



How Can 100-year+ Events Possibly be Overlooked?

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2018 AUG
Conference
Ventura, CA



A woman with blonde hair, wearing a white sleeveless shirt and a black skirt, is captured in the middle of a golf swing on a lush green golf course. She is holding a golf club with a dark head. In the background, there are rolling green hills, a few scattered trees, and a range of blue mountains under a bright blue sky with scattered white clouds. A small white golf ball sits on the grass near her feet. To the right of the golfer, a large wooden sign is posted. The sign has a header that reads 'The Ranch Country Club' with a logo of a horse and rider, followed by 'HOLE-IN-ONE HONOR ROLL'. Below the header, there are five columns, each representing a different hole (HOLE #1 through HOLE #5). Each column contains a small graphic of a hole-in-one and a list of names and dates of achievements. The text overlay on the right side of the image provides statistical information about the odds of achieving a hole-in-one.

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A woman with blonde hair, wearing a white sleeveless shirt and a black skirt, is captured in the middle of a golf swing on a lush green golf course. She is holding a golf club with a dark head. In the background, there are rolling green hills, a few houses, and a range of mountains under a blue sky with scattered white clouds. A large, semi-transparent text box is overlaid on the right side of the image. It contains the question 'What are your chances of getting a hole in one?' followed by the answer 'A: For the average golfer about 12,000 to 1 for each attempt, requiring ~3000 rounds to achieve the goal.' Below the text, there is a graphic of a golf ball with the number '120+' and the text 'in ~20 years'. At the bottom right, there is a 'HOLE-IN-ONE HONOR ROLL' board for 'The Ranch Country Club'. The board lists names and dates for five holes: #4, #6, #13, #15, and #17. The text is in a bold, sans-serif font. The overall scene is bright and sunny, suggesting a clear day for golfing.

SO...WHAT ABOUT STORMS?

July 31, 1976



What caused the Big Thompson flood

The causes of the July 31, 1976, Big Thompson Canyon flood — about 50 miles northwest of Denver — were similar to those of other flash floods, especially a flood that hit the South Dakota Black Hills June 10, 1972, killing 237 people.

5 Hardly any of the rain soaked into the steep-sided canyon.

6 The river quickly went over its banks, and with debris that acted like battering rams against downstream buildings, cars.

7 Water backed up in the canyon's narrow mouth. In floods, water often backs up as debris piles against bridges.

4 Humid high-altitude air combining with weak winds meant the storm pulled in little dry air to weaken its rainfall.

3 Winds were less than 20 mph above 10,000 feet, too weak to move the storm away.

2 The unstable air continued rising as its water vapor condensed.

1 Winds from the east pushed very humid air up the mountains.

8 Flood water speeds up as it squeezes through narrow places, or is roiled when a dam formed by debris bursts loose.

Normal river size



HUFFPOST

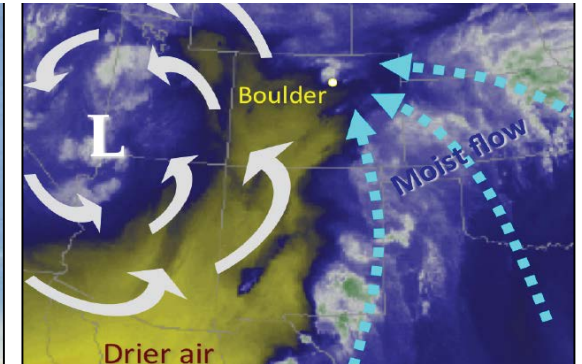
The 1,000 Year Storm: Colorado's Flood Is One For The History Books

By Matt Ferner

09/20/2013 12:11 pm ET | Updated Dec 06, 2017

Just how rare was the deluge in Colorado that resulted in the deaths of as many as 10 people, hundreds unaccounted for, nearly \$2 billion in property damage, the evacuation of more than 10,000 people that affected at least a 200 mile stretch of the state, north to south?

Very rare. So rare that the amount of rainfall is likely to occur less than once every 1,000 years.



Nobody missed this one!

A SEPTEMBER TO REMEMBER



How about 2017

☐ Did something big happen?



