## Special Climate Statement 43 - extreme heat in January 2013

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## 1 Introduction

An exceptionally extensive and long-lived heatwave affected large parts of Australia in late December 2012 and the first weeks of January 2013. Whilst the heat was most extreme and persistent in the central and southern interior of the continent, most of Australia experienced extreme heat at some stage during the event.

The recent heat was notable for the extent, with records set in every State and Territory, and the nationally averaged daily temperature rose to levels never previously observed, and did this for an extended period. The heatwave was a major factor in January 2013 being the hottest month on record for Australia.

A past event where record hot conditions for an extended period across much of Australia occurred was in late 1972 and early 1973. The previous hottest day on record for Australia as a whole was recorded in this event, but was broken by recent conditions. Like recent events, the 1972-73 heatwave coincided with the late onset of the northern Australian monsoon, preventing moisture and cloud of tropical origin from moderating temperatures inland. However, the most extreme aspects of the 1972-73 event were confined to inland areas, whereas in late 2012 and early $2013,40^{\circ} \mathrm{C}$ was reached at least once in every capital city except Brisbane and Darwin.

## 2 Significant aspects of the heatwave

### 2.1 Background and evolution of the heatwave

The last four months of 2012 were abnormally hot across Australia, and particularly so for maximum (daytime) temperatures. For September to December (i.e. the last four months of 2012) the average Australian maximum temperature was the highest on record with maximum temperatures averaged across Australia as a whole, $1.61^{\circ} \mathrm{C}$ warmer than average, slightly ahead of the previous record set in 2002 when nationally averaged maximum temperatures were $1.60^{\circ} \mathrm{C}$ warmer than average (nationally averaged temperature records go back to 1910).
During spring and early summer in 2012 extreme high temperatures for the time of year occurred on numerous occasions in inland Australia; for example, a State temperature record was set for Victoria in November (see Special Climate Statement 41), Alice Springs equalled its record highest temperatures for both September and October, and Birdsville recorded its earliest-ever 40-degree day in spring in September. Also, much of Australia has also been drier than normal since mid-2012 with record lowest July to December rainfall across central South Australia, and below average rainfall across almost all of southeastern Australia.

The current heatwave event commenced with a build up of extreme heat in the southwest of Western Australia from 25-30 December 2012 as a high in the Bight and a trough near the west coast directed hot easterly winds over the area. Particularly hot conditions were observed on the $30^{\text {th }}$, with Cape Naturaliste observing $37.7^{\circ} \mathrm{C}$, its hottest December day on record. Perth equalled a record when it experienced seven consecutive days above $37^{\circ} \mathrm{C}$ from 25-31 December.
From 31 December the high pressure system began to shift eastward, bringing well above average temperatures across southern WA between 30 December and 2 January. A number of records were set, particularly on the Nullarbor (see Table 1), with Red Rocks Point, west of Eucla, reaching $48.6^{\circ} \mathrm{C}$ on 2 January.
By 4 January the high pressure system had moved off eastern Australia, with northerly winds directing very hot air into southeast Australia, while southerly winds eased temperatures in WA. The $4^{\text {th }}$ was the most extreme day of the event in Tasmania and coastal areas of Victoria and South Australia. Numerous records were set in southern Tasmania, most notably at Hobart, whose maximum of $41.8^{\circ} \mathrm{C}$ was the highest in 120 years of records there, the highest on record anywhere in southern Tasmania, and the second-highest for the State as a whole. Adelaide reached $45^{\circ} \mathrm{C}$ for only the fourth time in its history.
Southern coastal areas of Australia cooled from the $5^{\text {th }}$ onwards, but areas of intense heat lingered inland over eastern SA and the southern half of NSW until 8 January when the high pressure system in the Tasman Sea began to move eastward and
northwesterly winds ahead of a cold front extended the heat to coastal NSW with temperatures widely exceeding $40^{\circ} \mathrm{C}$ from Sydney southwards, and fire danger reaching catastrophic levels in parts of the State's southern inland.

Conditions cooled temporarily in the eastern States after the $8^{\text {th }}$. Meanwhile, Western Australia saw a second wave of recording breaking heat on 8-10 January as a second high pressure system moved into the Great Australian Bight directing hot easterly winds into the State. Conditions were particularly extreme over the State's central and southern interior. The highest temperature recorded in WA during this event was $49.0^{\circ} \mathrm{C}$ at Leonora, while Wiluna ( $48.0^{\circ} \mathrm{C}$, 8 January) equalled the record for the highest sea-level equivalent temperature ever observed in Australia ${ }^{1}$.
Intense heat from the interior of Australia moved east again on the $11^{\text {th }}$ of January with the most extreme heat of the whole event occurring on the weekend of 12-13 January. Temperatures exceeding $48{ }^{\circ} \mathrm{C}$ were recorded at numerous locations in northwestern New South Wales, northeastern South Australia and western Queensland. Moomba reached $49.6^{\circ} \mathrm{C}$ on the $12^{\text {th }}$, the highest temperature of the event the highest temperature recorded in South Australia since 1960, and the sixth hottest temperature ever officially recorded in Australia. On the $13^{\text {th }}$, Birdsville set a new Queensland January record with $49.0^{\circ} \mathrm{C}$, the State's highest temperature since December 1972, and Wanaaring's $48.6^{\circ} \mathrm{C}$ was the hottest temperature recorded in New South Wales since 1939. Overnight minimum temperatures were also very high in places, with Bedourie (Queensland) only falling to $34.1^{\circ} \mathrm{C}$ on the $14^{\text {th }}$, the highest in Queensland since 2006.
Temperature moderated slightly in eastern inland areas from the $14^{\text {th }}$, whilst remaining very high in the western interior. But northwesterly winds brought a final phase of extreme heat to South Australia and Victoria on the $17^{\text {th }}$ and New South Wales on the $18^{\text {th }}$. Conditions were particularly extreme on the coast and adjacent ranges of central and southern New South Wales. Sydney's long-standing record high temperature was broken when it reached $45.8^{\circ} \mathrm{C}$ at Observatory Hill, and numerous other records were broken elsewhere in the greater Sydney region, the Hunter, South Coast and Illawarra.
The main part of the heatwave finally ended on the $19^{\text {th }}$, as southerly winds cooled the southern States and tropical moisture from a late developing monsoon moderated conditions further north. The $19^{\text {th }}$ was the first day since 31 December 2012 that it did not reach $45^{\circ} \mathrm{C}$ somewhere in Australia, with above-normal temperatures becoming confined to the southern half of Queensland.

