



Australian Government
Bureau of Meteorology

Tropical Cyclone *Ophelia*

1 - 6 March 2008

Joe Courtney
Perth Tropical Cyclone Warning Centre
Bureau of Meteorology
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A. Summary

A low moved from the Northern Territory across the north Kimberley then developed after moving off the northwest Kimberley coast on the morning of 1 March reaching cyclone intensity that evening about 80 km north of Cape Leveque. The midget cyclone *Ophelia* quickly developed to category 2 intensity on the morning of 2 March *Ophelia* and remained a category 2 cyclone through to 5 March as it moved to the west to west southwest well off the Pilbara coast. *Ophelia* then weakened as it changed track to the south southwest and finally weakening below cyclone intensity late on 6 March well west of Carnarvon (see figure 1).

Although advices were issued for the Kimberley coast north of Broome prior to *Ophelia* moving away from the coast, there were no community alerts issued and no impact to coastal areas. Some offshore industry installations were evacuated as a precautionary measure resulting in some economic losses, however the confidence in the forecast track allowed coastal and near coastal facilities to continue operations during the cyclone event.

B. Meteorological Description

Intensity analysis

A weak low formed over the central Northern Territory on 25 February and tracked west moving across the Kimberley on 29 February. When the low finally moved offshore from the northwest Kimberley coast on the morning of 1 March, development occurred rapidly with convection becoming more organised that evening prompting the upgrade to tropical cyclone *Ophelia*.

Overnight satellite imagery showed an increase in curvature in the deep convection sufficient for *Ophelia* to reach category 2 intensity on the morning of 2 March. Maximum intensity is estimated later that day when an eye emerged on microwave imagery as shown in figure 3. The faster than standard development rate (low to category 2 within 30 hours) was supported by low environmental shear, a pre-existing deep level vorticity structure prior to moving offshore and the small-scale nature of the low allowing a rapid spin-up process to occur.

Subsequent imagery showed that development was not sustained and convection about the eye weakened despite the wind shear remaining low. Imagery on 3 March

showed the low level circulation centre (LLCC) exposed to the north of a diminished area of convection suggesting the system was highly vulnerable to fluctuations in wind shear. Later on 3 March convection increased about the LLCC and Quikscat image (in figure 4) showed storm-force winds near the centre.

During 4 March convection became more organised for a period but overnight the convection weakened and became limited to the southern side although Quikscat imagery showed storm-force winds were maintained. A tight LLCC remained evident during 5 March although convection remained only partly organised.

Ophelia commenced a more southerly track on 6 March towards a region of higher NW wind shear and over cooler SSTs below 27°C heralding the weakening phase. During the day convection weakened and the evening Quikscat image showed gales restricted to the southwest quadrant only, followed by the absence of gales on the subsequent AScat image. These confirmed that *Ophelia* had weakened below cyclone intensity. This weakening was also consistent with the Dvorak intensity estimates.

The low level circulation then moved to the southeast towards the Shark Bay coast with some convection again redeveloping on the southern side of the system early on 7 March and near-gales were observed by a ship prior to sustained weakening during the day.

While *Ophelia* developed quickly to category 2 intensity a factor limiting further intensification were the cooler than normal SSTs off the West Kimberley and Pilbara coasts following the earlier passage of TC *Nicholas*. *Ophelia* moved over water of about 28-29°C until it reached cooler waters south of 24°S off the west coast. Waters off the upper west coast were much warmer than is typical, which would have assisted *Ophelia* maintaining cyclone intensity as long as it did in this area.

Based upon Dvorak methodology, *Ophelia* was maintained at T3.5/4.0 (50-55 knots) from the morning of 2 March through to late on 5 March. It is highly likely that the actual intensity of such a small system underwent considerable variation that is difficult to detect or assess without observations.

