



Australian Government
Bureau of Meteorology

Tropical Cyclone *Jacob*
3-12 March 2007

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17 August 2007

A. Summary

A low formed well northwest of the Kimberley early in March and moved steadily westwards eventually reaching cyclone intensity at 06/18UTC. Cyclone advices were issued for Christmas Island on 7 March as *Jacob* moved to the northwest but were cancelled as *Jacob* recurved to the southeast on the 8th. *Jacob* reached category three intensity late on the 9th but weakened the following day under moderate northeasterly shear. *Jacob* continued its southeast then east southeast track eventually crossing the coast just east of Port Hedland as a tropical low on the morning of the 12th. Coincidentally this was almost the exact point at which category five *George* crossed only two days before.

Although *Jacob* weakened before impacting the coast, the threat of a second cyclone put communities on high alert and hampered recovery operations following TC *George*. In addition there was an economic impact due to loss of production from oil and gas facilities and closure of port operations. Arterial roads were closed through eastern and central inland parts of the Pilbara because of heavy rain exacerbated by rainfall associated with TC *George* just a few days earlier.

B. Meteorological Description

Intensity analysis

A low was identified within the monsoon trough at 02/18UTC. Convection about the low was subject to diurnal forcing and hampered by strong easterly shear. This pattern of convective pulsing continued through the 4th, 5th and 6th with shear remaining on the order of 30-40 knots. At times satellite imagery suggested Dvorak intensity of cyclone level (DT=3.0-3.5) but given that such patterns were not sustained owing to the shear it is unlikely that cyclone intensity was reached during this phase. However, overnight on the 4-5th gales are estimated under convection in the western quadrant at 04/18 to 05/00UTC supported by rain-affected gales on the Quikscat pass. The “best track” is shown in Figure 1 and the maximum wind shown in Figure 2. The best track positions and intensities are listed in Table 1.

By 05/0430UTC the low level centre was well exposed although convection again developed near the centre and gales in western quadrant are likely at 05/12UTC. This pattern repeated on the 6th with continuing strong shear above 30 knots.

However, overnight from the 6th to the 7th convection became more sustained as shear eased to 20-25 knots. Gales are evident in the northern quadrant only at 06/12UTC and then cyclone intensity is estimated at 06/18UTC on the basis of subsequent improved convection. Operationally the system was named *Jacob* at 07/00UTC.

Development appears to be ongoing later on the 7th as suggested by as shear finally fell below 20 knots and maximum winds were estimated at 55 knots (category 2) at 07/18UTC. Some weakening was evident during the 8th and at this point *Jacob* halted its WNW track and subsequently began its SE track towards the Australian coast. Possibly weakening was assisted by ongoing moderate shear during the diurnal minimum and also by sea surface temperatures (SST) in the area falling below 27C caused by the slow moving *Jacob* itself.

Jacob recommenced development overnight from 8-9th continuing until 09/18UTC when the maximum intensity was estimated at 70 knots (category 3) when microwave imagery showed a ragged eye pattern.

Thereafter weakening was evident assisted by movement over an area of cooler SST and on the 11th the low-level circulation centre briefly became exposed despite the estimated shear remaining below 20 knots. Brief periods of gales were observed at some offshore observing sites and on the 11th Quikscat passes indicated some areas of gales mainly in northern and western quadrants. Convection was only just sufficient to hold the system at cyclone intensity.

By landfall at 12/03UTC it is estimated that the system fell below cyclone intensity. This is despite Bedout Is registering gales at this time to the NNE and radar imagery suggesting offshore gales in the southerlies. Overall gales are estimated as extending less than halfway about the centre. As the system moved inland imagery became more unorganised.

A feature of *Jacob* was the diurnal fluctuation in intensity. Aside from the expected diurnal variations prior to cyclone intensity phase when strong shear was evident, *Jacob* showed peaks overnight on each of the nights from the 6-7 to the 9-10th culminating in maximum intensity. It is likely the relatively small size of the system contributed to this.

Motion

A strong mid-latitude ridge steered the low steadily to the west. The close proximity of TC *George* east of the low complicated the pattern, particularly as *George* was a large and dominant system. As *George* took a WSW course *Jacob's* westerly track took a shift to the northwest.

By the 8th and 9th the ridge to the south was eroded by a mid-latitude trough. In response to this trough and also to strengthening NW winds to the northeast, *Jacob* recurved to the southeast towards the Pilbara coast. A steady SE track continued through the 10th and 11th towards the now weakening *George* over inland WA, until landfall just to the east northeast of Port Hedland on the morning of the 12th.

