



Australian Government
Bureau of Meteorology

Tropical Cyclone *Fay*

16 - 28 March 2004

Perth Tropical Cyclone Warning Centre
Bureau of Meteorology

A. Summary

Tropical cyclone *Fay* was a long-lived intense cyclone off northern Australia. *Fay* formed from a tropical low in the Gulf of Carpentaria, was named in the Timor Sea and then reached category 5 intensity off the Kimberley coast on 20 – 21 March. *Fay* went through a weakening then re-intensification period taking a generally southerly track before finally crossing the Pilbara coast east of Port Hedland as a category 4 cyclone on 27 March.

Fortunately *Fay* made landfall in a remote part of the east Pilbara coastline and consequently only impacted sparsely populated pastoral and mining areas. Damage was reported from the Yarrie mine site where 200 workers were locked down for 8 hours. Heavy rain caused East Pilbara rivers to flood particularly at Nullagine and along the De Grey River. The coral at Scott Reef was severely damaged.

B. Meteorological Description

The low that was to become TC *Fay* developed in the Gulf of Carpentaria and moved westward into the Timor Sea where it was named as a cyclone at 1230 UTC (2030 WST, 2200 CST) on 16 March, when it was 400 kilometres north of Wyndham and 330 kilometres west northwest of Darwin. Strong to gale force winds were reported along the northern Kimberley coast as *Fay* remained seawards coming within 135 km of Kalumburu late on the 18 March before turning toward the northwest and moving away from the coast.

Tropical Cyclone *Fay* steadily intensified reaching peak intensity of 115 knots (category 5) on 21 March approximately 280 km north northwest of Cape Leveque (see Fig. 2 and Fig. 3). At the time of peak intensity environmental shear was less than 20 knots. Over the following two days the shear diminished further, to less than 10 knots, and *Fay* would very likely have continued to intensify and become a very intense system if it had not simultaneously ingested a dry airmass (see Fig. 4 Water vapour image 23 March).

During 23 March, as the system began to show the effects of the dry air, *Fay* completed a loop and then turned to the south southeast toward the west Kimberley coast. There is evidence that continued mixing of the ocean due to the slow looping motion over this period reduced the sea surface temperatures beneath *Fay* to below 26°C, thus having an additional impact on

Fay's intensity (see Fig. 5). *Fay* weakened to a category 2 system before beginning to reintensify as the moisture available to the system increased and a poleward outflow channel developed.

Early on 25 March *Fay* re-intensified to category 3 and approached to within 90 kilometres of Broome before taking on a more southwesterly track (see radar image in Fig. 6a). Broome experienced strong winds with gale-force gusts, some heavy rain and heavy seas but escaped serious damage.

Fay then headed further away from the coast on 25 March before resuming a general southerly track the following day. *Fay* crossed the Pilbara coast between the pastoral stations of Pardoo and Wallal between 0800 and 0900 WST on Saturday 27 March as a Category 4 cyclone with estimated maximum wind gusts of around 235 km/h near the centre (see radar image in Fig. 6b).

The cyclone began weakening as it moved further inland. *Fay* appears to have weakened below cyclone strength between Nullagine and Telfer.

B. Impact

A post-event survey of Scott Reef by Australian Institute of Marine Science showed the reef sustained severe damage from *Fay* which passed close by late on 21 March when *Fay* was close to maximum intensity. Many large coral colonies were uprooted and boulders up to 5 metres in diameter were broken off. Even colonies down to 20 metres were damaged (see Fig. 7).

Fortunately *Fay* made landfall in a remote part of the east Pilbara coastline and consequently only impacted sparsely populated pastoral and mining areas. As the system passed close to the Yarrie mine some 200 workers were locked down for 8 hours in two squash courts as accommodation units were overturned, water tanks described as being "shredded" and power lines cut.

The heavy rain associated with TC *Fay* (see Fig. 8) caused flooding in the De Grey and Oakover river systems. Flooding in the Nullagine River split the town of Nullagine into four sections (a relatively common occurrence as the town is particularly vulnerable), resulting in the evacuation of the town's population of 140 to the police station, court house and buildings on the outskirts of the town. Heavy rain in the Oakover and Nullagine River catchments produced moderate flooding in the De Grey River. Floodwaters inundated the Mulyie station homestead on 30 March.

D. Observations

Unfortunately the cyclone did not pass over any wind or pressure recording sites during its lifetime. Troughton Island, off the north Kimberley coast, recorded gales for a ten hour period overnight on 18 March. Gales occurred at Bedout Island, northeast of Port Hedland, for a period overnight on 25/26 March and then continuously from 0800 WST 26 March until 1100 WST 27 March as *Fay* passed within 100 kilometres to the east.

Heavy rainfall was recorded along its track and several Pilbara sites recorded accumulated falls in excess of 200 mm. Telfer recorded 24 hour falls of 159 mm to 0900 WST on 28 March and 200 mm to 0900 on 29 March. This

included 72.4 mm in the two hours between 1350-1550 WST on 28 March. Nifty Mine registered 701 mm over two days (525 and 176 mm) including 108mm in two hours to 2100 WST on 27 March.

Other rainfall data (daily falls to 0900 LST):

15 March -Elcho Island 91 mm

16 March - Point Fawcett 180 mm, Maningrida 94 mm, Warruwi 80 mm

18 March - Troughton Island 122 mm, Point Stuart 110 mm

19 March - Troughton Island 90 mm.

24 March - Cygnet Bay 87 mm

25 March - Cygnet Bay 124 mm, Country Downs 120 mm.

26 March - Bidyadanga 106 mm, Broome 84 mm.

27 March - Mandora 99 mm, Broome 86 m, Bidyadanga 83 mm.

28 March - Wallal Downs 198/2days, Telfer 159 mm, Warrawagine 134 mm, Mandora 111 mm, Camp Nifty Mine 287 mm (gauge overflowed and company AWS TBRG measures 525 mm).

