

THE PACIFIC CLIMATE IMPACTS CONSORTIUM - HYDROLOGIC MODELLING PROJECT

Recent accomplishments, challenges, and future
directions

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IP3-WC2N, Lake Louise
18 October, 2009

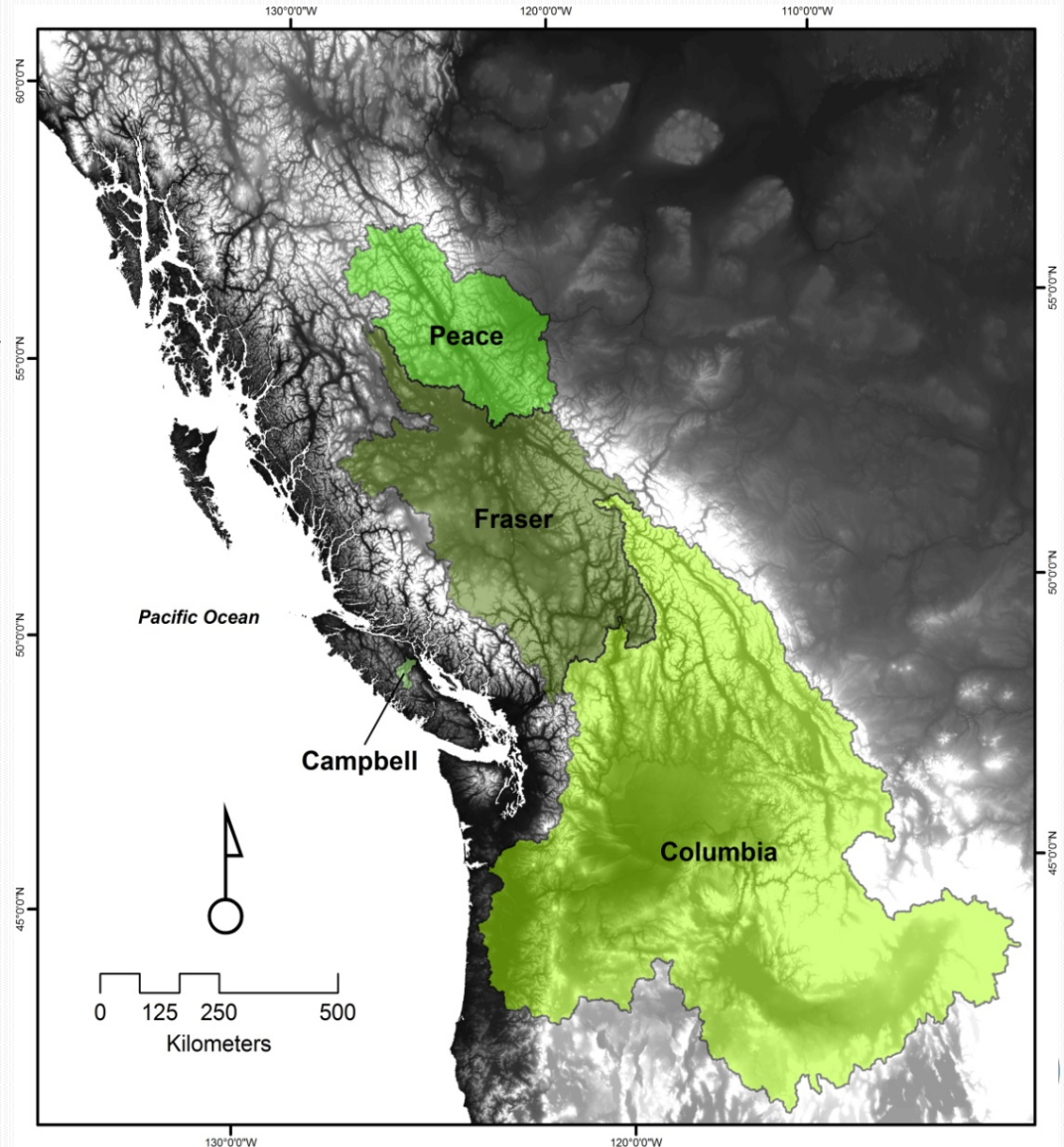
WHAT IS PCIC?

- Vision: to stimulate collaboration among government, academe and industry to reduce vulnerability to extreme weather events, climate variability and the threat of global change. The consortium for climate impacts will *bridge the gap between climate research and climate applications and will make practical information available to government, industry, and the public.*
- Mission: to *quantify the impacts of climate change and variability on the physical environment in Pacific North America.*



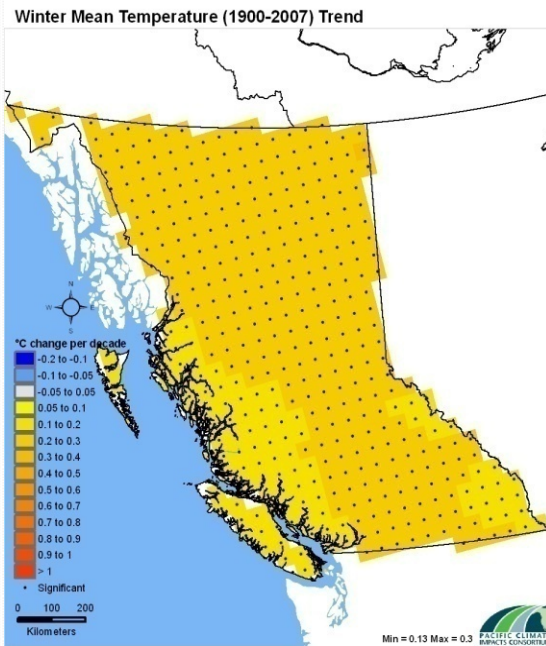
PCIC HYDROLOGY THEME

- BC Hydro driven
- Four projects
 - Climate Overview
 - Hydrologic Modelling
 - Regional Climate Modelling
 - Synthesis
- Study of three major watersheds in British Columbia using the VIC hydrologic model
- 2007 - 2010

