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Seven things you need to know about State of the Climate 2022

The State of the Climate report summarises observations and trends in Australia's climate and outlines what we know about our climate future.

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BY CHRIS GERBING • 23 NOVEMBER 2022 • 5 MIN READ

We have released a new [State of the Climate 2022](#) report with the [Bureau of Meteorology](#). 

The report, our seventh in the bi-annual series, summarises observations and trends in Australia's climate. It provides a glimpse into what we know about Australia's climate future.

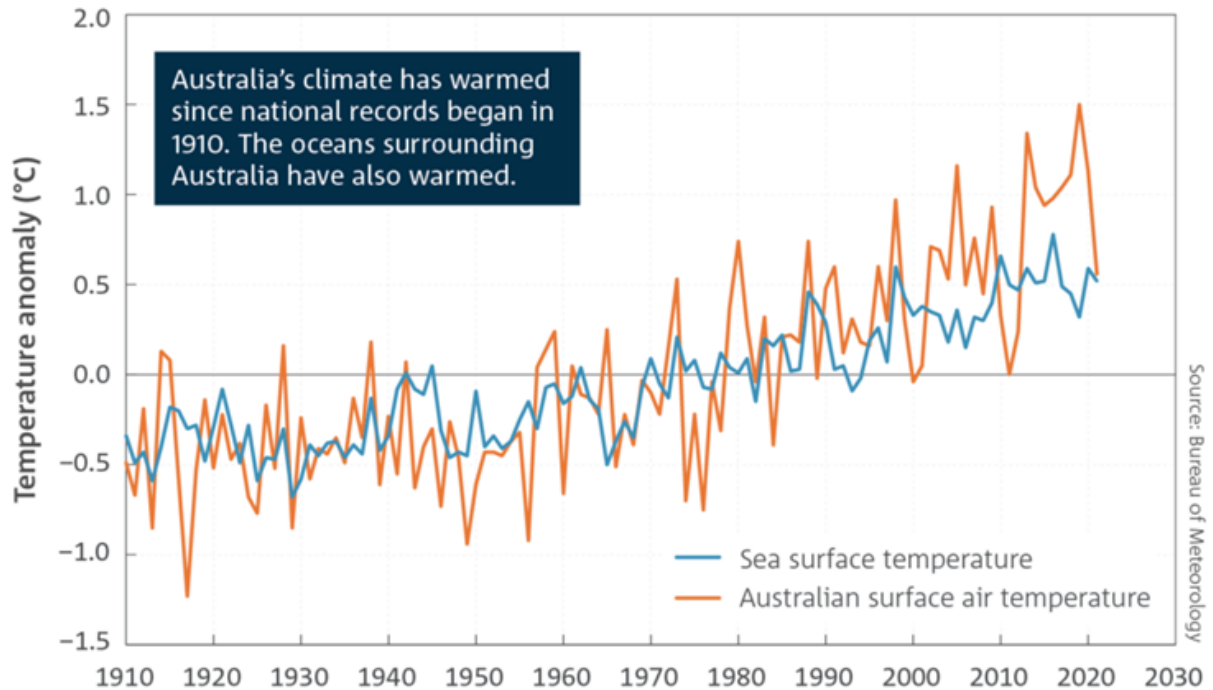
The report's release comes at a time when many Australians are being affected by our weather and climate systems.

Here are seven key take-outs from *State of the Climate 2022*.

1. Our climate is warmer

The atmosphere and ocean are warmer and will continue to warm.

Observational data show Australia has warmed on average by 1.47°C since 1910.



Australia's climate has warmed since national records began in 1910. The oceans surrounding Australia have also warmed.

2. Greenhouse gas concentrations are higher than ever before

Long-lived greenhouse gases contribute to global warming. They include carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). Observations of these greenhouse gasses are reported in *State of the Climate*.

In 2021 the world reached an annual mean CO₂ concentration of 414.4 parts per million (ppm). This is a 50 per cent increase from the concentration of 277 ppm in 1750.

There has been a [recent rapid rise of methane](#) and nitrous oxide concentrations in the atmosphere. These rises are unprecedented in three decades of monitoring.

It is not yet clear what is causing the CH₄ and N₂O increases. Scientists around the world, including our scientists and at the Bureau, are actively investigating.



The Kennaook/Cape Grim Baseline Air Pollution Station is the Southern Hemisphere's key greenhouse gas monitoring station in the World Meteorological Organization's Global Atmosphere Watch Programme.

3. Sea levels are rising

The *State of the Climate* report shows global mean sea level has risen by around 25 cm since 1880. Half of this has occurred since 1970, and sea levels will continue to rise.

Scientists have identified that one third of this rise has been caused by thermal expansion. When the ocean warms, it expands and sea level rises.

Two thirds of sea level rise is attributed to ice loss from glaciers and polar ice sheets, along with changes to water stored on the land.

The rate of global sea level change has accelerated. It grew from around 1.5 cm per decade between 1901 and 2000, to 3.5 cm per decade between 1993 and 2021.

For Australia, sea level varies from place to place and year to year. Tide gauges with good long-term records around Australia show that overall sea levels have risen. Satellite altimetry (measuring altitude) observations also show a consistent picture of sea level rise in the Australian region.



