Australian Meteorological and Oceanographic Journal 58 (2009) 199-208

Seasonal climate summary southern hemisphere (spring 2008): La Niña pattern returning across the equatorial Pacific

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(Manuscript received August 2009)

Southern hemisphere circulation patterns and associated anomalies for the austral spring 2008 are reviewed, with emphasis given to the Pacific Basin climate indicators and Australian rainfall and temperature patterns. During spring 2008, the tropical Pacific showed some characteristics of a La Niña development. Sea-surface temperatures were below the long-term average across the central equatorial Pacific. Subsurface waters showed a large volume of cooler-than-average water stretching from the central to eastern Pacific. Over the western parts of the central Pacific, the trade winds were enhanced. The Southern Oscillation Index (SOI) was persistently positive. Nationally the seasonal maximum and minimum temperatures were generally above average. The Indian Ocean Dipole and the Southern Annular Mode were both in their positive phases, with rainfall generally below normal across southeastern Australia.

Introduction

This summary reviews the southern hemisphere and equatorial climate patterns for spring 2008, with particular attention given to the Australasian and Pacific regions. The main sources of information for this report are analyses prepared by the Bureau of Meteorology's National Climate Centre and the Centre for Australian Weather and Climate Research (CAWCR).

Pacific Basin climate indices

The Troup Southern Oscillation Index

The Troup Southern Oscillation Index (Troup 1965) is calculated from the standardised difference between the mean sea-level pressure (MSLP) between Tahiti and Darwin, and the SOI used in this article is ten times the standardised monthly anomaly of the difference in MSLP between Tahiti and Darwin. The Tahiti MSLP data are provided by Météo France interregional direction for French Polynesia.

Figure 1 shows the SOI values from January 2004 to November 2008, together with a five-month weighted moving average. The means and standard deviations used in Fig. 1 are based on a sixty-year climatology (1933-1992). The positive values of the SOI starting from August 2007 continued through to the end of spring 2008, with only one exception (–4.3 in May 2008). Monthly values for the season were +14.1 (September), +13.4 (October) and +17.1 (November), resulting in a seasonal value of +14.9.

The positive SOI values were largely the result of above average MSLP at Tahiti, while the MSLP at Darwin fluctuated around climatology in September, October and November 2008. For these three months, the MSLP anomalies at Darwin were –0.3, +0.3 and –0.7 hPa, respectively; at Tahiti, the anomalies were +2.0, +2.5 and +1.9 hPa, respectively.

A composite monthly El Niño-Southern Oscillation (ENSO) index, which is calculated as the standardised amplitude of the first principal component[1] of five variables (5VAR): monthly MSLP[2] at Darwin and Tahiti, and monthly NINO3, NINO3.4

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[1] The principal component analysis and standardisation of this ENSO index is performed over the period 1950-1999.

[2] Obtained from http://www.bom.gov.au/climate/current/soihtm1.shtml . As with the SOI calculation, the Tahiti MSLP data are provided by Météo France interregional direction for French Polynesia.

Fig. 1 Southern Oscillation Index, from January 2004 to November 2008, together with a five-month binomially weighted moving average. Means and standard deviations used in the computation of the SOI are based on the period 1933-1992.

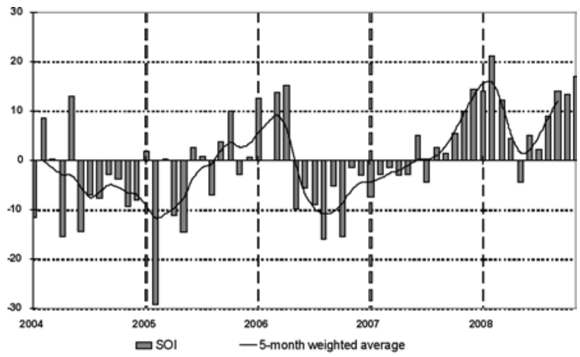
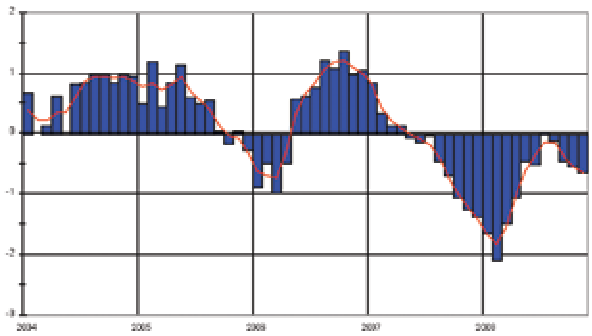


Fig. 2 Composite standardised monthly ENSO index from January 2004 to November 2008, together with a three-month moving average. See text for details.



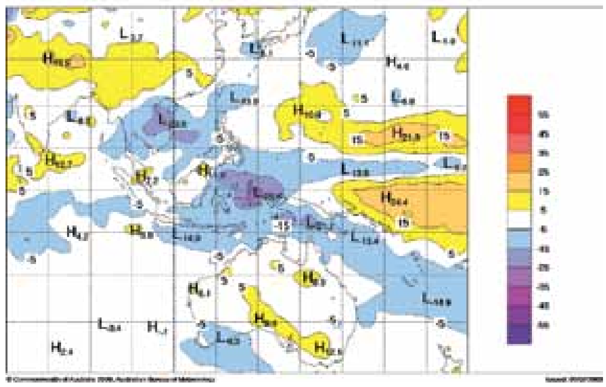
and NINO4 sea-surface temperatures (SSTs)[3] (Kuleshov et al. 2008), was consistent with the SOI variation during this season, and remained negative mostly from May 2007 to November 2008, except for July 2008 (+0.03). Monthly values of the index in this season were –0.46 (September), –0.52 (October) and –0.64 (November), respectively.

