

Extreme Precipitation Events and the Recent Drought over the Canadian Prairies

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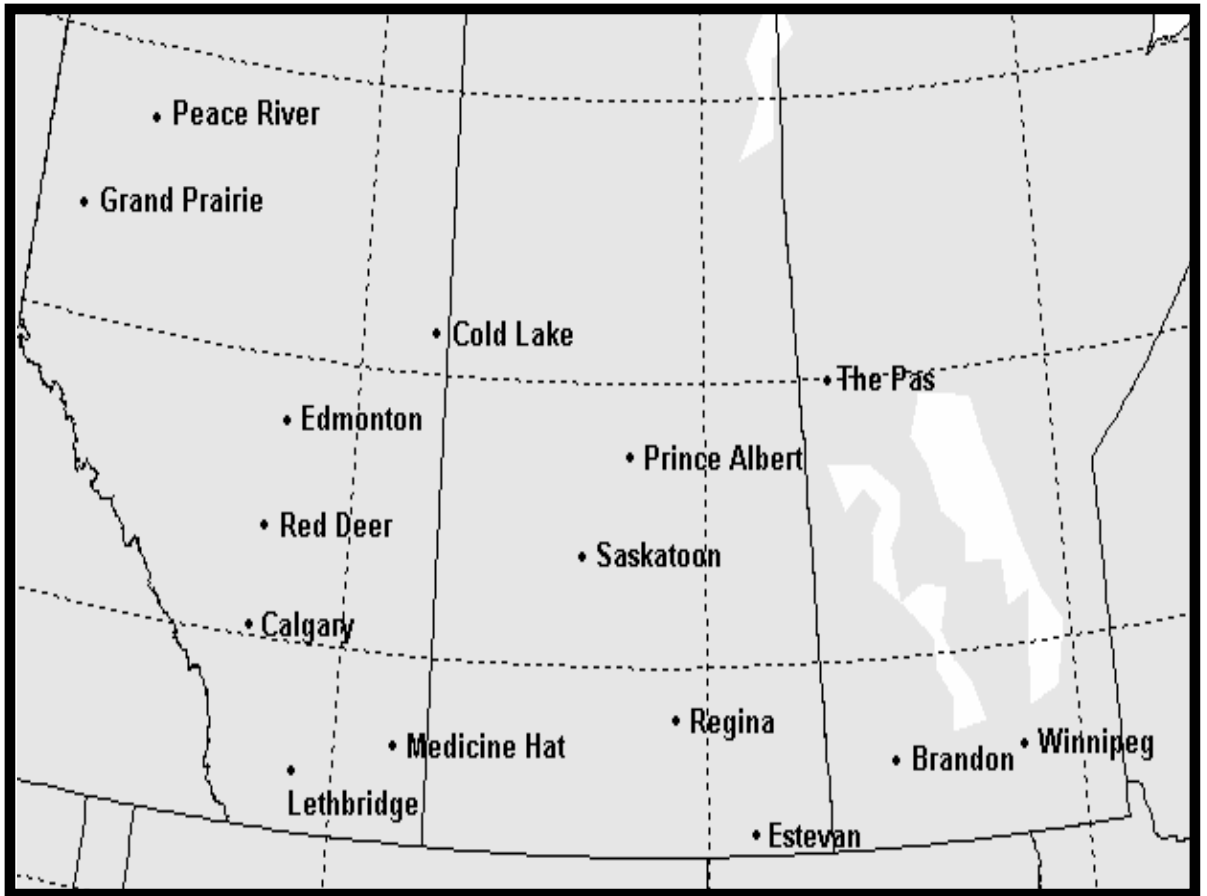
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Background and Objective

- Though drought is characterized by overall dryness, extreme precipitation events do still occur.
- The objective is to better understand the occurrence of heavy precipitation events associated with drought.
- The focus is on a recent catastrophic drought that occurred over the Canadian Prairies from 1999-2005, causing an enormous loss of ~\$5 billion US to the economy (Lawford et al., 2008).

