

THE WINTER STORMS OF 2013/14: OCEANOGRAPHY AND COASTAL IMPACTS

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**COASTAL
RESEARCH
WITH
PLYMOUTH
UNIVERSITY**

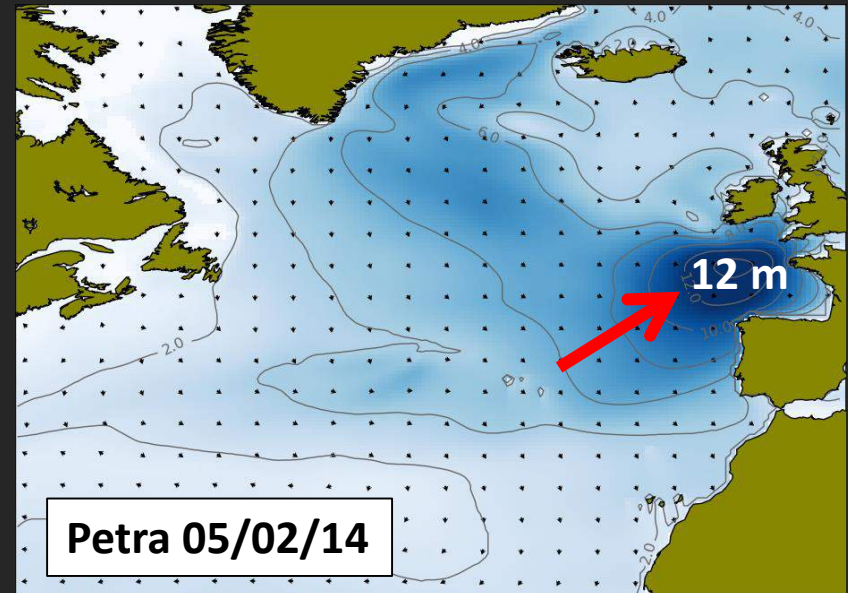
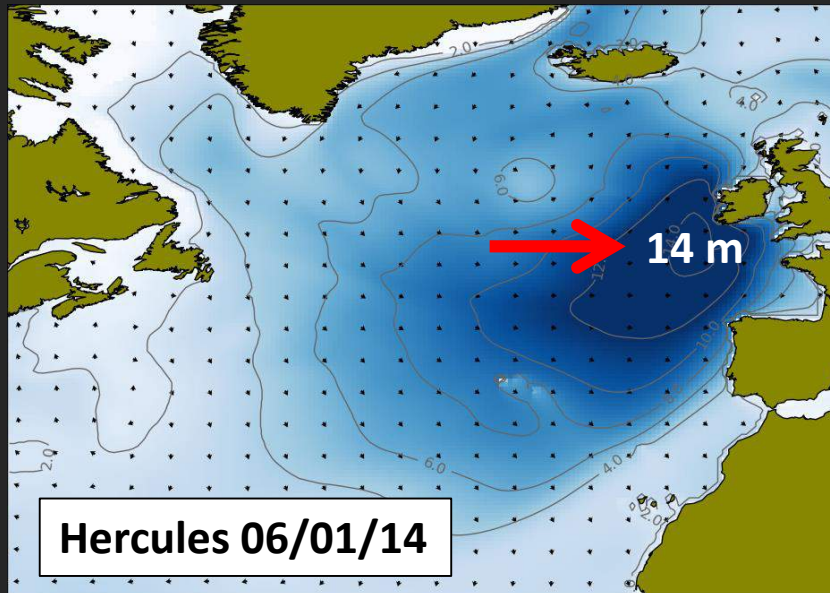
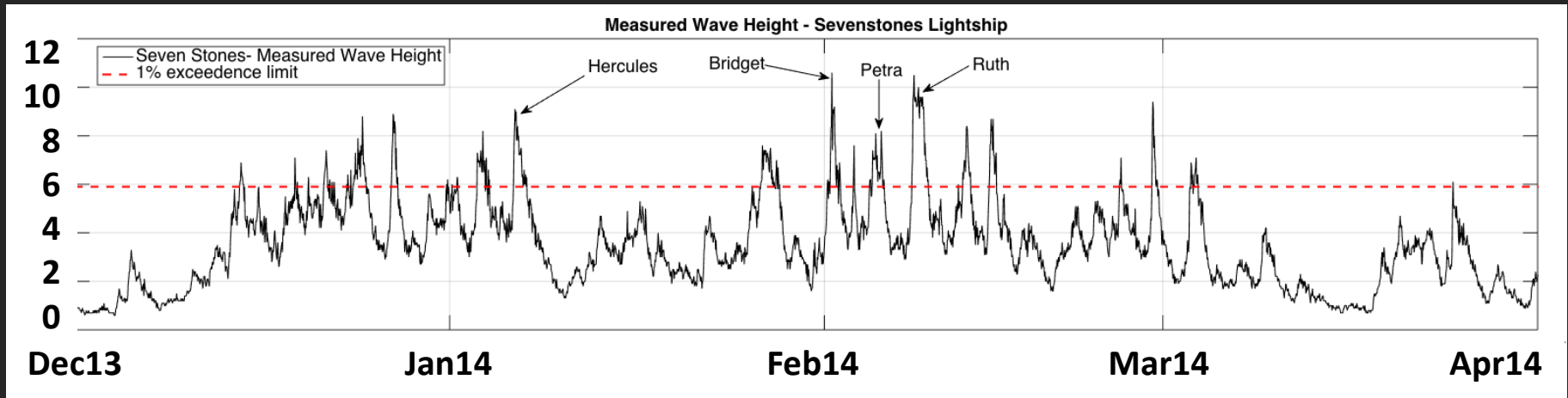
**Coastal Futures
2015**

OUTLINE

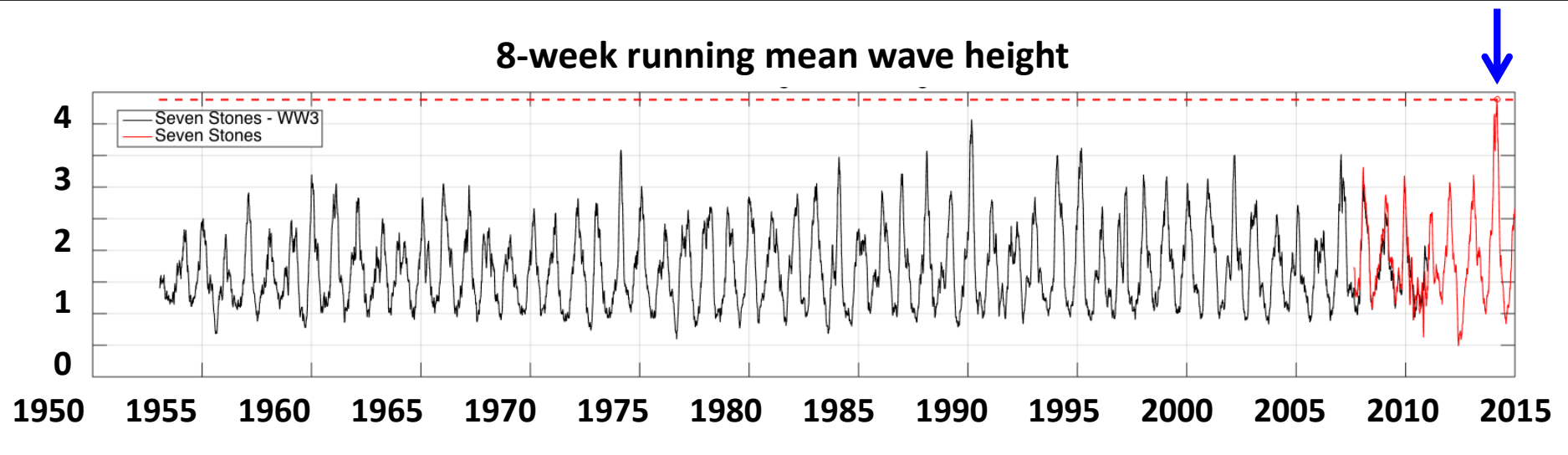
- **Wave conditions during 2013-2014 winter**
- **Pictorial overview of storm impacts in SW England**
- **Regional overview of coastal response in SW England**
- **Coastal response on the North coast – Perranporth**
- **Coastal response on the South coast – Slapton Sands**
- **Conclusions**

WINTER STORMS OF 2013/14

Measured and modelled wave heights

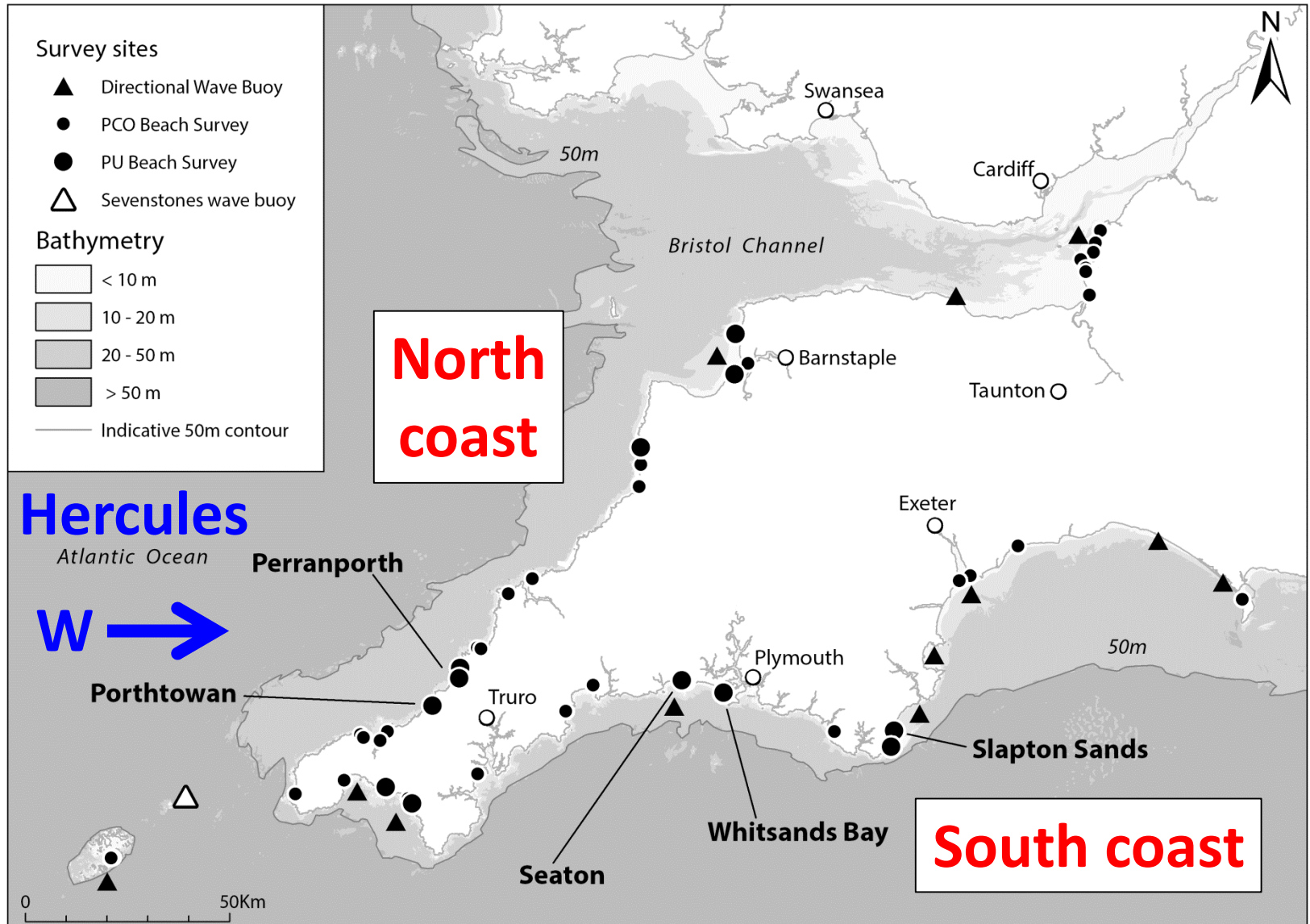


Comparison 2013/2014 winter with 60-year wave record



PHOTOGRAPHIC OVERVIEW OF IMPACTS

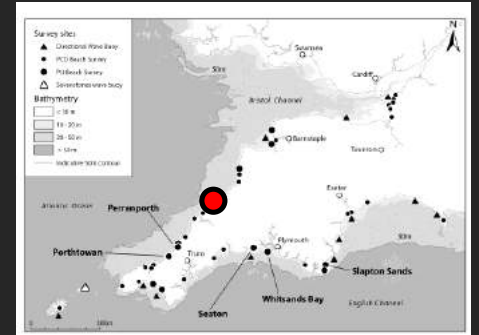
Southwest coast of England



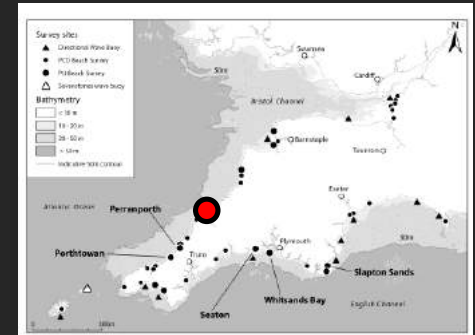
Overwash gravel ridge at Westward Ho!, North Devon



