TROPICAL CYCLONES IN THE NORTH-WESTERN AUSTRALIAN REGION DURING THE 1960/61 SEASON

by Staff of Divisional Office, Perth

(Manuscript received February 1962)

Abstract: During the 1960/61 season, cyclonic activity along the northern and western coasts of Western Australia and over adjacent waters was very marked, being almost constant from late December 1960 until early March 1961. During this period, a number of major cyclones caused damage and severe flooding in the northern parts of the State, and were responsible for consistent heat wave conditions, accompanied by disastrous forest and scrub fires, in the southern parts.

The depressions are classified into three types according to the diameter of the area affected by the winds of gale force. The depressions are listed and catalogued. Finally each depression is 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 stated hours. The central pressure in millibars and the Greenwich date and hour are shown in the form PPYYGG.

The catalogue identification code is as follows:

\[ \text{NNTY}_yY_yY_1Y_1Y_2Y_2MQL_aL_oL_oPPYYGG\quad \text{QL}_aL_aL_oL_oPPYYGG\ldots \]

where

\[ \begin{align*}
\text{NN} & = \text{identification number of disturbance} \\
T & = \text{class of disturbance} \\
Y_yY_y & = \text{year (tens and units)} \\
Y_1Y_1 & = \text{Greenwich date of first location} \\
Y_2Y_2 & = \text{Greenwich date of last location} \\
Q & = \text{octant of the globe} \\
L_aL_a & = \text{latitude (tens and units)} \\
M & = \text{Month of } Y_2Y_2 \text{ (November = 1, December = 2 when 50 is added to } Y_2Y_2) \\
\end{align*} \]
\[ L_o L_o = \text{longitude (tens and units)} \]

\[ PP = \text{central pressure (tens and units of mb)} \]

\[ YY = \text{Greenwich date} \]

\[ GG = \text{Greenwich hour} \]

2. LIST OF TROPICAL DISTURBANCES

<table>
<thead>
<tr>
<th>No.</th>
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<th>Area of Operation</th>
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<td>15th to 21st July, 1960</td>
<td>East Indian Ocean</td>
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<tr>
<td>2</td>
<td>1</td>
<td>29th to 30th November, 1960</td>
<td>Central Indian Ocean</td>
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<td>15th to 24th December, 1960</td>
<td>Arafura Sea to Northwest Coast W. A.</td>
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<td>29th December, 1960 to 3rd January, 1961</td>
<td>Northeastern Indian Ocean</td>
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<tr>
<td>5</td>
<td>3</td>
<td>8th to 11th January, 1961</td>
<td>Cocos Island Region</td>
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<tr>
<td>6</td>
<td>1</td>
<td>15th to 27th January, 1961</td>
<td>Arafura Sea to Northwest coast of W. A. through Gascoyne and Goldfields into Bight</td>
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<tr>
<td>7</td>
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<td>8th to 13th February, 1961</td>
<td>Timor Sea to upper West Coast of W. A.</td>
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<tr>
<td>8</td>
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<td>12th to 17th February, 1961</td>
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<td>21st February to 2nd March, 1961</td>
<td>Cocos Island and Christmas Island region</td>
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The catalogue identifications are given at the commencement of the detailed discussions of the individual depressions.

3. CASE HISTORIES

CYCLONE NO. 1 CLASS 1
EAST INDIAN OCEAN
15-21 JULY 1960

01160 15217 70598 xx1501 70796 xx1601 71093 xx1701 71592 991801
72797 951901 73305 952001 73814 952101

The first known cyclone was unseasonable, occurring over the northeastern Indian Ocean during July 1960.

On the 15th, a circulation became apparent in tropical waters some 400 miles to the north of Cocos Island, and commenced to move to the southwest. Early on the 17th, at Cocos Island, the pressure had fallen rapidly, winds had strengthened from the northeast with frequent gusts to gale force, while the rain had increased its intensity and a heavy swell was running at a time when the centre was over 200 miles to the west.
During the 18th, when the centre was approximately 300 miles to the southwest of the Island, it assumed a more southerly path, and commenced to accelerate. On the 19th, the centre was about 1000 miles off the central west coast of Western Australia causing winds of 45 knots within a radius of 100 miles and 30/35 knots within a radius of 200 miles of the centre. On the 20th the system recurved to the southeast and as a deep extratropical depression moved to the vicinity of Cape Leeuwin on the 21st, causing strong to gale force winds over wide areas of the surrounding seas.

