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The Australian tropical cyclone season 1980-81

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There were fourteen tropical cyclones in the Australian region during the 1980–81 tropical cyclone season. The first cyclone occurred in November 1980, and the development of a late cyclone in the Indian Ocean caused the season to extend until the end of May 1981. One Indian Ocean cyclone caused major loss of life, but those cyclones that affected the mainland caused relatively little damage and only one death.

Introduction

The 1980–81 tropical cyclone season was again dominated by events that occurred in the Western Region. There were more cyclones in this region than in the Eastern and Northern Regions combined. The first and last cyclones of the season developed in the west, as well as the most intense cyclone in the Australian region. The season ran from 5 November 1980 to 29 May 1981, with the last cyclone being unusually late.

Most of the fourteen cyclones that occurred in the Australian region reached severe cyclone (hurricane) intensity (mean winds above 120 km/h). However, only four cyclones crossed the coast and all but one of these had passed their peak intensities when making landfall. **Neil** crossed the Western Australian coast, **Cliff** made landfall in Queensland, **Max** crossed more than one part of the Northern Territory coast, and **Eddie** moved rapidly across Cape York Peninsula to make its final landfall on the southern coast of the Gulf of Carpentaria. The degree of damage and the amount of flooding were relatively minor in all four cases. However, it is noteworthy that two of the cyclones, **Eddie** and **Neil**, maintained organised cloud structures, low pressures and strong winds well inland. Though it was still in its early stages of development, **Max** had a significant impact on the cyclone-conscious residents of Darwin when it passed close to the city centre. **Cliff** was weakening as it approached the Queensland coast but it was the only cyclone affecting the mainland that caused a death, albeit indirectly. However, far from land **Alice**, the first cyclone of the season in the Australian region, caused twelve deaths as well as sinking two vessels.

The season provided some indirect evidence of the effect of broadscale controls on cyclone development. During February **Eddie** and **Cliff** began nearly simultaneously in the Eastern Region; during December **Carol, Dan, Edna,** and **Felix** developed in rapid succession in the Western Region. **Carol** and **Dan** were also of interest in that interaction occurred between them. This initially affected the direction of their movements, but ultimately **Carol's** larger circulation caused **Dan** to weaken.

Seasonal statistics

Figure 1 shows the area over which the Australian Bureau of Meteorology has international tropical cyclone warning responsibilities. Any reference in this report to behaviour and tracks of cyclones outside of this area is tentative only. Figure 1 also shows place names and localities referred to in this report. Tables 1 and 2 contain a statistical summary of some aspects of the 1980–81 cyclone season.

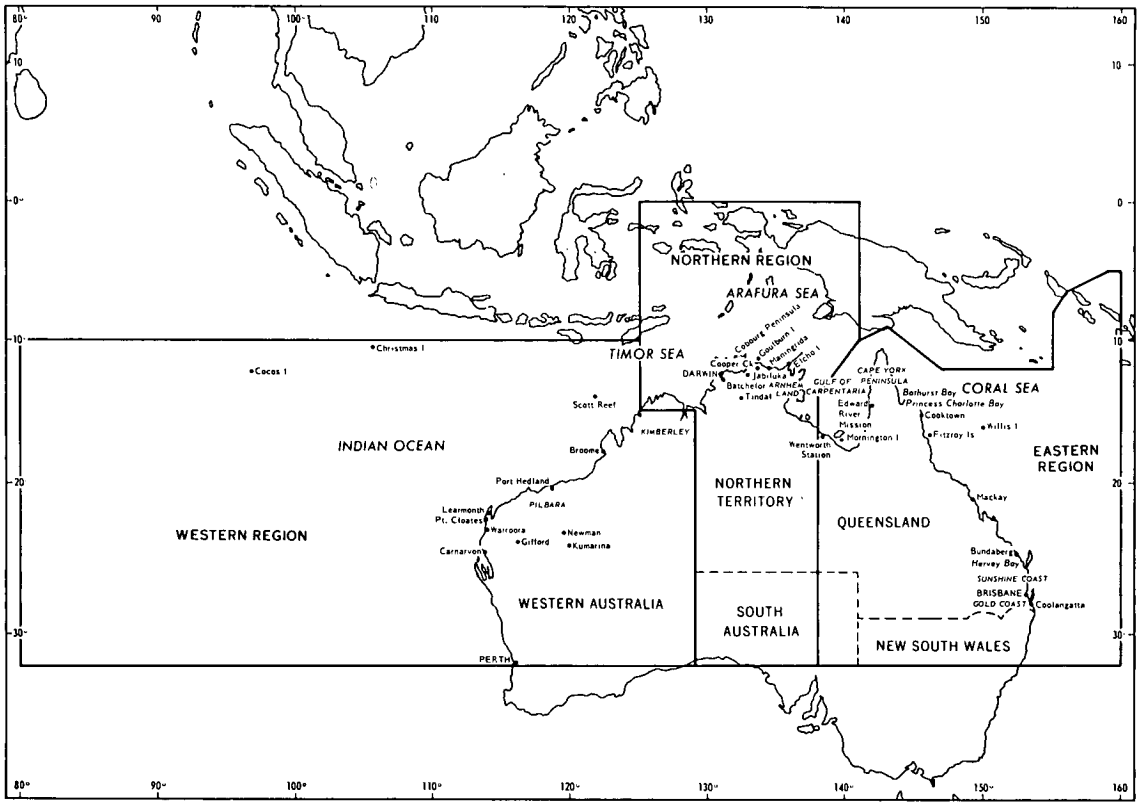
There has been no attempt made to compare this season's events with averages as there is a difference in the area considered in this report and that considered in climatological summaries.

Central pressures and maximum winds stated in this report have been estimated by the Dvorak (1975, 1979, 1980) technique; the winds are ten-minute averages.

A tropical cyclone day is defined here as a day on which a tropical circulation of at least tropical cyclone intensity (mean wind of 63 km/h) existed in the Australian region for any part of the day commencing at 0000 GMT.

The tropical depressions tabulated are those that later developed into tropical cyclones. It should be noted that the initial location is not associated with the first appearance of a distur-

Fig. 1 Locality map, including the Western, Northern, and Eastern Regions that comprise the Australian area of tropical cyclone forecasting responsibility.



bance, but is taken as that point from which a closed circulation deepened into a tropical cyclone in an uninterrupted development.

