

Canadian Prairie Snow Cover Variability

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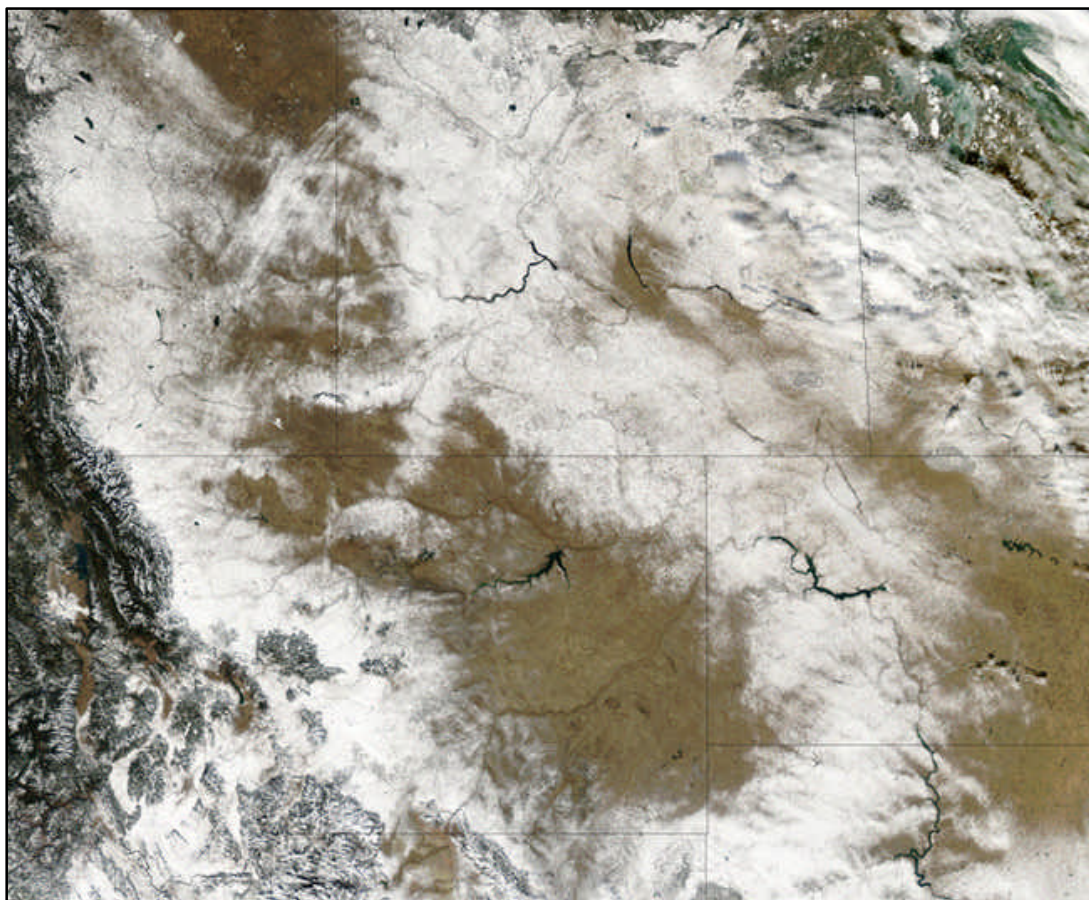
Climate Research Division

Environment Canada

Ongoing Activities:

📄 **Snow Cover Variability
and Links to Atmospheric
Circulation/Regional Climate
Modeling**

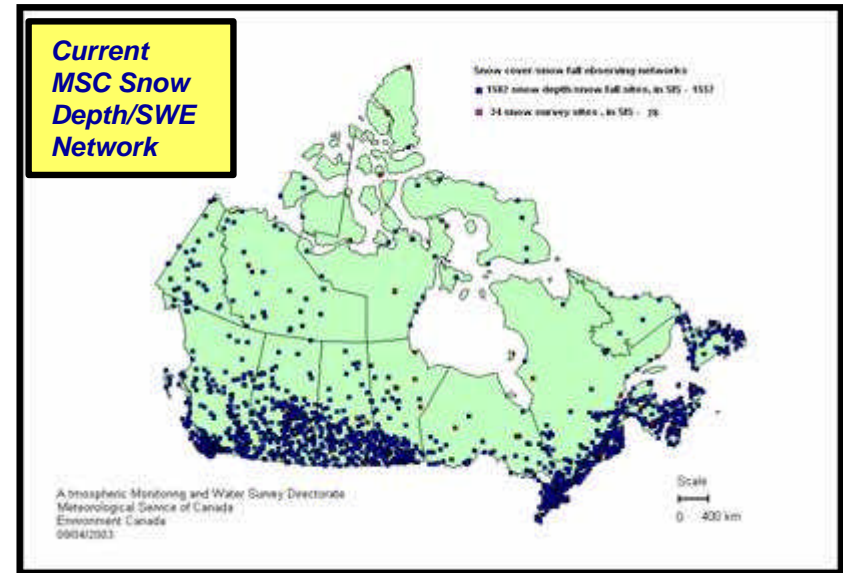
📄 **Near Real Time SWE
Monitoring: Passive
Microwave Data/Algorithm
Enhancements**



