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Surface inversions & ground spray operations

At the October 2011 meeting, Dr Warwick Grace presented a talk about the significance of surface inversions to ground spraying operations and his research work with Graeme Tepper for the GRDC (Grains Research & Development Corporation).

For growers spraying pesticides, herbicides and fungicides from tractors there are several weather-related factors that need to be considered. These are shown in the following slide:

- **Not too windy, but some wind [3-15 kph]**
- **Not too humid, not too dry [Delta T 2 - 8°]**
- **Not too hot, not too cold [10 – 28°C]**
- **Not too unstable, not too stable [neutral]**
- **No inversion (low-level)**
- **No Local quirks**

Figure 1 Meteorological factors involved in spray operations.

This talk concentrated on the problems due to the presence of inversion, and briefly mentioned the research that Warwick Grace and Graeme Tepper are undertaking to assist growers in recognising and expecting inversions.

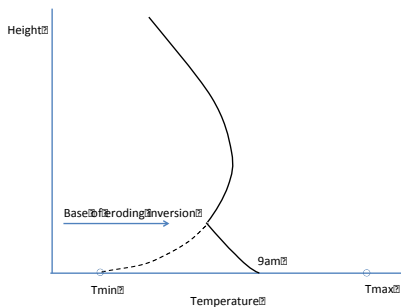
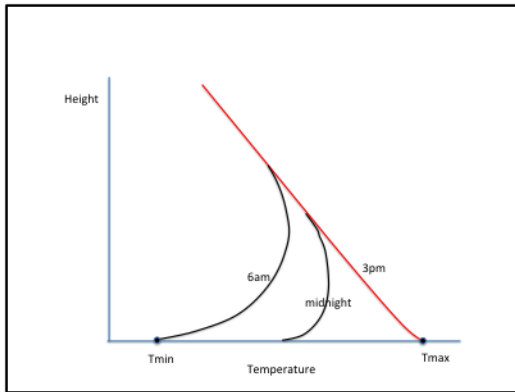


Figure 2 Schematic of temperature profile evolution. (a) Mid-afternoon profile with overnight cooling and stabilisation. (b) Initial shallow warming after sunrise. (c) Continued warming and eroding of overnight inversion. (d) Return to mid-afternoon conditions with near adiabatic profile.

The formation overnight of a surface inversion is easy to understand and is depicted in the left panel of Figure 2. However the dissipation of the inversion next morning is NOT a mirror image. What happens is that the air close to the surface is heated and begins to ‘bubble up’ - and erodes the inversion from the ground up as shown in the second panel at Figure 2. This means that spraying could unknowingly be done under a low inversion – this can have serious consequences entirely unexpected by the sprayer.

Under a surface inversion:

- The air is very stable (resists relative vertical motion) and tends to form in multiple horizontal layers or ‘laminates’;
- Air movement is much less turbulent so the air does not mix as it usually does during the daytime;
- Airborne droplets can remain concentrated in the inversion layer for long periods of time;
- The direction and distance of these pesticide droplets move is hard to predict;
- Their movement depends very much on the local topography and local drainage winds or ponding.

When the sun rises and begins to heat the ground, the inversion is eroded from its base such that it appears to lift. The wind in the inversion proper may be very different to the wind just above the inversion, and to any layer just below the inversion. Several photos of conditions showing laminates of mist and/or smoke were presented. Some were used to highlight the existence of these different wind regimes (see Figure 3 for example).



Figure 3 The wind at 32m is obviously different to that lower down. The lower smoke lifts only to about 10m before it is suppressed. Note that it can travel a long distance in concentrated form.

Figure 4 attempts to show the evolution of the surface inversion erosion and how the spray droplets may be held aloft in concentrated form for some considerable time and be carried some considerable distance. Eventually the spray material either disperses widely under vigorous thermal activity but it may be fumigated down to the ground if the thermal activity is gentler.

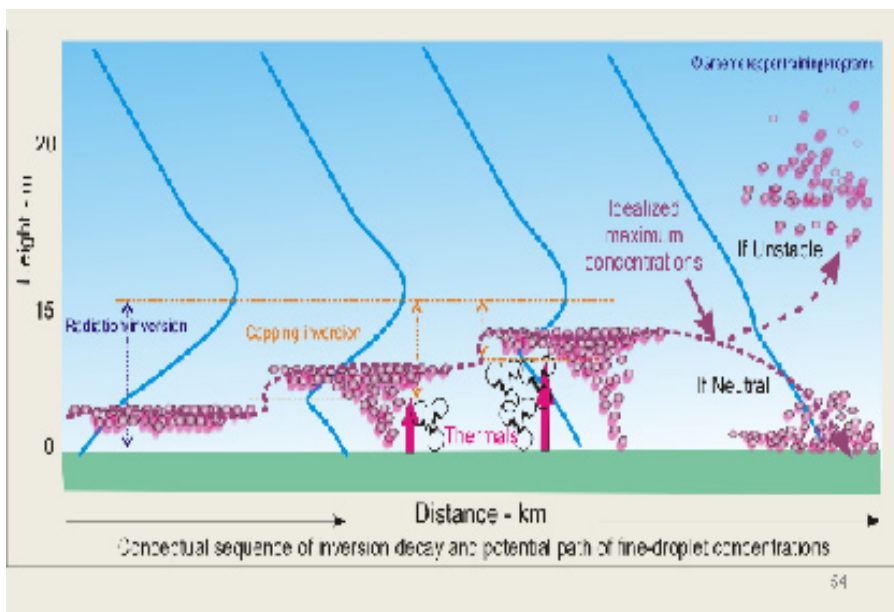


Figure 4 Schematic of temperature profile changing with time from sunrise and the manner in which any spray droplets are concentrated and transported to off-target sites. The height is arbitrary and could in fact be a few hundred metres.

By using the Bureau's high resolution sonde data records, Warwick showed relations between inversion base height and other factors. One simple relation is the hours of sunshine since dawn – the more hours the higher we expect the base height of the eroding inversion to be. Such a relation for all 30 sonde sites and the average observed base height with the hours since sunrise is shown at Figure 5.

Whenever pesticide or herbicide is sprayed the droplet sizes form a spectrum from fine to coarse. For adherence and absorption by the foliage, droplets that are too coarse are inefficient and wasteful, while droplets which are too fine tend to float and drift away from the target. Though there is technology and techniques to reduce the amount of material occurring in fine size, there is, in practice, always fine material ejected. This material gets in to the inversion and may travel in concentrated form to impact elsewhere (unintentionally). The three most likely scenarios are identified at Figure 6. The third scenario in particular was described in some detail. Warwick provided many other photos that illustrated these scenarios.

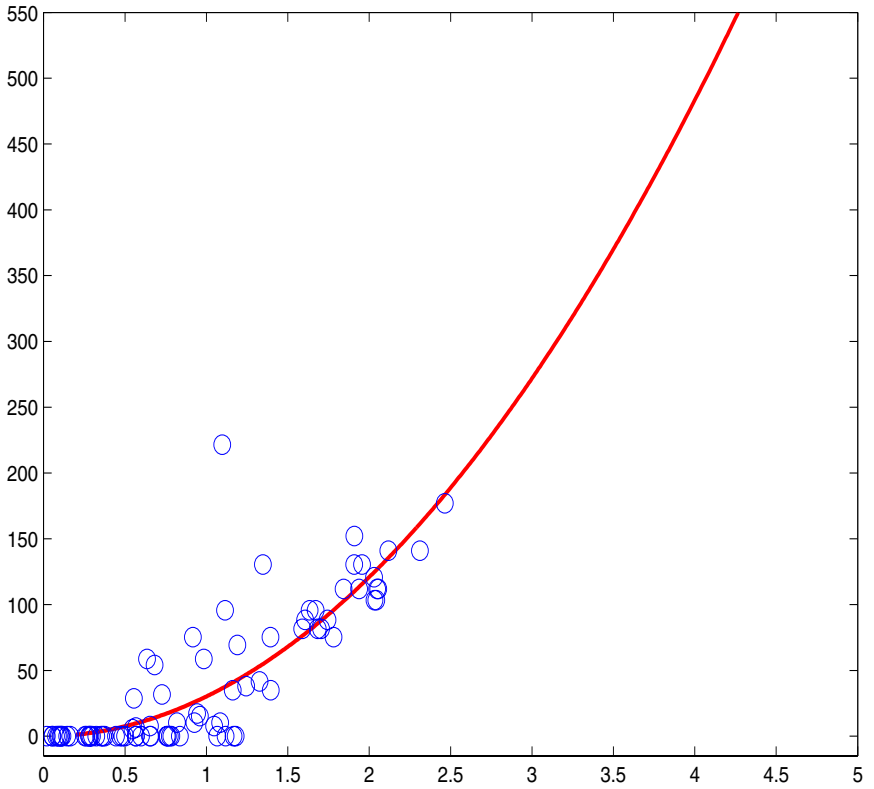


Figure 5 Using 10 years of sonde data from 30 sites. For each of the 30 sonde sites and for each month of winter, the average observed base height of the inversion at 2300UTC is plotted against the hours since sunrise.