Cyclone **Max** crossed Cobourg Peninsula and also crossed a neck of land near Darwin, thus recording two land to sea and two sea to land crossings. Cyclone **Eddie** crossed Cape York Peninsula and redeveloped in the Gulf of Carpentaria before making final landfall.

Tropical cyclones of the 1980-81 season

1. Tropical cyclone Alice, 3 to 10 November 1980 (Fig. 2)

Alice was the first of eleven topical cyclones that operated in the Western Region during the 1980–81 season.

On 3 November a low that showed early signs of development was located just west of Sumatra. As this system drifted slowly west-southwest, the associated cloud cluster became more organised. Cyclonic intensity was reached on 5 November when the centre was located approximately midway between Sumatra and Cocos Island.

During the next few days Alice moved steadily west-southwest into the central Indian Ocean. It was most intense late on 7 November when the central pressure was estimated to be 940 mb with a maximum wind of 180 km/h.

Alice continued moving west-southwest around the northwestern flank of a sub-tropical ridge that was centred in the east Indian Ocean. On 10 November it moved into the Mauritius Region and was renamed **Adelaide.**

The highest wind reported was 63 km/h from the southwest by a ship located about 140 km northwest of the centre at 0900 GMT on 8 November.

Twelve crewmen were lost from one of two fishing vessels that were sunk in the very high seas generated by this cyclone. Those killed were from a Taiwanese vessel, the *Sing Long No. 21,* which sank on 8 November. As it foundered the crew boarded two liferafts. Seven crew members on one raft were rescued by a freighter about 24 hours later; the twelve missing men were on the second raft which was never found. The other vessel lost was the *Gammiri No. 5* from South Korea which sank on 9 November; her crew of twenty-four was rescued by a sister ship. The two vessels were valued at $1 million each.

2. Tropical cyclone Bert, 24 November to 4 December 1980 (Fig. 4)

On 24 November the initial low and the large cloud cluster from which **Bert** developed were located about 500 km north of Cocos Island. This cloud system was part of a quasi-stationary convergence zone that extended across Indonesia. Initially the cluster showed little organisation but, early on 26 November, the Geostationary Meteorological Satellite (GMS) imagery showed that cloudbands were becoming more tightly curved.

Cyclonic intensity was reached late on 26 November when the system was located about 850 km northwest of Cocos Island. **Bert** moved west to southwest and continued to deepen, reaching peak intensity on 29 November with an estimated central pressure of 965 mb and a maximum wind of about 150 km/h.

On 29 November the system moved to the southeast and then on 1 December it again curved to the west-southwest as it came under the influence of a strong high pressure system to the south of the centre.

On 3 December **Bert** moved into the Mauritius Region as a severe cyclone with an estimated central pressure of 975 mb and was renamed **Christelle.**

The strongest wind reported was 63 km/h by a ship some 220 km to the south-southwest of the centre at 0000 GMT on 2 December.

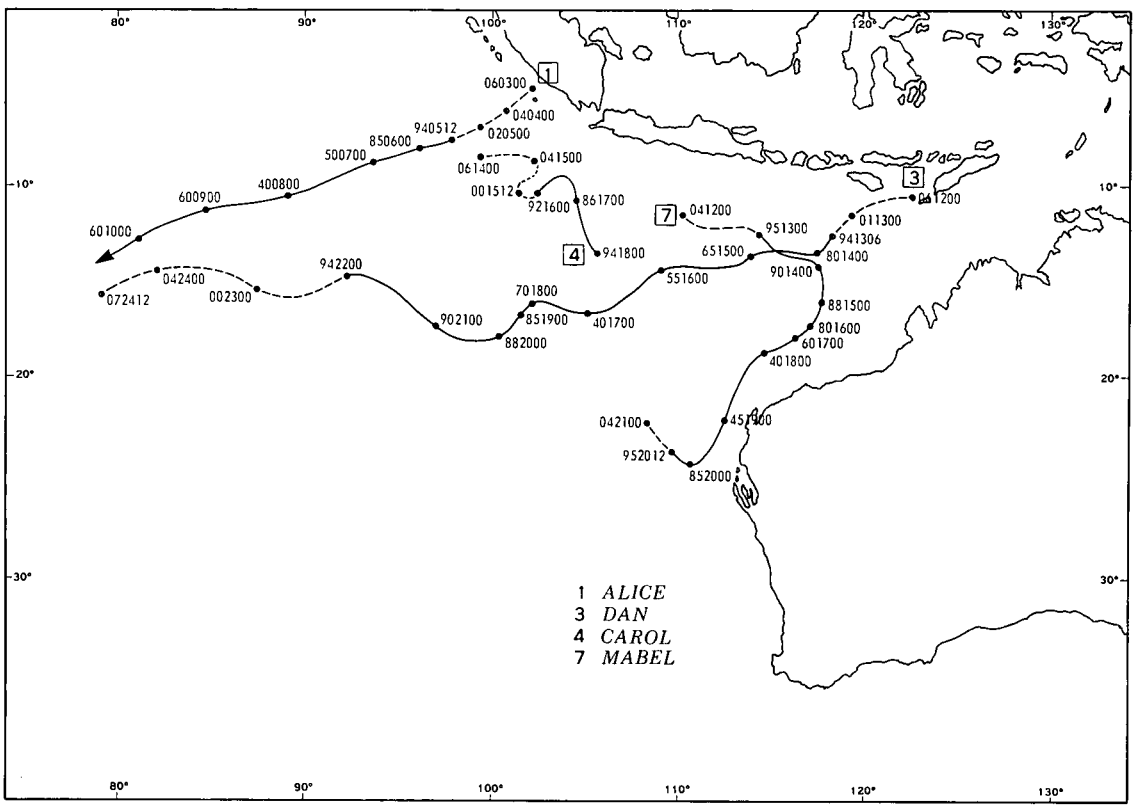
There was no damage or loss of life reported.

