

TROPICAL CYCLONES IN THE NORTHWESTERN AUSTRALIAN REGION DURING
THE 1961/62 SEASON

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Abstract: The 1961/62 season of five cyclones did not commence until after the first week in January, and activity continued until 6th March. The first four cyclones brought heavy and wide-spread rains to the Kimberley region of Western Australia which caused flooding and erosion and resultant damage to roads and crossings, but no damage from wind was reported. The last identified cyclone of the season, and the least active, occurred in the Cocos Island area. There were, however, a number of likely circulations in the Indian Ocean as late as May.

Two of the cyclones followed unusual paths. One moved inland from the ocean, intensified, and then moved out to sea again after several days. The other originated over the land, moved out to sea and then exhibited multiple recurvature. The depressions are classified according to size and intensity, listed and catalogued, and finally, discussed in detail.

1. INTRODUCTION

The tropical disturbances are classified as follows:

- Class 1: Major cyclones with gale winds extending over 100 miles from the centre.
- Class 2: Cyclones with gales not extending more than 100 miles from the centre.
- Class 3: Tropical depressions with central winds of less than 34 kt.

Maps showing the tracks of the storms have been prepared, giving the positions at 0100-G. M. T. The central pressure in millibars and the Greenwich date and hour are shown in the form FPYYGG.

The catalogue identification code is as follows:

NNTY_yY_y Y₁Y₁Y₂Y₂M QL_aL_aL_oL_o FPYYGG QL_aL_aL_oL_o FPYYGG ..

where

- NN = identification number of disturbance
- T = class of disturbance
- Y_yY_y = year (tens and units)
- Y₁Y₁ = Greenwich date of first location

Y_2Y_2	=	Greenwich date of last location
M	=	month of Y_2Y_2 (November = 1, December = 2 when 50 is added to Y_2Y_2)
Q	=	octant of the globe
L_aL_a	=	latitude (tens and units)
L_oL_o	=	longitude (tens and units)
FP	=	central pressure (tens and units of mb)
YY	=	Greenwich date
GG	=	Greenwich hour

2. LIST OF TROPICAL DISTURBANCES AND GENERAL DISCUSSION

No.	Class	Date	Area of Operation
1	1	7th to 14th January 1962	Off northwest coast of W. A. to inland Kimberley.
2	1	20th to 31st January 1962	Over ocean areas off northwest coast of W. A. to off central west coast of W. A.
3	1	27th January to 12th February 1962	From Timor Sea over Kimberley to off northwest coast of W. A., to Indian Ocean.
4	1	9th to 22nd February 1962	Inland Kimberley to off northwest coast of W. A., to Indian Ocean.
5	1	2nd to 6th March 1962	Indian Ocean, Cocos Island area.

Five cyclones operated in the northwestern Australian region during the 1961/62 season.

The first cyclone occurred later than usual, in the first week of January, but then consistent activity continued for six weeks, by which time four cyclones had affected the tropical areas of Western Australia. The fifth, and least active, cyclone occurred over the Indian Ocean in the Cocos Island area during the first week in March.

Although this was the last identified cyclone of the season, a number of likely circulations occurred during the next few months.

At the end of March, a centre formed between Cocos Island and Christmas Island and drifted westwards during the early days of April, passing to the north of Cocos Island. However, the system filled in favour of a very intense cyclone (Maud) operating over the central Indian Ocean.

A number of circulations persisted in the northeastern Indian Ocean during April, but none of these developed.

As late as May, a centre formed south of Cocos Island, but became an extra-tropical depression before it developed.

Two of the cyclones followed unusual paths. One moved from the ocean inland, intensified, and then moved out to sea again after several days. The other originated over the land, moved out to sea and then exhibited multiple recurvature.

Of the four cyclones which affected tropical areas of Western Australia, only one caused high winds at land stations, but heavy and widespread rains were associated with all four systems.

During January and February, particularly heavy rains fell over the Kimberley, where widespread flooding occurred on a number of occasions. Most stations in this area received over twice the average rainfall and Kuri Bay, on the North Kimberley coast, recorded over sixty inches during this period.

In all, the season was beneficial. No damage due to high winds was reported, and flood damage in the Kimberley was negligible compared with the immense value of the rains to pastoral interests.

3. CASE HISTORIES

Each case history is presented in chronological order, under the headings:- Development, Track, Rainfall, Winds and Seas, and Damage. The catalogue identification appears at the beginning of each case history.

CYCLONE No. 1 CLASS 1

Off northwest coast of W. A. to inland Kimberley, 7 to 14 January 1962.

01162	07141	71415	000701	71517	980801
		71618	950901	71720	931001
		71821	931101	71924	971201
		72026	011301	72027	011401

This cyclone was the first of the season and although not severe, was rated Class 1 owing to some local winds exceeding 34 knots when the centre was over 100 miles distant.

