

# NEARSHORE HYDRODYNAMICS DURING HURRICANE MATTHEW

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## ABOUT

Tropical and extratropical storms play a significant role in Rincón's coastal morphology, reducing the dry beach size and damaging coastal structures, thus affecting the beach capacity to withstand an increased incidence of extreme events. Despite the severe problems observed, our knowledge about the regional forcing inducing the severe erosion is currently limited and in need of better understanding. Hence, the main objective of this study is to understand better the regional coastal processes in order to assess coastal hazards.



Figure 1 Aerial image showing a stretch of Rincón's coast.

## FIELD SITE

In situ measurements of offshore and nearshore hydrodynamic processes were collected at 3 different locations (●) from October 1st to 24th, 2016 in Rincón, Puerto Rico.

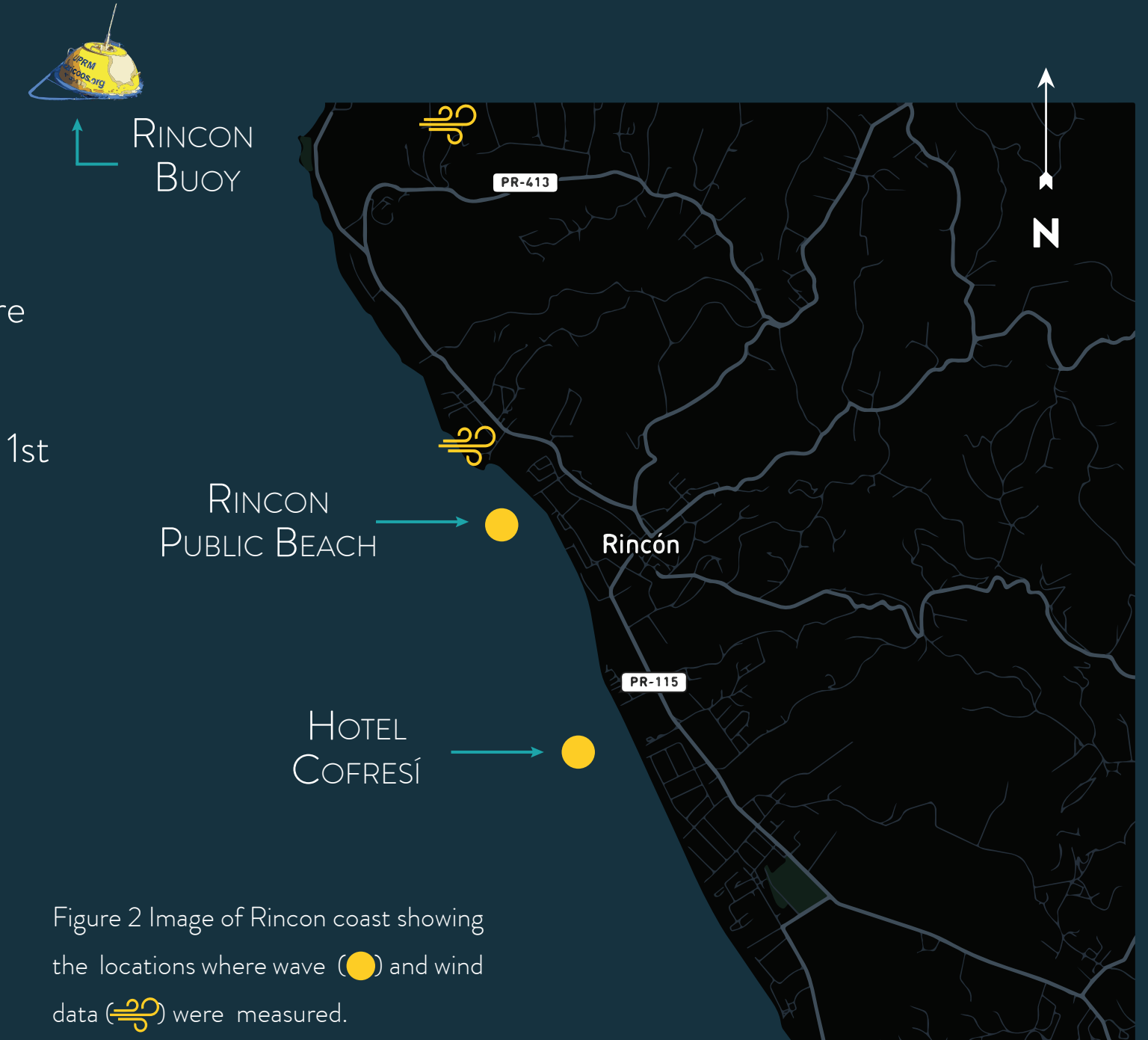


Figure 2 Image of Rincón coast showing the locations where wave and wind data were measured.

