Seasonal forecasts of Canadian winter precipitation by post-processing GCM integrations

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Funded by the Canadian Foundation for Climate and Atmospheric Sciences

II.3.3 Forecast Combination, Calibration and Verification

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Based on HFP2 Output

- 4 AGCMs (GCM2, GCM3, SEF, GEM)
- 4-month integrations
- 12 times/year
- 10 members for each model
- 1969 – 2003

- Initial conditions: NCEP reanalyses
- SST: Persist anomaly of previous month

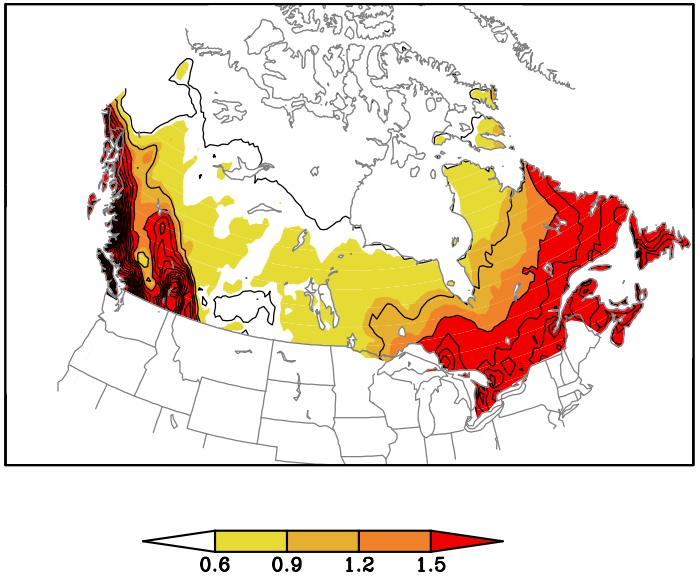
HFP2 and Data

- Here we look at precip forecasts
  - Notoriously difficult in extra-tropics
  - Can a statistical post-processing improve dynamical forecasts?
- DJFM forecasts for Canada

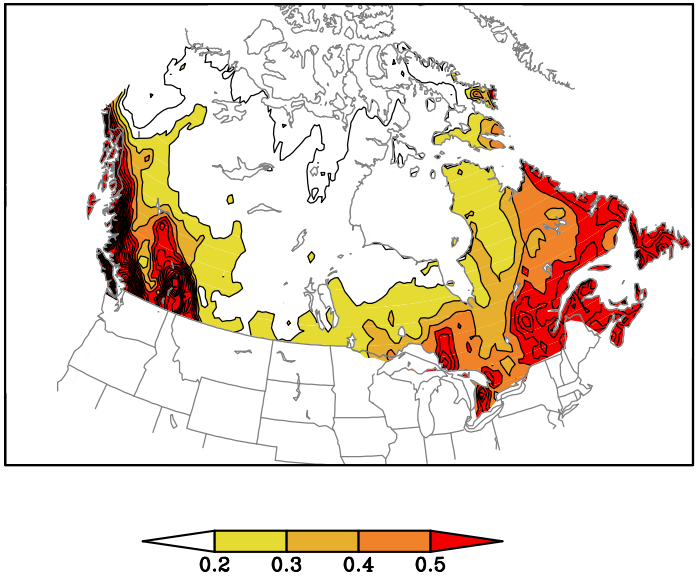
- Observations
  - Monthly precip. - Climate Research Unit (CRU)
  - 500 hPa height -NCEP reanalysis

