Integrated Modelling Program for Canada (IMPC)

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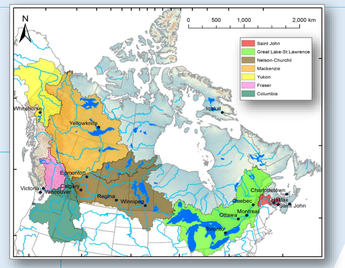
IMPC

Integrated Modelling Program for Canada (IMPC) aims to develop a **pan-Canadian integrated modelling platform** to diagnose, simulate, and predict interactions **amongst natural and human-driven** water-resource components of the changing Earth and environmental systems, and to deliver optimal **decision making tools and solutions** for uncertain future water resources, considering the range of **stakeholder needs** in Canada's major river basins.



IMPC Integrates

- **Atmospheric science**
- **Hydrology**
- **Water resource**
- **Ecology**
- **Social science**
- **Computer science**
- **Economics**

Transdisciplinary:

- **5 Universities**
- **10 Government agencies**
- **10 User communities**
- **3 Indigenous groups**

$1.65M for 3 yrs (Jun 2017-Aug 2020)

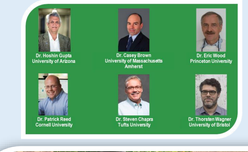
IMPC team

Investigators

User Community

Manitoba Hydro · Water Security Agency · Environment and Parks Alberta · Yukon Government · Calgary 2026 · Cumberland House · Statistics Canada · Natural Resources Canada · Agriculture and Agri-Food Canada · Environment and Climate Change Canada · MWB · NOAA · NCAR · US Army Corps of Engineers · European Union

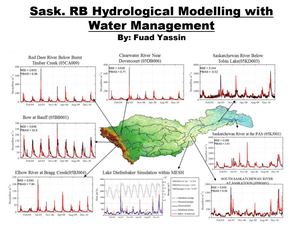
International Advisors



Knowledge Mobilization Committee

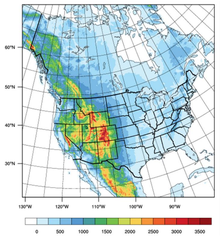
Sask. RB Hydrological Modelling with Water Management

By: Fuad Yassin



The setup of the WRF 4-KM CONUS II simulation

By Yanping Li et al.



Simulation time periods confirmed:

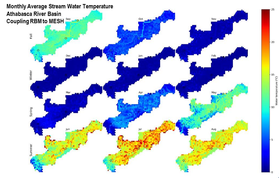
1) Historical period simulation: 20-year integration plus 1-year spinup: 1995-2015
2) Future period simulation: 20-year integration plus 1-year spinup: 2080-2100

Forcing information:

1) Historical period simulation: It will be forced with 6-hr CCSM4 data, and ERA-Interim reanalysis will be used for bias correction
2) Future period simulation: It will be forced with 6-hr CCSM4 data, and 19 CMIP5 model ensemble mean will be used for bias correction.

Coupling Stream Water Temperature Model to Hydrological Model

By Luis Morales



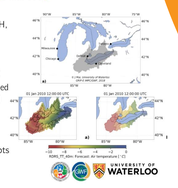
Coupling River Ice Model to Hydrological Model

By Prabin Rokaya

Model Inter-comparison

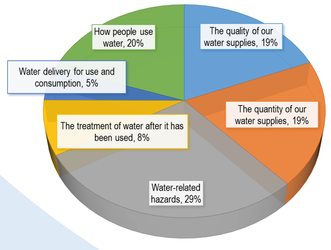
By Julie Mai et al.

- **9 models**: LBRM, HYPE, SWAT, VIC, VIC-GRU, MESH, WATFLOOD, GEM-Hydro, WRF-Hydro
- **27 collaborators** from 16 institutions (Canada and US)
- **1 domain**: Lake Erie watershed incl. Lake St. Clair (GRIP-E)
- **1 forcing dataset**: hourly RDRS dataset (2010-2014) incl. all main forcings
- **1 platform:** all data and scripts shared on GitHub