29 March - Telfer 200 mm, Camp Nifty 186 mm, Yarrie 145 mm.

E. Forecast Performance

Darwin TCWC issued timely warnings to the northern Kimberley area while the cyclone was in their area of responsibility. Perth TCWC cancelled advices to the public on 20 March as the cyclone moved seawards from the Kimberley and posed no threat for some days. Watch messages were resumed on Tuesday 23 March and these were upgraded to warnings for the west Kimberley coast on 24 March. Warning areas were progressively extended along the Pilbara coast as *Fay* headed south. The last warning was issued at 1900 WST Sunday 28 March.

Table 1. Best track summary for *Fay*, 19 - 28 March 2004.

Note: Add 8 hours to convert to WST. Refer to best track database for complete track details.

Year	Month	Day	Hour (UTC)	Position Latitude S	Position Longitude E	Central Pressure hPa	Max wind 10min knots	Max gust knots	Rad. of Gales nm	Rad. storm force winds nm	Radius hurricane Force winds nm
2004	3	12	0000	11.0	146.0	1006	15				
2004	3	12	0600	11.0	145.0	1005	15				
2004	3	12	1200	11.0	143.5	1007	15				
2004	3	12	1800	11.0	143.0	1006	15				
2004	3	13	0000	11.0	142.0	1008	15				
2004	3	13	0300	10.5	140.7	1006	15				
2004	3	13	0600	10.5	140.0	1004	15				
2004	3	13	1200	10.5	139.0	1005	15				
2004	3	13	1800	10.5	137.5	1004	15				
2004	3	14	0000	10.5	136.5	1005	15				
2004	3	14	0300	10.5	136.3	1003	15				
2004	3	14	0600	10.6	136.2	1002	20	45			
2004	3	14	1200	10.6	135.2	1002	20	45			
2004	3	14	1800	10.6	134.8	1001	20	45			
2004	3	14	2100	10.5	134.5	1001	20	45			
2004	3	15	0000	10.6	134.0	1000	25	45			
2004	3	15	0300	10.6	133.5	999	25	45			
2004	3	15	0600	10.7	132.8	998	25	45			
2004	3	15	0900	10.7	131.9	998	25	45			
2004	3	15	1200	10.7	131.3	997	25	45			
2004	3	15	1500	10.7	130.8	997	25	45			
2004	3	15	1800	10.9	130.3	996	30	45			
2004	3	15	2100	11.1	129.9	995	30	45			
2004	3	16	0000	11.4	129.5	994	30	45			
2004	3	16	0300	11.6	129.1	993	30	45			
2004	3	16	0600	11.6	128.5	992	30	45			
2004	3	16	0900	11.6	128.2	991	40	55	50		
2004	3	16	1200	11.7	127.9	990	40	55	60		
2004	3	16	1500	11.8	127.9	989	40	55	80		
2004	3	16	1800	11.9	127.8	988	40	55	80		
2004	3	16	2100	12.0	127.8	987	40	55	80		
2004	3	17	0000	12.1	127.8	986	40	55	90		
2004	3	17	0300	12.3	127.6	985	40	55	90		
2004	3	17	0600	12.4	127.4	984	40	55	90		
2004	3	17	0900	12.5	127.3	982	40	55	80		
2004	3	17	1200	12.7	127.2	981	40	55	80		
2004	3	17	1500	12.7	127.2	979	50	70	80		
2004	3	17	1800	12.8	127.2	978	50	70	80		
2004	3	17	2100	13.0	127.1	976	60	85	70		
2004	3	18	0000	13.1	126.9	974	60	85	70		
2004	3	18	0300	13.1	126.8	973	60	85	70		
2004	3	18	0600	13.1	126.8	971	60	85	70		
2004	3	18	0900	13.2	126.7	970	60	85	80		
2004	3	18	1200	13.2	126.6	968	70	100	90		20
2004	3	18	1500	13.1	126.3	966	70	100	90		20
2004	3	18	1800	12.9	126.1	964	70	100	90		20
2004	3	18	2100	12.8	125.8	962	70	100	90		20
2004	3	19	0000	12.8	125.5	960	70	100	100		20

