Future sea level rise dominates changes in worst case extreme sea levels along the global coastline by 2100

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Coastal zones contain large human populations, significant socio-economic activities and assets, and fragile ecosystems. With climate change and sea level rise coastal communities face increasing risk of more frequent and severe coastal inundation, leading to huge economic losses. While the focus of sea level change studies tends to be on quantifying the rate and magnitude of mean sea level rise, most threats of coastal flooding are governed by a combination of extreme sea levels due to storm surges and waves, and sea level rise. In our study we estimate the magnitude of a worst case scenario for extreme sea levels along the global coastline by 2100. This worst case scenario for extreme sea levels is calculated as a combination of sea surface height associated with storm surge and wave (100-year return period, the 95th percentile), high tide (the 95th percentile) and a low probability sea level rise scenario (the 95th percentile). We show that by 2100 extreme sea levels have a 5% chance of exceeding 4.2 m (global coastal average), compared to 2.6 m during the baseline period (1980-2014). Almost 45% of the global coastline would experience extreme sea levels above the global mean of 4.2 m, with up to 9-10 m for the East China Sea, Japan and North European coastal areas. Up to 86% of coastal locations would face extreme sea levels above 3 m (100-year return period) by 2100, compared to 33% currently. Up to 90% of increases in magnitude of extreme sea levels are driven by future sea level rise, compare to 10% associated with changes in storm surges and waves. By 2030-2040 the present-day 100-year return period for extreme sea levels would be experienced at least once a year in tropical areas. This 100-fold increase in frequency will take place on all global coastlines by 2100.