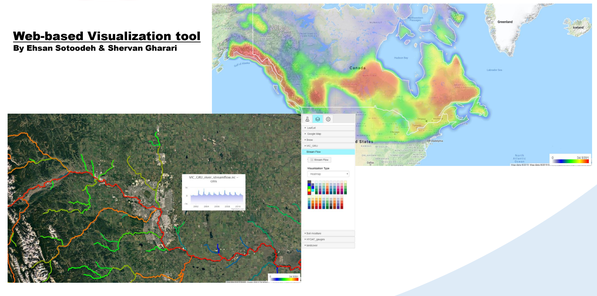
Water issues discussed in the Nelson-Churchill Basin

By Hayley Carlson



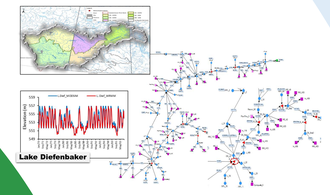
Web-based Visualization tool

By Ehsan Sotoodeh & Shervan Gharari



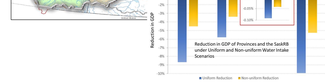
Water Management Modelling of Sask RB (MODSIM-DSS)

By: Mustakim ali Shah



Hydro Economic Modelling of Sask RB

By: Leila Eamen

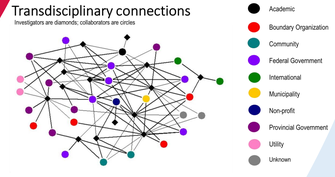


Social Network Analysis

By Hayley Carlson

Transdisciplinary connections

Investigators are diamonds; collaborators are circles



International Links

Link to GWF GOALS

IMPC is closely tied to GWF core team. It builds on and extend core GWF modelling, data and knowledge mobilisation capabilities and focuses on their application to Canada's major river basins.

1 Improving disaster warning

High resolution atmospheric modelling coupled with advanced watershed models equipped with improved cold region processes (e.g., snow and glacier dynamics and ice jams), and floodplain mapping, significantly improves our ability to predict extreme events such as floods, seasonal water flows, and droughts. (Theme A)

2 Predict water futures

Our holistic and transdisciplinary modelling approach allows us to more robustly understand and predict the interactions between natural and human-driven components of our changing climate and environmental. This improves future predictions of water quantity and quality in Canada's major river basins and allows for exploring alternative multi-perspective future scenarios. We utilize advanced web-based model/data visualization tools for improved understanding, communication, and decision analysis that involves end-users. (All Themes)

3 Adapting and managing risk

Our integrated water resources modelling and management approach that represents socio-economic and hydro-ecologic aspects, provides a powerful tool for optimizing multi-criteria scenario-based decision-making, adaptation, and risk management under uncertain changing climate, land, and society. (Themes B & C)

6 Ensure access to water and sanitation for all

- **GOAL 6.1** By 2030, achieve universal and equitable access to safe and affordable drinking water for all. — Central to our program is designing user-focussed advanced holistic solutions to water security for humans and environment.
- **GOAL 6.5** By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate. — We link atmospheric, hydrologic, water resources, ecologic, and socio-economic models to support integrated water resources management in multi-jurisdictional river basins across Canada.
- **GOAL 6.B** Support and strengthen the participation of local communities in improving water and sanitation management. — We formalize user engagement activities to support and strengthen participation of stakeholders, including indigenous communities, in the modelling and management of water resources.

13 Take urgent action to combat climate change and its impacts

- **GOAL 13.1** Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries. — We develop advanced modelling and decision-making tools to represent interactions across natural and human systems to improve prediction of floods and droughts under climate change. We lead writing of a book chapter on water resources and climate change adaptation for Canada.
- **GOAL 13.2** Integrate climate change measures into national policies, strategies and planning. — Integrated water management modelling and decision-making tools support the exploration of future challenges such as climate and land-use change to inform policy and planning.
- **GOAL 13.3** Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning. — We bring together stakeholders and researchers to build human and institutional capacity to consider climate change mitigation and adaptations strategies for water resources.

GWF collaboration

PRAIRIE WATERS · Northern Water Futures

Contact: Amin.Haghnegahdar@usask.ca

GLOBAL WATER FUTURES: SOLUTIONS TO WATER THREATS IN AN ERA OF GLOBAL CHANGE · CANADA FIRST RESEARCH EXCELLENCE FUND · APOGÉE CANADA · UNIVERSITY OF SASKATCHEWAN · UNIVERSITY OF WATERLOO · McMaster University · LAURIER