Directors:

Sonia Castanedo Bárcena

Fernando J. Méndez Incera

PhD Student:

Manuel Zornoza Aguado

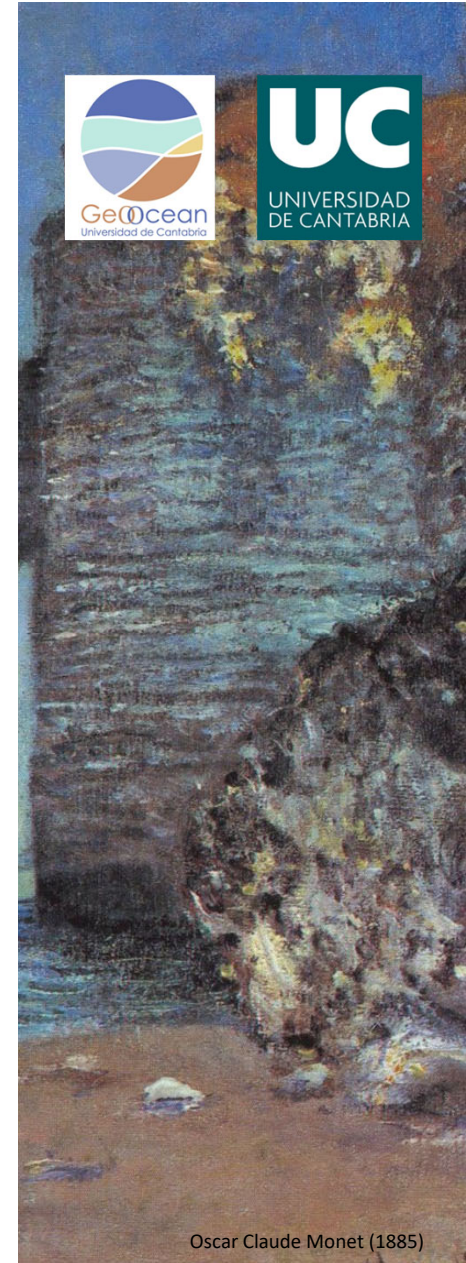(zornozam@unican.es)

PhD in Civil Engineering

Climate Change Adaptation: Early Warning System of Coastal Flooding (Beach4Cast)

