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Bureau of Meteorology

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SPECIAL CLIMATE STATEMENT 17

The exceptional January-February 2009 heatwave in south-eastern Australia

Issued 4th February 2009
National Climate Centre

Cite: National Climate Centre, 2009. The exceptional January-February 2009 heatwave in south-eastern Australia, Bureau of Meteorology, Special Climate Statement 17.

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Introduction

An exceptional heatwave affected south-eastern Australia in late January and early February 2009. The most extreme conditions occurred in northern and eastern Tasmania, most of Victoria and adjacent border areas of New South Wales, and southern South Australia, with many records set both for high day and night time temperatures as well as for the duration of extreme heat.

Widespread very hot conditions began to develop in the southeast from 27 January onwards. The presence of a slow-moving high pressure system in the Tasman Sea, combined with an intense tropical low off the northwest coast of Western Australia and an active monsoon trough, provided the ideal conditions for hot tropical air to be directed over the southern parts of the continent. The most acute phase of the heatwave extended from 28 to 30 January, with most individual-day records set on those days. A weak change brought some relief to southern coastal areas from 31 January onwards, but inland areas, as well as much of South Australia, remained very hot.

Highest temperatures reached during the heatwave

Selected individual record high temperatures set during the heatwave are shown in Table 1.

The most exceptional heat, compared with historic experience, occurred in northern and eastern Tasmania. The previous state record of 40.8°C, set at Hobart on 4 January 1976, was broken on 29 January when it reached 41.5°C at Flinders Island Airport. This record only lasted one day, as Scamander, on the east coast, reached 42.2°C on the 30th. Four other sites broke the previous Tasmanian record that day, St. Helens (41.8), Ross (41.6), Cressy (41.4) and Fingal (41.3). Fingal also reached 40.6°C on the 29th, only the second time that a Tasmanian site has reached 40°C on two successive days¹.

Nearly half of Tasmania had its hottest day on record on 30 January (Figure 1), with many records broken by large margins, particularly in the north. Launceston Airport (39.9) broke its previous record (37.3) by 2.6 degrees.² This is the second-largest margin by which a record high maximum has been broken at any of the 103 locations in the long-term high-quality Australian temperature data set³. Launceston Airport also reached 37.2°C on the 29th and 37.5°C on the 30th, meaning that three of the four warmest days on record at the site now come from the 2009 heatwave. (Whilst the Launceston Airport site was not open in January 1939, data from Launceston city indicate the temperatures in that year were well below 2009 levels).

The January 2009 event has now been responsible for seven of the eight highest temperatures in record in Tasmania; a total of eight sites reached 40°C, a mark which had only been reached on 16 previous occasions in the state's recorded history. Another unusual feature of the event was that the highest temperatures occurred in the state's northern half, whereas most extreme high temperatures in Tasmania (including all 16 previous observations of 40°C or above) have been in the southeast around Hobart, or on the east coast from Swansea southwards.

In southern South Australia, and much of central, southern and western Victoria, maximum temperatures widely reached their highest levels since at least 1939. Melbourne and Adelaide both narrowly missed all-time records. Melbourne's 45.1°C on 30 January was the second-highest on

¹ The previous occasion was at Hobart on 29-30 December 1897.

² Two sites are currently operating in parallel at Launceston Airport, on opposite sides of the airport 1.4 km apart. All data quoted in this statement are from the old site (91104), which is scheduled to close later in 2009. The new site (91311), which opened in 2004, reached 40.4°C on 30 January 2009.

³ Tewantin (Queensland) reached 44.2°C on 26 January 1940 and has not exceeded 41.1°C on any other day.

record behind 45.6°C on 13 January 1939, while Adelaide's 45.7°C on the 28th ranks third behind two 1939 readings of 46.1°C and 45.9°C. At a few mainland locations, including Geelong (45.3°C on the 29th) and Wilsons Promontory (41.4°C on the 30th) even the 1939 marks were surpassed, while post-1939 stations where all-time records were set or equalled included Nuriootpa, Mount Barker, Cape Borda, Keith and Mount Gambier (SA), Omeo and Mangalore (Victoria), and Tumbarumba (NSW).