Nothing was known of conditions near the centre of the cyclone. The lowest pressure recorded was 1002 mb by a ship over 200 miles from the centre. Rainfall associated with the system was probably very intense. Although the centre was more than 200 miles distant from Cocos Island, 5½ inches of rain were recorded there during the 24 hours ending 9 a.m. on the 17th, with a further inch by 3 p.m. that day.

**CYCLONE NO. 2 CLASS 1**
**CENTRAL INDIAN OCEAN**
**29-30 NOVEMBER 1960**

02160 29801 71287 992901 71182 033001

This cyclone occurred in the central Indian Ocean at the end of November 1960, but the only information available was from several ships which were in the vicinity of the storm at a time when it was decaying.

On 29 November 1960, two ships in the area some 600 miles to the west of Cocos Island reported wind speeds of 35/45 knots with a barometric pressure of 1001 mb. At this stage the system was moving to the west, and apparently decaying, as on the 30th the two ships pinpointed the centre and although only 30 miles on either side the pressure had risen to 1004 mb.

During the next few days, the system degenerated into a number of weak centres, which then filled.

**CYCLONE NO. 3 CLASS 1**
**ARAFURA SEA TO NORTHWEST COAST W. A.**
**15-24 DECEMBER 1960**

03160 15742 70831 xx1501 70930 691601 71029 691701 71029 691801
71029 691901 71128 692001 71324 692101 71421 692201
71623 752301 71729 002401

The third cyclone of the season was the first to operate in coastal waters, and originated in either the Banda Sea or the Arafura Sea.

On 15 December 1960, this cyclone struck Saumlaki in the Tanimbar Islands, where it caused the loss of three lives and tremendous damage, wrecking substantial buildings and uprooting thousands of coconut palms. The storm raged for four hours with wind speeds of over 100 knots, after which 20,000 of the 23,000 inhabitants were homeless.

After leaving the Islands, the cyclone moved slowly to the southwest and early on 16 December 1960 the centre passed over the ship "Silindoeng" with hurricane force winds and a pressure of 969 mb near the centre. During the next four days the system drifted very slowly to the south and on the 20th of the month was located by an airliner some 200 miles to the northwest of Darwin, moving to the southwest. At this stage the movement accelerated and by the morning of the 22nd the centre was approximately 200 miles to the northwest of Cape Leveque, where it recurved to the southeast and commenced to move towards the Kimberley coast.

During the early morning of the 23rd, winds at Cape Leveque increased to gale force and gradually veered from the northeast to the southeast as the centre of the cyclone passed to the north of the station, causing very rough seas as it moved across the mouth of King Sound towards Yampi Sound. During the same morning, northerly winds at Cockatoo Island in Yampi Sound steadily
FIG. 2: The 1960-1961 Cyclone Season in the northwestern Australian Region. Cyclone Nos. 3, 4, and 7.
increased in strength as the cyclone approached and had exceeded 80 knots with frequent gusts beyond 100 knots by the time the eye of the system reached the Island. With the arrival of the eye, the wind velocity dropped suddenly to 15 knots and remained there during the next half an hour as the eye passed directly over the Island with the wind direction backing gradually to the south. The wind then commenced to strengthen from the southeast during the next few hours to over 60 knots, with gusts beyond 90 knots, after which it moderated rapidly and veered slowly to the north again.

As the cyclone approached, the barometric pressure at Cockatoo Island commenced to fall very rapidly and had fallen nearly an inch during the five hours before the arrival of the eye over the station. As the system moved away to the east the pressure rose as rapidly as it had fallen.

The winds caused severe damage to the Australian Iron and Steel Company's Yampi Sound iron ore project on Cockatoo and Koolan Islands. People were injured, an aircraft was wrecked, a landing barge and a number of small boats were sunk and buildings were damaged. Heavy rains accompanying the winds caused further damage to unprotected property.

