

Precipitation Atlases -2020

History of Extreme Precipitation

Technical Paper NO. 40
Rainfall Frequency Atlas of the Eastern United States
for Duration from 30 minutes to 24 hours and
Return Periods from 1 to 100 years -

NOAA

FIVE- TO 60-MINUTE PRECIPITATION FREQUENCY
FOR THE EASTERN AND CENTRAL UNITED STATES

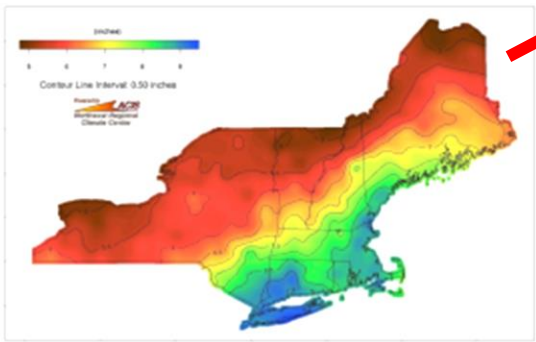
Silver Spring, Md.
June 1977



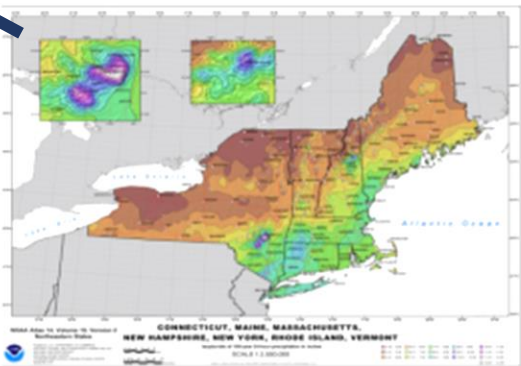
Technical Paper 40 (1961)



Wilks (1993)



NRCC (2010)



NOAA Atlas 14 (2015)

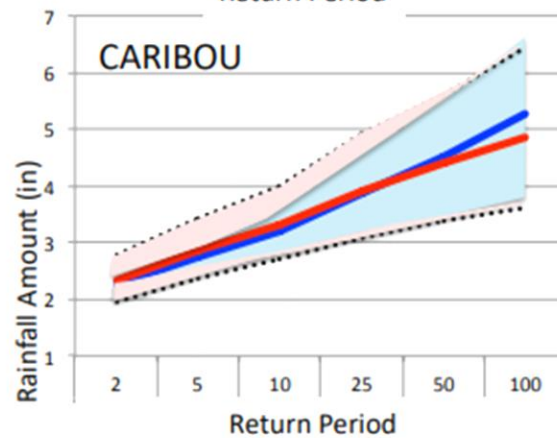
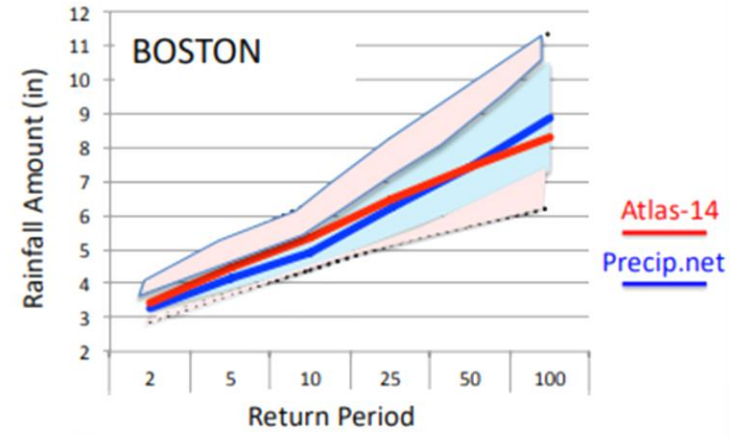
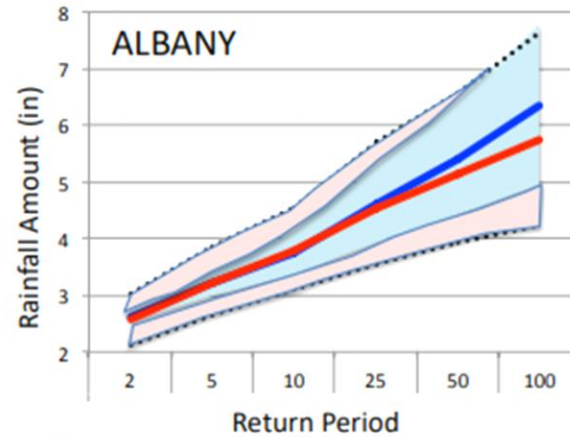
NRCC



