

# SEASCAPES

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## Are tropical cyclones getting more intense?

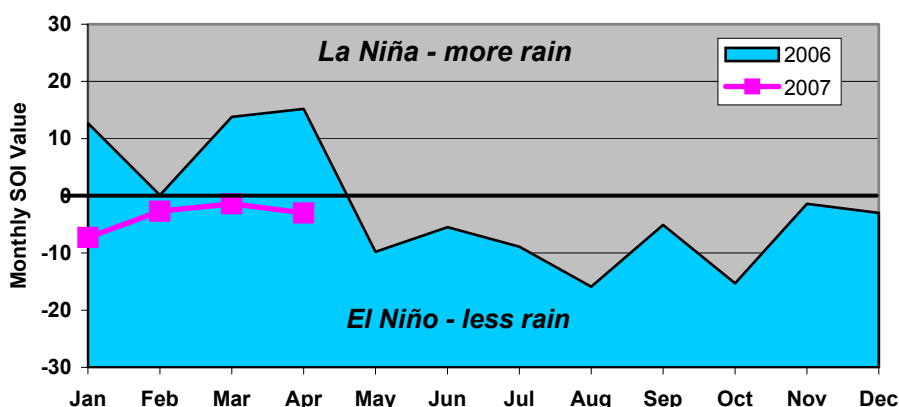
Tropical cyclones have and always will be a significant threat to life and property across northern Australia and, although their incidence on the QLD coast has been much reduced over the past two decades due to prolonged El Niño episodes, the WA coast has experienced an increase and it is highly likely that these potentially devastating storms will again impact some of our major centres of population in the near future. Cyclone Larry (a Category 4) was a sobering example of how quickly such a storm can appear, inflict enormous damage and essentially cripple an entire region for at least 12 months. The big question around the world in recent years has been - will potential "climate change" increase the intensity and/or frequency of occurrence of such devastating tropical cyclones?

Just in the past two years there has been a vigorous and sometimes acrimonious debate amongst the international tropical cyclone research community as to whether there is already evidence for an increasing trend in the intensity of tropical cyclones, potentially linked with climate change impacts. In 1998, the community was united in its assessment that some small increases might be expected over the next 50 to 100 years if the global air and sea temperatures continued to rise as predicted by many climate scientists. However, in a series of scientific papers published in 2005 (just before Hurricane Katrina devastated New Orleans and the USA experienced a record-breaking season), some of the same noted scientists highlighted alarming increases in the incidence of extreme tropical cyclones based on the analysis of global datasets collected over the past 30 years. How could this be - and is it true?

Over the past several years, Dr Bruce Harper of SEA has become a major participant in this debate through his involvement in assessing the accuracy of the historical tropical cyclone record, not just within Australia but also internationally. Based on his knowledge of the problems with the datasets that had been used for these recent analyses, Dr Harper joined with other colleagues, headed by Dr Chris Landsea from the NOAA National Hurricane Center in Miami, to question the veracity of these findings with a paper published in the journal *Science* last July (3). The issues raised in the paper were known to be supported by the majority of practising tropical cyclone forecasters and had gained increased acceptance by many researchers and academics over the past few years. Dr Harper had previously raised the issue of poor historical data quality at the American Meteorological Society's 26th Conference on Hurricanes and Tropical Meteorology (1) in Miami (2004) and also at the 27th Conference (2) in Monterey (2006). In spite of the rising awareness of data issues, some researchers continued to treat the datasets as being sufficiently reliable to detect

## La Niña could just be on the horizon

Could this be the beginning of the end of the present severe drought conditions across much of eastern Australia? After the "surprise" El Niño event of last year the monthly SOI (Southern Oscillation Index) has gradually edged its way back to the neutral zone. The SOI, which is simply ten times the ratio of the mean surface pressure between Darwin and Tahiti, has been shown to be a reasonable indicator of the El Southern Oscillation (ENSO) - a tendency for the Pacific Ocean sea surface temperatures (SSTs) to fluctuate from "warm" to "cool" over a number of months or years. If the SOI maintains a generally positive outlook there will likely be more cyclones than average next season. The chance of a La Niña developing during 2007, and in particular over the coming 2 to 3 months, continues to be significantly elevated above the long-term likelihood of around 20%.  
[Data and comments based on Bureau of Meteorology sources.]



(Continued on page 2)

## SEASCAPES

SEASCAPES features the developing risk assessment capabilities of Systems Engineering Australia Pty Ltd (SEA).

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trends in the incidence of intense tropical cyclones. However, at the World Meteorological Organisation's Sixth International Workshop on Tropical Cyclones held at Costa Rica in November 2006 (IWTC-VI) a consensus statement was issued that rejected the evidence for increasing intensities based on analyses of the historical dataset. Dr Harper was an active participant in this debate and helped frame a number of the recommendations ([http://www.wmo.int/web/arep/press\\_releases/2006/iwtc\\_summary.pdf](http://www.wmo.int/web/arep/press_releases/2006/iwtc_summary.pdf)).

