# Precipitation Extremes in the Current and Future Climate


PROJECT SUMMARY

CRPE project is providing users with new insights on current and future features of precipitation-related extremes including hazardous winter precipitation, hail, intense precipitation and drought



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# Climate-Related Precipitation Extremes (CRPE)

## Project progress

A few examples are:

- The WRF CONUS I simulations of extremes have been extensively evaluated and utilized, and CONUS II simulations are now being examined
- Factors leading to hazardous accreting precipitation on electrical transmission lines operated by Manitoba Hydro and New Brunswick Power have been analyzed, and related work across Canada is underway
- The challenging issue of the future occurrence of hail continues to be addressed
- Downscaling future heavy precipitation from large scale models has been carried out through novel approaches
- A study of the different stages of drought evolution in the current and future climate has been completed.

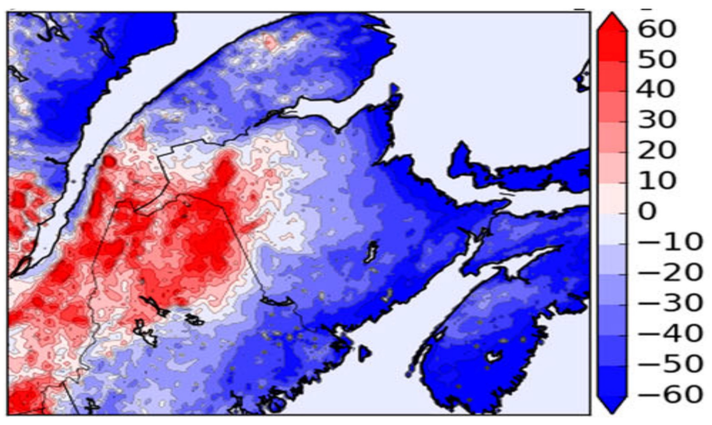


Fig. 1: Changes in average annual amount (%) of freezing rain between the current and future warmer climate using CONUS I simulations.

## User Engagement

- Strong interactions with Manitoba Hydro and NB Power, including the identification of hazardous events as well as especially susceptible transmission lines
- Invited keynote address to the 2022 CEATI Transmission Conference
- Continual communication with CatIQ regarding current and future summer severe weather events
- Project researchers have engaged with BC Hydro, informing their engineers of projected changes in climate and precipitation extremes
- The project works closely with the BC Ministry of Transportation and Infrastructure, who are interested in projected changes in extreme precipitation and streamflow as they work to improve the resilience of BC's highways
- The project has worked closely with Agriculture and Agri-Food Canada regarding drought over the Prairies in particular

## Results

A sampling is:

- Freezing rain will decrease over much of New Brunswick [Fig. 1]
- An unusual-tracking October 2019 storm led to the longest recorded duration of Manitoba adhering snow/strong winds
- Catastrophic November 2021 BC atmospheric river was influenced by anthropogenic climate change
- The western Prairies will experience an increase in 2-4 cm damaging hail [Fig. 2]
- Factors contributing to the longevity of, often flood-producing, MCSs (mesoscale convective systems) have been identified
- Human influence on extreme precipitation has been identified through a novel detection and attribution method
- A new approach to estimating very long return period precipitation extremes has been proposed [Fig. 3]

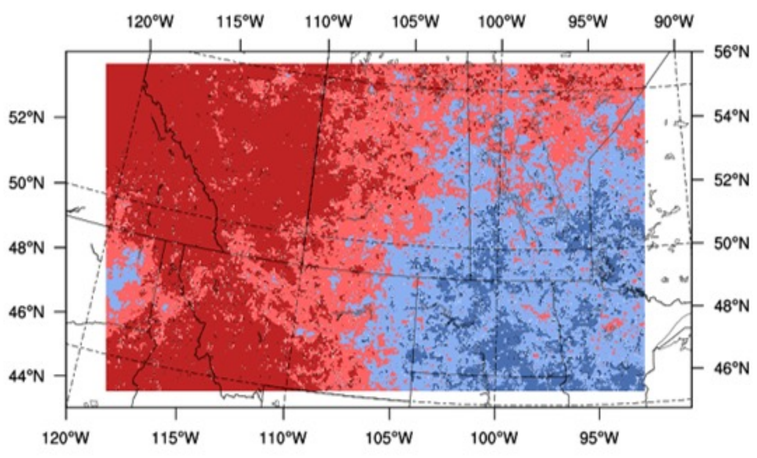


Fig. 2: Changes in 2-4 cm hail occurrence (red – increase, blue – decrease, dark shading statistically significant) between the current and future warmer climate using CONUS I simulations.

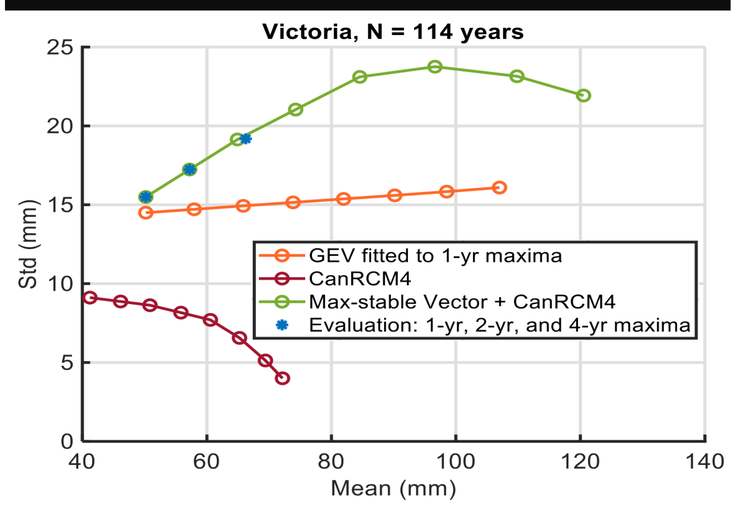


Fig. 3: Mean and standard deviation of block maxima of for blocks of length 1 to 128 years for Victoria based on observations and CanRCM4. Multi-year block maxima enable better estimates of very long period return levels.

## Outcomes and application uptake

Insights into current and future precipitation-related extremes are being utilized including:

- Hazardous winter precipitation insights contributing to electrical utilities' plans for more resilient transmission systems
- Hailstorm-related briefings to the insurance sector are contributing to their risk assessments
- Intense precipitation occurrence insights are contributing to National Building Code of Canada updates
- Drought evolution stage insights utilized by Agriculture and Agri-Food Canada for drought response planning


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