



Convection Permitting 4-km WRF Western Canada Simulation

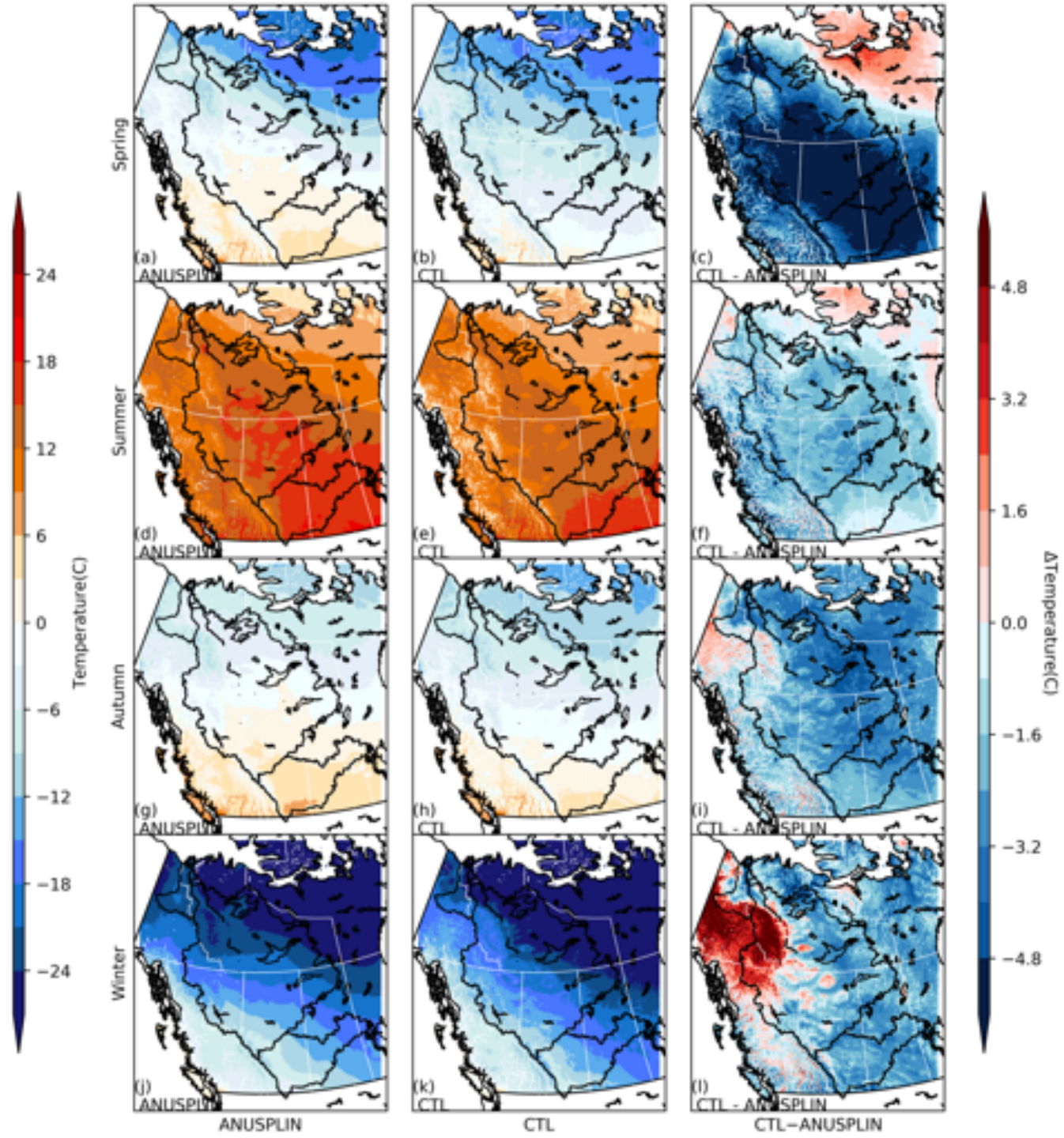
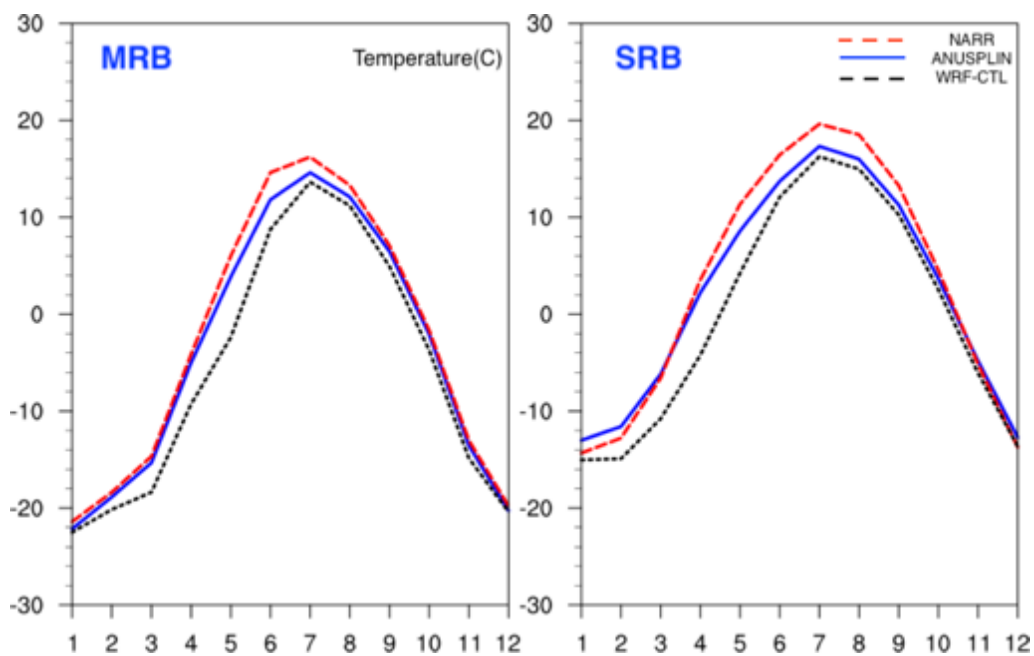
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Fei Huo

March 26, 2019

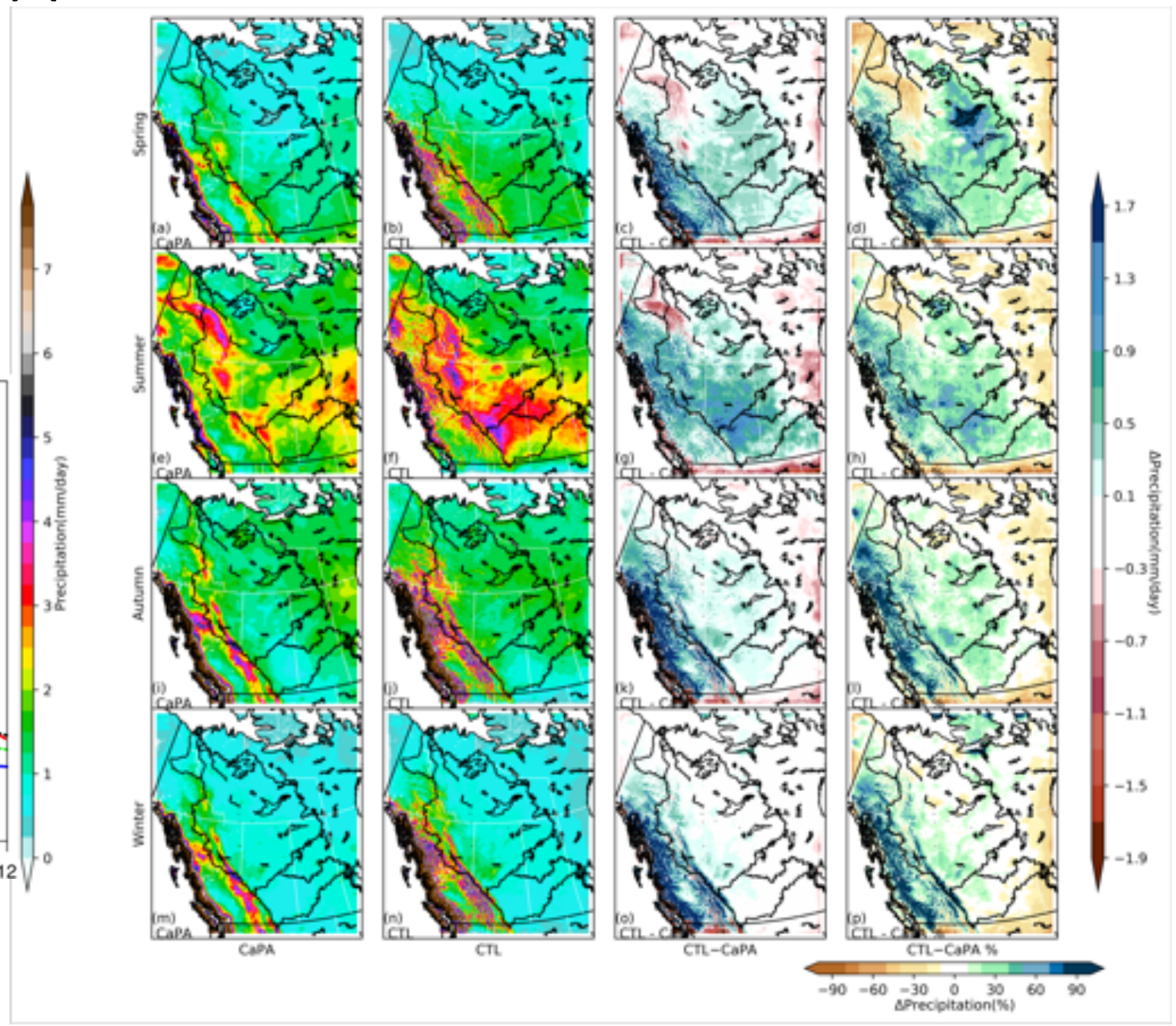
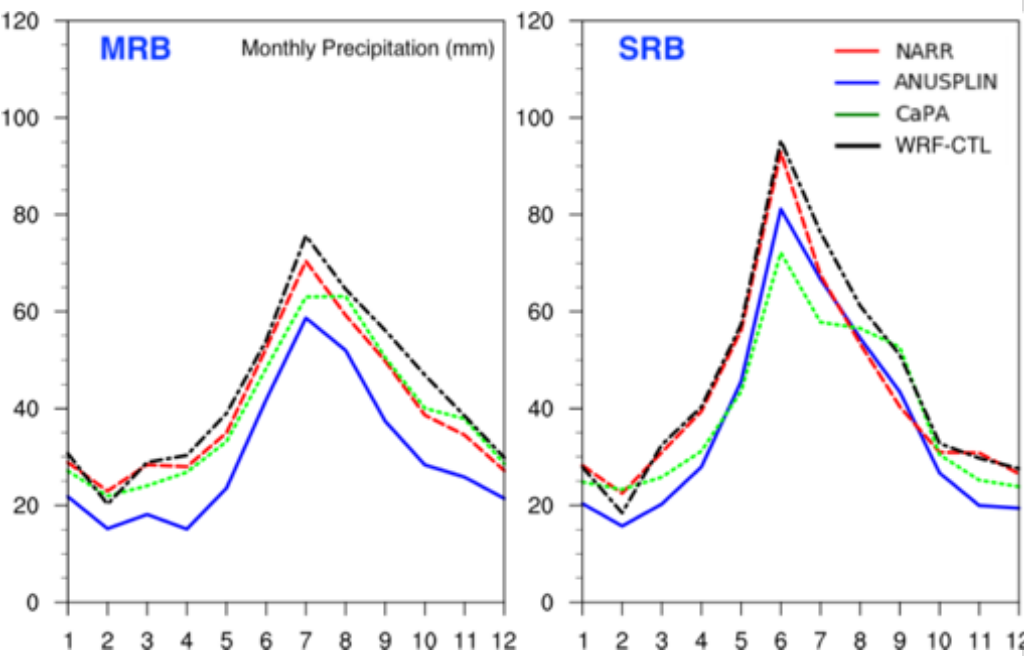
Evaluation of WRF Western Canada simulation

