NARCliM

South East and Tablelands

Climate Change Snapshot

environment.nsw.gov.au

Acknowledgement of Country

The NSW Government acknowledges First Nations people as the first Australian people and the traditional owners and custodians of the country's lands and water. The NSW Government acknowledges the Wiradjuri, Ngunnawal, Ngarigo, Tharawal, Gundungurra, Dharug, Yuin and Bidwell Aboriginal people from the South East and Tablelands region as having an intrinsic connection with the lands and waters. The landscape and its waters provide the First Nations people with essential links to their history and help them to maintain and practise their traditional culture and lifestyle.

Australia's First Nations people have lived in NSW for over 60,000 years and have significant spiritual, cultural and economic connections with its lands, waters, seas and skies.

They are the first astronomers and scientists who have been listening to and caring for Country for generations.

We pay respects to Elders past and present and acknowledge the significance of their traditional knowledge in adapting to changes in climate over tens of thousands of years.

We recognise the importance of their wisdom at this pivotal moment in time.

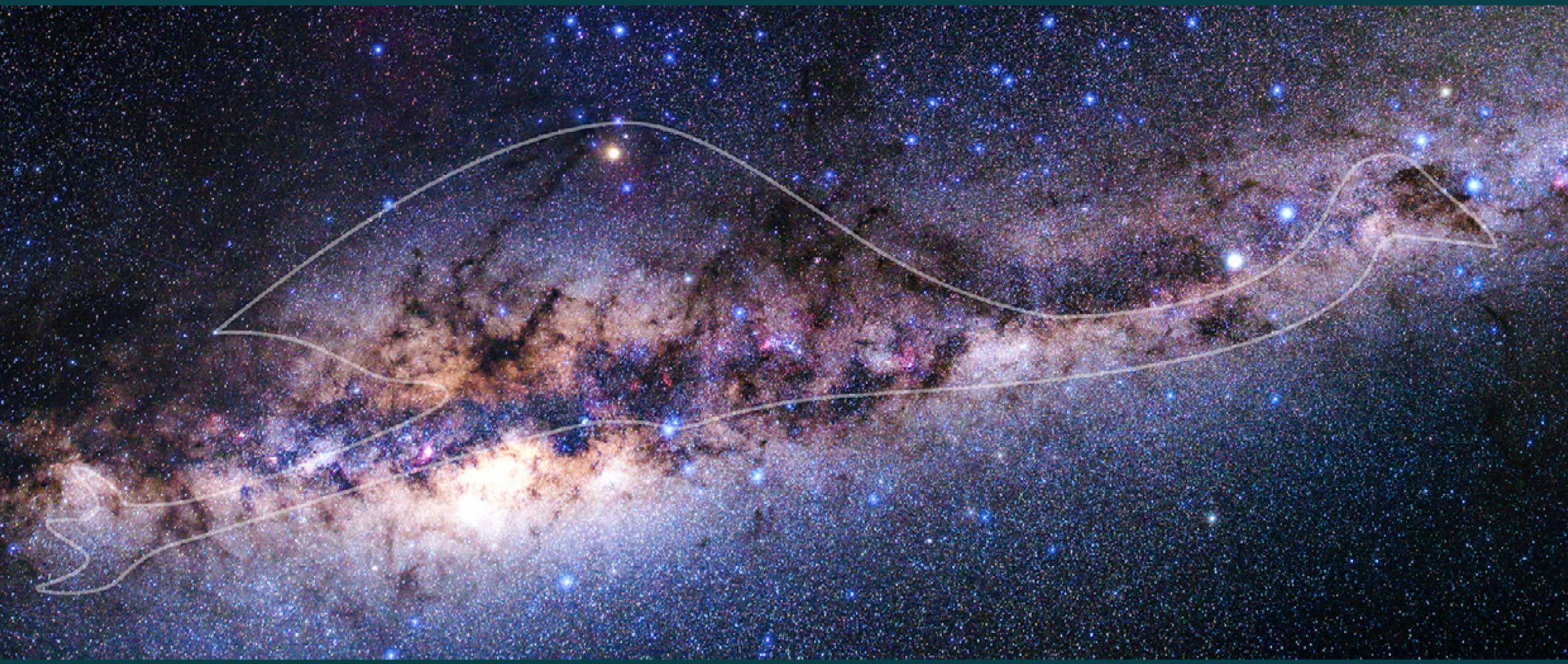


Photo caption:
The Emu in the Sky is an Aboriginal constellation that is made up of the dark clouds of the Milky Way. With the movement of the earth, the position of the Emu in the Sky changes throughout the year. Aboriginal people in some nations across NSW and Australia relate the position of the Emu in the Sky to the breeding behaviour of the emu on the land. Cultural astronomy teaches us about the relationship between the sky and land; and that we are all interconnected.

Published by:
Department of Climate Change, Energy, the Environment and Water
Locked Bag 5022, Parramatta NSW 2124

T +61 2 9995 5000 (switchboard)
T 1300 361 967 (Environment and Heritage enquiries)
TTY users: phone 133 677 then ask for 1300 361 967
Speak and listen users: phone 1300 555 727 then ask for 1300 361 967

E info@environment.nsw.gov.au

W www.environment.nsw.gov.au

ISBN 978-1-76058-804-5 Published: August 2024

About this snapshot

The New South Wales (NSW) and Australian Regional Climate Modelling (NARCliM) project delivers high-resolution climate change projections for NSW and south-east Australia.

This snapshot summarises the latest NARCliM2.0 projections for temperature, average rainfall, hot days 35°C and above, cold nights under 2°C and severe fire weather (Forest Fire Danger Index greater than 50) at a 4km resolution for NSW and the Australian Capital Territory (ACT). There is information for both a low-emissions scenario (SSP1-2.6), and a high-emissions scenario (SSP3-7.0) to the year 2100 to show the range of plausible climates that may be experienced, depending on our actions to reduce greenhouse gas emissions. The snapshot also summarises the latest projections for sea-level rise, derived from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report released in 2021. Detailed climate projection information is available through the AdaptNSW Interactive Map and the Climate Data Portal.

Understanding current warming

NSW and the ACT have already warmed by 1.4°C since national records began in 1910.[1] This local warming figure represents surface air temperature over land in NSW and is not directly comparable to average estimates of global warming which include surface air temperature over both land and ocean. Surface warming occurs faster over land than the ocean. Significant impacts from climate change are already occurring in NSW and are expected to be felt more widely in the future, particularly if concerted global effort is not taken to reduce greenhouse gas emissions and adapt to the expected impacts of climate change.

How to use this snapshot

This snapshot provides a summary of plausible future climate change in the in the South East and Tablelands region relative to a baseline of average climate from 1990–2009. The projections for 2050 represent averaged data for 2040–2059 and projections for 2090 represent averaged data for 2080–2099. In translating the projections, it is important to consider the previous historical changes that occurred prior to 1990–2009. For example, national temperature records indicate that NSW has warmed by 0.84°C between 1910–1930 and the 1990–2009 baseline.[1]

Modelling climate change at a local level provides detailed insights into how NSW communities, built environments and natural environments will continue to be impacted by climate change. Information in this snapshot can be used in conjunction with detailed information that is available through the AdaptNSW Interactive Map and the Climate Data Portal.

NARCliM climate projections

NARCliM2.0 projections provide nation-leading climate model data that span the range of plausible future changes in climate for south-east Australia at a 4km resolution, and for the broader Australasian region at a 20km resolution. NARCliM2.0 projections are the next generation of NARCliM, building on previous generations delivered in 2014 and 2021. NARCliM is the NSW Government's trusted source of climate information and data for all audiences and sectors. Detailed information on NARCliM can be found at AdaptNSW.

Methods and uncertainty

To help address future uncertainty, NARCliM2.0 is built on a selection of emissions scenarios, global climate models and regional climate models that, together, capture a range of climates that could occur. This is referred to as the NARCliM model ensemble. The NARCliM2.0 model ensemble is made up of different combinations of 5 selected global climate models and 2 regional climate models, giving 10 model combinations in total. Unless otherwise specified, the presentation of data in this snapshot is averaged across a 20-year period from the NARCliM model ensemble.

Combining multiple models through averaging and other statistical methods produces better projections by providing a comprehensive range of possible future climate scenarios. To ensure that NARCliM models adequately simulate regional climate, scientists use them to simulate the past climate and compare the results with actual observations. Outputs undergo rigorous quality control and scientific technical peer review. There is more information on the modelling project and scientific methods at AdaptNSW.

