Australian Government
Bureau of Meteorology

Unnamed Tropical Cyclone

4 - 25 January 2003

Darwin and Perth Tropical Cyclone Warning Centres
Bureau of Meteorology

A. Summary

A tropical low that originated in the Arafura Sea intensified to cyclone intensity before passing near Elcho Island late on 5 January causing a brief period of storm-force winds. Strong winds caused significant damage to vegetation and light structures on Elcho Island and in adjacent mainland areas near Maningrida, Ramingining and Lake Evella. The low subsequently meandered inland for the next few weeks causing flooding rains particularly in rivers flowing to the western Gulf of Carpentaria.

Later in the month the low moved to the northwest over waters north of the Kimberley then tracked to the southwest eventually crossing the Pilbara coast near Port Hedland on 25 January. Port Hedland registered near gale-force winds but there was no known wind damage. Heavy rain south of the centre in the vicinity of Port Hedland caused the Yule River to break its banks cutting the Northwest Highway.

In a post-analysis the low is estimated as reaching cyclone intensity prior to landfalls in both NT and WA.

B. Meteorological Description

Part 1. The NT phase

Intensity Analysis

A low was spawned in an active monsoon trough in the Arafura Sea on 3 January. With good low-level moisture inflow and favourable upper-level divergence the system intensified reaching cyclone intensity early on 5 January with a midget core region of around 15 nm radius. At this time, a band of near-gale force monsoonal northwesterlies was also present in the northeastern sector of the low, at a radius of 100-150 nm.

The system reached Elcho Island at about 1800 CST 5 January and produced a brief period of storm-force winds at Ngayawili AWS (data not available in real-time). Although marine and land gale warnings had been issued for the monsoonal flow, residents (population around 1500) were surprised and frightened when winds caused wind gusts to 115 km/h (62 knots). Images

from Gove radar showed a C-shaped structure with radius of around 10 nautical miles which persisted for many hours, and can be associated with the band of maximum winds. It is estimated that the radius of gales in the core region was around 28 km (15 nm).

The system crossed the mainland coast that night as it tracked southwest of Elcho Island and the cyclone's core region weakened below cyclone intensity as it moved further southwest over Arnhem Land, while monsoonal gales associated with the broader circulation persisted in the Arafura Sea and Gulf of Carpentaria. In subsequent days, the residual low meandered over land, briefly moving over the western Gulf of Carpentaria on 12 January and then on 15 January. The rain bearing depression caused a record monthly rainfall total of 1252.1 mm at Red Bank Mine at the base of the Gulf of Carpentaria.

Part 2. The WA phase

The system remained over land until 21 January before moving offshore of the Kimberley and gradually developed with reasonable monsoonal flow to the north. Strong north to northwesterly flow developed in eastern quadrants on the 23rd in an increasingly meridional low-level pattern. However, strengthening upper level winds associated with a deep trough to the west increased the wind shear constraining development.

Convection developed over land overnight on the 24/25th as the low approached the coast. At 1100 WST (0300 UTC) on 25 January the visible satellite image shows the most organised cloud structure of the system's lifetime with circular low level cloud about the centre following landfall. However, the observed winds were appreciably higher than the theoretically Dvorak-derived maximum winds. This suggests that other mechanisms were involved. The maximum winds occurred in western quadrants despite the south-southeasterly movement at about 12-15 km/h (6-8 knots). Gales were first recorded by a ship, call sign V2FM, at 19.5°S 117.9°E at 0200 WST 25 January and then by Beacon16, an automatic weather station 18 km offshore from Port Hedland. Gales were later recorded at Bedout Island to the north of the centre in west-northwesterlies.

Asymmetries in the wind field can have several causes (shear, motion, proximity to land, etc). However, enhanced offshore flow in these cases appears to be consistent with modelling results on how the boundary-layer winds (and frictionally forced convergence) adjust at landfall. Over land, the increased surface roughness gives stronger inflow and therefore increased advection of angular momentum, which helps maintain the near-surface winds against frictional dissipation. As the offshore flow goes over the water, the reduced surface friction together with the inertia of the inflow give an acceleration of the wind, and a surface wind speed maximum just off the coast. This idealised modelling result has some observational support. For example, Powell's (MWR 1982) observational paper on Hurricane *Frederic* clearly shows the development of a secondary maximum in the offshore flow at landfall.

