

Victoria's Future Climate Tool User Guide

June 2026



We acknowledge and respect Victorian Traditional Owners as the original custodians of Victoria's land and waters, their unique ability to care for Country and deep spiritual connection to it.

We honour Elders past and present whose knowledge and wisdom has ensured the continuation of culture and traditional practices.

DEECA is committed to genuinely partnering with Victorian Traditional Owners and Victoria's Aboriginal community to progress their aspirations.



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Contents

1. About Victoria’s Future Climate Tool	2
1.1 What is VFCT?	2
1.2 What information can VFCT provide?	2
1.3 The two dashboards	3
2. Key concepts	4
3. Data available in VFCT	7
3.1 What resources exist to support the use of VFCT?	8
4. What VFCT can’t help with	9
5. How do I use VFCT?	12
5.1 Location	13
5.2 Climate variables, emissions scenarios and climate models	14
5.3 Time horizons and temporality	15
5.4 How can I view and understand the data?	16
6. What to consider when using VFCT projections	18
6.1 Consider potential extremes that aren’t highlighted by the projections	18
6.2 Factor in some uncertainty into your decision-making	18
7. Technical FAQs for VFCT	19
7.1 Which climate models are included in VFCT?	19
7.2 What is application ready data?	20
7.3 How can I use VFCT24 data if it’s not bias-corrected?	20
7.4 What are the differences in data in VFCT19 and VFCT24?	20
7.5 Can I compare VFCT19 data with VFCT24 data?	21
7.6 How should I treat uncertainty in VFCT24 data?	21

1. About Victoria's Future Climate Tool

This user guide provides detailed information for using Victoria's Future Climate Tool (VFCT).

VFCT lets you easily explore how Victoria's climate may change in the future. It is an interactive online data portal that shows projected future changes in climate variables across Victoria, from the 2030s through to the 2090s.

1.1 What is VFCT?

VFCT provides a user-friendly approach to considering climate change in your work. You don't need to be a climate scientist or an expert to use the data from this tool to inform your work. VFCT is useful for:

- Decision-makers across government, businesses and the community.
- People conducting climate risk assessments, or risk practitioners and project and policy staff to whom risk management is devolved.
- People seeking to understand the potential impacts of climate change in particular locations, or on assets, projects, or decisions.
- People who are exploring climate adaptation options.
- People conducting research and planning for climate resilience.
- Specialists managing programs, services and infrastructure.
- People seeking climate data to use in other software.

1.2 What information can VFCT provide?

VFCT lets you explore climate projections for Victoria, including specific areas like local government or catchment management regions, shown at a 5km grid resolution.

It shows projected changes in temperature and rainfall, including extreme events.

If you only need high-level information, in most cases you will find what you need in:

- Victoria's Climate Science Reports (state-level information).
- Regional climate summaries (reports giving more localised information for ten regions across Victoria).

If you need information for a specific location or want more detail about future climate conditions, VFCT can provide it.



I want to...	What VFCT can do
Compare the recent climate in an area with what the future climate is projected to be	Compare past climate (a 20-year average for the baseline period 1986-2005) for a particular area with the projected climate in the 2030s, 2050s, 2070s, 2090s.
Focus on a particular geographic area	Display Local Government Areas, Catchment Management Areas, Registered Aboriginal Parties, National Parks, as well as a variety of other preset boundaries. You can also draft or input your own boundaries or view a particular point of interest (at a 5km resolution).
Find information about projected changes to average temperature	Display information about average maximum and minimum temperature and rainfall, on an annual, seasonal or monthly basis.
Find information about projected climate extremes for temperature or rainfall, and some hazards	Display information about extreme heat days and nights (intensity and frequency), and days of extreme rainfall (intensity and frequency). The 2019/CMIP5 dashboard also contains some additional data regarding sea-level rise projections, heatwaves (number, duration and intensity), and 1-in-20-year extreme heat and rainfall events.
Understand the range of plausible climate futures	Display the variability across different climate models, illustrating the full range of plausible future scenarios and allowing for 'worst-case-scenario' stress-testing.
Compare different future emissions scenarios	Compare very high (RCP8.5), high (SSP3-7.0), medium (RCP4.5) and low (SSP1-2.6) emissions pathways.
Use climate projections data in my own GIS program	Export climate data in JSON format, from VFCT directly and through the API, to quickly retrieve climate data for multiple locations or integrating climate data into your own software application.

1.3 The two dashboards

VFCT is made up of two dashboards, which you can easily switch between:

- 2019/CMIP5 dashboard
- 2024/CMIP6 dashboard

The two dashboards can be used side by side, giving you access to a vast amount of data regarding possible climate futures across the state.

These dashboards provide you with reliable and robust climate projections to support all kinds of decision making and information gathering.

CMIP stands for Coupled Model Intercomparison Project and refers to the generation of climate model that the projections draw on. VFCT CMIP6 draws on the most recent generation of global climate models, whereas the CMIP5 dashboard was built using the previous generation of modelling.

The CMIP6 dashboard builds on, rather than supersedes, the CMIP5 dashboard. While newer model generations offer incremental improvements to our understanding of our potential future climate, CMIP5 projections are still considered to be scientifically robust and fit for decision-making purposes.

The 2019/CMIP5 dashboard uses the same projections as used for the 2019 Victorian Climate Science Report, which was the first ever statewide climate science report published. The 2024/CMIP6 dashboard corresponds to the 2024 Climate Science Report. Climate Science Reports are required to be published every five years under the *Climate Action Act 2017*.

2. Key concepts

Climate projections are an estimate of what the climate could be like in the future if the world follows certain levels of future greenhouse gas emissions scenarios.

Climate projections are not predictions or forecasts and cannot pinpoint the timing or size of a particular change in the climate. Instead, projections can provide a likely range of change to a specific element of the climate (e.g. temperature) over a given time frame in response to a specific emissions scenario.

Climate models provide a set of plausible ways the climate will respond to changes in global greenhouse gas levels.

VFCT contains different climate models and future emissions scenarios to support you in your decision making.

You don't need to be an expert in climate models and scenarios to use VFCT but below is some basic information that might be helpful.





Definitions

Climate hazards are a natural or human-caused event or condition that may cause damage and loss. In Victoria, climate hazards include riverine and coastal flooding, bushfires, heatwaves, drought and sea-level rise. Physical climate risk refers to the potential of these hazards to cause physical harm or damage.

Climate models are run on large computers and paint a picture of the earth's climate system, defining physical processes in the atmosphere, ocean and land through complex mathematics.

Climate projections are estimates of what the climate could be like in the future, based on greenhouse gas concentrations and other factors. Climate projections are the modelled response of the climate system to specific potential greenhouse gas and aerosols concentrations, generally derived using climate models. Climate projections are based on a specific emissions scenario.

Emissions scenarios are a plausible representation of the future development of greenhouse gas emissions (such as Shared Socio-economic Pathways (SSPs)) based on a set of assumptions about factors such as demographic and socio-economic development, and technological change.

Climate scenarios are a way of describing differences between possible futures. Emissions scenarios are often confused with climate scenarios. Climate scenarios use climate models, climate projections and emissions scenarios to explain and show how the climate may change in different possible futures. Each climate scenario presents a possible future climate.

