Using climate data, landscape parameterization, and a LiDAR generated digital elevation model to map flood risk in Oxford, Nova Scotia

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From September 21–23, 1999, remnants of Hurricane Harvey converged with another active storm and 302 mm of rain fell in a 30-hour period in the area surrounding the town of Oxford, Nova Scotia. The town site is situated on the flood plain of the River Phillip at the confluence of River Phillip and Black River. This event resulted in the flooding of River Phillip and severe damage to infrastructure in the town. The damage associated with this flood event (and a subsequent event in March 31, 2003), has led to the need to better understand the interplay between weather, landscape, and river stage in this area.

In this study we reconstruct the climate factors that preceded the September 1999 flood. We have focused on this flood event as complicating factors such as the presence of snowpack and river ice do not need to be considered. For the upper catchment we classify landuse using multispectral Landsat ETM+ imagery in conjunction with surficial geology maps and assign hydraulic properties to each. In the floodplain, we calculate vegetation heights from the digital elevation model (DEM) which was acquired via airborne LiDAR (Light Detection and Ranging) to calculate surface roughness and coefficients of friction. We also use our DEM to provide a platform for flood inundation models.

Preliminary results indicate that changes in the parameterization of land use play a significant factor when modelling the relationship between weather and river stage and must be carefully considered when modelling hydrological events. DEMs derived from LiDAR are a valuable source of data for understanding the subtle behaviour of water flow within ditches and along roads within a town landscape which are very difficult to map using traditional larger scale DEMs. However, modelling using higher resolution LiDAR-derived DEMs come with its own difficulties such as file size and flow obstructions which are not otherwise encountered when working with traditional scale DEMs.