Development of Early Warning Systems in Bangladesh for Flash Floods and Cyclonic Storm Surges to Enhance Climate Resilience

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Abstract

Flash Flood Forecasting: The northeast region of Bangladesh is highly vulnerable to flash floods which often damage the only crop of that region, the boro rice. Developing an efficient and real-time flash flood forecasting system for that region is found essential. We have developed an open-source data-centric integrated flash flood modeling approach using a platform named Delft-FEWS. It is based on three inter-dependent models, e.g., meteorological (WRF), hydrologic (HEC-HMS), and hydrodynamic (HEC-RAS). The hydrodynamic model was calibrated and validated with the flash flood data of 2010-12 and 2013-15, respectively. The performance of the model in real-time was assessed in the context of the 2021 and 2022 flash flood seasons. The entire system helps the practitioners to work in a flexible environment to generate flash flood forecasting and early warnings.

Storm Surge Forecasting: The coastal region of Bangladesh is highly vulnerable to climate change. Enhancing coastal resilience under the changing climate is crucial for Bangladesh. Coastal Communities are highly vulnerable to storm surge and their impacts. Global warming is expected to increase both the frequency and the intensity of tropical cyclones. The country still lacks developing near real-time storm surge inundation early warning systems with adequate accuracy. We have developed a storm surge inundation model and database using the available tropical cyclones' database and simulated inundation for the past 12 cyclones in the Bay of Bengal, near the coastal regions of Bangladesh. The model uses a suite of Delft3D hydrodynamic and Delft Dashboard cyclone models. The model was calibrated and validated for major cyclones, namely Sidr and Aila, using historical track data from Indian Meteorological Department. This model could be used for operational storm surge inundation forecasting and early warnings.