SOCIB ocean prediction systems and applications in the Western Mediterranean Sea

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SOCIB Balearic Islands Coastal Observing and Forecasting System

SOCIB is a multi-platform coastal ocean observatory located in the Balearic Islands (Western Mediterranean Sea), aiming to characterize the ocean state and variability, understand the associated ecosystem response and address society needs.
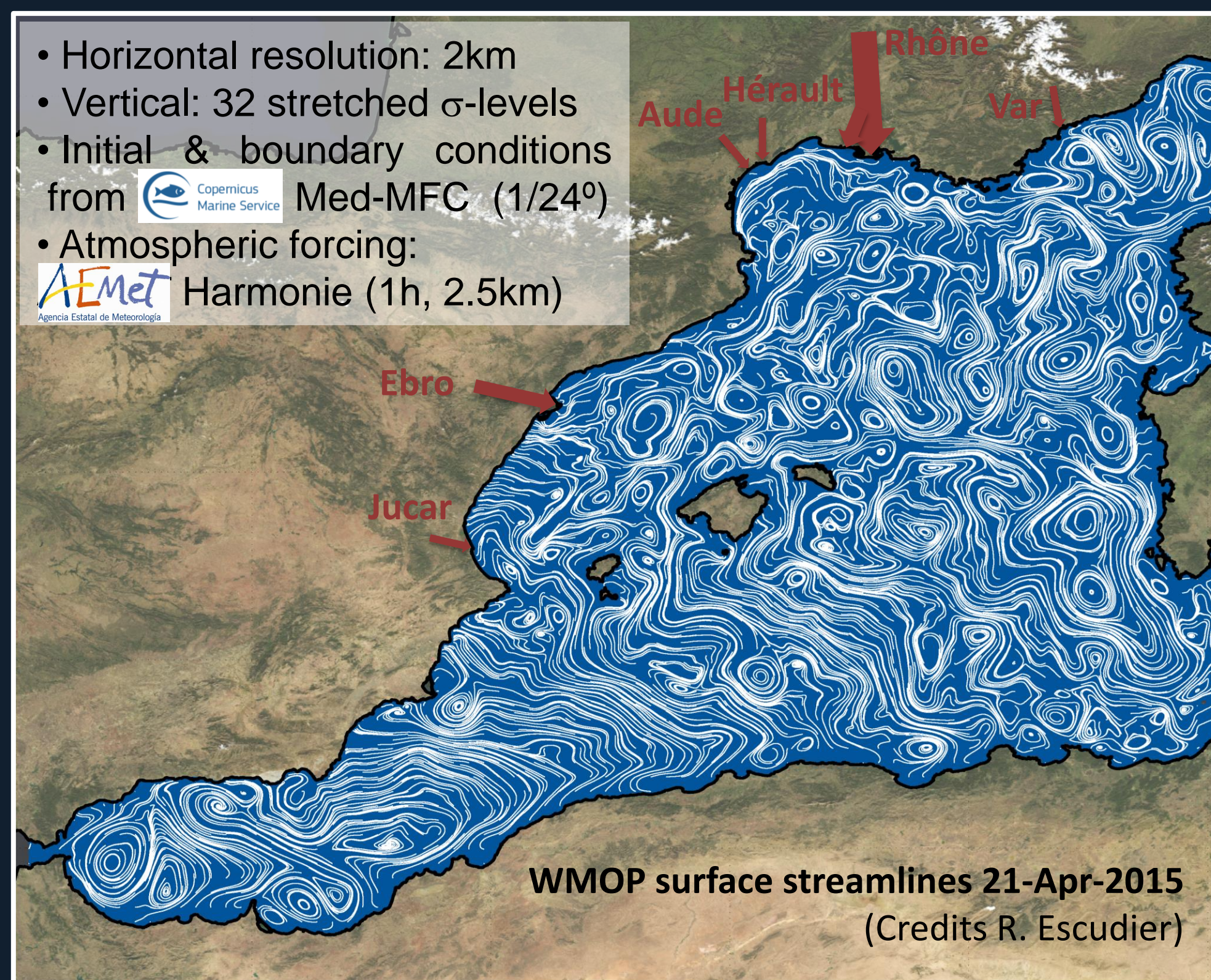
As part of SOCIB strategy, ocean modelling activities are carried out to help understanding observed processes, integrate multi-platform observations and predict the short-term evolution of the ocean. This poster overviews the three modelling systems run operationally at SOCIB, simulating (1) the ocean circulation in the Western Mediterranean Sea, (2) high-frequency sea level oscillations associated with meteotsunamis in Ciutadella harbour (Menorca), and (3) wave conditions around the Balearic Islands.