NOAA Atlas 14
Duration
5 min to 60 day
Return Period
1yr to 1000yr

Precipitation Atlases -2020

Select Precip.net Atlas-14 Comparisons



NOAA Atlas 14 – Vol 10

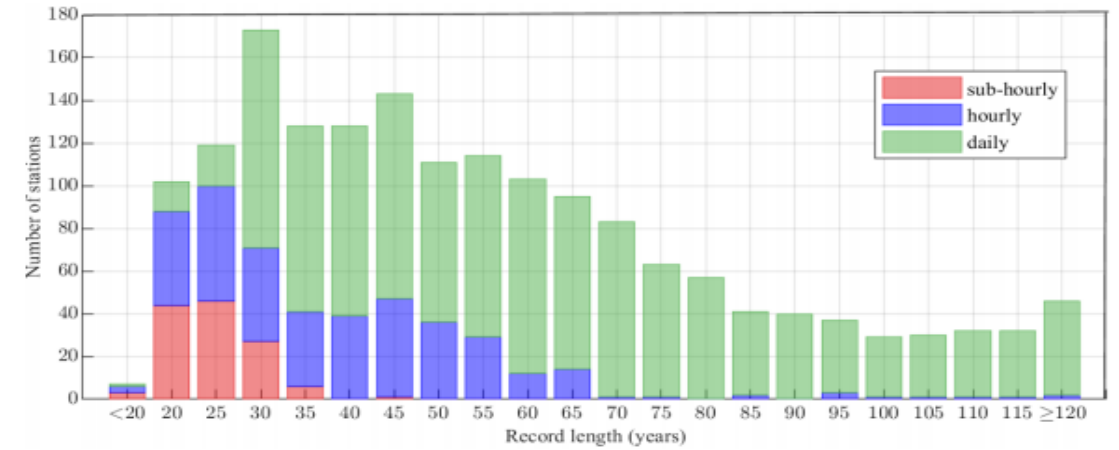
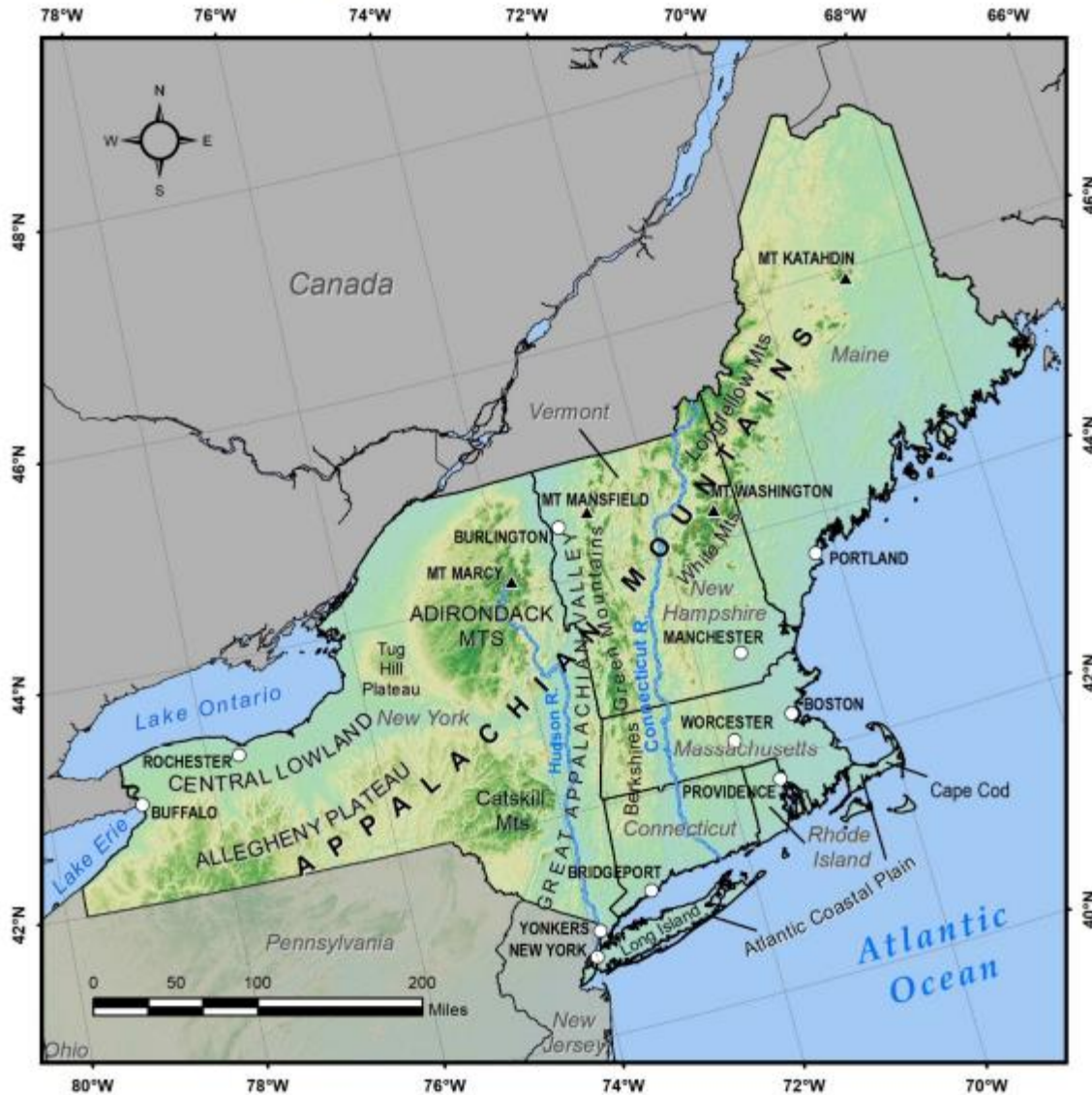


