Examination of the Spatial Correlation Among Gauge Precipitation Data and Gridded Radar Data for the Determination of Sufficient In-Situ Network Coverage

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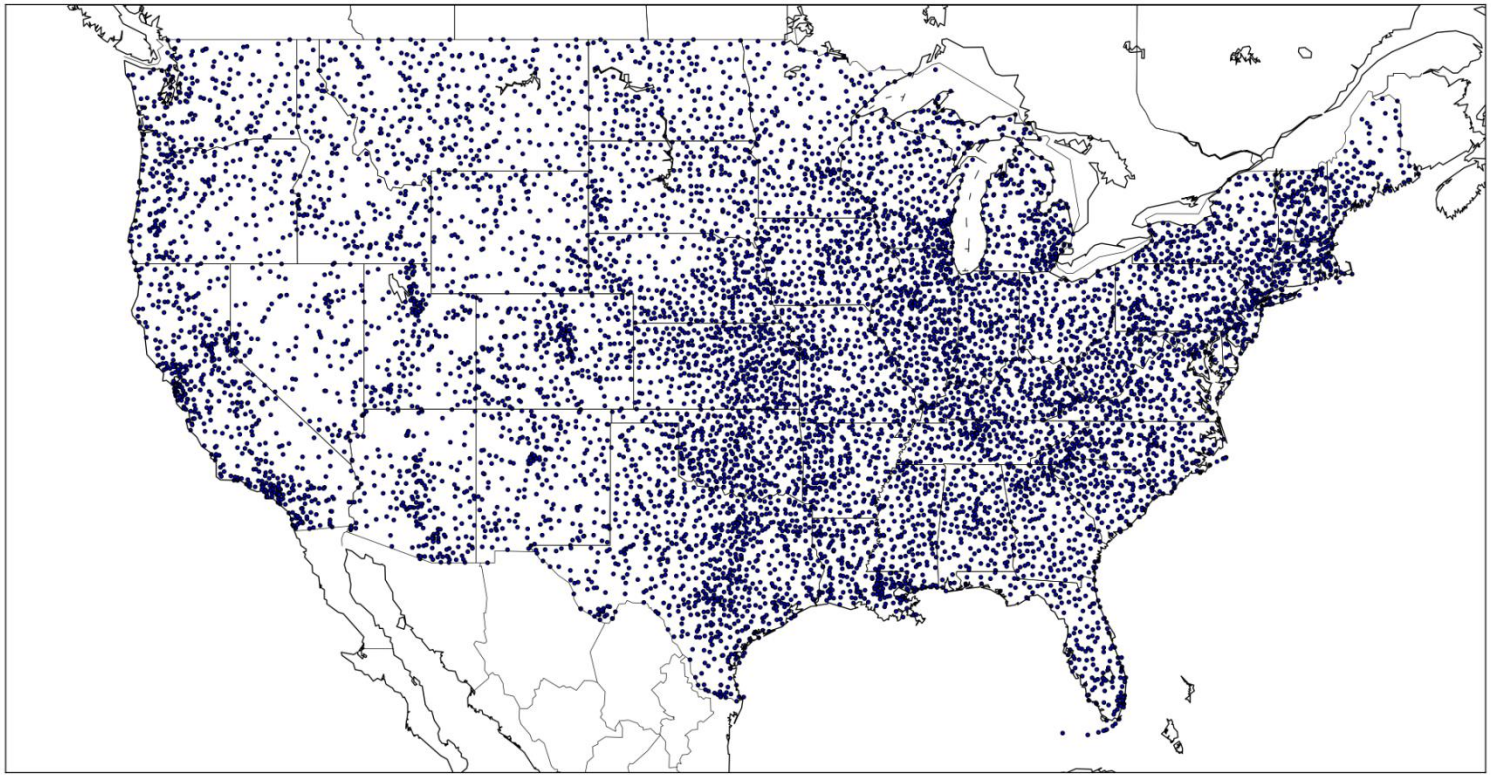
Background

- Global Historical Climatology Network (GHCN)-Daily in-situ rain gauges are used extensively in reports such as the National Climate Assessment
  - These gauges are not evenly distributed across the United States
  - Many gauges have incomplete records
  - Point measurements from in-situ gauges may not be representative of the larger surrounding area

