



Drone-based monitoring of sandy coasts

Lara Talavera Madrigal: lara.talavera@uca.es



1 Motivation and aims

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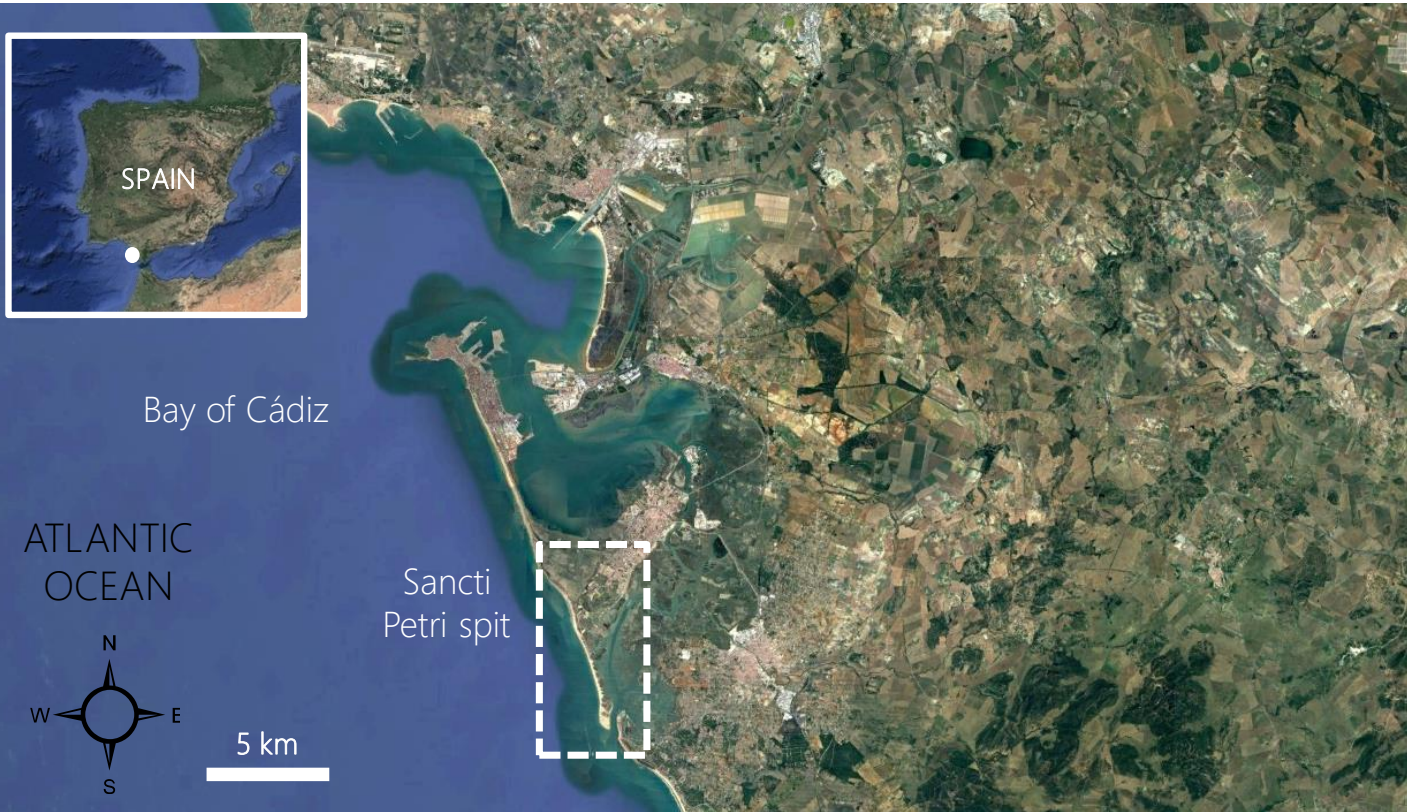


Analysis of the processes influencing the **short-term evolution** of the Sancti Petri sand spit, especially before and after the occurrence of **storm** events, using **Remotely Piloted Aircraft Systems** (RPAs)



