SYMPOSIUM OP'24

Ocean Predict

In partnership with unesco Intergovernmental Oceanographic Commission

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Towards a regional operational modelling system of the Catalan Coast (NW Mediterranean Sea)

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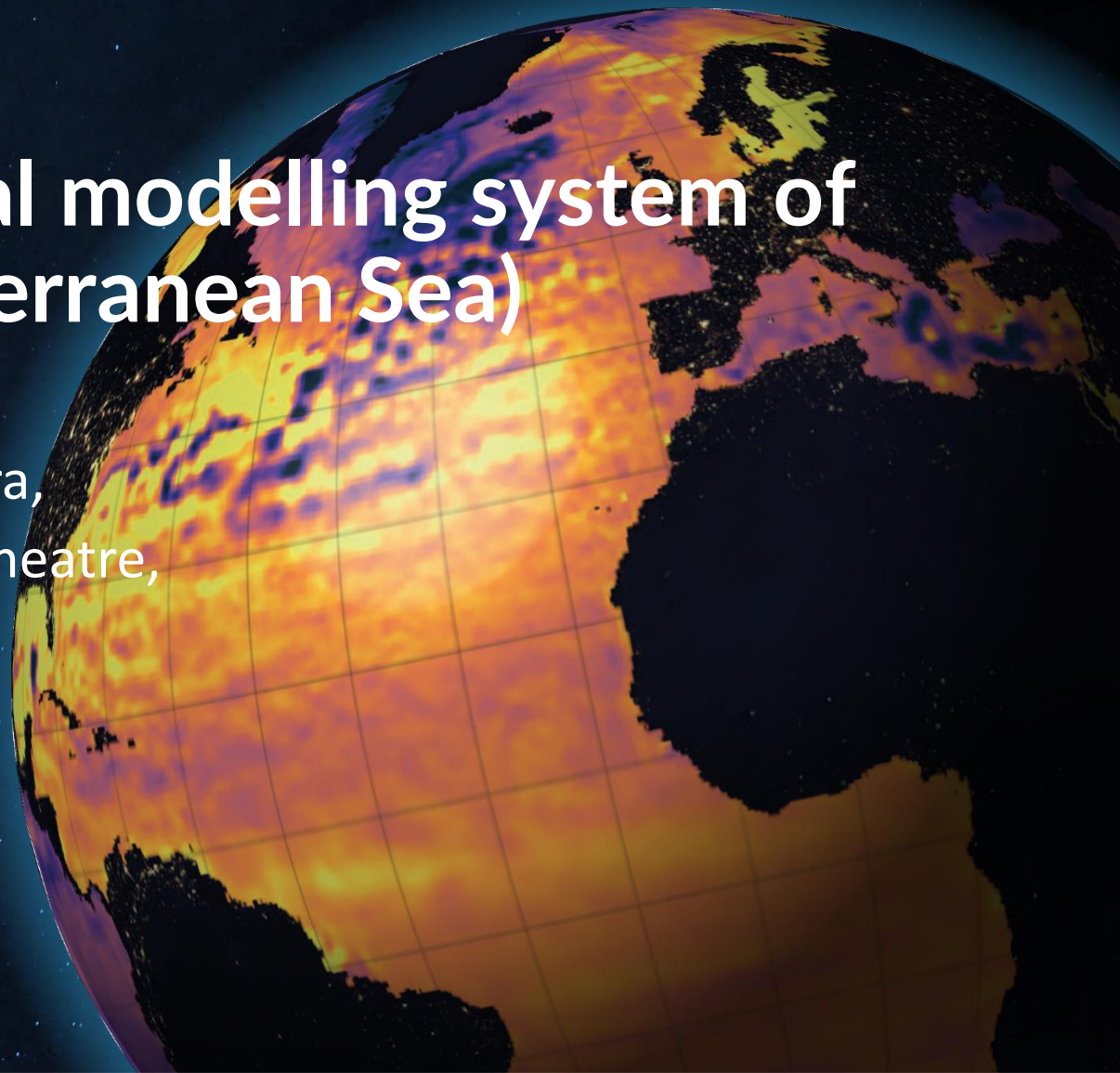
Institut de Ciències del Mar

