

# State of the Climate 2018

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Australian Government  
Bureau of Meteorology



25 Aug 2018 Sheep on a drought affected farm near the NSW town of Bigga. Source ABC News Franklin Hood

Integrated  
risks are now  
well-  
recognised

# World Economic Forum — Global Risks Report 2018

## Top 10 risks in terms of Likelihood

- 1 Extreme weather events
- 2 Natural disasters
- 3 Cyberattacks
- 4 Data fraud or theft
- 5 Failure of climate-change mitigation and adaptation
- 6 Large-scale involuntary migration
- 7 Man-made environmental disasters
- 8 Terrorist attacks
- 9 Illicit trade
- 10 Asset bubbles in a major economy

## Top 10 risks in terms of Impact

- 1 Weapons of mass destruction
- 2 Extreme weather events
- 3 Natural disasters
- 4 Failure of climate-change mitigation and adaptation
- 5 Water crises
- 6 Cyberattacks
- 7 Food crises
- 8 Biodiversity loss and ecosystem collapse
- 9 Large-scale involuntary migration
- 10 Spread of infectious diseases

## Categories

- Economic
- Environmental
- Geopolitical
- Societal
- Technological

Source: World Economic Forum Global Risks Perception Survey of Almost 750 experts and decision-makers in the World Economic Forum's multistakeholder communities



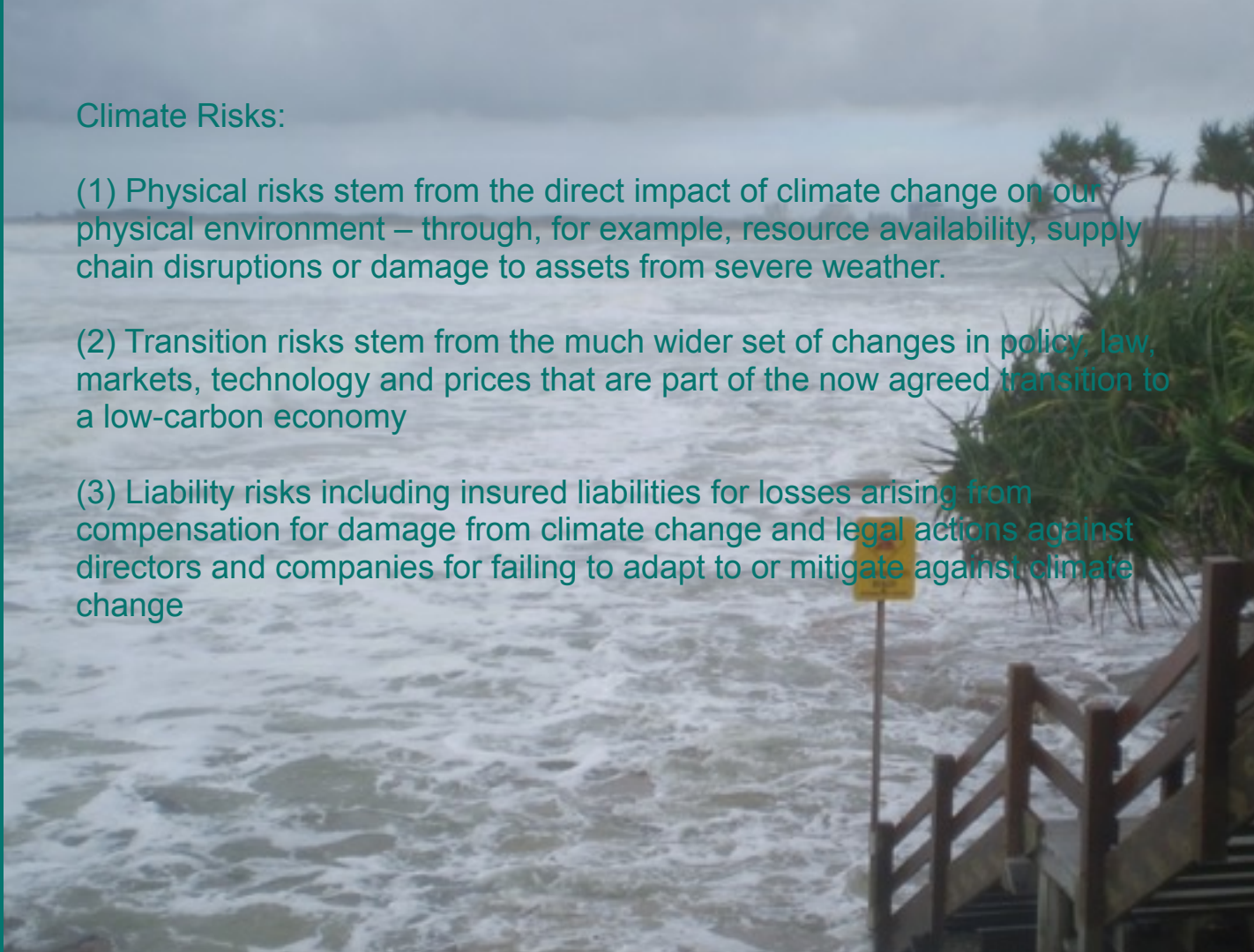
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**Managing  
climate risk:**

**The  
regulatory  
environment  
is changing**

Climate Risks:

- (1) Physical risks stem from the direct impact of climate change on our physical environment – through, for example, resource availability, supply chain disruptions or damage to assets from severe weather.
- (2) Transition risks stem from the much wider set of changes in policy, law, markets, technology and prices that are part of the now agreed transition to a low-carbon economy
- (3) Liability risks including insured liabilities for losses arising from compensation for damage from climate change and legal actions against directors and companies for failing to adapt to or mitigate against climate change