## WAVE AND WIND CLIMATE

Offshore and nearshore wave and wind data were collected with CariCOOS Rincón wave buoy, 2 acoustic Doppler Aquadopp Profiler (Aquadopp) and 2 local anemometers.

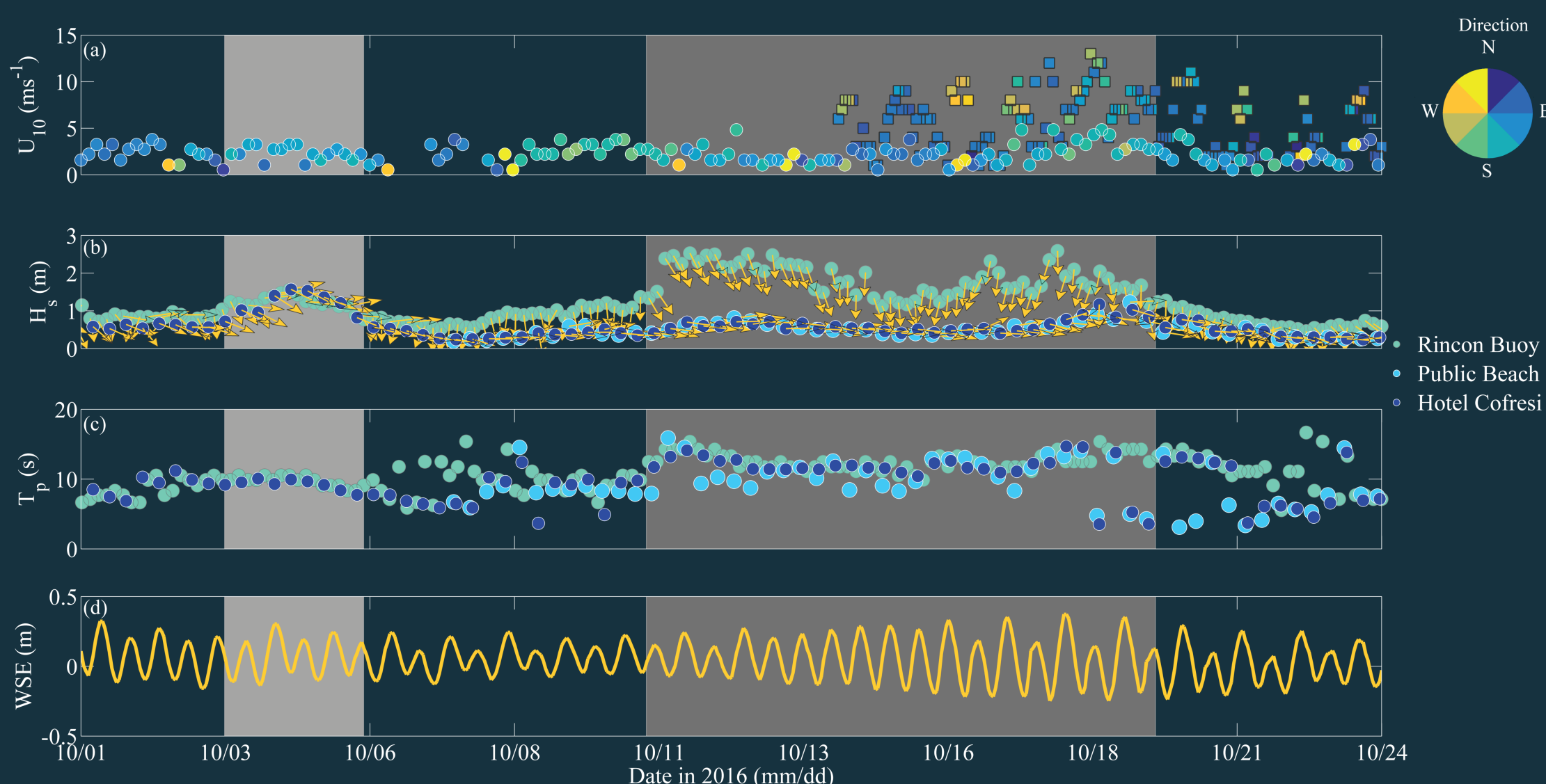


Figure 3 Offshore and nearshore conditions at the CariCOOS Rincón wave buoy (dark blue), Rincón Public Beach (light blue) and Hotel Cofresi (green) during the study period: (a) wind speed ( $U_{10}$ ); (b) significant wave height ( $H_s$ ); (c) wave period ( $T_p$ ); (d) water surface elevation (WSE). Gray shading indicates the duration of the waves events caused by Hurricane Matthew. The color scheme in panel (a) depicts the direction of the winds and the vector in panel (b) indicates the direction of the waves.

## CURRENTS

Currents are predominantly directed alongshore and the velocity field is relatively depth-uniform.

