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Atlas of Extreme Snow Water-Equivalent for the Northeastern United States

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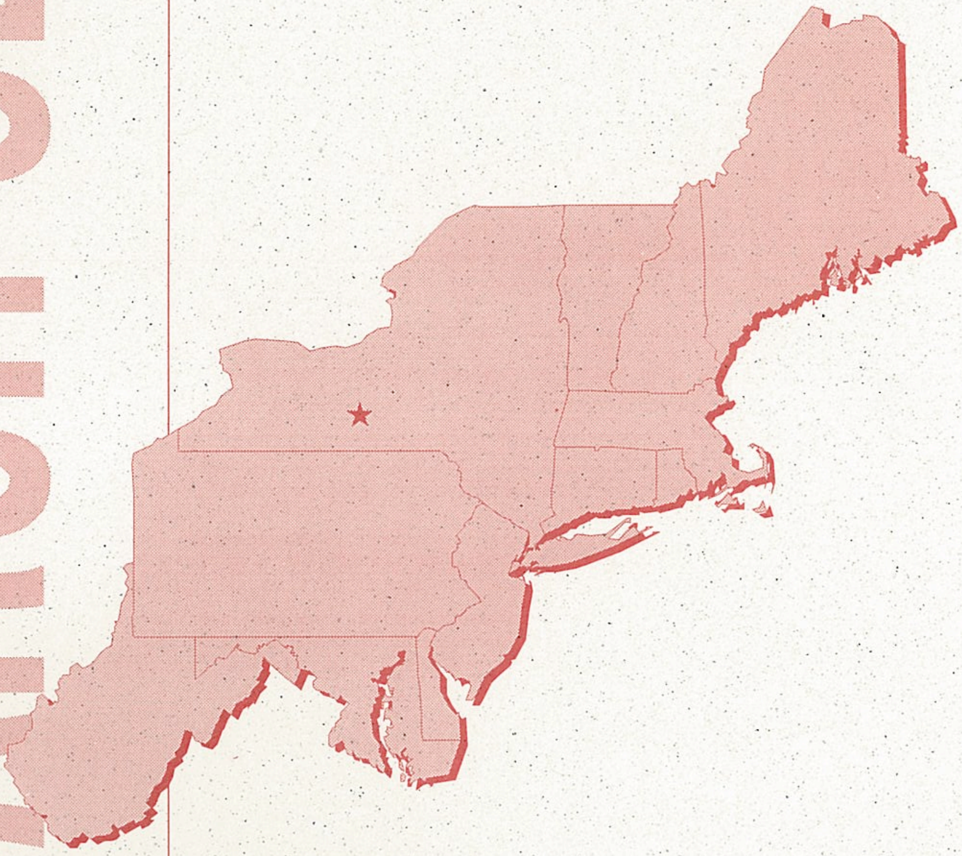

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INTRODUCTION

Extreme values of snowpack water equivalent [SWE] are of interest for both flood management and engineering design. Direct analyses of historical SWE in the U.S. (Thom 1966, Ellingwood and Redfield 1984) are inadequate for many purposes due to the fact that continuous observations are limited almost entirely to the rather sparse network of first-order National Weather Service stations. A more spatially dense network is available from the cooperative network stations, although these do not routinely measure SWE. Rather, analysis of the SWE climatology using these stations must be based on snow depths [SD], from which SWE may be estimated through a specified density for the snowpack (ASCE 1990, Schmidlin et al. 1992).

Snowpack characteristics, including snowpack density and depth, vary significantly on the scale of a region such as the northeastern U.S. However, previous studies have assumed snowpack density to be spatially invariant for the purpose of estimating SWE from SD. Alternatively in this atlas, densities are allowed to take on different values at individual cooperative network stations. The specified densities are based on a regression analysis involving several climatic variables to improve the accuracy of the extreme SWE estimates derived from SD observations. In addition, the Wakeby distribution (Houghton 1978) is used to extrapolate the estimated extreme SWE values beyond the length of the current observational record. Both the conversion from extreme SD to extreme SWE, and the Wakeby distribution are discussed in more depth in the "Technical Details" section.

USING THIS ATLAS

Extreme SWE amounts are expressed in this atlas in units of inches of water, for seven different return periods. It is estimated that extreme seasonal SWE amounts as large, or larger, than the magnitudes shown on the maps will be separated, on average, by the number of years given by the return period. It is important to realize that the actual number of years between the occurrences of two extreme SWE amounts of a particular magnitude is not expected to correspond exactly to the return period. Rather, over the course of centuries, the average of separation times between occurrences of these amounts should be close to the specified return period. Thus, the "hundred-year event," or SWE amount corresponding to the one-hundred-year return period, might not occur in a given century, but could occur more than once in some other century. In a hypothetical average over many centuries at a given location, however, one would expect about as many occurrences of the hundred-year amount as the number of centuries being averaged.

The data record lengths for most of the stations on which this atlas is based are shorter than fifty seasons. This implies that the SWE estimates for the fifty year (and longer) return period are extrapolated beyond the observed data. These extrapolations are achieved by fitting a theoretical probability function to the estimated extreme SWE values at each station. SWE amounts corresponding to shorter (i.e. not necessarily extrapolated) return periods are also computed using the fitted probability function in order to smooth out sampling irregularities in the data. The extreme amounts corresponding to particular return periods are computed using Eq. 7, given below in the "Technical Details" section. In all cases, the data are represented using the Wakeby distribution (Houghton 1978), which is found to give the best results among many candidate distributions for extreme SWE values in the northeastern U.S. (Wilks and McKay 1995).

Many users of this atlas will require SWE information expressed as horizontal ground snow-loads, in pounds per square foot. The mapped SWE values can easily be converted to these units by multiplying by 5.20. That is, one inch of snow water-equivalent exerts an equivalent pressure of 5.20 pounds per square foot.

Finally, it should be realized that the maps in this atlas are likely to exhibit a bias in regions containing large topographic variations. This is because the places where measurements are made tend to be locations where people live and work, which are generally valley locations in preference to those at higher elevations. Cember and Wilks (1993) found that the existing station locations underestimate average elevations in mountainous areas of the northeastern U.S. by about 500 feet. Therefore, the mapped quantities in this atlas should accurately reflect climatological conditions at locations typical of the observing stations, but should be expected to underestimate extreme SWE amounts at elevations substantially above the local settlements.

METHODOLOGY AND DATA

This atlas has been prepared by using two different sets of daily data. In developing the conversion from extreme SD to extreme SWE, daily SD and SWE data from 30 first-order National Weather Service stations (Table 1) were used. The climatology of SWE extremes, however, is based on daily data from 756 cooperative network stations (Table 2). It should be noted that the spatial density of these stations in northwestern portions of Maine is quite low. Hence, this data-sparse region is indicated in the maps by light stippling to remind the user that the mapped SWE amounts may be unreliable in these areas.

