Climate projections informing hazard-based impact assessments

EXPLAINER

Vanuatu Klaemet Infomesen blong Redy, Adapt mo Protekt
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Introduction

The Van-KIRAP project has undertaken preliminary, climate hazard-based impact assessments relevant over current to multi-decadal (climate change) time scales across priority sectors, including fisheries, infrastructure, agriculture, water and tourism. The purpose is to demonstrate the practical application of science-based Climate Information Services (CIS) for informing policy development, adaptation planning and associated climate risk-based decision-making. The CIS products are in the form of an integrated portfolio of infobytes, factsheets and digital capability (via the Van-KIRAP portal) tailored to meet the priority needs of sectoral stakeholders in Vanuatu. The Van-KIRAP portal specifically provides enhanced visualisation, geo-spatial referencing and online analytics capability for both climate and non-climate information across the priority sectors, together with additional resources such as guidance materials to facilitate user access and applications.

This explainer provides a summary description of how climate model output is processed and used for informing the Van-KIRAP sectoral impact assessments. Best-practice projections science dictates the need to utilise multiple lines of evidence to inform hazard-based climate impact assessments. The Van-KIRAP case studies utilise multiple lines of evidence based on a selection of GCMs and a range of global greenhouse gas (GHG) emission scenarios. Assessments have been undertaken for different time periods into the future centred on 2030, 2050, 2070 and 2090 [1].


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Climate projections for climate hazard-based impact assessments

The climate has changed over past decades, mainly because of increasing concentrations of global GHGs in the atmosphere (also see GHG emissions factsheet), and these changes will continue in future decades [2]. Climate hazard-based impact assessments are designed to inform sectoral planning for the future in order to better adapt to climate change and to mitigate risks. Such assessments require imagining what the 'future world' may be like, including different climate change scenarios. Global Climate Models (GCMs) (see GCM factsheet) can simulate how changes in the global climate system may evolve depending on future GHG concentrations in the atmosphere. Climate projections data and information from GCMs is available out to 2100 (and in some cases beyond) for many climate variables, including temperature and precipitation, for all regions of the planet.

Direct GCM output is generally not suitable for direct input for informing climate related applications without some further processing. This is because there are differences, or 'biases', between GCM simulations and actual climate observations (which also affect future simulations). Also, direct output from GCMs is often at coarse spatial scales which can limit utility for informing decisions at finer spatial scales. To overcome these issues, the GCM climate projections data typically need further processing to make the data 'application-ready'.

'Application-ready' data

'Application-ready' data sets can be directly input to climate change impact assessments. There are two ways of doing this:

1. Use observed data (e.g. Table 1) for the 'current' climate baseline[1], e.g. 1986–2005, then adjust these data to represent the future climate, e.g. 2046–2065. The adjustments are based on changes simulated by GCMs, i.e. the difference between the GCM future and current climate. The adjustment is termed 'scaling', or 'delta scaling' [3] (e.g. see [4-6]). This method was used to produce application-ready temperature, rainfall, and sea surface temperature (SST) projections data for Van-KIRAP.
2. Use bias-corrected data simulated by GCMs for the current climate baseline, e.g. 1986–2005. The bias corrections are derived from the difference between the GCM current climate and the observed current climate. The same bias corrections can be applied to the GCM future climate data. This method was used to produce tropical cyclone projections for Van-KIRAP.

Each method has strengths and weaknesses. The Van-KIRAP project often applies method 1 because it uses current station-based (observed) climate data that are widely used by sectoral stakeholders that can be linked to documented impacts. This can be important for establishing historical climate-impact relationships.

Scaling can be used to produce:

- average climate observations over a defined period which can then be displayed in geo-spatially referenced map formats
- observed daily, monthly or seasonal data for specific sites/ regional averages, which can then be displayed in a graphical or tabular timeseries format (see [7] Section 6.1).

More complex methods of scaling to generate application-ready data include quantile or percentile scaling, where projected change at various percentiles is applied to those percentiles in the observed data [8]. These methods better represent projected changes in climate variability, including future extreme events, which are highly relevant for daily rainfall and wind speed related hazards. For Van-KIRAP projections, the quantile scaling method is used to estimate future extremes including for rainfall and wind.

Table 1 Observational data sets used to create application-ready projection data using mean scaling for Van-KIRAP sectoral case studies (infobytes)

Climate variable	Data set	Infobytes
Temperature and rainfall (point location)	Vanuatu Meteorology and Geo-hazards Department (VMGD) daily station data from 1986–2005 (e.g. Figure 1; Appendix A). These data are not available on the Van-KIRAP portal. Permission from VMGD is required to access the data.	Electricity demand
Temperature and rainfall (gridded)	WorldClim baseline climatology for 1970–2000 [9] available at ~1 km resolution (see Appendix B for baseline inconsistency discussion).	Coffee Cocoa
Sea surface temperature (gridded)	NOAA daily Optimum Interpolation Sea Surface Temperature v2-1 data set (OISST v2-1[2]; [10]). Baseline data used for Van-KIRAP spans 1995–2014 (in line with CMIP6).	Seagrass Coral bleaching
Sea surface temperature (point location)	Ocean spotter buoys. These have been recently deployed in Vanuatu (see Ocean monitoring factsheet)	Sea turtles
Ocean chemistry (gridded)	Ocean chemistry observations (OceanSODA-ETHZ[3]) come from a global gridded data set of the surface ocean carbonate system at a monthly resolution over the period 1985–2018 at a spatial resolution of 1° x 1° (about 100 km) [11]. Baseline data used for Van-KIRAP span 1986–2005 (in line with CMIP5).	Coral: Ocean acidification

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[1] The time period for the observed data should align as closely as possible with the 'baseline' used by the GCMs to calculate the projected future change e.g. 1986–2005 for CMIP5 GCMs or 1995–2014 for CMIP6 GCMs (see Appendix C).

[2] Daily OISST is an analysis constructed by combining observations from different platforms (satellites, ships, buoys, and Argo floats) on a regular ¼° global grid (around 27 km at the equator) with interpolation to fill the gaps. Full year data are available from 1982–2019.

[3] OceanSODA-ETHZ was created by extrapolating in time and space the surface ocean observations of CO_2 concentration (pCO_2 from the Surface Ocean CO_2 Atlas, SOCAT) and total alkalinity (TA; from the Global Ocean Data Analysis Project, GLODAP). Surface ocean dissolved inorganic carbon, pH and aragonite saturation state were computed from the globally mapped pCO_2 and TA using the thermodynamic equations of the carbonate system.

