



# December Forecast Update for Australian-Region Tropical Storm Activity in 2006/7

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## Forecast Summary

**TSR continues to anticipate the 2006/7 Australian season will see activity approximately 20% below norm.**

The TSR (Tropical Storm Risk) early December forecast update for Australian-region tropical cyclone activity in 2006/7 continues to anticipate activity ~20% below average. The forecast spans the Australian season from the 1st November 2006 to the 30th April 2007 and is based on data available through the end of November 2006. Our main predictor is the actual anomaly in October-November Niño 4 sea surface temperatures (SST) which is above-average by 0.72°C. Since SSTs in this region are linked to vertical wind shear over the Australian region during Austral summer, an above-average Niño 4 SST indicates above-average wind shear and below-average tropical storm activity. Thus we expect Australian basin cyclone activity and landfalling numbers to be below-average in 2006/7.

## Australian Region Total Numbers Forecast for 2006/7

		ACE Index	Severe Tropical Cyclones	Tropical Storms
TSR Forecast ( $\pm$ FE)	2006/7	59 ( $\pm$ 37)	4.6 ( $\pm$ 2.0)	7.9 ( $\pm$ 3.0)
31yr Climate Norm ( $\pm$ SD)	1975/6-2005/6	83 ( $\pm$ 42)	5.7 ( $\pm$ 2.4)	10.6 ( $\pm$ 3.6)
Forecast Skill at this Lead	1975/6-2005/6	21%	28%	33%

Key: ACE Index	=	Accumulated Cyclone Energy Index = Sum of the Squares of 6-hourly Maximum Sustained Wind Speeds (in units of knots) for all Systems while they are at least Tropical Storm Strength. ACE Unit = $\times 10^4$ knots <sup>2</sup>
Severe Tropical Cyclone	=	1 Minute Sustained Wind > 63Kts = Hurricane Category 1 to 5.
Tropical Storm	=	1 Minute Sustained Wind > 33Kts.
SD	=	Standard Deviation.
FE (Forecast Error)	=	Standard Deviation of Errors in Simulated Real Time Forecasts 1975/6-2005/6.
Forecast Skill	=	Percentage Improvement in Mean Square Error Afforded by Cross-Validated Hindcasts 1975/6-2005/6 with 5-year block elimination over Hindcasts Made with the 1975/6-2005/6 Climate Norm.
Australian Region	=	Southern Hemisphere 100°E to 170°E (Storm Must Form as a Tropical Cyclone Within to Count).

- Very severe tropical cyclones (hurricane category 3-5) are not forecast due to data reliability problems in the historical record.
- Our Australian-region (100°E to 170°E), while slightly non-standard, is selected to provide the best overview for tropical cyclone activity around the whole of Australia.

There is only a 4% probability that Australian-region tropical storm numbers in 2006/7 will be above average (defined as more than 12 tropical storms), a 44% likelihood they will be near normal (defined as between 9 and 12 tropical storms) and a 52% chance they will be below normal (defined as less than 9 tropical storms). The 1975/6-2005/6 climatology probabilities for each category are 29% (above-normal), 36% (near-normal) and 35% (below-normal).

## Australian Landfalling Numbers in 2006/7

		Tropical Storms
TSR Forecast ( $\pm$ FE)	2006 /7	3.6 ( $\pm$ 2.0)
Average ( $\pm$ SD)	1975/6-2005/6	4.6 ( $\pm$ 2.1)
Forecast Skill at this Lead	1975/6-2005/6	13%

Key: Landfalling Region = Northern Australian coast from Perth around to Brisbane.

- Severe tropical cyclone strikes are not forecast due to their low occurrence rate and to their lack of correlation with tropical storm strike numbers.

There is only a 12% probability that Australian tropical storm strike numbers in 2006/7 will be above average (defined as more than 5 landfalling tropical storms), a 51% likelihood they will be near normal (defined as 4 or 5 landfalling tropical storms) and a 37% chance they will be below normal (defined as less than 4 landfalling tropical storms). The 1975/6-2005/6 climatology probabilities for each category are 32% (above-normal), 42% (near-normal) and 26% (below-normal).

## Predictors and Key Influences for 2006/7

Our model exploits the predictability of tropical SSTs. Anomalous patterns of SST are the primary source of tropical atmosphere forcing at seasonal and interannual timescales. The predictors in our model for Australian-region tropical storm numbers are:

1. The forecast October-November SST for the El Niño Southern Oscillation (ENSO) Niño 4 region 5°N-5°S, 150°W-160°E. (Main predictor for leads up to November).
2. The observed October-November SST for the Niño 4 region. (Main predictor for December forecast).

Australian severe tropical cyclone numbers are forecast from an ensemble of two separate severe tropical cyclone forecasts generated from (1) thinning from the total tropical storm numbers and (2) surface pressure anomaly in the region 5°S-12.5°S, 175°W-140°W.