The data were obtained from the archives of the Northeast Regional Climate Center (Ithaca, New York) and the National Climatic Data Center (Asheville, North Carolina). The locations of most of the cooperative network stations listed in Table 2 are shown in Map 1. Those stations not shown in Map 1 are included in the analysis to improve the representation at the edges of the maps. They are located within about 1° of longitude of the map rectangle to the west, and extend to the southern borders of Virginia and Kentucky to the south. To be included in this atlas, cooperative network stations are required to have at least 30 seasons of SD record which passed quality-control consistency checks (Robinson 1993), and no more than 40 missing SD measurements during a season. Missing SD measurements, averaged over the stations, were fewer than 4 per season. In addition, the maps are constructed in a way that gives more weight in the spatial analysis to stations with longer data records.

Table 1: First-order stations used to derive density relationships, with 5-digit station identifiers, numbers of usable years of record, and estimated values of the parameter α ($in^{-0.33}$) [Eqs. 2 and 3].

Station id	Name	Years	α value
03860	Huntington, WV	26	0.060
03872	Beckley, WV	29	0.060
04725	Binghamton, NY	41	0.057
13729	Elkins, WV	30	0.053
13739	Philadelphia, PA	37	0.047
13781	Wilmington, DE	36	0.054
13866	Charleston, WV	33	0.051
14732	NYC-La Guardia, NY	36	0.044
14733	Buffalo, NY	41	0.053
14734	Newark, NJ	30	0.048
14735	Albany, NY	40	0.053
14737	Allentown, PA	38	0.049
14739	Boston, MA	37	0.063
14740	Hartford, CT	38	0.057
14742	Burlington, VT	39	0.049
14745	Concord, NH	39	0.070
14751	Harrisburg, PA	19	0.064
14764	Portland, ME	39	0.071
14765	Providence, RI	38	0.053
14768	Rochester, NY	39	0.057
14771	Syracuse, NY	42	0.042
14777	Wilkes-Barre-Scranton, PA	38	0.040
14778	Williamsport, PA	39	0.049
14860	Erie, PA	32	0.031
93721	Baltimore, MD	30	0.055
93730	Atlantic City, NJ	29	0.044
94702	Bridgeport, CT	38	0.056
94746	Worcester, MA	35	0.044
94789	NYC-JFK, NY	17	0.052
94823	Pittsburgh, PA	41	0.061

TECHNICAL DETAILS

I. Conversion Method

For the cooperative network stations, representing the great majority of available snow data in the region, the distributions of seasonal maximum SWE must be estimated from the distributions of seasonal maximum SD. Both SWE and SD data are available at the first-order stations, allowing the relationships between the pairs of maximum distributions to be investigated for these locations. Table 1 lists the thirty northeastern U.S. first-order stations used to develop relationships between seasonal maxima of SD and SWE, and the number of seasons of usable data remaining after application of the SWE quality-control procedure described in Schmidlin et al. (1995). The first-order SD data were also required to pass the quality-control consistency checks of Robinson (1993).

For each station, the largest SWE and SD values are extracted independently for each winter during the period of record. The sorted seasonal maxima of SWE and SD values, for each station, are related through the "pseudo-density," ψ, such that

$$SWE = \psi\ SD. \qquad (1)$$

The ASCE (1990, as reported by Schmidlin et al. 1992), specified pseudo-densities using the power law relationship

$$\psi = \alpha\ SD^{0.33}, \qquad (2)$$

or

$$SWE = \alpha\ SD^{1.33}. \qquad (3)$$

In general, pseudo-densities are lower than the actual densities of the heaviest seasonal snowpacks because of the independent sorting processes, and because settling, compaction, and additional precipitation tend to occur between the times of the deepest and the heaviest snowpacks, in a given season.

Values of α for the thirty northeastern U.S. first-order stations, based on Eqs. 2 and 3, are also given in Table 1. The spatial variations in the parameter α can be reasonably well specified using the multiple regression equation:

$$\alpha = 0.0699 + 0.000751\ J_L + 0.525\ \rho_{sf} - 0.00255\ \phi, \qquad (4)$$

where α is expressed in inches$^{-0.33}$, J_L is the average last Julian date on which there were five consecutive days with snow on the ground (i.e., there were four more days of recorded snow on the ground past the J_L date), ρ_{sf} is the average density of the largest 5% of daily snowfalls greater than 2 inches (or the average of the largest 5, if fewer than 100 such snowfalls occur in the record of a particular station), and ϕ is the latitude. For seasons in which the last snowpack occurred before 1 January, the Julian date is considered to be negative. Seasons having fewer than five consecutive days with snow on the ground are not included when calculating J_L. The performance characteristics of Eq. 4 are presented in Wilks and McKay (1995).

Using Eq. 4, an α value is calculated for each of the cooperative network stations. These values are presented in Map 2. The anomalously large α value of 0.140 in$^{-.33}$ for the cooperative network station located at Mt. Washington, NH, has been removed only from Map 2 because it is unrepresentative of the surrounding area on the scale defined by the cooperative network stations. Using these α values, the seasonal extreme SD values are transformed into seasonal extreme SWE amounts. The statistical distributions of these estimated extreme SWE values are then represented using fitted Wakeby distributions.

II. Wakeby Distribution and Computation of Return Periods

Extreme events corresponding to average return periods longer than the climate record (i.e., with exceedence probabilities smaller than the reciprocal of the length of record) must be extrapolated. Fitting an appropriate probability distribution to the series of seasonal maxima is a convient and consistent approach for making such extrapolations. Quantiles of that fitted distribution corresponding to the desired exceedence probabilities can then be evaluated. Extrapolation of the estimated extreme SWE data for all cooperative network stations is based on fitted Wakeby distributions (Houghton 1978).

For each station, the five parameters of the Wakeby distribution are estimated by using the L-moment routines of Hosking (1991). The actual quantiles (extrapolated SWE estimates) are calculated using the quantile function

$$x = \xi + \frac{\alpha}{\beta}\left\{1-(1-F)^{\beta}\right\} - \frac{\gamma}{\delta}\left\{1-(1-F)^{-\delta}\right\}, \quad (5)$$

where x is the SWE estimate, and ξ, α, β, γ, and δ are the Wakeby distribution parameters, which are fit separately for each station. F is the cumulative probability corresponding to the return period, R (years), according to

$$R = 1/(1-F), \quad (6)$$

where (1-F) is the exceedence probability. Therefore, the approximated extreme SWE amounts are calculated by

$$x = \xi + \frac{\alpha}{\beta}\left\{1 - R^{-\beta}\right\} - \frac{\gamma}{\delta}\left\{1 - R^{\delta}\right\}. \quad (7)$$

III. Interpolation, Gridding, Smoothing and Contouring

The extreme SWE amounts (inches of water), calculated for selected return periods with the Wakeby quantile function at individual stations, are cast into a 54 x 82 (latitude by longitude) grid, with points spaced at 0.2° intervals. This grid is confined to the map rectangle, but stations outside the rectangle are also used to improve the representation at the edges of the map, as noted above. The gridding algorithm finds the smallest circle around each grid point that encloses at least two stations, where the circle radius is an integer multiple of 0.2 great-circle degrees. If the circle has a radius of 1.4° or less, the grid point is assigned a weighted average of the station values enclosed. Otherwise, the grid point is assigned a missing value code.