Data and Classification

- Precipitation data (1960-2008) from 15 sites were obtained as well as radar data from the Canadian Radar Network and soundings from Edmonton.
- An event was considered extreme if the total precipitation recorded was greater than the average monthly precipitation. The severity (%) was total of the event relative to the monthly average.

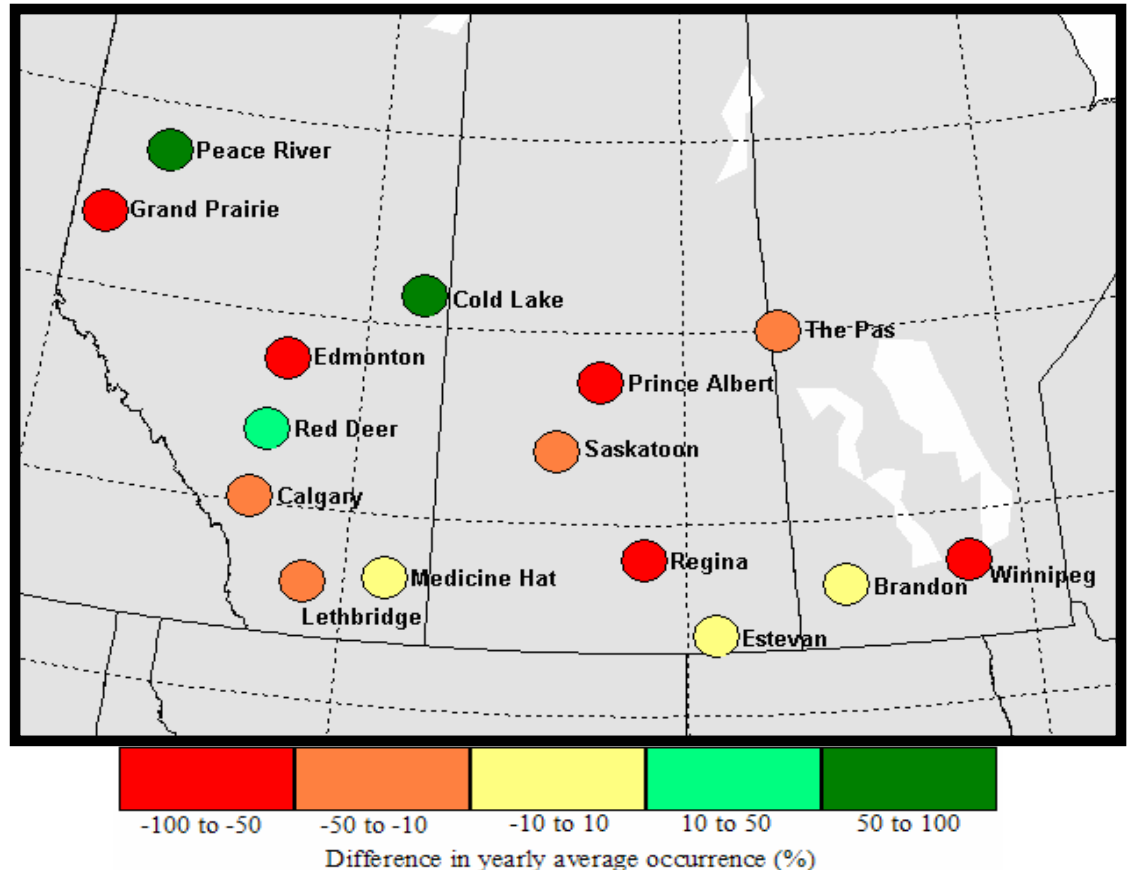


Occurrence of Extreme Events

- Drought (1999-2005)
 - 64 extreme events in 7 years
 - 9.1/year on average
- Climatology (1960-1998, 2006-2008)
 - 471 extreme events in 42 years
 - 11.2/year on average
- Overall there were, on average, fewer extreme events during the drought than in the climatology.
- This confirms what was found at Edmonton by Evans (2008)

