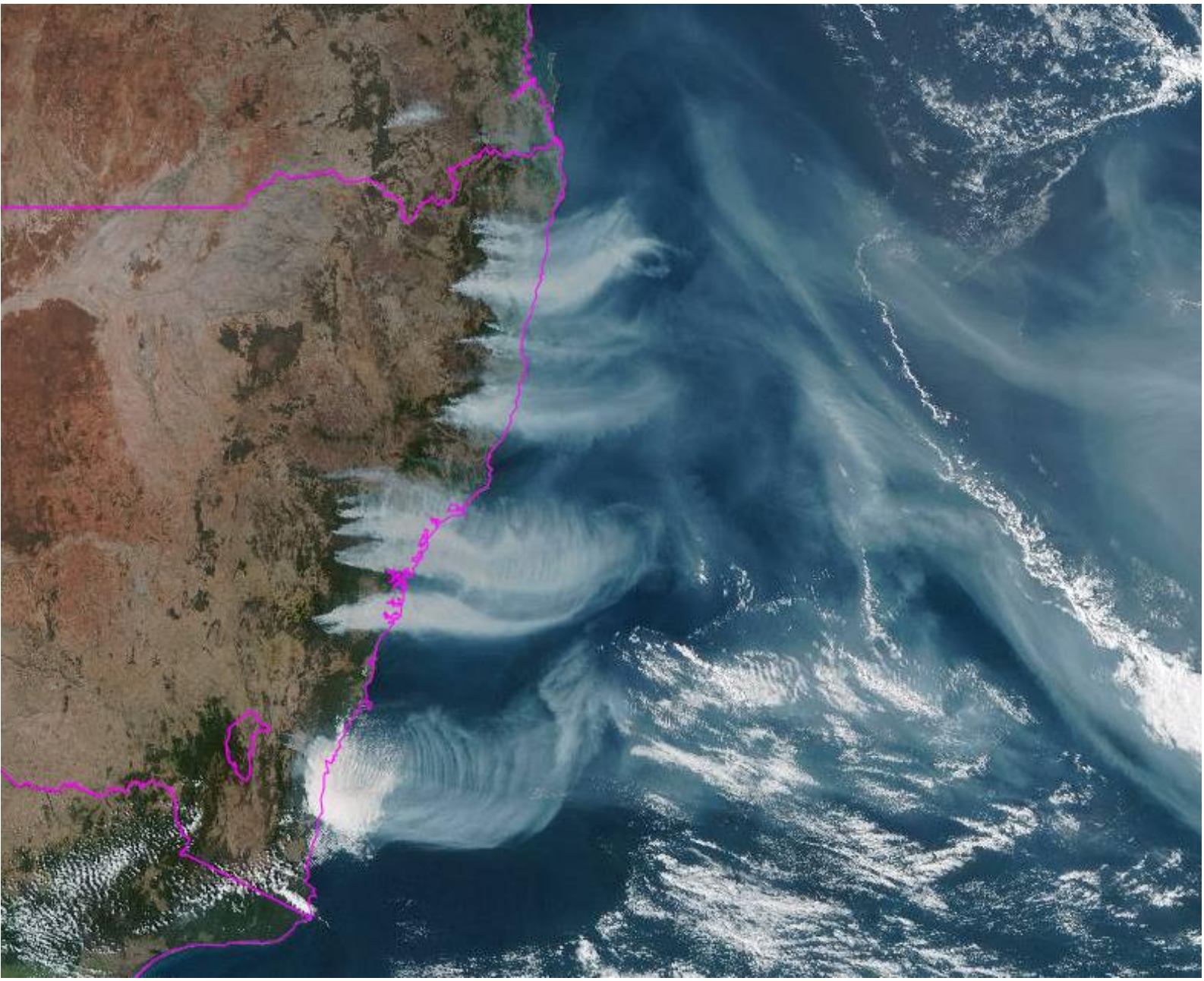
Australian Government
Bureau of Meteorology

Special Climate Statement 72—dangerous bushfire weather in spring 2019

18 December 2019



Version number/type	Date of issue	Comments
1.0	18 December 2019	

Published by the Bureau of Meteorology

Cover image: Satellite image from Himawari-8 on 4 December 2019 showing plumes of smoke extending eastwards from fires burning in eastern Australia and a large area of smoke over the Tasman Sea. Some of these fires had been burning for several months after starting on days of elevated fire weather conditions in early September.

Table of contents

Summary

- This Statement describes the dangerous fire weather conditions during spring 2019.
- Across Australia as a whole, spring 2019 saw the highest fire weather danger as measured by the Forest Fire Danger Index (FFDI)[1], with record high values observed in areas of all States and Territories.
- More than 95% of Australia by area had spring accumulated FFDI values that were very much above average (highest 10% of years), including almost 60% of the country that was highest on record for spring.
- The season began with areas of northeast New South Wales and southeast Queensland having above average daytime temperatures, very low humidity, and gusty winds leading to dangerous fire weather conditions. FFDI values were 100 or above (catastrophic category) at some locations in New South Wales on 6 September, which marked the onset of numerous large fires in eastern Australia.
- In October and November, days of dangerous fire weather conditions affected all States and Territories.
- For northeast New South Wales, the area averaged daily FFDI value was 25 or above (very high category) on 21 days during spring 2019. This was well above the previous highest count since 1950 of 11 such days in spring 2002 and an average count of 2 days.
- On 20 November, the area-averaged daily FFDI value for the Agricultural districts of South Australia was the region's highest on record for any month.
- The high fire dangers were exacerbated by widespread and severe rainfall deficiencies and hydrological drought, with continued low rainfall during spring and much above average temperatures.
- The dangerous fire weather conditions during spring 2019 is consistent with the increasingly severe fire weather seen in many areas of the country, owing to increasing temperatures and reduced cool season rainfall. This trend is largest in southern and eastern Australia, including areas that were affected by the elevated fire weather conditions in spring 2019.

[1] FFDI is one common measure of fire weather conditions.

1. Preceding climate conditions and drivers

Fire weather reflects a combination of factors, including rainfall and temperature patterns and shorter-term weather. Fire risk is driven by factors including fire weather and fuel availability. Rainfall influences the dryness of fuels and is a key component of indices for fire weather risk such as the Forest Fire Danger Index (FFDI).

By the start of September 2019, much of eastern Australia was primed for high fire danger ratings. Rainfall for January to August 2019 was very much below average to driest on record in some locations (Figure 1). Rainfall was particularly low across the northern Murray-Darling Basin, which has had very much below average rainfall and warmer than average maximum temperatures since at least 2017[2].

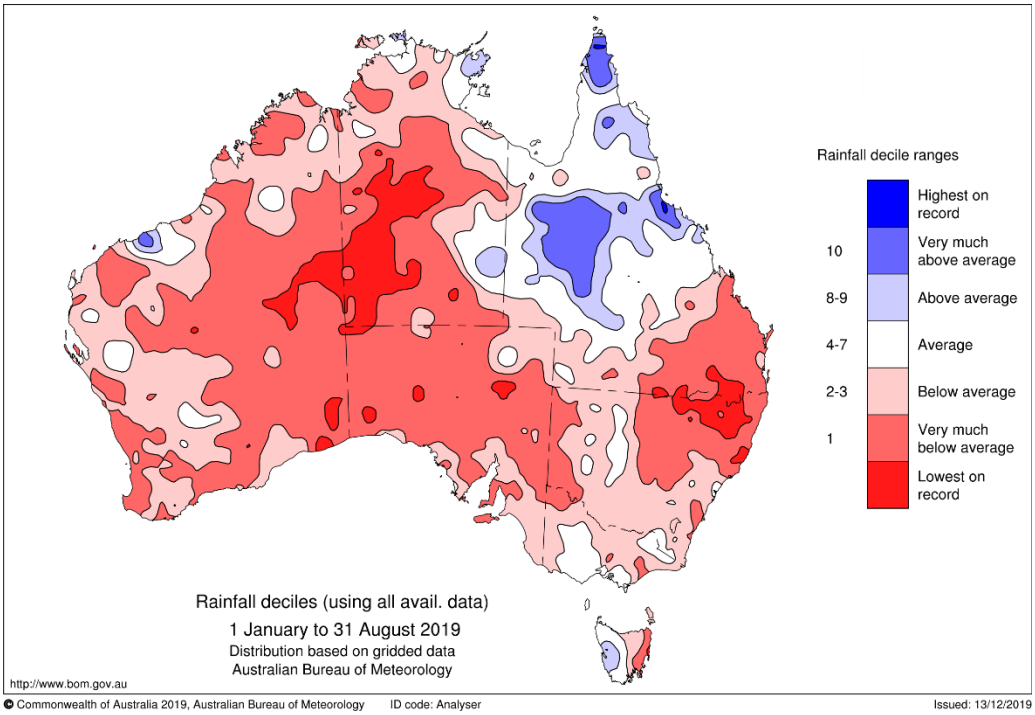


Figure 1: Rainfall deciles for January to August 2019 (based on all years since 1900).

Based on the Australia Water Resources Assessment Landscape model (AWRA-L) 6.0, the modelled root-zone soil moisture (top 100 cm of the soil profile) ranged from below average to lowest on record for winter 2019 over much of Australia (Figure 2). The low soil moisture put in place severely dry conditions that allowed the early onset of dangerous fire weather conditions.

