Australian Government
Bureau of Meteorology

Special Climate Statement 73—extreme heat and fire weather in December 2019 and January 2020

17 March 2020

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Version number/type	Date of issue	Comments
1.0	17 March 2020	

Published by the Bureau of Meteorology

Cover image: Sunrise at Gan Gan Lookout, Port Stephens, by Mark Wilgar, October 2019.

Summary

- 18 December 2019 was the hottest Australia-wide (area averaged) day on record, peaking at 41.88 °C.
- In December 2019 there were 11 days in which the national area-averaged maximum was 40 °C or above. Prior to December 2019 there had been only 11 such days recorded since 1910, seven of which occurred in the summer of 2018–19.
- 2019 was the warmest December on record Australia-wide and for all mainland States except Victoria. 2019−20 went on to be the second-warmest summer on record Australia-wide, and for area-averaged Queensland, the Northern Territory, and Western Australia.
- South Australia and the Northern Territory each had their hottest area-averaged day on record. Previous records were exceeded on several days, and new peaks were reached for South Australia on 19 December and for Northern Territory on 25 December.
- Numerous high temperature records occurred at individual sites across southern and eastern Australia throughout December into early January, and at the end of January
- Dangerous fire weather conditions continued from spring 2019 into summer
- In 2019, large areas of Australia had their highest accumulated Forest Fire Danger Index (FFDI) for December. FFDI records date back to 1950.
- 2019 had the highest December accumulated FFDI for Australia as a whole, continuing the pattern seen in spring

1. Preceding climate conditions, drivers and description of the event

2019 was the warmest and driest year on record for Australia as a whole, and spring was also the driest on record nationally. Record low rainfall for the year occurred over large areas of inland Australia (Figure 1). Rainfall was also well below average in the 2018–19 wet season in most parts of tropical Western Australia and the Northern Territory. This resulted in very low soil moisture levels over most of the continent leading into December.

The very dry conditions continued through December. It was the driest December on record nationally, with rainfall below average nationwide apart from western Tasmania and parts of Western Australia (Figure 1). Record low December falls were experienced in scattered parts of northern and eastern Australia. Most areas of South Australia, New South Wales (apart from the northeast), and Victoria (apart from the eastern ranges and the southwest coast) had less than 10 millimetres for the month.

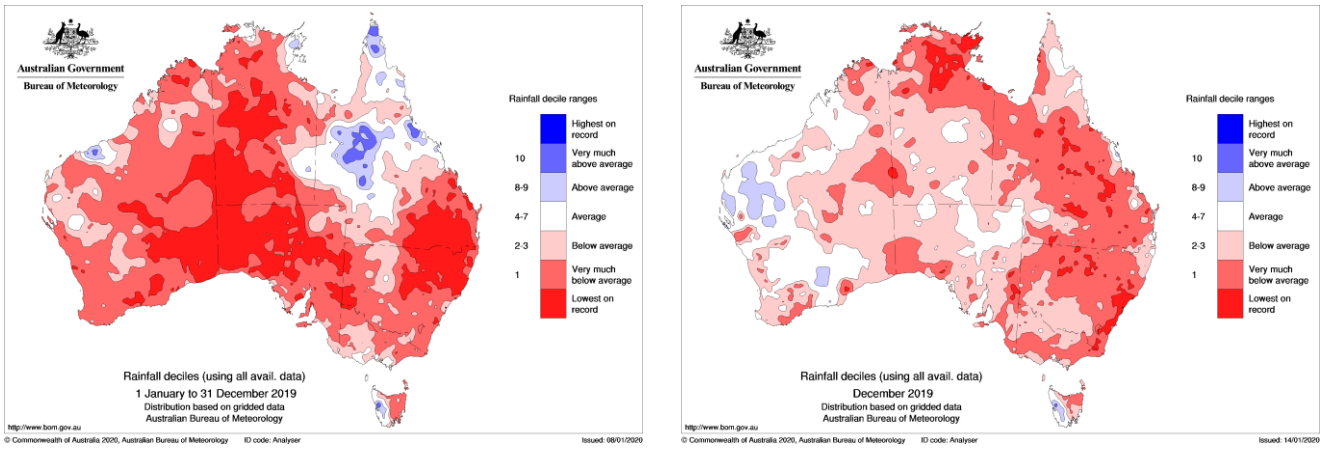

Figure 1: Rainfall deciles for 2019 (left) and December 2019 (right) (based on all years since 1900).

One of the strongest positive Indian Ocean Dipoles on record was a substantial contributor to the dry conditions in the second half of the year. The Southern Annular Mode (SAM) was also in a persistent negative phase for much of the period from September to December (following a marked sudden stratospheric warming over the Antarctic in early spring), resulting in anomalous westerly flow over southern Australia. In spring and early summer, a negative phase of the SAM is typically associated with dry conditions in New South Wales and Queensland, and warm conditions over much of the continent apart from the southeast. The combination of these two climate drivers was highly favourable for dry conditions in the eastern States and above-average temperatures across the continent.

Heat built up in the northern tropics from the start of December in the absence of any early wet-season rain. Many sites, apart from those close to exposed coasts, reached 40 °C regularly during the first week of the month. A number of sites across the north of Western Australia, the Northern Territory and Queensland set December high temperature records. During the first half of December, Darwin had a record-long sequence of 11 consecutive days of 35 °C or above. The heat continued in northern Australia throughout most of the month, with only brief interruptions.

From 12 December onwards, extreme heat moved into the south of Western Australia. Whilst no significant long-term site records were broken on individual days, the length of the heatwave was highly unusual for December. Perth Airport had three consecutive days of 40 °C or above in December for the first time, whilst five consecutive days above 40 °C also set December records at a number of sites in the inland southwest, as well as at Geraldton. There was also some extreme heat on parts of the east coast during this period, including 41.2 °C at Brisbane, equalling its December record.

The heat extended more broadly east through southern Australia from 16 December onwards to cover most areas. The peak of the extreme heat moved progressively east, being centred over the Nullarbor and Eyre Peninsula on 19 December (when the highest temperatures of the event were recorded), eastern South Australia and western Victoria on 20 December, southern New South Wales on 21 December, and northern inland New South Wales and southern Queensland on 22 December.

