

# The Australian tropical cyclone season 1986-87

W. Manchur, Regional Office, Bureau of Meteorology,  
Brisbane, Australia

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**Seven tropical cyclones occurred in the Australian region during the 1986-87 season. Three of these cyclones were classified as severe (mean 10-minute wind speed of 120 km/h or more) and five of them crossed the coast. Sixteen deaths were attributed to one of the cyclones when two fishing vessels sank. Only light to moderate structural damage and stock losses were reported with the cyclones which crossed the coast. The second highest recorded wind gust in Australia, 222 km/h, occurred during tropical cyclone *Elsie*. The estimated lowest pressure in a cyclone this season was 940 hPa, also in tropical cyclone *Elsie*.**

## Introduction

The first tropical cyclone of the 1986-87 season occurred in mid-January and the last occurred in late May, which is well beyond the normal end to a cyclone season. Seven cyclones occurred during the season compared to the 10-year average of about thirteen. This is the least number of cyclones in a season since 1982-83. Five cyclones crossed the Australian mainland coast compared with a 21-year average of 4.8 (Lourensz 1981), six originated in the Australian region and three became severe cyclones.

One main cyclogenetic period was evident, lasting from mid-January to mid-February, during which four of the cyclones developed. Two of the cyclones developed during the intense scientific investigations of the Australian Monsoon Experiment (AMEX), Equatorial Mesoscale Experiment (EMEX) and Stratosphere-Troposphere Exchange Project (STEP) (see Holland et al. 1986). Another two occurred in late February and early April, and the last one developed in the far Eastern region late in May.

Residents of Karumba, on the southern Gulf of Carpentaria coast, were evacuated as a precaution against a significant predicted storm surge with tropical cyclone *Jason*. Some residents in Port Hedland were also evacuated prior to cyclone *Connie* crossing the coast.

No major damage was reported with any of the three severe cyclones which crossed the coast. However, varying amounts of structural damage and stock losses were reported through wind damage and subsequent flooding.

Sixteen lives were lost when an Indonesian fishing fleet was caught up in cyclone *Kay* in the northern Indian Ocean.

## Seasonal statistics

The area for which the Australian Bureau of Meteorology had international tropical cyclone warning responsibility during the 1986-87 season is shown in Fig. 1. A statistical summary of some aspects of the cyclone season is given in Table 1 and Table 2.

The average number of tropical cyclones in the three regions for the 10-year period ending 30 June 1987 has been derived from Lourensz (1981), Kingston (1986) and records held in the Brisbane Regional Office.

Over the Australian region, the number of cyclones for the season (seven) was well below (55 per cent) the ten-year average (12.8). Both the Western region and the Eastern region had about half their average number of cyclones per season while the Northern region had a slightly higher than average number of cyclones per season.

Five of the seven cyclones crossed the coast from sea to land with one of them, *Jason*, crossing the coast in two regions. This is close to the 21-year average of 4.8 (Lourensz 1981) but on a percentage of cyclones per season basis it is much higher than the average.

A tropical cyclone day is defined as a day on which one or more tropical cyclones (10-minute mean winds of 63 km/h or more) existed in the Australian region for any part of the day commencing 0000 UTC. There were 32 cyclone days during 1986-87 in the Australian region. This is about 70 per cent of the long-term average value.

Estimates of central pressure and maximum wind speed have been based on the Dvorak (1984) technique with modifications in some regions to take into account local conditions.

Table 2 provides more detailed information on the tropical disturbances which developed into tropical cyclones.

Fig. 1 Australian tropical cyclone warning and advisory area of responsibility.