Photo: Lee Scott

THESIS THEMES

- Coastal variability

- Costal hazards and risks

- Wave climate

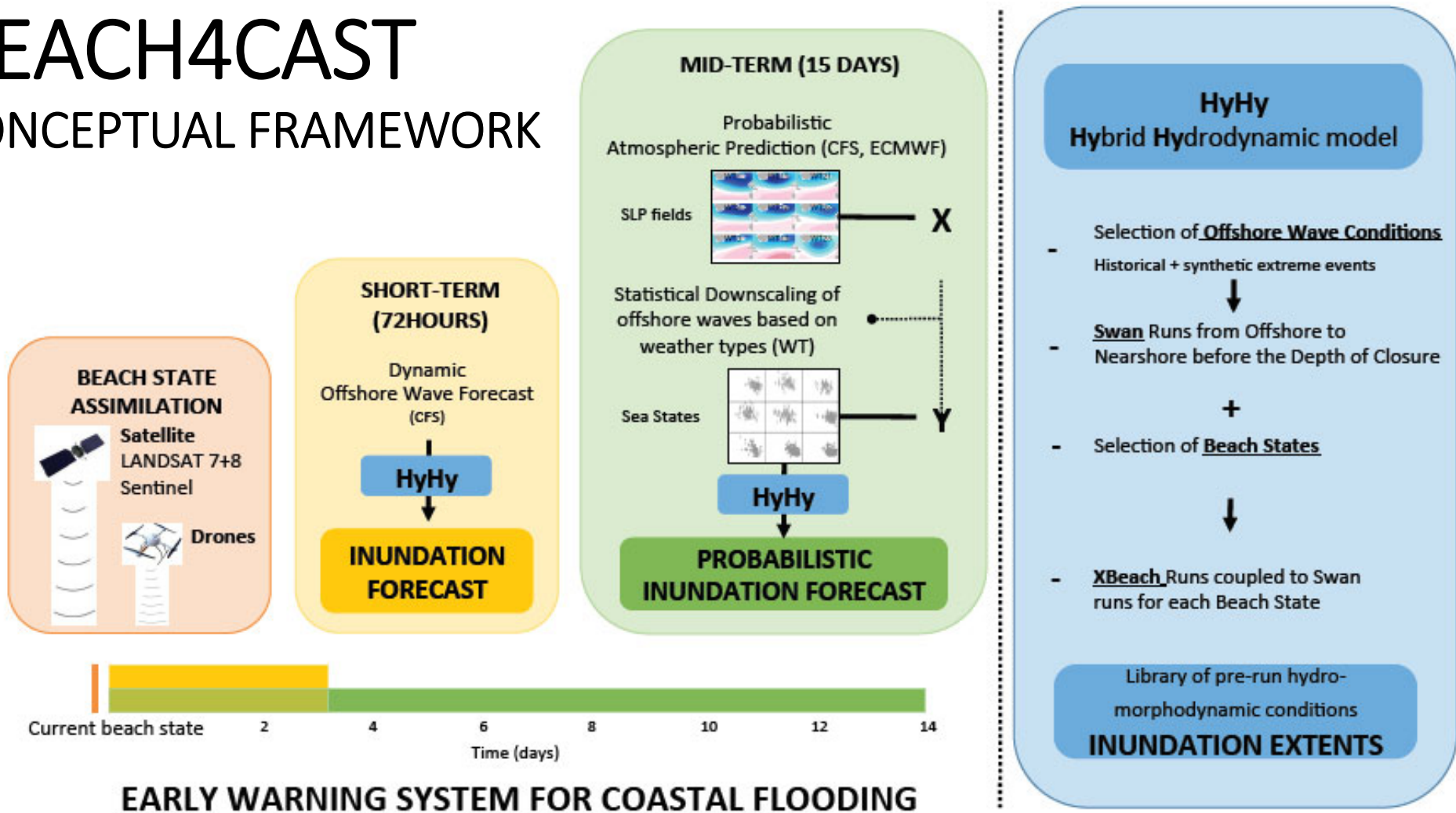- Hybrid methodologies

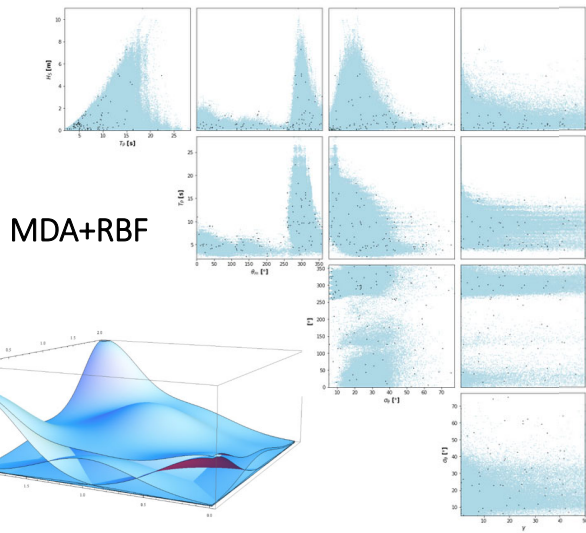- **Probabilistic Early Warning System**

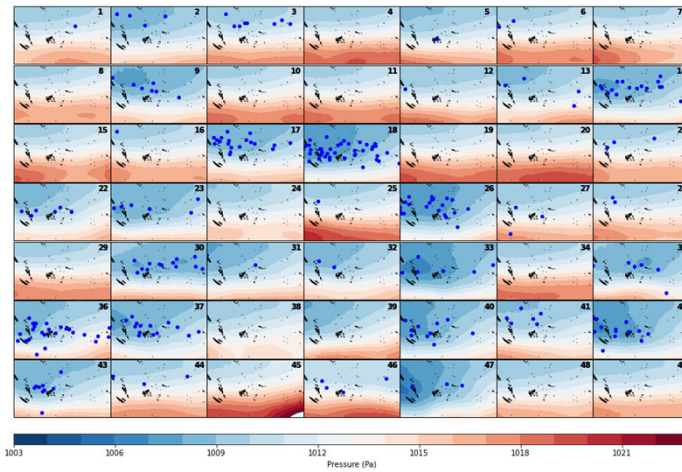   **BEACH4CAST**

Oscar Claude Monet (1885)

