地中海预报系统：蓝色增长的应用

Mediterranean Forecasting System: Blue growth applications
Giovanni Coppini (CMCC)
CMEMS MED-MFC Leader
MONGOOS co-chair

credits @neva chieregato

Euro-Mediterranean Centre on Climate Change Foundation

Mission
To investigate and model Earth climate system and its interactions with society to provide reliable, rigorous, and timely scientific results to stimulate sustainable growth, protect the environment and to develop science-driven adaptation and mitigation policies in a changing climate.

a) Contribution to Copernicus Services:

1. **Coordination of the Copernicus Marine Environment Monitoring Service (CMEMS) Monitoring and Forecasting Centre (MFC) in the Mediterranean**
2. Contribution to the CMEMS Black Sea MFC
3. Global Ocean reanalysis for the CMEMS
4. Seasonal Forecast of Copernicus Climate Change Service (C3S)

b) Contributing to EMODNET Med and Black Sea Check Points

c) **Development of BG applications with Industry**

User-centered Services
Why? For whom?

Safety of navigation

Coastal protection and erosion

Search and Rescue

Pollution emergencies

Climate Change

Protection&management of maring ecosystems

Off-shore activities

Military activities

Renewable energies

Fishery&acquacolture

Tourism

Harbours

How are we organized in the Mediterranean are and international level?

Mediterranean Operational Network for the Global Ocean Observing System

- GOOS regional alliance for Operational Oceanography at the Med Sea.
- Objective of fostering operational oceanography in the Med Sea and promote collaboration
- Mediterranean component of EUROGOOS
- 38 partners form 13 countries
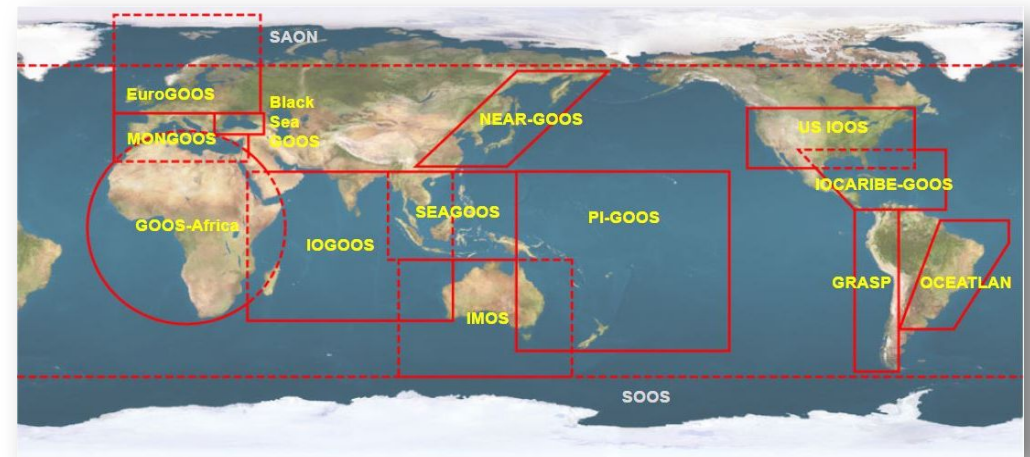
MONGOOS principal objectives:
- **Improved Fitness for Purpose.**
- **Greater Awareness.**
- **Increased Down-streaming.**
- **Improved Capacity.**

www.mongoos.eu

EU Copernicus Marine Environment Monitoring Service (CMEMS)

Arctic

Baltic

North West Shelves

Global Ocean

Black Sea

Eastern North Atlantic

Mediterranean
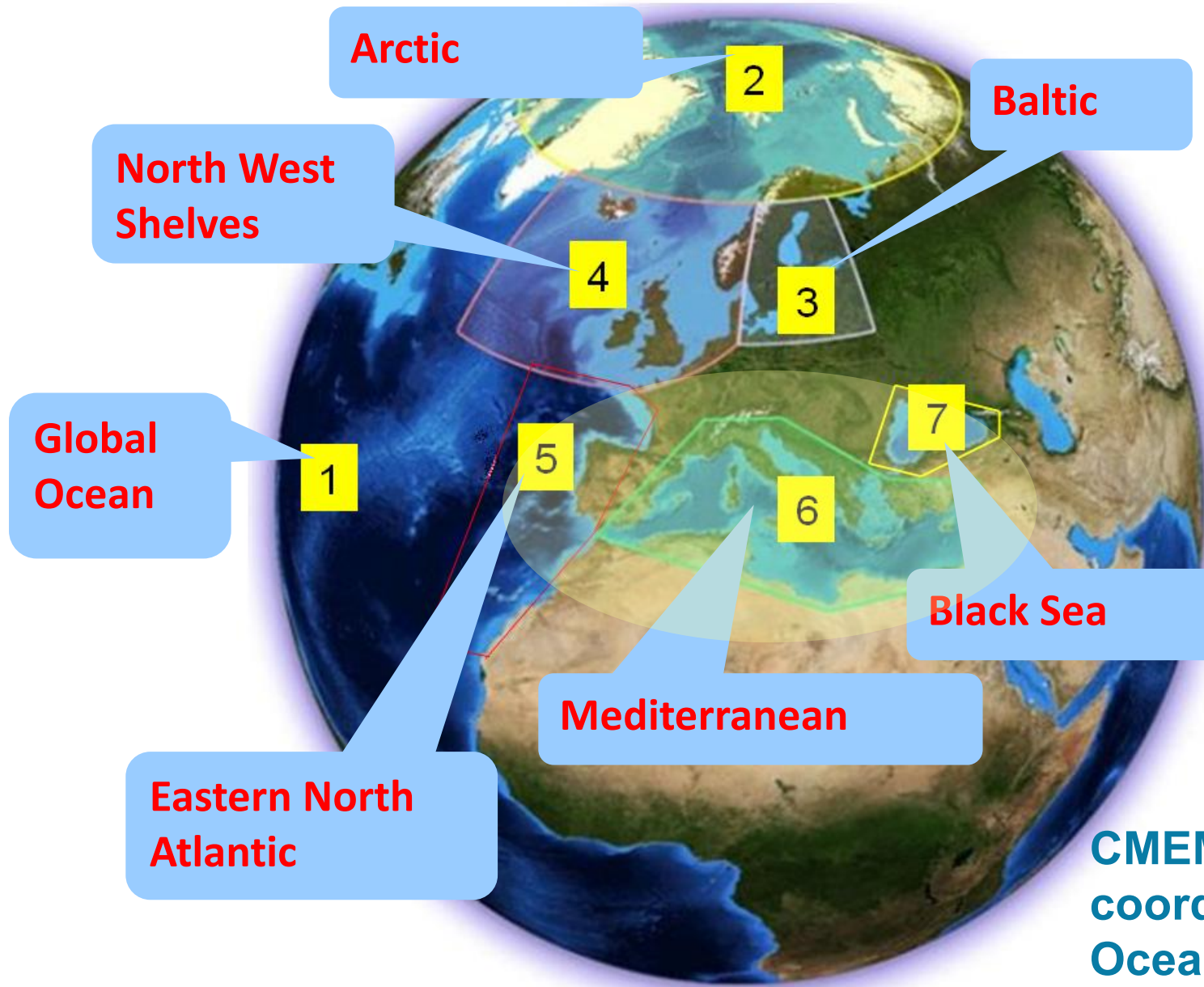
A Pan-European network of existing infrastructures, value-added by the Copernicus initiative, coordinated and with common quality standards
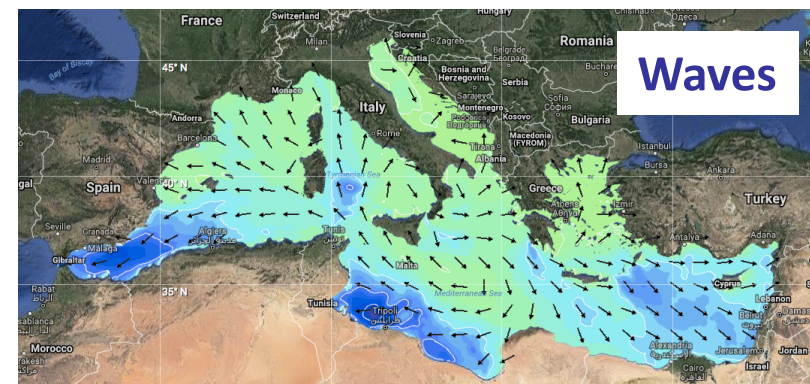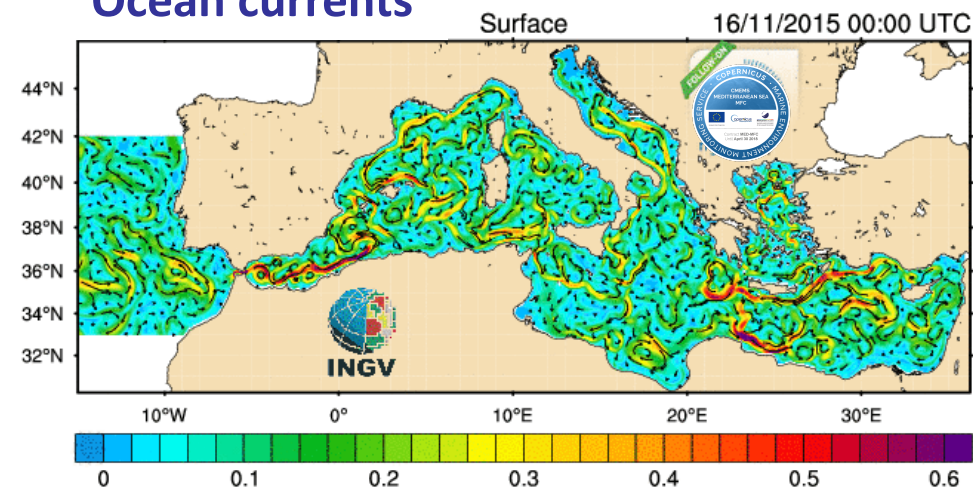
CMEMS is coordinated by Mercator Ocean

