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TITLE: Compound simulation of fluvial floods and storm surges in a global coupled river?coast flood model: Model development and its application to 2007 Cyclone Sidr in Bangladesh

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ABSTRACT:

Abstract Water?related disasters, such as fluvial floods and cyclonic storm surges, are a major concern in the world's mega?delta regions. Furthermore, the simultaneous occurrence of extreme discharges from rivers and storm surges could exacerbate flood risk, compared to when they occur separately. Hence, it is of great importance to assess the compound risks of fluvial and coastal floods at a large scale, including mega?deltas. However, most studies on compound fluvial and coastal flooding have been limited to relatively small scales, and global?scale or large?scale studies have not yet addressed both of them. The objectives of this study are twofold: to develop a global coupled river?coast flood model; and to conduct a simulation of compound fluvial flooding and storm surges in Asian mega?delta regions. A state?of?the?art global river routing model was modified to represent the influence of dynamic sea surface levels on river discharges and water levels. We conducted the experiments by coupling a river model with a global tide and surge reanalysis data set. Results show that water levels in deltas and estuaries are greatly affected by the interaction between river discharge, ocean tides and storm surges. The effects of storm surges on fluvial flooding are further examined from a regional perspective, focusing on the case of Cyclone Sidr in the Ganges?Brahmaputra?Meghna Delta in 2007. Modeled results demonstrate that a >3 m storm surge propagated more than 200 km inland along rivers. We show that the performance of global river routing models can be improved by including sea level dynamics.

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