icat mar Institut Català de Recerca per a la Governança del Mar

CSIC Consejo Superior de Investigaciones Científicas

OGS

BEC Barcelona Expert Center



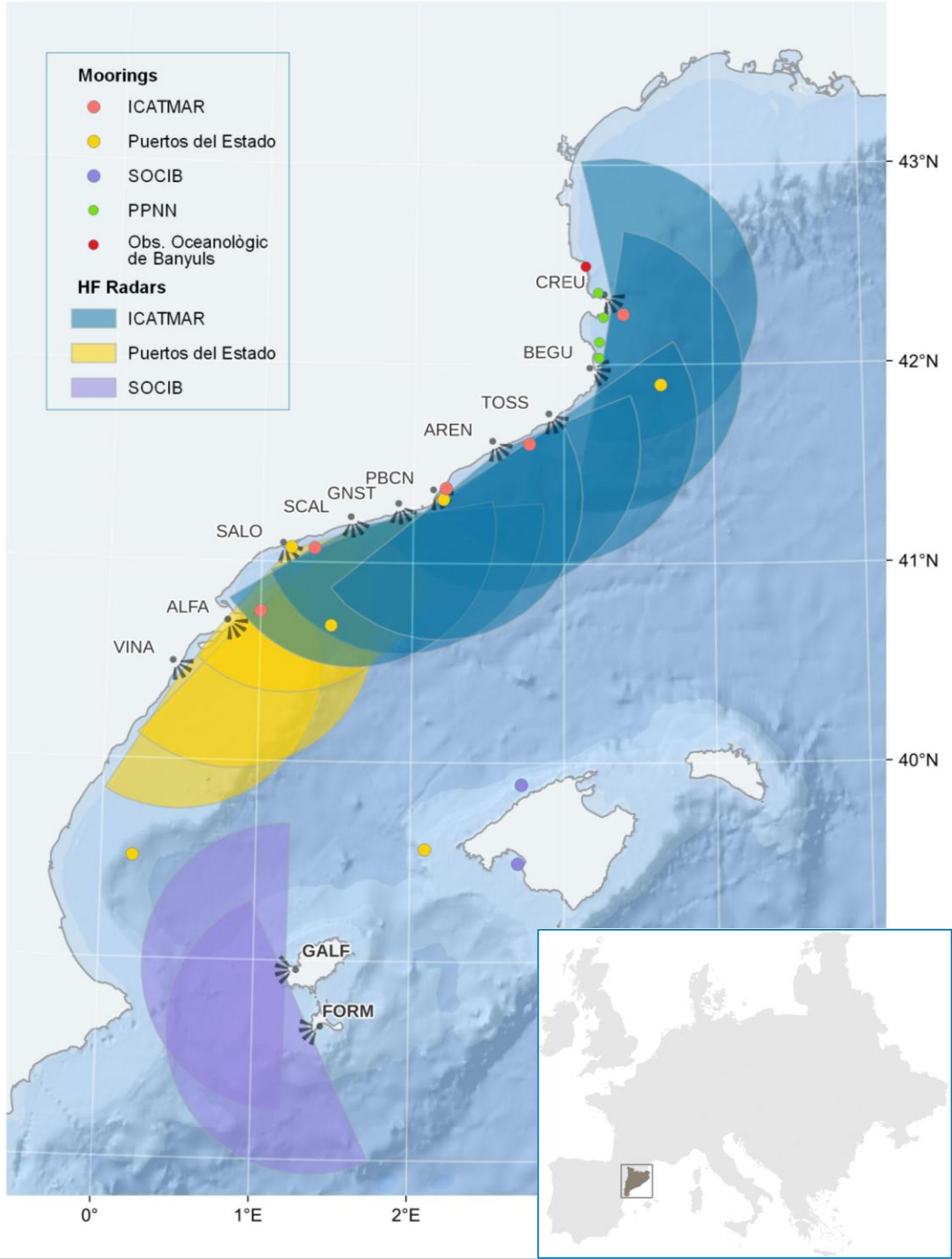
Catalan coast and ICATMAR

- The Catalan coast encompasses a 580 km-long coastline subjected to strong anthropogenic pressure

- The Catalan Research Institute for the Governance of the Sea (ICATMAR):
  - Is a cooperation body between the Government of Catalonia and the Institut de Ciències del Mar (ICM-CSIC)

- The Operational Oceanography Service started on 2023 with the aim of:
  - Enlarging the observing network and implementing a forecasting system
  - Contributing to national and international programs

https://www.icatmar.cat/en/operational-oceanography/



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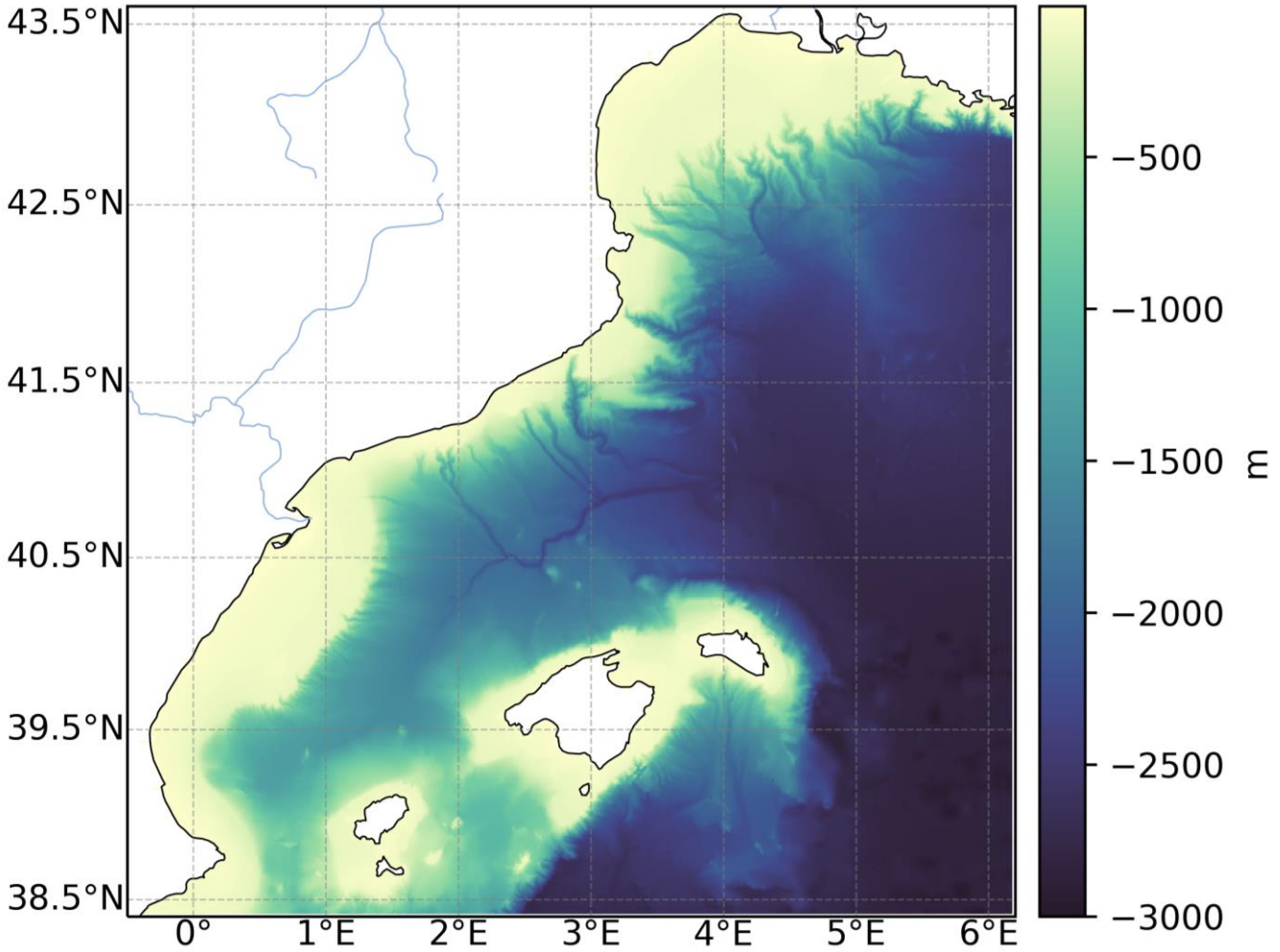
ICATMAR Ocean Forecasting system