1 WMOP: Western Mediterranean Operational ocean circulation model

1 Model configuration

Regional configuration of the **ROMS** model (www.myroms.org).

Data assimilation: local multimodel Ensemble Optimal Interpolation with 3-day cycles assimilating along-track satellite SLA, SST, Argo TS & Ibiza Channel HF radar velocities.

- Horizontal resolution: 2km
- Vertical: 32 stretched σ-levels
- Initial & boundary conditions from Med-MFC (1/24º)
- Atmospheric forcing: AEMet Harmonie (1h, 2.5km)

WMOP surface streamlines 21-Apr-2015
(Credits R. Escudier)

2 Operational validation

Near real-time & Delayed mode

WMOP ocean forecasts
- Satellite (altimetry, SST)
- Gliders
- Ship-based CTDs
- HF radar
- Surface drifters
- Argo floats
- Moorings
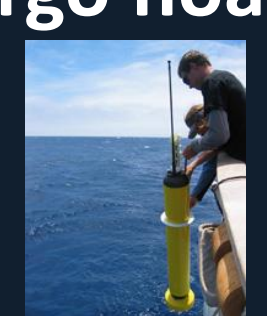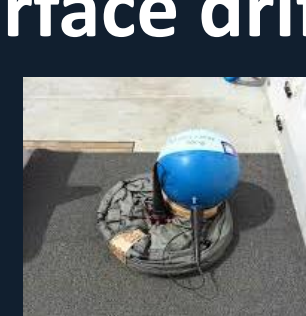
Available online @ www.socib.es

& Web-based visualization and data access

→ Static / interactive figures and animations, regional indicators, netcdf data access through SOCIB Data Centre.

3 WMOP simulations

FORECAST
FORECAST oct 2013 – present (with the current version of WMOP)
data assimilation (since Oct 2018)
climatological river inputs
→ operational daily production of 72-hour predictions

HINDCAST
HINDCAST 2009-2016
free run
daily river discharges
→ used for ocean process studies and variability analysis

REANALYSIS
REANALYSIS of specific past periods
data assimilation
possible model grid refinements
→ analysis of sea trial experiments & impact of observations

4 Applications

Science
- Ocean process studies
- Support to sea trial experiments
- Optimization of observational sampling
- Evaluation of the impact of observations
- Impact of hydrodynamics on ecosystems
- Ocean connectivity studies
- …

