

GUY CARPENTER

Tropical Cyclone Review 2002



January 30, 2003

Executive Summary

Through the CAT-i service, Guy Carpenter Instrat provided more than 50 bulletins to 1000 subscribers on tropical cyclones and associated losses in the North Atlantic, the North East Pacific and the North West Pacific basins. This report provides a summary of events for the 2002 hurricane/typhoon seasons.

Figure 1: Location of Basins



North Atlantic

The North Atlantic hurricane season formally begins on 1st June and finishes on 30th November with peak activity occurring in early to mid September. The 2002 season got off to a slow start with the first hurricane (hurricane Gustav) reaching hurricane status on 11th September 2002. This is the latest date for the appearance of the first hurricane of the season since 1941. By the end of the season overall activity was above normal, with 12 named storms compared to an average of 10 named storms (based on data between 1972–2001¹). However, many storms were weak and short-lived. There were only 4 storms that reached hurricane status compared to an average of 6 (based on data between 1972–2001¹). There were also 2 tropical depressions.

In 2002 the number of major hurricanes (category 3 and above on the Saffir-Simpson scale) was average¹ but there were no super hurricanes (category 5 on the Saffir-Simpson scale). The two major hurricanes were named Lili and Isidore and these storms caused the largest insured losses in the North Atlantic in 2002.

Lili caused most damage in the Caribbean, Louisiana and Mississippi. 12 people were killed in Haiti, Jamaica, Cuba and St. Vincent. Thousands of homes were destroyed in Cuba and hundreds were destroyed in Barbados, Haiti and Jamaica. There was some damage in the Cayman Islands. Swiss Re reported that the insured loss in the US and Caribbean was USD 700 million².

Isidore hit Mexico and the US hardest but also caused some damage in Jamaica and western Cuba. Estimates by the Insurance Services Office, Inc.'s (ISO) Property Claim Services (PCS) unit showed that Isidore had caused USD 165 million in insured losses in Louisiana, Mississippi, Alabama and Florida³. The Mexican Insurance Industry Association claimed that Isidore had cost Mexican insurers about 2.76 billion pesos (USD 272 million) (USD 1= 10.1550 pesos) but total claims paid

¹ Seasonal Weather Forecasts, Predictions of Weather and Extreme Weather to Business, Industry and Society, Benfield Greig Hazard Research Centre, Dept. of Space and Climate Physics, University College London. <http://forecast.mssl.ucl.ac.uk>

² Swiss Re – Sigma Study News Release 19th December 2002

³ ISO Press Release 2002, http://www.iso.com/press_releases/2002/index.html

could end up in excess of 3.1 billion pesos (USD 305 million)⁴. Considering the potential for USD 305 million loss in Mexico and USD 165 million in the US, the total market loss for the US and Mexico could equate to USD 470 million.

Besides Lili and Isidore the other tropical cyclones that caused damage in 2002 were Bertha, Edouard, Fay, Gustav, Hanna and Kyle.

Only one storm (hurricane Lili) directly hit the United States mainland (Louisiana state) at hurricane force. Six additional storms made landfall in the United States as tropical storms. In chronological order they were Bertha, Edouard, Fay, Hanna, Isidore and Kyle which made landfall in the states of Louisiana, Florida, Texas, Mississippi, Louisiana and South Carolina respectively.

In terms of named storms, the season ended relatively early on the 16th October. It has not been since 1993, when the last named storm of the season (hurricane Harvey) died out on an earlier date (21st September).

North East Pacific

The North East Pacific hurricane season runs from 15th May to 30th November with a peak in late August or early September. On average about 16 named storms (based on data between 1970-2001⁵) form in the East Pacific each year. In 2002 there were 15 named storms, 8 hurricanes and 7 tropical storms. Out of the hurricanes, 5 became major hurricanes (Elida, Fausto, Ele, Hernan and Kenna) and 2 reached super hurricane status (Hernan and Kenna).

Tropical cyclones are more likely to make landfall in Mexico than in the US and in 2002 this pattern was recognised with 2 storms making landfall in Mexico (Hurricane Kenna and Tropical Storm Julio) but none making landfall in the US.

Some tropical cyclones, for example, Hurricane Iniki (1992), have hit Hawaii causing significant damage but it is rare for a storm to affect Hawaii. In 2002 no storms came close enough to Hawaii to cause any damage.

With the exception of hurricane Kenna the North East Pacific was fairly uneventful in terms of damage and disruption. The Mexican Insurance Industry Association reported that Kenna had caused an estimated USD 96 million insured loss in Mexico⁴.

Several other cyclones brought heavy rain to the west coast of north and central America but there were no reports of associated economic or insured losses.

North West Pacific

The North West Pacific season starts on the 1st January and ends on 31st December but the main season tends to be from July to November with a peak in late August or early September. The North East Pacific and North Atlantic tropical cyclones with windspeeds of at least 74 mph are called hurricanes. In contrast, any tropical cyclone that exists west of the International Date Line (near 180 degrees longitude) with a windspeed of at least 74 mph is called a typhoon.

There are normally 8 major typhoons (category 3 on the Saffir-Simpson Scale and above), 16 typhoons and 26 named storms in an average year (based on statistics

⁴ Dow Jones International News, 18 November 2002

⁵ NOAA <http://www.nhc.noaa.gov/pastall.shtml>

between 1972-2001⁶). 2002 was above average in terms of the number of major storms – there were 12 in comparison to the average of 8. Otherwise the season was fairly normal with 17 typhoons and 26 named tropical storms. The storms that were responsible for the greatest economic and/or insured losses were Rusa, Sinlaku, Higos and Pongsona.

Typhoon Rusa made landfall in South Korea on 31st August. The south and east coasts, in particular the city of Kangnung, were hit hardest. More than 36,000 homes were flooded and there was severe damage and/or disruption to infrastructure, vessels, maritime facilities and agriculture. Rusa claimed more than 210 lives. The Ministry of Government Administration and Home Affairs in South Korea reported within local media that the floods and landslides associated with Typhoon Rusa had caused 5.15 trillion Kwon (USD 4.2 billion) in property damage. There was also some damage in North Korea, Japan and Russia's far east. Munich Re reported that the insured loss for Rusa totalled USD 170 million⁷.

Typhoon Sinlaku battered the Japanese Island of Okinawa on 4th September, brushed past Taiwan causing minor damage and finally made landfall in Zhejiang Province, China causing significant damage. The storm prompted the evacuation of more than 300,000 people and was responsible for approximately 28 fatalities in eastern China. Thousands of houses were damaged or destroyed, there was major disruption to transport and significant damage to crops. Munich Re estimated a total economic loss of USD 240 million⁸.

