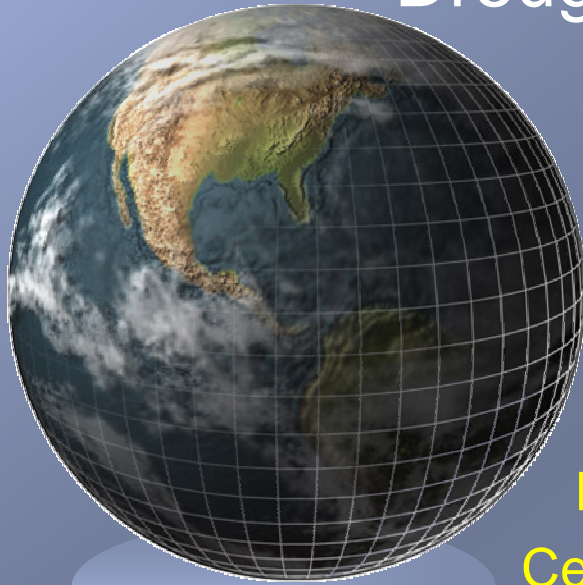


Drought Research Initiative (DRI) Theme 1 Characterization with Possible Applications to Drought Monitoring

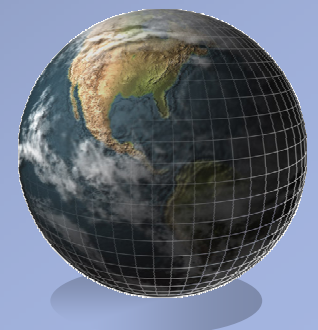


John Hanesiak
Department of Environment & Geography
Centre for Earth Observation Science (CEOS)
University of Manitoba

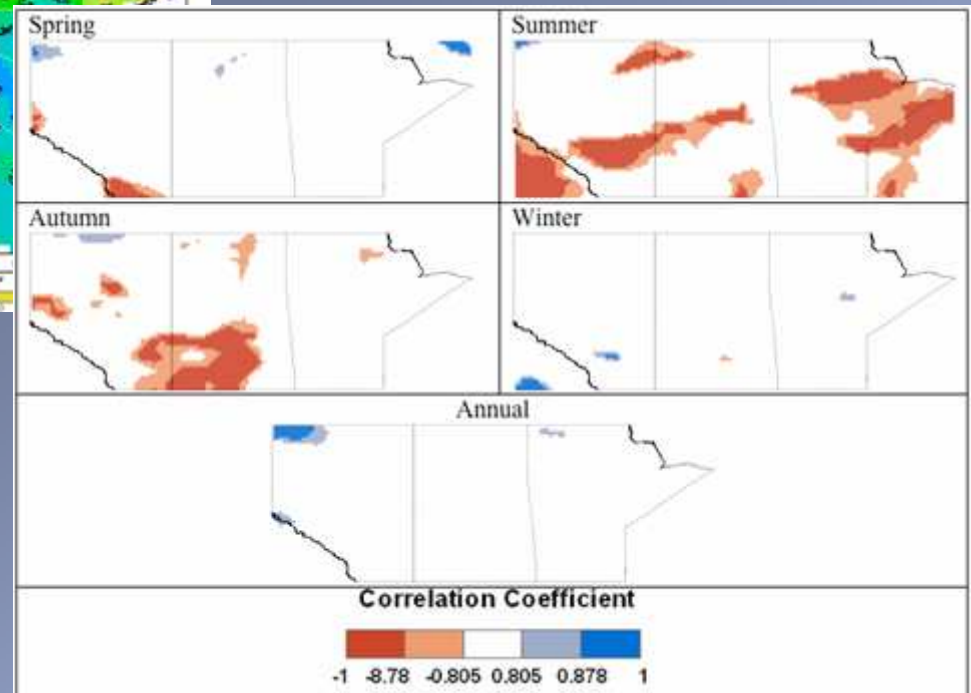
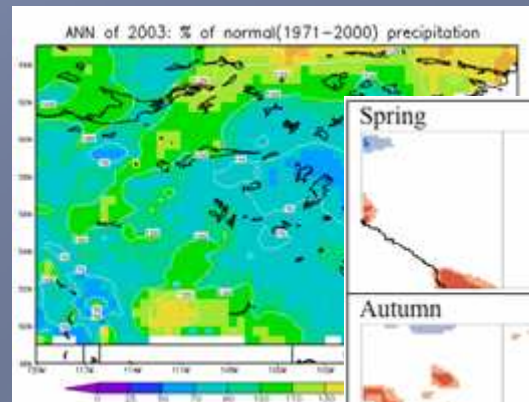
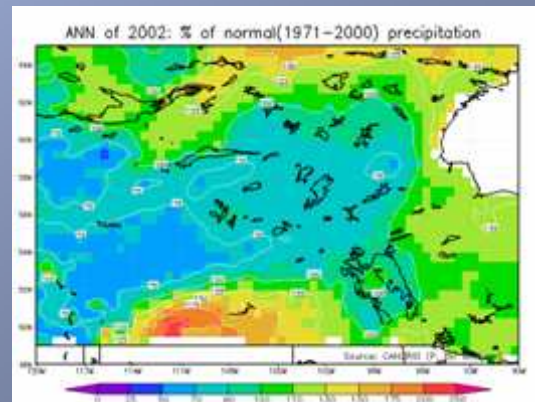
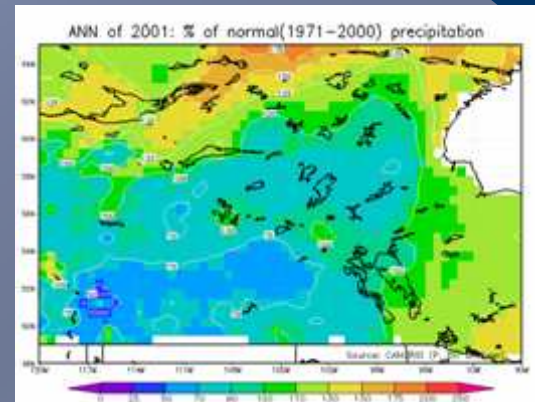
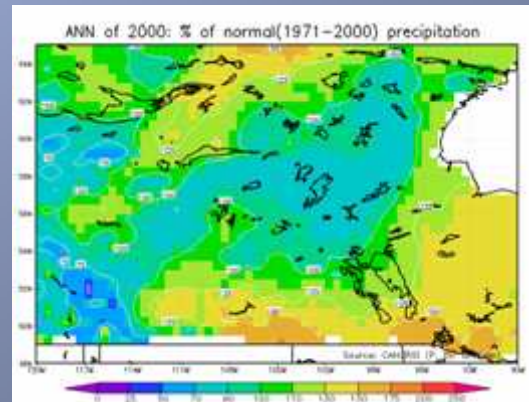
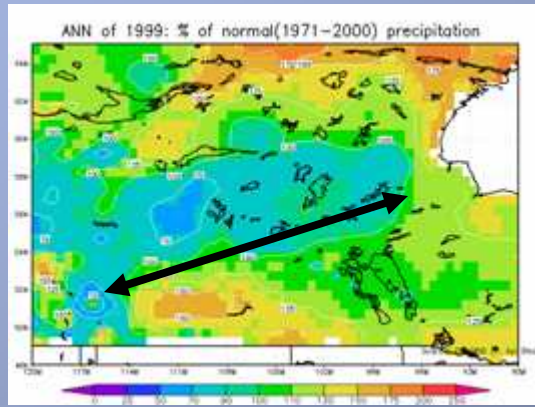
DRI Users Workshop
Winnipeg, MB Jan. 14, 2010

Research Questions of Theme 1

- Q1: What variables are required to quantify the characteristics of the recent drought?
- Q2: What data sources and model outputs are available for quantifying these parameters?
- Q3: How do we characterize and “close the budgets” of water and energy over the Prairies?
- Primary goal is to physically characterize the drought period through these 3 questions