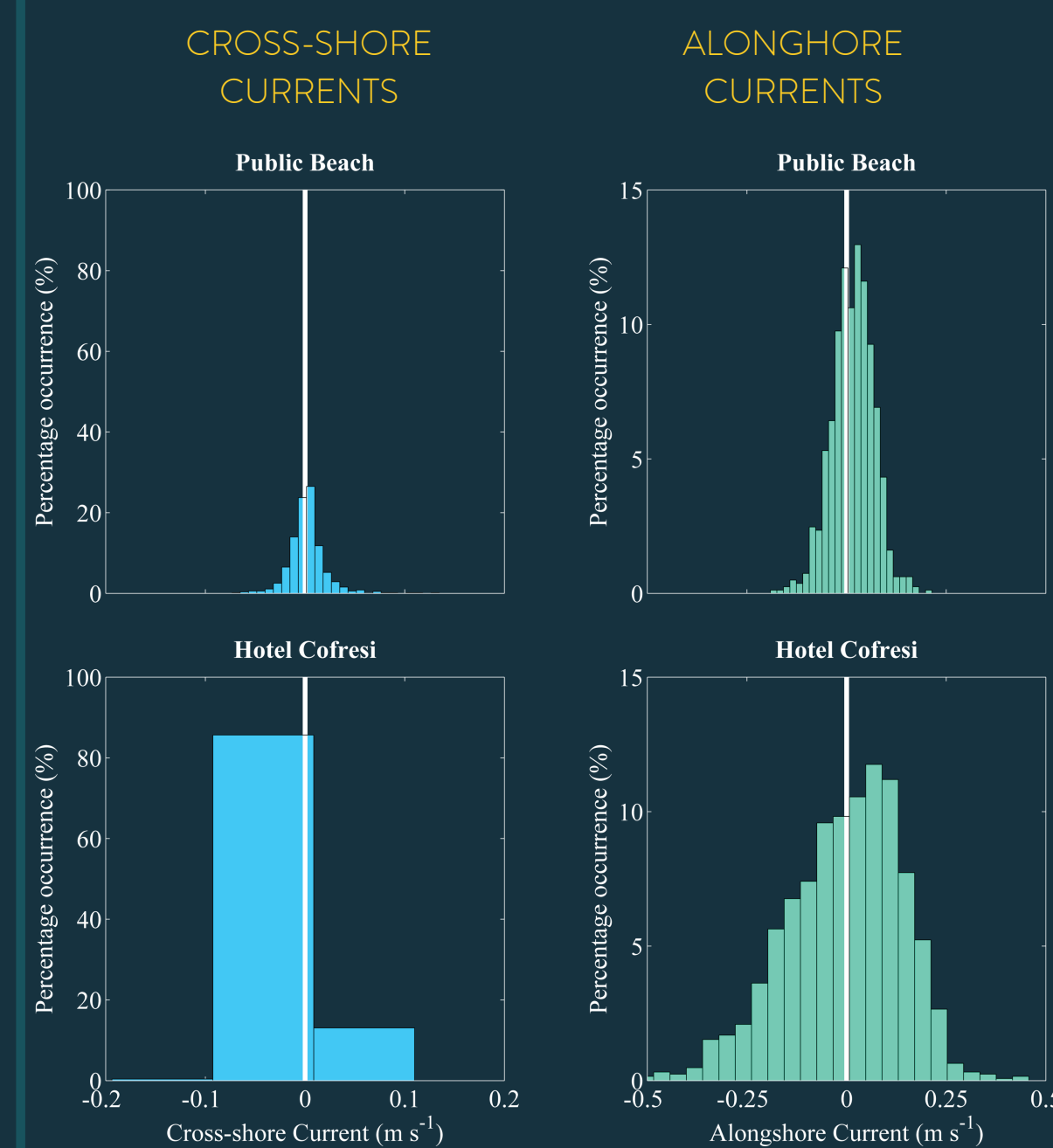


Figure 4 Distribution of the [LEFT] cross-shore and [RIGHT] alongshore current velocities at [TOP] Rincón Public Beach and [BOTTOM] Hotel Cofresi.