The September-October and October-November values of the Climate Diagnostics Center (CDC) bi-monthly Multivariate ENSO Index (MEI[4]; Wolter and Timlin 1993, 1998) were –0.739 and –0.563, respectively. The MEI was consistently negative from July-August 2008 to October-November 2008 after the end of the 2007/08 La Niña. The consistent information from the SOI, 5VAR and MEI indicated a returning La Niña event.

[3] Obtained from ftp://ftp.cpc.ncep.noaa.gov/wd52dg/data/indices/sstoi.indices .

[4] Obtained from http://www.cdc.noaa.gov/people/klaus.wolter/MEI/table.html. The MEI is a standardised anomaly index.

Fig. 3 OLR anomalies for spring 2008 (W m^{-2}). Base period 1979 to 1998. The mapped region extends from 40°S to 40°N and 70°E to 180°E.



Outgoing long-wave radiation

The Climate Prediction Center, Washington, computes a standardised monthly anomaly[5] of outgoing long-wave radiation (OLR) for an equatorial region ranging from 5°S to 5°N and 160°E to 160°W (not shown). Tropical deep convection in this region is particularly sensitive to changes in the phase of the Southern Oscillation. During El Niño events, convection is generally enhanced, resulting in a reduction in OLR. This reduction is due to the lower effective black-body temperature and is associated with increased high cloud and deep convection. The reverse applies in La Niña events, with less convection in the vicinity of the date-line (and consequently, positive anomalous OLR). Monthly standardised values for the season were +0.3 (September), +1.1 (October) and +1.2 (November), respectively, showing a rising OLR trend through the season.

Figure 3 shows the seasonal OLR anomalies for the Asia-Pacific region between 40°N and 40°S. Positive anomalies were found over the equatorial Pacific from eastern Papua New Guinea to the date-line, consistent with La Niña features. The maximum OLR anomaly over that region was 24.4 W m^{-2}. A negative OLR anomaly zone, with a minimum centre of –26.8 W m^{-2} at about 130°E over the equator, extended south-eastward from Indonesia to the areas around New Caledonia.

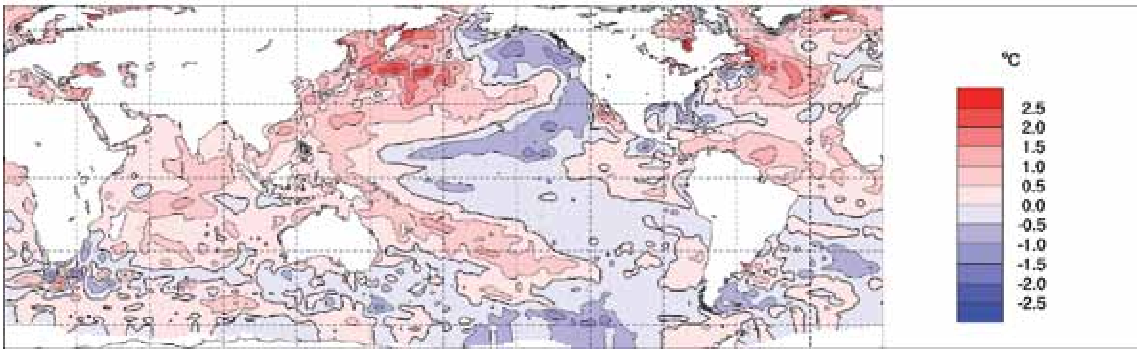
Oceanic patterns

Sea-surface temperatures

Figure 4 shows spring 2008 sea-surface temperature (SST) anomalies in degrees Celsius (°C). These have been obtained from the US National Oceanic and Atmospheric Administration (NOAA) Optimum Interpolation analyses (Reynolds et al. 2002). The base period is 1961-1990. The seasonal pattern of SST anomalies in the tropical Pacific Ocean was characterised by a weak La Niña pattern. The positive anomalies in

[5] Obtained from http://www.cpc.ncep.noaa.gov/data/indices/olr

Fig. 4 Anomalies of SST for spring 2008 (°C). The contour interval is 0.5°C.



the eastern equatorial Pacific were considerably weaker than those of winter (Fawcett 2009), surrounded by a pattern of negative anomalies. The anomalous warmth of the Coral Sea may have contributed to above average rainfall in northern New South Wales and southern Queensland (see the rainfall discussion for the Australian region in the next section).

The SST anomaly indices[6] for the NINO3 region were +0.35 (September), +0.01 (October) and –0.09 (November), those for the NINO3.4 region –0.16 (September), –0.28 (October) and –0.20 (November), and those for the NINO4 region –0.26 (September), –0.12 (October) and –0.30 (November). These values are consistent with the equatorial pattern of the SST anomalies shown in Fig. 4.

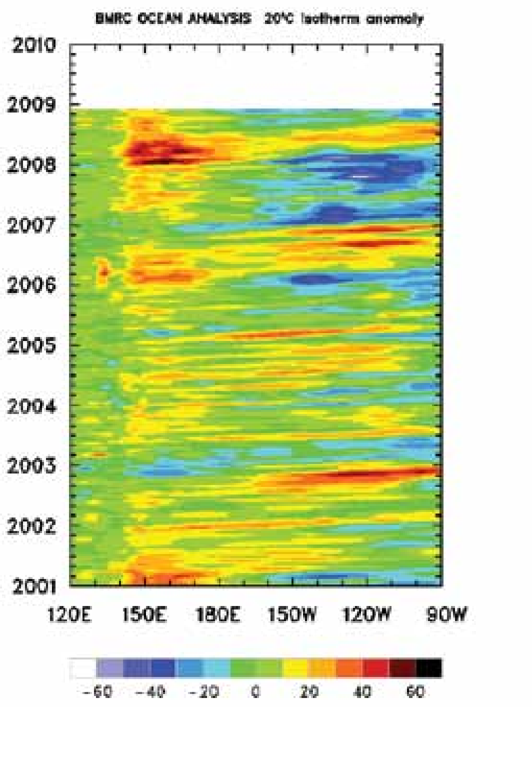
In the Australian region, SSTs were generally warmer than average around the continent during spring 2008, in particular over the northern part. Indian Ocean SSTs were warmer than average over most areas of the basin, with a maximum located in the central area of the ocean (at about 75°E). The waters close to the east coast of Africa were warming up quickly when compared with winter 2008 (Fawcett 2009). The monthly Indian Ocean Dipole (IOD) index[7] of Saji et al. (1999) was still in the positive phase but getting weaker than in winter 2008.