Typhoon Higos made landfall in Kanagawa county, Japan on 1st October. The storm was responsible for around 5 fatalities. Hundreds of houses were damaged or destroyed and there was serious disruption to transport and power. Munich Re estimated economic losses to be in the region of USD 125 million⁹. The cargo ship 'Hual Europe' ran aground on Izu-Oshima Island as a result of the storm. More than a month later the ship caught fire and was declared a total loss. Higos also caused some damage in the Kuril Islands and Sakhalin Island, Russia.

Typhoon Pongsona impacted the islands of Guam and Rota (Northern Mariana Islands) on the 8th December. Both islands received federal disaster declarations from the US president. The typhoon devastated houses, businesses, government buildings, farms, seaports, airports, schools, utility services and other properties. The Federal Emergency Management Administration (FEMA) declared that more than USD 109 million in assistance had been approved for Guam¹⁰. Local media reports put the damage on Rota between USD 30 million and USD 50 million. Other Northern Mariana Islands and Chuuk, in the Federated States of Micronesia, suffered some damage.

Other tropical cyclones that were responsible for a notable amount of damage were Mitag, Chataan, Rammasun, Halong, Nakri, Fengshen, Kammuri, Phanfone, Vongfong, Hagupit and Mekkhala.

⁶ Seasonal Weather Forecasts, Predictions of Weather and Extreme Weather to Business, Industry and Society, Benfield Greig Hazard Research Centre, Dept. of Space and Climate Physics, University College London. <http://forecast.mssl.ucl.ac.uk>

⁷ Munich Re – Natural Cat Loss Press Release 30th December 2002

⁸ Munich Re NatCat Service, 2 August 2002, 14 November 2002

⁹ Munich Re NatCat Service, 5 December 2002

¹⁰ Federal Emergency Management Agency, <http://www.fema.gov/diz02/d1446n31.shtm>

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North Atlantic

Summary of 2002 Storms

Table 1: Summary of 2002 Tropical Cyclone Season – North Atlantic

#	Name	Dates	Max Wind (knots)	Cat	Landfall	Economic Loss (USD)	Insured Loss (USD)
1	Tropical Storm Arthur	14 th – 16 th July	50	TS	X	-	-
2	Tropical Storm Bertha	4 th –9 th August	35	TS	Y	-	-
3	Tropical Storm Cristobal	5 th – 8 th August	40	TS	X	-	-
4	Tropical Storm Dolly	29 th August – 4 th September	55	TS	X	-	-
5	Tropical Storm Edouard	1 st – 6 th September	55	TS	Y	-	-
6	Tropical Storm Fay	5 th – 8 th September	50	TS	Y	-	-
7	Tropical Depression 7	7 th – 8 th September	30	TD	X	-	-
8	Hurricane Gustav	8 th – 12 th September	80	1	Y	-	-
9	Tropical Storm Hannah	12 th –14 th September	45	TS	Y	-	-
10	Hurricane Isidore	14 th – 26 th September	110	3	Y	-	470 million (US+Mexico)
11	Tropical Storm Josephine	17 th – 19 th September	50	TS	X	-	-
12	Hurricane Kyle	20 th September – 12 th October	75	1	Y	-	-
13	Hurricane Lili	21 st September – 4 th October	125	4	Y	-	700 million (US+ Caribbean)
14	Tropical Depression 14	14 th – 16 st October	30	TD	Y	-	-

Sources: NOAA, Dow Jones International News, 18 November 2002, ISO Press Release 2002, Swiss Re – Sigma Study News Release 19th December 2002

Table 2 provides a summary of some of the most costly hurricanes in terms of insured losses for comparative purposes¹¹.

Table 2: Costly Tropical Cyclones

Hurricane Name/Date	Insured Loss (adjusted to year 1999 USD excluding Tropical Storm Allison)
Hurricane Andrew/ 1992	\$22.9billion
Hurricane Hugo/ 1989	\$7.4billion
Hurricane Betsy/ 1965	\$7.4 billion
Hurricane Celia/ 1970	\$4.2billion
Hurricane Georges/ 1998	\$3.0billion
Hurricane Hazel/ 1954	\$3.0billion
Hurricane Frederic/ 1979	\$2.8billion
Hurricane Carol/ 1954	\$2.7billion
Hurricane Donna/ 1960	\$2.7billion
Hurricane Opal/ 1995	\$2.6billion
Tropical Storm Allison/ 2001	\$2.5 billion
Hurricane Carla/ 1961	\$2.4billion
Hurricane Iniki/ 1992	\$2.2billion
Hurricane Cleo/ 1964	\$2billion
Hurricane Floyd/ 1999	\$2billion

¹¹ ISO Studies and Analyses, http://www.iso.com/studies_analyses/hurricane_experience/exhibits.html

