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ICCE
2018

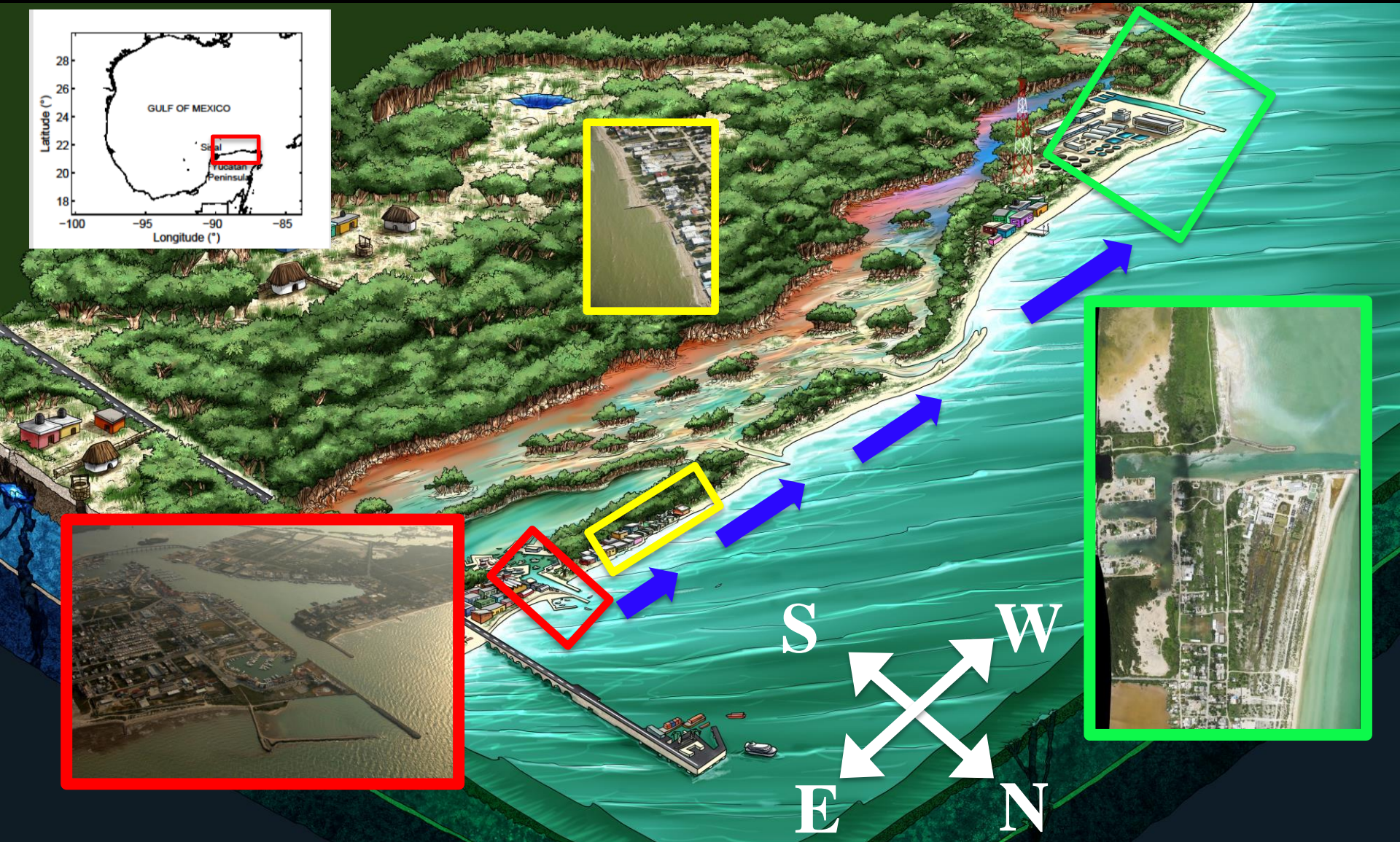
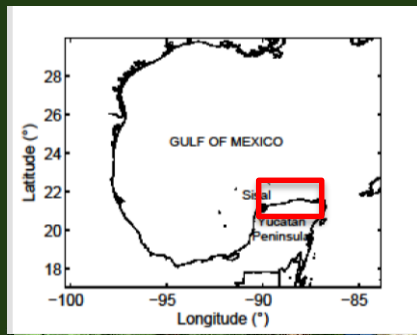
On the assesment of detached breakwaters on a sea-breeze dominated beach



Alec Torres-Freyermuth, Gabriela Medellín, Tonatiuh Mendoza, Elena Ojeda & Paulo Salles

1. Motivation

Coastal structures along the Yucatan Coast



Ports impoundment (Abstract #1146)

- Shoreline retreat of 1 to 6 m/year along 1.5 km of coast

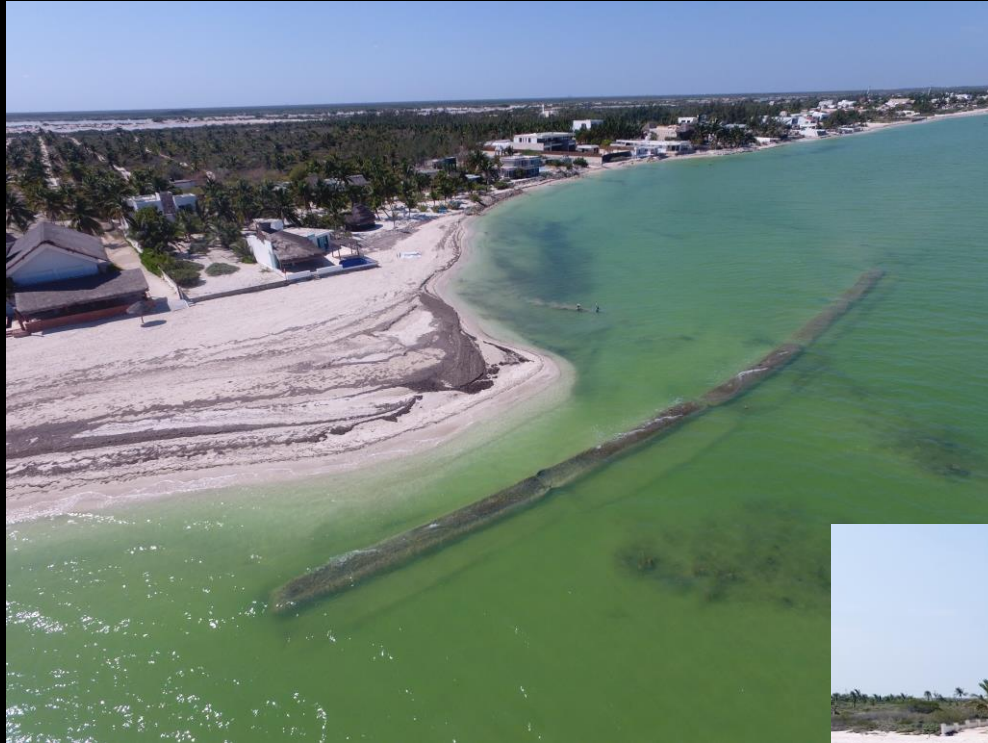
- Net subaerial sand accumulation of 11,500 m³/year



Impact of small structures (Abstract #1346)