CRU Observations 1948/49 – 2001/02

a) Climatology



b) Standard deviation



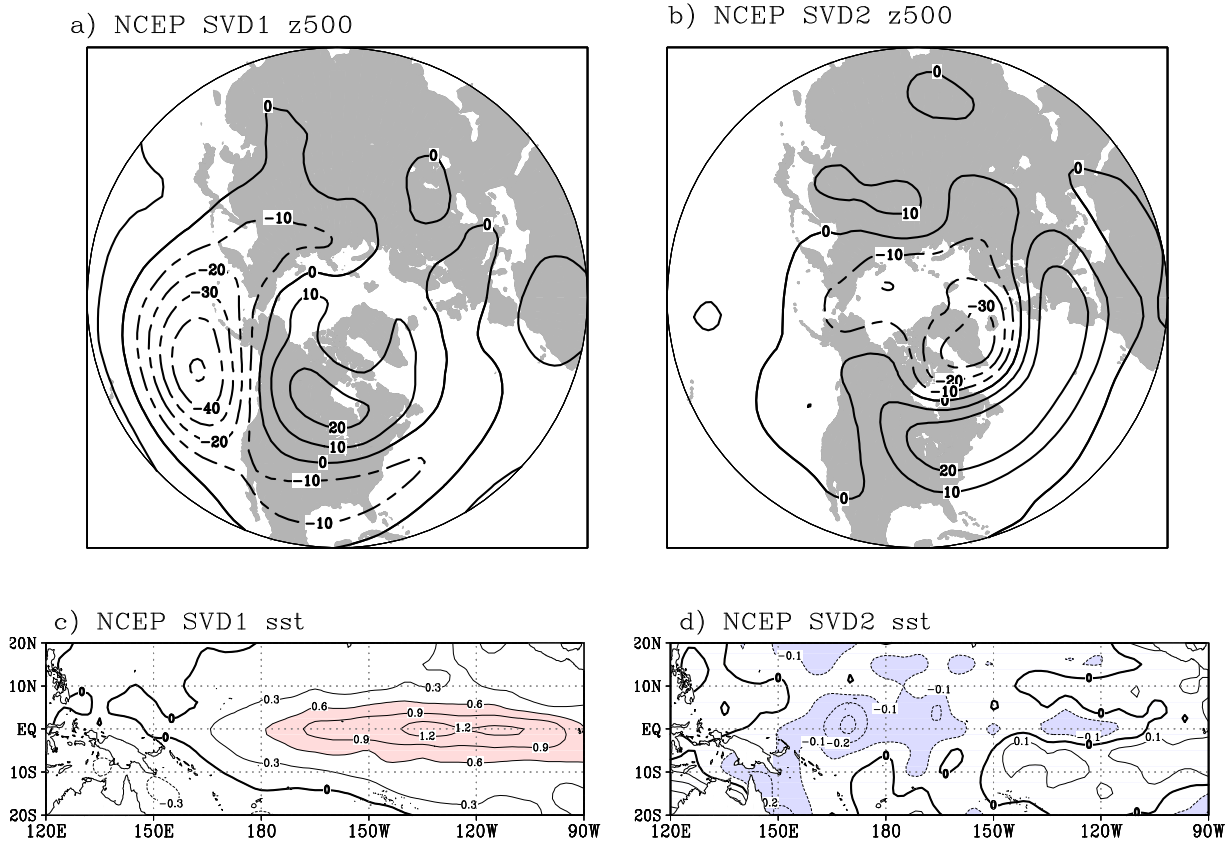
DFJ, mm/day

Basis for Statistical Approach

- Use observed link b/w Tropical Pacific SST and extra-tropical large-scale flow to correct dynamical precip. forecasts

