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Development and calibration of hydraulic models using GIS and remotely sensed data

Abdollah Asadzadeh Jarihani and John Nikolaus Callow
University of Queensland, Brisbane, Australia (abdollah.asadzadehjarihani@uqconnect.edu.au)

Floodplains are morphologically dynamic areas of strategic economic, environmental and socio-political interest. Accurate models of floodplain hydrodynamics are essential tools for mitigating severe social and economic losses associated with floods. This study investigated the possibility of building and calibrating hydraulic models using remotely sensed data to overcome issues of scale, and only limited field access on an 80 km reach of Aras River forms the boundary of the Islamic Republic of Iran and Nakhchivan Autonomous Republic (Azerbaijan).
Shuttle Radar Topographic Mission (SRTM) and Advanced Space borne Thermal Emission and Reflection Radiometer (ASTER) Digital Elevation Models (DEM), and archival Landsat imagery that included before, during and after flood event was combined with field data to build a one dimensional hydrodynamic model of the river and floodplain using the U.S. Army Corps of Engineers - River Analysis System HEC-RAS/HEC-GeoRAS. Topographic data (DEM) were compared and calibrated against a 1:2000 scale ground surveyed derived DEM that included 45river cross-sections, and flood discharge calibrated at two gauging stations. Using the geospatial interface of HEC-GeoRAS, flood inundation was mapped onto the DEM for all flood events, and flow hydraulics calibrated between gauging stations using opportunistic Landsat imagery that captured flood events.
This project provided a novel approach to accurately map flood inundation and hydraulics in a large, trans-national study reach, by integrating remotely sensed data and ground-based control points. Results of the satellite imagery archive also identified that the channel is dynamic and the hydraulic model and DEM require editing to reflect the dynamic nature of the floodplain and channel morphology, however, this problem is also common to ground only based studies that also treat topography as a static quality in time. The study reports on a method that showed advantages and increased the reliability through the use of remotely sensed data in calibrating hydrodynamic models in data-poor, morphologically dynamic and trans-national floodplains.