[^0]
### 2.2 National and State average temperatures and the spatial extent of the extreme heat

A particular feature of this heatwave event was the exceptional spatial extent of high temperatures. Table 3 gives the national and State/Territory area-average maximum temperature for each day of the heatwave event. Australia set a new record for the hottest day for Australia as a whole on 7 January, recording $40.30^{\circ} \mathrm{C}$, surpassing the previous record set on 21 December $1972\left(40.17{ }^{\circ} \mathrm{C}\right)$. The area-averaged temperature for Australia as a whole exceeded $39^{\circ} \mathrm{C}$ on seven consecutive days from 2-8 January; the longest such period previously recorded was four days in December 1972. There have only been 21 days in 102 years of records where the national area-averaged maximum temperature has exceeded $39^{\circ} \mathrm{C}$; eight in 2013 (2-8 January and 11 January), seven in 1972-73, and only six in all other events combined (Table 4).
On 7 January Australia recorded a new area-averaged mean temperature (average of the maximum and minimum temperatures) record of $32.21^{\circ} \mathrm{C}$, surpassing the previous record of $31.86^{\circ} \mathrm{C}$ from 21 December 1972. This new record was then subsequently broken on 8 January ( $32.30^{\circ} \mathrm{C}$ ), making 7-8 January 2013 Australia's hottest 2-day period on record. The national area-averaged minimum temperature on 8 January was $24.49^{\circ} \mathrm{C}$, the second-highest on record after $24.69^{\circ} \mathrm{C}$ on 23 January 1982.
Maximum temperatures over the period 1-18 January have been $6^{\circ} \mathrm{C}$ or more above normal over a wide area of interior central and southern Australia (Figure 1), and $45^{\circ} \mathrm{C}$ has been reached at least once during the event over 46.9 per cent of Australia (Figure 3). Overnight minimum temperatures have been less extreme but have still been well above normal (Figure 2).

### 2.3 Record-breaking daily temperatures

Tables 1 and 2 give a list of all significant daily maximum and minimum temperature records broken during the course of this heatwave event to date. A total of 44 stations with 30 years or more of data have set all-time record high maximum temperatures during this event, with a further 15 setting January records. For minimum temperatures, seven such stations set all-time records and a further 13 set January records. Some stations exceeded their previous records on multiple occasions; for example, Giles surpassed its previous record ( $44.8^{\circ} \mathrm{C}$ ) on three separate occasions during the event, peaking at $45.7^{\circ} \mathrm{C}$ on 16 January.

Figure 4 shows the area over which record, and other notably high, maximum temperatures were set during the course of the event ${ }^{2}$, whilst Figure 5 shows the occurrence of record temperatures on some individual days during the event. Over the full course of the event, records were set over 14.2 per cent of Australia's area, including 21.7 per cent of Western Australia and between 13 and 16 per cent of Tasmania, New South Wales and Queensland. Temperatures that, on average, occur once every ten years were exceeded across 52.3 per cent of Australia, including 79.1 per cent of New South Wales and 73.7 per cent of South Australia. The only large areas over which significant extremes did not occur were the northern tropics, the west coast of Western Australia from Perth northwards, and coastal Queensland.

Fourteen of the 112 stations in the Bureau's long-term high-quality temperature observation network (ACORN-SAT) set all-time record high maximum temperatures during the 2013 event (Table 1), with a fifteenth (Mount Gambier) equalling its record. No previous event has resulted in so many records at ACORN-SAT stations, the previous benchmark being set in the January 1939 heatwave, in which eleven ACORNSAT stations set records and three equal records.

No States or Territories set all-time records during the event. Moomba's $49.6^{\circ} \mathrm{C}$ ranks as the eighth-highest temperature on record in Australia (Table 5), whilst Birdsville's $49.0^{\circ} \mathrm{C}$ set a January record for Queensland. Whilst, unlike the 1939, 1960 and 2009 heatwaves, the 2012-13 event did not set any State or Territory single-day records, it affected a much larger area, and lasted for longer, than any of those events did.

### 2.4 The prolonged nature of the extreme heat

A major feature of the 2012-13 heatwave was its duration, particularly in inland areas, where some stations experienced well above normal temperatures on every, or almost every, day over a period of three weeks or more.
A number of stations set or equalled records for the longest continuous run of hot days (Table 6). Alice Springs had 17 consecutive days of $40^{\circ} \mathrm{C}$ or above, easily breaking its previous record of $12^{3}$. Birdsville had a run of 31 consecutive days of $40^{\circ} \mathrm{C}$ or above (as of 24 January), equalling the record for any Queensland location, 31 days at Boulia and Urandangi in 1972-73.

