U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Weather Service
8250 Kentucky Highway 3520
Paducah, Kentucky 42086

November 22, 2023

MEMORANDUM FOR: Karin L. Gleason
Chief, Climate Monitoring Section
Climatic Science and Services Division
National Centers for Environmental Information (NCEI)

FROM: Sean Poulos
Forecaster, National Weather Service, Paducah, KY

SUBJECT: SCEC Report for Kentucky 24-Hour Precipitation on 18-19 July 2023

Summary

On July 18-19, 2023 a flash flooding event occurred across far west Kentucky due to extreme rainfall rates from training thunderstorms. The Kentucky Mesonet station in Graves County (6 miles southwest of Mayfield) measured 11.28 inches of precipitation from 1 PM CDT July 18 - 1 PM CDT July 19.

In the months following this event, a State Climate Extremes Committee (SCEC) was convened to discuss this measurement. The Kentucky state record for 24-hour precipitation is listed as 10.48 inches set back on March 1, 1997 in Louisville. However, after further investigation into that event, it was determined that the 24-hour total was actually 10.50 inches from 1 AM CST March 1 through 1 AM CST March 2, 1997. In either case, the 24-hour amount at the Graves County Mesonet was higher.

The SCEC considered several factors, including:

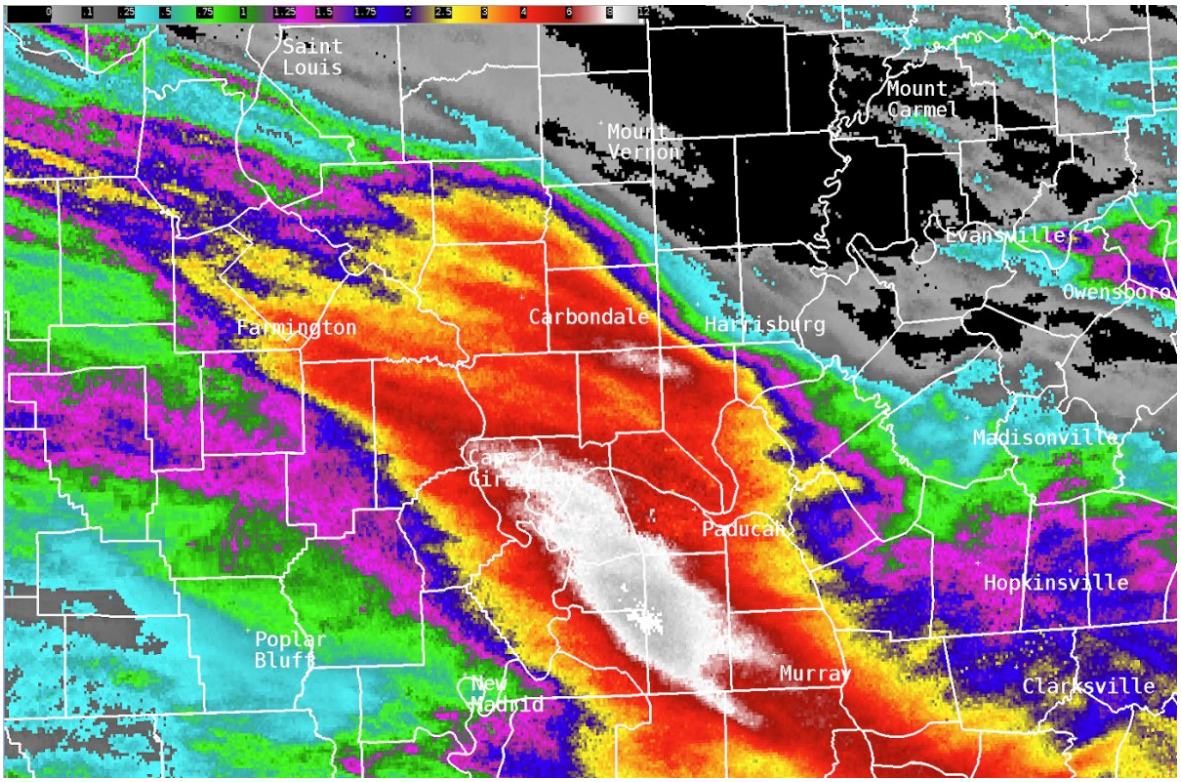
- Meteorological plausibility
- A review of the equipment used
- Degree of damage caused nearby
- Other heavy rain events that may also be contenders for the state record.

