The South Pacific and southeast Indian Ocean tropical cyclone season 1994-95

I. J. Shepherd
Severe Weather Section, Regional Office, Bureau of Meteorology, Darwin
and
P. W. Bate
Climate and Consultancy Section, Regional Office, Bureau of Meteorology, Darwin

(Manuscript received March 1997)

Eight tropical cyclones formed in the South Pacific and southeast Indian Ocean during the 1994-95 season, well below the long-term averages for the two basins. The 1994-95 summer monsoon was generally less well developed than normal as El Niño conditions peaked during early summer then dissipated during 1995. Above average sea-surface temperatures across most of the tropical Pacific contributed to above average tropical convection east of the date-line early in the season. The distribution of cyclone genesis was linked with active phases of the intraseasonal oscillation in most cases. Six of the season's cyclones formed in Australian longitudes (115°E-160°E) and two in the South Pacific, one well east of the date-line.

Introduction

This paper presents a summary of tropical cyclone activity in the South Pacific and southeast Indian Ocean basins during the 1994-95 season. The summary is compiled from material provided by the Fiji Meteorological Service at Nadi and the Australian Bureau of Meteorology's Tropical Cyclone Warning Centres (TCWCs) at Perth and Brisbane.

The cyclone season extended from 14 November to 21 April, during which time eight cyclones were named between 80°E and 120°W (see Table 1). Of these, six reached hurricane intensity. There were 32 days during the season on which a cyclone was present and 12 days during which a cyclone had hurricane-force winds. The three most intense cyclones, *Annette*, *Bobby* and *Chloe*, each with estimated peak mean winds in excess of 50 m/s, caused significant damage along parts of the Western Australian coast.

The 1994-95 summer monsoon was generally less well developed than normal and tropical cyclone activity was below long-term averages quoted by the Joint Typhoon Warning Centre (JTWC 1995)*, Guam. Six cyclones formed in Australian longitudes between 105°E

Corresponding author address: Mr I.J. Shepherd, Bureau of Meteorology, PO Box 735, Darwin, NT 0801, Australia.

* It should be noted that the 14-year mean figures given by JTWC may include small numbers of tropical depressions with maximum mean winds below 17 m/s. They are, moreover, full-year (July - June) means. Comparison with monthly figures for the entire south Indian and Pacific basins shows that about 91 per cent of cyclones occur in the months November to April.

Table 1. Tropical cyclones in the South Pacific and southeast Indian Oceans 1994-95.

	Low first identified			*Initial tropical cyclone phase*			
Name	*Date*	*Lat.*	*Long.*	*Date*	*Time (UTC)*	*Lat.*	*Long.*
Vania	12 Nov	11°S	171°E	14 Nov	0000	12.5°S	169.2°E
Annette	13 Dec	12°S	116°E	14 Dec	1800	12.5°S	115.6°E
William	30 Dec	12°S	163°W	1 Jan	2100	18.0°S	160.8°W
Bobby	19 Feb	11°S	134°E	21 Feb	1500	16.1°S	120.8°E
Violet	2 Mar	13°S	154°E	3 Mar	0600	16.0°S	152.5°E
Warren	4 Mar	13°S	140°E	4 Mar	1100	14.1°S	140.2°E
Chloe	3 Apr	9°S	128°E	5 Apr	0300	10.3°S	121.6°E
Agnes	16 Apr	11°S	146°E	17 Apr	0600	12.1°S	147.6°E

	Maximum intensity					*End tropical cyclone phase*			
Name	*Date*	*Time (UTC)*	*Lat.*	*Long.*	*Mean wind (m/s)*	*Date*	*Time (UTC)*	*Lat.*	*Long.*
Vania	15 Nov	1200	17.4°S	168.5°E	28	17 Nov	1800	19.1°S	166.2°E
Annette	18 Dec	0000	18.1°S	120.2°E	55	18 Dec	2100	22.7°S	122.6°E
William	3 Jan	0000	21.6°S	154.5°W	31	3 Jan	1200	25.0°S	149.0°W
Bobby	24 Feb	0900	21.3°S	115.6°E	55	27 Feb	0000	28.8°S	120.3°E
Violet	5 Mar	1200	22.2°S	158.1°E	42	6 Mar	1200	30.1°S	159.1°E
Warren	5 Mar	1800	16.8°S	138.8°E	40	6 Mar	0300	17.2°S	138.3°E
Chloe	7 Apr	0600	14.6°S	123.3°E	56	8 Apr	1500	17.3°S	123.8°E
Agnes	18 Apr	1200	13.1°S	147.8°E	47	22 Apr	0000	10.8°S	147.8°E

and 165°E (mean 9.9) and a further two in the South Pacific east of 165°E (mean 5.2), of which one formed well east of the date-line. Cyclone genesis this far east is unusual but tends to occur more frequently in El Niño years (Revell and Goulter 1986). The distribution of cyclone genesis in the 1994-95 season was linked with active phases of the intraseasonal oscillation in all except one case (i.e., *Vania* – the first cyclone of the season).

