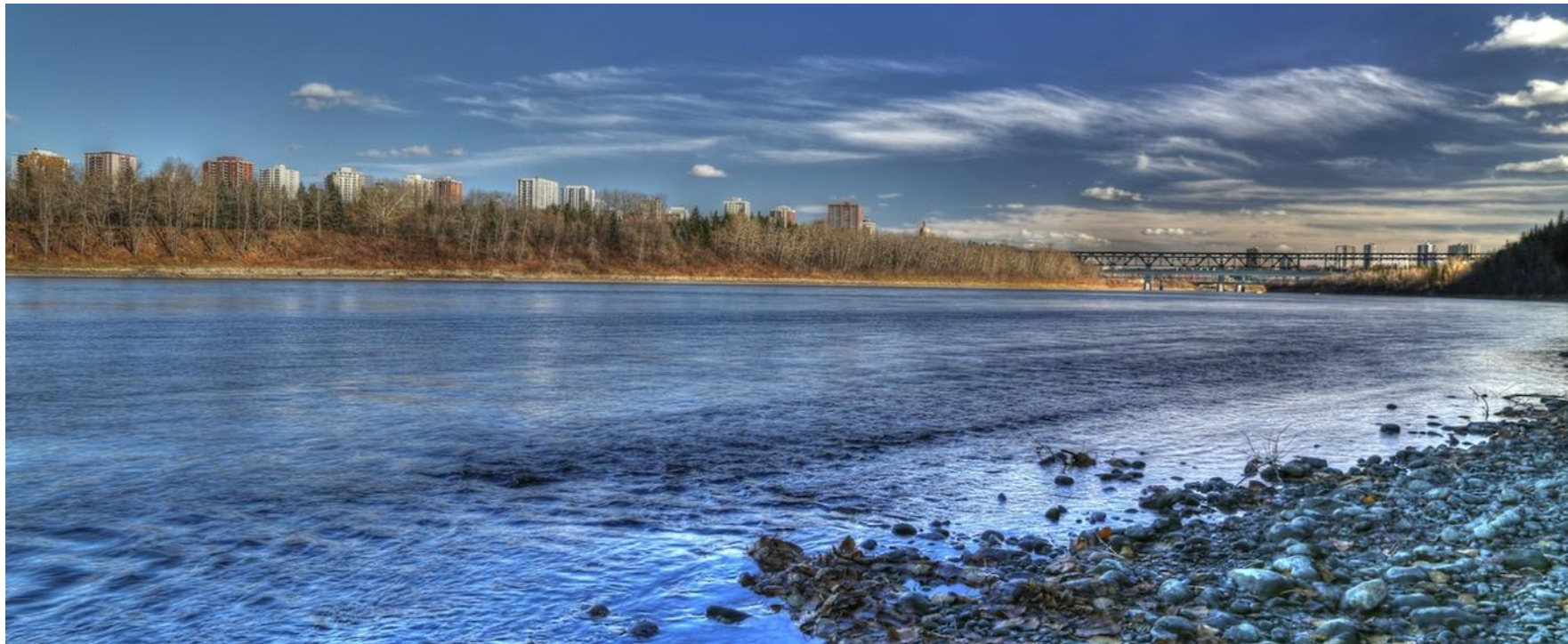


# Climate Change Risks to Water Security in Canada's Western Interior

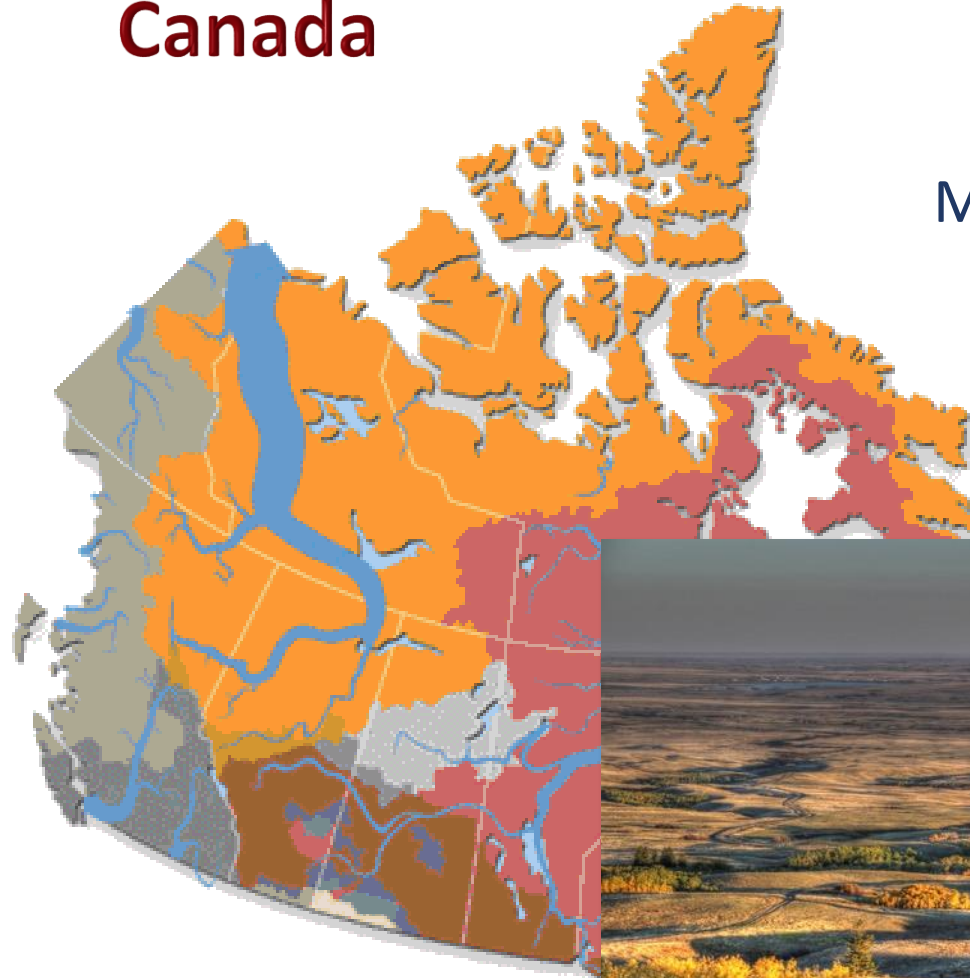
Dr. Dave Sauchyn, Director  
Prairie Adaptation Research Collaborative  
University of Regina, Canada

