

Tropical Cyclone Alby 27/03/1978 to 04/04/1978

(i) General

"Alby" was the fifth tropical cyclone of the season to operate in the Northwestern Australian Region. It was also the most noteworthy. "Alby" reached maturity on 2 April 1978 with an estimated central pressure of 930 mb and was one of the more severe storms to operate off the coast of Western Australia.

During Tuesday 4 April "Alby" accelerated towards the lower west coast as it slowly degenerated into an extra-tropical depression. As it passed to the southwest of the continent it caused strong to storm force winds over a large area of the southwest of Western Australia. A wind gust observed at the Perth Regional Office was the highest on record for the month of April. The highest wind gust recorded throughout the lifetime of "Alby" was 150 km/h at Albany.

Five people died as a result of the destructive effects of "Alby". Widespread damage caused by wind, dust, fire and the sea was estimated to cost the community about \$50,000,000. In terms of damage it is estimated that "Alby" was the most devastating storm on record to affect the southwestern areas of Western Australia.

(ii) Development

The development of "Alby" was monitored chiefly by using satellite imagery. Few ship reports were received from the area in which the system deepened. The first confirmation that the system had deepened to tropical cyclone intensity was from the ship "Martha Bakke" located about 385 km westnorthwest of the centre at 300000 GMT. That gale force winds extended so far from the centre indicated that the development of "Alby" was already well under way, thereby confirming the satellite evidence. The central pressure was estimated to be 990 mb at 300000 GMT.

"Alby" continued deepening until 2 April when, as estimated from the satellite imagery, it reached a central pressure of 930 mb. On that day "Alby" re-curved towards the southsoutheast. By 040100 GMT "Alby" was located about 635 km westnorthwest of Perth. The central pressure of the storm was then estimated to be about 960 mb. Pressures over the southwestern corner of Western Australia were about 1005 mb having fallen about 10 mb during the preceding 24 hours.

The thermal characteristics associated with "Alby" changed as the tropical cyclone moved to the southsoutheast. Satellite imagery and surface observations indicated that the belt of strongest winds moved away from the centre spreading the energy of the storm over a much larger area. This type of behaviour is typical of a system becoming extra-tropical.

Although the cyclone was weakening as it moved rapidly towards the southsoutheast it was still a severe storm and the strong to gale force winds circulating about it caused widespread damage over the southwest of the State. The former tropical cyclone approached to within 100 km of Cape Leeuwin and at 041300 GMT the mean sea level pressure there was 980.9 mb. The lowest station level pressure observed at Cape Leeuwin occurred at 041315 GMT when it reached a minimum of 972.5 mb. This corresponds to a

mean sea level pressure of approximately 977 mb. This was the lowest recorded pressure associated with "Alby".

During 4 April and the early hours of 5 April "Alby" was caught up in the strong northwesterly flow ahead of a southern depression and cold front and rapidly lost its identity during the early hours of 5 April as it neared this system.

(iii) Features of the Track

The track followed by "Alby" is shown in Figure 5.1. "Alby" existed for nine days and during that time travelled about 4100 km. The track of "Alby" displays many of the features common to tropical cyclones operating in the Region during March and April. Although "Alby" moved further west than is normal it recurved towards the southsoutheast at about the climatologically expected latitude of 20°S. The rapid acceleration of "Alby" as it moved into higher latitudes is a feature of some late season tropical cyclones.

On the morning of 27 March a closed system could be identified well off the northwest coast some 800 km northnorthwest of Karratha. As is typical of most tropical cyclones that form in this area, it drifted very slowly southwest and later southsouthwest until 30 March at speeds ranging between 7 and 9 km/h. On the morning of 30 March "Alby" was located about 500 km northnorthwest of Exmouth. Between 30 March and 1 April the cyclone veered towards the westsouthwest and its speed ranged between 8 and 10 km/h.