2 Study area

2 Study site



2 Study site



2 Study site

Spit suffers a
landward
migration: 1 m/yr

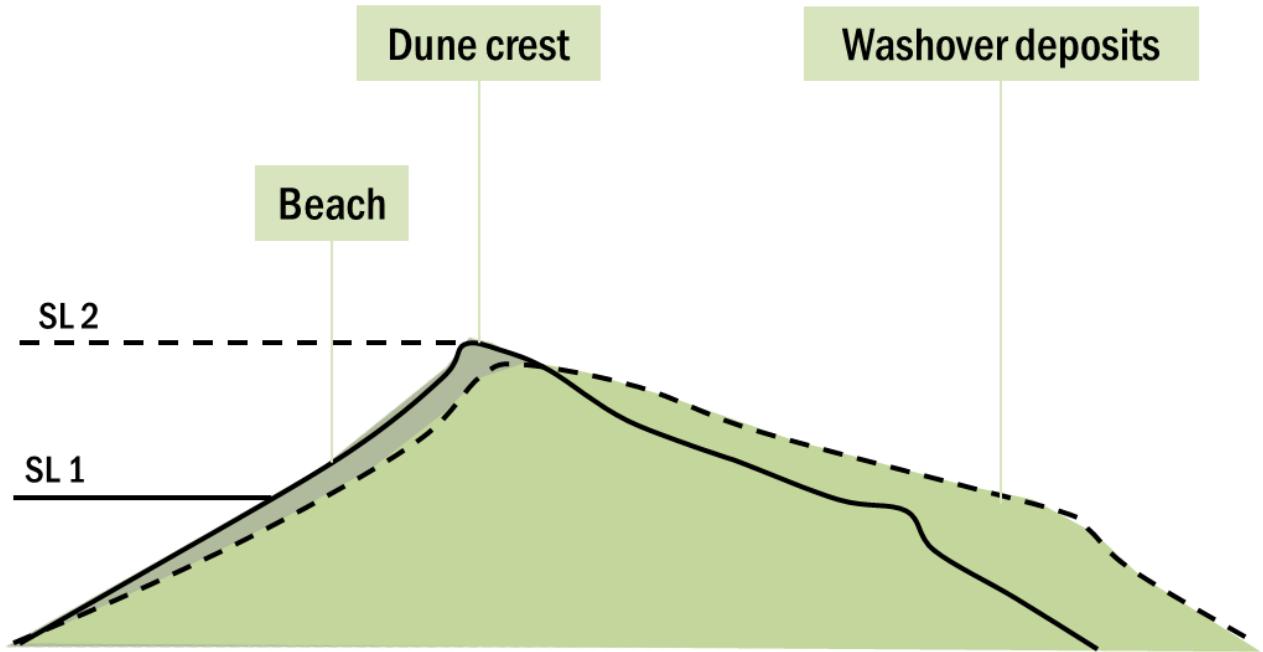
1 Decreased
longshore drift

2 Storms and
tides

3 Human
Infrastructures

2 Study site

Overwash processes



2 Study site





3 Methodology

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Topographic data:

DEMs

(RMS Error: 5 – 8 cm)

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DEMs

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Flight planning

- Flight height
- Flight speed
- Focal distance
- GSD
- Overlap
- Others



3 Methodology

Topographic data:

DEMs

(RMS Error: 5 – 8 cm)

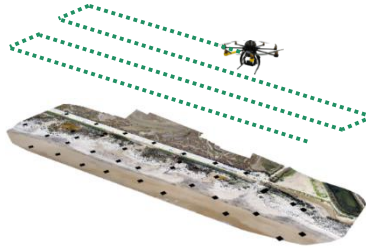


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Flight execution

~ 30 GCPs
~ 1500 ICPs

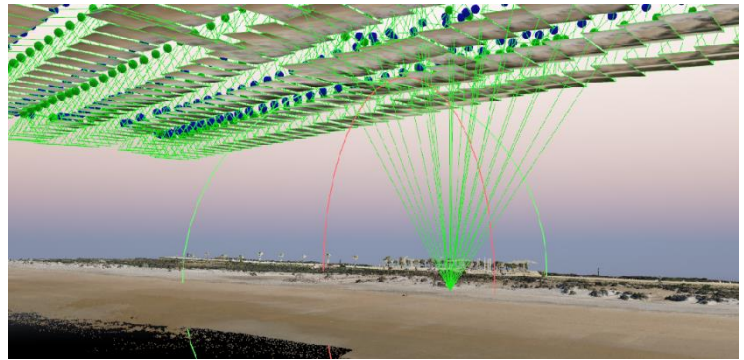


3 Methodology

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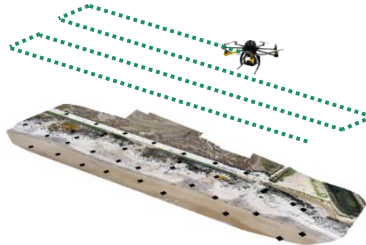


