August Forecast Update for Atlantic Hurricane Activity in 2012

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by Professor Mark Saunders and Dr Adam Lea
Dept. of Space and Climate Physics, UCL (University College London), UK

Forecast Summary

TSR continues to predict the 2012 Atlantic hurricane season will see activity close to the long-term (1950-2011) norm. TSR reduces its forecast for US landfalling hurricane activity to 10% below-norm. The precision of TSR's early August outlooks for Atlantic hurricane activity for the past decade is good.

The TSR (Tropical Storm Risk) August forecast update for Atlantic hurricane activity in 2012 continues to anticipate near-normal activity. Based on current and projected climate signals, Atlantic basin tropical cyclone activity is forecast to be close to the 1950-2011 long-term norm but 30% below the recent 2002-2011 10-year norm. U.S. landfalling hurricane activity is forecast to be 10% below the 1950-2011 norm and 25% below the 2002-2011 norm. The forecast spans the period from 1st June to 30th November 2012 and employs data through to the end of July 2012. TSR's two predictors are the forecast July-September trade wind speed over the Caribbean and tropical North Atlantic, and the forecast August-September 2012 sea surface temperatures in the tropical North Atlantic. The former influences cyclonic vorticity (the spinning up of storms) in the main hurricane track region, while the latter provides heat and moisture to power incipient storms in the main track region. At present, TSR anticipates the trade wind predictor to have a neutral effect on activity and the SST predictor to have a slight enhancing effect on activity.

Atlantic ACE Index and System Numbers in 2012

		ACE Index	Intense Hurricanes	Hurricanes	Tropical Storms
TSR Forecast (±FE)	2012	106 (±39)	2.9 (±1.2)	6.0 (±1.7)	14.2 (±2.9)
62yr Climate Norm (±SD)	1950-2011	103 (±60)	2.7 (±1.9)	6.2 (±2.7)	10.7 (±4.3)
10yr Climate Norm	2002-2011	136	3.8	7.5	15.7
Forecast Skill at this Lead	1980-2011	57%	48%	64%	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 Winds > 33Kts.
- SD = Standard Deviation.
- FE (Forecast Error) = Standard Deviation of Errors in Replicated Real Time Forecasts 1980-2011.
- Forecast Skill = Percentage Improvement in Mean Square Error over Running 10-year Prior Climate Norm from Replicated Real Time Forecasts 1980-2011.

There is a 37% probability that the 2012 Atlantic hurricane season ACE index will be above-average (defined as an ACE index value in the upper tercile historically (>119)), a 45% likelihood it will be near-normal (defined as an ACE index value in the middle tercile historically (71 to 119) and an 18% chance it will be below-normal (defined as an ACE index value in the lower tercile historically (<71)). The 62-year period 1950-2011 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 (1950-2011).

- Upper Tercile = ACE index value greater than 119.
- Middle Tercile = ACE index value between 71 and 119.
- Lower Tercile = ACE index value less than 71.

ACE Index & Numbers Forming in the MDR, Caribbean Sea and Gulf of Mexico in 2012

		ACE Index	Intense Hurricanes	Hurricanes	Tropical Storms
TSR Forecast (±FE)	2012	84 (±41)	2.6 (±1.1)	4.3 (±1.5)	8.1 (±2.4)
62yr Climate Norm (±SD)	1950-2011	81 (±58)	2.4 (±1.8)	4.4 (±2.5)	7.4 (±3.5)
Forecast Skill at this Lead	1980-2011	47%	51%	65%	53%

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 39% probability that the 2012 Atlantic hurricane season ACE index will be above-average (defined as an ACE index value in the upper tercile historically (>95)), a 45% likelihood it will be near-normal (defined as an ACE index value in the middle tercile historically (41 to 95) and a 16% chance it will be below-normal (defined as an ACE index value in the lower tercile historically (<41)). The 62-year period 1950-2011 is used for climatology.