[^1]Another indicator of the extreme heat was the number of days on which particular thresholds were reached in various States. It reached at least $47^{\circ} \mathrm{C}$ somewhere in New South Wales on six separate days during the event, and $48^{\circ} \mathrm{C}$ somewhere in South Australia on five consecutive days. In both cases the number of such days already observed in 2013 surpassed the number observed in any other year in the 1957-2013 ${ }^{4}$ period.

### 2.5 Monthly mean temperatures for January

January 2013 was Australia's hottest month on record. Averaged nationally, the maximum temperature was $36.92^{\circ} \mathrm{C}, 2.28^{\circ} \mathrm{C}$ above the $1961-1990$ average, and $0.11^{\circ} \mathrm{C}$ above the previous record of $36.81^{\circ} \mathrm{C}$, set in January 1932 . The monthly mean temperature (day and night combined) also set a record. It was $29.68^{\circ} \mathrm{C}, 1.77^{\circ} \mathrm{C}$ above the 1961-1990 average and $0.27^{\circ} \mathrm{C}$ above the previous record of $29.41^{\circ} \mathrm{C}$, also set in January 1932. Minimum temperatures $\left(22.43^{\circ} \mathrm{C}, 1.26^{\circ} \mathrm{C}\right.$ above average) ranked as the third highest on record for January, after 2006 and 1999. It was also the hottest month on record for monthly mean temperature for the Northern Territory and Queensland.

Temperatures were above average across most of the country, especially maximum temperatures, where the only area which was below average was a portion of the Pilbara region in Western Australia (Figure 6). In parts of inland New South Wales and Queensland mean maximum temperatures for the month were 5 to $6^{\circ} \mathrm{C}$ above normal. The widespread nature of the heat across the country was the major contributor to the record nationally-averaged value; many individual locations have had at least one hotter month in their history ${ }^{5}$, but no previous month has seen countrywide heat on the scale of that observed in January 2013. A number of individual stations did have their hottest month on record (Table 7), particularly in east-central Australia.

[^2]

Figure 1. Maximum temperature anomaly (departure from 1961-1990 average) for Australia, 1-18 January 2013.


Figure 2. Minimum temperature anomaly (departure from 1961-1990 average) for Australia, 1-18 January 2013.


Figure 3. Highest reported temperature in period 25 December 2012-18 January 2013.


Figure 4. Highest reported temperature in period 1-19 January, compared to January records and 1-in-30 year, 1-in-10 year and 1-in-3 year values.


Figure 5. Areas of record-breaking temperatures (dark red) on selected days during heatwave: from top to bottom, 2, 4, 8, 12 and 13 January.


Figure 6. Australian maximum (left) and minimum (right) temperature anomalies from 19611990 average, January 2013.

Table 1. New daily maximum temperature records set during the event (stations with 30 or more years of historical records). Highlighted records indicate the monthly record is also an annual record. Where two station numbers are shown data from two sites are combined. If the previous all-time record was set in a month other than January both the previous January and all-time records are shown. Stations with an asterisk (*) against the station number are part of the Australian Climate Observations Network - Surface Air Temperature (ACORN-SAT) network.

