CLIMATE COUNCIL

CLIMATE WHIPLASH: WILD SWINGS BETWEEN WEATHER EXTREMES

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Key findings

1

Australians are weathering climate whiplash, as communities are hurtled between flooding rains to heatwaves and fierce fire conditions, and back again.

- Australia's driest three months on record (August to October 2023) was followed immediately by a month of well above average rainfall in Victoria, New South Wales and Queensland.
- A deadly Queensland blaze in October 2023 destroyed more homes in that state than the infamous 2019-20 Black Summer fires did; and weeks later nearby weather stations registered their highest November rainfall on record.
- An early and ferocious fire season in Gippsland, Victoria was followed almost immediately by extreme rainfall and flash flooding.
- Despite wetter conditions along the east coast this summer, temperatures have been well above average in the east and across most of the country.
- Almost every state and territory has broken weather records in recent months, as communities experience wild swings between all types of extremes including cyclones, flooding rains, heatwaves and extreme fire conditions.

2

In a rapidly changing climate, historical weather patterns may no longer be the best guide for what's happening, or what's next, as records keep tumbling.

- Millions of Australians living on the east coast sweltered through weeks of high humidity, with all eastern state capitals more humid than the long-term average for January, and Sydney registering its highest dew point on record.
- Homes around Perth have been threatened three times by large fires so far this season; with Western Australia recording its warmest September on record by a staggering margin.
- Towns in the Pilbara, Western Australia and outback Queensland recorded new January temperature records, with temperatures just shy of 50°C.
- Parts of South Australia, Tasmania and Victoria all recorded record rainfalls in December or January, as overall temperatures remained high.

3

This summer, Australia is experiencing six, clear symptoms of an overheating planet that's caused by pollution from coal, oil and gas.

- Rising ocean temperatures along our east coast, with sea surface temperatures more than 3 degrees above average in some areas, and strong easterly winds are behind the unbearable humidity and conditions conducive to storms.
- By changing the climate, we are changing the conditions that govern natural climate drivers like El Niño and the conditions under which all weather forms. There are early signs that our overheating planet may also be changing the ways these drivers interact and behave.
- Much of the flooding we've experienced this summer has been the result of short, intense downpours that catch communities off guard, and can lead to dangerous flash flooding. Such events are expected to occur more often due to climate change.
- Despite the wet conditions, maximum temperatures recorded in December were well above average across much of the country, including in northern New South Wales and southeast Queensland.
- The unusually early arrival of Cyclone Jasper in Queensland, and its slow movement across land which resulted in enormous dumps of rainfall is consistent with what's expected of cyclones on an overheating planet.

4

Our weather is now more chaotic, unpredictable and dangerous due to climate change, which presents challenges for us all.

- In this new era of climate chaos, communities have been caught off guard, emergency services strained, and conventional meteorological wisdom challenged.
- Extreme rainfall and flooding is possible in any year, even if climate drivers including El Niño have loaded the dice towards drier conditions. We always need to be prepared.
- Further investment in climate and weather information services, as well as helping communities and first-responders prepare for and cope with worsening extremes, is vital.
- Scientists agree that we need to phase out heat-trapping pollution from using coal, oil and gas as quickly as possible. The next two priorities for the Australian Government should be: 1) reforming our national environment law so we can say a quick yes to responsible clean energy projects and no to polluting ones; and 2) locking in the proposed national standards for vehicles so Australians have access to cleaner, and cheaper-to-run cars, and we reduce transport pollution.

1. Introduction

In late October 2023, after three years of above average rainfall had given way to El Niño and Australia's driest three months on record, fires in the Western Downs Region of southeast Queensland destroyed more homes than were lost in that state in the infamous 2019-20 Black Summer fires. Just weeks later, nearby weather stations were registering their highest November rainfall on record, and December saw southeast Queensland hammered by extreme downpours and reeling from billions of dollars in flood damages. January has delivered severe and extreme heatwave conditions at times, as well as flooding rains.

Some have described the summer so far as one of whiplash – being hurtled violently from one extreme to another. Such experiences are not confined to Queensland, Australia's most disaster-prone state. Communities throughout our eastern states, including Victoria and New South Wales, have similarly experienced wild swings between scorching heat and fire risk to intense downpours and flash floods, and back again. What was originally expected to be a mostly dry El Niño summer has instead dispatched almost every possible extreme. Communities have been caught off guard, emergency services strained, and conventional meteorological wisdom challenged. Almost every state and territory has broken an extreme weather record.

Communities across the east coast are experiencing climate whiplash this summer - wild swings between many extremes - as climate change makes our weather more chaotic and dangerous.

In a rapidly changing climate, history may no longer be our best guide for what's next. Our weather is noticeably more chaotic, unpredictable and dangerous.[1] Climate drivers – recurring phenomena such as El Niño/La Niña, the Southern Annular Mode, and the Indian Ocean Dipole – may be interacting in complex new ways. Rising ocean temperatures are affecting rainfall patterns. Extreme events are becoming worse, more common, and less predictable. We are poorly prepared for these changes, and still doing far too little to tackle the root cause of the climate crisis: pollution from the relentless burning of coal, oil and gas.

In this interim report, the Climate Council presents some key observations from the summer so far. What have we learned? What has surprised our experts? What has it taught us about our changing climate, and how we need to respond? This will be followed in March by a comprehensive analysis of the summer and the urgent actions needed to protect Australian communities from further climate harm.

Figure 1: Flash flood in Maroochydore, Queensland, 30 January 2024. Much of the flooding we've seen this summer has been the result of short, intense downpours. Such events, which are becoming more intense due to climate change, often catch communities off guard and can lead to dangerous flash flooding.

1 Polling undertaken by Essential Media for Climate Council in January 2024 revealed that 74 percent of Australians have noticed impacts of climate change in their communities in the last five years.

2. Recap: Our El Niño so far

In September, when the Bureau of Meteorology declared that both an El Niño event and positive Indian Ocean Dipole were underway, Australians were warned to prepare for some hot and dry months ahead and the return of dangerous fire conditions. 2023 was already well on track to be the hottest year on record globally, and the Northern Hemisphere summer had been marked by extreme heatwaves and record-breaking fire seasons.

Early to mid spring in Australia felt very typical of El Niño. The August to October period was our country's driest three months on record. Fires started early in Victoria, New South Wales, Western Australia and Queensland, and huge parts of the Northern Territory burned for months.

But by late spring things were changing for the eastern states, although major fires have continued in Western Australia. November saw above average rainfall in Victoria, New South Wales and Queensland. The first days of summer saw heavy downpours in eastern Victoria and southern New South Wales, leaving communities wading through flood waters - some of which had only just finished battling fires. Up north, Cyclone Jasper, a powerful and long-lasting tropical cyclone, dumped enormous volumes of rain over Far North Queensland. The Daintree River peaked at more than two metres above its previous record and - at one point - the city of Cairns was cut off in all directions by floodwaters.