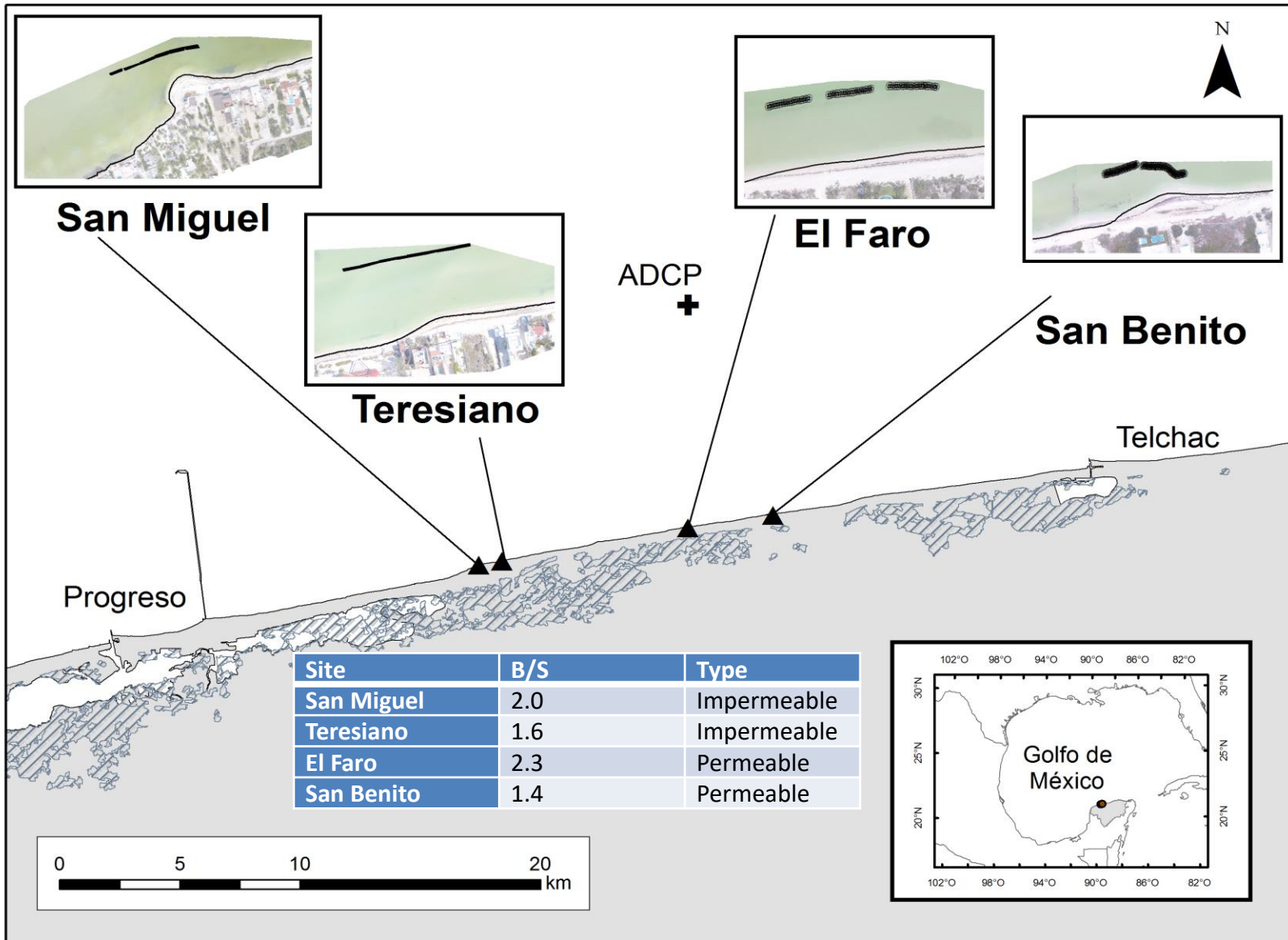


Aim: to assess the performance of (permeable & impermeable) detached breakwaters on a sea-breeze dominated beach

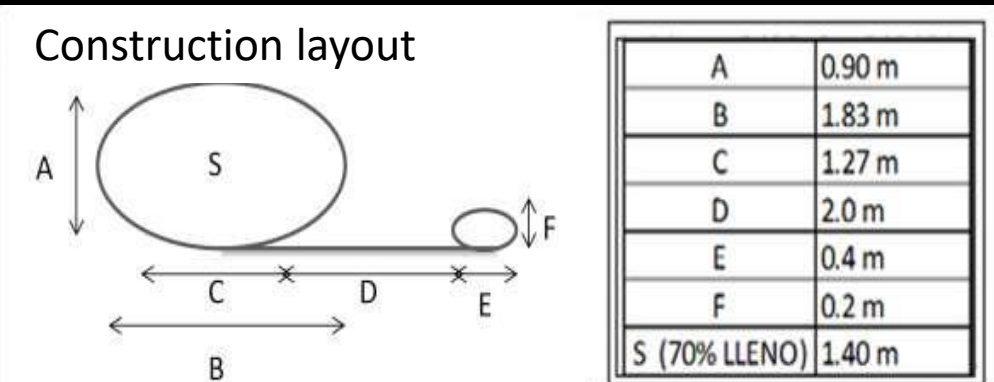
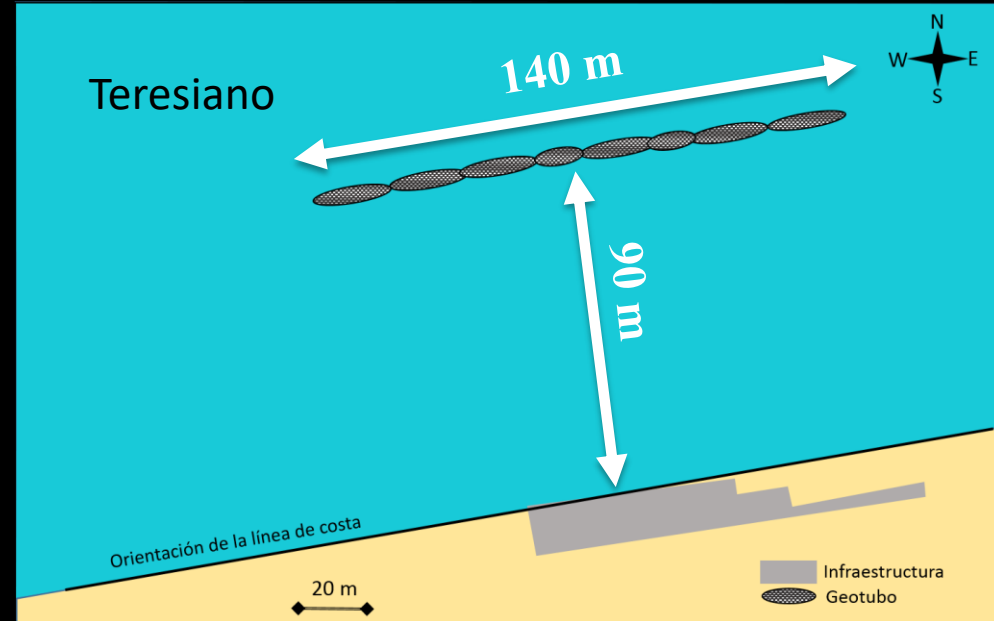
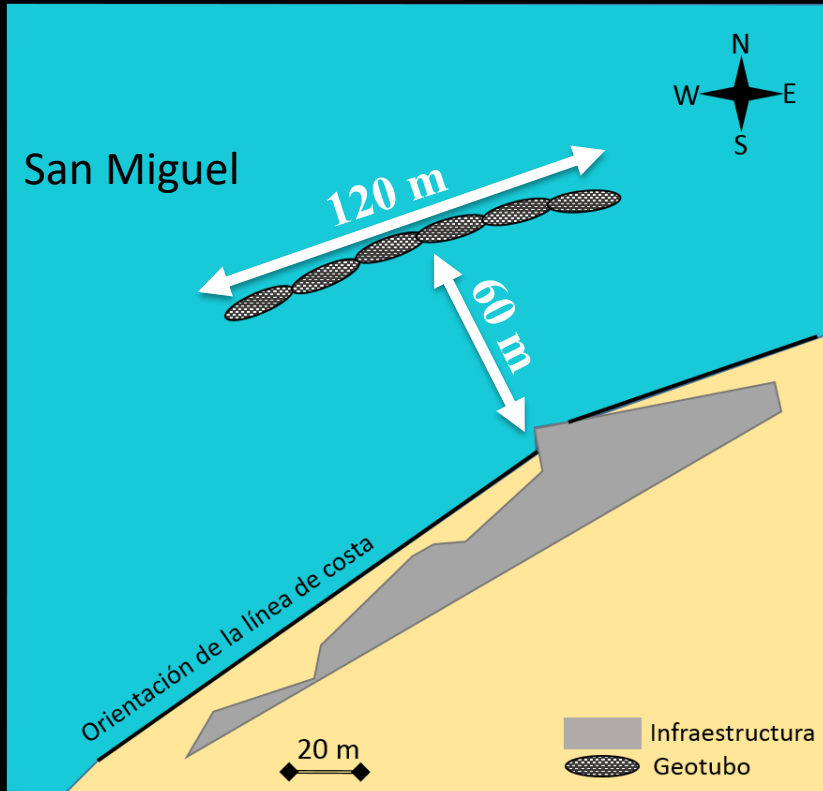