- Horizontal resolution: 1/128 ° (~800m)
- Model dimensions:
  - 850 x 664 x 61 grid nodes
- Maximum depth: 3000m
- Vertical grid spacing:
  - Min.: 4m, Max.: 100m
  - 20 levels in the first 200 m
- Bathymetry from:
  - EMODnet 2020 DTM , 1/16 arcmin (~113 m)



ICATMAR ocean forecasting system (pre-operational)

European Centre for Medium-Range Weather Forecasts Reanalysis v5 (ERA5):
2m temperature,
2m dewpoint temperature,
Surface pressure,
10m u component of wind,
10m v component of wind,
Total precipitation,
Surface solar radiation downwards,
Surface thermal radiation downwards

ECMWF

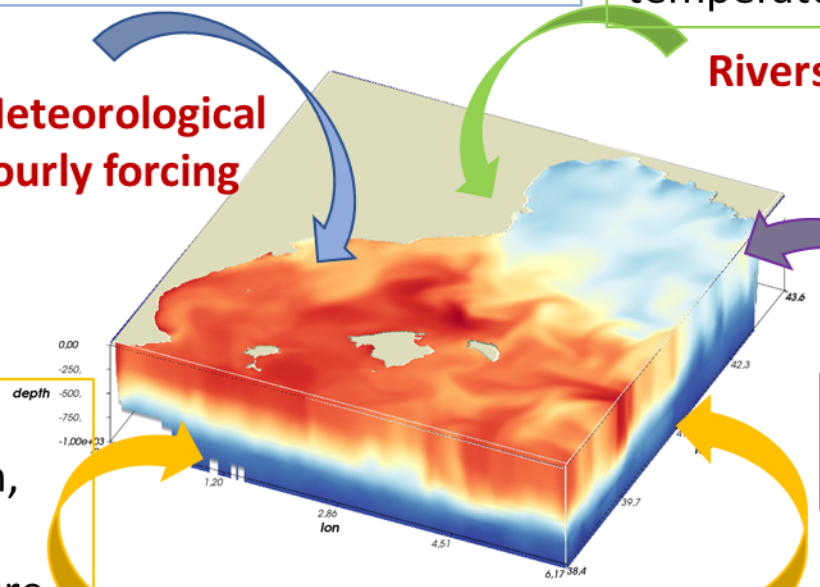
Soon:

meteo.cat

Meteorological hourly forcing

17 rivers including the Ebro and the Rhone, River water discharges, salinity and temperature

Rivers



OSU TPXO Tide Model

Daily input,
4km resolution,
3D info of:
Sea Temperature,
Sea Salinity,
Ocean currents
Sea Surface height

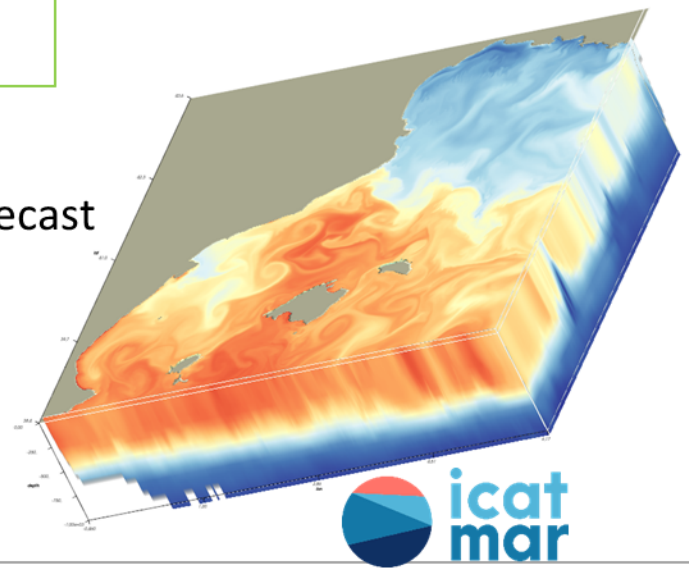
Initial conditions
Daily boundary conditions

Copernicus Europe's eyes on Earth

Copernicus Marine Service

CMEMS Mediterranean Sea Physics Analysis and Forecast

7 days Hindcast + 3 days Forecast



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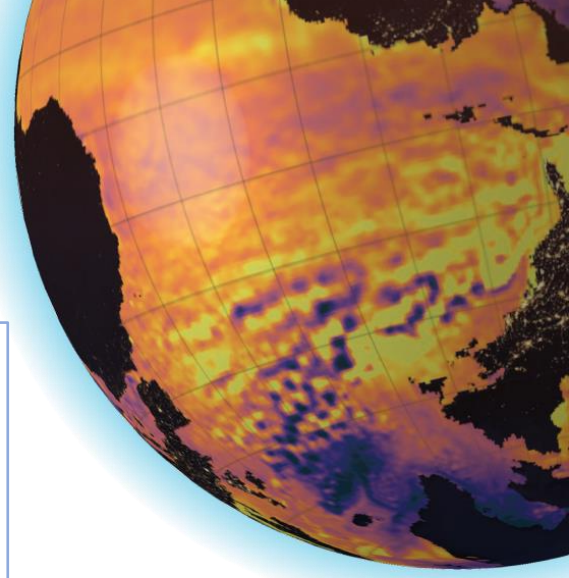
Hourly output
800m horizontal resolution, 3D info of:
Sea Temperature,
Sea Salinity,
Ocean currents,
Sea Surface height

Ocean models



MITgcm

Massachusetts Institute of Technology

- Ocean general circulation model of MIT
- A single dynamical kernel which allows oceanic or atmospheric simulations
- Non-hydrostatic capabilities extensively tested
- Spatial scales: from hundred of metres to thousands of kilometres
- Finite volume and z-level vertical coordinates
- Tides can be included through OBCs
- We have done some experiments with the MITGcm coupled with the Biogeochemical Flux Model

