

AWCI Training Course: Rainfall bias correction



Provided by the University of
Tokyo

March 11 2011



Three steps

1. Evaluation of models -> selecting suitable ones for the region
2. Downloading model precipitation output of selected models and gap-filling
3. Bias correction of historical simulation precipitation output and future projection precipitation output of selected models – using observed precipitation data

Folder organization

- **Training-2011-03-11-Bias**
 - **Bias_correction**
 - Model_output_gapfill.xls
 - Bias_corr_tmp.xls (Bias_corr_tmp_Indonesia-19years.xls, Bias_corr_tmp_Pakistan-10years.xls, Bias_corr_tmp_Thailand-13years.xls)
 - Bias_corr.doc
 - **Data_observation**
 - 06-Japan_Precipitation_Maebashi.xls (and other basins observation data files)
 - **Model_eval**
 - Scoring_CMIP3_Models.xls
 - **Results** (prepared by UT team)
 - Bias_correction (completed bias correction sheets)
 - Model_eval (completed model evaluation sheets -> model selection)

Step 1: Evaluation of Climate Model Output

- Using an internet-based tool developed by UT – IIS
- Evaluating model performance during past simulation (1981 – 2000) against a reference dataset over a region of interest and/or regions closely climatologically/meteorologically related to the region of interest
- Evaluation is based on selected key meteorological elements

Quantitative Evaluation of AOGCM

*** Pre-release Beta Version ***

1. Intercomparison : Re-analysis/Observation Data vs. CMIP3 Model Output

- [1-D Plot \(time-series\)](#)
- [2-D Plot](#)
- [Vector Diagram](#)
- Cross-sectional View
 - [Longitude-time / Latitude-time](#)
 - [Longitude-height / Latitude-height](#)

2-D Plot option for evaluation

2. Comparison of Global Warming Projection between:

- [Climate Models](#)
- [Emission Scenarios](#) --- implementation in progress; only monthly data supported
- Periods of Analysis Time
 - [Monthly data](#)
 - [Daily data](#)

3. Tools

- [CMIP3 Daily Data Download](#)
- Interannual Variations at a Glance
 - [2-D Plot](#)
 - [Vector Diagram](#)
 - Cross-sectional View
 - [Long/Lat-time](#)
 - [Long/Lat-height](#)

For more details, contact [Akio Yamamoto](#).

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Meteorologic Element	Please select one of the following: <input type="text"/>	Level or Layer: <input type="text"/>
Analysis Area <input type="button" value="Check World Map"/>	Lon1(West): <input type="text" value="40"/> Lat2(North): <input type="text" value="40"/> Lon2(East): <input type="text" value="140"/> Lat1(South): <input type="text" value="-10"/>	
Time Range	From <input type="text" value="1981"/> To <input type="text" value="2000"/> ; For <input type="text" value="1"/> month(s) starting from <input type="text" value="January"/>	
Display Option	<input type="checkbox"/> Maskout the altitude above <input type="text"/> meters	
	Colorbar for diffs <input type="radio"/> Max range <input type="radio"/> Manual: <input type="text"/> (absolute value of range) <input checked="" type="radio"/> Separate setting <input type="button" value="Recalculation"/>	
<input checked="" type="checkbox"/> Display area	Lon1(West): <input type="text" value="-10"/> Lat2(North): <input type="text" value="60"/> Lat1(South): <input type="text" value="-25"/> Lon2(East): <input type="text" value="155"/>	

Reference Data

(per row)

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Model Output: CMIP3

Meteorologic Element	Precipitation <input type="button" value="v"/>	Level or Layer: ----- <input type="button" value="v"/>
Analysis Area <input type="button" value="Check World Map"/>	Please select one of the following: Precipitation Ground Temperature Outgoing Longwave Radiation (OLR) Sea Level Pressure Sea Surface Temperature Air Temperature Geopotential Height Specific Humidity Zonal Wind Meridional Wind ----- Horizontal Divergence Vorticity	North: <input type="text" value="40"/> Lon2(East): <input type="text" value="140"/> South: <input type="text" value="-10"/>
Time Range		1 <input type="button" value="v"/> month(s) starting from <input type="button" value="January"/> <input type="button" value="v"/>
Display Option	<input type="checkbox"/> meters	<input type="radio"/> Manual: <input type="text"/> (absolute value of range)
	<input checked="" type="checkbox"/> Display area	<input checked="" type="radio"/> Separate setting <input type="button" value="Recalculation"/>
	Lon1(West): <input type="text" value="-10"/> Lat2(North): <input type="text" value="60"/> Lat1(South): <input type="text" value="-25"/> Lon2(East): <input type="text" value="155"/>	

Reference Data

(per row)

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Model Output: CMIP3

Meteorologic Element	Precipitation <input type="button" value="v"/>	Level or Layer: Ground/water surface <input type="button" value="v"/>
Analysis Area <input type="button" value="Check World Map"/>	Lon1(West): <input type="text" value="105"/> Lat2(North): <input type="text" value="55"/> Lat1(South): <input type="text" value="20"/> Lon2(East): <input type="text" value="155"/>	
Time Range	From <input type="button" value="1981"/> <input type="button" value="v"/> To <input type="button" value="2000"/> <input type="button" value="v"/> ; For <input type="button" value="1"/> <input type="button" value="v"/> month(s) starting from <input type="button" value="June"/> <input type="button" value="v"/>	
Display Option	<input type="checkbox"/> Maskout the altitude above <input type="text"/> meters	
	Colorbar for diffs	<input type="radio"/> Max range <input type="radio"/> Manual: <input type="text"/> (absolute value of range) <input checked="" type="radio"/> Separate setting <input type="button" value="Recalculation"/>
	<input checked="" type="checkbox"/> Display area	Lon1(West): <input type="text" value="95"/> Lat2(North): <input type="text" value="65"/> Lat1(South): <input type="text" value="10"/> Lon2(East): <input type="text" value="165"/>

Reference Data: GPCP

(per row)

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Model Output

List of reference datasets for individual meteorological elements

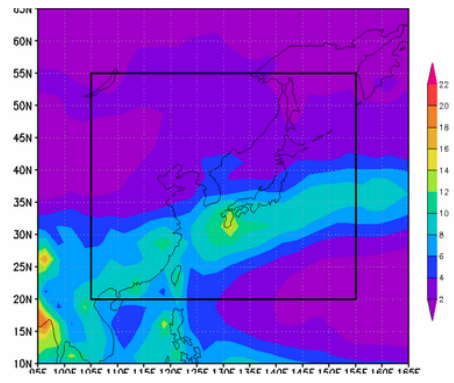
- ❑ Precipitation: **GPCP**
- ❑ Ground Temperature: **JRA25**
- ❑ Outgoing Longwave Radiation: **NOAA**
- ❑ Sea Level Pressure: **JRA25**
- ❑ Sea Surface Temperature: **HADLEY**
- ❑ Air Temperature: **JRA25**
- ❑ Geopotential Height: **JRA25**
- ❑ Specific Humidity: **JRA25**
- ❑ Zonal Wind: **JRA25**
- ❑ Meridional wind **JRA25**
- ❑ Horizontal divergence: **JRA25**
- ❑ Vorticity: **JRA25**

Meteorologic Element	Precipitation	Level or Layer:	Ground/water surface
Analysis Area Check World Map	Lon1(West): 105	Lat2(North): 55	Lon2(East): 155
		Lat1(South): 20	
Time Range	From 1981 To 2000 ; For 1 month(s) starting from June		
Display Option	<input type="checkbox"/> Maskout the altitude above _____ meters		
	Colorbar for diffs	<input type="radio"/> Max range <input type="radio"/> Manual: _____ (absolute value of range) <input checked="" type="radio"/> Separate setting Recalculation	
	<input checked="" type="checkbox"/> Display area	Lon1(West): 95	Lat2(North): 65
		Lat1(South): 10	Lon2(East): 165

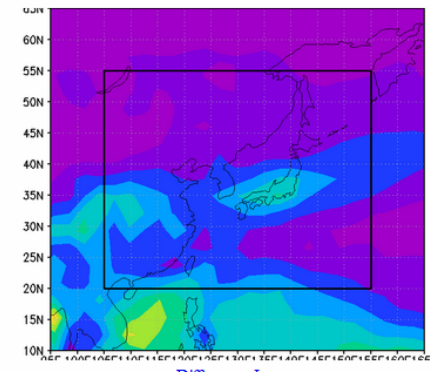
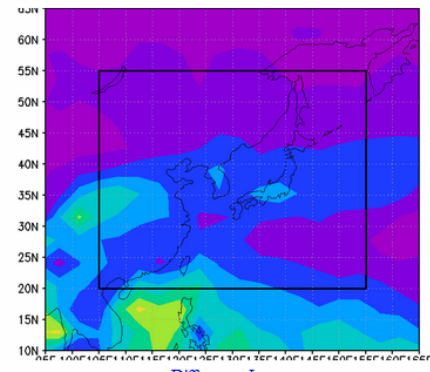
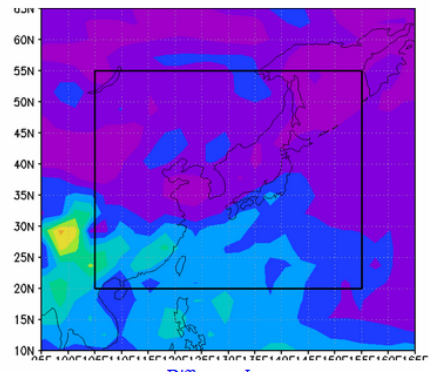
[View Reference Data](#) [View Model Output](#) (4 per row) [Clear All](#)

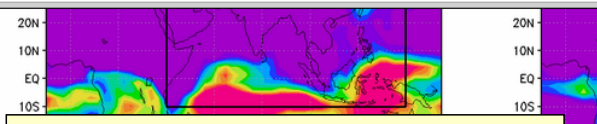
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Reference Data: GPCP



CMIP3 Model Output [Open as New Window/Tab](#) [View All Difference Images](#)





Scroll down the result page to see the summary of analysis results

Microsoft Excel - pr_Surface_Jan_1981-2000_A(40E-140E,10S-40N)_D(10W-155E)

File Edit View Insert Format Tools Data Window Help

Share This File WebEx

	A	B	C	D	E
1	bccr_bcm2_0	0.803488	2.55526		
2	cccma_cgcm3_1	0.753476	2.63272		
3	cccma_cgcm3_1_t63	0.707119	2.86139		
4	cnrm_cm3	0.841968	2.69926		
5	csiro_mk3_0	0.815304	2.3014		
6	csiro_mk3_5	0.866608	2.38598		
7	gfdl_cm2_0	0.868471	2.37104		
8	gfdl_cm2_1	0.892548	2.50294		
9	giss_aom	0.731086	3.11295		
10	giss_model_e_h	0.703246	2.72236		
11	giss_model_e_r	0.756397	2.95968		
12	iap_fgoals1_0_g	0.771298	2.48557		
13	ingv_echam4	0.843576	2.09155		
14	inmcm3_0	0.849952	2.017		
15	ipsl_cm4	0.865569	2.24632		
16	miroc3_2_hires	0.780891	2.82709		
17	miroc3_2_medres	0.825645	2.19177		
18	miub_echo_g	0.888917	1.80879		
19	mpi_echam5	0.854794	2.29265		
20	mri_cgcm2_3_2a	0.82656	1.8486		
21	ncar_ccsm3_0	0.766107	3.03576		
22	ncar_pcm1	0.704558	3.83237		
23	ukmo_hadcm3	0.855597	3.48288		
24	ukmo_hadgem1	0.835898	3.62627		
25					
26					

