

The National Network of Regional Coastal Monitoring Programmes of England



Strategic Coastal Monitoring A Resource for Resilience

Dr Charlie Thompson,
Director, Channel Coastal Observatory
celt2@soton.ac.uk



www.coastalmonitoring.org

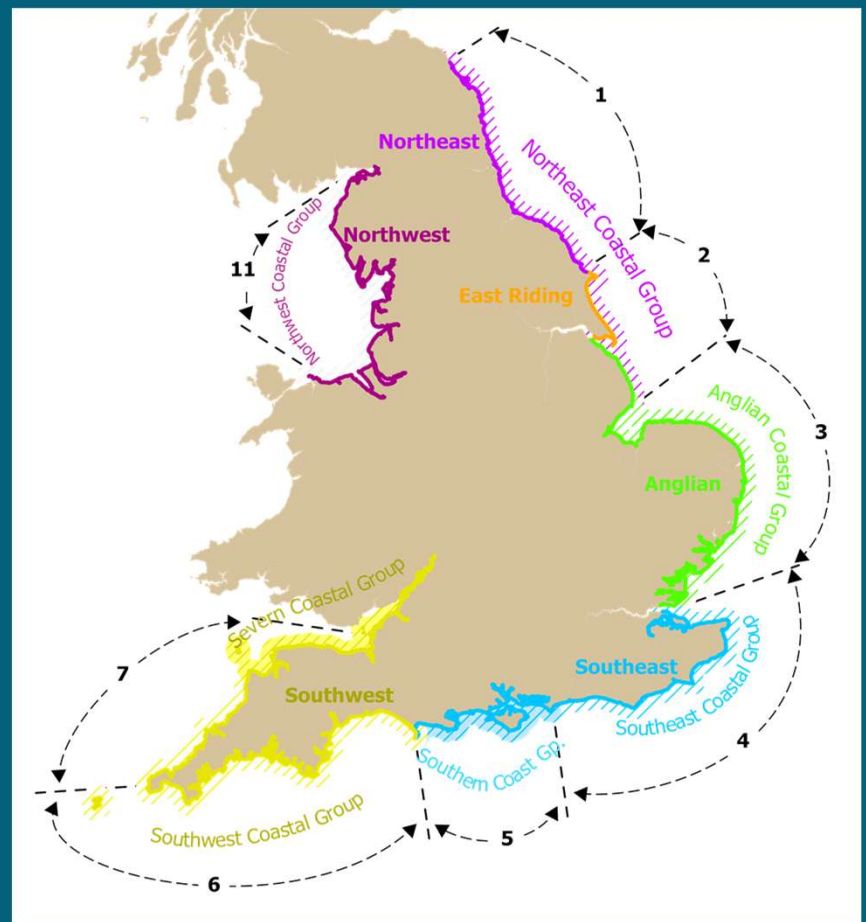
The Development of Strategic Monitoring

Historic Approach

- Localised Programmes
- Privately held data
- Varied approaches
 - Monitoring methods
 - Data types
 - Specifications

Strategic Approach

- Regional management, national coordination
- Consistent, transparent approaches
- Risk-based monitoring across a range of scales



A BRIEF HISTORY OF STRATEGIC COASTAL MONITORING

The National Network of Regional Coastal Monitoring Programmes provides strategic monitoring to support FCERM. This is a brief history of the programme.

- **Ad-hoc Monitoring**
Local and regional ad-hoc coastal monitoring to address local needs
- **1987**
Anglian Sea Defence Management Study was the first regional scale monitoring programme, and forerunner to the development of **Shoreline Management Plans (SMPs)**.
- **1990'S**
Shoreline Management Plans Established Identifying the need for a standard, repeatable and cost-effective method of monitoring the coastal environment.
- **2000'S**
Regional Monitoring Programmes are established, combining many local monitoring efforts, to address the needs of the SMP's
- **2006-2011 SMP2**
- **2011-2016**
Phase I of the National Network of RCMPs of England brings together the regions and establishes strategic monitoring in its current form
- **2016-2021**
The success of the first 5 years of strategic monitoring secures continuation into **Phase II**.
EA GIA: £23.0k
2019 SMP refresh begins
- **2018**
The Welsh Coastal Monitoring Centre (WCMC) is funded by Welsh Government
- **2021-2027**
Phase III is currently underway, extended to 6 years and including an Asset Register
EA GIA: £38.1k
- **2027+**
Phase IV bid is in preparation



FCERM Framework

Strategic, Risk-based Monitoring

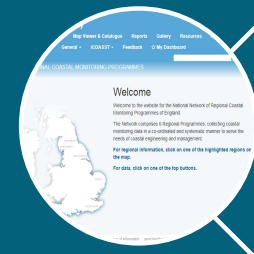
Providing the Evidence to Underpin FCERM decision making