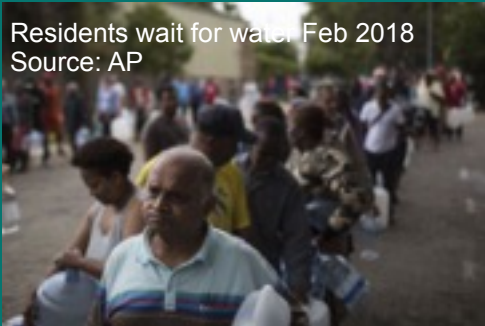
Theewaterskloof Dam  
Source: ABC 2018



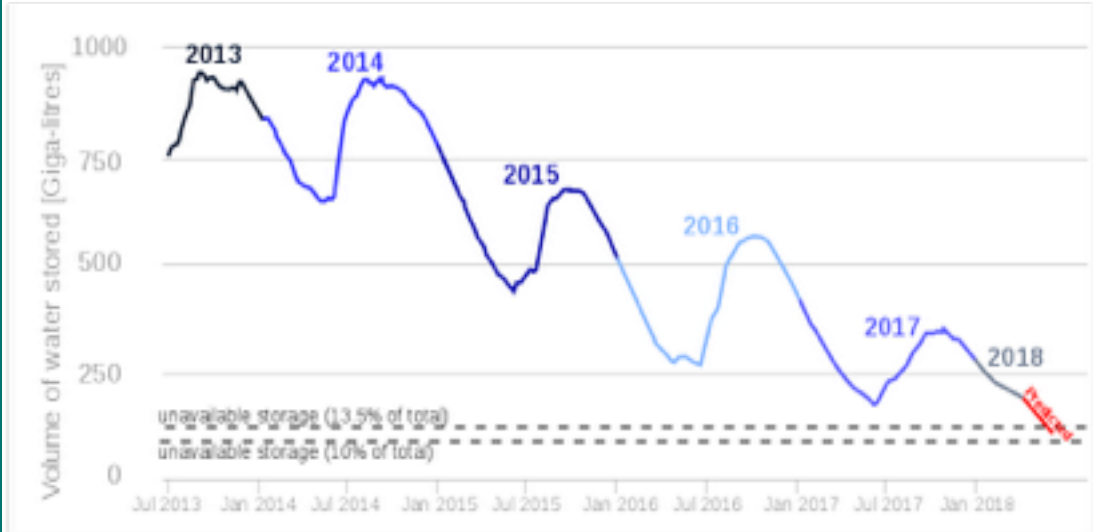
Theewaterskloof Dam  
Source: ABC 2018



Residents wait for water, Feb 2018  
Source: AP



# Water supply: Cape Town



Water stored in the Western Cape's largest six dams from 30 June 2013 to 31 March 2018. The graph illustrates the declining water storage levels over the course of the Cape Town water crisis, and the impact of reduced usage since early 2018.

Data obtained from the [Climate Systems Analysis Group](#) (CSAG)



## Water Supply:

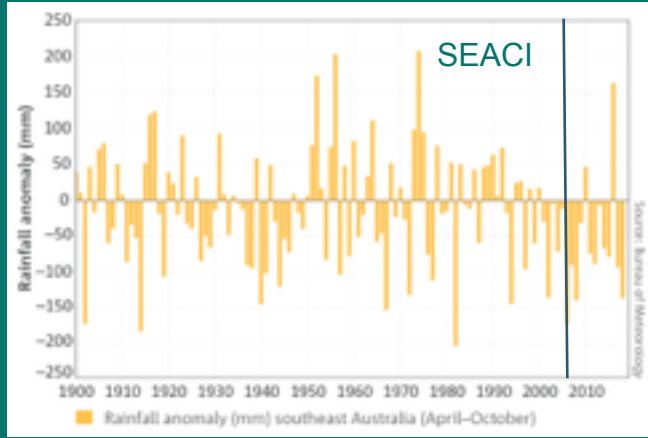
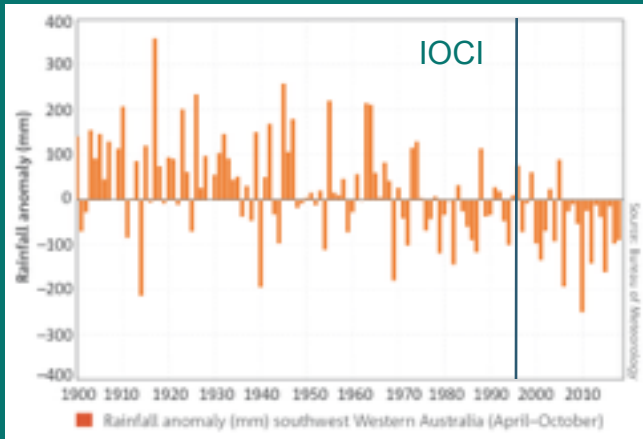
### A major driver of climate research in Australia

The Indian Ocean Climate Initiative (IOCI) research partnership between the WA State Government, Bureau of Meteorology and CSIRO that was established in 1998, and supported subsequent key decision making on climate variability and change in WA.

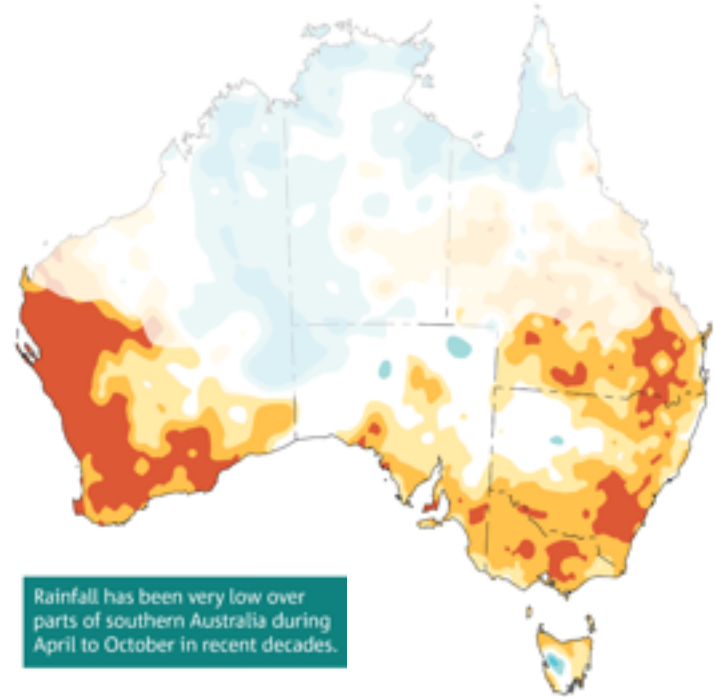
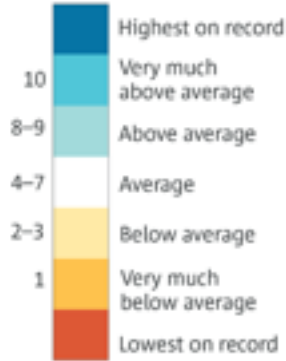
The South Eastern Australian Climate Initiative (SEACI) research partnership between CSIRO, the Federal Department of Climate Change and Energy Efficiency, the Murray-Darling Basin Authority, the Bureau of Meteorology and the Victorian Department of Sustainability and Environment, established in 2005 .



# Drying over southern Australia



Rainfall decile ranges





# Drying over southern Australia

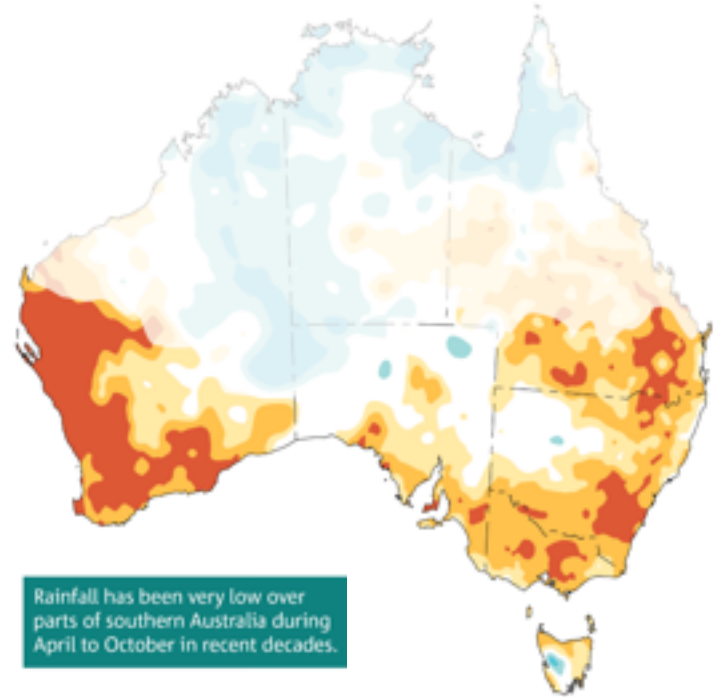
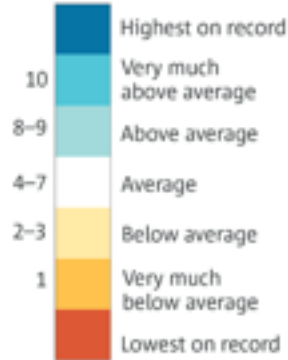
## Cost of desalination plants