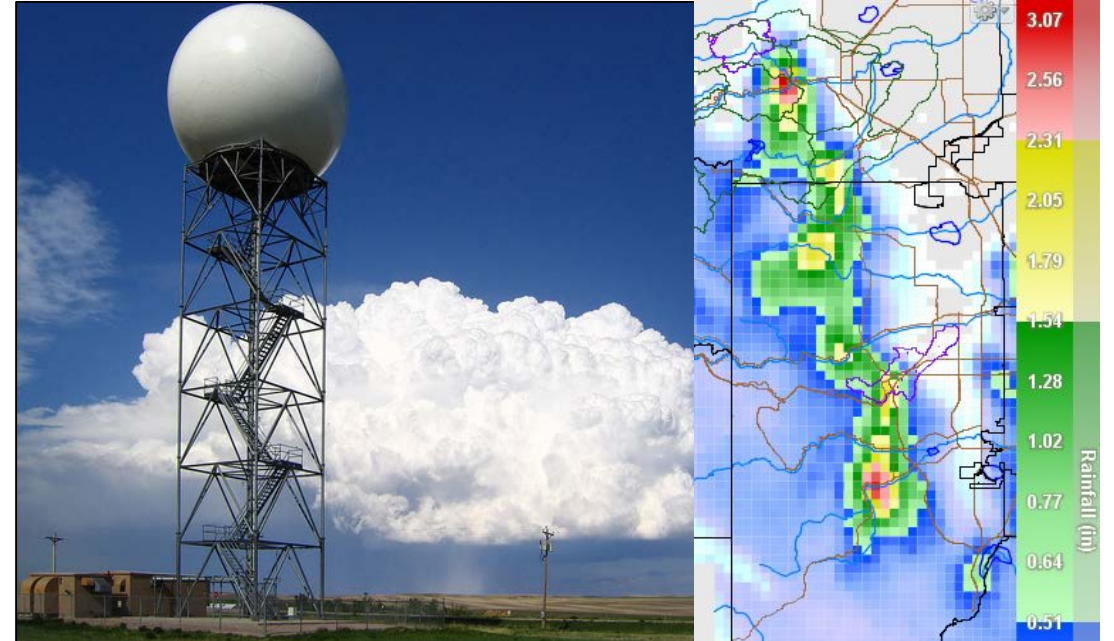
☐ Is there one in particular that you remember?

☐ If so, why?

Tools for today's analysis



An ALERT rain gage at the
Denver Tech Center
(over 200 system-wide)



Radar & Derivatives

Let's first look back at September 2013.

HUFFPOST

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A view from a single rain gauge point.

