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FUTURE EVOLUTION OF SANDY BEACHES IN A CHANGING CLIMATE. THE CASE OF THE BALEARIC ISLANDS

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Funded by:

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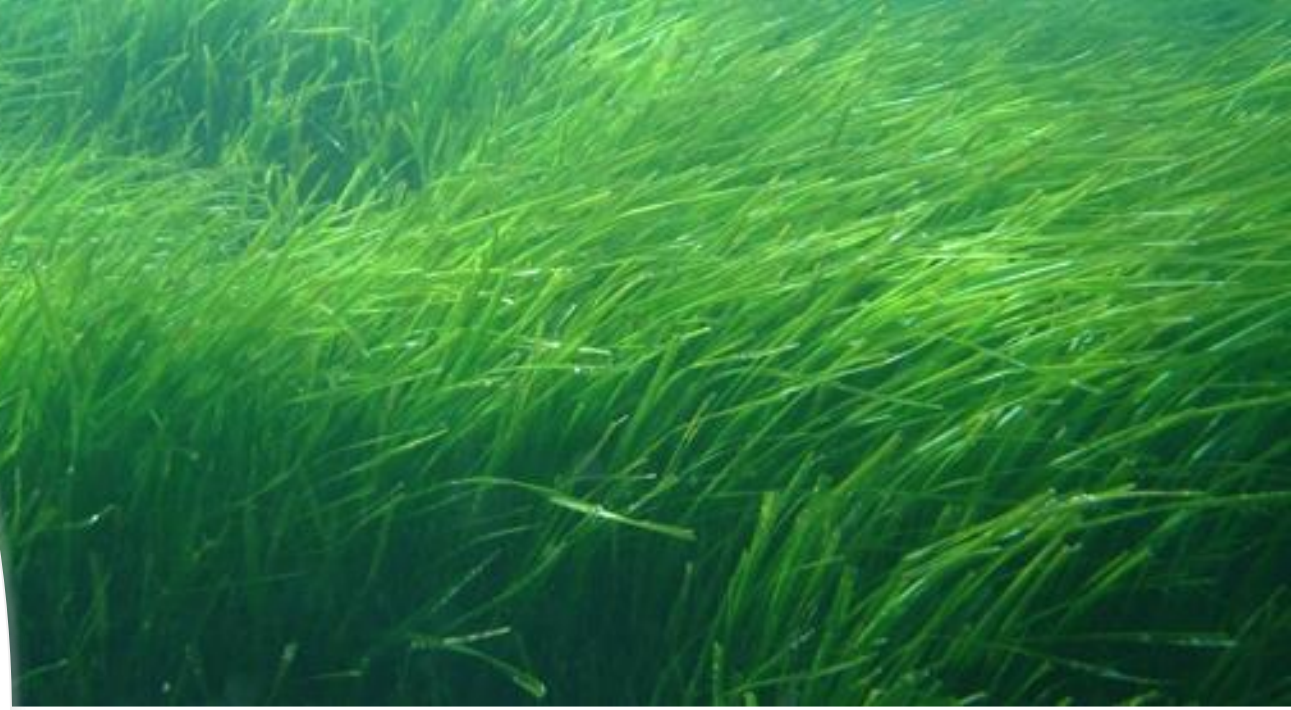
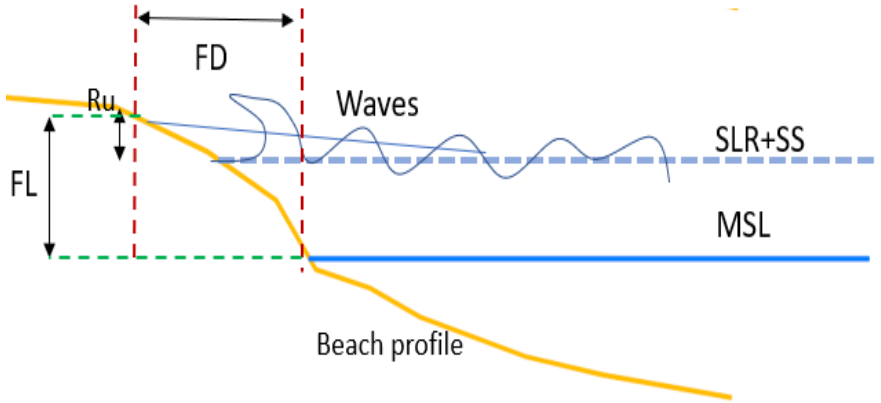