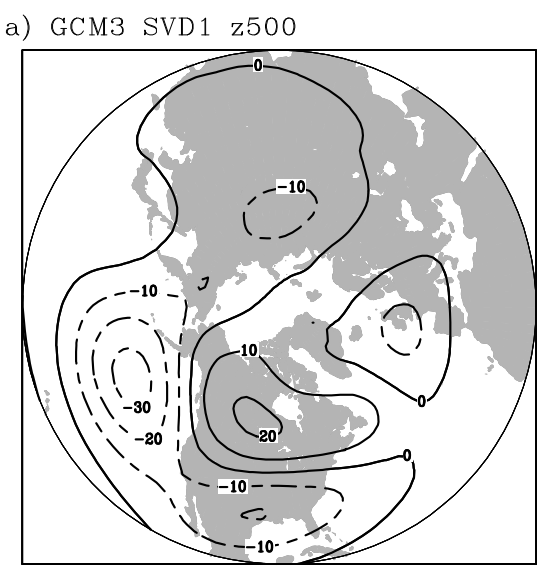
Identification of the forced patterns

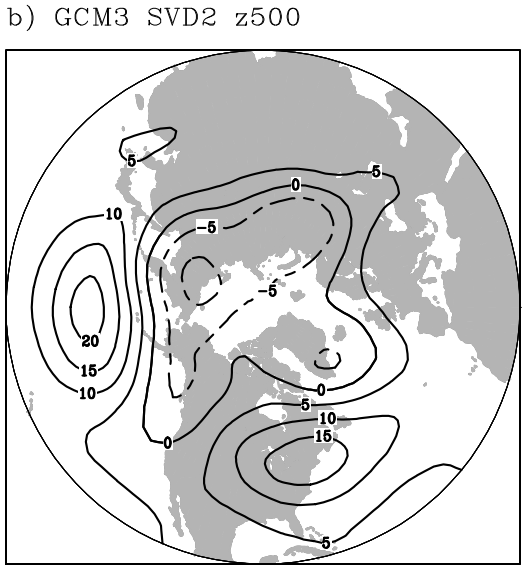
Tropical/extra-tropical link in observations: November SST vs DJF Z500

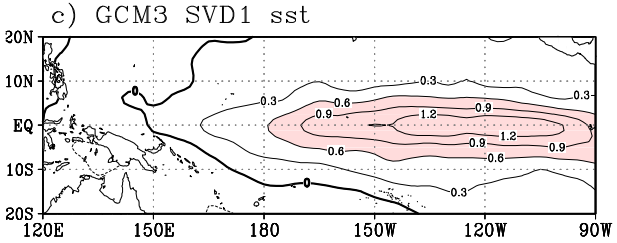


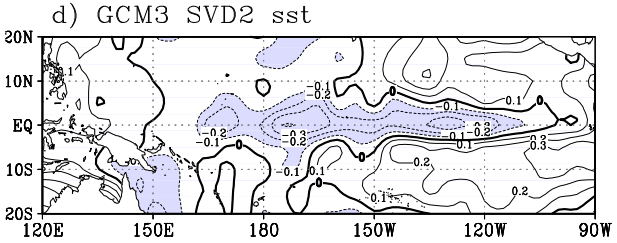
Identification of the forced patterns

Tropical/extra-tropical link in GCM3: November SST vs DJF Z500









Correlation with observed PNA and NAO indices

	APC1 vs PNA		APC2 vs NAO	
	DJF	JFM	DJF	JFM
GCM2	0.58	0.59	0.30	0.40
GCM3	0.49	0.62	0.57	0.47
SEF	0.45	0.55	0.47	0.42
GEM	0.53	0.59	0.39	0.31

In the model forecasts

- The time evolution of the model forced Z500 patterns (SVDs)
  - Time series of SVD1 correlates with PNA index time series
  - Time series of SVD2 correlates with NAO index time series
- We use those time series as predictors

The Statistical Scheme

- At each grid point:

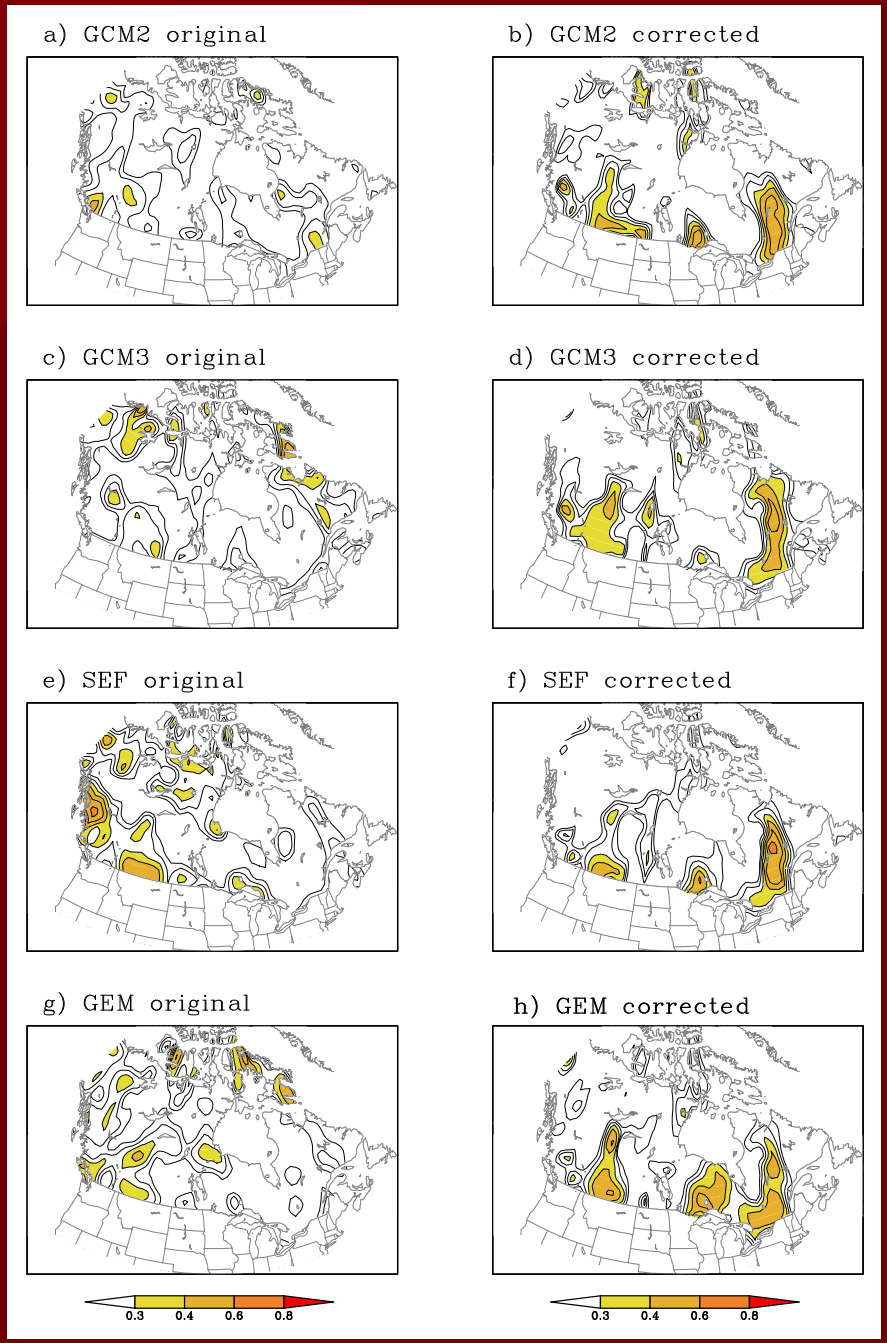
- Training:
  - Generate spatial strucures a_1, a_2, a_3 with

$$P_{obs}(t) = a_1 APC_1(t) + a_2 APC_2(t) + a_3 APC_3(t) + \varepsilon$$

- Forecasts:

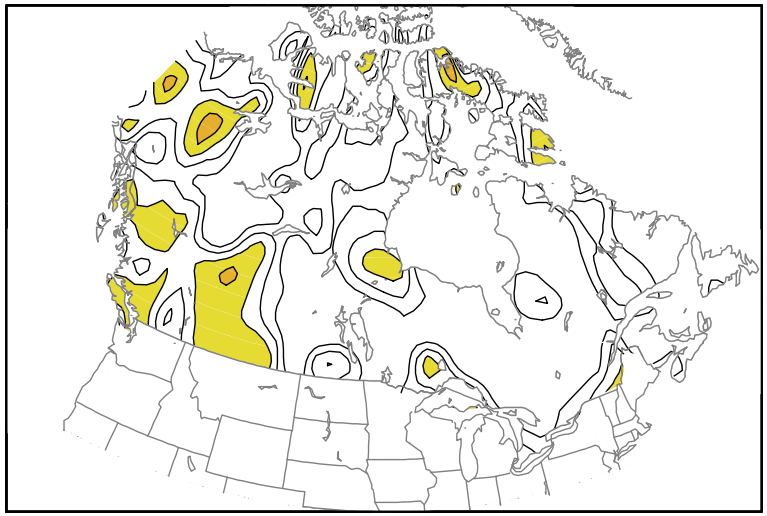
$$P_{forc}(t) = a_1 APC_1(t) + a_2 APC_2(t) + a_3 APC_3(t)$$

