6. Annual Review and Significant Events

January-April: wet in the tropics and WA, very hot in central to eastern Australia

For northern Australia, the tropical wet season (October 2005 – April 2006) was the fifth wettest on record, with an average of 674 mm falling over the period. The monsoon trough was somewhat late in arriving over the Top End (mid-January as opposed to the average of late December), but once it had become established, widespread heavy rain featured for the next four months, except over the NT and Queensland in February. One particularly noteworthy event occurred towards the end of January when an intense low (central pressure near 990 hPa) on the monsoon trough, drifted slowly westward across the central NT generating large quantities of rain. A two-day deluge of 482 mm fell at Supplejack in the Tanami Desert (NT), resulting in major flooding over the Victoria River catchment. A large part of the central NT had its wettest January on record.

Widespread areas of above average rain in WA were mainly due to the passages of several decaying tropical cyclones, and to a lesser extent southward incursions of tropical moisture interacting with mid-latitude systems. Severe tropical cyclone *Clare* crossed the Pilbara coast on 9th January and then moved on a southerly track across the western fringes of WA as a rain depression. Significant flooding occurred around Lake Grace where 226 mm of rain fell in a 24-hour period from 12th to 13th January. Tropical cyclone *Emma* crossed the Pilbara coast on 28th February and moved on a southerly track; very heavy rain fell in the headwaters of the Murchison River on 1st March causing this river's highest flood on record. The flood peak moved slowly downstream, eventually reaching Kalbarri on the coast on 15th March. Severe tropical cyclone *Glenda* crossed the coast near Onslow on 30th March; widespread rain fell over the western half of WA during the next four days as the weakening system moved on a southerly track across the State.

The most damaging cyclone for the season was severe tropical cyclone *Larry*, which reached category 5 intensity shortly before it made landfall near Innisfail, Queensland, on 20th March. It was the strongest cyclone at landfall (category 4) in Queensland since 1918. Major damage occurred around Innisfail, Babinda, and the Atherton Tableland, including the destruction of 80-90% of Australia's banana crop. Total immediate economic losses were estimated at $360 million. The heaviest rain fell as *Larry* weakened and slowed: Gereta Station north of Mt Isa had 583 mm in the 48 hours to 23rd March. Tropical cyclone *Monica* followed a track from the Coral Sea east of Queensland, across Cape York Peninsula, the Gulf of Carpentaria and then along the northern coast of the NT, before making landfall north of Jabiru on 24th April. During its passage along the NT coast *Monica* reached category 5 intensity and became the strongest cyclone ever observed in the Northern Territory region, with a central pressure in the vicinity of 900 hPa and estimated wind gusts of 360 km/h. Property damage was minor as the cyclone did not directly hit any major communities, but there was widespread vegetation damage and stock losses on Cape York Peninsula.

Outside the tropics, the eastern half of Australia was much warmer than average during this period, particularly the Murray-Darling Basin from January to March. Despite April being mainly cooler than normal, the mean temperatures for January to April were the highest on record for NSW, Queensland and the Murray-Darling Basin, with departures from average of +1.2 to +1.3°C. Persistent extreme heat affected much of the eastern inland from late December 2005 through to early March, with many records being set for average temperatures or consecutive days above thresholds. At Windorah (Qld), there were 63 consecutive days above 35°C from 30th December to 2nd March, the first 55 of which were above 37.8°C (100°F). At Birdsville, the January average minimum temperature of 30.0°C was an Australian record for any month. However, January-April maximum temperatures were the second lowest on record over WA, with a state-wide anomaly of –1.7°C.

May-December: El Niño develops – drought intensifies in the east & south. Frosty in May/June, warm from August

The first signs of an impending El Niño came in May, when the Southern Oscillation Index (SOI) dropped to –10 after being +15 in April. Furthermore, over the southern half of the country May and June were characterized by widespread frosts that revived memories of similar conditions at the start of the strong 1982/83 El Niño. One extreme event occurred on 30th May, when state records for the month were set for Queensland (–6.8°C at Stanthorpe) and Tasmania (–10.5°C at Liawenee). The second was between 12th and 17th June, when all-time records were set at many locations in both southeastern and southwestern Australia. In the west, a state record for June (–6.0°C) was set at Collie East on 17th June, the same day that saw all-time records of –1.3°C set at Perth Airport and –0.7°C at Perth Metro (the first sub-zero minimum ever at the Perth city site). In the southeast, all-time station records included –7.5°C at Rutherglen and –7.2°C at Wangaratta, both on 14th June.