Time periods help demonstrate how a climate variable is projected to change over time. One way of understanding future climate is to consider the amount of change in a climate variable (e.g. temperature) between a time period in the past (the **reference** or **baseline time period**) and a time period in the future (a **time horizon**).

Climate models

Climate models are complex mathematical representations of the global climate system. They are made up of series of equations based on fundamental laws of physics that simulate the dynamics of the atmosphere, oceans and ice. The simulations they produce indicate how temperature, rainfall and other climate variables can change over a region, for different greenhouse gas concentrations.

There are many models that sit behind climate projections. While most climate models perform well enough to help answer some of our questions about the climate, there is no single 'best' model, as no model can perfectly represent all aspects of Earth's climate. Researchers use ensembles, or collections, of models to understand the range of possible future climate conditions.

The dashboards will default to showing you the multi-model mean; that is, the average of all models. It is best practice to use the multi-model mean in your analysis, even in comparison to results from individual climate models. You may find this useful for a high-level assessment of your region.

In both dashboards of VFCT, results are also presented as a range. The range represents the 10th to the 90th percentile of the ensemble of the models (i.e. representing 80% of the results). The median (the 50th percentile) represents the midpoint of this range.

Both dashboards also allow you to look at the results of individual models by themselves. These are included as they are representations of particularly notable climate futures (called Representative Climate Futures), for example, a model that represents a very hot and dry future, or a model that represents a particularly wet future. You may choose to investigate a particular model to stress-test or see the 'worst-case' scenario for a particular location. However, it is important to not use results from a singular model in isolation, without the context of the full range of plausible changes.

Emissions scenarios

The amount of greenhouse gases that will be emitted in the future is unknown. We cannot say with certainty how technological, economic and political systems will impact future emissions. Considering different, plausible emissions scenarios can help you navigate this uncertainty.

Most people are familiar with emissions scenarios, or emissions pathways – a possible trajectory of how global emissions might track over the next century. These scenarios are developed by the Intergovernmental Panel on Climate Change (IPCC) and are very widely used across the scientific community. All scenarios are plausible and useful in a range of contexts. There is not a 'correct' scenario to use.

Each dashboard of VFCT contains two emissions scenarios:





- Very high (RCP8.5) and medium (RCP4.5) in the 2019/CMIP5 dashboard
- High (SSP3-7.0) and low (SSP1-2.6) in the 2024/CMIP6 dashboard.

At the time that the 2019 projections were undertaken, Representative Concentration Pathways (RCPs) were the standard emissions scenarios used within the climate modelling community. They are straightforward hypothetical pathways of future greenhouse gas emissions.

In the IPCC's Sixth Assessment Report in 2021, Shared Socio-economic Pathways (SSPs) have become more widely used. The SSPs, similar to RCPs, represent future levels of greenhouse gas emissions, but also incorporate explorations of population growth, economic growth, urbanisation and technological developments. It is important to note that despite some differences between them, RCPs and SSPs can be used side-by-side for most purposes.

The SSP3-7.0 emissions scenario is increasingly considered to be a more realistic high-end emissions scenario than SSP5-8.5 by climate scientists.¹ However, very high emissions scenarios cannot be ruled out, and can be useful for some contexts of adaptation planning and risk assessments, such as stress testing or sea-level rise.

¹ [Explainer: The high-emissions 'RCP8.5' global warming scenario](#)

Emissions pathway	Description	Future climate	Dashboard
 <p>Low (SSP1-2.6)</p>	A low emissions scenario following a 'sustainability' narrative with immediate significant cuts in emissions to reach net zero around 2075, roughly compliant with the Paris Agreement.	Reaches 2°C around 2050s and stabilises	2024/CMIP6
 <p>Medium (RCP4.5)</p>	A medium emissions scenario with global emissions of carbon dioxide peaking around 2040 before declining to 1960s levels by 2100.	Around 2°C warmer in the 2050s and 2.7°C by 2100	2019/CMIP5
 <p>High (SSP3-7.0)</p>	A high emissions scenario following a 'fossil-fuelled development' narrative with carbon dioxide emissions continuing to increase to roughly double present levels by 2100.	Around 2°C warmer in 2050s and 3°C around 2070s	2024/CMIP6
 <p>Very high (RCP8.5)</p>	A very high emissions scenario with carbon dioxide emissions continuing to increase to almost triple present levels by 2100.	Around 2°C warmer in 2050s, 3°C around 2060s, 4°C by around 2080s.	2019/CMIP5

For further information on selecting climate models and emissions scenarios, see the Climate Scenario Selection Guidance for Victoria.

3. Data available in VFCT

A range of data is available across the 2019/CMIP5 and 2024/CMIP6 dashboards.

	2019/CMIP5 dashboard	2024/CMIP6 dashboard
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Emissions scenarios

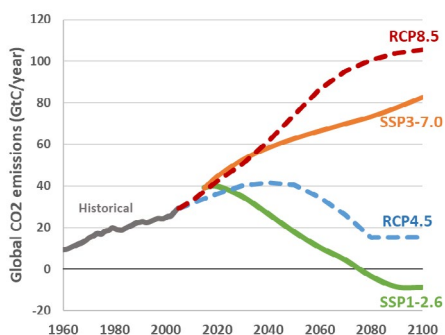


Figure 1 - Global CO₂ emissions out to 2100 under the emissions scenarios used in VCP19 (RCP4.5 and RCP8.5) and VCP24 (SSP1-2.6 and SSP3-7.0). Historical emissions are shown in grey from 1960 to 2005.

Figure sourced from *Victoria's Climate Projections Technical Report 2024*

- | | |
|---|--|
| <ul style="list-style-type: none"> RCP4.5: a medium emissions scenario with global emissions of carbon dioxide peaking around 2040 before declining to 1960s levels by 2100. Net zero emissions are not achieved under this scenario RCP8.5: a very high emissions scenario with carbon dioxide emissions continuing to increase to almost triple present levels by 2100. | <ul style="list-style-type: none"> SSP1-2.6: a low emissions scenario following a 'sustainability' narrative with immediate significant cuts in emissions to reach net zero around 2075, roughly compliant with the Paris Agreement. SSP3-7.0: a high emissions scenario following a 'fossil-fuelled development' narrative with carbon dioxide emissions continuing to increase to roughly double present levels by 2100. |
|---|--|

Spatial resolution	5km	5km
Baseline	1986-2005 (SLR: 1993-2009)	1986-2005
<i>The reference time period which projections are compared to.</i>		
Time horizons	2030s (2020-2029) 2050s (2040-2059) 2070s (2060-2079) 2090s (2080-2099) (SLR: 2040, 2070, 2100)	2030s (2020-2029) 2050s (2040-2059) 2070s (2060-2079) 2090s (2080-2099)
<i>The timeframe over which climate-related risks and impacts are considered, usually with reference to a baseline period (i.e. the current climate).</i>		
Temporal resolution	Full daily time-series, monthly averages, seasonal averages and 20-year averages	Monthly averages, seasonal averages and 20-year averaged time periods
API data available	Full time series	20-year averaged time periods
Application ready data	Yes	Yes
Climate variables	<ul style="list-style-type: none"> Average temperature Average rainfall Extreme temperature (using thresholds) Extreme rainfall (using thresholds) Heatwaves 1-in-20 year extremes 	<ul style="list-style-type: none"> Average temperature Average rainfall Extreme temperature (using percentiles) Extreme rainfall (using percentiles)
<i>See Appendix 2 for a detailed list of each climate variable layer included in VFCT.</i>		
Coastal inundation variables	<ul style="list-style-type: none"> Sea-level rise Sea-level rise + storm tide (1-in-100 years) Coastkit should be used for detailed sea level rise information 	No
<i>Not part of VCP19, provide a 1st pass, screening-level interpretation of sea level rise which does not fully represent coastal erosion processes.</i>		



Dashboard Modes

The 2024/CMIP6 dashboard has two modes, custom scenario mode and snapshot mode.

