The role of ports on coastal flood risk

4th International workshop on Waves, Storm Surges and Coastal Hazards, Santander, Spain

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Beaches and ports

Enemies or allies in the face of coastal flood risk?

R+D+i for sustainable development
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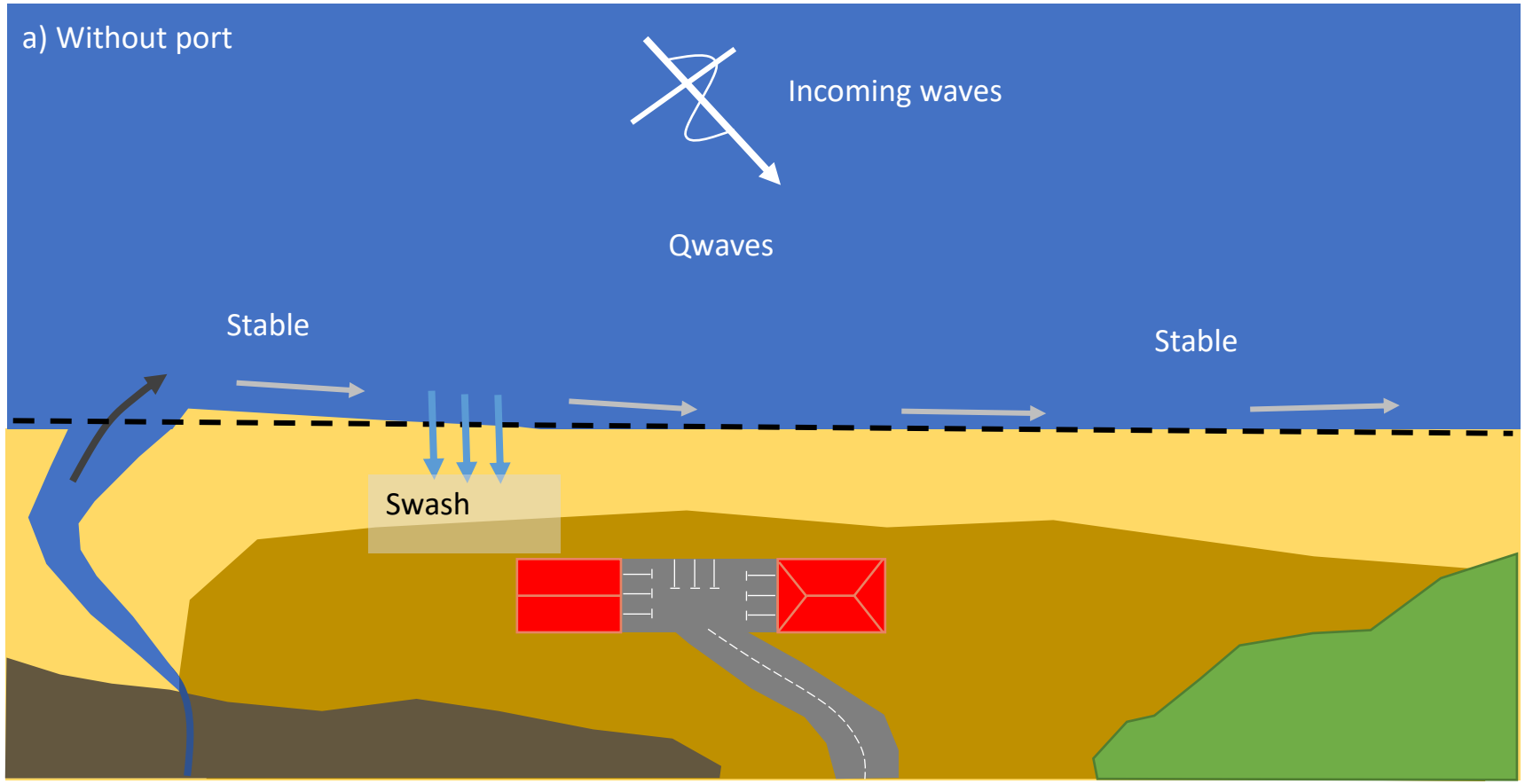
Index

