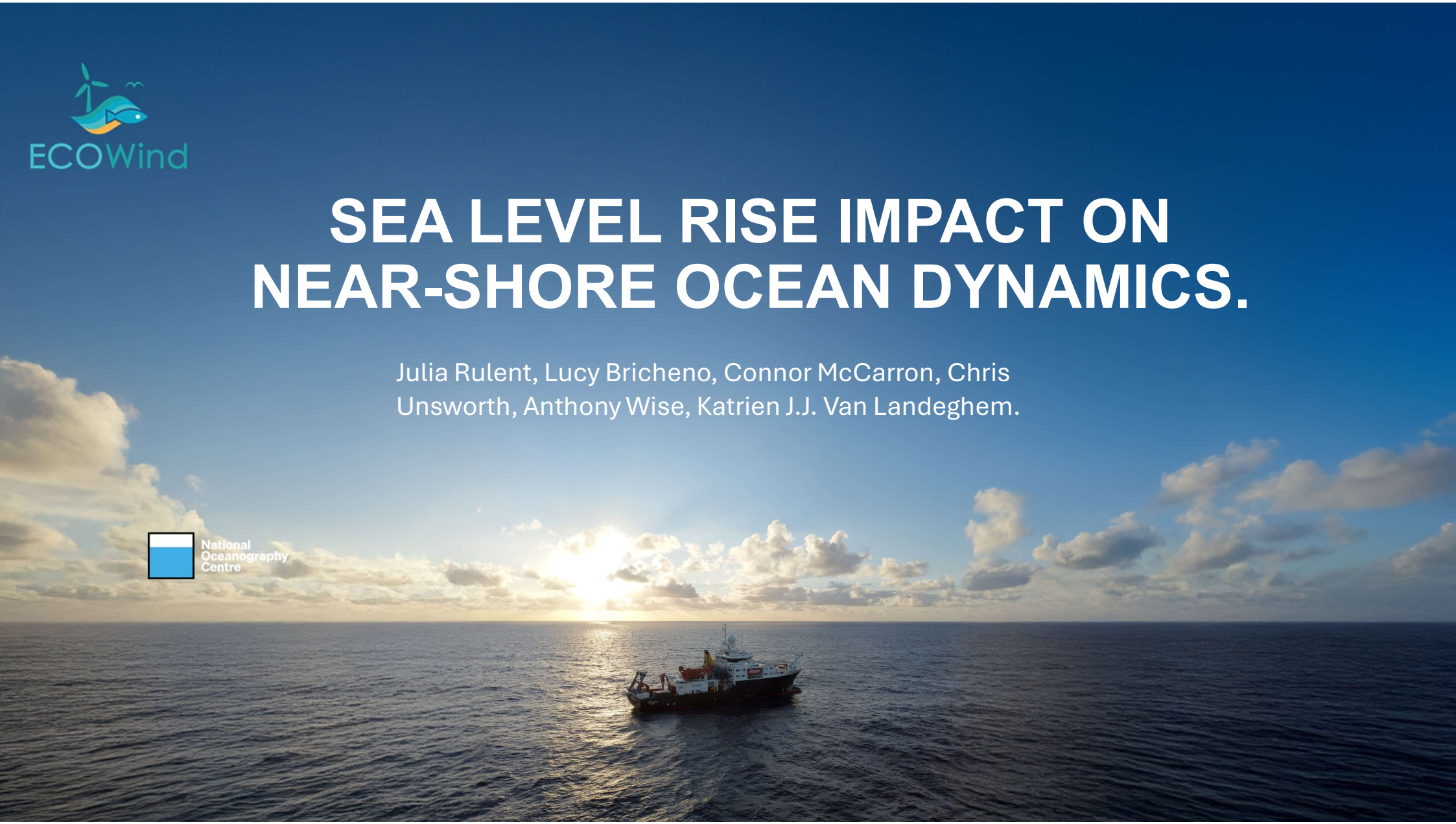


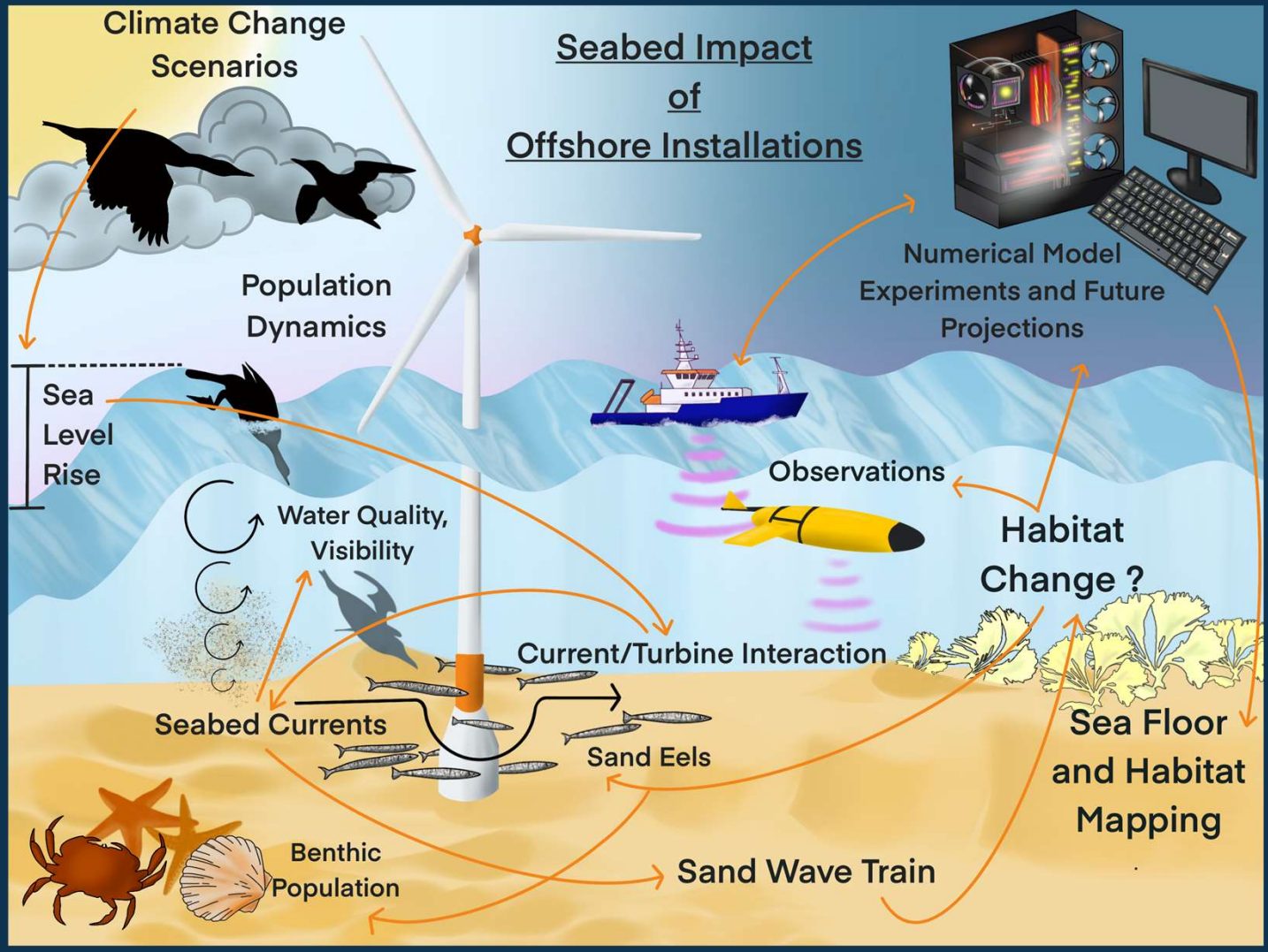
SEA LEVEL RISE IMPACT ON NEAR-SHORE OCEAN DYNAMICS.

Julia Rulent, Lucy Bricheno, Connor McCarron, Chris Unsworth, Anthony Wise, Katrien J.J. Van Landeghem.

