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Simulation of subsurface water, nutrients and contamination discharge to coast

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Ecosystems of the coastlines are receiving extraordinary amounts of nutrients as a consequence of human activities such as fertilizers, industrial emissions to the atmosphere, and disposal of waste water in coastal watersheds. The loadings of nitrogen and phosphorous to coastal aquatic environments even exceed those to fertilized agro-ecosystem. Increased nutrient loading from anthropogenic sources is pervasive and function of shallow coastal ecosystems during coming decades.

During the last decade, it has become apparent that subsurface water flow and transport of nutrients into shallow coastal water are far more significant and widespread than had been realized. The importance of subsurface water is not so much because of the magnitude of flow rates, but rather because of the high nutrient concentrations in subsurface water compared to those in receiving sea / lake water. Although highly variable, the nutrient content of subsurface water discharging onto coastal water may be up to five orders of magnitude larger than concentrations in receiving sea / lake water.

Subsurface water discharge has shown to be a source of nitrogen, typically as nitrate, in shallow sediments of lakes and coastlines. The response of primary producers to nutrient loading within an estuary must be dependent on the balance between increased growth due to elevated inputs of the limiting nutrient and losses related to the flushing rate, as per the model. This is the point of the well documented relation between phosphorous loading and phytoplankton chlorophyll.

In this talk, some Canadian and Indian examples (Port Granby radio active disposal site, Lambton County and Krishna- Godavari Delta) shows the roles of geo-hydrology and hydro-geochemical processes are investigated by the application of numerical models for water quantity and quality modelling of receiving waters. This model also predicts the movements of contaminants in subsurface and surface waters and coastal sediments.