Introduction

Motivation: Balearic beaches are at risk of disappearing due to sea level rise

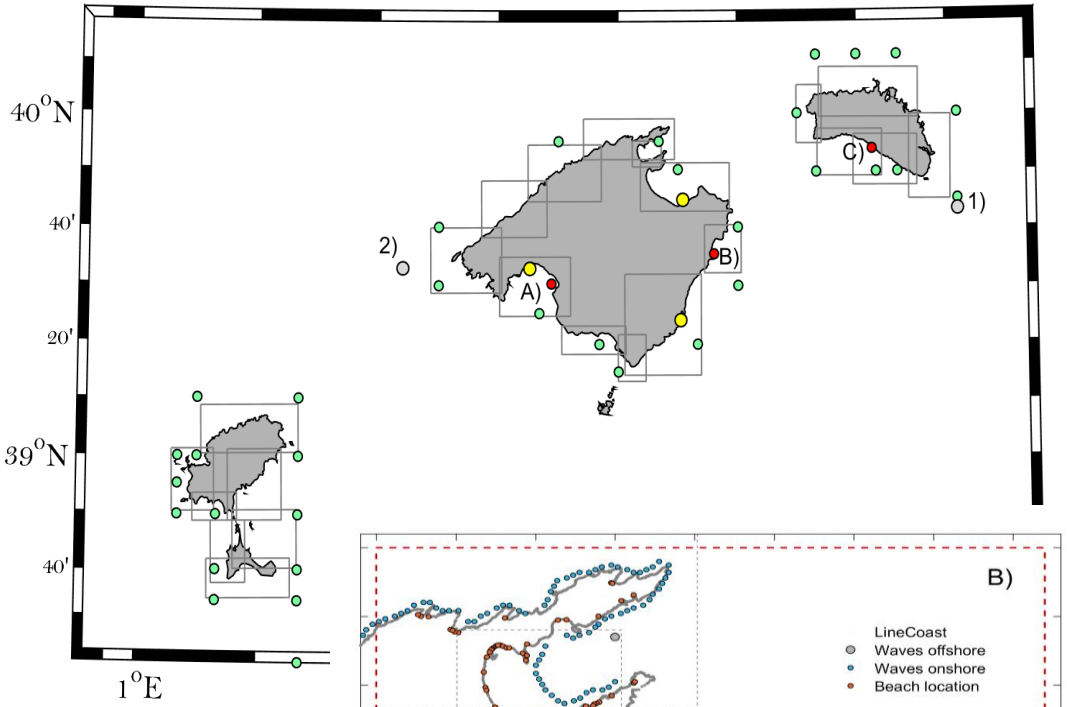
- *Sun and beach tourism (42% PIB)*
- *16M euros income per year*

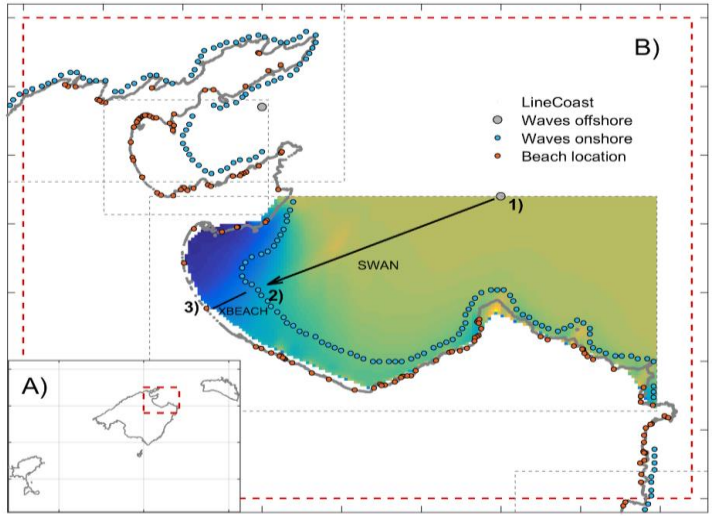
Objetive: to estimate the beach area loss under different climate scenarios



Methods

Total water level estimation on beaches



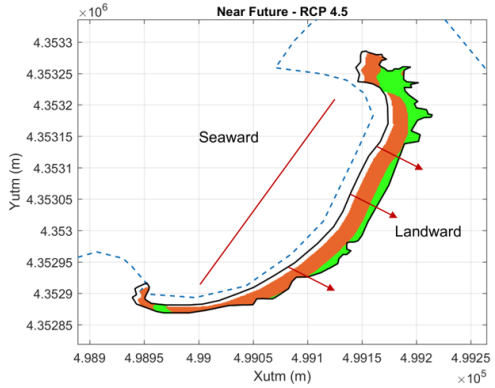


Wave Runup (SWAN +XBEACH)

