



Australian Government
Bureau of Meteorology

Tropical Cyclone *Robyn*

1 - 7 April 2010

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

Tropical Cyclone *Robyn* developed well to northwest of Cocos Islands in early April and reached cyclone intensity at 0000 UTC 3 April as it moved slowly to the south. *Robyn* peaked at 60 knot intensity at 0000 UTC 5 April but weakened rapidly later that day to increasing northwesterly wind shear. *Robyn* is estimated to have weakened below cyclone intensity at 0600 UTC 6 April by which stage it had begun tracking to the northwest. Shipping warnings remained current for easterly gales on the southern side until 0600 UTC 7 April because of westerly motion and a strong high to the south.

TC *Robyn* remained over open waters in the central Indian Ocean and had no known impact.

Note: Operationally *Robyn* was rated as a category three cyclone but was downgraded to category two intensity upon post-analysis.

B. Meteorological Description

Intensity analysis

Towards the end of March the monsoon trough became active over central and eastern parts of the Indian Ocean associated with an active MJO phase.

Initial (Dvorak) classification was estimated at 0000 UTC 1 April following an overnight increase in convection near the low. Moderate to strong easterly wind shear inhibited rapid development and convection developed on the western side.

Ascat at 0353 UTC 2 April showed 35-40 knots towards the eastern edge of the swathe to the west of the centre suggesting gales were occurring under the deep convection. Given the sustained nature of convection with very cold cloud top temperatures, gales are estimated to occur in western quadrants but not in eastern quadrants, so technically the system remained at tropical low intensity (TC intensity requires gales to occur more than halfway around the centre).

Cyclone intensity is estimated at 0000 UTC 3 April when the curvature improved to about 0.6-0.7 (see Fig. 2 Visible image at 0230 UTC), although curvature was a bit less on microwave imagery. The corresponding Ascat 0330UTC showed 30 knots in all quadrants and an area of 35-40 knots on the northern side, although it is possible

that gales were also occurring to the west in the area of deepest convection as was evidenced on the previous pass.

The low level circulation remained quite broad and convection remained constrained to western quadrants in the following 24 hours. By this stage *Robyn* was located under the upper level ridge but under NE winds of about 15-25 knots which maintained the shear at about 15 knots (CIMSS estimate).

During 4 April the circulation strengthened and by 1200 UTC *Robyn* reached category 2 (storm-force) intensity with microwave imagery showing a much tighter circulation with convection extending around the centre. The 0730 UTC SATCON intensity estimate was 68 knots (one minute mean) biased towards the CIMMS AMSU-B estimate of 80 knots (ADT was 48 knots), however there is some suspicion that the AMSU-B method may over-estimate the intensity for tilted systems under shear.

Despite this improvement, the difference in the position of the mid-level centre (85 GHz) and the low level centre (37 GHz) of about 60 km (0.5 degree) shows the considerable tilt of the circulation (see Fig. 3 SSMIS 91 GHz image at 1132 UTC 4 April with overlay of the 37 GHz centre (note: parallax correction would shift the 91 GHz centre to the southeast but would not change the difference in the distance).

Overnight the low level circulation continued to become more organised, although convection seemed slower to respond. The convective signature appeared to peak on the SSMIS 04/2244 UTC 91GHz image, shown in Fig. 4 which indicated an emerging eye pattern.

According to the Dvorak technique *Robyn* appeared to peak at 2100 UTC 4 April to 06 UTC 5 April when estimates reached 4.0 based on a (white) curved band of 1.0 and 1.3 wrap on visible images. Using the embedded centre technique estimates from 04/2200-05/0100 UTC reached 5.0 but these were discounted given the known high bias of this method. The estimated intensity of 60 knots is consistent with SATCON 62-69 knots (one-minute) values.