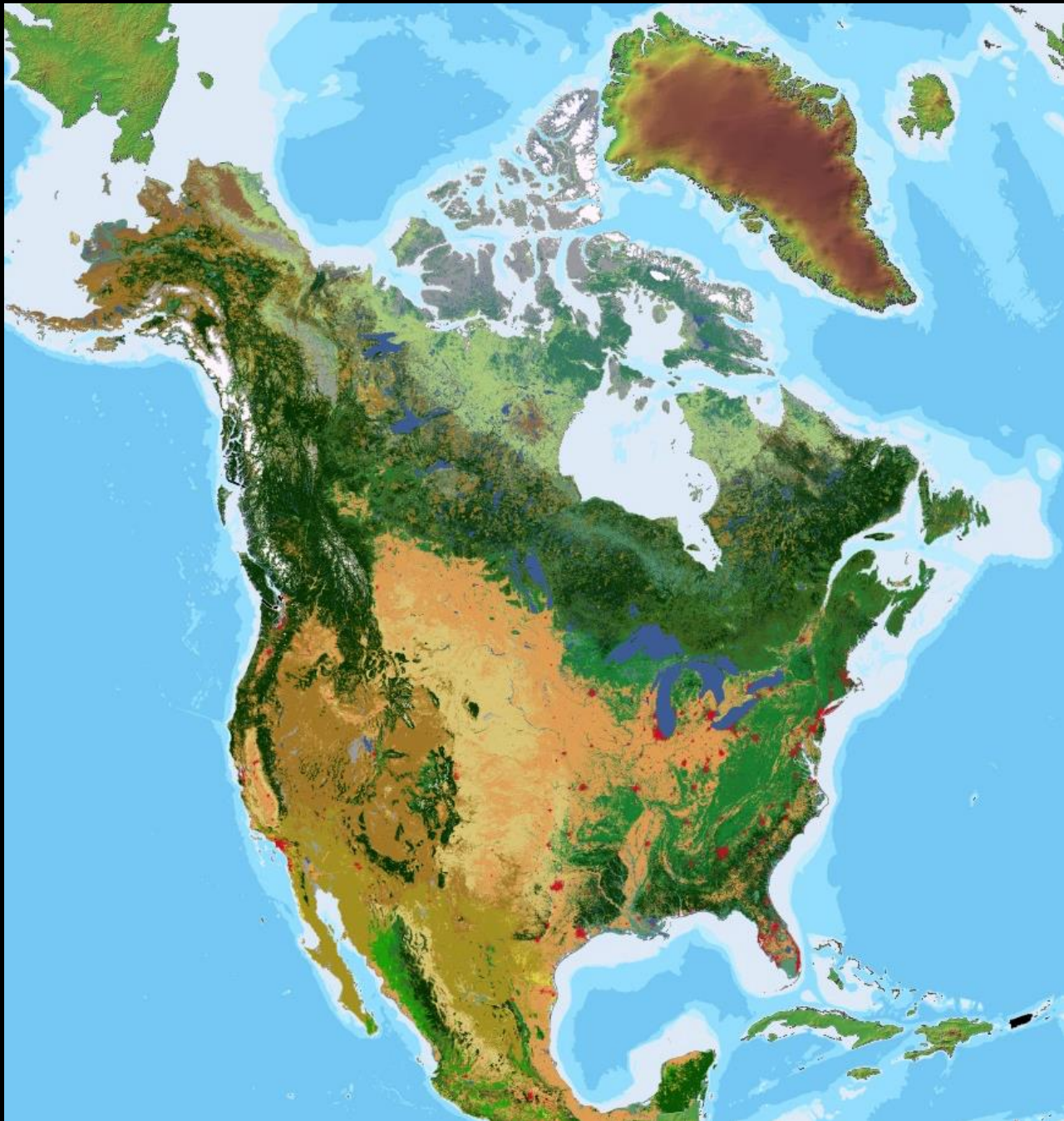


Roorkee Water Conclave, 26-28 February 2020

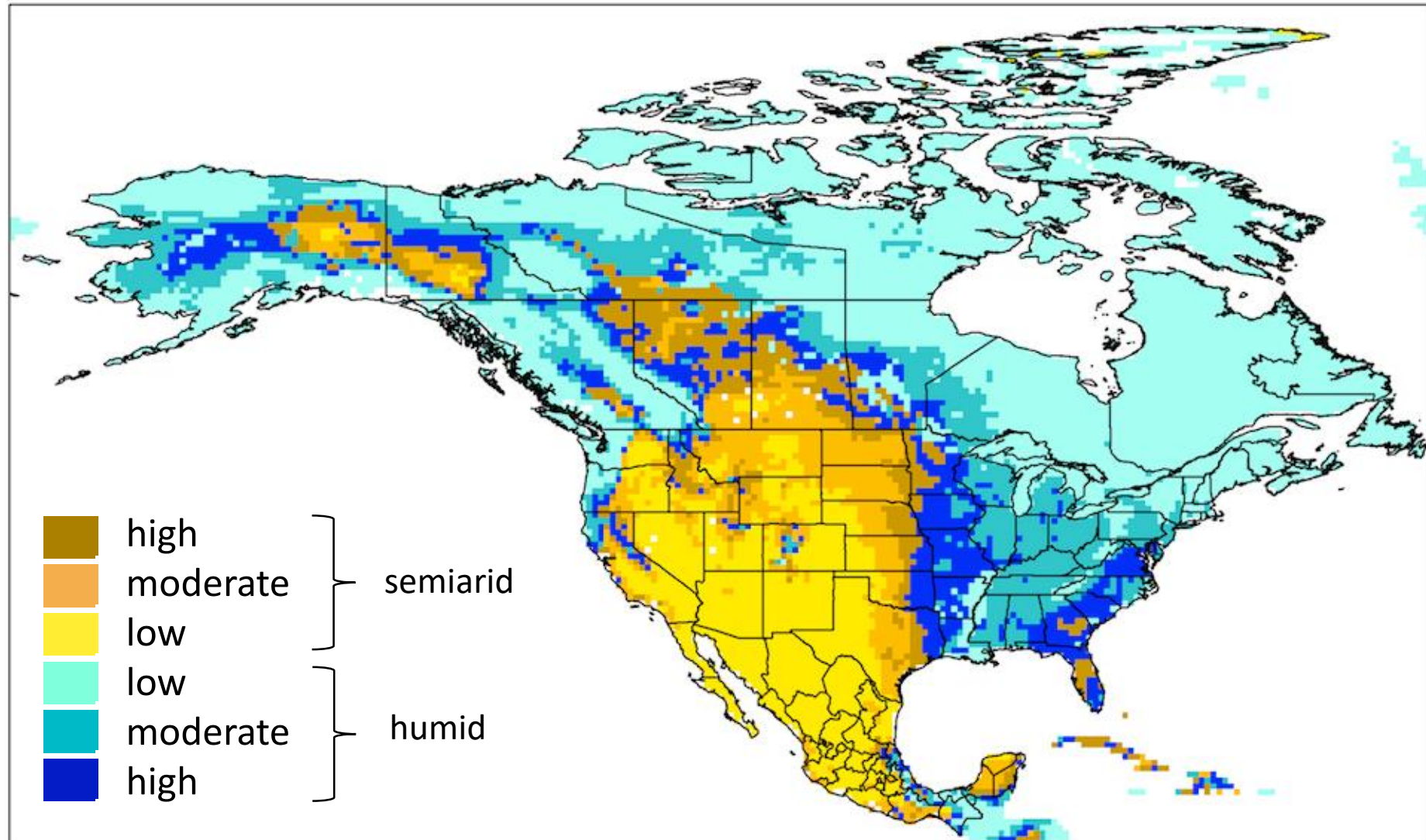
# Canada

## Major Rivers and Watersheds



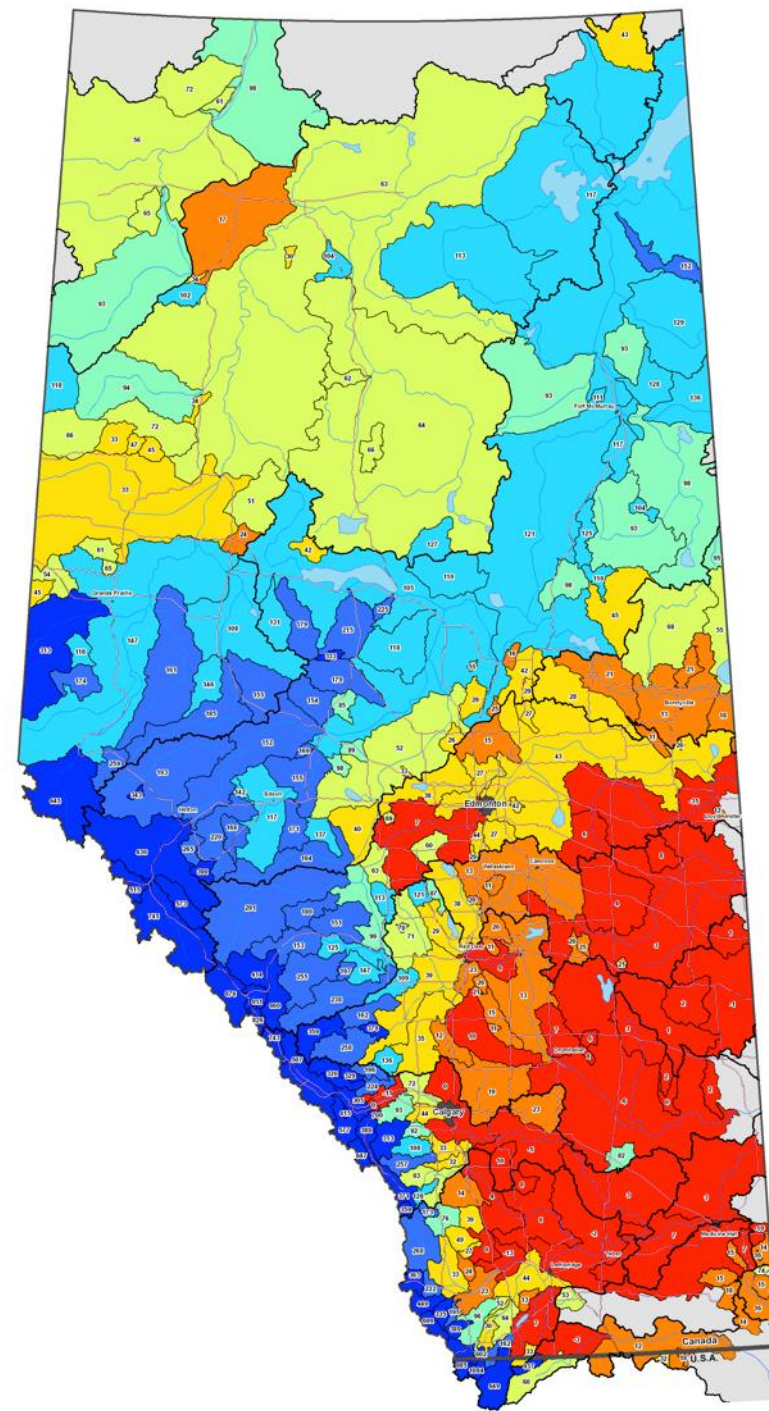
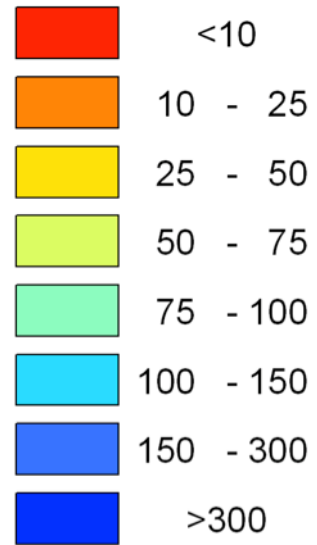