Figure 4.4.1. Number of stations available for precipitation frequency analysis across sub-hourly, hourly and daily durations.

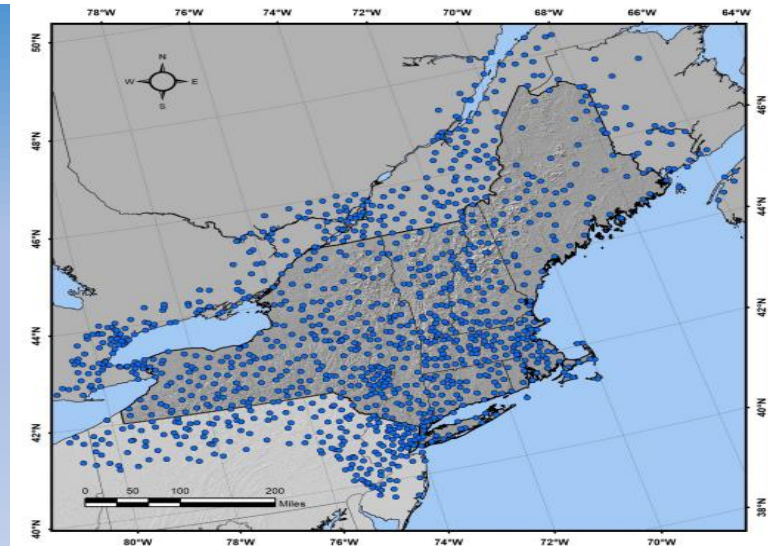


Figure 4.4.2. Map of stations recording at 1-day interval used in frequency analysis.