Despite the SOI remaining negative during the early winter, there remained some hope that an El Niño event would not develop as equatorial Pacific temperatures were only slightly above average and not showing any significant trends. This view was reinforced during July when a strong upper-level trough delivered widespread soaking rains over central to eastern Australia (see front cover). However, such hopes were dashed as the Pacific began to warm strongly from August, with El Niño thresholds being reached in early September.

The strengthening of the Pacific warm signal coincided with a distinct worsening of the drought across Australia, with the effects of dry conditions being intensified by excessive heat. Overall, the widespread very dry conditions from May to December resulted in an Australian-average value of only 139 mm (average 218 mm), the fifth driest out of the 107 years of record. It was the second and third-driest May-December on record in Victoria and Tasmania respectively, with state-wide averages of 238 mm (51% below normal) and 603 mm (31% below). In regional terms southwest WA, as well as southern coastal Australia, were severely impacted: both areas experienced their driest May to December on record (352 mm and 232 mm respectively).

For southeastern Australia, total winter-spring rainfall (182 mm) was only less during the droughts of 1914 (164 mm) and 1982 (152 mm). In Melbourne it was the driest June-Nov on record, with only 164.8 mm, some 10 mm below the previous record of 175.0 mm in 1982, and less than 50% of average (333 mm). The southwest of WA suffered an extremely poor start to the winter rainy season: Perth had its second-driest autumn with only 61.0 mm of rain, and then no rain fell for the first 19 days of June, on average its wettest month (normal 179 mm). The June total eventually reached 24.6 mm, a new record low and some 30 mm less than the previous record of 54.9 mm in 1877.

Drought-affected country near Geraldton, WA. Geraldton had its driest year on record in 2006, with a paltry 197 mm (previous low 226 mm in 1948).

Such acute short-term rainfall deficits further depleted water supplies in the east and south of the country. Over inland eastern Australia, reservoir levels had not recovered from the severe drought of 2002, while in Victoria water supplies had been in steady decline since 1997. Winter-spring inflows to the Murray River were the lowest on record, the previous record being set during the Federation Drought in 1902. This was largely due to the extremely dry year in northeast Victoria where record low annual falls broke old records by large margins. For example, Harrietville (opened 1884, average 1435 mm) had 503 mm in 2006, over 200 mm below the previous record of 707 mm in 1982. Similar anomalies also occurred in northern Tasmania: Burnie (opened 1944, average 950 mm) had 408 mm, more than 250 mm less than the old record of 670 mm in 1972.

Maximum temperatures were the highest on record for the August to December period averaged over Australia, Victoria, SA and WA, while they were the second-highest in NSW. There were several noteworthy bursts of hot weather: Melbourne recorded its earliest (for spring) 30-degree day (30.1°C on 19th September) and its earliest 35-degree day (36.6°C on 12th October), the latter being its second-highest October temperature on record. Adelaide (37.9°C) and Hobart (33.1°C) also set early-season records on this day. Extreme heat affected the eastern and central inland in late November, culminating in 48.5°C at Birdsville on the 30th, Australia's highest temperature in 2006 and the second-highest November temperature on record in Australia.

August to December was also notable for the strong contrast between daytime and night-time temperatures, classic drought weather. The *difference* between the two averaged 0.86°C more than normal across the nation, the fourth highest on record. The effect was especially pronounced over Victoria where maximum temperatures were the highest in the post-1950 record, while minima were the third lowest. The very low levels of soil moisture across the southeast are likely to have played a key role in several severe frosts during spring. The most damaging event occurred on 25th September, when widespread sub-zero temperatures developed in northern Victoria following a day with strong, gusty winds. Damage to the Goulburn Valley fruit crop was estimated at $70 million. Several cold outbreaks and subsequent frosts in October also resulted in crop losses (particularly grapes) in southeastern Australia. Ararat's previous October record low was broken four times during the month, with the lowest being –4.5°C on the 22nd, while Charlotte Pass (NSW) set a new Australian record low for October with a minimum of –12.0°C on the 29th.