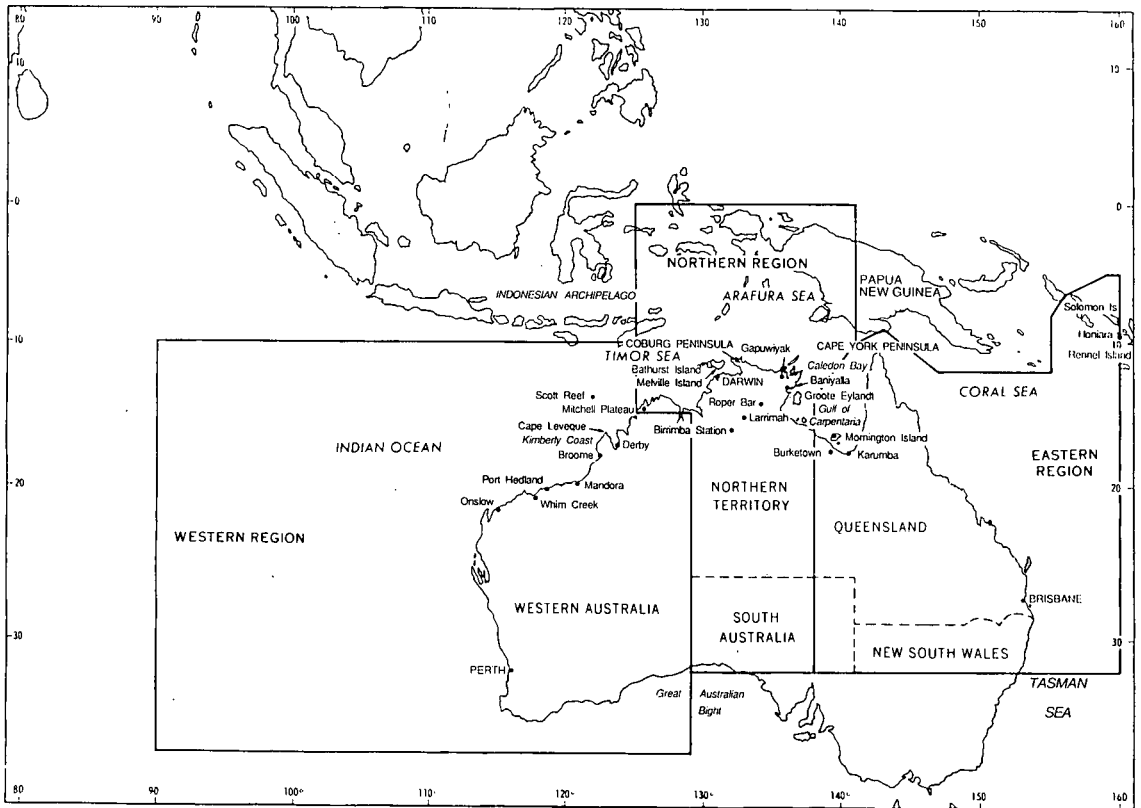


Table 1. Summary of the 1986-87 tropical cyclone season in the Australian region.

	Australian region	Western region	Northern region	Eastern region
Number of cyclones (1986-87)	7	4	3	2
Average number of cyclones (1977-78 to 1986-87)	12.8	7.9	2.3	4.1
Tropical depression initial location	6	2	3	1*
Coastal crossing at cyclone intensity (sea to land)	6	2	3+	1
Tropical cyclone days (one active)	32	18	11	7
Tropical cyclone days (two active)	2	0	0	0
Severe tropical cyclones	3	2	1	1

\* One tropical depression which formed outside the Australian region subsequently developed into a tropical cyclone in the Australian region.

+ Includes Cobourg Peninsula crossing by *Kay*.

## Large-scale features

The cyclone season was, in the main, dominated by large-scale circulations characteristic of an El Niño-Southern Oscillation (ENSO) episode (see Gaffney and Casey 1987).

As early as September 1986 there were indications that an ENSO event was developing, albeit later than normal. The indications were provided by: (a) a small

eastward displacement of the Walker circulation from its mean position; (b) a weaker than normal Indian monsoon trough; (c) a continued low value of the Southern Oscillation Index (SOI – a measure of the pressure difference between Darwin and Tahiti) and (d) sea-surface temperature (SST) anomalies near the dateline comparable to the 1982-83 ENSO episode.

**Table 2. Tropical cyclones in the Australian region during the 1986-87 season.**

No.	Name and life span as a cyclone	Initial location of tropical depression	First reached tropical cyclone intensity	Estimated lowest central pressure (hPa)	Weakened below tropical cyclone intensity
1	<i>Connie</i> 15 Jan-23 Jan	15.8°S, 124.8°E 150000	17.1°S, 121.9°E 171200	950	23.5°S, 118.2°E 201200
2	<i>Irma</i> 19 Jan-21 Jan	12.2°S, 138.9°E 180300	12.5°S, 138.6°E 191200	978	15.4°S, 134.1°E 210000
3	<i>Damien</i> 31 Jan-9 Feb	14.6°S, 124.0°E 310000	15.4°S, 123.3°E 011800	980	18.1°S, 117.6°E 050000
4	<i>Jason</i> 6 Feb-13 Feb	10.0°S, 142.3°E 060000	12.6°S, 139.7°E 070600 13.9°S, 136.3°E 110300	970	10.8°S, 136.1°E 100600 18.6°S, 140.0°E 130900
5	<i>Elsie</i> 22 Feb-27 Feb	Over land	15.0°S, 124.5°E 220300	940	23.0°S, 122.5°E 261500
6	<i>Kay</i> 9 Apr-17 Apr	8.5°S, 140.1°E 080000	10.1°S, 135.1°E 090600	976	17.7°S, 110.4°E 160600
7	<i>Blanch</i> 22 May-25 May	10.0°S, 167.7°E 210300	11.1°S, 160.1°E 220600	990	17.5°S, 156.5°E 251800

