



Australian Government
Bureau of Meteorology

Severe Tropical Cyclone *Clare*

6-11 January 2006

Perth Tropical Cyclone Warning Centre
Bureau of Meteorology

A. Summary

Severe tropical cyclone *Clare* crossed the Pilbara coast between Dampier and Mardie after midnight early on Monday 10 January. Dampier experienced very destructive winds for a period Monday evening as the eye wall passed over the town. Karratha narrowly escaped the eye wall but still experienced destructive winds (equivalent to category 2 intensity) for over seven hours and gale force winds for sixteen hours. Estimated maximum winds near the time of coastal impact were 135 km/h (75 knots) gusting to 195 km/h (105 knots). The highest recorded sustained winds speeds were 131 km/h (71 knots) at Legendre Island. Karratha recorded wind gusts to 142 km/h (77 knots).

Communities in the path of the cyclone escaped major structural damage although many properties sustained minor damage. Downed power lines and flooding disrupted power and telecommunication to many parts of the Pilbara including Dampier and Karratha.

Many roads were cut by floodwaters including the Northwest Highway. The remains of *Clare* continued to move south producing heavy rain and some flooding through the Gascoyne and inland parts of the Southwest Land Division in the following days.

B. Meteorological Description

A tropical low formed northwest of Darwin and moved in a general west to southwesterly track roughly parallel to the coast at speeds of 25 km/h initially then 20 km/h as it neared the coast. On the evening of 7 January the low passed near Browse Island where 43 and 35 knots were recorded at 1700 and 1800 WST respectively. Based on these observations cyclone intensity is estimated at 2000 WST 7 January although Dvorak estimates suggest a weaker intensity. At 1400 WST 7 January, just three hours prior to observed gales at Browse Is, the Dvorak DT number was estimated at just 1.5. Indeed the Dvorak analysis for much of *Clare*'s lifetime was difficult especially when reconciling with microwave imagery, scatterometry and surface observations. In general the technique gave a lower intensity estimate than that measured via scatterometry and by surface observations. At 2000 WST *Clare* was located 250 km north of Cape Leveque and 430 km north of Broome.

Microwave imagery suggested continued development during 8 January showing a tight low level circulation. The small core was detected on Port Hedland radar from about 2300 WST 8 January and from then was tracked by radar until it moved well inland.

Clare passed close to Rowley Shoals at 2100 WST 8 January when a central pressure of 986 hPa was reported. However Rowley Shoals did not record gales until 2300 WST when *Clare* was moving further away to the southwest and recorded maximum winds of 45 knots at midnight some 60 km from the centre (note: only hourly reports are available from Rowley Shoals). However, Quikscat at 1747 WST 8 January indicated winds were 90-110 km/h (50-60 knots) near the centre then the next Quikscat at 0615 WST 9 January suggested 90-130 km/h (50-70 knots) winds near the centre.

Indications of an eye emerged on microwave imagery overnight from 8-9 January. However, conventional Dvorak estimates of intensity lagged behind, with the maximum intensity of 140 km/h (75 knots, T4.5) estimated from 1100 – 2000 WST as *Clare* approached the coast. The visible image at 11:30 WST 9 January (Fig 2.) showed strong banding around the CDO. Microwave imagery show a stronger eye signature on the morning of 9 January (see Fig. 3) compared to later in the day.

Legendre Island registered sustained winds to 131 km/h (71 knots) at 1800 WST as *Clare* passed 20 km to the northwest (note: only observations on the hour are available at Legendre Island). Unofficial observations from Dampier confirm hurricane-force winds however Karratha airport winds were only storm force (see Fig. 4). The estimated central pressure of 960 hPa is generally consistent with readings of 970 hPa at Dampier and 973 hPa at Legendre Is which were some 20-25 km from the centre at the time.

Gales extended east to Port Hedland (1030-1530 WST) and Bedout Is (0000-1500 WST) on 9 January.

An interesting feature of *Clare* was the asymmetry in the convection with the strongest convection generally being to the northeast of the centre. The radar signature and IR imagery suggested weakening prior to coastal crossing and combined with a period of land interaction, it is estimated that maximum winds were at 120 km/h (65 knots) at 1000 WST 10 January after crossing the coast.

