

EXTREME WEATHER AND CLIMATE CHANGE IN AUSTRALIA: TODAY AND INTO THE FUTURE

Australia has always been a land of extremes. However, the basic features of the climate system have now shifted, changing the conditions for all weather. We live in a hotter climate than 50 years ago, and this extra energy in the system is influencing many types of extreme weather events.

All information in the following table is taken from *'The Critical Decade: Extreme Weather'*.



Extreme event: Heat waves and hot days

How are extreme weather events changing?

Climate change is making hot days and heat waves more frequent and severe with the number of record hot days in Australia doubling since the 1960s.

For Melbourne, Adelaide and Canberra the annual number of hot days is increasing more quickly than expected, and is already at the level projected for 2030.

Heat records have always been broken from time to time; however, records are now being broken more frequently. For example, the summer of 2012/2013 set more than 100 heat-related records, including the hottest summer, hottest month, and hottest day on record.

What is the influence of climate change?

Greenhouse gases in the atmosphere trap heat near the Earth's surface. Greenhouse gases have increased by around 40% since the industrial revolution and there is now significantly more heat in the atmosphere than 50 years ago.

What is the impact of these types of events?

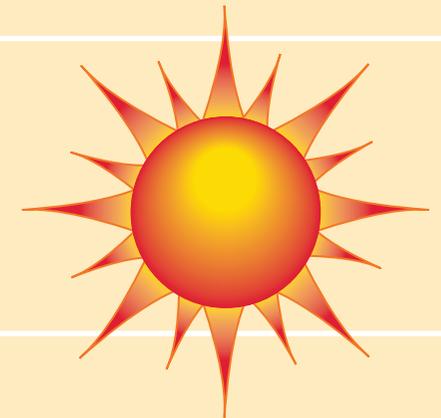
Heatwaves are the most significant natural hazard in Australia in terms of loss of life. The risk of heat-related deaths in Australia is increasing.

Children, the elderly, people with existing health issues and workers with heat-exposed jobs are the most vulnerable to extreme heat.

Plants and animals are also vulnerable to heat. Agricultural productivity is expected to suffer net decreases with increasing temperatures.

What are the risks for the future?

Australians will face extreme hot weather far more often and the impacts will become more severe.



How quickly and deeply we reduce greenhouse gas emissions will greatly influence the severity of extreme events our children and grandchildren experience.

Find out more: www.climatecommission.gov.au

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Extreme event: Heavy rain

How are extreme weather events changing?

Heavy rainfall is increasing globally.

Over the last three years Australia's east coast has experienced several very heavy rainfall events, fuelled by record-high surface water temperatures in the adjacent seas.

Northwest Australia has experienced a significant increase in the frequency of heavy rainfall events.

What is the influence of climate change?

Higher temperatures in the surface ocean waters lead to more evaporation, which leads to increased water vapour in the atmosphere. Overall that means there is more water vapour available to fall as precipitation.

What is the impact of these types of events?

Floods cause significant societal disruption including damage to human health, buildings, infrastructure, ecosystems and agricultural land.

During the 2010/2011 Queensland floods 33 people died, 29,000 homes and businesses were flooded and over 3000 km of rail track were affected. The economic cost of the flood was estimated at more than \$5 billion dollars.

What are the risks for the future?

As global temperature rises there is a higher risk of heavy rainfall events.

Across Australia, it is more likely than not that heavy rainfall events will become more frequent as temperature increases.



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Extreme event: Drought

How are extreme weather events changing?

A long-term drying trend is affecting the southwest corner of Western Australia which has experienced a 15% drop in rainfall since the mid-1970s.

Since the 1990s the southeast has also been experiencing a drying trend.

In the southeast the period of 1997-2009, the Millennium Drought, was unusual in terms of its duration and severity. Annual rainfall was 12% below the long-term average.

What is the influence of climate change?

Climate change has contributed to the southwards shift in the air flow that affects cool season rainfall in southern Australia.

What is the impact of these types of events?

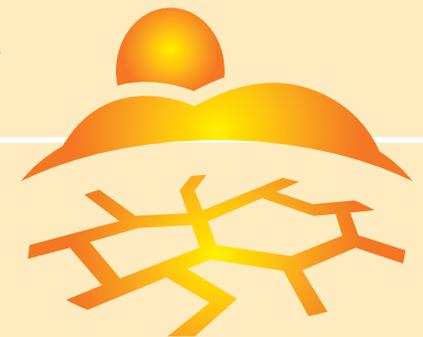
Rural communities face large economic and social consequences from droughts when incomes decline and people move away.

In the Wimmera Mallee region of Victoria, the 1997-2009 drought was estimated to have resulted in an 80% reduction in grain production and a 40% reduction in livestock production.

What are the risks for the future?

