Institut national de la recherche scientifique

CENTRE EAU TERRE ENVIRONNEMENT

Hydrology and Remote sensing

2019-2020

Canada possesses about 9% of the world's renewable water supply

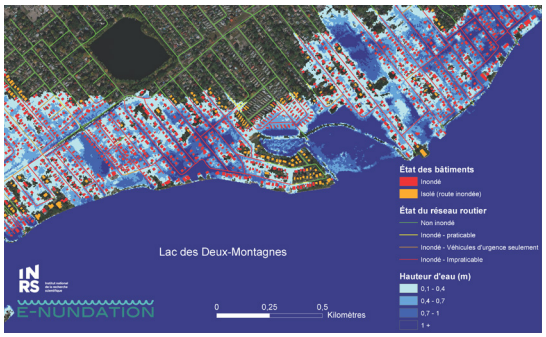
Sustainable management of this vital resource is a priority research subject at the INRS Eau Terre Environnement Research Centre, which hosts a major group of university experts in water research.

The Centre's expertise derives from its long experience in developing and applying numerical approaches to analysis and decision-making in a range of water management contexts. The group's multidisciplinary skills enable thorough analysis of resource availability and associated environmental problems.

Examples of research and training applied to current challenges

Modelling = better planning

Floods cause significant damage in Quebec each year. A group of INRS researchers has been working for many years to improve flood forecasting and management. Among other initiatives, they have designed a web platform to help managers better plan flood responses in relation to the vulnerability of populations and expected property damage. Researchers are also developing mathematical models based on artificial intelligence to improve forecasting of flood risks in a changing climate. These tools are used for short-term forecasts such as spring floods, but also for long-term planning when designing hydraulic structures such as dams and dikes.



Corrosion = pipe breaks

Urban drinking water systems include kilometres of often aging pipes which are complex and costly to maintain and repair. Pipe corrosion causes ruptures which in turn cause problems for citizens. The objective of this INRS research project is to make recommendations on how to prevent corrosion of water pipes. The project includes analysis of data provided by the partner city and a study of broken pipes using CT scanning. Mathematical models are used by researchers to determine and predict pipe break rates in order to identify the best preventive measures.

Wetlands = ecological services

Wetlands provide many ecological services, such as water filtration, aquifer replenishment, and mitigation of both low water flows and floods. The loss of wetlands through development has a cumulative effect within a watershed. In Quebec, when a wetland is destroyed for development, the law states that a wetland of the same size must be preserved, restored, or created. However, the replacement wetland may not have the same effect on the watershed's hydrological dynamics. An INRS research team is working to identify a network of wetlands that should be designated for preservation within the conservation and restoration plans for the St. Charles River watershed in the Quebec City area.

Main study themes and researchers involved

WATERSHED HYDROLOGY AND HYDRAULICS

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STATISTICAL HYDROLOGY

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Examples of recent publications

(Names of ETE Centre's authors are in **bold**)

- Abbesnezhadi K, **Rousseau AN**, Wruth AM & Zahmatkesh Z (2019). Synchronized generation of high-resolution gridded precipitation and temperature fields. *Journal of Hydrology,* 573: 631-647. http://dx.doi.org/10.1016/j.jhydrol.2019.03.096
- Alobaidi MH, Meguid MA & **Chebana F** (2020). Varying-parameter modeling within ensemble architecture: Application to extended streamflow forecasting. *Journal of Hydrology*, 582: Art. 124511. http://dx.doi.org//10.1016/j.jhydrol.2019.124511
- **Boudreau J, Bergeron NE, St-Hilaire A** & **Chebana F** (2019). Stream temperature modeling using functional regression models. *Journal of the American Water Resources Association*, 55 (6): 1382-1400. http://dx.doi.org/10.1111/1752-1688.12778
- **Doghri M, Duchesne S**, Poulin A & **Villeneuve J-P** (2020). Comparative study of pressure control modes impact on water distribution system performance. *Water Resources Management*, 34: 231-244. http://dx.doi.org/10.1007/s11269-019-02436-z
- Jamshidpour N, Safari A & **Homayouni S** (2020). A GA-based multi-view, multi-learner active learning framework for hyperspectral image classification. *Remote Sensing*, 12 (2): Art. 297. http://dx.doi.org/10.3390/rs12020297
- Martel J-L, **Mailhot A** & Brissette F (2020). Global and regional projected changes in 100-yr subdaily, daily, and multiday precipitation extremes estimated from three large ensembles of climate simulations. *Journal of Climate*, 33 (3): 1089-1103. http://dx.doi.org/10.1175/JCLI-D-18-0764.1
- **Ouarda TBMJ, Charron C** & **St-Hilaire A** (2020). Uncertainty of stationary and nonstationary models for rainfall frequency analysis. *International Journal of Climatology*, 40 (4): 2373-2392. http://dx.doi.org/10.1002/joc.6339
- **Oubennaceur K, Chokmani K**, Nastev M, **Gauthier Y, Poulin J, Tanguy M, Raymond S** & **Lhissou R** (2019). New sensitivity indices of a 2D flood inundation model using gauss quadrature sampling. *Geosciences*, 9 (5): Art. 220. http://dx.doi.org/10.3390/geosciences9050220

Examples of research partners

- Association de protection de la rivière Moisie
- Cities of Québec and Montréal
- Fisheries and Oceans Canada
- Geosapiens
- Government of Quebec (Environment and Climate Change, Public Security, Transport)
- International Joint Commission
- Kativik Regional Government
- Ouranos Consortium