## Inter-Annual Moisture Variability, North America

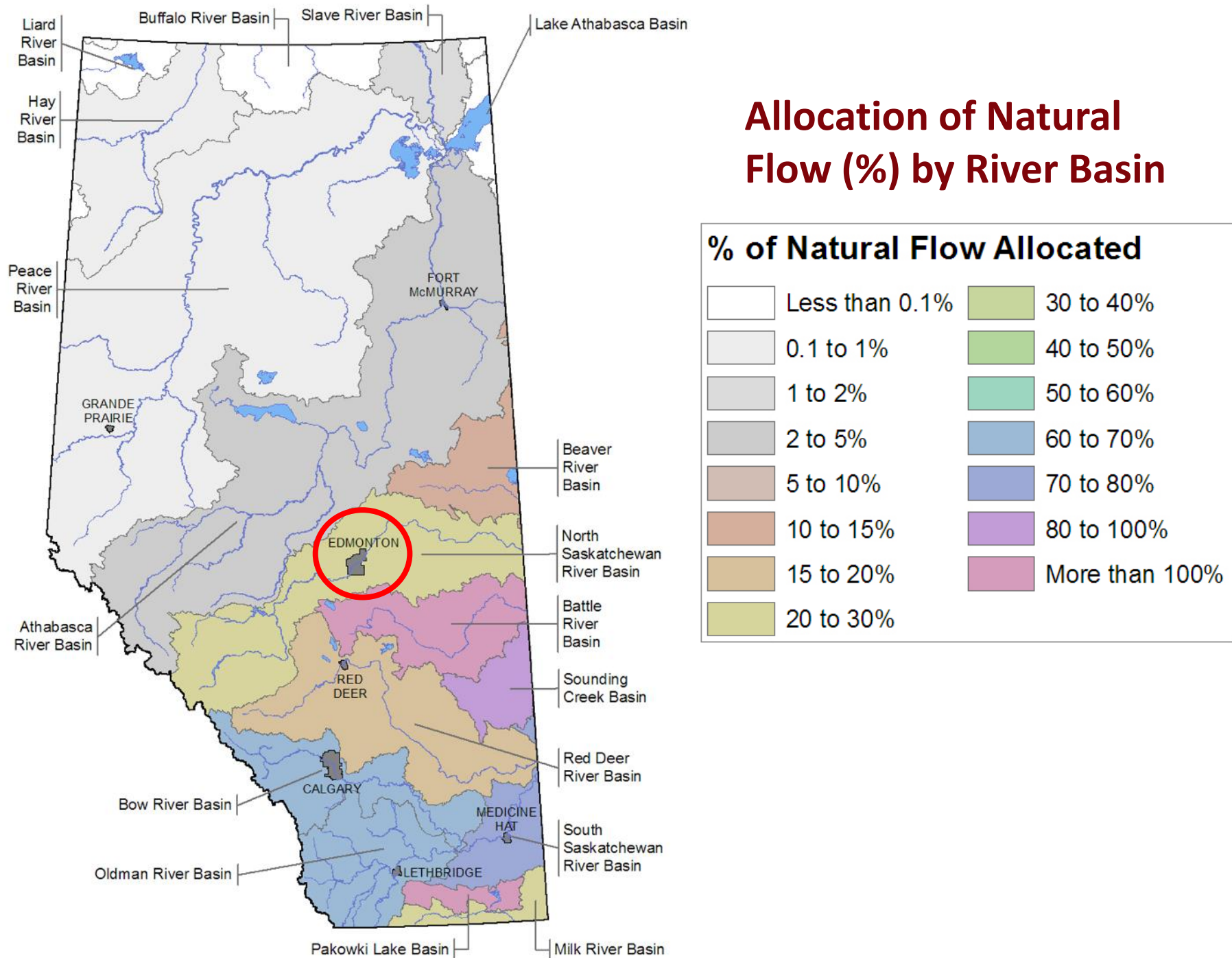


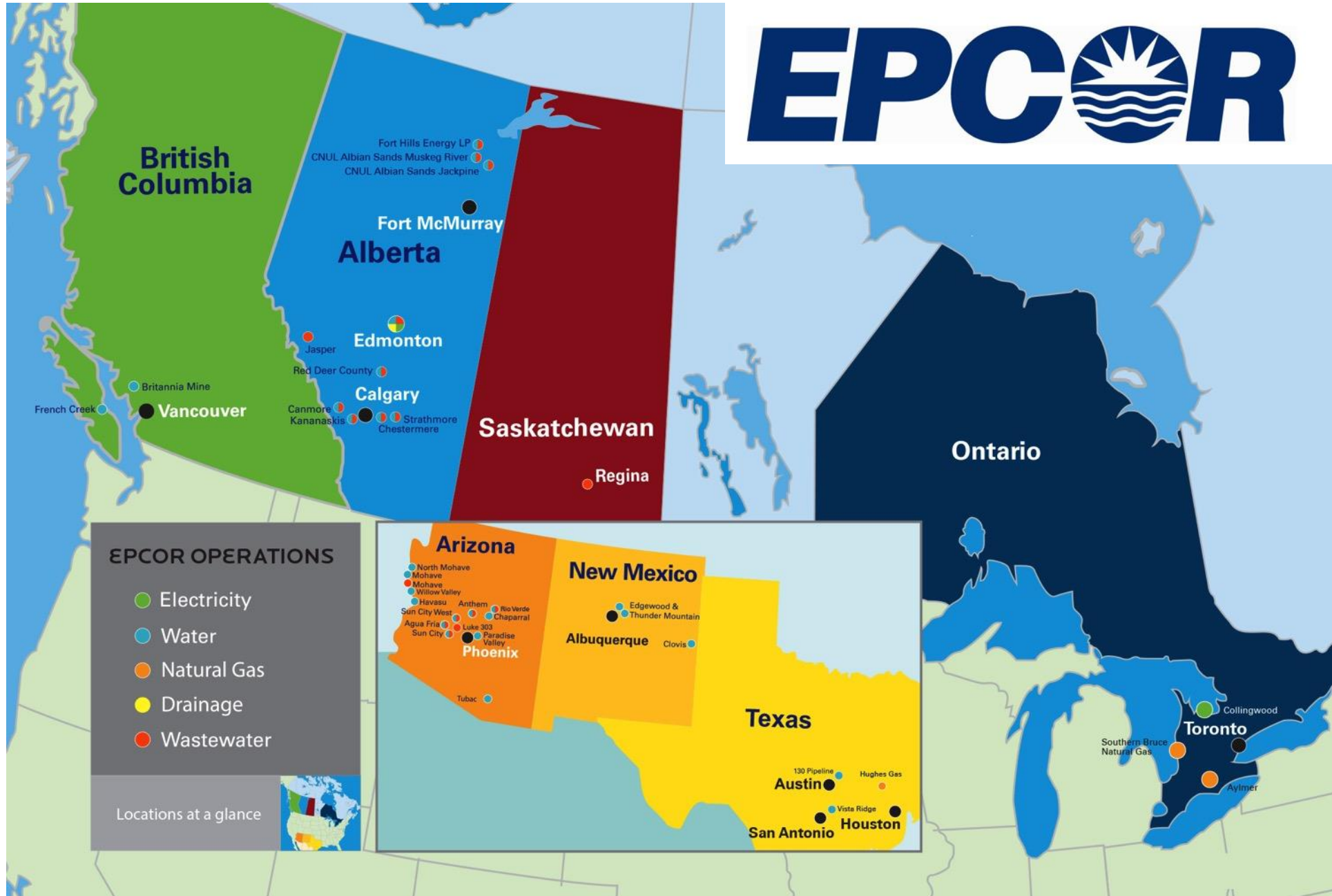


# Annual Water Yield (1000m<sup>3</sup>/km<sup>2</sup>) Alberta



## Allocation of Natural Flow (%) by River Basin





**EPCOR OPERATIONS**

- Electricity
- Water
- Natural Gas
- Drainage
- Wastewater

Locations at a glance

**Arizona**

- North Mohave
- Mohave
- Willow Valley
- Havasu
- Sun City West
- Agua Fria
- Sun City
- Phoenix
- Tubac

**New Mexico**

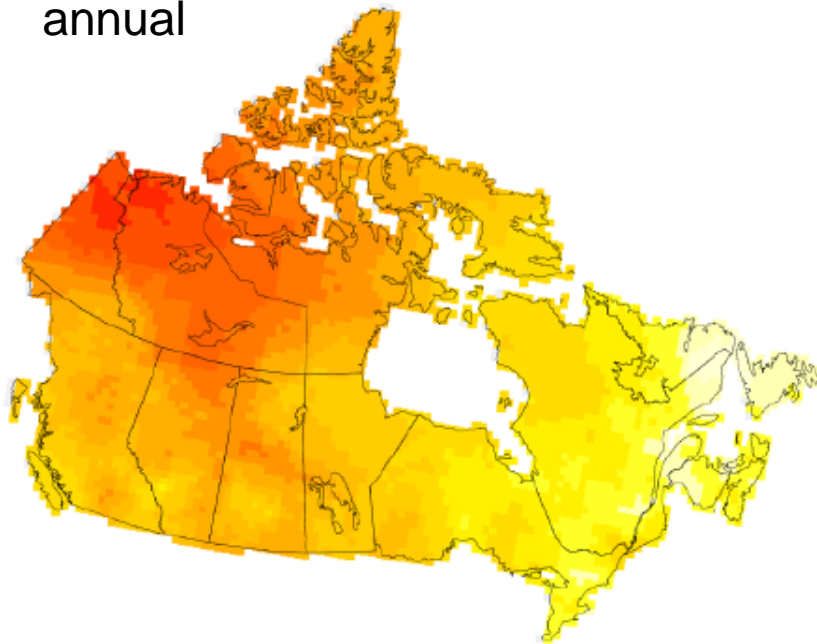
- Edgewood & Thunder Mountain
- Albuquerque
- Clovis

**Texas**

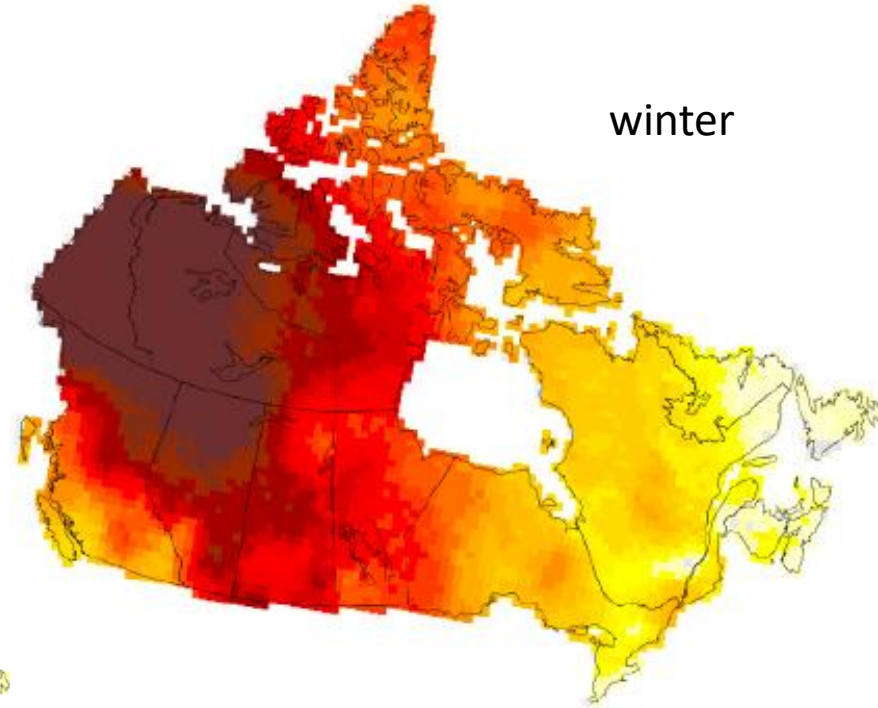
- 130 Pipeline
- Austin
- Hughes Gas
- San Antonio
- Vista Ridge
- Houston

