April Forecast Update for Atlantic Hurricane Activity in 2015

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Forecast Summary

TSR lowers its extended range forecast and predicts Atlantic hurricane activity in 2015 will be about 45% below the long-term average. However, forecast uncertainties remain large.

The TSR (Tropical Storm Risk) April forecast update reinforces the TSR extended range forecast and anticipates hurricane activity in 2015 will be below norm. Based on current and projected climate signals, Atlantic basin tropical cyclone activity is forecast to be about 45% below the 1950-2014 long-term norm and about 50% below the recent 2005-2014 10-year norm. The forecast spans the period from 1st June to 30th November 2015 and employs data through to the end of March 2015. The TSR forecast has reduced since early December 2014 due to updated climate signals indicating that the tropical North Atlantic and Caribbean Sea in August-September 2015 will likely be cooler than norm and cooler than thought previously. Should the TSR forecast for 2015 verify it would mean that the ACE index total for 2013-2015 was easily the lowest 3-year total since 1992-1994 and it would imply that the active phase of Atlantic hurricane activity which began in 1995 has likely ended. However, it should be stressed that the precision of hurricane outlooks issued in April is low and that large uncertainties remain for the 2015 hurricane season.

Atlantic ACE Index and System Numbers in 2015

		ACE Index	Intense Hurricanes	Hurricanes	Tropical Storms
TSR Forecast	2015	56	2	5	11
65yr Climate Norm	1950-2014	102	3	6	11
10yr Climate Norm	2005-2014	113	3	7	15
Forecast Skill at this Lead	1980-2014	16%	13%	2%	10%

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.
Forecast Skill = Percentage Improvement in Mean Square Error over Running 10-year Prior Climate Norm from Replicated Real Time Forecasts 1980-2014.

There is only a 13% probability that the 2015 Atlantic hurricane season ACE index will be above-average (defined as an ACE index value in the upper tercile historically (>120)), a 27% likelihood it will be near-normal (defined as an ACE index value in the middle tercile historically (70 to 120) and a 60% chance it will be below-normal (defined as an ACE index value in the lower tercile historically (<70)). The 65-year period 1950-2014 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 (1950-2014).
Upper Tercile = ACE index value greater than 120.
Middle Tercile = ACE index value between 70 and 120.
Lower Tercile = ACE index value less than 70.

ACE Index & Numbers Forming in the MDR, Caribbean Sea and Gulf of Mexico in 2015

		ACE Index	Intense Hurricanes	Hurricanes	Tropical Storms
TSR Forecast	2015	34	1	3	6
65yr Climate Norm	1950-2014	80	2	4	7
10-yr Climate norm	2005-2014	90	3	6	11
Forecast Skill at this Lead	1980-2014	18%	15%	12%	20%

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 only a 14% probability that the 2015 Atlantic hurricane season ACE index will be above-average (defined as an ACE index value in the upper tercile historically (>92)), a 30% likelihood it will be near-normal (defined as an ACE index value in the middle tercile historically (42 to 92) and a 56% chance it will be below-normal (defined as an ACE index value in the lower tercile historically (<42)). The 65-year period 1950-2014 is used for climatology.

USA Landfalling ACE Index and Numbers in 2015

		ACE Index	Hurricanes	Tropical Storms
TSR Forecast	2015	1.1	1	2
65yr Climate Norm	1950-2014	2.3	1	3
10yr Climate Norm	2005-2014	2.1	1	3
Forecast Skill at this Lead	1980-2014	4%	4%	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 = $x10^4$ $knots^2$.
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 25% probability that in 2015 the USA landfalling ACE index will be above average (defined as a USA ACE index value in the upper tercile historically (>2.51)), a 25% likelihood it will be near-normal (defined as a USA ACE index value in the middle tercile historically (1.09 to 2.51)) and a 50% chance it will be below-normal (defined as a USA ACE index value in the lower tercile historically (<1.09)). The 65-year period 1950-2014 is used for climatology.

Caribbean Lesser Antilles Landfalling Numbers in 2015

		ACE Index	Intense Hurricanes	Hurricanes	Tropical Storms
TSR Forecast	2014	0.3	0	0	1
65yr Climate Norm	1950-2014	1.3	0	0	1
10yr Climate Norm	2005-2014	0.9	0	1	1
Forecast Skill at this Lead	1980-2014	5%	0%	6%	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 within the region 10°-18°N, 63°-60°W (reduced by a factor of 6).
ACE Unit = $x10^4$ $knots^2$.
Strike Category = Maximum 1 Minute Sustained Wind of Storm Directly Striking Land.
Lesser Antilles = Island Arc from Anguilla to Trinidad Inclusive.