Significant Individual Tropical Cyclones

Figure 2: Significant Tropical Cyclones in the North Atlantic

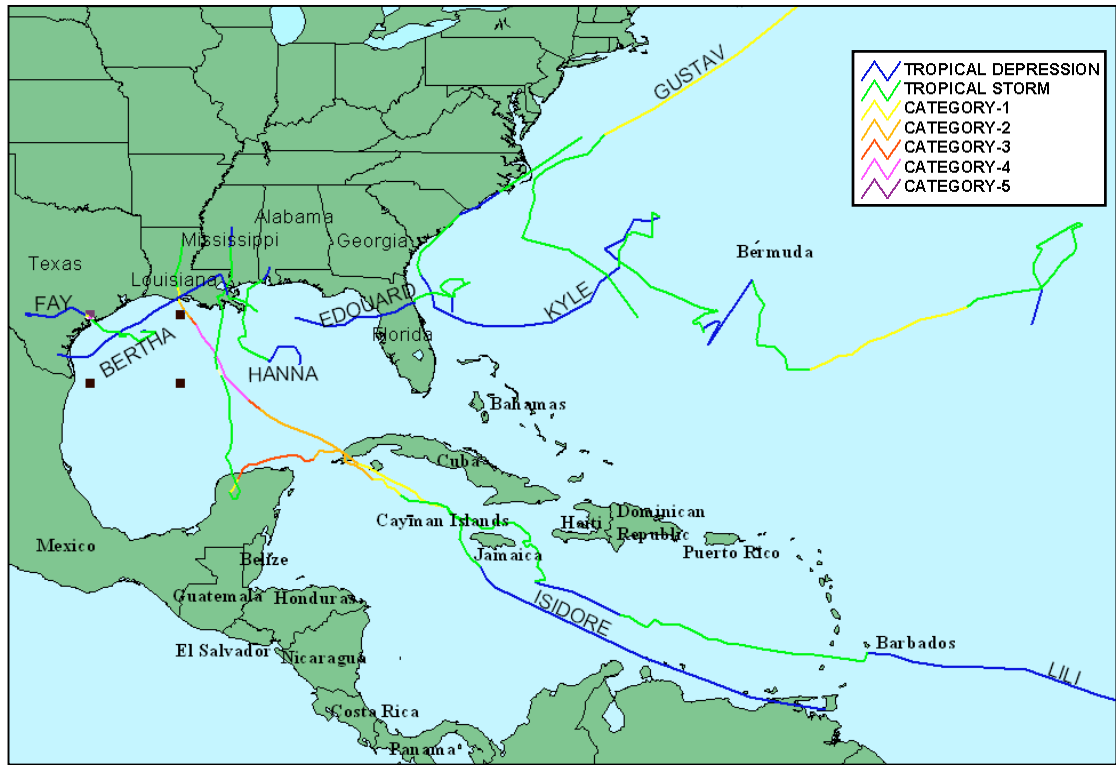


Table 3: Saffir-Simpson Scale for Hurricanes/Typhoons

Scale	Central Pressure (mb)	Winds (mph)	Surge (ft)	Damage
Tropical Depression	-	<39	-	-
Tropical Storm	-	39-73	-	-
Category 1	>980	74-95	4-5	Minimal
Category 2	980-965	96-110	6-8	Moderate
Category 3	964-945	111-130	9-12	Extensive
Category 4	944-920	131-155	13-18	Extreme
Category 5	<920	>155	>18	Catastrophe

Tropical Storm Bertha

Tropical Storm Bertha formed on the 4th August just to the east of the mouth of the Mississippi River. The storm moved northwestwards over the south east of Louisiana as a weak tropical storm but soon reduced in strength to form a tropical depression. On the 7th August the storm moved southwestwards out into the Gulf of Mexico and then into the state of Texas as a tropical depression. Minor floods were caused in southeast Louisiana and southern Mississippi and one person was drowned by high surf in the west of Florida.

Tropical Storm Edouard

Edouard developed about 90 miles east of Brevard county, Florida on the 1st September. It remained east of Florida travelling in a clockwise loop for several days and then moved westwards making landfall in Volusia county as a weak tropical storm. Edouard soon fell to tropical depression status as it moved southwestwards across the Florida Panhandle. The storm dissipated on the 6th September about 110

miles southwest of Gulf county, Florida. There was some minor flooding after heavy rains in north central Florida.

Tropical Storm Fay

The remnants of Edouard entered into the circulation of Tropical Storm Fay, which started off as a tropical depression on 6th September about 100 miles south east of Galveston county, Texas. The storm soon reached tropical storm status making landfall in Matagorda county on the 7th September. Fay dumped heavy rains and spawned tornadoes as the storm moved inland over Texas. Street flooding, coastal erosion and scattered power outages were reported in southeastern Texas. Heavy rainfall was experienced in Brazoria, Matagorda and Wharton counties. No major damage or deaths were reported.

Hurricane Gustav

Gustav formed as a tropical depression on the 8th September about 600 miles east of Florida. The storm moved northwest quickly becoming a tropical storm. On the 10th September the storm turned sharply northwards passing about 10 miles east of North Carolina. Gustav veered northeastwards on the 11th September becoming the first hurricane of the season on the same date. It finally made landfall in Nova Scotia on 12th September as a hurricane (category 1) and became extratropical near western Newfoundland later that day. Hurricane force winds were experienced in parts of Nova Scotia and tropical storm force winds in North Carolina. Damage was minor and one death was caused by high surf on the South Carolina coast.

Tropical Storm Hanna

On the 12th September Hanna was classified as a tropical depression about 230 miles south of Gulf County, Florida. By the 13th Hanna had reached tropical storm status. Hanna meandered about for a day progressing mostly in a northerly direction. Hanna made landfall in Jackson county, Mississippi at tropical storm status on the 14th September and soon fell to tropical depression status. Between the 13th and 15th of September heavy rainfall was experienced over much of eastern US with flash floods in parts of Georgia, South Carolina and Florida. In the Florida panhandle rip currents were responsible for 3 deaths.

Hurricane Isidore

Isidore became a tropical depression on the 14th September near Trinidad and Tobago. The depression then passed over Venezuela moving northwestwards reaching tropical storm status close to Jamaica. On the 19th September Isidore reached hurricane status about 130 miles south of Cuba. Isidore Passed over the western tip of Cuba as a category 2 hurricane and then moved westwards hitting the east of Mexico as a category 3 hurricane on the 22nd. The storm then weakened over land, circled anticlockwise over Mexico, and then moved northwards making landfall in Louisiana to the west of Grand Isle on the 26th September as a tropical storm.

Isidore hit Mexico and the US hardest but also caused some damage in Jamaica and western Cuba. 4 people drowned in the US, 3 were killed in the Caribbean and Mexico. Agriculture suffered large losses.

Estimates by the Insurance Services Office, Inc.'s (ISO) Property Claim Services (PCS) unit showed that Isidore had caused USD 165 million in insured losses in Louisiana, Mississippi, Alabama and Florida¹². The Louisiana Department of Insurance stated that losses in Louisiana alone would be USD 105 million including

¹² ISO Press Release 2002, http://www.iso.com/press_releases/2002/index.html

USD 71 million in homeowners losses, USD 24 million in private passenger auto losses and USD 10 million in commercial property losses¹³.

The Mexican Insurance Industry Association claimed that Isidore had cost Mexican insurers about 2.76 billion pesos (USD 272 million) (USD 1= 10.1550 pesos) but total claims paid could end up in excess of 3.1 billion pesos (USD 305 million). Industry accounted for the most in payouts, at 1.06 billion pesos, followed by businesses and agriculture¹⁴.

Considering the potential for USD 305 million loss in Mexico and USD 165 million in the US, the total market loss for the US and Mexico could equate to USD 470 million.

Hurricane Kyle

Kyle was one of the longest lasting storms on record lasting a total of 22 days. It formed about 830 miles southeast of Bermuda on 20th September. Kyle looped around moving gradually westwards but then moved sharply northwards on approach to land about 60 miles east of Florida. The storm made landfall in South Carolina on the 11th October at tropical storm status producing heavy rain, strong winds and minor flooding and then moved northeastwards along the North Carolina coast. Kyle died out at sea on the 20th October.

Hurricane Lili

Lili formed a day after Kyle on 21st September about 950 miles southeast of Barbados. The storm reached tropical storm status in the vicinity of Barbados. It tracked northwestwards passing close by Jamaica at tropical storm status. It then nipped the west of Cuba as a hurricane category 2. The storm reached hurricane category 4 over the Gulf of Mexico and made landfall in Vermilion county, Louisiana as a hurricane category 1.

A total of 12 people were killed in Haiti, Jamaica, Cuba and St. Vincent. Thousands of homes were destroyed in Cuba and hundreds were destroyed in Barbados, Haiti and Jamaica. There was some damage in the Cayman Islands.

The storm knocked out power and cut off phone services in Louisiana. Lili tore roofs from homes and buildings and snapped trees. It also flooded much of Montegut, about 40 miles southwest of New Orleans. Most of the Grand Isle was said to be under water. Lili added to the flood conditions caused by Isidore, which had struck Louisiana the previous week. Louisiana experienced severe crop damage.