2. Study sites

Sites locations



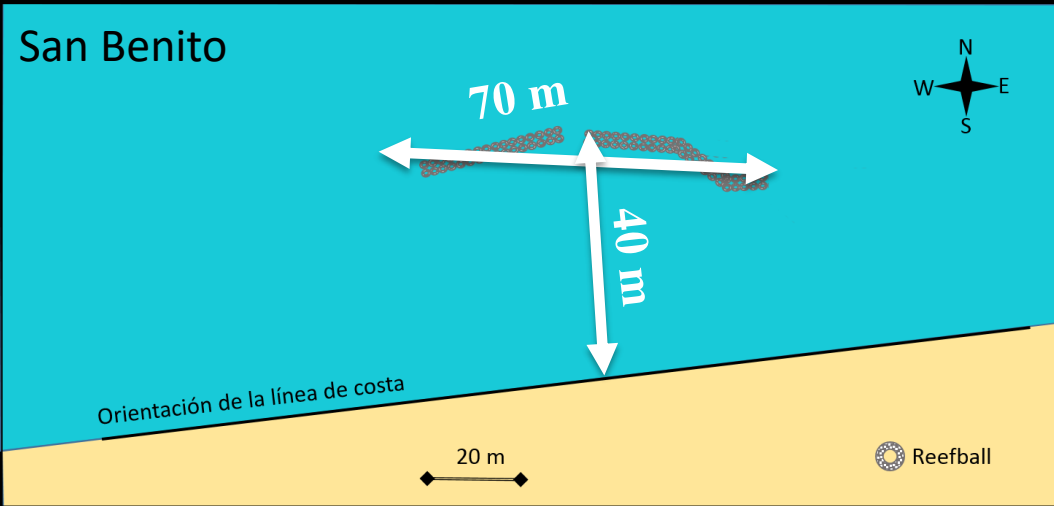
Impermeable breakwaters characteristics



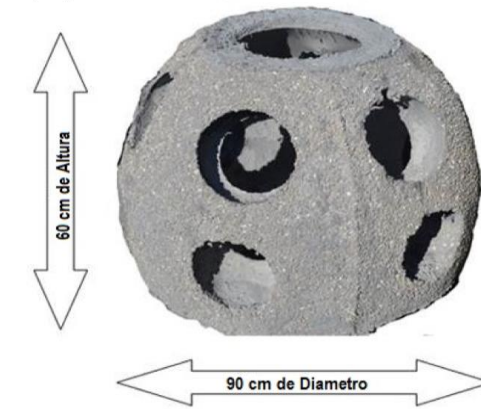
- Geotextile sections 20 and 10 m long
- 0.90 m high
- Filled with sand taken on site (600-700 m³)

