Australian Government

Bureau of Meteorology

DARWIN REGIONAL SPECIALISED METEOROLOGICAL CENTRE

May 1986, VOL 05 No 05

ISSN 1321 - 4233

THIS PAGE INTENTIONALLY LEFT BLANK

DARWIN TROPICAL DIAGNOSTIC STATEMENT

MAY 1986

ISSUED BY DARWIN RMC

INDICES

The Darwin mean MSL pressure for May was 1011.6 hPa, 0.5 hPa above the 1882/1985 mean. The Tahiti mean MSL pressure for May was 1012.4 hPa, 0.3 hPa below the 1882/1985 mean. These give a value of the SOI of -6 with a five month running mean centred on March of -2.1 using the 1882/1985 data base.

TROPICAL CYCLONES

Two tropical cyclones formed in the southern hemisphere between 70E and 180E during May 1986. Both of these affected the area between 105E and 165E where the May long term mean of cyclone occurrence is 0.8.

Two tropical cyclones formed in the northwest Pacific during May where the long term mean is 1.1. Unofficial tracks are shown in fig 1a-c.

Tropical cyclone "Ken" continued (from April) its slow westward movement and weakened over water on the 1st May.

Tropical cyclone "Billy" (32S) formed in the monsoon trough in the Indian Ocean on the 6th May. An increase in the northwest monsoon and the southeast trade flow led to increased vorticity near the monsoon trough contributing to Billy's genesis. The system moved steadily south southwest until the 11th May before it recurved southeastwards and accelerated. Billy attained severe tropical cyclone status on the 11th May. The system dissipated over water on the 13th May due to being sheared off in the middle levels.

Tropical cyclone "Lola" and tropical cyclone "Namu" formed in the northern and southern branches, respectively, of the split monsoon trough within 12 hours of each other on the 17th May. Both cyclones developed rapidly. "Lola" attained severe tropical cyclone status on the 17th May and peaked at an estimated maximum mean wind of 150 knots on the 20th May. After only a slow north northwest movement on the 17th to 19th May Lola accelerated and recurved northeastwards during the 21st May. Lola acquired the characteristics of a cold core system on the 23rd May. "Namu" moved initially southwest recurving southeastwards on the 20th May. The system dissipated over water on the 22nd May due to being sheared off in the middle levels.

Tropical cyclone "Mac" formed in the monsoon trough in the northern South China Sea on the 26th May following a four to five day southwest surge over the Indo-China and South China Sea regions. The system moved steadily northeast dissipating over water on the 28th May. "Mac" was a small system and never attained severe tropical cyclone status.

SEA SURFACE TEMPERATURES

The mean sea surface temperature (SST), during May 1986, and SST anomalies averaged over the two week period May 12 - 26 are shown in figs 2 and 3.

Positive SST anomalies persisted in the western equatorial Pacific during May extending southward to the Australian coast between 125E and 135E and eastward along the equator.

SST anomaly patterns south of Australia and in the southern Indian Ocean and Tasman Sea have changed little since April while the northern Indian Ocean has near mean sea surface temperatures for May.

The intensification and eastward movement since April of the cold anomaly in the northern Pacific was contributed to upwelling associated with the path of Severe Tropical Cyclone "Lola".

MSL AND GRADIENT LEVEL FLOW

The mean MSL pressure and anomaly charts are shown in figs 4 and 5, and the gradient level (950 hPa) streamline and anomaly charts at figs 6 and 7.

The South Pacific Convergence Zone (SPCZ) continues to be slightly stronger than usual as shown by troughing on the gradient level (950 hPa) anomaly chart. It is felt the anomalously strong south southeast winds in the southern sector of the SPCZ as shown in the 950 hPa vector wind anomaly chart are largely contributed by tropical cyclone NAMU.

The SPCZ area is linked with a well defined trough, as seen on the gradient level chart in the northwest Pacific Ocean, indicating an early development of the northern hemisphere's intertropical convergence zone. The anomalous westerlies between 10N and the equator, east of 110E, is indicative of the strength of this trough in which tropical cyclone "Lola" developed.

The higher than normal April 1986 mid latitudes pressures in the southern hemisphere weakened during May. This was particularly evident in the Indian Ocean where the gradient level (950 hPa) shows most of the ocean covered with anamalous westerly winds.

500 hPa FLOW

Mean 500 hPa streamline analysis and geopotential height anomaly charts are shown in figs 8 and 9 respectively.

The high anomaly over the Tasman Sea has weakened slightly since April 1986 and changed its ridge orientation to a more east-west direction reflecting the northwards surface movement of the sub-tropical ridge (STR).

The low anomaly over the area of the South Pacific convergence zone (SPCZ) also has persisted since March 1986.

Low anomalies over Japan and southwest Australia are associated with persistent long wave troughs. Low anomalies are also evident in the vicinity where tropical cylones Billy, Lola and Mac reached their maximum intensities.

200 hPa FLOW

The mean 200 hPa streamline analysis for May 1986 and the vector wind anomaly, are shown in figs. 10 and 11 respectively.

The northern hemisphere sub tropical jet stream (STJ) in May 1986 was close in position and strength to the long term May mean after being stronger than normal during April.

A persistent 200 hPa trough in the higher northern latitudes near 80E gave rise to an anamalous southerly component in the flow at 90E. Westerly wind anomalies south of Japan near 25N and anomalous northerly winds in higher latitudes near 170E were contributed to by a persistent 200 hPa trough near 170E and the passage of Severe Tropical Cyclone "Lola" during May 1986.

Easterly 200 hPa anomalies to the north and westerly wind anomalies to the south of the May 1986 southern hemisphere STJ position indicate a southward displacement of the STJ from the long term mean position while being of close to mean strength.

The anomalous northeasterly flow over the Coral Sea and adjacent South Pacific is probably associated with outflow from Tropical Cyclone Namu.

Sub-tropical ridges in both hemispheres at 200 hPa are near their long term mean positions however little faith is held in the depiction of the flow near Timor.

VELOCITY POTENTIAL AND DIVERGENT WIND

Charts of the 950 and 200 hPa velocity potential, and the 950 and 200 hPa divergent wind, are shown in figs. 12, 13, 14 and 15 respectively.

The charts suggest that areas of most convective activity are in the South China Sea, the West Pacific Ocean and immediately to the east of Papua New Guinea. This is consistent with the split monsoon trough seen in mid May and the subsequent movement of the monsoon trough into the northern hemisphere during late May.

The 200 hPa divergent wind shows divergence at 28S 108E. Due to the poor data base in this region not much reliance can be placed on this.

While April saw the Tasman Sea dominated by long wave ridging May saw the reverse. The Tasman Sea area was dominated by long wave troughing and lower level convergence.

WIND CROSS-SECTIONS

Cross sections of zonal wind taken through 100E and 130E, together with a cross section of latitudinal wind taken along the equator, are shown at figs 16, 17, 18 and 19 respectively.

The northern hemisphere sub tropical jet (STJ) had decreased in strength since April. It is near normal strength and position for May.

The southern hemisphere STJ has strengthened since April and is near the May long term mean strength except in the eastern section where STJ is less than the mean strength. STJ is southwards of the May mean position between 130E and 160E. As in April the thin band of weak low level westerlies shown in the longitudinal cross sections through 100E and 130E corresponds to the northern side of the monsoon trough. These westerlies have shown a northwards movement which is consistent with the movement of the monsoon trough.

SUMMARY

The southern oscillation index for May 1986 was -6 with a 5 month running mean centred on March of -2.1. Although this value is a little low, it is still within one standard deviation of normal variation. Neither the sea surface temperature anomalies nor the wind anomalies give any consistent support at this stage to the hypothesis that an El Nino may be developing.

CORRESPONDENCE REGARDING THIS PUBLICATION
SHOULD BE ADDRESSED TO:

The Regional Director
Bureau of Meteorology
PO Box 735
DARWIN NT 5794
Northern Territory
Australia