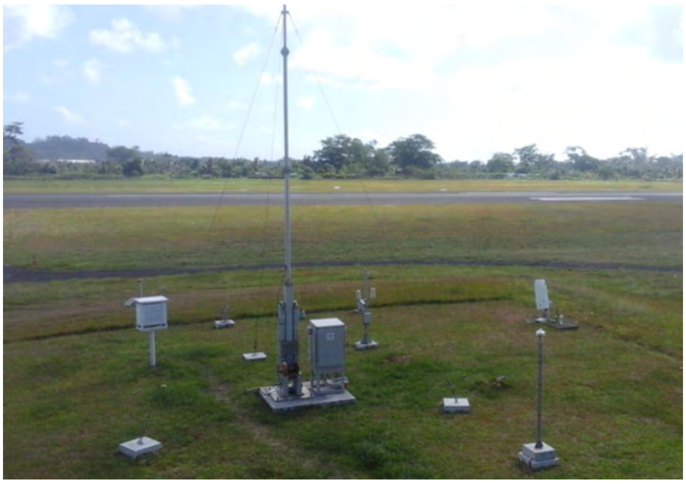
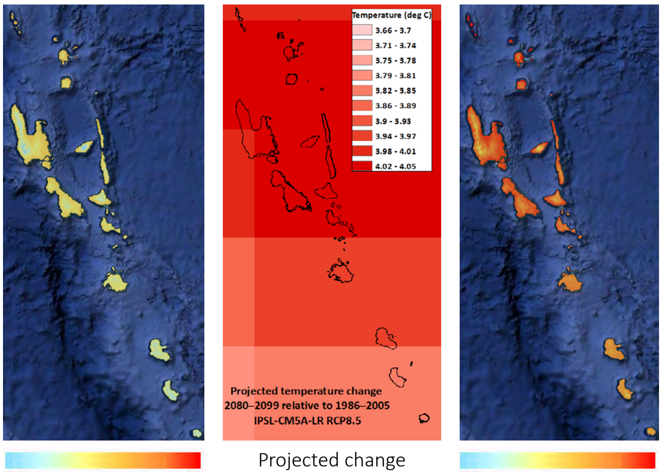


Figure 1 Bauerfield weather station (VMGD) https://www.vmgd.gov.vu/vmgd/index.php/observation/surface-monitoring/bauerfield

Gridded data and maps

For the Van-KIRAP portal, projections are derived for monthly, seasonal or annual timeframes and various future periods. Average changes simulated by GCMs (~200 km resolution) are applied to the historical gridded data with much finer spatial resolution. For temperature related variables, average changes from GCMs are <u>added</u> to observed daily data in each month. For all other variables (e.g. rainfall) observed data are adjusted by the <u>percent change</u> for each month.

The example in Figure 1 shows temperature projections are created by adding the GCM simulated change to the Worldclim 1970–2000 climatology (Table 1) (also see Appendix B describing differences in baselines). In this way, the climate and underlying weather conditions from the observational period are altered, or adjusted, to represent plausible future conditions. These gridded data can be visualised as a map using software such as ArcGIS. Maps are also available for viewing on the Van-KIRAP portal (Figure 2, left and right). We note the numerical precision of these data must not be confused with accuracy; the scaled projections are plausible, rather than precise (see later section on Data limitations).



Projected change (above) is added to left map→ right map

Figure 2 Historical annual mean temperature (°C; 1970–2000) from WorldClim (left). Projected temperature change (°C; 2080–2099 relative to 1986–2005[4]) (middle). The WorldClim (1970–2000) temperature climatology (left) is 'scaled' with the GCM-projected change to produce future annual mean temperature (°C; 2076–2105) (right). The GCM represented here is IPSL-CM5A-LR under the high GHG emission scenario (RCP8.5).

Projected climatology for ocean variables, such as sea surface temperature (SST), marine heatwaves, and ocean chemistry have also been developed for the Van-KIRAP portal using the same scaling method.

Data presented as graphs and timeseries

Observed annual, seasonal or monthly average climate data for sites or regions can be scaled by projected changes from GCMs. As well as a map (Figure 2), regional averages of the output can be visualised as a graph. Figure 3 shows an example for Port Vila monthly average temperature and rainfall where the observed monthly averages for 1986–2005 have been adjusted by projected changes for 2036–2065 from a GCM driven by a high emissions scenario (RCP8.5). This method of scaling could also be undertaken using the annual projected change values for the Vanuatu Central region in which Port Vila is located (Appendix A and B).

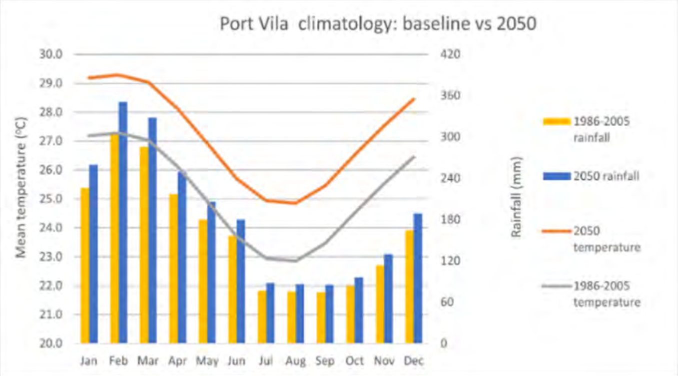


Figure 3 Port Vila monthly mean temperature (°C) and rainfall (mm) averaged over 1986–2005, then scaled with projected changes in mean temperature and rainfall for 20-years centred on 2050 (2036–2065) relative to 1986–2005 from the 'IPSL-CM5A-LR' model under a high emissions GHG scenario (RCP8.5).

Observed daily weather station data (e.g. Appendix A) [12], or point location SST data (e.g. Ocean monitoring factsheet), ideally spanning 20- to 30-year observational periods, can also be scaled with projected monthly changes for the variable of interest from selected climate models using the delta-scaling method (model/GHG emissions specific data available in Appendix C). In the example shown, a February daily maximum temperature timeseries value from the Bauerfield observation station is scaled by the projected change for February. Daily data for a selected site can be visualised as a timeseries graph. From this, analyses such as extreme value statistics can be calculated for future periods e.g. average number of days with temperature over 35 °C or rainfall over 50 mm.

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[4] See Appendix B for an explanation of baseline inconsistencies.

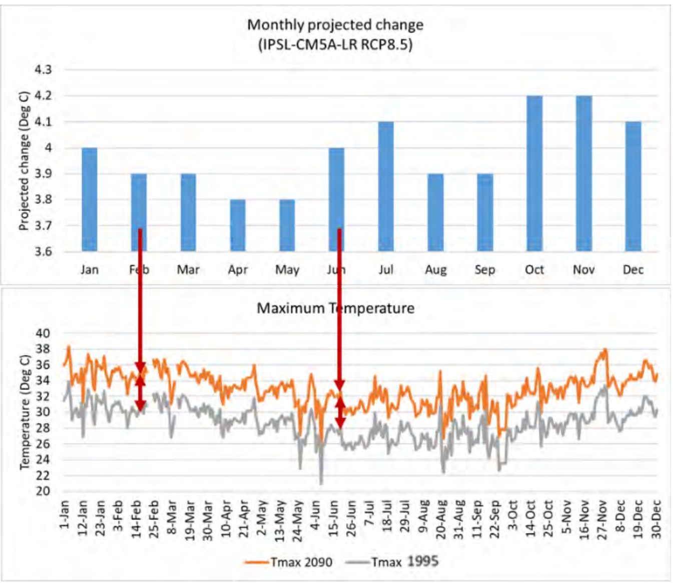

Figure 4 Maximum daily temperature (°C) timeseries (1995) (grey) being scaled by monthly mean change (IPSL-CM5A-LR/RCP8.5) (blue bars) relative to the 20-year period centred on 1995 to produce a plausible future maximum daily temperature (°C) timeseries for the 2090 period (orange). The arrow shows a June day from the observations being scaled by the change value for Vanuatu Central from IPSL-CM5A-LR under RCP8.5 (e.g. Feb: 3.9 °C; June: 4.1 °C) (Appendix D; Table 5) to produce the corresponding future daily temperature.