South Australia's highest temperature during the event was 48.2°C at Kyancutta on 28 January, while Victoria's peak was 45.8°C at Avalon Airport on 29 January and Charlton on 31 January. These values fell short of state records (which are 50.7°C and 47.2°C for SA and Victoria, respectively). However, the Avalon temperature, as well as a reading of 48.0°C at Pallamana (near Murray Bridge) on the 28th, are believed to be the highest ever observed so far south in Australia. The Pallamana temperature is also the highest recorded in South Australia outside the pastoral districts or the Eyre Peninsula.

Overnight minimum temperatures were also very high in many places during the event. Adelaide experienced its warmest night on record when the temperature only fell to 33.9°C in the early hours of 29 January, and other site records included those at Ceduna and Murray Bridge (Table 1). In Victoria, Melbourne Airport's minimum of 30.5°C on the 29th was only 0.4°C short of the Victorian record, set at Mildura in 1999 and Kerang in 2001, while Melton Mowbray's 24.0°C on the 30th was the fourth-highest January minimum on record for Tasmania. The extremely high day and night temperatures combined for a record high daily mean temperature at Melbourne (35.4°C on 30 January), which, along with the previous day (35.0), were the first time Melbourne's daily mean temperature has exceeded 35°C.

On the morning of 29 January, an exceptional event also occurred in the northern suburbs of Adelaide around 3 a.m. when strong north-westerly winds mixed hot air aloft to the surface. At RAAF Edinburgh, the temperature rose to 41.7°C at 3.04 a.m. Such an event appears to be without known precedent in southern Australia.

The duration of the heatwave

In addition to its peak intensity, the 2009 heatwave was also notable for its duration. The 1939 heatwave was similarly prolonged in many inland areas, but sea-breezes and weak changes brought temporary relief to coastal areas, a feature which was absent in 2009. (In 1939, Melbourne had three days above 43°C between 8 and 13 January, but there were interspersed with days in the 20s and low 30s, and there was no night in the period warmer than 18°C). At Adelaide and Melbourne, the event most directly comparable with the 2009 heatwave was that of January 1908, which had lower peak temperatures but set records in both locations for consecutive days above 40°C. Over the five days 27-31 January 2009, maximum temperatures were 12-15°C above normal over much of Victoria and southern South Australia (Figure 2).

Table 2 shows a range of records set during the event for consecutive days above threshold, both by day and night. Both Adelaide and Melbourne set records for the most consecutive days above 43°C. Adelaide's temperatures were at this level on each of the four days 27-30 January, and Melbourne's for three days from 28-30 January, breaking the previous records of two at both locations. Adelaide also equalled its 1908 record with six consecutive days above 40°C, while Melbourne's three consecutive days above 40°C was the first time this had occurred since 1959, and the seventh time in history. Hot conditions continue in Adelaide, which has now had nine consecutive days above 35°C; after never having experienced more than eight consecutive days above 35°C before March 2008, it has now happened twice within a year.

In most inland areas the number of consecutive days above 40°C has not (yet) reached the levels set in 1939, although there are exceptions. Nhill's six consecutive days above that level set a new record, while Bendigo and Rutherglen both experienced five consecutive days above 40°C, setting a record at the former and equalling it at the latter. Nuriootpa (SA) and Sale (Victoria) have also set records for the most consecutive days above 40°C. Records have, however, been set for consecutive days above more extreme thresholds at numerous inland locations, including Kerang, Deniliquin, Snowtown and Nhill. A notable record for prolonged heat was also set at Launceston Airport, where there were three consecutive days above 37°C in a location which had never previously experienced consecutive days above 35°C.

The prolonged nature of the heatwave, and in coastal areas the replacement of a very hot and dry air mass with a warm, humid one, has also led to many records being set or approached for consecutive days with minimum temperatures above thresholds. Melbourne (six consecutive nights above 20°C) equalled its record set during the 1908 heatwave, while Adelaide (six consecutive nights above 25°C) fell just short. At Mildura a record was set with seven consecutive nights above 24°C, while an indication of the depth of the warm air was that Cabramurra in the Snowy Mountains (elevation 1482 m) remained above 19°C for four days, having never done so for more than two days previously. (Cabramurra also equalled its all-time record high with 32.0°C on 30 January, while further south Mount Baw Baw (1561 m) reached 30°C for the first time on record with 30.9°C on the same day).

The dry conditions before and during the heatwave

The heatwave, as would be expected, was accompanied by very dry conditions, with only isolated thunderstorms occurring during the period. Conditions were also very dry in the weeks leading up to the event, especially in Victoria and South Australia.