Sea level rise affecting ocean dynamics

Nearshore waves depend on water depth

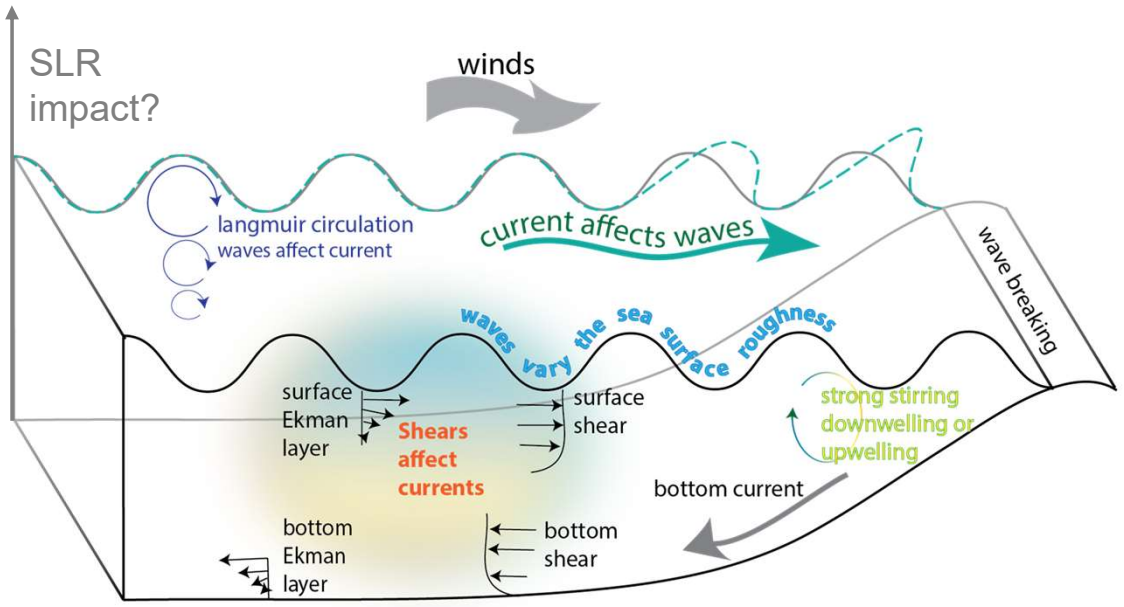
Orbital velocities and bottom stress affected



ECOWind

SEA LEVEL, OCEAN CURRENTS AND WAVES INTERACTION

- Ocean current can **refract** waves affecting they're **propagation**.
- Wave affect **surface stress** which can impact current.
- In **shallow water**, wave can impact **bottom currents and friction**.
- Wave can affect stirring and therefore **upwelling/downwelling** processes.

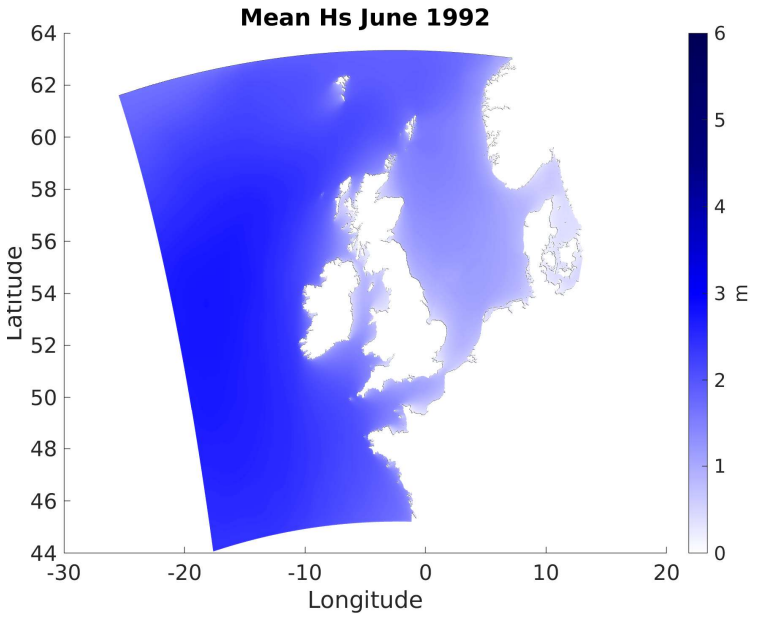


Processes strongly affected by water depth, what happens when the sea level rises?

