Environment and Climate Change Canada
Environnement et Changement climatique Canada
Canada

Future Projections of Climate Design Values
(related to precipitation extremes)

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GWF Precipitation Extremes Kickoff Meeting
Manitoba Hydro
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MOU with NRC on Design Standards

Guidance on climate change impacts on climatic design values for building and highway bridge design in Canada

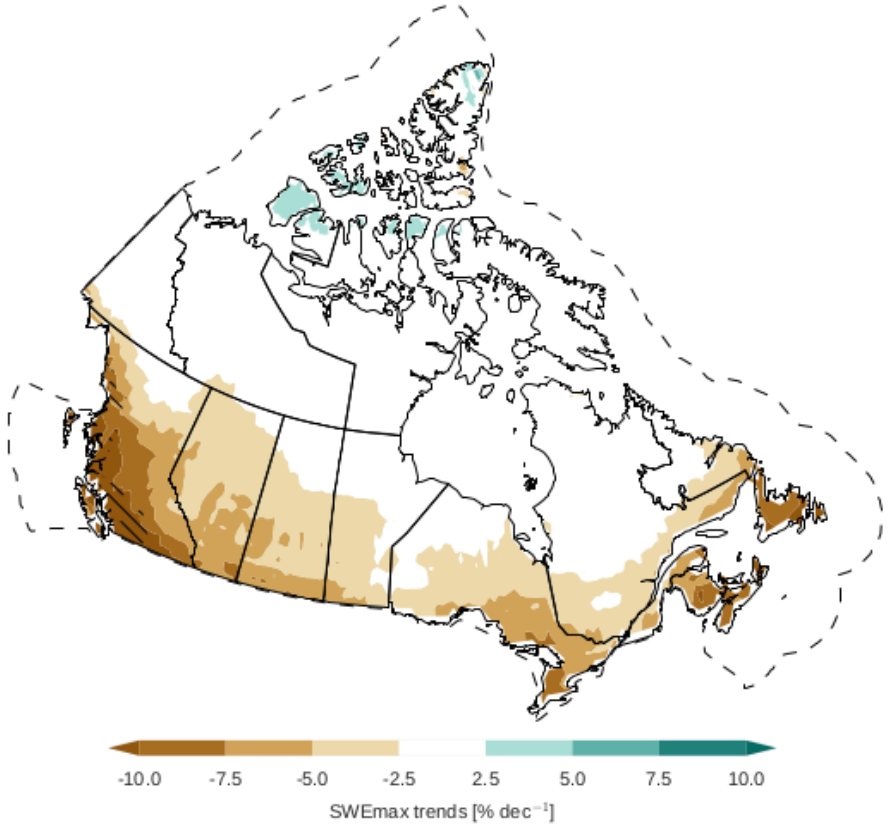
Spatially varying design value tracked to local levels of warming

Some of these are not related to extremes, but some are

Table C-2
Climatic Design Data for Selected Locations in Canada

Province and Location	Elev., m	Design Temperature				De-gree-Days Below 18°C	15 Min. Rain, mm	One Day Rain, 1/50, mm	Ann. Rain, mm	Moist. Index	Ann. Tot. Ppn., mm	Driv-ing Rain Wind Pres-sures, Pa, 1/5	Snow Load, kPa, 1/50		Hourly Wind Pressures, kPa	
		January		July 2.5%												
		2.5% °C	1% °C	Dry °C	Wet °C								S_s	S_r	1/10	1/50
British Columbia																
100 Mile House	1040	-30	-32	29	17	5030	10	48	300	0.44	425	60	2.6	0.3	0.27	0.35

e.g. Snow Loads



2020-2050 trends in annual maximum SWE (CMIP5 ensemble) Mudryk et al. (2017)

Some regions may expect snow loads to be determined from accumulated snow where decreased accumulations may be expected. Effects on water supply

Are there regions where snow loads are determined by extreme snow events? Maritime climates?