[2] For more information see Special Climate Statement 70—drought conditions in eastern Australia and impact on water resources in the Murray–Darling Basin

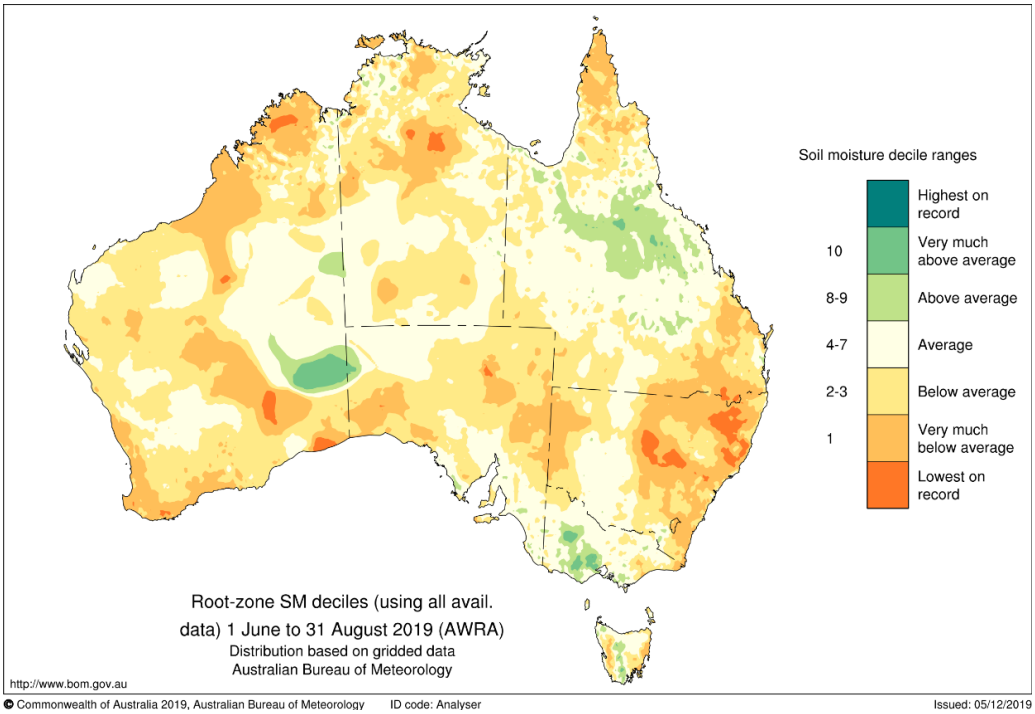


Figure 2: Root-zone soil moisture deciles for winter 2019 (based on all years since 1911).

The year-to-date mean maximum temperature for Australia to the end of spring 2019 ranged from very much above average to highest on record over large areas (Figure 3), including locations that were impacted by fires.

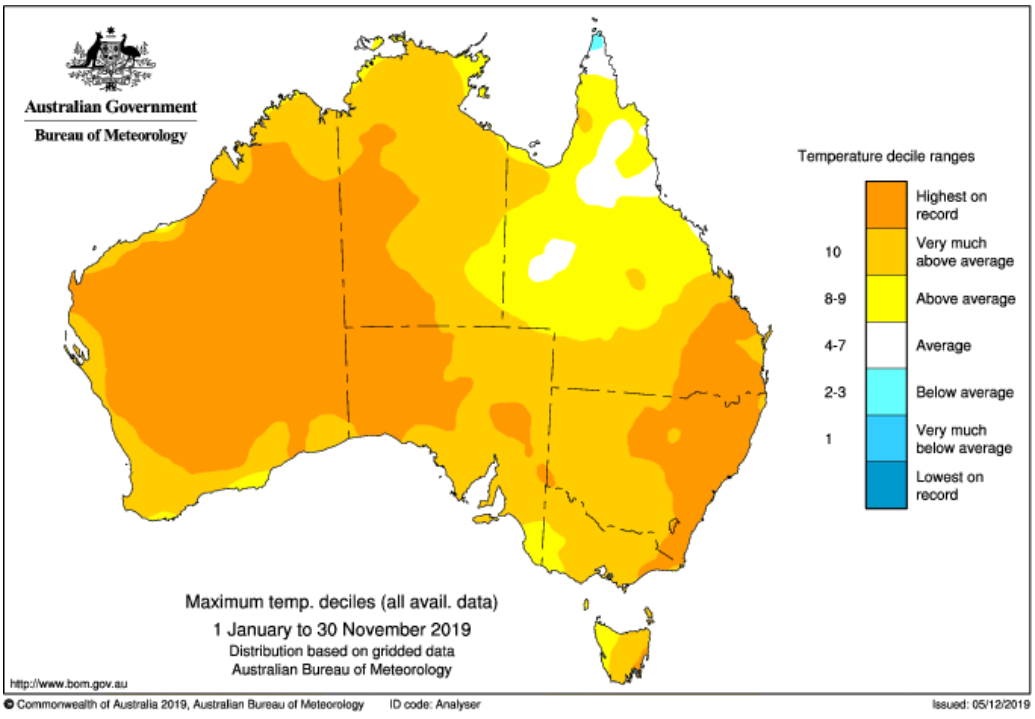


Figure 3: Maximum temperature deciles for January to November 2019 (based on all years since 1910).

Australia's climate was impacted by a positive Indian Ocean Dipole (IOD) in 2019, exerting a drying influence over many parts of the country. The positive IOD is characterised by cooler waters to the northwest of Australia and warmer waters further west towards Africa. Positive IOD events lead to reduced rainfall and low humidity across Australia. Recent months have seen notably low humidity, which enhances potential evaporation and increases fire danger.

During October and November 2019, a prolonged negative phase of the Southern Annular Mode (SAM) enhanced the warm and dry conditions in areas of eastern Australia. Sudden Stratospheric Warming (SSW) during September above Antarctica preceded the period of negative SAM. The SSW was caused by a weakening of the stratospheric vortex (high level winds) and such events in the upper atmosphere can later affect Australia's weather. SSW events weaken the westerly winds over the Southern Ocean, shifting the winds further north, which is what occurred in October and November 2019. For Australia, SSW events tend to have their biggest impacts in New South Wales and southern Queensland, increasing spring temperatures and decreasing rainfall.

2. Fire weather in spring 2019

Daytime temperatures were above average to highest on record for spring over most of Australia (Figure 4). Australia's mean maximum temperature for spring 2019 was 2.41 °C above average, the second-warmest on record behind 2014.[3]

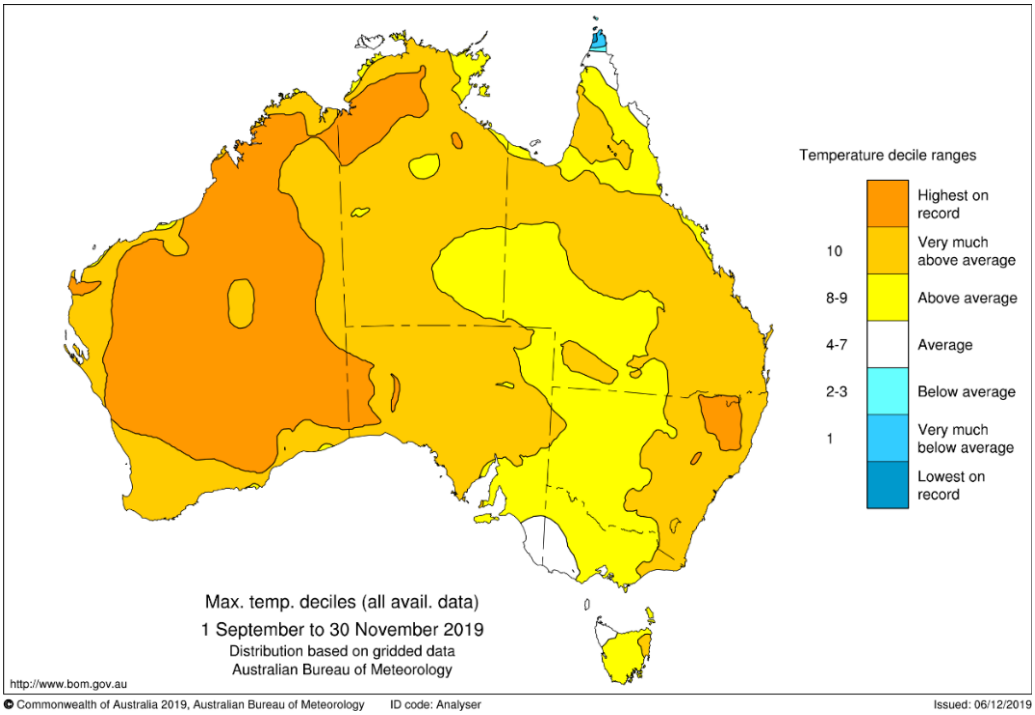


Figure 4: Mean maximum temperature deciles for spring 2019 (based on all years since 1910).

Analysis of vapour pressure, dewpoint temperature, and precipitable water—measures of water in the atmosphere—all show that the air masses over the fire affected regions in spring 2019 were very dry. The 3pm vapour pressure[4] was very much below average to lowest on record across much of Australia (Figure 5).

[3] Further information in the spring 2019 Climate Summary for Australia.

[4] For more information about vapour pressure see http://www.bom.gov.au/climate/austmaps/about-vprp-maps.shtml

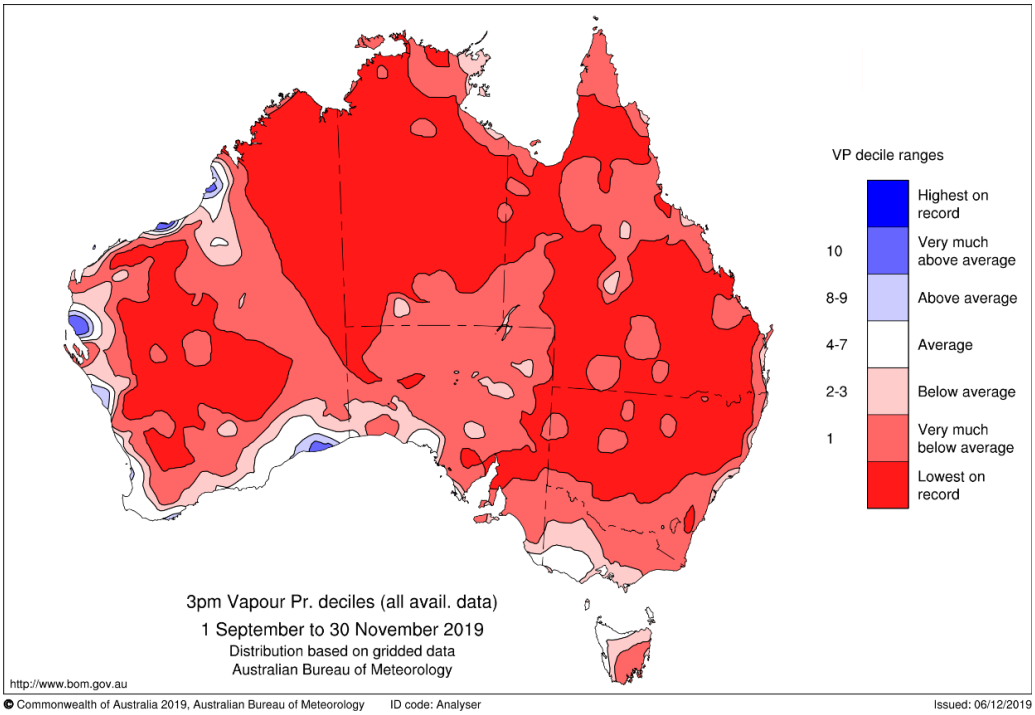


Figure 5: 3pm vapour pressure "humidity" deciles for spring 2019 (based on all years since 1950).

