

# Role of soil moisture initialization in seasonal climate prediction:

The Global Ocean-Atmosphere Predictability and Prediction (GOAPP) Network and Relationships to the DRI

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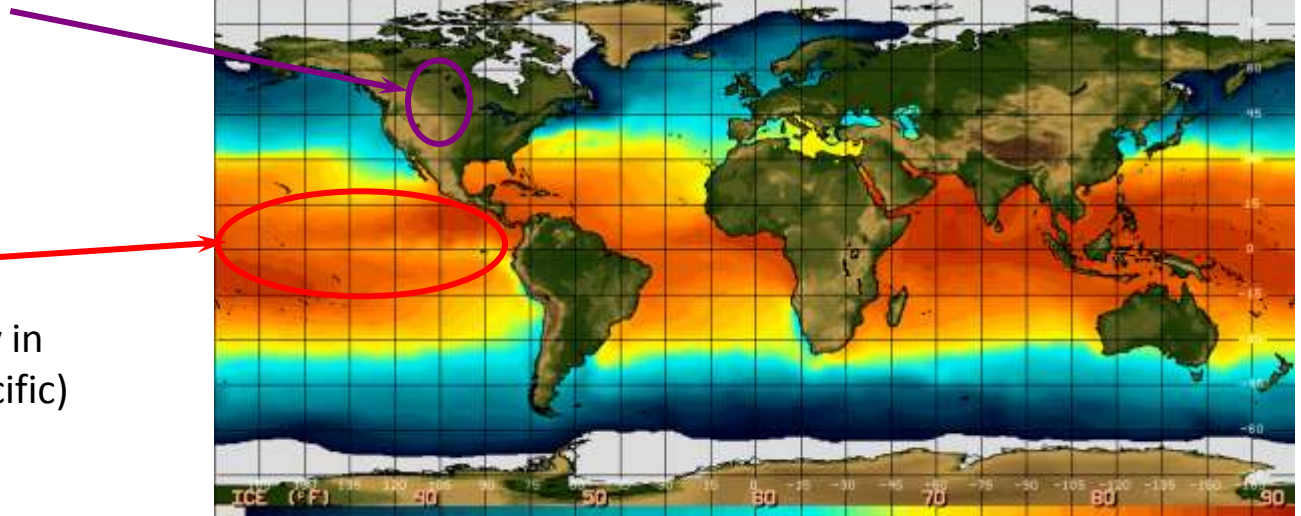
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# Motivation for Seasonal Forecasting

- Although *weather* not predictable beyond ~10 days, *climate statistics* contain predictable component due to forcing by slowly evolving boundary conditions, *notably*