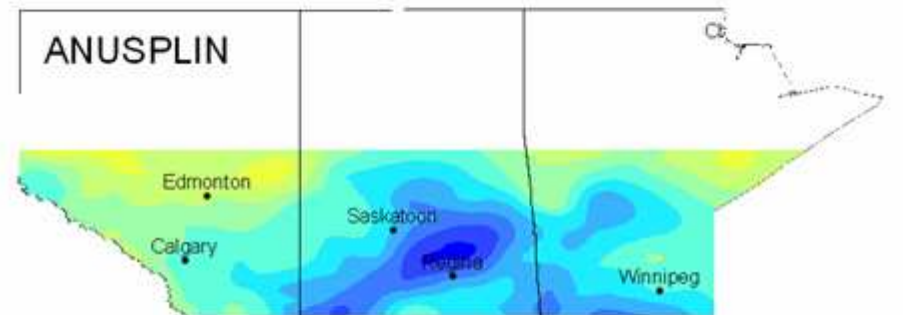
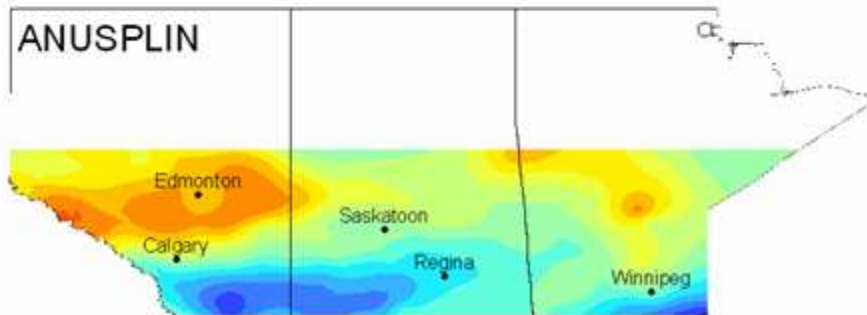
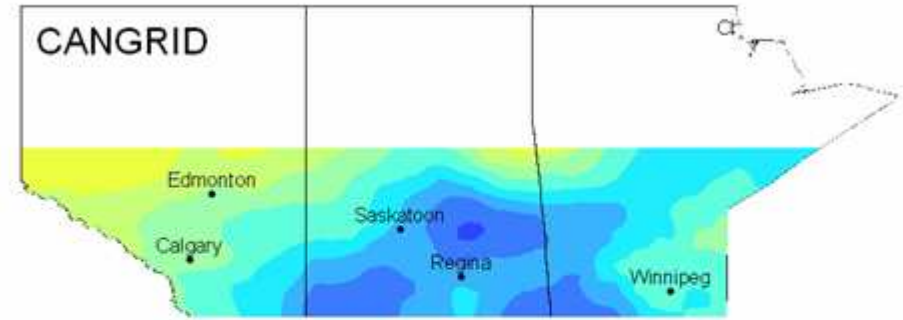
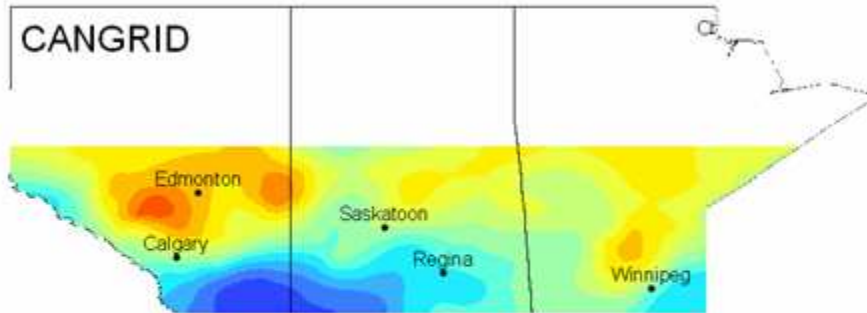


CanGrid Precipitation

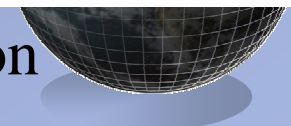
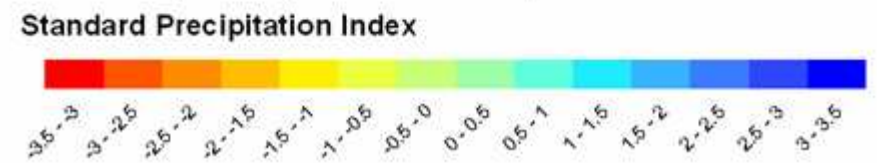
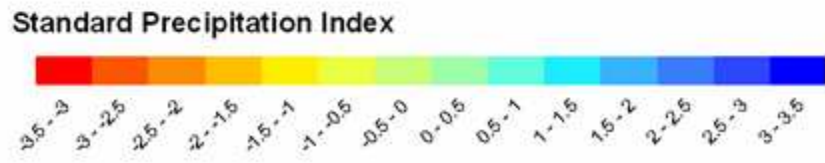


1-month SPI - June 2002

1-month SPI - August 2002



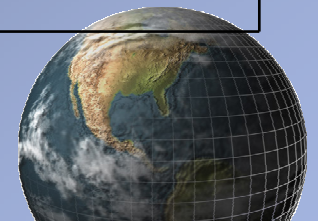
CRU **PFRA products are the only real-time sources**

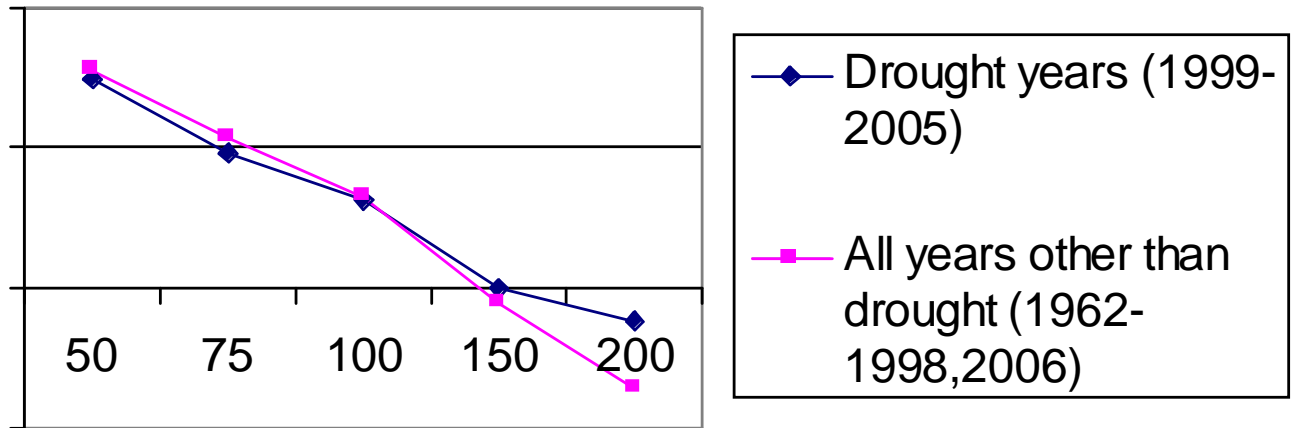


Averaged mean cloud amount anomaly and associated standard deviations from May to September for five moisture categories and for two periods: the satellite record (1984-2004); and the current drought study period, 1999-2004.

Moisture Category	1984 – 2004		09/1999 – 12/2004	
	Anomaly (%)	σ (%)	Anomaly (%)	σ (%)
Severe Drought	-5.9	6.6	-3.2	6.6
Mild Drought	-2.3	5.9	-0.2	5.5
Normal	0.0	5.6	1.6	5.2
Mild Wet	2.3	5.6	3.7	4.9
Severe Wet	4.3	5.4	4.5	4.9

Cloud anomaly for recent drought not as great as previous droughts



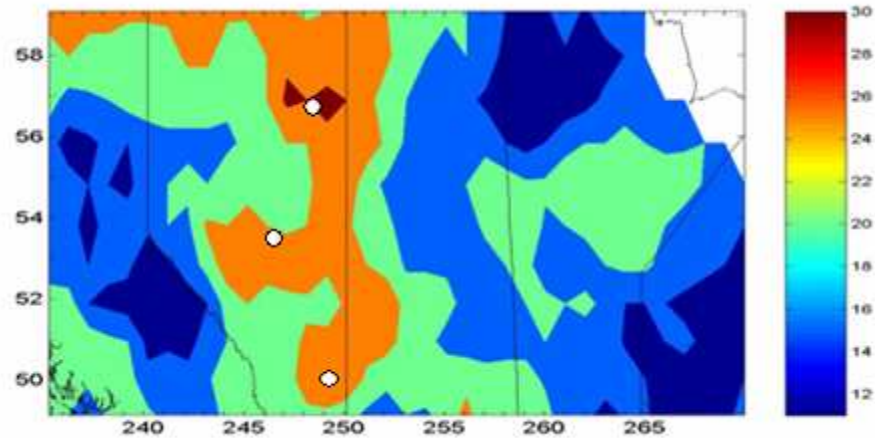


More extreme precipitation events during drought

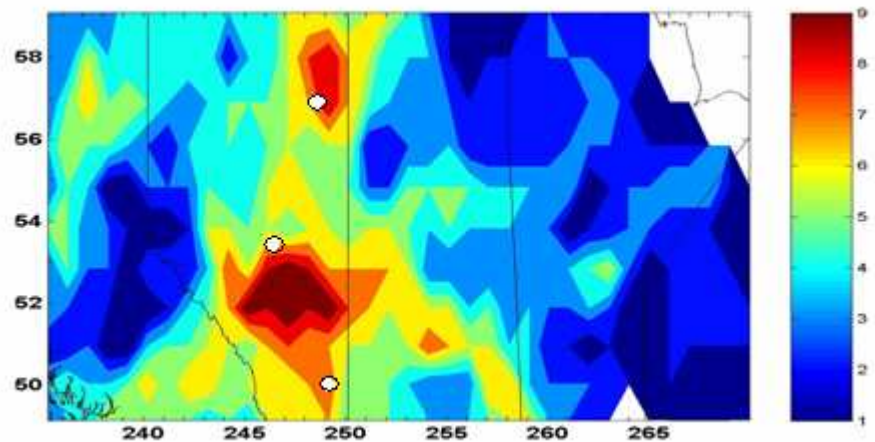


Henson, Stewart

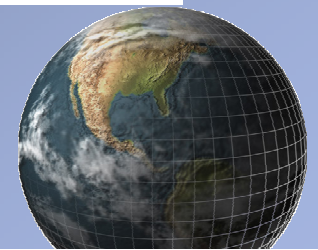
Number of months that experienced (a) drought ($SPI \leq -0.5$) and (b) severe drought ($SPI \leq -1.5$) from September 1999 - December 2004. The white points indicate, from north to south, the locations of Fort McMurray, Edmonton and Medicine Hat.