NOTE: All times in UTC.

During October and November the large-scale circulations did not vary a great deal from the mean, except for the continuing low-level westerly wind anomaly in the equatorial Pacific region east of 155°E. However, from December to the end of the cyclone season, the general circulation in the region confirmed that an ENSO event was occurring and, in fact, was intensifying towards the end of the season. The Walker circulation reorganised with the descending branch becoming established in the Coral Sea/northeast Australian region. The consequence of this was a suppression of tropical cyclogenesis in this region while enhanced activity occurred near to and east of the dateline.

To the west of the continent, the monsoon trough was rather poorly developed, reflecting the reduced cross-equatorial flow as a result of weaker than normal northeasterly trade wind flow in the north Indian Ocean. Only in the Northern region was there a significant interruption to the climate control of the ENSO event when active monsoonal conditions arrived in mid-January and continued for about a month.

A rapid transition to trade wind flow in the Northern region occurred early in March and virtually brought an end to the Australian cyclone season. The upper-level ridge migrated north of its mean position, allowing high-level westerlies to extend to the far north coast. An upper-level cyclonic anomaly began developing in the south Indian Ocean during March and increased during the next two months. The stronger and northward extension of the westerly flow in the tropical Indian Ocean area was consistent with a low level of monsoon activity in the Indian region during May.

Blocking activity through the season tended to concentrate in two areas, one just east of the dateline and the other in the southern Indian Ocean. Enhanced blocking was also evident in the Tasman Sea/New

Zealand area during December. Positive pressure anomalies continued off the east coast of Australia during January and February, as would be expected from the general circulation considerations.

Sea-surface temperatures in the equatorial belt were generally above normal, with pockets as much as three degrees above normal during January in the Indonesian Archipelago area. A persistent cold anomaly was evident in the southwest Pacific near the dateline but this weakened toward the end of the season.

## Tropical cyclones of the 1986-87 season

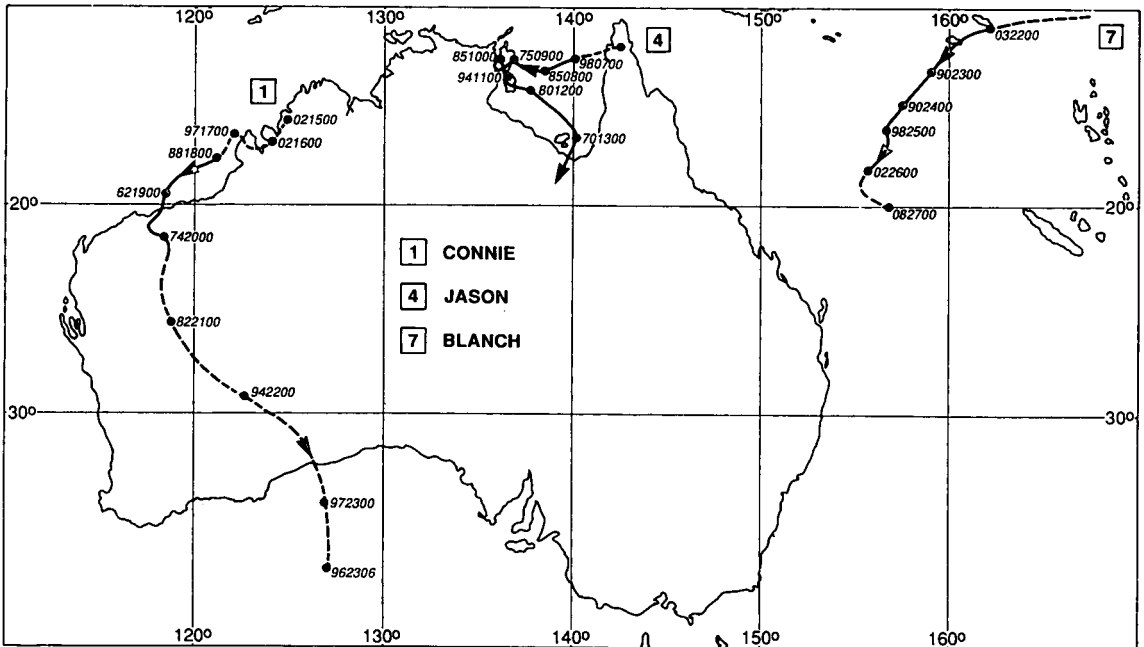
### 1. Tropical cyclone *Connie*, 15 January to 23 January 1987 (Fig. 2)