2004	3	19	0300	12.8	125.4	958	70	100	100		20
2004	3	19	0600	12.9	125.4	955	80	115	100		20
2004	3	19	0900	12.9	125.3	952	80	115	100		20
2004	3	19	1200	12.8	125.1	949	90	125	100		20
2004	3	19	1500	12.8	124.8	946	90	125	100		20
2004	03	19	18	12.80	124.9	945	90	125	100	50	20
2004	03	20	00	12.90	124.8	940	90	125	100	60	20
2004	03	20	06	13.10	124.6	940	90	125	80	50	20
2004	03	20	12	13.30	124.2	935	90	125	70	45	20
2004	03	20	18	13.60	123.6	935	90	125	70	45	20
2004	03	21	00	13.30	123.0	930	95	130	80	50	20
2004	03	21	03	13.45	122.9	920	100	140	80	50	20
2004	03	21	06	13.60	122.8	915	115	160	80	50	20
2004	03	21	12	14.00	122.2	910	115	160	90	50	20
2004	03	21	18	14.00	121.7	915	115	160	90	50	20
2004	03	22	00	13.90	121.2	920	100	140	100	50	25
2004	03	22	06	13.90	120.9	930	90	125	100	50	25
2004	03	22	12	14.20	120.9	920	100	140	100	55	25
2004	03	22	18	14.40	120.5	920	100	140	100	60	25
2004	03	22	21	14.30	120.4	930	95	130	100	60	25
2004	03	23	00	14.20	120.5	935	90	125	110	60	25
2004	03	23	03	14.15	120.6	945	80	11	110	60	25
2004	03	23	06	14.30	120.7	950	80	110	100	50	20
2004	03	23	12	14.30	121.2	960	70	100	100	50	20
2004	03	23	18	15.20	121.4	970	60	85	100	60	
2004	03	24	00	15.50	121.6	970	60	85	100	60	
2004	03	24	06	15.90	121.6	960	70	100	100	60	25
2004	03	24	12	16.30	121.7	955	75	105	110	60	25
2004	03	24	15	16.50	121.7	955	75	105	110	60	25
2004	03	24	18	16.75	121.65	950	80	110	90	55	25
2004	03	24	21	16.95	121.65	950	80	110	90	55	25
2004	03	25	00	17.10	121.6	950	80	110	80	55	25
2004	03	25	03	17.40	121.5	950	80	110	80	55	25
2004	03	25	06	17.70	121.25	955	75	105	70	50	25
2004	03	25	09	17.90	121.00	955	75	105	70	50	25
2004	03	25	12	17.95	120.80	955	75	105	75	50	25
2004	03	25	15	17.95	120.60	955	75	105	75	50	25
2004	03	25	18	18.00	120.40	955	75	105	70	50	25
2004	03	25	21	18.05	120.25	950	75	105	70	50	25
2004	03	26	00	18.15	120.20	950	80	110	70	50	25
2004	03	26	03	18.30	120.15	940	85	115	70	50	25
2004	03	26	06	18.55	120.05	935	90	125	70	55	30
2004	03	26	09	18.75	120.00	930	95	130	70	55	30
2004	03	26	12	18.90	119.95	920	100	140	80	55	30
2004	03	26	15	19.05	119.95	925	100	140	80	55	30
2004	03	26	18	19.25	120.00	930	95	130	70	45	25
2004	03	26	21	19.50	120.05	930	95	130	70	45	25
2004	03	27	00	19.80	120.10	935	90	125	70	40	20
2004	03	27	03	20.20	120.10	940	90	125	70	40	20
2004	03	27	06	20.50	120.10	945	85	120	40	40	15
2004	03	27	09	20.70	120.20	950	85	120	40	25	15
2004	03	27	12	21.00	120.30	960	80	110	30	20	15
2004	03	27	15	21.00	120.50	965	70	100	30	20	

2004	03	27	18	21.20	120.60	975	60	85	25	20	
2004	03	28	00	21.40	120.80	985	50	70	25	15	
2004	03	28	06	21.50	120.90	992	35	50	25		
2004	03	28	12	21.50	120.90	997	25	40			

Figure 1 Best Track Summary for Tropical Cyclone Fay, 12 – 28 March 2004
All times in WST.