Most of southern Australia had cooled by 22 December, but extreme heat continued in central and northern areas. Numerous records were set in the central and northern interior of Australia, particularly in the Northern Territory, from 24 to 26 December. The heat returned to southeastern Australia from the 28 December onwards, peaking on 30 December. Unlike earlier parts of the event, the heat extended to Tasmania, with numerous site records in that State and also in eastern Victoria. Some of the most significant fire weather conditions of the period occurred on 30 and 31 December as a wind change moved through southeastern Australia. Conditions eased at the national scale from 31 December as tropical moisture started to move into northern Australia, but there was a further round of extreme heat in southern Australia in early January 2020, peaking in southern and central New South Wales on 4 January.

There was a significant pattern change after early January, as the positive Indian Ocean Dipole and the negative Southern Annular Mode broke down, and moisture began to enter northern Australia. There were no further extreme hot days at the national scale after the first week of January, but a final significant heatwave affected southeastern Australia at the end of January and start of February, while February was consistently hot across some parts of northern Australia, with some records set.

2. Extreme heat in December 2019 and January 2020

A major feature of the heatwave was the extent of the extreme heat. This resulted in area-averaged records for the hottest day being exceeded for Australia (Table 1), South Australia, and the Northern Territory.

The national area-averaged maximum temperatures were well beyond previous records. Averaged over the country[1], Australia had its hottest day on record on 18 December 2019; the average of 41.88 °C was far above the previous record of 40.30 °C set on 7 January 2013. Six other days in the month also exceeded the previous record, with 24 December (41.06 °C) and 19 December (41.01 °C) reaching 41 °C. In total, 11 days during the month had a national area-averaged maximum of 40 °C or above, seven of them consecutively from 23 to 29 December. Prior to December 2019, there had been only 11 such days on record in Australia since 1910 (seven of which occurred in the 2018–19 summer). Temperatures this high are indicative of the dangerous heat conditions that affected large parts of Australia.

Averaged over South Australia, the State had its hottest December day on 18 December (45.33 °C), which was followed by its hottest day for any month (47.11 °C) on 19 December. The Northern Territory first exceeded its previous hottest day on record with 43.46 °C on 17 December, and in total had five days above its previous record of 42.93 °C, peaking at 44.31 °C on 25 December. Victoria (43.08 °C) had its hottest December day on record on the 20th.

At individual sites, Nullarbor reached 49.9 °C on 19 December, a December record for Australia and the highest daily maximum in any month since February 1998. Eucla's 49.8 °C on the same day was a December record for

[1] The average is calculated by breaking the Australian continent and the main island of Tasmania up into a 0.05° grid by longitude and latitude—which is roughly 5km × 5km—with each grid cell assigned a maximum temperature based on the temperatures from the weather stations around it. An area-weighted average of the grid cells is then calculated.

For daily average temperatures, the average is calculated from the Bureau's real-time, unadjusted whole-network, gridded temperature data set, which takes in all available temperature observations each day (around 700 observations). The ranks of this value are cross-checked against the Bureau's adjusted climate reference network (ACORN-SAT).

For more information see http://www.bom.gov.au/climate/austmaps/about-temp-maps.shtml.

The daily average maximum temperature uses the AWAP gridded dataset (methodology described in Jones D A et al. (2009), High-quality spatial climate data-sets for Australia, Australian Meteorological and Oceanographic Journal 58 233-248).

Western Australia. Other readings over 49 °C were at Forrest (49.5 °C) and Keith (49.2 °C); the latter was the furthest south that 49 °C has been reached anywhere in Australia[2]. A Victorian December record was set on 20 December, with 47.9 °C at Hopetoun and Horsham - only Black Saturday in 2009 has seen a higher temperature in Victoria.

On 4 January 2020, the most extreme heat occurred in eastern New South Wales and the Australian Capital Territory. The temperature reached 48.9 °C at Penrith, the highest known temperature in the Sydney basin (surpassing 47.8 °C at Richmond in January 1939) and at any site east of the ranges in New South Wales[3]. A number of other sites in metropolitan Sydney, away from the coast, exceeded 47 °C. Canberra reached 44.0 °C, 1.2 °C above the previous record for any Australian Capital Territory site. The value at Penrith was a new record high value for any metropolitan area in Australia. Such temperatures are dangerously hot, and place extreme thermal stress on humans and the environment.

A final period of extreme heat affected southeastern Australia at the end of January and the start of February, with a number of locations in Tasmania, northeastern Victoria, and southern and eastern New South Wales setting record high maximum temperatures on 31 January and 1 February. Canberra reached a February record high maximum temperature of 42.7 °C on 1 February, meaning that records were set there in all three summer months. Braidwood, which also reached a February record on this day, set records in five consecutive months from October to February. Cabramurra reached its highest temperature on record, 34.0 °C[4], on 31 January.

Unlike earlier in the summer, extreme high minimum temperatures were widespread during this period in early February. Two different sites at Condobolin, the airport and the Agricultural Research Station, both had a minimum temperature of 34.7 °C on 1 February, the highest on record for New South Wales for February. 26.7 °C on 2 February was the hottest night on record at Canberra Airport[5].

Large numbers of sites set December records, with some setting all-time records, particularly in the Nullarbor region, and in parts of eastern South Australia and western Victoria. Mount Gambier's 45.9 °C on 20 December was 1.7 °C above its previous record for any month. In total, 47 of the 111 currently operating ACORN-SAT stations[6] set December records, 12 of which were records for any month (Table 3). A further two all-month records were set or equalled in early January, making a total of 14 ACORN-SAT locations that set new all-month high temperature records during the event. The previous largest number of records set in the ACORN-SAT network in a single month was September 2017, when monthly records were set at 32 locations.

