Climate change and impacts on the built environment

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Climate Comms

Overview

Observed climate change
Future climate change
Impacts on the built environment

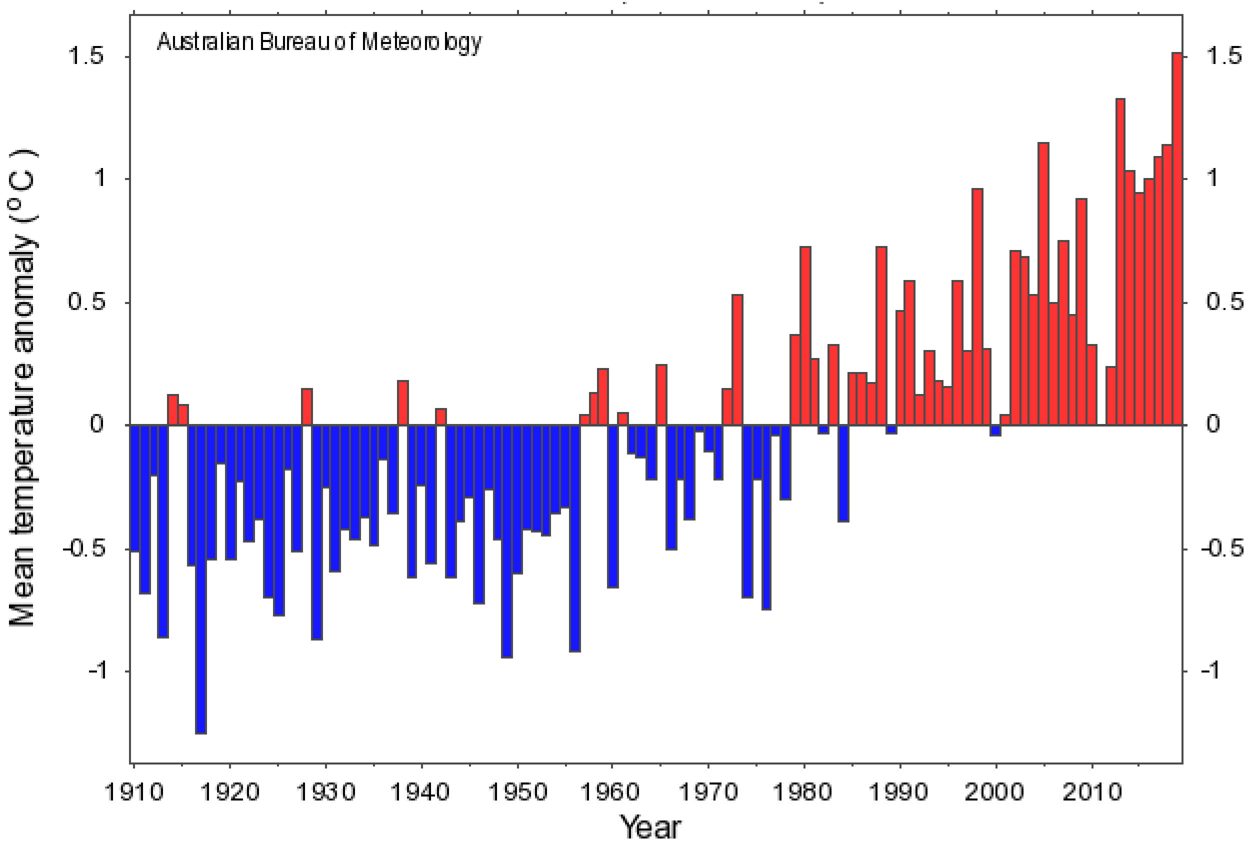
Observed climate change

Global climate change

- Human activities have increased greenhouse gas concentrations
- Human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea level rise, and in changes in some climate extremes
- It is *extremely likely* that human influence has been the dominant cause of the observed warming since the mid-20th century

IPCC (2013)