From about 0600 UTC 5 April *Robyn* weakened rapidly owing to northwesterly shear of ~15-20 knots. Convection weakened and the low level circulation centre became displaced to the NNW of the convection. Based upon the Dvorak weakening constraints (using 6 hour weakening rule) the CI is estimated to fall to 2.5 at 0600 UTC 6 April. However, the maximum wind is estimated to remain at 35 knots on the southern side until about 0300 UTC 7 April, owing to the contribution of the westerly motion and a strong ridge to the south. The weakening low passed west of 90E at 1200 UTC 7 April.

Motion

For much of its lifetime, *Robyn* moved at speeds of less than 10 km/h being in an environment of light steering winds with the mid-level ridge to the south being weak. *Robyn* moved slowly south in the initial and middle stages of its lifetime before a mid-latitude trough developed to the south on 5 April steering *Robyn* to the east for a period. An ensuing strong ridge in the wake of the trough steered *Robyn* to the northwest then to the west southwest.

Structure

Convection was displaced west of the centre during the initial and middle stages of *Robyn*'s life cycle owing to easterly shear. The circulation struggled to be vertically aligned and even as convection became more organised on 4 April, the vortex was tilted as shown in the differences between the SSMIS microwave 37 GHz (low-level) and 91 GHz (mid-level) frequencies at 1132 UTC 4 April in Fig 3. As upper level winds shifted to northwesterly, the convection and strongest winds became displaced to the south of the centre on 6 and 7 April.

C. Impact

TC *Robyn* remained over open waters in the central Indian Ocean and had no known impact.

D. Observations

There were no surface observations available near the centre of TC *Robyn*.

Table 1. Best track summary for TC *Robyn*, April 2010.

Refer to the Australian Tropical Cyclone database for complete listing of parameters.

Year	Month	Day	Hour UTC	Position Latitude S	Position Long. E	Position Accuracy nm	Max wind 10min knots	Max gust knots	Central Pressure hPa	Rad. of Gales nm	Rad. of storm force winds	Radius Max. Wind (RMW)
2010	4	1	00	8.8	93.3	25	25	45	1004			
2010	4	1	06	8.9	93.1	25	25	45	1002			
2010	4	1	12	9.4	93.1	25	25	45	1002			
2010	4	1	18	10.1	93.0	30	30	45	1000			
2010	4	2	00	10.5	92.9	25	30	45	1000			
2010	4	2	06	11.2	92.7	25	35	50	1000			
2010	4	2	12	11.8	92.5	25	35	50	998			
2010	4	2	18	12.4	92.4	25	35	50	998			
2010	4	3	00	12.9	92.4	20	35	50	996	90		30
2010	4	3	06	13.3	92.4	25	40	55	994	95		30
2010	4	3	12	13.6	92.4	25	40	55	994	100		25
2010	4	3	18	13.9	92.4	25	45	65	990	100		20
2010	4	4	00	14.2	92.3	25	45	65	990	105		20
2010	4	4	06	14.5	92.0	20	50	70	988	105	25	20
2010	4	4	12	14.8	91.8	20	55	75	985	105	25	20
2010	4	4	18	15.2	91.5	20	55	75	985	108	25	20
2010	4	5	00	15.6	91.4	20	60	85	980	115	25	20
2010	4	5	06	16.1	91.6	25	55	75	985	113	25	20
2010	4	5	12	16.1	92.2	20	50	75	986	105	25	20
2010	4	5	18	16.0	92.2	20	45	70	988	95		20
2010	4	6	00	15.8	92.1	15	40	55	994	85		30
2010	4	6	06	15.5	91.8	15	35	45	996			
2010	4	6	12	15.2	91.5	15	35	45	996			
2010	4	6	18	15.4	91.0	20	35	45	996			
2010	4	7	00	15.8	90.7	15	35	45	996			
2010	4	7	06	16.0	90.2	15	30	45	998			

Figure 1. Track of Tropical Cyclone *Robyn*, 1-7 April 2010. Times in WST (subtract 8 hours to convert to UTC).

