



Summary of the 2000 NW Pacific Typhoon Season and Verification of Authors' Seasonal Forecasts

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Executive Summary

**A year with slightly below average activity predicted precisely
for basin numbers and for Japan strike numbers**

The *Tropical Storm Risk* (TSR) consortium presents a validation of their pre-season NW Pacific forecast for tropical storm, typhoon and intense typhoon numbers, and for Japanese tropical storm and typhoon strike numbers. Issued on the 26th May 2000, the pre-season forecast covered the entire NW Pacific typhoon season from 1 January 2000 to 31 December 2000. We show that the mean forecast values were all within 1-standard error of the observed totals, and for tropical storms, typhoons, intense typhoons, and Japanese landfalling typhoons, the forecasts were exactly correct.

Features of the 2000 NW Pacific Season

- The 2000 NW Pacific typhoon season was slightly below average with 25 tropical storms, 14 typhoons and 7 intense typhoons. These figures compare to the 1971-2000 climatology values of 27.2, 17.0 and 8.2 respectively. It was the 3rd consecutive year with below average activity.
- Japan was affected by 4 tropical storms, 2 of which were of typhoon strength. Typhoon Saomai caused the most damage, producing record rainfall (23 inches in 24 hours at Nagoya) and considerable flooding. It was the 2nd consecutive year with below average tropical storm strikes on Japan.
- Super typhoon Saomai which affected Guam, Japan and Korea, was the most damaging of the NW Pacific 2000 storms causing economic losses of at least \$US 1.3bn and insured losses of US \$925m [Munich Re, 2000].
- Taiwan was hit by 3 typhoons (twice its average), with super typhoon Bilis causing economic losses of US \$100m [Munich Re, 2000].



2000 Individual Storm Summary

No.	Name	Dates	Peak Wind (kts)	Typhoon Category	Category at Japan Landfall
1	Damrey	05-12 May	155	5	
2	Longwang	18-19 May	40	-	
3	Kirogi	02-08 Jul	115	4	1
4	Kai-Tak	04-10 Jul	75	1	
5	Tembin	17-21 Jul	45	-	
6	Bolaven	24-30 Jul	50	-	TS
7	Chanchu	28-29 Jul	40	-	
8	Jelawat	01-11 Aug	125	4	
9	Ewiniar	09-18 Aug	75	1	
10	Bilis	18-24 Aug	140	5	
11	Kaemi	20-22 Aug	45	-	
12	Prapiroon	26 Aug-01 Sep	85	2	
13	Maria	28 Aug-01 Sep	55	-	
14	Saomai	03-16 Sep	140	5	1
15	Wukong	05-10 Sep	95	2	
16	Bopha	05-11 Sep	55	-	
17	Sonamu	14 Sep	75	1	
18	Shanshan	17-24 Sep	130	4	
19	27W	28-30 Sep	35	-	
20	28W	06-12 Oct	35	-	
21	Yagi	22-27 Oct	105	3	
22	Xangsane	25 Oct-01 Nov	90	2	TS
23	Bebinca	01-06 Nov	90	2	
24	Rumbia	28 Nov-06 Dec	50	-	
25	Soulik	29-31 Dec	55	-	

(See page 4 for definitions of Japan landfall and typhoon category)

Verification of Forecasts

1. NW Pacific Total Numbers

NW Pacific Total Numbers 2000			
	Tropical Storms	Typhoons	Intense Typhoons
Average Number (\pm SD) (1971-2000)	27.2 (\pm4.6)	17.0 (\pm4.1)	8.2 (\pm3.4)
Actual Number 2000	25	14	7
TSR Forecast (\pm SD) 26 May 2000	25.3 (\pm3.2)	14.1 (\pm2.5)	7.0 (\pm2.2)
Chan Forecast (\pm SD) End June 2000	28 (\pm3)	16 (\pm2)	-

The numbers of tropical storms (25), typhoons (14), and intense typhoons (7) were all correctly forecast. Chan's team at the University of Hong Kong slightly over-predicted the number of tropical storms and typhoons by 12% and 14% respectively (see http://aposf02.cityu.edu.hk/~mcg/tc_forecast/forecast.htm for details).

2. Japan Landfalling Numbers

Japan Landfalling Numbers 2000		
	Tropical Storms	Typhoons
Average Number (\pm SD) (1971-2000)	4.1 (\pm1.7)	2.5 (\pm1.5)
Actual Number 2000	4	2
TSR Forecast (\pm SD) 26 May 2000	3.1 (\pm1.8)	1.8 (\pm1.4)

The number of Japanese landfalling typhoons (2) was correctly forecast whilst the number of tropical storm strikes (4) was under-predicted by 1. Overall, the TSR 2000 Pre-Season forecasts for NW Pacific and Japanese landfalling typhoons were very successful.

Definitions

In accordance with the definition in Chapter 1 of the *Global Guide to Tropical Cyclone Forecasting*, World Meteorological Organisation Report No. 560 (1993), the NW Pacific basin is defined, as the northern hemisphere region west of 180°E. The windspeed assigned to a given storm is the highest 1-minute sustained windspeed achieved within this region, irrespective of whether the storm first develops in the East or West Pacific. Windspeeds are converted to typhoon categories based on the thresholds given in the table overleaf.

Our forecasts are validated using Joint Typhoon Warning Center (JTWC) track data obtained from the Unisys Website (<http://weather.unisys.com/hurricane/index.html>). Position and maximum windspeeds are supplied at 6-hour time intervals. We interpolate these to 12-minute intervals.

Definitions				
Tropical Cyclone Type	Category	Peak 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)

Landfalling events are defined as the maximum 1-minute sustained windspeed of a storm coming within 140km of land. (This definition accounts for the fact that the radius of damaging winds typically extends out from a storm centre to 140km). We define Japan as the islands north of 31°N.

Potential Benefits

Tropical cyclones are the most costly and deadly natural disaster affecting much of Japan, South Korea, Taiwan, the Philippines, and coastal areas in other southeast Asian countries. The annual damage bill and fatality rate from tropical cyclone impacts in southeast Asia 1990-1998 averages respectively US \$3.3 billion (2000 \$) per year and 740 deaths [information from Munich Re]. Skilful long-range forecasts of seasonal tropical cyclone strikes on Japan would benefit society, business and government by reducing - through the available lead-time - the risk, uncertainty and the financial volatility inherent to varying active and inactive storm seasons

Future Forecasts and Verifications

1. End-of-year summary and forecast verification for the Atlantic 2000 season will be issued shortly.
2. Extended-range forecast for NW Pacific and Japan landfalling tropical cyclone activity in 2001 will be issued at the end of January 2001.

Tropical Storm Risk.com (TSR)

TropicalStormRisk.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 leading UK insurance industry experts and scientists at the forefront of seasonal forecasting. The *TSR* insurance expertise is drawn from the UK composite and life company *CGNU Group*, the *Royal and Sun Alliance* insurance company, and *Benfield Greig*, a leading independent global reinsurance and risk advisory group. 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>.

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