Summary of Analysis Results

Download: [CSV file](#)

Model	Scorr	RMSE
bccr_bcm2_0	0.803488	2.55526
cccma_cgcm3_1	0.753476	2.63272
cccma_cgcm3_1_t63	0.707119	2.86139
cnrm_cm3	0.841968	2.69926
csiro_mk3_0	0.815304	2.3014
csiro_mk3_5	0.866608	2.38598
gfdl_cm2_0	0.868471	2.37104
gfdl_cm2_1	0.892548	2.50294
giss_aom	0.731086	3.11295
giss_model_e_h	0.703246	2.72236
giss_model_e_r	0.756397	2.95968
iap_fgoals1_0_g	0.771298	2.48557
ingv_echam4	0.843576	2.09155

Limited evaluation during the course

- Due to limited time during the training course, evaluation presented here is based on the following items:
 - Only one region that includes the basin of interest
 - Only two meteorological elements, namely precipitation and geopotential height at 500hPa
 - Only three months (20-year monthly mean values) out of the whole year

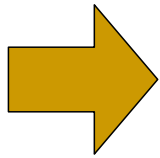
Please consider more precise evaluation for the real study (more regions, meteorological parameters, and months)

Evaluation of precipitation element – refer to the excel file: Scoring_CMI P3_Models.xls in the folder Model_eval

Meteorological Element: Precipitation							
		June		July		August	
model		S_corr	RMSE	S_corr	RMSE	S_corr	RMSE
1	bccr_bcm2_0	0.612577	2.9638	0.641915	3.14939	0.654535	3.04457
2	cccma_cgcm3_1	0.67809	2.80344	0.702107	2.9001	0.705981	2.95936
3	cccma_cgcm3_1_t63	0.668077	2.82739	0.699067	2.92443	0.679764	3.07007
4	cnrm_cm3	0.525991	3.40764	0.616057	3.33114	0.658663	3.10189
5	csiro_mk3_0	0.634887	3.01851	0.701048	2.99784	0.804089	2.35907
6	csiro_mk3_5	0.604204	3.39617	0.637255	3.36531	0.765534	2.62358
7	gfdl_cm2_0	0.699975	2.881	0.764176	2.69764	0.722448	2.97213
8	gfdl_cm2_1	0.745677	2.67032	0.77535	2.70179	0.763758	2.77364
9	giss_aom	0.508475	3.4729	0.606315	3.34358	0.68674	2.94604
10	giss_model_e_h	0.522648	4.00037	0.475727	4.49904	0.450178	4.32617
11	giss_model_e_r	0.479788	3.83325	0.595113	3.79972	0.627638	3.51206
12	iap_fgoals1_0_g	0.2221	3.99231	0.45438	3.68498	0.606514	3.1221
13	ingv_echam4	0.712693	2.73918	0.644567	3.17053	0.718778	2.78949
14	inmcm3_0	0.493076	3.41301	0.555526	3.56882	0.655465	3.0002
15	ipsl_cm4	0.468554	3.56933	0.516445	3.75673	0.626658	3.24568
16	miroc3_2_hires	0.759938	2.6016	0.573135	3.74899	0.566137	3.67448
17	miroc3_2_medres	0.778193	2.40629	0.591421	3.54172	0.53499	3.64249
18	miub_echo_g	0.501836	3.57485	0.621491	3.41304	0.7526	2.53125
19	mpi_echam5	0.700632	3.27375	0.667879	3.54028	0.726193	3.01962
20	mri_cgcm2_3_2a	0.624962	3.32155	0.592236	3.59373	0.64089	3.25602
21	ncar_ccsm3_0	0.586914	3.15148	0.607632	3.33779	0.621849	3.3873
22	ncar_pcm1	0.592746	3.73951	0.510997	4.16259	0.593308	3.61601
23	ukmo_hadcm3	0.602475	3.87233	0.656899	3.7304	0.69017	3.61585
24	ukmo_hadgem1	0.63235	3.66643	0.713683	3.61798	0.747354	3.45026

Scorr and RMSE averaging: 1. Analysis period
2. All models

Meteorological Element: Precipitation							
		June		July		August	
model		S_corr	RMSE	S_corr	RMSE	S_corr	RMSE
1	bccr_bcm2_0	0.612577	2.9638	0.641915	3.14939	0.654535	3.04457
2	cccma_cgcm3_1	0.67809	2.80344	0.702107	2.9001	0.705981	2.95936
3	cccma_cgcm3_1_t63	0.668077	2.82739	0.699067	2.92443	0.679764	3.07007
4	cnrm_cm3	0.525991	3.40764	0.616057	3.33114	0.658663	3.10189
5	csiro_mk3_0	0.634887	3.01851	0.701048	2.99784	0.804089	2.35907
6	csiro_mk3_5	0.604204	3.39617	0.637255	3.36531	0.765534	2.62358
7	gfdl_cm2_0	0.699975	2.881	0.764176	2.69764	0.722448	2.97213
8	gfdl_cm2_1	0.745677	2.67032	0.77535	2.70179	0.763758	2.77364
9	giss_aom	0.508475	3.4729	0.606315	3.34358	0.68674	2.94604
10	giss_model_e_h	0.522648	4.00037	0.475727	4.49904	0.450178	4.32617
11	giss_model_e_r	0.479788	3.83325	0.595113	3.79972	0.627638	3.51206
12	iap_fgoals1_0_g	0.2221	3.99231	0.45438	3.68498	0.606514	3.1221
13	ingv_echam4	0.712693	2.73918	0.644567	3.17053	0.718778	2.78949
14	inmcm3_0	0.493076	3.41301	0.555526	3.56882	0.655465	3.0002
15	ipsl_cm4	0.468554	3.56933	0.516445	3.75673	0.626658	3.24568
16	miroc3_2_hires	0.759938	2.6016	0.573135	3.74899	0.566137	3.67448
17	miroc3_2_medres	0.778193	2.40629	0.591421	3.54172	0.53499	3.64249
18	miub_echo_g	0.501836	3.57485	0.621491	3.41304	0.7526	2.53125
19	mpi_echam5	0.700632	3.27375	0.667879	3.54028	0.726193	3.01962
20	mri_cgcm2_3_2a	0.624962	3.32155	0.592236	3.59373	0.64089	3.25602
21	ncar_ccsm3_0	0.586914	3.15148	0.607632	3.33779	0.621849	3.3873
22	ncar_pcm1	0.592746	3.73951	0.510997	4.16259	0.593308	3.61601
23	ukmo_hadcm3	0.602475	3.87233	0.656899	3.7304	0.69017	3.61585
24	ukmo_hadgem1	0.63235	3.66643	0.713683	3.61798	0.747354	3.45026



			Analysis Period	
			S_corr	RMSE
			0.63634233	3.0525867
			0.69539267	2.8876333
			0.68230267	2.94063
			0.600237	3.2802233
			0.71334133	2.7918067
			0.66899767	3.1283533
			0.72886633	2.8502567
			0.761595	2.71525
			0.60051	3.2541733
			0.482851	4.2751933
			0.567513	3.71501
			0.42766467	3.5997967
			0.69201267	2.8997333
			0.56802233	3.3273433
			0.537219	3.5239133
			0.63307	3.34169
			0.634868	3.1968333
			0.625309	3.1730467
			0.69823467	3.2778833
			0.61936267	3.3904333
			0.605465	3.29219
			0.56568367	3.83937
			0.649848	3.7395267
			0.69779567	3.5782233
Total Averag			0.62885435	3.2946292

Analysis Period	
S_corr	RMSE
0.63634233	3.0525867
0.69539267	2.8876333
0.68230267	2.94063
0.600237	3.2802233
0.71334133	2.7918067
0.66899767	3.1283533
0.72886633	2.8502567
0.761595	2.71525
0.60051	3.2541733
0.482851	4.2751933
0.567513	3.71501
0.42766467	3.5997967
0.69201267	2.8997333
0.56802233	3.3273433
0.537219	3.5239133
0.63307	3.34169
0.634868	3.1968333
0.625309	3.1730467
0.69823467	3.2778833
0.61936267	3.3904333
0.605465	3.29219
0.56568367	3.8393
0.649848	3.7395267
0.69779567	3.5752233
Total Average	0.62885435 3.2946292

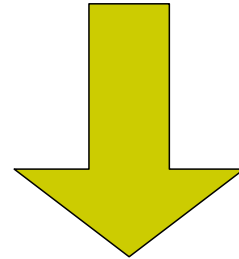
Scoring

$$\text{Scorr}_{\text{model}} \geq \text{Scorr}_{\text{total average}} \Rightarrow \text{Index}_{\text{Scorr}} = 1$$

$$\text{Scorr}_{\text{model}} < \text{Scorr}_{\text{total average}} \Rightarrow \text{Index}_{\text{Scorr}} = 0$$

$$\text{RMSE}_{\text{model}} \leq \text{RMSE}_{\text{total average}} \Rightarrow \text{Index}_{\text{RMSE}} = 1$$

$$\text{RMSE}_{\text{model}} > \text{RMSE}_{\text{total average}} \Rightarrow \text{Index}_{\text{RMSE}} = 0$$



$$\text{Index}_{\text{Scorr}} = 1 \text{ and } \text{Index}_{\text{RMSE}} = 1 \Rightarrow \text{Index}_{\text{total}} = 1$$

$$\text{Index}_{\text{Scorr}} = 1 \text{ and } \text{Index}_{\text{RMSE}} = 0 \Rightarrow \text{Index}_{\text{total}} = 0$$

$$\text{Index}_{\text{Scorr}} = 0 \text{ and } \text{Index}_{\text{RMSE}} = 1 \Rightarrow \text{Index}_{\text{total}} = 0$$

$$\text{Index}_{\text{Scorr}} = 0 \text{ and } \text{Index}_{\text{RMSE}} = 0 \Rightarrow \text{Index}_{\text{total}} = -1$$

S_corr Index	RMSE Index	Total Index	Gr To
1	1	1	
1	1	1	
1	1	1	
0	1	0	
1	1	1	
1	1	1	
1	1	1	
1	1	1	
0	1	0	
0	0	-1	
0	0	-1	
0	0	-1	
1	1	1	
0	0	-1	
0	0	-1	
1	0	0	
1	1	1	
0	1	0	
1	1	1	
0	0	-1	
0	1	0	
0	0	-1	
1	0	0	
1	0	0	

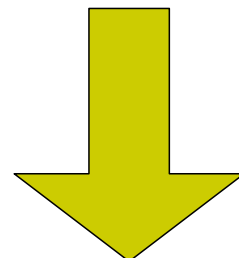
Scoring

$$\text{Scorr}_{\text{model}} \geq \text{Scorr}_{\text{total average}} \Rightarrow \text{Index}_{\text{Scorr}} = 1$$

$$\text{Scorr}_{\text{model}} < \text{Scorr}_{\text{total average}} \Rightarrow \text{Index}_{\text{Scorr}} = 0$$

$$\text{RMSE}_{\text{model}} \leq \text{RMSE}_{\text{total average}} \Rightarrow \text{Index}_{\text{RMSE}} = 1$$

$$\text{RMSE}_{\text{model}} > \text{RMSE}_{\text{total average}} \Rightarrow \text{Index}_{\text{RMSE}} = 0$$



$$\text{Index}_{\text{Scorr}} = 1 \text{ and } \text{Index}_{\text{RMSE}} = 1 \Rightarrow \text{Index}_{\text{total}} = 1$$

$$\text{Index}_{\text{Scorr}} = 1 \text{ and } \text{Index}_{\text{RMSE}} = 0 \Rightarrow \text{Index}_{\text{total}} = 0$$

$$\text{Index}_{\text{Scorr}} = 0 \text{ and } \text{Index}_{\text{RMSE}} = 1 \Rightarrow \text{Index}_{\text{total}} = 0$$

$$\text{Index}_{\text{Scorr}} = 0 \text{ and } \text{Index}_{\text{RMSE}} = 0 \Rightarrow \text{Index}_{\text{total}} = -1$$

