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NARCCAP

NARCCAP Second Users' Meeting

Overview of Climate Change Results

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National Center for Atmospheric Research

Boulder, CO
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National Center for Atmospheric Research

NARCCAP PLAN – Phase II

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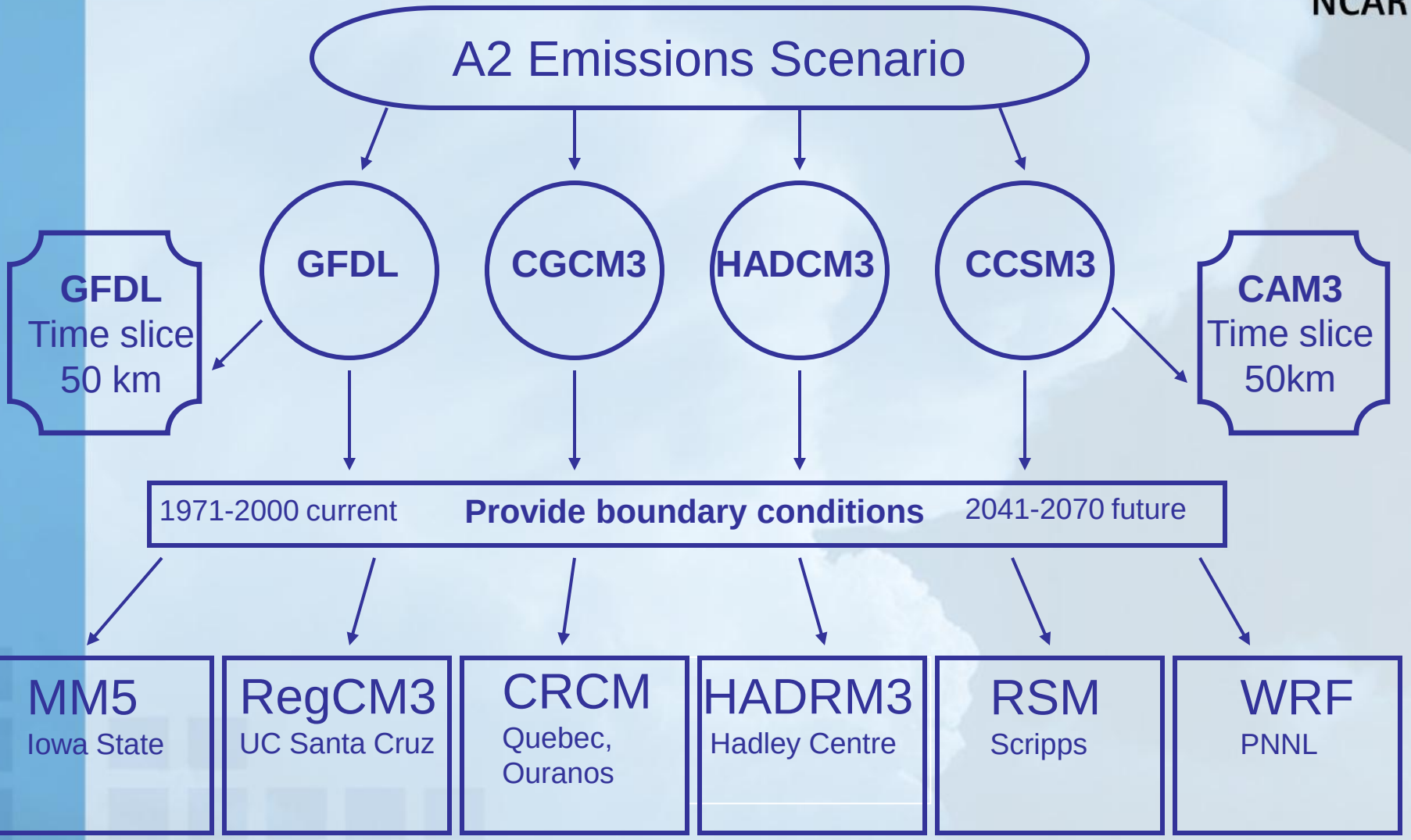

GCM-RCM Matrix

AOGCMS

RCMs

	GFDL	CGCM3	HADCM3	CCSM
MM5			X	X1
RegCM	X1**	X		
CRCM		X1**		X
HADRM	X		X1**	
RSM	X1		X	
WRF		X		X1
*CAM3				X
*GFDL	X**			

1 = chosen first GCM
*= time slice experiments
Red = run completed
** = data loaded

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Phase II (Climate Change) Results

Temperature and precipitation changes with model agreement

(2080-2099 minus 1980-1999) A1B Scenario

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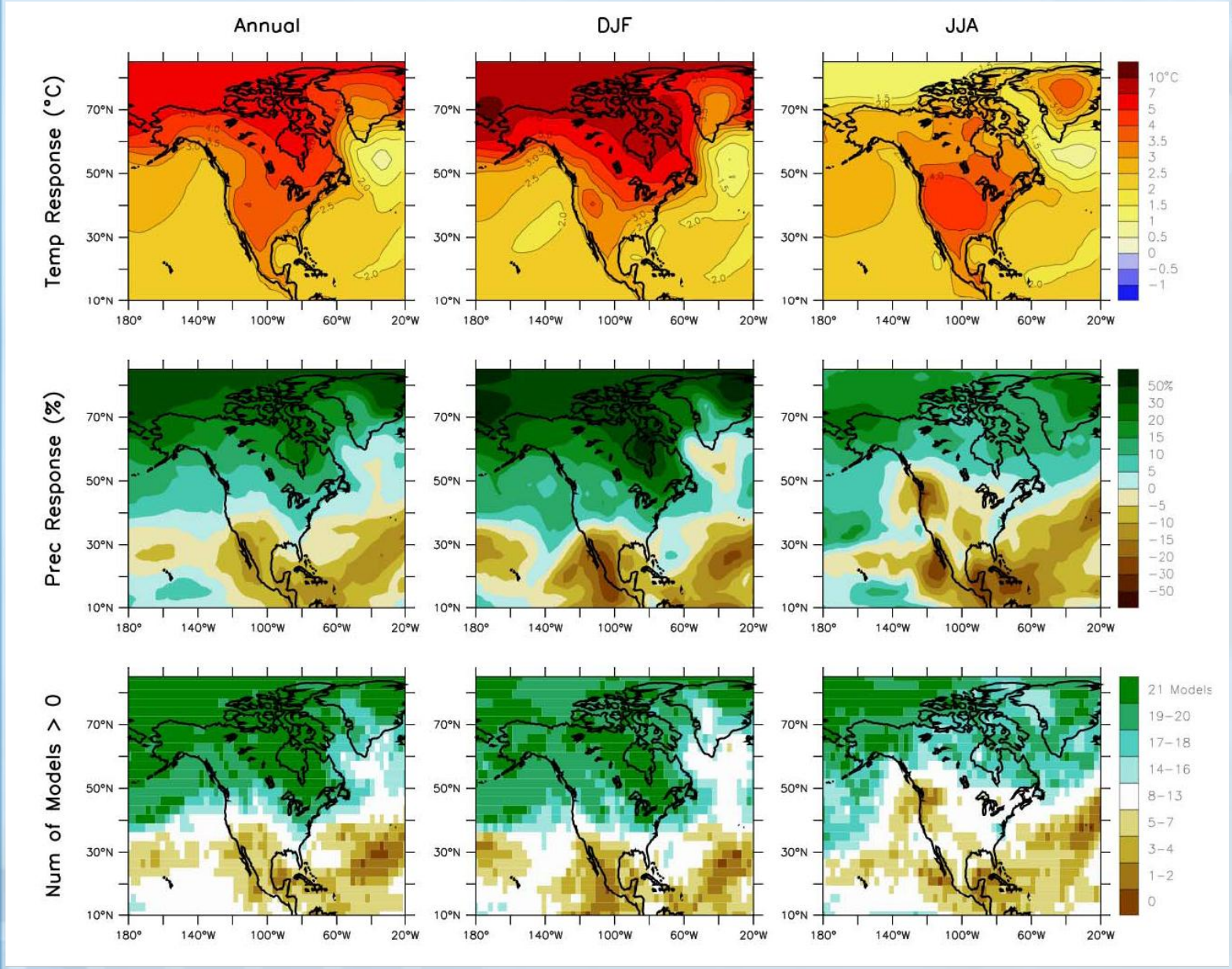

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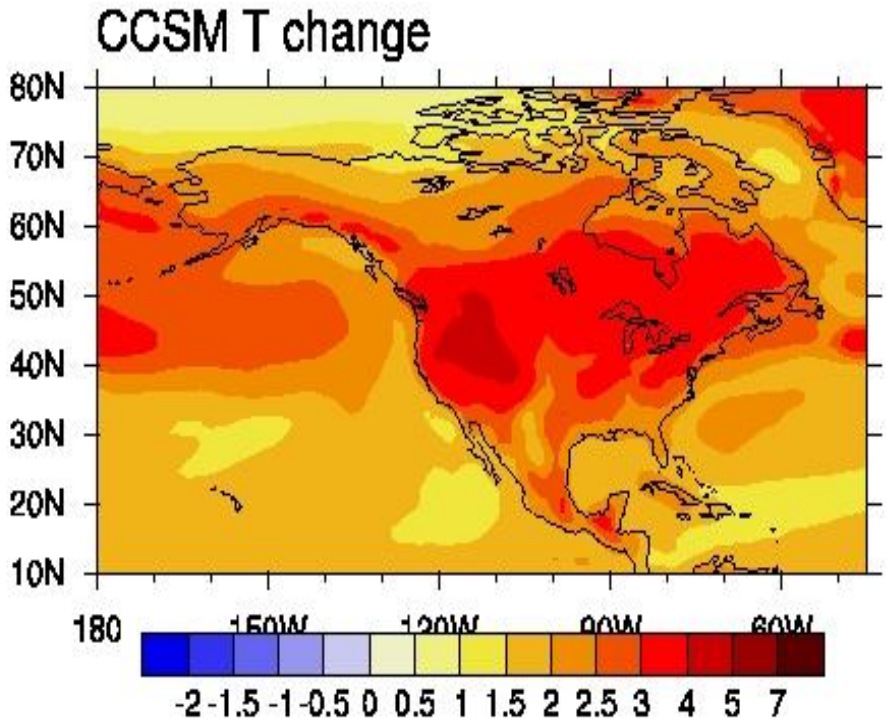
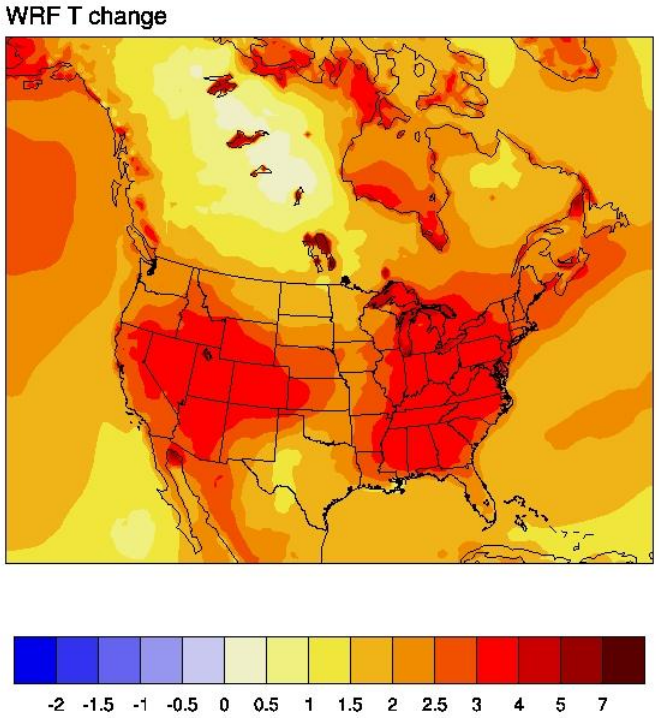
Summer Temp Changes 2051-2070—1980-1999