1. The port footprint concept
2. Erosion-flooding modelling chain
3. Response to climate change

The port footprint on coastal areas

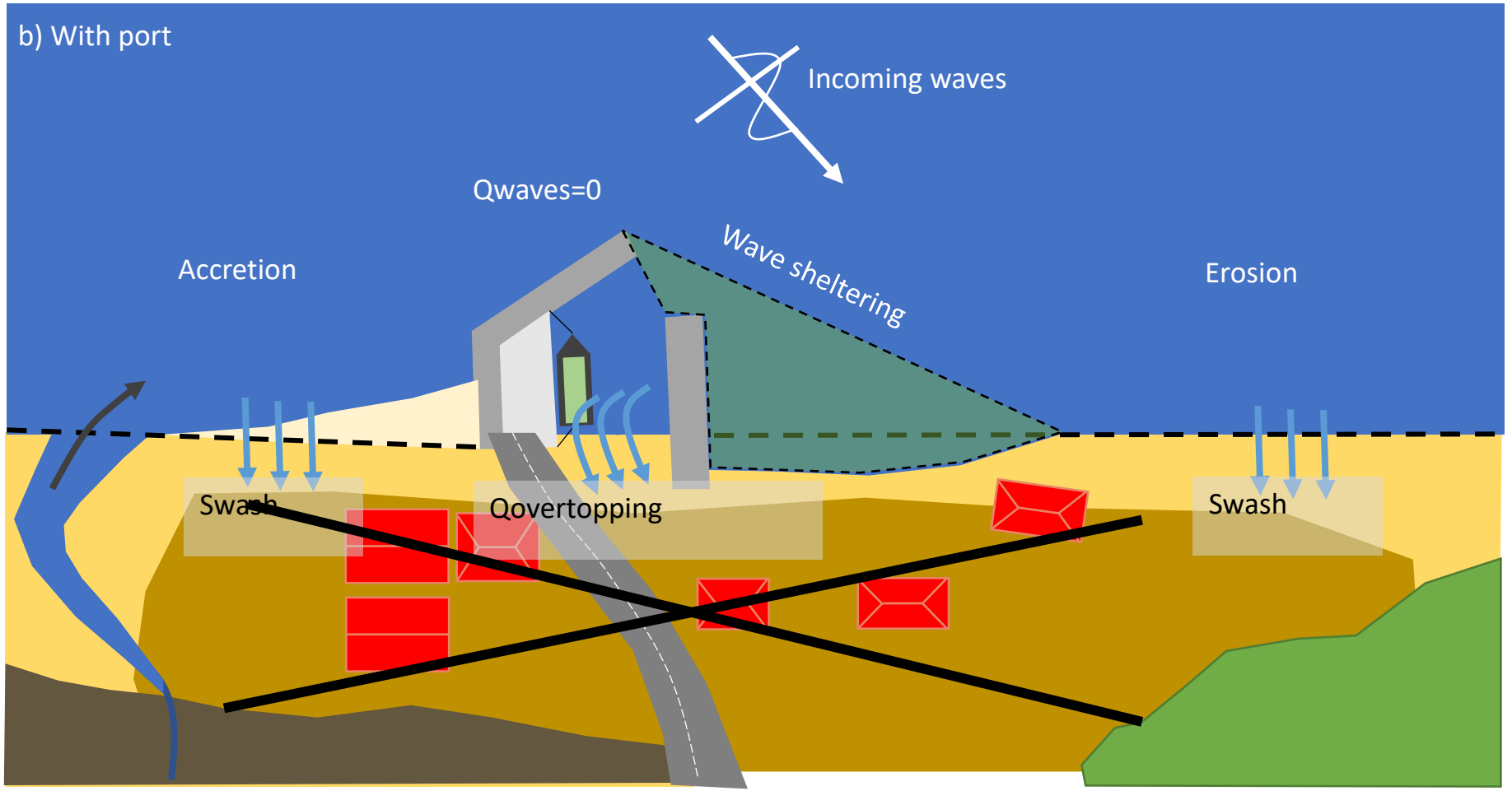


The port footprint on coastal areas

Physical

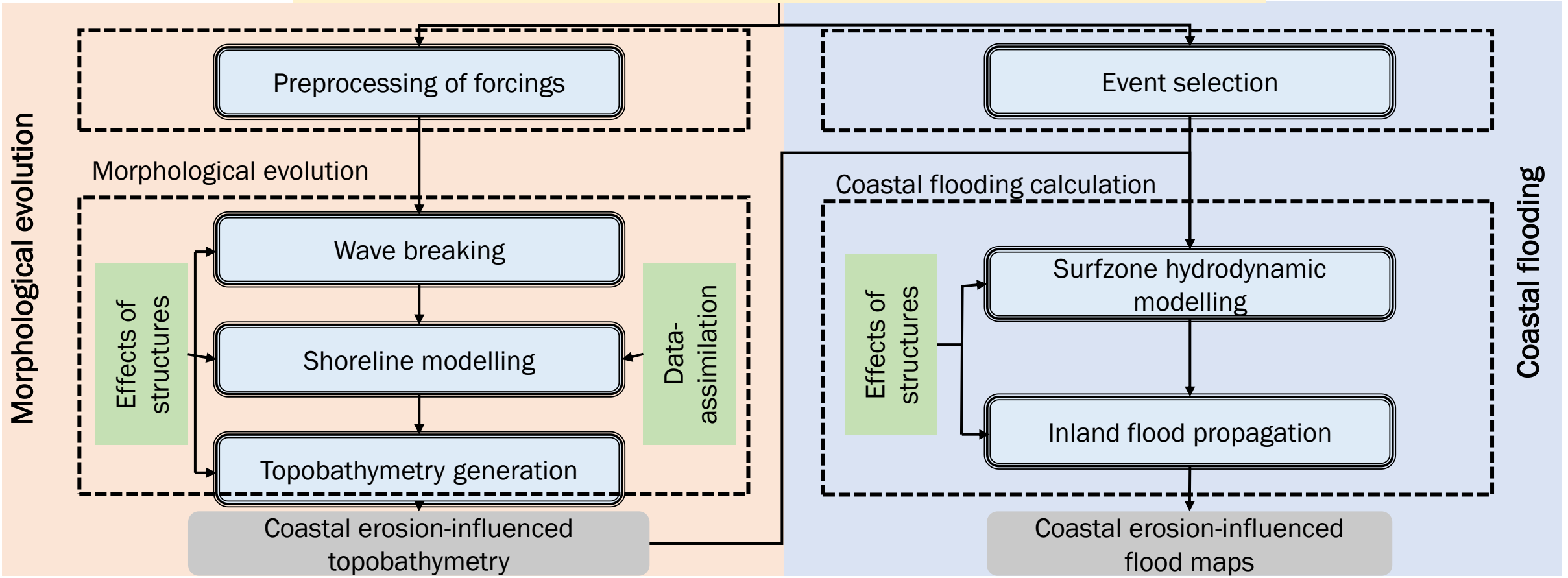
