Regional Variability in the Relative Importance of Surge and Wave Forecasting around the English Coastline

Channel Coastal Observatory
Regional Coastal Monitoring Programmes
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Introduction

Coastal zones and communities are expected to be increasingly threatened by changing sea-levels, particularly during times of storm surges and high waves which can cause overtopping or overwashing, leading to beach erosion, damage to coastal structures and defences and flooding.

Although waves are commonly regarded as significant contributors to extreme sea levels, coastal forecasting and analysis in the UK is arguably still weighted towards the prediction of tidal surges, particularly in view of the notable extreme water levels recorded during the North Sea storm surge event of 31 January 1953 and more recently 5 December 2013.

This poster compares the maximum surge, maximum significant wave height (Hs), duration of extreme waves and occurrence of bimodal seas measured around the English coastline, in order to bring attention to the regional variability in the importance of waves and tides to forecasting.

Data Sources

Figure 1: tide gauge data from 2004 to 2017 from the 46 National Tidal and Sea Level Facility's (NTSLF) Class A tide gauges and the 15 tide gauges operated by the Regional Coastal Monitoring Programmes (RCMP).

Figures 2, 3 & 4: wave data from 2004 to 2017 from the RCMP's 40 shallow water wave buoy sites.

Regional Coastal Monitoring Programme's tide gauge locations (Figure 1) and length of time series:

- Arun Platform (c. 10y)
- Brighton Marina (c. 8y)
- Deal Pier (c. 12.5y)
- Exmouth (c. 2.5y)
- Hastings Pier (c. 1y)
- Herne Bay (c. 22.5y)
- Lymington (c. 11y)
- Penarth (c. 1y)
- Port Isaac (c. 8y)
- Sandown Pier (c. 12y)
- Scarborough (c. 15y)
- Severn Bridge (c. 6.5y)
- Swanage Pier (c. 10.5y)
- West Bay Harbour (c. 10.5y)
- Whitby Harbour (c. 4.5y)

Discussion

For the south coast and the southern Celtic Sea, tidal surges exceeding ~ 1 m are uncommon (Figure 1) and serious risks to property and life tend to be associated with high wave action and bimodal sea conditions spanning High Water as the primary factor, rather than or supplemented by extreme water levels generated by surges (Figures 2, 3 & 4).

Along the North Sea coast, especially north of the Humber, wave action can be of similar importance as extreme water levels (Figures 1 & 2), particularly in light of the long duration of extreme wave events and the high occurrence rate of bimodal seas with high chances of spanning High Water (Figures 3 & 4).

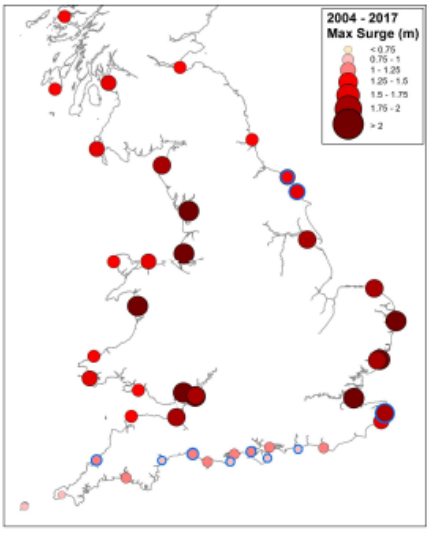

Figure 1: Maximum surge measured since 2004 by the NTSLF and RCMP tide gauges.

The sites circled in blue are operated by the RCMP.

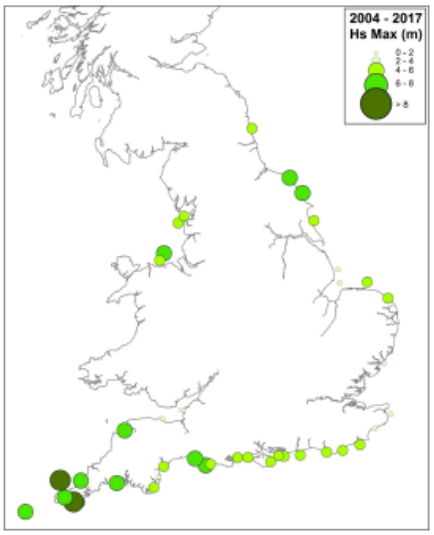

Figure 2: Maximum Hs measured since 2004 by the RCMP wave buoy network.

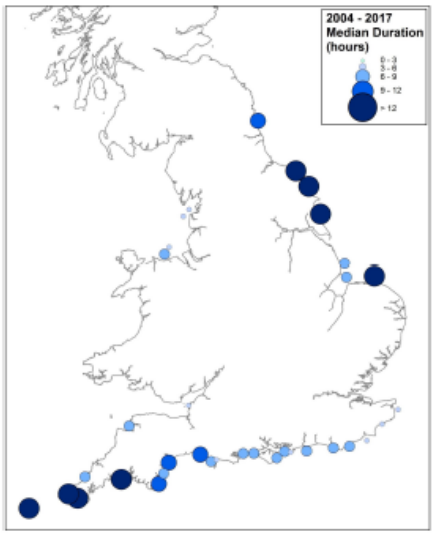

Figure 3: Median duration of extreme wave events since 2004 measured by the RCMP wave buoy sites.

The duration of a storm is defined as the time that Hs exceeded the 0.25 year return period (Dhoop & Mason 2018).

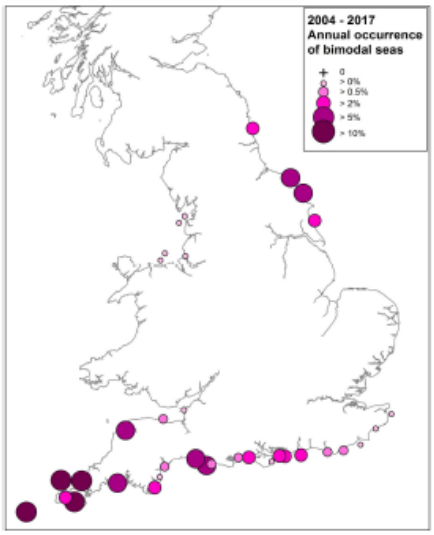

Figure 4: Annual occurrence of bimodal seas, which is the combination of wind-seas, generated by local winds, and swell-sea, ordinarily generated in a distant storm and dispersed out of the generating area.

The long periods of the swell lead to longer run-up and potentially overtopping of sea defences.

The method used to identify bimodal seas is described in Mason & Dhoop 2018.

Dhoop, T. & Mason, T. (2018) Spatial Characteristics and Duration of Extreme Wave Events around the English Coastline. *Journal of Marine Science and Engineering*. 6(1), 14; DOI: 10.3390/jmse6010014.

Mason, T., Bradbury, A., Poate, T. & Newman, R. (2008) Nearshore Wave Climate of the English Channel – Evidence for Bi-Modal Seas. *Proceedings of the 31st International Conference on Coastal Engineering*, American Society of Civil Engineers, 605-616.

Mason, T. & Dhoop, T. (2017) Quality Assurance & Quality Control of Wave Data. Channel Coastal Observatory. Available at: http://www.channelcoast.org/ccoresources/dataqualitycontrol/

Mason, T. & Dhoop, T. (2018) Occurrence of bimodal seas around the English coastline. TN02. Available at: http://www.channelcoast.org/ccoresources/