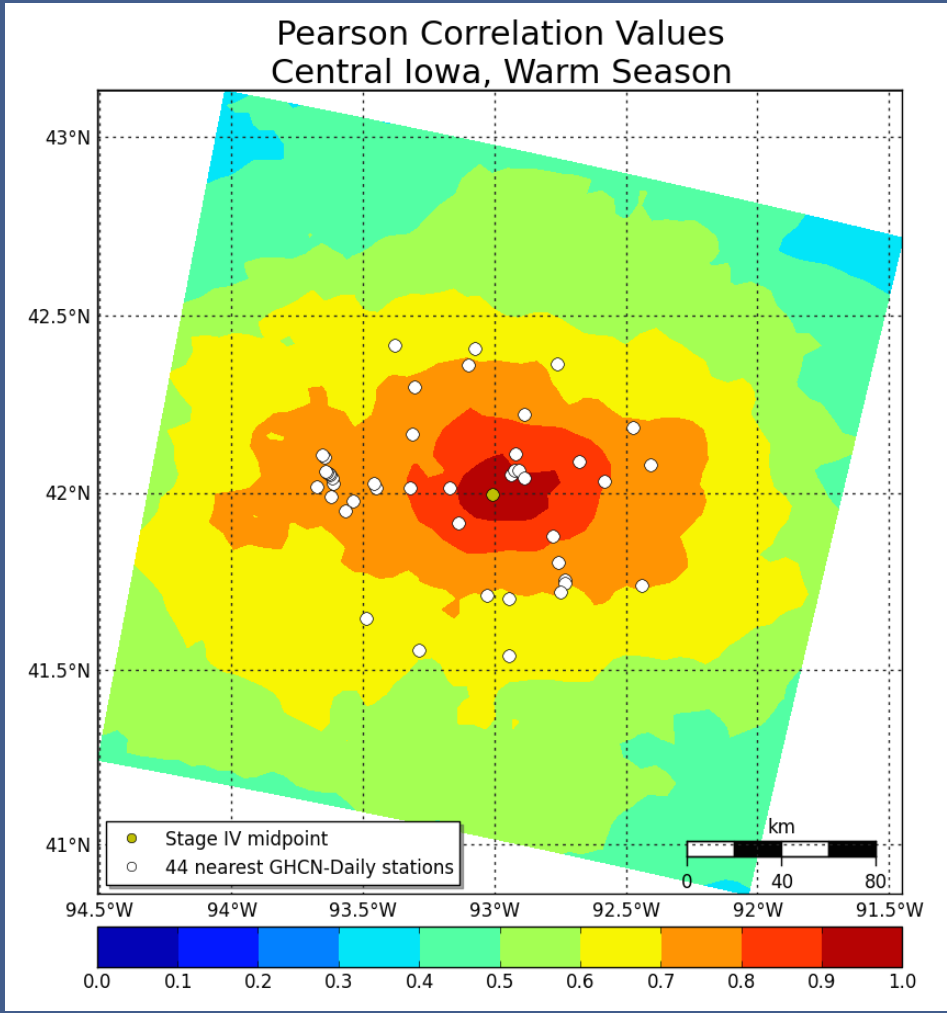


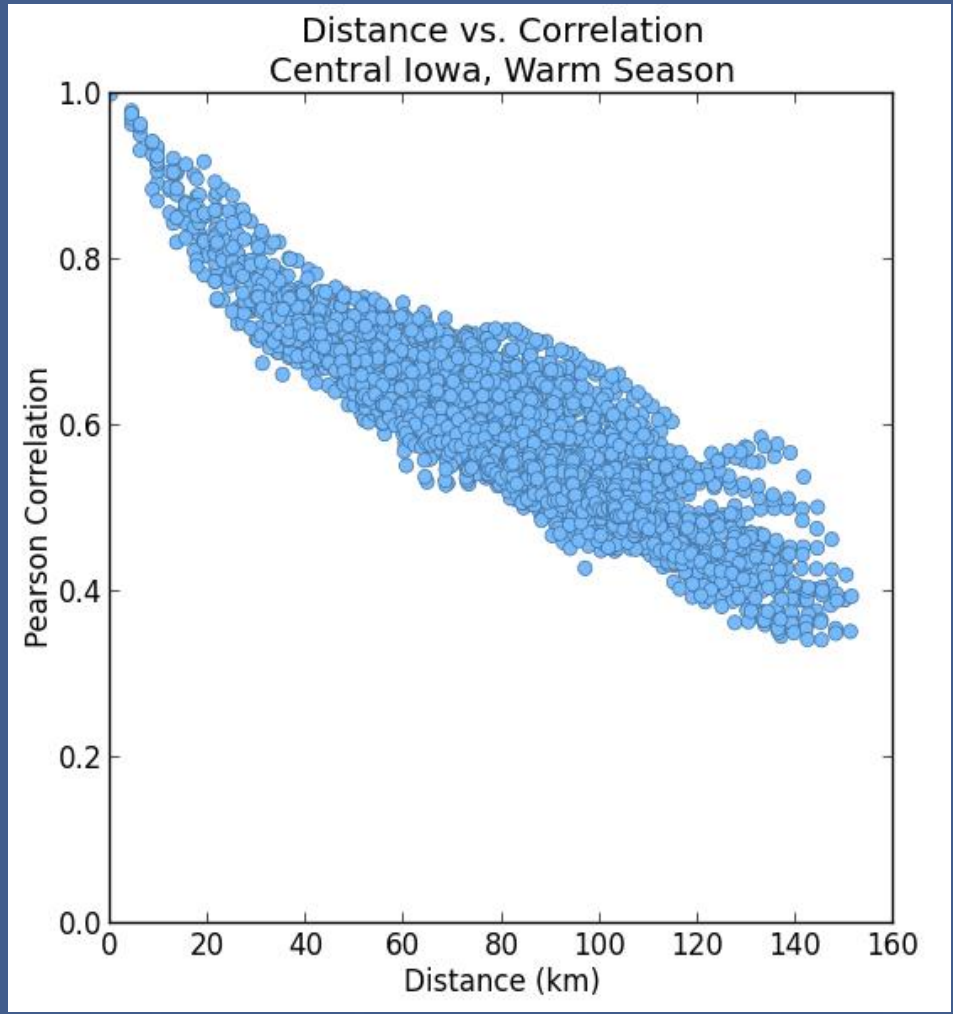
GHCN-Daily stations in contiguous USA with known reporting time

