April Forecast Update for Atlantic Hurricane Activity in 2013

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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 an active Atlantic hurricane season in 2013 with levels about 30% above the 1950-2012 norm. However, uncertainties remain large and the precision of hurricane outlooks issued in April is low.

The TSR (Tropical Storm Risk) April forecast update for Atlantic hurricane activity in 2013 continues to anticipate an active hurricane season to moderate probability. Based on current and projected climate signals, Atlantic basin tropical cyclone activity is forecast to be about 30% above the 1950-2012 long-term norm but slightly below the recent 2003-2012 10-year norm. The forecast spans the period from 1st June to 30th November 2013 and employs data through to the end of March 2013. TSR's two predictors are the forecast July-September trade wind speed over the Caribbean and tropical North Atlantic, and the forecast August-September 2013 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 both predictors will have a small enhancing effect on activity.

Atlantic ACE Index and System Numbers in 2013

		ACE Index	Intense Hurricanes	Hurricanes	Tropical Storms
TSR Forecast (±FE)	2013	131 (±55)	3.4 (±1.6)	7.5 (±2.8)	15.2 (±4.1)
63yr Climate Norm (±SD)	1950-2012	103 (±59)	2.7 (±1.9)	6.3 (±2.7)	10.8 (±4.4)
10yr Climate Norm	2003-2012	143	3.7	8.1	16.4
Forecast Skill at this Lead	1980-2012	15%	12%	6%	6%

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 1980-2012.
Forecast Skill = Percentage Improvement in Mean Square Error over Running 10-year Prior Climate Norm from Replicated Real Time Forecasts 1980-2012.

There is a 57% probability that the 2013 Atlantic hurricane season ACE index will be above-average (defined as an ACE index value in the upper tercile historically (>121)), a 29% likelihood it will be near-normal (defined as an ACE index value in the middle tercile historically (72 to 121) and only a 14% chance it will be below-normal (defined as an ACE index value in the lower tercile historically (<72)). The 63-year period 1950-2012 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 (1950-2012).
Upper Tercile = ACE index value greater than 121.
Middle Tercile = ACE index value between 72 and 121.
Lower Tercile = ACE index value less than 72.

ACE Index & Numbers Forming in the MDR, Caribbean Sea and Gulf of Mexico in 2013

		ACE Index	Intense Hurricanes	Hurricanes	Tropical Storms
TSR Forecast (±FE)	2013	106 (±52)	3.0 (±1.5)	5.6 (±2.4)	9.9 (±3.3)
63yr Climate Norm (±SD)	1950-2012	81 (±58)	2.4 (±1.8)	4.4 (±2.5)	7.4 (±3.5)
Forecast Skill at this Lead	1980-2012	17%	18%	16%	14%

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 58% probability that the 2013 Atlantic hurricane season ACE index will be above-average (defined as an ACE index value in the upper tercile historically (>96)), a 30% likelihood it will be near-normal (defined as an ACE index value in the middle tercile historically (44 to 96) and only a 12% chance it will be below-normal (defined as an ACE index value in the lower tercile historically (<44)). The 63-year period 1950-2012 is used for climatology.

USA Landfalling ACE Index and Numbers in 2013

		ACE Index	Hurricanes	Tropical Storms
TSR Forecast (±FE)	2013	3.2 (±2.1)	1.9 (±1.5)	4.4 (±2.2)
63yr Climate Norm (±SD)	1950-2012	2.4 (±2.2)	1.4 (±1.3)	3.1 (±2.0)
10yr Climate Norm	2003-2012	2.9	1.7	3.9
Forecast Skill at this Lead	1980-2012	6%	8%	7%

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 63% probability that in 2013 the USA landfalling ACE index will be above average (defined as a USA ACE index value in the upper tercile historically (>2.54)), a 21% likelihood it will be near-normal (defined as a USA ACE index value in the middle tercile historically (1.15 to 2.54)) and only a 16% chance it will be below-normal (defined as a USA ACE index value in the lower tercile historically (<1.15)). The 63-year period 1950-2012 is used for climatology.

Caribbean Lesser Antilles Landfalling Numbers in 2013

		ACE Index	Intense Hurricanes	Hurricanes	Tropical Storms
TSR Forecast (±FE)	2013	1.8 (±2.0)	0.3 (±0.4)	0.6 (±0.6)	1.5 (±1.0)
63yr Climate Norm (±SD)	1950-2012	1.3 (±2.0)	0.2 (±0.5)	0.5 (±0.7)	1.1 (±1.0)
10yr Climate Norm	2003-2012	1.0	0.1	0.5	1.3
Forecast Skill at this Lead	1980-2012	1%	0%	13%	0%

