Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Swift Current Creek Watershed

Agro-Climate Variability during the last 100 years

Presented by Darrell Corkal, AAFC Saskatoon

Analysis by: Jessica Vanstone, Aston Chipanshi

VACEA – AAFC Stakeholder Collaboration and Knowledge Outreach Planning

AAFC Swift Current Research Station, January 23, 2013

Canada

Climate Extremes Indicators (in development)

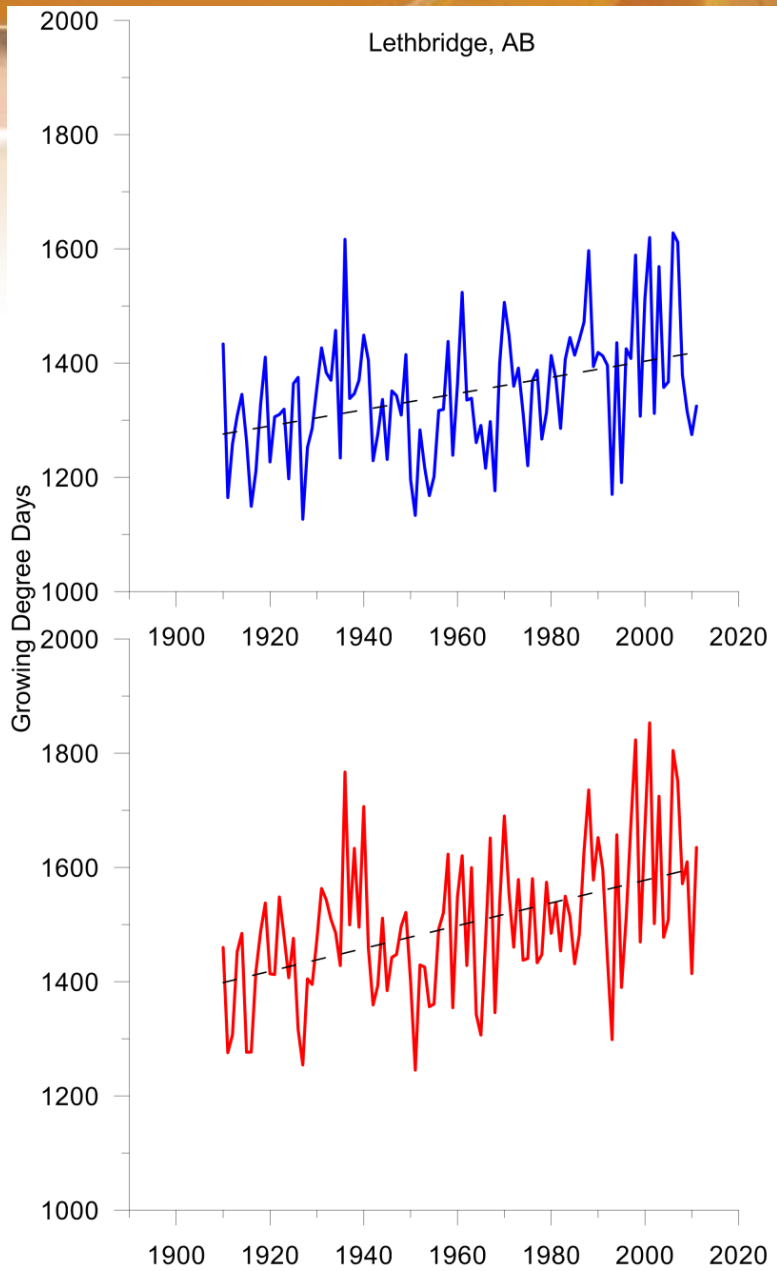
Analysis not complete yet; this PPT shows example data

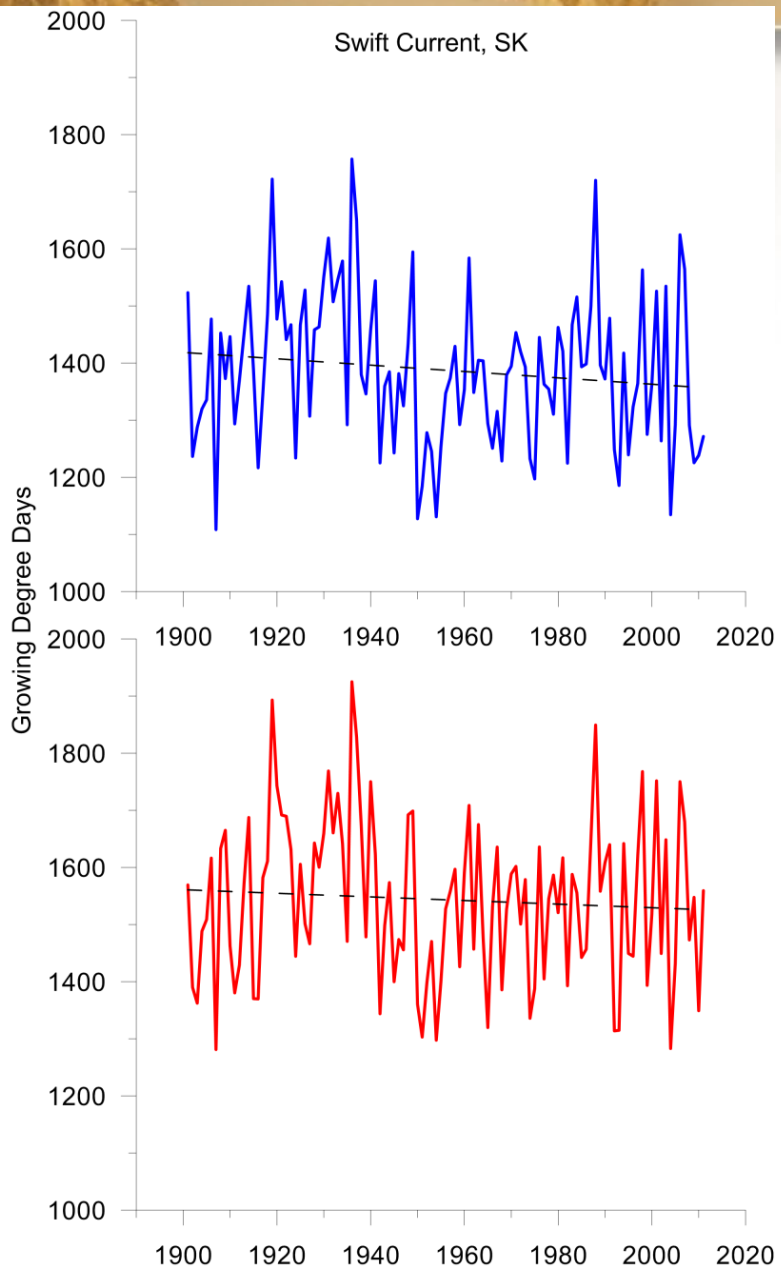
- Analysis of Meteorology During the last 100 years (in progress)
  - Growing Degree Days, Temperature, Precipitation
  - Cumulative Effects of wet and dry years
  - Precipitation Extremes
    - Annual Return Period Probability
    - Hourly Probability (Updates of Env Can's 6, 12, 24 hr probability density functions)
    - 25^{th} and 75^{th} percentile values
  - Temperature Extremes
    - 10^{th} and 90^{th} percentile values of average temperatures
    - Frost and freezing days → Tmin<0°C; Tmax<0°C
  - Drought Indicators
    - Growing Degree Days (GDDs)
    - Consecutive dry days
    - Standardized Precipitation-Evapotranspiration Index (SPEI)