Before Hercules



Removal of Whipsiderry beach, North Cornwall



Before Hercules



After Hercules

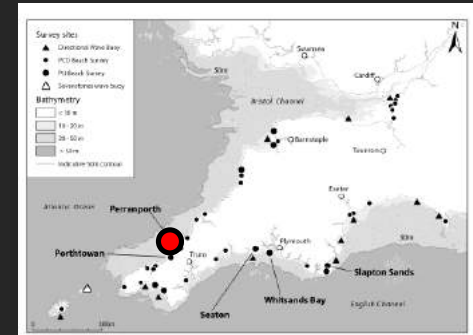


Destruction of sea defence, Fistral Blu bar, Newquay



Beach erosion, Perranporth, North Cornwall

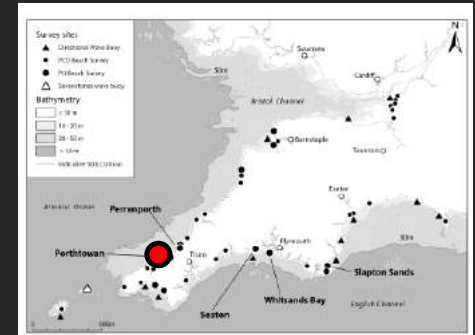
End of summer 2013



After Hercules



Removal of Monkey House, Porthreath, North Cornwall



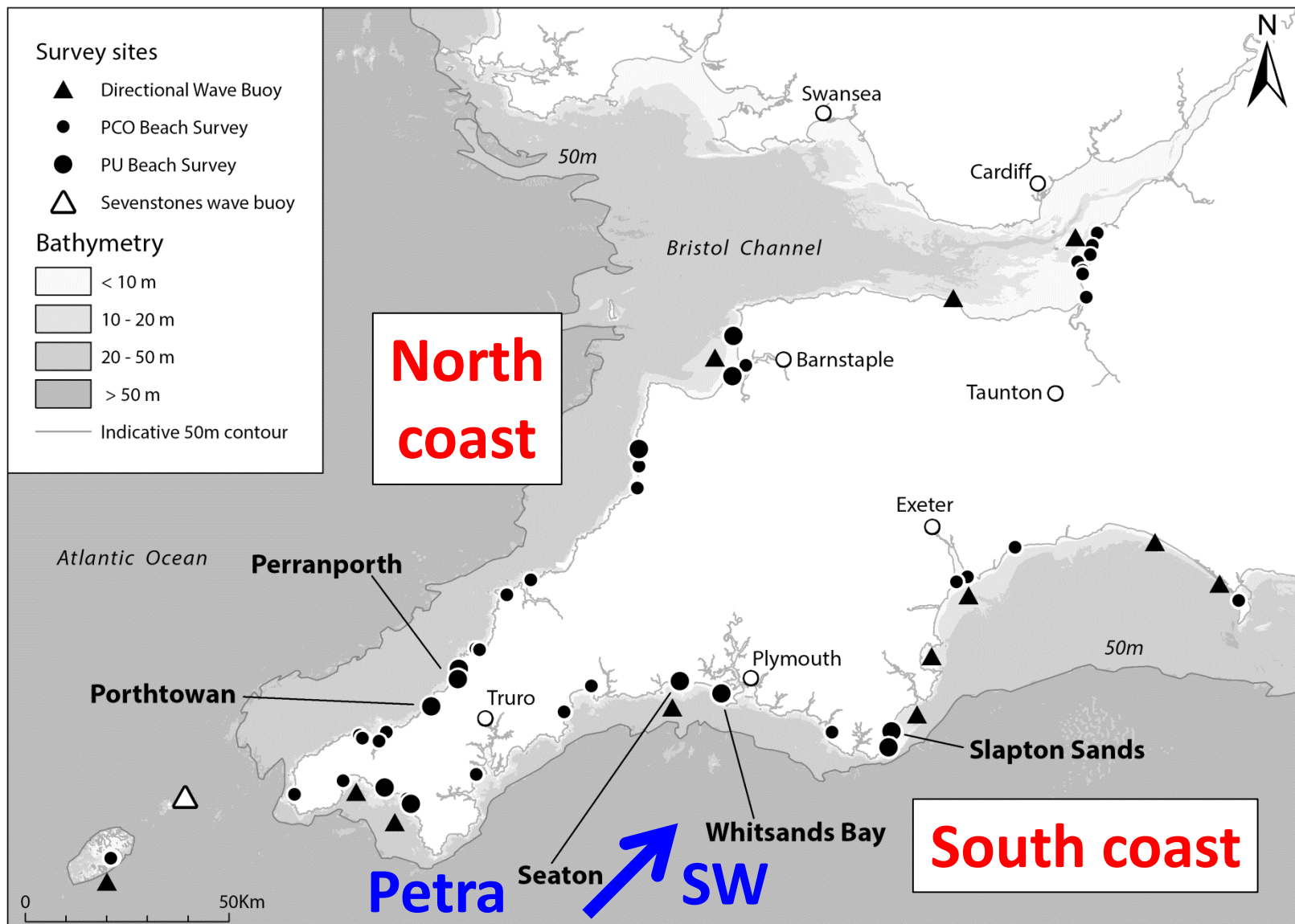
Before Hercules



After Hercules

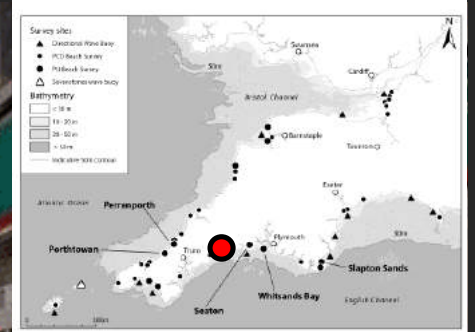


Southwest coast of England

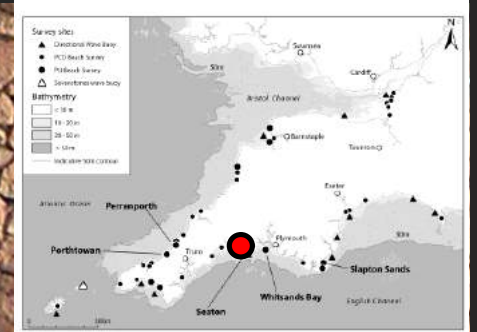


Coastal flooding, Porthleven, South Cornwall





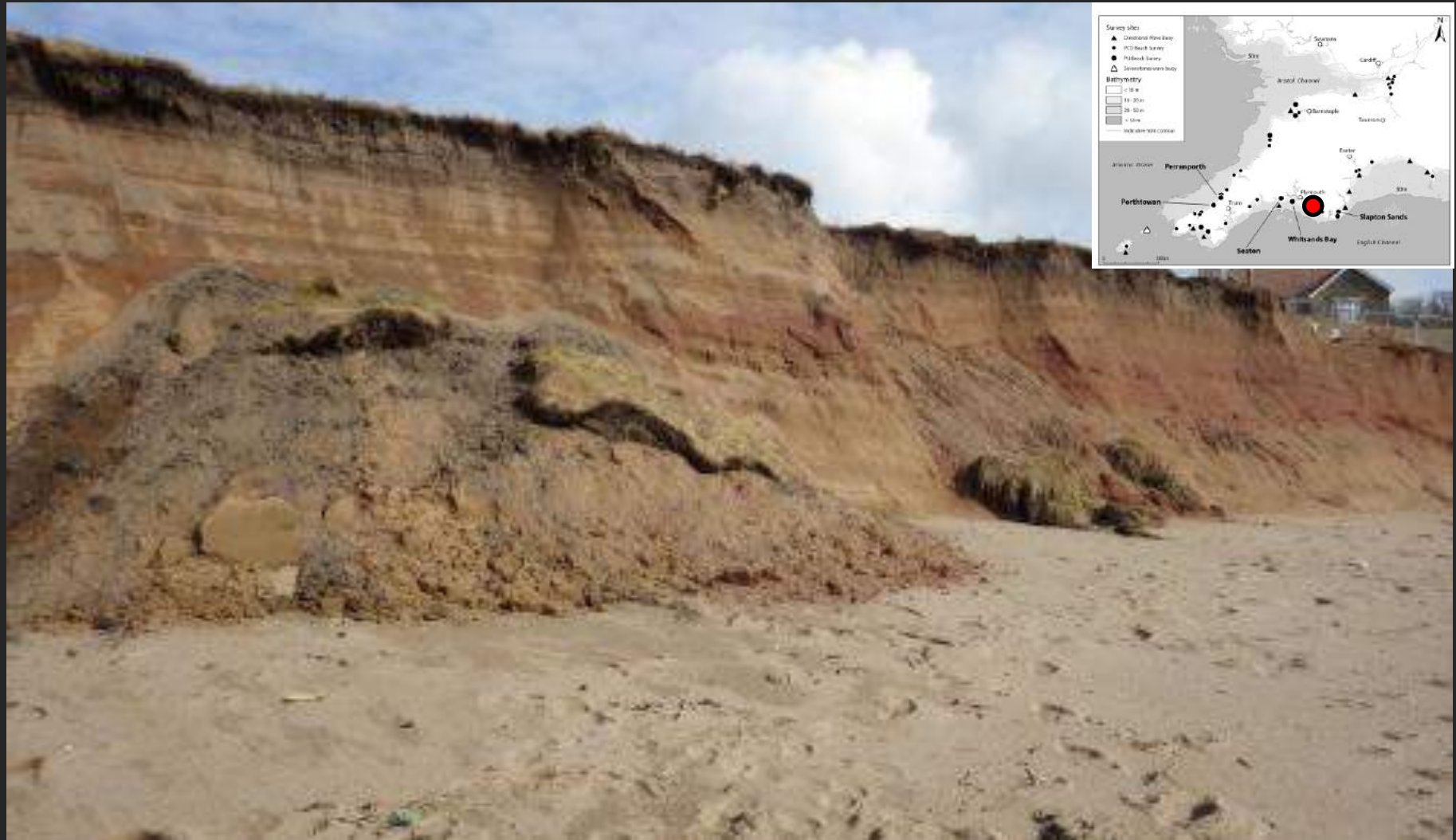
Beach lowering, Seaton, South Cornwall



Hot Wok Restaurant, Plymouth, South Devon

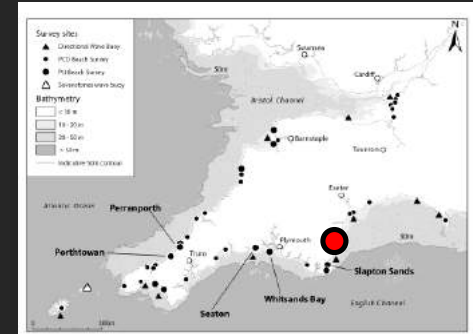


Dune erosion, Thurlstone, South Devon