Permeable breakwaters characteristics

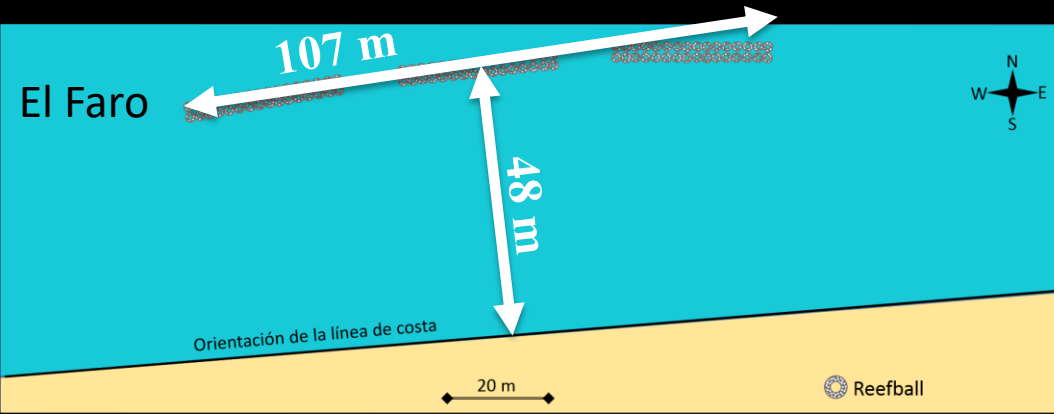
San Benito



(a) 240 kg



El Faro

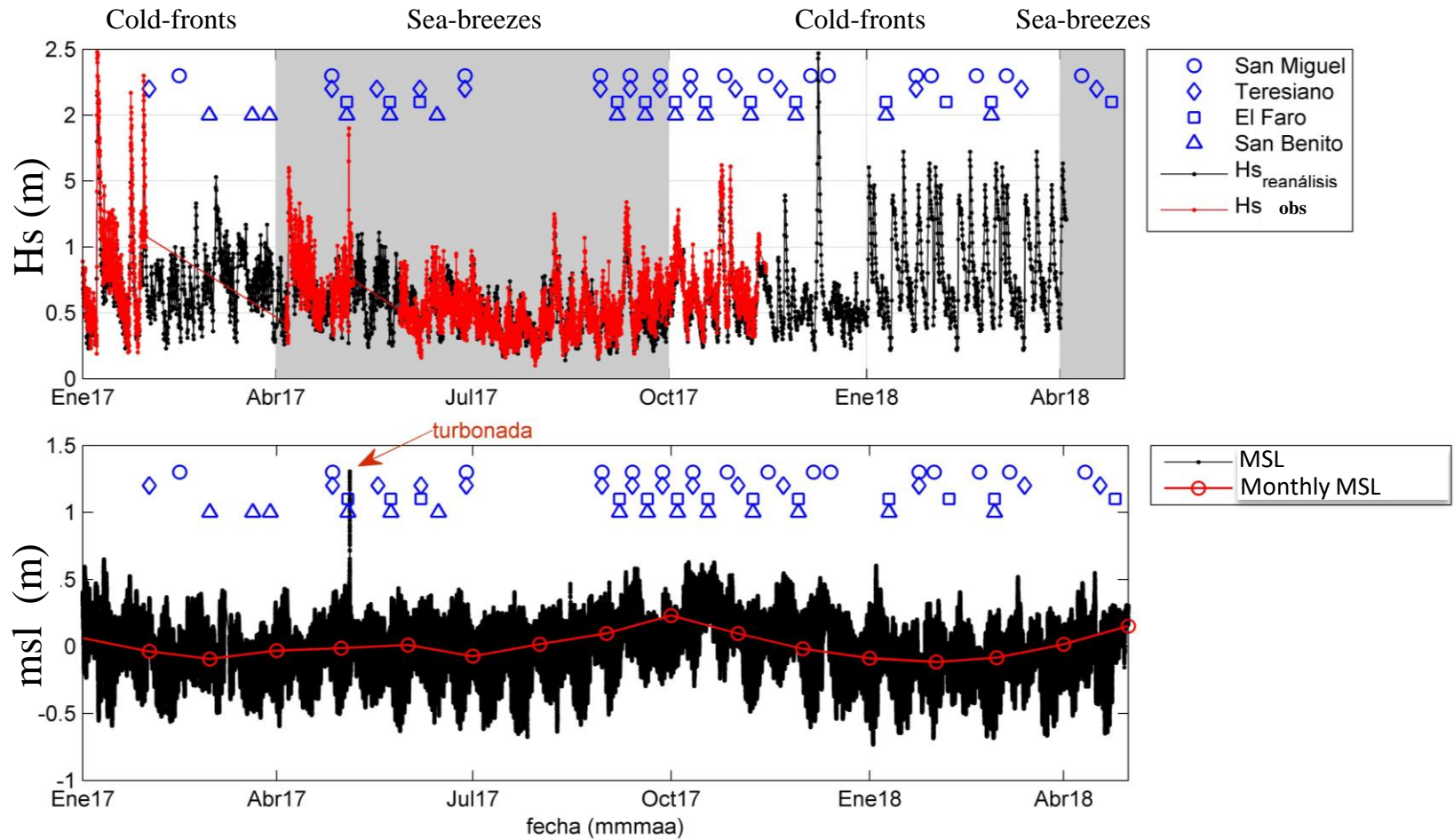


(b) 800 kg



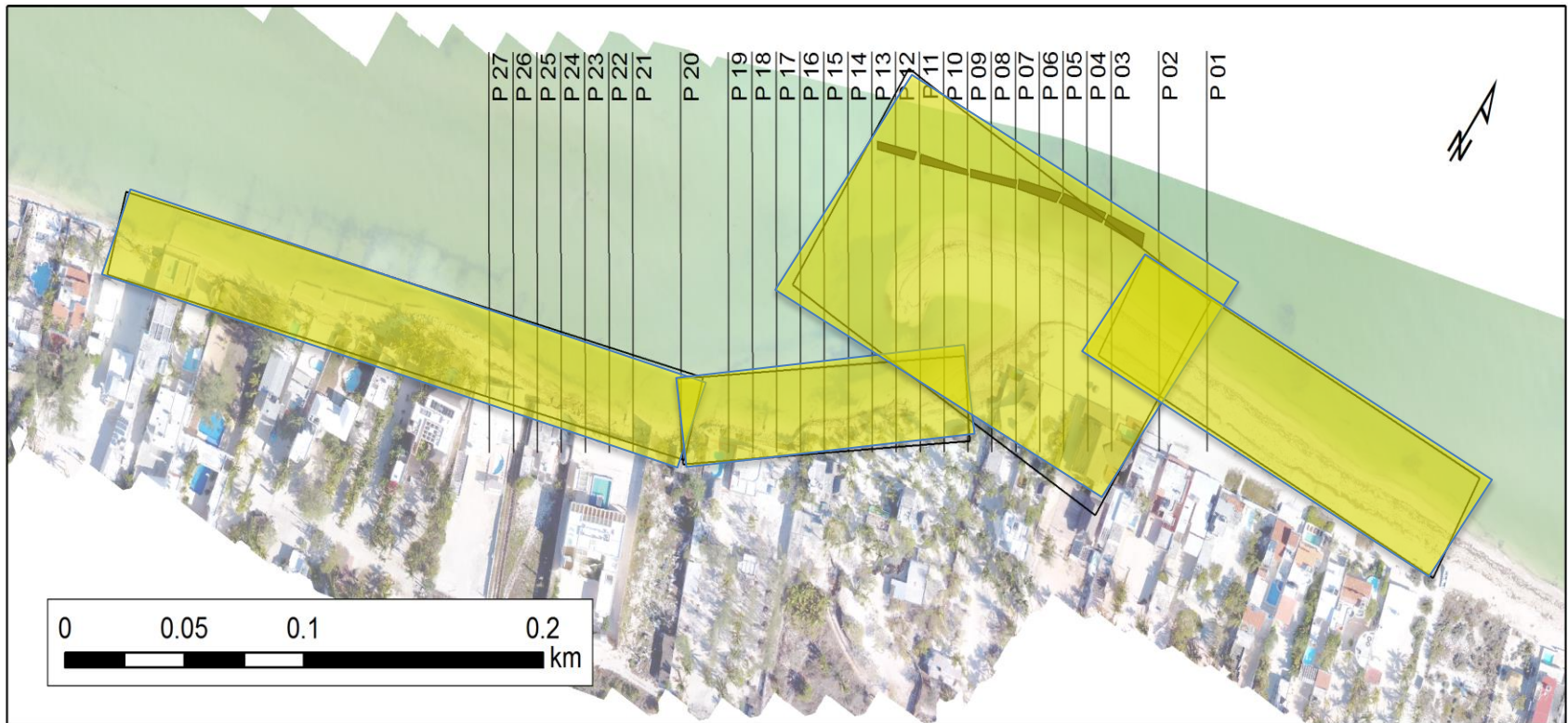
3. Methods

Field surveys and measurements

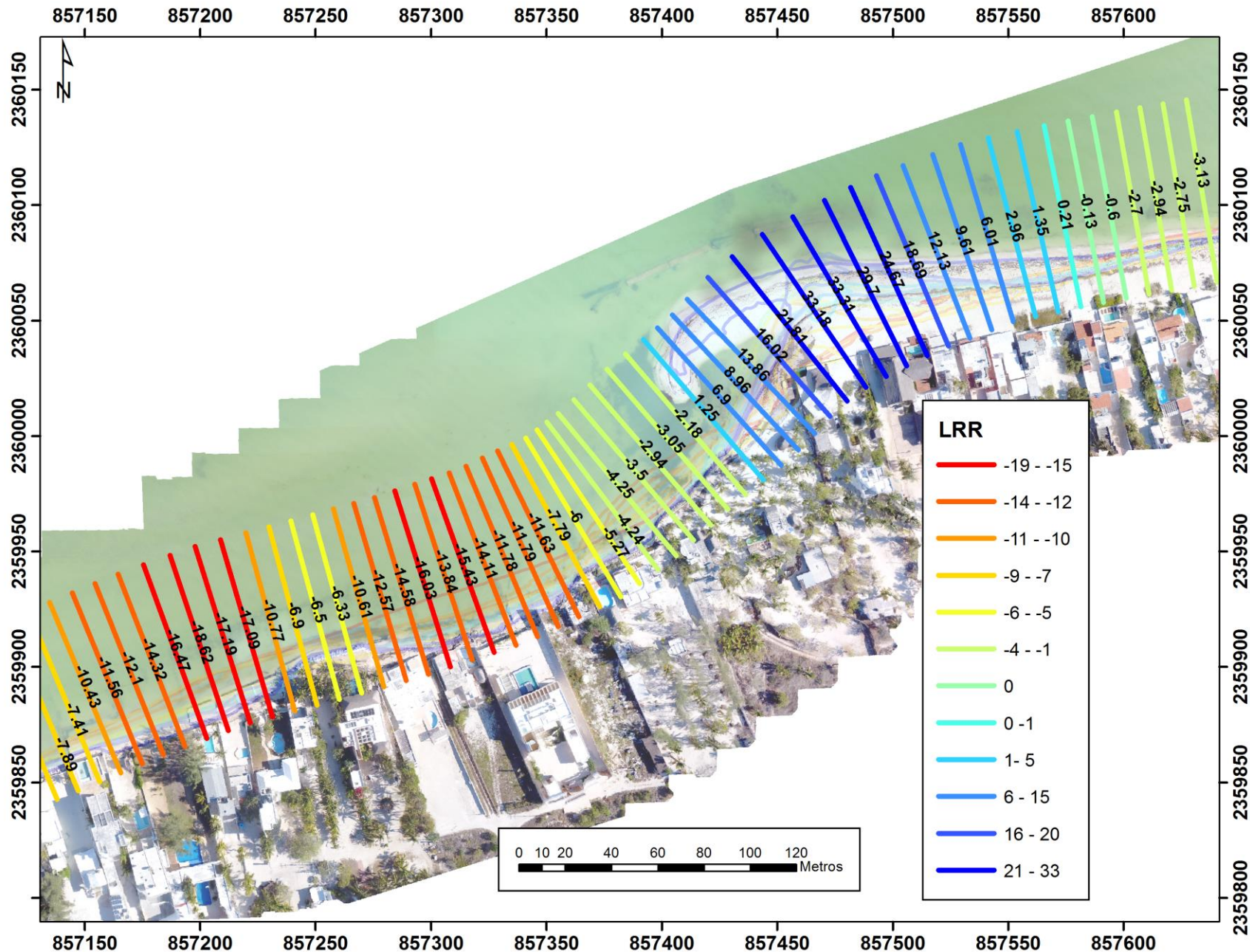


Sitie	First campaign	Last campaign	Total number of campaiings
San Miguel	15/02/2017	11/04/2018	16
Teresiano	01/02/2017	18/04/2018	14
El Faro	04/05/2017	25/04/2018	13
San Benito	01/03/2017	28/02/2018	14