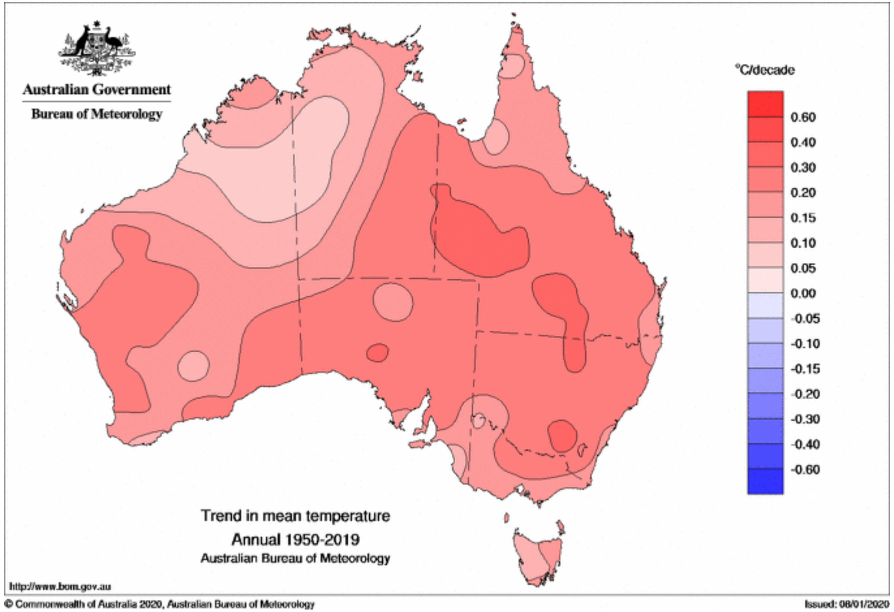
Australian climate change



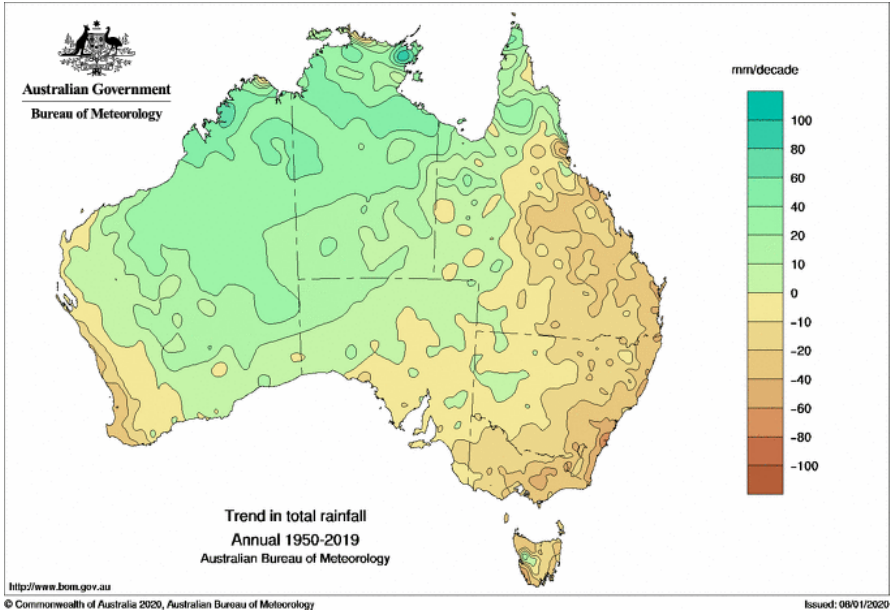
- Warming of 1.4 °C since 1910
- Nine of the ten warmest years have occurred since 2004
- 2019 was the warmest, followed by 2013, 2005 and 2018

BoM (2020)

