

CASE STUDY: Tropical Cyclone Alan, 1976

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Tropical Cyclone *Alan* crossed the NQ coast near Bloomfield River Mission early on 2 February 1976 and caused no structural damage. During the next ten days it became an intense monsoon depression and had a central pressure of 989 hPa near Tennant Creek. It recurved and passed near Birdsville and moved out to sea near Byron Bay. In its traverse of the inland it caused widespread flooding and in particular record flooding in the Condamine near Warwick. The track of *Alan* (Figure 1) shows the cyclone cross the coast and move across northern Queensland and then turn southwards through the Northern Territory before turning into Southwest Queensland.

Mean sea level

The analyses in Figure 2 show the system clearly intensify as it moved through the Northern Territory with its large circulation covering much of Central Australia. This massive low pressure system then moved into and across Southern Queensland (Figure 3).

Rainfall

As evidence that this was an unprecedented event, stations which have been in operation for up to 138 years registered record daily rainfall. Some of the more intense 24 hour totals with the rankings and the period the stations were opened were:-

Darling Downs

Dalveen (104km S of Toowoomba) 223.0mm 11th. Ranked first 1887-2011.
Riverview (74km ESE of Goondiwindi) 223.0mm 11th. Ranked first 1969-2011.
Fairleigh (86km S of Toowoomba) 219.6mm 11th. Ranked second 1959-2011.
Top Plains (95km SSE of Toowoomba) 210.8mm 11th.
Valhalla (91km S of Toowoomba) 209.6mm 11th. Ranked second 1959-2011.
Clare Hills (86km S of Toowoomba) 202.0mm 10th. Ranked first 1959-2003.
Tannymorel (86km SSE of Toowoomba) 200.0mm 11th. Ranked first 1916-2011.
Stanthorpe Post Office 199.0mm 11th. Ranked first 1873-2011
Glenrae (85km S of Toowoomba) 197.0mm 11th. Ranked first 1959-2003.
The Head (92km SSE of Toowoomba) 196.0mm 11th.
Silverwood Dam (89km S of Toowoomba) 197.0mm 11th. Ranked first 1974-2011.
Ardenlea (120km ESE of Goondiwindi) recorded 193.0mm 10th. Ranked first 1968-1984.
Braeside (93km S of Toowoomba) 192.0mm 11th. Ranked first 1885-1980.
Leslie Dam (73km S of Toowoomba) 190.5mm 11th. Ranked first 1915-2011.

Gold Coast and Southeast Queensland Border areas

Boonah Border Gate 246.2mm 11th. Ranked first 1958-2007.
Hinze Dam 307.0mm 11th. Ranked first 1974-2011.
Miami 265.4mm 11th. Ranked First 1969-2011.
Mt Alford 225.0mm 11th. Ranked second 1911-2011.

NSW NW Slopes-North

Bingarra 171.0mm 11th. Ranked First 1899-2006.

Coolatai 222.6 11th. Ranked first 1901-2011.
 Coolatai (Willunga) 201.4mm 11th. Ranked first 1903-2011.
 Croppa Creek (Belford Street) 189.6mm 11th. Ranked first 1969-2011
 Delungra (Craigmore) 177.6mm 11th. Ranked first 1889-2011.
 Warialda Post Office 231.0mm 11th. Ranked first 1878 to 2011.
 Warialda (Croppa). 213.4mm 11th. Ranked first 1966 to 2011
 Yetman 176.4mm 11th. Ranked first 1884 to 2011.

NSW Northern Tablelands West

Rivertree (Myall) 240.0mm 11th. Ranked first 1893-1991.
 Tenterfield (Sandy Hill (Boorook)) Tenterfield 229.0mm 11th. Ranked first 1970 to 2011.
 Wylie Creek (Aloomba) 229.6mm 11th. Ranked first 1914 to 2011.

NSW Northern Tablelands East

Urbenville Old Post Office 210.0mm 11th. Ranked first 1935 to 2011.

NSW Northwest Plains East

Ashley (The Prairies) 207.0mm 10th. Ranked first 1928 to 2011.
 Garah (Delvin) 219.8mm 11th. Ranked first 1967 to 2011.
 Garah (Ulinga) 208.0mm 11th. Ranked first 1936 to 2011.
 Garah Post Office 199mm 11th. Ranked first 1906 to 2011.
 Moree (Mallowa (Narba)) 168.0mm, 11th. Ranked first 1967 to 2011.