- Data Server
- GIS Grids
- Maps
- Time Series
- Temporals
- Documents

- Probable Maximum Precipitation
- Documents

- Miscellaneous
- Publications
- Storm Analysis
- Record Precipitation

- Contact Us
- Inquiries



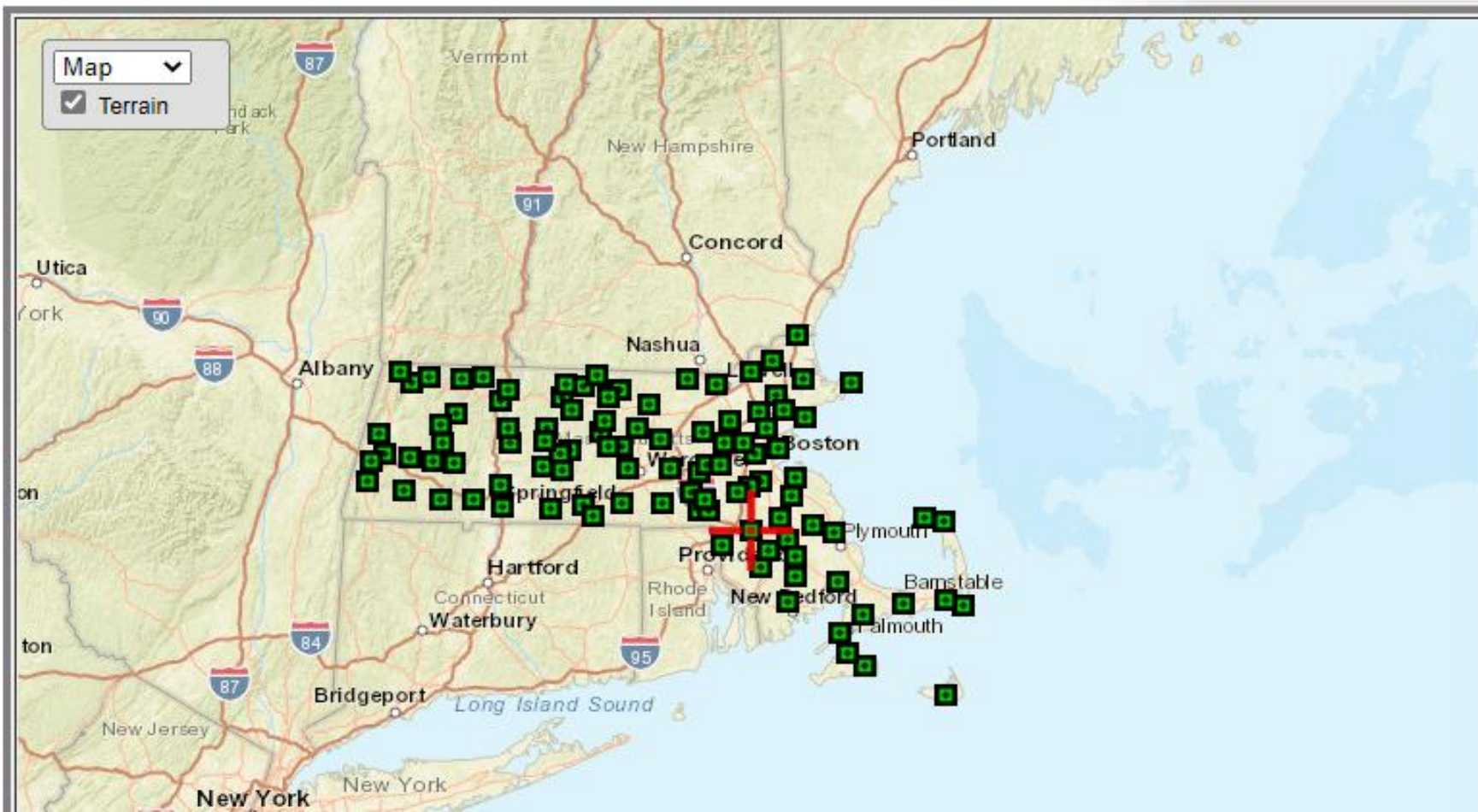
1) Manually:

a) By location (decimal degrees, use "-" for S and W): Latitude: Longitude:

b) By station (list of MA stations):

c) By address

2) Use map (if ESRI interactive map is not loading, try adding the host: <https://js.arcgis.com/> to the firewall, or contact us at hdsc.questions@noaa.gov):



- a) Select location
Move crosshair or double click
- b) Click on station icon
 Show stations on map

Location information:
Name: Norton, Massachusetts, USA*
Station name: NORTON WEST
Site ID: 19-5984
Latitude: 41.9928°
Longitude: -71.1667°
Elevation: 95 ft

