August Forecast Update for Atlantic Hurricane Activity in 2009

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Forecast Summary

TSR raises its forecast and predicts the 2009 hurricane season will see basin activity close to the 1950-2008 average and US landfalling activity 15% below-norm.

The TSR (Tropical Storm Risk) August forecast update for Atlantic hurricane activity in 2009 anticipates a season with near-norm basin activity but US landfalling activity 15% below-norm. The forecast spans the period from 1st June to 30th November 2009 and employs data through to the end of July 2009. TSR's two predictors for basin activity are the forecast July-September 2009 trade wind speed over the Caribbean and tropical North Atlantic, and the forecast August-September 2009 sea surface temperature in the tropical North Atlantic. TSR anticipates the trade wind predictor having a weak suppressing effect on activity and the sea surface temperature predictor having a weak enhancing effect on activity. US landfalling activity is predicted from the persistence of July steering winds (*Saunders and Lea, 2005*). These winds are slightly unfavourable in 2009. The reason for increasing the forecast for basin activity from 20% below-norm last month to near-norm activity now is that August/September sea surface temperatures in the Atlantic main development region are expected to be warmer than thought previously.

Atlantic ACE Index and System Numbers in 2009

		ACE Index	Intense Hurricanes	Hurricanes	Tropical Storms
TSR Forecast (±FE)	2009	105 (±40)	2.8 (±1.3)	6.5 (±1.7)	12.6 (±2.8)
59yr Climate Norm (±SD)	1950-2008	102 (±60)	2.7(±1.9)	6.2 (±2.6)	10.4 (±4.0)
Forecast Skill at this Lead	1984-2008	55%	44%	60%	51%

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 1984-2008.
Forecast Skill = Percentage Improvement in Mean Square Error over Running 10-year Prior Climate Norm from Replicated Real Time Forecasts 1984-2008.

There is a 40% probability that the 2009 Atlantic hurricane season ACE index will be above average (defined as an ACE index value in the upper tercile historically (>116)), a 41% likelihood it will be near-normal (defined as an ACE index value in the middle tercile historically (71 to 116) and a 19% chance it will be below-normal (defined as an ACE index value in the lower tercile historically (<71)). The 59-year period 1950-2008 is used for climatology.

Key: Terciles = Data groupings of equal (33.3%) probability corresponding to the upper, middle and lower one-third of values historically (1950-2008).
Upper Tercile = ACE index value greater than 116.
Middle Tercile = ACE index value between 71 and 116.
Lower Tercile = ACE index value less than 71.

ACE Index & Numbers Forming in the MDR, Caribbean Sea and Gulf of Mexico in 2009

		ACE Index	Intense Hurricanes	Hurricanes	Tropical Storms
TSR Forecast (±FE)	2009	79 (±44)	2.5 (±1.2)	4.3 (±1.6)	7.6 (±2.2)
59yr Climate Norm (±SD)	1950-2008	79 (±59)	2.4 (±1.8)	4.3 (±2.4)	7.1 (±3.4)
Forecast Skill at this Lead	1984-2008	45%	49%	62%	61%

The Atlantic hurricane Main Development Region (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 38% probability that in 2009 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 (>92)), a 42% likelihood it will be near-normal (defined as an ACE index value in the middle tercile historically (41 to 92) and a 20% chance it will be below-normal (defined as an ACE index value in the lower tercile historically (<41)). The 59-year period 1950-2008 is used for climatology.

USA Landfalling ACE Index and Numbers in 2009

		ACE Index	Hurricanes	Tropical Storms
TSR Forecast (±FE)	2009	2.1 (±1.7)	1.4 (±1.5)	3.0 (±1.9)
59yr Climate Norm (±SD)	1950-2008	2.5 (±2.2)	1.5 (±1.3)	3.2 (±2.0)
Forecast Skill at this Lead	1984-2008	46%	25%	24%

Key: ACE Index = Accumulated Cyclone Energy 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 Directly Striking 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 38% probability that in 2009 the USA landfalling ACE index will be above average (defined as a USA ACE index value in the upper tercile historically (>2.60)), a 33% likelihood it will be near-normal (defined as a USA ACE index value in the middle tercile historically (1.15 to 2.60) and a 29% chance it will be below-normal (defined as a USA ACE index value in the lower tercile historically (<1.13)). The 59-year period 1950-2008 is used for climatology.

