

Operational SOCIB forecasting system and multi-platform validation in the Western Mediterranean

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Development of ocean forecasting systems at global, regional and local scales

- Enhance our knowledge of marine sub-systems (physical process & impact on ocean circulation, biology, sedimentology, acoustics ...)
- Support the management of marine environment (maritime security, fisheries, environmental & resources protection, naval operations, tourism ...)

Context: science and society needs

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Mediterranean Sea

- 46 000 km coastline, 22 countries, 3300 islands: society issues and needs
- Miniature ocean (world ocean physical processes): scientific interest
- Dominant spatial & interacting scales: basin, sub-basin & (sub-)meso-scales
- Internal Rossby radius deformation = 10-15km

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→ High resolution regional ocean forecasts and observations are required to represent (sub-)mesoscale features & to understand their interaction with the general circulation, their impact on vertical motions & ecosystem variability.

SOCIB: Balearic Islands Coastal Observing & Forecasting System



Tintoré et al. (2013)

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Tintoré et al. (2013)

Multiplatform observing system



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Tintoré et al. (2013)

Multiplatform observing system

- Coastal research vessel
- Coastal HF radar
- Underwater gliders
- Lagrangian platforms (drifters, Argo)
- Fixed moorings
- Satellite products

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Modelling & forecasting system

High resolution operational
model of ocean circulation
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*12:00 Auditorium 2: Oceanographic data management
at SOCIB (C. Troupin)*

*12:45 Meeting Room 1: SOCIB multi-platform observing
and forecasting integrated approach in response to
science and society needs (J. Tintoré)*

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*12:00 Auditorium 2: Oceanographic data management
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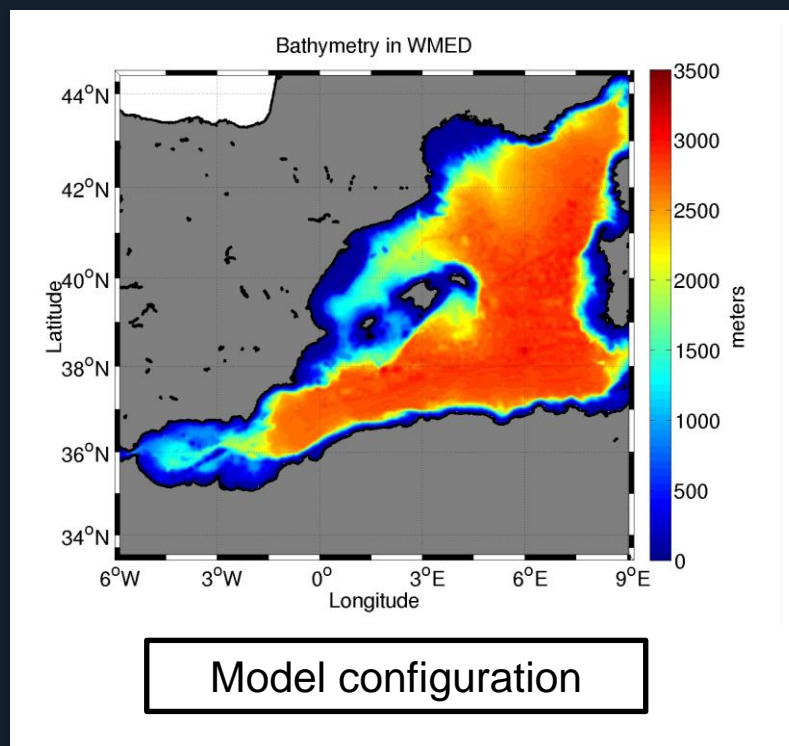
*12:45 Meeting Room 1: SOCIB multi-platform observing
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Necessary connection between the systems

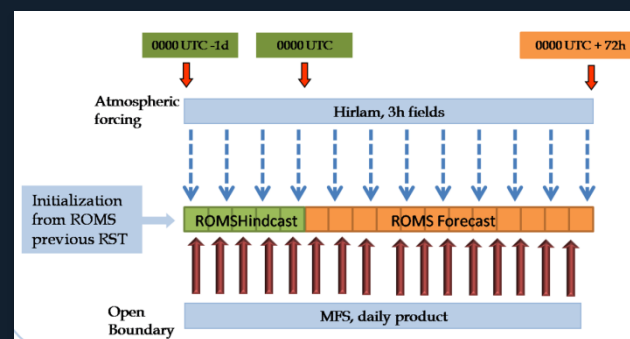
Combination of simulations & obs. to understand ocean processes at different scales
Use of observations to assess the model performance & improve the simulations

Ocean forecasting: the WMOP system

WMOP = **W**estern **M**editerranean high resolution **O**perational model



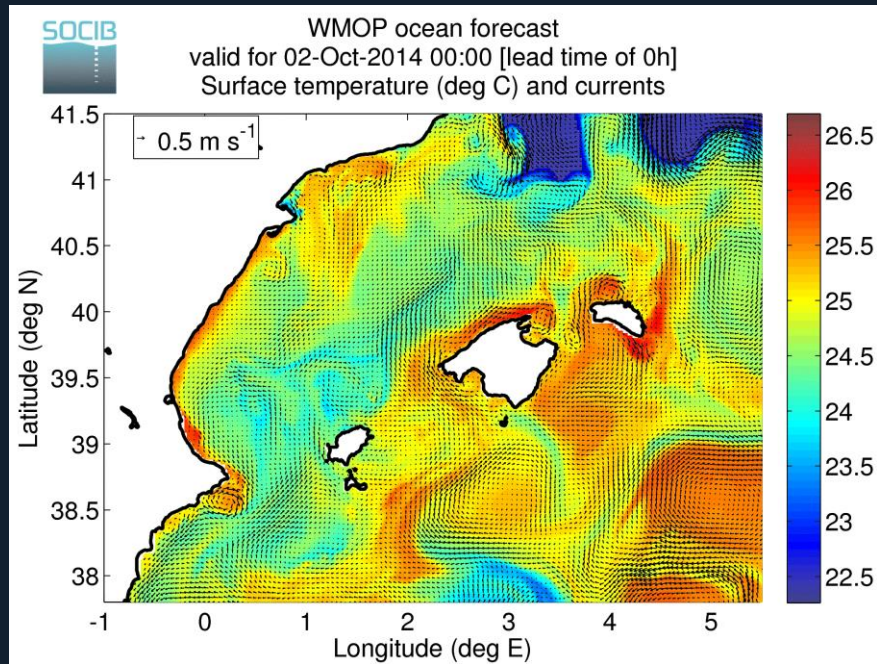
- Regional configuration of ROMS model (a)
- [6°W-9°E], [35°N-44.5°N]
- Bottom topography (30'') (b)
- Spatial resolution $\sim 1.5\text{-}2\text{km}$ ($1/50^\circ$)
- Vertical resolution: 32 sigma levels
- Initial /boundary conditions: Mediterranean Forecasting System ($1/16^\circ$) (c)
- Atmospheric forcing: AEMET Hirlam (3h, 5km)
- Ebro/Rhone climatological runoffs (d)
- Weekly restart using a 3 weeks spinup