Meteorologic Element: Geopotential Height

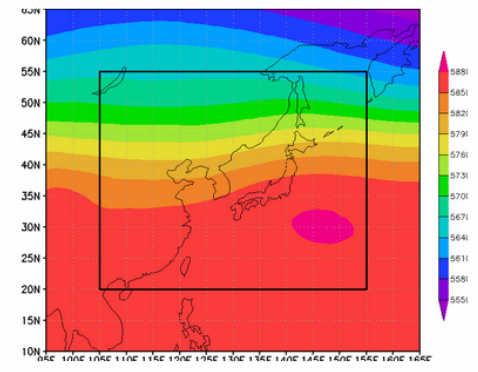
Level or Layer: 500hPa

Analysis Area: Lon1(West): 105, Lat2(North): 55, Lon2(East): 155, Lat1(South): 20

Time Range: From 1981 To 2000; For 1 month(s) starting from August

Display Option:
 Maskout the altitude above _____ meters
 Max range Manual: _____ (absolute value of range)
 Separate setting
 Display area Lon1(West): 95, Lat2(North): 65, Lat1(South): 10, Lon2(East): 165

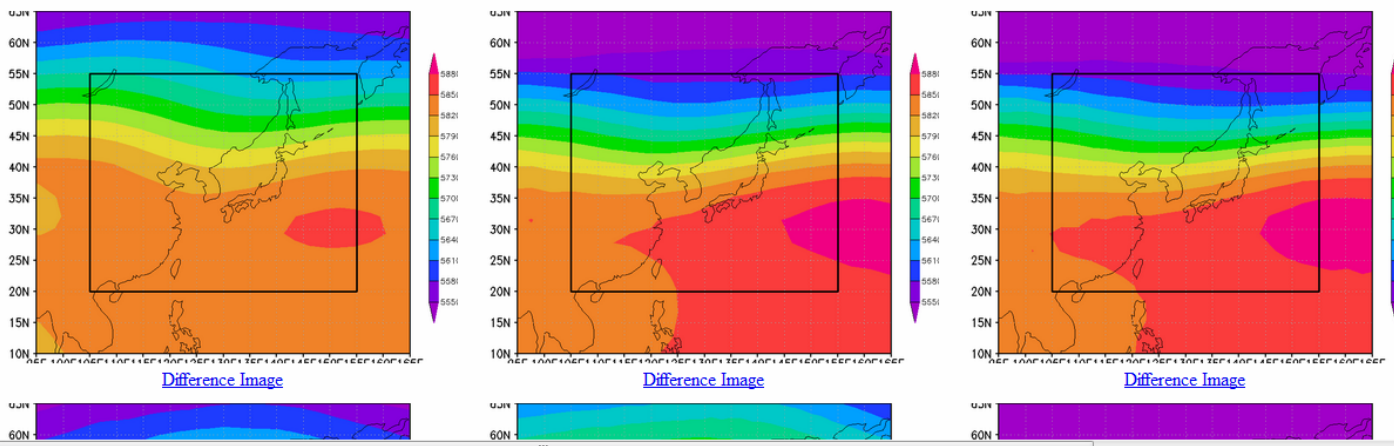
Reference Data: JRA25



(4 per row)

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CMIP3 Model Output

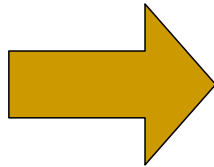


Meteorological Element: Precipitation										Analysis Period			Ranking			
June July August										S_corr	RMSE	Total	Grand Total	Model name	Grand Total Index	
model	S_corr	RMSE	S_corr	RMSE	S_corr	RMSE	S_corr	RMSE	S_corr	RMSE	S_corr	RMSE	Total	Grand Total	Model name	Grand Total Index
1 bccr_bcm2_0	0.61258	2.3638	0.64192	3.14939	0.65454	3.04457	0.636342	3.052587	1	1	1	1	1	1	bccr_bcm2_0	1
2 cccma_cgcm3_1	0.67809	2.80344	0.70211	2.9001	0.70598	2.95936	0.695393	2.887633	1	1	1	1	2	2	cccma_cgcm3_1	2
3 cccma_cgcm3_1_t63	0.66808	2.82739	0.69907	2.92443	0.67976	3.07007	0.682303	2.94063	1	1	1	1	2	2	cccma_cgcm3_1_t63	2
4 cnrm_cm3	0.52599	3.40764	0.61606	3.33114	0.65866	3.10189	0.600237	3.280223	0	1	0	1	1	1	cnrm_cm3	1
5 csiro_mk3_0	0.63489	3.01851	0.70105	2.99784	0.80409	2.35907	0.713341	2.791807	1	1	1	1	1	1	csiro_mk3_0	1
6 csiro_mk3_5	0.6042	3.39617	0.63726	3.36531	0.76553	2.62358	0.668998	3.128353	1	1	1	1	0	0	csiro_mk3_5	0
7 gfdl_cm2_0	0.69998	2.881	0.76418	2.69764	0.72245	2.97213	0.728866	2.850257	1	1	1	1	2	2	gfdl_cm2_0	2
8 gfdl_cm2_1	0.74588	2.67032	0.77535	2.70179	0.76376	2.77364	0.761535	2.71525	1	1	1	1	2	2	gfdl_cm2_1	2
9 giss_aom	0.50848	3.4729	0.60532	3.34358	0.68674	2.94604	0.60051	3.254173	0	1	0	1	1	1	giss_aom	1
10 giss_modelE_h	0.52285	4.00037	0.47573	4.49904	0.45018	4.32617	0.482851	4.275193	0	0	-1	-2	-2	-2	giss_modelE_h	-2
11 giss_modelE_r	0.47979	3.83325	0.59511	3.79972	0.62764	3.51206	0.565753	3.71501	0	0	-1	-2	-2	-2	giss_modelE_r	-2
12 iap_fgoals1_0_g	0.2221	3.99231	0.45438	3.68498	0.60651	3.1221	0.427665	3.599797	0	0	-1	0	0	0	iap_fgoals1_0_g	0
13 ingv_echam4	0.71269	2.73918	0.64457	3.17053	0.71878	2.78949	0.692013	2.899733	1	1	1	1	1	1	ingv_echam4	1
14 inmcm3_0	0.49308	3.41301	0.55553	3.56882	0.65547	3.0002	0.568022	3.327343	0	0	-1	-2	-2	-2	inmcm3_0	-2
15 ipsLcm4	0.46855	3.56933	0.51645	3.75673	0.62666	3.24568	0.537219	3.523913	0	0	-1	-1	-1	-1	ipsLcm4	-1
16 miroc3_2_hires	0.75994	2.6016	0.57314	3.74899	0.56614	3.67448	0.63307	3.34169	1	0	0	1	1	1	miroc3_2_hires	1
17 miroc3_2_medres	0.77819	2.40629	0.59142	3.54172	0.53499	3.64249	0.634868	3.196833	1	1	1	2	2	2	miroc3_2_medres	2
18 miub_echo_g	0.50184	3.57485	0.62149	3.41304	0.7526	2.53125	0.625309	3.173047	1	1	0	0	0	0	miub_echo_g	0
19 mpi_echam5	0.70063	3.27375	0.66788	3.54028	0.72619	3.01962	0.698235	3.277883	1	1	1	2	2	2	mpi_echam5	2
20 mi_cgcm2_3_2a	0.62496	3.32155	0.59224	3.59373	0.64089	3.25602	0.619363	3.390433	0	0	-1	-1	-1	-1	mi_cgcm2_3_2a	-1
21 near_ccsm3_0	0.58691	3.15148	0.60763	3.33779	0.62185	3.3873	0.605485	3.29219	0	1	0	0	0	0	near_ccsm3_0	0
22 near_pcm1	0.59275	3.73951	0.511	4.16259	0.59331	3.61601	0.565864	3.83937	0	0	-1	-1	-1	-1	near_pcm1	-1
23 ukmo_hadcm3	0.60248	3.87233	0.6569	3.7304	0.69017	3.61585	0.649848	3.739527	1	0	0	1	1	1	ukmo_hadcm3	1
24 ukmo_hadgem1	0.63235	3.66643	0.71368	3.61798	0.74735	3.45026	0.697796	3.382223	1	0	0	1	1	1	ukmo_hadgem1	1
Total Aver										0.62885	3.2946					
Meteorological Element: Geopot. Height (500hPa)										Analysis Period			Sorted			
June July August										S_corr	RMSE	Total	Grand Total	Model name	Grand Total Index	
model	S_corr	RMSE	S_corr	RMSE	S_corr	RMSE	S_corr	RMSE	S_corr	RMSE	S_corr	RMSE	Total	Grand Total	Model name	Grand Total Index
1 bccr_bcm2_0	0.92835	42.137	0.68805	38.7503	0.69066	31.2514	0.769018	37.37957	1	1	0	0	0	0	cccma_cgcm3_1	2
2 cccma_cgcm3_1	0.96034	12.1987	0.82921	14.5219	0.80023	18.0919	0.863257	14.9375	1	1	1	1	1	1	cccma_cgcm3_1	2
3 cccma_cgcm3_1_t63	0.95007	14.3994	0.83283	15.8524	0.78427	19.6293	0.855891	16.62703	1	1	1	1	1	1	gfdl_cm2_0	2
4 cnrm_cm3	0.90154	17.0395	0.67893	18.977	0.66063	18.0058	0.746865	18.00743	1	1	1	1	1	1	gfdl_cm2_1	2
5 csiro_mk3_0	0.80627	23.1564	0.6043	23.1591	0.70118	27.1938	0.703951	24.5031	0	1	0	1	1	1	miroc3_2_medres	2
6 csiro_mk3_5	0.88601	63.9483	0.55536	59.6278	0.68586	54.8755	0.709078	59.48387	0	0	-1	0	0	0	mpi_echam5	2
7 gfdl_cm2_0	0.94046	31.4908	0.83179	27.3932	0.87713	29.223	0.883127	29.369	1	1	1	1	1	1	bccr_bcm2_0	1
8 gfdl_cm2_1	0.92567	24.4431	0.79289	17.2348	0.83797	18.0807	0.852177	19.91953	1	1	1	1	1	1	cnrm_cm3	1
9 giss_aom	0.93177	13.1936	0.76769	16.0444	0.80164	13.4748	0.833701	14.2376	1	1	1	1	1	1	csiro_mk3_0	1
10 giss_modelE_h	-0.0596	58.0014	-0.089	54.7427	0.02033	52.6278	-0.04274	55.12397	0	0	-1	-1	-1	-1	giss_aom	1
11 giss_modelE_r	0.02228	62.4547	-0.0987	61.4984	0.05355	57.5357	-0.007683	60.49627	0	0	-1	-1	-1	-1	ingv_echam4	1
12 iap_fgoals1_0_g	0.94534	25.5939	0.83552	32.7476	0.70043	29.6172	0.827099	29.31957	0	0	-1	0	0	0	miroc3_2_hires	1
13 ingv_echam4	0.89798	44.285	0.79143	46.5454	0.66853	44.3619	0.785983	45.0641	0	0	0	0	0	0	ukmo_hadcm3	1
14 inmcm3_0	0.91836	41.0846	0.54528	41.1217	0.4309	39.6705	0.631515	40.6256	0	0	-1	-1	-1	-1	ukmo_hadgem1	1
15 ipsLcm4	0.93275	38.4356	0.62588	39.9597	0.62993	40.5019	0.729519	39.6324	1	0	0	0	0	0	csiro_mk3_5	1
16 miroc3_2_hires	0.94224	9.93756	0.77507	12.7123	0.83326	10.3543	0.850188	10.82139	1	1	1	1	1	1	iap_fgoals1_0_g	0
17 miroc3_2_medres	0.91122	21.0351	0.71776	19.0286	0.77466	22.107	0.801216	20.72357	1	1	1	1	1	1	miub_echo_g	0
18 near_ccsm3_0	0.89361	17.0725	0.7286	16.2374	0.80024	13.6242	0.807485	15.6447	1	1	1	1	1	1	near_ccsm3_0	0
19 near_pcm1	0.94695	46.519	0.73166	51.0715	0.72191	52.6381	0.800174	50.0762	1	0	0	0	0	0	ipsLcm4	-1
20 mi_cgcm2_3_2a	0.95232	43.5029	0.92088	45.0631	0.77055	43.9763	0.88125	44.18077	1	0	0	0	0	0	mi_cgcm2_3_2a	-1
21 near_ccsm3_0	0.82989	22.5139	0.38696	18.9013	0.54189	12.9726	0.586249	18.12327	0	1	0	0	0	0	near_pcm1	-1
22 near_pcm1	0.3263	11.2868	0.79111	12.4782	0.81675	-10.68	0.844717	11.48167	0	1	0	0	0	0	giss_modelE_h	-2
23 ukmo_hadcm3	0.94347	19.894	0.84893	21.0376	0.71469	23.4727	0.835696	21.4681	1	1	1	1	1	1	giss_modelE_r	-2
24 ukmo_hadgem1															inmcm3_0	-2
Total Aver										0.71947	30.315					