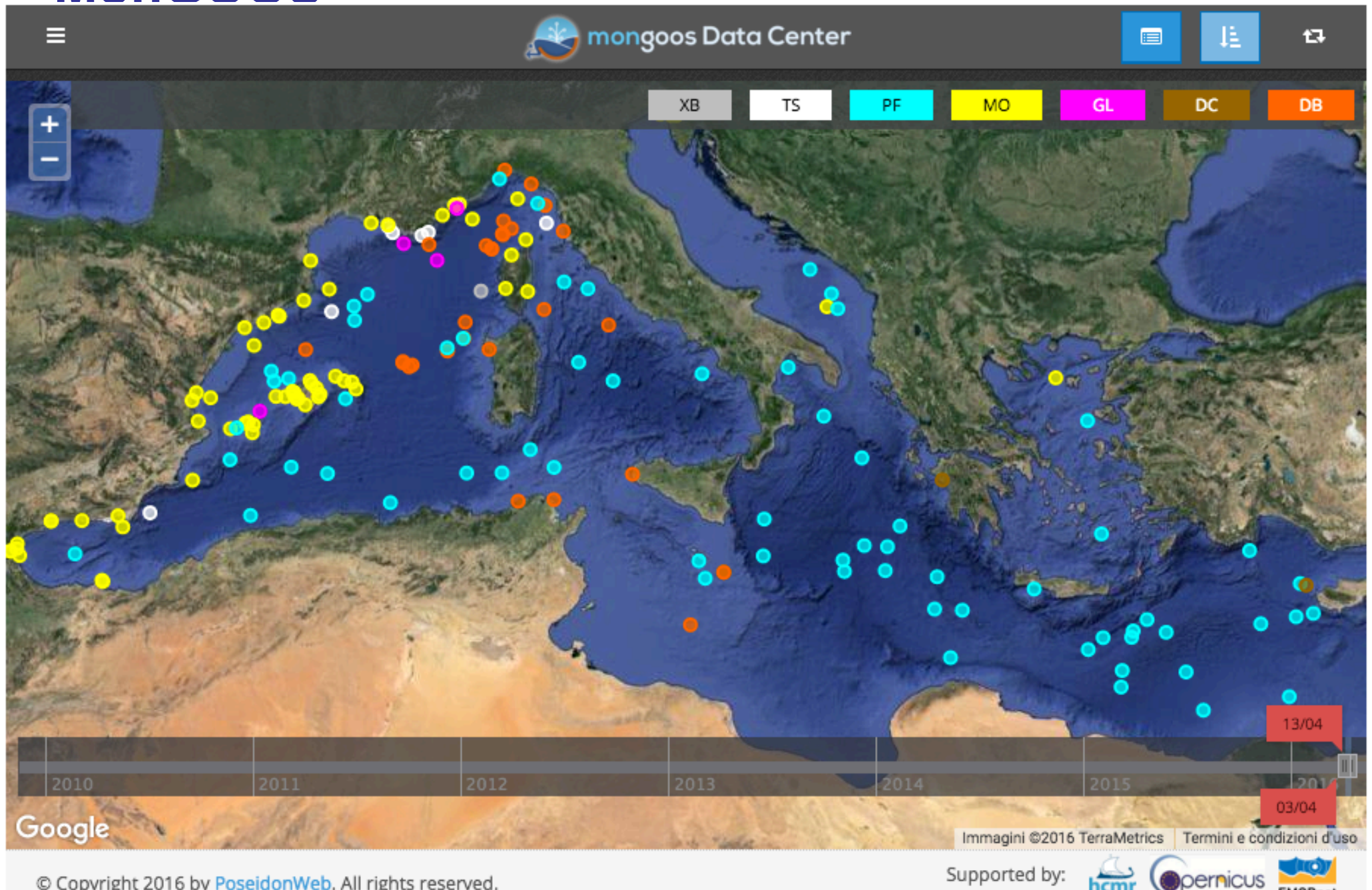# EU Copernicus Marine Environment Monitoring Service (CMEMS) Mediterranean Monitoring and Forecasting Centre (MED-MFC)
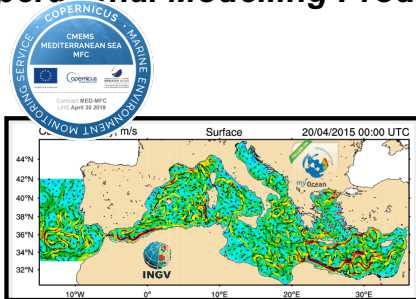
Ocean temperature

Biogeochemistry (Chl-a)