# Canada is warming at twice the global rate, report says

annual



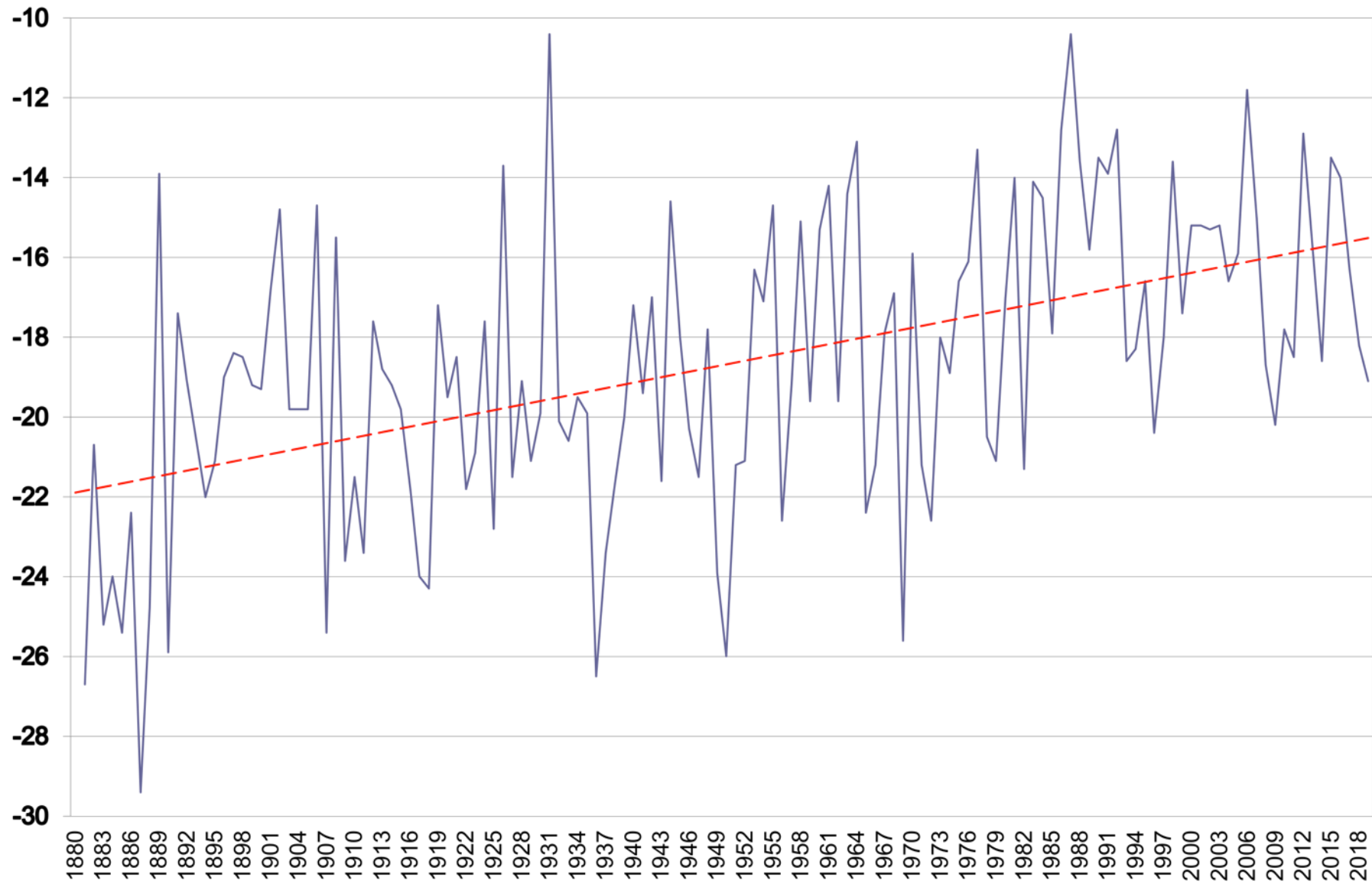
winter



**Temperature Trends across Canada, 1948-2016**



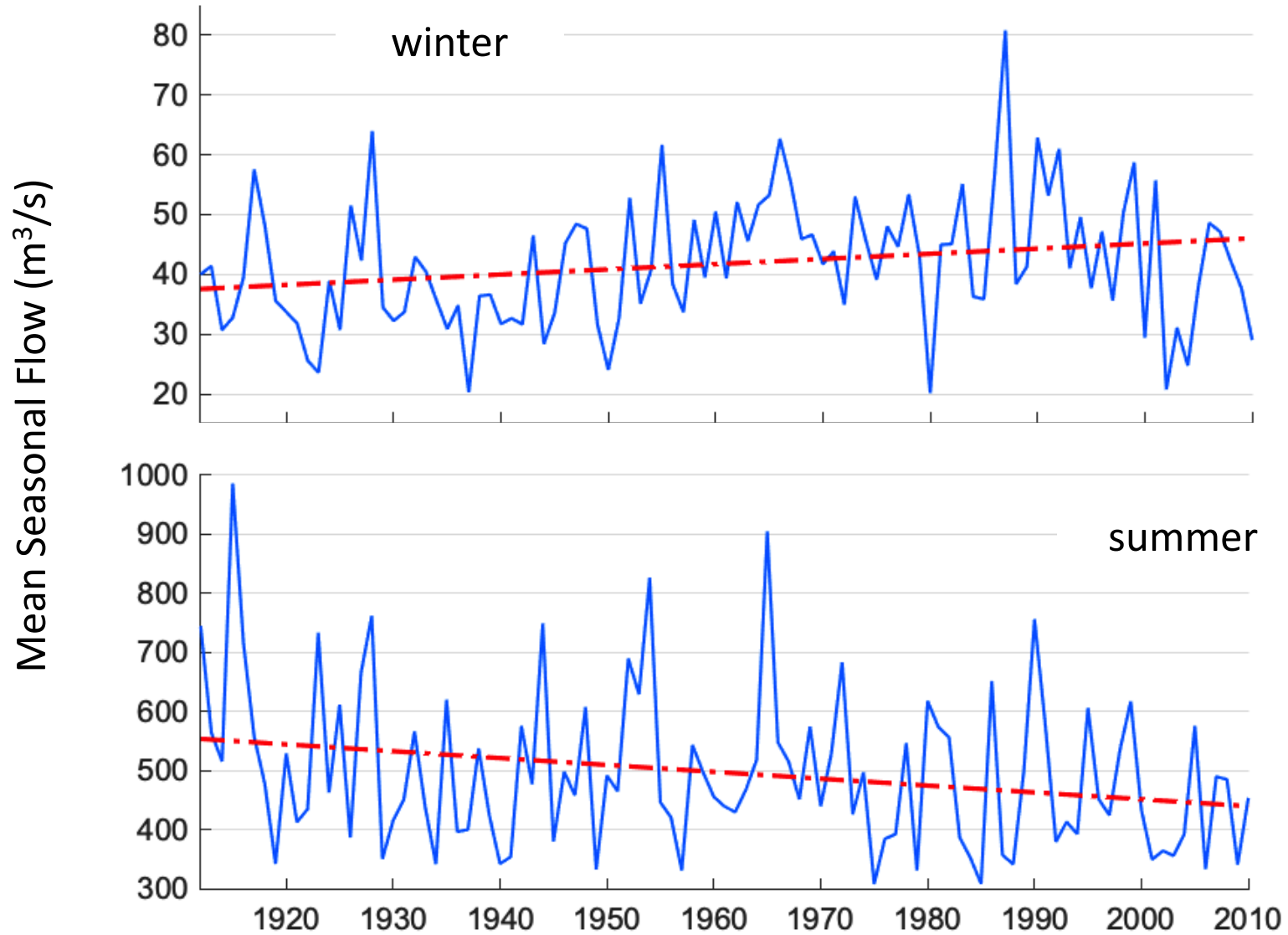
# Average Minimum Winter Temperature (°C) at Edmonton, 1880 to 2019



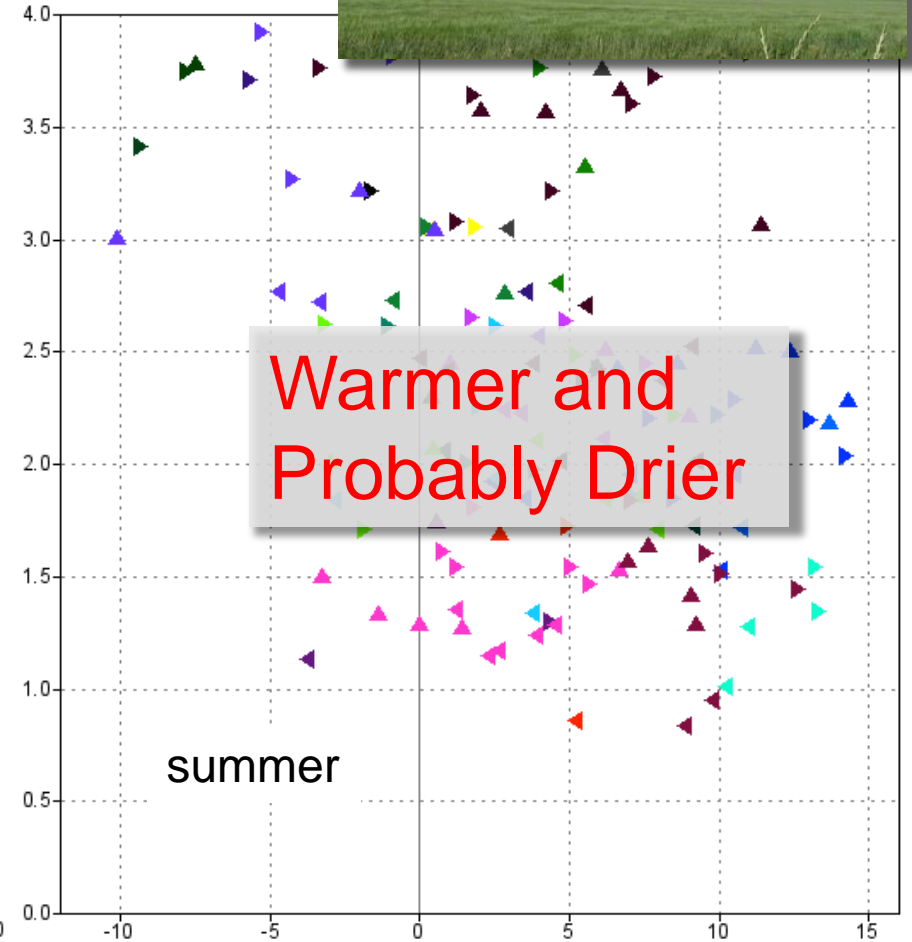
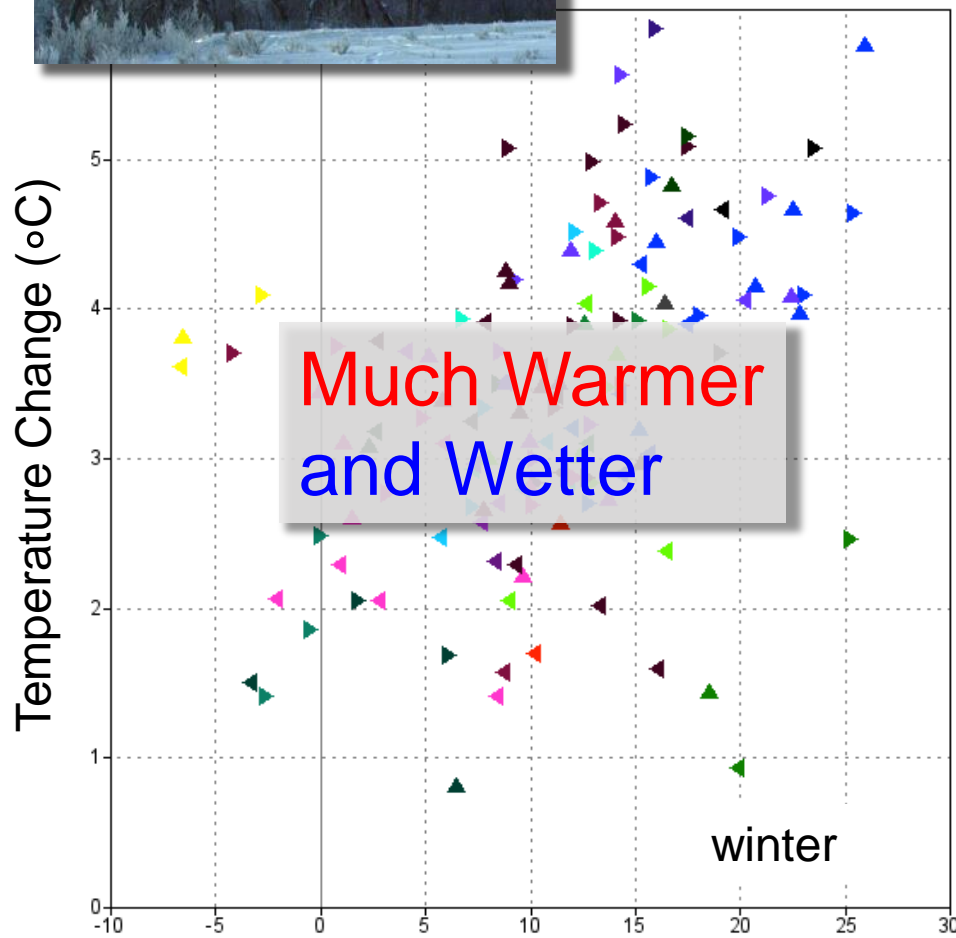
We are losing the advantage of a cold winter



