

ABOUT

- Winter Storm Riley slammed the east coast of the United States on March 2, 2018 with wind gusts reaching as high as 40 m s^{-1} and a pressure of at least 24 millibars. On March 4, Puerto Rico began to feel the effects of the storm waves coming in from a northerly direction. The storm waves started coming into Rincón from a northerly/northwesterly direction generating peak conditions by March 5.
- An analysis of storm-driven morphodynamics was performed along the coast of Rincón, Puerto Rico to understand the effects of the largest swell to hit this coast in more than a decade.

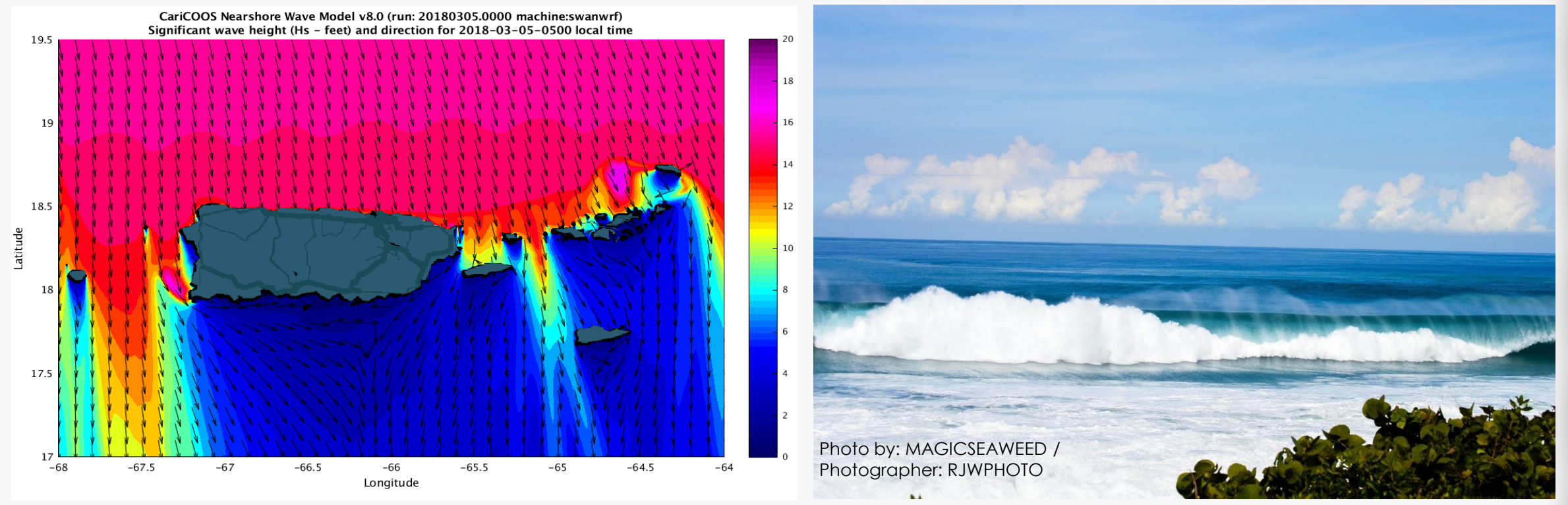


Figure 1 (Left panel) CARICOOS Wave Model forecast map corresponding to the peak of the northwesterly wave event with a significant wave height of nearly 6 meters and (right panel) a photograph showing the highly-energetic conditions observed in Puerto Rico during the winter storm.