Tropical cyclone *Connie* formed from a low which originated over land to the northeast of Derby. The low, with a central pressure of 1002 hPa at 150000 UTC, drifted southwest past Derby and then northwest, moving out to sea near Cape Leveque. Rapidly intensifying, the low reached tropical cyclonic intensity by 171200 UTC at 17.1°S, 121.9°E, about 650 km northwest of Broome.

*Connie* then moved southwest under the influence of an upper-level high pressure system located over central Australia and continued to intensify. By 190600 UTC the cyclone reached maximum intensity with a central pressure of 950 hPa and an estimated mean maximum wind speed of 149 km/h.

Three hours later *Connie* crossed the coast at 20.3°S, 118.5°E about 20 km west of Port Hedland and continued inland on a southerly track and weakened slowly. By 201200 UTC, at 23.5°S, 118.2°E (about 350 kilometres south of Port Hedland), the system ceased producing gale force winds. However, a deep low with a central

Fig. 2 Tracks of tropical cyclones *Connie*, *Jason* and *Blanch* of the 1986-87 season. Broken lines denote pre- and post-cyclone stage. Details in code form PPYYGG where PP is central pressure (tens and units of hPa); YY is date and GG is time (UTC whole hours).



pressure of 980 hPa still remained and moved steadily south-southeast, crossing into the Great Australian Bight at 32.1°S, 126.2°E (221800 UTC) with a central pressure of 996 hPa. The system finally lost identity at 36.9°S, 127.1°E (230600 UTC) and became part of a southern low pressure system.

A maximum wind gust of 171 km/h was recorded at Port Hedland Airport at 191147 UTC, when the mean wind speed was 93 km/h. This was the strongest wind recorded during the cyclone.

Only moderate damage was sustained due to the cyclone. Beach erosion and minor flooding occurred at Port Hedland, where a number of houses were also unroofed. No human deaths or injuries were reported, though 30 people were evacuated in the Port Hedland area as a precautionary measure. At Whim Creek the hotel was unroofed. Pastoral stations in the area reported stock losses, as well as damage to windmills and buildings.