- This guide primarily concerns how to use the **custom scenario** mode, which will allow you to select and adjust any variable to create future scenarios of your choosing.
- The **snapshot mode** allows you to quickly assess a selection of future climate outcomes that reflect some of the key projected climate changes, rather than choosing your own variables. You can copy and edit Snapshot templates by clicking Edit as Custom Scenario.

3.1 What resources exist to support the use of VFCT?




VFCT is supported by a range of resources, including:

- [2019 user guide](#) - Victoria's Future Climate Tool – an introduction and guidance for risk management (PDF, 1.1 MB)
- 2024 user guide (this document)
- [The Victorian Managed Insurance Authority's climate change risk management service](#)
- Victoria's Climate Projections Technical Reports – which provide comprehensive assessments of Victoria's changing climate for a technical audience, including information about how the projections were developed.
 - [VCP 2019 Technical Report](#)
 - [VCP 2024 Technical Report](#)
- Other guidance documents in development, including case studies using VFCT in a range of decision-making and adaptation planning contexts.
- Get in touch with the DEECA Climate Science & Impacts team at: climate.science@deeca.vic.gov



4. What VFCT can't help with

VFCT doesn't provide data on every climate hazard. Use this Table to understand why and where to look instead.

Hazard	What we know about the impact of climate change on this hazard in Victoria	Why VFCT doesn't cover this	Where to go instead A large amount of the data outlined below is also available on Digital Twin Victoria .
<p>Drought</p> 	<p>There are different types of drought, including meteorological, agricultural, hydrological, ecological, socio-economic, anthropogenic (human-caused) and flash drought.</p> <p>Droughts in Victoria are likely to continue to increase under a warming climate, although the precise nature and extent of the impacts are unclear. Future droughts will be hotter than past droughts, which can affect compounding heat and drought events.</p>	<p>There are different definitions of drought and no single climate variable or climate index.</p>	<p>Victoria's Climate Science Report 2024</p> <p>Victorian Water and Climate Initiative</p> <p>Victorian guidelines for assessing the impact of climate change on water availability (including associated CSIRO hydroclimate projections)</p>
<p>Flooding</p> 	<p>Extreme, short-duration rainfall events in Victoria are becoming more frequent and intense, particularly in the warm season.</p> <p>However, the only extreme rainfall event represented in the 2024/CMIP6 dashboard at this stage is the 99th and 99.9th percentile value for rainfall, which roughly correspond to the 3-4 heaviest rainfall events of the year and of the decade respectively. This does not indicate flooding.</p>	<p>Flooding is dependent on landscape factors, not just climate variables, so requires specialised flood models to assess. Estimates of the most extreme precipitation events vary widely between different geographic locations and can have high levels of uncertainty. This makes representing them and the impact on flooding visually very difficult.</p>	<p>Further information on extreme rainfall and flooding is available from:</p> <p>Victoria's Climate Science Report 2024</p> <p>Australian Rainfall and Runoff</p> <p>Flood overlay maps within Victoria's planning system can be found on VicPlan.</p> <p>Melbourne Water has updated modelling for a number of Council areas in their region: Greater Melbourne Flood Information Program Let's Talk Melbourne Water</p>
<p>Bushfire risk (including Forest Fire Danger Index values)</p> 	<p>Changes to Victoria fire regimes have already been observed, including a longer fire season, with more frequent days of significant fire danger.</p> <p>Low fuel moisture plays an important role in fire ignitions in Victoria, with potential increased ignition risk under warmer and drier climate futures.</p> <p>Changes in fire risk will not be the same everywhere and will depend strongly on local fire conditions.</p>	<p>Bushfire risk data is not included in VFCT. The complexity and variability of what causes bushfires and how they behave mean that we are unable to represent them visually.</p>	<p>Further information on bushfire risk and fire risk management is available from Safer Together.</p> <p>Fire weather climatology data can be accessed at the VicClim website.</p> <p>Fire overlay maps within Victoria's planning system can be found on VicPlan.</p>

Hazard	What we know about the impact of climate change on this hazard in Victoria	Why VFCT doesn't cover this	Where to go instead
<p>Coastal erosion</p> 	<p>Coastal erosion impacts are increasing across vulnerable areas with sea level rise and changing wind, wave conditions and storm intensity.</p> <p>Coastal erosion can include event-based loss of sand/foreshore with recovery, as well as long-term gradual recession (retreat) of beach and foreshore.</p>	<p>Coastal hazard modelling and assessments are complex and locally specific.</p>	<p>A large amount of the data outlined below is also available on Digital Twin Victoria.</p> <p>CoastKit has been developed by DEECA to provide an online interactive data repository and web-mapping portal for managers, researchers, consultants and community to explore and use Victoria's marine and coastal information, including sea level rise, storm tide inundation and erosion hazard mapping. CoastKit promotes standardised data classification for collection, reporting, monitoring, assessment, and evaluation. An example of detailed hazard mapping includes scenarios incorporated in the Port Phillip Bay Coastal Hazard Assessment.</p> <p>Coastal erosion data in Coastkit includes a statewide cliff risk assessment and local erosion hazard mapping.</p>
<p>Sea level rise</p> 	<p>Sea-level trends assessed between 1901 and 2018 indicate that globally the average rate of sea-level rise is accelerating, including within Victoria.</p> <p>Sea level rise increases the extent of area that regularly experiences tidal inundation, as well as contributing to the extents of other hazards like erosion and storm tide inundation.</p>	<p>Sea level rise data from VCP19 is included in VFCT19 dashboard as basic coastal inundation information for limited scenarios.</p> <p>Coastal hazard modelling and assessments are complex and locally specific. Although some detailed assessments have been completed for parts of the coast, multiple scenarios and locally specific sea level rise data is not currently available in VFCT.</p>	<p>Detailed sea level rise data from VCP19 is included in CoastKit for multiple scenarios at statewide and local scales.</p>
<p>Local storm tide inundation</p> 	<p>Storm tide inundation refers to the area of coastal land that may be inundated in a storm event due to elevated water levels driven by wind, waves and tides.</p>	<p>Projected storm tide (coastal) inundation layers for limited scenarios are included in the 2019/CMIP5 dashboard, but these provide only a simple interpretation of sea level rise which does not fully represent local storm tide inundation extents.</p>	<p>Storm tide inundation data is included in CoastKit for multiple scenarios at statewide and local scales.</p>