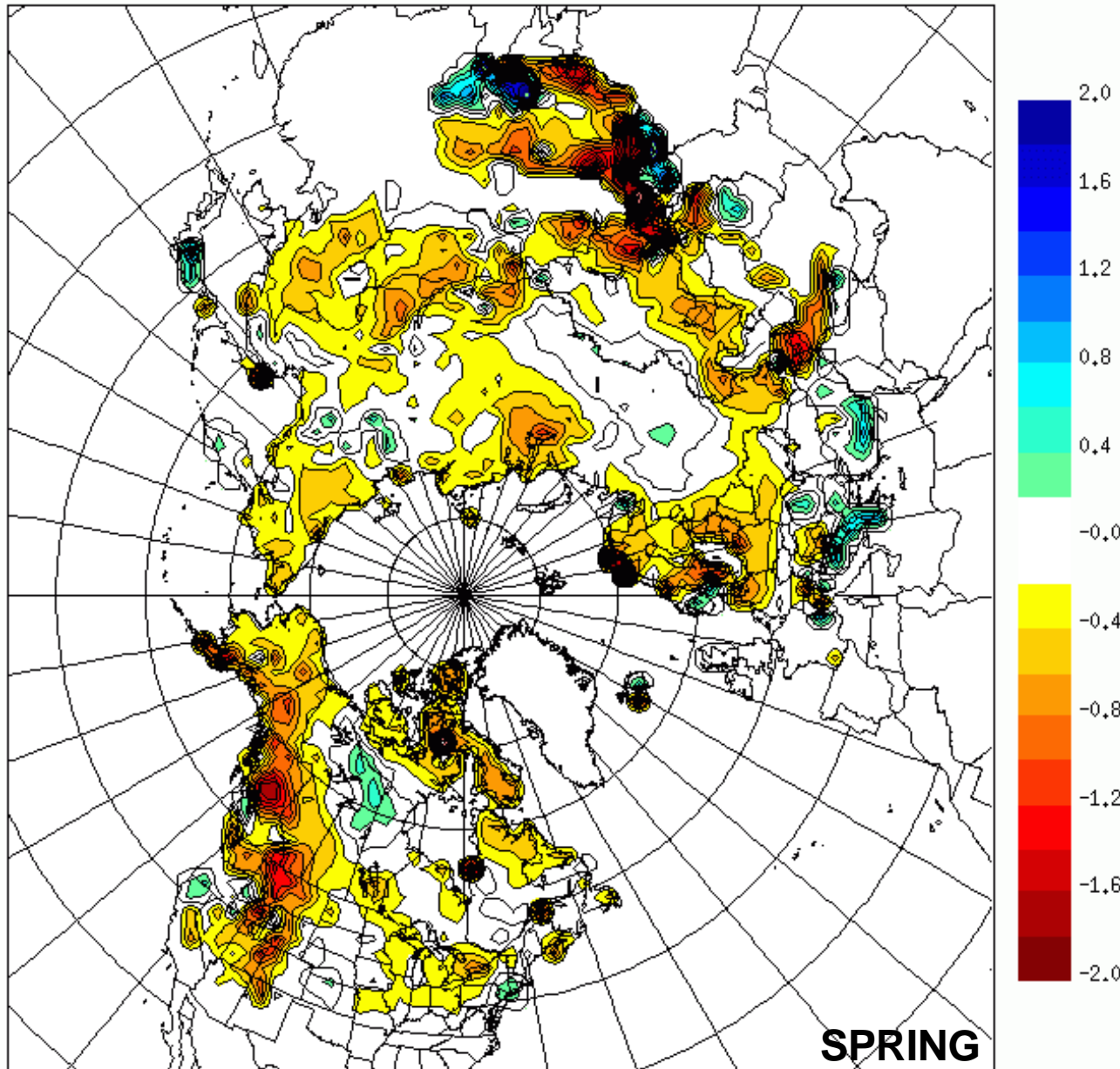
Environment Environnement
Canada Canada

Snow Cover and Drought

- ✍ Insulating layer between soil/surface vegetation and the boundary layer.
- ✍ Melt release for surface, soil, and groundwater recharge.
- ✍ Potential impact as a drought amplifier/contribution as a drought breaker.
- ✍ Synoptic scale influences on overlying air masses.
- ✍ Low-frequency interactions with atmospheric circulation (i.e. ENSO; PNA).



Observed change (days/yr) in snow cover duration from the NOAA weekly satellite product, 1966 to 2004