Standard, repeatable and cost effective monitoring

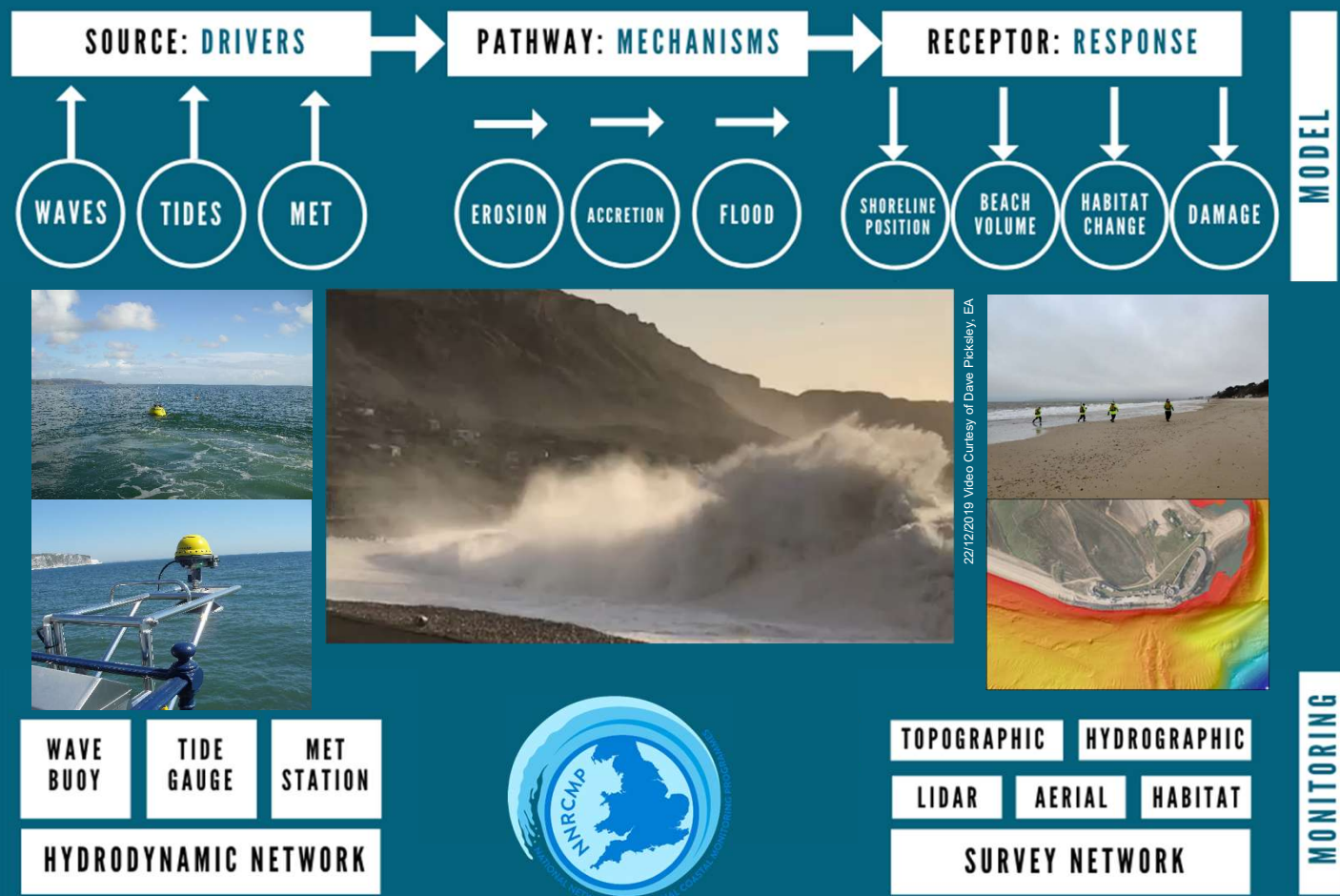


Working closely with RMAs and coastal managers & engineers



Open access to data, analysis and reports

National Network of Regional Coastal Monitoring Programmes

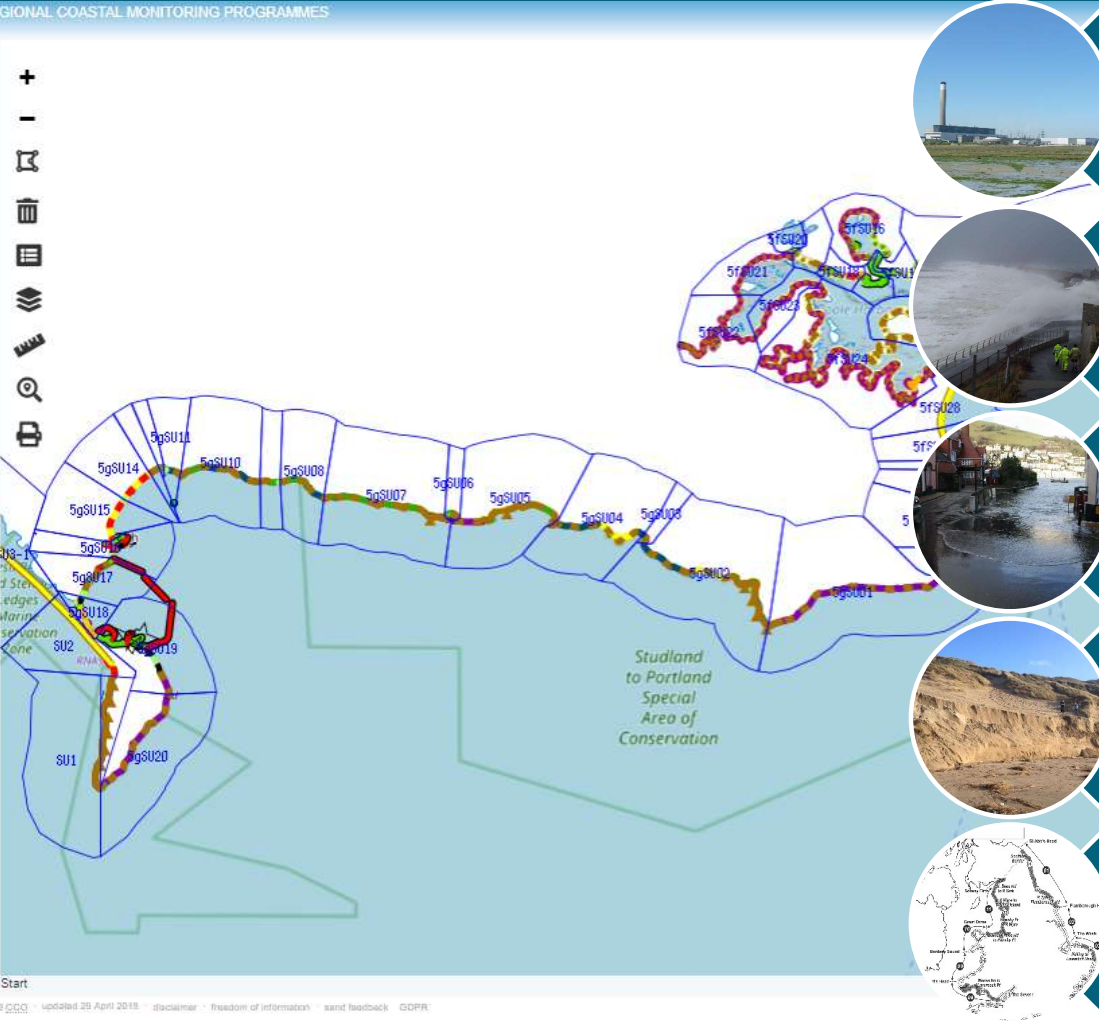


www.coastalmonitoring.org



Risk-based approach

REGIONAL COASTAL MONITORING PROGRAMMES



Assets at risk



Exposure to Waves



Tidal Flood Risk



Geomorphology, Geology, Erosion Potential, Defence Type



Shoreline Management Plan Policy Option

Survey Reviews – risk balance

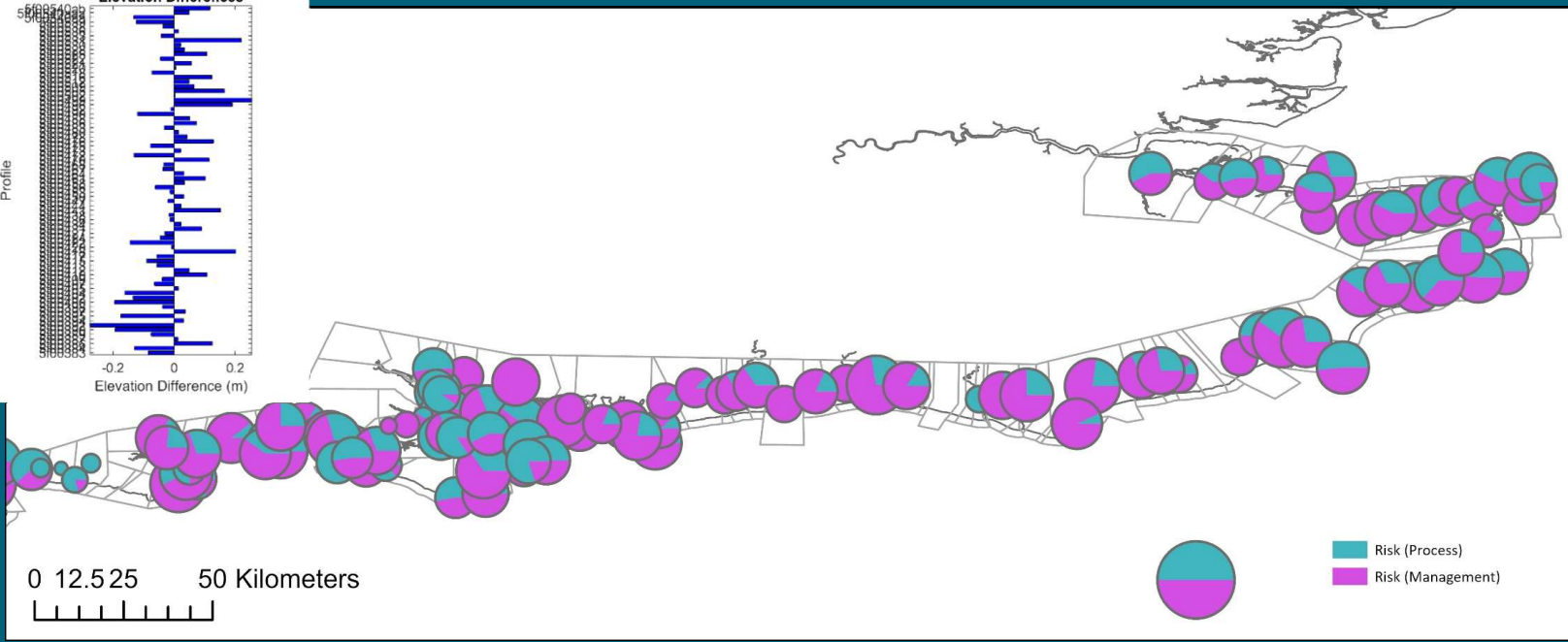
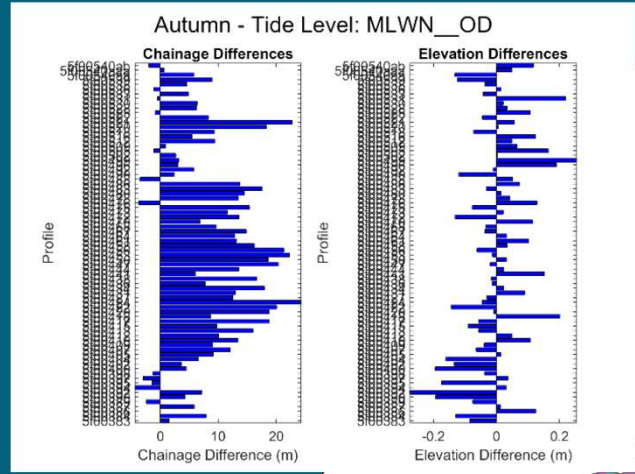


Coastal Processes

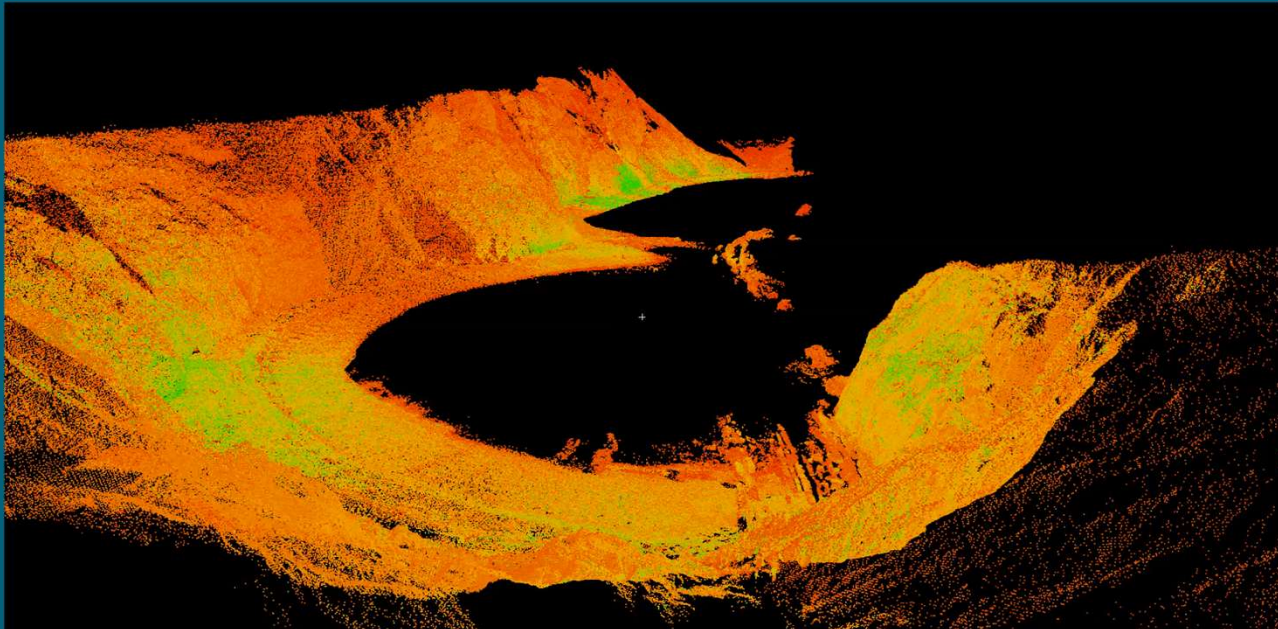
- Shoreline position
- Shoreline position variability
- Beach behaviour
- Beach behaviour variability