Hazard	What we know about the impact of climate change on this hazard in Victoria	Why VFCT doesn't cover this	Where to go instead A large amount of the data outlined below is also available on Digital Twin Victoria .
<p>Storms and Wind</p> 	<p>Interpreting changes in storms and lightning is a challenge for climate models. There is limited consensus between climate models on how storms and wind may change in the future. In broad terms, projections suggest an increase in the favourable conditions for thunderstorm formation under a warming climate.</p>	<p>The impact of climate change on storms and wind is an ongoing area of research. Trends in extreme wind events, including those caused by thunderstorms, are difficult to determine in Australia due to a lack of a long-term high-quality observations. Future changes in thunderstorms are relatively uncertain for convective storms, lightning, hail, tornados, and extreme wind gusts, with potentially large increases for short-duration rainfall extremes. Further research and additional downscaling experiments by different climate models will be required to better understand how thunderstorms will change in future.</p>	<p>VCP24 Fact Sheet: Unmodelled futures and the Victorian Climate Projections 2024</p>
<p>Compound events</p> 	<p>This refers to the situation where two or more extreme weather events combine to produce impacts that are worse than the effects of each event independently (e.g. a heatwave during a drought period increasing the severity bushfires). Climate change will affect the incidence of extremes weather events, but also increase the chances of compound events.</p>	<p>Projecting the occurrence and severity of future compound extreme events is important to understand future risks, however, modelling compound events is a large, complex and interdisciplinary undertaking and the relevant data is not currently available.</p>	<p>In assessing the risk of compound events, it is important to look at the impact of past events and consider future scenarios where such events are more extreme and happen more frequently.</p>

5. How do I use VFCT?

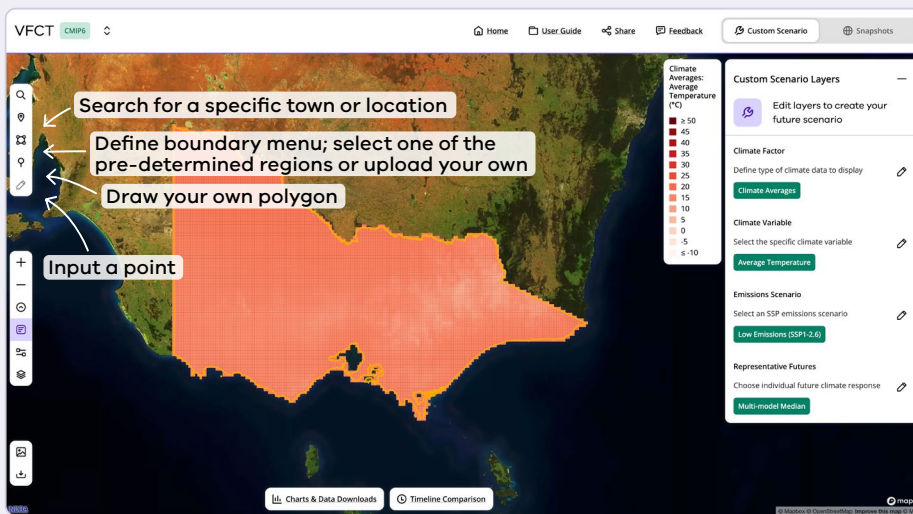
In both dashboards, you'll need to decide what you are interested in exploring. Decide what location you are interested in, what climate variable you would like to look at (like temperature or rainfall), which emissions scenario to use, how far into the future you want to explore, and the part of the year you want to focus on (annual, seasonal, or monthly). You can also choose to look at individual climate models, as well as the combined range from all models.



5.1 Location

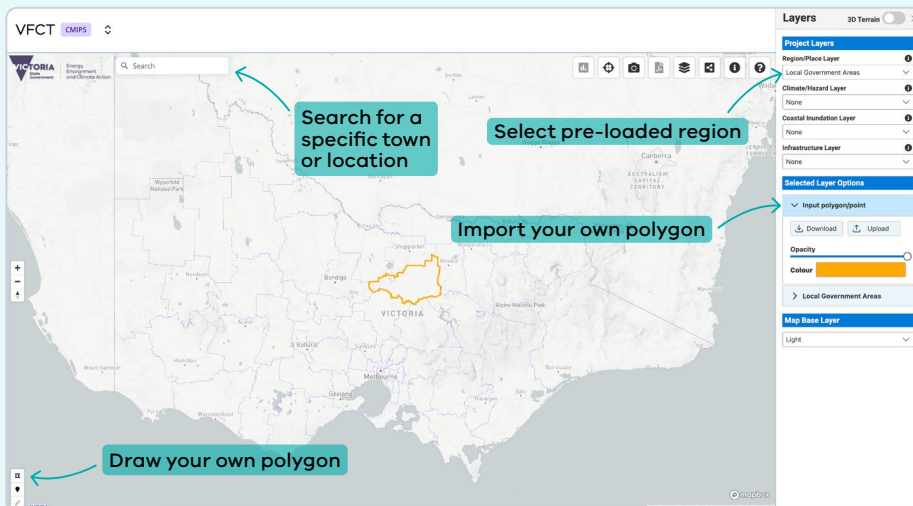
In 2024/CMIP6 Dashboard

- Use the 'define location using existing region/place layer' dropdown menu, (found under the Define Boundaries menu in the left hand tool bar), to select the area of interest (e.g. Local Government Area, BOM forecast district, Catchment Management Area).
- Alternatively, upload your own polygon (.json or .geojson file) using the 'Define location using your own boundary' option, also in the Define Boundaries menu.
- You can also draw your own polygon directly onto the map with the "draw your own polygon" tool found under the "Add Input Polygon" menu, or add an input point with the "Add input point" tool.



In 2019/CMIP5 Dashboard

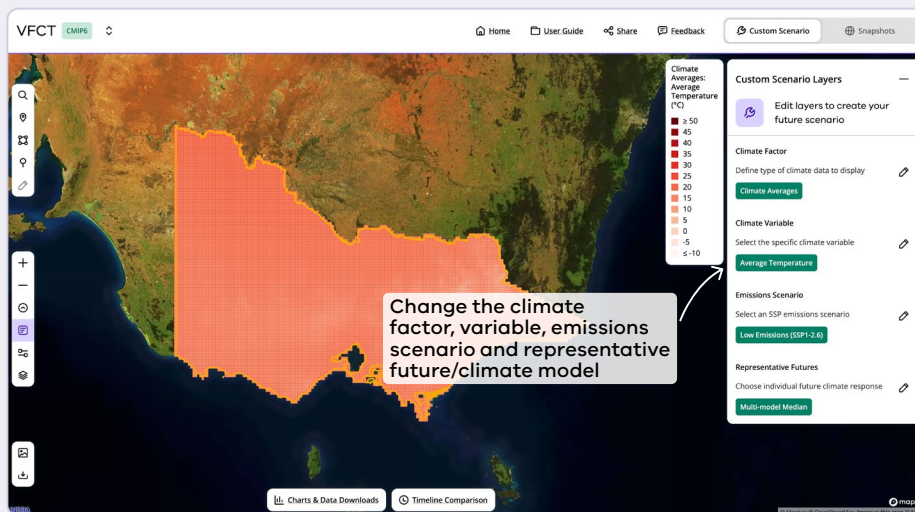
- Use the 'Region/Place Layer' dropdown menu to select the area of interest (i.e. Local Government Areas, Catchment Management Authority areas, etc).
- Or upload your own polygon using the 'input polygon/point' option under the 'Selected Layer Options' heading.
- Or use the 'draw polygon' or 'add point' tools on the bottom left of the screen.



