2 Methods

2.1 Models and Scenarios

Grids containing monthly climate model output for precipitation, evaporation and near-surface air temperature were downloaded from the multi-model climate data archive (https://esgcet.llnl.gov:8443/index.jsp). Output from 20 models were downloaded for the historic period known as the 20C3M scenario (20th Century Model Runs) and for two future scenarios known as the A1B and A2 scenarios. The future scenarios assume an emissions trajectory with the A1B scenario based on mid-range emissions while the A2 scenario assumes a higher level of emissions (see Appendix for details). In some cases, multiple runs from a given model were available and these were analysed individually. The number of available runs for each model-scenario combination are summarised in Table 1. In total, we prepared maps and summary tables based on the 39 model runs that covered both the historic period (20C3M) and the future (A1B scenario). When an A2 scenario was available the results were summarised in tables.

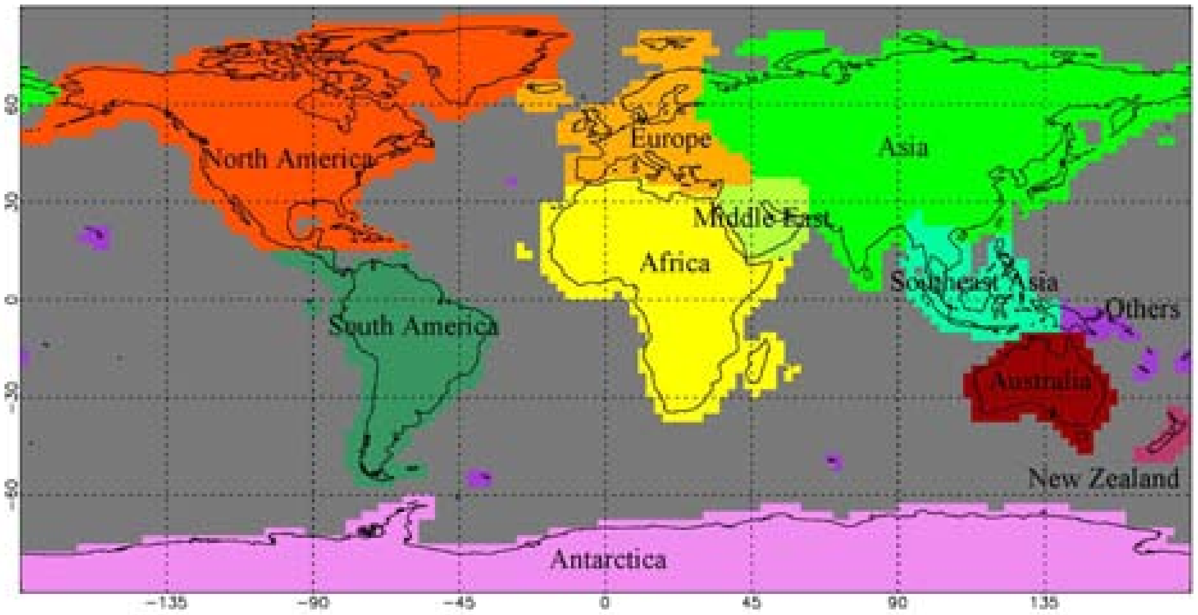
Table 1: Summary of the climate model output showing number of monthly runs available for each model-scenario combination.

Model (Country)	**Scenario**		
	20C3M	**A1B**	**A2**
BCCR-BCM2.0 (Norway)	1	1	1
CGCM3.1(t63) (Canada)	1	1	-
CNRM-CM3 (France)	1	1	1
CSIRO-Mk3.0 (Australia)	3	1	1
CSIRO-Mk3.5 (Australia)	1	1	1
GFDL-CM2.0 (USA)	3	1	1
GISS-AOM (USA)	2	2	-
GISS-EH (USA)	5	3	-
GISS-ER (USA)	9	2	-
INGV-ECHAM4 (Europe, ECMWF[a])	1	1	1
INM-CM3.0 (Russia)	1	1	1
IPSL-CM4 (France)	1	1	1
MIROC3.2_HIRES (Japan)	1	1	-
MIROC3.2_MEDRES (Japan)	2	2	2
MIUB-ECHO-G (Germany/Korea)	5	3	3
MPI-ECHAM5 (Germany)	4	4	3
NCAR-CCSM3.0 (USA)	8	7	3
NCAR-PCM1 (USA)	4	4	4
UKMO-HADCM3 (UK)	2	1	1
UKMO-HADGEM1 (UK)	2	1	1
Total	57	39	25

[a] European Centre for Medium-Range Weather Forecasts

2.2 Definition of Regions

Figure 1: Continental regions defined in the report. Continental totals for precipitation and evaporation (as reported in the summary tables) were calculated using this mask combined with the land area fraction (downloaded from the multi-model archive) for each model.



2.3 Calculations

Monthly Precipitation (P, kg m^{-2} s^{-1}), surface latent heat flux (hfls, W m^{-2}), mean surface air temperature (T, K), and land area fraction (sftlf, %) were downloaded for each model run from the CMIP3 online archive. To convert the evaporation (E) from energetic- to mass-based units we divided the surface latent heat flux by the latent heat of vapourisation. In doing that we assumed that all evaporation was from ice when T was less than or equal to zero degrees Celsius while for T greater than zero degrees Celsius, evaporation was assumed to be from the liquid phases and the latent heat of vaporisation was set accordingly.

The spatial details of each model were different. The largest were 4° × 4° (~ 400 km × 400 km) while in the other extreme a few models had pixel sizes of 1° × 1° (~ 100 km × 100 km). To facilitate comparisons, the P and E data were resampled (using bilinear interpolation) to the most common geographic grid. The final dimensions were 2.5° × 2.5° (~ 270 km × 270 km). Using the resulting grids we calculated annual averages for P and E for the 1970-1999 (inclusive) period from the 20C3M scenario. For the two future scenarios (A1B, A2) the averages were calculated for the 2070-2099 (inclusive) period.

When integrated over the globe, P and E must balance for periods of a month or longer (Wentz *et al*. 2007). For the 30 year global averages considered here, we found small disagreements, possibility because of small uncertainties in the latent heat of vapourisation we used as well as uncertainties when resampling to a common geographic grid. The global average for E was adjusted to equal P by applying a correction factor, denoted as $E'(=P/E)$. The correction was typically small. For example, for the BCCR-BCM2.0 model for the 1970-1999 period, E' was 1.0081 (see Table on p. 8). The correction factors as applied are listed on the tables throughout.

All maps and tables are presented using traditional hydrologic units, i.e., depth of precipitation (or evaporation) per unit time (mm per yr). Over the land surface, the difference between P and E is equal to the runoff plus any change in storage (e.g. soil water). For the thirty year periods used here, the change in terrestrial storage is expected to be small and the difference between P and E over land is accordingly a very good approximation of the runoff.