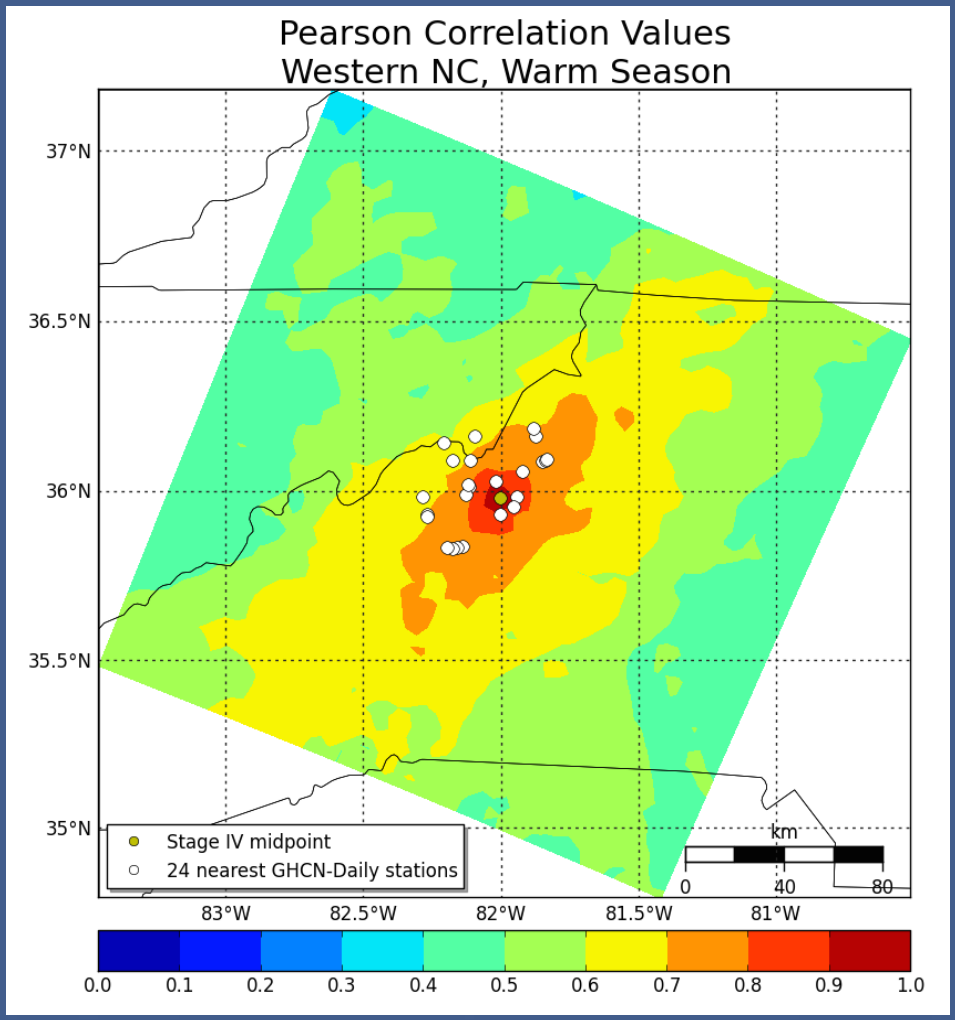
How representative of the surrounding area is rainfall reported by one in-situ gauge?

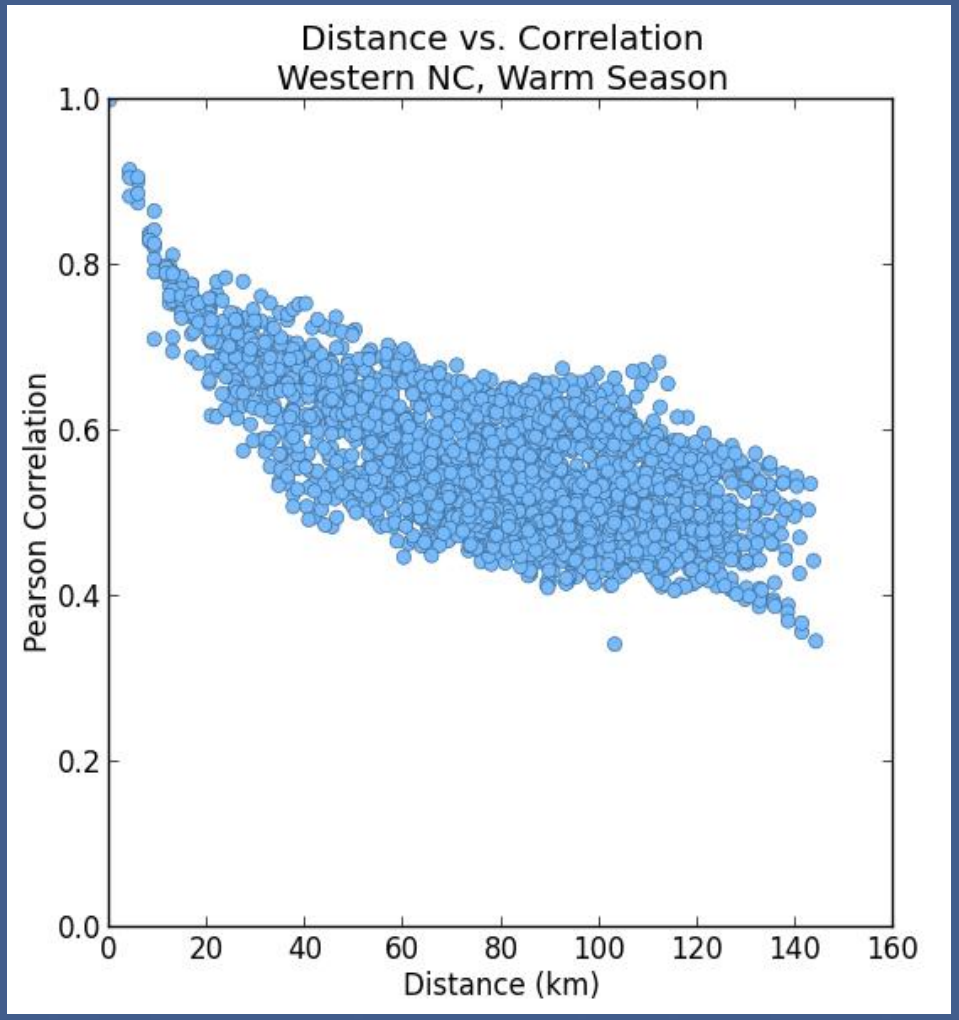
Stage IV Gridded Radar Data

- Allows for uniform spatial analysis of rainfall patterns and correlation
  - Fills in the gaps between in-situ gauges
  - Determine correlation rates of decay at any given location


Pearson Correlation Values
Central Iowa, Warm Season
43°N
42.5°N
42°N
41.5°N
41°N
94.5°W
94°W
93.5°W
93°W
92.5°W
92°W
91.5°W
Stage IV midpoint
44 nearest GHCN-Daily stations
km
0
40
80
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