After a conference call on November 9, 2023, the SCEC voted unanimously, 5-0, to accept the July 18-19, 2023 Graves County Mesonet 24-hour precipitation amount of 11.28 inches as the new state record for Kentucky.

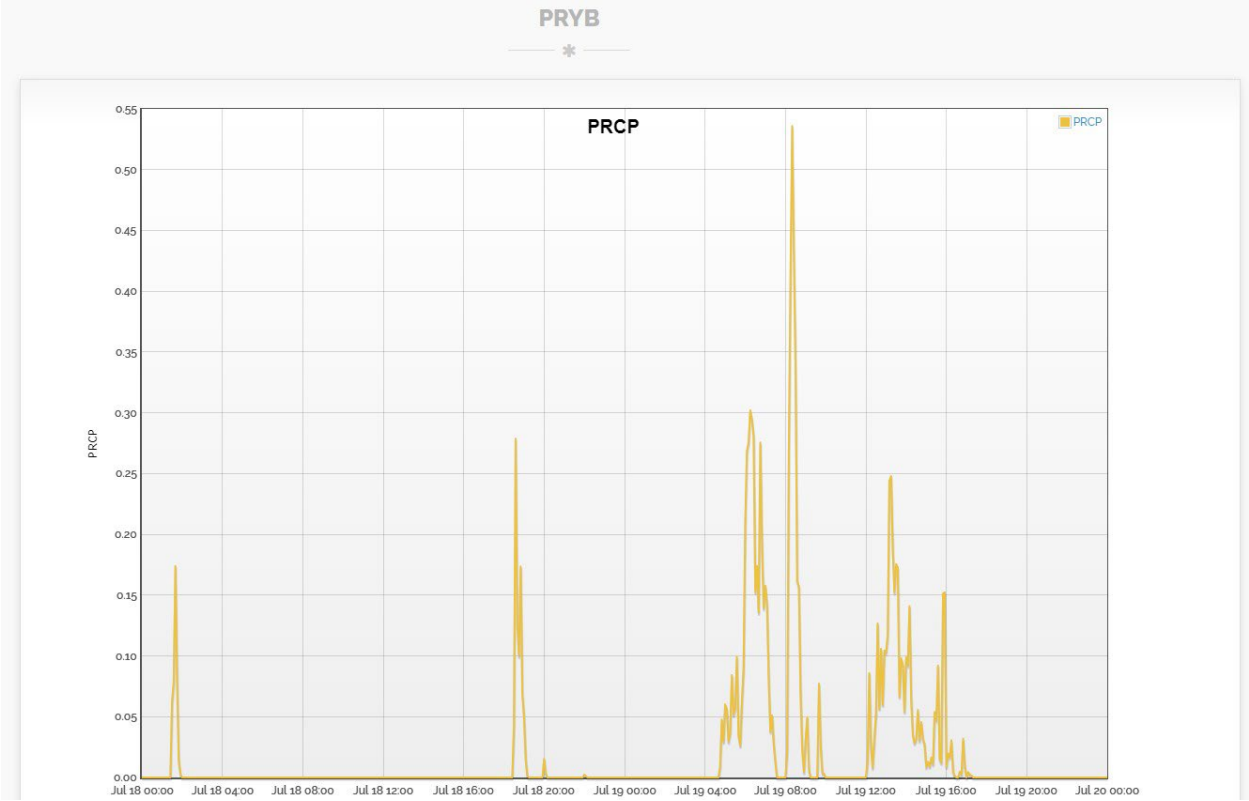
Sequence of Events, Examination, and Decision

The synoptic environment of this event consisted of a stationary frontal boundary that lifted northeastward across southeast Missouri into northwest Tennessee on the morning of July 19th. There was strong convergence in the 850-700mb layer with a robust low level jet streaming a deep plume of moisture into the region. Precipitable water values were as high as 2.3 inches. The 500mb flow was oriented parallel to the surface front, providing an ideal scenario for training thunderstorms to develop and move southeastward fueled by deep moisture ingested into the environment.

