

## Pre-Season Forecast

### Atlantic and U.S. Landfalling Tropical Cyclones 1999

Issued: 1<sup>st</sup> June, 1999.

Not for public circulation before 1<sup>st</sup> July, 1999.

## The TSUNAMI Initiative

TSUNAMI aims to improve the competitiveness of the UK insurance industry by using the UK science effort to improve the assessment of risk. TSUNAMI is funded by a consortium of companies from the UK insurance industry and the Treasury. Government funding is through the DTI's Sector Challenge and administered by the British Antarctic Survey, a component body of the Natural Environment Research Council.

## Seasonal prediction of tropical cyclones

This two year TSUNAMI-funded research project is endorsed and managed by the Met. Office. The research is being undertaken by University College London and Reading University.

The research project is establishing a new methodology for the long-range seasonal prediction of landfalling tropical cyclones in three ocean basins. The TSUNAMI forecasts will offer improved lead-time and skill level over that currently available.

Statistical methods are used to identify predictors of landfalling events. The predictions used in the forecast are a mix of current climate parameters and dynamical and statistical model predictions of climate parameters for the coming tropical cyclone season. This paper presents our first pre-season forecast for the North Atlantic Basin.

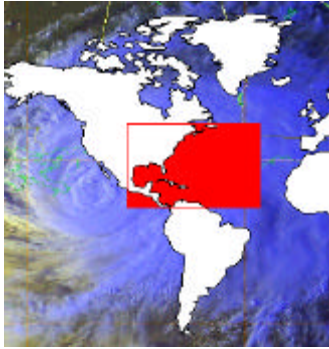
## Project Team

The forecast is produced by Dr Mark Saunders and Dr Chris Merchant of the Benfield Greig Hazard Research Centre, University College London. The project is managed by Mrs Alyson Bedford of The Met. Office.

We also wish to thank the insurance industry representative, Lance Garrard, Dr Chris Thorncroft and Ioannis Pytharoulis of the Meteorology Department, Reading University for dynamical model research, Dr Mike Davey of the Hadley Centre for Climate Prediction & Research, and Dr Richard Chandler of the Department of Statistical Science, University College London.



The Met. Office



**Key for tables and graphs:**

**Sustained Wind**

TS	Tropical Storms	34-63 Kts
1&2	Hurricanes, Category 1 & 2 only	64-95 Kts
H	All Hurricanes	>63 Kts
IH	All Intense Hurricanes, Category 3-5	>95 Kts
TC	Tropical Cyclones (TS + H)	
Average	Refers to the 1951-1998 period	

**Summary**

Based on information available through May 1999 we forecast:

**Atlantic Total Numbers**

- Tropical storm and hurricane numbers to be above average but not significantly so to within the model error. Intense hurricane numbers are forecast to be near average.
- Numbers of events originating between the west coast of Africa and the Caribbean will be below average. Numbers forming in the Caribbean, Gulf of Mexico and extra-tropical North Atlantic will be above average.
- Chance of at least 1 intense hurricane is 89±8% . (Average chance is 91%).