Shared Socioeconomic Pathways

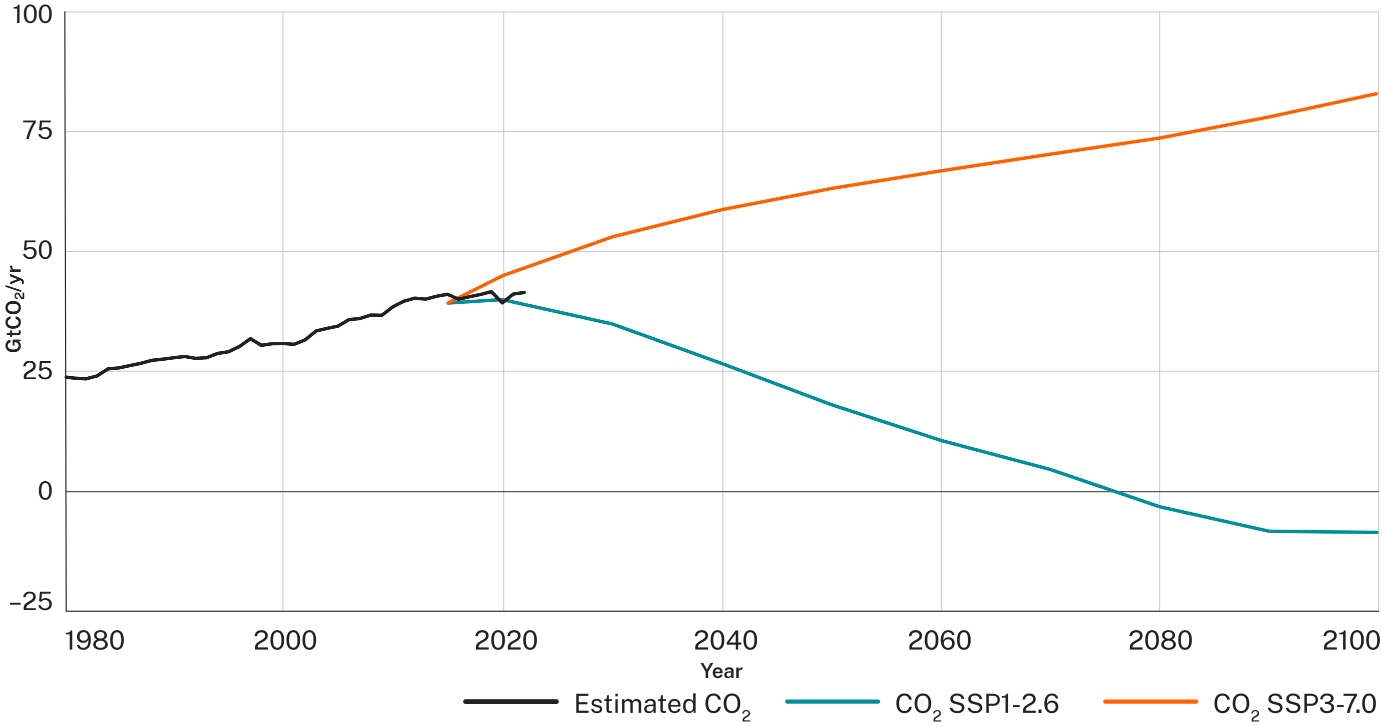
Shared Socioeconomic Pathways (SSPs) are the most recent emissions scenarios adopted in the IPCC's Sixth Assessment Report.

The SSPs describe how greenhouse gas emissions and socioeconomic factors – such as population, economic growth, education, urbanisation and land use – may change in the future. Global carbon dioxide emissions modelled for a low-emissions scenario and a high-emissions scenario are displayed below (Figure 1). For more information on emissions scenarios, visit AdaptNSW.

SSP1-2.6 describes a low-emissions future with a global transition towards sustainable and equitable development.

SSP3-7.0 describes a high-emissions future of regional conflict and development where countries do not collaborate on tackling climate change and do not focus on sustainable and equitable development.

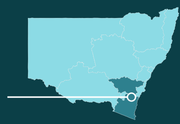
Figure 1. Human-caused global emissions of carbon dioxide – past and projected



Mental health support

Climate change information can be distressing for some readers, with many Australians of all ages experiencing significant eco-anxiety. For supporting information, please visit the Black Dog Institute or Australian Psychological Society or speak with your local healthcare provider.

Projected changes
South East and Tablelands

NSW


Low-emissions scenario

Average temperature increase

↑1.1°C
2050

↑1.2°C
2090

Cold nights per year will decrease by:

2050	2090
16.4	19.8

Sea level will rise by:

2050	2090
17cm	33cm

Severe fire weather days per year will increase by:

2050	2090
0.5	0.7

High-emissions scenario

Average temperature increase

↑1.8°C
2050

↑3.6°C
2090

Cold nights per year will decrease by:

2050	2090
28.0	55.2

Sea level will rise by:

2050	2090
21cm	55cm

Severe fire weather days per year will increase by:

2050	2090
1.2	2.4

Regional impacts

Agriculture

Increased extreme heat

River headwaters

Changes to rainfall

Decrease in cold nights

Alpine tourism

Increased severe fire weather

Isolated small towns

Data is based on NARCliM2.0 (2024) projections for SSP1-2.6 (low-emissions) and SSP3-7.0 (high-emissions) and is presented relative to the historical climate baseline of 1990–2009. The projections for 2050 represent averaged data for 2040–2059 and projections for 2090 represent averaged data for 2080–2099. Values presented are averages across the NARCliM2.0 model ensemble, and do not represent the full range of plausible climate futures. Regional climate change impacts are used to highlight how the region is likely to be affected by climate change, and impacts are not limited to the examples provided. Sea-level rise data is from the IPCC's Sixth Assessment Report is presented relative to a baseline of 1995–2014.

Climate of the South East and Tablelands

The climate of NSW underpins a diverse array of important lifestyles, industries and natural ecosystems. A stable climate is critical to support a range of values in NSW, including our food systems, recreational activities and unique biodiversity.

The South East and Tablelands region is in the south-east corner of NSW, and includes cities, towns and settlements surrounding the ACT, including Batemans Bay, Bega, Cooma, Goulburn, Moss Vale, Queanbeyan, Yass and Young.
The South East and Tablelands region offers snow, surf and rural living, with connections to Canberra and Sydney. The region is known for its beautiful beaches, large coastal embayments and Australia's highest summits, including Mount Kosciuszko. It also contains the headwaters of some of Australia's most famous rivers including the Lachlan, Murray, Murrumbidgee and Snowy.

Current climate

The topography of the South East and Tablelands region results in a large range of climates. It is relatively wet close to the coast and Snowy Mountains and drier inland. It is hot in summer in the northern inland areas and very cold in winter in the Snowy Mountains. Milder conditions are found along the coast, with cooler temperatures in summer and warmer temperatures in winter. The southern tablelands and south-eastern slopes contain many temperate grassland, woodland, wet forest and alpine ecosystems, and plant and animal species not found elsewhere in NSW.

Table 1. Baseline climate for the South East and Tablelands

	Average temperature	Hot days	Cold nights	Rainfall	Severe fire weather days
Observed	13.0°C	4.9	86.8	723mm	0.5
Historical model	12.7°C	4.4	88.9	743mm	1.2

Table 1 outlines the annual average values for the 1990–2009 baseline period in this snapshot. All observed data is calculated from Bureau of Meteorology products. Long-term temperature change data is from the long-term temperature record.[1] Observed information and data in graphs come from Australian Gridded Climate Data (AGCD).[2]

Temperature

The South East and Tablelands is getting warmer

Temperature is the most robust indicator of climate change. In NSW, 6 of the 10 warmest years on record since 1910 have occurred since 2013. The warmest year on record for both mean temperature and maximum temperature in the South East and Tablelands region was 2019, when average temperature was 0.9°C above the 1990–2009 average.[2]

3.6°C

rise in temperature across the South East and Tablelands by 2090 under a high-emissions scenario

6 of 10

warmest years on record have occurred since 2013

Projections

Across the South East and Tablelands region, average temperatures will continue to increase throughout this century (Figure 2).

Under a low-emissions scenario, the average temperature increase across the region is projected to be less than 0.1°C between 2050 and 2090 (Table 2). However, a major temperature increase of 1.8°C is projected during the same period under a high-emissions scenario. Notably, the temperature projections for 2050 under a high-emissions scenario are expected to exceed the projections for 2090 under a low-emissions scenario.