Australian climate change



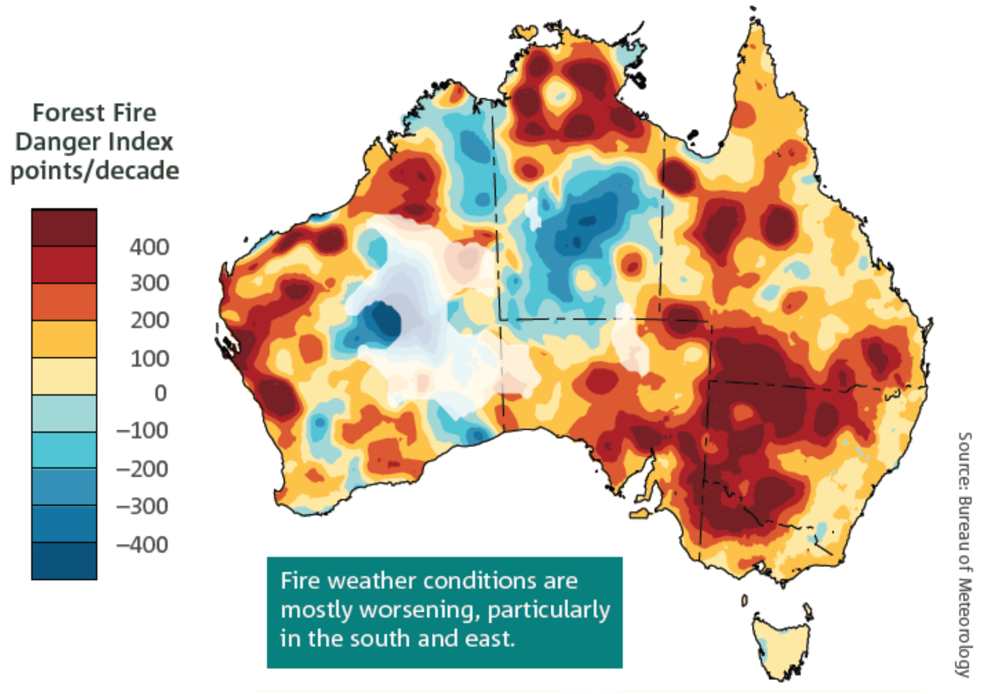
Greatest warming in the south and east, with more hot days and fewer cold days



Less rain in the south and east, more rain in the north-west

BoM – Issued 08/01/2020

Fire weather



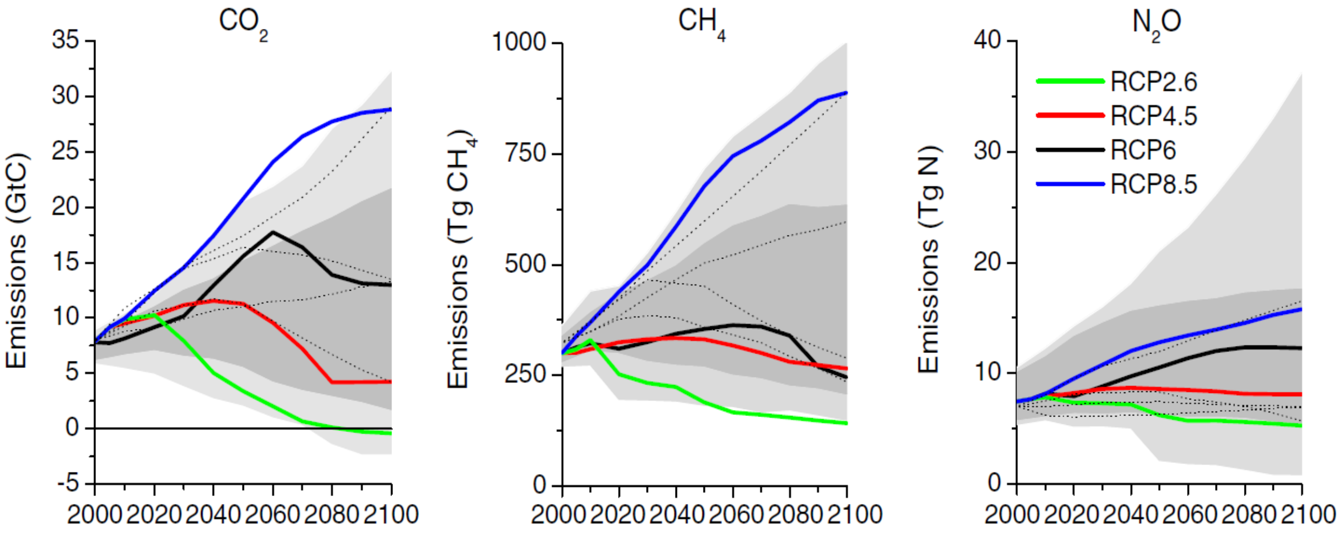
Trends from 1978 to 2017 in the annual (July to June) sum of the daily Forest Fire Danger Index—an indicator of the severity of fire weather conditions. Positive trends, shown in the yellow to red colours, are indicative of an increasing length and intensity of the fire weather season. A trend of 300 FFDI points per decade is equivalent to an average trend of 30 FFDI points per year. Areas where there are sparse data coverage such as central parts of Western Australia are faded.