3. Tropical cyclone Carol, 12 to 24 December 1980 (Fig. 2)

Carol developed from a weak low that was near the southwest tip of Timor on 12 December. Cyclone intensity was attained late on the 13th when the GMS imagery showed a large cloud cluster with strong banding to the south of the centre. During the next few days **Carol** moved westwards and became a severe cyclone. It was most intense late on 16 December when a clearly discernible circular eye could be seen on satellite imagery. The central pressure at this time was estimated to be 940 mb with a maximum wind of 180 km/h.

On the 17th **Carol** encountered a strong upper-level northwesterly flow. The low-level centre continued moving westward while the dense overcast cloud associated with the storm sheared

Fig. 2 Tracks of tropical cyclones in the Western Region. Broken line (--) denotes pre or post cyclone stage; full line (—) denotes system at tropical cyclone intensity. Numbers against points on the tracks identify pressure, date, and time as per key.



away to the southeast causing the storm to weaken rapidly. **Carol** tracked westward for several days and finally dissipated over tropical waters in the central Indian Ocean on 24 December. The strongest reported wind was 69 km/h from the south-southeast at 0600 GMT on the 19th by a ship located about 200 km southwest of the centre.

No damage or loss of life was reported.

An interesting feature of **Carol** was its interaction with the weaker cyclone **Dan** which was operating to the north of **Carol** from 14 to 18 December. The movement of these cyclones relative to each other on 16 and 17 February (see Fig. 2) was an example of the Fujiwhara effect. Ultimately **Carol's** stronger circulation caused **Dan** to substantially weaken due to upper-level shearing.

4. Tropical cyclone Dan, 14 to 18 December 1980 (Fig. 2)

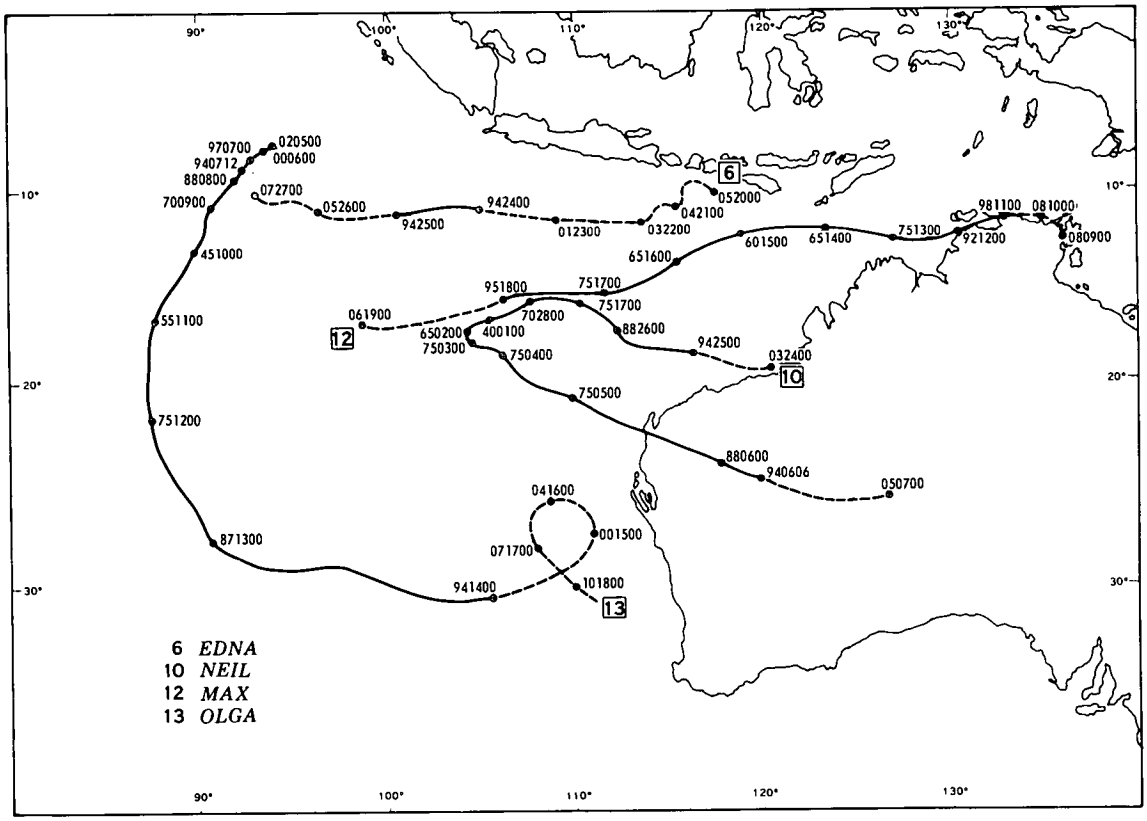
There was a large area of convection north of Cocos Island for some days prior to the formation of **Dan.** On 14 December a tropical low, which could be identified in the general area of convection, moved steadily eastwards. During the 15th the centre turned to the southwest and slowly intensified. Peak intensity occurred during 16 December with an estimated central pressure of 980 mb and maximum winds of about 100 km/h. Cyclone **Dan** then moved in an erratic path and passed about 140 km to the west of Christmas Island on the morning of the 17th, where northwest winds of up to 74 km/h were recorded.

Dan did not develop into a severe cyclone and was one of the less common types of cyclones encountered in this Region, in that it had an overall southeasterly track during its lifetime. This track was due to the circulation of cyclone **Carol** which was moving westwards about 800 km south of **Dan.** As **Dan** neared **Carol** during 16 to 18 December, it encountered a region of increased vertical shear which caused a rapid dissipation as the upper portion of **Dan** sheared to the southeast. The low-level circulation finally dissipated about 370 km south of Christmas Island.

5. Tropical cyclone Felix, 22 to 31 December 1980 (Fig. 4)

Felix started as a tropical low about 180 km south of Timor on 22 December 1980. This low was part of an active monsoonal trough which was quasi-

Fig. 3 Tracks of tropical cyclones in the Western and Northern Regions. Symbols as per Fig. 2.



stationary north of latitude 10°S.

The low deepened as it moved steadily westward along the northern periphery of a strong mid-tropospheric ridge and on the 23rd it attained cyclonic intensity when the centre was located just southwest of Timor.