- (a) *Shchepetkin and McWilliams (2005)*
- (b) *Smith and Sandwell (1997)*
- (c) *Tonani et al. (2012)*
- (d) *RivDis (UNESCO) database*

- Variables: T, S, U, V saved every 3h
- 3-day ocean forecast

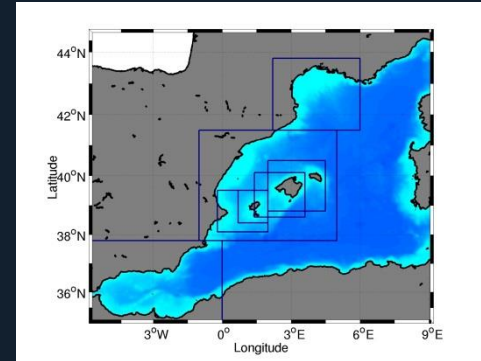
On-line ocean forecast



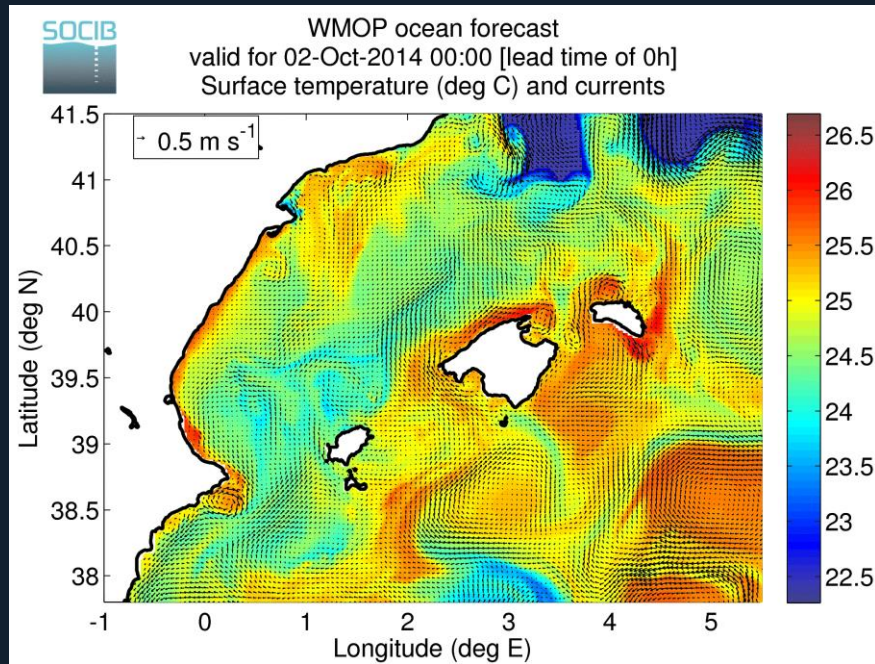
3-day forecast: 3h, 1.5-2km
High resolution animations & figures

Select a specific region:

Western Mediterranean Sea, Alboran Sea, **Balearic Islands**, Ibiza Channel, Ibiza-Formentera, Mallorca Channel, Mallorca-Menorca, Gulf of lion



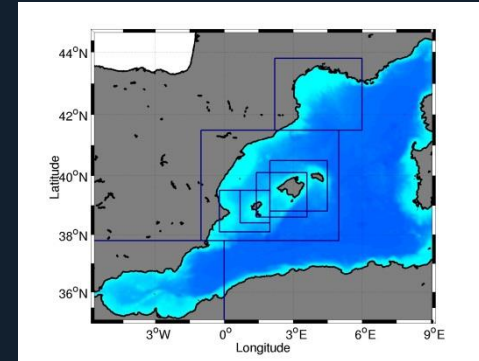
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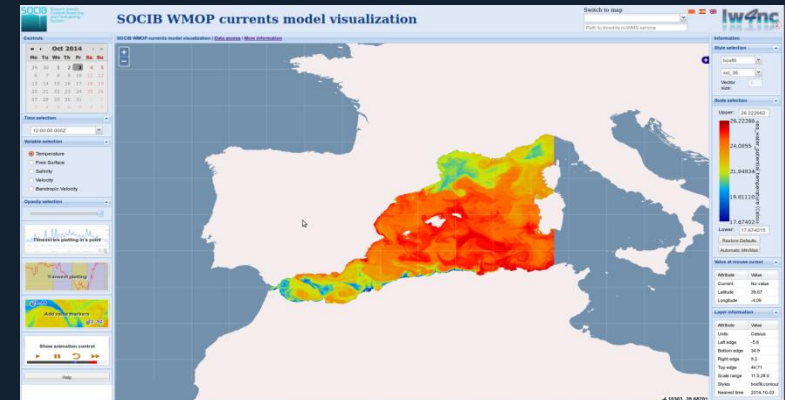
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Lw4nc application

Interactive system to visualize models outputs selecting variables and visualization types (snapshots, animations, maps, time series, regional zooms, section, fixed position etc...)