# Naturalized flow (m<sup>3</sup>/s) of the North Saskatchewan River at Edmonton by season, 1912-2010



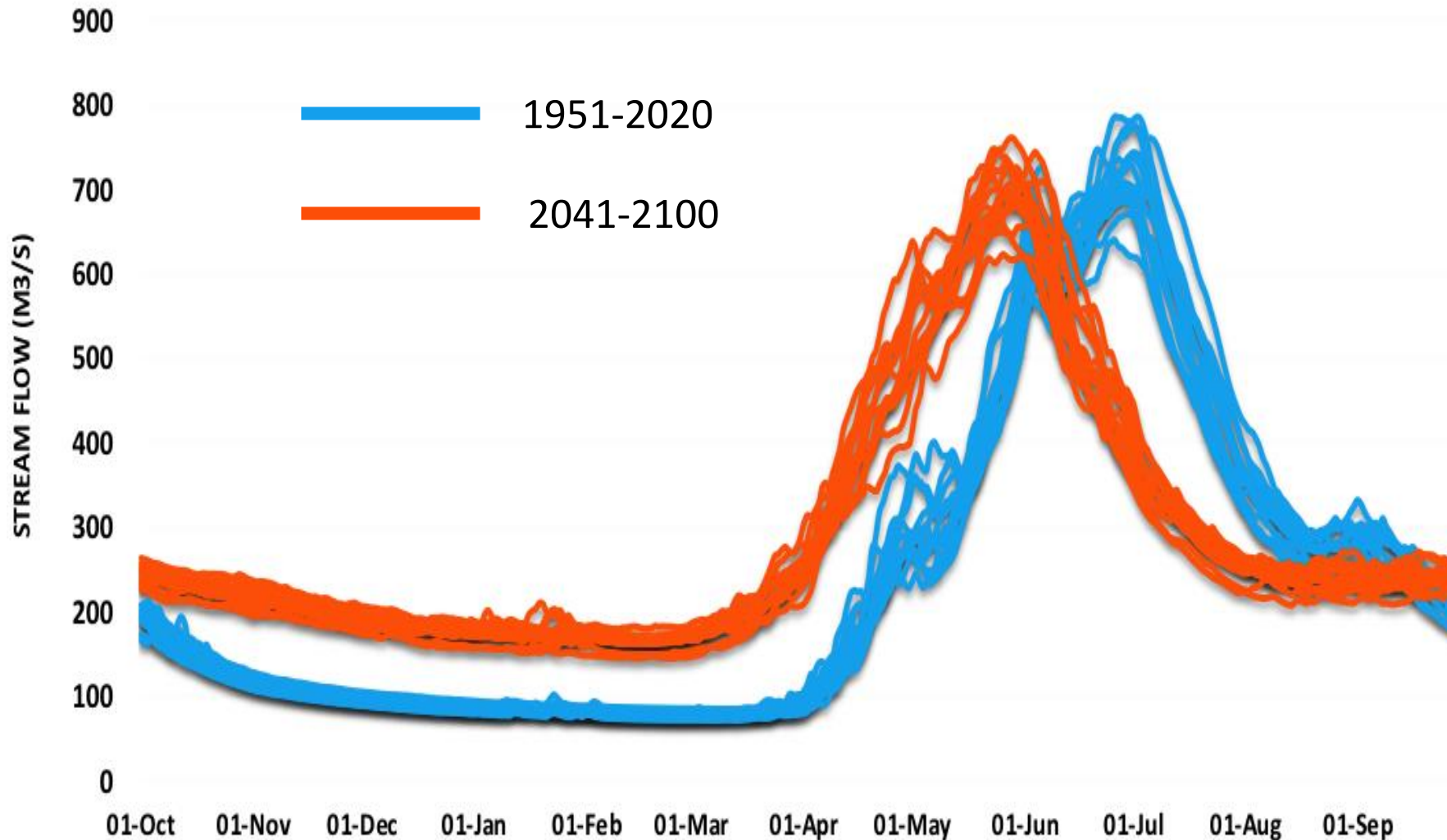
# Projected Climate Changes Western Canada 1971-2000 vs 2040-69



Precipitation Change (%)

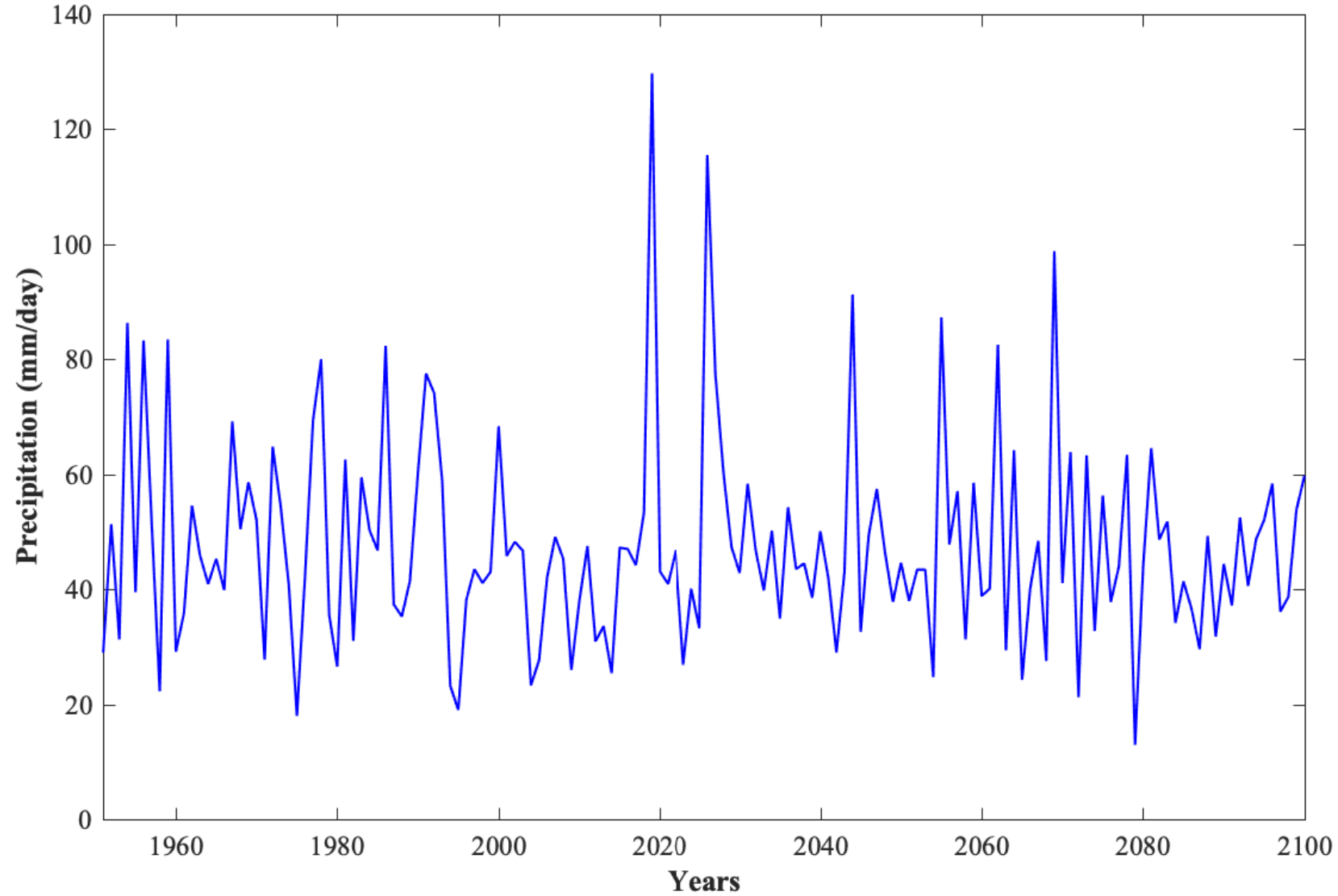
# Annual Hydrograph, North Saskatchewan River at Edmonton

From the MESH hydrological model run with a 13-member ensemble of bias-corrected CanRCM4 data and the high emission scenario RCP 8.5