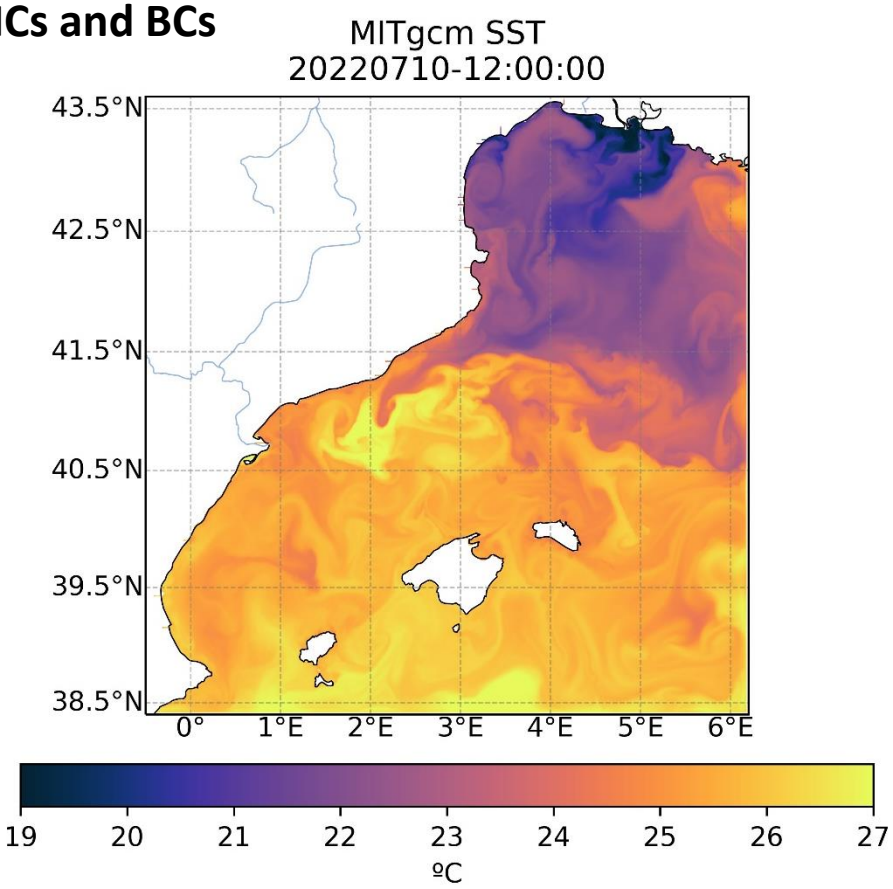
CROCO

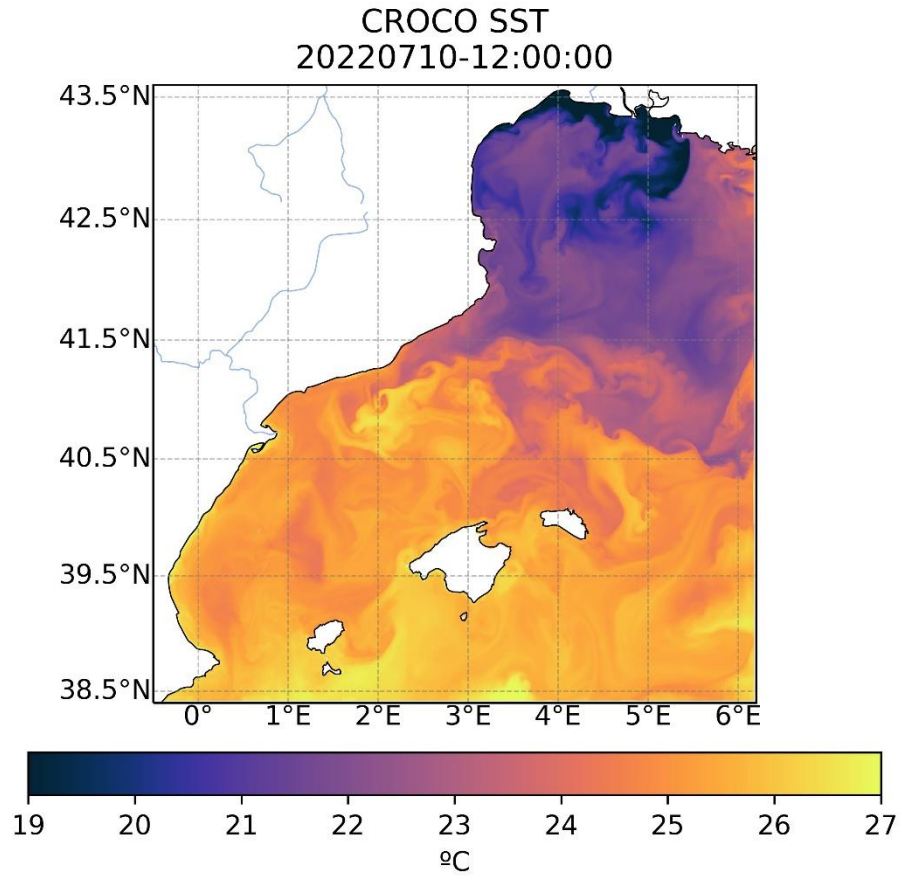
Coastal and Regional Ocean COmmunity model

- Coastal and Regional Ocean Community Model
- Important objective: to resolve very fine scales and their interactions with larger scales
- Built upon ROMS and the non-hydrostatic kernel of SNH, gradually including algorithms from MARS3D and HYCOM
- Finite differences and sigma coordinates
- Tides can be included as a surface forcing
- We are interested in the coupling of CROCO with WaveWatch III