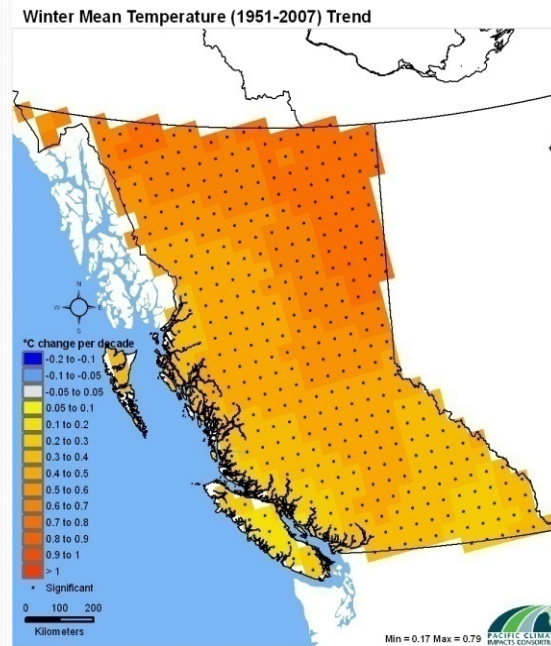


CLIMATE OVERVIEW

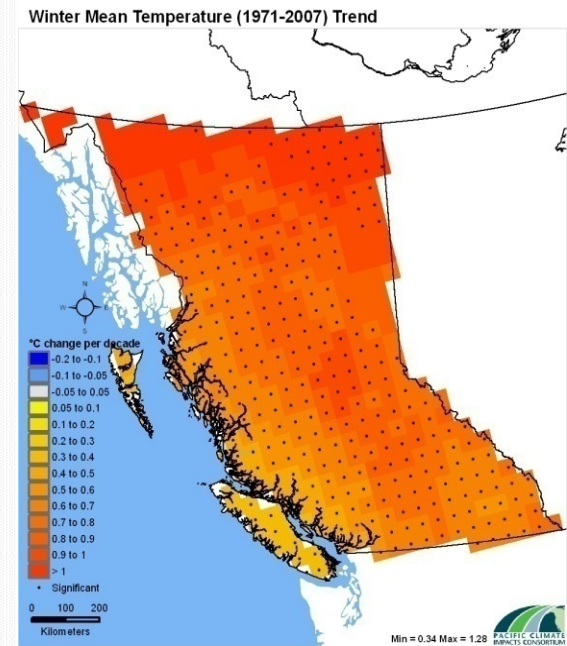
Winter Mean Temperature



1900-2007

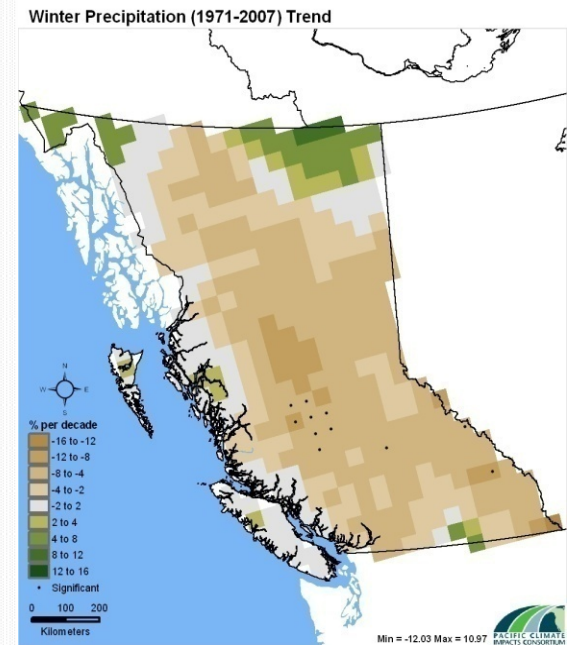
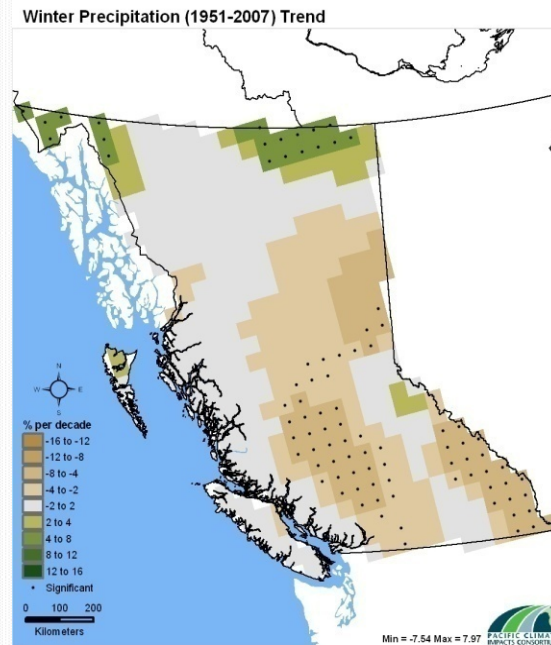
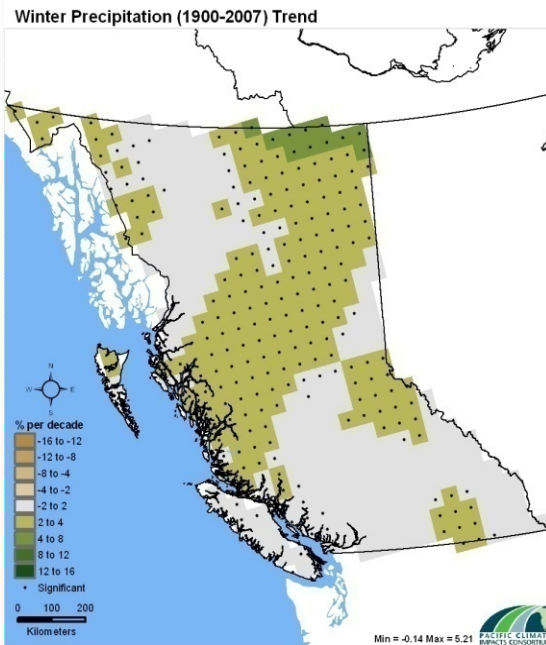


1951-2007



1971-2007

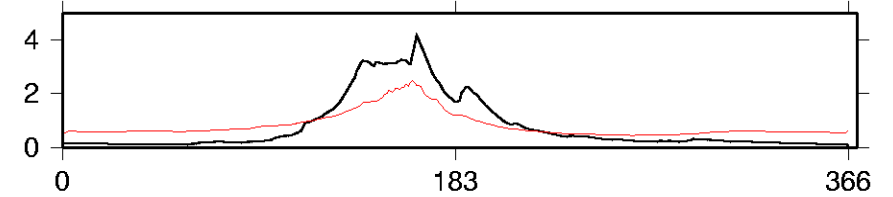
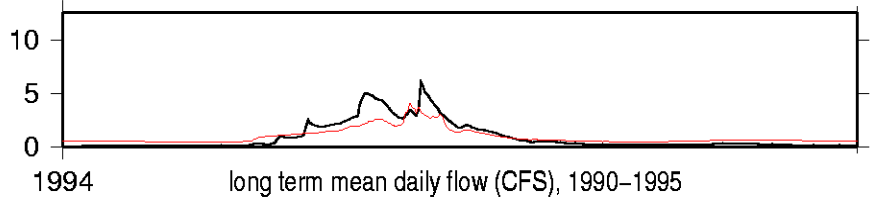
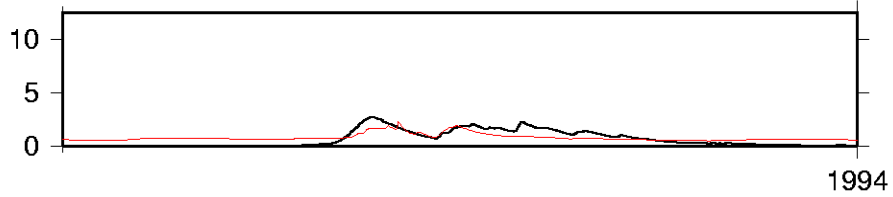
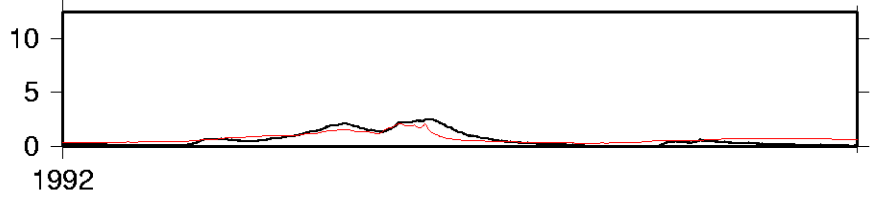
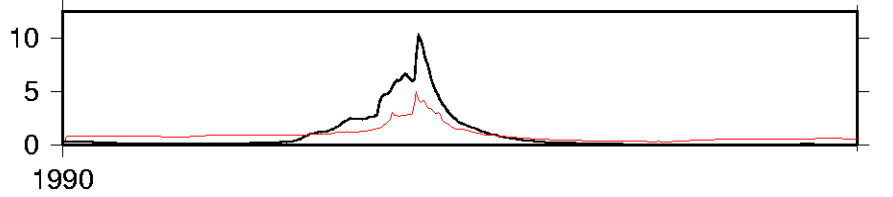
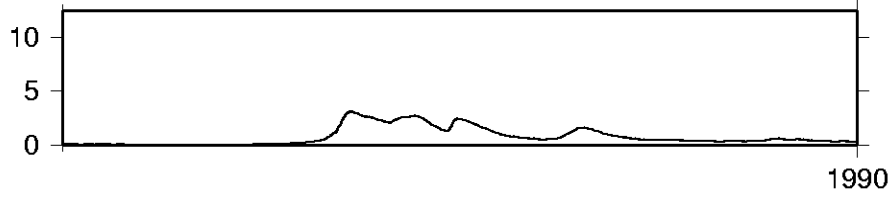
Winter Precipitation



HYDROLOGIC MODELLING - RECENT PROGRESS

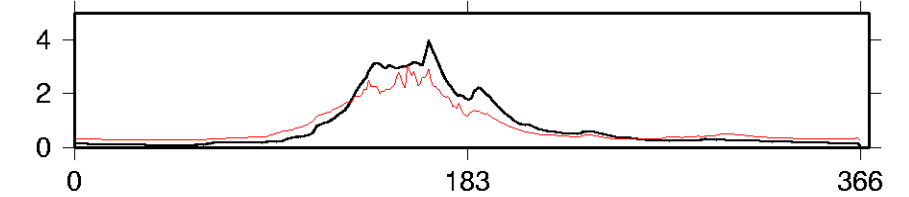
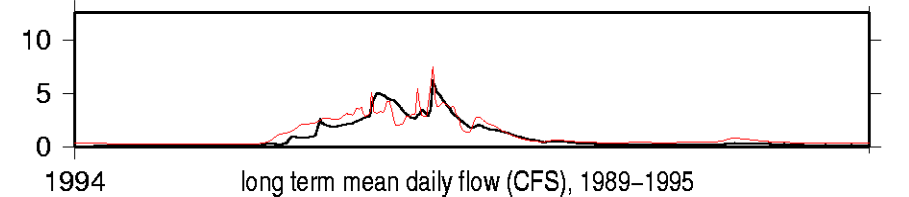
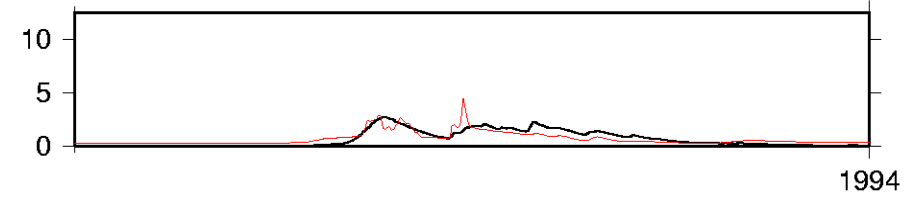
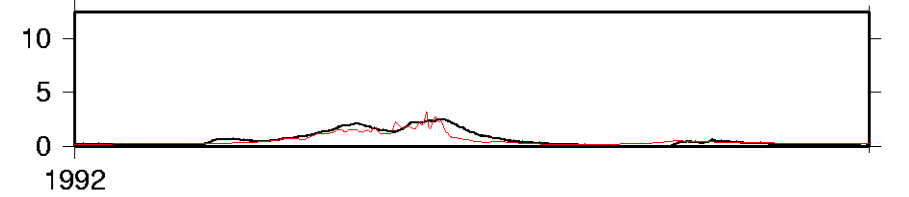
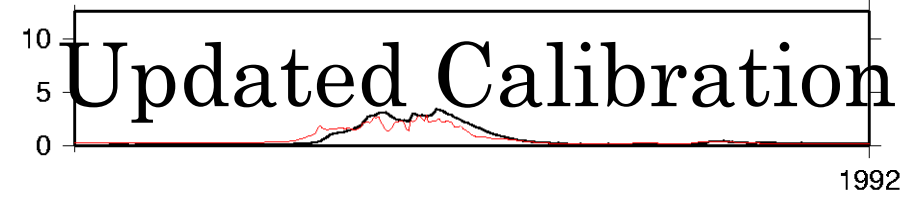
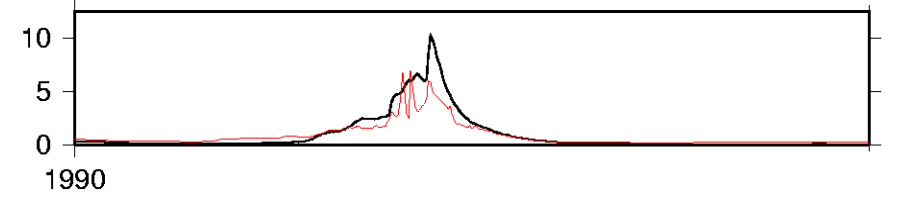
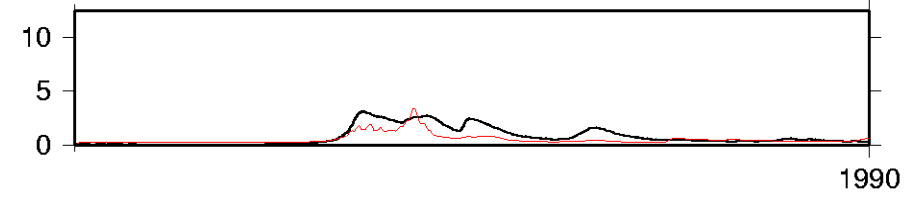
- Peace River Basin
 - Model calibration and validation
 - Sensitivity analysis
 - Uncertainty analysis
- Campbell River Basin – calibrated/validated
- BC Hydro's Technical advisory committee for the project
- Columbia River Basin – working on next