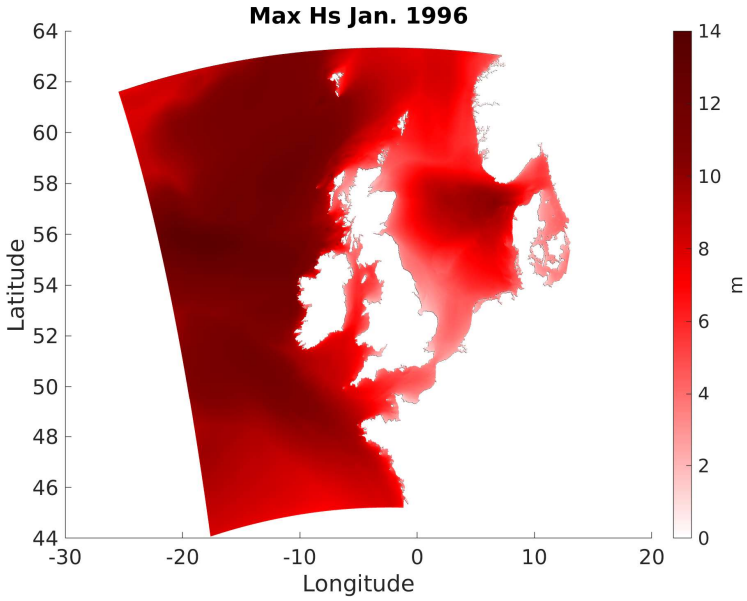
WW3 MODEL

WaveWatchIII configuration:

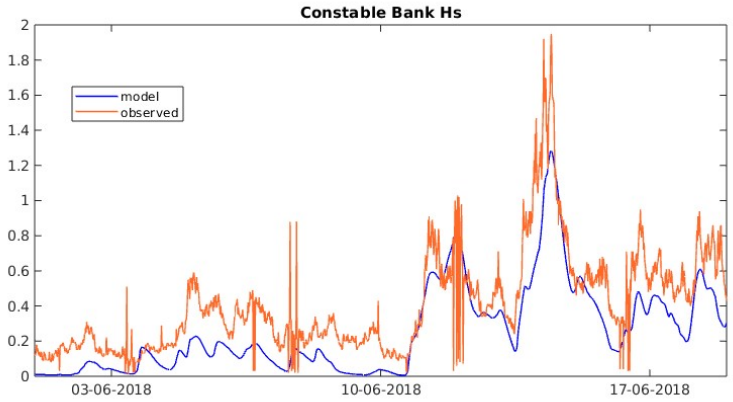
- 1.5km resolution.
- NWEU Shelf domain
- Forcing based on HADGEM3 GCM under RCP 8.5
- Present days and projections:
  - ~0.20m SLR for 2050s.
  - ~0.30m SLR for 2100s.

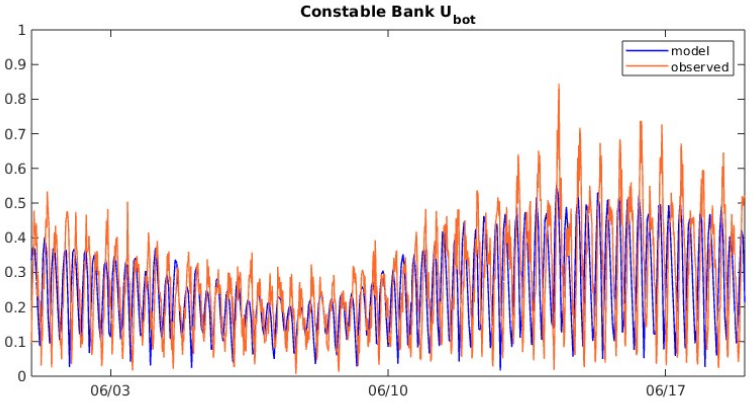


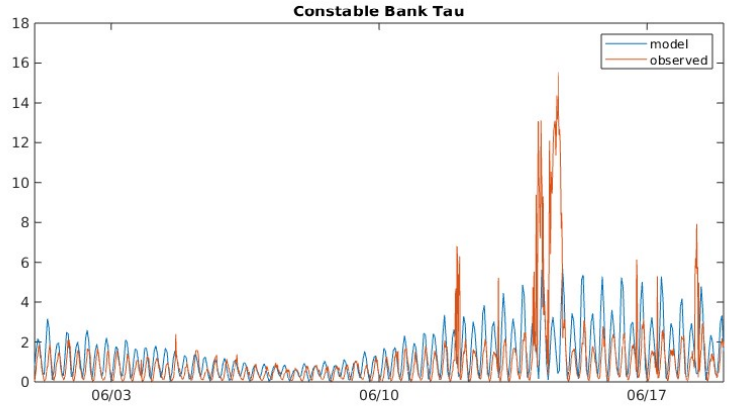
Present day baselines
mean and max Hs for 1990s

