Lagrangian Observations of Horizontal Dispersion in the US Caribbean

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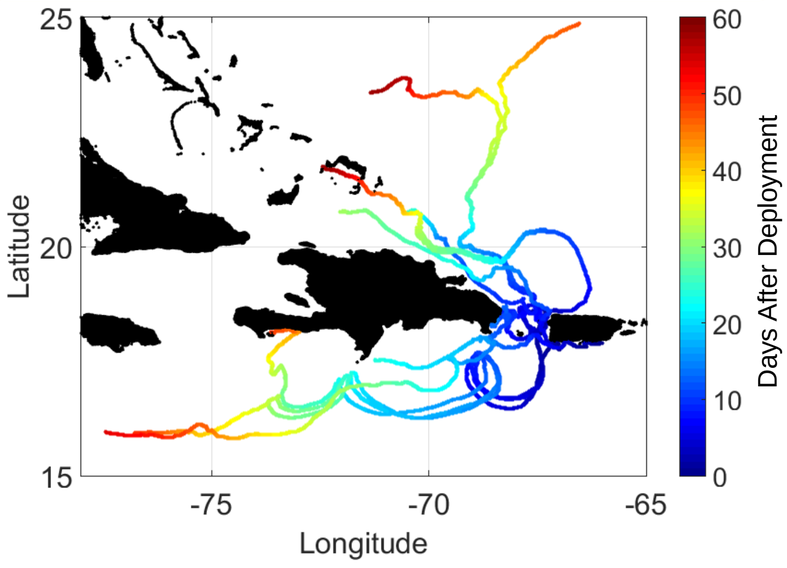
OVERVIEW

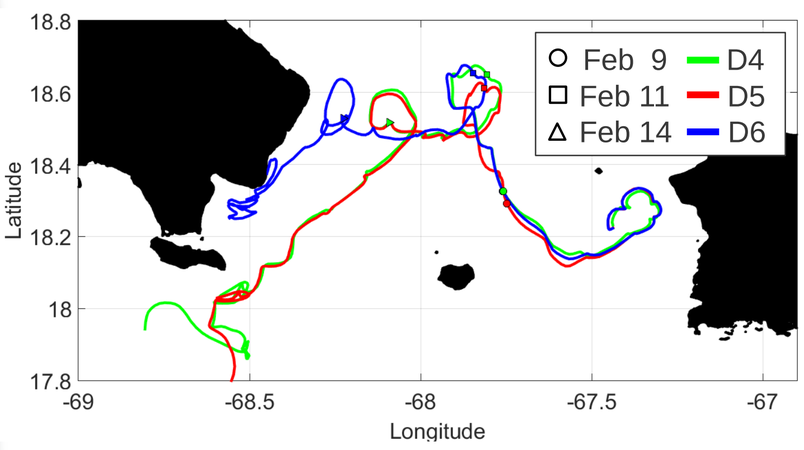
Over the last couple of years, CariCOOS has been able to conduct multiple drifter deployments within the US Caribbean. The original study site was the Mona Passage due to the very complex circulation patterns that dominate this region. The following deployments extended to cover a larger area within the US Caribbean, which includes waters surrounding the islands of Puerto Rico and the US Virgin Islands. The most recent deployment took place in late April 2017 and consisted of twenty-two satellite-tracked drifters released within the Mona Passage and to the south of Puerto Rico. This was the largest drifter deployment recorded for the region. The drifters transmitted their location every ten minutes and were made out of wood to prevent the pollution of our oceans. The acquired data from all of these deployments has allowed the direct observation of the main features of the circulation in the Mona Passage and the lateral dispersion of particles in the US Caribbean; both processes caused by the interaction between tidal currents, large-scale circulation and mesoscale phenomena.

2015

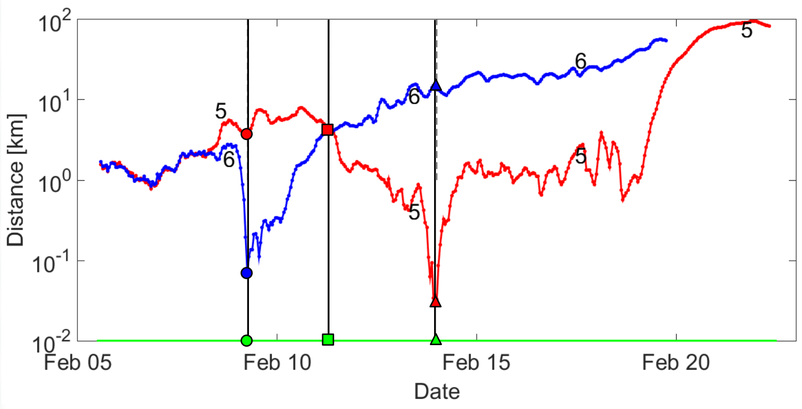
MONA PASSAGE



[Top] Trajectories for the first 19 drifters ever deployed within MPA's off the west coast of Puerto Rico.