Soil moisture



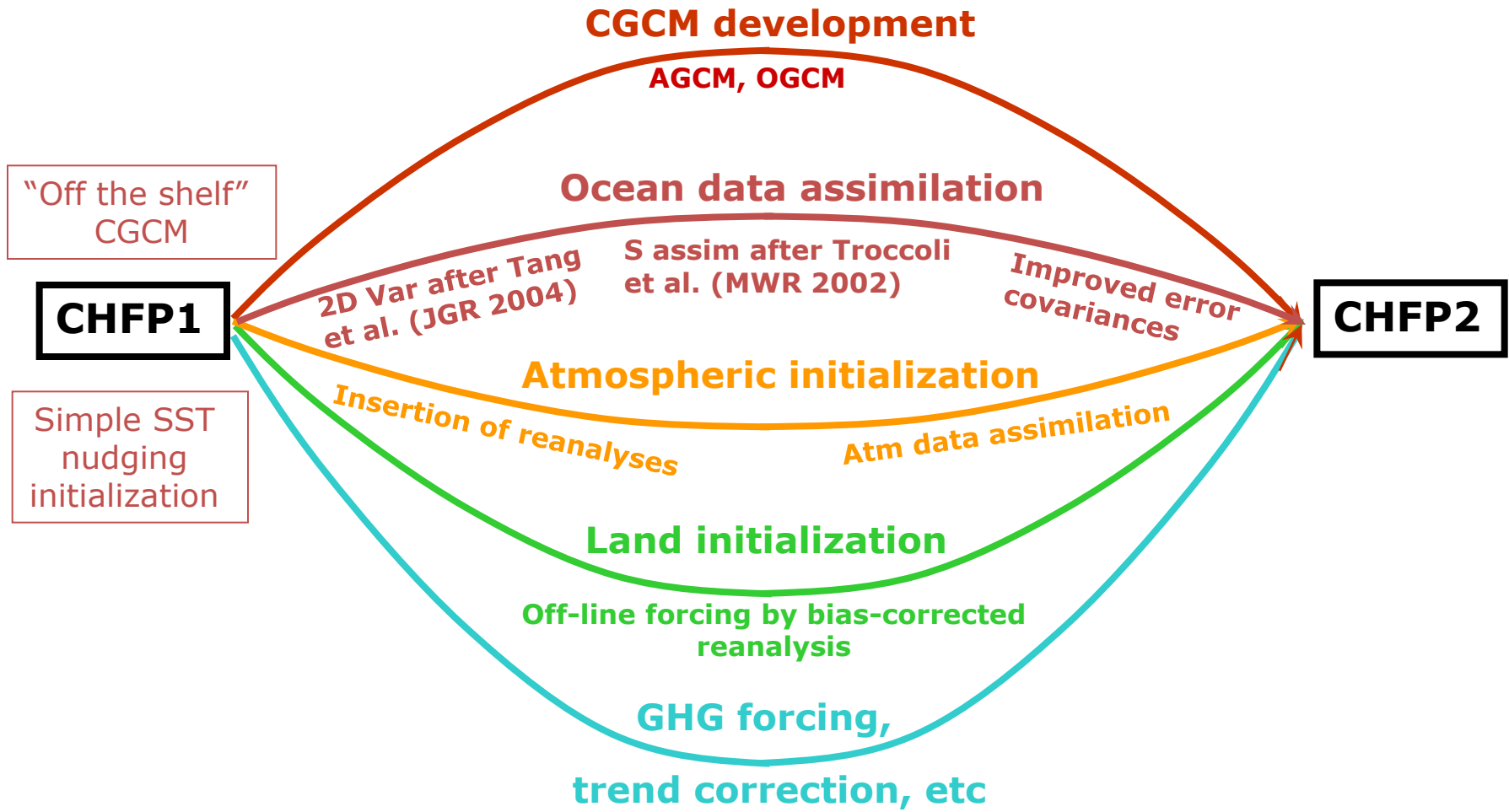
SST

(especially in  
tropical Pacific)