Development continued as it changed direction slightly to the west-southwest and moved into open waters. **Felix** was most intense on 26 December with an estimated central pressure of 940 mb and a maximum wind of about 180 km/h.

On the 28th **Felix** recurved to the south and began to weaken. It degenerated into a tropical low late on the 29th, drifted northwards during 30 December and finally dissipated some 900 km west of Northwest Cape.

The demise of **Felix** was principally due to strong northwesterly vertical shear just after recurvature commenced and was accompanied by the strengthening of a surface ridge south of the cyclone centre, which blocked the recurvature of the low-level centre and reinforced the shearing and weakening process.

The highest reported wind was 93 km/h from the west-northwest by a ship located about 105 km north of the centre at 1200 GMT on 27 December.

No damage was reported.

6. Tropical cyclone Edna, 20 to 27 December 1980 (Fig. 3)

There is some doubt whether this system reached tropical cyclone intensity. On 20 December, the initial low and associated cloud cluster were linked to the convergence zone across the Indonesian archipelago. The low then moved westwards and developed.

Edna was thought to be most intense during 24 December when its estimated central pressure was 994 mb and gale force winds were suspected. This may have been an overestimate because locating the centre was somewhat speculative. No surface reports were available to verify the intensity of this system.

7. Tropical cyclone Mabel, 12 to 21 January 1981 (Fig. 2)

A monsoonal trough along latitude 11°S was very active for some days prior to 12 January. A weak tropical low developed about 600 km east of Christmas Island and became the dominant circulation associated with the monsoonal trough. The low moved steadily east-southeast and was named as a cyclone on 13 January.

On 14 and 15 January the Pilbara coast was threatened as **Mabel** moved southwards. The

Fig. 4 Tracks of tropical cyclones in the Western Region. Symbols as per Fig. 2.

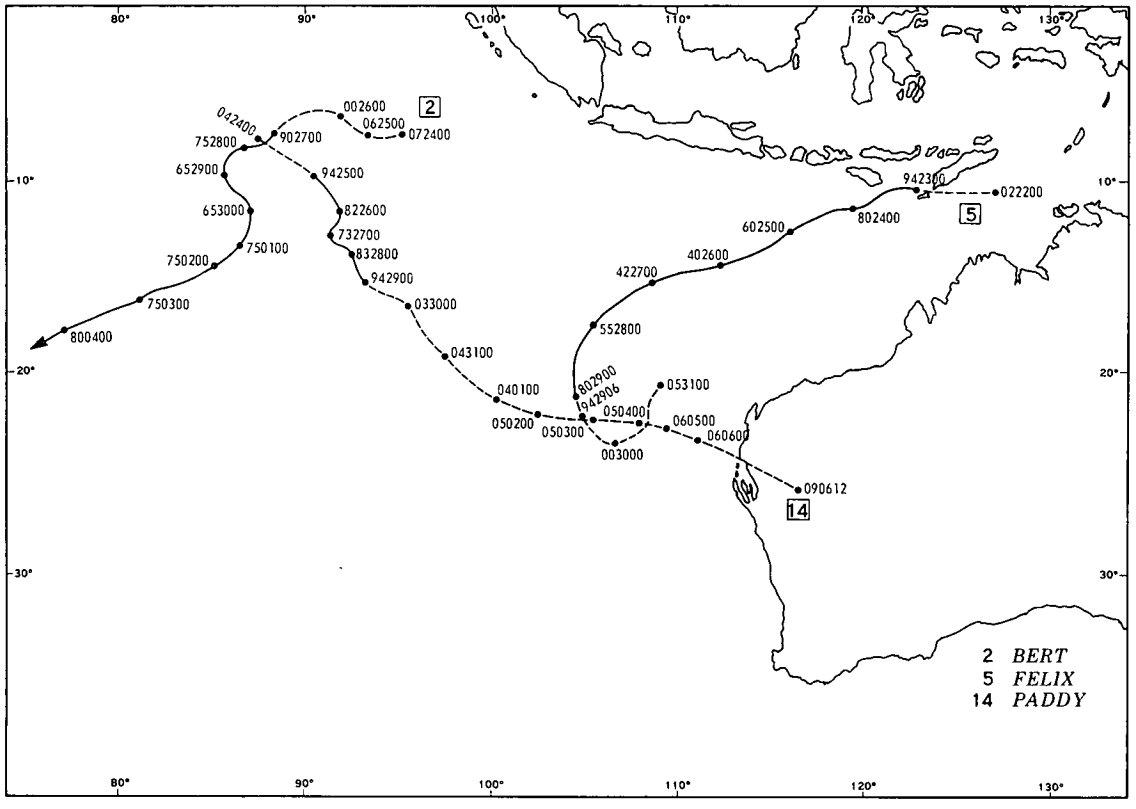
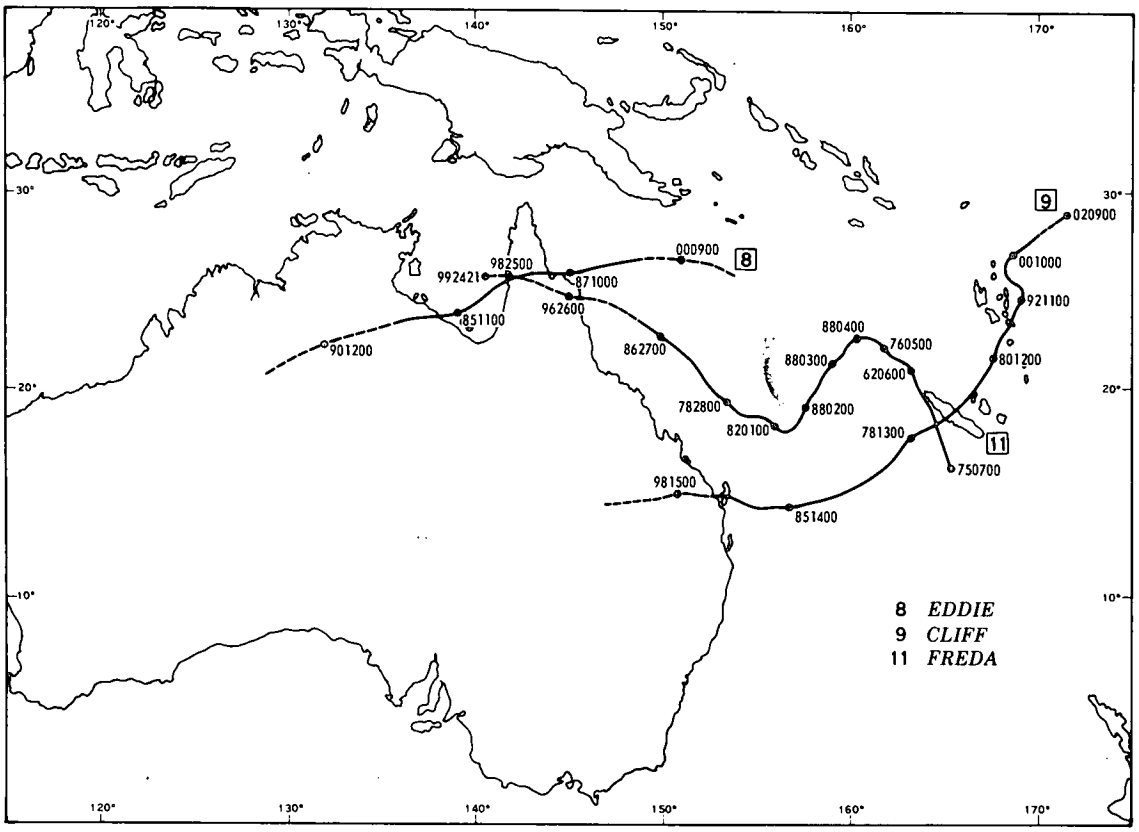


