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Flood risk uncertainty surrounding a 0.5% annual probability extreme event

Thomas Prime (1), Jennifer Brown (2), and Andrew Plater (1)

(1) University of Liverpool, Environmental Sciences, Liverpoool, United Kingdom (tprime@liv.ac.uk), (2) National Oceanography Centre, Liverpool, United Kingdom

To enable effective coastal defence design, a better understanding of the uncertainty in flood risk due to natural variability within the forcing is required. The typical UK design level is for a 0.5% annual probability event, historically known as a 1 in 200 year return period event. However, joint wave-water level probability curves provide a range of combined wave height and water level conditions that meet this criterion. The uncertainty of the 0.5% probability flood hazard is examined to identify tipping points in the degree of flooding, along with an assessment of which wave and water level combinations are most hazardous.
Wave rider and tide gauge data are analysed to define joint probability curves. Points are taken along the 0.5% probability curve to form an ensemble of flood simulations to assess the uncertainty in impact of variable conditions that meet this classification.

By modelling the flooding for a range of wave-water level conditions, which are all classified as the same 0.5% probability extreme event, we show that there is a great uncertainty in determining the flood hazard. Higher water levels enable greater wave overwashing, which counteracts any influence of a decreasing wave height. The longest period low swell waves combined with the highest extreme water levels cause the greatest flooding. The results suggest it is the high water level and low wave end of the probability curve that needs to be considered when designing the next generation of coastal schemes to meet a specified return level in extreme events.