day

— OBS — SIM_OPTI

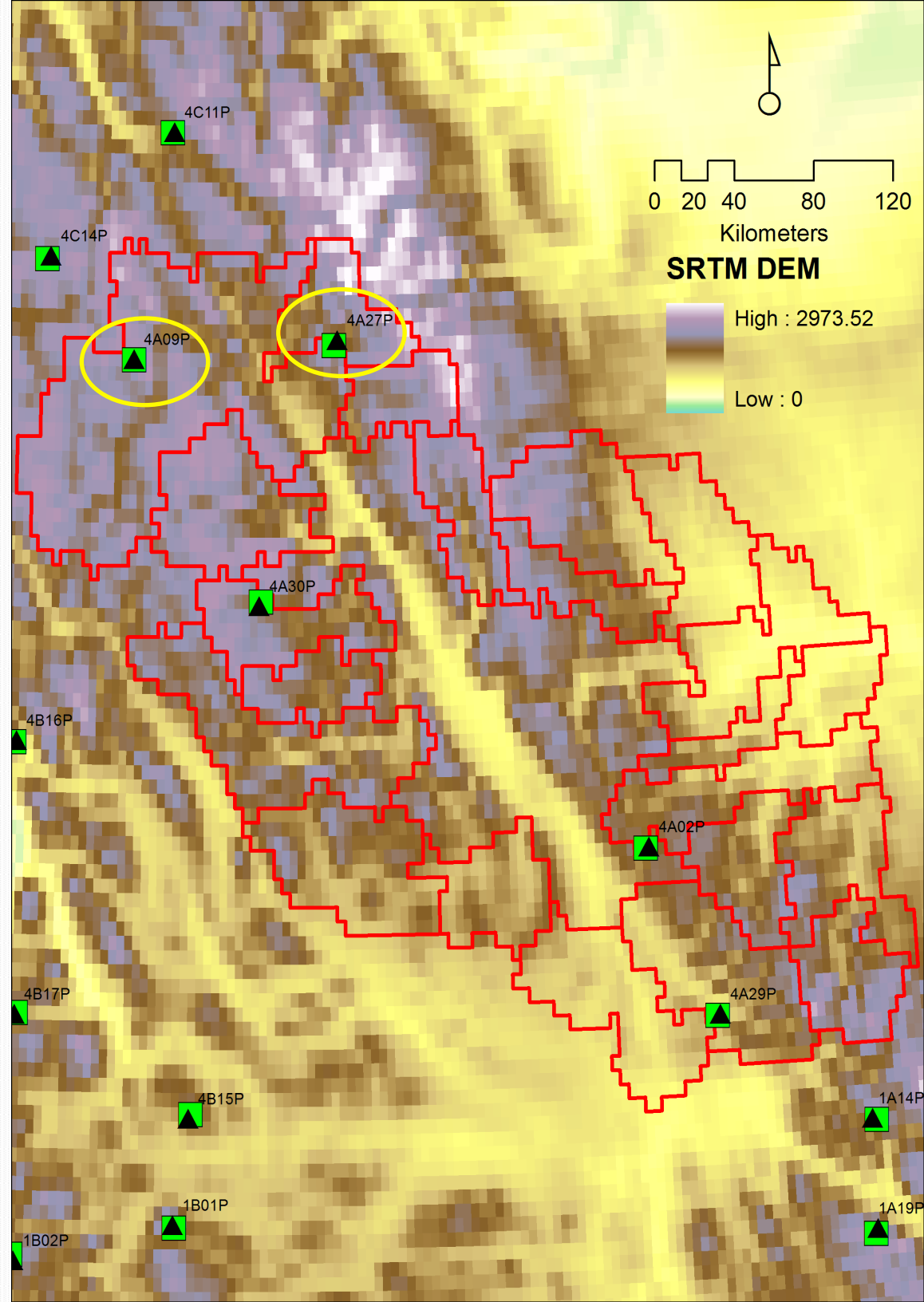


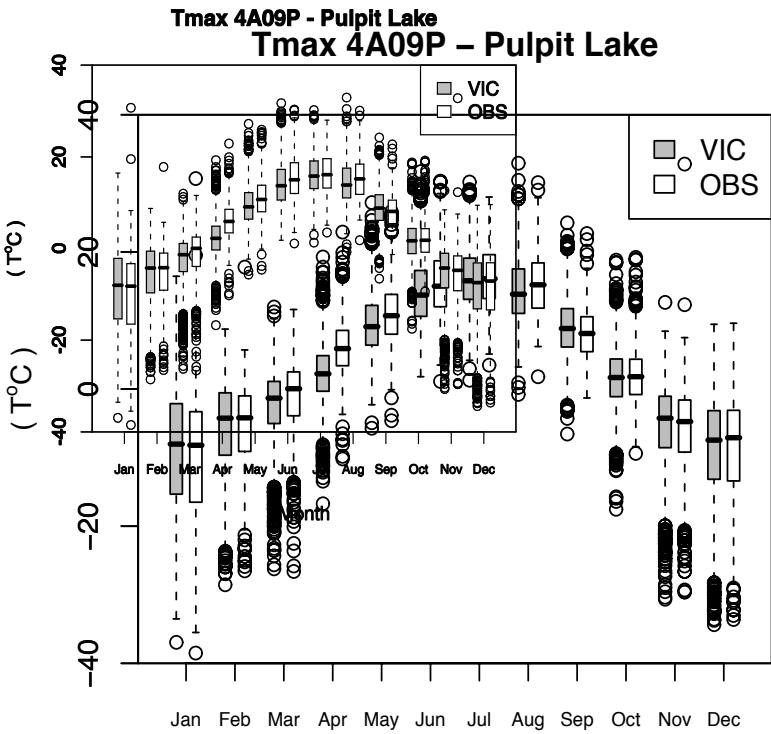
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— OBS — SIM_OPTI

MODEL VALIDATION

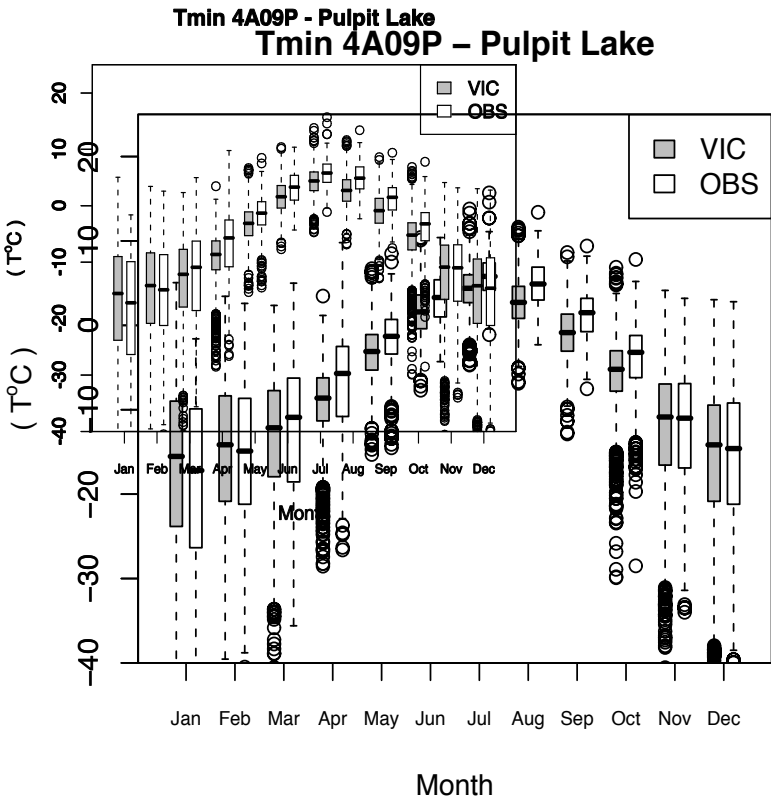
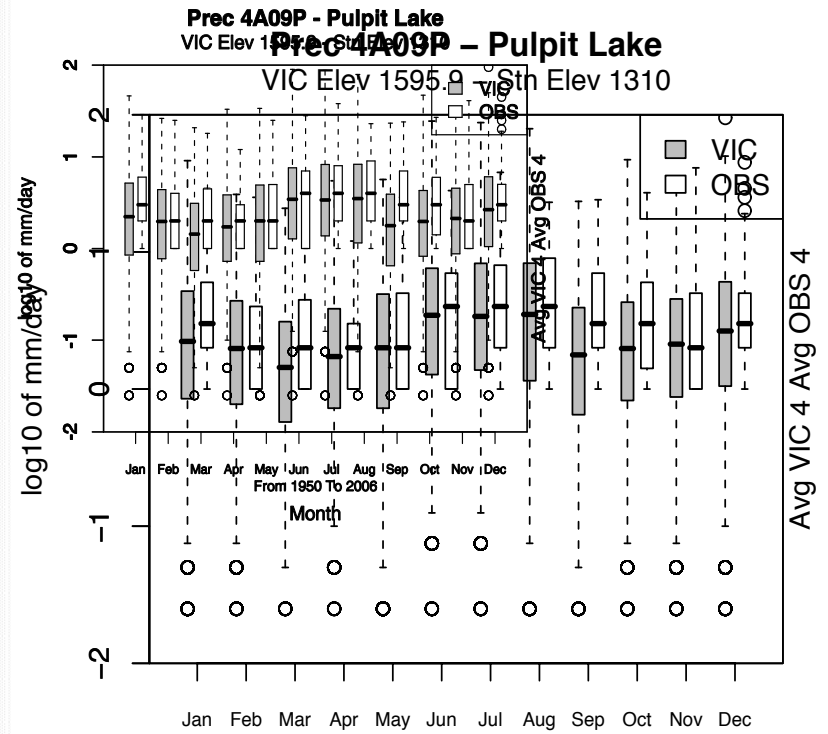
- Inputs
 - Forcings
 - Downscaling approach
- Output
 - Runoff
 - Snowpack
 - Evapo-transpiration?
 - Soil moisture?
 - Glaciers?





