Tropical Cyclone Annie 21/11/1973 to 08/12/1973

(i) General

"Annie" was the second cyclone of the season to operate in the Northwestern Australian Region. This system spent its entire life over the tropical waters of the central Indian Ocean although it passed within 30 km of Cocos Island on 25 November. "Ines" had dissipated over the Kimberley before "Lnnie" attained tropical cyclone characteristics. Tropical cyclone "Beryl" developed and moved inland over the Pilbara and Gascoyne while "Annie" was operating farther west.

Cyclone "Annie" was an identifiable circulation for 17 days and for 10 of these, 25 November to 5 December, it possessed tropical cyclone characteristics. At no time however was the cyclone of more than moderate intensity.

The maximum 10 minute mean wind reported was 89 km/h with gusts to 145 km/h at Cocos Island at 250140 GMT.

(ii) Development

Immediately prior to the development of cyclone "Annie" the Intertropic Convergence Zone (ITCZ) over the eastern Indian Ocean was readily apparent on satellite photographs. It was oriented zonally along about 9°S between 80°E and Java. Farther east the ITCZ dipped southwards over the Kimberley and Northern Territory where "Ines" was a degenerating system.

An eastward moving aloud mass on the southern side of the ITCZ was evident from 21 November. This suspicious area gradually became more organised over the next few days. Synoptic evidence for the development of the system was provided by the strengthening of the surface winds at Cocos Island. On 25 November the first tropical cyclone warning was issued. Later that day winds at Cocos Island reached 90 km/h. Over the next few days the cyclone maintained its intensity but then began to strengthen again and reached its maximum development on 30 November. Thereafter it degenerated only slowly. By 5 December its tropical cyclone characteristics had disappeared although a cyclonic organisation of the remnants was still visible on 8 December. Fluctuations in "Annie's" intensity could be related to the presence to the east of cyclone "Beryl" resulting in interactions between their respective regimes.

"Annie" was a tropical cyclone for ten days yet at no time did it exceed moderate intensity.

The first anticyclonically curved isobar outside the system at maturity was 1010 mb.

(iii) Features of the Track (Fig. 2.1)

Tropical cyclone "Annie" operated in the Northwestern Australian Region for 17 days during which time it travelled about 4100 km.
A notable feature of its track was the early movement to the southeast and then to the east. During its period of maximum development the cyclone was slow moving, and its track consisted of a loop which changed its direction to the west.

While "Arnie" was operating the general synoptic pattern south of the cyclone was of a complex nature. For the first week the pattern was dominated by a moderate high pressure cell in the Great Australian Bight with the low pressure system formerly "Ines" over the northern regions of Australia. South of the cyclone itself the subtropical ridge was quite weak and allowed cold fronts to penetrate northward at about longitude 105°E. After 30 November a new major subtropical high became centred about that same longitude and persisted there until "Annie" had weakened completely.

(iv) Rainfall

The only recording station whose weather was influenced by "Annie" was Cocos Island. In the 24 hours ending at 0001 GMT on the days when "Annie" was nearby the station reported the following amounts: 25 November 7.4 mm, 26 November 23.4 mm, 27 November 26.2 mm, 28 November 9.9 mm.

(v) Winds

No reports of winds near the cyclone centre were received during its most intense period. It is estimated using the Dvorak technique for cloud photograph interpretation that sustained winds would probably have exceeded 110 km/h at that time.

A series of observations from Cocos Island provide a record of winds associated with the cyclone during its developmental period (Table 2.1). For 15 hours between 250001 and 251500 GMT, winds exceeded gale force. The maximum gust recorded was 145 km/h at about 250140 GMT. Some of the winds reported are stronger than those expected using the Dvorak technique. The explanation may be related to the rapid intensification of the cyclone occurring at the time.

No damage relating to these gale force winds was reported.

A small number of ship reports were received during the cyclone's existence but as they were mostly on the periphery of the cyclone's influence no gale forge winds were experienced.

Table 2.1 Winds Recorded at Cocos Island

Date/Time (GMT)	Direction (degrees)	Speed (km/h)	Max. Gust (km/h)
250001	330	65	92
250300	310	80	122
250600	290	78	110
250900	290	80	107
251200	280	74	104
251500	280	65	89
251800	280	61	91
252100	280	57	80

(vi) Seas and Swell

Both Cocos Island and Christmas Island mentioned ocean conditions in their regular synoptic reports. When "Annie" was close to Cocos Island on 25 November the sea was reported as "very rough" or "very high" and the swell "confused".

Seas reported by ships did not exceed "moderate" on any occasion but the southeasterly swell to the south of the cyclone and within 800 km of its centre was reported as 4 m or 4.5 m on several occasions between 26 November and 2 December.

(vii) Satellite Photograph Analysis

Cloud photographs from the satellites ESSA 8 and NOAA 2 were received regularly while tropical cyclone "Annie" operated.

Analysis of these photographs shows that the cyclone underwent at least two fluctuations in intensity during its lifetime. The first interrupted its regular development, and was shown by a temporary weakening of the system in the ESSA 8 photographs 260330 GMT and 270226 GMT. After deepening to a T-number 4 in Dvorak's classification on 30 November the cyclone appeared to be about to interact with an extensive stratocumulus field. Ongoing weakening was therefore anticipated.

The second fluctuation in the cyclone's intensity occurred during its weakening when a relative intensity increase was apparent in the ESSA 8 photographs of 030304 GMT and 040240 GMT. Subsequently the degeneration of the cyclone occurred at about the typical rate until 8 November when the system was no longer a closed circulation.

A summery of the satellite photograph analysis is given in Table 2.2

Table 2.2 Data from Satellite Photographs

Satellite Name	Orbit Number	Date/Time (GMT)	Estimated posn. of centre		Final T No.	Min Sea Level Pressure (mb)
ESSA 8	22615	210257	9.0	91.0	1	-
	22628	220355	11.0	92.3	1	-
	22640	230245	11.1	94.1	1.5	-
	22653	240337	11.3	95.6	2	1003
	22665	250238	12.7	97.6	3	994
	22678	260330	12.8	97.2	3	994
	22690	270226	12.0	99.0	2.5	994
	22703	280317	11.5	101.4	3	994
	22714	290214	14.0	102.0	3.5	988
	22728	300447	15.2	102.5	4	981
	22740	010201	15.1	104.0	3.5	988
	22753	20246	15.1	102.8	3	994
	22766	030343	15.8	100.0	3	994
	22778	040240	16.3	97.2	3	994
	22791	050331	16.0	90.5	2	1003
	22804	060422	17.0	86.5	1.5	1005
	22816	070318	17.5	86.3	1	-
	22829	080410	19.1	84.8	0.5	-