Australian Government
Bureau of Meteorology

Tropical Cyclone *Daryl*

17-23 January 2006

Perth Tropical Cyclone Warning Centre
Bureau of Meteorology

A. Summary

A low moved off the West Kimberley coast and supported by strong monsoonal flow reached cyclone intensity north of Cape Leveque late on 18 January. *Daryl* reached category 2 intensity on the 19th northwest of Broome and maintained this strength for the next few days while following a track parallel to the coast. Although it threatened the Pilbara coast, *Daryl* remained offshore and weakened to below cyclone intensity on 22 January north of Northwest Cape.

The greatest impact was to the offshore oil and gas industry which suffered economic losses associated with evacuations and reduced production.

B. Meteorological Description

During mid January a strong NW monsoonal flow extended over the tropics. A weak surface low over the north Kimberley drifted westwards moving off the coast near Kuri Bay at 0000 UTC 18 January. The circulation was well developed in depth with strong SE'lies to the south and the monsoon flow to the north.

At 1200 UTC 18 January the low passed just south of Adele Island which began recording NW'ly gales. Although gales are estimated to extend for a significant distance to the northwest and north of the low, it doesn't appear that gales extended more than half way around the centre and so by definition, cyclone intensity was not yet reached. (Note: it was legitimately named *Daryl* operationally based on these wind reports.) However soon after, the improved organisation in satellite imagery indicates that gales extended towards eastern quadrants by 1500 UTC. Indeed Adele Island recorded strong gales overnight.

At 0100 UTC 19 January the low passed close to Cape Leveque, north of Broome where the pressure at Cygnet Bay fell to 984 hPa. Although reported winds in the southeasterlies to the south of the low were light, as soon as the low passed by the reported northwesterlies reached gale force (Note: Cygnet Bay estimates wind speeds and while winds were reported at 50 knots (at 0700 UTC) it is more than likely the actual winds were a bit lighter).

The 1000 UTC 19 January Quickscat analysis shows strong northwesterly winds on the northern side of *Daryl* but no gales on the southern side.

From 0700 UTC 19 January convection with very cold cloud tops developed and the LLCC moved under the convection suggesting a Dvorak intensity of 3.5 (shear pattern). The very cold cloud cover persisted overnight suggesting a possible Dvorak CCC pattern, although microwave imagery indicated further intensification with an eye emerging on several images, although convection remains predominantly in northern and western quadrants. Rowley Shoals recorded gales some 150 nm west of the centre in the outer convective band at 1800 UTC.

Peak intensity is estimated at 55 knots at 0000 UTC 20 January which is slightly higher than the Dvorak T3.5 rating. The intensity estimate is influenced by the Quickscat which shows winds to the north of the centre in excess of 50 knots, and also by the microwave imagery patterns. The fact that 50 knot winds and pressures below 980 hPa were recorded later when the imagery suggests some weakening also supports a higher intensity rating than 50 knots. The CIMMS ensemble of AMSU and AODT indicated a peak of 65 knots (1 minute).

Daryl then accelerated to the southwest then west southwest following a track roughly parallel to the coastline about 80 nm offshore.

However, convection fails to organise any further. At 0900 UTC 20 January Quickscat showed weakening of winds below storm force although the subsequent 2200 UTC analysis indicated 50 knots to the north and south of the system. *Daryl*'s faster movement enhanced winds on the southern side and Bedout Island recorded 50 knots up to 60 nm from the centre at 1300 UTC. While gales were not recorded at Port Hedland, there was a short duration of gales just offshore.

During 21 January convection contracted to the western side leaving the LLCC exposed. Gales were recorded at several offshore observation sites, but gales were not recorded at Karratha (maximum 31 knots) or Roebourne.

The weakening continued on 22 January with convection well removed to the west. *Daryl* is estimated to have weakened below cyclone intensity by 0600 UTC 22 January north of NW Cape.

Why didn't Daryl intensify further?
Although *Daryl* experienced moderate shear as it moved off the coast, it initially developed rapidly which suggested that shear wasn't constraining the system and particularly as it moved further offshore into open waters it would continue its development curve especially if shear was to drop. As it eventuated development was not sustained and a maximum intensity of 55 knots (category 2) was attained.

Part of the answer for this may lie in ocean temperatures. The Sea Surface Temperatures (SSTs) off the Pilbara coast following TC *Clare* had cooled by several degrees as shown in Fig. 2. *Clare* moved over water of approximately 29-30°C about a degree above normal, but SST cooled by several degrees in the wake of its path. *Daryl* moved over similar waters less than 10 days later. The SST analysis on 17 January in Fig. 2 shows the water immediately adjacent to the NW Kimberley coast at approx. 29°C (where initial development occurred) but further west off the Pilbara coast SST were approximately 27-28°C sufficient for cyclogenesis but not conducive for severe TC intensity. Further west again off NW Cape SST fall to less than 26°C and it is in this region where *Daryl* weakened below TC intensity.

