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Research Brief 2010/06

2010/11 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 subregions (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 2010/11

As an important determinant is the status of the ENSO condition, it is useful to have a discussion on the possible ENSO situation in 2010/11. A La Niña event has developed in the summer of 2010. SSTs remain cooler than normal in the central and eastern equatorial Pacific Ocean in October. The Niño3.4 and Niño4 indices in October are -1.61 and -1.34 respectively. A summary of the various ENSO model forecasts from different climate centres[1] suggests that cold conditions persisting in the next 5 to 7 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	22	0.81
DMI	20	0.74
OLR	17	0.77
Final forecast	***19***	
Normal	***12-15***	
Western Australian Region		
Predictor	Prediction	Weight
NINO4	13	0.58
TW	14	0.72
DMI	16	0.56
OLR	14	0.82
Final forecast	***14***	
Normal	***9-10***	
Eastern Australian Region		
Predictor	Prediction	Weight
NINO4	8	0.60
TW	5	0.67
DMI	7	0.60
Final forecast	***7***	
Normal	***5-6***	

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°)

[1] http://www.bom.gov.au/climate/ahead/ENSO-summary.shtml

A possible negative IOD event is currently developing, as suggested by the negative 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 2010/11 season.

3. The predictions for 2010/11

For the entire Australian region, all the ENSO predictors (NINO4 index, trade wind index and OLR index) consistently forecast an above-normal activity (ranging from 17 to 22) (Table 1). The IOD predictor also suggests an above-normal TC activity (predicted number being 20), which is related to the observed negative IOD event in September and October. The final forecast is therefore for an above-normal TC activity (19 tropical cyclones) for this region.

A similar forecast is obtained for the western Australian region. The ENSO and IOD predictors suggest an above-normal TC activity, with the predicted numbers ranging from 13 to 16. Therefore, the final forecast is 14 tropical cyclones, which is above the normal number.

For the eastern Australian region, the NINO4 index and IOD predictor suggest an above-normal TC activity (ranging from 7 to 8) while the trade wind index gives a normal TC activity (predicted number being 5). The final forecast is 7 tropical cyclones affecting this region, which is slightly above 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 and the western Australian region is likely to be above-normal and a slightly above-normal TC activity is expected for the eastern Australian region. The quantitative predictions are given in Table 1.

As a La Niña event has developed in 2010 (see section 2), it is useful to discuss the TC activity during previous La Niña years. Out of the 12 TC seasons associated with La Niña, 7 are associated with above-normal TC activity (TC number ≥ 16) and 4 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. Therefore, the TC activity in the 2010/11 season will likely to be above normal in the entire and western Australian regions and slightly above normal or near-normal in the eastern Australian region, which are consistent with our forecasts.

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^{o}-160^{o}E)	Western Australian region (90^{o}-135^{o}E)	Eastern Australian region (135^{o}-160^{o}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

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)	**19** (above-normal)	12 - 15
Western Australian region (90°E-135°E, 40°S-0°N)	**14** (above-normal)	9 - 10
Eastern Australian region (135°E-160°E, 40°S-0°N)	**7** (slightly above-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. *International Journal of Climatology* (in press)