BoM and CSIRO (2018)

- Warmer and drier conditions have increased fire-weather risk
- Annual fire danger index increased across most of Australia since 1978
- Largest increases in spring and autumn
- Longer fire season and greater overlap with northern hemisphere fire seasons
- Shorter period for fuel-reduction burning
- More resources needed for fire management

Future climate change

Greenhouse gas emission scenarios



Van Vuuren et al (2011)

Emission scenarios are based on different assumptions about socio-economic development

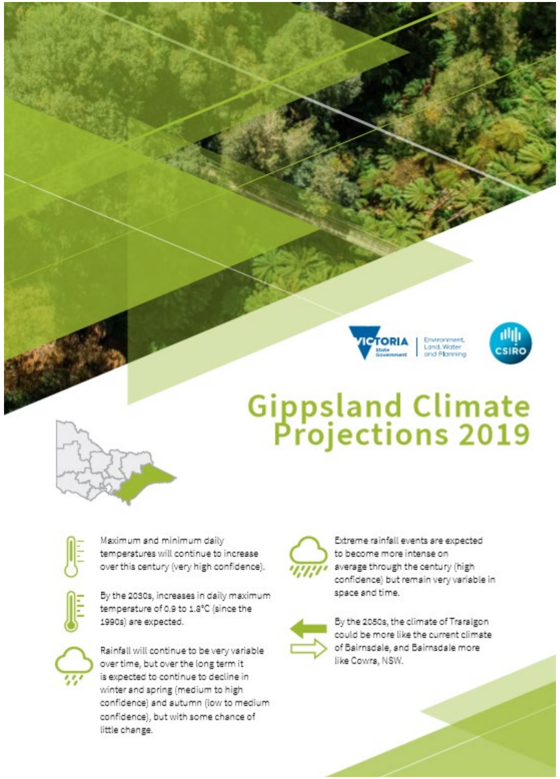
These scenarios drive future climate simulations using global climate models

Victorian climate projections

High confidence for

- Hotter with more heatwaves and less frost
- Drier with more droughts in winter and spring
- More extreme rainfall and flood events
- More extreme fires and a longer fire season
- Further sea level rise
- Rate of change depends on emission scenario

Victorian climate projections



https://www.climatechange.vic.gov.au/adapting-to-climate-change-impacts/victorian-climate-projections-2019

Impacts on the built environment

Impacts on the built environment

- Built infrastructure is a critical enabler for activity across all sectors of the economy, with interdependencies increasing exposure to supply-chain disruptions
- Assets are built to last for decades: electricity networks for 60 years, buildings over 100 years, bridges and dams 200 years
- Existing assets and those constructed in the future will need to cope not only with gradual warming, drying and sea level rise, but with the growing risk of extreme events

Climate Institute (2012)
Climate Council (2019)

Impacts on the built environment

- Coastal cities, settlements and key infrastructure including seaports, airports, water treatment plants, desalination plants, roads and railways are increasingly exposed to climate change
  - 2007-2016: $2.7 billion annual-average cost of natural disasters in Victoria (Deloitte, 2017)
  - January 2009 Melbourne heatwave: blackouts, shut down rail and tram networks, closed thousands of businesses, crippled internet services and cut power to 500,000 homes (Climate Institute, 2012)
  - February 2009 Victorian fires: cost $4.4 billion, including loss and damage to public infrastructure; asset damage; costs to Telstra and Melbourne Water; cost of Victorian Bushfire Reconstruction and Recovery Authority (Deloitte, 2016).
  - Nov 2019 to Jan 2020 fires in Victoria: 5 deaths, 300 homes destroyed, emergency evacuations, roads closed, 1.2 million ha burnt, hazardous air quality (Parliament of Vic, 2020)

