

# Summary of 1999 Atlantic Tropical Cyclone Season and Verification of Authors' Seasonal Forecasts

Issued: 7<sup>th</sup> December, 1999

## Summary

**An active year successfully predicted in terms of US strike numbers and Atlantic total numbers**

### 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, endorsed and managed by the Met. Office, is being undertaken by University College London and Reading University.

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

Statistical methods are used to identify predictors of landfalling events. The predictors used in the forecast are a mix of current climate parameters and dynamical and statistical model predictions of climate parameters for the coming Atlantic tropical cyclone season.

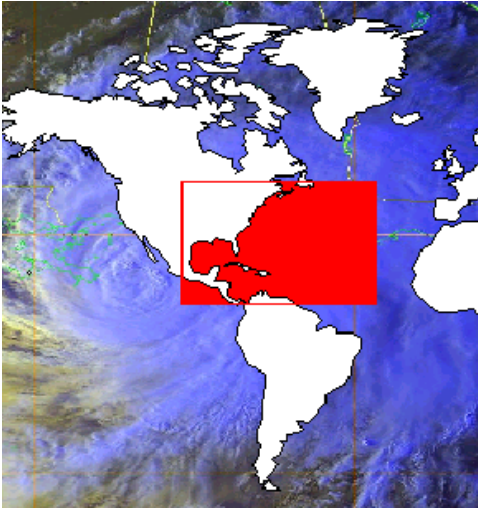
### Project Team

The forecasts and this verification document are produced by Dr Mark Saunders and Dr Paul Rockett of the Benfield Greig Hazard Research Centre, University College London.

The project is coordinated by Mrs Alyson Bedford of The Met. Office. We wish to thank Lance Garrard (TSUNAMI Director) and Mike Cooper (Insurance Industry Representative) for industrial



liaison, Dr Richard Chandler (Department of Statistical Science, University College London) for statistical advice, Dr Chris Thorncroft and Ioannis Pytharoulis (Meteorology Department, Reading University) for dynamical model research, and Dr Mike Davey (Hadley Centre for Climate Prediction & Research) for meteorological advice.



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

## Summary of the 1999 Atlantic Season

- The 1999 Atlantic hurricane season ranks as the 6th most active season since reliable records began in 1950. Only 1950, 1955, 1961, 1995 and 1996 were more active than 1999 in terms of Gray's Net Tropical Cyclone Activity Index.
- A total of 1 intense hurricane, 3 hurricanes and 5 tropical storms made US landfall in 1999. This is the second consecutive year with above average US strike numbers.

<b>1999 Individual Storm Summary</b>						
No.	Name	Dates	Peak Wind (kts)	Minimum Pressure (mb)	Hurricane Category	Category at US Landfall
1	Arlene	Jun 11-18	50	1006	-	
2	Bret	Aug 18-24	125	944	4	4
3	Cindy	Aug 19-31	120	944	4	
4	Dennis	Aug 24 - Sep 5	90	963	2	TS
5	Emily	Aug 24-28	45	1004	-	
6	Floyd	Sep 7-17	135	921	4	2
7	Gert	Sep 11-23	130	930	4	
8	Harvey	Sep 19-22	50	995	-	TS
9	Irene	Oct 13-19	90	958	2	1
10	Jose	Oct 17-25	85	977	2	
11	Katrina	Oct 28 - Nov 1	35	999	-	
12	Lenny	Nov 13-21	130	934	4	

- The season continues the recent resurgence in Atlantic hurricane and intense hurricane activity. The 1995-1999 5-year total of 41 hurricanes is the highest 5-year Atlantic hurricane total on record. Intense hurricanes are averaging 4 per year since 1995. This compares to the long-term (1950-1998 average) of just 2.5 intense hurricanes per year.
- 1995 witnessed 5 category 4 hurricanes - the highest annual number of such events since at least 1950.
- The season continues the recent trend towards late starts (only one tropical storm before 18th August) and late finishes (intense hurricane Lenny formed in mid-November). Records suggest that there have been only two other major hurricanes of Lenny's intensity so late in the season. These occurred in 1912 and 1932.

## Verification of Forecasts

### 1. Atlantic Total Numbers

<b>Atlantic Total Numbers 1999</b>			
	Named Tropical Storms	Hurricanes	Intense Hurricanes
<b>Average Totals (1951-1998)</b>	9.8	5.9	2.5
<b>Actual Totals 1999</b>	12	8	5
<b>TSUNAMI Forecast 1 June 1999</b>	12 ( $\pm 3$ )	7 ( $\pm 3$ )	2 ( $\pm 1$ )
<b>Gray Forecast 4 June 1999</b>	14	9	4

The number of named tropical storms (12) was correctly forecast. The number of hurricanes (8) was underforecast by one. The number of intense hurricanes (5) was underforecast by three. Overall the forecast was successful and compares closely to the skill of the 'Gray' June forecast.

