NOAA Atlas 14: Why Should a Local Official Review?

FMA 2016
Michelle Iblings
Alameda County Flood Control District
Agenda

• Implications
• Brief summary of NOAA14 and PFE in Alameda County
• Comparisons
• Findings
Alameda County – The Facts

- 80 mi shoreline
- 0 – 3,843 ft
- 12-30 MAP
- Low-High Urbanization
- Coastal, inland, leeward mountain rain patterns
NOAA Atlas 14, Volume 6 – Brief History

- Atlas 2 Volume 11 – For Western US
- Atlas 14 Volume 1 – For Semiarid SW
- Atlas 14 Volume 6 – For California
  - Version 1.0 (2011)
  - Version 2.3 (2014)
  - “Region of Influence”
- ONLINE PFDS (Precipitation Frequency Data Server)
Why Should I Care?

3 Implications

1. Rainfall → Runoff
2. Design Considerations
3. Impacts to the Public
#1 – We really only care about RUNOFF

Calibration to **Streamflow Gages**
#2 – Design Implications

- Liability of prior design
- Reduce PFE – Flooding
- Increase PFE – Waste $
#3 – Public Implications

“Never Underestimate the Power of a Line on a Map”
Alameda County – How We Find PFE’s

My Office MAP=18.9”

100-year, 24-hour PFE = 4.72”
NOAA 14 – How To Find PFE’s

"My Office"
Lat: 37.656
Long: -122.1

100-year, 24-hour PFE = 4.99"
Alameda County vs. NOAA 14

- Let’s Compare...
  - 100-year frequency
  - 24-hour duration
  - At one location (“My office”)
- Alameda County = 4.74 inches
- NOAA 14 = 4.99 inches
- Difference = 0.25 inches (5.3%)
Other frequencies, durations, and locations...

<table>
<thead>
<tr>
<th>Return Period</th>
<th>Duration in Minutes</th>
<th>Duration in Hours</th>
</tr>
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<tbody>
<tr>
<td>in Years</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>-9.4</td>
<td>-3.9</td>
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<tr>
<td>5</td>
<td>-19.2</td>
<td>-13.1</td>
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<td>-17.9</td>
<td>-12.9</td>
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100-year, 6-hour Min and Max PFE...

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<thead>
<tr>
<th></th>
<th>MIN</th>
<th>MAX</th>
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<tbody>
<tr>
<td>ACFCD</td>
<td>1.8</td>
<td>3.8</td>
</tr>
<tr>
<td>NOAA</td>
<td>1.8</td>
<td>3.8</td>
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</table>
100-year, 24-hour Min and Max PFE...

<table>
<thead>
<tr>
<th></th>
<th>MIN</th>
<th>MAX</th>
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</thead>
<tbody>
<tr>
<td>ACFCD</td>
<td>3.2</td>
<td>7.1</td>
</tr>
<tr>
<td>NOAA</td>
<td>3.3</td>
<td>7.8</td>
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## Spatial Comparison

<table>
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<tr>
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<th>1-hour</th>
<th>6-hour</th>
<th>24-hour</th>
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<tbody>
<tr>
<td></td>
<td>3 – 14% for 2-year</td>
<td>19 – 24% for 2-year</td>
<td>16 – 36% for 2-year</td>
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<tr>
<td></td>
<td>-4 – 5% for 5-year</td>
<td>8 – 10% for 5-year</td>
<td>3 – 23% for 5-year</td>
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<tr>
<td></td>
<td>-5 – 9% for 100-year</td>
<td>10 – 14% for 100-year</td>
<td>5 – 30% for 100-year</td>
</tr>
<tr>
<td></td>
<td>Average 2%</td>
<td>Average 14%</td>
<td>Average 16%</td>
</tr>
</tbody>
</table>

**Overall Range from –19 to 36%**
Some other considerations...

- Alameda County values within NOAA 90% Confidence Interval (not +/- 5%!)

- Alameda County uses MAP to determine PFE (no MAP in NOAA14 online)
Another Study?!

2016 Analysis vs. NOAA Atlas 14
“Regional Frequency Analysis based on L-moment Statistics”

**Major Differences**
1. Additional data (more gages and longer records)
2. CRA (not ROI)
3. Refined resolution (smaller study size)

**Similarities**
2. Data QC
3. GEV distribution
Alameda County – Rain Data QC

- **15 Hourly**
  (min 15 years)
- **39 Daily/Recording**
  (min 20 years)
### 2016 Analysis – More Data

<table>
<thead>
<tr>
<th></th>
<th>Number of Stations Used in NOAA Atlas 14</th>
<th>Number of Stations Used After QC and Screening</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Daily</td>
<td>Hourly</td>
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<tr>
<td>24-hr Analysis</td>
<td>172</td>
<td></td>
</tr>
<tr>
<td>1-hr Analysis</td>
<td>45</td>
<td></td>
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<tr>
<td>15-m Analysis</td>
<td>~45</td>
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</table>

- **77% more Daily Stations**
- **165% more Hourly Stations**
2016 Analysis – Climate Region Approach

- **ROI** (Burn, 1990) – Each station has its own region with a potentially unique combination of nearby stations, based on maximum allowable distance from the target station.

- **CRA** – Regions are delineated based on climate, season(s) of highest precipitation, type of storm, topography, and the homogeneity of these characteristics in a given geography.
ROI (NOAA14 in CA) vs. CRA (2016 Analysis)
2016 Analysis – Spatial Resolution

(A) 

(B) 

Temperature (C)
Value
3.4 - 17.3
17.4 - 19.8
19.9 - 21.8
21.9 - 23.5
23.6 - 25.1
25.2 - 26.5
26.6 - 27.8
27.9 - 29
29.1 - 30.1
30.2 - 31.3
31.4 - 32.5
32.6 - 33.9
34.0 - 35.4
35.5 - 37.6
37.7 - 40.2
40.3 - 46.3
2016 Analysis – Findings

1. Differences are from TWO sources:
   Statistical Methodology & Spatial Distribution

2. Rainfall Frequency ≠ Runoff Frequency!
   “30 year window”
Conclusion

“Knowledge is Power!”
-Sir Francis Bacon

“Question everything!”
-Euripides

Consider the 3 Implications
1. Rainfall → Runoff
2. Design
3. Public
2016 Analysis – MAP to PFE

MAP $\rightarrow \sqrt{MAP} \rightarrow$ MAM $\rightarrow$ Weight 1 $\rightarrow$ Weight 2 $\rightarrow$
Spatially Interpolate Residuals (PRISM) $\rightarrow$ PFE

Where
• MAP = At-site, recorded Mean Annual Precipitation
• MAM = Mean Annual Maxima (duration-based)
• Weight 1 = Data-year weighting to get an Improved MAM
• Weight 2 = Improved vs. Polynomial Estimation

Lots of Boring Math...