Fig. 5 Tropical cyclones in the Eastern Region. Symbols as per Fig. 2.



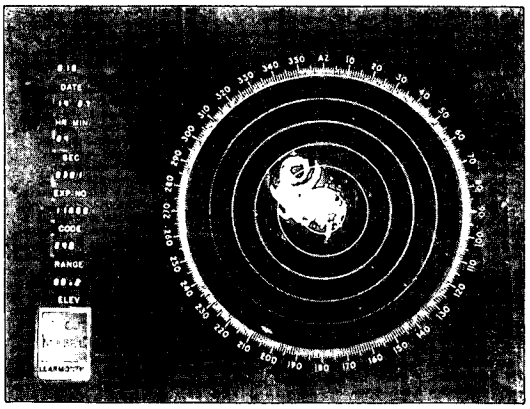
threat decreased the following day when the cyclone began moving to the southwest. **Mabel** had a central pressure of 980 mb when it changed direction from about 320 km north of Port Hedland.

On the 17th there was confirmation that **Mabel** was still intensifying when enhanced GMS imagery showed a small warm eye. **Mabel** was most intense later that day when the central pressure was estimated to be 930 mb and the maximum wind 200 km/h. This was the most intense of the Australian region cyclones during the season.

The radar at Learmonth monitored **Mabel** as it moved closer to the coast on the 18th and 19th. By the morning of the 20th the centre was approximately 300 km west of Carnarvon; the cyclone then moved to the northwest and finally dissipated about 600 km west of Northwest Cape on 21 January.

Two oil rigs, the *Regional Endeavour* and the *Southern Cross*, operating off the Pilbara coast were buffeted by cyclone **Mabel.** The *Regional Endeavour* reported north-northeast winds up to 93 km/h on the morning of 18 January with 7 metre seas. A ship located about 75 km northwest of the centre at 1200 GMT on the 19th also reported winds of 93 km/h from the west-southwest. The closest meteorological office to the cyclone was Learmonth which recorded a maximum wind gust of 78 km/h at 0437 GMT on 19 January when the cyclone was about 180 km to the west-southwest.

Fig. 6 Photograph of radar display of tropical cyclone Mabel taken at Learmonth Meteorological Office at 1427 GMT 18 January 1981. Note: Range rings are at 40 nautical miles (74.13 km) intervals.



The only damage **Mabel** caused was snapped anchor chains on the *Regional Endeavour* and the

Southern Cross when the cyclone passed about 90 km west of these oil rigs on 18 January. Both were closed down and personnel evacuated before the onset of the storm. Two of the anchor chains securing the *Regional Endeavour* snapped as high seas, heavy swells, and gale force winds swept the area. The *Southern Cross* lost three anchor chains and drifted a considerable distance from the well hole. A large operation was necessary to recover equipment, relocate the seabed drill site and reposition the rig.

The threat of **Mabel** to the Pilbara coast caused the mining industry in the area to close down temporarily, leading to production losses estimated at $2 million per day over about three or four days.

8. Tropical cyclone Eddie, 8 to 11 February 1981 (Fig. 5)

There was an area of low pressure south of the Solomon Islands for several days before **Eddie** began developing. Following a surge in the northwest monsoon an extensive area of convective cloud developed north of the Solomons and then moved southwestwards to the region of the weak low. Deepening was slow, but by 1800 GMT 8 February there was a significant circulation. The system moved steadily to the west-southwest, crossing Bathurst Bay and Princess Charlotte Bay before making landfall on the afternoon of 10 February. **Eddie** moved rapidly across Cape York Peninsula and only seven hours elapsed before the cyclone entered the Gulf of Capentaria just north of Edward River Mission.

In the Gulf, **Eddie** initially moved more to the southwest but it again turned to the west-southwest as it passed just north of Mornington Island. At 0400 GMT 11 February, its final landfall was made close to the Queensland-Northern Territory border when it was at its peak intensity with a central pressure of 980 mb. Winds estimated to be 120 km/h were reported from Wentworth Station approximately 30 km south of the cyclone's path.

Eddie continued moving quite rapidly to the west-southwest and weakened only slowly — more than twenty-four hours elapsed before the pressure rose above 990 mb. A wind gust of 143 km/h was recorded overnight on 11/12 February as the low brushed past Elliott in the Northern Territory. Despite its persistent strength, **Eddie's** impact on the sparsely settled areas of northern Queensland and the Northern Territory was minimal. There was moderate to heavy rain accompanying the system in these areas, but only minor flooding resulted in Queensland's northeastern coastal rivers and there was also some disruption to land services in the Gulf country. No significant structural damage was attributed to the cyclone.