Removal of beach in Torcross, South Devon

End of summer

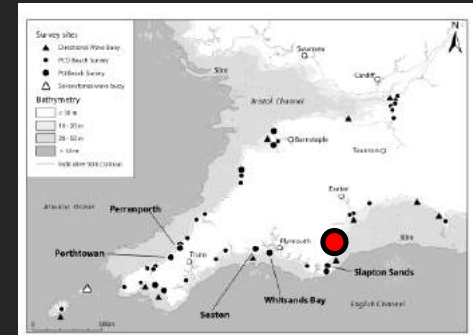


During Petra



Removal of beach in Torcross, South Devon

End of summer



After Petra

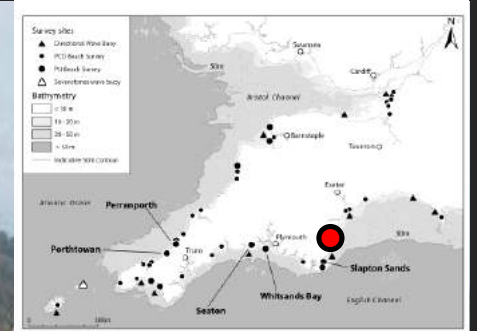


Gravel on road, Slapton Sands, South Devon

Before Hercules



After Hercules



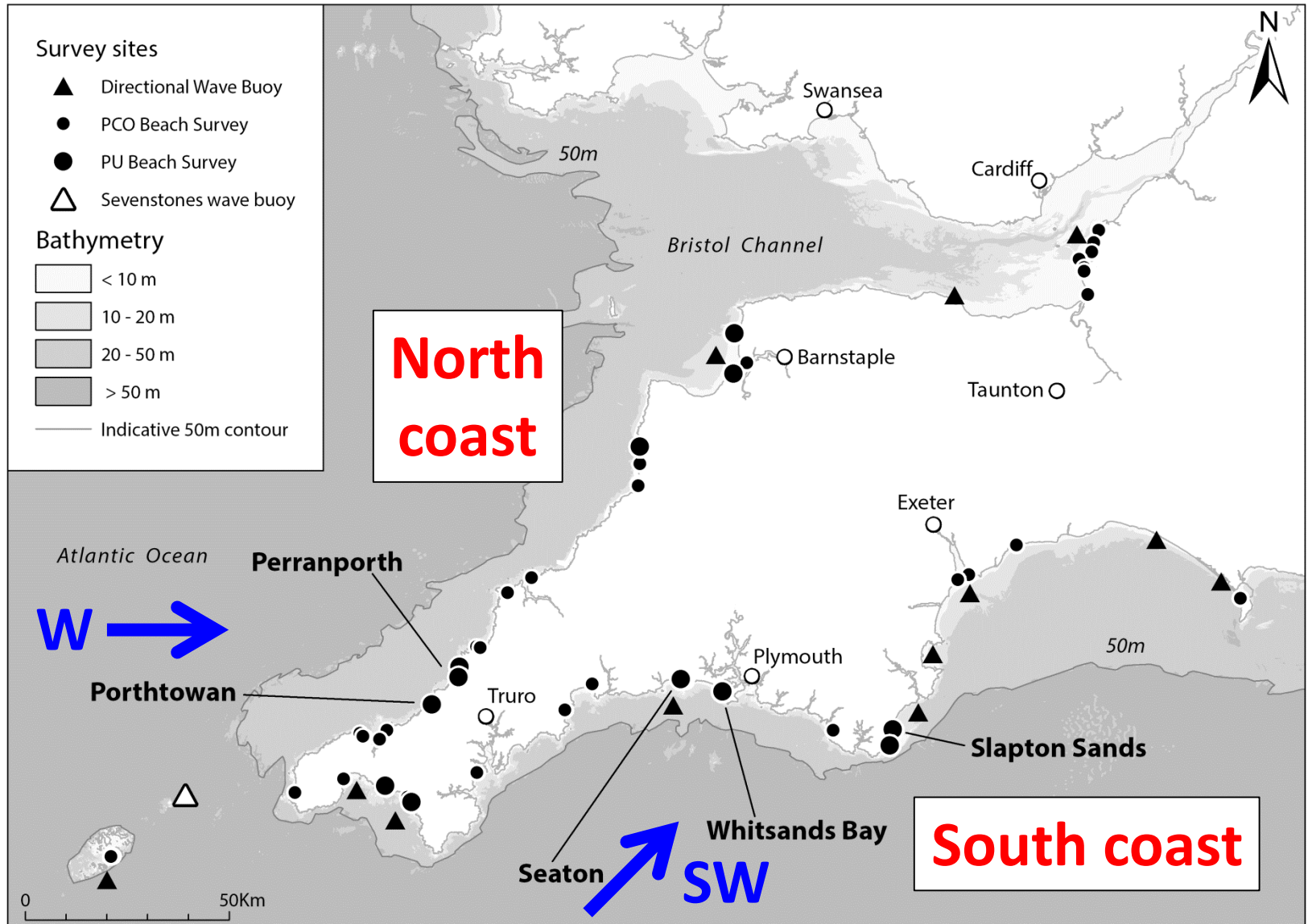
Damage to SW railway line, Dawlish, South Devon



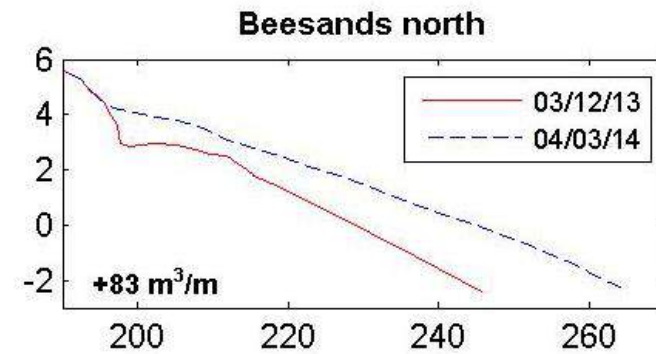
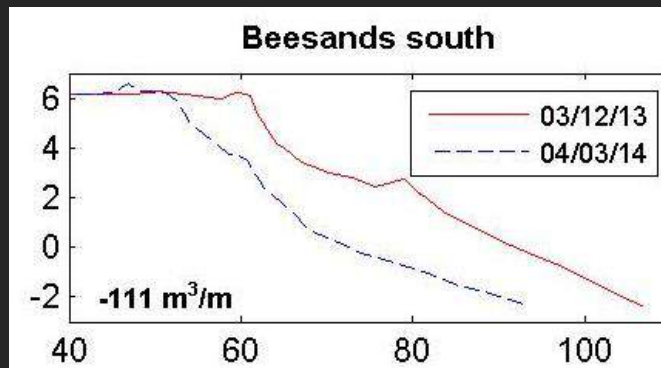
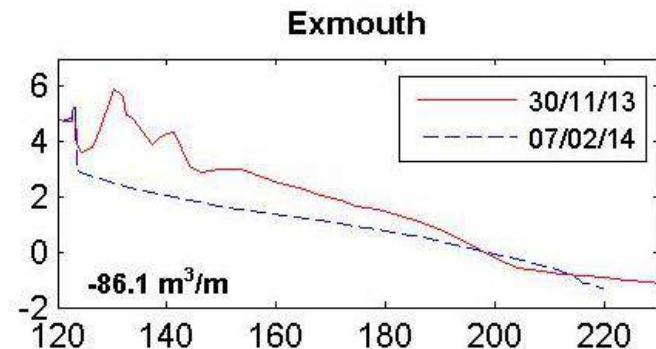
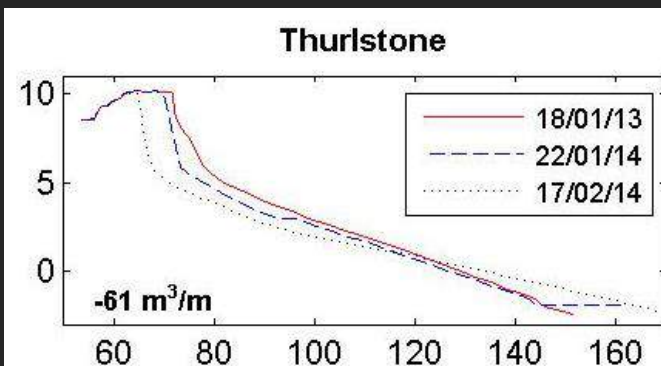
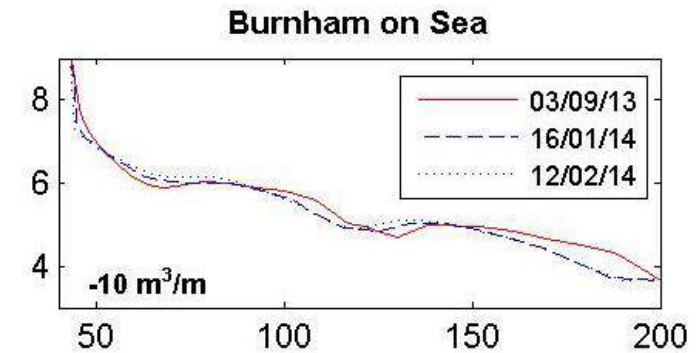
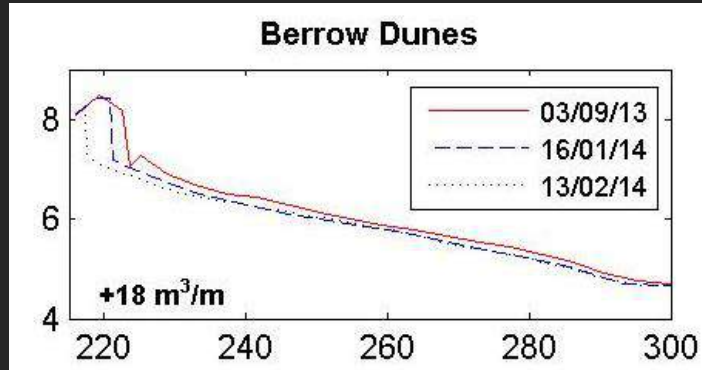
Cost: £1M per day to the SW economy

COASTAL IMPACTS – REGIONAL OVERVIEW

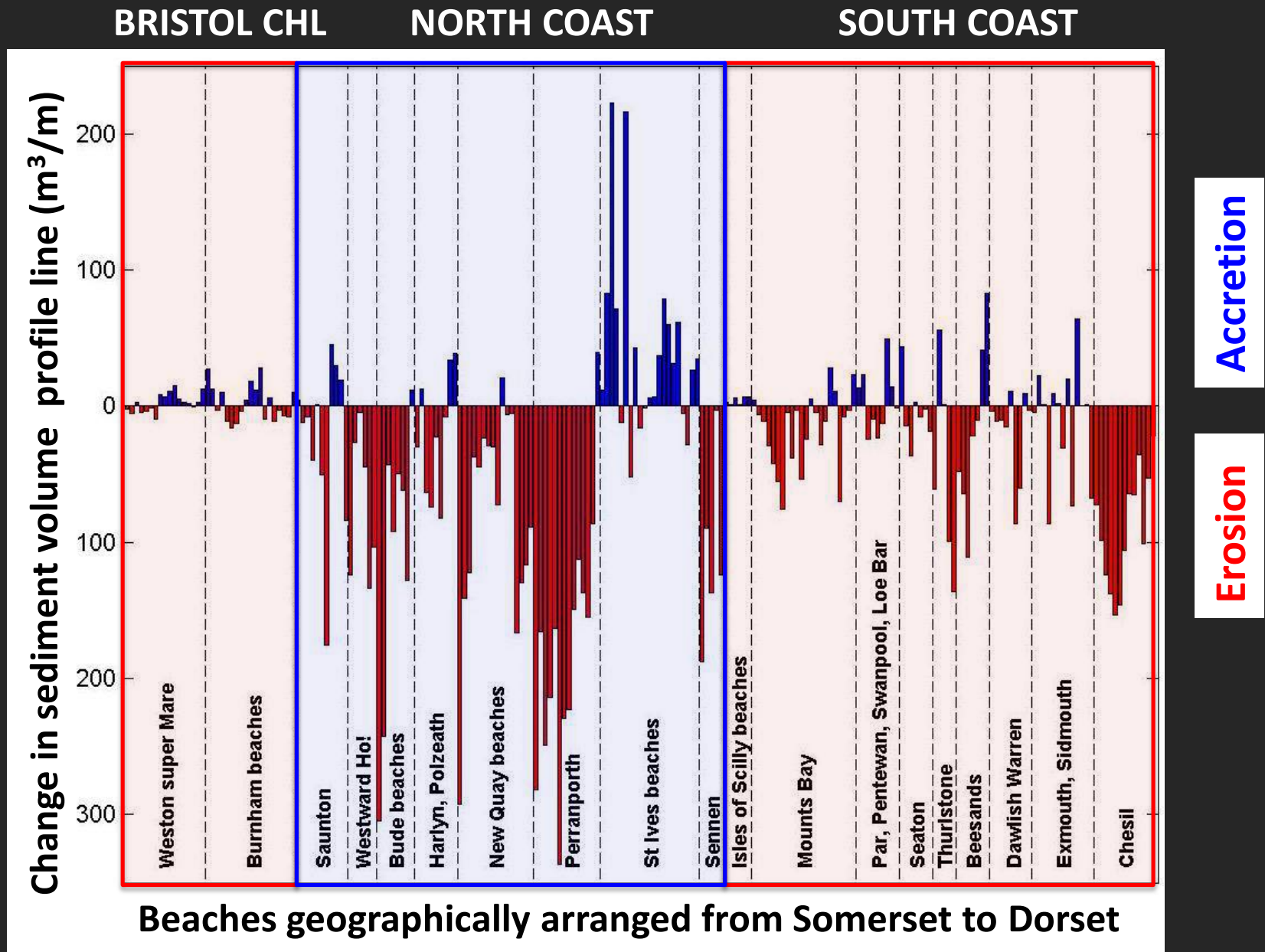
SW England and PCO beach monitoring sites