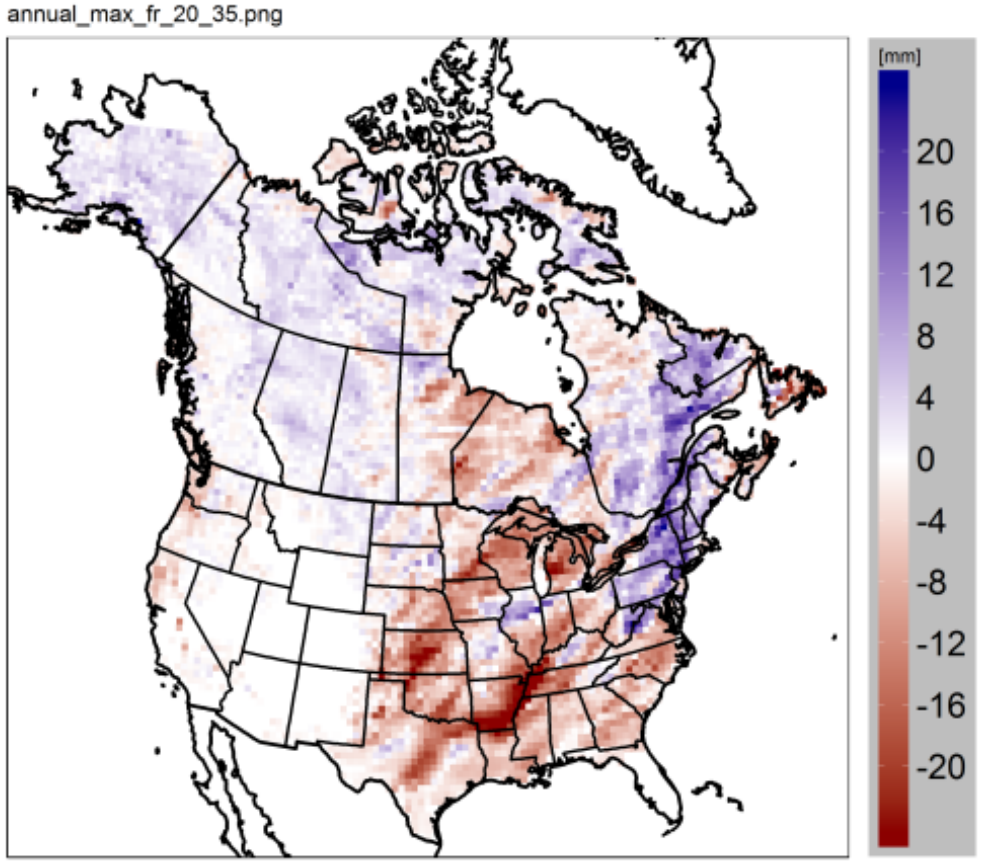
Freezing rain events (weight on power transmission lines, bridges)

These all required multiple realizations, high resolution model data

e.g. Future Changes in Freezing Rain

Projected changes at +3.5K
(20-yr return level daily max)

Diagnosed from CanRCM4
(50 realizations/"pseudo histories")



Dynamical Downscaling

CanESM2-CanRCM4 Large Ensemble (LE):

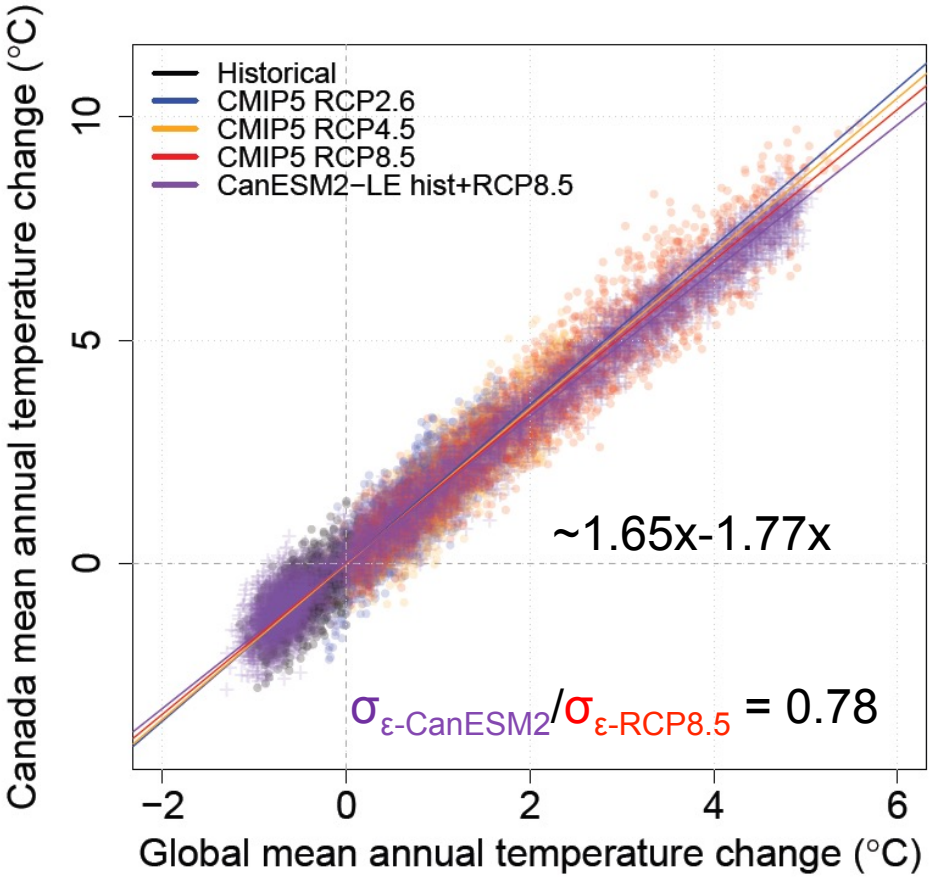
- 50 member dynamically downscaled ensemble (0.44-deg over North America)
- historical + RCP8.5 forcings (1950-2100)
- large samples with which to characterize extremes, role of internal variability (**I**)
- large effort on model verification/understanding of the model's biases (e.g. sensitivity of model projections to + SWE bias)