Drought, heat and wind lead to several significant bushfires, some of which were unseasonably early (e.g., across Victoria on 16th September). Lightning strikes across eastern Victoria on 1st December sparked numerous fires, many of which were in rugged and inaccessible country. As these fires continued to burn for the rest of the month, they gradually merged into a giant conflagration; fire-fighters concentrated on protecting property, as the only prospects for extinguishing the blaze lay with widespread heavy rain. Twenty houses were lost, one person died in a fire-related road accident and the total area burned had reached 900 000 hectares by year's end, a figure comparable to the 1.1 million hectares of Victoria charred in the long-lasting 2003 fires. There were also major fires in eastern Tasmania: 14 houses were destroyed in Scamander on 11th December.

A. Heavy rain 11th – 13th Jan. Lake Grace recorded 226 mm in 24 hours from the remnants of tropical cyclone *Clare*, with widespread flooding.

B. Widespread flooding in west NT in late Jan/early Feb. Supplejack (B1), in the Tanami Desert, had 482 mm in two days 31st Jan – 1st Feb.

C. 14th – 17th March: Largest ever flood on the Murchison River.

G. 1st Jan: Extreme heat - Sydney's 44.2°C on was its second-hottest day on record (G1).

H. Persistent extreme heat late Dec to early March. Windorah (H1) had 55 days above 37.8°C (100°F) from 30th Dec to 22nd Feb. Birdsville's (H2) Jan mean monthly minimum of 30.0°C was an Australian record for any month.

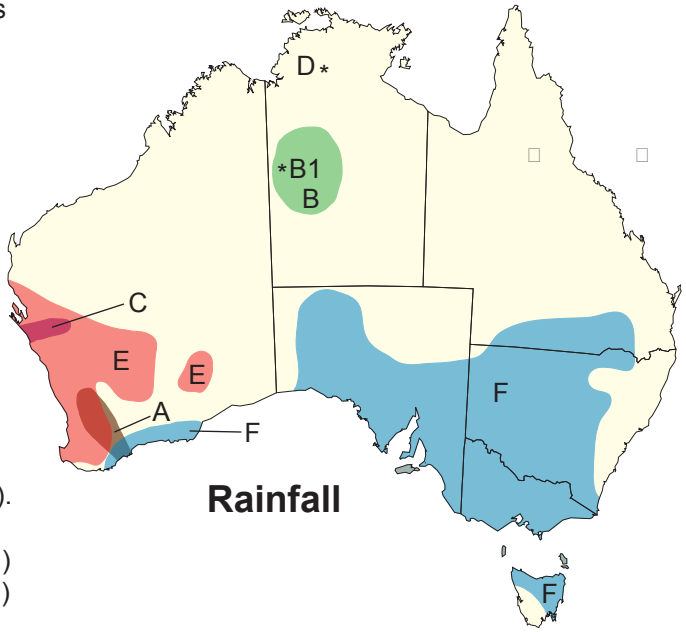
I. Record warm August over much of WA. Mean max temp records were easily broken as monthly anomalies widely exceeded +5°C. Twelve sites in the southwest exceeded 30°C for the first time in Aug on either the 29th or 30th.

M. Severe tropical cyclone *Larry*, the strongest cyclone to cross the Qld coast since 1918, made landfall near Innisfail on 20th March. Total economic losses estimated at $360 million, including destruction of 80-90% of Australia's banana crop. As *Larry* weakened and slowed, Gereta Station (M1) had 583 mm of rain in two days.

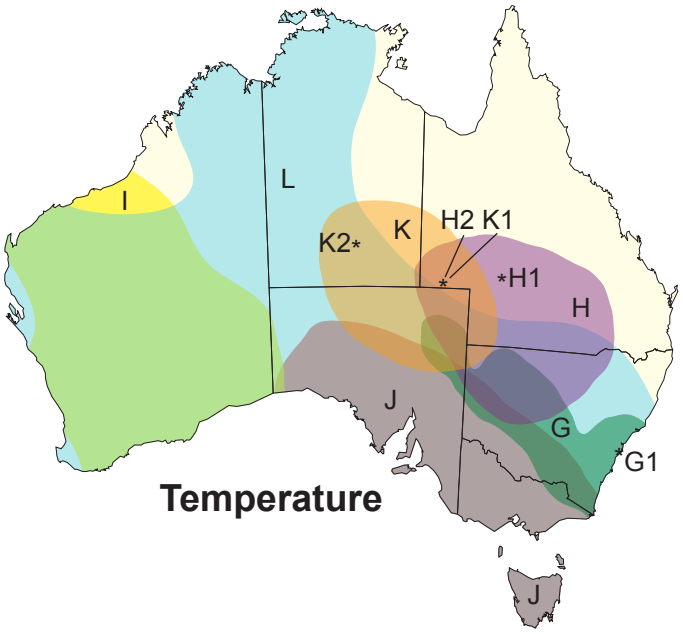
N. Tropical cyclone *Monica*, 17th – 26th April: Just north of the NT, the storm reached category 5 and became the most intense tropical cyclone ever observed in the NT region.