Caribbean Lesser Antilles Landfalling Numbers in 2009

		ACE Index	Intense Hurricanes	Hurricanes	Tropical Storms
TSR Forecast (±FE)	2009	1.4 (± 1.9)	0.3 (±0.3)	0.5 (±0.5)	1.1 (±0.9)
59yr Climate Norm (±SD)	1950-2008	1.4 (±2.0)	0.2 (±0.5)	0.5 (±0.7)	1.1 (±1.0)
Forecast Skill at this Lead	1984-2008	23%	20%	37%	16%

Key: ACE Index = Accumulated Cyclone Energy 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 Directly Striking Land.

Lesser Antilles = Island Arc from Anguilla to Trinidad Inclusive.

Key Predictors for 2009

The key factors behind the TSR forecast for a near-norm hurricane season in 2009 are the anticipated weak suppressing effect of July-September forecast trade winds at 925mb height over the Caribbean Sea and tropical North Atlantic region (7.5°N - 17.5°N, 30°W - 100°W), combined with the weak enhancing effect of August-September forecast sea surface temperature (SST) for the Atlantic MDR (10°N - 20°N, 20°W - 60°W). The current forecasts for these predictors are 0.21±0.42 ms^{-1} stronger than normal (1979-2008 climatology) and 0.18±0.14°C warmer than normal (1979-2008 climatology). For comparison, July's values for these two predictors were 0.67±0.58 ms^{-1} stronger than normal and 0.15±0.17°C cooler than normal. The forecast skills (assessed for the period 1984-2008) for these predictors at this lead are 77% and 83% respectively.

The July-September trade wind speed influences cyclonic vorticity (the spinning up of storms) in the main hurricane track region. The August-September MDR SST provides heat and moisture to power incipient storms in the main track region.

Forecast Model for US ACE Index and US Landfalling Hurricane Numbers

The TSR early August forecast for the US ACE index and US landfalling hurricane and tropical storm numbers in 2009 is made with an ensemble of two models. These are: (1) the July 2009 tropospheric wind anomalies between heights of 925mb and 400mb over North America, the east Pacific and the North Atlantic (*Saunders and Lea, 2005*). Wind anomalies in these regions in July are indicative of persistent atmospheric circulation patterns that either favour or hinder evolving hurricanes from reaching US shores during August and September; (2) the TSR early August forecast for the North Atlantic ACE index and hurricane numbers in 2009.

Saunders, M. A. and A. S. Lea, Seasonal prediction of hurricane activity reaching the coast of the United States, *Nature*, 434, 1005-1008, 2005.

The Precision of Seasonal Hurricane Forecasts

The precision of seasonal Atlantic hurricane forecasts as a function of issue time is assessed over many years in this recent article:

Saunders, M. A., Winds of change, *Post Magazine Risk Report*, pp28-29, 9 November 2006, http://www.tropicalstormrisk.com/docs/Hurricanes-Post09112006.pdf

Further Information and Next Forecast

Further information about TSR forecasts, verifications and hindcast skill as a function of lead time may be obtained from the TSR web site *http://www.tropicalstormrisk.com*. This is the final TSR forecast update for the 2009 Atlantic hurricane season. A summary of the 2009 Atlantic hurricane season and a verification of the TSR seasonal forecasts will be issued in early January 2010.