Selecting GCMs to use when producing application-ready data

Different GCMs can result in a range of future projections. For example, over Vanuatu by 2030 the projected annual-average temperature change is 0.3–1.1 °C and the projected annual-average rainfall change is -9 to +13 % relative to 1986–2005 [12]. Where possible it is therefore recommended to consider a range of possible future climate scenarios for examining sectoral impacts [13].

Multiple lines of evidence

According to CSIRO and SPREP [1], the GHG emissions scenarios need to be both representative and internally consistent:

- Representative means sampling the full range of plausible future climates including:
  - the range of plausible emissions pathways, termed Representative Concentration Pathways (RCPs) [14] (see GHG emissions factsheet)
  - the range of plausible climate responses to each emissions pathway, simulated by the different climate models (see Climate model factsheet).
- Internally consistent means that the changes in different climate variables (e.g. temperature and rainfall) make physical sense. Mixing variables from different models (e.g. temperature from Model A, and rainfall from Model B) may result in physically implausible combinations. To avoid this, it is recommended to employ projections for different variables from a consistent climate model (e.g. scenario 1 has temperature and rainfall projections from Model A, while scenario 2 has temperature and rainfall projections from Model B).

As the climate impact assessments are undertaken to assist with decision making, it is useful to frame the analysis to align with potential questions, such as: What would we do under a 'warmer-drier' scenario or 'hotter-wetter' scenario? This is known as the 'storyline approach' [15, 16].

A standardised storyline approach has been adopted for Vanuatu's Van-KIRAP project [1] (Table 2). It is noted that projections of average temperature and rainfall change are strongly determined by changes to the South Pacific Convergence Zone (SPCZ) [17]. A low GHG emissions pathway (RCP2.6) and a high GHG emissions pathway (RCP8.5) have been recommended where the data is available. The CMIP5 models selected for the Van-KIRAP project (GISS-E2-H and IPSL-CM5A-LR) performed well in simulating current climate features in the Pacific region and they represent a broad range of future climate scenarios (Table 2) [1, 18].

Table 2 Standardised scenarios for Vanuatu for the period 2040–2059 relative to 1986–2005 for low and high emissions pathways and two climate change scenarios defined by movement of the SPCZ. Scenario 1 is derived from the GISS-E2-H climate model while Scenario 2 is derived from the IPSL-CM5A-LR climate model [1].

	Scenario 1 (GISS-E2-H) **SPCZ moves north**	**Scenario 2 (IPSL-CM5A-LR)** **SPCZ moves south**
Low emissions (RCP2.6)	***Warmer & drier*** • Annual temperature: +0.5 °C • Annual rainfall: -10 % • More heatwaves • Heavier rainfall events	***Much warmer & wetter*** • Annual temperature: +1.0 °C • Annual rainfall: +10 % • More heatwaves • Heavier rainfall events
High emissions (RCP8.5)	***Much warmer & drier*** • Annual temperature: +0.8 °C • Annual rainfall: -10 % • More heatwaves • Heavier rainfall events	***Hotter & much wetter*** • Annual temperature: +2.0 °C • Annual rainfall: +20 % • Many more heatwaves • Much heavier rainfall events

Data limitations

Users of the climate projections data should ensure that applications work within the stated limitations of the data, including the inherent 'uncertainties' in the GCM (and downscaled) model output, and consider how these might affect their conclusions and the confidence that they express in them as part of the impact assessments.

Confidence ratings are provided by Van-KIRAP to inform how the projections are used for hazard-based climate impact assessments across priority sectors. If confidence is high, then the range of projections can be used as a good guide to potential climate change; if confidence is low then the results are plausible, but caution is advised. For rainfall, where topography can have a large influence on climate processes, the limitations around the modelling become greater. In some cases, dynamically downscaling the GCM data can provide meaningful added value (see Climate model factsheet).

For example:

- GCMs can provide useful climate projections at global and continental scales. There is greater scientific confidence in projections over large spatial scales and longer time periods (e.g. global climate change over multiple decades) than for smaller spatial scales (e.g. regionally explicit national/sub-national projections) and shorter time periods (e.g. over periods of less than 10 years). Uncertainties at regional and local scales over the next decade are strongly influenced by large-scale natural climate variability processes such as ENSO [1].
- GCMs have coarse resolution and may not resolve important processes on finer spatial scales, especially where mountainous or coastal areas are involved. Because of this, climate projections generated for smaller regions or districts and/or for specific points in time should be used as a guide only. In this context it is very important to understand the spatial, temporal and associated methodological limitations in the detail of data presented in maps and graphs (see Climate model factsheet).
- Downscaled, or regional climate model (RCM) output has a finer spatial scale which may resolve more detailed climate information, including relevant micro-climate variability. However, the limitations in downscaled projections data include the inherent uncertainty from the relevant GCMs as well as the physical limitations of the downscaling method (statistical, dynamical, hybrid). For example, some local phenomena such as land-sea breezes, mountain winds, cold fronts and extreme rainfall can only be realistically represented at a resolution of less than 10 km (see Climate model factsheet).
- There are some climate phenomena that are not well represented by GCMs, or even RCMs, e.g. weather-scale phenomena (1–10 km), and other short-lived phenomena such as tropical cyclones (TCs). Understanding future TC frequency and intensity requires specialised analysis (see Tropical cyclone explainer).
- WorldClim historical temperature data are computed by spatially interpolating weather station data, thereby creating a 1 km gridded surface [9]. Around the Pacific region, locations of weather stations are sparse, so there is less confidence in WorldClim data accuracy over the Pacific compared to other regions with dense station networks, and it should be interpreted with caution (see Appendix B).
- There is greater confidence in the accuracy of projections for some variables (e.g. temperature) than others (e.g. rainfall) because of the resolution of the model and its ability to resolve some drivers of variability e.g. topography affecting rainfall. Less frequent or extreme events have less underlying evidence around patterns and drivers of variability therefore lowering confidence e.g. TCs (see Tropical cyclone explainer).

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Appendices

Appendix A: Observational data (source: VMGD)

Meteorological stations record observed weather data. Key stations in Vanuatu are shown in Figure 5, along with three regions used for climate projections. Details for the temperature and rainfall data recorded at seven stations are summarised in Table 3 [7].

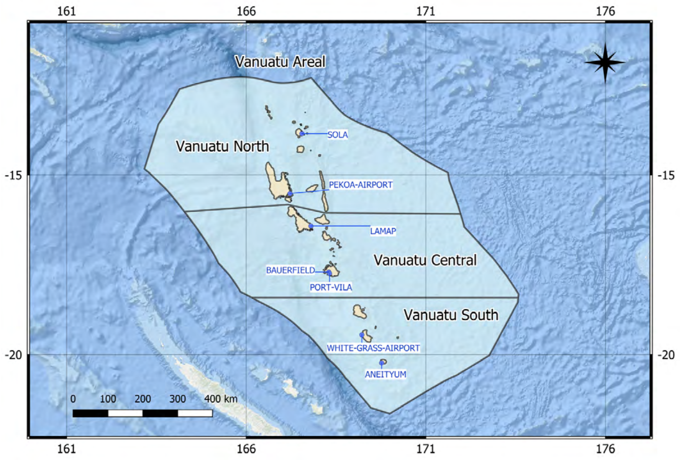

Figure 5 Map of Vanuatu and the three sub-national regions for which climate projections are reported. The locations of key meteorological stations used for the study are also shown (blue text). The pale blue shaded region delineates the Exclusive Economic Zone (EEZ) of Vanuatu.