Each grid point value is computed as

$$x_g(\lambda_g, \phi_g) = \frac{\sum_{i=1}^{I} w_i(\lambda_g, \phi_g, \lambda_i, \phi_i)\, x_i(\lambda_i, \phi_i)}{\sum_{i=1}^{I} w_i(\lambda_g, \phi_g, \lambda_i, \phi_i)}, \quad (8)$$

where w_i is a modified McLain (1974) weighting function

$$w_i(\lambda_g, \phi_g, \lambda_i, \phi_i) = \frac{\sqrt{N_i}\,\exp\left[-\frac{\cos^2\phi_0(\lambda_g-\lambda_i)^2 + (\phi_g-\phi_i)^2}{d_{scale}^2}\right]}{f + \frac{\cos^2\phi_0(\lambda_g-\lambda_i)^2 + (\phi_g-\phi_i)^2}{d_{scale}^2}}. \quad (9)$$

Here x represents SWE amount, λ is longitude, ϕ is latitude, the subscript g refers to the grid point, the subscript i distinguishes among the I individual cooperative network stations within each circle, and N_i is the sample size (number of seasons of record) of the estimated SWE data at station i. The parameter d_{scale} = 1.2° is a scaling distance, ϕ_0 = 42.45° is a reference latitude, and f = 10^{-6} is a small constant used to prevent division by zero.

The gridded fields are smoothed using the moving average in a 3 x 3 cell window (i.e., by an unweighted averaging of each grid point with its eight adjacent neighbors). These smoothed gridded values are contoured and plotted using the NCAR Graphics software package, version 3.2.

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Table 2: List of cooperative network stations used, their locations, and digitally available periods of record.