On the morning of 2 April when the centre was approximately 790 km west of Exmouth it slowed to about 8 km/h and recurved to the southsoutheast. For the rest of that day the movement continued to be slow but on 3 April the cyclone began to accelerate averaging about 25 km/h during the day and evening of 3 April. During the night of 3 April and the early morning of 4 April its speed increased to 50 km/h so that by 040100 GMT "Alby" was located about 580 km westsouthwest of Perth. During the rest of the morning and early afternoon of 4 April the speed gradually increased to over 60 km/h. At 040700 GMT the centre was approximately 390 km west of Mandurah. By late in the afternoon it had accelerated to 90 km/h and it reached the Cape Leeuwin area during the evening. It then changed direction slightly to the eastsoutheast while maintaining a speed of about 90 km/h. The closest the centre approached the coast was at about 041300 GMT when it was located about 100 km south of Cape Leeuwin. Early on 5 April it was moving east- southeast at about 90 km/h and later in the day dissipated over cold waters south of latitude 40°S.

(iv) Rainfall

The rainfall produced by tropical cyclone "Alby" over the southwest of the State was of only minor consequence. Light to moderate falls occurred in the Central West Coastal and Northern Agricultural districts and scattered light falls were reported from the Lower Southwest and western parts of the Central Agricultural district.

A cold front which entered the lower southwest during the night of 4 April also produced light to moderate rainfall primarily over the lower southwest. Total falls for the period were mostly less than 20 mm.

(v) Winds

"Alby" was the most intense cyclone of the season. During 2 and 3 April winds generated by the storm reached an estimated peak of 200 km/h. During 30 March, 1 April and on 4 April winds were estimated to have exceeded 120 km/h.

No ships were close enough to the centre to experience the strongest winds but many ships on the periphery of the storm were battered by gale to storm force winds. A selection of observations from ships affected by "Alby" is given in Table 5.1.

As "Alby" accelerated towards the southsoutheast on 4 April it caused strong to storm force winds over a large area of the southwest of Western Australia. Winds at Geraldton began to freshen after about 032230 GMT and they reached a maximum between 040500 and 040700 GMT. Maximum wind speed data for various locations is given in Table 5.2.

Near Perth wind speeds slowly increased after about 040100 GMT. At inland stations on the coastal plain winds were at their highest between 040830 and 041030 GMT, but on the coast at Fremantle and Kwinana the strongest winds occurred between 040700 and 041030 GMT.

At Bunbury winds increased from 040500 GMT onwards and were strongest during the period 041000 to 041330 GMT. Some wind gusts noted at the Bunbury Power Station exceeded the 130 km/h maximum scaled reading of the anemometer.

Albany experienced a rapid increase in wind speed at about 040920. Mean wind speeds of about 90 km/h were maintained from 041300 until 041640 GMT. At 041510 GMT a gust of 150 km/h was recorded at Albany. This was the highest wind gust recorded throughout the lifetime of "Alby". After 041640 GMT a rapid moderation of the wind occurred at Albany.

From the measured and estimated wind speeds available mean wind speeds exceeding gale force (63 km/h) seem to have been confined westward of a line joining Kalbarri and Ravensthorpe. This line is almost parallel to the track of "Alby" at a distance of about 450 km.

Strong winds were instrumental in the deaths of three people. A woman was killed by a falling pine tree while helping to fight a bushfire at Tone River near Mt Barker. A man was killed near Manjimup by a tree which fell onto the cabin of the bulldozer he was operating during the bushfires. Another man fell to his death from the roof of a hayshed at Toodyay. He was trying to fix the roof when the wind caught a sheet of metal roofing and dislodged him.

Widespread damage caused directly or indirectly by the strong winds was reported from the Southwest division. About 80% of the apple crop in the Donnybrook-Manjimup area was blown to the ground. Forestry plantations at Kirup, Nannup, Harvey and Collie were badly damaged by the strong winds. Some 154,400 m³ of timber was lost. Of more importance in the longer term was the loss of future growth to established trees which was estimated at over 200,000 m³ by 1995. Hundreds of trees in the National Forests were also blown over. Vegetable crops in the metropolitan area and in the southwest were severely damaged.