Precipitation		Precipitation								Analysis Period			Grand Total		Ranking		
		July				August				Analysis Period		S_corr Index	RMSE Index	Total Index	Grand Total	Model name	Grand Total Index
model	S_corr	RMSE	S_corr	RMSE	S_corr	RMSE	S_corr	RMSE	S_corr	RMSE	S_corr Index	RMSE Index	Total Index	Grand Total	Model name	Grand Total Index	
1	bccr_bcm2_0	0.61258	2.3638	0.64192	3.14939	0.65454	3.04457	0.636342	3.052587	1	1	1	1	bccr_bcm2_0	1		
2	ccocma_cgcm3_1	0.67809	2.80344	0.70211	2.9001	0.70598	2.95936	0.695393	2.887633	1	1	1	2	ccocma_cgcm3_1	2		
3	ccocma_cgcm3_1_t63	0.66808	2.82739	0.69907	2.92443	0.67976	3.07007	0.6822303	2.94063	1	1	1	1	ccocma_cgcm3_1	2		
4	cnrm_cm3	0.52539	3.40764	0.61606	3.33114	0.65866	3.10189	0.600237	3.280223	0	1	0	1	cnrm_cm3	2		
5	csiro_mk3_0	0.63489	3.01851	0.70105	2.99784	0.80409	2.35907	0.713341	2.791807	1	1	1	1	csiro_mk3_0	1		
6	csiro_mk3_5	0.6042	3.39617	0.63726	3.36531	0.76553	2.62358	0.668998	3.128353	1	1	1	0	csiro_mk3_5	0		
7	gfdl_cm2_0	0.63998	2.881	0.76418	2.69764	0.72245	2.97213	0.728866	2.850257	1	1	1	2	gfdl_cm2_0	2		
8	gfdl_cm2_1	0.74588	2.67032	0.77535	2.70179	0.76376	2.77364	0.761595	2.71525	1	1	1	2	gfdl_cm2_1	2		
9	giss_aom	0.50848	3.4729	0.60632	3.34358	0.68674	2.94604	0.60051	3.254173	0	1	0	1	giss_aom	1		
10	giss_model_e_h	0.52285	4.00037	0.47573	4.49904	0.45018	4.32617	0.482851	4.275193	0	0	-1	-2	giss_model_e_h	-2		
11	giss_model_e_r	0.47979	3.83325	0.59511	3.79972	0.62764	3.51206	0.567513	3.71501	0	0	-1	-2	giss_model_e_r	-2		
12	iap_fgoals1_0_g	0.2221	3.99231	0.45438	3.68498	0.60651	3.1221	0.427665	3.599797	0	0	-1	0	iap_fgoals1_0_g	0		
13	ingv_echam4	0.71269	2.73916	0.64457	3.17053	0.71878	2.78949	0.692013	2.899733	1	1	1	1	ingv_echam4	1		
14	inmcm3_0	0.49308	3.41301	0.55553	3.56882	0.65547	3.0002	0.568022	3.327343	0	0	-1	-2	inmcm3_0	-2		
15	ipsl_cm4	0.46855	3.56933	0.51645	3.75673	0.62666	3.24568	0.537219	3.523913	0	0	-1	-1	ipsl_cm4	-1		
16	miroc3_2_hires	0.75994	2.6016	0.57314	3.74899	0.56614	3.67448	0.63307	3.34169	1	0	0	1	miroc3_2_hires	1		
17	miroc3_2_medres	0.77819	2.40629	0.59142	3.54172	0.53499	3.64249	0.634868	3.196833	1	1	1	2	miroc3_2_medres	2		
18	miub_echo_g	0.50184	3.57485	0.62149	3.41304	0.7526	2.53125	0.625309	3.173047	1	1	0	0	miub_echo_g	0		
19	mpi_echam5	0.70063	3.27375	0.66788	3.54028	0.72619	3.01962	0.698235	3.277883	1	1	1	2	mpi_echam5	2		
20	mri_cgcm2_3_2a	0.62436	3.32155	0.59224	3.59373	0.64089	3.25602	0.619363	3.390433	0	0	-1	-1	mri_cgcm2_3_2a	-1		
21	ncar_ccsm3_0	0.56691	3.15448	0.60763	3.33779	0.62195	3.3873	0.605485	3.29219	0	1	0	0	ncar_ccsm3_0	0		
22	ncar_pcm1	0.59275	3.73951	0.511	4.16259	0.59331	3.61601	0.565684	3.83937	0	0	-1	-1	ncar_pcm1	-1		
23	ukmo_hadcm3	0.60248	3.87233	0.6569	3.7304	0.69017	3.61855	0.649848	3.739527	1	0	0	1	ukmo_hadcm3	1		
24	ukmo_hadgem1	0.63235	3.66643	0.71368	3.61798	0.74735	3.45026	0.697796	3.578223	1	0	0	1	ukmo_hadgem1	1		
Total Aver									0.62885	3.2946							

Geopot. height		Geopot. height								Analysis Period			Sorted			
		July				August				Analysis Period		S_corr Index	RMSE Index	Total Index	Model name	Grand Total Index
model	S_corr	RMSE	S_corr	RMSE	S_corr	RMSE	S_corr	RMSE	S_corr	RMSE	S_corr Index	RMSE Index	Total Index	Model name	Grand Total Index	
1	bccr_bcm2_0	0.92835	42.137	0.68805	38.7503	0.63066	31.2514	0.769018	37.37957	1	0	0	2	ccocma_cgcm3_1	2	
2	ccocma_cgcm3_1	0.96034	12.1987	0.82921	14.5219	0.80023	18.0919	0.863257	14.9375	1	1	1	2	ccocma_cgcm3_1	2	
3	ccocma_cgcm3_1_t63	0.95057	14.3994	0.83283	15.8524	0.78427	19.6293	0.855891	16.62703	1	1	1	2	gfdl_cm2_0	2	
4	cnrm_cm3	0.90104	17.0395	0.67893	18.977	0.66063	18.0058	0.746865	18.00743	1	1	1	2	gfdl_cm2_1	2	
5	csiro_mk3_0	0.80627	23.1564	0.6043	23.1591	0.70118	27.1938	0.703915	24.5031	0	1	0	2	miroc3_2_medre	2	
6	csiro_mk3_5	0.88601	63.9483	0.55536	59.6278	0.68586	54.8755	0.709078	59.48387	0	0	-1	2	mpi_echam5	2	
7	gfdl_cm2_0	0.94046	31.4908	0.83179	27.3932	0.87713	29.223	0.883127	29.369	1	1	1	1	bccr_bcm2_0	1	
8	gfdl_cm2_1	0.92567	24.4431	0.79289	17.2348	0.83797	18.0807	0.852177	19.91953	1	1	1	1	cnrm_cm3	1	
9	giss_aom	0.93177	13.1936	0.76769	16.0444	0.80164	13.4748	0.833701	14.2376	1	1	1	1	csiro_mk3_0	1	
10	giss_model_e_h	-0.9576	58.0014	-0.089	54.7427	0.02033	52.6278	-0.04274	55.12397	0	0	-1	2	giss_aom	1	
11	giss_model_e_r	0.02228	62.4547	-0.0987	61.4984	0.05355	57.5357	-0.00763	60.49627	0	0	-1	1	ingv_echam4	1	
12	iap_fgoals1_0_g	0.94534	25.5339	0.83552	32.7476	0.70043	29.6172	0.827099	23.91957	1	1	1	1	miroc3_2_hires	1	
13	ingv_echam4	0.89798	44.285	0.79143	46.5454	0.66853	44.3619	0.785983	45.0641	1	0	0	1	ukmo_hadcm3	1	
14	inmcm3_0	0.91836	41.0846	0.54528	41.1217	0.4309	39.6705	0.631515	40.6256	0	0	-1	1	ukmo_hadgem1	1	
15	ipsl_cm4	0.888	39.9597	0.62993	40.5019	0.729519	39.6324	0.729519	39.6324	1	0	0	0	csiro_mk3_5	0	
16	miroc3_2_hires	0.907	12.7123	0.83326	10.3543	0.850188	10.82139	0.850188	10.82139	1	1	1	0	iap_fgoals1_0_g	0	
17	miroc3_2_medres	0.876	19.0286	0.77466	22.107	0.801216	22.7357	0.801216	22.7357	1	1	1	0	miub_echo_g	0	
18	miub_echo_g	0.89361	17.0725	0.7286	16.2374	0.80024	13.6242	0.807485	15.6447	1	1	1	0	ncar_ccsm3_0	0	
19	mpi_echam5	0.94695	46.519	0.73166	51.0715	0.72191	52.6381	0.800174	50.0762	1	0	0	-1	ipsl_cm4	-1	
20	mri_cgcm2_3_2a	0.95232	43.5029	0.92088	45.0631	0.77055	43.9763	0.88125	44.18077	1	0	0	-1	mri_cgcm2_3_2a	-1	
21	ncar_ccsm3_0	0.82989	22.5139	0.38696	18.9013	0.54189	12.9726	0.586249	18.12327	0	1	0	0	ncar_pcm1	0	
22	ncar_pcm1	0.3263	11.2868	0.79111	12.4782	0.81675	10.68	0.844717	11.48167	1	1	1	1	giss_model_e_h	-2	
23	ukmo_hadcm3	0.94347	19.894	0.84893	21.0376	0.71469	23.4727	0.835696	21.4681	1	1	1	1	giss_model_e_r	-2	
24	ukmo_hadgem1													inmcm3_0	-2	
Total Aver									0.71947	30.315						

Missing model output!