US Landfalling ACE Index and Numbers in 2012

		ACE Index	Hurricanes	Tropical Storms
TSR Forecast (±FE)	2012	2.0 (±1.8)	1.4 (±1.4)	4.2 (±2.0)
62yr Climate Norm (±SD)	1950-2011	2.4 (±2.2)	1.5 (±1.3)	3.1 (±2.0)
10yr Climate Norm	2002-2011	2.8	1.7	4.4
Forecast Skill at this Lead	1980-2011	31%	23%	22%

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

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

There is a 38% probability that in 2012 the US landfalling ACE index will be above average (defined as a US ACE index value in the upper tercile historically (>2.54)), a 31% likelihood it will be near-normal (defined as a US ACE index value in the middle tercile historically (1.11 to 2.54)) and a 31% chance it will be below-normal (defined as a US ACE index value in the lower tercile historically (<1.11)). The 62-year period 1950-2011 is used for climatology.

Caribbean Lesser Antilles Landfalling Numbers in 2012

		ACE Index	Intense Hurricanes	Hurricanes	Tropical Storms
TSR Forecast (±FE)	2012	1.4 (±1.7)	0.3 (±0.4)	0.5 (±0.5)	1.2 (±0.8)
62yr Climate Norm (±SD)	1950-2011	1.4 (±2.0)	0.2 (±0.5)	0.5 (±0.7)	1.1 (±1.0)
10yr Climate Norm	2002-2011	1.0	0.1	0.5	1.1
Forecast Skill at this Lead	1980-2011	27%	15%	37%	34%

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.

Lesser Antilles = Island Arc from Anguilla to Trinidad Inclusive.

Key Predictors for 2012

The key factors behind the TSR forecast for a near-average hurricane season in 2012 are the anticipated neutral effect of the July-September forecast trade wind at 925mb height over the Caribbean Sea and tropical North Atlantic region (7.5°N – 17.5°N, 30°W – 100°W), and slight enhancing effect 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 -0.03±0.48 ms^{-1} (up from the June forecast value of -0.18±0.61 ms^{-1}) weaker than normal (1980-2011 climatology) and 0.11±0.13°C warmer than normal (1980-2011 climatology) (up slightly from the June forecast value of 0.09±0.17°C warmer than normal). The July-September 2012 trade wind prediction at this lead is based on the observed July 2012 trade wind speed anomaly. The forecast skills for these predictors at this lead are 73% and 86% respectively.

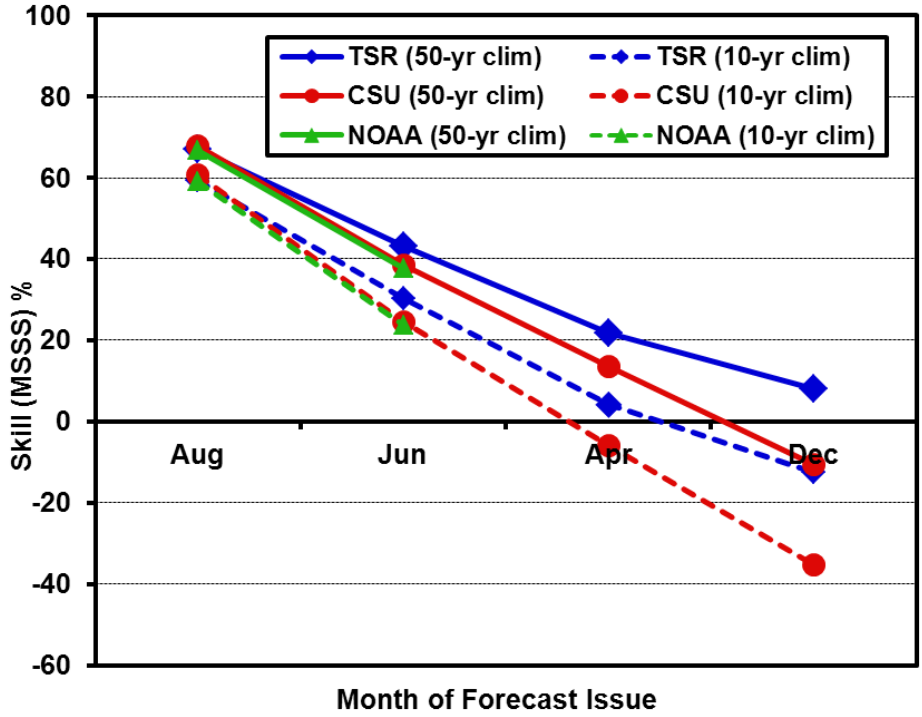
Forecast Model for US ACE Index and US Landfalling Hurricane Numbers