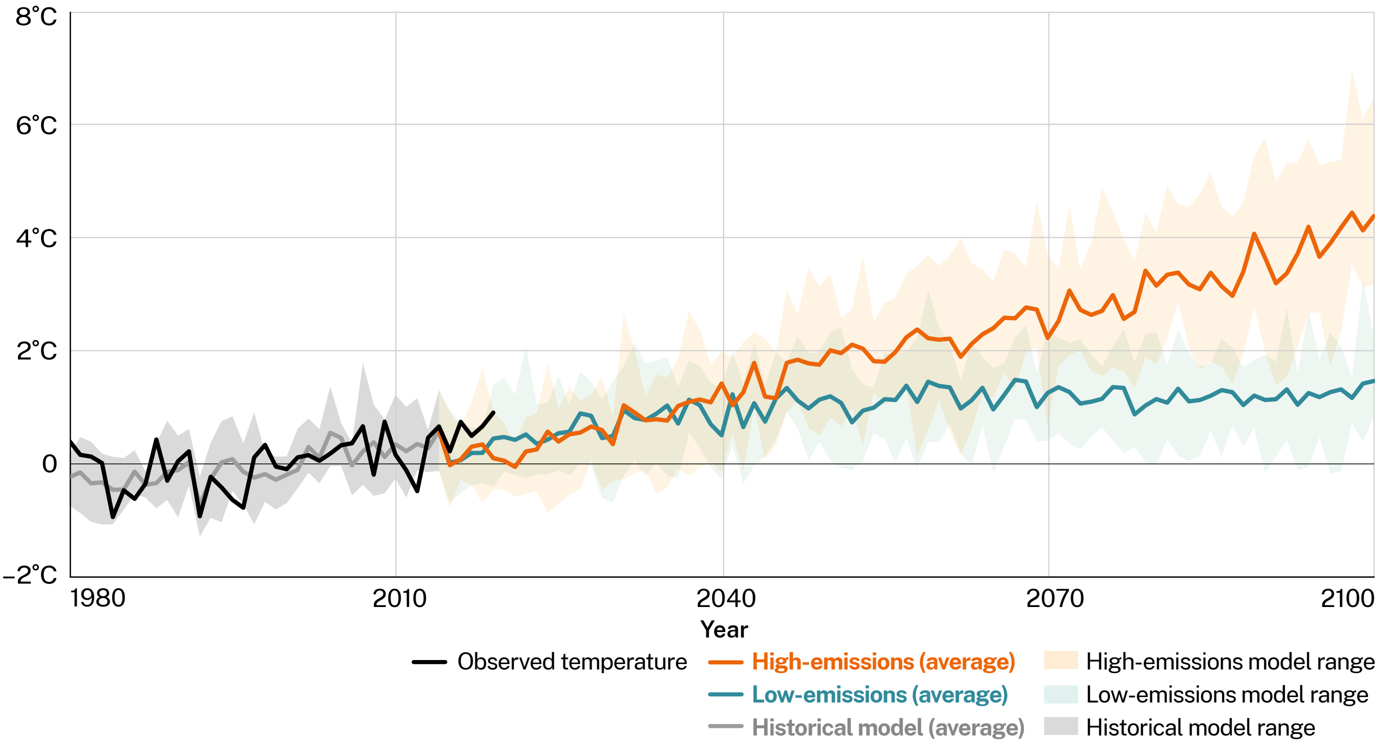
Temperature increases are expected in all parts of the region (Figure 3) and across all seasons. The ocean's moderating influence results in somewhat lower temperature increases along the coast compared to inland areas. Inland areas of the region, including towns such as Queanbeyan, Cooma and Young, will experience the greatest increases in temperature. By 2090, Cooma is likely to experience an increase in temperature of 1.2°C under a low-emissions scenario and 3.6°C under a high-emissions scenario. Comparatively, Batemans Bay is likely to experience an increase in temperature of 1.1°C under a low-emissions scenario and 3.2°C under a high-emissions scenario.

Table 2. Projected annual average temperature increase – South East and Tablelands

	2050		2090	
	Low-emissions	High-emissions	Low-emissions	High-emissions
Temperature	**1.1°C** (0.5–1.5°C)	**1.8°C** (0.8–2.6°C)	**1.2°C** (0.5–1.8°C)	**3.6°C** (2.3–5.1°C)
Maximum temperature	**1.2°C** (0.5–1.7°C)	**2.0°C** (0.9–2.9°C)	**1.3°C** (0.5–2.1°C)	**3.8°C** (2.5–5.4°C)
Minimum temperature	**1.0°C** (0.5–1.4°C)	**1.7°C** (0.8–2.4°C)	**1.1°C** (0.6–1.6°C)	**3.5°C** (2.3–4.9°C)

The bold number is the ensemble average for the period. Underneath the average is the ensemble range.

Figure 2. Historical and projected average temperature change – South East and Tablelands

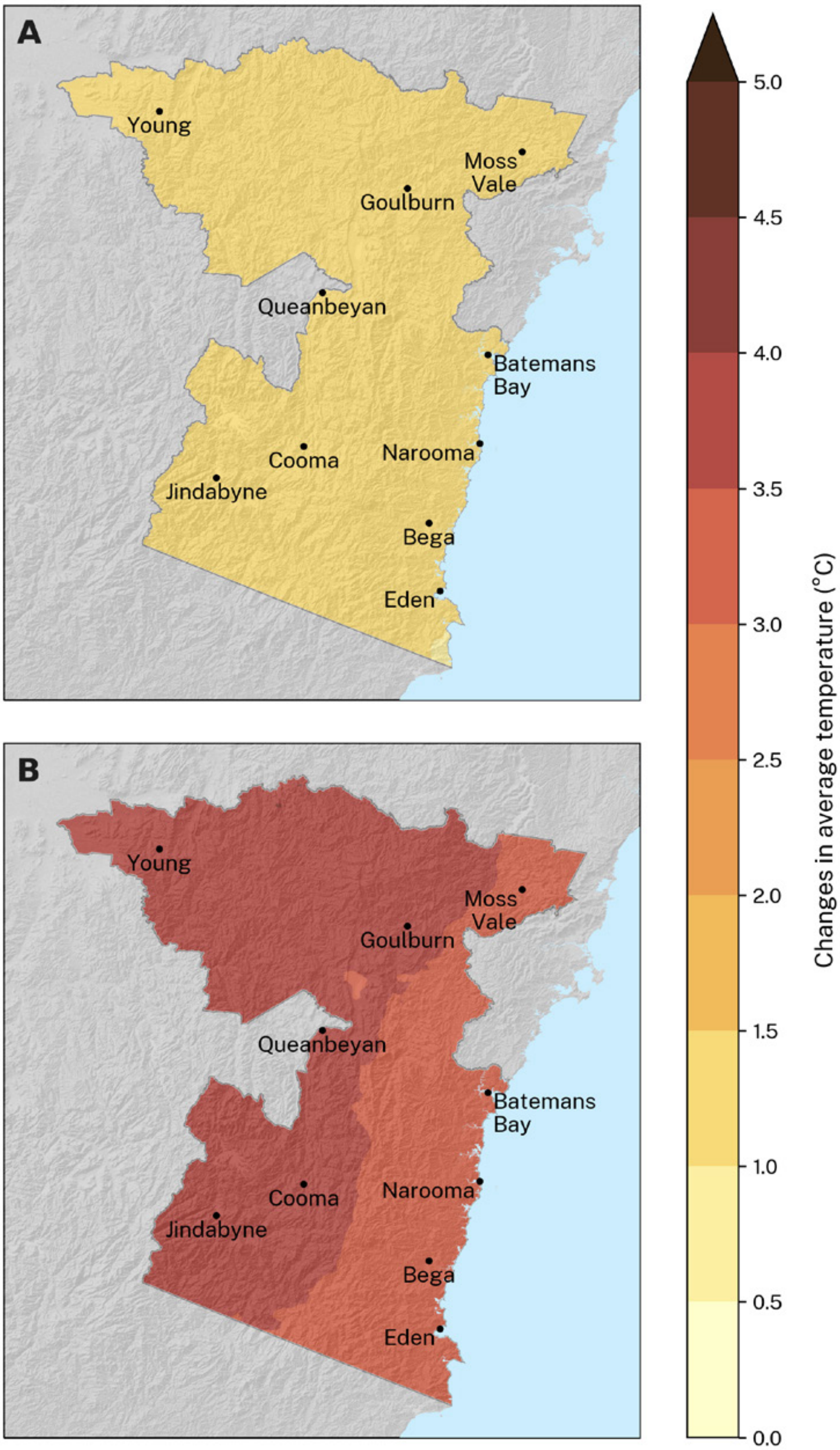


The shading around the graphs

The climate change projections presented in this snapshot are relative to the historical climate baseline of 1990–2009. The graphs provide a projected annual average for the 2 emissions scenarios.

The range of plausible climate futures across the NARCliM model ensemble is shown by light shading. For historical climate data, both recorded observational data (dark line) and modelling of the past climate in NARCliM2.0 (grey) are presented.

Figure 3. Projected change in average temperature by 2090 for the South East and Tablelands under A) a low-emissions scenario and B) a high-emissions scenario



www.climatechange.environment.nsw.gov.au/

Hot days

Hot days will become more frequent

Prolonged hot days where maximum temperatures are equal to or above 35°C increase the incidence of illness and death – particularly among vulnerable people. Seasonal changes in hot days could have significant impacts on bushfire danger, infrastructure and native species.

Projections

The number of hot days varies widely across the South East and Tablelands region. During the baseline period, areas along the coast and higher-elevation alpine areas had on average less than 1 hot day per year. Inalnd areas, such as Moss Vale, Goulburn and Queanbeyan, had on average fewer than 5 hot days per year, while western areas of the region near Young had on average fewer than 20 hot days per year.

Changes to **temperature extremes** often have **more pronounced impacts** than changes in average **temperatures.**

Higher maximum temperatures affect health through **heat stress** and exacerbate existing health conditions.

The number of hot days will increase for the South East and Tablelands region by 2050 for both a low-emissions and a high-emissions scenario, with an even greater increase by 2090 under a high-emissions scenario (Table 3). The number of hot days is projected to increase across spring, summer and autumn, with the largest increase in summer.

Under a low-emissions scenario, there is a minimal increase of less than 1 additional hot day per year projected across the region between 2050 and 2090. However, an increase of 8.9 additional hot days per year is projected under a high-emissions scenario during the same period.

By 2090, the South East and Tablelands could experience nearly five times the number of hot days per year under a high-emissions scenario.

The changes will occur across most of the region (Figure 5). The north-western area of the region near Young and Goulburn is projected to experience pronounced increases in the number of hot days. Coastal areas will experience a comparatively lower increase due to the moderating influence of the ocean. By 2090, Young is projected to experience 13.2 additional hot days per year under a low-emissions scenario and 39.9 additional hot days per year under a high-emissions scenario. A high-emissions scenario is projected to more than triple Young's baseline period average of 16.7 hot days per year. Comparatively, on the coast, Batemans Bay's baseline period average is 1 hot day per year. By 2090, Batemans Bay is projected to experience an additional 1.3 hot days per year under a low-emissions scenario and 3.8 additional hot days per year under a high-emissions scenario.