Dust was lifted by the strong winds over a large area extending from Kalbarri in the north to Wiluna in the east and southward to the south coast. In the agricultural districts a large amount of topsoil with its nutrients and seeds was lost.

Power lines of the State Energy Commission became caked with dust and salt spray, poles were blown down and power lines were cut by falling trees and branches. These conditions caused an almost complete breakdown of electricity services in the metropolitan area and over the southwest of the State. Secondary damage was caused by the power failure: communications were badly disrupted, dairy farmers were unable to milk their herds, and factories in the metropolitan area lost an estimated \$3,000,000 of production.

At Bunbury thousands of tonnes of woodchips were ruined by contamination from mineral sands whipped up by the strong winds and deposited on the stockpile at the woodchip terminal.

The high winds caused damage to houses and other buildings over a wide area from approximately Geraldton southwards to Albany. The most common form of damage was the partial or complete loss of roof cladding. Insurance companies reported that they had several hundred claims of this type. The town that appeared to suffer the worst damage in this respect was Albany where it was reported that scores of houses and buildings were unroofed. Structures in Albany also suffered a great deal of damage from flying debris.

The winds fanned fires which were part of the normal burning operations in the agricultural and forest areas. Many such fires burned out of control causing widespread damage. According to the Bushfires Board there were over 360 fires through 43 Shires southwest of a line from Eneabba in the north to Lake Grace in the east. The area burnt was estimated at over 110,000 ha. In the forest areas 6852 ha of State Forest were burnt as were 338 ha of forestry plantations and 830 ha of privately owned plantations.

Also destroyed in the fires were over 100 farm sheds and buildings and a similar number of farm vehicles and machines. Over 1300 km of fencing and tens of thousands of bales of hay were burnt. Stock losses exceeded 10,000 sheep and 500 cattle and horses. Damage to railway property was estimated at \$1,000,000. This included damage to 500 wagons, 8 diesel locomotives, bridges and communication and signalling circuits.

(vi) Seas, Swell, Storm Surge and Related Damage

At no time during its mature stage were ships within 330 km of the centre of "Alby" yet many reports of very high seas and heavy swells were received. A selection of these ship reports is given in Table 5.1. Ten m seas were reported by the ship "Cape Sable" at 040600 GMT when it was 210 km to the eastnortheast of "Alby". At the same time the ship was experiencing a 6 m swell. Between 021200 and 022100 GMT the ship "British Centaur" reported 10 m swells when it was some 340 km northwest of the centre.

West coastal areas south of Carnarvon were affected by sea action as the weakening cyclone moved southsoutheastwards. Two men were drowned in Albany Harbour when their dinghy capsized. The seas also caused severe erosion to beaches, undermined coastal roads and severely damaged groynes, jetties and hundreds of small boats. At Busselton four large sections of the 1.8 m jetty were washed away.

As the remnants of "Alby" moved past the southwest of the State abnormal tidal fluctuations were produced along the coast from Geraldton to Esperance, however significant storm surges were probably confined to the area between Lancelin and Cape Naturaliste.

The tendency in this region for the small actual tide to differ from the predicted tide means that the storm surge cannot simply be assumed to be that part of the tide in excess of the predicted tide. At all tide gauges in the area the observed tidal levels exceeded the predicted levels in the three days before the evening of 4 April by heights ranging from 0.3 to 0.6 m. By 6 April the predicted and observed levels at all stations were in approximate agreement.

At Sunbury the tide height expected at the time of the maximum surge, based on the tides of the previous days, would have been about 1.2 m but the actual tide reached almost 2.5 m above chart datum. The storm surge of 1.3 m was thus some 1.2 m above the highest astronomical tide predicted.

At Busselton the tide reached almost 2.6 m above chart datum, that is about 1.1 m above the high tide level that would have been expected from the tides of the previous days.