Growing season classification:

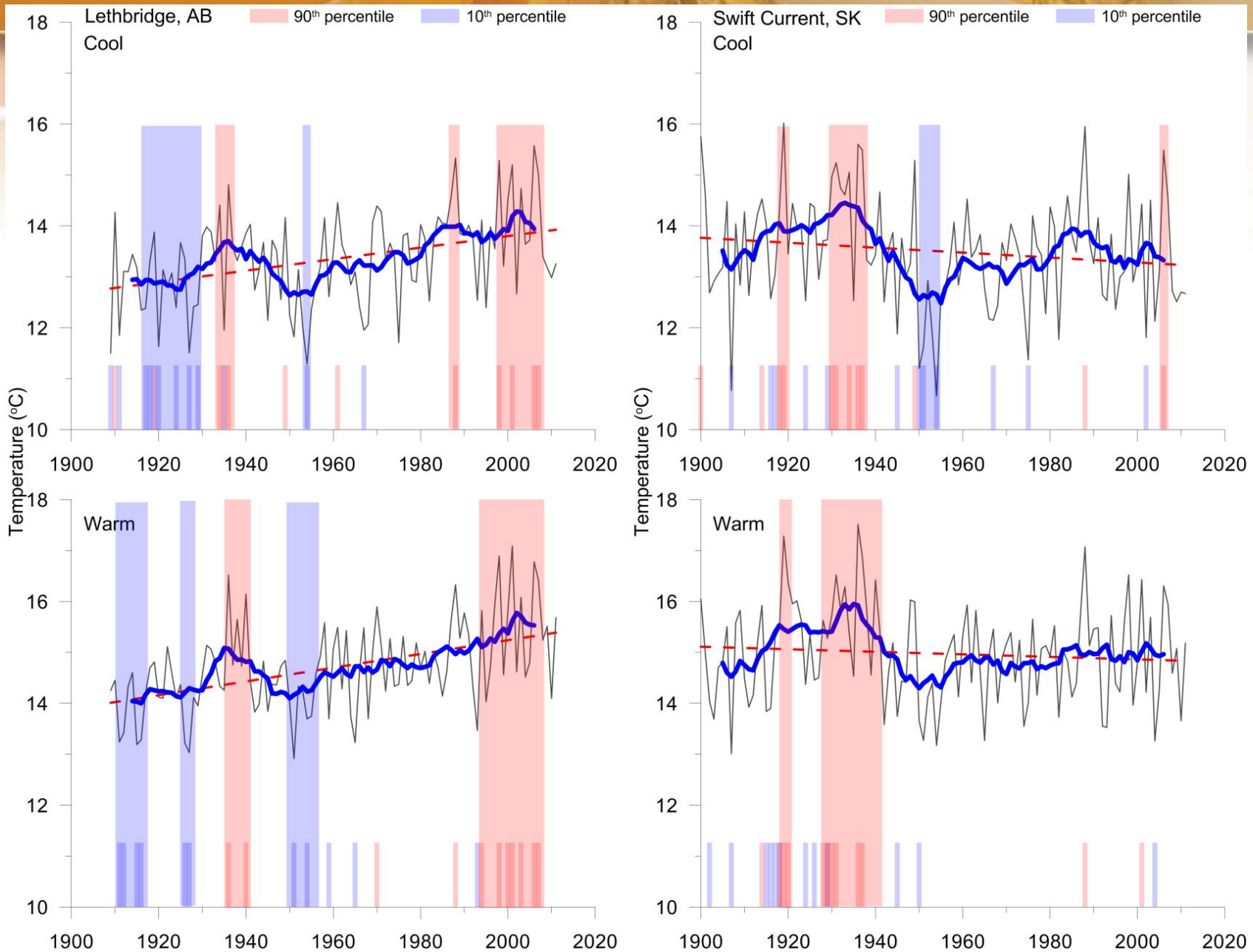
Crop Type	Cool Season Crops				Warm Season Crops		
Crop Name	Wheat	Oat	Barley	Canola	Corn	Bean	Soybean
GDD Range	1538 to 1680	1483 to 1750	1269 to 1540	1152 to 1445	1173 to 1779	1100 to 1300	1186 to 1719
Criteria	On an average for a cool-season crop: 1485 days				On an average for a warm-season crop: 1375 days		
Time frame	**April 1 - August 31**				**May 1 - September 30**		

Historic Growing Degree Days:

