Precip.net: A precursor to NOAA Atlas 14 for the Northeast and a Living Extreme Precipitation Climatology

Art DeGaetano Northeast Regional Climate Center Department of Earth and Atmospheric Science, Cornell









History of Extreme Precipitation



Technical Paper 40 (1961)



NRCC (2010)





Wilks (1993)



NOAA Atlas 14 (2015)



Project History 2009-2011

- USDA NRCS funded project for updated New York New England extreme precipitation atlas
- Match the products and output of NOAA Atlas 14 for NRCS compatibility.
- Add additional products to supplement NRCS hydrologic design.
- Produce automated real-time monitoring tools.

Data

- 2,070 Coop Stations
- 649 daily stations in eastern Canada.
- Start of record to end of 2008
- At least 20 year and<25% of data record missing
- Available NOAA hourly and sub-hourly datasets





NRCC QC Process

- Screened by Automated NOAA QC and than Validated by NRCC/NWS before entering database
- Further manual check of >5 inch PDS events that are not corroborated with nearby station reports of >3 inches.
- Correspondence between hourly PDS data and corresponding daily
 - Hours no greater than daily
- Manually screen PDS values > 2 standard deviations of the mean of all Northeast stations

Screening of only PDS values makes annual updates manageable





Estimating Current Rainfall Extremes is like.....



Estimating the probabilities of poker hands Without knowing the values and suits of all the cards!







Estimating the probabilities of poker hands Without knowing the values and suits of all the cards

AND

Adding more face cards to the deck at an unknown rate





Precipitation Extremes 101

• Partial Duration Series (PDS)

n highest independent daily rainfalls in n year period

Boston	Logan Inte	ernation Ai	rport (#19	0770) – 193	36-2008 (7	2 complete years)
7.06"	3.84"	3.11"	2.81"	2.64"	2.52"	2.42"
6.11"	3.77"	3.00"	2.80"	2.64"	2.52"	2.40"
5.69"	3.58"	2.98"	2.77"	2.63"	2.50"	2.40"
5.63"	3.51"	2.95"	2.77"	2.60"	2.50"	2.40"
4.88"	3.49"	2.94"	2.76"	2.59"	2.49"	2.39"
4.71"	3.36"	2.91"	2.76"	2.59"	2.49"	2.38"
4.47"	3.34"	2.90"	2.71"	2.58"	2.47"	
4.29"	3.32"	2.89"	2.67"	2.55"	2.46"	
4.21"	3.31"	2.89"	2.66"	2.54"	2.46"	
4.12"	3.16"	2.87"	2.64"	2.54"	2.46"	
4.00"	3.15"	2.82"	2.64"	2.53"	2.42"	





Precipitation Extremes 101

Fitting the Distribution



Precipitation (inches)





Precipitation Extremes 101

Fitting Introduces Uncertainty







Precipitation Extremes 101

Quantify Uncertainty



Randomly Draw 1000x Refit Distribution Retain 5th and 95th Percentiles



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Methodology Differences

- **DIFFERENCE 1** PDS versus AMS which is then converted to partial duration series results.
- **DIFFERENCE 2** Max Likelihood fit of Beta-P versus L-moments fit of the mainly GEV distribution.





Spatial Interpolation and Smoothing

Beta-P results regionalized based on

 Distance to Nearby Stations and the Period of Record of Nearby Stations.-

$$\theta_k = \alpha (\theta_d)_k + (1 - \alpha) (\theta_n)_k$$

From the August 2004 *Journal of Hydrology*: "Regionalization of extreme precipitation estimated for the Alabama rainfall atlas" (Durrans & Kirby)

Methodology Differences

- DIFFERENCE 1 PDS versus AMS which is then converted to partial duration series results.
- **DIFFERENCE 2** Max Likelihood fit of Beta-P versus L-moments fit of the mainly GEV distribution.
- **DIFFERENCE 3** Post Analysis regionalization vs. regional Lmoments. This also affects CI computation.
- **DIFFERENCE 4** No explicit elevation adjustment in mapped and gridded products vs PRISM-based interpolation.

