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Special Climate Statement 54 – extreme rainfall in northern and eastern Tasmania

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Extreme rainfall in northern and eastern Tasmania

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[Cover picture: Flood waters over the Tasman Highway south of Cranbrook, on the afternoon of 29 January 2016. \(Photo: Kelvin Jones, Manager, Glamorgan-Spring Bay State Emergency Service Unit\).](#)

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1 Introduction and background

A large and slow-moving cutoff low pressure system affected southeastern Australia during the last week of January 2016. The surface low, which was accompanied by an intense upper-level low, formed west of Tasmania on the 27th, moving northeast over the southeastern mainland by the 29th before becoming nearly stationary for the rest of the month. A number of smaller secondary lows also formed in the broader system, one moving north across the Adelaide region on the 29th and a second moving west across central Victoria overnight from the 30th to the 31st. The primary low gradually weakened and moved eastwards off the Victorian coast on 1 February.

The most significant rainfalls from the event were in Tasmania. The centre of the low was to the north or west of Tasmania throughout the event, placing the State in a very moist east to northeasterly airstream. This produced rain across most of the State, with the heaviest totals on the east coast and in the central north. Thunderstorms were widespread in these regions and contributed to some of the heaviest falls. More modest falls occurred on the west coast and in the southern third of the State.

On the mainland, the widespread unstable conditions resulted in numerous outbreaks of severe thunderstorms across Victoria, New South Wales, the ACT, and southern Queensland, with large hail and flash flooding reported in numerous locations over the period. A number of suspected tornadoes also occurred in New South Wales and Victoria. Rainfall was substantial over much of eastern mainland Australia, with weekly totals for 25–31 January in the range of 25 to 100 millimetres over most of the eastern halves of Queensland, New South Wales and Victoria, although few significant records were set on the mainland.

It was exceptionally dry across most of Tasmania in the months leading up to the event, with significant impacts on agriculture and water storages. A large number of bushfires were started in the western half of the State in the middle of January and, whilst some of these fires received significant rain from this system, many of them did not.

Unlike previous major rain events in northern and eastern Tasmania (see section 2.6), this event took place with a strong El Niño in place. However, the influence of El Niño on Tasmanian rainfall is concentrated in the second half of the year with little signal in the January to March period. Local sea surface temperatures around Tasmania in the lead-up to the event were exceptionally high, with waters off the eastern and southern coasts more than 2 °C warmer than normal during the last week of January (Figure 1), the warmest on record for this time of year. These very high temperatures would be expected to locally increase rainfall through increased availability of moisture.

The principal purpose of this Statement is to document the rainfall aspects of the event. Severe weather aspects of the event are expected to be documented separately.

2 Rainfall during the event

2.1 Evolution of the rain event in Tasmania

Rain initially developed in eastern Tasmania on the 27th. In the initial stage of the event, the rain was largely confined to areas near the east coast, with most other parts of the State remaining dry. The heaviest falls were on the northern East Coast and into the Northeast Highlands, with totals exceeding 25 millimetres in the region from Bicheno to Larapuna (Eddystone Point), with the highest total for the 24 hours to 9 am on the 28th being 126.0 millimetres at Gray¹.

Significant rainfall extended to cover most of the State, except for King Island and parts of the far northwest, the next day, with extensive thunderstorm activity and broader areas of rain. Daily totals for the 24 hours ending at 9 am on the 29th exceeded 25 millimetres over about three-quarters of the State. The largest area of heavy rain was in the central north. Daily totals were 50 millimetres or more over an area extending south from Devonport and Launceston over much of the Central Plateau, with 100 millimetres being exceeded in a number of locations, particularly on the northern foothills of the Great Western Tiers. Heavy rain also continued near the East Coast, with totals of 50 to 100 millimetres between Orford and St Helens, and locally much higher totals. In the east, Gray again topped the State with 221.0 millimetres, alongside 168.0 millimetres at Sandspit River (Ringrove), 161.4 millimetres at St Marys and 138.2 millimetres at Friendly Beaches, while the highest total in the central north was 148.6 millimetres at Quamby Bluff.

The central north and the east were again the focus of the heaviest rain for the 24 hours to 9 am on the 30th. On the East Coast, the heaviest rain shifted further south, with especially intense falls in the Orford/Triabunna region during the morning and early afternoon of the 29th. Grindstone Point, northeast of Triabunna, registered 210.8 millimetres, nearly all of it in the four hours between 9 am and 1 pm, including 106 millimetres in the two hours from 9 am to 11 am, and 193 millimetres in the five hours between 9 am and 2 pm, both well in excess of values with an expected annual exceedance probability of 1% (Figure 3). Other notable totals in this region included 190.0 millimetres at Little Swanport (Lisdillon Farm) and 161.0 millimetres at Orford South. Further north, the heaviest rain was a little further inland than on the two previous days, with totals locally in excess of 100 millimetres in the Fingal area. In the central north, heavy rain extended somewhat further west than it had the previous day; many locations had a second successive day with more than 50 millimetres, and a broad area inland from the north coast exceeded 100 millimetres. Notable heavy falls in

¹ References to Gray in this statement are to the Dalmayne Road site. There is a second site at Gray (Haven of Hope), which received rainfalls similar to, but slightly lower than, Dalmayne Road throughout the event.

this region included 122.2 millimetres at Frankford and 117.0 millimetres at Sheffield. Widespread thunderstorm activity contributed to many of the heaviest rainfall totals on both the 29th and 30th.

