

NW Pacific and Asian Landfalling Typhoons in 2000

Extended Range Forecast Issued 21st January, 2000

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Forecast Summary

NW Pacific typhoon activity and Asian typhoon strike numbers are expected to be 20% above average in 2000

This document presents, to our knowledge, the first ever extended range forecast for NW Pacific tropical cyclone activity, and the first ever seasonal forecast for Asian typhoon strike numbers. The forecast spans the full 2000 NW Pacific typhoon season from 1st January to 31st December. Predictions are provided for basin tropical cyclone, typhoon and intense typhoon numbers, and for tropical cyclone and typhoon strike numbers on Japan, Taiwan and the Philippines. Further south-east Asian countries will be included in later forecasts as will intense typhoon impacts. The latter require forecasts of sea surface temperatures which will become available later in 2000. Rigorous hindcast testing show that the forecasts herein have skill levels which exceed those in equivalent forecasts for Atlantic and US hurricane strikes at the same lead time.

1. NW Pacific Total Numbers in 2000

		Intense Typhoons	Typhoons	Tropical Cyclones
Forecast (\pm SD)	2000	9.3 (\pm 1.5)	19.0 (\pm 2.2)	32.3 (\pm 2.6)
Actual	1999	5	12	25
Average (\pm SD)	1969-1999	7.9 (\pm 2.8)	16.1 (\pm 3.7)	26.4 (\pm 4.3)

Key: Intense Typhoons = Sustained Wind > 95Kts = Category 3 to 5
Typhoons = Sustained Wind > 63Kts = Category 1 to 5
Tropical Cyclones = Sustained Wind > 33Kts
'Average' refers to the 1969-1999 period.

2. Japan Landfalling Numbers in 2000

		Typhoons	Tropical Cyclones
Forecast (\pm SD)	2000	2.7 (\pm 1.0)	5.7 (\pm 1.6)
Actual	1999	1	2
Average (\pm SD)	1969-1999	2.5 (\pm 1.5)	4.3 (\pm 1.7)



3. Taiwan Landfalling Numbers in 2000

		<u>Typhoons</u>	<u>Tropical Cyclones</u>
Forecast (\pm SD)	2000	2.5 (\pm 0.9)	4.0 (\pm 1.1)
Actual	1999	1	4
Average (\pm SD)	1969-1999	1.7 (\pm 1.0)	3.0 (\pm 1.4)

4. Philippines Landfalling Numbers in 2000

		<u>Typhoons</u>	<u>Tropical Cyclones</u>
Forecast (\pm SD)	2000	2.8 (\pm 0.8)	5.4 (\pm 1.4)
Actual	1999	1	2
Average (\pm SD)	1969-1999	1.9 (\pm 1.2)	3.7 (\pm 1.8)

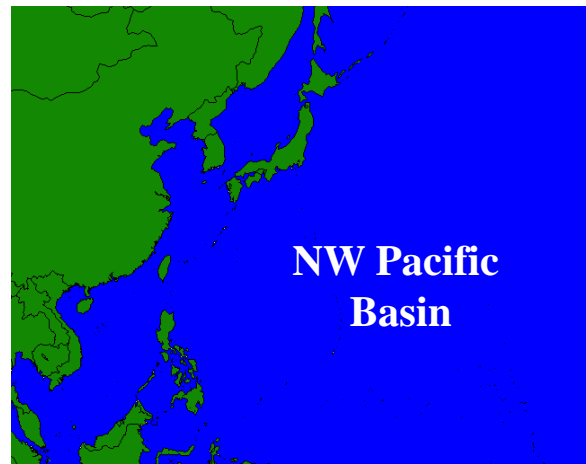
Predictors in the model include sea surface temperature (SST) in the Pacific and Indian Oceans, 500mb geopotential height, mean sea level pressure, and outgoing longwave radiation. The SST predictors are lagged and forecast while the other predictors are lagged. Different predictors are used in different forecasts. The strongest factor behind the forecast of above average activity in 2000 is the moderate cold ENSO (La Nina) conditions persisting in October and November 1999. These are strongly associated with above average NW Pacific tropical cyclone activity the following summer.

