Geophysical Research Abstracts
Vol. 20, EGU2018-17557, 2018
EGU General Assembly 2018

Flood hazard assessment for a hyper-tidal estuary and river as a function of tide-surge-morphology interaction

Charlotte E. Lyddon (1,2), Jennifer M. Brown (2), Nicoletta Leonardi (1), and Andrew J. Plater (1)

(1) University of Liverpool, Liverpool, United Kingdom (c.e.lyddon@liverpool.ac.uk), (2) National Oceanography Centre, Liverpool, United Kingdom

In heavily populated and industrialized estuaries, accurate prediction of extreme water level and its timing is essential for storm hazard mitigation. Such prediction requires accurate understanding of the interaction between tide and surge, how this varies as a function of the timing and shape of the storm surge relative to high water, and how such interaction changes due to estuary morphology. This is especially critical in hyper-tidal estuaries and rivers where the consequences of tide and storm surge concurrence can be catastrophic. Delft3D-FLOW is used to assess up-estuary variability in extreme water levels for a range of historical events of different severity within the River Severn estuary, southwest England. The influence of the following on flood hazard is investigated: i) event severity, ii) timing of the peak of a storm surge relative to tidal high water and iii) the temporal distribution of the storm surge component (here in termed the surge skewness). Results show when modelling a local area event severity is most important control on flood hazard. Tide-surge concurrence increases flood hazard throughout the tidal domain and influences the nature of saltwater penetration. Positive surge skewness can result in a greater variability of extreme water levels, the effects of which are magnified up-estuary by geometry to exacerbate flood hazard. When viewed in the context of the Source-Pathway-Receptor-Consequence model, these results help to identify the combined effect of factors which contribute to extreme water levels for local scale, flood hazard management. The severity of an extreme water level event and the timing of the storm surge are identified as sources to flood hazard. The morphological form of a hyper-tidal estuary and river is a ‘source’ or ‘pathway’ in itself, influencing how floodwaters are conveyed through the system. The concepts and methodology presented can be applied to other estuaries worldwide.