Data collection: experimental setup

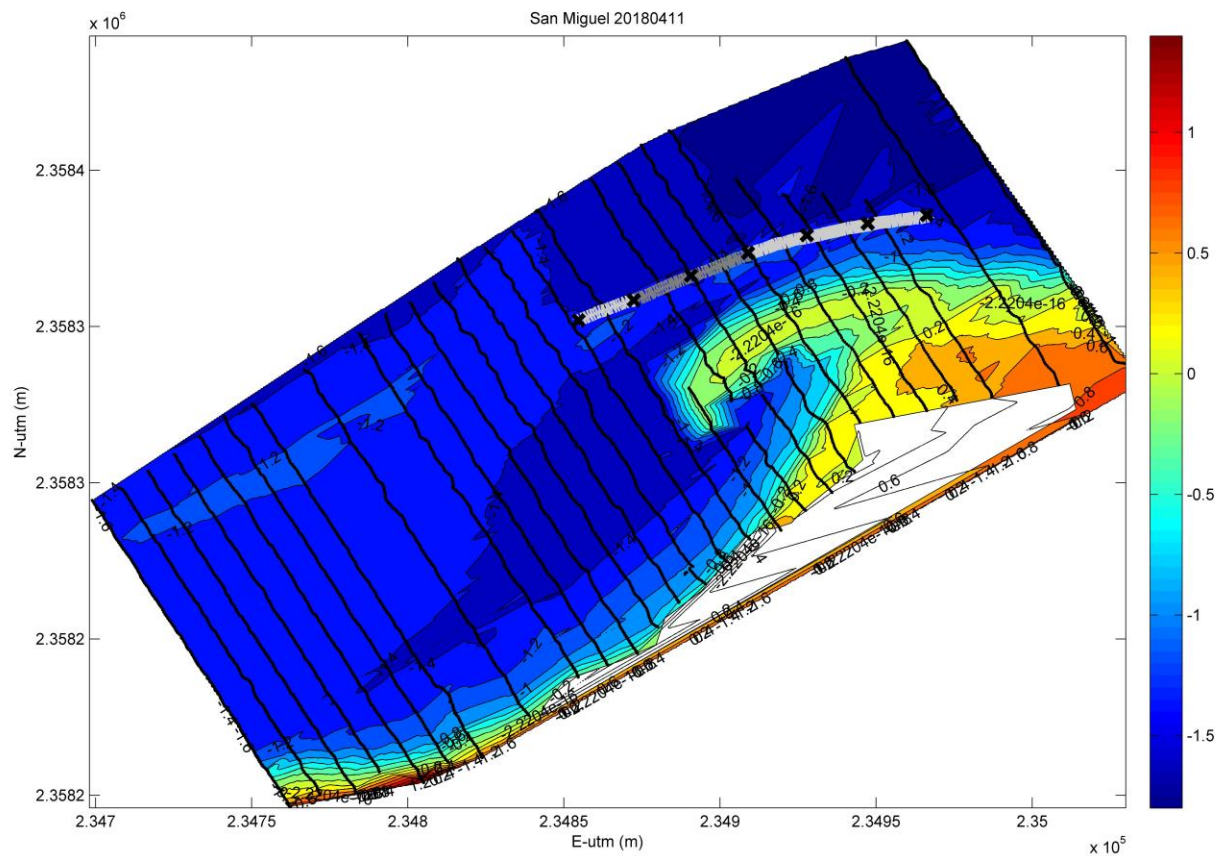
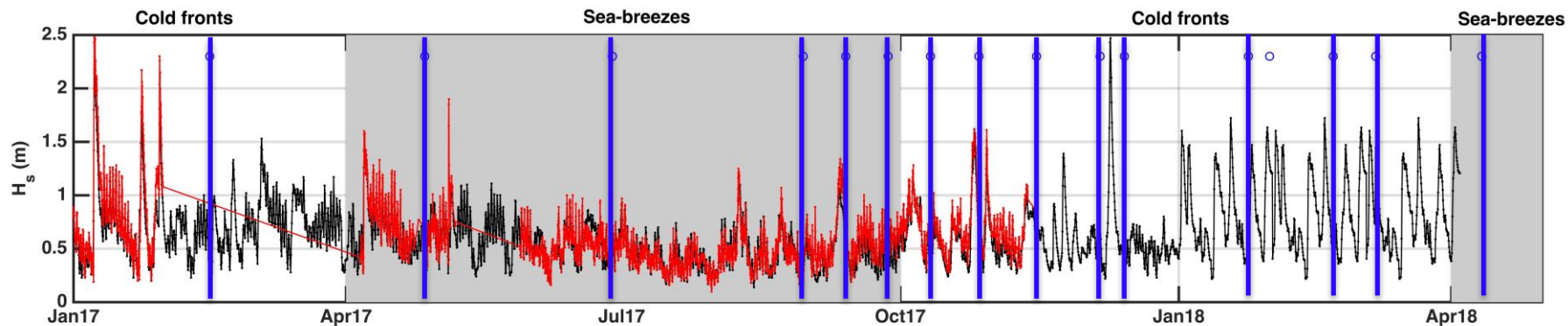


- High-resolution beach profiles
- UAVs flights with control ground points
- Breakwater surveys (freeboard, length, orientation, etc.)
- Total of 57 beach suveys and 51 UAVs flights.

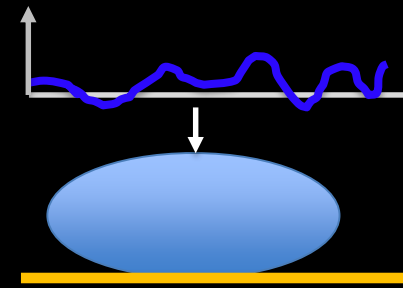
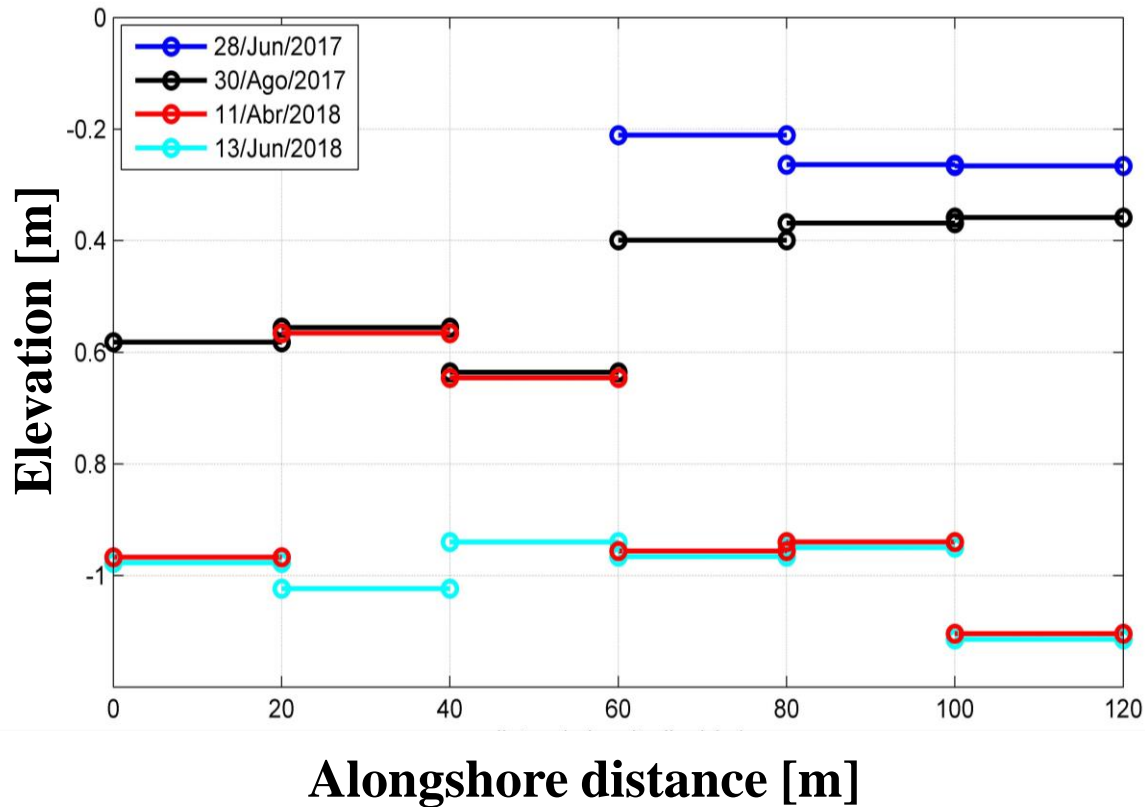