5.2 Climate variables, emissions scenarios and climate models

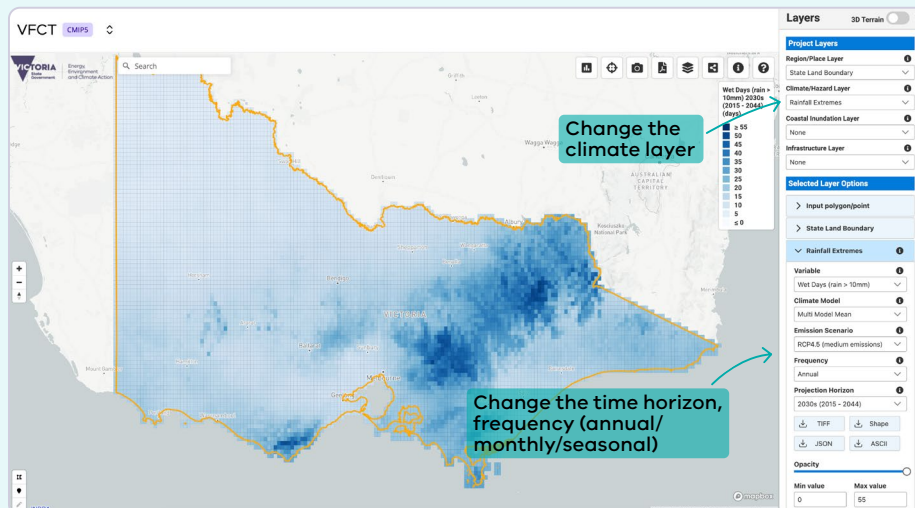
In 2024/CMIP6 Dashboard

- Select 'Climate Averages', 'Temperature Extremes', or 'Rainfall Extremes' from the 'Climate Factor' dropdown menu on the right-hand side.
- The map will auto populate with data.
- From the 'Climate Variable' dropdown menu, select the specific variable you are interested in (e.g. average temperature, total rainfall, very hot days, number of hot nights, etc. For a full list of climate variables in the CMIP6 dashboard, please refer to Appendix 2).
- Select 'Low Emissions' or 'High Emission's from the 'Emissions Scenario' dropdown menu.
- Select if you would like to view a particular 'Representative Climate Future' (climate model) from the dropdown menu. It will otherwise default to displaying the multi-model mean



In 2019/CMIP5 Dashboard

- Select one of the 'Climate/Hazard Layers' from the dropdown menu (e.g. projected climate change or temperature extremes.)
- The map will auto populate with data, and a new layer will appear under the 'Selected Layer Options' heading in the toolbar with the heading of the climate /hazard layer you have selected.
- From this new dropdown menu, select the specific variable you are interested in. (For a full list of climate variables in the CMIP5 dashboard, please refer to Appendix 2).
- Select Medium Emissions or Very High Emissions from the Emissions Scenario dropdown menu.
- Select if you would like to view a particular 'Climate Model' (Representative Climate Future) from the dropdown menu. It will default to displaying the multi-model mean.

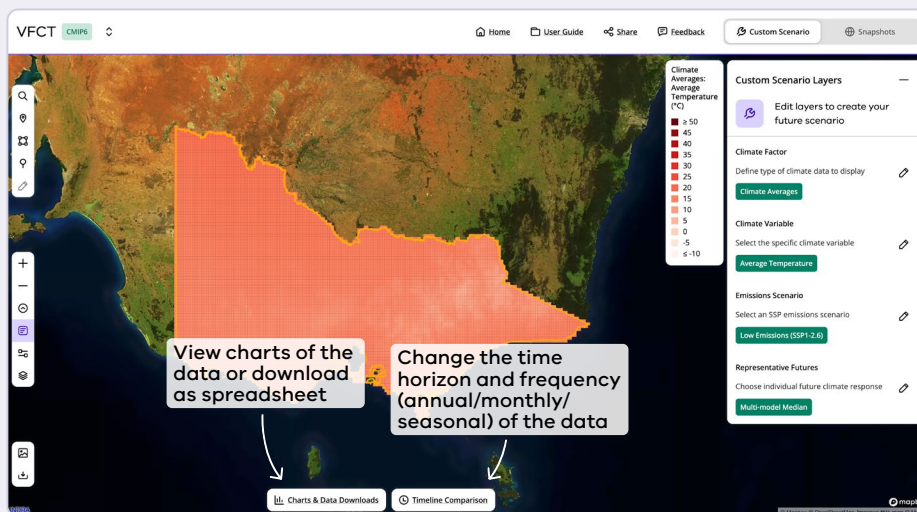


5.3 Time horizons and temporality

Climate models use time horizons to project climate change scenarios over the short-, medium- and long-term. VFCT includes a range of time horizons, which allows you to consider the impact of climate on your assets and to evaluate different mitigation pathways and adaptation strategies.

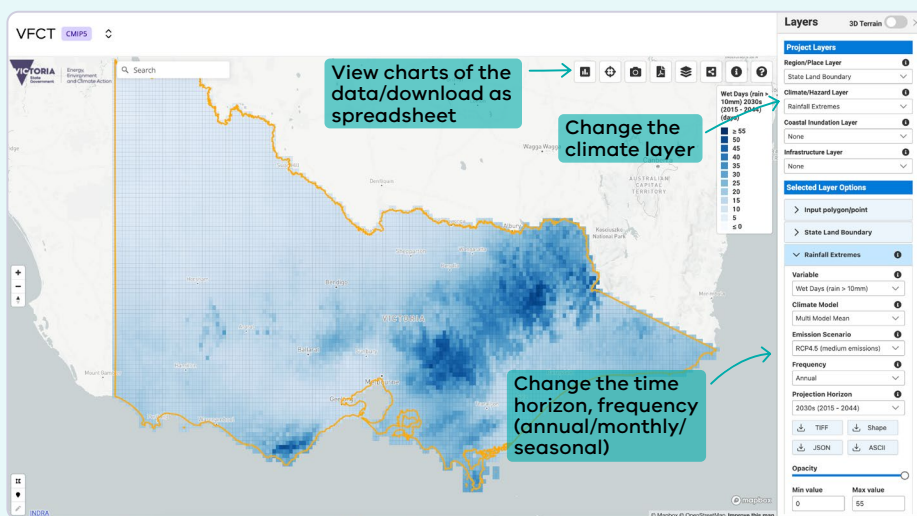
In 2024/CMIP6 Dashboard

- The 'Timeline Comparison' bar at the bottom of the screen will become selectable once you have chosen a climate factor and variable.
- You can select to view the historical baseline, the 2030s, the 2050s, the 2070s, or the 2090s. The map will change accordingly.
- You can change the temporality of data by clicking 'Frequency' on the 'Timeline Comparison' bar, and selecting if you want to view annual, seasonal, or monthly data.