~~Environmental~~

~~Socioeconomic~~

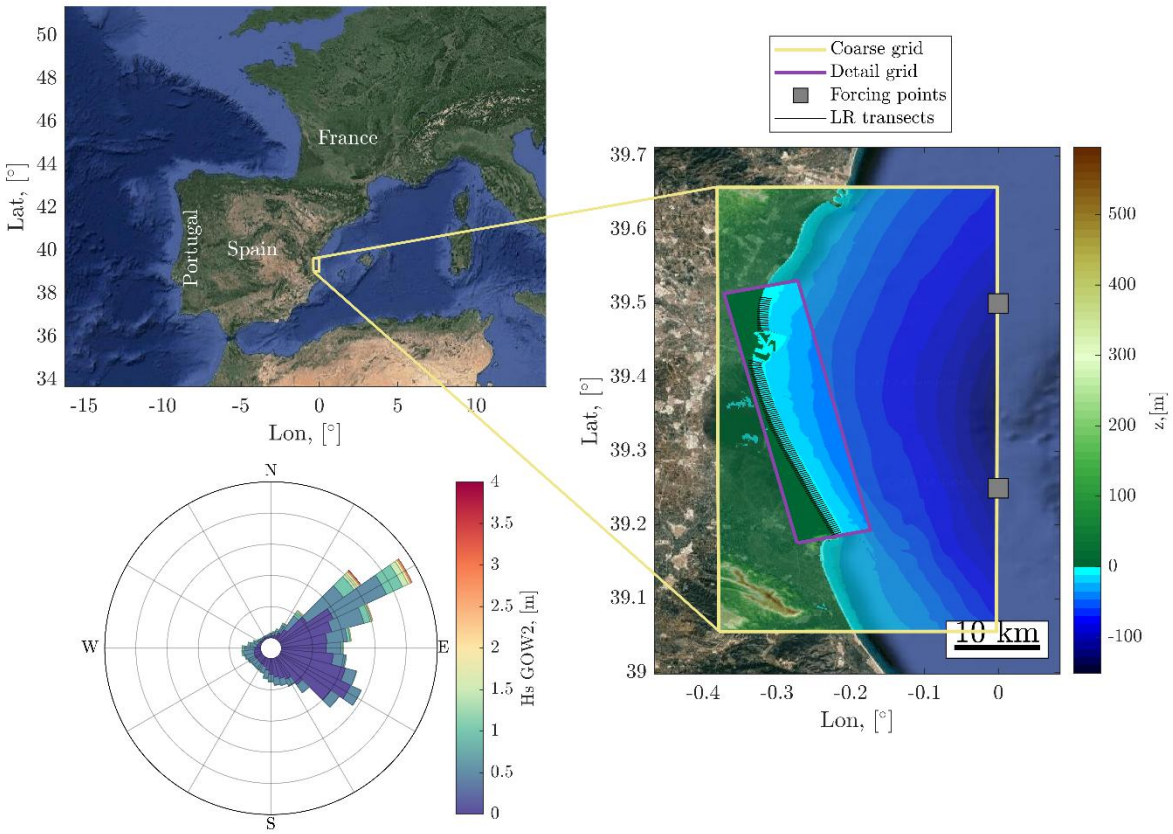


Erosion-flood modelling methodology

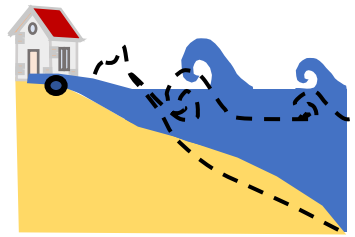
Waves and water levels, structures characteristics and time evolution, ecosystems, topobathymetry, shoreline