NOAA Atlas 14 – Vol 10

https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ma

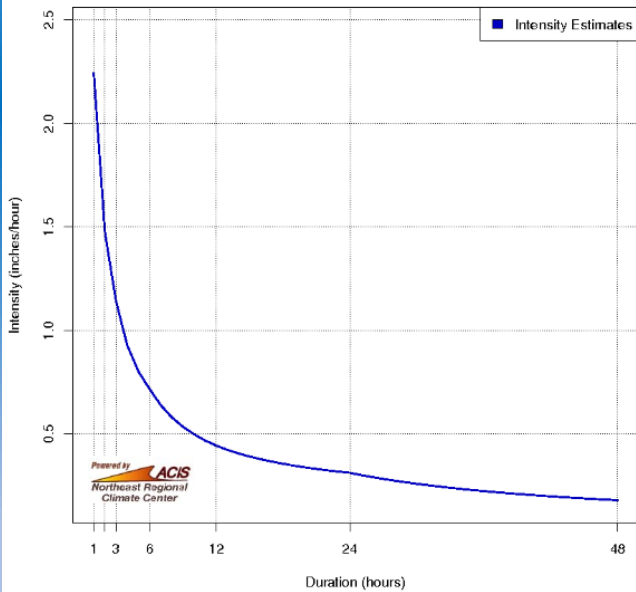
PDS-based precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.307 (0.247-0.375)	0.380 (0.305-0.464)	0.499 (0.400-0.613)	0.597 (0.475-0.737)	0.732 (0.563-0.950)	0.832 (0.626-1.11)	0.941 (0.686-1.30)	1.07 (0.727-1.50)	1.27 (0.824-1.84)	1.44 (0.909-2.13)
10-min	0.435 (0.350-0.531)	0.538 (0.433-0.658)	0.706 (0.566-0.866)	0.845 (0.673-1.04)	1.04 (0.797-1.35)	1.18 (0.887-1.57)	1.33 (0.972-1.85)	1.52 (1.03-2.13)	1.80 (1.17-2.61)	2.04 (1.29-3.01)
15-min	0.511 (0.412-0.625)	0.633 (0.509-0.774)	0.831 (0.667-1.02)	0.995 (0.792-1.23)	1.22 (0.938-1.58)	1.39 (1.04-1.84)	1.57 (1.14-2.17)	1.79 (1.21-2.50)	2.11 (1.37-3.07)	2.39 (1.52-3.54)
30-min	0.715 (0.576-0.873)	0.887 (0.714-1.09)	1.17 (0.937-1.43)	1.40 (1.12-1.73)	1.72 (1.33-2.24)	1.96 (1.48-2.61)	2.22 (1.62-3.07)	2.53 (1.72-3.54)	2.99 (1.95-4.34)	3.39 (2.14-5.01)
60-min	0.918 (0.740-1.12)	1.14 (0.919-1.40)	1.51 (1.21-1.85)	1.81 (1.44-2.24)	2.23 (1.71-2.89)	2.54 (1.91-3.37)	2.87 (2.09-3.97)	3.27 (2.22-4.58)	3.87 (2.51-5.62)	4.38 (2.77-6.48)
2-hr	1.17 (0.946-1.41)	1.47 (1.20-1.79)	1.98 (1.60-2.41)	2.40 (1.92-2.94)	2.97 (2.30-3.83)	3.40 (2.57-4.48)	3.86 (2.84-5.31)	4.42 (3.02-6.14)	5.28 (3.45-7.59)	6.02 (3.83-8.81)
3-hr	1.35 (1.10-1.64)	1.71 (1.39-2.07)	2.30 (1.86-2.79)	2.79 (2.24-3.40)	3.46 (2.69-4.43)	3.95 (3.01-5.19)	4.49 (3.32-6.15)	5.15 (3.53-7.10)	6.15 (4.04-8.78)	7.02 (4.49-10.2)
6-hr	1.78 (1.46-2.14)	2.22 (1.82-2.67)	2.94 (2.40-3.54)	3.53 (2.86-4.27)	4.34 (3.40-5.52)	4.95 (3.79-6.43)	5.60 (4.15-7.58)	6.39 (4.41-8.72)	7.57 (5.00-10.7)	8.59 (5.52-12.3)
12-hr	2.35 (1.94-2.80)	2.85 (2.35-3.40)	3.67 (3.02-4.39)	4.35 (3.55-5.23)	5.29 (4.16-6.64)	5.98 (4.60-7.68)	6.73 (5.00-8.96)	7.59 (5.28-10.3)	8.87 (5.90-12.4)	9.94 (6.43-14.1)
24-hr	2.88 (2.40-3.41)	3.47 (2.88-4.11)	4.44 (3.67-5.27)	5.24 (4.31-6.25)	6.34 (5.02-7.90)	7.17 (5.54-9.11)	8.04 (6.01-10.6)	9.06 (6.34-12.1)	10.5 (7.06-14.6)	11.8 (7.68-16.6)
2-day	3.27 (2.74-3.84)	3.99 (3.34-4.69)	5.17 (4.31-6.10)	6.15 (5.09-7.29)	7.50 (5.98-9.28)	8.50 (6.63-10.7)	9.58 (7.24-12.6)	10.9 (7.65-14.4)	12.8 (8.61-17.5)	14.4 (9.46-20.1)
3-day	3.56 (3.00-4.17)	4.34 (3.65-5.08)	5.61 (4.69-6.59)	6.66 (5.54-7.86)	8.11 (6.50-9.99)	9.18 (7.20-11.6)	10.3 (7.85-13.5)	11.7 (8.29-15.4)	13.8 (9.35-18.8)	15.6 (10.3-21.6)
4-day	3.84 (3.24-4.48)	4.64 (3.91-5.42)	5.95 (4.99-6.97)	7.04 (5.87-8.28)	8.53 (6.86-10.5)	9.64 (7.58-12.1)	10.8 (8.25-14.1)	12.3 (8.70-16.1)	14.4 (9.78-19.5)	16.3 (10.7-22.4)
7-day	4.60 (3.90-5.33)	5.43 (4.61-6.30)	6.80 (5.74-7.91)	7.93 (6.65-9.27)	9.49 (7.67-11.5)	10.7 (8.41-13.2)	11.9 (9.08-15.3)	13.4 (9.53-17.4)	15.5 (10.6-20.8)	17.4 (11.5-23.6)
10-day	5.32 (4.53-6.14)	6.18 (5.25-7.14)	7.58 (6.42-8.79)	8.74 (7.36-10.2)	10.3 (8.38-12.5)	11.5 (9.13-14.2)	12.8 (9.78-16.3)	14.3 (10.2-18.4)	16.4 (11.2-21.8)	18.1 (12.1-24.5)