Management and Policy

- NAI: 22%
- HTL: 25%
- MR/BMP: 53%



The Data: Topographic Survey



E2 GPS STATION DESCRIPTION
 SIN: 5PHB15_E2_01

Channel Coastal Observatory

LOCATION
 Warden Lake, Sandbanks

DESCRIPTION
 EA brno number on seawall. Opposite house number 49

SURVEYED BY
 Channel Coastal Observatory

DATE SURVEYED
 14/10/2009

SESSION TIME
 2 hours

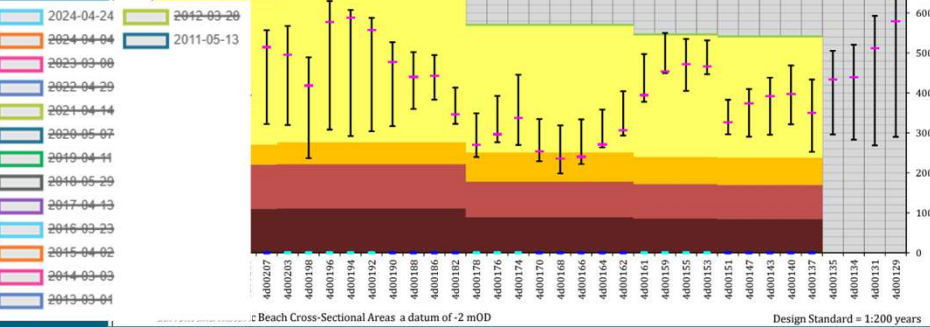
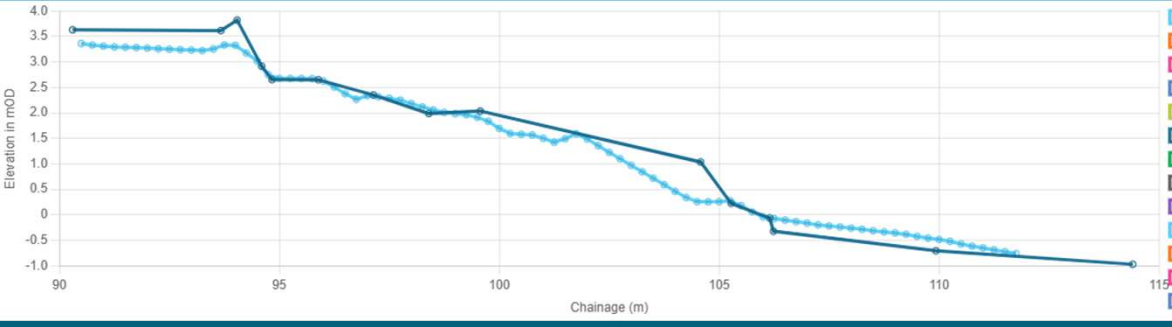
NETWORK BASED ON EI STATIONS
 1. POOL
 2. HIST9802

OSGB36 CO-ORDINATES
 (CONVERTED BY OSINTO/OSGARD)
 EASTING: 404815.024m
 NORTHING: 80136.509m

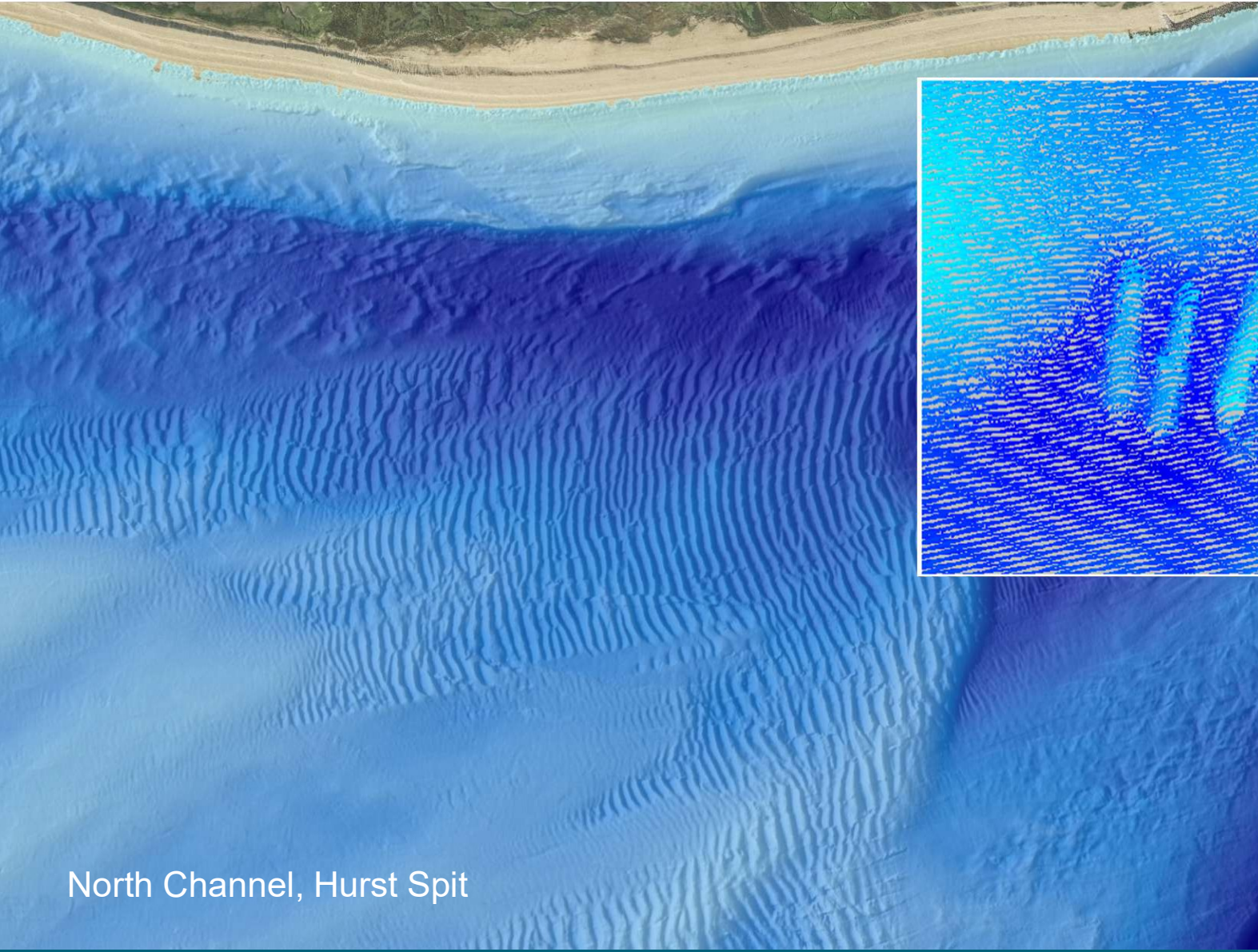
ETRS89 CO-ORDINATES
 LATITUDE: 50°41'34.0473"N
 LONGITUDE: 1°53'59.44148"W
 ELLIPSOIDAL HEIGHT (m): 49.103m

ALTITUDE (m) ODN: 1.719m
(GPS ORTHOMETRIC HEIGHT)

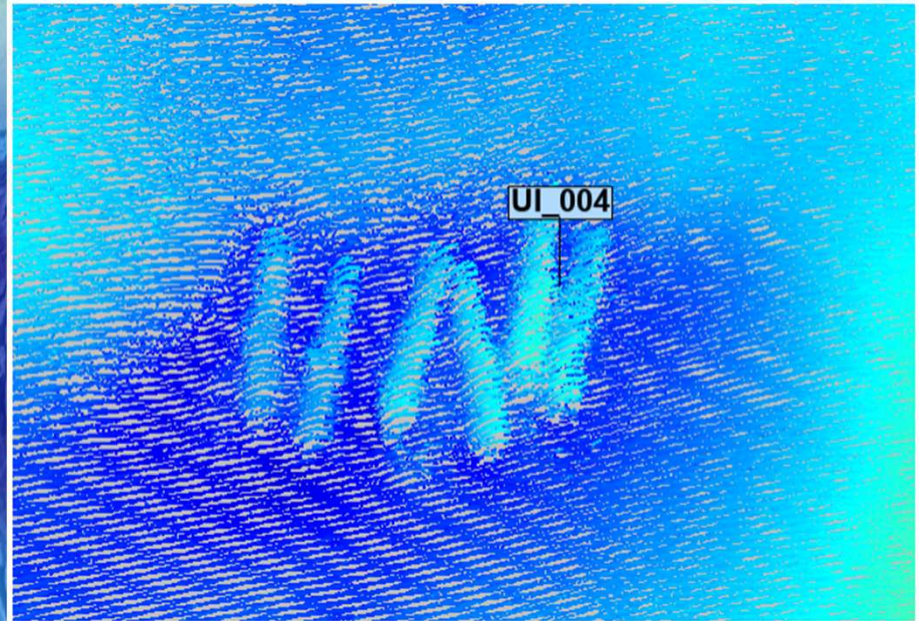
VALIDATED: K.M. Square: SZ 0487



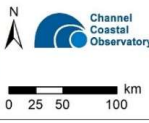
Beach Cross-Sectional Areas a datum of -2 mOD Design Standard = 1:200 years