Change in Winter Temperature Canadian Models

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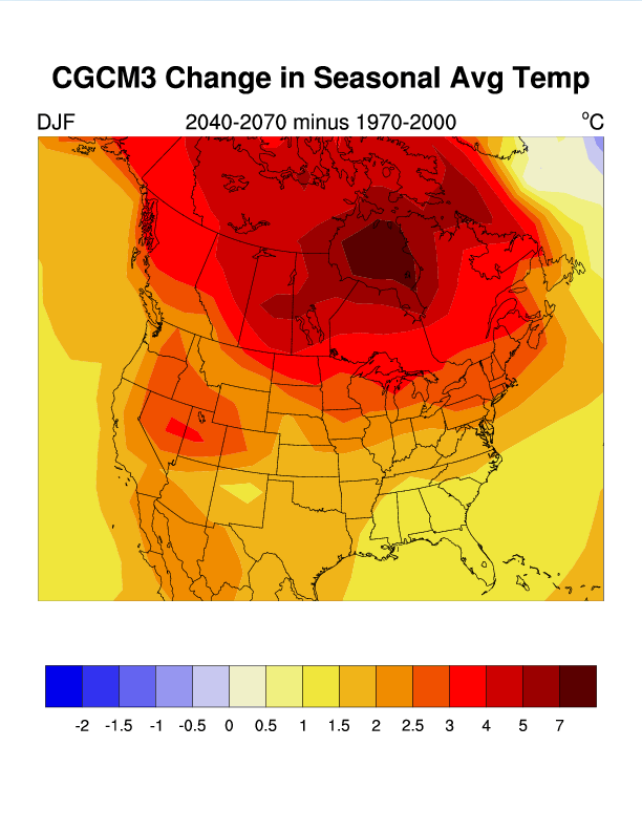
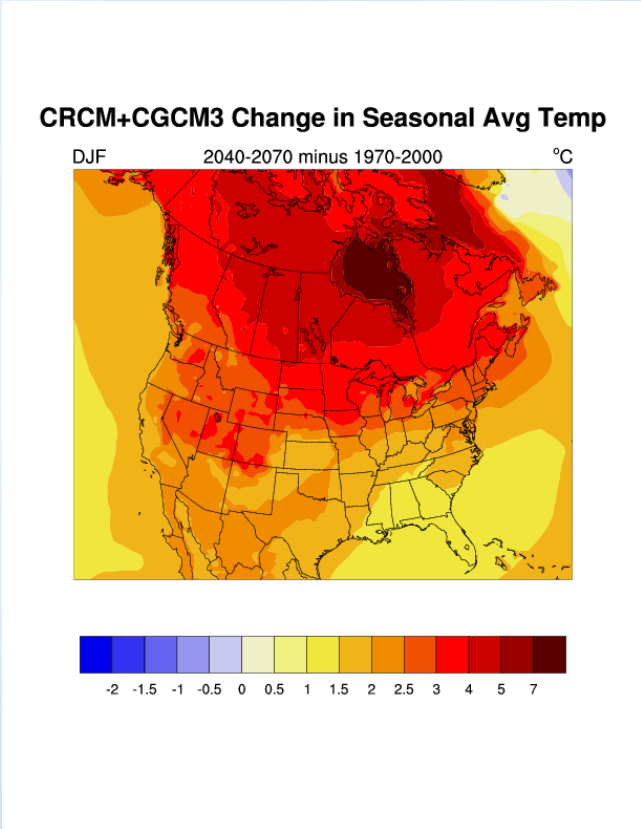
Global Model



Regional Model



Change in Winter Precip Canadian Models

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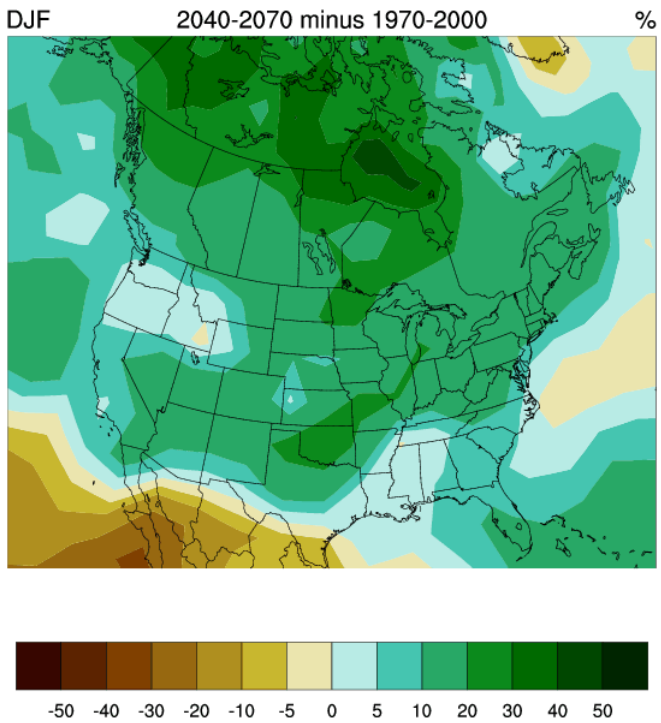

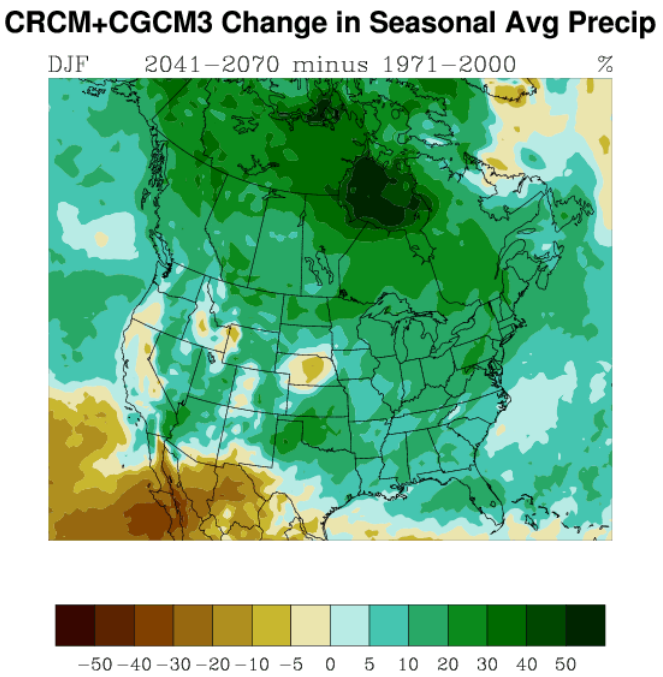

HadRM3 Climate Change

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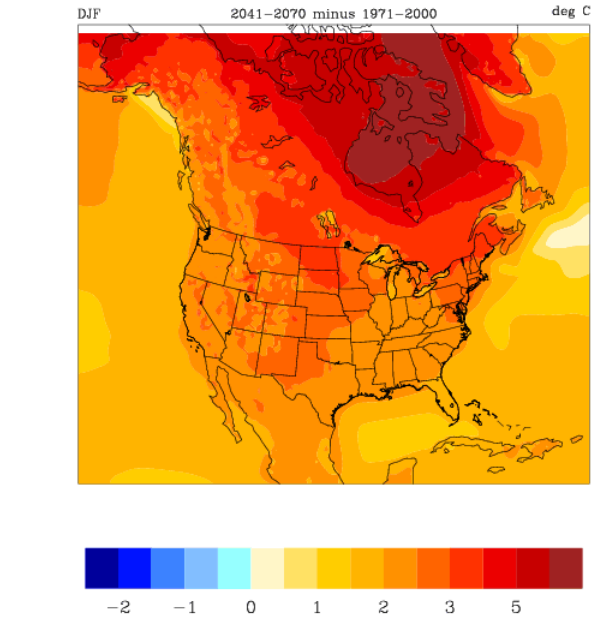
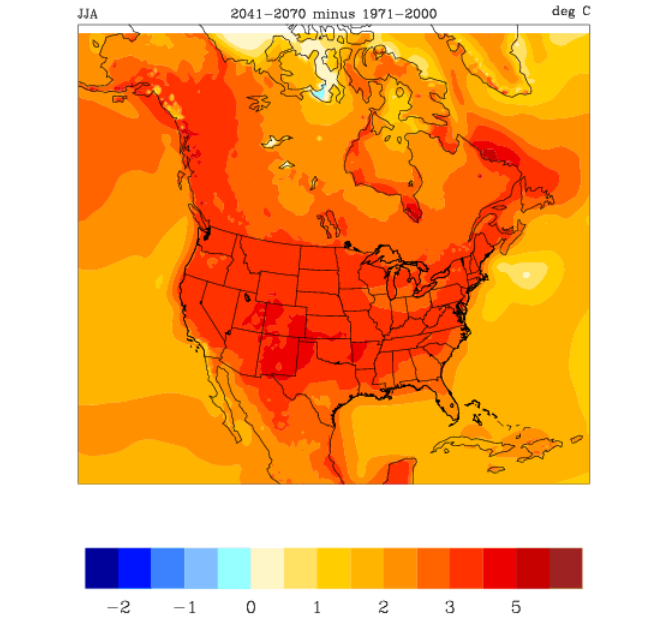
Winter Temperature