At Fremantle the tide reached 1.8 m above chart datum, that is 0.4 m above the highest astronomical tide.

Following the storm surge, oscillations in the water level having a period of about 4 hours occurred at Bunbury and Busselton for at least 36 hours. Similar oscillations with a smaller amplitude and a period of one or two hours were recorded at Albany and Esperance.

The surge caused some of the lower lying areas of the coast between Rockingham and Dunsborough to be inundated with sea water.

At Palm Beach the sea washed across the front lawns of houses along the coastal road after it had been partially eroded.

At Bunbury the sea breached the retaining wall along Leschenault Inlet and flooded 100 homes in the nearby residential area. 130 people were forced to evacuate their homes. Ocean Drive, the main coastal road at Sunbury, was badly eroded and closed to traffic. Westrail rolling stock in the railway complex at Bunbury was damaged by the salt water.

Many people at Busselton evacuated their homes when sea water moved inland some 200m.

(vii) Satellite Analysis

Satellite imagery played a very important part in determining the location and intensity of tropical cyclone "Alby". Observations from two satellites were available throughout the lifetime of "Alby". The American satellite NOAA 4 gave infra-red pictures twice daily and the Japanese satellite GMS 1 gave approximately three hourly low resolution pictures either in the visible or in the infra-red spectra as well as high resolution pictures in the infra-red at approximately three hourly intervals. The Dvorak (1975) technique was used for the analysis and forecasting of the tropical cyclone intensity from the satellite imagery. Selected data from this analysis is shown in Table 5.3.

On 27 March satellite photographs showed a large amorphous convective cloud cluster covering the genesis area. By 28 March a marked change had occurred as the system had become more organised with convective cloud bands curving into a common centre, The system was judged to be T 1.5 with ongoing development predicted.

During the following days the system steadily developed. On 30 March satellite imagery showed that the cloud bands emanating from the lower latitudes were tightly coiled around a large ragged eye. The system was then estimated to be T 3.5. On 1 April the eye although still ragged had become smaller and more deeply embedded. The main feeder band was coiled tightly around the central features.

"Alby" reached maturity on the morning of 2 April. A ragged eye was still visible but the CDO had increased in width during the previous 24 hours and the main feeder band coiled twice about the central features. The system was estimated to be T 6.5 in Dvorak's classification.

The first signs of weakening occurred on 3 April as the eye had become longer and oval shaped, the CDO was fractured and strong upper level outflow to the southeast was apparent.

Satellite photographs on 4 April show that the upper level clouds were oriented strongly to the southeast and that the convective cloud near the centre had decreased markedly. At this time the system was classified as T 4.5.

On the morning of 5 April as the remnants of the cyclone merged with a cold front a thin cloud of what was believed to be dust stretched ahead of the front from near Kalgoorlie to south of 46°S.