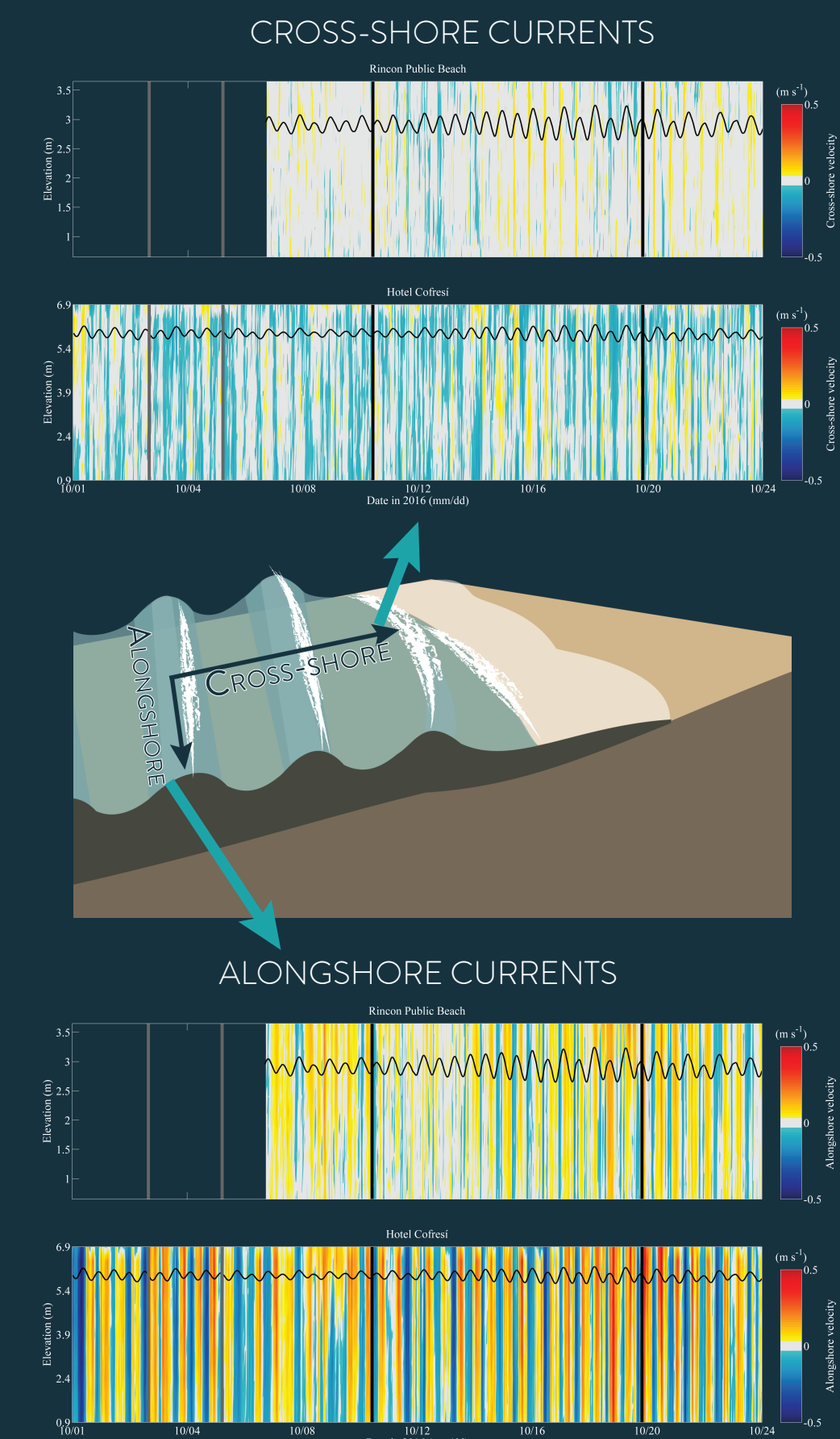