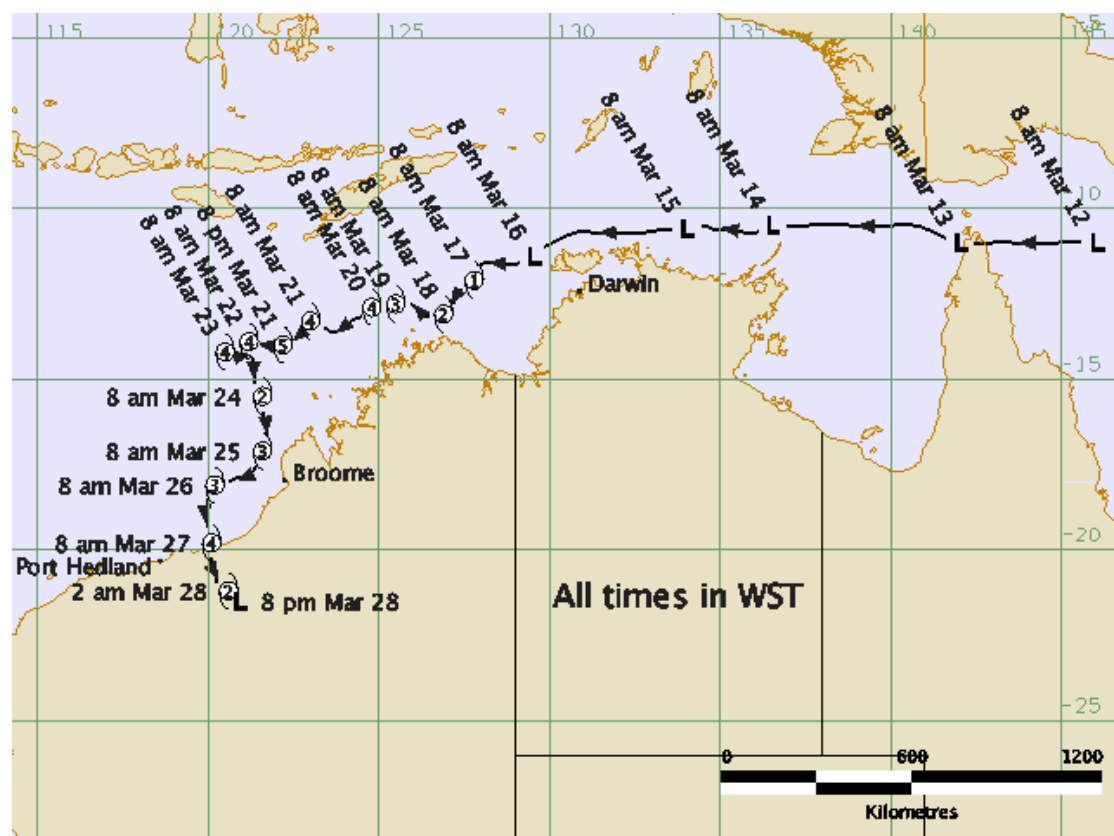
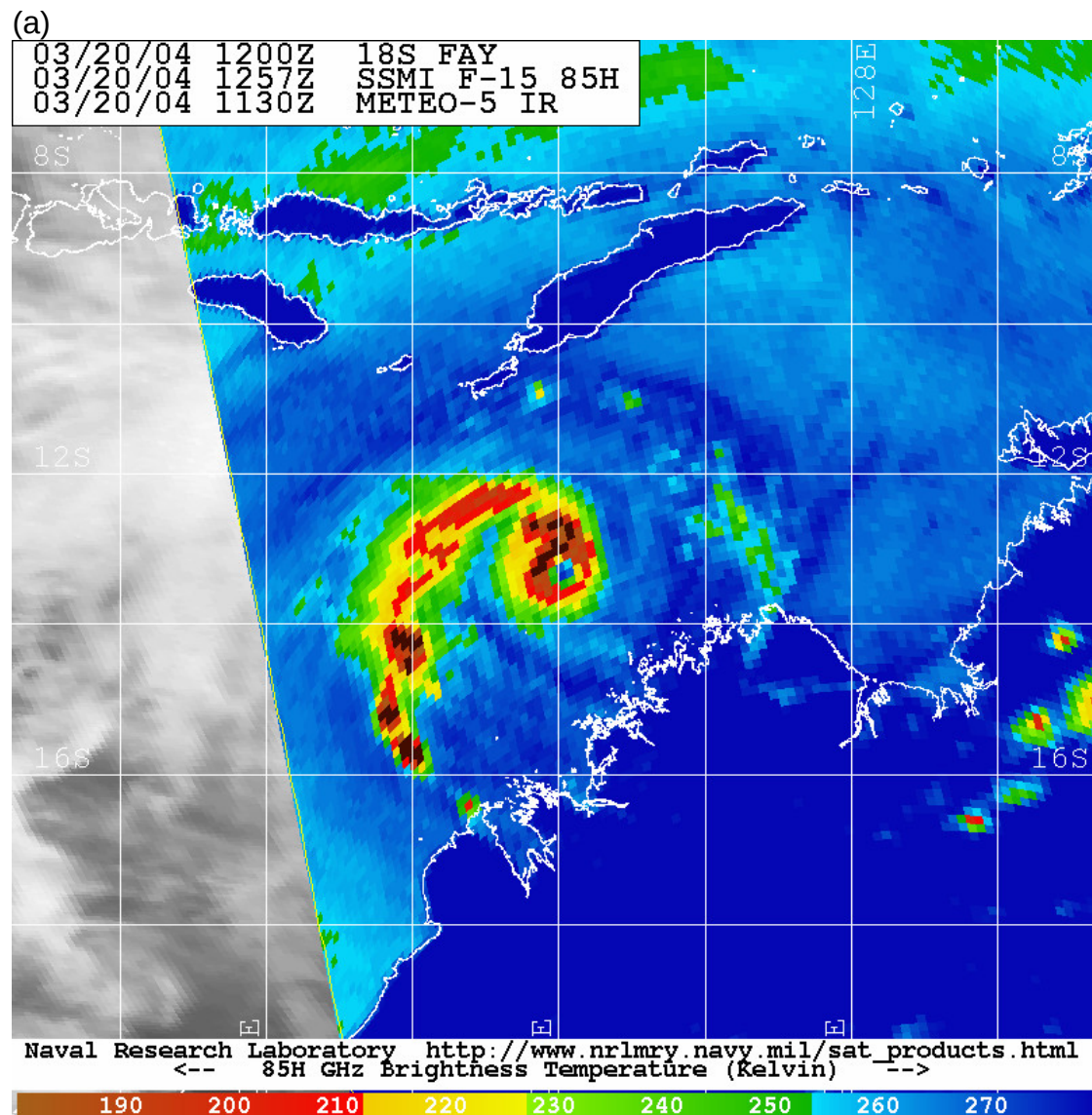


Figure 2.85GHz Microwave images of Tropical Cyclone *Fay* at near maximum intensity at (a) 1257 UTC 20 March (SSMI) and (b) 0539 UTC 21 March (AMSRE). (images courtesy of US NRL: <http://www.nrlmry.navy.mil/>)



(b)