Image processing

SfM (2D → 3D)
Pix4D



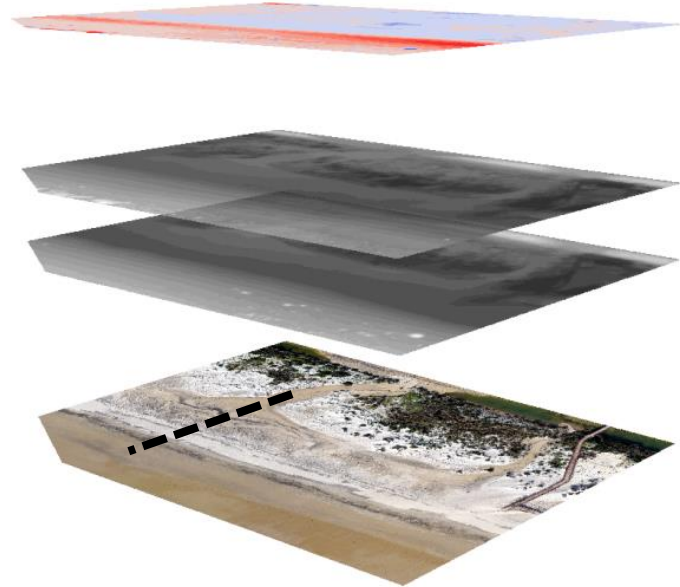
3 Methodology

Detection of morphological changes

DoD

Post-storm DEM

Pre-storm DEM



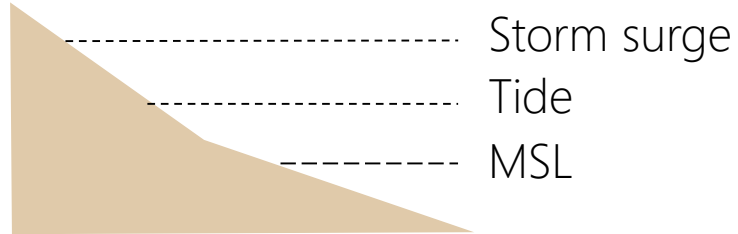


4 Results

4 Results: Case 1

STORM 1:

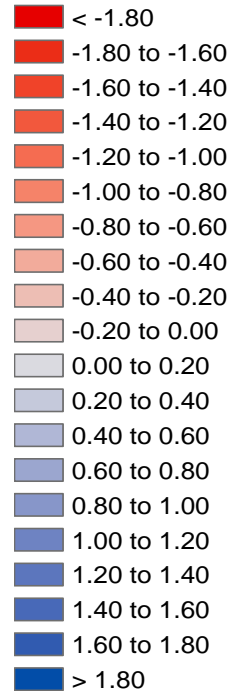
- 63 h
- Max. Wave Height = 2.6 m
- Water level = 3.12 m



4 Results: Case 1



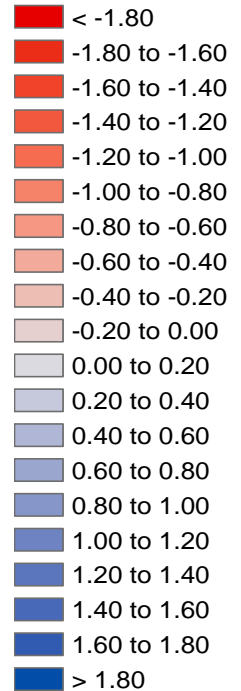
Legend (m)



4 Results: Case 1



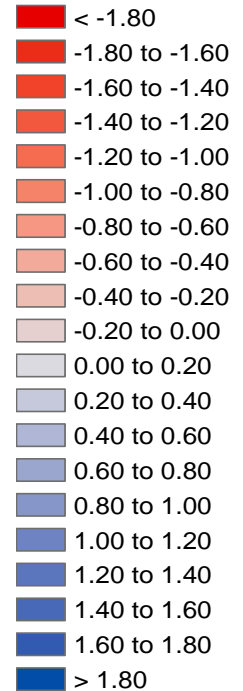
Legend (m)



4 Results: Case 1



Legend (m)






5 General conclusions

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- The **UAS&SfM approach** is an adequate methodology for the acquisition of **highly precise, dense, and cost-effective topographic data** of coastal areas, when the correct setting of flight and camera parameters are chosen, and the GCPs evenly distributed.
- This methodology presents disadvantages too: meticulous **flight planning, time-consuming** deployment, measurement, and ulterior removal of **GCPs** in the field, the duration of the **batteries, memory** demands, and/or **weather** conditions.
- **Suitable and useful** technique for **monitoring and mapping** the **dynamics** of coastal elements at **high temporal and spatial scales** not previously achievable by traditional remote-sensing or ground-based techniques, or not conveniently achieved in terms of the associated logistics, precision, spatial/temporal coverage, and/or economic costs.



"As sea level rises, smaller and weaker storms will cause flood damage... It's like playing basketball and raising the level of the court so that shorter and shorter people can dunk."

Professor Andrew Kemp

Thanks!