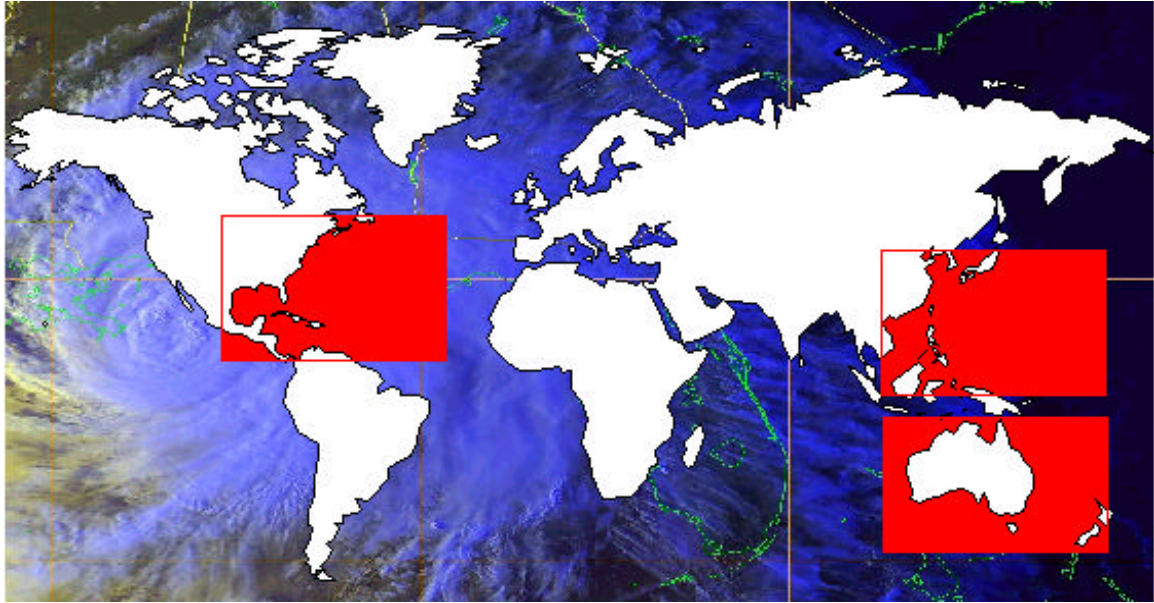
**Comparison:**

			<b>IH</b>	<b>H</b>	<b>TC</b>
Average	1951-1998	Total 10 :	2.4	5.8	9.8
Actual	1998	Total 14 :	3	10	14
Gray April Forecast	1999	Total 14:	4	9	14
TSUNAMI Forecast	1999	Total 12 :	2 (±1)	7 (±3)	12 (±3)

The main factor behind our forecast of above average tropical cyclone activity in the Caribbean and Gulf of Mexico is the moderate La Niña (cold ENSO episode) conditions expected to persist through October 1999. Colder than normal mid-Atlantic sea surface temperatures are the main reason for our forecast of lower than normal Cape-Verde type tropical cyclone activity.

**US Landfalling Activity**

- Above average overall but not significantly so to within the model error.
- The Gulf Coast and Caribbean are at an above average risk.
- The U.S. East Coast is at an average risk.



**Chance of at least one intense hurricane strike:**

- $47 \pm 7\%$  overall (average is 44%).
- $19 \pm 7\%$  for the U.S. East Coast (average is 20%).
- $39 \pm 5\%$  for the Gulf Coast (average is 33%).

**Comparison:**

			<b>IH</b>	<b>H</b>	<b>TC</b>
Average	1951-1998	Total 3:	0.6	1.5	3.1
Actual	1998	Total 7:	0	3	7
TSUNAMI Dec. Forecast	1999	Total 4:	1 ( $\pm 1$ )	2 ( $\pm 1$ )	4 ( $\pm 2$ )
TSUNAMI June Forecast	1999	Total 4:	1 ( $\pm 1$ )	2 ( $\pm 1$ )	4 ( $\pm 2$ )

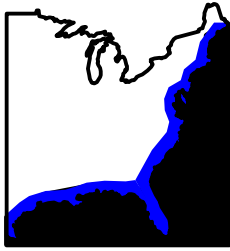
The main environmental factors influencing landfalling activity in 1999 are similar to those affecting total numbers; namely moderate La Niña conditions (enhancing factor for Gulf and Caribbean landfalls) and colder than normal sea temperatures in the tropical Atlantic (depressing factor for U.S. East Coast landfalls).