Appendix - Predictions from Previous Months

1. Atlantic ACE Index and System Numbers

Atlantic ACE Index and System Numbers 2009					
		ACE Index (x 10^4 kts^2)	Named Tropical Storms	Hurricanes	Intense Hurricanes
Average Number (±SD) (1950-2008)		102 (±60)	10.4 (±4.0)	6.2 (±2.6)	2.7 (±1.9)
TSR Forecasts (±FE)	4 Aug 2009	105 (±40)	12.6 (±2.8)	6.5 (±1.7)	2.8 (±1.3)
	6 Jul 2009	80 (±46)	11.4 (±3.2)	5.6 (±2.2)	2.4 (±1.6)
	4 Jun 2009	69 (±50)	10.9 (±3.3)	5.2 (±2.4)	2.2 (±1.6)
	6 Apr 2009	135 (±56)	15.0 (±3.8)	7.8 (±2.6)	3.6 (±1.7)
	5 Dec 2008	136 (±60)	14.8 (±4.3)	7.7 (±2.8)	3.5 (±1.8)
CSU Forecasts	2 Jun 2009	85	11	5	2
	9 Apr 2009	100	12	6	2
	10 Dec 2008	125	14	7	3
NOAA forecast	21 May 2009	57-114	9-14	4-7	1-3
Met Office Forecast	18 June 2009	40-80	3-9	-	-

2. MDR, Caribbean Sea and Gulf of Mexico ACE Index and Numbers

MDR, Caribbean Sea and Gulf of Mexico ACE Index and Numbers 2009					
		ACE Index (x 10^4 kts^2)	Named Tropical Storms	Hurricanes	Intense Hurricanes
Average Number (±SD) (1950-2008)		79 (±59)	7.1 (±3.4)	4.3 (±2.4)	2.4 (±1.8)
TSR Forecasts (±FE)	4 Aug 2009	79 (±44)	7.6 (±2.2)	4.3 (±1.6)	2.5 (±1.2)
	6 Jul 2009	54 (±45)	6.4 (±2.3)	3.4 (±1.8)	2.1 (±1.4)
	4 Jun 2009	43 (±47)	5.9 (±2.6)	3.0 (±2.0)	1.9 (±1.4)
	6 Apr 2009	109 (±54)	10.0 (±3.2)	5.6 (±2.3)	3.3 (±1.6)
	5 Dec 2008	109 (±57)	9.8 (±3.7)	5.5 (±2.5)	3.2 (±1.6)

3. US ACE Index and Landfalling Numbers

US Landfalling Numbers 2009				
		ACE Index (x 10^4 kts^2)	Named Tropical Storms	Hurricanes
Average Number (±SD) (1950-2008)		2.5 (±2.2)	3.2 (±2.0)	1.5 (±1.3)
TSR Forecasts (±FE)	4 Aug 2009	2.1 (±1.7)	3.8 (±1.9)	1.6 (±1.5)
	6 Jul 2009	1.9 (±2.0)	3.4 (±2.0)	1.4 (±1.5)
	4 Jun 2009	1.6 (±2.1)	3.2 (±2.1)	1.3 (±1.5)
	6 Apr 2009	3.6 (±2.1)	4.8 (±2.1)	2.1 (±1.6)
	5 Dec 2008	3.4 (±2.1)	4.7 (±2.2)	2.1 (±1.6)

4. Lesser Antilles ACE Index and Landfalling Numbers

Lesser Antilles Landfalling Numbers 2009					
		ACE Index (x 10^4 kts^2)	Named Tropical Storms	Hurricanes	Intense Hurricanes
Average Number (±SD) (1950-2008)		1.4 (±2.0)	1.1 (±1.0)	0.5 (±0.7)	0.2 (±0.5)
TSR Forecasts (±FE)	4 Aug 2009	1.4 (±1.9)	1.1 (±0.9)	0.5 (±0.5)	0.3 (±0.3)
	6 Jul 2009	0.9 (±2.0)	1.0 (±0.9)	0.4 (±0.5)	0.2 (±0.4)
	4 Jun 2009	0.7 (±2.0)	0.9 (±0.9)	0.4 (±0.6)	0.2 (±0.4)
	6 Apr 2009	1.8 (±2.2)	1.4 (±1.0)	0.6 (±0.6)	0.3 (±0.4)
	5 Dec 2008	1.8 (±2.2)	1.4 (±1.0)	0.6 (±0.6)	0.3 (±0.4)