Field observations and modeling investigation of interaction between vegetation and marine debris along Barbamarco sandy spit in the northern Adriatic (Italy)

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Abstract

Human pressures on the coastal zones and oceans have increased considerably in the last decades. Human activities constitute the greatest threat to the coastal and marine environment, generating considerable quantities of plastic waste. Currently, it is widely recognized that the increase of marine-related activities has adversely affected the coastal environment as well as the associated ecosystems. Our study focuses on marine litter and specifically on the floating part of it which is frequently composed of plastic materials. Floating litter tends to accumulate on beach-dune ecosystems, already characterized by multiple anthropogenic pressures and environmental factors. In addition, litter items may be trapped by coastal dune vegetation or saltmarsh. Successively, the degradation of marine litter will cause the entering of secondary microplastics. Most of the previous studies are based on monitoring activities and aim to identify the origin and destination of litter in order to manage the fate and transport issues. Therefore, it is important to develop modeling and monitoring tools to detect and prevent marine debris dispersal in coastal environments. We applied field sampling and UAVs (Unmanned Aerial Vehicles) survey over a complex geomorphic set up in the Po River Delta (Italy). Our field data are implemented into a high-resolution hydro-morphodynamic numerical model for validation. Then, we are able to project into different scenarios of plastic debris accumulation in the coastal zone. Our preliminary results show an accumulation of floating debris in coastal dunes vegetation mainly driven by alongshore currents and wave set up in the nearshore area. Then, wind-dominated directions and magnitude disperse plastic debris in embryo dunes and back-barrier marshes. Specific cleaning operations are therefore needed. Considering that coastal management scenarios and decisions rely on numerical models that can predict best practices for coastal sustainability, our results might help local agencies and stakeholders to manage coastal environments.

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