Precipitation Atlases -2020

NRCC Extreme Precip Atlas

Design Criteria for Small Watersheds -- 1 to 1000 Acres
Let's look some IDF information from each Atlas

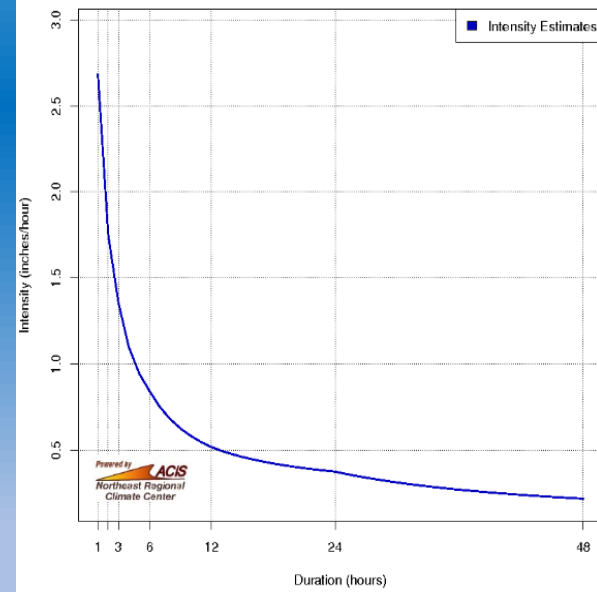
Intensity Frequency Duration - 50yr
(41.99N, -71.111W)



Time (hours)	Intensity (in/hr)
1	2.24
2	1.47
3	1.14
4*	0.93
5*	0.80
6	0.72
7*	0.64
8*	0.58
9*	0.53
10*	0.50
11*	0.47
12	0.44
13*	0.42
14*	0.41
15*	0.39
16*	0.38