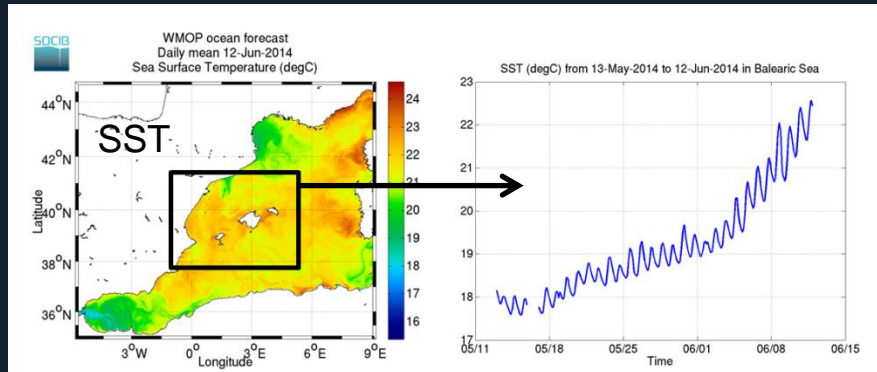


Temporal evolution of ocean indicators

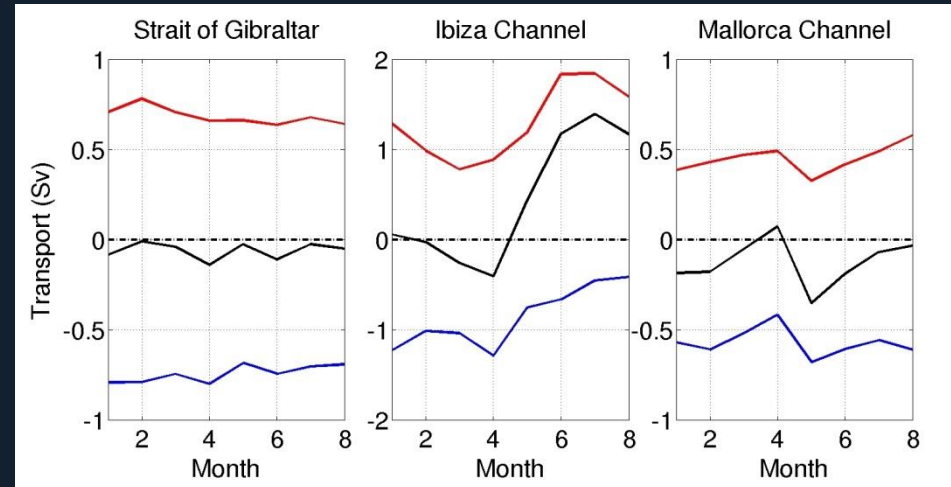
Monitoring of model behavior

Temporal evolution of ocean indicators (SST, SSS, KE, MLD, HC[0-150m]) over the whole basin and in sub-regions (Balearic Sea, Gulf of Lion, Alboran Sea) and of transports in key sections. Last 30-day time series are updated and published daily.

Sea Surface Temperature in Balearic Islands



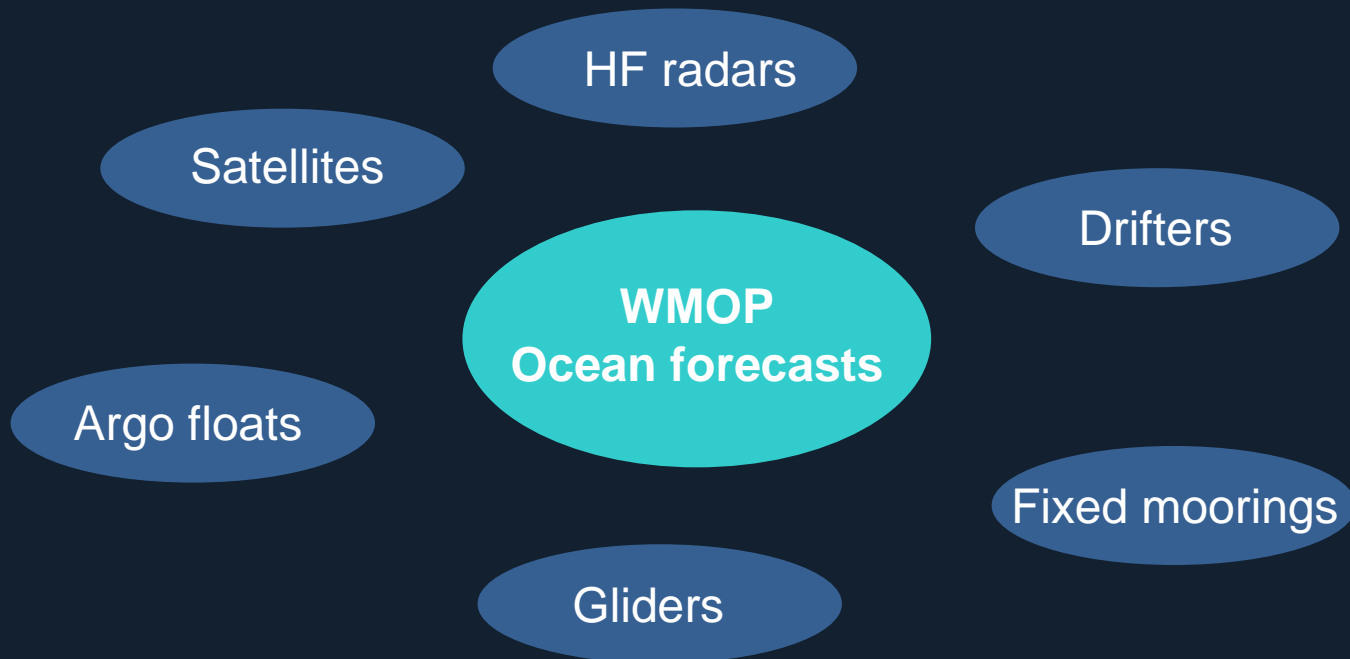
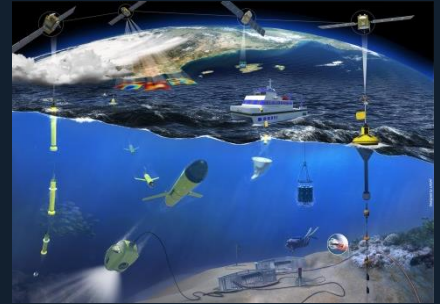
Monthly transports January-August 2014



Validation procedures

Approach

- Multi-platform observations with various spatial/temporal resolutions and coverage
- Near-Real Time & Delayed Mode model-data comparisons through statistical metrics & diagnostics
- Validation: multi-variable and multi-scale (from basin to sub-basin and local scales)
- Large-scale features, surface conditions, ocean circulation and variability, 4D properties and water masses



Validation procedures

Near-Real Time validation (published on-line)

Every day, yesterday model outputs are compared against available observations to monitor the system & keep informed the users about the model performance

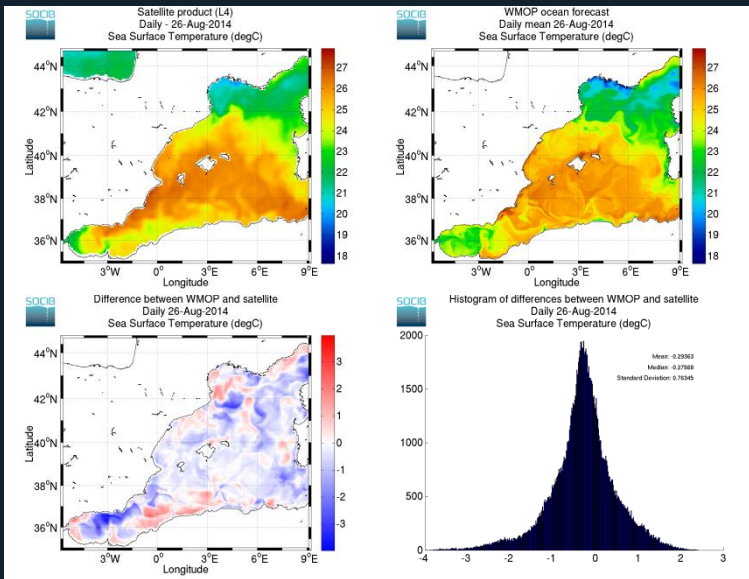
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Sea Surface Temperature