By the time of coastal crossing *Clare* had adopted a more south southwesterly track and had slowed to about 12 km/h.

Clare weakened once making landfall passing over Pannawonica at about 0800 WST 10 January. *Clare* was estimated to weaken below cyclone intensity at 0200 WST 11 January well inland although no observations were available to confirm this.

Clare developed over very warm waters in excess of 29°C but then moved over waters of less than 28°C as it approached the coast which may have contributed to some weakening prior to coastal crossing.

C. Impact

Communities in the path of the cyclone escaped major structural damage although many properties sustained minor damage. Downed power lines and flooding disrupted power and telecommunication to many parts of the Pilbara including Dampier and Karratha.

Many roads were cut by floodwaters including the Northwest Highway. The remains of *Clare* continued to move south producing heavy rain and some flooding through the Gascoyne and inland parts of the Southwest Land Division in the following days. Flooding was particularly significant in the area around Lake Grace (Great Southern district) where 224 mm of rain was recorded in a 24 hour period on the 12-13 January (see Fig. 5). The Greenough River in the Midwest region also flooded and only a sandbagging effort prevented floodwaters inundating the town of Walkaway south of Geraldton. The owners of Yuin station provided a report of the flooding there describing the floodwaters flowing through the homestead following heavy rain for three and a half hours from 2100 WST 11 January. This flood is the highest known at since records were kept in over 100 years, exceeding the previous mark by 34 cm.

Fortunately the storm surge on the Pilbara coast peaked as the tide was near low tide (at 0100 WST) and it seems the overall storm tide did not rise above the highest astronomical tide. There have not been any known reports of storm surge damage. The storm surge ('residual') was measured to 1.65m at 2255 WST at King Bay and to 1.23 m at 1250 WST at Port Hedland.

D. Observations

Wind and Pressure

Site	Maximum 10 min Wind (knots)	Maximum Wind Gust (knots)	Lowest Pressure (hPa)
Browse Is	43 @ 07/1900 WST		994.9 @ 07/1800 WST
Rowley Shoals	45 @ 09/0000 WST		986.0 @ 08/2100 WST
Port Hedland	41 @ 09/1230 WST	52 @ 09/1132 WST	
Legendre Is	71 @ 09/1800 WST		973.3 @ 1700 WST
Roebourne	54 @ 09/2030 WST	71 @ 09/2040	991.0 @ 09/2020 WST
Karratha	59 @ 09/2040 WST	77 @ 09/1950, 2250	978.4 @ 09/2030 WST
Mardie	44 @ 10/0400 WST	57 @ 10/0400 WST	984.2 @ 10/0400 WST

*Note: Browse Is, Rowley Shoals and Legendre Island only reports hourly. Mardie data was only captured in "metar" format (hourly and "speci").

Given the small scale nature of the eye-wall region, the speed of movement it is likely that the maximum winds and lowest pressure was not captured by the hourly readings even as *Clare* passed close to Rowley Shoals and Legendre Island.

Storm surge

King Bay: 1.65 m at 2255 WST 9 January.

Port Hedland: 1.23 m at 1250 WST 9 January.

Note: the storm surge on the Pilbara coast peaked as the tide was near low tide and it seems the overall storm tide did not rise above the highest astronomical tide.

Rainfall

Lake Grace recorded 224 mm in a 24-hour period from 12-13 January.

Table 1. Best track summary for *Clare*, 6-11 January 2006.

Note: Add 8 hours to convert to WST.