NSW Northwest Plains West

Boomi (Barwon St) 180.4mm 11th. Ranked first 1908 to 2011.

NSW Upper Western - Upper Darling

Barrington 151.0mm 10th. Record February daily rainfall 1881 to 2011
 Collarenebri (Albert St) 158.2mm 11th. Record February daily rainfall 1884 to 2011.
 Enngonia (Shearer Street) 162.6mm 10th. Record February daily rainfall 1889 to 2011.
 Goodooga Post Office 177.8mm 10th. Record February daily rainfall 1891 to 2011
 Wanaaring Post Office 214.2mm 10th. Ranked first 1884 to 2011.
 Yantabulla Station 174.0mm 10th. Ranked first 1892 to 2011.

Rainfall distributions in Figure 4 show the weekly rainfall up to 8 February as *Alan* tracked through Central Australia with heavy rainfall in the northern and western parts of the states. The remainder of Figure 4 shows the daily rainfall as *Alan* tracked across Southern Queensland with heavy rain developing about the southern border areas. The NSW rainfall distribution (Figure 5) illustrates the areas of record rainfall about the northern border while in Figure 6 the whole of the rainfall across Central Australia is shown as *Alan* traversed the region.

Warm Air Advection

In Figure 7 the NCEP/NCAR chart shows 700hPa warm air advection over the heaviest rain area with the closest upper wind station (Brisbane) showing the warm air advection signature at that time with 850hPa winds 050/25knots, 700hPa 340/43knots backing to 500hPa 280/56knots.

Flooding

During the first week of the month moderate to minor flooding eased in the Fitzroy River basin and the Condamine and Balonne rivers. By mid month, major flooding was occurring in most streams in the Brisbane Valley, the Albert and Logan rivers, the Macintyre, Moonie and Weir rivers, the Condamine, Balonne, Bulloo and Paroo rivers, the Warrego, Thomson and Barcoo rivers, and Cooper Creek, plus Diamantina and Georgina rivers and Eyre Creek. Major flooding in these rivers was caused by the low pressure system formally Cyclone "Alan". Record flood levels and near record flood levels were recorded in many streams

between Warwick and Mungindi and many houses were inundated at Warwick, Inglewood, Stanthorpe, Texas, Mungindi and smaller settlements along the main rivers. A number of houses were also inundated on the Logan River at Waterford. At the end of the month major flooding was still occurring in the Balonne River following the extensive flooding in the Condamine River.

Details of record heights reached during these floods are shown below:-

Condamine River to Warwick

at Killarney 6.13m 3rd highest on record.
at Elbow Valley 6.68m highest on record.
at Emu Vale 5.23m 5th highest on record.
at Yangan 6.65m 2nd highest on record.

Condamine River Warwick to Cotswold

at Warwick (McCahon Bridge) 9.10m highest on record
at Pratten 10.50m highest on record
at Tummaville 11.11m 2nd highest on record.
at Centenary Bridge 8.20 m 2nd highest on record.
at Cecil Plains 9.17m 2nd highest on record.
at Tipton Bridge 11.36m highest on record.
at Loudoun Bridge 10.89m highest on record.
at Ranges Bridge 11.05m highest on record.
at Brigalow Bridge 13.99m 3rd highest on record.
at Chinchilla Weir 13.90m 3rd highest on record.
at Condamine Town 12.74m 7th highest on record.
at Cotswold TM 14.22m 5th highest on record.

Macintyre and Weir River catchment

at Yetman 12.34m highest on record.
at Riverton 6.13m highest on record.
at Texas 10.80m highest on record.
at Woodspring 8.53m 2nd highest on record.
at Inglewood Bridge 11.73m 2nd highest on record.
at Bengalla 11.90m highest on record.
at Goondiwindi 10.50m 3rd highest on record.
at Riverview 5.57m 2nd highest on record.
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at Giddi Giddi South 6.48m highest on record. at Talwood 4.74m highest on record.

Moonie River

Moonie River at Nindigully 4.3m 2nd highest on record.
Moonie River at Thallon 5.9m 2nd highest on record.

Paroo River

at Eulo 4.96m 6th highest on record.
at Caiwarro 4.81m 2nd highest on record.
at Hungerford 2.78m 4th highest on record.

