

# MONITORING OF THE COASTAL DYNAMICS ON THE SAND SPIT AT TORTUGUEROS BEACH, MEXICO

Mireille Escudero, Universidad Nacional Autónoma de México, [mescudero@ingen.unam.mx](mailto:mescudero@ingen.unam.mx)

Gregorio Posada, Universidad Autónoma de Campeche, [gposadav@uacam.mx](mailto:gposadav@uacam.mx)

Beatriz Edith Vega, Universidad Autónoma de Campeche, [beavega@uacam.mx](mailto:beavega@uacam.mx)

Edgar Mendoza, Universidad Nacional Autónoma de México, [emendoza@ingen.unam.mx](mailto:emendoza@ingen.unam.mx)

## INTRODUCTION

Sand spits occur worldwide in different shapes, from a single, relatively simple arc to an irregular, crenulated, and complex barrier. Cross-shore and longshore sediment transport often influence spit dynamics (Nagarajan et al., 2015), strongly linked to wave energy and sediment supply.

The present analysis focuses on a dynamic and complex spit at Tortugueros beach, a re-entrant bay, 1 km in length, on the Gulf of Mexico (Fig. 1a). Tortugueros beach is a wave-dominated beach with very fine to fine sand that forms a fairly gentle sloping beach profile. The sediment sources are longshore sediment transport and onshore sandbar migration, while sediment loss is due to long- and cross shore (during storms) transport. The region is micro-tidal, with mean and maximum high tide levels of 0.18 m and 0.92 m above the mean sea level.

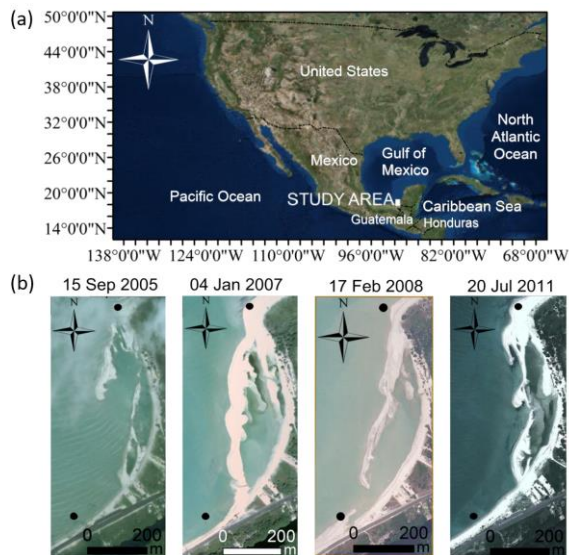


Figure 1 - (a) Location of the study area, (b) Historical satellite images

Previous studies by Escudero et al., 2019 showed dramatic shoreline changes on this beach, with accretion rates up to 160 m/yr and erosion up to 196 m/yr. These authors related the multi-annual shoreline evolution of the spit to the variations in the cross-shore and longshore energy flux of the breaking waves, based on digitized information from satellite images and aerial photographs in a 31-year period (1985-2016) (some of the satellite images are shown in Fig. 1b). The spit growth and breaching cycles were observed seasonally, governed by the combination of the short period local wave climate of

the area and large-scale weather cycles related to the El Niño and La Niña phenomena.

Given the high dynamics of the Tortugueros beach spit system and the lack of data measured on the beach, a monitoring system was developed to collect field data regularly to help us improve the understanding of the functioning of the coast on this beach, and the international knowledge related to the formation and morphological evolution of this type of spits in other similar beaches around the world.

## FIELD DATA COLLECTION

Starting December 9, 2020, a bi-monthly monitoring program was carried out, with aerial photos taken by a UAV, sediment samples and differential topographic data with GPS. During these surveys, the critical connection of the beach system with a small inland lagoon, not considered in previous studies, was identified. This was also confirmed by measuring the lagoon's salinity compared to seawater. In addition, during autumn, the sea level data showed an astronomical rise with an annual frequency that connects the water flows between the sea and the lagoon. Therefore, the analysis presented in this research integrates the knowledge of the dynamics of the sand spit as a function of wave climate (as in previous studies) and considers the importance of sea level variation, lagoon functioning and lagoon-sea exchange fluxes throughout the year.



Figure 2 - UAV mosaics of Tortugueros beach

## REFERENCES

- Escudero, Silva, Hesp, Mendoza (2019): Morphological evolution of the sandspit at Tortugueros Beach, Mexico. *Marine Geology*. vol. 407, pp. 16-31.
- Nagarajan, Jonathan, Roy, Muthusankar, Lakshumanan (2015): Decadal evolution of a spit in the Baram river mouth in eastern Malaysia. *Cont. Shelf Res.* vol. 105, pp. 18-25.