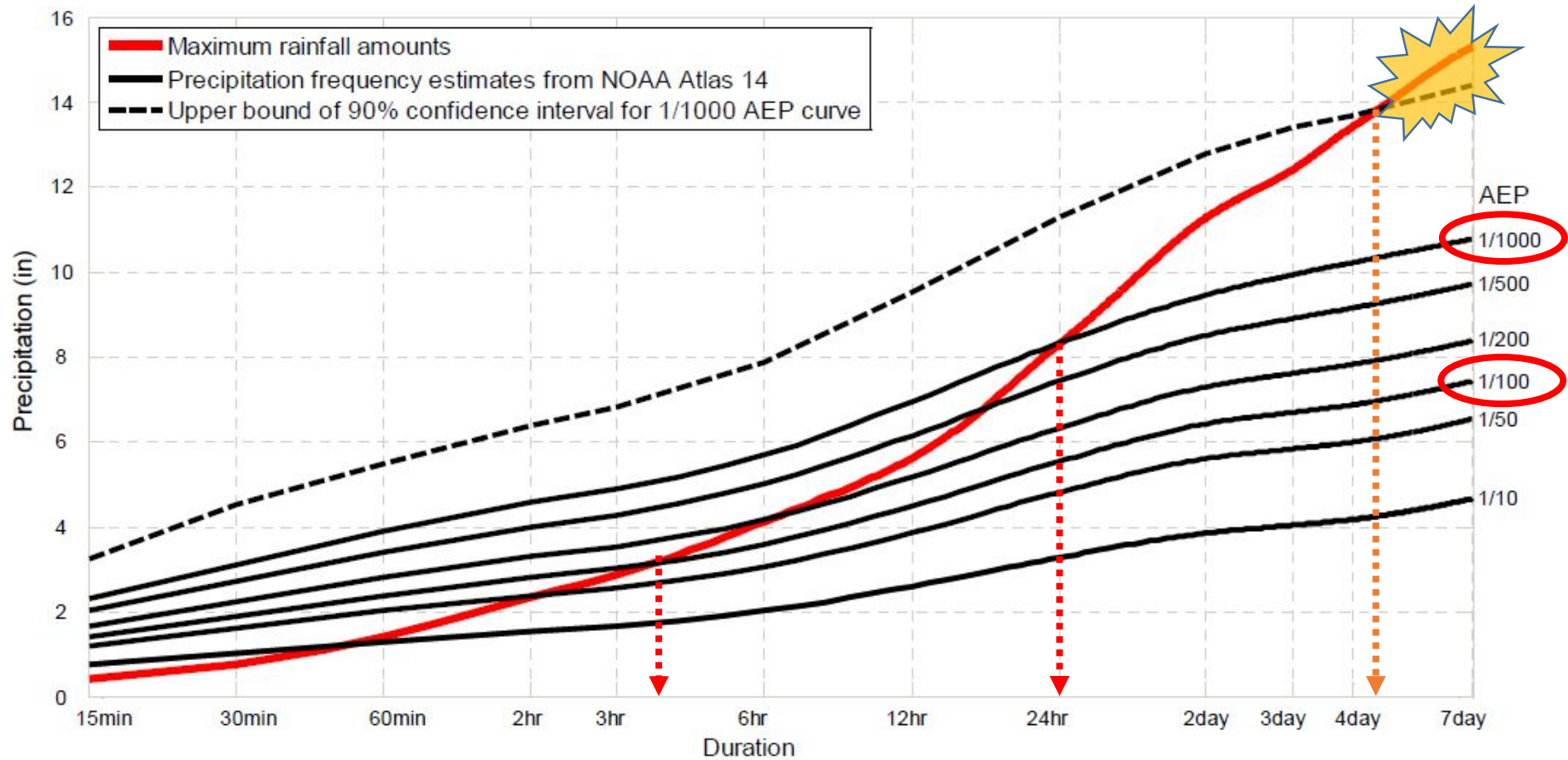