North Channel, Hurst Spit



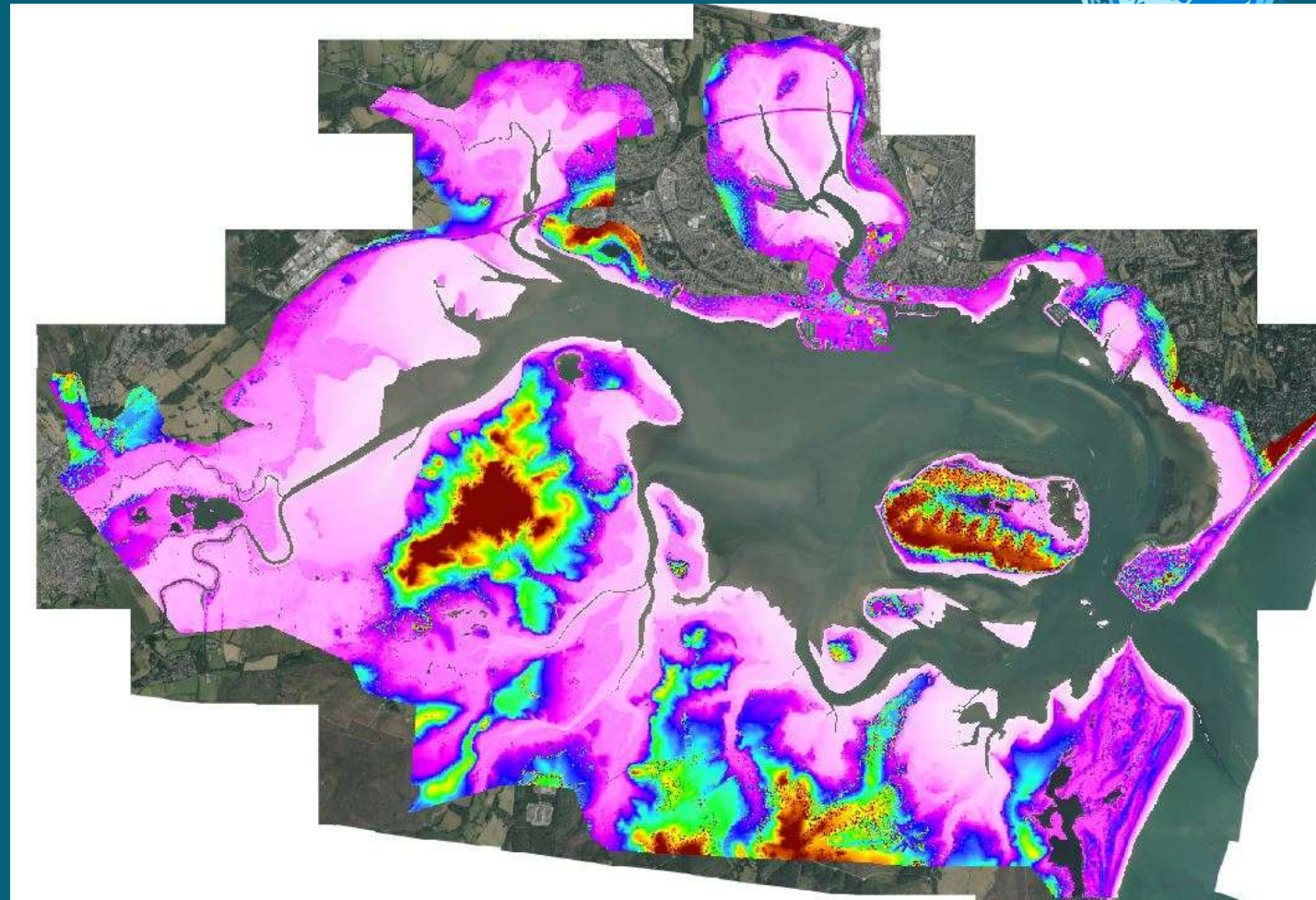
- Programme**
- CMP, Completed
 - MCA, Completed
 - MCA, Ongoing



The Data: Lidar

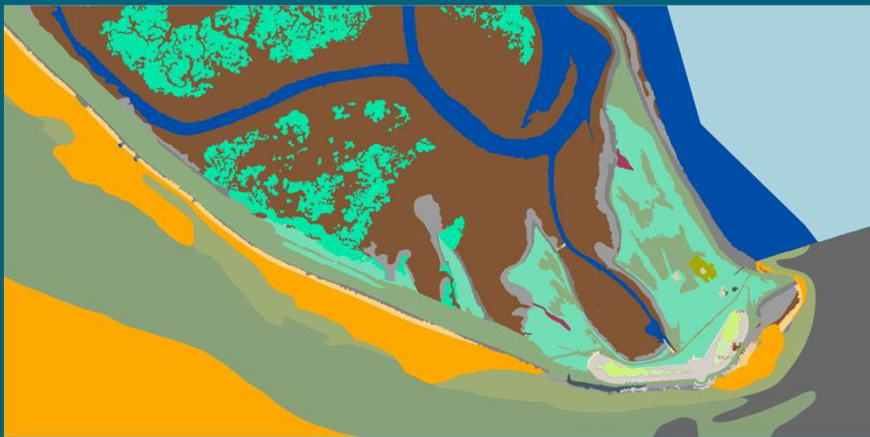


- Elevation
- ~2 yearly (alternating)
- Higher in high-risk areas
- 1m horizontal resolution (2m for older data)
- Unfiltered/Filtered
- Vertical accuracy $\pm 0.15\text{m}$



The Data: Aerial Photography & Habitat Mapping

- Aerial Photography
 - 3 year frequency
 - Orthorectified
 - FCIR
 - 10cm gsd
- Habitat Mapping
 - 6-year frequency





The Data: Hydrodynamics Network



Wave

Characterise wave climate
 Design coastal defences
 BMP evaluation
 Validation of numerical models
 Forecasting & Prediction



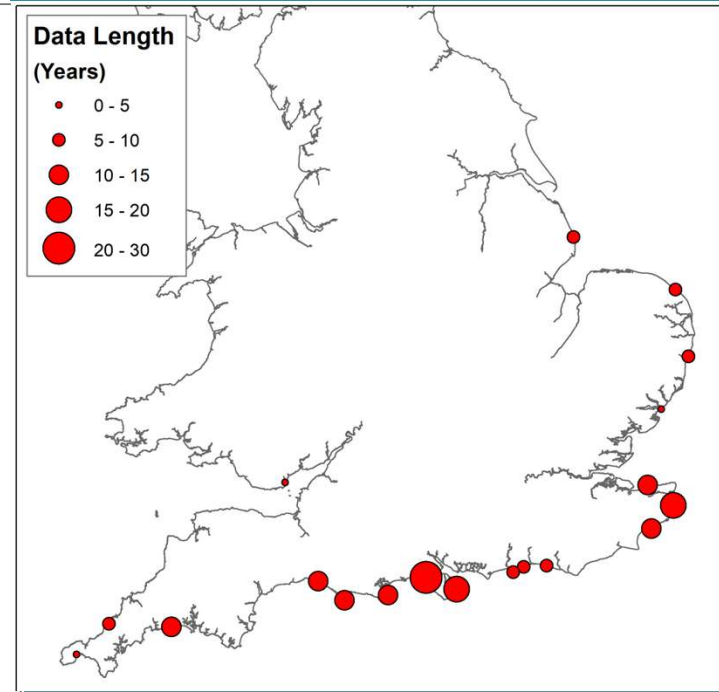
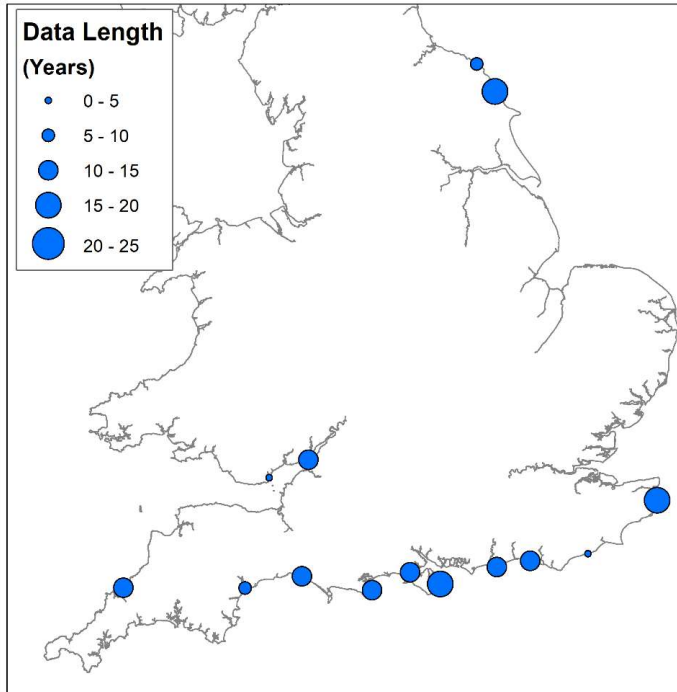
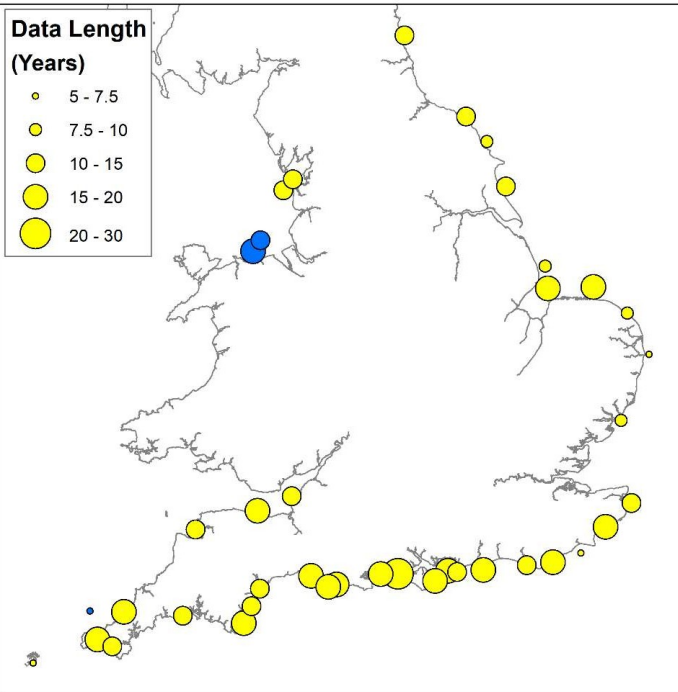
Tide

Coastal flood and erosion hazard
 Work alongside National Tidal and Sea Level Facility