observations, sediment characteristics



Erosion-flood modelling methodology

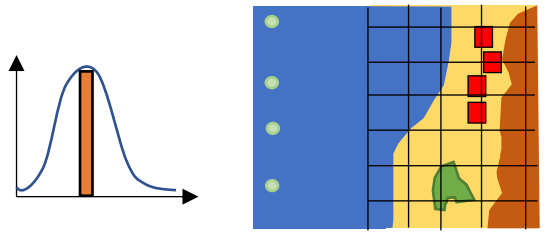


Morphological modelling



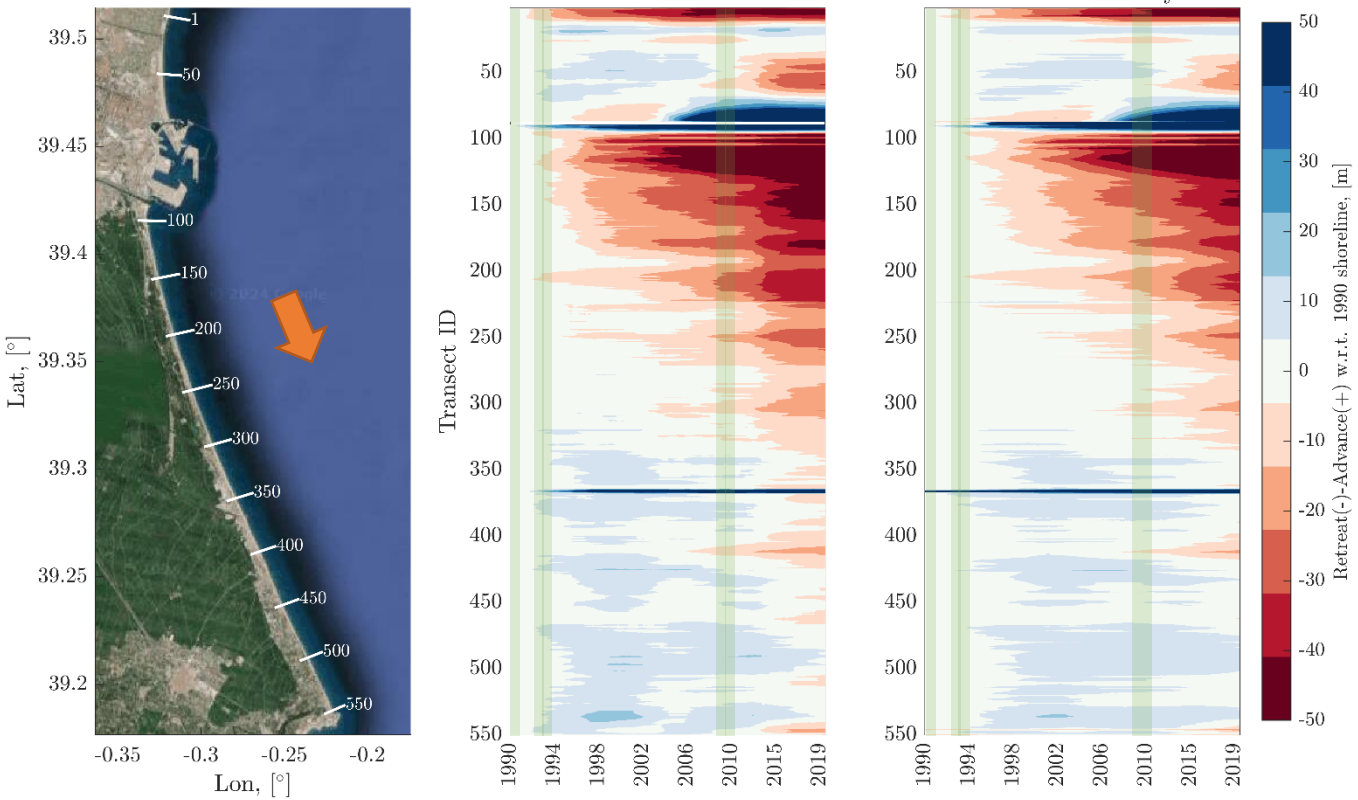
- Nearshore evolution model (IH-LANSloc, Álvarez-Cuesta et al., 2023)