Motion

A persisting deep level mid-level ridge was responsible for the steady west to west southwest motion from 27 February to 3 March. On 4 March the system moved around the northwest shoulder of the anti-cyclone resulting in a more southwest motion. The approach of a mid-latitude trough on 6 March threatened to capture the system in the northwest flow. However, the trough was not of sufficient amplitude and the weakening circulation quite small to result in any accelerated motion to represent a true 'capture' situation. Nevertheless the system was steered to the south then southeast as it weakened. Had *Ophelia* been of much greater strength and size then there would have been a serious risk of a west coast impact.

Structure

Ophelia was a midget cyclone having a radius of gales less than 150 km. The system was also quite asymmetric with the strongest winds being evident on the southern side throughout much of its lifetime.

C. Impact

Aside from some economic impact due to the loss of production at some offshore oil and gas facilities, there was no reported impact or damage to coastal parts. Parts of the Kimberley received heavy rainfall but no flooding was reported.

D. Observations

Wind/Pressure

As *Ophelia* was developing off the northwest Kimberley coast it passed just south of Adele Island. The minimum pressure was 1001.4hPa at 1500 WDT 1 March while the highest recorded winds were 57 km/h (31 knots) in northwesterlies at 1900 WDT 1 March.

Ophelia also passed close by to a buoy (56520) located at 16.9°S 115.9°E late on 3 March where the minimum hourly pressure was recorded at 992.6 hPa (no winds recorded).

Rainfall

Heavy rain fell as the tropical low moved across the northern Kimberley. A swathe of rainfall in excess of 100 mm was registered, the highest being in the northeast Kimberley where Wyndham recorded a daily fall of 135 mm to 0900 WDT 29 February (see figure 2).

E. Forecast Performance

Table 2 is a summary of advices issued by Darwin and Perth TCWCs. Darwin TCWC issued advices on 27-28 February for coastal areas of the Joseph Bonaparte Gulf on the basis of potential northwest movement that failed to eventuate. Advices were then issued for the northwest Kimberley coast between Mitchell Plateau and Cape Leveque prior to the low moving offshore. Warnings commenced at 0430 WDT 29 February. Perth assumed responsibility for the developing low at 1000 WDT 1 March. As *Ophelia* moved away from the coast the warning area was revised and eventually advices were cancelled at 1000 WDT 2 March.

For the remainder of *Ophelia*'s lifetime shipping warnings, technical summaries and track maps were issued but no advices were issued based on the confidence in the model guidance.

Table 1. Best track summary for *Ophelia*, March 2008.

Year	Month	Day	Hour (UTC)	Position Latitude S	Position Longitude E	Position Accuracy nm	Max wind 10min knots	Max gust knots	Central Pressur e hPa	Rad. of Gale s nm	Rad. of storm force winds	Radius Max. Wind (RMW)
2008	2	29	18	15.1	124.8	20	25	45	1003			
2008	3	1	0	15.4	124.0	20	30	45	1000			
2008	3	1	06	15.7	123.3	15	30	45	1000			
2008	3	1	12	15.8	122.7	20	35	50	998	30		
2008	3	1	18	16.0	122.2	20	45	65	992	35		
2008	3	2	00	16.2	121.4	15	50	70	988	50	15	10
2008	3	2	06	16.5	120.6	15	55	80	985	55	20	15
2008	3	2	12	16.5	120.0	20	55	80	985	55	20	15
2008	3	2	18	16.5	119.1	20	55	80	985	40	20	15
2008	3	3	00	16.5	118.4	15	50	70	989	40	10	15
2008	3	3	06	16.5	117.3	15	50	70	988	55	10	15
2008	3	3	12	16.7	116.3	20	50	70	988	65	10	15
2008	3	3	18	16.9	115.3	20	50	70	988	70	15	15
2008	3	4	00	17.2	114.3	20	50	70	988	70	15	15
2008	3	4	06	17.5	113.4	15	50	70	988	70	15	15
2008	3	4	12	18.0	112.6	15	50	70	988	60	15	20
2008	3	4	18	18.5	111.9	15	50	70	987	60	15	20
2008	3	5	00	19.3	111.2	20	50	70	987	55	15	20
2008	3	5	06	20.1	110.4	20	50	70	987	60	15	15
2008	3	5	12	20.8	109.8	20	50	70	988	60	10	15
2008	3	5	18	21.6	109.4	20	45	60	993	45		15
2008	3	6	00	22.4	109.3	25	40	55	995	50		15
2008	3	6	06	23.4	109.2	20	40	55	996	40		15
2008	3	6	12	24.0	109.3	20	30	45	1001			
2008	3	6	18	24.8	109.8	20	30	45	1001			
2008	3	7	00	25.3	110.6	15	30	45	1001			
2008	3	7	06	25.4	111.6	15	25	45	1004			