The TSR early August forecast for the US ACE index and US landfalling hurricane and tropical storm numbers in 2012 is predicted from an ensemble of two models: (1) the July 2012 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) thinning from the forecast total Atlantic basin activity.

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 figure displays the recent 10-year (2002-2011) skill for the forecast number of North Atlantic hurricanes issued by different organisations.



Forecast precision is assessed using the Mean Square Skill Score (MSSS) which is the percentage improvement in mean square error over a climatological forecast. Positive skill indicates that the model performs better than a climatology forecast, whilst a negative skill indicates that it performs worse than climatology. Two different climatologies are used: a fixed 50-year (1950-1999) climatology and a running prior 10-year climate norm.

The figure compares the forecast skill of the TSR, NOAA (National Oceanic and Atmospheric Administration) and CSU (Colorado State University) seasonal hurricane outlooks 2002-2011 as a function of lead time. NOAA does not release seasonal outlooks before late May. It is clear there is little skill in forecasting the upcoming number of Atlantic hurricanes from the prior December. Skill climbs slowly as the hurricane season approaches. Moderate skill levels are reached by early June and good skill levels are achieved from early August.

In terms of TSR forecast successes and failures in recent years, the 2004, 2005, 2008, 2010 and 2011 North Atlantic hurricane seasons were predicted to have 'high activity' (i.e. in the top one third of years historically) to high (60-70%) probability from the previous December. In contrast, the TSR extended range forecasts for the 2006, 2007 and 2009 hurricane seasons were less impressive.

Further Information and Next Forecast

Further information about TSR forecasts and verifications may be obtained from the TSR web site *http://www.tropicalstormrisk.com*. This is the final TSR forecast update for the 2012 Atlantic hurricane season. A summary of the 2012 Atlantic hurricane season and a verification of the TSR seasonal forecasts will be issued in early January 2013.

References

- Knaff, J. A. and C. W. Landsea, An El Niño-Southern Oscillation Climatology and Persistence (CLIPER) Forecasting Scheme, *Wea. Forecasting*, **12**, 633-652, 1997.
- Lloyd-Hughes, B., M. A. Saunders and P. Rockett, A consolidated CLIPER model for improved August-September ENSO prediction skill, *Wea. Forecasting*, **19**, 1089-1105, 2004.

Appendix – Predictions from Previous Months

1. Atlantic ACE Index and System Numbers

Atlantic ACE Index and System Numbers 2012						
		ACE Index	Named Tropical Storms	Hurricanes	Intense Hurricanes
Average Number (±SD) (1950-2011)		103 (±60)	10.7 (±4.3)	6.2 (±2.7)	2.7 (±1.9)
Average Number (2002-2011)		136	15.7	7.5	3.8
TSR Forecasts (±SD)	6 Aug 2012	106 (±39)	14.2 (±2.9)	6.0 (±1.7)	2.9 (±1.2)
	6 Jul 2012	103 (±44)	13.9 (±3.4)	5.8 (±2.2)	2.8 (±1.4)
	6 Jun 2012	100 (±47)	13.8 (±3.5)	5.8 (±2.4)	2.7 (±1.5)
	23 May 2012	98 (±52)	12.7 (±3.9)	5.7 (±2.7)	2.7 (±1.5)
	12 Apr 2012	95 (±55)	12.5 (±4.1)	5.6 (±2.8)	2.6 (±1.6)
	7 Dec 2011	117 (±58)	14.1 (±4.2)	6.7 (±3.0)	3.3 (±1.6)
CSU Forecasts	3 Aug 2012	99	14	6	2
	1 Jun 2012	80	13	5	2
	4 Apr 2012	70	10	4	2
NOAA Forecast	24 May 2012	60-130	9-15	4-8	1-3
Met Office Forecast	24 May 2012	90 (±62)	10* (±3)	-	-
Institute of Meteorology, Cuba	6 Aug 2012	-	11	5	-
	4 May 2012	-	10	5	-