Models results

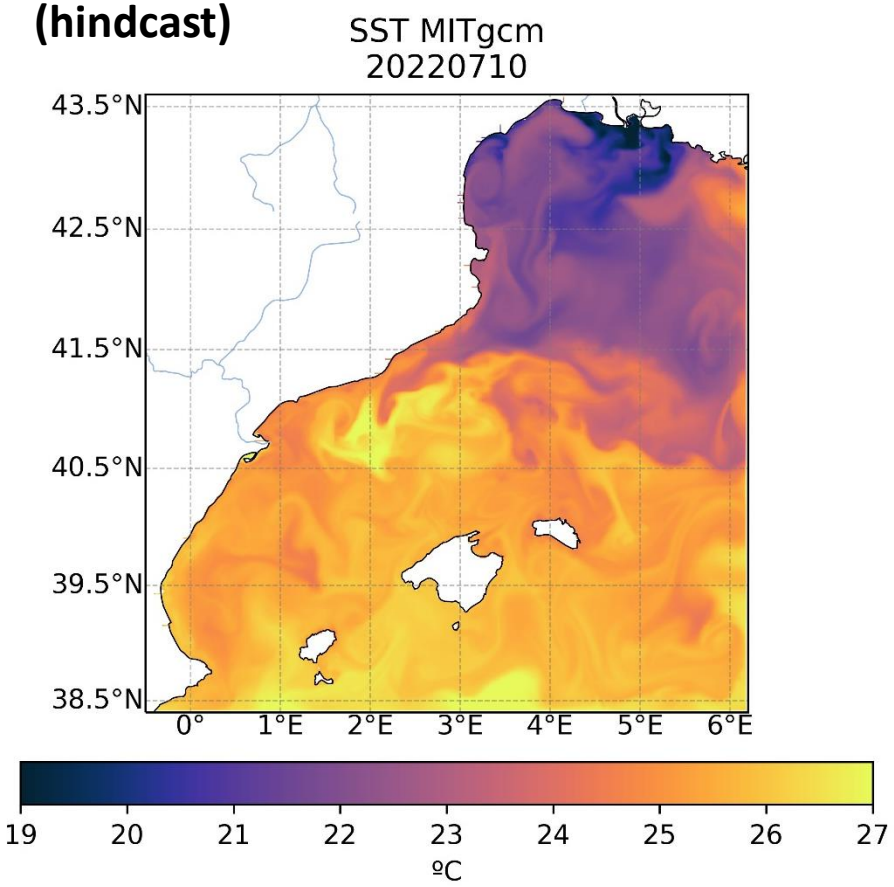
MITgcm and CROCO snapshot results after 10 days of simulation (hindcast) and using the same ICs and BCs



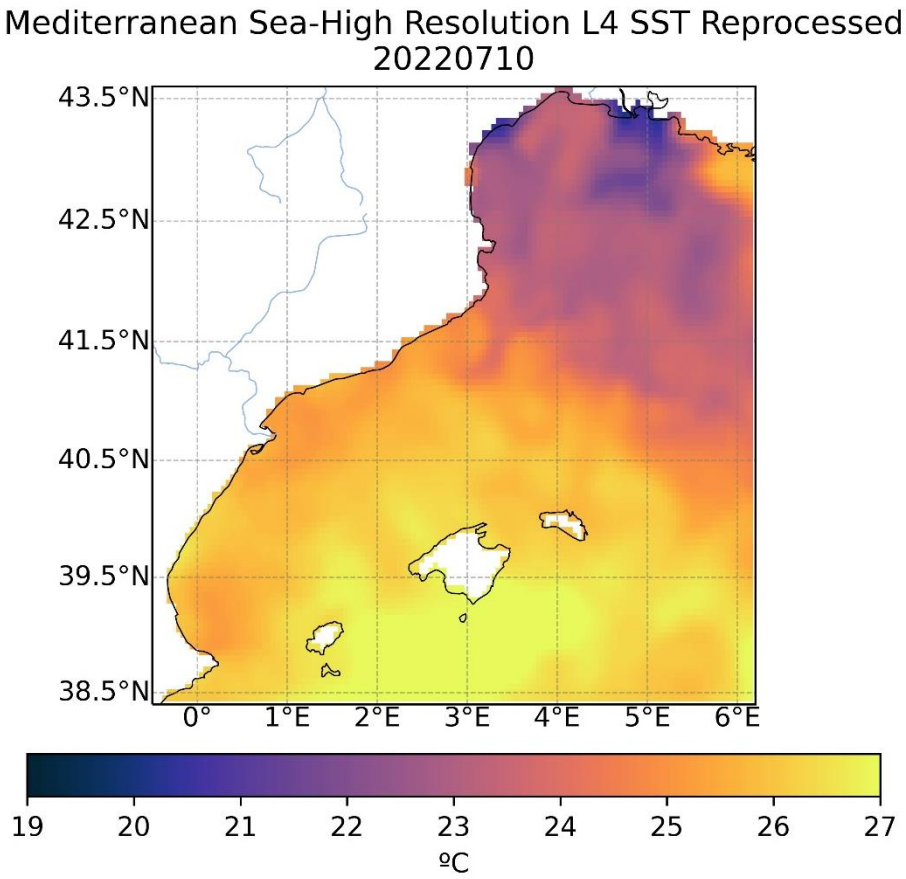


Comparison with satellite data

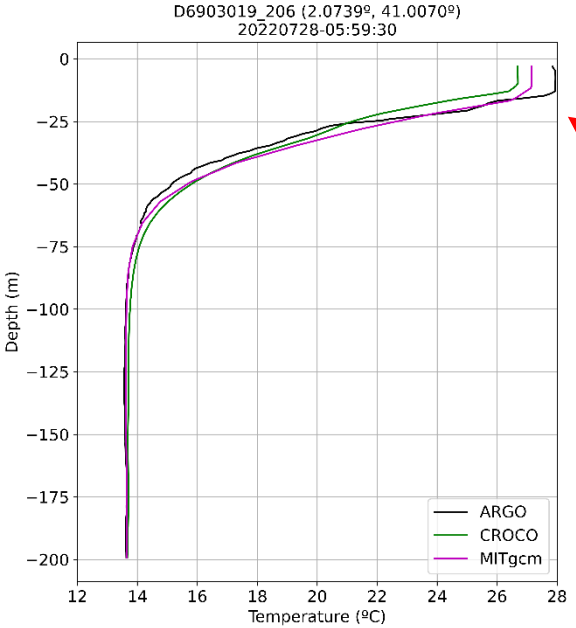
MITgcm result after 10 days of simulation (hindcast)