For southeast Queensland as a whole, the highest daily FFDI value of the season was on 9 November. The 3pm dewpoint temperatures on the day were very low. Dewpoints were below -10 °C over large areas of northeast New South Wales and southeast Queensland and locations such as Warwick (-7.5 °C), Glen Innes (-10.9 °C), and Scone (-10.2 °C) had their lowest 3pm dewpoint temperature on record for November (Table 4). Similar low dewpoints were a regular feature of the season, often in combination with high air temperatures.

Using National Centers for Environmental Prediction II Reanalysis mean sea level pressure data, high pressure systems were more common than average over southeastern Australia during spring 2019, and less common south of Tasmania. This resulted in the pressure over central and northern areas of Australia being more than 4 hPa above average for spring and below average in areas south of Tasmania (Figure 6). This pattern drove abnormal westerly flow over the fire affected regions of eastern Australia.

The pressure anomalies in the Australian region were consistent with increased westerly winds over southeastern Australia and increased easterlies over northern and western parts of the country. This was especially noticeable in November, with higher than average pressure over central and western Australia and below average MSLP south of Tasmania, resulting in windy conditions across Australia's southeast (Figure 7). Although relatively few sites exceeded records for strong wind gusts, winds were consistently stronger than average during the month.

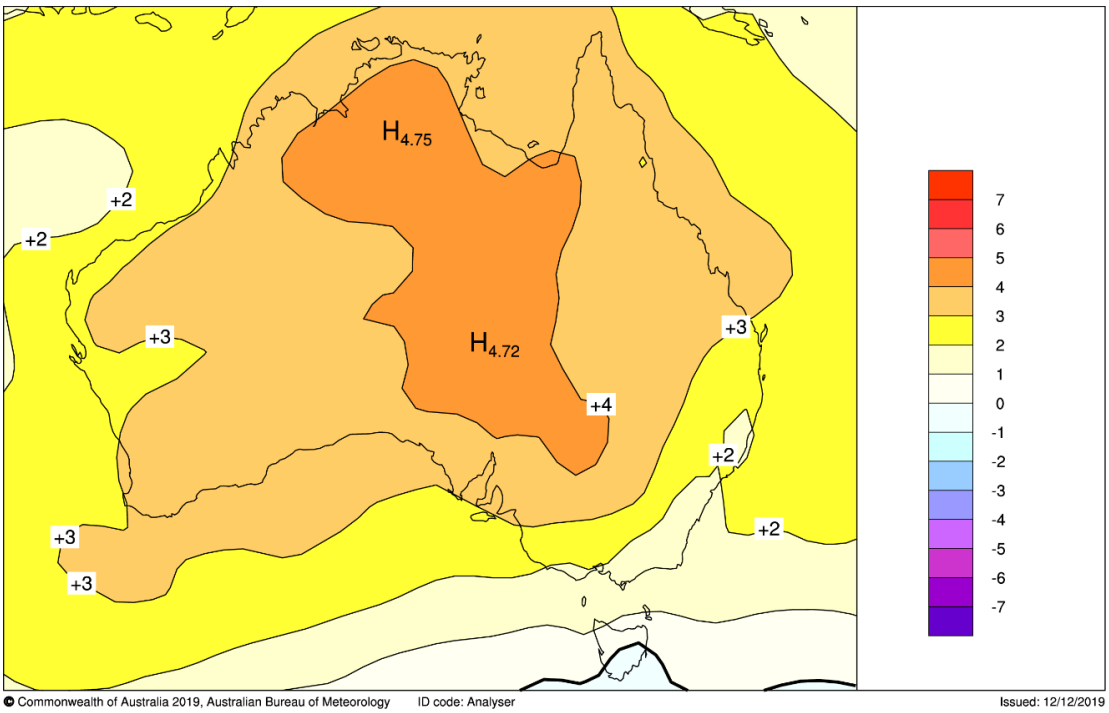


Figure 6: Mean sea level pressure anomalies for spring 2019 (from the ACCESS-G model relative to NCEP II Reanalysis climatology) in hPa, based on 1979–2000.

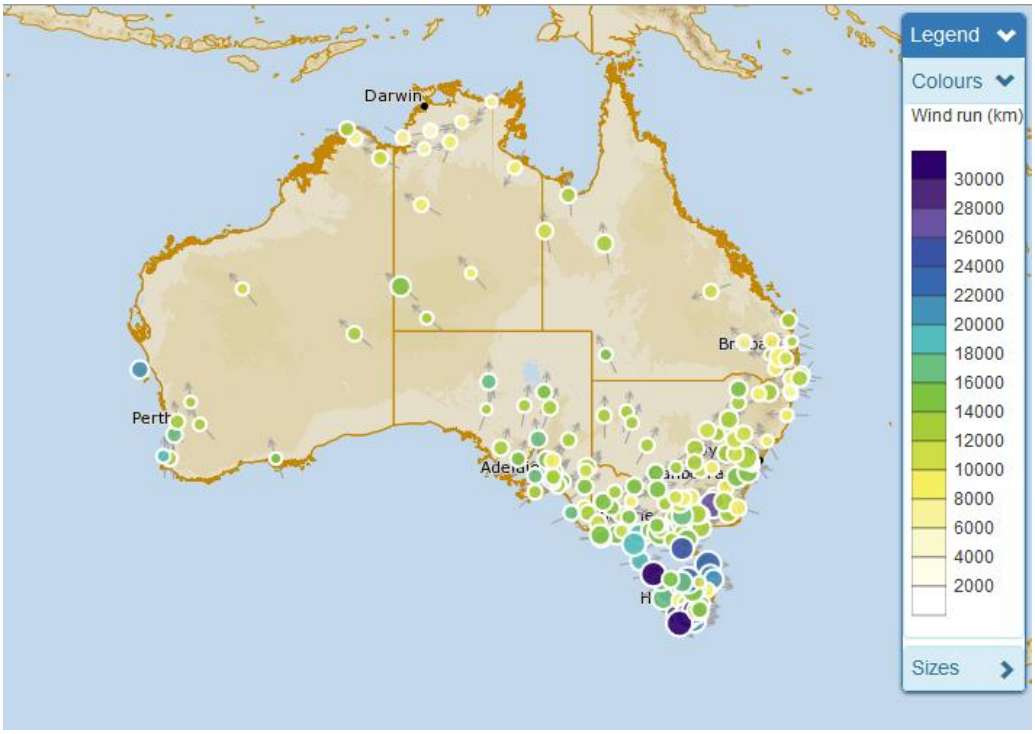


Figure 7: Sites that had their highest November total wind run for at least 10 years.

Rainfall in spring 2019 was below average to lowest on record over many areas of Australia (Figure 8). For Australia as a whole, rainfall was 62% below average, making it the driest spring on record (previous low in 1967). The low rainfall added to pre-existing rainfall deficiencies and low soil moisture, exacerbating the meteorological and hydrological drought conditions and meaning forest fuels remained dry.

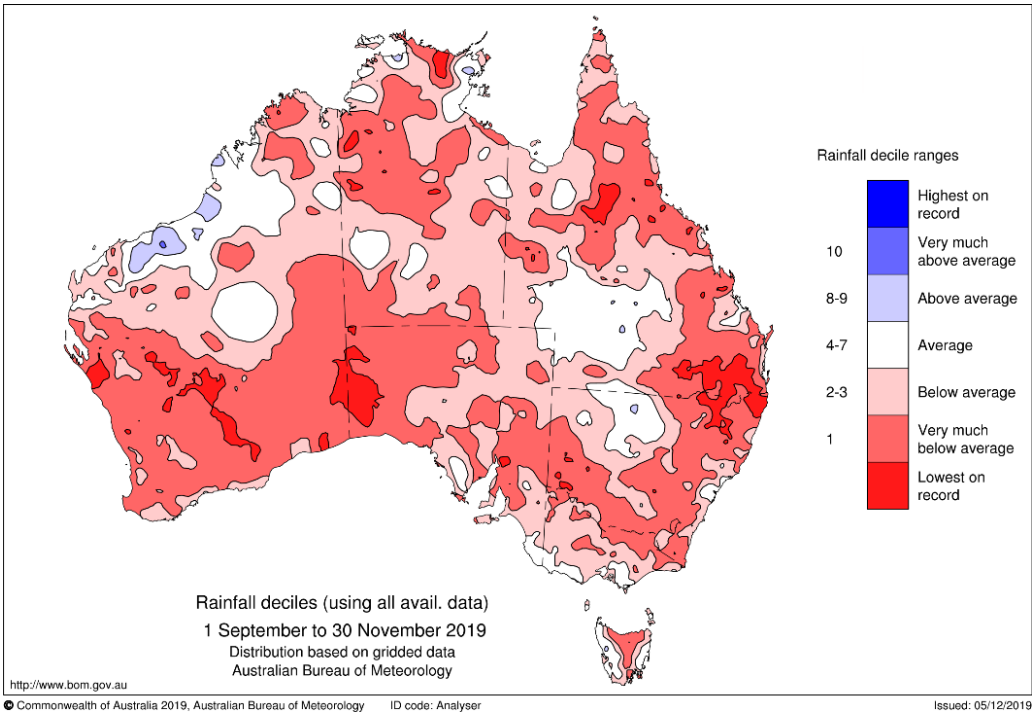


Figure 8: Map of rainfall deciles for spring 2019 (based on all years since 1900).

Daily FFDI values can be accumulated (summed) over longer periods of time and the accumulated FFDI values for spring 2019 were highest on record over large areas of Australia (Figure 9). More than 95% of Australia by area had spring accumulated FFDI values that were very much above average (decile 10), including almost 60% of the country that was highest on record. New South Wales, Queensland, Northern Territory, Western Australia and Tasmania all experienced record-high spring FFDI. Victoria was the only State with an area-averaged accumulated FFDI value for spring well below its previous record high while South Australia was second-highest.

