

Authors

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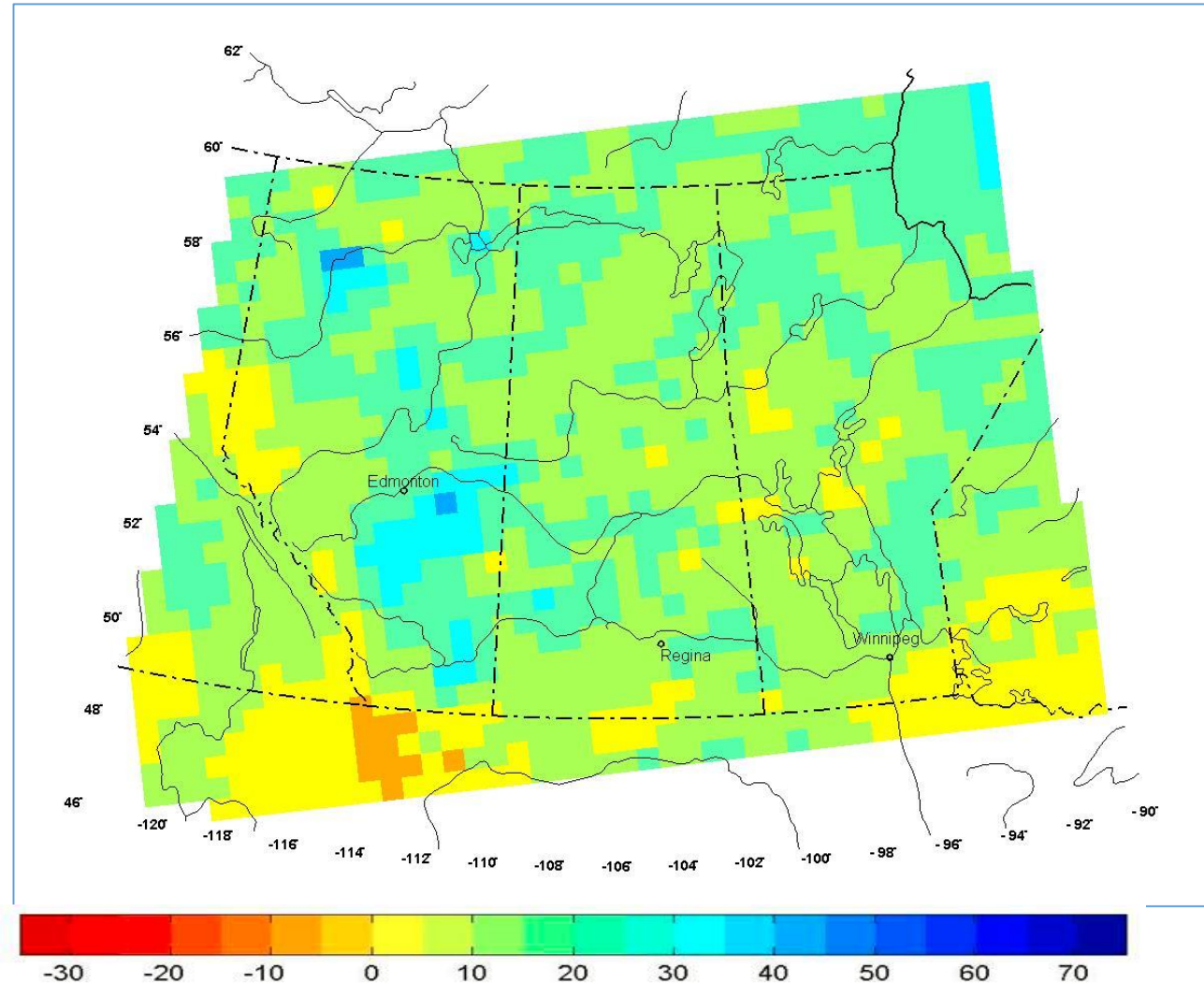
Background