Generally, wind strength was not great and, although some flooding occurred, the heavy rains associated with the system were of great benefit to the pastoral interests over a wide area of the tropics.

Development:

During the first days of January 1962, an extensive area of low pressure existed off the northwest of Western Australia and with a persistent westerly stream over the area from Christmas Island to the north of Australia, it was likely that a closed circulation existed in the area.

At this stage, the system appeared to be of open gradient and was of complex structure, with several centres of pressure in the vicinity of 1000 mb.

On January 7, one of the centres, located approximately 500 miles northwest of Broome, was moving very slowly towards the northwest coast of W. A. and by January 10 was 150 miles northwest of Broome, with a central pressure of 993 mb.

The cyclone then continued its slow movement to the southeast without further development and crossed the northwest coast of Western Australia about 50 miles south of Broome, gradually filling as it moved into the central Kimberley, while the other centres of the complex system off the coast lost identity.

Track:

Owing to lack of reports over the ocean, a set track was difficult to define. However, the track shown in Fig. 1, a steady but very slow movement to the southeast, was likely and even may have been the track after recurvature of the centre moving southwest in the Timor Sea area prior to January 7.

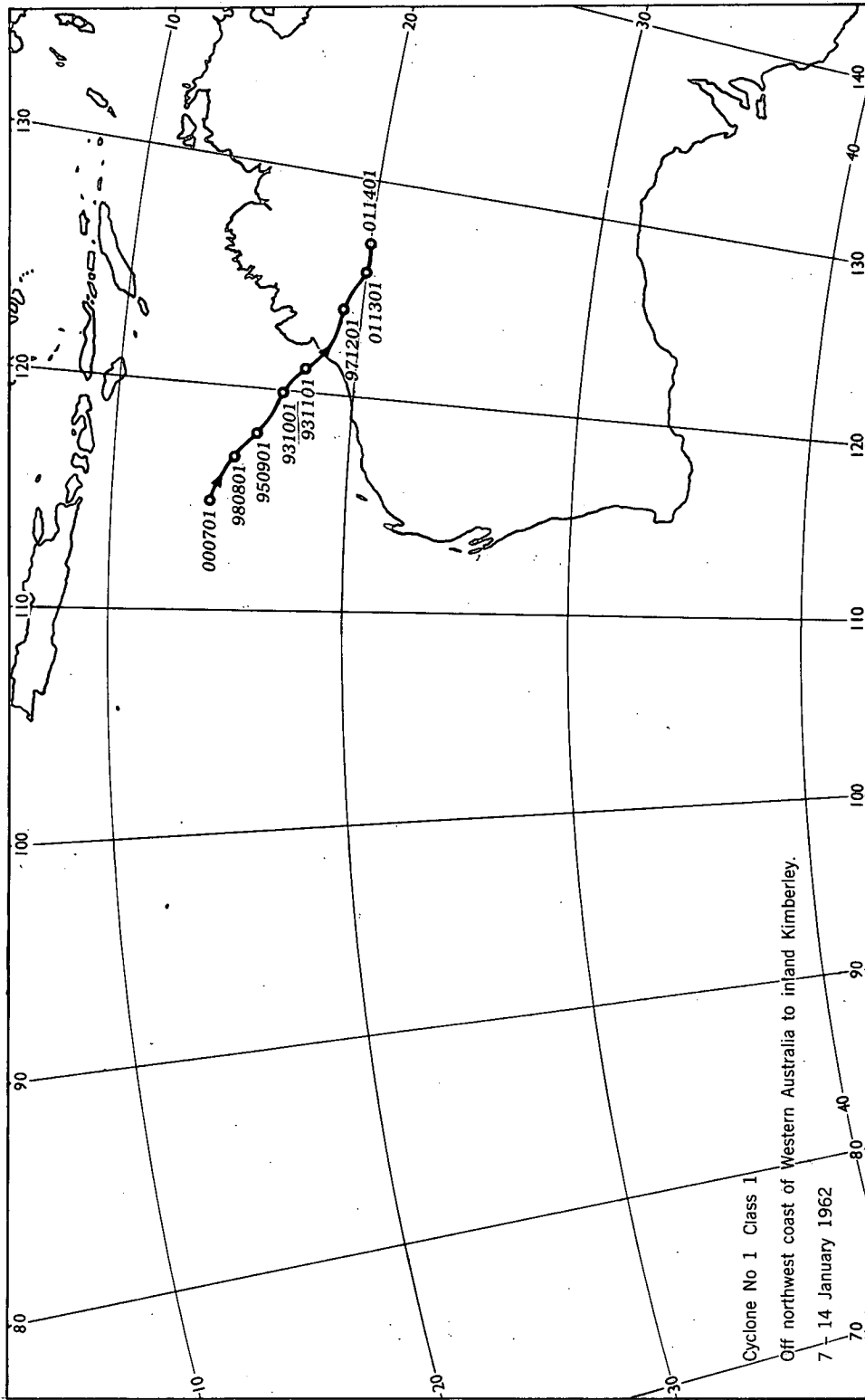


Fig. 1 The 1961 - 62 Cyclone Season in the Northwestern Australian Region. Cyclone No 1

Rainfall:

During the existence of the complex system off the northwest coast of W. A., persistent rains fell over the Kimberley, with some 24-hour falls of up to 5 in., and scattered and lighter falls extended southwards into the De Grey and Fortescue.