50 yr value = 2.24"

Intensity Frequency Duration - 100yr
(41.99N, -71.111W)




Time (hours)	Intensity (in/hr)
1	2.68
2	1.75
3	1.35
4*	1.10
5*	0.94
6	0.84
7*	0.75
8*	0.68
9*	0.62
10*	0.58
11*	0.55
12	0.52
13*	0.49
14*	0.48
15*	0.46
16*	0.44
17*	0.43
18*	0.42
19*	0.41
20*	0.40
21*	0.39
22*	0.39
23*	0.38
24	0.37

100 yr = 2.68"

Precipitation Atlases -2020

Atlas 14 Vol 10

Design Criteria for Small Watersheds -- 1 to 1000 Acres
Let's look some IDF information from each Atlas

PF tabular PF graphical Supplementary information  [Print page](#)

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches/hour) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	3.67 (2.96-4.48)	4.55 (3.67-5.56)	5.99 (4.82-7.34)	7.19 (5.75-8.87)	8.83 (6.82-11.5)	10.1 (7.58-13.4)	11.4 (8.32-15.8)	13.0 (8.81-18.2)	15.4 (10.00-22.3)	17.4 (11.0-25.8)
10-min	2.60 (2.10-3.17)	3.22 (2.60-3.94)	4.24 (3.41-5.20)	5.09 (4.07-6.28)	6.26 (4.82-8.12)	7.12 (5.37-9.46)	8.06 (5.89-11.2)	9.18 (6.25-12.9)	10.9 (7.07-15.8)	12.3 (7.81-18.3)
15-min	2.04 (1.65-2.49)	2.53 (2.04-3.09)	3.33 (2.68-4.09)	3.99 (3.19-4.93)	4.91 (3.78-6.36)	5.59 (4.21-7.42)	6.32 (4.62-8.75)	7.20 (4.89-10.1)	8.54 (5.55-12.4)	9.67 (6.12-14.3)
30-min	1.43 (1.15-1.74)	1.77 (1.43-2.17)	2.34 (1.89-2.87)	2.81 (2.25-3.47)	3.46 (2.67-4.49)	3.94 (2.97-5.23)	4.46 (3.26-6.17)	5.08 (3.45-7.12)	6.01 (3.91-8.73)	6.81 (4.31-10.1)
60-min	0.917 (0.742-1.12)	1.14 (0.922-1.40)	1.51 (1.21-1.85)	1.81 (1.45-2.24)	2.23 (1.72-2.89)	2.54 (1.92-3.38)	2.88 (2.10-3.98)	3.28 (2.23-4.60)	3.88 (2.52-5.63)	4.39 (2.78-6.50)

50 yr value = 2.54"

100 yr value = 2.88"

Precipitation Atlases -2020

Design Criteria for Small Watersheds -- 1 to 1000 Acres

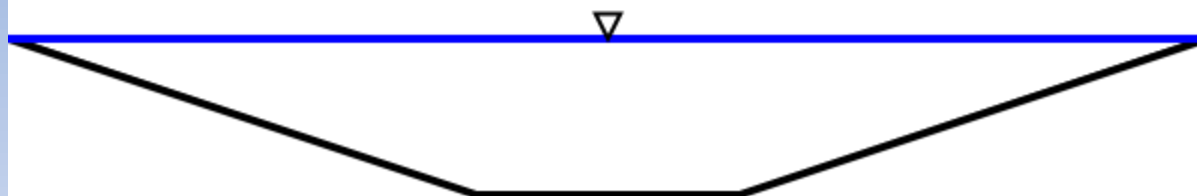
Let's look some flow in CFS from each Atlas

Small Watershed Peak Flow Calculations						
Rainfall Atlas	Intensity (inches)	Return Period	Area1 (acres)	Area2 (acres)	Area3 (acres)	Area4 (acres)
			1	10	100	1000
NERCC Precip.net	2.24	50yr	1.6	16	160	1600
NERCC Precip.net	2.68	100yr	1.9	19	190	1900
NOAA Atlas-14	2.54	50yr	1.8	18	180	1800
NOAA Atlas-14	2.88	100yr	2	20	200	2000