Select Precip.net Atlas-14 Comparisons







Select Precip.net Atlas-14 Comparisons















Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	Massachusetts
Location	
Longitude	71.520 degrees West
Latitude	42.215 degrees North
Elevation	0 feet
Date/Time	Tue, 08 Oct 2019 09:05:49 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.29	0.44	0.54	0.71	0.89	1.13	1yr	0.77	1.07	1.31	1.65	2.10	2.68	2.92	1yr	2.37	2.81	3.25	3.91	4.56	1yr
2yr	0.35	0.54	0.67	0.89	1.11	1.40	2yr	0.96	1.29	1.63	2.04	2.56	3.23	3.51	2yr	2.85	3.38	3.88	4.62	5.25	2yr
5yr	0.42	0.65	0.81	1.09	1.39	1.77	5yr	1.20	1.61	2.06	2.59	3.24	4.06	4.48	5yr	3.59	4.31	4.93	5.83	6.52	5yr
10yr	0.47	0.74	0.93	1.27	1.65	2.11	10yr	1.42	1.90	2.46	3.10	3.88	4.83	5.38	10yr	4.27	5.17	5.90	6.95	7.68	10yr
25yr	0.56	0.89	1.13	1.55	2.06	2.66	25yr	1.78	2.36	3.11	3.92	4.91	6.08	6.86	25yr	5.38	6.60	7.50	8.77	9.55	25yr
50yr	0.63	1.01	1.29	1.81	2.44	3.19	50yr	2.11	2.79	3.74	4.71	5.87	7.24	8.26	50yr	6.41	7.94	8.99	10.47	11.26	50yr
100yr	0.72	1.17	1.51	2.13	2.90	3.80	100yr	2.50	3.30	4.47	5.64	7.01	8.64	9.94	100yr	7.64	9.55	10.78	12.50	13.29	100yr
200yr	0.82	1.34	1.74	2.49	3.44	4.54	200yr	2.97	3.90	5.35	6.75	8.39	10.30	11.97	200yr	9.11	11.51	12.93	14.93	15.69	200yr
500yr	0.99	1.64	2.13	3.09	4.32	5.75	500yr	3.73	4.87	6.78	8.57	10.63	13.00	15.31	500yr	11.51	14.72	16.46	18.88	19.54	500yr

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.23	0.35	0.43	0.57	0.70	0.94	1yr	0.61	0.92	1.07	1.42	1.85	2.34	2.70	1yr	2.07	2.60	2.96	3.59	4.11	1yr
2yr	0.34	0.53	0.65	0.88	1.08	1.27	2yr	0.93	1.24	1.45	1.91	2.44	3.13	3.40	2yr	2.77	3.27	3.76	4.46	5.08	2yr
5yr	0.38	0.59	0.73	1.00	1.28	1.52	5yr	1.10	1.48	1.72	2.25	2.86	3.73	4.12	5yr	3.30	3.96	4.54	5.36	6.03	5yr
10yr	0.42	0.65	0.80	1.12	1.45	1.73	10yr	1.25	1.69	1.95	2.55	3.22	4.26	4.75	10yr	3.77	4.57	5.24	6.15	6.85	10yr
25yr	0.49	0.74	0.92	1.31	1.72	2.05	25yr	1.49	2.00	2.31	3.02	3.78	5.11	5.71	25yr	4.52	5.49	6.33	7.38	8.10	25yr
50yr	0.53	0.81	1.01	1.46	1.96	2.33	50yr	1.69	2.28	2.62	3.42	4.26	5.84	6.57	50yr	5.17	6.32	7.32	8.47	9.22	50yr
100yr	0.59	0.90	1.12	1.62	2.22	2.65	100yr	1.92	2.59	2.97	3.87	4.81	6.69	7.53	100yr	5.92	7.24	8.46	9.75	10.50	100yr
200yr	0.65	0.98	1.25	1.80	2.52	3.02	200yr	2.17	2.95	3.37	4.41	5.44	7.67	8.62	200yr	6.78	8.29	9.78	11.21	11.97	200yr
500yr	0.75	1.11	1.43	2.07	2.95	3.59	500yr	2.55	3.51	3.98	5.24	6.41	9.21	10.28	500yr	8.15	9.89	11.86	13.49	14.26	500yr