Ranking	Model name	Grand Total Index
	bccr_bcm2_0	1
	ccocma_cgcm3_1	2
	ccocma_cgcm3_1	2
	cnrm_cm3	1
	csiro_mk3_0	1
	csiro_mk3_5	0
	gfdl_cm2_0	2
	gfdl_cm2_1	2
	giss_aom	1
	giss_model_e_h	-2
	giss_model_e_r	-2
	iap_fgoals1_0_g	0
	ingv_echam4	1
	inmcm3_0	-2
	ipsl_cm4	-1
	miroc3_2_hires	1
	miroc3_2_medre	2
	miub_echo_g	0
	mpi_echam5	2
	mri_cgcm2_3_2a	-1
	ncar_ccsm3_0	0
	ncar_pcm1	-1
	ukmo_hadcm3	1
	ukmo_hadgem1	1

Sorted	Model name	Grand Total Index
	ccocma_cgcm3_1	2
	ccocma_cgcm3_1	2
	gfdl_cm2_0	2
	gfdl_cm2_1	2
	miroc3_2_medre	2
	mpi_echam5	2
	bccr_bcm2_0	1
	cnrm_cm3	1
	csiro_mk3_0	1
	giss_aom	1
	ingv_echam4	1
	miroc3_2_hires	1
	ukmo_hadcm3	1
	ukmo_hadgem1	1
	csiro_mk3_5	0
	iap_fgoals1_0_g	0
	miub_echo_g	0
	ncar_ccsm3_0	0
	ipsl_cm4	-1
	mri_cgcm2_3_2a	-1
	ncar_pcm1	-1
	giss_model_e_h	-2
	giss_model_e_r	-2
	inmcm3_0	-2

Step 2: Downloading and correcting the model output

- Using an internet-based tool developed by UT – IIS
- Check the observation data file – coordinates of the selected raingauge (*raingauge selected and data prepared by the UT team in advance; gap filling applied: no data -> 0*)
- Downloading precipitation data of the selected models and of the grid cell corresponding to the selected raingauge. Both datasets: 20 century experiment and future scenario.
- Gap-filling of the model output data (correcting model calendar).

	A	B	C	D	E
1	Year	Month	Day	Original Data	Gap-filled Data
2	1981	1	1	0	0
3	1981	1	2	2	2
4	1981	1	3	0	0
5	1981	1	4	0	0
6	1981	1	5	0	0
7	1981	1	6	0	0
8	1981	1	7	0	0
9	1981	1	8	0	0
10	1981	1	9	0	0
11	1981	1	10	0	0
12	1981	1	11	0	0
13	1981	1	12	0	0
14	1981	1	13	0	0
15	1981	1	14	0	0
16	1981	1	15	0	0
17	1981	1	16	0	0
18	1981	1	17	0	0
19	1981	1	18	0	0
20	1981	1	19	0	0
21	1981	1	20	0	0
22	1981	1	21	0	0
23	1981	1	22	0	0
24	1981	1	23	0	0
25	1981	1	24	0.5	0.5
26	1981	1	25	0	0
27	1981	1	26	0	0
28	1981	1	27	0	0
29	1981	1	28	0	0
30	1981	1	29	0	0
31	1981	1	30	0	0
32	1981	1	31	0	0
33	1981	2	1	2	2
34	1981	2	2	0	0
35	1981	2	3	0	0
36	1981	2	4	0	0
37	1981	2	5	0	0
38	1981	2	6	0	0
39	1981	2	7	0	0
40	1981	2	8	0	0
41	1981	2	9	0	0
42	1981	2	10	0	0
43	1981	2	11	0	0
44	1981	2	12	0	0
45	1981	2	13	0	0
46	1981	2	14	0	1
47	1981	2	15	0	0
48	1981	2	16	0	0
49	1981	2	17	25.5	25.5

- Open the Excel file with the observed precipitation data for the selected station: e.g. **06-Japan_Precipitation_Maebashi.xls**
- Check the **"Station Info"** sheet for the station coordinates and data period



Microsoft Excel - 06-Japan_Precipitation_Maebashi

File Edit View Insert Format Tools Data Window Help

K15 fx

	A	B	C	D	E	F	G
1	Name	From	To	Lat(decimal)	Lon(decimal)	Elev	
2	Maebashi	1981/01/01	2000/12/31	36.41	139.06	112	
3							
4							
5							
6							
7							
8							

Quantitative Evaluation of AOGCM

*** Pre-release Beta Version ***

1. Intercomparison : Re-analysis/Observation Data vs. CMIP3 Model Output
 - [1-D Plot \(time-series\)](#)
 - [2-D Plot](#)
 - [Vector Diagram](#)
 - Cross-sectional View
 - [Longitude-time / Latitude-time](#)
 - [Longitude-height / Latitude-height](#)
2. Comparison of Global Warming Projection between:
 - [Climate Models](#)
 - [Emission Scenarios](#) --- implementation in progress; only monthly data supported
 - Periods of Analysis Time
 - [Monthly data](#)
 - [Daily data](#)
3. Tools
 - [CMIP3 Daily Data Download](#)
 - Interannual Variations at a Glance
 - [2-D Plot](#)
 - [Vector Diagram](#)
 - Cross-sectional View
 - [Long/Lat-time](#)
 - [Long/Lat-height](#)

CMIP3 daily data download

For more details, contact [Akio Yamamoto](#).

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Meteorologic Element	Please select one of the following: <input type="button" value="v"/> Level or Layer: <input type="button" value="v"/>	Climate Model	Time Range
Emission Scenario	20C3M <input type="button" value="v"/>	bcc_cm1 bccr_bcm2_0 cnrm_cm3 giss_aom miroc3_2_hires miroc3_2_medres mpi_echam5 ipsl_cm4 ingv_echam4 miub_echo_g	For <input type="text" value="365"/> days; from <input type="text" value="01"/> (MM) / <input type="text" value="01"/> (DD)
Download Data Type	Areal Average <input type="button" value="v"/>		From: <input type="text" value="1981"/> To: <input type="text" value="2000"/>
Area	West: <input type="text" value="100"/> North: <input type="text" value="55"/> East: <input type="text" value="165"/> South: <input type="text" value="20"/>		

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CMIP3 Daily Data

Meteorologic Element Precipitation (pr)
Level or Layer: Ground/water surface

Emission Scenario 20C3M

Download Data Type Gridded Data

Area West: 139.05 North: 36.42 East: 139.07
South: 36.40

Climate Model

- bcc_cm1
- bccr_bcm2_0
- cnrm_cm3
- giss_aom
- miroc3_2_hires
- miroc3_2_medres
- mpi_echam5
- ipsi_cm4
- ingy_echam4
- miub_echo_g

Time Range

For 365 days; from 01 (MM) / 01 (DD)

From: 1981 To: 2000

According to available observation

Selected rain gauge

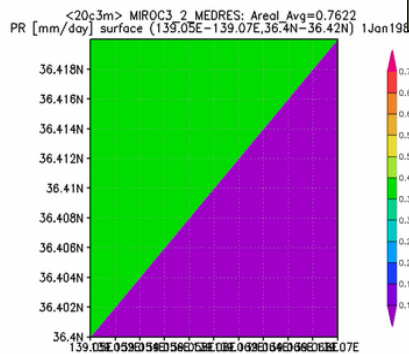
Clip Daily Data Clear All

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CMIP3 Daily Data Open as New Window/Tab

CSV Download : [miroc3_2_medres](#) , [mpi_echam5](#) , [cccma_cgcm3_1](#) , [cccma_cgcm3_1_t63](#) , [gfdl_cm2_0](#) , [gfdl_cm2_1](#) (ZIP archive of all CSV and Grid Map files)

Download the ZIP archive to the working folder



First Day (1Jan1981)



Grid Map

<20c3m> MPI_ECHAM5: Areal_Avg=0.584609 PR [mm/day] surface (139.05E-139.07E,36.4N-36.42N) 1Jan1981

MPI_ECHAM5: Area (139.05E-139.07E,36.4N-36.42N) Grid (1x1)

Correcting the model output for missing values

- Three different "calendars" used by CMIP3 models:
 - "Correct" calendar (365 days, leap years considered)
 - No leap years considered (29 February missing)
 - 360-day year calendar (29 February, 31 May, 31 July, 31 August, 31 October, and 31 December are all missing)
- Observation in the "correct" calendar – we need to adjust those model outputs using different calendars to the "correct" one.

	A	B	C	D	E
1	time in nc	correct tim	model nam	1 (38 34)	
2	#####	1/1/1981	cccma_cg	0.001156	
3	#####	2/1/1981	cccma_cg	1.22819	
4	#####	3/1/1981	cccma_cg	1.9044	
5	#####	4/1/1981	cccma_cg	0.195379	
6	#####	5/1/1981	cccma_cg	0.002187	
7	#####	6/1/1981	cccma_cg	0.127914	
8	#####	7/1/1981	cccma_cg	0.748566	
9	#####	8/1/1981	cccma_cg	0.366801	
10	#####	9/1/1981	cccma_cg	10.9606	
11	#####	10/1/1981	cccma_cg	2.25395	
12	#####	11/1/1981	cccma_cg	27.0339	
13	#####	12/1/1981	cccma_cg	0.367401	
14	#####	13/1/1981	cccma_cg	1.34455	
15	1/12/1980	14/1/1981	cccma_cg	0.366162	
16	2/12/1980	15/1/1981	cccma_cg	0.050405	
17	3/12/1980	16/1/1981	cccma_cg	0.842435	
18	4/12/1980	17/1/1981	cccma_cg	2.26E-05	
19	5/12/1980	18/1/1981	cccma_cg	3.90862	
20	6/12/1980	19/1/1981	cccma_cg	0.507117	
21	7/12/1980	20/1/1981	cccma_cg	0.742456	
22	8/12/1980	21/1/1981	cccma_cg	0.02088	
23	9/12/1980	22/1/1981	cccma_cg	0.493923	
24	#####	23/1/1981	cccma_cg	0.873639	
25	#####	24/1/1981	cccma_cg	1.4759	
26	#####	25/1/1981	cccma_cg	0.489548	
27	#####	26/1/1981	cccma_cg	0.887414	
28	#####	27/1/1981	cccma_cg	0.049876	
29	#####	28/1/1981	cccma_cg	20.0824	
30	#####	29/1/1981	cccma_cg	0.584784	
31	#####	30/1/1981	cccma_cg	0.403377	
32	#####	31/1/1981	cccma_cg	1.10557	
33	#####	1/2/1981	cccma_cg	0.314795	
34	#####	2/2/1981	cccma_cg	0.419418	
35	#####	3/2/1981	cccma_cg	0.368945	
36	#####	4/2/1981	cccma_cg	3.77445	
37	#####	5/2/1981	cccma_cg	0.449212	
38	#####	6/2/1981	cccma_cg	0.61717	
39	#####	7/2/1981	cccma_cg	15.3979	
40	#####	8/2/1981	cccma_cg	0.138247	
41	#####	9/2/1981	cccma_cg	30.5729	
42	#####	10/2/1981	cccma_cg	2.43288	
43	#####	11/2/1981	cccma_cg	0.048676	
44	#####	12/2/1981	cccma_cg	0.803033	
45	#####	13/2/1981	cccma_cg	40.1363	
46	1/1/1981	14/2/1981	cccma_cg	0.448283	
47	2/1/1981	15/2/1981	cccma_cg	0.852612	
48	3/1/1981	16/2/1981	cccma_cg	0.746594	
49	4/1/1981	17/2/1981	cccma_cg	1.67163	