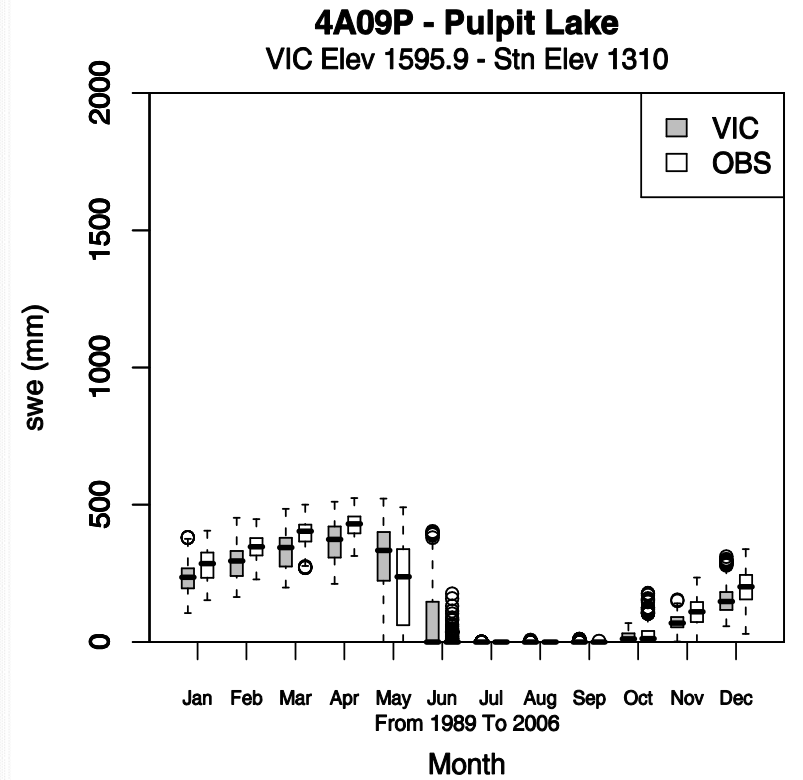
Tmax

Precip

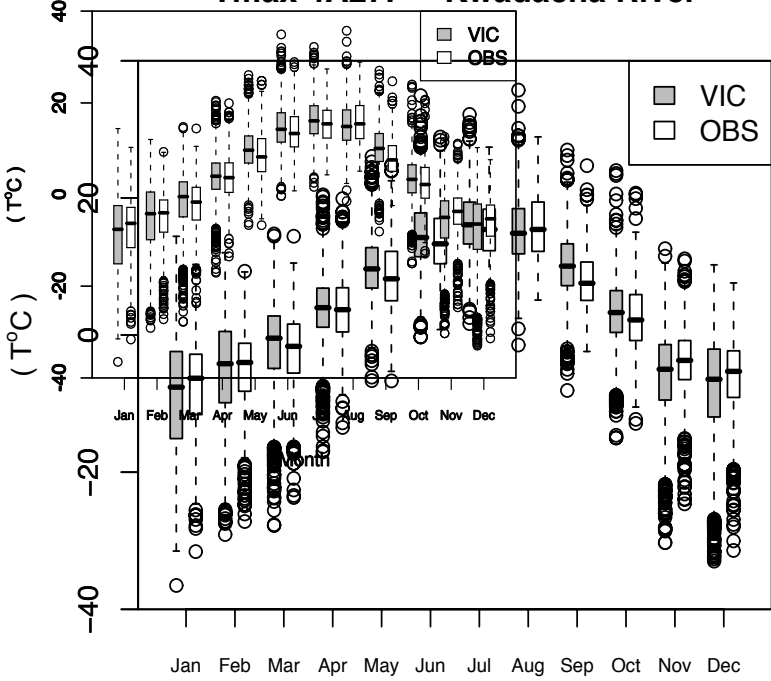


Tmin

SWE

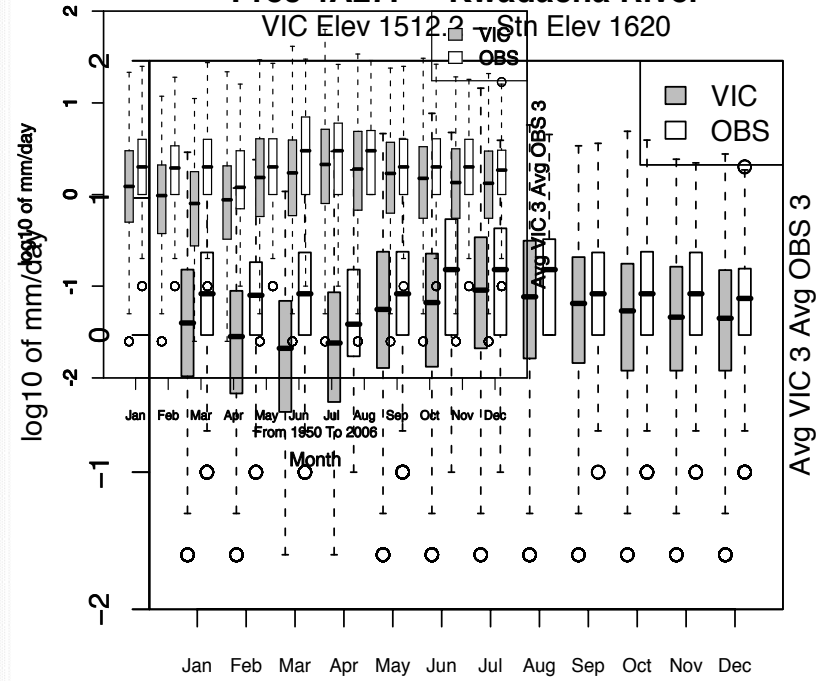


Tmax 4A27P - Kwadacha River
Tmax 4A27P - Kwadacha River



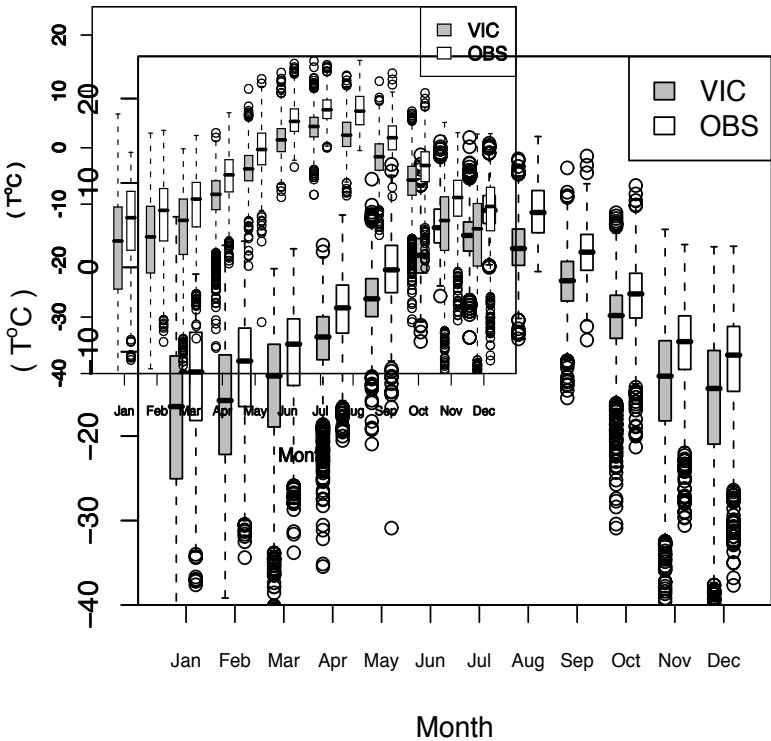
Tmax