After passing through Yampi Sound, the cyclone moved due east and crossed the Kimberley coast. Once inland, the system lost all wind intensity very rapidly, but brought heavy rains in its vicinity as it moved through the Kimberley to north of Hall's Creek, where it became stationary on 24 December and lost identity on the following day. The heavy rains over the Kimberley caused flooding and damage to station homesteads and properties.

**CYCLONE NO. 4 CLASS 1**  
**NORTHEASTERN INDIAN OCEAN**  
**29 DECEMBER 1960 - 3 JANUARY 1961**

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Another disturbance became apparent in the northeastern Indian Ocean and two centres of circulation developed, one to the southwest of Cocos Island, the other to the southwest of Christmas Island.

From 29 December 1960 to 3 January 1961 ships in the area reported wind speeds of 30/40 knots, and observers on both Islands reported gusts to gale force, accompanied by heavy swells, but the lowest barometric pressure reported was only 1004 mb.

Again little is known of this system, which filled during 4 January 1961.

**CYCLONE NO. 5 CLASS 3**  
**COCOS ISLAND REGION**  
**8-11 JANUARY 1961**

05361 08111 No Definable Track

On 8 January 1961 another circulation formed in the region to the west of Cocos Island, but this showed no development and dissipated on the 11th of the month.

**CYCLONE NO. 6 CLASS 1**  
**ARAFURA SEA TO NORTHWEST COAST OF W.A. THROUGH GASCOYNE AND GOLDFIELDS INTO BIGHT**  
**15-27 JANUARY 1961**

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FIG. 3 The 1960-1961 Cyclone Season in the northwestern Australian Region. Cyclone Nos 6 and 8.
A closed low pressure system formed off the coast of the Northern Territory and this developed into a major storm, bringing disaster to wide areas of the state, with flood and wind damage in the north and fire damage in the south.

The system commenced to move on a southwesterly parabolic path, passing from the Arafura Sea through the Timor Sea into the Indian Ocean and then along the preferred track almost parallel to the northwest coast of Western Australia, deepening in its travel. The cyclone passed inland in the vicinity of Onslow on a southeasterly track and passed through the Gascoyne and the Goldfields into the Bight just west of Eucla.

This storm became apparent in the Arafura Sea on 15 January 1961 as a complex circulation with two centres, one fixed by an airliner 120 miles to the northwest of Darwin, the other by coastal and shipping reports some 250 miles to the east. This latter system developed into the major cyclone and by the 16th gale force easterly winds, very heavy rains and very rough seas were being experienced along the north coast of the Northern Territory. As the system moved through the Timor Sea and then parallel to the northwest coast of Western Australia, gale to hurricane force winds, rough to high seas and heavy rains were experienced along the coasts as the cyclone passed. On the 24th of the month, the centre was approaching Onslow, where increasing winds and high seas accompanied a rapidly falling pressure, with rain gradually increasing in intensity. By the evening the rain had increased to a heavy steady fall and the pressure commenced to fall at an alarming rate. By midnight the pressure was falling at the rate of 10 mb an hour and the rate was increasing, while easterly winds had increased in velocity to 70 knots with gusts to over 100 knots. The eye of the storm passed over the coast just west of the township in the early hours of the 25th, by which time the pressure at Onslow had fallen to 921 mb, a fall of 76 mb in 17 hours, the last 60 mb in 6 hours.

At Onslow, severe damage was caused by the high seas, hurricane winds and heavy rain. The seas swept away 700 feet of the jetty and its approaches and breached the foreshore wall to inundate the township to a depth of five or more feet, disrupting communications, power and the water supply. Winds demolished several buildings and damaged others, while nearly 10 inches of rain during the storm washed away roads and other facilities.

Meanwhile, in the southern parts of the State the cyclone was maintaining a strong flow of hot and dry northerly air into a trough of low pressure off the lower west coast, and high temperatures and dangerous fire hazards continued in forest and agricultural areas during 24 January, with many fires over widespread areas. With the development of the trough during the day, atmospheric instability was increasing and lightning strikes were igniting parts of the bush and forests so widespread that control was impossible and homes and camps were abandoned to the flames. The final disaster occurred during the evening of the 24th, when a possible tornado roared through the burning forests into the township of Dwellingup which was almost completely destroyed by fire. Fortunately there was no loss of human life but the combustion was so spontaneous that it was impossible to save anything else.