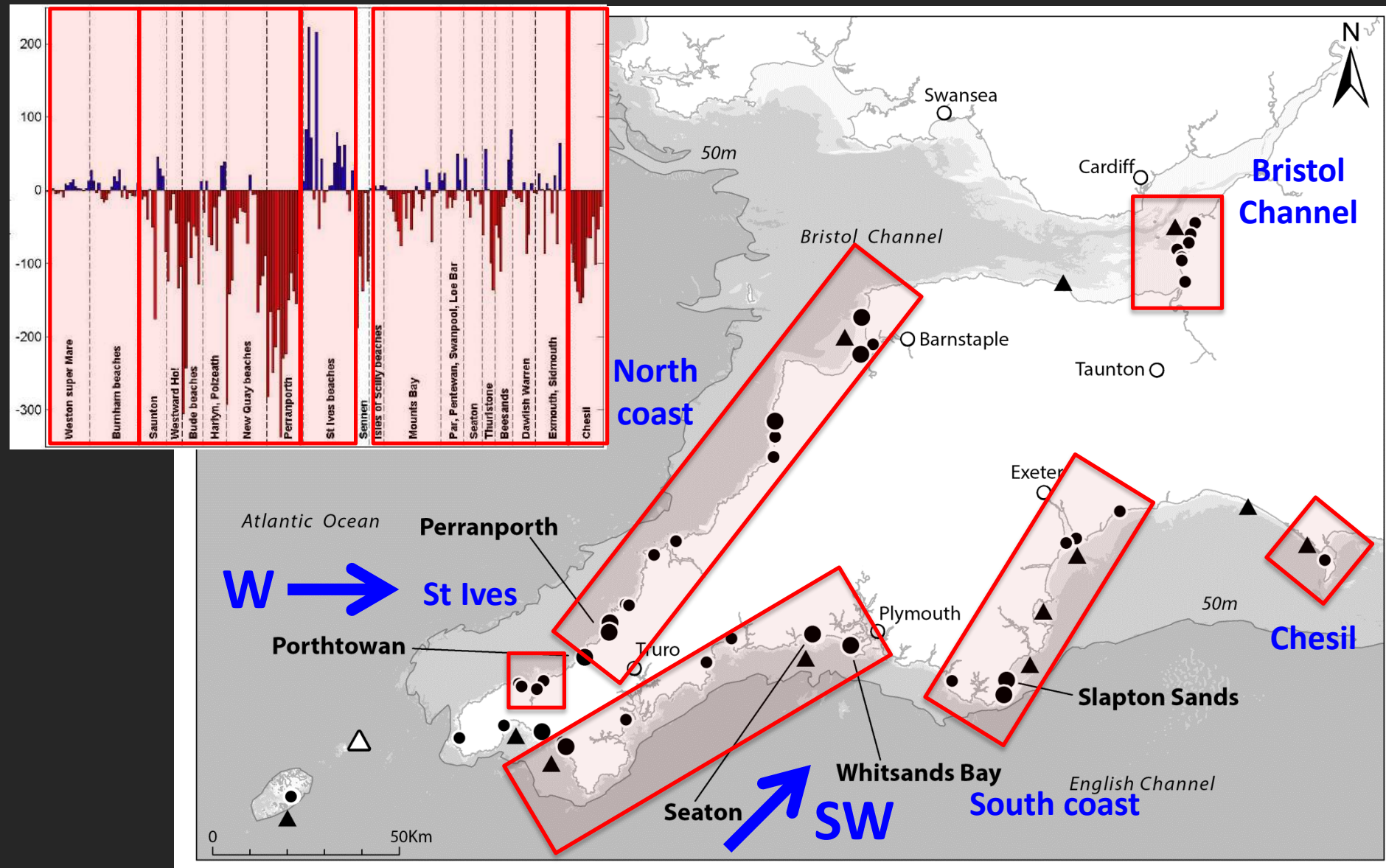
Beach monitoring (> 30 beaches, >200 profiles)