Potential Benefits and Methodology

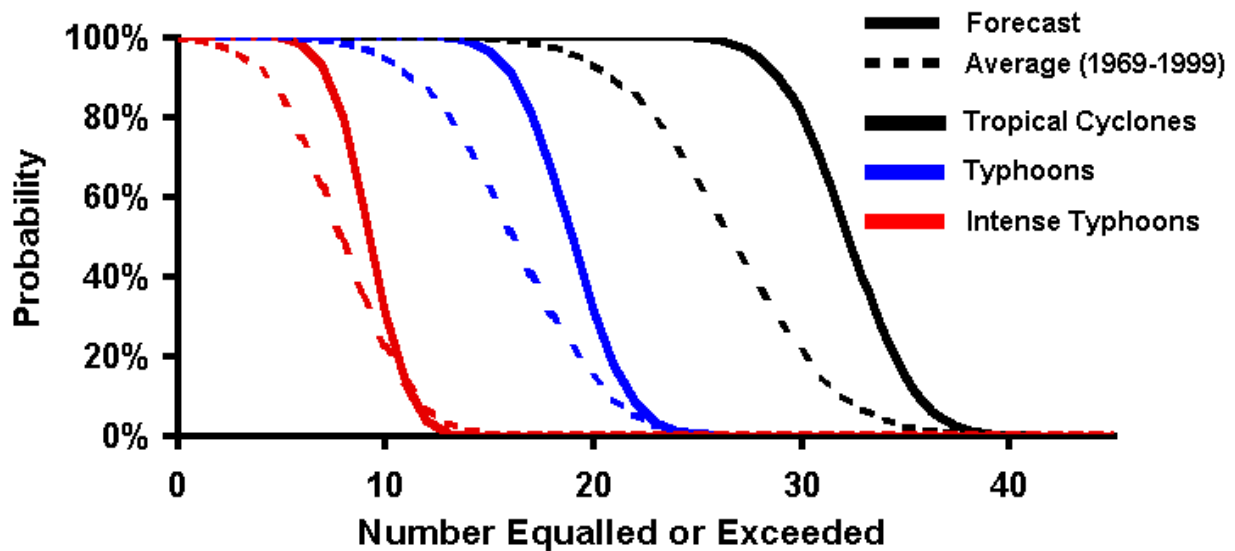
Tropical cyclones are the most costly and deadly natural disaster affecting much of Japan, South Korea, Taiwan, the Philippines, and coastal areas in other southeast Asian countries. The annual damage bill and fatality rate from tropical cyclone impacts in southeast Asia 1990-1998 averages respectively US \$3.1 billion (1997 \$) per year and 740 deaths [information from Munich Re]. Intense tropical cyclones - or typhoons - are responsible for the vast majority of this damage. Satellites and numerical weather models provide warnings of impending landfall up to a week ahead. However, efforts are now being given to the seasonal probabilistic forecasting of these landfalls many months in advance. Such long-range forecasts would benefit a range of industry including insurance, energy and power, agriculture and tourism.

The forecast builds upon the methodology of our Atlantic hurricane forecasts. Statistical methods are used to identify predictors of landfalling events. These predictors are a mix of current climate parameters and of dynamical and statistical model predictions of climate parameters at the time of the coming NW Pacific tropical cyclone season. A fundamental principle underlying our approach is to forecast probability distributions for typhoon occurrence. In this way, imperfection in the forecast is recognised while at the same time providing quantitative information. Forecast errors are given as the standard deviation of the hindcast errors for 1990-1999.

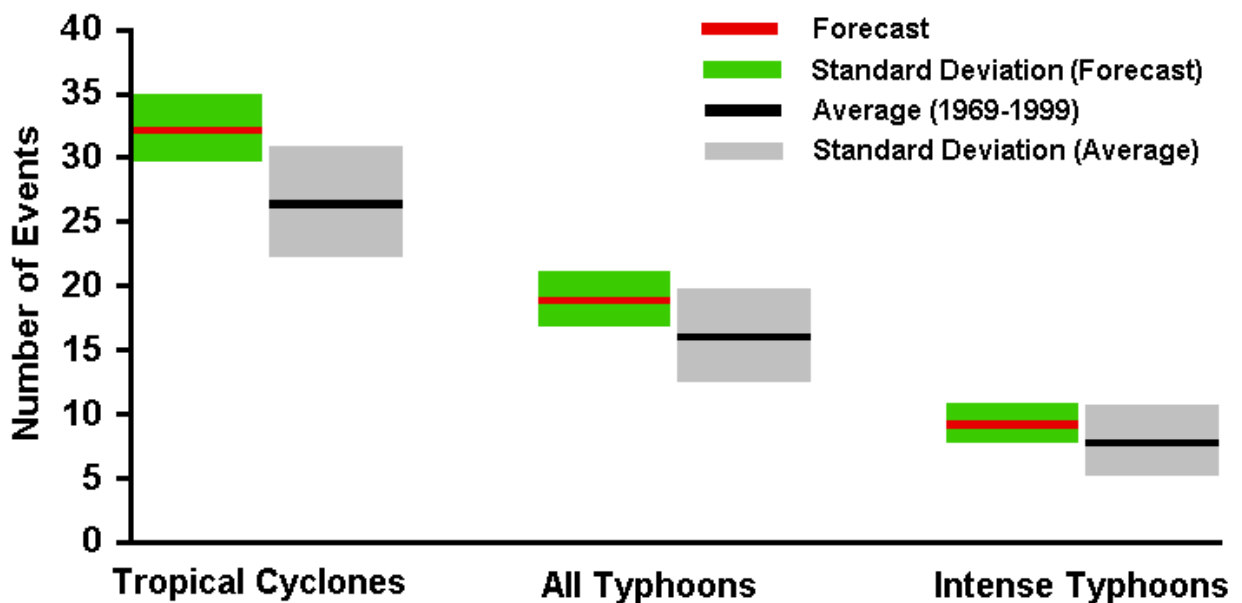
Total Number of NW Pacific Tropical Cyclones