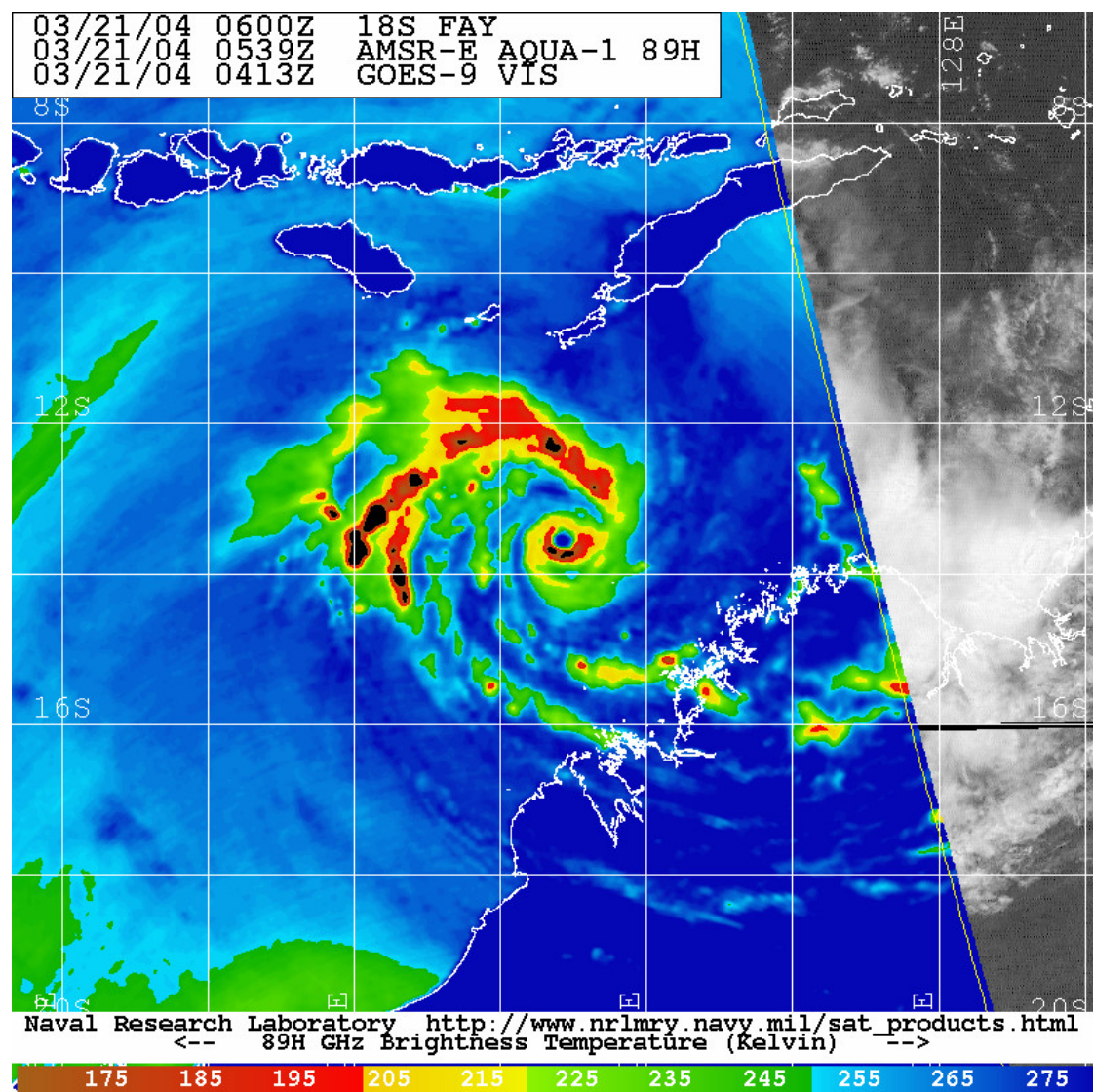


Figure 3. Visible image from the Aqua satellite: (a) 0540UTC 21 March and (b) 0555 UTC 26 March(received by Bureau of Meteorology courtesy of NASA).