Downloaded file of the ingv_echam4 model

661	14/10/1982	22/10/1982	ingv_echar	0.319351
662	15/10/1982	23/10/1982	ingv_echar	1.33775
663	16/10/1982	24/10/1982	ingv_echar	0.632415
664	17/10/1982	25/10/1982	ingv_echar	0.095554
665	18/10/1982	26/10/1982	ingv_echar	0.124471
666	19/10/1982	27/10/1982	ingv_echar	0.817236
667	20/10/1982	28/10/1982	ingv_echar	0.015087
668	21/10/1982	29/10/1982	ingv_echar	6.09783
669	22/10/1982	30/10/1982	ingv_echar	2.14241
670	N/A	31/10/1982	ingv_echar	missing
671	23/10/1982	1/11/1982	ingv_echar	1.21454
672	24/10/1982	2/11/1982	ingv_echar	0.345753
673	25/10/1982	3/11/1982	ingv_echar	0.003772
674	26/10/1982	4/11/1982	ingv_echar	8.20127
675	27/10/1982	5/11/1982	ingv_echar	0.443822
676	28/10/1982	6/11/1982	ingv_echar	0
677	29/10/1982	7/11/1982	ingv_echar	0
678	30/10/1982	8/11/1982	ingv_echar	3.4261
679	31/10/1982	9/11/1982	ingv_echar	22.3231
680	1/11/1982	10/11/1982	ingv_echar	2.14996
681	2/11/1982	11/11/1982	ingv_echar	5.7722
682	3/11/1982	12/11/1982	ingv_echar	0.887644
683	4/11/1982	13/11/1982	ingv_echar	0.446336
684	5/11/1982	14/11/1982	ingv_echar	0.298605
685	6/11/1982	15/11/1982	ingv_echar	1.72122
686	7/11/1982	16/11/1982	ingv_echar	0.722939
687	8/11/1982	17/11/1982	ingv_echar	0.320608
688	9/11/1982	18/11/1982	ingv_echar	0.817236
689	10/11/1982	19/11/1982	ingv_echar	0.665104
690	11/11/1982	20/11/1982	ingv_echar	2.11601
691	12/11/1982	21/11/1982	ingv_echar	14.4204
692	13/11/1982	22/11/1982	ingv_echar	4.91724
693	14/11/1982	23/11/1982	ingv_echar	1.50434
694	15/11/1982	24/11/1982	ingv_echar	1.49743
695	16/11/1982	25/11/1982	ingv_echar	1.86958
696	17/11/1982	26/11/1982	ingv_echar	1.54898
697	18/11/1982	27/11/1982	ingv_echar	0.663847
698	19/11/1982	28/11/1982	ingv_echar	0.116928
699	20/11/1982	29/11/1982	ingv_echar	3.67002
700	21/11/1982	30/11/1982	ingv_echar	21.6391
701	22/11/1982	1/12/1982	ingv_echar	1.16676

Previous day value replaces the "missing" one

2.14241

Corrected file of the ingv_echam4 model

661	14/10/1982	22/10/1982	ingv_echar	0.319351	0.319351
662	15/10/1982	23/10/1982	ingv_echar	1.33775	1.33775
663	16/10/1982	24/10/1982	ingv_echar	0.632415	0.632415
664	17/10/1982	25/10/1982	ingv_echar	0.095554	0.095554
665	18/10/1982	26/10/1982	ingv_echar	0.124471	0.124471
666	19/10/1982	27/10/1982	ingv_echar	0.817236	0.817236
667	20/10/1982	28/10/1982	ingv_echar	0.015087	0.015087
668	21/10/1982	29/10/1982	ingv_echar	6.09783	6.09783
669	22/10/1982	30/10/1982	ingv_echar	2.14241	2.14241
670	N/A	31/10/1982	ingv_echar	missing	2.14241
671	23/10/1982	1/11/1982	ingv_echar	1.21454	1.21454
672	24/10/1982	2/11/1982	ingv_echar	0.345753	0.345753
673	25/10/1982	3/11/1982	ingv_echar	0.003772	0.003772
674	26/10/1982	4/11/1982	ingv_echar	8.20127	8.20127
675	27/10/1982	5/11/1982	ingv_echar	0.443822	0.443822
676	28/10/1982	6/11/1982	ingv_echar	0	0
677	29/10/1982	7/11/1982	ingv_echar	0	0
678	30/10/1982	8/11/1982	ingv_echar	3.4261	3.4261
679	31/10/1982	9/11/1982	ingv_echar	22.3231	22.3231
680	1/11/1982	10/11/1982	ingv_echar	2.14996	2.14996
681	2/11/1982	11/11/1982	ingv_echar	5.7722	5.7722
682	3/11/1982	12/11/1982	ingv_echar	0.887644	0.887644
683	4/11/1982	13/11/1982	ingv_echar	0.446336	0.446336
684	5/11/1982	14/11/1982	ingv_echar	0.298605	0.298605
685	6/11/1982	15/11/1982	ingv_echar	1.72122	1.72122
686	7/11/1982	16/11/1982	ingv_echar	0.722939	0.722939
687	8/11/1982	17/11/1982	ingv_echar	0.320608	0.320608
688	9/11/1982	18/11/1982	ingv_echar	0.817236	0.817236
689	10/11/1982	19/11/1982	ingv_echar	0.665104	0.665104
690	11/11/1982	20/11/1982	ingv_echar	2.11601	2.11601
691	12/11/1982	21/11/1982	ingv_echar	14.4204	14.4204
692	13/11/1982	22/11/1982	ingv_echar	4.91724	4.91724
693	14/11/1982	23/11/1982	ingv_echar	1.50434	1.50434
694	15/11/1982	24/11/1982	ingv_echar	1.49743	1.49743
695	16/11/1982	25/11/1982	ingv_echar	1.86958	1.86958
696	17/11/1982	26/11/1982	ingv_echar	1.54898	1.54898
697	18/11/1982	27/11/1982	ingv_echar	0.663847	0.663847
698	19/11/1982	28/11/1982	ingv_echar	0.116928	0.116928
699	20/11/1982	29/11/1982	ingv_echar	3.67002	3.67002
700	21/11/1982	30/11/1982	ingv_echar	21.6391	21.6391
701	22/11/1982	1/12/1982	ingv_echar	1.16676	1.16676

MS Excel formula:
=IF(D670="missing",D669,D670)

1. Please open the file **Model_output_gapfill.xls** in the folder **Bias_correction**

2. Copy and paste the data from the downloaded model output files – expand the sheet for more model outputs

Microsoft Excel - Model_output_gapfill

	A	B	C	D	E
1	time in nc	correct time	model name	raw data	gap filled
2		1/1/1981		0	0
3		2/1/1981		0	0
4		3/1/1981		0	0
5		4/1/1981		0	0
6		5/1/1981		0	0
7		6/1/1981		0	0
8		7/1/1981		0	0
9		8/1/1981		0	0
10		9/1/1981		0	0
11		10/1/1981		0	0
12		11/1/1981		0	0
13		12/1/1981		0	0
14		13/1/1981		0	0
15		14/1/1981		0	0
16		15/1/1981		0	0
17		16/1/1981		0	0
18		17/1/1981		0	0
19		18/1/1981		0	0
20		19/1/1981		0	0
21		20/1/1981		0	0
22		21/1/1981		0	0
23		22/1/1981		0	0
24		23/1/1981		0	0
25		24/1/1981		0	0
26		25/1/1981		0	0
27		26/1/1981		0	0
28		27/1/1981		0	0
29		28/1/1981		0	0
30		29/1/1981		0	0
31		30/1/1981		0	0
32		31/1/1981		0	0
33		1/2/1981		0	0
34		2/2/1981		0	0
35		3/2/1981		0	0
36		4/2/1981		0	0

Model_output_gapfill.xls

	E	F	G	H	I	J	K
time in nc	correct time	model name	gap filled	time in nc	correct time	model name	gap filled
2	18/11/1980	1/1/1981	cccma_cgcm3_1	0.00115643	0.00115643	18/11/1980	1/1/1981
3	19/11/1980	2/1/1981	cccma_cgcm3_1	1.22819	1.22819	19/11/1980	2/1/1981
4	20/11/1980	3/1/1981	cccma_cgcm3_1	1.9044	1.9044	20/11/1980	3/1/1981
5	21/11/1980	4/1/1981	cccma_cgcm3_1	0.195379	0.195379	21/11/1980	4/1/1981
6	22/11/1980	5/1/1981	cccma_cgcm3_1	0.0021866	0.0021866	22/11/1980	5/1/1981
7	23/11/1980	6/1/1981	cccma_cgcm3_1	0.127914	0.127914	23/11/1980	6/1/1981
8	24/11/1980	7/1/1981	cccma_cgcm3_1	0.748566	0.748566	24/11/1980	7/1/1981
9	25/11/1980	8/1/1981	cccma_cgcm3_1	0.366801	0.366801	25/11/1980	8/1/1981
10	26/11/1980	9/1/1981	cccma_cgcm3_1	10.9606	10.9606	26/11/1980	9/1/1981
11	27/11/1980	10/1/1981	cccma_cgcm3_1	2.25395	2.25395	27/11/1980	10/1/1981
12	28/11/1980	11/1/1981	cccma_cgcm3_1	27.0339	27.0339	28/11/1980	11/1/1981
13	29/11/1980	12/1/1981	cccma_cgcm3_1	0.367401	0.367401	29/11/1980	12/1/1981
14	30/11/1980	13/1/1981	cccma_cgcm3_1	1.34455	1.34455	30/11/1980	13/1/1981
15	1/12/1980	14/1/1981	cccma_cgcm3_1	0.366162	0.366162	1/12/1980	14/1/1981
16	2/12/1980	15/1/1981	cccma_cgcm3_1	0.0504053	0.0504053	2/12/1980	15/1/1981
17	3/12/1980	16/1/1981	cccma_cgcm3_1	0.842435	0.842435	3/12/1980	16/1/1981
18	4/12/1980	17/1/1981	cccma_cgcm3_1	2.26E-05	2.2631E-05	4/12/1980	17/1/1981
19	5/12/1980	18/1/1981	cccma_cgcm3_1	3.90862	3.90862	5/12/1980	18/1/1981
20	6/12/1980	19/1/1981	cccma_cgcm3_1	0.507117	0.507117	6/12/1980	19/1/1981
21	7/12/1980	20/1/1981	cccma_cgcm3_1	0.742456	0.742456	7/12/1980	20/1/1981
22	8/12/1980	21/1/1981	cccma_cgcm3_1	0.0208802	0.0208802	8/12/1980	21/1/1981
23	9/12/1980	22/1/1981	cccma_cgcm3_1	0.493923	0.493923	9/12/1980	22/1/1981
24	10/12/1980	23/1/1981	cccma_cgcm3_1	0.873639	0.873639	10/12/1980	23/1/1981
25	11/12/1980	24/1/1981	cccma_cgcm3_1	1.4759	1.4759	11/12/1980	24/1/1981
26	12/12/1980	25/1/1981	cccma_cgcm3_1	0.489548	0.489548	12/12/1980	25/1/1981
27	13/12/1980	26/1/1981	cccma_cgcm3_1	0.887414	0.887414	13/12/1980	26/1/1981
28	14/12/1980	27/1/1981	cccma_cgcm3_1	0.0498759	0.0498759	14/12/1980	27/1/1981
29	15/12/1980	28/1/1981	cccma_cgcm3_1	20.0824	20.0824	15/12/1980	28/1/1981
30	16/12/1980	29/1/1981	cccma_cgcm3_1	0.584784	0.584784	16/12/1980	29/1/1981
31	17/12/1980	30/1/1981	cccma_cgcm3_1	0.403377	0.403377	17/12/1980	30/1/1981
32	18/12/1980	31/1/1981	cccma_cgcm3_1	1.10557	1.10557	18/12/1980	31/1/1981
33	19/12/1980	1/2/1981	cccma_cgcm3_1	0.314795	0.314795	19/12/1980	1/2/1981
34	20/12/1980	2/2/1981	cccma_cgcm3_1	0.419418	0.419418	20/12/1980	2/2/1981
35	21/12/1980	3/2/1981	cccma_cgcm3_1	0.368945	0.368945	21/12/1980	3/2/1981
36	22/12/1980	4/2/1981	cccma_cgcm3_1	3.77445	3.77445	22/12/1980	4/2/1981
37	23/12/1980	5/2/1981	cccma_cgcm3_1	0.449212	0.449212	23/12/1980	5/2/1981
38	24/12/1980	6/2/1981	cccma_cgcm3_1	0.61717	0.61717	24/12/1980	6/2/1981
39	25/12/1980	7/2/1981	cccma_cgcm3_1	15.3979	15.3979	25/12/1980	7/2/1981
40	26/12/1980	8/2/1981	cccma_cgcm3_1	0.138247	0.138247	26/12/1980	8/2/1981
41	27/12/1980	9/2/1981	cccma_cgcm3_1	20.5720	20.5720	27/12/1980	9/2/1981