Cumulative Probability of Events

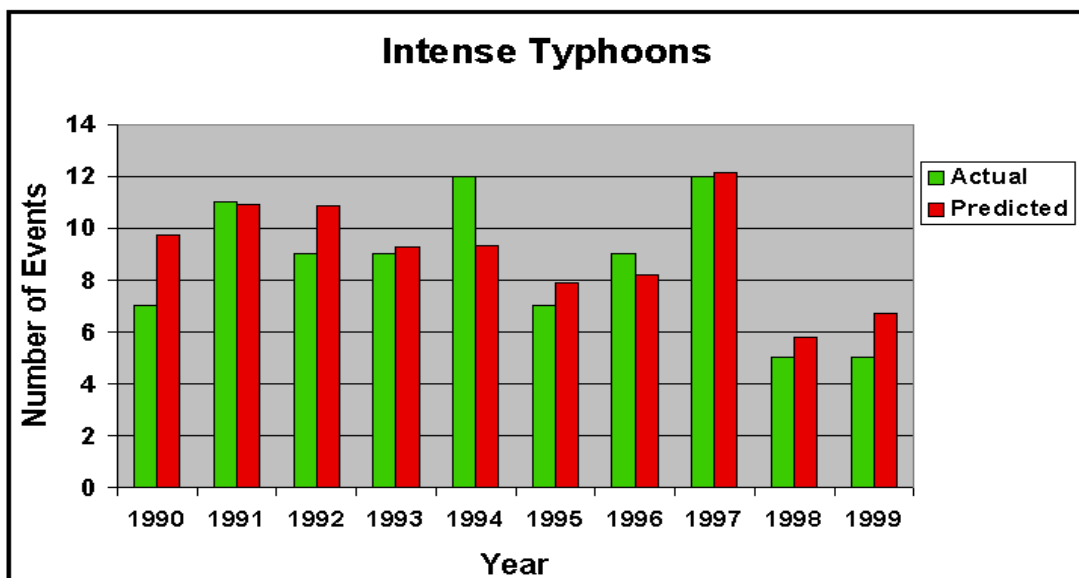
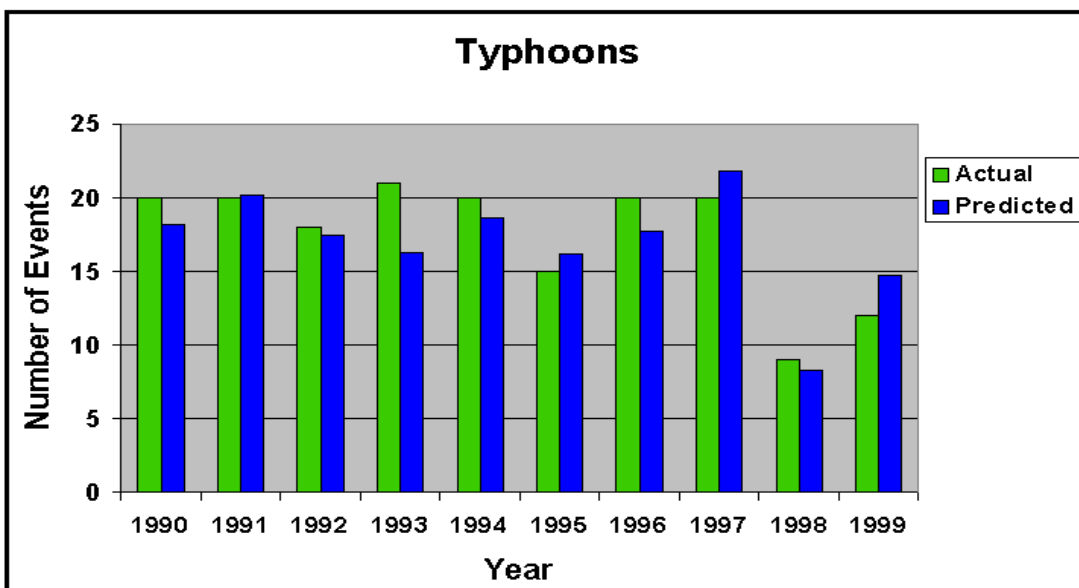
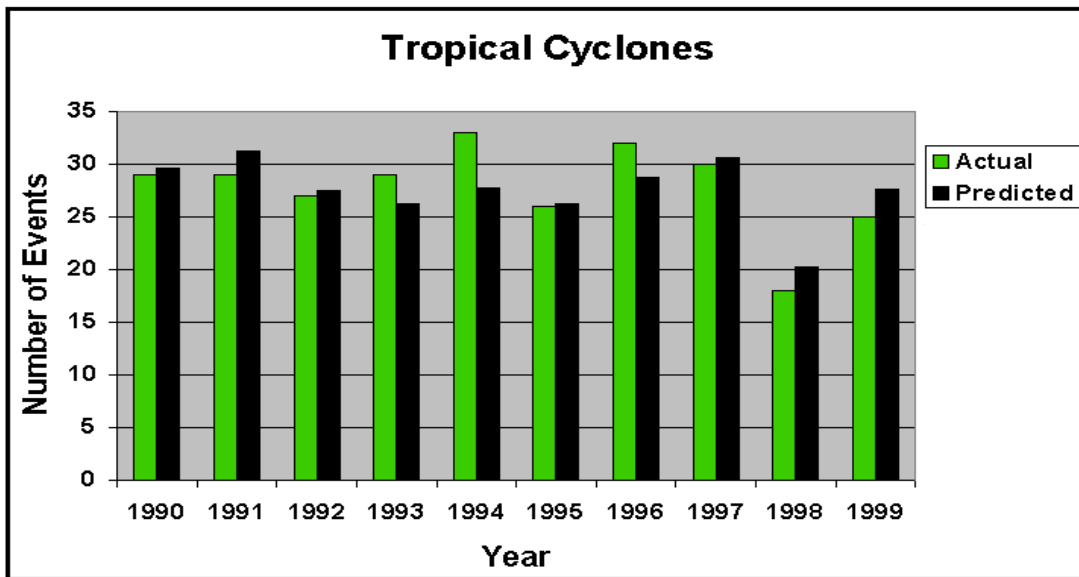