Hurricane Lili produced high winds, rain and flooding in South Mississippi. The biggest blast in South Mississippi from Hurricane Lili was felt in the west. Lili produced winds of 80 to 100 mph and tornadoes, at least six of which toppled trees and power lines in Mississippi.

The storm shut down all 12 of Mississippi's Gulf Coast casinos, NASA's Mission Control in Houston, and caused significant damage to the oil and gas industry. Six offshore oil and gas platforms and four drilling rigs were severely damaged.

¹³ Louisiana Department of Insurance, [http://www.lds.state.la.us/public_affairs/press_releases/Isidore%20and%20Lili%20now%20\\$576%20million.htm](http://www.lds.state.la.us/public_affairs/press_releases/Isidore%20and%20Lili%20now%20$576%20million.htm)

¹⁴ Dow Jones International News, 18 November 2002

In Louisiana Lili accounted for about USD 400 million in homeowners losses, USD 22 million in private passenger auto losses and USD 49 million in commercial property losses¹⁵. Swiss Re reported that the insured loss in the US and Caribbean was about USD 700 million¹⁶.

¹⁵ Louisiana Department of Insurance,
[http://www.lds.state.la.us/public_affairs/press_releases/Isidore%20and%20Lili%20now%20\\$576%20million.htm](http://www.lds.state.la.us/public_affairs/press_releases/Isidore%20and%20Lili%20now%20$576%20million.htm)

¹⁶ Swiss Re – Sigma Study News Release 19th December 2002

Predictions for 2002/2003

William Gray and his team at Colorado State University have been making predictions for the North Atlantic for 20 years. In September 2002 Gray's team lowered their initial 2002 predictions to 8 named storms, 3 hurricanes and 1 intense hurricane¹⁷.

Forecasts of North Atlantic Tropical Cyclones are also provided by 'Tropical Storm Risk' (TSR) – a consortium including the University College London and Benfield Greig Hazard Research Centre. In August 2002 their predictions were revised and they reported that there would be 8.1 named storms, 3.9 hurricanes and 1.3 intense hurricanes¹⁸.

Both the Gray and TSR predictions for 2002 were successful in anticipation of below average activity but they underestimated the number of named storms. The TSR prediction was somewhat closer to what was actually experienced in the 2002 North Atlantic hurricane season.

Initial forecasts for 2003 by TSR and Professor Gray are summarised in Table 4. Forecasters will start to make updates to their predictions in April 2003. Both teams predict Atlantic hurricane activity to be well above average for 2003

Table 4: Tropical Cyclone Forecasts for 2003

	Tropical Storms or greater (≥34kts)	Hurricanes (≥64kts)	Intense Hurricanes (≥97kts)
Average*	9.5 [9.6]	5.7 [5.9]	2.1 [2.3]
Average US landfalling storms*	2.6	1.2	-
TSR (Jan 2003)			
Forecast Number of Storms	12.3 (+/-3.4)	6.9 (+/-2.8)	2.7 (+/-1.8)
Number forecast to make US landfall	3.6 (+/-2.0)	1.6 (+/-1.1)	-
Professor Gray (Dec 2003)			
Forecast Number of Storms	12	8	3
Probability of at least 1 intense hurricane making US Landfall	-	-	68%

* **Source for average figures: TSR, based on data between 1972-2001; Source for average figures in []: Gray Research Team, based on data between 1950-2000**

¹⁷ North Atlantic Basic Forecasts, William M. Gray, Professor of Atmospheric Science, Colorado State University. <http://hurricane.atmos.colostate.edu/forecasts/>

¹⁸ Seasonal Weather Forecasts, Predictions of Weather and Extreme Weather to Business, Industry and Society, Benfield Greig Hazard Research Centre, Dept. of Space and Climate Physics, University College London. <http://forecast.mssl.ucl.ac.uk>

North East Pacific

Summary of 2002 Storms

Table 5: Summary of 2002 Tropical Cyclone Season – North East Pacific

#	Name	Dates	Max Wind (knots)	Cat	Landfall	Economic Loss (USD)	Insured Loss (USD)
1	Hurricane Alma	24 th May – 1 st June	95	2	X	-	-
2	Tropical Storm Boris	8 th –11 th June	50	TS	X	-	-
3	Tropical Depression 3	27 th – 29 th June	30	TD	X	-	-
4	Tropical Storm Cristina	9 th – 16 th July	55	TS	X	-	-
5	Hurricane Douglas	20 th – 26 th July	90	2	X	-	-
6	Hurricane Elida	23 rd – 30 th July	135	4	X	-	-
7	Tropical Depression 7	6 th – 8 th August	30	TD	X	-	-
8	Hurricane Fausto	21 st August – 3 rd September	125	4	X	-	-
9	Tropical Storm Alika	22 nd – 28 th August	55	TS	X	-	-
10	Tropical Storm Genevieve	26 th August – 1 st September	60	TS	X	-	-
11	Hurricane Ele	25 th – 29 th August	100	3	X	-	-
12	Hurricane Hernan	30 th August – 6 th September	140	5	X	-	-
13	Tropical Depression 11	5 th – 8 th September	30	TD	X	-	-
14	Tropical Storm Iselle	15 th – 20 th September	60	TS	X	-	-
15	Tropical Storm Julio	25 th – 26 th September	35	TS	Y	-	-
16	Hurricane Kenna	22 nd October	145	5	Y	-	96 million
17	Tropical Storm Lowell	22 nd – 31 st October	45	TS	X	-	-
18	Hurricane Huko	24 th October – 3 rd November	75	1	X	-	-
19	Tropical Depression 16	14 th – 16 th November	30	TD	X	-	-

Sources: NOAA, Dow Jones International News, 18 November 2002

Significant Individual Tropical Cyclones

Figure 3: Significant Tropical Cyclones in the North East Pacific



Hurricane Kenna

Kenna started off as a tropical depression about 370 miles south of Acapulco on the 22nd of October. The storm travelled northwestwards and by the 23rd of October had reached hurricane status. Kenna curved back towards Mexico reaching hurricane category 5 on the 24th of October. After falling back to hurricane category 4 Kenna made landfall on the western coast of Mexico just north of Puerto Vallarta on the 25th October. Kenna was reported to be the third most powerful hurricane to ever strike Mexico from the Pacific.

Kenna caused damage in Mazatlan, Puerto Vallarta and San Blas. More than 20,000 people were evacuated before the storm made landfall. Most of the buildings in San Blas were destroyed or badly damaged. The government declared the region a disaster area, eligible for emergency funds.

In Puerto Vallarta, seawater rushed in from the bay, floating cars, stranding boats, and damaging hundreds of businesses. Power was cut in much of the city. At least 42 people were hurt as the hurricane hurled objects through the air. Cars were overturned and half-buried in the streets near houses and hotels whose walls were partly ripped away. The ground floors of several hotels suffered considerable damage. Bars and other businesses along the famous boardwalk began cleaning up from the devastation of a hurricane that left them battered but still standing.