Large-scale circulation features

Averaged over the six months November 1994 to April 1995, mean low-level wind and wind anomaly analyses show that the monsoon trough was generally poorly defined from eastern Indian Ocean to western Australian longitudes, where it was located a little north of its mean latitude. Monsoon westerlies west of 130°E were below average strength and mean sea-level pressures (MSLP) were higher than average over most of the southern hemisphere tropics west of the date-line. The subtropical ridge was near its climatological location across the region but further north than normal over eastern Australia and the southwest Pacific.

The monsoon trough was well defined in the extreme western Pacific (southern hemisphere) and pressures were mostly a little lower than normal east of the date-line. Typical of El Niño, westerly anomalies affected much of the tropical Pacific, owing to generally below average easterly wind flow. These anomalies turned easterly during summer 1994-95 and the following autumn (in global three-month anomaly analyses; Beard (1995), de Hoedt (1995)), indicating a weakening of El Niño conditions. Northerly cross-equatorial wind-flow components were below average across longitudes west of 160°E, suggesting that the summer low-level monsoon circulation was less well developed than usual in the Australian region.

At upper levels, six-month averaged charts indicated an east to northeasterly anomaly pattern in the tropics east of Papua New Guinea, also typical of the El Niño phase. These were gradually replaced by westerly anomalies during summer 1994-95 and autumn 1995 (Beard 1995;

de Hoedt 1995) as El Niño conditions weakened. Weak upper-flow anomalies in the Australian and Indonesian region indicated near-average monsoon return flow.

Climatic indices

Moderate warm-phase El Niño/Southern Oscillation (ENSO) conditions dominated the region for much of the period from 1991 to 1994 (Bigg 1995). After weakening during the second half of 1993, El Niño conditions redeveloped during 1994, peaking in early summer, finally dissipating during 1995. The 1994-95 cyclone season was characterised by mostly negative values of the Southern Oscillation Index (SOI)* and the six-month mean SOI from November 1994 to April 1995 was -6.5. Values of the SOI from June 1993 to July 1995 are shown in Fig. 1.

Sea-surface temperatures across most of the tropical Pacific were above normal, averaged over the six months, with the warmest region straddling the equatorial date-line. The South Pacific, especially the southwestern sector, was generally cooler than average as was the subtropical southern Indian Ocean. Later in the season warm anomalies replaced cool in the southwest Pacific and warm anomalies decreased throughout the equatorial Pacific as a weak cool anomaly region appeared along the equator in the east.

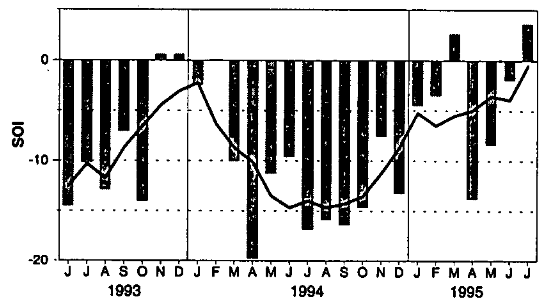
Intraseasonal modulation

Four major active phases of the 30 to 60-day intraseasonal oscillation occurred (inferred from time-longitude sections of 200 hPa velocity potential, outgoing longwave radiation anomaly and station pressure series), though higher frequency modes were also present. Major active phases occurred in early to mid December, mid to late January (with enhanced convective activity continuing through February), early March and early April. The first of these had less effect in the southern hemisphere than did the latter three.

Tropical convection was above normal from November to February over much of the tropical Indian Ocean and the equatorial Pacific near the date-line. In the latter region convection was strongest in December and January associated with the first two active phases. In contrast, convection was below normal between 90°E and 160°E early in the season, reflecting reduced activity associated with the monsoonal circulation. These relatively inactive conditions became confined to eastern parts of this region by January. Except for the first

* The SOI used here is defined as ten times the standard deviation normalised monthly difference in pressure anomaly between Tahiti and Darwin, based on the reference period 1876-1993.