When the identified centre passed inland further good rains persisted in the Kimberley for some days, with scattered heavy 24-hour falls of up to 8 in. Rivers in the Kimberley flooded and rivers in the De Grey and Fortescue flowed strongly into the sea.

Winds and Seas:

Generally, wind strength was not great and the system was predominantly a rain-bearing depression.

On January 10, when the centre was 150 miles northwest of Broome, northerly winds at Cockatoo Island, 150 miles northeast of Broome, had increased to 35 knots and these persisted during the day, while at the ship "Koojarra" in the vicinity of the Island, northerly winds increased to 40 knots early on January 11 as the cyclone moved towards the coast south of Broome. However, these were the only reported winds of gale force and winds at other stations in the area did not exceed 30 knots, although the centre passed inland only 50 miles south of Broome.

After the centre had passed inland, strong winds persisted in some areas for 24 hours, but then gradually abated.

Cape Leveque, 120 miles north of Broome, reported rough to very rough seas on January 9 and these persisted for several days. However, generally seas were not heavy, although a confused moderate swell was experienced over an area over 500 miles from the centre.

Damage:

No damage due to wind strength was reported, but some damage due to the heavy rains occurred in the Kimberley.

Strong run off caused erosion and damage to fences and roads, while the flooding of the Fitzroy and Margaret Rivers caused further erosion, damage to river crossings, and the loss of some sheep.

However, the damage was not severe and was insignificant when compared to the great benefit of the widespread heavy rains.

CYCLONE No. 2 CLASS 1

Over ocean areas off northwest coast of W. A. to off central west coast of W. A., 20 to 31 January 1962.

02162	20311	71223	022001	71321	022101
		71419	002201	71517	002301
		71615	952401	71813	802501
		71912	832601	72110	832701
		72309	872801	72408	902901
		72508	943001	72404	943001
		72604	973101		

The second cyclone of the season developed in the same circulation as the first system, and although this did not eventuate for some days after the disappearance of the first cyclone, the circulation maintained good rains over the Kimberley during the interval.

With the advent of the second cyclone, although the centre remained over the ocean well off the W. A. coast during its life, the rain became more general again and extended southwards over the remainder of the W. A. tropics.

The main force of the cyclone was experienced in its vicinity over the ocean and no strong winds were reported from land stations.

Although widespread flooding was experienced in the Kimberley, once again the heavy rains were of immense value to pastoral interests over a wide area of the W. A. tropics.

Development:

After the disappearance of the first cyclone, the associated circulation persisted off the northwest coast of W. A., and on 15 January a centre was located 400 miles southeast of Christmas Island. This centre drifted eastwards for some days without development and on 20 January was 500 miles northwest of Broome. At this stage two other centres appeared, one 400 miles northwest of Wyndham, the other between Christmas Island and Cocos Island.

During the next few days two of the centres filled, but the centre initially located 400 miles northwest of Wyndham commenced to develop and move southwest.

On 24 January the centre was located 500 miles westnorthwest of Broome with a central pressure of 995 mb. The ship "Lillevanng", 150 miles north of the centre, reported rough seas with westerly winds of 45 knots and increasing, while the ship "Charon", over 500 miles northwest of the centre, reported rough seas and northwest winds of 25 knots.

At this stage, the cyclone developed rapidly and by the morning of 25 January was fully matured with 980 mb central pressure 300 miles westnorthwest of Port Hedland and ships within 500 miles of the centre reporting winds up to 50 knots accompanied by rough seas and heavy swell.

The system then commenced to weaken slowly as it moved in a more southerly direction, although late on 27 January Christmas Island, over 500 miles northwest of the centre, reported westerly winds of 40 knots, rough seas and heavy swell. On 30 January, as the cyclone drifted southward 350 miles west of Carnarvon, a secondary centre developed 250 miles west of the primary. The primary centre then decayed rapidly while the secondary commenced to fill, losing its identity during the next two days.

The cyclone was tracked by a number of ships in the area. The lowest pressure recorded was at the ship "Anna Bakke", 991 mb on 20 January, 250 miles distant from the centre.

Track:

The cyclone moved slowly to the southwest on a parabolic path, and probably decayed at the point of recurvature to the east.

