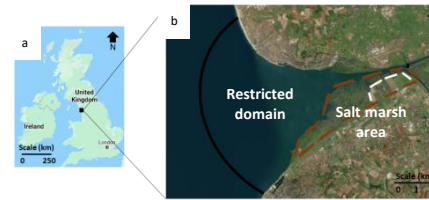


## 1) Aim and objectives

Investigate marsh resilience under various scenarios of climate and environmental change using a sediment budget approach:

- Study n. 1 investigates changes in sediment budget in relation to storm surges and sea-level rise using Delft 3D.
- Study n. 2 investigates changes in sediment budget in relation to sediment supply and embankment construction using a combination of paleoenvironmental analysis and Delft 3D.

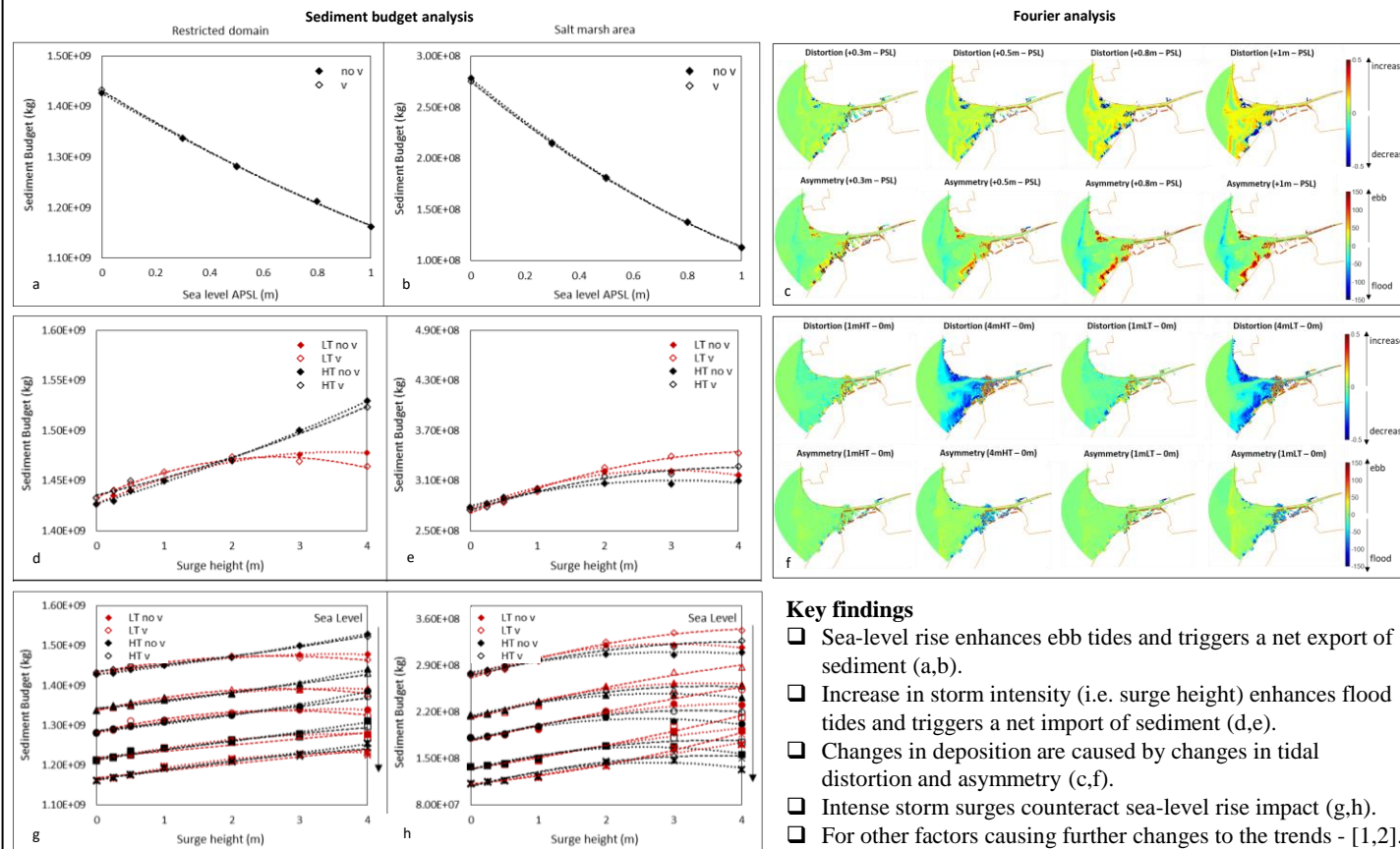


## 2) Study site

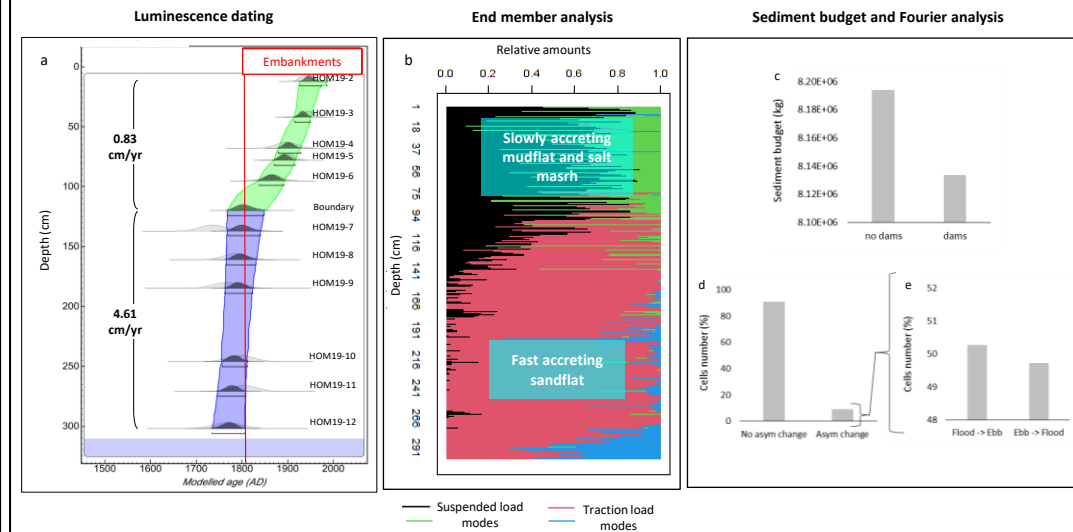
Ribble estuary, North West England:

- Funnel shaped, hypertidal.
- Widespread anthropogenic interventions including embankment construction since 1810.
- One of the largest tidal flat - salt marsh complexes in Europe, part of which recently restored through managed realignment.
- Marsh accreting at a fast rate, previously thought to be linked to embankment presence.

## 3) Study n. 1 - Sea-level rise threatens marsh resilience but intense storm surges counteract sea-level rise impact



## 4) Study n. 2 – Embankments threaten marsh resilience but high sediment supply helps marsh survival



## Key findings

- The rapid accretion precedes embankment construction (a).
- Correlation between accretion rates (a) and natural evolution of the system from rapid accreting sandflat to slower accreting mudflat and salt marsh (b).
- Geochemistry correlated sediment supply to the marsh platform with sediments from the bed of the Irish Sea, characterised by high quantity of mobile sediment, legacy of Irish Sea Glacier [3].
- Embankments enhanced ebb tides and increased sediment export (c,d,e).

## 5) Conclusions

- Sea-level rise and embankment construction threaten marsh resilience.
- Intense storm surges and high natural sediment supply help marsh survival.

## References

- [1] Panno<sup>1</sup> et al. (2021). *Geomorphology*, 389 (4): 107825. [2] Panno<sup>1</sup> et al. (2021). *Data in Brief*, 38: 107336. [3] Panno<sup>1</sup> et al. (2021). *JGR: Earth Surface*, In Review.

## 6) Future research

Using a combination of Delft3D, field monitoring and machine learning to characterise spatial variability of storm deposits on salt marsh platforms.