Frequency and Severity Distribution

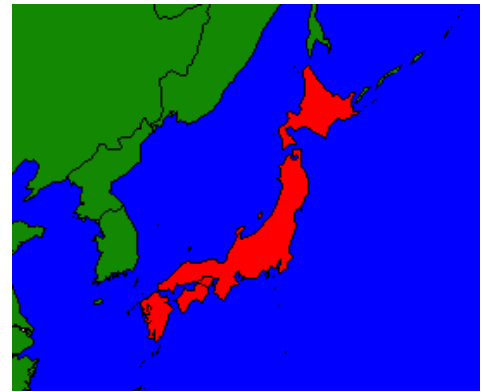


Model Hindcast Performance 1990-1999: Total Basin Numbers

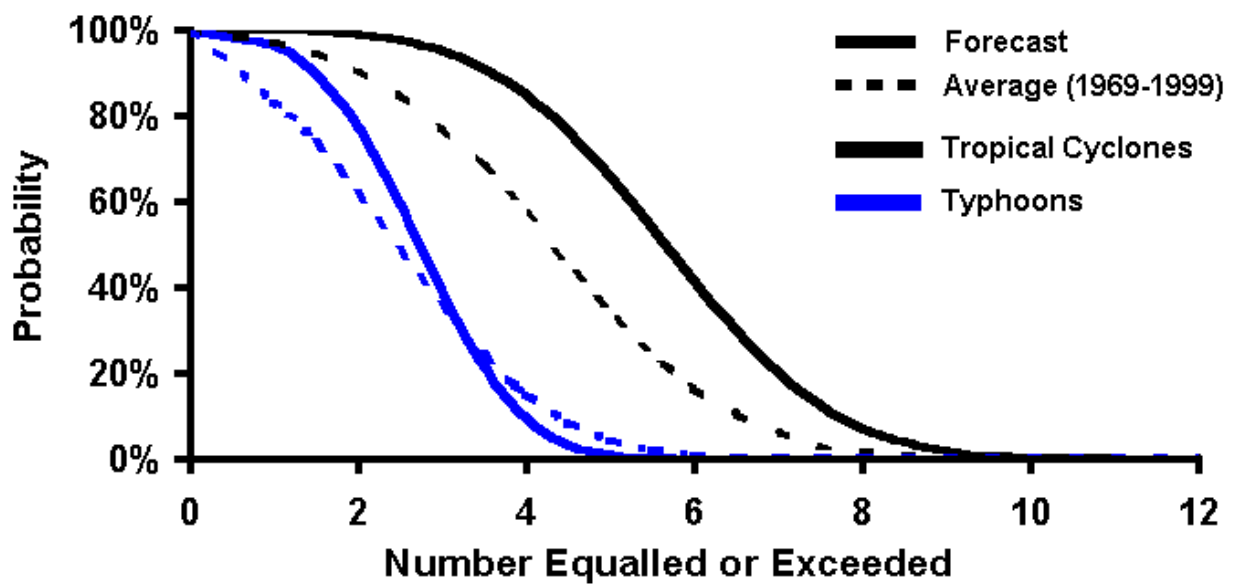
How would the model have done had it been available in previous years?