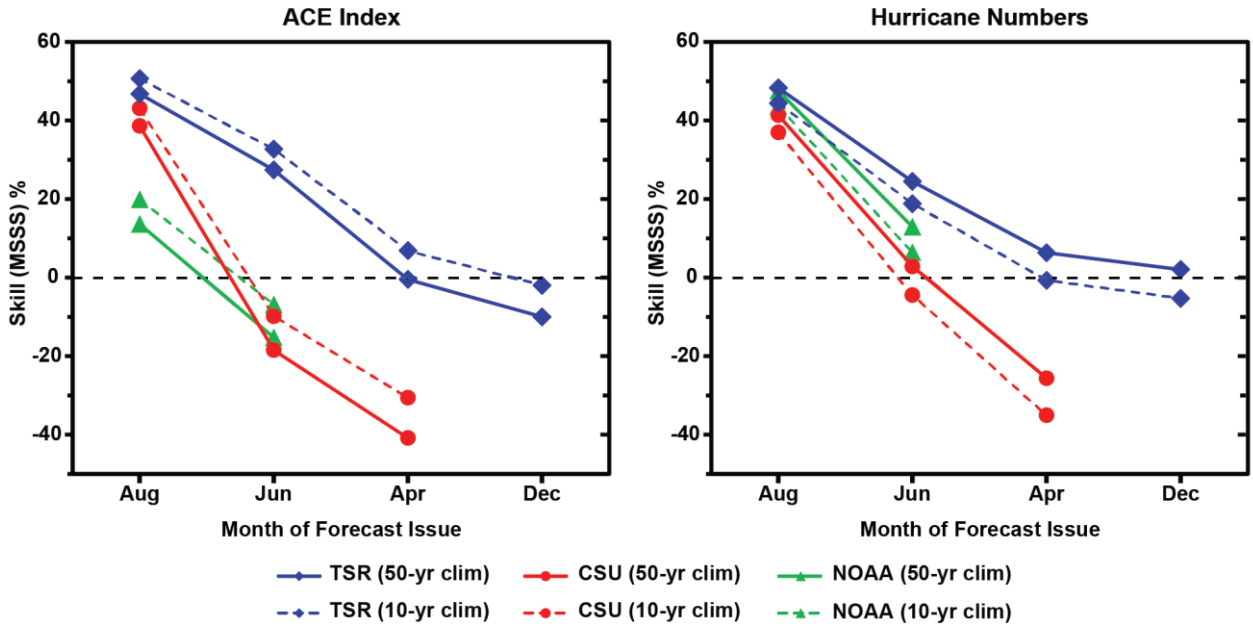
Methodology and Key Predictors for 2015

The TSR statistical seasonal hurricane forecast model divides the North Atlantic into three regions and employs separate forecast models for each region before summing the regional hurricane forecasts to obtain an overall forecast. For two of these three regions (tropical North Atlantic, and the Caribbean Sea and Gulf of Mexico) the forecast model pools different environmental fields involving August-September sea surface temperatures (SSTs) and July-September trade wind speed to select the environmental field or combination of fields which gives the highest replicated real-time skill for hurricane activity over the prior 10-year period. The nature of this process means that the details of the seasonal forecast model can vary subtly from year-to-year and also with lead time within the same year. Separate forecast models are employed to predict the July-September trade wind speed and to predict the August-September SSTs. Finally bias corrections are employed for each predictand based on the forecast model performance for that predictand over the prior 10 years.

The main factors behind the TSR forecast for a below-norm hurricane season in 2015 are the anticipated moderate supressing 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 0.78±0.86 ms^{-1} stronger than normal which is up from the December forecast value of 0.17±0.83 ms^{-1} stronger than normal (1980-2014 climatology), and 0.30±0.27°C cooler than normal which is cooler than the December forecast value of 0.15±0.28°C warmer than normal (1980-2014 climatology). The July-September 2015 trade wind prediction is based on an expectation of neutral El Niño ENSO conditions in August-September 2015 which differs from the current consensus ENSO outlook by dynamical and statistical models documented on the International Research Institute for Climate and Society website *http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/*. The forecast skills for these predictors at this lead are 27% and 29% respectively assessed for 1980-2014. However, it should be stressed that uncertainties in the forecast July-September 2015 trade wind speed from a forecast made in April are large due to uncertainties in August-September ENSO and in August-September tropical North Atlantic and Caribbean Sea SSTs.

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 2005-2014 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 35-year period 1980-2014.



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.

TSR was the best performing statistical seasonal forecast model at all lead times for 2005-2014.

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 2015 Atlantic hurricane season will be a pre-season forecast issued on the 27th May 2015.

Appendix – Predictions from Previous Months

1. Atlantic ACE Index and System Numbers

Atlantic ACE Index and System Numbers 2015					
		ACE Index	Named Tropical Storms	Hurricanes	Intense Hurricanes
Average Number (1950-2014)		102	11	6	3
Average Number (2005-2014)		113	15	7	3
TSR Forecasts	8 Apr 2015	56	11	5	2
	9 Dec 2014	79	13	6	1

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

MDR, Caribbean Sea and Gulf of Mexico ACE Index and Numbers 2015					
		ACE Index	Named Tropical Storms	Hurricanes	Intense Hurricanes
Average Number (1950-2014)		80	7	4	2
Average Number (2005-2014)		90	11	6	3
TSR Forecast	8 Apr 2015	34	6	3	1

3. US ACE Index and Landfalling Numbers

US Landfalling Numbers 2015				
		ACE Index	Named Tropical Storms	Hurricanes
Average Number (1950-2014)		2.3	3	1
Average Number (2005-2014)		2.1	3	1
TSR Forecast	8 Apr 2015	1.1	2	1

4. Lesser Antilles ACE Index and Landfalling Numbers

Lesser Antilles Landfalling Numbers 2015					
		ACE Index	Named Tropical Storms	Hurricanes	Intense Hurricanes
Average Number (1950-2014)		1.3	1	0	0
Average Number (2005-2014)		0.9	1	1	0
TSR Forecast	8 Apr 2015	0.3	1	0	0