The 30th was the last day of heavy rain over most of “mainland” Tasmania, with rain clearing the next day to the northeast and the Bass Strait islands (as well as far southern Victoria, where Wilsons Promontory received 121 millimetres). For the 24 hours to 9 am on the 31st, Gray, with 88.6 millimetres, was the only site on the main island of Tasmania to exceed 50 millimetres, but Killiecrankie, on Flinders Island, received 110.0 millimetres, and totals in the 50 to 70 millimetre range were recorded at a number of other sites on King and Flinders Islands and smaller Bass Strait islands. This was effectively the last day of the event in Tasmania, with only a few sites exceeding 10 millimetres in the 24 hours to 9am on 1 February.

2.2 Total rainfalls for the event

Total rainfall for the week from 25 to 31 January, nearly all of which fell in the four days from 9 am on the 27th to 9 am on the 31st, exceeded 100 millimetres over most of the east coast and central north of Tasmania (Figure 2). The heaviest weekly total was at Gray, where 500.4 millimetres fell, 489.4 of which was in the final four days of the month.

While Gray’s total was a standout and no other sites had weekly totals above 300 millimetres, there were numerous locations with event totals in the 200 to 300 millimetre range, both on the east coast (294.2 millimetres at Grindstone Point, 269.4 at Little Swanport, 230.2 at Swansea, 217.9 at Orford, 211.4 at Point Lesueur on Maria Island) and in the central north (216.6 millimetres at Quamby Bluff, 216.2 at Frankford, 214.2 at Glengarry). Totals for the event exceeded 150 millimetres over most areas within 30 kilometres of the east coast between St Helens and Orford, as well as over a broad area of the central north with a northeastern boundary near Devonport, Launceston and Low Head, and extending southwest to Cradle Mountain.

Event totals were 25 to 50 millimetres along the west coast north of Strahan, the northwest coast west of Wynyard, the Derwent Valley, and the far south, with only very small areas around Zeehan, Cape Bruny and Dover having lighter falls. Most remaining areas of the State received 50 to 100 millimetres.

At some locations rainfall during the event was sufficient for January 2016 to be the wettest January on record, even allowing for the very dry conditions until the final week of the month. For example, the monthly total of 153.4 millimetres at Launceston (Ti Tree Bend), 140.0 of which fell in two days, surpassed the previous January record of 139.4 millimetres (set in 1996) for any Launceston city site.

2.3 Record rainfalls occurring during the event

A number of locations had their highest daily January rainfall on record during the event (Table 1). The majority of records were set in the central north of Tasmania; whilst absolute totals were higher on the east coast, historically that is the region most susceptible to high daily totals in Tasmania, and hence most totals there were less historically significant than those which occurred further west.

Most records were set on the 29th or 30th, although on King Island they also occurred on the 31st. The 30th saw the greatest number of records, including daily records for any month at Frankford and Latrobe in the north, and Orford in the east. Significant areas of record daily rainfall for January were analysed on both the 29th and 30th in the central north. Of the 20 long-term stations in the central north² which have reported for the event at the time of writing, 12 have set January daily records, two of which are records for any month. Two-day totals for 29–30 January were also significant, but fell short at most locations of those observed during one or more of the April 1929, April 1974 or January 2004 events (see section 2.5).

The daily total of 85.8 millimetres at Launceston (Ti Tree Bend) for the 24 hours to 9 am on the 29th is a record for any month at the current site, which has been making observations since 1980; rainfall in excess of the 1% annual exceedance probability was recorded at a wide range of durations from two hours to three days (Figure 3). Combining data from all Launceston city sites, it is the city's second-wettest day (and wettest January day) on record, while the two-day total of 140.0 millimetres is the highest on record (Table 2)³. At Low Head, 91.8 millimetres on the 30th ranks in the combined record⁴ as fourth-highest for any month and second-highest for January, while at Devonport, 86.4 millimetres on the same day ranks sixth and second respectively. (In both cases, the January record was set in the 2004 event).

² For the purposes of this section, this refers to all parts of the Bureau rainfall district 91 except for the northwest coast from Burnie westwards. Long-term stations are defined here as those which have 60 or more years of observations under a single station number.

³ Values of 52.0 and 104.0 millimetres at Launceston (Mount Pleasant) on 27 and 28 April 1974 respectively are considered to be suspect after comparison with other sites in the Launceston region. It is believed that these may be imperial measurements which had not been correctly converted (metric measurements were introduced for rainfall in Australia in January 1974).