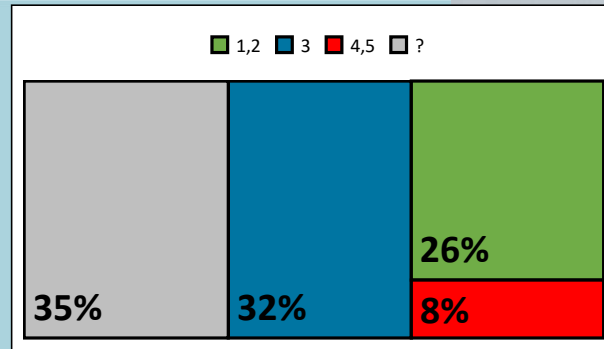
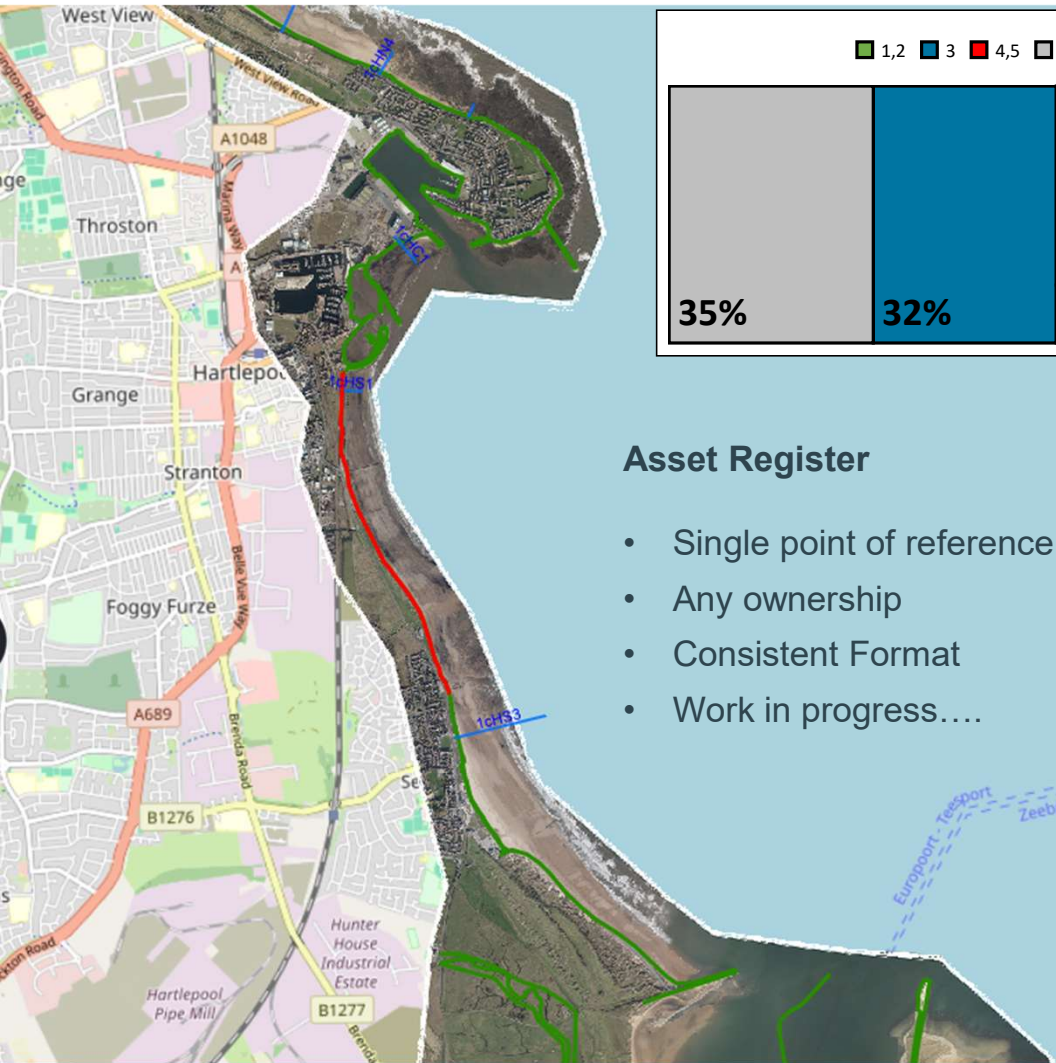
Met

Provide data in tandem with tide gauges
 Barometric pressure, wind speed and direction



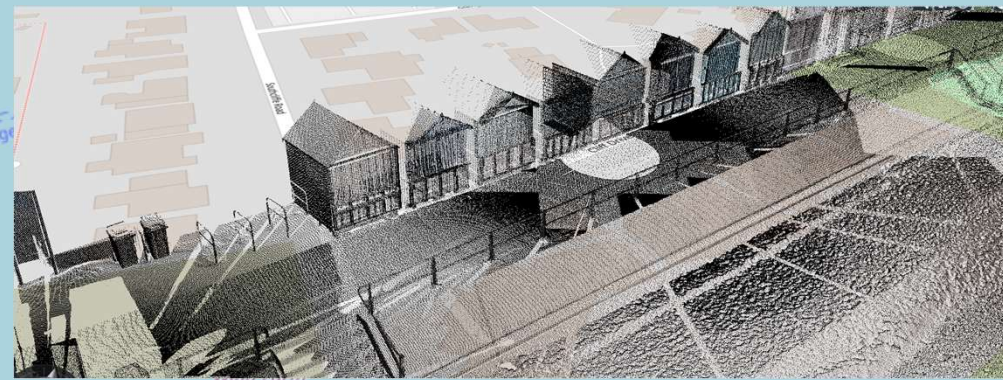
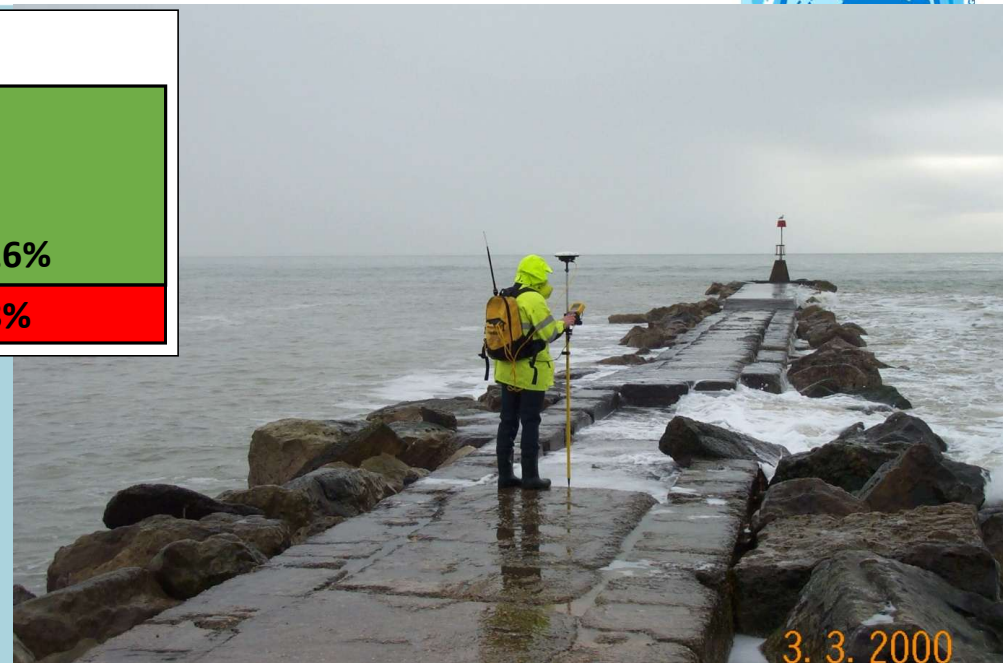


The Data: Coastal Defence Assets

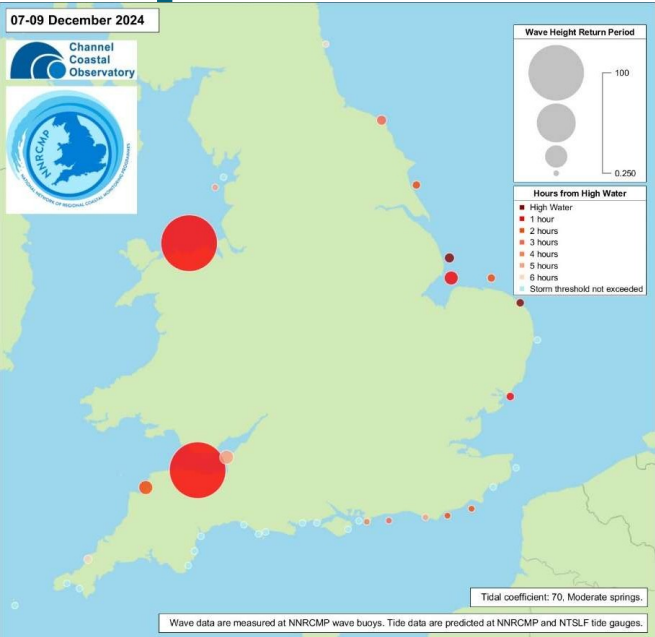


Asset Register

- Single point of reference
- Any ownership
- Consistent Format
- Work in progress....