Impacts on the built environment

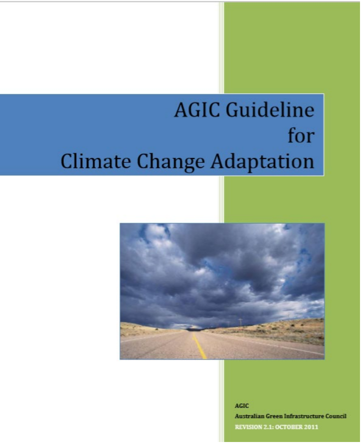
	2030	2050	2100
Damage-related loss of property value in Australia[1]	$571 b	$611 b	$770 b
Property damage in Australia[1]		$91 b / year	$117 b / year
Loss of asset value of road infrastructure[2]			$46-60 billion
Loss of asset value of rail and tramway infrastructure[2]			$4.9-6.4 b
Loss of asset value of residential buildings[2]			$51-72 b
Loss of asset value of light industrial buildings[2]			$4.2-6.7 b
Loss of asset value of commercial buildings[2]			$58-81 b

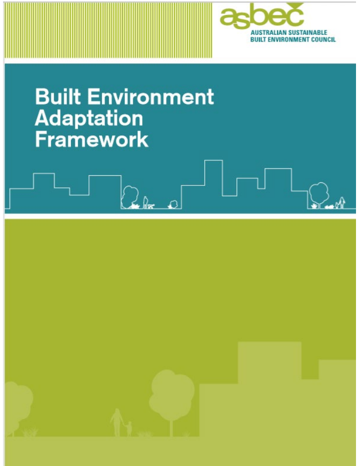
1 Steffen et al. (2019)
2 DCCEE (2011) for sea level rise of 1.1 metres by 2100

Adaptation for the built environment

- *National Climate Resilience and Adaptation Strategy* includes cities and built infrastructure as one of the eight focal areas
- *Critical Infrastructure Resilience Strategy* notes that Australian businesses and governments have a shared responsibility for the resilience of critical infrastructure, requiring strong partnerships and institutional arrangements
- *Roadmap for Enhancing Disaster Resilience in the Built Environment* focuses on integrating legislation, developing comprehensive data and mapping, enhancing collaborative vendor disclosure, governance partnerships, education, training and inter-jurisdictional coordination
- *Australian Standard 5344 Climate Change Adaptation for Settlements and Infrastructure* provides general guidance
- *Infrastructure Australia Assessment Framework* includes climate change
- *Australian Transport and Planning User Guide* includes climate change and describes scenario analysis

Adaptation for the built environment





- Australian Green Infrastructure Council (AGIC) produced a *Climate Change Adaptation Guideline for Infrastructure* in 2011
- Green Building Council of Australia (GBCA) incorporated climate adaptation and resilience into its *Green Star* program (and will use ICA Building Resilience Standards)
- Australian Sustainable Built Environment Council (ASBEC) resilience fact sheets for cities, housing and infrastructure including climate change
- ASBEC *Built Environment Adaptation Framework* (2012)
- Infrastructure Sustainability Council of Australia (ISCA) has the *IS Rating Scheme* for evaluating sustainability across the planning, design, construction and operational phases of infrastructure programs, projects, networks and assets
- Industry-led climate risk assessments are being done for the electricity sector and finance sector (insurance, banks, investors)
- Leverage this work in a risk assessment for the built environment