OGS
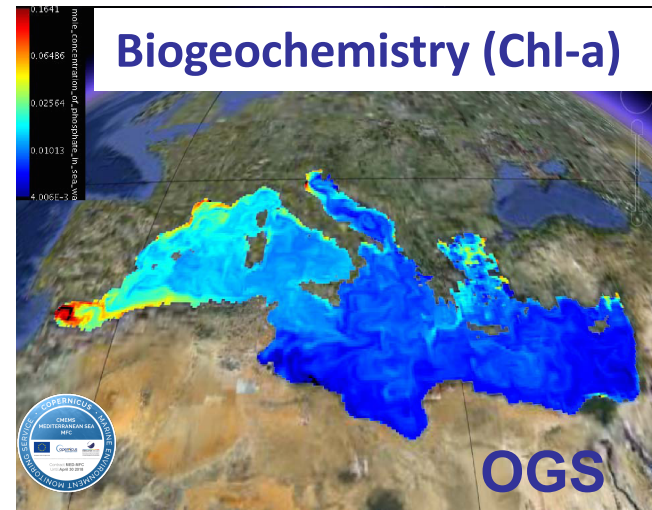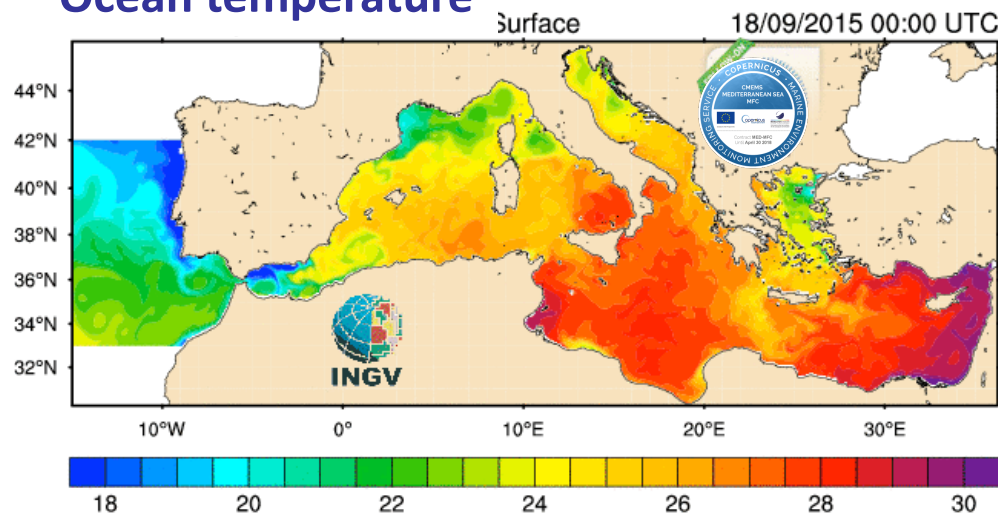
Ocean currents

Waves

Contribution to the CMEMS in situ TAC by MonGOOS

Sea Situational Awareness services: how we produce them

Downscaling in the Mediterranean Sea to the subregional → coastal → harbour scale (unstructured grid model shyfem)

Winter: DJF

Spring: MAM

Summer: JJA

Autumn: SON

η [cm]

Otranto tidegauge

02/06/2012　　　　　22/06/2012

Time-series comparisons between the simulated sea level and the observed height at the Italian tide-gauges stations have been performed.

Vieste

Bari

Crotone

Otranto

- Vieste
- Bari
- Otranto
- Taranto
- Crotone

Percentage error of model for the most significant tidal constituents in terms of amplitude and phase.

Phase

DIFF (%)

M2　S2　O1　K1　AVG

Tidal constituents

Amplitude

DIFF (%)

M2　S2　O1　K1　AVG

SANIFS-v2: operational forecasting at the Brindisi harbour scale (20 m horizontal resolution)

START
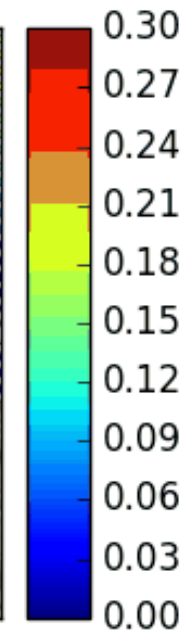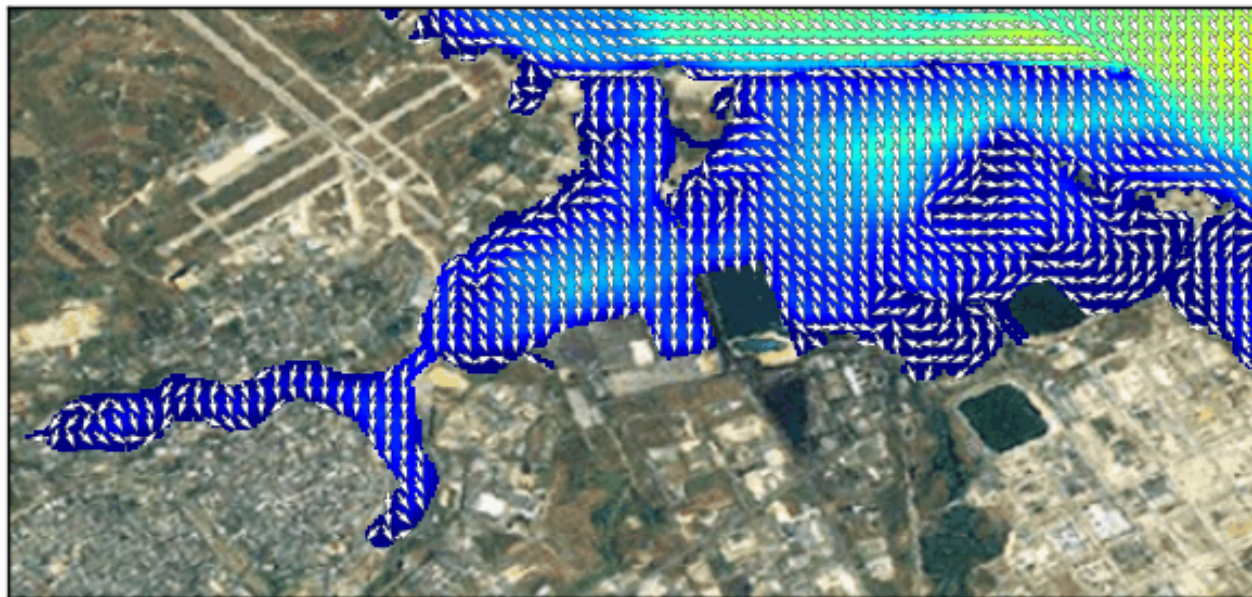
EU Copernicus Sentinel-2B satellite first delivered image of Earth

It is used for tourism, commercial and industrial shipping on the Adriatic Sea.
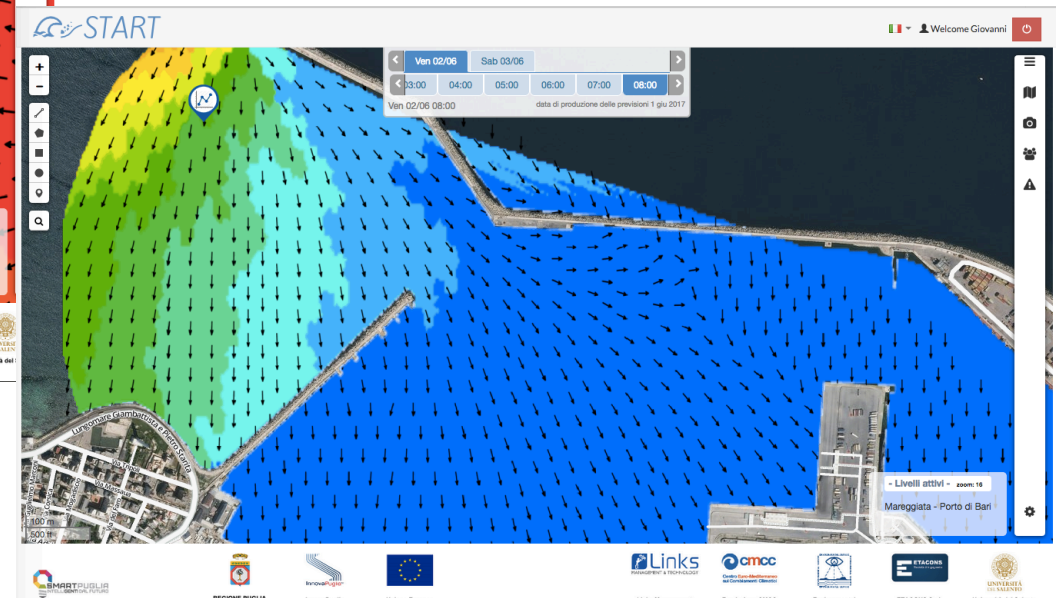**Tourist traffic offer connections with the Balkan Peninsula and Turkey.**
Commercial concerns include coal, fuel oil, natural gas and chemicals.