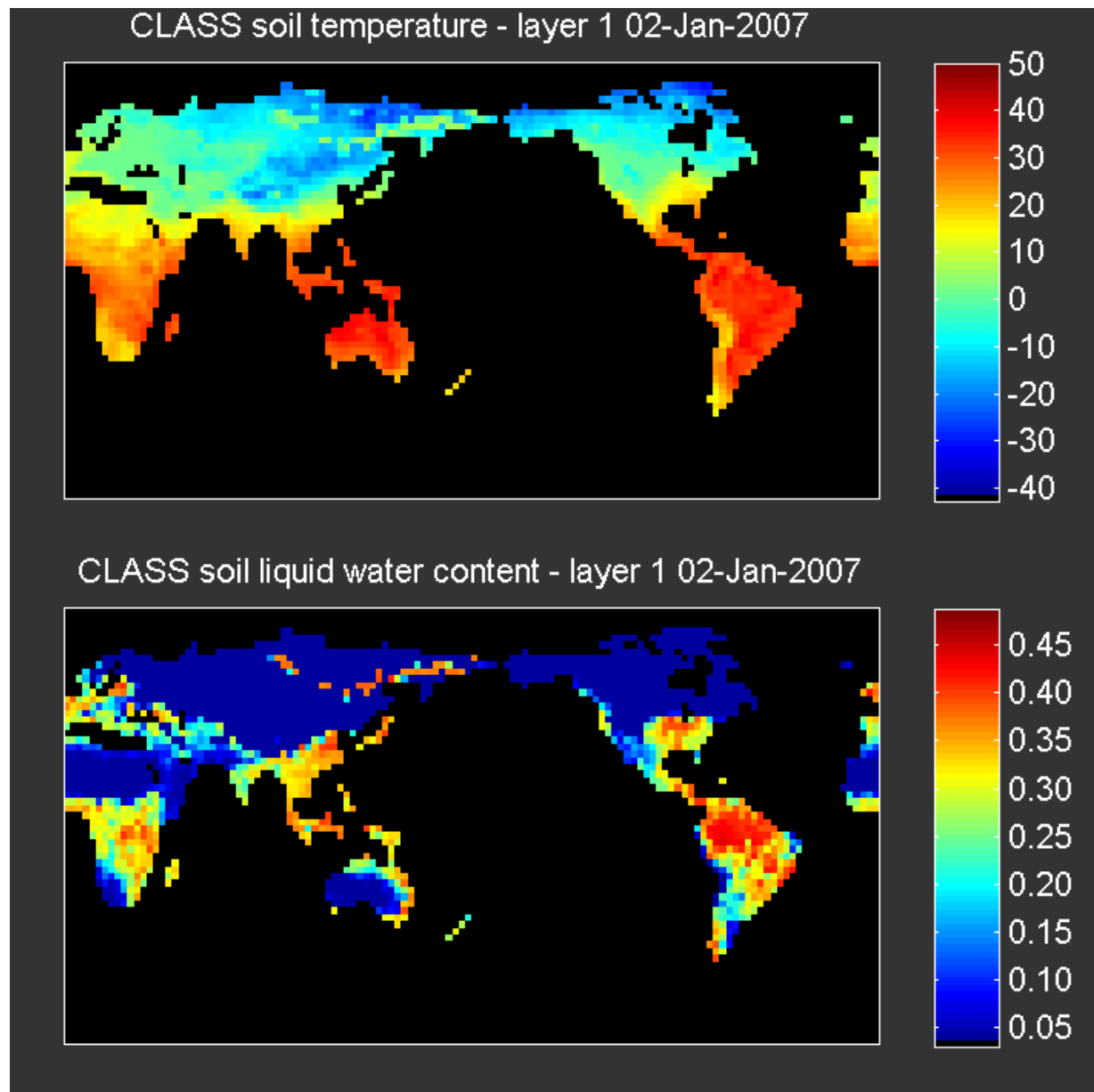
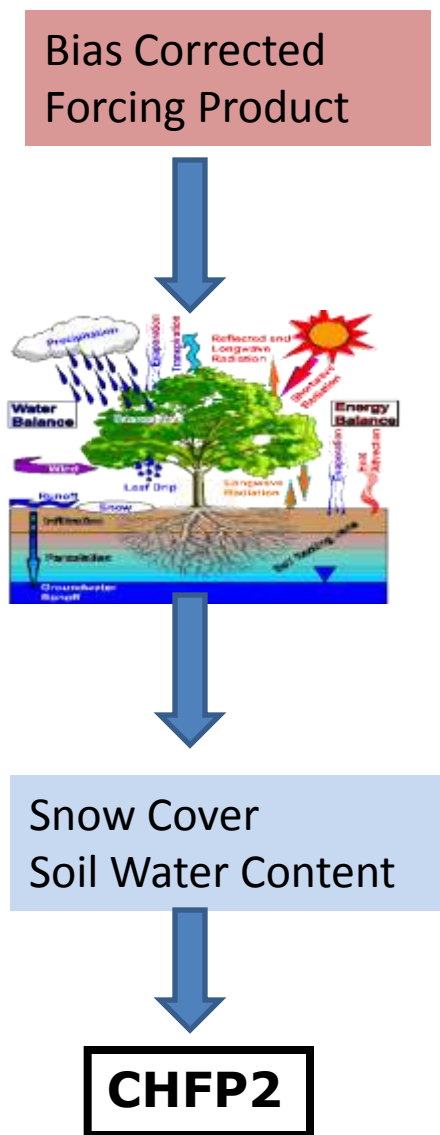
# Dynamical Seasonal Forecasts

- Current Environment Canada operational system:
  - 4 AGCMs x 10-ensemble
  - SST “forecast” = persisted anomalies
  - forecast duration = 4 months
  - validated by 2<sup>nd</sup> Historical Forecast Project (HFP2)
- GOAPP:
  - Develop *coupled* seasonal forecast system
    - SST anomalies part of forecast