| Station number | Location | State | Temperature ( ${ }^{\circ} \mathrm{C}$ ) | Date | Previous Record | Date | Years of record |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 7045* | Meekatharra | WA | 47.1 | 8/1 | 45.7 | 5/1/2008 | 63 |
| 7139 | Paynes Find | WA | 47.2 | 8/1 | $\begin{aligned} & 46.5 \\ & 46.6 \\ & \hline \end{aligned}$ | $\begin{gathered} \text { 20/1/1991 } \\ 3 / 2 / 2007 \\ \hline \end{gathered}$ | 34 |
| 9519 | Cape Naturaliste | WA | 37.7 | 30/12 | 37.6 | 26/12/2007 | 104 |
| 11003* | Eucla | WA | 48.2 | 3/1 | 47.9 | 3/1/1979 | 97 |
| 12046 | Leonora | WA | 49.0 | 9/1 | 47.8 | 17/1/1958 | 57 |
| 12090 | Yeelirrie | WA | 47.9 | 8/1 | $\begin{aligned} & 45.8 \\ & 46.0 \end{aligned}$ | $\begin{gathered} 7 / 1 / 1983 \\ 11 / 2 / 1991 \end{gathered}$ | 40 |
| 13012 | Wiluna | WA | 48.0 | 8/1 | 46.9 | 1/1/1990 | 56 |
| 13017* | Giles | WA | 45.7 | 16/1 | 44.8 | 28/1/2011 | 57 |
| 15511 | Curtin Springs | NT | 46.4 | 11/1 | $\begin{aligned} & 45.5 \\ & 46.0 \\ & \hline \end{aligned}$ | $\begin{aligned} & 28 / 1 / 2011 \\ & 17 / 2 / 1992 \end{aligned}$ | 49 |
| 17110 | Leigh Creek | SA | 46.3 | 6/1 | 46.1 | 25/1/2011 | 31 |
| 18040 | Kimba | SA | 46.0 | 4/1 | 45.6 | 31/1/1968 | 46 |
| 23034 | Adelaide Airport | SA | 44.1 | 4/1 | 44.0 | 28/1/2009 | 58 |
| 38024 | Windorah | QLD | 47.6 | 12/1 | $\begin{aligned} & \hline 47.0 \\ & 47.1 \\ & \hline \end{aligned}$ | $\begin{gathered} \hline \text { 4/1/1973 } \\ 22 / 12 / 1990 \end{gathered}$ | 47 |
| $\begin{aligned} & \hline 38026 / \\ & 38002^{*} \end{aligned}$ | Birdsville | QLD | 49.0 | 13/1 | 48.5 | 5, 6/1/2004 | 58 |
| 44026 | Cunnamulla | QLD | 47.0 | 13/1 | 46.9 | 4/1/1973 | 56 |
| $\begin{aligned} & \hline \text { 45025/ } \\ & \text { 45017* } \end{aligned}$ | Thargomindah | QLD | 48.8 | 13/1 | 47.5 | 3/1/1994 | 57 |
| 46037* | Tibooburra | NSW | 47.9 | 12/1 | 47.6 | 3/1/1973 | 103 |
| 48015 | Brewarrina | NSW | 48.1 | 13/1 | 47.4 | 3/1/1973 | 49 |
| 50031 | Peak Hill | NSW | 44.5 | 12/1 | 44.3 | 3/1/1973 | 46 |
| 51039 | Nyngan | NSW | 47.0 | 12/1 | 46.8 | 15/1/1939 | 93 |
| 51049 | Trangie | NSW | 46.1 | 12/1 | $\begin{aligned} & 45.0 \\ & 45.8 \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 15 / 1 / 2001 \\ & 21 / 2 / 2004 \\ & \hline \end{aligned}$ | 45 |
| 52020 | Mungindi | NSW | 46.8 | 12/1 | 46.5 | 4/1/1990 | 48 |
| $\begin{aligned} & \hline 52088 / \\ & 52026 * \end{aligned}$ | Walgett | NSW | 48.5 | 13/1 | 48.0 | 4/1/1973 | 104 |
| 55049 | Quirindi | NSW | 42.9 | 12/1 | 41.4 | 27/1/2011 | 48 |
| 61051 | Murrurundi | NSW | 40.9 | 12/1 | $\begin{aligned} & 40.2 \\ & 40.7 \\ & \hline \end{aligned}$ | $\begin{gathered} \hline 27 / 1 / 1981 \\ 2 / 2 / 2006 \\ \hline \end{gathered}$ | 49 |
| 61055 | Newcastle | NSW | 42.5 | 18/1 | 41.4 | 1/1/2006 | 56 |


| Station number | Location | State | Temperature ( ${ }^{\circ} \mathrm{C}$ ) | Date | Previous Record | Date | Years of record |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | (Nobbys Head) |  |  |  | 42.0 | 23/12/1990 |  |
| 61078* | Williamtown | NSW | 44.8 | 18/1 | 44.4 | 1/1/2006 | 63 |
| 61087 | Gosford (Narara) | NSW | 44.8 | 18/1 | 43.8 | 1/1/2006 | 30 |
| 61250 | Paterson | NSW | 44.4 | 18/1 | 43.7 | 15/1/2001 | 43 |
| 61288 | Lostock Dam | NSW | 43.5 | 13/1 | $\begin{aligned} & \hline 42.4 \\ & 42.5 \end{aligned}$ | $\begin{aligned} & \hline 23 / 1 / 2001 \\ & 21 / 2 / 2004 \end{aligned}$ | 44 |
| $\begin{aligned} & \hline 61363 / \\ & \text { 61089* } \end{aligned}$ | Scone | NSW | 44.2 | 12/1 | $\begin{aligned} & 42.5 \\ & 43.4 \end{aligned}$ | $\begin{gathered} \hline 26 / 1 / 2011 \\ 19 / 11 / 1968 \end{gathered}$ | 49 |
| 62013 | Gulgong | NSW | 42.0 | $\begin{gathered} \hline 12, \\ 18 / 1 \end{gathered}$ | 41.5 | 15/1/2001 | 43 |
| 63039 | Katoomba | NSW | 36.4 | 12/1 | 36.2 | 14/1/2005 | 51 |
| 63063 | Oberon | NSW | 36.0 | 18/1 | 35.9 | 3/1/1973 | 33 |
| 63254 | Orange Ag Inst | NSW | 37.2 | 12/1 | 36.7 | 15/1/2001 | 38 |
| 64009 | Dunedoo | NSW | 43.7 | 12/1 | 43.4 | 3/1/1973 | 49 |
| 65034 | Wellington | NSW | 43.7 | 12/1 | 42.5 | 3/1/1990 | 46 |
| 66037 | Sydney Airport | NSW | 46.4 | 18/1 | 45.2 | 1/1/2006 | 74 |
| 66062* | Sydney | NSW | 45.8 | 18/1 | 45.3 | 14/1/1939 | 155 |
| 66124 | Parramatta North | NSW | 45.5 | 18/1 | 44.8 | 1/1/2006 | 45 |
| 66137 | Bankstown | NSW | 46.1 | 18/1 | 44.8 | 18/1/2003 | 45 |
| 67019 | Prospect Res | NSW | 45.1 | 18/1 | 44.7 | 15/1/2001 | 49 |
| 67105* | Richmond | NSW | 46.4 | 18/1 | 44.9 | 15/1/2001 | 67 |
| $\begin{aligned} & \text { 68072I } \\ & \text { 68076* } \end{aligned}$ | Nowra | NSW | 45.4 | 18/1 | 45.1 | 30/1/2003 | 58 |
| 68192 | Camden | NSW | 46.4 | 18/1 | 45.0 | 30/1/2003 | 38 |
| $\begin{aligned} & 70351 / \\ & 70014^{*} \end{aligned}$ | Canberra | ACT | 42.0 | 18/1 | 41.4 | 31/1/1968 | 74 |
| 72043 | Tumbarumba | NSW | 40.0 | 5, 6/1 | 39.8 | 30/1/2009 | 46 |
| 75031 | Hay | NSW | 47.7 | 5/1 | $\begin{aligned} & 46.0 \\ & 47.2 \end{aligned}$ | $\begin{gathered} 23 / 1 / 2001 \\ 1 / 2 / 1968 \end{gathered}$ | 56 |
| 90171 | Portland Airport | VIC | 42.1 | 4/1 | 41.6 | 26/1/2006 | 31 |
| 91223 | Marrawah | TAS | 33.2 | 4/1 | 33.0 | 29/1/2009 | 42 |
| 92027 | Orford | TAS | 38.8 | 4/1 | 38.7 | 21/1/1997 | 45 |
| 92045* | Larapuna (Eddystone Point) | TAS | 36.5 | 4/1 | 36.1 | 16/1/1960 | 104 |
| 94008 | Hobart Airport | TAS | 40.3 | 4/1 | 40.1 | 3/1/1991 | 55 |
| 94029* | Hobart | TAS | 41.8 | $4 / 1$ | 40.8 | 4/1/1976 | 120 |
| 94087 | Mount Wellington | TAS | 29.5 | 4/1 | 29.2 | 22/1/2006 | 34 |
| $\begin{aligned} & \hline 94220 / \\ & 94069^{*} \end{aligned}$ | Grove | TAS | 40.9 | 4/1 | 40.4 | 19/1/1959 | 59 |
| 95003 | Bushy Park | TAS | 40.3 | 4/1 | 39.5 | 20/1/1973 | 53 |
| 97053 | Strathgordon | TAS | 34.8 | 4/1 | 34.5 | 4/1/1976 | 32 |

