



## 2011/12 Predictions of Seasonal Tropical Cyclone Activity in the Australian Region

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### 1. Introduction

Since the 2009/10 season, the Guy Carpenter Asia-Pacific Climate Impact Centre (GCACIC) at City University of Hong Kong has been issuing real-time predictions of the annual number of tropical cyclones (TCs) affecting the Australian region (90°E-160°E, 40°S-0°N) and its sub-regions (eastern Australian region, 135°E-160°E, 40°S-0°N and western Australian region, 90°E-135°E, 40°S-0°N). Hindcasts for the period of 1970-2008 have shown that the predictions are mostly correct within the error bars. These are all statistical predictions with predictors drawn from a large group of indices that represent the atmospheric and oceanographic conditions. The most prominent ones include the proxies for El Niño/Southern Oscillation (ENSO) and Indian Ocean Dipole (IOD). These should be considered to be experimental forecasts and verifications will be made after each season.

### 2. ENSO and IOD conditions in 2011/12

As an important determinant is the status of the ENSO condition, it is useful to have a discussion on the possible ENSO situation in 2011/12. A weak La Niña event has developed in the fall of 2011. SSTs remain cooler than normal in the central and eastern equatorial Pacific Ocean in October. The Niño3.4 and Niño4 indices in October are -0.97 and -0.72 respectively. A summary of the various ENSO model forecasts from different climate centres<sup>1</sup> suggests that

cold conditions may persist in the next 4 to 6 months. Based on observations and model forecasts, the La Niña event is expected to continue into the Southern Hemisphere summer.

**Table 1. Forecasts from various predictors and the weighted average of the forecasts.**

Annual number of tropical cyclones		
Entire Australian Region		
Predictor	Prediction	Weight
NINO4	18	0.82
TW	14	0.81
DMI	11	0.74
OLR	16	0.70
<b>Final forecast</b>	<b>15</b>	
<b>Normal</b>	<b>12-15</b>	
Western Australian Region		
Predictor	Prediction	Weight
NINO4	13	0.56
TW	11	0.66
DMI	7	0.53
OLR	11	0.74
<b>Final forecast</b>	<b>10</b>	
<b>Normal</b>	<b>9-10</b>	
Eastern Australian Region		
Predictor	Prediction	Weight
NINO4	8	0.61
TW	5	0.68
DMI	5	0.60
<b>Final forecast</b>	<b>6</b>	
<b>Normal</b>	<b>5-6</b>	
NINO4	Sea surface temperature anomalies in the NINO4 region (5°S-5°N, 160°E-150°W)	
TW	Trade wind index: mean 850-hPa zonal wind anomaly index over the West Pacific (5°S-5°N, 135°E-180°E)	
OLR	Outgoing long wave radiation (OLR) index near equator (160°E-160°W)	
DMI	Dipole mode index: difference in SST anomaly between tropical western Indian Ocean (60°E-80°E, 10°S-10°N) and tropical south-eastern Indian Ocean (90°E-110°E, 10°S-0°)	

<sup>1</sup> <http://www.bom.gov.au/climate/ahead/ENSO-summary.shtml>

A weak positive IOD event has developed, as suggested by the positive values of the Dipole Mode Index (DMI) in the last few months. Thus, ENSO and IOD will likely be the dominant factors affecting the TC activity in the Australian region during the 2011/12 season.

### 3. The predictions for 2011/12

For the entire Australian region, all the ENSO predictors (NINO4 index, trade wind index and OLR index) consistently forecast a near-normal to above-normal activity (ranging from 14 to 18) (Table 1). However, the IOD predictor suggests a below-normal TC activity (predicted number being 11), which is related to the observed weak positive IOD event in September and October. The final forecast is therefore for a near-normal TC activity (15 tropical cyclones) for this region.

A similar forecast is obtained for the western Australian region. The ENSO predictors suggest an above-normal TC activity, with the predicted numbers ranging from 11 to 13, but the IOD predictor gives a below-normal TC activity (predicted number being 7). Therefore, the final forecast is 10 tropical cyclones, which is near the normal number.