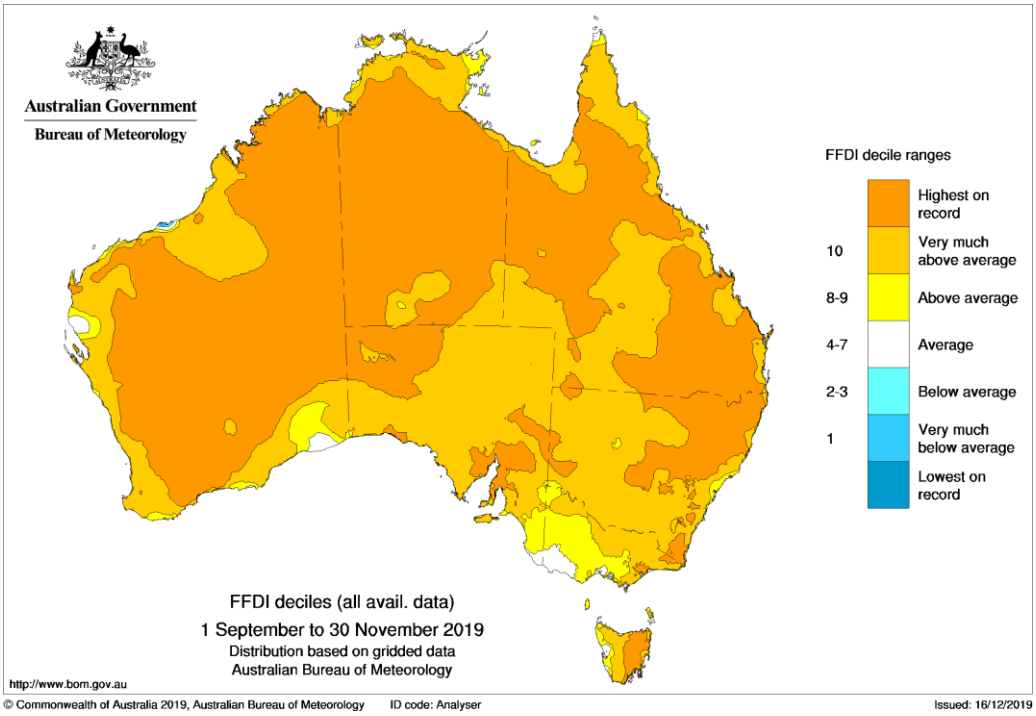


Figure 9: Accumulated-FFDI deciles for spring 2019 (based on all years since 1950).

Accumulated FFDI values for spring were more than twice the average in large areas of eastern Australia (Figure 10). The area-averaged accumulated FFDI for Australia in spring 2019 was the highest on record, significantly above the previous highest from 2002 (Figure 11).

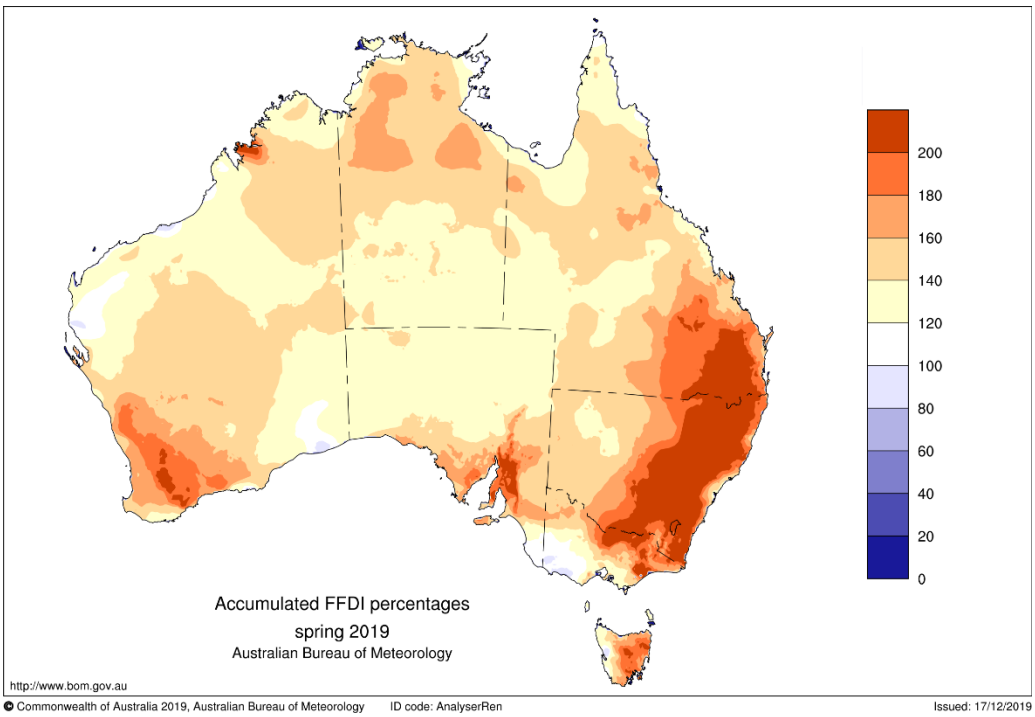


Figure 10: Accumulated FFDI percentages for spring 2019 compared to the long-term mean for 1950–2018.

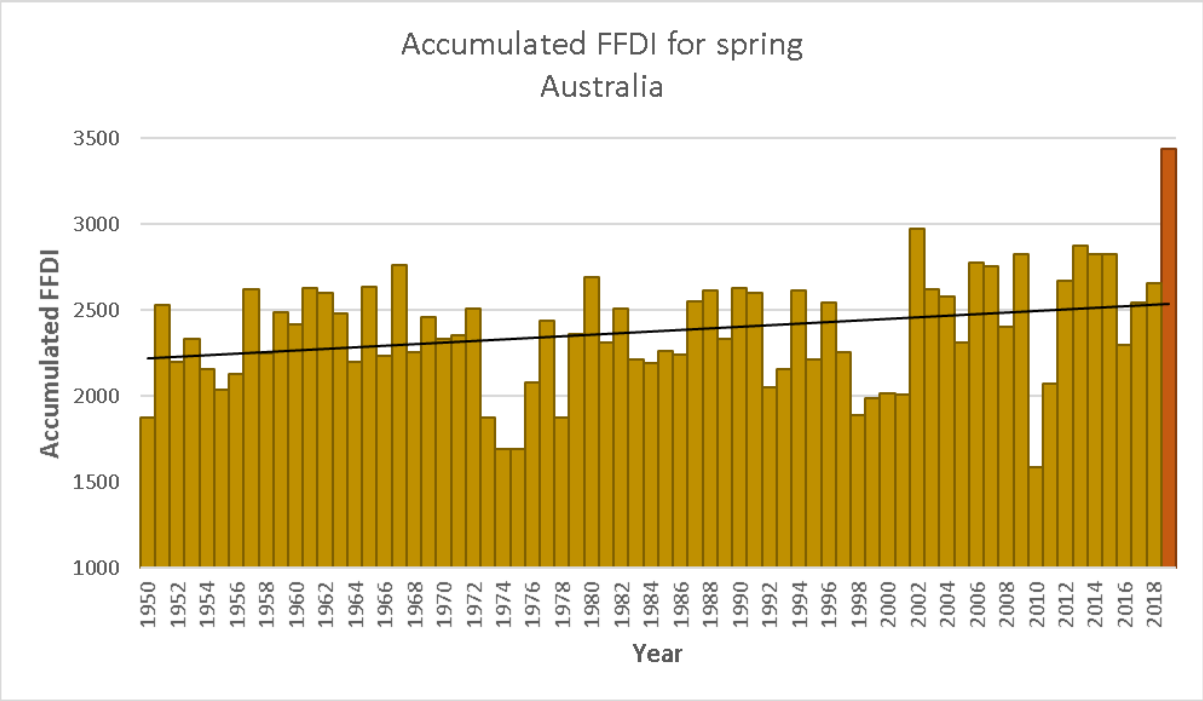


Figure 11: Spring accumulated FFDI values for Australia from 1950 to 2019. Accumulated FFDI for spring 2019 shown in orange. Linear trend line shown in black.

Highest on record daily FFDI values for spring were experienced in areas of all States and Territories (Figure 12). Across northern Australia, the Grassland Fire Danger Index (GFDI) is more routinely used to assess fire weather conditions, with fuel load an important consideration. Nevertheless, several fires started across northern Australia, with FFDI values highest on record for spring across large areas.

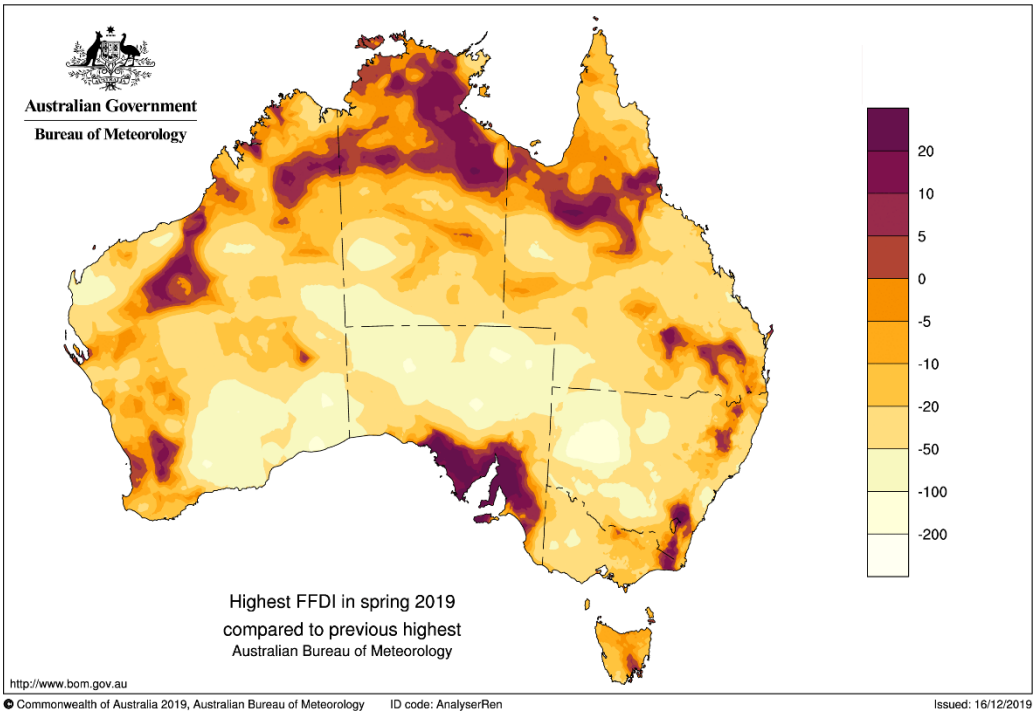


Figure 12: Difference between the highest daily FFDI during spring 2019 and the previous highest on record for spring (1950-2018). Areas of dark colours had their highest FFDI on record for spring.