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Table 3 Details of meteorological stations (north to south) with an indication of data availability for raw data and homogenised data from the Pacific Climate Change Data Portal [19].

Station name and site code	WMO number	Precipitation data	Temperature data (mean, maximum and minimum)
Sola (Vanua Lava) VUT_000002	91551	Dec 1948–Apr 2017 (raw) Jan 1951–Apr 2017 (homogenised)	Sep 1953–Apr 2017
Pekoa Airport (Santo) VUT_000003	91554	Jan 1960–Dec 2015	Jan 1960–Dec 2015
Lamap (Malekula) VUT_000004	91555	Jul 1960–Dec 2016	Jul 1960–Dec 2016
Bauerfield (Efate) VUT_000005	91557	Jun 1984–Dec 2017	Apr 1983–Dec 2017 (raw) Jan 1951–Dec 2016 (homogenised)
Port Vila (Efate) VUT_000008	91558	Apr 1905–Jun 2017 (raw) Jan 1951–Jun 2017 (homogenised)	Nov 1947–Jun 2010 (raw) Mar 1947–Dec 2010 (homogenised)
White Grass Airport (Tanna) VUT_000006	91565	Jan 1961–Jun 2016	Jan 1961–Jul 2016
Aneityum VUT_000007	91568	Aug 1948–Apr 2017 (raw) Jan 1951–Apr 2017 (homogenised)	Oct 1953–Apr 2017

Appendix B: Baseline climate periods

Climate is usually defined as the average weather. The relevant quantities being defined are atmospheric variables such as temperature, precipitation and wind, and ocean variables such as SST, sea level, salinity, aragonite saturation, and pH. In various parts of this portal, different averaging periods, such as a period of 20 or 30 years, are used. The classical period for averaging these variables is 30 years, as specified by the World Meteorological Organization (WMO). The Intergovernmental Panel on Climate Change (IPCC) uses 20-year averaging periods [20].

We need to define the baseline period of the climate in impact studies [1]:

- Because climate change is underway and ongoing, it is important to define the baseline period. We report projections in context of the baseline.
- When creating application ready data, projected changes relative to a baseline period are used.
- The historical observed data set representing the baseline period should be aligned as closely as possible with the 1986–2005 baseline period if using CMIP5 GCMs (Figure 6). This is consistent with the IPCC approach [20].
- If the available data differs from the 1986–2005 baseline period, try to estimate differences between your baseline period and the 1986–2005 baseline to ensure you are not overestimating or underestimating the change[5].
- The early pre-industrial baseline of 1850–1900 is now used widely for some climate variables (e.g. global-average warming in the Paris Agreement and IPCC reports). In these cases, we must allow for changes that have already occurred since that time.

The baseline period is often determined or defined by the climate data produced for various experiments. For studies employing data from CMIP5 climate models, the IPCC 5th Assessment Report (AR5) used the baseline period of 1986–2005 [20]. The baseline period has been updated to 1995–2014 for CMIP6 climate models used in the IPCC 6th Assessment Report (AR6) [2].

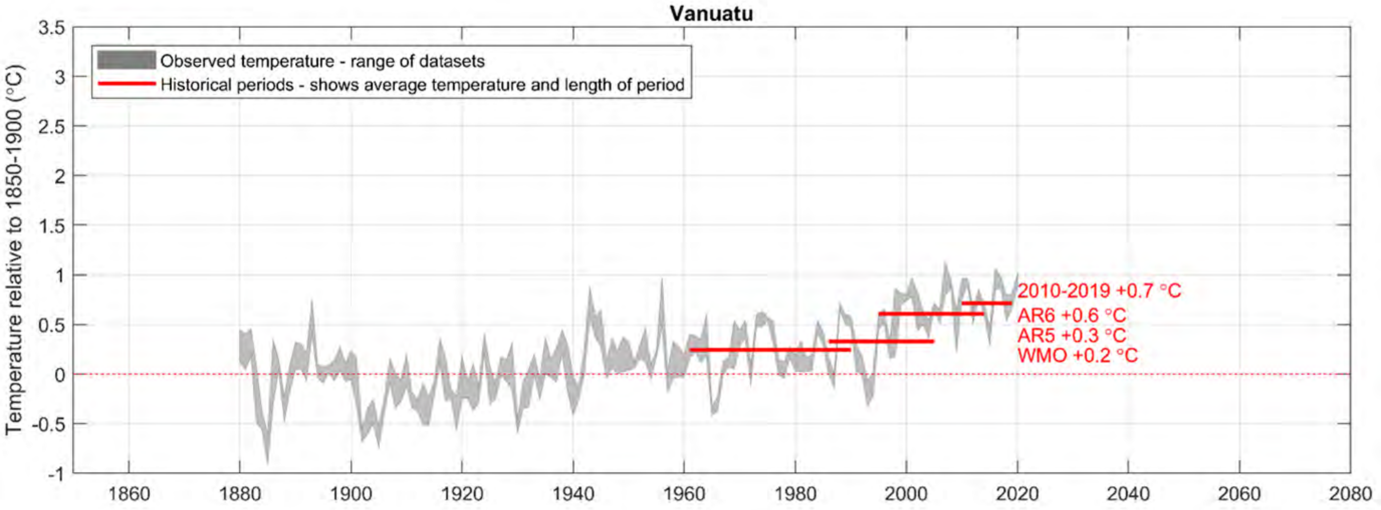

Figure 6 Average annual temperature of Vanuatu relative to 1850–1900 (°C; grey band indicates five global temperature data sets) and the climate average (the climatology) for four different historical periods (baselines), as marked:

- *WMO 1961–1990 is a common World Meteorological Organization baseline*
- *AR5 1986–2005 is the baseline used in the IPCC fifth assessment report (AR5)*
- *AR6 1995–2014 is the baseline used in the IPCC sixth assessment report (AR6)*
- *2010–2019 is a recent ten-year period*

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[5] WorldClim gridded climatology data is based on the 1970–2000 period. Through analysing station data and global gridded data products, it was determined differences were insignificant when comparing the 1970–2000 and 1986–2005 climatological periods.

Appendix C: Atmospheric climate projections data

Temperature and rainfall projections for three Vanuatu sub-regions: North (Table 4 and Table 7), Central (Table 5 and Table 8) and South (Table 6 and Table 9) [7].