Fig. 1 Monthly SOI values and 5-month centred running means for the period June 1993 to July 1995.



cyclone genesis (*Vania*), the geneses of all of the cyclones discussed below occurred during active phases of the intraseasonal oscillation.

Verification statistics

Position verification statistics for each cyclone were derived by comparing the official warnings issued by the relevant TCWCs with post-analysis best-track positions (Table 2). For comparison, verification statistics for persistence forecasts based on 12-hour best-track movement vectors were also calculated. A substantial improvement in average initial position error by 40 per cent (17 km) occurred since the 1993-94 season (Hanstrum et al. 1996), which contributed to significant improvements in average 12, 24 and 48-hour forecast position errors (up to 49 per cent, i.e. 43 km for the 24-hour forecast).

A factor in improved initial position errors was that the majority of the small number of cyclones in the 1994-95 season formed between 115°E and 160°E, well within the GMS-4 (Geostationary Meteorological Satellite) footprint, allowing good initial position fixes. The large initial position error for *William* was mainly due to poor satellite coverage and a lack of other data near the Cook Islands.

Largest forecast errors occurred with *Vania, William* and *Violet,* each of which displayed large changes in either direction or speed. Shearing of the high-level cloud mass away from the slowing and weakening low-level circulation also contributed to large forecast errors towards the end of *Vania's* lifetime. Despite the overall improvement in verification statistics compared with the previous season, significant improvements in skill over persistence forecasts at 24 hours* occurred only in forecasts for *William, Violet* and *Annette.*

* A twelve-hour persistence forecast is not strictly a 'no-skill' forecast as it is based on the post-analysed best track which has no initial position error. This forecast is information not available to forecasters in real time.

Table 2. Position forecast verification statistics for official warnings issued by relevant TCWCs: Nadi (N), Brisbane (B), Darwin (D), Perth (P). Forecast positions verified against official best-track data. Square brackets denote best-track 12-hour persistence forecasts.

Forecast lead time	*0 h*		*12 h*		*24 h*		*48 h*	
Name	*error (km)*	*number*	*error (km)*	*number*	*error (km)*	*number*	*error (km)*	*number*
Vania (N)	17	22	107 [100]	16	248 [253]	14		
Annette (P)	21	18	76 [75]	14	165 [224]	12		
William (N)	56	11	197 [211]	6	354 [565]	3		
Bobby (P)	35	19	83 [91]	16	151 [150]	13	317 [525]	6
Violet (B)	30	17	129 [130]	10	278 [473]	10		
Warren (B,D)	20	7	98 [50]	5	172	4		
Chloe (P)	28	14	69 [49]	8	119 [103]	6		
Agnes (B)	16	21	62 [60]	19	119 [111]	17		
Total		129		94		79		6
Weighted mean	26		94		186		317.	

Tropical cyclones in the South Pacific and southeast Indian Oceans 1994-95

Vania (Nadi TCWC): 14 November to 17 November (Fig. 2)