*Does not include tropical storms Alberto and Beryl.

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

MDR, Caribbean Sea and Gulf of Mexico ACE Index and Numbers 2012					
		ACE Index	Named Tropical Storms	Hurricanes	Intense Hurricanes
Average Number (±SD) (1950-2011)		81 (±58)	7.4 (±3.5)	4.4 (±2.5)	2.4 (±1.8)
Average Number (2002-2011)		114	10.6	5.8	3.5
TSR Forecast (±SD)	6 Aug 2012	84 (±41)	8.1 (±2.4)	4.3 (±1.5)	2.6 (±1.1)
	6 Jul 2012	80 (±42)	7.8 (±2.4)	4.1 (±1.7)	2.5 (±1.3)
	6 Jun 2012	78 (±44)	7.8 (±2.6)	4.1 (±1.9)	2.4 (±1.3)
	23 May 2012	76 (±48)	7.6 (±3.0)	4.0 (±2.2)	2.4 (±1.4)
	12 Apr 2012	72 (±52)	7.4 (±3.3)	3.9 (±2.4)	2.3 (±1.5)

3. US ACE Index and Landfalling Numbers

US Landfalling Numbers 2012				
		ACE Index	Named Tropical Storms	Hurricanes
Average Number (±SD) (1950-2011)		2.4 (±2.2)	3.1 (±2.0)	1.5 (±1.3)
Average Number (2002-2011)		2.8	4.4	1.7
TSR Forecasts (±SD)	6 Aug 2012	2.0 (±1.8)	4.2 (±2.0)	1.4 (±1.4)
	6 Jul 2012	2.5 (±2.1)	4.7 (±2.2)	1.6 (±1.5)
	6 Jun 2012	2.5 (±2.1)	3.7 (±2.2)	1.6 (±1.5)
	23 May 2012	2.4 (±2.1)	3.6 (±2.2)	1.6 (±1.5)
	12 Apr 2012	2.4 (±2.1)	3.6 (±2.2)	1.5 (±1.5)
	7 Dec 2011	3.0 (±2.1)	4.3 (±2.2)	1.8 (±1.5)

4. Lesser Antilles ACE Index and Landfalling Numbers

Lesser Antilles Landfalling Numbers 2012					
		ACE Index	Named Tropical Storms	Hurricanes	Intense Hurricanes
Average Number (±SD) (1950-2011)		1.4 (±2.0)	1.1 (±1.0)	0.5 (±0.7)	0.2 (±0.5)
Average Number (2002-2011)		1.0	1.1	0.5	0.1
TSR Forecast (±SD)	6 Aug 2012	1.4 (±1.7)	1.2 (±0.8)	0.5 (±0.5)	0.3 (±0.4)
	6 Jul 2012	1.4 (±1.8)	1.2 (±0.9)	0.5 (±0.6)	0.2 (±0.4)
	6 Jun 2012	1.3 (±1.8)	1.2 (±0.9)	0.5 (±0.6)	0.2 (±0.4)
	23 May 2012	1.3 (±1.9)	1.2 (±0.9)	0.5 (±0.6)	0.2 (±0.4)
	12 Apr 2012	1.2 (±2.0)	1.2 (±1.0)	0.5 (±0.6)	0.2 (±0.4)

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