



Increasing risk of compound flooding from storm surge and rainfall for major US coastal cities

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Flood risk is a well-known facet of natural hazards along the US coastline where nearly 40% of the population resides in coastal counties. Given the heavy reliance on the coastal zone for natural resources and economic activity, flood preparedness and safety is a key element of long-term resilience. A clear understanding of the various flood types and changes in the frequency of their occurrence is critical towards reliable estimates of vulnerability and potential impacts in the near-term as well as into the future. When the two main flood drivers for coastal areas storm surge and heavy precipitation occur in tandem the potential for significant flooding is much greater than from either in isolation. Exploring the probability of these 'compound events' and understanding the processes driving them is essential to mitigate the associated high impact risks. For the contiguous US the likelihood of the joint occurrence of the two phenomena is largely unknown. Here we show – using storm surge and precipitation records spanning the last century – that the risk of compound flooding is higher for the US east and Gulf coasts, relative to the west coast. We also show that the number of compound events has increased significantly over the last century along large coastline stretches including many of the major coastal cities. For New York City – as an example – this increase is attributed to a shift towards storm surge weather patterns also favouring high precipitation. Preliminary analyses reveal that these synoptic scale changes are closely linked to large scale and low frequency climate variations. Our results demonstrate the importance of assessing the risk of compound flooding within the design process of coastal and urban infrastructure in a non-stationary framework and to explore the potential effects of climate change on these high impact events.