Year	Month	Day	Hour (UTC)	Position Latitude S	Position Longitude E	Position Accuracy nm	Max wind 10-min knots	Max gust knots	Central Press. hPa	Rad. of gales nm	Rad. of storm force winds nm	Radius of hurricane force winds nm	Radius Max. Wind (RMW)
2006	1	6	6	11.3	129.1	60	20	45	1002				
2006	1	6	12	11.4	127.9	50	25	45	1000				
2006	1	6	18	11.8	126.5	40	25	45	996				
2006	1	7	0	12.7	125.3	40	25	45	996				
2006	1	7	6	13.6	124.2	30	35*	45	996				
2006	1	7	12	14.5	123.2	25	40	55	994	30	20		
2006	1	7	18	15.4	121.8	25	45	60	990	35	20		
2006	1	8	0	16.0	120.6	25	50	70	982	40	20		
2006	1	8	6	16.5	119.9	20	50	70	982	45	20		
2006	1	8	12	17.4	119.2	15	50	70	982	45	20		
2006	1	8	18	18.1	118.3	10	60	85	972	90	60	40	
2006	1	8	21	18.5	117.9	10	60	85	972	95	60	45	
2006	1	9	0	18.8	117.7	10	70	95	964	95	60	45	15
2006	1	9	3	19.3	117.4	10	75	105	960	95	60	45	15
2006	1	9	6	19.7	117.1	10	75	105	960	90	60	45	15
2006	1	9	9	20.1	116.8	10	75	105	960	85	60	45	15
2006	1	9	12	20.4	116.6	10	75	105	960	85	60	40	15
2006	1	9	15	20.7	116.4	15	70	95	964	75	40	30	15
2006	1	9	18	20.9	116.3	15	65	90	968	70	40	25	15
2006	1	9	21	21.3	116.2	15	65	90	968	60	35	20	15
2006	1	10	0	21.7	116.3	15	60	85	972	50	30	15	
2006	1	10	3	22.2	116.2	20	55	80	974	40	30	15	
2006	1	10	6	22.6	116.2	20	55	80	974	40	30	15	
2006	1	10	9	22.8	116.2	20	50	70	982	30	20		
2006	1	10	12	23.0	116.2	20	40	55	990	25	20		
2006	1	10	15	23.3	116.2	25	35	50	992	25			
2006	1	10	18	23.6	116.2	25	30	45	996				

* at 06 UTC 7 January the maximum wind was 35 knots. However, gales were confined to one quadrant only and hence the system was not deemed at cyclone intensity and the overall gale radius is considered as null.

Figure 1. Track of Tropical Cyclone *Clare*, 6-11 January 2006. Note: Times in WST.