BEACH4CAST
CONCEPTUAL FRAMEWORK

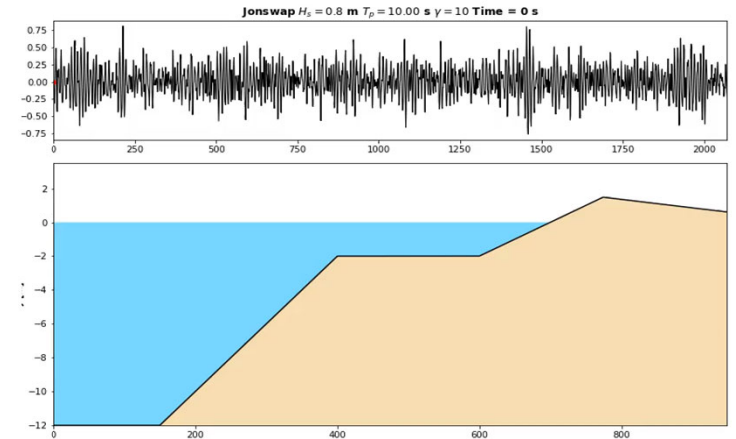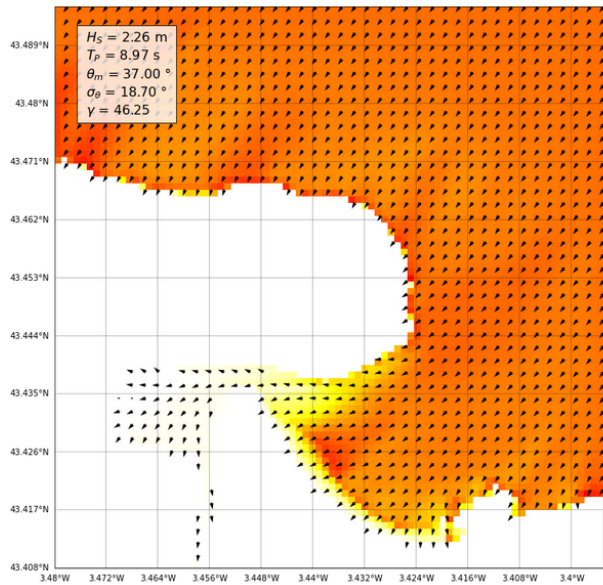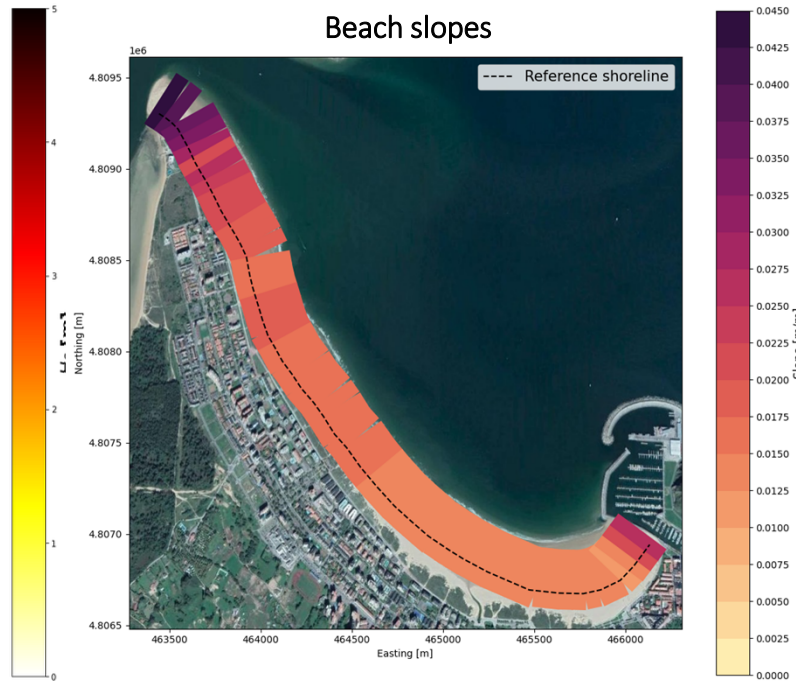**BEACH STATE ASSIMILATION**
Satellite
LANDSAT 7+8
Sentinel