In coastal areas of southeast Queensland and northeast New South Wales, September has historically had the highest FFDI values of the year. Further south and inland, the highest FFDI values are typically later in the season, with most areas west of the ranges in New South Wales and other areas of southern Australia typically not having their peak fire weather until January. The dangerous fire weather conditions in early September in northeast New South Wales and southeast Queensland included FFDI values that were early-season records and highest on record for September over large areas (Figure 13). During October and November, many more areas of the country had their highest FFDI on record for the month.

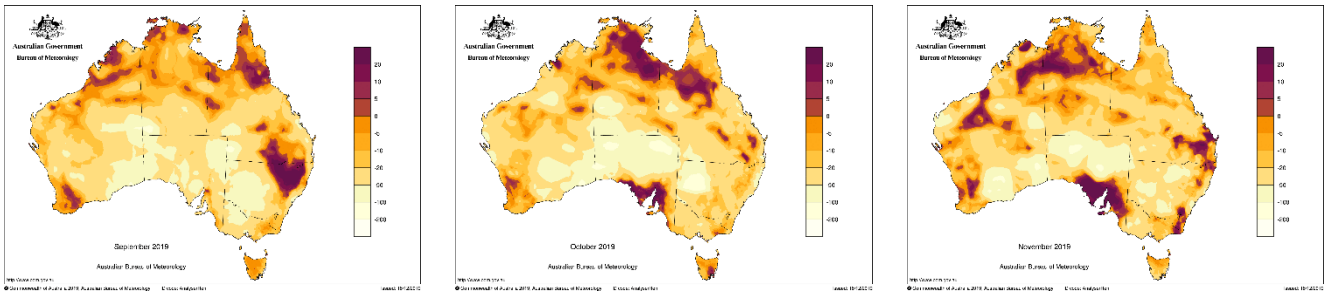


Figure 13: Difference between the highest daily FFDI during September (left), October (middle), and November (right) and the previous highest on record for the respective month (1950–2018). Areas of dark colours had their highest daily FFDI on record for the month.

In southern South Australia, the highest FFDI values are, on average, during January, which is the region's warmest month of the year. However, the high fire dangers in South Australia in November included areas of highest FFDI values for any month (Figure 14).

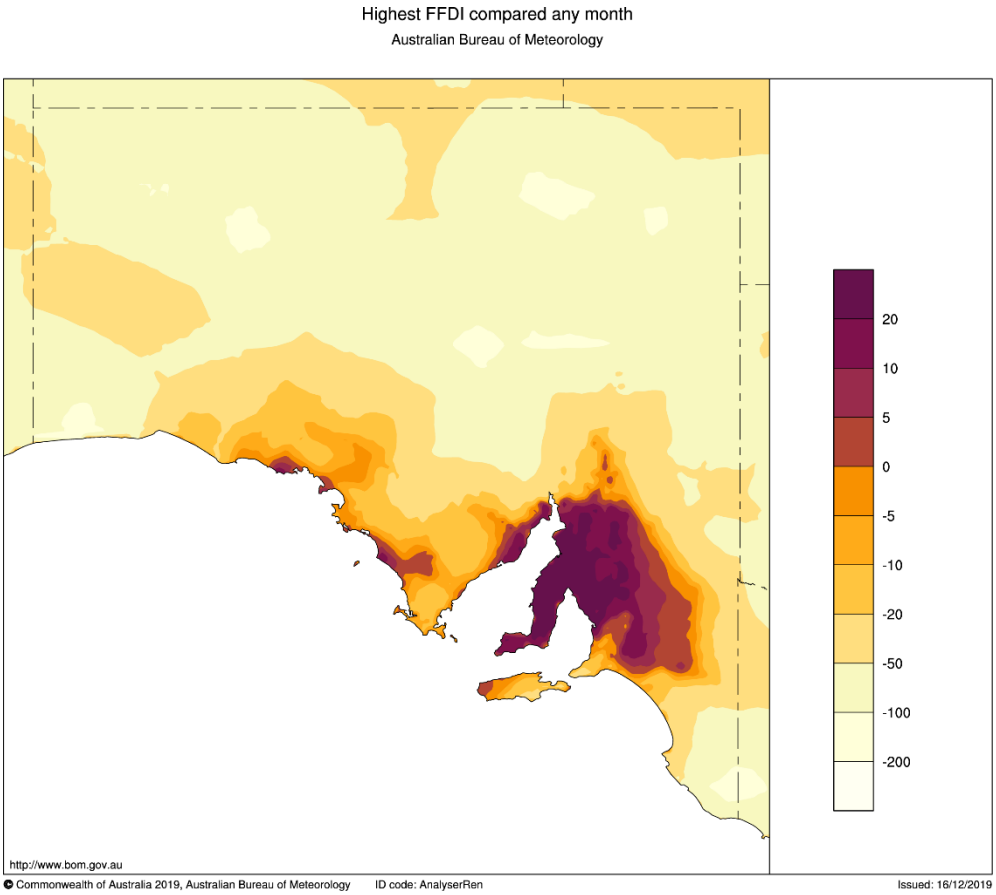


Figure 14: Difference between the highest daily FFDI during spring 2019 and the previous highest on record for any month (1950–2018). Areas of dark colours had their highest daily FFDI on record for any month.

From early September, high temperatures, low humidity, and strong winds, coupled with the dry conditions, led to elevated fire danger across southeast Queensland and northeast New South Wales on numerous days.

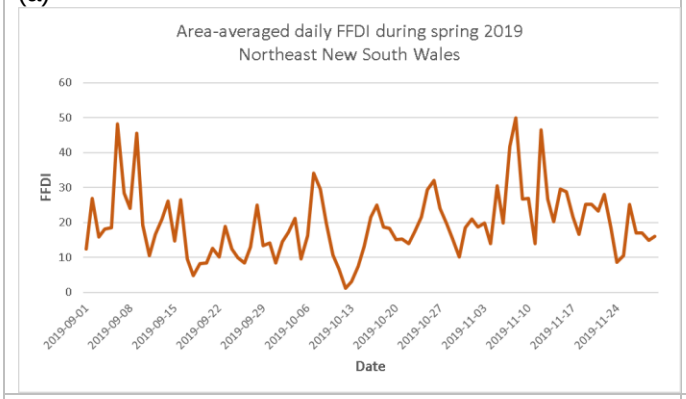
On 6 September, the measured FFDI values were in the extreme category (75 or above) across large areas, reaching the catastrophic category (100 or above) at some locations in New South Wales. Averaged over northeast New South Wales, 6 September had the second-highest daily FFDI value for spring 2019, slightly below 8 November (Figure 15a). The area averaged daily FFDI value for the region stayed above average for most of the season. It was 25 or above (very high category) on 21 days during spring, compared to an average of 2 such days in spring and the highest count on record (previous highest was 11 days in spring 2002).

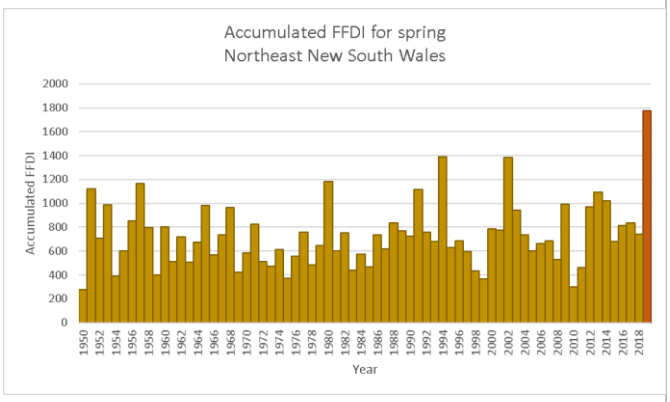
Southeast Queensland also had its highest daily FFDI value for spring on 8 November, followed closely by 6 September and 8 October (Figure 15b). FFDI values for the region remained above average for much of the season and the accumulated FFDI value for spring 2019 was much higher than in any previous year since 1950.

In the Agricultural districts of South Australia, the peak fire weather season is typically in January. Consistent with that, the peak area-averaged FFDI value tended to increase as spring 2019 went on (Figure 15c). However, the highest value for the season on 20 November was over 100, which was easily the highest on record for the region as a whole in spring and the highest for any day of the year for at least 50 years.

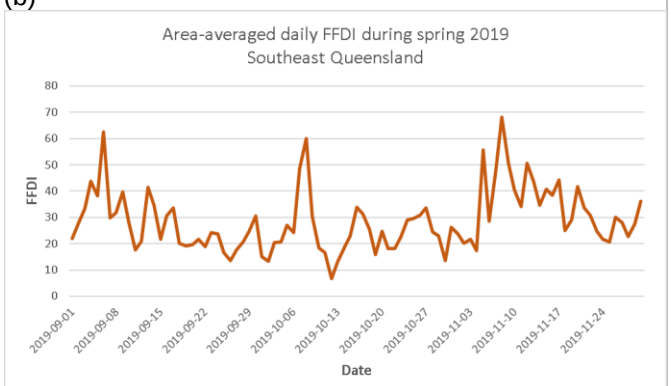
Western Australia had its warmest spring on record, which included Perth recording its hottest spring day on record (following its hottest winter day on record). For the South West Land Division, 9 November had the highest area-averaged daily FFDI for the season, and the accumulated FFDI for spring was the highest on record (Figure 15e).