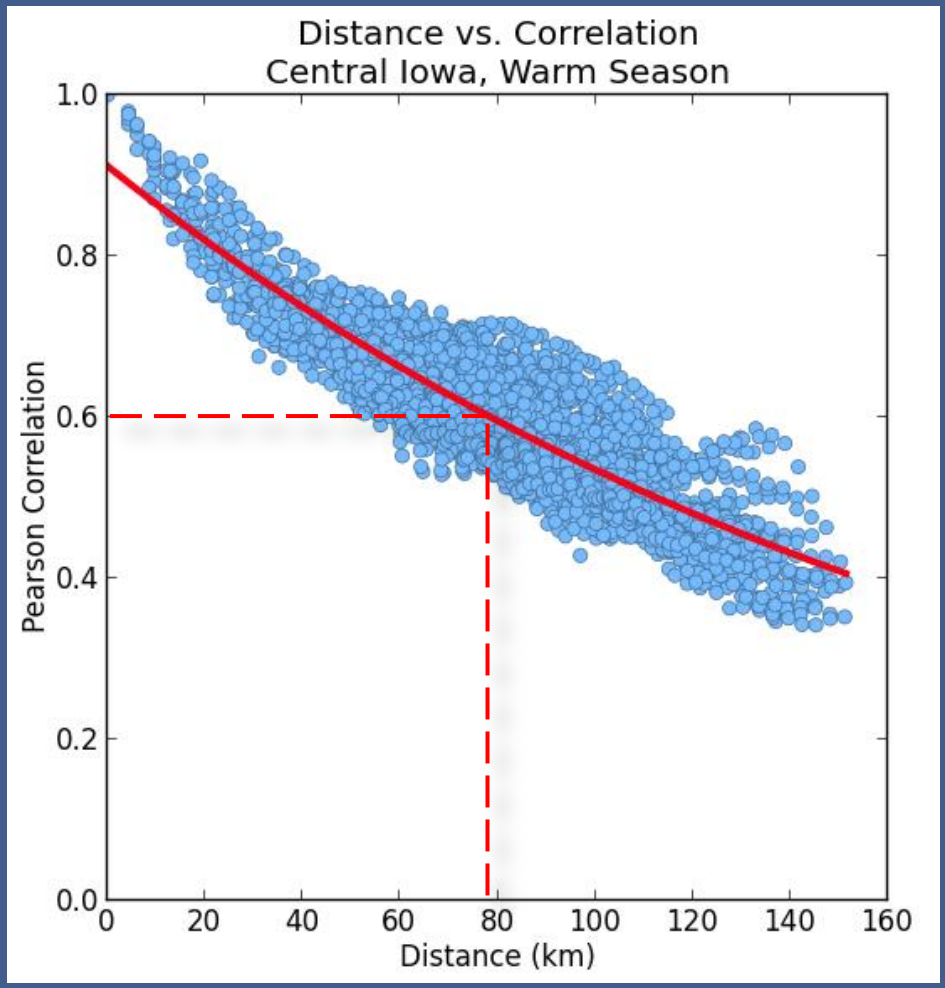

Distance vs. Correlation
Central Iowa, Warm Season
Pearson Correlation
1.0
0.8
0.6
0.4
0.2
0.0
0
20
40
60
80
100
120
140
160
Distance (km)


Pearson Correlation Values
Western NC, Warm Season
37°N
36.5°N
36°N
35.5°N
35°N
83°W
82.5°W
82°W
81.5°W
81°W
Stage IV midpoint
24 nearest GHCN-Daily stations
km
0
40
80
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0


Distance vs. Correlation
Western NC, Warm Season
Pearson Correlation
1.0
0.8
0.6
0.4
0.2
0.0
0
20
40
60
80
100
120
140
160
Distance (km)

- At what distance from the midpoint does correlation drop to a certain threshold?