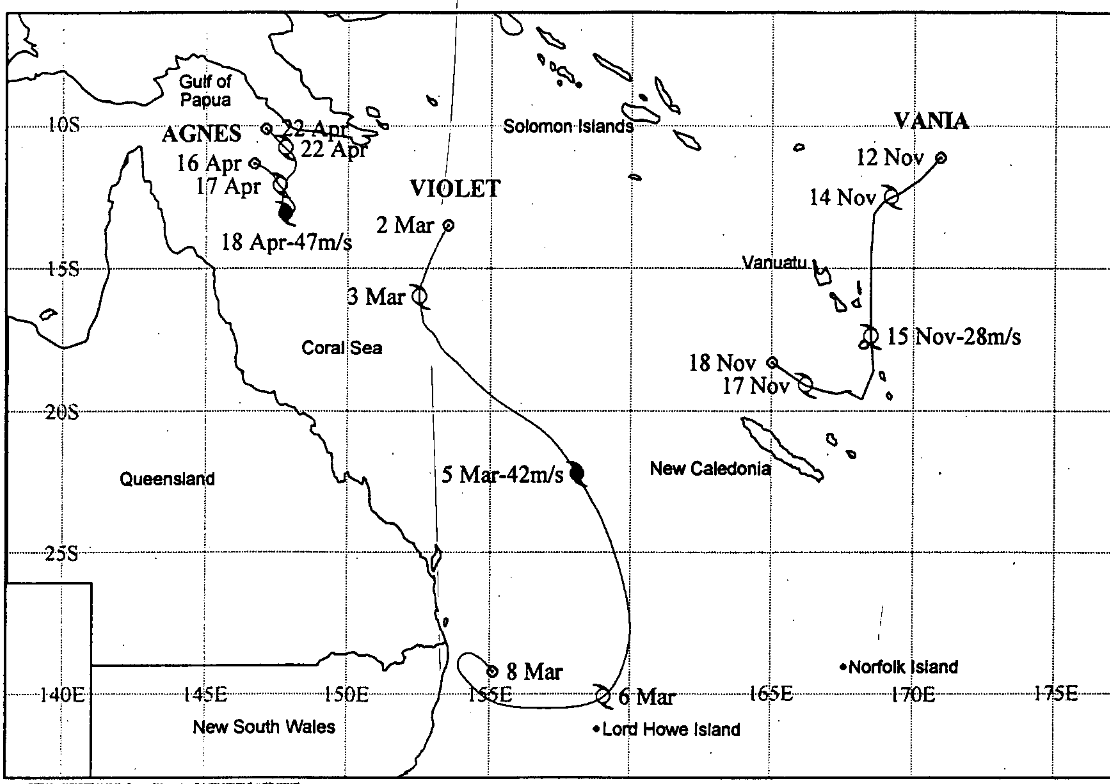
Tropical cyclone *Vania* was the first tropical cyclone to form in the South Pacific during the 1994-95 season. The incipient low formed in a persistent area of convection east of the Solomon Islands on 12 November and moved slowly southwestward as it developed. *Vania* was named at 0000 UTC 14 November after which it tracked southwards over Vanuatu, reaching peak intensity (with estimated maximum mean winds of 28 m/s) over southern parts of the island group on 15 November. The cyclone became sheared and weakened during 16 November as the low-level circulation stalled and turned westwards north of New Caledonia before dissipating late on 17 November. *Vania* was a small cyclone that brought the end of a long dry spell in Vanuatu. Storm-force winds associated with *Vania* produced only minor damage to crops and bush houses in the island group.

Annette (Perth TCWC): 14 December to 18 December (Fig. 3)

Annette was a large, intense cyclone which formed in the southeast Indian Ocean about the same time as *Vania* and tracked southeastwards across the Australian continent. A low to mid-level cyclonic circulation was first analysed over Java on 9 December and moved south to be near 12°S 116°E by 12 November. The low remained almost stationary for two days as weak vertical wind shear and strong cross-equatorial monsoonal flow below 700 hPa contributed to a favourable development environment.

Tropical cyclone *Annette* was named early on 15 December and rapidly intensified to hurricane intensity the next day under the influence of a mid to high-level trough passing to the south. The cyclone moved southeastward and reached maximum intensity with estimated mean winds of 55 m/s (estimated central pressure 925 hPa) at 0000 UTC 18 December prior to crossing the Western Australian coast. *Annette's* eye passed over Mandorah Station about 10 km inland from the coast

Fig. 2 Tracks of cyclones *Vania, Violet* and *Agnes*. Open circles denote positions at which a tropical low was first identified and when the low dissipated. Cyclone symbols mark the start and finish of the tropical cyclone phase and the position and date when maximum intensity was reached.