⁴ For the purposes of this section, the 'combined record' for Launceston city refers to Bureau site numbers 91237 (Ti Tree Bend, 1980 to present), 91123 (Mount Pleasant, 1962 to 1980) and 91049 (1884 to 1961, at a number of city sites). At Low Head, it refers to sites 91293 (1998 to present) and 91057 (1895 to 2001), in close proximity at the lighthouse. At Devonport, it refers to 91126 (Devonport Airport, 1962 to present), 91232 (Devonport East, 1975 to 1991), 91111 (Devonport, 1954 to 1975) and 91025 (Devonport Harbour, 1903 to 1977).

A small number of daily rainfall records were also set outside Tasmania (Table 1), as a result of thunderstorm activity or secondary low pressure systems.

2.4 The rain event in the context of major rainfall deficiencies in Tasmania

Much of Tasmania had been experiencing rainfall deficiencies in the lead-up to this rain event. Most northern and eastern parts of the State have had severe rainfall deficiencies (in the lowest 5% of records) for the 8 months from May to December 2015, and for the 18 months from July 2014 to December 2015 (Figure 4). The period from September 2015 was especially dry; rainfall from September to December 2015 was the lowest on record for most areas of the State, except for the east and southeast coast, with rainfall more than 60 per cent below normal along most of the north coast and on Flinders Island, and 40 to 60 per cent below normal in most remaining areas. The four-month September to December period was easily the driest on record, with the statewide mean of 223.5 millimetres far below the previous record of 277.1 millimetres (set in 1914), and 53 per cent below the 1961 to 1990 average. The 18-month period from July 2014 to December 2015 was also the State's driest on record. The dry conditions continued in the weeks leading up to the rain event, with totals for 1 to 26 January being only 10 to 25 millimetres over most of the State, and less than 10 millimetres in north and northwest coastal areas and in the Derwent Valley.

The rain event had a major impact on short-term rainfall deficiencies in northern and eastern Tasmania (Figure 5), largely eliminating them for the period from May 2015 to the present on the east coast, and in northern areas east of Burnie. However, substantial deficiencies remain at this timescale on the West Coast and Highlands and in the far northwest. At longer timescales, rainfall deficiencies remain over most northern areas for the 19 months starting in July 2014. Rainfall on the western coast and highlands from this event was not sufficient to have much impact on deficiencies at any timescale.

The strong contrast between the heavy rain in late January, and the dry conditions which preceded it, is illustrated by the fact that Swansea received more rain in the last four days of January than it had between 1 June and 27 January; Orford received more in this event than it had had since 1 July, and Launceston and Low Head more than they had had since 1 August.⁵ Some locations which had been on track to have their driest January on record as of the 27th went on to have record- or near-record high January monthly rainfall.

⁵ At Flinders Island Airport, where there was significant rain in early August, there was more rain from 28 to 31 January than there had been from 6 August to 27 January.

2.5 Flooding from the event

The heavy rainfall during the event resulted in widespread flash flooding on much of the East Coast and adjacent ranges, as well as in parts of the central north, particularly in the Launceston area. Flooding of properties was reported in a number of locations, including Orford and St Marys.

The most significant main river flooding occurred in the South Esk and its tributaries. Moderate flood levels were reached in the South Esk at Fingal and Llewellyn, and in the St Pauls River at Lewis Hill, although river levels stayed below the minor flood level in lower sections of the river at Longford and downstream. There was also flooding in some shorter rivers draining to the east coast, including a record height in the Meredith River at Swansea. However, the dry antecedent conditions limited flooding in other catchments, with little significant flooding in the Meander catchment or areas westward from there.

2.6 Comparison with previous events

The most significant widespread rainfall events historically in northern and eastern Tasmania have been those of April 1929, April 1974⁶, January 2004 and January 2011. Rainfall maps from the 1929, 1974 and 2004 events, as well as the 2016 event, are shown in Figure 6⁷. Extreme rainfall events on the east coast are relatively more common but are often quite localised.

The April 1929 event remains the benchmark heavy rain and flood event for northern Tasmania. Totals in that event were significantly higher than those in any other event in most of northern Tasmania, except for the Tamar Valley and the northern Midlands, and the resultant flooding also set records at many northern Tasmanian locations, including Launceston.

The April 1974 event was comparable with the 2016 event on parts of the east coast, and in the inland northwest. Gray had 511.4 millimetres over the five days from 26 to 30 April 1974, its record five-day total and marginally higher than the 495.2 millimetre five-day total in the 2016 event (albeit at a different site). However, totals in the 1974 event in the central north were much lower than those in any of the other three events, and the event did not extend as far south on the east coast as the 2016 event. The

⁶ This is a separate event to the 22 March 1974 event, which produced a Tasmanian State daily record total of 352 millimetres at Cullenswood (near St Marys), but was relatively localised.

⁷ These maps use a grid with a resolution of 5 kilometres, so do not capture the most intense localised rainfalls, especially around St Marys where rainfall varies greatly over short distances.

January 2011 event had a similar geographic footprint and intensity to the April 1974 event.

The January 2004 event bears many similarities to the January 2016 event, with a very similar geographic footprint (although the heaviest rains extended further south along the east coast in 2016 than they did in 2004). Rainfall totals in the two events were generally very similar through most of the northern third of Tasmania. In an interesting coincidence, the lead-up to the 2004 event was also very dry; statewide rainfall for October to December 2003 ranks second-lowest on record, after 2015.