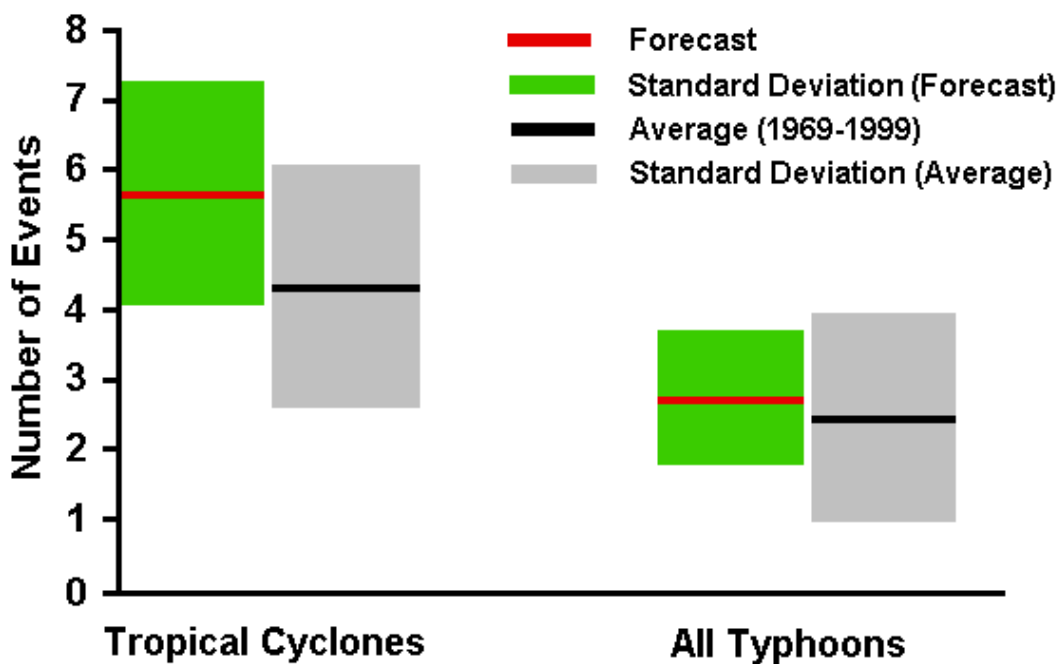
Japan Landfalling Tropical Cyclones



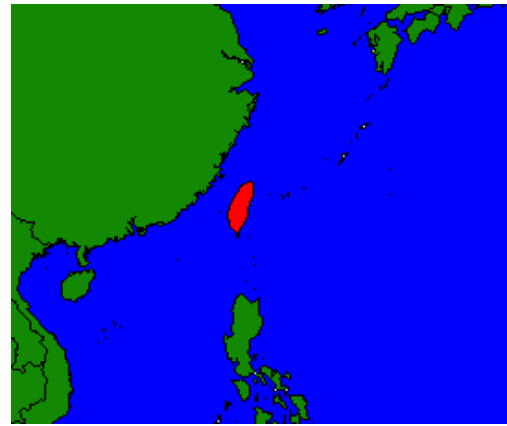
Cumulative Probability of Events



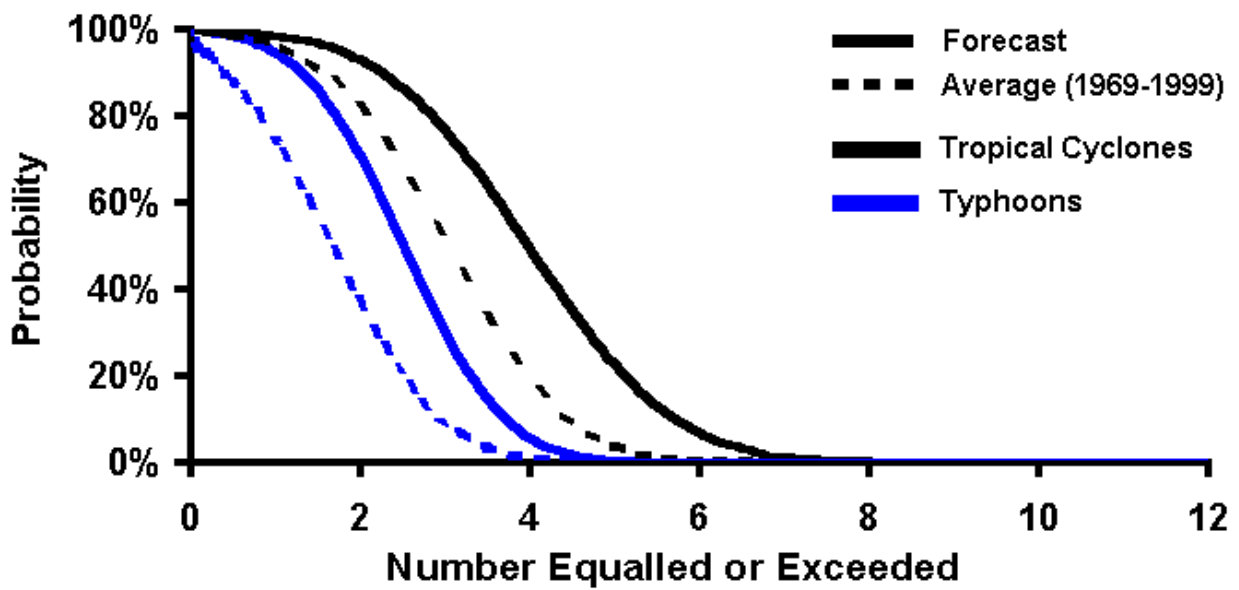