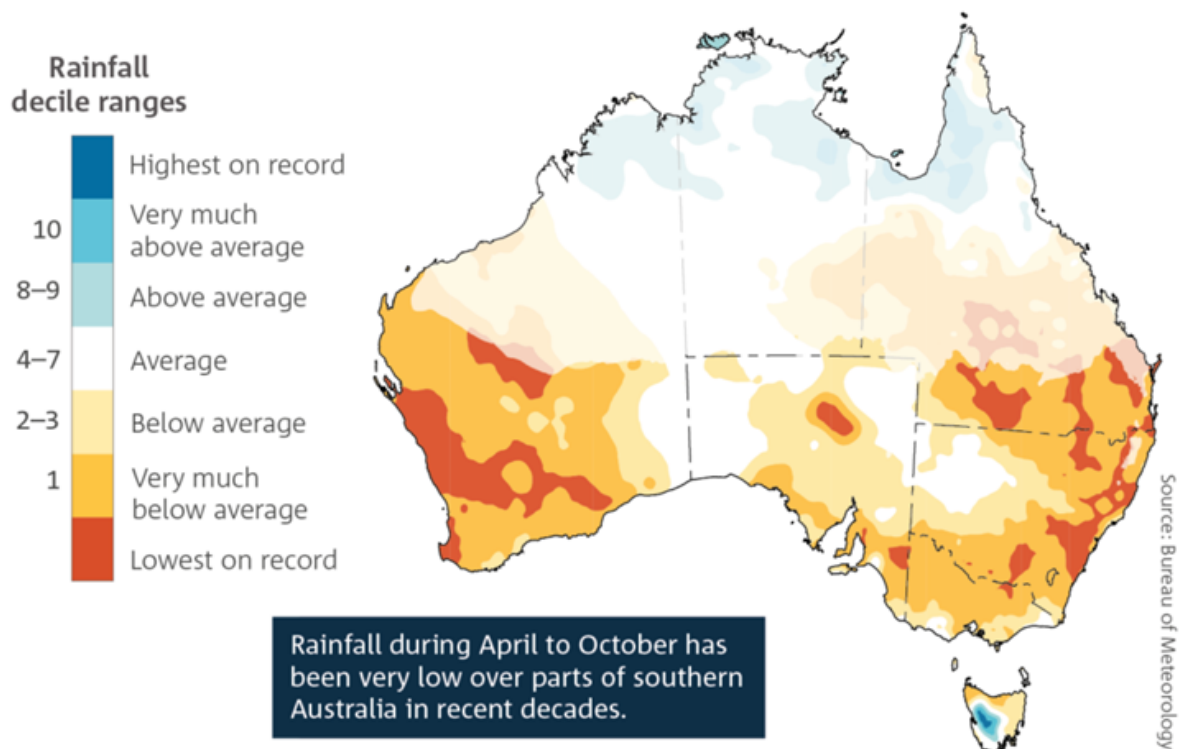
Australia's rainfall is strongly influenced by drivers such as [El Niño](#), [La Niña](#), the Indian Ocean Dipole and the Southern Annular Mode.

Despite three consecutive La Niña events leading to exceptionally wet conditions in many parts of eastern Australia, the observed trends for the south-east and south-west of the country show a shift towards drier conditions. This is especially true for the cool season months of April to October.

Three consecutive La Niña events are rare, but not unprecedented, with previous events including 1998-2001 and 1973-1976. Both of these occasions were also associated with widespread and prolonged flooding.

For northern Australia, the trend is different. Rainfall in the north of Australia has been increasing. Northern Australia has been wetter in the 21st century than in the 20th century across all seasons.

These trends are expected to continue into the future.



April to October rainfall deciles for the past 22 years (2000-21). This map shows where rainfall is above average, average, or below average for this period compared to all years from 1900. Areas across northern and central Australia that received less than 40% of their annual rainfall from April to October are faded.



occur on timescales of less than a day.

The intensity of short-duration (hourly) extreme rainfall events has increased by around 10 per cent or more in some regions in recent decades. Larger increases have been observed in the north.

Short-duration extreme rainfall events are often associated with flash flooding, which brings increased risk to communities.

As the climate warms our atmosphere can hold more water vapour. For every degree of warming the atmosphere can hold seven per cent more moisture.



Many Australians are already being affected by our weather and climate systems. Image credit: Clare Seibel-Barnes, [austockphoto.com.au](https://www.austockphoto.com.au). © Clare Seibel-Barnes, [austockphoto.com.au](https://www.austockphoto.com.au)

6. Don't forget about fire weather

While heavy rainfall and flooding is on our collective minds, the *State of the Climate* report reminds us about fire weather trends.

Since the 1950s, there has been an ongoing increase in extreme fire weather and in the length of the fire season across large parts of Australia.



Niña years can contribute to vegetation growth, which increases fuel loads when the vegetation dries out. High fuel loads are a key contributing factor to fire risk, particularly in northern and central regions.

Projections show fire weather is expected to, on average, continue to become more extreme.

7. Climate change impacts are being felt now

Climate change is already having widespread impacts on Australian industries such as agriculture. This affects food production and supply chains.

Large impacts can especially be seen during extreme events such as heatwaves or widespread flooding. Understanding how climate change contributes to extreme events is called 'event attribution'.

Scientists don't ask specifically if climate change is the cause, but whether human-caused climate change contributed to making an event more likely or more severe.

We now know with great certainty that human-caused climate change has made some [extreme events more likely or more severe](#).

Australia's climate will continue to change, but the rates of change will depend on future greenhouse gas emissions. The *State of the Climate* report shows Australia needs to plan for, and adapt to, the changing nature of climate risk now and in the decades ahead.

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