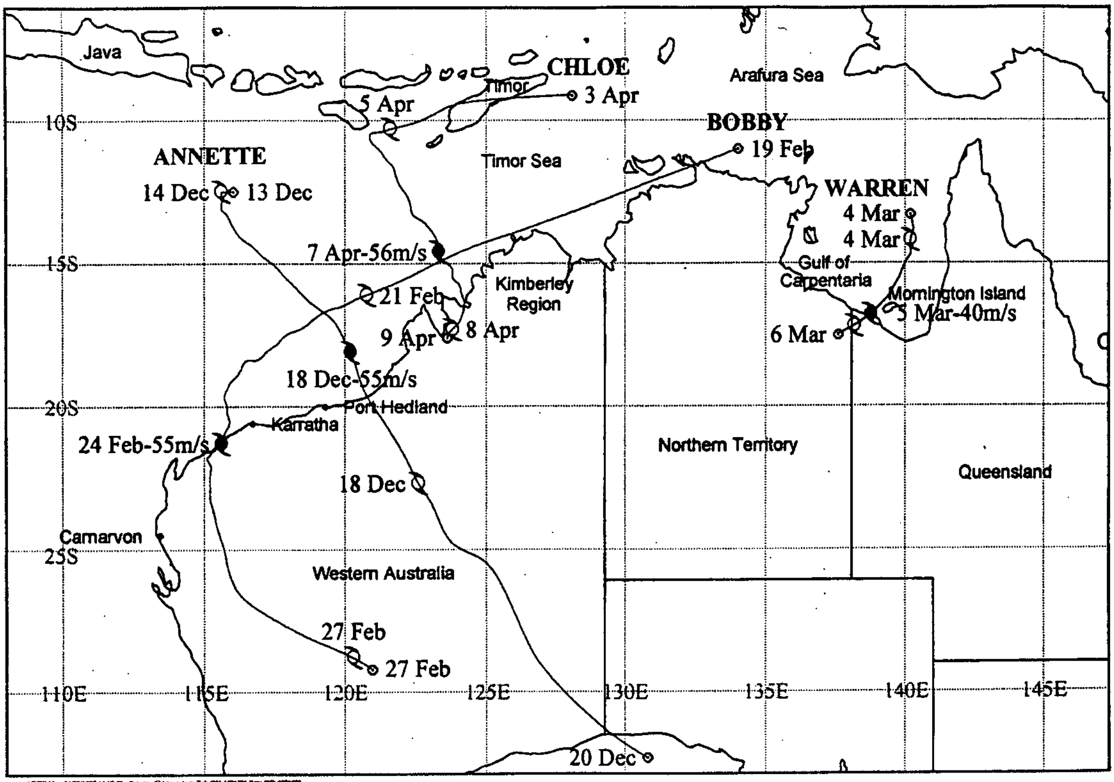
(240 km east northeast of Port Hedland) at about 0900 UTC 18 December where a minimum MSLP pressure of 933 hPa and wind gusts to 60 m/s were recorded. The cyclone caused extensive damage to station and roadhouse buildings within 30 km of the coast. Five hundred cattle were drowned by the storm surge after being driven towards the sea by the wind.

Annette accelerated southeastward on 19 December as upper-level northwesterly flow strengthened ahead of an approaching trough to the southwest. The cyclone underwent an extratropical transition as it moved overland and the resultant low pressure system retained gale-force mean winds with gusts to 25 m/s on its eastern side as it moved into the Great Australian Bight early on 20 December.

***William* (Nadi TCWC): 1 January to 3 January (Fig. 4)**
El-Niño conditions contributed to several periods when areas of deep convection formed east of the date-line during the 1994-95 season. Tropical cyclone *William* formed in an area of persistent convection south of the Northern Cook Islands near 12°S 163°W on 1 January and initially moved south-southeastwards towards the Southern Cook Islands. This small cyclone passed close to Aitutaki (18.5°S 159.5°W) in the Southern Cook Islands on 2 January, producing gusts to 33 m/s and a measured MSLP pressure of 960 hPa. *William* turned southeastwards and accelerated before reaching a peak of just below hurricane intensity (estimated mean winds 31 m/s) over Maria and Rimatara Islands in French Polynesia. This intensity was partly due to a translation speed of 13 m/s. The cyclone underwent an extratropical transition on 3 January and continued to move rapidly into the southeastern Pacific Ocean. Damage to houses, crops and coconut trees resulted from high winds and seas in the Southern Cook Islands, including the destruction of a causeway to a tourist resort on Aitutaki.

***Bobby* (Perth TCWC): 21 February to 27 February (Fig. 3)**
Tropical cyclone *Bobby* was a large, intense cyclone that moved along the entire length of the northwest Australian coast, then inland over western and southern parts of Western Australia. A tropical low first devel-

Fig. 3 Tracks of cyclones *Annette, Bobby, Chloe* and *Warren*. Symbols as in Fig. 2.