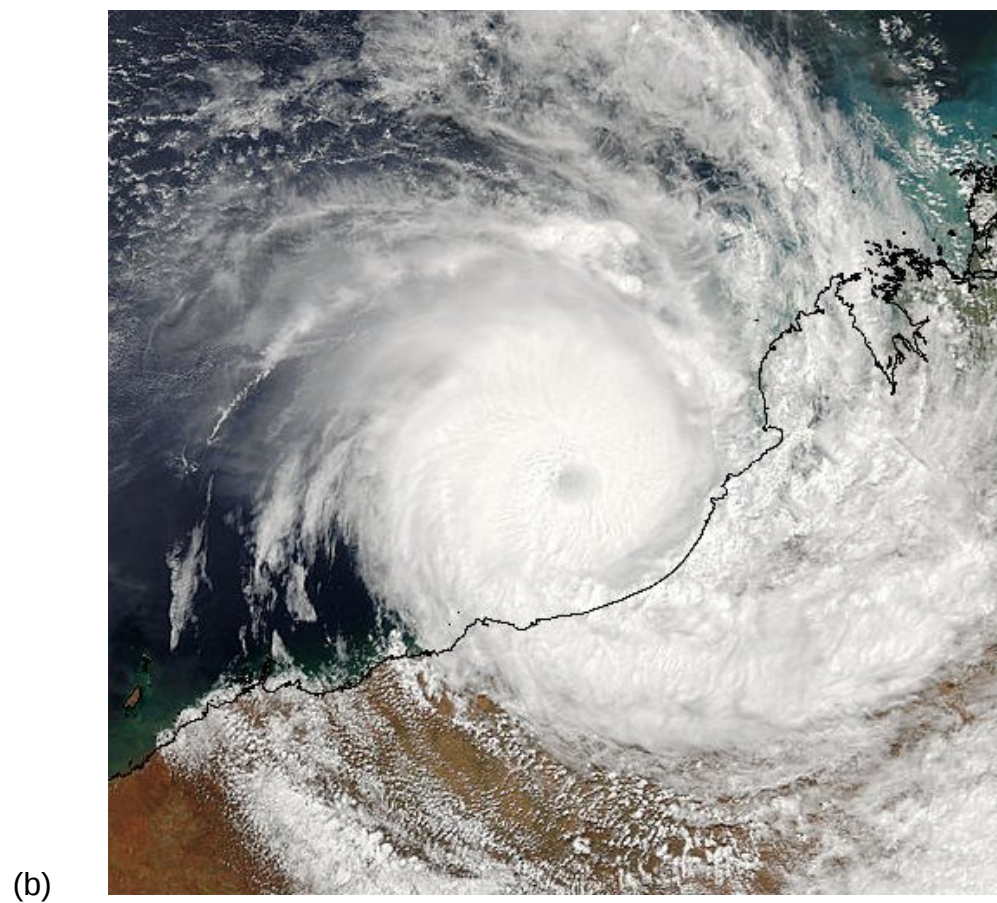
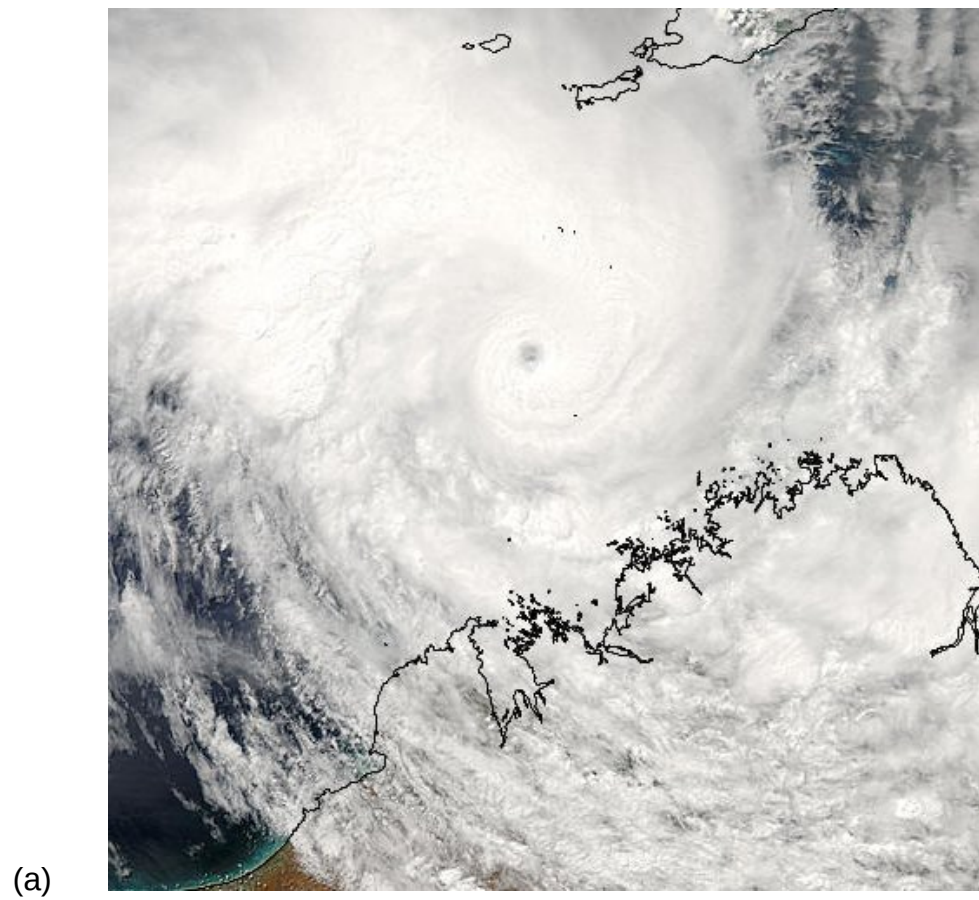


Figure 4. GOES Water vapour image for 1013 UTC 23 March (image courtesy of US NRL: <http://www.nrlmry.navy.mil/>).