4. Results

Beach-structure evolution

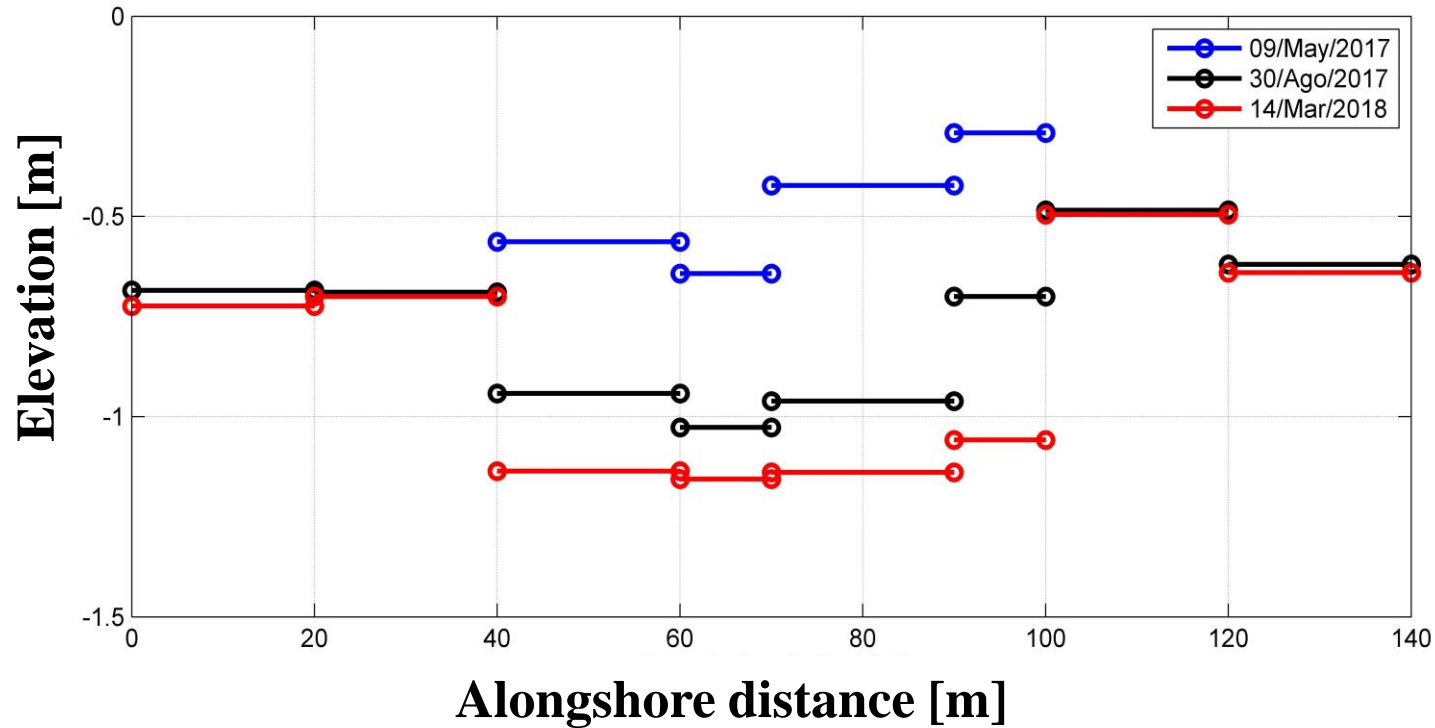
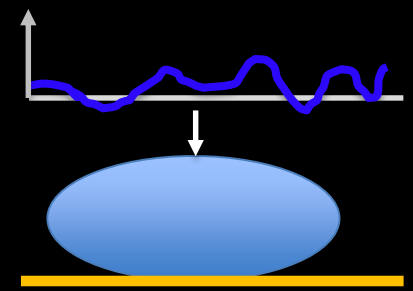


Stability analysis: San Miguel



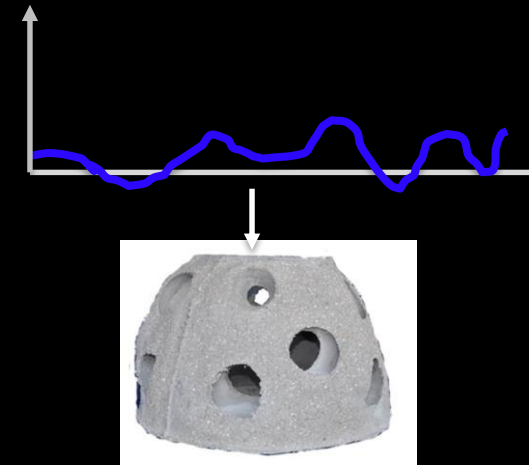
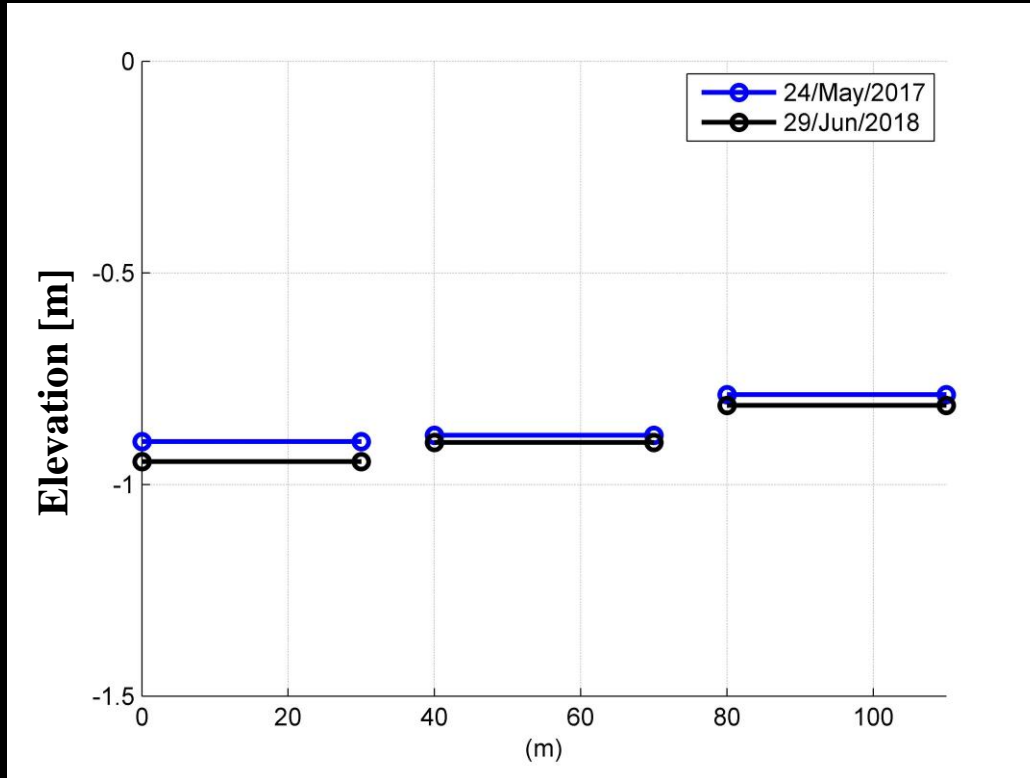
- Non-uniform elevation along the structure
- Significant freeboard change in 2 months
- Partially destroyed 9 months after deployment
- Fully destroyed one year after deployment.