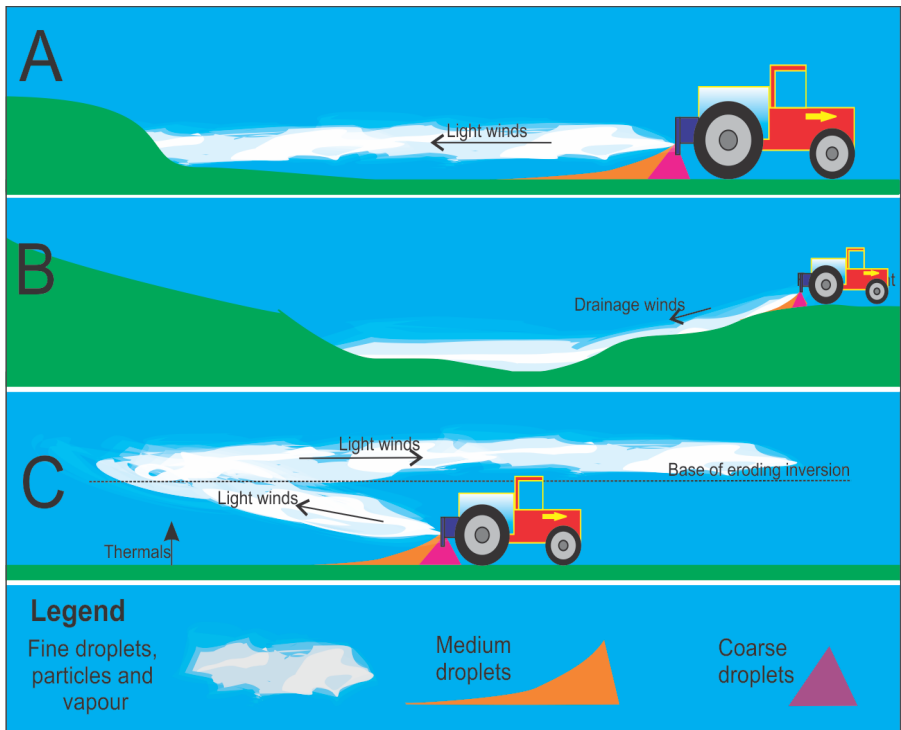


Figure 5

- A** High concentrations of airborne pesticides float just above the surface. Light winds may transport the plume to non-targets.
- B** Airborne pesticides can be caught up in drainage winds which carry them downslope and may concentrate them along slope and into lower lying regions.
- C** Airborne pesticides caught up in a complex thermal and wind shear situation may be lifted into the capping inversion and then transported in completely different directions to any surface wind.

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2011 Christmas Dinner

The 2011 Christmas Dinner was held at the Morphett Arms Hotel on 5th December. It proved to be an enjoyable and educational evening.

The topic for the evening's presentation was changes in forecasting then and now presented by Graham Furler, ex Bureau of Meteorology South Australia Office Regional Director. Graham gave a fascinating insight into the changes brought about by technology, particularly the use of computers, and the consequent effect on forecasting. This address was followed by a Q and A session.

Thanks must go to Arthur Beales for organising the evening, as it proved to be an excellent way to round out an exciting year for the AMETA.



ADELAIDE AND HILLS REGION WEATHER SUMMARY

OCTOBER 2011

Summary

- Despite mild conditions for much of the month, warmer temperatures mid month took the average for the whole month to slightly above average for maximum temperatures, and well above average for night time temperatures.
- Warmest October nights for 38 years for Adelaide.
- Rainfall was generally below average, typically 70 to 80% of October average rainfall.

Rainfall

Rainfall totals in the Adelaide region were generally below average for October 2011. A series of weak cold frontal systems moved across the region during the month with no significant tropical moisture associated with these systems until the last week of the month.

Adelaide (Kent Town) rainfall for October 2011 was 42.6mm recorded on 12 days, 1.2mm below the long term average for October for this site of 43.8mm occurring on average over 10 days of rain (this rainfall total is from the manually observed 203mm rain gauge making up the long term rainfall record. This may differ from totals on the Bureau's webpage as these may be from the automatic tipping bucket rain gauge). Median rainfall for October is 37.0mm. October rainfall total recorded at Adelaide (Kent Town) has not been above average since October 2005 when 88.4mm was recorded. The wettest October on record at this site was in 1980 with 105.0 mm.

Rainfall totals across the Adelaide metropolitan were also generally below, ranging from about 20 mm to 40mm. In the Adelaide Hills rainfall totals were generally also below average and between 40 to 60mm. The highest reading was 66.0mm at Crafrers (Mt Lofty). These rainfall totals are about 70 to 80% of average October rainfall. For the first 10 months of 2011, Adelaide (Kent Town) recorded 494.4mm which is 9.7 mm above the long-term average of 484.7 mm. Last year 489.5mm was recorded over the same period. Rainfall totals are near average across the Adelaide Hills and Metropolitan area for this year so far, despite the well above average for the first 3 months of the year, reflecting generally drier than average conditions since April 2011.

Temperatures

The month started and ended with relatively mild temperatures, with a burst of warmer weather in the middle of the month that meant maximum temperatures averaged across the month slightly warmer than average, and well above average minimum temperatures.

Mean maximum temperatures were generally up to 1°C warmer than average, being about 22 °C across the Adelaide plains, and 3 to 4°C cooler in hills locations. The mean maximum temperature at Adelaide (Kent Town) was 22.2°C which is 0.4°C above the long-term October average of 21.8°C. In 2010 the October average was 21.4°C. The coldest October on record at the Kent Town site was in 2001 when

18.8°C was recorded.

Adelaide had two days this month that had a maximum temperature that exceeded 30°C, where on average three might be expected, and five or more have been experienced in most recent Octobers. The coldest day was the 5th with 17.0°C, while the warmest was the 19th with 34.5°C.

The highest daily maximum temperature in the Adelaide and Adelaide Hills region, of 35.2°C was recorded at Edinburgh Airport, in the northern suburbs, on the 19th, whilst the lowest daytime temperature was 10.7°C at Mount Lofty in the Adelaide Hills, on the 10th.

Minimum temperatures were very much above average this October, typically by 1.5 to 2 °C. The mean minimum temperature at Adelaide (Kent Town) was 13.0°C, 1.5°C above the long-term October average of 11.5°C, and the warmest October nights since 1973 for the Adelaide Regional Office readings (West Terrace and Kent Town sites). Edinburgh Airport did have record warmest October minimum temperatures, while Adelaide Airport had equal record highest. The lowest daily minimum temperature recorded at Adelaide (Kent Town) was 7.1°C recorded on both the 1st and 2nd of the month.

Across the metropolitan and hills areas the lowest daily minimum temperature of 1.7°C recorded at Mount Barker on the morning of the 3rd, whilst the warmest night was 22.1°C at Adelaide (Kent Town) on the 20th.

Meteorological Observations at Adelaide Regional Office, October 2011



Australian Government
Bureau of Meteorology

DATE	DAILY		9am		3pm		RELATIVE HUMIDITY (Percent)		BRIGHT SUNSHINE (hours)		RAINFALL (mm)		EVAPORATION (mm)		WIND RECORDED at 9am (km/h)		WIND RECORDED at 3pm (km/h)		MAXIMUM WIND GUST		TIME OF MAX WIND		Summary
	MAX. TEMP. (°C)	MIN. TEMP. (°C)	TEMP. (°C)	TEMP. (°C)	Humidity (5am)	Humidity (3pm)	5am	4pm	5am	4pm	to 9am	to 3pm	9am	3pm	9am	3pm	9am	3pm	9am	3pm	9am	3pm	
1	17.3	7.1	12.9	16.2	57	44	57	44	10.0	3.6	0.4	SSW	18	S	17	SSW	44	10:53	10:53			Rain (mm)	Actual
2	18.1	7.1	12.1	17.1	51	35	51	35	11.3	0.4		E	11	NW	9	ESE	30	01:21	01:21			Year to date	Average
3	22.2	10.6	16.0	21.8	41	30	41	30	11.4			ENE	13	NW	9	ESE	28	00:12	00:12			Spring to date	494.4
4	21.5	15.9	18.5	20.8	31	31	31	31	0.0			ENE	15	NNE	13	ENE	42	02:07	02:07			Raindays	89.4
5	17.0	13.4	13.7	16.1	93	82	93	82	0.2	8.6		NNE	9	NW	11	NNE	26	02:12	02:12			Year to date	106
6	19.4	13.6	15.7	18.5	85	68	85	68	3.3	0.8		S	9	SW	13	WSW	26	09:25	09:25			Spring to date	26
7	18.6	14.3	15.4	17.9	77	53	77	53	5.4			WSW	4	WSW	13	W	30	14:32	14:32				
8	19.5	11.5	14.8	18.5	75	47	75	47	9.5	0.2		WSW	9	SSW	15	WSW	35	11:51	11:51			Extremes for West Terrace and Kent Town	
9	20.2	13.3	15.1	19.8	78	43	78	43	7.3	0.6		WSW	9	SSW	15	WSW	35	12:04	12:04			October Daily Extremes	Extreme
10	17.4	9.6	13.1	16.0	49	50	49	50	2.7			SW	17	WSW	24	SW	39	10:59	10:59			Highest maximum (°C)	31st 1987
11	19.3	11.4	14.4	18.3	63	47	63	47	8.9	0.6		SW	13	SSW	18	W	31	15:12	15:12			Lowest maximum (°C)	39.0
12	19.9	7.7	14.1	19.4	55	43	55	43	11.4			E	13	WSW	15	W	30	13:21	13:21			Lowest minimum (°C)	11.2
13	26.7	12.3	19.2	25.9	36	22	36	22	10.3			NNE	11	NE	13	E	31	19:10	19:10			Highest minimum (°C)	2.7
14	22.0	19.2	20.8	17.3	35	81	35	81	2.8			NW	24	ESE	9	NW	70	07:37	07:37			Highest 24 hour rainfall (mm)	26.2
15	20.6	14.1	16.4	19.1	71	37	71	37	8.3	4.2		WNW	24	WSW	31	W	57	15:05	15:05			Strongest wind gust (km/h)	56.9
16	18.8	11.5	14.9	18.3	57	41	57	41	11.3	0.2		SSW	11	WSW	21	SW	41	14:35	14:35				WSW 121
17	24.1	8.1	14.9	22.5	48	28	48	28	12.3			ENE	17	NNE	13	ENE	28	07:59	07:59			October Monthly Extremes	
18	29.8	13.2	20.9	28.2	17	8	17	8	12.5			NE	18	NNE	24	NNE	44	09:32	09:32			Highest mean maximum (°C)	26.8
19	34.5	18.7	27.3	33.7	27	10	27	10	11.4			NNE	13	NW	21	NW	54	11:16	11:16			Lowest mean maximum (°C)	17.4
20	25.3	22.1	24.4	19.7	42	69	42	69	1.2			N	9	SSW	13	WNW	48	10:40	10:40			Lowest mean minimum (°C)	8.0
21	21.9	15.8	16.6	19.7	76	67	76	67	0.7	8.2		ESE	8	NE	9	NE	22	16:01	16:01			Highest mean minimum (°C)	14.0
22	26.0	16.3	18.7	25.4	74	47	74	47	10.5			SW	2	WSW	15	W	22	13:49	13:49			Highest rainfall (mm)	153.2
23	31.8	16.7	21.9	25.9	68	46	68	46	4.4			WSW	2	S	5	NNW	31	12:23	12:23			Lowest rainfall (mm)	1.0
24	22.5	19.0	22.1	16.8	65	65	65	65	1.7	0.2		SSW	11	SE	17	SE	54	14:44	14:44			Comments, October 2011	
25	25	19.1	9.8	12.6	18.4	48	32	48	32	12.4		SE	22	SSE	15	SE	50	21:17	21:17			Mean monthly temperature (Max+Min/2)	17.6
26	20.7	10.7	13.9	19.2	54	42	54	42	10.9			S	5	SW	13	ESE	46	23:26	23:26			Mean monthly wind gust during the month	NW 70 on 14th
27	27.6	9.8	18.3	25.6	44	24	44	24	10.1			N	11	NW	11	W	28	12:22	12:22				
28	24.8	18.3	22.7	18.7	53	91	53	91	1.4			NNW	9	SSW	9	SSW	35	13:32	13:32				
29	19.2	12.1	13.9	16.8	89	59	89	59	11.1	15.0		SW	9	SW	21	WSW	43	12:48	12:48				
30	19.5	11.3	14.0	18.9	49	38	49	38	11.5			SSE	13	SSE	18	SSE	42	13:27	13:27				
31	20.6	9.5	13.0	20.1	54	37	54	37	10.9			N	5	SE	15	SSE	35	16:13	16:13				
TOTAL	695.4	404.0	522.1	650.6	769.2	1417	237.1	428	on 12 days			112.8											
MEAN	22.1	13.0	16.8	20.3	57	46	57	46	7.6			5.6											
AVG**	21.8	11.5	16.8	20.3	55	44	55	44	8.3			4.6											