- Project was financially supported through an IDRC grant to University of Regina for the VACEA (Vulnerability and Adaptation to Climate Extremes in the Americas) project
- Study was undertaken to estimate impact of climate change and extremes (droughts) on economic conditions facing a mixed farm in the provinces of Alberta and Saskatchewan
- Model was used to evaluate economic efficacy of adaptation scenarios
- Economic efficacy of adaptation measures was also tested
- Involved a number of models:
 - 1. Climate change scenario (Barrow)
 - 2. FAO Crop Yield model (Kienzle)
 - 3. Pasture growth model (Thorpe)
 - 4. Simulation model for economic results (Poudel)
- This presentation does not deal with the pasture model; only crop yields

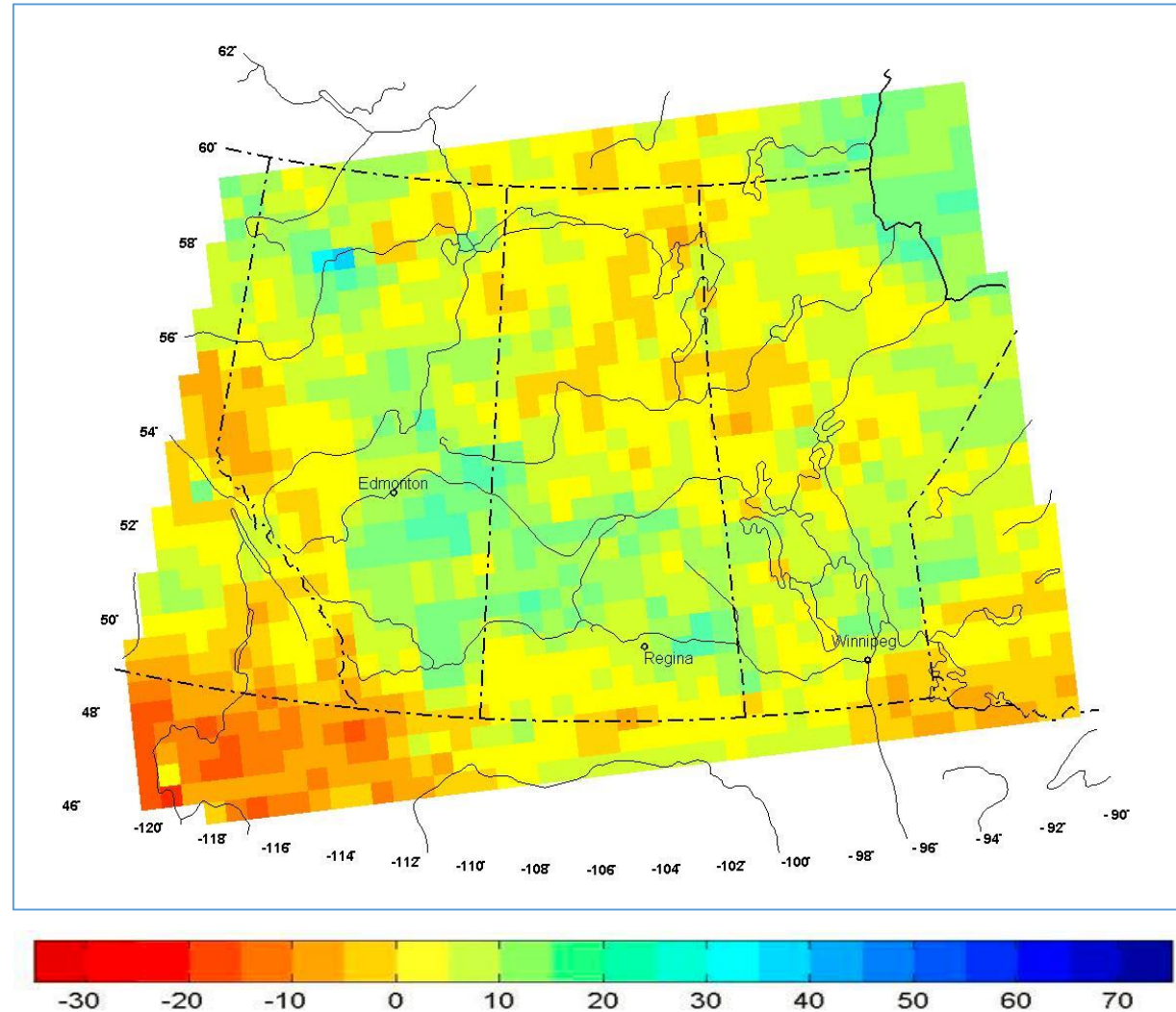
Climate Scenario

- Simulations were made for two time periods – Baseline (1971-2000) and Future Climate (2041-2070)
- There are several climate scenarios, each of which results in a different future change in temperature and precipitation
- Results are based on the scenario: Regional Climate Model Version 3 [RCM3_CGCM3_A2] driven by the Third Generation Coupled Global Climate Model of the Canadian Center for Modelling and Analysis
 - This model used emission scenario IPCC SRES A2

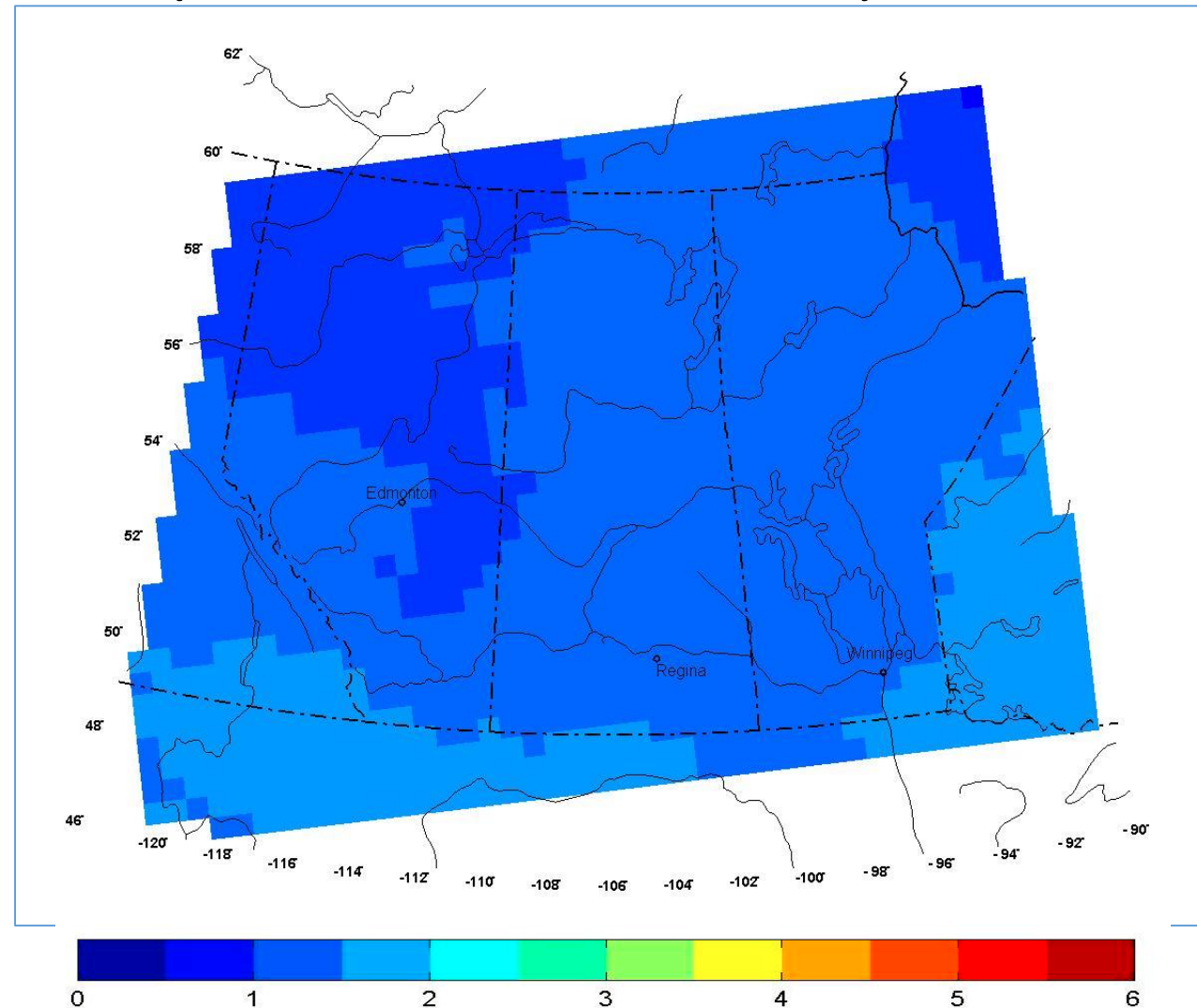
Annual total precipitation change (%) for the 2050s relative to the baseline scenario of 1971-2000 under RCM3_CGCM3_A2 climate scenario (Source: Barrow, 2012)