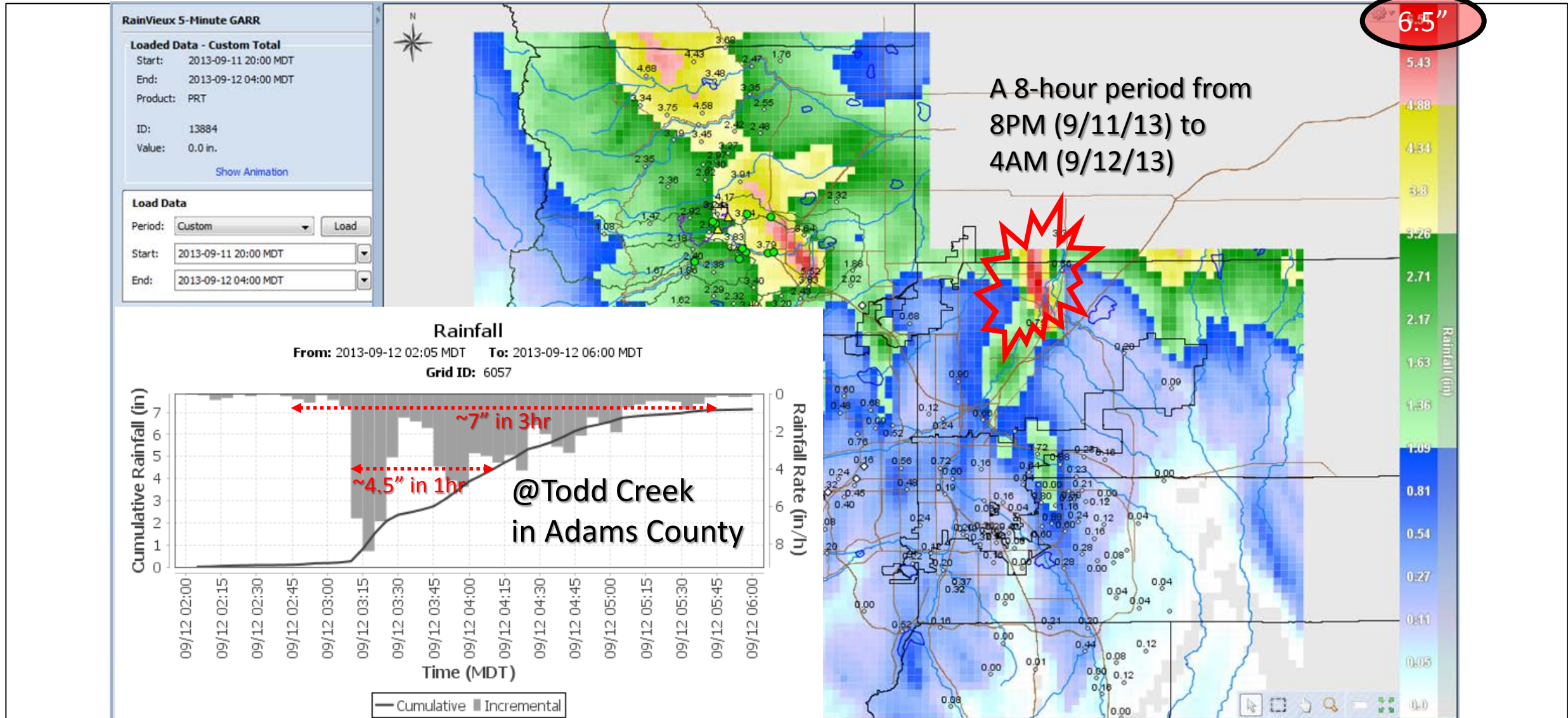