Table 2. New daily minimum temperature records set during the event (stations with 30 or more years of historical records). Details as for Table 1.

| Station number | Location | State | Temperature ( ${ }^{\circ} \mathrm{C}$ ) | Date | Previous Record | Date | Years of record |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 5007* | Learmonth | WA | 28.7 | 25/12 | 27.6 | 30/12/1994 | 38 |
| 9021* | Perth Airport | WA | 27.5 | 29/12 | 26.9 | 24/12/1960 | 69 |
| 9021* | Perth Airport | WA | 27.8 | 15/1 | 27.3 | 21/1/1989 | 69 |
| 9111 | Karnet | WA | 23.5 | 29/12 | 22.6 | 29/12/2009 | 47 |
| 9518* | Cape Leeuwin | WA | 24.2 | 8/1 | 23.5 | 26/1/2012 | 107 |
| $\begin{aligned} & \text { 9617I } \\ & \text { 9510* } \end{aligned}$ | Bridgetown | WA | 24.5 | 8/1 | $\begin{aligned} & 23.9 \\ & 24.0 \end{aligned}$ | $\begin{gathered} \text { 25/1/1961 } \\ 4 / 2 / 1933, \\ 28 / 12 / 2000 \end{gathered}$ | 104 |
| 9741* | Albany Airport | WA | 20.9 | 16/1 | 20.0 | 26/1/1974 | 48 |
| 9842 | Jarrahwood | WA | 26.0 | 8/1 | $\begin{array}{r} 24.3 \\ 24.4 \\ \hline \end{array}$ | $\begin{gathered} 12 / 1 / 1978 \\ 6 / 3 / 1990 \\ \hline \end{gathered}$ | 33 |
| 10092* | Merredin | WA | 29.7 | 8/1 | $\begin{aligned} & 29.3 \\ & 29.4 \end{aligned}$ | $\begin{aligned} & \hline 26 / 1 / 2011 \\ & 27 / 2 / 1997 \end{aligned}$ | 48 |
| 15511 | Curtin Springs | NT | 31.5 | 13/1 | 31.4 | 4/1/2006 | 49 |
| 45015 | Quilpie | QLD | 32.5 | 13/1 | 32.1 | 30/1/2003 | 57 |
| 50031 | Peak Hill | NSW | 30.9 | 18/1 | $\begin{aligned} & 29.4 \\ & 30.3 \end{aligned}$ | $\begin{gathered} 1 / 1 / 2006 \\ 12 / 2 / 2004 \end{gathered}$ | 46 |
| 51039 | Nyngan | NSW | 33.0 | 18/1 | $\begin{aligned} & 30.7 \\ & 32.0 \end{aligned}$ | $\begin{aligned} & 1 / 1 / 2006 \\ & 2 / 2 / 2006 \end{aligned}$ | 55 |
| 51049 | Trangie | NSW | 31.3 | 18/1 | $\begin{aligned} & \hline 28.4 \\ & 29.3 \end{aligned}$ | $\begin{aligned} & \hline 28 / 1 / 1981 \\ & 12 / 2 / 2004 \end{aligned}$ | 45 |
| 71032 | $\begin{aligned} & \text { Thredbo (Top } \\ & \text { Stn) } \end{aligned}$ | NSW | 17.1 | 5/1 | 17.0 | 26/1/2003 | 33 |
| 71041 | Thredbo Village | NSW | 21.0 | 8/1 | $\begin{aligned} & 19.2 \\ & 20.2 \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 8 / 1 / 1979 \\ & 8 / 2 / 2009 \\ & \hline \end{aligned}$ | 42 |
| 84070 | Point Hicks | VIC | 25.0 | 5/1 | 23.8 | 3/1/2012 | 47 |
| 94008 | Hobart Airport | TAS | 21.8 | 4/1 | 21.2 | 3/1/2012 | 55 |
| 94010* | Cape Bruny Lighthouse | TAS | 20.4 | 4/1 | 20.0 | 16/1/1960 | 57 |
| 94029* | Hobart | TAS | 23.4 | 4/1 | 22.9 | 10/1/1887 | 120 |