* Maximum temperatures are taken from 9am to 9am. **Long term average, currently 33 years in 2011
Climate Services Centre, Adelaide, South Australia. Phone 08 8366 2664 Fax 08 8366 2693

SOUTH AUSTRALIA'S WEATHER SUMMARY

OCTOBER 2011

Summary

- Minimum temperatures up to 2°C above average over the western agricultural and pastorals, with record warmest October minimum temperatures at Nonning and Elliston, but within 1°C of average elsewhere.
- Maximum temperatures up to 2°C below average on the Eyre Peninsula.
- Whilst the rainfall across most of the agricultural areas was above average for October, the growing season (April to October) rainfall has been below average in many locations.

Rainfall

Rainfall in South Australia was mostly above average during October. Averaged across the state as a whole, rainfall was 54% higher than the long term October average of 18.4 mm. Most of the month's rainfall was associated with the passage of upper level troughs and weak cold fronts that crossed the State during the first and second week of October. An upper level prefrontal trough brought high rainfall totals for much of the northwest and central districts at the end of the month.

South Australian average total rainfall for 2011 (January to October) is ranked as fourth wettest on record. The years where similar rainfall totals are higher than 2011, all occurred during the La Nina years of 2010 and 1973-74. Despite a wet first 3 months of 2011, growing season rainfall (April to October) was below average, particularly in relation with a dry spell during late August through September that resulted in low accumulations for many locations through this period.

Pastoral Districts

Rainfall totals for October 2011 over the pastoral districts were mostly above average to very much above average in the far northwest, with the wettest periods being between the 4th and 6th of October following the passage of a low pressure trough. Yardea recorded 45.6 mm of rain in the 24 hours to 9am on the 5th of October. Another trough that developed over the Northwest of the State at the end of the month resulted in Marla recording a record highest 35.2 mm of rain in the 24hrs to 9am on the 29th. Monthly totals generally ranged from about 20 to 50 mm, with some locations receiving greater than 60 mm. The wettest overall was Marla Police Station with 71.6 mm for the month.

Agricultural Districts

Western agricultural and parts of the upper north saw mainly above average rainfall totals during October, although a large part of north-eastern Eyre Peninsula received very much above average rainfall. Below average totals were recorded over the lower southeast district, while the central districts and the Murray Valley regions received near average totals.

The Murray Valley, Southeast districts, Kangaroo Island, Yorke Peninsula, and the Adelaide Plains generally received between 20 to 50 mm of rainfall while the Mount Lofty Ranges received rainfall totals of between 40 to 60 mm. Rainfall totals of more than 70 mm were recorded over parts of the Western agricultural area. The wettest overall was at Kimba where 81.2 mm was recorded for the month.

Temperature

The mean temperature (the average of the daily maximum and daily minimum temperatures) for South Australia as a whole in October 2011 was 20.8 °C, which is 0.9 °C warmer than the long-term average.

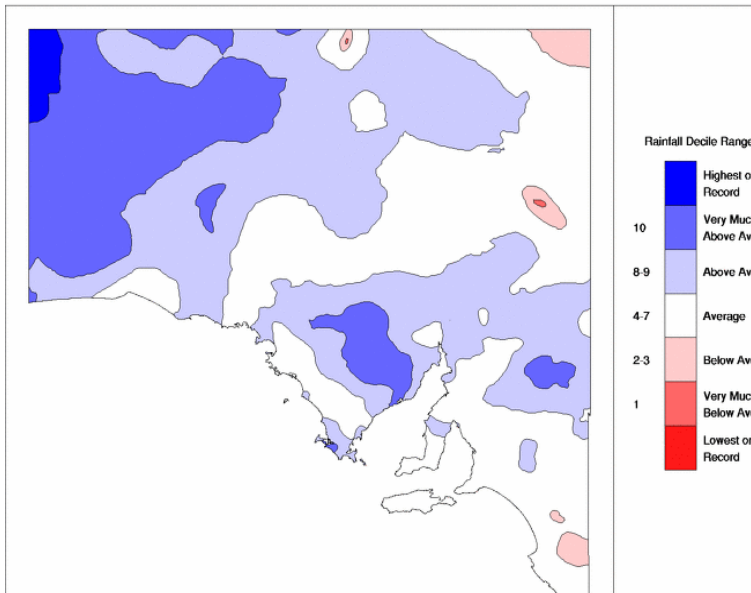
Maximum

The area-averaged mean maximum temperature of 28.1°C was 0.4°C above the long-term October average for South Australia as a whole.

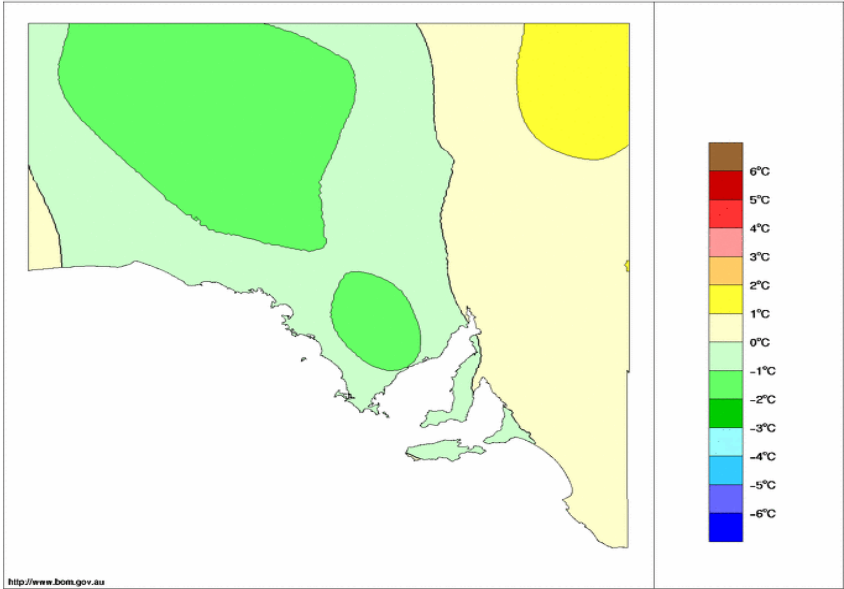
Mean maximum temperatures averaged over South Australia were up to 2°C below average across parts of the central Eyre Peninsula and up to 1°C below the long-term average over the rest of the western agricultural and northwest pastoral districts when averaged across the whole month. Temperatures across parts of the far northeast were up to 1°C warmer than average.

The coldest period was between the 1st though to the 10th of October when conditions were cloudy and wet following the passage of a low pressure trough and weak cold fronts which then cleared under a high pressure system in the Great Australian Bight. Mount Lofty recorded the coldest day of the month in these conditions when its maximum temperature only reached 10.7°C on the 10th.

South Australian Rainfall Deciles October 2011
Distribution Based on Gridded Data
Product of the National Climate Centre



Maximum Temperature Anomaly (°C) October 2011
Product of the National Climate Centre



<http://www.bom.gov.au>

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Issued: 21/11/2011

ADELAIDE AND HILLS REGION WEATHER SUMMARY

NOVEMBER 2011

Summary

- Above average temperatures, despite mild conditions towards the end of the month.
- Rainfall generally below average, most locations typically receiving only 50 to 80% of November average rainfall.

Rainfall

Rainfall totals in the Adelaide region were generally below average for November 2011. Much of the month's rainfall was recorded in the last week of November associated with the passage of a series of low pressure troughs and frontal systems.

A total of 25.2 mm of rainfall was recorded over 10 rain days at Adelaide (Kent Town) during November 2011, 6.2mm below the long term November average of 31.5 mm for this site, occurring on an average of 8 days of rain. November 2010 saw 23.2mm of rainfall recorded, with the driest November at the Adelaide (Kent Town) site being 1.0mm in 1996.