Precipitation Atlases -2020

Inputs				Results			
Bottom width	10	ft	X	Flow area	166.7656	ft ²	X
Side slope 1 (horiz./vert.)	3		X	Wetted perimeter	47.7766	ft	X
Side slope 2 (horiz./vert.)	3		X	Hydraulic radius	3.4904	ft	X
Manning roughness, n ?	0.03		X	Velocity, v	11.3970	ft/sec	X
Channel slope	.01	rise/run	X	Flow, Q	1900.5443	cfs	X
Flow depth	5.973	ft	X	Velocity head, h _v	2.0187	ft	X
Bend Angle? (for riprap sizing)	0		X	Top width, T	45.8380	ft	X
Stone specific gravity (2.65)	2.65		X	Froude number, F	1.05		X
				Shear stress (tractive force), tau	2.1791	psf	X
				Implied design ? riprap size based on n	0.2111	ft	X
				Required bottom angular riprap size, D50, Maricopa County	1.5029	ft	X
				Required side slope 1 angular riprap size, D50, Maricopa County	1.5842	ft	X
				Required side slope 2 angular riprap size, D50, Maricopa County	1.5842	ft	X
				Required angular riprap size, D50, per Maynard, Ruff, and Abt (1989)	1.7376	ft	X
				Required angular riprap size, D50, per Searcy (1967)	0.8710	ft	X

Printable version (reload/refresh to restore)



NERCC Precip.net

100 yr flow

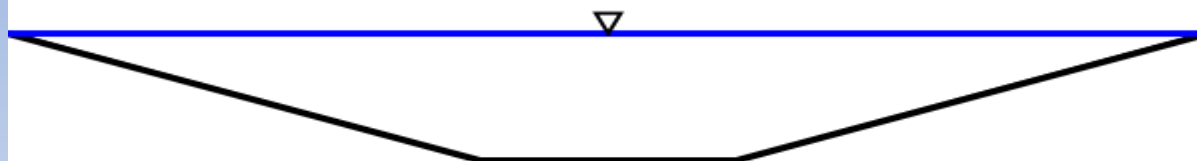
100 yr depth.....5.973ft

Precipitation Atlases -2020

Design Criteria for Small Watersheds -- 1 to 1000 Acres
 Let's look some IDF information from each Atlas

Inputs				Results			
Bottom width	10	ft	X	Flow area	173.2420	ft ²	X
Side slope 1 (horiz./vert.)	3		X	Wetted perimeter	48.6620	ft	X
Side slope 2 (horiz./vert.)	3		X	Hydraulic radius	3.5600	ft	X
Manning roughness, n ?	0.03		X	Velocity, v	11.5479	ft/sec	X
Channel slope	.01	rise/run	X	Flow, Q	2000.5014	cfs	X
Flow depth	6.113	ft	X	Velocity head, h _v	2.0726	ft	X
Bend Angle? (for riprap sizing)	0		X	Top width, T	46.6780	ft	X
Stone specific gravity (2.65)	2.65		X	Froude number, F	1.06		X
				Shear stress (tractive force), tau	2.2225	psf	X
				Implied design ? riprap size based on n	0.2111	ft	X
				Required bottom angular riprap size, D50, Maricopa County	1.5430	ft	X
				Required side slope 1 angular riprap size, D50, Maricopa County	1.6265	ft	X
				Required side slope 2 angular riprap size, D50, Maricopa County	1.6265	ft	X
				Required angular riprap size, D50, per Maynard, Ruff, and Abt (1989)	1.7853	ft	X
				Required angular riprap size, D50, per Searcy (1967)	0.8942	ft	X

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NOAA Atlas-14
 100 yr flow
 100 yr depth.....6.113ft

Precipitation Atlases -2020

Some Design Information

This I just one case.....using IDF for the Norton, MA area

Differences Negligible

More Case Studies Needed to see the possible Design Differences

Using/designing Drainage Networks.....HEC-RAS for rivers/reservoirs

Using Precip Depths Atlases and developing hydrographs

In Larger Watersheds where the difference between the Atlases can be between 0.5 to 1 inches of depth....volumes for storage....pipes for systems...and all other hydraulic structures will be larger for NERCC Precip Atlas compared to the NOAA Atlas-14