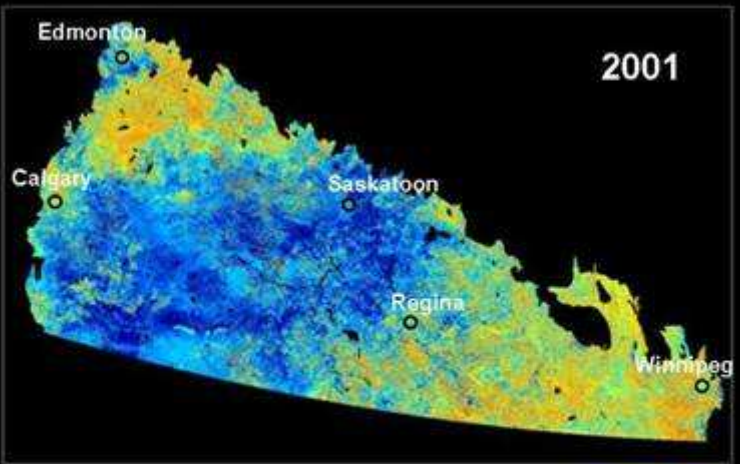
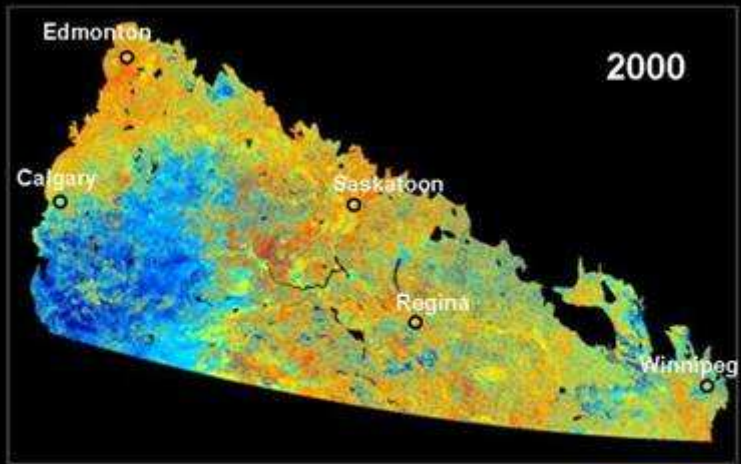


$SPI \leq -0.5$

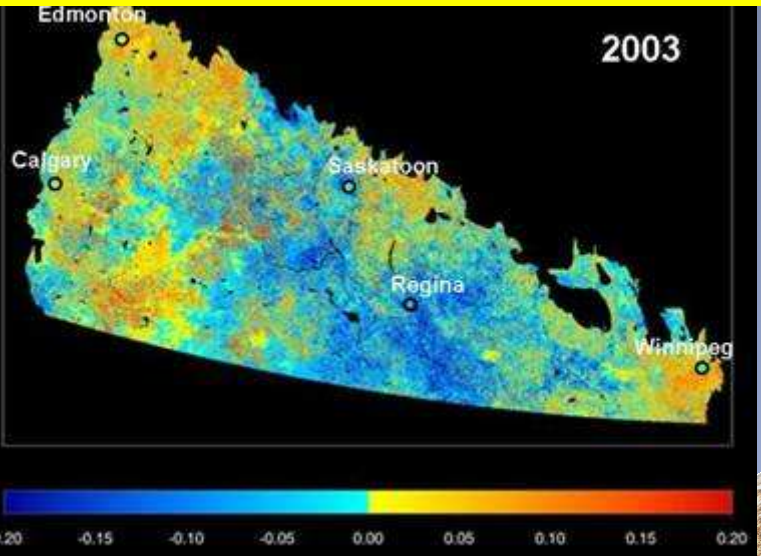
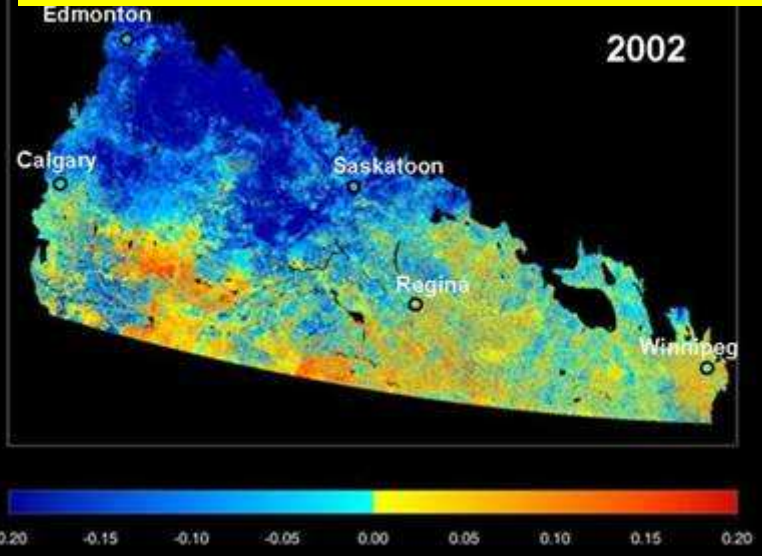


$SPI \leq -1.5$





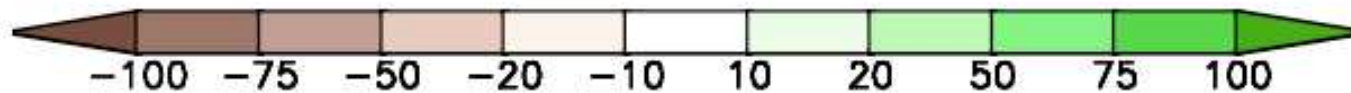
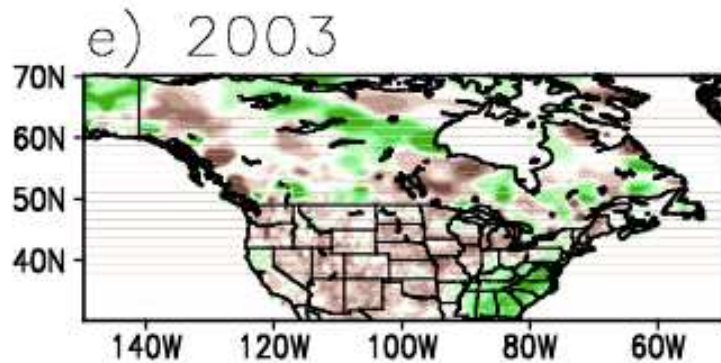
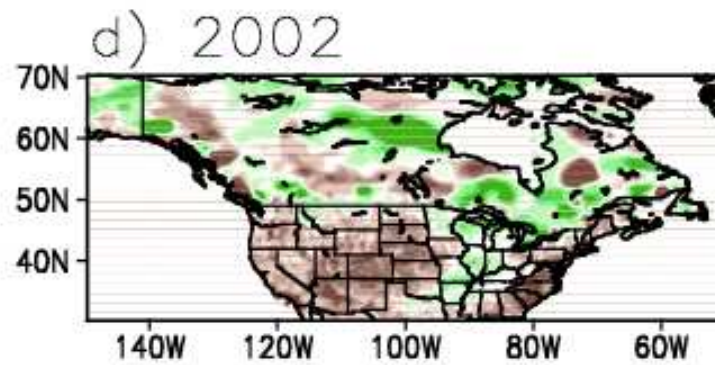
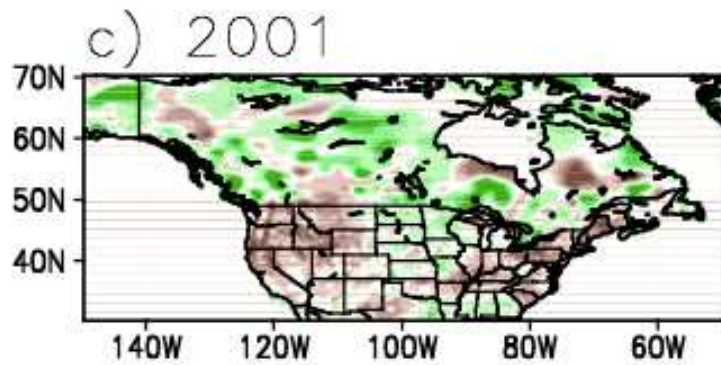
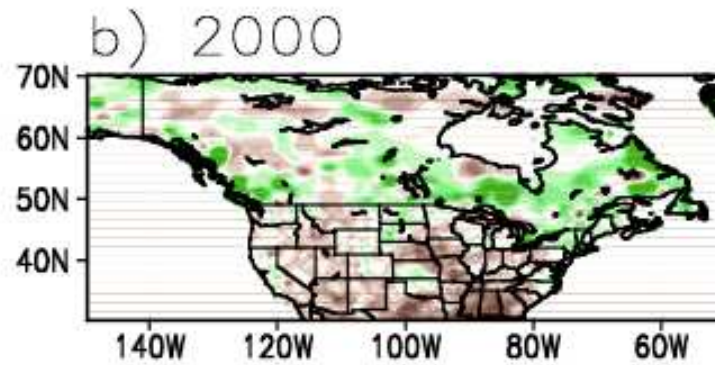
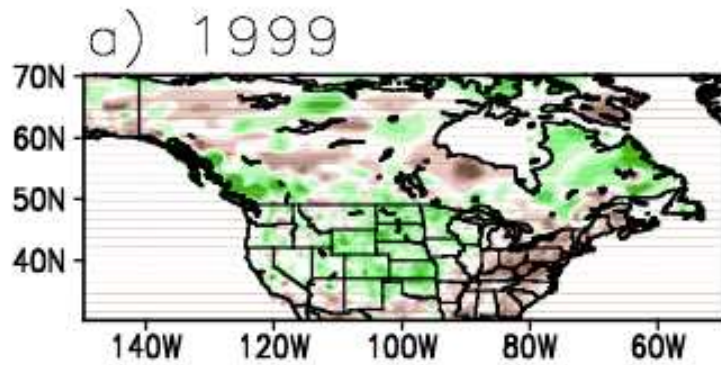
NDVI at <http://www26.statcan.ca/ccap/map.jsf?lang=en>
 VTI and VHI at http://www.star.nesdis.noaa.gov/smcd/emb/vci/VH/vh_currentImage.php