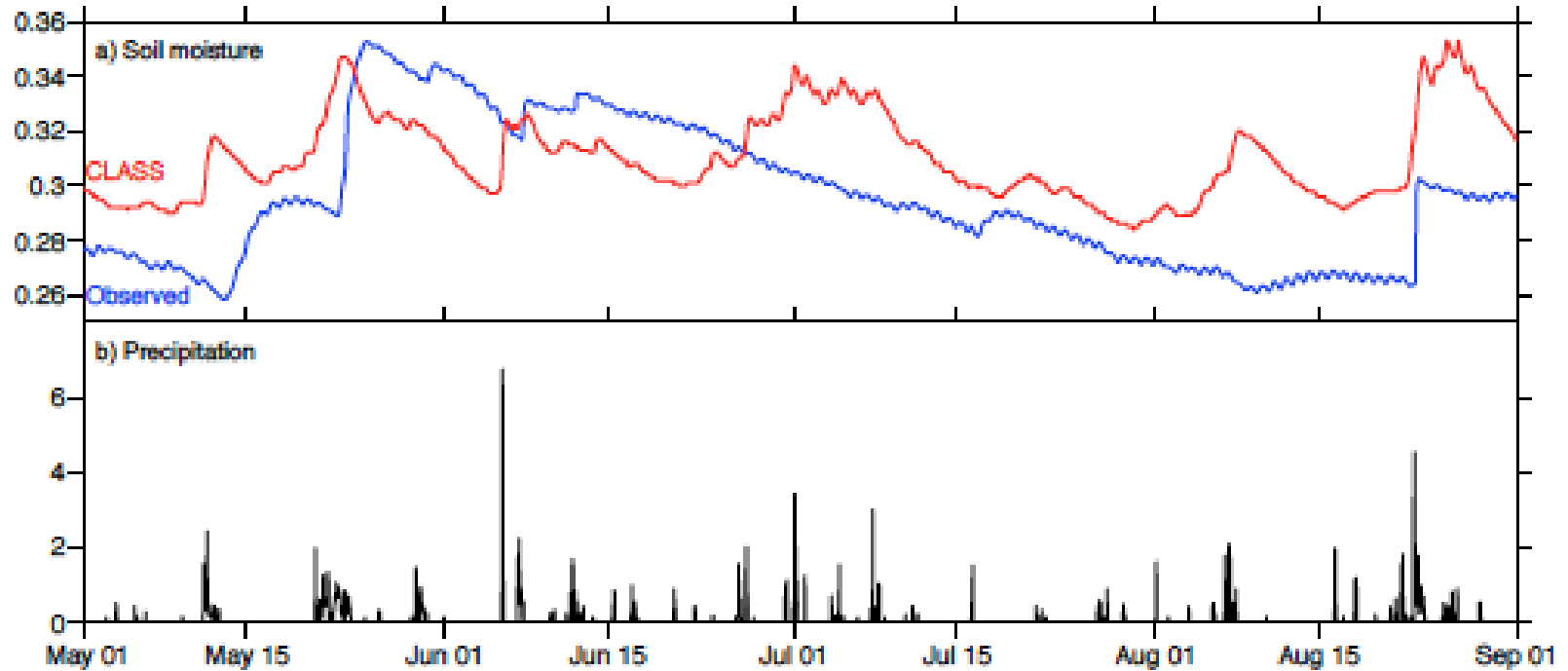
# Coupled Forecast System Development Path



