CSU researchers successfully predict above-normal 2025 Atlantic hurricane season

Note to Reporters: The full verification report and a chart showing the predicted vs. observed storms are available with this news release at http://tropical.colostate.edu/. This report includes an extensive discussion of the climate features that caused the 2025 hurricane season to end up above normal despite a marked mid-season lull.

FORT COLLINS, COLORADO – The 2025 Atlantic hurricane season ended up an above-normal season[1], as measured by the number of major hurricanes and Accumulated Cyclone Energy (ACE). This activity was well forecast by Colorado State University's July and August updates and slightly over-forecast with our April and June forecasts. The season had an unusual distribution of tropical cyclone activity, with 13 named storms, 5 hurricanes and 4 major hurricanes. The 1991–2020 average season has 14 named storms, 7 hurricanes and 3 major hurricanes. All four major hurricanes reached at least Category 4 intensity, with three reaching Category 5 intensity (Erin, Humberto and Melissa). The season was benign for continental US impacts, with only one tropical storm (Chantal) making landfall, costing ~$500 million USD in damage. However, Hurricane Melissa caused devastation when it made landfall as a Category 5 hurricane in Jamaica, with preliminary estimates of $6–$7 billion USD in damage. The storm also caused extensive damage in Cuba and Hispaniola.

"The 2025 Atlantic hurricane season was relatively well-predicted by our seasonal outlooks, although we somewhat overpredicted the number of hurricanes that occurred this year, while under predicting the longevity of time that hurricanes would spend at major hurricane intensity. Our forecasts of Accumulated Cyclone Energy were quite successful, correctly anticipating above-normal values with all of our forecasts." said Phil Klotzbach, lead author of the forecast. Accumulated Cyclone Energy is an integrated metric accounting for intensity and duration of storms. Observed seasonal Accumulated Cyclone Energy (ACE) was 108% of the 1991–2020 average, while CSU predicted ACE to be approximately 125% of the 1991–2020 average with their April and June outlooks and 115% of the 1991–2020 average with their July and August outlooks.

Colorado State University also continued to forecast ACE west of 60°W, as ACE in the western part of the basin is particularly impactful to heavily populated regions. The forecast correctly anticipated a higher percentage of basinwide ACE occurring west of 60°W this year, although the percentage of ACE west of 60°W was higher than anticipated. While there was extensive tropical cyclone activity in the western half of the basin, the only hurricane with widespread significant impacts was Melissa.

The report summarizes all tropical cyclone activity in the Atlantic basin during the 2025 hurricane season and compares the team's seasonal and two-week forecasts to what occurred.

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[1] NOAA defines above-normal seasons to have Accumulated Cyclone Energy between 126.2 – 159.6 (https://www.cpc.ncep.noaa.gov/products/outlooks/Background.html)

The above-normal active Atlantic hurricane season was likely driven in part by warmer than normal sea surface temperatures in the tropical Atlantic and Caribbean. The tropical Pacific was characterized by cool neutral ENSO conditions during the early part of the season, transitioning to La Niña during October. The combination of a warmer-than-normal Atlantic and cooler-than-normal central and eastern tropical Pacific favors more conducive Atlantic hurricane conditions due to reduced levels of vertical wind shear (the change in wind direction and speed with height). Despite these favorable conditions, the Atlantic underwent a mid-season lull (similar to 2024), with no named storms forming between 24 August–16 September – the first time that this had occurred since 1992. This lull was likely driven by a combination of factors including a dry and stable atmosphere in the tropical Atlantic, increased vertical wind shear due to low pressure at high altitudes in the central tropical Atlantic, and pronounced sinking motion and dryness over West Africa, suppressing African easterly waves that serve as seeds for Atlantic tropical cyclones. These hurricane-unfavorable conditions switched to much more hurricane-favorable conditions around mid-September. After September 16th, the ACE that was generated by tropical cyclones was the 5th most on record in the satellite era (since 1966).