Table 5.1

Selected Ship Reports

Ship	Position		Date/ Time (GMT)	Bearing/ Distance from Centre (km)	Wind Direction/ Speed (km/h)	Sea (m)	Swell(m)	Pressure (mb)
	°S	°E						
Martha Bakke	16.4	108.1	300000	WNW/385	SSW/ 65	-	-	1001
Koyomaru	20.3	114.8	300000	SE /440	ENE/ 78	4.5	ENE 5.5	1002.1
Martha Bakke	18.2	108.0	300600	W W/365	SSW/ 74	-	-	999.5
Koyomaru	19.4	115.7	300900	ESE/480	NNE/ 83	3.5	NNE 6	1002.5
Koyomaru	19.0	115.0	301200	ESE/420	NNE/ 78	-	-	1004.5
Turkmenia	16.7	107.8	310000	NW /340	SW / 82	-	SSE	1001.0
Martha Bakke	21.2	108.1	310000	SW /345	SSE/ 87	-	-	999
Martha Bakke	24.0	113.7	010000	SE /650	NE / 65	2.5	N 5	1009.3
British Centaur	22.2	101.9	020300	WSW/410	S/ 80	4	E 3	1007.2
British Centaur	21.9	102.0	020600	W/400	SSE/ 80	4	ESE 5	1004.1
Lisselotte Essberger	22.6	110.7	020600	ESE/530	NE / 69	2	N 3.5	1008.5
Lisselotte Essberger	21.4	110.0	021200	ENE/420	NE / 82	4.5	-	1006.0
British Centaur	20.7	102.8	021200	WNW/360	SSW/ 85	6	ESE 10	1003.0
British Centaur	20.4	103.4	021500	NW /340	S/ 85	4	SE 10	1003.3
British Centaur	20.4	104.0	021800	NW /340	WSW/ 74	4	S 10	1001.4
British Centaur	20.5	104.5	022100	NW /330	WSW/ 83	5	S 10	1000.1
British Centaur	21.8	107.2	030900	N/400	NW / 89	4.5	WSW6.5	1003.0
British Centaur	24.4	109.3	040000	N/610	WNW/ 70	4	WSW5.5	1007.1
Cape York	28.7	111.9	040000	ENE/260	NNW/ 83	2	NNW 5	995.9
Cape York	28.5	111.9	040300	NE /290	N/ 78	6.5	-	996.3
Nisshin Maru	32.9	110.7	040300	S/230	SE / 72	2.5	SE 5	990.7
Cape York	28.4	111.9	040600	N/390	NW / 81	5	NW 8	1000.4
9VUU	30.3	114.3	040600	ENE/330	NW /102	5	-	997.5
Cape Sable	31.1	113.5	040600	ENE/210	N/111	10	Confused 6	988.7
Nisshin Maru	32.8	110.0	040600	S/170	S/ 96	3	SE 5	986.6
Nisshin Maru	32.3	110.0	040900	W/280	SW / 70	4	SSE 7	997.3
Nisshin Maru	30.3	114.4	040800	NE /330	NW /106	5	-	997.5

Table 5.2 Wind Speed Data from Sites with Recording Anemometers (except at Bunbury where the Dial Output was observed)

Station	Anemometer Elevation (m)	Maximum gust speed (km/h) and direction	Maximum 10 minute mean wind speed (km/h) and direction	Maximum hourly mean wind speed (km/h) and direction
Geraldton Met. Office	10	110 NW	74 NW	70 NW
Pearce Met. Office	10	113 NNW	80 NNW	63 NNW
Perth Regional Office	39	122 NNW	70 NNW	65 NNW
Perth Airport Met. Office	10	98 NNW	65 NNW	56 NNW
Jandakot Airport	10	119 NNW	70 NNW	65 NNW
Fremantle Port Authority	60	143 NNW	102 NNW	96 NNW
Australian Iron Steel, Kwinana	10	136 NNW	85 NNW	80 NNW
Naval Base Kwinana (Mt Medina)	8	-	-	65 NNW
Wellard	10	-	-	63 NNW
Point Peron	10	-	-	61 NNE
Garden Island (northern end)	9	-	-	75 NNE
Bunbury (SEC Power Station)	9	-	-	58 NNW
Bunbury (SEC Power Station)	8	>130 NNW	-	-
Albany Met. Office	10	150 NNW	96 NNW	91 NW

Table 5.3

Data from Satellite Photographs

Satellite Name	Orbit Number	Date/Time (GMT)	Estimated posn. of Centre °S°E		Final T No.	Min. Sea Level Pressure (mb)
GMS	-	270000	13.7	115.0	-	1006
NOAA 4	15380	280024	14.6	113.7	1.5	1002
	15393	290119	15.8	112.2	2.5	997
	15405	300019	17.6	111.6	3.5	990
	15418	310118	18.8	110.1	4.5	970
	15430	010015	19,9	108.3	5.5	950
	15443	020123	21.4	105.7	6.5	930
	15455	030010	23.7	106,3	5.5	940
	15468	040105	29.9	109.6	4.5	960