How is the surface Atlantic water inflow through the Gibraltar Strait forecasted?

A lagrangian validation of operational oceanographic services in the Alboran Sea and the Western Mediterranean.

MG SOTILLO¹, A AMO-BALADRÓN¹, E GARCIA-LADONA², A ORFÍLJA³, P RODRÍGUEZ-RUBIO⁴, D CONTI³, JA JIMÉNEZ MADRID², F J DE LOS SANTOŠ⁴, E ALVAREZ FANJUL¹
Objective

**Validation** of operational ocean forecast products available in the Gibraltar Strait and the Alboran Sea.

Evaluate **skill of ocean model solutions** in reproducing complex **surface dynamics**.

Using in-situ measurements (**MEDESS-GIB database**) as observational reference.
The Context: The MEDESS$_4$MS Project

An integrated real time multi-model oil spill prediction system with:

- Service functionalities for key end-users including REMPEC, EMSA, and National agencies in charge of responding to oil spill crisis.

- An interconnected network of environmental data repositories. Access to data from CMEMS Core Service & national ocean forecasting systems.

http://www.medess4ms.eu

The Mediterranean Decision Support System for Marine Safety dedicated to oil slicks predictions.

Operational products: The regional CMEMS IBI-MFC

Operational products: The local SAMPA solution

Donstream Service for Bahia de Algeciras Port

Daily Forecasts < 2 h

360x96x46 = 1,589,760 gridpoint

100-150m

312x160x35 = 1,747,200

IBI & SAMPA Validation:
A big effort, ..., but what about the currents?

Specific campaigns ("Serious Games") to increase knowledge on specific waters and to validate oil spill predictions.

Also useful to validate ocean model data used as forcing (particularly, ocean currents).

In Western Med 2 MEDESS$_4$MS SGs organized by Spanish partners

- In the Balearic Sea (coordinated by IMEDEA)
- In the Gibraltar Strait Area (coordinated by PdE)
The MEDESS-GIB Campaign

- 35 Drifter buoys (ICM, IMEDEA, PdE)
- 30 CODE/Davies

- 4 vessels involved (3 SASEMAR Salvamar + 1 APBA)
  - Synoptic deployment (covering 680 nm²)

- All buoys released in less than 6 hours
  - 25 buoys released within 2 h.

The MEDESS-GIB Campaign

The MEDESS-GIB database: tracking the Atlantic water inflow

Marcos García Sotillo1, Emilio García-Ladona2, Alejandro Orzála3, Pablo Rodríguez-Rubío4, José Cristobal Maraver5, Daniel Conti6, Elena Pardomo7, José Antonio Jiménez8, Este Capó9, Fernando Pérez10, Juan Manuel Sayol11, Francisco Javier de los Santos12, Arancha Amo13, Ana Rietz14, Charles Troupin9, Joaquín Tintore10,11, and Enrique Álvarez Fanjul11

1Puertos del Estado, 28041 Madrid, Spain
2ICM-CSIC, 08003 Barcelona, Spain
3IMEDEA (CSIC-UIB), 07190 Esplugues, Spain
4Autoridad Portuaria Bahía de Algeciras, 11207 Algeciras, Spain
5SEAHAR, 20011 Malaga, Spain
6SOCIB, 07121 Palma de Mallorca, Spain

Correspondence: Marcos García Sotillo (marcos@puertos.es)
IBI Validation in WMED Region

IBI Virtual trajectories computed every 6h (for +24h horizon) from hourly surface field

![IBI Validation in WMED Region](image)

**IBI vs MEDESS-GIB**

- **Dist. 80%**: 55.58
- **Mean Dist.**: 33.60
- **STD Dist.**: 23.79

Lagrangian metrics (definition of normalized Skill Score) as in Liu and Weisberg, 2011

3290 IBI trajectories
IBI & SAMPA Validation in ALBO Region
IBI SST Validation in WMED

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IBI & SAMPA SST Validation in ALBO

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IBI & SAMPA SST Validation in ALBO

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Key Messages

**MEDESS-GIB** provides a complete Lagrangian view of surface Atlantic water intrusion through Gibraltar and its evolution along the Western Med. Useful for Model validation (particularly, currents).

**CMEMS IBI Regional solution** Strengths & shortcomings identified.

- Realistic simulation of Atlantic water intrusion through Gibraltar (velocities + re-circulations)
- Accurate IBI simulation of the Algerian Current flow. (right Almeria-Oran front position)
- Excessive zonallity in the AJ. Negative impacts on subsequent simulation of the Alboran dynamics: mismatch in the simulation of the Alboran Gyres position (particularly the WAG ones; biased SST signal associated) + Unrealistic dynamics in the transitioning area between the WAG & EAG synoptic features.

Effectiveness of the **SAMPA dynamical downscaled solution** verified.

- SAMPA improves IBI surface solution in the Alboran Sea.
- Added value of the SAMPA solution mostly linked to a more realistic simulation of the north-easterly flow of the surface Atlantic water along the northern branch of the synoptic WAG.