Station number	Station name	Latitude (degrees)	Longitude (degrees)	Years of data
CONNECTICUT				
060806	BRIDGEPORT WSO ARPT	41.17	73.13	44
060918	BROOKLYN	41.79	71.94	31
061715	CREAM HILL	41.90	73.32	48
061762	DANBURY	41.39	73.45	41
063207	GROTON	41.35	72.05	42
063451	HARTFORD BRAINARD FIELD	41.73	72.65	52
063456	HARTFORD WSO AIRPORT	41.93	72.68	38
064488	MANSFIELD HOLLOW DAM	41.75	72.18	40
064767	MIDDLETOWN 4 W	41.55	72.72	35
065077	MOUNT CARMEL	41.40	72.90	57
065273	NEW HAVEN AIRPORT	41.27	72.88	30
065445	NORFOLK 2 SW	41.97	73.22	50
068138	STORRS	41.80	72.25	50
069067	WESTBROOK	41.30	72.43	39
DELAWARE				
071330	BRIDGEVILLE	38.74	75.63	38
072730	DOVER	39.15	75.52	44
073570	GEORGETOWN 5 SW	38.63	75.46	44
075320	LEWES	38.77	75.13	44
075852	MIDDLETOWN 2 S	39.43	75.71	31
075915	MILFORD	38.92	75.45	35
076410	NEWARK UNIVERSITY FARM	39.66	75.75	43
079595	WILMINGTON WSO ARPT	39.67	75.60	44
079605	WILMINGTON PORTER RSVR	39.77	75.53	43
KENTUCKY				
150254	ASHLAND DAM 29	38.45	82.61	54
151080	BUCKHORN	37.35	83.38	31
151120	BURDINE 2 NE	37.22	82.58	32
152791	FARMERS	38.14	83.55	55
152903	FLEMINGSBURG	38.43	83.73	33
153052	FRENCHBURG 1 SW	37.95	83.65	31
153391	GRAYSON 5 SE	38.30	82.94	34
153741	HEIDELBERG LOCK 14	37.55	83.77	53
154093	HYDEN	37.17	83.38	30
156136	PAINTSVILLE	37.82	82.81	54
156353	PIKEVILLE 2	37.48	82.52	43
156679	RAVENNA LOCK 12	37.67	83.95	31
158551	WEST LIBERTY WATER WORK	37.92	83.26	43
158724	WILLOW LOCK 13	37 60	83.83	30
MAINE				
170275	AUGUSTA FAA ARPT	44.32	69.80	44
170355	BANGOR FAA AIRPORT	44.80	68.82	40
170371	BAR HARBOR	44.40	68.23	34
170480	BELFAST	44.40	69.00	34
170934	BRUNSWICK	43.90	69.93	37
171175	CARIBOU WSO AIRPORT	46.87	68.02	53
171628	CORINNA	44.93	69.26	42
172426	EASTPORT	44.92	67.00	43
172620	ELLSWORTH	44.53	68.43	25
172765	FARMINGTON	44.67	70.15	31
172878	FORT KENT	47.25	68.59	37
173353	GREENVILLE	45.47	69.58	35
173892	HOULTON FAA AIRPORT	46.13	67.79	42
173897	HOULTON	46.13	67.83	50
174878	MACHIAS	44.72	67.46	37
175460	MOOSEHEAD	45.58	69.72	25
175675	NEWCASTLE	44.05	69.53	27
176905	PORTLAND WSMO ARPT	43.65	70.32	58
176937	PRESQUE ISLE	46.65	68.00	42
177250	ROCKLAND	44.10	69.12	40
177325	RUMFORD 3 SW	44.53	70.54	42
177479	SANFORD 2 NNW	43.47	70.78	29
178398	SQUA PAN DAM	46.55	68.33	32
178965	VAN BUREN 2	47.17	67.94	26
178974	VANCEBORO 2	45.57	67.43	27
179151	WATERVILLE PUMP STN	44.55	69.65	33
179314	WEST BUXTON 2 NNW	43.70	70.62	29
MARYLAND				
180015	ABERDEEN PROVING GROUND	39.47	76.17	37
180193	ANNAPOLIS WATER WORKS	38.98	76.51	30
180465	BALTIMORE WSO AIRPORT	39.22	76.60	44
180700	BELTSVILLE	39.03	76.88	40
180705	BELTSVILLE PLANT STN 5	39.02	76.95	31
180732	BENSON POLICE BARRACKS	39.50	76.38	44
181032	BOYDS 2 NW	39.21	77.33	32
181125	BRIGHTON DAM	39.20	77.02	41
181385	CAMBRIDGE 5 W	38.57	76.11	40
181627	CENTREVILLE	39.05	76.07	33
181750	CHESTERTOWN	39.22	76.07	44
181995	COLLEGE PARK	38.98	76.94	43
182060	CONOWINGO DAM	39.65	76.17	50
182325	DALECARLIA RESVR DC	38.93	77.12	31
182523	DENTON 1 NE	38.88	75.82	37
182770	EDGEMONT	39.67	77.55	40
182906	EMMITSBURG 2 SE	39.68	77.30	35
183348	FREDERICK POLICE BRKS	39.42	77.43	33
183675	GLENN DALE BELL STN	38.97	76.80	44
183975	HAGERSTOWN	39.65	77.73	44
MARYLAND (continued)				
184030	HANCOCK FRUIT LAB	39.70	78.18	44
184780	KEEDYSVILLE	39.48	77.70	36
185080	LA PLATA	38.53	76.99	42
185985	MILLINGTON	39.26	75.85	43
186350	NATIONAL ARBORETUM DC	38.90	76.98	35
186620	OAKLAND 1 SE	39.40	79.40	42
186770	OWINGS FERRY LANDING	38.69	76.68	43
186844	PARKTON 2 SW	39.63	76.70	35
187140	POCOMOKE CITY	38.06	75.57	30
187330	PRINCESS ANNE 1 E	38.21	75.68	39
187705	ROCKVILLE	39.10	77.10	44
187806	ROYAL OAK 2 SSW	38.72	76.18	44
188000	SALISBURY	38.37	75.58	40
188005	SALISBURY FAA ARPT	38.33	75.52	42
188065	SAVAGE RIVER DAM	39.51	79.13	38
188380	SNOW HILL	38.20	75.39	43
189030	UNIONVILLE	39.45	77.18	40
189140	VIENNA	38.48	75.83	37
189195	WALDORF POLICE BARRACK	38.65	76.88	30
189435	WESTMINSTER	39.56	76.99	31
189750	WOODSTOCK	39.33	76.87	36
MASSACHUSETTS				
190049	ADAMS	42.65	73.10	38
190120	AMHERST	42.39	72.53	55
190190	ASHBURNHAM	42.64	71.88	44
190408	BARRE FALLS DAM	42.43	72.03	34
190535	BEDFORD	42.47	71.28	35
190666	BIRCH HILL DAM	42.63	72.12	44
190736	BLUE HILL	42.22	71.12	52
190770	BOSTON WSO ARPT	42.37	71.03	68
192107	EAST BRIMFIELD DAM	42.12	72.13	30
192451	EAST WAREHAM	41.77	70.67	60
193505	HAVERHILL	42.77	71.07	40
193624	HINGHAM	42.23	70.92	32
193702	HOLYOKE	42.20	72.60	37
193985	KNIGHTVILLE DAM	42.28	72.87	44
194744	MIDDLETON	42.60	71.02	39
196486	PLYMOUTH	41.97	70.69	34
196783	READING	42.52	71.13	33
196938	ROCHESTER	41.78	70.92	31
196977	ROCKPORT 1 ESE	42.65	70.60	35
197627	SOUTHBRIDGE 3 SW	42.05	72.08	37
198046	SPRINGFIELD	42.11	72.58	39
198181	STOCKBRIDGE	42.30	73.32	32
198367	TAUNTON	41.90	71.07	42
198573	TULLY DAM	42.63	72.22	43
199316	WEST MEDWAY	42.13	71.43	36
199360	WESTON	42.38	71:32	37
199923	WORCESTER WSO AIRPORT	42.27	71.87	44
NEW HAMPSHIRE				
270681	BENTON 5 SW	44.03	71.93	28
270690	BERLIN	44.46	71.18	60
270703	BETHLEHEM	44.28	71.69	40
270741	BLACKWATER DAM	43.32	71.72	43
270910	BRADFORD	43.25	71.97	32
271552	CLAREMONT	43.38	72.36	25
271647	COLEBROOK	44.89	71.49	29
271683	CONCORD WSO AIRPORT	43.20	71.51	50
272174	DURHAM	43.14	70.94	47
272999	FIRST CONNECTICUT LAKE	45.08	71.28	43
273182	FRANKLIN FALLS DAM	43.47	71.65	44
273850	HANOVER	43.70	72.28	53
274399	KEENE	42.92	72.27	44
274475	LAKEPORT	43.55	71.47	35
274556	LANCASTER	44.48	71.58	34
274656	LEBANON FAA AIRPORT	43.63	72.32	42
275013	MACDOWELL DAM	42.90	71.98	41
275150	MARLOW	43.12	72.20	33
275211	MASSABESIC LAKE	42.98	71.40	26
275400	MILAN 3 NNW	44.64	71.21	31
275412	MILFORD	42.83	71.65	42
275639	MOUNT WASHINGTON	44.27	71.30	44
275712	NASHUA 2 NNW	42.78	71.48	28
275868	NEWPORT	43.38	72.18	36
276234	NORTH STRATFORD	44.75	71.63	30
276550	OTTER BROOK DAM	42.95	72.23	33
276697	PETERBORO 2 S	42.85	71.95	43
278539	SURRY MOUNTAIN DAM	43.00	72.32	43
278855	WALPOLE 2	43.07	72.44	27
279740	WINDHAM	42.80	71.32	29
279940	WOODSTOCK	43.98	71.68	33
NEW JERSEY				
280311	ATLANTIC CITY WSO AP	39.45	74.57	34
280346	AUDUBON	39.88	75.08	39
280690	BELLEPLAIN	39.26	74.87	55
280729	BELVIDERE	40.83	75.08	36
281327	CANISTEAR RESERVOIR	41.11	74.50	36
281335	CANOE BROOK	40.75	74.35	41