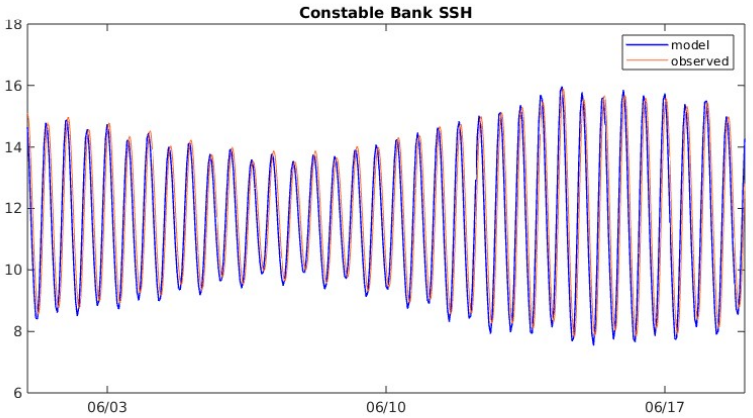


VALIDATION









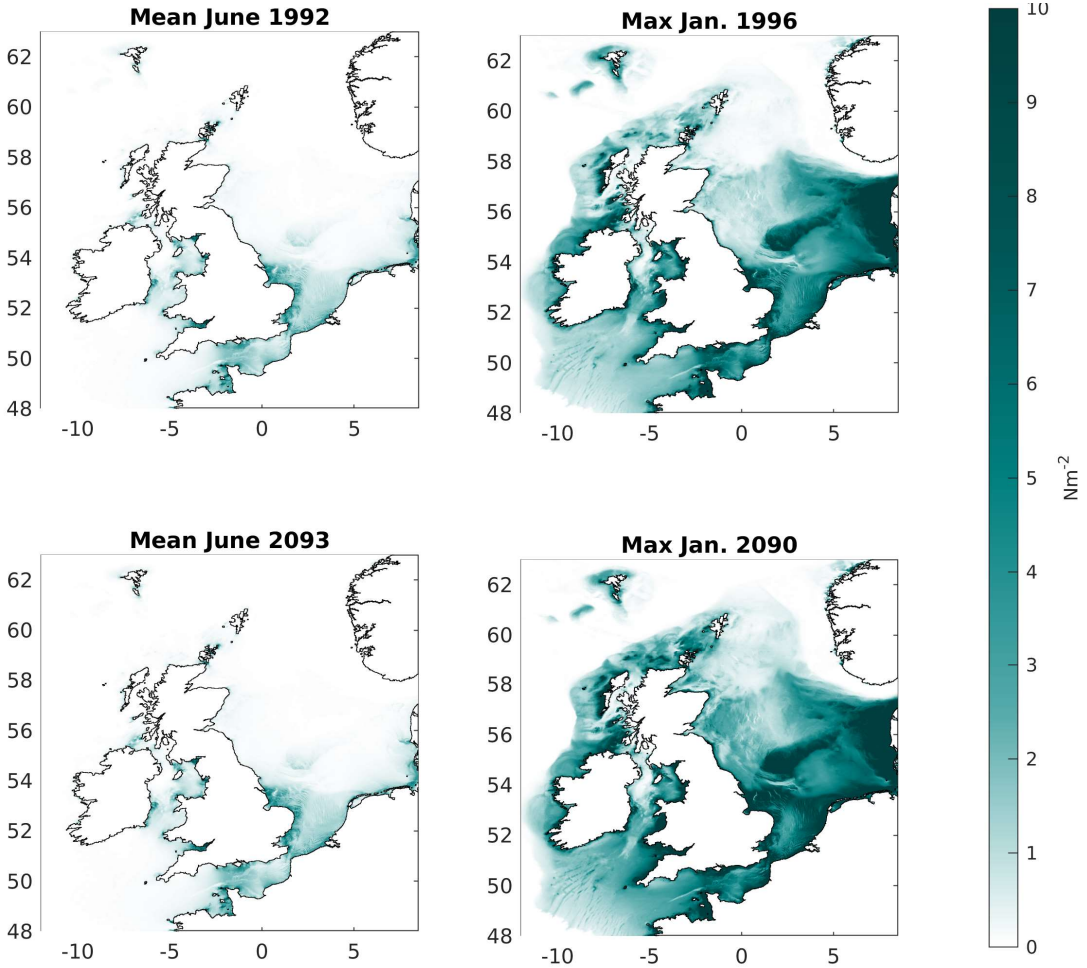
Validating the configuration:

Wave buoys

TGs

Sea bed stress
derived from currents observations, ECOWind field campaign

SEA BEAD STRESS



Seabed stress estimated from:

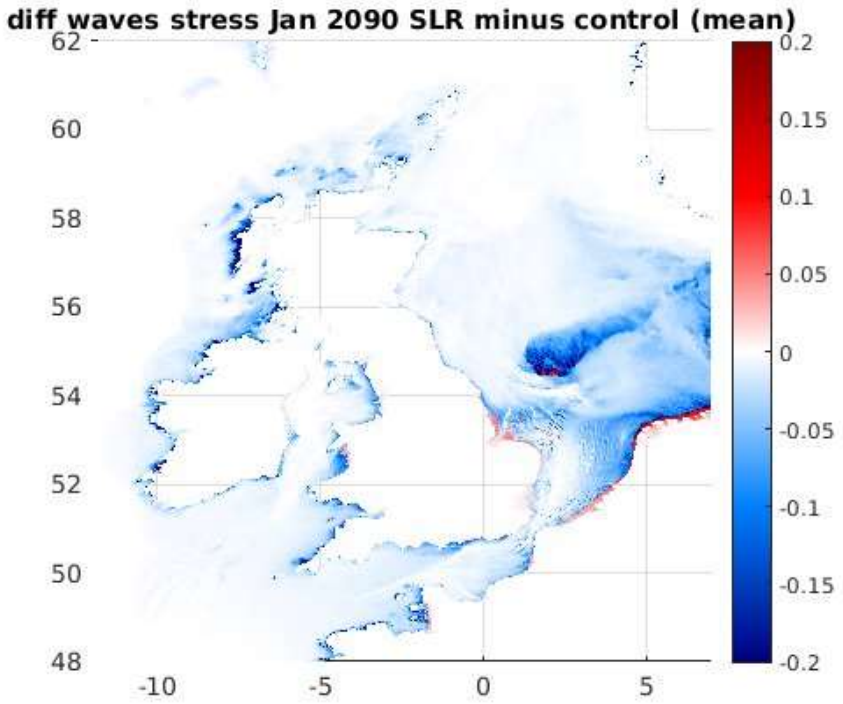
bottom **ocean current** (NEMO)
+
wave orbital velocities deriver **current** (WWIII)

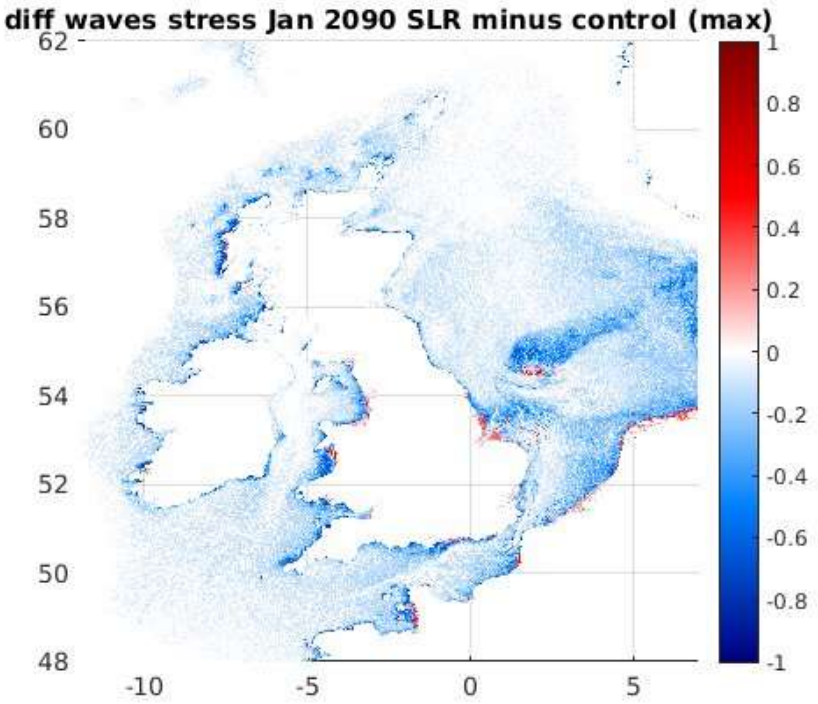
SLR results in an **overall reduction** in energy reaching the sea floor

The **stress** on the bed is slightly **reduced** on **average** (mean 1992 vs mean 2093).