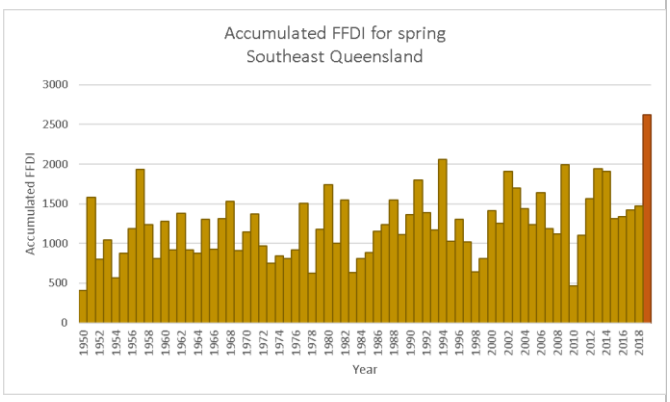
(a)


Area-averaged daily FFDI during spring 2019
Northeast New South Wales
FFDI
Date

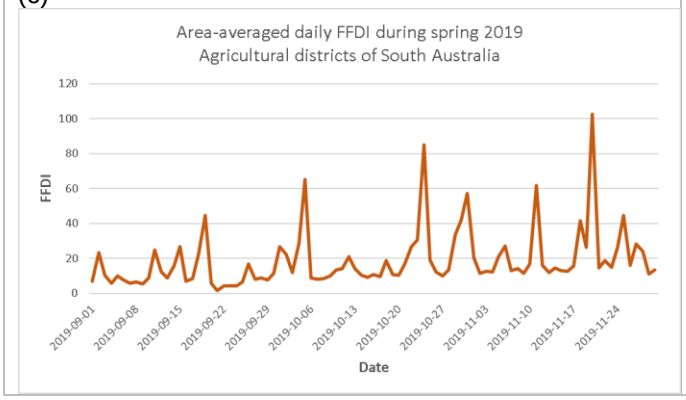

Accumulated FFDI for spring
Northeast New South Wales
Accumulated FFDI
Year

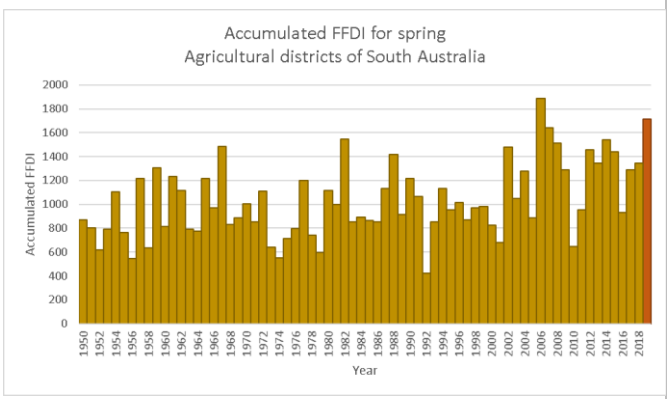
(b)


Area-averaged daily FFDI during spring 2019
Southeast Queensland
FFDI
Date

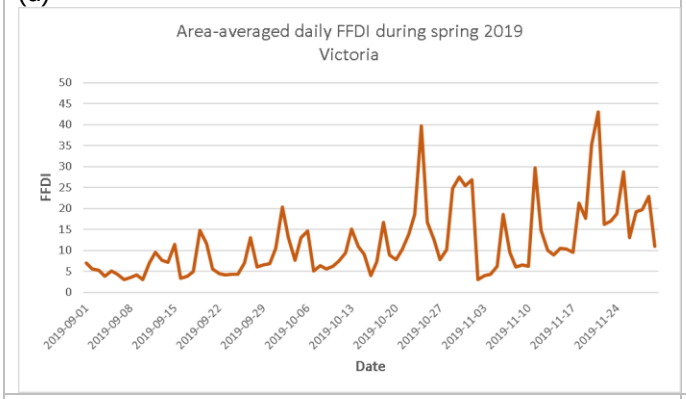

Accumulated FFDI for spring
Southeast Queensland
Accumulated FFDI
Year

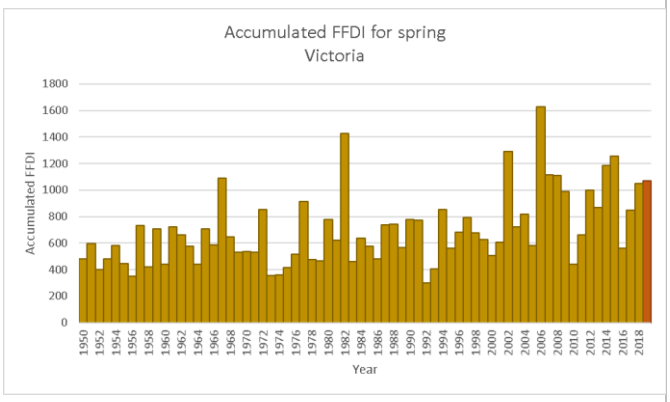
(c)


Area-averaged daily FFDI during spring 2019
Agricultural districts of South Australia
FFDI
Date

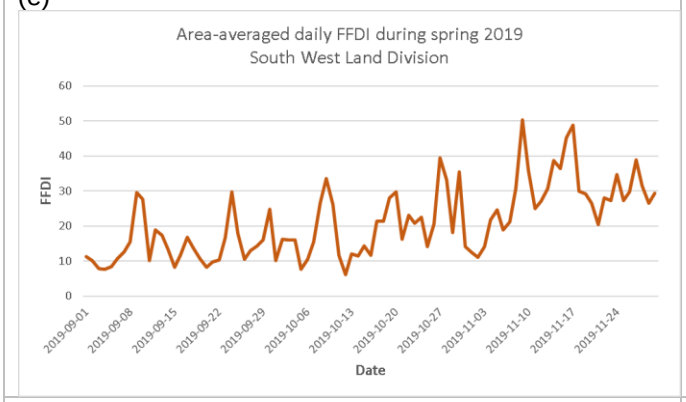

Accumulated FFDI for spring
Agricultural districts of South Australia
Accumulated FFDI
Year

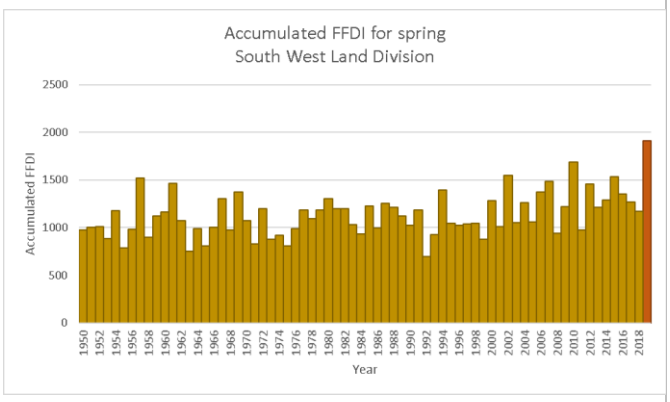
(d)


Area-averaged daily FFDI during spring 2019
Victoria
FFDI
Date

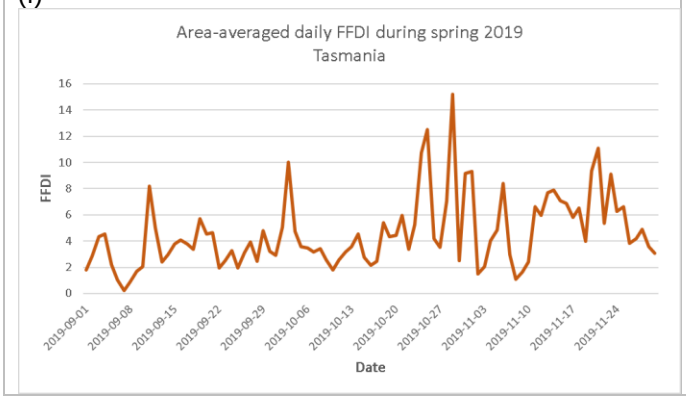

Accumulated FFDI for spring
Victoria
Accumulated FFDI
Year

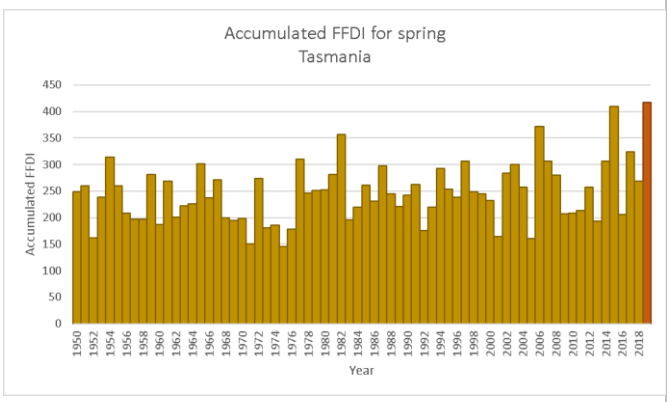
(e)


Area-averaged daily FFDI during spring 2019
South West Land Division
FFDI
Date


Accumulated FFDI for spring
South West Land Division
Accumulated FFDI
Year

(f)


Area-averaged daily FFDI during spring 2019
Tasmania
FFDI
Date


Accumulated FFDI for spring
Tasmania
Accumulated FFDI
Year

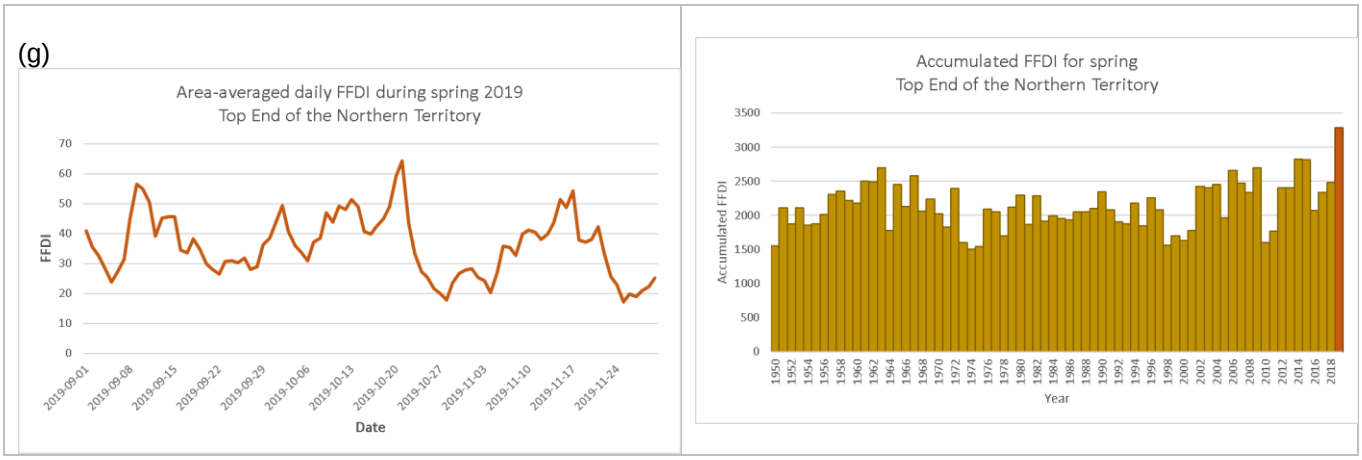


Figure 15: Area-averaged daily FFDI values from 1 September to 30 November 2019 (left) and accumulated FFDI values for spring each year from 1950 to 2019 (right, with 2019 shown in orange). Pairs of graphs for regions: (a) northeast New South Wales; (b) southeast Queensland; (c) Agricultural districts of South Australia; (d) Victoria; (e) South West Land Division of Western Australia; (f) Tasmania; (g) Top End of the Northern Territory.