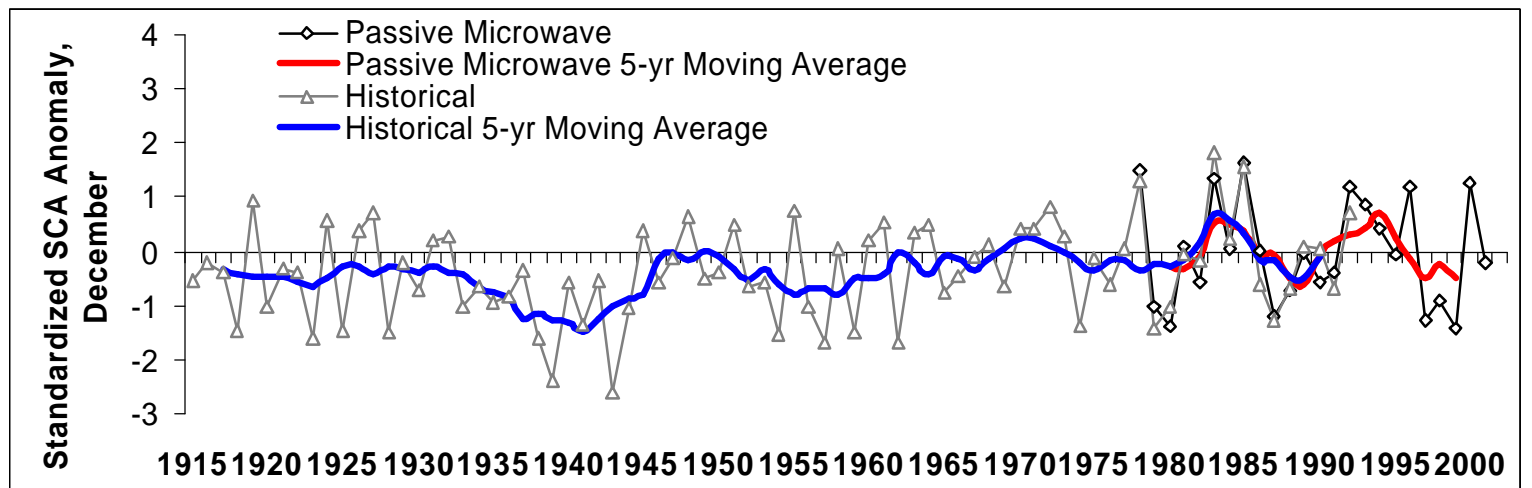
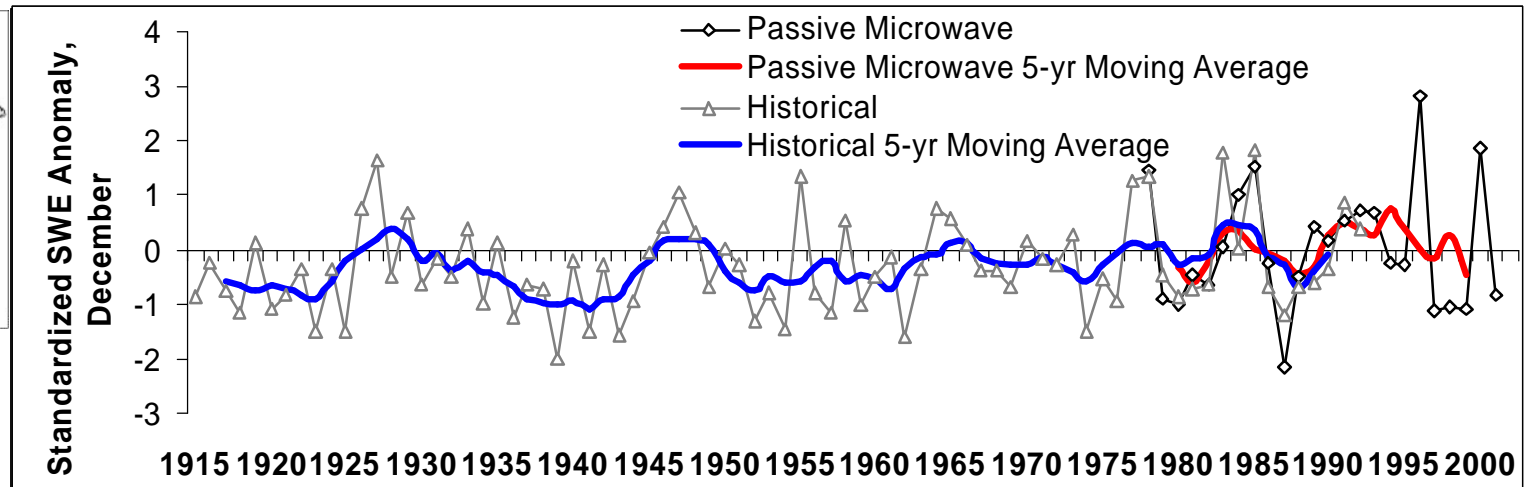
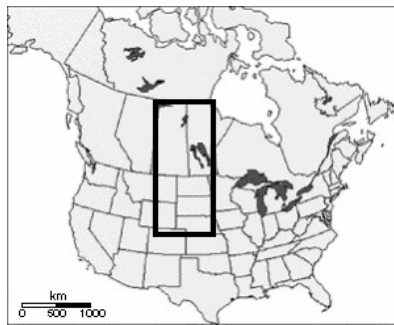
✍ Fall data suggest a slight advance in the start date of snow cover.

✍ Spring data show a shortened snow cover duration across the Canadian prairies.