Of the events considered in this section, the 2016 event is the only one to have occurred during an El Niño event. The 1929, 1974 and 2011 events took place during La Niña events (strong ones in the case of 1974 and 2011), while the 2004 event took place under neutral conditions.

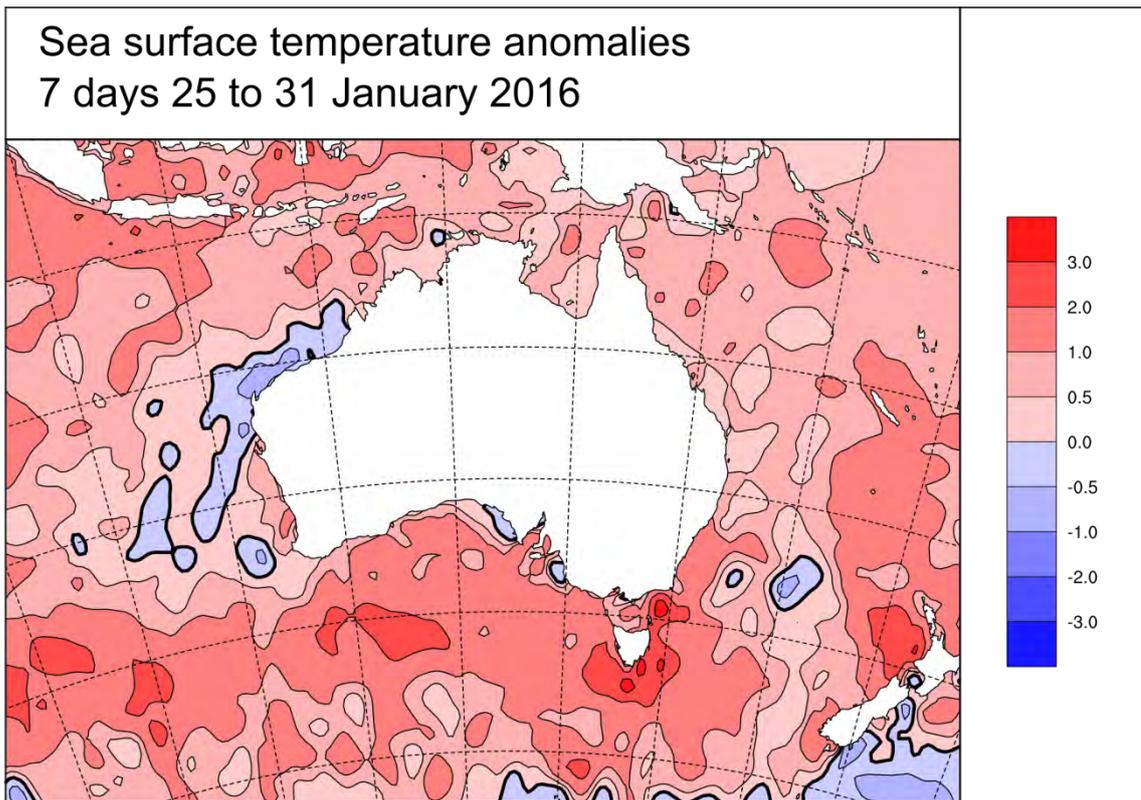


Figure 1. Sea surface temperature anomalies for the week of the event, relative to a 1961 to 1990 baseline. Note the area of positive anomalies (SST warmer than usual) exceeding +2 °C around Tasmania, with patches exceeding +3 °C.