Bullo River

at Adavale 3.51m 9th highest on record.
at Quilpie 5.20m 10th highest on record.
at South Comongin 3.70m 9th highest on record.
at Autumnvale 7.72m 6th highest on record.

at Thargomindah 6.00m 6th highest on record.

Diamantina River

at Diamantina Lakes 7.29m 2nd highest on record.

at Monkira 5.25m 3rd highest on record.

at Durrie Station 3.90m 3rd highest on record.

at Birdsville 8.20m 3rd highest on record.

Albert Logan Rivers

at Lumeah 9.25m 2nd highest on record.

at Bromfleet 14.88m 3rd highest on record.

at Wolffdene 9.77m 3rd highest on record.

at Boonah 8.16m 2nd highest on record.

at The Overflow 12.47m 3rd highest on record.

at Dulbolla 12.00m 3rd highest on record.

at Round Mountain 16.98m highest on record.

at Yarrahappini 18.54m 3rd highest on record.

at Maclean Bridge 18.35m 3rd highest on record.

at Waterford 10.00m 2nd highest on record.

at Eagleby 5.28m 2nd highest on record.

NSW

7.62metres at Lismore (7.2m moderate)

Tabulam (between Tenterfield and Casino) was devastated – the worst flood ever.

The Tweed River at Murwillumbah 5.01metres which was a major flood.

The Clarence River at Grafton on 12 February reached 7.28m (major flood).

At Inverell the flood peaked at 8am 11 February 1976 at 5.44metres at the Ross Hill Bridge which is the fifth highest ranked flood at Inverell.

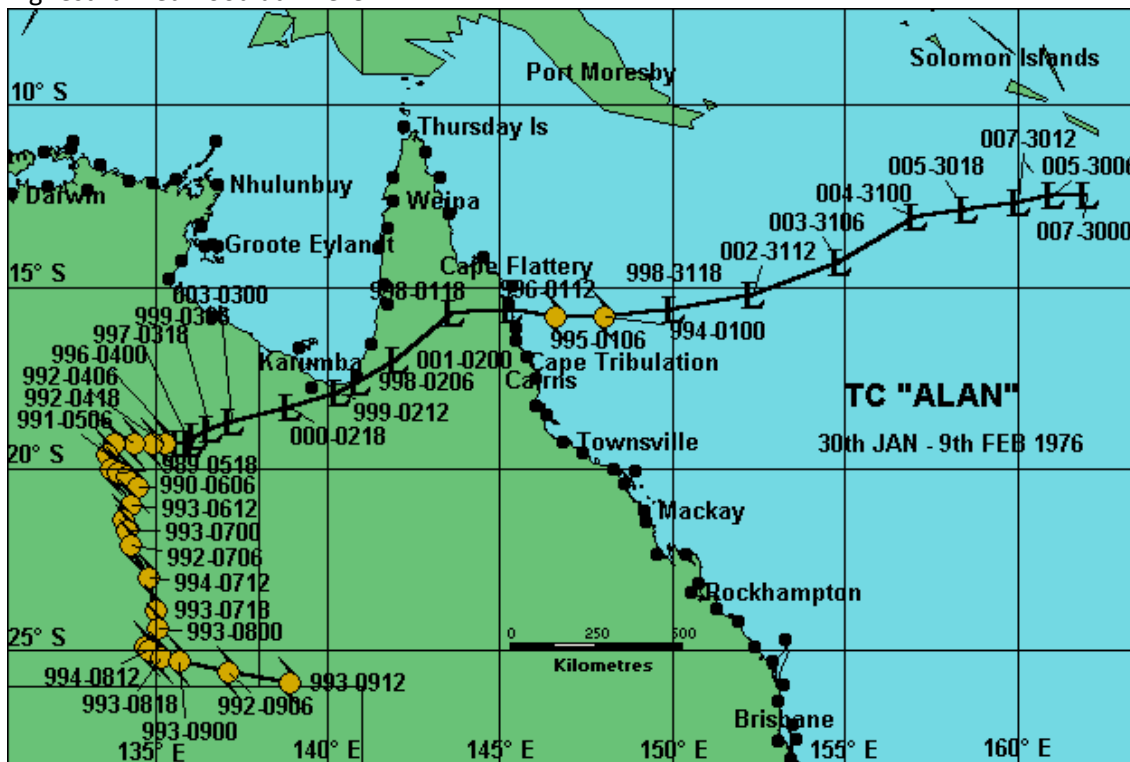


Figure 1 Track of Tropical Cyclone Alan, seven figure group gives central pressure in hPa followed by date time where 000-3000 means 1000hPa 0000UTC 30 January 1976 and 993-0912 means 993hPa 1200UTC 9 February 1976.