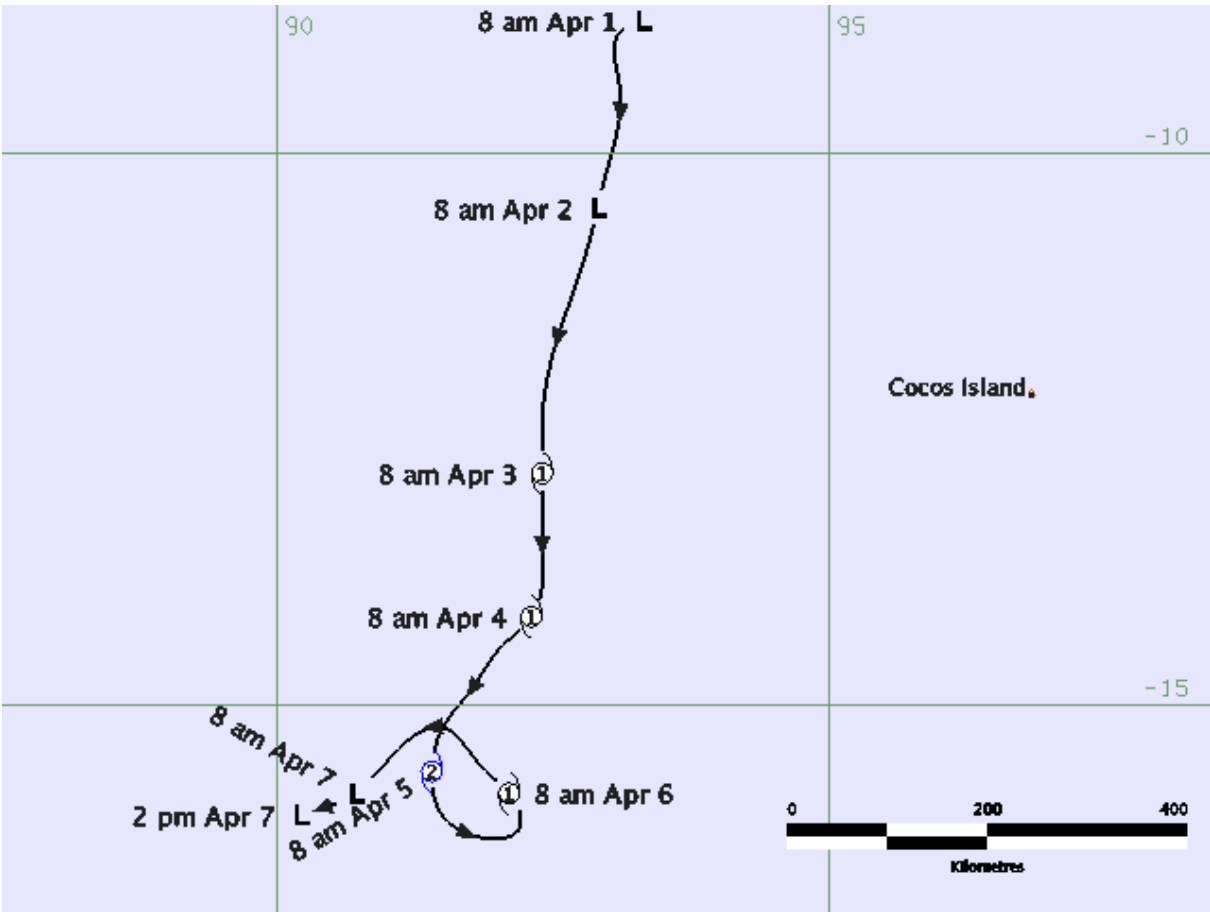


Figure 2. Initial cyclone intensity: visible image at 0230 UTC 3 April showing the curved band convective pattern.