Rainfall:

Substantial rains continued in the Kimberley with some 24-hour falls of over 3 in., and extended southwards with the travel of the cyclone.

In the De Grey and Fortescue, some 24-hour falls of 3 to 4 in. were experienced with an isolated 24-hour fall of over 10 in. at Mulga Downs Station by the morning of 27 January.

In the Gascoyne, some 24-hour falls of 1 to 2 in. were experienced on January 29 and 30.

Winds and Seas:

Although the cyclone centre approached 200 miles off Northwest Cape during 26 January, no strong winds were reported from mainland stations.

Gale force winds were reported by ships and island stations over 500 miles from the centre. When the cyclone was fully matured, the ship "Anna Bakke" closest to the centre but 250 miles distant reported 50 knot winds, and at this stage winds of the order of 100 knots were likely closer to the centre.

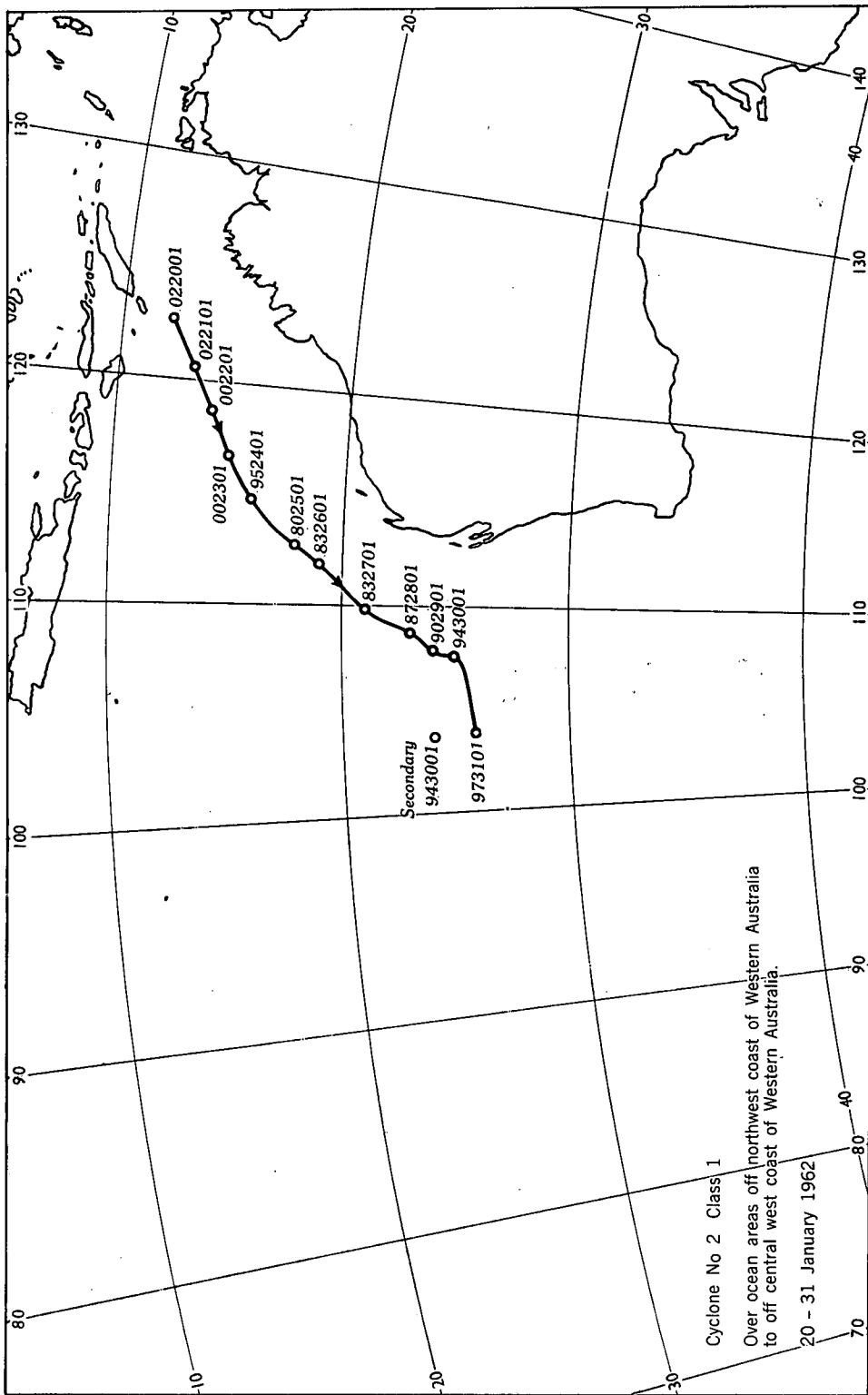


Fig. 2 The 1961 - 62 Cyclone Season in the Northwestern Australian Region. Cyclone No 2