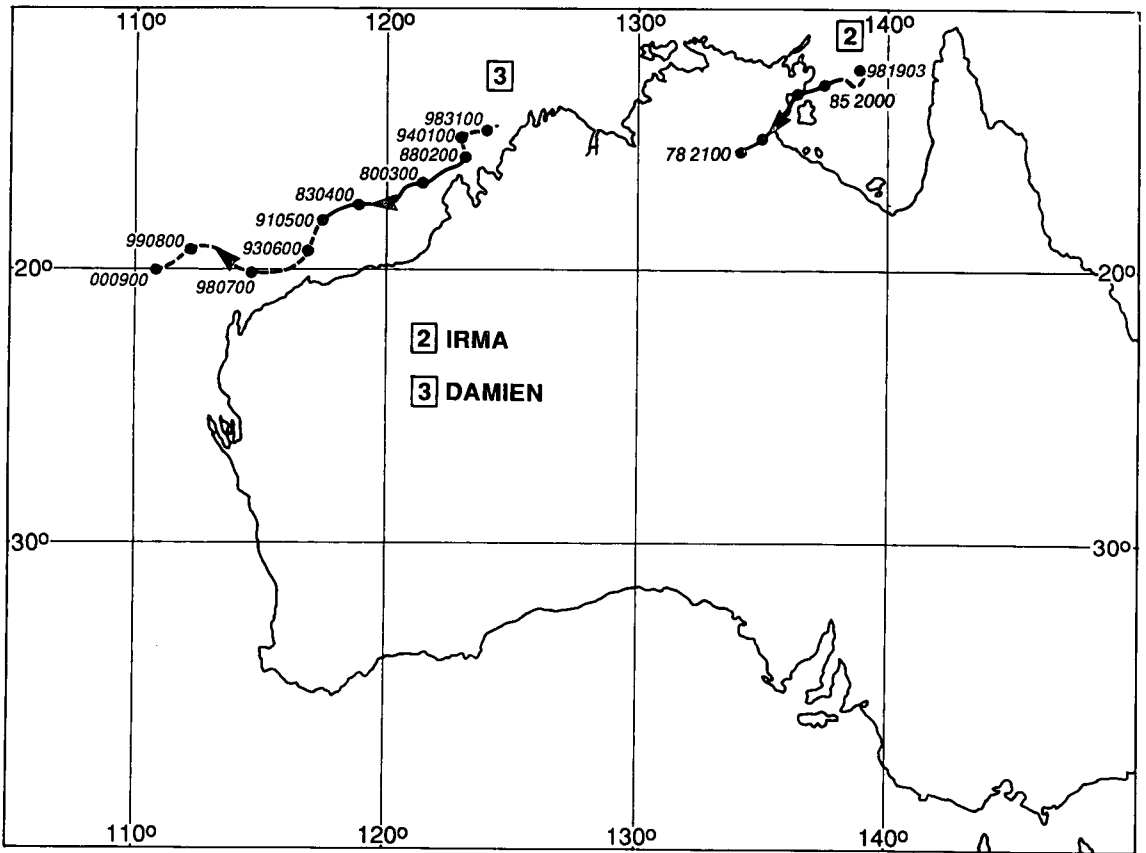
At Port Hedland a positive tidal anomaly of 2.0 metres was recorded at 191130 UTC shortly after the cyclone had crossed the coast. The anomaly occurred at a predicted low tide of 2.0 metres. (Highest astronomical tide for Port Hedland is 7.6 metres.) A maximum wave height of 6.8 metres was recorded 15 kilometres offshore from Port Hedland by professional survey instrumentation.

## 2. Tropical cyclone *Irma*, 19 January to 21 January 1987 (Fig. 3)

Tropical cyclone *Irma* developed from an area of deep convection in the northern Gulf of Carpentaria that had persisted for several days prior to 19 January. During this period the upper-level flow was quite zonal and hence unfavorable for cyclogenesis but the vigorous monsoon continued and by the morning of 19 January a Chinese research vessel anchored in the northern Gulf reported winds up to 74 km/h in the westerly flow to the north of the incipient depression. The low continued to intensify as it moved in a west-southwesterly direction across the Gulf of Carpentaria and at 191200 UTC, when gales had developed through all sectors, the low was upgraded to a cyclone.

After crossing the coast at 201200 UTC, *Irma* moved in a south-southwesterly direction almost parallel to the coast for the next nine hours before resuming a southwesterly track and heading further inland. *Irma* became a very active rain depression and produced areas of flooding in the central Northern Territory. Rainfall figures from the area included a 24-hour total of 409 mm at Larrimah. A number of people had to be evacuated from Birrimba Station as floodwaters threatened their homestead. The lowest pressure recorded was 989.9 hPa

Fig. 3 Tracks of tropical cyclones *Irma* and *Damien* of the 1986-87 season (symbols as in Fig. 2).



at Roper Bar after *Irma* had made landfall. The strongest wind reported was 111 km/h from a ship west of Groote Eylandt just prior to landfall.

Wind damage caused by *Irma* was only slight.

**3. Tropical cyclone *Damien*, 31 January to 9 February 1987 (Fig. 3)**

Tropical cyclone *Damien* formed from a monsoonal low that developed off the Kimberley coast, to the north of Cape Leveque, on 31 January 1987. The developing low moved generally southwest under the influence of an upper-level high pressure system located over central Australia.

Cyclonic intensity was not attained until 012100 UTC at 15.5°S, 123.3°E, with a central pressure of 988 hPa. Continuing to move southwest, parallel to the coast, the cyclone intensified slightly to reach a maximum intensity by 030000 UTC near 16.7°S, 121.5°E. Central pressure at this time was 980 hPa and this was maintained for 12 hours before the cyclone began to weaken.

A series of frontal passages to the south of the continent with subsequent advection of cold air into the cyclone caused it to weaken. By 050000 UTC the central pressure had risen to 991 hPa and winds decreased below gale force. The resulting tropical depression moved erratically westward and by 090000 UTC at 20.0°S, 111.0°E had dissipated.