Table 4 Projected changes in annual, seasonal, and monthly mean temperature (°C) over ***Vanuatu North*** *based on two CMIP5 climate models (GISS-E2-H and IPSL-CM5A-LR) that represent a broad range of future climates. Projected changes are relative to 1986–2005 and are shown for three different future 20-year periods (centred on 2050, 2070 and 2090) and two emissions pathways (RCP2.6 and RCP8.5).*

	2040–2059				2060–2079				2080–2099			
	GISS-E2-H		IPSL-CM5A-LR		GISS-E2-H		IPSL-CM5A-LR		GISS-E2-H		IPSL-CM5A-LR	
	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5
Annual	0.5	0.9	1.0	2.0	0.4	1.4	1.0	2.9	0.4	1.9	1.1	4.0
Monthly												
January	0.6	1.0	1.1	2.0	0.4	1.5	1.1	3.0	0.6	2.1	1.2	4.0
February	0.6	1.0	1.1	1.9	0.4	1.6	1.0	2.9	0.6	2.1	1.1	4.0
March	0.5	0.8	0.9	1.9	0.4	1.4	1.0	2.8	0.4	2.0	1.1	3.9
April	0.5	0.8	1.0	1.9	0.4	1.4	1.0	2.8	0.3	1.8	1.1	3.9
May	0.4	0.9	0.8	1.8	0.3	1.5	1.0	2.7	0.4	1.8	1.0	3.9
June	0.6	0.8	0.8	1.8	0.4	1.5	0.8	2.9	0.4	1.9	1.0	4.0
July	0.5	0.8	1.1	2.2	0.3	1.3	1.0	3.0	0.4	1.7	1.0	4.2
August	0.5	0.8	1.0	2.0	0.3	1.4	1.1	2.9	0.5	1.9	0.9	4.1
September	0.4	0.8	1.1	2.2	0.3	1.3	1.2	3.0	0.3	1.7	1.1	4.0
October	0.4	0.9	1.2	2.2	0.4	1.3	1.2	3.0	0.5	1.8	1.2	4.1
November	0.5	1.0	1.0	2.0	0.5	1.4	1.1	2.9	0.5	1.9	1.2	4.1
December	0.5	1.0	0.9	2.0	0.4	1.5	1.1	2.9	0.6	2.0	1.2	4.1
Season												
djf	0.5	0.9	1.1	1.9	0.4	1.4	1.1	3.0	0.5	1.9	1.2	4.0
mam	0.4	0.7	0.9	1.8	0.2	1.4	1.0	2.8	0.3	1.7	1.0	3.8
jja	0.5	0.8	1.0	2.0	0.3	1.4	1.0	2.8	0.4	1.8	0.9	4.0
son	0.4	0.9	1.1	2.2	0.4	1.3	1.1	3.0	0.4	1.8	1.2	4.1
mjjaso	0.4	0.8	1.0	2.0	0.3	1.4	1.0	2.8	0.4	1.8	1.0	4.0
ndjfma	0.4	0.8	1.0	2.0	0.4	1.3	1.0	2.9	0.4	1.9	1.1	4.0

Table 5 Projected changes in annual, seasonal, and monthly mean temperature (°C) over ***Vanuatu Central*** *based on two CMIP5 climate models (GISS-E2-H and IPSL-CM5A-LR) that represent a broad range of future climates. Projected changes are relative to 1986–2005 and are shown for three different future 20-year periods (centred on 2050, 2070 and 2090) and two emissions pathways (RCP2.6 and RCP8.5).*

	2040–2059				**2060–2079**				**2080–2099**			
	GISS-E2-H		**IPSL-CM5A-LR**		**GISS-E2-H**		**IPSL-CM5A-LR**		**GISS-E2-H**		**IPSL-CM5A-LR**	
	RCP2.6	**RCP8.5**	**RCP2.6**	**RCP8.5**	**RCP2.6**	**RCP8.5**	**RCP2.6**	**RCP8.5**	**RCP2.6**	**RCP8.5**	**RCP2.6**	**RCP8.5**
Annual	0.4	0.8	1.0	2.0	0.3	1.4	1.0	2.9	0.4	1.8	1.1	4.0
Monthly												
January	0.5	0.8	1.1	1.9	0.4	1.4	1.1	3.0	0.5	1.9	1.2	4.0
February	0.5	0.8	1.1	1.8	0.4	1.4	1.0	2.9	0.4	1.9	1.1	3.9
March	0.3	0.7	0.9	1.9	0.3	1.3	1.0	2.8	0.4	1.9	1.0	3.9
April	0.4	0.7	0.9	1.9	0.2	1.3	1.0	2.8	0.2	1.7	1.0	3.8
May	0.3	0.8	0.7	1.7	0.1	1.4	0.9	2.7	0.3	1.7	0.9	3.8
June	0.5	0.7	0.8	1.8	0.3	1.4	0.8	2.8	0.3	1.8	1.0	4.0
July	0.5	0.8	1.0	2.2	0.3	1.4	1.0	2.8	0.3	1.7	1.0	4.1
August	0.5	0.9	1.0	2.0	0.3	1.5	1.1	2.8	0.5	2.0	0.9	3.9
September	0.4	0.8	1.1	2.2	0.3	1.3	1.1	2.9	0.3	1.7	1.1	3.9
October	0.5	0.9	1.2	2.2	0.4	1.3	1.2	3.0	0.6	1.8	1.2	4.2
November	0.4	1.0	1.0	2.1	0.5	1.3	1.1	3.0	0.5	1.9	1.3	4.2
December	0.4	0.9	1.0	2.1	0.5	1.4	1.1	3.0	0.5	1.8	1.3	4.1
Season												
djf	0.5	0.9	1.1	1.9	0.4	1.4	1.1	3.0	0.5	1.9	1.2	4.0
mam	0.5	0.8	1.0	2.0	0.3	1.4	1.0	2.8	0.4	1.8	0.9	4.0
jja	0.4	0.7	0.9	1.8	0.2	1.4	1.0	2.8	0.3	1.7	1.0	3.8
son	0.4	0.8	1.0	2.0	0.3	1.4	1.0	2.8	0.4	1.8	1.0	4.0
mjjaso	0.4	0.8	1.0	2.0	0.4	1.3	1.0	2.9	0.4	1.9	1.1	4.0
ndjfma	0.4	0.9	1.1	2.2	0.4	1.3	1.1	3.0	0.4	1.8	1.2	4.1

Table 6 Projected changes in annual, seasonal, and monthly mean temperature (°C) over ***Vanuatu South*** *based on two CMIP5 climate models (GISS-E2-H and IPSL-CM5A-LR) that represent a broad range of future climates. Projected changes are relative to 1986–2005 and are shown for three different future 20-year periods (centred on 2050, 2070 and 2090) and two emissions pathways (RCP2.6 and RCP8.5).*