Australian-region landfalling tropical storm numbers are forecast by thinning from the total tropical storm numbers.

The Niño 4 forecast comes from an in-house multi-ensemble extension of the Knaff and Landsea (1997) ENSO-CLIPER model (Lloyd-Hughes et al, 2004).

The key factor behind our forecast for Australian-region tropical storm activity in 2006/7 being ~20% below average is the anticipated suppressing effect of early austral summer SSTs in the Niño 4 region. Warmer than normal SSTs in this region lead to increased atmospheric vertical wind shear over the Australian region during Austral summer; a condition favouring reduced tropical storm activity. Our current SST anomaly (1975-2005 climatology) for October-November 2006 Niño 4 SST is 0.72°C.

## Further Information

Further information on the TSR forecast methodology and on TSR in general, may be obtained from the TSR website (<http://tropicalstormrisk.com>). This is the final TSR monthly forecast update for Australian-region tropical storm activity in 2006/7. A summary of the 2006/7 Australian tropical cyclone season and a verification of the TSR seasonal forecasts will be issued in early May 2007. The TSR first extended range forecast for Australian-region tropical storm activity in 2007/8 will be issued in early May 2007.

## Appendix - Predictions from Previous Months

### 1. Australian Region Total Numbers

#### a) Deterministic forecasts

<b>Australian Region Total Numbers 2006/7</b>				
		ACE Index	Severe Tropical Cyclones	Tropical Storms
Average Number ( $\pm$ SD) (1975/6-2005/6)		83 ( $\pm$ 42)	5.7 ( $\pm$ 2.4)	10.6 ( $\pm$ 3.6)
TSR Forecasts ( $\pm$ FE)	5 December 2006	59 ( $\pm$ 37)	4.6 ( $\pm$ 2.0)	7.9 ( $\pm$ 3.0)
	8 November 2006	59 ( $\pm$ 37)	4.4 ( $\pm$ 2.0)	8.3 ( $\pm$ 3.0)
	4 October 2006	59 ( $\pm$ 37)	4.6 ( $\pm$ 2.1)	7.6 ( $\pm$ 3.2)
	7 September 2006	59 ( $\pm$ 37)	4.9 ( $\pm$ 2.0)	8.1 ( $\pm$ 3.0)
	4 August 2006	-	5.8 ( $\pm$ 2.1)	9.3 ( $\pm$ 3.0)
	5 July 2006	-	5.5 ( $\pm$ 2.1)	9.0 ( $\pm$ 3.2)
	7 June 2006	-	5.7 ( $\pm$ 2.3)	9.9 ( $\pm$ 3.3)
	12 May 2006	-	5.6 ( $\pm$ 2.2)	10.0 ( $\pm$ 3.4)

#### b) Probabilistic forecasts

<b>Australian Region Tropical Storm Numbers 2006/7</b>				
		Tercile Probabilities		
		below normal	normal	above normal
Climatology 1975/6-2005/6		35	36	29
TSR Forecasts	5 December 2006	52	44	4
	8 November 2006	46	48	6
	4 October 2006	55	41	4
	7 September 2006	48	47	5
	4 August 2006	33	56	11
	5 July 2006	38	51	11
	7 June 2006	29	54	17
	12 May 2006	28	53	19

## 2. Australian Landfalling Numbers

### a) Deterministic forecasts

<b>Australian Landfalling Numbers 2006/7</b>		
		<b>Tropical Storms</b>
Average Number ( $\pm$ SD) (1975/6-2005/6)		4.6 ( $\pm$ 2.1)
TSR Forecasts ( $\pm$ FE)	5 December 2006	3.6 ( $\pm$ 2.0)
	8 November 2006	3.8 ( $\pm$ 2.0)
	4 October 2006	3.5 ( $\pm$ 2.0)
	7 September 2006	3.7 ( $\pm$ 1.9)
	4 August 2006	4.1 ( $\pm$ 2.0)
	5 July 2006	4.0 ( $\pm$ 2.0)
	7 June 2006	4.3 ( $\pm$ 2.0)
	12 May 2006	4.4 ( $\pm$ 2.0)

### b) Probabilistic forecasts

<b>Australian Landfalling Numbers 2006/7</b>				
		<b>Tercile Probabilities</b>		
		<b>below normal</b>	<b>normal</b>	<b>above normal</b>
Climatology 1975/6-2005/6		26	42	32
TSR Forecasts	5 December 2006	37	51	12
	8 November 2006	36	51	13
	4 October 2006	39	50	11
	7 September 2006	36	52	12
	4 August 2006	28	55	17
	5 July 2006	31	53	16
	7 June 2006	25	54	21
	12 May 2006	21	54	25