Prec 4A27P - Kwadacha River
Prec 4A27P - Kwadacha River



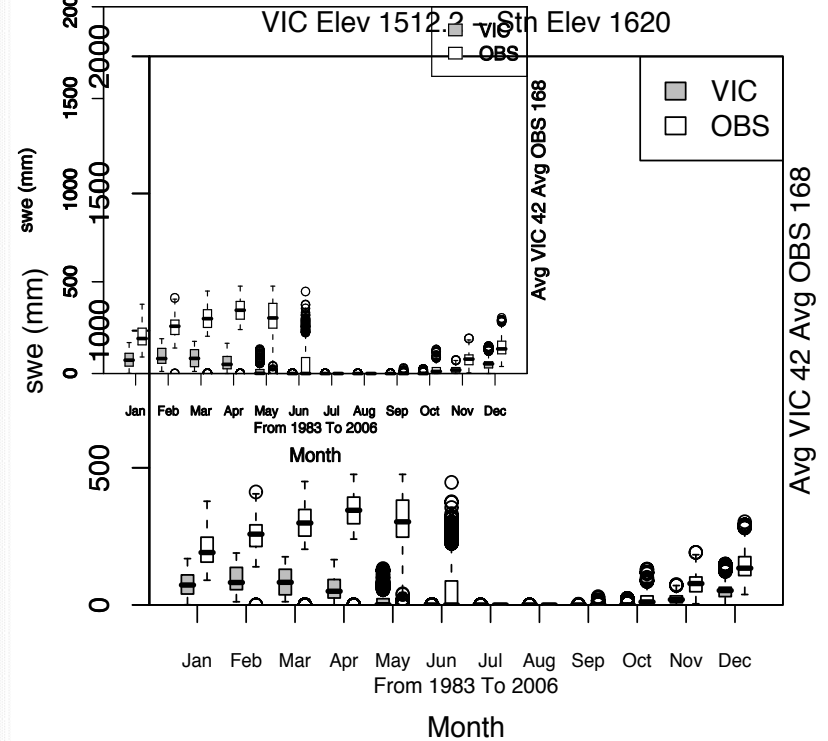
Precip

Tmin 4A27P - Kwadacha River
Tmin 4A27P - Kwadacha River



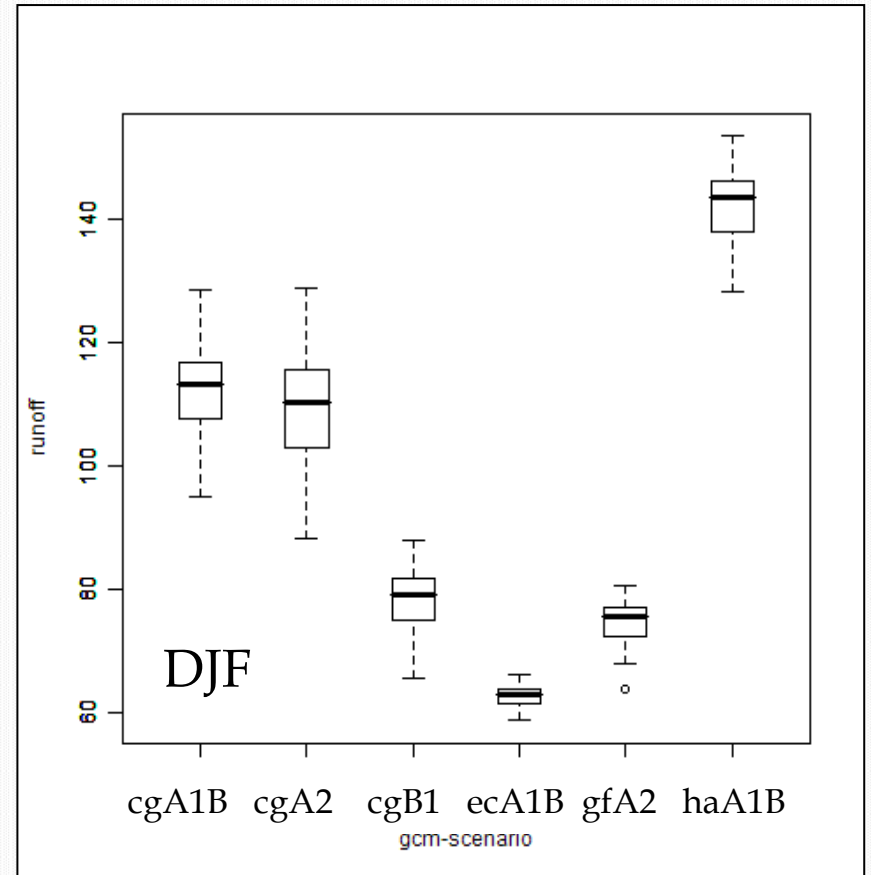
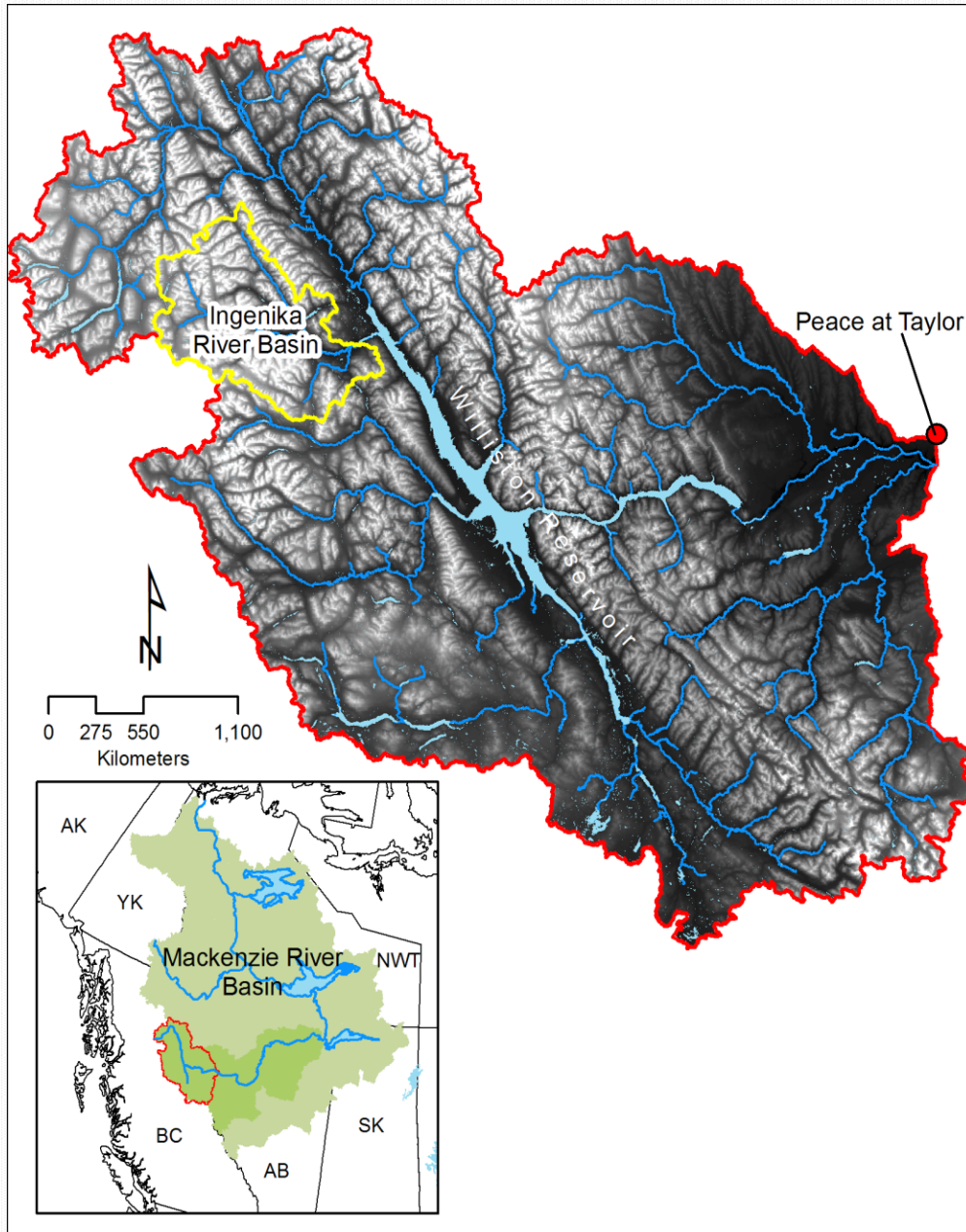
Tmin

