CLOUDS, STORMS AND DROUGHT

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with

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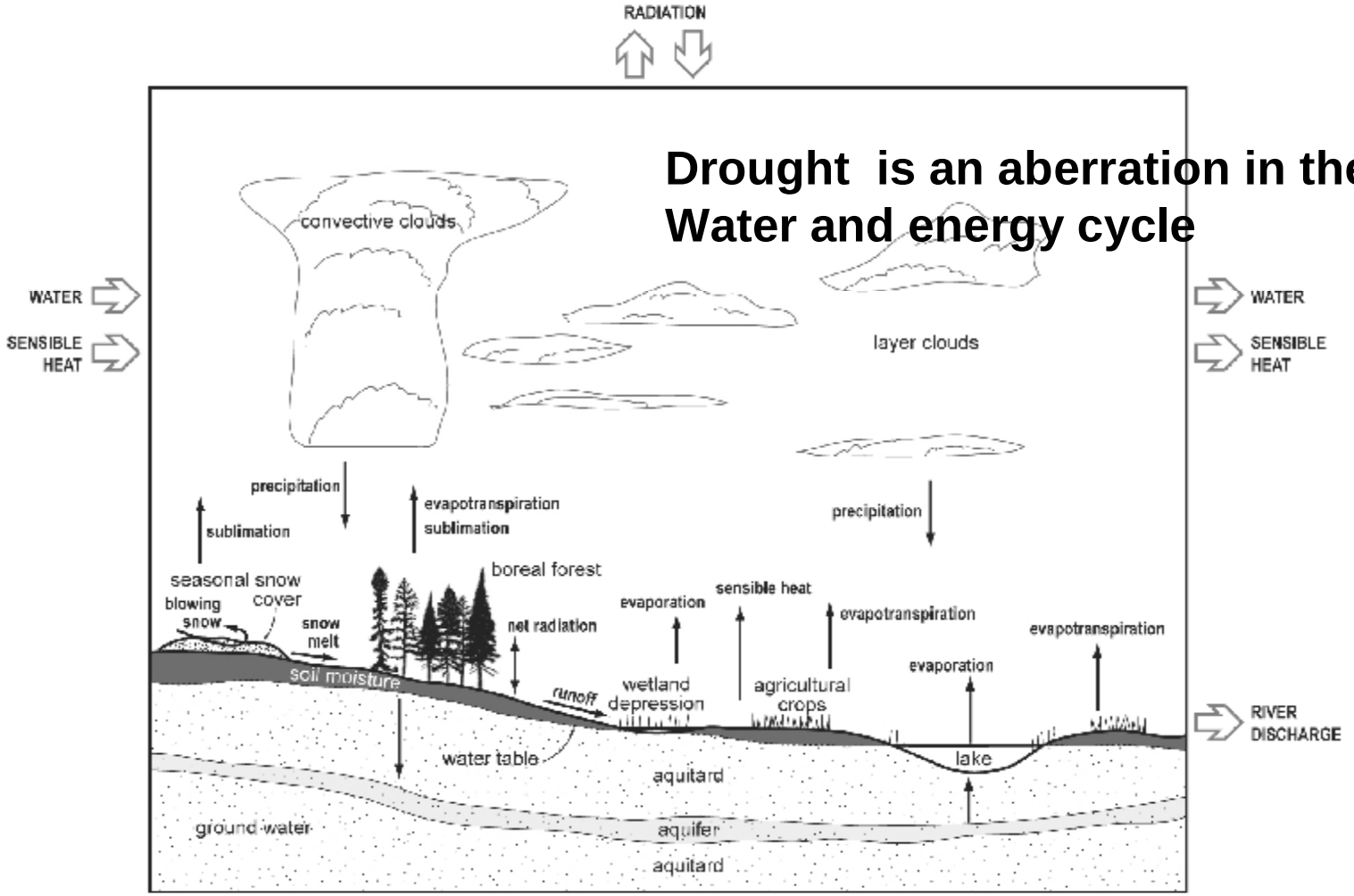
OBJECTIVES

- ***To better understand the flow of water vapour into and through clouds and precipitating systems to the surface within and adjacent to drought regions***

- ***To apply these advances to prediction capabilities and to surface and sub-surface water issues***