C. Impact

Having developed into a category 2 cyclone within 36 hours of moving off the NW Kimberley coast, *Daryl* had been forecast to develop further into a severe cyclone and impact the Pilbara coast. Coming immediately after the severe impact of TC *Clare* with power and communication utilities under pressure to be restore supply, this scenario was of great concern to emergency management and to the general community in the Pilbara. Furthermore *Clare* produced widespread severe flooding so mobility was restricted and the potential for further heavy rain was great. Fortunately *Daryl* remained sufficiently offshore not to have any direct impact on coastal communities.

However, there were significant economic losses owing to disruptions to industry production and shipping operations.

D. Observations

Gales were recorded at many offshore sites including Adele Island, Rowley Shoals, Bedout Island and Legendre Island.

Table 1. Best track summary for Tropical Cyclone *Daryl,* 17-23 January 2006.

Year	Month	Day	Hour	Position Latitude S	Position Longitude E	Position Accuracy nm	Central Pressure hPa	Max Wind 10min knots	Max Gust knots	Radius Gales knots	Radius Storm Wind knots	Radius Max Winds (RMW)
2006	1	17	0	15.3	125.6	60	998	20	45			150
2006	1	17	6	15.3	125.3	60	996	20	45			150
2006	1	17	12	15.4	124.9	60	996	20	45			150
2006	1	17	18	15.5	124.6	60	994	25	45			120
2006	1	18	0	15.6	124.2	50	994	25	45			120
2006	1	18	6	15.7	123.6	40	992	25	45			120
2006	1	18	12	15.8	123.3	30	990	35	45			80
2006	1	18	18	15.8	123.1	25	984	40	55	140		40
2006	1	19	0	16.1	123	20	980	45	65	115		40
2006	1	19	6	16.5	122.5	20	980	45	65	120		50
2006	1	19	12	16.8	121.9	20	976	50	70	115	50	50
2006	1	19	18	17	121.1	20	976	55	80	120	50	40
2006	1	20	0	17.4	121	25	976	55	80	115	50	30
2006	1	20	6	18.1	120.5	20	976	50	70	95	50	30
2006	1	20	12	18.6	119.5	20	976	50	70	90	50	30
2006	1	20	18	19	117.7	20	976	50	70	85	50	30
2006	1	21	0	19.4	116.7	20	976	50	70	80	50	30
2006	1	21	6	19.6	116.3	25	976	50	70	85	35	30
2006	1	21	12	19.8	115.8	25	976	50	70	85	30	30
2006	1	21	18	20.1	115.4	20	980	45	60	80		30
2006	1	22	0	20.2	114.8	20	986	35	50	70		30
2006	1	22	6	20.4	114.1	25	990	30	45			30
2006	1	22	12	20.7	113.8	25	992	25	40			30
2006	1	22	18	20.9	112.9	25	994	25	35			30
2006	1	23	0	22.1	111.7	25	996	25	35			30

Figure 1. Track of Tropical Cyclone *Daryl,* 17-23 January 2006.
All times in WST.