4A27P - Kwadacha River
4A27P - Kwadacha River



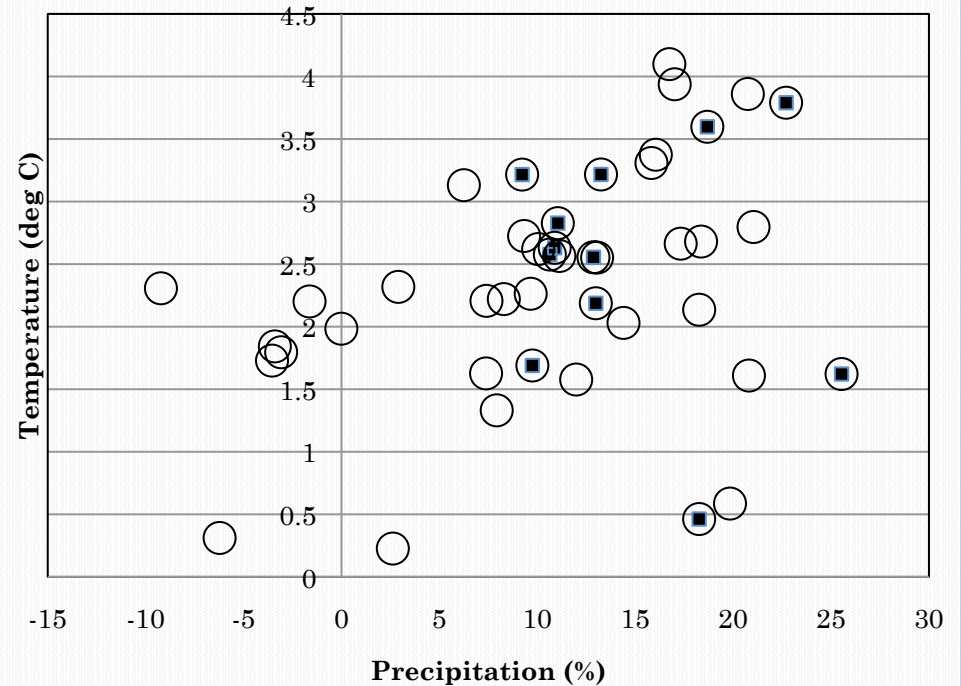
SWE

UNCERTAINTY ANALYSIS

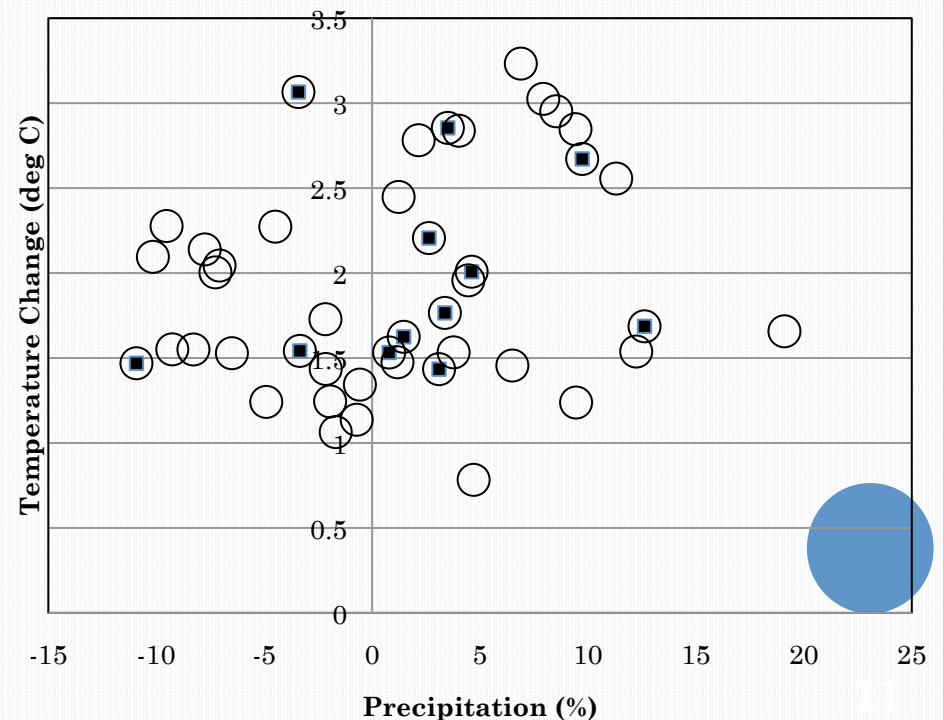


Modeling Laboratory (GCM name-version)	Scenario
Max Planck Institute for Meteorology (mpi_echam5)	A1B, A2
Canadian Centre for Climate Modelling and Analysis (cccma_cgcm3)	B1, A1B, A2
Hadley / United Kingdom Meteorological Office (ukmo_hadcm3)	A1B, A2
Geophysical Fluid Dynamics Laboratory (gfdl_cm20)	A2, B1
Community Climate System Model (ccsm3_20c)	A2, B1
Commonwealth Scientific and Industrial Research Organization (csiro_3_5_20c)	B1

Winter (DJF)

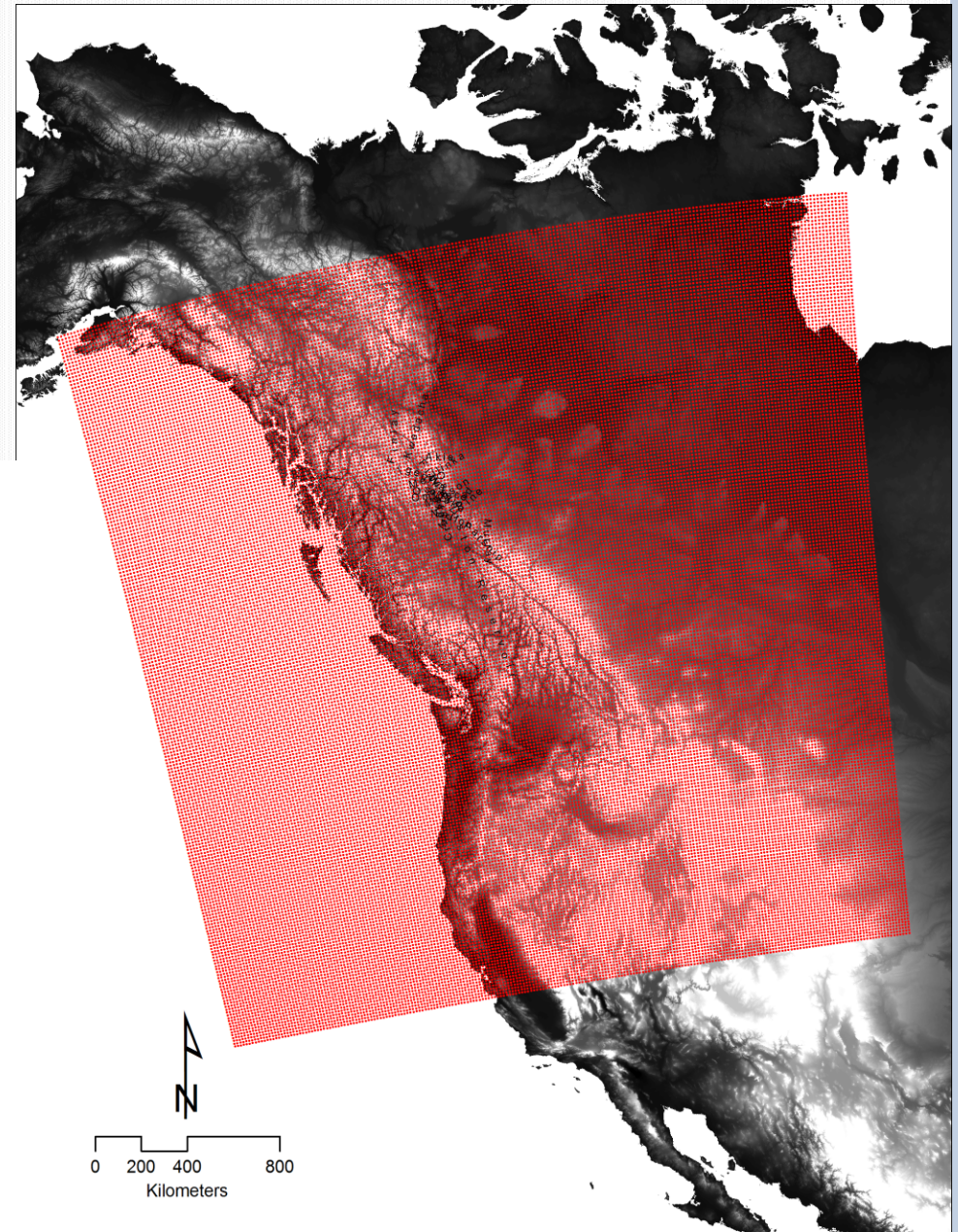


Summer (JJA)

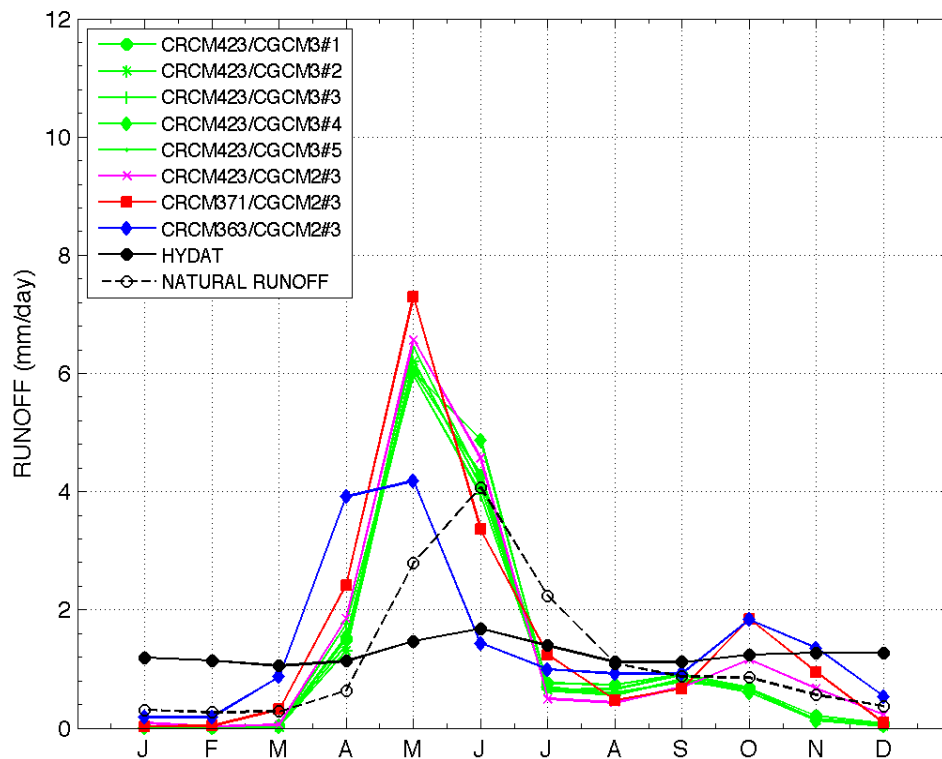


REGIONAL CLIMATE MODELLING

- Dynamical downscaling
- Running RCM at 15 km
- Zhang (PCIC) + Caya Music, Braun (Ouranos)