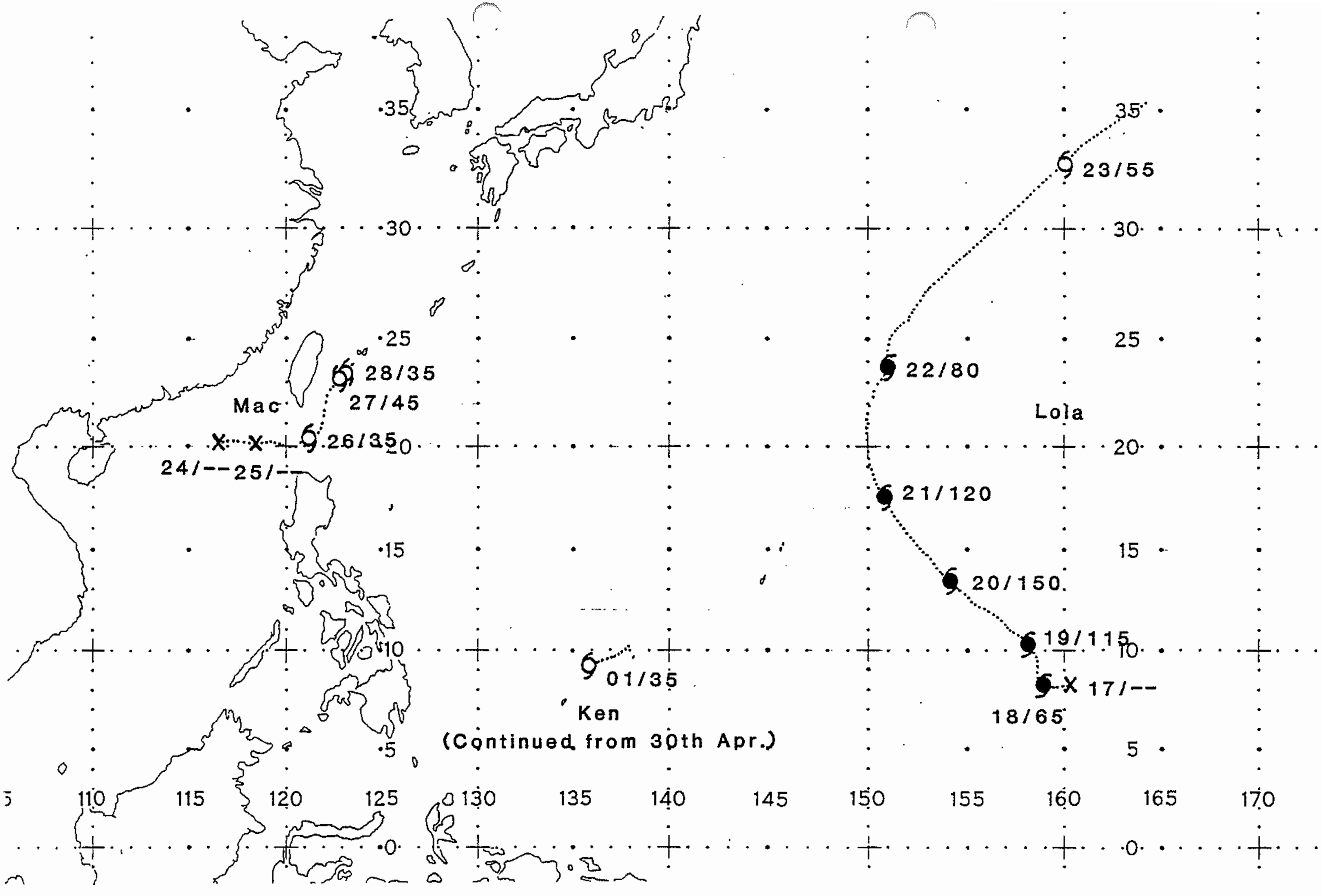

Fig. 1a UNOFFICIAL CYCLONE TRACK OF CYCLONE MAC, KEN AND LOLA FOR MAY 1986.
Date (DD) and maximum sustained wind in knots (ff) are given as DD/ff.

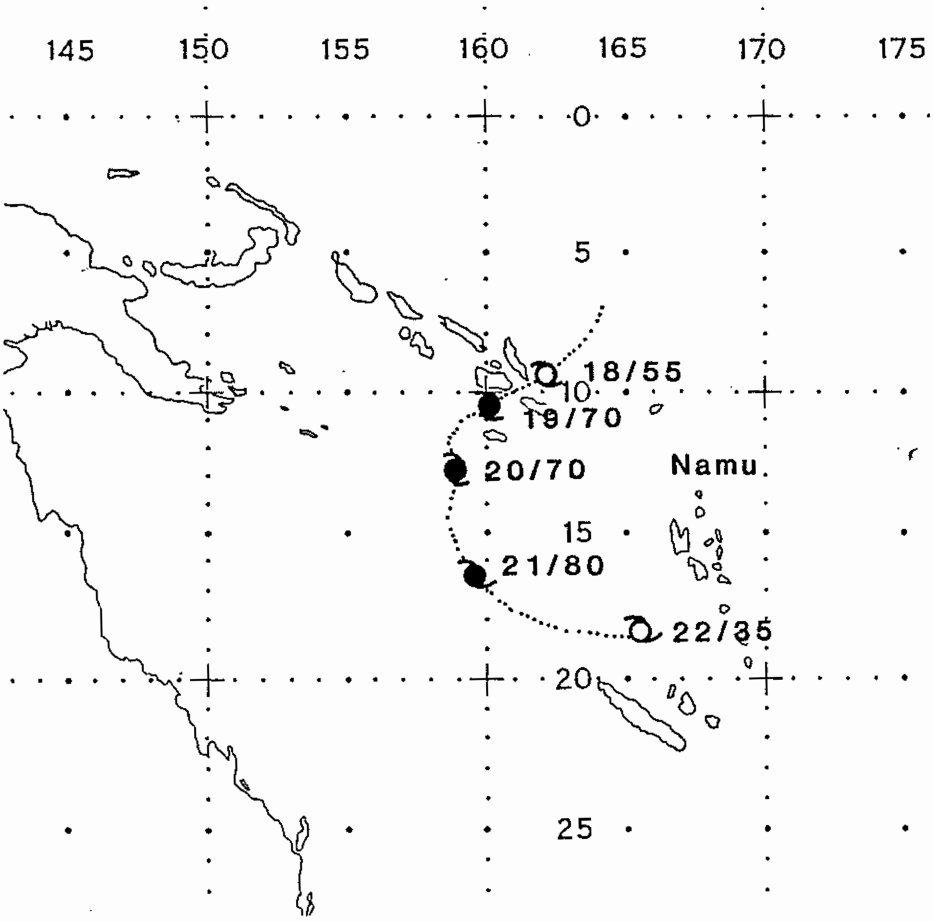

Fig. 1b UNOFFICIAL CYCLONE TRACK OF CYCLONE NAMU FOR MAY 1986.
Date (DD) and maximum sustained wind in knots (ff) are given as Dd/ff.

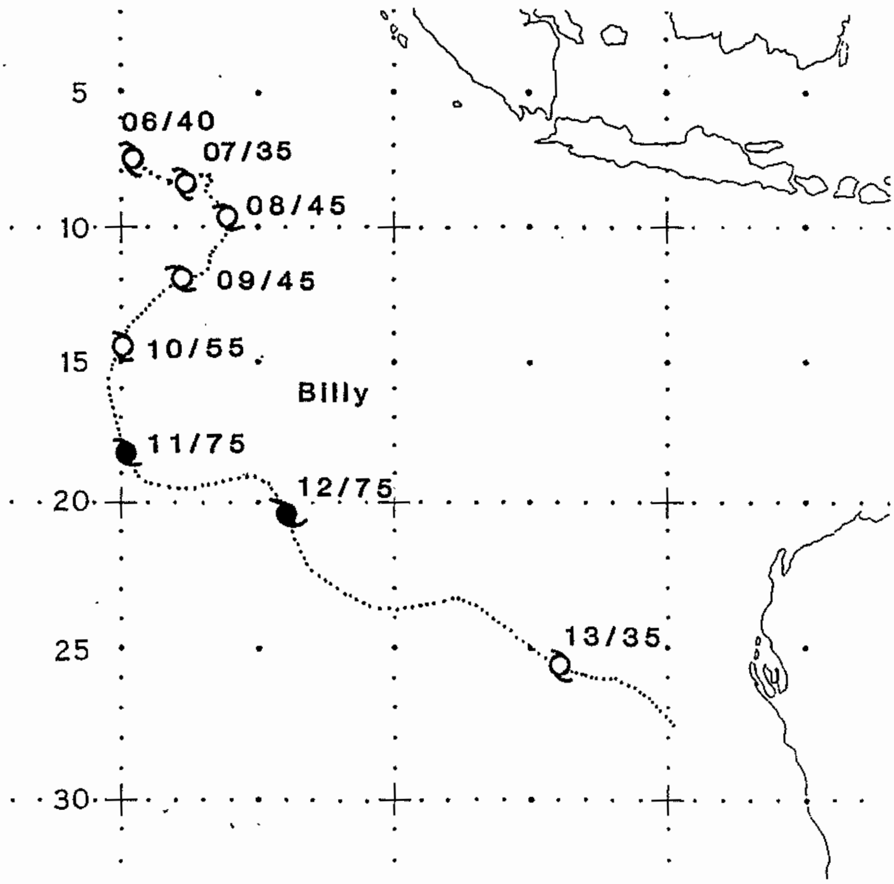

Fig. 1c UNOFFICIAL CYCLONE TRACK OF CYCLONE BILLY FOR MAY 1986.
Date (DD) and maximum sustained wind in knots (ff) are given as DD/ff.

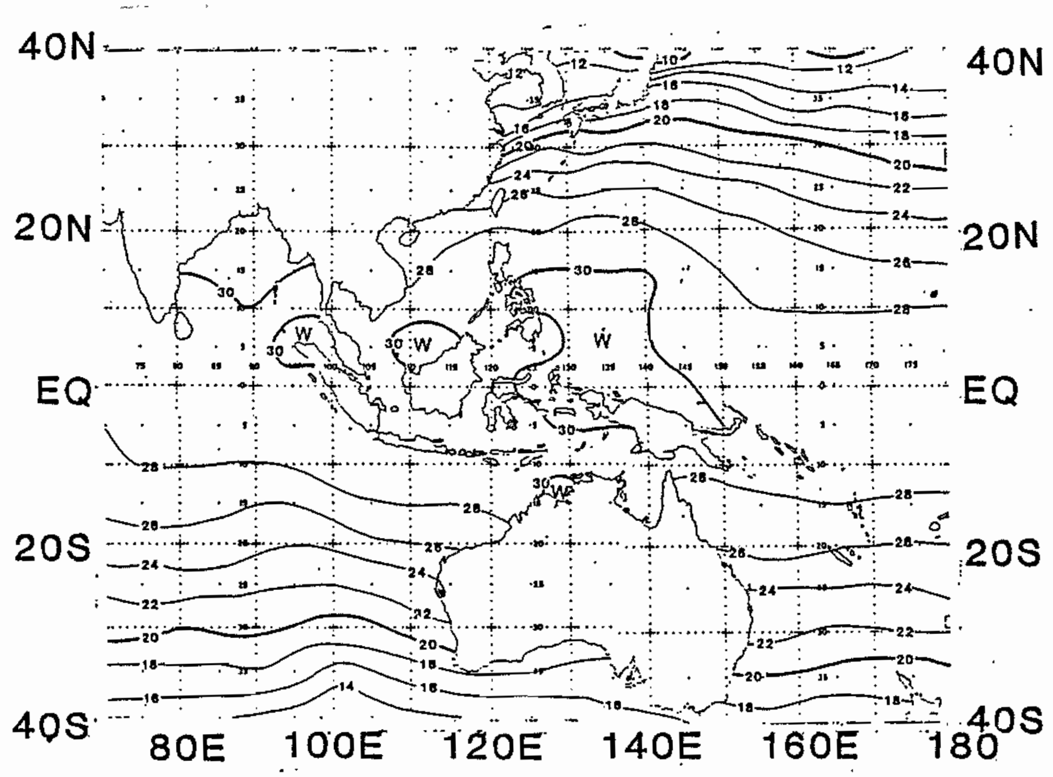

Fig. 2 MEAN SEA SURFACE TEMPERATURES, BASED ON DARWIN RMC ANALYSIS AVERAGED OVER THE MIDDLE 3 WEEKS OF MAY 1986. (CONTOUR INTERVAL 2 deg C).