Year-to-date rainfall (January to November 2011) at Adelaide (Kent Town) was 519.6 mm, slightly above than the long-term year-to-date average of 516.2 mm. Last year, 505.6 mm was recorded over the same 11-month period. Well above average rainfall for the first three months of 2011 and generally drier than normal conditions since April kept rainfall totals near the long term average across the Adelaide Hills and Metropolitan area for 2011.

Rainfall totals varied across the Adelaide metropolitan area and Mount Lofty Ranges, however most were generally below average, ranging between about 15 mm to 30mm on the Adelaide plains and between 20 mm to 35 mm in the hills. These rainfall totals range between 50 to 80% of the average November rainfall. The highest rainfall reading was 49.2 mm at Athelstone (Black Hill).

Temperature

Average monthly maximum temperatures were up to 2.0°C above average for November 2011 across the Adelaide metropolitan and hills area. The warmest days were experienced between the 17th and 19th of the month, where north to north westerly winds were directed over the region ahead of a low pressure trough.

The November 2011 mean maximum temperature at Adelaide (Kent Town) was 26.7°C which is 1.5°C above the long-term mean maximum temperature. In comparison, November 2010 saw below average maximum temperatures of 24.3°C at Adelaide (Kent Town). November 2009 was the warmest on record for this site, with 30.8°C.

The hottest day for in November 2011 in the Adelaide region was on the 18th, recorded at both Edinburgh RAAF and Parafield Airport where the maximum temperature reached 38.3°C. Parafield Airport recorded the warmest days on average, with maximum temperatures averaging 28.0°C for the month.

The coldest November day in 2011, at Adelaide (Kent Town), was on the 25th, with the maximum only reaching 18.7°C, and the coldest maximum temperature recorded in the Adelaide & hills area being 14.9°C at Mt Lofty. The coolest days on average were recorded at Mount Lofty, where maximum temperatures averaged 20.9 °C.

Mean minimum temperatures were close to 1.0°C above average this November. The mean minimum temperature for November 2011 at Adelaide (Kent Town) was 14.7°C, which is 0.7C above the long-term mean minimum temperature.

The coolest nights on average were recorded at Mount Lofty, where minimum temperatures averaged 10.2 °C. The coldest minimum temperature recorded for the month in the Adelaide and hills area was 4.7°C on the 24th at Mount Lofty, whilst the warmest night was 24.6°C at Noarlunga on the 18th.

Meteorological Observations at Adelaide Regional Office, November 2011



Australian Government
Bureau of Meteorology

DATE	DAILY		9am		3pm		RELATIVE HUMIDITY (Percent)		BRIGHT SUNSHINE (hours)		RAINFALL to 9am (mm)		EVAPO-RATION to 9am (mm)		WIND RECORDED at 9am (km/h)		WIND RECORDED at 3pm (km/h)		MAXIMUM WIND GUST (km/h)		TIME OF MAX WIND GUST		Summary	
	MAX. TEMP. (°C)	MIN. TEMP. (°C)	TEMP. (°C)	TEMP. (°C)	HUMIDITY (9am)	HUMIDITY (3pm)	SUNSHINE (9am)	SUNSHINE (3pm)	RAINFALL (9am)	RAINFALL (3pm)	WIND DIRECTION	WIND SPEED	WIND DIRECTION	WIND SPEED	WIND DIRECTION	WIND SPEED	WIND DIRECTION	WIND SPEED	WIND DIRECTION	WIND SPEED	WIND DIRECTION			
1	21.9	8.1	14.1	20.3	56	46	46	12.6	12.6	0.4	4.4	S	5	WSW	17	WSW	35	16:24	18:24	16:24	18:24	Rain (mm)		
2	21.2	9.3	16.3	20.4	59	51	51	12.6	12.6	0.4	5.0	S	2	SE	22	W	41	13:47	15:32	13:47	15:32	Year to date		
3	24.2	13.3	16.0	23.0	68	47	47	7.5	7.5	0.4	5.4	E	8	ESE	1	SSE	30	15:32	15:32	15:32	15:32	Year to date		
4	26.2	11.5	18.9	30.0	53	18	18	11.8	11.8	0.4	3.8	N	5	ESE	8	ENE	26	08:58	08:58	08:58	08:58	Raindays		
5	24.8	18.0	28.2	33.5	22	13	13	8.3	8.3	0.4	1.1	NNE	15	WSW	21	N	42	09:53	09:53	09:53	09:53	Year to date		
6	24.0	17.8	18.3	22.6	75	53	53	6.2	6.2	0.4	1.1	SW	13	WSW	9	WSW	26	04:05	04:05	04:05	04:05	Spring to date		
7	23.4	12.9	22.5	29.2	48	26	26	7.4	7.4	0.4	1.1	NE	18	SW	17	SSW	46	13:52	13:52	13:52	13:52	Extremes for West Terrace and Kent Town		
8	29.5	18.0	20.5	28.5	94	44	44	7.4	7.4	0.4	4.4	N	7	NW	13	NW	24	14:27	14:27	14:27	14:27	November Daily Extremes		
9	29.9	20.0	25.0	23.5	47	62	62	9.7	9.7	0.2	4.6	NNW	15	SW	22	NNW	50	08:51	08:51	08:51	08:51	Extremes for West Terrace and Kent Town		
10	21.4	13.2	17.0	20.3	60	46	46	11.9	11.9	3.4	6.8	NNW	19	WSW	15	WSW	41	23:04	23:04	23:04	23:04	Highest maximum (°C)		
11	26.3	11.9	18.4	25.7	48	23	23	9.9	9.9	0.4	4.8	N	11	W	17	WNW	35	11:36	11:36	11:36	11:36	Lowest maximum (°C)		
12	30.9	12.0	21.7	30.1	30	12	12	7.7	7.7	0.4	1.1	NE	8	NW	13	NW	31	17:18	17:18	17:18	17:18	Lowest minimum (°C)		
13	32.8	21.4	23.8	31.8	32	25	25	8.3	8.3	0.4	1.1	NE	8	WNW	26	W	42	13:57	13:57	13:57	13:57	Highest minimum (°C)		
14	26.1	14.5	19.3	24.3	65	47	47	12.3	12.3	0.4	17.0	NW	11	WSW	17	NW	35	11:14	11:14	11:14	11:14	Highest 24 hour rainfall (mm)		
15	29.0	14.6	22.9	27.1	43	28	28	10.7	10.7	0.2	5.6	NNW	13	SW	18	SSE	37	17:36	17:36	17:36	17:36	Strongest wind gust (km/h)		
16	27.7	14.3	16.5	26.1	49	25	25	10.5	10.5	0.2	6.2	ESE	6	ENE	7	E	33	22:57	22:57	22:57	22:57	Strongest wind gust (km/h)		
17	32.9	16.5	25.9	31.0	38	27	27	12.5	12.5	0.2	7.0	NNW	17	W	15	ENE	37	23:57	23:57	23:57	23:57	November Monthly Extremes		
18	36.8	21.8	29.6	36.5	27	18	18	8.9	8.9	0.2	8.4	NNE	13	NW	22	NW	61	11:12	11:12	11:12	11:12	Highest maximum (°C)		
19	23.4	19.2	21.3	20.8	62	58	58	1.9	1.9	0.2	1.1	SW	11	SSE	18	SW	41	04:50	04:50	04:50	04:50	Lowest mean maximum (°C)		
20	21.5	11.8	15.4	20.5	68	39	39	10.8	10.8	0.2	14.0	NNE	4	WSW	15	W	41	09:28	09:28	09:28	09:28	Lowest mean minimum (°C)		
21	23.0	11.4	16.3	21.9	57	34	34	8.3	8.3	0.4	6.0	NW	4	WSW	9	WNW	30	11:48	11:48	11:48	11:48	Lowest mean minimum (°C)		
22	21.7	12.7	16.6	21.1	67	32	32	5.3	5.3	0.4	6.0	NW	4	WSW	21	SW	42	13:19	13:19	13:19	13:19	Highest rainfall (mm)		
23	21.9	12.8	15.1	20.9	67	29	29	10.2	10.2	0.4	5.3	SSE	1	S	18	SSE	61	22:13	22:13	22:13	22:13	Lowest rainfall (mm)		
24	24.8	11.6	17.4	23.1	43	26	26	10.6	10.6	0.4	7.0	WNW	11	SE	13	SE	65	00:09	00:09	00:09	00:09	Comments, November 2011		
25	18.7	15.3	16.2	17.4	90	74	74	0.0	0.0	0.4	5.0	NNW	9	SW	19	SW	37	16:44	16:44	16:44	16:44	Mean monthly temperature (Max+Min/2)		
26	21.6	14.9	17.5	20.1	82	63	63	5.3	5.3	0.4	6.0	NW	9	SW	19	SW	41	14:12	14:12	14:12	14:12	Mean monthly temperature (Max+Min/2)		
27	28.5	16.0	16.8	26.2	67	34	34	12.4	12.4	0.4	10.2	NNE	9	WSW	13	NNW	24	15:43	15:43	15:43	15:43	Highest wind gust during the month		
28	33.5	16.0	26.1	31.3	32	21	21	6.4	6.4	0.4	6.6	ENE	17	W	9	NNW	41	12:05	12:05	12:05	12:05	SE 65 on 24th		
29	30.2	20.4	23.4	28.2	59	33	33	2.5	2.5	0.4	6.6	ENE	5	WSW	5	SW	46	17:45	17:45	17:45	17:45	SE 65 on 24th		
30	19.7	13.7	15.6	18.9	42	27	27	12.8	12.8	0.4	4.2	SW	28	SW	24	W	50	23:24	23:24	23:24	23:24	SE 65 on 24th		
31										0.4	4.2	SW	28	SW	24	W	50	23:24	23:24	23:24	23:24	SE 65 on 24th		
TOTAL	802.5	440.9	592.6	754.3	1640	1081	262.3	252.2 on 10 days	158.5	158.5	7.2	158.5												
MEAN	25.8	14.7	19.8	25.1	56.8	39.6	8.7	8.7	8.7	8.7	7.2	7.2												
AVG**	26.1	14.0	18.8	23.6	53	39	9.1	9.1	9.1	9.1	6.0	6.0												

* Maximum temperatures are taken from 9am to 9am. ** Long term average, currently 33 years in 2011
Climate Services Centre, Adelaide, South Australia. Phone 08 8366 2664 Fax 08 8366 2833

SOUTH AUSTRALIA'S WEATHER SUMMARY

NOVEMBER 2011

Summary

- Above average rainfall for the state as a whole, with most rainfall in northern and eastern districts.
- Near average to below average rainfall over southern coastal regions.
- Warmer than average temperatures by up to 2°C.