Occurrence by Station

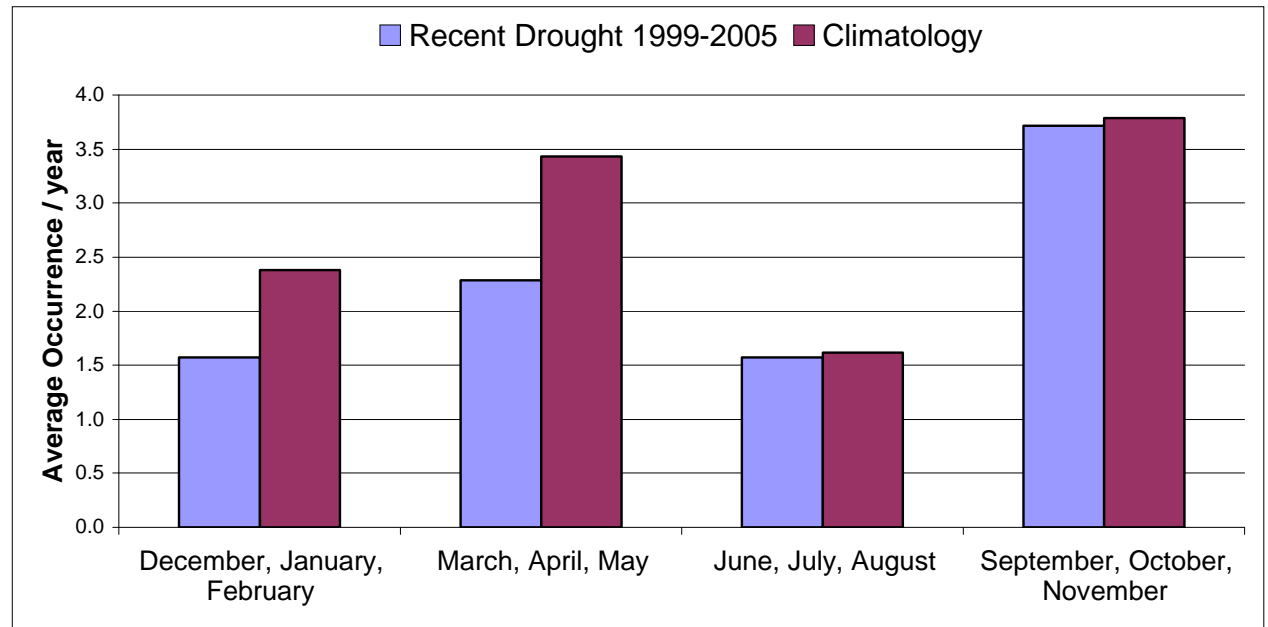
- Most stations experienced fewer extremes during the drought
- Cold Lake had the highest relative occurrence of extremes during the drought.



- Stations where many more extremes occurred are close geographically to those that had significantly fewer.