*A post season assessment will be issued in December 1999.*

*Our long-range forecast for the 2000 Atlantic season will be issued on 1st October 1999.*

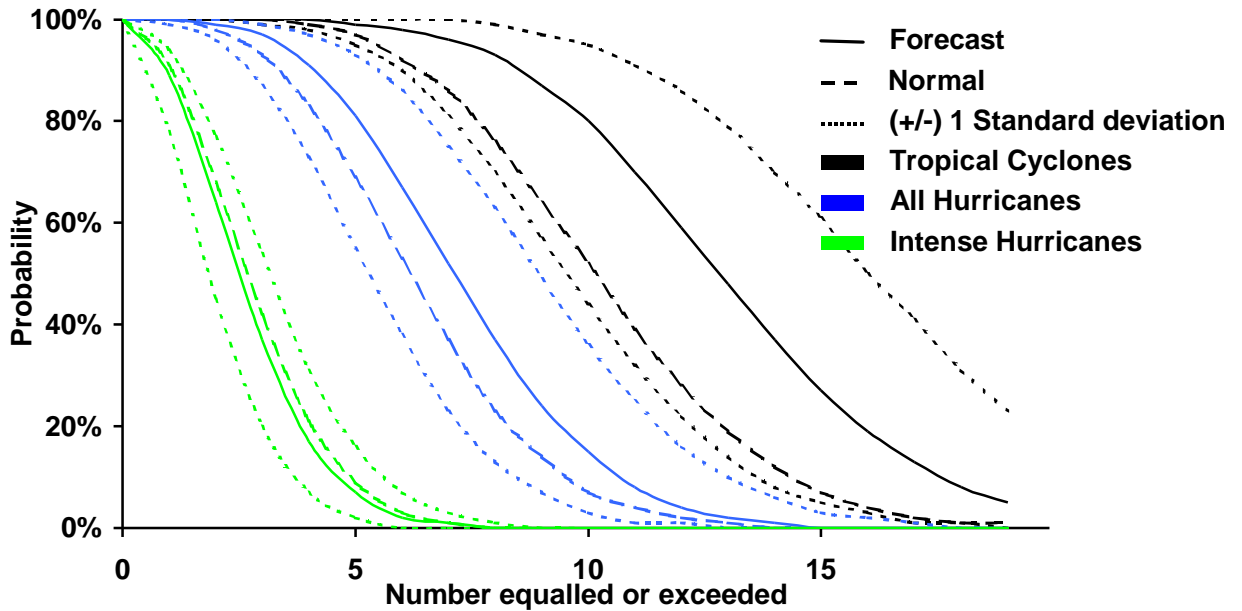
*A detailed report on the research methodology together with a forecast skill comparison against Gray and co-workers will be available shortly from the TSUNAMI website:  
<http://www.nerc-bas.ac.uk/public/tsunami/>*