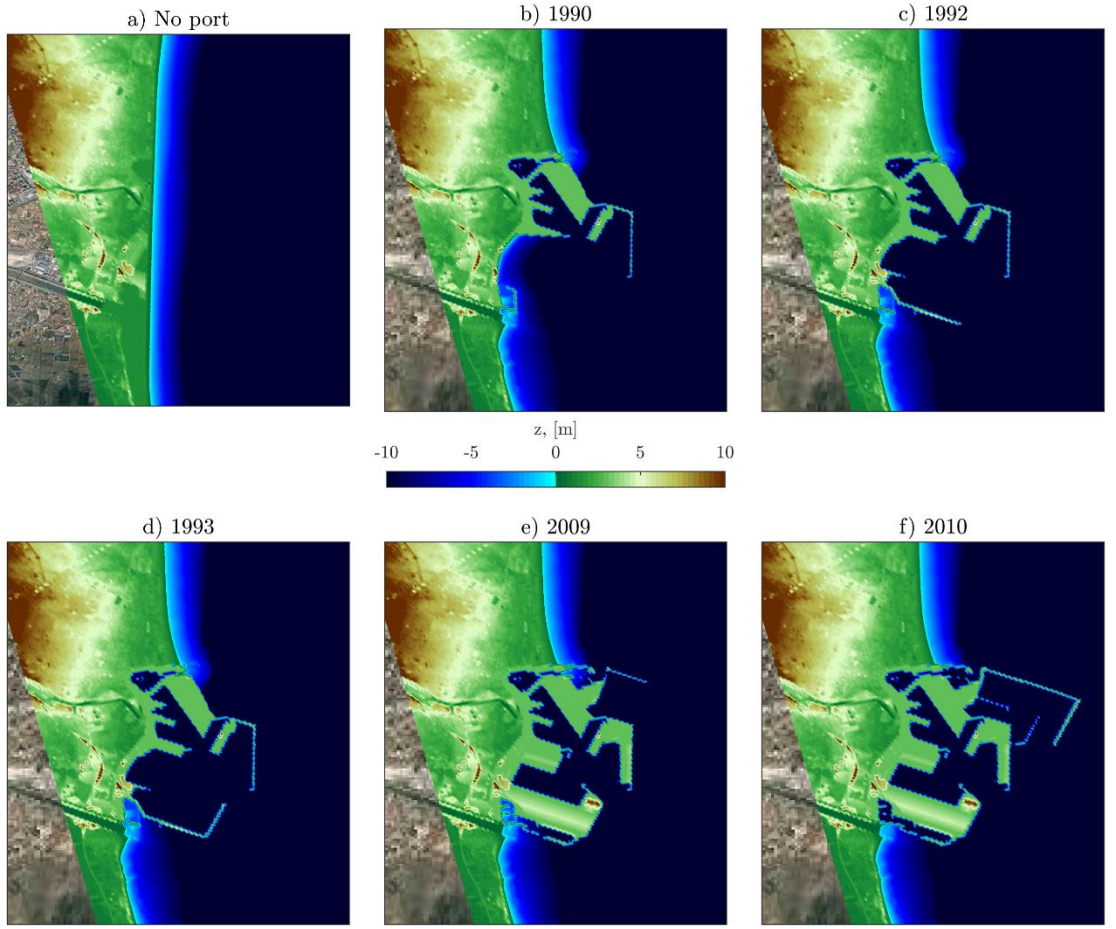
Coastal flood modelling



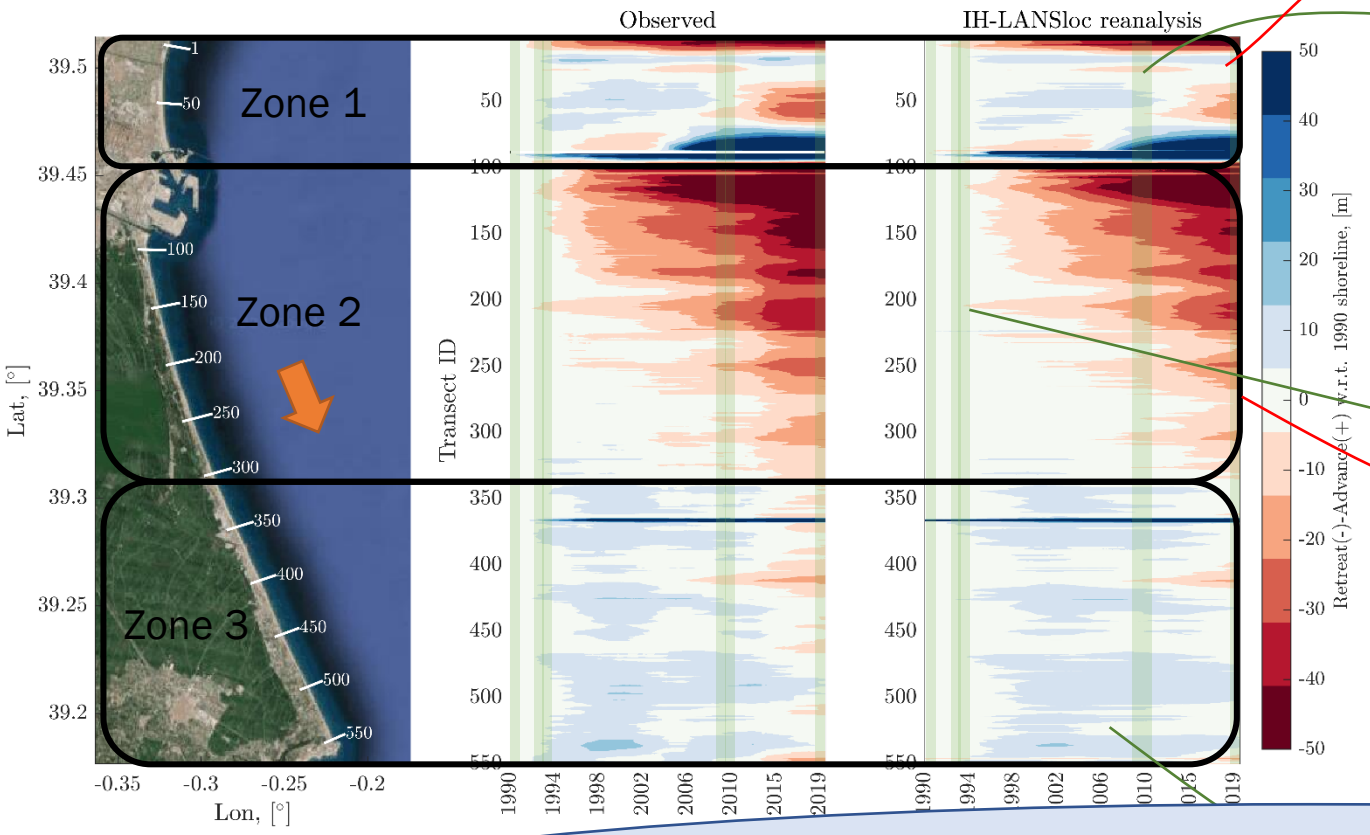
- Deterministic event (Storm Gloria)
- Empirical TWL (Stockdon et al., 2006)
- Inland flooding (SFINCS, Leinjse et al., 2021)