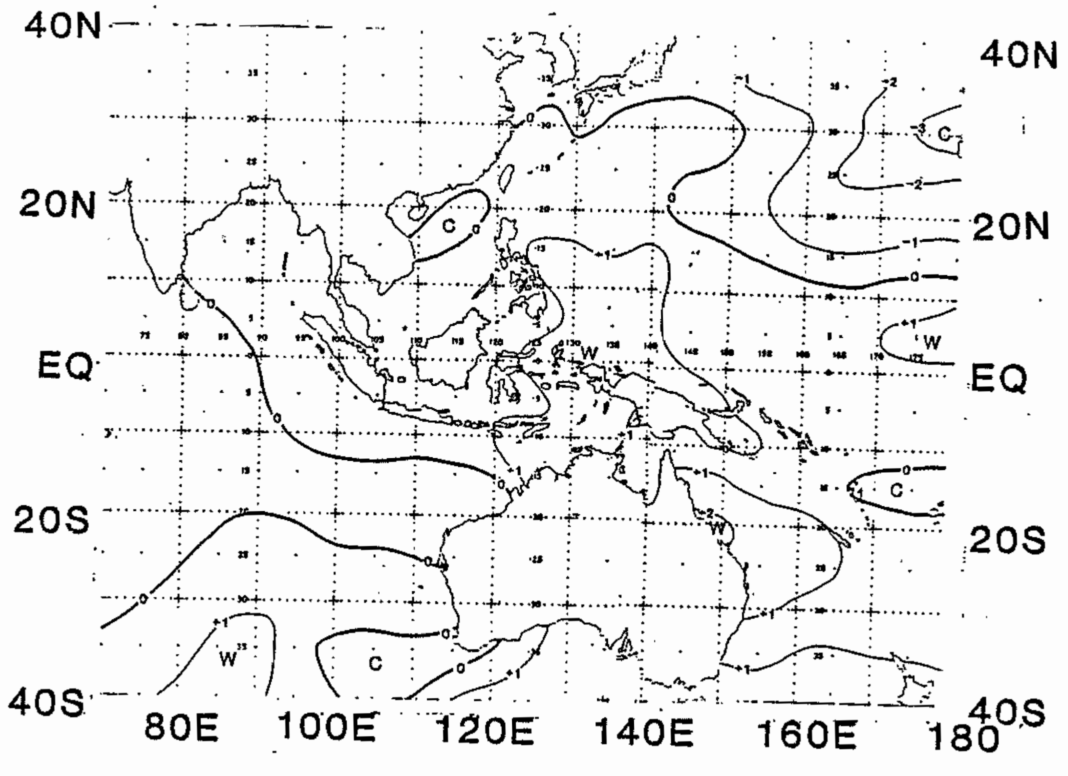

Fig. 3 SST ANOMALY CHART, BASED ON FIG. 2 AND THE CLIMATOLOGY OF REYNOLDS, NOAA REPORT NWS 31, 1983. (CONTOUR INTERVAL 1 deg C).

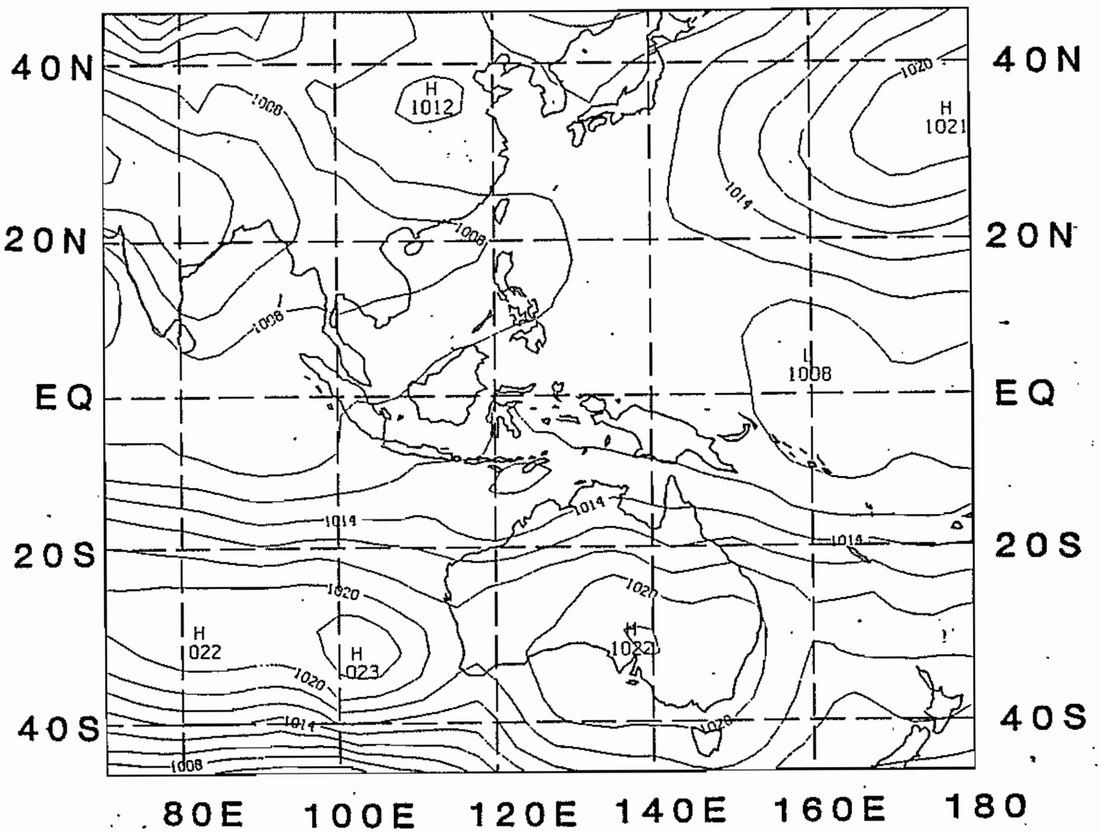

Fig. 4 MAY 1986 MONTHLY MEAN MSL PRESSURE
(CONTOUR INTERVAL 2 hPa).

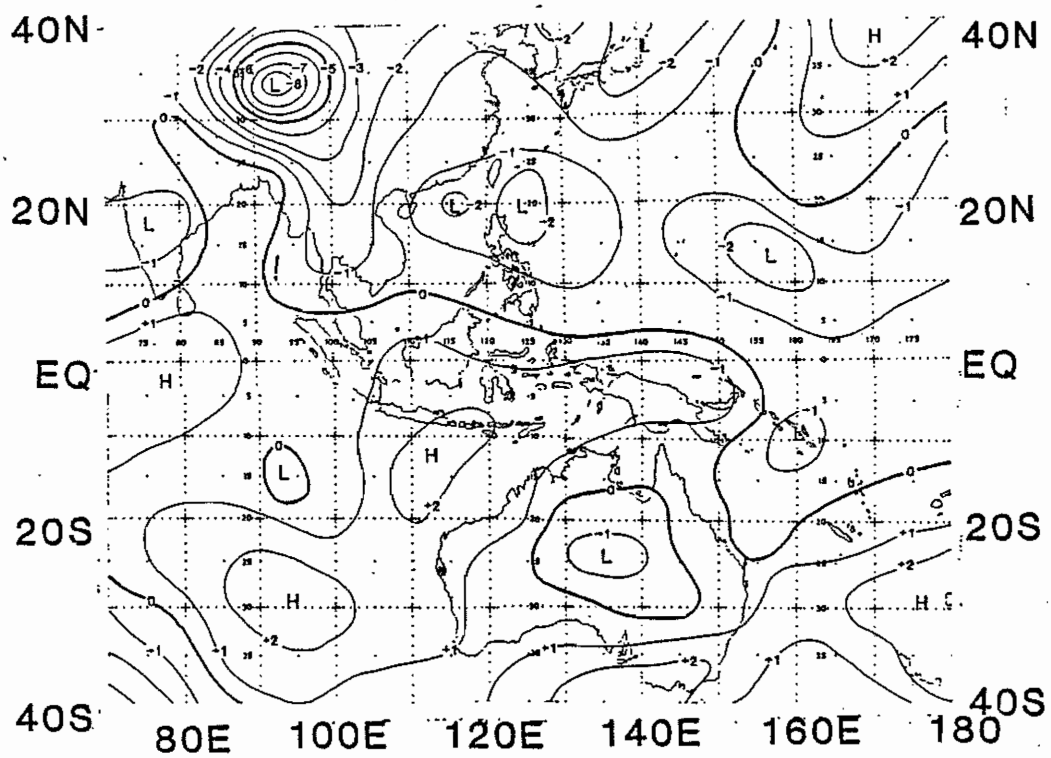

Fig. 5 . MSL PRESSURE ANOMALY BASED ON MELBOURNE WMC DATA
SOUTH OF 10 DEG S, ADJUSTED TO FIT CLIMATE MESSAGES
WHERE AVAILABLE. (CONTOUR INTERVALS 1 mb).