In February this year, Dr Harper was privileged to be part of a team lead by Dr Jim Kossin from the University of Wisconsin who published the results of the first truly objective analysis of global tropical cyclone intensity trends (4) using all available satellite data from 1983 to 2005. The results based on 2000 storms over this 23 year period showed a cyclical behaviour (blue line below) in the relative percentage of very intense cyclones (2 x std-dev above the mean) compared with the stronger increasing trend (red line) previously proposed by others. While these results confirm that biases exist in the present (largely subjective) datasets from the agencies, and that the alarmist predictions have been misguided, the question of climate change impact is still somewhat open for the future. As the IWTC-VI consensus view stated "It is likely that some increase in tropical cyclone peak wind-speed and rainfall will occur if the climate continues to warm. Model studies and theory project a 3-5% increase in wind-speed per degree Celsius increase of tropical sea surface temperatures." The US/Atlantic basin is the only region that shows a significant increase over the 23 year period.

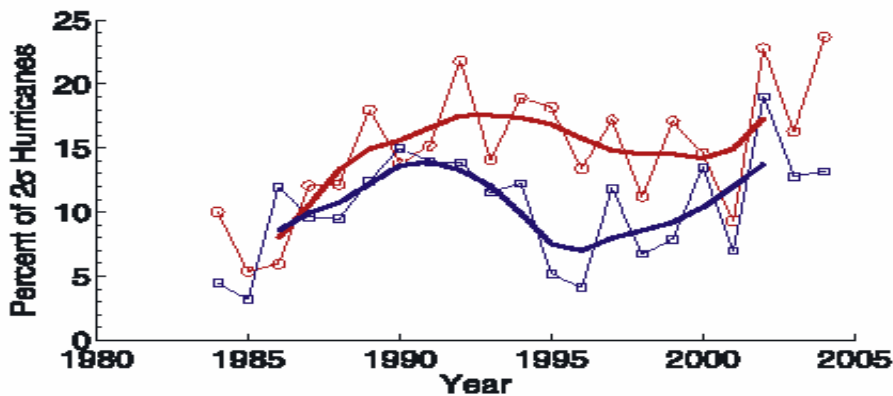


Figure 3c of Kossin et al. (2007) showing the global variation in very intense tropical cyclones as a percentage of all cyclones. The thin lines are annual values while the thick lines are smoothed. Red lines are based on largely subjective estimates of intensity made by forecasting agencies, while blue lines are derived from the new objective technique.

## References:

- 1 Harper B.A., *Globalisation, Calibration and Opportunities for Enhancement of the Dvorak Technique*, 30 yr of the Dvorak Technique Special Session, *American Meteorological Society, Proc 26<sup>th</sup> Conf Hurricanes and Tropical Meteorology*, Miami, May, 218-219, 2004.
- 2 Harper B.A. and Callaghan J., *On the importance of reviewing historical tropical cyclone intensities*. *American Meteorological Society, Proc 27<sup>th</sup> Conf Hurricanes and Trop Meteorology*, Monterey, 2C.1, April, 2006.
- 3 Landsea, C.W., B. A. Harper, K. Hoarau, and J. Knaff, *Can we detect trends in extreme tropical cyclones?* *Science*, Vol 313, 28 July 2006, (10.1126/science.1128448).
- 4 Kossin, J. P., K. R. Knapp, D. J. Vimont, R. J. Murnane, and B. A. Harper, *A globally consistent reanalysis of hurricane variability and trends*, *Geophys. Res. Lett.*, 34, L04815, doi:10.1029/2006GL028836, 2007.

## Workshops:

SEA's Dr Bruce Harper continued his active local and international participation in several scientific meetings and workshops over the past 6 months:

- *WMO Sixth International Workshop on Tropical Cyclones*, San Jose, Costa Rica, 21 - 30 Nov 2006 (IWTC-VI) and TCP Expert Meeting;
- *Workshop on Priorities for Climate Change Research linked to Tropical Cyclones*. Bureau of Meteorology Research Centre, Melbourne, 8 Dec 2006.
- *Storm Surge Risk: Vulnerability of Queensland Coastal Communities*. Coastal Cities Natural Disasters Conference, Communique Australia, Sydney, 20 Feb 2007.
- *Wind Vulnerability Research Workshop #2*. Geoscience Australia, James Cook University, 22 - 23 Feb 2007.
- *Workshop on Tropical Cyclones: Building Design and Regulation*, Northern Territory Government, Darwin, 19 - 20 April 2007.

### Some of the SEA Clients:

#### Coastal and Ocean Hazards:

- Woodside Energy Ltd, WA
- Dept Natural Resources, VIC
- Dept Natural Res. and Mines, QLD
- EPA, QLD
- Dept Infrastructure Planning and Natural Resources, NSW
- Commonwealth Dept of Transport and Regional Services
- GHD Pty Ltd
- Bureau of Meteorology
- Kvaerner E&C Australia
- McConnell Dowell

#### Multi-Hazard Studies:

- Dept Emergency Services, QLD
- Bureau of Meteorology / GA

#### Tropical Cyclone Risks:

- Willis Re
- RACQ Insurance
- CGU Insurance
- Suncorp Metway Insurance
- IAG
- Powerlink Queensland
- Geoscience Australia
- CSIRO Atmospheric Research
- Risk Management Solutions

#### Severe Thunderstorm Risks:

- Suncorp Metway Insurance
- Macquarie University, NHRC
- Powerlink Queensland

#### Flood Risks:

- RACQ Insurance, QLD

#### Research:

- Risk Prediction Initiative, Bermuda.
- James Cook University CTS

#### Guidelines:

- World Meteorological Organisation
- Engineers Australia

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