Storm Surge

MSLR

Total Water level

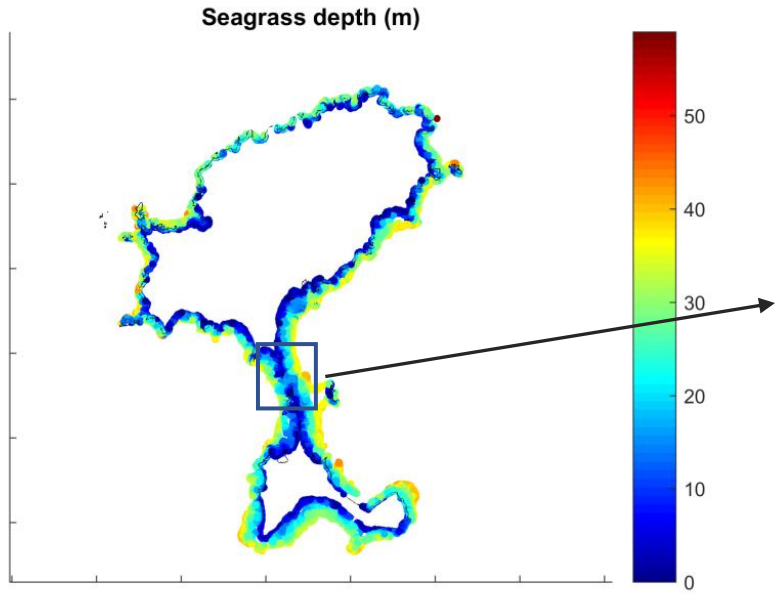


Mean conditions
RCP4.5
RCP8.5

Extreme conditions
RCP4.5
RC

Methods

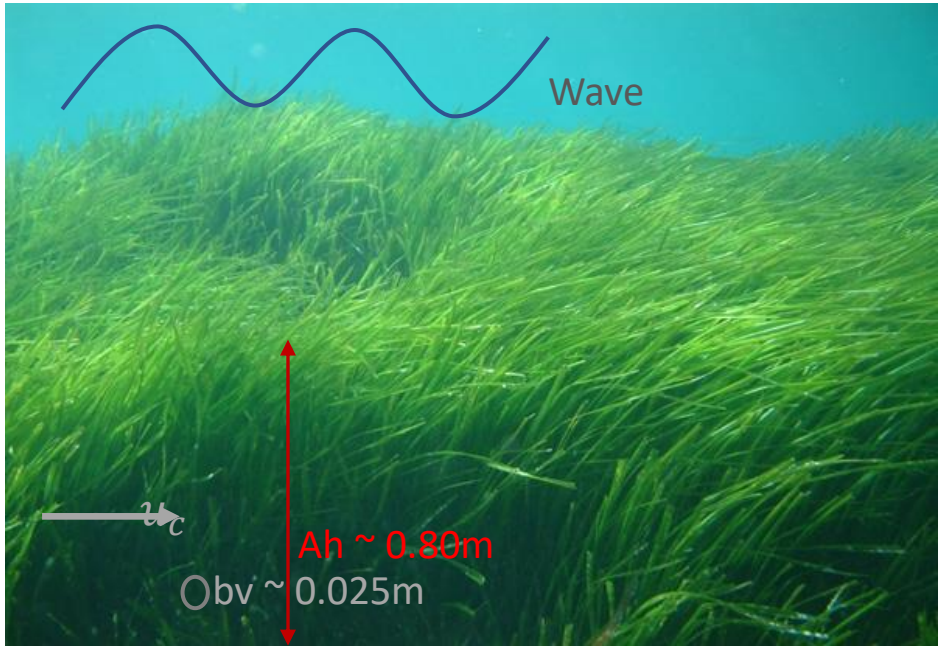
Waves and seagrass interaction



Do the seagrass meadows reduce the energy of the waves ? How much ?

Methods

Waves and seagrass interaction



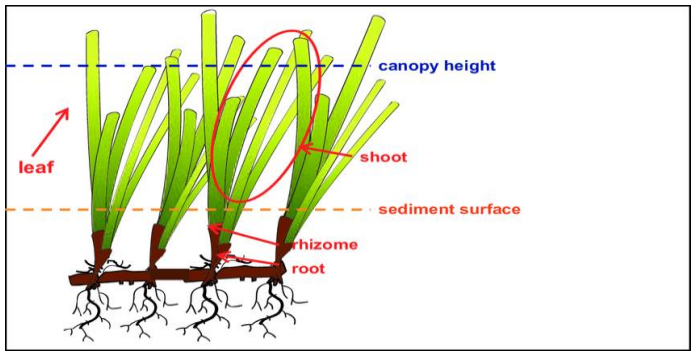
$$\frac{dEC_g}{dx} = -\varepsilon_b - \varepsilon_v$$