Late December brought more challenges. Over the Christmas period millions of Australians along the east coast were hammered by severe thunderstorms and heavy downpours. Tragically, at least 10 people were killed. Meanwhile, many West Australians continued to face dangerous fires and extreme heat.

There were more extremes in the new year. Record breaking rains in parts of central Victoria in early January brought another round of flooding to rural communities. Up north, the late arrival of the monsoon brought exceptionally heavy rainfall to tropical parts of the country, including to areas still sodden from Cyclone Jasper. Western Australia continued to bake, with temperature records broken in the Pilbara, and homes around Perth threatened by large fires for the third time this season. Kalgoorlie, located 600 km east-northeast of Perth, was left to weather extreme temperatures without power, after thunderstorms knocked out electricity infrastructure. As the heat spread east, remote Birdsville broke Queensland's record for the hottest ever January day, and severe temperatures combined with high humidity meant tough conditions for millions on the east coast over the 26 January public holiday, including in Sydney and Brisbane.

At the time of writing, most of the country is expected to experience well above average temperatures through the rest of summer, with the exception of Victoria. Rainfall is likely to be low for most of the country, with the exception of the southeast and our main population centres, which may continue to see significant rain.

Rainfall
(Deciles)

- Highest on record
- Very much above average
- Above average
- Average
- Below average
- Very much below average
- Lowest on record

Temperature
(Mean decile)

- Highest on record
- Very much above average
- Above average
- Average
- Below average
- Very much below average
- Lowest on record

All maps generated using the Bureau of Meteorology's rainfall and temperature data services, and further information reproduced from the Bureau of Meteorology's monthly climate summaries: bom.gov.au

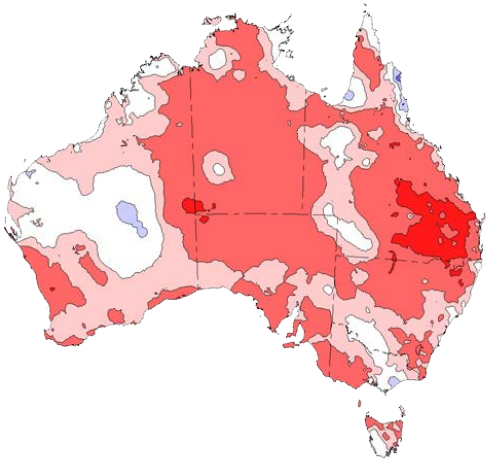
SUMMARY

KEY EVENTS

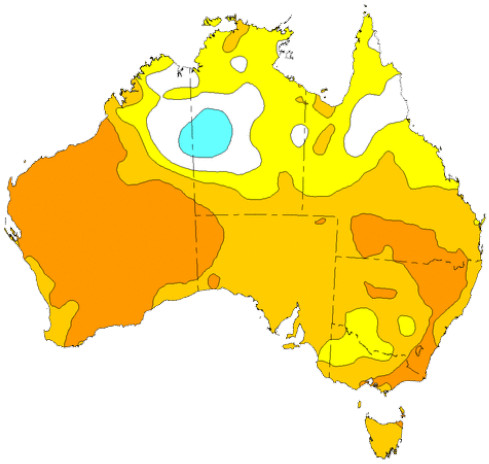
AUGUST-OCTOBER 2023

Hot and dry across almost all the country. Typical of an El Niño pattern, and likely boosted by the positive Indian Ocean Dipole.

Rainfall



Temperature



- Australia's driest three-month period on record
- Nationally, the mean temperature was the second warmest on record for August and third warmest for September
- Western Australia had its warmest September on record; the mean maximum temperature was 3.54°C above the 1961–1990 average and 0.7 °C higher than the previous record (2019)
- Large areas of northern Western Australia and the Northern Territory burn
- An early and ferocious start to the fire season in Queensland, Victoria and New South Wales

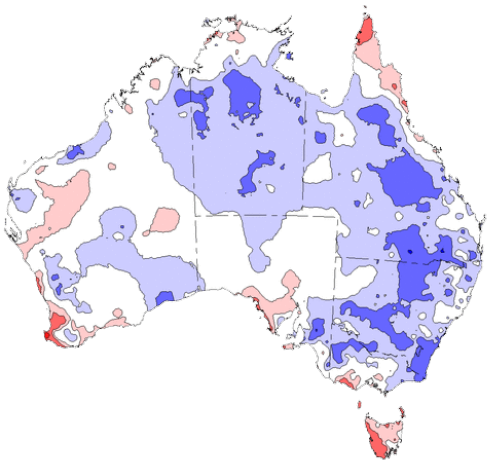
SUMMARY

KEY EVENTS

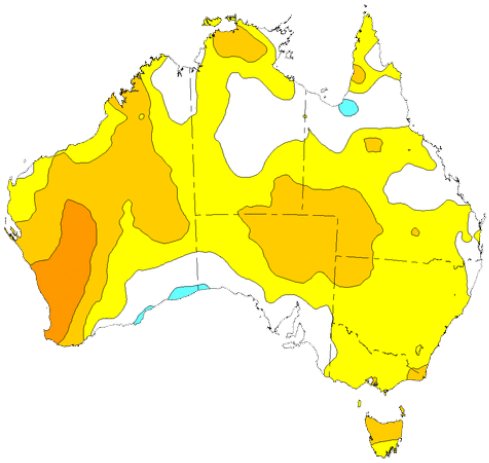
NOVEMBER 2023

The dry period comes to an abrupt end for the eastern states.

Rainfall



Temperature



- Victoria, New South Wales and Queensland all record well above average rainfall; rainfall is above average for all states and territories except Tasmania
- Severe thunderstorms impact parts of Queensland, New South Wales, Victoria, South Australia and Tasmania
- Temperatures are above average for almost all the country, despite the wet conditions

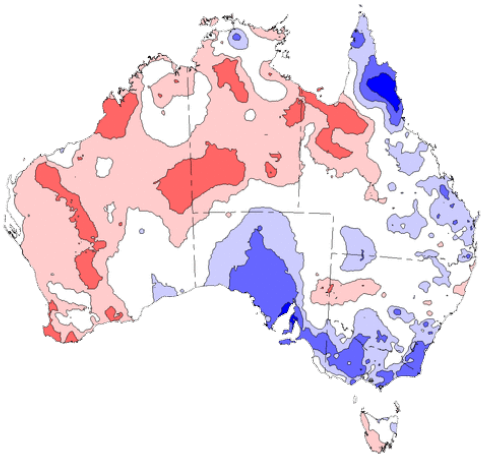
SUMMARY

KEY EVENTS

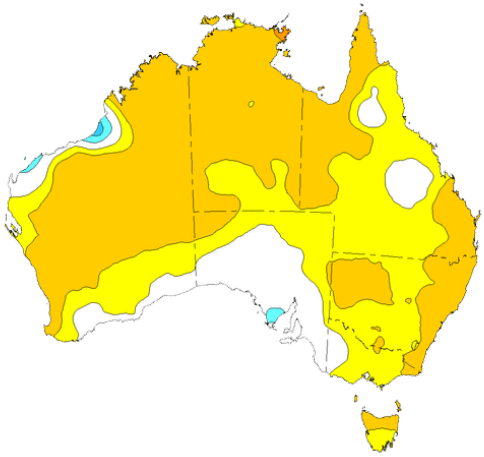
DECEMBER 2023

Many eastern parts of the country continue to have above average rainfall. El Niño is not following its usual script, due in part to warm waters down the east coast and a persistent positive Southern Annular Mode (see more in Section 5). Much of the west and north remain dry.