Tides around the southeast Gulf of Carpentaria were substantially higher than normal; at Wentworth Station the level was estimated at 1.5 m higher than predicted and 'an extremely high tide' was reported from Edward River Mission. On the east Queensland coast the automatic storm surge recorder at Cooktown indicated a surge of 0.64 m at 092330 GMT as **Eddie** passed approximately 140 km to the north.

9. Tropical cyclone Cliff, 9 to 15 February 1981 (Fig. 5)

Cliff developed shortly after the formation of cyclone **Eddie.** By 9 February the initial low had formed northeast of Vanua Lava and developed to tropical cyclone intensity during that day. **Cliff** generally moved to the southwest until 14 February, though there were variations from this direction on 10 February when it moved near Vanuatu. The cyclone reached peak intensity on 12 February when the central pressure was estimated to be 975 mb. During 14 February **Cliff** moved firstly to the west and then to the west-northwest, finally crossing the coast near Bundaberg. Its central pressure on landfall was 990 mb. **Cliff's** overall movement was probably due to the presence of a pronounced trough in the upper-easterly flow over the Pacific Ocean east of Queensland.

Until the morning of 13 February, the evolution of the cloud pattern was unexceptional with increasing organisation and with the central dense overcast becoming larger. However the central dense overcast then decreased and the overall cloud signature degenerated. In this weakening phase a clear eye appeared for the first time. As the cyclone neared land, the cloud pattern was noteworthy for the degree of dissipation and disorganisation.

The cyclone passed over New Caledonia as it was nearing peak intensity, but the strongest wind reported from the island was only 92 km/h. No surface reports were then available until **Cliff** approached the south coast of Queensland. At that time strong gales were common and there was a ship report of 110 km/h.

Cane crops around Bundaberg were damaged by the wind and there was also some damage to several houses in the Moreton district. Rainfall and flooding were minor, but there was some marine inundation around Hervey Bay. Beach erosion occurred from Bundaberg to Coolangatta, particularly on the Gold and Sunshine Coasts. One man was drowned off the beach on the Gold Coast.

10. Tropical cyclone Neil, 24 February to 7 March 1981 (Fig. 3)

Tropical cyclone **Neil** was the only cyclone of the season to cross the Western Australian coast.

About mid-February, the monsoon trough moved southward and became established over

the Kimberleys. A semi-permanent low formed in the trough south of Broome and large cloud clusters developed in association with this low. Initially these moved out to sea and weakened. Gradually the low became better developed and on 24 February a cloud cluster moving out to sea showed strong signs of cyclonic development. The low moved westward and deepened into tropical cyclone **Neil** on 25 February.

The cyclone continued to intensify over the next few days as it travelled over warm tropical waters, reaching peak intensity late on the 28th with an estimated central pressure of 940 mb and maximum winds of about 180 km/h.

On 2 March **Neil** recurved to the southeast as it came under the influence of a strong cold front located to its south. On 4 and 5 March it accelerated and crossed the upper west coast just south of Point Cloates at approximately 1500 GMT (11 pm local time) 5 March. At the time of landfall **Neil** was moving east-southeast at about 40 km/h with an estimated central pressure of 980 mb.

As the storm moved inland it weakened, but it was still intense enough to cause gale force winds along its track up to 500 km from the coast. **Neil** finally became a rain bearing depression on 6 March when it was located about 170 km south of Newman.

There were no major towns in the path of cyclone **Neil** and damage reported by station homesteads was minor. Several station windmills and water tanks were blown over, trees were snapped, and there was minor damage to buildings. The Kumarina Motel on the Great Northern Highway reported winds of 120 km/h which caused the roof of a store to cave in.

Neil passed about 80 km to the south of the Learmonth Meteorological Office and the storm's centre was tracked continuously by the radar during 5 March. The highest wind gust recorded at Learmonth was 104 km/h from the north-northwest at 1437 GMT 5 March, the pressure at this time being 1000 mb.

Heavy rain fell in the Gascoyne River basin but was not sufficient to cause any major flooding. A few stations reported 48-hour falls in excess of 100 mm, the highest being 106 mm at Gifford and Waroora. Some local flooding occurred, temporarily isolating stations, cutting unsealed roads, and flooding parts of the North West Highway. Two cars were swept away at flooded creek crossings and one driver was nearly drowned. He was rescued by a helicopter after being marooned for three days.

11. Tropical cyclone Freda, 24 February 1981 to 7 March 1981 (Fig. 5)

Freda began as a persistent low in a monsoon trough that extended through the southern Gulf of Carpentaria. At 1800 GMT 24 February the low began moving eastward, crossing the west coast of Cape York Peninsula approximately 65 km north of Edward River Mission at 2300 GMT 24 February. The low continued to slowly deepen and moved east-southeast, reaching the Coral Sea at about 0200 GMT 26 February. Heavy rainfall was associated with its passage across the Peninsula and 24-hour totals of up to 260 mm were recorded along the far north Queensland coast and in adjacent inland areas. This caused some flooding in coastal streams, particularly the Barron, Herbert, Tully, and Johnstone rivers.

The low continued to deepen and move east-southeast. By 2300 GMT 26 February surface reports indicated that gale force winds had encircled the system. **Freda** then moved to the southeast, parallel to the Queensland coast and about 380 km off shore. During the next 24 hours **Freda** caused gales on the off shore islands and the exposed parts of the central Queensland coast, but there was no loss of life and no significant damage reported. However, a ten-metre fishing trawler capsized about 300 km east of Mackay in the very rough seas generated by **Freda.** The four people aboard the vessel were subsequently rescued.