Summer Temperature



There is a consistency in the anticipated temperature change signal of HadRM3PvsHadCM3

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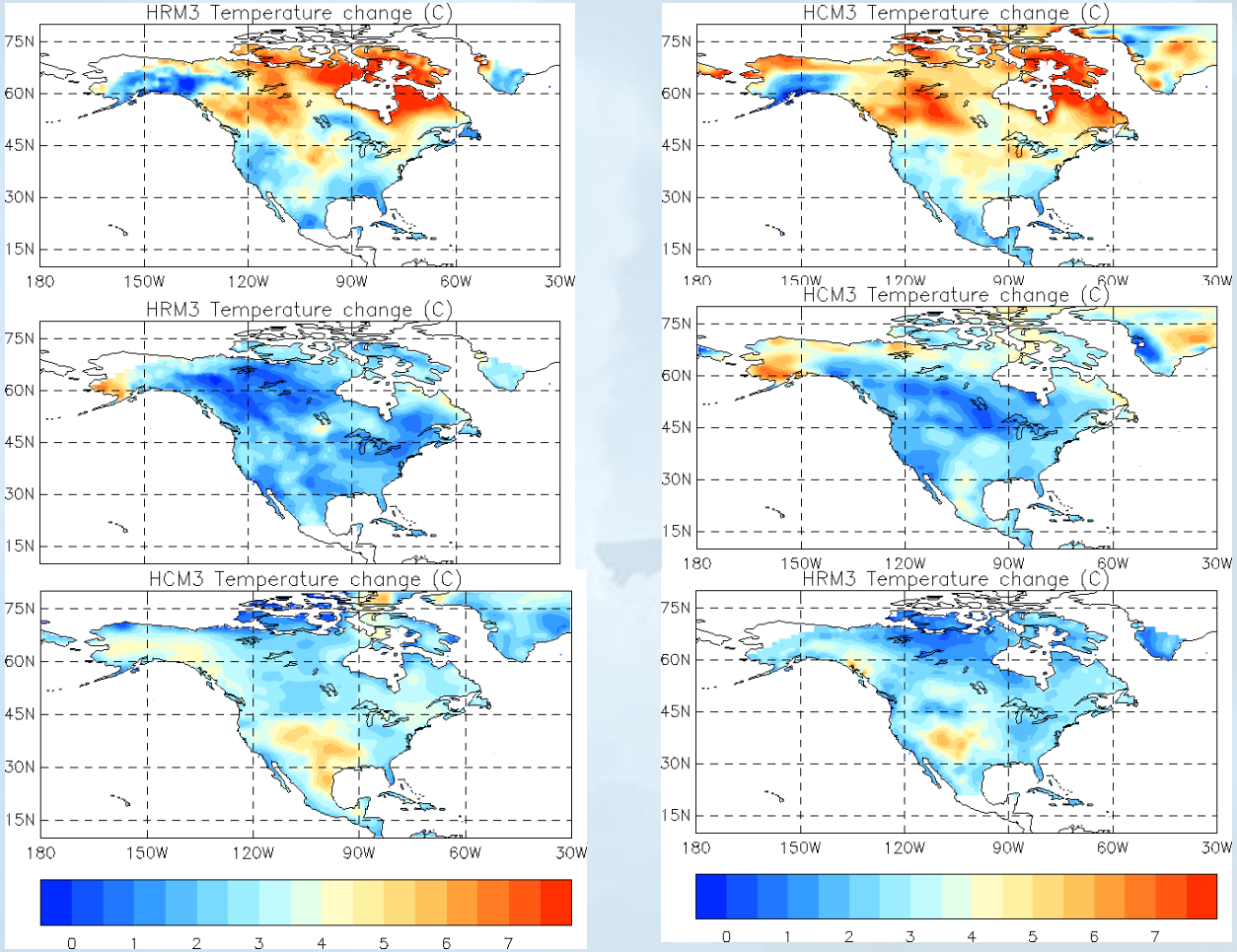
RCM

GCM

DJF

MAM

JJA



Projected seasonal changes in temperature, between 1971-2000 and 2041-2070

HadRM3
Climate Change

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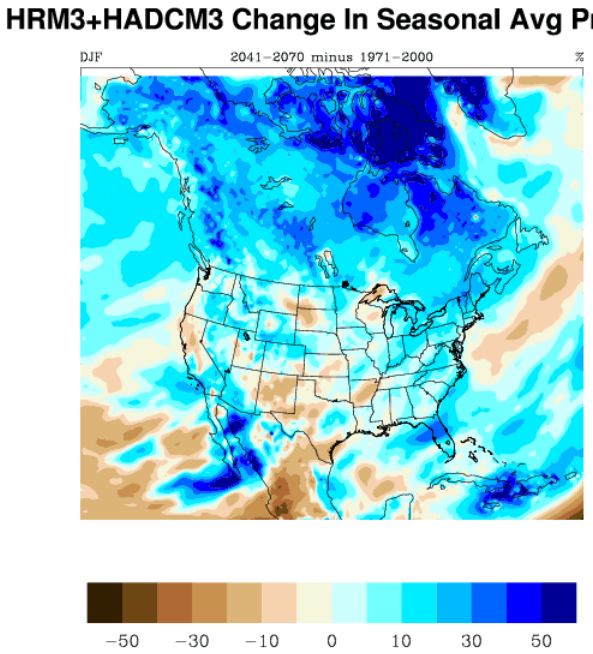
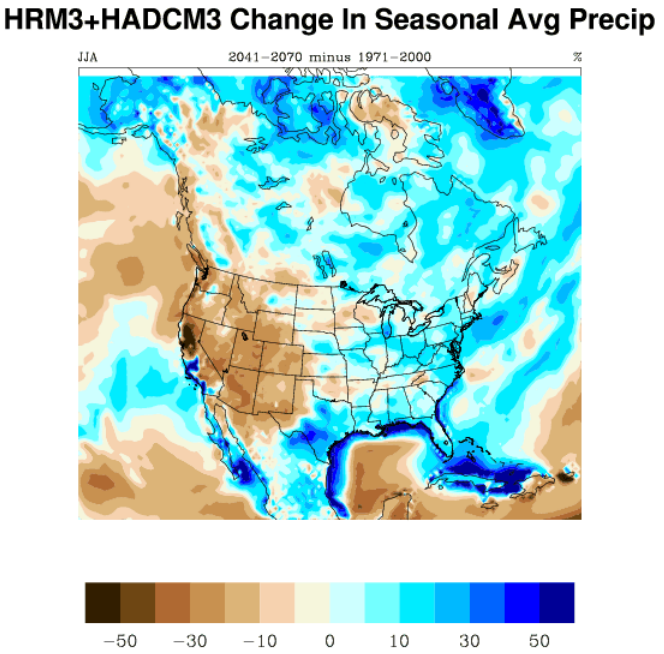
Winter Precipitation



Summer Precipitation



Global Time Slice / RCM Comparison

at same resolution (50km)

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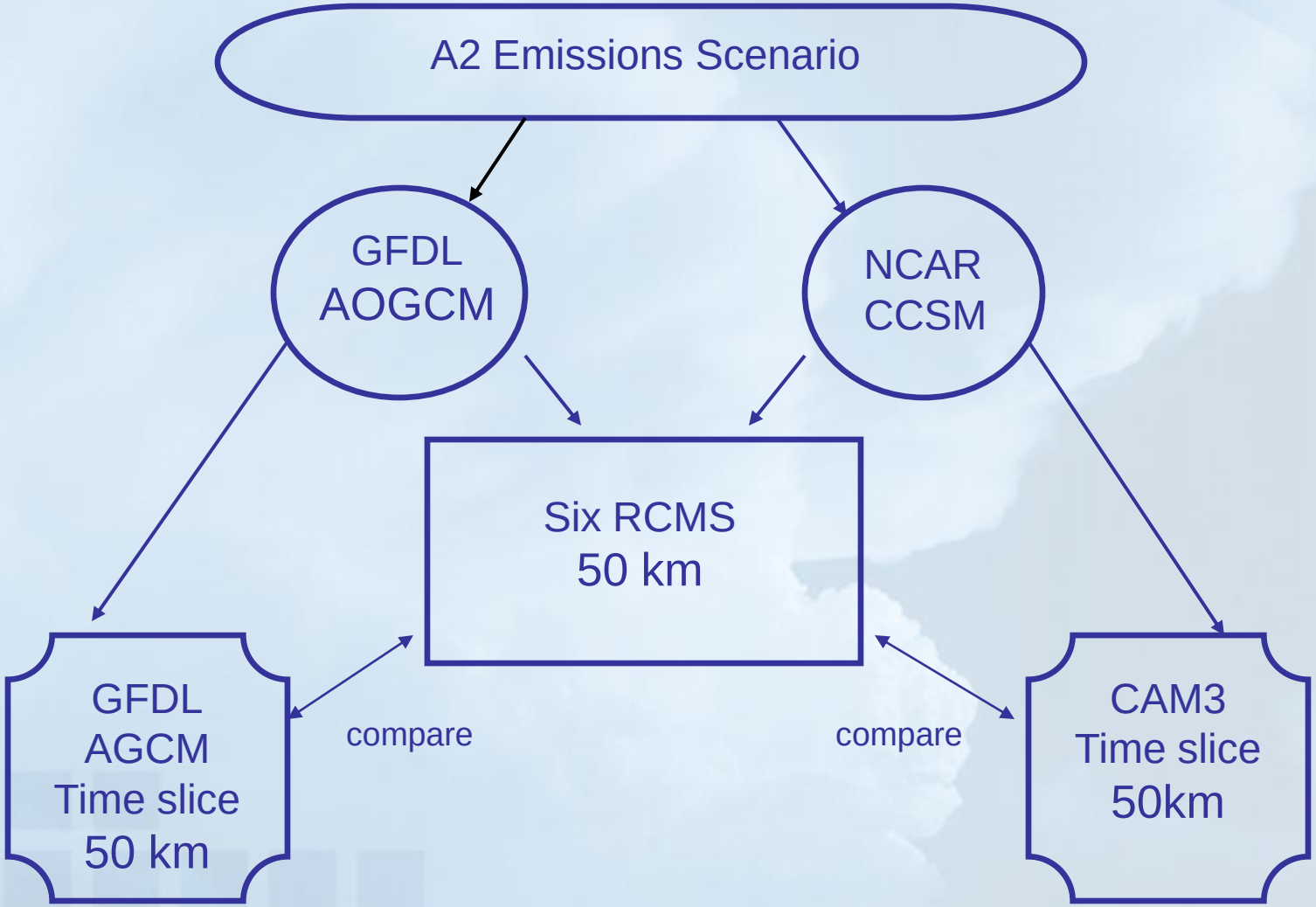

