Diagnostic analysis of GCM simulations driven by SRES A2 and B2 emissions scenarios

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Introduction

To conduct climate change impact, vulnerability and adaptation (I, V&A) assessments, integrated scenarios of socio-economic and environmental features are required. As a result from the initial project development and two AIACC training workshops, most regional study teams have indicated that SRES driving GCM (General Circulation Model) experiments will be used to derive climate scenarios for these projects. Due to the limitation of both the computing and analytical resources, most project teams may have to make choices from a large number of available GCM experiments.

As an attempt to assist the AIACC study partners in selecting the most "appropriate" GCM experiments to develop climate scenarios for their projects, we performed a preliminary diagnostic analysis of climate simulations from 9 different GCMs driven by SRES A2 and B2 emissions scenarios, for 13 regions covered by 11 AIACC projects.

Methodology and Data

To evaluate the performance of different GCMs for different regions over the globe, we looked at two sets of quantities: different model simulations of quantities (e.g. mean temperature, precipitation,…) versus global 0.5 degree observed climatology for the baseline period (i.e. 1961~90); simulations of changes in seasonal climate quantities by different GCMs for the period of 2071~2100. In order to do so, datasets were extracted and plotted as maps for each region/area.

By comparing model simulated baseline period climatology against observations, one could make a judgment on which simulations perform better over the others for a specific region/area, in term of reproducing observed average climate features. Meanwhile, by examining the range of changes in primary climate features simulated by various GCMs, one could then decide, depending on how much of the uncertainty span should be explored in the I, V &A assessment, which model simulation(s) to use to derive regional climate scenarios.

CRU05 0.5 degree seasonal mean climatology was used and compared against GCM simulations. This data set is described in New, M., M. Hulme and P. Jones, 1999. Simulations of "present-day" (1961~90) climatology and climate futures towards the end of this century (2071~2100) from 9 state-of-the-art GCMs driven by SRES emissions scenarios were analysed. These model simulations were reviewed by the IPCC Third Assessment Report (TAR).

Two variables (***mean temperature*** and ***precipitation***), two seasons [***JJA***(June-July-August) and ***DJF*** (December-January-February)], and two SRES emissions scenarios (***A2*** and ***B2***) are included in this analysis.

Results

Results of the analysis are presented in three sets of maps:

- baseline (1961~90) period observed and simulated seasonal climatology (in maps);
- simulations of seasonal anomalies from 9 GCMs (in maps);
- scatter plots for each region/area illustrating the range of anomalies simulated by different GCMs[1]

Follow the links below to view and/or download the results corresponding to your region/area:

AF23
AF38
AS12
AS21 - Indonesia
AS21 - Philippines
AS25
Bhutan
INOC
LA06
LA26
LA29 - Mexico
LA29 - Argentina
NOAF

[1] The aggregation of anomalies over each region was achieved by simply averaging the numbers for GCM grid boxes falling inside each region. Scatter plots are missing for a few regions. This is due to the fact that some models produce 0 mm of seasonal precipitation over the baseline period. Therefore, the percentage change of precipitation in the 2080s was not attainable.

AF23

Time Periods	Variables	SRES Emissions Scenario			
		A2		B2	
		DJF	JJA	DJF	JJA
1961~90	**Mean temperature** (deg C)	X	X		
	Precipitation (mm)	X	X		
2080s	**Mean temperature** (deg C)	X	X	X	X
	Precipitation (%)	X	X	X	X
Scatter plot (2080s)		X			

AF38

Time Periods	Variables	SRES Emissions Scenario			
		A2		B2	
		DJF	JJA	DJF	JJA
1961~90	**Mean temperature** (deg C)	X	X		
	Precipitation (mm)	X	X		
2080s	**Mean temperature** (deg C)	X	X	X	X
	Precipitation (%)	X	X	X	X
Scatter plot (2080s)		X			

AS12

Time Periods	Variables	SRES Emissions Scenario			
		A2		B2	
		DJF	JJA	DJF	JJA
1961~90	**Mean temperature** (deg C)	X	X		
	Precipitation (mm)	X	X		
2080s	**Mean temperature** (deg C)	X	X	X	X
	Precipitation (%)	X	X	X	X
Scatter plot (2080s)		X			

AS21 - Indonesia

Time Periods	Variables	SRES Emissions Scenario			
		A2		B2	
		DJF	JJA	DJF	JJA
1961~90	**Mean temperature** (deg C)	X	X		
	Precipitation (mm)	X	X		
2080s	**Mean temperature** (deg C)	X	X	X	X
	Precipitation (%)	X	X	X	X
Scatter plot (2080s)		X			