WATER AND ENERGY CYCLING

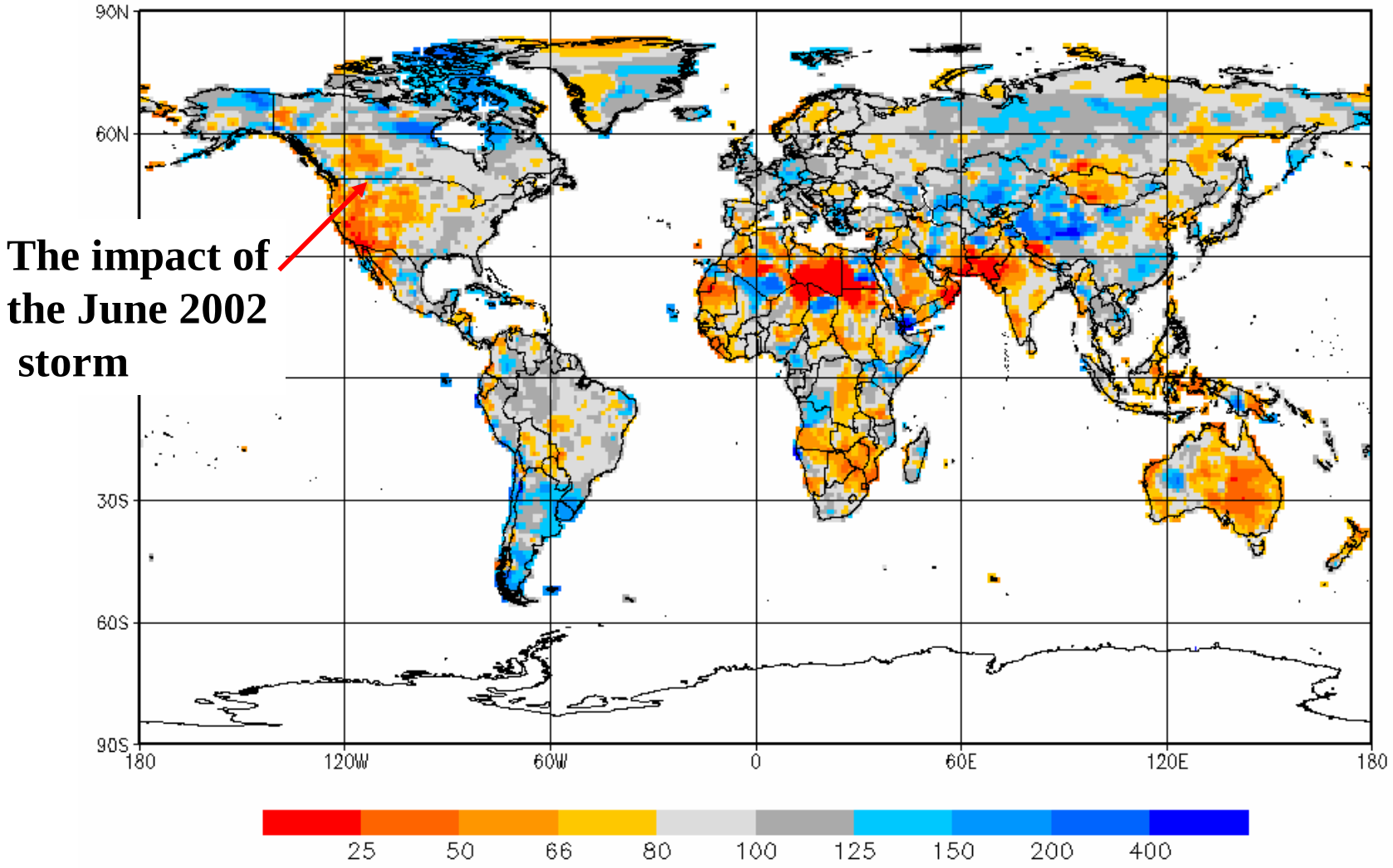


Drought is an aberration in the Water and energy cycle

SPECIFIC ISSUES

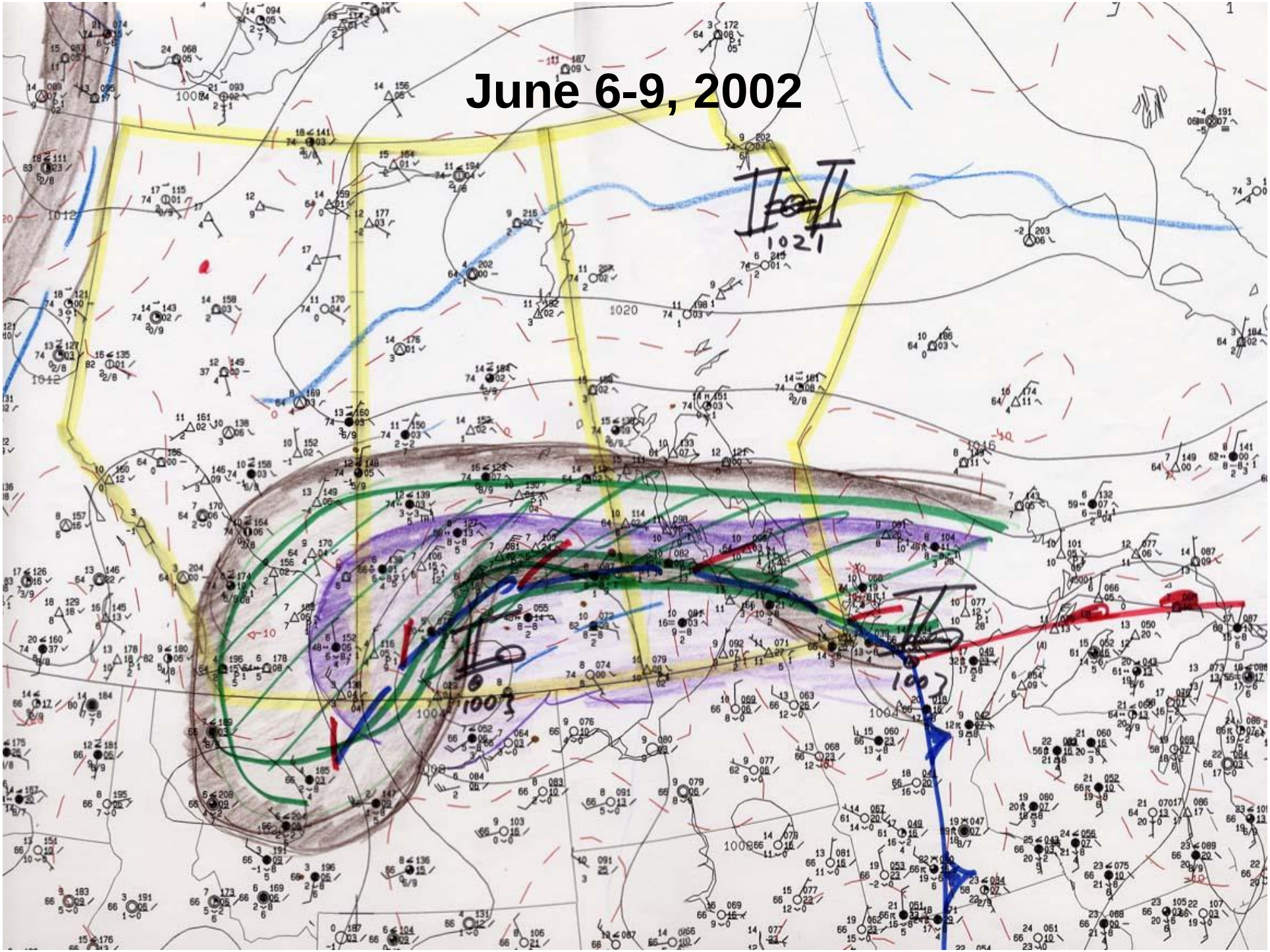
- **cloud and precipitation features during the drought**
- **episodic events producing heavy, widespread precipitation**
- **threshold conditions for precipitation to reach the surface**
- **cold season precipitation**