CMEMS Wave downscaling to the coastal and harbour area (few meters resolution)

Torre Canne, area exposed to erosion
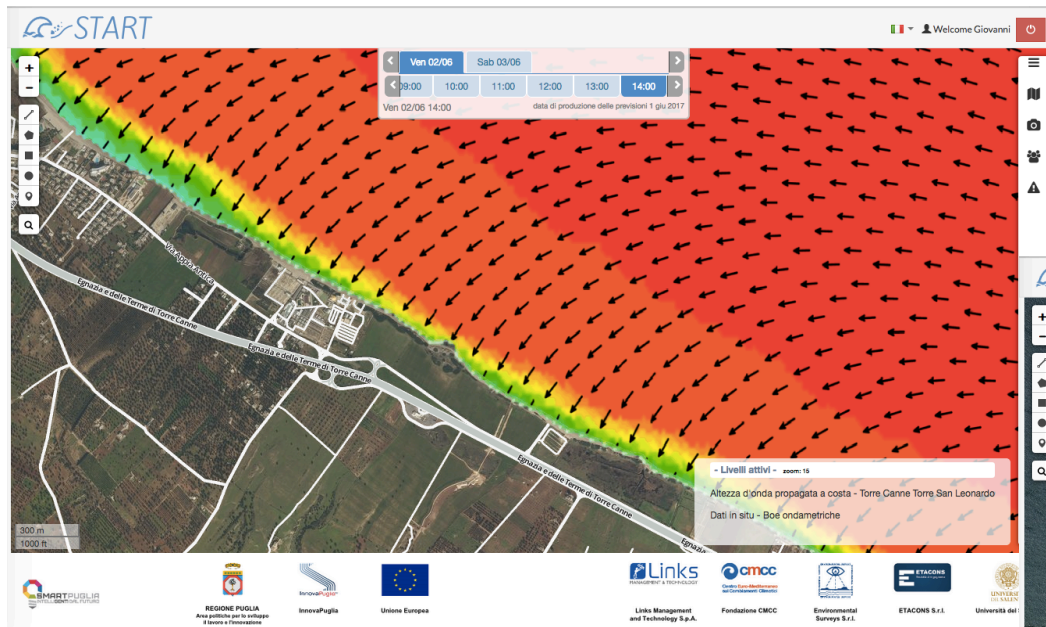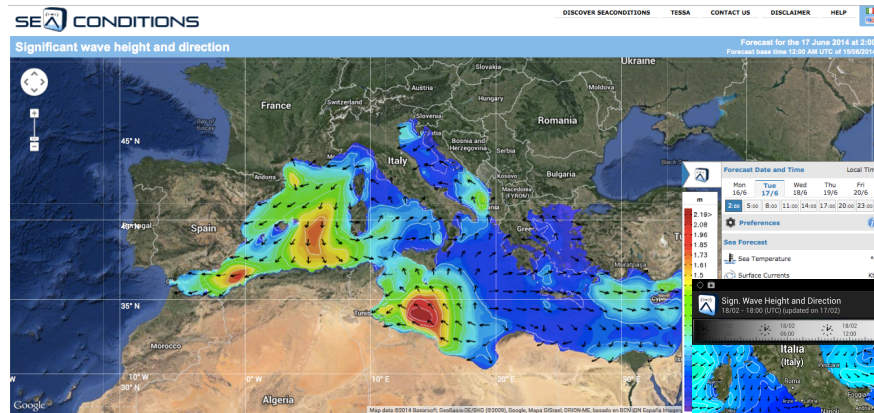

Port of Bari

Start Project

www.Sea-Conditions.com

Situational Sea Awareness technology develops multi-channel services, customized for general public and special users

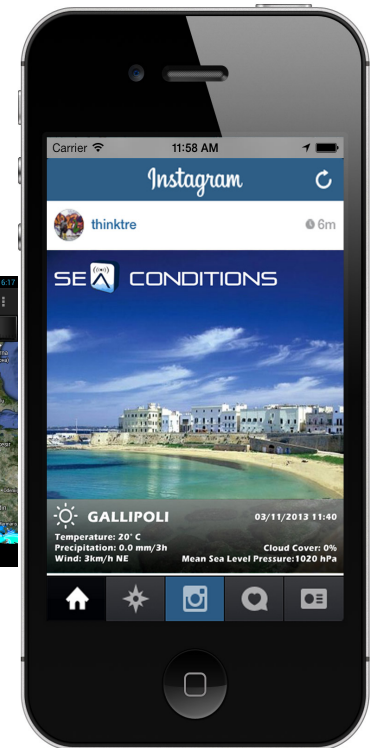**Currents, waves and winds forecasted in the area**

Web Portal…

Smartphone…

Tablet…

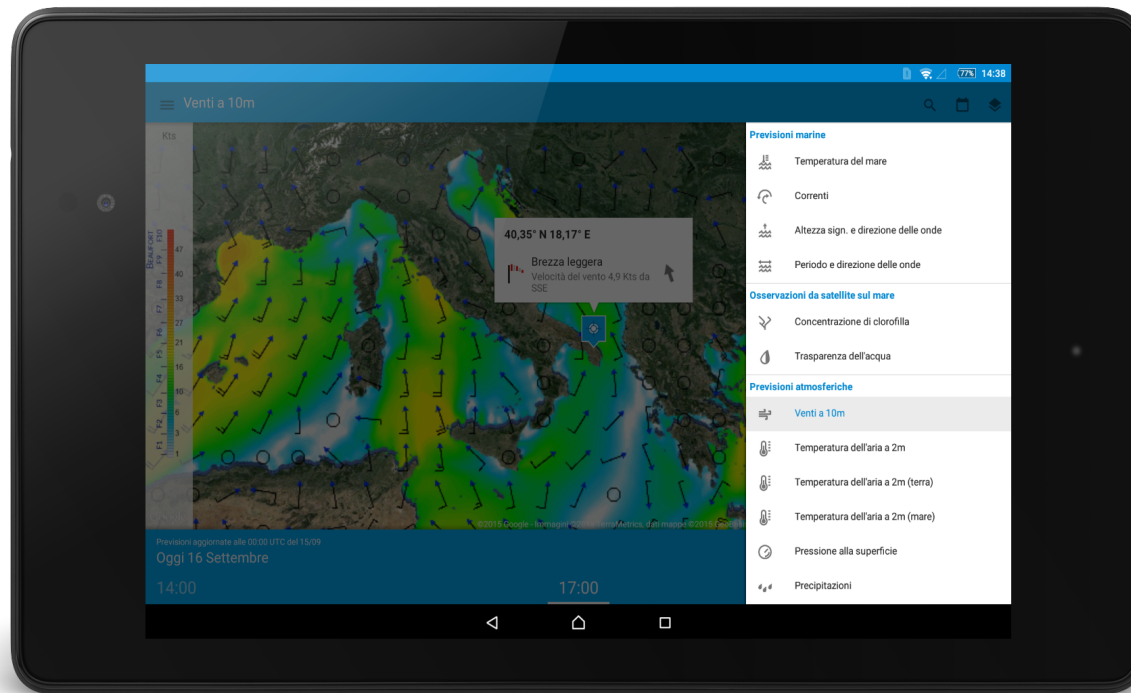# The mobile application

With SeaConditions it's possible to view forecasts every 3 hours for 5 days. The variable selected in the mediterranean sea are:

Sea forecast:
- Sea temperature
- Currents
- Sign. Weave height and direction
- Weave period and direction