Rainfall

South Australia received nearly double the November rainfall average for the state as a whole. This is mostly accounted for by very much above average rainfall across the north and northeast of the state, whereas central coastal locations generally received below average rainfall. Large parts in the west and areas in the southeast received close to average rainfall. South Australian average year-to-date total rainfall for 2011 (January to November) was ranked as fourth wettest on record. Last year was slightly wetter over the state for the same 11-month period. The years when the highest November rainfall for the state occur, are all during La Nina years of 2010-11 and 1973-74.

Pastoral Districts

Rainfall totals for November 2011 over the pastoral districts were mostly above average to very much above average, apart from some areas on the western border where totals were mostly near average.

The wettest period for the pastoral areas was between the 7th and 10th of November and again later in the month between the 21st and 26th. Arkaroola recorded 30.3 mm of rain in the 24 hours to 9am on the 9th. Kalamurina received a record highest total for the month of 48.4 mm of rain all of which occurred on the one day, the 22nd. Monthly totals in the pastoral districts generally ranged from about 20 to 50 mm, although some locations in the Far North and Northeast received up to 80 mm. The wettest location overall in the pastoral districts was Manna Hill with 89.8 mm for the month.

Agricultural Districts

Western agricultural districts, and parts of the Upper North district saw mainly average to below average rainfall totals during November. The Murray Mallee, The Upper Murray Valley and the Upper and Lower North districts generally received average to above average rainfall. Below average totals were recorded over Yorke Peninsula and southern parts of the Mount Lofty Ranges, while in other agricultural districts stations generally received near average totals.

Totals were in the range of 20 to 30mm in most locations, but tending to higher totals up to about 60mm in many locations in the Mount Lofty and Flinders ranges, the southeast of the state, and the Murray Malley and Riverland. The wettest overall for the month in the agricultural districts was Parilla in the Murray Mallee, with 81.6 mm.

Temperature

The mean temperature (the average of the daily maximum and daily minimum temperatures) for South Australia as a whole in November 2011 was 1.0 °C warmer than the long-term November average. By contrast, November 2010 was 1.1°C cooler than average.

Maximum Temperature

The area-averaged mean maximum temperature for South Australia as a whole was 1.0°C above the long-term November average. By contrast November 2010 was 1.9°C cooler than average.

Mean maximum temperatures were up to 2°C above average across most of the south-eastern part of the state, but parts of the far northwest were 1 to 2°C cooler than average. Average daily maximum temperatures ranged from 20.3 °C at Neptune Island to 35.1°C at Marree Comparison in the Northeast.

The warmest period for many locations was between the 18th and 19th of November as northwesterly winds were directed over the state ahead of a low pressure trough. The hottest day of the month was recorded at Oodnadatta Airport on the 29th with the maximum temperature reaching 43.4 °C.

Minimum Temperature

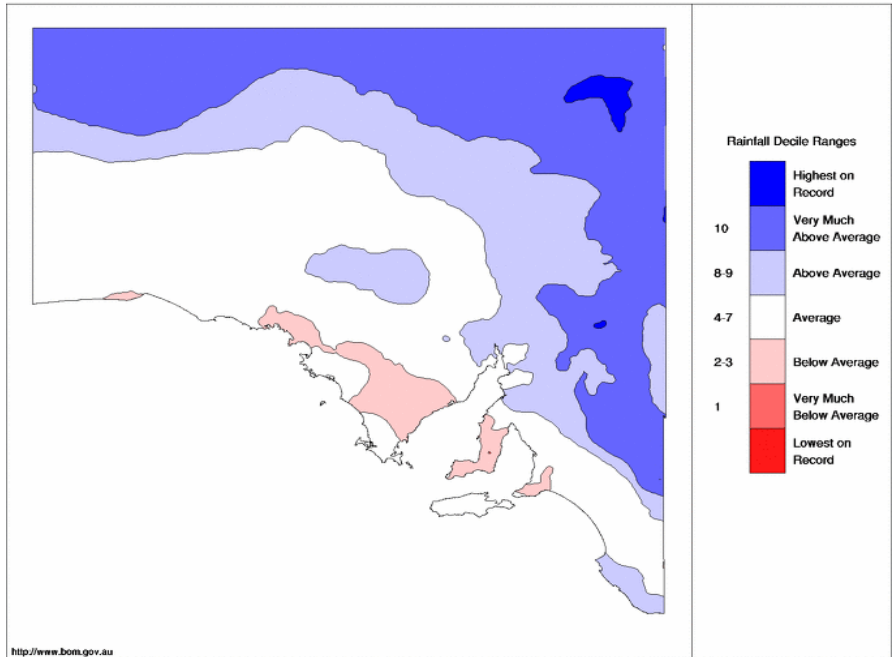
The area-averaged mean minimum temperature for South Australia as a whole was 1.1°C above the long-term November average. By contrast, November 2010 was 0.3°C cooler than average.

Mean minimum temperatures were up to 2°C above average across parts of the eastern agricultural, central and western districts, and near average across most of the Yorke and Eyre Peninsulas. Parts of the far northwest of the state were cooler than average for November. Average minimum temperatures across the State ranged from 9.1°C at Keith (Munkora) in the State's southeast to 19.0 °C at Oodnadatta airport in the Northeast District.

The coldest nights were between the 1st and 3rd, when winds were generally light as a high pressure system moved across the south of the State. The coldest night was recorded at Keith (Munkora) with a minimum of -0.6 °C. Another cold period, under the influence of another high pressure system in the Great Australian Bight, brought minimum temperatures down across a number of locations in the northern pastoral districts from about the 24th through to the 27th.

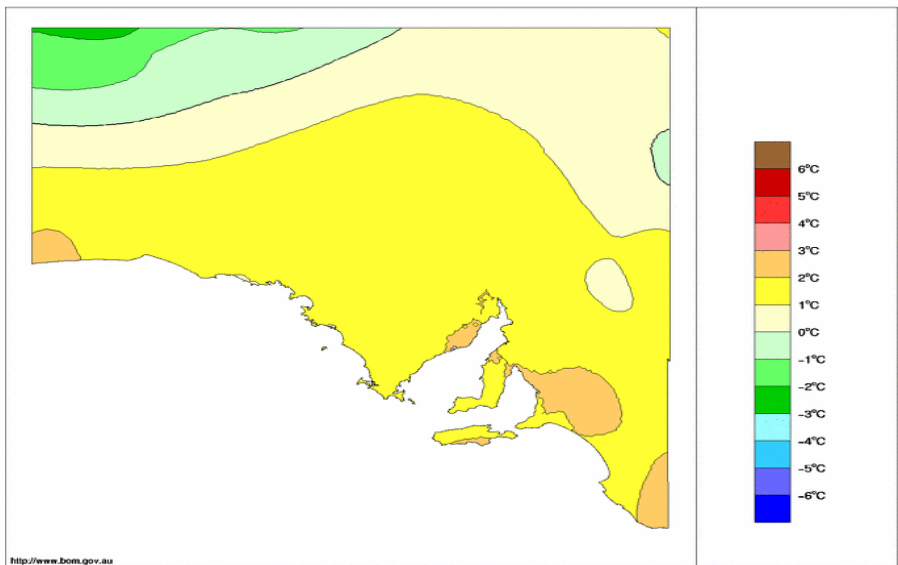
The warmest nights for many locations were around the 18th and 19th of November which was associated with warm northerly winds being directed over much of the state. Oodnadatta Airport recorded the warmest night of the month on the 19th with 27.8°C.

South Australian Rainfall Deciles November 2011
 Distribution Based on Gridded Data
 Product of the National Climate Centre



Issued: 21/12/2011

Maximum Temperature Anomaly (°C) November 2011
 Product of the National Climate Centre



Issued: 21/12/2011

ADELAIDE AND HILLS REGION WEATHER SUMMARY

SPRING 2011

Summary

- Below average spring rainfall, typically about 80% of average across the region.
- Warmer than average temperatures, by up to 2°C.

Rainfall

Spring rainfall across the metropolitan area was mostly below average with some locations receiving up to 30% less than normal. Although rainfall totals for the month of October were near average, rainfall across the region was well below average through September and November 2011. Rainfall totals for the season as a whole were typically 80 to 110mm on the Adelaide plains, and ranging between 120 to 200mm in the Adelaide Hills. The wettest location in the Adelaide metropolitan and hills area during spring 2011 was at Piccadilly (Woodhouse) with 211.3 mm.

Adelaide (Kent Town) recorded 114.6 mm for spring 2011, which is 21.3 mm below the long-term spring rainfall average. In 2010, spring rainfall at Kent Town totalled 124.6 mm

Temperature

Both maximum and minimum temperatures were warmer than average across the Adelaide metropolitan and hills area this spring. September and November days were warmer than average, with cooler days in October, while night-time temperatures were cooler in September but warmer in both October and November.

The spring 2011 average maximum temperature at Adelaide (Kent Town) was 23.2 °C, which is 1.2 °C above the average spring maximum. The hottest maximum temperature recorded in the Adelaide metropolitan and hills area was 38.3 °C, recorded at both Edinburgh RAAF and Parafield Airport on the 18th of November. The coldest day was recorded at Mount Lofty on September 10, with 7.9 °C. Parafield Airport recorded the warmest days on average with 24 °C, which is 2.0 °C above spring average recorded at this location. The coolest days on average were recorded at Mount Lofty with 17.2 °C.