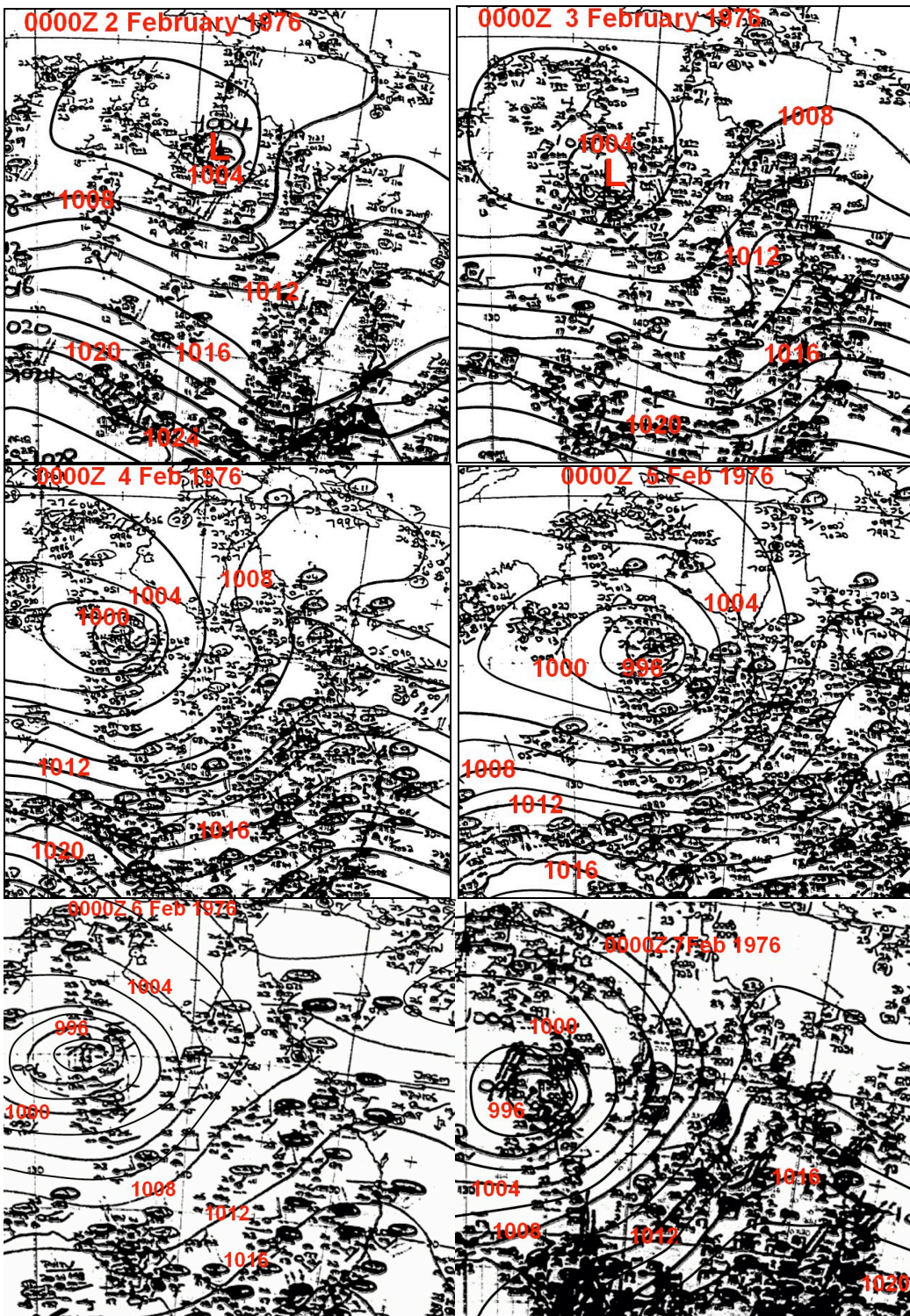


Figure 2 Mean sea level analyses from Bureau of Meteorology archives in Melbourne from 0000UTC 2 February 1976 (10am AEST 2nd) to 0000UTC 7 February 1976 (10am AEST 7th).

