Improved Resiliency through Detection of Flood-Producing Precipitation with Observational Networks Composed of Radar and Precipitation Gauges

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1. ABSTRACT

Efficient detection of flood-producing storms depends on observational sensor network density that leverages high-resolution precipitation measurement by radar and rain gauge network. A review of probability of detection of flood-producing events for semiarid Colorado Front Range is examined. The observational network consists of a dense rain gauge network, which is used independently and in combination with weather radar (NEXRAD) measurements.

Resiliency for infrastructure flooding is often defined by precipitation exceedance probabilities or return intervals for specific durations. Results demonstrate that rainfall patterns associated with extreme events are difficult to detect with rain gauges alone, and that radar can increase the success in flood detection by these networks.

2. STUDY OBJECTIVES

- Real-time rainfall is needed for flood alert decisions, but how much are we missing with a rain gauge-only network compared to radar?
  - Rainfall is monitored by 202 ALERT gauges over approximately 8,705 km^2 (3,400 mi^2).
  - Gauge-adjusted radar rainfall (GARR) monitors this domain, over 11,541 km^2 as 1x1 km pixels.
- Whether rain gauge networks (RGN) alone can adequately detect extreme events, is analyzed.

3. Results

The rain gauge networks (RGN) in Fig. 1 shows 8 rain gauges exceeding the 100-yr threshold, while Fig. 2 shows GARR events exceeding 100-yr, for the same period, 2013-2018.

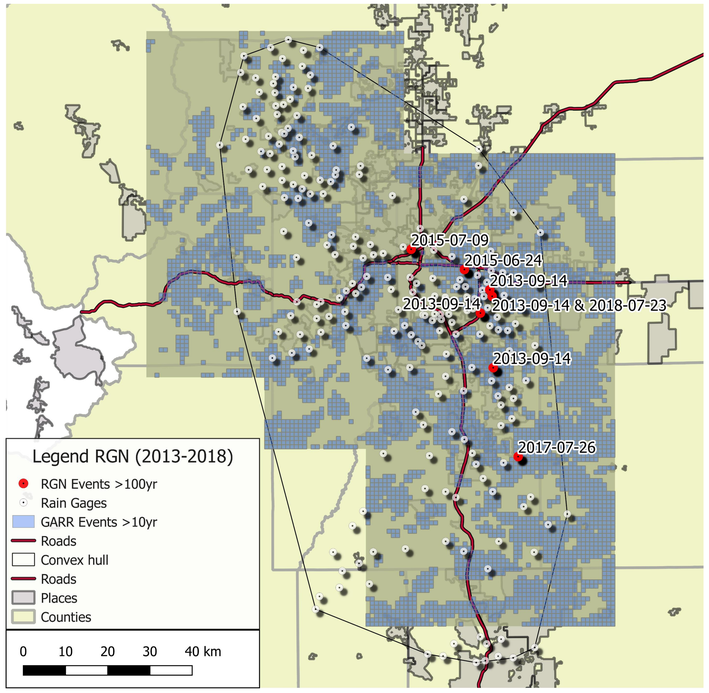

Fig. 1 RGN Events >100 yr (2013-2018)

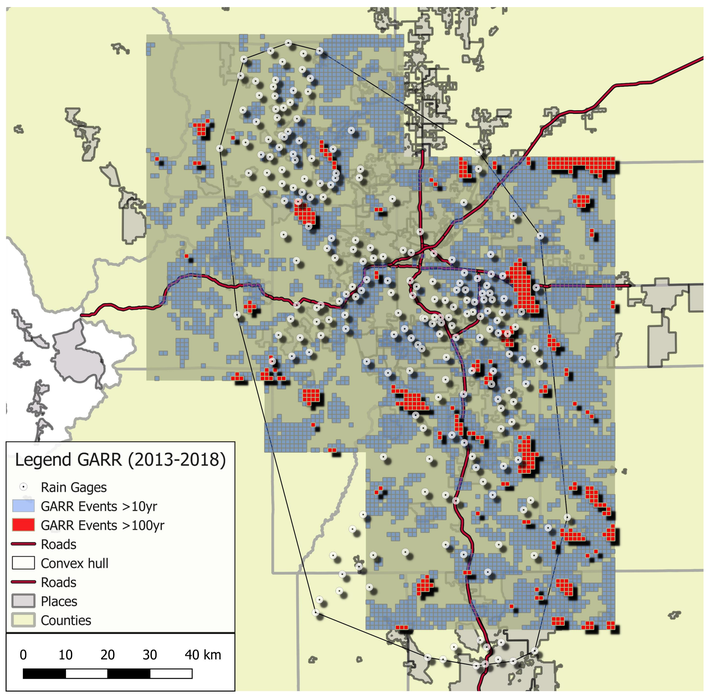

Fig. 2 GARR Events >100 yr (2013-2018)

4. SUMMARY

Analysis of archival precipitation data reveals that extreme events are not always captured by the rain gauge network alone, and occur more often over a region than expected from point probabilities. GARR found many times more 100-yr events than the gauge network over the same 6-yr period, as noted in the table below.

Number of 100-yr Events Detected (2013-2018)

Year	Rain Gauge Network	GARR
2013	5	23
2014	0	9
2015	2	7
2016	0	3
2017	1	9
2018	1	20
Total	9	71
Average	1.5	11.8

5. REFERENCES

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