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Investigating the impact of wind, waves and currents on the distribution of surface drifting particles with drifter data and a high resolution numerical model in the nearshore region

Florian Hahner, Jens Meyerjürgens, Tim Wüllner, Karsten Alexander Lettmann, Thomas Badewien, Oliver Zielinski, and Jörg-Olaf Wolff
(florian.hahner@uni-oldenburg.de)

A coupled wave and ocean model within the COAWST Modelling System is used in a one-way nesting scenario to investigate the importance of wind, surface currents and Stokes drift for the distribution of surface drifting objects in the nearshore region of the East Frisian barrier island Spiekeroog in the North Sea. Stokes drift and surface currents are computed on a high resolution grid. Combination with meteorological data, Lagrangian floats and in situ data of surface drifters and wave radar measurements allows for a realistic estimation of wind drag coefficients and Stokes Drift. Therefore GPS-Box Drifters have been developed which resemble surface floating macroplastics. Complex topographic features with shallow areas and deep channels within this coastal region lead to strongly heterogeneous wave and current fields. Due to the high resolution of our numerical model these features can be described with the needed accuracy. At the same time computational costs are minimized by using a two-step nesting approach. We show that Stokes Drift becomes a major role in shallow coastal regions, even exceeding the influence of the wind drag, hence playing a key role for realistic descriptions of beaching and the recognition of litter accumulation.