

INTERPRETATION ARTICLE: Flash Flood Guidance by Andrea Melvin

Tropical systems are heavy rain producers for not only coastal regions but for inland states, especially if the system slows down and becomes stationary. Some of Oklahoma's most significant flooding events have occurred due to a stalled tropical system.

National Weather Service (NWS) River Forecast Centers routinely issue Flash Flood Guidance (FFG) throughout the day for every county in their area. The river forecast centers determine 1- 3- and 6-hour flash flood guidance values for all counties. The NWS Weather Forecast Offices use this guidance when issuing flash flood watches and warnings to the public. Flash Flood Guidance estimates the average number of inches of rainfall for given durations required to produce flash flooding in the indicated county. These estimates are based on current soil moisture conditions. Note, in urban areas, less rainfall is required to produce flash flooding.

On August 3, 1995, the following Flash Flood Guidance values were issued for Custer County, Oklahoma: 1-hr FFG 1.0, 3-hr FFG 1.4 and 6-hr FFG 1.7. FFG values are reported in inches. So how do you use FFG values to make decisions? Let's say it rained 1 in. from 5 PM to 8 PM in Custer County. Our time interval is 3 hours. Compare the actual rainfall (1 in.) measured with the 3-hr FFG value (1.4 in.). The actual rainfall is less than the 3-hr FFG value so you would not expect there to be any flash flooding in Custer County. But what if the 1 in. of rain fell from 6 PM to 7 PM? The time interval has changed to 1 hour. The rainfall equals the 1-hr FFG value. A flash flood has begun in Custer County.

The FFG values are generated by a computer model. The model keeps track of past rainfall to decide how much more rain an area can receive before flooding will begin. A heavy rainfall in a short period of time or several days of constant rainfall can contribute to flash flooding. The soil can only absorb a limited amount of water. Rain that falls faster than the soil can absorb will cause flooding. Once the soil becomes saturated (the point where the soil can no longer absorb any more water), any additional rainfall will contribute to flooding conditions.

The computer models are updated throughout the day with any rainfall that has occurred since the last time the FFG values were created. Emergency managers and local officials keep an eye on daily rainfall totals throughout the day. They then compare the total to the latest FFG values. The FFG model is run three times a day at 0Z, 12Z, and 18 Z. In Central Standard Time, the Z times convert to 6 PM the day before, 6 AM, 12 PM.



Important Terms

(Source - <http://www.weather.gov/glossary/>):

Flash Flood

A flood which is caused by heavy or excessive rainfall in a short period of time, generally less than 6 hours. Also, at times a dam failure can cause a flash flood, depending on the type of dam and time period during which the break occurs.

Flash Flood Guidance

Forecast guidance, often produced by computer models, specific to the potential for flash flooding (e.g., how much rainfall over a given area will be required to produce flash flooding).

Flash Flood Warning

Issued to inform the public, emergency management, and other cooperating agencies that flash flooding is in progress, imminent, or highly likely.

Flash Flood Watch

Issued to indicate current or developing hydrologic conditions that are favorable for flash flooding in and close to the watch area, but the occurrence is neither certain or imminent.

CLASSROOM ACTIVITY

As discussed in the historical article on hurricanes, tropical systems can produce heavy rains for Oklahoma. In August of 1995, Tropical Storm Dean traveled north through Texas and stalled over western Oklahoma. Examine the rainfall for August 1st and 2nd to see where flooding may have occurred.

Oklahoma Mesonet Stations - <http://www.mesonet.org/sites/>

Oklahoma County Names - <http://climate.ocs.ou.edu/statewide/CountyNames.gif>

1. During the 6 days shown on Map 1, what was the maximum rainfall total? Which county was this station located?
 2. Find the following locations on Map 1: Custer County (Butler, OK), Dewey County (Putnam, OK) and Payne County (Stillwater, OK). The Butler site recorded 7.0 in. while Putnam and Stillwater received 9.25 in. and 4.65 in. respectively.
- Use Graph 1 to answer questions 3-5 and Graph 2 to answer questions 6-8. The graphs show the accumulated rainfall at each station. Notice at 7 PM the rainfall value resets to zero. This marks the end of the Universal Time Coordinate (UTC) day.
3. How much total rain fell at each location on August 1st?
 4. How much rain fell at Butler from Noon until 6 PM? (Hint: Subtract the Noon rainfall from the 6 PM rainfall.) At Putnam? At Stillwater?
 5. Compare you answers from Question 4 to the 6-hr Flash Flood Guidance (FFG) values in Table 1. Which stations observed more rainfall than their FFG value?
 6. How much total rain fell at each location on August 2nd?
 7. How much rain fell at Putnam from Noon until 6 PM (6-hr)? Between Noon and 2 PM (3-hr)? Between 1 PM and 2 PM (1-hr)?
 8. Compare you answers from Question 7 to the 1-hr, 3-hr and 6-hr Flash Flood Guidance (FFG) values in Table 1.
 9. If it was 2 PM and all you knew were the 1-hr rainfall total and FFG value, would you expect to have flooding in Putnam soon?
 10. How does your flooding expectation change when you look at the longer guidance intervals?
 11. Let's say the National Weather Service had forecasted 1.5 in. of rain by 1 PM in Putnam. Has the criteria been met to issue a Flash Flood Watch or Flash Flood Warning? At what time would you issue your watch and/or warning?

