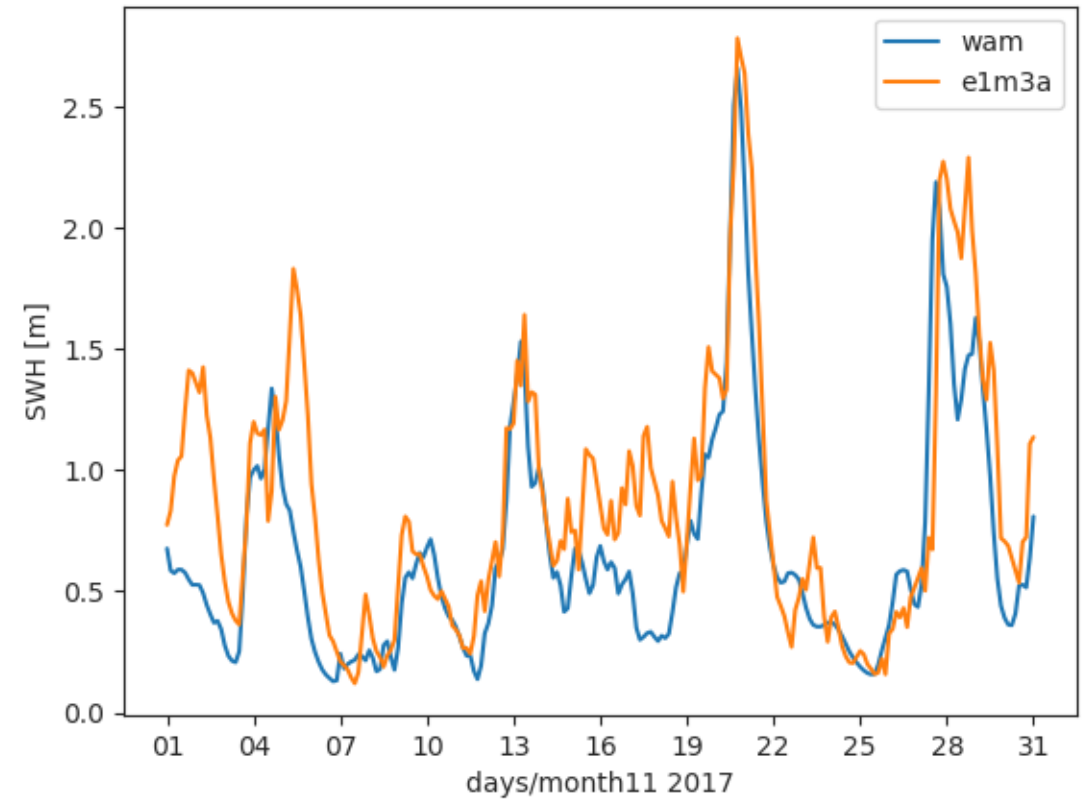
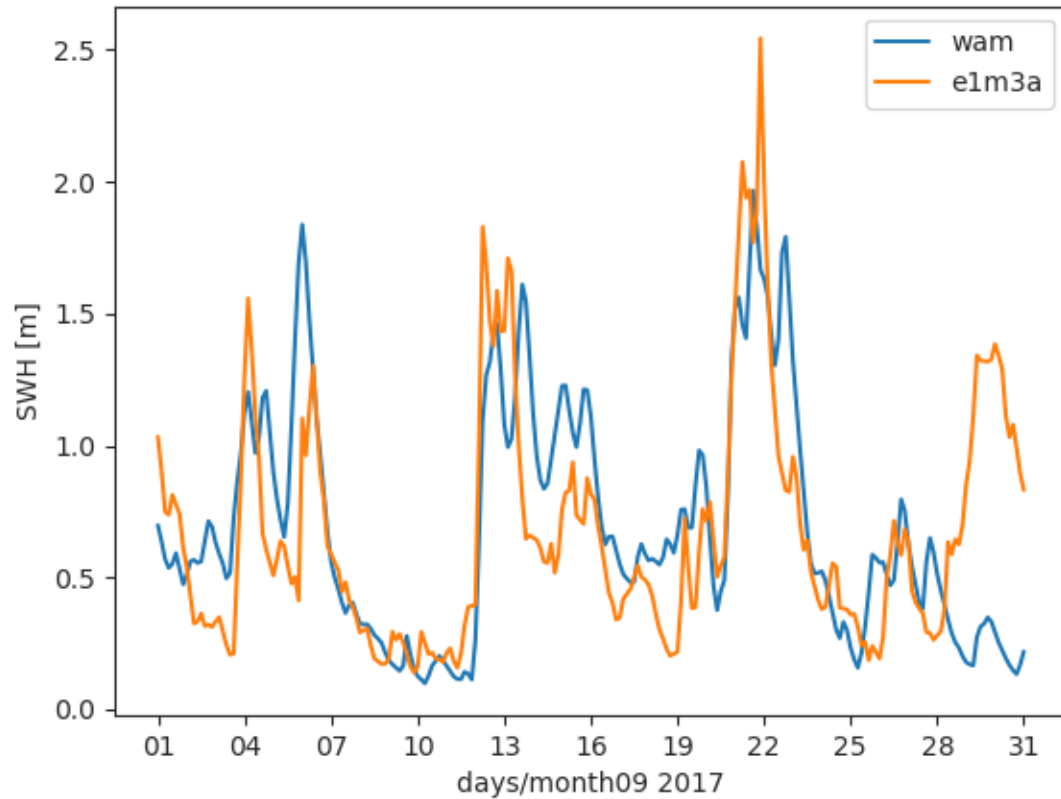
## context and description