In 2019/CMIP5 Dashboard

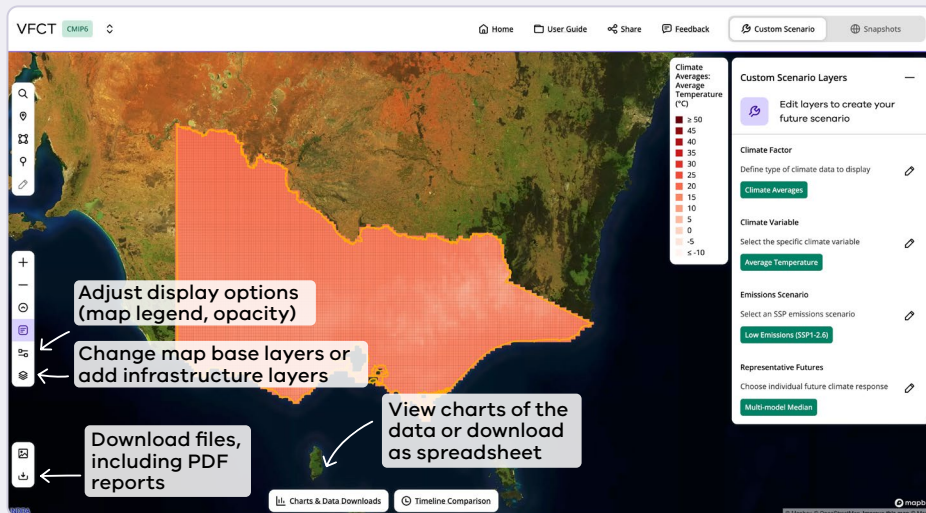
- In the righthand toolbar, select from the 'Project Horizon' dropdown menu to switch between viewing the 2030s, the 2050s, the 2070s, or the 2090s. The map will change accordingly.
- Use the 'Frequency' dropdown menu to change the temporality of data. You can select to view annual, seasonal, or monthly data.



5.4 How can I view and understand the data?

In 2024/CMIP6 Dashboard

There are a few key ways to view projections data within the 2024/CMIP6 dashboard. These include the main map, the 'Charts and Data Downloads' tab, and PDF-generated reports. You are also able to download data in a spreadsheet format (.csv), as image files (.tiff, .png) or as shapefiles (.shp, .json).



Map

- The map displays Victoria on a 5km grid and will automatically populate with data as you select a climate variable. Colours correspond to the legend in the right-hand side.
- You can change the map display and layers by clicking on the 'Display Option' and 'Map Layers' options on the left-hand side toolbar. Depending on the climate variable, adjusting the 'min value' and 'max value' of the map legend (within the 'Display Option' menu) can better help illustrate the variability of projected change across the state.
- Adjusting the 'Display Base Layers' (within the 'Map Layers' menu) can help make certain landmarks or street names more visible. You can also choose to 'Display Additional Infrastructure' layers, such as road or railway lines.

Reports

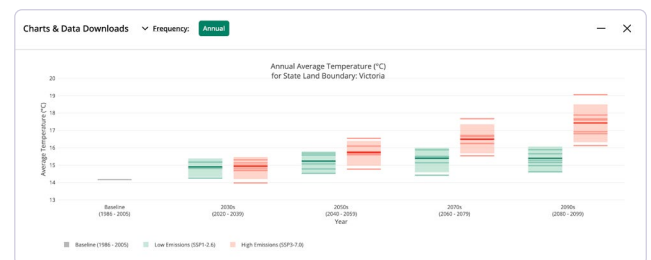
- PDF summary reports can be generated by clicking on the 'Download Files' button on the lefthand toolbar, then clicking 'Download PDF.' This will generate a multi-page report for your chosen climate variable and location, including maps, charts, and tables of the relevant projections data. The PDF report also includes a summary information table for your chosen location, which incorporates a large number of projected climate variables without the need to manually generate each variable individually.

Other filetypes

- Under the 'Download Files' button menu, you can also choose to download .tiff, .json, or .shp files.

Charts

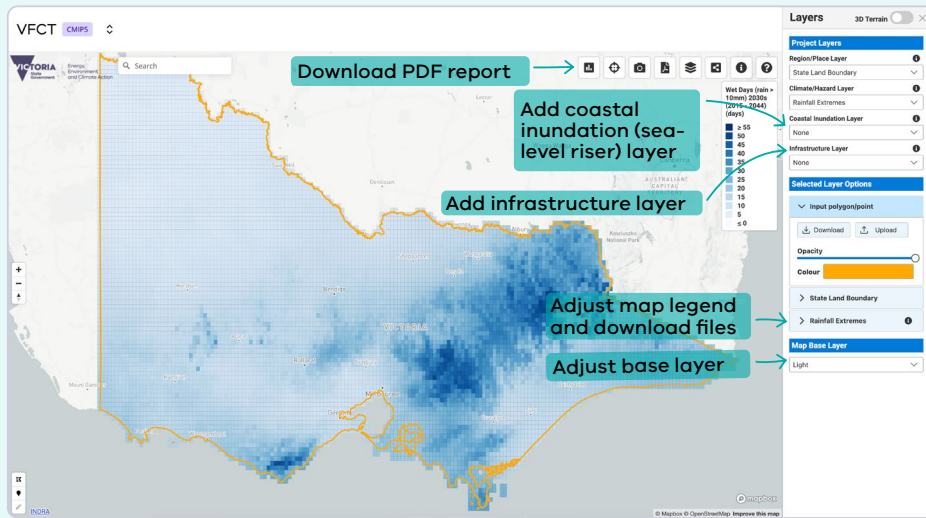
- Clicking on the 'Charts and Data Downloads' button at the bottom of the page will bring up a tab displaying bar graphs of the range of projections for whichever climate variable you have selected. Unlike the map, the charts display all four-time horizons, as well as both a low and high emissions scenario.
- The shaded area represents the 10th to 90th percentile of model results. The solid dark line indicates the median (or 50th percentile) of model results. The lighter lines indicate the output of a selection of individual models used as representative climate futures.
- Hovering your mouse over each bar chart will bring up a display of the percentile values and representative climate future outputs.
- These values can be downloaded as a spreadsheet by clicking the 'Download CSV' button at the bottom of the tab. Alternatively, the charts can be downloaded as a .png image file.



Example of temperature projection chart – hover mouse over bar chart to display values

In 2019/CMIP5 Dashboard

You can choose to access data through the main map, the 'Show/Hide Chart' tab, and PDF-generated reports. You are also able to download data in a spreadsheet format (.csv), as image files (.tiff) or shapefiles (.json, .shp) or as an ASCII file.



Map

- The map displays Victoria on a 5km grid and will automatically populate with data as you select a climate variable. Colours correspond to the legend in the right-hand side.
- You can adjust the map display using the 'Opacity' slider and 'min/max value' inputs at the bottom of the climate factor layer menu. Depending on the climate variable, adjusting the 'min value' and 'max value' of the map legend can better help illustrate the variability of projected change across the state.
- You can change the map base layer using the Map Base Layer dropdown menu.
- At the top of VFCT toolbar, under the 'Project Layers' heading, you can choose to add coastal inundation layers and infrastructure layers (such as road and railway lines) by choosing from the dropdown menus accordingly.