Table 3. Projected increase in average annual number of hot days – South East and Tablelands

2050		2090	
Low-emissions	High-emissions	Low-emissions	High-emissions
3.9 days (0.7 to 7.3 days)	**7.0 days** (1.0 to 15.0 days)	**4.7 days** (1.2 to 11.0 days)	**15.9 days** (7.0 to 30.9 days)

The bold number is the ensemble average for the period. Underneath the average is the ensemble range.

Figure 4. Historical and projected change in annual number of hot days – South East and Tablelands

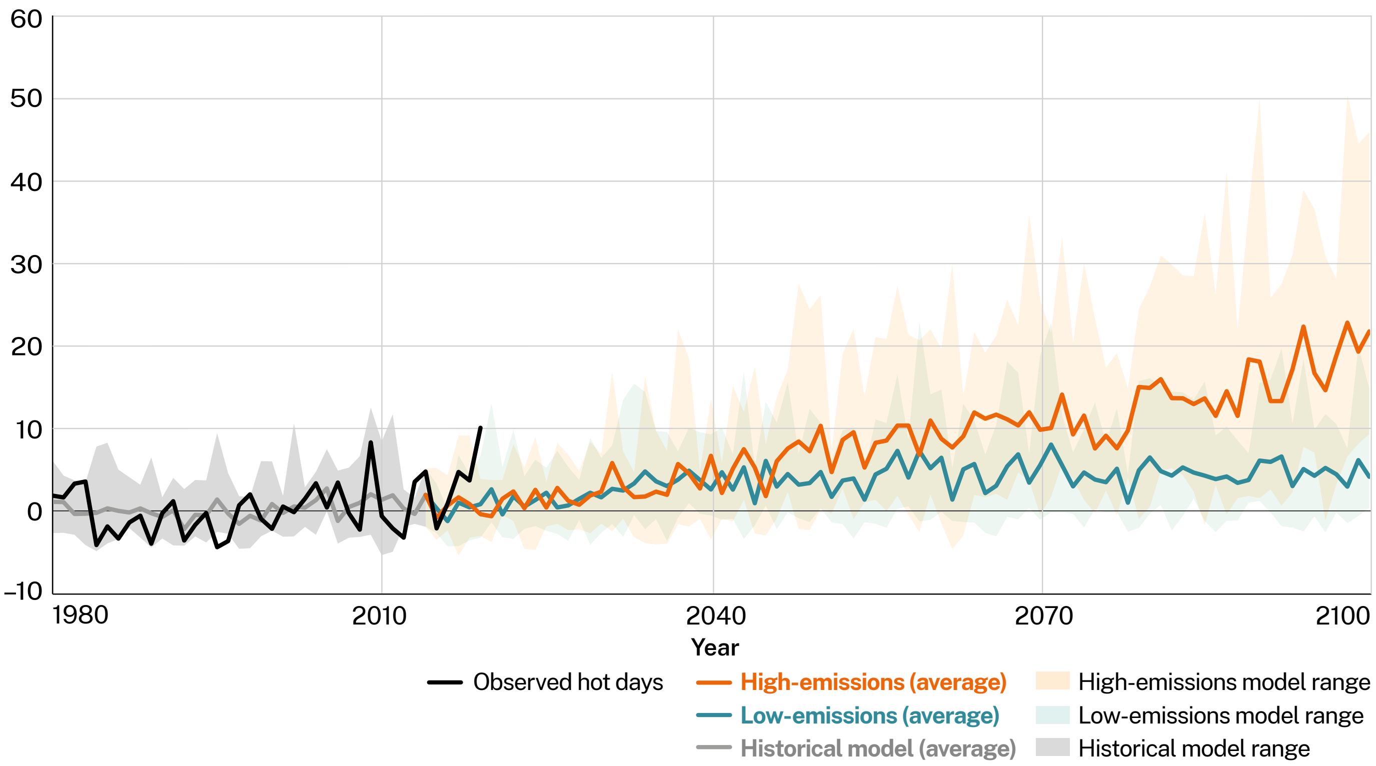
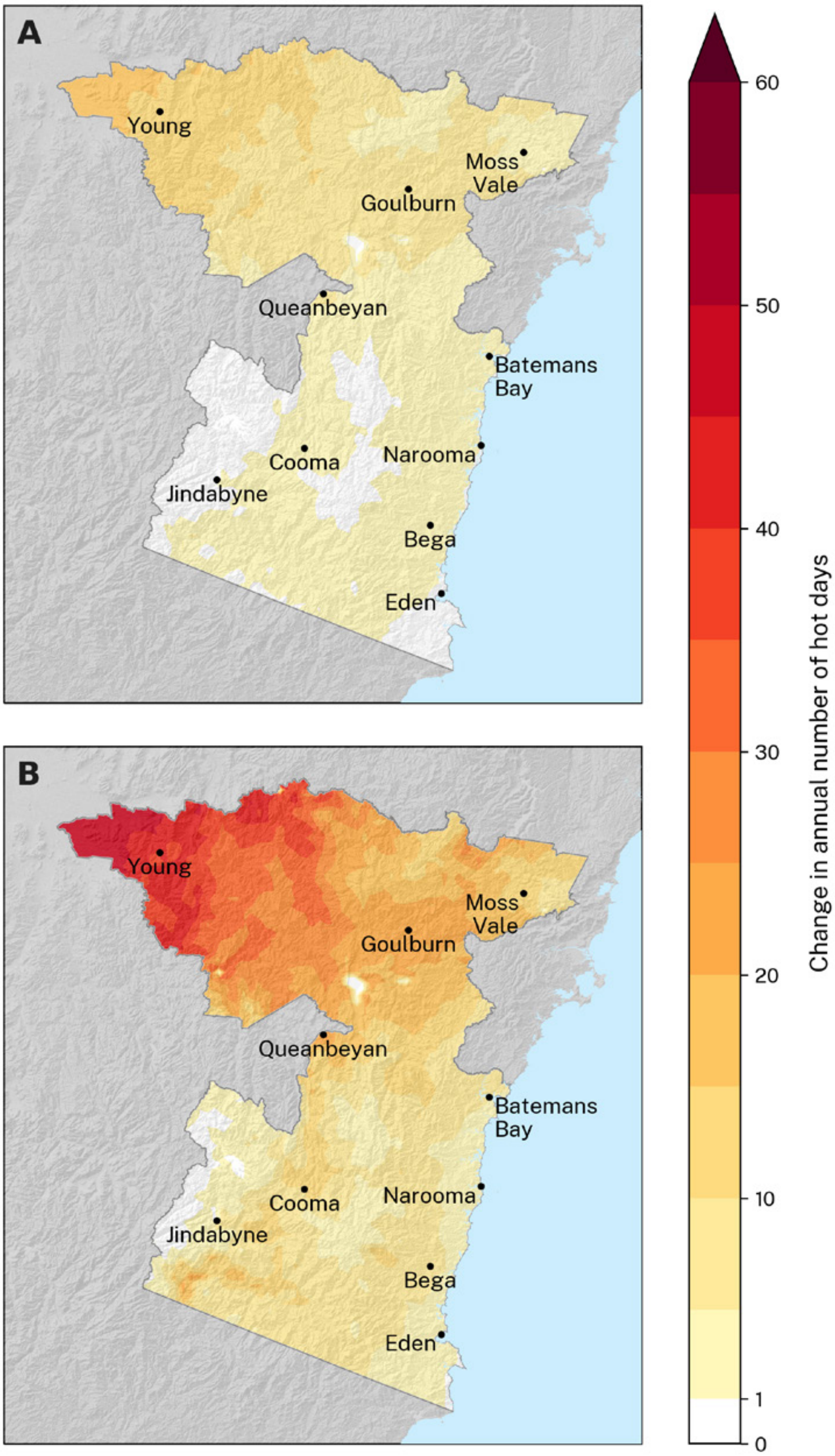


Figure 5. Projected change in annual number of hot days by 2090 for the South East and Tablelands under A) a low-emissions scenario and B) a high-emissions scenario



www.climatechange.environment.nsw.gov.au/

Cold nights

Cold nights will decrease

Cold nights are those where the minimum temperature drops below 2°C. These are important for the viability of some important plant species. For example, some common temperate fruit species require sufficiently cold winters to produce flower buds and alpine ecosystems are reliant on cold nights.

Projections

Cold nights in the South East and Tablelands region generally occur for most inland areas of the region, particularly in the Snowy Mountains. During the baseline period, areas of higher elevation in the Snowy Mountains including regional towns such as Cooma had on average more than 140 cold nights per year. Lower elevation inland areas such as Goulburn, Queanbeyan and Young had on average 70–90 cold nights per year. Areas along the coast rarely experience cold nights, with locations such as Batemans Bay and Eden having 1 cold night per year.

The number of cold nights will decrease for the South East and Tablelands region by 2050 for both a low-emissions and a high-emissions scenario, with an even greater decrease by 2090 under a high-emissions scenario (Table 4). The number of cold nights is projected to decrease across autumn, winter and spring, with the largest decreases in winter.

Under a high-emissions scenario, alpine areas of the region could experience **half the annual number** of cold nights by 2090.

Under a low-emissions scenario, the number of cold nights across the South East and Tablelands could **reduce by less than 25%** by 2090.

