JOURNAL OF
ENVIRONMENTAL HYDROLOGY
The Electronic Journal of the International Association for Environmental Hydrology
On the World Wide Web at http://www.hydroweb.com
VOLUME 12 2004

# DEM-RS-GIS BASED STORM RUNOFF HYDROGRAPH ESTIMATION FOR THE HEART RIVER SUB-BASIN, MISSOURI RIVER BASIN

**Assefa M. Melesse** | Earth Systems Science Institute, University of North Dakota
Grand Forks, North Dakota, USA

*Accurate representation of the physical and biological features of the landscape within the watershed is required as the extent and type of watershed cover affects the movement of water in the hydrologic cycle. Remote sensing (RS), such as satellite imagery from Landsat and other satellites, provides land-cover and surface microclimate information with high temporal and spatial accuracy. The use of these data to understand hydrologic processes depends on how accurately they are interpreted and mapped. A study conducted at the Heart River sub-basin in the Missouri River basin, located on southwestern North Dakota, utilizes Landsat Enhanced Thematic Mapper Plus imagery and geographic information system (GIS) tools to derive land-cover for the summer of 2002. Land surface temperature and Normalized Difference Vegetation Index (NDVI) from the Landsat image was used to better map the land-cover and estimate runoff response. The corresponding infiltration excess runoff response of the study area was estimated using the United States Department of Agriculture, Natural Resources Conservation Service Curve Number (USDA-NRCS-CN) method. A Digital Elevation Model (DEM)-RS-GIS routing technique based on a 1-D kinematic wave approximation was developed to predict stream response to runoff events based on the travel time from each grid cell to the watershed outlet. Simulated and observed runoff volume and hydrographs were compared for three storm events. The NRCS-CN method with the DEM-RS-GIS routing technique predicts the observed runoff volume with mean error and residual standard deviation of (–38% and 5 mm), peak flow (-15% and 2.38 $m^3$/sec), and time to peak flow (17% and, 1.26 day), respectively.*