Thunderstorms developed shortly after 11 PM CDT on July 18, 2023 and continued training over the same areas until around Noon CDT on July 19, 2023. These storms produced widespread rain amounts of 5 to 10 inches across parts of the Jackson Purchase Region of west Kentucky, far southern Illinois, and southeast Missouri. The heaviest swath of precipitation was focused across far western Kentucky including the counties of Ballard, Calloway, Carlisle, Hickman, McCracken, and Graves. A small corridor focused around western Graves into extreme northeast Hickman and far eastern Carlisle county received amounts over 10 inches. The Kentucky Mesonet station located 6 miles southwest of Mayfield recorded 11.28 inches. Observations from nearby trained storm spotters were of a similar magnitude. This combined with MRMS radar estimates reveal that these high totals appear to be legitimate.



MRMS Precipitation Estimates from July 18-19, 2023



Graph of site showing 5- min precipitation increments

Review of KY Mesonet Precipitation Measuring Equipment

The precipitation amount in Graves County was measured by equipment that is part of the statewide Kentucky Mesonet.

Station Metadata:

- County: Graves
- Station Identifier: PRYB
- Site Name: Mayfield 6 SW
- Location: 36.69823, -88.72388

Sensor Metadata:

- Manufacturer: HACH OTT Hydromet
- Model: Pluvio 2 L 400 RH
- Installation Date: 2018-11-14
- Most Recent Calibration Verification Date: 2023-08-10

The sensor was installed in 2018 and was new at that time. It has been maintained at regular intervals since its installation. The instrument calibration was verified in 2022 and was re-verified following this event. Results from the re-verification along with the gauge being level upon arrival suggest the sensor was in working order during this event. The committee believes the instrument

was maintained appropriately prior to and following the event and was working properly during the event in question.

Mayfield 6 SW site photos

The SCEC committee discussed the tall grass that was present when the Graves County Mesonet site was mowed in August, approximately 3 weeks after this extreme rain event. The grass hadn't been mowed since June 1. However, it was noted that a Flash Drought had developed across this area in the latter part of May and continued into mid-July. The U.S. Drought Monitor introduced D0 conditions in Graves County on May 30 and eventually upgraded to D1 drought on June 13. This area remained in D0 or D1 drought through the July 18 outlook. The committee was in agreement that the grass likely didn't grow uncontrollably until after this heavy rain event on July 19. Therefore, the committee agreed that the tall grass, which was present 3 weeks after the event in question, did not interfere with the reliability of the measurement observed during this event.

Finding of Committee

All of the above evidence was shared with the SCEC via e-mail and was discussed on an hour-long conference call on November 9, 2023. Based upon the meteorological evidence, thorough inspection of the equipment, and support from flash flood reports in the area, it was decided that the 24-hour precipitation amount of 11.28 inches measured by the Kentucky Mesonet's observation site in Graves County from 1 PM CDT July 18, 2023 to 1 PM CDT July 19, 2023 was valid.

NCEI Climate Monitoring Chief Decision:

Approved as recommended in boldface above:	Not approved returned to SCEC with no action taken:
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Appendix A

Below is a list of the top 5 highest calendar day precipitation totals within the state of Kentucky.

Location	Source	Amount	Date
Louisville WFO	COOP	10.48”	3/1/1997
BELTON 6 SW	COOP	10.40”	6/28/1960
MADISONVILLE	COOP	10.25”	3/2/1997
GREENVILLE 2 W	COOP	10.10”	6/21/1935
SCOTTSVILLE	COOP	9.68”	6/23/1969

Appendix B

State Climate Extremes Committee for the Establishment of a Kentucky State 24 hour Precipitation Record.

Voting Members:

- Karin Gleason, Climate Monitoring Chief, NCEI
- Melissa Widhlam, Associate Director/Regional Climatologist, MRCC
- Audra Bruschi, Services Program Manager for Climate, Central Region
- Dr. Jerald Brotzge, Kentucky State Climatologist
- Sean Poulos, Forecaster, NWS, Paducah, KY

Non-Voting Members:

- Tamara Houston, National Partnership Liaison, NCEI
- Tiffany Clark, Mesonet Manager, Kentucky Climate Center
- John Gordon, Meteorologist-In-Charge, NWS, Louisville, KY

Karin Gleason, Melissa Widhlam, Audra Bruschi, Dr. Jerald Brotzge, and Sean Poulos were present at the conference call on November 9, 2023. All voted in favor of the new record.