Melbourne	\$3.5bn
Sydney	\$2.4bn
Adelaide	\$1.83bn
Gold Coast	\$1.2bn
Perth	\$955m



Wonthaggi Desalination Plant, Victoria

## Rainfall decile ranges



Rainfall has been very low over parts of southern Australia during April to October in recent decades.

# Changes in climate requiring adaptation



Increased frequency of large-scale heatwaves and record-high temperatures



Longer fire season with more extreme fire danger days



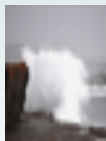
Prolonged high ocean temperatures



Reduced average rainfall and more time spent in drought



An increase in heavy rainfall



Increased frequency of coastal storm surge inundation

occurring now



emerging threat



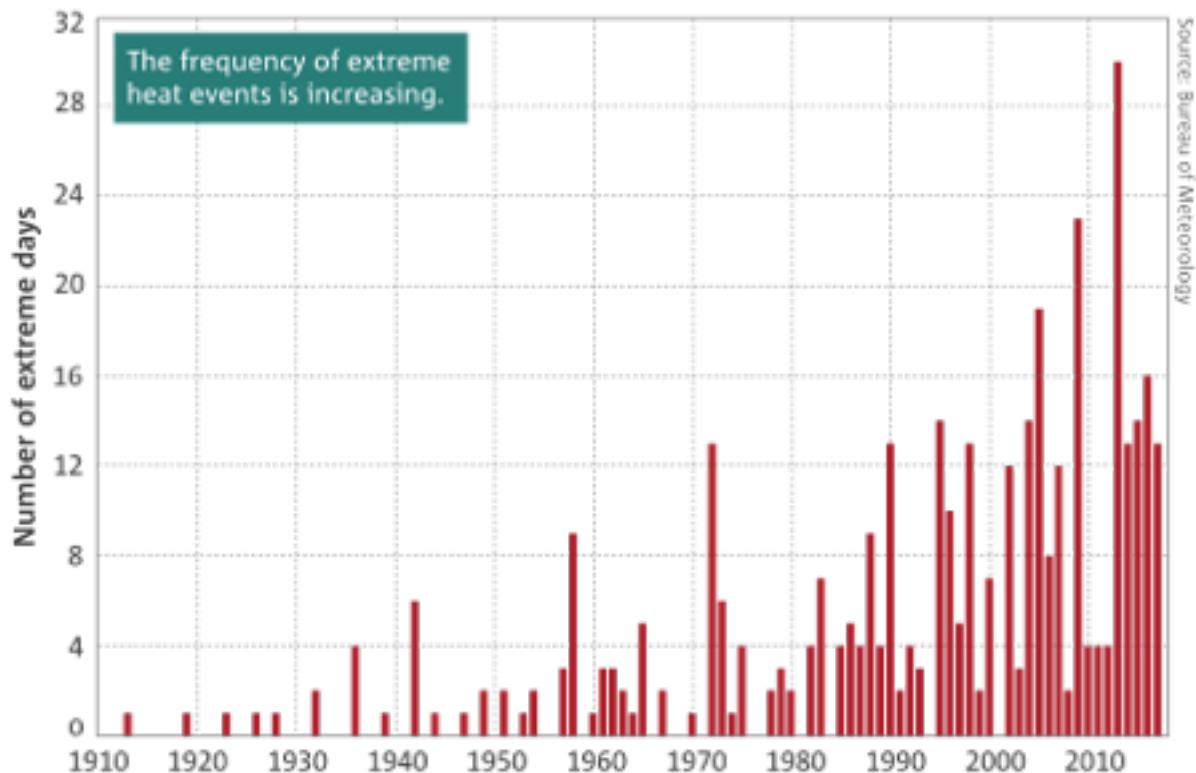
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# Australia's changing climate



## Increasing Extreme heat



## Black Saturday 2009

- Record-breaking heatwave across southeastern Australia
- Many all-time daily records set

## January 2013

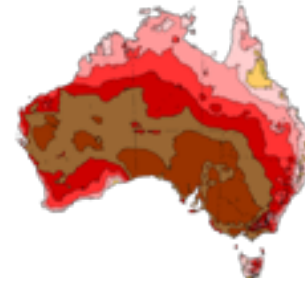
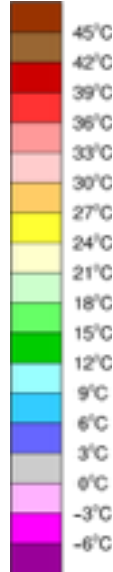
- Over 70% of the continent recording temperatures in excess of 42 °C
- Broke every sequential national heat record from 1 day through to 1 month

## February 2017

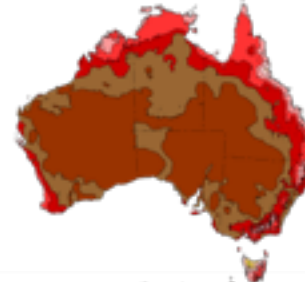
- Broke area-averaged records for NSW maximum temperatures