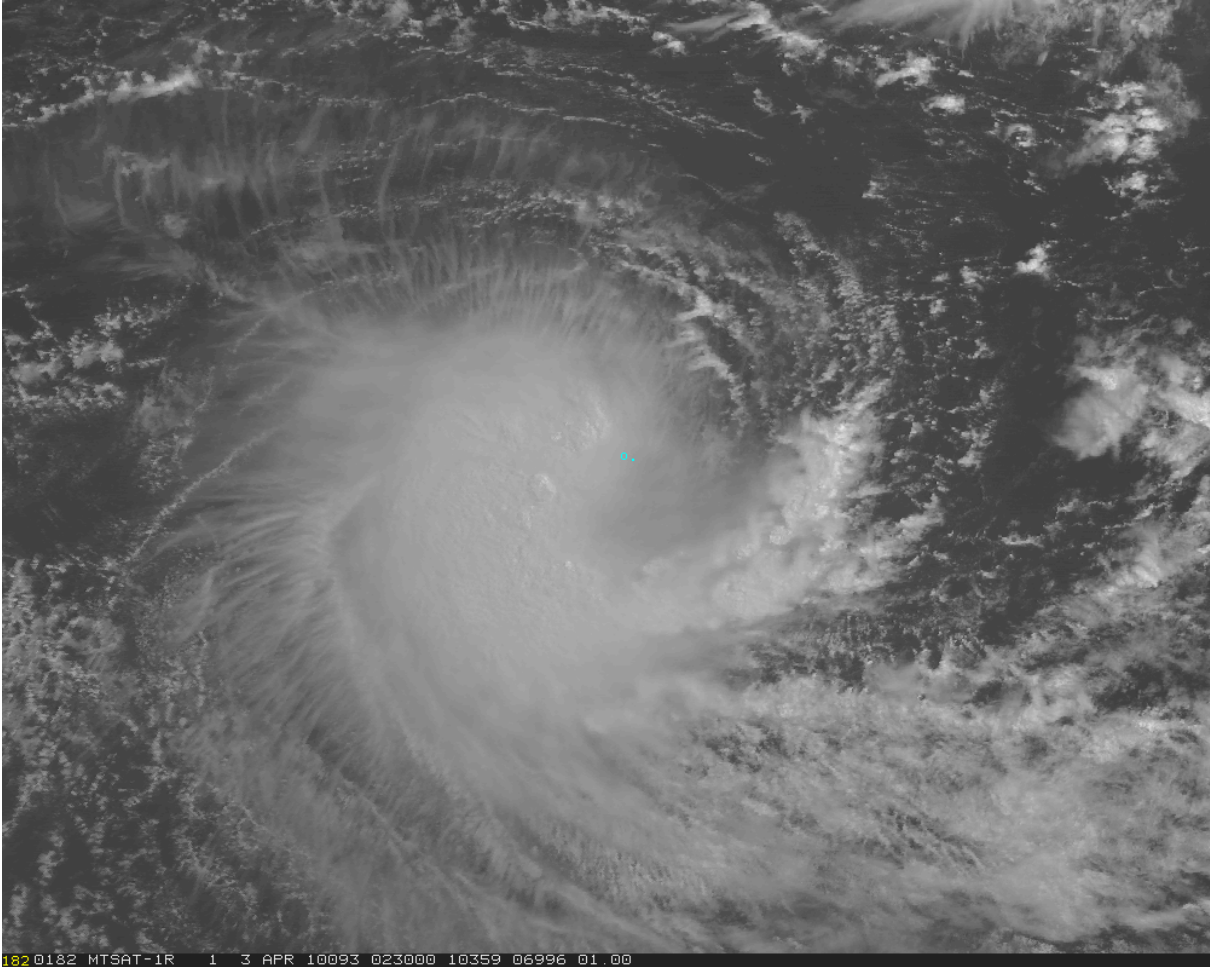


Figure 3. Microwave image (91GHz SSMIS) of Tropical Cyclone *Robyn* at 1132UTC 4 April 2010. The yellow ring indicates the low-level circulation centre as indicated by the corresponding 37GHz image (not shown) (image courtesy of US NRL: <http://www.nrlmry.navy.mil/>).