Subsurface patterns

The Hovmöller diagram from January 2001 to November 2008 for the 20°C isotherm depth anomaly across the equator (obtained from CAWCR) is shown in Fig. 5. The 20°C isotherm is generally situated close to the equatorial thermocline, the region of greatest temperature gradient with depth and the boundary between the warm near-surface and cold deep-ocean waters. Positive anomalies correspond to the 20°C isotherm being deeper than average, and negative anomalies to it being shallower than average. Changes in the thermocline depth may act as a precursor to subsequent changes at the surface.

During spring 2008 the positive anomalies west of the date-line weakened significantly when compared with their strengths during summer, autumn and winter 2008. To the east of the date-line, negative anomalies dominated the equatorial Pacific, with signs that they were intensifying. The strengthening negative anomalies of the 20°C isotherm depth are also supported by Fig. 6, which shows a vertical cross-section of equatorial subsurface temperature anomalies from August to November 2008. In November, subsurface waters showed a large volume of cooler than average water stretching from the central to the eastern Pacific.

Fig. 5 Time-longitude section of the monthly anomalous depth of the 20°C isotherm at the equator for January 2001 to November 2008. The contour interval is 10 m.



[6] As before, obtained from ftp://ftp.cpc.ncep.noaa.gov/wd52dg/data/indices/sstoi.indices. All anomaly values in °C and calculated with respect to the base period 1961-1990.

[7] Obtained from http://www.jamstec.go.jp/frcgc/research/d1/iod/DATA/dmi_HadISST.txt, and consisting of monthly values from 1958 to 2008, derived from the HadISST data-set.

Fig. 6 Four-month August to November 2008 sequence of vertical temperature anomalies at the equator for the Pacific Ocean. The contour interval is 0.5°C.

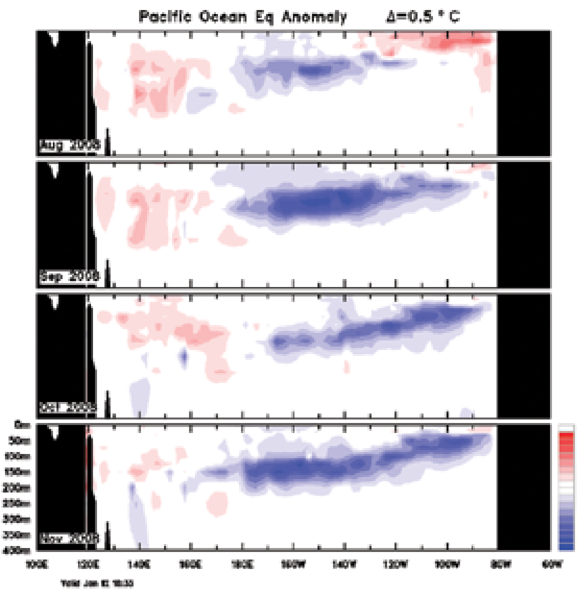


Fig. 7 Spring 2008 MSLP (hPa).

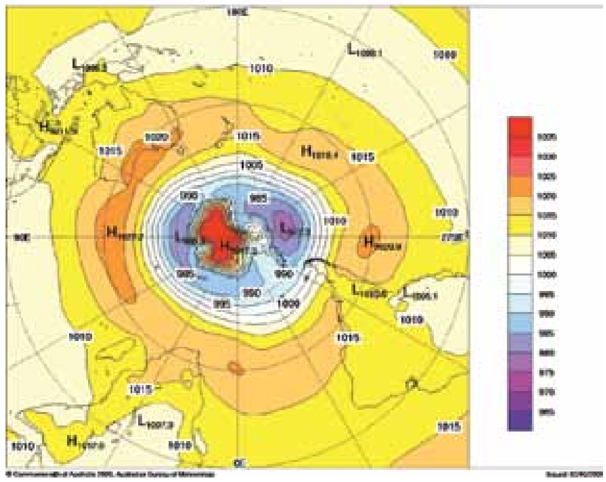
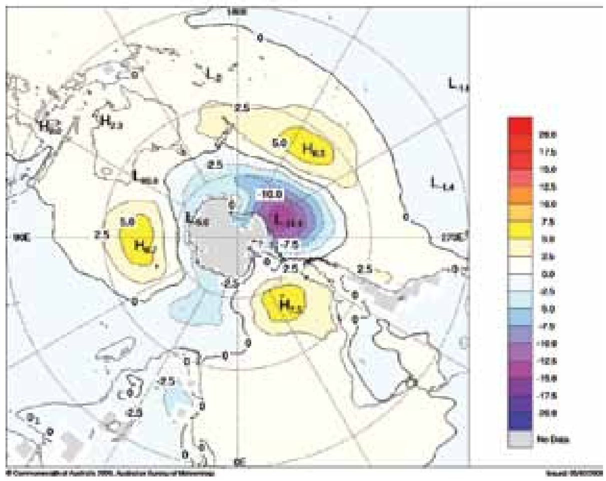


Fig. 8 Spring 2008 MSLP anomalies (hPa).