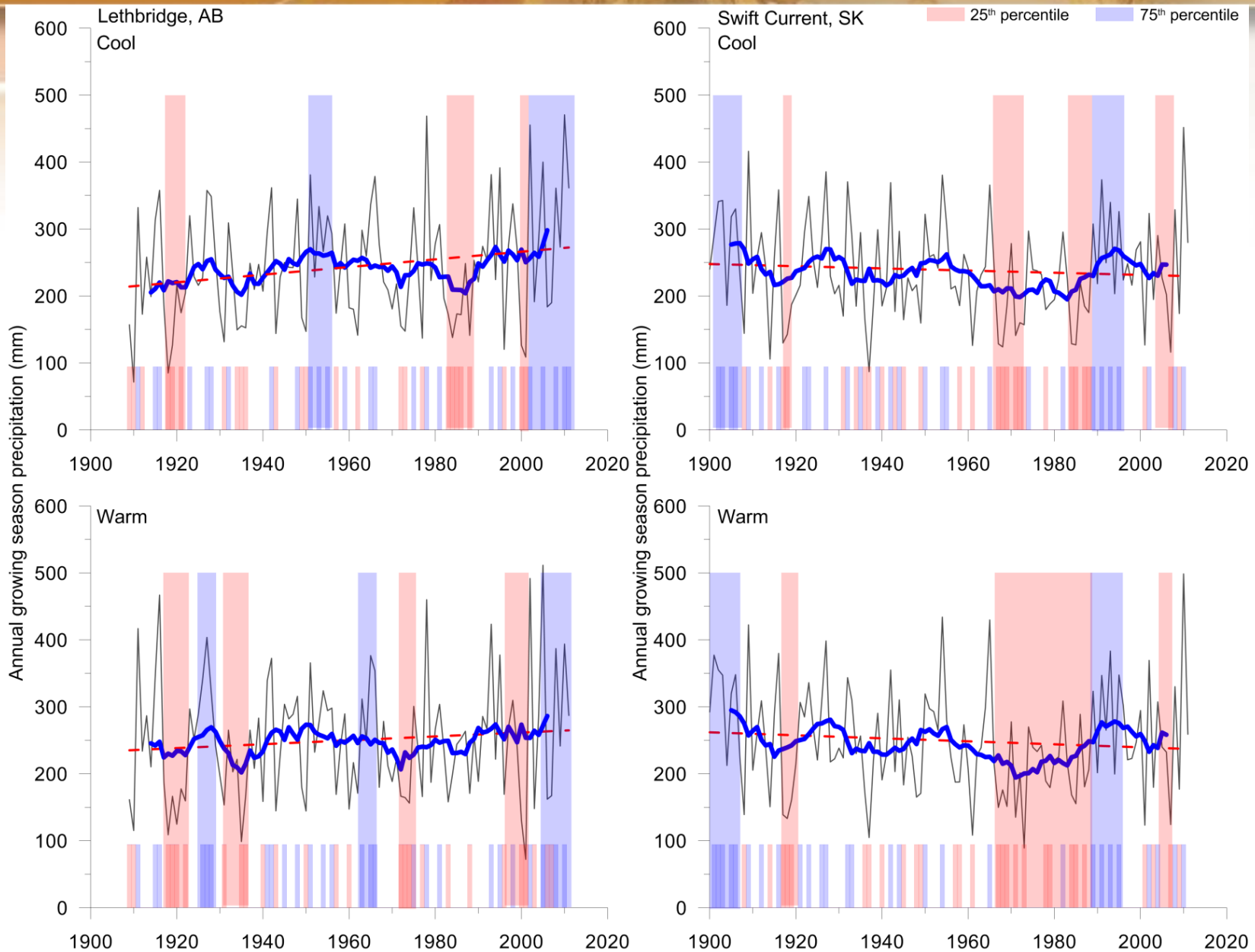


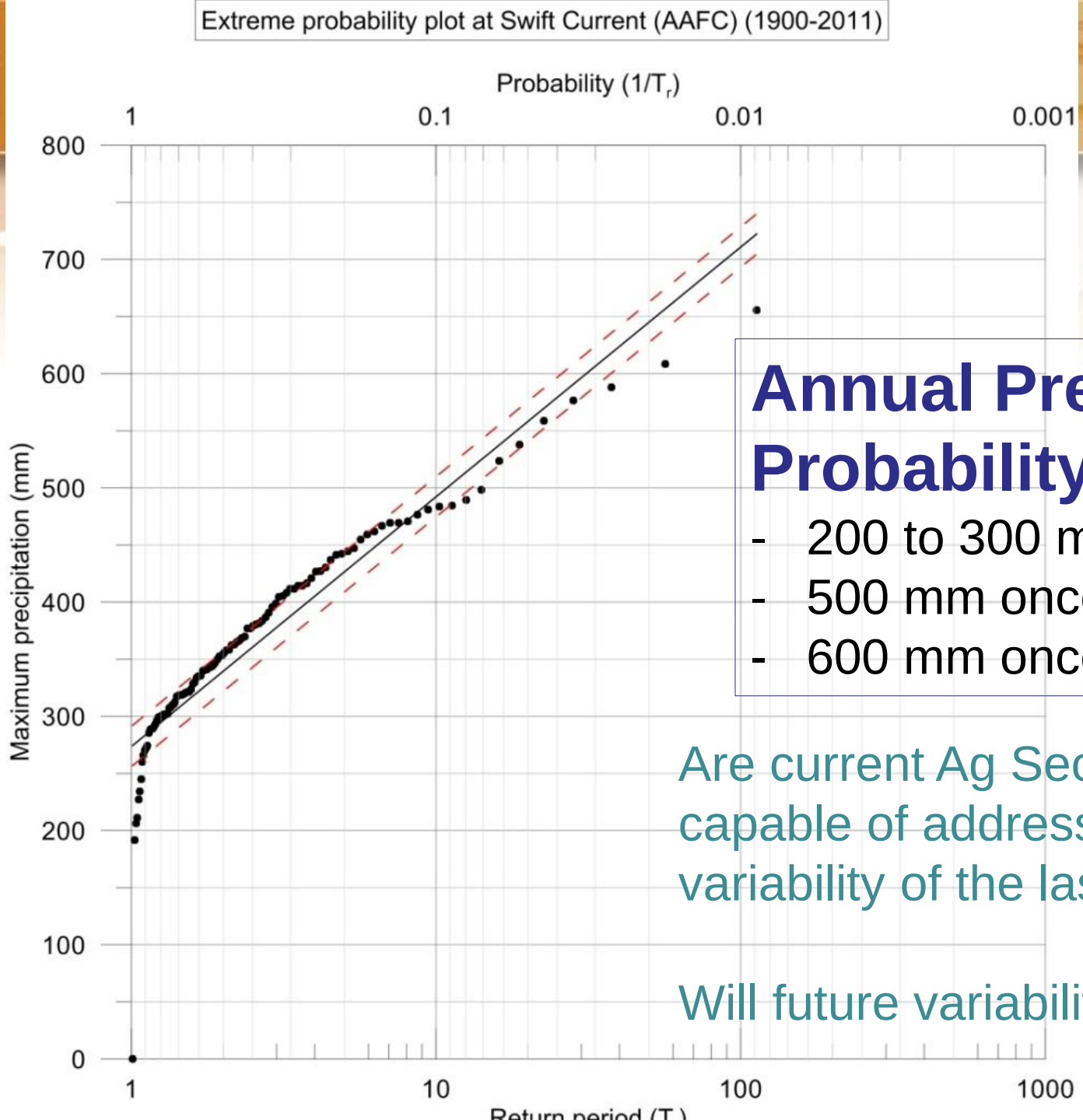


Historic Temperature:



Historic Precipitation:



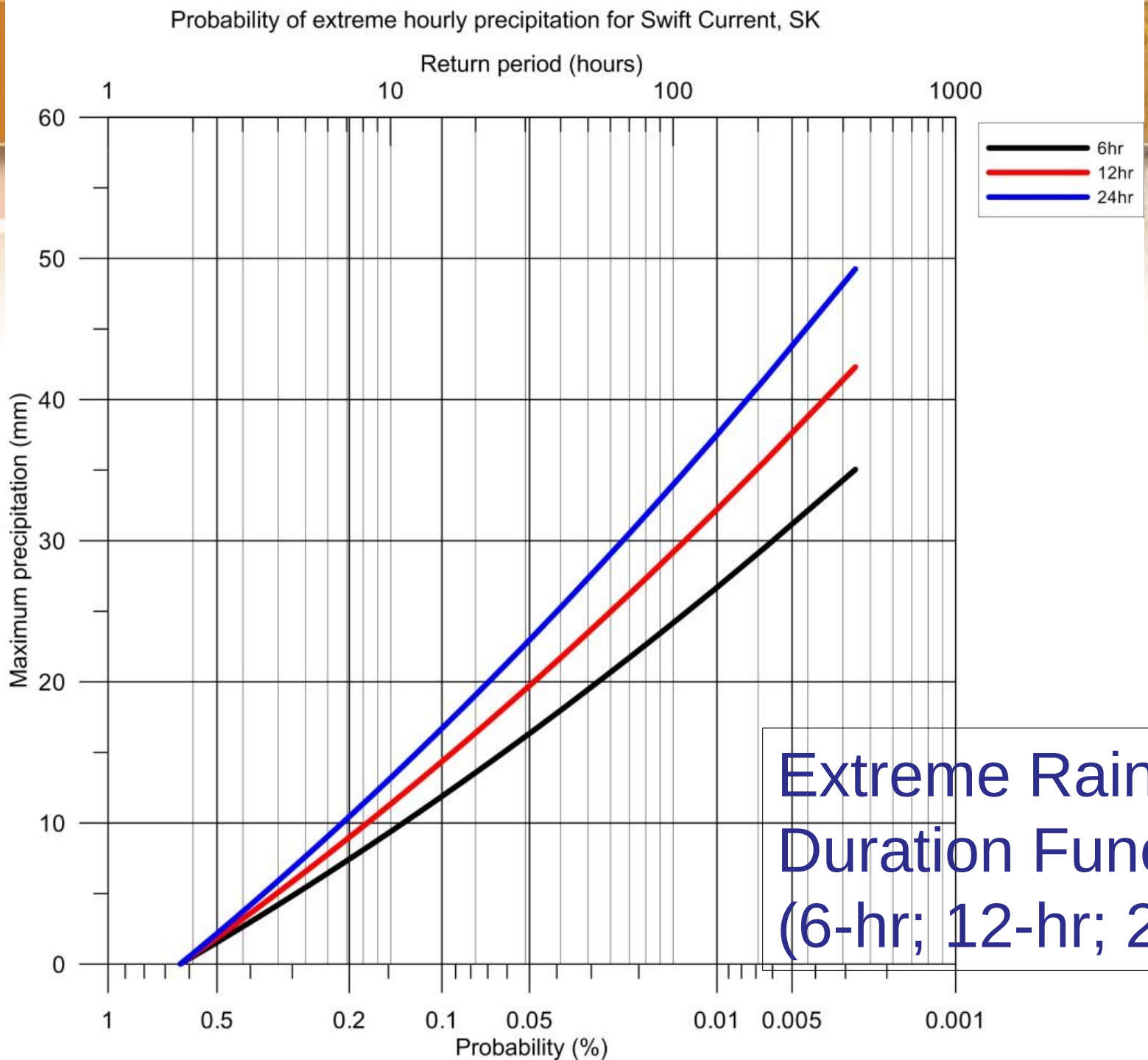


Annual Precipitation Probability:

- 200 to 300 mm/year
- 500 mm once/10 yrs
- 600 mm once/80 yrs

Are current Ag Sector adaptations capable of addressing the natural variability of the last 100 years?

Will future variability be different?

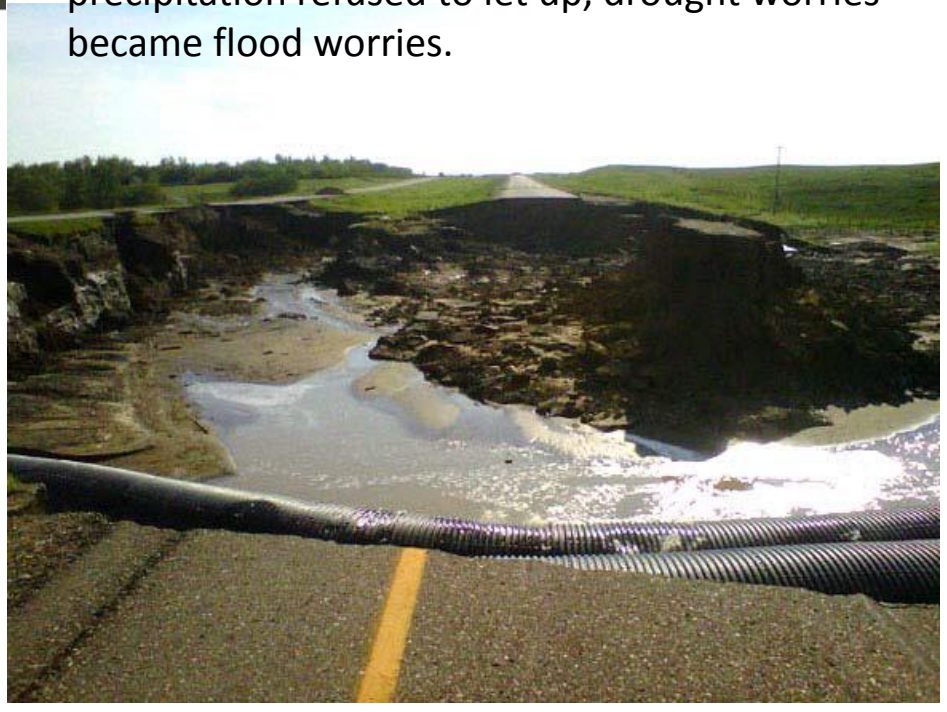


Extreme Rainfall Duration Functions: (6-hr; 12-hr; 24 hr)