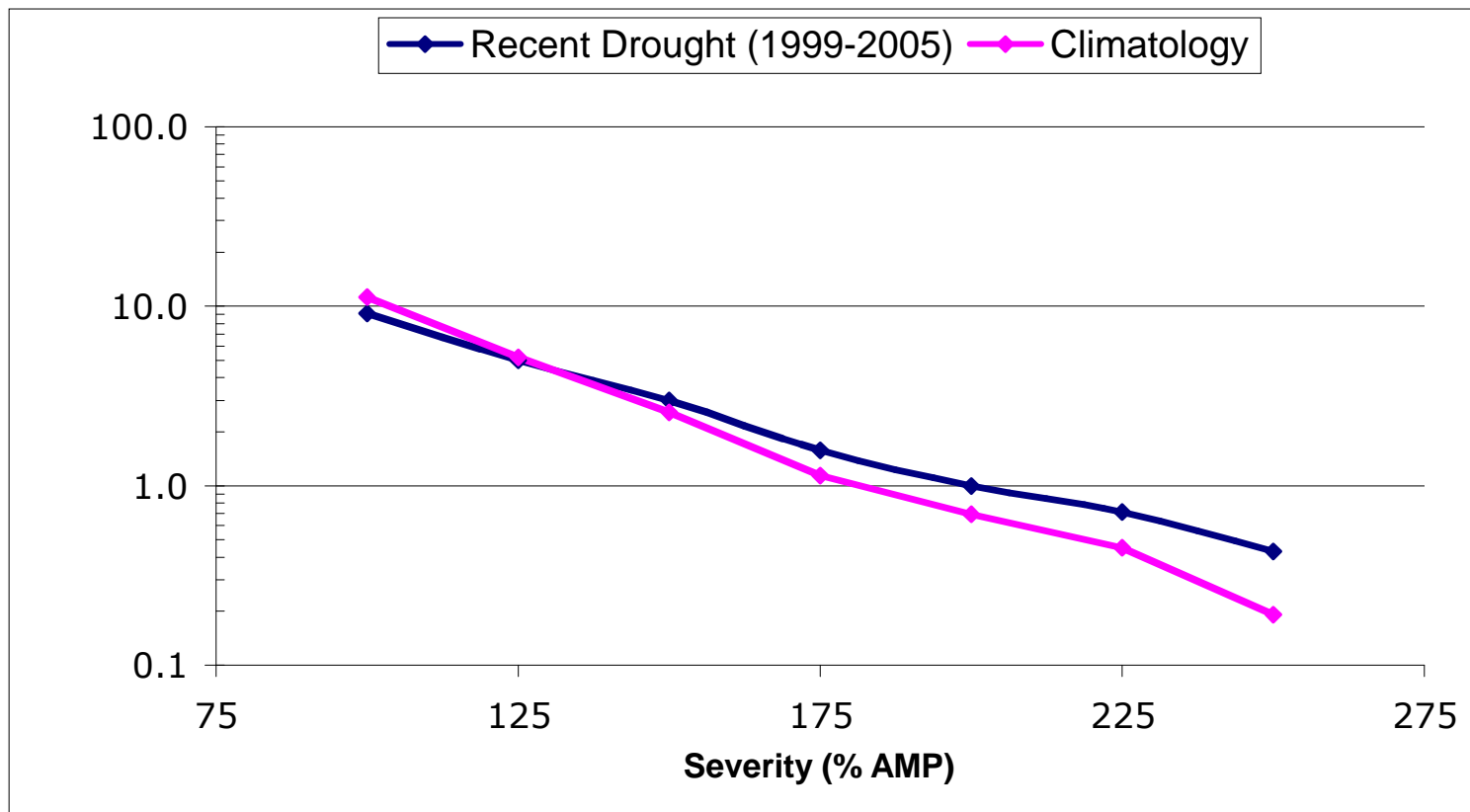
Occurrence by Season

- Seasonal occurrence of extremes during the drought is similar to the climatology in summer and fall, but significantly lower in winter and spring.
- The reduced occurrence of extreme events in winter and spring could have led to lower snowmelt and runoff (Bonsal and Wheaton, 2005) and could have initiated or accentuated drought conditions.



Occurrence by Severity

- While all extreme events were less common during drought, events with precipitation greater than 150% of the AMP were more common during the drought.
- This difference is statistically significant.