Atmospheric patterns

Surface analyses

The spring 2008 mean sea-level pressure (MSLP) field, computed by the Bureau of Meteorology's Global Assimilation and Prognosis (GASP) model, is shown in Fig. 7, and the associated anomaly pattern in Fig. 8. These anomalies are the difference from a 1979-2000 climatology obtained from the National Centers for Environmental Prediction (NCEP) II Reanalysis data (Kanamitsu et al. 2002). The MSLP analysis has been computed using data from the 0000 UTC daily analyses of the GASP model. The MSLP anomaly field is not shown over areas of elevated topography (grey shading). Figure 7 shows there was a major minimum centre (977.3 hPa) in a polar trough around the Antarctic continent, located at around 110°W, with another less intense centre at about 90°E. The subtropical ridge was observed across a large area from the middle of the South Indian Ocean to southern Australia.

From the MSLP anomaly field (Fig. 8), it was found that the major minimum centre at about 110°W was noticeably stronger than the average, with a negative anomaly value of –14.4 hPa. The subtropical ridge was also stronger than the average, in particular over the South Indian Ocean (about 90°E) and the Southern Pacific Ocean (around 135°W), while over southern Australia it was close to normal strength. The negative anomalies were mostly found in areas close to the coast of Antarctica. In general, the features of the MSLP distribution suggest a positive mode of the Southern Annular Mode (SAM).

The monthly SAM index[8] was noticeably positive during spring 2008, though in the last two months of the season, it showed a declining trend. The SAM index was 1.39, 1.21 and 0.92 in September, October and November, respectively.

Mid-tropospheric analyses

The 500 hPa geopotential height (an indicator of the steering of surface synoptic systems) across the southern hemisphere is shown in Fig. 9, with the associated anomalies shown in Fig. 10. In general, the field of geopotential height at 500 hPa level appeared quite zonal, although a weak three-wave pattern could be found when examining carefully. There was a slight divergence in the seasonal flow from the Tasman Sea to New Zealand. The seasonal anomaly pattern (Fig. 10) is consistent with the MSLP anomaly field shown in Fig. 8, with the major minimum centre (–146 gpm) at about 110°W and three

[8] Obtained from http://www.cpc.noaa.gov/products/precip/CWlink/daily_ao_index/aao/monthly.aao.index.b79.current.ascii.table, and derived from daily 700 hPa height anomalies south of 20°S.

Fig. 9 Spring 2008 500 hPa mean geopotential height (gpm).

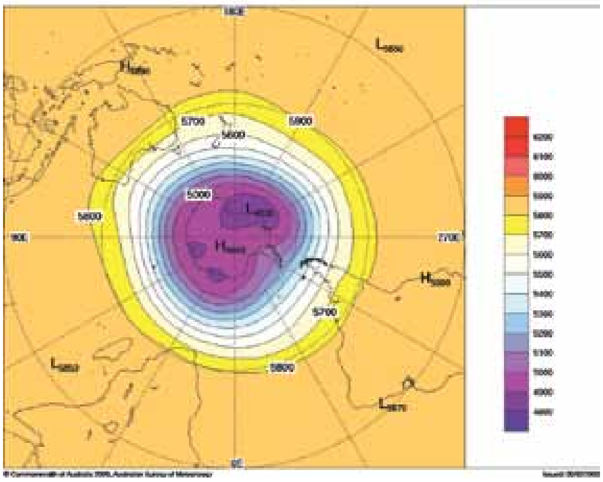
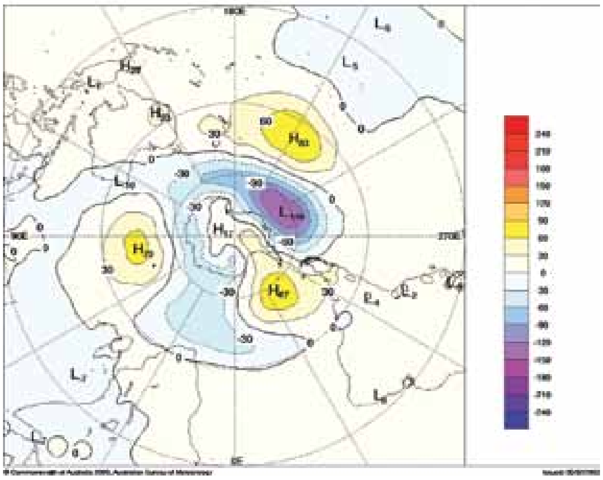


Fig. 10 Spring 2008 500 hPa mean geopotential height anomalies (gpm).



maximum centres at 90°E (+70 gpm), 40°W (+87 gpm) and 150°W (+83gpm). Positive anomalies were dominant over Australia except for the southwest areas of the continent.

Blocking

The time-longitude section of the daily southern hemisphere blocking index (BI[9]) is shown in Fig. 11, with the start of the season at the top of the figure. This index is a measure of the strength of the zonal 500 hPa flow in the mid-latitudes (40°S to 50°S) relative to that of the subtropical (25°S to 30°S) and high (55°S to 60°S) latitudes. Positive values of the blocking index are generally associated with a split in the mid-latitude westerly flow centred near 45°S and mid-latitude blocking activity.

[9] The blocking index is defined as $BI = 0.5\ [(u_{25} + u_{30} - (u_{40} + 2\ u_{45} + u_{50}) + u_{55} + u_{60}]$, where u_x is the westerly component of the 500 hPa wind at latitude x.

Fig. 11 Spring 2008 daily southern hemisphere blocking index (m s^{-1}) time-longitude section. The horizontal axis shows degrees east of the Greenwich meridian. Day one is 1 September.