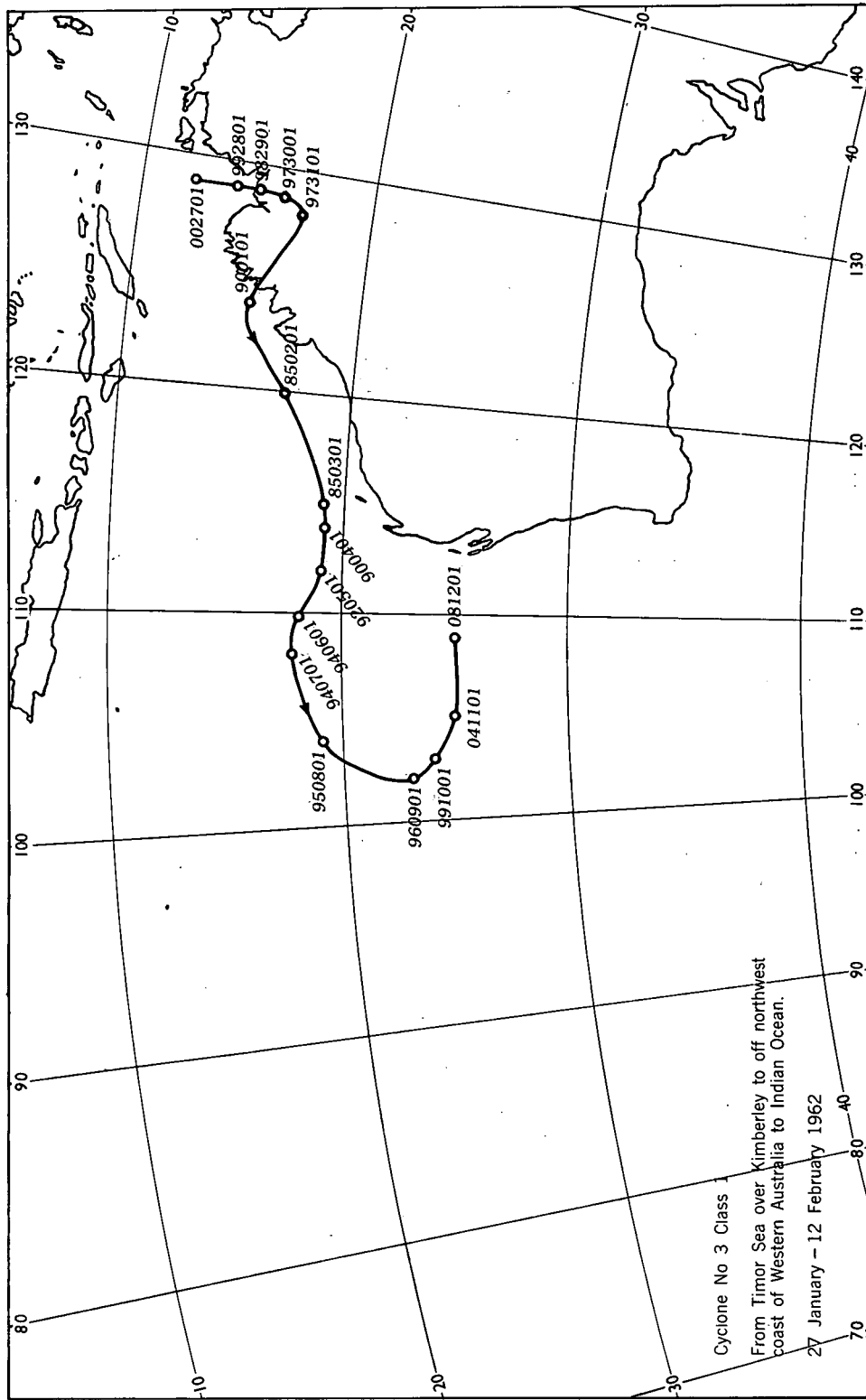


Fig. 3 The 1961 - 62 Cyclone Season in the Northwestern Australian Region. Cyclone No 3

Rough to very rough seas and heavy swells were experienced over a great expanse of ocean of more than 500 miles radius of the centre.

Damage:

Although several ships hove to, there were no reports of damage to shipping.

Some minor damage occurred due to flooding in parts of the Kimberley.

CYCLONE No. 3 CLASS 1

From Timor Sea over Kimberley to off northwest coast of W. A., to Indian Ocean, 27 January to 12 February 1962.

03162	27311	01122	71229	002701	71429	992801
			71529	982901	71629	973001
			71728	973101	71524	900101
			71720	850201	71915	850301
			71914	900401	71912	920501
			71810	940601	71808	940701
			71904	950801	72302	960901
			72403	991001	72505	041101
			72509	081201		

The third cyclone of the season originated as a rainbearing depression over the sea between Darwin and Wyndham, while the second cyclone was operating off the upper west coast of W. A.