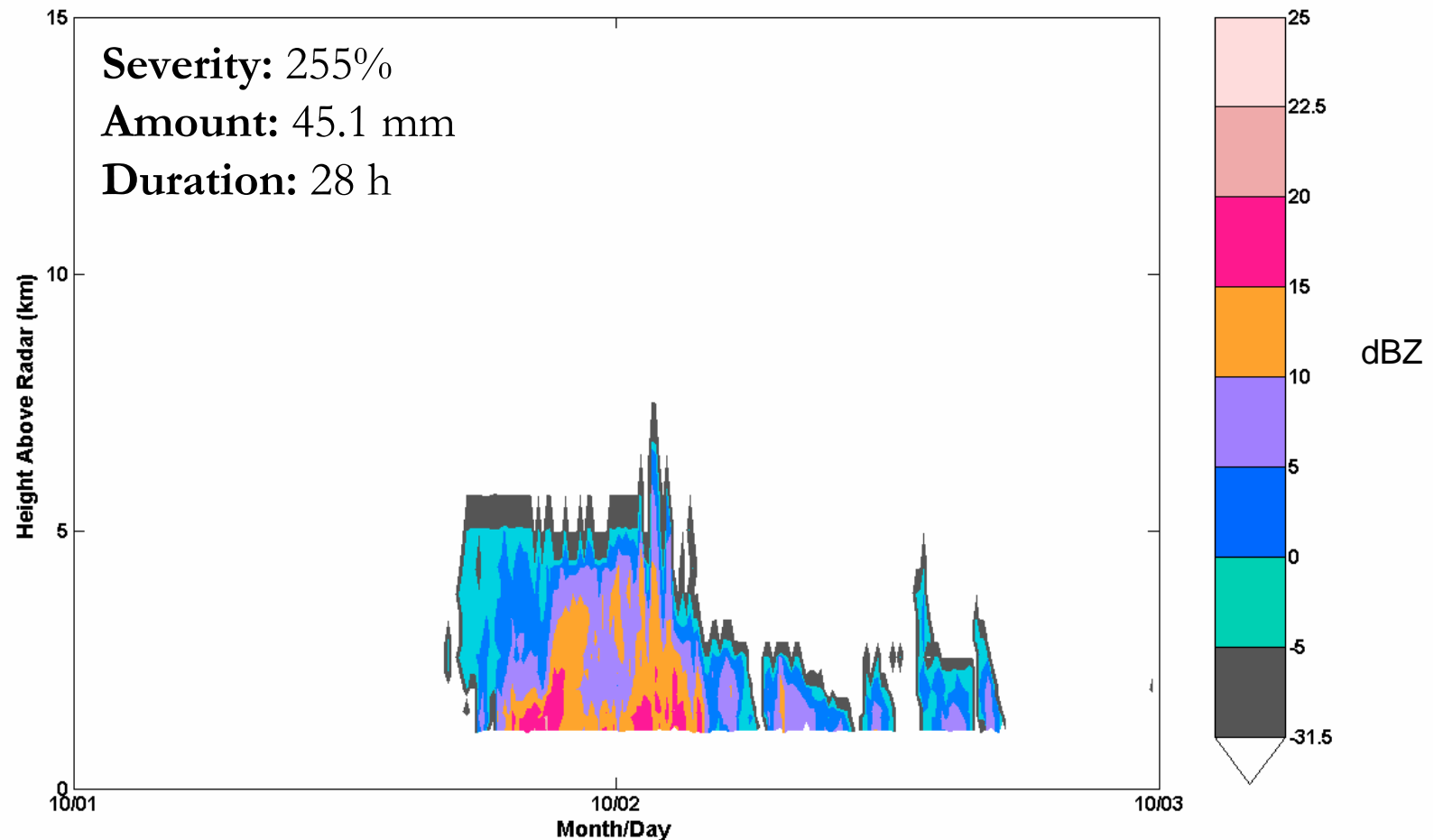


AMP is the
Average Monthly
precipitation

Radar Case Studies

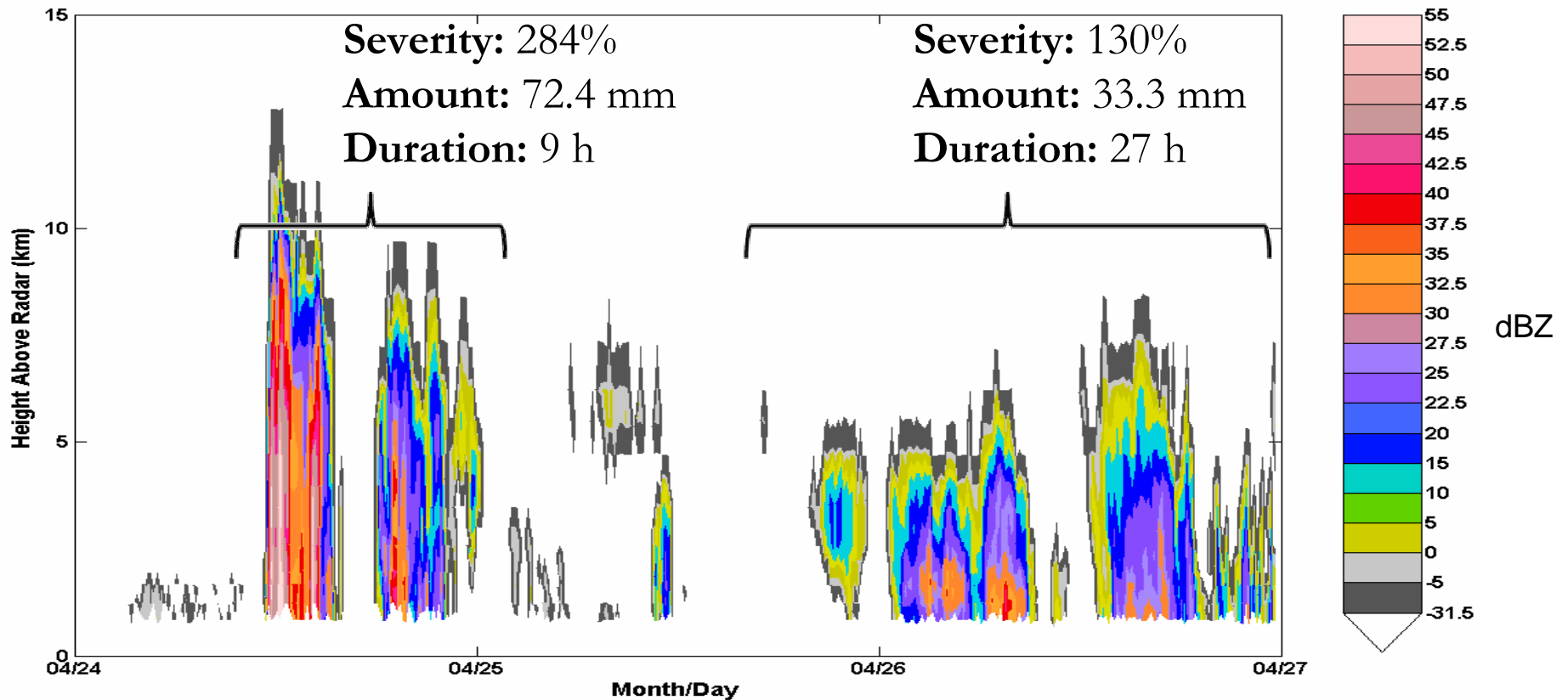
- Objective was to investigate the similarities and differences of vertical radar profile characteristics of severe precipitation events
- Examined the four most severe events occurring near Cold Lake during the drought
- Cold Lake is close to a radar and 4 of the 10 most severe events occurred there

1-2 October 2005



Observations: Very low heights and low reflectivity values. Long-lived event, likely stratiform. Surface observations recorded rain and snow. Slight overhang at beginning of event.

