The use of high density filtered LiDAR and optically derived land use information in modeling surface water quality: The case of a metropolitan catchment

Cyril Wilson¹
¹Geography, University of Wisconsin-Eau Claire

Adequate water quality is pivotal for the health of aquatic organisms and the sustainability of these ecosystems. Notwithstanding the key role played by water quality sampling in providing crucial information for specific locations within rivers, lakes and other terrestrial water bodies, hydrologic water quality modeling is still needed to obtain a comprehensive picture of the status of water quality for an entire water body. As a result of this critical role of hydrologic water quality models, they must be accurately constructed in order to produce appropriate water quality information for a watershed. Using high density filtered LiDAR, optically derived land use/land cover information from multiple Landsat satellite sensors, and sampled points for stream flow and water constituents, this study simulated three scenarios of LiDAR surface features and gauged their impacts on the efficacy of hydrologic-water quality modeling in the DesPlaines River Watershed, Chicago Metropolitan Statistical Area. The LiDAR scenarios encompass 1) the above ground features of the LiDAR point cloud minus high and medium vegetation, 2) Above ground features minus all vegetation point clouds, and 3) the bare Earth point clouds. Prior to operationalizing the hydrologic water quality modeling, a hybrid classification approach which encompass object-based and decision tree classifiers was undertaken to extract land use/land cover information from the Landsat images. In modeling surface water quality, the role of each of the filtered LiDAR scenarios on model calibration and validation was critically assessed. Result of the study clearly pointed the type of filtered LiDAR point cloud scenario that can result in more efficient model calibration and validation and hence lead to effective simulation of water quality information for an entire urban metropolis.

Keywords: Surface water quality, filtered LiDAR, hydrologic modeling, DesPlaines River, Chicago Metropolitan Statistical Area.