2002 GLOBAL PRECIPITATION ANOMALY
Global Precipitation Climatology Project

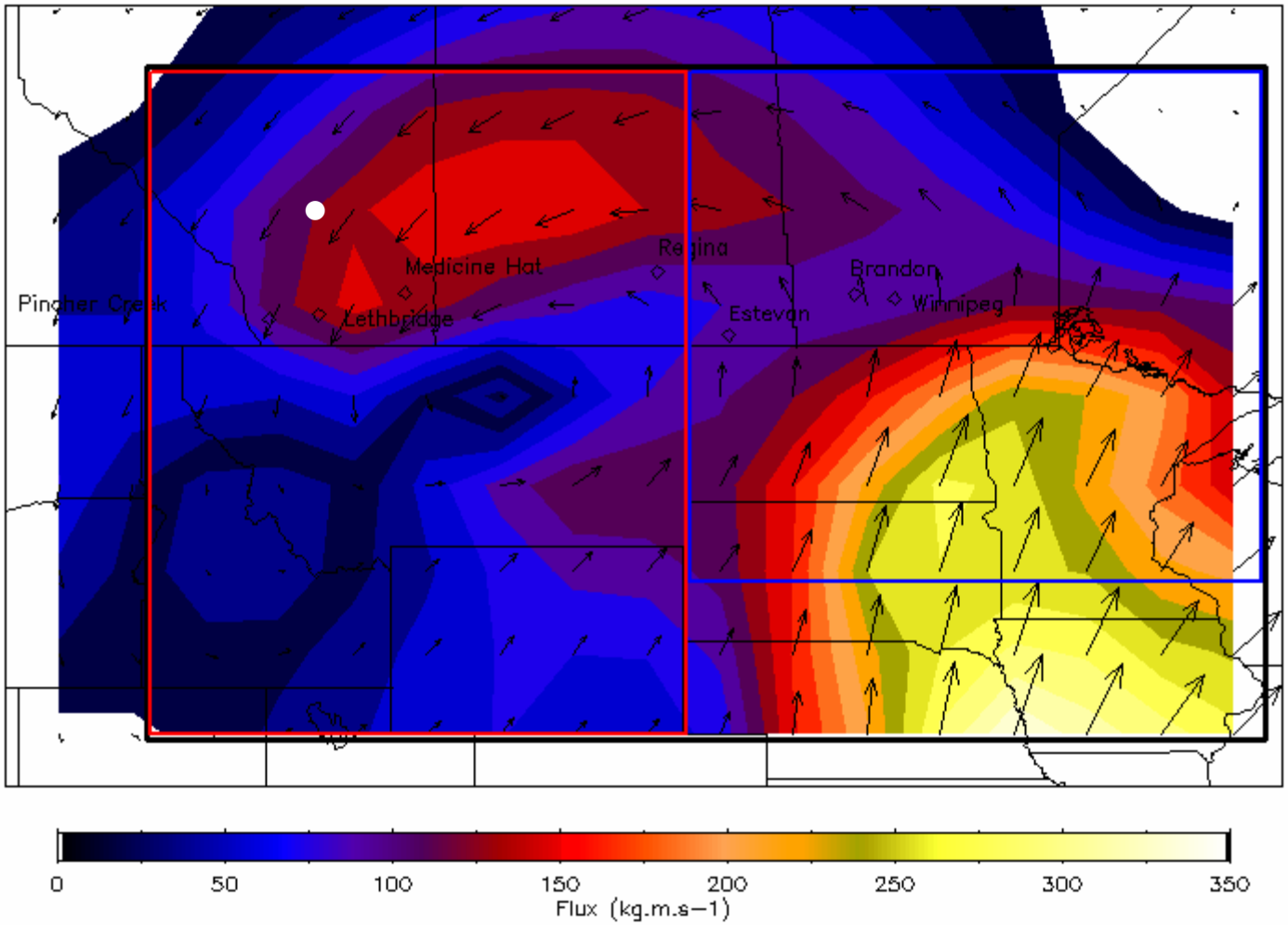


The impact of the June 2002 storm

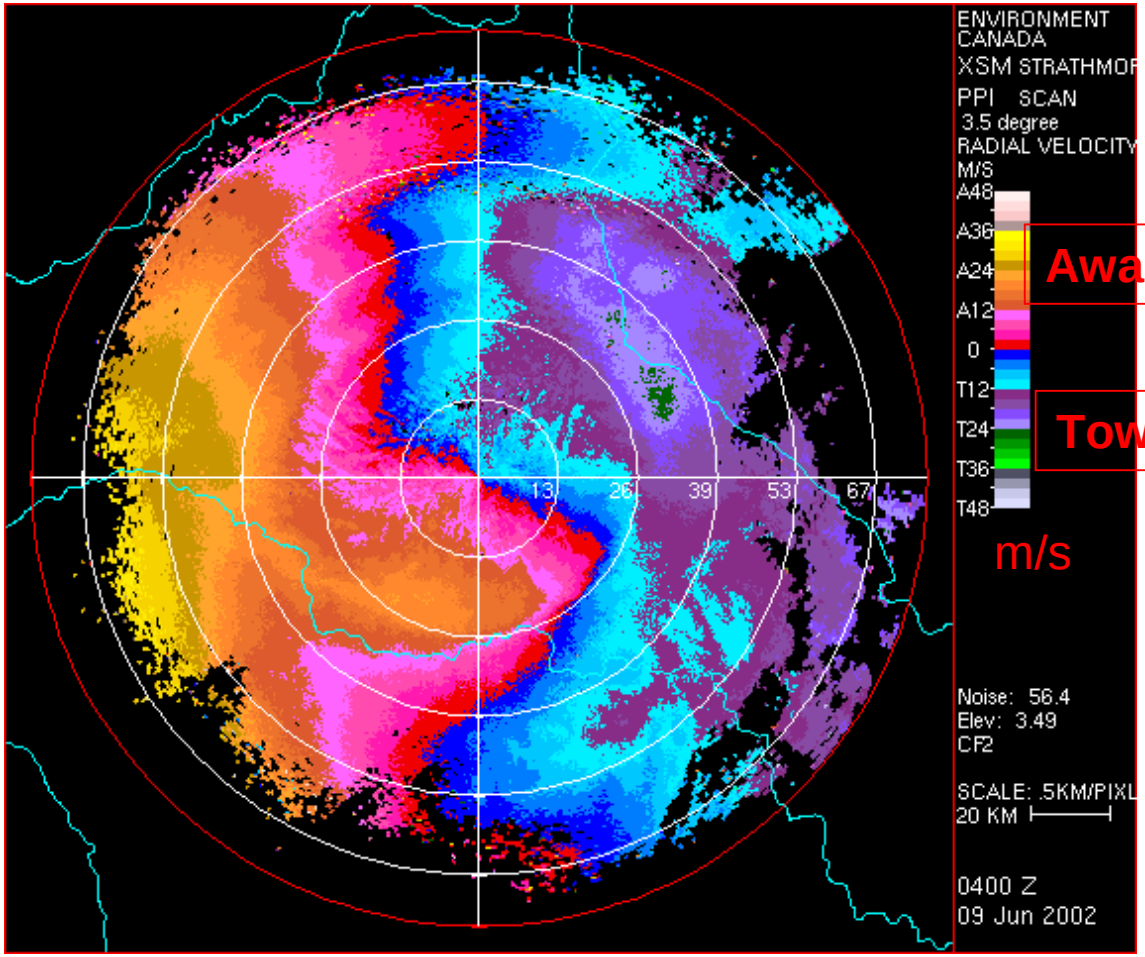
Percentage of normal (100% is normal on this scale)


June 6-9, 2002

WATER VAPOUR FLUX
(over the duration of the storms)