Table 3. Daily area-average maximum temperatures during the event. Values in bold exceed the long-term $99^{\text {th }}$ percentile.

|  | Australia | WA | NT | SA | QLD | NSW | VIC | TAS |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Record (pre-2013) | $\begin{gathered} 40.17 \\ 21 \mathrm{Dec} \\ 1972 \end{gathered}$ | $\begin{gathered} 42.95 \\ 31 \mathrm{Dec} \\ 1972 \end{gathered}$ | $\begin{gathered} 42.91 \\ 27 \mathrm{Dec} \\ 1990 \end{gathered}$ | $\begin{aligned} & 45.25 \\ & 2 \text { Jan } \\ & 1960 \\ & \hline \end{aligned}$ | $\begin{gathered} 41.64 \\ 15 \text { Nov } \\ 1915 \end{gathered}$ | $\begin{gathered} 44.06 \\ 14 \text { Jan } \\ 1939 \end{gathered}$ | $\begin{aligned} & 44.48 \\ & 7 \text { Feb } \\ & 2009 \end{aligned}$ | 33.31 30 Jan 2009 |
| 1961-90 January average | 34.64 | 35.62 | 36.35 | 34.72 | 34.80 | 31.68 | 27.28 | 19.76 |
| 25 December | 36.38 | 39.19 | 38.98 | 32.62 | 37.33 | 31.04 | 23.99 | 18.47 |
| 26 December | 36.27 | 39.09 | 38.55 | 34.74 | 36.48 | 29.43 | 26.63 | 19.64 |
| 27 December | 36.08 | 36.63 | 38.97 | 35.30 | 36.34 | 33.00 | 30.06 | 21.04 |
| 28 December | 35.89 | 37.58 | 39.12 | 34.14 | 35.96 | 32.08 | 24.67 | 17.95 |
| 29 December | 36.79 | 38.40 | 39.12 | 35.55 | 37.39 | 32.85 | 25.98 | 18.11 |
| 30 December | 37.09 | 38.56 | 39.19 | 37.27 | 37.29 | 32.87 | 27.06 | 18.33 |
| 31 December | 37.64 | 39.59 | 39.42 | 39.05 | 35.56 | 35.24 | 29.56 | 19.20 |
| 1 January | 38.57 | 41.28 | 39.12 | 40.36 | 35.91 | 37.01 | 29.71 | 17.70 |
| 2 January | 39.22 | 41.09 | 39.81 | 41.36 | 38.76 | 35.63 | 28.05 | 19.02 |
| 3 January | 39.58 | 39.33 | 40.78 | 43.55 | 39.24 | 36.10 | 36.77 | 26.65 |
| 4 January | 39.33 | 37.31 | 41.01 | 43.79 | 38.38 | 39.37 | 41.19 | 32.99 |
| 5 January | 39.23 | 39.16 | 40.32 | 40.39 | 38.05 | 41.05 | 35.35 | 24.46 |
| 6 January | 39.66 | 40.20 | 40.88 | 41.80 | 37.93 | 40.09 | 33.27 | 24.50 |
| 7 January | 40.30 | 42.29 | 40.73 | 43.40 | 36.82 | 38.87 | 37.80 | 27.05 |
| 8 January | 40.10 | 42.69 | 40.51 | 41.42 | 37.20 | 39.63 | 32.45 | 21.80 |
| 9 January | 38.37 | 41.93 | 41.36 | 33.96 | 39.94 | 30.90 | 22.69 | 15.26 |
| 10 January | 38.65 | 38.89 | 41.21 | 38.55 | 40.67 | 33.82 | 29.54 | 18.43 |
| 11 January | 39.00 | 35.96 | 41.39 | 40.90 | 40.54 | 40.60 | 37.56 | 22.47 |
| 12 January | 37.95 | 34.86 | 41.34 | 38.57 | 40.84 | 40.12 | 25.08 | 19.68 |
| 13 January | 36.92 | 34.98 | 40.62 | 35.23 | 41.19 | 36.28 | 19.64 | 17.02 |
| 14 January | 37.33 | 38.92 | 40.63 | 34.51 | 40.13 | 29.72 | 24.35 | 18.96 |
| 15 January | 37.89 | 40.63 | 39.63 | 38.09 | 36.51 | 32.88 | 30.24 | 20.91 |
| 16 January | 38.44 | 40.51 | 41.35 | 40.17 | 34.50 | 36.71 | 32.61 | 20.63 |
| 17 January | 37.47 | 35.00 | 37.56 | 43.46 | 36.46 | 40.00 | 39.90 | 25.00 |
| 18 January | 34.78 | 32.30 | 33.80 | 34.61 | 36.87 | 41.89 | 31.45 | 18.79 |

Table 4. Days with an Australian area-averaged maximum temperature of $39^{\circ} \mathrm{C}$ or above (values in 2013 shown in bold).