Rainfall



Temperature



- Heatwave conditions experienced across most of Australia
- Further thunderstorms in the east and southeast, with heavy impacts on southeast Queensland in particular
- Cyclone Jasper brings heavy rainfall and flooding to northern Queensland
- Parts of northern Queensland see their highest December monthly rainfall on record
- Nationally, the fourth warmest December on record

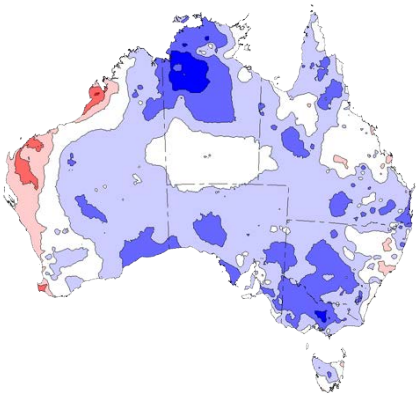
SUMMARY

KEY EVENTS

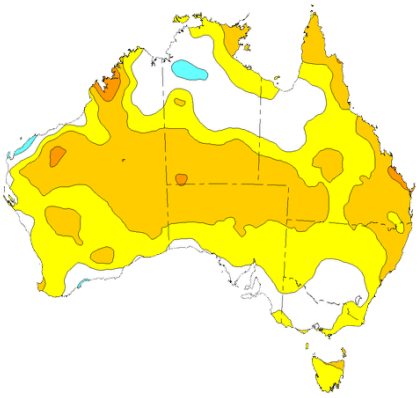
JANUARY 2024

The arrival of the monsoon brings heavy rainfall across the north. Most of the east of the country continues to receive above average rainfall. Temperatures remain high despite the rain.

Rainfall

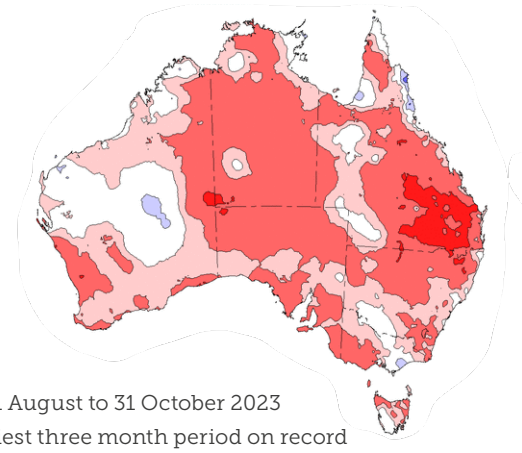


Temperature

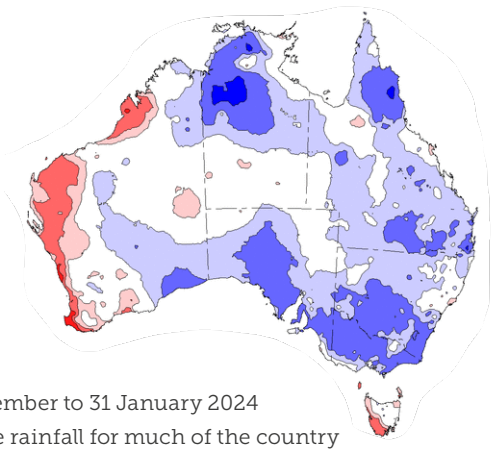


- Unusually high humidity for millions of Australians on the east coast; Sydney registers its highest dew point on record
- Intense downpours and flash floods in parts of central Victoria, with impacts on tourism and on stone fruit
- A heatwave from west to east sees temperature records broken in Western Australia and Queensland
- Cyclone Kirrily makes landfall near Townsville; Kirrily's remnants fuel severe thunderstorms in the south of the state
- Rainfall above average for most of the country
- Nationally, the third warmest January on record

FROM RECORD DRY TO FLOODING RAIN: COMPARING RAINFALL IN AUGUST-SEPTEMBER 2023 (LEFT) AND NOVEMBER-JANUARY 2024 (RIGHT)

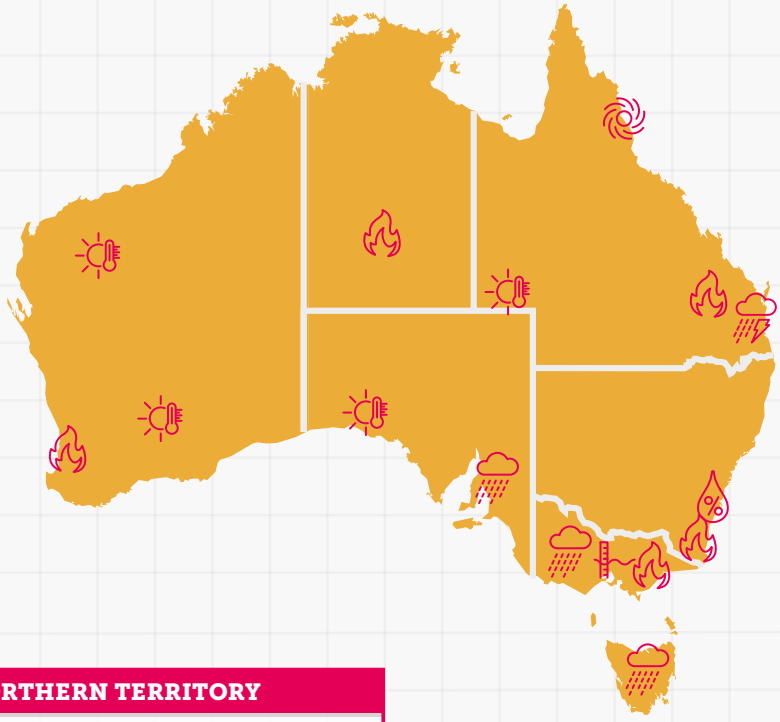


1 August to 31 October 2023
Our driest three month period on record



1 November to 31 January 2024
Above average rainfall for much of the country

Figure 2: From flooding rains to heatwaves and fierce fire conditions and back again, spring and summer 2023-24 has seen each state and territory face a wide variety of weather extremes. Here are just some of the many examples.