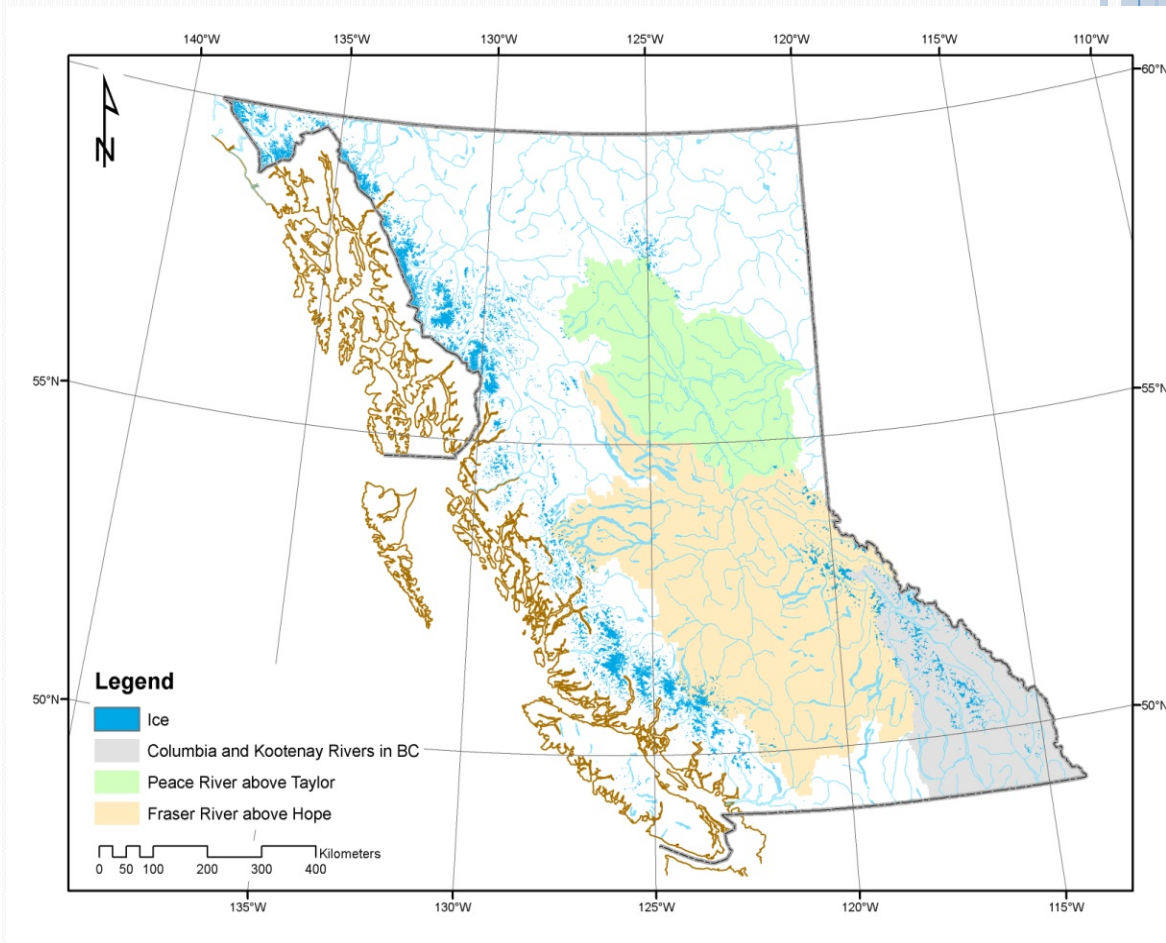


PEACE AT TAYLOR: 1961-1990

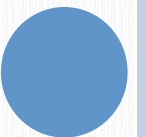


DIRECTIONS FOR PCIC

- Hydrologic impacts of changing glacier mass balance
- Improved validation of snow process modelling at regional scales
- Challenges of downscaling to high elevation, poorly monitored watersheds in BC
- April workshop

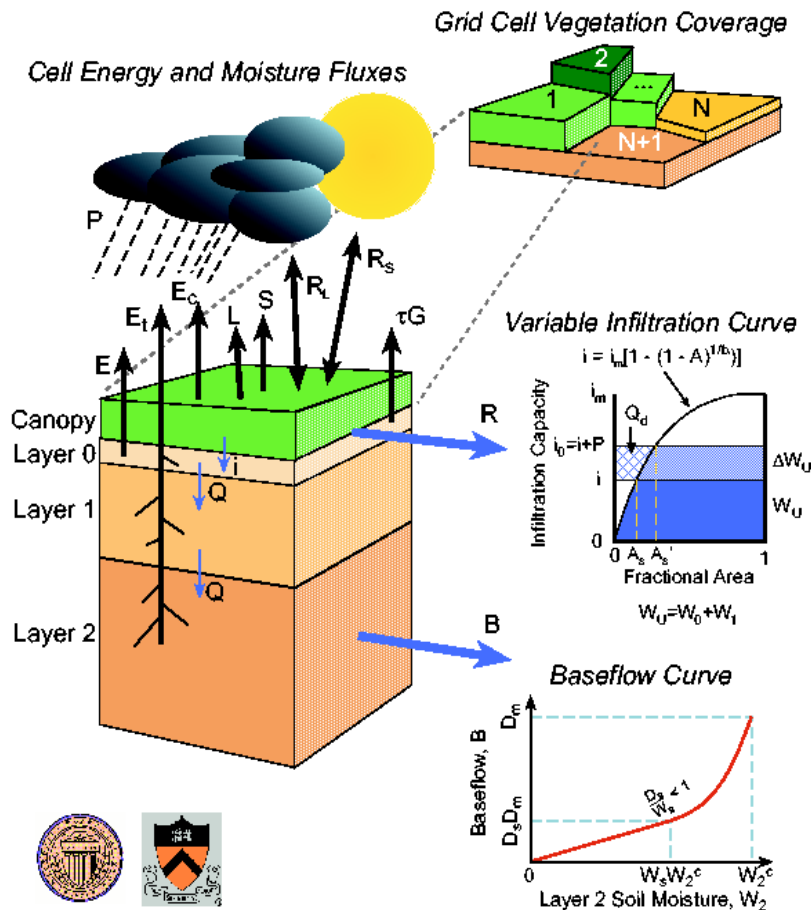


ADDITIONAL MATERIALS



VARIABLE INFILTRATION CAPACITY HYDROLOGIC MODEL

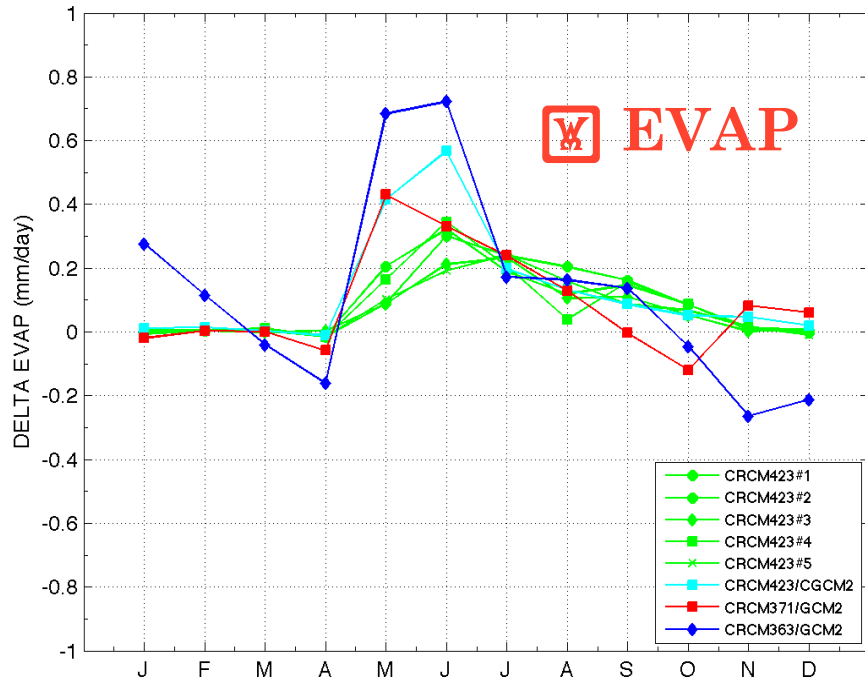
Variable Infiltration Capacity (VIC) Macroscale Hydrologic Model



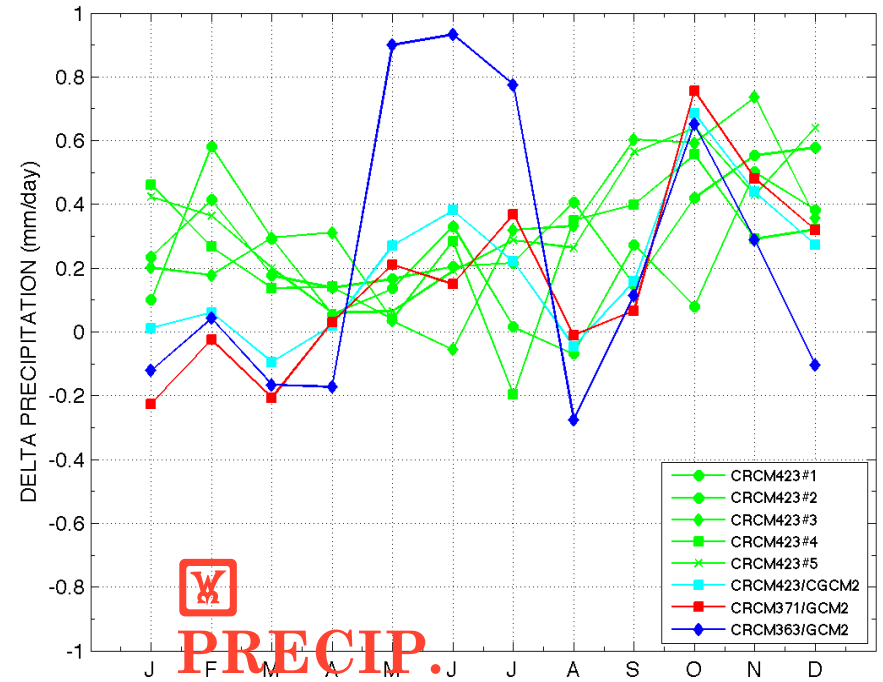
- ▶ Macro-scale hydrologic model
- ▶ Model runs for 1 grid cell, calculates fluxes
- ▶ No horizontal transfer of flow
- ▶ Model resolves fluxes at a daily or sub-daily time step

Peace RB (at Taylor)