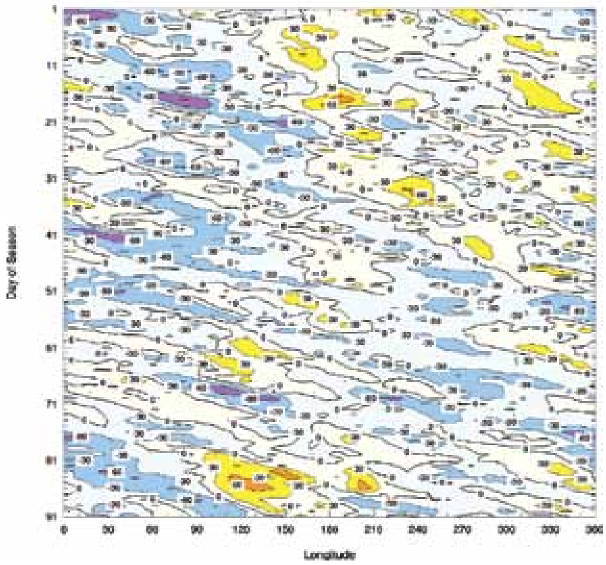
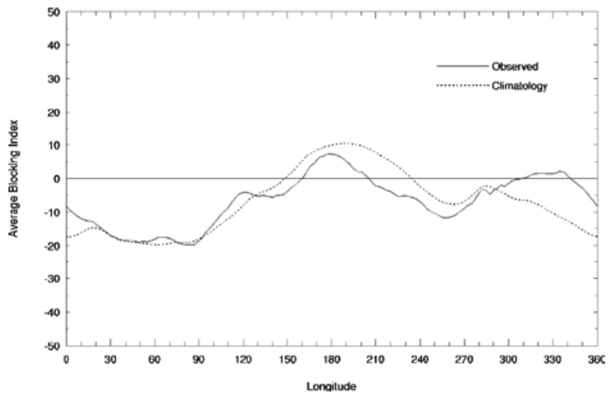


Fig. 12 Mean southern hemisphere blocking index BI (m s^{-1}) for spring 2008 (solid line). The dashed line shows the corresponding long-term average. The horizontal axis shows degrees east of the Greenwich meridian.



A few strong blocking episodes were observed during spring 2008 (Fig. 11). Blocking was observed around the dateline for the second and third weeks of September. The next event was centred on 120°W, and started in the first week of October, though was relatively weak in comparison with the first event. A large and strong blocking event centred around 130°E occurred in the third and fourth weeks of November. Figure 12, which shows the seasonal average BI for each longitude, indicates that blocking was around the average from about 20°E to 130°E, while two areas showed notable anomalies: below average in the regions from about 130°E to 70°W, and above average from about 70°W to 20°E, respectively. The peak BI values were located around 170°W.

Winds

Spring 2008 low-level (850 hPa) and upper-level (200 hPa) wind anomalies from the 22-year NCEP II climatology are shown in Figures 13 and 14 respectively. Isotach contours are at 5 m s^{-1} intervals, and in Fig. 13, regions where the surface rises above the 850 hPa level are shaded grey.

At the 850 hPa level, the wind anomalies generally reflected the MSLP anomalies (Fig. 8), and were quite small across most of the South Pacific, while there were two maximum centres over the eastern South Indian Ocean: one close to the equator (4.2 m s^{-1}), and the other to the southwest of Western Australia (3.7 m s^{-1}). Over the western and central parts of the equatorial Pacific, low-level easterlies were enhanced, while southwesterly anomalies were found over the eastern part. For the Australian region, northerly anomalies dominated inland areas.

At the 200 hPa level (Fig. 14), strong westerly anomalies (with a central maximum value of 9.3 m s^{-1}) were found throughout the equatorial Pacific, in particular over the western and central parts. Such a pattern is indicative of the strengthening of the Walker Circulation, and hence the development of a La Niña event. A cyclonic anomaly pattern was located over the Coral Sea, to the southeast of which there was an anticyclonic anomaly over the central Southern Pacific. Over the Southern Indian Ocean, a broad anticyclonic anomaly was identified across Madagascar to the high latitude areas of the central Southern Indian Ocean, and a cyclonic anomaly pattern was found to the southwest of Western Australia.

Australian region

Rainfall

Figure 15 shows the spring rainfall totals for Australia, while Fig. 16 shows the spring rainfall deciles, where the deciles are calculated with respect to gridded rainfall data for all springs from 1900 to 2008.

Spring rainfall patterns (Fig. 15) showed an uneven distribution across Australia. In general, rainfall amounts increased from the west to east, with maximum centres located over the southeast of Queensland and northeastern New South Wales as well as western Tasmania. There were large areas of very much below average (decile 1) rainfall across southeastern South Australia and southwestern Victoria (Fig. 16), while large contiguous areas of average to above average rainfall were found across most other areas, in particular over central and southern Western Australia where rainfall in a few small areas was the highest on record. In area-averaged terms, rainfalls are ranked from the lowest to highest in Table 1. Nationally, spring 2008 was ranked the 91st out of 109 years (1900 to 2008) of record, well above median, with area-averaged rainfall of 93.4 mm. Western Australia experienced its ninth highest spring rainfall (66.3 mm) on record, in contrast to the droughts in southeastern Australia that contributed to a State-wide average in Victoria which ranked the 16th driest of 109 years of record.

Drought

At the end of spring 2008, 2.9% of Australia was in serious rainfall deficiency (decile 1) for the three months in spring

Fig. 13 Spring 2008 850 hPa vector wind anomalies (m s^{-1}).