This fact is also highlighted by the radar imagery that shows the convection limited in the offshore flow, in somewhat similar fashion to the 'C' shaped Elcho Island radar image discussed previously. This is consistent with studies suggesting that frictional asymmetry also gives an asymmetry in the boundary-layer convergence, which would be expected to introduce an asymmetry in the eyewall convection (the 'C' shape). This may have also enhanced the appearance of the annulus of low level cloud about the centre on the visible image. Another possibly mechanism for higher than expected offshore southerlies was the asymmetric nature of the rainfall. Heavy rain (150 mm registered at several sites) may have elevated pressures inland enhancing the pressure gradient, particularly in the southwestern quadrant. However if this was the case one would have expected the easterlies to have increased at Port Hedland.

Motion
During the initial phase the system moved on a general southerly track although this varied in response to subtle changes in the strength and location of the mid-level ridge over the mainland.

During the second phase, the low was steered westwards from the Top End by a mid to upper level ridge to the southeast but as a strong trough approached from the Indian Ocean the system took a more southerly course on 23 January until it crossed the coast.

C. Impact

Part 1. NT
Gale-force winds associated with the cyclone caused significant damage to vegetation and light structures on Elcho Island and in adjacent mainland areas near Maningrida, Ramingining and Lake Evella. On the evening of the event, people in the Elcho Island community (population around 1500) were frightened because they did not know what was happening and had not heard any cyclone warnings. Luckily there were no injuries reported. Although gale warnings were in force for Arnhem land, these were not generally heard or understood by the people on the island.

Gales around the periphery of the low affected the Arafura Sea and the Gulf of Carpentaria on 5, 6, 9 and 10, and between 13-16 January. Onshore flow caused an estimated 1-metre rise in sea level at Numbulwar in the southwestern Gulf, which combined with high river levels to produce flooding around the mouth of the Rose River on 6 January, inundating workshops near the coast.

Heavy rain produced floods in the Arnhem and Roper-McArthur districts. The McArthur River peaked at major flood level at McArthur River Mine on 15 January and at Borroloola the following day. At this time the river was 5-6 kilometres wide and close to the lowest buildings in Borroloola. The Waterhouse River reached minor flood level at Beswick on 9 January causing a temporary evacuation of residents. Minor flood level was also reached by

the Roper River at Mataranka Resort and Elsey Station, and by the Hodgson River at Hodgson River Station.

The Carpentaria Highway between Daly Waters and Borroloola, and the Tablelands Highway were cut for short periods. The Central Arnhem Road between Maranboy and Gove, was also cut for a number of days.

Part 2. WA
Although Port Hedland registered near gale force winds, there was no known wind damage. Heavy rain in the vicinity of Port Hedland caused the Yule River to break its banks cutting the North-West Highway.

D. Observations

Part 1. NT
Wind/Pressure
Ngayawili AWS and Galiwińku: 989.8 hPa at 2110 CST (1040 UTC).
Ngayawili: 93 km/h (50 kn) gusts to 115 km/h (62 kn) at 1720CST (0950UTC).

Gales were also observed at Ramingining (peaking around 1600 UTC) and Milingimbi (230/40G48kts at 1630 UTC).

Rainfall
Redbank Mine (near the NT/Qld border in the southern Gulf country), broke the NT's monthly rainfall record with an unofficial total up to 28 January of 1252 mm. Other significant falls between 7 and 22 January were Wollogorang 880 mm and Westmorland 889 mm. Some record 24-hour totals: Limmen River 347 mm and Nathan River 340 mm (9 Jan), Mornington Island 298mm (11 Jan) and 210mm (16 Jan); Redbank Mine 249 mm (11 Jan), Milingimbi 192 mm (13 Jan), Borroloola 179 mm (10 Jan) and Bing Bong Port 169 mm (10 Jan).

