



# Summary of 2014 Atlantic Tropical Cyclone Season and Verification of Authors' Seasonal Forecasts

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

## Summary

The 2014 North Atlantic hurricane season was relatively quiet with an ACE index 63% of the 1981-2010 climate norm. All forecasts predicted the below-norm activity well except the December extended range forecast.

## Features of the 2014 Atlantic Season

- Comprised eight tropical storms, six hurricanes, two major hurricanes and an ACE index of 66. This was the second year in a row with activity in the lowest tercile (below-norm category). The last two consecutive below-norm activity years were 1993 and 1994.
- The U.S. has now gone nine years without a major hurricane landfall. This is unprecedented in U.S. hurricane records back to 1851.
- Two hurricanes (Fay and Gonzalo) made landfall on Bermuda in 2014. This is the first year since records began in 1851 that two hurricanes have directly struck Bermuda. Hurricane Gonzalo was the strongest October hurricane to make landfall in Bermuda since 1939, with 1-minute sustained winds near 95 kts (110 mph). Gonzalo was responsible for four fatalities and \$200-\$400 million in insured damage on Bermuda.
- The second half of the season (ACE of 44) was noticeably more active than the first half of the season (ACE of 21). The last year with a ratio of late to early season ACE as large as this was 2006.
- The ratio of named storms to hurricanes (4:3) was the lowest since 1983 when four storms and three hurricanes formed.

### Individual Storm and Loss Summary 2014

No.	Name	Dates	Peak 1-min Sustained Wind (kts)	Minimum Pressure (mb)	Hurricane Category	Category at US Landfall	Estimated US Insured Loss (US \$bn)
1	Arthur	1-5 Jul	85	973	2	2	minimal
2	Bertha	1-6 Aug	70	998	1	-	-
3	Cristobal	24-29 Aug	75	970	1	-	-
4	Dolly	2-3 Sep	45	1003	-	-	-
5	Edouard	12-19 Sep	100	954	3	-	-
6	Fay	10-13 Oct	70	983	1	-	-
7	Gonzalo	12-19 Oct	125	940	4	-	-
8	Hanna	22-28 Oct	35	1005	-	-	-

## Verification of Forecasts

All forecasts performed well in 2014 except for the TSR December forecast which over-predicted activity. Forecast precision improved in general with proximity to the hurricane main season start on 1<sup>st</sup> August.

CSU performed best for predicting the ACE index whilst TSR and the Met Office performed best for predicting hurricane numbers. All agencies over-predicted tropical storm numbers although the Institute of Meteorology, Cuba forecasts were closest overall. There were an unusually low number of named storms in 2014 relative to the overall activity, in contrast to 2013 in which the ACE index was approximately half that of 2014 but with five more named storms. The MDR, Caribbean and Gulf of Mexico hurricane activity was very well predicted overall with the ACE index predicted to within 8% at all leads and hurricane numbers predicted correctly at all leads except August.

U.S. landfalling activity was over-predicted, with just one hurricane and making landfall in 2014. During the past 20 years it is unusual to have a U.S. hurricane landfall with no additional tropical storm landfalls; the only other such instance was in 1997. All storms that developed in the Atlantic took a recurving track due to a strong and persistent mid-level trough near the U.S. East Coast which acted to steer storms away from the U.S. mainland. In addition, high vertical wind shear over the Caribbean Sea and Gulf of Mexico inhibited storm development in these regions and thus storm-tracking towards the U.S. Gulf Coast.

Lesser-Antilles landfalling activity was close to the long-term norm in 2014 and was slightly under-predicted, although all observed parameters fell within the forecast range.