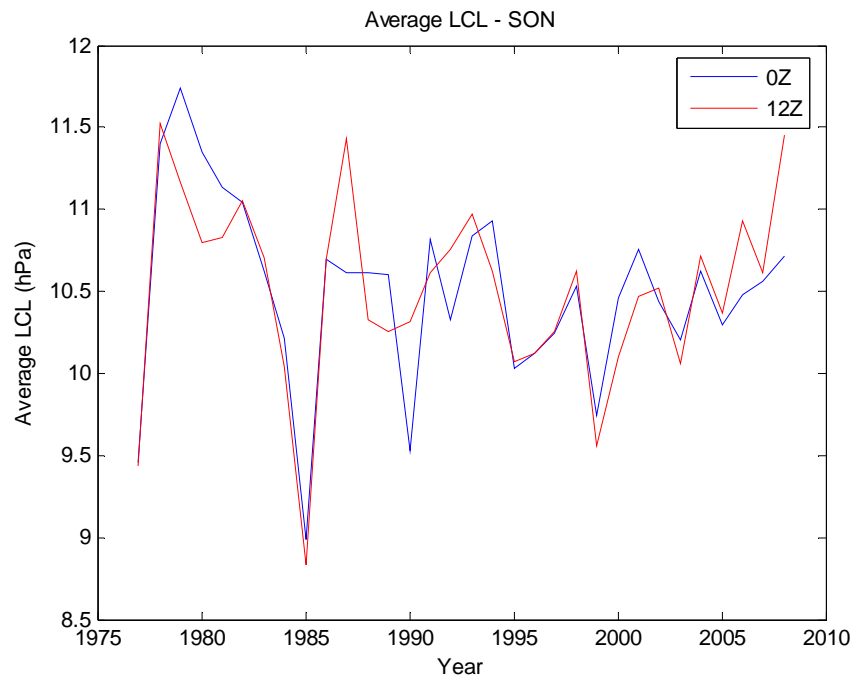
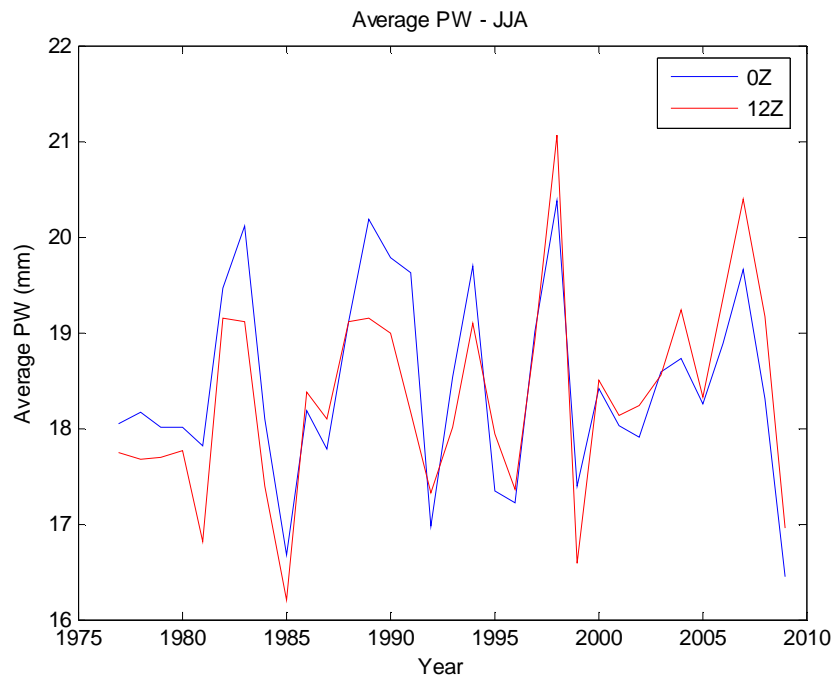
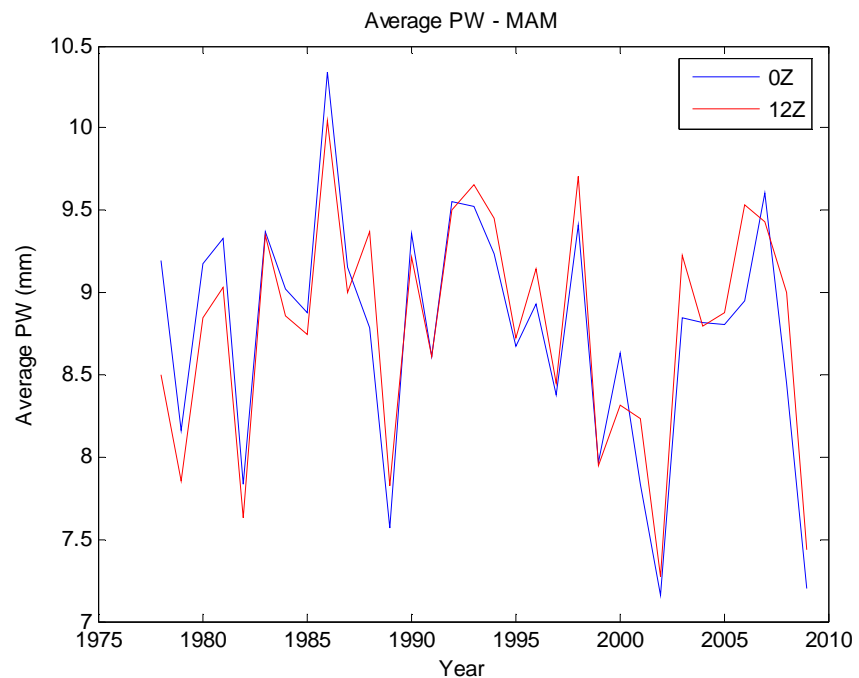
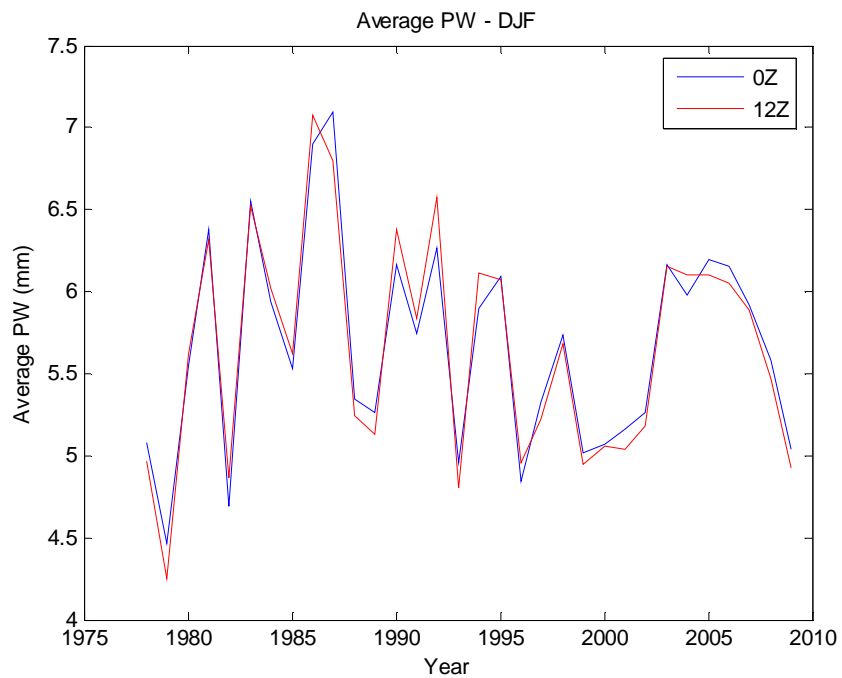
24-27 April 2003



- **Sub - event 1:** Highest cloud heights. High intensity, short lived shower. Convective development, rain and hail reported.
- **Sub - Event 2:** Low cloud heights. Indication of virga/sub-cloud evaporation. The accumulation could have been higher if the precipitation reached the ground.

Soundings

- 32 years of soundings from Stony Plain (~80km east of Edmonton) were examined
- CAPE, CIN, SWEAT, LIFT, Precipitable Water etc. was averaged over the four seasons
- Only going to show Precipitable Water



Conclusions

- **Extreme precipitation events do commonly occur during drought conditions over the Prairies**
- Certain areas and seasons were more prone to extremes during the recent drought.
- During the drought there was a higher average occurrence of extreme events greater than 150% of the average monthly precipitation.

- The radar imagery indicates there are a wide range of events (development, duration, phase of precipitation)
- Soundings from Stony Plain – dry(ish) in 1999 and MAM of 2002 but nothing else really stands out

Palmer Drought Severity Index (PDSI)

- For the all events, the PDSI was found for the month before the event and the month of the event.
- All PDSI values are higher in the month of the event than in the month before the event occurred.
- 4 were in areas of severe drought (PDSI ≤ -4)