Reports, Analysis and Resources



Southeast Regional Coastal Monitoring Programme

ANNUAL SURVEY REPORT 2023

SELSEY BILL TO SOUTHAMPTON

AR 204
December 2023

Annual Wave Report 2020

Folkestone Directional Wave Buoy

Location

OS	619260 E 133909 N
WGSS84	Latitude: 51° 03.76' N Longitude: 01° 07.67' E
Instrument type	Wave Buoy
Manufacturer	Wave Buoy

Annual Wave Report 2020

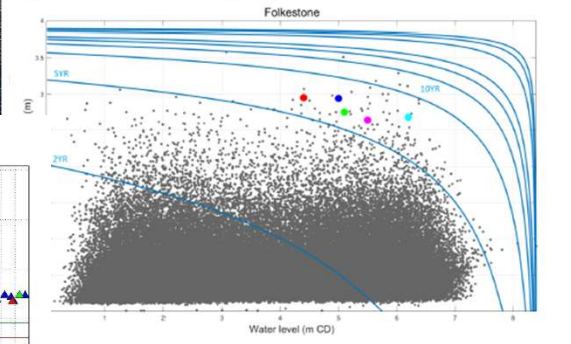
Storm Analysis

Date/Time	H _s (m)	T _p (s)	T _z (s)	Dir. (°)	Water level elevation* (OD)	Tidal stage (hours re. HW)	Tidal range (m)	Tidal surge (m)	Max. surge (m)
09-Feb-2020 14:00:00	2.95	7.7	5.3	167	0.65	HW +3	6.20	-	-
27-Dec-2020 07:00:00	2.94	8.3	5.1	173	1.25	HW -2	4.50	-	-
13-Jan-2020 23:00:00	2.75	6.7	4.9	186	1.35	HW +2	6.30	-	-
03-Dec-2020 13:30:00	2.68	7.1	5.1	179	2.45	HW +2	5.40	-	-
16-Feb-2020 06:00:00	2.64	6.7	4.9	174	1.75	HW +2	5.30	-	-
21-Oct-2020 13:30:00	2.53	6.7	4.9	180	3.35	HW	6.10	-	-
28-Feb-2020 13:30:00	2.50	6.3	4.9	177	2.75	HW	5.40	-	-

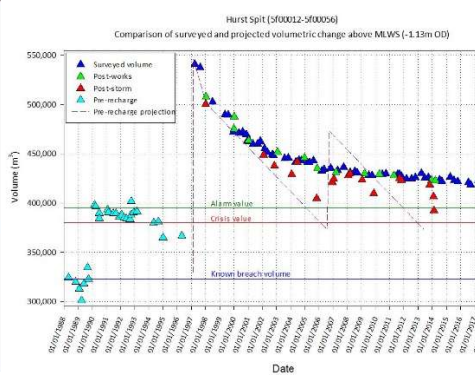
* Tidal information is estimated from the predicted tide levels (Admiralty Total Tide).

Joint return periods

Joint return periods for water level and significant wave height are based on 0.5 hourly records and calculated using a copula function. For more details on the copula function, see Dhoop & Thompson 2021. The grey point cloud represents the measured joint wave heights and water levels at Folkestone and Dover respectively, plotted against one another.



Date/Time	Symbol	H _s (m)	Water level elevation	Joint Return Period	
			OD	CD	
13b-2020 14:00:00	●	2.95	0.65	4.40	1 in 5 years
27c-2020 07:00:00	●	2.94	1.25	5.00	1 in 5 years
13a-2020 23:00:00	●	2.75	1.35	5.10	1 in 5 years
28c-2020 13:30:00	●	2.68	2.45	6.20	1 in 5 years
16b-2020 06:00:00	●	2.64	1.75	5.50	1 in 5 years



Open Access Data

<https://www.coastalmonitoring.org/>



Channel Coastal Observatory | Realtime Data | Map Viewer & Catalogue | Reports | Gallery | Resources | General ▾

Reports

- All Regions
- Northeast
- East Riding
- Anglia
- Southeast
- Southwest
- Northwest

National

All Regions Wave Reports

- Coastal Wave Network Report 2023
- Coastal Wave Network Report 2022
- Coastal Wave Network Report 2021
- Coastal Wave Network Report 2019
- Coastal Wave Network Report 2018
- Coastal Wave Network Report 2017
- Coastal Wave Network Report 2016
- Coastal Wave Network Report 2015
- Coastal Wave Network Report 2014
- Coastal Wave Network Report 2011
- Coastal Wave Network Report 2008
- Coastal Wave Network Report 2007
- Coastal Wave Network Report 2006
- Coastal Wave Network Report 2005

All Regions Tide Reports

All Regions Meteorological Reports

Technical Notes and Reports

- Assessing Drift and Step-Changes in Significant Wave Height at the Milford Wave Buoy Site TN06 - February 2025
- Datawell Directional Waverider MkIII Buoys and Infragravity Waves BN09 - January 2025
- Tidal Prediction for NNRCMP Tide Gauges TN05 - February 2024
- Re-processing Datawell Directional Waverider MkIII heave data affected by breaking waves TR121 - June 2023
- Comparison of Wave Parameters Measured at the Perranporth and Bideford Bay DWRs TN04 - September 2022
- Extreme Value Analysis for CCO Coastal Wave Data TN03 - September 2018, updated July 2021
- Supplement to TN03: Extreme Value Analysis Parameter Details 2017-2018
- Occurrence of Bimodal Seas around the English Coastline TN02 - June 2018
- Method for Extremes Analysis of Coastal Wave Data TN01 - May 2018

Progress Reports



...made available for lidar, aerial photography, topographic data, hydrodynamics, ...
...in region has its own data requirements, the National Network of Regional Coastal ...
...r the same level of data quality throughout the Network.

...available for download such as defences, survey unit boundaries, profile lines etc. They ...
...Government Licence.

...open Application Programming Interface (API). This page has instructions on how to obtain ...

...is deployed by the National Network of Regional Coastal Monitoring Programmes of ...
...y provided by RWE Innogy and Wave Hub Limited, together provide an opportunity to ...
...ly and temporally.

...dynamic model developed in DelFT3D for the southwest of the UK. The model is forced along ...
...wave data, water levels, and currents, and the entire domain is forced with gridded wind

...ta. Professor Ian Townsend, University of Southampton has kindly made available this ...
...e and beach profile data downloaded from the website. Beach dynamics, spatial and ...
...fluence of clustering are just some of the aspects which can be examined.



Realtime data
QC'd data
API
WMS
Reports/Analysis

OGL – free to all.

Just tell us why/
what you're using
the data for!

Standardisation



SPECIFICATIONS

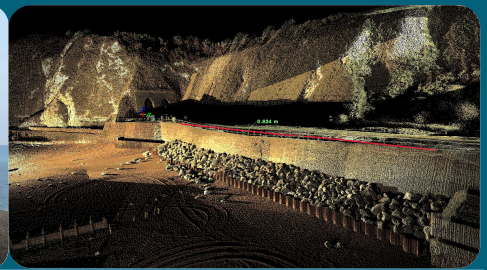
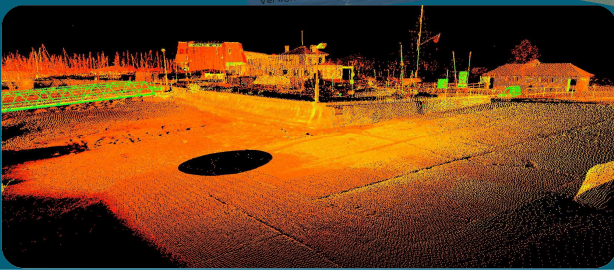
- Industry Standards
- Custom

QUALITY CONTROL

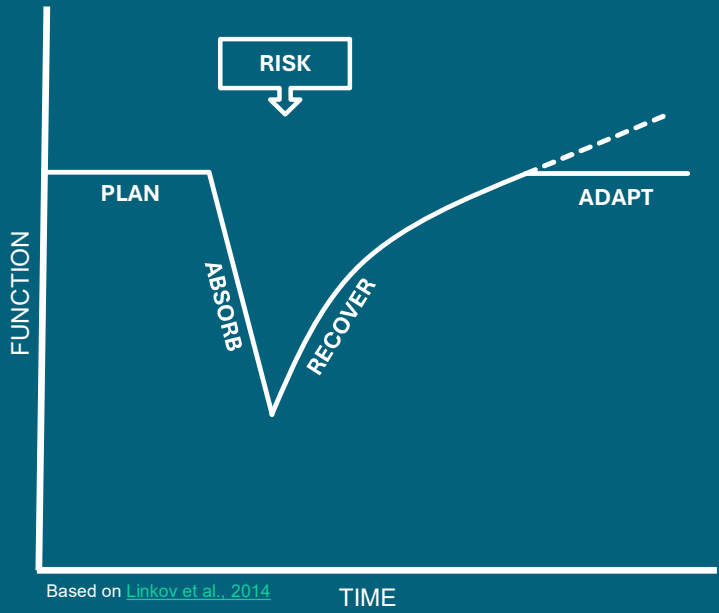
- Clarity for Users
- Clarity for Contractors

R & D

- Exploring new technology
- Knowledge Exchange



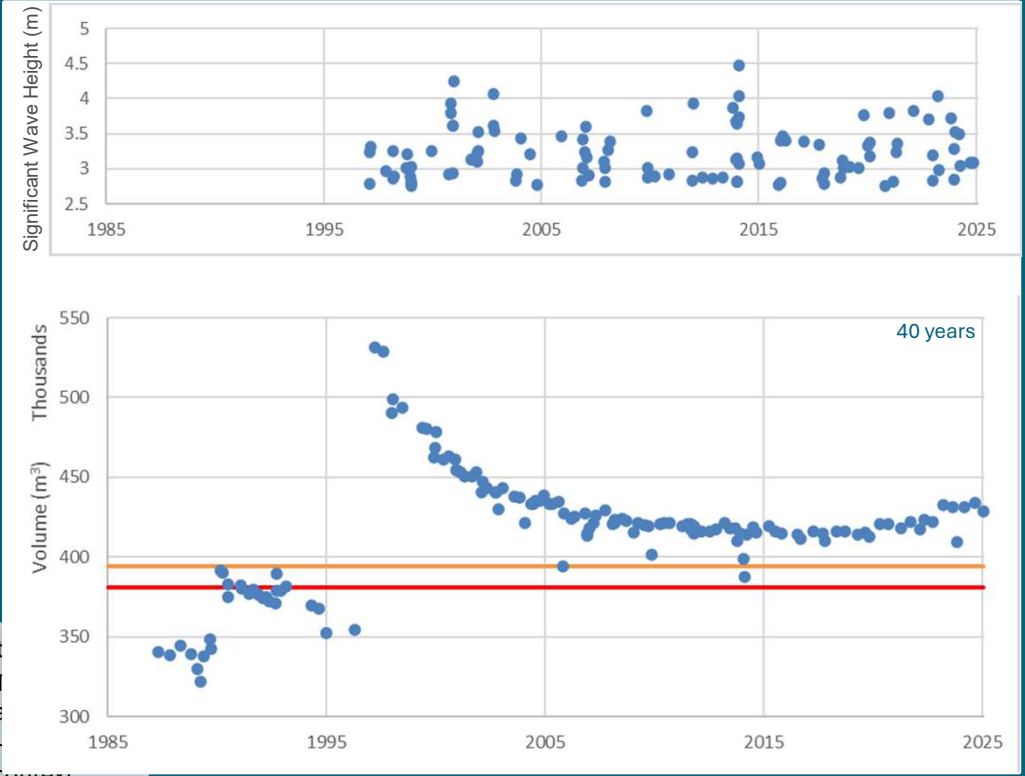
Resilience & Data Length



Based on [Linkov et al., 2014](#)