- How does correlation vary with:
  - Location?
  - Season?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Pearson Correlation
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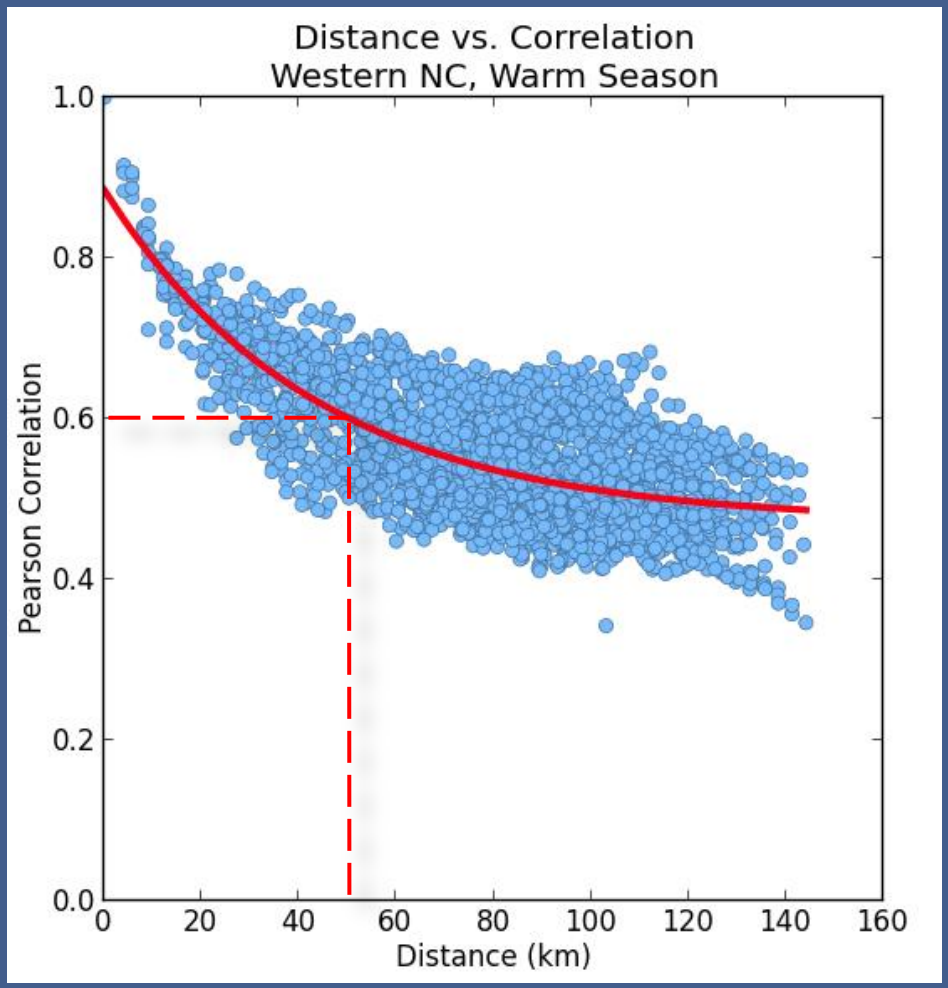
0.6
0.4
0.2
0.0
0
20
40
60
80
100
120
140
160
Distance (km)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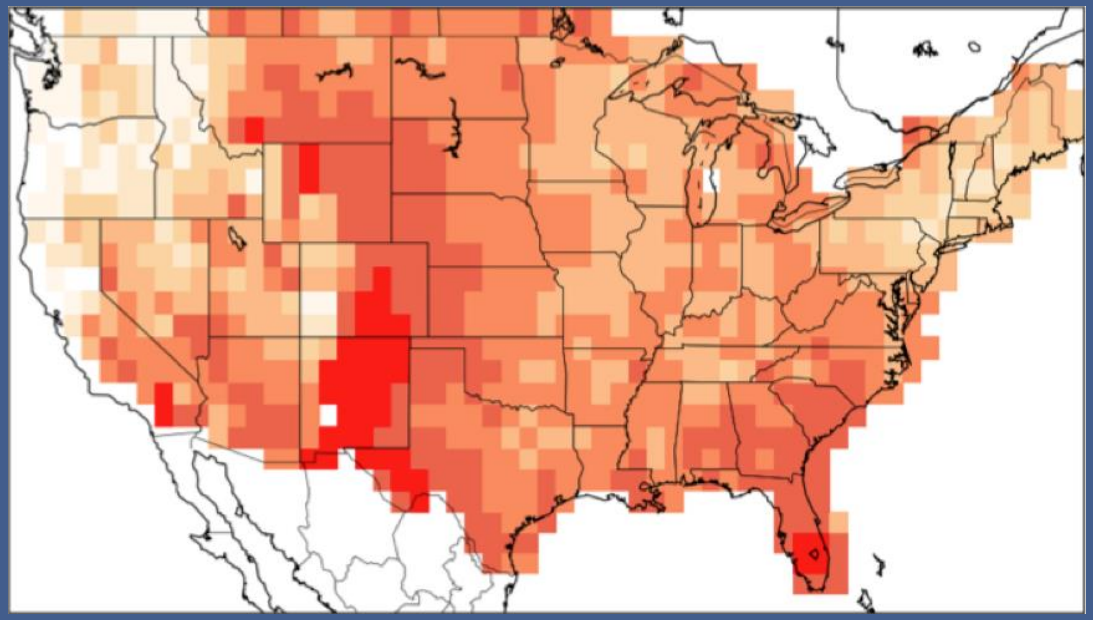
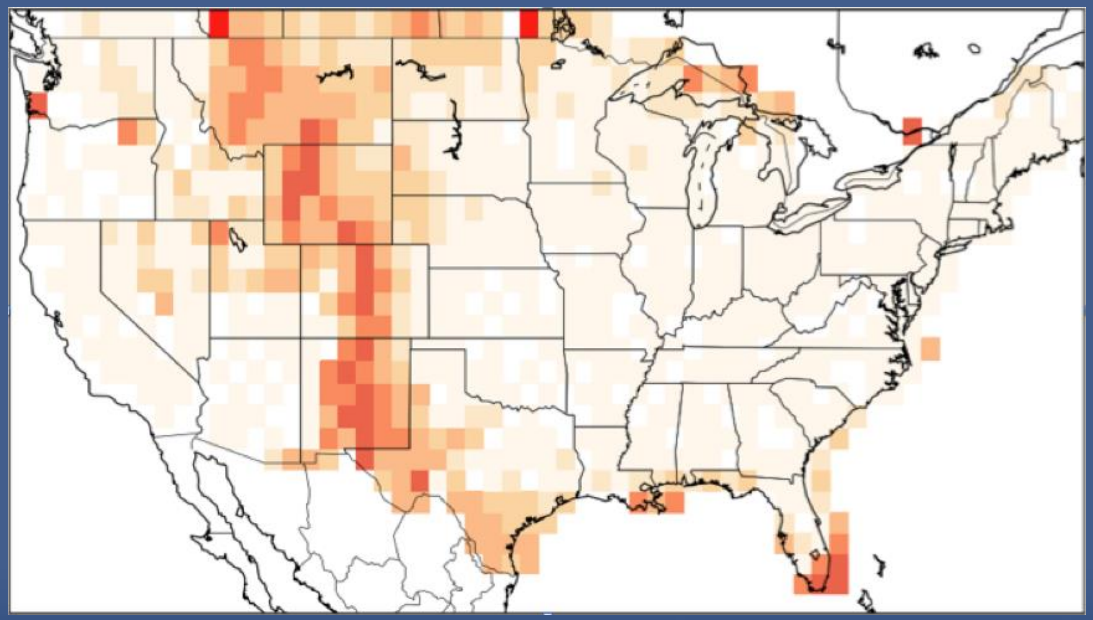
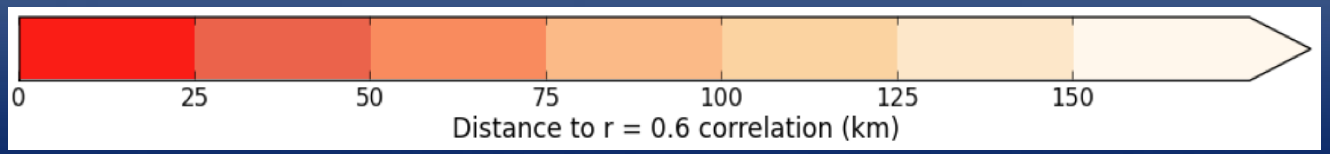
Western NC, Warm Season
Pearson Correlation
1.0
0.8
0.6
0.4
0.2
0.0
0
20
40
60
80
100
120
140
160
Distance (km)

