Extended Range Forecast for Atlantic Hurricane Activity in 2004

Issued: 5th December 2003

by Drs Mark Saunders and Adam Lea

Benfield Hazard Research Centre, UCL (University College London), UK

Forecast Summary

The 2004 Atlantic hurricane season will see activity above average to 70% probability.

The TSR (Tropical Storm Risk) extended range forecast for Atlantic hurricane activity in 2004 anticipates a season with above average activity similar to 2003. Atlantic basin and US landfalling tropical cyclone activity are forecasted to be about 140% of average in 2004. The forecast spans the period from 1st June to 30th November 2004 and employs data through to the end of November 2003. TSR's two predictors are the forecast July-September 2004 trade wind speed over the Caribbean and tropical North Atlantic, and the forecast August-September 2004 sea surface temperature in the tropical North Atlantic. At present TSR anticipates both predictors having a moderate enhancing effect on activity. Monthly updated forecasts will be issued through to August 2004.

Atlantic ACE Index and System Numbers in 2004

		ACE Index	Intense Hurricanes	Hurricanes	Tropical Storms
TSR Forecast (±FE)	2004	132 (±59)	2.9 (±1.6)	7.2 (±2.7)	13.0 (±4.0)
54yr Climate Norm (±SD)	1950-2003	95 (±54)	2.5 (±1.9)	6.0 (±2.4)	9.9 (±3.3)
Forecast Skill at this Lead	1989-2003	16%	20%	9%	0%

Key:
ACE Index	=	Accumulated Cyclone Energy Index = Sum of the Squares of 6-hourly Maximum Sustained Wind Speeds (in units of knots) for all Systems while they are at least Tropical Storm Strength. ACE Unit = x10^4 knots^2.
Intense Hurricane	=	1 Minute Sustained Wind > 95Kts = Hurricane Category 3 to 5.
Hurricane	=	1 Minute Sustained Wind > 63Kts = Hurricane Category 1 to 5.
Tropical Storm	=	1 Minute Sustained Wind > 33Kts.
SD	=	Standard Deviation.
FE (Forecast Error)	=	Standard Deviation of Errors in Replicated Real Time Forecasts 1989-2003.
Forecast Skill	=	Percentage Improvement in Mean Square Error over Running 10-year Prior Climate Norm from Replicated Real Time Forecasts 1989-2003.

There is a 65% probability that the 2004 Atlantic hurricane season ACE index will be above average (defined as an ACE index value in the upper tercile historically (>108)), a 23% likelihood it will be near-normal (defined as an ACE index value in the middle tercile historically (64 to 108) and a 12% chance it will be below-normal (defined as an ACE index value in the lower tercile historically (<64)). The 54-year period 1950-2003 is used for climatology.

ACE Index & Numbers Forming in the MDR, Caribbean Sea and Gulf of Mexico in 2004

		ACE Index	Intense Hurricanes	Hurricanes	Tropical Storms
TSR Forecast (±FE)	2004	115 (±63)	2.9 (±1.7)	5.5 (±2.8)	9.5 (±4.2)
54yr Climate Norm (±SD)	1950-2003	73 (±55)	2.2 (±1.5)	4.1 (±2.5)	6.8 (±2.6)
Forecast Skill at this Lead	1989-2003	15%	20%	11%	0%

The Atlantic hurricane <u>M</u>ain <u>D</u>evelopment <u>R</u>egion (MDR) is the region 10°N - 20°N, 20°W - 60°W between the Cape Verde Islands and the Caribbean Lesser Antilles. A storm is defined as having formed within this region if it reached at least tropical depression status while in the area.

There is a 71% probability that in 2004 the MDR, Caribbean Sea and Gulf of Mexico ACE index will be above average (defined as an ACE index value in the upper tercile historically (>79)), a 20% likelihood it will be near-normal (defined as an ACE index value in the middle tercile historically (33 to 79) and a 9% chance it will be below-normal (defined as an ACE index value in the lower tercile historically (<33)). The 54-year period 1950-2003 is used for climatology.

