



Summary of 2003 NW Pacific Typhoon Season and Verification of Authors' Seasonal Forecasts

Issued: 12th January 2004

by Drs Mark Saunders and Adam Lea
Benfield Hazard Research Centre, UCL (University College London), UK.

Summary

Activity overall was slightly above average in 2003. The total accumulated cyclone energy (ACE) index was 10% above norm. Intense typhoon numbers were above average, typhoon numbers were close to average and tropical storm numbers were below average. The TSR seasonal forecasts proved successful, anticipating average or slightly above average overall activity at all leads from early March.

The Tropical Storm Risk (TSR) consortium presents a validation of their seasonal forecasts for the NW Pacific total ACE index, and for tropical storm, typhoon and intense typhoon numbers in 2003. These forecasts were issued monthly from 5th March 2003 to 5th August 2003 and refer to activity over the full NW Pacific typhoon season from 1st January to 31st December 2003. The TSR forecasts were all correct to within 1-standard error of the observed results. They accurately predicted the total ACE index, typhoon and intense typhoon numbers at all leads but overpredicted the number of tropical storms. The April and August forecasts proved the best overall.

Features of the 2003 NW Pacific Season

- The 2003 NW Pacific tropical cyclone season featured an ACE index of 322×10^4 knots², 23 tropical storms with 17 of these being typhoons and 10 of these intense typhoons. This compares to 1973-2002 climatologies of 285×10^4 knots², 26.7, 16.6 and 8.0 respectively.
- Typhoon Maemi struck South Korea on the 12th September as a category 3 typhoon with sustained winds of 125 mph. Maemi killed 118 people and caused economic and insured damages of US\$ 4.5 billion and US\$ 0.5 billion respectively. 2003 is the second year in succession that South Korea has been struck by a devastating typhoon.
- Typhoon Dujuan struck China's Guangdong province (brushing Hong Kong) on the 2nd September as a category 1 typhoon with sustained winds of 90 mph. Dujuan killed 36 people and was the worst typhoon to hit the Guangdong province in 24 years. The direct economic losses due to the typhoon are estimated at US\$ 241 million.



NW Pacific Tropical Storm Catalogue 2003

Individual Storm Summary 2003				
No.	Name	Dates	Peak Wind (kts)	Typhoon Category
1	Yanyan	18-21 Jan	50	-
2	Kujira	09-25 Apr	130	4
3	03W	17-20 May	35	-
4	Chan-Hom	19-27 May	115	4
5	Linfa	25-30 May	60	-
6	Nangka	01-03 Jun	50	-
7	Soudelor	11-19 Jun	115	4
8	Imbudo	16-24 Jul	130	4
9	Koni	18-22 Jul	65	1
10	Morakot	01-05 Aug	65	1
11	Etau	03-09 Aug	110	3
12	Krovanh	15-25 Aug	90	2
13	Vamco	19-20 Aug	35	-
14	Dujuan	30 Aug-03 Sep	125	4
15	Maemi	05-13 Sep	150	5
16	Choi-Wan	17-22 Sep	95	2
17	Koppu	24-30 Sep	80	1
18	Ketsana	18-26 Oct	125	4
19	Parma	20-31 Oct	130	4
20	Melor	30 Oct-04 Nov	75	1
21	Nepartak	13-19 Nov	75	1
22	Lupit	19 Nov-01 Dec	145	5
23	27W	02-11 Dec	35	-

The NW Pacific tropical storms observed in 2003 and their associated peak 1-minute sustained windspeeds are verified using the following data sources: the Joint Typhoon Warning Center best track data, Gary Padgett's monthly global tropical cyclone summaries issued through the tropical storms mailing list at *tropical-storms@tstorms.org* and Julian Heming's Met Office tropical cyclone website (<http://www.met-office.gov.uk/sec2/sec2cyclone/tcver.html>).

Definitions

The Accumulated Cyclone Energy (ACE) index is our measure of basin overall activity. The ACE index was developed originally by NOAA to assess North Atlantic basin tropical cyclone activity. The ACE index is calculated as the 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. The ACE index unit is $\times 10^4$ knots². Since the total ACE index reflects a combination of intensity and duration of all NW Pacific tropical storm systems during a given season it is a better measure of basin 'overall activity' than the individual number of storms and typhoons.

Storm Strength Definitions				
Tropical Storm Type	Category	Peak 1-Min Sustained Wind		Minimum Pressure (mb)
		knots	mph	
Tropical Storm	TS	34-63	39-73	-
Typhoon	1	64-82	74-95	>980
Typhoon	2	83-95	96-110	965-980
Typhoon*	3	96-113	111-130	945-965
Typhoon*	4	114-135	131-155	920-945
Super Typhoon*	5	>135	>155	<920

* Denotes Intense Typhoon Strength (Category 3 and Above)

