Improving our knowledge on precipitation phase over the Upper Saint John River Basin

PROJECT SUMMARY

Snow on the ground is impacted by the phase of precipitation. The Upper Saint John River Basin receives ~1200 mm annually, including 400 mm of snow. Rapid snowmelt can lead to ice breakup, and possible ice jams on the Saint John River. It can also lead to extreme flooding downstream, in the Fredericton, N.-B., area.

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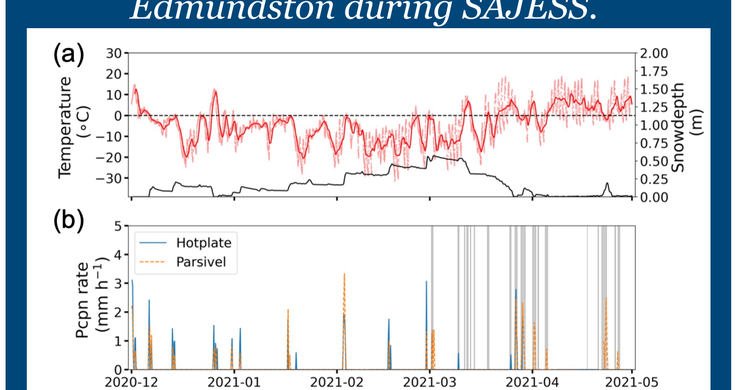
Saint John River Experiment on Cold Season Storms (SAJESS)

Progress

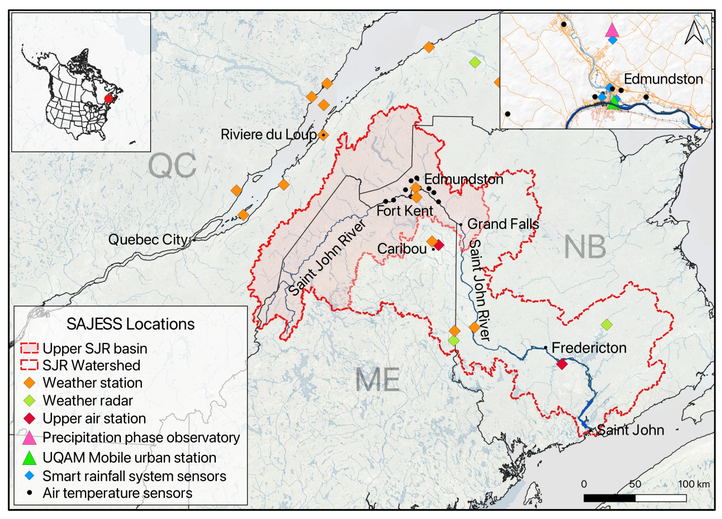
- Conducted a field experiment over the Upper Saint John River Basin from December 2020 to April 2021
- The 2020-2021 winter was anomalously warm for the whole basin. December 2020 and January 2021 were > 3°C warmer than normal for the upper basin*. Years of notable flooding usually experience negative temperature anomalies
- Although total precipitation for the 2020-2021 winter was average, there was less solid precipitation and therefore less SWE on the ground, and more liquid precipitation*
- River ice breakup was ~10 days earlier than normal. This coincided with anomalously warm air temperatures (daytime air temperatures up to 15 °C), and a series of precipitation events that included solid and liquid particles

*compared to 1991-2020 climatology

Timeseries of the air temperature, snow depth and precipitation rate at Edmundston during SAJESS.



The study region, including the field experiment sites, the Smart Rainfall System locations, and the CoCoRaHS stations.



User Engagement

- Collaboration with Edmundston Emergency Measures and the Ministry of Environment during the field experiment
- Sharing of atmospheric soundings in real-time with the ECCC Atlantic Region forecasters during the experiment.
- Collaboration with ECCC scientists on the impact of the precipitation phase on the snowpack.

Preliminary Results

- Occurrence of near 0°C was 16%, almost half of this occurrence was during precipitation (43%) at Edmundston.
- Students/volunteers recorded manual observations during a total of 15 precipitation events:
  - 6 snow; 4 rain; 5 mixed (either mixed precipitation or a rain-snow transition)
  - Atmospheric conditions aloft were often close to 0°C
  - Despite freezing rain being often forecasted, no observations of it were reported during the experiment
  - Precipitation phase data provided by the optical-laser disdrometer suggests promising results for its use in the modelling of the snowpack during relatively warm conditions.

An early morning weather balloon launch to measure atmospheric conditions such as temperature, relative humidity, wind speed and direction to up to 20 km above the surface.

Outcomes and application uptake

- Real-time meteorological data from the primary instrumentation site are shared with our users/partners
- Dataset of meteorological and observation data are being published on the Federated Research Data Repository (GWF special collection)
- The project provided training and information for the community about the importance, value, and challenges with precipitation measurements
- SAJESS publications in preparation: 1) Impact of precipitation phase on the snowpack, 2) Data collected, 3) Overview of the scientific findings