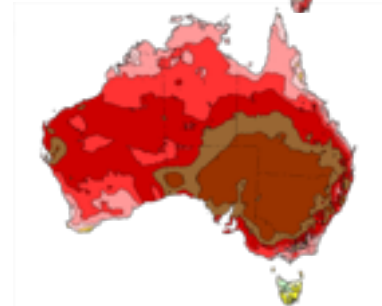
# Summer heatwaves



**Highest maximum temperature:**  
**27 Jan – 8 Feb 2009**

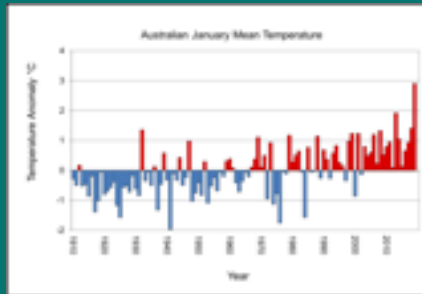


**Highest maximum temperature:**  
**First half of Jan 2013**



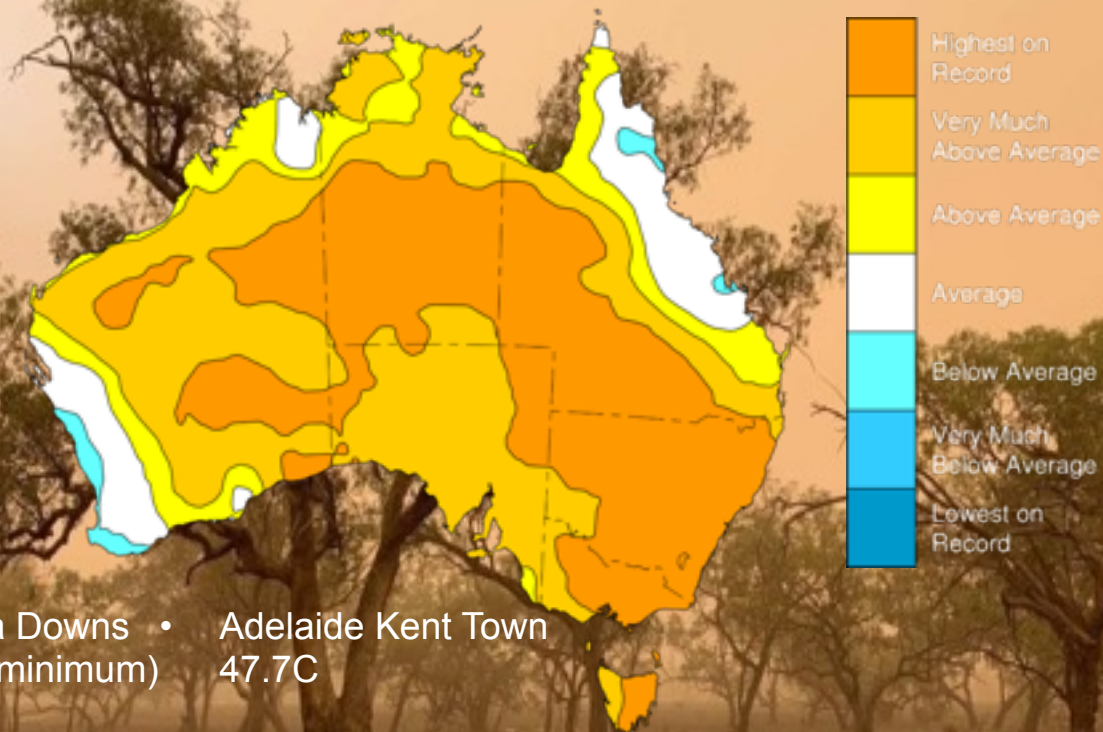
**Highest maximum temperature:**  
**31 Jan – 12 Feb 2017**

# January 2019: Australia's hottest month on record



- Borrona Downs 36.6C (minimum)
- Adelaide Kent Town 47.7C
- Port August 49.5C
- Hobart six days above 30C

Averaged across the country, 8 of the 10 warmest days on record occurred during January 2019



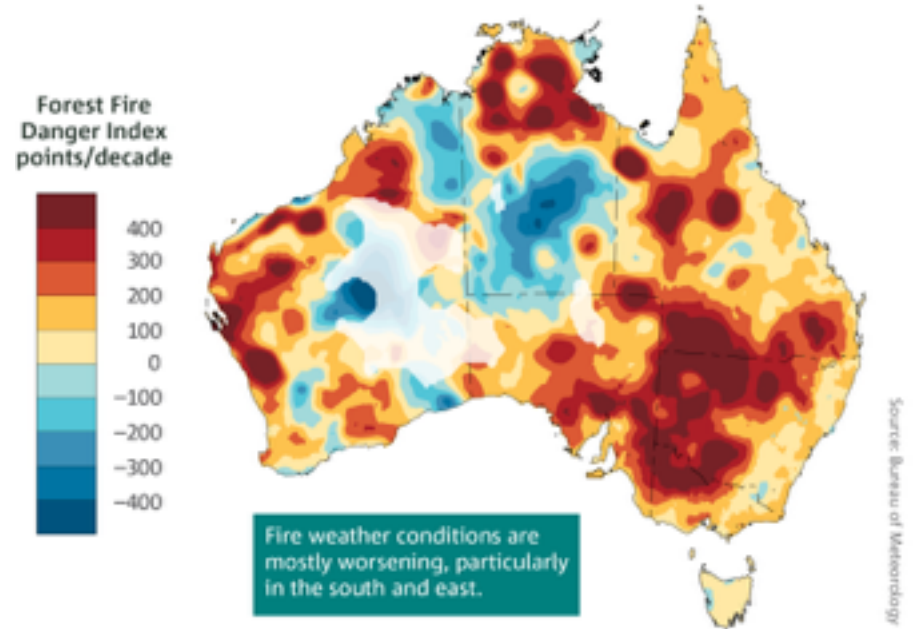
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## Worsening fire seasons



Escaped control burn, October 2015, Lancefield, Victoria.







Bega Valley, NSW  
15 August 2018  
(Source: ABC)



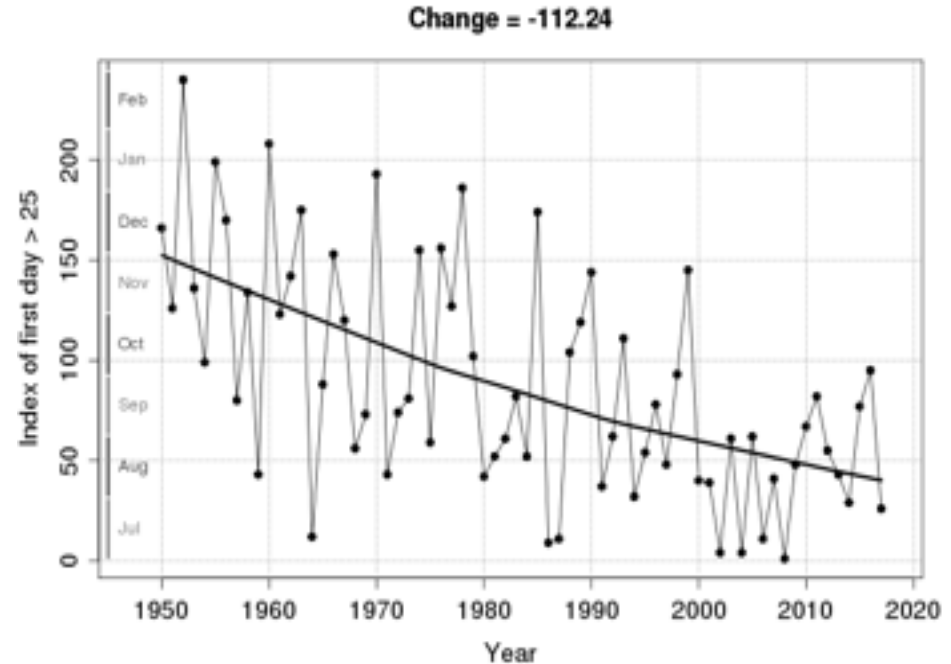
Albany, WA  
25 May 2018  
(Source: ABC)



Ranch Fire, California  
August 2018 (Source:  
SFGate)