Table 2. Tropical Cyclone Advice summary for TC *Ophelia*.

Date/Time (WDT)	Action	Location
27/2/2008 1631	TC Watch issued.	Kalumburu to Port Keats (NT)
28/2/2008 1616	Watch area changed.	Mitchell Plateau to Cape Leveque
29/2/2008 1621	Warning issued.	Mitchell Plateau to Cape Leveque
01/3/2008 1631	Warning area changed	Kuri Bay to Broome
1/3/2008 1600	Warning area changed.	Cockatoo Island to Broome
1/3/2008 2145	Warning area changed.	Cape Leveque to Broome
2/3/2008 1000	Warning cancelled.	

Table 3. Verification statistics: Track and Intensity.

Parameter	0 hr	6 hr	12 hr	18 hr	24 hr	36 hr	48 hr
Count	21	22	21	19	18	15	12
Distance (km)	31	49	66	76	87	115	138
Mean Wind (knots)	1.8	3	4.6	6.4	7.3	9.5	13.1

Figure 1. Track of Tropical Cyclone *Ophelia*, 29 Feb-7 March 2008.

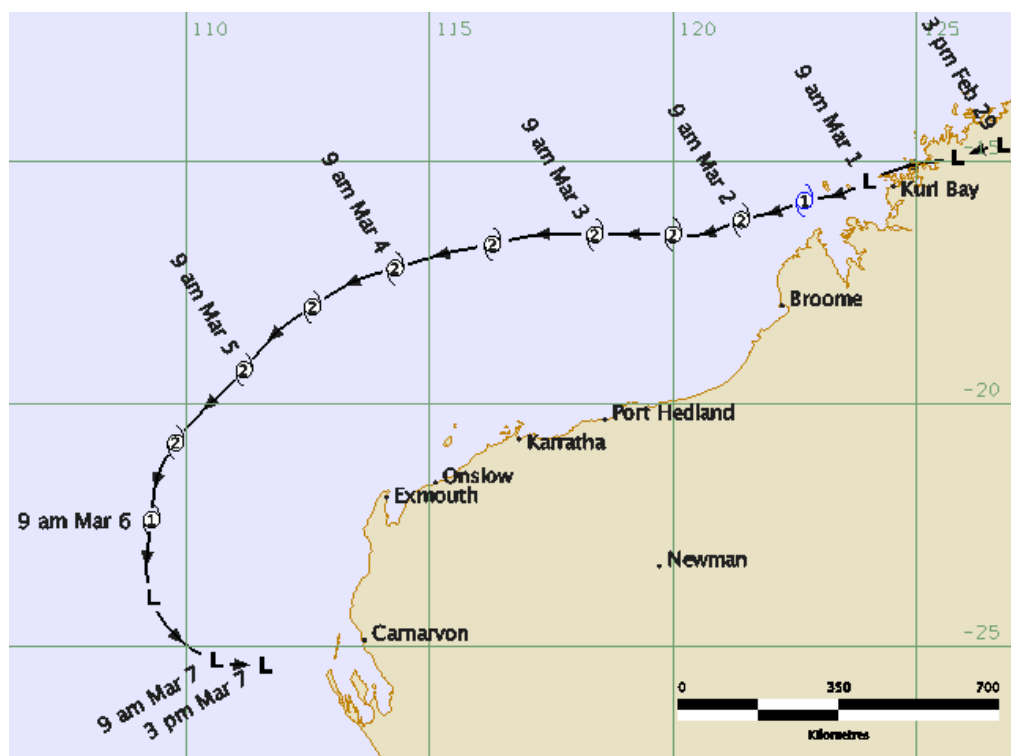


Figure 2. Weekly rainfall to 9am 1 March showing rainfall associated with the tropical low (pre-*Ophelia*).

Western Australian Rainfall (mm) Week Ending 1st March 2008
Product of the National Climate Centre

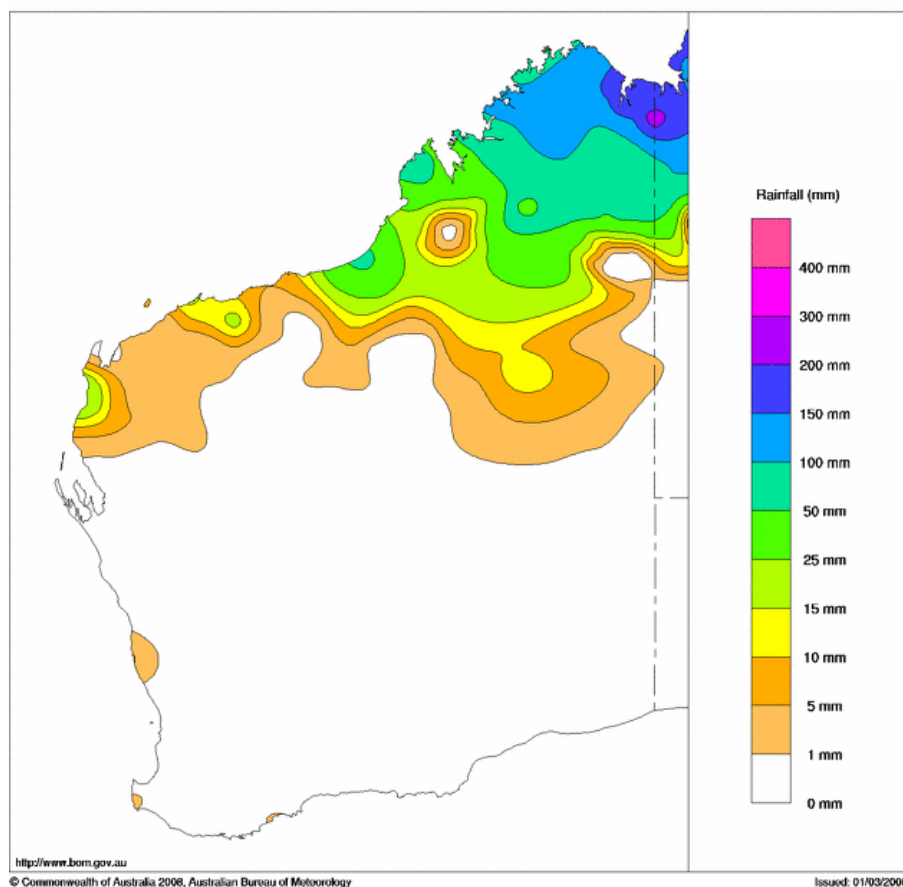


Figure 3. Microwave (AMSRE colour 89GHz) image at 02/0528UTC.
 (image courtesy of US NRL: <http://www.nrlmry.navy.mil/>)