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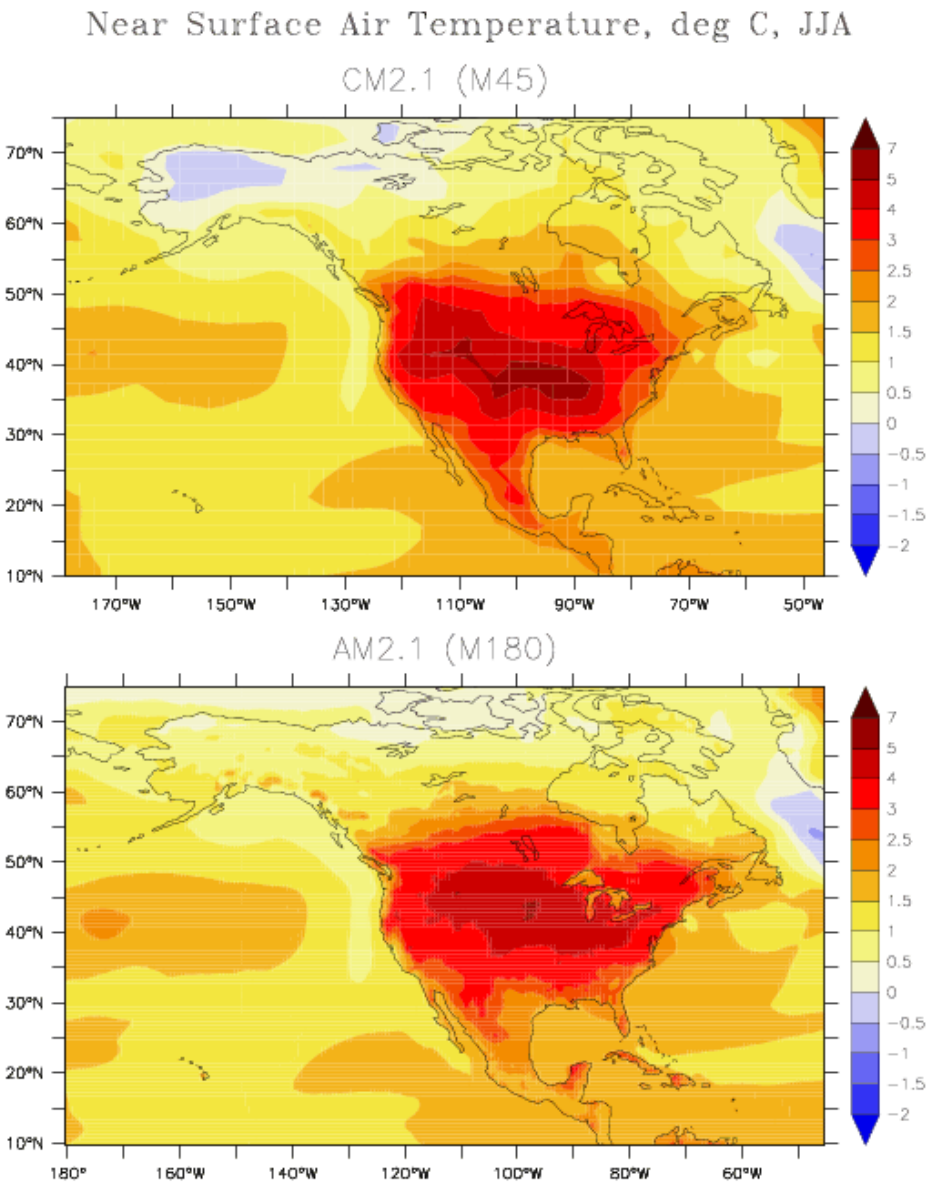
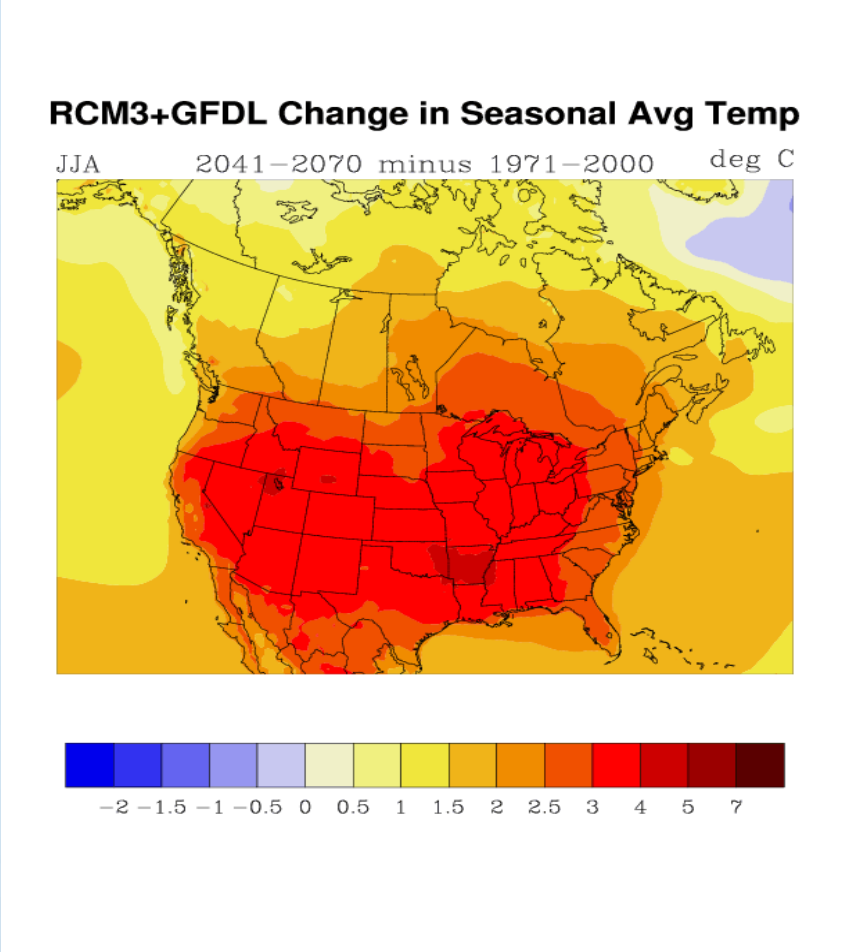
GFDL
CM2.1