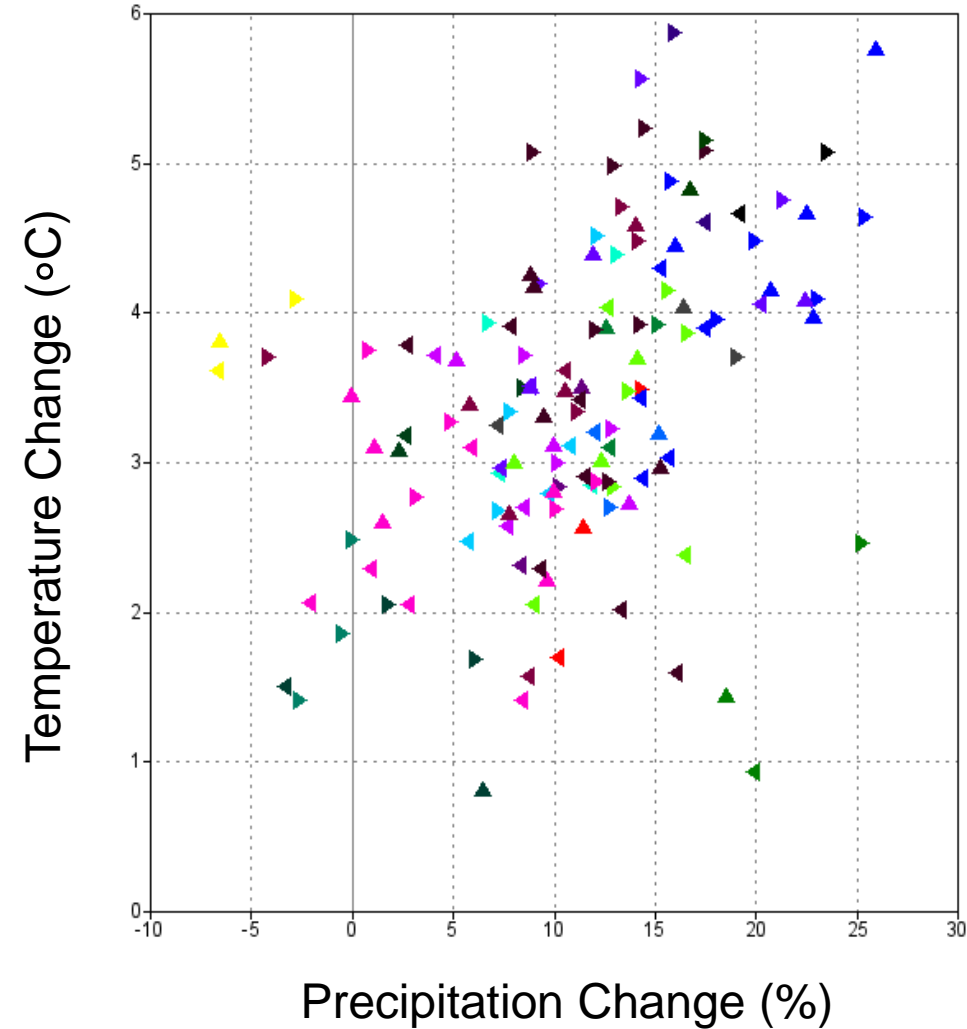


# Maximum Daily Precipitation (mm) at Edmonton, 1950 to 2010

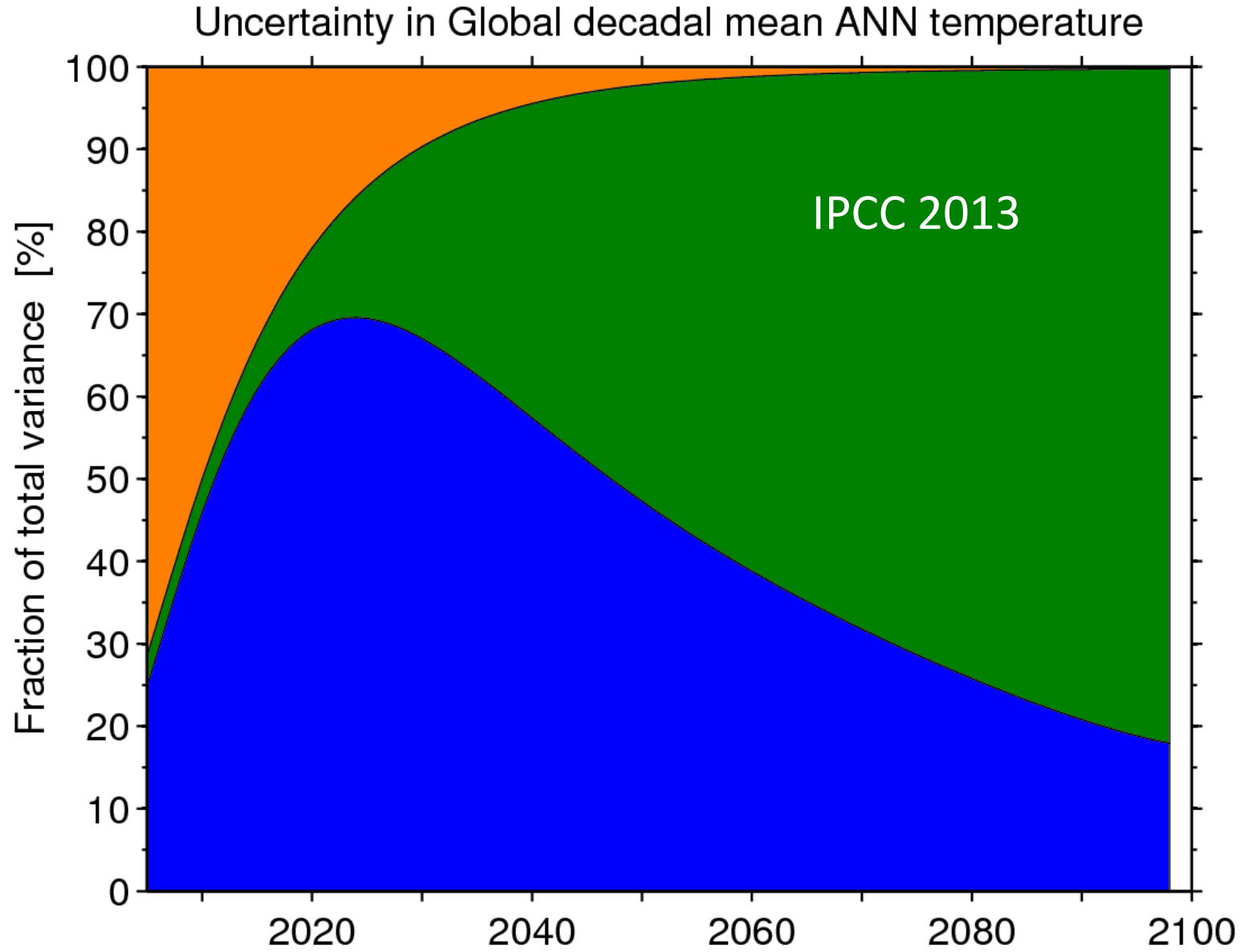
## Data from Canadian RCM version 5



# Projected Winter Climate Changes, Western Canada 1971-2000 versus 2040-2069

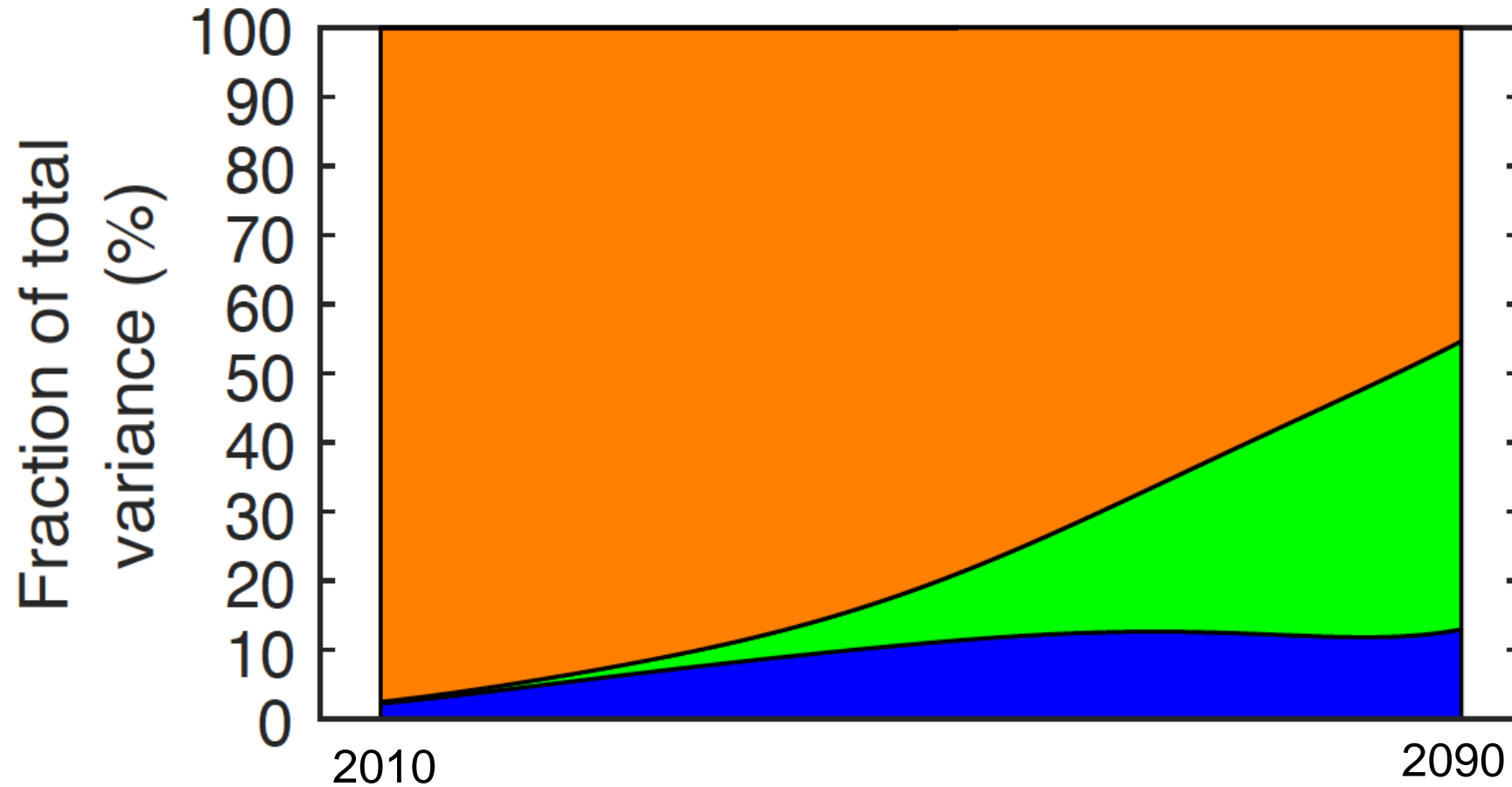


■ natural variability   ■ climate models   ■ GHG scenarios



# Sources of Uncertainty - Future Winter Temperature, Canadian Prairies

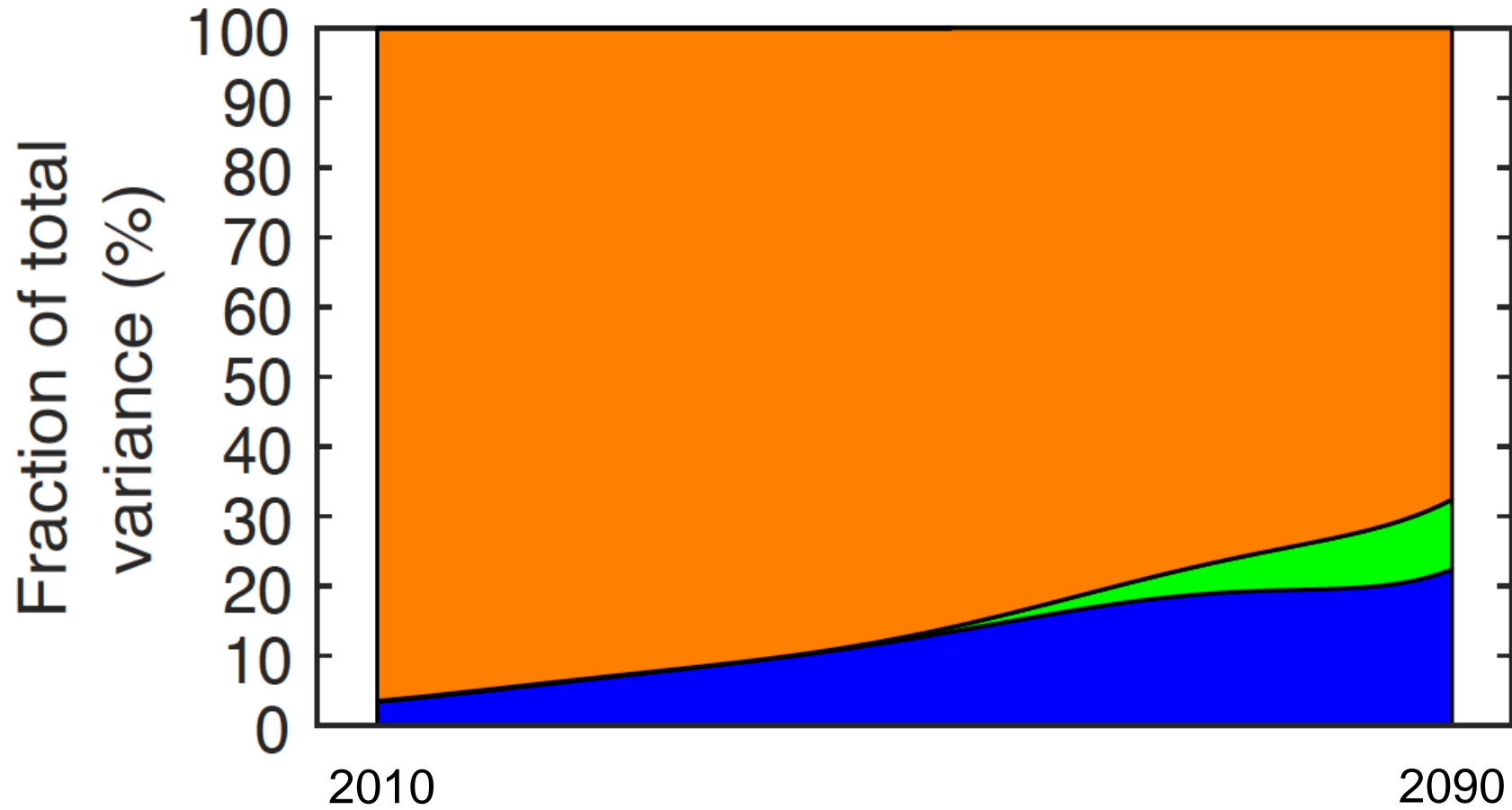
■ natural variability   ■ climate models   ■ GHG scenarios