2<sup>nd</sup> grid, hindcast, comparison with HCMR buoy E1M3A data, 2017, ERA 5 wind forcing

# COASTAL CRETE

## context and description

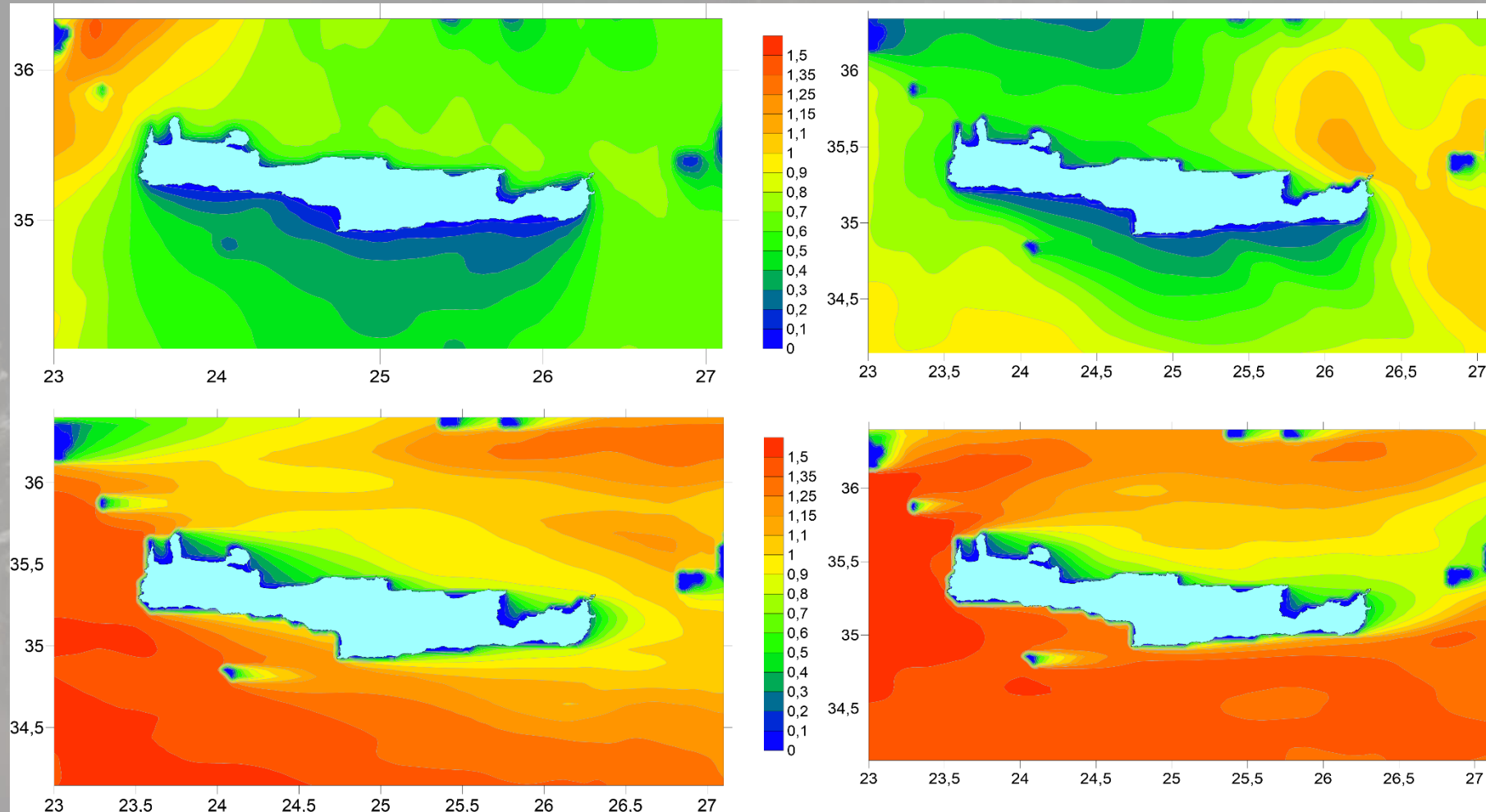


2<sup>nd</sup> grid, hindcast, comparison with HCMR buoy E1M3A data, 2017, ERA 5 wind forcing



