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Corrigendum to "Towards using state-of-the-art climate models to help constrain estimates of unprecedented UK storm surges" published in Nat. Hazards Earth Syst. Sci., 21, 3693–3712, 2021

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In the paper "Towards using state-of-the-art climate models to help constrain estimates of unprecedented UK storm surges" by Tom Howard and Simon David Paul Williams (Nat. Hazards Earth Syst. Sci., 21, 3693–3712, 2021), the following error occurred: in the abstract, the simulation was incorrectly described as a "present-day control simulation". The phrase should be "pre-industrial control simulation" (as correctly stated in the main text). The corrected abstract in full is as follows.

Our ability to quantify the likelihood of present-day extreme sea level (ESL) events is limited by the length of tide gauge records around the UK, and this results in substantial uncertainties in return level curves at many sites. In this work, we explore the potential for a state-of-the-art climate model, HadGEM3-GC3, to help refine our understanding of present-day coastal flood risk associated with extreme storm surges, which are the dominant driver of ESL events for the UK and wider European shelf seas.

We use a 483-year pre-industrial control simulation from HadGEM3-GC3-MM (1/4° ocean, approx. 60 km atmosphere in mid-latitudes) to drive a north-west European shelf seas model and generate a new dataset of simulated UK storm surges. The variable analysed is the skew surge (the difference between the high water level and the predicted astronomical high tide), which is widely used in analysis of storm surge events. The modelling system can simulate skew surge events comparable to the catastrophic 1953 North Sea storm surge, which resulted in widespread flooding, evacuation of 32 000 people, and hundreds of fatalities across the UK alone, along with many hundreds more in mainland Europe. Our model simulations show good agreement with an independent re-analysis of the 1953 surge event at the mouth of the river Thames. For that site, we also revisit the assumption of skew surge and tide independence. Our model results suggest that at that site for the most extreme surges, tide-surge interaction significantly attenuates extreme skew surges on a spring tide compared to a neap tide.

Around the UK coastline, the extreme tail shape parameters diagnosed from our simulation correlate very well (Pearson's r greater than 0.85), in terms of spatial variability, with those used in the UK government's current guidance (which are diagnosed from tide gauge observations), but ours have smaller uncertainties.

Despite the strong correlation, our diagnosed shape parameters are biased low relative to the current guidance. This bias is also seen when we replace HadGEM3-GC3-MM with a reanalysis, so we conclude that the bias is likely associated with limitations in the shelf sea model used here.

Overall, the work suggests that climate model simulations may prove useful as an additional line of evidence to inform assessments of present-day coastal flood risk.