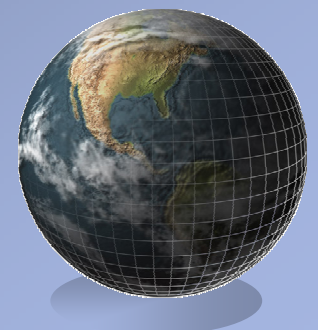
NDVI anomalies (based on 2000-08 mean) for 2000-2003
 250m spatial resolution for 10-day period of July 11-20

Yang, Wang, Trishchenko

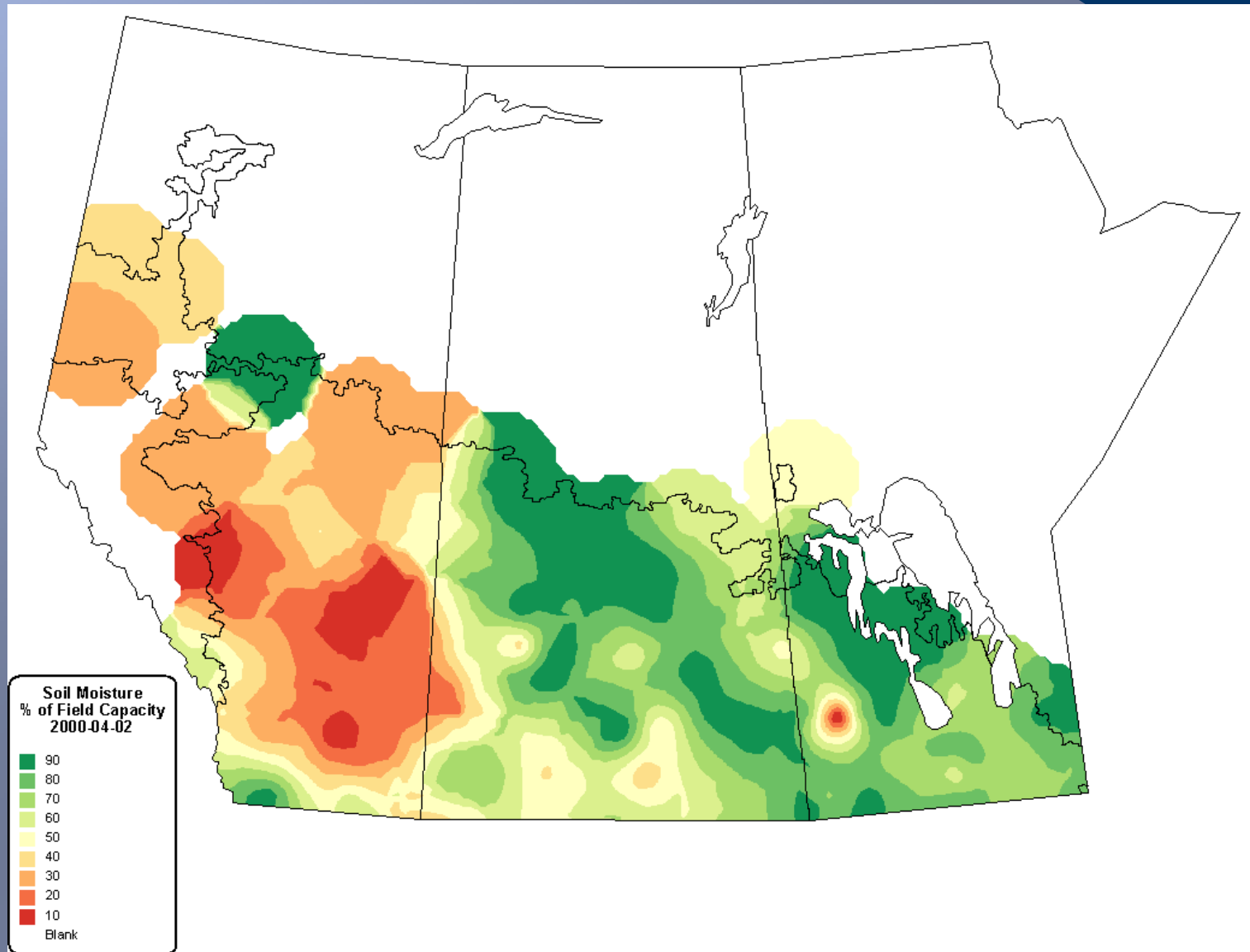




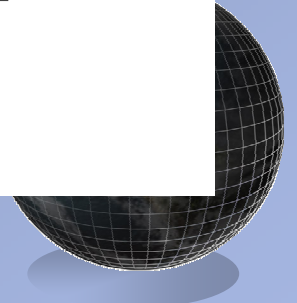
Shabbar



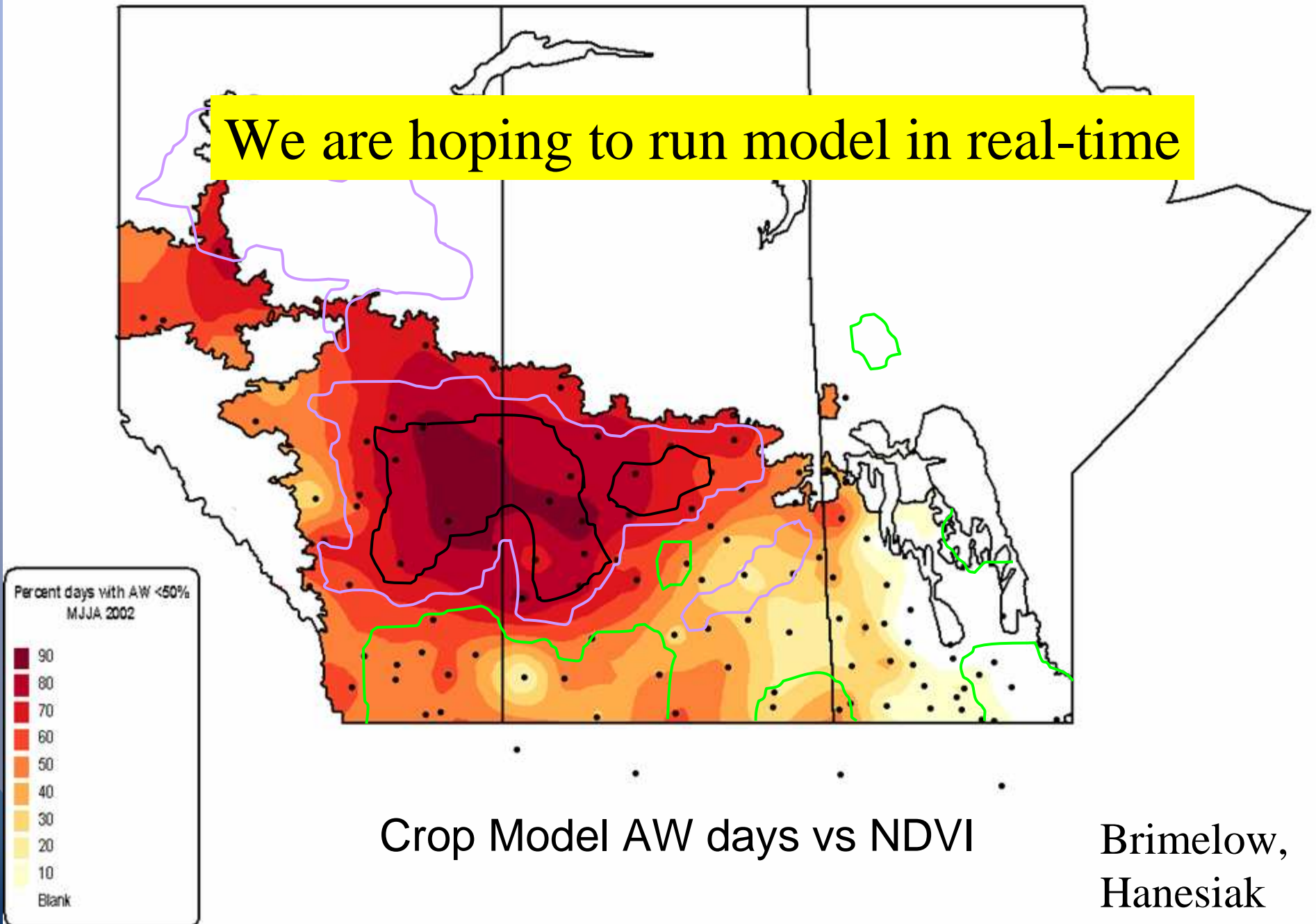
Soil Moisture (crop root-zone)