Erosion-flood modelling methodology





Erosion-flood modelling methodology



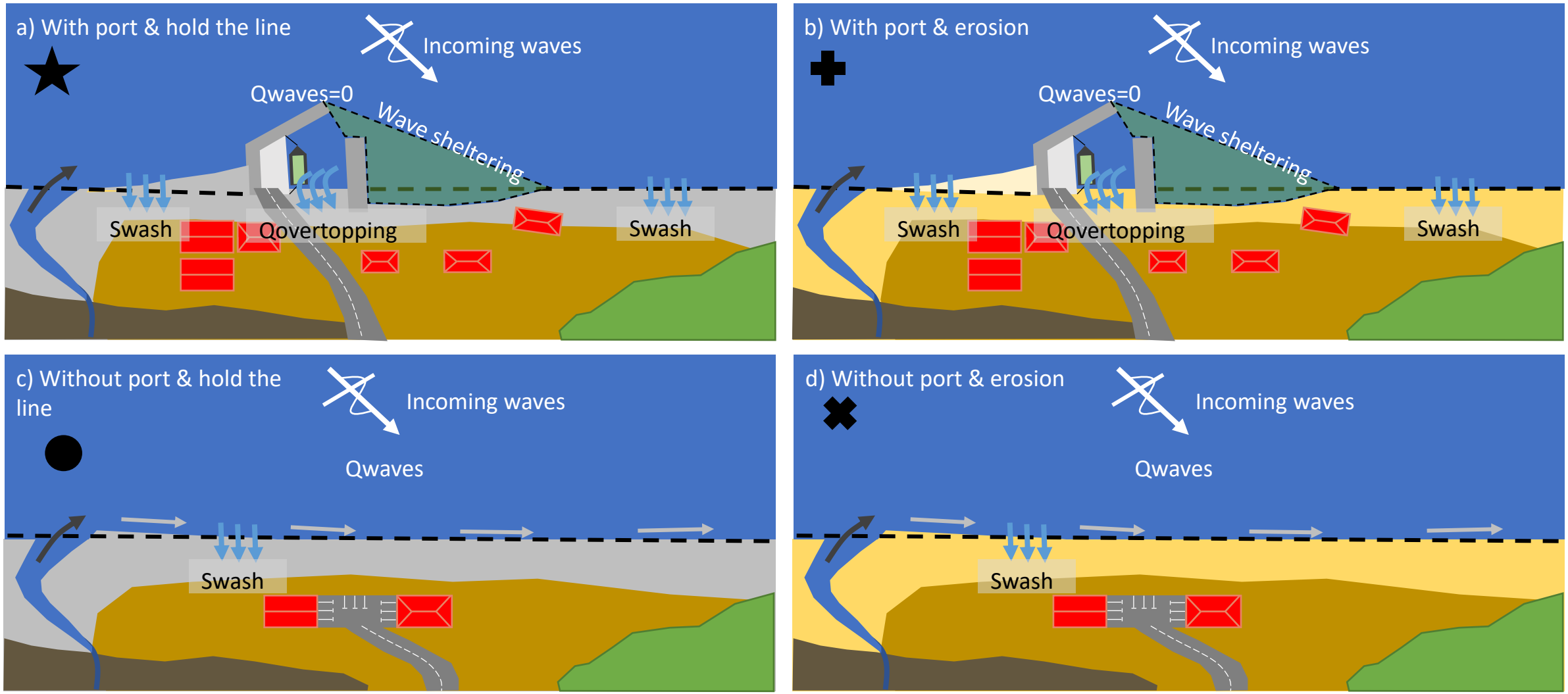
Alternative erosion/accretion

Strong accretion

Flooded area, (ha)	1990	1992	1993	2009	2010	2020
Zone 1	24.1	24.15	24.15	23.92	23.98	24.05
Zone 2	81.55	77.52	77.04	78.78	79.01	81.91
Zone 3	18.23	18.2	18.15	16.99	17.01	16.36

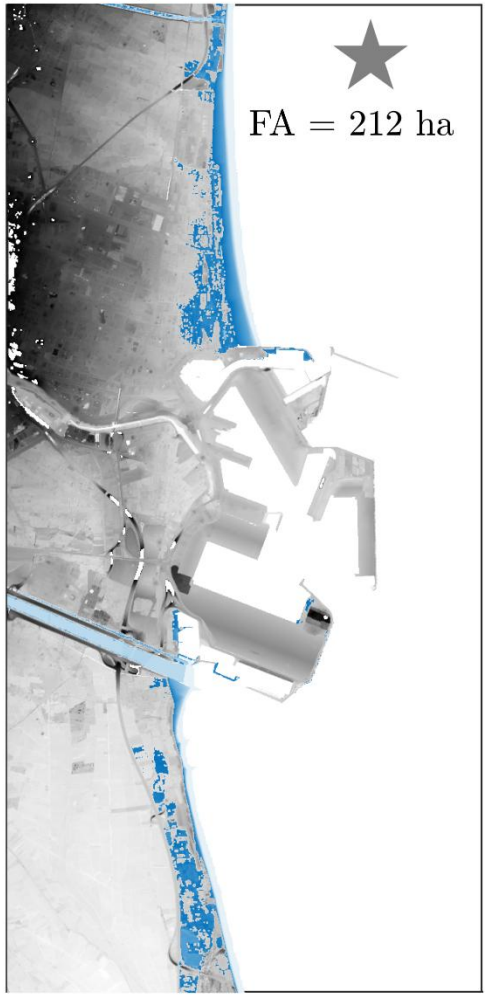
Enemies or allies in the face of coastal flood risk?