- The CTL simulation captures the mean and seasonal change of spatial/geographical distribution of temperature and precipitation.
- Cold bias in the spring over the Canadian Prairies due to excess snow cover and albedo feedback
- Large wet bias against ANUSPLIN, better agreement with CaPA.
- We have generated a bias-corrected WRF output using a multi-variate quantile-mapping method (Cannon 2018) for application of our regional climate downscaling dataset.

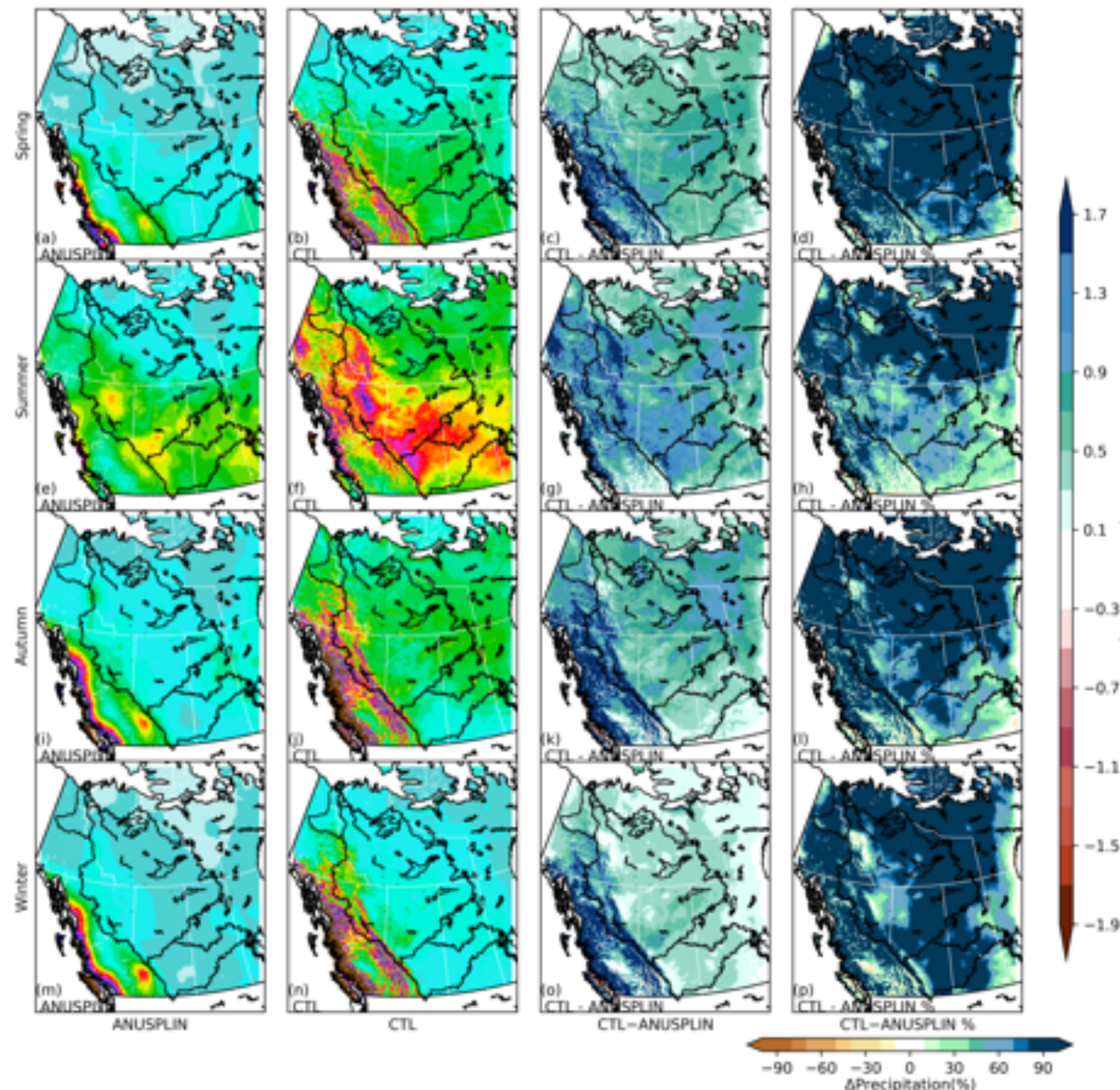
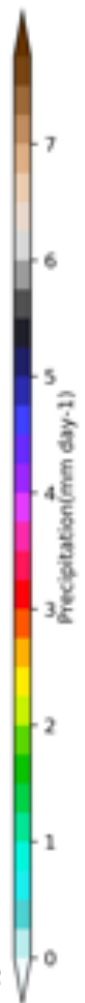
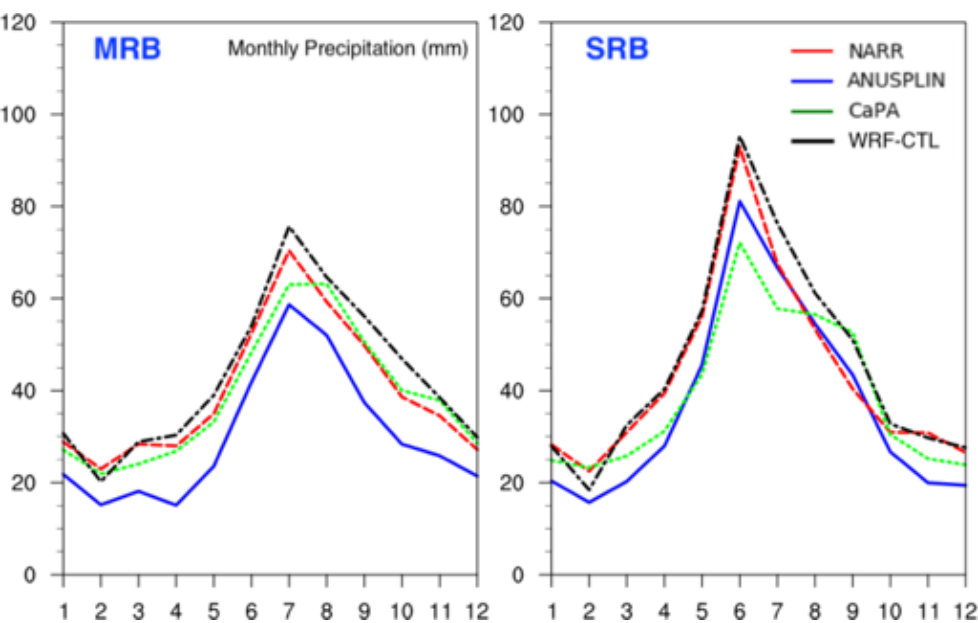
Temperature vs ANUSPLIN