Station number	Station name	Latitude (degrees)	Longitude (degrees)	Years of data
NEW JERSEY (continued)				
281582	CHARLOTTEBURG	41.03	74.43	63
282644	ELIZABETH	40.67	74.23	38
283029	FLEMINGTON 1 NE	40.54	74.86	67
283181	FREEHOLD	40.26	74.26	52
283516	GREENWOOD LAKE	41.13	74.33	41
283951	HIGHTSTOWN 1 N	40.28	74.54	61
284229	INDIAN MILLS 2 W	39.80	74.78	67
284635	LAMBERTVILLE	40.37	74.95	62
284735	LAYTON 3 NW	41.25	74.85	37
284887	LITTLE FALLS WATER CO	40.88	74.23	34
284987	LONG BRANCH	40.29	74.00	64
285003	LONG VALLEY	40.78	74.78	37
285581	MILLVILLE FAA AIRPORT	39.37	75.07	41
285728	MOORESTOWN	39.97	74.97	57
285769	MORRIS PLAINS 1 W	40.83	74.50	38
286026	NEWARK WSO AIRPORT	40.70	74.17	44
286062	NEW BRUNSWICK EXP STN	40.47	74.43	55
286177	NEWTON	41.04	74.78	42
286460	OAK RIDGE RESERVOIR	41.03	74.50	36
286843	PEMBERTON 1 E	39.95	74.67	43
286974	PHILLIPSBURG	40.68	75.18	47
287079	PLAINFIELD	40.60	74.40	62
287393	RAHWAY	40.60	74.27	34
287587	RINGWOOD	41.13	74.27	39
288194	SOMERVILLE	40.59	74.63	57
288644	SUSSEX	41.21	74.60	30
288883	TRENTON WSO CITY	40.22	74.77	52
288899	TUCKERTON 1 S	39.60	74.34	37
289187	WANAQUE RAYMOND DAM	41.05	74.30	38
289910	WOODSTOWN 2 NW	39.65	75.35	41
NEW YORK				
300023	ADDISON	42.10	77.23	37
300042	ALBANY WSFO AP	42.75	73.80	54
300055	ALBION 3 NE	43.28	78.15	34
300085	ALFRED	42.25	77.78	66
300093	ALLEGANY STATE PARK	42.10	78.75	43
300183	ANGELICA	42.30	78.02	50
300220	ARCADE	42.53	78.42	44
300254	ARKVILLE	42.14	74.64	33
300321	AUBURN WATER WORKS	42.92	76.54	52
300331	AURORA RESEARCH FARM	42.73	76.65	36
300360	BAINBRIDGE	42.29	75.46	42
300443	BATAVIA	42.99	78.18	40
300448	BATH	42.34	77.34	39
300452	BATTENVILLE	43.11	73.43	34
300500	BEAVER FALLS	43.88	75.43	38
300608	BENNETTS BRIDGE	43.54	75.93	37
300687	BINGHAMTON WSO AP	42.22	75.98	41
300691	BINGHAMTON WB CITY	42.10	75.92	44
300785	BOONVILLE 3 SE	43.45	75.32	43
300889	BRIDGEHAMPTON	40.95	72.30	61
300929	BROADALBIN	43.08	74.18	38
300937	BROCKPORT 2 NW	43.22	77.95	37
301012	BUFFALO WSO AP	42.93	78.73	71
301168	CANDOR	42.22	76.33	44
301185	CANTON	44.58	75.13	68
301207	CARMEL 1 SW	41.42	73.70	38
301387	CHASM FALLS	44.75	74.22	44
301401	CHAZY 3 E	44.88	73.40	54
301413	CHEMUNG	42.00	76.63	44
301424	CHEPACHET	42.91	75.12	35
301436	CHERRY VALLEY 2 NNE	42.82	74.73	42
301492	CINCINNATUS	42.53	75.90	44
301593	COBLESKILL 2	42.68	74.48	31
301623	COLDEN 1 N	42.67	78.68	35
301752	COOPERSTOWN	42.70	74.92	62
301799	CORTLAND	42.60	76.18	44
301966	DANNEMORA	44.72	73.72	36
301974	DANSVILLE	42.57	77.71	44
302036	DELHI	42.25	74.91	53
302129	DOBBS FERRY	41.02	73.87	44
302554	ELIZABETHTOWN 1 N	44.22	73.59	42
302574	ELLENBURG DEPOT	44.90	73.80	44
302610	ELMIRA	42.09	76.80	66
302829	FISHS EDDY	41.97	75.18	32
303025	FRANKLINVILLE	42.33	78.46	41
303033	FREDONIA	42.44	79.34	67
303050	FREEVILLE 2 NE	42.53	76.32	43
303259	GLENHAM	41.52	73.93	43
303284	GLENS FALLS FARM	43.33	73.73	44
303294	GLENS FALLS FAA AIRPORT	43.35	73.62	44
303319	GLOVERSVILLE	43.05	74.34	43
303346	GOUVERNEUR	44.34	75.50	44
303360	GRAFTON 2 N	42.78	73.46	40
303444	GREENE	42.32	75.77	38
303507	ROME GRIFFISS FIELD	43.23	75.40	30
303722	HASKINVILLE	42.42	77.57	44
303773	HEMLOCK	42.78	77.62	45
303983	HORNELL ALMOND DAM	42.35	77.70	38
NEW YORK (continued)				
304025	HUDSON 2	42.24	73.79	30
304174	ITHACA CORNELL UNIV	42.45	76.46	65
304206	JAMESTOWN	42.10	79.25	36
304647	LAWRENCEVILLE	44.75	74.66	44
304731	LIBERTY	41.80	74.74	31
304772	LINDLEY	42.03	77.13	38
304791	LITTLE FALLS CITY RSVR	43.07	74.87	63
304796	LITTLE FALLS MILL ST	43.03	74.87	51
304808	LITTLE VALLEY	42.25	78.81	44
304844	LOCKPORT 2 NE	43.18	78.65	67
304849	LOCKPORT 4 NE	43.20	78.63	31
305134	MASSENA FAA AIRPORT	44.93	74.85	44
305334	MILLBROOK	41.85	73.62	36
305377	MINEOLA	40.73	73.63	41
305426	MOHONK LAKE	41.77	74.15	44
305512	MORRISVILLE	42.86	75.65	52
305597	MOUNT MORRIS 2 W	42.73	77.90	41
305639	NARROWSBURG	41.58	75.04	34
305673	NEW ALBION	42.30	78.90	32
305687	NEW BERLIN	42.62	75.33	34
305714	NEWCOMB 2 W	43.97	74.16	34
305796	NEW YORK BENSONHURST	40.60	73.98	37
305801	NEW YORK CENTRAL PARK	40.78	73.97	83
305803	NEW YORK JFK ARPT	40.65	73.78	30
305804	NEW YORK LAUREL HILL	40.73	73.93	31
305811	NEW YORK LAGUARDIA WSO	40.77	73.89	44
305821	NEW YORK WESTERLEIGH	40.60	74.17	41
305925	NORTH CREEK	43.68	73.94	35
306062	NORTHVILLE	43.23	74.17	38
306085	NORWICH	42.53	75.52	60
306196	OLEAN	42.08	78.45	44
306314	OSWEGO EAST	43.47	76.51	64
306411	PARISHVILLE 1 WNW	44.63	74.83	32
306441	PATCHOGUE	40.78	73.03	43
306464	PAVILION	42.88	78.03	36
306510	PENN YAN 2 SW	42.66	77.07	30
306659	PLATTSBURGH	44.66	73.47	39
306774	PORT JERVIS	41.38	74.68	59
306817	POUGHKEEPSIE	41.68	73.93	33
306820	POUGHKEEPSIE FAA ARPT	41.63	73.88	44
306831	PRATTSBURG 2 NW	42.53	77.30	39
307134	RIVERHEAD RESEARCH FARM	40.97	72.72	44
307167	ROCHESTER WSO ARPT	43.13	77.67	67
307317	ROXBURY	42.28	74.57	46
307405	SALEM	43.17	73.32	36
307413	SALISBURY	43.17	74.86	46
307484	SARATOGA SPRINGS 7 SE	43.03	73.81	37
307497	SCARSDALE	40.98	73.80	35
307513	SCHENECTADY	42.83	73.92	31
307705	SHERBURNE 1 S	42.67	75.49	44
307713	SHERMAN	42.17	79.60	41
307772	SINCLAIRVILLE	42.27	79.26	33
307780	SKANEATELES	42.95	76.43	44
307799	SLIDE MOUNTAIN	42.02	74.42	30
307842	SODUS	43.21	77.04	40
308058	SOUTH WALES EMERY PARK	42.72	78.60	50
308080	SPECULATOR	43.50	74.37	31
308088	SPENCER	42.22	76.51	42
308383	SYRACUSE WSO AIRPORT	43.11	76.16	71
308586	TRIBES HILL	42.95	74.28	34
308594	TROUPSBURG 3 NE	42.07	77.49	44
308600	TROY LOCK AND DAM	42.75	73.68	35
308631	TUPPER LAKE	44.23	74.43	44
308737	UTICA FAA ARPT	43.15	75.38	42
308739	UTICA SOUTHERN RSVR	43.08	75.22	36
308902	WALDEN 2 NE	41.57	74.17	33
308936	WALTON	42.17	75.13	36
308944	WANAKENA RANGER SCHOOL	44.15	74.90	65
308962	WARSAW 5 SW	42.68	78.21	38
309000	WATERTOWN	43.97	75.87	50
309005	WATERTOWN FAA AIRPORT	44.00	76.02	43
309072	WELLSVILLE	42.11	77.94	34
309189	WESTFIELD	42.28	79.60	44
309292	WEST POINT	41.38	73.97	40
309425	WHITESVILLE	42.03	77.77	39
OHIO				
330058	AKRON CANTON WSO ARPT	40.92	81.43	44
330083	ALEXANDRIA 4 W	40.08	82.68	34
330256	ASHLAND 3 NW	40.85	82.34	56
330279	ATHENS 1 E	39.33	82.09	42
330298	ATWOOD DAM	40.52	81.28	39
330430	BARNESVILLE WATER WORKS	39.98	81.15	47
330493	BEACH CITY DAM	40.63	81.57	37
330563	BELLEFONTAINE SEWAGE	40.36	83.77	47
330823	BOLIVAR DAM	40.65	81.43	39
330862	BOWLING GREEN SEWAGE PL	41.38	83.63	37
331072	BUCYRUS SEWAGE PLANT	40.81	82.97	46
331152	CADIZ	40.27	81.00	58
331178	CALDWELL 6 NW	39.82	81.60	34
331245	CANFIELD 1 S	41.01	80.76	60