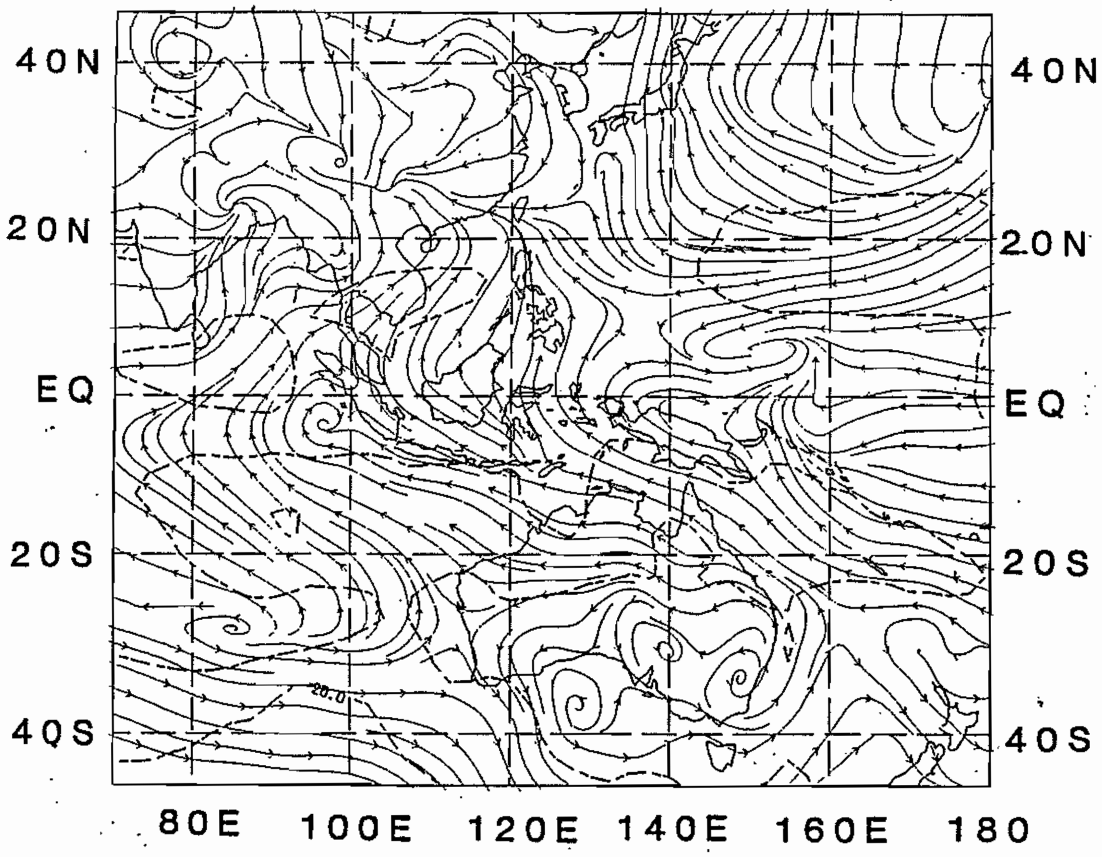

Fig. 6 MAY 1986 950 hPa STREAMLINE/ISOTACH ANALYSIS. (10 KNOT INTERVAL ISOTACHES DASHED LINE).

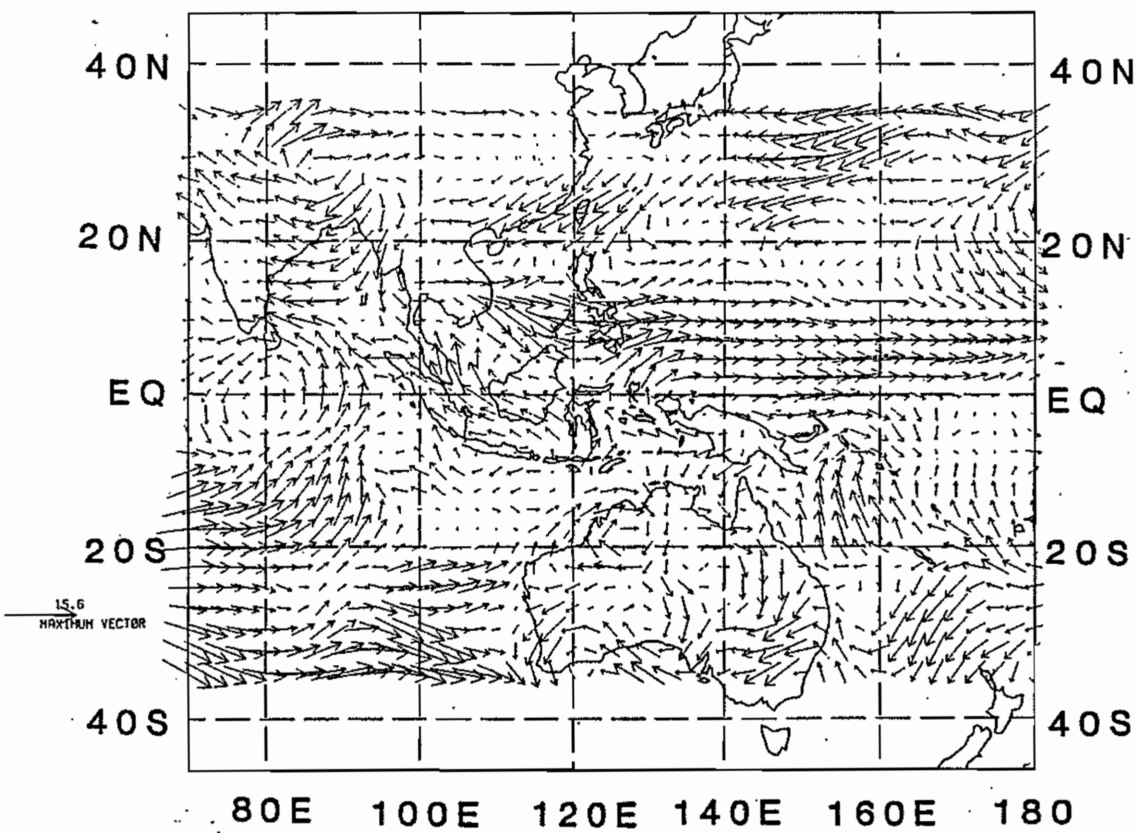

Fig. 7 950 hPa VECTOR WIND ANOMALY BASED ON FIG. 6. (ARROW LENGTH INDICATES MAGNITUDE).

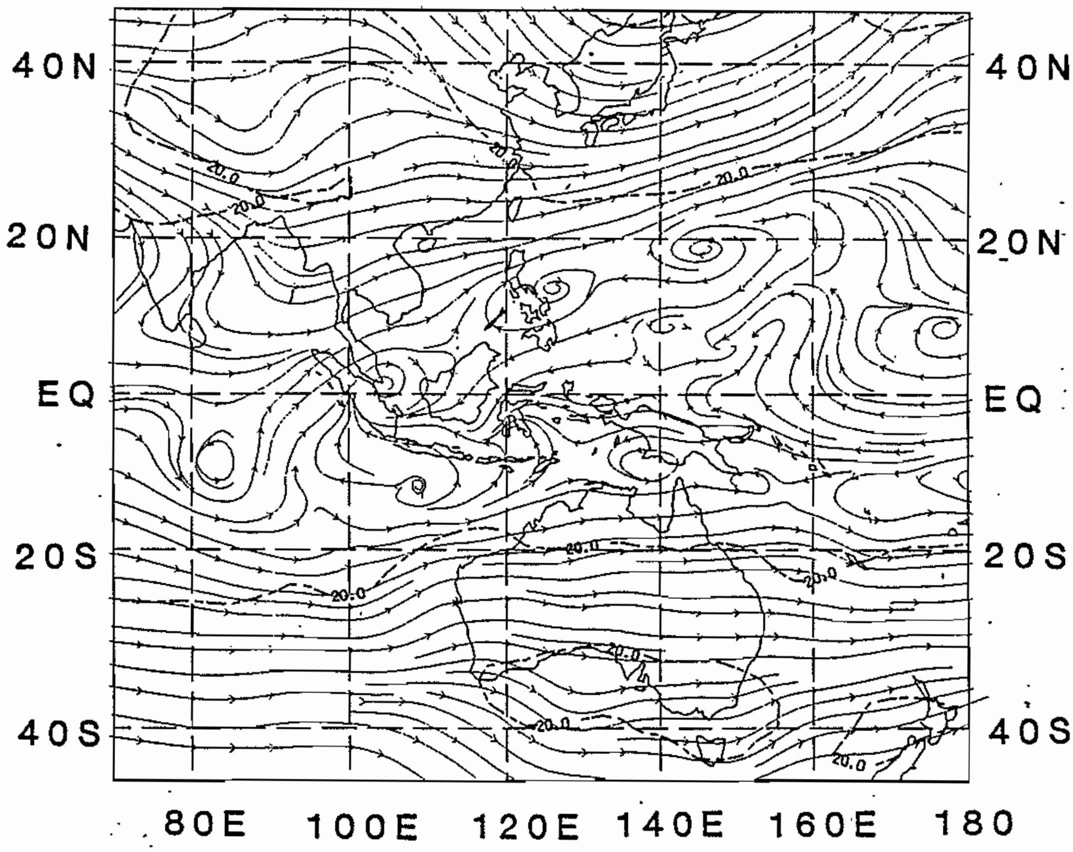

Fig. 8 MAY 1986 500 hPa STREAMLINE/ISOTACH ANALYSIS.
(10 KNOT INTERVAL ISOTACHS DASHED LINE).