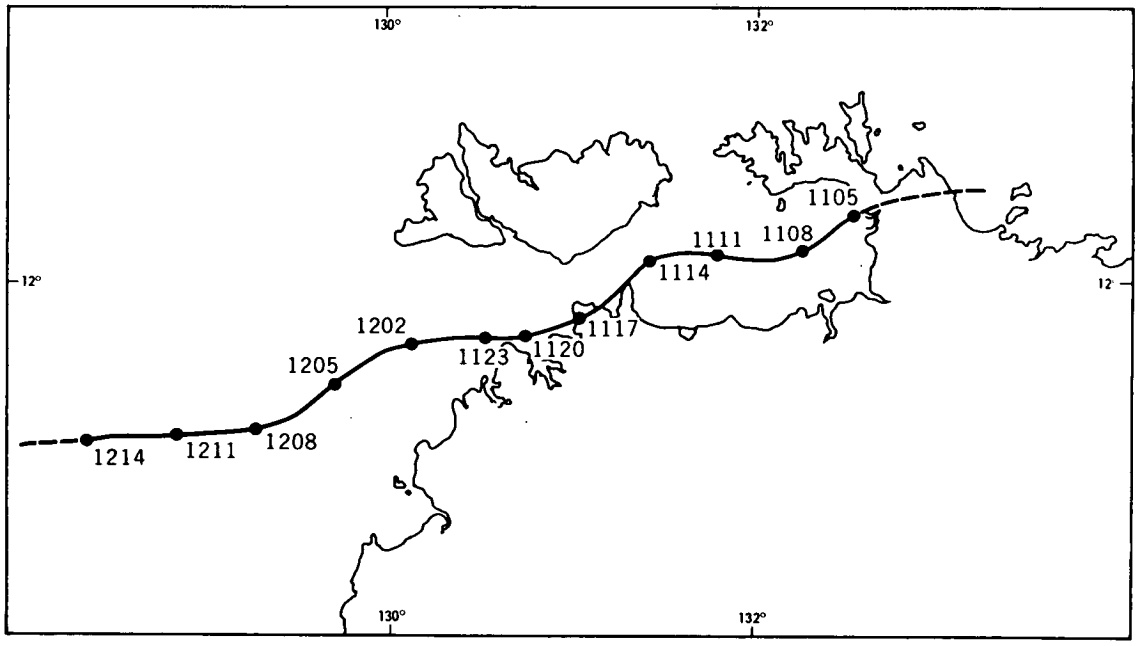
Freda was somewhat erratic in both its movement and rate of development. It reached its peak intensity in the Eastern Region at 0800 GMT 28 February when its central pressure was estimated to be 972 mb, it then began to move away from the coast and weaken for a period. There was a major change of direction on the afternoon of 1 March when **Freda** began moving towards the northeast. This direction was maintained until 4 March when **Freda** began to move to the southeast again. The cyclone rapidly deepened as it passed close to the northwest of New Caledonia on the night of 6 March. At this time it reached its overall peak intensity with a central pressure of 962 mb. **Freda** then accelerated to the south-southeast, gradually weakened, and became a cold-cored system.

12. Tropical cyclone Max, 9 to 19 March 1981 (Figs 3 and 7)

Max was the only cyclone to develop in the Northern Region during the 1980–81 season. In early March the monsoon trough moved northward to lie along the north coast. A low was detected on synoptic charts and an organised cloud mass was apparent near Darwin on 3 March. The system tracked eastwards into the Arafura Sea and showed signs of development before moving inland near Maningrida on 7 March.

Re-intensification occurred on 9 March as the low moved back into the Arafura Sea near Elcho

Fig. 7 Track of tropical cyclone Max from 0500 GMT 11 March to 1400 GMT 12 March. This track is compiled from cyclone centre positions established by the radar at the Darwin Airport Meteorological Office.



Island, on a west-northwest track. Heavy falls of rain were reported over Arnhem Land during this period; 368 mm at Cooper Creek in the 24 hours to 9 am 7 March, and 426 mm at Maningrida in the 24 hours to 9 am 10 March.

Cyclone intensity was reached at 1800 GMT 10 March, with the centre near Goulburn Island. After crossing the Cobourg Peninsula during the morning of 11 March, **Max** changed direction to west-southwest, eventually passing within 15 km of Darwin Airport radar at 1900 GMT 11 March. The detailed track that it was possible to maintain when the cyclone was within radar range showed sinusoidal-type oscillations from this basically west-southwest direction (Fig. 7). Maximum sustained winds of 74 km/h were recorded at the airport and the central pressure was estimated at 993 mb.

Max intensified and changed course to westerly as it moved away from the Top End coast and into the Timor Sea.

The cyclone tracked steadily westward during the 14th along the northern edge of a high pressure ridge that became well established over Western Australia. GMS imagery showed a well-defined eye late on the 14th when **Max** was most intense. The central pressure was estimated at 960 mb with maximum winds of about 150 km/h.

On the 15th and 16th **Max** changed direction to the west-southwest. It finally weakened as it came under the influence of a strong upper level northwesterly flow which sheared the cloud away from the storm's centre during the 17th and 18th.

The maximum recorded wind gust was 107 km/h from the southeast at approxmiately 1915 GMT 11 March at Darwin Airport. At this time **Max** was located 15 km north-northwest of the airport.

No loss of life or major injuries were reported and only minor structural damage was experienced at Darwin. Nevertheless, a large number of trees were uprooted, some bringing down power lines and blacking out parts of the city. The first cyclone warning for Darwin was issued at 5 am CST 11 March and by mid afternoon all normal business activity had ceased. An estimated 2500 people left the city, while 7000 spent the night in public cyclone shelters. Darwin Airport was closed at 10 pm and all light aircraft ferried inland to Batchelor or Tindal. Small craft moved to sheltered areas in Darwin Harbour, while large vessels left port.

Widespread flooding occurred in the uranium province, with most rivers at their highest known levels; the Pancontinental Mining camp at Jabiluka was evacuated on 12 March.

13. Tropical cyclone Olga, 5 to 18 April 1981 (Fig. 3)

Early in April there was a persistent low with associated convective activity northwest of Cocos Island. This low slowly moved southwest and deepened, attaining cyclone intensity on 7 April. The storm continued deepening and reached peak intensity three days later when a clear eye could be seen on satellite imagery. At that time the central pressure was estimated at 940 mb with maximum winds of about 180 km/h.

During 10 and 11 April **Olga** moved steadily south-southwest. This movement was probably influenced by a very intense low that was operating in the Amsterdam-Kerguelen Island area near longitude 80°E.