There were also some notable runs of consecutive hot days during December. Darwin had 11 consecutive days of 35 °C or above from 3 to 13 December, a record for any time of year, surpassing the 7-day runs in December 2004 and October 2019. Ceduna had three consecutive days of 45 °C or above for the first time. Whilst southwestern Western Australia did not see any significant records for individual days, a number of sites set records for consecutive December days of 40 °C or above in mid-month, including Perth Airport (three days) and Geraldton, Dalwallinu and Merredin (all had five consecutive days).

There were very large numbers of hot days in the month in some regions, particularly in northern Australia and the south of Western Australia. In the north, Darwin had 21 days of 35 °C or above, easily the largest number in any month (exceeding 13 days in October 2009). Jabiru Airport, which had never previously reached 40 °C in December, did so on ten occasions in December 2019, whilst Tindal RAAF (near Katherine) reached 40 °C on 23 days in the month, more than it had ever experienced in a full year prior to 2019. In Western Australia, Dalwallinu

[2] Higher than the World Meteorological Organization (WMO)-recognised record for South America, and further south than anywhere in Africa.

[3] The only known higher observations on record anywhere in New South Wales were at Menindee, Walgett, and Wilcannia.

[4] The Cabramurra site was affected by fire on 4 January. While it is possible that 34.0 °C was exceeded there that day, the point at which radiant heat from the fires began to influence the temperature observations cannot be determined with any certainty.

[5] The former Acton site at Canberra had a minimum of 27.2 °C on 14 January 1939.

[6] The ACORN-SAT network is the Bureau's long-term temperature reporting network. It includes 112 stations, one of which was not reporting in December 2019.

reached 40 °C on 13 days and Cunderdin on 12 days, both records for any month. Perth Airport's six days of 40 °C is a December record, and only exceeded by seven days in January 1956. Canberra's 11 days of 35 °C or above was only exceeded by January 2019 (19 days) and January 2017 (12 days).

There were some very high minimum temperatures at times during December, most notably on 20 December in South Australia as a change approached. Marree Airport's 34.9 °C that day was the second-highest December minimum on record for Australia and a South Australian State December record, whilst numerous other site records were set.

Conversely, dry air, and the relatively short duration of extreme heat in the area, resulted in some very large diurnal temperature ranges on 20 December in southern Victoria and Tasmania. Melbourne's diurnal range of 29.8 °C (maximum 43.5 °C, minimum 13.7 °C) is its largest of the post-1900 period, whilst 34.8 °C at Westmere (45.4 °C/10.6 °C) is the largest known diurnal range at a Victorian site. Such large ranges in daily temperature are an indication of a very dry landscape.

While minimum temperatures were not as extreme at the national level as daytime maximum temperatures, 25 December was still the warmest December night on record averaged over Australia, with a national average of 25.02 °C. It was the second-warmest night on record for any month, just behind 25.08 °C on 22 January 2019. Combining daytime and night-time temperatures, the five highest daily mean temperatures on record for Australia occurred during December 2019, with the highest being 32.99 °C on 18 December, 0.36 °C above the previous record set in January 2019.

Overall, December 2019 had the highest area-averaged maximum (4.15 °C above the 1961–90 average), minimum (+2.26 °C) and mean (+3.21 °C) temperatures on record for Australia (Figure 2). The maximum and mean values were both the largest anomalies on record for any month (surpassing +3.60 °C and +3.03 °C respectively, both in October 2015), and it was the first time any month has had a mean maximum 4 °C or more above average. In absolute terms, the national area-average maximum (38.39 °C) was also the warmest for any month, exceeding the 37.99 °C in January 2019. Every State and mainland Territory except for Victoria (2nd highest) and Tasmania (30th highest) had its highest mean maximum temperature on record (Table 3), with South Australia breaking its previous record by more than 2 °C. All States and Territories also had record December monthly mean temperatures, with South Australia and Western Australia also having their warmest December minimum temperatures on record. Whilst mean temperatures were not as far above average in January and February—in particular, February was relatively cool in the southeast—the very high temperatures in December were a major contributor to summer 2019−20 being the second-warmest on record for Australia (after 2018−19). It was also the second-warmest for Queensland, the Northern Territory, and Western Australia.

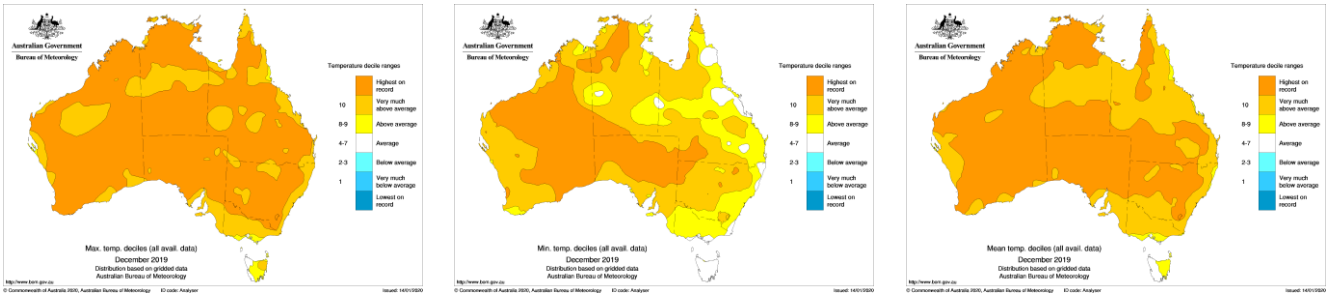

Figure 2: Maximum temperature deciles (left), minimum temperature deciles (middle), and mean temperature deciles (right) for December 2019 (based on all years since 1910).