# COASTAL CRETE

## context and description



**2<sup>nd</sup> grid, hindcast, January 2017**  
**(2017-1-1 00:00, 2017-1-2 12:00, 2017-15-1 12:00, 2017-19-1 00:00)**

# COASTAL CRETE

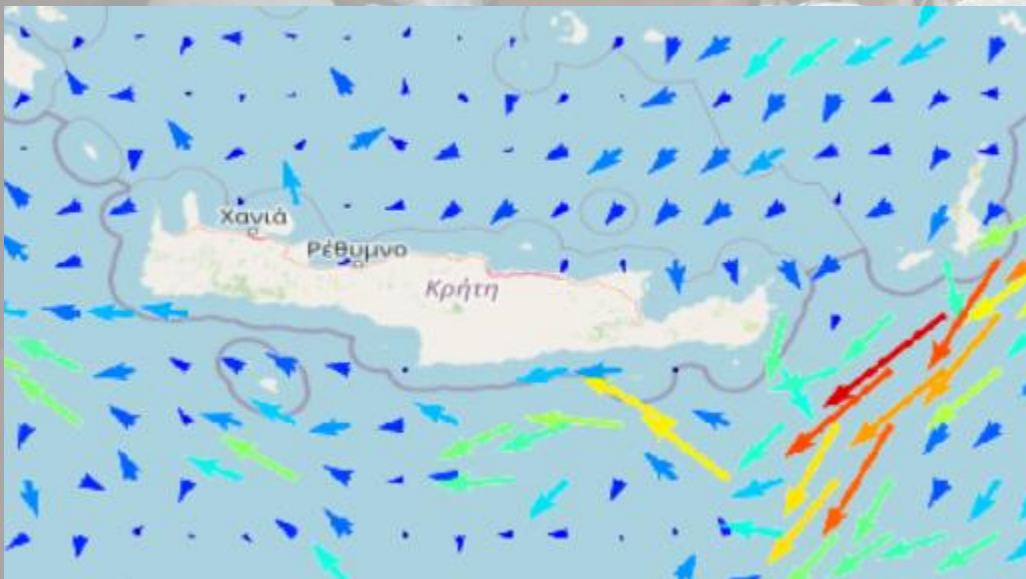
## context and description



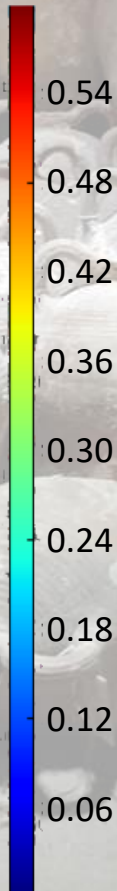
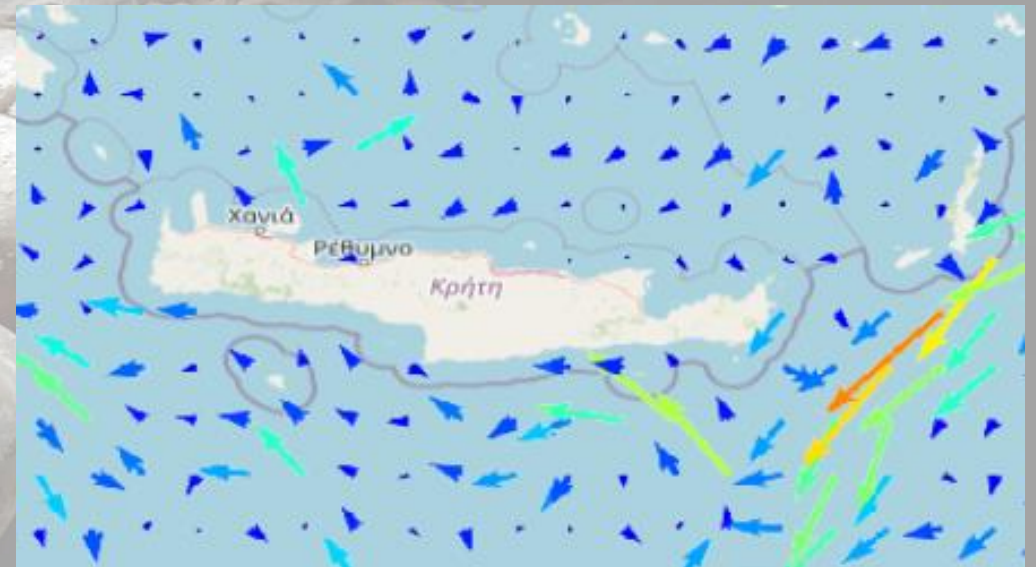
❖ The COASTAL CRETE high-resolution (~1km) hydrodynamic model is based on a modified POM novel parallel code previously implemented by the CYCOFOS in the Eastern Mediterranean and the Levantine Basin