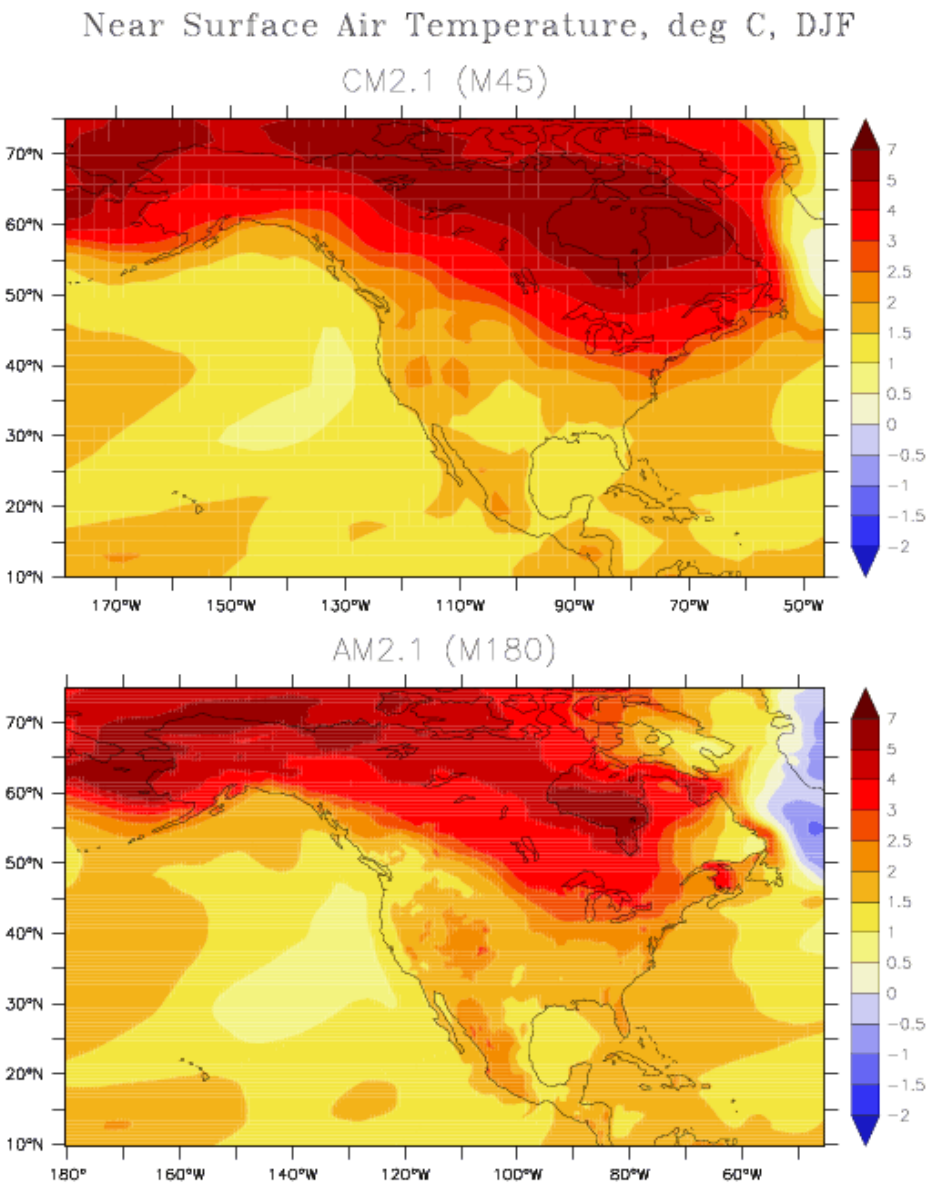
GFDL
AM2.1



Future-current
Summer
Temperatures

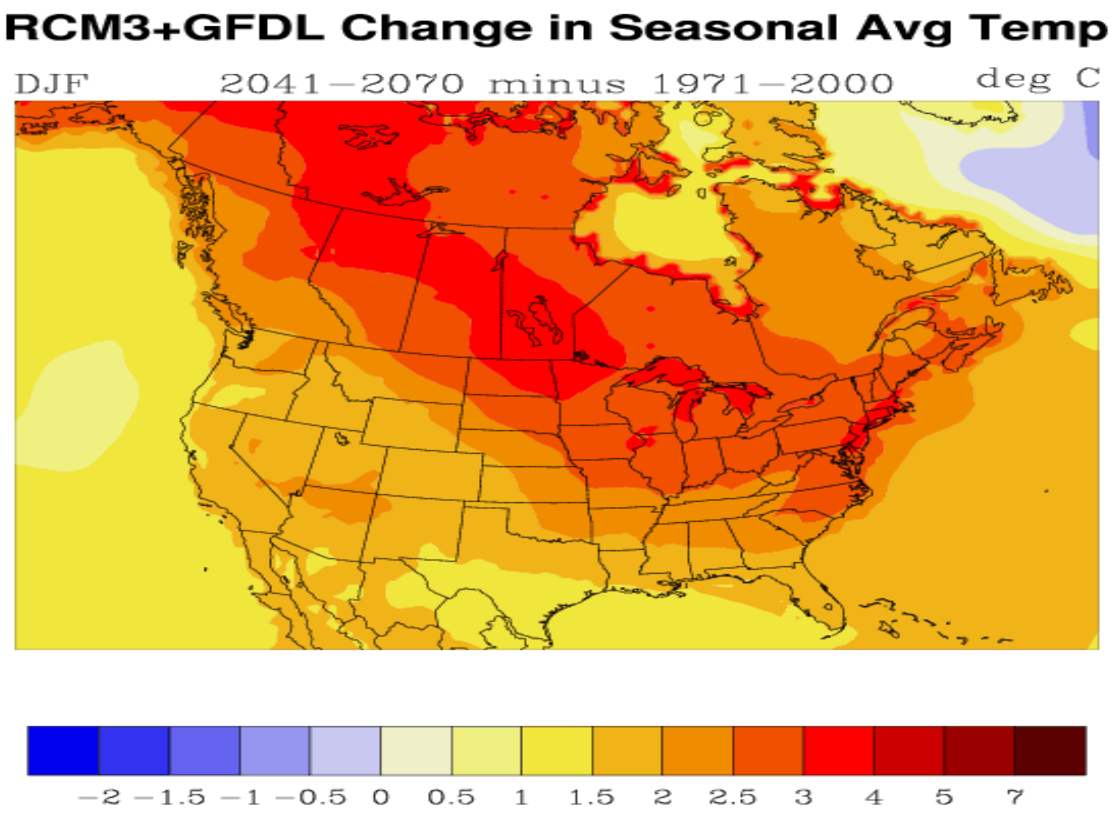
RegCM3 in GFDL
Change in Summer Temperature

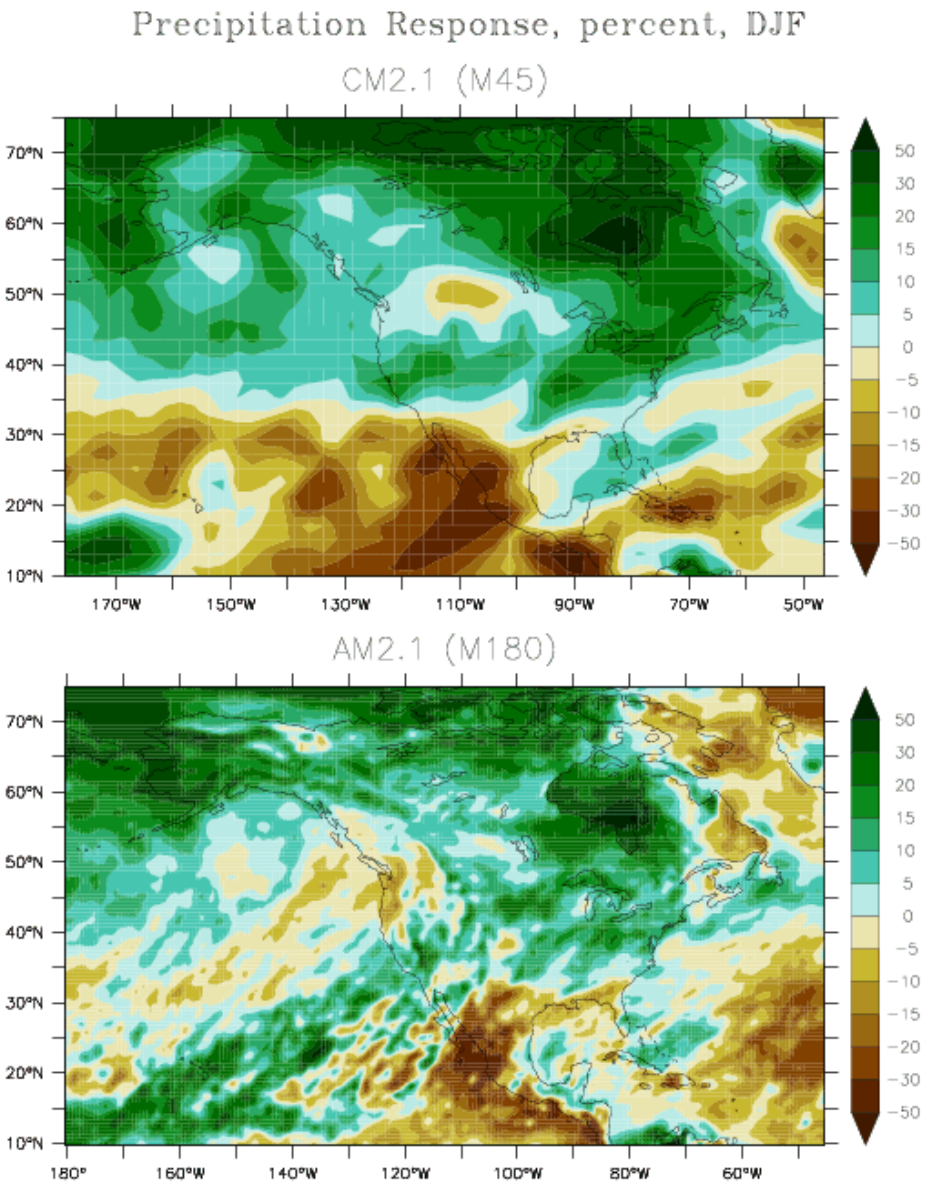



Near Surface Air Temperature, deg C, DJF
CM2.1 (M45)
70°N
60°N
50°N
40°N
30°N
20°N
10°N
170°W
150°W
130°W
110°W
90°W
70°W
50°W
7
5
4
3
2.5
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2
AM2.1 (M180)
70°N
60°N
50°N
40°N
30°N
20°N
10°N
180°
160°W
140°W
120°W
100°W
80°W
60°W
7
5
4
3
2.5
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2

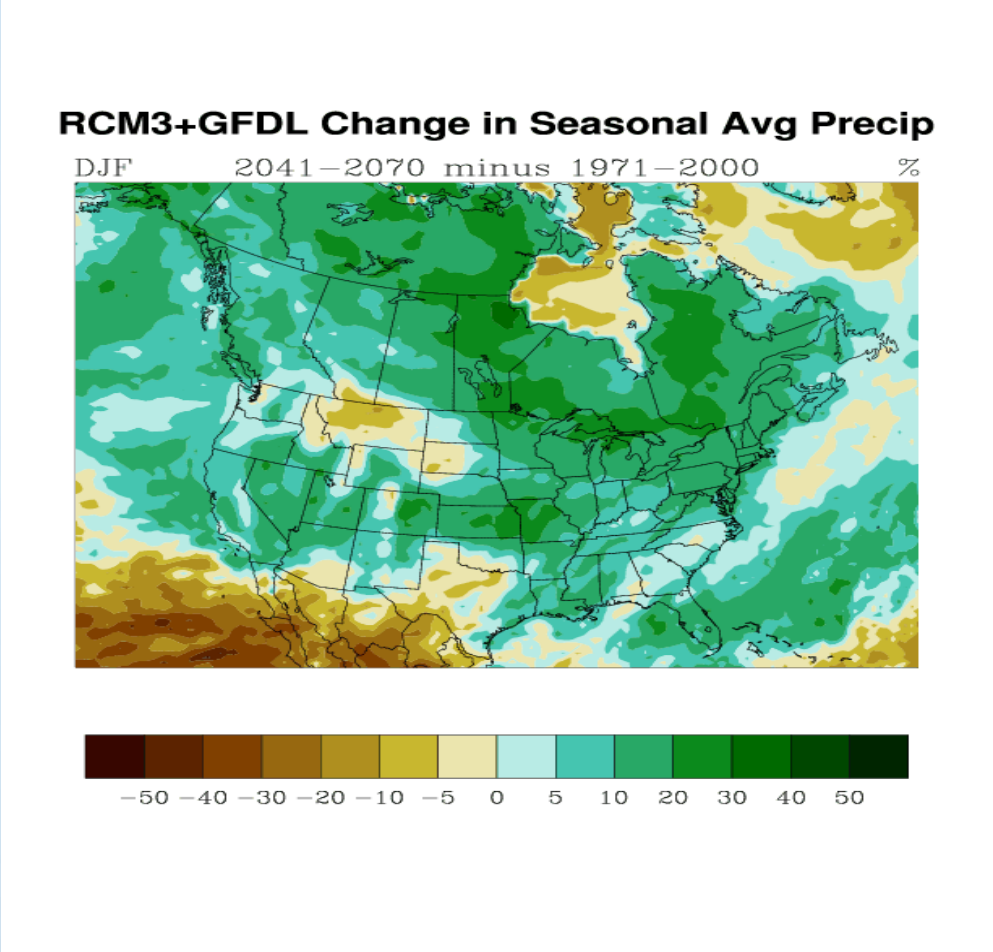
RegCM3 in GFDL
Change in Winter Temperature

