



Blowholes, Tongatapu

Appendix 1

CMIP3 Models Used in Climate Projections

For many of the climate projections presented in Chapters 6 and 7, CMIP3 data were either analysed directly (e.g. temperature, rainfall) or used to calculate a climate variable (e.g. surface relative humidity, potential evapotranspiration) or diagnostic (e.g. Genesis Potential Index, aragonite saturation state) of interest (Table A1). However, many research institutions participating in CMIP3 did not provide data for all the model variables and SRES emission scenarios requested by the project organisers. As such, data availability is inconsistent for different variables, emission scenarios (i.e. A2, A1B and B1) and output frequencies (i.e. daily or monthly).

Information on the CMIP3 model data used in providing information on each PCCSP climate variable / diagnostic is therefore provided here (Table A2, Table A3, Table A4). It should be noted that:

- For any given variable and timescale, where data are available for one or more of the A2, A1B or B1 scenarios, data are also available for the corresponding 'Climate of the Twentieth Century' (20c3m) simulation.
- Due to high data archiving costs, daily GCM data are typically only available for the periods 1980–1999, 2046–2065 and 2080–2099. No such limitations apply for monthly data.
- For certain variables and emission scenarios, modelling groups provided data for multiple simulations of the same model, using slightly different initial conditions. The information outlined here indicates the models for which at least one simulation is available.
- The CMIP3 data are freely available, along with detailed documentation, from the Program for Climate Model Diagnosis and Intercomparison at Lawrence Livermore National Laboratory (www-pcmdi.llnl.gov).

Table A1. CMIP3 model variables required to provide information on each PCCSP variable / climate diagnostic.

PCCSP variable / climate diagnostic	Required model output (CMIP3 naming convention)
Surface air temperature	Surface air temperature (tas)
Daily maximum surface air temperature	Daily maximum surface air temperature (tasmax)
Daily minimum surface air temperature	Daily minimum surface air temperature (tasmin)
Rainfall	Precipitation (pr)
Surface wind	Calculated from zonal surface wind speed (uas) and meridional surface wind speed (vas)
Solar radiation	Surface downwelling shortwave radiation (rsds)
Surface relative humidity	Calculated from surface specific humidity (huss), sea level pressure (psl), surface altitude (orog) and surface air temperature (tas) data
Potential evapotranspiration	Calculated from surface downwelling shortwave radiation (rsds), surface air temperature (tas), surface altitude (orog), (calculated) surface relative humidity and precipitation (pr) data (Morton, 1983)
Sea surface temperature	Sea surface temperature (tos)
Sea surface salinity	Salinity (so)
Ocean temperature	Sea water potential temperature (thetao)
Ocean salinity	Salinity (so)
Ocean density	Calculated from potential temperature (thetao) and salinity (so) data
Ocean circulation	Calculated from eastward seawater velocity (uo) and northward seawater velocity (vo)
Buoyancy frequency squared	Calculated from potential temperature (thetao) and salinity (so) data
Steric sea level	Calculated from potential temperature (thetao) and salinity (so) data
Dynamic component of sea level	Sea surface elevation (zos)
Genesis potential index	Calculated from sea surface temperature (tos), sea level pressure (psl), air temperature (ta), specific humidity (hus), zonal wind speed (ua) and meridional wind speed (va) data
Curvature vorticity parameter	Calculated from air temperature (ta), specific humidity (hus), zonal wind speed (ua) and meridional wind speed (va) data
CSIRO direct detection method	Requires sea level pressure (psl), air temperature (ta), zonal wind speed (ua), meridional wind speed (va) data
Aragonite saturation state (Ω_{ar})	Requires sea surface temperature (tos) and sea surface salinity (so) data

Table A2. CMIP3 models used in calculating atmospheric projections requiring daily timescale data.

		Temperature ^a				Rainfall				Tropical cyclones ^b		
		A2	A1B	B1		A2	A1B	B1		CVP	CDD	GPI
1	BCCR-BCM2.0											
2	CCSM3											
3	CGCM3.1 (T47)											
4	CGCM3.1 (T63)											
5	CNRM-CM3											
6	CSIRO-Mk3.0											
7	CSIRO-Mk3.5											
8	ECHAM5/MPI-OM											
9	ECHO-G											
10	FGOALS-g1.0											
11	GFDL-CM2.0											
12	GFDL-CM2.1											
13	<i>GISS-AOM</i>											
14	<i>GISS-EH</i>											
15	<i>GISS-ER</i>											
16	<i>INGV-SXG</i>											
17	<i>INM-CM3.0</i>											
18	IPSL-CM4											
19	MIROC3.2 (hires)											
20	MIROC3.2 (medres)											
21	MRI-CGCM2.3.2											
22	<i>PCM</i>											
23	UKMO-HadCM3											
24	UKMO-HadGEM1											
	Total models used	11	15	15		14	16	16		4	10	14

Pale blue cells denote those models and scenarios used in calculating projections. Italicised model names indicate those models excluded due to unacceptable performance in simulating the current climate (Section 5.5.1)

^aRefers to both the daily maximum and minimum surface air temperature

^bThe Curvature Vorticity Parameter (CVP), CSIRO Direct Detection (CDD) scheme and Genesis Potential Index (GPI) were only calculated for the A2 emission scenario.

Table A3. CMIP3 models used in calculating atmospheric projections requiring monthly timescale data.

Model name		Surface air temperature, rainfall			Surface wind			Solar radiation			Surface relative humidity, potential evapotranspiration		
		A2	A1B	B1	A2	A1B	B1	A2	A1B	B1	A2	A1B	B1
1	BCCR-BCM2.0												
2	CCSM3												
3	CGCM3.1 (T47)												
4	CGCM3.1 (T63)												
5	CNRM-CM3												
6	CSIRO-Mk3.0												
7	CSIRO-Mk3.5												
8	ECHAM5/MPI-OM												
9	ECHO-G												
10	FGOALS-g1.0												
11	GFDL-CM2.0												
12	GFDL-CM2.1												
13	<i>GISS-AOM</i>												
14	<i>GISS-EH</i>												
15	<i>GISS-ER</i>												
16	<i>INGV-SXG</i>												
17	<i>INM-CM3.0</i>												
18	IPSL-CM4												
19	MIROC3.2 (hires)												
20	MIROC3.2 (medres)												
21	MRI-CGCM2.3.2												
22	<i>PCM</i>												
23	UKMO-HadCM3												
24	UKMO-HadGEM1												
Total models used		15	18	17	13	16	15	15	18	16	9	11	10

Pale blue cells denote those models and scenarios used in calculating projections. Italicised model names indicate those models excluded due to unacceptable performance in simulating the current climate (Section 5.5.1).

Table A4. CMIP3 models used in calculating oceanic projections requiring monthly timescale data.

Model name	Sea surface temperature			Sea surface salinity ^a			T, S, density, buoyancy, steric sea level ^b		Dynamic sea level		Circulation		Qar
	A2	A1B	B1	A2	A1B	B1	A1B		A1B		A1B		
1													All ^c
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
Total models used	14	16	16	11	15	13	11		13		15		6

Pale blue cells denote those models and scenarios used in calculating projections. Italicised model names indicate those models excluded due to unacceptable performance in simulating the current climate (Section 5.5.1)

^aModel numbers are greater for sea surface salinity than for salinity through the depth of the ocean, as PCCSP researchers approached CMIP3 modelling groups requesting additional surface salinity data.

^bRefers to the potential temperature (T), salinity (S), potential density and buoyancy frequency squared through the depth of the ocean.

^cThe same models were used for the A2, A1B and B1 scenarios.

Qar = Aragonite saturation state.