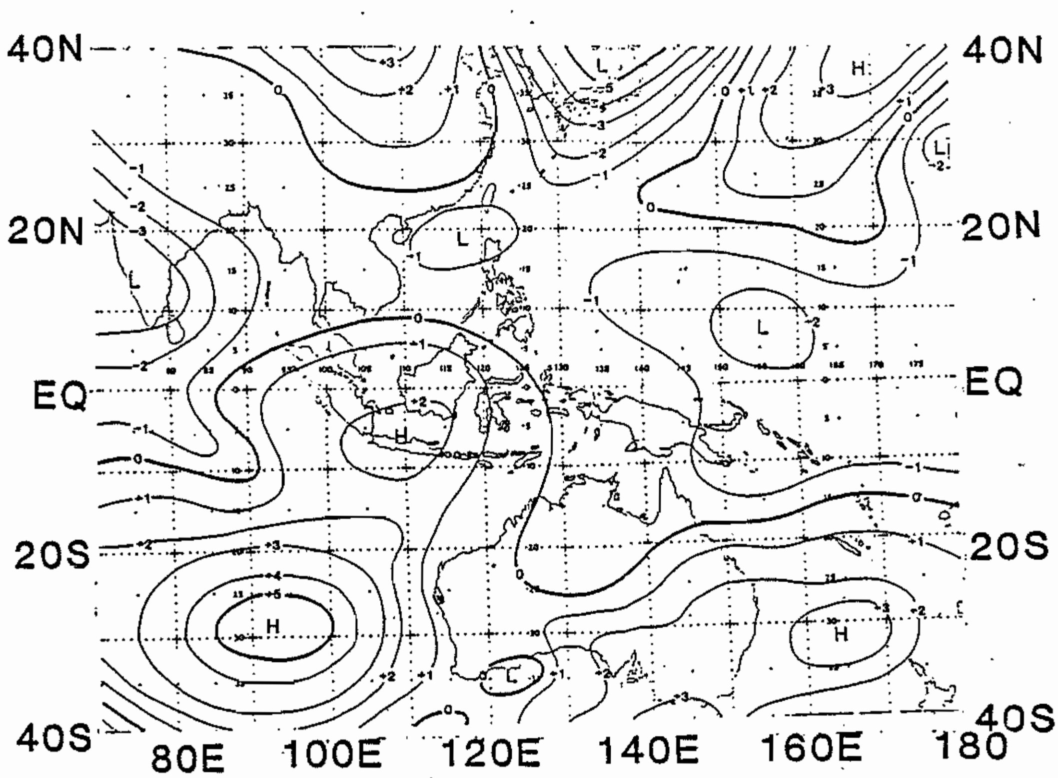

Fig. 9 MAY 1986 500 hPa GEOPOTENTIAL HEIGHT ANOMALY.
(CONTOUR INTERVAL 1 gpdm) (DATA BASE AS PER FIG. 5).

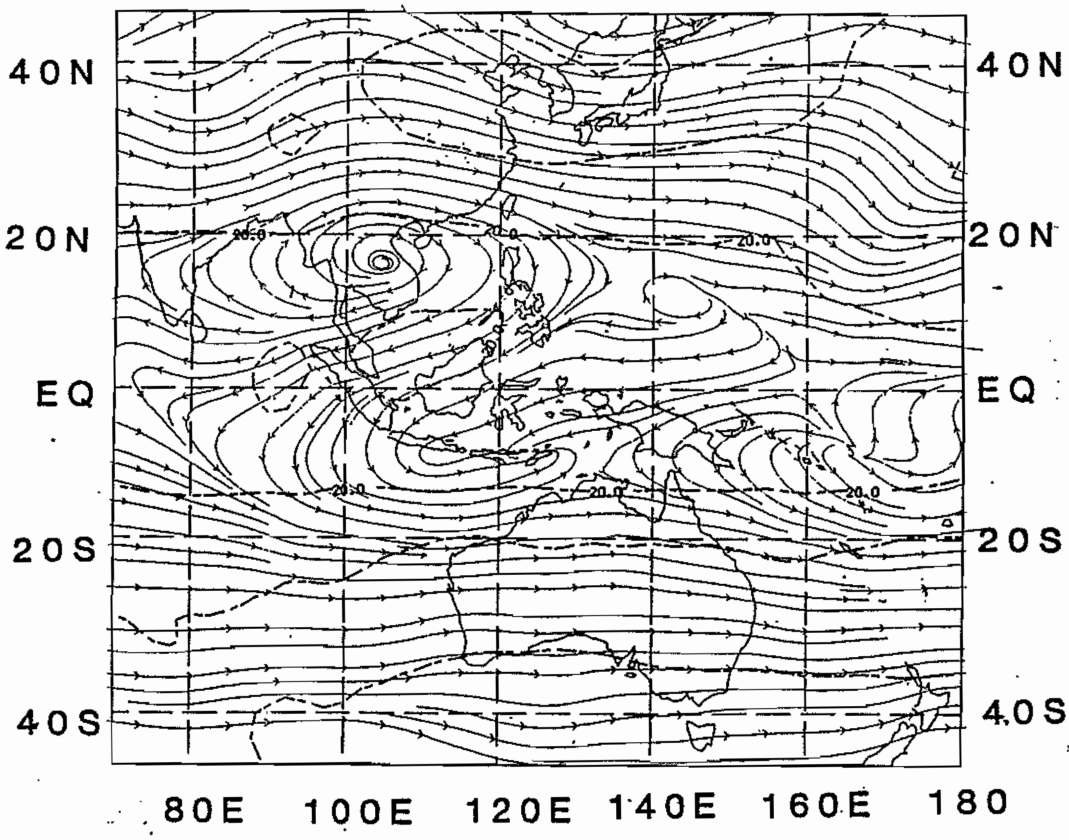

Fig. 10 MAY 1986 200 hPa STREAMLINE/ISOTACH ANALYSIS.
(40 KNOT INTERVAL ISOTACH DASHED LINE).

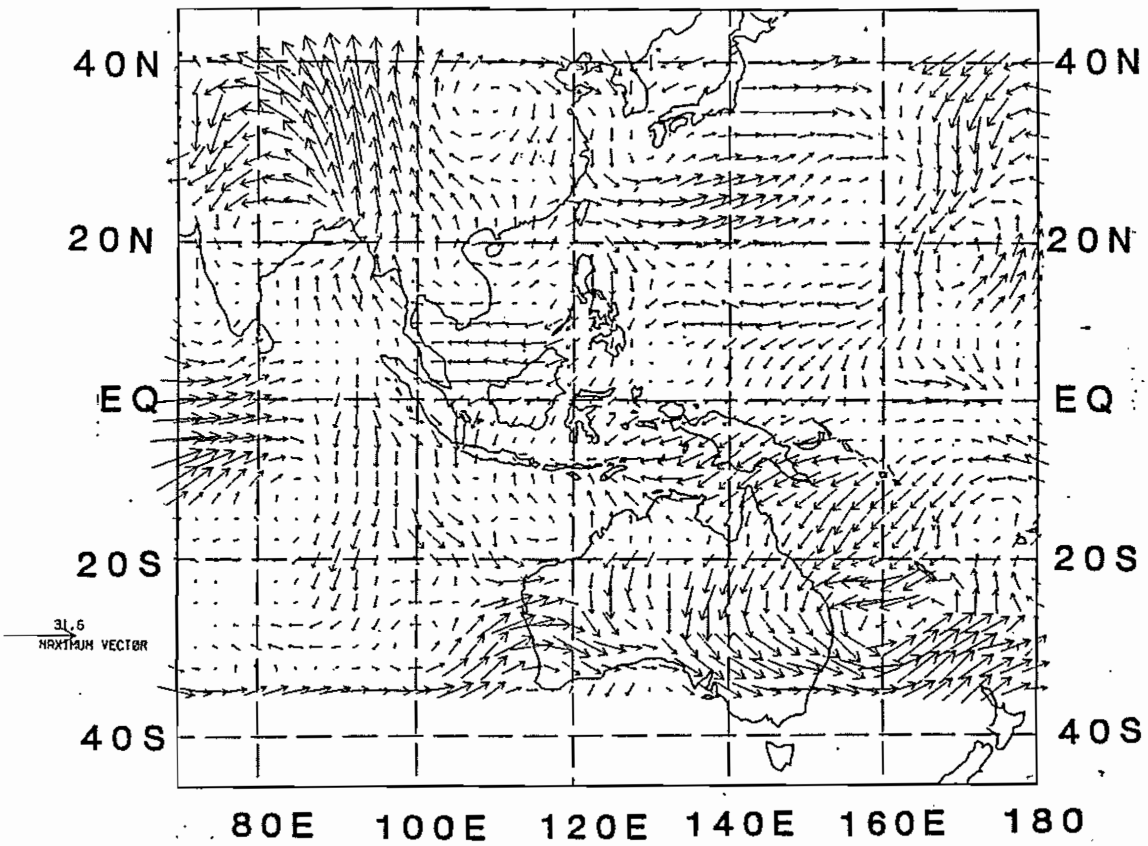

Fig. 11 MAY 1986 200 hPa VECTOR WIND ANOMALY.
(ARROW LENGTH INDICATES MAGNITUDE).