Melbourne had no measurable rain after 3 January. The rainless period of 32 days is the longest experienced in the city since 1956, and approaches the record of 40 days set in 1954-55. Melbourne (0.8 mm) had its second-driest January on record, and a number of locations around Melbourne (including Preston and Toorourrong Reservoir, near Whittlesea), as well as Ballarat, set new January records for rainfall. Many stations in Victoria north and west of Melbourne, and in South Australia and southern New South Wales, had no rain in January, including Port Pirie, Clare, Adelaide Airport, Renmark and Keith (SA), Swan Hill, Nhill, Stawell, Bendigo, Yarrawonga, Heathcote and Maryborough (Victoria) and Deniliquin (NSW). Most of these locations have experienced at least one rainless January previously.

Contacts for further information

The following climate meteorologists may be contacted for further information about this event:

National: Blair Trewin (03-9669 4623), David Jones (03-9669 4085), Andrew Watkins (03-9669 4360).

State-specific: David Walland (SA) (08-8366 2686), Ian Barnes-Keoghan (Tasmania) (03-6221 2043), Perry Wiles (NSW) (02-9296 1525), Agata Imielska (NSW) (02-9296 1539), Harvey Stern (Victoria) (03-9669 4956).

Notes

All data in this statement are correct as of 4 February (minimum temperature and rainfall) or 3 February (maximum temperature). An update of this statement is expected to be released after the heatwave ends in inland areas, with a planned release date at this stage of 9 or 10 February.

Temperature observations in Australia under standard conditions comparable with present-day instruments began around 1910. Pre-1910 temperature data are only used in this statement if it is known that the instruments used at that site at the time were comparable with current standards.

Some 1939 records quoted in Tables 1 and 2 are drawn from recently digitised data which are yet to be fully incorporated in the Bureau's climate database and are not yet included in Bureau web pages.

Where two or more station numbers are quoted in Tables 1 and 2, data from two or more sites have been merged. The station number currently in operation is quoted first.

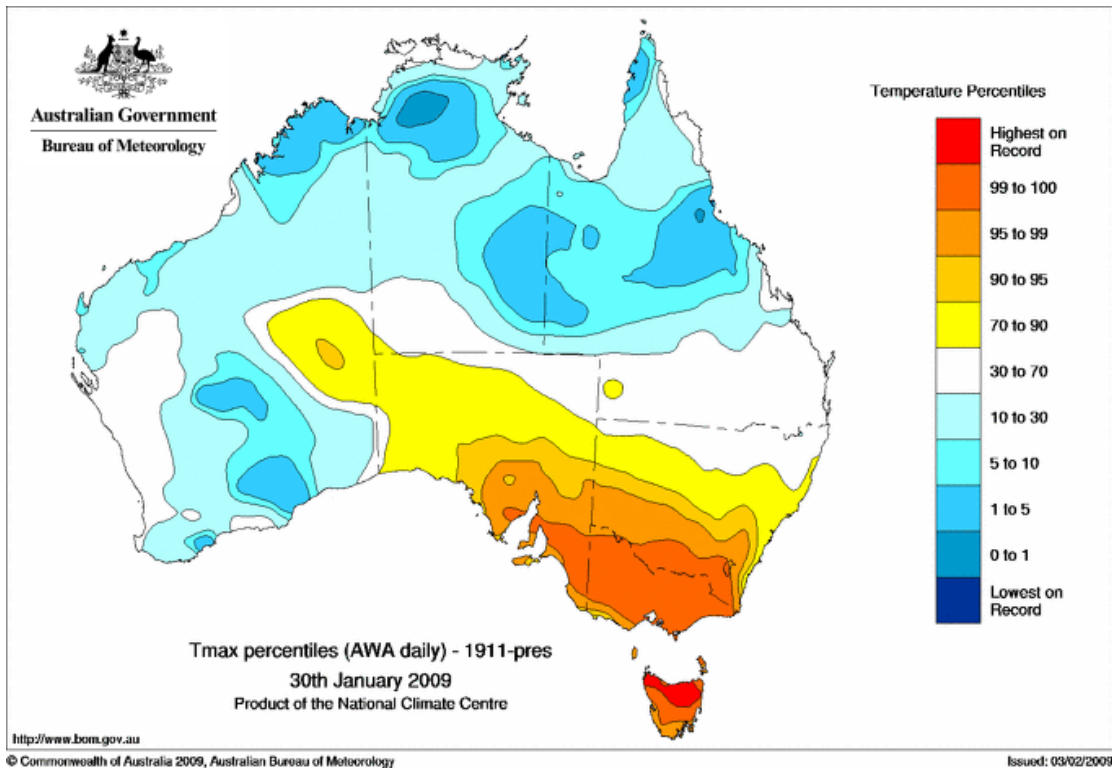


Figure 1. Australian temperature deciles for 30 January 2009, showing the large area in Tasmania which experienced its hottest day on record