## Total Number of Atlantic tropical cyclones

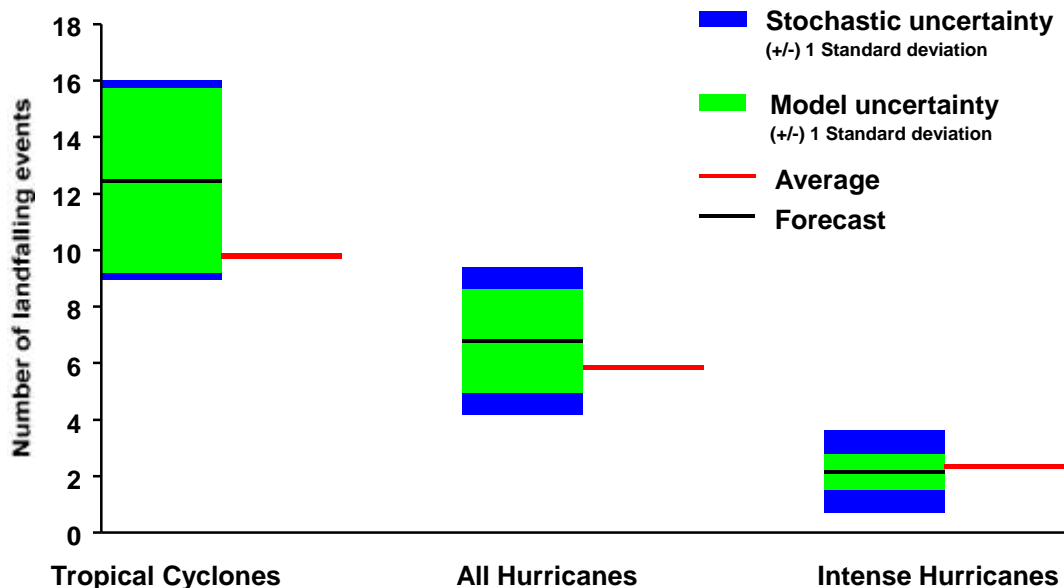


No. of events	Probability of N events (mutually exclusive)							
	Forecast				Normal			
	TC	TS	1&2	IH	TC	TS	1&2	IH
0	0%	0%	1%	11%	0%	2%	3%	9%
1	0%	2%	5%	25%	0%	8%	11%	22%
2	0%	6%	11%	27%	0%	15%	19%	26%
3	0%	10%	16%	19%	1%	20%	22%	21%
4	0%	15%	19%	11%	2%	20%	19%	12%
5	1%	17%	17%	5%	4%	15%	13%	6%
6	2%	16%	13%	2%	7%	10%	8%	2%
7	4%	13%	9%	1%	10%	6%	4%	1%
8	6%	9%	5%	0%	12%	3%	2%	0%
9	8%	6%	3%	0%	13%	1%	1%	0%
10	10%	3%	1%	0%	12%	0%	0%	0%
11	11%	2%	0%	0%	11%	0%	0%	0%
12	11%	1%	0%	0%	9%	0%	0%	0%
13	11%	0%	0%	0%	7%	0%	0%	0%
14	10%	0%	0%	0%	5%	0%	0%	0%
15	8%	0%	0%	0%	3%	0%	0%	0%
16	6%	0%	0%	0%	2%	0%	0%	0%
17	5%	0%	0%	0%	1%	0%	0%	0%
18	3%	0%	0%	0%	1%	0%	0%	0%
19	2%	0%	0%	0%	0%	0%	0%	0%