Frequency and Severity Distribution



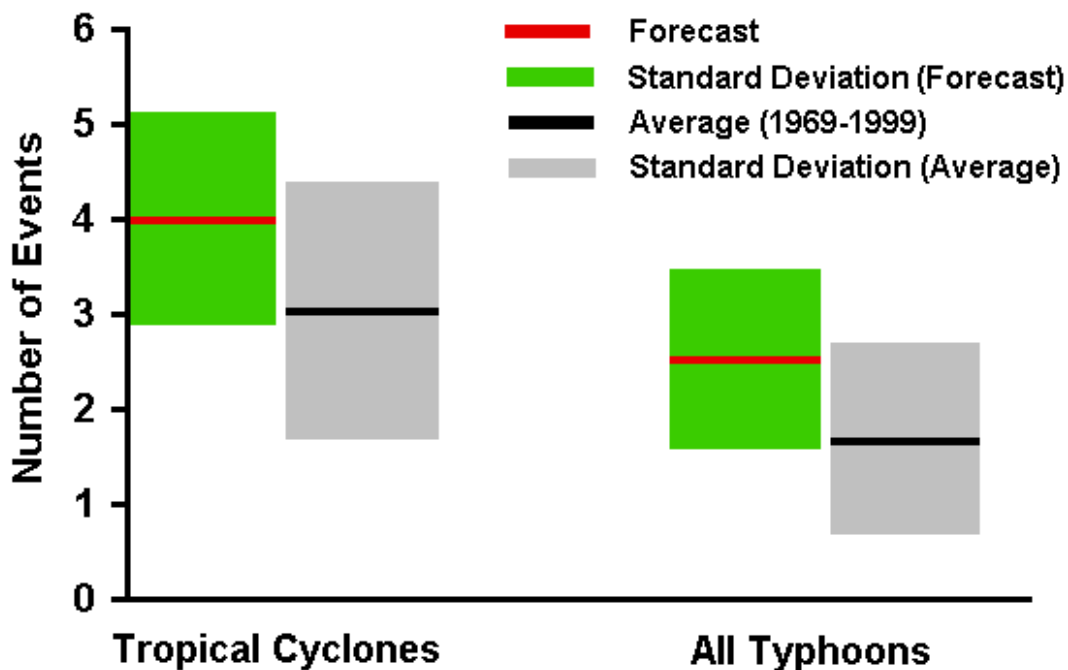
Taiwan Landfalling Tropical Cyclones



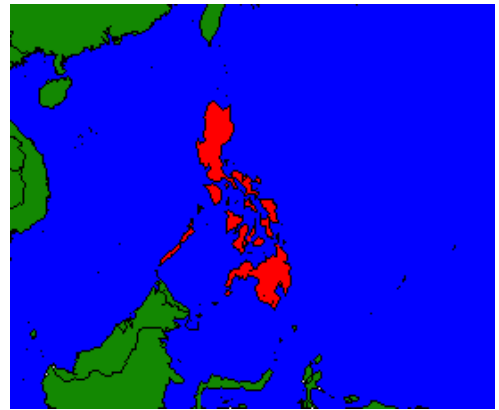