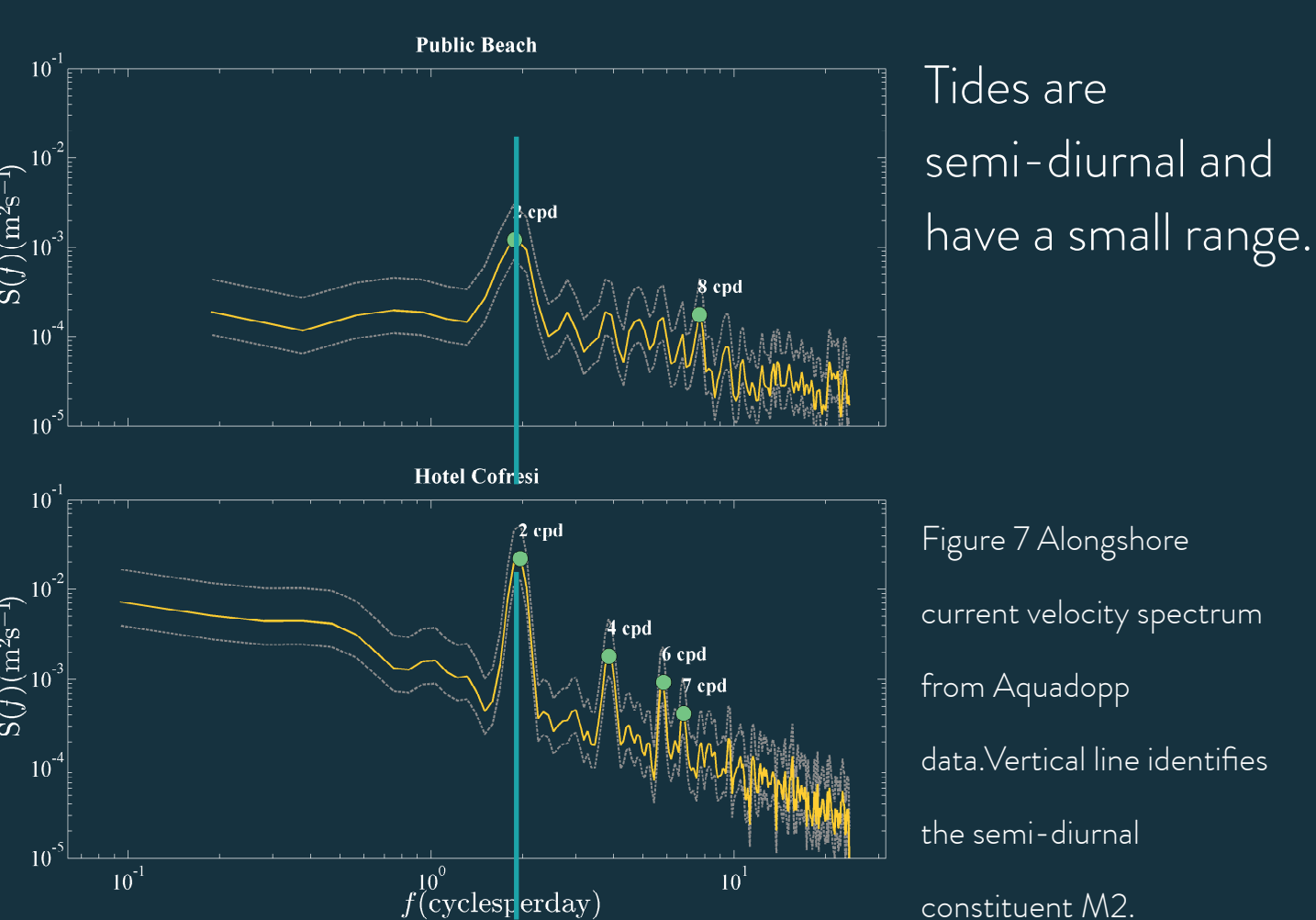