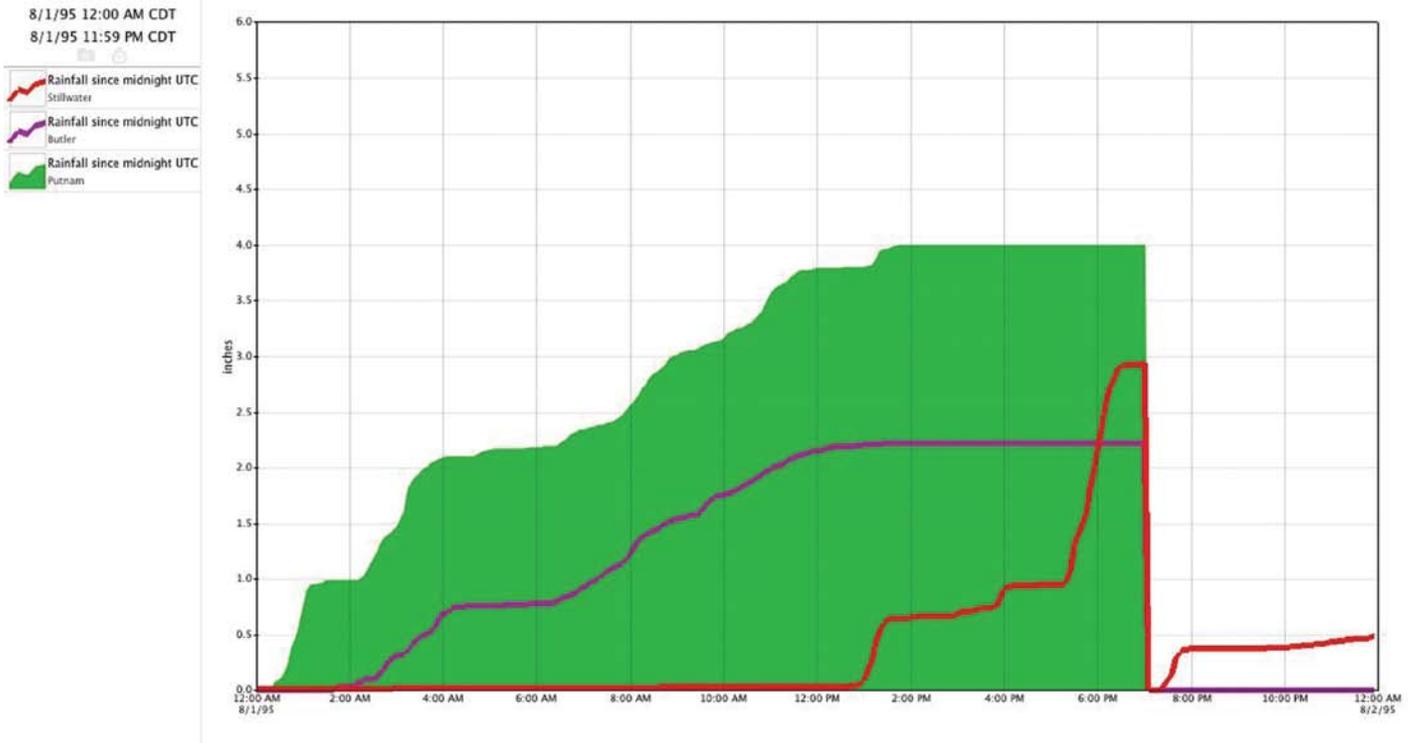
Table 1 - Selected Flash Flood Guidance values issued by the Arkansas-Red Basin River Forecast Center during the time remnants of Tropical Storm Dean were stalled over Oklahoma.

ARKANSAS-RED BASIN RIVER FORECAST CENTER...TULSA OK

AVERAGE INCHES OF RAINFALL FOR GIVEN DURATIONS REQUIRED TO PRODUCE FLASH FLOODING IN THE INDICATED COUNTY FORECAST AREAS. LESS RAINFALL REQUIRED IN URBAN AREAS.

Date	Time	County Name	1 HR (inches)	3 HR (inches)	6 HR (inches)
Aug 1, 1995	9:22 AM	Custer	2.5	3.0	3.3
		Dewey	2.1	2.5	2.7
		Payne	1.2	1.7	2.0
Aug 2, 1995	11:00 AM	Custer	1.7	2.2	2.6
		Dewey	1.7	2.1	2.4
		Payne	0.7	1.2	1.5

Graph 1 - Rainfall at Stillwater (red), Putnam (green), and Butler (purple) on Aug 1, 1995.



Graph 2 - Rainfall at Stillwater (red), Putnam (green), and Butler (purple) on Aug 2, 1995.