Barrow and Sauchyn, 2019, *IJC*

## Sources of Uncertainty - Winter Precipitation, Canadian Prairies

■ natural variability   ■ climate models   ■ GHG scenarios



Barrow and Sauchyn, 2019, *IJC*

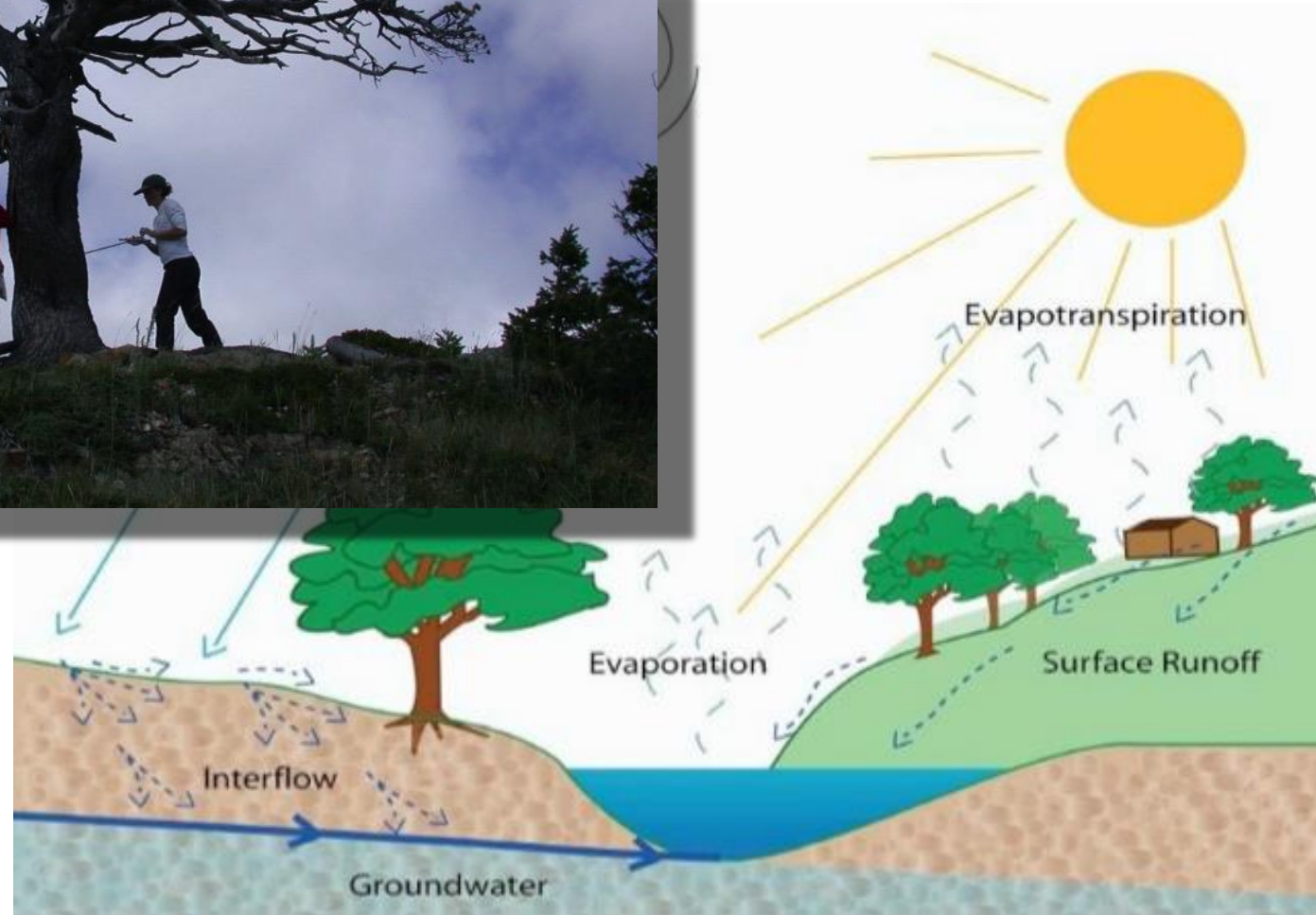




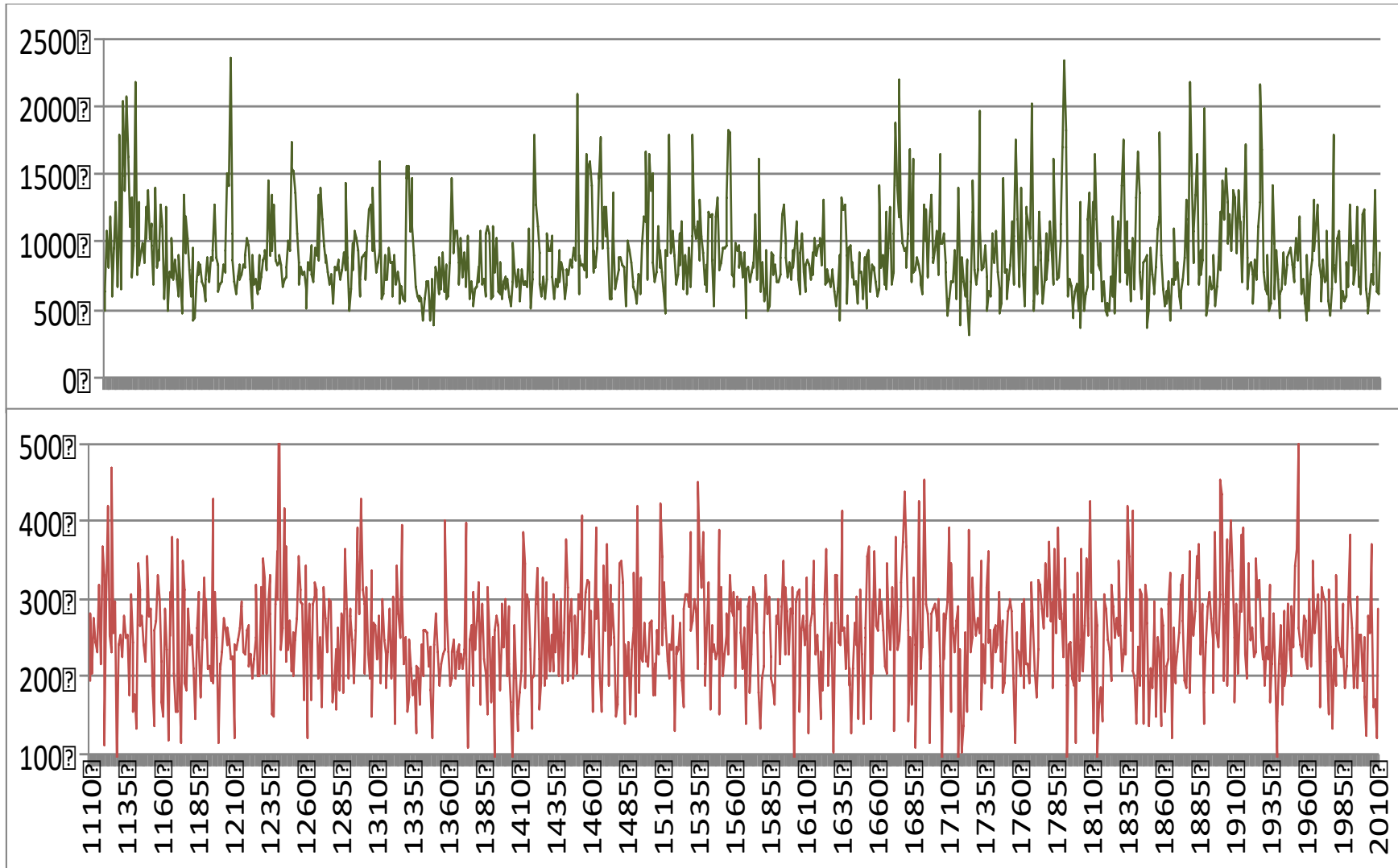
542 CE



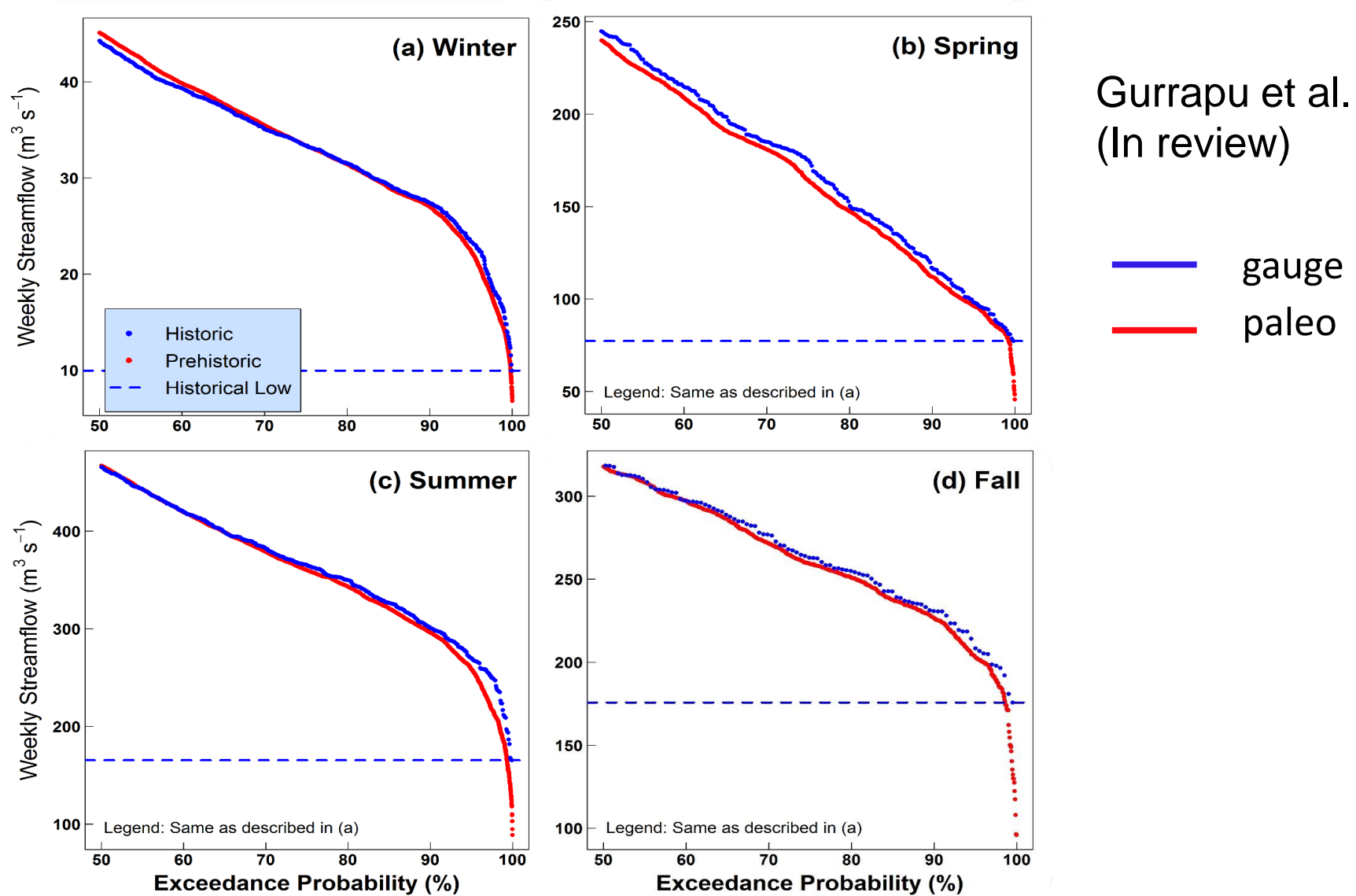
## The Hydrological Cycle



# Maximum and Minimum Weekly Summer Flow (m<sup>3</sup>/s) North Saskatchewan River at Edmonton, 1110-2011

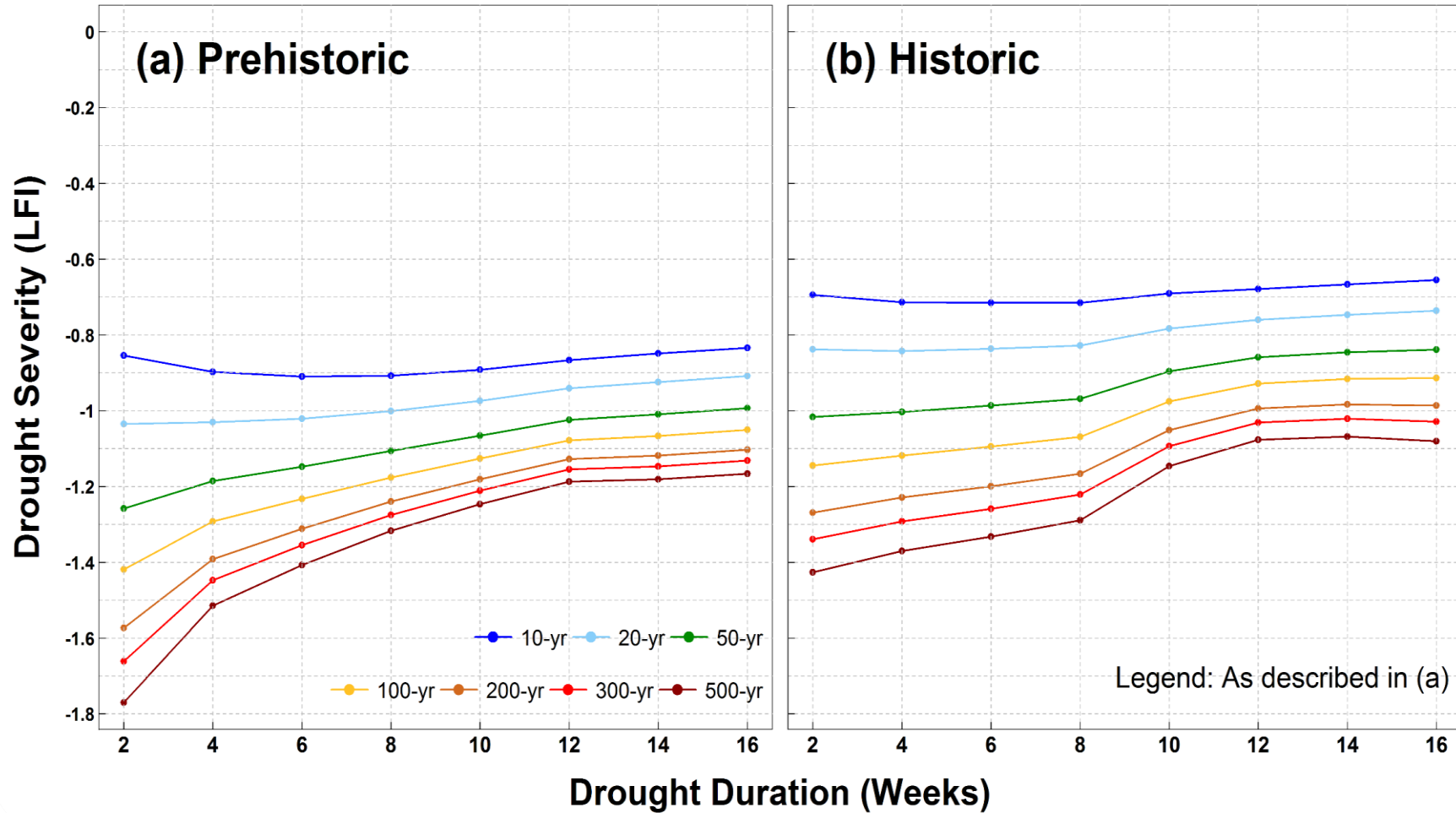


# Seasonal flow duration curves derived from gauged (historical) and paleo (pre-historic) flows of the NSR at Edmonton



# Drought (75<sup>th</sup> percentile) SDF curves derived from paleo and historical streamflow data

Gurrapu et al. (In review)



**March 2007:** Traditional planning would consider **flow characteristics of the raw water streams as “knowns”** in the system. [ i.e., a stationary climate and water regime]

**February 2012:** water utilities including EPCOR are **revisiting this assumption of a static water supply.** ..This work [PARC] will allow EPCOR to better assess future risks to water supply and quality and develop risk mitigation strategies

**December 2014:** **Understanding that water resources are not stationary,** water management must be adjusted to a hydrological cycle which is increasingly sensitive ...





The Prairie Adaptation Research Collaborative (PARC) was **established in 2000** to undertake research on climate change science, impacts and adaptation in the Prairie Provinces. The aim of this applied research is to **support science-based adaptation** to current and future climate change. PARC also contributes to training in the emerging field of climate change adaptation and resilience planning.



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