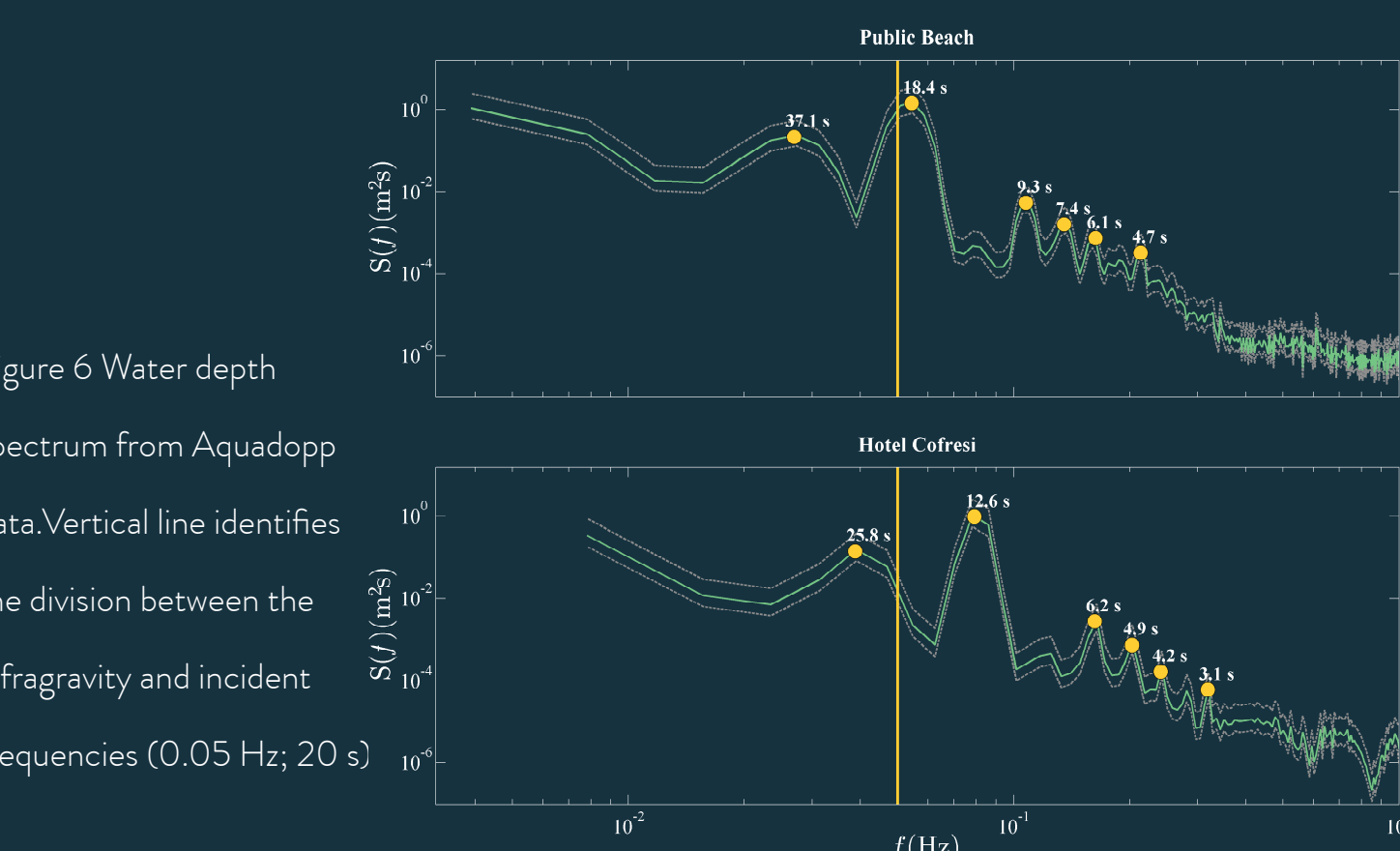