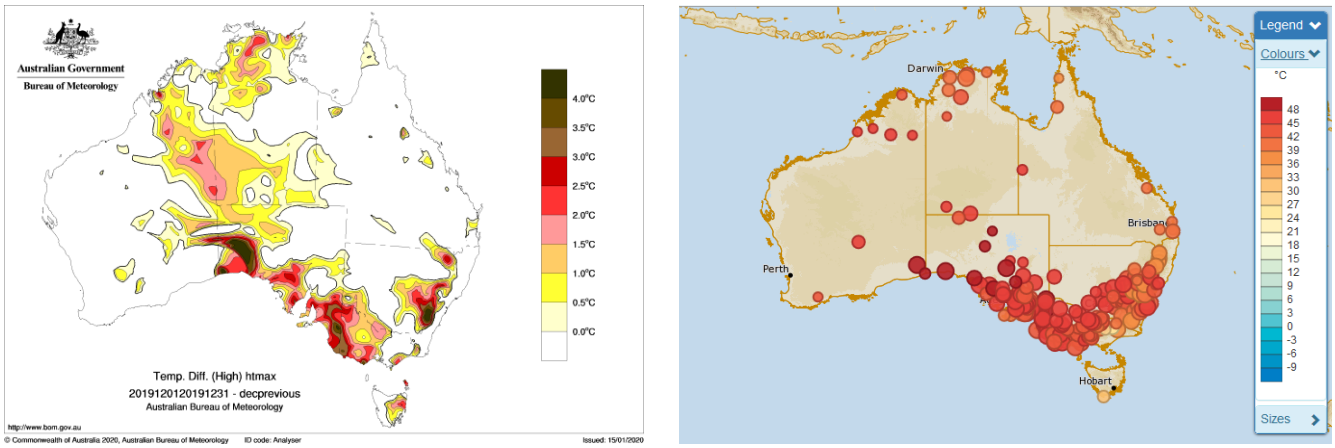

Figure 3: Difference between the highest daily maximum temperature in December 2019 and the previous highest on record for December (1910–2018) (left). Composite locations with 30 or more years of data that had their hottest December day on record (right).

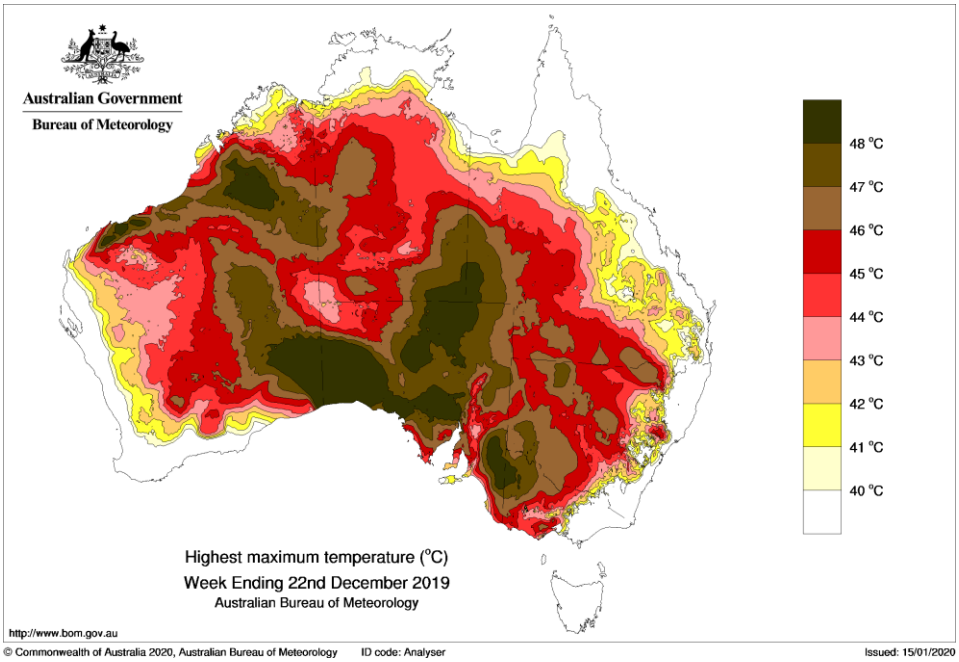

Figure 4: Highest daily maximum temperature from 16–22 December 2019.

3. Fire weather in December 2019 and January 2020

The hot conditions combined with the dry landscape and strong winds to produce dangerous fire weather conditions during December 2019 into early January 2020, extending on those reported previously[7].

The Forest Fire Danger Index (FFDI) is one common measure of fire weather conditions and reflects longer-term rainfall and temperature patterns and shorter-term weather. Fire risk is driven by fire weather and fuel availability. The severe rainfall deficiencies and hydrological drought[8] exacerbated the fire weather conditions.

Daily FFDI values can be accumulated (summed) over longer periods of time and the accumulated FFDI values for spring 2019 were the highest on record for Australia as a whole (based on all years since 1950), with record high values observed in areas of all States and Territories.

Those dangerous fire weather conditions continued into summer, with December accumulated FFDI values highest on record across large areas of the country (Figure 5). Accumulated FFDI values for December were more than twice the average over large areas of Australia (Figure 6) and the accumulated FFDI value for December was highest on record (Figure 7). The area-averaged accumulated FFDI values for December were also highest on record for each State and Territory except Tasmania (second-highest). That included the highest accumulated FFDI for any month in Queensland, New South Wales, the ACT, and South Australia. For Queensland, the Northern Territory, and Western Australia, December 2019 continued a run of three consecutive months of highest FFDI on record.