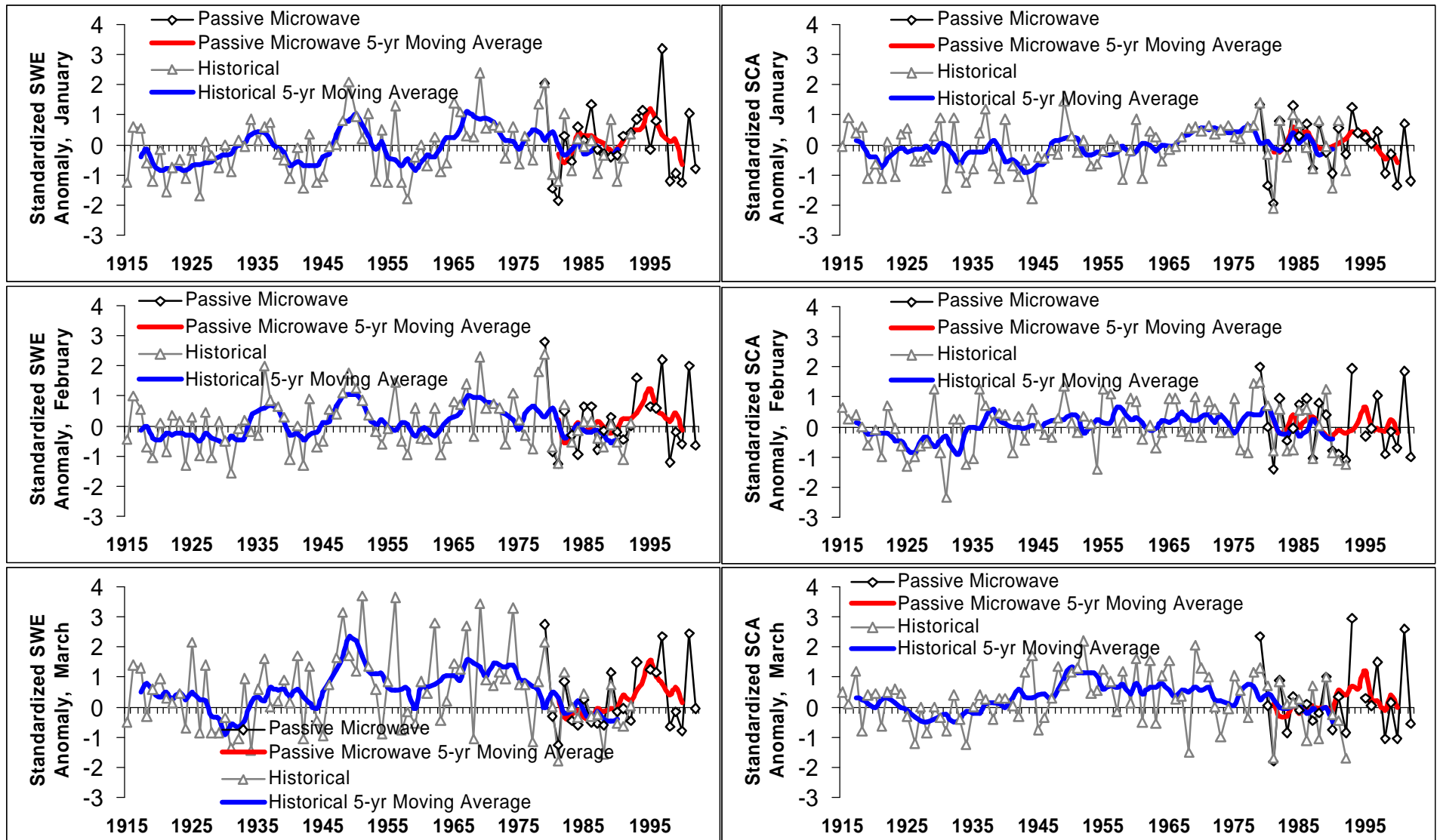
Merging Passive Microwave and Conventional Data Records

✈ Brown (J. Climate, 2000) produced a gridded snow extent and water equivalent dataset for North America from historical conventional observations (1915-1992).

✈ Strong agreement with the passive microwave time series was exhibited for the 1978-1992 overlap period, allowing the satellite record to be viewed within the context of a longer dataset.