Westbound Highway #1, near Maple Creek
The washout occurred downstream of Junction Dam, which experienced an est'd 1:1000 yr flood (200 $m^{3/}s$). The spillway capacity was improved from 100 to 300 $m^{3/}s$ capacity (re-constructed in 2008). This adaptation likely prevented more catastrophic failure of the dam and other infrastructure.

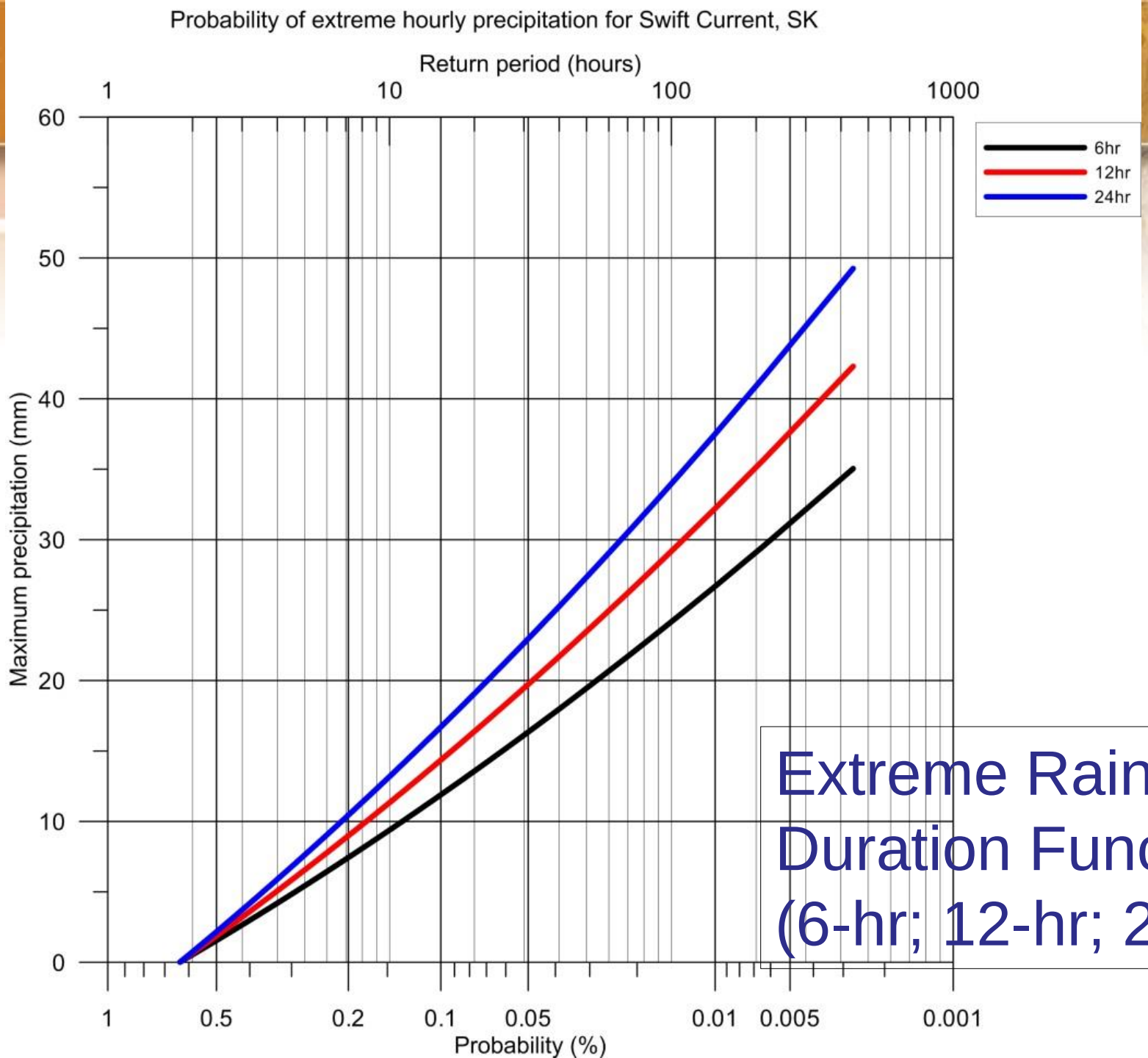
2009-10 Extremely Dry Winter:
Canada has had its warmest, driest winter on record CTV.ca News Staff
Published Saturday, Mar. 6, 2010 8:18PM EST
Last Updated Saturday, May. 19, 2012 1:07AM EDT

2010 Summer was Extremely Wet:
From Dry to Drenched on the Prairies; Env. Canada: Above-normal temperatures in spring meant an early start to planting in southern and western growing areas, and in mid-April – almost miraculously – it started to rain. But when the precipitation refused to let up, drought worries became flood worries.