Under a low-emissions scenario, there is a small decrease of 3.4 fewer cold nights per year projected across the region between 2050 and 2090 (Table 4). However, a decrease of 27.2 fewer cold nights per year is projected under a high-emissions scenario during the same period.

Cold nights will decrease across most of the region, particularly in the higher elevation areas in the south-west (Figure 7). Coastal areas will not experience any changes, as they rarely experience cold nights. The greatest decreases are projected to occur for the Snowy Mountains including Jindabyne and Cooma. By 2090, Cooma is projected to have 22.0 fewer cold nights per year under a low-emissions scenario and 69.4 fewer cold nights per year under a high-emissions scenario. A high-emissions scenario is projected to reduce Cooma's 143.6 cold nights per year base period average by more than 45%.

Table 4. Projected decrease in average annual number of cold nights – South East and Tablelands

2050		2090	
Low-emissions	High-emissions	Low-emissions	High-emissions
16.4 days (7.9 to 24.0 days)	**28.0 days** (15.9 to 36.1 days)	**19.8 days** (11.9 to 26.0 days)	**55.2 days** (43.1 to 69.3 days)

The bold number is the ensemble average for the period. Underneath the average is the ensemble range.

Figure 6. Historical and projected change in annual number of cold nights – South East and Tablelands

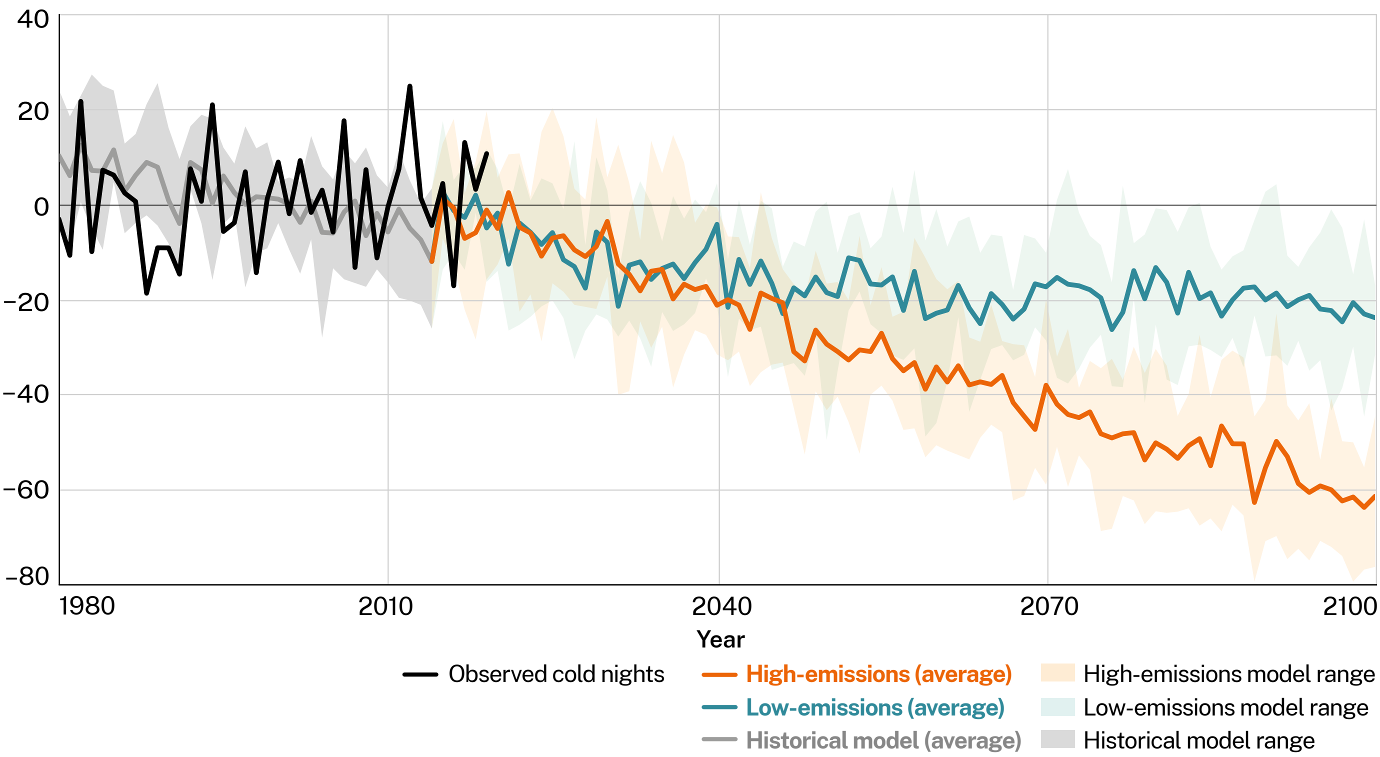
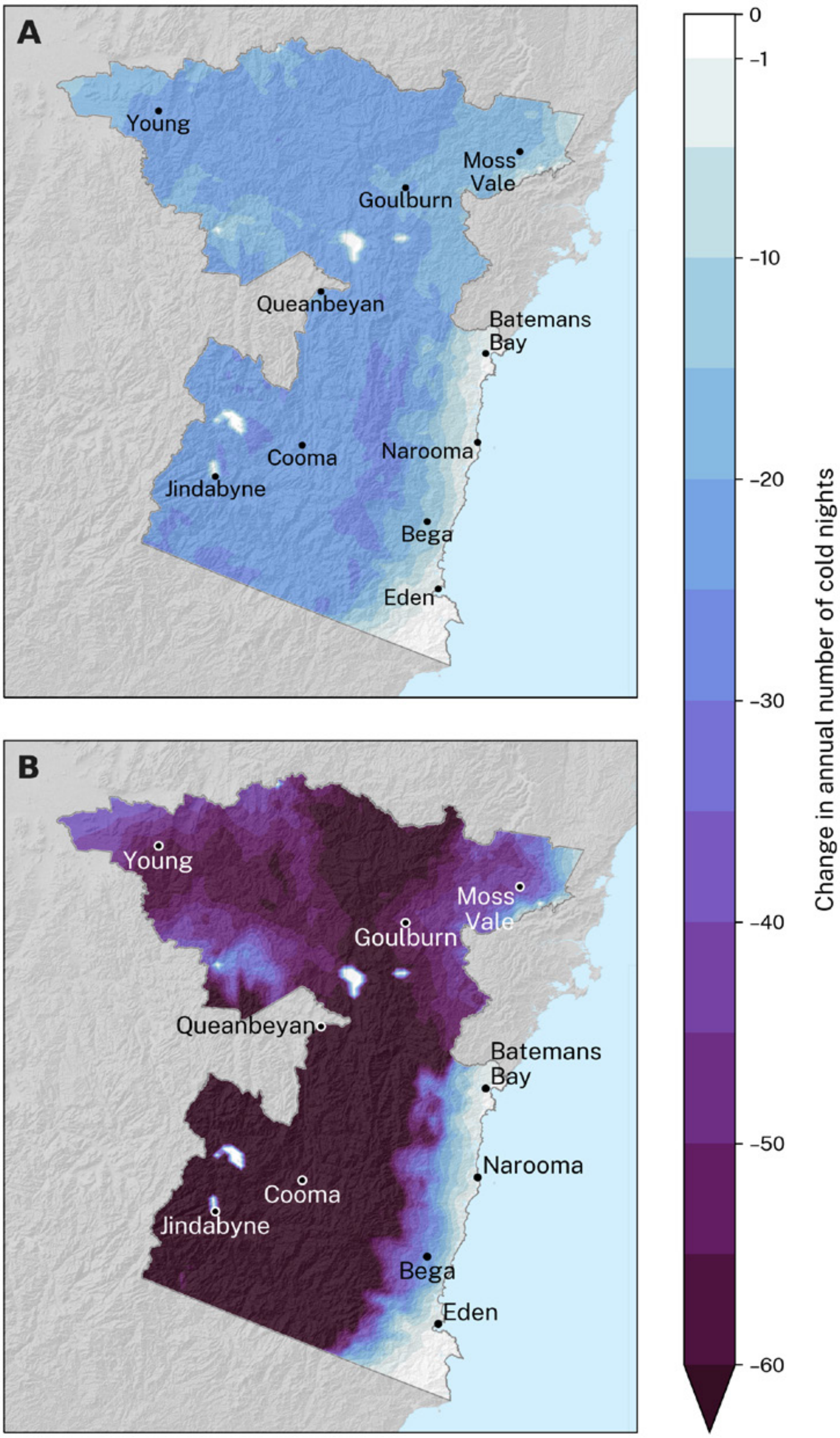


Figure 7. Projected change in annual number of cold nights by 2090 for the South East and Tablelands under A) a low-emissions scenario and B) a high-emissions scenario



Rainfall

Rainfall is projected to remain variable

Climate change will influence rainfall patterns and total amount of rainfall that NSW receives. These changes may have widespread impacts on water security, agricultural productivity and native species' reproductive cycles.

Modelling rainfall is more difficult than modelling temperature due to the complexities of the weather systems that generate rain. NARCliM projections capture a range of plausible climate futures under the 2 emissions scenarios, including wet and dry outcomes. This means that rainfall is inherently more variable in the NARCliM projections than temperature, and the full range of rainfall projections should be taken into account. This can be explored further on the AdaptNSW Interactive Map.

NSW has experienced rainfall extremes in recent decades, with significant impacts on communities, infrastructure and natural ecosystems.