forecast

8-5-2020 03:00



9-5-2020 03:00





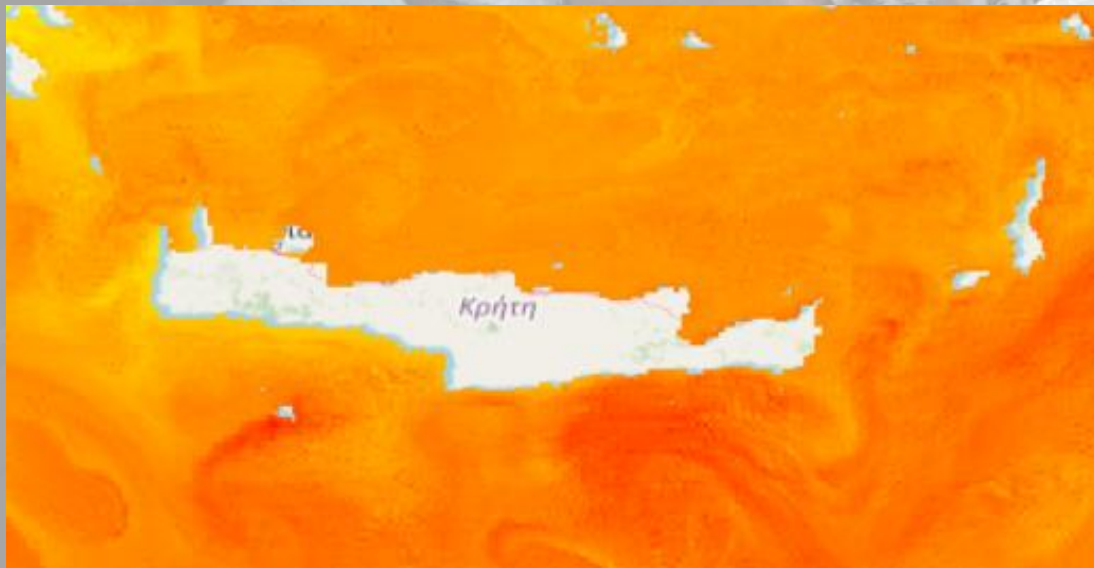
# COASTAL CRETE

## context and description



forecast

8-5-2020 03:00

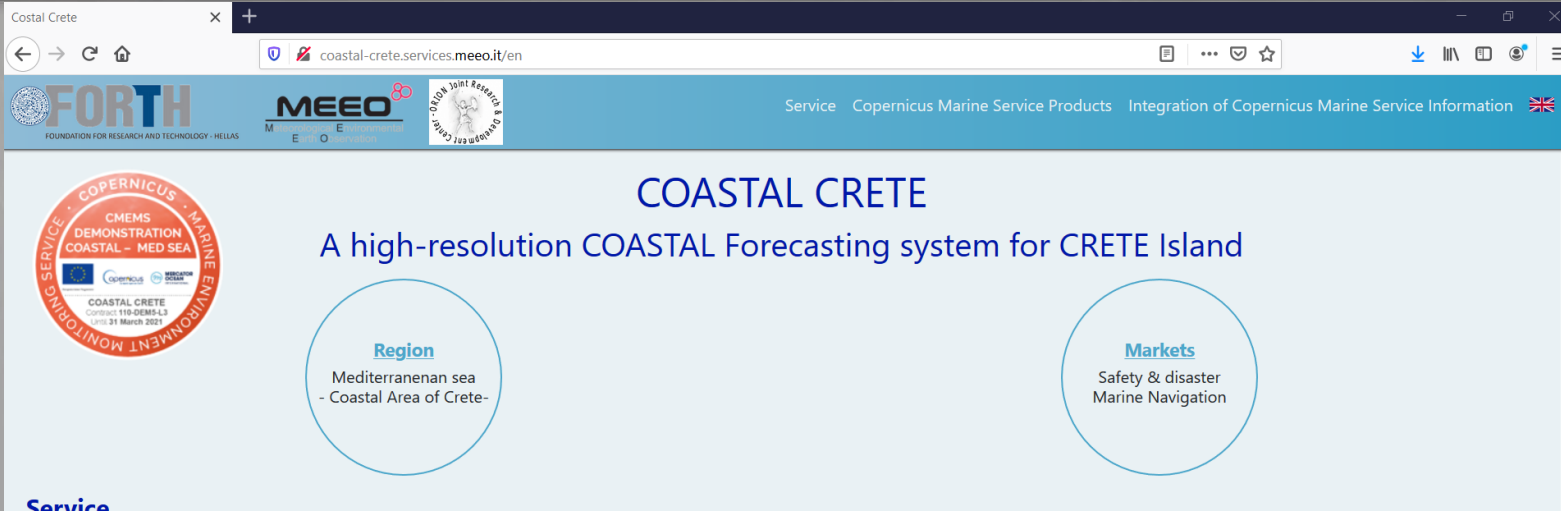


9-5-2020 21:00





# COASTAL CRETE SERVICES



The screenshot shows the homepage of the Coastal Crete service. The header includes logos for FORTH, MEEO, and Copernicus, along with navigation links for Service, Copernicus Marine Service Products, and Integration of Copernicus Marine Service Information. The main content area features the title "COASTAL CRETE" and the subtitle "A high-resolution COASTAL Forecasting system for CRETE Island". Below this, there are two circular icons: "Region" (Mediterranean