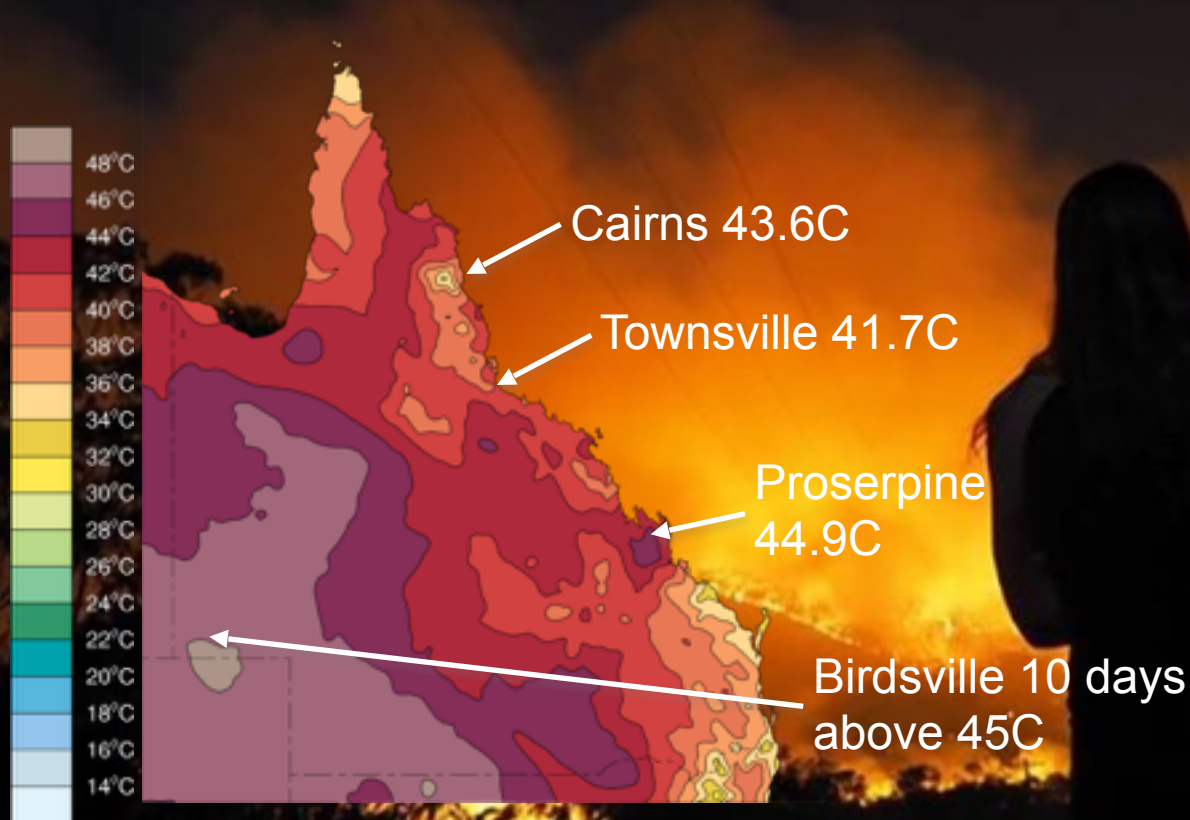
## Worsening fire seasons



Earliest day with south-coastal NSW daily FFDI > 25

# Record-breaking heat and fire weather: the new normal?

Highest temperature observed in November-December 2018



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Bushfire at Agnes Water on Monday 26 Nov. Source ABC Supplied: Benjamin Potts

# Record-breaking heat and fire weather: the new normal?



Bushfire plumes from Himawari 8 Japanese weather satellite; 7:30am on 29 November 2018

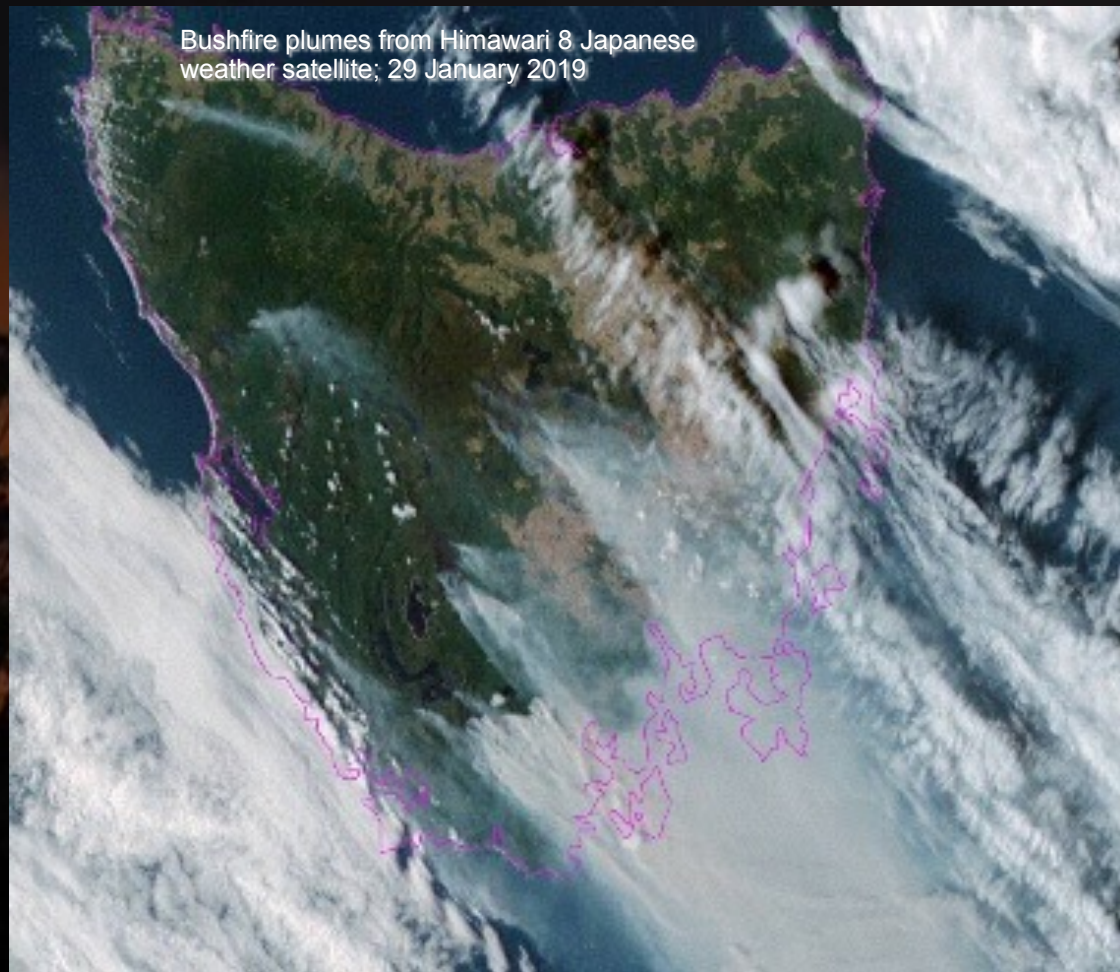


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# Record-breaking heat and fire weather: the new normal?



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# Record-breaking heat and fire weather: the new normal?