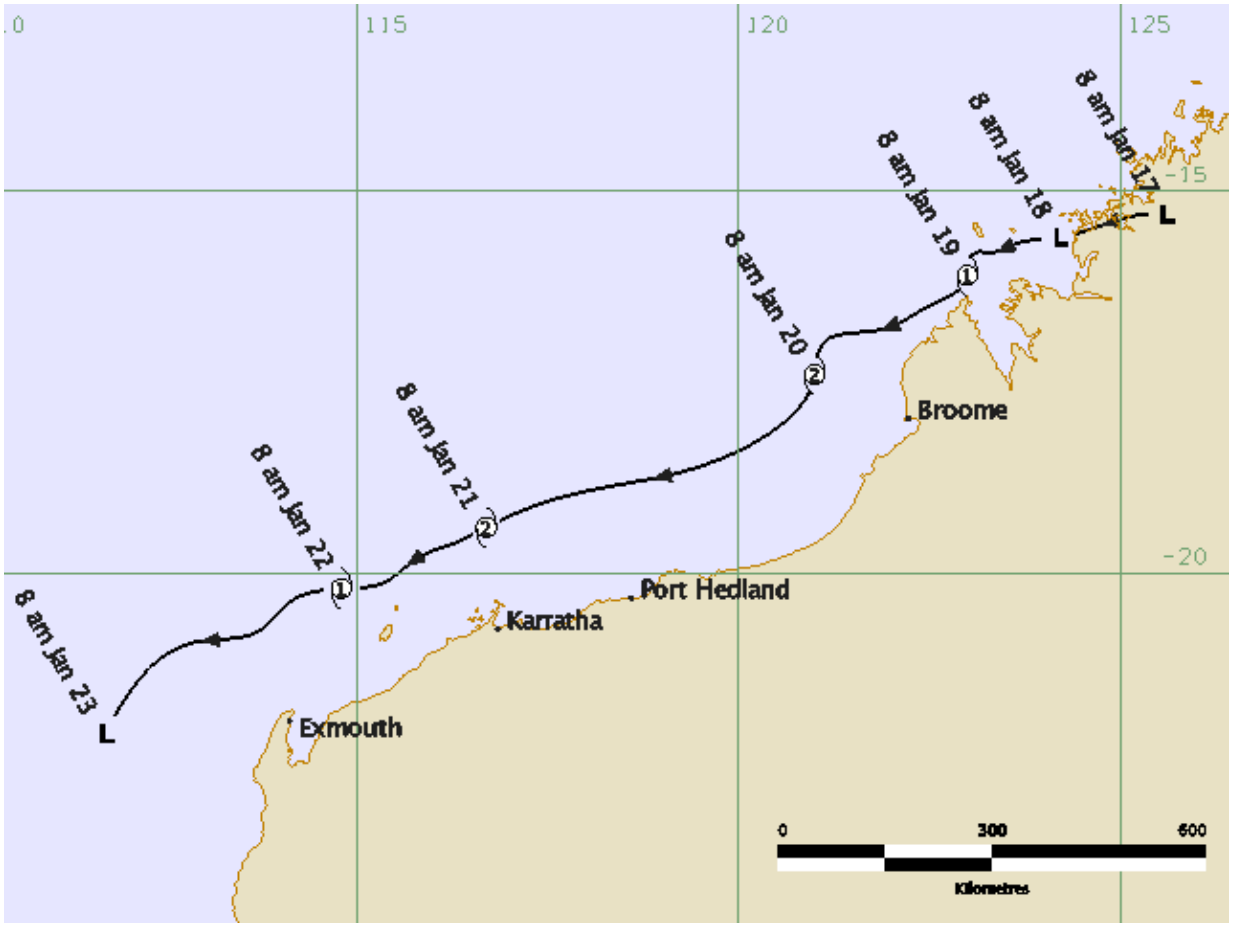
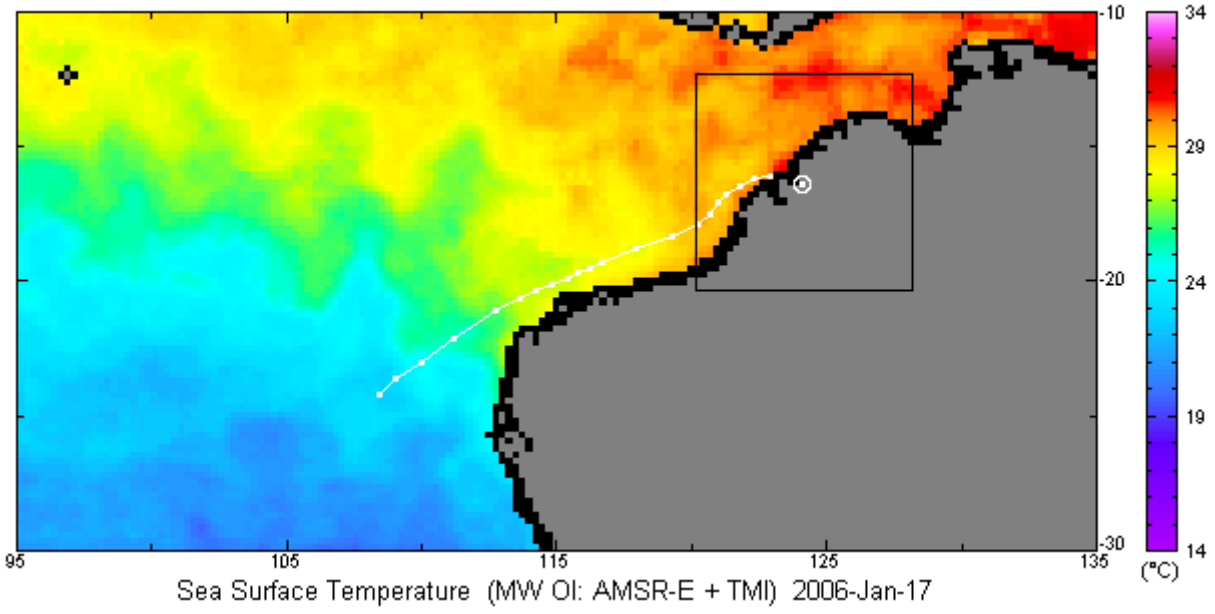


Figure 2. Sea Surface Temperature analyses 17 January 2006 (before TC *Daryl* formed): a. SST b. SST anomaly. Images courtesy of RSS (www.rss.com).

a.



b.