A snapshot of findings from the Victorian Climate Initiative (VicCI)

VicCI was a three-year regional research initiative by the Victorian Government and research partners the Bureau of Meteorology and the CSIRO.

Findings from VicCI provide new insights into the impact of climate change and variability on Victorian water availability.

Learning from the past

From 1986-2016, Victoria experienced its warmest 30-year period on record. It was also the driest 30-year period for cool season rainfall (April to October). The warm and dry conditions are in part due to increasing greenhouse gas concentrations.

Streamflows in Victoria have also been among the lowest on record over recent decades, with many catchments experiencing declines of more than 50 per cent over the past 20 years. (Figure 1)

Given the changes experienced in Victoria's climate and streamflow, the climate of recent decades is considered to be a more reliable baseline for water resource planning, than the longer-term climate or streamflow record.

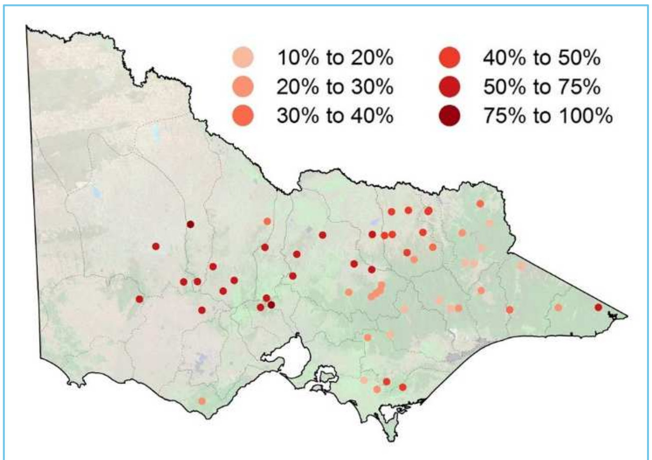

Figure 1: Streamflow reductions since 1997.

Shift in weather systems toward the poles

The decline in rainfall during the cool season is associated with a poleward shift in rainfall bearing weather systems. Global warming is a significant contributor to this southerly shift, which means that the downward trend in cool season rainfall is likely to continue over this century.

The tropical component of the global scale north-south atmospheric circulation, called the Hadley cell, has also been expanding south over the past 50 years. The expansion may have contributed to wetter summers, with more tropical influences.

Future trends in warm season rainfall are less clear than for the cool season. Even if there is an increase in warm season rainfall, it is unlikely to offset the impact of declines in cool season rainfall because most of the runoff in Victoria occurs in winter.

Influences on Victoria's climate

The key modes of climate variability that affect Victorian rainfall are the El Niño – Southern Oscillation (ENSO: El Niño and La Niña), the Indian Ocean Dipole (IOD), and the Southern Annular Mode (SAM).

The dominant impact of ENSO and the IOD is on rainfall during winter and spring, although strong ENSO events can impact summer rainfall.

SAM has different impacts in different seasons, with high SAM associated with winter drying and wetter summers.

In addition to ENSO, there is another mode of climate variability in the Pacific Ocean called the Interdecadal Pacific Oscillation (IPO). The IPO fluctuates over a longer timescale than ENSO, and tends to remain in each phase for a decade or more. It has a cold (La Niña-like) phase and a warm (El Niño-like) phase.

Seasonal climate prediction

Predictability of Victoria's climate originates from predictability of ENSO and the IOD. However, this predictability is not the same over time – it is influenced by the phase of the IPO.

During IPO cold phases, which we have been in since 1998, large impacts on Victoria's rainfall can be expected from relatively minor ENSO and IOD events, due to the stronger connection with Victorian rainfall.

When the IPO switches to a warm phase, less influence on Victorian rainfall can be expected from ENSO and

IOD events due to the weaker connection with Victorian rainfall.

The phase of the IPO also influences the likelihood of both ENSO and the IOD being in the same phase, and the lead time for prediction of ENSO and IOD events.

The Bureau of Meteorology seasonal forecasts integrate the influences of all these factors on Victoria's climate.

Long-term climate and streamflow projections

Streamflows in Victoria are likely to decline over coming decades. This is driven by the expected declines in future cool season rainfall, along with increasing temperatures and potential evapotranspiration.

While future declines in rainfall and streamflow are expected, there is a wide range of uncertainty about when the reductions will occur, and the magnitude of the reductions.

A range of approaches to derive future projections of rainfall and streamflow were investigated in VicCI. Figure 2 shows projections of future streamflow assuming 'business as usual' future emissions, simulated using a hydrological model informed by projections from the latest global climate models. The median as well as the range of plausible projections are presented.

Given the large range of possible reductions in streamflow, a scenario-based approach to planning is recommended.

Guidelines for assessing the impact of climate change on water supplies in Victoria are available at: www.water.vic.gov.au/climate-change

VicCI synthesis report

To view the full VicCI synthesis report, visit: www.water.vic.gov.au/climate-change

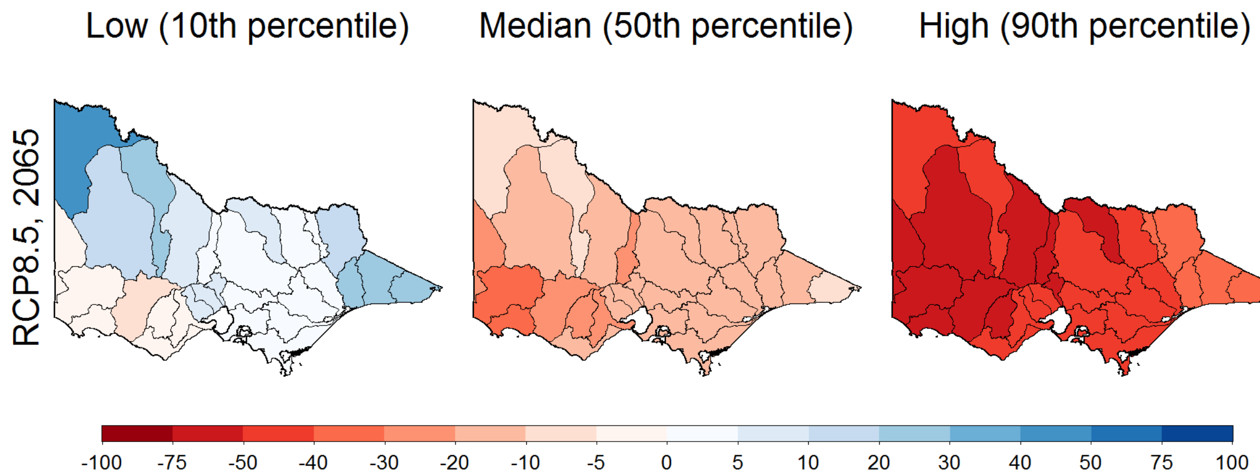

Figure 2: Projections of the percentage change in basin runoff by 2065 as a result of climate change. The range of responses, modelled using a hydrological model, informed by different climate models is shown (low, median and high percentiles)

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