The system maintained heavy rains over the Kimberley as it drifted southwards with little intensification and passed inland. The system intensified over the land and caused gale force winds and torrential rains over wide areas in the Kimberley. Then, more unusual still, the centre moved northwest and regained the ocean again.

Once over the ocean, the cyclone assumed major proportions and accelerated southwards parallel to the northwest coast of W. A., but after several days it veered out to sea and remained there for the remainder of its existence.

Torrential rains in the Kimberley, following consistent heavy rains due to previous cyclones, caused severe widespread flooding, but were of immense value to pastoral interests.

Development:

The system originated as a rain-bearing depression, centre 1000 mb, over the sea between Darwin and Wyndham during 27 January.

At this stage there were no strong winds associated with the system which was maintaining heavy rains over the Kimberley as it drifted with little intensification southwards into Joseph Bonaparte Gulf north of Wyndham.

The centre passed inland during 29 January and continued its slow movement southwards and, although the centre did not deepen appreciably, the system commenced to intensify - an unusual occurrence with a cyclonic centre over land.

During the next few days gale force winds and torrential rains were experienced over wide areas of the Kimberley, while coastal stations reported rough seas and ships some 300 miles off the North Kimberley coast experienced winds up to 30 knots.

More unusual still, the system then commenced to move northwest, developing and deepening in its travel, and the centre of 990 mb regained the ocean north of Kuri Bay early on 1 February.

Once over the ocean the cyclone recurved and assumed major proportions as it commenced to accelerate to the southwest, and during the afternoon of 1 February Cockatoo Island reported 80 knot winds, pressure 993 mb, as the cyclone passed 100 miles west of the station.

The cyclone matured to a central pressure of 985 mb, but on 3 February it retarded, assumed a westerly movement and commenced to weaken very slowly. On 7 February, the system, central pressure 994 mb, accelerated to the southwest on a parabolic path, recurved to the east on 9 February, and then filled as it travelled towards the west coast of W. A. to lose identity 300 miles west of Carnarvon on 12 February.

Track:

The track of this cyclone was most unusual and was probably influenced by the presence of a deep easterly stream further south than usual.

After passing inland on a southerly path, the cyclone veered to the northwest and regained the ocean. Here it assumed a normal and preferred southwest path parallel to the northwest coast of W. A., but after several days became abnormal again, moving slowly to the west for some days. The centre then accelerated on a normal parabolic path, but on recurvature assumed a more easterly path than usual and decayed as an easterly stream established itself in the area off the west coast of W. A.

Rainfall:

Heavy rains were associated with this system and 24-hour falls of 3 to 5 in. were widespread in the Kimberley for some days, while scattered 24-hour falls up to 5 in. were experienced in the De Grey, Fortescue and Gascoyne.

During the five days the cyclone was affecting the Kimberley, Kuri Bay received over 27 in., of which 17 in. were recorded in 48 hours.

Severe and widespread flooding occurred over the Kimberley.

Winds and Seas:

Initially there were no strong winds associated with the system and it was not until it had passed inland and intensified that gale force winds were experienced. During 30 January winds over a wide area increased to 30 knots and by the following day stations over 200 miles from the centre were experiencing 35/45 knot winds and as high as 55 knots at isolated places.

When the centre regained the ocean and intensified, 80 knot winds were recorded at Cockatoo Island during the afternoon of 1 February when the centre was 100 miles seaward of the station, and this was the highest wind velocity reported.

As the cyclone continued its path over the ocean, winds up to 40 knots were reported by ships over 100 miles from the centre until 10 February, when the system lost intensity and associated wind strength abated.

Seas associated with the cyclone were not particularly rough.

Damage:

The only damage reported was due to severe flooding in the Kimberley, particularly in the vicinity of the Margaret and Fitzroy Rivers.

The Fitzroy River reached a peak height of 36 feet and overflowed the country many miles from its normal banks, causing severe erosion and damaging roads, crossings and fences.

However, damage was offset by the immense value of the rains.

CYCLONE No. 4 CLASS 1

Inland Kimberley to off northwest coast of W. A., to Indian Ocean,
9 to 22 February 1962.

04162	09222	71728	050901	71726	051001
		71825	051101	71824	031201
		71922	021301	71919	991401
		72014	971501	72013	951601
		71911	951701	71809	951801
		71805	951901	72007	982001
		71906	932101	72005	982201

The fourth cyclone of the season originated as a rain-bearing depression in the central Kimberley and, once again, heavy rains and flooding were experienced over the Kimberley as the centre drifted westwards for some days without intensification before it crossed the coast.

Over the ocean, the system intensified slightly and accelerated southwest almost parallel to the coast, but after several days the system retarded and commenced to move into the Indian Ocean where it exhibited unusual behaviour before decaying some days later.