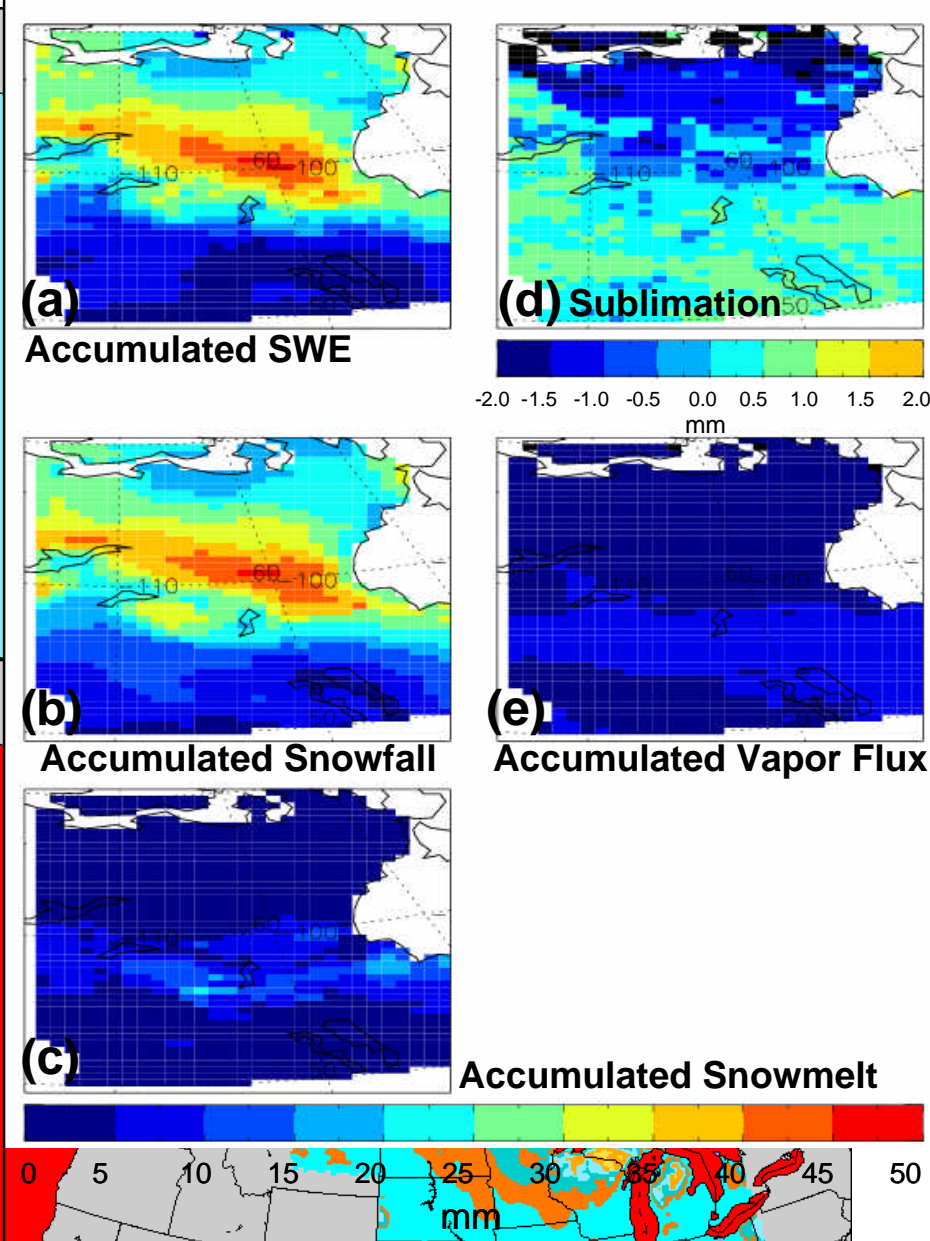
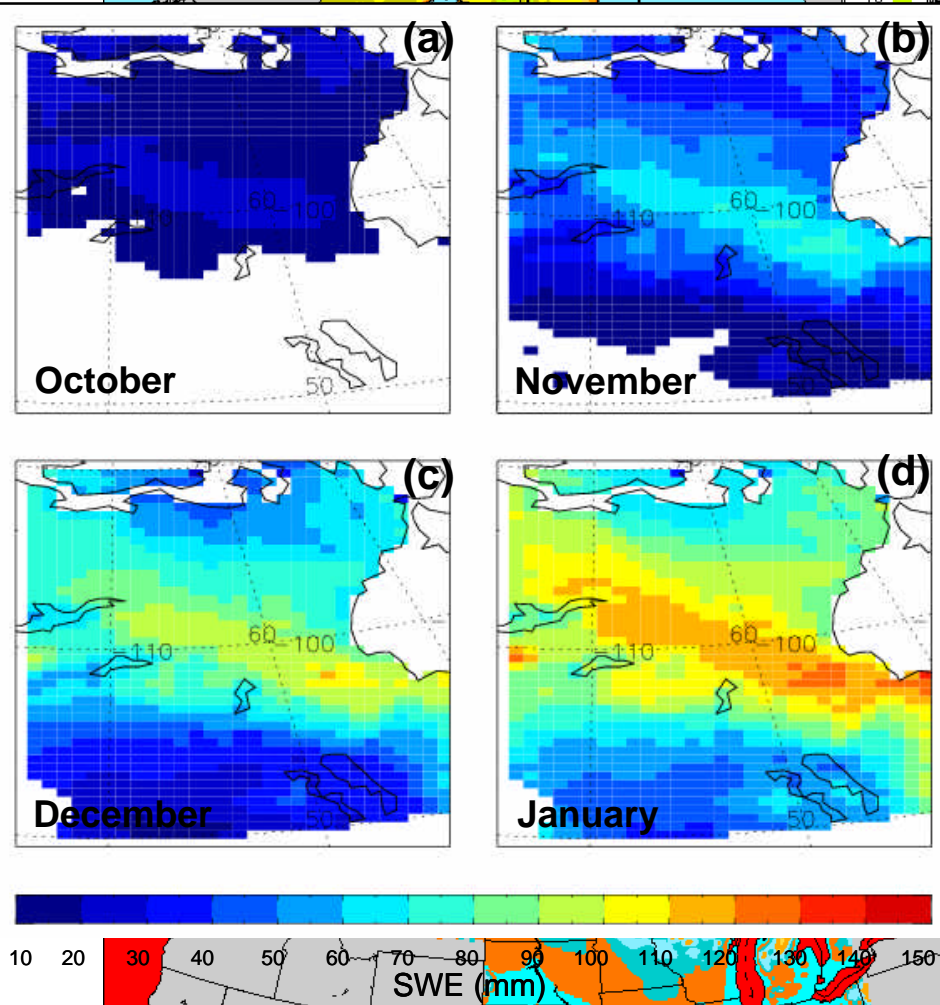
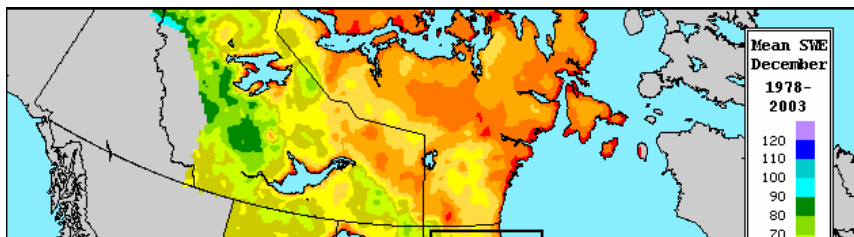
Merging Passive Microwave and Conventional Data Records



✈ Anomalies during the passive microwave era are not more extreme than those in the historical record.