Jacob was tracked by Dampier radar from about 09/12UTC and then on Port Hedland radar from about 11/22UTC, although by this stage the system was poorly defined.

Structure

Being affected by moderate to strong easterly shear initially, gales were initially confined to western and northern quadrants, and even during the initial stages of *Jacob's* development the area of gales was greatest in these sectors. As *Jacob* began to track to the southeast the area of gales increased on the southern side but as *Jacob* neared the coast the only observed gales were in the western and northern parts.

Throughout its lifetime the area of gales was only on the order of 50-100 nm. The radius of maximum winds is estimated at just 10 nm during its peak intensity.

C. Impact

Although *Jacob* weakened before impacting the coast, the threat of a second cyclone put communities on high alert and hampered recovery operations following TC *George*. In addition there was an economic impact due to loss of production from oil and gas facilities and closure of port operations.

The combination of *George* and *Jacob* caused heavy rain over 200mm across parts of the central and eastern Pilbara. The rain caused road closures on most roads through the area except for the Great Northern Highway. The rainfall also delayed recovery efforts following TC *George* particularly about Port Hedland on the 12th. Road closures also cut access for mining and pastoral activities. Otherwise no major flooding was reported.

D. Observations

Wind

Gales were recorded at some privately operated offshore buoys but not at any coastal observation sites. Gales were observed at Bedout Island as the system crossed the coast at about 12/03UTC.

Rainfall

Rainfall totals on the 12 and 13 March averaged 50-100mm across much of the Pilbara. Some significant daily falls recorded on the 12th included: 114mm at Port Hedland, 86mm at Mundabullangana, 58mm at Marble Bar, 50 mm at Karratha and 49mm at Telfer; and on the 13th included: 123mm at Yarrie Station, 73mm at Telfer and 43mm at Marble Bar.

The combination of *George* and *Jacob* caused heavy rain over 200mm across parts of the central and eastern Pilbara as shown on the weekly rainfall map to 9am on the 13th in Figure 3. Yarrie recorded a total of 335mm of rain in the 96 hours to 9am the 13th.

E. Forecast Performance

A gale warning was first issued for the low that was to become *Jacob* at 11:42am WDT 5 March (05/0242UTC) for gales in western quadrants but intensification to

tropical cyclone intensity (having gales extend more than halfway around the centre) was not expected while it was experiencing such strong shear.

The low was named *Jacob* operationally at 9:50 am WDT 7 March (07/0050UTC) when the first advice (TC Watch) was issued for Christmas Island. This was upgraded to a TC Warning at 4:35pm WDT (7/0735UTC). A FESA Yellow alert was included on the warning issued at 8:45am WDT 8 March (07/2345TC). The warning was cancelled at 11:00pm WDT 8 March (08/1400UTC) when *Jacob* moved away from the island.

Advices were renewed when a TC Watch was declared for areas between Coral Bay and Sandfire at 4:05pm WDT 9 March (09/0705UTC). This was upgraded to a warning for areas between Onslow and Port Hedland at 10:10am WDT 10 March (10/0110UTC). By 3:50pm WDT (10/0650UTC) the area under warning was extended from Onslow to Pardoo and the area was gradually amended until *Jacob* moved inland and advices were cancelled at 3:45pm 12 March (12/0645UTC). A summary of Tropical Cyclone Advices is given in Table 3.

As *Jacob* intensified into a category three system, there was concern that in an anticipated ongoing environment of low wind shear that further development was possible. This had major consequences for the highly sensitive communities of the Northwest who were in the process of bracing for severe TC *George*. Indeed the forecasts issued on the 10th were for a potential severe crossing within 48 hours. These forecasts were revised down once *Jacob* commenced weakening and the warning issued at 12:55pm WDT 11 March (11/0355UTC) were for a category 1 impact on the central Pilbara coast. As it turned out *Jacob* took a more east southeast track crossing east of Port Hedland.