WAVE AND WIND CONDITIONS

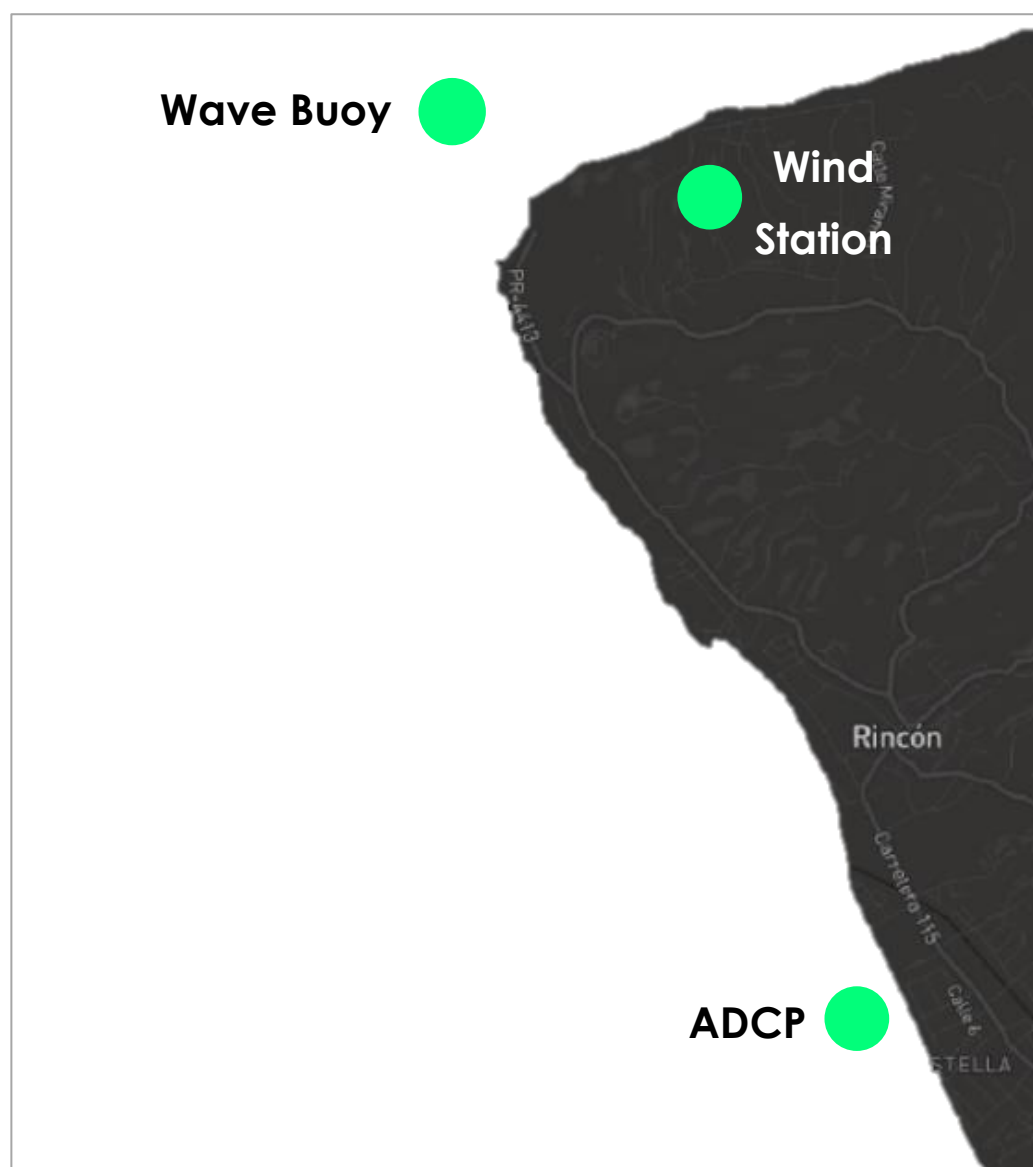


Figure 2 Image of Rincón showing the locations where wave and wind data were measured.

- In-situ measurements were collected at three different locations (Figure 2) from March to April, 2018.
- Offshore and nearshore wave and wind data (Figure 3) were collected with an acoustic Doppler current profiler (ADCP), CARICOOS buoy, and local anemometer, respectively.
- CARICOOS Rincón buoy measured a wave height nearly twice as the one recorded by the ADCP during the peak conditions. The storm generated maximum wave heights of up to 10 m at 17 s.