Storm impacts along coast of SW England – per profile



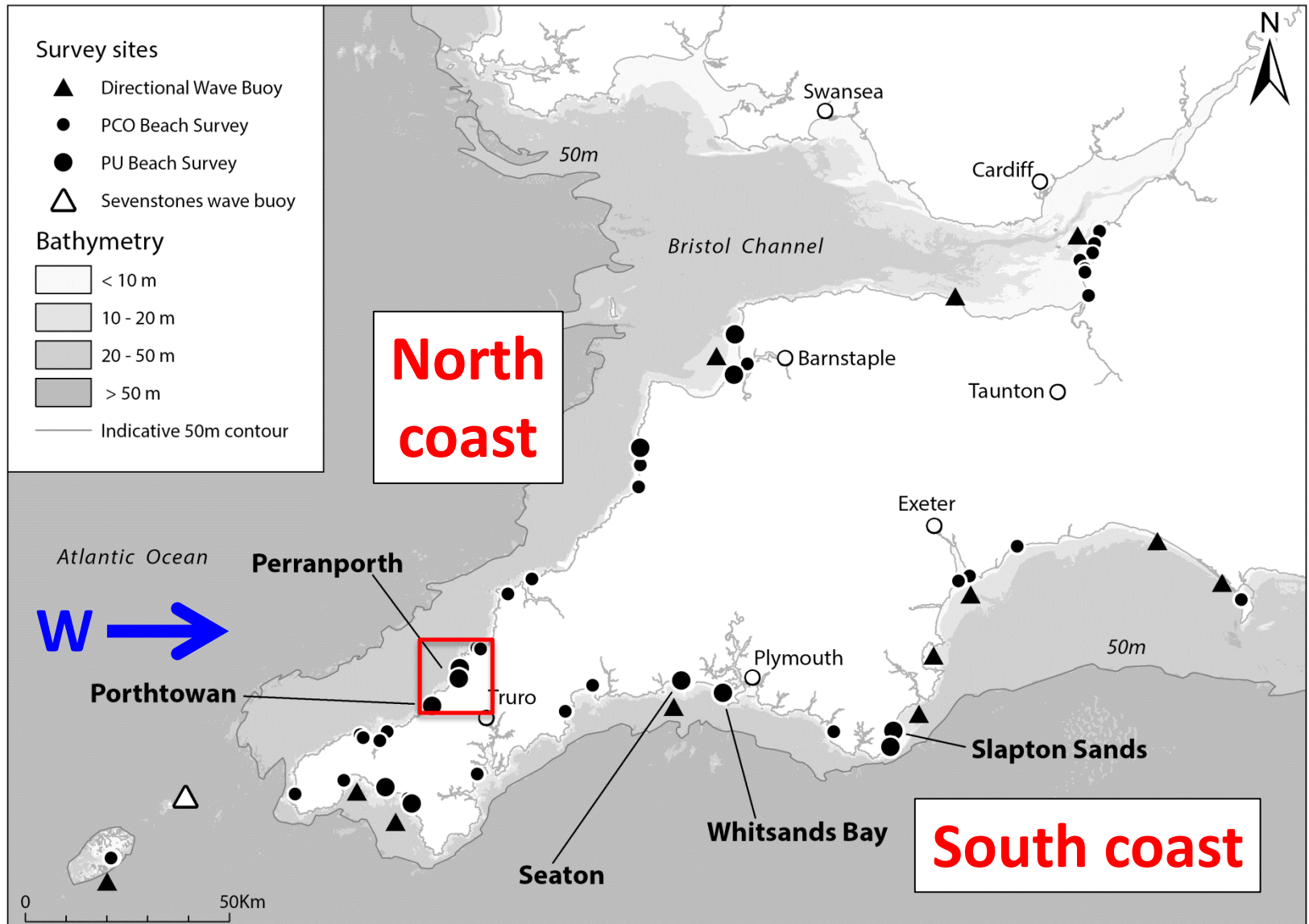
SW England and beach monitoring sites



COASTAL IMPACTS – NORTH COAST

Perranporth

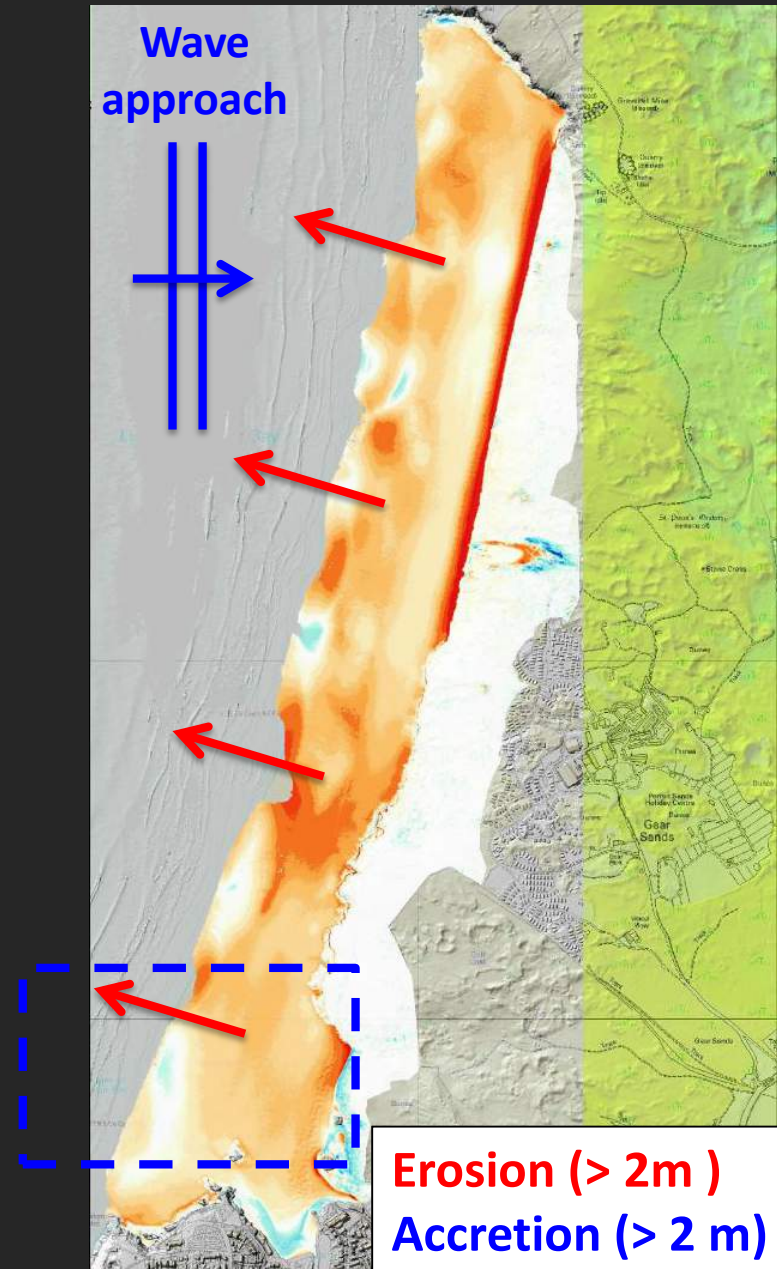
Impact of Hercules on Perranporth



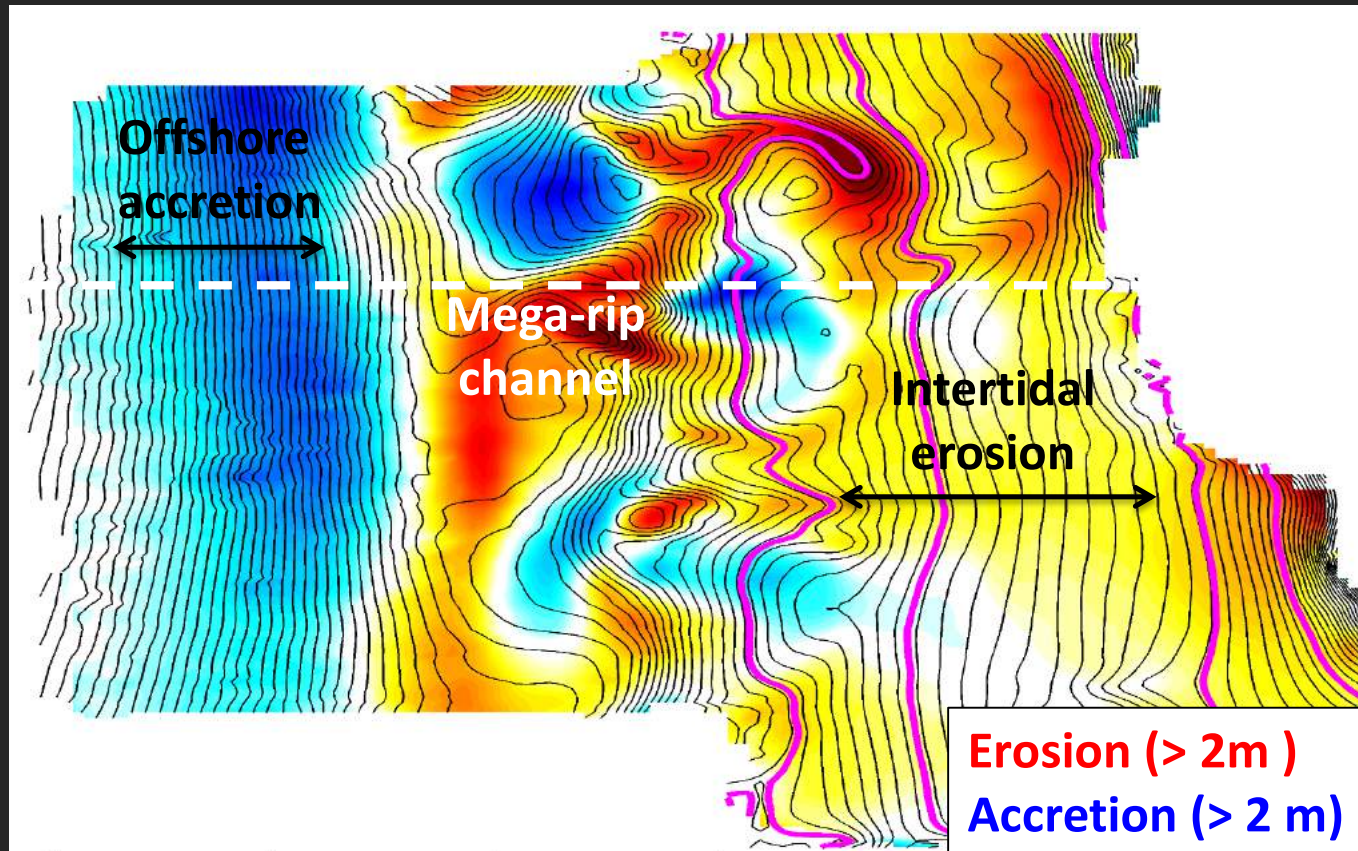
Perranporth beach in summer



Perranporth response from LiDAR (Hercules)

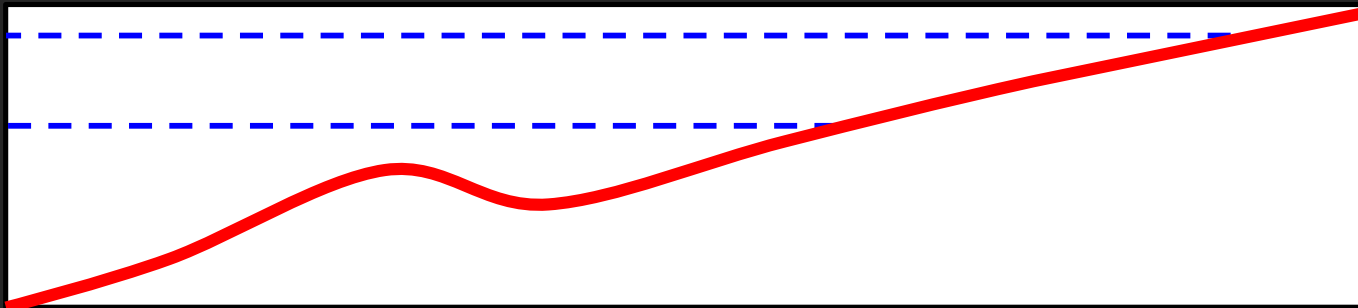


Where has the sand gone?