breaking

Bottom friction

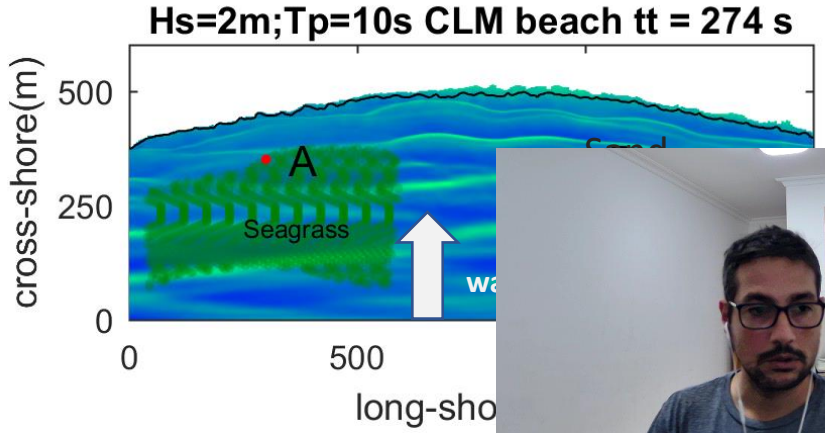
$$\langle \varepsilon_v \rangle = \frac{1}{2\sqrt{\pi}} \rho C_D b_v N \left(\frac{kg}{2\sigma}\right)^3 \frac{\sinh^3 k\alpha h + 3\sinh k\alpha h}{3k\cosh^3 kh} H_{rms}^3$$

Mendez&Losada 2004



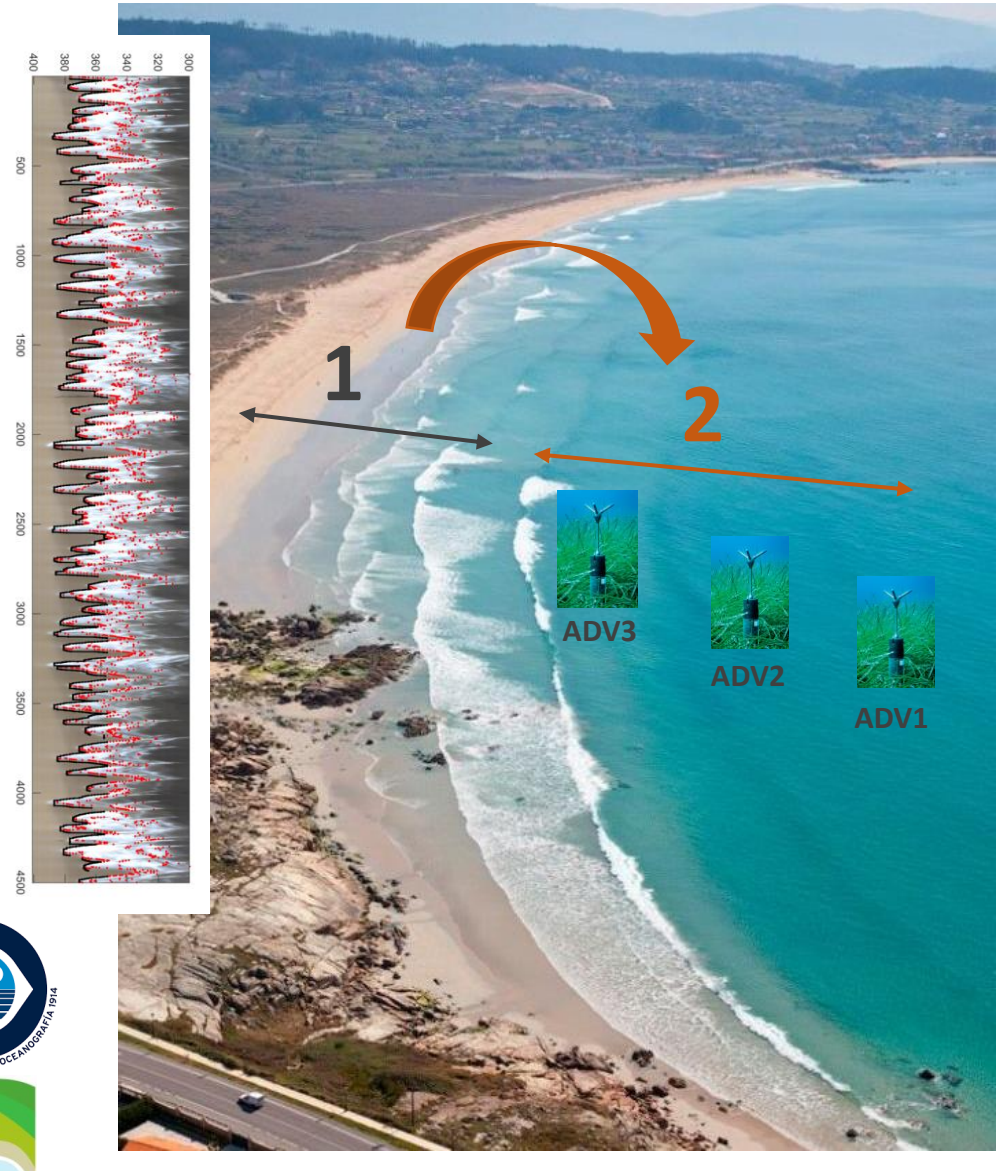
XBEACH (Vegetation module)