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 2013

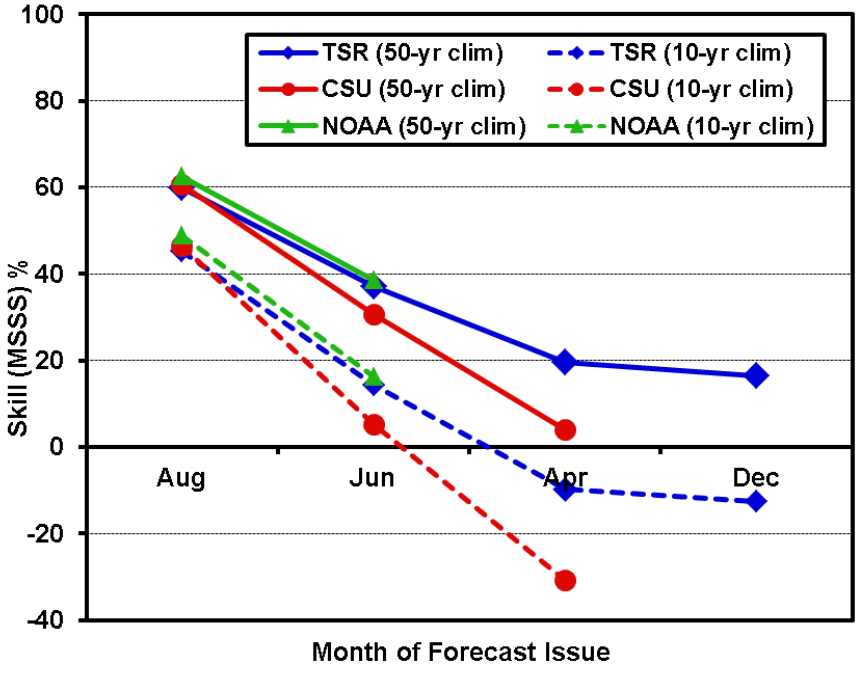
The key factors behind the TSR forecast for a moderately active hurricane season in 2013 are the anticipated small enhancing effects of the July-September forecast trade wind at 925mb height over the Caribbean Sea and tropical North Atlantic region (7.5°N – 17.5°N, 30°W – 100°W), and of August-September forecast sea surface temperature for the Atlantic MDR (10°N – 20°N, 20°W – 60°W). The current forecasts for these predictors are 0.26±0.84 ms^{-1} (down from the December forecast value of 0.36±0.82 ms^{-1}) weaker than normal (1980-2012 climatology) and 0.15±0.28°C warmer than normal (1980-2012 climatology) (down from the December forecast value of 0.27±0.28°C warmer than normal). The July-September 2013 trade wind prediction is based on an expectation of neutral to weak La Niña ENSO conditions in August-September 2013 as forecast by an in-house multi-ensemble extension of the Knaff and Landsea (1997) ENSO-CLIPER model (Lloyd-Hughes et al, 2004). The forecast skills for these predictors at this lead are 23% and 29% respectively. However, it should be stressed there are large forecast uncertainties in both these predictors at this lead.

The Precision of Seasonal Hurricane Forecasts

The figure below displays the seasonal forecast skill as a function of lead time for predicting the number of North Atlantic hurricanes. Skill is displayed for the most recent 10-year period 2003-2012 and is shown for three forecast centres: TSR, NOAA (National Oceanic and Atmospheric Administration) and CSU (Colorado State University). The TSR skills below differ from those on page 1 as the latter are computed for the 33-year period 1980-2012.

Forecast precision is assessed using the Mean Square Skill Score (MSSS) which is the percentage improvement in mean square error over a climatology forecast. Positive skill indicates that the model performs better than climatology, while 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.

It should be noted that NOAA does not issue seasonal hurricane outlooks before late May and that CSU stopped providing quantitative extended-range hurricane outlooks from the prior December in 2011. It is clear from the figure that there is little skill in forecasting the upcoming number of hurricanes from the previous December. Skill climbs slowly as the hurricane season approaches with moderate-to-good skill levels being achieved from early August.



In terms of recent seasonal forecast successes and failures, TSR correctly predicted the tercile (lower, middle, upper) of the North Atlantic hurricane seasons in 2004, 2005, 2008, 2010, 2011 and 2012 from the previous December. In contrast, the TSR extended range forecasts for the 2003, 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*. The next TSR forecast update for the 2013 Atlantic hurricane season will be a pre-season forecast issued on the 24th May 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 2013					
		ACE Index	Named Tropical Storms	Hurricanes	Intense Hurricanes
Average Number (±SD) (1950-2012)		103 (±59)	10.8 (±4.4)	6.3 (±2.7)	2.7 (±1.9)
Average Number (2003-2012)		143	16.4	8.1	3.7
TSR Forecasts (±SD)	5 Apr 2013	131 (±55)	15.2 (±4.1)	7.5 (±2.8)	3.4 (±1.6)
	5 Dec 2012	134 (±56)	15.4 (±4.3)	7.7 (±2.9)	3.4 (±1.6)

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

MDR, Caribbean Sea and Gulf of Mexico ACE Index and Numbers 2013					
		ACE Index	Named Tropical Storms	Hurricanes	Intense Hurricanes
Average Number (±SD) (1950-2012)		81 (±58)	7.4 (±3.5)	4.4 (±2.5)	2.4 (±1.8)
Average Number (2003-2012)		119	11.1	6.2	3.4
TSR Forecast (±SD)	5 Apr 2013	106 (±52)	9.9 (±3.3)	5.6 (±2.4)	3.0 (±1.5)

3. US ACE Index and Landfalling Numbers

US Landfalling Numbers 2013				
		ACE Index	Named Tropical Storms	Hurricanes
Average Number (±SD) (1950-2012)		2.4 (±2.2)	3.1 (±2.0)	1.4 (±1.3)
Average Number (2003-2012)		2.9	3.9	1.7
TSR Forecasts (±SD)	5 Apr 2013	3.2 (±2.1)	4.4 (±2.2)	1.9 (±1.5)
	5 Dec 2012	3.2 (±2.1)	4.5 (±2.2)	2.0 (±1.5)

4. Lesser Antilles ACE Index and Landfalling Numbers

Lesser Antilles Landfalling Numbers 2013					
		ACE Index	Named Tropical Storms	Hurricanes	Intense Hurricanes
Average Number (±SD) (1950-2012)		1.3 (±2.0)	1.1 (±1.0)	0.5 (±0.7)	0.2 (±0.5)
Average Number (2003-2012)		1.0	1.3	0.5	0.1
TSR Forecast (±SD)	5 Apr 2013	1.8 (±2.0)	1.5 (±1.0)	0.6 (±0.6)	0.3 (±0.4)