Extreme Precipitation Statistics
Adjusted for a Changing Climate

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Northeast Regional Climate Center
Department of Earth and Atmospheric Science, Cornell
Gather Observed Rainfall

Extreme Rainfall 101

1 Day Partial Duration Series for Boston, MA

Precipitation Amount (inches) vs Frequency
Choose and Fit a Distribution

Extreme Rainfall 101

(a) Location shift in seasonal minima

(b) Scale shift in seasonal minima

(c) Shape shift in seasonal minima

1day Partial Duration Series for Boston, MA

Frequency vs. Precipitation Amount (inches)
Choose a Period of Record

Extreme Rainfall 101

Number of Events

0 1 2 3 4 5 6 7 8

99 Largest Daily Rainfall Events

Northeast Regional Climate Center
Choose a Period of Record

Extreme Rainfall 101

5-yr ARI

10-yr ARI

25-yr ARI

Trend

0% decade$^{-1}$

0.02% decade$^{-1}$

0.04% decade$^{-1}$

0.07% decade$^{-1}$

0.1% decade$^{-1}$

Stationary 150-yr PDS

90% CI
Recent Extreme Rainfall Changes

For PDS starting in 1950
Recent Extreme Rainfall Changes

https://precipchange.nrcc.cornell.edu
Recent Extreme Rainfall Changes

precipchange.nrcc.cornell.edu
# Future Extreme Rainfall: Data

**EXTRACT DATA**

- **BCCAV2**
  - **RCPs**: 4.5, 8.5
  - **Approximate gridded spatial resolution**: 12 km (7.5 miles)
  - **Temporal resolution**: Daily
  - **Downscaling approach**: Statistical

- **MACA**
  - **RCPs**: 4.5, 8.5
  - **Approximate gridded spatial resolution**: 4 km (2.5 miles)
  - **Temporal resolution**: Daily
  - **Downscaling approach**: Statistical

- **LOCA**
  - **RCPs**: 4.5, 8.5
  - **Approximate gridded spatial resolution**: 6 km (3.7 miles)
  - **Temporal resolution**: Daily
  - **Downscaling approach**: Statistical

- **NA CORDEX**
  - **RCPs**: 8.5
  - **Approximate gridded spatial resolution**: 25 km (15.5 miles)
  - **Temporal resolution**: Daily and Sub-daily
  - **Downscaling approach**: Dynamical

- **NA CORDEX**
  - **RCPs**: 4.5
  - **Approximate gridded spatial resolution**: 25 km (15.5 miles)
  - **Temporal resolution**: Daily
  - **Downscaling approach**: Dynamical

- **NA CORDEX**
  - **RCPs**: 4.5
  - **Approximate gridded spatial resolution**: 50 km (31 miles)
  - **Temporal resolution**: Daily
  - **Downscaling approach**: Dynamical
Future Extreme Rainfall: Extreme Value Analysis
Future Extreme Rainfall: Compute Change Factor

\[ CF_i = \frac{P_{i,r,future}}{P_{r,historical}} \]
Future Extreme Rainfall: Interpolate and Smooth

Low (RCP4.5) Emissions 2050-2099 100-yr Storm
Future Extreme Rainfall: Extract Ensemble Statistics

High Emissions 2050-2099 100-yr Storm

EXTRACT MODEL ENSEMBLE STATISTICS

- 1000 x number of models CF per grid
- Retain 10th, 17th, 25th, 50th, 75th, 83rd, and 90th percentile
- Extract values for grid closest to county centroid
Future Extreme Rainfall
https://midatlantic-idf.rcc-acis.org

Projected Intensity-Duration-Frequency (IDF) Curve Data Tool for the Chesapeake Bay Watershed and Virginia

Selection Panel
Return Period
100-year

Emissions Scenario
High RCP 8.5

Time Period
2050-2100

Median County Change Factor
0.7 1.0 1.3

Northeast Regional Climate Center
Future Extreme Rainfall

https://midatlantic-idf.rcc-acis.org
Future Extreme Rainfall
https://midatlantic-idf.rcc-acis.org
# Future Extreme Rainfall County Values

## Northeast Regional Climate Center

<table>
<thead>
<tr>
<th>Percentile</th>
<th>10th</th>
<th>25th</th>
<th>Median</th>
<th>75th</th>
<th>90th</th>
<th>Atlas 14 Depth (inches)</th>
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<tbody>
<tr>
<td>County Change Factors:</td>
<td>0.98</td>
<td>1.05</td>
<td>1.14</td>
<td>1.26</td>
<td>1.481</td>
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<th>10 min</th>
<th>15 min</th>
<th>30 min</th>
<th>60 min</th>
<th>2 hr</th>
<th>3 hr</th>
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<td>0.76</td>
<td>1.19</td>
<td>1.49</td>
<td>2.22</td>
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<td>0.82</td>
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<td>1.38</td>
<td>1.73</td>
<td>2.59</td>
<td>3.52</td>
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## Future Extreme Rainfall County Values

### Comparison Table

<table>
<thead>
<tr>
<th>Duration</th>
<th>Atlas 14 Depth (inches)</th>
<th>Projected 2050-2100 Depth (inches)</th>
<th>Change (inches)</th>
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<tbody>
<tr>
<td>5 min</td>
<td>0.78</td>
<td>0.89</td>
<td>+0.11</td>
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<tr>
<td>10 min</td>
<td>1.21</td>
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<td>+0.43</td>
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<tr>
<td>2 hr</td>
<td>3.88</td>
<td>4.42</td>
<td>+0.54</td>
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<tr>
<td>3 hr</td>
<td>4.18</td>
<td>4.77</td>
<td>+0.59</td>
</tr>
<tr>
<td>6 hr</td>
<td>5.16</td>
<td>5.86</td>
<td>+0.72</td>
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</tbody>
</table>
Future Extreme Rainfall

Hourly CF
THANK YOU!