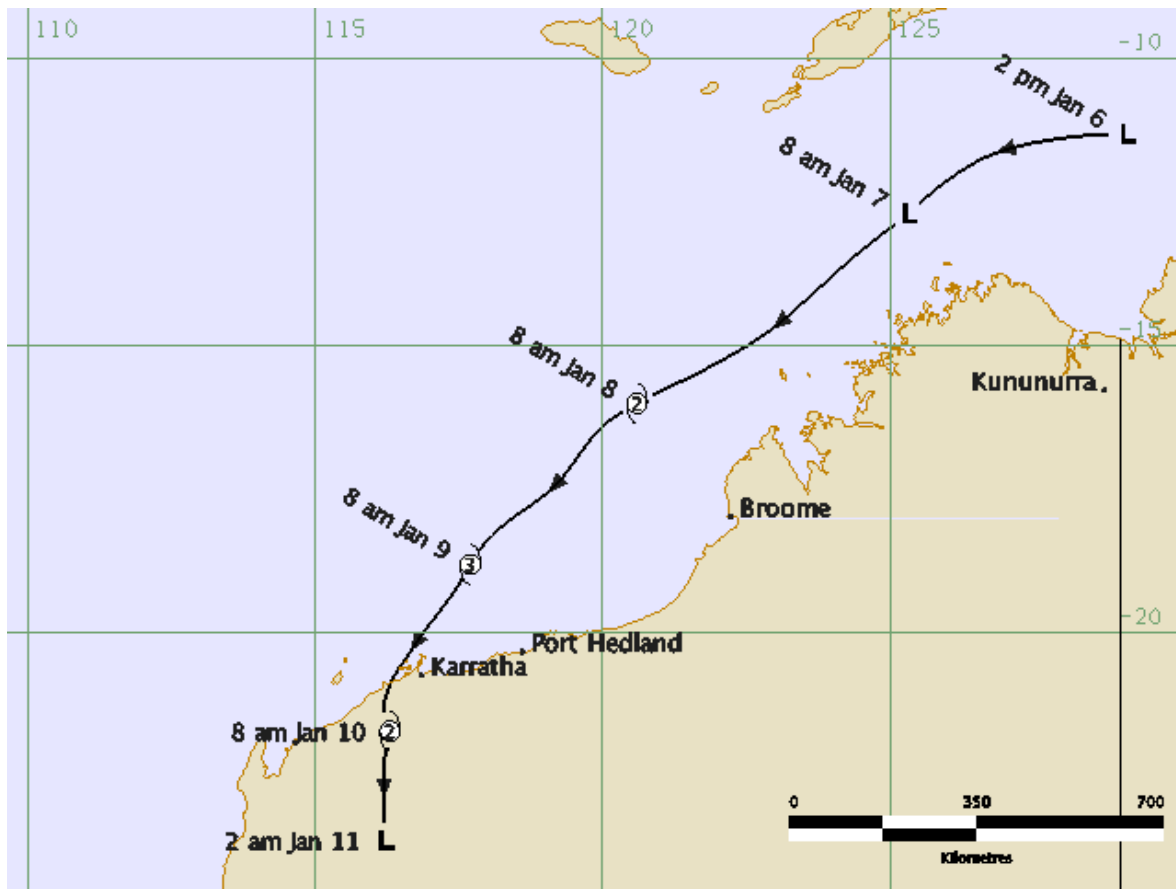


Figure 2. Visible image at 1130 WST 9 January 2006.

