Integrated water quality forecasting system for the Annapolis Basin, Nova Scotia

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Water quality is important to those living in coastal communities, to the shellfish industry, and to regulatory agencies. This work focuses on developing an integrated forecasting system to predict areas of poor water quality within the Annapolis Basin, as a result of *E.coli* contamination, up to 72 hours in advance. Forecast information will provide the predicted spatial extent of contamination and will be used to improve the efficiency of regulatory sampling, reduce unnecessary closures, and identify major sources of contamination.

Water quality forecasts will be determined by linking dynamic environmental variables (such as time, temperature, precipitation, and ultraviolet light) to a robust database composed of contamination sources, estuarine hydrodynamics, watershed hydrology, and *E.coli* loading scenarios. Loading concentrations and decay rates of *E.coli* are calculated for surrounding watersheds, and anthropogenic sources (municipal wastewater treatment and rural septic systems) using hydrological, hydrodynamic, and advection dispersion models which incorporate land cover attributes and flow dynamics. At each loading confluence, the estuarine hydrodynamics of the Annapolis Basin are modelled to simulate unsteady flow dynamics of water in response to dynamic tidal elevations. The estuarine hydrodynamic model provides the computational basis for an estuarine particle tracking module which simulates the transport and dispersion of suspended *E.coli* within the estuary. Sensitive zones, such as shellfish harvesting areas, are monitored during particle tracking runs. Extracted data are used to produce the final product of the model, concentration of *E.coli* contamination over time within sensitive zones.

To increase model efficiency, and allow for real time predictions, a database approach was adopted. A database of concentration extractions was developed by identifying unique tidal scenarios (n = 104) to undergo a battery of particle tracking runs (n = 319488) in order to simulate all possible contamination extents for each source point. Loading scenarios were developed to account for environmental and seasonal *E.coli* concentrations on the watershed level. Future system development will allow for rapid retrieval of contamination extents and concentrations based on current and predicted environmental conditions, seasonality, and time.

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