Geophysical Research Abstracts
Vol. 21, EGU2019-13483, 2019
EGU General Assembly 2019

Trajectories of state-of-the-art surface drifters reveal pathways of floating marine litter in the North Sea

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Floating marine litter (FML) is dispersed in the world oceans and poses one of the major threats to marine ecosystems. Lagrangian observations are a fundamental key to gain deeper insights into complex transport processes of FML at the ocean's surface. A number of studies have focused on global, large scale transport modelling of FML by using Lagrangian observations from satellite tracked drifters. Sub-mesoscale transport patterns in coastal and estuarine environments have an enormous impact on the dispersion, accumulation and beaching locations of FML and are not fully understood up to now.
This study presents a dataset of 38 drifter deployments, which were conducted in 2017 and 2018 in the southern North Sea. The drifters were designed for the investigations of surface velocity fields and sub-mesoscale processes in strongly tidally-influenced shallow water areas. The drifter motion simulates currents of the ocean surface layer (0.5 m) taking into account wave and wind induced motions. Residual drifter velocities were derived from high resolution geospatial data and compared to local wind field observations. The net transport of the drifters far away from the coast are strongly affected by wind-driven surface currents, approximately 1% of the wind speed, whereas the transport patterns, beaching locations and the travel times in coastal areas are dominated by local small-scale processes like estuarine frontal systems, tidal jet currents and interactions with a complex shoreline.