Sea satellite observation:
- Chlorophyll concentration
- Water transparency

Weather forecast:
- Wind at 10m
- Air temp. at 2m
- Air temp. at 2m (land)
- Air temp. at 2m (ocean)
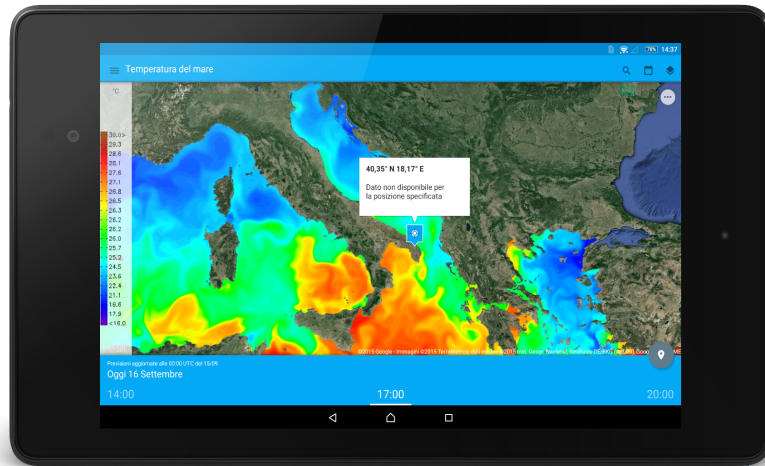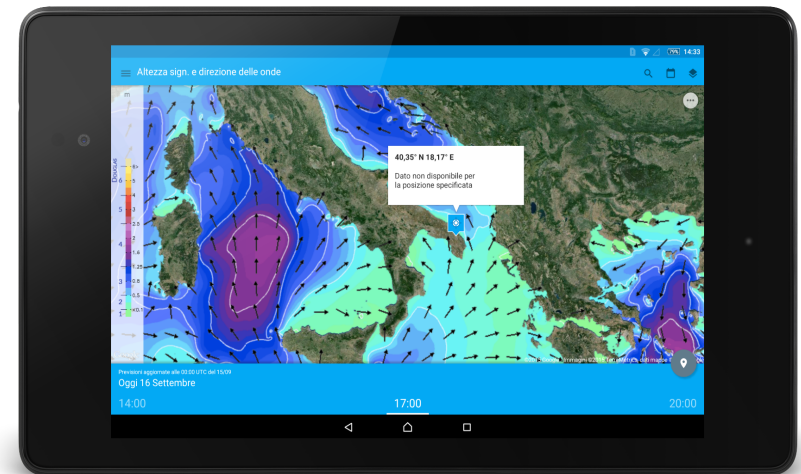- Mean sea level pressure
- Precipitation
- Cloud cover

The mobile application
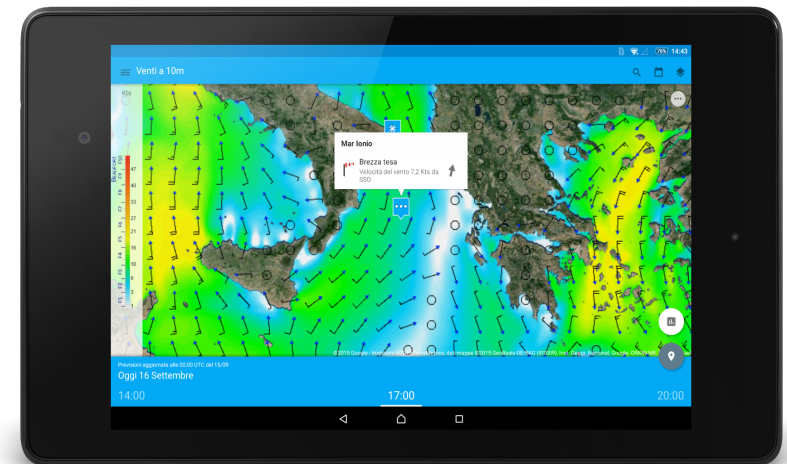
SEA TEMPERATURE

SIGN. WAVE HEGHT AND DIRECTION

SOME EXAMPLES

CURRENTS

WINDS

SeaConditions: *the main features*
Forecast on Google maps
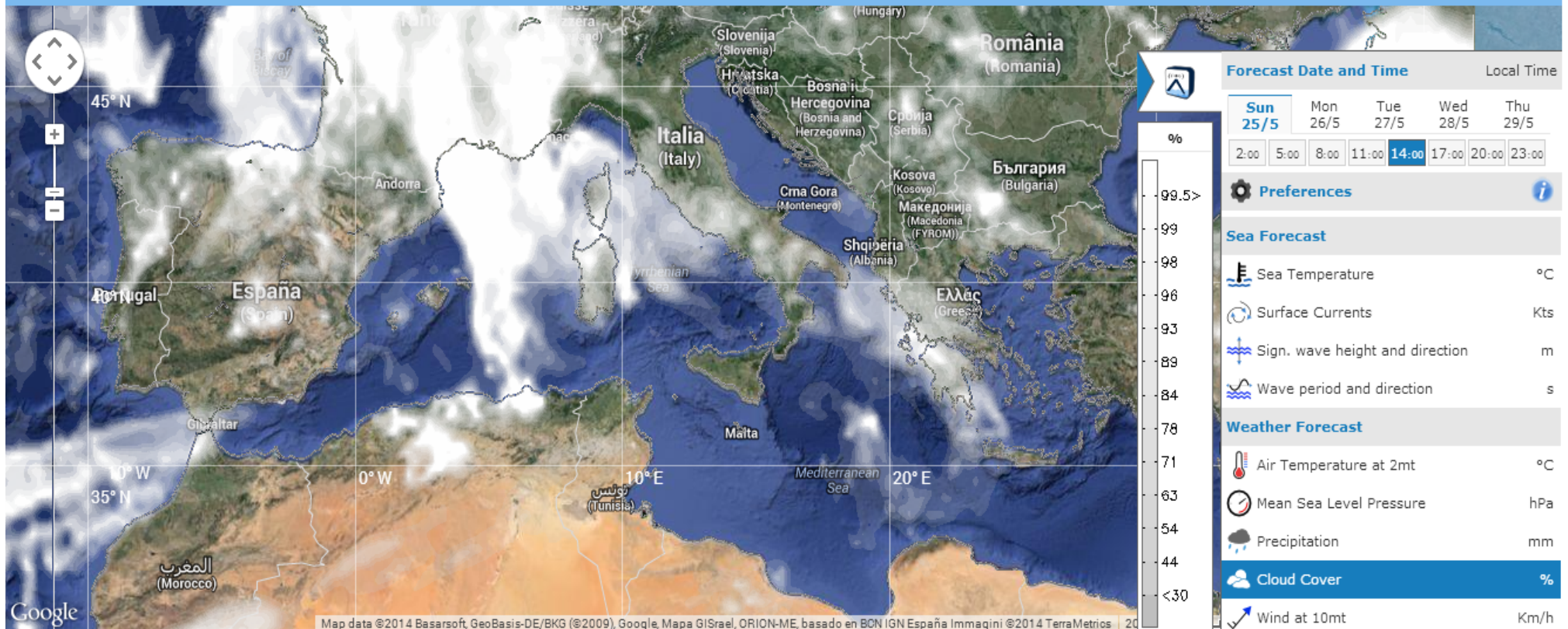
SeaConditions: *the main features*