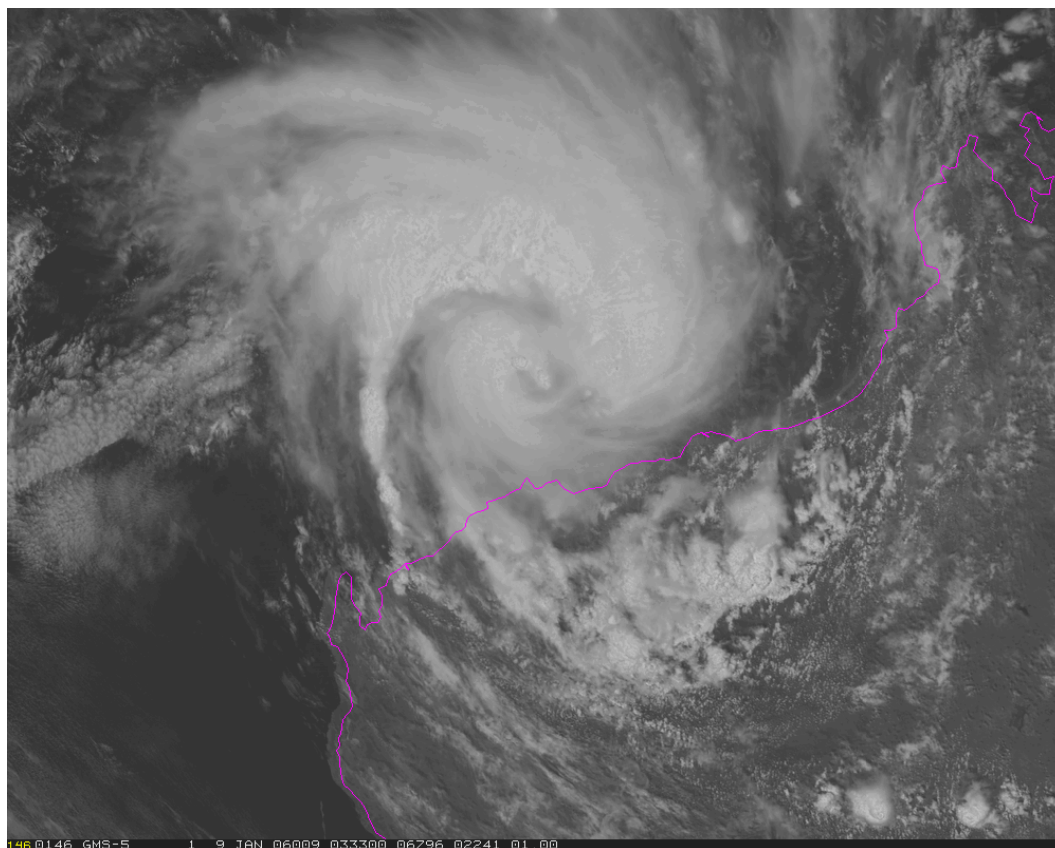


Figure 3. Microwave (SSMI colour 85GHz) image at 0609 WST 9 January (08/2209 UTC). (image courtesy of US NRL: <http://www.nrlmry.navy.mil/>)

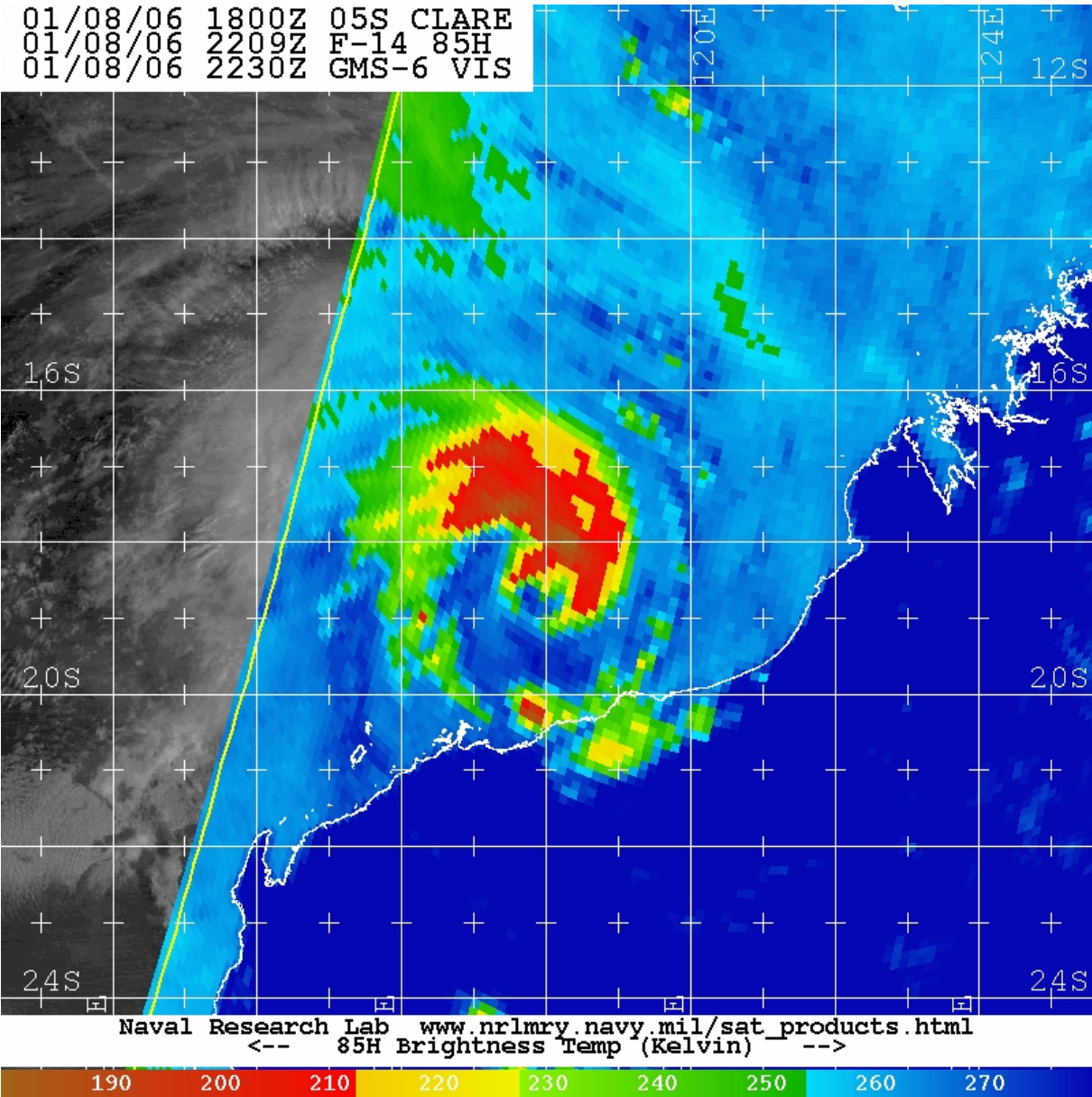


Figure 4. Wind observations at Karratha 9-10 January 2006.