- Leaf shoot length ~(0.35-0.8m)
- Vegetation density ~(600-900 ud/m2)
- Stem width ~(2-3 cm)
- **Damping coeficient ???**



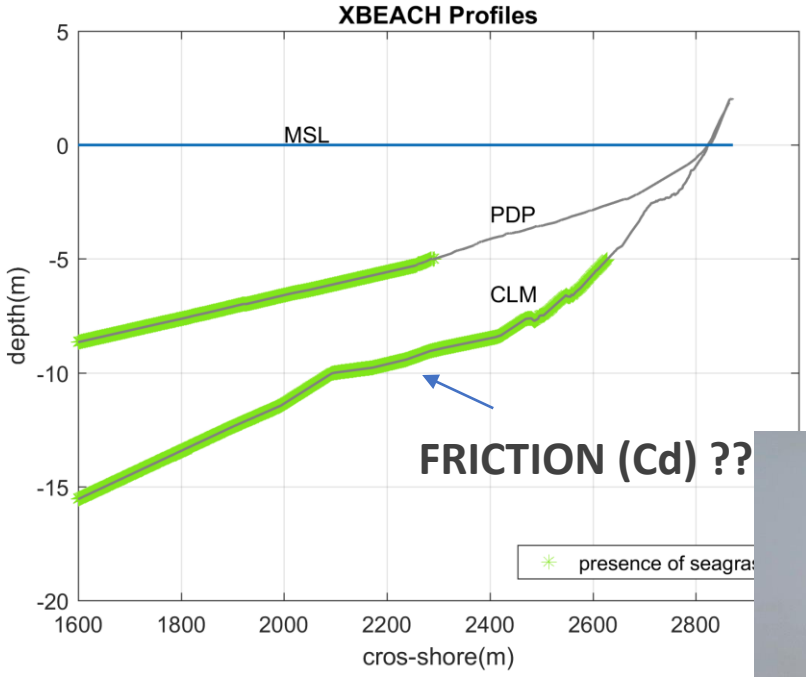
Methods

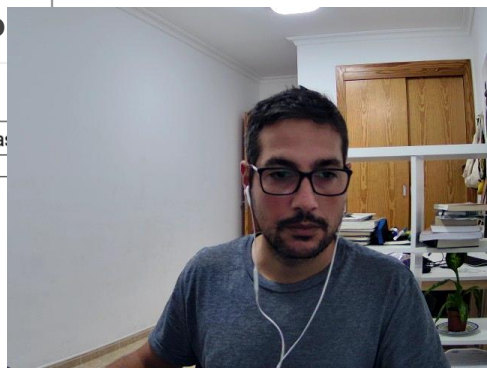
Calibration of Xbeach vegetation module



1. CALIBRATION OF XBEACH BOTTOM FRICTION BASED ON SWASH OBSERVATIONS (TIMESTACK IMAGES) (2011-2018). Playa de Palma Beach and Cala Millor

2. VALIDATION OF XBEACH BOTTOM FRICTION BASED ON Hs in shallow waters. Cala Millor Beach (N~615 stems/m2; L~0.80cm; D~2.5cm; Cd~0.05)