Cyclone *Damien* was a maritime cyclone throughout its life cycle and no coastal damage occurred. The strongest observed wind (83 km/h) was recorded by a ship 150 km to the north of the storm at 031200 UTC. The estimated strongest winds were 97 km/h from 030000 UTC to 030600 UTC when the cyclone was near 16.7°S, 121.5°E.

**4. Tropical cyclone *Jason*, 6 February to 13 February 1987 (Fig. 2)**

Tropical cyclone *Jason* was the first tropical cyclone to affect the Eastern region during the 1986/87 season. It developed into a tropical low at about 060000 within a

cloud mass over northern Cape York Peninsula and the northeastern Gulf of Carpentaria.

The tropical low then moved west-southwest across the Gulf of Carpentaria and deepened gradually, even though the upper air structure was not favorable for cyclogenesis. When midway across the Gulf near 12.6°S, 139.7°E, the system reached cyclonic intensity, with a central pressure of 985 hPa, at 070600 UTC. The system continued to move west-southwest and deepened a further 10 hPa before turning west-northwest around 081200 UTC when near 13.4°S, 137.4°E. Up to this time the track was similar to *Irma's*, some three weeks earlier. As the cyclone approached the coast the first of two loops commenced at 081800, taking about 12 hours to complete. The coastal crossing occurred about 090000 UTC near Caledon Bay. As *Jason* weakened over land on the 10th it looped a second time.

Ex-tropical cyclone *Jason* then drifted slowly southward and moved over water again by 110000 UTC. It had moved into an area where the upper air structure favored development and it reached cyclonic intensity a second time at about 110300 UTC near 13.9°S, 136.3°E with a central pressure of 990 hPa. From this point its track was first east across Groote Eylandt, then southeast. *Jason* continued to intensify and became a severe tropical cyclone about 121800 UTC with a central pressure of 970 hPa near 15.1°S, 139.6°E. At about 130000 UTC *Jason* made its final turn from southeast to southwest and three hours later made landfall some 40 kilometres northeast of Burketown with a central pressure of 975 hPa.

The maximum intensity was reached at about 121800 UTC with a central pressure of 970 hPa which was maintained until 130000 UTC. The highest reported wind speed was 158 km/h at Burketown at 130520 UTC. The lowest recorded pressure was 981 hPa at Mornington Island at 130030 UTC. The highest reported storm surge was 2 metres at 130500 UTC at Karumba but it is estimated that the surge reached 3.5 metres along the uninhabited coast west of Karumba. The residents of Karumba were evacuated as *Jason* approached the coast.

*Jason* destroyed most buildings in the Northern Territory community of Banyiyalla. Some damage was also reported from Burketown and Gapuwiyak. There were no deaths or serious injuries.

### 5. Tropical cyclone *Elsie*, 22 February to 27 February 1987 (Fig. 4)

Deep convection associated with a low in the monsoon trough began to develop in the western Gulf of Carpentaria at 181200 UTC. The resulting system developed a persistent westerly movement, crossing the north of the continent and subsequently moving out to sea near Mitchell Plateau in the Kimberley region at 220000 UTC.

Cyclonic intensity was reached by 220300 UTC and *Elsie* maintained an erratic, but basically westerly, movement until 230600 UTC (15.0°S, 122.0°E), by which time the central pressure had fallen to 976 hPa. The cyclone then moved southward under the influence of an

upper-level high centred over the Northern Territory and continued to deepen.

*Elsie* crossed the coast at 15.2°S, 121.8°E at 250900 UTC, passing over the cooperative observing station, Mandora, with a central pressure of 940 hPa. Figure 5 shows the barograph trace as the cyclone passed over the station. The geometric centre was estimated to be some five kilometres north of the station. A maximum wind gust of 222 km/h was recorded on the Maximum Gust Indicator. This is the second highest gust reliably recorded on the Australian mainland, being exceeded only by a gust of 248 km/h recorded at Onslow during cyclone *Trixie* in February 1975.

Severe damage was sustained at Mandora, and the two main homestead buildings had to be bulldozed away to allow rebuilding to commence. Damage was also sustained at nearby stations. Heavy rain caused moderate flooding.

