Water quality and river ice (A3 and A4)

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Outline

• MESH – RBM coupling
  • ice breakup timing

• MESH – RIVICE coupling
  • ice-jam flood forecasting
  • with Nadia Kovachis, Alberta Env. & Parks
  • with Ali Khan, Water Resources Management Division, Gov’t Newfoundland & Labrador,
HYDROLOGICAL MODELLING (MESH)

1. Precipitation
2. Air temperature
   - Max.
   - Min.
3. Wind speed
4. Incoming solar radiation
   - Long wave
   - Short wave
5. Pressure
6. Specific humidity

LAND-SURFACE SCHEME (CLASS)

FLOW ROUTING (WATFLOOD)

WATROF/PDMROF

CALIBRATION?

Yes

No

Hydrological data & river network

WATER TEMPERATURE MODELLING (RBM)

Hydrological data

River network

Meteorological data

1. Air temperature
2. Precipitation
3. Wind speed
4. Incoming solar radiation
5. Pressure
Athabasca River basin

- AB07CC0030 (Fort McMurray)
- AB07BE0010 (Town of Athabasca)
- AB07AD0100 (Hinton)

DEM (m):
- 385
- 2178
- Canada provinces

- Gauging station 07DA001
- Catchment boundary
- Water temperature station
- Athabasca River
MESH simulations

Morales-Marin, L.A., Sanyal, P.R., Kadowaki, H., Li, Z., Rokaya, P. and Lindenschmidt, K.-E. (in prep.) A hydrological and water temperature modelling framework to simulate the timing of river freeze-up and ice-cover breakup in large-scale catchments.
Water temperatures at Fort McMurray

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Landsat 8 image

Jasper Lake

Jasper Warden Weather Station

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Water temperatures at Hinton

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(1) Remote sensing: provides info on
- ice types
- ice thicknesses
- upstream ice extent

(2) Stochastic, real-time, river ice flood modelling:

(3) Dynamic flood hazard assessment & mapping:

(4) Flood advisories & warnings: provides info for
- decision support
- preparedness measures
- disaster management
MESH – RIVICE coupling for operational ice-jam flood forecasting
MESH secondary calibration

RIVICE forecasting boundary conditions

\[ Q \rightarrow V_{\text{ice}} \rightarrow W \]
Stochastic modelling framework

MESH 10-day forecasts

Flood extent hazard maps of six forecasts prior to ice-out at Fort McMurray

Future work

• MESH – RBM coupling
  • juvenile Athabascan Rainbow Trout (8°C – 10°C)
  • with Jeff Sereda, Water Security Agency

• MESH – RIVICE coupling
  • Ice-jam flood forecasting of Red River
  • with Bin Luo & Chris Propp, Manitoba Infrastructure

• MESH – SED coupling
  • sediment and nutrient transport
  • with John-Mark Davies (WSA) and Mike Renouf (PPWB)