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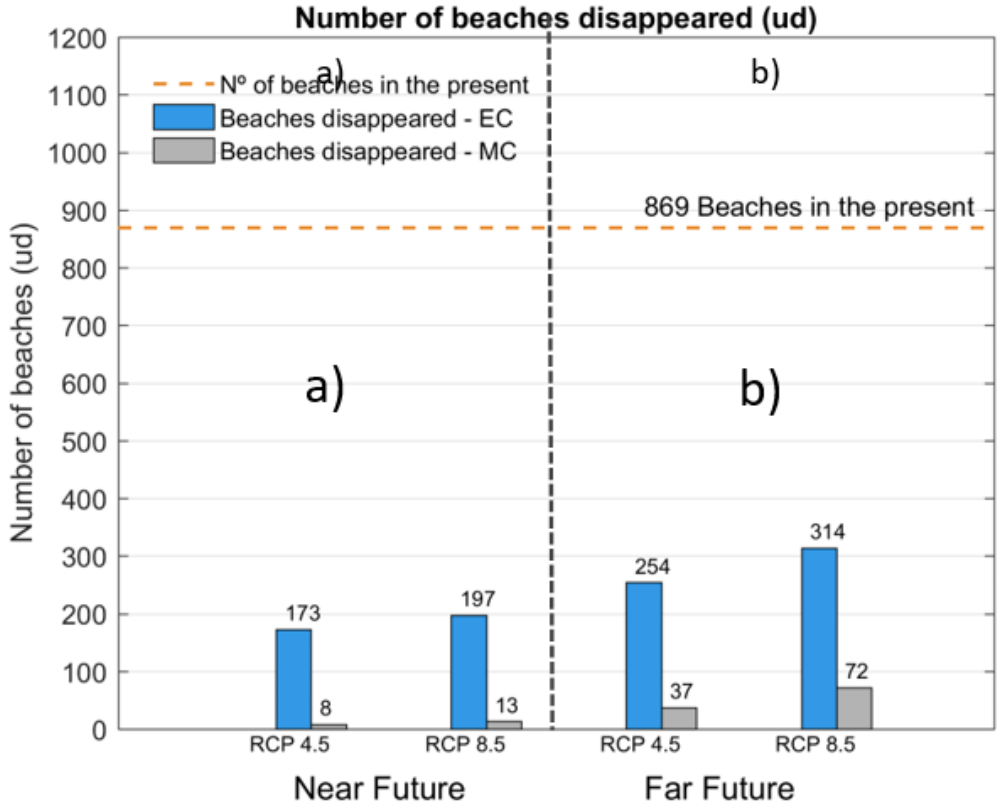
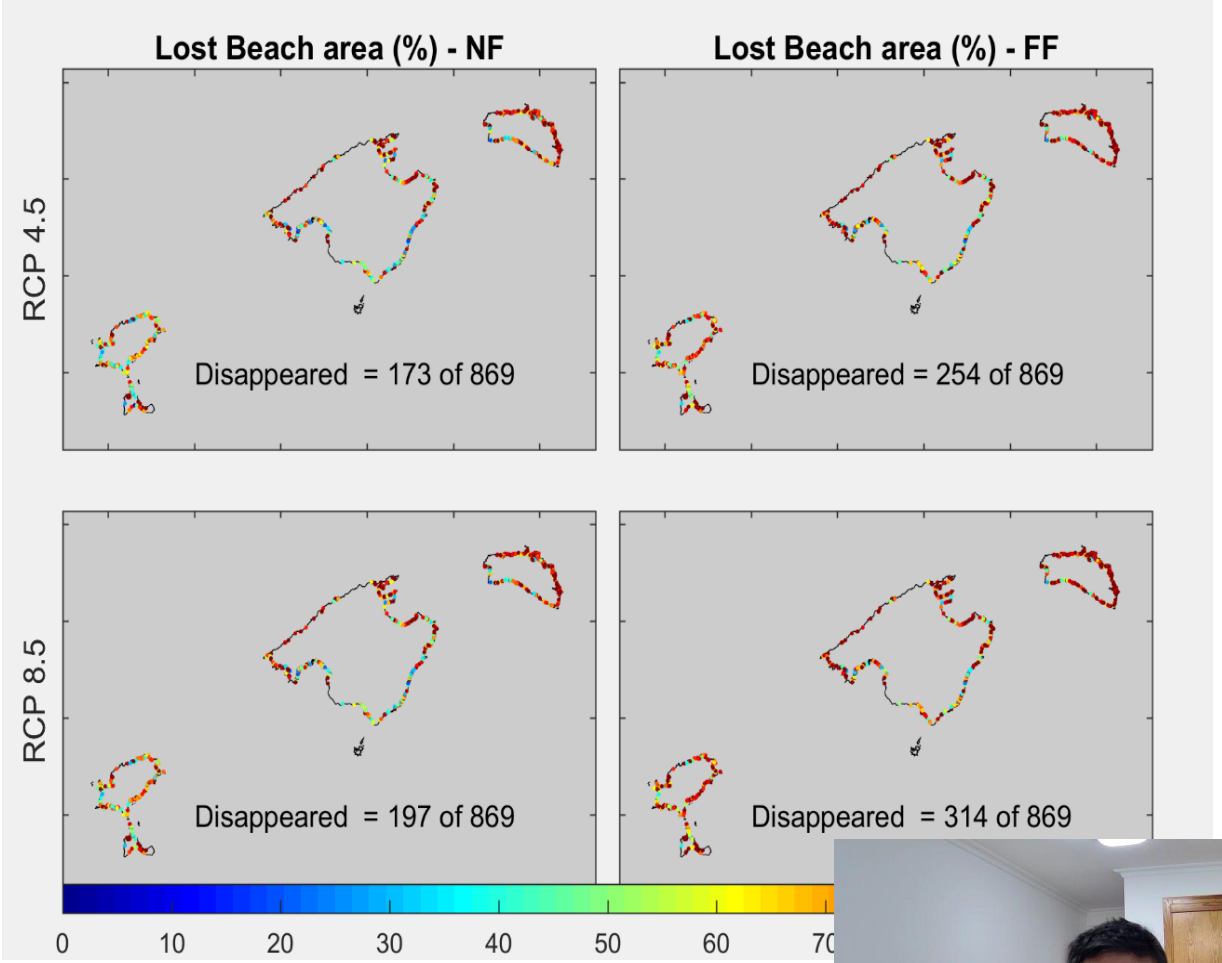
Results