With the passage of the cyclone inland in the vicinity of Onslow, the trough of low pressure rapidly moved eastwards, with a wind change and rain bringing relief from the acute fire danger.

Although the cyclone lost some intensity over the land, gales and heavy rains continued in its vicinity as it passed through the State to reach the Bight on the 27th of the month. Torrential rains in the Hammersley Ranges caused flooding and endangered lives at Wittenoom, while in the southern divisions heavy rains caused local flooding in the Goldfields and washed away a section of the East-West railway between Coolgardie and Kalgoorlie.

The general heavy rains in all divisions were of great benefit to the pastoral and agricultural industries of the State, some rivers in the Gascoyne flowing to the sea for the first time in many years.
Early in February an extensive trough existed over tropical waters between the northwestern coast of Western Australia and Cocos Island and a number of closed circulations had formed in this area by the 8th of the month.

One of these centres, approximately 400 miles to the northwest of Broome, intensified and commenced to move along a southwesterly parabolic path, recurving to the southeast when some 500 miles to the west of Port Hedland to cross the west coast of the State about 80 miles to the north of Carnarvon late on the 12th of the month. Once over land, the system became stationary and lost intensity, filling during the next few days.

No information concerning conditions near the centre of this system was available before it crossed the coast, but the centre passed close to Minilya Station as it crossed the coast. The station reported that "wind and rain increased sharply from 10 p.m. on the 12th to 1 a.m. on the following morning, when the wind and rain were the worst experienced at the station, with the aneroid at an all time low as the wind veered to the southeast about 90 miles per hour and the rain gauge up to about 8 inches".

Gale force winds were experienced along the coast between Onslow and Carnarvon, with the highest velocity recorded being 55 knots at Northwest Cape as the cyclone crossed the coast over 100 miles to the south.

The eye of the storm did not pass close to settled areas and no damage from winds was reported, but the torrential rains associated with the system caused severe and widespread flooding in the Fortescue and Gascoyne divisions.

Onslow recorded over 14 inches of rain from 9 to 14 February, nearly 11 inches of this falling during the 24 hours ended 9 a.m. on the 12th. With the ground completely saturated by the sea water flooding of a few weeks previously, the township was flooded again and roads and facilities suffered further damage. Meanwhile, falls of up to 14 inches inland caused rivers to overflow the countryside with waters from the Ashburton River flowing through the aerodrome at Onslow, some 20 miles distant from the normal water course.

In the inland Gascoyne, heavy rains caused greatly swollen rivers and although these overflows the countryside a huge volume of water was carried towards the sea. At the junction of the Lyons and Gascoyne Rivers the water level reached a record height and although the Gascoyne overflowed along its length, the town of Carnarvon at its mouth was endangered with the waters rising to record levels on the 15th of the month. The lower part of the town was inundated and only prompt action with sand bags prevented the water from the Fascine overflowing the remainder. The railway bridge over the Fascine nearly collapsed, but prompt action to reinforce the decking saved the bridge and the board wall around the fascine, again preventing the flooding of the remainder of the town. All facilities in the town were damaged by the water and the surrounding countryside was deeply scoured by raging torrents of water with severe damage to most of the banana plantations.

Meanwhile, one of the other centres which although weak had maintained its identity, had drifted northwards between Christmas Island and Cocos Island and commenced to intensify on 12 February. The system commenced to move in a westerly direction, but on the 13th curved to the
FIG. 4 The 1960–1961 Cyclone Season in the Northwestern Australian Region. Cyclone Nos. 9 and II.
southwest and then recurved to the southeast, passing to the west of Cocos Island on its south-easterly track.

During the afternoon of the 13th, the wind at Cocos Island gradually backed from the southeast to the northeast at 35 knots, with gusts to over 50 knots as the pressure fell to 990 mb. After a marked decrease in velocity late in the afternoon, the winds backed to the northwest and the pressure commenced to rise rapidly. During the evening, the wind continued to back more westerly and increased in strength with gusts to 65 knots and on the Island a number of Coconut palms were uprooted, power lines were blown down and a shed was unroofed.

The cyclone continued its southeasterly path for several days and by the 17th of the month was some 500 miles to the southeast of the Island, where it commenced to fill rapidly to lose identity shortly afterwards.