NORTHERN TERRITORY

September-October

Over 300,000km² of the Northern Territory burn in the **worst fire season for over a decade**

WESTERN AUSTRALIA

14 January

Homes in and around Perth threatened by **large fires for third time this season**

Mid January

Kalgoorlie weathers **extreme heatwave without power** after storms damage electricity infrastructure

21 January

Paraburdoo, a town in the Pilbara, registers its **hottest day on record at 48.1°C**

SOUTH AUSTRALIA

September

Numerous sites set new September **temperature records**, with Nullabor registering 40°C on 30 September

10-11 December

Numerous sites record their **highest daily December rainfall** on record

TASMANIA

14 December

Multiple sites have their **highest December daily rainfall** on record

QUEENSLAND

31 October

Bushfire west of Brisbane razes more Queensland homes than the Black Summer fires (58 compared to 49)

13 December

Cyclone Jasper brings **heavy rains and flooding** to north Queensland

25-26 December

Southeast Queensland struck by **severe thunderstorm outbreaks**

25 January

Birdsville breaks Queensland's record for the **hottest January day, registering 49.4°C**

NEW SOUTH WALES

28 September

Catastrophic fire danger rating issued for the New South Wales far south coast. An early and ferocious start to the fire season

11 January

Sydney registers its highest dew point on record. Communities face **stifling humidity** through much of January

VICTORIA

Early October

Fire season starts early with multiple out-of-control fires in Gippsland, followed almost immediately by extreme rainfall and flash floods

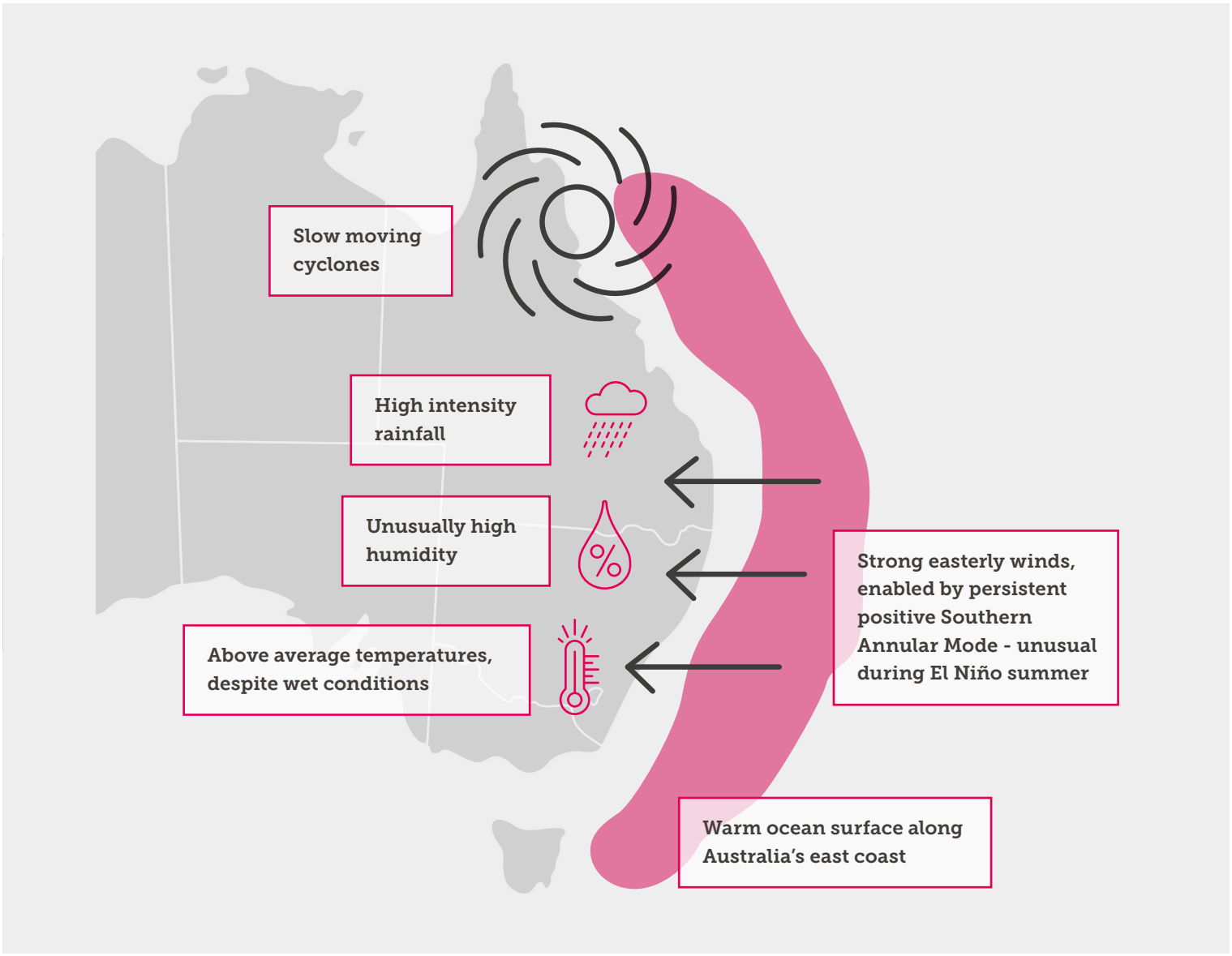
7 January

Record rains bring flooding to parts of central Victoria

3. Six symptoms of an overheating planet

While it may be feeling a bit different from the summer that many were expecting, recent events nonetheless exemplify much of what we've been warned to expect due to climate change. From high temperatures and stifling humidity to intense summer storms and slow-moving cyclones, in this section we look at how the 2023-24 summer has displayed six key symptoms of a planet made warmer by the burning of coal, oil and gas.

Figure 3: Events over the summer bear many of the signs of a fast warming planet.



1. RISING OCEAN TEMPERATURES

Global sea surface temperatures have been extraordinarily high throughout 2023 and into 2024 (Cheng et al. 2024). This has included very warm sea surface temperatures on Australia's east coast and across the Tasman Sea, which were more than 3°C above average in some areas (BoM 2024). As explored later (Section 5), the warm waters to our east and broader pattern of rising sea surface temperatures globally due to climate change, may be one of the factors underpinning why this year's El Niño event has felt different from many in the past. Warm waters mean more evaporation. Combined with easterly winds (see Figure 3), this has meant more moist air blowing onto the eastern seaboard, creating some very humid days and the conditions for storm systems that bring heavy rain.