Cumulative Probability of Events



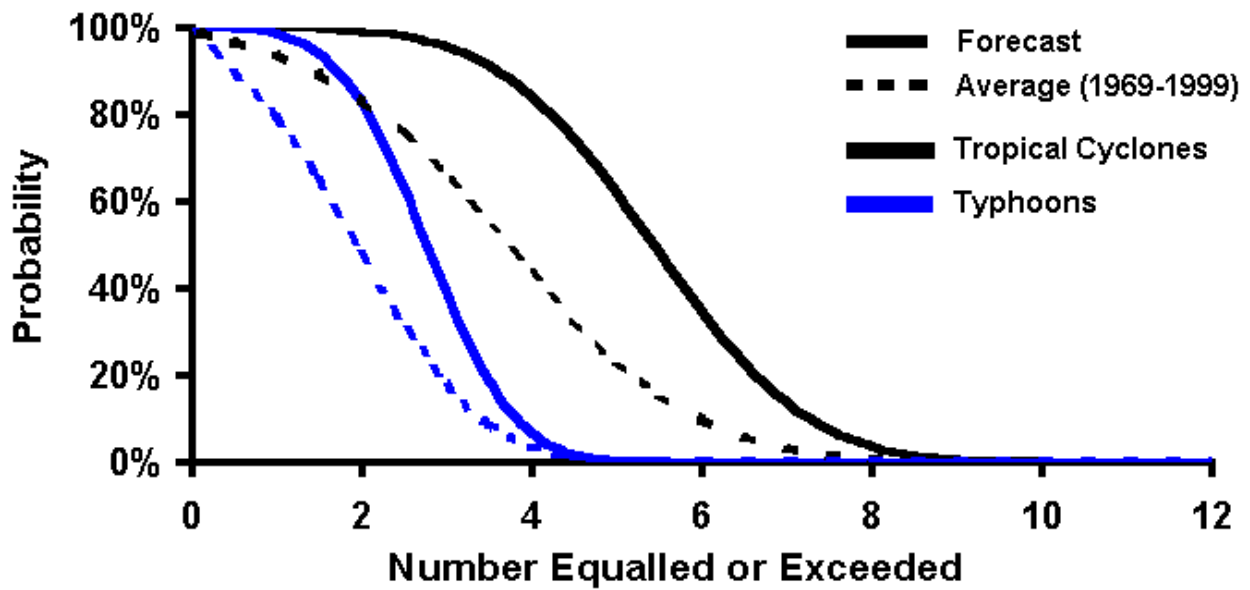
Frequency and Severity Distribution



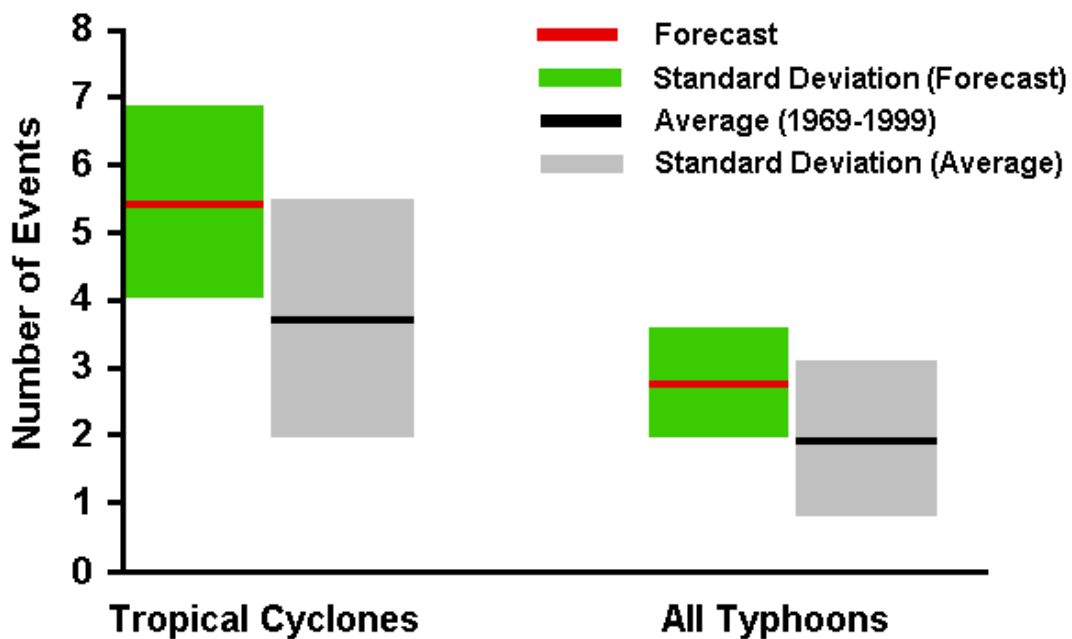
Philippines Landfalling Tropical Cyclones