<b>Atlantic ACE Index and System Numbers 2014</b>					
		ACE Index	Named Tropical Storms	Hurricanes	Intense Hurricanes
Average Number ( $\pm$ SD) (1981-2010)		104 ( $\pm$ 66)	12 ( $\pm$ 5)	6 ( $\pm$ 3)	3 ( $\pm$ 2)
Actual Number 2014		66	8	6	2
TSR Forecasts ( $\pm$ SD)	5 Aug 2014	70 ( $\pm$ 41)	12 ( $\pm$ 3)	6 ( $\pm$ 2)	2 ( $\pm$ 1)
	4 Jul 2014	74 ( $\pm$ 45)	12 ( $\pm$ 3)	5 ( $\pm$ 2)	2 ( $\pm$ 2)
	5 Jun 2014	77 ( $\pm$ 50)	12 ( $\pm$ 4)	5 ( $\pm$ 3)	2 ( $\pm$ 2)
	27 May 2014	73 ( $\pm$ 53)	12 ( $\pm$ 4)	5 ( $\pm$ 3)	2 ( $\pm$ 2)
	7 Apr 2014	75 ( $\pm$ 57)	12 ( $\pm$ 4)	5 ( $\pm$ 3)	2 ( $\pm$ 2)
	12 Dec 2013	106 ( $\pm$ 58)	14 ( $\pm$ 4)	6 ( $\pm$ 3)	3 ( $\pm$ 2)
CSU Forecasts	31 Jul 2014	65	10	4	1
	1 Jun 2014	65	10	4	1
	2 Jun 2014	65	10	4	1
	10 Apr 2014	55	9	3	1
NOAA Forecasts	7 Aug 2014	37-83	7-12	3-6	0-2
	22 May 2014	37-93	8-13	3-6	1-2
UK Met Office Forecast	22 May 2014	84 ( $\pm$ 37)	10 ( $\pm$ 3)	6 ( $\pm$ 3)	-
Institute of Meteorology, Cuba	1 Aug 2014	-	9	4	-
	4 May 2014	-	9	4	-

<b>MDR, Caribbean Sea and Gulf of Mexico ACE Index and Numbers 2014</b>					
		ACE Index	Named Tropical Storms	Hurricanes	Intense Hurricanes
Average Number ( $\pm$ SD) (1981-2010)		82 ( $\pm$ 65)	8 ( $\pm$ 4)	5 ( $\pm$ 3)	2 ( $\pm$ 2)
Actual Number 2014		51	5	3	2
TSR Forecast ( $\pm$ SD)	5 Aug 2014	47 ( $\pm$ 42)	7 ( $\pm$ 2)	4 ( $\pm$ 2)	1 ( $\pm$ 1)
	4 Jul 2014	51 ( $\pm$ 43)	7 ( $\pm$ 2)	3 ( $\pm$ 2)	1 ( $\pm$ 2)
	5 Jun 2014	54 ( $\pm$ 45)	7 ( $\pm$ 3)	3 ( $\pm$ 2)	1 ( $\pm$ 1)
	27 May 2014	51 ( $\pm$ 49)	7 ( $\pm$ 3)	3 ( $\pm$ 2)	1 ( $\pm$ 1)
	7 Apr 2014	52 ( $\pm$ 52)	7 ( $\pm$ 3)	3 ( $\pm$ 2)	2 ( $\pm$ 2)

<b>US Landfalling Numbers 2014</b>				
		ACE Index	Named Tropical Storms	Hurricanes
Average Number ( $\pm$ SD) (1981-2010)		2.3 ( $\pm$ 2.2)	3 ( $\pm$ 2.0)	2 ( $\pm$ 2)
Actual Number 2014		0.4	1	1
TSR Forecasts ( $\pm$ SD)	5 Aug 2014	1.8 (0.4-3.0)	3 (1-5)	2 (1-3)
	4 Jul 2014	1.8 (0-3.8)	3 (1-5)	2 (0-3)
	5 Jun 2014	1.9 (0-3.9)	3 (1-5)	1 (0-3)
	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)

<b>Lesser Antilles Landfalling Numbers 2014</b>					
		ACE Index	Named Tropical Storms	Hurricanes	Intense Hurricanes
Average Number ( $\pm$ SD) (1981-2010)		1.3	1	0	0
Actual Number 2014		1.3	2	1	0
TSR Forecast ( $\pm$ SD)	5 Aug 2014	0.8 (0.3-1.1)	1 (1-2)	0 (0-1)	0 (0-1)
	4 Jul 2014	0.8 (0-2.6)	1 (0-2)	0 (0-1)	0 (0-1)
	5 Jun 2014	0.9 (0-2.7)	1 (0-2)	0 (0-1)	0 (0-1)
	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)

### Forecasts for 2015

The TSR extended range forecast for 2015 North Atlantic hurricane activity was issued on the 9<sup>th</sup> December 2014. Updated TSR outlooks will be issued on the 8<sup>th</sup> April 2015, 27<sup>th</sup> May 2015, 5<sup>th</sup> June 2015, 6<sup>th</sup> July 2015 and 5<sup>th</sup> August 2015.