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New Research Sheds Light on Texas Hill Country Floods

Two papers published in AMS journals find that experimental models skillfully predict 2025's disastrous Texas floods, and detail why flooding was so extreme near Camp Mystic.

[Boston, MA, 21 July 2026] Two companion papers published in the *Bulletin of the American Meteorological Society* provide new insight into the causes and predictability of the 2025 Texas Hill Country floods, the deadliest flash flood event in the United States since 1976.

In 2025, catastrophic flash floods claimed at least 135 lives across the Texas Hill Country, including 119 in Kerr County**.** Among the victims were 28 people at Camp Mystic, including campers, counselors, and the camp's director. Since the disaster, researchers have extensively analyzed its meteorological causes, the performance of flood forecasts, and opportunities to reduce future flood risk. Two papers published this month provide new insights.

Experimental models accurately forecast catastrophic Guadalupe River flooding

Read the paper: "WoFS-FLASH coupled forecasts for the July 2025 Texas Hill Country Flash Flood Disaster"

The precise location of heavy rainfall makes a major difference in areas like the Hill Country, where many different river basins are close together. National Weather Service models in operational use in July 2025 were able to highlight the potential for flash flooding, but researchers hope that ongoing advances in forecasting could someday help predict precipitation intensity and location far in advance for vulnerable places like Camp Mystic.

Incorporating higher-resolution data may help account for the local atmospheric factors that determine when and where flash floods take place. To find out whether models still in development might have been able to provide a more precise and usable forecast, Jonathan Gourley and colleagues at the National Oceanic and Atmospheric Administration (NOAA)/National Severe Storms Laboratory and University of Oklahoma ran an experimental, fine-resolution configuration of the NOAA/National Severe Storms Laboratory's "Warn on Forecast" system (WoFS) with model runs fed into the "FLASH" flood prediction system. They fed in data from the lead-up to 2025's flood disaster.

As the authors note, **more than 50% of the model runs "would have yielded forecasts of extreme and record-breaking flows 5–7 [hours] in advance"**—accuracy which, in an operational model, would have provided much greater lead time for places like Camp Mystic. This, the authors say, "provid[es] strong motivation to develop a coupled WoFS-FLASH for real-time application" which might help save lives in the future.

"The scientific community has recognized the need for forecasting improvements of extreme rainfall events," says Gourley. "The system we evaluated shows the potential to improve information availability and accuracy in the watch-to-warning gap. With better information, users like National Weather Service forecasters and emergency managers will be able to anticipate the specific locations of impending flash flood threats with more lead time so they can respond and communicate more effectively."

Gourley adds that "NOAA is leading an effort called the Precipitation Prediction Grand Challenge and a component of this project is improving flash flood prediction. Our model, WoFS-FLASH, will be advanced for eventual operational implementation. The project is just beginning, and our partners at CIWRO are already advertising new positions to join the team."

A lingering storm, a vulnerable watershed, and simultaneous surges doomed Camp Mystic

Read the paper: "Hydrometeorological Analysis of the July 2025 Texas Hill Country Flash Flood Disaster"

Thomas Galarneau and colleagues at NOAA published an extensive analysis of the Hill Country disaster to analyze why flooding was so extreme in the area of Camp Mystic, and find that in addition to the large-scale atmospheric patterns and moisture, local atmospheric dynamics played a major role in the disaster.

A small-scale circulation pattern that moved into the Hill Country on July 3-4, 2025 fed off “an unusually deep plume of tropical moisture,” the authors write.

“This circulation increased lift and wind shear in the environment enough to help organize the thunderstorm upstream of Camp Mystic into a rotating supercell,” says Galarneau. “The combination of [local] supercell dynamics and a tropical, moisture-rich environment was critical to producing the extreme rain rates and resulting flood waves. The storm generated more than 10 inches of rain in roughly three hours.”

Camp Mystic sat at the confluence of two rivers. Crucially, says Galarneau, “**because [the storm] remained over the same watershed for several hours, flood waves from the South Fork of the Guadalupe River and Cypress Creek reached Camp Mystic at nearly the same time, greatly worsening the inundation**.”

Galarneau adds: “This research highlights the importance of closely monitoring situations in which local surface boundaries and smaller-scale atmospheric circulations strengthen winds within a tropical, moisture-rich environment. Even when the broader environment wind shear appears only marginal, these local changes can support dangerous, slow-moving supercells capable of extreme rainfall. It is also important to recognize that small shifts in storm location can determine which watershed receives the heaviest rain and whether multiple flood waves converge on a vulnerable community, as occurred at Camp Mystic.”

More AMS resources on the Texas Hill Country Floods

Several sessions at the AMS 106th Annual Meeting in Houston in January 2026 discussed aspects of the Texas Hill Country Floods. You can watch recordings of these sessions at the links below.

- Joint Panel Discussion JPD9 - Kerr County, TX Flooding Discussion
- Joint Session J11 - Kerr County, TX Flooding Discussion II
- Session 5A - Extreme Precipitation V

About the American Meteorological Society

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