**Black  
Saturday  
2009**

**Record preceding heatwave  
across southeastern Australia**

**Prolonged drought (record  
breaking in some aspects)**

**Record daytime and overnight  
temperatures**

**Record fire danger Black  
Saturday**

**173 deaths, 414 serious  
injuries, total cost of ~\$5 billion**

**~500 excess deaths from  
extreme heat**



Kinglake Fire. Source: CSIRO Science Image, Nick Pitsas, February 25 2009

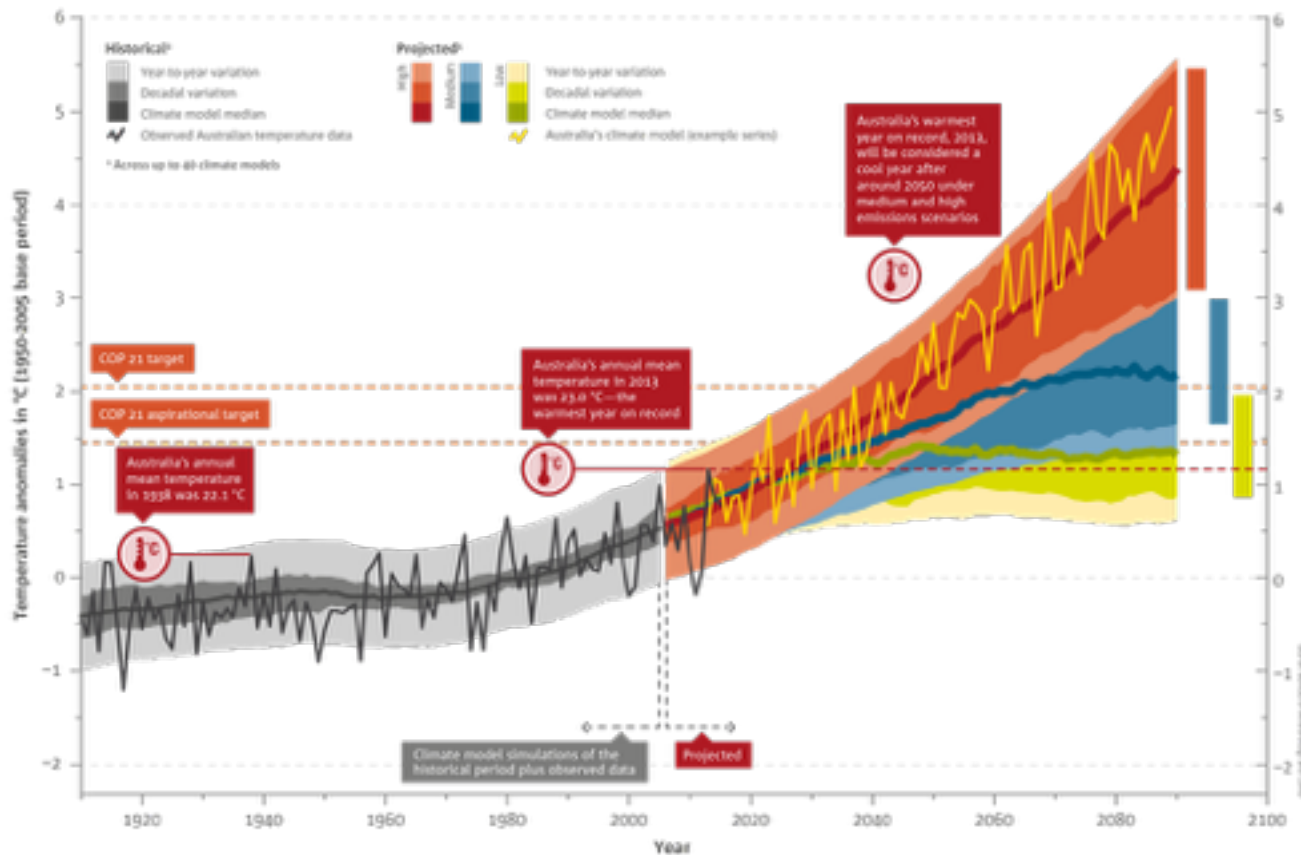


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# Australia's future climate



## Australian temperature projections



# Changing paradigms

**Future planning,  
resilience and  
disaster mitigation**



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# Future sea level

Inundation from storm tide under a business-as-usual median-estimate sea level rise by 2050

(1-in-100 year storm tide ~1.33m)



Fishermans Bend projected storm tide inundation

Inundation from storm tide under a business-as-usual high-estimate sea level rise by 2100

(1-in-100 year storm tide ~2.05m)



Data sources: <http://www.climatechangeinaustralia.gov.au/en/> McInnes et al, (2009; 2015)

<http://coastalrisk.com.au/viewer>





Cairns projected storm tide inundation



# Future sea level

Inundation from storm tide under a business-as-usual median-estimate sea level rise by 2050

(1-in-100 year storm tide ~2.32 metres)

Inundation from storm tide under a business-as-usual high-estimate sea level rise by 2100

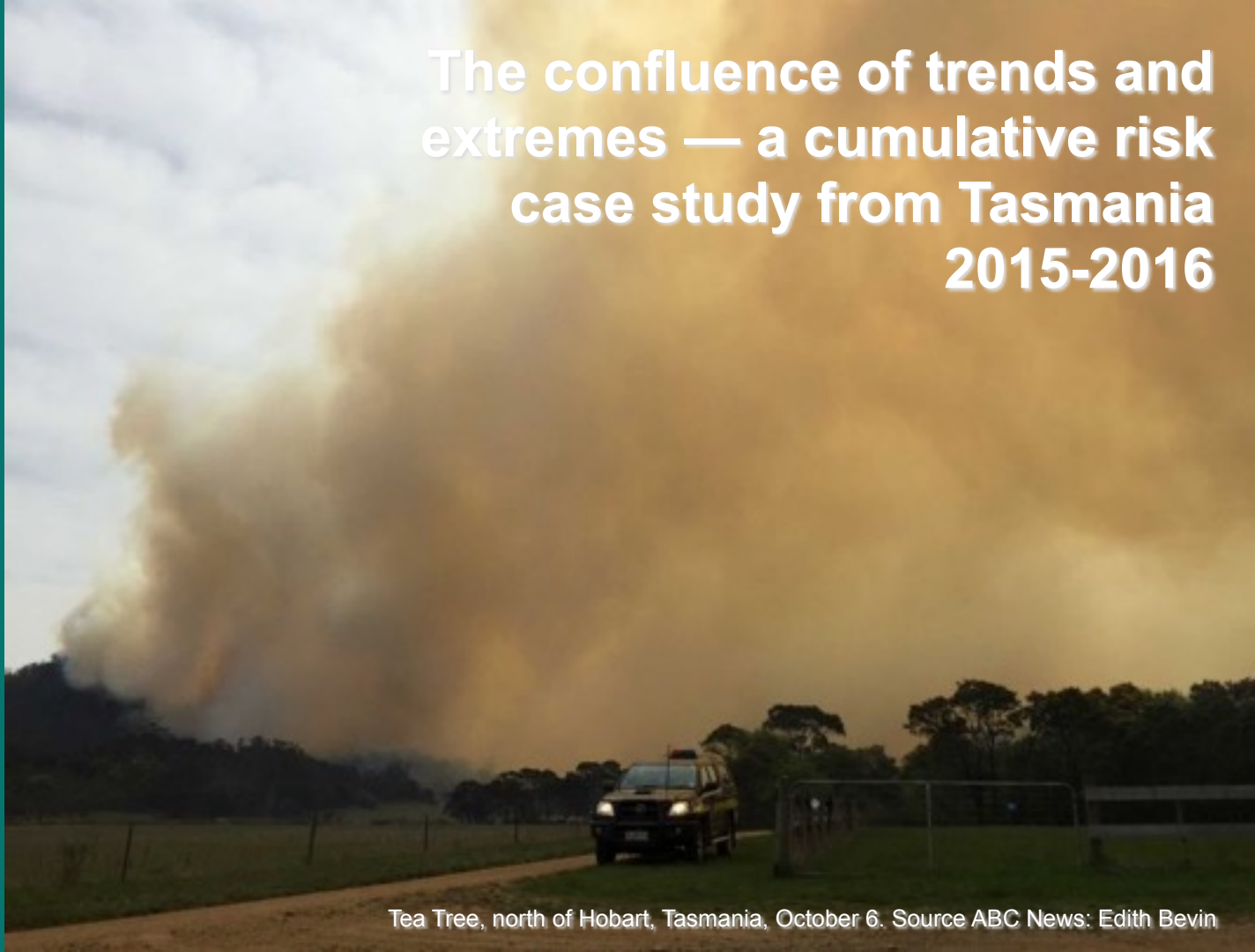
(1-in-100 year storm tide ~3.08 metres)