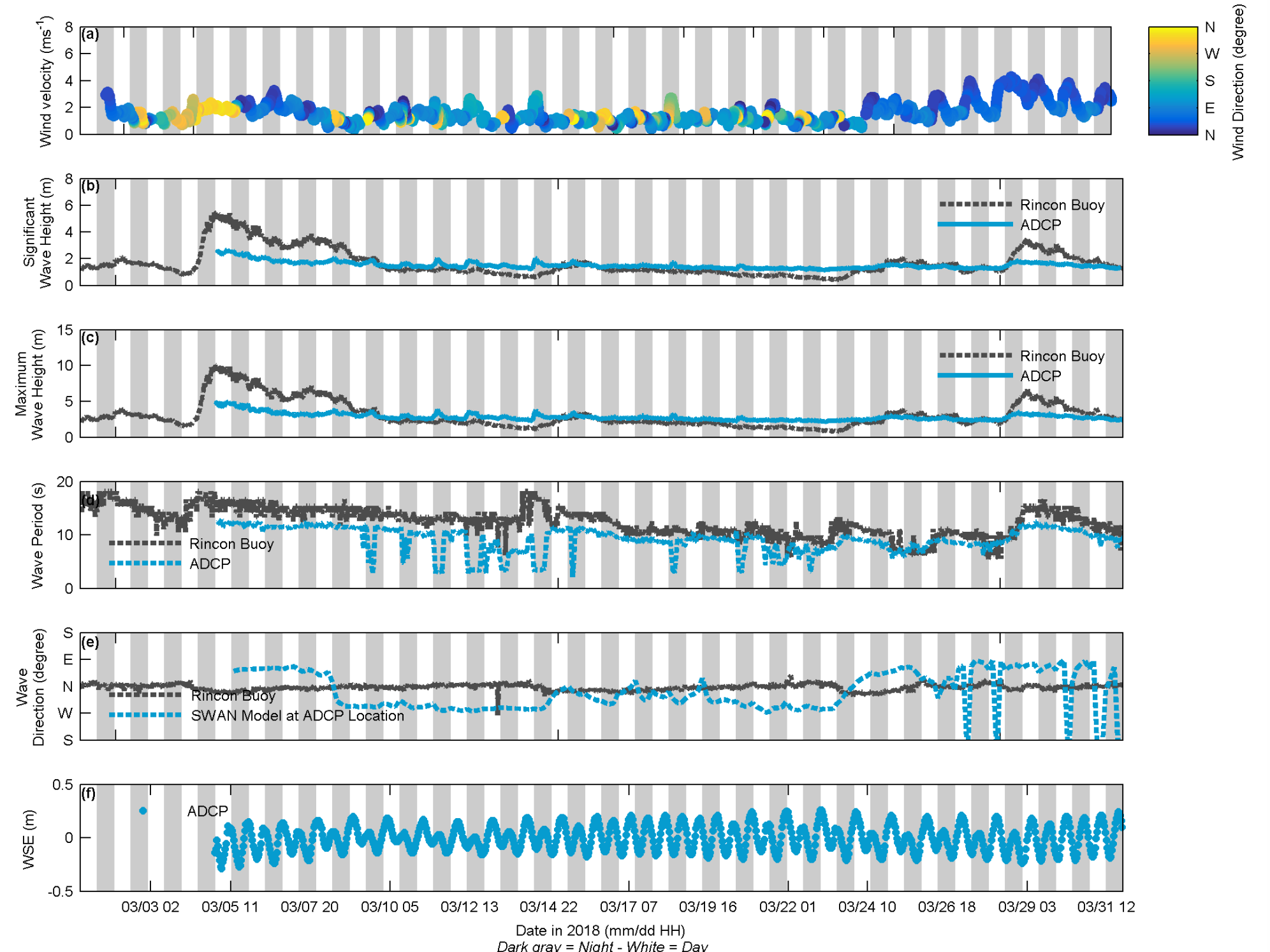


Figure 3 Wave and wind conditions during Hurricane María measured by Rincón buoy (gray dashed line) and Acoustic Doppler Current Profiler (ADCP; blue lines): (a) sustained wind speed and direction; (b) significant wave height (H_s); (c) maximum wave height (H_{max}); (d) wave period (T_p); (e) wave direction (D_p); (f) water surface elevation (WSE). Gray shading in all panels indicate measurements during night time.

