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Effects of Changes in LULC on Hydrological Response in Upper Indus Basin

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Abstract : Empirically based lumped hydrologic models have an extensive track record of use for various watershed managements and flood related studies. This study focuses on the impacts of LULC change for 10 year period on the discharge in watershed using lumped model HEC-HMS. The Indus above Tarbela region acts as a source of the main flood events in the middle and lower portions of Indus because of the amount of rainfall and topographic setting of the region. The discharge pattern of the region is influenced by the LULC associated with it. In this study the Landsat TM images were used to do LULC analysis of the watershed. Satellite daily precipitation TRMM data was used as input rainfall. The input variables for model building in HEC-HMS were then calculated based on the GIS data collected and pre-processed in HEC-GeoHMS. SCS-CN was used as transform model, SCS unit hydrograph method was used as loss model and Muskingum was used as routing model. For discharge simulation years 2000 and 2010 were taken. HEC-HMS was calibrated for the year 2000 and then validated for 2010.The performance of the model was assessed through calibration and validation process and resulted R2=0.92 during calibration and validation. Relative Bias for the years 2000 was -9% and for2010 was -14%. The result shows that in 10 years the impact of LULC change on discharge has been negligible in the study area overall. One reason is that, the proportion of built-up area in the watershed, which is the main causative factor of change in discharge, is less than 1% of the total area. However, locally, the impact of development was found significant in built up area of Mansehra city. The analysis was done on Mansehra city sub-watershed with an area of about 16 km2 and has more than 13% built up area in 2010. The results showed that with an increase of 40% built-up area in the city from 2000 to 2010 the discharge values increased about 33 percent, indicating the impact of LULC change on discharge value.

Keywords : LULC change, HEC-HMS, Indus Above Tarbela, SCS-CN
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