	2040–2059				2060–2079				2080–2099			
	GISS-E2-H		IPSL-CM5A-LR		GISS-E2-H		IPSL-CM5A-LR		GISS-E2-H		IPSL-CM5A-LR	
	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5
Annual	0.4	0.8	0.9	2.0	0.3	1.4	1.0	2.8	0.4	1.8	1.0	3.9
Monthly												
January	0.4	0.7	1.0	1.8	0.4	1.3	1.0	3.1	0.4	1.7	1.1	3.9
February	0.4	0.6	1.0	1.8	0.3	1.2	0.9	2.8	0.3	1.7	1.0	3.7
March	0.3	0.7	0.9	1.9	0.3	1.2	1.0	2.7	0.3	1.7	1.0	3.8
April	0.4	0.6	0.9	1.9	0.2	1.3	0.9	2.7	0.3	1.6	1.0	3.7
May	0.2	0.7	0.7	1.7	0.1	1.4	0.9	2.6	0.3	1.6	0.8	3.7
June	0.4	0.7	0.8	1.8	0.2	1.4	0.8	2.7	0.3	1.8	0.9	3.8
July	0.4	0.8	0.9	2.0	0.3	1.4	1.0	2.6	0.2	1.7	0.9	3.9
August	0.4	0.9	1.0	1.9	0.4	1.6	1.1	2.6	0.5	2.0	0.9	3.7
September	0.4	0.8	1.0	2.1	0.3	1.4	1.0	2.8	0.3	1.8	1.1	3.7
October	0.5	0.9	1.1	2.2	0.4	1.4	1.1	2.9	0.6	1.9	1.2	4.1
November	0.4	1.0	1.0	2.1	0.5	1.4	1.0	3.0	0.5	2.0	1.2	4.2
December	0.3	0.9	1.0	2.1	0.5	1.4	1.1	3.1	0.5	1.8	1.3	4.1
Season												
djf	0.4	0.8	1.0	1.9	0.4	1.3	1.0	3.0	0.4	1.7	1.2	3.9
mam	0.3	0.7	0.8	1.8	0.2	1.3	0.9	2.7	0.3	1.6	0.9	3.7
jja	0.4	0.8	0.9	1.9	0.3	1.5	1.0	2.6	0.3	1.9	0.9	3.8
son	0.4	0.9	1.0	2.1	0.4	1.4	1.1	2.9	0.5	1.9	1.2	4.0
mjjaso	0.4	0.8	0.9	2.0	0.3	1.4	1.0	2.7	0.3	1.8	1.0	3.8
ndjfma	0.4	0.8	1.0	1.9	0.4	1.3	1.0	2.9	0.4	1.8	1.1	3.9

Table 7 Projected percentage (%) changes for annual, seasonal, and monthly rainfall over ***Vanuatu North*** *based on two CMIP5 climate models (GISS-E2-H and IPSL-CM5A-LR) that represent a broad range of future climates. Projected changes are relative to 1986–2005 and are shown for three different future 20-year periods (centred on 2050, 2070 and 2090) and two emissions pathways (RCP2.6 and RCP8.5).*

	2040–2059				2060–2079				2080–2099			
	GISS-E2-H		IPSL-CM5A-LR		GISS-E2-H		IPSL-CM5A-LR		GISS-E2-H		IPSL-CM5A-LR	
	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5
Annual	-6.5	-7.5	12.0	19.4	-7.3	-11.8	12.1	28.2	-0.1	-13.9	6.2	36.6
Monthly												
January	-16.2	-10.7	13.2	30.7	-2.7	-16.9	26.0	25.6	-4.1	-6.8	3.9	33.1
February	12.6	18.2	23.8	31.9	10.7	1.7	12.5	32.3	12.9	6.7	24.3	63.1
March	2.2	6.0	3.7	4.6	13.2	2.4	2.3	3.5	10.9	2.4	-0.8	11.0
April	-8.0	-4.1	-3.3	10.0	-8.7	-6.2	-0.8	11.5	-6.6	-13.4	-3.5	14.3
May	-9.8	-28.3	3.5	0.4	-28.6	-25.7	-2.0	15.8	0.2	-37.6	-5.1	18.7
June	-20.4	-30.3	-9.4	-4.9	-29.3	-8.4	-8.1	9.4	-15.0	-38.2	-28.2	32.3
July	-4.4	-20.7	30.6	39.9	-29.1	4.5	10.3	52.3	-3.1	-15.0	12.9	83.6
August	-26.8	-8.1	-8.4	7.0	-7.6	-18.8	2.1	13.3	-6.3	-16.9	-26.7	-4.6
September	-24.0	-16.6	58.3	39.3	-18.3	-31.1	15.4	71.7	-10.7	-15.0	17.0	39.4
October	-28.0	-14.6	75.5	62.7	-10.5	-30.1	54.3	56.6	5.5	-26.1	60.9	74.5
November	-0.1	-3.8	20.5	37.9	-16.9	-25.1	37.9	99.5	7.7	-5.2	35.2	89.1
December	7.0	-3.1	6.4	25.8	3.8	-4.1	27.7	36.3	1.0	-15.0	22.8	62.0
Season												
djf	-4.4	-2.4	14.4	27.3	1.8	-10.3	19.2	29.5	-0.6	-7.1	14.0	47.8
mam	-5.3	-8.2	1.2	5.3	-7.5	-9.4	0.1	9.8	0.9	-15.6	-2.7	14.5
jja	-18.3	-22.9	0.6	9.3	-24.4	-8.3	-0.9	20.9	-10.3	-27.4	-17.6	34.8
son	-13.6	-9.8	46.9	46.2	-15.2	-27.9	38.0	78.7	3.3	-13.8	39.1	72.3
mjjaso	-17.6	-23.2	17.3	16.8	-23.0	-21.4	7.9	29.0	-4.1	-29.8	0.4	35.6
ndjfma	-3.3	-1.5	8.4	20.0	-0.9	-8.9	13.3	25.9	1.2	-7.0	8.8	36.3

Table 8 Projected percentage (%) changes for annual, seasonal, and monthly rainfall over ***Vanuatu Central*** *based on two CMIP5 climate models (GISS-E2-H and IPSL-CM5A-LR) that represent a broad range of future climates. Projected changes are relative to 1986–2005 and are shown for three different future 20-year periods (centred on 2050, 2070 and 2090) and two emissions pathways (RCP2.6 and RCP8.5).*

	2040–2059				2060–2079				2080–2099			
	GISS-E2-H		IPSL-CM5A-LR		GISS-E2-H		IPSL-CM5A-LR		GISS-E2-H		IPSL-CM5A-LR	
	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5
Annual	-13.4	-15.7	6.7	14.8	-9.3	-19.9	8.8	24.3	-0.7	-21.6	5.0	33.1
Monthly												
January	-18.0	-7.9	21.3	37.5	4.9	-24.2	27.6	53.1	1.5	-16.3	18.1	53.0
February	0.0	-3.1	21.8	25.5	6.5	-5.3	22.7	18.4	21.9	-19.6	22.0	62.7
March	4.6	1.9	1.8	7.0	-4.1	-6.8	1.5	-4.0	7.8	-1.9	0.6	-8.5
April	-27.4	-31.9	-21.4	-0.9	-16.9	-21.4	-11.6	5.7	-14.7	-32.2	-4.6	1.2
May	-1.9	-22.7	-14.0	-17.4	-19.8	-15.5	-14.2	8.4	19.5	-17.6	-23.3	6.7
June	-27.0	-37.2	-0.2	11.3	-40.9	-32.1	8.9	14.1	-23.9	-35.8	-19.3	44.8
July	-3.5	-12.0	11.3	7.3	-32.0	-15.2	8.8	16.9	-14.1	-19.5	2.1	65.2
August	-18.2	-5.0	18.2	41.9	-5.0	-12.1	10.6	21.7	-2.0	-8.7	-13.8	2.7
September	-5.5	-7.4	34.6	35.2	6.3	-9.1	11.1	61.7	-6.3	-5.1	13.8	17.4
October	-32.5	-27.8	50.8	41.4	-7.5	-32.0	21.0	37.9	-3.3	-29.2	39.0	97.2
November	-15.0	-3.1	17.9	27.6	-1.7	-29.0	34.3	109.4	15.1	-5.0	46.5	94.4
December	-15.4	-18.8	10.3	24.5	-9.1	-32.2	25.7	44.9	-14.7	-41.5	21.1	77.7
Season												
djf	-12.9	-11.3	17.5	27.1	-0.7	-22.4	21.7	34.5	1.8	-25.9	17.4	57.8
mam	-11.3	-18.8	-10.4	-2.0	-13.5	-15.7	-7.3	2.4	0.3	-19.3	-7.4	-1.3
jja	-19.0	-22.6	7.7	17.4	-30.0	-22.7	8.8	16.3	-16.4	-25.0	-11.8	38.6
son	-18.9	-12.6	33.2	34.1	-2.2	-25.7	23.6	72.4	3.9	-13.4	34.6	73.8
mjjaso	-15.1	-22.7	10.1	12.5	-20.3	-21.8	3.9	21.9	-2.9	-22.2	-5.5	34.9
ndjfma	-13.4	-13.3	4.8	16.4	-5.8	-20.0	10.1	24.0	0.4	-21.2	10.7	30.4

