DARWIN TROPICAL DIAGNOSTIC STATEMENT

December 2004

ISSUED BY DARWIN RSMC

SUMMARY

A combination of El Niño like and neutral ENSO conditions persisted during December. The El Niño like indicators included warm SST anomalies in the central Pacific and suppressed convection over the maritime continent. Neutral ENSO indicators include near average cloudiness over the central Pacific and near average trade flow over much of the tropical Pacific. The east Pacific cold tongue persisted close to climatology during the month. Thus the ENSO phase remained delicately balanced. A weak MJO, which developed during late November in the Indian Ocean, propagated through the maritime continent and a fresh active MJO event developed in the Indian Ocean during the second half of the month. Onset of the north Australian monsoon occurred late in the month. Three tropical cyclones developed in the region during the month while one, which formed in November, continued into the first week of December.

INDICES

Troup's Southern Oscillation Index (SOI) for December 2004	- 8
5-month mean (centred upon October)	- 6
Darwin mean MSL pressure for December 2004	1007.4 hPa
Pressure anomaly (1933 – 1992 mean)	0.0 hPa
Tahiti mean MSL pressure for December 2004	1009.3 hPa
Pressure anomaly (1933 – 1992 mean)	- 1.6 hPa

Time series of Troup's SOI:

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002	+3	+8	-5	-4	-14	-6	-8	-15	-8	-7	-6	-11
2003	-2	-7	-7	-5	-7	-12	+3	-2	-2	-2	-3	+10
2004	-12	+9	0	-15	+13	-14	-7	-8	-3	-4	-9	-8

The above table presents the monthly values of SOI from the year 2002. Fig.1 shows the monthly SOI and its five-month running mean for the past ten years.

The monthly SOI has remained negative for several months, but has been confined to within one standard deviation since July.

TROPICAL CYCLONES

[Fig. 2]

Three tropical cyclones developed in the RSMC area during December. One of them reached typhoon intensity and two developed in the southern Indian Ocean. Another system, Typhoon Nanmadol, formed during the end of November and continued into early December. In addition to these cyclones at least one tropical low formed over the Philippines but did not reach cyclone intensity. The climatological averages of cyclones for December are 1.3 for the northwest Pacific, 0.5 for the north Indian Ocean and 3.3 for the southern Indian and Pacific Oceans combined.

Typhoon Nanmadol *(The following text and the track appeared in the November issue)*

Typhoon Nanmadol formed during the end of November and continued into early December. It started off as a low on the 26th within the monsoon trough in the northwestern Pacific around 160°E and slowly drifted to 150°E on the 28th. Good low level convergence, weak vertical windshear and good upper level divergence helped the system to intensify and become a tropical storm by the 29th. It moved west northwest and became a typhoon on the 30th. It crossed the northern Philippines on the 2nd December and entered the South China Sea. After making landfall the system weakened and began recurvature on the 3rd of December, moving initially to the north and then to the northeast. On the 4th of December it just touched the southern tip of Taiwan and merged in a frontal system while undergoing transition to an extra tropical system. Media reports indicate several people were evacuated in the northern Philippines to reduce the loss of life after a tropical depression had caused extensive loss of life and property damage just before the approach of the typhoon.

Tropical Storm Talas

Tropical Storm Talas started off as a low in the near equatorial trough near 175°E in the northwestern Pacific on the 9th. It drifted west within the trough. With a favourable weak vertical wind shear and upper level divergence, it became a tropical storm on the 11th and continued to drift west along the mid-level steering flow associated with the STR to the north. The system did not greatly intensify, being a small system in strong steering flow and having suppressed outflow. It moved northwest and then north along the steering flow associated with a ridge to the east. As the system moved polewards, it began extratropical transition and entered a zone of strong vertical windshear. It became a low on the 19th and merged in an extratropical frontal system.

Tropical Storm Noru

This system was first analysed as a low on the 18th and soon after intensified to a tropical storm in the tropical northwestern Pacific. It tracked northwest and then north along the mid-level steering flow associated with a ridge to the northeast and changed its direction of movement to the northeast. As it moved further north, it weakened due to a strong vertical windshear and extratropical transition. It became a low on the 22nd and merged in a frontal system.

Severe Tropical Cyclone Chambo

Severe Tropical Cyclone Chambo appeared as a low in the southern Indian Ocean near-equatorial trough on the 18th and remained in the area for a while. Weak vertical windshear and good upper level divergence helped the system to intensify and become a tropical cyclone on the 24th. The system moved southwest along the steering flow associated with a ridge to the southeast and intensified to a

severe cyclone on the 25th. As the system moved southwest, it entered into unfavourable conditions for cyclone intensification such as cooler SSTs and strong vertical wind shear and weakened below severe tropical cyclone intensity on the 28th. It drifted further southwest and became a low on the 30th, then dissipated soon after.

