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Extreme waves and surges interaction with tides during storms in winter 2013/2014.

Julia Rulent

Bangor University, College of Environmental Sciences and Engineering, School of Ocean Sciences, United Kingdom of Great Britain – England, Scotland, Wales (osu024@bangor.ac.uk)

The interaction between waves, surges and tides is one of the main drivers of coastal total water levels (TWL). Understanding this interaction is crucial for studying high TWL formation near shore, and to do this it is important to not only evaluate how high the TWL is but also when and where it occurs.

In this study we use a high resolution (1.5 km) three-way coupled (waves-atmosphere-ocean) numerical model developed by the MetOffice (UKC4) to study coastal conditions at the UK coast during the extreme events of winter 2013, which was chosen as case study because of the amount of flooding that occurred in relation to storms and surges during this period.

For each coastal grid point the ten strongest storms of that winter, ranked by the significant wave height (Hs) magnitude, were selected. During these storm periods, the number of hours in which Hs and surges exceeded the 90th percentile of winter 2013 were evaluated considering what tidal stage they occurred on. The same was done for instances where high Hs and surges occurred simultaneously. The aim is to understand if specific areas were predominantly affected by one of the TWL components and how Hs and surges interacted with the tide. What was the spatial distribution of the waves, surges, and tides during winter 2013? Did extreme Hs and Surges occur more often over specific stages of the tidal cycle? Did they occur simultaneously?

In this study we show that during the winter 2013, Hs and surges above the 90th percentile value did occur simultaneously at all stages of the tidal cycle. They more often occurred together over the rising tide with in average 8.7% and 8.6% of instances found two and three hours before high tide. In 7.7% of cases high wave and surges also concurred at high tide.