Stability analysis: Teresiano



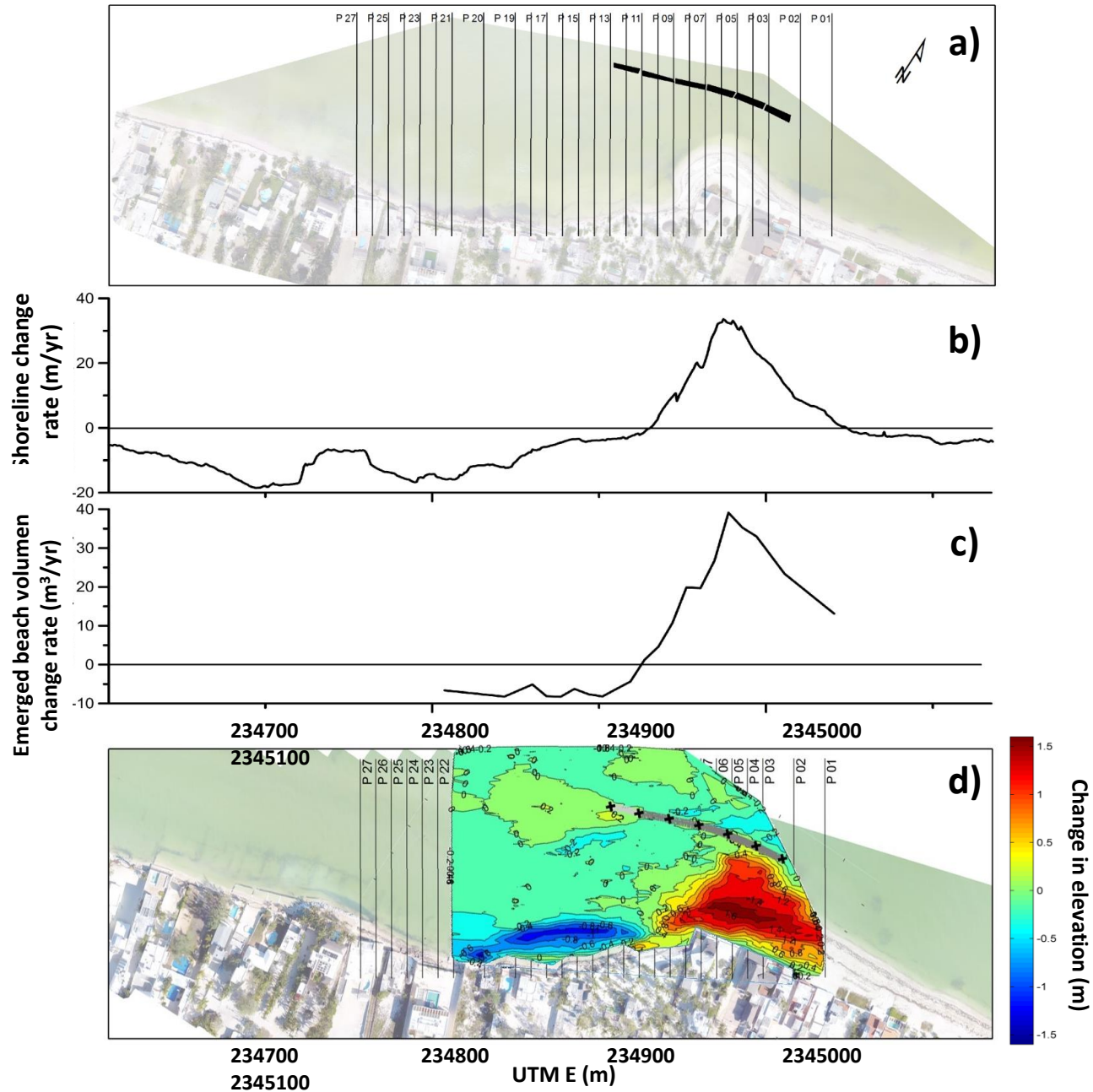
- Non-uniform elevation along the structure (max differences of 0.5 m)
- Significant freeboard change in 2 months at the middle sections
- Middle section almost completely destroyed after 10 months.

Stability analysis: El Faro

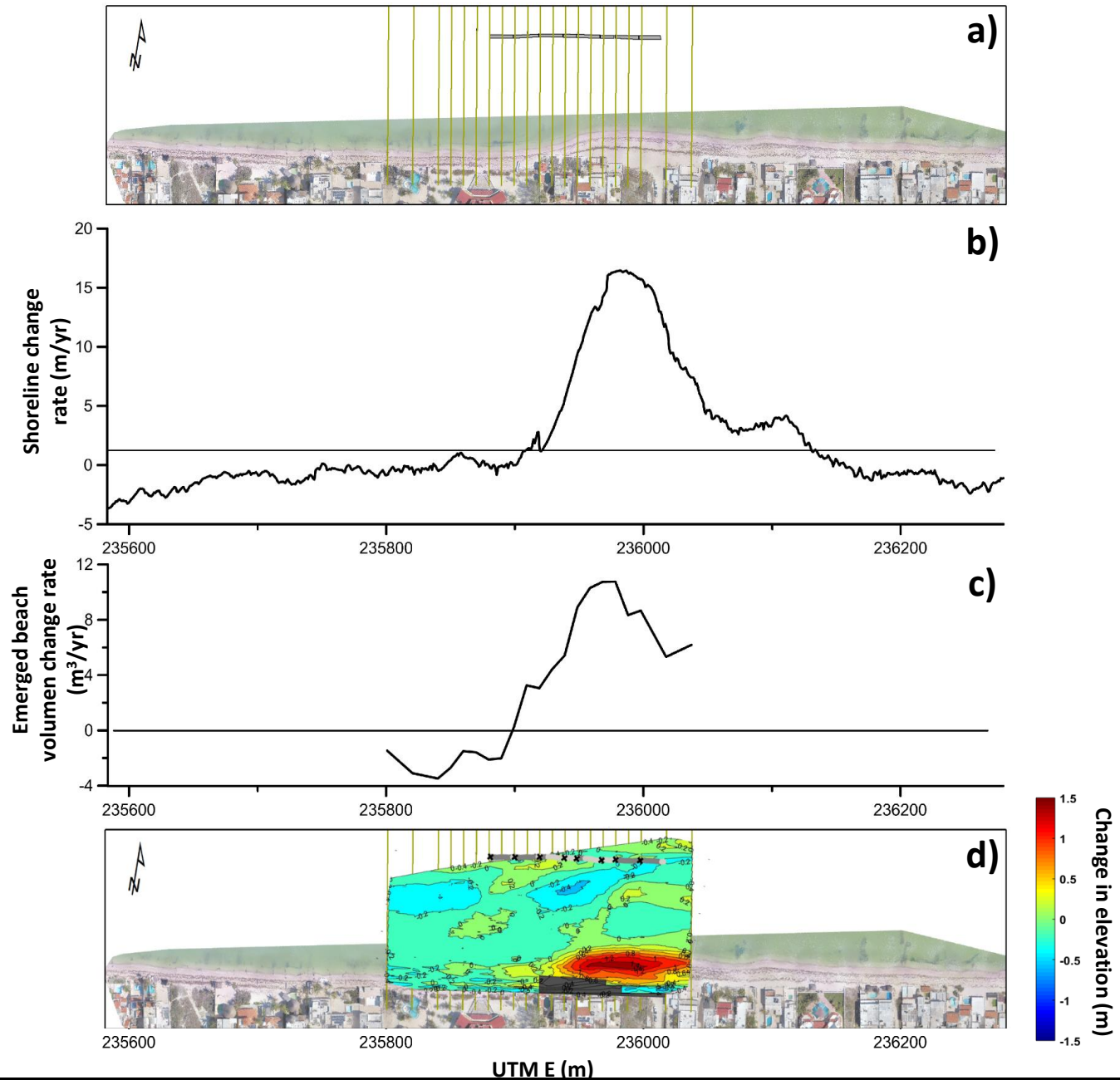


- Almost uniform elevation along the structure (max differences of 0.1 m)
- 0.1 m freeboard change in one year