SEA SURFACE TEMPERATURE

[Figs. 3a, 3b]

Warm SST anomalies between +0.5 and +1.0ºC dominated large areas within the equatorial oceans. The west Pacific warm pool remained focussed near the date line, though warm anomalies extended both eastwards and westwards during December. The large pool of warm sub-surface waters in the central Pacific that has been evident for several months weakened during December (outside of map coverage). Though this trend was previously considered consistent with a shift towards El Niño, other trends such as the east Pacific cool tongue close to the South American coast (not shown on the map) support the near neutral ENSO conditions. The northern Indian Ocean remained mostly warmer than normal.

MSL PRESSURE

[Figs. 4a, 4b]

Above average mean sea level pressures prevailed over most of the equatorial western Pacific and maritime continent except for a few equatorial areas close to the date line. Most of the tropical Indian Ocean experienced pressures lower than climatology. Negative pressure anomalies persisted to the north of the Philippines in the Northwestern Pacific where Typhoon Nanmadol passed over early in the month. In the southern extratropical regions, the pressures in the STR were weaker than normal giving rise to negative pressure anomalies in the southern Indian Ocean and Tasman Sea. However, pressures in the STR were mostly higher than average over Australian longitudes.

850 hPa FLOW

[Figs. 5a, 5b]

The near-equatorial trough remained close to the equator and extended almost the full length of the RSMC longitude range. The monsoon trough was well defined in the tropical southern Indian and Pacific oceans. The anomalies near the date line remained small. In the northern extratropics the STR remained stronger in the northwestern Pacific. In the southern STR there were stronger than normal meridional winds giving rise to anomalous troughs in the Indian Ocean and Tasman Sea as consistent with the pressure pattern.

200 hPa FLOW

[Figs 6a, 6b]

A stronger than normal easterly flow prevailed in the equatorial Pacific whilst over the equatorial Indian Ocean it was weaker than normal. In the extratropical regions, the STR's were dominated by propagating long waves giving rise to a more meridional flow than climatology. Patches of greater than 10 m/s anomalous wind were evident over most of Asia, consistent with below normal convection over the region. The southern hemisphere STR displaced northwards over Australia giving rise to patches of anomalous winds grater than 10 m/s over the region including the Australian continent.

VELOCITY POTENTIAL

[Figs 7a, 7b]

Velocity potential, which is a proxy for convergence, indicates a good vertical alignment of low-level convergence and upper level divergence associated with the near equatorial trough and the SPCZ region. The foci of implied vertical motion are located near the SPCZ and central Indian Ocean, rather than the maritime continent, implying a shift in the typical Walker circulation during the month.

OUT-GOING LONG-WAVE RADIATION (OLR)

[Figs 8a, 8b]

The OLR anomaly pattern for the month of December indicates active convection over the equatorial Indian Ocean and the South China Sea. Most of Australia and areas around PNG had less than average convection for the month. The above average convection in the northwestern Pacific matches with the areas of cyclone tracks in the region. The east coast of Australia and some areas in the SPCZ had above average convection for the month. Equatorial areas near the date line indicate less than average convection.

CROSS-EQUATORIAL INTERACTION

[Fig. 9]

The vertical cross-section of the meridional wind pattern across the equator is shown in figure 9. Above average northerly winds prevailed between 100 - 110°E in contrast to the climatological southerlies. Similarly, southerlies instead of northerlies persisted around 80°E. However, the upper levels indicate supporting return flow thus suggesting a good Hadley circulation in the region. The Hadley circulation was close to normal near the date line.

850 hPa WIND COMPONENTS AT DARWIN

[Figs. 10a, 10b]

Mostly northeasterly winds prevailed in Darwin during the first half of December. Southwesterlies dominated over the 3rd week with the strength of the winds increasing gradually until the 30th when they reached around 25 knots and turning northwesterly after the 27th. Though monsoon type of cloudiness / weather appeared over Darwin from the 23rd, rainfall remained contained until after Christmas. The onset of the monsoon over Northern Australia took place around the 27th, close to the climatological date of the 28th of December. The rainfall for the month was 236.8 mm. The median and mean rainfalls for the month of December are 215.0 mm and 247.8 mm respectively.

INTRA-SEASONAL VARIATIONS

[Figs. 11,12,13]

The active phase of Madden-Julian Oscillation [MJO] was evident about the eastern Indian Ocean late in the months of July, August and September. Each of these events propagated east across the Darwin RSMC longitude range (though the August event was quite weak). Enhanced convection again become apparent over the East Indian Ocean during late October and late November. Convection over the maritime continent subsequently increased during early December and propagated eastwards as a weak MJO event. Another pulse of active convection was apparent in the equatorial Indian Ocean during the second half of December. An active MJO and a westward propagating equatorial Rossby waves subsequently enhanced convection over much of northern Australia and contributed to the onset of monsoon rainfall during the last week of December. The propagation of this MJO pulse contributed to some active convection over the western Pacific and SPCZ.