The southeast and southwest regions of Australia are expected to experience more droughts, and a return to the earlier, wetter climate is unlikely.

Increasing frequency of very hot days and hot periods will likely exacerbate the severity of drought conditions in the drier parts of Australia.



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Extreme event: Bushfires

How are extreme weather events changing?

Many parts of Australia, including southern NSW, Victoria, Tasmania and parts of South Australia, have seen an increase in extreme fire weather over the last 30 years.

The fire season in the southeast is now longer with fire weather extending into November and March. This means the opportunity for fuel reduction burning is reducing.

Overall, this means that fire prone conditions and vulnerability to fire are increasing in much of southern Australia.

What is the influence of climate change?

Daily weather conditions play a strong role in the outbreak of bushfires. Very hot, dry and windy days create very high bushfire risk. Climate change is increasing the frequency of very hot days. In this way climate change aggravated bushfire conditions across southern Australia during the 2012/2013 summer.

What is the impact of these types of events?

Over the past decade large and uncontrollable fires devastated several suburbs in Canberra in 2003 and took 173 lives and destroyed over 2,000 houses in Victoria in 2009. In 2013 a large fire in Tasmania destroyed nearly 200 properties and forced the evacuation of hundreds of people from the Tasman Peninsula.

The economic cost of the 2009 Black Saturday bushfires to Victoria was estimated to be \$4.4 billion.

What are the risks for the future?

The projected increases in hot days across the country, and in consecutive dry days and droughts in the southwest and southeast, will very likely lead to increased frequencies of days with extreme fire danger in those regions.



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Extreme event: Sea-level rise and coastal flooding

How are extreme weather events changing?

A rise in coastal flooding over the last century has been observed in places with long tidal records. For instance, since 1950 Fremantle has experienced a 3-fold increase in flooding events.

Major flooding events in 2005, 2006, 2009 and 2010 in the Torres Strait Islands were very likely exacerbated by the increases in sea level that the Torres Strait Islands have already experienced.

What is the influence of climate change?

Sea level has risen by 0.21 m and is continuing to rise as the ocean becomes warmer, and glaciers and polar ice sheets melt with increasing temperatures.

Storm surges ride on sea levels that are higher than they were a century ago, increasing the risk of coastal flooding.

What is the impact of these types of events?

High sea-level events can threaten human physical safety and health, damage settlements and infrastructure in low-lying coastal areas, and erode sandy beaches.

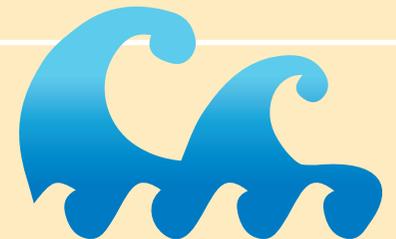
Communities in the Torres Straits Islands have experienced several major flooding events in the last decade, affecting roads, residential buildings, cultural sites and community gardens.

It is estimated that between 157,000 and 247,600 individual buildings across Australia are at risk from a 1.1 m sea-level rise.

What are the risks for the future?

Sea level is likely to rise by 0.5–1.0 m by the end of the century compared to 1990. Larger rises cannot be ruled out because of uncertainties around the stability of the large ice sheets on Greenland and Antarctica.

Even a sea-level rise of 0.5 m could lead to large increases in the frequency of flooding, typically by several hundred times compared to the baseline.



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Extreme event: Cyclones

How are extreme weather events changing?

The understanding of the physical relationship between warmer surface ocean waters and a warmer atmosphere suggests that cyclone behaviour is already being influenced by climate change. However, the observational constraints do not yet allow an unequivocal statistical link to be made.

What is the influence of climate change?

A higher surface ocean temperature means that cyclones have a larger source of energy (heat) to draw from, increasing wind speeds and the intensity of rainfall associated with a cyclone.

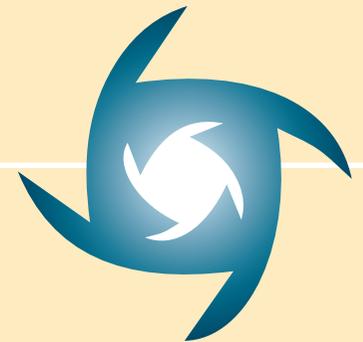
What is the impact of these types of events?

Tropical cyclones are dangerous because they produce destructive winds, heavy rainfall, storm surges and enhanced wave action that can cause flooding of low-lying coastal areas.

Cyclone Yasi caused an estimated \$1.6 billion in damages to agriculture and \$600 million damage to tourism. In addition 15% of the Great Barrier Reef was damaged.

What are the risks for the future?

Tropical cyclones are likely to become more intense; however, they are not likely to increase in number. Maximum wind speeds and rainfall associated with tropical cyclones are likely to increase, and thus pose a greater risk in terms of their impacts on people, property and ecosystems.



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