| Date | Value $\left({ }^{\circ} \mathrm{C}\right)$ | Date | Value $\left({ }^{\circ} \mathrm{C}\right)$ | Date | Value $\left({ }^{\circ} \mathrm{C}\right)$ |
| :--- | :---: | :---: | :---: | :---: | :---: |
| $\mathbf{7 / 1 / 2 0 1 3}$ | $\mathbf{4 0 . 3 0}$ | $\mathbf{6 / 1 / 2 0 1 3}$ | $\mathbf{3 9 . 6 6}$ | $1 / 1 / 1990$ | 39.39 |
| $21 / 12 / 1972$ | 40.17 | $2 / 1 / 1973$ | 39.65 | $\mathbf{4 / 1 / 2 0 1 3}$ | $\mathbf{3 9 . 3 3}$ |
| $\mathbf{8 / 1 / 2 0 1 3}$ | $\mathbf{4 0 . 1 0}$ | $\mathbf{3 / 1 / 2 0 1 3}$ | $\mathbf{3 9 . 5 8}$ | $\mathbf{5 / 1 / 2 0 1 3}$ | $\mathbf{3 9 . 2 3}$ |
| $20 / 12 / 1972$ | 40.01 | $16 / 12 / 2002$ | 39.54 | $2 / 1 / 1990$ | 39.22 |
| $22 / 12 / 1972$ | 39.82 | $30 / 12 / 1972$ | 39.48 | $\mathbf{2 / 1 / 2 0 1 3}$ | $\mathbf{3 9 . 2 2}$ |
| $1 / 1 / 1973$ | 39.79 | $31 / 12 / 1972$ | 39.43 | $18 / 12 / 2002$ | 39.20 |
| $\mathbf{1 7 / 1 2 / 2 0 0 2}$ | 39.70 | $27 / 1 / 1936$ | 39.40 | $\mathbf{1 1 / 1 / 2 0 1 3}$ | $\mathbf{3 9 . 0 0}$ |

Table 5. Observed temperatures of $49^{\circ} \mathrm{C}$ or above in Australia since 1910. Values observed in the 2012-13 event are shown in bold.

| Temperature ( ${ }^{\circ} \mathrm{C}$ ) | Location | State | Date | Comments |
| :---: | :---: | :---: | :---: | :---: |
| 50.7 | Oodnadatta | SA | 2/1/1960 | Australian record |
| 50.5 | Mardie | WA | 19/2/1998 | WA record, Australian February record |
| 50.3 | Oodnadatta | SA | 3/1/1960 |  |
| 49.8 | Mundrabilla | WA | 3/1/1979 | WA January record (equal) |
| 49.8 | Forrest | WA | 13/1/1979 | WA January record (equal) |
| 49.8 | Emu Creek | WA | 21/2/1998 |  |
| 49.7 | Menindee | NSW | 10/1/1939 | NSW record |
| 49.6 | Moomba | SA | 12/1/2013 |  |
| 49.5 | Birdsville | QLD | 24/12/1972 | Queensland record, Australian December record |
| 49.4 | Marree | SA | 2/1/1960 |  |
| 49.4 | Whyalla | SA | 2/1/1960 |  |
| 49.4 | Madura | WA | 7/1/1971 |  |
| 49.4 | Emu Creek | WA | 16/2/1998 |  |
| 49.4 | Roebourne | WA | 21/12/2011 | WA December record |
| 49.3 | Kyancutta | SA | 9/1/1939 |  |
| 49.2 | Marble Bar | WA | 3/1/1922 |  |
| 49.2 | Oodnadatta | SA | 1/1/1960 |  |
| 49.2 | Mardie | WA | 9/2/1977 |  |
| 49.2 | Onslow | WA | 11/1/2008 |  |
| 49.2 | Onslow | WA | 1/1/2010 |  |
| 49.2 | Onslow Airport | WA | 22/12/2011 |  |
| 49.1 | Moomba | SA | 23/12/1972 | SA December record |
| 49.1 | Roebourne | WA | 18/2/1998 |  |
| 49.1 | Emu Creek | WA | 2/1/2010 |  |
| 49.0 | Marree | SA | 22/12/1972 |  |
| 49.0 | Birdsville | QLD | 6/12/1981 |  |
| 49.0 | Birdsville | QLD | 13/1/2013 | Queensland January record |
| 49.0 | Marla | SA | 12/1/1988 |  |
| 49.0 | Port Hedland | WA | 11/1/2008 |  |
| 49.0 | Roebourne | WA | 11/1/2008 |  |
| 49.0 | Emu Creek | WA | 10/1/2009 |  |
| 49.0 | Mardie | WA | 1/1/2010 |  |
| 49.0 | Roebourne Airport | WA | 21/12/2011 |  |
| 49.0 | Leonora | WA | 9/1/2013 |  |

Table 6. Selected records set or equalled for long runs of consecutive days with maximum temperatures at or above specified thresholds. An asterisk (*) indicates that the run is ongoing as of 31 January.