Annual rainfall across the South East and Tablelands region averages about 720mm.[2] Rainfall is highest in the Snowy Mountains. The coast and the Southern Highlands also experience high rainfall, with the area around Goulburn and the Monaro experiencing relatively lower rainfall. Rainfall is nearly uniformly distributed throughout the year with slightly more rain in summer and autumn. The driest year on record was 1982, which had an average rainfall of only 370mm. A notably dry year was also experienced in 2019, with approximately 460mm of rainfall across the region.[2]

Projections

This snapshot provides data on average rainfall change and does not provide data on rainfall extremes and the impacts of climate change on flooding.

By 2090, average spring rainfall could decrease by more than 15% across the South East and Tablelands under a high-emissions scenario.

Annual average rainfall in the region is projected to remain variable throughout this century (Figure 8). By 2090, on average, annual rainfall is projected to decrease by 10% under a low-emissions scenario and by 12% under a high-emissions scenario (Table 5).

By 2090, on average, winter rainfall is projected to decrease across the region by 8% under a low-emissions scenario and by 24% under a high-emissions scenario. Areas near the Great Dividing Range and in the Southern Highlands are projected to experience the greatest decreases in average winter rainfall. By 2090, for average winter rainfall, Moss Vale is projected to experience a decrease by 22% under a low-emissions scenario and approximately 41% under a high-emissions scenario.

By 2090, on average, spring rainfall is projected to decrease across the region by 14% under a low-emissions scenario and by 18% under a high-emissions scenario. Areas in the west and north-west of the region including the Snowy Mountains are projected to experience the greatest decreases in average spring rainfall.

On average, summer and autumn rainfall is projected to change by 10% or less across the region by 2090 under both a low-emissions scenario and a high-emissions scenario. Refer to the Interactive Map for further seasonal information.

Table 5. Projected change to average rainfall – South East and Tablelands

	2050		2090	
	Low-emissions	High-emissions	Low-emissions	High-emissions
Annual	**–7.7%** (–14.9% to +10.0%)	**–14.3%** (–31.5% to –0.5%)	**–9.9%** (–22.3% to +11.3%)	**–11.6%** (–32.9% to +10.5%)
Summer	**–7.6%** (–22.2% to +22.2%)	**–15.9%** (–33.6% to +15.6%)	**–11.9%** (–31.1% to +31.9%)	**–4.1%** (–38.1% to +40.9%)
Autumn	**–4.8%** (–19.7% to +13.8%)	**–9.6%** (–36.6% to +16.1%)	**–6.7%** (–24.5% to +13.1%)	**–1.7%** (–20.8% to +32.1%)
Winter	**–9.7%** (–22.8% to +32.6%)	**–17.2%** (–35.1% to +8.3%)	**–8.3%** (–28.3% to +19.8%)	**–23.7%** (–40.3% to +13.1%)
Spring	**–8.7%** (–25.2% to +30.4%)	**–14.1%** (–23.3% to –1.8%)	**–12.3%** (–25.3% to +3.7%)	**–18.3%** (–38.4% to –3.5%)

The bold number is the ensemble average for the period. Underneath the average is the ensemble range.

Figure 8. Historical and projected change to average rainfall – South East and Tablelands

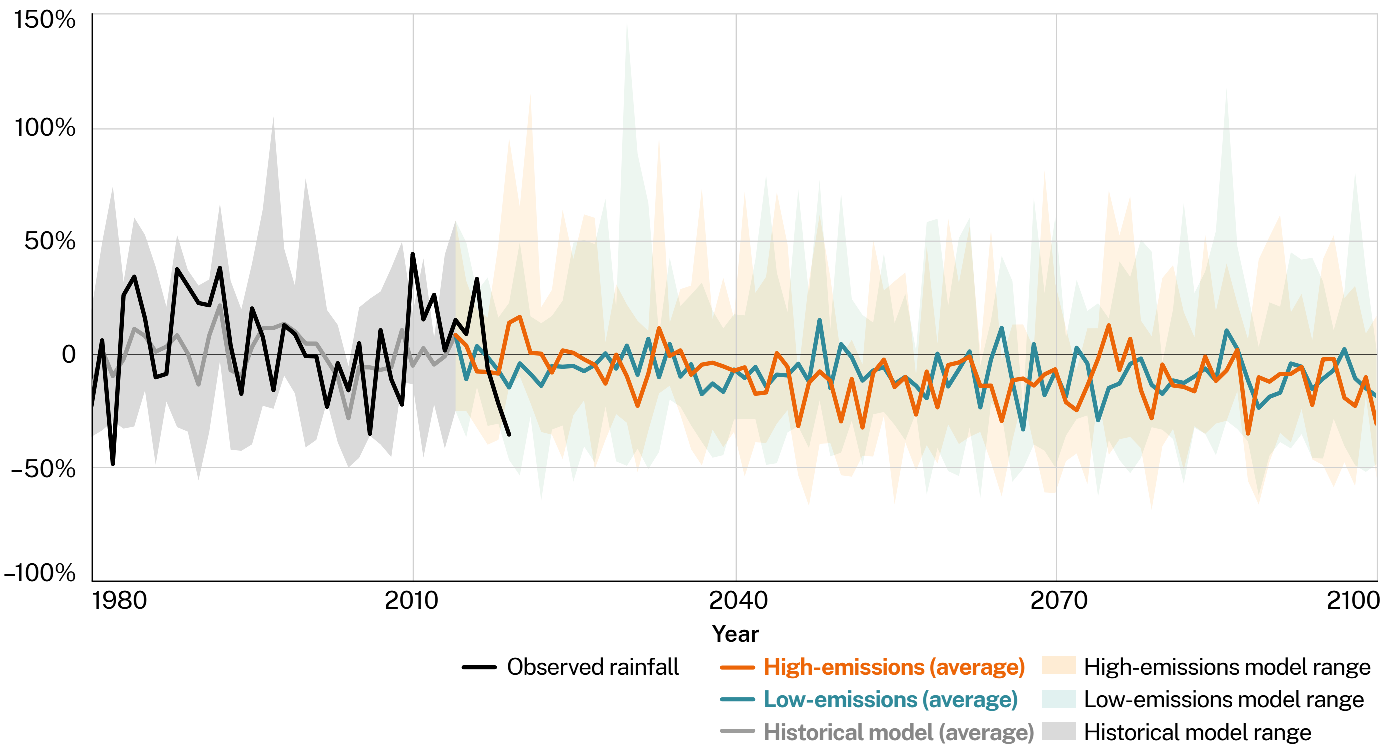
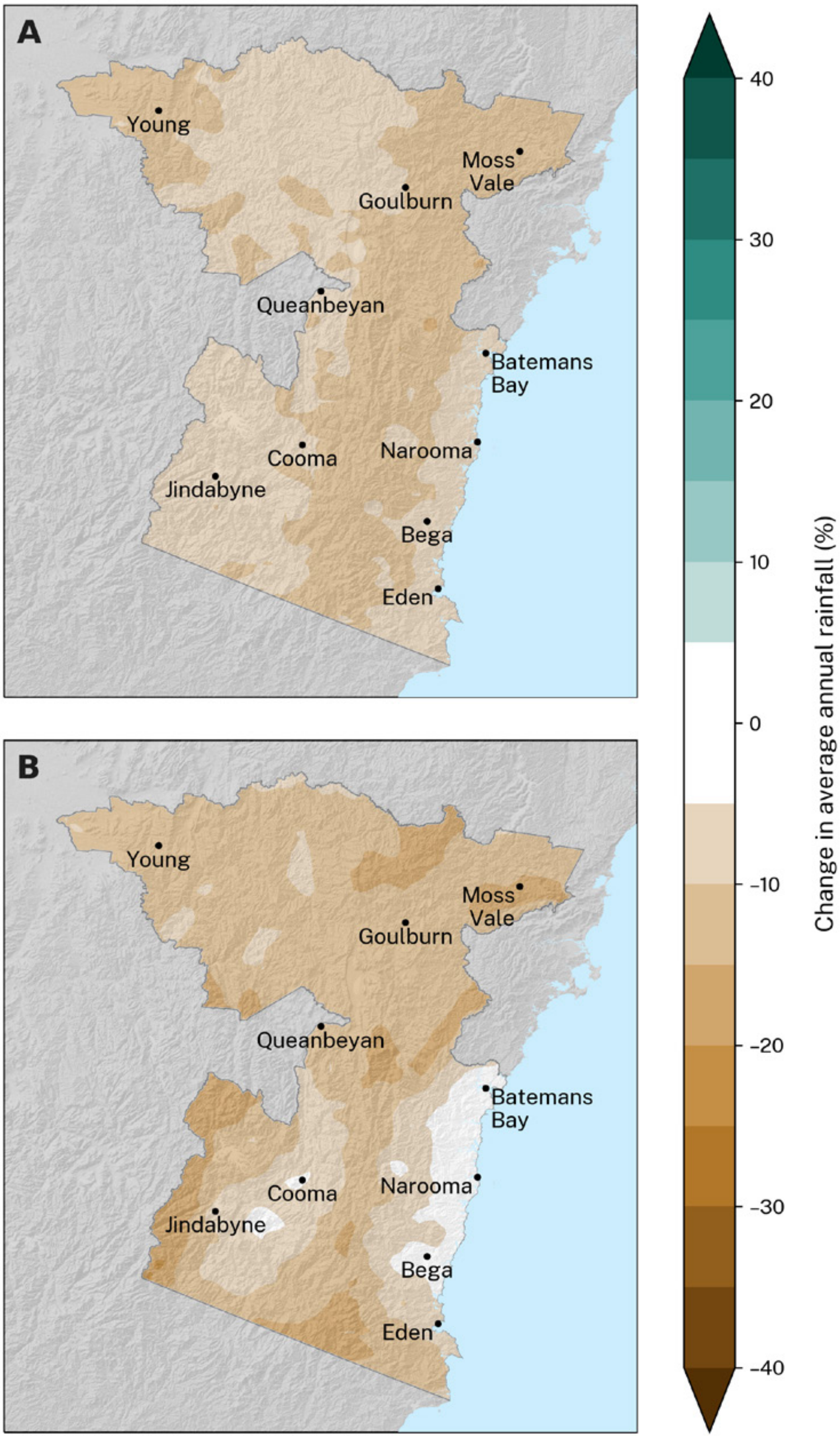


Figure 9. Projected change to average rainfall by 2090 for the South East and Tablelands under A) a low-emissions scenario and B) a high-emissions scenario



Severe fire weather

Severe fire weather will increase

The Forest Fire Danger Index (FFDI) represents an estimate of fire weather risk. The FFDI is calculated from temperature, relative humidity and wind speed, as well as a number representing fuel dryness.