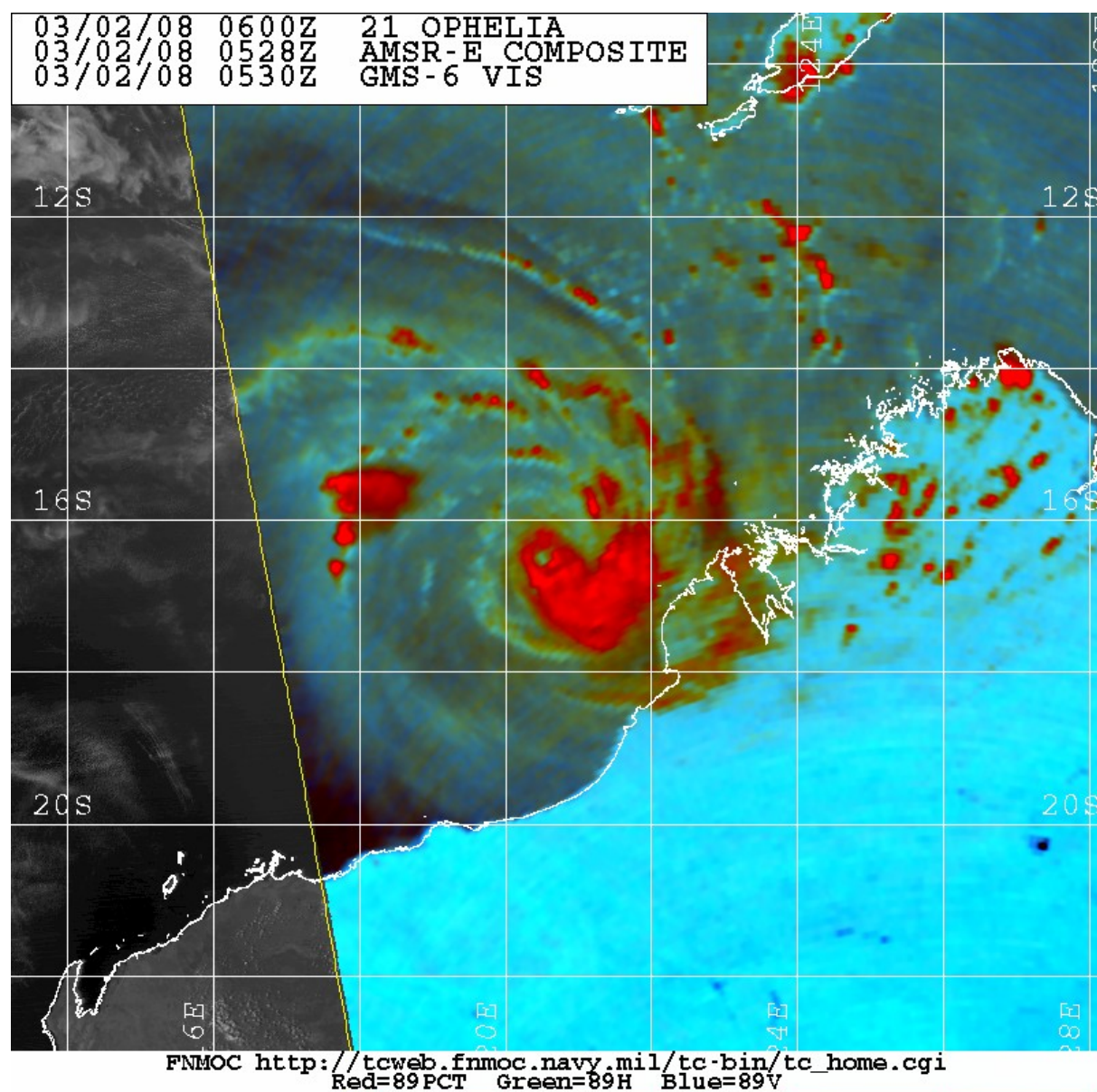


Figure 4. Quikscat at 10:27UTC 3 March 2008.

(image courtesy of RSS: <http://www.ssmi.com/>)