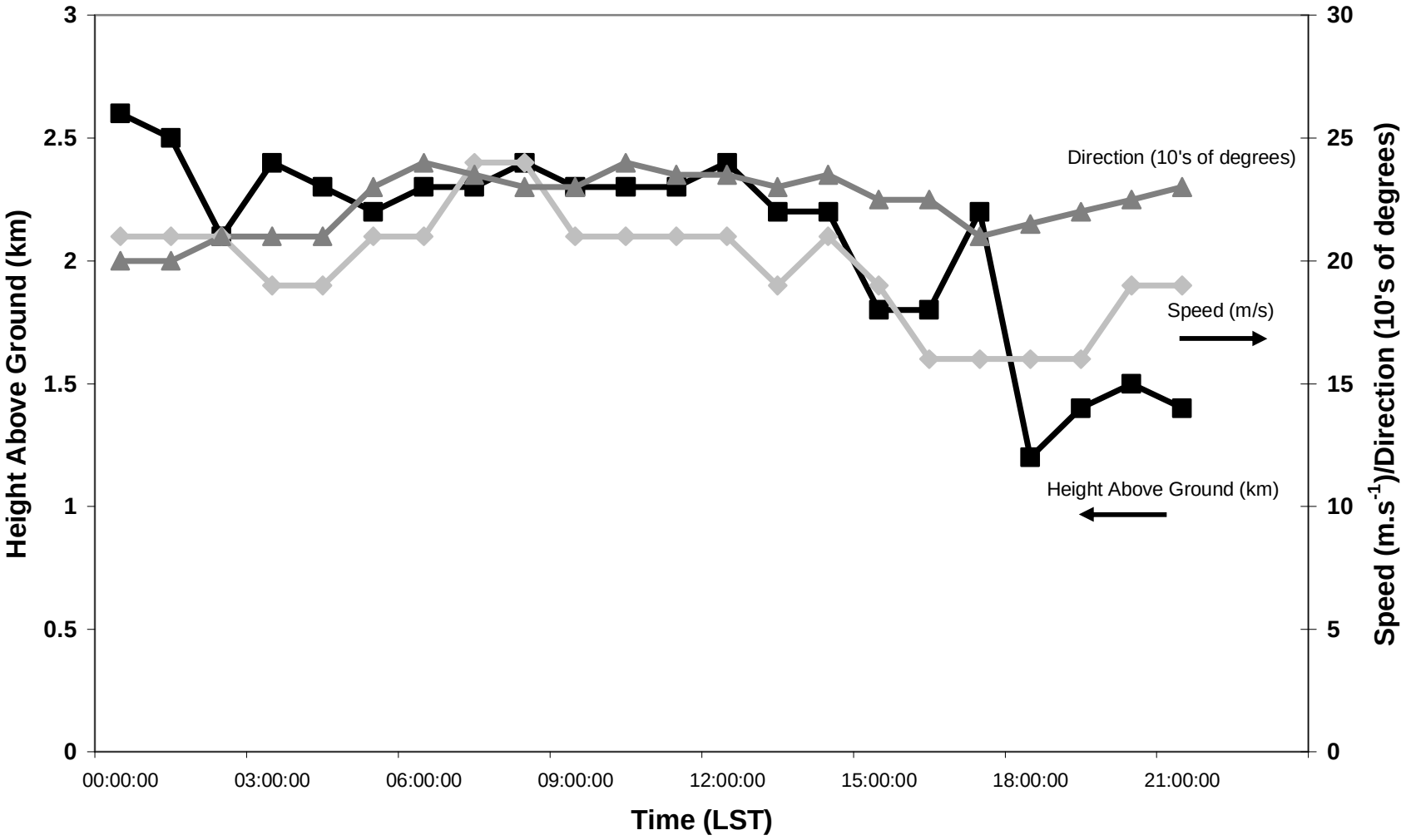
WIND FIELDS



Away from the radar

Towards the radar

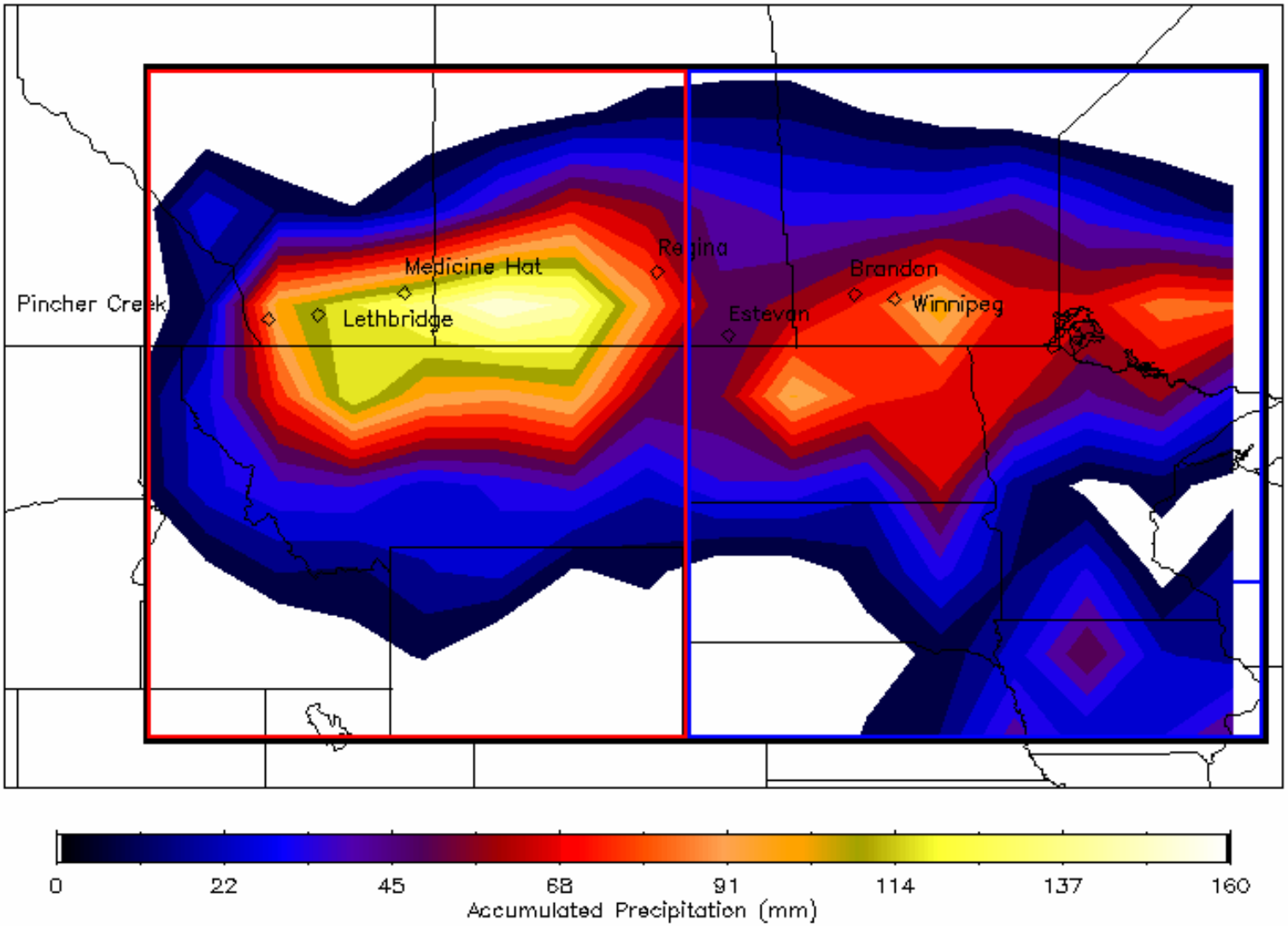
‘JET’ EVOLUTION