Skill of PR forecasts for DJF 1969/70 - 2001/02

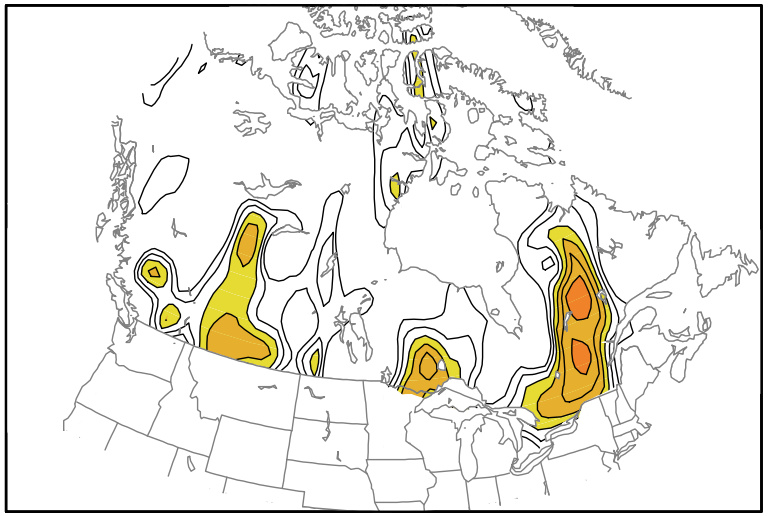


Skill of Precipitation Forecasts for DJF

a) 4models original

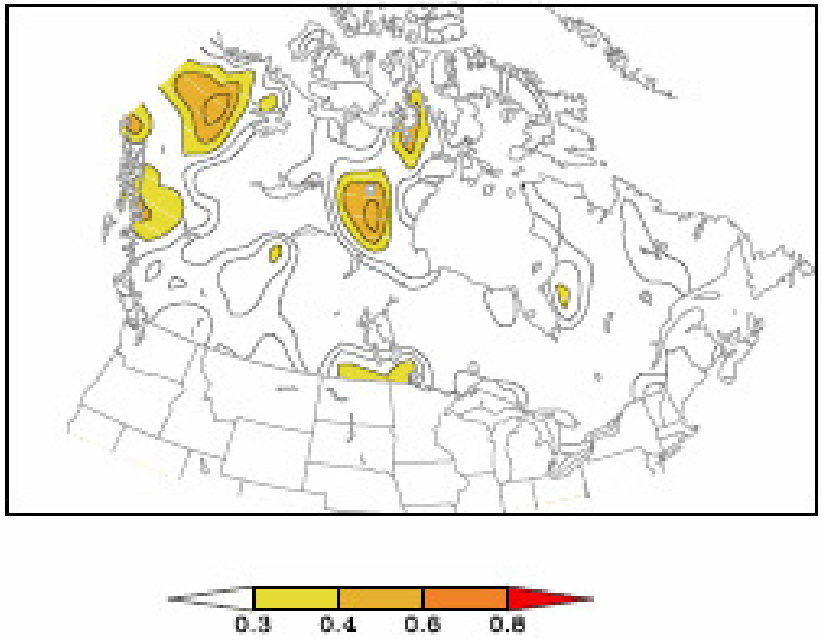


b) 4models corrected

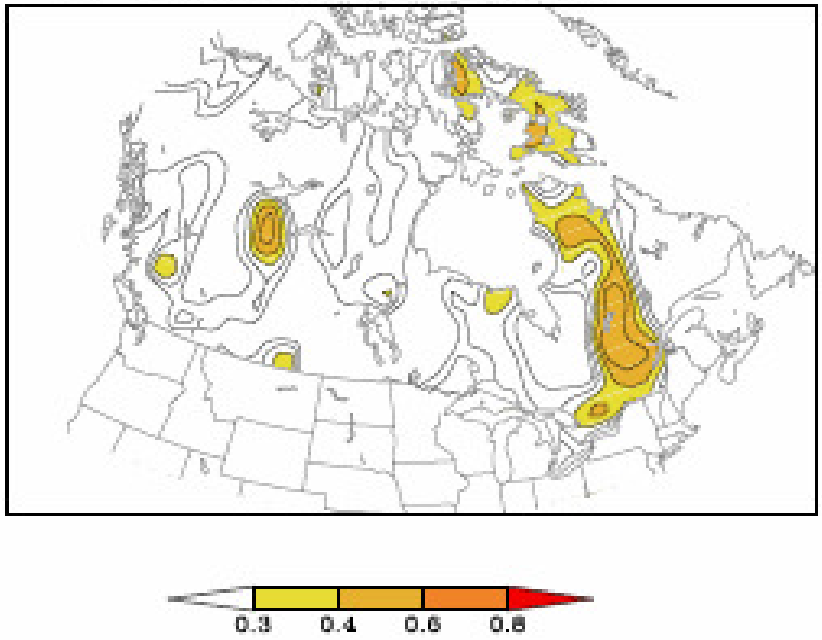


Skill of Precipitation Forecasts for JFM

a) 4models original



b) 4models corrected

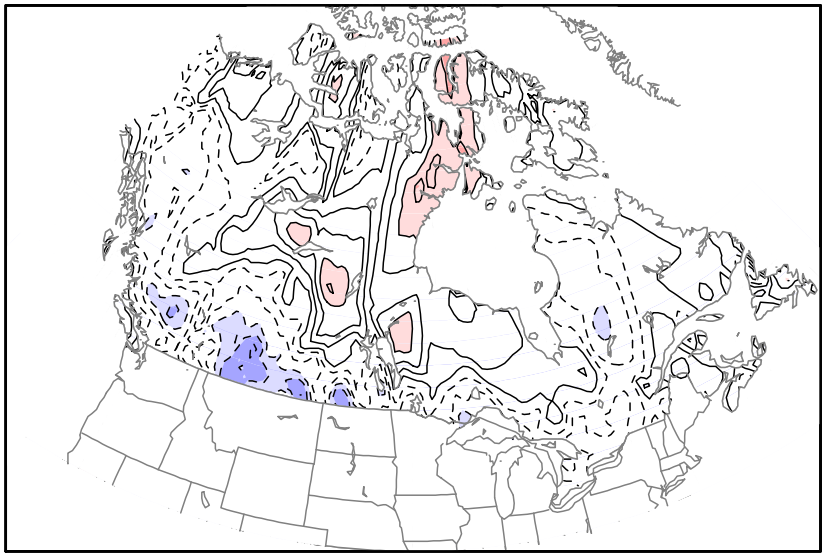


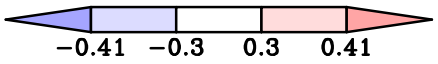
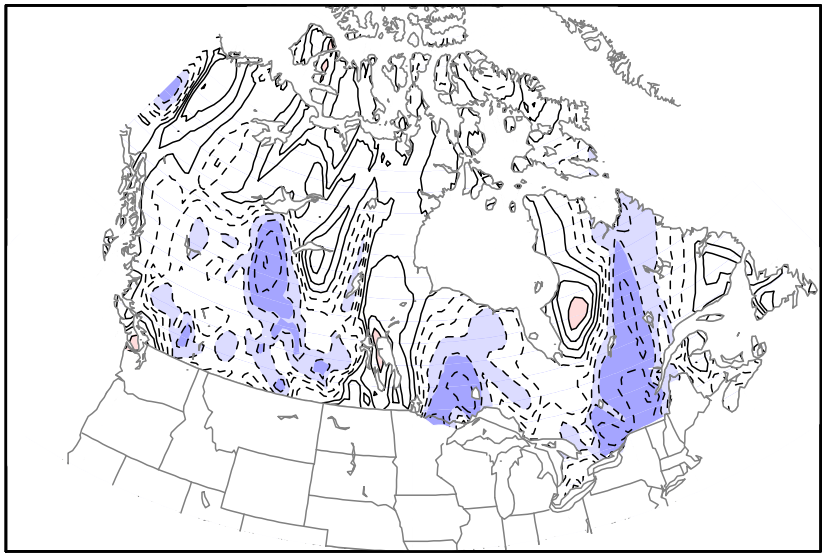
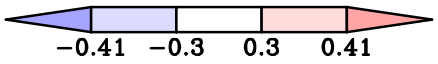
Concluding Remarks

- There is information content in the time series of the Z500 response to the Tropical SST anomalies
- Post-processing uses this information content to predict the precipitation
- The Canadian winter precipitation forecasts (one-month lead) have significant skill over the southern prairies and parts of Quebec and Ontario.

Association of observed PR with forced patterns

a) Correlation PR & APC1





b) Correlation PR & APC2