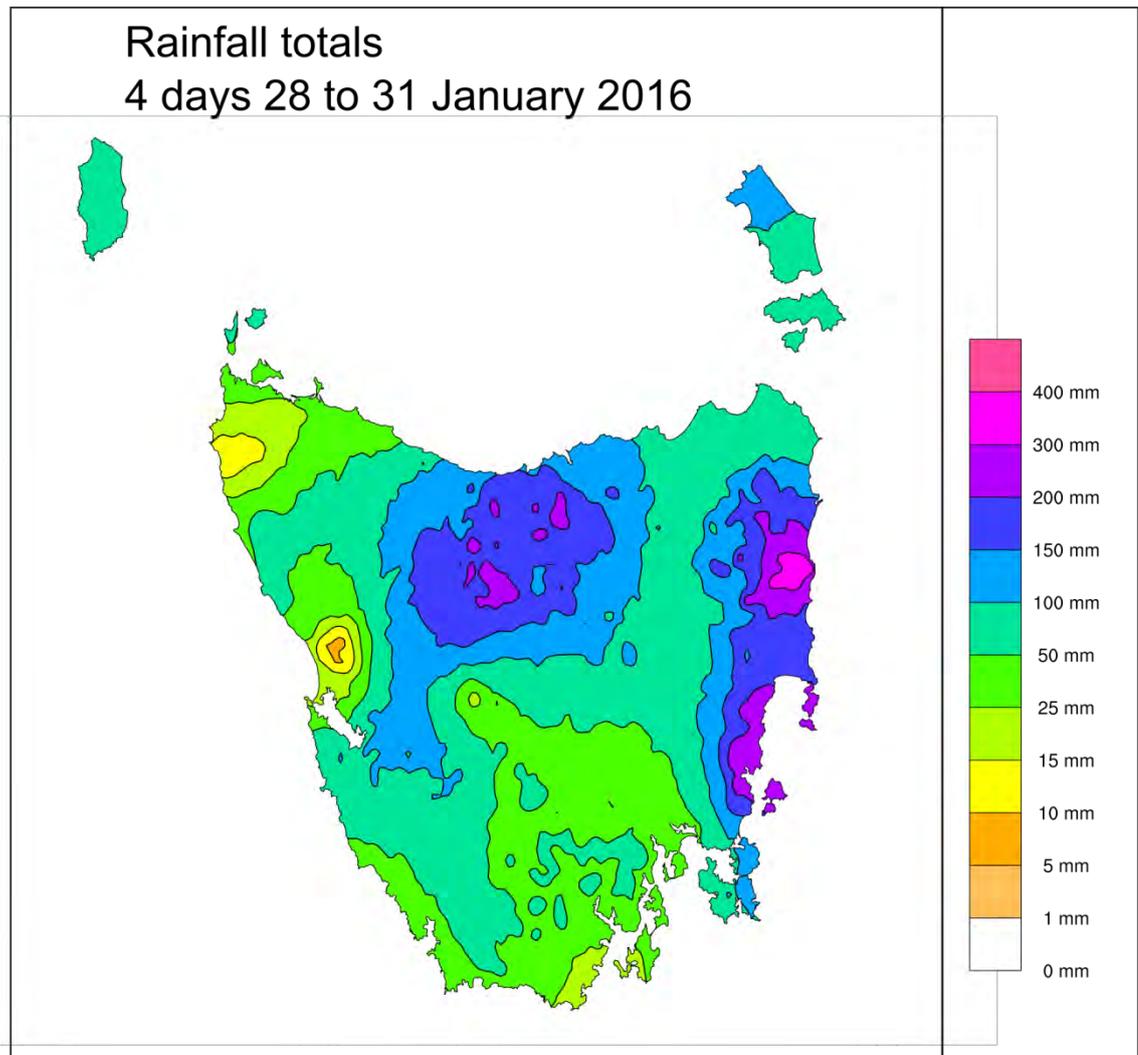


Figure 2. Total rainfall for the event, from 9 am on 27 January to 9 am on 31 January 2016. These rainfalls are recorded against the four days from the 28th to the 31st.