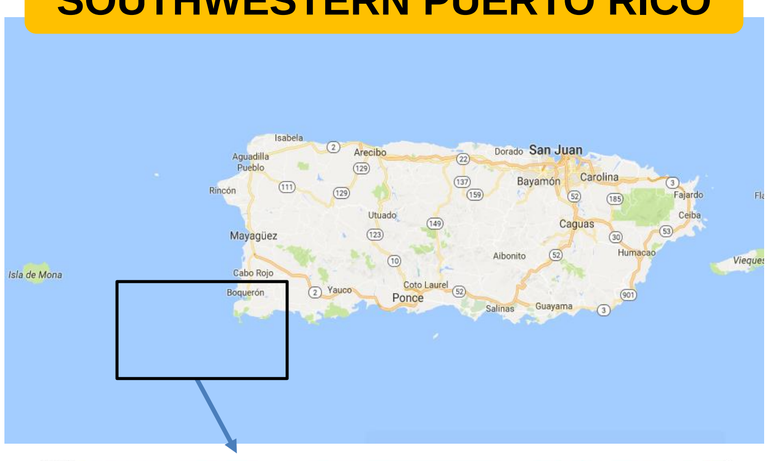
[Top] Trajectories for drifters 4, 5, and 6 after interpolating the position data to an hourly time step. Drifters' locations for February 9, 11, and 14 are highlighted.

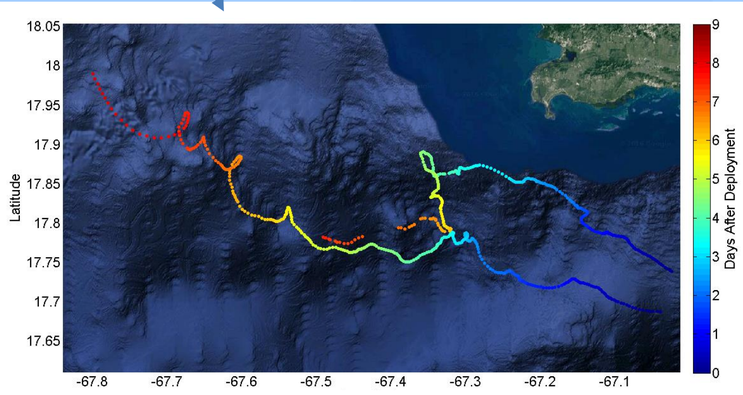


[Top] Distances between pairs of drifters active at the same time were calculated. The case for pairs 4-5 and 4-6 is shown.