Warm Season

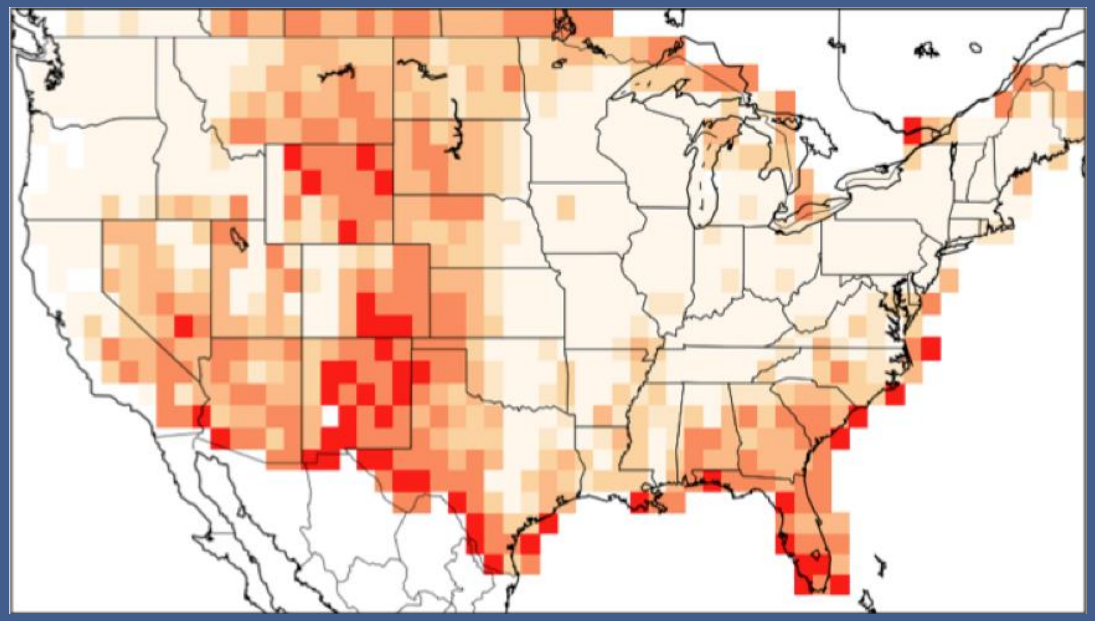


Cold Season

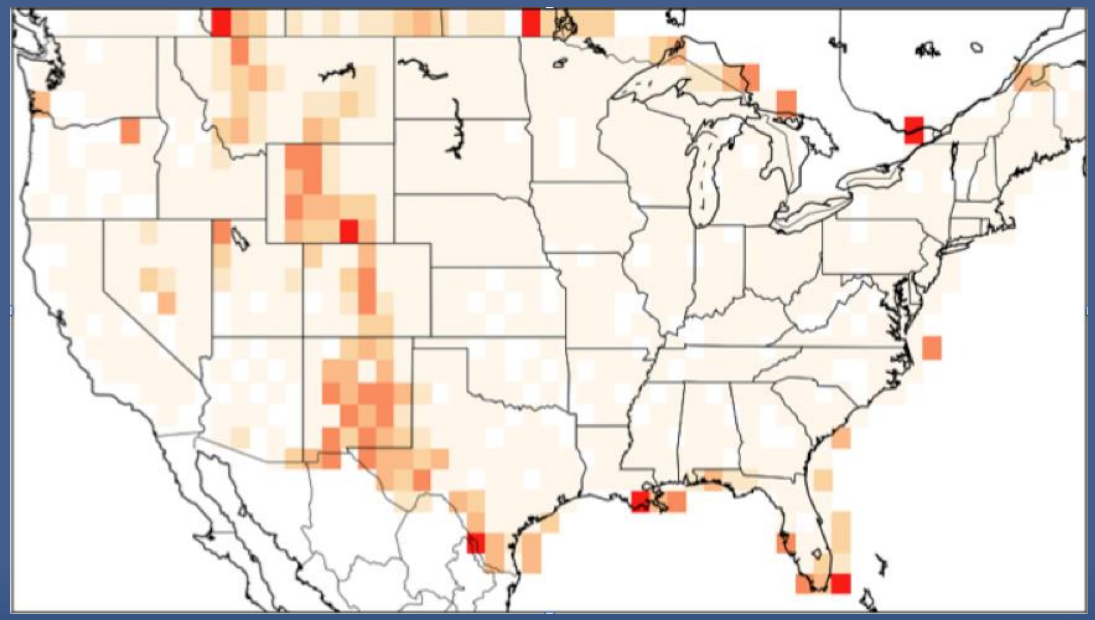


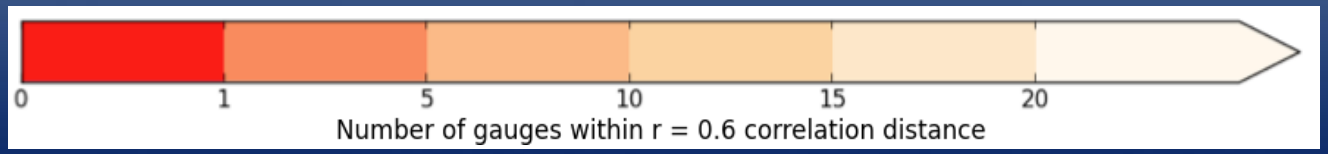


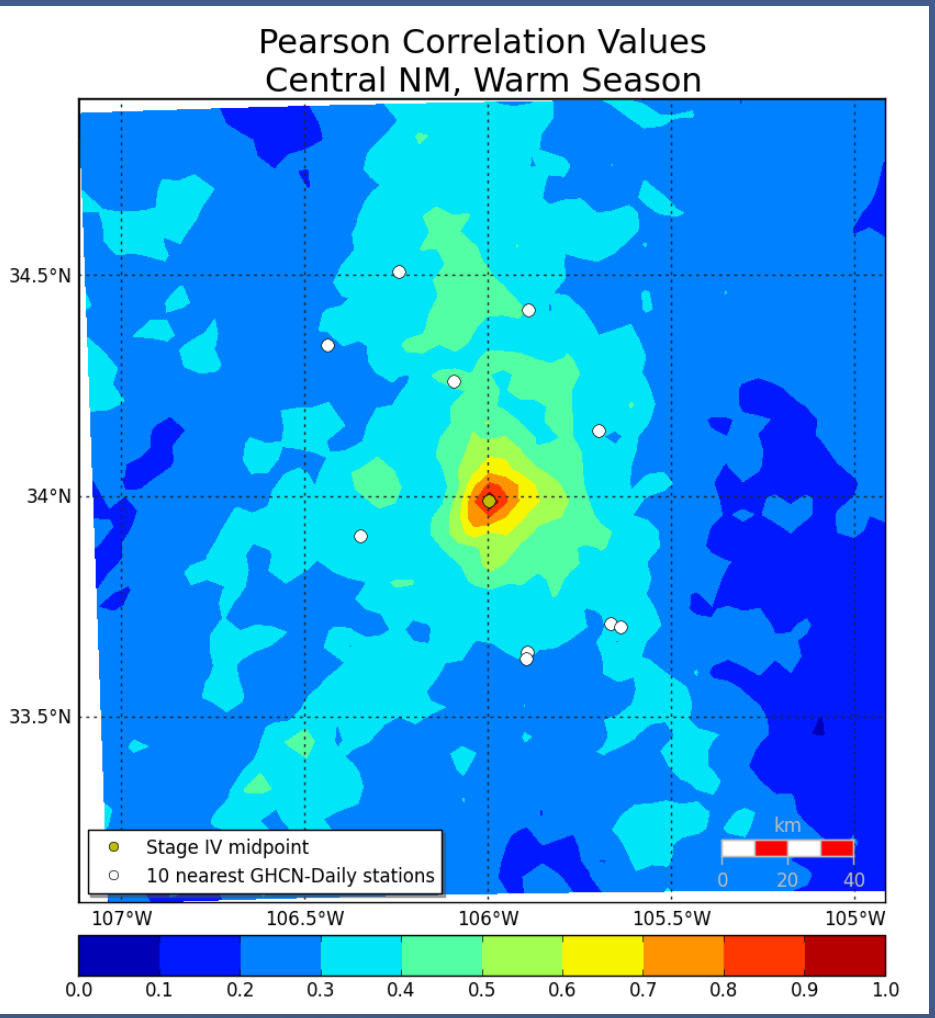
Warm Season

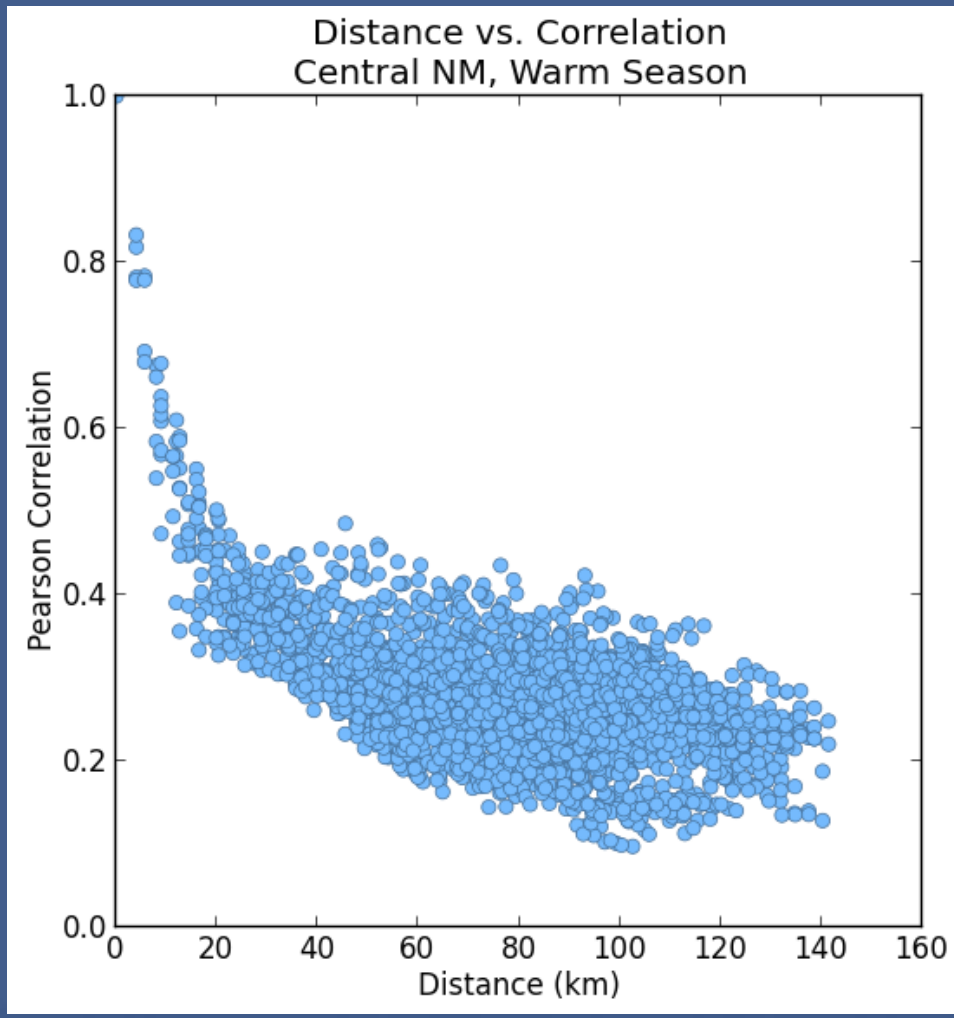


Cold Season






Pearson Correlation Values
Central NM, Warm Season
34.5°N
34°N
33.5°N
107°W
106.5°W
106°W
105.5°W
105°W
Stage IV midpoint