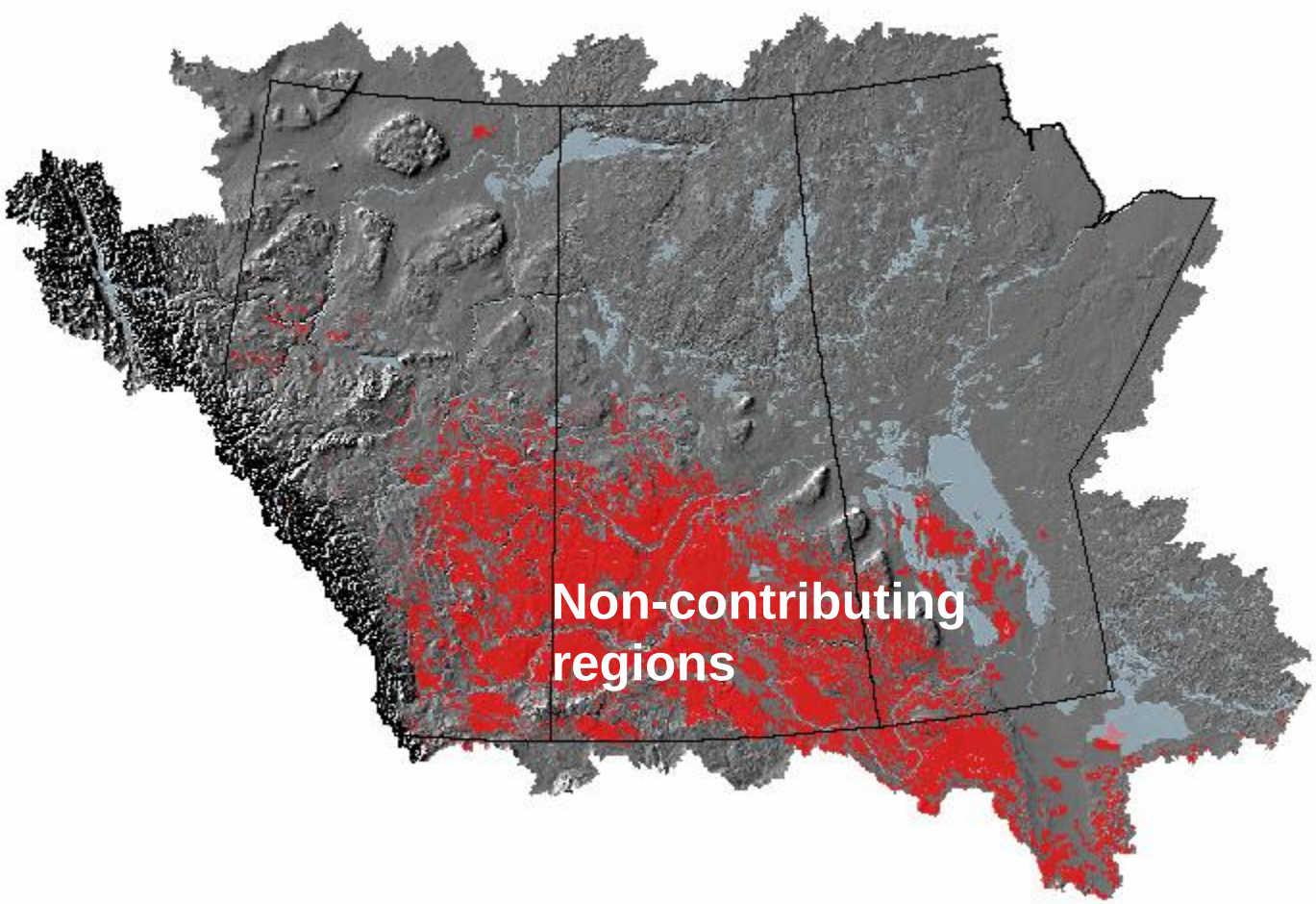
JUNE 9, 2002

Single Storms in Drought Change the Annual Precipitation Pattern and Drought Extent