NCAR




Precipitation Response, percent, DJF
CM2.1 (M45)
70°N
60°N
50°N
40°N
30°N
20°N
10°N
170°W
150°W
130°W
110°W
90°W
70°W
50°W
50
30
20
15
10
5
0
−5
−10
−15
−20
−30
−50
AM2.1 (M180)
70°N
60°N
50°N
40°N
30°N
20°N
10°N
180°
160°W
140°W
120°W
100°W
80°W
60°W
50
30
20
15
10
5
0
−5
−10
−15
−20
−30
−50

RegCM3 in GFDL
% Change Precip - Winter



Why quantification of uncertainty is important

- Because the uncertainties are not going away any time soon
- Because we need to make decisions under conditions of uncertainty
- Because many resource managers need this information (but doesn't have to be probabilistic information – can be a range of scenarios)

Quantification of Uncertainty

NCAR

- The four GCM simulations already ‘situated’ probabilistically based on earlier work (Tebaldi et al., 2004)
- RCM results nested in particular GCM would be represented by a probabilistic model (derived assuming probabilistic context of GCM simulation)
- Use of performance metrics to differentially weight the various model results

Probabilistic Information on Climate Change for Colorado

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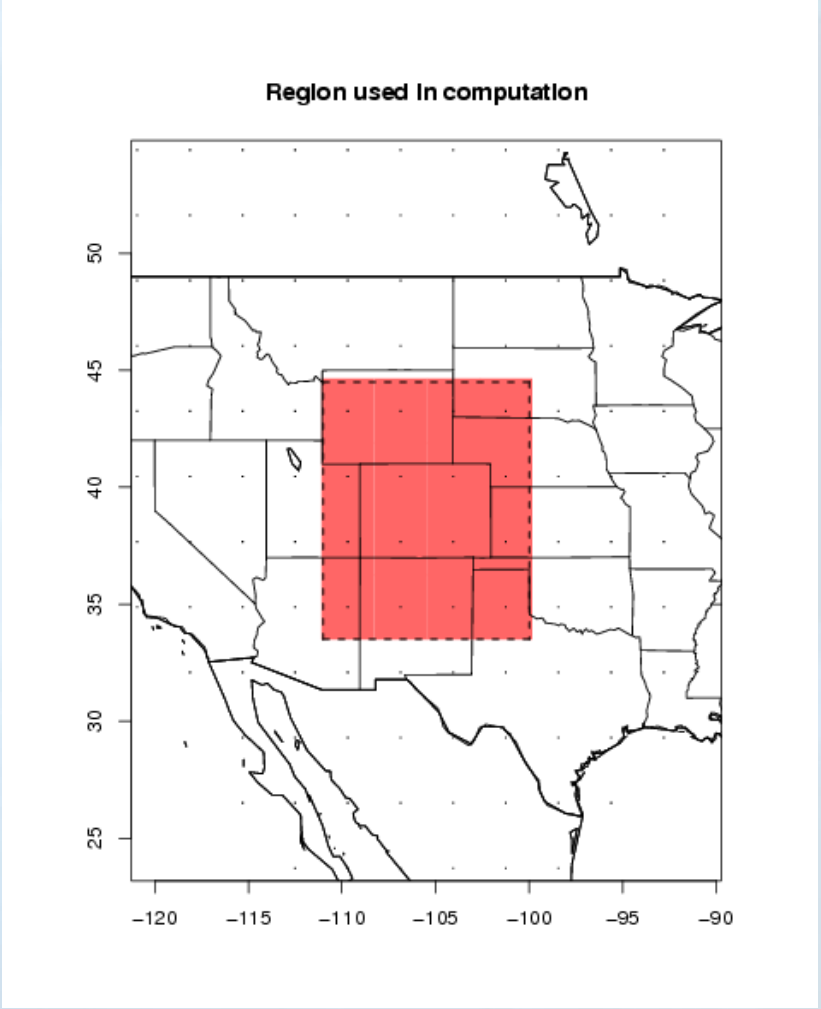
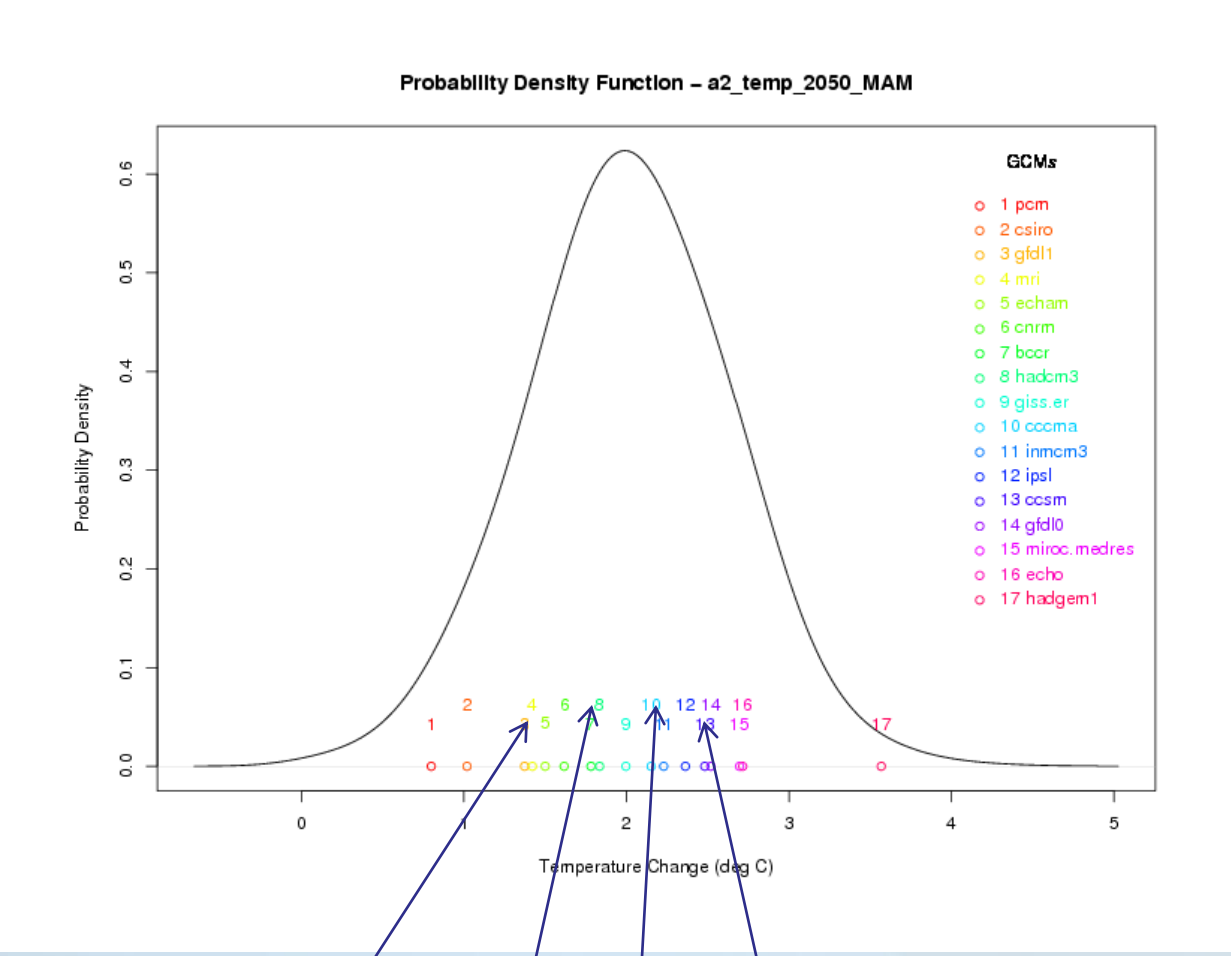
For 2040-2060 compared to current 1971-2000

Based on global model results from the IPCC archive (about 21 models)