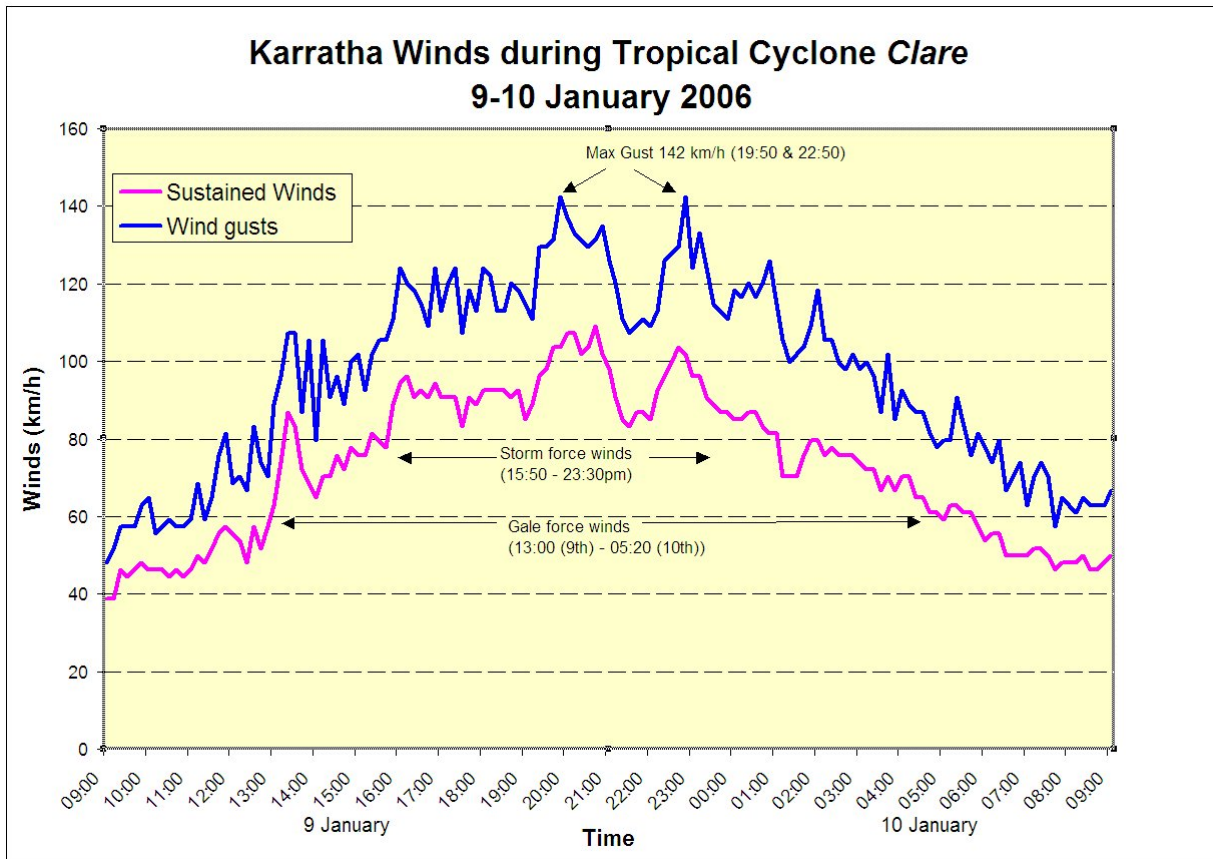


Figure 5. Cumulative rainfall at Lake Grace 12-13 January 2006.