Minimum temperatures were also warmer than average across the Adelaide metropolitan and hills area. The mean minimum temperature for spring 2011 at Adelaide (Kent Town) was 12.7, which is 1.0 °C above the average spring mean minimum, and is ranked as the third warmest since records began in 1977. Last spring the mean minimum was 11.7°C. The coldest night during spring was recorded at Edinburgh RAAF on the 25th of September where the minimum went down to 1.2 °C. Noarlunga recorded the warmest night during spring with 24.6 °C on 18th November. The coolest nights on average were at Mount Lofty where minimum temperatures averaged 8.3 °C.

SOUTH AUSTRALIA'S WEATHER SUMMARY

SPRING 2011

Summary

- Warmer spring days as South Australian maximum temperatures exceed the long term average by 1 to 2 °C.
- Drier than average spring rainfall for many coastal districts but wetter than average across northern parts of the state.

Rainfall

Averaged across the state as a whole, South Australia received ~30% more rainfall in spring 2011 than the long-term spring average. This comes after a record wettest spring in 2010. While the far Northwest and parts of the far Northeast of the state received well above average rainfall in spring 2011, rainfall totals across much of the rest state were close to average, though tending below average in the southern agricultural areas.

Spring began with well below average rainfall in September across much of the state. Rainfall was mostly average during October, although areas in the states west received well above average rainfall. The season finished with well above average November rainfall across northern areas of the state while southern and coastal districts received average to below average November rainfall.

Pastoral Districts

Spring rainfall was average to well above across the Pastoral districts. Rainfall totals varied typically between 50 to 100mm, with some locations recording larger totals in isolated thunderstorm events. The highest spring rainfall total in the pastoral districts was at Manna Hill, in the Northeast, which recorded 128.6 mm.

Agricultural Districts

Rainfall totals were average across most parts, though tending to below average through the southern agricultural areas including the Yorke Peninsula, Kangaroo Island, the Mount Lofty Ranges and parts of the Southeast districts. These districts generally received 70-80% of average spring rainfall.

Rainfall totals were typically 80 to 180mm throughout agricultural districts for the spring season. The highest total for the state was 211.3 mm at Piccadilly (Woodhouse) in the Mount Lofty Ranges.

Temperature

Temperatures across South Australia were above average to very much above average during spring 2011. The spring daily average temperature for South Australia as a whole was 1.0 °C warmer than the long term spring average, in comparison to spring 2010 which was 1.1°C cooler than average. The warmest spring for South Australia was recorded in 2006 where temperatures were 2.1 °C above the long term average.

Maximum

Maximum temperatures were above average this spring, with temperatures generally up to 1 to 2°C above the average across most of the agricultural areas. Maximum temperatures were slightly cooler than average in the far northwest of the state. Average maximum temperatures ranged from 17.2 °C at Mount Lofty to 31.2 °C at Moomba Airport in the far Northeast of the State.

The warmest spring daily maximum temperature was 43.4°C recorded at Oodnadatta Airport in the far North on the 29th of November. The coldest daily maximum was 7.9 °C at Mount Lofty on the 10th of September.

Minimum

Minimum temperatures were also above the long-term average this spring. Large areas of the western agricultural region had temperatures in excess of 1°C above the long term spring minimum average. Minimum temperatures were only slightly above average for most other districts. Mean minimum temperatures for the whole season ranged from 6.9°C at Keith (Munkora) in the Southeast to 15.9 °C at Oodnadatta Airport in the states north.

The lowest overnight spring minimum temperature recorded was -3.6 °C at Yongala on the 7th of September. The highest minimum temperature recorded was 27.8°C at Oodnadatta on the 19th of November.

ADELAIDE AND HILLS REGION WEATHER SUMMARY

DECEMBER 2011

Summary

- Above average temperatures, despite mild conditions through much of the month.
- Drier than average on the plains, but average rainfall in the hills.

Rainfall

Rainfall totals were typically below average on the Adelaide plains, generally about 80% of average, with totals of between 15 to 30 mm being reported. Hills locations tended closer to average, and up to 20% above average at several locations, with totals ranging from 30 to 50 mm. The highest rainfall total in the Adelaide and Hills region for December 2011 was 70.8mm at Chain of Ponds in the Adelaide Hills. Much of the month was dry, with rainfall largely occurring in two events, one a significant rain event mid-month with associated severe thunderstorm activity.

A total of 18.2 mm of rainfall was recorded on 5 rain days at Adelaide (Kent Town) during December 2011, 11.6 mm below the long term December average for this site of 29.8 mm on 7 rain days. In contrast, December 2010 saw 87.0 mm of rainfall recorded, with the driest December at the Adelaide (Kent Town) site being 5.8mm in 1991.

Temperature

Much of the month was relatively mild, with little in the way of very hot conditions occurring until about the last week of the month, when a burst of hot conditions extended into the New Year.

Average monthly maximum temperatures were generally about 1.0°C above average for December 2011 across the Adelaide metropolitan and hills area. The December 2011 mean maximum temperature at Adelaide (Kent Town) was 27.9°C which is 0.9°C above the long-term mean maximum temperature of 27.0°C. In comparison, December 2010 saw below average maximum temperatures of 26.7°C at Adelaide (Kent Town). December 2003 was the warmest on record for this site, with 29.0°C. Only two days with maximum temperatures exceeding 35°C were recorded at Adelaide (Kent Town) in December 2011 when three or four might be expected on average, indicative of the mild conditions in place through much of the month.

The hottest day for December 2011 in the Adelaide region was on the 24th, when 39.7°C was recorded at Edinburgh RAAF aerodrome. Parafield Airport recorded the warmest days on average, with maximum temperatures averaging 29.0°C for the month.

The coldest December day in 2011 at Adelaide (Kent Town) was on the 18th with the maximum only reaching 20.7°C, and the coldest maximum temperature recorded in the Adelaide & hills area being 14.8°C at Mt Lofty on the same day. The coolest days on average were recorded at Mount Lofty, where maximum temperatures averaged 22.6 °C.

Mean minimum temperatures this December were warmer than average, but by only about 0.5°C. The mean minimum temperature for December 2011 at Adelaide

(Kent Town) was 16.3°C, which is 0.7C above the long-term mean minimum temperature. In 2010 Adelaide (Kent Town) averaged 16.0°C for December minimum temperatures. The coolest December at this site was in 2001 when the average for the month was only 12.8°C.

The coolest nights on average in December 2011 were recorded at Mount Barker, where minimum temperatures averaged 11.2 °C. The coldest minimum temperature recorded for the month in the Adelaide and hills area was 4.7°C on the 5th at Mount Lofty, whilst the warmest night was 24.7°C at Adelaide (Kent Town) on the 17th.

Meteorological Observations at Adelaide Regional Office, December 2011



DATE	DAILY MAX. TEMP (°C)	DAILY MIN. TEMP (°C)	9am		3pm		RELATIVE HUMIDITY (Percent)	BRIGHT SUNSHINE (hours)	RAINFALL to 9am (mm)	EVAPO- RATION to 9am (mm)	WIND RECORDED at 9am (km/h)	WIND RECORDED at 3pm (km/h)	MAXIMUM WIND GUST (km/h)	TIME OF MAX WIND GUST	Summary				
			TEMP (°C)	TEMP (°C)	TEMP (°C)	TEMP (°C)													
1	22.5	9.5	16.2	21.2	48	35	48	8.0		7.0	SSE	15	SE	18	ESE	41	15:38	Rain (mm) Year to date	
2	25.1	12.4	17.4	22.4	38	33	33	13.5		4.8	E	9	S	13	SSE	48	18:30	Year to date	
3	25.7	12.9	18.2	24.1	55	36	36	13.5			SE	13	ESE	21	SE	41	00:55	Raindays Year to date	
4	22.9	11.9	15.8	22.3	41	24	24	13.5		21.6	ENE	17	ESE	12	E	44	05:11	Year to date	
5	28.2	12.2	16.7	26.2	40	16	16	13.4		7.0	NNE	15	SW	22	ESE	42	21:27	Year to date	
6	30.2	16.3	24.7	28.7	17	13	13	13.5		9.2	NE	5	WSW	15	ESE	37	00:08	Summer to date	
7	33.1	17.0	25.5	31.8	23	14	14	13.5		9.2	ENE	2	E	4	NW	44	17:17	Extremes for West Terrace and Kent Town	
8	31.4	18.1	23.0	30.5	39	20	20	0.0	2.4	8.2	ENE	5	E	4	NW	44	17:17	December Daily Extremes	
9	23.0	18.5	18.8	21.7	89	59	59	0.0	1.6	3.6	NW	11	NNE	22	NNE	50	13:04	Extreme	
10	23.7	18.5	19.4	22.8	85	57	57	5.8			WSW	13	WSW	22	WSW	39	14:18	Highest maximum (°C)	
11	22.2	14.6	17.1	21.4	50	36	36	9.0		14.2	SSE	13	WSW	22	W	44	14:21	Lowest maximum (°C)	
12	22.1	15.2	16.9	21.1	54	42	42	4.9	0.2	4.8	SSW	8	WSW	21	W	39	12:54	Lowest minimum (°C)	
13	23.6	14.2	16.7	23.3	50	32	32	10.3		7.4	E	18	SW	8	ESE	41	01:26	Highest 24 hour rainfall (mm)	
14	26.8	12.9	17.4	26.2	39	27	27	10.3		4.8	SSE	9	SSE	17	SE	35	08:14	Highest minimum (°C)	
15	30.8	17.3	22.5	29.8	29	18	18	10.9		6.8	NE	13	WSW	18	SE	54	19:49	Strongest wind gust (km/h)	
16	33.9	20.3	25.2	32.5	32	11	11	9.8		8.4	NE	17	E	17	SE	48	20:28	December Monthly Extremes	
17	25.4	24.7	25.1	24.8	51	62	62	0.0	8.6	12.6	NNE	24	NE	28	NNE	55	08:12	Highest mean maximum (°C)	
18	20.7	18.7	19.9	18.8	74	92	92	0.9	5.4	6.4	NW	15	WNW	13	WNW	41	14:36	Lowest mean maximum (°C)	
19	26.0	16.5	19.3	23.7	61	44	44	10.9		4.2	WSW	11	SSW	11	WSW	35	16:07	Lowest mean minimum (°C)	
20	24.9	14.4	17.8	22.8	61	47	47	4.4		6.4	E	8	WSW	11	ESE	30	22:51	Highest mean minimum (°C)	
21	30.9	17.8	23.1	30.4	42	23	23	13.6		9.2	ENE	18	ESE	17	E	39	05:53	Highest rainfall (mm)	
22	32.1	15.7	23.9	31.6	36	17	17	12.6		8.0	WSW	5	WSW	17	SW	28	14:21	Lowest rainfall (mm)	
23	33.3	17.5	25.1	32.4	30	9	9	12.7			CALM		SW	13	WSW	33	14:21	Comments, December 2011	
24	39.0	20.2	26.6	35.7	39	11	11	9.3			SSW	5	NNE	13	SW	24	18:23	Mean monthly temperature (Max+Min/2)	
25	29.9	22.3	24.6	26.2	64	47	47	8.4		22.4	N	11	SW	9	S	35	20:14	Highest wind gust during the month	
26	24.1	16.7	18.2	23.0	58	40	40	11.2		11.6	S	15	SW	24	SW	48	16:06	NNE 55 on 17th	
27	22.8	15.5	19.8	21.5	50	51	51	3.4			SSE	17	SE	13	W	31	13:08		
28	28.8	14.4	20.0	28.1	54	19	19	13.3			SE	8	WSW	21	SSE	37	15:36		
29	31.0	13.3	20.3	28.1	40	28	28	13.2		24.4	WNW	4	WSW	18	SW	35	16:36		
30	34.5	17.1	26.8	33.1	33	15	15	13.1		10.1	WNW	4	WSW	21	SW	35	13:40		
31	38.0	19.8	31.7	36.4	14	8	8				NE	13							
TOTAL	865.6	502.6	653.7	822.6	1436	986	986	276.9	18.2 on 5 days	201.8									
MEAN	27.9	16.3	21.1	26.5	46	32	32	9.2	23.8 on 7 days	10.1									
AVG**	27.0	15.6	20.4	25.3	52	38	38	9.5		6.8									