Data sources: <http://www.climatechangeinaustralia.gov.au/en/> McInnes et al, (2009; 2015)

<http://coastalrisk.com.au/viewer>

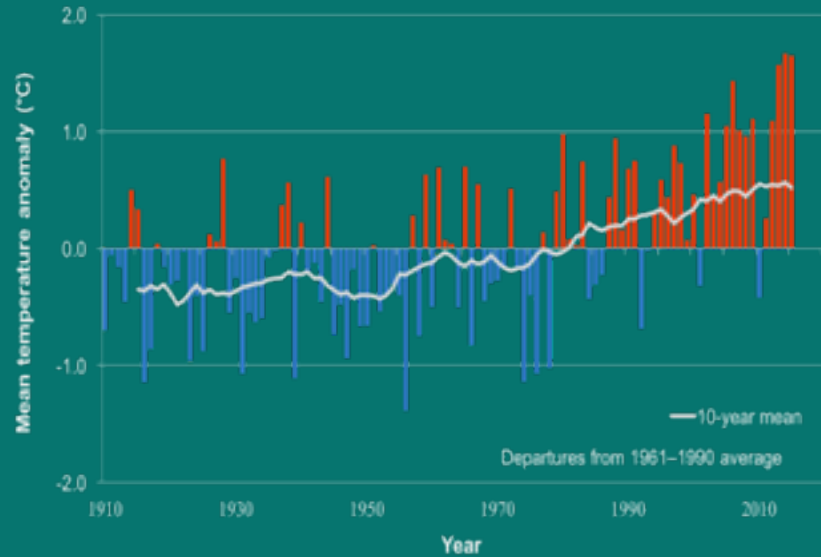
# Compound Extreme Events

The confluence of trends and  
extremes — a cumulative risk  
case study from Tasmania  
2015-2016

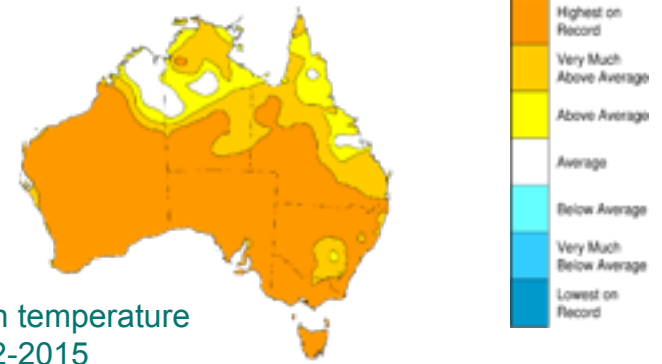


Tea Tree, north of Hobart, Tasmania, October 6. Source ABC News: Edith Bevin

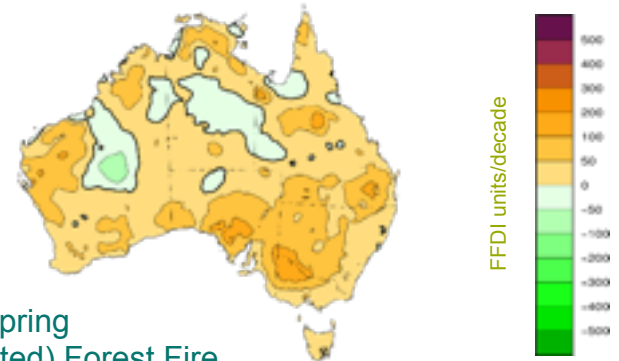
## Spring is getting warmer with an accompanying increase in fire danger