Satellite products (1/16°) [www.myocean.eu]



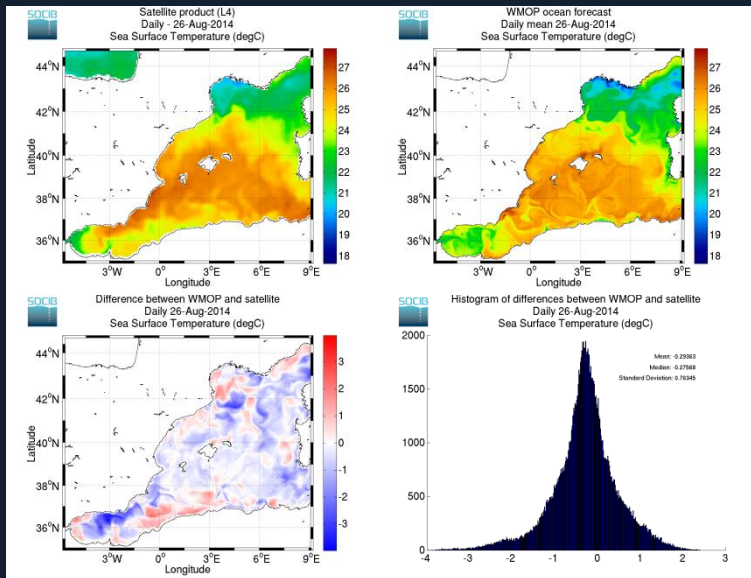
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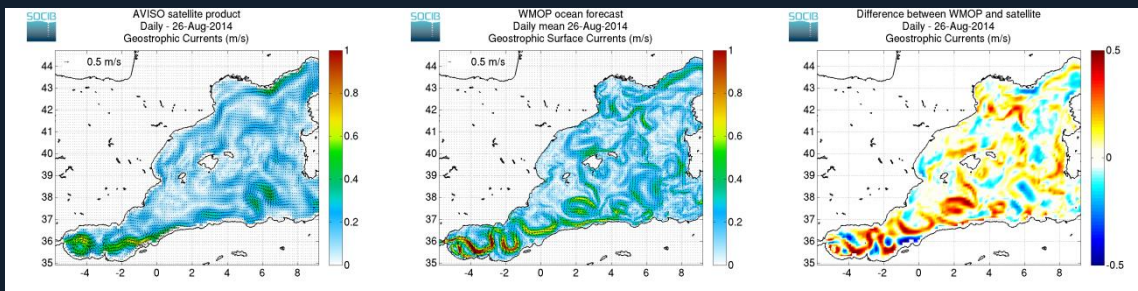
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Geostrophic Current

Altimetry products (1/8°) [www.aviso.oceanobs.com]



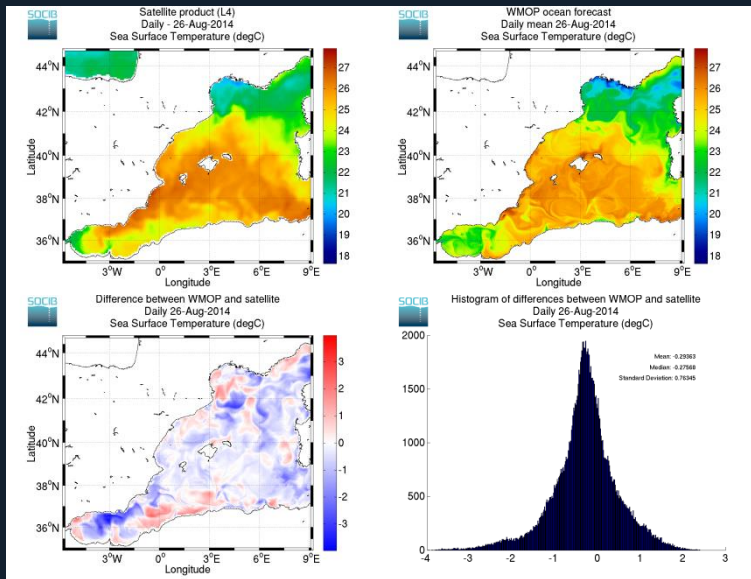
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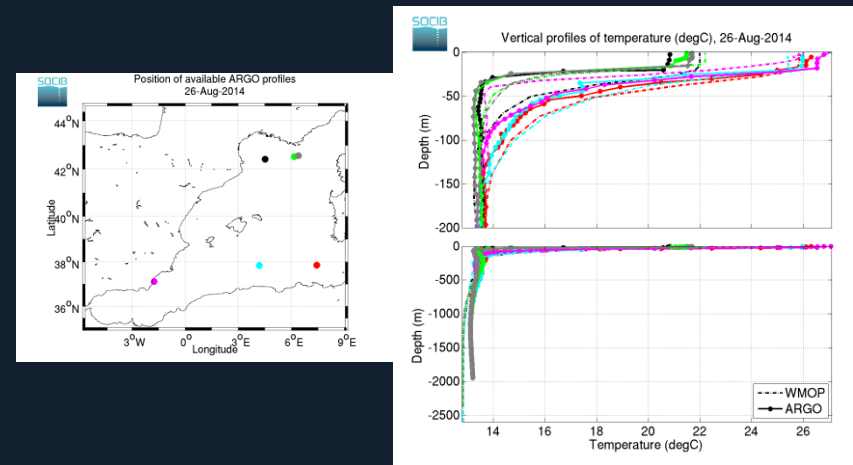
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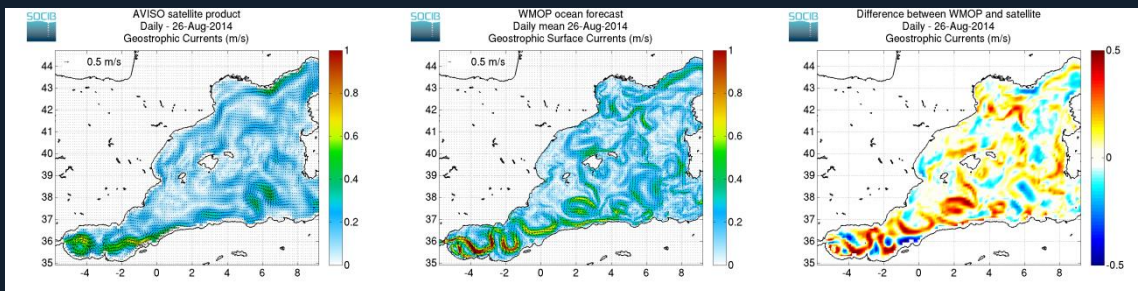
Temperature/Salinity profiles