Repeat the same data download procedure for the future scenario

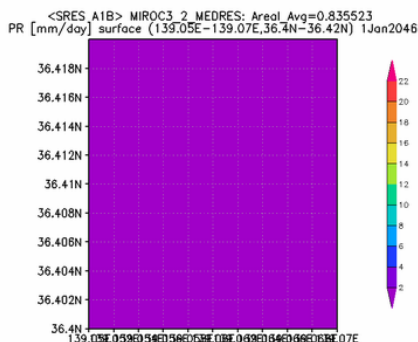
Meteorologic Element	Precipitation (pr)	Climate Model	Time Range	
Level or Layer:	Ground/water surface	bcc_cm1 bccr_bcm2_0 cnrm_cm3 giss_aom miroc3_2_hires miroc3_2_medres mpi_echam5 ipsl_cm4 ingv_echam4 miub_echo_g	For	365 days; from 01 (MM) / 01 (DD)
Emission Scenario	SRES A1B		From:	2046 To: 2065
Download Data Type	Gridded Data			
Area	West: 139.05 North: 36.42 East: 139.07 South: 36.40			

Clip Daily Data Clear All

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CMIP3 Daily Data Open as New Window/Tab

CSV Download : [miroc3_2_medres](#), [mpi_echam5](#), [cccma_cgcm3_1](#), [cccma_cgcm3_1_t63](#), [gfdl_cm2_0](#), [gfdl_cm2_1](#) (ZIP archive of all CSV and Grid Map files)



First Day (1Jan2046)

MIROC3_2_MEDRES: Area (139.05E-139.07E,36.4N-36.42N) Grid (1x1)



Grid Map

Step 3: Rainfall bias correction

- Using a method developed at UT – available through the prepared MS Excel sheet
- Inputting gap filled observation and model output data into the template sheet
- Reading the corrected model rainfall data output.
- Excel sheet explanation.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	yr	mo	day	OBS	model name	model no	model no	model no									
2	1/1/1981	1981	1	1	0	0	0	0									
3	2/1/1981	1981	1	2	0	0	0	0									
4	3/1/1981	1981	1	3	0	0	0	0									
5	4/1/1981	1981	1	4	0	0	0	0									
6	5/1/1981	1981	1	5	0	0	0	0									
7	6/1/1981	1981	1	6	0	0	0	0									
8	7/1/1981	1981	1	7	0	0	0	0									
9	8/1/1981	1981	1	8	0	0	0	0									
10	9/1/1981	1981	1	9	0	0	0	0									
11	10/1/1981	1981	1	10	0	0	0	0									
12	11/1/1981	1981	1	11	0	0	0	0									
13	12/1/1981	1981	1	12	0	0	0	0									
14	13/1/1981	1981	1	13	0	0	0	0									
15	14/1/1981	1981	1	14	0	0	0	0									
16	15/1/1981	1981	1	15	0	0	0	0									
17	16/1/1981	1981	1	16	0	0	0	0									
18	17/1/1981	1981	1	17	0	0	0	0									
19	18/1/1981	1981	1	18	0	0	0	0									
20	19/1/1981	1981	1	19	0	0	0	0									
7283	8/12/2000	2000	12	8	0	0	0	0									
7284	9/12/2000	2000	12	9	0	0	0	0									
7285	10/12/2000	2000	12	10	0	0	0	0									
7286	11/12/2000	2000	12	11	0	0	0	0									
7287	12/12/2000	2000	12	12	0	0	0	0									
7288	13/12/2000	2000	12	13	0	0	0	0									
7289	14/12/2000	2000	12	14	0	0	0	0									
7290	15/12/2000	2000	12	15	0	0	0	0									
7291	16/12/2000	2000	12	16	0	0	0	0									
7292	17/12/2000	2000	12	17	0	0	0	0									
7293	18/12/2000	2000	12	18	0	0	0	0									
7294	19/12/2000	2000	12	19	0	0	0	0									
7295	20/12/2000	2000	12	20	0	0	0	0									
7296	21/12/2000	2000	12	21	0	0	0	0									
7297	22/12/2000	2000	12	22	0	0	0	0									
7298	23/12/2000	2000	12	23	0	0	0	0									
7299	24/12/2000	2000	12	24	0	0	0	0									
7300	25/12/2000	2000	12	25	0	0	0	0									
7301	26/12/2000	2000	12	26	0	0	0	0									
7302	27/12/2000	2000	12	27	0	0	0	0									
7303	28/12/2000	2000	12	28	0	0	0	0									
7304	29/12/2000	2000	12	29	0	0	0	0									
7305	30/12/2000	2000	12	30	0	0	0	0									
7306	31/12/2000	2000	12	31	0	0	0	0									
7307																	
7308																	

Open **Bias_corr_tmp.xls** in the folder **Bias_correction**

Copy in the gap-filled observation data and model output of selected models.

20 century experiment output (1981 – 2000)

	A	B	C	D	E	F
1	yr	mo	da	OBS	model name	mod
2	1/1/2046	2046	1	1	0	0
3	2/1/2046	2046	1	2	0	0
4	3/1/2046	2046	1	3	0	0
5	4/1/2046	2046	1	4	0	0
6	5/1/2046	2046	1	5	0	0
7	6/1/2046	2046	1	6	0	0
8	7/1/2046	2046	1	7	0	0
9	8/1/2046	2046	1	8	0	0
10	9/1/2046	2046	1	9	0	0
11	10/1/2046	2046	1	10	0	0
12	11/1/2046	2046	1	11	0	0
13	12/1/2046	2046	1	12	0	0
14	13/1/2046	2046	1	13	0	0
15	14/1/2046	2046	1	14	0	0
16	15/1/2046	2046	1	15	0	0
17	16/1/2046	2046	1	16	0	0
7282	7/12/2065	2065	12	7	0	0
7283	8/12/2065	2065	12	8	0	0
7284	9/12/2065	2065	12	9	0	0
7285	10/12/2065	2065	12	10	0	0
7286	11/12/2065	2065	12	11	0	0
7287	12/12/2065	2065	12	12	0	0
7288	13/12/2065	2065	12	13	0	0
7289	14/12/2065	2065	12	14	0	0
7290	15/12/2065	2065	12	15	0	0
7291	16/12/2065	2065	12	16	0	0
7292	17/12/2065	2065	12	17	0	0
7293	18/12/2065	2065	12	18	0	0
7294	19/12/2065	2065	12	19	0	0
7295	20/12/2065	2065	12	20	0	0
7296	21/12/2065	2065	12	21	0	0
7297	22/12/2065	2065	12	22	0	0
7298	23/12/2065	2065	12	23	0	0
7299	24/12/2065	2065	12	24	0	0
7300	25/12/2065	2065	12	25	0	0
7301	26/12/2065	2065	12	26	0	0
7302	27/12/2065	2065	12	27	0	0
7303	28/12/2065	2065	12	28	0	0
7304	29/12/2065	2065	12	29	0	0
7305	30/12/2065	2065	12	30	0	0

The future scenario raw data sheet

Copy in the gap-filled observation data and model output of selected models.

Future scenario (sresa1b) (2046 – 2065)

s1b_raw

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1									Weibul	Hazen	Cunnane				
2	$=(\$A2-I\$22)*100/(20+1-2*I\$22)$														
3	1	-1.668	-1.960	-1.914	-1.113	-1.305	-1.276		4.762	2.500	2.783				
4	2	-1.309	-1.440	-1.422	-0.851	-0.952	-0.939		9.524	7.500	7.753				
5	3	-1.068	-1.150	-1.140	-0.561	-0.732	-0.724		14.286	12.500	12.724				
6	4	-0.876	-0.935	-0.927	-0.366	-0.556	-0.549		19.048	17.500	17.694				
7	5	-0.712	-0.755	-0.750	-0.161	-0.400	-0.395		23.810	22.500	22.664				
8	6	-0.566	-0.598	-0.594	0.025	-0.255	-0.252		28.571	27.500	27.634				
9	7	-0.431	-0.454	-0.451	0.094	-0.117	-0.114		33.333	32.500	32.604				
10	8	-0.303	-0.319	-0.317	0.036	0.019	0.021		38.095	37.500	37.575				
11	9	-0.180	-0.189	-0.188	0.166	0.156	0.157		42.857	42.500	42.545				
12	10	-0.060	-0.063	-0.062	0.298	0.295	0.296		47.619	47.500	47.515				
13	11	0.060	0.063	0.062	0.436	0.440	0.439		52.381	52.500	52.485				
14	12	0.180	0.189	0.188	0.581	0.592	0.590		57.143	57.500	57.455				
15	13	0.303	0.319	0.317	0.735	0.755	0.752		61.905	62.500	62.425				
16	14	0.431	0.454	0.451	0.903	0.934	0.930		66.667	67.500	67.396				
17	15	0.566	0.598	0.594	1.089	1.134	1.129		71.429	72.500	72.366				
18	16	0.712	0.755	0.750	1.302	1.367	1.359		76.190	77.500	77.336				
19	17	0.876	0.935	0.927	1.554	1.648	1.636		80.952	82.500	82.306				
20	18	1.068	1.150	1.140	1.870	2.013	1.994		85.714	87.500	87.276				
21	19	1.309	1.440	1.422	2.302	2.552	2.517		90.476	92.500	92.247				
22	20	1.668	1.960	1.914	3.020	3.676	3.567		95.238	97.500	97.017				
23									0	0.5	0.44				

Plotting position for extreme events: $q_i = (i-a)/(n+1-2a)$
i: rank of an extreme value in a sample
a: plotting-position parameter – for different alternatives
n: size of the sample – number of years considered for the analysis
 -> **need to be changed** to be consistent with available data (here *n* = 20 years)

The *Prob* sheet

Prob

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1					OBS	miroc3_2_h	0	0							
2				a 1	0.03	0.09	#DIV/0!	#DIV/0!							
3				a 2	0.03	0.03	0.03	0.03							
4				b 1	-2.64	-5.22	#DIV/0!	#DIV/0!							
5				b 2	-2.64	-2.64	-2.64	-2.64							
6				bottom	56.50	43.86	0.00	0.00							
7				Rank	55	69	1	1							
8															
9				Norain rank	2306										

In observed 20yr data, start from 2782th rank is no_rain_day(rainfall = 0)

$=7305 - \text{COUNTIF}('20c_raw'!E2:E7306,0) + 1$

Need to change total number of days in the analyzed period according to the available data – for finding a rank of no-rain day in observed data and thus determining the no-rain amount in the model output. Here 20 years means 7305 days.