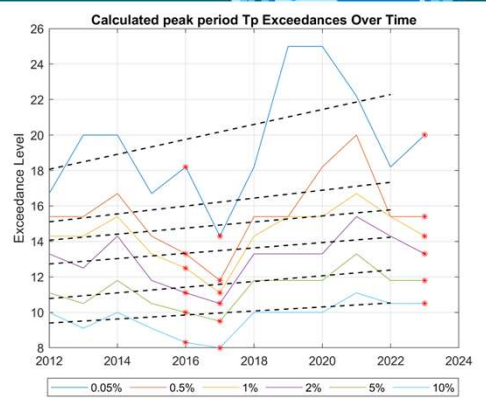
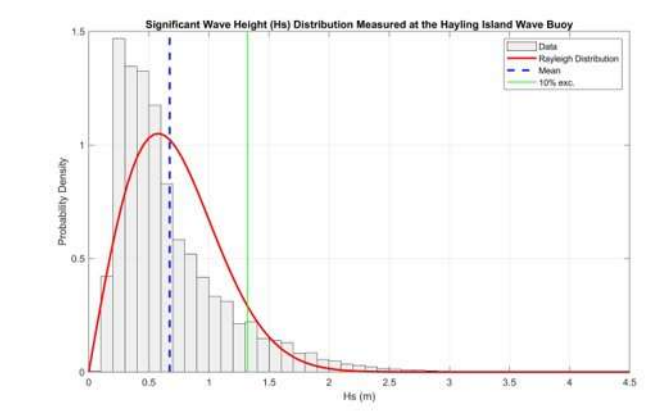
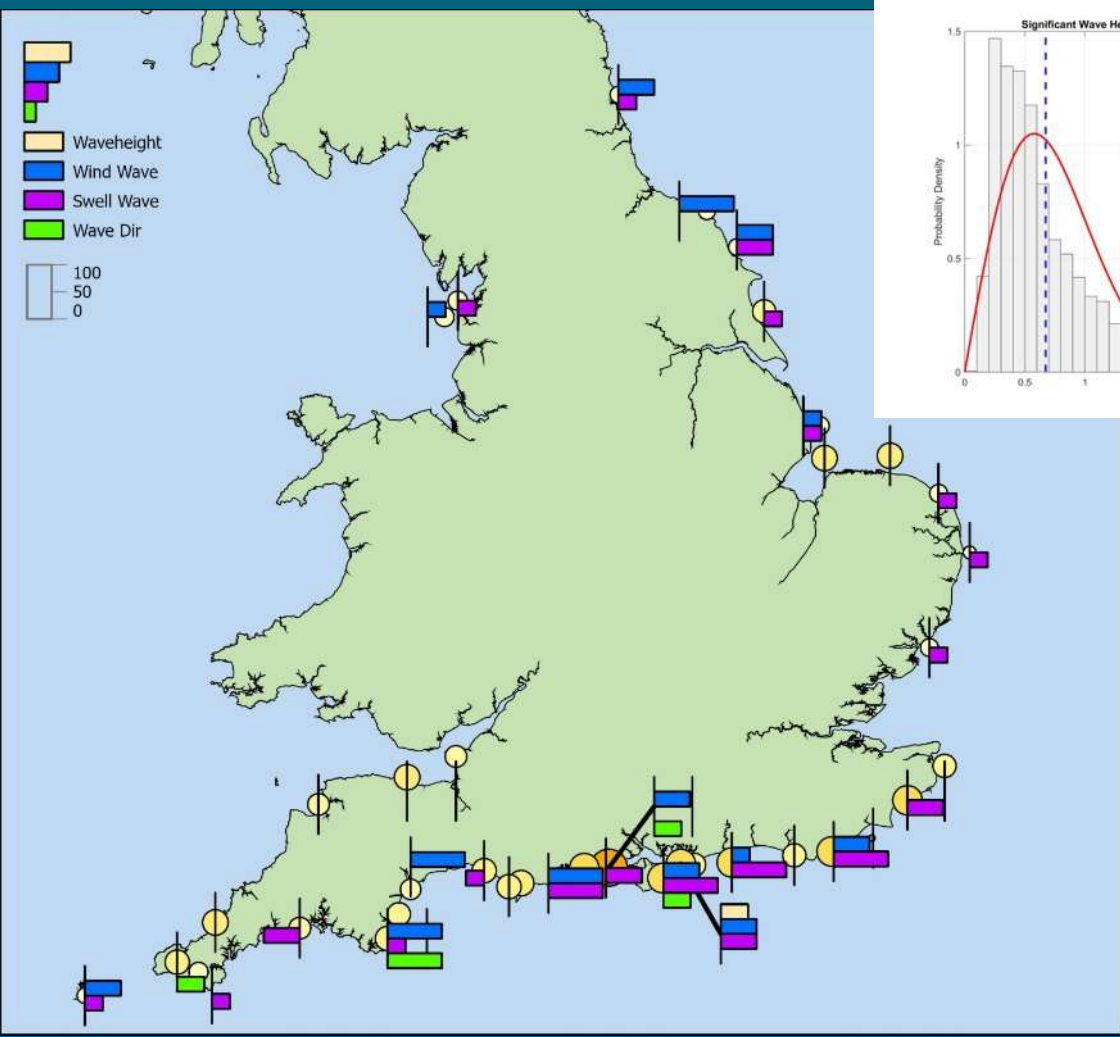
- | RISK | PLAN | ABSORB | RECOVER |
|---|---|---|--|
| Define <ul style="list-style-type: none"> • Hazard • Impact • Vulnerability | Understand <ul style="list-style-type: none"> • Coastal Process • Historic Response • Predictions | Assess <ul style="list-style-type: none"> • Real-time monitoring • Incident Response | Monitor <ul style="list-style-type: none"> • Post-event surveys • Historic Response |

Storm Calendar & Beach Volume



- Context
- Updating risk, making new plans...

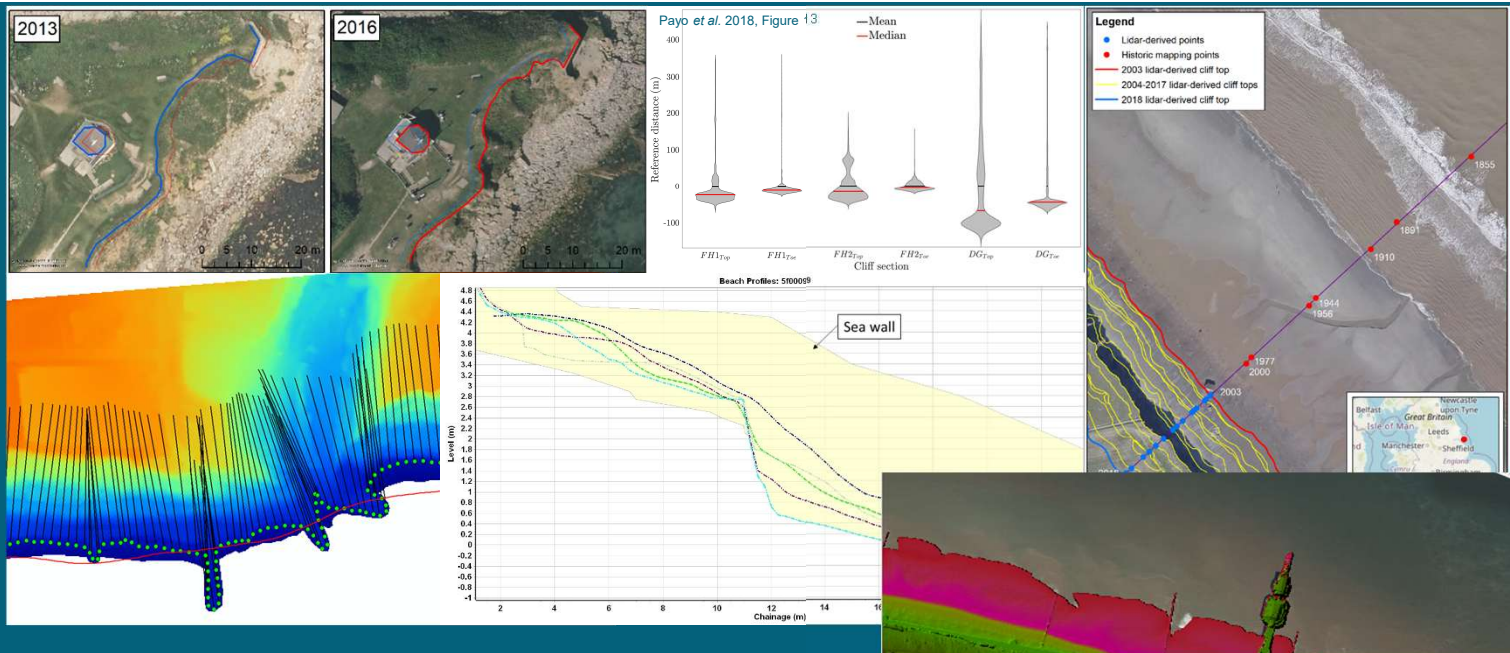
Long Term Trends in wave climate



Parameter	Sites with sig. trend /37 (%)	Confidence			Magnitude /yr (median)	Spatial Patterns/Focus
		H	M	L		
Wind Wave Period	18 (49%)	1 0	2	6	0.03s	E/SE exposed sites (-ve for Looe Bay)
Swell Period	21 (57%)	7	2	1 0	0.07s	Highest conf. for South Coast
Direction	6 (16%)	3	3	0	0.5°	Only South & Northeast coasts
Bimodality	7 (19%)	4	0	3	7 days	Only South & Northeast coasts
Wave Height	1 (3%)	0	0	1	0.05 m	Whitby Only

