Please click here for a less technical forecast summary and a discussion of the underpinning science and uncertainties.

Pre-Season Forecast for Atlantic Hurricane Activity in 2014

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Forecast Summary

TSR continues to predict Atlantic hurricane activity in 2014 will be about 30% below the long-term (1950-2013) norm. The precision of TSR's pre-season outlooks for upcoming Atlantic hurricane activity since 2004 is moderate.

The TSR (Tropical Storm Risk) pre-season forecast for Atlantic hurricane activity in 2014 continues to anticipate below-normal activity. Based on current and projected climate signals, Atlantic basin tropical cyclone activity and U.S. landfalling activity is forecast to be about 30% below the 1950-2013 long-term norm and about 45% below the recent 2004-2013 10-year norm. The forecast spans the period from 1st June to 30th November 2014 and employs data through to the end of April 2014. TSR's two predictors are the forecast July-September trade wind speed over the Caribbean and tropical North Atlantic, and the forecast August-September 2014 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 to have a moderate supressing effect on activity.

Atlantic ACE Index and System Numbers in 2014

		ACE Index	Intense Hurricanes	Hurricanes	Tropical Storms
TSR Forecast (±FE)	2014	73 (±53)	2 (±2)	5 (±3)	12 (±4)
64yr Climate Norm (±SD)	1950-2013	102 (±59)	3 (±2)	6 (±3)	11 (±4)
10yr Climate Norm	2004-2013	129	4	8	16
Forecast Skill at this Lead	1980-2013	24%	20%	14%	12%

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 1980-2013.
Forecast Skill = Percentage Improvement in Mean Square Error over Running 10-year Prior Climate Norm from Replicated Real Time Forecasts 1980-2013.

There is a 19% probability that the 2014 Atlantic hurricane season ACE index will be above-average (defined as an ACE index value in the upper tercile historically (>120)), a 33% likelihood it will be near-normal (defined as an ACE index value in the middle tercile historically (70 to 120) and a 48% chance it will be below-normal (defined as an ACE index value in the lower tercile historically (<70)). The 64-year period 1950-2013 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 (1950-2013).
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 2014

		ACE Index	Intense Hurricanes	Hurricanes	Tropical Storms
TSR Forecast (±FE)	2014	51 (±49)	1 (±1)	3 (±2)	7 (±3)
64yr Climate Norm (±SD)	1950-2013	80 (±58)	2 (±2)	4 (±2)	7 (±4)
Forecast Skill at this Lead	1980-2013	27%	27%	27%	24%

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 20% probability that the 2014 Atlantic hurricane season ACE index will be above-average (defined as an ACE index value in the upper tercile historically (>92)), a 36% likelihood it will be near-normal (defined as an ACE index value in the middle tercile historically (43 to 92) and a 44% chance it will be below-normal (defined as an ACE index value in the lower tercile historically (<43)). The 64-year period 1950-2013 is used for climatology.

USA Landfalling ACE Index and Numbers in 2014

		ACE Index	Hurricanes	Tropical Storms
TSR Forecast (Range)	2014	1.8 (0-3.9)	1 (0-3)	3 (1-5)
64yr Climate Norm (±SD)	1950-2013	2.4 (±2.2)	1 (±1)	3 (±2)
10yr Climate Norm	2004-2013	2.7	2	4
Forecast Skill at this Lead	1980-2013	7%	10%	6%

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 36% probability that in 2014 the USA landfalling ACE index will be above average (defined as a USA ACE index value in the upper tercile historically (>2.51)), a 27% 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 37% chance it will be below-normal (defined as a USA ACE index value in the lower tercile historically (<1.09)). The 64-year period 1950-2013 is used for climatology.

Caribbean Lesser Antilles Landfalling Numbers in 2014

		ACE Index	Intense Hurricanes	Hurricanes	Tropical Storms
TSR Forecast (Range)	2014	0.8 (0-2.7)	0 (0-1)	0 (0-1)	1 (0-2)
64yr Climate Norm (±SD)	1950-2013	1.3	0	0	1
10yr Climate Norm	2004-2013	1.0	0	1	1
Forecast Skill at this Lead	1980-2013	8%	2%	18%	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.

Lesser Antilles = Island Arc from Anguilla to Trinidad Inclusive.