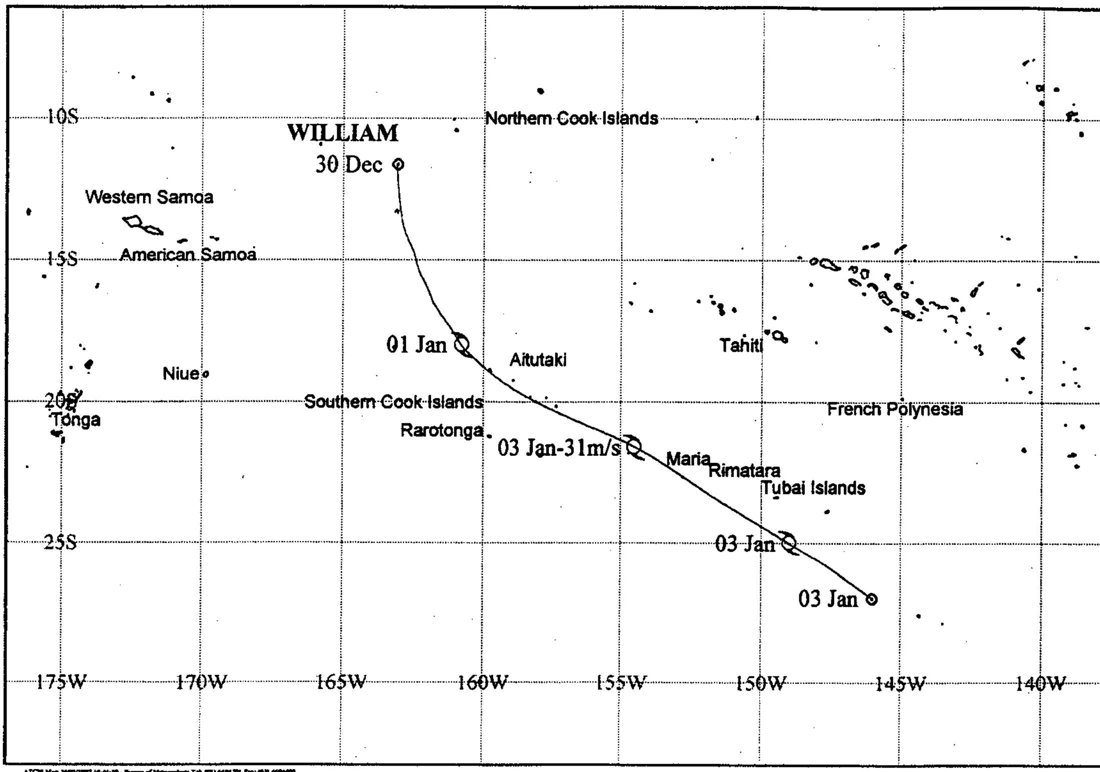
oped on 19 February in the monsoon trough north of the Northern Territory coast. Initial development was retarded by strong easterly shear as the low moved steadily west-southwestwards north of a mid-level ridge axis. The zonal ridge pattern was disturbed by the approach of a large-amplitude frontal system during 21 and 22 February, decreasing wind shear over the system. Rapid cyclogenesis followed as deep convective cloud wrapped around the surface centre late on 21 February and *Bobby* was named early on 22 February near 16.1°S 120.8°E, about 500 km north of Port Hedland.

The cyclone continued to intensify during the next two days in an environment of decreasing shear as it moved south-southwestwards, closer to the mid-level ridge axis. *Bobby* reached hurricane intensity early on 23 February and peaked with estimated mean winds of 55 m/s (estimated central pressure 925 hPa) at 0900 UTC on 24 February, as it approached the Western Australian coast near Mardie (100 km west southwest of Karratha). A contraction of the radius of hurricane-force winds from 80 km to less than 30 km during this period of intensification was detected by a network of offshore automatic weather stations. However, the radius of gales remained unchanged at about 150 km which coincided approximately with the radius of central dense overcast cloud.

Bobby moved erratically for about 24 hours, executing several loops as it travelled along the coast. The cyclone crossed the coast near near Onslow around 1800 UTC on 25 February (between midnight and 1.00 a.m. Western Standard Time), where a maximum gust of 51 m/s and minimum pressure of 952 hPa were recorded. A storm surge of 1.3 m was recorded at King Bay about 30 km west of Karratha. The weakening cyclone maintained a southward overland track for another 24 hours then turned southeastwards and finally weakened into a rain-bearing depression over southern parts of Western Australia early on 27 February.

Eight people died during *Bobby,* seven in two fishing trawlers which foundered offshore from Onslow and one motorist who was drowned while attempting to cross a flooded creek near Carnarvon. Very heavy rain associated with the cyclone caused serious flooding over widespread areas throughout western and southern

Fig. 4 Track of cyclone *William*. Symbols as in Fig. 2.



parts of Western Australia (Pilbara, Gascoyne, Goldfields and Eucla regions). Record February rainfall totals were measured at several centres in the Goldfields region. The estimated property damage bill was around $A2 million due to wind and flooding at Karratha, Onslow and pastoral stations up to 250 km inland along *Bobby's* track.