Development:

The cyclone originated as a rain-bearing depression, centre 1005 mb, over the central Kimberley during 9 February and slowly drifted westwards without intensification to cross the coast just south of Broome early 13 February.

After reaching the ocean, the centre accelerated to the southwest near and parallel to the coast, and wind strength near the centre increased gradually. On 14 February when the centre of 999 mb was 50 miles off Port Hedland, winds at that station increased to 35 knots with gusts of 44 knots, although wind at other stations in the vicinity did not reach gale force.

At this stage the system veered to the west, retarded on 15 February and moved slowly northwest. Although the central pressure did not fall appreciably, wind strength near the centre continued to increase and late 16 February, the ship "Adolf Leonhardt" reported 60 knot winds, pressure 998 mb, when 50 miles from the centre. The area of gale force winds then expanded and winds in the southwest quadrant over 300 miles from the centre increased to 30/35 knots during 17 February as the centre of 995 mb accelerated to the northwest.

On 19 February the centre recurved to the southeast and commenced to fill, although gale force winds persisted within 50 miles of the centre.

On 20 February the centre was located by an aircraft, the crew of which stated, "from observation of weather, consider it could intensify". During the day, this opinion was verified, as the centre recurved northward again, executed a complete loop and deepened. During this manoeuvre, the ship "Bulimba", 100 miles from the centre, reported 45 knot winds, pressure 995 mb, and rough seas.

On 21 February, the centre of 993 mb retarded in its southwest movement and commenced to decay, losing all identity by 23 February.

Track:

The track of this cyclone was also most unusual.

After originating over land, the system moved westwards to gain the ocean and accelerated on a preferred path to the southwest, parallel to the northwest coast of W. A. After several days, however, it retarded and commenced to move northwest, accelerating again after several days. A few days later it recurved in a parabolic path to the southeast, but a day later, again retarded and commenced to move northwest, executed a complete loop and assumed a southwest movement, to decay without further change.