Precipitation vs CaPA



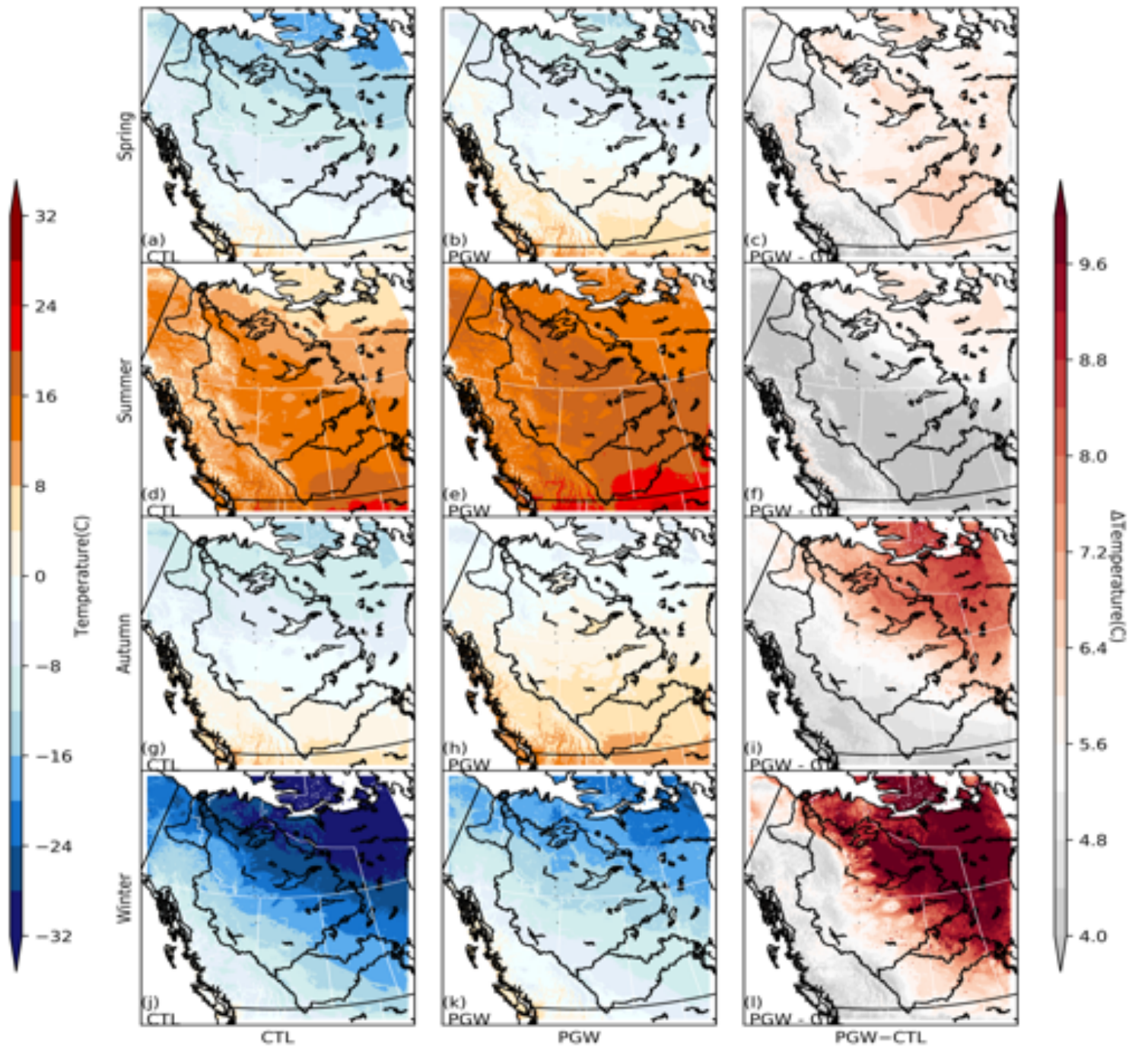
Prec vs ANUSPLIN



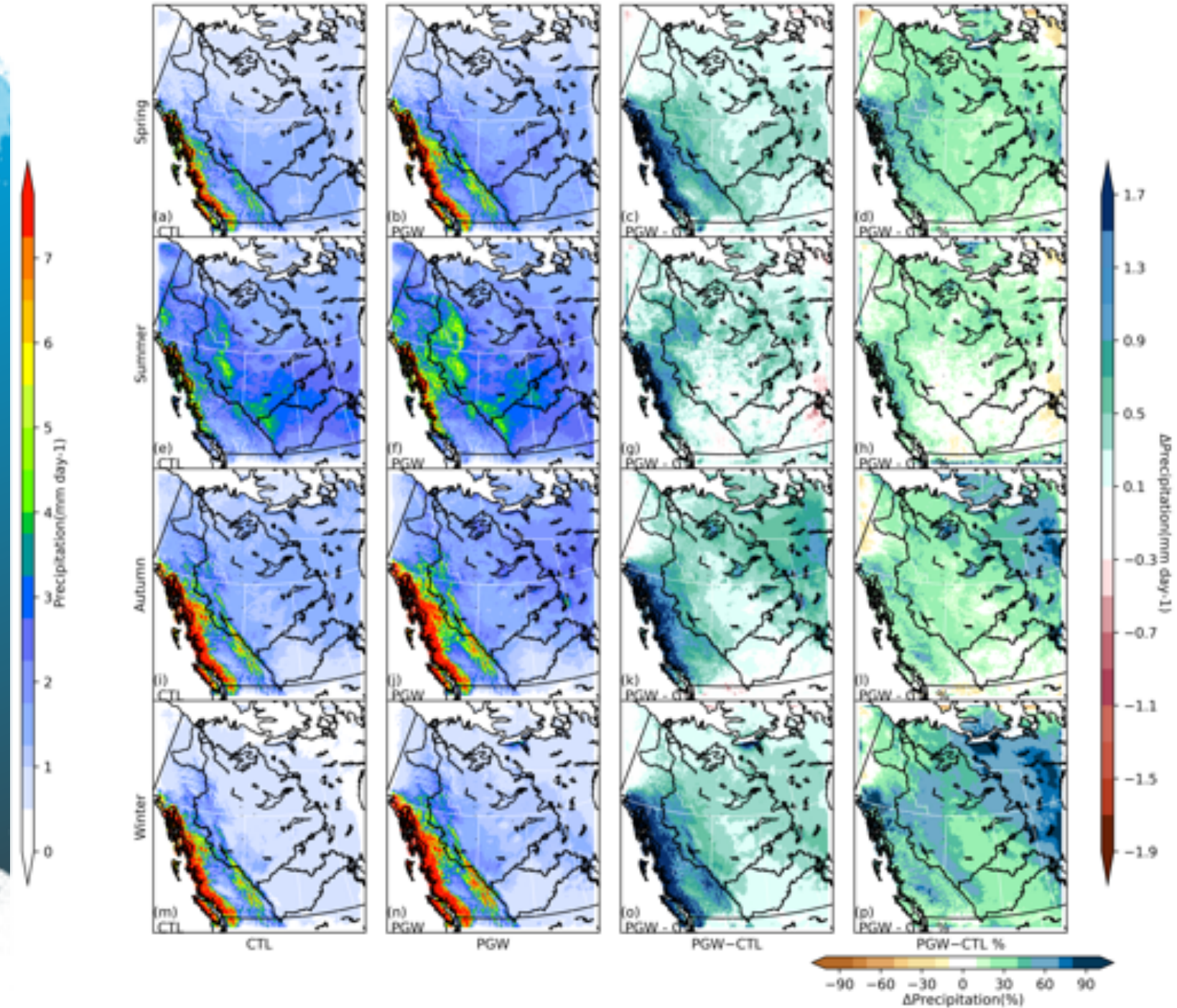
PGW vs CTL

- Temperature increase is higher in the north and northeast, especially in winter and spring.
- Temperature increase in spring is high due to the snow albedo feedback.
- Precipitation increase is consistent over the domain except in summer.
- Over the Canadian Prairies, the PGW precipitation keeps the same level or decrease in summer.
- Extreme precipitation shows mid-high daily precipitation decrease over the Prairies whereas both the lower and higher percentile precipitation increases, which poses a problem for bias correction based on quantile mapping.

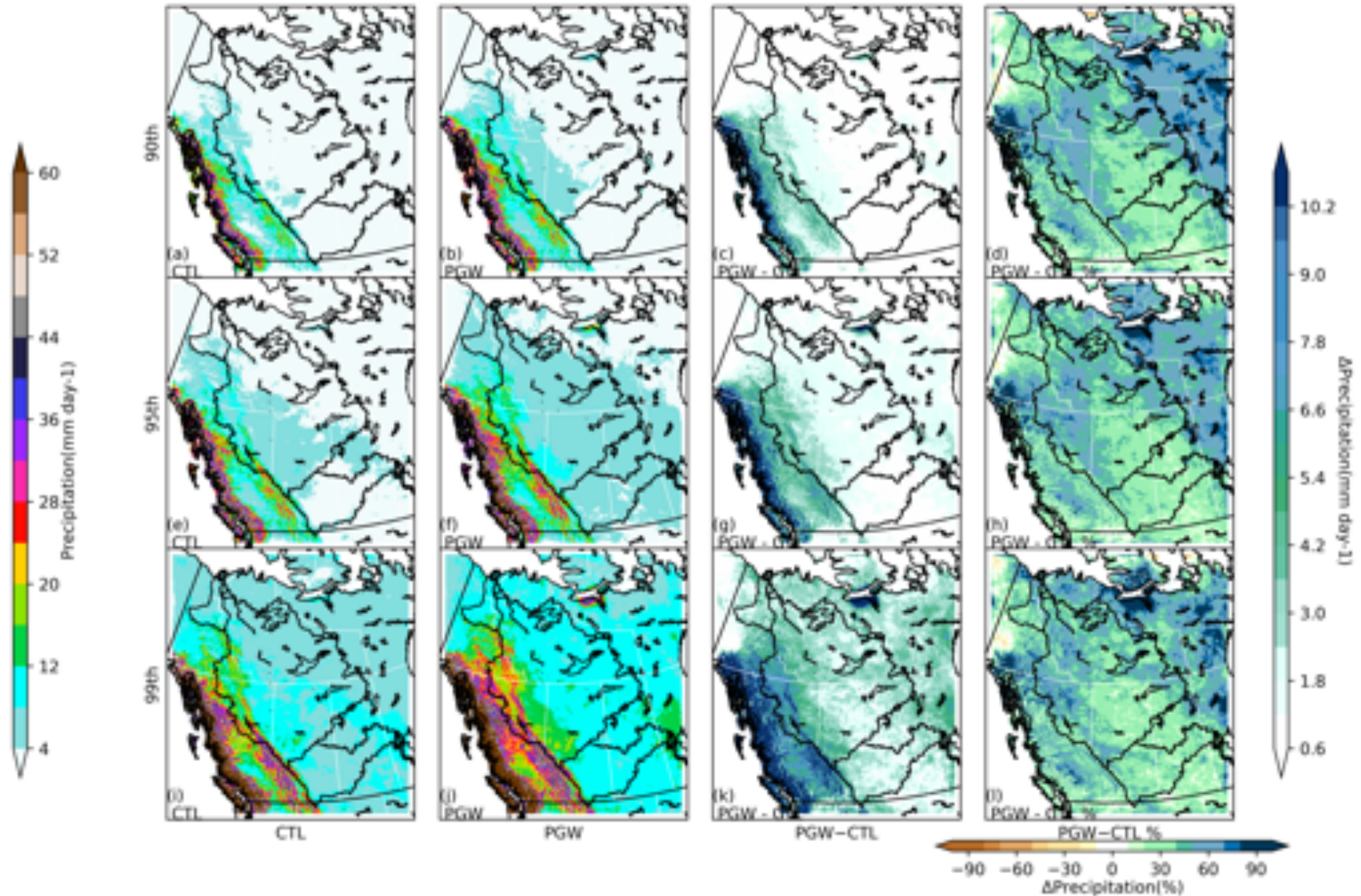
Temperature Change under RCP8.5 at end of century, PGW - CTL



