

Contribution of coastal HF Radar to enhance maritime safety and environmental applications

Emma Reyes¹, Adèle Revelard¹, Baptiste Mourre¹, Paz Rotllán¹ and Joaquín Tintoré^{1,2}

¹ *SOCIB, Parc Bit, Naorte, Bloc A, 2^op, pta 3. 07122-Palma, Spain (ereyes@socib.es)*

² *IMEDEA (CSIC-UIB), Carrer de Miquel Marquès, 21. 07190- Esporles, Spain*

Maritime safety and environmental applications, mostly based on Lagrangian trajectory models, require timely and accurate surface current data for determining a search area, particularly in coastal risk-prone regions. In order to cover diverse spatio-temporal scales and to guarantee near-real time availability, their catalogues combine multi-platform observations with multiple ocean models. However, when different models result in disparate trajectories, the major concern of users is to select the most accurate prediction. This has led to the development of automated skill assessment services, where satellite-tracked drifters are often used to evaluate the performance of each model. However, the current lack of drifter availability in coastal areas restrict the potential of these services. Therefore, the use of coastal HF Radar -HFR- derived simulated trajectories as benchmark offers a valuable asset for model assessment. Moreover, HFR derived surface currents can also be used as alternatives of the models for backtracking purposes.

In this study, we first assess the skill of HFR derived data compared with hindcast simulations of different ocean models from SOCIB and Copernicus Marine Service and then we evaluate its role as benchmark in model assessment, in substitution of drifters. The trajectories retrieved from 22 drifters between September 2014 and December 2018 in the Ibiza Channel (Western Mediterranean) and 5 different ocean models overlapping in the region are used. The evaluation is based on the Normalized Cumulative Lagrangian Separation distances between simulated-real trajectories, resulting in a dimensionless index ranging from 0 to 1 (value= 1 implies perfect fit). To be able to compute HFR-derived Lagrangian trajectories, the Open-boundary Modal Analysis has been applied to the radial current fields in order to obtain gap-filled surface currents.

HFR data show much better performance on average than any of the models in reproducing the drifter trajectories, except for an event when drifter motions were dominated by inertial oscillations embedded in a meridional flow. However, in areas with higher HFR observational errors (two-station baseline and at the outer edges of the domain), the performance decreases. Models present varying skill levels predicting the drifter trajectories, depending on the region and on the analyzed period. This is mainly related to their different capacities to reproduce coastal and shelf processes at short timescales and due to the misrepresentation of diverse flow regimes at larger scales. When HFR simulated trajectories are used as benchmark, the evaluation of the models provides similar results than when compared with the real trajectories from drifters. This analysis suggests that HFR could indeed be used as benchmark for near-real time model assessment in maritime safety and environmental applications.