Figure 1. Maximum observed rainfall amounts in relationship to corresponding precipitation frequency estimates for the Justice Center gauge.

Let's broaden our perspective a little.



Who remembers...

The Great Todd Creek Flood of September 12, 2013



So again, how about 2017?

☐ Did something big happen?



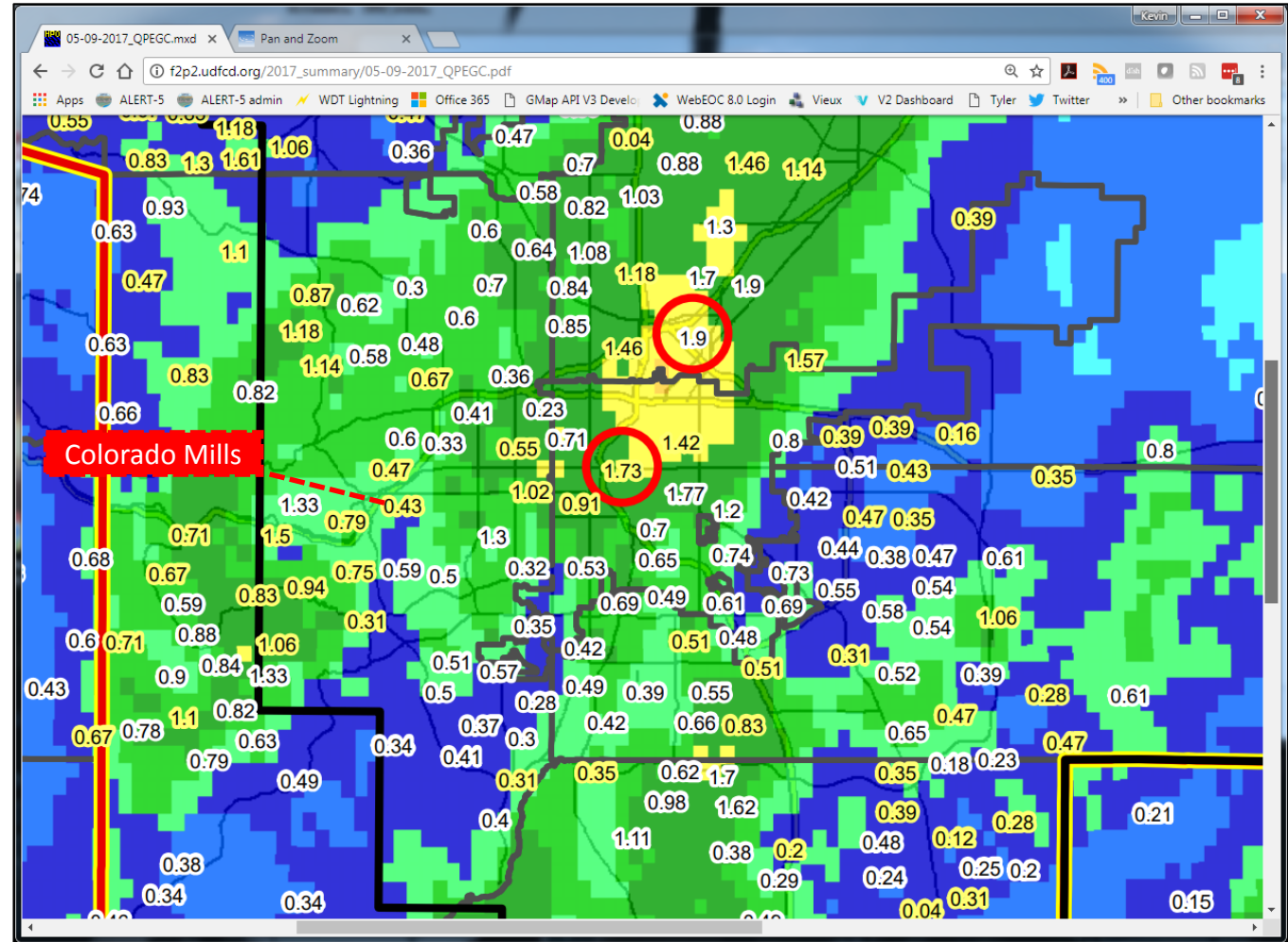
☐ Is there one in particular that you remember?