Table 9 Projected percentage (%) changes for annual, seasonal, and monthly rainfall over ***Vanuatu South*** *based on two CMIP5 climate models (GISS-E2-H and IPSL-CM5A-LR) that represent a broad range of future climates. Projected changes are relative to 1986–2005 and are shown for three different future 20-year periods (centred on 2050, 2070 and 2090) and two emissions pathways (RCP2.6 and RCP8.5).*

	2040–2059				2060–2079				2080–2099			
	GISS-E2-H		IPSL-CM5A-LR		GISS-E2-H		IPSL-CM5A-LR		GISS-E2-H		IPSL-CM5A-LR	
	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5
Annual	-12.4	-20.2	-0.1	9.4	-8.1	-20.5	5.9	20.0	-6.1	-26.2	0.7	21.4
Monthly												
January	-10.3	-12.0	3.5	21.5	2.3	-27.0	12.8	67.5	-8.6	-28.5	12.7	38.3
February	-24.0	-28.4	2.1	10.5	-3.2	-25.2	32.8	19.0	9.8	-48.2	1.7	35.4
March	1.5	-14.9	-0.1	14.2	-1.8	-8.7	7.9	-1.2	-4.0	-7.4	5.0	-27.8
April	-20.8	-36.5	-30.7	-19.1	-22.1	-14.0	-27.0	-11.4	-24.9	-40.7	-16.7	-16.9
May	14.4	-11.2	-10.4	-18.7	-0.6	9.3	-8.4	9.4	18.6	-1.3	-16.9	-11.7
June	-12.1	-37.9	18.7	24.6	-33.1	-40.2	26.5	17.9	-13.3	-21.3	-1.2	61.4
July	-17.3	-20.6	5.2	-1.7	-39.0	-31.0	1.8	10.6	-27.4	-32.9	-4.3	38.3
August	-25.3	-16.5	47.8	94.3	-16.2	-31.2	35.5	43.7	-17.1	-13.8	-2.5	24.8
September	6.8	9.6	30.6	33.8	16.6	4.0	34.4	60.3	8.1	2.9	8.2	-9.0
October	-17.0	-20.1	19.4	39.5	9.1	-20.4	-7.4	45.6	16.7	-22.5	36.5	117.0
November	-6.6	9.9	-7.7	17.6	13.5	-16.1	-6.3	50.9	27.0	0.0	11.6	63.8
December	-17.1	-17.1	0.9	-5.4	-3.5	-36.3	23.4	29.9	-21.4	-41.5	19.3	95.8
Season												
djf	-17.4	-19.7	3.6	10.5	-2.2	-29.2	22.6	37.8	-3.8	-39.5	9.5	50.5
mam	-5.7	-23.6	-14.4	-6.7	-10.4	-7.6	-9.6	-3.0	-8.5	-20.6	-8.9	-19.8
jja	-18.1	-26.5	20.3	31.0	-30.5	-34.8	19.0	21.1	-19.3	-23.6	-2.9	43.7
son	-7.1	-1.1	12.2	29.2	12.4	-12.6	4.9	51.4	17.9	-7.4	18.5	59.6
mjjaso	-8.6	-18.7	12.9	18.5	-13.9	-19.3	9.5	25.9	-3.5	-15.9	-0.2	31.8
ndjfma	-13.6	-20.4	-6.9	4.5	-5.5	-20.7	3.0	16.2	-6.2	-30.5	1.8	14.0

Appendix D: Ocean variable projections data

Sea surface temperature (SST) projections for three Vanuatu sub-regions: North (Table 10), Central (Table 11) and South (Table 12) [7].

Table 10 Projected changes in annual, monthly, and seasonal SST (°C) over ***Vanuatu North*** *based on two CMIP5 climate models (GISS-E2-H and IPSL-CM5A-LR) that represent a broad range of future climates. Projected changes are relative to 1986–2005 and are shown for three different future 20-year periods (centred on 2050, 2070 and 2090) and two emissions pathways (RCP2.6 and RCP8.5).*

	2040–2059				**2060–2079**				**2080–2099**			
	GISS-E2-H		**IPSL-CM5A-LR**		**GISS-E2-H**		**IPSL-CM5A-LR**		**GISS-E2-H**		**IPSL-CM5A-LR**	
	RCP2.6	**RCP8.5**	**RCP2.6**	**RCP8.5**	**RCP2.6**	**RCP8.5**	**RCP2.6**	**RCP8.5**	**RCP2.6**	**RCP8.5**	**RCP2.6**	**RCP8.5**
Annual	0.5	0.8	1.0	1.8	0.4	1.4	1.0	2.7	0.4	1.8	1.0	3.7
Monthly												
January	0.6	1.0	1.2	1.8	0.4	1.5	1.0	2.8	0.6	2.0	1.2	3.7
February	0.6	0.9	1.0	1.6	0.4	1.5	0.9	2.7	0.5	2.0	1.0	3.6
March	0.5	0.9	0.9	1.7	0.4	1.4	0.9	2.6	0.5	2.0	0.9	3.6
April	0.4	0.7	0.9	1.9	0.3	1.3	1.0	2.7	0.3	1.6	1.0	3.7
May	0.5	0.9	0.8	1.6	0.3	1.5	0.8	2.6	0.4	1.6	0.8	3.6
June	0.5	0.8	0.9	1.7	0.2	1.4	0.8	2.6	0.3	1.7	0.9	3.7
July	0.5	0.7	0.9	1.9	0.2	1.3	0.9	2.6	0.3	1.7	0.9	3.8
August	0.5	0.8	1.0	2.0	0.3	1.3	1.0	2.7	0.4	1.8	0.9	3.8
September	0.3	0.8	1.1	2.0	0.3	1.3	1.0	2.8	0.3	1.7	1.0	3.7
October	0.4	0.9	1.1	2.0	0.4	1.3	1.1	2.8	0.5	1.7	1.1	3.7
November	0.5	0.9	1.1	1.9	0.4	1.4	1.0	2.7	0.5	1.9	1.2	3.9
December	0.5	1.0	1.0	2.0	0.4	1.4	1.0	2.7	0.6	1.9	1.1	3.7
Season												
djf	0.6	1.0	1.1	1.8	0.4	1.5	1.0	2.7	0.6	2.0	1.1	3.7
mam	0.5	0.8	0.9	1.7	0.4	1.4	0.9	2.6	0.4	1.7	0.9	3.6
jja	0.5	0.7	0.9	1.9	0.2	1.3	0.9	2.6	0.3	1.7	0.9	3.8
son	0.5	0.7	0.9	1.9	0.2	1.3	0.9	2.6	0.3	1.7	0.9	3.8
mjjaso	0.4	0.8	1.0	1.9	0.3	1.3	1.0	2.7	0.4	1.7	0.9	3.7
ndjfma	0.5	0.9	1.0	1.8	0.4	1.4	1.0	2.7	0.5	1.9	1.1	3.7