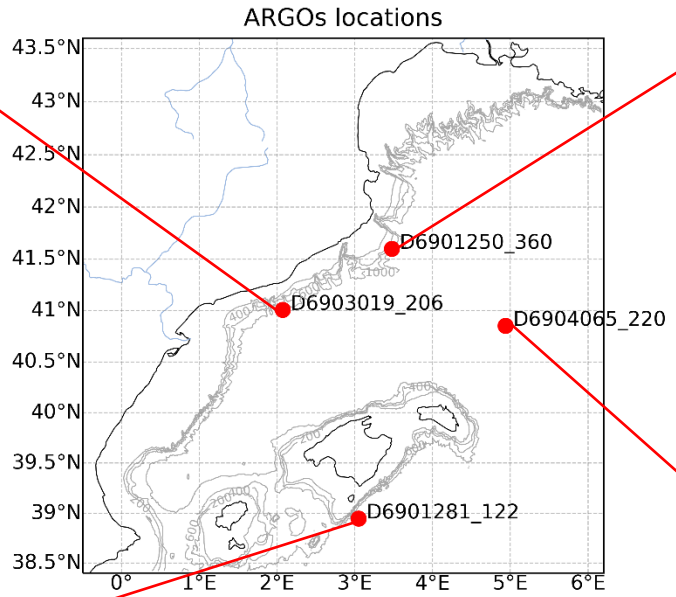


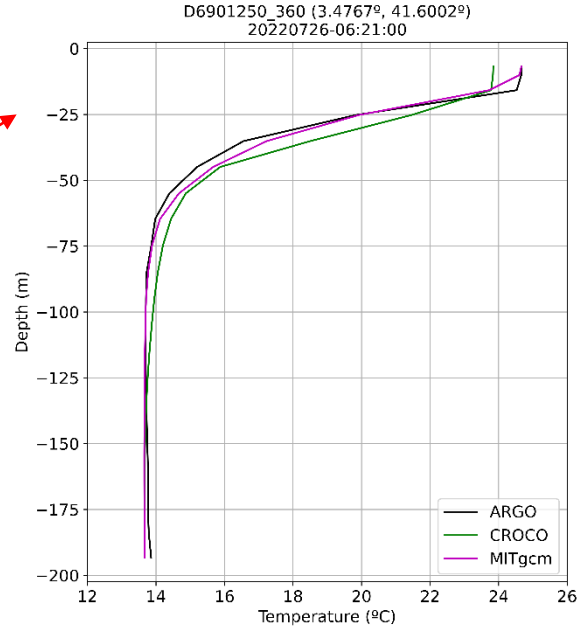
CMEMS satellite product from CNR-GOS

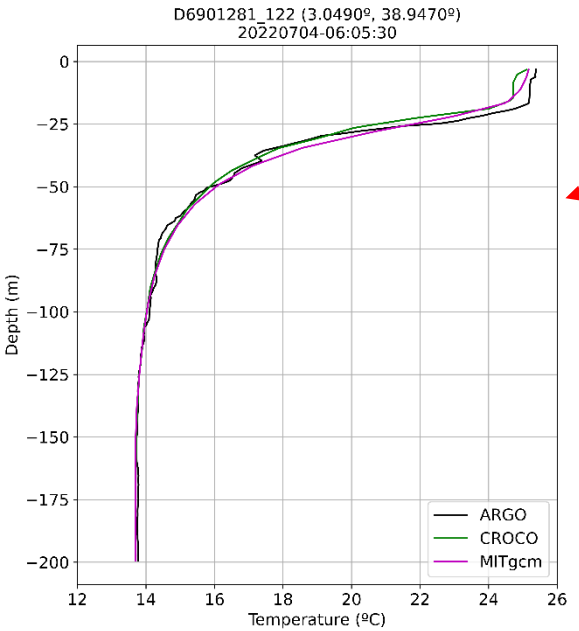


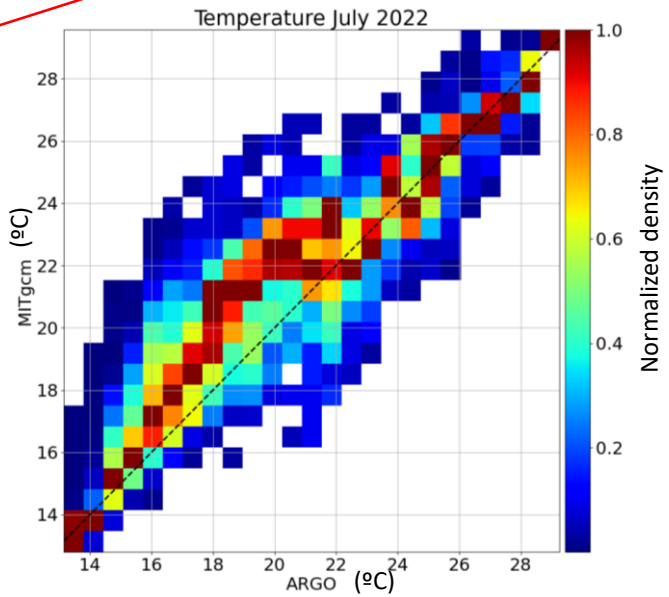
Comparison with ARGO data

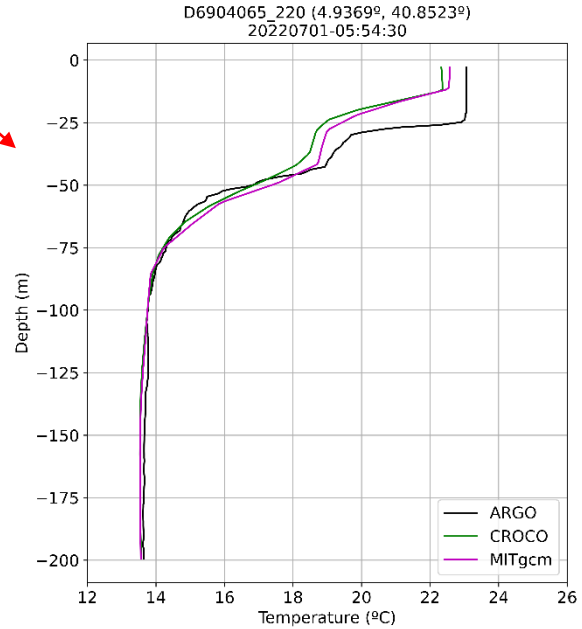




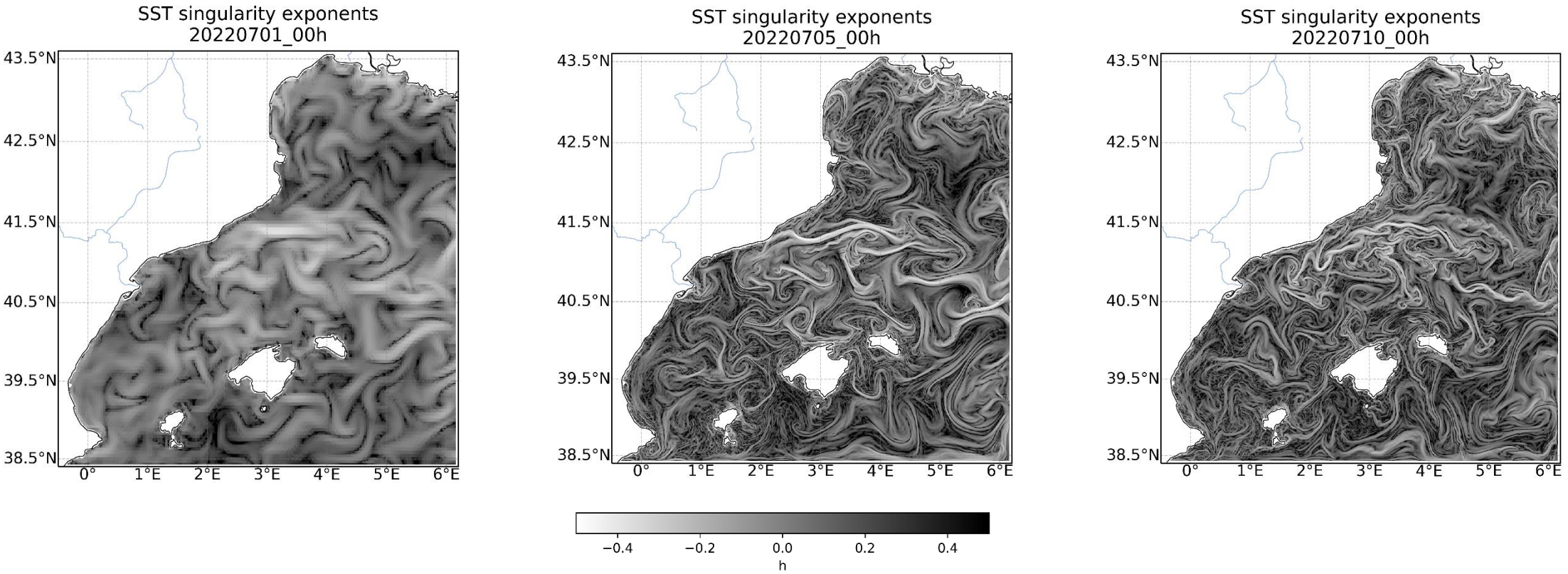








Dynamical downscaling assessed by singularity exponents



* A. Turiel, H. Yahia, C. J. Pérez-Vicente Microcanonical multifractal formalism—a geometrical approach to multifractal systems: Part I. Singularity analysis, Journal of Physics A: Mathematical and Theoretical, 41(1), pp. 015501-015536, 2008

* J. Isern-Fontanet, A. Turiel On the Connection between Intermittency and Dissipation in Ocean Turbulence: A Multifractal Approach, Journal of Physical Oceanography, 51(8), pp. 2639–2653, 2021

Validation studies in the Ocean Predict Symposium