After crossing the coast, the cyclone moved in a more southeasterly direction, maintaining cyclonic strength until 261200 UTC at 22.7°S, 122.1°E with a central pressure of 986 hPa. The weakening low moved southeasterly and then easterly before dissipating at 23.8°S, 124.9°E with a central pressure of 998 hPa at 270600 UTC.

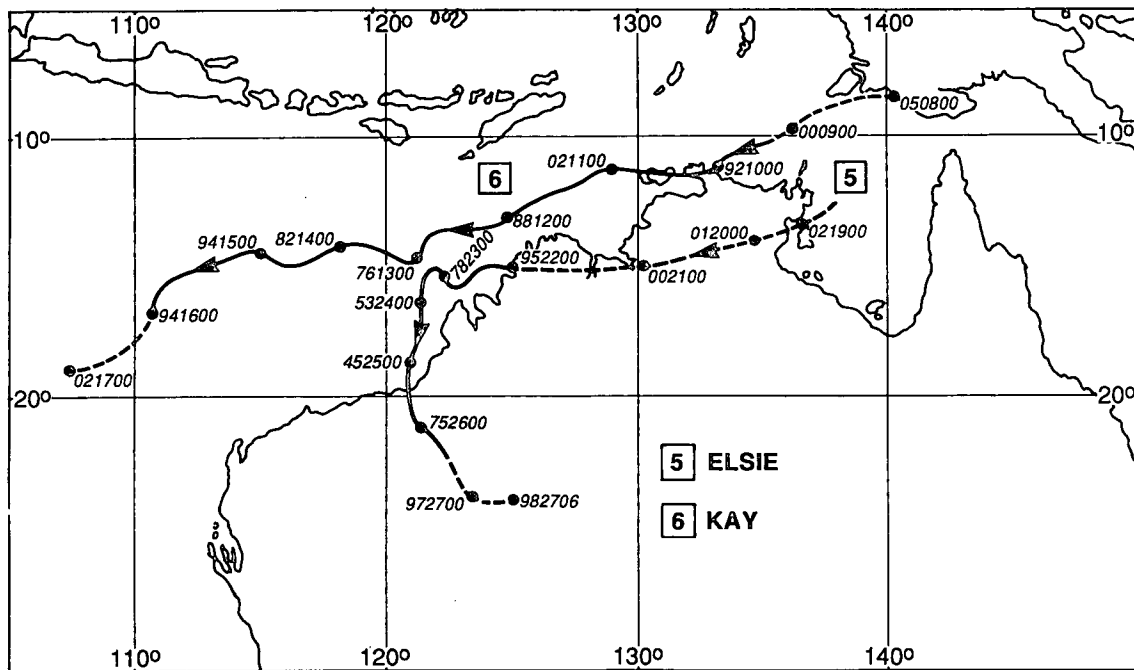
### 6. Tropical cyclone *Kay*, 9 April to 17 April 1987 (Fig. 4)

Tropical cyclone *Kay* began as a weak depression in the Gulf of Papua on 5 April. For the next four days the depression moved slowly in a west-southwesterly direction, gradually intensified, and was named at 090600 UTC. Ship observations near the centre reported 50 knot winds and a pressure of 996 hPa at 090900 UTC.

*Kay* continued in a west-southwesterly direction into an area of strong middle and upper-level easterly flow. At 100000 UTC satellite imagery indicated that the upper-level cloud had sheared away from the low-level circulation. While the upper cloud moved rapidly southwestward the low-level circulation moved westward across the Cobourg Peninsula, Bathurst Island and Melville Island to the north of Darwin. The low-level circulation was clearly evident on satellite imagery to the west of Bathurst Island at 101800 UTC but through the shearing mechanism and the passage over the islands to the north of Darwin, *Kay* had weakened considerably and the central pressure was estimated at only 1002 hPa.

Throughout the next 6 to 12 hours the depression underwent massive reorganisation and intensification. The reorganisation could have been due to development from the middle-level circulation (located to the southwest of the low-level circulation following shearing) in which case a new system centre was formed, or alternatively, rapid realignment occurred between the existing low-level circulation and the middle-levels. Complex satellite imagery and a sparse surface network, make an accurate positioning of the system very difficult during this period. However, a reorganised *Kay* passed south of the drilling platform near 11.5°S, 129°E at about 111800 UTC with an estimated central pressure of 992 hPa. The cyclone continued to intensify and moved

Fig. 4 Tracks of tropical cyclones *Elsie* and *Kay* of the 1986-87 season (symbols as in Fig. 2).



into the Western region near 13.1° S, 124.9° E at 120000 UTC as a fully developed cyclone.