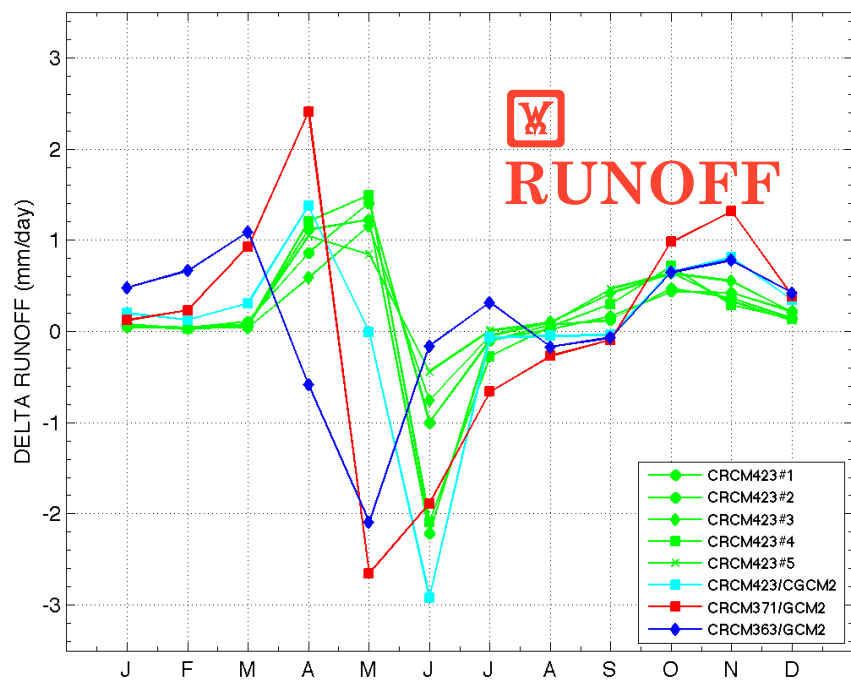
PEACE AT TAYLOR: 2041-2070, relative to 1961-1990



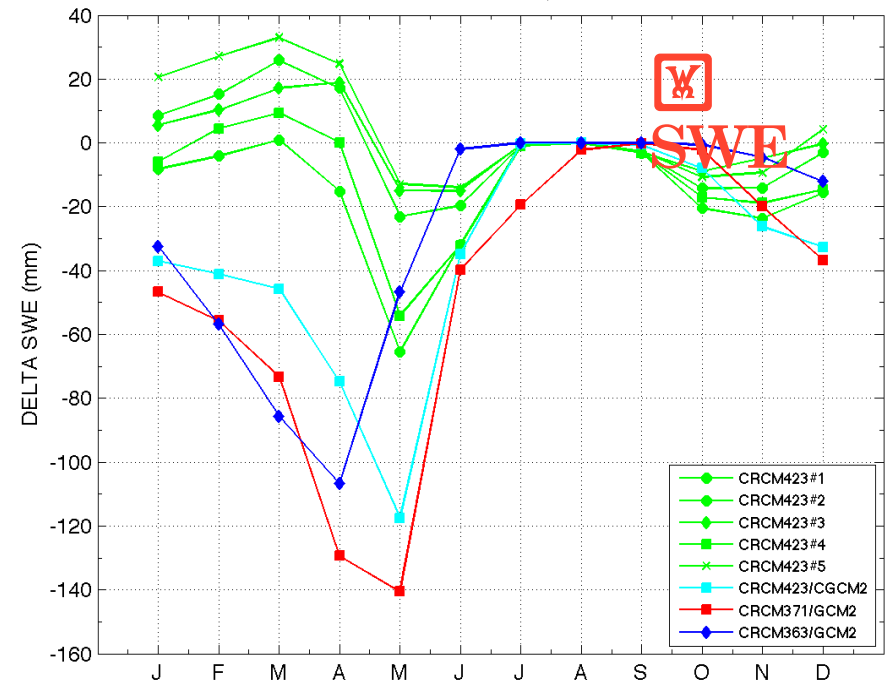
PEACE AT TAYLOR: 2041-2070, relative to 1961-1990



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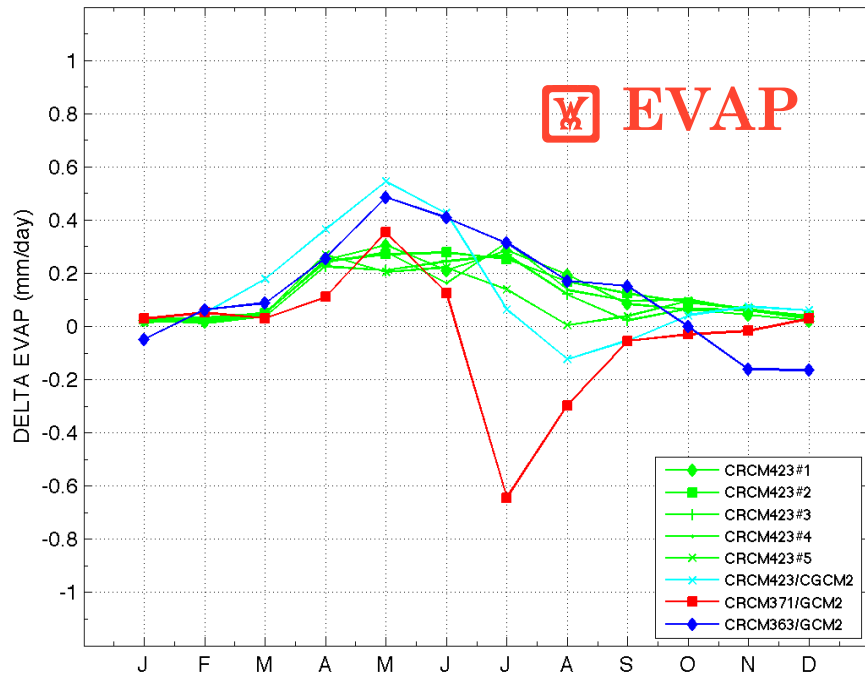


PEACE AT TAYLOR: 2041-2070, relative to 1961-1990

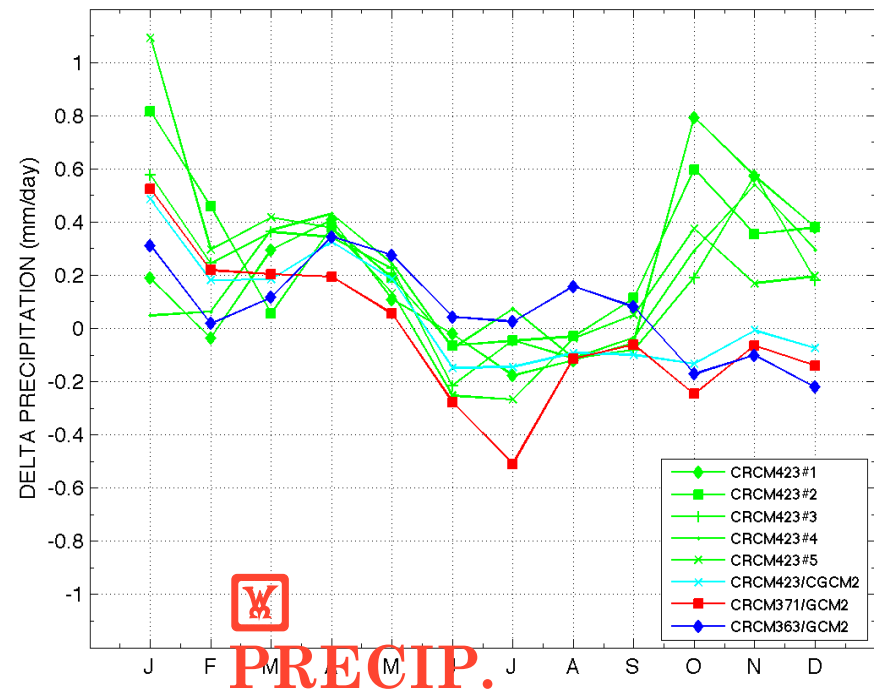


Columbia RB

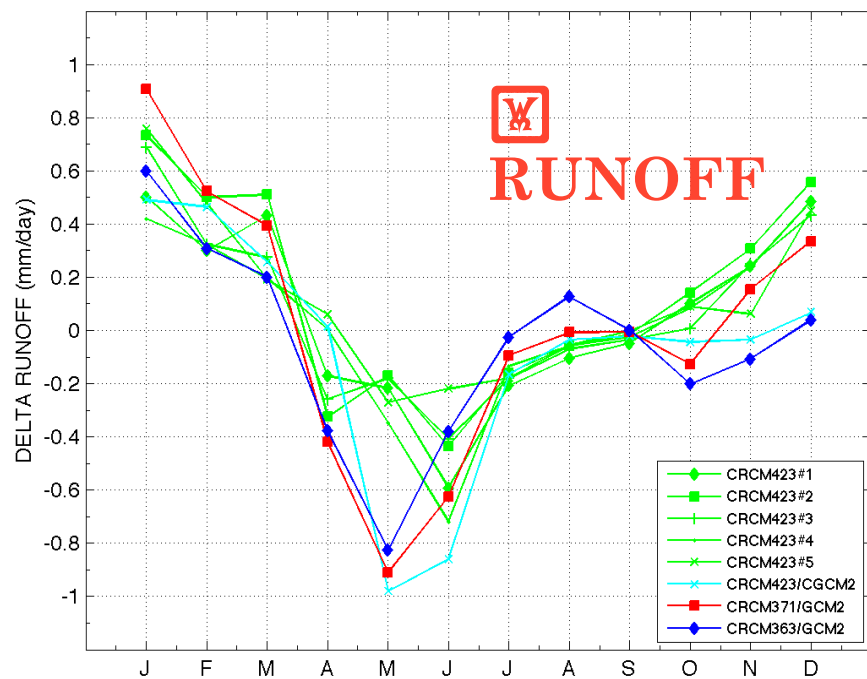
COLUMBIA RB: 2041-2070, relative to 1961-1990



COLUMBIA RB: 2041-2070, relative to 1961-1990



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COLUMBIA RB: 2041-2070, relative to 1961-1990