In **winter**, now and in future, the biggest **waves** (storms) are a **dominant signal**.

WAVE STRESS CHANGES (WINTER)

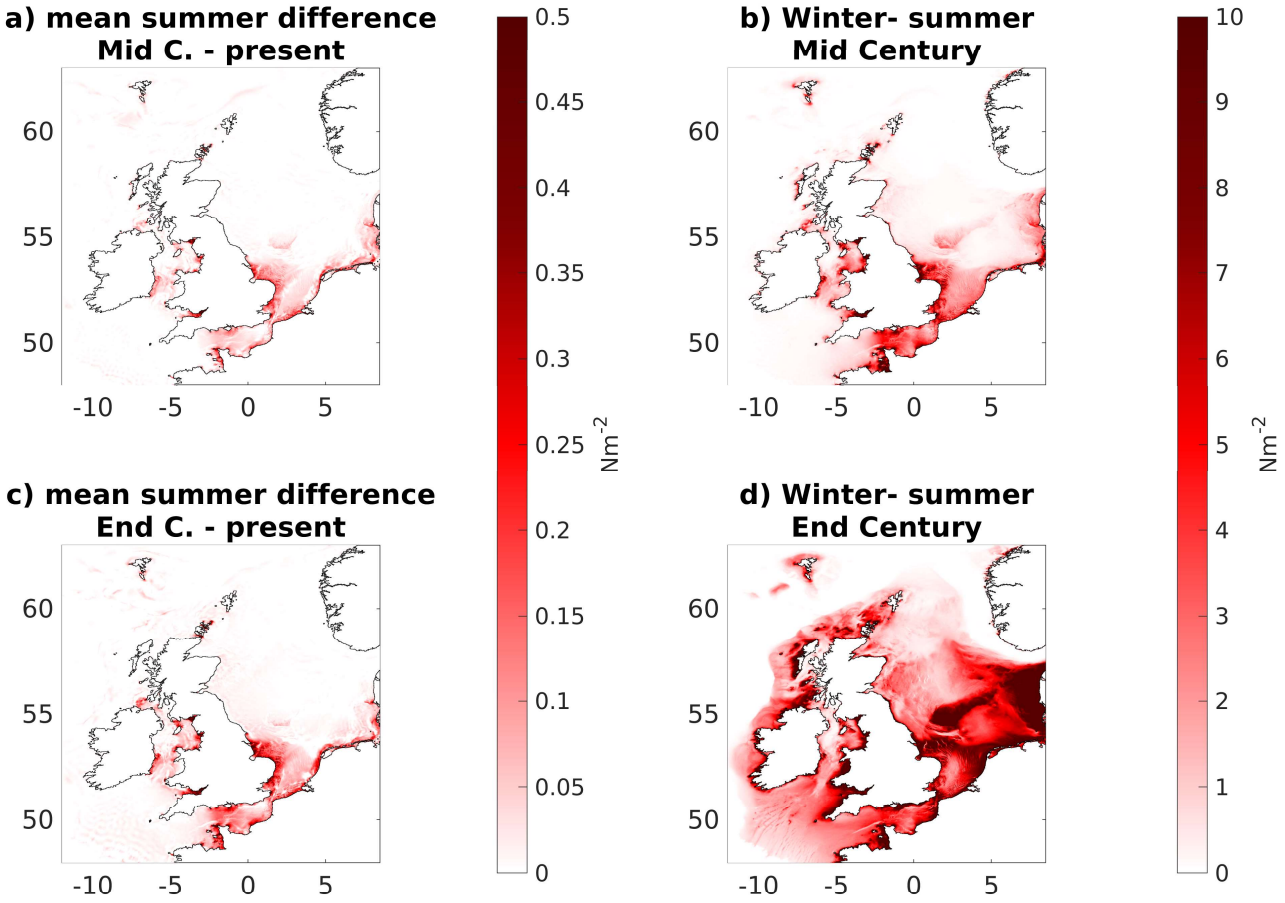




•deeper water decouples waves from the bed, so overall impact on the seabed stress is pretty small.