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.32	0.49	0.60	0.81	1.00	1.19	1yr	0.86	1.17	1.37	1.76	2.29	2.92	3.14	1yr	2.59	3.02	3.51	4.20	4.88	1yr
2yr	0.37	0.56	0.69	0.94	1.16	1.36	2yr	1.00	1.33	1.56	2.04	2.60	3.35	3.65	2yr	2.97	3.51	4.04	4.80	5.44	2yr
5yr	0.45	0.70	0.87	1.19	1.51	1.78	5yr	1.31	1.74	2.04	2.62	3.31	4.39	4.86	5yr	3.89	4.67	5.37	6.34	7.03	5yr
10yr	0.54	0.83	1.03	1.44	1.86	2.19	10yr	1.60	2.14	2.50	3.18	3.96	5.39	6.06	10yr	4.77	5.83	6.66	7.82	8.57	10yr
25yr	0.69	1.05	1.30	1.86	2.45	2.88	25yr	2.11	2.82	3.27	4.08	5.06	7.07	8.13	25yr	6.26	7.82	8.87	10.36	11.13	25yr
50yr	0.82	1.25	1.56	2.24	3.02	3.55	50yr	2.61	3.47	4.02	4.94	6.06	8.69	10.15	50yr	7.69	9.76	11.02	12.80	13.59	50yr
100yr	1.00	1.50	1.88	2.72	3.73	4.37	100yr	3.22	4.27	4.94	5.98	7.29	10.68	12.71	100yr	9.45	12.23	13.70	15.82	16.57	100yr
200yr	1.20	1.81	2.29	3.31	4.62	5.39	200yr	3.99	5.27	6.09	7.24	8.75	13.13	15.94	200yr	11.62	15.33	17.02	19.56	20.18	200yr







Select station to view Partial Duration Series

	Station ID	Station Name	Length of PDS
View PDS	#190049	ADAMS, MA	48 years
View PDS	#190120	AMHERST, MA	111 years
View PDS	#190190	ASHBURNHAM, MA	67 years
View PDS	#190213	ASHFIELD, MA	30 years
View PDS	#190218	ASHLAND, MA	72 years
View PDS	#190257	ATHOL, MA	29 years
View PDS	#190408	BARRE FALLS DAM, MA	49 years
View PDS	#190535	BEDFORD, MA	51 years
View PDS	#190551	BEECHWOOD, MA	54 years
View PDS	#190562	BELCHERTOWN, MA	66 years
View PDS	#190666	BIRCH HILL DAM, MA	60 years
View PDS	#190736	BLUE HILL, MA	103 years
View PDS	#190759	BORDEN BROOK RSVR, MA	25 years
View PDS	#190770	BOSTON LOGAN INTL AP, MA	72 years
View PDS	#190775	BOSTON CITY WSO, MA	63 years
View PDS	#190801	BOYLSTON, MA	77 years

Select Product ?

Extreme Precipitation Tables - HTML ?

Extreme Precipitation Tables - Text/CSV?

Partial Duration Series by Point ?

Partial Duration Series by Station ?

Distribution Curves -Graphical ?

Distribution Curves -Text/TBL ?

Intensity Frequency Duration Graphs?

Precipitation Frequency Duration Graphs ?

GIS Data Files ?

Regional/State Maps ?

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0.0013

0.0010

0.1

















Select Product ?

Extreme Precipitation



Daily Monitoring

Extreme Precipitation in New York & New England An Interactive Web Tool for Extreme Precipitation Analysis











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