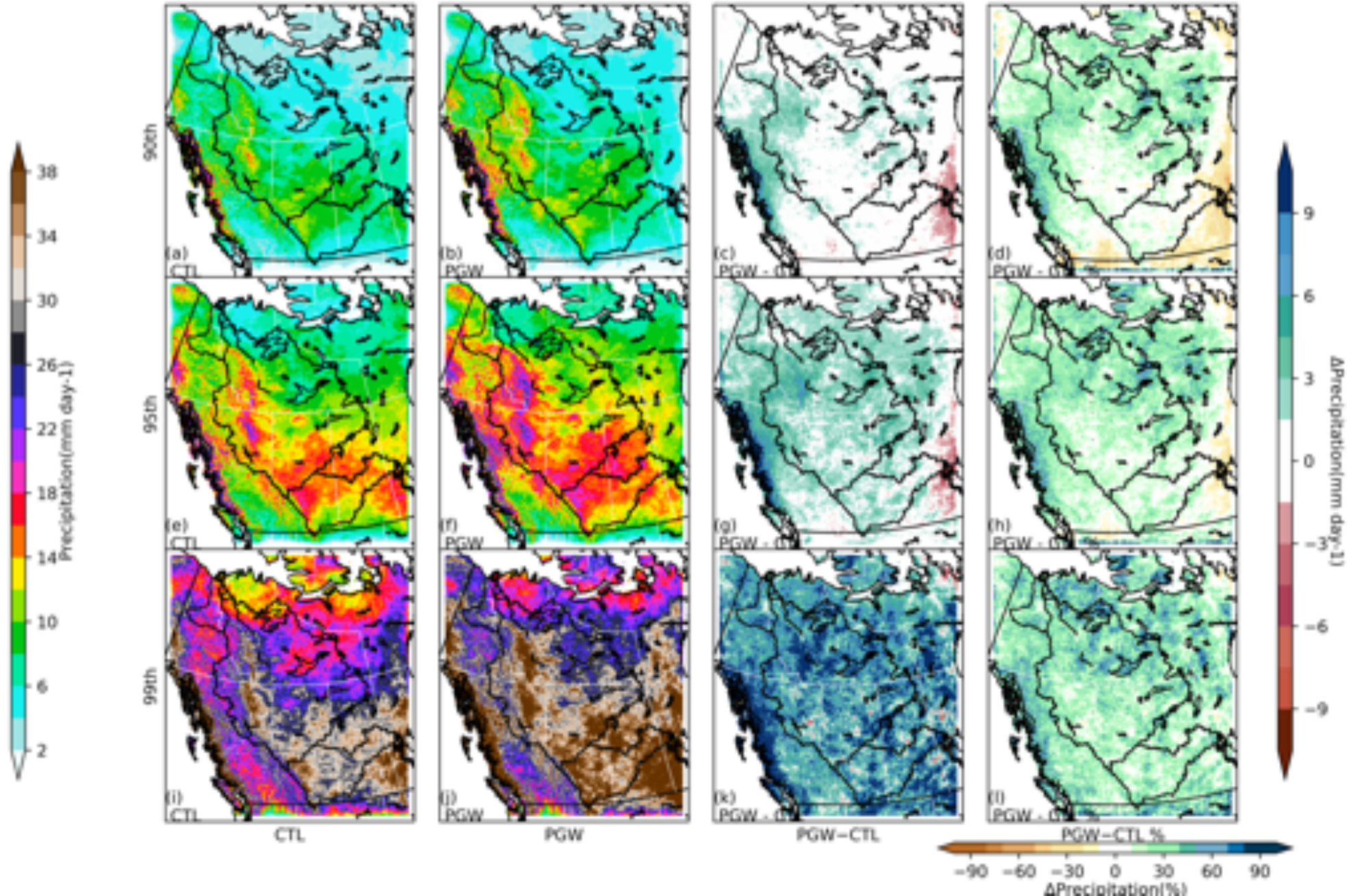
Precipitation change under RCP8.5 at end of century, PGW - CTL

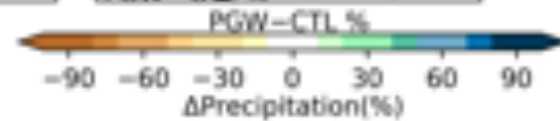
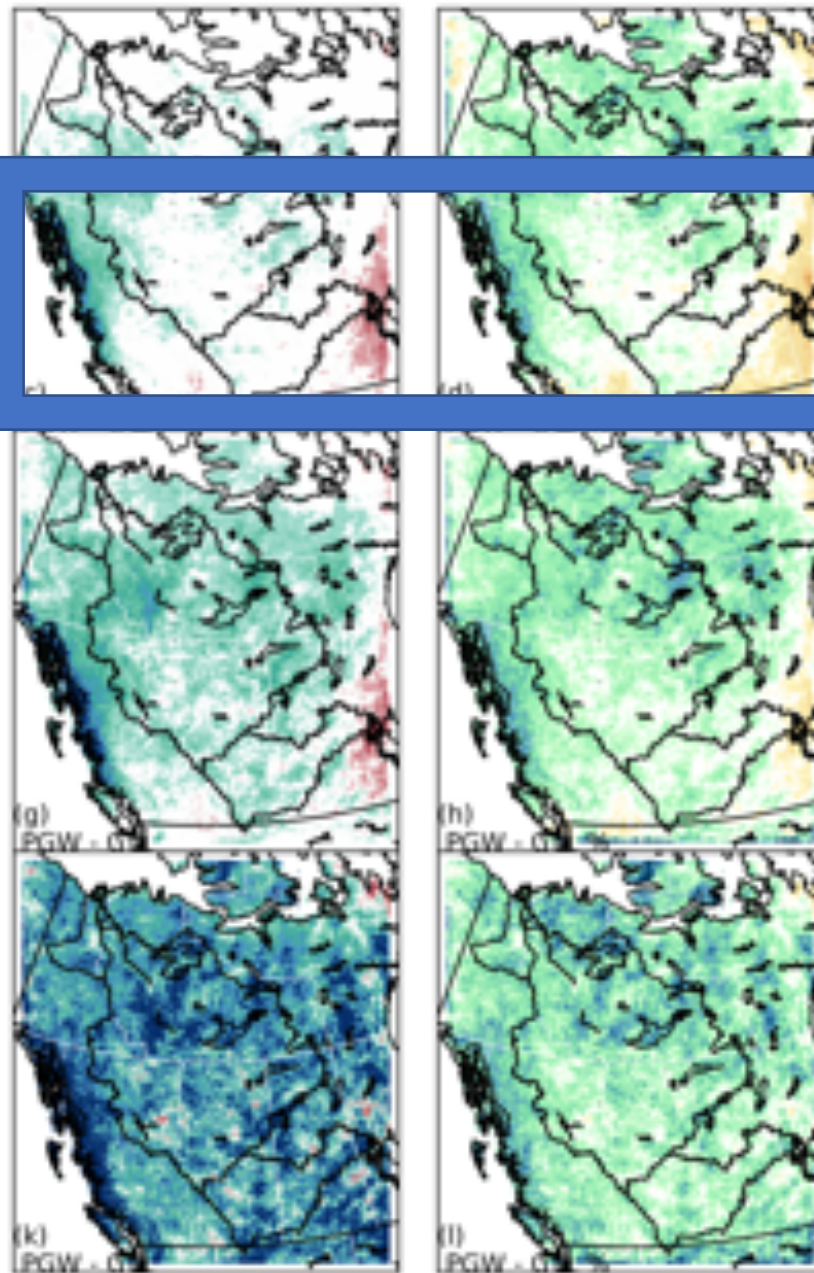
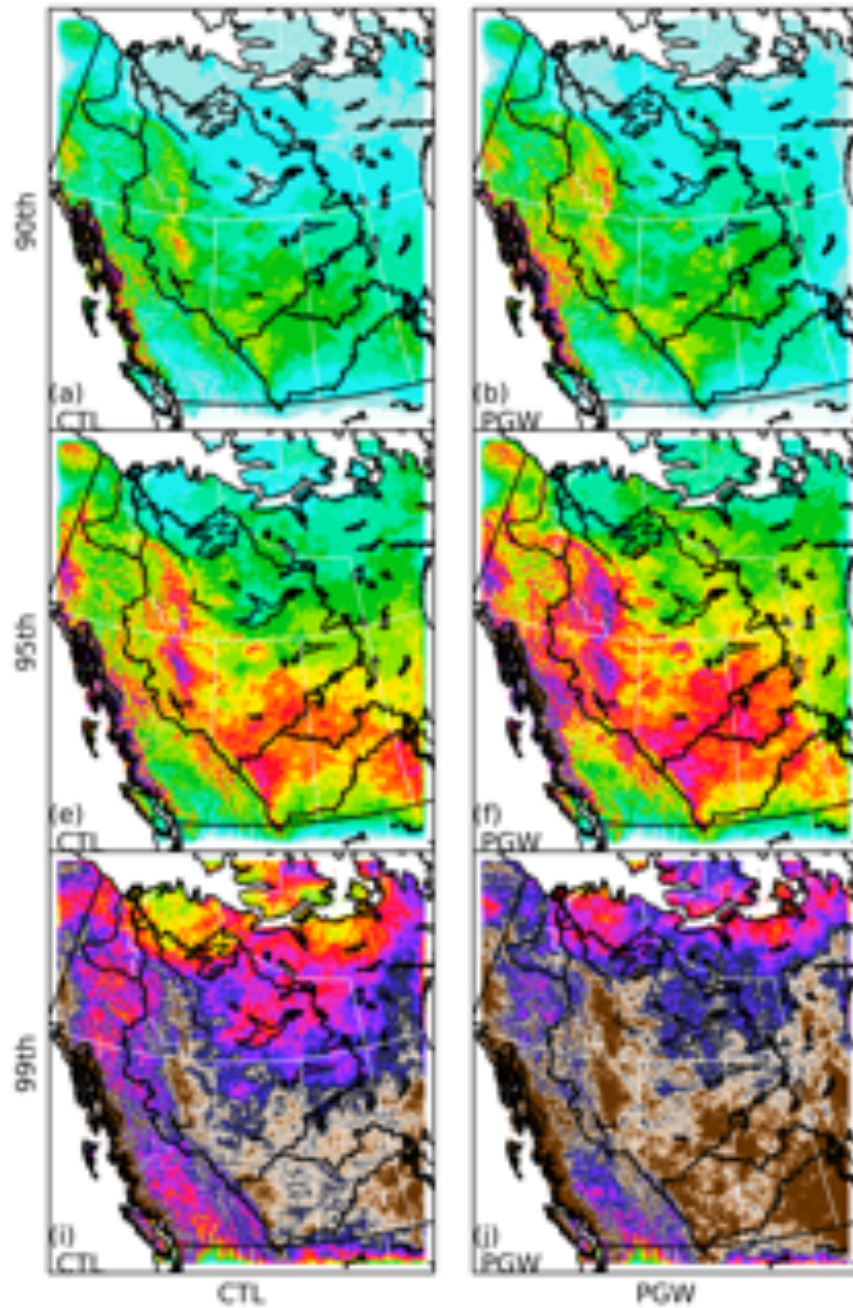
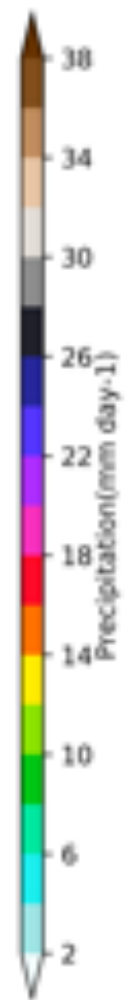