2. POSSIBLE CHANGES IN THE BEHAVIOUR AND INTERACTION OF OUR CLIMATE DRIVERS

The year-to-year variations in our weather are determined by a series of natural 'climate drivers'. The most important of these relate to what's happening in the seas around Australia - the Pacific Ocean to our east, Indian Ocean to our west, Southern Ocean to our south, and the tropical waters to our north. Of these, the El Niño-Southern Oscillation - the periodic but irregular changes in winds and temperatures across the tropical Pacific - is the most significant.

By changing the climate, we are changing the conditions for these climate drivers and the conditions under which all weather forms. While it is too early to draw any conclusions, there are early signs that as the planet warms, the way in which these drivers interact may be changing.

While an El Niño event does not always mean dry conditions through summer (see Section 5), the 2023-24 summer has nonetheless been unusual, with well above average rainfall for the eastern states through November and December. This has been due at least in part to what is happening in the waters to our south and the status of another key climate driver: the Southern Annular Mode.

The Southern Annular Mode refers to the north-south movement of the strong westerly winds that blow almost continuously in the Southern Ocean. If those winds are further south in summer, this is known as the positive phase of the Southern Annular Mode. During this phase we tend to see a corresponding increase in winds blowing from the Tasman Sea onto the southeast of Australia (BoM 2019). A positive Southern Annular Mode thereby increases the chances of above average rainfall for eastern New South Wales, southeast Queensland, and eastern Victoria, as moist air is blown onshore.

It is unusual to see a persistently positive Southern Annular Mode during an El Niño event. This is something more commonly expected during La Niña conditions. However, recent decades have seen an overall more positive trend in the Southern Annular Mode, with some evidence this may be the result of climate change (King 2023a).

3. INTENSE DOWNPOURS

As outlined above, warm waters and easterly winds have conspired to create the conditions for more rainfall for much of Australia's east in recent weeks. Much of the flooding we've seen this summer has been the result of short, intense downpours. Such events often catch communities off guard and lead to dangerous flash flooding. These "short-duration heavy-rainfall events" are also the kind of downpours that are becoming more intense with climate change (BoM and CSIRO 2022). For every one degree Celsius of warming, air's capacity to hold water vapour goes up by about 7 percent. An atmosphere with more moisture will produce more intense downpours.

4. STIFLING HUMIDITY

Millions of Australians on the east coast have been living through very high humidity in recent weeks. This is again a function of high ocean surface temperatures driven by climate change. When the ocean surface is warmer, more air evaporates. The air, which has also been warm and therefore able to hold a lot of water vapour, has been carried onto the eastern seaboard by persistent easterly winds (see Figure 3), creating uncomfortably humid conditions.

In January, all Australia's eastern state capitals were more humid than the long-term average, and on 11 January Sydney registered its highest dew point on record (Saunders 2024; McSweeney 2024).[2]

A combination of high heat and high humidity is dangerous for humans. Evaporative cooling through sweating is one of the body's key mechanisms for staying cool. When the relative humidity is higher and the air closer to being saturated with water, less of our sweat evaporates and so the body is less able to cool itself.

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2 Relative humidity and dew point are both measures of humidity. Relative humidity is expressed as a percentage of the maximum amount of water vapour that the air can hold. Warmer air is able to hold more water vapour, and so relative humidity is dependent on the air's temperature. A 20°C day with 90 percent relative humidity will have around the same amount of water vapour in the air as a 30°C day with 50 percent relative humidity, though the 20°C will feel much more humid as the air is almost saturated with water vapour.

Dew point is the temperature to which air needs to be cooled for it to reach 100 percent relative humidity, beyond which some of the water vapour it is holding will start to condense as dew. The more vapour there is in the air, the higher the dew point. For example, if the temperature is 30°C and the relative humidity is 50 percent, the dew point is around 18°C. If the temperature is 30°C and the relative humidity is 80 percent, the dew point is 26°C.

5. HIGH TEMPERATURES, DESPITE THE RAIN

Despite the wet conditions, maximum temperatures recorded in December were well above average across much of the country, including northern New South Wales and southeast Queensland. While not as hot as the record breaking December of 2019, maximum temperatures were 1.92°C warmer than the long-term average, and the mean temperature for eastern Australia was half a degree warmer than during the last El Niño.