Reports

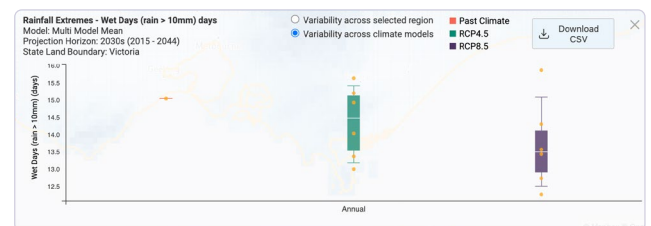
- PDF summary reports can be generated by clicking on the 'Download PDF' button along the top of the screen. This will generate a multi-page report for your chosen climate variable and location, including maps, charts, and tables of the relevant projections data. The PDF report also includes a summary information table for your chosen location, which incorporates many projected climate variables without the need to manually generate each variable.

Other filetypes

- In the lefthand toolbar menu, you can also choose to download .tiff, .json, .shp or .acsi files.

Charts

- Click on the 'Show/Hide Chart' button along the top of the screen. It will bring up a tab displaying bar graphs of the range of projections for whichever climate variable and time horizon you have selected.
- The box and whisker plot represents the 10th to 90th percentile of model results, with the middle white line indicating the median (or 50th percentile) of all model results. The yellow dots indicate the output of a selection of individual climate models used as representative climate futures (see above section).
- Hovering your mouse over each bar chart will bring up a display of individual climate model outputs.
- These values can be downloaded as a spreadsheet by clicking the 'Download CSV' button at the top of the tab.
- You can also choose to select to view the variability of projected change across your selected region.



Example of rainfall projection chart – hover mouse over bar chart to display values

6. What to consider when using VFCT projections

6.1 Consider potential extremes that aren't highlighted by the projections

Climate projections provide a strong basis for planning, management and policy decisions. However, projections are usually calculated as an amount of change in a climate variable between a baseline (a past 20–30-year time period) and a future time horizon (a future 20–30-year time period). Climate projections show the average for a 20–30-year period, and don't show the full range of extreme conditions that could occur during that time. As a result, they may understate risks which are often associated with short-term or extreme climate conditions.

To properly test assumptions about the future, it may be important to consider more extreme but plausible outcomes. Some climate processes are not fully understood and could trigger larger or faster changes than expected — for example, rapid melting of Antarctic ice sheets or shifts in the strength and timing of El Niño and La Niña.

For these reasons, climate projections should be used as a guide. Climate projections are not a precise prediction. When managing risk, it's sensible not to rule out changes that fall above or below the projected range.

6.2 Factor in some uncertainty into your decision-making

Some uncertainty is unavoidable in climate projections. We don't know exactly how global greenhouse gas emissions will change in the future. And while climate models are built on strong scientific understanding of how the Earth's systems work, they are still simplified representations — they can't perfectly predict how the climate will respond to rising greenhouse gases.

Importantly, uncertainty is not a reason to delay action. In some cases, we know the range of possible outcomes but not which one will occur (the known unknowns). In other cases, we may not even fully understand what outcomes are possible (the unknown unknowns). Being upfront about these uncertainties is essential when making decisions about the future.

Risk practitioners routinely work with uncertainty, and climate change is no different. Climate projections provide a strong evidence base for understanding plausible future conditions. Given the deep uncertainty about longer term change, decisions should be designed to perform well across a range of possible futures — and avoid focusing on a single pathway that may not eventuate over time.



7. Technical FAQs for VFCT

7.1 Which climate models are included in VFCT?

Both VFCT19 and VFCT24 dashboards include climate data from the VCP19 and VCP24 respectively.

VFCT19

7 model choices, drawn from the downscaled VCP19 model projections. This includes climate projections from 6 dynamically downscaled global climate models (GCMs), plus the multi-model mean (midpoint of these models).

Downscaled GCM	Description
ACCESS 1-0	A hot, dry model in the south of Victoria, Representative of the consensus of GCM projections in northern Victoria
CNRM-CM5	Representative of the consensus of GCM projections over Victoria, particularly in the north
GFDL-ESM2M	Often a hot, dry model for Victoria
HadGEM2-CC	Often a hot, dry model for Victoria
MIROC5	Often a low warming, wet model for Australia and Victoria
NorESM1-M	Often a low warming, wet model for Victoria, especially in the south

VFCT24

8 model choices, drawn from the downscaled VCP24 model projections. This includes climate projections from multiple regional climate models downscaled from 34 global climate models (GCMs), plus the multi-model mean (midpoint of these models).

Downscaled GCM	Description
NARClim2.0-R3_UKESM1-0-LL	Represents the upper end of projected warming, considered unlikely but providing a 'worst case' scenario for temperature increase. It also generally shows large reduction in rainfall in all seasons.
NARClim2.0-R3_ACCESS-ESM1.5	Represents the dry end of the projections, generally showing large amount of drying in all seasons but especially in spring and summer. It shows a mid level of warming.
NARClim2.0-R3_MPI-ESM1-2-HR	Represents the middle of the projected range of change for warming and drying. It generally shows drying across all seasons
NARClim2.0-R5_EC-Earth3-Veg	Represents the upper end of the likely warming range and little change in rainfall.
BARPA-ACS_MPI-ESM1-2-HR	Represents the middle of the projected range of change for warming and drying. It generally shows overall drying but tends to show increased summer rainfall.
CCAM-Qld_EC-Earth3	Represents a much hotter future, with larger variability in rainfall from year to year an increase in very wet periods and especially increases in summer rainfall. It also represents a future with large increases in extreme rainfall.
NARClim2.0-R3_NorESM2-MM	Represents the least amount of warming. It also generally shows drying across all seasons, similar to the model consensus.

For further information on the climate models and projections see [Victorian Climate Projections 2024 Technical Report](#) and [Victorian Climate Projections 2019 Technical Report](#).

7.2 What is application ready data?

'Application ready' data is climate projections data made relevant to a local context. This often requires climate model results to be calibrated with local data.

Climate model results often include biases. To remove the bias, climate model results require calibration.

There are two main ways of calibrating climate model results so that these results can be used in local contexts (made into 'application-ready' data):

- **scaling** – modifying observation data by applying projected change values from the output of models
- **bias correction** – altering the output of models so it matches observations more closely.

Both VFCT19 and VFCT24 dashboards include application ready data. The data in the VFCT19 and VFCT24 dashboards was calculated by scaling observational data (5km AGCD gridded data) by modelled projected changes from Victoria's Climate Projections 2019 and 2024 respectively. This means the data in VFCT is not affected by biases in the climate models.

7.3 How can I use VFCT24 data if it's not bias-corrected?

While both VFCT19 and VFCT24 dashboards do not include bias corrected data, both the VFCT19 and VFCT24 dashboards include 'application ready' data rather than raw climate model output.

VFCT19 and VFCT24 dashboard data is calibrated using the scaling approach. By scaling observational data (5km AGCD gridded data) we produce 'application-ready' data.

Application ready data is often calculated as a 'projected change' or the amount of change expected in the future. To calculate this using the scaling approach, we used raw (i.e. non bias-corrected) climate model data output and calculated the difference between modelled historical values and the modelled future values. Because both sets of values included the model bias, this means that any model bias is negated in the results.