Intermediate Complexity Atmospheric Model (ICAR):

- Produce high resolution regional data sets in mountain regions

→ **Comparisons with Statistical Downscaling Results**

Partitioning uncertainty



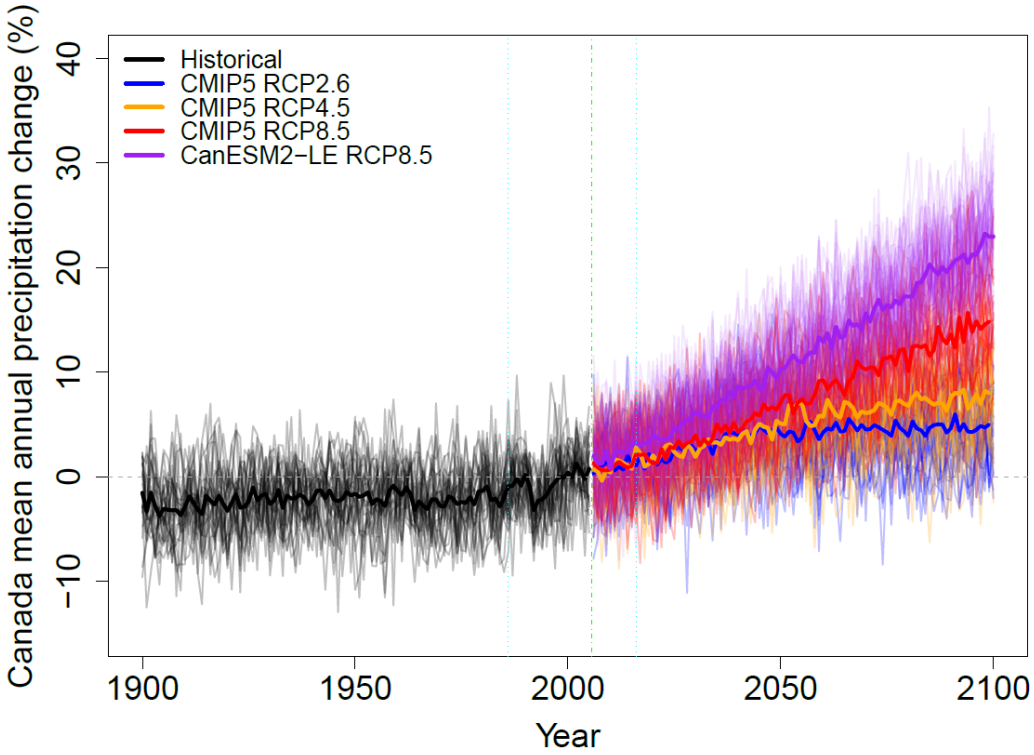
Partition uncertainty into global and regional components:

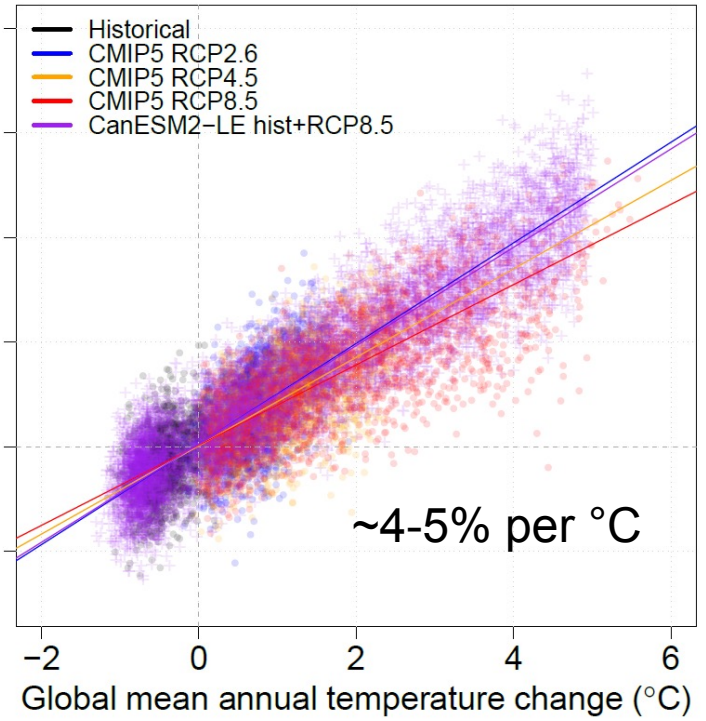
Global → When does a given level of global mean temperature change (GMTC) occur? **(F + M)**
Regional → For a given GMTC, what is the associated impact on Canada? **(m + l)**

Assumptions: **F + M** uncertainty is mainly expressed in timing of GMTC, not in the impacts of that warming on Canada.

Expression of regional change for a given GMTC does not depend on **F**, i.e., how you reach a given GMTC.

Partitioning uncertainty – Precipitation





$\sigma_{\varepsilon\text{-CanESM2}}/\sigma_{\varepsilon\text{-RCP8.5}} = 1.0$