Climate change and Victoria's alpine regions

Climate variability and change

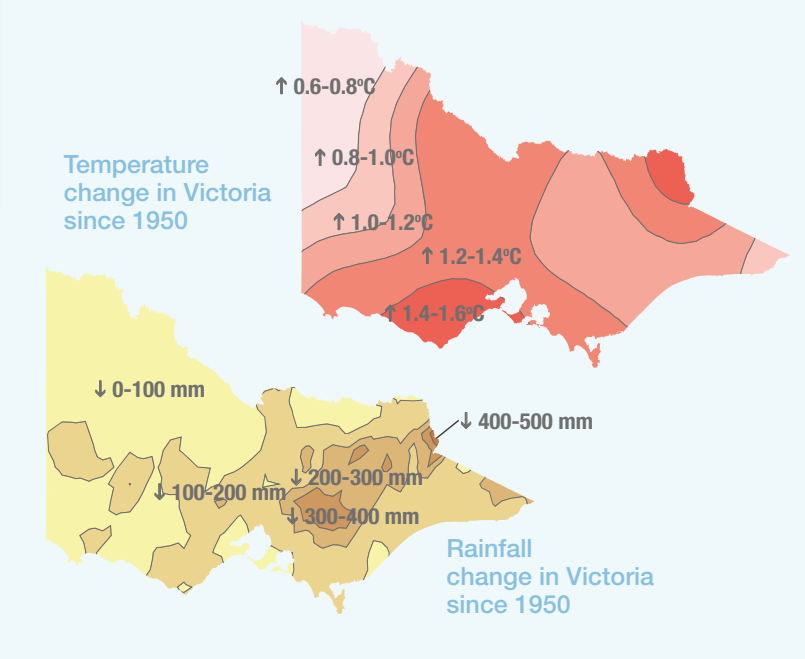
Our climate varies

Climate has always varied – from season to season, year to year and decade to decade. This climate variability means that some periods are cooler and wetter than average (as was the case in the 1970s), and others are hotter and drier (such as during the 1996 to 2009 Millennium Drought). However, due to climate change, the *long-term* average is changing. Future climate will be different from that in the past.

Victoria getting warmer and drier

Over the past 100 years, global surface air temperatures have risen by almost 1 °C. Both the atmosphere and the oceans have warmed. Human activity is causing climate change through our release of greenhouse gases from activities including the burning of fossil fuels, land use change and agriculture. Atmospheric concentrations of carbon dioxide are now more than 40 per cent higher than they were before industrialisation.

In Victoria, the rate of warming has increased since 1960. On average, rainfall has declined since the 1950s, especially in autumn.



Victoria has warmed and dried since the 1950s

Less snow in the alpine regions

The climate of Victoria's alpine regions is changing.
Temperatures are rising (especially minimum temperatures) and precipitation (rain and snow) is decreasing.

The **highest elevation areas** of the Australian alpine region are **drying faster than the lower slopes**, especially during winter.

Snow cover has declined by about **50%** since the **1960s**

Since the **1980s**, the alpine regions have experienced a **30% reduction** in the number of light snow days.

A decrease in annual maximum snow depths of about **20cm** **per decade.**

The impacts of climate change are expected to accelerate during this century.

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Projected changes in alpine region climate

Warming, drying trend to continue in alpine region

In 2016, the Alpine Resorts Co-ordinating Council commissioned the Antarctic Climate and Ecosystems Cooperative Research Centre to use high-resolution models to determine the likely climatic changes in alpine regions.

The researchers produced the following projections for the Australian alps by the end of the century based on a scenario of high future emissions of greenhouse gases.

Average temperatures could **increase**

4-5°C

The **greatest increase** in **mean temperature** will occur at the **higher altitudes** and inland

Changes in **temperature** and **precipitation** vary across the region and seasonally

Increases in mean daily minimum temperature of up to

6°C

may occur at the **highest peaks** in winter

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The **greatest declines** in precipitation tend to occur in the northern region around Mount Perisher, and at higher altitudes

The **greatest increases** in daily maximum temperature tend to **occur in spring** with **increases** of **across much of the Victorian alps**

5-6°C

Annual precipitation may **decline** by

5% - 20%

There are **declines** in precipitation in

autumn winter spring

up to **10%** in each

and **increases** in summer precipitation

summer

up to **20%**

The **maximum** extent of snow contracts upslope so that snow **occurs only on the very highest peaks**.