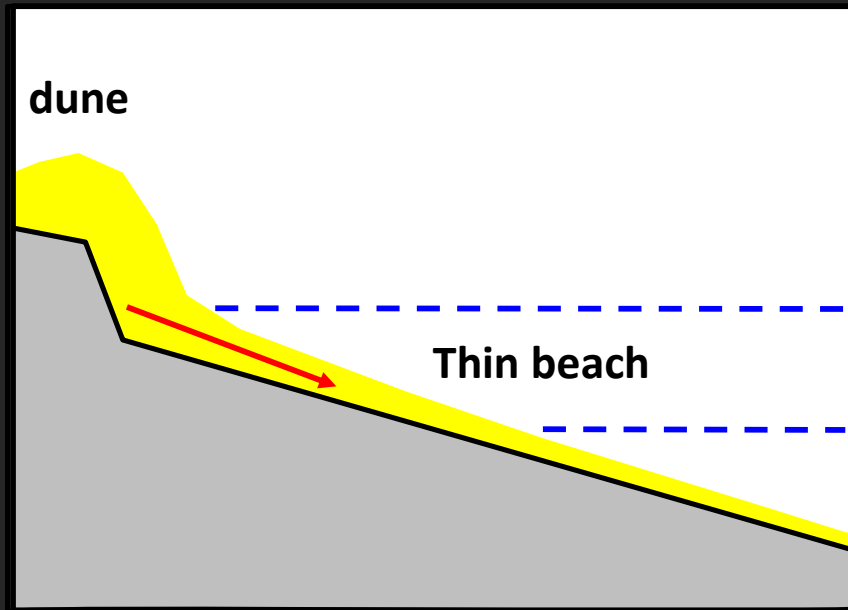
High tide

Low tide

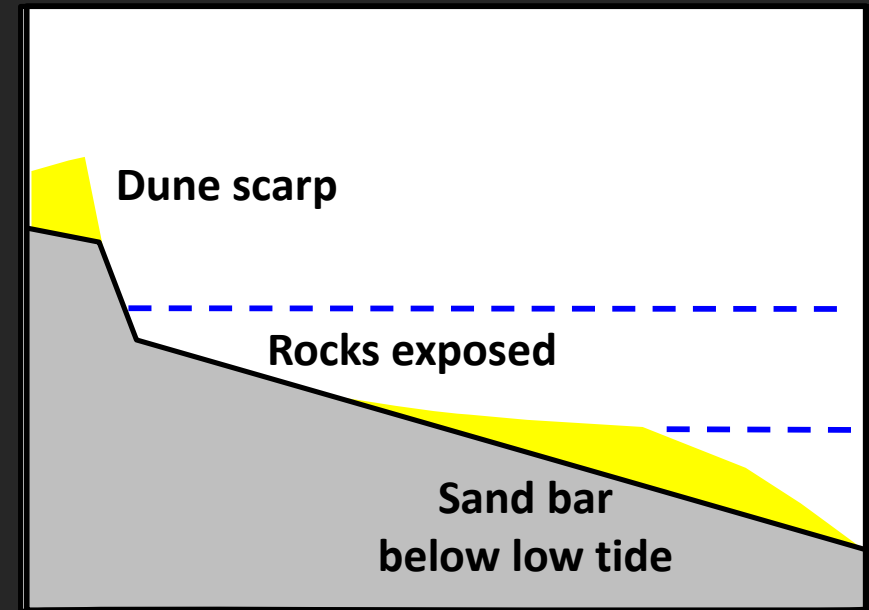


Offshore sand model – North coast

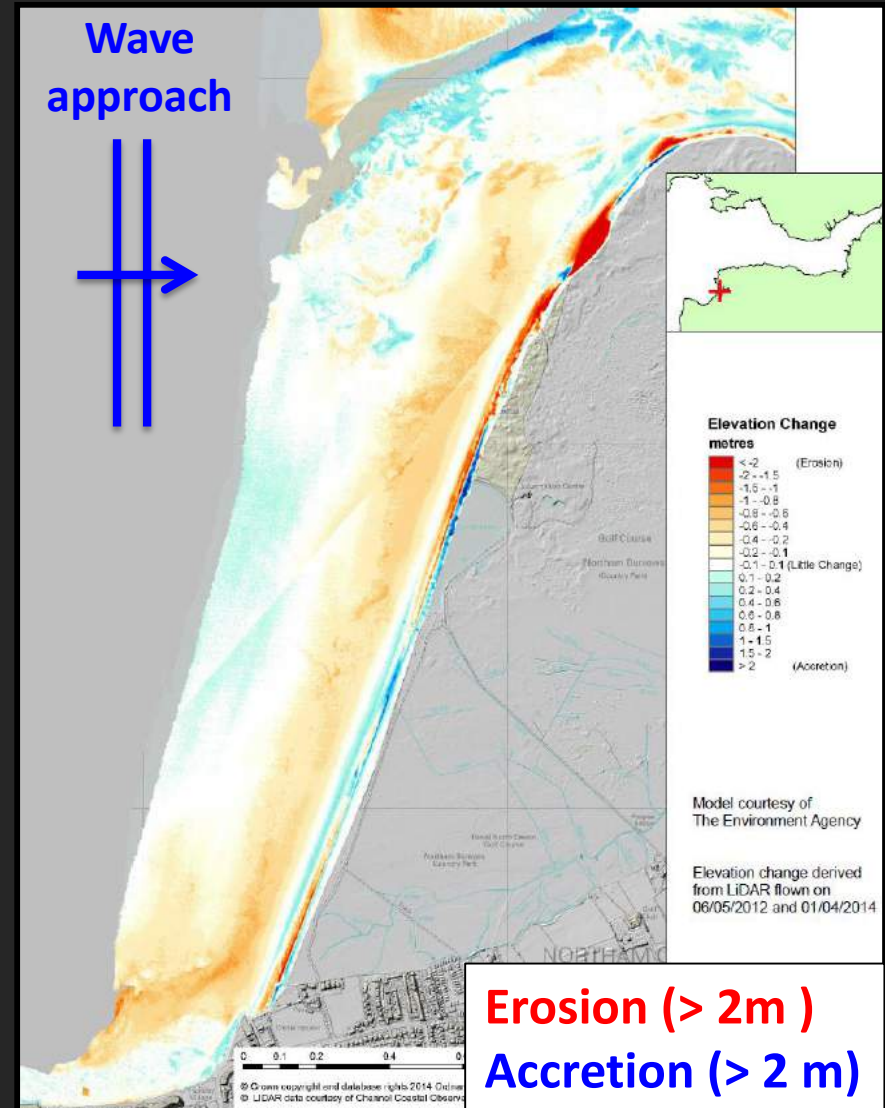
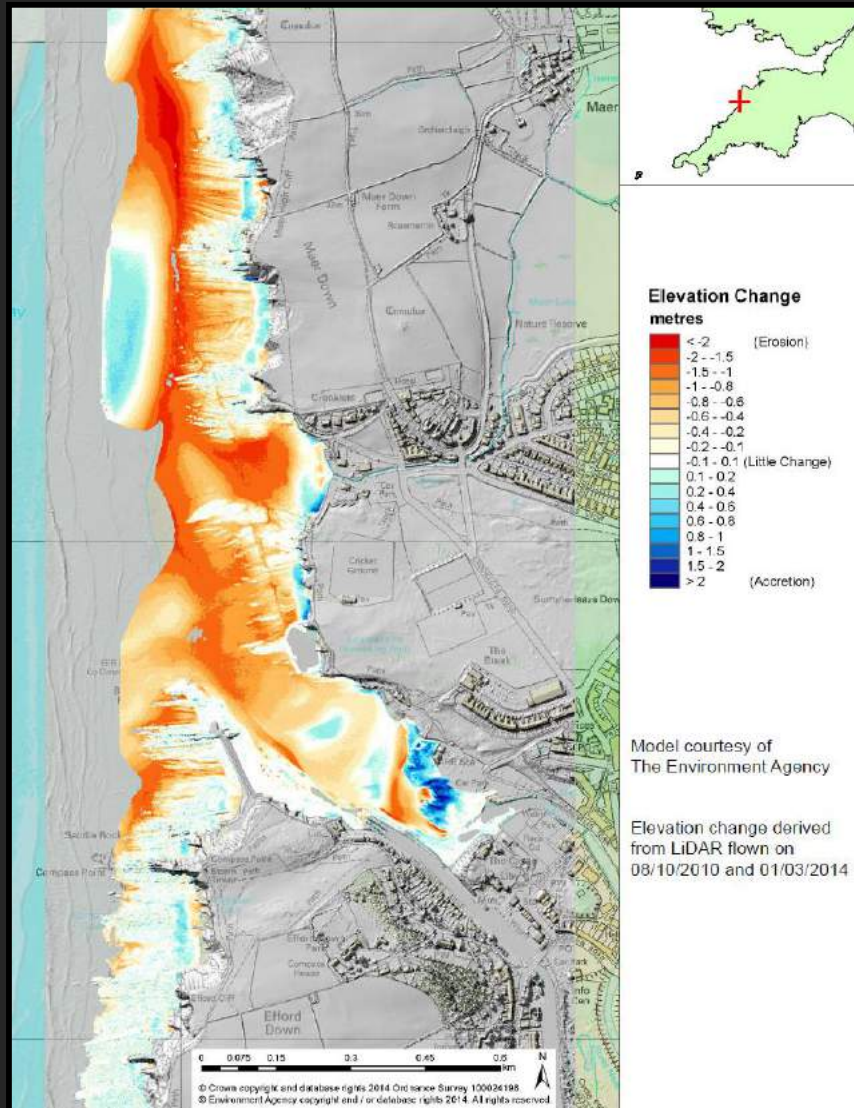
Before the winter



After the winter



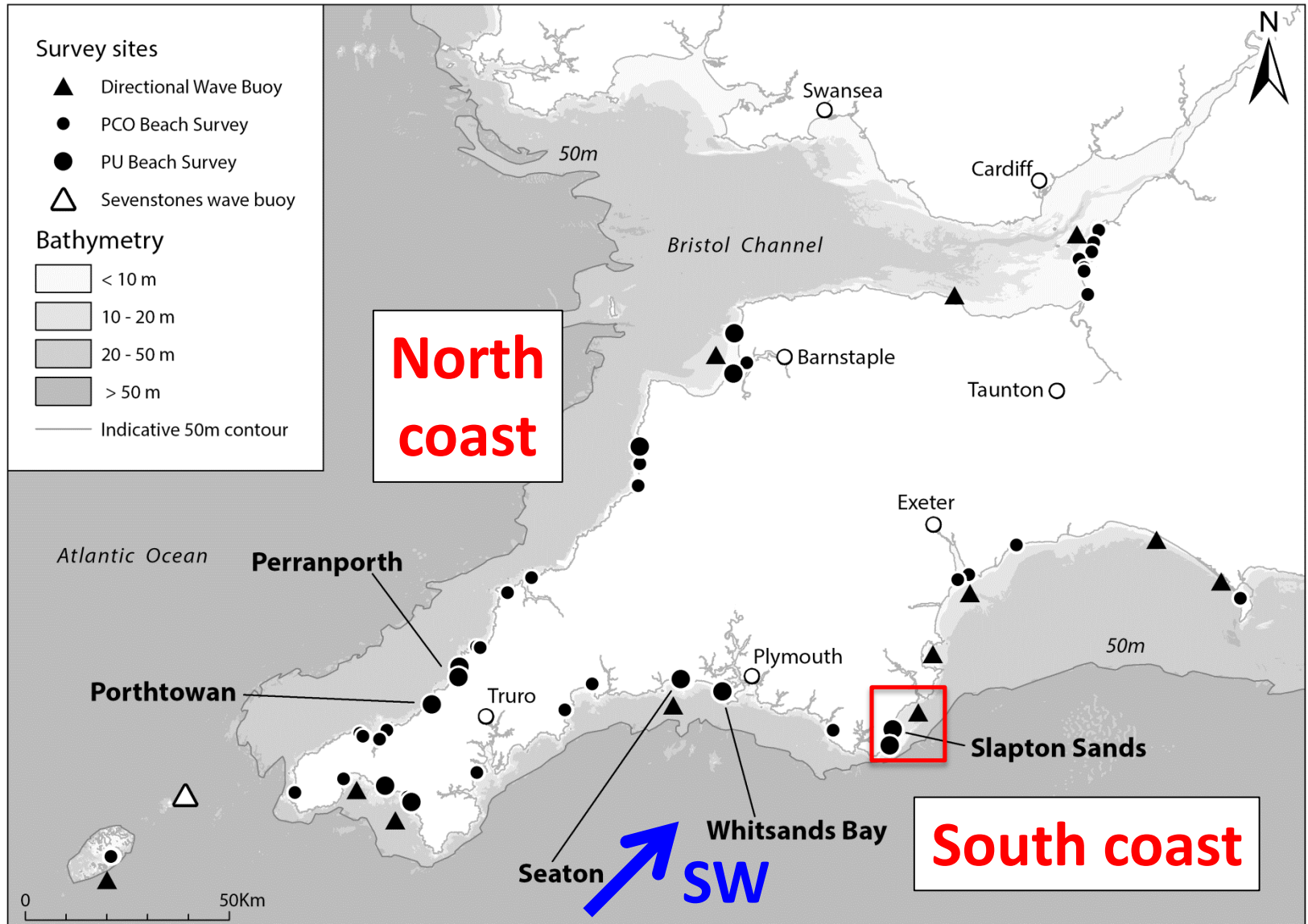
Storm response Bude and Westward Ho! from LiDAR



COASTAL IMPACTS – SOUTH COAST

Slapton Sands

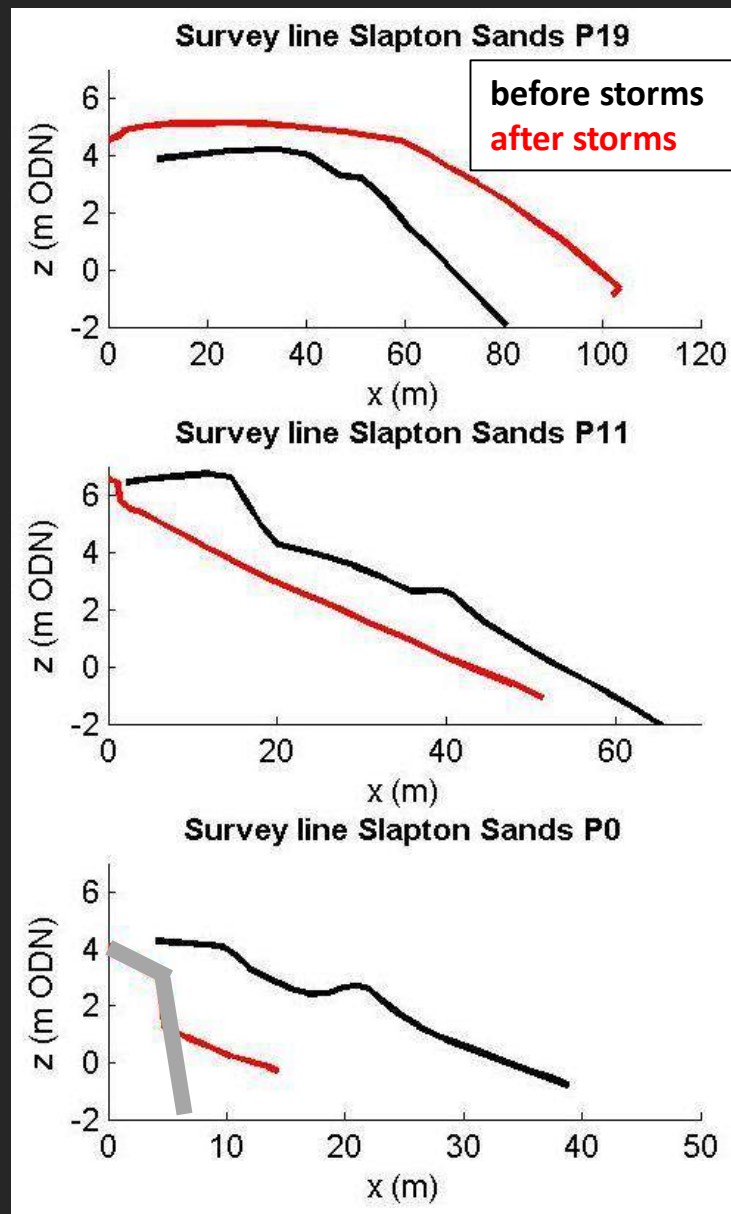
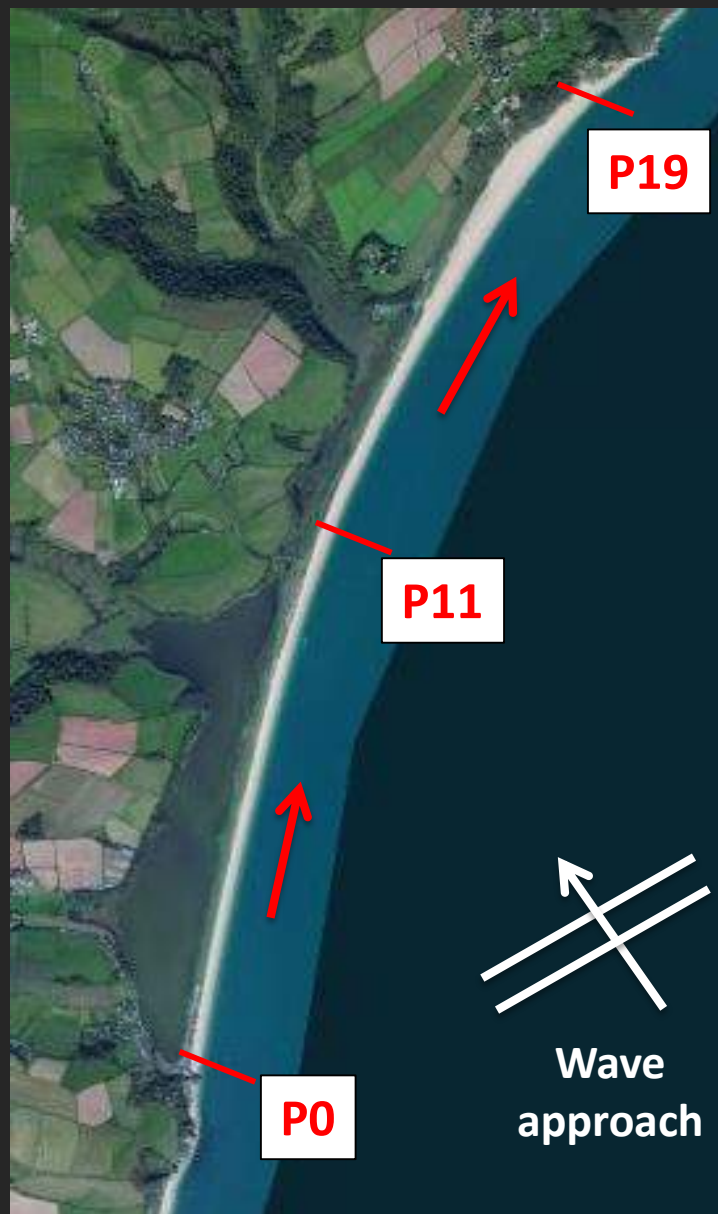
Impact of Petra on Slapton Sands