## Cumulative probability of events



## Frequency & severity distribution

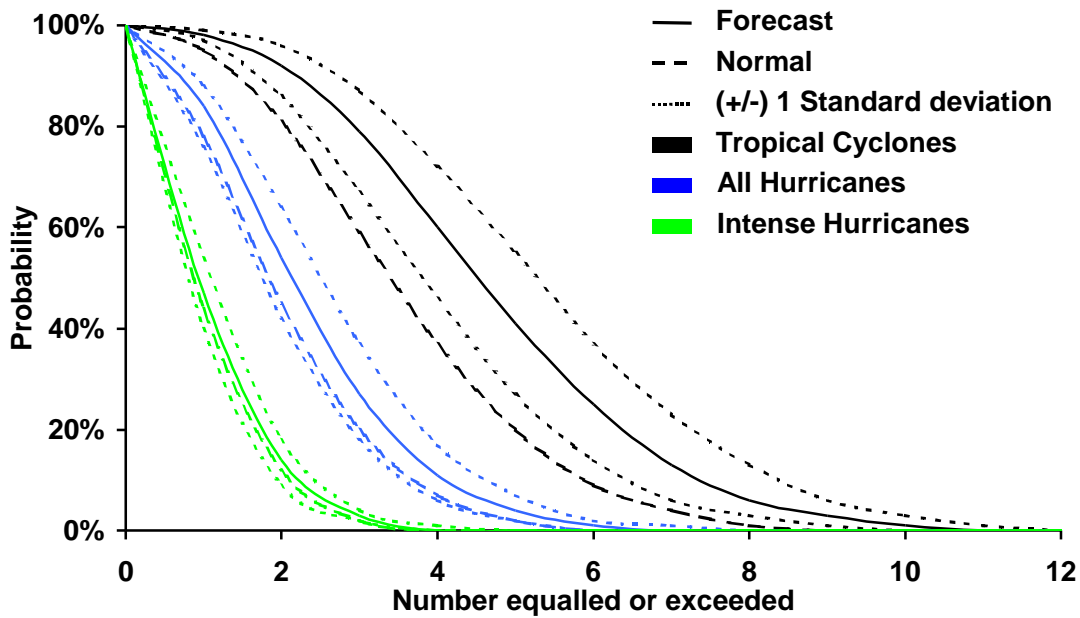


# U.S.A. Landfalling tropical cyclones

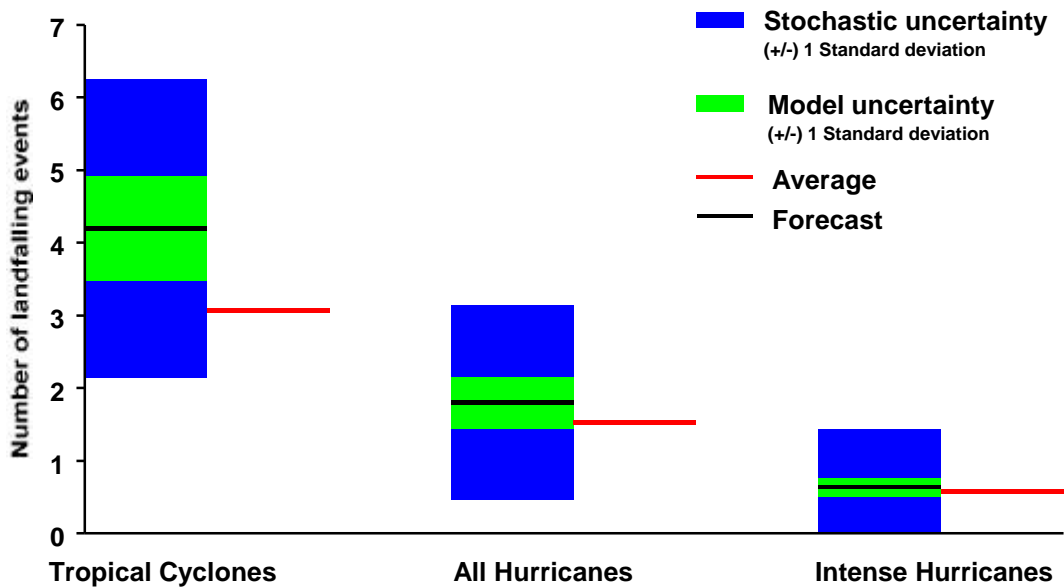


No. of events	Probability of N events (mutually exclusive)							
	Forecast				Normal			
	TC	TS	1&2	IH	TC	TS	1&2	IH
0	2%	9%	31%	53%	5%	21%	39%	56%
1	6%	22%	36%	34%	14%	33%	37%	33%
2	13%	26%	21%	11%	22%	25%	17%	9%
3	19%	21%	8%	2%	22%	13%	5%	2%
4	19%	12%	2%	0%	17%	5%	1%	0%
5	16%	6%	1%	0%	10%	2%	0%	0%
6	11%	2%	0%	0%	5%	0%	0%	0%
7	7%	1%	0%	0%	2%	0%	0%	0%
8	4%	0%	0%	0%	1%	0%	0%	0%
9	2%	0%	0%	0%	0%	0%	0%	0%
10	1%	0%	0%	0%	0%	0%	0%	0%
11	0%	0%	0%	0%	0%	0%	0%	0%
12	0%	0%	0%	0%	0%	0%	0%	0%

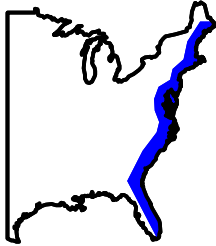
## Cumulative probability of landfalling events