AS21 - Philippines

Time Periods	Variables	SRES Emissions Scenario			
		A2		B2	
		DJF	JJA	DJF	JJA
1961~90	**Mean temperature** (deg C)	X	X		
	Precipitation (mm)	X	X		
2080s	**Mean temperature** (deg C)	X	X	X	X
	Precipitation (%)	X	X	X	X
Scatter plot (2080s)		X			

AS25

Time Periods	Variables	SRES Emissions Scenario			
		A2		B2	
		DJF	JJA	DJF	JJA
1961~90	**Mean temperature** (deg C)	X	X		
	Precipitation (mm)	X	X		
2080s	**Mean temperature** (deg C)	X	X	X	X
	Precipitation (%)	X	X	X	X
Scatter plot (2080s)		X			

Bhutan

Time Periods	Variables	SRES Emissions Scenario			
		A2		B2	
		DJF	JJA	DJF	JJA
1961~90	**Mean temperature** (deg C)	X	X		
	Precipitation (mm)	X	X		
2080s	**Mean temperature** (deg C)	X	X	X	X
	Precipitation (%)	X	X	X	X
Scatter plot (2080s)		X			

INOC

Time Periods	Variables	SRES Emissions Scenario			
		A2		B2	
		DJF	JJA	DJF	JJA
1961~90	**Mean temperature** (deg C)	X	X		
	Precipitation (mm)	X	X		
2080s	**Mean temperature** (deg C)	X	X	X	X
	Precipitation (%)	X	X	X	X
Scatter plot (2080s)		X			

LA06

Time Periods	Variables	SRES Emissions Scenario			
		A2		B2	
		DJF	JJA	DJF	JJA
1961~90	**Mean temperature** (deg C)	X	X		
	Precipitation (mm)	X	X		
2080s	**Mean temperature** (deg C)	X	X	X	X
	Precipitation (%)	X	X	X	X
Scatter plot (2080s)		X			

LA26

Time Periods	Variables	SRES Emissions Scenario			
		A2		B2	
		DJF	JJA	DJF	JJA
1961~90	**Mean temperature** (deg C)	X	X		
	Precipitation (mm)	X	X		
2080s	**Mean temperature** (deg C)	X	X	X	X
	Precipitation (%)	X	X	X	X
Scatter plot (2080s)		X			

LA29 - Mexico

Time Periods	Variables	SRES Emissions Scenario			
		A2		B2	
		DJF	JJA	DJF	JJA
1961~90	**Mean temperature** (deg C)	X	X		
	Precipitation (mm)	X	X		
2080s	**Mean temperature** (deg C)	X	X	X	X
	Precipitation (%)	X	X	X	X
Scatter plot (2080s)		X			

LA29 - Argentina

Time Periods	Variables	SRES Emissions Scenario			
		A2		B2	
		DJF	JJA	DJF	JJA
1961~90	**Mean temperature** (deg C)	X	X		
	Precipitation (mm)	X	X		
2080s	**Mean temperature** (deg C)	X	X	X	X
	Precipitation (%)	X	X	X	X
Scatter plot (2080s)		X			

NOAF

Time Periods	Variables	SRES Emissions Scenario			
		A2		B2	
		DJF	JJA	DJF	JJA
1961~90	**Mean temperature** (deg C)	X	X		
	Precipitation (mm)	X	X		
2080s	**Mean temperature** (deg C)	X	X	X	X
	Precipitation (%)	X	X	X	X
Scatter plot (2080s)					

Useful web sources on GCM diagnostic analyses

Atmospheric Model Intercomparison Project (AMIP): AMIP is a standard experimental protocol for global atmospheric general circulation models (AGCMs). It provides a community-based infrastructure in support of climate model diagnosis, validation, intercomparison, documentation and data access. This framework enables a diverse community of scientists to analyze AGCMs in a systematic fashion, a process which serves to facilitate model improvement. Virtually the entire international climate modeling community has participated in this project since its inception in 1990. Documentation on the participating GCMs, results of diagnostic analyses and publications are available from http://www-pcmdi.llnl.gov/amip

Coupled Model Intercomparison Project (CMIP): This is a sister project to PMIP. It archived and analysed model output from the pre-industrial climate simulations ("control runs") and 1% per year increasing-CO2 simulations of 29 coupled GCMs. A new phase of CMIP ("CMIP2+") will extend the database to include all output originally archived during model runs. Documentation on the participating GCMs, results of diagnostic analyses and publications are available from http://www-pcmdi.llnl.gov/covey/cmip/cmiphome.html.

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