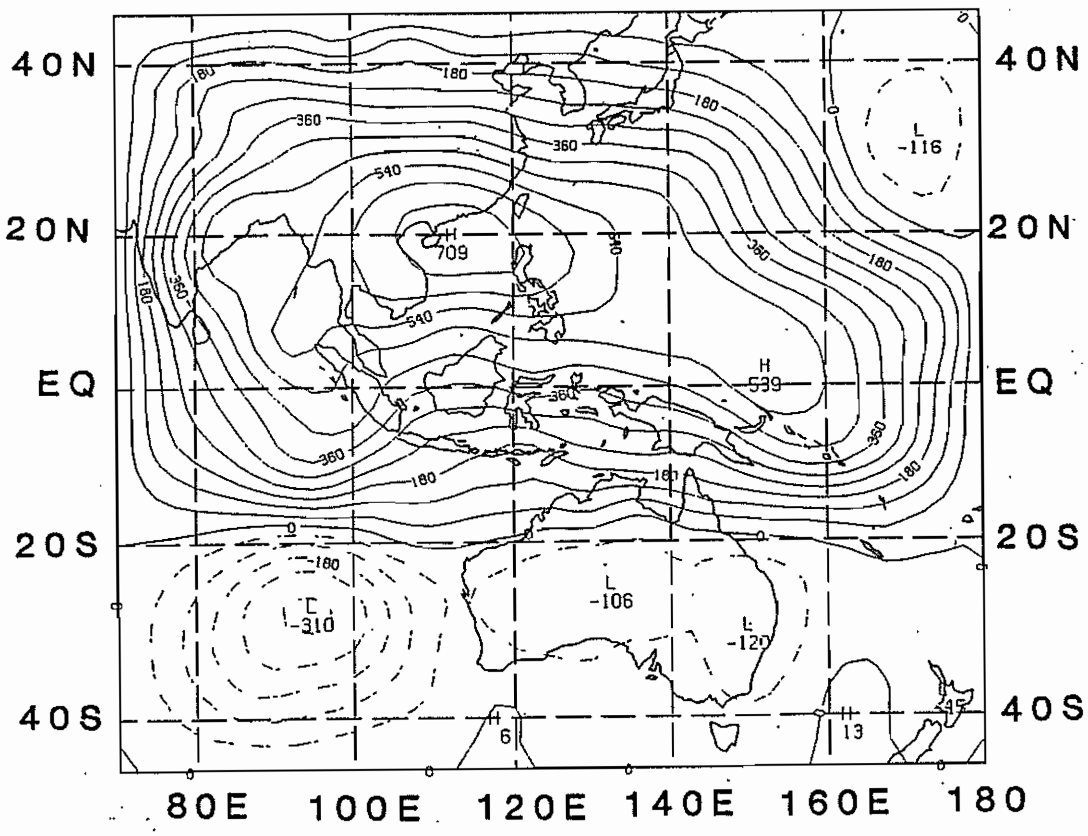

Fig. 12 MAY 1986 950 hPa VELOCITY POTENTIAL
5 2 1
(CONTOUR INTERVAL 60 X 10 M S).

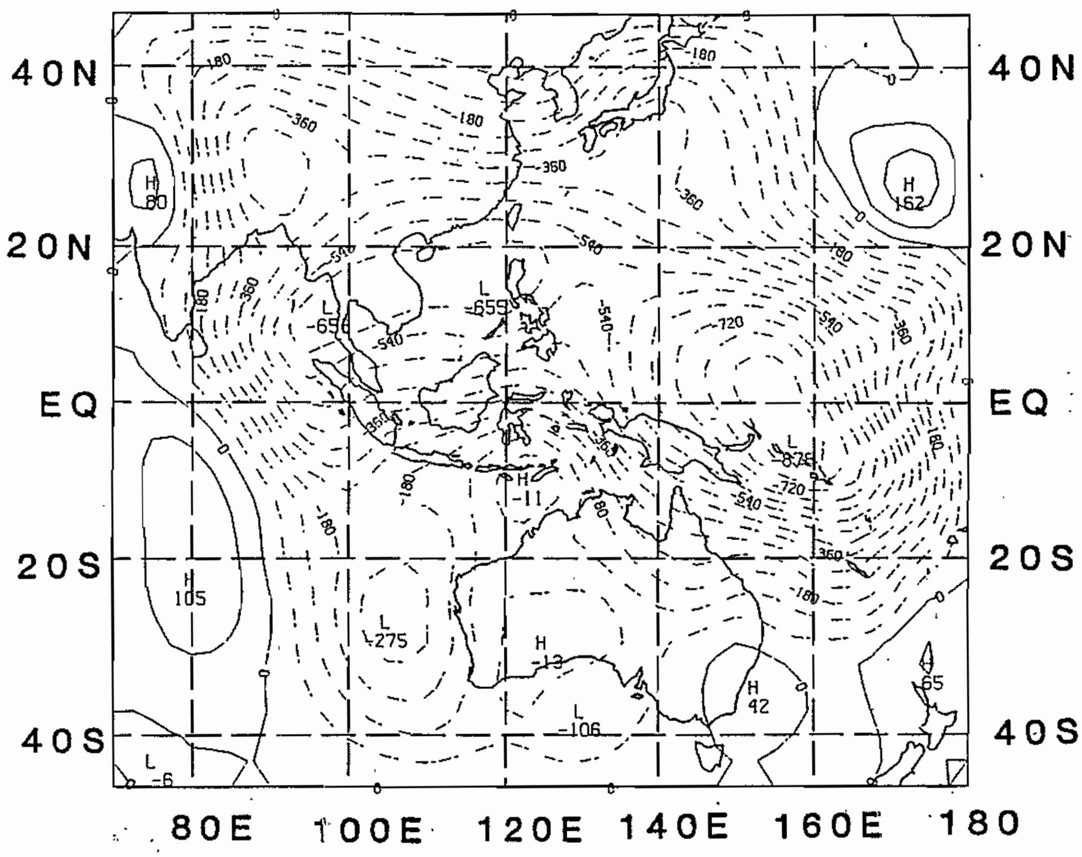

Fig. 13 MAY 1986 200 hPa VELOCITY POTENTIAL
5 2 1
(CONTOUR INTERVAL 60 x 10 M S)

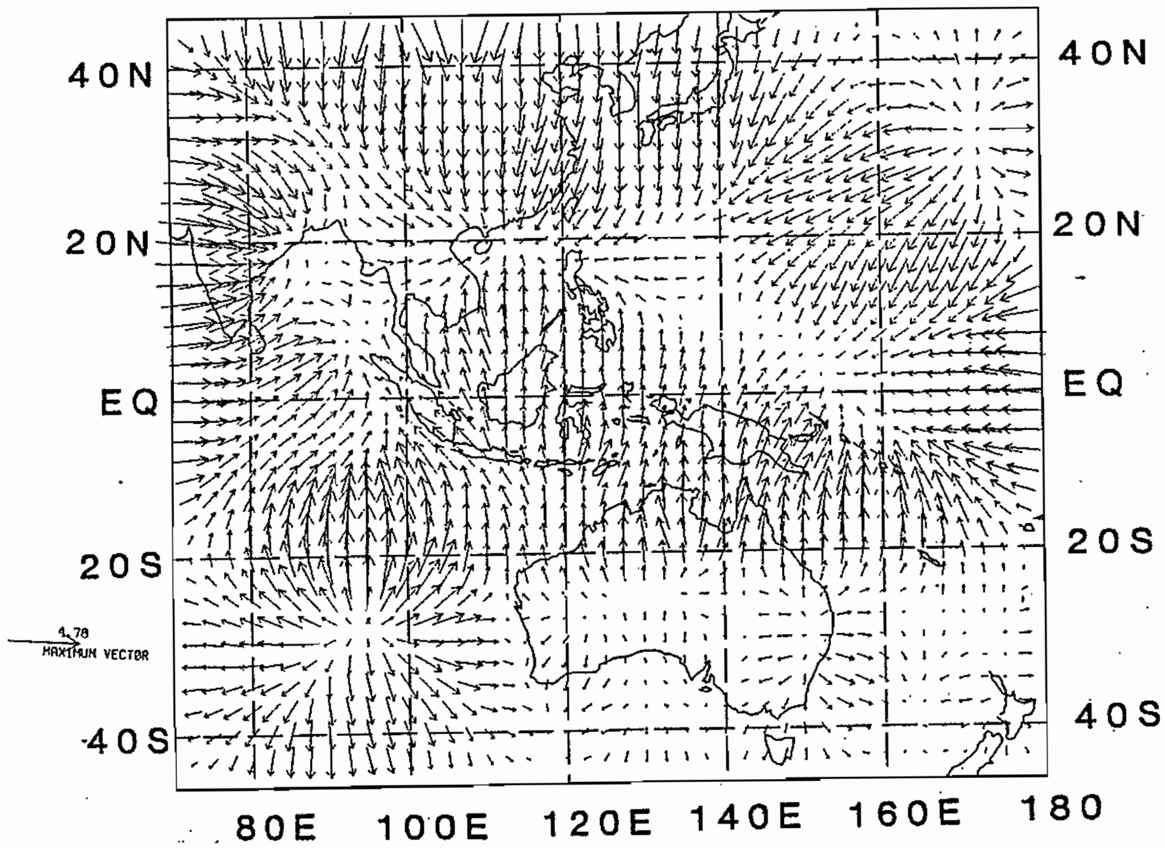

Fig. 14 MAY 1986 950 hPa DIVERGENT WIND.
(ARROW LENGTH INDICATES MAGNITUDE).