Interactive maps, with drag and zoom

The mobile application

SELECT A VARIABLE ON LIST AND THE DATE, TAP THE POINT OF INTEREST ON THE MAP AND VISUALIZE THE TABLE OF VALUE PER DAY EVERY 3 HOURS
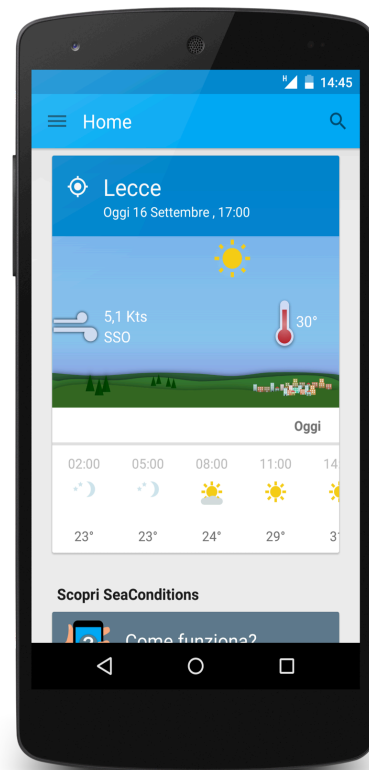
More than 100K SeaConditions apps downloads

Based on CMEMS products

Visir: ship safety and routing

Ferry, fishing, sailing Boats & Yachts routing in the ocean dynamical environment: shortest time with IMO safety constraints
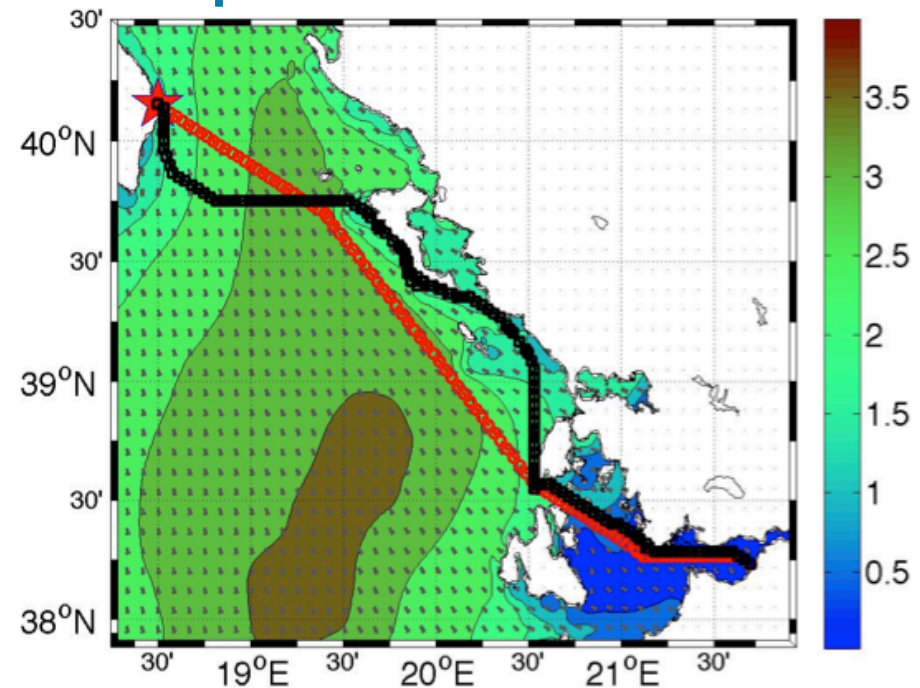
Waves, winds and currents forecasted in the area