Table 1. Best track summary

Year	Month	Day	Hour (UTC)	Position Latitude S	Position Longitude E	Position Accuracy nm	Max wind 10min knots	Max gust knots	Central Pressure hPa	Radius of Gales nm	Radius storm force winds nm	Radius Maximum Wind nm
2007	3	2	18	13.8	118.9	25	20	45	1000			30
2007	3	3	0	13.8	118.1	25	25	45	998			40
2007	3	3	6	13.8	117.7	25	25	45	994			20
2007	3	3	12	13.8	117.3	25	25	45	994			20
2007	3	3	18	14.1	116.7	25	25	45	994			20
2007	3	4	0	14.5	116.3	15	25	45	994			20
2007	3	4	6	14.4	116.1	15	25	45	994			20
2007	3	4	12	14.6	116.1	20	25	45	994			30
2007	3	4	18	14.7	115.5	20	25	45	994			25
2007	3	5	0	14.6	114.8	15	25	45	994			30
2007	3	5	6	14.5	114.2	10	25	45	994			25
2007	3	5	12	14.3	113.4	20	30	45	992			25
2007	3	5	18	14.2	112.3	25	30	45	992			20
2007	3	6	0	14.2	111.0	20	30	45	992			20
2007	3	6	6	13.6	110.1	15	30	45	992			15
2007	3	6	12	13.4	109.8	20	30	45	990			20
2007	3	6	18	13.1	108.9	20	35	50	984	60		20
2007	3	7	0	12.6	108.3	20	40	55	982	50		20
2007	3	7	6	12.6	107.8	20	45	65	978	60		15
2007	3	7	12	12.7	107.1	25	50	70	974	70	20	15
2007	3	7	18	12.9	106.3	20	55	80	966	80	25	15
2007	3	8	0	12.5	106.0	15	55	80	966	80	25	15
2007	3	8	6	12.6	105.9	15	50	70	976	60	25	15
2007	3	8	12	13.0	106.3	20	50	70	976	55	25	15
2007	3	8	18	13.5	107.0	25	50	70	976	60	25	15
2007	3	9	0	14.0	107.7	15	50	70	978	65	25	15
2007	3	9	6	14.5	108.3	20	55	80	970	70	25	15
2007	3	9	12	15.0	109.2	20	65	90	964	75	25	10
2007	3	9	18	15.6	109.8	25	70	100	960	75	25	10
2007	3	10	0	16.0	110.6	20	65	90	964	65	25	10
2007	3	10	6	17.1	111.4	20	60	85	966	60	20	10
2007	3	10	12	17.9	112.4	20	55	80	968	55	20	15
2007	3	10	18	18.4	113.1	20	50	70	976	45	20	15
2007	3	11	0	19.0	113.9	15	50	70	978	40	20	15
2007	3	11	6	19.3	114.5	15	40	55	986	40		15
2007	3	11	12	19.5	115.6	20	35	50	988	40		15
2007	3	11	18	19.7	117.0	15	35	50	988	40		15
2007	3	12	0	20.0	118.3	15	35	50	988	40		15
2007	3	12	3	20.1	118.9	10	30	45	992			20
2007	3	12	6	20.4	119.7	15	25	45	992			20

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

Date/Time (UTC)	Action	Location
05/0242	Shipping warning issued for gales in western quadrants.	
07/0100	Named <i>Jacob</i> . Watch issued.	Christmas Island
07/0735	Warning issued.	Christmas Island
08/1400	Warning cancelled.	Christmas Island
09/0705	Watch issued.	Coral Bay to Sandfire
10/0100	Warning issued. Watch current.	Onslow to Port Hedland
10/0650	Warning current. Watch current.	Onslow to Pardoo Coral Bay to Bidyadanga, inland Pilbara.
11/0355	Warning current. No watch.	Exmouth to Pardoo, inland Pilbara
11/1847	Warning current.	Dampier to Pardoo, adj. inland Pilbara
12/0645	Advices cancelled.	

Table 3. Verification statistics: Track and Intensity.

Parameter	0 hr	6 hr	12 hr	18 hr	24 hr	36 hr	48 hr	72 hr
Count	19	17	17	15	15	11	8	3
Distance (km)	25	39	66	87	99	144	210	342
Mean Wind (knots)	3	4	8	13	16	23	26	18

Figure 1. Track of Tropical Cyclone *Jacob*, 3-12 March 2007.