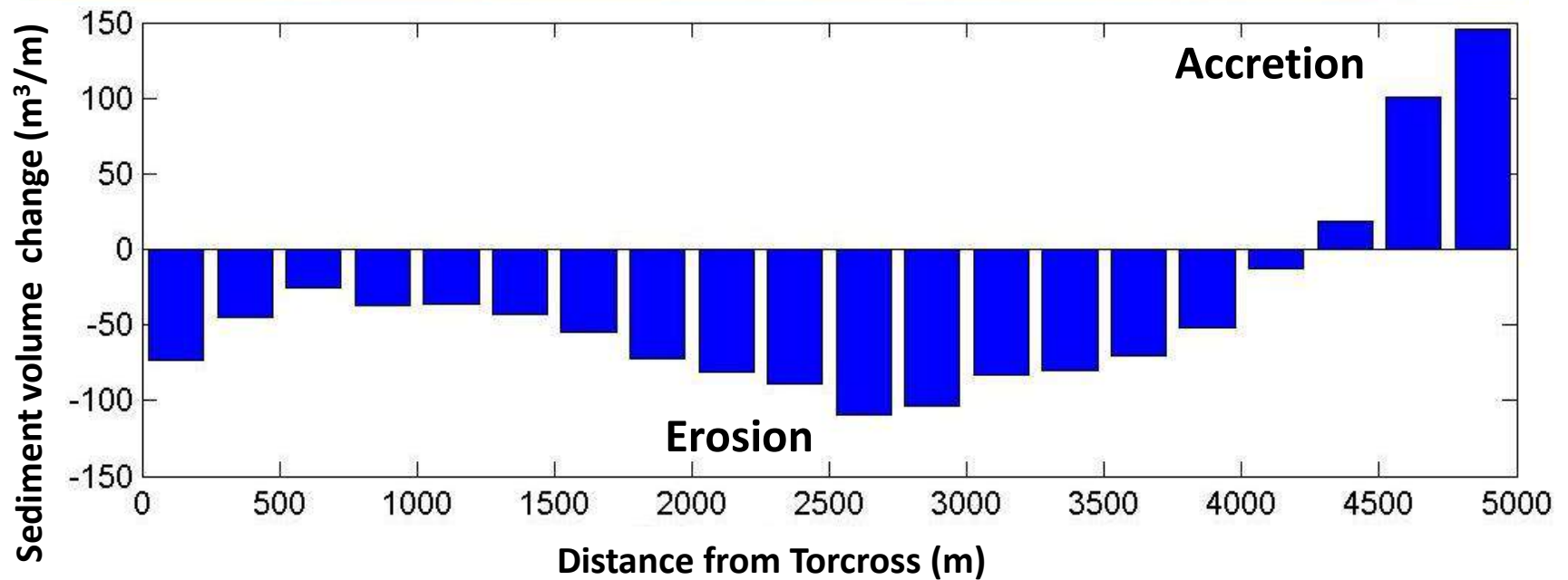
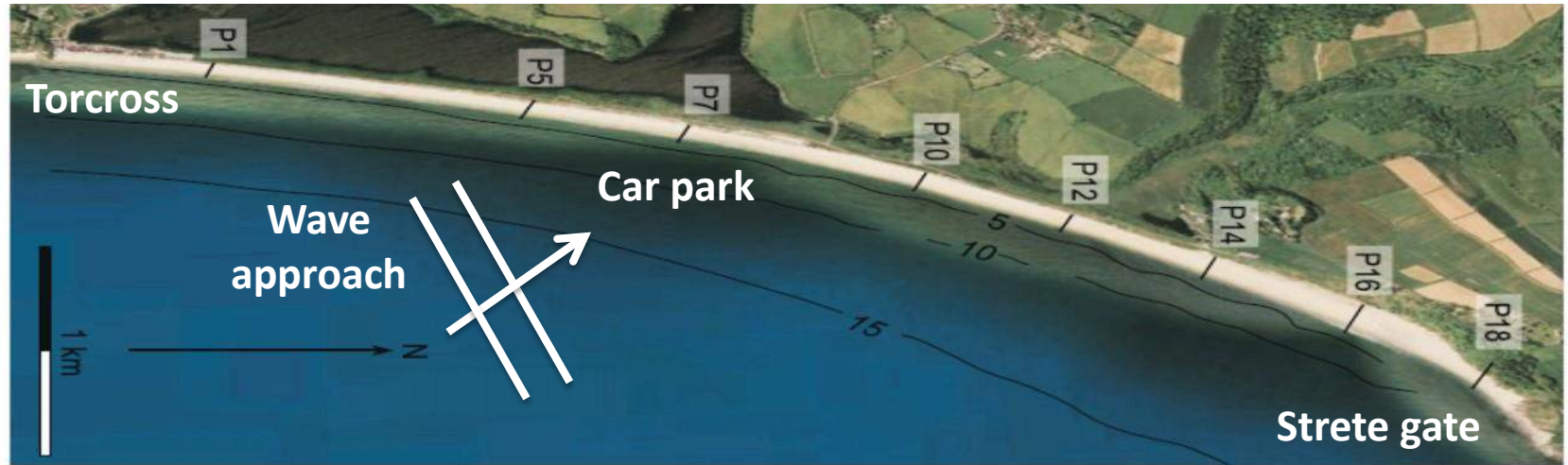
Gravel beaches of Start Bay, South Devon



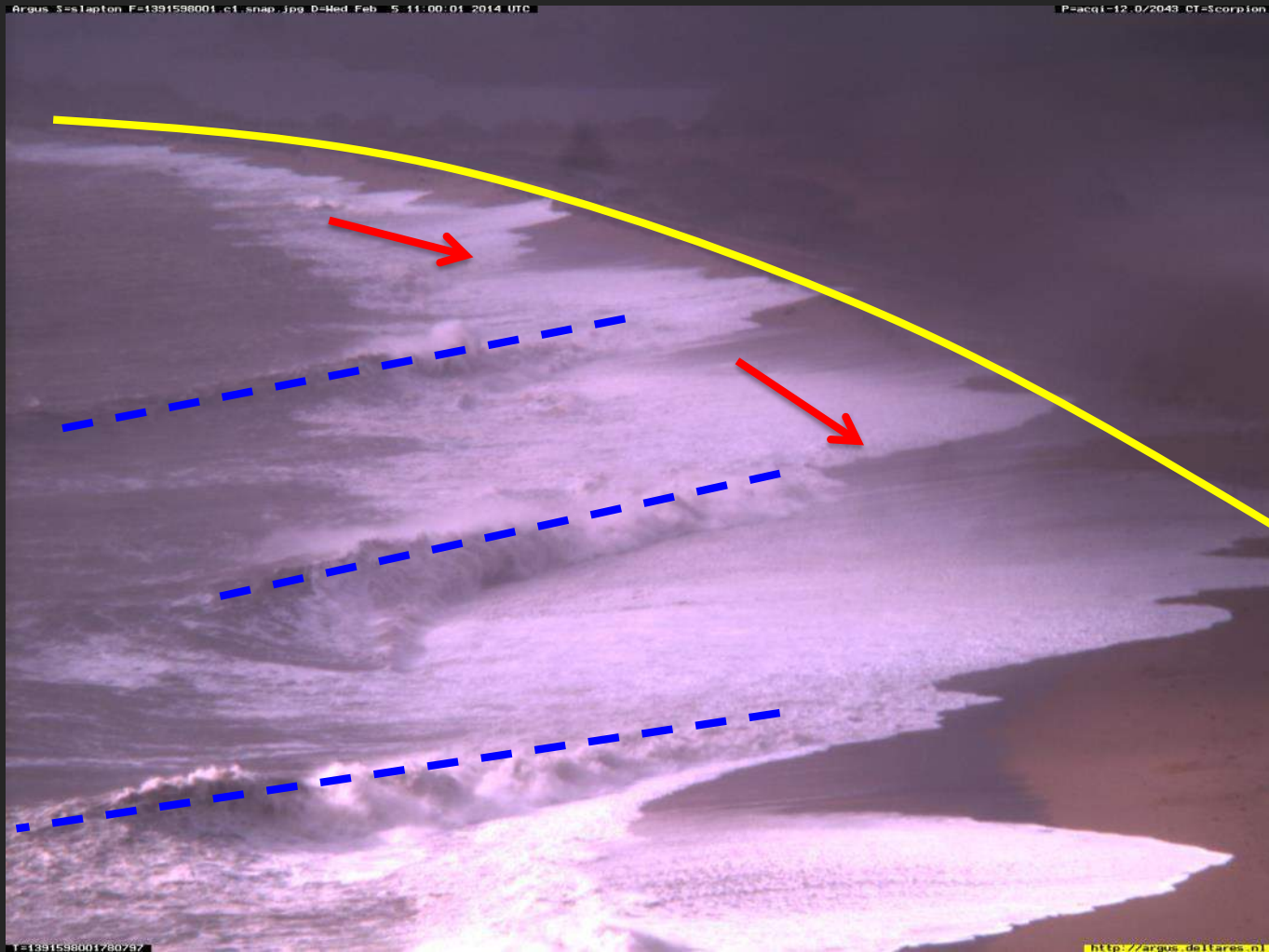
Slapton response from RTK-GPS (Petra)