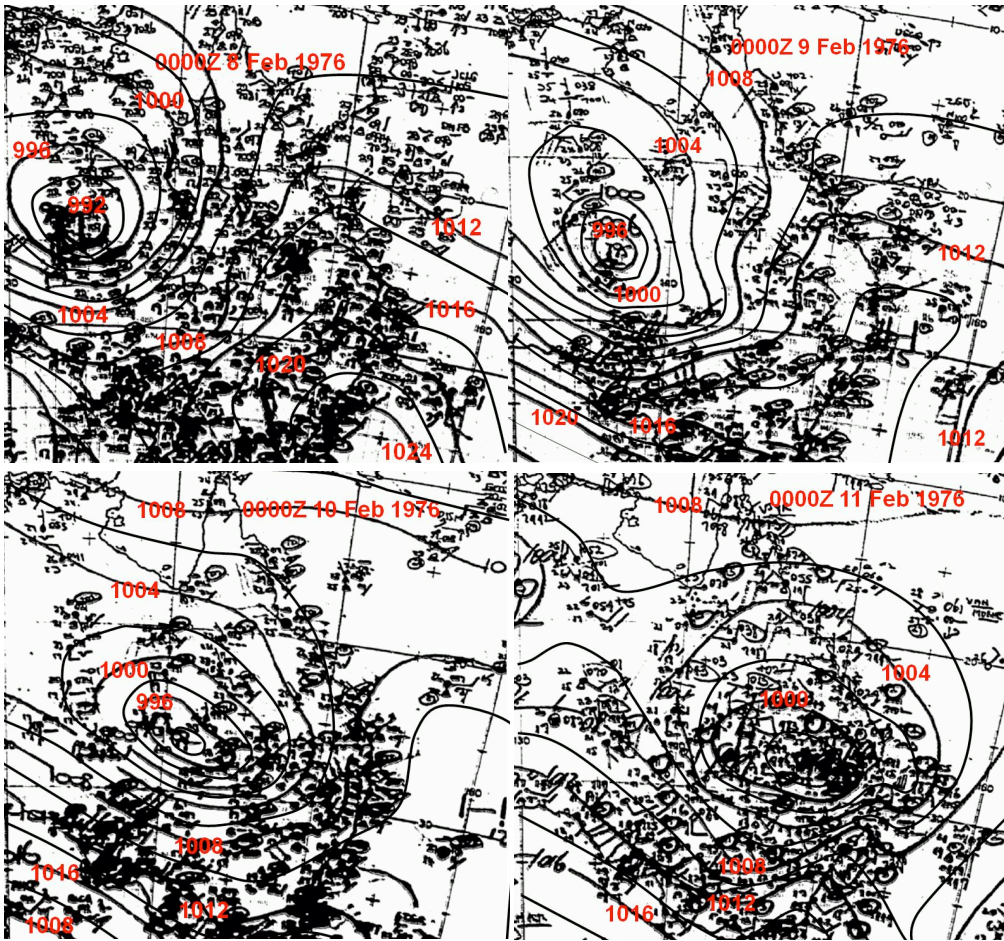


Figure 3 Mean sea level analyses from Bureau of Meteorology archives in Melbourne from 0000UTC 8 February 1976 (10am AEST 8th) to 0000UTC 11 February 1976 (10am AEST 11th).