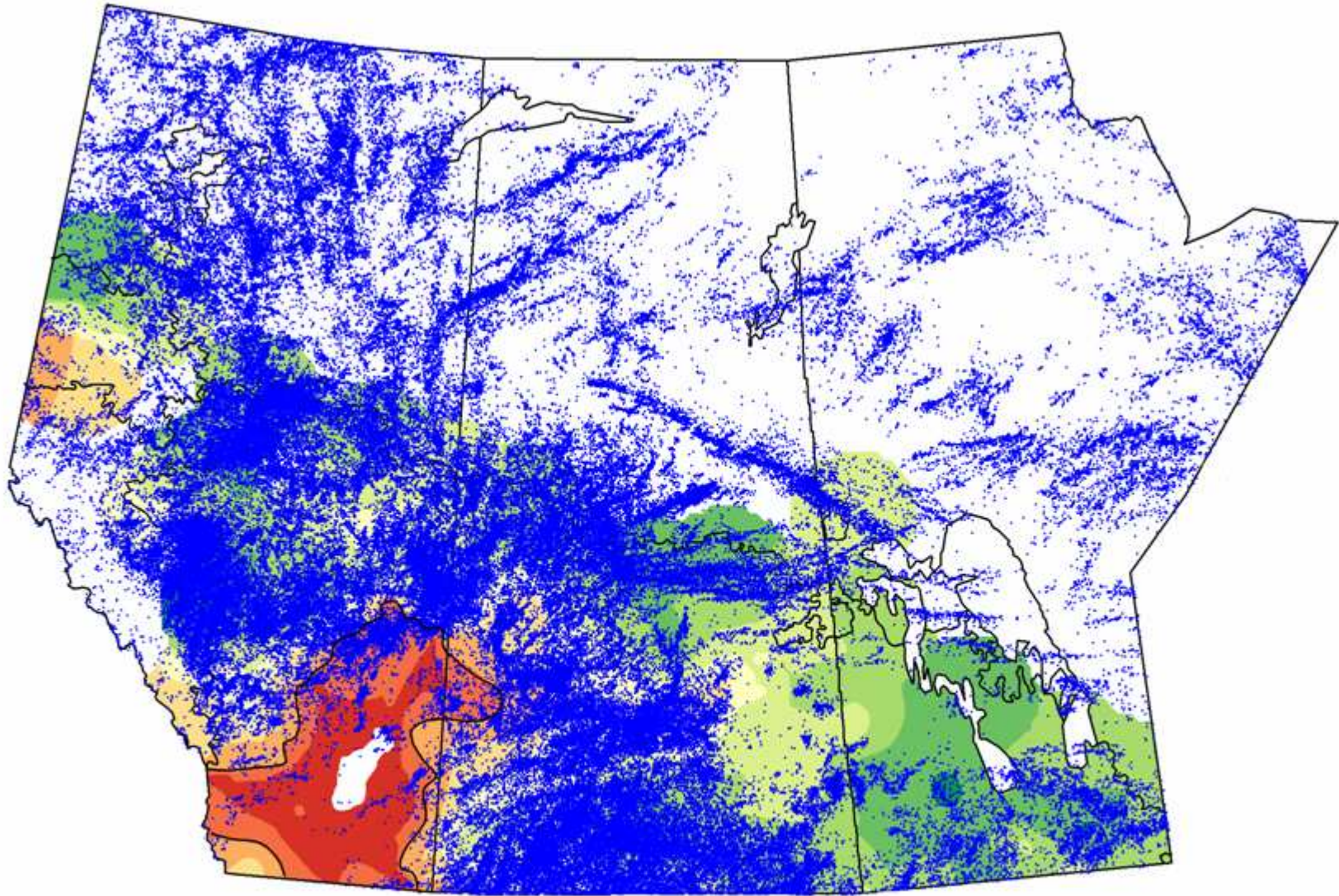
Brimelow, Hanesiak



We are hoping to run model in real-time



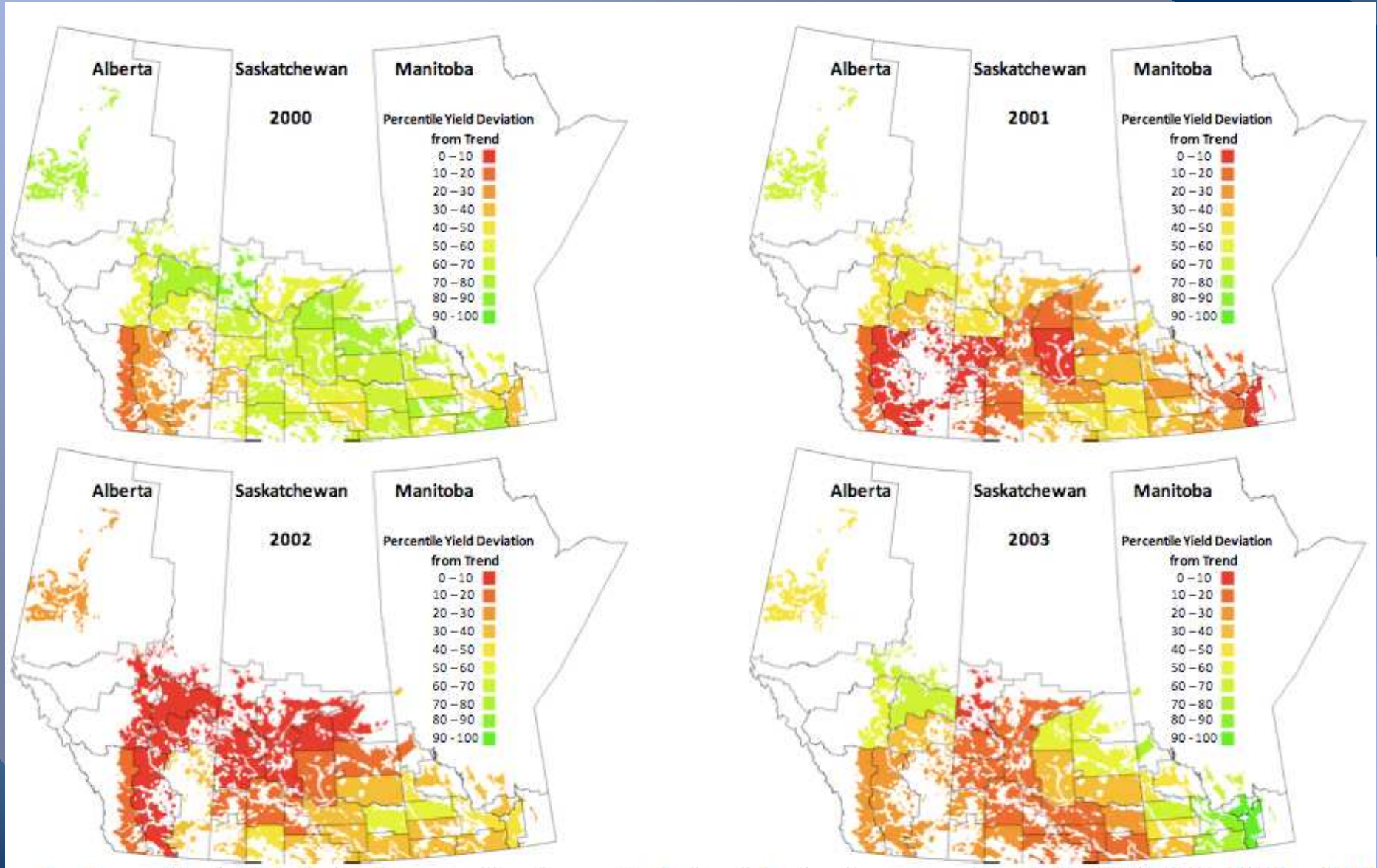
July 2000 Soil Moisture and Lightning



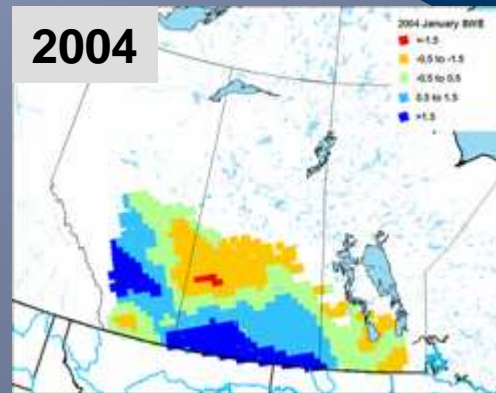
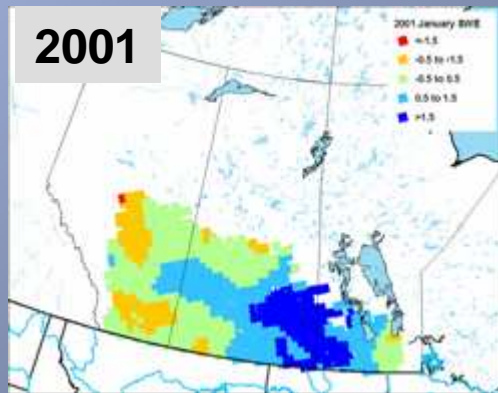
Brimelow, Hanesiak, Kusyk