☐ If so, why?

May 8, 2017...THE WINNER



Colorado Mills Hail Storm
Insured losses > \$2.2 Billion



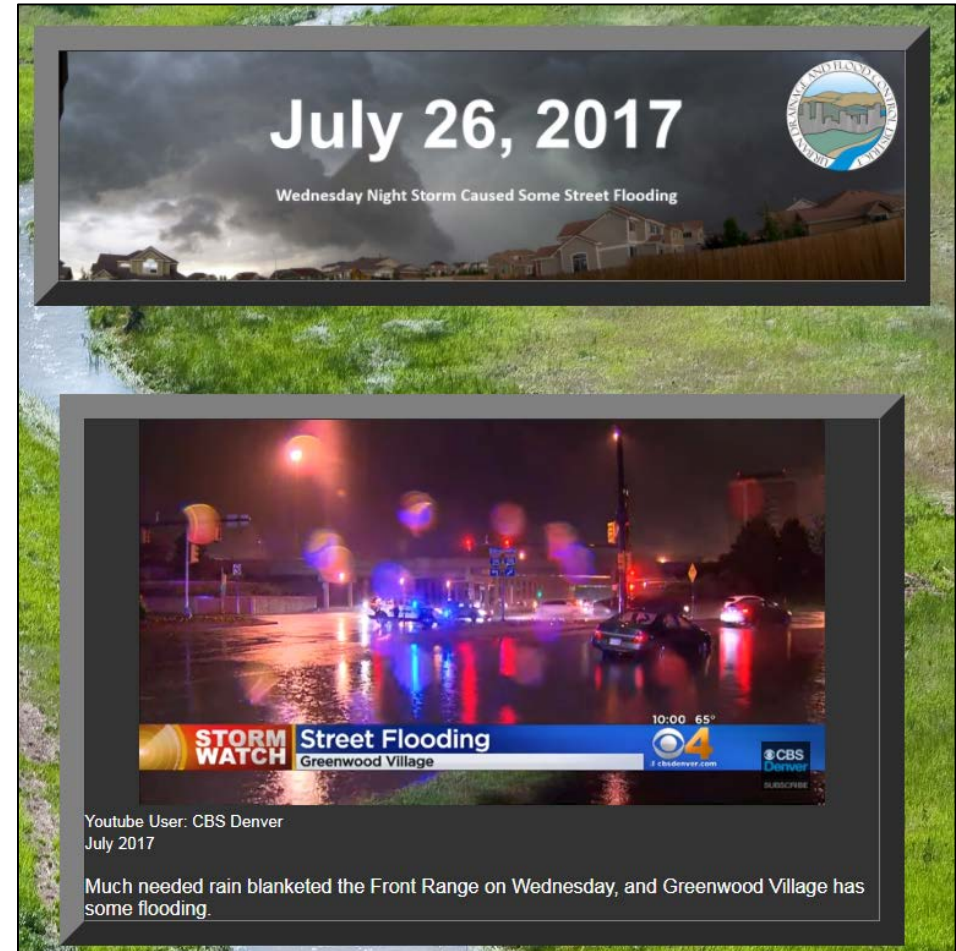
Rainfall amounts not very notable.

