

# Using the Victorian Climate Projections 2024

Climate projections are a valuable resource for planning for a changing climate, but given their complexity they can be difficult to use in practice. This fact sheet outlines some of the features of *Victorian Climate Projections 2024* (VCP24) that can assist decision-makers to apply them.

## Key messages:

- A range of different information products on Victoria's climate projections are available for decision-makers with different needs and capabilities, including an overarching climate science report, technical report, regional reports, and a tool to visualise and access projections data.
- As well as projections for scenarios of future global greenhouse gas emissions, VCP24 includes projections for global warming levels. These help decision-makers understand the implications of meeting or failing to meet the goals of the Paris Agreement<sup>1</sup>.
- VCP24 includes uncertainties in future climate changes. Decision-makers should have plans that are robust to, or can be adapted to, a range of scenarios for future climate changes.
- To effectively assess and manage climate change risks, decision-makers should complement climate projections from

VCP24 with other sources of hazard, exposure and vulnerability information.

## Different information products for different decision-makers

**A range of information products on VCP24 are available for decision makers with different needs and capabilities.**

VCP24 is a valuable resource to a wide range of different decision-makers, with different needs and capabilities. Numerical data is useful for some decision-makers but others need high-level messages about climate change. For this reason, VCP24 is being communicated through a range of different information products:

- **The *Victorian Climate Science Report 2024*<sup>2</sup>** is an appropriate 'first port of call' for most decision-makers. In addition to a summary of projections, it includes contextual information about climate change and information on climate hazards, such as flood, heatwaves, drought, bushfire and sea level rise.
- **The *VCP24 Technical Report*<sup>3</sup>** provides detailed information about how the projections were produced and technical descriptions of what they show. This is a resource for decision-makers who find require more detail than is in the Victorian Climate Science Report or the Regional Reports.
- **Fact Sheets** like this one focus on specific aspects of the projections that will be of particular relevance to some decision-makers. These include how VCP24 compares to VCP19, what VCP24 says about changes in rainfall, and important aspects of

<sup>1</sup> [The Paris Agreement | UNFCCC](#)

<sup>2</sup> [Victoria's Climate Science Report 2024](#)

<sup>3</sup> [Victorian Climate Projections 2024 Technical Report](#)



Energy,  
Environment  
and Climate Action

climate change that are not well addressed by climate models.

- **Regional Reports** provide decision-makers with a summary of climate projections for ten Victorian regions. Regional reports are available now for the *Victorian Climate Projections 2019* (VCP19) and will be available shortly for VCP24.
- **The Victorian Climate Futures Tool** is for decision-makers who need a deeper dive into the climate model projections. It allows decision-makers to visualise and download projections data for Victoria and its regions and includes data on ~5 km x ~5 km grid cells covering all of Victoria. The tool currently provides access to VCP19 data and is being updated to include VCP24 data.

The VCP19 technical report also provides more detailed guidance on how climate projections can be used in impact assessments and this guidance applies equally to VCP24.

## Projections for emissions scenarios and global warming levels

**VCP24 includes projections based on different scenarios for future global greenhouse gas emissions and a more limited set of projections for different future global warming levels. Each of these ways of framing future climate change will better suit different decision-makers.**

### Emissions scenario framing

Climate change projections mostly present future climate information framed around one or more future time horizons under one or more future global greenhouse gas emissions scenarios. This ‘emissions scenario’ framing is used in VCP24, with the greatest emphasis given to changes by the 2050s and 2090s under a low and a high emissions scenario. Many decision-makers using climate projections are familiar with this framing, and emissions scenario projections can be relatively easily incorporated into narratives about the future world and thus used in risk assessments. These projections provide decision-makers with information about when certain climate changes are expected to take place. The most commonly used emissions scenario types are Representative Concentration Pathways (RCPs) and Shared Socio-economic Pathways (SSPs).

### Global warming levels framing

Emissions scenario projections	Global warming level projections
<b>Advantages</b>	
<ul style="list-style-type: none"> <li>• Familiar to most decision-makers who use climate projections</li> <li>• Gives time-bound narratives about the future world</li> <li>• Provides information about when in the future certain climate changes may occur</li> </ul>	<ul style="list-style-type: none"> <li>• Helps decision-makers understand the implications of the Paris Agreement</li> <li>• Easy to compare a wide range of climate model results (e.g., from modelling of different emissions scenarios)</li> <li>• Communicates only the uncertainty in future regional climate changes and not the in the timing of future global warming</li> </ul>
<b>Disadvantages</b>	
<ul style="list-style-type: none"> <li>• More difficult to relate to global warming levels referred to in global climate change mitigation targets</li> <li>• Difficult to seamlessly incorporate a wide range of climate model results</li> </ul>	<ul style="list-style-type: none"> <li>• Not appropriate for all aspects of climate change (e.g., sea-level rise)</li> <li>• Cannot be related to time horizons for future planning without additional information</li> </ul>