10 nearest GHCN-Daily stations
km
0
20
40
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0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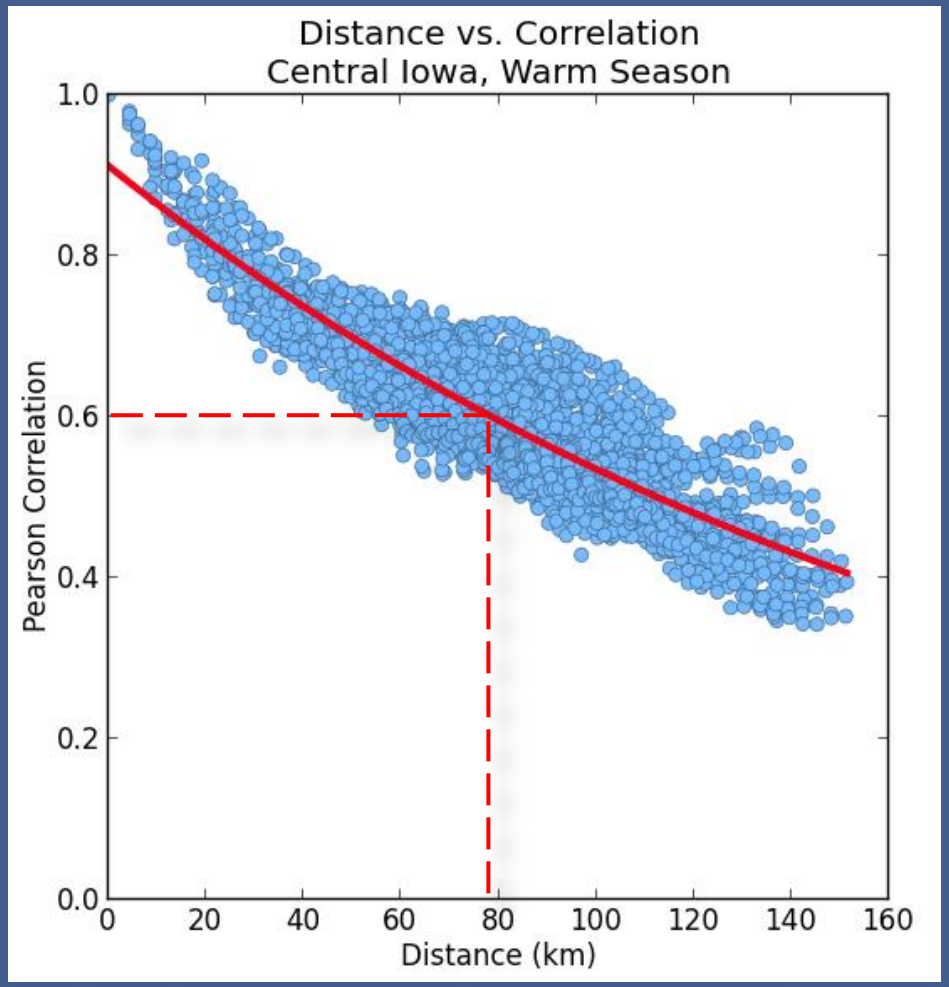
Central NM, Warm Season
Pearson Correlation
Distance (km)
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
100
120
140
160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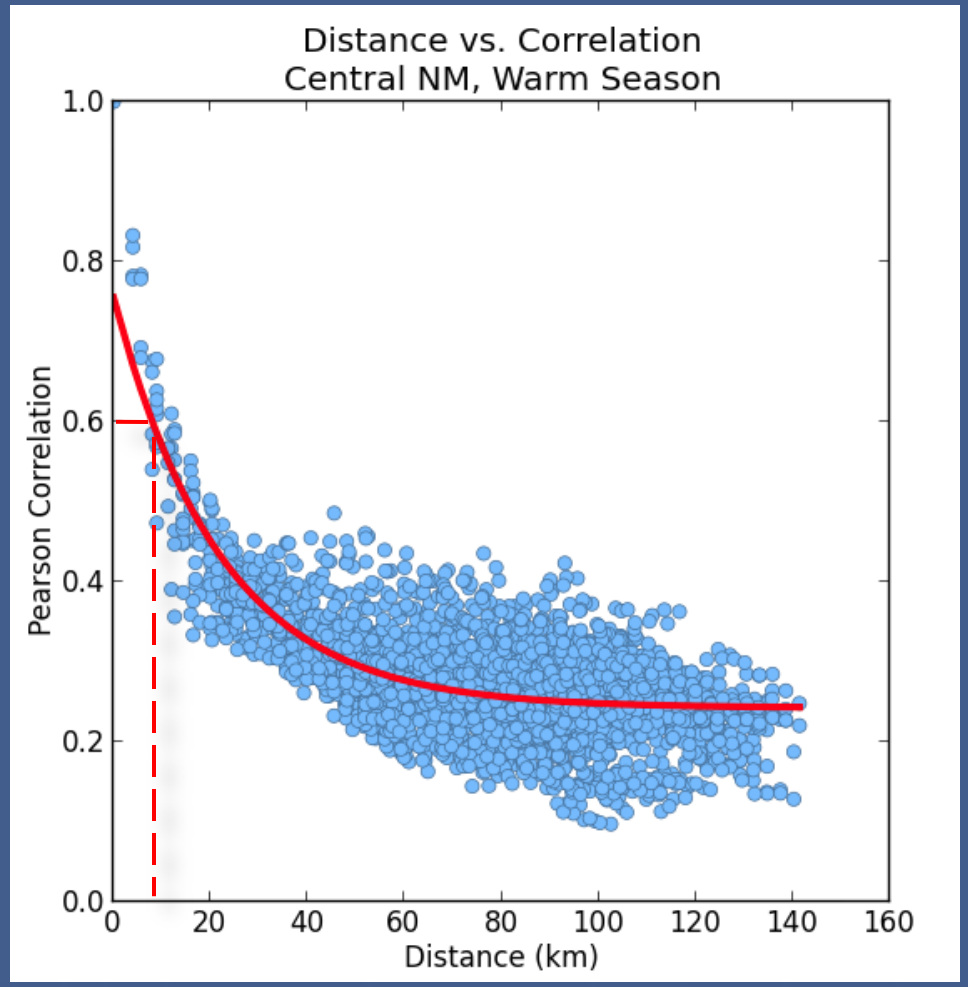
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140
160

Conclusions

- Sufficient coverage for vast majority of contiguous USA

- Gauge density requirements vary from region to region
  - Quicker correlation drop-off rates in Western United States necessitate denser in-situ gauge network to correctly capture rainfall variation

Questions?
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