Society
- Search and rescue
- Response to emergencies
- Lifeguards Mobile App
- Support to open water swimming
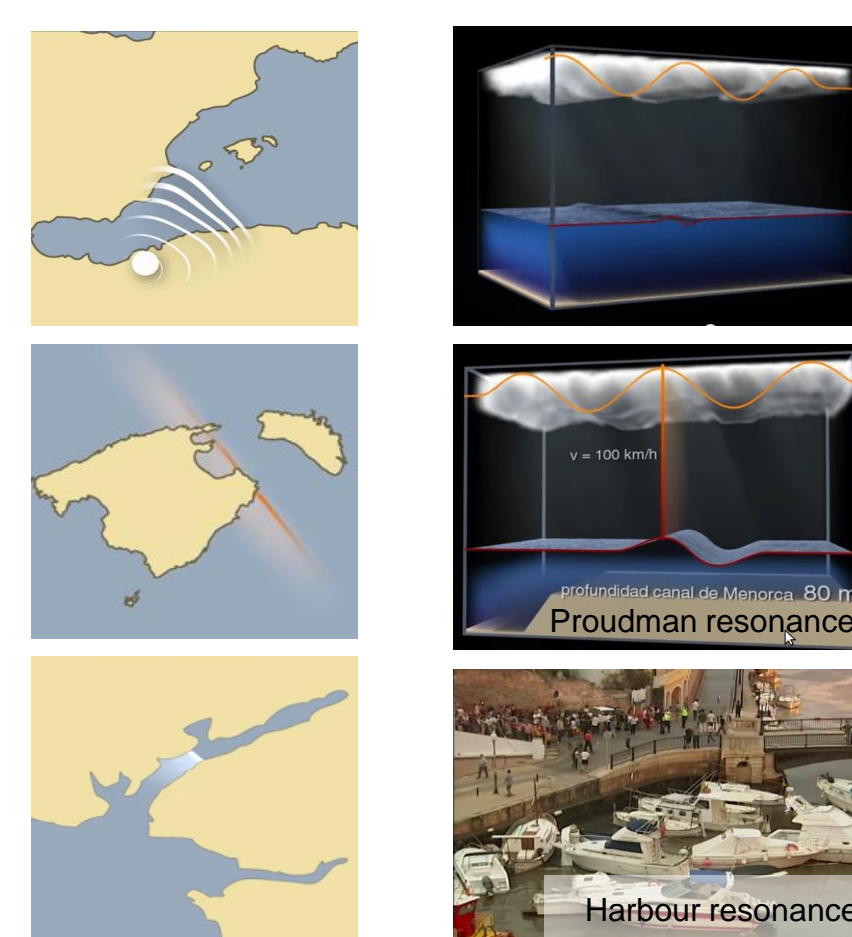- Forensic science
- Fishery management
- …