# Development of a 30 year data set of land surface initial conditions

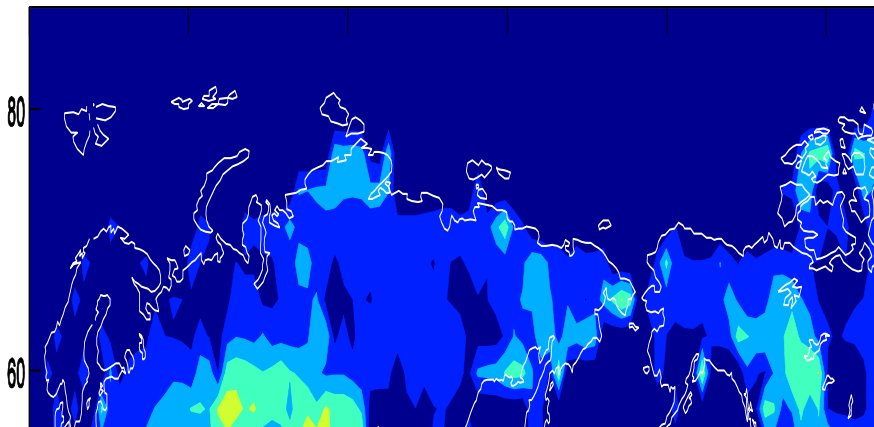


## Comparison to Observations

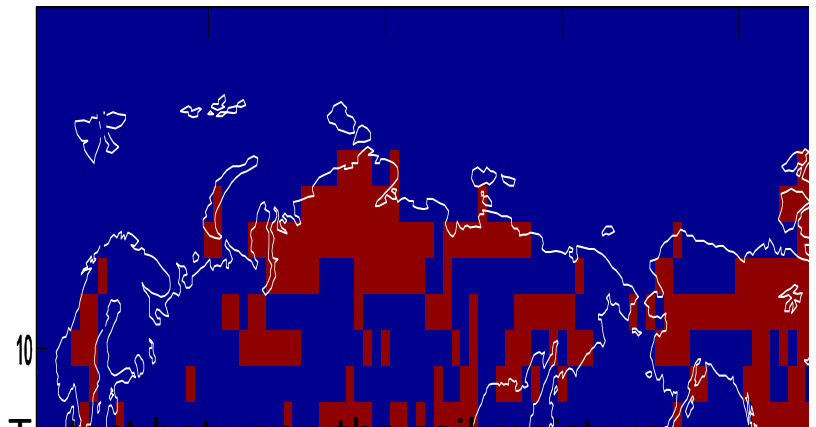


Alberta (2004-2007)

# Impact of land surface initialization errors in current forecasting system (HFP-2)



Mean absolute error of CLASS soil moisture data and Climatology soil moisture (May-Sep)



T-test between the soil moisture initialization errors (SM-IE) of the worst **temperature** forecasts and SM-IE of the best **temperature** forecasts