### 2. US Landfalling Activity

<b>US Landfalling Numbers 1999</b>			
	Named Tropical Storms	Hurricanes	Intense Hurricanes
<b>Average Totals (1951-1998)</b>	3.1	1.6	0.7
<b>Actual Totals 1999</b>	5	3	1
<b>TSUNAMI Forecast 1 December 1998</b>	4 ( $\pm 2$ )	2 ( $\pm 1$ )	1 ( $\pm 1$ )
<b>TSUNAMI Forecast 1 June 1999</b>	4 ( $\pm 2$ )	2 ( $\pm 1$ )	1 ( $\pm 1$ )

<b>Chance of at Least One Intense Hurricane Strike 1999</b>			
	<b>Forecast Chance</b>	<b>Average 1951-1998</b>	<b>Actual 1999</b>
<b>Entire US Coast</b>	<b>47%</b>	<b>44%</b>	<b>1</b>
<b>US East Coast</b>	<b>19%</b>	<b>20%</b>	<b>0</b>
<b>US Gulf Coast</b>	<b>39%</b>	<b>33%</b>	<b>1</b>

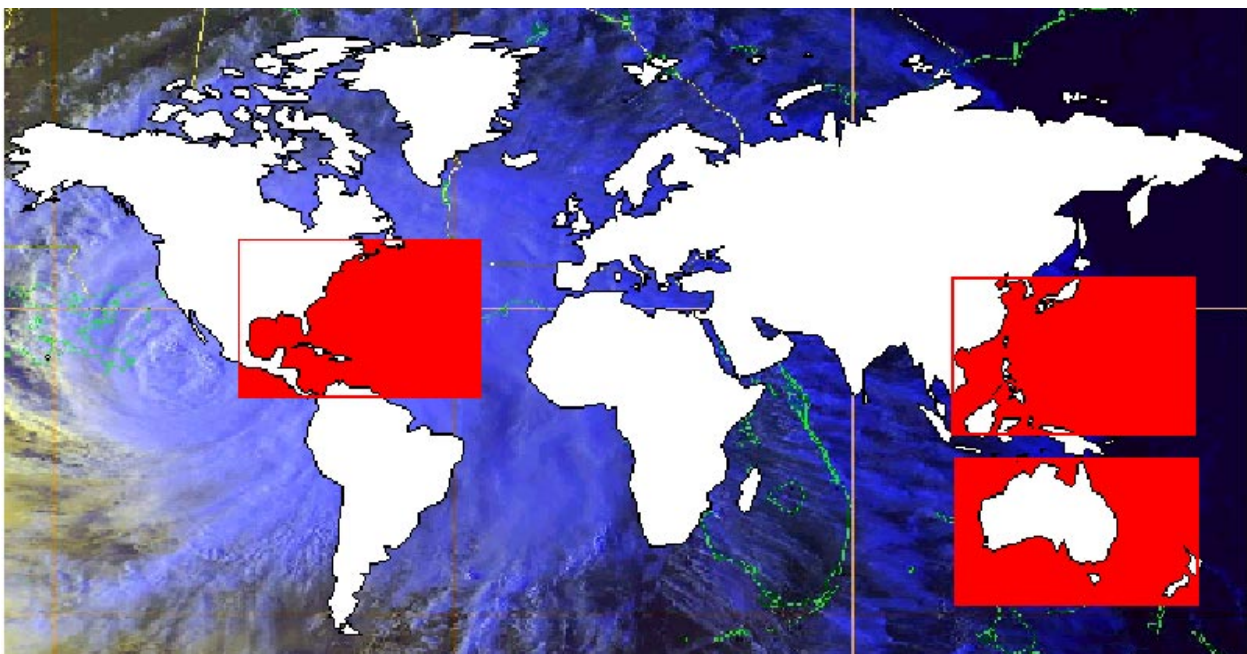
The December 1998 forecast correctly predicted that US landfalling activity would be above average in 1999. The numbers of landfalling named tropical storms (5), hurricanes (3) and intense hurricanes (1) were all successfully forecast to within the stated error. The landfalling forecast was also successful in terms of its regional predictions (see above) - the forecasts giving a higher chance of an intense hurricane strike on the U.S. Gulf Coast than on the U.S. East Coast.

Overall the forecast ranks as a success - the first, to our knowledge, to skilfully predict the numbers of US striking tropical cyclones at lead-times of interest to insurers and reinsurers.

## **Future Tropical Cyclone Forecasts from TSUNAMI**

*An extended-range forecast for the NW Pacific seasonal typhoon activity and Asian strike probability in 2000 will be issued in early January 2000.*

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



Basins for which TSUNAMI are issuing extended-range landfalling tropical cyclone forecasts.