Power was knocked out in parts of the state capital of Tepic, a city of 250,000 people, and officials cut the rest because of danger from downed power lines. The Mexican

Insurance Industry Association reported that losses from Kenna would probably be around 975 million pesos (USD 96 million) (USD 1=10.1550 pesos)¹⁹.

¹⁹ Dow Jones International News, 18 November 2002

North West Pacific

Summary of 2002 Storms

Table 6: Summary of 2002 Tropical Cyclone Season – North West Pacific

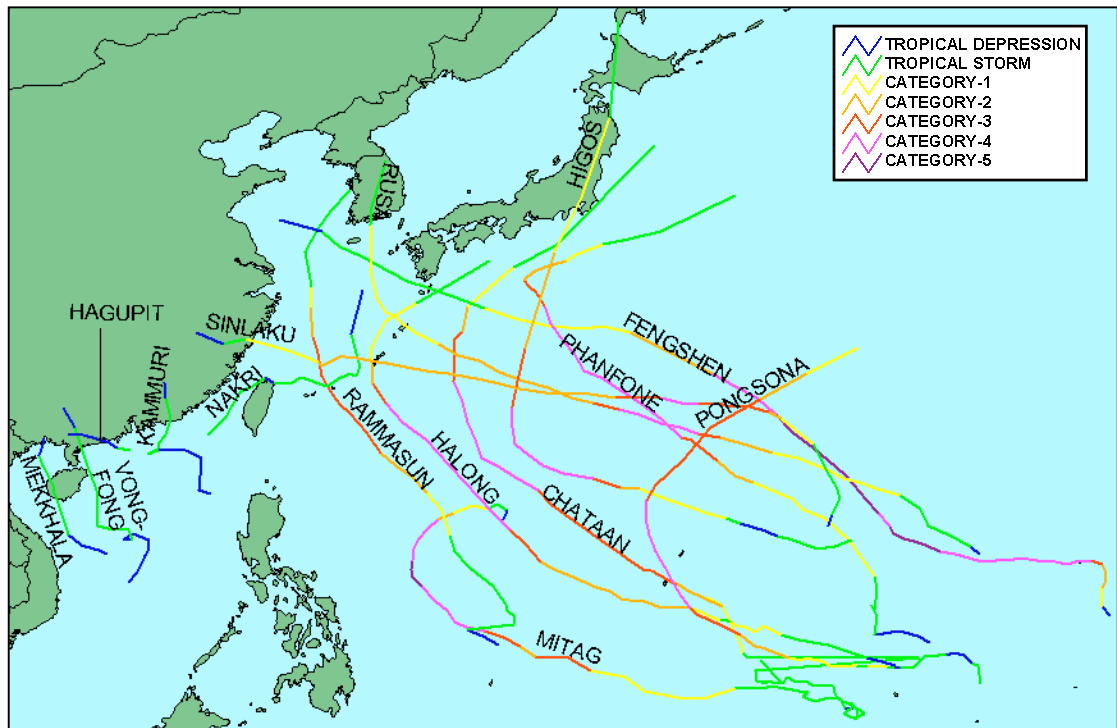
#	Name	Dates	Max Wind (knots)	Cat	Landfall	Economic Loss (USD)	Insured Loss (USD)
1	Typhoon Mitag	26 th February – 8 th March	140	5	X	-	-
2	Tropical Depression 3W	19 th –25 th March	30	TD	Y	-	-
3	Tropical Depression 4W	5 th – 7 th April	30	TD	X	-	-
4	Typhoon Hagibis	15 th – 21 st May	140	5	X	-	-
5	Tropical Depression 6W	28 th – 29 th May	25	TD	X	-	-
6	Typhoon Noguri	6 th – 11 th June	85	2	X	-	-
7	Tropical Storm 8W	28 th June	35	TS	X	-	-
8	Typhoon Chataan	29 th June – 11 th July	130	4	Y	59.9 million (Guam)	-
9	Typhoon Rammasun	28 th June – 6 th July	110	3	Y	94 million	-
10	Typhoon Halong	7 th – 15 th July	135	4	X	-	-
11	Tropical Storm Nakri	8 th –13 th July	40	TS	Y	-	-
12	Typhoon Fengshen	14 th – 27 th July	145	5	X	-	-
13	Tropical Depression 13W	18 th – 21 st July	30	TD	Y	-	-
14	Tropical Depression Kalmaegi	20 th – 21 st July	30	TD	X	-	-
15	Typhoon Fung_Wong	20 th – 27 th July	65	1	X	-	-
16	Tropical Storm Kammuri	2 nd – 5 th August	45	TS	Y	-	-
17	Tropical Depression 17W	5 th August	25	TD	X	-	-
18	Tropical Depression 18W	10 th – 13 th August	30	TD	Y	-	-

#	Name	Dates	Max Wind (knots)	Cat	Landfall	Economic Loss (USD)	Insured Loss (USD)
19	Typhoon Phanfone	11 th – 20 th August	135	4	X	-	-
20	Tropical Storm Vongfong	15 th – 20 th August	55	TS	Y	30 million	-
21	Typhoon Rusa	22 nd August – 1 st September	115	4	Y	4.2 billion	170 million
22	Typhoon Sinlaku	28 th August – 8 th September	115	4	Y	240 million	-
23	Typhoon Ele	30 th August – 10 th September	115	4	X	-	-
24	Tropical Depression 23W	10 th September	30	TD	X	-	-
25	Tropical Storm Hagupit	11 ^h – 12 th September	45	TS	Y	18.1 million (Guangdong Province)	-
26	Tropical Storm Mekkhala	23 rd – 27 th September	55	TS	Y	80 million (China)	-
27	Typhoon Higos	26 ^h September – 2 nd October	135	4	Y	125 million	-
28	Typhoon Bavi	9 ^h – 14 th October	70	1	X	-	-
29	Tropical Storm 27W	17 ^h – 19 th October	35	TS	X	-	-
30	Tropical Storm 28W	18 ^h – 19 th October	35	TS	X	-	-
31	Tropical Depression 14E	22 nd October	30	TD	X	-	-
32	Tropical Depression 15E	22 nd October	30	TD	X	-	-
33	Tropical Storm Lowell	24 ^h – 28 th October	45	TS	X	-	-
34	Typhoon Huko	24 ^h October – 7 th November	75	1	X	-	-
35	Tropical Depression 29W	26 ^h – 27 th October	30	TD	X	-	-
36	Tropical Storm Maysak	28 th – 29 th October	55	TS	X	-	-
37	Tropical Depression 16E	14 th – 16 th November	30	TD	X	-	-
38	Typhoon Haishen	20 th – 24 th November	95	2	X	-	-
39	Typhoon Pongsona	2 nd – 11 th December	130	4	X	> 109 million (Guam) 30-50 million (Rota)	-

Sources: NOAA, Reliefweb, Munich Re, The Ministry of Government Administration and Home Affairs in South Korea, Media Reports, FEMA

Significant Individual Tropical Cyclones

Figure 4: Significant Tropical Cyclones in the North West Pacific



Typhoon Mitag

Mitag formed in the western Pacific Ocean on the 26th February. The storm travelled northwest reaching typhoon category 5 on the 3rd March. Typhoon Mitag affected the islands in the Federated States of Micronesia during the first few days of March, impacting the main island of Yap on the 3rd March causing widespread light damage but no injuries or deaths. A combination of strong winds, heavy rains and a large tidal surge flooded many areas and destroyed large areas of crops. Yap was declared a state of emergency. In particular the town of Colonia was badly hit. The region of Chuuk, Federated States of Micronesia also sustained some damage and one person was killed.