## Frequency & severity distribution

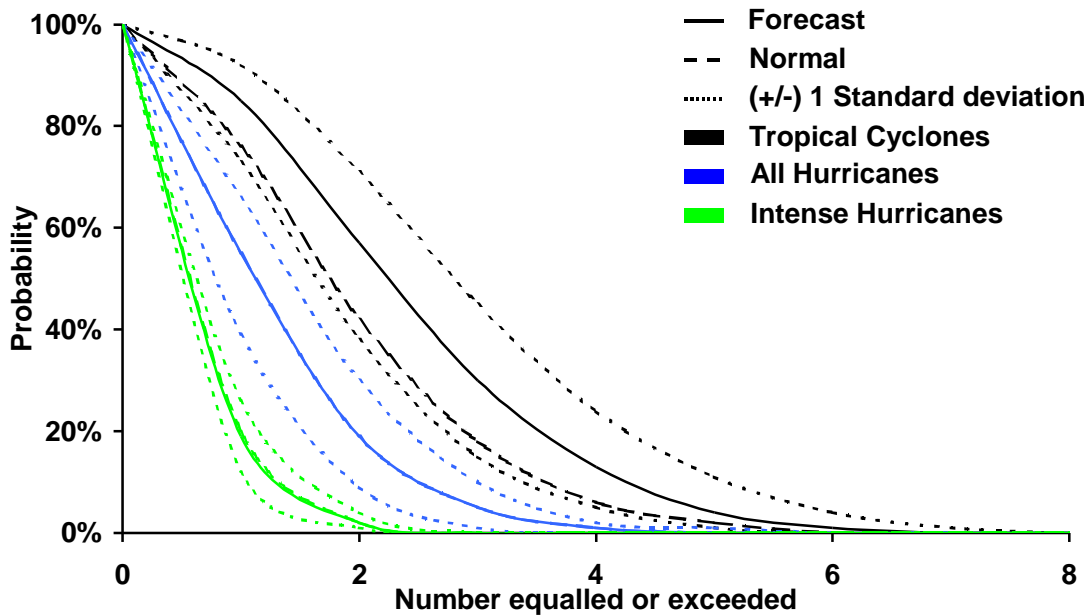


## East Coast Landfalling tropical cyclones

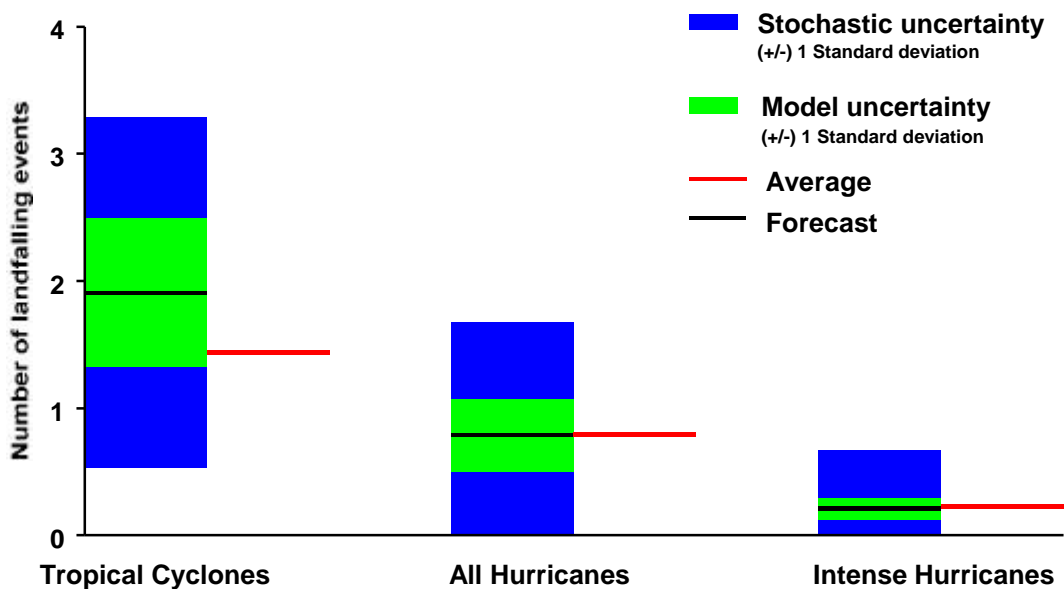


No. of events	Probability of N events (mutually exclusive)							
	Forecast				Normal			
	TC	TS	1&2	IH	TC	TS	1&2	IH
0	15%	33%	56%	81%	24%	52%	57%	80%
1	28%	37%	33%	17%	34%	34%	32%	18%
2	27%	20%	9%	2%	25%	11%	9%	2%
3	17%	8%	2%	0%	12%	2%	2%	0%
4	8%	2%	0%	0%	4%	0%	0%	0%
5	3%	0%	0%	0%	1%	0%	0%	0%
6	1%	0%	0%	0%	0%	0%	0%	0%
7	0%	0%	0%	0%	0%	0%	0%	0%
8	0%	0%	0%	0%	0%	0%	0%	0%
9	0%	0%	0%	0%	0%	0%	0%	0%
10	0%	0%	0%	0%	0%	0%	0%	0%
11	0%	0%	0%	0%	0%	0%	0%	0%
12	0%	0%	0%	0%	0%	0%	0%	0%