PRECIPITATION FROM THE JUNE 2002 STORM



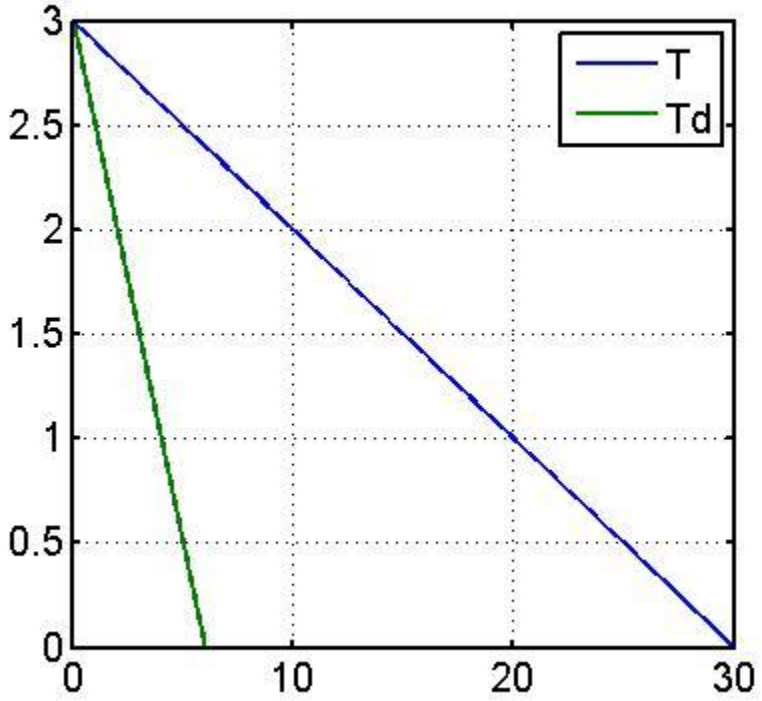
Accumulated Precipitation



VIRGA

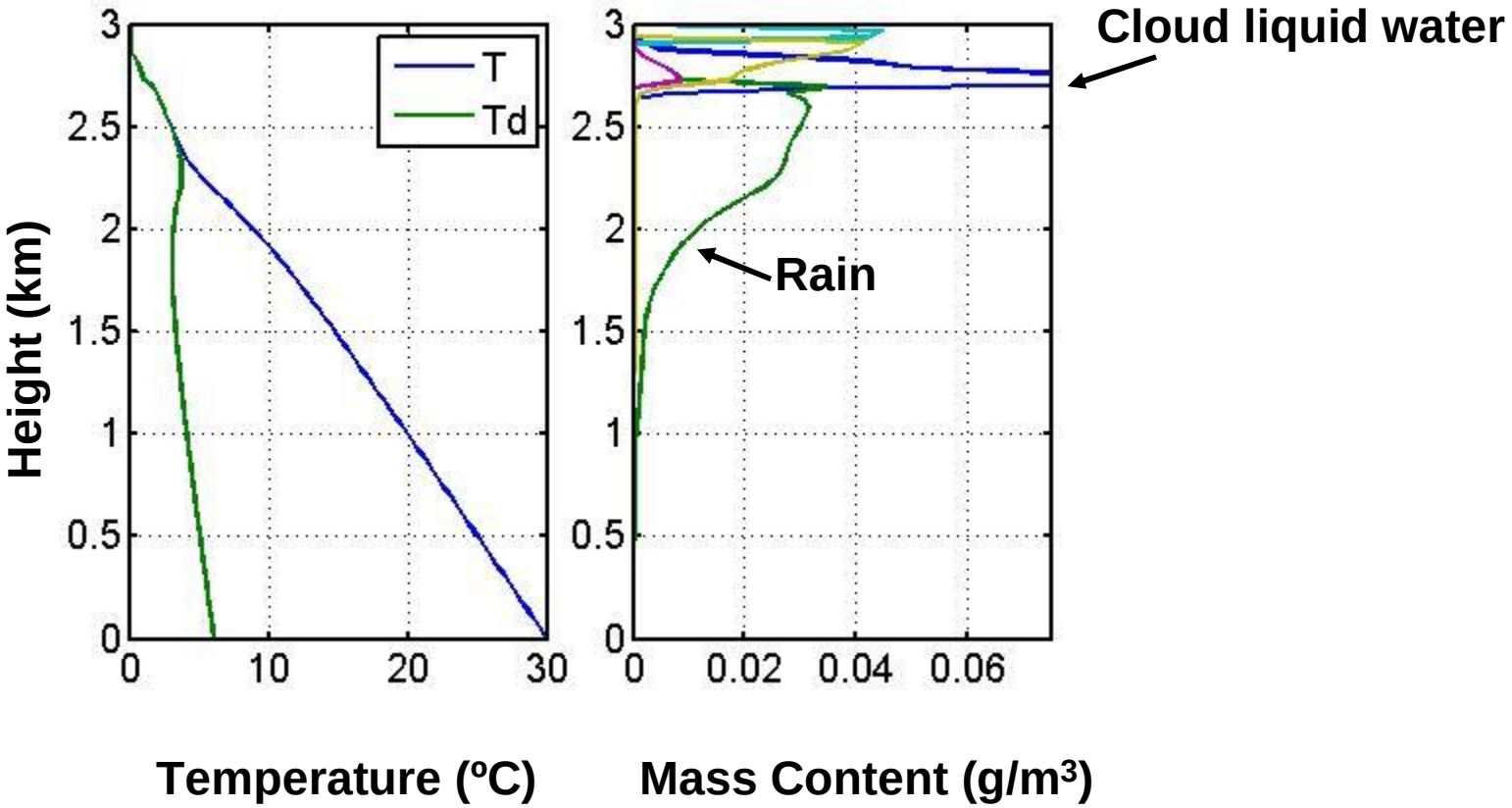
Courtesy of Barrie Bonsal

INITIAL VERTICAL PROFILE



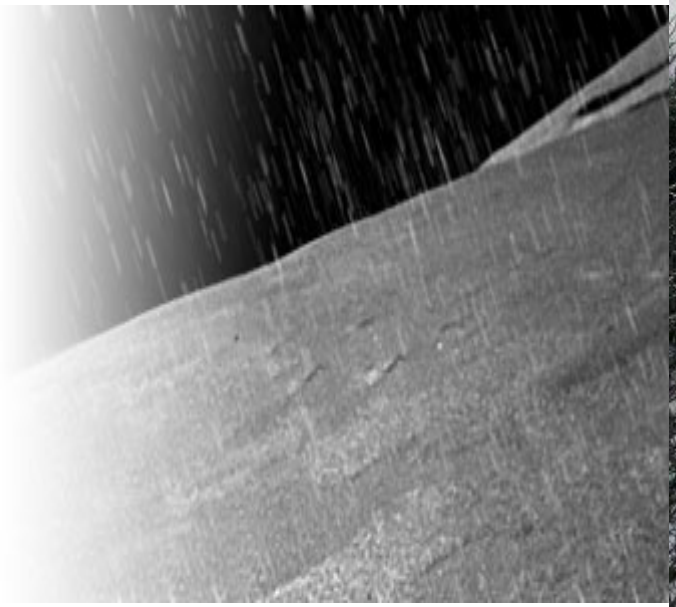
Snow is falling from 3 km above the surface

50 MIN LATER …


Height (km)
T
Td
Cloud liquid water
Rain
Temperature (ºC)
Mass Content (g/m3)

“CRUSTS” ON SNOW

- Rain and freezing rain during the cold season
- Warm days …



Occurrence of Freezing Rain
(hours observed November-March

	1998	1999	2000	2001	2002	2003	2004
Brandon	15	0	0	2	4	1	2
Edmonton	1	16	2	4	4	7	12
Lethbridge	4	3	3	1	0	1	4
Medicine Hat	0	0	1	0	0	0	0
Regina	1	1	1	0	3	4	6
Lloydminster	2	1	0	3	2	8	4
Prince Albert	3	8	13	2	2	0	19

Locations not receiving rain are shown in Red

OUTCOMES

This research will result in several outcomes including:

- Greater understanding of the role of clouds and storms in the cycling of moisture during drought
- Quantitative assessment of several branches of the water cycle in relation to drought
- Assessment of simulation and predictive models and recommendations for their improvement

RELEVANCE TO DRI …

Drought is an aberration in the Water and energy cycle