Assessment of river flood vulnerability and possible adaptation options

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In hydrology, flood frequency analysis is defined as the likelihood of various discharges as a function of exceedance probability and it is used to relate flow discharge to its recurrence interval (the probability of occurrence of flood being equaled to or exceeding in any year). This technique would allow hydrologists to predict magnitudes of flow corresponding to specific recurrence intervals for a given stream. Applications of flood frequency analysis can be extended to evaluations of possible over-designing or under-designing and optimizing the design specification for hydraulic structures constructed along rivers, estimation of possible damages corresponding to peak flows, floodplain mapping including floodplain management, mitigation and insurance activities. These examples further highlight the importance of accurate estimation of flood frequency. Historical records from Ferizi river located at Khorasan province was used for this study since flood events are one of the top three natural disasters faced by this province. Prediction of flood recurrence interval along with flood depth and the exact scope of the zoning decisions for crisis response to reduce damage and save lives is of particular importance.

In this regard, HEC_RAS software was used for flood modeling which is considered throughout the literature as a valid model for hydraulic calculations in natural waterways. One dimensional simulation of rivers in HEC_RAS provides the possibility of stable and unstable currents calculations. Several cross-sections were drawn orthogonally with respect to river line in GIS environment and then introduced to the model by georeferencing. Hereafter, other information required such as roughness coefficient, spaces between the left and right coast and etc. are fed into HEC_RAS model. Based on results obtained from running HEC_RAS it was found that 13 cross-sections from the entire study are experiencing severe erosion. Plus, inappropriate land use and undesirable advancement of arable lands in the margins of the river as well as violating the river bed by altering it can increase the peak discharge of floods and the surface of the flood catchment area. On the other hand, it was found that an increase in height of the flood does not have much impact on expanding flood zone as well as the roughness factor does not show a significant impact on increasing the height of flood.