These changes in climate are likely to have significant consequences for natural ecosystems and recreational use across the alpine region.

Climate models use physical laws to simulate the climate

The climate projections are based on sophisticated national and international global climate models. These models use the physical laws that govern the way the world's climate works to simulate the climate from high in the atmosphere to the depths of the oceans. The models run on powerful supercomputers, and successfully represent the important features of today's climate as well as those of past climate.

The alpine regions' climate has followed that projected by climate models since 1990.

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Impacts of climate change

Less snow cover, more floods and bushfires

Climate change will continue to drive up average temperatures in the Victorian alps, while precipitation will diminish. The consequences are reduced snow cover and more heatwaves. Increasing temperatures coupled with a drying of soil and ground fuels will increase the likelihood of bushfires.

Flash flooding and landslides could affect alpine regions, with access roads being susceptible, particularly as some resorts have only one road in and out.

Higher temperatures reduce the proportion of precipitation falling as snow. More snow falling as sleet will affect snow retention. The change in the total snowfall and rising temperature affects both the number of days on which there is natural snow on the ground and the maximum annual snow depth. Of course, resorts supplement snowfall by snowmaking.

Snow cover and volume will decline; eventually only the highest peaks will experience any snow. These changes are likely to have a significant impact on natural ecosystems and recreational use. The Australian alps represent a biodiversity 'hotspot', in which climate change could have a significant impact on rare plants that live only in a narrow climatic range.

Climate change could potentially benefit some resorts as people travel to the mountains to escape summer heat.

Adapting to the changes

Tackling the cause versus adjusting to the likely changes

There are two main ways to respond to climate change: *mitigation and adaptation*. Mitigation addresses the root causes, by reducing greenhouse gas emissions. An example of mitigation is using renewable energy resources rather than fossil fuels. Adaptation seeks to lower the risks posed by the impacts of climate change.

We have always adapted to our environment by developing activities and approaches suited to local conditions. However, climate change creates shifts (in temperature, storm frequency, flooding and other factors) at an unprecedented magnitude and rate.

Reducing bushfire risk

Good management, including reducing fire hazards around the resorts, providing shelters and ensuring appropriate warnings and information to those using roads to reach or leave the resorts will be essential measures.

Snowmaking helps, but costs will rise

Snowmaking is an important part of Victoria's resort management and is likely to play an increasing role as resorts adapt to declining natural snow cover. Snowmaking is used to guarantee the season start, extend its duration, and maintain the viability of heavily used and lower slopes.

Snowmaking using current technologies (a combination of evaporative and refrigerated technology) is expected to sustain the ski industry in some regions until the middle of the century. By mid-century, there will be less natural snow and a significantly increased need for snowmaking at the same time as a decline in snowmaking opportunities. This may lead to shorter and less reliable ski seasons.

The costs of snowmaking are likely to rise as natural snow cover declines, melting and evaporation rates increase and water and electricity costs rise. More snow will need to be made at higher temperatures, particularly at the beginning of the ski season, at greater cost.

Snowmaking under warmer conditions requires a shift from conventional methods using evaporative cooling to freeze the water, to more energy consuming refrigerant technology (snow factories). Some Victorian resorts have already deployed snow factory technology to supplement snow guns.

Expanding snow season activities

There may be more opportunities to diversify offerings in the 'white' season to include activities less dependent on traditional snow cover distribution and facilities. Such activities include snow play, snow shoeing, cross country skiing and snowmobiles. Some snowmaking may still be required to support these activities.

Year-round activities

Resorts can encourage greater take up of 'green season' activities, such as bushwalking, guided history tours, road cycling, mountain biking and four-wheel driving, and look for opportunities for new green season activities. Efforts to grow the green season have yielded low economic returns and a more severe and extended bushfire season is constraining visitor numbers.

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CLIMATE CHANGE

Average temperatures could increase by 4-5 °C; greatest increase in temperature at the higher altitudes; greatest increases in daily maximum temperature occur in spring, with increases of 5-6 °C

Increases in mean daily minimum temperature of up to 6 °C may occur at the highest peaks in winter

Annual precipitation may decline by 5 to 20%; greatest declines in precipitation occur at higher altitudes; declines in precipitation in winter, autumn and spring, and increases in summer precipitation

Maximum extent of snow contracts upslope.

References

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