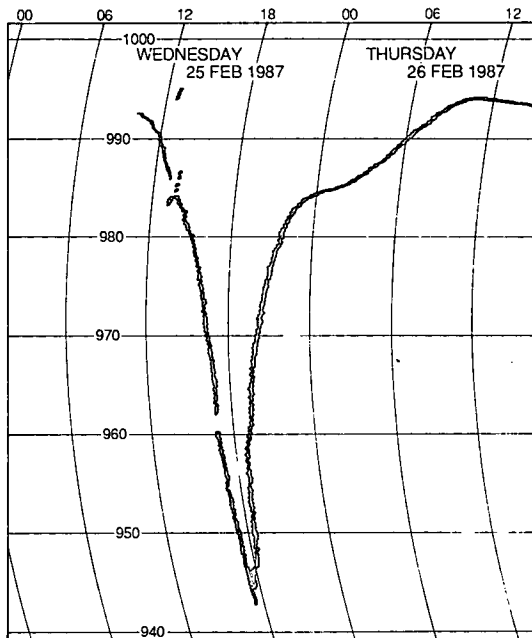
*Kay* maintained a basic west-southwesterly course, though the passage of weak frontal systems to the south caused minor variations in the track. The cyclone intensified to reach its lowest pressure of 976 hPa by 121800 UTC at 13.7° S, 121.8° E. This pressure was maintained for 24 hours before the system began to weaken. By 160000 UTC at 16.8° S, 110.8° E the central pressure had risen to 994 hPa and the system was no longer considered to be producing gale force winds. The resulting low was absorbed into a broad maritime trough in the vicinity of 19.0° S, 107.5° E at 170000 UTC.

The strongest wind reported was 121 km/h from the northwest, reported by a ship 160 km to the north of the centre when the cyclone was at 13.6° S, 122.8° E (121200 UTC). As this wind strength exceeds the Dvorak-derived estimate of the strongest winds near the centre at the time, monsoonal northwesterlies are assumed to have contributed the excess.

The cyclone was entirely maritime and did not cause winds exceeding gale force in coastal areas.

A newspaper article (*Australian*, 21 April 1987) reported that two Indonesian fishing vessels had capsized in wild seas off Scott Reef during 16 April with the loss of 16 lives. This tragedy was reported to Australian authorities by the five survivors several days after the event.

Fig. 5 Barograph trace from Mandora, WA during passage of tropical cyclone *Elsie* over station on 25 February 1987.



### 7. Tropical cyclone *Blanch*, 22 May to 25 May 1987 (Fig. 2)

The circulation which developed into tropical cyclone *Blanch* was first identified on 21 May 1987 some 800 kilometres east of Honiara. This system moved quickly west-southwest and slowly deepened until it crossed the southern tip of San Christobal Island in the Solomon Island group at 220000 UTC.

The next six hours saw rapid deepening until the system reached cyclonic intensity when near 11° S, 161° E with a central pressure of 998 hPa. Tropical cyclone *Blanch* then took on a southwesterly track, crossed Rennell Island around 221000 UTC and then slowed down. It continued to deepen and reached its lowest pressure of 990 hPa around 221800 UTC. This was maintained until 240000 UTC when it was near 15° S, 158° E.

The cyclone then began weakening whilst moving rather slowly first southwest then south-southeast and finally southwest again. It weakened below cyclonic intensity around 251800 UTC when near 17.5° S, 156.5° E. The resulting low was identifiable for a further 30 hours during which time the speed gradually increased and the track gradually turned from southwest to southeast. The system dissipated near 20° S, 157° E.

The lowest reported pressure was 1002.6 hPa at 220600 UTC at Kira Kira on San Christobal Island. The highest reported wind speed was 111 km/h also at Kira Kira but at 221200 UTC.

Other than contributing to the production of strong winds along the Queensland coast, this system had no effect on the Australian mainland. Some minor damage occurred in the Solomon Island group but no injuries were reported.

### Acknowledgment

This report was prepared from material supplied by staff of the Tropical Cyclone Warning Centres in Darwin, Perth and Brisbane.

Details on the large-scale circulations were obtained from the *Darwin Tropical Diagnostic Statements* prepared by the Regional Office in Darwin and from the 'Climate Monitoring Bulletins' prepared by the National Climate Centre in Melbourne.

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