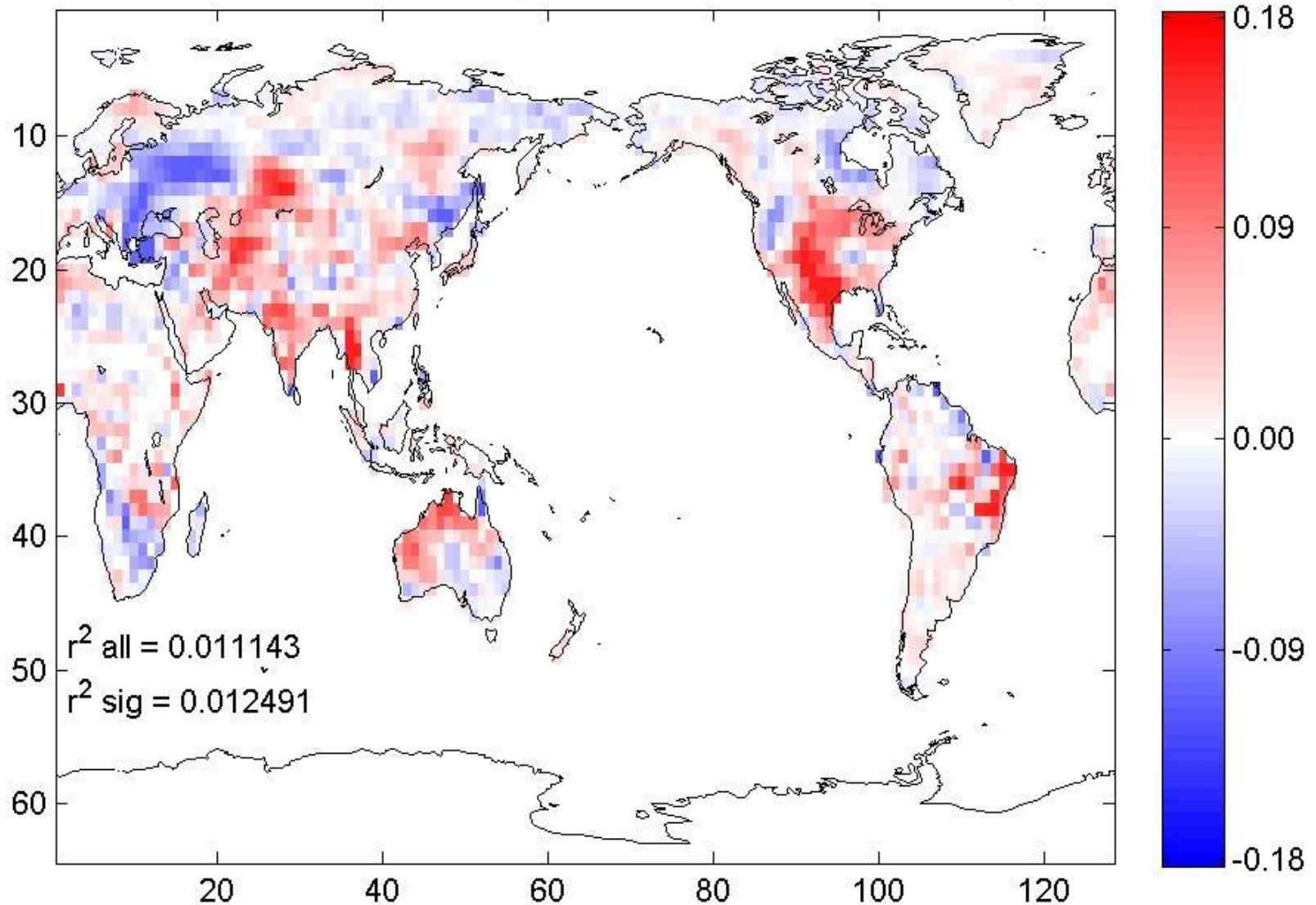
# Forecast Experiment

- In the first set of forecasts, the initial land for all ensemble members are set to realistic values (1980-2004)
- In the second set, the initial land states are chosen randomly for each ensemble member from a background distribution (climatology)