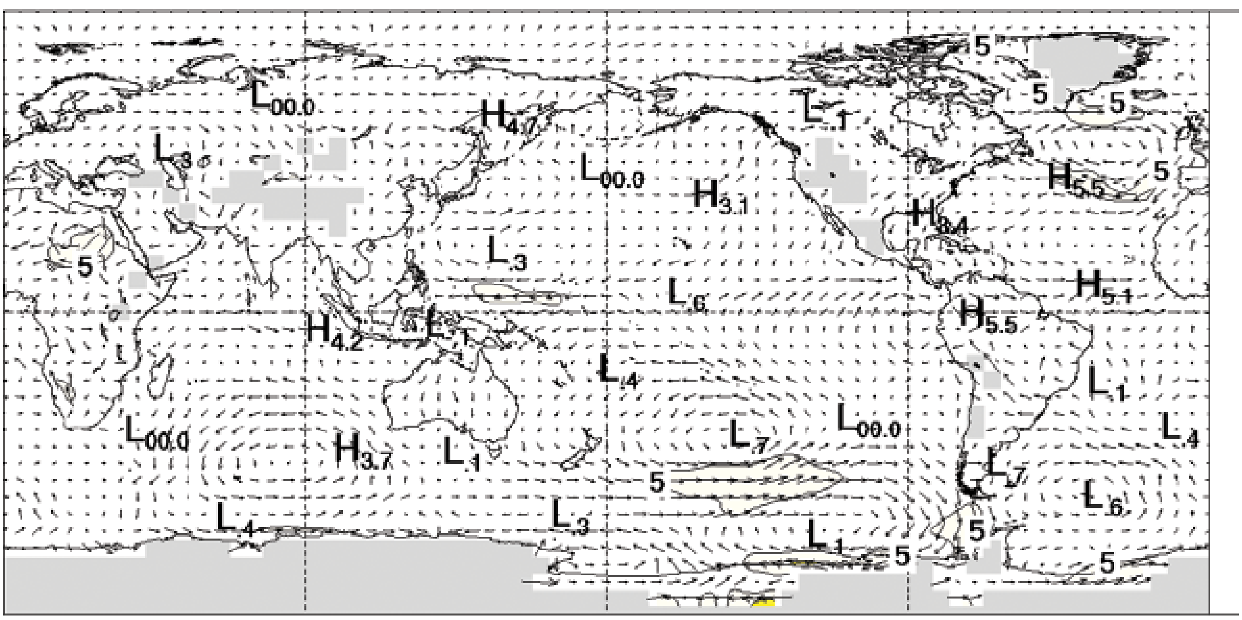


Fig. 14 Spring 2008 200 hPa vector wind anomalies (m s^{-1}).

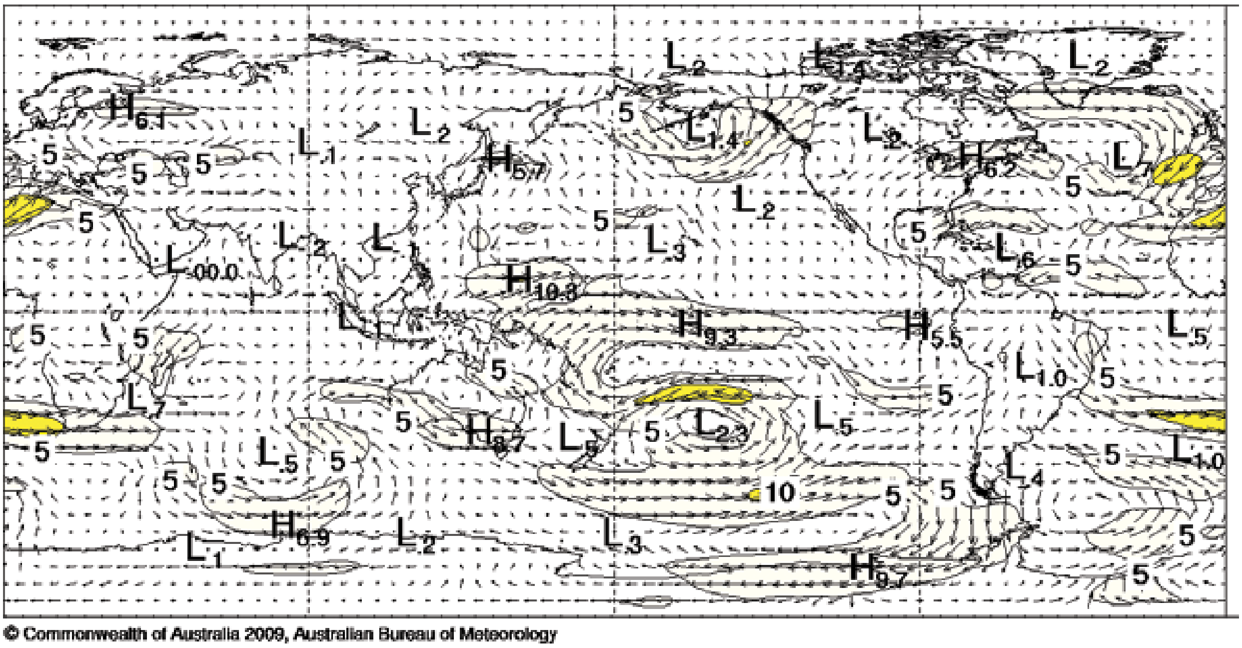


Fig. 15 Spring 2008 rainfall totals (mm) for Australia.

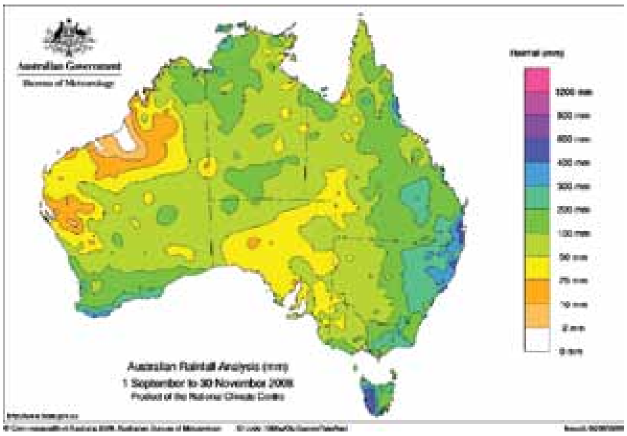
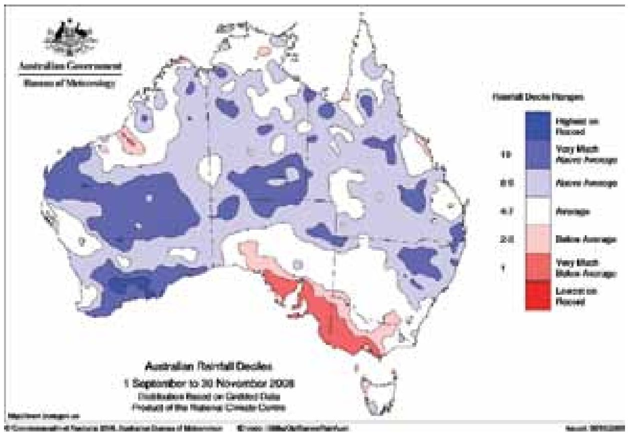