Typhoon Chataan

Typhoon Chataan was classified as a tropical storm on 29th June. The storm then circulated around for 5 days before reaching typhoon category 1. The typhoon intensified as it progressed in a northwesterly direction, having category 3 status directly over Guam. On the 7th July Chataan reached a Typhoon category 4 but dropped back to category 1 status by 10th July when it hit Japan.

Chuuk in the Federated States of Micronesia suffered severely from Chataan with more than 40 fatalities and many people left homeless and/or injured. The Embassy of the Federated States of Micronesia reported that Chuuk would receive more than USD 6 million from the Federal Emergency Management Administration (FEMA)²⁰.

²⁰ Embassy of the Federated States of Micronesia, http://www.fsmbassay.org/statement_display.cfm?PRID=37

The storm went on to cause considerable damage in Guam although no deaths or serious injuries were reported. About 2000 homes were destroyed or seriously damaged. The President of the US declared a major disaster in the Territory of Guam and ordered Federal aid to supplement territory and local recovery efforts. According to preliminary assessments from the Office of Civil Defense, the economic loss incurred was USD 59.9 million²¹.

The Northern Mariana Islands suffered some damage. In addition Chataan contributed to the winds and rains, which lashed the Philippines, flooding streets (including the capital Manila), killing around 61 and injuring approximately 41 people. Over 14,000 people were evacuated. Typhoon Rammasun, Tropical Storm Nakri and Typhoon Halong were also accountable for the destruction and deaths in the Philippines over the period 28th June – 14th July.

Chataan hit southern Japan on July 10th dumping heavy rain and forcing thousands to evacuate to escape a swelling river. More than 16,000 people had to evacuate the city of Ogaki and other areas in Gifu-ken. Kushiro and Hokkaido also suffered some disruption. About 5 people were killed in Japan as a result of the storm. Traffic was severely disrupted.

Typhoon Rammasun

Rammasun formed on the 28th June about 600 miles east of the Philippines. As the storm moved northwest it brought heavy rain to the Philippines adding to the impact of 3 additional storms that were in the region over the period 28th June–14th July, namely Typhoon Chataan, Tropical Storm Nakri and Typhoon Halong.

The storm intensified to a category 3 typhoon as it continued northwest passing close to the Okinawa Islands, Japan. The typhoon left at least one person dead and two seriously injured, disrupted transport and cut power supplies in Okinawa.

The typhoon brought much needed heavy rains to the northern and central parts of Taiwan. The storm then lashed coastal China with flooding rains, resulting in at least 6 deaths, destroying crops and cutting power supplies.

Rammasun finally weakened into a tropical storm before making landfall in South Korea late on the 5th July where it killed 4 people. Munich Re estimated that the total economic losses from the typhoon would be around USD 94 million²².

Typhoon Halong

Halong formed as a tropical depression on the 7th July, and travelled northwestwards passing south of Guam on the 10th where it produced heavy rains and winds and halted recovery operations from Typhoon Chataan but caused no major damage. The storm reached typhoon category 4 on the 12th July before dropping off to tropical storm status on approach to the main island of Japan.

The storm enhanced cyclone induced monsoon conditions in the Philippines along with 3 other storms, namely Typhoon Chataan, Typhoon Rammasun and Tropical Storm Nakri. About 10 deaths in the Philippines were attributed to Halong. Japan was lashed with heavy rain and strong winds leaving 9 people injured, seriously disrupting transport, cutting power, forcing thousands to evacuate their homes and flooding about 200 houses.

²¹ Reliefweb,
<http://www.reliefweb.int/w/rwb.nsf/6686f45896f15dbc852567ae00530132/27e4d2e8bec9bbafc1256bfb005b2530?OpenDocument>

²² Munich Re NatCat Service, 2 August 2002

Tropical Storm Nakri

Nakri was classified as a tropical depression on the 8th July. It travelled northeast reaching tropical storm status but fell back to a depression to the north of Taiwan. The storm soon reached tropical storm status again as it moved eastwards passing just north of the Okinawa Islands, Japan before curving northwards and dropping back to a depression.

Nakri caused some flooding and landslides in Taiwan but no major damage. Nakri also enhanced cyclone induced monsoon conditions in the Philippines along with 3 other storms, namely Typhoon Chataan, Typhoon Rammasun and Typhoon Halong.

Typhoon Fengshen

Fengshen became a tropical depression on the 14th July about 88 miles to the northwest of the Marshall Islands. The storm travelled in a northerly direction reaching typhoon category 3 by the 15th July before turning northwestwards and reaching typhoon category 5. The typhoon fell back to tropical storm status before making landfall in Japan on the 25th July.

The storm brought torrential rain, disrupted transport, cut electricity and led to the evacuation of close to 200 families on Kyushu Island, Japan. Media reported that Five people were killed and one person was injured.

Tropical Storm Kammuri

Kammuri became a depression to the west of the Philippines on the 2nd August and became a tropical storm further to the northwest on the 3rd August. The storm made landfall to the east of Hong Kong in Shanwei county, China.

Media reported that 10 people were killed in China and thousands were left homeless when floodwaters destroyed 2 dams. There was heavy property damage and disruption to transport was experienced in eastern parts of Guangdong Province. The city of Meizhou, in particular, was hit badly.

In South Korea Kammuri added to storm conditions and heavy rainfall resulting from another weather system that was being experienced over the country.

Typhoon Phanfone

On the 11th August Phanfone was classified as a tropical depression. It progressed steadily northwestwards reaching typhoon category 4. About 165 miles south of Wakayama county, Japan the storm made a turn towards the north east falling off in windspeed to a tropical storm by the 19th August.

Phanfone dumped heavy rain and brought strong winds when it passed the Izu Islands, south of Tokyo, Japan. Parts of the Kanto-Koshin region and the Tokai region on mainland, Japan, experienced heavy rain. Phanfone caused disruption to transport but there were no reports of casualties or major damage.

