Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Modification of Stokes Drift in Coastal Areas due to Surface Wave, Current and Topography Interactions AKANKSHA GUPTA, Department of Mechanical Engineering, Indian Institute of Technology, Kanpur, U.P. 208016, India., ANIRBAN GUHA, School of Science and Engineering, University of Dundee, Dundee DD1 4HN, UK. — Surface gravity waves cause floating particles to undergo a slow drift in the direction of wave propagation. This forward drift, commonly known as the Stokes drift, plays a crucial role in transporting various tracer parcels, from sediments to pollutants, in the marine environment. In the classical analysis, the effect of mean current and sea-bed undulations are not factored in while calculating Stokes drift. We find that in the nearshore region, Stokes drift is non-trivially affected by alongshore current and sea-bed undulations. We theoretically show that the time-independent particular solution, arising from mean-current and bottom-ripple interactions, leads to additional terms in the Stokes drift. Next, using High-order Spectral method, we numerically simulate wave-current-topography interactions in a 3D setting and compute the Lagrangian drift. We find that the resulting drift in the presence and absence of sea-bed corrugations have significant differences. Topographic interactions are inevitable in the nearshore region, and our study reveals that sea-bed corrugations can significantly affect cross-shelf exchange of microplastics and other nearshore tracers like pathogens, contaminants, nutrients, larvae, and sediments.

Akanksha Gupta
Indian Institute of Technology Kanpur (IIT)

Date submitted: 10 Aug 2020 Electronic form version 1.4