Alongshore variation in storm response

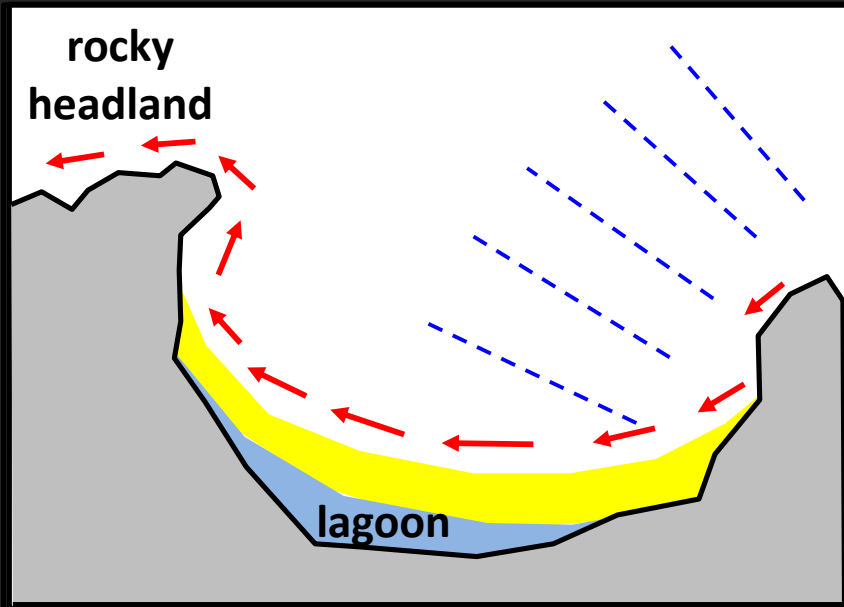


Angle of breaking waves during Petra on Slapton Sands

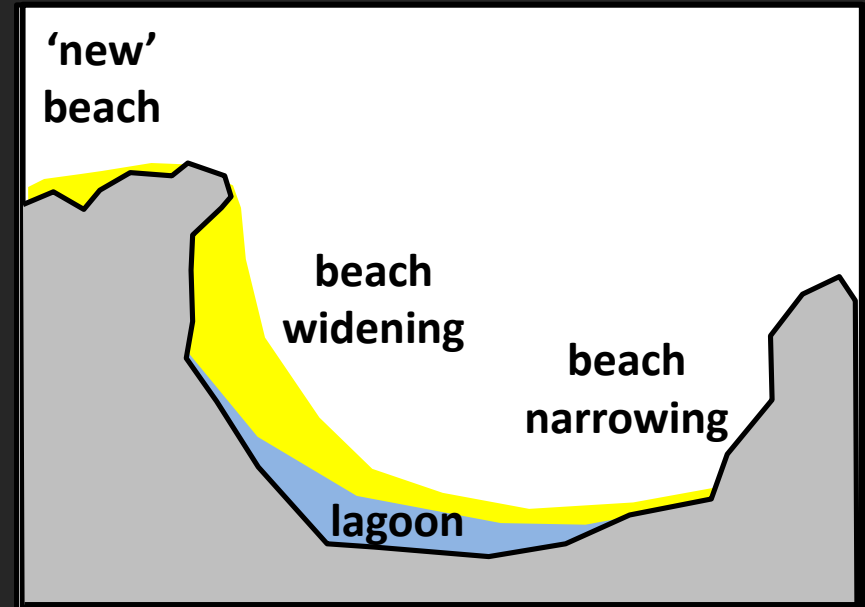


Longshore sand model – South coast

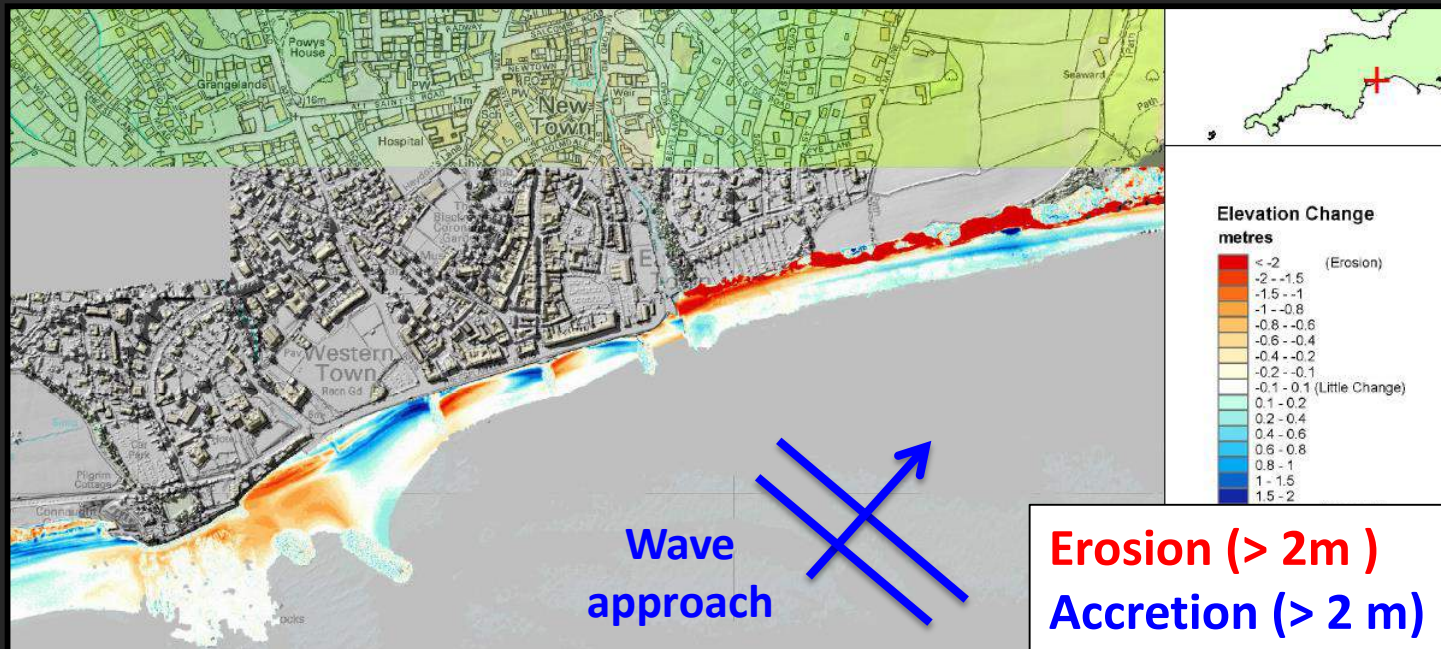
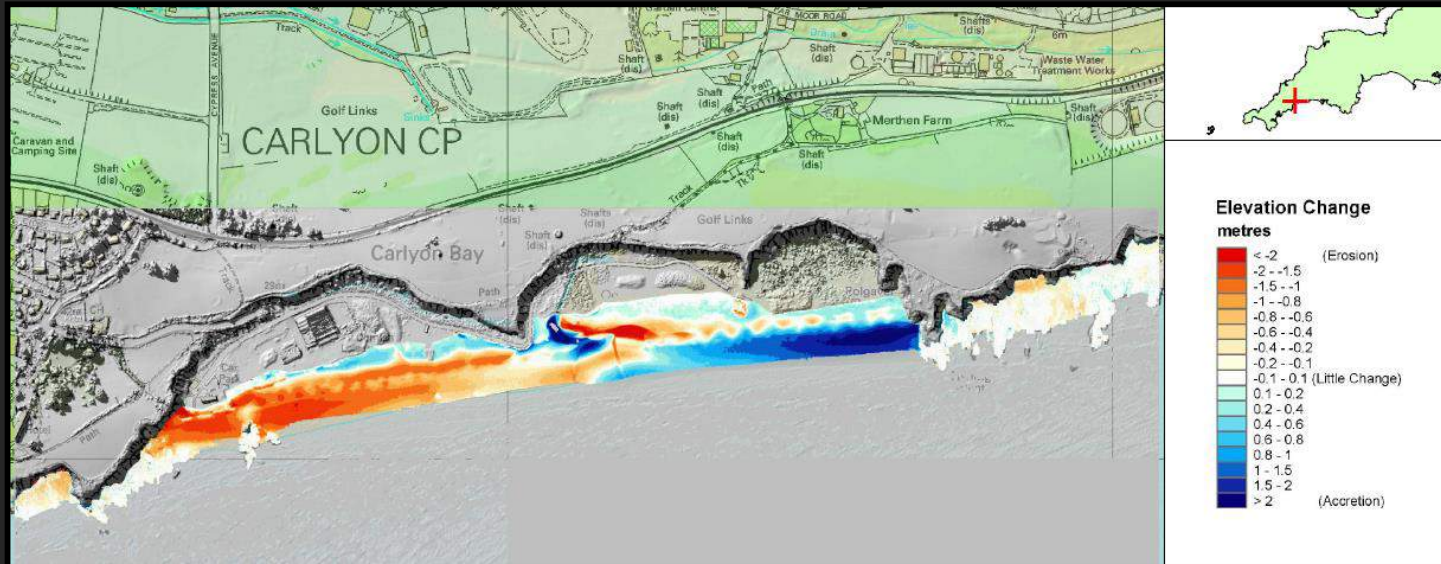
Before the winter



After the winter



Storm response Carlyon and Exmouth from LiDAR



CONCLUSIONS

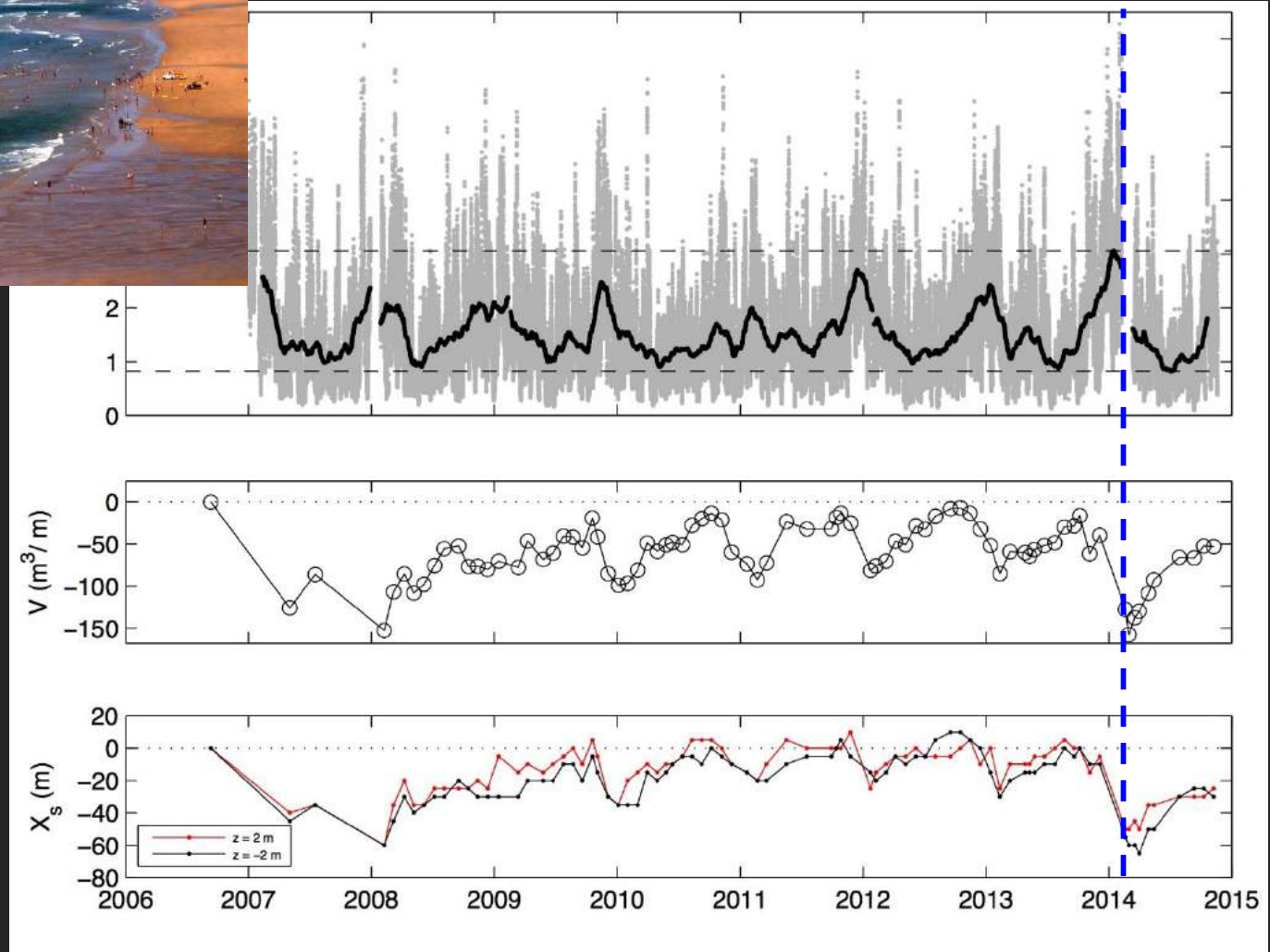
- Storm waves are related to **Atlantic low pressure systems** – the storm frequency, intensity and tracks will be affected by climate change
- The 2013/2014 winter was the **stormiest winter since 1950**
 - 1% exceedence H_s was exceeded by 20 storm events
 - 10 storms with peak $H_s > 8$ m
 - 2 storm with peak $H_s > 10$ m
- Storm impacts show a **large geographical variability**
 - North coast = **offshore** sediment transport and beach erosion
 - South coast = **longshore** sediment transport and beach rotation
- Coastal response is strongly related to the **storm-wave direction**
- Beach sediment has not 'disappeared', but has been **transported elsewhere** (in nearshore bars, along the beach, around the corner)
- Beach recovery during the spring and summer 2014 has been **limited**
- Incomplete recovery leaves beaches **vulnerable to further erosion**
- Remedial action must be informed by understanding of the processes obtained from **monitoring** – state-funded organisation such as the PCO play a key role

LONG-TERM CONTEXT

Waves and beach volume Perranporth since 2006



**2013/2014
winter**



Waves and beach volume Slapton Sands since 2007

2013/2014
winter