Table 11 Projected changes in annual, monthly, and seasonal SST (°C) over ***Vanuatu Central*** *based on two CMIP5 climate models (GISS-E2-H and IPSL-CM5A-LR) that represent a broad range of future climates. Projected changes are relative to 1986–2005 and are shown for three different future 20-year periods (centred on 2050, 2070 and 2090) and two emissions pathways (RCP2.6 and RCP8.5).*

	2040–2059				**2060–2079**				**2080–2099**			
	GISS-E2-H		**IPSL-CM5A-LR**		**GISS-E2-H**		**IPSL-CM5A-LR**		**GISS-E2-H**		**IPSL-CM5A-LR**	
	RCP2.6	**RCP8.5**	**RCP2.6**	**RCP8.5**	**RCP2.6**	**RCP8.5**	**RCP2.6**	**RCP8.5**	**RCP2.6**	**RCP8.5**	**RCP2.6**	**RCP8.5**
Annual	0.4	0.8	1.0	1.9	0.3	1.3	1.0	2.7	0.4	1.7	1.0	3.7
Monthly												
January	0.5	0.9	1.1	1.7	0.4	1.3	0.9	2.9	0.5	1.8	1.1	3.8
February	0.4	0.8	0.9	1.6	0.4	1.3	0.9	2.8	0.4	1.8	0.9	3.6
March	0.4	0.7	0.9	1.9	0.3	1.3	1.0	2.7	0.4	1.8	1.0	3.7
April	0.4	0.7	1.0	1.9	0.2	1.3	1.0	2.8	0.2	1.6	1.0	3.7
May	0.4	0.7	0.7	1.7	0.2	1.4	0.8	2.6	0.3	1.6	0.9	3.5
June	0.4	0.7	0.9	1.8	0.2	1.4	0.8	2.6	0.3	1.7	1.0	3.6
July	0.5	0.6	0.9	1.9	0.2	1.3	0.9	2.5	0.3	1.6	1.0	3.6
August	0.5	0.7	1.0	1.9	0.3	1.3	1.0	2.5	0.3	1.7	1.0	3.6
September	0.3	0.7	1.0	2.0	0.3	1.3	1.0	2.7	0.3	1.7	1.0	3.6
October	0.4	0.9	1.0	2.1	0.4	1.2	1.1	2.8	0.5	1.7	1.1	3.8
November	0.4	0.9	1.1	1.9	0.5	1.2	0.9	2.7	0.5	1.8	1.2	4.0
December	0.4	0.8	1.0	2.0	0.4	1.3	1.0	2.8	0.5	1.8	1.1	3.8
Season												
djf	0.4	0.8	1.0	1.8	0.4	1.3	0.9	2.8	0.5	1.8	1.1	3.7
mam	0.4	0.7	0.9	1.8	0.3	1.3	1.0	2.7	0.3	1.7	1.0	3.6
jja	0.5	0.7	0.9	1.9	0.2	1.3	0.9	2.6	0.3	1.7	1.0	3.6
son	0.5	0.7	0.9	1.9	0.2	1.3	0.9	2.6	0.3	1.7	1.0	3.6
mjjaso	0.4	0.7	0.9	1.9	0.3	1.3	0.9	2.6	0.3	1.7	1.0	3.6
ndjfma	0.4	0.8	1.0	1.8	0.4	1.3	1.0	2.8	0.4	1.8	1.1	3.8

Table 12 Projected changes in annual, monthly, and seasonal SST (°C) over ***Vanuatu South*** *based on two CMIP5 climate models (GISS-E2-H and IPSL-CM5A-LR) that represent a broad range of future climates. Projected changes are relative to 1986–2005 and are shown for three different future 20-year periods (centred on 2050, 2070 and 2090) and two emissions pathways (RCP2.6 and RCP8.5).*

	2040–2059				2060–2079				2080–2099			
	GISS-E2-H		IPSL-CM5A-LR		GISS-E2-H		IPSL-CM5A-LR		GISS-E2-H		IPSL-CM5A-LR	
	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5	RCP2.6	RCP8.5
Annual	0.3	0.7	0.9	1.8	0.3	1.3	0.9	2.6	0.4	1.7	1.0	3.6
Monthly												
January	0.3	0.7	1.0	1.6	0.4	1.2	0.9	2.9	0.5	1.6	1.1	3.7
February	0.3	0.6	0.8	1.6	0.3	1.1	0.9	2.7	0.3	1.5	0.9	3.5
March	0.3	0.6	0.9	1.9	0.3	1.2	1.0	2.7	0.3	1.7	1.0	3.6
April	0.4	0.6	1.0	1.9	0.2	1.2	1.1	2.8	0.2	1.6	1.0	3.7
May	0.3	0.6	0.7	1.7	0.2	1.3	0.9	2.5	0.3	1.6	0.9	3.5
June	0.3	0.6	0.9	1.8	0.2	1.4	0.8	2.5	0.3	1.6	0.9	3.5
July	0.3	0.6	0.9	1.8	0.2	1.3	0.9	2.4	0.2	1.6	0.9	3.5
August	0.4	0.7	0.9	1.8	0.3	1.3	1.0	2.4	0.3	1.7	1.0	3.5
September	0.3	0.7	0.9	1.9	0.3	1.3	1.0	2.5	0.3	1.7	1.0	3.5
October	0.5	0.9	1.0	2.0	0.4	1.3	1.0	2.6	0.6	1.8	1.0	3.7
November	0.4	1.0	1.0	2.0	0.5	1.4	0.9	2.7	0.6	1.9	1.2	3.9
December	0.3	0.8	1.0	2.0	0.4	1.3	1.0	2.9	0.5	1.7	1.2	3.8
Season												
djf	0.3	0.7	1.0	1.7	0.4	1.2	0.9	2.8	0.4	1.6	1.1	3.6
mam	0.3	0.6	0.9	1.8	0.2	1.3	1.0	2.6	0.3	1.6	1.0	3.6
jja	0.3	0.7	0.9	1.8	0.2	1.3	0.9	2.4	0.3	1.7	1.0	3.5
son	0.3	0.7	0.9	1.8	0.2	1.3	0.9	2.4	0.3	1.7	1.0	3.5
mjjaso	0.4	0.7	0.9	1.8	0.2	1.3	0.9	2.5	0.3	1.7	1.0	3.5
ndjfma	0.3	0.7	1.0	1.8	0.3	1.2	1.0	2.8	0.4	1.7	1.1	3.7