

Characterizing the surface circulation in the Ebro Delta using a HF radar data-model approach

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One year-long (2014) quality-controlled current observations from a CODAR SeaSonde High Frequency (HF) radar network deployed in the Ebro Delta (northwestern Mediterranean) were combined with operational products provided by a regional ocean forecasting system named IBI (Iberia–Biscay–Ireland) in order to comprehensively portray the ocean state and its variability.

First, accurate HF radar data were used as benchmark for the rigorous validation of IBI performance by means of the computation of skill metrics and quality indicators. The analysis of the monthly averaged current maps for 2014 showed that IBI properly captured the prevailing dynamic features of the coastal circulation observed by the HF radar, according to the resemblance of circulation patterns and the eddy kinetic energy spatial distribution. The model skill assessment was completed with an exploration of dominant modes of variability both in time and space. The EOF analysis confirmed that the modeled surface current field evolved in space and time according to three significantly dominant modes of variability which accounted for the 49.2% of the total variance, in close agreement with the results obtained for the HF radar (46.1%).

The response of the subtidal surface current field to prevalent wind regimes in the study area was examined in terms of induced circulation structures by performing a conditional averaging approach. This data-model synergistic approach has proved to be valid to operationally monitor and describe the complex coastal circulation in Ebro Delta despite the observed model drawbacks in terms of reduced energy content in surface currents and some inaccuracies in the wind-driven low frequency response.

This integrated methodology constitutes a powerful tool for improving operational ocean forecasting systems at European level within the frame of the Copernicus Marine Environment Monitoring Service (CMEMS). It also facilitates high-stakes decision-making for coastal management and mitigation of environmental risks in the Ebro River Delta marine protected area.