Linking watershed rainfall and storm surge models to better predict flooding in coastal communities: an example from River Phillip and Oxford, Nova Scotia

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Traditional flood modelling has focused on either fluvial runoff scenarios or storm surge scenarios. It is often the case that significant weather events result in both storm surge and high rain fall simultaneously. The traditional approaches to flood modelling fail to capture the interactive nature of these events. Flood events due to high rain fall are exacerbated by higher tides, which in effect of restrict the outward flow of the flooding river system. Our study aimed to develop an integrated system for amalgamating land and sea borne high water in order to (i) reproduce real world flood conditions for a given storm events and (ii) project future storm scenarios.

To satisfy the study objectives, flood models were developed and integrated using the MIKE software suite developed by DHI for Oxford, Nova Scotia. The town of Oxford is known to be prone to flooding in response to heavy rainfall and is linked to the Northumberland Strait by the River Phillip. The fluvial response to heavy rainfall was simulated using a rainfall dependent inflow and infiltration model linked to a one-dimensional hydrodynamics model. The marine response to tidal surge was simulated using a two-dimension hydrodynamic model. Model results demonstrated realistic flood extents in response to a historical rainfall event in September of 1999. Flood extents were found to increase when an artificial tidal surge was applied during the same event. The results yield important information on flow bottlenecks, and the timing and severity of flooding in response to rainfall and tidal events.

With current sea level rise at an observable rate of 29 cm per century for the region, it is important that aggravating factors related to estuarine flooding, such as precipitation, be accounted for in the modelling process so future planning practices do not underestimate flood impacts.

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