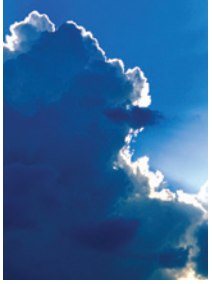
South Eastern Australian
Climate Initiative


Key findings from the South Eastern Australian Climate Initiative (SEACI)

At a glance

Over the past six years, the South Eastern Australian Climate Initiative (SEACI) has improved our understanding of climate variability and change in south-eastern Australia. It has also examined how these changes affect water availability across the region. Finally, it has improved short-term (seasonal) forecasts of climate and streamflow.

South-eastern Australia's climate is significantly influenced by the Pacific, Indian and Southern Oceans. Multiple lines of evidence indicate that tropical weather systems and their influences are expanding southward, exerting considerable influence on the climate of south-eastern Australia. There is also evidence that the southern storm tracks that historically brought reliable cool season rainfall to southern Australia have shifted southward.

These influences have resulted in a decline in cool season rainfall for the region. SEACI research shows that human influences, such as an increase in greenhouse gases, appear to be a cause of the expansion of tropical climate influences.

The recent climate of south-eastern Australia

Rainfall totals across south-eastern Australia during the 13 years of the Millennium drought (1997–2009) were the lowest on record. The average annual rainfall for south-eastern Australia during this period of 512 mm was 12 percent below the long term (1900–2010) average of 582 mm.

The decline in water availability in south-eastern Australia during the Millennium drought was also unprecedented, with annual runoff estimated to have declined by up to 50 percent in parts of the region compared to the long term average.

The Millennium drought was broken by Australia's wettest two year period in 2010 and 2011. Most of this rain fell during the warm season; cool season rainfall continues to be well below average across south-eastern Australia.

Renmark, South Australia, October 2004
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What drives the climate of south-eastern Australia?

Changes in the Pacific, Indian and Southern Oceans, as measured by indices such as the El Niño-Southern Oscillation, the Indian Ocean Dipole and the Southern Annular Mode, drive southern Australia's climate variability. These changes contributed to the record-breaking rainfall received in 2010 and 2011. However, these changes do not explain the unprecedented large cool season rainfall deficit observed during the Millennium drought and continuing to the present.

SEACI research has demonstrated that an expansion of the tropics, indicated by the Hadley Circulation expanding at the rate of 0.5° of latitude (approximately 50 km) per decade, is pushing mid-latitude storm tracks further south and leading to reduced cool season rainfall across southern Australia.

Climate modelling shows that this observed expansion of the tropics can only be reproduced if human influences (such as greenhouse gases, aerosols and stratospheric ozone) are included in the climate models. This provides evidence that observed changes in large-scale atmospheric circulation patterns affecting south-eastern Australia are at least partly attributable to climate change.

SEACI is a partnership between the CSIRO Water for a Healthy Country Flagship, the Bureau of Meteorology, the Murray–Darling Basin Authority, the Victorian Department of Sustainability and Environment, and the Australian Government Department of Climate Change and Energy Efficiency.

What will the future look like?

Climate models predict a reduction in winter rainfall for south-eastern Australia, translating to a considerable reduction in both winter and annual runoff. For example, if the global average temperature increases by 1 °C, average annual rainfall is expected to decline by between 0 and 9 percent, and average annual runoff is expected to decline by between 2 and 22 percent for the southern section of the SEACI region (south of 33° latitude). Reductions in rainfall and runoff for 2 °C of global warming are projected to be approximately double these. Projected changes across the northern half of the region are less certain, with some models projecting an increase, and some a decrease in rainfall and therefore runoff.

What are the implications of these changes for water availability?

The cool season is the traditional 'filling season' for water supply systems across most of the region, with most of the runoff produced by this cool season rainfall. One of the key implications of SEACI research findings is that this filling season may be less reliable in the future. However, in the light of expansion of tropical influences, this may be offset to some extent by increased rainfall in spring and summer, depending on the state of the Pacific, Indian and Southern Oceans.

SEACI research also demonstrated changes to surface water and groundwater connectivity during the Millennium drought, particularly in low relief catchments. The results show that during an extended drought, rainfall replenishes near-surface soil water and groundwater stores rather than being converted to runoff. In addition, activities such as farm dams intercept proportionally more water during dry periods. As a result, some catchments showed a disconnection between surface and groundwater, leading to much lower runoff than might be expected. The same processes may accentuate the decline in future water availability under a drier climate.

Climate change projections show a range of possible and plausible impacts, and water resource managers need to ensure that their planning and management processes are robust and adaptive across a wide range of future climate and streamflow scenarios.

Improvements in seasonal forecasting

SEACI research has contributed to improvements in the seasonal forecasting of rainfall and streamflow across south-eastern Australia. These improved forecasts will assist resource managers and users in adapting to a variable and changing climate. Seasonal streamflow forecasts can be accessed at www.bom.gov.au/water/ssf/index.shtml.

For further information and to download data on projected changes in climate and runoff for 1 °C and 2 °C of global warming, please visit www.seaci.org.

Yarrawonga Weir on the River Murray, Victoria, 2000 © CSIRO

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