BEACH MORPHOLOGY

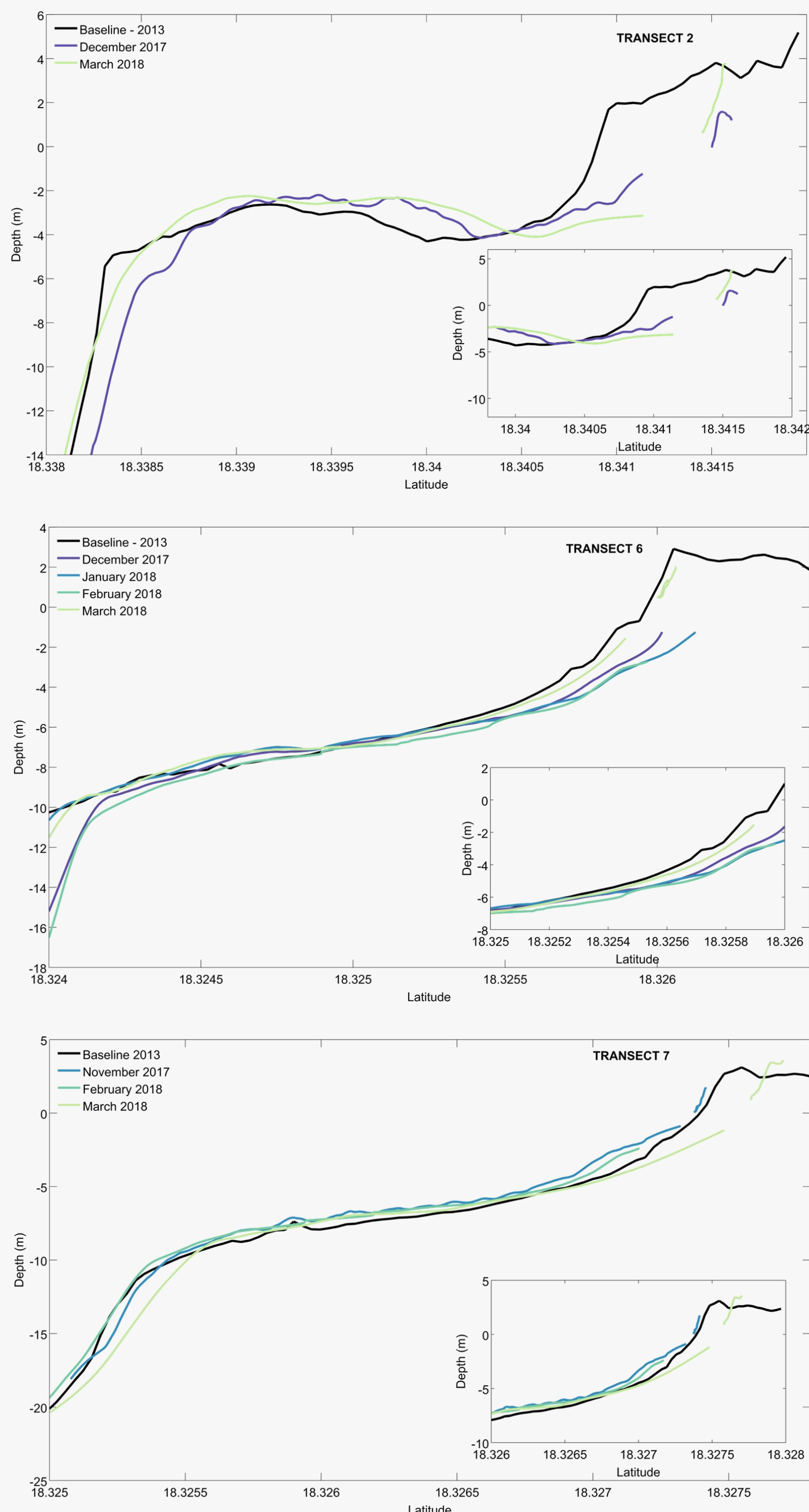


Figure 4 Beach profiles collected at: (TOP) Rincón Public Beach, (MIDDLE) Hotel Villa Cofresí, and (BOTTOM) Stella.

RINCÓN PUBLIC BEACH

HOTEL VILLA COFRESÍ

- Transect 1
- Transect 2
- Transect 3
- Transect 4
- Transect 5
- Transect 6
- Transect 7
- Transect 8
- Transect 9
- Transect 10
- Transect 11
- Transect 12
- Transect 13

STELLA

- Topographic and bathymetric profiles were collected before, during, and after the winter storm.
- Significant sand deposition was observed between depths of -2 and -4 m in transect 2, suggesting that the sand that eroded from the berm was transported seaward by the wave-induced currents.
- Large portion of the eroded sand transported seaward led to the formation of shore-parallel sandbars as observed in transects 2 and 7.
- Difference between profiles in transect 6 suggests that after 6 months the seabed is slowly recovering from the effects of two severe storms (Hurricane María and Winter Storm Riley).
- The northerly/northwesterly long-period waves helped replenish the southern coast of Rincón. While the coast has recovered some sand, it is not nearly as much as it has lost in recent time.
- It could take years or decades for the beach to recover completely, however, it is likely that the suspended sand went too far seaward and would be extremely difficult to recover.
- Shore protection can reduce damages resulting from storm waves, as well as mitigate coastal erosion. There are several ways to protect the shore, such as hard coastal structures and beach nourishment, among others.