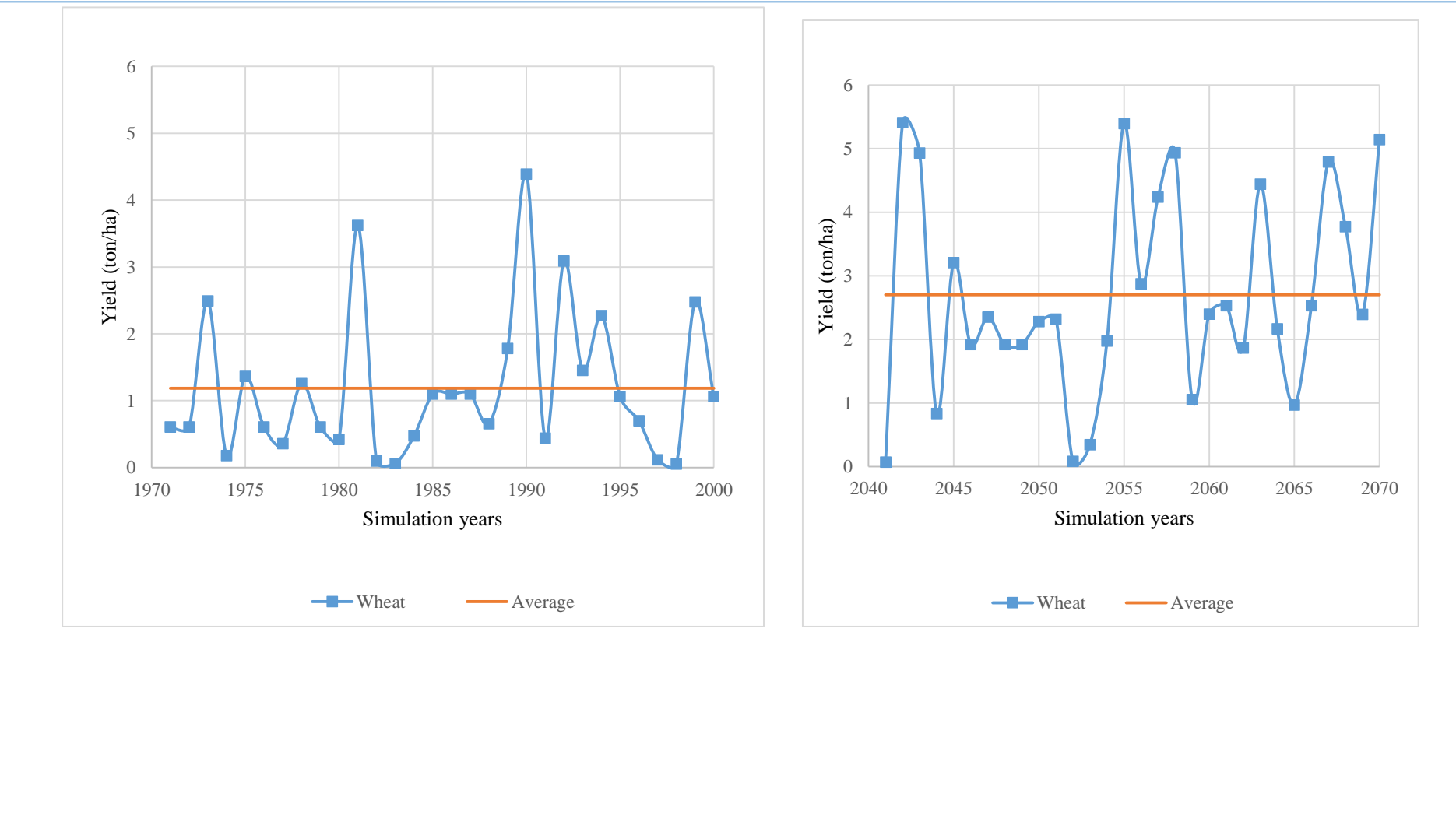
Summer mean precipitation change (%) for the 2050s relative to the baseline scenario of 1971-2000 under RCM3_CGCM3_A2 climate scenario (Source: Barrow, 2012)