Now let's take a look at July 26, 2017



A small stream out of its banks but no notable damages.

- Consistent with evening news reports about street flooding in Greenwood Village

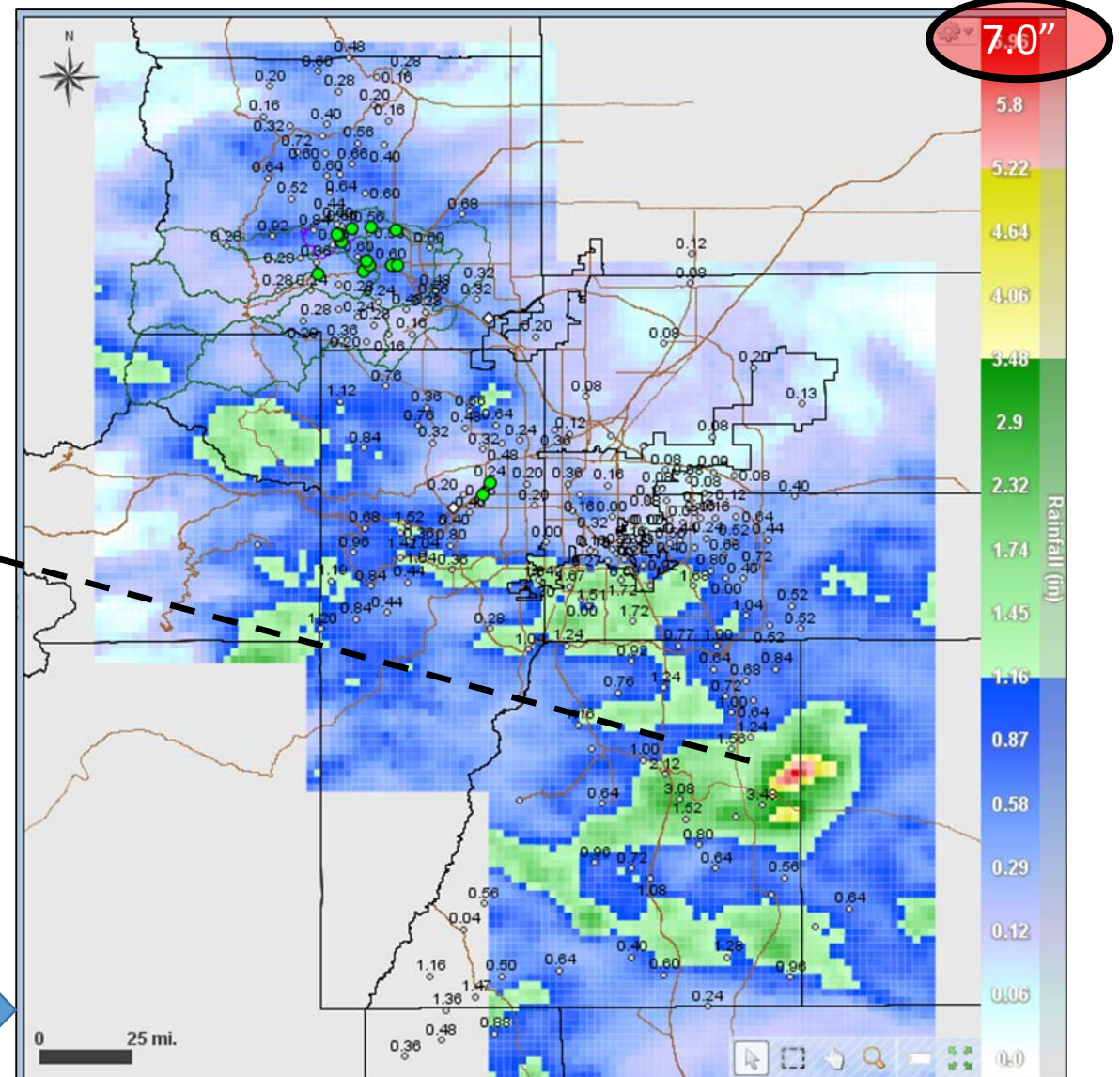


July 26, 2017

If not in Greenwood Village,
where was the big event this day

?

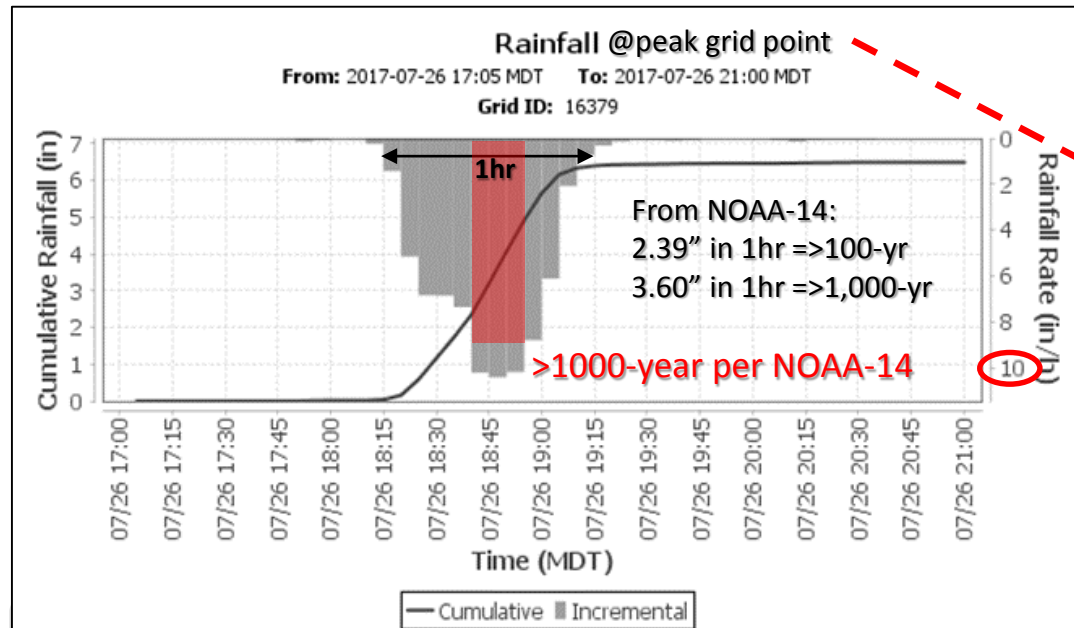
12-hour Gage-Adjusted Radar
Rainfall (GARR) estimates
between Noon and Midnight