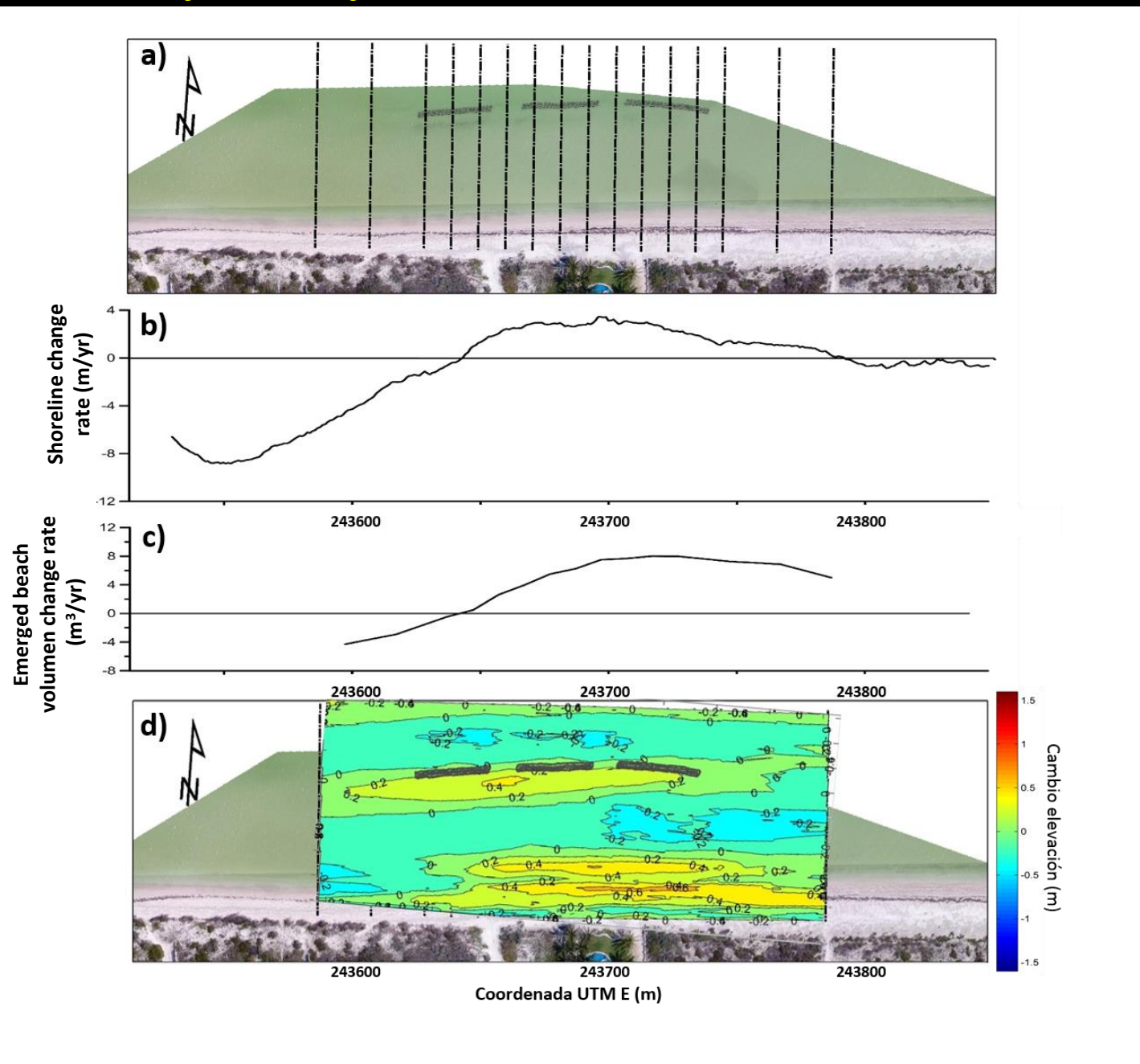
Functionality analysis: San Miguel

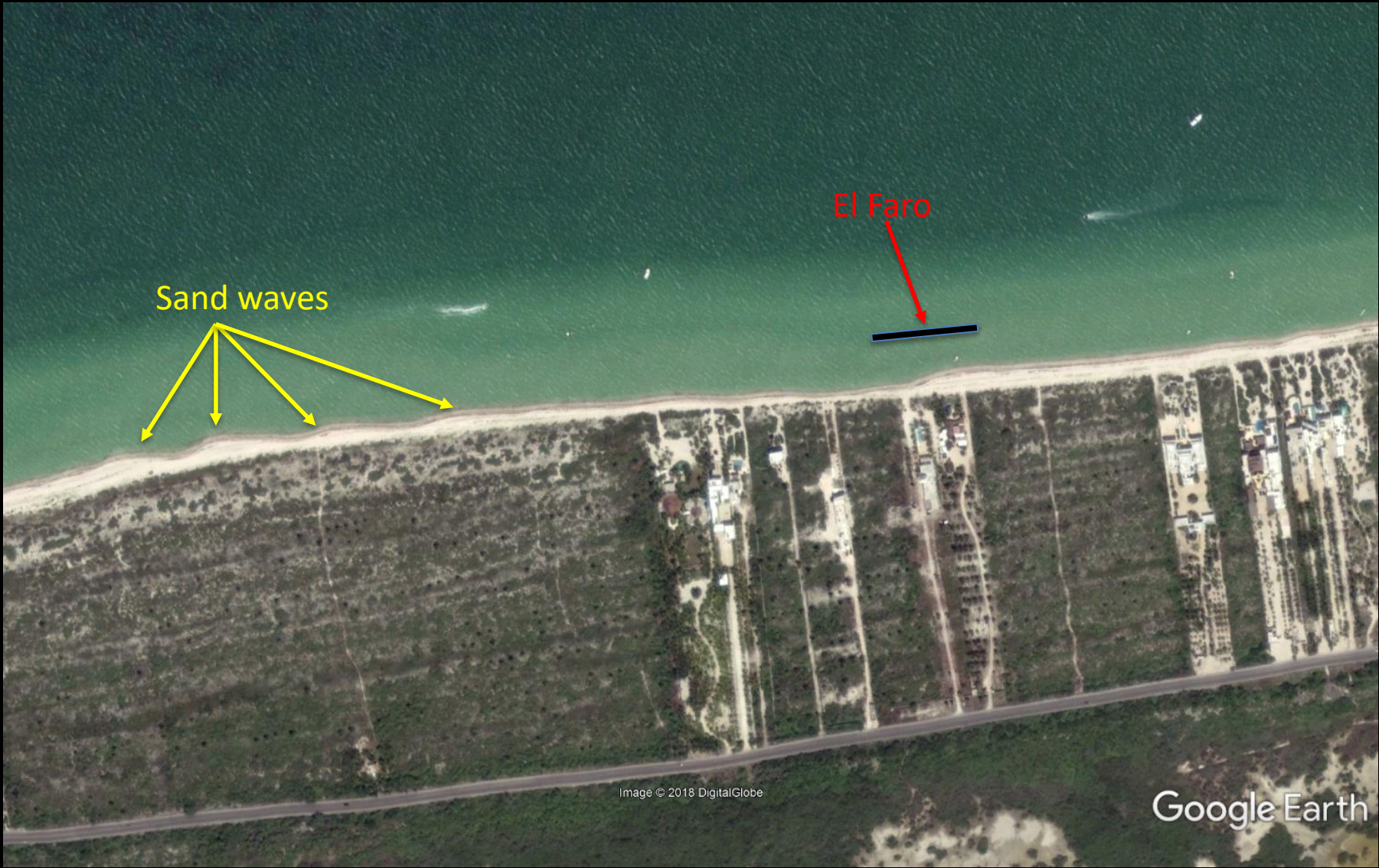


Functionality analysis: Teresiano



Functionality analysis: El Faro





Sand waves

El Faro

5. Conclusions

Concluding remarks

➤ Impermeable (Geotextile) breakwaters:

- ❑ Large accretion/erosion at the up-/down- drift side of the structures
- ❑ Low stability: very short useful life due to failure of their elements
- ❑ Differential sand volumen accumulation behind the structure
- ❑ Broken geotextile difficult to remove

➤ Permeable (Reef Ball) breakwaters:

- ❑ Moderate accretion
- ❑ Large erosion downdrift that can be enhanced by the presence of sand waves
- ❑ High stability: small freeboard variability in one year
- ❑ Uniform sand volume accumulation behind the structure
- ❑ Creates habitat

➤ Breakwaters are not a suitable measure to mitigate beach erosion at this sea-breeze dominated coast.

➤ Interaction with sand waves deserves future investigation.



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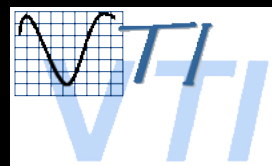
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