Thank you

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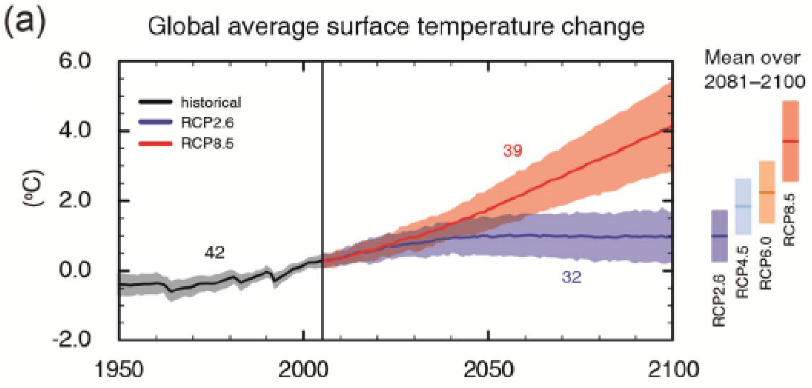
Optional slides

Global climate projections



IPCC (2019)

- Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system
- Global warming by 2100
  - 0.3-1.7^{o}C for low emissions (RCP2.6)
  - 2.6-4.8^{o}C for high emissions (RCP8.5)
- Sea level rise by 2100
  - 29-59 cm for low emissions (RCP2.6)
  - 61-110 cm for high emissions (RCP8.5)
- More and longer heat waves
- More extreme rainfall over most mid-latitude land masses and over wet tropical regions

Annual-average number of days over 35ºC

	1981-2010	2040-2059
Melbourne	8	10-16 (RCP4.5)
		13-20 (RCP8.5)
Cranbourne	6	6-14 (RCP4.5)
		9-20 (RCP8.5)

CSIRO (2019)

Annual-average number of severe fire-weather days

	1981-2010	2020-2039	2080-2099
Melbourne	2.7	3-4 (RCP4.5)	3-4 (RCP4.5)
		3-4 (RCP8.5)	4-6 (RCP8.5)

CSIRO and BoM (2019)

Annual-average sea level rise

	2040-2059
Williamstown	13-29 cm (RCP4.5)
	15-32 cm (RCP8.5)

CSIRO and BoM (2015)

Extreme rainfall intensity

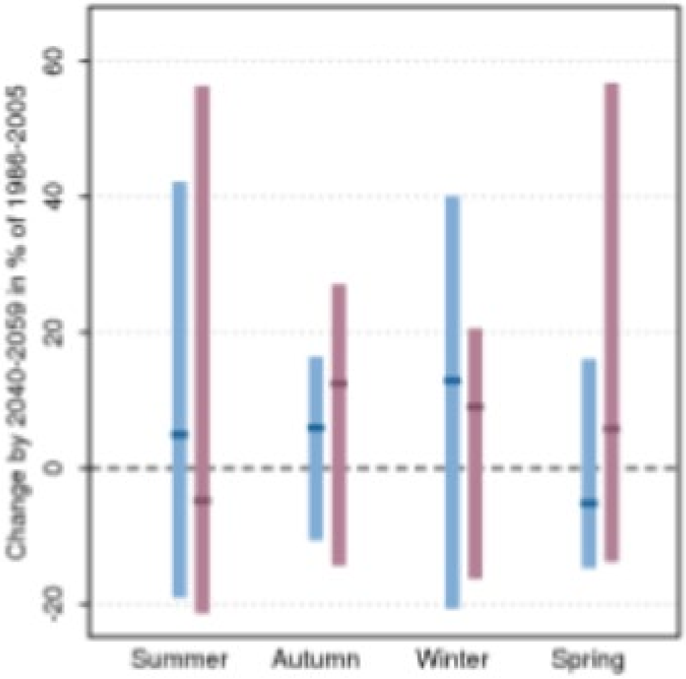


Figure 4. Projected percentage change in the 1-in-20-year maximum daily rainfall for 2040–2059 compared to the 1986–2005. Blue bars (left): medium emissions. Purple bars (right): high emissions. Dark horizontal lines: median.

Projected changes in extreme rainfall (daily maximum occurring once in 20 years) by 2050 have a large range of uncertainty (-20% to +60%), but the median (horizontal bar) tends to increase by around 10% in autumn and winter, with little change in spring and summer over Victoria

CSIRO (2019)