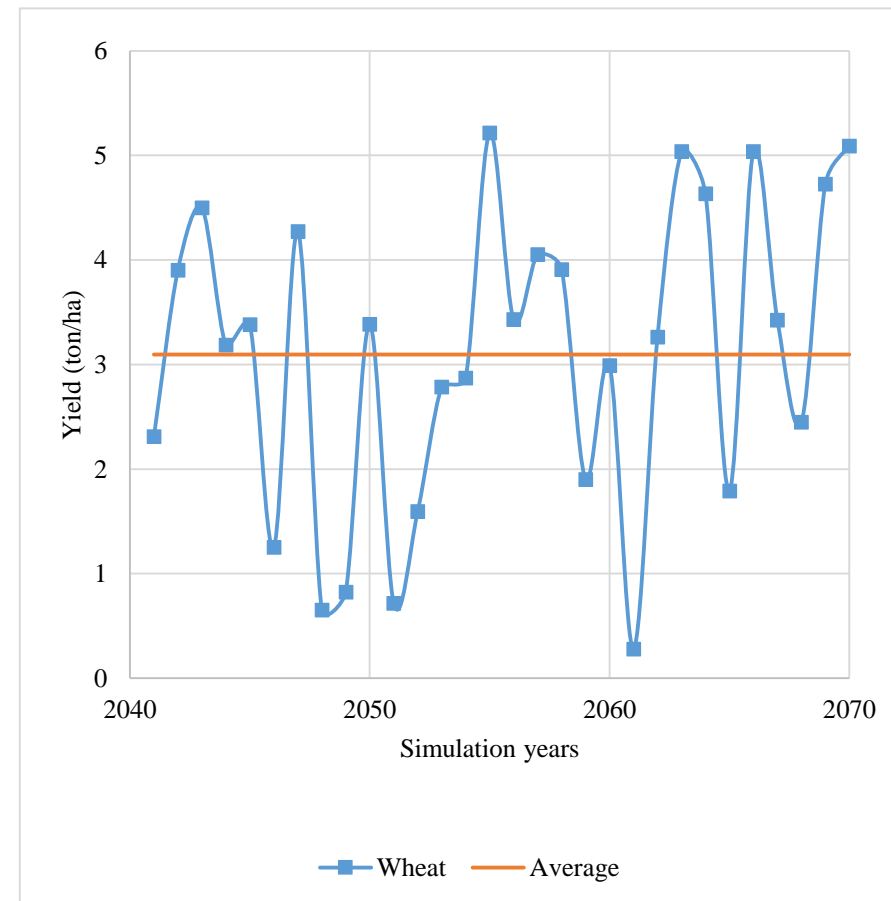
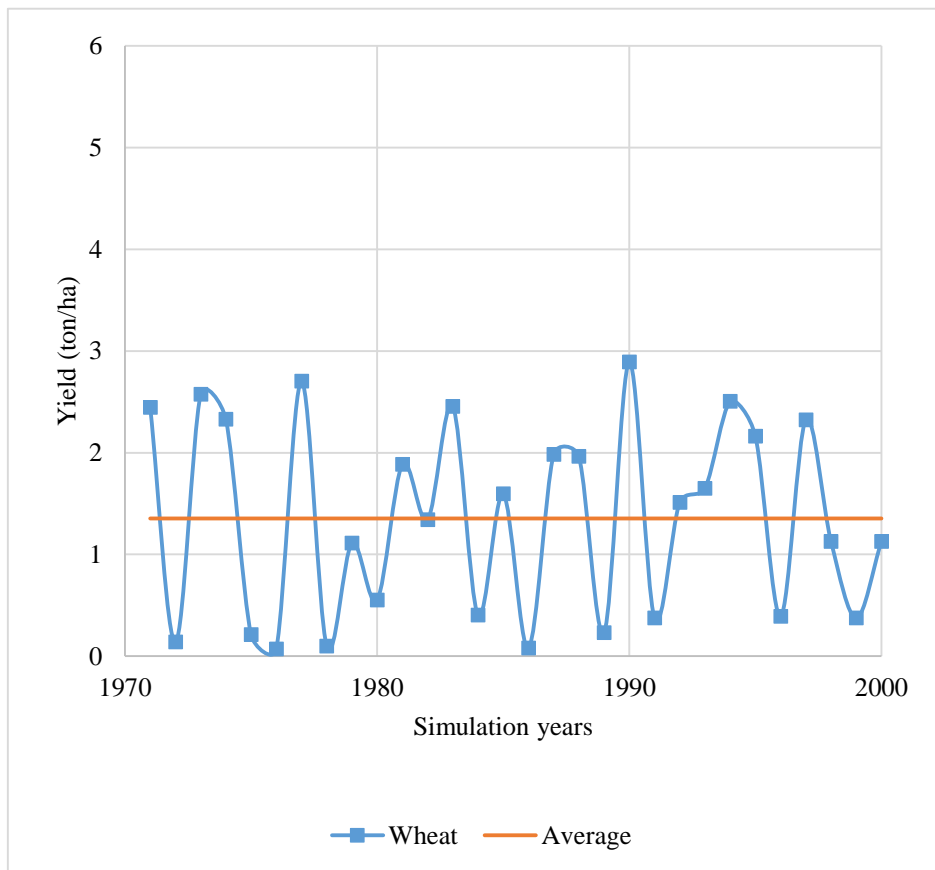
Summer mean temperature ($^{\circ}\text{C}$) change for the 2050s relative to the baseline scenario of 1971-2000 under RCM3_CGCM3_A2 climate scenario (Source: Barrow, 2012).