sea - Coastal Area of Crete-) and "Markets" (Safety & disaster Marine Navigation). A sidebar on the left contains a "Service" section with a "What we offer" list.

**COASTAL CRETE**  
A high-resolution COASTAL Forecasting system for CRETE Island

**Region**  
Mediterranean sea  
- Coastal Area of Crete-

**Markets**  
Safety & disaster  
Marine Navigation

**Service**

**What we offer**

- ✓ COASTAL CRETE is an operational high-resolution coastal forecasting service for Crete Island, implementing advanced numerical hydrodynamic and sea state models nested in Copernicus Marine Service products
- ✓ The service provides hourly and 6-hourly averaged high-resolution short-term (5-day) forecasts of sea temperature, salinity, velocity fields, wave characteristics, on a daily basis
- ✓ Delivers (on demand) customized and ready to use information and derived products for maritime safety, using the downscaled high-resolution COASTAL CRETE forecasts, e.g. for oil spill and floating objects trajectories predictions and transport and safety of ships
- ✓ Products and information are accessible and visualized through **ADAM** platform

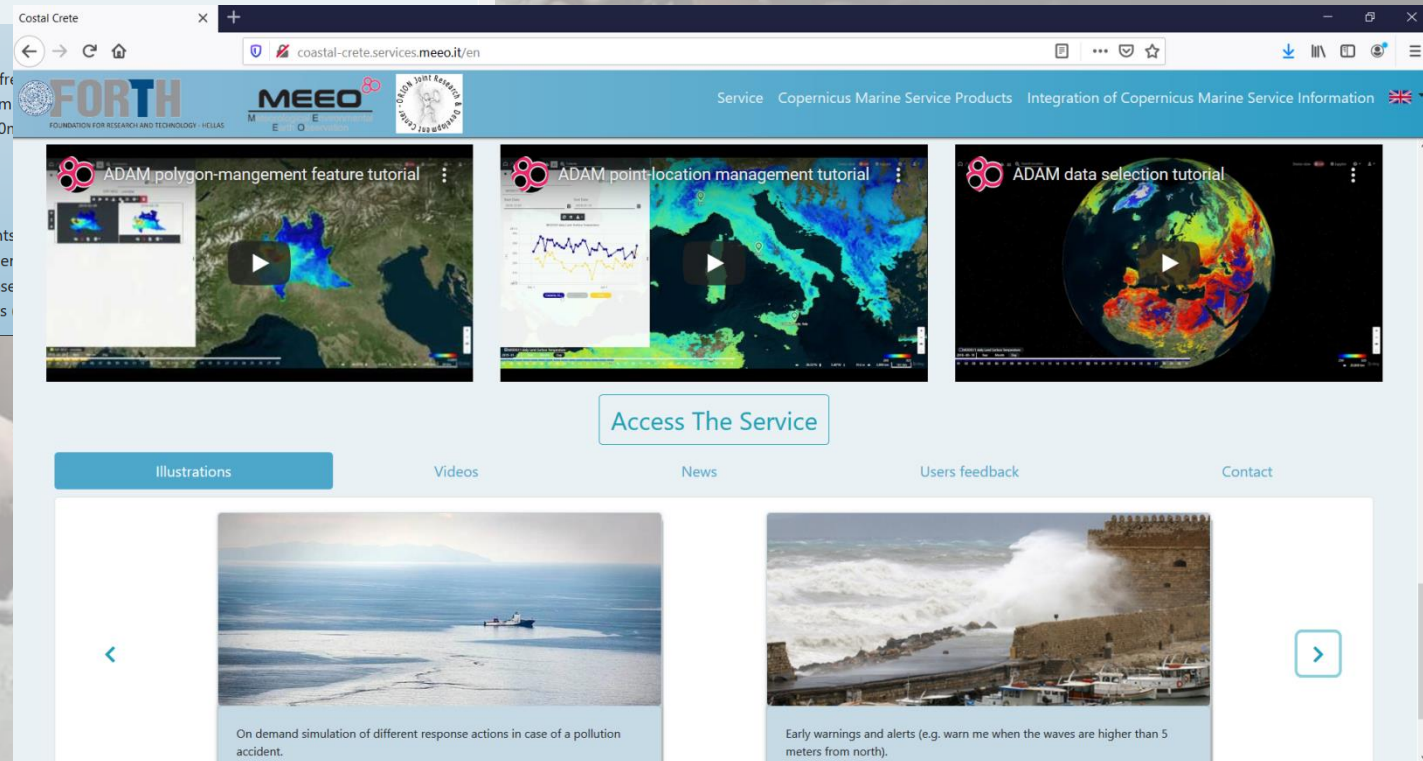
**ADAM** provides automatic data exchange management capabilities between the CMEMS Med MFC and the COASTAL CRETE models, enabling data visualization, combination, processing and download through the implementation of the Digital Earth concept.