7.2 - Coastal activities

Exhibition - Thursday 21 Nov. 2024

Estimating trajectories of floating objects using the new ICATMAR high-frequency radar network

Lucía Quirós-Collazos, J. Ballabrera-Poy, C. Bueno, J. Martínez, S. Galiana, G. Llorach-Tó, C. González-Haro, J. Iglesias, G. Gantés, E. García-Ladona, Jordi Isern-Fontanet

Poster sessions in MIROS area
12:15-13:45h
16:45-18:30h

5.4 - Impact of observations on forecasting systems

Exhibition - Monday 18 Nov. 2024

Evaluating dynamical quality of ocean prediction modeling and satellite observations

Cristina González-Haro, J. Isern-Fontanet , A. Turiel, V. G. Gea , S. Galiana, J. Martínez, J. Ballabrera-Poy, E. García-Ladona

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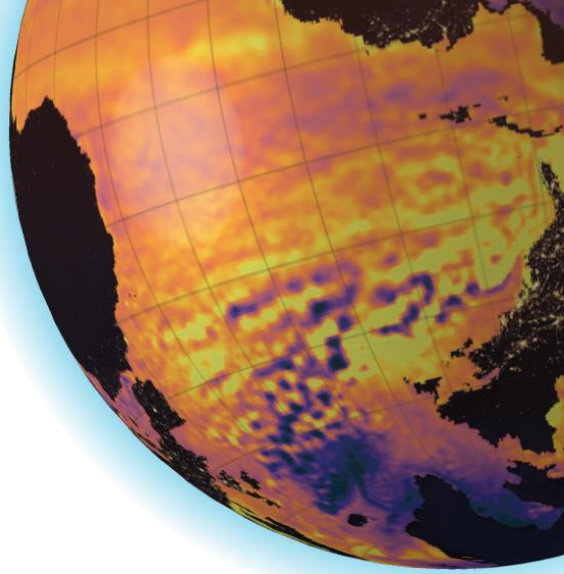
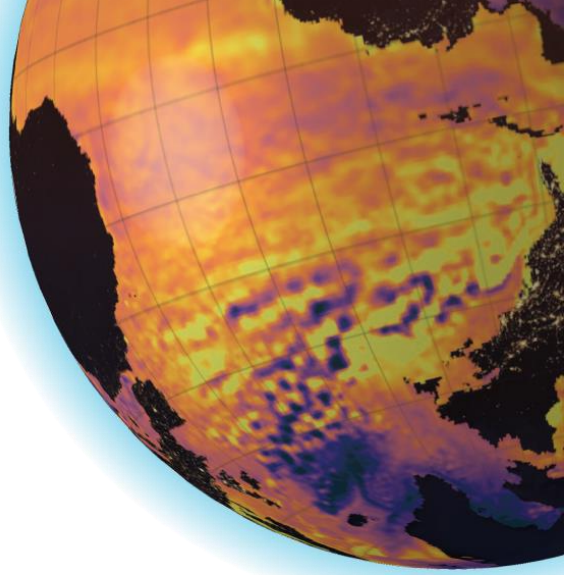
2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Summary