Key Predictors for 2014

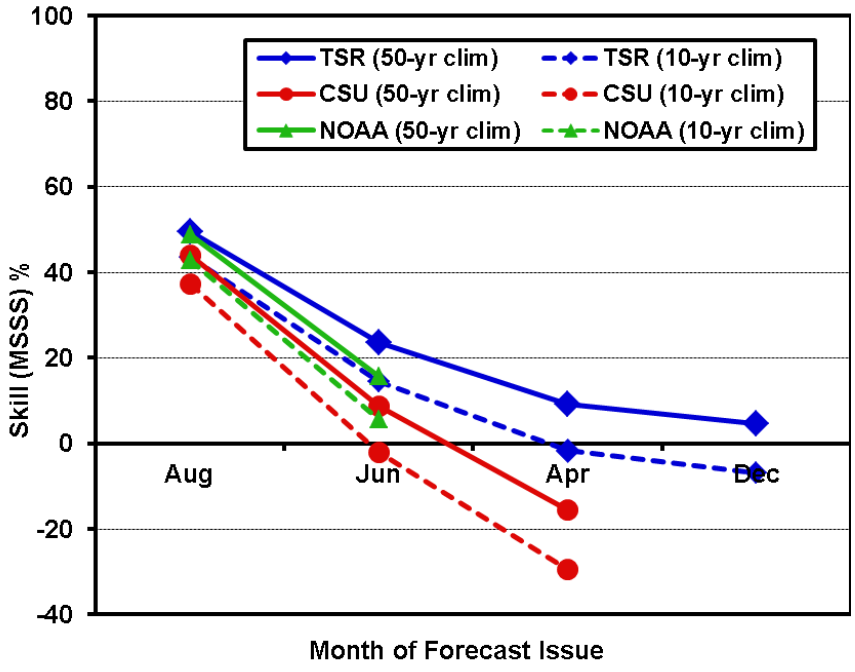
The key factors behind the TSR forecast for a below-average hurricane season in 2014 are the anticipated moderate supressing effect of the July-September forecast trade wind at 925mb height over the Caribbean Sea and tropical North Atlantic region (7.5°N–17.5°N, 30°W–100°W), and of August-September forecast sea surface temperature for the Atlantic MDR (10°N–20°N, 20°W–60°W). The current forecasts for these predictors are 1.15±0.78 ms^{-1} (up slightly from the April forecast value of 1.01±0.83 ms^{-1}) stronger than normal (1980-2013 climatology) and 0.26±0.25°C colder than normal (1980-2012 climatology) which is slightly warmer than the April forecast value of 0.32±0.27°C colder than normal. The July-September 2014 trade wind prediction is based on an expectation of moderate El Niño ENSO conditions in August-September 2014 as forecast by a consensus of dynamical and statistical models obtained from *http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current* at the International Research Institute website. The forecast skills for these predictors at this lead are 30% and 38% respectively. However, it should be stressed that forecast uncertainties remain 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 2004-2013 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 34-year period 1980-2013.

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 skill levels being achieved from late May/early June (especially by TSR), and good skill levels being achieved from early August.



Skill of seasonal outlooks for North Atlantic hurricane activity 2004-2013 as a function of issue month and climatology.

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, 2009 and 2013 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 2014 Atlantic hurricane season will be issued on the 5th June 2014.

Appendix – Predictions from Previous Months

1. Atlantic ACE Index and System Numbers

Atlantic ACE Index and System Numbers 2014					
		ACE Index	Named Tropical Storms	Hurricanes	Intense Hurricanes
Average Number (±SD) (1950-2013)		102 (±59)	11 (±4)	6 (±3)	3 (±2)
Average Number (2004-2013)		129	16	8	4
TSR Forecasts (±SD)	27 May 2014	73 (±53)	12 (±4)	5 (±3)	2 (±2)
	7 Apr 2014	75 (±57)	12 (±4)	5 (±3)	2 (±2)
	12 Dec 2013	106 (±58)	14 (±4)	6 (±3)	3 (±2)
CSU Forecast	10 Apr 2014	55	9	3	1
NOAA Forecast	22 May 2014	37-93	8-13	3-6	1-2
UK Met Office Forecast	16 May 2014	84 (±37)	10 (±3)	6 (±3)	-
Institute of Meteorology, Cuba	4 May 2014	-	9	4	-

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

MDR, Caribbean Sea and Gulf of Mexico ACE Index and Numbers 2014					
		ACE Index	Named Tropical Storms	Hurricanes	Intense Hurricanes
Average Number (±SD) (1950-2013)		80 (±58)	7 (±4)	4 (±2)	2 (±2)
Average Number (2004-2013)		106	11	6	3
TSR Forecast (±SD)	27 May 2014	51 (±49)	7 (±3)	3 (±2)	1 (±1)
	7 Apr 2014	52 (±52)	7 (±3)	3 (±2)	2 (±2)

3. US ACE Index and Landfalling Numbers

US Landfalling Numbers 2014				
		ACE Index	Named Tropical Storms	Hurricanes
Average Number (±SD) (1950-2013)		2.4 (±2.2)	3 (±2)	1 (±1)
Average Number (2004-2013)		2.7	4	2
TSR Forecasts (Range)	27 May 2014	1.8 (0-3.9)	3 (1-5)	1 (0-3)
	7 Apr 2014	1.8 (0.1-3.9)	3 (1-5)	1 (0-3)
	12 Dec 2013	2.6 (0.5-4.7)	4 (2-6)	2 (1-3)

4. Lesser Antilles ACE Index and Landfalling Numbers

Lesser Antilles Landfalling Numbers 2014					
		ACE Index	Named Tropical Storms	Hurricanes	Intense Hurricanes
Average Number (1950-2012)		1.3	1	0	0
Average Number (2003-2012)		1.1	1	1	0
TSR Forecasts (Range)	27 May 2014	0.8 (0-2.7)	1 (0-2)	0 (0-1)	0 (0-1)
	7 Apr 2014	0.9 (0-2.8)	1 (0-2)	0 (0-1)	0 (0-1)