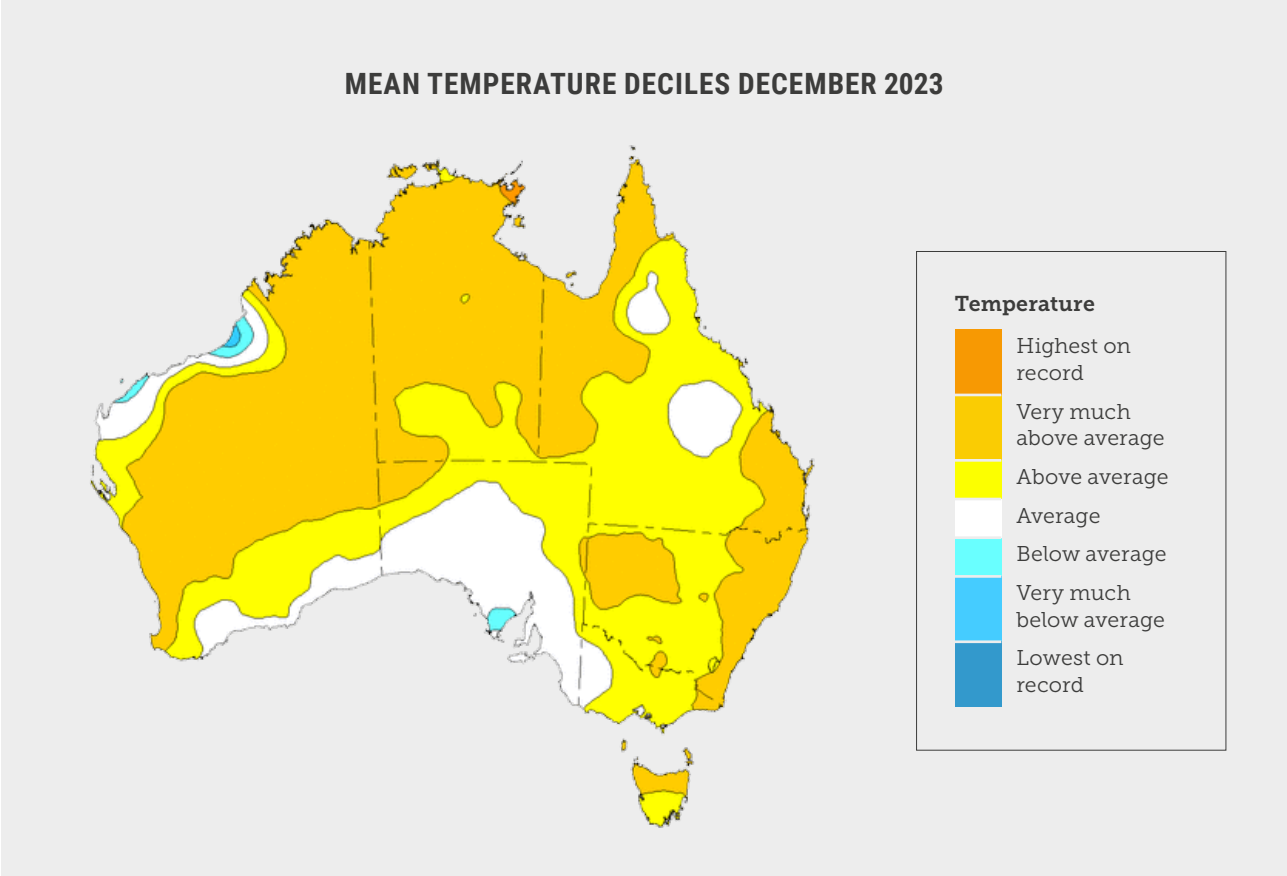


Figure 4: Despite the wet conditions, December temperatures were well above average in southeast Queensland and northern New South Wales, and above average almost everywhere. (Map genrerated using the Bureau of Meteorology's temperature data service.)

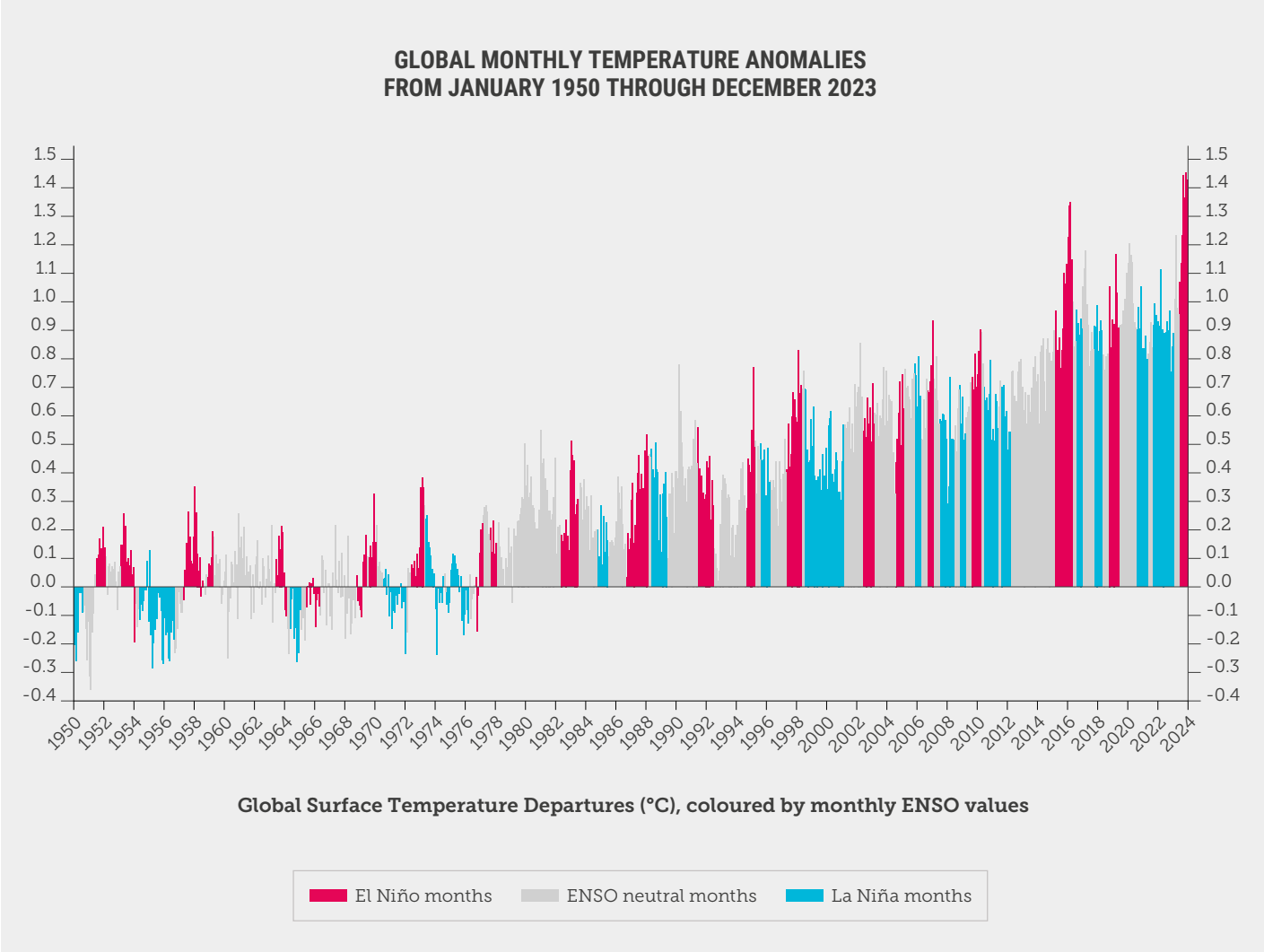


Figure 5: As temperatures in Australia and around the world have become warmer due to climate change, so too El Niño events are now warmer than in the past. **Source:** Annual 2023 Global Climate Report, US National Oceanic and Atmospheric Administration.

6. AN UNUSUAL AND HIGHLY DESTRUCTIVE CYCLONE

With a mid-December arrival, Cyclone Jasper was unusually early for a landfalling cyclone during an El Niño event. While only a Category 2 storm upon making landfall, its slow movement, long life, and ability to dump enormous amounts of rain were consistent with what we've been warned to expect of cyclones on a warming planet (Climate Council 2024).

4. Weather forecasts in a fast changing climate

Back in September, the long-range rainfall forecast suggested below average summer rainfall for most of the continent, including the southeast. The corresponding temperature outlook saw the whole of mainland Australia shaded dark red, indicating an 80 percent chance of exceeding average maximum temperatures over the summer.

However, by October, the long-range forecasts were indicating a mixed picture for the eastern states when it came to rainfall (see Figure 6). New South Wales and southern Queensland in particular looked as though they might receive average or even above average levels of rainfall through the late spring and into summer. This has proven to be the case.