✈ Linear trend analysis provided no evidence of any significant long term trends in either SCA or SWE over the December-March period, but there is a significant periodicity in the SWE record.

Regional Climate Model Simulations



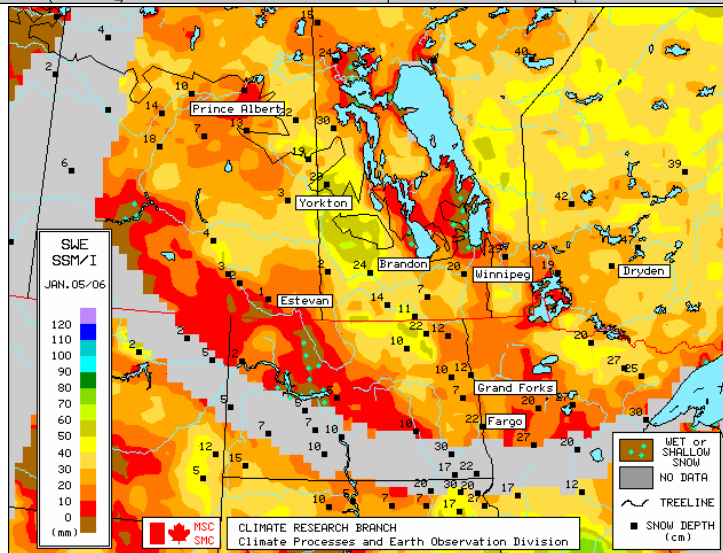
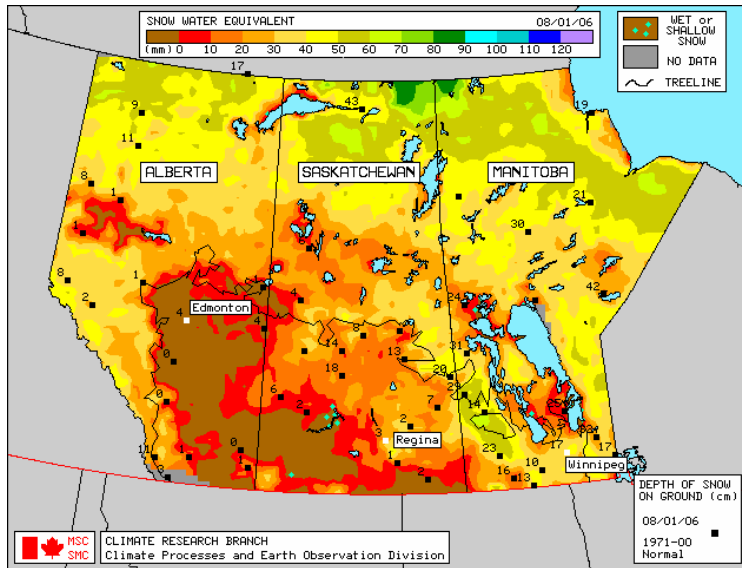
SWE **Water Budget Computations**

Regional SSM/I SWE Products

Canadian Prairies

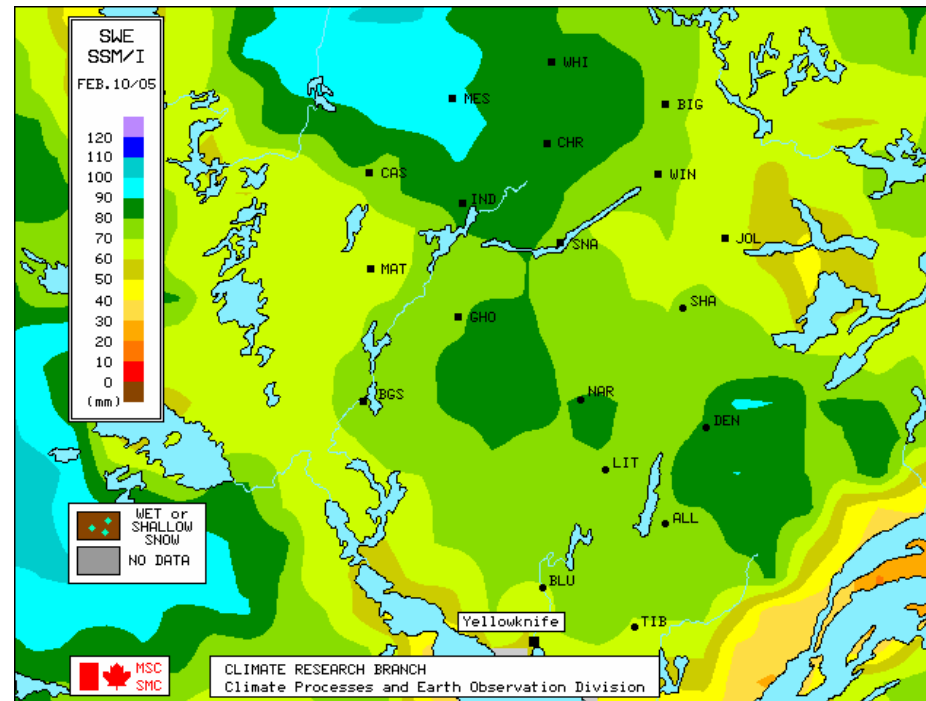
- weekly maps produced and sent to users (federal, provincial agencies, private industry) who have a requirement for regular monitoring of snow cover in western Canada