The storm also brought torrential rains and strong winds to the Central Kurile Islands (Russian territory) which lies to the north of Japan.

Tropical Storm Vongfong

Vongfong formed about 280 miles to the east of Phu Yen Province, Vietnam. As the storm moved northwards Vongfong became a tropical storm passing to the east of Hainan Province, China before making landfall in Guangdong, China.

High wind speeds, heavy rain, flooding and landslides were experienced to the south of China, in particular Guangdong, Hainan, Hunan and Guizhou provinces. Thousands of homes, dykes, reservoirs and bridges were damaged or destroyed. Transport was disrupted, power was cut, many crops were damaged and about 140,000 head of livestock were killed. About 8 people were killed and 3 injured. Munich Re estimated economic losses of around USD 30 million²³.

Typhoon Rusa

Rusa formed in the west Pacific Ocean on 22nd August and strengthened into a typhoon on 24th August whilst tracking northwest. The typhoon crossed the Japanese Island of Amami O-shima on 29th August with maximum sustained winds close to 90 mph (145 kph). Rusa then turned northwards across the East China Sea, making landfall along the south coast of South Korea on 31st August.

900 mm of rain fell, in less than 2 days, in eastern and southern South Korea before Rusa moved out to sea on 1st September.

South Korea experienced most of the damage, which was mainly caused by floods and mudslides. The eastern port city of Kangnung was hit hardest. In addition, Rusa had maximum sustained windspeeds of around 80 mph (130 kph) at landfall, with higher gusts, causing significant damage to the southern and eastern coastal regions.

The Ministry of Government Administration and Home Affairs figures in local media showed that 213 people were confirmed dead, 33 declared as missing, presumed dead, and that more than 36,000 homes were flooded. Extensive damage also occurred to the country's infrastructure, hundreds of thousands of people were without electricity, gas and water after floodwaters and mudslides disrupted supplies. Local media reports claimed that more than 640 vessels and 200,000 maritime facilities were damaged by the high winds. Air, land and sea transport was severely disrupted. Several rivers were polluted with chemicals, heavy metals and other waste products. Water in the Kangwon and North Kyongsang provinces was seriously polluted when abandoned slag heaps collapsed. Industry was badly affected by the typhoon with some 265 small and medium sized firms being damaged with major losses in raw material, plant equipment and buildings. The agricultural ministry statistics within media reports showed that 6% of the country's total agricultural area was affected, but damage was mainly confined to fruit and vegetables.

Other areas that were affected by Typhoon Rusa included Okinawa, Japan, North Korea and Russia's far east. The Ministry of Government Administration and Home Affairs in South Korea confirmed within local media reports that the floods and landslides associated with Typhoon Rusa had caused 5.15 trillion Kwon (USD 4.2 billion) in property damage. Munich Re reported that the insured loss for Rusa totalled USD 170 million²⁴.

Typhoon Sinlaku

Sinlaku formed to the east of the Northern Mariana Islands on 28th August and curved westwards making category 4 status on 1st September. The storm eased in strength as it progressed further west. It battered the Japanese Island of Okinawa on 4th September with maximum sustained winds of 110 mph (177 kph) but with higher gusts damaging houses and causing injuries and powercuts. A ship and its crew were reported missing.

Sinlaku brushed Taiwan on September 7th and warnings were issued for possible landslides and flooding after nearly 100 mm of rain fell in Taipei, however despite

²³ Munich Re NatCat Service, 2 August 2002, 27 September 2002

²⁴ Munich Re – Natural Cat Loss Press Release 30th December 2002

these warnings the system caused very little damage as the eye of the storm passed about 150 miles north east of the capital, Taipei. Two people were lost at sea.

Sinlaku made landfall in Zhejiang Province, China with maximum sustained winds of about 80 mph (129 kph) on September 7th. The storm prompted the evacuation of more than 300,000 people from the cities of Wenzhou, Taizhou and Ningbo, damaged thousands of properties and was blamed for approximately 28 fatalities in Zhejiang and Fujian Provinces, China. Many trees, power and communication lines were downed after severe winds and heavy rains. There was major disruption to transport networks, significant damage to crops (around 420,000 acres) and closure of financial markets, schools and businesses. Thousands of houses were damaged or destroyed. Munich Re estimated a total economic loss of USD 240 million²⁵.

Tropical Storm Hagupit

Tropical Storm Hagupit formed on the 11th September and tracked into China's Guangdong province later that day with maximum sustained winds of around 35 mph (56 kph).

In the city of Hong Kong the storm caused significant disruption closing government offices, the stock exchange and other businesses as heavy rains and gusty winds affected the city. Around 32 people suffered mainly minor injuries but there was little damage. A chemical tanker seeking shelter from the storm exploded and sank.

In Jiangxi province, China, flooding associated with the storm destroyed around 4,000 residential properties and flooded about 160 villages. Approximately 180,000 people were affected and 25 killed. Around 110,000 hectares of agricultural was flooded.

In Guangdong province the cities of Yangjiang, Zhuhai, Maoming and Zhanjiang were hardest hit by the typhoon. Coastal dykes, reservoirs and crops were destroyed. Power supplies and transport networks were severely disrupted. Local media reported that the direct economic loss in Guangdong was estimated to reach more than USD 18.1 million.

Tropical Storm Mekkhala

On the 23rd September Mekkhala became a tropical depression about 200 miles to the east of Vietnam. Mekkhala moved northwards picking up windspeed and hit Hainan province, China on 25th September with heavy rain and winds of around 60 mph (97 kph). Most of Sanya city in the south was flooded and some trees were uprooted by the strong winds. Transport was significantly affected and around 58,000 acres of farmland was destroyed. Some rain was also experienced in northern Vietnam and the Philippines. Local media in China reported an economic loss of around USD 80 million.

Typhoon Higos

Higos was classified as a tropical storm on 26th September and proceeded in a northwesterly direction reaching typhoon category 4 before turning northeastwards towards Japan. The storm made landfall in Kanagawa county on 1st October continually moving northeastwards past Tokyo right up the middle of Honshu Island (the main island of Japan) and then into Hokkaido Island. The storm then proceeded towards the south tip of Sakhalin Island, Russia.

The storm was responsible for around 5 fatalities in Japan. Hundreds of houses were damaged or destroyed. The strong winds caused several ports and highways to close and many flights to be cancelled. Oil deliveries to refineries were disrupted. Tens of

²⁵ Munich Re NatCat Service, 2 August 2002, 14 November 2002

thousands of homes were left without electricity as the typhoon passed through. Munich Re estimated economic losses to be in the region of USD 125million²⁶.

The cargo ship 'Hual Europe' ran aground on Izu-Oshima Island as a result of the storm. More than a month later the ship caught fire and was declared a total loss.