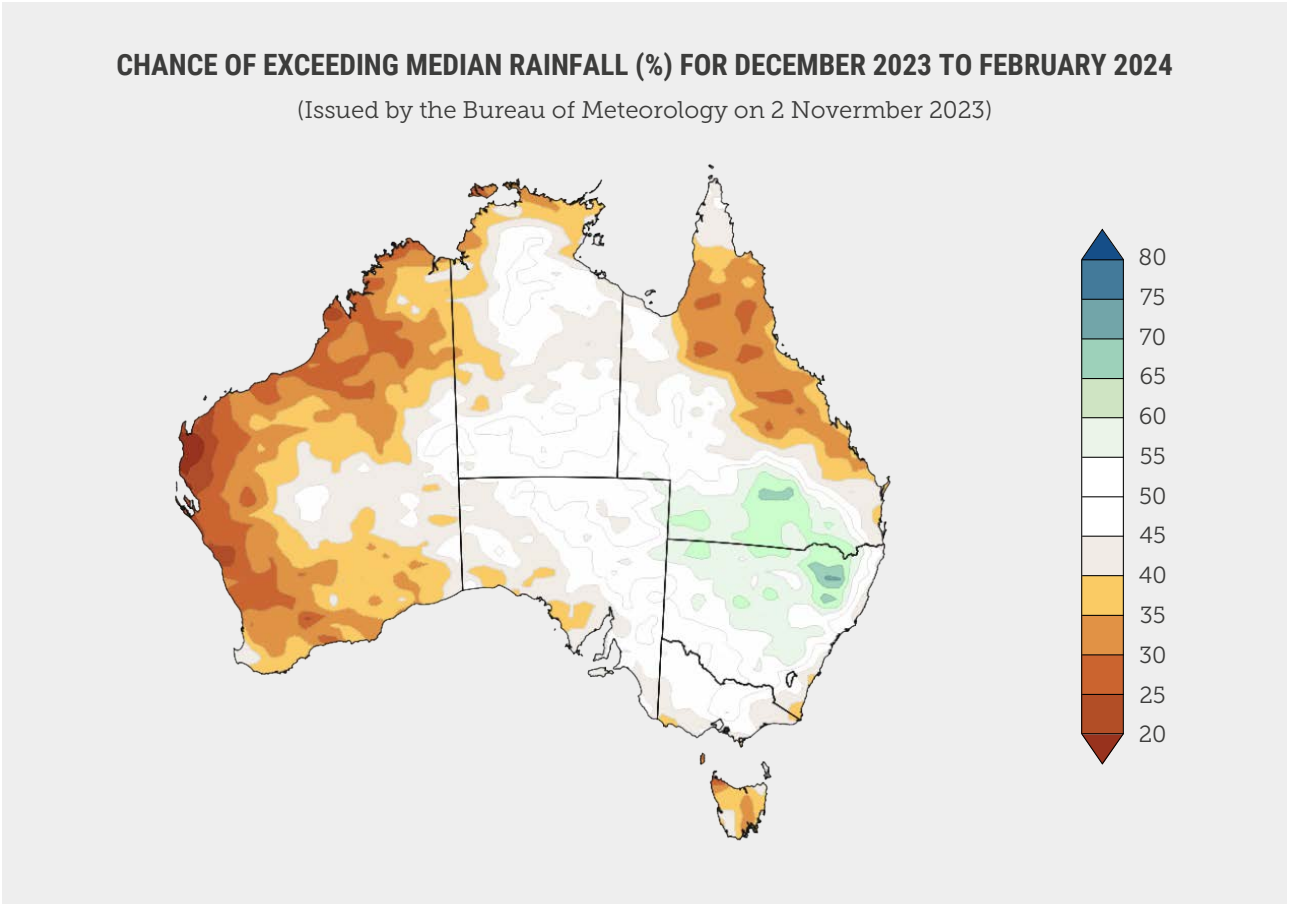


Figure 6: From October, long-range rainfall forecasts from the Bureau of Meteorology began to show a more mixed outlook for rainfall. (Image adapted from Bureau of Meteorology.)

While the long-range forecasts for this summer have been mostly accurate, history may no longer be the best guide for what's happening as it once was. By changing the climate we are changing the conditions under which all weather forms. Furthermore, while long-range forecasters are usually very good at predicting the average conditions over a given period, it is much harder and perhaps impossible when looking weeks or months ahead to predict when and where short duration weather events - such as very intense downpours from thunderstorms - are going to strike. That is only possible much closer to when the event is about to happen, and even then it can remain difficult to accurately forecast these extremes.

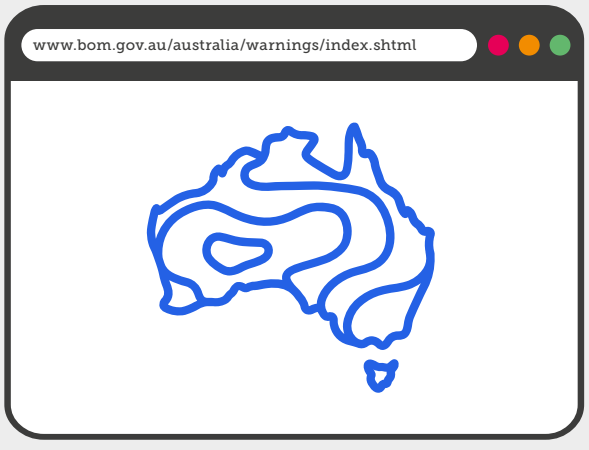
Our weather and emergency services, including the Bureau of Meteorology, do a remarkable job bringing us the information we need to plan our summers and stay safe. It is essential that we follow the forecasts, listen to the advice, and heed any emergency warnings.

Further investment in climate and weather information services is vital to ensure we get the most accurate and up-to-date information as possible. This is essential for keeping our communities safe, as well as to supporting farming and many other industries.

BUREAU OF METEOROLOGY NATIONAL WARNINGS

This page provides a summary of the current weather warnings issued in each state and territory.

Visit http://www.bom.gov.au/australia/warnings/index.shtml for more information.



5. But aren't El Niño summers meant to be dry?

El Niño-Southern Oscillation is the most significant influence on year-to-year variations in our weather.

An El Niño event typically means reduced rainfall for Australia through winter and spring, particularly for the eastern and northern parts of the continent (BoM 2021). In simple terms, warm waters in the eastern tropical Pacific off the coast of South America are conducive to cloud formation and rainfall. This shifts rainfall away from our side of the Pacific.

This doesn't mean we won't get rain during an El Niño event, particularly in the form of summer storms. El Niño events have less influence on rain patterns over summer, owing to the development of the monsoon in northern Australia and heightened thunderstorm activity.

Notably, many of the intense downpours over the late spring and summer were the result of thunderstorm outbreaks. Thunderstorms are more common during summer as the supply of solar energy is at its greatest, providing more moisture for storm systems. While intuitively we might expect fewer thunderstorms during an El Niño period, the different phases of the El Niño Southern Oscillation do not in fact appear to influence the likelihood of thunderstorms (Dowdy 2020). In other words, even if we expect a particular summer to be relatively dry on average, we always need to be prepared for the possibility of heavy rain and flash floods.