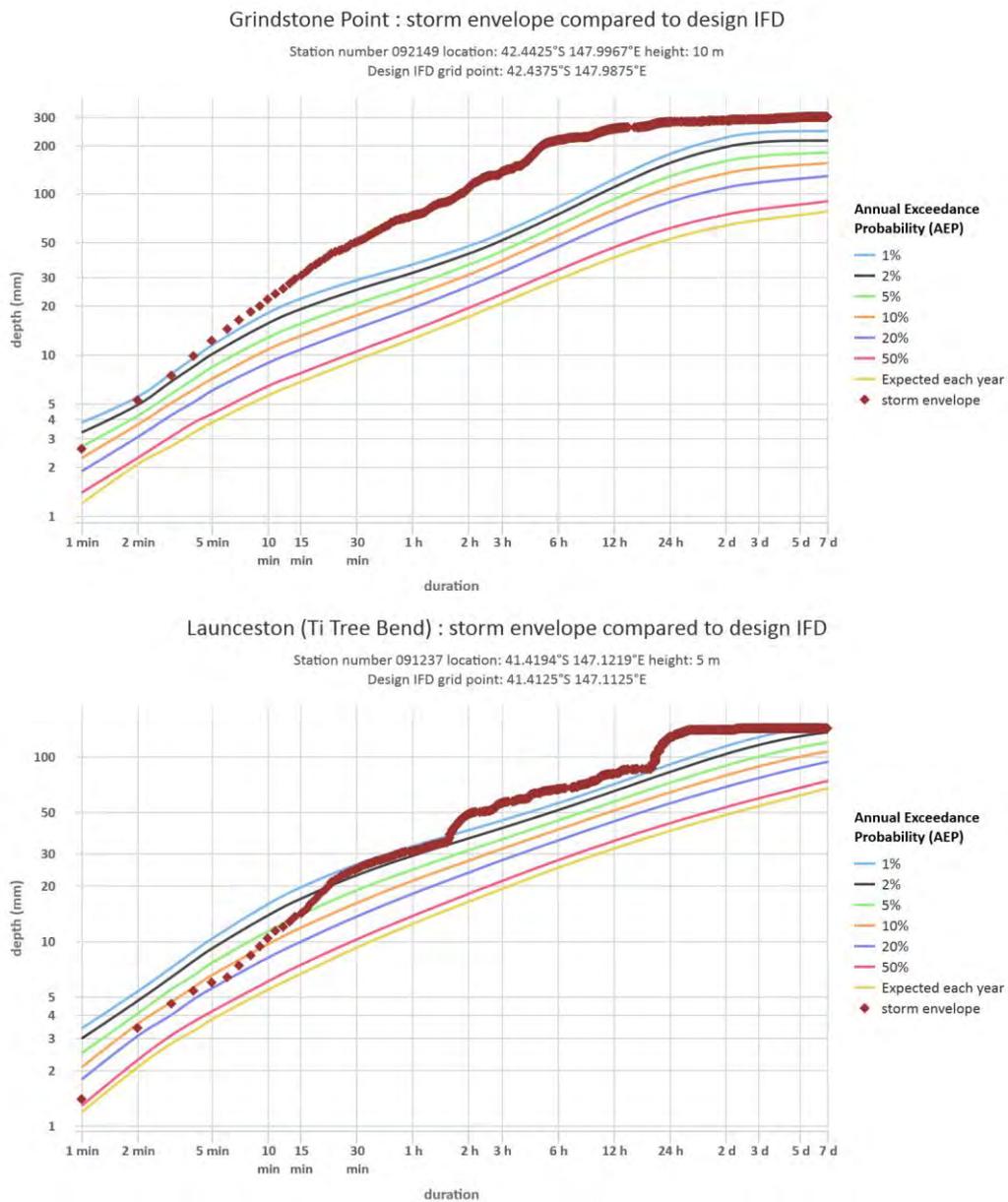


Figure 3. Storm envelope at Grindstone Point (top) and Launceston (bottom), compared to the design IFD curves. Storm envelope is the greatest amount of rainfall recorded over various durations through the event. At Grindstone Point, the observed rainfall at durations from five minutes to seven days had a less than 1% probability of exceedance in any given year; at Launceston this was for periods from two hours to five days

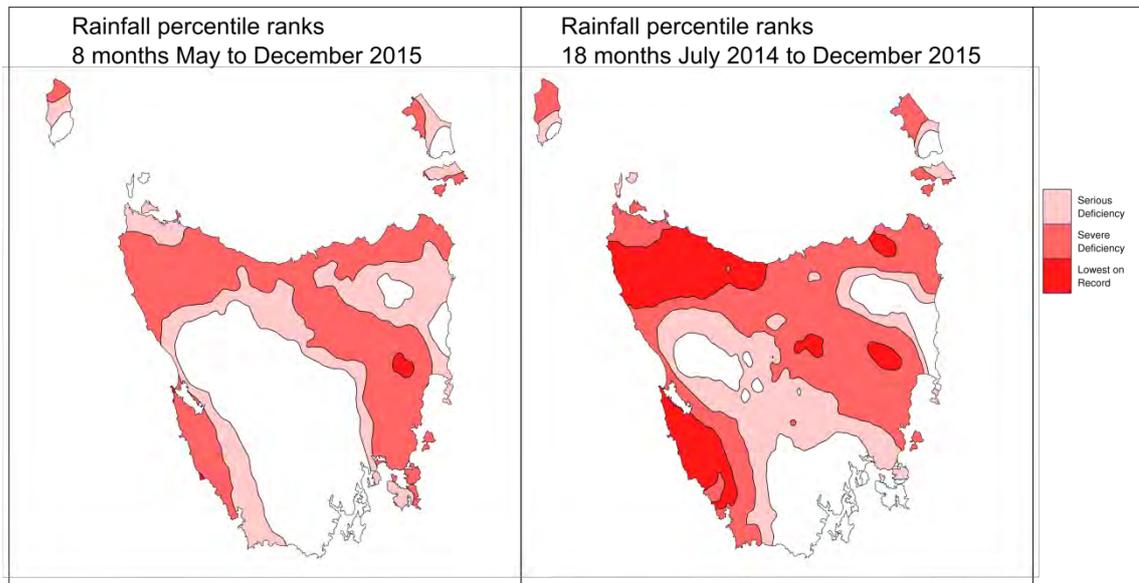


Figure 4. Areas of rainfall deficiencies for Tasmania leading up to the rainfall event: for the eight months May to December 2015 (left) and for the 18 months July 2014 to December 2015 (right).