Fig. 16 Spring 2008 rainfall deciles for Australia: decile ranges based on grid-point values over the springs 1900 to 2008.



2008. This area mainly comprised Victoria (39.4%), together with adjacent parts of southern South Australia (12.6%). For the same period of time, 4.5% of the country was in decile 1 or decile 2 of rainfall.

For longer drought assessment periods, the total national area in serious rainfall deficiency was more than the local temporal maximum mentioned above, with a temporal maximum at a period length of 17 months for the period ending November 2008, in which 11.6% of Australia was in serious rainfall deficiency. For local temporal maxima in States and Territories, the main regions affected were Tasmania (65.1%) and South Australia (41.6%), both for a period length of 18 months, and Victoria (61.2%) at a period length of 16 months.

Temperatures

Figures 17 and 18 show the maximum and minimum temperature anomalies, respectively, for spring 2008. The anomalies have been calculated with respect to the 1961-1990 period, and use all temperature-observing stations for which a 1961-1990 normal is available. A high-quality subset of the

Table 1. Summary of the seasonal rainfall ranks and extremes on a national and State basis for spring 2008.

	Highest seasonal total (mm)	*Lowest seasonal total (mm)*	*Highest 24 hour fall (mm)*	*Area-averaged rainfall (AAR) (mm)*	*Rank of AAR**
Australia	1238 at Bellenden Ker Top Station (Qld)	Zero at several locations in WA	250 at Rosewood (Qld), 20 November	93.4	91
WA	492 at Weraroa	Zero at several locations	138 at Emma Gorge, 15 November	66.3	101
NT	320 at Darwin River Dam	4 at Ngayawili	116 at Palm Valley, 16 November	93.8	92
SA	151 at Amata Airstrip	12 at McDouall Peak	76 at Amata Airstrip, 17 November	49.1	62
QLD	1238 at Bellenden Ker Top Station	7 at Mt Dangar, Moss Vale and Lotus Vale	250 at Rosewood, 20 November	116.5	90
NSW	809 at Tweed Heads	23 at Monolon	235 at Tweed Heads, 27 November	153.6	77
VIC	413 at Rocky Valley	22 at Ailsa	142 at Bullumwaal, 23 November	117.9	16
TAS	885 at Strathgordon	84 at Darlington	103 at Breona, 8 November	351.4	49

* The rank goes from 1 (lowest) to 109 (highest) and is calculated over the years 1900 to 2008 inclusive.

network is used to calculate the spatial averages and rankings shown in Tables 2 and 3. These averages are available from 1950 to the present. All ranking of the spring 2008 temperatures against the historical record is done in terms of this high-quality subset.

Seasonal maximum temperatures (Fig. 17) were above average across most of the country, with the notable exception being across central to southwestern Western Australia and two small areas in Queensland, as well as the northwest corner of Tasmania, where seasonal maximum temperatures were below average. In area-averaged terms (Table 2) spring 2008 was nationally ranked as the eleventh highest out of 59 years of record, with a maximum-temperature anomaly of +0.85°C with respect to the 1961 to 1990 period. All States and Territories experienced positive anomalies. The Northern Territory reached the fifth highest positive anomaly on record. As in winter 2008 (Fawcett 2009), maximum temperatures were generally above average across most of the country; however, the areas which were below average were much smaller in spring 2008. Nationally the highest seasonal mean temperature was 40.1°C at Fitzroy Crossing in Western Australia, and the lowest was 7.2°C at Mt Read in Tasmania. The highest daily temperature during spring 2008 was 45.2°C, recorded at Argyle in Western Australia on 22 November, and the lowest was –2.4°C at Thredbo Top Station in New South Wales on 16 September.

Seasonal minimum temperatures for spring 2008 (Fig. 18) were generally above average across most northern and central areas of the country by between 1°C and 3°C. In contrast, seasonal minimum temperatures were below average in some small areas of southern Western Australia and southern South Australia, much of Victoria, the southwestern corner of Tasmania, and small areas of New South Wales and Queensland.

Consistent with the maximum temperature anomaly, the minimum temperature anomaly for the country (+1.01°C) was the fourth highest positive anomaly on record (Table 3),

Fig. 17 Spring 2008 maximum temperature anomalies (°C) for Australia.

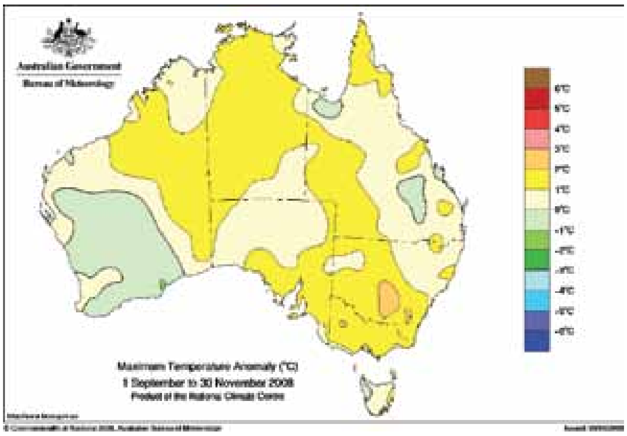


Fig. 18 Spring 2008 minimum temperature anomalies (°C) for Australia.