- available to public on www.socc.ca (State of Canadian Cryosphere)



Manitoba – Red River watershed

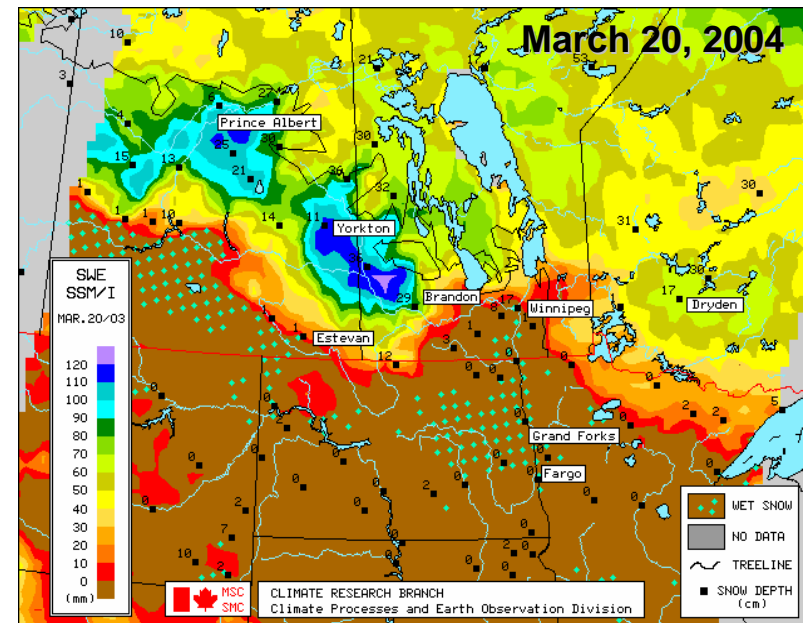
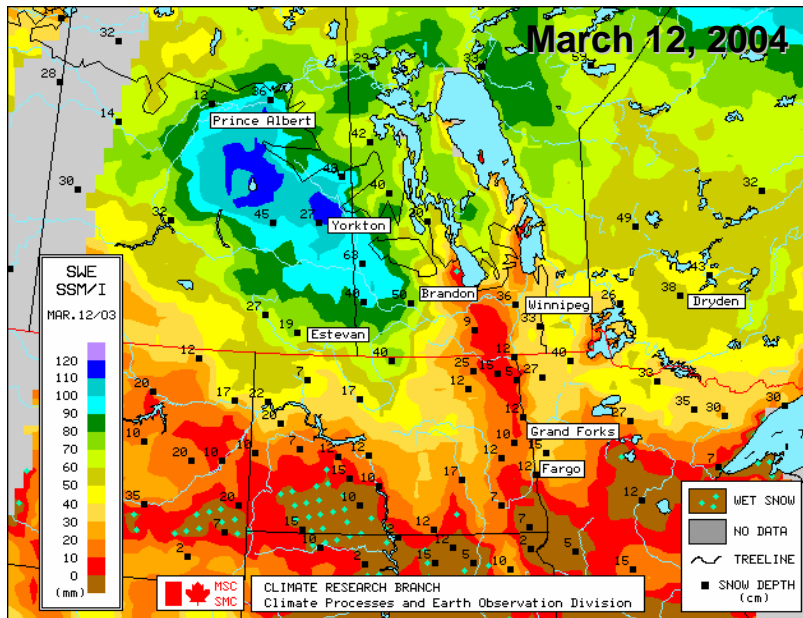
- specialized maps sent to provincial water resource agencies focussed on priority river basins for forecasting spring runoff and flood risk



Snare River Basin – NWT

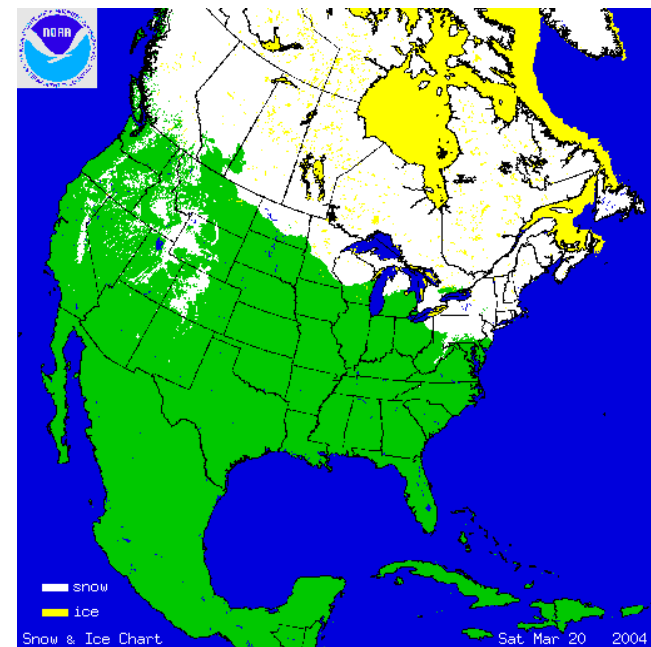
- maps for hydro companies (e.g. NWT Power; Manitoba Hydro) in support of planning hydroelectric power operations

Information During Wet Snow Periods



During melt episodes, SWE cannot be retrieved, but areas of wet snow cover can be identified.

