Geophysical Research Abstracts
Vol. 19, EGU2017-4430, 2017
EGU General Assembly 2017

Advancements in the global modelling of coastal flood hazard

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Storm surges and high tides can cause catastrophic floods. Due to climate change and socio-economic development the potential impacts of coastal floods are increasing globally. Global modelling of coastal flood hazard provides an important perspective to quantify and effectively manage this challenge.

In this contribution we show two recent advancements in global modelling of coastal flood hazard: 1) a new improved global dataset of extreme sea levels, and 2) an improved vertical datum for extreme sea levels. Both developments have important implications for estimates of exposure and inundation modelling.

For over a decade, the only global dataset of extreme sea levels was the DINAS-COAST Extreme Sea Levels (DCESL), which uses a static approximation to estimate total water levels for different return periods. Recent advances have enabled the development of a new dynamically derived dataset: the Global Tide and Surge Reanalysis (GTSR) dataset. Here we present a comparison of the DCESL and GTSR extreme sea levels and the resulting global flood exposure for present-day conditions. While DCESL generally overestimates extremes, GTSR underestimates extremes, particularly in the tropics. This results in differences in estimates of flood exposure. When using the 1 in 100-year GTSR extremes, the exposed global population is 28% lower than when using the 1 in 100-year DCESL extremes.

Previous studies at continental to global-scales have not accounted for the fact that GTSR and DCESL are referenced to mean sea level, whereas global elevation datasets, such as SRTM, are referenced to the EGM96 geoid. We propose a methodology to correct for the difference in vertical datum and demonstrate that this also has a large effect on exposure. For GTSR, the vertical datum correction results in a 60% increase in global exposure.