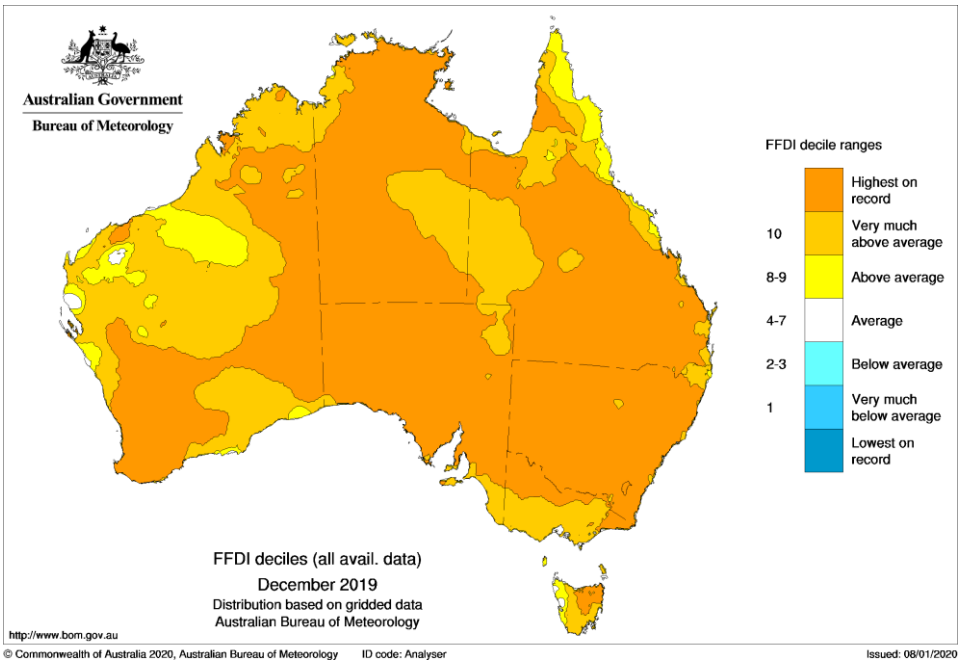

Figure 5: Accumulated FFDI deciles for December 2019 (based on all years since 1950).

[7] For more information see Special Climate Statement 72—dangerous bushfire weather in spring 2019.

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

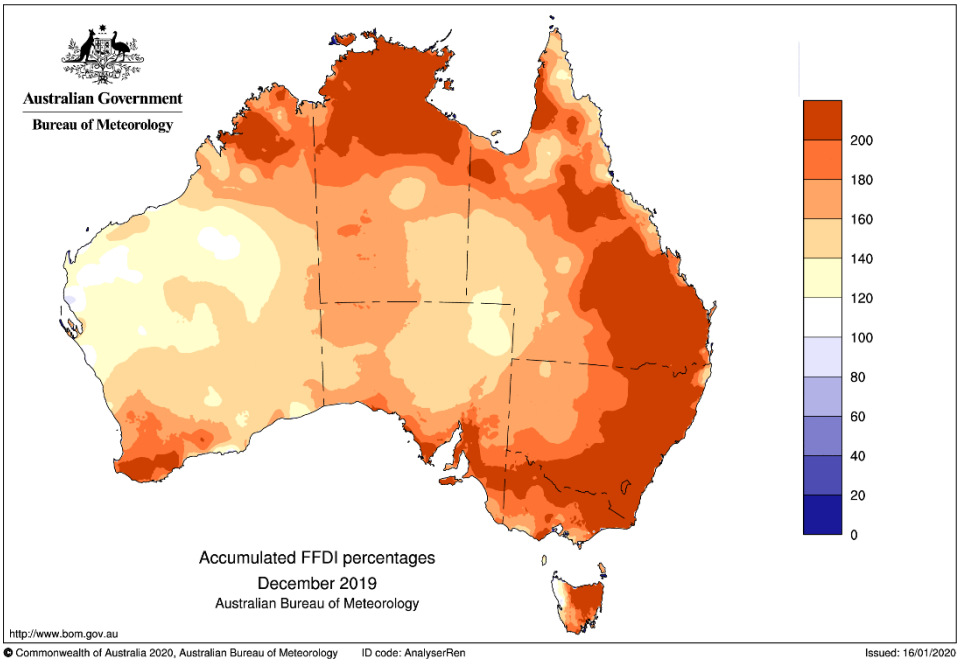

Figure 6: Accumulated FFDI percentages for December 2019 compared to the long-term mean for 1950–2018.

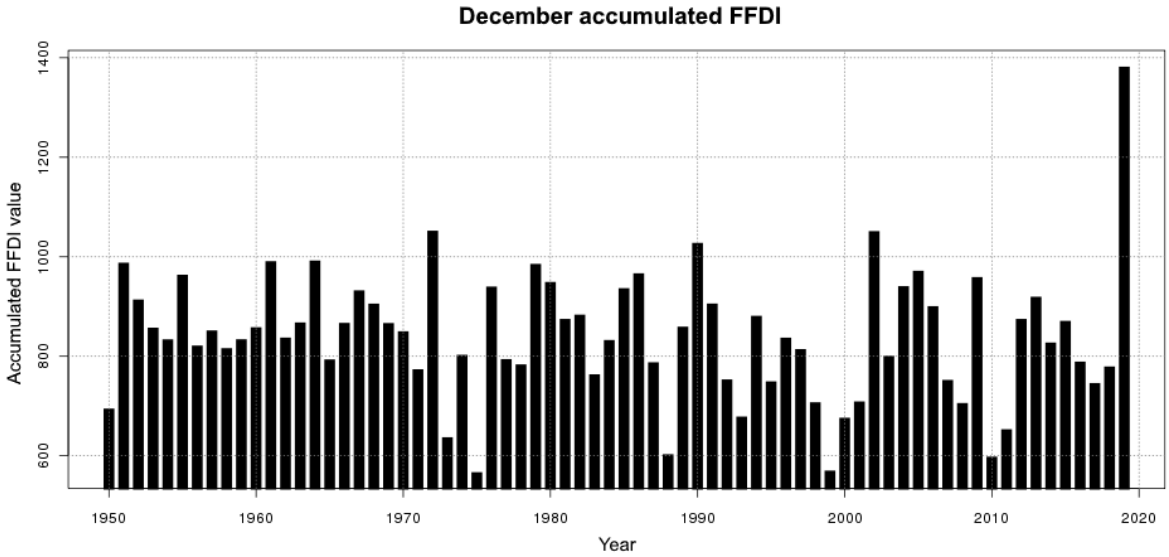

Figure 7: December accumulated FFDI for Australia since 1950.

There were also individual days with FFDI values very much above average or highest on record for December across large areas of the country. During December, daily FFDI values of 100 or above (catastrophic or code red category) were observed in all mainland States and the Northern Territory, and many areas had their highest FFDI on record for December (Figure 8). December began with daily FFDI values above 100 in northern Western Australia, but later in the month the highest daily FFDI values were across central and southern Australia. FFDI values were 100 or above across areas of southern South Australia, New South Wales, and Victoria on 20 and 30 December. There were similarly high values in southern areas of Western Australia on 19 and 29 December, as the high temperatures and areas of strong winds moved from west to east across the country.

