**Spatial footprints of extreme storm surge events around the coastline of the UK**

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**Abstract**

Flooding is among the most dangerous and costly natural hazards with storm surges being the deadliest driver at coast. For example, the 2013/2014 season produced damages around £2.5 billion in UK due to an unusual high frequent and in close succession extreme sea levels and wave events. Furthermore, it was observed that the spatial footprint of some of these events (i.e., the simultaneous exceedance of critical thresholds along extended coastline stretches) were remarkable large. Therefore, the recognition and analysis of spatial and temporal extreme sea level characteristics is required to improve coastal impact assessment.

In this work, we apply a tracking algorithm to a high-resolution surge hindcast (CODEC, 1980-2017) to identify spatial footprints of extreme surge events along the coastline of UK and Ireland. We analyze the duration and the extension of this collection of spatial extreme surge events. We observe that the northeast coastline is the most intense impacted stretch by episodes that last at average more than one day. Besides the season of 2013/2014, the highest number of extreme surge events occurred in 1989/1990 with the coastlines of the Irish Sea most affected during this period. The most severe event also happened in the winter of 1989/1990 in terms of duration (around 39 hours) and the extended coastal stretch with the highest surge registered during the 38 years covered by the hindcast (Figure 1). This new analysis approach of surge extremes allows us to distinguish several categories of spatial footprints of events along the coast of the study domain that are linked to distinct storm tracks across the area.



Figure 1: The most severe surge event during the season 1898/1999: the spatial footprints every 3 hours (left) and the maximum empirical return value (in years) reached during this event (right).