OHIO (continued)

Station number	Station name	Latitude (degrees)	Longitude (degrees)	Years of data
331399	CENTERBURG	40.30	82.70	32
331458	CHARDON	41.58	81.19	47
331466	CHARLES MILL DAM	40.73	82.37	50
331541	CHIPPEWA LAKE WATER WOR	41.06	81.92	56
331592	CIRCLEVILLE HIWAY DEPT	39.61	82.95	34
331642	CLENDENING DAM	40.27	81.28	30
331657	CLEVELAND WSO AIRPORT	41.42	81.87	44
331783	COLUMBUS VLY CROSSING	39.90	82.92	35
331786	COLUMBUS WSO AIRPORT	39.99	82.88	44
331890	COSHOCTON 2 N	40.26	81.87	56
332119	DELAWARE	40.28	83.07	57
332124	DELAWARE DAM	40.37	83.07	38
332251	DORSET 2 E	41.68	80.65	36
332272	DOVER DAM	40.57	81.42	39
332599	ELYRIA 3 E	41.38	82.05	43
332626	ENTERPRISE	39.58	82.48	40
332786	FINDLAY FAA AIRPORT	41.02	83.67	44
332791	FINDLAY SEWAGE PLANT	41.05	83.67	57
332956	FREDERICKTOWN SEWAGE PL	40.45	82.53	36
332974	FREMONT WATER WORKS	41.33	83.12	31
333021	GALION WATER WORKS	40.72	82.80	42
333029	GALLIPOLIS 5 W	38.82	82.21	45
333758	HILLSBORO 1 E	39.18	83.61	90
333780	HIRAM	41.31	81.15	90
333874	HOYTVILLE 2 NE	41.22	83.77	37
333915	HUNTSVILLE 1 SW	40.46	83.82	38
333971	IRONTON	38.53	82.68	78
333987	IRWIN	40.12	83.48	48
334004	JACKSON	39.06	82.65	35
334189	KENTON 2 W	40.65	83.60	73
334363	LAKEVIEW	40.50	83.90	35
334383	LANCASTER POWER SUBSTN	39.72	82.61	34
334434	LAURELVILLE	39.47	82.73	36
334473	LEESVILLE DAM	40.47	81.19	39
334681	LONDON 4 W	39.89	83.49	32
334728	LOUISVILLE	40.83	81.26	44
334865	MANSFIELD WSO AIRPORT	40.82	82.52	41
334942	MARION WATER WORKS	40.61	83.14	49
334967	MARSHALLVILLE	40.89	81.73	33
334979	MARYSVILLE	40.23	83.37	52
335029	MC ARTHUR 2 N	39.25	82.47	33
335041	MC CONNELSVILLE LOCK	39.65	81.85	58
335199	MIDDLEBOURNE	40.05	81.33	36
335297	MILLERSBURG 1 W	40.55	81.92	46
335315	MILLPORT 2 NW	40.72	80.90	45
335356	MINERAL RIDGE WTR WKS	41.15	80.78	52
335398	MOHAWK DAM	40.35	82.08	37
335406	MOHICANVILLE DAM	40.73	82.15	39
335505	MOSQUITO CREEK DAM	41.30	80.77	44
335718	NELSONVILLE 1 WNW	39.47	82.25	41
335747	NEWARK WATER WORKS	40.08	82.42	52
335857	NEW LEXINGTON 2 NW	39.73	82.22	50
335894	NEW PHILADELPHIA	40.50	81.45	32
335904	NEW PHILADELPHIA 1 A	40.49	81.44	42
335947	NEW STRAITSVILLE	39.58	82.25	38
336118	NORWALK HIWAY DEPT	41.26	82.62	92
336196	OBERLIN	41.28	82.22	35
336389	PAINESVILLE 2 N	41.75	81.30	38
336405	PANDORA 2 NE	40.97	83.96	43
336590	PHILO	39.87	81.90	31
336600	PHILO 3 SW	39.83	81.92	44
336616	PIEDMONT DAM	40.18	81.22	34
336702	PLEASANT HILL DAM	40.62	82.33	40
336729	PLYMOUTH	40.99	82.68	41
336781	PORTSMOUTH	38.74	82.91	51
336861	PROSPECT WATER ST BRIDG	40.47	82.20	30
336882	PUT IN BAY STONE LAB	41.65	82.82	51
336949	RAVENNA 2 S	41.13	81.26	40
337120	RIPLEY EXP FARM	38.78	83.82	33
337447	SANDUSKY	41.45	82.72	56
337538	SEDALIA	39.74	83.48	44
337559	SENECAVILLE DAM	39.92	81.43	46
338025	STEUBENVILLE WATER WORK	40.38	80.63	35
338240	TAPPAN DAM	40.35	81.23	40
338313	TIFFIN	41.12	83.17	57
338357	TOLEDO EXPRESS WSO AP	41.60	83.80	38
338378	BURR OAK DAM	39.55	82.07	35
338534	UPPER SANDUSKY	40.83	83.28	55
338552	URBANA JR COLLEGE	40.11	83.77	31
338560	UTICA	40.24	82.45	42
338769	WARREN	41.22	80.83	57
338794	WASHINGTON COURT HOUSE	39.52	83.42	56
338830	WAVERLY	39.13	82.99	41
338951	WESTERVILLE	40.13	82.94	40
339211	WILLS CREEK DAM	40.15	81.85	40
339219	WILMINGTON	39.48	83.83	57
339312	WOOSTER EXP STN	40.78	81.93	92
339361	XENIA 2 N	39.63	83.90	44
339406	YOUNGSTOWN WSO AIRPORT	41.25	80.67	44
339417	ZANESVILLE FAA AIRPORT	39.95	81.90	47