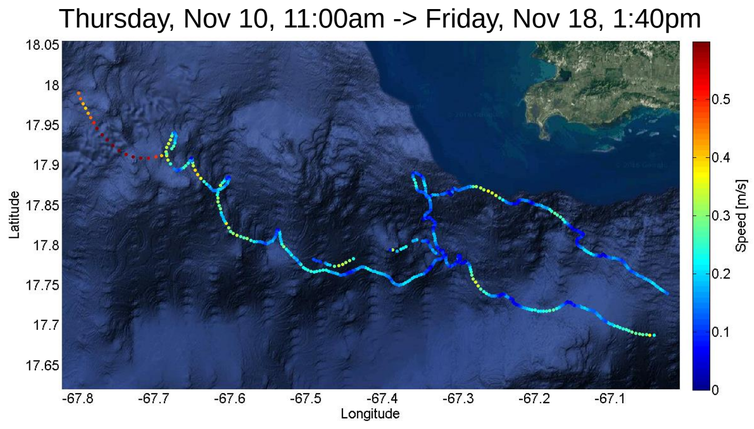
2016

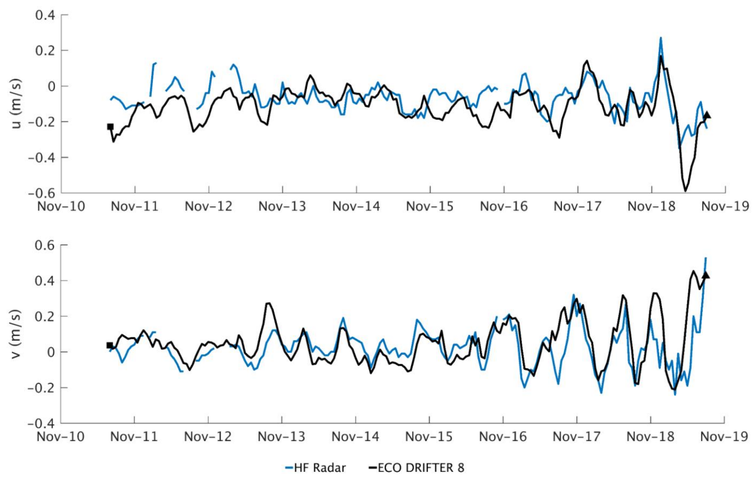
SOUTHWESTERN PUERTO RICO





Thursday, Nov 10, 11:00am -> Friday, Nov 18, 1:40pm

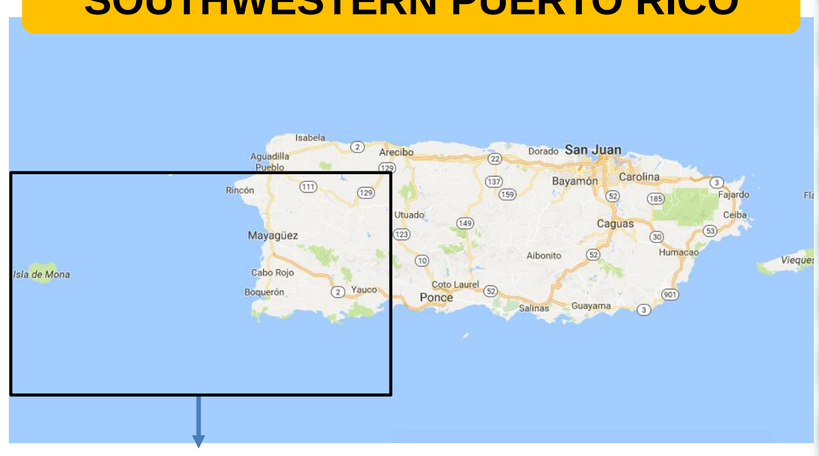


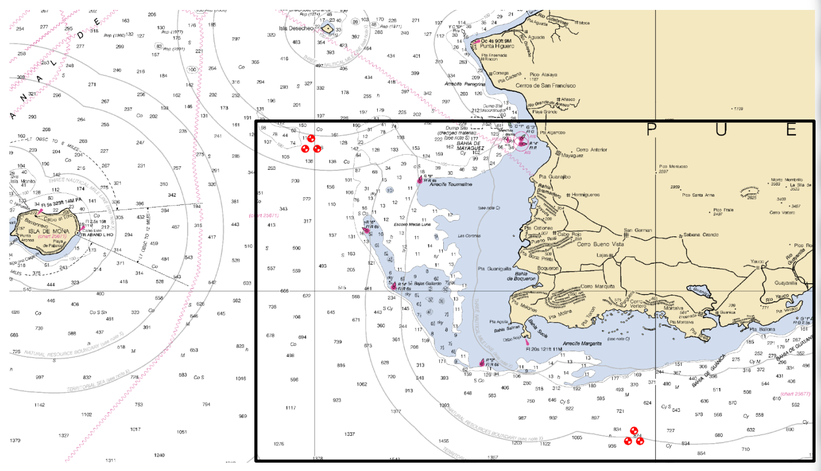


[Top] Comparison between drifters and HF-radar derived UV components for first eco-drifter deployed in open ocean.

