Hydrologic Terrain Analysis Using Web Based Tools

David G. Tarboton (1), Nazmus Sazib (2), Anthony Castronova (3), Yan Liu (4), Xing Zheng (5), David Maidment (5), Anthony Aufdenkampe (6), and Shaowen Wang (4)

(1) Utah State University, Utah Water Research Laboratory, Civil and Environmental Engineering, Logan, United States (dtarb@usu.edu), (2) Science Application International Corporation , (3) Consortium of Universities for the Advancement of Hydrologic Science, Inc., (4) University of Illinois, Urbana Champaign, (5) University of Texas at Austin, (6) LimnoTech

Digital Elevation Models (DEM) are widely used to derive information for the modeling of hydrologic processes. The basic model for hydrologic terrain analysis involving hydrologic conditioning, determination of flow field (flow directions) and derivation of hydrologic derivatives is available in multiple software packages and GIS systems. However as areas of interest for terrain analysis have increased and DEM resolutions become finer there remain challenges related to data size, software and a platform to run it on, as well as opportunities to derive new kinds of information useful for hydrologic modeling. This presentation will illustrate new functionality associated with the TauDEM software (http://hydrology.usu.edu/taudem) and new web based deployments of TauDEM to make this capability more accessible and easier to use. Height Above Nearest Drainage (HAND) is a special case of distance down the flow field to an arbitrary target, with the target being a stream and distance measured vertically. HAND is one example of a general class of hydrologic proximity measures available in TauDEM. As we have implemented it, HAND uses multi-directional flow directions derived from a digital elevation model (DEM) using the Dinfinity method in TauDEM to determine the height of each grid cell above the nearest stream along the flow path from that cell to the stream. With this information, and the depth of flow in the stream, the potential for, and depth of flood inundation can be determined. Furthermore, by dividing streams into reaches or segments, the area draining to each reach can be isolated and a series of threshold depths applied to the grid of HAND values in that isolated reach catchment, to determine inundation volume, surface area and wetted bed area. Dividing these by length yields reach average cross section area, width, and wetted perimeter, information that is useful for hydraulic routing and stage-discharge rating calculations in hydrologic modeling. This presentation will describe the calculation of HAND and its use to determine hydraulic properties across the US for prediction of stage and flood inundation in each NHDPlus reach modeled by the US NOAA's National Water Model. This presentation will also describe two web based deployments of TauDEM functionality. The first is within a Jupyter Notebook web application attached to HydroShare that provides users the ability to execute TauDEM on this cloud infrastructure without the limitations associated with desktop software installation and data/computational capacity. The second is a web based rapid watershed delineation function deployed as part of Model My Watershed (https://app.wikiwatershed.org/) that enables delineation of watersheds, based on NHDPlus gridded atat anywhere in the continental US for watershed based hydrologic modeling and analysis.