* Maximum temperatures are taken from 9am to 9am. **Long term average, currently 33 years in 2011
Climate Services Centre, Adelaide, South Australia. Phone 08 8366 2664 Fax 08 8366 2833

SOUTH AUSTRALIA'S WEATHER SUMMARY

DECEMBER 2011

Summary

- Maximum temperatures were up to 2°C above average at several locations across southern parts of South Australia.
- Rainfall was mostly above average across the State with several locations having their wettest December on record.

Rainfall

Rainfall across much of South Australia during December was well above average, with many locations receiving highest on record daily and monthly totals. The wettest periods for much of the State were between the 9th and 11th and between the 17th and 19th. Many locations recorded most of December's rainfall in the latter period, as a low pressure system and trough that had developed over the western border of South Australia moved over the State.

The highest December total rainfall in the State was observed at Cowell (Winter Springs) where 111.4 mm was recorded. The highest December daily rainfall total was recorded at Gluepot Reserve where 102 mm of rain was recorded on the 18th.

Pastoral Districts

Rainfall for December 2011 was mostly average across areas of the Pastorals, though tending to above average in the Northeast and the Northwest districts. Rainfall totals of 15 to 35mm were reported across the Northwest and Far North, while in the Northeast some locations recorded totals of more than 50 mm.

Agricultural Districts

Rainfall totals over the Eyre and Yorke Peninsulas, Flinders and Mount Lofty Ranges and Murray Valley districts were above average for December 2011, generally ranging between 30 to 50mm, with several locations recording their wettest December on record with totals in excess of 60mm. Rainfall was generally near average across the Adelaide Plains and parts of the Southeast of the State where totals ranged between 20 to 30mm.

Temperature

The mean temperature (the average of the daily maximum and daily minimum temperatures) for South Australia as a whole in December 2011 was 0.3 °C above than the long-term December average. In comparison, December 2010 was 0.5 °C cooler than average. Mean temperatures for December 2011 ranged from 17.1°C at Mount Lofty to 28.6°C at Oodnadatta Airport.

Maximum Temperature

The area-averaged mean maximum temperature for South Australia as a whole was 0.4°C above the long-term December average maximum temperature.

Average December maximum temperatures were close to 2°C below average across most of the Northern parts of the State, while coastal, central and southeast districts were 1 to 2°C warmer than average. Average maximum temperatures for the month ranged from 19.9 °C at Cape Willoughby to 36.1°C at Oodnadatta Airport in the Northeast.

The warmest period for many locations occurred in the last week of December, from the 24th through to 26th of December and again on the 31st. The hottest day of the month for any

location was recorded at Oodnadatta Airport on the 25th where the maximum temperature reached 44.9 °C. Mount Lofty had the coldest day on the 18th with a maximum of 14.8°C.

Minimum Temperature

The area-averaged mean minimum temperature for South Australia as a whole was 0.3°C above the long-term December average.

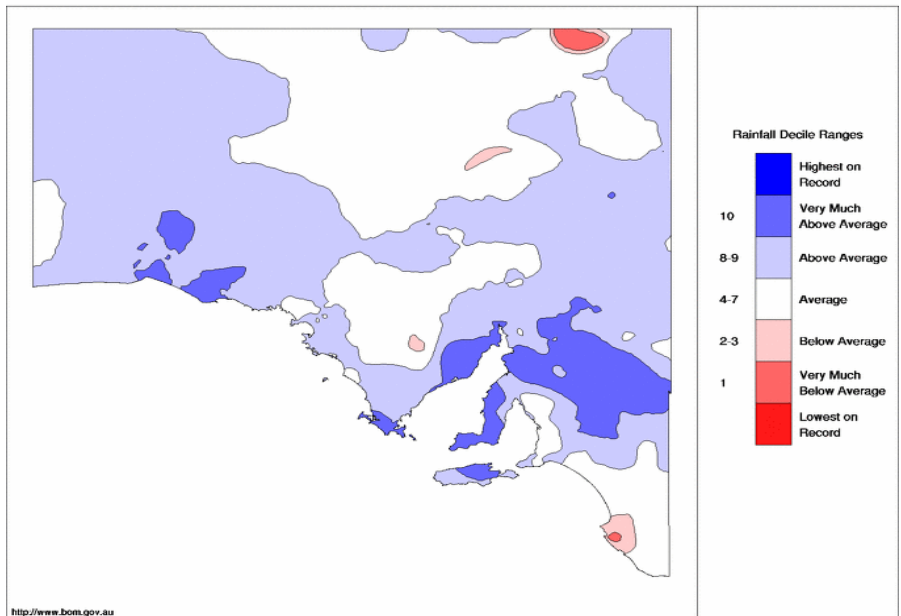
Mean minimum temperatures were generally up to 1°C cooler than average across most of the Northern parts of the State, while elsewhere, minimum temperatures were near 1°C warmer than average. Average minimum temperatures across the State ranged from 9.9°C at Naracoorte Aerodrome in the State's southeast to 21.1 °C at Oodnadatta Airport in the Northeast Pastoral district.

The coldest nights for many locations was between the 1st and 6th as a high pressure system moved across the south of the State. Naracoorte Aerodrome had the coldest night on December 5th with a minimum temperature of 2.4 °C. Another cold period, under the influence of another high pressure system in the Great Australian Bight, brought minimum temperatures down across several locations in the southeast districts on the 14th.

The warmest nights for many locations was around the 16th and 17th and again during the last week of December; both of these periods were associated with warm northerly winds being directed over much of the State ahead of low pressure trough. Andamooka recorded the warmest night of the month on the 25th with 29.3°C.

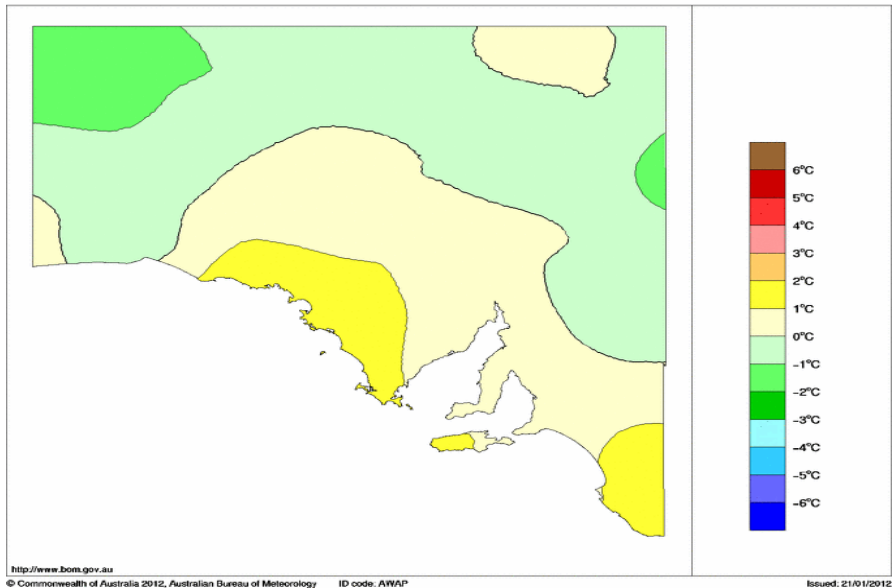
South Australian Rainfall Deciles December 2011

Distribution Based on Gridded Data
Product of the National Climate Centre



Maximum Temperature Anomaly (°C) December 2011

Product of the National Climate Centre



SOUTH AUSTRALIA'S

2011 ANNUAL CLIMATE SUMMARY

Summary

- South Australia had its 5th wettest year on record in 2011, with the state-wide area averaged total more than one and a half times the long-term annual average rainfall.
- Rainfall was above average across almost all of the state with much of northern South Australia receiving up to two to three times its annual average rainfall.
- Rainfall in the first 3 months of the year was record highest for South Australia, and remained above average generally until June when most months after that tended below average.
- Growing Season (April to October) rainfall in 2011 was below average across much of the agricultural districts, apart from Eyre Peninsula.
- Some locations had record highest daily rainfall amounts, mainly in the rainfall events early in 2011, while Tarcoola in the Northwest Pastoral area recorded its wettest years on record in 2011.
- In 2011 the mean temperature for South Australia as a whole was 20.0°C. This is 0.5°C warmer than the average temperature (using the standard climatological base period of 1961 to 1990).
- For Adelaide, temperatures were warmer than average, with the annual mean maximum temperature 0.5°C above average.
- Temperatures for the decade from 2002 to 2011 have been 0.7°C above average for South Australia as a whole.
- Despite significant rainfall in 2010 and 2011, rainfall in South Australia over the last decade has been below average across the agricultural areas, particularly in the eastern districts, but tending above average in the far west of the state.