References: Juza et al., *JOO 2016*; Mourre et al., *GODAE book New Front. in Op. Oceanogr. 2018*; Hernandez-Lasheras and Mourre, *Oc. Sci. 2018*; Pascual et al., *Frontiers Mar. Sci. 2017*; Capó et al., *DSR 2016*; Calò et al., *Mar. Env. Res. 2018*; Gomez-Navarro et al., *Rem. Sens. 2018*; Fablet et al., *IEEE Trans. Geos. And Rem. Sens. 2018*; Heslop et al., *JOO 2019*.
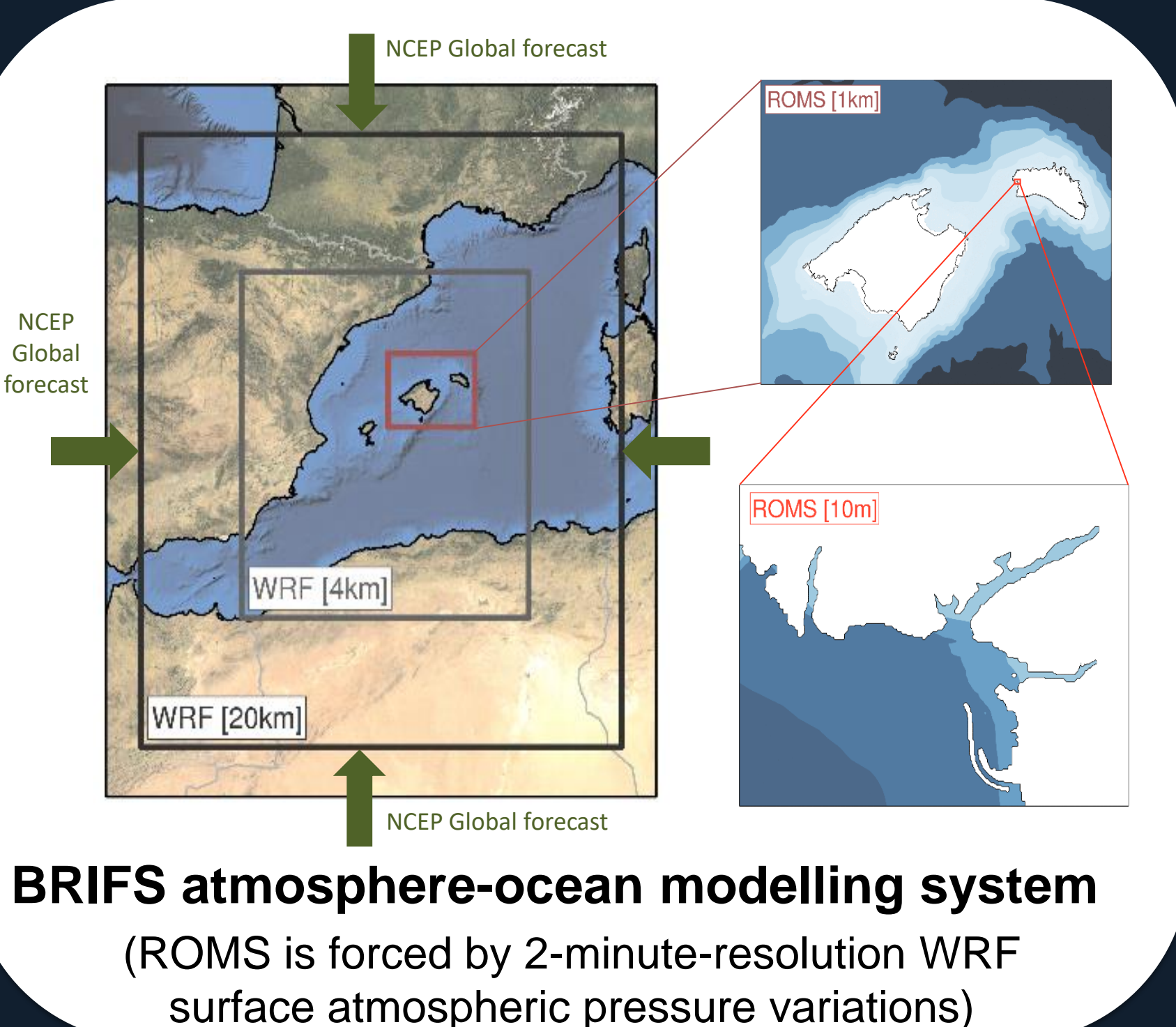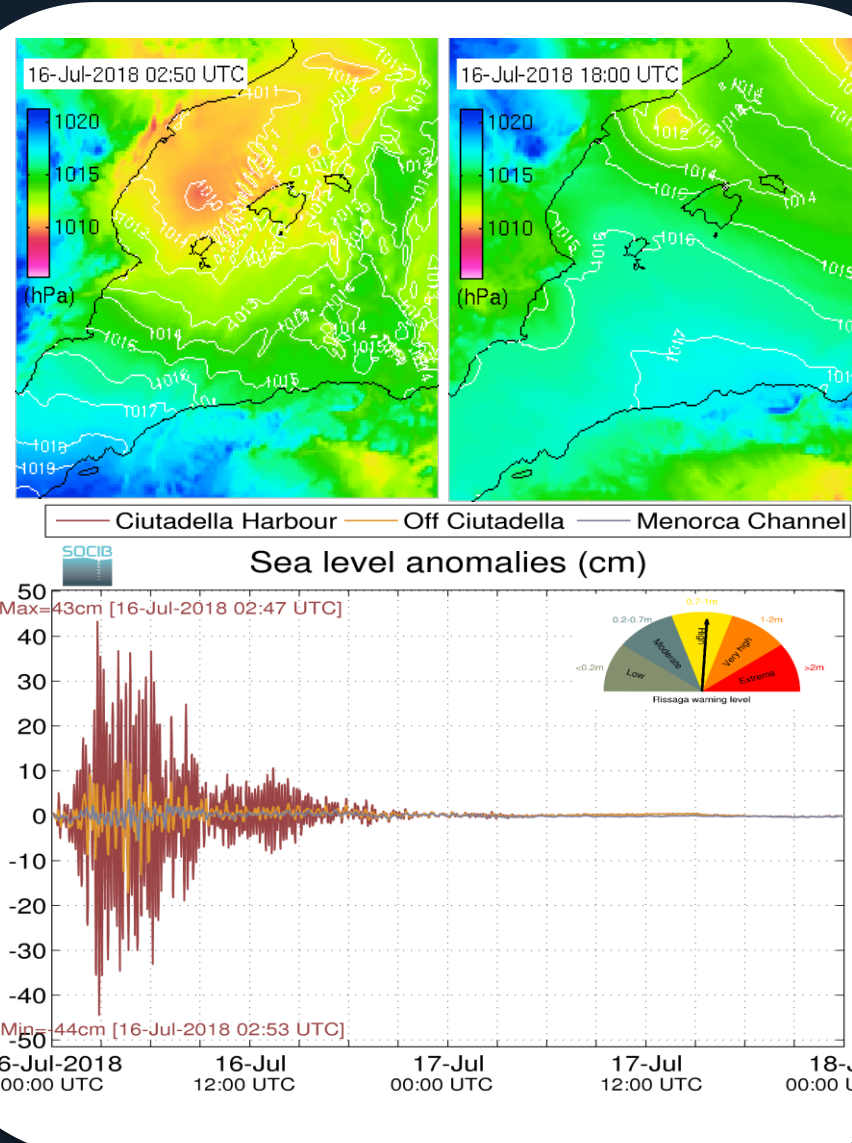
2 BRIFS: Balearic Rissaga Forecasting System