| Station number | Location | State | Threshold ( ${ }^{\circ} \mathrm{C}$ ) | Number of days | Dates | Previous record |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 10917/10648 | Wandering | WA | 35 | 8 | $\begin{gathered} \text { 25/12/2012- } \\ \text { 1/1/2013 } \end{gathered}$ | $\begin{gathered} 8(17- \\ 24 / 1 / 1961 \\ 30 / 12 / 1964- \\ 6 / 1 / 1965) \\ \hline \end{gathered}$ |
| 12038 | KalgoorlieBoulder | WA | 45 | 2 | 8-9/1/2013 | 1 (numerous occasions) |
| 13017 | Giles | WA | 40 | 17 | 1-17/1/2013 | $\begin{gathered} 17(5- \\ 21 / 2 / 2007,14- \\ 30 / 1 / 2011) \\ \hline \end{gathered}$ |
| 15590 | Alice Springs | NT | 40 | 17 | 1-17/1/2013 | $\begin{gathered} 12(4- \\ 15 / 1 / 1971,1-1 \\ 12 / 1 / 2006) \end{gathered}$ |
| 17043 | Oodnadatta | SA | $\begin{aligned} & 45 \\ & 35 \end{aligned}$ | $\begin{gathered} 7 \\ 46 \end{gathered}$ | $\begin{gathered} \hline 2-8 / 1 / 2013 \\ 11 / 12 / 2012- \\ 25 / 1 / 2013 \\ \hline \end{gathered}$ | $\begin{gathered} 5 \text { (3 previous } \\ \text { occasions) } \\ 38 \text { (3/1- } \\ 9 / 2 / 2009) \\ \hline \end{gathered}$ |
| 38026/38002 | Birdsville | QLD | $\begin{aligned} & 45 \\ & 40 \end{aligned}$ | $\begin{gathered} 6 \\ 31 \end{gathered}$ | $\begin{gathered} \hline 2-7 / 1 / 2013 \\ 27 / 12 / 2012- \\ 26 / 1 / 2013 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 6(1-6 / 1 / 2004) \\ 24(2- \\ 25 / 1 / 2006) \\ \hline \end{gathered}$ |
| $\begin{aligned} & 48245 / 48239 / \\ & 48013 \end{aligned}$ | Bourke | NSW | 35 | 50* | $\begin{gathered} \hline 13 / 12 / 2012- \\ 31 / 1 / 2013 \end{gathered}$ | $\begin{gathered} \hline 41 \\ (16 / 12 / 1938- \\ 25 / 1 / 1939) \\ \hline \end{gathered}$ |

Table 7. Stations which had their highest mean January maximum temperature on record in January 2013. Details as for Table 1.

| Station number | Location | State | Temperature ( ${ }^{\circ} \mathrm{C}$ ) | Previous Record | Years of record |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 14626 | Daly Waters | NT | 39.7 | 38.8 (Jan 1947) | 44 |
| 15528 | Yuendumu | NT | 40.7 | 40.6 (Jan 2008) | 44 |
| 15666/15548 | Rabbit Flat | NT | 42.0 | 41.9 (Jan 1996) | 44 |
| 17123/17096 | Moomba | SA | 41.9 | 41.4 (Jan 2006) | 41 |
| 38003* | Boulia | QLD | 42.5 | 42.2 (Jan 1947) | 104 |
| 38026/38002* | Birdsville | QLD | 43.3 | 42.9 (Jan 2006) | 59 |
| 44026 | Cunnamulla | QLD | 40.1 | 40.0 (Jan 1932) | 104 |
| 45015 | Quiplie | QLD | 41.2 | 40.6 (Jan 1947) | 72 |
| 45025/45017* | Thargomindah | QLD | 41.6 | 41.3 (Jan 2011) | 76 |
| 50031 | Peak Hill | NSW | 37.1 | 37.0 (Jan 1981) | 46 |
| 51039 | Nyngan | NSW | 39.2 | 38.9 (Jan 1932) | 91 |
| 54003 | Barraba | NSW | 35.4 | $\begin{aligned} & 34.7 \text { (Jan 2007) } \\ & 35.0 \text { (Dec 1979) } \end{aligned}$ | 47 |
| 63303/63231 | Orange Airport | NSW | 30.5 | $\begin{aligned} & 29.7 \text { (Jan 1981) } \\ & 29.9 \text { (Feb 1991) } \\ & \hline \end{aligned}$ | 44 |
| 70351/70014 | Canberra | ACT | 32.3 | $\begin{aligned} & 31.8 \text { (Jan 2010) } \\ & 32.0 \text { (Feb 1968) } \end{aligned}$ | 74 |

## Notes and contacts

Values in this statement are current as of 1 February 2013, and subject to the Bureau's normal quality control processes.

The data set from which area averages and other spatial analyses are drawn commences in 1911. Station data prior to national introduction of standardised instrument shelters in 1910 are used only if they are known to have been measured using standard equipment comparable with current standards.

The following climatologists may be contact for further information about this event:
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[^0]:    ${ }^{1}$ Using the standard lapse rate for dry air of $1^{\circ} \mathrm{C}$ per 100 metres, the temperature at Wiluna (elevation 521 metres) equates to $53.2^{\circ} \mathrm{C}$ at sea level. This equals the value at Yuendumu, NT $\left(46.5^{\circ} \mathrm{C}\right.$, elevation 667 metres) set on 15 January 1980.

[^1]:    ${ }^{2}$ The spatial resolution of the analysis used in Figure 4 is not sufficient to identify the records set along the NSW coastal strip on 18 January.
    ${ }^{3}$ By way of comparison, in the 1972-73 event Alice Springs had a run of 17 consecutive days of $39.5^{\circ} \mathrm{C}$ or above, but it failed to reach $40^{\circ} \mathrm{C}$ on three of those days.

[^2]:    ${ }^{4}$ Pre-1957 data are not used in this comparison as the available network of digitised daily data prior to 1957 is much sparser, and thus it is likely that a number of days prior to 1957 which would meet these criteria had the present network been in place would have been missed.
    ${ }^{5}$ For example, January 1939 was hotter than January 2013 in most of northern Victoria and inland New South Wales, but was cooler than normal in much of northern and western Australia, with record lows along parts of the Western Australia coast.