**Accessibility of the service**

The information is distributed both in a free marine parameters) and by paid premium derived from very high-resolution (~ 200m information and specific alerts

Examples of such services are:

- ✓ Very high-resolution wave and currents
- ✓ Support to the response to environmental accident: where shall I put my response
- ✓ Personalized early warnings and alerts



The screenshot shows a section of the Coastal Crete website with three video tutorials: "ADAM polygon-mangement feature tutorial", "ADAM point-location management tutorial", and "ADAM data selection tutorial". Below the videos is a "Access The Service" button. At the bottom, there is a gallery with two images: "On demand simulation of different response actions in case of a pollution accident" and "Early warnings and alerts (e.g. warn me when the waves are higher than 5 meters from north)".

**Access The Service**

**Illustrations** **Videos** **News** **Users feedback** **Contact**

**On demand simulation of different response actions in case of a pollution accident.**

**Early warnings and alerts (e.g. warn me when the waves are higher than 5 meters from north).**

The harvesting of the CMEMS Med MFC products has been set in an automatic way and managed through the EODATASERVICE technology developed by MEEO, i.e. **ADAM** (Advanced geospatial Data Management platform - <https://adamplatform.eu/>).

# COASTAL CRETE SERVICES



On demand simulation of different response actions in case of a pollution accident.



Early warnings and alerts (e.g. warn me when the waves are higher than 5 meters from north).

## Accessability of the service

The information is distributed both in a free public basis (high-resolution short-term forecasts of marine parameters) and by paid premium services. Premium services may include information derived from very high-resolution (~ 200m) forecasts, non-public local data, user tailored information and specific alerts. Examples of such services are:

- ✓ Very high-resolution wave and currents forecasts
- ✓ Support to the response to environmental hazards such as oil spills (there was a pollution accident: where shall I put my response effort ?)
- ✓ Personalized early warnings and alerts (e.g. warn me when the waves become higher than 5 meters)

## End users

COASTAL CRETE services are addressed both to the public and private sector. Examples of users in the coastal area of Crete are port authorities (e.g. Heraklion Port Authority S.A., Souda Port), the Hellenic Coast Guard, the shipping sector, oil and gas companies, the Region of Crete.





**Acknowledgment: Copernicus Marine Environment Monitoring Service (CMEMS) DEMONSTRATION  
COASTAL-MED SEA. COASTAL-CRETE, Contract: 110-DEM5-L3.**



BY