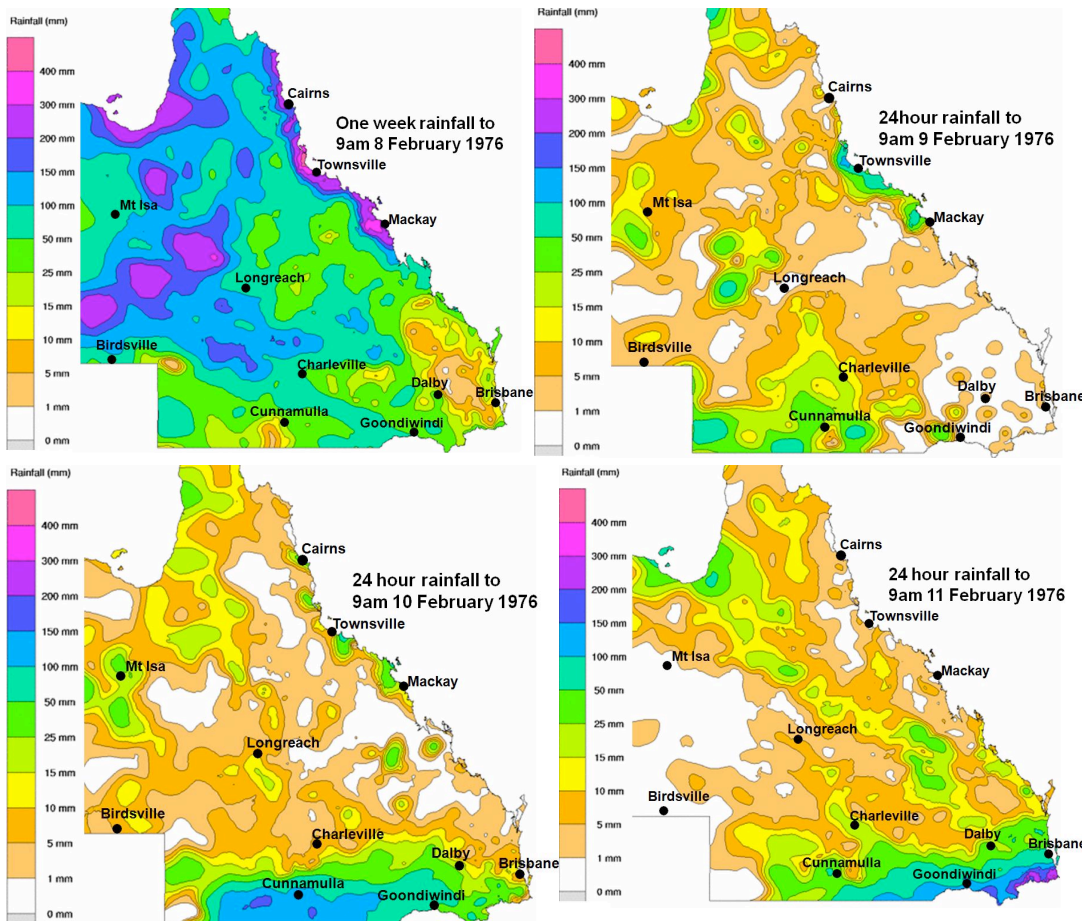


Figure 4 Rainfall distribution for the week to 9am 8 February 1976 (top left), 24hours to 9am 9 February 1976 (top right), 24hours to 9am 10 February 1976 (lower left) and 24hours to 9am 11 February 1976 (lower right).