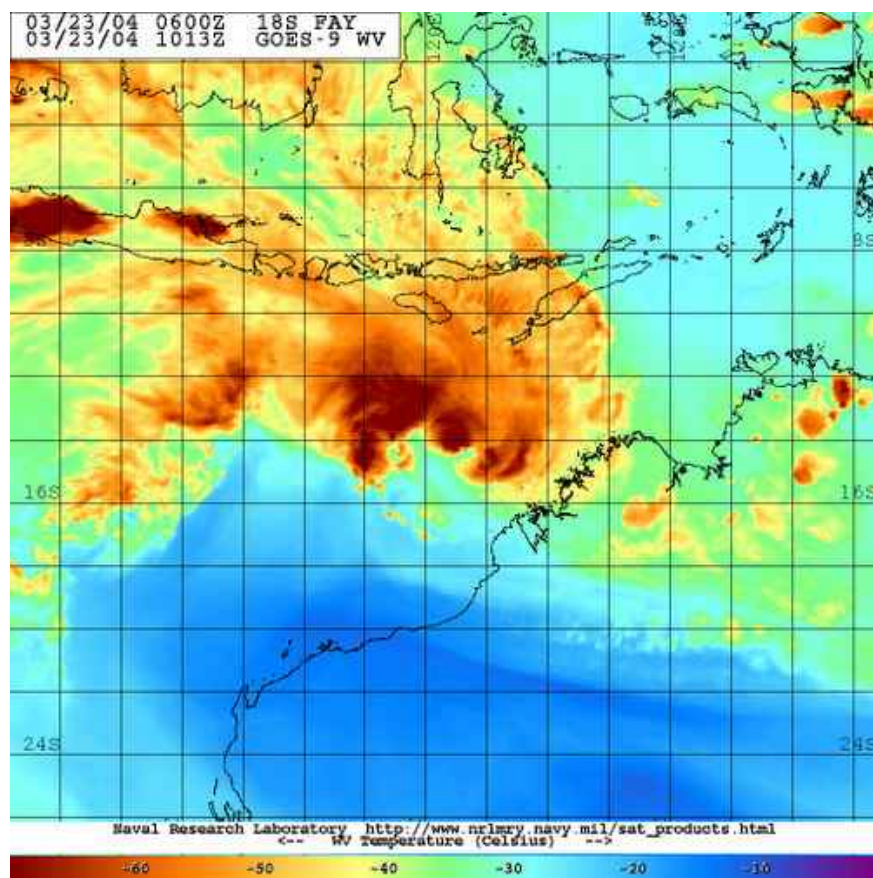
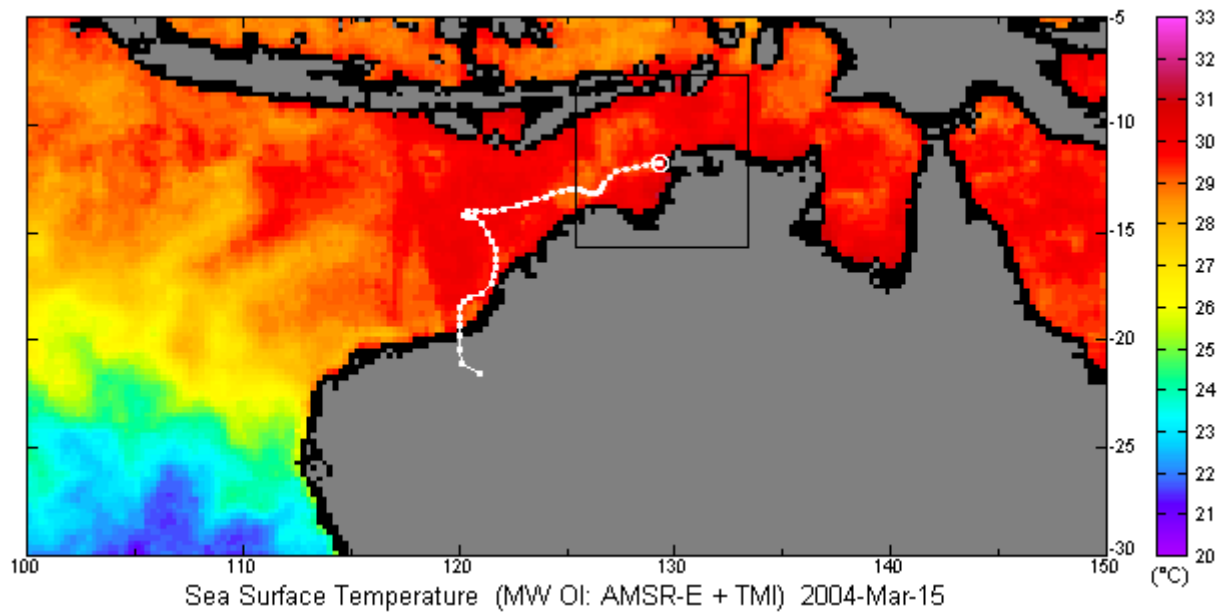


Figure 5. Sea Surface Temperature analysis on (a) 15 March and (b) 27 March. Images courtesy of RSS (www.rss.com).

(a)



(b)

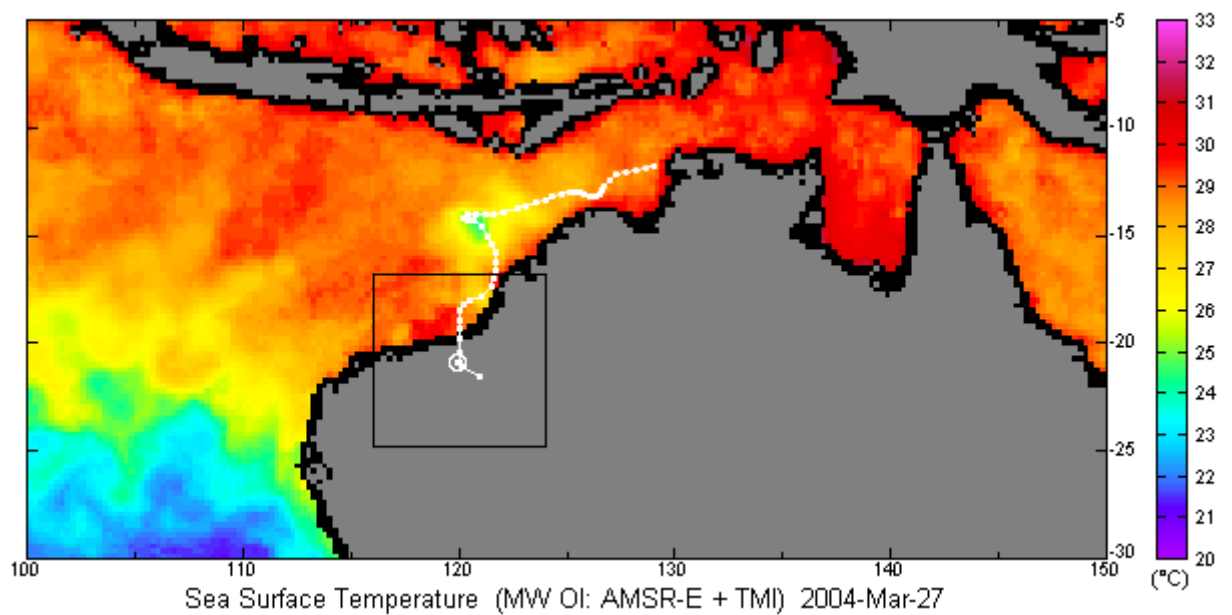


Figure 6. Radar images at (a) Broome at 0540 UTC 25 March and (b) Port Hedland at 0040 UTC 27 March.