- ICATMAR is enlarging the observing network in the Catalan Coast and implementing a regional forecasting system
- The model resolution is 1/128º (~800m)
- CMEMS products are used for ICs and BCs
- The model includes 17 river inputs and a tidal model
- The meteorological forcing is the ERA5 product from ECMWF, but soon will be a high resolution (~3km) forcing from METEOCAT
- We are working with two models: MITgcm and CROCO, in the same domain and with the same resolution
- Validation studies show good agreement with observations

Outlook



- High resolution forcings from METEOCAT
- Coupling with WAVEWATCH III

- Data assimilation

2023 Development of hydrodynamical models

2024 Development of an operational chain system

2025 Forecasting in downscaling mode

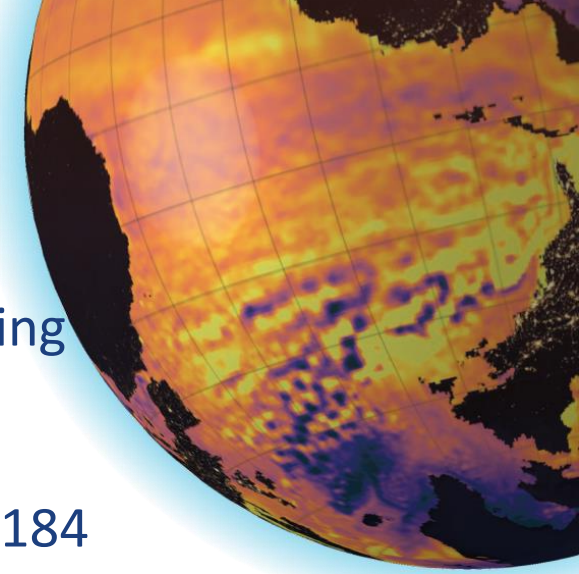
2026 Forecasting with the Hydrodynamical-waves coupled model

CROCO
Coastal and Regional Ocean COmmunity model

MITgcm

Massachusetts Institute of Technology

Acknowledgments



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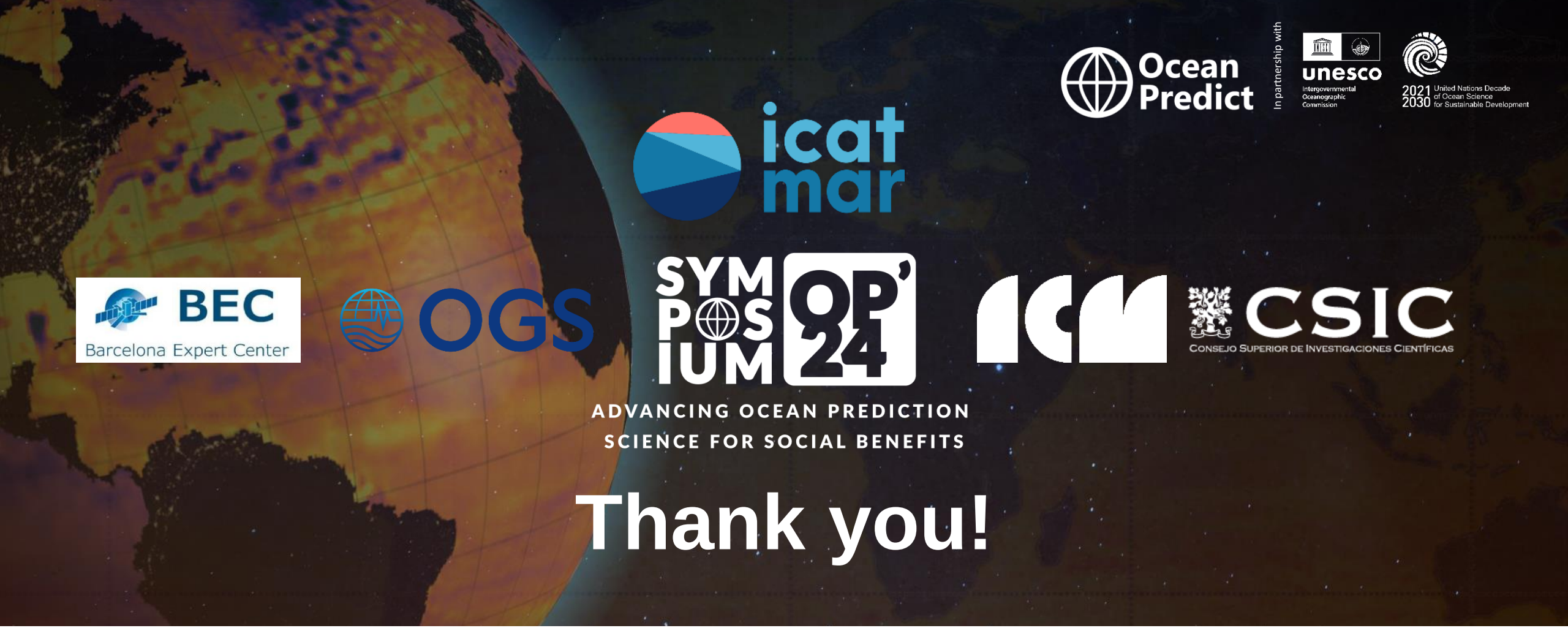

European Commission

Copernicus Marine Service

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