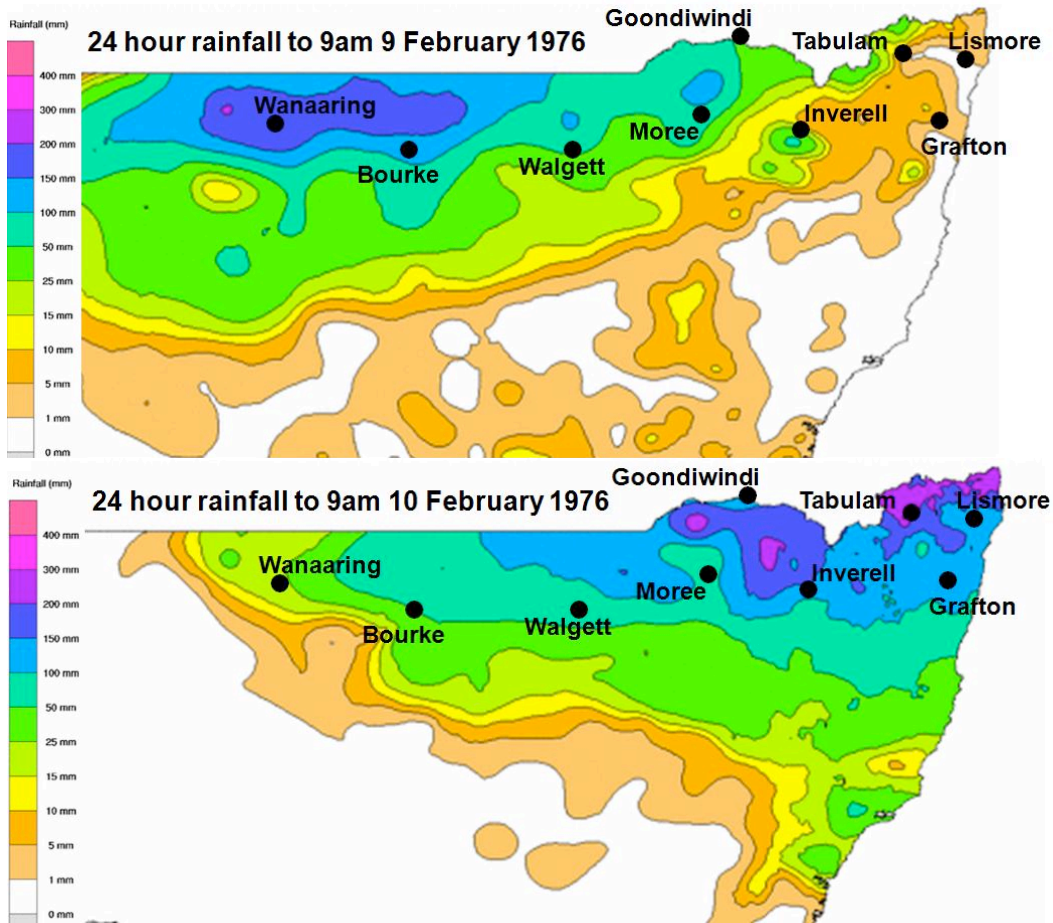


Figure 5 Rainfall distribution over Northern NSW for the 24hours to 9am 9 February 1976 (top) and for the 24hours to 9am 10 February 1976 (bottom).

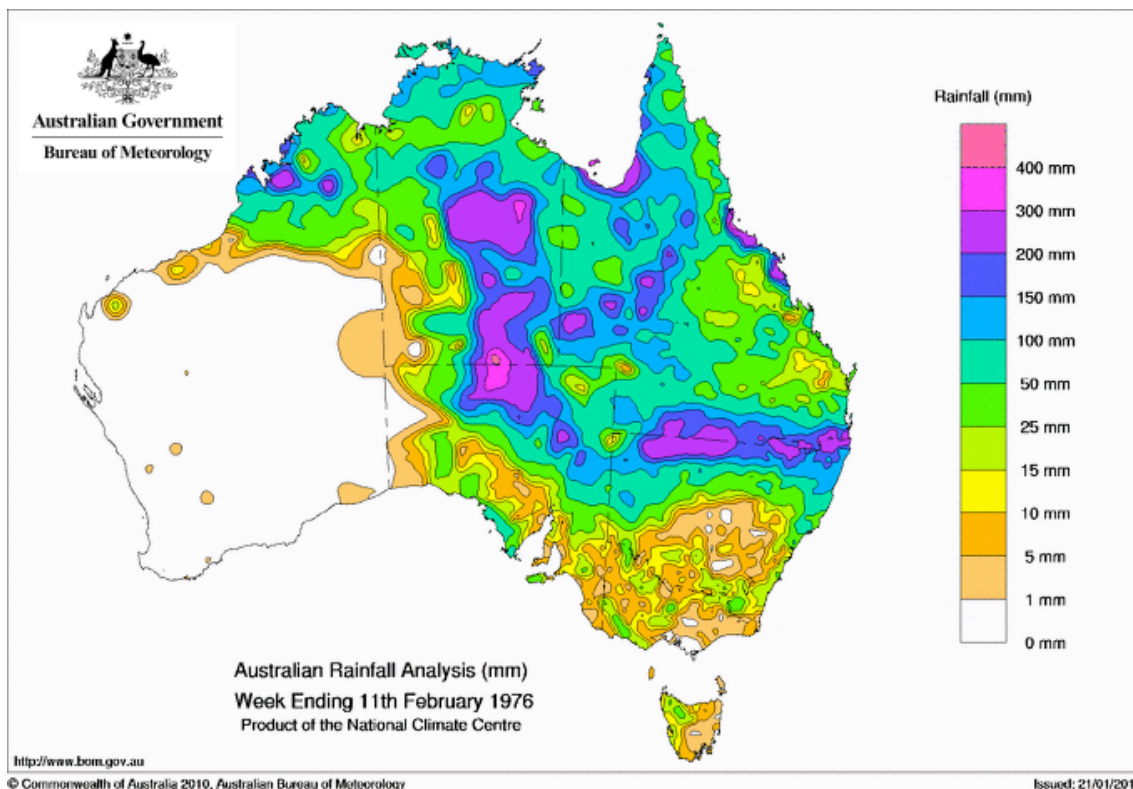


Figure 6 Rainfall distribution over Australia for the week ending 9am 11 February 1976.