Management scenario

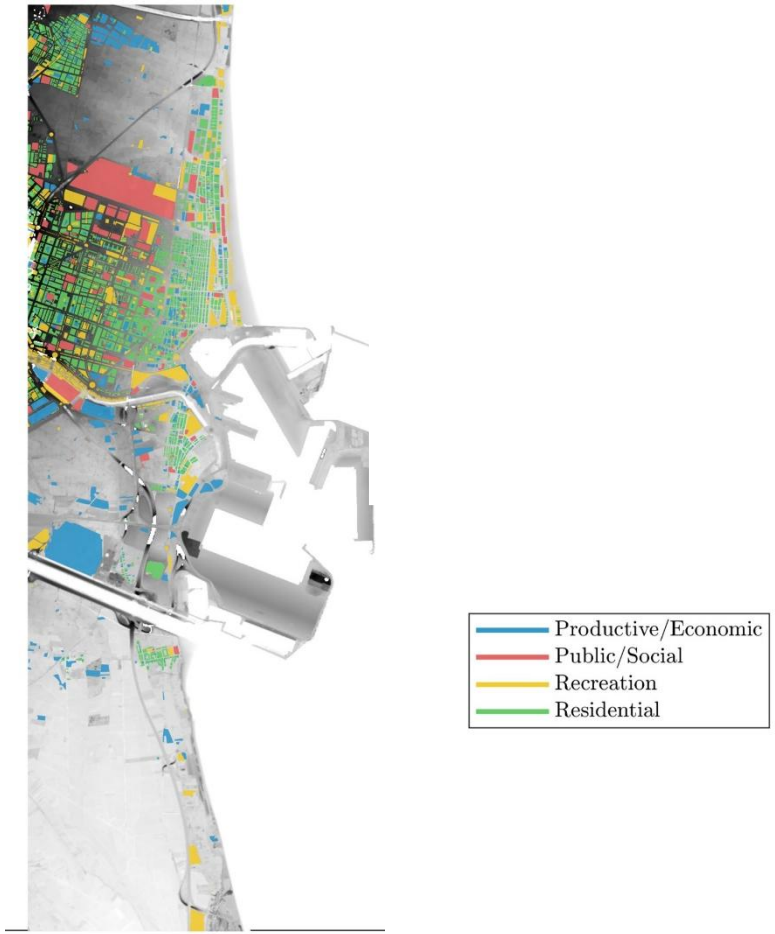


Response to climate change

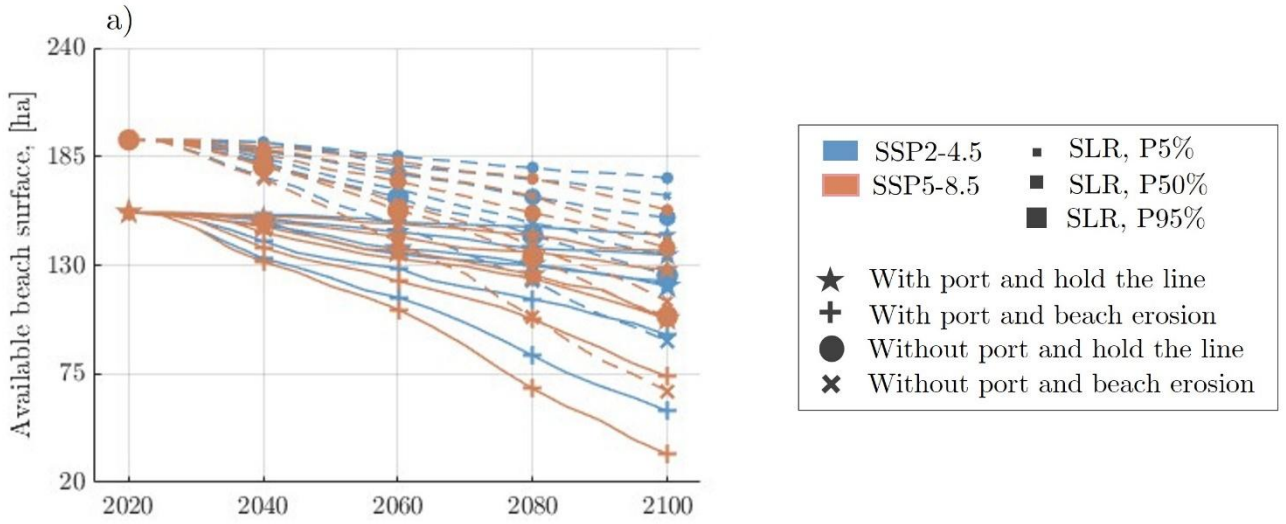
a) With port and hold the line



Response to climate change



Response to climate change



COSTS
Toimil et al., 2019

BENEFITS
Avoided flood damage

- >5 30-yr storms for B/C>1
- 5% chance by 2100
- Trade-related benefits not accounted for
- Beach recreation is an intangible asset

Allies in the face of coastal flood risk

Conclusions:

1. Novel methodology to account for port imprints on coastal flood and erosion risks at long-term scales

2. Port reduces overall coastal flood risk

3. Ports and beaches are allies regarding coastal flood risk

Álvarez-Cuesta et al., 2025. Assessing the port footprint on coastal flood and erosion risks. *Accepted Earth's Future*

THANKS FOR YOUR ATTENTION

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