Crop Yields

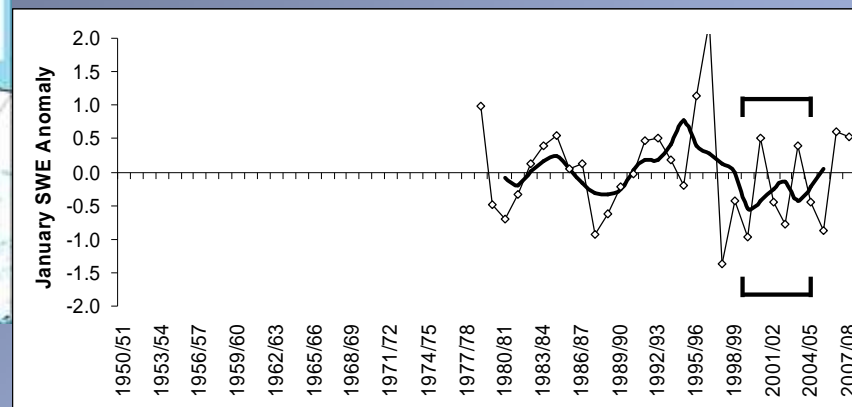
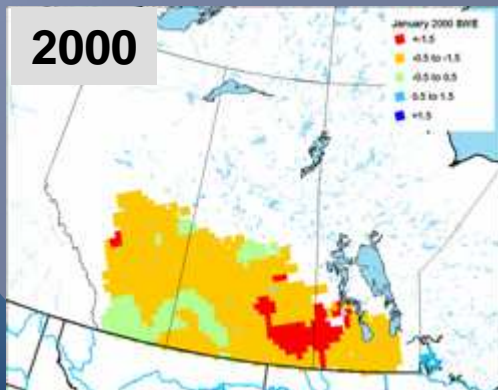
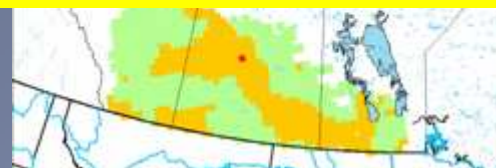
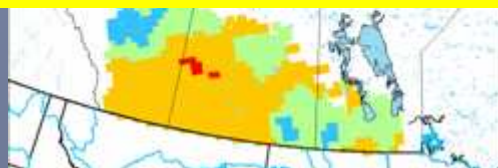
Bullock

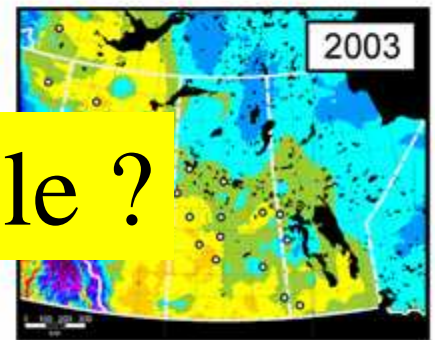
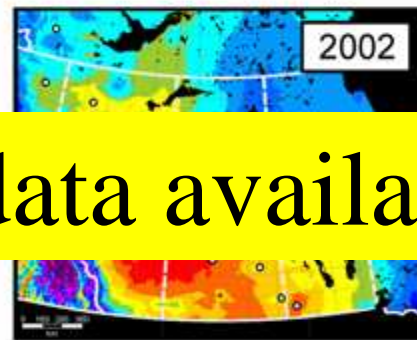
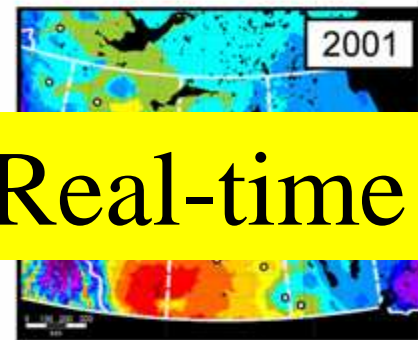
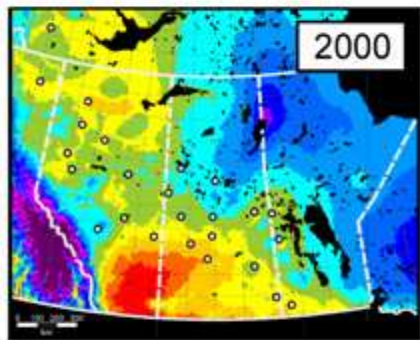
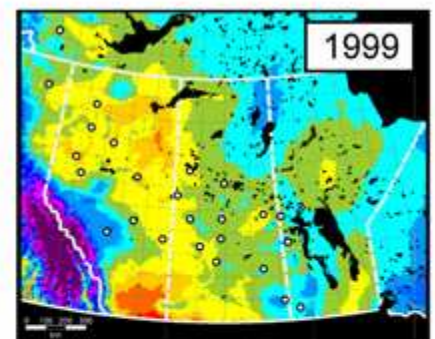
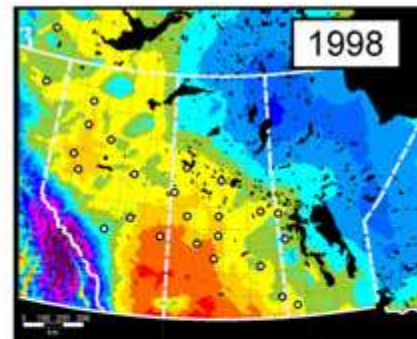
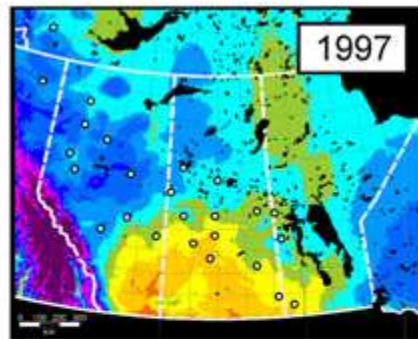
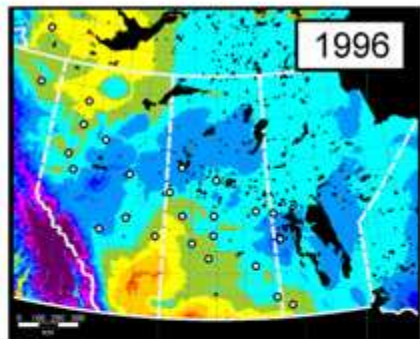


Passive Microwave Derived SWE

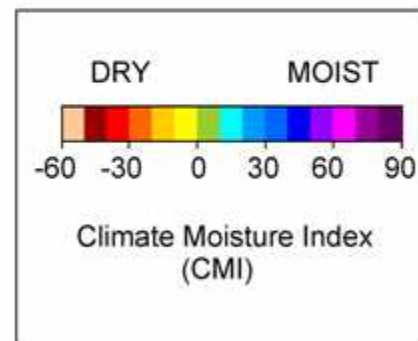
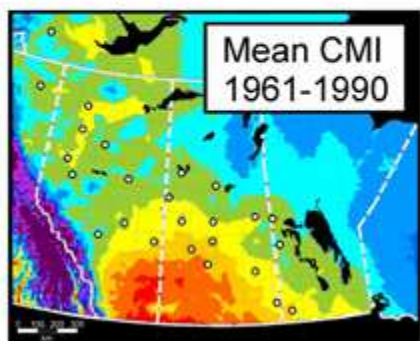


http://www.ccin.ca/CMS%20FTP%20Data/snow/swe/snow_swe.html



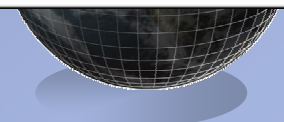


Real-time data available ?