Yield of Spring Wheat in Pincher Creek (AB)



Yield of Spring Wheat in Swift Current (SK)



Increase in Spring Wheat yield under future climate over baseline in Pincher Creek (AB) and Swift Current (SK)

Location	Yield in tons / ha		% Increase in Future Yields relative to Current Yield
	1971-2000	2041-2070	
Pincher Creek	1.19	2.70	126.9%
Swift Current	1.35	3.10	129.6%

Possible explanations for the higher increases in yield

- Future yields are affected by:
 - Climate scenario – More optimistic scenario would lead to higher yields in the future
 - Model Used – Study used the AquaCrop model of the Food and Agriculture Organization
- Yield responses are uncertain due to:
 - Regional precipitation amounts; extreme weather incidence; and CO₂ fertilization effect, among other factors

Features of the AquaCrop Model that may result in overestimated yields

- AquaCrop is water-driven crop simulation model
 - Works better where water is a key limiting factor
- Overestimation of the CO₂ fertilization effect
 - Yield increases were only about half as large without the increases in CO₂ effect
- Unlimited availability of nutrients for the plants in the model

Future Directions

- Urgent need for developing a yield estimation model suitable for alternative climate scenarios and locations in Canada
 - Analyst should have a choice of factors that affect yields
- Choice of climate scenarios greatly influences future results and this is an important decision in this respect. Some help in this regard to the analysis is needed.
- More adaptation research is needed for various regions of Canada
- Many more research needs