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Station number	Station name	Latitude (degrees)	Longitude (degrees)	Years of data
360022	ACMETONIA LOCK 3	40.53	79.82	44
360106	ALLENTOWN WSO ARPT	40.65	75.43	44
360134	ALTOONA HORSESHOE CURVE	40.50	78.48	43
360355	BAKERSTOWN 4 WNW	40.66	79.99	39
360409	BARNES	41.67	79.03	38
360475	BEAVER FALLS	40.77	80.32	44
360611	BERWICK	41.07	76.25	31
360634	BETHLEHEM LEHIGH UNIV	40.60	75.38	34
360763	BLOSERVILLE 1 N	40.27	77.37	35
360821	BOSWELL 1 SW	40.15	79.03	32
360861	BRADDOCK LOCK 2	40.40	79.87	33
360865	BRADFORD FAA AIRPORT	41.80	78.63	35
360867	BRADFORD CITY HALL	41.96	78.65	43
360868	BRADFORD 4 W RES 1	41.93	78.73	43
361002	BROOKVILLE FAA AIRPORT	41.15	79.10	34
361087	BUFFALO MILLS	39.95	78.65	39
361105	BURGETTSTOWN 2 W	40.38	80.43	35
361130	BUTLER	40.87	79.90	34
361234	CARLISLE	40.21	77.21	56
361255	CARROLLTOWN	40.58	78.70	43
361301	CEDAR RUN	41.52	77.45	37
361354	CHAMBERSBURG	39.93	77.63	44
361377	CHARLEROI LOCK 4	40.15	79.90	38
361480	CLARENCE 1 E	41.05	77.93	40
361485	CLARION 3 SW	41.20	79.43	44
361512	CLAYSVILLE	40.12	80.44	44
361519	CLEARFIELD	41.02	78.44	61
361534	CLERMONT 4 NW	41.73	78.53	32
361589	COATESVILLE 1 SW	39.97	75.83	35
361705	CONFLUENCE 1 SW DAM	39.80	79.37	43
361710	CONFLUENCE 1 NW	39.83	79.37	32
361737	CONSHOHOCKEN	40.07	75.32	43
361749	COOKSBURG	41.33	79.22	35
361790	CORRY	41.92	79.63	67
361806	COUDERSPORT 3 NW	41.83	78.07	32
361833	COVINGTON 2 WSW	41.73	77.12	36
361881	CREEKSIDE	40.68	79.20	35
362013	DANVILLE	40.97	76.62	43
362108	DERRY	40.30	79.33	61
362190	DONORA	40.17	79.87	54
362260	DUBOIS FAA AP	41.18	78.90	30
362343	EAGLES MERE	41.40	76.58	35
362466	EBENSBURG	40.48	78.73	39
362633	EMPORIUM 1 E	41.52	78.22	32
362644	ENGLISH CENTER	41.43	77.28	35
362682	ERIE WSO ARPT	42.08	80.18	66
362942	FORD CITY 4 S DAM	40.72	79.50	49
363028	FRANKLIN	41.38	79.82	66
363056	FREELAND	41.02	75.90	62
363130	GALETON	41.73	77.63	43
363200	GEORGE SCHOOL	40.22	74.93	52
363218	GETTYSBURG	39.83	77.23	57
363311	GLEN HAZEL 2 NE DAM	41.57	78.60	39
363321	LYNDELL 2 NW	40.10	75.78	33
363343	GLENWILLARD DASH DAM	40.55	80.22	38
363394	GOULDSBORO	41.25	75.45	39
363503	GREENSBORO LOCK 7	39.78	79.92	44
363526	GREENVILLE	41.41	80.38	56
363662	HANOVER	39.80	76.98	39
363699	HARRISBURG WSO	40.22	76.85	67
363758	HAWLEY	41.48	75.17	64
364008	HOLLISTERVILLE	41.38	75.43	44
364047	HONEY BROOK 1 W	40.09	75.88	32
364159	HUNTINGDON 1 WNW	40.49	78.02	46
364166	HUNTSDALE	40.10	77.31	38
364190	HYNDMAN	39.82	78.73	35
364214	INDIANA 3 SE	40.60	79.12	44
364325	JAMESTOWN 2 NW	41.50	80.47	43
364385	JOHNSTOWN	40.33	78.92	62
364432	KANE 1 NNE	41.68	78.80	44
364611	KITTANNING LOCK 7	40.82	79.53	34
364758	LANCASTER 2 NE PUMP STN	40.05	76.28	50
364778	LANDISVILLE	40.11	76.43	40
364873	LAWRENCEVILLE	41.98	77.13	50
364934	LEHIGHTON	40.83	75.72	39
364992	LEWISTOWN	40.58	77.57	34
365104	LOCK HAVEN	41.13	77.43	52
365160	LONG POND 2 W	41.05	75.50	42
365336	MADERA	40.82	78.42	36
365381	MAPLETON DEPOT	40.40	77.93	44
365390	MARCUS HOOK	39.82	75.42	36
365408	MARION CENTER 2 SE	40.75	79.03	44
365470	MATAMORAS	41.37	74.70	42
365606	MEADVILLE 1 S	41.63	80.17	44
365651	MERCER	41.23	80.23	43
365790	MILLHEIM	40.89	77.48	43
365817	MILLVILLE 2 SW	41.10	76.57	42
365902	MONTGOMERY DAM	40.65	80.38	31
365915	MONTROSE 3 E HIWAY SHED	41.83	75.85	67
366055	MOUNT POCONO	41.14	75.37	32
366151	NATRONA LOCK 4	40.62	79.72	44