CSU's Tropical Cyclones, Radar, Atmospheric Modeling, and Software (TC-RAMS) team within the Department of Atmospheric Science bases its annual forecasts on 70 years of historical data and includes factors such as Atlantic sea surface temperatures and sea level pressures, vertical wind shear, El Niño (an anomalous warming of waters in the central and eastern tropical Pacific) and other factors. While these forecast factors generally work well and explain approximately 50–60 percent of the year-to-year hurricane variability in these 70 years of historical data, there remains 40–50 percent of this variability which is not explained.

Hurricane statistics for 2025 contained in the report include:

- 3 hurricanes reached Category 5 intensity (Erin, Humberto and Melissa). That is the 2nd most on record for the Atlantic, trailing only 2005 which had 4 Category 5 hurricanes. No other season has had more than 2 Category 5 hurricanes.

- Only 1 named storm (Chantal) and 0 hurricanes made landfall in the continental US this year. The last season with 0 hurricane landfalls in the continental US was 2015.

- 133 ACE were generated during 2025, making the season above-normal by NOAA's definition. 9 out of the past 10 Atlantic hurricane seasons have been either above-normal or extremely active by NOAA's definition, with the only exception being 2022 – classified as a normal season.

- No named storms formed in the Atlantic between 24 August–16 September. The last time that this occurred was in 1992. Prior to 1992, the last time we had no named storm formations between 24 August–16 September was in 1939.

- No ACE occurred in the Atlantic between 29 August–16 September. The last time that this occurred was in 1992.

- The Atlantic had only one hurricane through 21 September. This is the first time since 1994 with only one Atlantic hurricane through 21 September.

- 0 ACE was generated in the Caribbean through 20 October – the first time that this has occurred since 1997.

- Four storms (Erin, Gabrielle, Humberto and Melissa) underwent extreme rapid intensification (50+ kt 24 hr^{-1}). 2025 tied 2005, 2008 and 2020 for the most 50+ kt 24 hr^{-1} intensifying storms on record.

- Hurricane Melissa's lowest pressure was 892 hPa – tied for the 3rd lowest for an Atlantic hurricane on record with the Labor Day Hurricane (1935), trailing Wilma (2005, 882 hPa) and Gilbert (1988, 888 hPa).

- Hurricane Melissa's strongest winds were 160 kt – trailing only Allen (1980; 165 kt) for the strongest winds for an Atlantic hurricane on record. Melissa is tied with several other Atlantic hurricanes at 160 kt peak maximum sustained winds.

- Hurricane Melissa's landfall pressure of 892 hPa is tied with the Labor Day Hurricane (1935) in the Florida Keys for the strongest landfall on record by pressure.

CSU's seasonal hurricane forecasts were developed by the late Dr. William Gray and have been issued every year since 1984. The first forecast for the 2026 Atlantic hurricane season will be issued on Thursday, 9 April.

ATLANTIC BASIN SEASONAL HURRICANE FORECASTS FOR 2025

Forecast Parameter and 1991–2020 Average (in parentheses)	Issue Date 3 April 2025	Issue Date 11 June 2025	Issue Date 9 July 2025	Issue Date 6 August 2025	**Observed 2025 Activity Thru 11/19**	% of 1991–2020 Average
Named Storms (NS) (14.4)	17	17	16	16	**13**	90%
Named Storm Days (NSD) (69.4)	85	85	80	80	**59.50**	86%
Hurricanes (H) (7.2)	9	9	8	8	**5**	69%
Hurricane Days (HD) (27.0)	35	35	30	30	**24.75**	92%
Major Hurricanes (MH) (3.2)	4	4	3	3	**4**	125%
Major Hurricane Days (MHD) (7.4)	9	9	8	8	**11.50**	155%
Accumulated Cyclone Energy (ACE) (123)	155	155	140	140	**133**	108%
ACE West of 60°W (73)	93	93	87	87	**100**	137%
Net Tropical Cyclone Activity (NTC) (135%)	165	165	145	145	**141**	104%