ABSTRACT

Saksena, Siddharth. M.S., Purdue University, May 2014. Investigating the Role of DEM Resolution and Accuracy on Flood Inundation Mapping. Major Professor: Venkatesh Merwade.

Topography plays an important role in determining the accuracy of flood inundation maps. A lot of the current flood inundation maps are created using topographic information derived from Light Detection and Ranging (LiDAR) data. Although LiDAR data is very accurate, it is expensive, computationally time consuming and not available in several areas across the United States and around the world. As a result, coarser resolution DEMs which are easily available but less accurate are used for flood modeling. It is essential to understand the properties of LiDAR data to create methods to modify coarser resolution DEMs and increase their accuracy. These properties can be used to understand how elevation errors propagate within a DEM and reduce the impact of errors in coarser resolution datasets.

The first objective of this study is to quantify the errors arising from DEM properties such as resolution and accuracy on flood inundation maps. The results from these six study areas show that water surface elevations and flood inundation area have a linear relationship with the DEM resolution and accuracy.

The second objective of this study is to use the linear relationship between hydraulic outputs and the DEM resolution or accuracy to create an approach for developing accurate flood inundation maps using less accurate DEMs by modeling the spatial distribution of DEM errors. Application of this new approach on USGS NED 30 m DEMs and SRTM 90 m resolution DEMs shows significant increase in the accuracy of water surface elevations and improvement in predicted flood extents created from coarser resolution DEM when compared to results from high resolution accurate DEMs.

A check on the applicability of this approach for different interpolation methods and river channel conditions is also presented in this study. The new approach thus provides promising results in obtaining more accurate flood maps from less accurate topographic data.