Argo floats [www.ifremer.fr]



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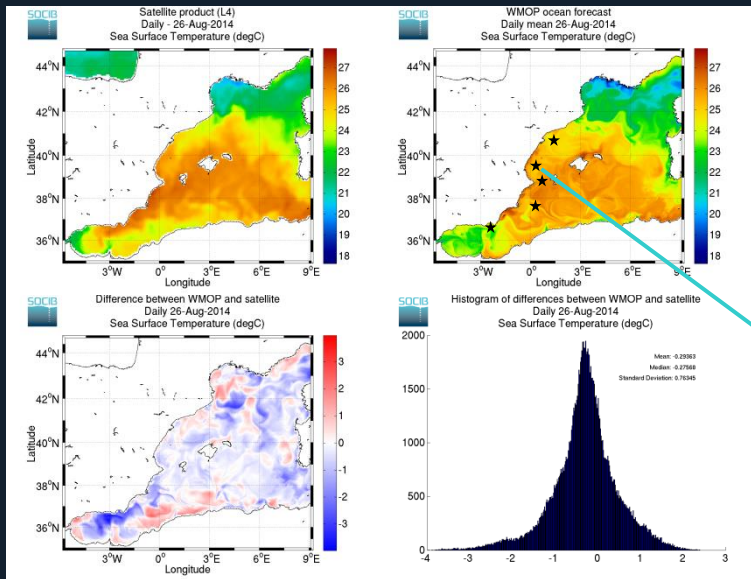
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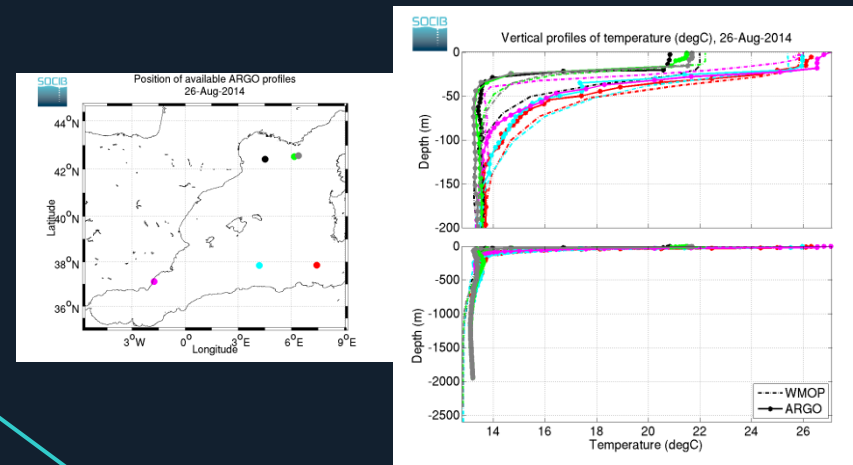
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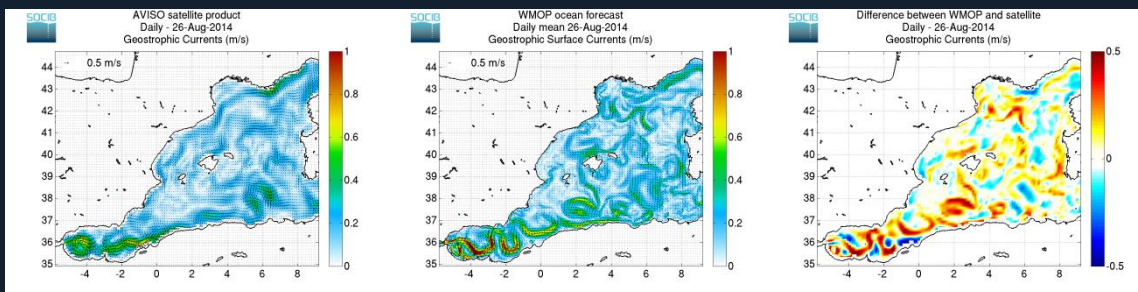
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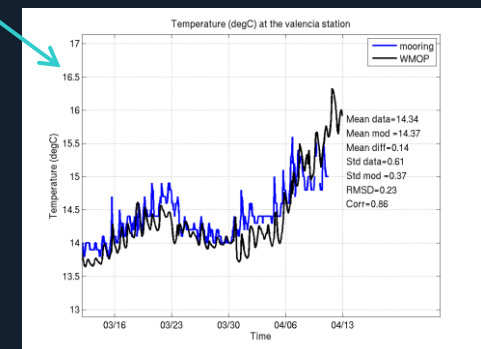


Geostrophic Current

Altimetry products (1/8°) [www.aviso.oceanobs.com]



Temperature, Salinity, Currents
Fixed moorings [www.puertos.es, www.socib.es]



Validation procedures

Delayed Mode validation

Model-data comparison over the last months

Intercomparison with the parent model (MFS)