Dangerous fire weather conditions continued into early January, with daily FFDI values above 75 (extreme category) in areas of Victoria, New South Wales, and South Australia on several days between 1 and 10 January. Some areas in eastern Victoria, northern Tasmania, and across parts of New South Wales had their highest daily FFDI values on record for January (Figure 8).

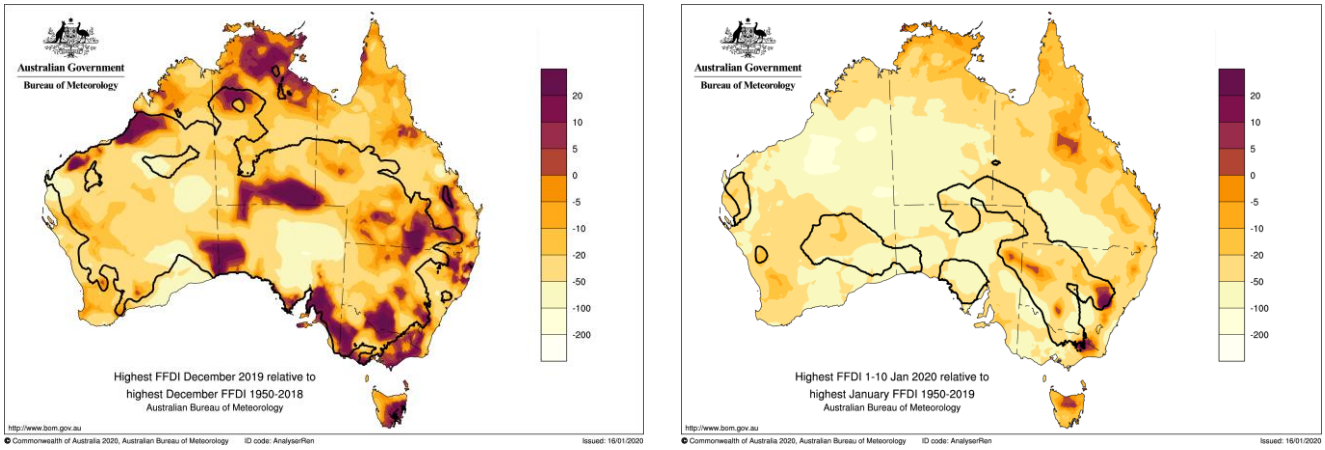

Figure 8: Difference between the highest daily FFDI during December 2019 (left) or 1–10 January 2020 (right), and the previous highest on record for the respective month (based on all years since 1950). Areas of dark colours had their highest FFDI on record for the month. The black contour lines enclose areas that had daily FFDI values of 75 or above (extreme category) on at least one day during the month.

Fire weather conditions generally eased back from record levels in the second half of January, but accumulated FFDI values for January 2020 as a whole were very much above average over southern and western New South Wales, northeast Victoria, eastern Tasmania, and southwest Western Australia. There was also a final episode of significant fire weather affecting southeast Australia, particularly southeast New South Wales and eastern Victoria, at the end of January and start of February, whilst early February saw some periods of significant fire weather in southern Western Australia. New South Wales had its fourth-highest accumulated FFDI for January on record since 1950, and Tasmania had its third-highest accumulated FFDI for January.

Tables

Table 1: Highest daily area averages for Australia (values in December 2019 shown in bold).

Maximum temperature (°C)		Minimum temperature (°C)		Mean temperature (°C)	
41.88	**18/12/2019**	25.08	22/1/2019	**32.99**	**18/12/2019**
41.06	**24/12/2019**	**25.02**	**25/12/2019**	**32.90**	**24/12/2019**
41.01	**19/12/2019**	**24.90**	**29/12/2019**	**32.82**	**19/12/2019**
40.97	**17/12/2019**	24.93	16/1/2019	**32.75**	**29/12/2019**
40.61	**29/12/2019**	24.91	23/1/2019	**32.75**	**25/12/2019**
40.48	**25/12/2019**	24.89	25/1/2019	32.63	22/1/2019
40.33	**23/12/2019**	**24.78**	**27/12/2019**	32.47	16/1/2019
40.30	7/1/2013	24.76	18/1/2019	32.45	15/1/2019
40.29	**20/12/2019**	**24.74**	**24/12/2019**	**32.42**	**20/12/2019**
40.26	15/1/2019	24.69	23/1/1982	**32.40**	**27/12/2019**

Table 2: National and State monthly area-averaged temperature (°C) anomalies (from 1961−90 average) for December 2019.

Region	Maximum temperature			Mean temperature			Minimum temperature		
	Value	Rank	Previous record	Value	Rank	Previous record	Value	Rank	Previous record
Australia	+4.15	1	+2.41 (2018)	+3.21	1	+2.13 (2018)	+2.26	1	+1.85 (2018)
WA	+4.25	1	+2.87 (1972)	+3.35	1	+2.59 (1972)	+2.44	1	+2.31 (1972)
NT	+4.01	1	+3.28 (2018)	+3.12	1	+2.88 (2018)	+2.23	2	
SA	+5.28	1	+3.01 (1972)	+4.09	1	+2.53 (2015)	+2.89	1	+2.32 (1965)
Queensland	+3.65	1	+2.87 (2005)	+2.74	1	+2.39 (2005)	+1.83	5	
NSW	+4.31	1	+2.93 (1990)	+3.32	1	+2.93 (2018)	+2.34	3	
Victoria	+3.13	2		+2.22	3		+1.31	13	
Tasmania	+0.96	30		+0.51	33		+0.05	49	

Table 3: Highest daily maximum temperature for December, January or February at locations in the ACORN-SAT dataset (records for any month highlighted in bold).