O. Major unseasonal cold outbreak 15th – 17th Nov: Widespread snow from southern Tas to Stanthorpe, Qld. Numerous record-low maximum temps were set on the 15th & 16th, & many record-low minimum temps occurred in southern Qld & northern NSW on the 17th.

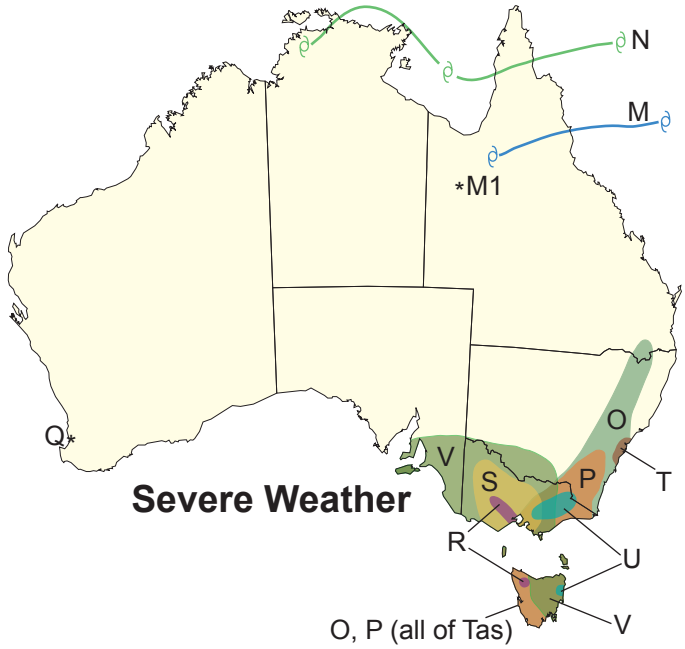
P. A major cold outbreak in SE Aus on Christmas Day. Significant snow fell on high ground in Tas, Vic & in the NSW Snowy Mountains. Australian record low max for Dec (–0.8°C) at Mount Buller.



Rainfall



Temperature



Severe Weather

D. Major flooding on the Katherine River, peaking 6th April. Damage in Katherine town centre estimated at $20 million.

E. Disastrous start to winter growing season: record low May to July rainfall over much of southwest WA.

F. Drought worsens from August. Driest ever Aug to Dec for the Murray-Darling Basin. Driest year on record in northern Tas, northeast Vic and southeast NSW west of the ranges.

J. Severe early spring heatwave in SE Aus in early Oct. On 12th Oct, Adelaide reached 37.9°C, Melbourne 36.6°C and Hobart 33.1°C, all early-season records.

K. Extreme heat late Nov: 48.5°C at Birdsville (K1) on the 30th, Australia's second-highest Nov temp on record. Alice Springs (K2) had 5 successive days over 42°C from the 26th to 30th.

L. Very low minima from April to June. Widespread frosts and many records broken in southern areas.

Q. 7th Aug: A tornado, with estimated wind gusts to 250 km/h, hit Australind near Bunbury. 40 houses significantly damaged; some completely destroyed.

R. 21st – 22nd Jan. Bushfire destroys a large part of the Grampians National Park, with the loss of 3 lives. Major fires also affected the Brisbane Ranges, Kinglake, Erica and northwest Tasmania.

S. 16th Sept: A very early major fire outbreak in Vic.

T. 24th Sept: Fires near Sydney, with several houses lost near Picton and on the Central Coast.

U. 1st Dec, eastern Vic: Numerous fires sparked by lightning, ultimately merged into a single fire - still uncontained at end of month. 900 000 hectares burnt, with more than 20 houses lost. Major fires in eastern Tas destroyed 14 houses in Scamander on 11th Dec.

V. Severe, damaging frosts: Worst was 25th Sept with major losses in the Goulburn Valley fruit crop (–2.7°C at Wangaratta). Several frosts in Oct caused crop losses in parts of SE Aus, particularly to grapes. 29th Oct: –12.0°C at Charlotte Pass is a new Australian record low for Oct.