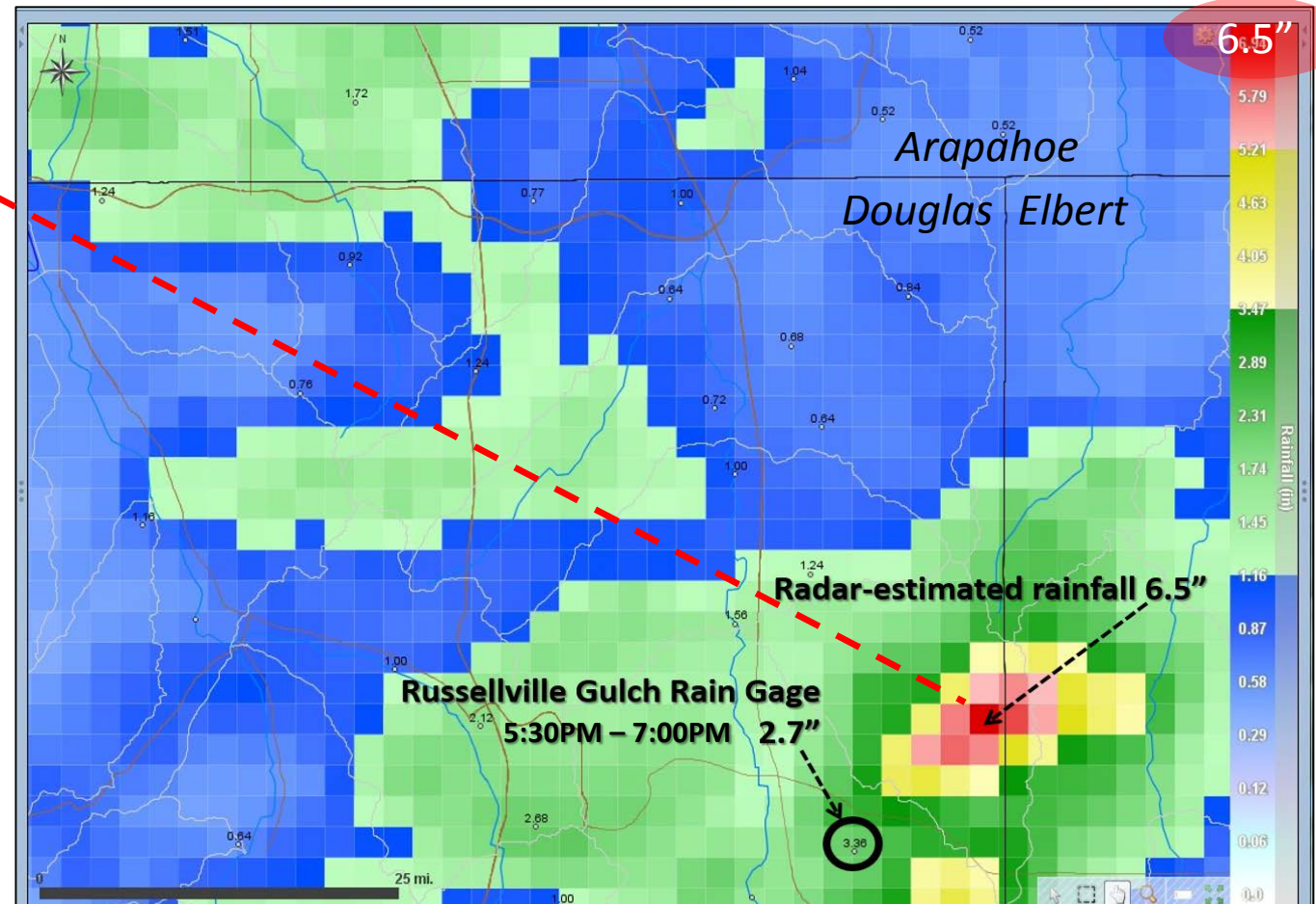
July 26, 2017...*The Unseen*

Russellville Gulch ALERT Station:

10 Minute Peak Intensities							15 Minute Peak Intensities							30 Minute Peak Intensities						
Station	Date	Tips	Inches	in/hr	Frequency		Station	Date	Tips	Inches	in/hr	Frequency		Station	Date	Tips	Inches	in/hr	Frequency	
2900	7/26/17 18:20:55	30	1.181	7.087	<200yr		2900	7/26/17 18:23:49	40	1.575	6.299	<200yr		2900	7/26/17 18:30:21	60	2.362	4.724	<500yr	



Check out these 5-min intensities!



Really...a 1,000-year event was overlooked?

If true, what must happen for events this big to get noticed?



1. Lots of broken stuff
2. People inconvenienced
3. Fatalities



The Historic “*1,000-YEAR*” Fox Hill Flood of 2017



Storm Date: July 26
Photo Date: July 28



Thank you!

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SOME OTHER CLOSING THOUGHTS...

- ✓ “Rare” events are not that rare.
- ✓ They happen all the time.
- ✓ Will your next big event get noticed?



Protecting People, Property, and the Environment