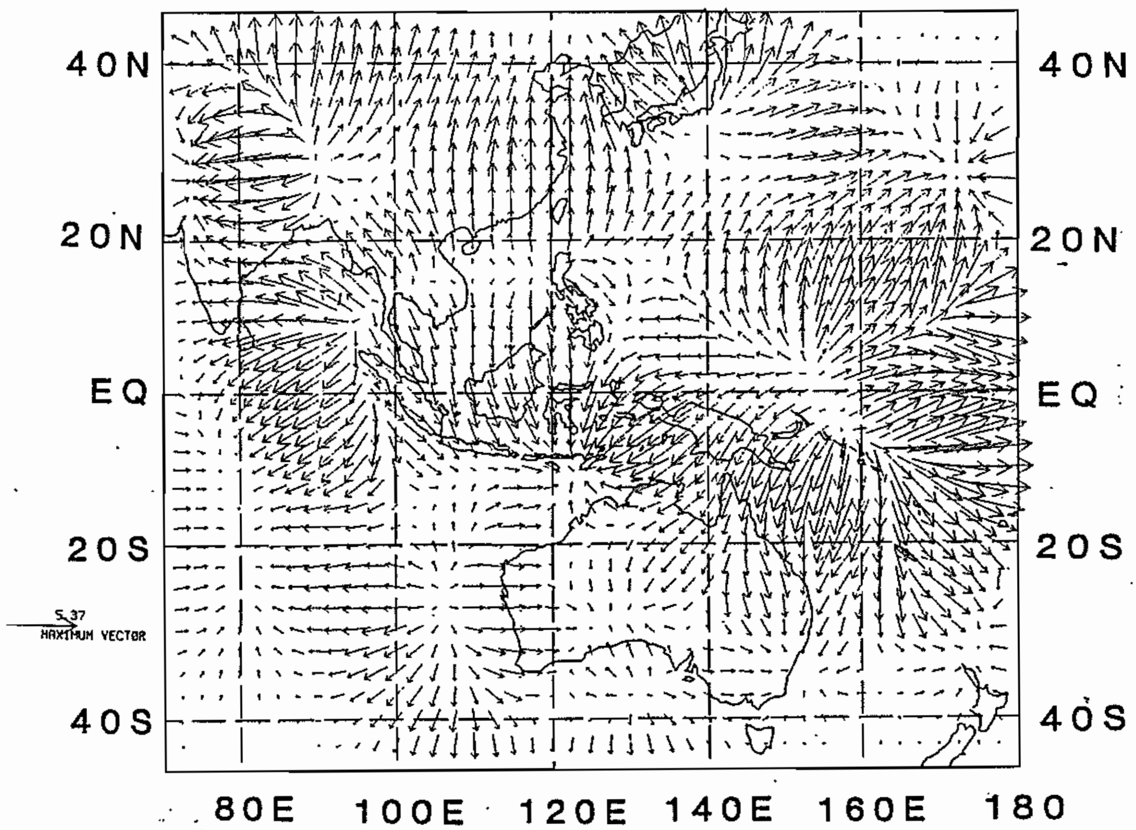

Fig. 15 MAY 1986 200 hPa DIVERGENT WIND.
(ARROW LENGTH INDICATES MAGNITUDE).

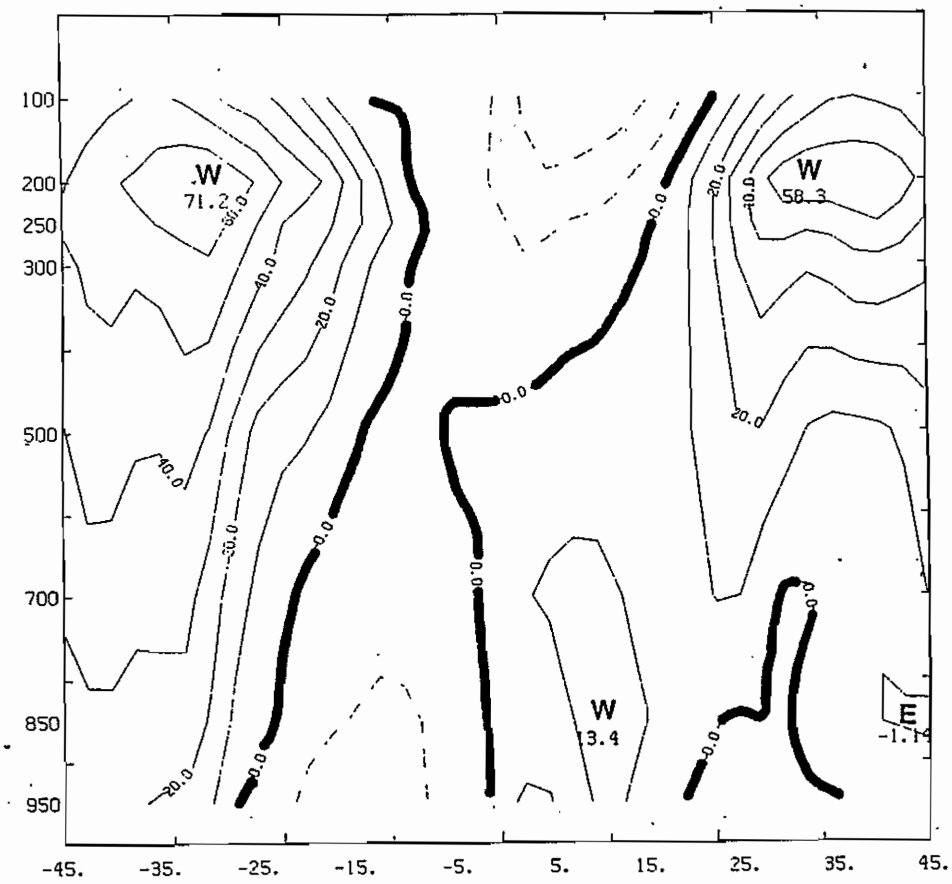

Fig. 16 MAY 1986 CROSS SECTION OF ZONAL WIND ALONG 100 DEG E (CONTOUR INTERVAL 10 KNOTS)

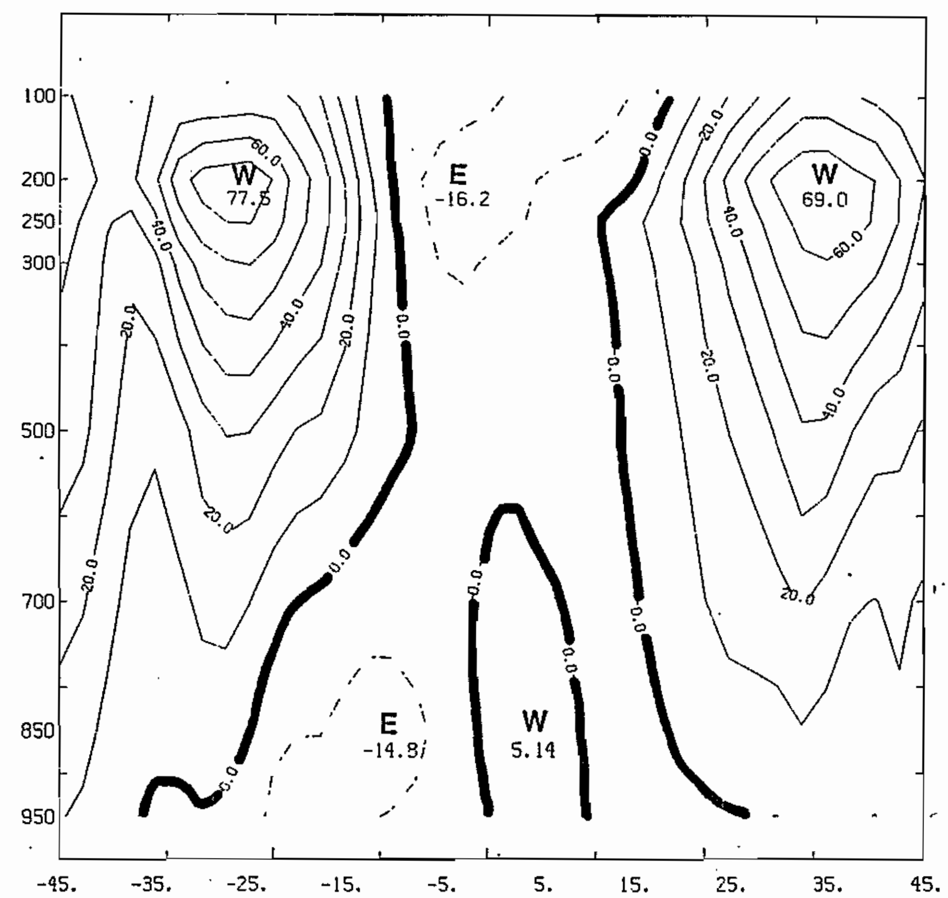

Fig. 17 MAY 1986 CROSS SECTION OF ZONAL WIND ALONG 130 DEG E (CONTOUR INTERVAL 10 KNOTS)

