Balearic Islands Coastal Observing
and Forecasting System





S

IBISAR: one year of supporting emergency response at sea



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SAR CASE HISTORY: DRIFTING SAILING VESSEL "BAHAYA"

SARMAP – scenario simulation:

- Time step: 10 min
- Number of particles: 5000
- Wind: AEMET HIRLAM HR (5 km)
- Drifting for 62 hours
- Currents: different models





Which model should I select?



SARMAP: Simulated trajectories and vessel initial/final location







How can we improve emergency response at sea?



End-users needs

Reliable current observations and forecasting are essential

Easily interpretable metrics

User-friendly automated skill assessment







IBISAR service

Provides real-time information of the most accurate ocean current forecast in the IBI area

Facilitates decision-making to SAR operators and emergency responders

End-users needs

Reliable current observations and forecasting are essential

Easily interpretable metrics

User-friendly automated skill assessment



IBISAR: MAIN ELEMENTS







04 IBISAR: DATA USED

Ocean models

What? Current forecast How? Target sources



Ocean current forecast



In-Situ Data What? Current surface observations How? Reference source

54⁰N 48⁰N 42⁰N 36⁰N 30⁰N 15°W 10°W $5^{\circ}W$ 00 5°E

Drifter trajectories

HFR surface currents





04 IBISAR: DATA USED

Ocean models

What? Current forecast How? Target sources



Ocean current forecast

Which model should I select?

Lack in coastal areas

 $5^{\circ}W$

0⁰

5°E

15°W 10°W

54⁰N

48⁰N

 $42^{\circ}N$

36⁰N

30⁰N

50% SAR cases: 3 km offshore



In-Situ Data What? Current surface observations How? Reference source

Drifter trajectories

First HFR surface currents





05 **HF RADAR CURRENT GAP-FILLING**



Open-boundary Modal Analysis (OMA) [Kaplan & Lekien, 2007]

- Obtain gap-free 2D surface currents from radials 0
- Gap-free needed for Lagrangian applications 0









05 HF RADAR CURRENT GAP-FILLING





https://github.com/rowg/hfrprogs

Velocity OMA (Open-boundary Modal Analysis) nowcast



Velocity modes

- Describe all possible patterns
- Only depend on the geometry
- Can be computed once
- Can be stored for real-time applications



IBISAR: HOW IT WORKS?

1.- Trajectory simulation













1.- Trajectory simulation





2.- Trajectory comparison





NCLS distance (Liu & Weisberg, 2011)







Simulated trajectories

NCLS distance (Liu & Weisberg, 2011)

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IBISAR methodology has been validated in <u>4 pilot areas using 144 drifters</u>



7°W

0

Puertos del Estado

MEMBER OF BASQUE RESEARCH



07 **RESULTS: IBIZA CHANNEL**

30 Sep-10 Oct 2014

- 13 drifter buoys
- 4 Ocean models:
 - 3 CMEMS models (IBI, MED, GLOBAL) •
 - 1 regional model (WMOP) •
- HFR Ibiza Channel ٠



https://doi.org/10.25704/MHBG-Q265

Spatial distribution of Skill Scores of models and HFR in the Ibiza Channel



15

15'

0.8

30

30





07 RESULTS: BAY OF BISCAY

17-19 Sep 2018 12-14 Feb 2019

- 5 drifter buoys: CMEMS & SASEMAR
- 5 Ocean models:
 - 4 CMEMS models (IBI, MED, GLOBAL, NWS)
 - 1 regional model (SAMOA-BIL)
- HFR Bay of Biscay (BoB)



Spatial distribution of Skill Scores of models and HFR in the BoB













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07 RESULTS: GIBRALTAR

9-13 Sep 2014

- 20 drifter buoys: MEDESS-GIB
- 5 Ocean models:
 - 3 CMEMS models (IBI, MED, GLOBAL)
 - 2 regional models
 (SOCIB-WMOP, PUERTOS-SAMPA)
- HFR Strait of Gibraltar (SoG)



Spatial distribution of Skill Scores of models and HFR in the SoG



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b) CMEMS-MED-MFC

11°W10°W 9°W 8°W

d) CMEMS-NWS-MFC

11°W10°W 9°W 8°W

0.5

44°N

43⁰N

42^oN

 $44^{\circ}N$

43⁰N

42°N

30'

30'

0

30'

30'



- 5 Ocean models:
 - 4 CMEMS models (IBI, MED, GLOBAL, NWS)
- HFR Galicia



Spatial distribution of Skill Scores of models and HFR in Galicia











SAR Operators needs data confidence

Lack of drifters in coastal prone-risk areas



- SA results in the pilot areas
- GLO model is able to reproduce the intense mesoscale activity
- Downscaling in needed to reproduce submesoscale patterns
- Skill Score is strongly region-dependant and scenario-specific
- HFR offers the highest performance in most scenarios
- HFR performance decreases in the baseline and domain outer-edges

HFR simulated trajectories for backtracking and forecast

- operational gap-filled HFR currents needed
- short-term predictions needed





- **IBISAR** complements the decision-support tools
- * User-friendly service
- * Improve SAR and pollution control operations



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INCREASE (Copernicus Marine Service – Service Evolution)



IBISAR (Copernicus Marine Service – User Uptake)



Copernicus Marine Service – INSTAC – phase2

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THANKS FOR YOUR ATTENTION