For the eastern Australian region, the trade wind index and the IOD predictor suggest a near-normal TC activity (predicted number being 5) while the NINO4 index gives an above-normal TC activity (predicted number being 8). The final forecast is 6 tropical cyclones affecting this region, which is near the normal number.

It should be noted that the sum of the TC numbers in the western and eastern Australian regions may not be equal to the TC number in the entire Australian region because some TCs may move through both the western and eastern Australian regions.

Thus, it is expected that the TC activity in the entire Australian region, the western Australian region and the eastern Australian region is likely to be near-normal. The quantitative predictions are given in Table 1.

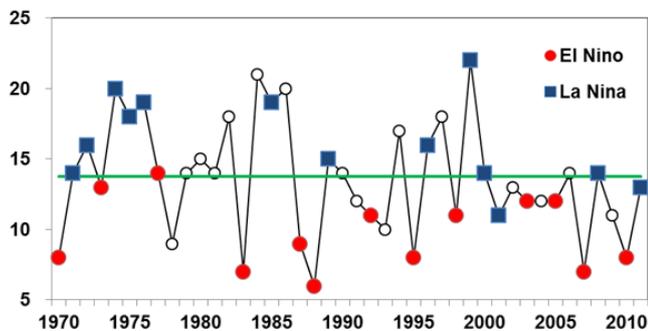
**Table 2. Annual number of tropical cyclones in the entire, western and eastern Australian regions in a La Niña year. Green and blue shadings indicate the above-normal and below-normal TC activity respectively.**

TC season with La Niña event	Entire Australian region (90°-160°E)	Western Australian region (90°-135°E)	Eastern Australian region (135°-160°E)
1970/1971	14	9	7
1971/1972	16	6	11
1973/1974	20	11	9
1974/1975	18	14	5
1975/1976	19	11	10
1984/1985	19	12	10
1988/1989	15	10	5
1995/1996	16	13	6
1998/1999	22	16	6
1999/2000	14	12	3
2000/2001	11	9	5
2007/2008	14	11	4
2010/2011	13	9	4

As a La Niña event has developed in 2011 (see section 2), it is useful to discuss the TC activity during previous La Niña years. Out of the 13 TC seasons associated with La Niña, 7 are associated with above-normal TC activity (TC number  $\geq 16$ ) and 5 are associated with normal TC activity (TC number between 12 and 15) in the entire Australian region (Table 2). Similar results are obtained for the western Australian region. Thus, the annual number of tropical cyclones tends to be normal or above-normal in the entire and western Australian regions. For the eastern Australian region, the enhancement of TC activity is less significant. The TC activity in the Australian region shows a decline in the recent decade (Fig. 1). In the last 12 years, all the TC seasons had near-

normal or below-normal TC activity, even for the four TC seasons associated with La Niña events (1999/2000, 2000/01, 2007/08 and 2010/11). Thus, the 2011/12 season (associated with a weak La Niña event) is expected to be not as active as other TC seasons associated with La Niña events, which are consistent with our forecasts.

**Fig. 1. Annual number of tropical cyclones in the entire Australian region between 1970 and 2011. The year 1970 denotes the TC season spanning from July 1969 to June 1970. The horizontal line indicates the climatological mean. Red circle and blue squares indicate the El Niño and La Niña years respectively.**



## Summary of predictions

	Annual number of tropical cyclones (with at least tropical depression intensity)	
	Forecast	Normal
Entire Australian region (90°E-160°E, 40°S-0°N)	<b>15</b> (near-normal)	12 - 15
Western Australian region (90°E-135°E, 40°S-0°N)	<b>10</b> (near-normal)	9 - 10
Eastern Australian region (135°E-160°E, 40°S-0°N)	<b>6</b> (near-normal)	5 - 6

## References

Liu, K. S. and J. C. L. Chan, 2010: Interannual variation of Southern Hemisphere tropical cyclone activity and seasonal forecast of tropical cyclone number in the Australian region. *Int'l J. Climatology*, DOI: 10.1002/joc.2259