***Violet* (Brisbane TCWC): 3 March to 6 March (Fig. 2)**
Tropical cyclone *Violet* was a large system that remained over water in the Coral Sea throughout its lifetime. A tropical low near 13.5°S 153.5°E began to deepen early on 2 March and move south-southwestwards. The low deepened further and was named tropical cyclone *Violet* at 0600 UTC on 3 March near 16.0°S 152.5°E. The cyclone turned towards the south-southeast and accelerated, continuing to intensify until its peak intensity (estimated mean winds 42 m/s, central pressure 960 hPa) was reached at 1200 UTC 5 March near 22.2°S 158.1°E. *Violet* weakened slightly but maintained hurricane intensity as it turned south-southwestward then west-southwestward late on 6 March. At this time the cyclone was beginning a transition into a deep extratropical low with estimated mean winds of 28 m/s and central pressure about 980 hPa.

The low continued to weaken slowly and move further westward, approaching within 50 km of the Australian coast off northern New South Wales at 1200 UTC 7 March. The system turned northeast away from the coast and continued around a loop towards the southeast before dissipating around 0000 UTC 8 March near 29.2°S 155.1°E. There were no reports of casualties and the only damage reported was beach erosion at Lord Howe Island and in northern New South Wales. Power supplies on Lord Howe Island were interrupted when water damaged a transformer – the strongest wind gust recorded on the island prior to power failure was 34 m/s at 1246 UTC, 6 March.

***Warren* (Brisbane and Darwin TCWCs): 4 March to 6 March (Fig. 3)**
Tropical cyclone *Warren* was a short-lived system which moved steadily south-southwestwards in the eastern Gulf of Carpentaria. A tropical low initially formed in the northeastern Gulf of Carpentaria, drifted southwards and was named *Warren* near 14.1°S 140.2°E at 1100

UTC 4 March. *Warren* turned south-southwestwards and intensified rapidly, reaching hurricane intensity by 1200 UTC 5 March near 16.2°S 139.4°E just north of Mornington Island. The cyclone peaked six hours later before crossing the southern coast of the Gulf of Carpentaria with estimated mean winds of 40 m/s (central pressure about 960 hPa). *Warren* weakened rapidly as it moved inland, dissipating near the Queensland-Northern Territory border at 0600 UTC 6 March.

Although *Warren* passed close to Mornington Island at near peak intensity, only minor damage was reported. Power supplies were disrupted in Gununa, the main town on the island and minor flooding blocked roads. Many houses were slightly damaged, extensive tree damage was reported and a light aircraft was overturned at the airport.

***Chloe* (Perth TCWC): 5 April to 9 April (Fig. 3)**

Tropical cyclone *Chloe* was the most intense cyclone to develop in the South Pacific and southeast Indian Oceans during the 1994-95 season. It was a very small cyclone with gale-force winds extending only about 80 km from the centre and displayed the rapid intensification and weakening phases typical of 'midget' tropical cyclones.

A low initially formed in an active monsoon trough to the east of Timor on 3 April and moved westward, north of an upper-level ridge. Easterly shear and passage over the mountains of Timor initially retarded development, however rapid cyclogenesis followed late on 4 April once the low moved west of Timor over the Savu Sea. During this period, the middle-level ridge was displaced northwards by an amplifying trough over southeastern Australia, reducing shear over the developing low. *Chloe* was named at 0300 UTC 5 April after which it stalled and turned southeastwards in response to strengthening northwesterly flow around 500 to 400 hPa. *Chloe* intensified rapidly to hurricane intensity within 24 hours then further to its peak intensity around 0600 UTC 7 April (estimated mean wind speed around 56 m/s) as it moved over the open waters of the Timor Sea.

Late on 7 April, *Chloe* began to weaken under the influence of increasing northwesterly shear and at 0300 UTC on 8 April the cyclone crossed an uninhabited section of the north Kimberley coast causing a swath of vegetation damage 30 km wide. *Chloe* then weakened rapidly and turned southwestwards in response to low-level northeasterly flow. *Chloe's* estimated central pressure rose from 955 hPa at landfall to 1000 hPa 12 hours later, as its remnants dissipated into a weak tropical low inland of Derby.