•NB decoupling also means more energy reaches some coasts (e.g. North Norfolk, German Bight)

IMPORTANCE OF STORM WAVES



This a case study, it is not a representative statistic of future conditions

Winter **storm** waves have a **big impact** over the bed.

The impact of extreme storm waves is **an order of magnitude higher** than the background signal.

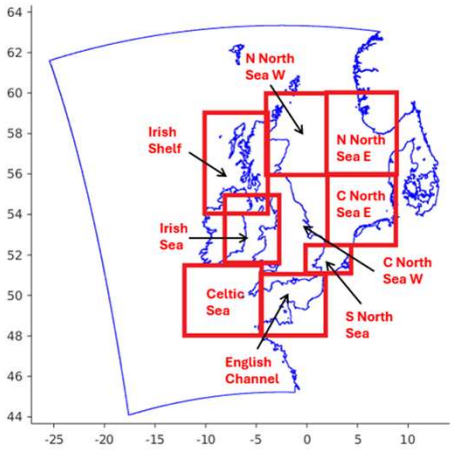
In this scenario, the effect **increase** with storms intensifying in future.

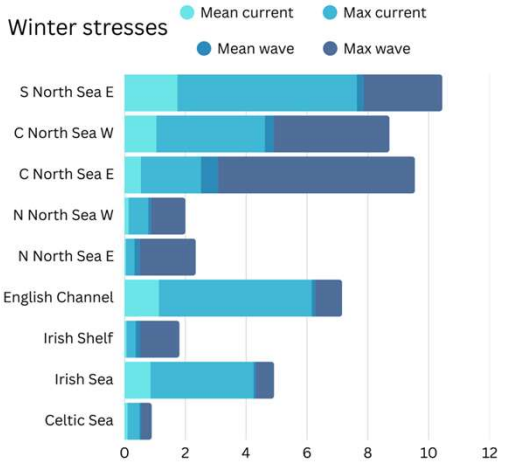
CONTROLLING PROCESSES

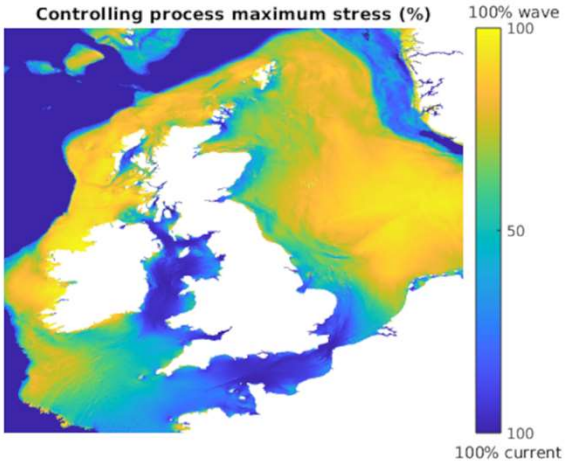
Where will waves matter the most ?

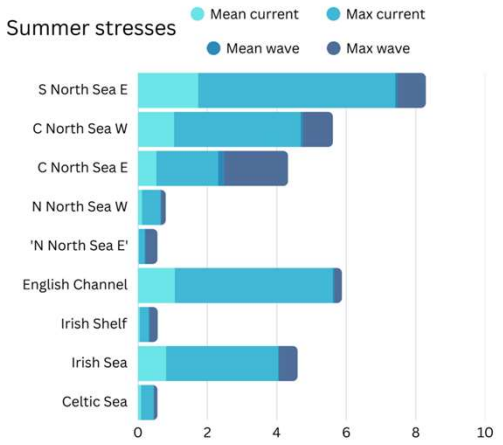
Different **controlling processes** are **dominant** in **different regions**.

The impact of waves will be particularly important over UK's **Atlantic facing coasts** and **shallow water** regions.









CONCLUSIONS:

The effects of waves onto the sea floor will change with sea level rise.

An increased water level will decouple wave from the seabed, leading to an overall reduction of seabed stress.

The impact of storms (bigger waves) can be up to an order of magnitude higher than that of the background signal, having a much bigger impact on the seabed.

National Oceanography Centre

THANK YOU