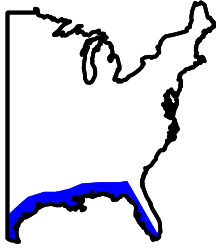
## Cumulative probability of landfalling events



## Frequency & severity distribution

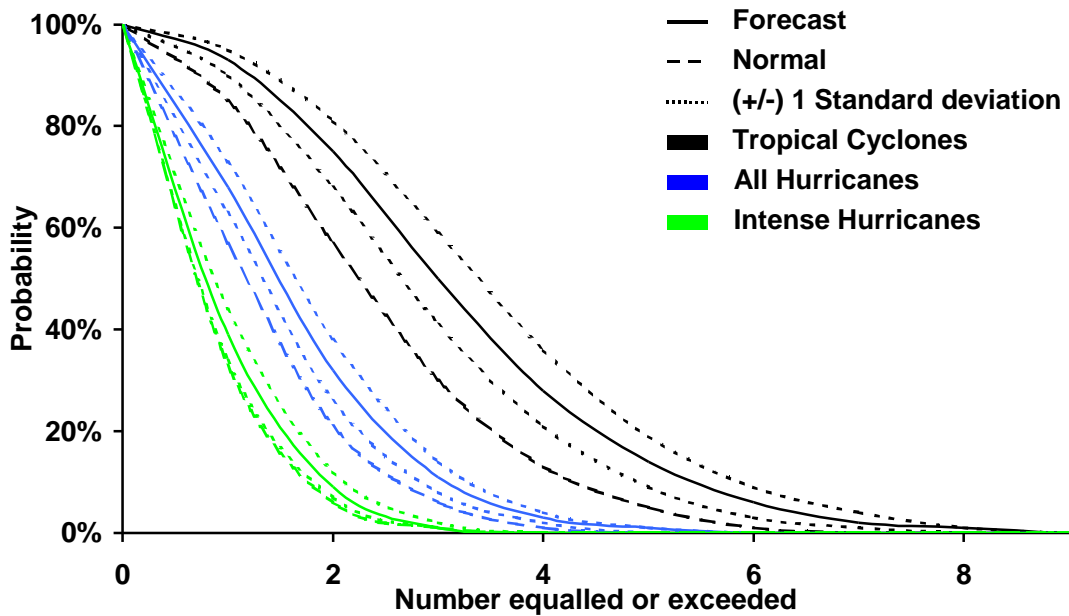


# Gulf Coast Landfalling tropical cyclones



No. of events	Probability of N events (mutually exclusive)							
	Forecast				Normal			
	TC	TS	1&2	IH	TC	TS	1&2	IH
0	7%	21%	52%	61%	15%	35%	63%	67%
1	18%	33%	34%	30%	28%	37%	29%	27%
2	25%	25%	11%	8%	27%	20%	7%	5%
3	22%	13%	2%	1%	17%	7%	1%	1%
4	15%	5%	0%	0%	8%	2%	0%	0%
5	8%	2%	0%	0%	3%	0%	0%	0%
6	4%	0%	0%	0%	1%	0%	0%	0%
7	1%	0%	0%	0%	0%	0%	0%	0%
8	0%	0%	0%	0%	0%	0%	0%	0%
9	0%	0%	0%	0%	0%	0%	0%	0%
10	0%	0%	0%	0%	0%	0%	0%	0%
11	0%	0%	0%	0%	0%	0%	0%	0%
12	0%	0%	0%	0%	0%	0%	0%	0%

## Cumulative probability of landfalling events



## Frequency & severity distribution