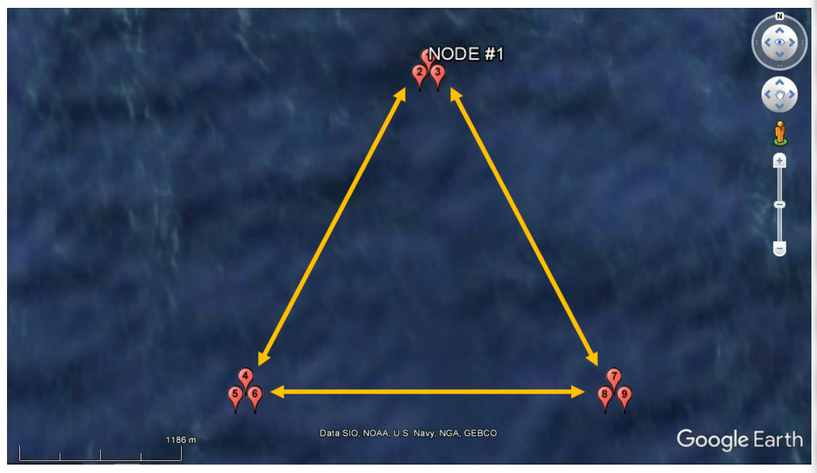
2017

SOUTHWESTERN PUERTO RICO



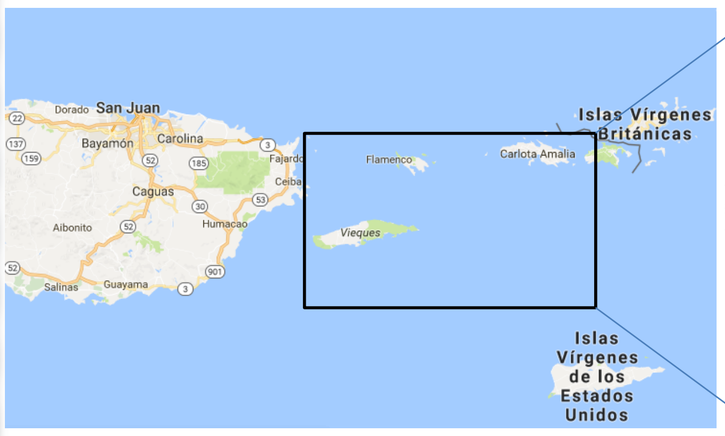


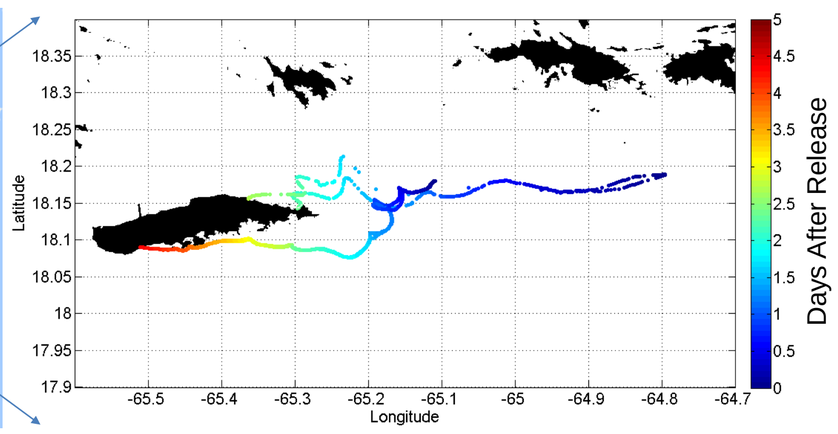
[Right] Deployment plan included 18 drifters in two sites: 5 nm south of Veril and 4.5 nm west of Bajo de Sico.

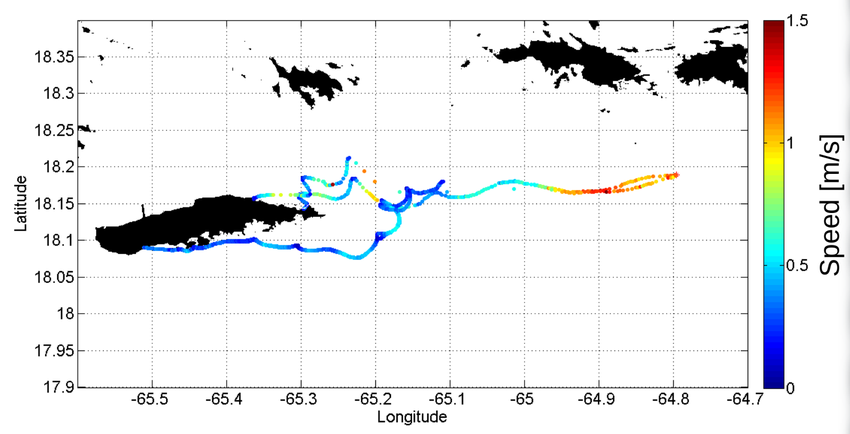


[Top] Inner triangles: 100 m distance between drifters Outer triangle: 2 km distance between drifters.

US VIRGIN ISLANDS DEPLOYMENT







[Left] Four drifters were deployed to the south of St. Thomas. [Center] This close-up shows the drifters' sensitivity to tidal fluctuations and the dominant westward direction of currents to the south of the Virgin Islands. [Right] During the first two days, stronger currents were observed (yellow and red tones).

FUTURE WORK

C.O.D.E. drifters were designed to reduce wind slippage, but wind effects still persist under strong winds and high sea conditions. The windage experienced by this drifter design is estimated to be about 3% of the incident wind speed (Poulain, P., et al., 2008). With the high density data of our latest deployment, we will be able to calculate the wind slippage for eco-friendly drifters and compare it to the result obtained for PVC drifters (~3%).