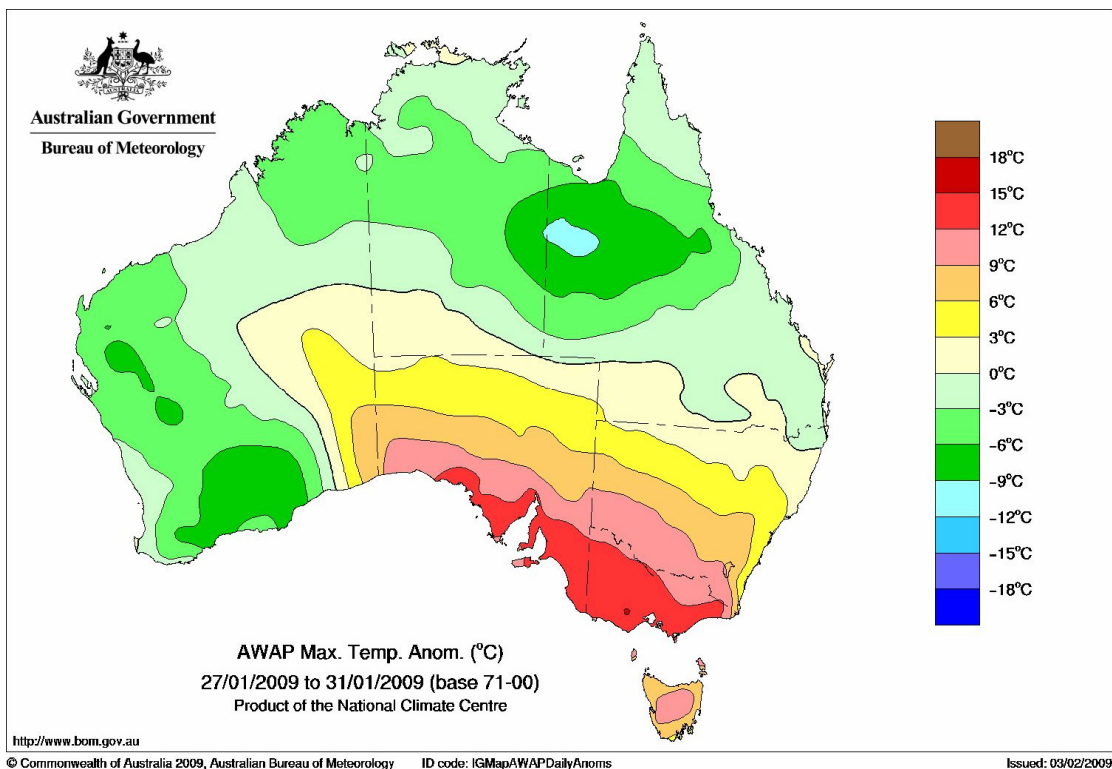


Figure 2. Maximum temperature anomalies for the period 27-31 January 2009

Station number	Location	Value	Date	Previous record	Date	Years of data
Maximum temperature						
<u>South Australia</u>						
19062	Yongala	43.5	28/1	43.4	25/1/2003	53
22823/22801	Cape Borda	40.0	28/1	39.0	23/1/1982	48
23373/23321	Nuriootpa	44.1 (=)	28/1	44.1	25/1/2003	53
23733	Mount Barker	44.5	28/1	43.0	23/1/1982	53
24518	Meningie	45.1	28/1	43.6	14/2/2004	42
24521	Murray Bridge	46.6	28/1	46.4	14/2/2004	42
25507	Keith	45.5	28/1	45.4	25/1/2003	47
26021/26020	Mount Gambier	43.6 (=)	28 and 29/1	43.6	16/2/1983	100
<u>New South Wales</u>						
71032	Thredbo (Top Stn)	27.8	30/1	27.0	6/2/1985	32
72043	Tumbarumba	39.8	30/1	39.4	31/1/1968	43
72091	Cabramurra	32.0 (=)	30/1	32.0	23/1/2003, 18/1/2003	47
<u>Victoria</u>						
81049	Tatura	43.5	31/1	43.3	24/1/1982	44
83025	Omeo	40.2	30/1	40.0	31/1/1968, 1/2/1968	53
85096	Wilsons Promontory	41.4	29/1	41.1	18/1/1959	101
87163/87117 /87025	Geelong	45.3	29/1	44.8	25/1/2003	102
88109	Mangalore	44.6	31/1	44.4	24/1/1982	50
<u>Tasmania</u>						
91009	Burnie	33.8	31/1	32.8	20/1/1982	44
91104	Launceston Airport	39.9	30/1	37.3	28/1/1943	70
91292/91092	Smithton	36.6	30/1	34.6	7/2/1983	47
99005	Flinders Island AP	41.5	29/1	38.8	25/1/2003	46
Minimum temperature						
<u>South Australia</u>						
18012	Ceduna	32.7	29/1	32.6	27/1/1967	70
18040	Kimba	31.5	29/1	30.6	22/1/2006	41
23090/23000	Adelaide	33.9	29/1	33.5	24/1/1982	123
24521	Murray Bridge	29.1	29/1	28.2	24/1/1982	42
<u>Victoria</u>						
78015/78031	Nhill	28.6	29/1	28.4	3/1/1991	102
86282	Melbourne Airport	30.5	29/1	27.3	1/1/2008	39

Table 1. Selected records for highest daily maximum and minimum temperature set in the period 27 January – 2 February 2009. Stations with data from 1939 have station numbers shown in bold.