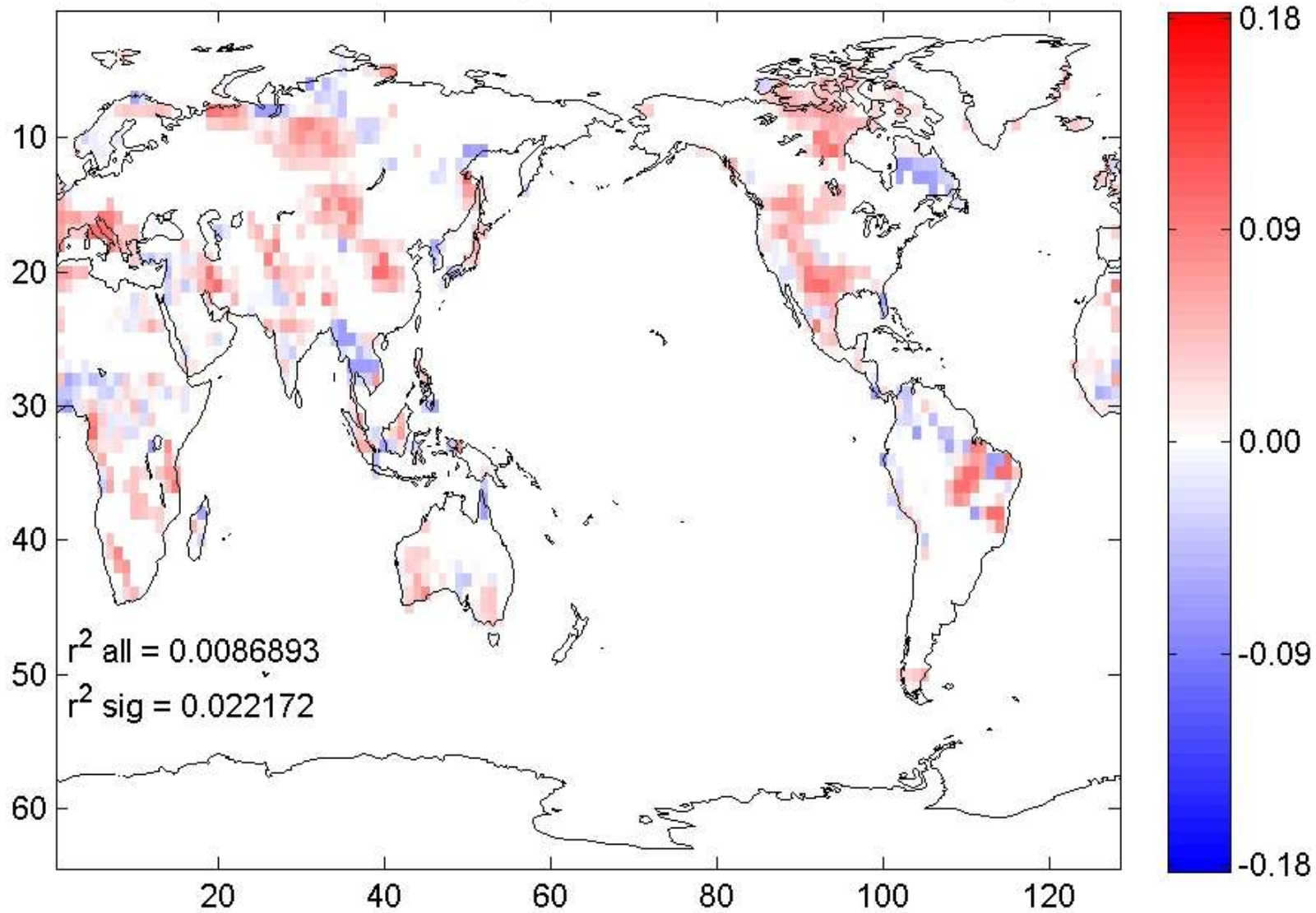


# Correlation ( $r^2$ ) differences of seasonal forecasts completed with and without soil moisture initialization.

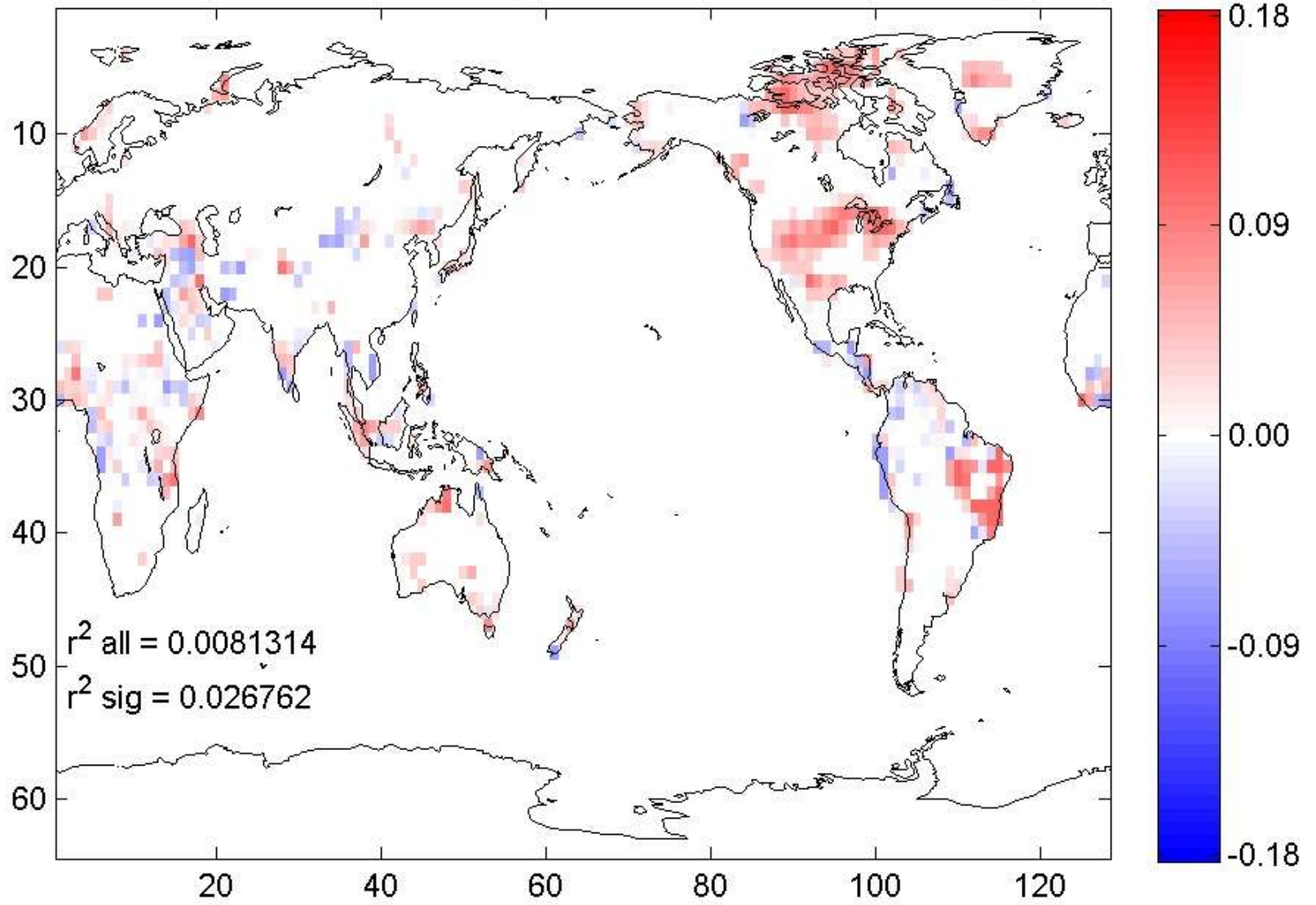
Series 1 - Series 2 land surface temperature  $r^2$  difference, 00 to 15 days forecast