The *Parameter* sheet

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1		yr	mo	da	OBS(Maebashi)	miroc3_2_hires	miroc3_2_hires	0	0					
2	1/1/1981	1981	1	1	0.00	0.000000		0	0					
3	2/1/1981	1981	1	2	2.00	0.000000		0	0					
4	3/1/1981	1981	1	3	0.00	0.000000		0	0					
5	4/1/1981	1981	1	4	0.00	5.701958	5.701958749	0	0					
6	5/1/1981	1981	1	5	0.00	0.000000		0	0					
7	6/1/1981	1981	1	6	0.00	0.000000		0	0					
8	7/1/1981	1981	1	7	0.00	0.000000		0	0					
9	8/1/1981	1981	1	8	0.00	0.000000		0	0					
10	9/1/1981	1981	1	9	0.00	0.000000		0	0					
11	10/1/1981	1981	1	10	0.00	0.000000		0	0					
12	11/1/1981	1981	1	11	0.00	0.000000		0	0					
13	12/1/1981	1981	1	12	0.00	0.000000		0	0					
14	13/1/1981	1981	1	13	0.00	0.000000		0	0					
15	14/1/1981	1981	1	14	0.00	0.000000		0	0					
16	15/1/1981	1981	1	15	0.00	0.000000		0	0					
17	16/1/1981	1981	1	16	0.00	0.000000		0	0					
18	17/1/1981	1981	1	17	0.00	0.000000		0	0					
19	18/1/1981	1981	1	18	0.00	0.000000		0	0					
7281	6/12/2000	2000	12	6	0.00	0.000000		0	0					
7282	7/12/2000	2000	12	7	0.00	0.000000		0	0					
7283	8/12/2000	2000	12	8	0.00	0.000000		0	0					
7284	9/12/2000	2000	12	9	0.00	0.000000		0	0					
7285	10/12/2000	2000	12	10	0.00	0.000000		0	0					
7286	11/12/2000	2000	12	11	0.00	0.000000		0	0					
7287	12/12/2000	2000	12	12	0.00	0.000000		0	0					
7288	13/12/2000	2000	12	13	0.00	0.000000		0	0					
7289	14/12/2000	2000	12	14	0.00	0.2028889	0.20288893	0	0					
7290	15/12/2000	2000	12	15	0.00	0.000000		0	0					
7291	16/12/2000	2000	12	16	0.00	0.000000		0	0					
7292	17/12/2000	2000	12	17	0.00	0.000000		0	0					
7293	18/12/2000	2000	12	18	0.00	0.000000		0	0					
7294	19/12/2000	2000	12	19	0.00	0.000000		0	0					
7295	20/12/2000	2000	12	20	0.00	0.000000		0	0					
7296	21/12/2000	2000	12	21	0.00	0.000000		0	0					
7297	22/12/2000	2000	12	22	0.00	0.000000		0	0					
7298	23/12/2000	2000	12	23	0.00	0.094156	0.094156158	0	0					
7299	24/12/2000	2000	12	24	0.00	0.000000		0	0					
7300	25/12/2000	2000	12	25	0.50	0.000000		0	0					
7301	26/12/2000	2000	12	26	0.00	0.000000		0	0					
7302	27/12/2000	2000	12	27	0.00	0.000000		0	0					
7303	28/12/2000	2000	12	28	0.00	0.000000		0	0					
7304	29/12/2000	2000	12	29				0	0					
7305	30/12/2000	2000	12	30				0	0					
7306	31/12/2000	2000	12	31				0	0					

The 20-th century experiment corrected model output

20c_correct sheet

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1		yr	mo	da	miroc3_2_hires	OBS(Maebashi)	miroc3_2_hires	0.00	0.00					
2	1/1/2046	2046	1	1	0.000000	0	0	0	0					
3	2/1/2046	2046	1	2	1.762939	2	1.762938562	0	0					
4	3/1/2046	2046	1	3	8.037374	0	8.037374053	0	0					
5	4/1/2046	2046	1	4	0.000000	0	0	0	0					
6	5/1/2046	2046	1	5	1.610385	0	1.610384594	0	0					
7	6/1/2046	2046	1	6	10.988917	0	10.98891704	0	0					
8	7/1/2046	2046	1	7	0.000000	0	0	0	0					
9	8/1/2046	2046	1	8	0.000000	0	0	0	0					
10	9/1/2046	2046	1	9	0.000000	0	0	0	0					
11	10/1/2046	2046	1	10	0.000000	0	0	0	0					
12	11/1/2046	2046	1	11	0.000000	0	0	0	0					
13	12/1/2046	2046	1	12	3.166402	0	3.166401527	0	0					
14	13/1/2046	2046	1	13	5.602045	0	5.602045019	0	0					
15	14/1/2046	2046	1	14	0.000000	0	0	0	0					
16	15/1/2046	2046	1	15	0.000000	0	0	0	0					
17	16/1/2046	2046	1	16	0.000000	0	0	0	0					
18	17/1/2046	2046	1	17	0.000000	0	0	0	0					
19	18/1/2046	2046	1	18	0.000000	0	0	0	0					
20	19/1/2046	2046	1	19	17.537229	0	17.53722851	0	0					
21	20/1/2046	2046	1	20	0.000000	0	0	0	0					
7285	10/12/2065	2065	12	10	0.000000	0	0	0	0					
7286	11/12/2065	2065	12	11	0.000000	0	0	0	0					
7287	12/12/2065	2065	12	12	0.000000	0	0	0	0					
7288	13/12/2065	2065	12	13	0.000000	0	0	0	0					
7289	14/12/2065	2065	12	14	0.000000	0	0	0	0					
7290	15/12/2065	2065	12	15	0.000000	0	0	0	0					
7291	16/12/2065	2065	12	16	0.000000	0	0	0	0					
7292	17/12/2065	2065	12	17	0.000000	0	0	0	0					
7293	18/12/2065	2065	12	18	0.217953	0	0.217953056	0	0					
7294	19/12/2065	2065	12	19	0.234716	0	0.2347161	0	0					
7295	20/12/2065	2065	12	20	0.000000	0	0	0	0					
7296	21/12/2065	2065	12	21	0.000000	0	0	0	0					
7297	22/12/2065	2065	12	22	0.000000	0	0	0	0					
7298	23/12/2065	2065	12	23	0.000000	0	0	0	0					
7299	24/12/2065	2065	12	24	0.000000	0	0	0	0					
7300	25/12/2065	2065	12	25	0.000000	0.5	0	0	0					
7301	26/12/2065	2065	12	26	0.000000	0	0	0	0					
7302	27/12/2065	2065	12	27	0.000000	0	0	0	0					
7303	28/12/2065	2065	12	28	0.000000	0	0	0	0					
7304	29/12/2065	2065	12	29	0.000000	0	0	0	0					
7305	30/12/2065	2065	12	30	0.000000	0	0	0	0					
7306	31/12/2065	2065	12	31	0.000000	0	0	0	0					
7307														
7308						3.358179329	4.273584543							
7309														

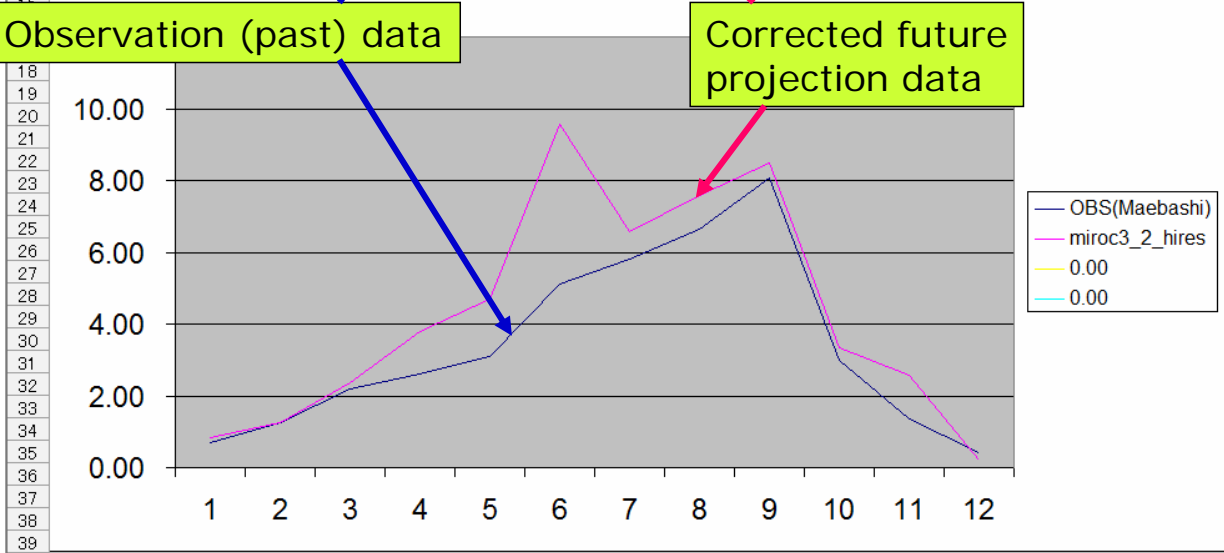
The future scenario (sres a1b) corrected model output

a1b_correct sheet

=SUMPRODUCT((a1b_correct!\$C\$2:\$C\$7306=\$C2)*a1b_correct!\$G\$2:\$G\$7306)/\$B2

	A	B	C	D	E	F	G
1		days	month		OBS(Maebashi)	miroc3_2_hires	0.00
2		620	1		0.70	0.82	0.00
3		565	2		1.25	1.26	0.00
4		620	3		2.18	2.35	0.00
5		600	4		2.61	3.79	0.00
6		620	5		3.09	4.69	0.00
7		600	6		5.12	9.57	0.00
8		620	7		5.82	6.58	0.00
9		620	8		6.65	7.57	0.00
10		600	9		8.08	8.50	0.00
11		620	10		2.98	3.34	0.00
12		600	11		1.37	2.58	0.00
13		620	12		0.41	0.20	0.00

20-year average monthly rainfall comparison: past and future



Observation (past) data

Corrected future projection data

Ses sheet

Thank you for your
attention



Enjoy your further, self-practice