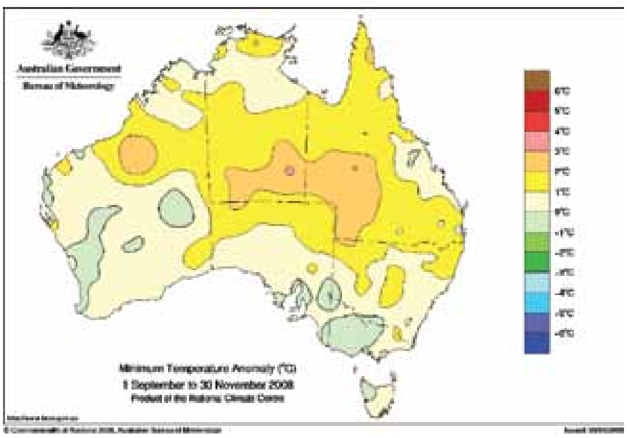


Table 2. Summary of the seasonal maximum temperature ranks and extremes on a national and State basis for spring 2008.

	Highest seasonal mean (°C)	*Lowest seasonal mean (°C)*	*Highest daily recording (°C)*	*Lowest daily recording (°C)*	*Anomaly of area-averaged mean (°C) (AAM)*	*Rank of AAM **
Australia	40.1 at Fitzroy Crossing (WA)	7.2 at Mt Read (Tas)	45.2 at Argyle (WA), 22 November	–2.4 at Thredbo Top Station (NSW), 16 September	+0.85	49
WA	40.1 at Fitzroy Crossing	17.8 at Shannon	45.2 at Argyle, 22 November	9.4 at Katanning, 21 September	+0.31	33
NT	38.9 at Bradshaw	30.8 at Dum In Mirrie	45.0 at Elliott, 22 and 23 November	16.7 at Arltunga, 23 September	+1.19	55
SA	30.4 at Oodnadatta	15.2 at Mount Lofty	42.9 at Oodnadatta, 27 November	6.1 at Mt Lofty, 15 September	+1.24	52
QLD	38.2 at Century Mine	22.6 at Applethorpe	43.8 at Birdsville, 30 October	11.9 at Applethorpe, 6 September	+0.87	50
NSW	29.6 at Wanaaring	8.4 at Thredbo Top Station	41.2 at Menindee 30 October	–2.4 at Thredbo Top Station, 16 September	+1.26	51
VIC	25.1 at Mildura	7.7 at Mt Hotham	38.9 at Mildura, 30 October	–1.4 at Mt Hotham, 16 September	+1.57	56
TAS	18.7 at Campania	7.2 at Mt Read	32.3 at Friendly Beaches, 27 October	–1.4 at Mt Wellington, 16 September	+0.39	39

*The temperature ranks go from 1 (lowest) to 59 (highest) and are calculated over the years 1950 to 2008 inclusive.

Table 3. Summary of the seasonal minimum temperature ranks and extremes on a national and State basis for spring 2008.

	Highest seasonal mean (°C)	*Lowest seasonal mean (°C)*	*Highest daily recording (°C)*	*Lowest daily recording (°C)*	*Anomaly of area-averaged mean (°C) (AAM)*	*Rank of AAM **
Australia	26.7 at Troughton Island (WA)	0.0 at Mt Wellington (Tas)	32.6 at Bedourie (Qld), 28 November	–12.0 at Charlotte Pass (NSW), 9 September and at Perisher Valley (NSW), 17 September	+1.01	56
WA	26.7 at Troughton Island	6.7 at Wandering	31.5 at Wyndham, 23 November	–3.5 at Eyre, 4 October	+0.65	51
NT	26.5 at McCluer Island	15.4 at Kulgera	30.7 at Elliott, 23 November	3.4 at Alice Springs, 24 September	+1.27	58
SA	16.2 at Oodnadatta	6.2 at Keith	29.4 at Moomba, 14 November	–3.5 at Mt Crawford, 8 September	+1.25	53=
QLD	25.5 at Horn Island	9.9 at Applethorpe	32.6 at Bedourie, 28 November	–0.1 at Stanthorpe, 9 September	+1.42	57
NSW	16.2 at Yamba	0.1 at Charlotte Pass	27.5 at Tibooburra, 14 November	–12.0 at Charlotte Pass, 9 September and at Perisher Valley, 17 September	+0.91	52
VIC	11.6 at Gabo Island	0.7 at Mt Hotham	25.0 at Mildura, 13 November	–6.7 at Mt Hotham, 7 and 22 October	+0.04	37
TAS	10.4 at Hogan Island	0.0 at Mt Wellington	18.1 at Flinders Island, 27 October	–7.5 at Liawenee, 23 October	+0.16	42

*The temperature ranks go from 1 (lowest) to 59 (highest) and are calculated over the years 1950 to 2008 inclusive. Ranks with '=' result from the presence of tied values within the time series.

with Northern Territory recording its second highest spring minimum temperature since records began (an anomaly of +1.27°C), and Queensland its third highest (an anomaly of +1.42°C). In all other States and Territories the seasonal minimum temperatures were above the mean. On 28 November, Australia's highest daily minimum temperature in spring 2008, 32.6°C, was recorded at Bedourie in Queensland. The lowest daily minimum temperature for the season was –12.0°C, recorded at Charlotte Pass on 9 September and at Perisher Valley on 17 September, both in New South Wales.

Acknowledgments

The author would like to thank Robert Fawcett, Grant Beard and Blair Trewin for their valuable inputs. The author is supported through the Pacific Climate Change Science Program by the Department of Climate Change, Australia.

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