RESPONSES OF COASTAL FLOOD RISK TO SEA LEVEL RISE: REMOTE SENSING AND HYDRAULIC APPROACH

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Currently, sea levels around the world are rising due to global warming which dramatically increases the odds of damaging floods in coastal zones. China has a long coastline extending over 18,000 km in which some developed and densely populated cities and large-river delta areas are distributed. It is difficult, however, to predict exactly how coastal flood risk will change in response to a specific rise in sea level at a particular location in time. The ability to predict this change is limited by uncertainties in both currently available data that describes the coastal environment, as well as gaps of appropriate models to simulate the flooding process in national-scale. Nonetheless, the likelihood and characteristics of flooding under the conditions of sea level rise are needed to make decisions to avoid or mitigate future flood hazards. The study demonstrates an innovative analysis framework for synthesizing information extracted from remote sensing images on coastal environments and storage-cell-based hydraulic model LISFLOOD-FP for rapid and high-performance simulation of large-scale flood events and prediction of future flood risk responses to different sea level scenarios. Research has been focused on three case study regions of China coastal zones including Yellow River delta, Yangtze River delta and Pearl River Delta. Firstly, satellite altimeters of TOPEX/POSEIDON (T/P) time series data and in situ measurements from a network of tide gauge stations are combined to estimate sea level variations in the past years and project future trends in the study areas. Secondly, return period of extremely high water levels is calculated based on a statistical analysis of historic values. Following the influence of sea level rise on expected extreme water levels and their frequencies along coastal zones are investigated. Thirdly, the large-scale coastal flood modeling approach is described. The numerical simulation of the hydrodynamic processes in coastal floodplains is essential for flood hazard analysis as well as for risk forecasting under global change. By integrating simple hydraulic model and remote sensing extracted coastal environment parameter, some serious flood events across large coastal areas are simulated and the results are validated by observed historic flood extend. According to the comparative study, the parameters derived from remote sensing data can improve the simulate results to some extent. Finally, based on the outputs and approaches mentioned above, the flooded areas and coastal risk maps in different future sea level rise scenarios are determined. With the aid of GIS tools, detailed analysis of affected population and economy due to sea level rise is presented. It is concluded that sea level rise will lead to a substantial increase in vulnerability of coastal

zones to storm surge floods. The analysis framework presented in this paper will contribute to a better understanding of coastal flood risk changes from sea level rise and provide methodology and information for management and ensuring sustainable development for China costal zones.