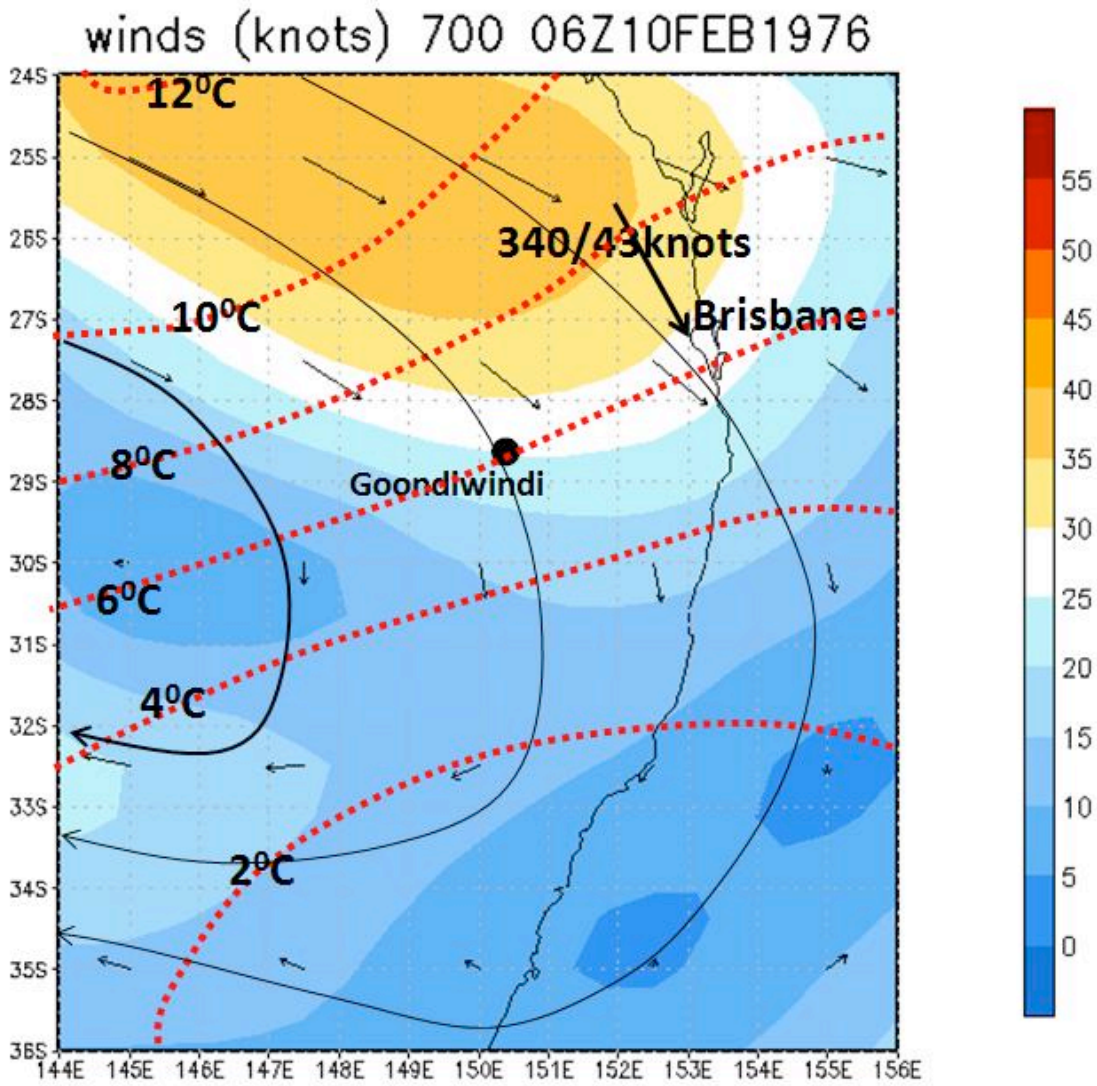


Figure 7 NCEP/NCAR 700hPa reanalyses winds and isotherms wind Brisbane 700hPa winds plotted for 0600UTC 10 February 1976.