Similarly, for those up north, while we typically see fewer tropical cyclones in Australia during an El Niño event, they can and will occur every year, and so each season brings the chance of heavy rains from a landfalling cyclone.

Furthermore, since Australia is a relatively dry continent, it only takes a few wet weather systems and rainy days to tip a month or season into being wetter than average. Or, for a period we're expecting to be dry to end up feeling much wetter. Owing to Australia's inherent arid conditions, La Niña has a stronger influence on unusually wet conditions than El Niño has on unusually dry conditions (King 2023b).

Every El Niño event is different, and this is not the first time we have experienced wet conditions during an El Niño event.[3] As explored in Section 3, a number of factors have conspired to create an unusually wet set of conditions since the late spring, including warm waters to Australia's east and a persistent positive Southern Annular Mode. Many of these symptoms are consistent with what we've been warned to expect with worsening climate change.

Overall, the summer has highlighted the complexity of different climate drivers interacting against the background of a warming planet. What we're experiencing is an example of what happens when you have different modes of climate variability, such as El Niño and a positive Southern Annular Mode, pulling in different directions. This is occurring against the backdrop of climate change, which is influencing ocean temperatures in the region and, therefore, the behaviour of these drivers. While it is too early to draw any conclusions about likely ongoing changes, the one thing we can be certain of is that our climate is changing and so are our weather patterns.

Figure 7: Fire fighters at work in Keysbrook, an outer southern suburb of Perth, Western Australia, 23 December 2023. While the eastern states have seen significant rain over summer, much of the west has remained dry. As well as very large fires up north in the Kimberley, a number of large fires have burned in the southwest, including on the outskirts of Perth.

3 Summaries of rainfall patterns during previous El Niño and La Niña events are available on the Bureau of Meteorology's website. The El Niño summers of 1993-94 and 2009-10 were also notably wet. http://www.bom.gov.au/climate/history/enso/

6. What we have learned

Some important lessons from the 2023-24 summer so far:

- The rulebook is changing, and history may no longer be the best guide for the present. The summer has highlighted the complex interaction of different natural climate drivers against the background of a rapidly warming planet. Our conditions have become more difficult to predict.
- Everything we experience today is in an ocean-atmosphere system made hotter and more energetic by the burning of coal, oil and gas. Our weather is more extreme and erratic. When storms develop they have the potential to become more destructive. Fire weather has been supercharged by higher temperatures, stronger winds and shifts in rainfall making vegetation drier and fire seasons longer and more destructive.
- Extreme rainfall and flooding is possible in any year, even if the climate drivers including El Niño have loaded the dice towards drier conditions. We always need to be prepared.
- While recent rains have lowered immediate fire risk in some eastern parts of the country, there is no grounds for complacency and it is only a matter of time before we see a return to very dangerous fire conditions.
- We must always stay up to date with the latest weather warnings.

Figure 8: Remote Indigenous communities in north Queensland were heavily impacted by floods brought on by Cyclone Jasper. The entire town of Wujal Wujal (pictured) had to be evacuated.

7. Conclusion

Using coal, oil and gas emits heat-trapping pollution that's overheating our planet and causing widespread damage. Scientists agree we need to phase out this pollution as quickly as possible. Our experiences so far during the 2023-24 summer underscore what's at stake as Australian communities continue to pay a heavy price for our polluting past – a toll that will only worsen unless we cut pollution.

We have seen how climate change is taking a heavy toll on First Nations communities. We have seen the disproportionate impact of extreme heat on children and on parts of our cities where the less wealthy live, and how this threatens to widen existing inequalities (Parents for Climate Action and Sweltering Cities 2024). We have seen how extreme weather is damaging our economy and driving up the cost of living, including repairing damage, rising power bills, and insurance premiums that are becoming unaffordable and out of reach for many (Choice 2023). We have seen the threat of compounding, consecutive events – such as when a community faces a heatwave immediately after its power has been knocked out by a storm.

The next, priority steps for Australia are clear, and there is no more time to waste. While we are making great strides in the rollout of clean energy sources like solar and wind, we are still effectively adding fuel to the fire by approving new coal and gas projects. We must urgently reform our national environmental law - the Environmental Protection and Biodiversity Conservation Act - so that climate is at the heart of the law and we can say a quick yes to responsible clean energy projects, and a firm no to polluting developments (Hughes et al. 2023). Similarly, Australia's gains in renewable energy have been wiped out by rising emissions in other sectors, notably transport (DCCEEW 2023). It's time to put in place long-promised national standards for vehicles so Australians have access to cleaner, and cheaper-to-run cars and we get our transport emissions trending downwards (Cheung et al. 2023).

Globally, we are at a point of inflection, both when it comes to climate impacts and the solutions (Morgan 2024). We are perilously close to crossing dangerous tipping points in the Earth's climate system – one-way doors that lead to abrupt, accelerating and irreversible changes, which threaten humanity (Bradshaw et al. 2023). At the same time, there are signs that global emissions may finally peak in 2024 (Fyson et al. 2023). This may be cause for cautious optimism, but is not enough: we must do more than take our foot off the over-heating accelerator – we must slam on the brakes. The opportunity for Australia to play a major positive role in helping not only cut pollution at home, but also around the rest of the world is undeniable, but that window of opportunity is narrowing fast.

Just as we must redouble our efforts to tackle the root causes of the climate crisis, this summer also reveals how much more work we need to do to prepare for and respond to climate impacts today and tomorrow. This year the Government will develop Australia's first comprehensive National Adaptation Plan. The need to invest in our climate science and information services, to boost our emergency response capabilities, and above all to be investing proactively in climate change preparation and response and the resilience of our communities, is urgent and growing. We ignore this summer's lessons at our peril.

Figure 9: Residents of Western Sydney swelter through another heatwave. Sydney's western suburbs can be several degrees hotter than the coastal eastern suburbs during a heatwave. Lower incomes, poor urban planning, lack of shade, and poor quality housing all leave people more vulnerable to extreme heat and threaten to widen existing inequalities.

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Page 2, Figure 1: Flash flood, Maroochydore, Queensland. Jacqui Street.

Page 17, Figure 7: Fire fighters at work in Keysbrook, Western Australia. AAP / Department of Fire and Emergency Services WA.

Page 18, Figure 8: Wujal Wujal, Queensland. Kylie Hanslow.

Page 20, Figure 9: Heatwave in Western Sydney. Climate Council.

The Climate Council is an independent, crowd-funded organisation providing quality information on climate change to the Australian public.

The Climate Council acknowledges the Traditional Owners of the lands on which we live, meet and work. We wish to pay our respects to Elders past and present, and recognise the continuous connection of Aboriginal and Torres Strait Islander peoples to Country.

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