Around **30-36 %** of Balearic beaches will be completely **disappear** under **Extreme conditions** at the end of the century (2080-2100)





Loss beach area under extreme conditions, for scenari
and for near future (2030-2050) and at the end of the

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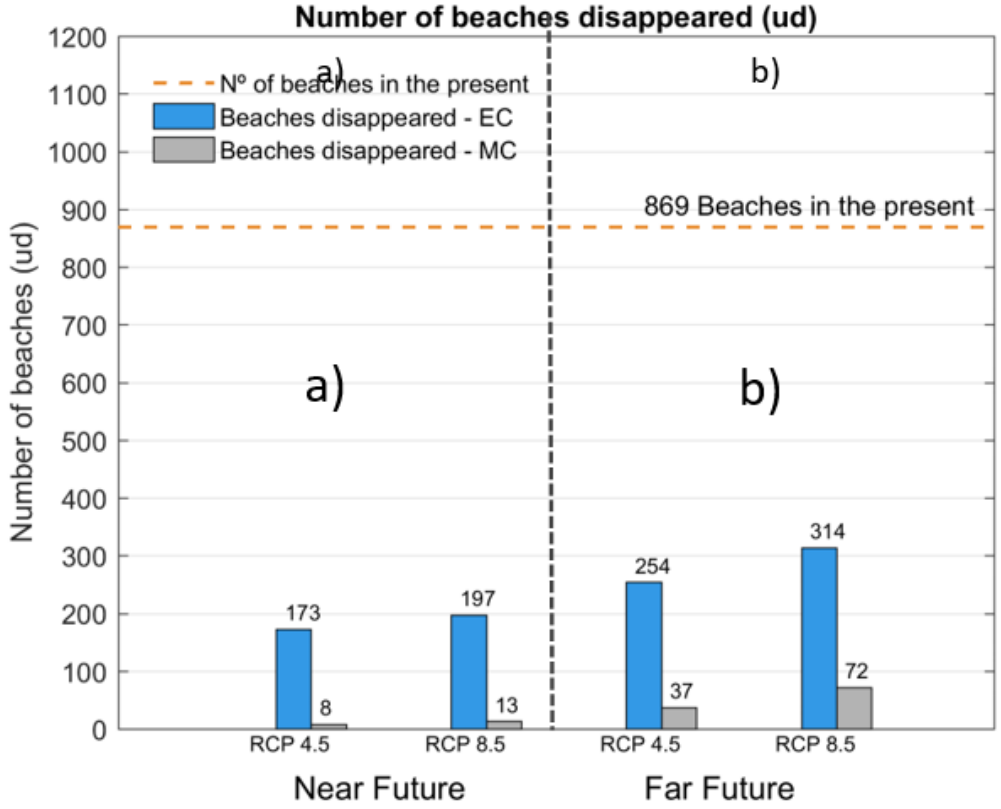
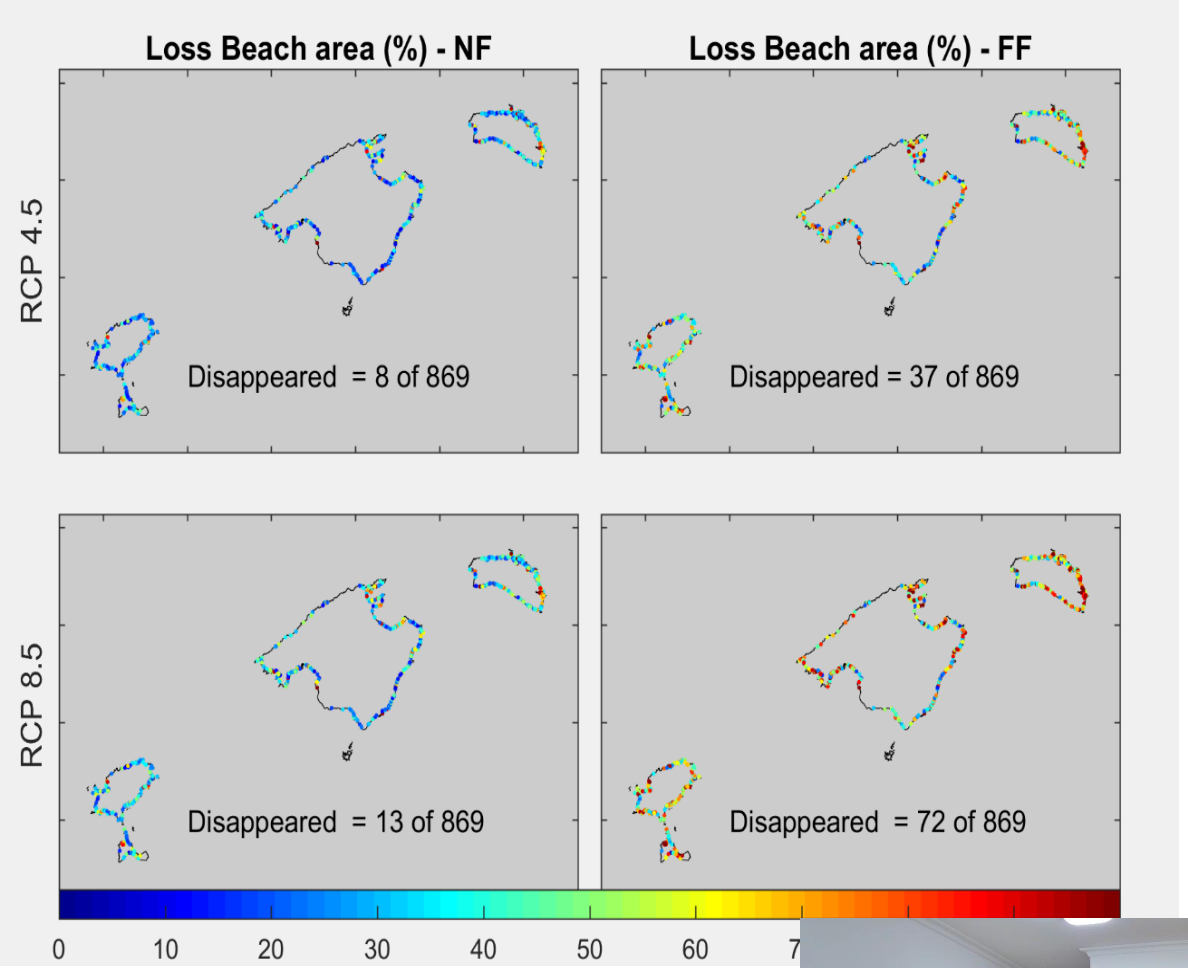
Results

In **Mean Conditions**, around **9%** of the Balearic beaches will be completely **flooded** at the end of the century (2080-2100), and **90% of the beaches**, **will lost** around **60-70%** of the current **beach area**





Loss beach area under mean conditions, for scenario R and for near future (2030-2050) and at the end of the

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Conclusions

- **Seagrass** is a **natural barrier** against extreme conditions and **Cd** is a **key parameter** to calibrate the numerical model.
- The possible **loss of seagrass** among 2 and 5 meters depth implies **an increase at around 30%** in coastal **flooding** under extreme conditions.
- Around **30-36 %** of Balearic beaches will be completely **disappear** under **Extreme conditions** at the end of the century (2080-2100).
- In **Mean Conditions**, around **9%** of the Balearic beaches will be completely **flooded** at the end of the century (2080-2100), and **90% of the beaches**, **will lost** around **60-70%** of the current **beach area**

Future steps

- To continue studying the seagrass meadows variability and their hazards (sea temperature, anthropogenic effects, storms etc), base on in situ data and satellite images
- To assess the coastal flooding **Risk** at Balearic Island considering the **Exposure** and **Vulnerability** components

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THANK YOU

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