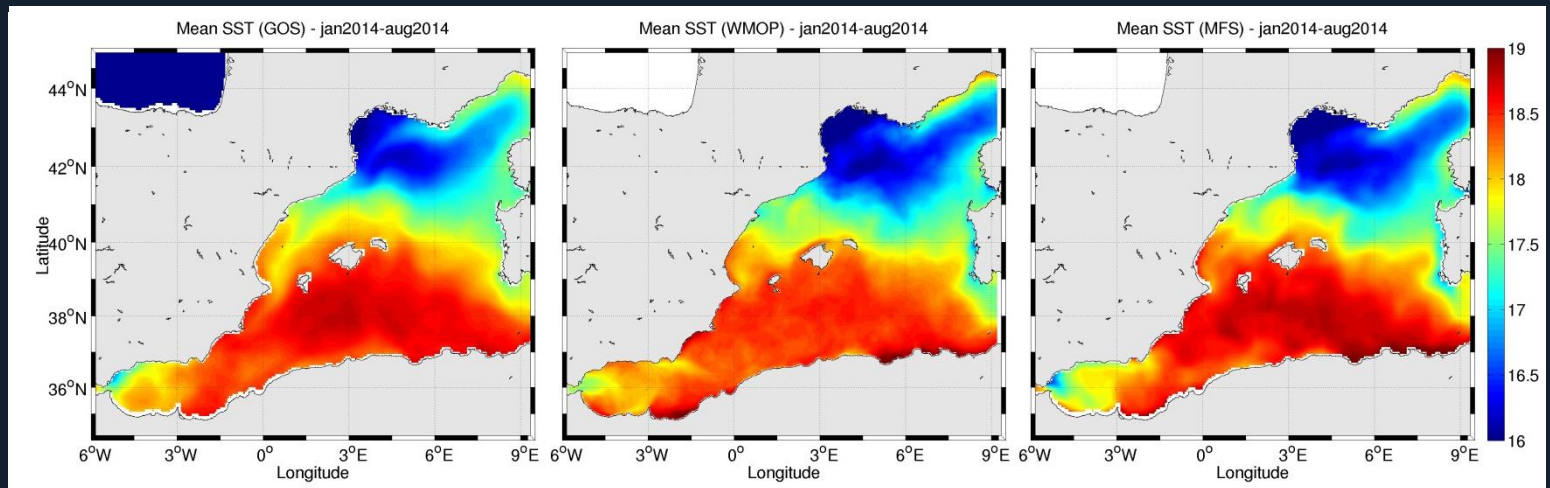
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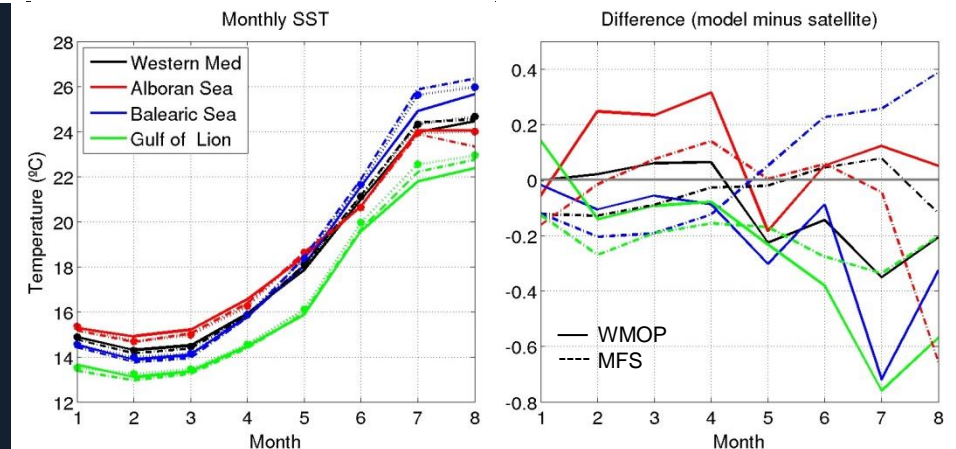
Intercomparison with the parent model (MFS)

Regional monthly Sea Surface Temperature January-August 2014



Sub-basin scale validation

Identification regional biases
Improvement physical processes



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15:15 Auditorium 2: High sub-seasonal variability at circulation “choke” point in the Western Mediterranean, through SOCIB glider monitoring (E. Heslop)

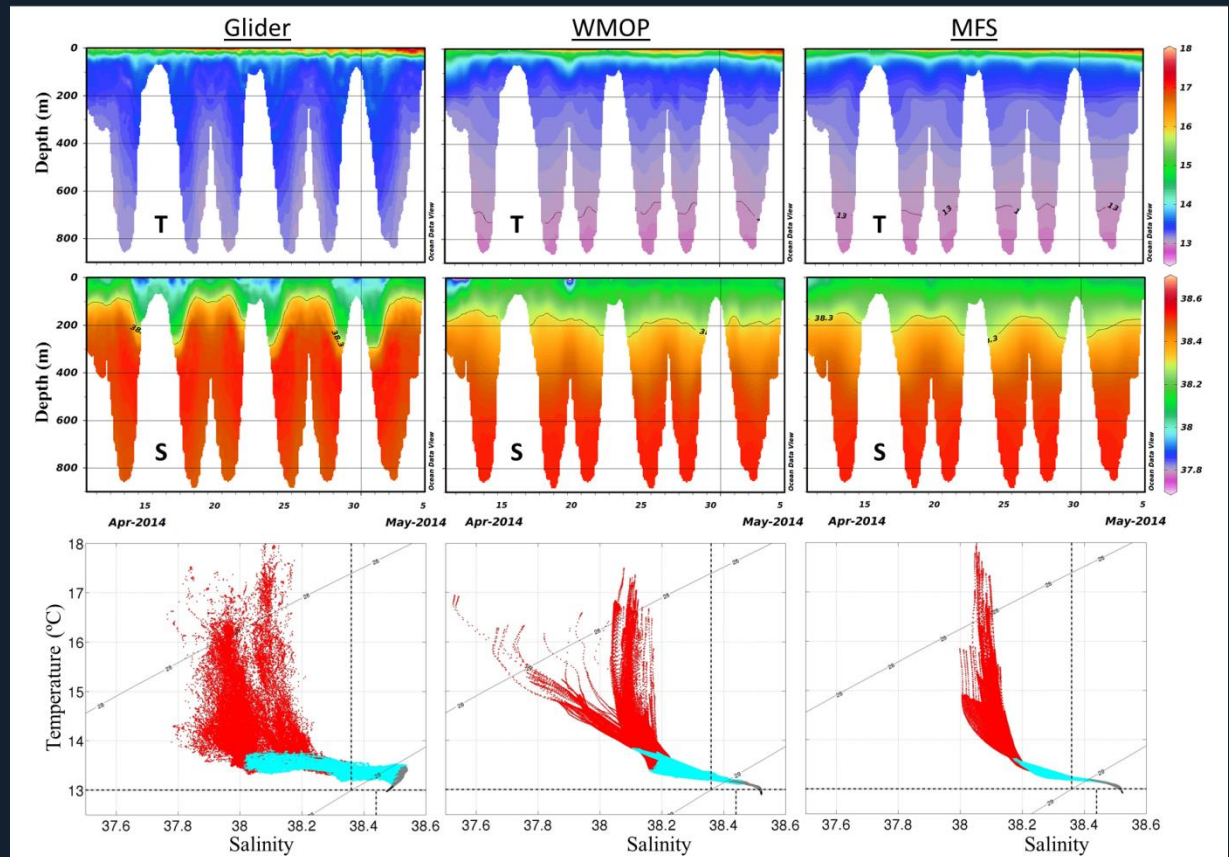
High resolution Temperature/Salinity profiles Gliders in the Ibiza Channel [www.socib.es]

New technologies
High resolution data

*Mesoscale features
Water masses*



Heslop et al. (2012)