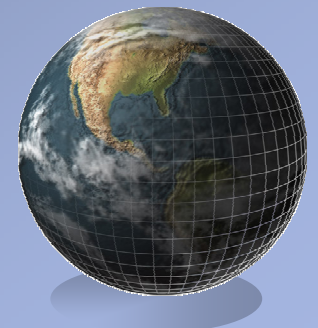
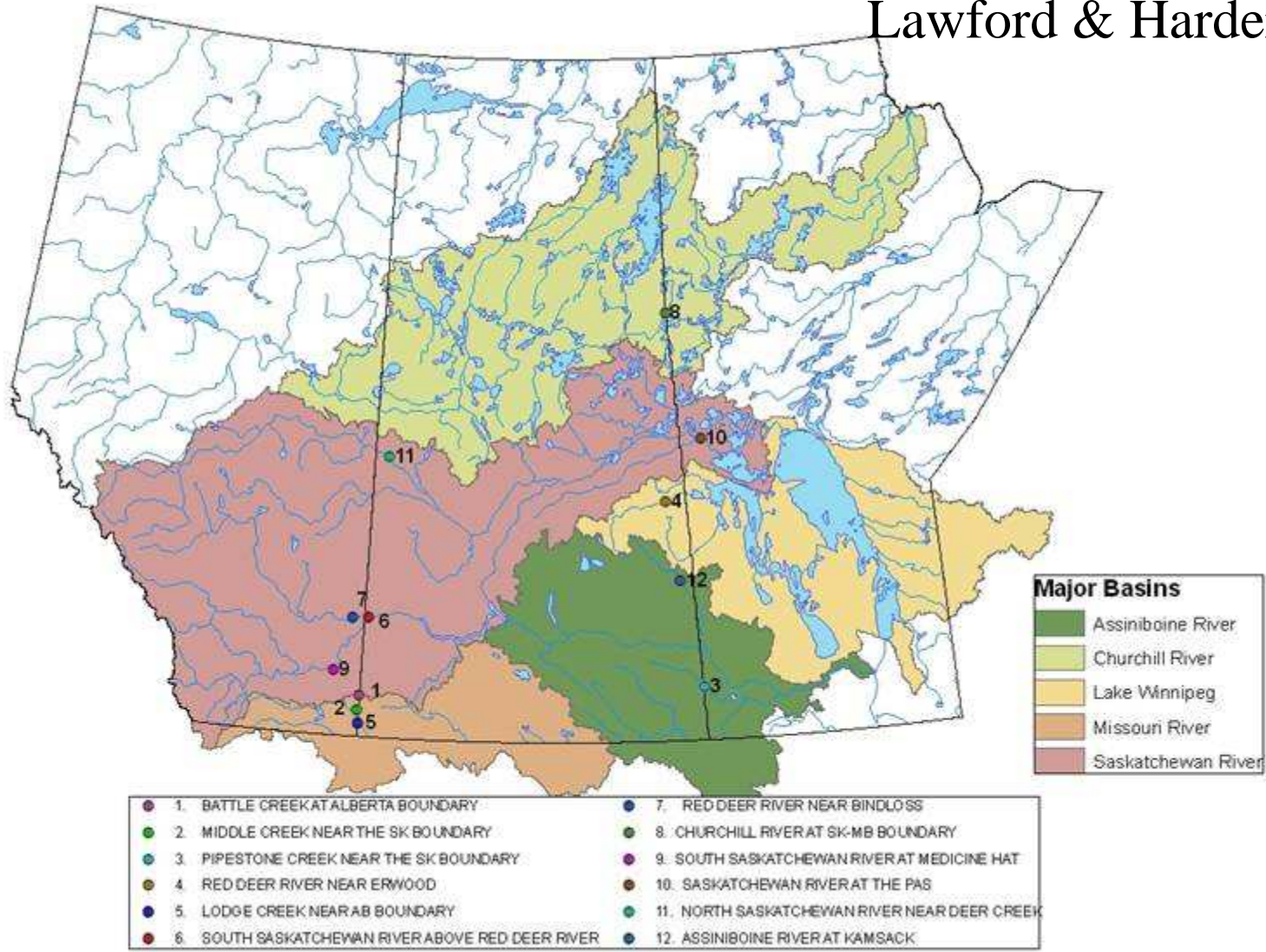
Maps by D.T. Price, M. Siltanen & D. McKenney
from Canadian gridded monthly climate
(interpolations based on ANUSPLIN)

Hogg



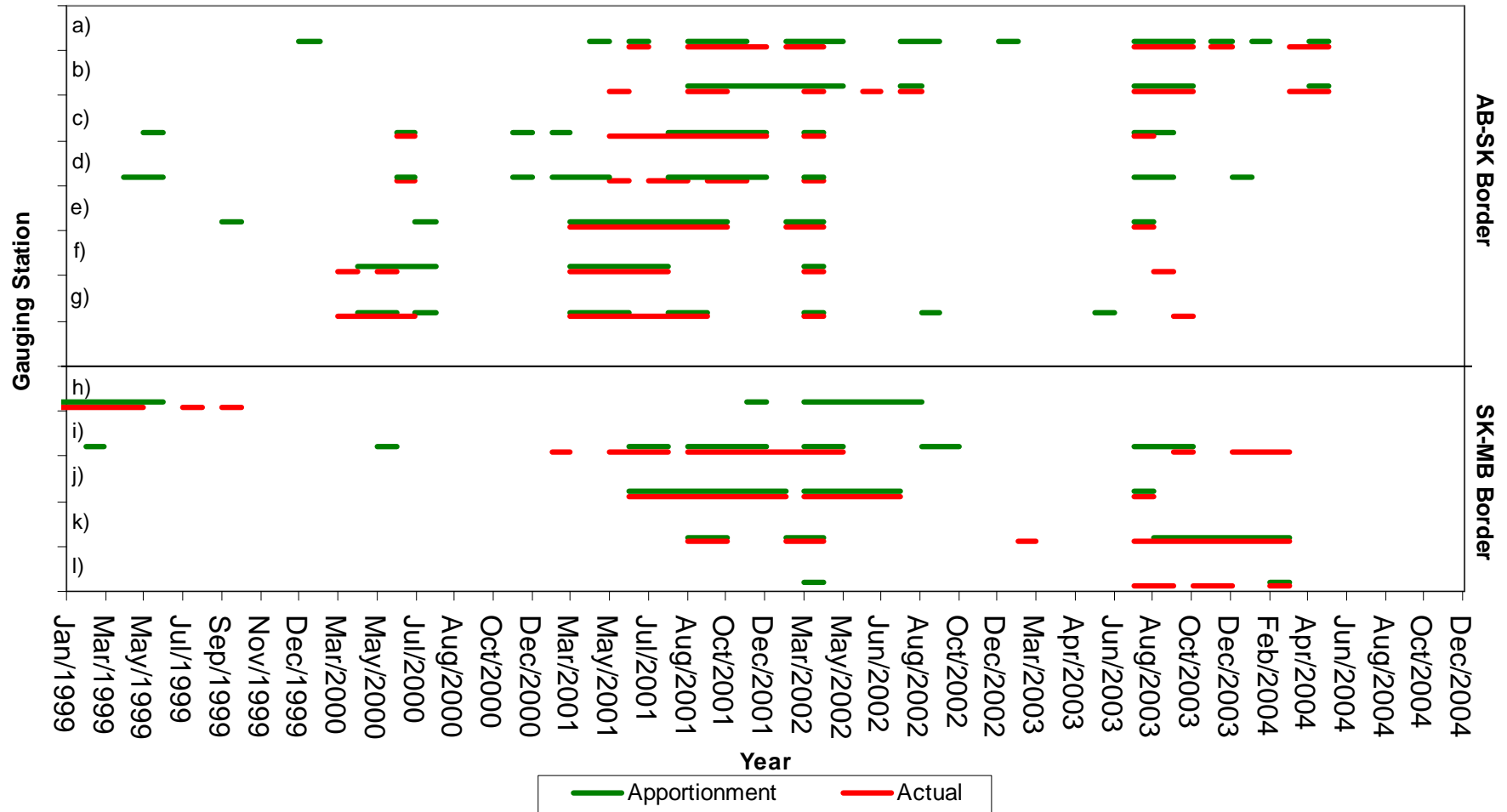
Surface Hydrology

Lawford & Harder



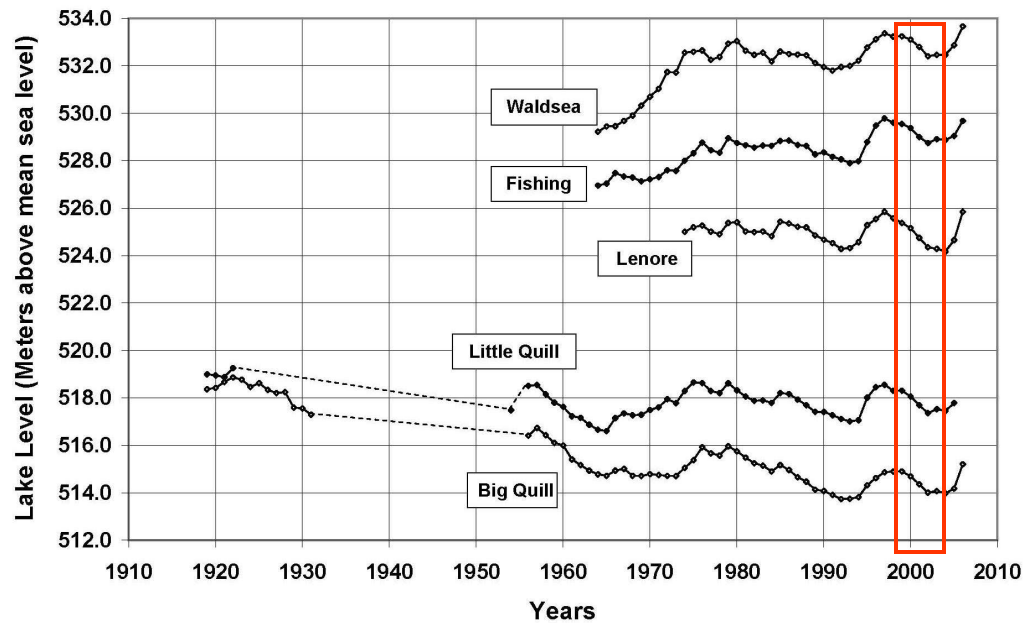
Surface Hydrology

Actual and Apportionment Streamflow Drought Occurrence at Provincial Boundaries

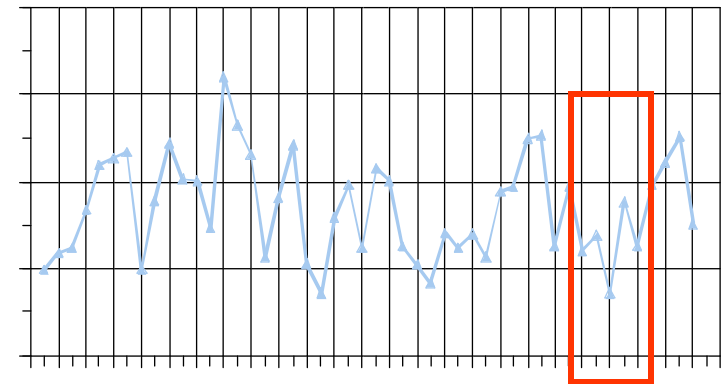


Gauging Stations: a) North Saskatchewan at Border, b) Red Deer at Bindloss, c) South Saskatchewan below Red Deer, d) South Saskatchewan at Medicine Hat, e) Battle Creek at Border, f) Lodge Creek at Border, g) Middle Creek at Border, h) Churchill River at the Border, i) Saskatchewan at The Pas, j) Red Deer near Erwood, k) Assiniboine at Kamsack and l) Pipestone Creek.

