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Seabird drift as a proxy to estimate surface currents in the western Mediterranean?

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Seabird trajectories can be used as proxies to investigate the dynamics of marine systems and their spatiotemporal evolution. Previous studies have mainly been based on analyses of long range flights, where birds are travelling at high velocities over long time periods. Such data have been used to study wind patterns, and areas of avian feeding and foraging have also been used to study oceanic fronts. Here we focus on "slow moving" periods (which we associate to when birds appear to be drifting on the sea surface), in order to investigate bird drift as a proxy for sea surface currents in the western Mediterranean Sea.

We analyse trajectories corresponding to "slow moving" periods recorded by GPSs attached to individuals of the species Calonectris diomedea (Scopoli's shearwater) from mid August to mid September 2012. The trajectories are compared with sea level anomaly (SLA), sea surface temperature (SST), Finite Size Lyapunov Exponents (FSLE), wind fields, and the outputs from an automated sea-surface-height based eddy tracker. The SLA and SST datasets were obtained from the Copernicus Marine Environment Monitoring Service (CMEMS) with a spatial resolution of 1/8 ° and 1/100 ° respectively while the FSLEs were computed from the SLA dataset. Finally, the wind data comes from the outputs of the CCMPv2 numerical model. This model has a global coverage with a spatial resolution of 1/4 °.

Interesting relationships between the trajectories and SLA fields are found. According to the angle between the SLA gradient and the trajectories of birds, we classify drifts into three scenarios: perpendicular, parallel and other, which are associated with different driving forces. The first scenario implies that bird drift is driven by geostrophic sea surface currents. The second we associate with wind drag as the main driving force. This is validated through the wind dataset. Moreover, from the SST, FSLEs and the eddy tracker, we obtain supplementary information on the presence of oceanic structures (such as eddies or fronts), not observed in the SLA field due to its limited spatial and temporal resolutions. Therefore, this data helps to explain some of the third case scenario trajectories.