**Table 1. Advantages and disadvantages of climate projections for emissions scenarios and global warming levels**

Global warming levels (GWLs) are increasingly being used to communicate future climate information, including by Australia’s National Climate Risk Assessment<sup>4</sup>. VCP24 includes some GWL projections, showing how Victoria’s climate is expected change by the time the globally averaged temperature reaches certain levels: 1.5 °C, 2 °C and 3 °C hotter than the pre-industrial climate. Framing climate projections in this way helps decision-makers understand the implications of the Paris Agreement. The aim of the Paris Agreement is to hold ‘the increase in the global average temperature to well below 2 °C above pre-industrial levels’ and pursue efforts ‘to limit the temperature increase to 1.5 °C above pre-industrial levels’. However, global warming level projections are not appropriate for some aspects of climate change, such as sea-level rise, where the trajectory and timing of future global warming is important, and not just the absolute amount. Additionally, global warming level projections cannot be used for future planning with a

<sup>4</sup> [Assessing and adapting to Australia’s climate risks - DCCEEW](#)

specific time horizon (such as a 50-year strategy) without additional projections on when GWLs may be reached.

For VCP24, the emissions scenario framing is used for a more complete set of projections, to support comparability with VCP19 and in recognition of emissions scenarios being already familiar to most decision-makers. In addition, global warming levels framing was used to provide projections for rainfall and temperature from a more limited set of modelling, in anticipation of a greater demand for global warming level framing in the future. More detailed information about interpreting GWL projections is also included in the *VCP24 Technical Report* and *Victoria's Climate Science Report 2024*.

## Climate scenarios are a useful tool for handling uncertainty in projections

**Decision-makers must account for uncertainty in using projections. They can do this by using multiple future climate scenarios. Climate scenarios encompass both the uncertainty in emissions and the uncertainty in climate changes that arise from them.**

One of the most challenging aspects of using climate projections is the inherent uncertainty associated with them. Uncertainty in projections arises for a variety of reasons and we deal with these uncertainties by using different **climate scenarios**. Climate scenarios encompass several different sources of uncertainty:

- **Uncertainty in future global greenhouse gas emissions:** The future evolution of global emissions is unknown and unknowable, as it depends on a myriad of decisions made around the globe now and in the future. In VCP24, we address emissions uncertainty by considering future climate change under a low emissions and a high emissions scenario, spanning two extremes of possible future emissions.
- **Uncertainty in how the climate will respond to emissions of greenhouse gases:** Even if we knew how greenhouse gas emissions would evolve, there is still uncertainty in how the climate will respond to emissions. This uncertainty is addressed in part by using a range of different climate models. In VCP24 we draw on a range of global and regional ('downscaling') models to represent as much of this range of uncertainty as we can. Natural climate variability also contributes to uncertainty around future climate response,

something also accounted for in part by using a range of climate models.

For some climate variables, like average temperature, there is less uncertainty in the climate response. In other climate variables, like rainfall, there is greater uncertainty. The uncertainty is reflected in the level of agreement between climate models. For example, all models used in VCP24 agree on future increases in temperature, although the rate of increase varies between emissions scenarios and models. For average summer rainfall, some models show a future increase and others a decrease, indicating high uncertainty. More information about uncertainty in rainfall projections can be found in the VCP24 Rainfall Fact sheet.<sup>5</sup>

Decision-makers must account for uncertainty to make good decisions under a changing climate. To do this, they need to be prepared to plan for a range of different future climate scenarios. In Victoria, the choice of which climate scenarios to consider can be informed by the details in VCP24 and VCP19 on different emissions scenarios, climate models and other lines of evidence about climate change. However, the decision-maker needs to decide which assets or values are important to them, which climate variables and hazards are relevant, how exposed and vulnerable the assets or values are to those hazards, whether there are thresholds in these variables that are particularly impactful if they are breached, and their appetite for risk.

Two illustrative examples are provided below.

### Example decision-making for temperature futures

A simple illustrative example of the selection of future climate scenarios might be for a decision-maker concerned with changes in the average annual temperature of Victoria by 2050 under a high future global greenhouse gas emissions scenario. A similar approach could apply to temperature extremes. VCP24 tells us that it is *virtually certain* that Victoria will continue to warm in the future and that average temperatures will likely increase by approximately 1.5 °C (1.1 to 1.9 °C range), compared to 1986–2005, by 2050 under a high emission scenario. The projection also includes a low-likelihood, high-warming future of up to 2.5 °C warming.

In a situation with a higher tolerance for decision-making risk, a decision-maker may want to consider a mid-range warming value of 1.5 °C of warming, perhaps in the knowledge that they can easily adapt their plans to other levels of warming in the future if warming is higher. In a situation of a lower risk tolerance, the decision-maker may want to also consider more extreme warming values in the 1.1 to 1.9 °C range to

<sup>5</sup> [What do the Victorian Climate Projections 2024 say about changes in rainfall?](#)

represent the likely range of warming. Where there is a low risk tolerance, the decision-maker may want to also consider the low-likelihood, high-warming projection of 2.5 °C of future warming.

