# December Forecast Update for Australian-Region Tropical Storm Activity in 2009/10

## Issued: 4th December 2009

by Dr Adam Lea and Professor Mark Saunders
Aon Benfield UCL Hazard Research Centre, UCL (University College London), UK

## Forecast Summary

**TSR lowers its forecast further and anticipates Australian tropical cyclone activity in 2009/10 will be about 30% below-norm.**

The TSR (Tropical Storm Risk) early December forecast for Australian-region tropical cyclone activity in 2009/10 anticipates activity ~30% below the 1975/6-2008/9 climate norm. The forecast spans the Australian season from the 1st November 2009 to the 30th April 2010 and is based on data available through the end of November 2009. Our main predictor is the observed anomaly in October/November Niño 4 sea surface temperature (SST) which is warmer than average at 0.94°C. Since SSTs in this region are linked to vertical wind shear over the Australian region during Austral summer, 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 2009/10. The reason for the slight reduction in forecast Australian-region tropical cyclone activity is that Niño 4 SSTs have warmed by 0.17°C from October to November.

### Australian Region Total Numbers Forecast for 2009/10

| | | ACE Index | Severe Tropical Cyclones | Tropical Storms |
|---|---|---|---|---|
| TSR Forecast (±FE) | 2009/10 | 60 (±40) | 3.9 (±2.1) | 7.3 (±2.8) |
| 34yr Climate Norm (±SD) | 1975/6-2008/9 | 80 (±41) | 5.6 (±2.4) | 10.6 (±3.5) |
| Forecast Skill at this Lead | 1975/6-2008/9 | 7% | 17% | 34% |

Key: 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 1975/6-2008/9.
Forecast Skill = Percentage Improvement in Mean Square Error Afforded by Cross-Validated Hindcasts 1975/6-2008/9 with 5-year block elimination over Hindcasts Made with the 1975/6-2008/9 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 7% probability that Australian-region tropical storm numbers in 2009/10 will be above average (defined as more than 12 tropical storms), a 26% likelihood they will be near normal (defined as between 9 and 12 tropical storms) and a 67% chance they will be below normal (defined as less than 9 tropical storms). The 1975/6-2008/9 climatology probabilities for each category are 38% (above-normal), 30% (near-normal) and 32% (below-normal).

## Australian Landfalling Numbers in 2009/10

| | | Tropical Storms |
|---|---|---|
| TSR Forecast (±FE) | 2009/10 | 3.4 (±2.0) |
| Average (±SD) | 1975/6-2008/9 | 4.5 (±2.1) |
| Forecast Skill at this Lead | 1975/6-2008/9 | 5% |

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 a 15% probability that Australian tropical storm strike numbers in 2009/10 will be above average (defined as more than 5 landfalling tropical storms), a 33% likelihood they will be near normal (defined as 4 or 5 landfalling tropical storms) and a 52% chance they will be below normal (defined as less than 4 landfalling tropical storms). The 1975/6-2008/9 climatology probabilities for each category are 35% (above-normal), 41% (near-normal) and 24% (below-normal).

## Predictors and Key Influences for 2009/10

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$^{o}$N-5$^{o}$S, 150$^{o}$W-160$^{o}$E. (Main predictor for leads up to November).
2. The observed October SST for the Niño 4 region. (Main predictor for November forecast).
3. The observed October-November SST for the Niño 4 region. (Main predictor for December forecast).

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

Australian-region ACE index is forecast by thinning from the total severe tropical cyclone 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 2009/10 being below-average is the anticipated supressing effect of early austral summer SSTs in the Niño 4 region. Warmer than norm SSTs in this region lead to above-average atmospheric vertical wind shear over the Australian region during Austral summer; a condition favouring below-average tropical storm activity. The current SST anomaly (1975-2008 climatology) for October-November 2009 Niño 4 SST is 0.94$^{o}$.

## 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 2009/10. A summary of the 2009/10 Australian tropical cyclone season and a verification of the TSR seasonal forecasts will be issued in early May 2010. The TSR first extended range forecast for Australian-region tropical storm activity in 2010/11 will be issued in early May 2010.

## Appendix - Predictions from Previous Months

### 1. Australian Region Total Numbers

### a) Deterministic forecasts

| Australian Region Total Numbers 2009/10 | | | | |
|---|---|---|---|---|
| | | ACE Index | Severe Tropical Cyclones | Tropical Storms |
| Average Number (±SD) (1975/6-2008/9) | | 80 (±41) | 5.6 (±2.4) | 10.6 (±3.5) |
| TSR Forecasts (±FE) | 4 Dec 2009 | 60 (±40) | 3.9 (±2.1) | 7.3 (±2.8) |
| | 6 Nov 2009 | - | 4.2 (±2.1) | 7.9 (±2.8) |
| | 4 Sep 2009 | 75 (±37) | 4.4 (±2.1) | 8.2 (±2.8) |
| | 6 July 2009 | - | 4.4 (±2.2) | 8.2 (±3.1) |
| | 7 May 2009 | - | 5.3 (±2.3) | 9.8 (±3.3) |

### b) Probabilistic forecasts

| Australian Region Tropical Storm Numbers 2009/10 | | | | |
|---|---|---|---|---|
| | | Tercile Probabilities | | |
| | | below normal | normal | above normal |
| Climatology 1975/6-2008/9 | | 32 | 30 | 38 |
| TSR Forecasts | 4 Dec 2009 | 67 | 26 | 7 |
| | 6 Nov 2009 | 59 | 31 | 10 |
| | 4 Sep 2009 | 54 | 34 | 12 |
| | 6 July 2009 | 54 | 32 | 14 |
| | 7 May 2009 | 34 | 35 | 31 |

### 2. Australian Landfalling Numbers

### a) Deterministic forecasts

| Australian Landfalling Numbers 2009/10 | | |
|---|---|---|
| | | Tropical Storms |
| Average Number (±SD) (1975/6-2008/9) | | 4.5 (±2.1) |
| TSR Forecasts (±FE) | 4 Dec 2009 | 3.4 (±2.0) |
| | 6 Nov 2009 | 3.6 (±2.0) |
| | 4 Sep 2009 | 3.7 (±2.0) |
| | 6 July 2009 | 3.7 (±2.0) |
| | 7 May 2009 | 4.3 (±2.0) |

## b) Probabilistic forecasts

| Australian Landfalling Numbers 2009/10 | | | | |
|---|---|---|---|---|
| | | Tercile Probabilities | | |
| | | below normal | normal | above normal |
| Climatology 1975/6-2008/9 | | 31 | 44 | 25 |
| TSR Forecasts | 4 Dec 2009 | 52 | 33 | 15 |
| | 6 Nov 2009 | 48 | 35 | 17 |
| | 4 Sep 2009 | 46 | 36 | 18 |
| | 8 July 2009 | 45 | 36 | 19 |
| | 7 May 2009 | 34 | 38 | 28 |