Part 2. WA
Wind/Pressure
The highest wind speed recorded was at Beacon16, which is located 18 km offshore from Port Hedland. The peak wind was 49 knots (91 km/h) at 0825 WST. Beacon16 recorded gales from 0310 to 1310 WST and Bedout Island recorded gales from 0900 to 1300 WST. The lowest official pressure recorded was 994.4 hPa at 0400 WST at Bedout Island, although unofficially a pressure of 991.3 hPa was recorded at 0755 WST at Beacon16.

Rainfall
Heavy rain fell to the south of the low, with the highest daily rainfall being 147 mm at Mundabullangana to 0900 WST on 25 January, with Port Hedland recording 146.6 mm for the same time period.

E. Forecast Performance

Part 1. NT

No TC Advices were issued for the initial landfall of the tropical low on 5 January – the strategy was to cover a monsoon low situation with land and marine gale warnings. The first Wind Warning for Land Areas was issued by Darwin TCWC at 0927 CST 5 January for strong to gale force winds with squalls to 90 km/h along the coast of northeastern Arnhem Land. The warning area was extended to include the Darwin-Daly District on 6 January but downgraded to severe wind squalls in showers and storms early on 7 January. The warning was cancelled at 1700 CST 7 January.

A TC Watch was issued for the southwestern Gulf coast between Cape Shield and the Queensland border at 1100 CST 11 January, continuing until 1100 CST 13 January while the low was over water.

Part 2. WA

The first warning was issued at 1600 WST on 23 January for a developing low for areas between Wallal and Mardie with a watch extending to Exmouth. The warning area was refined to Pardoo to Mardie the following day and eventually cancelled at 0430 WST on 25 January prior to crossing. This decision was made as there was no evidence of gales over land areas.

Table 1. Best track summary for 'Unnamed', 4-6 and 21- 25 January 2003.

Note: Add 8 hours to convert to WST. Refer to best track database for complete track details.

Year	Month	Day	Hour (UTC)	Position Latitude S	Position Longitude E	Max Wind 10min knots	Central Pressure hPa	Radius of Gales nm
2003	1	4	0000	10.0	135.5	15	1004	
2003	1	4	0300	10.2	136.0	15	1002	
2003	1	4	0600	10.4	136.3	20	1000	
2003	1	4	0900	10.7	136.4	20	999	
2003	1	4	1200	11.2	136.3	25	998	
2003	1	4	1500	11.3	135.9	30	996	
2003	1	4	1800	11.4	135.7	30	994	
2003	1	4	2100	11.4	135.6	35	992	250
2003	1	5	0000	11.4	135.4	35	991	250
2003	1	5	0300	11.5	135.5	40	990	250
2003	1	5	0600	11.6	135.8	45	989	250
2003	1	5	0900	11.9	135.8	50	988	250
2003	1	5	0950	11.9	135.7	50	988	
2003	1	5	1200	12.1	135.5	50	988	250
2003	1	5	1500	12.3	135.0	40	990	250
2003	1	5	1800	12.4	134.9	35	993	250
2003	1	6	0000	12.6	134.7	30	997	

Year	Month	Day	Hour (UTC)	Position Latitude S	Position Longitude E	Max wind 10min knots	Central Pressure hPa	Rad. of Gales nm
2003	01	21	0000	12.5	125.3	20	1005	
2003	01	21	0600	13.2	124.5	20	1004	
2003	01	21	1200	13.7	123.6	20	1005	
2003	01	21	1800	14.2	122.3	20	1005	
2003	01	22	0000	14.5	121.0	20	1006	
2003	01	22	0600	14.9	119.8	20	1004	
2003	01	22	1200	15.3	119.2	20	1004	
2003	01	22	1800	15.9	118.8	20	1004	
2003	01	23	0000	16.4	118.5	25	1002	
2003	01	23	0600	16.8	118.3	30	998	
2003	01	23	1200	17.1	118.1	30	998	
2003	01	23	1800	17.4	118.0	30	998	
2003	01	24	0000	17.8	118.0	30	998	
2003	01	24	0600	18.2	118.2	35	996	
2003	01	24	1200	18.6	118.4	35	995	
2003	01	24	1500	18.9	118.5	35	994	
2003	01	24	1800	19.4	118.6	35	994	40
2003	01	24	2100	19.8	118.8	35	994	40
2003	01	25	0000	20.1	118.9	35	994	40
2003	01	25	0300	20.3	119.1	35	994	40
2003	01	25	0600	20.6	119.3	35	994	
2003	01	25	0900	21.2	119.4	35	995	
2003	01	25	1200	21.9	119.4	35	995	