3. Some impacts of the conditions

New South Wales

A number of the large fires that had started in September in eastern New South Wales continued to burn through October and November. The extensive and long-lived fires appear to be the largest in area burnt in the modern record across eastern New South Wales.

Hot, dry and windy conditions ahead of a cold front passing through southeastern Australia on 25 and 26 October led to elevated fire dangers across parts of eastern Australia, with renewed fire activity in northeastern New South Wales and southeastern Queensland.

Thick smoke blanketed populated areas of coastal New South Wales including Sydney, particularly during November into December. Westerly winds continued to blow smoke from fires burning further inland towards the coast, resulting in poor air quality in the Sydney Basin and many other areas along the New South Wales coast.

By the end of November, the total area burnt during spring had risen to more than 1 650 000 hectares, with several lives lost and hundreds of homes destroyed. Fires continued burning into December, with substantial increases in the total area burnt across the State.

Queensland

A number of the large fires that had started in September in eastern Queensland continued to burn throughout October and into November. The fires flared in early September, during hot, dry and windy conditions, particularly around the Scenic Rim and southern Darling Downs, but also in the Northern Tablelands and in the South East. While the fires were contained, they continued to burn, and flared up in early October under similar hot, dry and windy conditions.

Dangerous fire weather conditions on 8 and 12 November led to renewed fire activity in eastern Queensland. Very hot, dry and windy conditions developed across southeastern districts on 8 November, with property losses around Cobraball (near Yeppoon), and in southeastern Queensland by the 13th.

By the end of November in Queensland, many homes and structures had been lost and about 220 000 hectares burnt since early September

South Australia

Fire impacts during the season weren't as extensive in South Australia, despite the record-high FFDI values on several days.

On 24 October, strong northerly winds combined with the dry conditions and high temperatures to create dangerous fire weather conditions. Several fires burnt across South Australia, including one at Wongulla in the Murraylands.

A fire near Port Lincoln on 12 November burnt about 5 000 hectares and damaged property.

Western Australia

Numerous fires started across Western Australia during spring, including several in the Kimberley region and one that burnt about 9 000 hectares near Derby.

By 13 November, several structures had been damaged by twin bushfires near the port city of Geraldton, with one burning close to a heavily populated residential area. Strong and gusty winds, and very hot temperatures with two days at or above 40 degrees on the 12th and 13th produced challenging fire conditions.

Victoria

In October, there were several days of elevated fire dangers, particularly across northern areas of Victoria, including extreme FFDI values in the northwest and total fire bans in the Mallee.

In November, a cool change with very dry air and strong and gusty winds led to elevated fire weather conditions, with lightning leading to the ignition of many new fires on the 21 November. Fires started in northern Victoria at Rochester near Shepparton, three large fires in East Gippsland near Bruthen, Gelantipy, and Ensay, and a fast-moving grass fire at Mount Glasgow, north of Ballarat.

By early December, more than 30 000 hectares had burnt in Victoria.

Tasmania

Gusty westerly winds combined with dry fuels in the east to create elevated fire dangers on some days in October and November. Several fires started during these months, particularly in the northeast quarter of the State, and some continued to burn for several weeks. However, the largest fire started early in December, west of Swansea on the East Coast, following lightning strikes. Fanned by westerly winds on several occasions, the fire had burnt more than 3 850 ha by mid-December and there was some concern for the township of Swansea. Back burning to contain the fire brought smoke to East Coast communities on several days.

Northern Territory

The 2019 Northern Fire Season in the Top End of the Northern Territory was longer than usual, extending from June until October and was characterised by longer periods of severe and extreme fire weather conditions than previous seasons. Fire managers described fire behaviour that was out of the ordinary. Fires reportedly burnt for

longer periods over larger areas, with fire spotting over greater distances than expected. The season placed increased pressure on fire agency resources and fire-fighting tactics, including the use of water-bombing aircraft.

4. Previous notable events in New South Wales

Most significant historical fire weather situations in eastern New South Wales have been relatively short-lived. They have typically been associated with strong westerly winds, bringing dry air from inland areas to the coast. Whilst temperatures in such situations are typically well above average in eastern coastal areas, they have mostly not approached record high levels. Such westerly flow is more characteristic of winter and early spring than it is of summer. Some of the most significant historical fire weather events in eastern New South Wales, such as those of January 1994 and December 2001, have occurred as a result of winter-type weather systems occurring out of season with westerly flow well north of its usual seasonal location, and have been accompanied by well-below average temperatures (and often unseasonable mountain snow) in Victoria and Tasmania.

Whilst antecedent rainfall in the one to three months prior to the events was below average, of these events only the 1968 event took place under severe drought conditions.

October–November 1968

Spring 1968 was exceptionally dry in coastal New South Wales, with Sydney only receiving 29.5 mm for the season, easily its driest spring on record (1968 as a whole was Sydney's driest year of the 20th century). There were numerous severe fire weather events during October and November, and a number of major fires, particularly in the Blue Mountains and the Illawarra region, with substantial property losses. The Blue Mountains fire burned for more than a month, with properties lost on three separate occasions separated by several weeks. There was also an exceptional heatwave in northeastern New South Wales in mid-November; Coffs Harbour experienced its hottest day on record for any month (43.3 °C) on 19 November, whilst several other sites set all-months records that were not exceeded until February 2017.

In terms of its duration and the contribution of drought to the event, the 1968 event is probably the closest analogue to the current event, although in 1968 the fire activity was less extensive than in 2019, being primarily focused on regions between the Hunter and Illawarra.

January 1994

Dangerous fire weather conditions occurred around Sydney and in northeast New South Wales during early January 1994. This was a prolonged episode of significant fire weather, with persistent westerly flow and temperatures of 34 °C in Sydney on four consecutive days from 5 to 8 January, one of only three instances of such extended heat. Major fires, with extensive property loss, occurred within the Sydney metropolitan area in both the northern and southern suburbs, as well as in some northern coastal areas; more than 800 000 hectares were burnt, including the vast majority of the Royal National Park. The westerly flow was also associated with extreme heat in northeast New South Wales and much of eastern Queensland, with record high temperatures set at a range of locations extending from Kempsey north to Charters Towers, including some sites in metropolitan Brisbane.

December 2001

Severe fire weather affected eastern New South Wales at Christmas 2001. Major fires occurred on 24 and 25 December, particularly on the southern fringes of Sydney, with fires travelling up to 50 kilometres within a few hours. There were also significant fires in the ACT. Temperatures in the Sydney Basin on both days were generally in the mid-30s, with strong westerly winds; the air was also exceptionally dry, with dewpoint temperatures at

Sydney Airport falling below −5 °C on both days. Fires continued to burn into early January, with more than 750 000 hectares burnt in total and severe smoke pollution in Sydney and other areas.

October 2013

Significant fire activity with major property losses occurred in the Blue Mountains and other areas around Sydney on 17 October 2013, on a day with FFDI values above 100 in the Sydney region. This day, which followed a dry and warm September, featured strong winds and exceptionally dry air, with dewpoint temperatures at some sites in the Sydney region falling below −10 °C.

Tables

Table 1: Districts in New South Wales that had their highest area-averaged accumulated FFDI for spring in 2019. Ranks for each individual month during the season are also shown.

Rainfall district	District name	Spring rank	September rank	October rank	November rank
50	Central Western Plains (S)	1	1	*2*	*6*
52	Northwest Plains (W)	1	1	*2*	*3*
53	Northwest Plains (E)	1	1	*2*	1
54	Northwest Slopes (N)	1	1	*2*	1
55	Northwest Slopes (S)	1	1	1	1
56	Northern Tablelands (W)	1	1	1	1
57	Northern Tablelands (E)	1	1	*2*	1
58	Upper North Coast	1	*5*	*4*	1
59	Lower North Coast	1	*6*	*11*	1
60	Manning	1	*4*	*5*	1
61	Hunter	1	*8*	*5*	*2*
62	Central Tablelands (N)	1	*2*	1	*2*
63	Central Tablelands (S)	1	*4*	*3*	1
64	Central Western Slopes (N)	1	1	1	*2*
65	Central Western Slopes (S)	1	1	*2*	*4*
69	South Coast	1	*9*	*7*	1

Table 2: Districts in New South Wales that had their highest area-averaged daily FFDI for the month during at least one of September, October, or November 2019.

Rainfall district	District name	September rank	October rank	November rank
52	Northwest Plains (W)	1	*6*	*12*
53	Northwest Plains (E)	1	*6*	*7*
54	Northwest Slopes (N)	1	*5*	*4*
55	Northwest Slopes (S)	1	*6*	*5*
56	Northern Tablelands (W)	1	*4*	*2*
57	Northern Tablelands (E)	1	*6*	*2*
58	Upper North Coast	*5*	*19*	1
62	Central Tablelands (N)	1	*7*	*5*
64	Central Western Slopes (N)	1	*11*	*6*
69	South Coast	*5*	*6*	1
70	Southern Tablelands (Goulburn-Monaro)	*9*	*6*	1

Table 3: Districts in New South Wales that had their highest count of days with an area-averaged daily FFDI >= 25 (very high category) for spring in 2019. Ranks for each individual month during the season are also shown. A "=" denotes a tied ranking with previous years.