Site number(s)	Location	State	Value (°C)	Date	Previous record
1019/1021	Kalumburu	WA	42.9	6/12	42.6 (20/12/2018)
2079/2012/2011	**Halls Creek**	**WA**	**45.0**	**18/12**	**44.9 (16/12/1972) (Dec)** **45.0 (8/11/1988) (all)**
11003	**Eucla**	**WA**	**49.8**	**19/12**	**47.4 (27/12/2013) (Dec)** **48.6 (23/1/2019) (all)**
11052/11004	Forrest	WA	49.5	19/12	46.5 (27/12/2013)
13017	**Giles**	**WA**	**46.8**	**25/12**	**45.1 (5/12/2014, 28/12/2018) (Dec)** **45.7 (16/1/2013) (all)**
14015	Darwin	NT	37.1	9/12	37.0 (18/12/1976)
14825	Victoria River Downs	NT	44.7 (=)	7/12	44.7 (11/12/2018)
15590/15540	**Alice Springs**	**NT**	**45.7**	**25/12**	**45.6 (29/12/2018) (Dec)** **45.6 (29/12/2018, 3/1/2019) (all)**
15666/15548	**Rabbit Flat**	**NT**	**47.9**	**25/12**	**47.1 (12/12/2018, 19/12/2018) (Dec and all)**
16001	**Woomera**	**SA**	**48.2**	**20/12**	**46.2 (28/12/2018) (Dec)** **48.1 (25/1/2011) (all)**
17043/17114	Oodnadatta	SA	48.4	19/12	48.3 (19/12/2019)
18012	**Ceduna**	**SA**	**48.9**	**19/12**	**47.3 (30/12/1976) (Dec)** **48.6 (24/1/2019) (all)**
18044	Kyancutta	SA	48.0	20/12[9]	46.4 (27/12/1961)
18192/18070	Port Lincoln	SA	45.6	20/12	43.9 (31/12/1904)
21133/21046	Snowtown	SA	46.9	20/12	45.2 (19/12/2015)
22823/22801	**Cape Borda**	**SA**	**40.0**	**18/12**	**38.5 (19/12/2013) (Dec)** **40.0 (28/1/2009) (all)**
23000/23090	Adelaide	SA	45.3	19/12	44.2 (31/12/1904)
23373/23321	Nuriootpa	SA	44.7	20/12	42.2 (27/12/2018)
26021/26020	**Mount Gambier**	**SA**	**45.9**	**20/12**	**43.3 (31/12/2007) (Dec)** **44.2 (2/2/2014) (all)**
27045/27042	Weipa	QLD	38.9	8/12	38.8 (11/12/2016)
29077/29004	**Burketown**	**QLD**	**43.8 (=)** **44.4**	**26/12** **19/1**	**43.8 (8/12/1934)** **44.2 (20/1/1985) (Jan)** **44.4 (8/11/1965) (all)**
31011	Cairns	QLD	40.0	15/2	39.5 (21/2/2019)
39083	Rockhampton	QLD	41.9	16/12	41.5 (30/12/2013)
43109/43034	St. George	QLD	45.9	22/12	45.5 (29/12/2013)
50017/73054	West Wyalong	NSW	44.6	21/12	43.6 (31/12/2005)
53115/53048/53027	Moree	NSW	45.9	22/12	45.8 (3/12/1913)
56242/56017	Inverell	NSW	41.8	22/12	40.8 (3/12/1913)
61078	**Williamtown**	**NSW**	**45.5**	**4/1**	**44.8 (18/1/2013) (Jan)** **45.5 (11/2/2017) (all)**
61363/61089	Scone	NSW	45.3 44.6	21/12 4/1	43.6 (23/12/1990) (Dec) 44.2 (12/1/2013) (Jan)
63005	Bathurst	NSW	40.3 41.0	21/12 4/1	38.9 (27/12/1938) (Dec) 40.6 (13/1/1939) (Jan)
65070/65012	Dubbo	NSW	44.9	21/12	42.8 (18/12/1938, 28/12/1949)

[9] 2-day maximum for 19–20 December 2019.

67105/67033	Richmond	NSW	45.0	31/12	43.7 (21/12/1994)
68072/68076	**Nowra**	**NSW**	**45.6**	**21/12**	**43.0 (17/12/2009) (Dec)** **45.4 (18/1/2013) (all)**
70351/70014/70099	**Canberra**	**ACT**	**41.1** **44.0** **42.7**	**21/12** **4/1** **1/2**	**39.7 (27/12/1938) (Dec)** **42.8 (11/1/1939) (Jan, all)** **42.2 (1/2/1968) (Feb)**
72161/72091	**Cabramurra**	**NSW**	**30.3** **34.0**	**20/12** **31/1**	**29.6 (31/12/2005)** **32.4 (16/1/2014) (Jan, all)**
74258/74128	Deniliquin	NSW	46.5	20/12	44.8 (31/12/2005)
76031/76077	Mildura	VIC	46.8	20/12	45.1 (31/12/2005)
78015/78031	**Nhill**	**VIC**	**47.1**	**20/12**	**46.0 (31/12/2005) (Dec)** **47.1 (7/2/2009) (all)**
80023	Kerang	VIC	46.6	20/12	45.0 (31/12/2005)
84145/84030	Orbost	VIC	43.1	30/12	41.3 (30/12/2003, 20/12/2015)
85072/85133	Sale	VIC	42.1	30/12	41.1 (24 and 25/12/1920, 27/12/1940)
85096	Wilsons Promontory	VIC	40.2	30/12	38.3 (24/12/1920)
87031	Laverton	VIC	45.2	20/12	44.3 (31/12/2005)
90015	**Cape Otway**	**VIC**	**43.4**	**20/12**	**40.5 (10/12/1980) (Dec)** **43.3 (24/1/1982) (all)**
91311/91104	Launceston Airport	TAS	35.2	30/12	34.7 (29/12/1979)
94010	Cape Bruny	TAS	38.0	30/12	37.2 (26/12/1945)
94029	Hobart	TAS	40.8	30/12	40.6 (30/12/1897)
94220/94069	Grove	TAS	39.4	30/12	37.2 (11/12/1998)
96003	Butlers Gorge	TAS	32.7	30/12	32.6 (19/12/2015)

Table 4: Monthly mean maximum temperatures at ACORN-SAT locations which were the highest on record for December. Values shown in bold are records for any month.