Winter extreme daily precipitation change



Summer extreme daily precipitation change



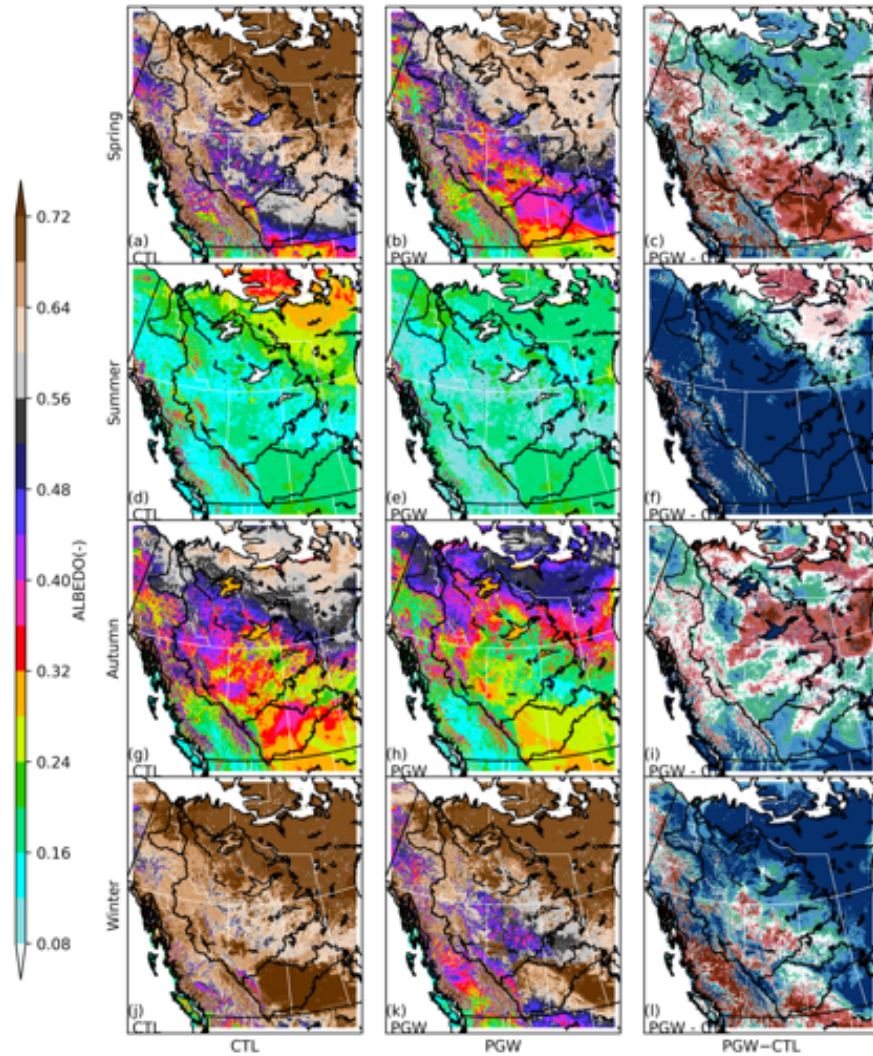


Prairies show a decrease
Of mid-high intensity
daily precipitation

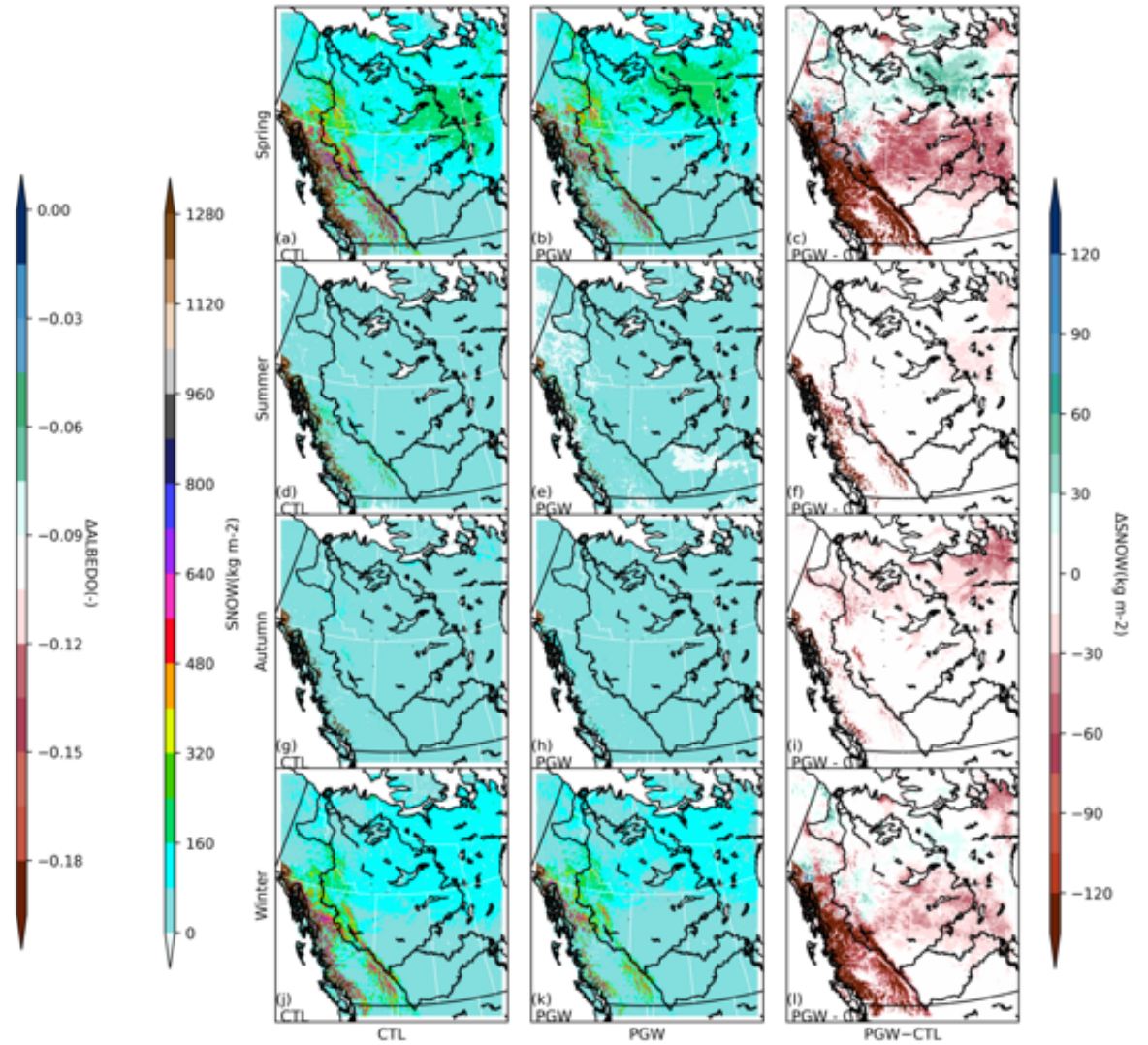
Land atmosphere coupling

- Causes the large temperature over the Prairies increase in spring
- Less precipitation increase over the Prairies in summer
- Latent heat / sensible heat partition; cloud cover, shortwave radiation; planetary boundary layer height change.

Albedo

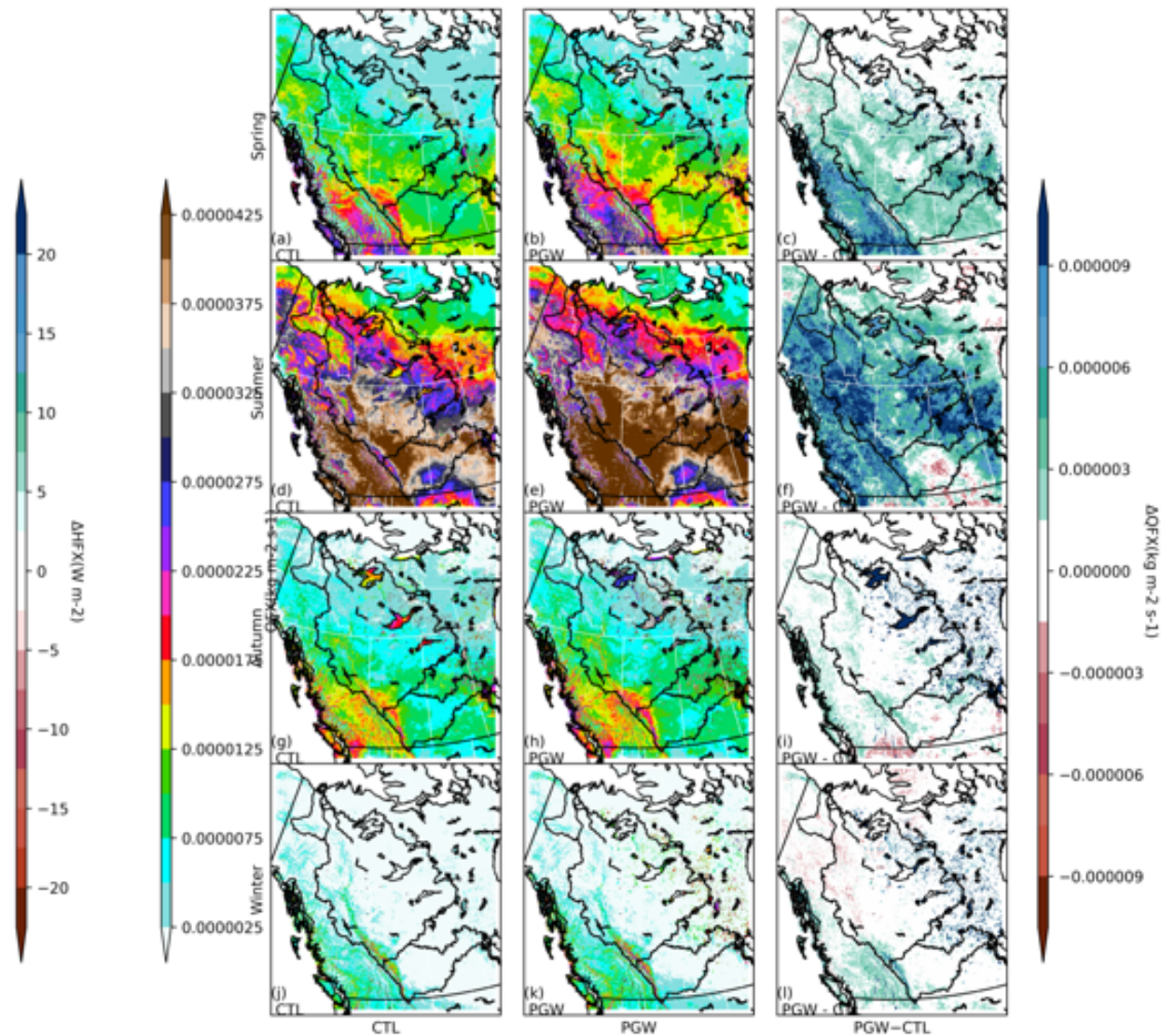
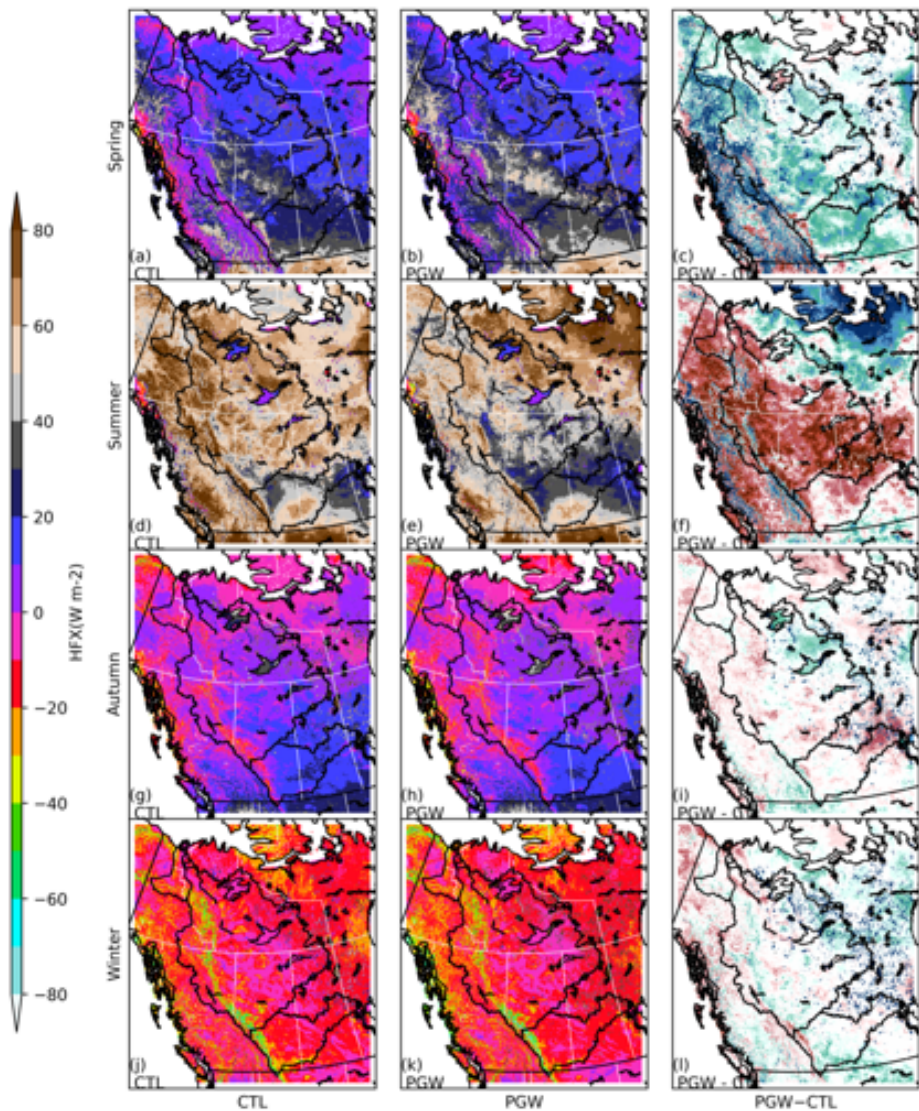