Station number	Location	Threshold	No of days	Dates	Previous record	Years of data
Maximum temperature						
18192/18070	<u>South Australia</u> Port Lincoln	30	7 (=)	27/1-3/2	7 (several)	100
21046/21133	Snowtown	43	6	27/1-1/2	4 (31/1-3/2/1912)	102
23090/23000	Adelaide	43	4	27-30/1	2 (several)	123
		40	6 (=)	27/1-1/2	6 (14-19/1/1908)	
23373/23321	Nuriootpa	40	5	27-31/1	3 (20-22/1/2006, 30/12/2007- 1/1/2008)	53
26021/26020	Mount Gambier	43	2	28-29/1	1 (several)	101
		39	3 (=)	27-29/1	3 (several)	
<u>New South Wales</u>						
74258/74128	Deniliquin	42	5	28/1-1/2	4 (10-13/1/1939)	100
<u>Victoria</u>						
78015/78031	Nhill	40	6	27/1-1/2	4 (several)	102
		44	4	28-31/1	2 (17-18/1/1959, 31/1-1/2/1968)	
80023	Kerang	44	4	28-31/1	2 (24-25/2/1968)	101
81123/81003	Bendigo	40	5	28/1-1/2	3 (17-19/1/1959, 4-6/1/1999)	101
		42	4	28-31/1	2 (14-15/2/2004)	
82039	Rutherglen	40	5 (=)	28/1-1/2	5 (11-15/1/1939)	98
85072	Sale	40	3	28-30/1	2 (17-18/1/1959)	64
86071	Melbourne	43	3	28-30/1	2 (20-21/1/1875)	155
87031	Laverton	43	3	28-30/1	1 (several)	65
89002	Ballarat	40	3 (=)	28-30/1	3 (17-19/1/1959)	102
		39	4	28-31/1	3 (17-19/1/1959)	
<u>Tasmania</u>						
91104	Launceston Airport	35	3	29-31/1	1 (several)	70
Minimum temperature						
26026	<u>South Australia</u> Robe	20	4 (=)	28-31/1	4 (16-19/1/1908)	102
72161/72091	<u>New South Wales</u> Cabramurra	19	4	29/1-1/2	2 (23-24/1/2001, 22-23/1/2006)	47
76031/76077	<u>Victoria</u> Mildura	24	7	28/1-3/2	5 (10-14/1/1939, 27-31/1/1943)	103
86071	Melbourne	20	6 (=)	29/1-3/2	6 (16-21/1/1908)	155

Table 2. Selected records for the greatest number of days with temperatures at or above set thresholds. Stations with data from 1939 have station numbers shown in bold.