Based on Tebaldi et al. 2005

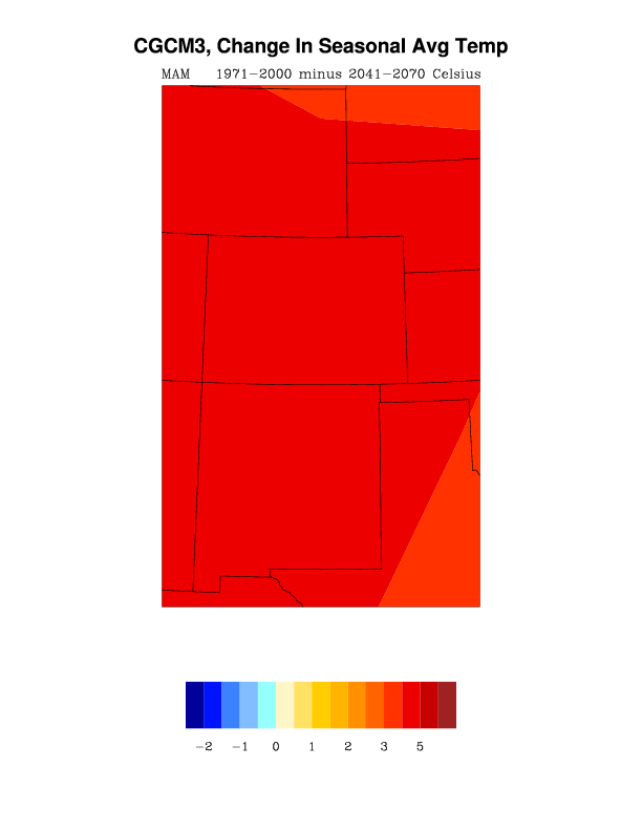


Probability of temperature change for Colorado, Spring- A2 scenario

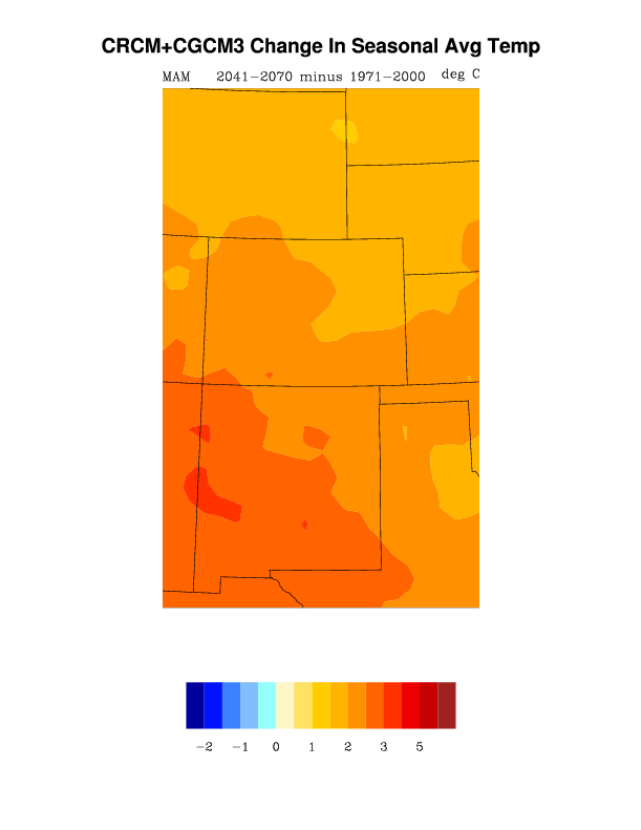


Change in Temperature Spring

Canadian Global Model

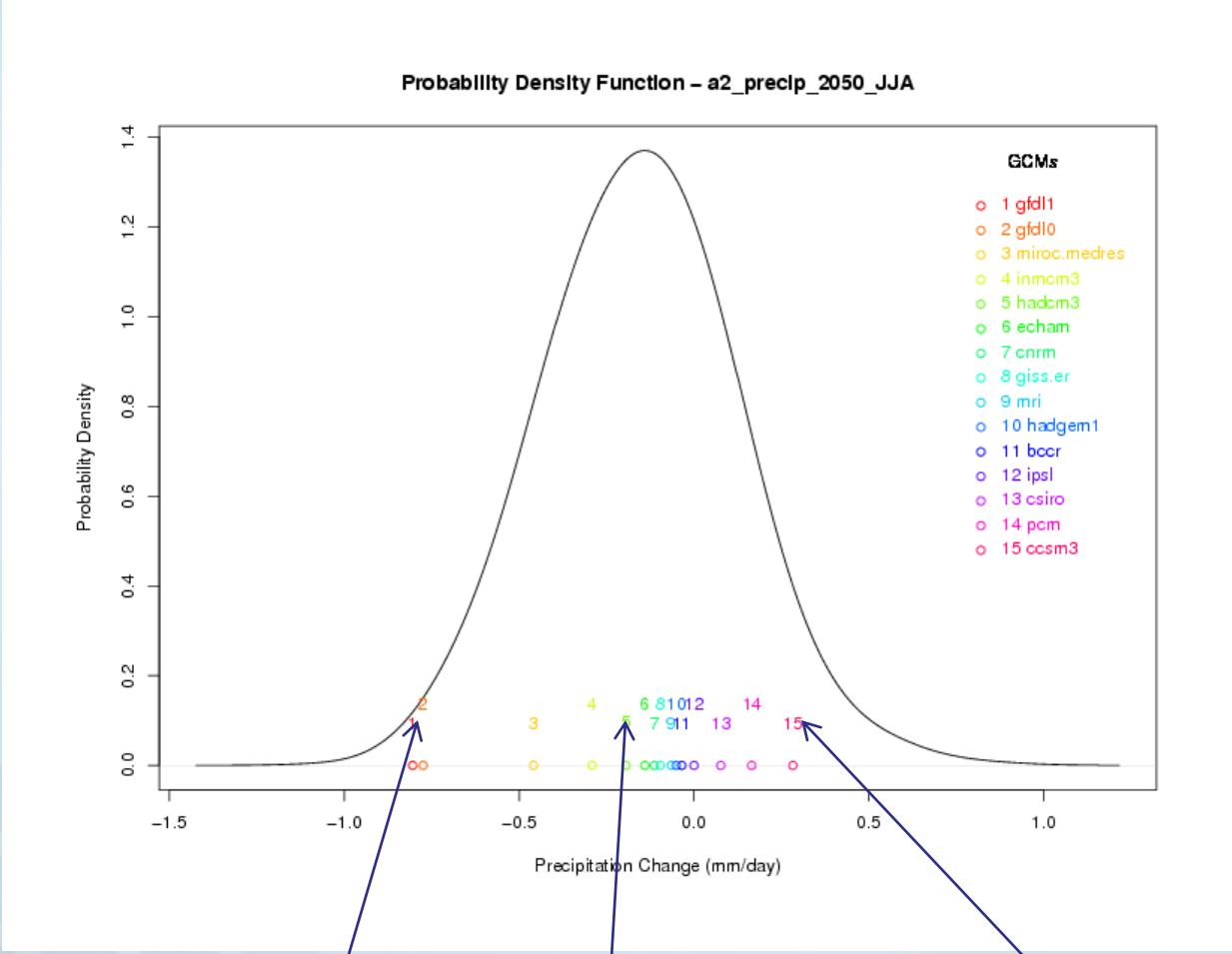


Canadian Regional Model



-2 -1 0 1 2 3 5

Probability of Change in Precipitation – A2 Scenario



Change in Precipitation in Spring (%)

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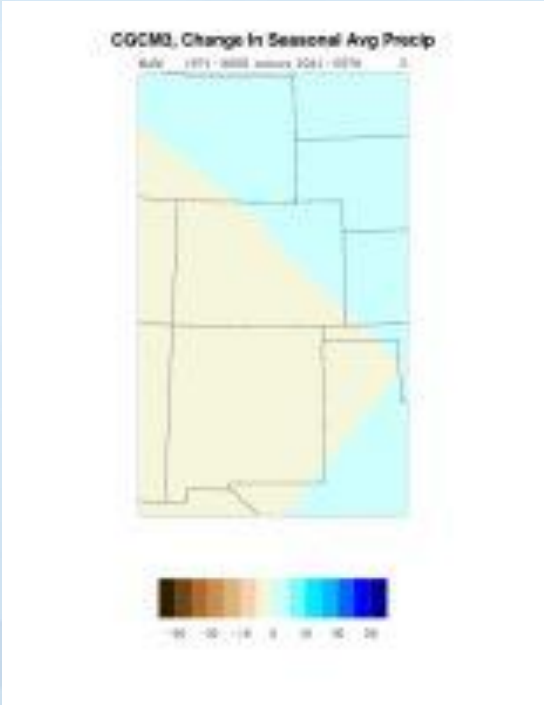
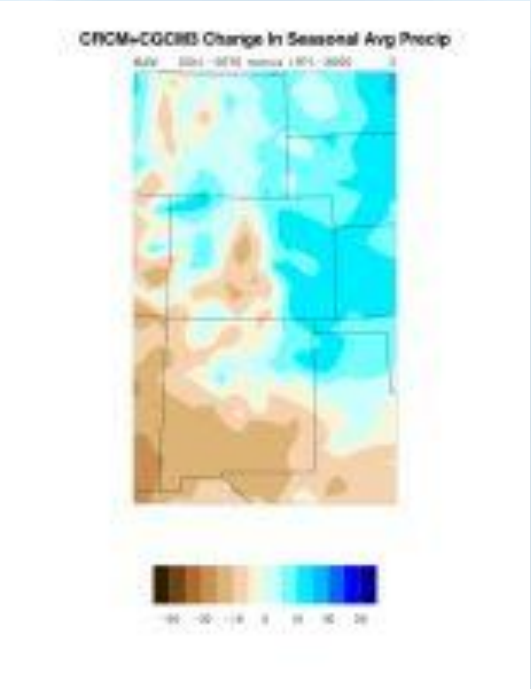
Canadian global model