Snow

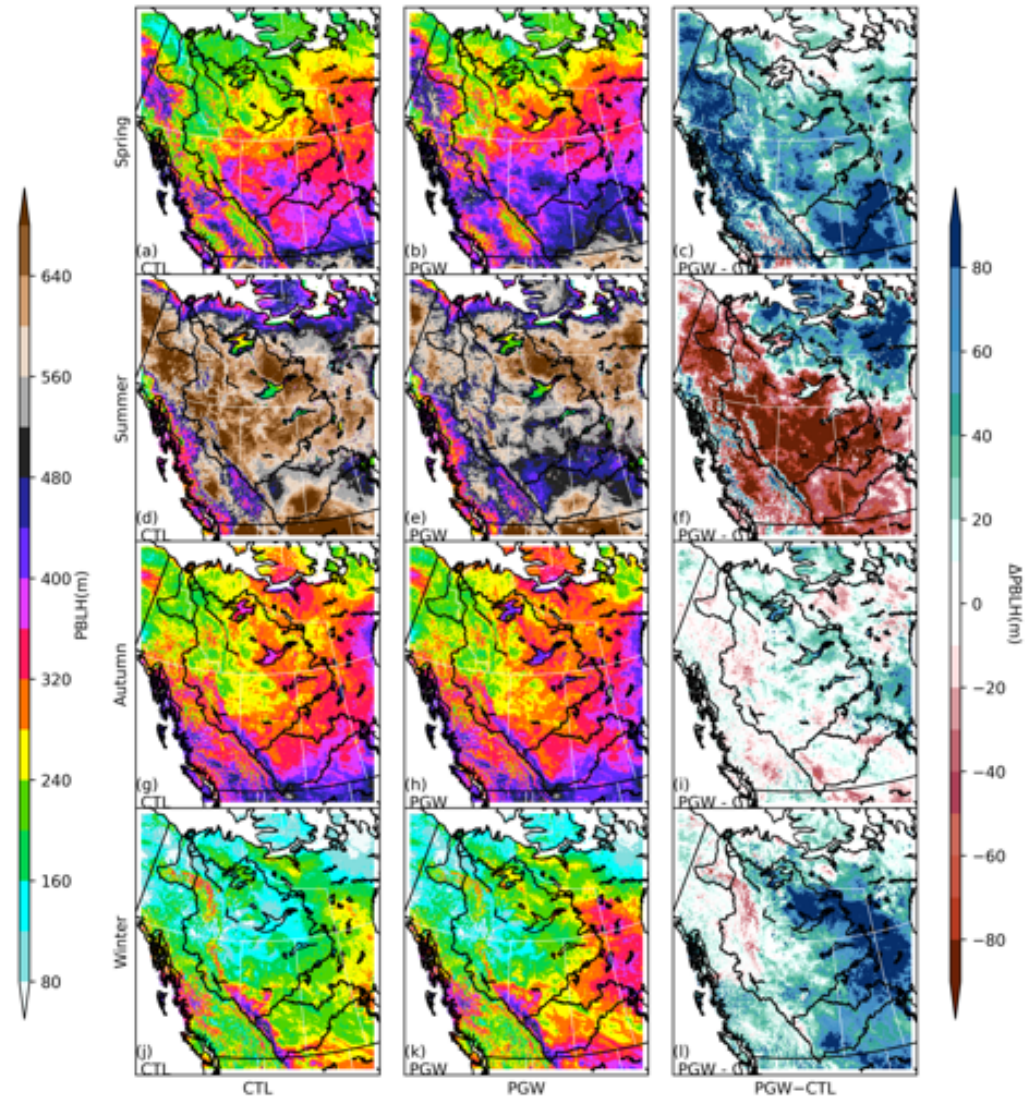


Sensible Heat

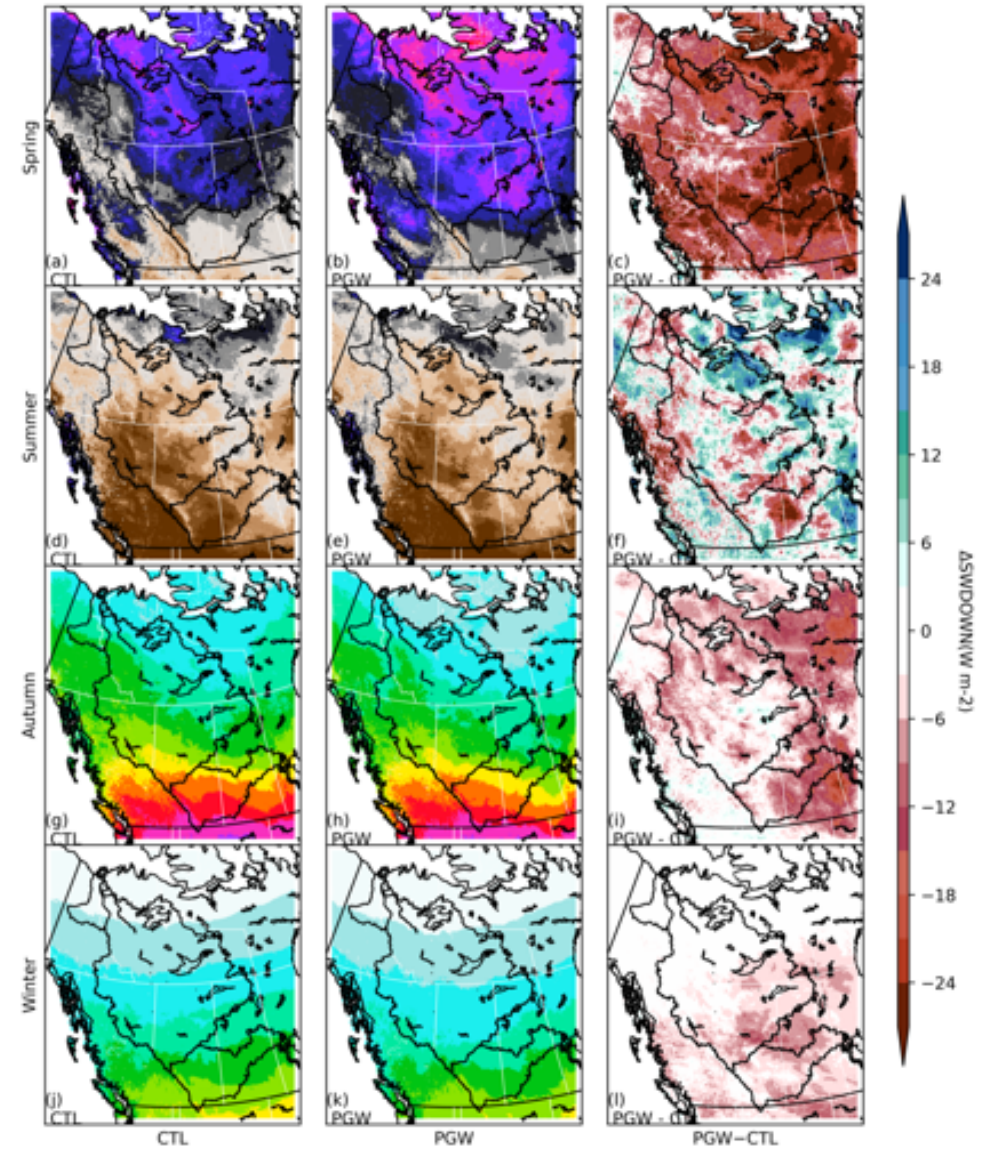
Latent Heat



PBLH



Downward Shortwave



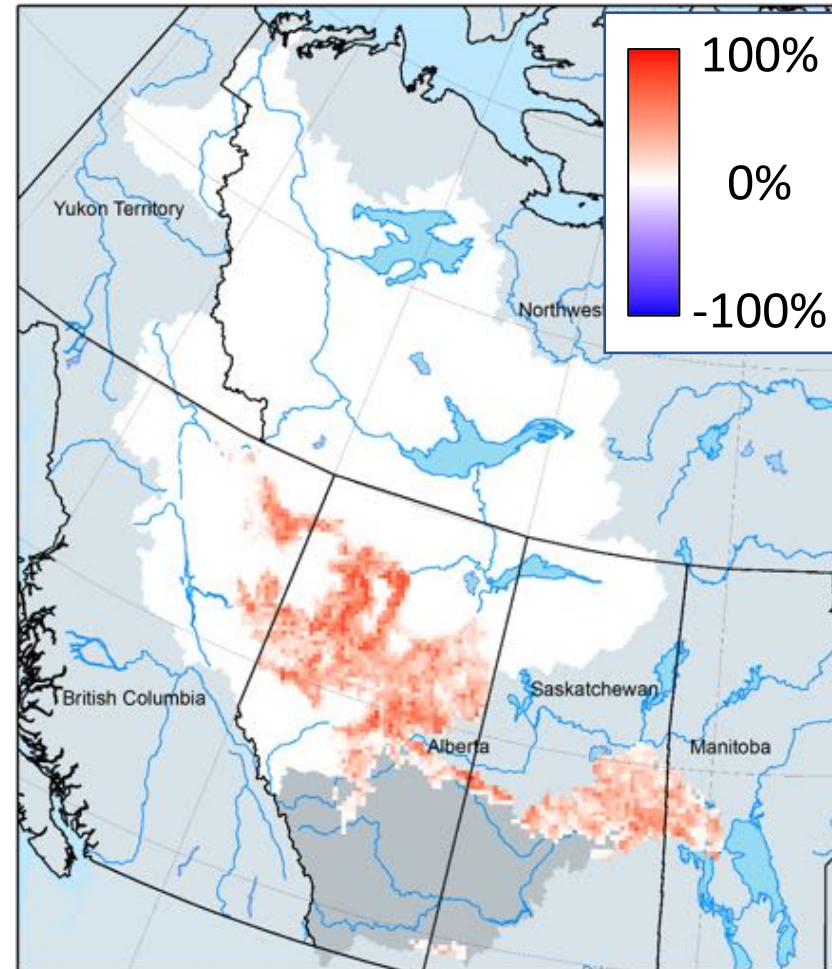
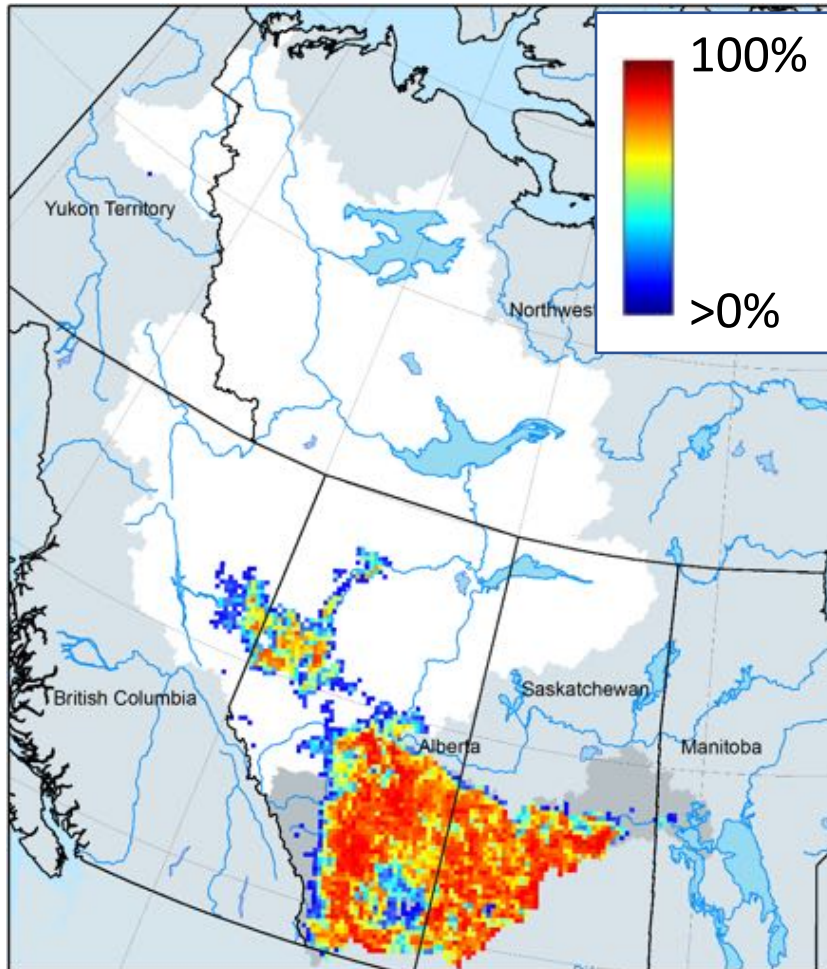
In light of the large impact of land-atmosphere coupling, a new set of WRF simulations combining land-use change and climate change forcing