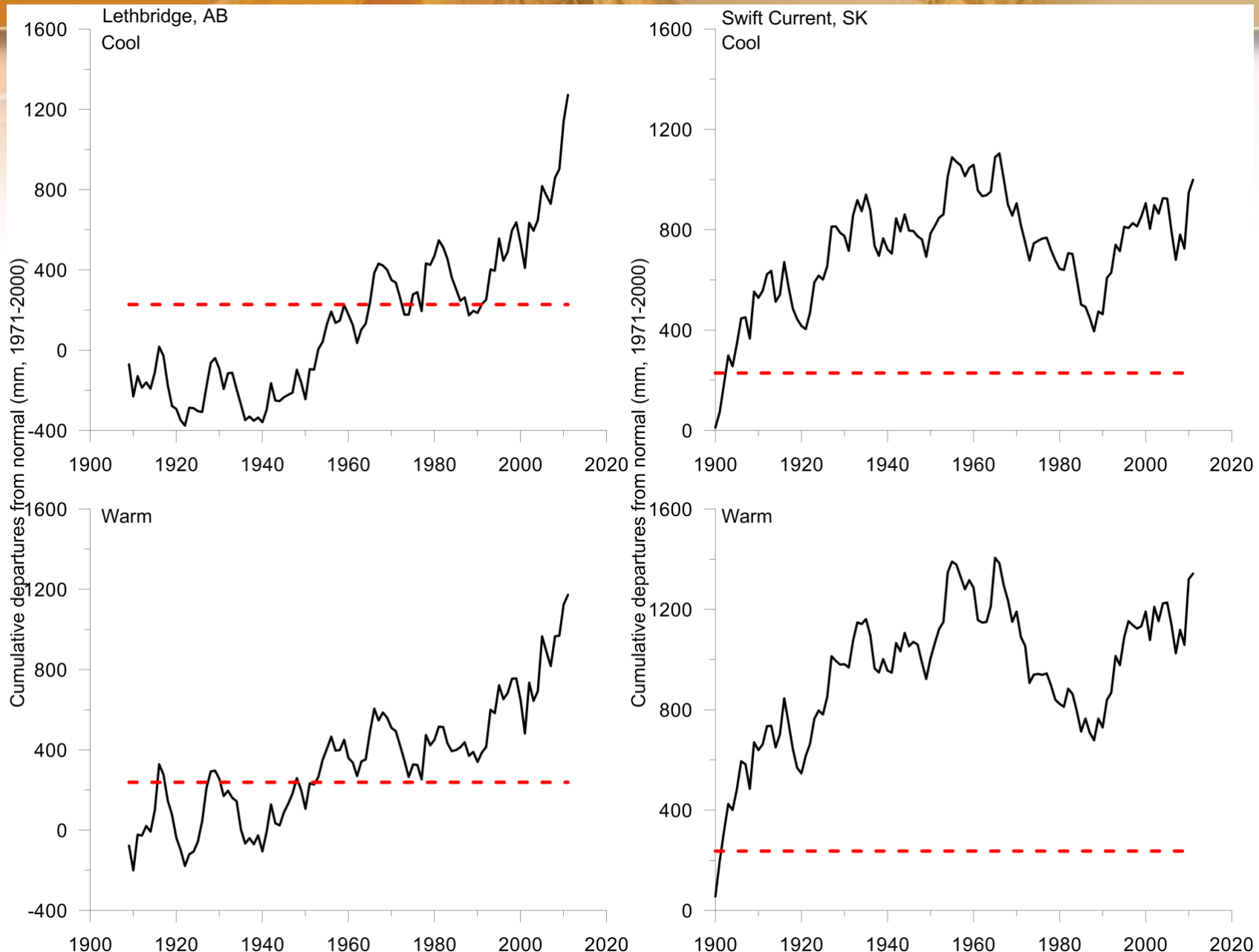
The Junction Dam as a Case Event in Local Context of Extreme Event Variability Data

- **Rainstorm Event:**
  - 24 hour duration
  - Variable rain across basin from 75 to 135 mm over 24 hours
  - On average, rain over 24 hours was estimated at just over 90 mm
  - Resulting flood event estimated at 200 m^3/s
    - Classified as 1:200 year storm by volume
    - Or, 1:3,700 year storm by "realized inflow flood peak" due to the steep topography of the Cypress Hills combined with extremely wet antecedent conditions
- **The Context for an Extreme Event Matters!**
- **Data analysis & real conditions matter at a LOCAL scale – LOCAL adaptation matters**

