

# Hurricane Beryl: A heavy hitting first storm of the 2024 season to make landfall in the US

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As the second named storm of the 2024 Atlantic storm season, Hurricane Beryl made history earlier this week. The storm was the easternmost hurricane to ever form and fastest intensifying hurricane (having wind speeds that increased by 95 mph in less than 48 hours), as well as the earliest category 4 hurricane (forming on July 1st) and earliest category 5 hurricane (forming on July 2nd) on record, beating the previous records by seven days and fourteen days, respectively. Beryl was also significant in that after passing through the Yucatan Peninsula and into the warm waters of the Gulf of Mexico, what had become a tropical storm re-strengthened into a category 1 hurricane before making landfall on the Texas Gulf Coast. Although Beryl's wind speeds peaked at 165 mph when it was a category 5 in the Eastern Caribbean, the hurricane significantly weakened on its passage westward. By the time Beryl hit Houston, it had sustained winds around 59 mph, and gusts at 84 mph.

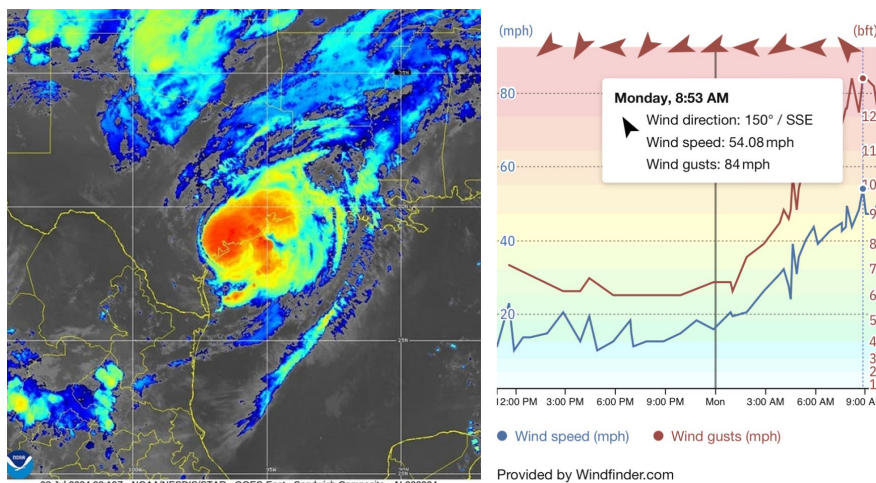


Fig. 1: *Right:* Radar image of Hurricane Beryl as it made landfall on the Texas Gulf Coast. Image provided by NOAA. *Left:* Sustained wind speeds and gusts, recorded at the Houston Hobby Airport.

As Hurricane Beryl passed through Houston on July 8th, the Rice SSPEED Center's FIRST System and FAS5 network were closely monitoring its progress. Developed in response to the extreme flooding in the Texas Medical Center during Hurricane Allison in 2001, both systems keep track of the rainfall and flooding over Brays Bayou, as well as the other watersheds of Houston. The FAS5 network utilizes the HEC-1 software to predict flow through Brays Bayou in response to the

recorded rainfall, and updates on a 5-minute basis. The website also indicates flood concern, and displays average rainfall and continuous footage of the gage at Harris Gully. The FIRST system additionally shows radar rainfall over the Houston area, and rainfall by subbasin based on 15-minute data.

Although meteorologists were predicting between 4-6 inches of rainfall from Beryl, FIRST recorded over 6 inches of 24-hour rainfall for all the main watersheds in Houston, and the Harris County Flood Warning System even recorded that some gages within Harris County received over 10 inches. FIRST also displayed a maximum rainfall rate of 3 in/hr in three of the White Oak subbasins around 9:15 am on July 8th (figure 2). In viewing the website at half-hour intervals, members of the SSPEED Center were able to observe the movement of rainfall intensity northward across Houston, and thus assess flooding risk across the city. Additionally, using the FAS5 software, the SSPEED Center was able to estimate a peak flow in Brays Bayou of just over 27,000 cfs. When compared with the observed flow, the model proved to be relatively accurate. While the software developed by the SSPEED Center was able to accurately display and predict the rainfall and flow resulting from the rainfall from Hurricane Beryl, developments are underway to further improve the accuracy and breadth of flood alert information available. For example, they plan on adjusting the R value used in the FAS5 flow computations to shift the hydrograph, as well as develop floodplain map libraries for each of the Houston watersheds to provide more information for Houston residents.

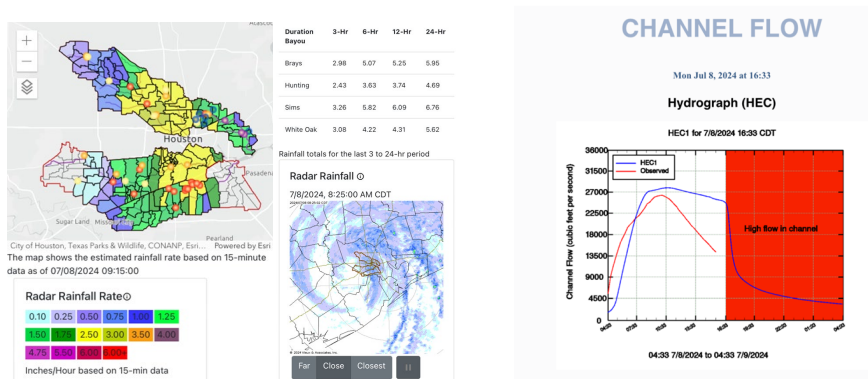


Fig. 2: *Right*: Screen capture of the FIRST Website at 9:15 am on July 8, 2024, showing the radar rainfall rate in the watersheds of Houston. Two of the subbasins of the White Oak Bayou show a rainfall rate of over 3.00 in/hr. *Left*: The FAS5 predicted (blue) versus observed (red) flows for Brays Bayou during Hurricane Beryl.

Although Hurricane Beryl hit Houston as only a category 1 after a deadly passage through the Caribbean, it caused widespread damage throughout Harris County. Buffalo Bayou and White Oak Bayou both overtopped their banks and their flood waters caused significant damage in downtown Houston. There were seven reported deaths in Texas and over 2.7 million were left without power, in addition to countless homes damaged by fallen trees and flooding. The infrastructure in the Houston area proved to be completely unprepared, and residents were frustrated with the length at which it has taken to recover, as many have suffered through humid and 90 or higher degree days without air conditioning. As of five days after the storm hit Texas, 850,000 people remained without power, and fallen trees still blocked passage through streets across Houston. Beryl was the first hurricane to make landfall in the US of what is predicted to be an extremely active Atlantic storm season, and it is essential to have accurate and widespread flood alert systems, and almost more importantly, appropriate infrastructure to weather the stronger storms looming on the horizon of this storm season.



Fig. 3: *Left:* Buffalo Bayou flooded in response to the rainfall from Hurricane Beryl (credit: David Smith, via [houstonpublicmedia.org](http://houstonpublicmedia.org)) *Middle:* Strong winds during the hurricane pushed trees down and often into power lines (credit: Elena Siemens) *Right:* Winds knocked over power lines and transmission towers across Harris County, leaving millions without power (credit: Meredith Kohut for the New York Times)