Drones

SHORT-TERM (72HOURS)

Dynamic Offshore Wave Forecast (CFS)

HyHy

INUNDATION FORECAST

MID-TERM (15 DAYS)

Probabilistic Atmospheric Prediction (CFS, ECMWF)

SLP fields

X

Statistical Downscaling of offshore waves based on weather types (WT)

Sea States

Y

HyHy

PROBABILISTIC INUNDATION FORECAST

Current beach state

2   4   6   8   10   12   14

Time (days)

EARLY WARNING SYSTEM FOR COASTAL FLOODING

HyHy
Hybrid **Hy**drodynamic model

- Selection of **Offshore Wave Conditions**
  Historical + synthetic extreme events

- **Swan** Runs from Offshore to Nearshore before the Depth of Closure

+

- Selection of **Beach States**

- **XBeach** Runs coupled to Swan runs for each Beach State

Library of pre-run hydro-morphodynamic conditions
INUNDATION EXTENTS

Geomatics and Ocean Engineering Group (UC)

MDA+RBF

Weather types

Run-up and overtopping rates

Jonswap $H_s = 0.8$ m $T_p = 10.00$ s $\gamma = 10$ Time = 0 s

Wave climate propagation

$H_S = 2.26$ m
$T_P = 8.97$ s
$\theta_m = 37.00$ °
$\sigma_\theta = 18.70$ °
$\gamma = 46.25$

Beach slopes

Reference shoreline

Flooding events

Geomatics and Ocean Engineering Group (UC)
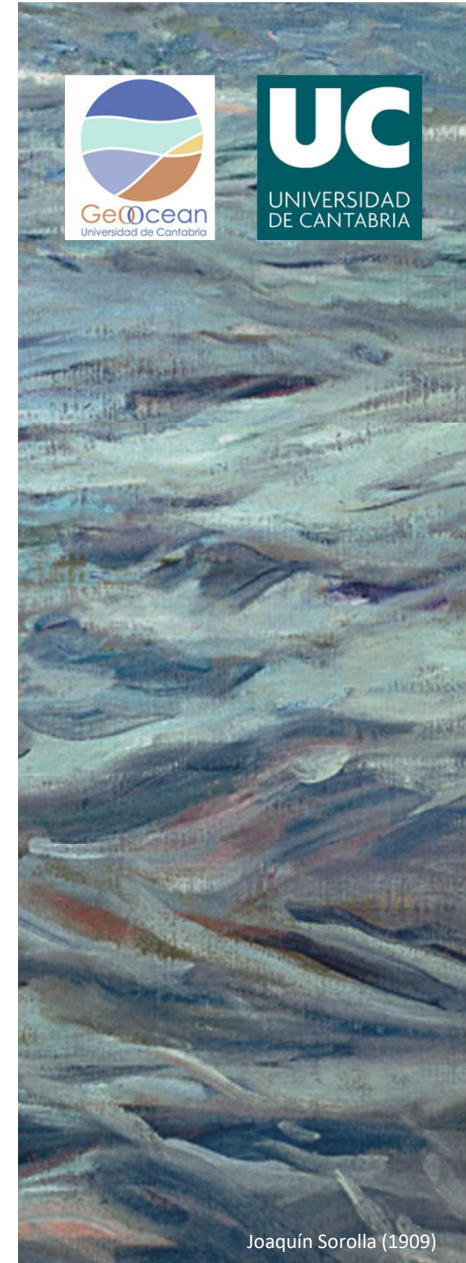
PERSONAL MOTIVATION

- Continue my learning in this exciting field

- Opportunity to be part of an excellent human and professional group

- Establish relationships with other scientifics around the world, improving our field together

- Enhance existing (or create new) methodologies and tools in coastal engineering

Katsushika Hokusai (1830-1833)

EXPECTATIONS

- Elaborate 'universal' methodologies which do not rely on high computational resources

- Develop tools to mitigate the effects of climate change, improving the existent ones and creating new ones

- Develop skills and capabilities

- Collaborate with international fellows

- Improve my divulgation skills (via publications or presentations)

Joaquín Sorolla (1909)

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UC UNIVERSIDAD DE CANTABRIA

Photo: Lee Scott