Severe fire weather (FFDI greater than 50) is most likely in summer and spring. Fire weather was the strongest determining factor of house loss during the Black Summer bushfires.[3] The number of severe fire danger days observed for the South East and Tablelands region is 0.5 days per year on average.[2] The number of severe fire danger days is generally low across the region, with relatively more severe fire danger days in northern inland areas of the region such as Goulburn and Young. The record number of severe fire danger days in a year was 2019 with approximately 3.7 days on average across the region,[2] including 3 days recorded at the Bega station and 5 days recorded at the Cooma station.[4]

Fire weather was the strongest determining factor of house loss during the Black Summer bushfires.[3]

FFDI was monitored by weather stations across NSW and the ACT until the introduction in 2022 of the Australian Fire Danger Rating System. FFDI is used in this snapshot as it can be simulated using the NARCliM projections, whereas data used by the Australian Fire Danger Rating System cannot. FFDI also provides a long history of data and gives context to the NARCliM projections.

Projections

The number of severe fire weather days will increase for the South East and Tablelands region by 2050 under both a low-emissions and a high-emissions scenario, with an even greater increase projected by 2090 under a high-emissions scenario (Table 6). The number of severe fire weather days is projected to increase during spring and summer, with the largest increase in summer.

Under a high-emissions scenario, the number of annual severe fire weather days could triple across the South East and Tablelands by 2090.

Increases to severe fire weather days are projected to occur across most of the region (Figure 11). The greatest increases are projected to occur in inland areas including Young, although coastal areas will also see increases. By 2090, Young is projected to experience 1.9 additional severe fire weather days per year under a low-emissions scenario and 5.7 additional severe fire weather days per year under a high-emissions scenario. A high-emissions scenario is projected to more than double Young's baseline period average of 3.8 severe fire weather days per year. Comparatively, on the coast, Batemans Bay's baseline period average is 0.5 severe fire weather days per year. By 2090, Batemans Bay is projected to experience 0.4 additional severe fire weather days per year under a low-emissions scenario and 0.9 additional severe fire weather days per year under a high-emissions scenario.

Table 6 Projected increase in average annual number of severe fire weather days – South East and Tablelands

2050		2090	
Low-emissions	High-emissions	Low-emissions	High-emissions
0.5 days (–0.6 to 1.4 days)	**1.2 days** (0.2 to 2.5 days)	**0.7 days** (–0.5 to 2.1 days)	**2.4 days** (0.3 to 5.5 days)

The bold number is the ensemble average for the period. Underneath the average is the ensemble range.

Figure 10. Historical and projected change to annual number of severe fire weather days – South East and Tablelands

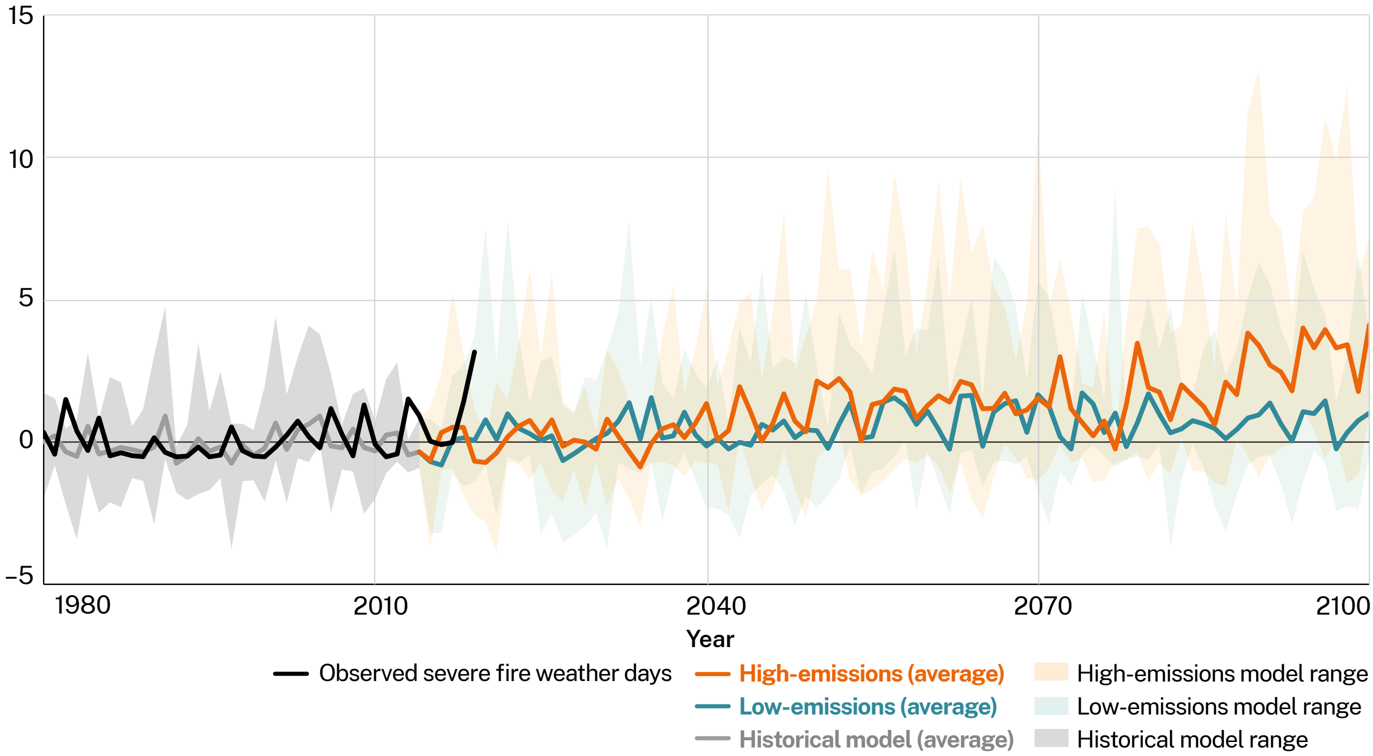
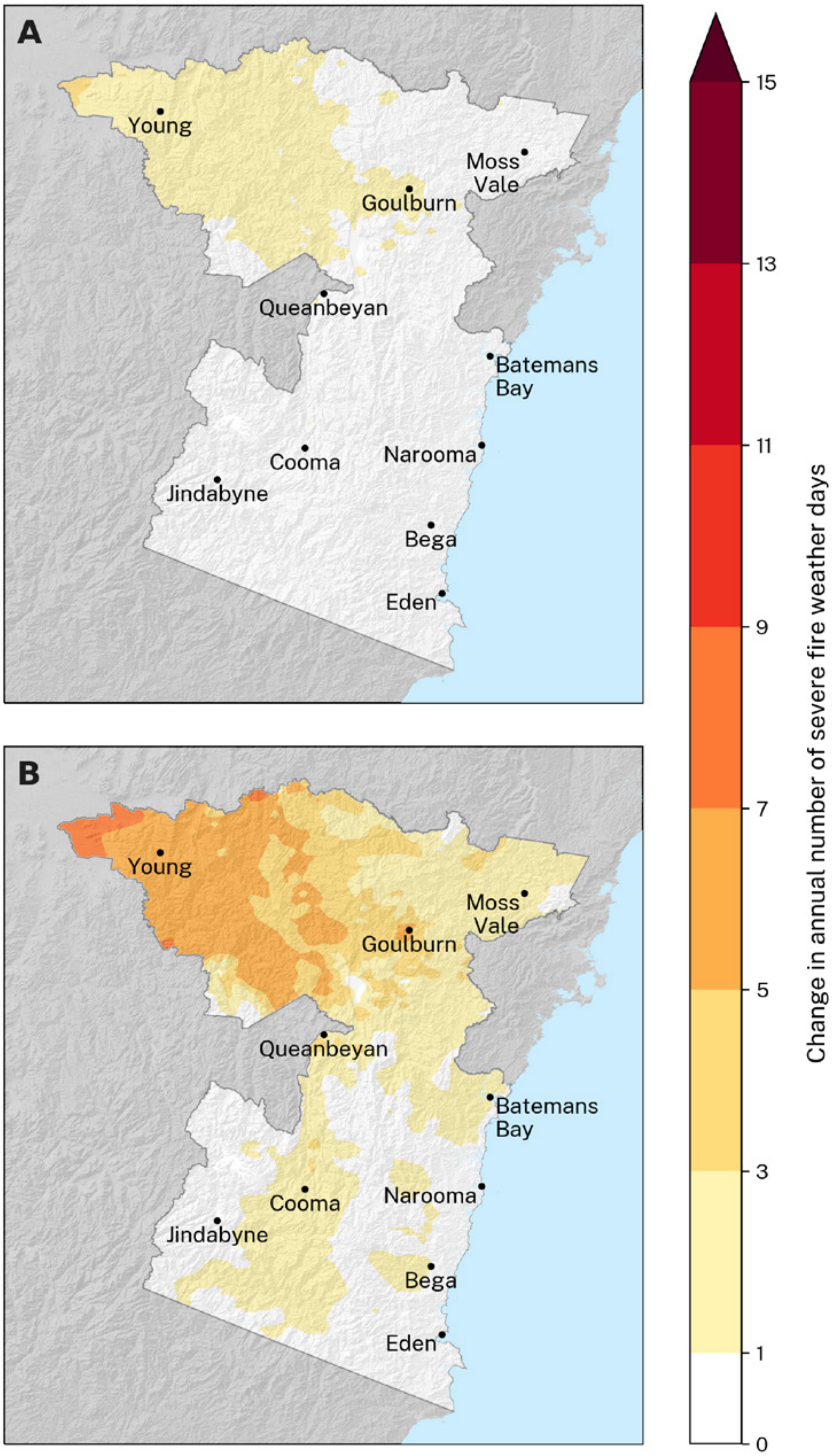