Spring mean temperature anomalies

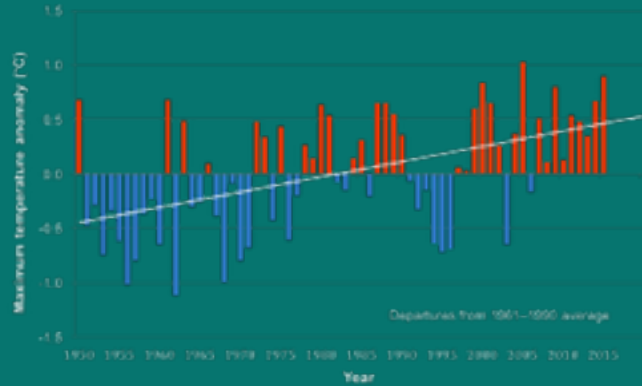


Spring mean temperature deciles 2012-2015

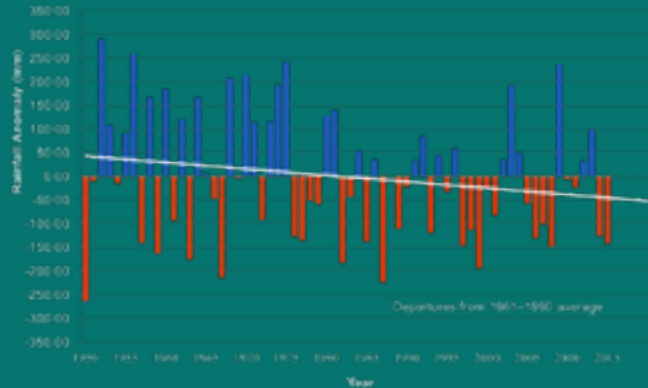


Trend in Spring (accumulated) Forest Fire Danger Index 1950-2015

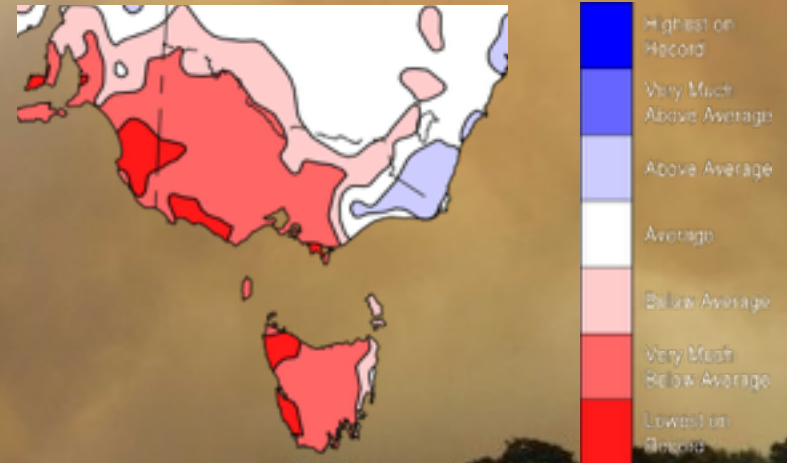
Tasmanian mean spring temperature



Tasmanian April-October rainfall



# Tasmania in 2015-2016: a confluence of climate extremes

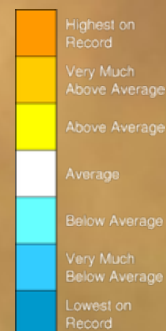


Rainfall deciles for the period Sept 2014 to April 2016



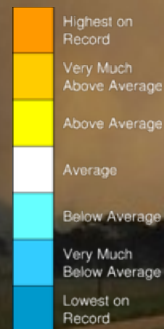
# Compound Extreme Events

Tasmania in October 2015 — record heat —  
record low rainfall — record high fire danger



October 2015 Rainfall Deciles

October 2015 Temperature Deciles



October 2015 Forest Fire Danger Index

Tea Tree, north of Hobart, Tasmania, October 6.  
Source ABC News: Edith Bevin

# Compound Extreme Events

## Tasmania in June 2016

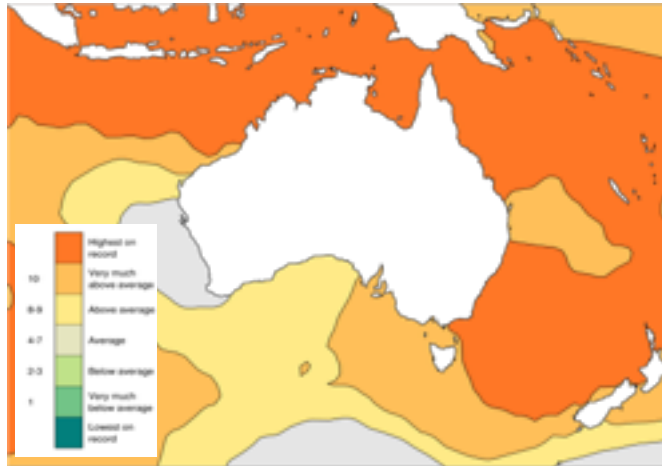


South Esk River Hadspen, Tasmania, 8 June 2016. Source Catherine Jolly, BoM

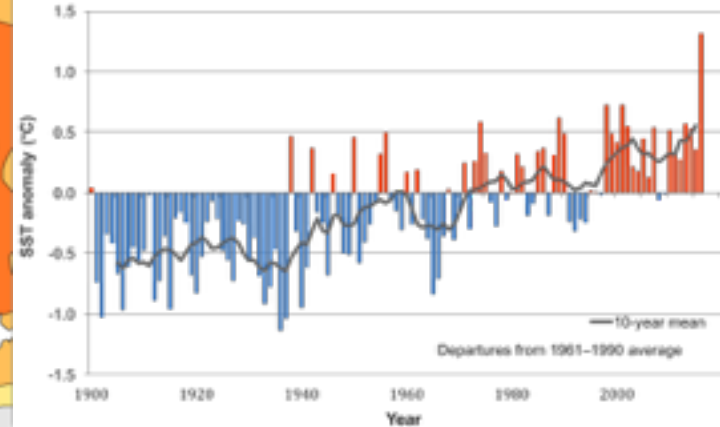
# Compound Extreme Events



## Sea surface temperatures during May 2016



May 2016

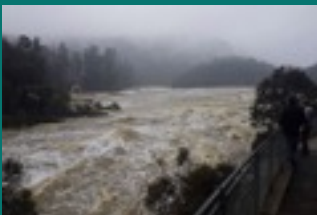


Tasman Sea May sea surface temperature anomalies

# Compound Extreme Events



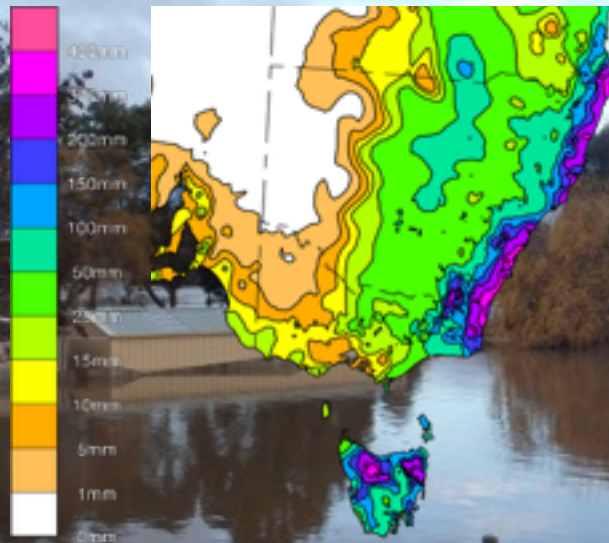
Collaroy Beach, NSW, 6 June 2016



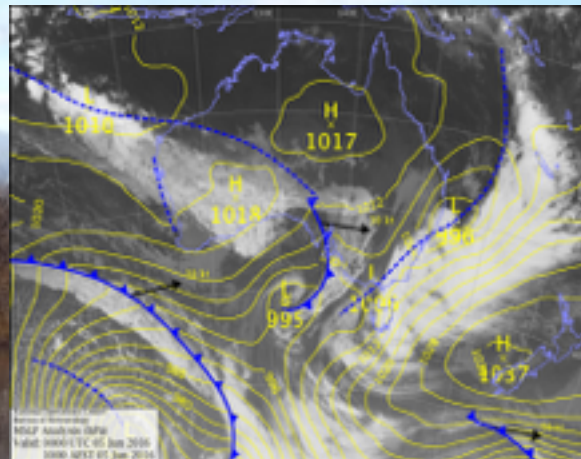
Cataract Gorge, Tasmania, 7 June 2016



Tasmania in June 2016 — record ocean temperatures — record high rainfall



Rainfall anomalies, early June 2016



MSLP and cloud, 5 June 2016



# Thank you

*"belief in climate change is optional, but participation is mandatory"*

*Jim Beever, southwest Florida Regional Planning Council*



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**More information**

[www.bom.gov.au/state-of-the-climate](http://www.bom.gov.au/state-of-the-climate)

[www.csiro.au/state-of-the-climate](http://www.csiro.au/state-of-the-climate)