Other additional layers of information (such as retrieval uncertainty) will be distributed to users.



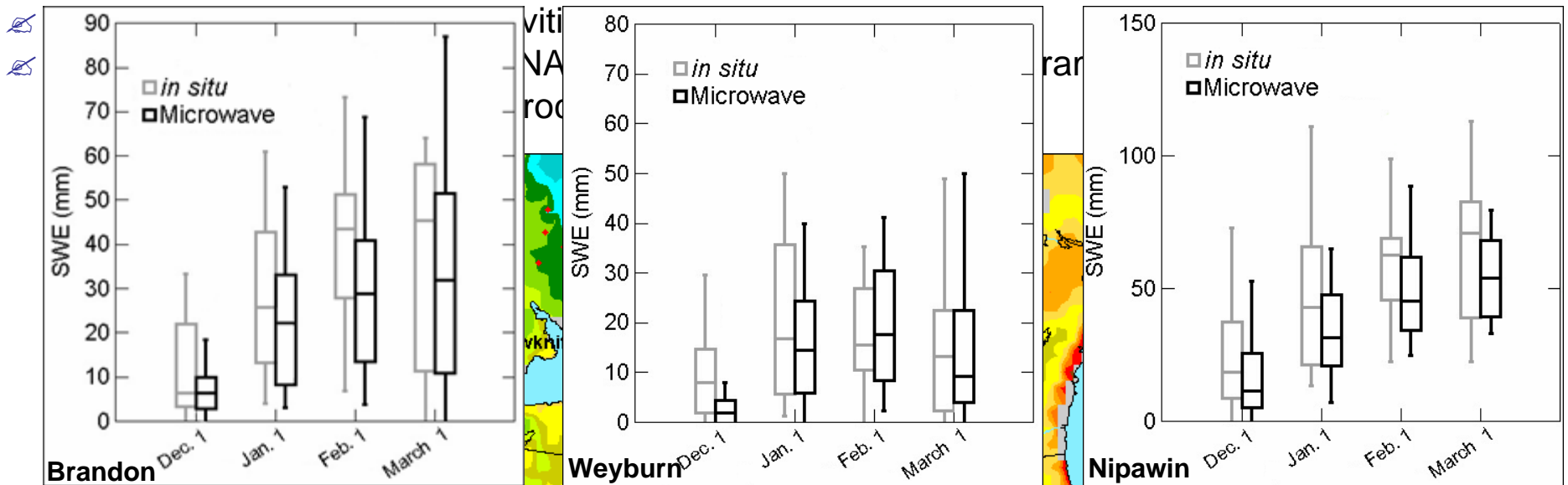
Algorithm Validation and Enhancements

Downside:

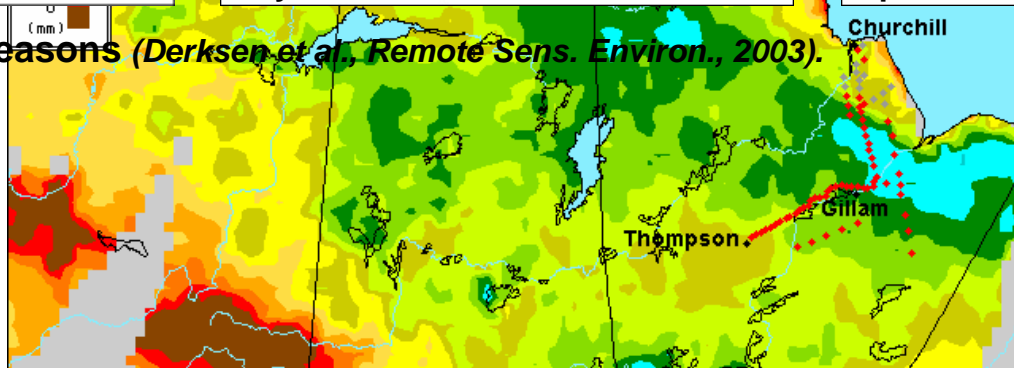
The open prairie environment is not a present region of focus (as opposed to the northern boreal forest and open tundra).

Upside:

Enhance regions with less certainty, possibly microwave SWE use of AMSR-E brightness and temperatures.



Comparison over 18 seasons (Derksen et al., Remote Sens. Environ., 2003).



Summary

✍ Snow cover is a significant climatological and hydrological variable to consider in the context of prairie droughts.

✍ Various sources of information on historical snow cover variability and present conditions:

- NOAA snow charts (*extent/duration*)
- Passive microwave (*SWE*)
- Conventional (*Depth/SWE*)
- Conventional + Microwave (*SWE*)

✍ Near real time monitoring of SWE with passive microwave data continues, and will be enhanced:

- Prairie
- Boreal Forest
- Tundra (under development)

Acknowledgments



National Snow and Ice Data Center
SUPPORTING CRYOSPHERIC RESEARCH SINCE 1976



Canadian Foundation for Climate
and Atmospheric Sciences (CFCAS)
Fondation canadienne pour les sciences
du climat et de l'atmosphère (FCSCA)

The logo for Manitoba Hydro, featuring a stylized white 'M' with a vertical line through it, resembling a water drop or a power symbol, on a dark blue background.

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