Rainfall district	District name	Spring rank	Count of spring days	September rank	October rank	November rank
50	Central Western Plains (S)	1	58	1	1	*3*
51	Central Western Plains (N)	1	61	1	*3=*	*7*
52	Northwest Plains (W)	1	64	*2=*	*4*	*4*
53	Northwest Plains (E)	1	59	1	*4*	1=
54	Northwest Slopes (N)	1	59	1	1	1
55	Northwest Slopes (S)	1	55	1	1	1
56	Northern Tablelands (W)	1	39	1	1	1
57	Northern Tablelands (E)	1	28	1	1	1
58	Upper North Coast	1	19	*5*	*2=*	1
59	Lower North Coast	1	10	*4*	*23*	*2*
60	Manning	1=	12	1=	*7=*	*3=*
61	Hunter	1	27	*7*	*4=*	1
62	Central Tablelands (N)	1	45	1	1	1
64	Central Western Slopes (N)	1	55	1	1	1
65	Central Western Slopes (S)	1	51	1	1	1=
69	South Coast	1	7	*3*	*3=*	1=

Table 4: November low 3pm dewpoint temperature records at sites with 20 years or more of data on 9 November 2019.

Station number	Station name	State	Dewpoint (°C)	Previous Nov record (°C)	Date of Nov record	Years of data
3080	Curtin Aero	WA	-10.9	-8.5	7 Nov 2019	31
33002	Ayr DPI Research Stn	QLD	-3.7	-1.3	16 Nov 2006	26
33308	Samuel Hill Aero	QLD	-2.5	1.4	23 Nov 2018	21
40284	Beerburrum Forest Station	QLD	-7.2	-5.0	16 Nov 2006	21
41525	Warwick	QLD	-7.5	-7.2	5 Nov 2019	26
56243	Glen Innes Airport AWS	NSW	-10.9	-7.2	8 Nov 2019	24
61260	Cessnock Airport AWS	NSW	-8.1	-6.9	5 Nov 2016	27
61363	Scone Airport AWS	NSW	-10.2	-9.0	2 Nov 2014	27
69017	Montague Island Lighthouse	NSW	0.9	1.0	17 Nov 1983	57
69132	Braidwood Racecourse AWS	NSW	-8.2	-8.1	4 Nov 2002	33
69137	Green Cape AWS	NSW	3.5	4.2	4 Nov 2002	20

Table 5: September high daily maximum temperature records at sites with 40 or more years of data.

Station number	Station name	State	New Sep record (°C)	Date of new record	Previous record (°C)	Date of previous record	Years of data
9114	Lancelin	WA	33.4	2019-09-09	32.5	2015-09-09	54
9573	Manjimup	WA	28.6	2019-09-09	28.5	2014-09-20	63
9592	Pemberton	WA	28.4	2019-09-09	28.4	2014-09-20	63
10622	Ongerup	WA	31.6	2019-09-30	31.5	2006-09-29	54
10633	Ravensthorpe	WA	33.0	2019-09-10	33.0	1987-09-21	58
39123	Gladstone Radar	QLD	33.9	2019-09-05	33.8	2017-09-29	62
39128	Bundaberg Aero	QLD	34.2	2019-09-05	34.1	2017-09-30	42

Table 6: October high daily maximum temperature records at sites with 40 or more years of data.

Station number	Station name	State	New Oct record (°C)	Date of new record	Previous record (°C)	Date of previous record	Years of data
9053	Pearce RAAF	WA	38.0	2019-10-27	38.0	1967-10-29	62
14198	Jabiru Airport	NT	42.3	2019-10-19	41.6	2014-10-29	44
18014	Cleve	SA	39.7	2019-10-05	39.0	2006-10-12	62
18040	Kimba	SA	39.0	2019-10-05	39.0	2006-10-12	52
26021	Mount Gambier Aero	SA	34.4	2019-10-24	33.3	1977-10-27	78
56013	Glen Innes Ag Research Stn	NSW	31.8	2019-10-07	31.0	2014-10-27	47
70005	Bombala (Therry Street)	NSW	32.0	2019-10-31	31.5	2008-10-19	55
85072	East Sale	VIC	34.9	2019-10-31	34.7	2006-10-12	75
85279	Bairnsdale Airport	VIC	35.8	2019-10-31	35.3	2012-10-31	40

Table 7: November high daily maximum temperature records at sites with 40 or more years of data. Records for any month are shown in bold.

Station number	Station name	State	New Nov record (°C)	Date of new record	Previous record (°C)	Date of previous record	Years of data
3003	Broome Airport	WA	44.6	2019-11-23	44.3	1961-11-23	81
4019	Mandora	WA	47.1	2019-11-14	46.5	1984-11-19	58
7045	Meekatharra Airport	WA	44.0	2019-11-18	42.6	2015-11-16	70
7139	Paynes Find	WA	44.8	2019-11-18	43.5	1996-11-22	41
8095	Mullewa	WA	43.5	2019-11-16	43.2	2003-11-11	75
8137	Wongan Hills	WA	43.2	2019-11-16	42.0	2006-11-23	54
9021	Perth Airport	WA	41.1	2019-11-16	40.8	2003-11-11	76
9037	Badgingarra Research Stn	WA	42.5	2019-11-16	42.2	1993-11-24	52
9053	Pearce RAAF	WA	43.1	2019-11-16	41.6	1978-11-22	62
9519	Cape Naturaliste	WA	35.2	2019-11-09	34.7	1982-11-20	63
9538	Dwellingup	WA	38.0	2019-11-16	38.0	2003-11-11	63
10007	Bencubbin	WA	43.1	2019-11-16	42.2	1996-11-22	60
10058	Goomalling	WA	43.0	2019-11-17	43.0	1978-11-24	43
10073	Kellerberrin	WA	44.5	2019-11-16	43.1	2006-11-23	110
10092	Merredin	WA	43.5	2019-11-17	41.9	2006-11-23	54
10524	Brookton	WA	41.4	2019-11-16	41.3	1978-11-23	54
10536	Corrigin	WA	42.0	2019-11-17	41.7	2006-11-23	72
10568	Hyden	WA	44.0	2019-11-17	43.2	2007-11-13	50
10612	Narembeen	WA	43.1	2019-11-17	42.2	1978-11-23	54
10626	Pingelly	WA	41.2	2019-11-16	40.3	1978-11-23	50
10647	Wagin	WA	40.9	2019-11-16	40.4	1996-11-22	50
11017	Balladonia	WA	44.5	2019-11-17	44.1	2006-11-28	55
12038	Kalgoorlie-Boulder Airport	WA	44.7	2019-11-17	42.9	2000-11-26	79

Station number	Station name	State	New Nov record (°C)	Date of new record	Previous record (°C)	Date of previous record	Years of data
12071	Salmon Gums Research Stn	WA	45.0	2019-11-17	42.4	2003-11-13	83
18115	Neptune Island	SA	34.4	2019-11-20	33.7	1966-11-22	58
23013	Parafield Airport	SA	44.3	2019-11-20	44.1	2009-11-19	63
23083	Edinburgh RAAF	SA	44.5	2019-11-20	44.5	2009-11-19	48
23343	Rosedale (Turretfield Research)	SA	44.1	2019-11-20	44.0	2009-11-19	58
24521	Murray Bridge	SA	44.3	2019-11-20	44.2	1993-11-30	54
29038	**Kowanyama Airport**	**QLD**	**41.5**	**2019-11-09**	**41.0**	**1995-11-24**	**52**
70005	Bombala (Therry Street)	NSW	37.5	2019-11-21	36.9	1997-11-26	55
70278	Cooma Visitors Centre	NSW	36.5	2019-11-21	36.5	2009-11-20	45
72023	Hume Reservoir	NSW	40.5	2019-11-21	40.3	1980-11-17	55
73007	Burrinjuck Dam	NSW	39.5	2019-11-21	39.4	1997-11-26	55
80091	Kyabram	VIC	43.6	2019-11-21	42.3	1980-11-17	55
81049	Tatura Inst Sustainable Ag	VIC	42.1	2019-11-21	40.3	2009-11-19	55
84070	**Point Hicks (Lighthouse)**	**VIC**	**43.4**	**2019-11-21**	**39.0**	**1980-11-18**	**54**
85072	East Sale	VIC	40.8	2019-11-21	39.8	1997-11-26	75
85096	Wilsons Promontory Lighthouse	VIC	38.0	2019-11-21	36.7	2007-11-20	110
86038	Essendon Airport	VIC	41.5	2019-11-21	39.3	2012-11-29	50
86077	Moorabbin Airport	VIC	40.7	2019-11-21	39.5	2012-11-29	49
86104	Scoresby Research Institute	VIC	39.4	2019-11-21	39.1	1997-11-26	52
86127	Wonthaggi	VIC	36.6	2019-11-21	36.1	1997-11-26	51
86282	Melbourne Airport	VIC	41.6	2019-11-21	39.6	1982-11-24	50
87031	Laverton RAAF	VIC	42.4	2019-11-21	40.3	1997-11-26	77
88109	Mangalore Airport	VIC	42.2	2019-11-21	41.0	1982-11-24	60
88110	Castlemaine Prison	VIC	40.1	2019-11-21	38.8	1982-11-24	54
92027	Orford (Aubin Court)	TAS	36.8	2019-11-21	35.6	1982-11-06	52

Station number	Station name	State	New Nov record (°C)	Date of new record	Previous record (°C)	Date of previous record	Years of data
94029	Hobart (Ellerslie Road)	TAS	36.8	2019-11-21	36.8	1937-11-26	134
95003	Bushy Park (Bushy Park Estates)	TAS	35.7	2019-11-21	35.0	1982-11-06	58
99005	Flinders Island Airport	TAS	35.9	2019-11-21	35.1	1997-11-26	57

References and further information

National gridded rainfall analyses are for the period since 1900 and national gridded temperature analyses are for the period since 1910. Gridded FFDI analyses are for the period since 1950.

This Statement in general covers information available as of 5 December 2019.

Links to further information

Australia's changing climate:

State of the Climate 2018

Climate information:

http://www.bom.gov.au/climate/

Australian Landscape Water Balance:

http://www.bom.gov.au/water/landscape

References

Dowdy, A.J., 2018: Climatological Variability of Fire Weather in Australia. Journal of Applied Meteorology and Climatology, 57, 221–234. https://journals.ametsoc.org/doi/full/10.1175/JAMC-D-17-0167.1

Dowdy, A.J., Ye, H., Pepler, A., Thatcher, M., Osbrough, S.L., Evans, J.P., Di Virgilio, G., McCarthy, N., 2019: Future changes in extreme weather and pyroconvection risk factors for Australian wildfires. Scientific Reports, 9, 2045-2322. https://www.nature.com/articles/s41598-019-46362-x.pdf