As a result, the bias is not a concern when using the percentiles data in the VFCT19 and VFCT24 dashboards. The data in the VFCT19 and VFCT24 dashboards is 'application ready' and applicable to the local context across Victoria.

The data provided in the VFCT24 dashboard is limited to showing only averages. If stakeholders need daily or monthly timeseries data, then they would need to get separate bias corrected model output data from the CSIRO team.

7.4 What are the differences in data in VFCT19 and VFCT24?

The key differences are:

- VFCT19 uses RCPs, and VFCT24 uses SSPs.
- Some variables exist in VFCT19 dashboard that are not included in VFCT24 dashboard.
- The metrics which variables are presented in, vary between the two dashboards. For example, the VFCT19 dashboard includes absolute values (for example days above 35degrees), while the VFCT24 dashboard includes percentiles (for examples days above 99th percentile)
- The daily timeseries data available in VFCT19 dashboard differs from the data provided in VFCT24 dashboard:
 - **VFCT19:** In VFCT19 application ready data was provided, which consists of historical timeseries data which has been scaled by the daily/monthly time series projected change from the climate models. This means that full daily, monthly, seasonal and 20-year average time series data are all available for download.
 - **VFCT24:** The VFCT24 application ready data consists of historical timeseries data which has been scaled by the 20-year averages of modelled projected changes. This means that only the 20-year averages, seasonal and monthly averages are available for download.

7.5 Can I compare VFCT19 data with VFCT24 data?

SSPs and RCPs can be used together, however they are presented in VFCT differently. Differences in the format of the data should be considered and documented.

For example, for direct comparison between VFCT19 and VFCT24 data the 20-year averages of modelled projected changes need to be used in VFCT19, as this is the only time series in both dashboards.

We encourage you to be transparent about which data you use and from which emission scenario, including which RCP or SSP is used.

Note- different SSP or RCP results should not be combined under a banner term e.g. 'low emission scenarios'. Different RCPs and SSPs are often referred to differently over time e.g. RCP8.5 was previously described as a 'high emission scenario', but at the time of writing is now generally described as a 'very high emission scenario'.

If you are doing quantitative analysis or numerical modelling, it's important to use climate data from only one source at a time. This means using projections that come from the same emissions scenario and the same climate model, rather than mixing data from different sources.

7.6 How should I treat uncertainty in VFCT24 data?

VFCT data comes with uncertainty from multiple sources. As with all climate model information, it should not be treated as certain. We encourage you to consider the full range of factors that contribute to uncertainty in climate projections.

For this reason, we recommend using the multi model median and the 10th to 90th percentile range wherever possible, rather than relying on a single model. This approach provides a clearer picture than treating a single percentile (such as the 90th percentile) or a single model as a standalone, precise result.



Appendix 1: List of climate variables within VFCT

2024/CMIP6 Dashboard

Climate Factor	Climate Variable
Past climate baseline (1986-2005)	<ul style="list-style-type: none"> • Max Temperature • Min Temperature • Avg Temperature • Rainfall (Precipitation)
Climate Averages <i>Visualises the future projected average.</i>	<ul style="list-style-type: none"> • Average Temperature (°C) • Average Minimum Temperature (°C) • Average Maximum Temperature (°C) • Total Rainfall (mm)
Temperature Extremes	<ul style="list-style-type: none"> • Hot Days: 99th percentile of Maximum Temperature • Very Hot Days: 99.9th percentile of Maximum Temperature • Hot Nights: 99th percentile of Maximum Temperature • Very Hot Nights: 99.9th percentile of Maximum Temperature • Number of Hot Days: Days above 99th percentile of Maximum Temperature • Number of Very Hot Days: Days above 99.9th percentile of Maximum Temperature • Number of Hot Nights: Days above 99th percentile of Maximum Temperature • Number of Very Hot Nights: Days 99.9th percentile of Maximum Temperature
Rainfall Extremes	<ul style="list-style-type: none"> • Heavy Rainfall Days: 99th percentile of Rainfall • Very Heavy Rainfall Days: 99.9th percentile of Rainfall

2019/CMIP5 Dashboard

Climate Factor	Climate Variable
Past climate baseline (1986-2005)	<ul style="list-style-type: none"> • Max Temperature • Min Temperature • Avg Temperature • Rainfall (Precipitation)
Projected climate: change <i>Visualises the amount of future projected change.</i>	<ul style="list-style-type: none"> • Max Temperature (°C change) • Min Temperature (°C change) • Avg Temperature (°C change) • Relative Humidity (% change) • Rainfall (Precipitation) (% change)
Projected climate: values <i>Visualises the exact values of the projected future climate.</i>	<ul style="list-style-type: none"> • Max Temperature (°C projected value) • Min Temperature (°C projected value) • Avg Temperature (°C projected value) • Relative Humidity (% value) • Rainfall (Precipitation) (mm value)
Temperature Extremes	<ul style="list-style-type: none"> • Very Hot Days with maximum temperature above 40°C • Hot Days with maximum temperature above 35°C • Days with maximum temperature above 30°C • Days with maximum temperature above 24°C • Very Cold Nights with minimum temperature below 0°C • Nights with minimum temperature below 2°C • Nights with minimum temperature below 7.2°C • Nights with minimum temperature below 13°C • Warm Nights with minimum temperature above 20°C • Stress Days with the difference between the minimum and maximum temperatures above 20°C
Rainfall Extremes	<ul style="list-style-type: none"> • Wet Days (rain > 10mm): Wet Days with rainfall greater than 10mm • Very Wet Days (rain > 20mm): Very Wet Days with rainfall greater than 20mm • Warm Moist Days (max > 25°C & rain): Moist Days with maximum temperature above 25°C and rainfall greater than 0mm
Extreme Value Analysis - One in 20 year events	<ul style="list-style-type: none"> • Precipitation (20yr return period) • Min Temp (20yr return period) • Max Temp (20yr return period)
Heatwaves	<ul style="list-style-type: none"> • Number of heatwaves • Duration (longest length) • Frequency (sum of days) • Amplitude (hottest day)
Extreme dry/wet (SPI)* <i>*standard precipitation index</i>	<ul style="list-style-type: none"> • Duration Wet - number of consecutive months with SPI > 1 • Duration Dry - number of consecutive months with SPI < -1 • Extreme Wet - number of consecutive months with SPI > 2 • Extreme Dry - number of consecutive months with SPI < -2 • Severe Wet - number of consecutive months with SPI between 1.5 and 2 • Severe Dry - number of consecutive months with SPI between -1.5 and -2 • Moderate Wet - number of consecutive months with SPI between 1 and 1.5 • Moderate Dry - number of consecutive months with SPI between -1 and -1.5
Heat health <i>The Heat Health Index (HHI) is calculated by counting the number of days when the mean air temperature exceeds the temperature specified (30°C, 32°C or 34°C).</i>	<ul style="list-style-type: none"> • Heat Health Index (mean temperature > 30°C) • Heat Health Index (mean temperature > 32°C) • Heat Health Index (mean temperature > 34°C)
Coastal Inundation Layer	<ul style="list-style-type: none"> • Sea Level Rise • Sea Level Rise + Storm Tide (1-in-100 years)

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