Site number(s)	Location	State	Value (°C)	Previous record[10]
1019/1021	**Kalumburu**	**WA**	**39.8**	**39.6 (Dec 2018) (Dec) 39.8 (Nov 1969) (all)**
2079/2012/2011	**Halls Creek**	**WA**	**41.8**	**41.5 (Dec 2018) (Dec, all)**
3003/3002	Broome	WA	36.7	36.3 (Dec 2012)
4032/4002	**Port Hedland**	**WA**	**40.8**	**39.4 (Dec 1961, 2009) (Dec) 40.6 (Nov 1990) (all)**
4106/4020	Marble Bar	WA	44.1 (=)	44.1 (Dec 2018)
5007	Learmonth	WA	41.0	39.1 (Dec 1979)
7045/7046	Meekatharra	WA	40.2	39.7 (Dec 1972)
8296/8093	Morawa	WA	38.8	38.3 (Dec 1952)
8297/8039	Dalwallinu	WA	37.4	36.4 (Dec 1972)
9021	Perth Airport	WA	33.9	32.4 (Dec 1999)
9617/9510	Bridgetown	WA	32.8	31.0 (Dec 1909)
9789/9541	Esperance	WA	28.2	28.1 (Dec 1972)
10092/10093	Merredin	WA	37.3	35.8 (Dec 1972)
10286/10035	**Cunderdin**	**WA**	**37.5**	**35.7 (Dec 1977) (Dec) 37.5 (Jan 2010) (all)**
10916/10579	Katanning	WA	33.1	32.8 (Dec 1972)
10917/10648	Wandering	WA	34.7	33.6 (Dec 1977)
11052/11004	Forrest	WA	36.3	35.7 (Dec 1972)
12038/12039	Kalgoorlie	WA	37.2	36.5 (Dec 1972)
13017	**Giles**	**WA**	**40.7**	**38.7 (Dec 1972) (Dec) 40.5 (Jan 2019) (all)**
14015	**Darwin Airport**	**NT**	**35.3**	**34.4 (Dec 2002) (Dec) 34.8 (Oct 2009) (all)**
14825	**Victoria River Downs**	**NT**	**41.6**	**41.3 (Dec 2018) (Dec) 41.5 (Nov 2019) (all)**
15135/15087	Tennant Creek	NT	41.4	41.3 (Dec 2018)
15590/15540	Alice Springs	NT	40.8	39.3 (Dec 1896)
16001	Woomera	SA	37.9	35.7 (Dec 2015)
16098/16044	Tarcoola	SA	39.2	37.2 (Dec 1972)
17043/17114	Oodnadatta	SA	41.6	39.9 (Dec 1972)
18012	Ceduna	SA	32.0	31.7 (Dec 2015)
18044	Kyancutta	SA	35.8	35.4 (Dec 2015)
21133/21046	Snowtown	SA	34.3	34.1 (Dec 2015)
23373/23321	Nuriootpa	SA	31.7	31.3 (Dec 2015)
28004	Palmerville	QLD	38.1 (=)	38.1 (Dec 1935)
29077/29004	**Burketown**	**QLD**	**38.9**	**38.5 (Dec 1959) (Dec, all)**
34084/34002	**Charters Towers**	**QLD**	**38.1 (=)**	**38.1 (Dec 1911) (Dec, all)**
37010	**Camooweal**	**QLD**	**42.0**	**41.7 (Dec 2018) (Dec) 41.9 (Jan 1971) (all)**
38026/38002	Birdsville	QLD	42.8	41.6 (Dec 1976)
39066/39039	**Gayndah**	**QLD**	**37.5**	**35.7 (Dec 1911) (Dec) 36.8 (Jan 2003) (all)**
39083	**Rockhampton**	**QLD**	**35.7**	**35.4 (Dec 2005) (Dec, all)**
39128/39015	Bundaberg	QLD	32.5	32.0 (Dec 2005)

[10] Excludes months which have 10 or more days of missing data.

40004	**Amberley**	**QLD**	**34.6**	**34.3 (Dec 1957) (Dec) 34.4 (Jan 1942) (all)**
40043	Cape Moreton	QLD	28.5 (=)	28.5 (Dec 2005)
42112/42023	Miles	QLD	37.2	37.0 (Dec 1938)
45025/45017	Thargomindah	QLD	40.5	39.3 (Dec 1979)
46012/46043	Wilcannia	NSW	37.7	37.2 (Dec 1972, 1990)
50017/73054	West Wyalong	NSW	34.8	33.5 (Dec 2018)
56242/56017	Inverell	NSW	34.5	34.2 (Dec 1957)
61363/61089	Scone	NSW	35.3	34.7 (Dec 1957)
63005	Bathurst	NSW	31.6	30.6 (Dec 1990)
65070/65012	Dubbo	NSW	35.8	35.6 (Dec 1913)
68072/68076	Nowra	NSW	29.2	28.4 (Dec 2016)
70351/70014/70099	Canberra	ACT	31.7	29.7 (Dec 1972)
72150/72151	Wagga Wagga	NSW	33.6	33.4 (Dec 1913)
72161/72091	Cabramurra	NSW	21.4	20.7 (Dec 1972)
74258/74128	Deniliquin	NSW	33.9	33.6 (Dec 2018)
76031/76077	Mildura	VIC	34.7	34.5 (Dec 2015)
80023	Kerang	VIC	33.4 (=)	33.4 (Dec 2015)

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.

In general, only temperatures measured since the introduction of standard instrument shelters (Stevenson screens) are considered in this statement. This is generally around 1910 but is earlier (mostly by 1895) at most South Australian, Queensland, and Tasmanian locations. At Eucla, a Stevenson screen was not installed until 1913, and a small number of sites in New South Wales (including White Cliffs, Scone and Jerrys Plains) did not have Stevenson screens installed until the late 1940s.

This Statement in general covers information available as of 9 March 2020.

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

Special Climate Statements

Special Climate Statement 70—drought conditions in eastern Australia and impact on water resources in the Murray–Darling Basin

Special Climate Statement 72—dangerous bushfire weather in spring 2019

References

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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