20 year analysis – funded by SCOPAC

National Scale Risk and Resilience: NCERM2



NNRCMP Data

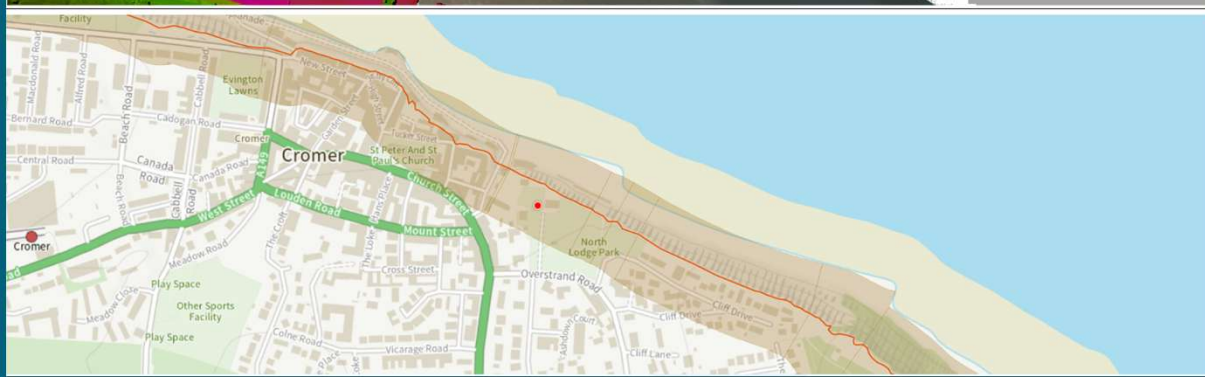
- Lidar
- Aerial Photography
- Topography
- Assets

Methodology for calculating recession

- Profile positioning
- Data/Methods decision making
- Underlying recession rates

Methodology for defining Origin Points

- Distinct from receptor line
- Ensuring longevity





Local Scale Risk and Resilience: FCRIP and beyond

making space for sand

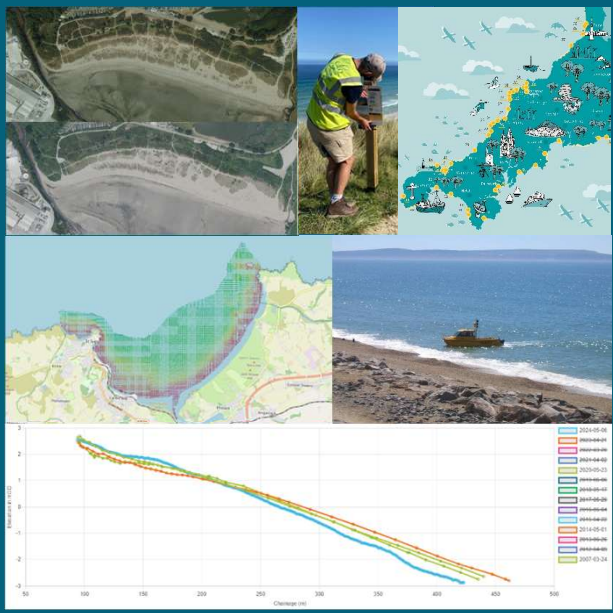
“adopting a more ecosystem approach to beach and dune management to reduce coastal communities' vulnerability”



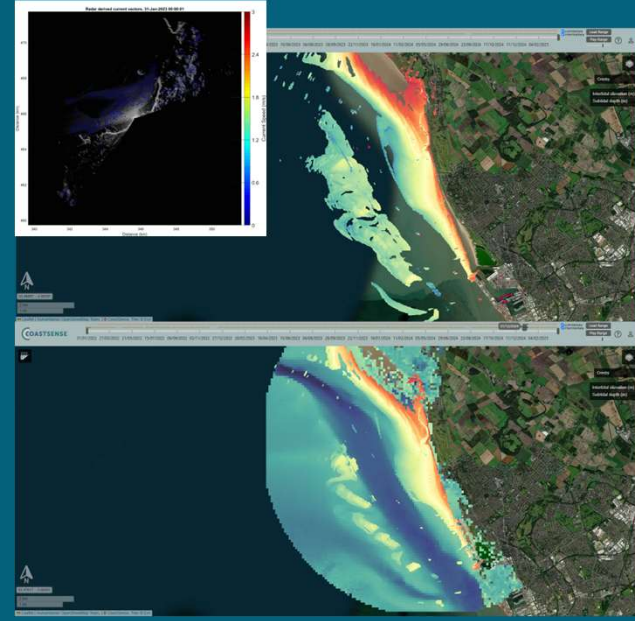
“working with nature to safeguard our coastal communities”



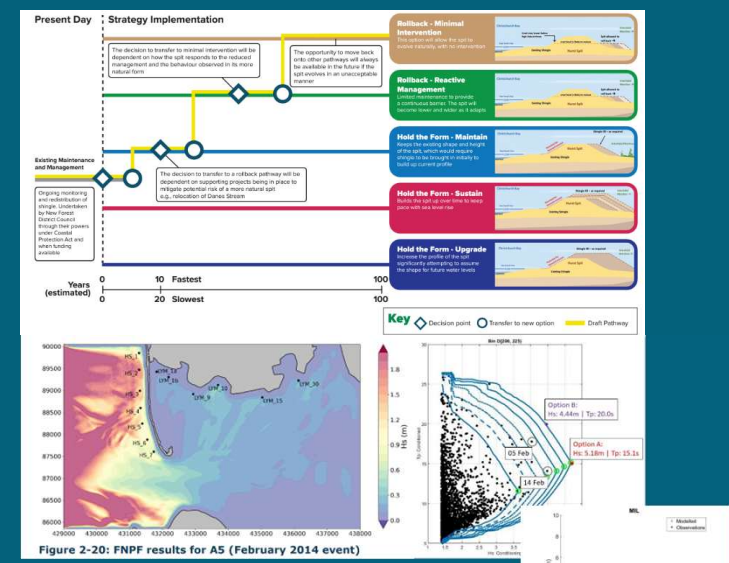
“a long term sustainable future for the coast”



Data supply & Monitoring Expertise
Topographic, Bathymetric, Aerial imagery (> £400,000)
CoastSnap



Knowledge exchange & Lessons Learned
Advice on radar installation, and setting up CoastSnap sites



Analytical Insights & Expert Advice
Wave, Water Level, Topographic, Bathymetric (30 years, > £1 Million)
Historic WL maxima, Synthetic Storm Events, Joint Probability

New Developments

Improving Coastal Resilience through AI-Driven Wave Predictions

Testing machine learning-based wave prediction:

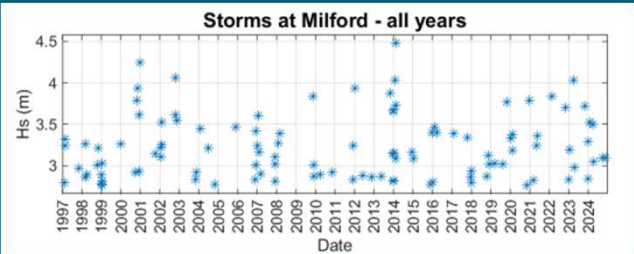
- historic data from NNRCMP
- external (modelled) data (e.g. ERA5)

Testing at Milford

- Statistical & simple ML models - poor predicted capability
- Testing other methodologies from literature
- Incorporating multiple datasets as drivers



Pilot Web Interface development



Wave Forecast for Milford

Predicted Wave Height (meters)

Day	Wave Height (m)
Mon	1.2
Tue	1.5
Wed	2.1
Thu	1.8
Fri	1.4
Sat	0.9
Sun	1.3

Likelihood of Calm Wave Days (%)

Day	Likelihood (%)
Mon	75
Tue	65
Wed	45
Thu	55
Fri	70
Sat	85
Sun	75

Prediction Options

Number of Days to Predict: 7

Model Options

- Wave Height (historical)
- Wave Height (historical) + Sea Temperature (OSTIA, Met Office)
- Wave Height (historical) + Sea Temperature (OSTIA, Met Office) + Wind Speed (ERA5)



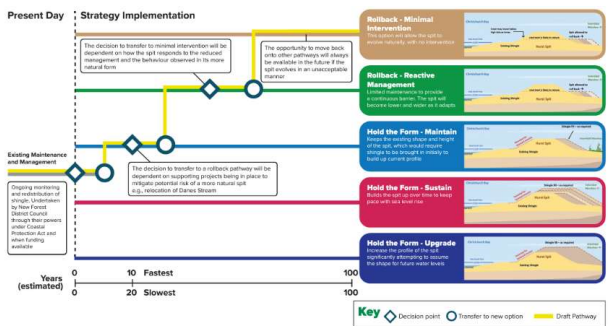
A resilient future for monitoring....

“An essential programme that builds national resilience.”

– Local Authority Stakeholder

USE

- **Explore** the data
www.coastalmonitoring.org
- **Use** the data, and encourage others to use it
- **Record** how/where/why you use the data



TELL & VALUE

- Tell **us** you use the data
 - When you download it
 - If we ask (questionnaires)
- Tell **other people** you use the data: help make us visible
 - Acknowledgements
 - When you present, report, reuse, discuss
- Tell the **government** you use the data
 - Funding Applications
 - Business Cases
 - Strategies

ENGAGE & INFORM

- Get involved
 - Annual Meetings
 - Stakeholder Events
- Let us know what you need
 - Survey Reviews
 - Business Case Planning
 - Email
 - Networking
- **Give us Feedback**
 - On the data
 - On the website
 - On anything.....

Feedback

The National Network of Regional Coastal Monitoring Programmes of England



Dr Charlie Thompson,
Director, Channel Coastal Observatory
celt1@noc.soton.ac.uk

www.coastalmonitoring.org