Cumulative Probability of Events



Frequency and Severity Distribution



Future Forecasts

An extended-range forecast for the SW Pacific seasonal cyclone activity and for Queensland strike probability in 2000/01 will be issued on 1st April 2000.

Pre-season forecasts for Atlantic seasonal hurricane activity and US strike probability in 2000 and for NW Pacific seasonal typhoon activity and Asian strike probability in 2000 will be issued at the end of May 2000.

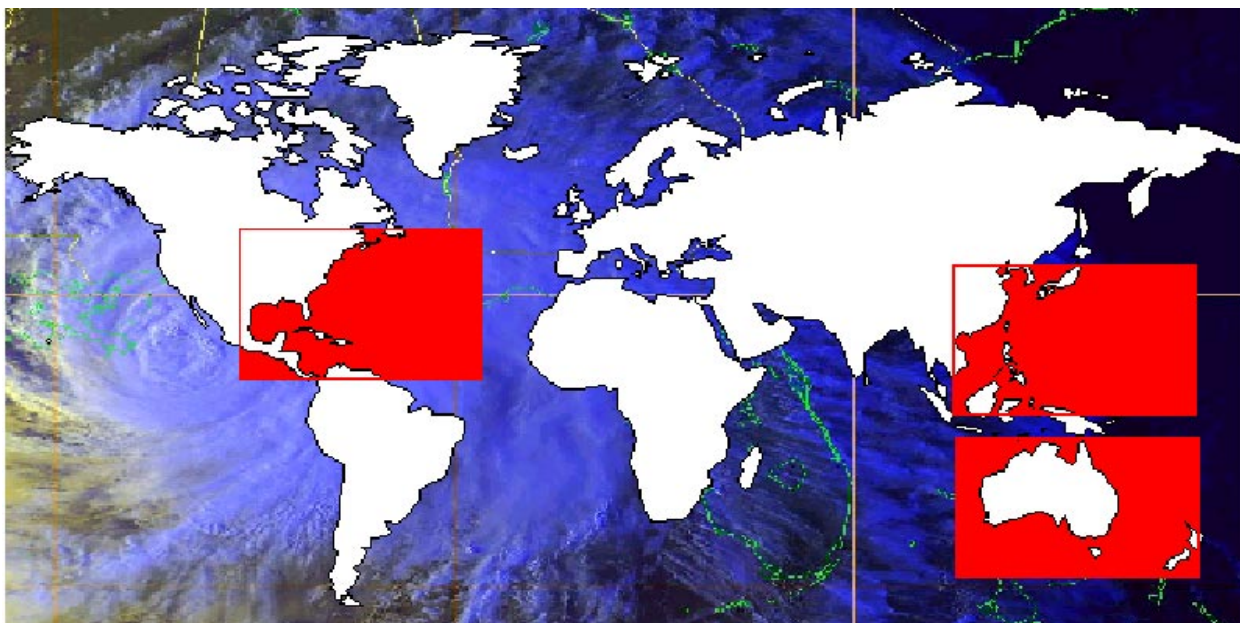
The TSUNAMI Initiative

The TSUNAMI initiative was established in response to the Foresight Programme, a UK Government initiative aimed at stimulating improved dialogue between academia and industry. TSUNAMI was formed in September 1997 by Dr Dougal Goodman, Deputy Director of the British Antarctic Survey a component part of the Natural Environment Research Council (NERC). It aims to improve the competitiveness of the UK insurance industry by using UK scientific expertise to improve the assessment of risk. TSUNAMI's three year programme is funded jointly by the Government through the Department of Trade and Industry's Sector Challenge, and by a consortium from the UK insurance industry comprising:

<i>UK Composite Companies:</i>	CGU Group, Royal and Sun Alliance Insurance Group
<i>Lloyd's Reinsurance Brokers:</i>	Benfield Greig Group, Guy Carpenter
<i>Lloyd's Managing Agencies:</i>	Catlin Underwriting Agencies Ltd, DP Mann Ltd, Wren Syndicates Management Ltd.

Acknowledgements

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The three basins under research in the TSUNAMI Seasonal Prediction of Tropical Cyclones project.