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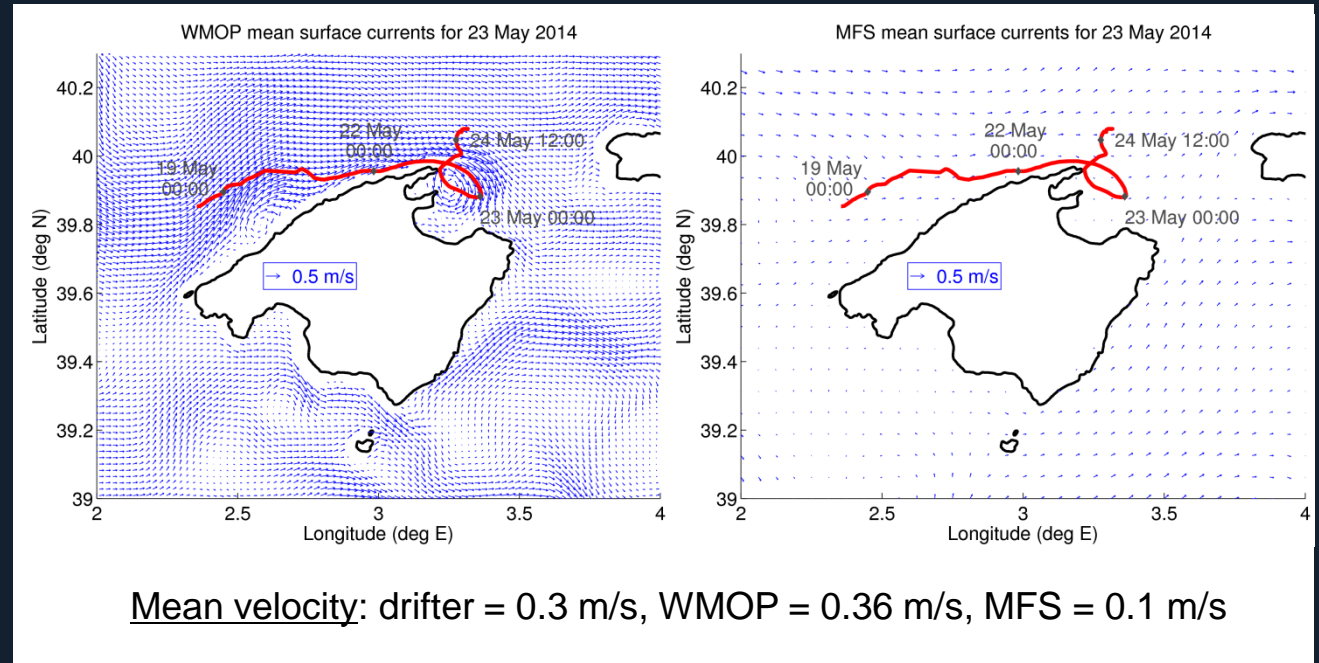
Intercomparison with the parent model (MFS)

Operational
case studies

Jellyfishes



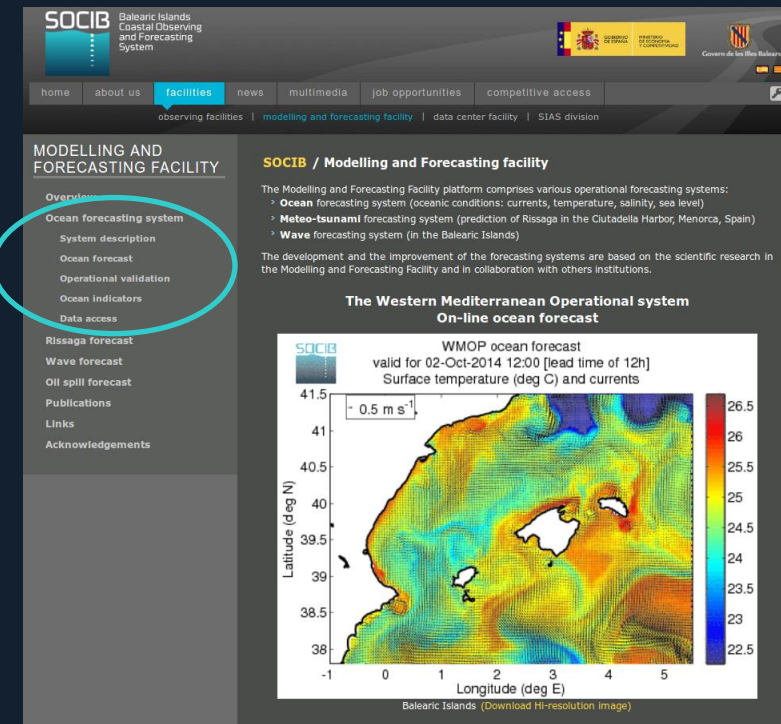
Trajectory around the Mallorca Island Drifters [www.socib.es]



Conclusions

- The high resolution WMOP forecasting system is operational, available and evaluated on-line

