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Generalizing flood damage mechanism processes of MC Type houses by developing comprehensive flood damage estimation method for Teesta River Basin, Bangladesh

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Flood is one of the most devastating natural disasters. The damages of flood usually vary with the consideration of different factors (depth, duration, velocity, materials of infrastructures) of flooding. Therefore, flood damage estimation is a complex process. Most of previous studies considered only flood depth in developing flood damage functions for residential houses. However, the consideration of other flood parameters such as flood duration and flood velocity are also crucial to estimate flood damage more reliably. Therefore, this study aimed to consider various flood parameters such as flood depth, flood duration, and flood velocity in development of flood damage functions for residential houses. In this study, the Teesta River Basin in Bangladesh was chosen as the study area. A detailed household questionnaire survey was conducted in flood-affected areas of Lalmonirhat and Rangpur districts (administrative unit of Bangladesh) to collect data of 2017 and 2019 flood events. Most of the houses in the surveyed flood-affected areas are composed of mud base and side wall of corrugated iron sheets (called “MC type”). For each house, the questionnaire aimed to identify the flood information (flood depth, flood duration, the qualitative representation of flood velocity), household structure information (area, plinth height, ceiling height), structural damage mechanism and the required amount of material with labor work to repair the damage after each flood event. Using the survey data, we have developed depth-damage functions for MC type of house by considering different flood velocity and flood duration combinations. The newly developed depth-damage functions can generalize thresholds of flood depth, flood velocity and flood duration that are responsible for specific type of structural damages (mud removal from the base, mud removal from the base together with side wall instability, full structure instability) of MC type house. Finally, a grid-based approach through the integration of new depth-damage functions with hydrologic-hydraulic model (RRI) and Nays2DFlood Solver (iRIC software) simulation results has been developed to estimate the total flood damage for MC type houses in flood-affected areas of the Teesta River Basin. This comprehensive method can be easily used to derive the depth-damage functions and estimation of total damage for other types of houses if enough surveyed data can be obtained from the field.

Keywords: Flood damage estimation, Depth-damage function, MC type house, Hydrologic-

hydraulic model