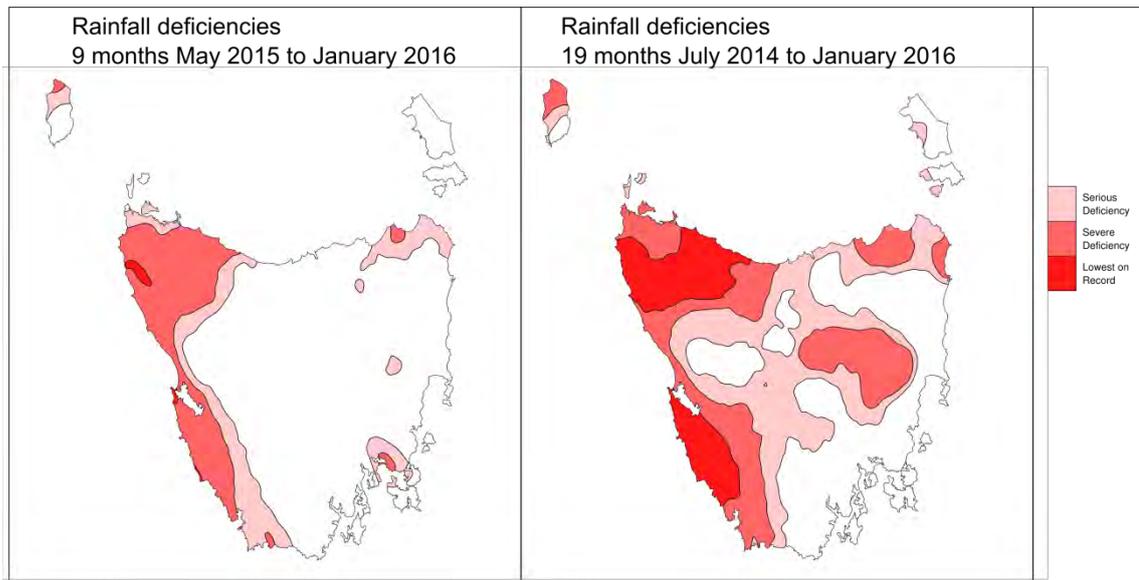


Figure 5. Rainfall deficiencies after the event, for the nine months May 2015 to January 2016 (left) and the 19 months July 2014 to January 2016 (right). In the east the event ameliorated but did not completely remove deficiencies, but in the west deficiencies remain much the same.

Extreme rainfall in northern and eastern Tasmania

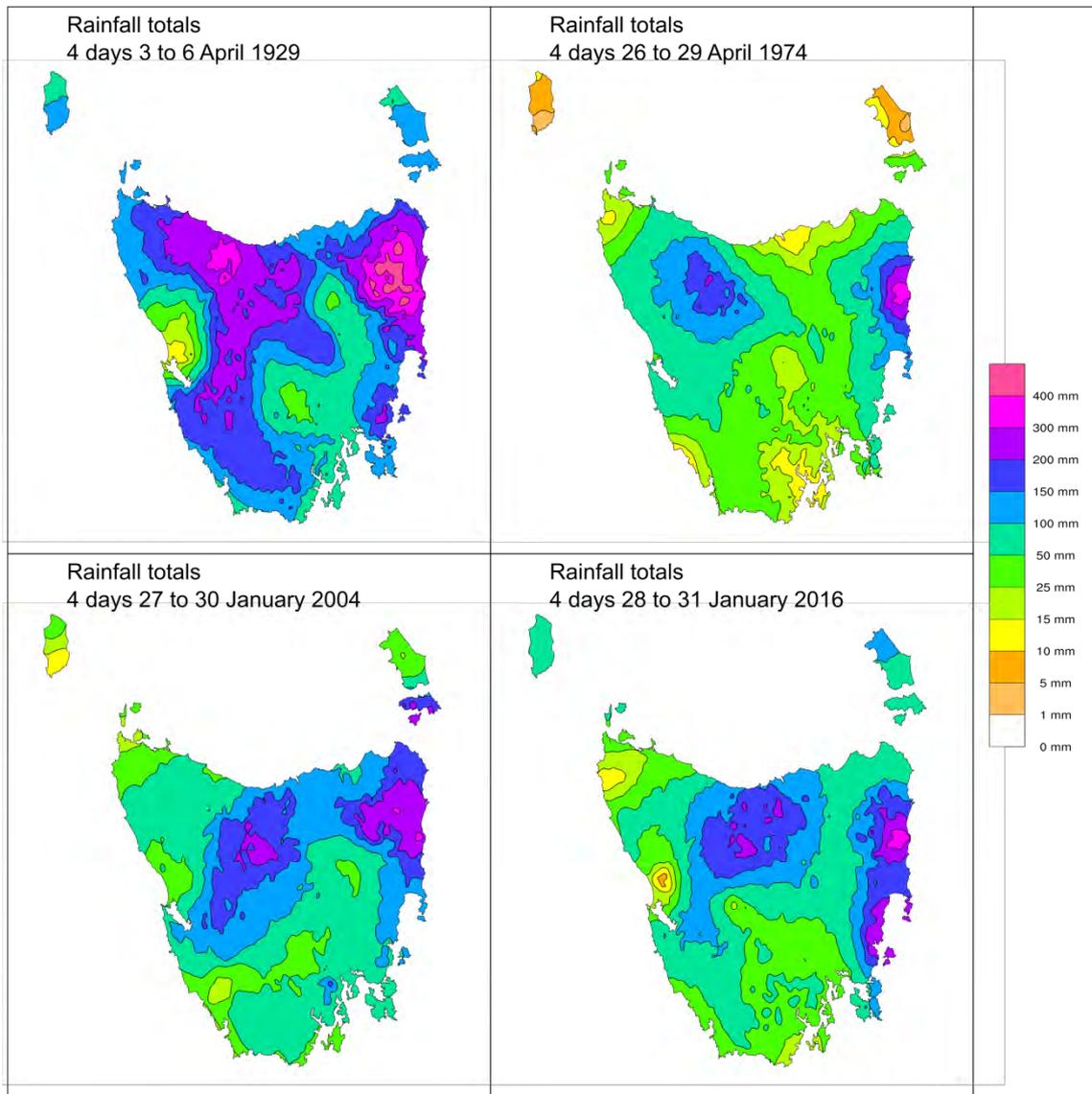


Figure 6. Four-day rainfall totals for Tasmania for (top left) 3 to 6 April 1929, (top right) 26 to 29 April 1974, (bottom left) 27 to 30 January 2004 and (bottom right) 28 to 31 January 2016.