- Land-use changed based on the projection of ECCO for the Mackenzie and Saskatchewan River Basins. (Alan Barr)
- Three sets of simulations for dry, wet and neutral years:
 - Control
 - PGW + Landuse change
 - PGW

Cropland: Displacing Mixedwood Forest

2005

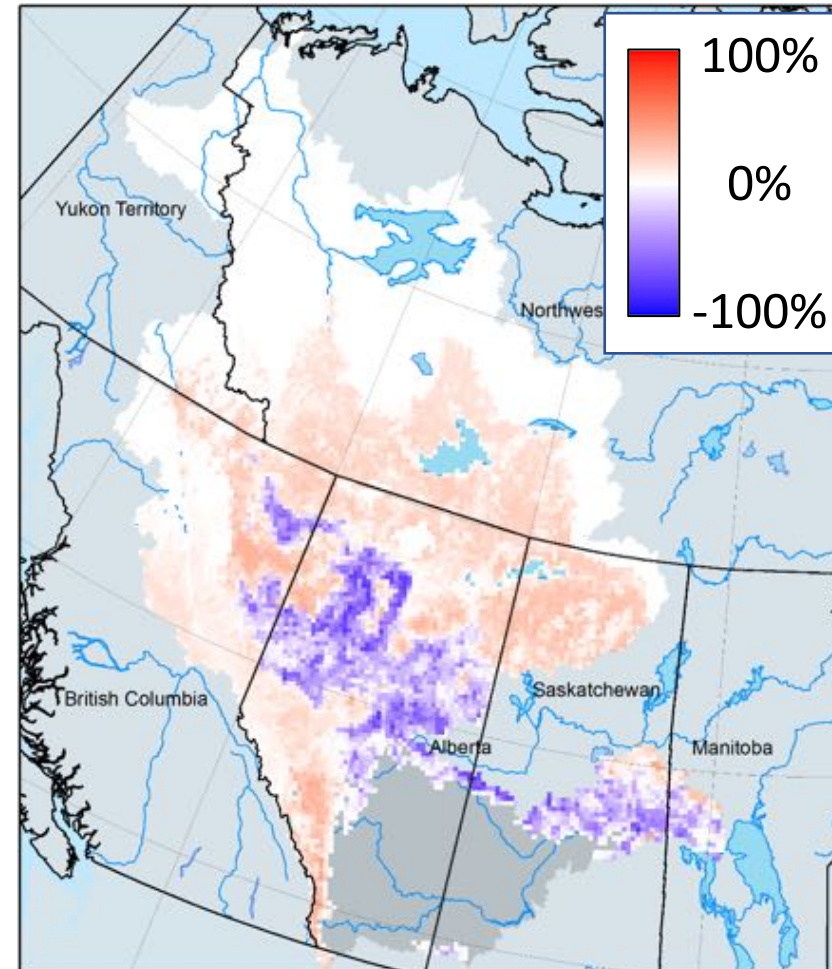
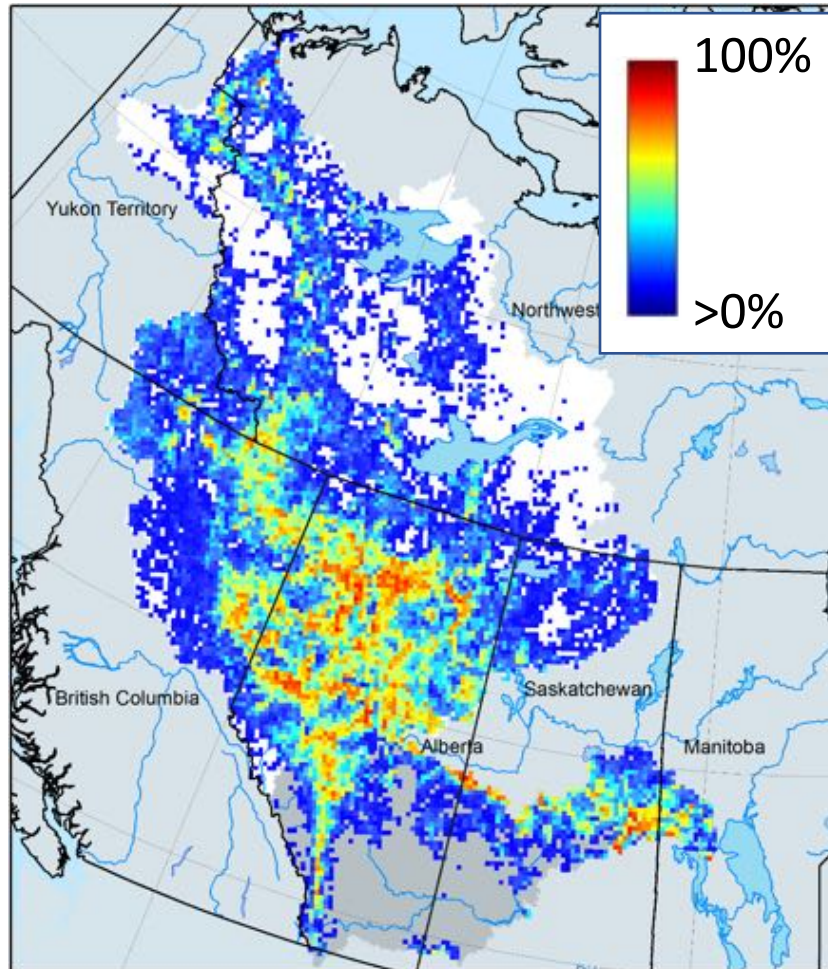
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Mixedwood Forest: Displacing Evergreen Forest After Fire Displaced by Cropland