Figure 5 Vertical profile of [TOP] cross-shore and [BOTTOM] alongshore current velocity at Rincón Public Beach and Hotel Cofresi.

## SPECTRAL ANALYSIS

The well defined primary peak in the short-wave frequency, smaller secondary peak at the first sub-harmonic, and a peak in the long-wave frequency band, characterize Rincón's beach as a reflective beach.



Tides are semi-diurnal and have a small range.

Figure 7 Alongshore current velocity spectrum from Aquadopp data. Vertical line identifies the semi-diurnal constituent M2.

## BEACH MORPHOLOGY

The peak conditions of the southwest wave event ( $H_s = 1.8$  m;  $T_p = 10$  s) eroded the southern stretch of Rincón's coast. Whereas, the peak conditions of the northwest event ( $H_s = 2.7$  m;  $T_p = 15$  s), eroded the northern stretch of Rincón's coast.

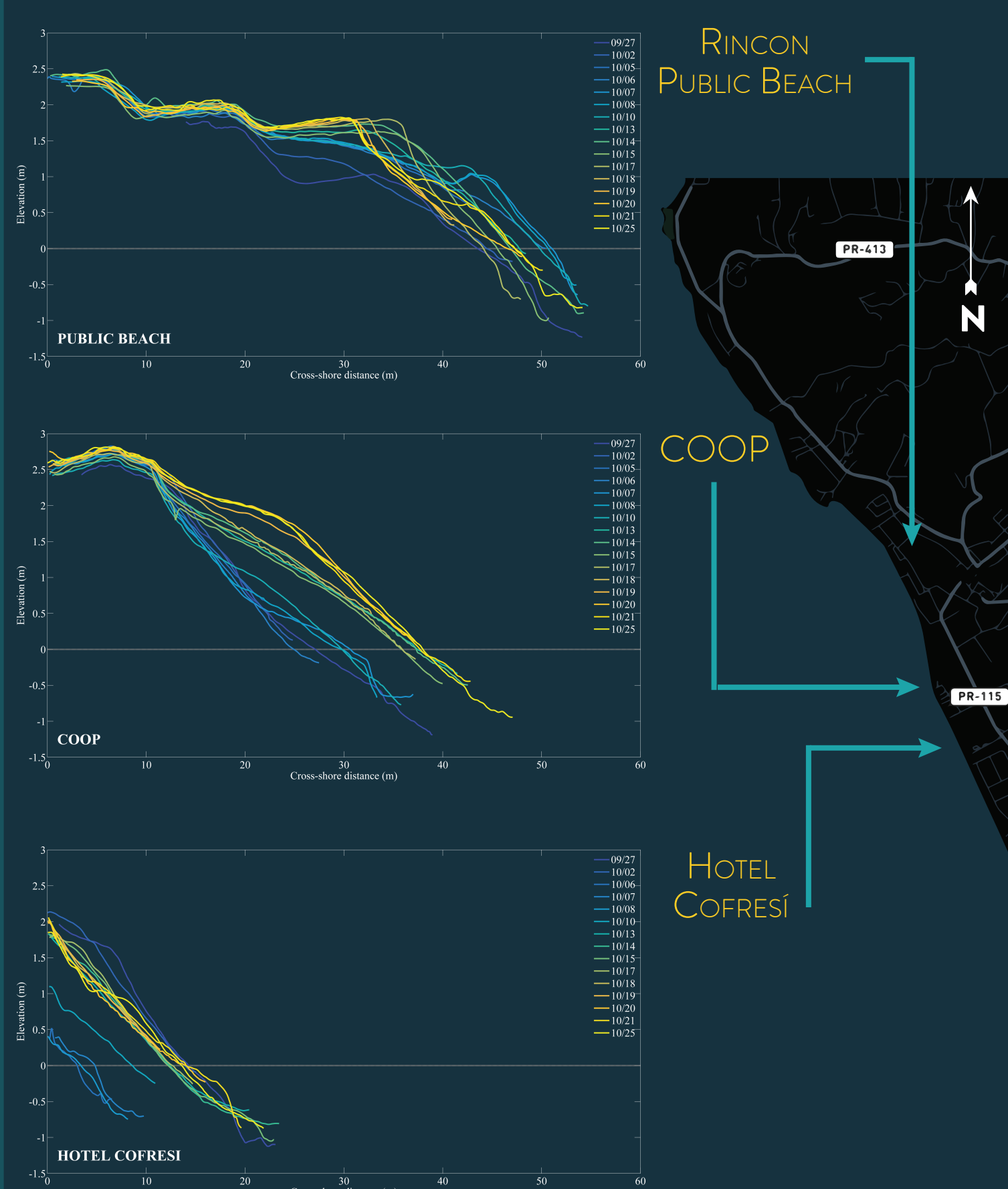


Figure 8 Beach profiles collected at [TOP] Rincón Public Beach, [MIDDLE] COOP, and [BOTTOM] Hotel Cofresi during the field study.

## CAUSES