The influence of this low continued as it moved eastwards. On the 13th **Olga** accelerated to the east-southeast as it came under the influence of strong northwesterly winds ahead of the southern depression. Most of the cloud sheared from the storm's centre and it had become extra-tropical by 14 April. The system finally dissipated on the 18th after moving erratically off the Western Australian coast.

The highest reported wind was north-northwest at 70 km/h at 1800 GMT on the 12th by a ship 220 km northeast of the centre. The closest land station to the cyclone was Cocos Island which recorded easterly winds up to 56 km/h during 7 April, and a pressure of 1004 mb when **Olga** was located about 620 km northwest of the island. No damage or loss of life was reported.

14. Tropical cyclone Paddy, 24 to 30 May 1981 (Fig. 4)

Paddy was the last cyclone in the Western Region during the 1980–81 season. It developed very late in the season during late May in an area of active convergence about 1000 km northwest of Cocos Island. It was a moderately intense cyclone with estimated mean maximum winds of 130 km/h and an estimated minimum pressure of 973 mb.

The highest measured mean wind associated with **Paddy** was 65 km/h from a ship 400 km south of the cyclone at 0600 GMT 26 May.

Paddy decayed rapidly after 27 May as a strong upper trough and cold front moving through the central Indian Ocean captured the upper-level cloud of the cyclone and sheared it away from the low-level circulation. This upper cloud streamed rapidly to the southeast as the front intensified approaching Western Australia, and a major rain situation developed over the western half of the State during the early days of June.

Meanwhile the low-level remnants of **Paddy** drifted slowly east-southeast as a weak tropical depression. The disturbance lay just off the upper Western Australian coast on 6 June. A cold front moving towards the coast interacted with the disturbance at this time, causing rapid acceleration towards the coast. This brought strong squally winds to the Carnarvon area during 6 June.

No damage or loss of life was reported.

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Table 1. Summary of the 1980–81 tropical cyclone season in the Australian region.

	Australian Region	*Western Region*	*Northern Region*	*Eastern Region*
Initial location of tropical depression	8	4	2	2
Coastal crossings (sea to land)	6	1	2	3
Coastal crossings (land to sea)	3		2	1
Tropical cyclone days (one cyclone active)	57	55	5	11
Tropical cyclone days (two cyclones active)	9	3		
Severe cyclones	11	9	1	2

(a) There were five cyclones for which the initial tropical depression was located in Indonesian waters.
(b) There was one cyclone for which the initial tropical depression was located in Nandi (Fiji) area of responsibility.
(c) Note that the second passage of **Max** over land was of very short duration.

Table 2. Tropical cyclones in the Australian region during the 1980–81 tropical cyclone season.

No.	*Name and lifespan as cyclone*	*Initial location of tropical depression*	*First reached tropical cyclone intensity*	*Estimated lowest central pressure*	*Weakened below tropical cyclone intensity*
1	**Alice** 5 Nov — 10 Nov	4.9°S 102.0°E 0000 GMT 3 Nov	7.7°S 97.9°E 1200 GMT 5 Nov	940 mb	West of 80°E after being renamed **Adelaide**
2	**Bert** 27 Nov — 4 Dec	7.7°S 95.0°E 0000 GMT 24 Nov	7.7°S 88.2°E 0000 GMT 27 Nov	965 mb	West of 80°E after being renamed **Christelle**
3	**Carol** 13 Dec — 22 Dec	10.5°S 122.4°E 0000 GMT 12 Dec	12.8°S 118.1°E 0600 GMT 13 Dec	940 mb	15.0°S 92.1°E 0000 GMT 22 Dec
4	**Dan** 16 Dec — 18 Dec	8.5°S 99.4°E 0000 GMT 14 Dec	10.3°S 102.4°E 0000 GMT 16 Dec	980 mb	13.7°S 105.5°E 0000 GMT 18 Dec
5	**Felix** 23 Dec — 29 Dec	10.6°S 127.0°E 0000 GMT 22 Dec	10.4°S 122.8°E 0000 GMT 23 Dec	940 mb	22.6°S 104.9°E 0600 GMT 29 Dec
6	**Edna** 24 Dec — 25 Dec	10.1°S 117.4°E 0000 GMT 20 Dec	11.0°S 105.0°E 0000 GMT 24 Dec	994 mb	11.1°S 100.8°E 0000 GMT 25 Dec
7	**Mabel** 13 Jan — 20 Jan	11.8°S 110.1°E 0000 GMT 12 Jan	12.9°S 114.1°E 0000 GMT 13 Jan	930 mb	24.0°S 109.6°E 1200 GMT 20 Jan
8	**Eddie** 9 Feb — 11 Feb	14.2°S 154.0°E 1800 GMT 8 Feb	13.5°S 148.7°E 0900 GMT 9 Feb	980 mb	16.8°S 135.8°E 1200 GMT 11 Feb
9	**Cliff** 9 Feb — 14 Feb	11.1°S 171.6°E 0000 GMT 9 Feb	12.2°S 169.9°E 1500 GMT 9 Feb	975 mb	25.4°S 152.5°E 2000 GMT 14 Feb
10	**Neil** 25 Feb — 6 Mar	19.4°S 120.3°E 0000 GMT 24 Feb	18.6°S 116.3°E 0000 GMT 25 Feb	940 mb	25.0°S 119.8°E 0600 GMT 6 Mar
11	**Freda** 26 Feb — 7 Mar	14.5°S 140.5°E 2100 GMT 24 Feb	16.6°S 148.8°E 1800 GMT 26 Feb	962 mb	24.0°S 165.3°E 0000 GMT 7 Mar
12	**Max** 11 Mar — 18 Mar	12.4°S 135.8°E 0000 GMT 9 Mar	11.5°S 133.4°E 1800 GMT 11 Mar	960 mb	16.0°S 106.3°E 0000 GMT 18 Mar
13	**Olga** 7 Apr — 14 Apr	7.5°S 94.0°E 0000 GMT 5 Apr	9.0°S 92.3°E 1200 GMT 7 Apr	940 mb	30.6°S 105.5°E 0000 GMT 14 Apr
14	**Paddy** 25 May — 29 May	7.8°S 88.5°E 0000 GMT 24 May	9.6°S 90.2°E 0000 GMT 25 May	973 mb	15.4°S 93.1°E 0000 GMT 29 May