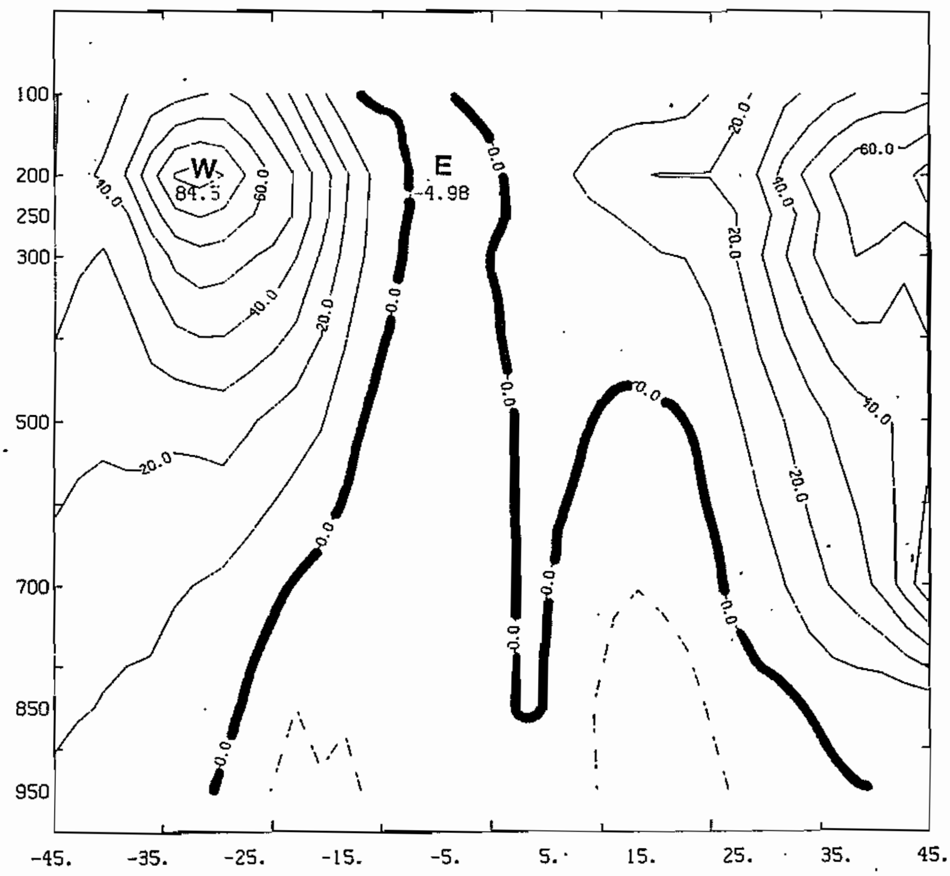

Fig. 18 MAY 1986 CROSS SECTION OF ZONAL WIND ALONG 160 DEG E (CONTOUR INTERVAL 10 KNOTS).

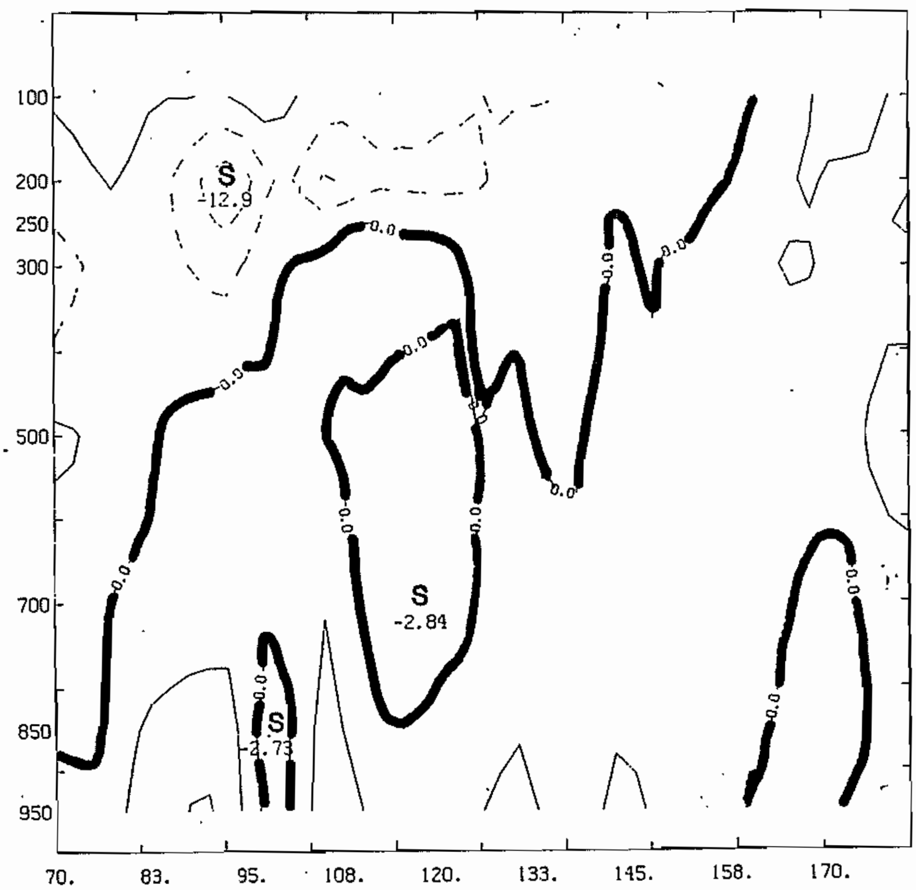

Fig. 19 MAY 1986 EQUATORIAL CROSS SECTION BETWEEN 70E and 180E (CONTOUR INTERVAL 5 KNOTS).

Explanatory Notes

1. **Darwin Tropical Diagnostic Statement** is a near real-time monthly diagnostic summary of the major tropical circulations within the Darwin Regional Specialised Meteorological Centre (RSMC) area of analysis responsibility, which covers 40°N-40°S, 70°E-180°. Caution does need to be exercised when quoting from this publication as not all information within it has been confirmed.

2. **Features** discussed generally include:

- El Niño - Southern Oscillation (ENSO) aspects
- Tropical cyclone (TC) occurrence
- Sea surface temperature (SST)
- Mean sea level pressure (MSLP).
- Lower and upper level wind
- Up-motion and convection
- Intra-seasonal variability

3. **Data sources:**

(i) SOI = 10 x(ΔP_{TAH} - ΔP_{DAR}) /σ

where ΔP_{TAH} =Tahiti (91938) monthly pressure anomaly (monthly mean minus 1933-1992 mean, averaging 3-hourly observations)

ΔP_{DAR} = Darwin (94120) monthly pressure anomaly (monthly mean minus 1933-1992 mean, averaging 0900, 1500LT observations)

σ = monthly deviation of the difference.

(ii) Operational tropical cyclone tracks based upon Darwin RSMC manual operational analyses. A tropical cyclone or cyclonic storm is defined as having mean wind > 17 ms^{-1} (34 kn) or a named system. Standard practice is to accept intensity and position as promulgated by the responsible warning agency, whenever possible. This may cause apparent discontinuities in intensity or track when cyclones cross warning area boundaries. Limited post analysis may sometimes be performed when warranted. A severe TC (equivalent to typhoon or hurricane) or very severe cyclonic storm is defined as having mean wind > 32 m s^{-1} (63 Kn).

(iii) Tropical cyclone climatology for the northwest Pacific and the south Indian and Pacific Oceans is based on *2004 Annual Tropical Cyclone Report*, by Atangan, J.F. and Preble, A., (2004), US Naval Pacific Meteorology and Oceanography Center/ Joint Typhoon Warning Center, Pearl Harbour, Hawaii, USA, (available at https://metoc.npmoc.navy.mil/jtwc/atcr/2004atcr/), which contains a climatology of 59 years. North Indian Ocean records are taken from WMO *Technical Document No. 430, Tropical Cyclone Report No.TCP-28* (Mandal, 1991), which contains a 99 year climatology.

(iv) SST analysis based on Darwin RSMC automated operational analyses (RSMC subset of the Australian National Meteorological and Oceanographic Centre (NMOC) global analysis: blended *in situ* and satellite data, 1°C resolution). The 1°x 1° global SST climatology from the US National Centers for Environmental Prediction (Reynolds and Smith 1995). A high resolution global sea surface temperature climatology, *J. Clim., 8,* 1571-1583 is used for the calculation of anomalies and as the default field for the analysis first guess.

(v) Mean MSLP, upper wind data, anomalies and velocity potential data from the Bureau of Meteorology's Global Assimilation and Prediction System (GASP - refer Bourke et al 1990. The BMRC global assimilation and prediction system. *ECMWF Seminar proceedings: Ten years of medium-range weather forecasting*, Sep 89) and NCEP2 22 year climatology, 1979-2000. MSLP anomaly analysis modified using CLIMAT messages.
Upper level equatorial cross section derived from Darwin RSMC real-time Tropical Limited Area Prediction Scheme (TLAPS - refer Puri et al, 1996, *BMRC Research Report No. 54, 41*).

(vi) The mean seasonal cycles for the Darwin 850 hPa wind components were constructed by averaging daily values over 39 years (1950 to 1988), each curve smoothed with 600 passes of a three day running mean weighted 1-2-1.

(vii) OLR time longitude plots and maps derived from the US National Oceanic and Atmospheric Administration.

4. **Some commonly-used acronyms:**

ISO	- Intra-seasonal oscillation
JMA	- Japan Meteorological Agency
JTWC	- Joint Typhoon Warning Center, Pearl Harbour
MT	- Monsoon trough
NET	- Near-equatorial trough
PAGASA	- Philippine Atmospheric, Geophysical and Astronomical Services
PNG	- Papua New Guinea
RSMC	- Darwin Regional Specialised Meteorological Centre (see note 1)
SCS	- South China Sea
SPCZ	- South Pacific convergence zone
STR	- Subtropical ridge
TD	- Tropical depression
TC	- Tropical cyclone (see note 3(ii))
STC	- Severe tropical cyclone
CS	- Cyclonic storm
VSCS	- Very severe cyclonic storm
TS	- Tropical storm (generally used for TC in northern Hemisphere sector)
TUTT	- tropical upper tropospheric trough

5. **Subscription rates** All costs in $AUSTRALIAN:

Annual subs.	Postage	Subs (incl postage)
95.50 (86.80 ex GST)	12.00 (Australia)	107.50
	24.00 (Asia/Pacific)	110.80
	36.00 (Rest of the world)	122.80

6. **For further details contact:**

The Regional Director,
Bureau of Meteorology,
PO Box 40050, Casuarina,
Northern Territory 0811 AUSTRALIA
Telephone: (International: 61) (08) 8920 3813
Fax: (International: 61) (08) 8920 3832
E-mail: climate.nt@bom.gov.au