### Example decision-making for rainfall futures

Similar thinking can be applied for an example of a hypothetical decision-maker concerned with changes in total rainfall of Victoria. VCP24 projects that cool season rainfall is expected to continue declining with *medium to high confidence*. Nonetheless, since some climate modelling projects increases in cool season rainfall, a highly risk-averse situation might require the decision-maker to consider a range of scenarios from a much drier cool season to a wetter cool season. In a more risk-tolerant setting, the decision-maker may want to consider a single scenario based on mid-range decreases in cool season rainfall. However, because there is *low confidence* in the direction of future change in summer rainfall, even a relatively risk-tolerant setting may require both drier and wetter scenarios for summer rainfall to be considered.

Robust planning for climate change generally means accepting that plans for the future may not be optimal for any specific future climate scenario. This may be an unavoidable cost of having plans that are robust to, or can be easily adapted to, a range of different climate scenarios, including different emissions scenarios and range of climate models.

## Potential ‘unmodelled futures’ not included in VCP24

**While the VCP24 provides a credible range of future climate change from available climate modelling, there is also the possibility of ‘unmodelled’ futures which are not represented. Some decision-makers may need to assess the additional risk of unmodelled hazards.**

Using a large array of climate models helps us to represent the range of future climate response to greenhouse gas emissions, however it is also possible that plausible future climate scenarios exist beyond the range of the model results. Unmodelled futures include climate ‘tipping points’ and some extreme climate hazards. These are outlined in more detail in the Fact Sheet on Unmodelled Futures. They also include climate hazards and extremes which are not modelled in VCP24, due to limitations in modelling variables such as extreme winds, hail and storms.

Changes associated with unmodelled futures are generally considered ‘High Impact, Low Likelihood’ risks (HILLs).

## VCP24 is one input into a climate change risk assessment

**To effectively assess and manage climate change risks, decision-makers must combine information from VCP24 with other sources of information.**

VCP24 provides information about future changes to climate and climate hazards for assessing the risks posed by climate change and climate-related stressors. A climate-related stressor could be individual extreme climate hazard events, such as severe heatwaves, storms and droughts, or several such events occurring around the same time.

However, information on climate and other related physical hazards is only one part of a climate change risk assessment and needs to be combined with appropriate knowledge of the assets or values being considered, including their climate exposure and vulnerability:

- **Exposure:** the extent to which people, assets and ecosystems are in areas that could be adversely affected by climate hazards. For example, the high density of housing and critical infrastructure in a climate hazard prone area. Exposure information includes data about the components of a system and where they are located, such as maps of infrastructure and housing.
- **Vulnerability:** likelihood or predisposition of systems, communities or individuals to be negatively impacted by climate hazards. Vulnerability information can include knowledge on a system, community or individuals susceptibility to harm if exposed to a climate related-stressor, such as economic, educational and social resources.

Importantly, exposure and vulnerability are dynamic and will also change in the future. This means that climate change risk assessments may need to include projections of future changes in relevant exposure and vulnerability variables (e.g. population and demographic projections), in addition to projections of future climate changes.

### Transboundary risk

Victoria is interconnected with the rest of Australia and the wider world. This means that climate changes outside Victoria, and beyond the scope of VCP24, will impact the state. Decision-makers assessing climate risks to Victoria should account for dependencies on inter-state (e.g. management of ecosystem resources or infrastructure that cross state boundaries), national (e.g. nationwide energy and transport systems) and international systems (e.g. the global finance system, international trade). They may need to consult climate change risk assessments for these systems, where they exist.

We acknowledge Victorian Traditional Owners and their Elders past and present as the original custodians of Victoria's land and waters and commit to genuinely partnering with them and Victoria's Aboriginal community to progress their aspirations.



The State of Victoria acknowledges the contribution of CSIRO, Australia's national science agency, in producing this document. The information in this document is drawn from the Victorian Climate Projections 2024 Technical Report which should be consulted for more detail ([Round V, Grose M, Macadam I, Bodman R, King M, Truong S, Heady C, Thatcher M, Clarke J M \(2024\) Victorian Climate Projections 2024 Technical Report. CSIRO](#)).

Peer review support was provided by Dr Karl Braganza, Bureau of Meteorology.

© The State of Victoria Department of Energy, Environment and Climate Action November 2024.

#### **Creative Commons**

This work is licensed under a Creative Commons Attribution 4.0 International licence, visit the [Creative Commons website](http://creativecommons.org/licenses/by/4.0/) (<http://creativecommons.org/licenses/by/4.0/>).

You are free to re-use the work under that licence, on the condition that you credit the State of Victoria as author. The licence does not apply to any images, photographs or branding, including the Victorian Coat of Arms, and the Victorian Government and Department logos.

ISBN 978-1-76136-387-0 (pdf/online/MS word)

#### **Disclaimer**

This publication may be of assistance to you but the State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.

#### **Accessibility**

To receive this document in an alternative format, phone the Customer Service Centre on 136 186, email [customer.service@delwp.vic.gov.au](mailto:customer.service@delwp.vic.gov.au), or contact National Relay Service on 133 677. Available at [DEECA website](http://www.deeca.vic.gov.au) ([www.deeca.vic.gov.au](http://www.deeca.vic.gov.au)).