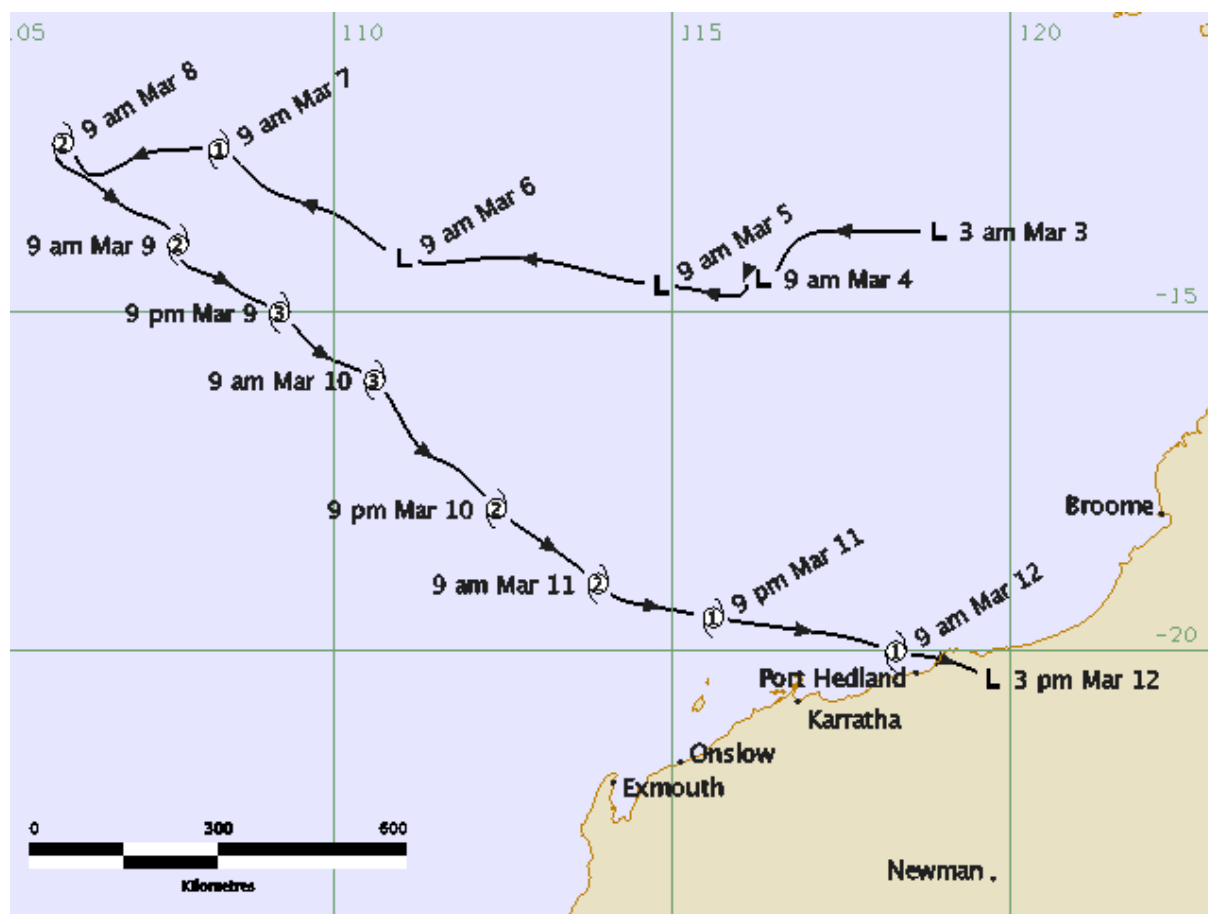


Figure 2. Best Track maximum mean winds (10 minute) for Tropical Cyclone *Jacob*, 3 -12 March 2007.