Rainfall

With a near record strength La Niña event in place in the Pacific Ocean, the first 3 months of 2011 were the wettest on record since records begin in 1900, for South Australia as a whole. As the event finished in April, conditions became drier than average up until October. The development of another, much weaker La Niña event in November led to rainfall totals tending to be above average across much of the State through the remainder of the year.

The record wettest start to the year, and subsequent rainfall, resulted in South Australia recording its fifth wettest year on record following 1974, 1973, 2011 and 1992. Averaged across the whole of South Australia, rainfall in 2011 was 157% of the long term annual average. In comparison, 1974 had more than twice the annual average rainfall.

The growing season (April to October) broke for most, but not all, locations in the agricultural areas with significant rainfall towards the end of May, though with generally drier than average conditions through following months. Conditions in the Indian Ocean through late winter and spring contributed to drier than average rainfall through that period. Much of September was very dry, though a rain event late that month proved very beneficial to many areas in the agricultural districts. Overall, growing season rainfall across agricultural districts was below average being the driest since 2008.

Of interest is that many locations across South Australia have rainfall totals in 2011 quite close to what was recorded in 2010, though with very different distributions of rainfall. In 2011 the start of the year was above average for rainfall tending drier towards the end, whereas in 2010, the distribution of the rainfall through the year was the other way around.

The wettest overall station across South Australia in 2011 was Crafrers (Mount Lofty) with 1084.4mm, followed by 1034mm at Woodhouse, both in the Mount Lofty Ranges. Several stations broke daily rainfall records in 2011, most of which occurred in the first 3 months of 2011. The wettest single daily rainfall total was observed at Ernabella (Pukatja) in the Far Northwest, where 173.6mm of rain fell on February 7th. A large number of stations had record highest daily rainfall readings in 2011, mainly in the rainfall events in the first three months of the year. Tarcoola in the Northwest Pastoral district had its wettest year on record, totalling 379.8mm.

Adelaide (Kent Town) annual rainfall was 537.8 mm over 119 days, 12.7mm below the annual average of 550.5 mm (this average is calculated over all years of record, from 1978 to 2010). In 2010, Adelaide received 592.6 mm. The record highest annual rainfall for the complete Adelaide record is 883.2 mm in 1992 at the Kent Town site. This is across the combined Adelaide rainfall record (of both Kent Town and West Terrace) dating back to 1839.

Temperature

The mean temperature (the average of daytime maximum temperatures and overnight minimum temperatures) for South Australia for 2011 was 0.5°C above the 1961-1990 climatological average of 19.5°C. In comparison, 2010 was exactly on average, while 2009 was the warmest year on record with temperatures 1.3°C above average.

For the decade from 2001 to 2010, South Australian temperatures have averaged +0.7°C above the 1961-1990 mean temperature, reflecting what has generally been a steady rise in annual temperatures for South Australia since the 1970's.

Adelaide (Kent Town) in 2011 had an annual mean temperature of 17.6°C, 0.4°C above the average of 17.2°C, slightly warmer than 2010 with an annual mean temperature of 17.5°C.

Maximum

The annual maximum temperature across the State for 2011 was 0.5°C above the average of 26.7°C. The warmest year on record for maximum temperatures across the state as a whole is 2007 and the coldest was in 1956. Maximum temperatures averaged across the year, were up to 1.0°C above average across central and eastern parts of the State, and about 0.5°C cooler in the far west.

Both Woomera Aerodrome and Leigh Creek Airport recorded highest daily maximum temperatures on record, respectively reaching 48.1°C and 46.1°C on January 25th as a slow moving trough of low pressure extended from the Northwest of the State. Despite maximum temperatures during January being 2°C to 4°C above normal in the northern and central parts of the State, the first 3 months of 2011 were generally cooler than average across South Australia, due to cooler conditions associated with widespread record breaking rainfall events. Maximum temperatures across the State were then generally near average, tending to warmer than average from May through to September, coinciding with below average growing season rainfall. The year finished with maximum temperatures being below average across much of northern South Australia from October onwards.

Adelaide's annual maximum temperature for 2011 was 22.7°C, which is 0.4°C above the long-term average of 22.3°C. The warmest year on record at for maximum temperatures in Adelaide was 2007 where the mean maximum temperature was 23.7°C. Moomba Airport in the far Northeast District, was the overall warmest location for 2011, with an average maximum temperature of 29.6°C. The coolest annual maximum in the State was 17.6°C at Parawa (Second Valley Forest). The hottest day in 2011 of 48.5°C was recorded at Roxby Downs (Olympic Dam Aerodrome) on January 25th 2011, with the coldest day recorded being on the 12th of July when Mount Lofty reported 5.8°C.

Minimum

The minimum temperature averaged across the state for 2011 was 0.6°C above the long-term of 12.2°C. Warmer night-time temperatures are also consistent with historical patterns, with high rainfall years having increased cloud cover resulting in typically warmer than average nights. 2009 was the warmest year on record for minimum temperatures across the state as a whole, being 1.2°C above average.

Adelaide had an annual mean minimum temperature of 12.9°C, which is 0.7°C above the long-term average for the Adelaide (Kent Town) site of 12.2°C. The warmest year for overnight temperatures was in 1973 where the mean minimum temperature was 13.5°C at West Terrace. The coldest night recorded in 2011 was -5.5°C at Gluepot Reserve on the 22nd of July. The coolest overnight minimum temperatures were recorded at Yongala where the annual average overnight minimum temperature was 7.8°C. The warmest minimum temperatures annually were 15.2°C at Oodnadatta Airport. The warmest night was on the 28th of January when the overnight minimum was 34.2°C at Oodnadatta Airport.

Significant Weather

Severe Weather summary for 2011:

On January 8th a trough which had developed over the State deepened into a low pressure system resulting in heavy rainfall and flooding in the State's east. 19 locations received record highest January daily rainfall totals associated with this system, the highest being 106.2 mm at Taldra in the Upper Murray Valley.

During the first week of February, a trough of low pressure with embedded thunderstorms moved across the State, as the remnants of tropical cyclone Yasi moved across the north of the State. The resulting high moisture levels and atmospheric instability produced heavy rain, thunderstorms and flash flooding across the northwest parts of the State. Ernabella received 174 mm of rainfall in 24 hours on the 6th. Later in the month, a low pressure system over Central districts produced heavy rain resulting in flash flooding in that area.

In early March, the remnants of a tropical low and a trough in the west produced broad areas of heavy rain with severe thunderstorms and flash flooding across the State; significant 24 hour rainfall totals include 134 mm at Kalamurina and 170 mm at Dulkaninna. Severe thunderstorms developed in the north of state on the 18th, deepening to produce heavy rain through to the 20th. Localised flooding was reported at several locations across the Yorke Peninsula.

An intense low pressure system in late May and high astronomical tides resulted in unusually high sea-level in both South Australian Gulfs, with storm surge flooding and some minor damage at several coastal locations.

Significant damage was reported on June 20th and ~10,000 homes were left without power following the passage of a pre-frontal trough and an intense low pressure system. Severe wind gusts were reported across the south of the state at several locations, with suspected tornado activity at Robe. In the first week of July, a low pressure system and trough saw severe winds, hail and thunderstorms across southern parts of the State. Later in July, gale-force winds associated with a low pressure trough brought down trees and power lines about the Adelaide Hills.

Severe winds around a deep low pressure system crossing the State's southeast saw reports of trees down and storm damage at Millicent in the southeast on August 17. On the 18th and 19th of September a strong cold front produced severe winds, while on the 28th, a pre-frontal trough ahead of a significant cold front produced thunderstorm activity and severe winds, with reports of trees down around Port Augusta and in the Mid North. On October 28, a trough moving across the State triggered severe thunderstorms about the North West Pastoral and eastern districts, and a tornado was reported at Winke in the Riverland causing damage to property and vegetation.

On November 8th, severe thunderstorms in the North West Pastoral region intensified into a meso-scale convective system, producing damaging wind gusts and local flash flooding. Severe wind gusts up to 120km/h were recorded at several sites, and power outages occurred with a tornado sighted in the Riverland, and golf ball sized hail reported at Gluepot and Waikerie.

On December 17th and 18th a deepening low pressure system and trough triggered large areas of rain and thunderstorm activity across central and eastern South Australia, with heavy rainfall, strong winds and golf ball sized hail causing damage on Yorke and Eyre Peninsulas, and in the Mid North and Riverland. Gluepot in the North East Pastoral district reported 102mm in 24 hours.



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Hon Sec - Email: d.ray@bom.gov.au

NEXT MEETING

5.30pm Monday 20th February 2012

Venue: South Australian Regional Office of the Bureau of Meteorology 25 College Road Kent Town 5:30pm

Subject: 'The Next Generation weather and warnings forecasting system in South Australia'

Learn about the new BoM Next Gen weather forecasting and warning system, a major innovation in the way weather forecasts and warnings are produced in South Australia, and weather permitting, take a guided tour of the Regional Forecasting Centre.

Join us for a fascinating look behind the daily forecasting service.

Friends are welcome so please feel free to invite others along.

*We look forward to seeing you.
For further information contact*

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<i>Phone</i>	<i>8302 3045</i>

Inquiries or suggestions, please contact the Secretary on the phone number listed above.