2005

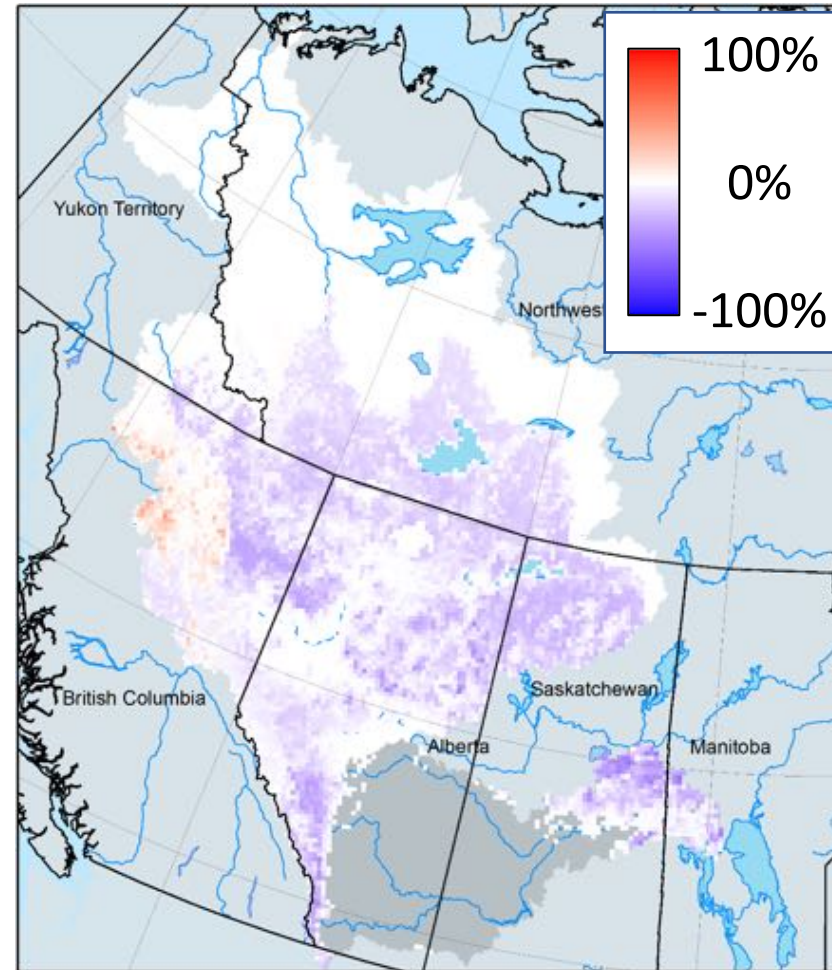
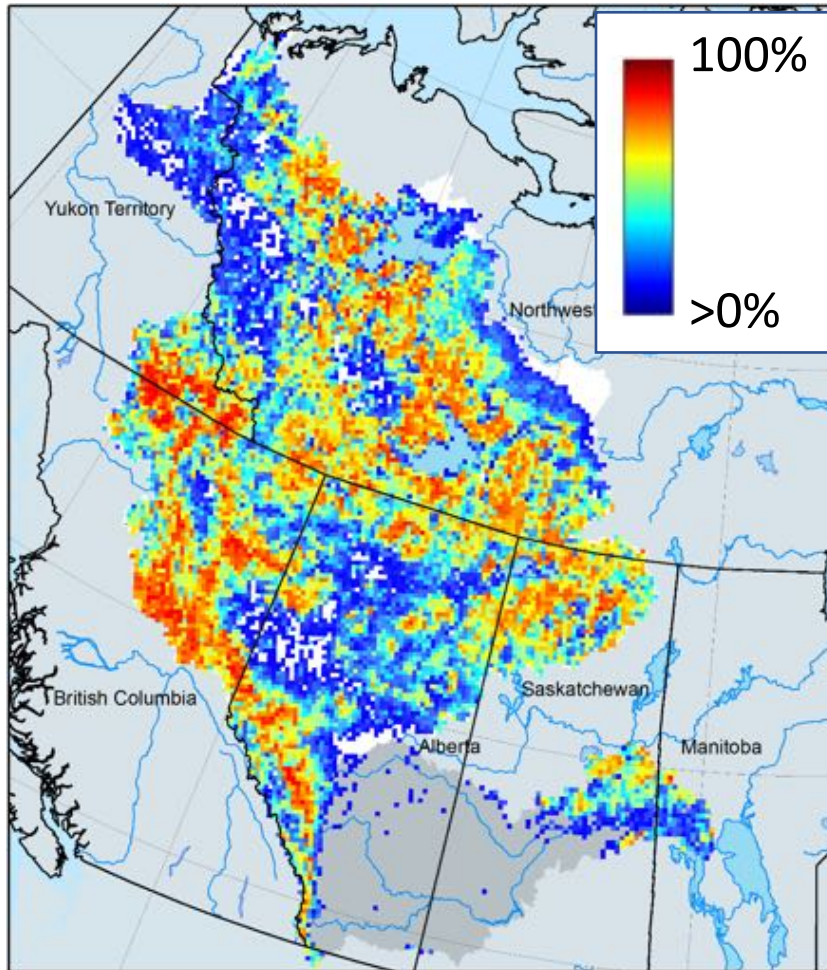
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Evergreen Forest: Displacing Shrubland Displaced by Mixedwood After Fire

2005

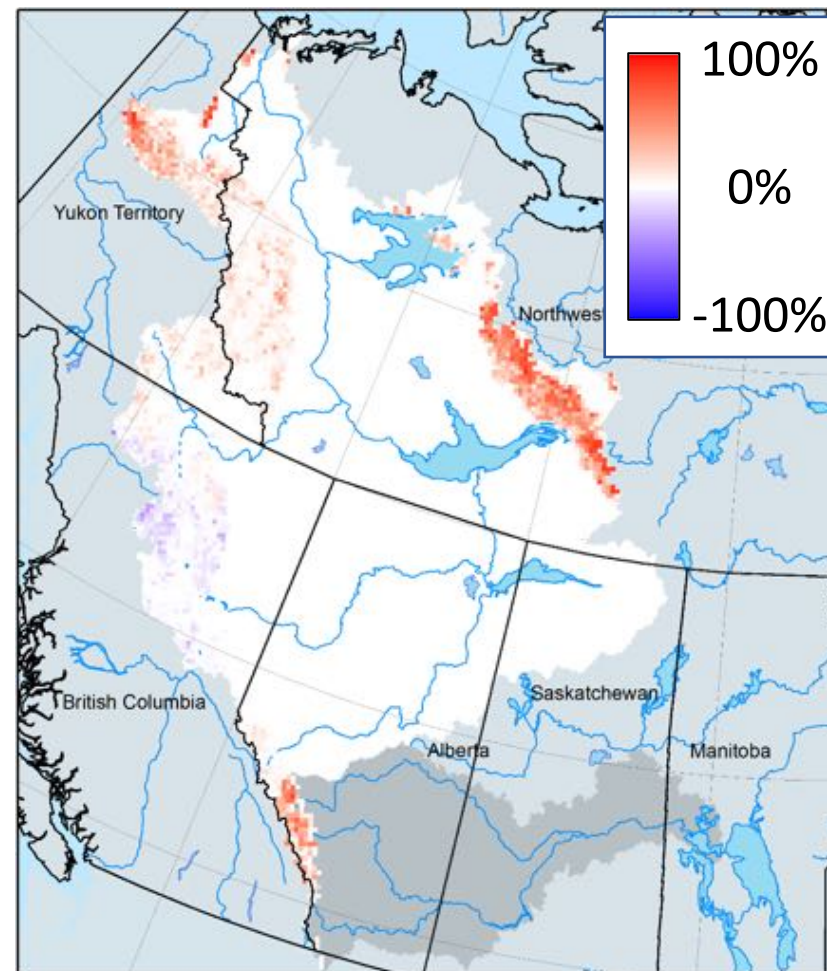
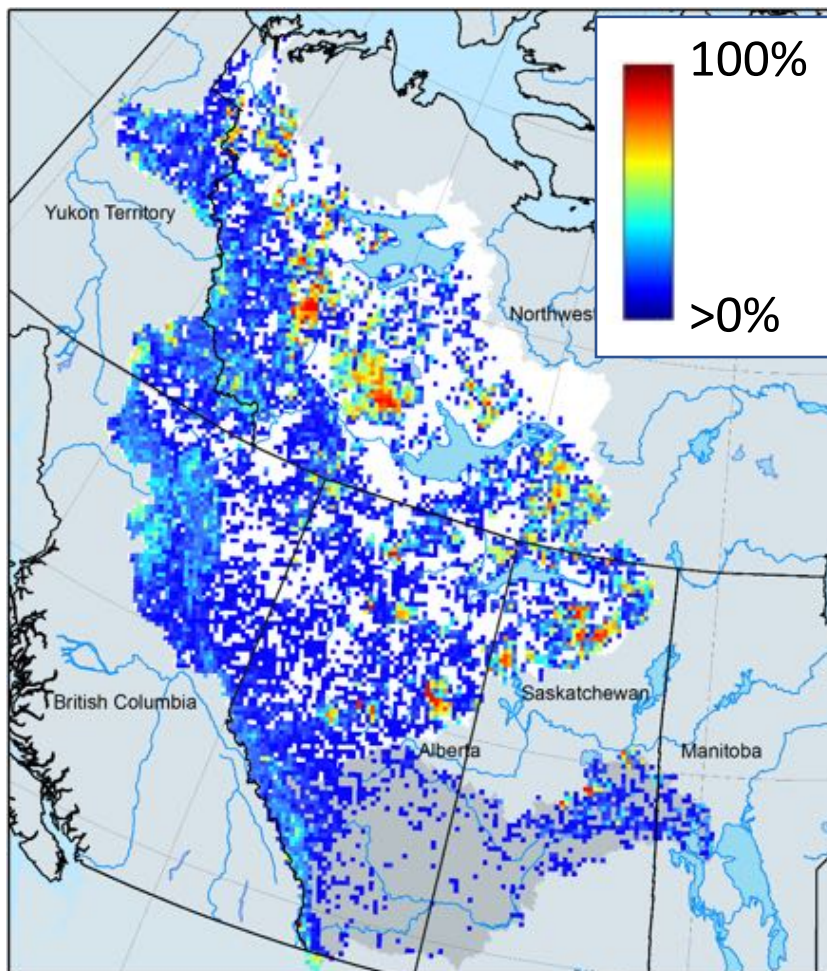
%Change 2005 to 2085



Shrubland: Displacing Alpine and Northern Tundra Displaced by Evergreen Forest

2005

%Change 2005 to 2085



Thank you!