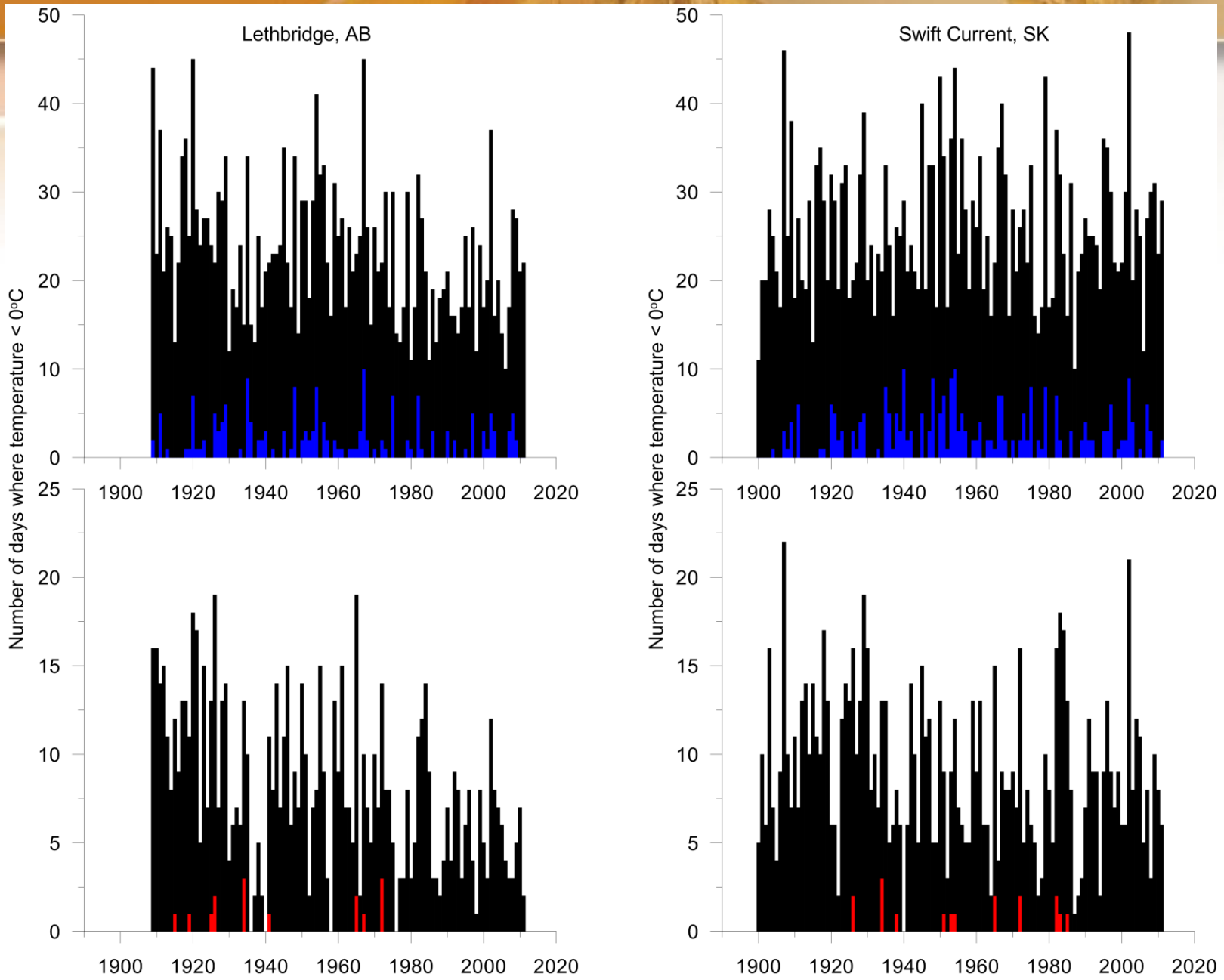


Extreme Rainfall Duration Functions: (6-hr; 12-hr; 24 hr)

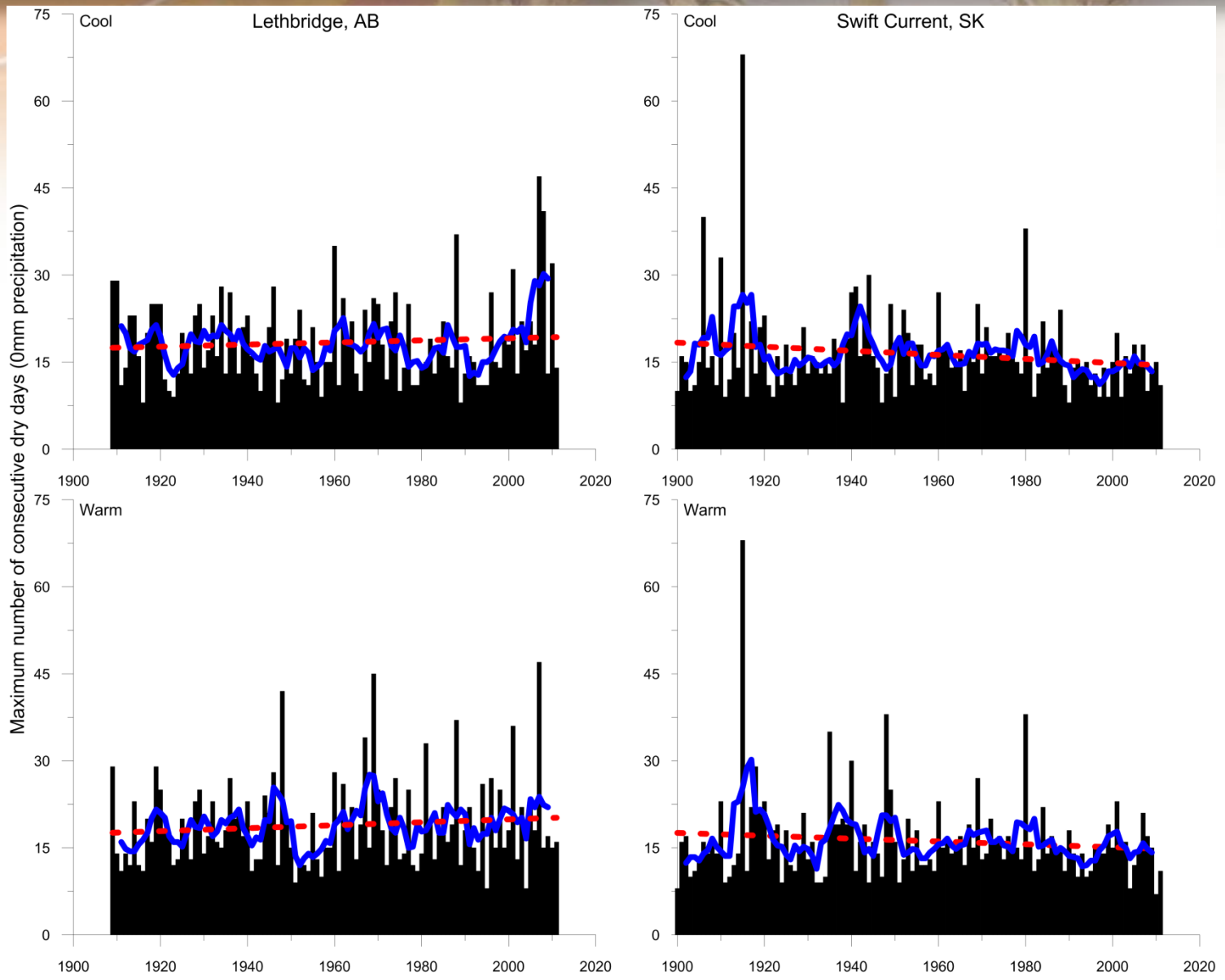
Cumulative effects of wet and dry years:



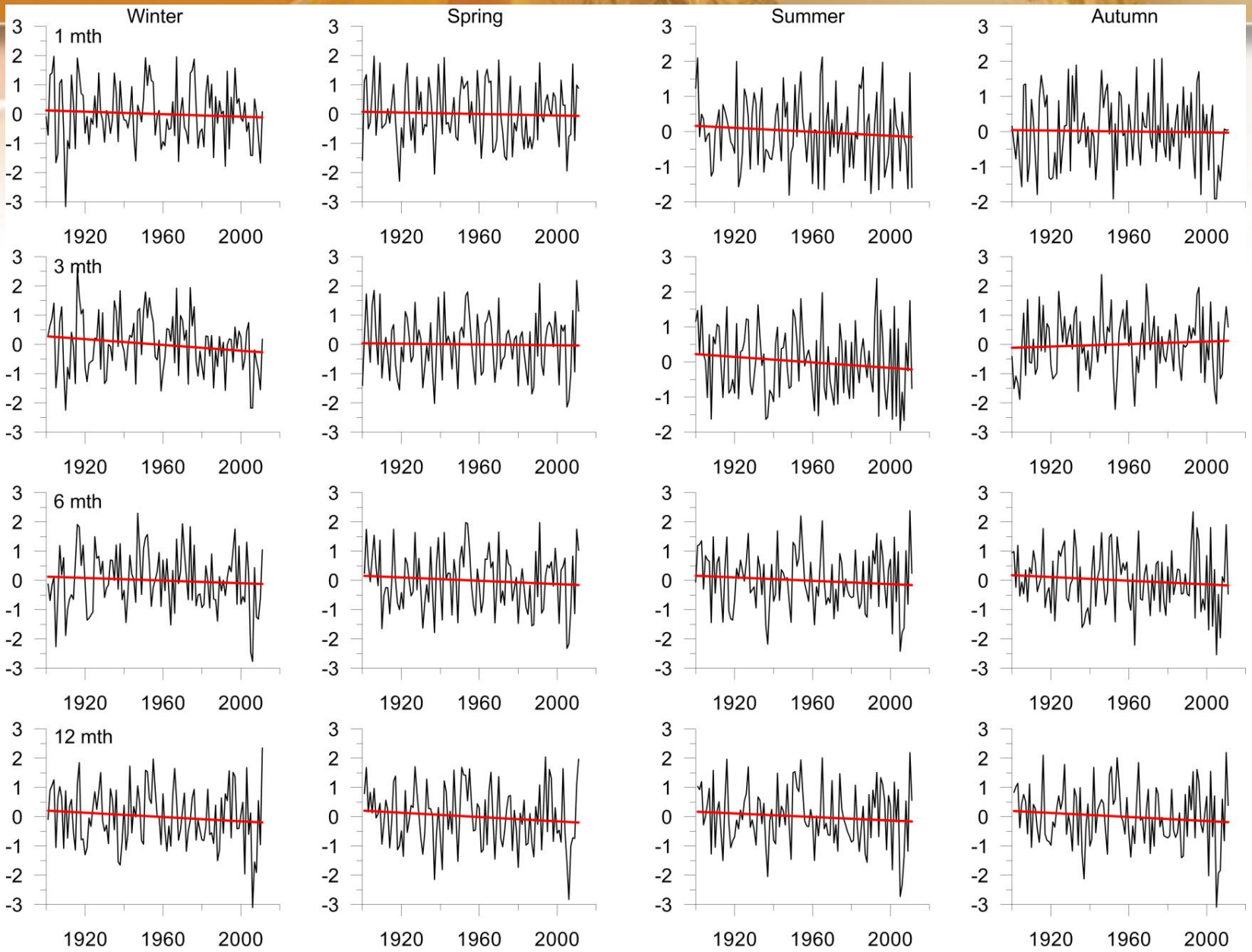
Frost and freezing days:



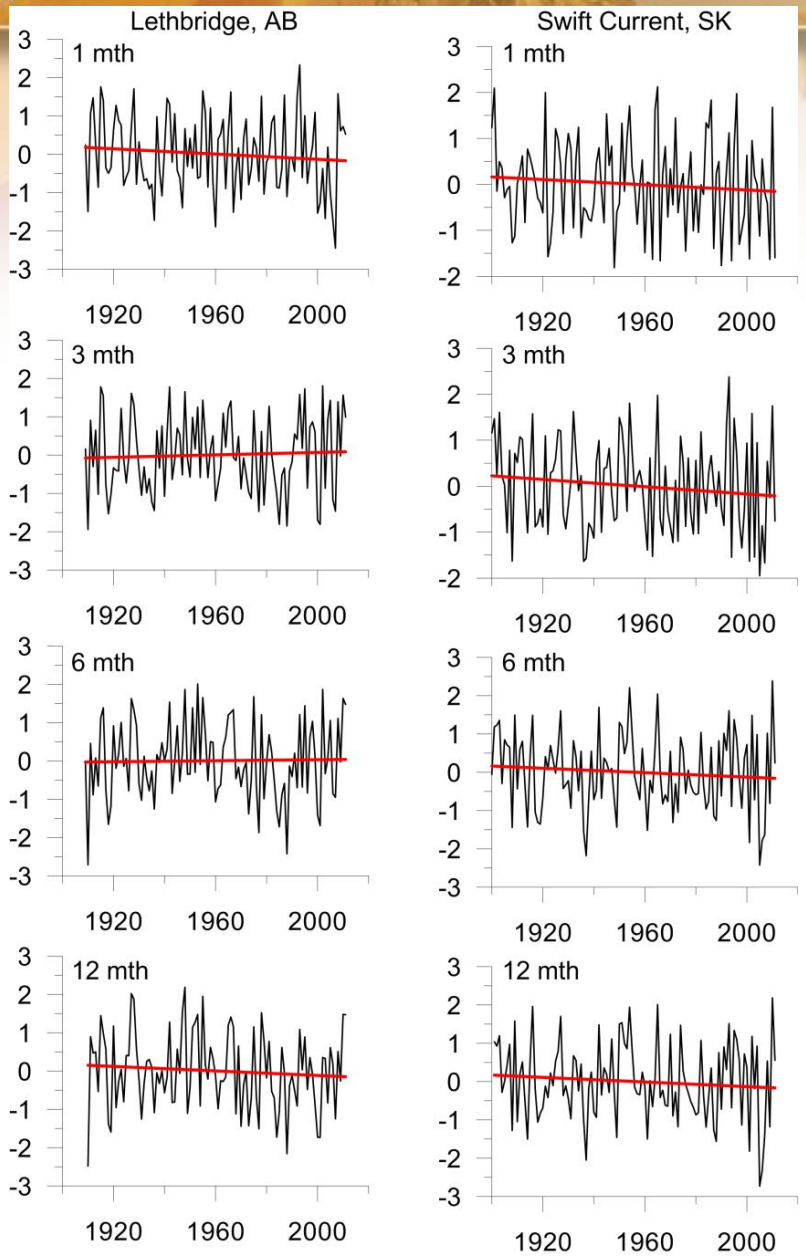
Consecutive dry days:



Seasonal SPEI, Swift Current, SK:



SPEI during the growing season:



Next steps:

- Agrometeorological Extremes Analyses:
  - Continue and apply analyses to subsequent stations within the Oldman and Swift Current Creek Watersheds
  - Produce a written report complementary to SRC's *Characterizing the Climates of the Swift Current Creek and Oldman River Watersheds* by V. Wittrock, 2012.
- Tangible Deliverables:
  - Extremes Fact Sheets
  - Extreme 'Top 10s'
- Future Climate Scenarios:
  - Repeat Agmet analyses with gridded data, as well as for future scenarios to determine how the trends observed under the present climate will behave under a changing future climate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