In collaboration with AEMet Agencia Estatal de Meteorología

→ High temporal frequency atmosphere-ocean modelling system aiming to simulate extreme sea level oscillations associated with **meteotsunamis** ("rissagues") in Ciutadella harbor (Menorca).

Rissaga phenomenon
- Proudman resonance
- Harbour resonance

BRIFS atmosphere-ocean modelling system
(ROMS is forced by 2-minute-resolution WRF surface atmospheric pressure variations)

NCEP Global forecast — WRF [20km] — WRF [4km] — ROMS [1km] — ROMS [10m]

Sea level anomalies (cm)

References: Renault et al., *GRL 2011*; Ličer et al. Ocean Modelling 2017

3 Balearic Islands Operational Wave Model

In collaboration with Puertos del Estado

- SWAN model configuration nested in Puertos del Estado larger scale operational system
- Horizontal resolution: 500m
- 72-hour forecast produced twice daily
- Outputs: significant wave height, period and direction
- Interactive visualization, operational validation with mooring observations and data access through SOCIB Data Centre @www.socib.es

Significant wave height
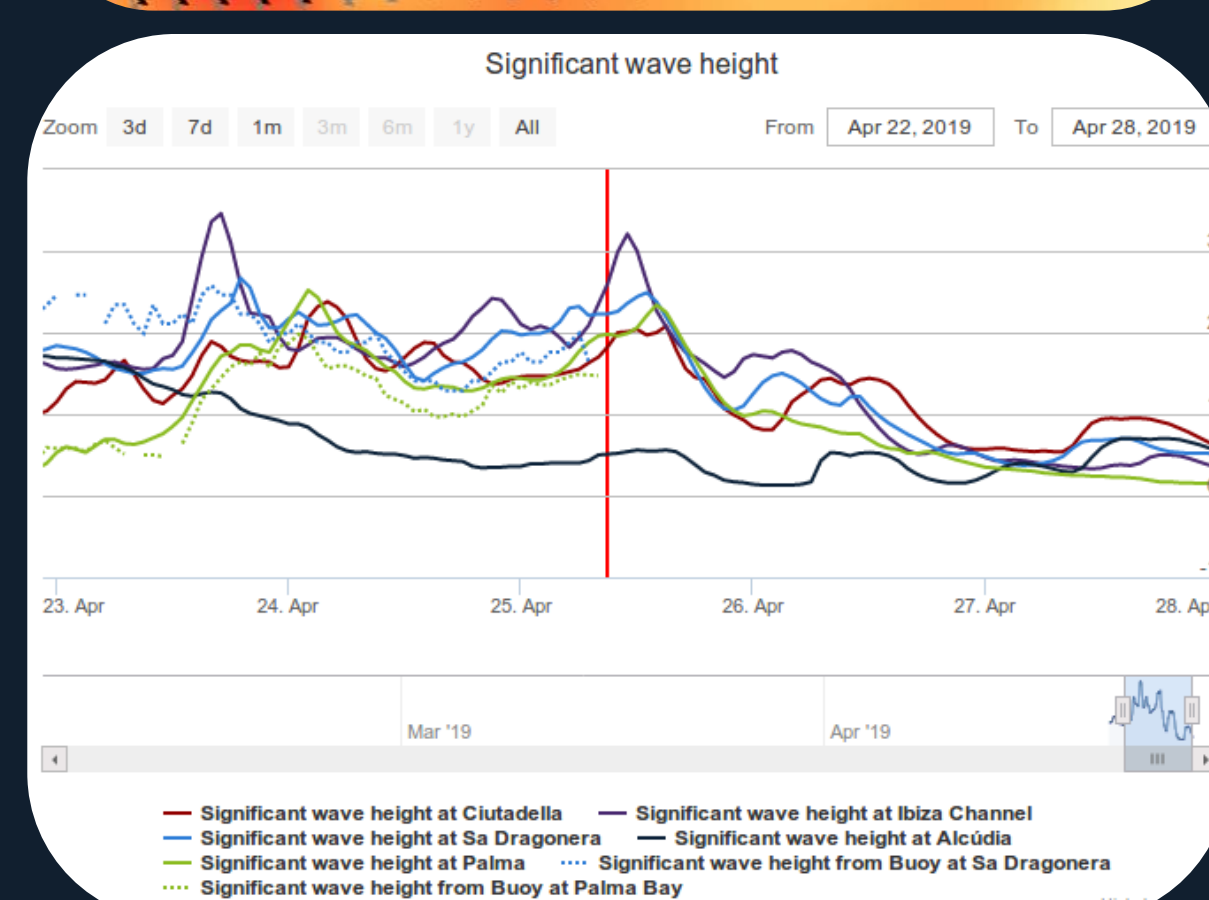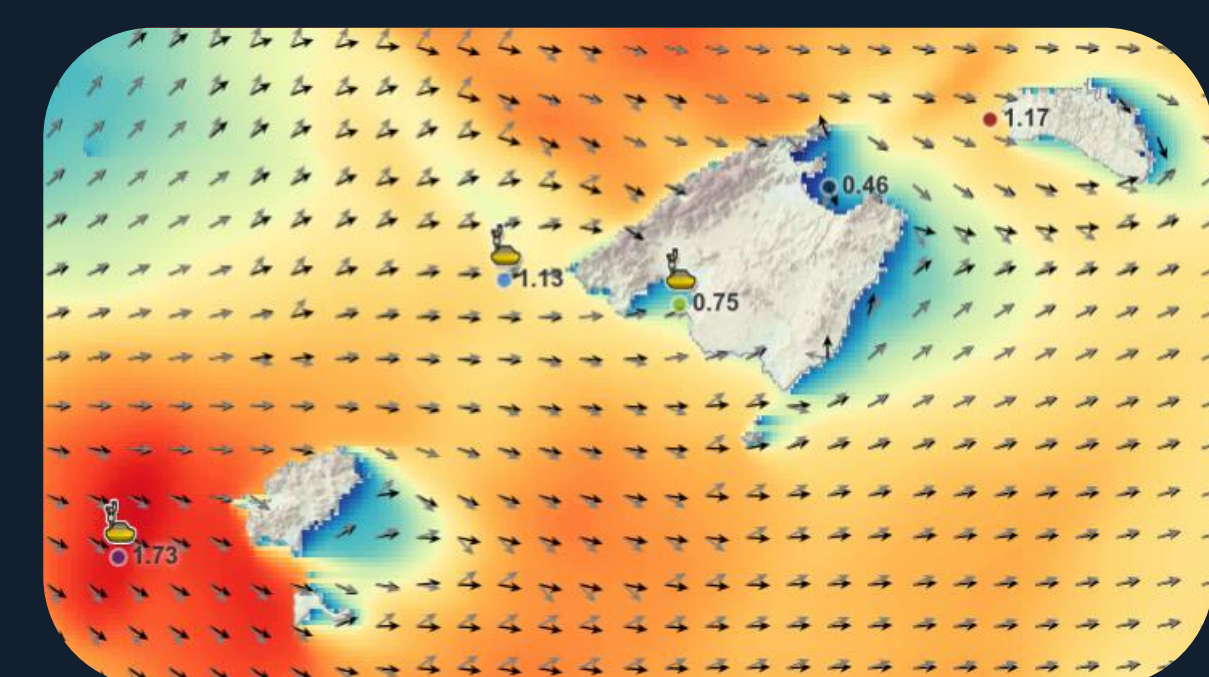
Applications Wave conditions for maritime activities, lifeguards App, beach morphodynamics analysis