Verification of Forecasts

NW Pacific Total Numbers and ACE Index

NW Pacific Total Numbers and ACE Index in 2003					
		ACE Index ($\times 10^4$ knots ²)	Tropical Storms	Typhoons	Intense Typhoons
Average Number (\pm SD) (1993-2002)		300 (\pm 113)	27.8 (\pm 5.0)	17.2 (\pm 4.7)	9.1 (\pm 3.2)
Average Number (\pm SD) (1973-2002)		285 (\pm 97)	26.7 (\pm 4.3)	16.6 (\pm 3.7)	8.0 (\pm 3.0)
Actual Number 2003		322	23	17	10
TSR Forecasts (\pm FE)	5 Aug 2003	331 (\pm 75)	27.0 (\pm 4.6)	17.5 (\pm 3.8)	9.6 (\pm 1.8)
	4 July 2003	299 (\pm 85)	26.3 (\pm 4.9)	16.7 (\pm 4.1)	8.6 (\pm 2.1)
	10 June 2003	275 (\pm 89)	25.8 (\pm 4.8)	16.1 (\pm 4.1)	7.9 (\pm 2.3)
	6 May 2003	284 (\pm 84)	26.0 (\pm 4.9)	16.3 (\pm 4.1)	8.2 (\pm 2.3)
	11 Apr 2003	318 (\pm 102)	26.7 (\pm 5.1)	17.1 (\pm 4.5)	9.2 (\pm 2.9)
	5 Mar 2003	297 (\pm 100)	26.2 (\pm 5.1)	16.6 (\pm 4.5)	8.5 (\pm 2.9)
Chan Forecasts (\pm SD)	24 June 2003	-	26 (\pm 3)	15 (\pm 2)	-
	24 Apr 2003	-	26 (\pm 3)	16 (\pm 2)	-

- 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 = $\times 10^4$ knots².
- Intense Typhoon = 1 Minute Sustained Wind > 95Kts = Hurricane Category 3 to 5.
- Typhoon = 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 Replicated Real Time Forecasts 1993-2002

In 2003, the NW Pacific accumulated tropical cyclone wind energy (ACE Index) was 13% (7%) higher than the prior 30-year (10-year) climate norms. This slightly above average overall activity arose from the number of intense typhoons being slightly above normal. Typhoon numbers were close to average and tropical storm numbers were somewhat below average. The

TSR forecasts were all correct to within 1-standard error of the observed results. They accurately predicted the total ACE index, typhoon and intense typhoon numbers at all leads but overpredicted the number of tropical storms. The April and August forecasts proved the best overall.

The seasonal predictions by Chan/University of Hong Kong were marginally better than TSR for tropical storm numbers but TSR outperformed Chan in predicting typhoon numbers. Chan does not forecast intense typhoon numbers and thus did not anticipate the slightly above average overall activity. Further details on the Chan forecasts may be obtained from http://aposf02.cityu.edu.hk/tc_forecast.

Environmental Factors in 2003

The principle of sound seasonal forecasting of NW Pacific typhoon activity is to forecast the key environmental conditions at the height of the NW Pacific typhoon season. We find that the most important contemporaneous factor influencing the overall activity of the NW Pacific typhoon season is the August-September (AS) Niño 4 SST [region 150°W-160°E, 5°S-5°N]. The Table below verifies our forecasts of this predictor.

Predictor Forecasts 2003		
		AS Niño 4 SST (°C)
Actual Value 2003 (1973-2002 Anomaly)		0.42
TSR Forecasts (±FE)	5 Aug 2003	0.31 (±0.15)
	4 July 2003	0.03 (±0.24)
	10 June 2003	-0.17 (±0.29)
	6 May 2003	-0.09 (±0.30)
	11 Apr 2003	0.20 (±0.39)
	5 Mar 2003	0.01 (±0.42)

Four of the six TSR AS Niño 4 forecasts were skillful compared to climatology with accuracy greatest for the shortest lead (August) forecast. The forecasts from May to July underpredicted the actual value by more than one standard forecast error. This resulted in a slight underprediction of intense typhoon numbers and of the total ACE index at these leads.

Future Forecasts and Verifications

1. The TSR extended range forecast for the 2004 NW Pacific typhoon season will be issued in early March 2004 followed by monthly forecast updates through to early August.
2. The extended-range forecast for Australian-region tropical storm activity in 2004/05 will be issued in April 2004 followed by monthly updates through to early December 2004. An end-of-season summary for the 2003/04 Australian-region tropical storm season will be released in May 2004.

Tropical Storm Risk.com (TSR)

Tropical Storm Risk.com (TSR) is a venture which has developed from the UK government-supported TSUNAMI initiative project on seasonal tropical cyclone prediction. The TSR consortium comprises experts on insurance, risk management and seasonal climate forecasting. The TSR industry expertise is drawn from *Benfield*, the leading independent reinsurance intermediary, *Royal & SunAlliance*, the global insurance group, and from *Crawford & Company*, a global claims management solutions company. The TSR scientific grouping brings together climate physicists, meteorologists and statisticians at *UCL* (University College London) and the *Met Office*. TSR forecasts are available from <http://tropicalstormrisk.com>.

Acknowledgements

We thank David Simmons (Benfield), Alan Fowler (Royal & SunAlliance) and Jonathan Clark (Crawford & Company) for industrial liaison. We acknowledge web-site assistance by Frank Roberts (UCL).