Flood hazard assessment using GIS/RS tools: A case study of Lower River Swat Basin, NW (Pakistan)

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Abstract

Flooding is the most frequent and devastating phenomena around the globe. With the rapid growth in population and relative disturbances in the natural ecosystem lead to global climatic changes and by these alterations natural hazards such as floods, earthquake, mass wasting and cyclone are tremendously increased. Heavy precipitation in monsoon season especially in south Asian countries like India, Bangladesh and Pakistan coupling with melting of snow generates high surface runoff resulting in overflow in the river channels. This overflow in the river body ravages the downstream areas, and caused damages to both life and property. Due to the frequent flooding and its destruction to the human society in Pakistan, the demand for flood hazard assessment using Geographical Information System (GIS) and remote sensing has increased. The scope of the present study is to model the Lower River Swat channel of district Swat having the length of 6 km from upstream Sangota to downstream Ayube Bridge by the integration of field data, Hydrodynamic Model (HEC-RAS), ASTER DEM and GIS. GIS and HEC-GeoRAS technology has been used for the geospatial analysis of the study by using the ASTER DEM (30 m). The river geometry data which is main input to HEC-RAS was obtained through by field survey with help of total station (Sokkia, Model No= CX105, made in Japan). HEC-RAS has been used for the simulation of the hydrological data. The HEC-RAS model was calibrated through by known water discharge (4971 m^3/s) for the peak flood year of 2010 with the support of Manning's 'n' values and contraction and expansion of the river channel. The results were slightly higher for some of the cross-sections but in comparison to overall the model results show an average difference of 0.36 m which is in the acceptable limits. To check out the model validity to that of known water surface (HFL) for the peak flood of 2010, a correlation curve was developed. The output of the curve indicate best correlation (R^2= 0.99) to that of model computed water surface level. However post- processing in the GIS environment was not possible due to the low resolution of ASTER DEM. Further the study suggested that the integration of GIS, RS (ASTER DEM) and Hydrodynamic model (HEC-RAS) play a vital role in predicting of future floods and its spatial inundation in the nearby floodplains.