Table 1. January record daily rainfalls set between 28 and 31 January 2016 at selected locations with 60 or more years of data. Values which are records for any month are shown in bold.

Station number(s)	Location	State	Rainfall (mm)	Previous record
023734	Mount Bold	SA	39.0 (30 th)	34.2 (15/1/1977)
043020	Mitchell	QLD	157.6 (28 th)	138.4 (30/1/1918, 24/1/1954)
085096	Wilson's Promontory	VIC	121.0 (31 st)	80.0 (31/1/1916)
091019	Connorville	TAS	61.2 (29 th)	47.8 (15/1/2011)
091022	Cressy	TAS	79.0 (29 th)	49.0 (29/1/1995)
091032	Epping Forest	TAS	72.2 (29 th)	44.2 (29/1/1995)
091033	Frankford (Rossville)	TAS	122.2 (30th)	104.8 (28/1/2004) (Jan) 109.0 (2/4/1989) (all)
091039	Northdown (Hamley)	TAS	98.8 (30 th)	84.4 (28/1/2004)
091041	Hillwood	TAS	103.4 (29 th)	51.3 (20/1/1946)
091048	Latrobe	TAS	104.4 (30 th)	88.8 (28/1/2004)
091054	Longford	TAS	82.0 (29th)	65.0 (28/1/2004) (Jan) 77.2 (26/5/2012) (all)
091055	Lorinna	TAS	105.2 (30 th)	105.0 (28/1/2004)
091072	Kings Meadows	TAS	71.6 (29 th)	55.2 (25/1/1996)
091090	Selbourne	TAS	112.0 (29 th)	53.8 (29/1/1995)
091095	Windermere	TAS	80.6 (29 th)	65.2 (29/1/1991)
091236/091103	Westbury	TAS	96.0 (30 th)	71.1 (21/1/1928)
091237/091123/ 091049	Launceston (city)	TAS	85.8 (29 th)	54.0 (29/1/2004)
091291/091091	Sheffield	TAS	117.0 (30 th)	90.4 (28/1/2004)
092002	Avoca	TAS	72.0 (30 th)	61.0 (5/1/1944)
092010	Maria Island (Darlington)	TAS	147.0 (30 th)	85.0 (25/1/1996)
092012	Fingal	TAS	113.8 (30 th)	111.0 (29/1/1995)
092020	Lewis Hill (St Pauls River)	TAS	130.0 (30 th)	77.6 (5/1/2000)
092027	Orford	TAS	140.5 (30th)	98.8 (29/1/1995) (Jan) 118.6 (7/6/1954) (all)
092028	Orford South	TAS	161.0 (30th)	97.0 (25/1/1996) (Jan) 144.8 (16/3/1938) (all)
092029	Ormley	TAS	81.8 (30 th)	69.4 (29/1/2004)
093008	Campbell Town (Greenhill)	TAS	61.0 (29 th)	51.8 (13/1/1962)
096046	Miena Dam	TAS	74.6 (29 th)	48.4 (28/1/2004)
098004	Naracoopa	TAS	48.4 (31 st)	46.7 (25/1/1952)
099019	Killiecrankie	TAS	110.0 (31st)	68.4 (26/1/2000) (Jan) 72.8 (16/5/1974) (all)

Table 2. Highest 1- and 2-day rainfalls at Launceston city (see section 2.3 for details of sites used).

1-day		2-day	
<i>Rainfall (mm)</i>	<i>Date</i>	<i>Rainfall (mm)</i>	<i>Date</i>
93.7	17 May 1897	140.0	28–29 January 2016
85.8	29 January 2016	117.8	16–17 May 1897
84.3	19 February 1946	102.4	8–9 March 1911
70.4	8 March 1911	91.9	17–18 February 1939
67.6	21 July 2000	88.0	28–29 January 2004
65.4	31 August 2005	87.6	20–21 January 2000
63.5	17 February 1939	87.1	19–20 February 1946
58.2	11 August 1984	85.6	23–24 February 1969
57.9	19 April 1909	84.8	30–31 August 2005
56.8	23 April 1980	77.9	12–13 February 1964

References and further information

Values in this statement are current as of 25 February 2016, and are subject to the Bureau's quality control processes. It is expected that additional data will be received over the coming weeks and the statement will be updated if required.

A paper on the 2004 event was published in the Australian Meteorological and Oceanographic Journal in 2009 and is available at http://www.bom.gov.au/amoj/docs/2009/foxhughes_hres.pdf.

A Special Climate Statement was also prepared for the January 2011 event, and is available at <http://www.bom.gov.au/climate/current/statements/scs25.pdf>.

Further information is available from <http://www.bom.gov.au/climate>.