Lakes and Ponds



Number of Ponds in the Canadian prairie region - spring pond counts 1961 -2008 (thousands)



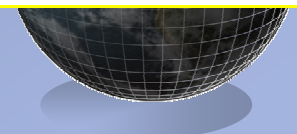
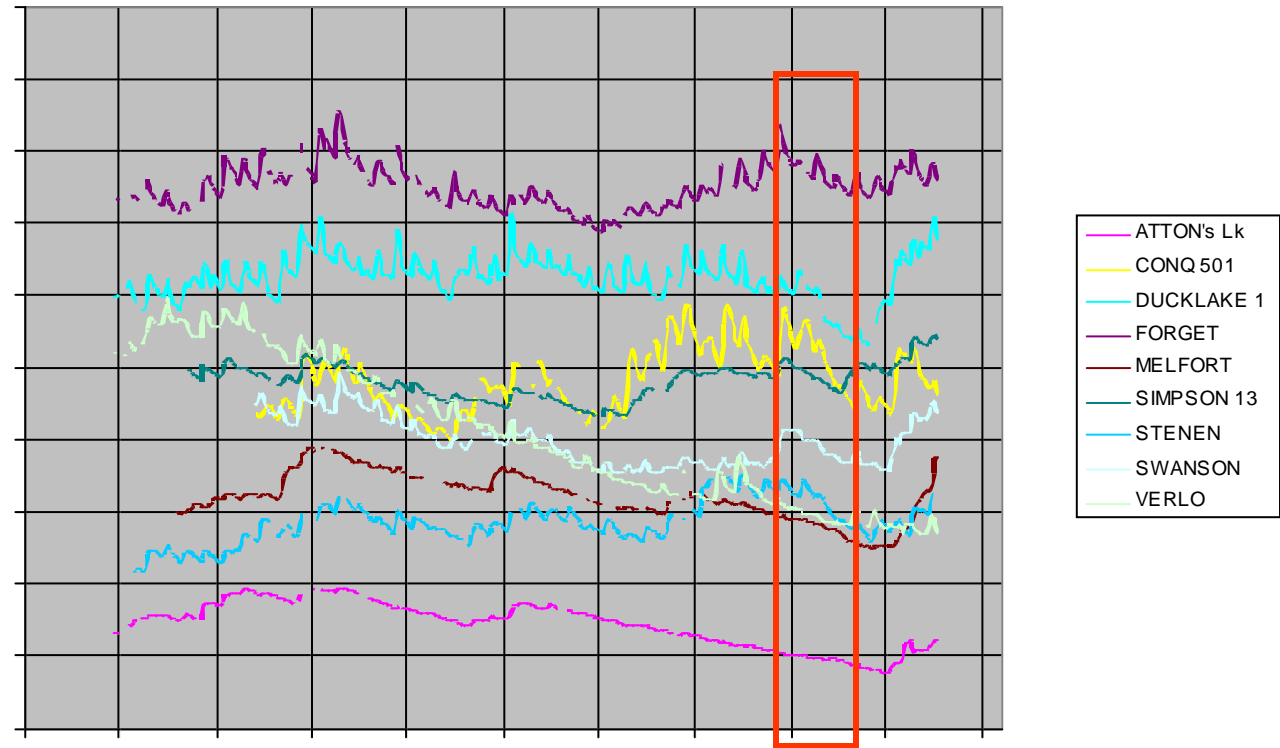
Van der Kamp

(Source: USFWS/CWS)

Year

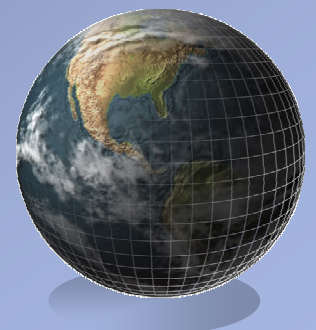
Shallow SK wells

Shallow observation wells in SK Š water level records 1964 -2007:
water table depths below ground level (m)



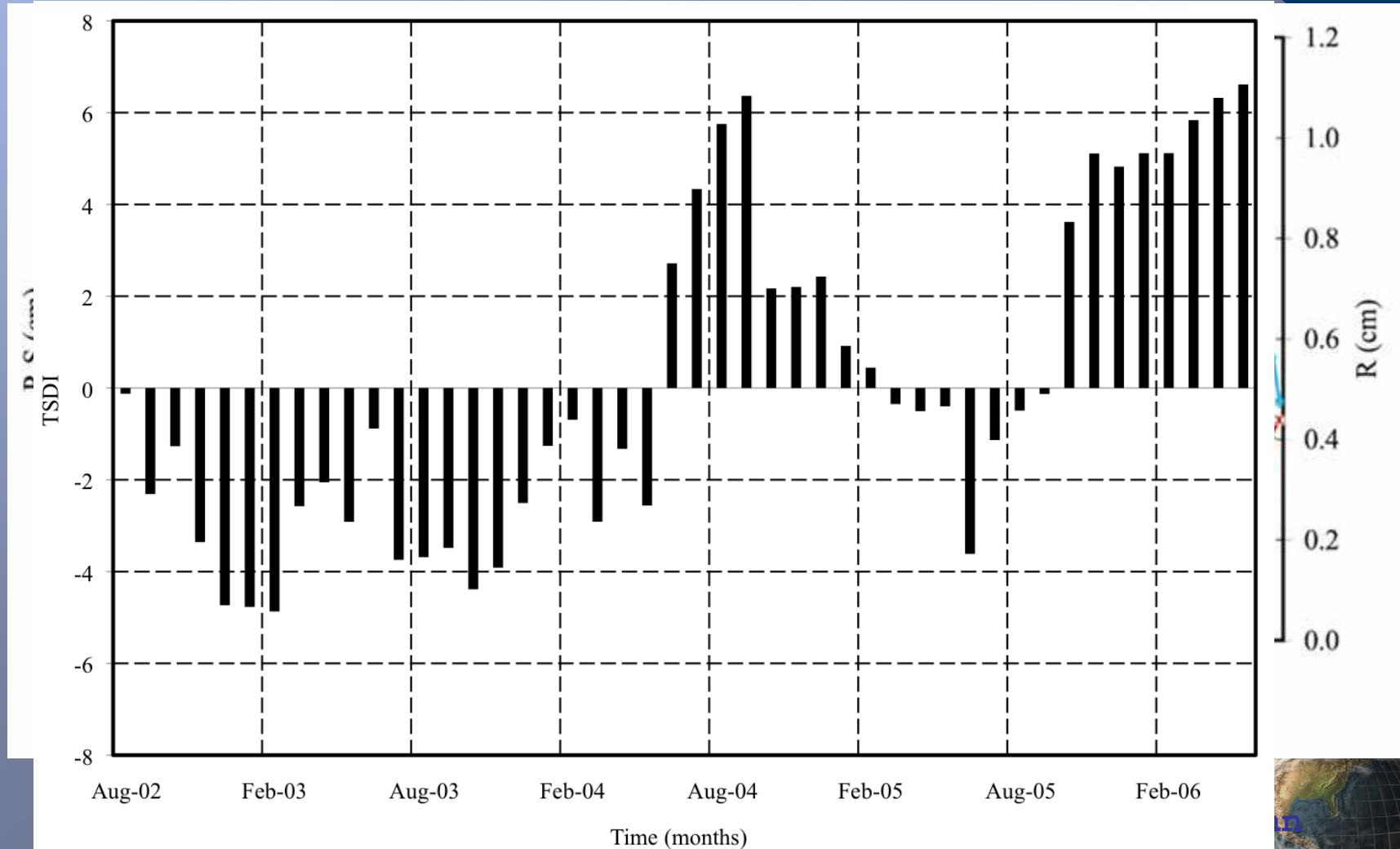
Surface Hydrology

- Modeling
 - MEC/MESH
 - Environment Canada / NHRI / HAL
 - Plans for operational use?

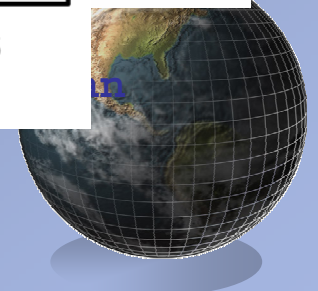


SRB Hydrology & GRACE

Yirdaw & Snelgrove



Real-Time monthly data available



Continued Theme 1 Work

Characterization of Drought

- journal article submission late summer 2010?
- synthesis and cohesion of drought spatial and temporal aspects (i.e. tie together atmospheric, surface hydrology and ground water)