USA Landfalling ACE Index and Numbers in 2004

		ACE Index	Hurricanes	Tropical Storms
TSR Forecast (±FE)	2004	3.1 (±1.4)	1.7 (±1.1)	3.9 (±1.9)
Average (±SD)	1950-2003	2.2 (±2.0)	1.4 (±1.2)	3.0 (±1.9)
Forecast Skill at this Lead	1989-2003	17%	10%	14%

Key: ACE Index   = <u>A</u>ccumulated <u>C</u>yclone <u>E</u>nergy Index = Sum of the Squares of hourly Maximum Sustained Wind Speeds (in units of knots) for all Systems while they are at least Tropical Storm Strength and over the USA Mainland (reduced by a factor of 6). ACE Unit = x10^4 knots^2.

Landfall Strike Category   = Maximum 1 Minute Sustained Wind of Storm Coming Within 30km of Land.

USA Mainland   = Brownsville (Texas) to Maine.

USA landfalling intense hurricanes are not forecast since we have no skill at any lead.

There is a 68% probability that in 2004 the USA landfalling ACE index will be above average (defined as a USA ACE index value in the upper tercile historically (>2.40)), a 26% likelihood it will be near-normal (defined as a USA ACE index value in the middle tercile historically (0.90 to 2.40) and a 6% chance it will be below-normal (defined as a USA ACE index value in the lower tercile historically (<0.90)). The 54-year period 1950-2003 is used for climatology.

Caribbean Lesser Antilles Landfalling Numbers in 2004

		ACE Index	Intense Hurricanes	Hurricanes	Tropical Storms
TSR Forecast (±FE)	2004	2.3 (± 2.7)	0.4 (±0.4)	0.7 (±0.7)	1.7 (±1.1)
54yr Climate Norm (±SD)	1950-2003	1.4 (±1.4)	0.2 (±0.5)	0.4 (±0.7)	1.1 (±1.1)
Forecast Skill at this Lead	1989-2003	3%	4%	18%	-6%

Key: ACE Index   = <u>A</u>ccumulated <u>C</u>yclone <u>E</u>nergy Index = Sum of the Squares of hourly Maximum Sustained Wind Speeds (in units of knots) for all Systems while they are at least Tropical Storm Strength and within the boxed region (10°N-18°N,60°W-63°W) (reduced by a factor of 6). ACE Unit = x10^4 knots^2.

Landfall Strike Category   = Maximum 1 Minute Sustained Wind of Storm Coming Within 30km of Land.

Lesser Antilles   = Island Arc from Anguilla to Trinidad Inclusive.

Key Predictors for 2004

The key factors behind the TSR forecast for an above-average hurricane season in 2004 are the anticipated moderate enhancing effect of July-September forecast trade winds at 925mb height over the Caribbean Sea and tropical North Atlantic region (7.5^{o}N - 17.5^{o}N, 30°W - 100°W), and of August-September forecast sea surface temperature for the Atlantic MDR (10°N - 20°N, 20°W - 60°W). The

current forecasts for these predictors are 0.49±0.86 ms^{-1} weaker than normal (1973-2002 climatology) and 0.25±0.27^{o}C warmer than normal (1973-2002 climatology) respectively. The corresponding forecast skills for these predictors at this lead are 14% and 26%.

Forecasts and New Developments for 2004

For the 2004 Atlantic hurricane season TSR will be: (1) Issuing monthly updated forecasts through to early August for each basin, landfalling strength category and ACE index listed above. The figures on the skill pages of *http://tropicalstormrisk.com* show the TSR forecast skill and uncertainty as a function of lead month; (2) Releasing an improved model for predicting USA and USA East Coast landfalling hurricane wind energy; (3) Incorporating a new multi-ensemble statistical model for predicting the Nino 3, 3.4 and 4 ENSO indices; (4) Providing real-time forecasts through the TSR Tropical Storm Tracker of system tracks, track uncertainties, intensities and wind speed contours.

Further Information and Next Forecast

Further information on the TSR forecast methodology, the TSR replicated real-time hindcast skill as a function of lead time, and on TSR in general, may be obtained either from the TSR web site (*http://tropicalstormrisk.com*) or from the 'Extended Range Forecast for Atlantic Hurricane Activity in 2002' document issued on the 23rd November 2001. The first TSR monthly forecast update for the 2004 Atlantic hurricane season will be issued on the 6th January 2004.