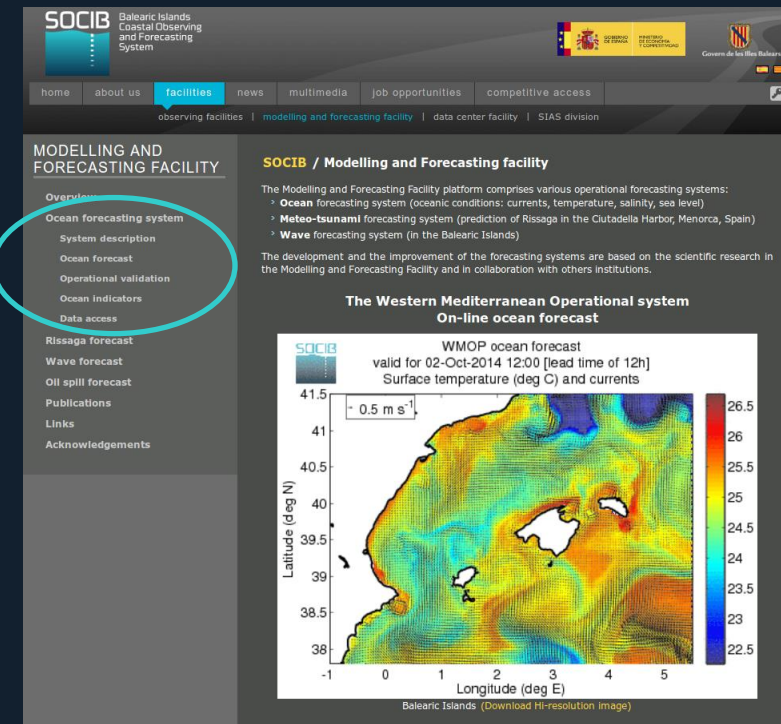
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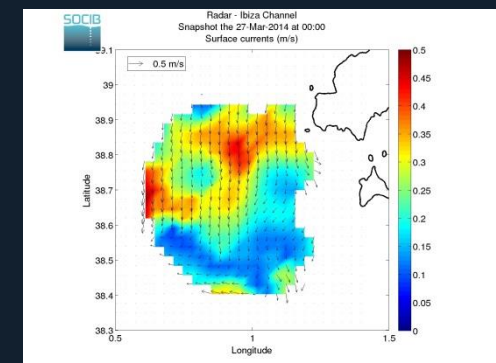
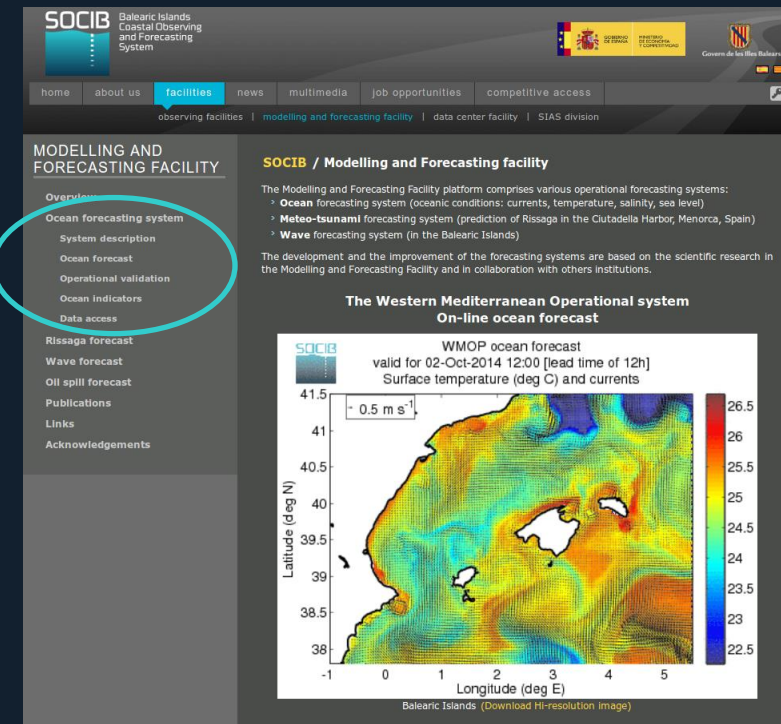
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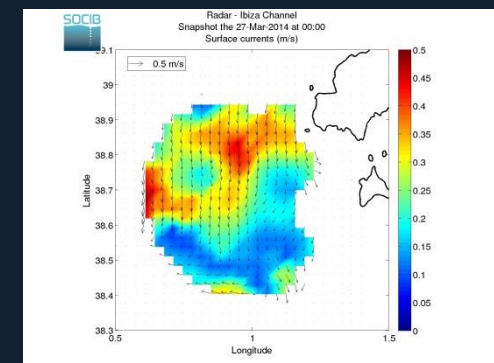
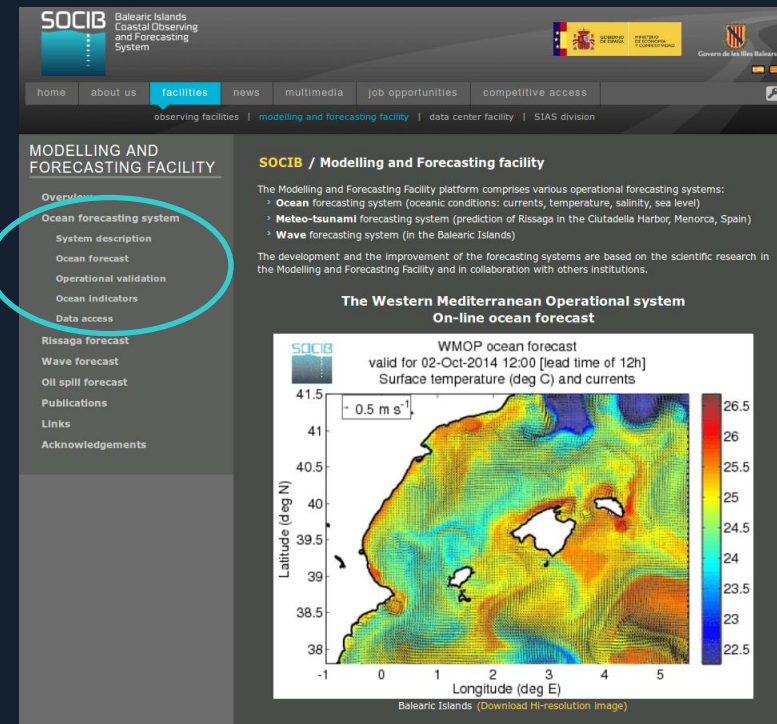
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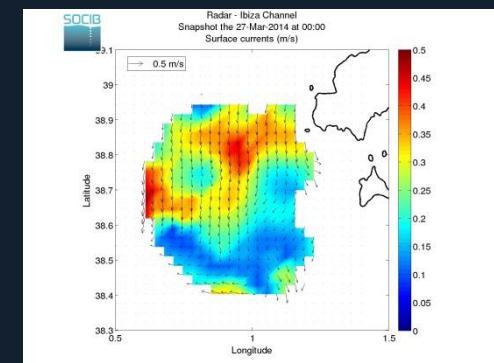
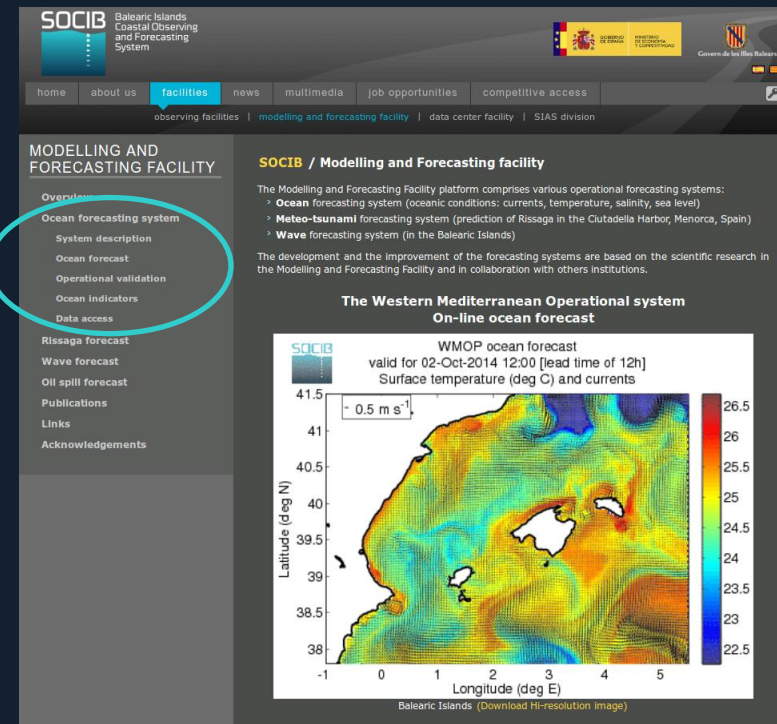
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Thanks for your attention !

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