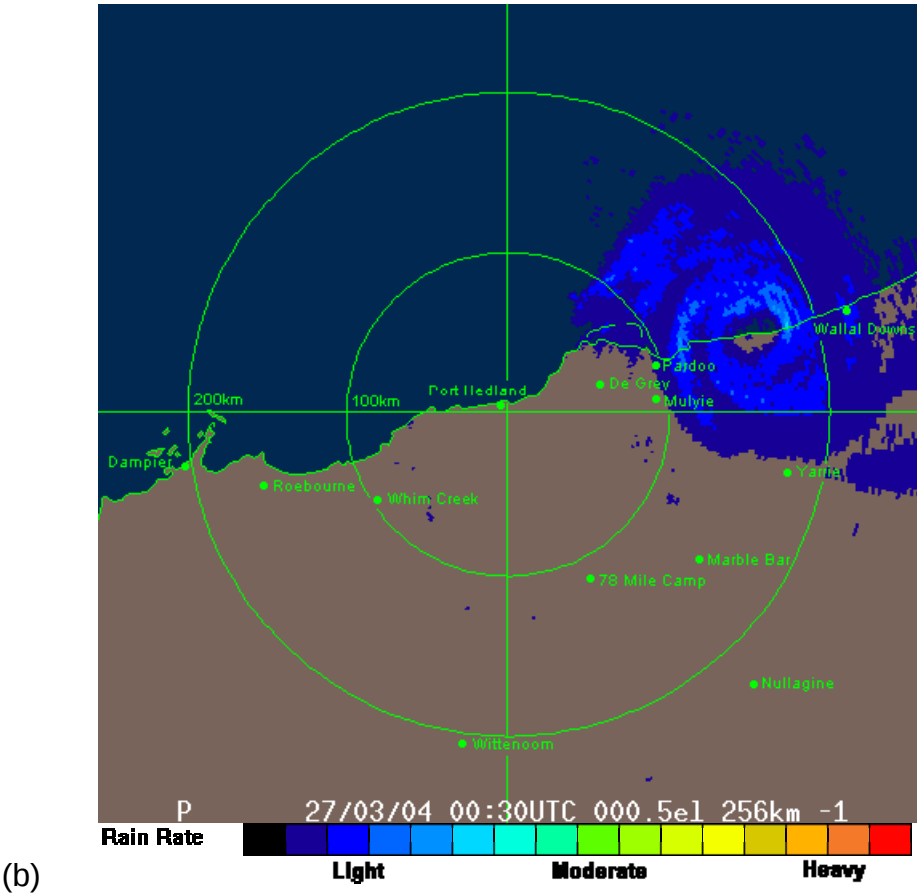
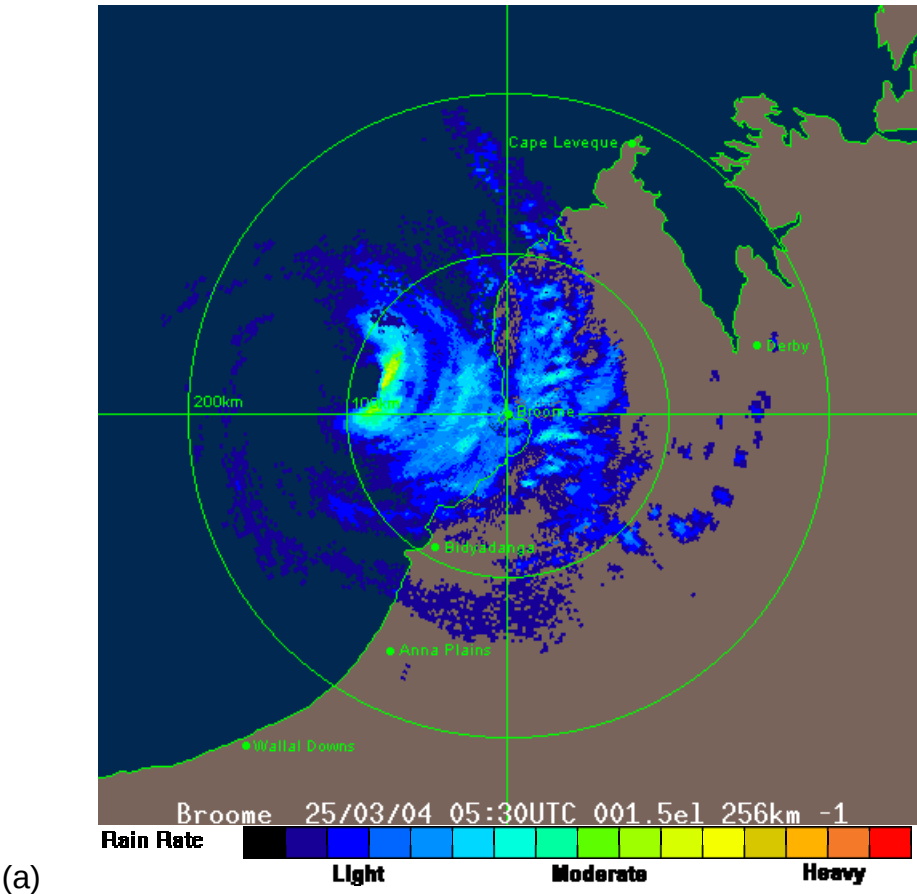


Figure 7. Photo of damaged coral at Scott Reef. Photo courtesy of Australian Institute of Marine Science (AIMS).



Figure 8. Rainfall distribution for March 2004, showing the high rainfall totals associated with TC Fay.