**CYCLONE NO. 9 CLASS 1**
**TIMOR SEA TO INDIAN OCEAN**
**20 FEBRUARY - 3 MARCH 1961**

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**CYCLONE NO. 10 CLASS 1**
**ARAFURA SEA TO NORTHWEST COAST OF W.A.**
**20 FEBRUARY - 3 MARCH 1961**

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**CYCLONE NO. 11 CLASS 1**
**COCOS ISLAND AND CHRISTMAS ISLAND REGION**
**21 FEBRUARY - 2 MARCH 1961**

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The activity in the area between the northwest coast of Western Australia and Cocos Island continued and on 19 February a heavy swell was running in the Christmas Island region with freshening westerly winds. On the 20th a centre of circulation was located midway between the northwest coast and Christmas Island, while on the following day another centre became apparent to the southwest of Cocos Island. Meanwhile a further centre developed in the Arafura Sea, some 300 miles to the north of Darwin, and during the next fortnight each of these three centres assumed major proportions, an extraordinary event which heralded further disaster to widespread parts of Western Australia.

The centre midway between the northwest coast and Christmas Island, commenced to move in a westerly direction, deepening rapidly in its travel to be fully matured on the 24th, when it changed its path to the south. The ship "Charon" proceeding northwards, passed through the eye of this storm about 300 miles to the southeast of Christmas Island and was hove to while waves to 45 feet high battered her and winds of 70 knots stripped paint from her superstructure as the pressure fell to 970 mb.

From the 24th the cyclone travelled almost due south, approximately 200 miles off the west coast of Western Australia, to reach a position southwest of Cape Leeuwin on 3rd March. This unusual track was probably due to the existence of two other cyclones in adjacent waters and its only direct effect on land areas was the heavy surf rolling in along the upper west coast, the sound
of which was clearly audible some 4 miles inland. Indirectly, in conjunction with one of the other cyclones, it maintained a flow of hot and dry air over the southern parts of Western Australia and once again high temperatures and dangerous fire hazards existed in these areas.

While this cyclone was developing, the centre north of Darwin drifted to the southwest, causing rain along the North Kimberley coast. By the 26th of the month the centre was approximately 200 miles to the west of Troughton Island and commenced to move almost parallel to the coast to reach the vicinity of Cape Leveque on the 27th. The path of this cyclone was also unusual and probably was likewise affected by the presence of the other major circulations. It appeared unlikely to move inland on several occasions, but remained over the sea although close to the coast till 2 March when it crossed the coast between Roebourne and Onslow. However, it still continued to move to the southwest and almost regained the ocean along the upper west coast. When approaching the coast it assumed a southerly path to move east of Carnarvon, but then veered to the southwest again and regained the ocean between Carnarvon and Shark Bay on 3 March. It then travelled southwards off the coast, degenerating into a number of centres. This cyclone caused high seas, hurricane force winds and heavy rains along the northern coasts and, in conjunction with the system further out to sea, maintained a strong flow of hot dry air over the southern parts of the State to bring a state of emergency owing to the extreme fire danger.

At maturity, this cyclone was probably more developed than the other centres. Ships along the northwest coast in the vicinity of the centre reported winds of 90 knots and pressures below 970 mb. Port Hedland experienced 70 knot easterly winds with gusts to 90 knots as the pressure fell to 972 mb on 1st March, while Onslow recorded northwesterly winds of 60 knots with gusts approaching 90 knots as the pressure fell to 974 mb.

Once again torrential rains fell along the northwest coast. Onslow recorded over 12 inches during the 24 hours ended at 9 a.m. on 3 March and for the third time in just over a month was severely flooded.

Although little is known of the winds and pressure at the centre of the third circulation, it maintained strong to gale force winds and rough seas with heavy swells in the vicinity of Cocos Island and Christmas Island for a long period.

Apparently, this system was stationary near Cocos Island for some time and then moved eastwards to the vicinity of Christmas Island, where it maintained strong winds and rough seas for a long while after the other two major centres had moved to the south.

This complex system was the final activity of the 1960/61 cyclone season.

Although the cyclones during the season were responsible for severe damage in widespread areas of the State, there was no loss of human life and the general and heavy rains throughout the whole State were of great benefit, particularly to the pastoral industries.