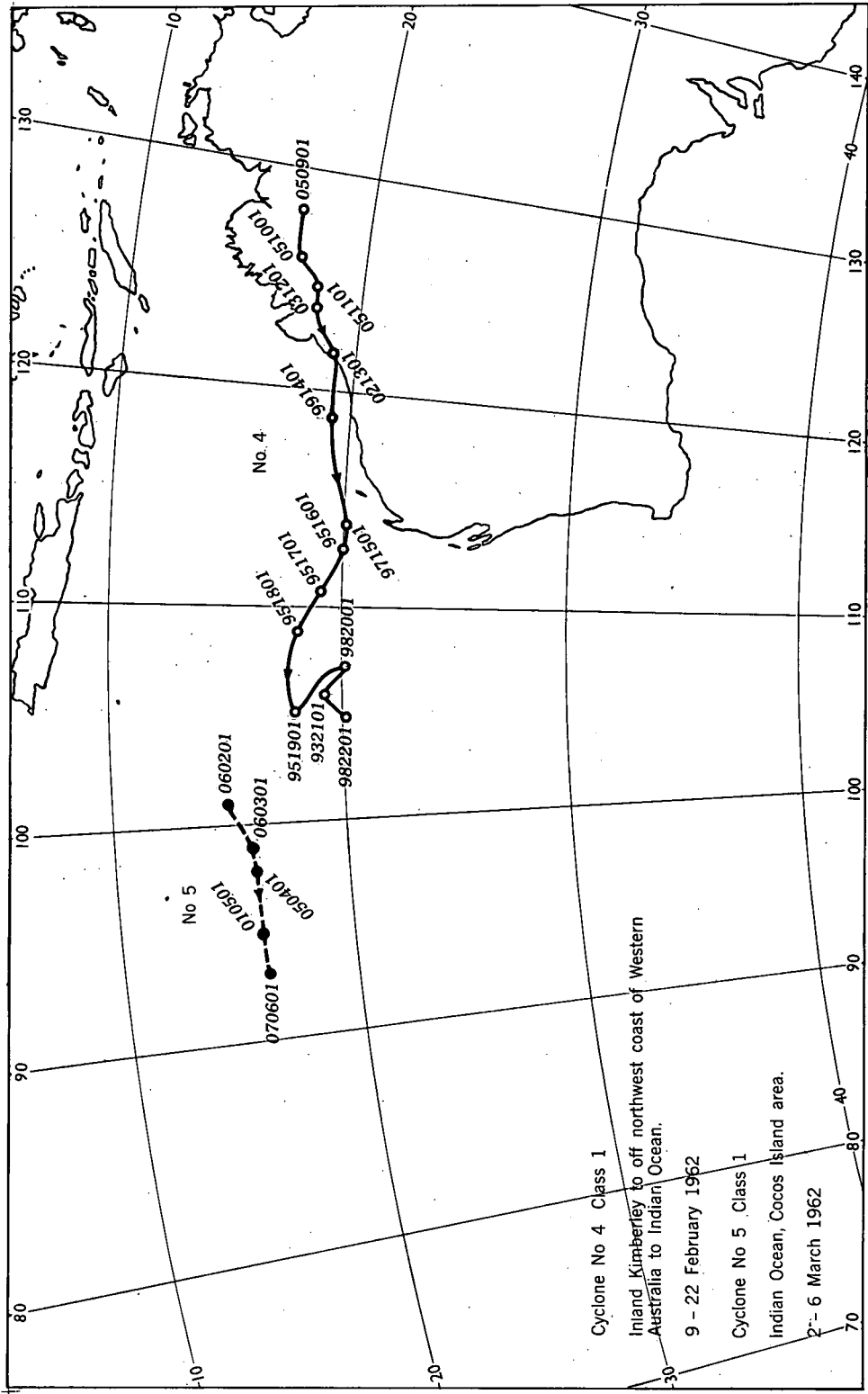


Fig. 4 The 1961 - 62 Cyclone Season in the Northwestern Australian Region. Cyclones No 4 and 5.

Rainfall:

Once again, heavy rains were experienced in the Kimberley as the depression drifted over the area and widespread flooding occurred again. 24-hour falls of 2 to 4 in. were recorded for some days, with isolated 24-hour falls of 4 to 6 in. Broome recorded 12 in. of rain in three days, with the intensity exceeding 2 in. per hour at times.

Good falls extended into the De Grey and Fortescue, with 24-hour falls exceeding 1 in. during several days. Pardoo Station, in the De Grey, recorded $1\frac{1}{2}$ in. on each of four successive days.

Scattered falls of over 1 in. extended further south into the Gascoyne.

Winds and Seas:

There were no strong winds associated with the system when centred over the land. During its travel over the ocean along the northwest coast of W. A., winds gradually strengthened and reached 35 knots 50 miles from the centre. As the system moved seawards, winds 50 miles from the centre increased to 60 knots, and gale force winds in the southwest quadrant expanded to over 200 miles from the centre.

As the system began to fill the first time, wind strength abated and again contracted to within 50 miles of the centre. However, when the system deepened again, wind strength increased and gale force winds expanded to over 100 miles from the centre, but rapidly weakened as the system decayed.

When the system intensified and winds 50 miles from the centre increased to 60 knots, very high seas were reported near the centre, while rough seas extended in the southwest quadrant to off the upper west coast of W. A., over 200 miles from the centre.

However, as the system commenced to fill the first time, seas moderated, and moderate to rough seas only persisted within 100 miles of the centre during the remainder of its existence.

Damage:

There was no damage due to wind strength over land and no damage was reported from shipping.

Once again, widespread flooding in the Kimberley caused extensive damage to roads and some minor damage to buildings. Road traffic on all roads in the West Kimberley was stopped for some weeks.

CYCLONE No. 5 CLASS 1

Indian Ocean, Cocos Island area, 2 to 6 March 1962.

05162	02063	71501	060201	71699	060301
		71698	050401	71695	010501
		71693	070601		

Little is known of this system, but it appeared likely that winds of 35 knots extended more than 100 miles from the centre when the cyclone was fully matured.

Development:

Early in March a number of circulations were apparent between the northwest coast of W. A. and Cocos Island.

On 2 March, reports from Cocos Island, Christmas Island and several ships confirmed a circulation 300 miles southeast of Cocos Island, with the ship closest to the centre but over 200 miles distant reporting winds of 25 knots.

Early on 3 March an aircraft near the centre reported strong northeast surface winds, broken cumuliform cloud and intermittent rain. Later in the day another aircraft in the same area reported that radar showed pronounced circular pattern, with towering cumuliform and layers of stratiform cloud.

The system drifted westwards, and moderate winds at Cocos Island gradually veered from southwest to northwest as the centre passed 250 miles south of the station.

On 5 March the ship "Clan MacIver", 400 miles south of the centre, reported easterly winds of 30 knots and backing, and rough seas, and at this stage it was likely that winds exceeding 35 knots extended over 100 miles from the centre.

The centre continued moving to the west and decayed rapidly, disappearing by 7 March.

Track:

The centre drifted westwards and decayed without recurvature.

Rainfall:

The aircraft near the centre reported intermittent rain, but apparently rain did not extend very far from the centre.

Winds and Seas:

The highest wind reported was 30 knots over 400 miles from the centre, and at this stage it was likely that winds exceeding 35 knots existed in the southwest quadrant over 100 miles from the centre.

The ship reporting 30 knot winds over 400 miles from the centre experienced rough seas, but rough seas appeared to be confined to the southwest quadrant of the system.

Damage:

No reports of damage were received.