Figure 1a. Track of Unnamed Tropical Cyclone 4-6 January 2003.
All times in UTC – add 9.5 hours to convert to CST.

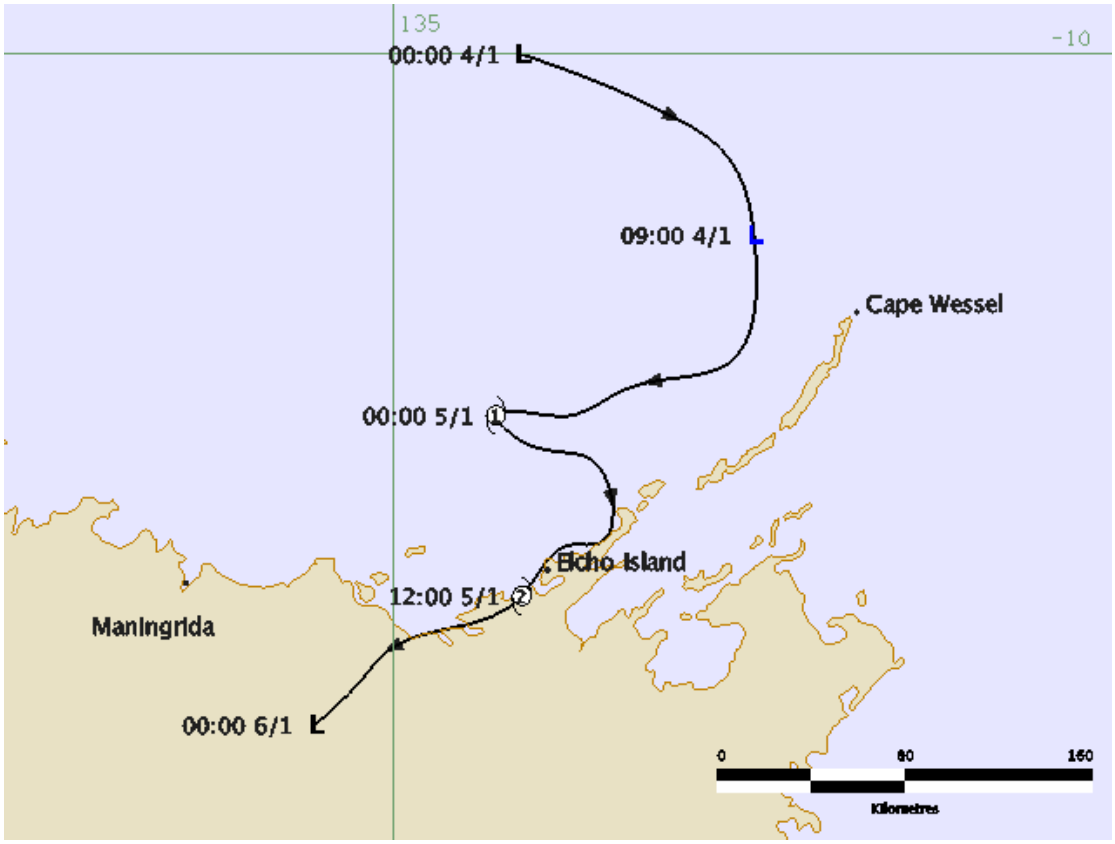

Figure 1b. Track of Unnamed Tropical Cyclone 21-25 January 2003.
All times in WST.