Canadian regional model

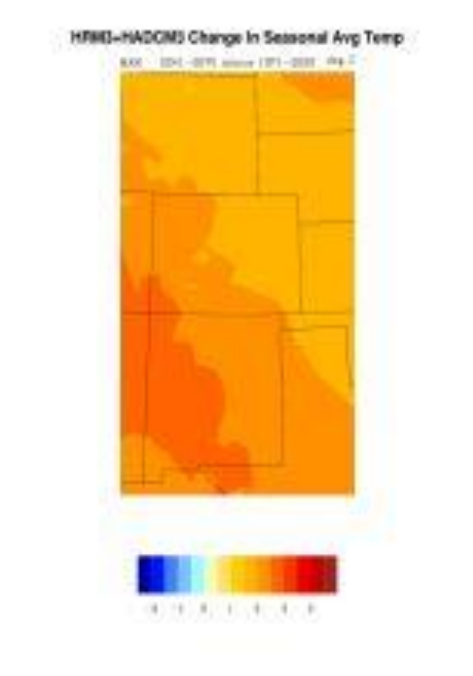


-50 -30 -10 0 10 30 50

Spring Temperature Change
2041-2070 compared to 1971-2000

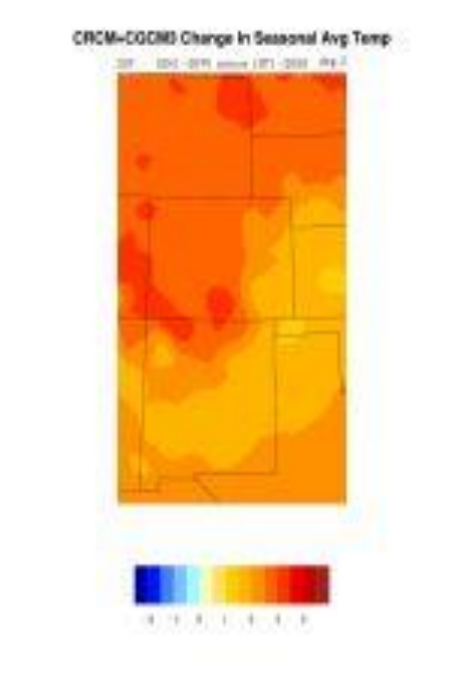
NCAR

HadRM3 in HadCM3

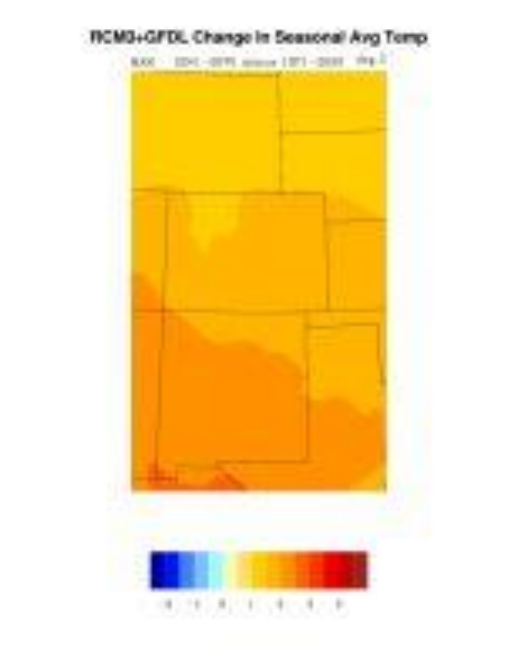


-2 -1 0 1 2 3 5

CRCM in CGCM3

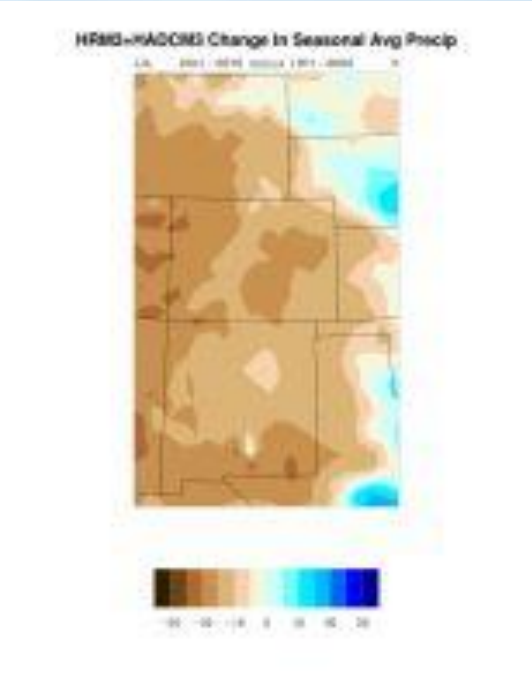


RegCM3 in GFDL

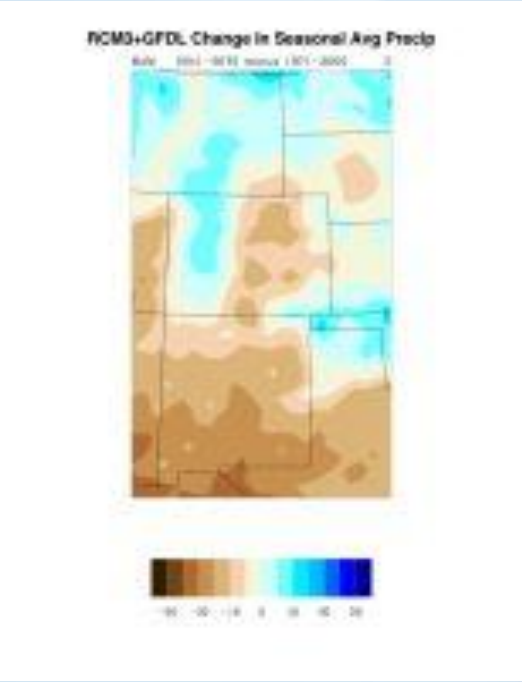


Change in Precipitation in Spring Regional Models

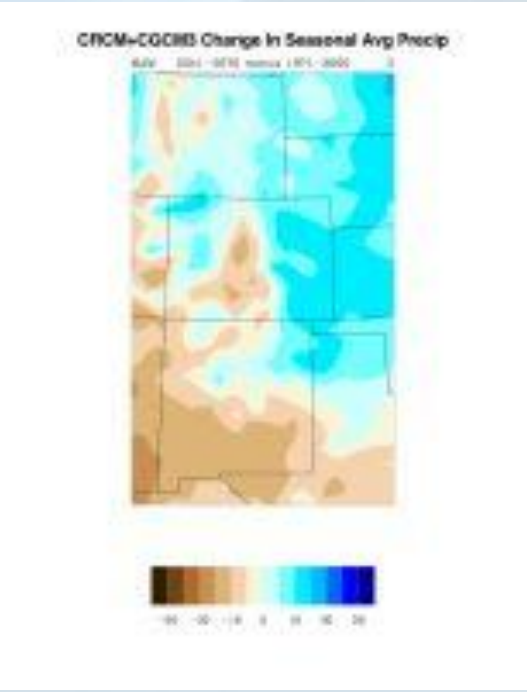
HadRM3 in HadCM3



RegCM3 in GFDL

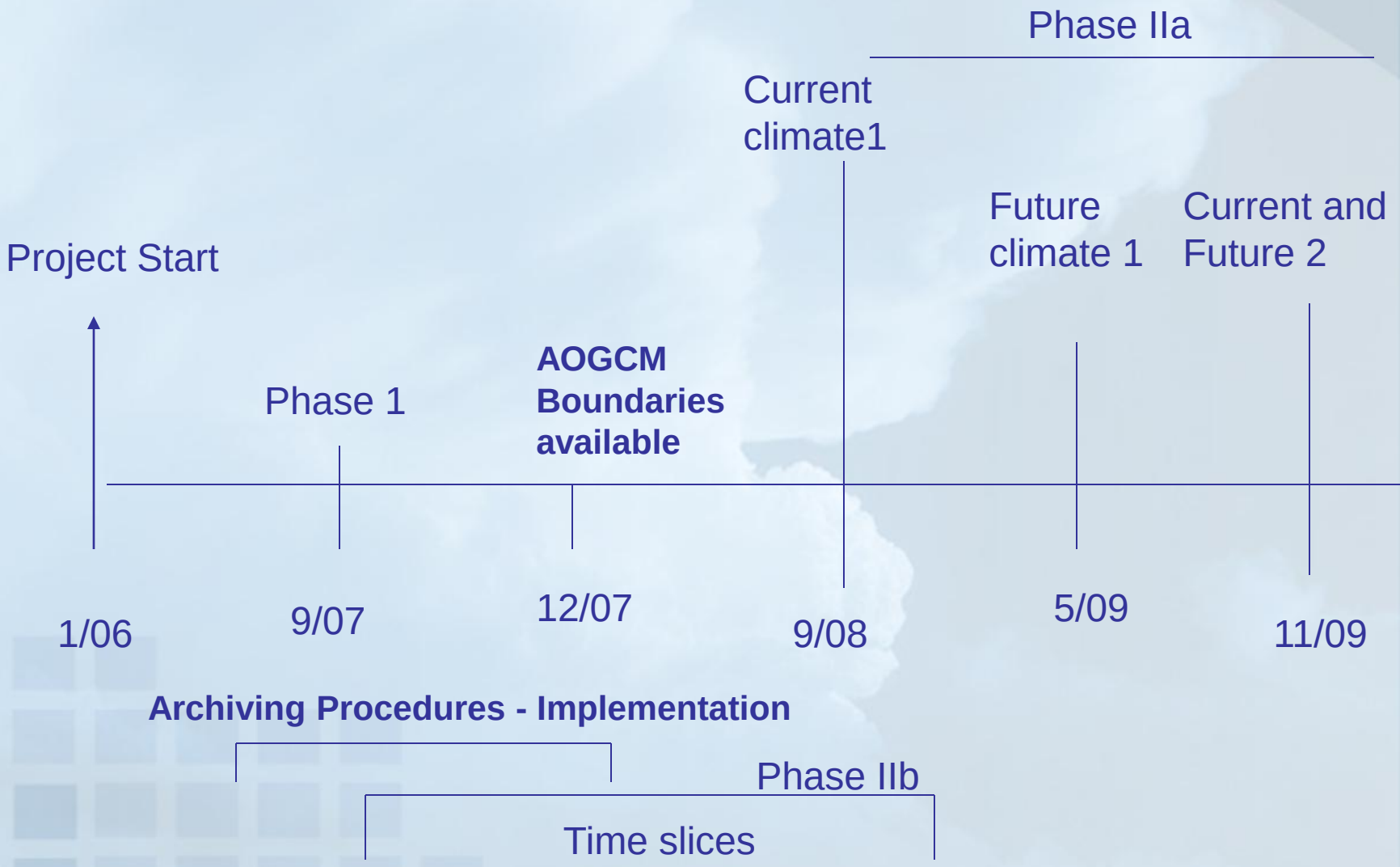


CRCM in CGCM3



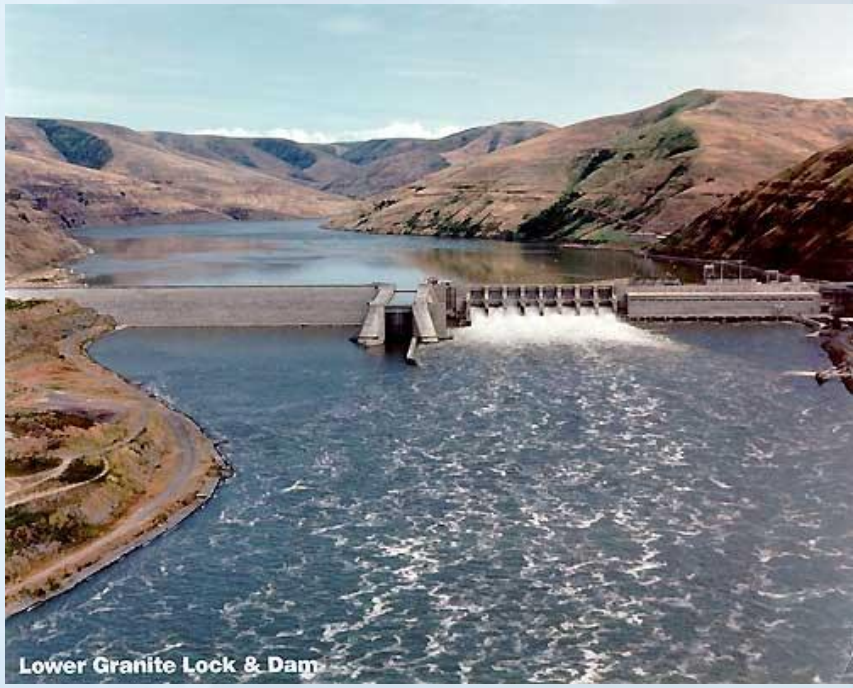
-50 -30 -10 0 10 30 50

NARCCAP Project Timeline



Adaptation Planning for Water Resources

- Develop adaptation plans for Colorado River water resources with stakeholders
- Use NARCCAP scenarios, simple DS, statistical DS
- Determine value of different types of higher resolution scenarios for adaptation plans
- NCAR, USGS, B. Reclamation, and Western Water Initiative



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End

Probability of temperature change for Colorado - A2 scenario