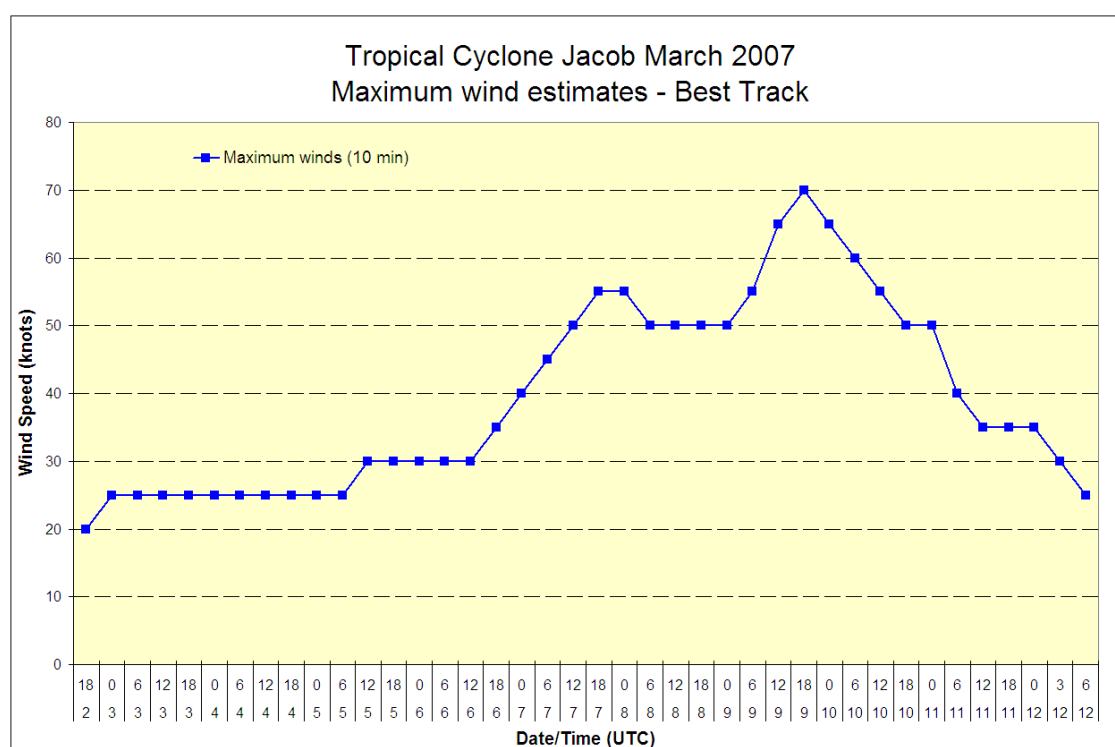


Figure 3. Weekly rainfall to 9am 13 March showing rainfall from *George* and *Jacob*.

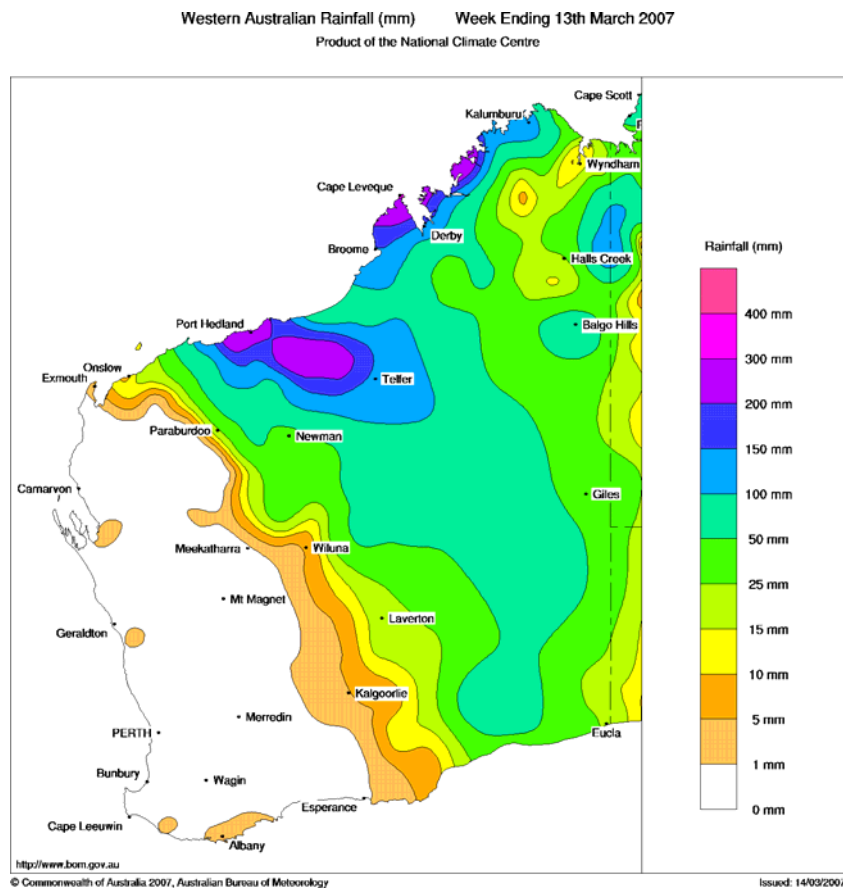


Figure 4. Microwave (AMSRE (Aqua) 89GHz) image at 09/1753UTC.

(image courtesy of NASA)