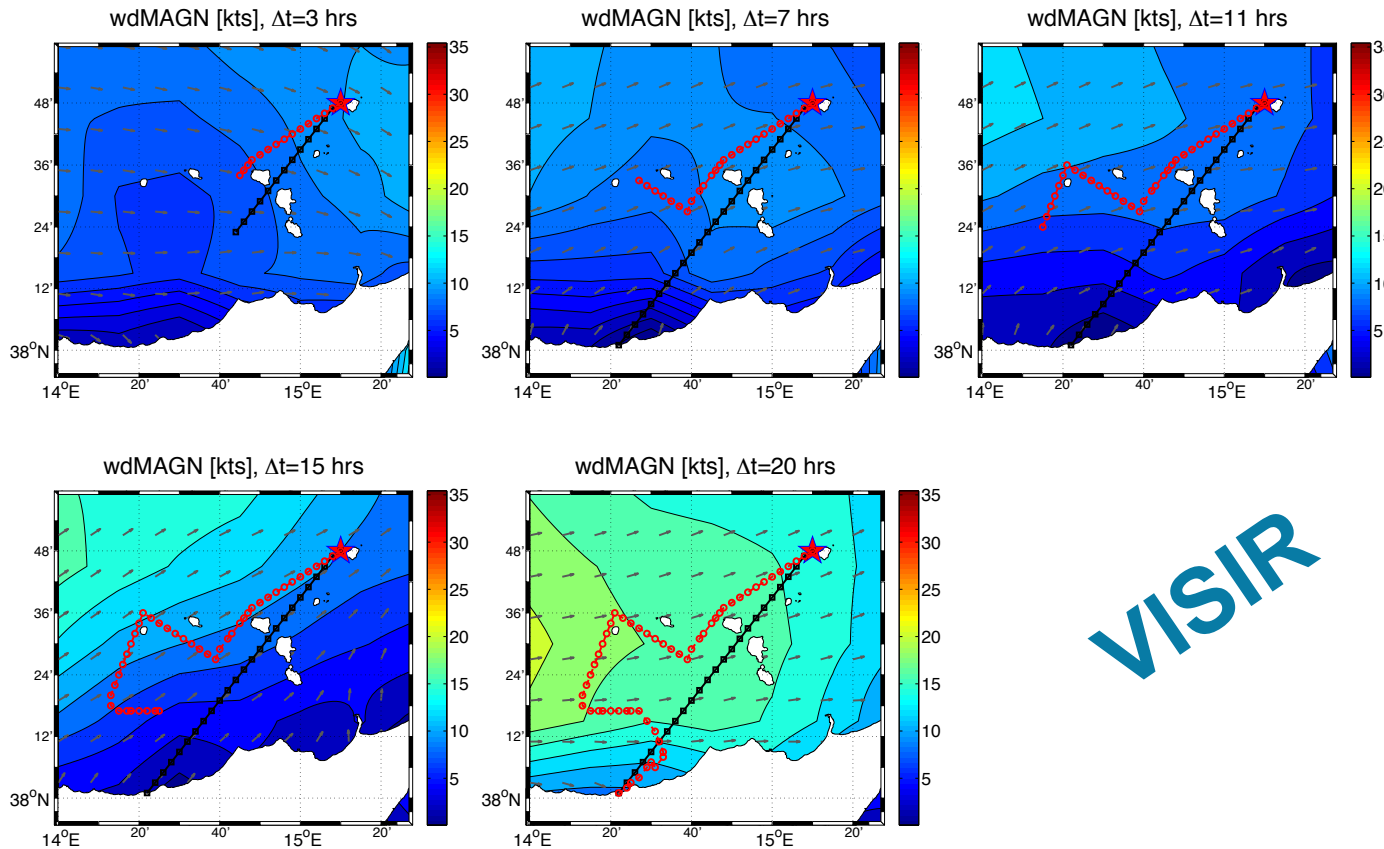**VISIR web and mobile applications**

Optimal Route Otranto-Patrasso

www.visir-nav.com

Based on CMEMS products

Tourism and sports activities

wdMAGN [kts], Δt=3 hrs

wdMAGN [kts], Δt=7 hrs

wdMAGN [kts], Δt=11 hrs

wdMAGN [kts], Δt=15 hrs

wdMAGN [kts], Δt=20 hrs

VISIR

Class

→Sailboat route planning even in coastal waters

www.visir-nav.com

7.3 Length [m]

1.2 Draught [m]

First-367 - Wind speed range [kts]: 4 - 30

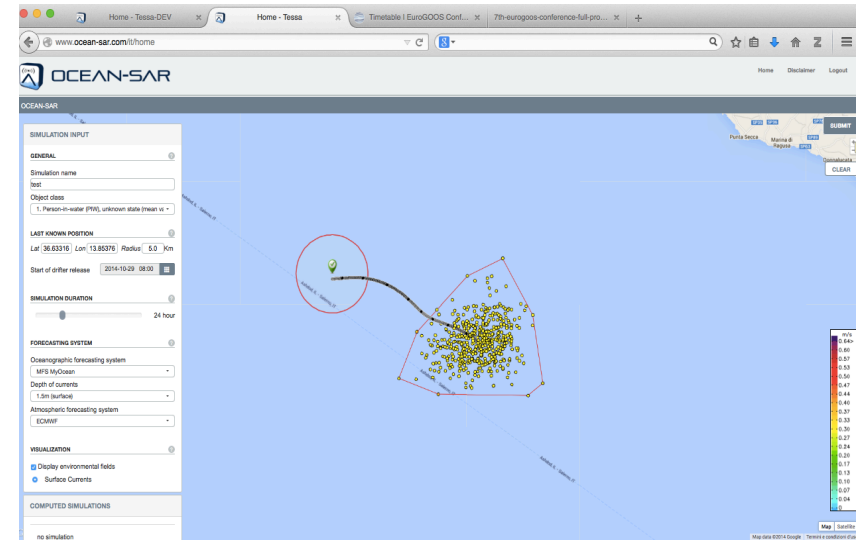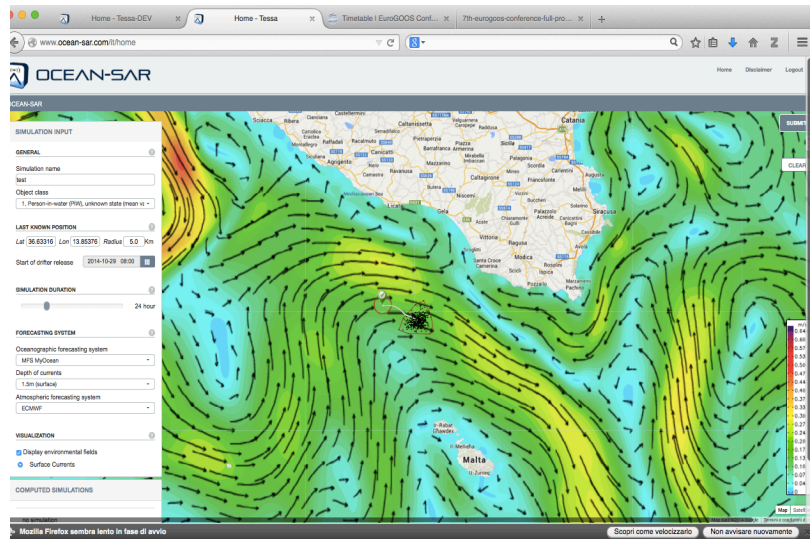Mannarini, G. et al., "Introducing sailboats into ship routing system VISIR," (2015)
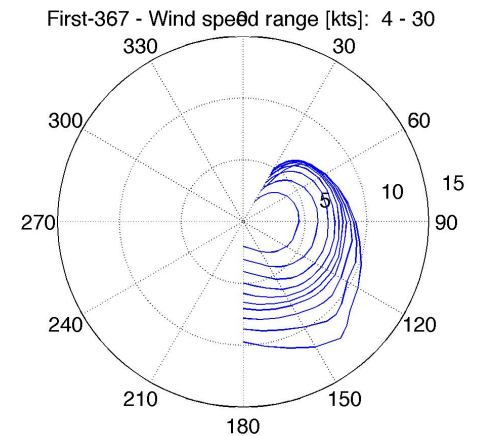
Search And Rescue
www.ocean-SAR.com

Based on CMEMS products

Search and Rescue / Lagrangian Modelling

- Multimodel approach used to simulate the drift of debris from flight MH370 that disappeared in the Indian Ocean in 2014

- Using over two years of high-resolution meteo-oceanographic data (CMEMS)

- Results predict the most likely area of the crash based on the discovered debris

- Publication in NHESS received international media attention

E.Jansen, G.Coppini and N.Pinardi, Nat. Hazards Earth Syst. Sci., 16, 1623-1628, doi:10.5194/nhess-16-1623-2016, 2016

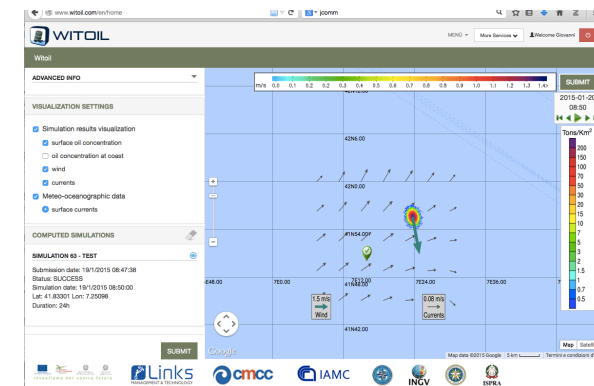**Based on CMEMS products**
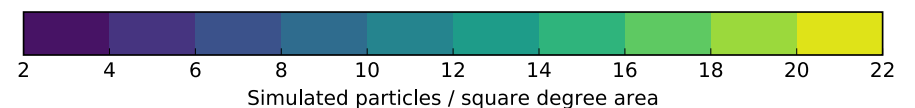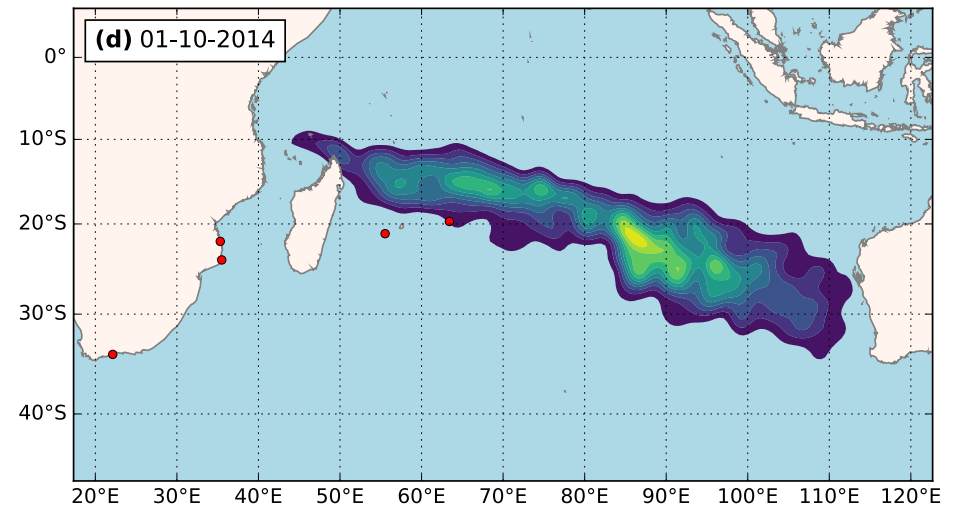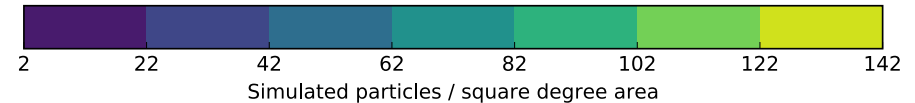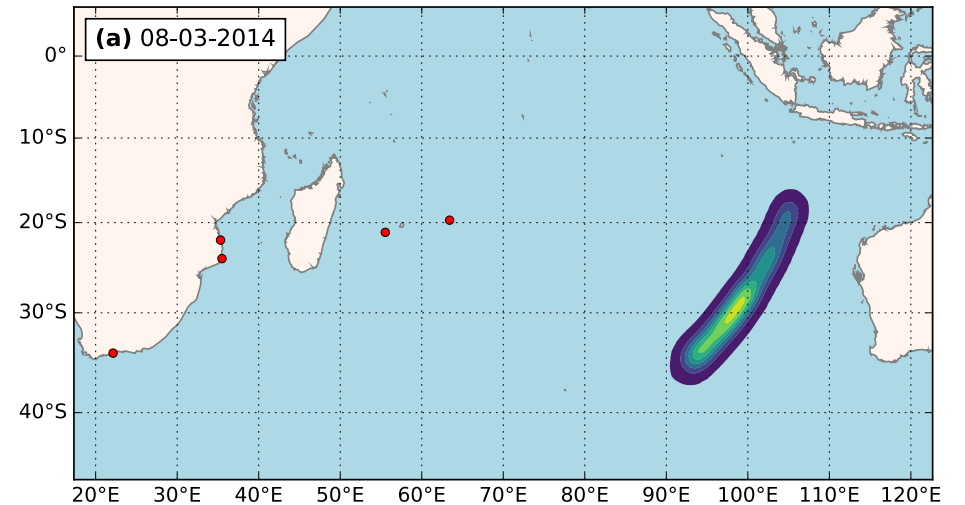
Oil spill emergency services
www.witoil.com