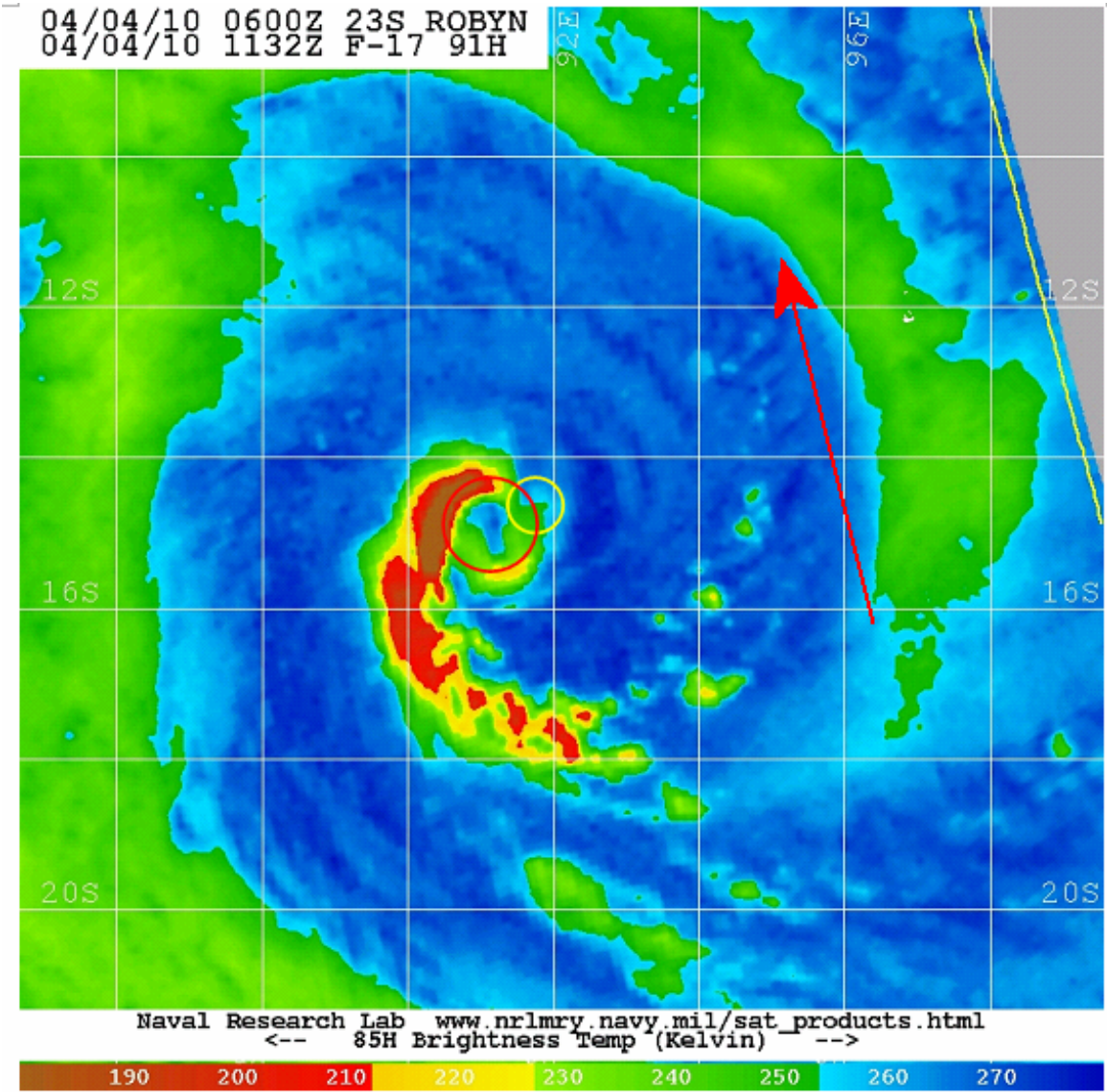


Figure 4. Microwave (SSMIS 91GHz) image at 2244 UTC 4 April near peak intensity
(image courtesy of US NRL: <http://www.nrlmry.navy.mil/>)

