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Surface wind-current interaction patterns and time-scales in the southeastern Bay of Biscay, extracted from high frequency radar currents

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Two high frequency radar stations were installed on the coast of the southeastern Bay of Biscay in 2009, providing high spatial (5 km) and temporal (1 hour) resolution and large radial coverage (approx. 150 km) of surface currents in the area. This has made it possible to quantitatively assess: (1) the air-sea interaction patterns and time-scales, and (2) the suitability of the Barnett-Preisendorfer approach to canonical correlation analysis (BPCCA) to undertake a statistical prediction model of hourly surface wind-induced currents. The BPCCA yields two canonical patterns with canonical correlation coefficients of 0.84 and 0.79, respectively, that describe the classical Ekman drift at the sea surface and an anticyclonic/cyclonic surface circulation. The results obtained reveal that currents over the study area are mainly forced by local rather than remote winds. The wind-current interaction time-scales are primarily associated with diurnal breezes and synoptic variability. It is concluded that the breezes force diurnal currents not only in coastal waters but also in waters of the continental shelf and slope of the southeastern Bay. Finally, the results obtained suggest that the BPCCA approach can be suitable for developing a prediction model of surface wind-induced circulation. These statistical prediction models have a broad range of applications including the forecasting of transport of pollutants and biologics, search and rescue, marine safety, offshore operations and risk assessment, among others.