The storm also caused some damage in the Kuril Islands and Sakhalin Island, Russia. The Makarov, Korsakov, Dolinsk, Aniva and Kholmsk regions suffered the most serious damage. Both electricity and communication lines were cut, ferries were cancelled. According to media reports at least 7 people were killed.

Typhoon Pongsona

On the 3rd December Pongsona was classified as a tropical storm close to the Federated States of Micronesia. The storm travelled northwest becoming a typhoon category 4 close to Guam. Pongsona then curved eastwards and faded out at sea.

Typhoon Pongsona impacted the islands of Guam and Rota (Northern Mariana Islands) on the 8th December. Both islands received federal disaster declarations from the US president. The typhoon devastated houses, businesses, government buildings, farms, seaports, airports, schools, utility services and other properties.

Media reported 3 casualties and extensive damage in Guam. The typhoon hit two villages and a US Air Force base in northern Guam, felled scores of telephone and power lines, disrupted water supplies and forced the evacuation of patients after structural damage to hospital buildings. Pongsona destroyed more than 1,700 and damaged more than 2,000 homes. Electricity and water were shut off. Schools were closed and transformed into emergency shelters. Concrete utility poles were snapped, sheet metal roofing was peeled off houses, and cars were flipped over. In Tumon Bay, some major Guam hotels suffered severe damage, including shattered glass walls, windows and flooding. A fire that erupted at three Exxon Mobil Corp fuel storage tanks during Pongsona blocked access to the island's gasoline supply leading to a ban on sales of fuel.

The Federal Emergency Management Administration (FEMA) declared that more than USD 109 million in assistance had been approved for individuals, families and businesses in Guam²⁷. Guam Power Authority (GPA) officials in local media reports claimed that Pongsona had caused an estimated USD 52 million damage to the GPA. Officials at the Guam Waterworks Authority estimated in local media reports that the agency had experienced more than USD 5.8 million in damage. Initial damage estimates for the Guam Telephone Authority in local media reports were USD 4.3 million.

Local media reported that approximately 200 homes were destroyed in Rota (Northern Mariana Islands). A further 150 houses sustained major damage and 150 suffered some damage. Close to 100% of Rota's agricultural products and vegetation were destroyed as well as 80% of government facilities. Roads, vehicles and harbours were damaged. Initial estimates published in local media reports put the damage on Rota between USD 30 million and USD 50 million.

The other Northern Mariana Islands also experienced some damage. Tinian experienced power outages and a disruption to water supplies as well as significant damage to crops. On the island of Saipan there was minimal damage, a few minor injuries and disruption to power and water.

²⁶ Munich Re NatCat Service, 5 December 2002

²⁷ Federal Emergency Management Agency, <http://www.fema.gov/diz02/d1446n31.shtm>

There were a few minor injuries to the inhabitants of the state of Chuuk, which made a disaster declaration to the president of the Federated States of Micronesia. The islands of Hall and Nomunwito suffered most. Water supplies were disrupted and crops damaged.

Predictions for 2002/2003

Forecasts of North West Pacific Tropical Cyclones are provided by 'Tropical Storm Risk' (TSR) – a consortium including the University College London and Benfield Greig Hazard Research Centre²⁸ and a consortium of researchers at the City University of Hong Kong led by Johnny Chan²⁹.

Table 7 shows the prediction of storms for 2002. In 2002 there were 12 major typhoons, 17 typhoons and 26 tropical storms. TSR were close in the prediction of the above average number of major storms (they predicted 11.5 and there were 12 in reality). The Chan consortium does not predict the number of intense storms. Both consortiums over predicted the number of tropical storms and typhoons although the Chan consortium was slightly closer.

Table 7: Tropical Cyclone Forecasts for 2002

	Tropical Storms or greater (≥34kts)	Typhoons (≥64kts)	Intense Typhoons (≥97kts)
Average*	26.3	16.4	8.2
TSR (Aug 2002)			
Forecast Number of Storms	28.4 (+/-4.2)	19.0 (+/-3.4)	11.5 (+/-1.7)
Chan (June 2002)			
Forecast Number of Storms	27 (+/-3)	18 (+/-2)	-

* Source for average figures: TSR, based on data between 1972-2001

Forecasts for 2003 have yet to be issued. The first TSR forecast for 2003 will be issued in early March and the first Chan forecast will be released in April.

²⁸ Seasonal Weather Forecasts, Predictions of Weather and Extreme Weather to Business, Industry and Society, Benfield Greig Hazard Research Centre, Dept. of Space and Climate Physics, University College London. <http://forecast.mssl.ucl.ac.uk>

²⁹ Seasonal Forecasting of Tropical Cyclone Activity over the Western North Pacific and the South China Sea, Chan et al., City University of Hong Kong. http://aposf02.cityu.edu.hk/tc_forecast/forecast.htm

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Glossary of Terms

Extratropical Cyclone – A term used in advisories and tropical summaries to indicate that a cyclone has lost its "tropical" characteristics. The term implies both poleward displacement of the cyclone and the conversion of the cyclone's primary energy source from the release of latent heat of condensation to baroclinic (the temperature contrast between warm and cold air masses) processes. It is important to note that cyclones can become extratropical and still retain winds of hurricane or tropical storm force (NOAA-NCEP).

Hurricane/Typhoon – An intense tropical weather system of strong thunderstorms with a well-defined surface circulation (windspeed > 73 mph). The term hurricane is used for Northern Hemisphere cyclones east of the International Dateline to the Greenwich Meridian. The term typhoon is used for Pacific cyclones north of the Equator west of the International Dateline (NOAA).

Hurricane Season – The portion of the year having a relatively high incidence of hurricanes. The hurricane season in the Atlantic, Caribbean, and Gulf of Mexico runs from June 1 to November 30. The hurricane season in the North Eastern Pacific basin runs from May 15 to November 30. The hurricane season in the North West Pacific basin runs from January 1 to December 31 (NOAA-NCEP).

Major Hurricane/Typhoon – Hurricanes or typhoons with windspeeds greater than 95 knots or 110mph (category 3 or above on the Saffir-Simpson scale).

Saffir-Simpson Scale – A measurement scale ranging from 1 to 5 of hurricane/typhoon wind and ocean surge intensity. 1 is a weak hurricane/typhoon whereas 5 is the most intense hurricane/typhoon.

Super Hurricane/Typhoon – Hurricanes or typhoons with windspeeds greater than 135 knots or 155mph (category 5 on the Saffir-Simpson scale).

Tropical Depression – An organized system of clouds and thunderstorms with a defined surface circulation (windspeeds < 39 mph but generally greater than 20-25 mph).

Tropical Cyclone – A nonfrontal, warm-core, low pressure system of synoptic scale, developing over tropical or subtropical waters and having a definite organised circulation. Rotates counter-clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere. Includes hurricanes, typhoons, tropical storms, and other weaker rotating vortices.

Tropical Storm – An organized system of strong thunderstorms with a defined surface circulation (windspeed 39 - 73 mph).