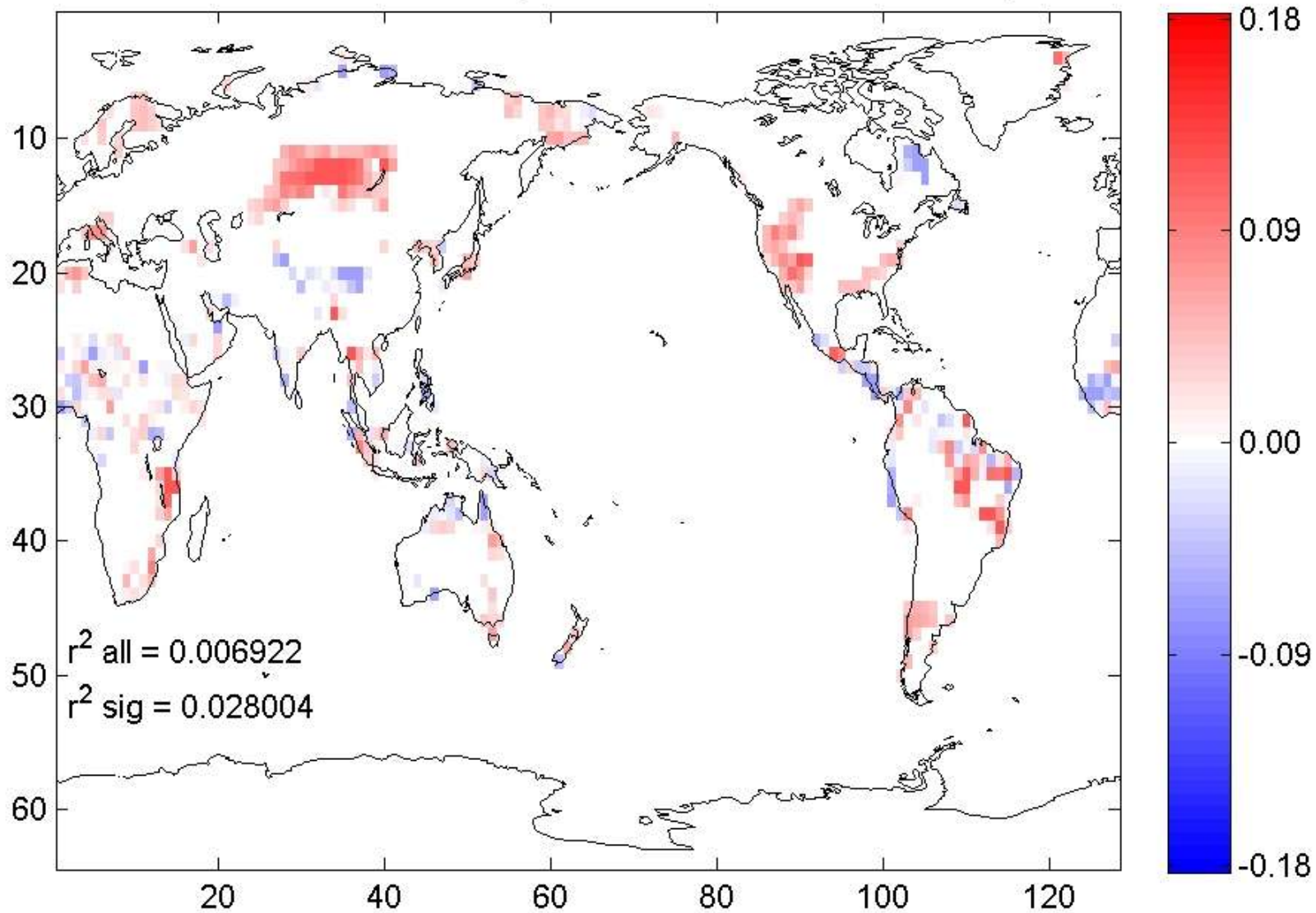
Series 1 - Series 2 land surface temperature  $r^2$  difference, 15 to 30 days forecast



Series 1 - Series 2 land surface temperature  $r^2$  difference, 30 to 45 days forecast



Series 1 - Series 2 land surface temperature  $r^2$  difference, 45 to 60 days forecast



# Summary and Next Steps

- Initialization of soil moisture in the CGCM has a small but statistically significant improvement to seasonal forecast skill (temperature)
- The initialization experiment work has been included as part of the Global Land-Atmosphere Coupling Experiment (GLACE-2)
- Focused study on Canadian Droughts to follow