Figure 11. Projected change to annual number of severe fire weather days by 2090 for the South East and Tablelands under A) a low-emissions scenario and B) a high-emissions scenario



Sea-level rise

Sea-level rise will accelerate

Sea levels are rising and are projected to have a major impact on coastal communities in NSW over coming decades. At the NSW baseline sea-level monitoring gauge at Port Kembla, average sea level has been rising at a rate of approximately 3.7mm/year since 1991.

Sea-level rise of 3.7mm/year has already led to increases in inundation of streets in some NSW coastal communities.[5,6]

The 'likely' range of sea-level rise is presented here by the low (SSP1-2.6) and high (SSP3-7.0) emissions scenarios, to correspond with the NARCliM climate projections. This likely range was assessed by the IPCC as data within an uncertainty interval of 66%. A broader range of projections and uncertainty is available in the 2021 IPCC Sixth Assessment Report.

Sea level along the South East and Tablelands coast is projected to continue rising under all emissions scenarios. At Eden, sea level is projected to rise by 11–25cm under a low-emissions scenario and by 16–28cm under a high-emissions scenario by 2050 relative to a baseline period of 1995–2014.

Later in the century, sea-level rise is projected to accelerate under both emissions scenarios, with significantly faster acceleration under a high-emissions scenario. Sea-level rise by 2100 is projected to be 22–57cm under a low-emissions scenario and 51–92cm under a high-emissions scenario. Even greater sea-level rise will occur by 2150, with a projected rise of 31–93cm under a low-emissions scenario and 85–167cm under a high-emissions scenario.

These projections do not factor in contributions from ice-sheet instability, which have high uncertainty. The IPCC addresses this uncertainty by providing modelling explained in a low-likelihood, high-impact storyline assessed as 'low-confidence'. At Eden, this low confidence modelling indicates a potential upper limit of sea-level rise of 41cm by 2050, 1.6m by 2100 and 4.7m by 2150.

Sea-level rise will continue for centuries to millennia due to the longer-term response of the oceans and ice sheets to climate change.

In the longer term, the IPCC indicates sea level will rise for centuries to millennia due to continuing deep ocean warming and ice-sheet melt, remaining elevated for thousands of years. If global warming is limited to 1.5°C, average sea level will rise by about 2–3m worldwide. For 2°C warming, sea-level rise of 2–6m is expected, and for 5°C warming, 19–22m is expected.

Climate change impacts on the South East and Tablelands

Climate change is already impacting the South East and Tablelands region, particularly through increased temperatures and changes to rainfall. Climate change will continue impacting a variety of important economic, cultural and environmental values across the region.

Decreased cold nights

Natural snow depth in alpine areas has declined by over one-third since the 1950s. Years with persistent heavy snow cover have become rare. Continued decline in snow depth is likely to have significant impacts on the Snowy Mountains Scheme that generates hydro-electric power and provides water for irrigation, which is highly reliant on spring snowmelt and rainfall.[7] Further reductions in natural snow depth are likely to cause a decline in recreational opportunities, with impacts to local economies dependent on snow-based tourism.

Other significant impacts from climate change can be expected on alpine biodiversity. Critically endangered snowpatch plant communities that depend on long-lasting snow cover may decline in extent as snow cover decreases and competition from other species increases.[8] The endangered mountain pygmy possum requires snow cover for hibernation and protection from predators. Reduced snow cover from climate change may further restrict available habitat for the mountain pygmy possum.[9]

Bushfires

The region also experienced significant impacts during the 2019–2020 bushfire season with extensive impacts on communities, infrastructure and natural ecosystems. Over 1,000,000 hectares of the region were burnt and 1135 homes were destroyed.[10] Large areas of bushland experienced extreme fire severity, including the Beowa, Deua, Wadbilliga and Kosciuszko National Parks. Over 27,000 hectares or 21% of NSW alpine vegetation was burnt, adding to extensive areas of alpine vegetation still recovering from severe fires that occurred in 2002–2003.[11] Severe fire danger days, which create the underlying conditions for large-scale bushfires, are expected to become more common in the future, particularly under a higher-emissions scenario.

References

[1] Long-term temperature record – webpage

[2] About Australian Gridded Climate Data maps and grids – webpage

[3] Price et al. 2020, Probability of house destruction. Theme 3A. People and Property Impacts, *Bushfire Risk Management Research Hub* for the NSW Bushfire Inquiry 2020 – webpage

[4] Bureau of Meteorology Station Data – webpage

[5] Hanslow et al. 2023, 'Sea level rise and the increasing frequency of inundation in Australia's most exposed estuary', *Regional Environmental Change,* 23:146

[6] Hague et al. 2020, 'Sea level rise driving increasingly predictable coastal inundation in Sydney, Australia', *Earth's Future*, 8:9

[7] Snowy Hydro – webpage

[8] Snowpatch Feldmark in the Australian Alps Bioregion – webpage

[9] Mountain Pygmy-possum – webpage

[10] Owens & O'Kane 2020, 'Final report of the NSW Bushfire Inquiry', *Department of Premier and Cabinet,* Sydney

[11] DPIE 2020, 'NSW fire and the environment 2019–20 summary', *Department of Planning, Industry and Environment,* Sydney

Climate action and information

Climate action

The NARCliM projections for the low-emissions scenario and the high-emissions scenario highlight the stark difference in climate change impacts that will be experienced under each scenario. The differences provide a reminder of the required action across the world to reduce emissions, and specifically within NSW to meet our legislated Net Zero by 2050 emissions reduction targets. This is our best chance at ensuring the future projections under the high-emissions scenario are avoided. The NARCliM projections highlight the importance of taking action to adapt to the impacts of climate change. For more resources on reducing emissions and adapting to the impacts of climate change, visit AdaptNSW.

Information

NARCliM projections are delivered with support from: the ACT, South Australian, Victorian and Western Australian governments; National Computational Infrastructure; Murdoch University; and the University of New South Wales. Detailed information on the methodology and application of the projections can be found on the AdaptNSW website.

Climate change information in this snapshot is delivered as part of the NSW Government's commitment to 'Publish regularly updated and improved local level climate change projections' under Action 3 of the NSW Climate Change Adaptation Strategy.

Photo credits
Cover page: Snow-covered moutains in Kosciuszko National Park, *leelakajonkij/iStock;* Photograph of dry alpine trees above the timberline in the Snowy Mountains in New South Wales, *Phillip Wittke/iStock*

Contents:
p.2: The Dark Emu Overhead, *Alan Dyer*
p.3: Revegetation in Australia, *MarkPlovesan/iStock*
p.6: Broadwater Oysters, Pambula, *Safari Global/ Destination NSW;* Streetscape, Central Tilba, *Destination NSW*
p.7: Surfer coming out of the ocean at sunrise, *Pat Suraseang/Destination NSW;* Navigate Expeditions, Pambula, *Safari Global/Destination NSW*
p.10: Hot day, *Serg64/Shutterstock*
p.13: Frost on the farm, *MacierPhotography/iStock;* Alpine vegetation, Kosciuszko Summit, Kosciuszko National Park, *John Spencer/NSW DCCEEW*
p.16: Rainforest, New South Wales, *Zaharov/iStock*
p.19: Forest fire, *byronsdad/iStock*
p.22: Top view drone aerial of coastal cliff rock formation above ocean, *Max2611/iStock*
p.23: Colourful Snow Gum trees (Eucalyptus pauciflora) and rocks line the Perisher Creek, *John Spencer/NSW DCCEEW*
p.24: Putting in a remote Rako line fire control, *Michael Jarman/DCCEEW*

NSW GOVERNMENT