Daily scenario forecasts of the oil spill drift and spreading during emergencies / operational service

Commercial for private users

Currents and winds forecasted in the area → **Oil spill scenario derived locally** →

ECMFC

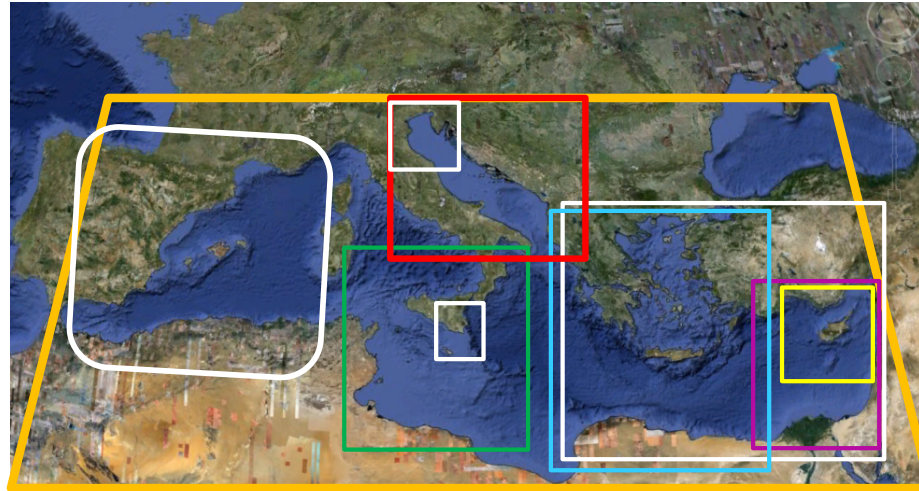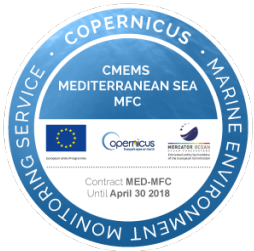**Collaboration with Institutional Users**

ITALIAN COAST GUARD HEADQUARTERS

Comando Generale del Corpo delle Capitanerie di Porto

REMPEC

Based on CMEMS products

MEDESS multi-model oil spill forecasting system

Advance visualization of ocean CMEMS forecasting products

Support to free-diving and sailing events

Support to Rimini-Corfù-Rimini 2015; Support to the Brindisi-Corfù 2015 and 2016 sailing races; Trani – Dubrovnik 2016

Support to the world champion athlet Alessia Zecchini and to the worls CMAS championship in Ischia (It) 2015
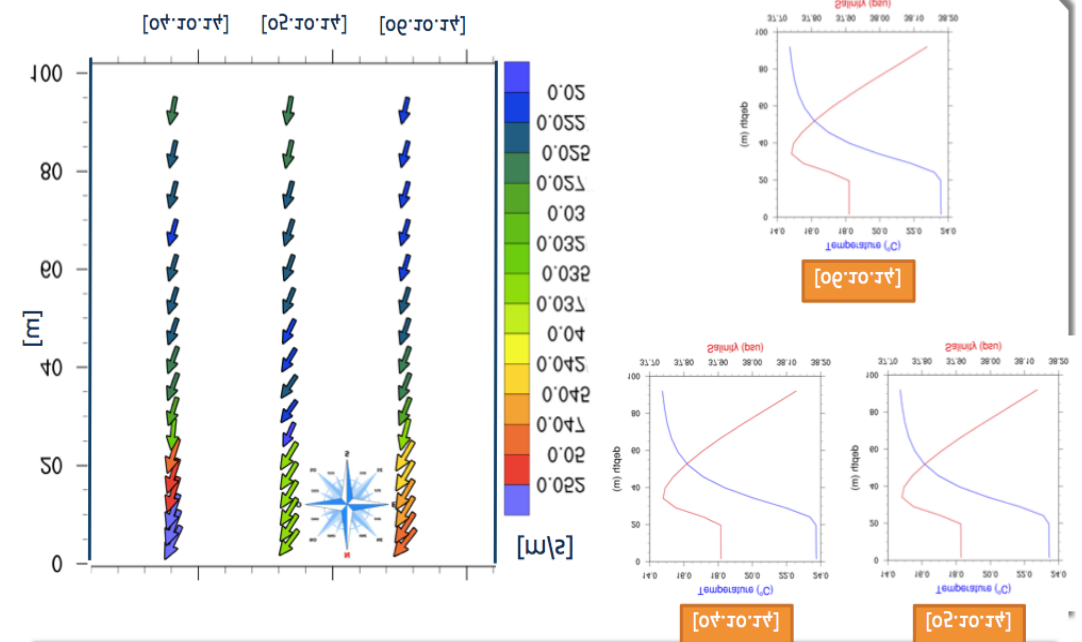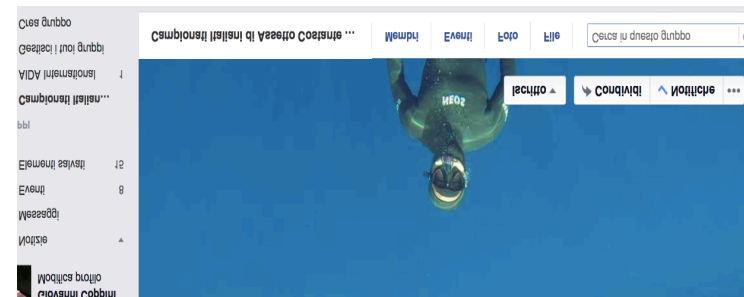
Operational Oceanography and Climate Change in shelf and coastal seas （OOCC）

Memorandum of Agreement

Italy – China

National Marine Environmental Forecasting Center (NMEFC)
Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC)
Istituto Nationale di Oceanografia e Geofisica Sperimentale (OGS)
Istituto Nazionale di Geofisica e Vulcanologia (INGV)

MOA 2017-2018 general objectives:

- Improve Predictions for oceans and climate
- Use predictions to understand ocean dynamics and climate variability and validate theories with observations
- Build an international community working together toward better understanding of the oceans and climate
- Apply this knowledge to improve human life and to construct a sustainable world

Key messages

- MONGOOS/EuroGOOS facilitate the consolidation of operational oceanography, observing and forecasting systems and the development of applications in the Mediterranean and European Seas

- EU Copernicus Marine Environment Monitoring Service (CMEMS) represents state of the art operational observing and forecasting system for the Global Ocean and the European regional Seas and allow together with EMODNET the development of services for tousands of users

- Research, enterprise and industry partnerships have developed new applications which are exploring new scientific and sociatal challenges for the benefit of citizens and society and that if well communicated bring the ocean to tousands of users

- The solid collaboration Italy-china is supporting the development on operational oceanography and climate change research