Dvorak (1984) satellite intensity analysis of *Chloe* yielded a peak Data T-Number of 7.0 over a six-hour period. This corresponds to a central pressure of 930 hPa using the empirical pressure-wind relationship derived by Love and Murphy (1985) for small cyclones over the Australian Northern Region, whereas the standard Atkinson and Holliday (1977) pressure-wind relationship would yield a central pressure around 900 hPa for this system. For a given intensity, central pressure estimates vary with cyclone size and environmental pressure, hence the estimated maximum wind (mean or gust) is generally a better measure of intensity than central pressure.

***Agnes* (Brisbane TCWC): 17 April to 22 April (Fig. 2)**

Tropical cyclone *Agnes* was the last cyclone to form in the South Pacific region in the 1994-95 season. It was a small system that moved erratically for several days around the northern Coral Sea just south of the Gulf of Papua. No reports of damage or injury have been received.

Agnes was named at 0600 UTC 17 April near 12.1°E 147.6°E and initially drifted slowly southeastwards. The cyclone continued to intensify as it turned south and then westwards, reaching its peak intensity with estimated mean winds of 47 m/s (central pressure about 945 hPa) at 1200 UTC 18 April. This intensity was maintained for 12 hours as *Agnes* became almost stationary near 13.1°S 147.6°E. By 1200 UTC 20 April, the central pressure had risen to about 970 hPa and the cyclone began to move slowly northeastwards. *Agnes* continued to weaken during the next 24 hours as it drifted further northwards, finally dissipating in the Gulf of Papua near 10°S 147°E on 22 April.

Acknowledgments

Descriptions of each cyclone were kindly provided by staff of the Fiji Meteorological Service and the Australian Bureau of Meteorology Tropical Cyclone Warning Centres in Perth and Brisbane. Lori-Carmen Chappel provided assistance with the diagrams.

References

Atkinson, G.D. and Holliday, C.R. 1977. Tropical cyclone minimum sea level pressure maximum sustained wind relationship for the western North Pacific. *Mon. Weath. Rev.*, *105*, 421-7.

Beard, G.S. 1995. Southern hemisphere climate summary by season from autumn 1994 to summer 1994-95: a warm Pacific (El Niño) episode peaks in early summer. *Aust. Met. Mag.*, *44*, 237-56.

Bigg, G.R. 1995. The El Niño event of 1991-94. *Weather*, *50*, 117-24.

de Hoedt, G.C. 1995. Seasonal climate summary southern hemisphere (autumn 1995): warm episode conditions in the tropical Pacific weaken. *Aust. Met. Mag.*, *44*, 323-9.

Dvorak, V.F. 1984. Tropical cyclone intensity analysis using satellite data. *NOAA Tech. Rep. NESDIS 11*, 47 pp.

Hanstrum, B.N., Bate, P.W. and Smith, R.K. 1996. The South Pacific and southeast Indian Ocean tropical cyclone season 1993-94. *Aust.*

Met. Mag., *45*, 137-47.

Joint Typhoon Warning Centre 1995. *1994 Annual Tropical Cyclone Report.* U.S. Naval Oceanography Command Center West/Joint Typhoon Warning Center, COMNAVMARIANAS, PSC 489, Box 12, FPO AP, 96536-0051, USA, 337 pp.

Love, G. and Murphy, K. 1985. The operational analysis of tropical cyclone wind fields in the Australian Northern Region. *NT Research Papers 1984-85*, 44-51.

Revell, C.G. and Goulter, S.W. 1986. South Pacific tropical cyclones and the Southern Oscillation. *Mon. Weath. Rev.*, *114*, 1138-45.

Appendix

Sources of data:

Averaged (1, 3 and 6-month) grid-point analysis data from Darwin Regional Specialised Meteorological Centre and National Meteorological Operations Centre (Melbourne), Bureau of Meteorology, Australia.

Climate Diagnostics Bulletin, November 1994-April 1995. Issued monthly by Climate Analysis Center, NOAA/NWS/NMC, Washington, D.C., USA.

Climate Monitoring Bulletin, Australia, November 1994-April 1995. Issued monthly by National Climate Centre, Bureau of Meteorology, Melbourne, Australia.

Darwin Tropical Diagnostic Statement, November 1994-April 1995. Issued monthly by Bureau of Meteorology, Darwin, Australia.

Australian tropical cyclone track data from the Australian Bureau of Meteorology's ADAM (Australian Data and Archive for Meteorology) database.

Tropical cyclone post-event reports, best-track data and verification statistics from: Fiji Meteorology Service, Nadi; Australian Bureau of Meteorology Severe Weather Program Office, Melbourne; Australian Bureau of Meteorology TCWCs in Brisbane, Darwin and Perth.