PENNSYLVANIA (continued)

Station number	Station name	Latitude (degrees)	Longitude (degrees)	Years of data
366194	NESHAMINY FALLS	40.15	74.95	34
366233	NEW CASTLE 1 N	41.02	80.37	54
366246	NEWELL	40.08	79.90	51
366297	NEWPORT	40.48	77.13	39
366326	NEW TRIPOLI	40.68	75.72	34
366681	PALM	40.40	75.51	33
366689	PALMERTON	40.80	75.62	63
366721	PARKER	41.09	79.68	37
366762	PAUPACK 2 WNW	41.40	75.23	40
366879	PHILADELPHIA DREXEL INS	39.95	75.18	30
366889	PHILADELPHIA WSO AP	39.88	75.24	44
366904	PHILADELPHIA SHAWMONT	40.03	75.25	32
366916	PHILIPSBURG FAA AIRPORT	40.91	78.07	42
366993	PITTSBURGH WSO AIRPORT	40.50	80.22	40
367029	PLEASANT MOUNT 1 W	41.73	75.45	44
367229	PUTNEYVILLE 2 SE DAM	40.93	79.28	43
367318	READING WB CITY	40.33	75.97	46
367409	RENOVO 1 W	41.33	77.75	36
367477	RIDGWAY	41.42	78.75	65
367727	RUSHVILLE	41.78	76.12	42
367782	SALINA 3 W	40.52	79.55	38
367846	SAXTON	40.21	78.25	36
367863	SCHENLEY LOCK 5	40.68	79.67	43
367902	SCRANTON	41.42	75.67	34
367931	SELINSGROVE AIRPORT	40.79	76.87	49
367978	SHAMOKIN	40.80	76.55	28
368073	SHIPPENSBURG	40.05	77.52	44
368145	SINNEMAHONING	41.32	78.09	42
368184	SLIPPERY ROCK	41.06	80.06	42
368244	SOMERSET 2 E SUBSTN	40.01	79.08	43
368249	SOMERSET WATER WORKS	40.02	79.08	33
368308	SOUTH MOUNTAIN	39.85	77.50	35
368379	SPRING GROVE	39.87	76.87	44
368449	STATE COLLEGE	40.80	77.87	66
368570	STRAUSSTOWN	40.48	76.18	31
368596	STROUDSBURG 2 E	40.99	75.19	65
368692	SUSQUEHANNA	41.95	75.60	44
368758	TAMAQUA	40.79	75.98	44
368763	TAMAQUA 4 N DAM	40.85	75.98	36
368873	TIONESTA 2 SE DAM	41.48	79.43	44
368888	TITUSVILLE WATER WORKS	41.63	79.70	37
368893	TOBYHANNA	41.18	75.42	30
368905	TOWANDA	41.76	76.43	67
369042	UNION CITY 3 SE	41.90	79.82	43
369050	UNIONTOWN	39.91	79.73	50
369298	WARREN 1 SSW	41.84	79.15	63
369367	WAYNESBURG 1 E	39.90	80.17	32
369408	WELLSBORO 3 S	41.71	77.27	65
369464	WEST CHESTER	39.97	75.61	41
369507	WEST HICKORY	41.58	79.40	39
369655	WHITESBURG	40.74	79.40	42
369702	WILKES-BARRE	41.25	75.87	39
369714	WILLIAMSBURG	40.47	78.20	38
369728	WILLIAMSPORT WSO ARPT	41.25	76.92	44
369823	WOLFSBURG	40.05	78.53	35
369933	YORK 3 SSW PUMP STN	39.92	76.75	61
369950	YORK HAVEN	40.12	76.72	39
369995	ZIONSVILLE 3 SE	40.47	75.46	42

RHODE ISLAND

Station number	Station name	Latitude (degrees)	Longitude (degrees)	Years of data
370896	BLOCK ISLAND WSO AP	41.17	71.58	31
374266	KINGSTON	41.48	71.53	43
376698	PROVIDENCE WSO AIRPORT	41.73	71.43	44
379423	WOONSOCKET	41.98	71.50	34

VERMONT

Station number	Station name	Latitude (degrees)	Longitude (degrees)	Years of data
430499	BELLOWS FALLS	43.13	72.45	43
430661	BETHEL 2	43.86	72.63	34
431081	BURLINGTON WSO AP	44.47	73.15	50
431243	CAVENDISH	43.38	72.60	44
431360	CHELSEA 2 S	43.98	72.46	44
431433	CHITTENDEN	43.70	72.95	41
434052	HUNTINGTON CENTER	44.28	72.97	35
435278	MONTPELIER FAA AIRPORT	44.20	72.57	44
435542	NEWPORT	44.93	72.20	51
435733	NORTHFIELD NORWICH UNIV	44.15	72.65	36
436335	PERU	43.25	72.90	35
436761	READSBORO 1 SSE	42.75	72.93	41
436893	ROCHESTER	43.86	72.81	44
436995	RUTLAND	43.61	72.97	39
437054	ST JOHNSBURY	44.42	72.02	67
437646	SOUTH NEWBURY	44.06	72.08	41
438556	UNION VILLAGE DAM	43.80	72.27	41
438600	VERNON	42.77	72.52	43

VIRGINIA

Station number	Station name	Latitude (degrees)	Longitude (degrees)	Years of data
440166	ALTAVISTA	37.10	79.30	43
440193	AMISSVILLE	38.68	78.02	35
440243	APPOMATTOX	37.36	78.84	41
440327	ASHLAND 1 SW	37.76	77.48	38
440551	BEDFORD	37.34	79.52	40

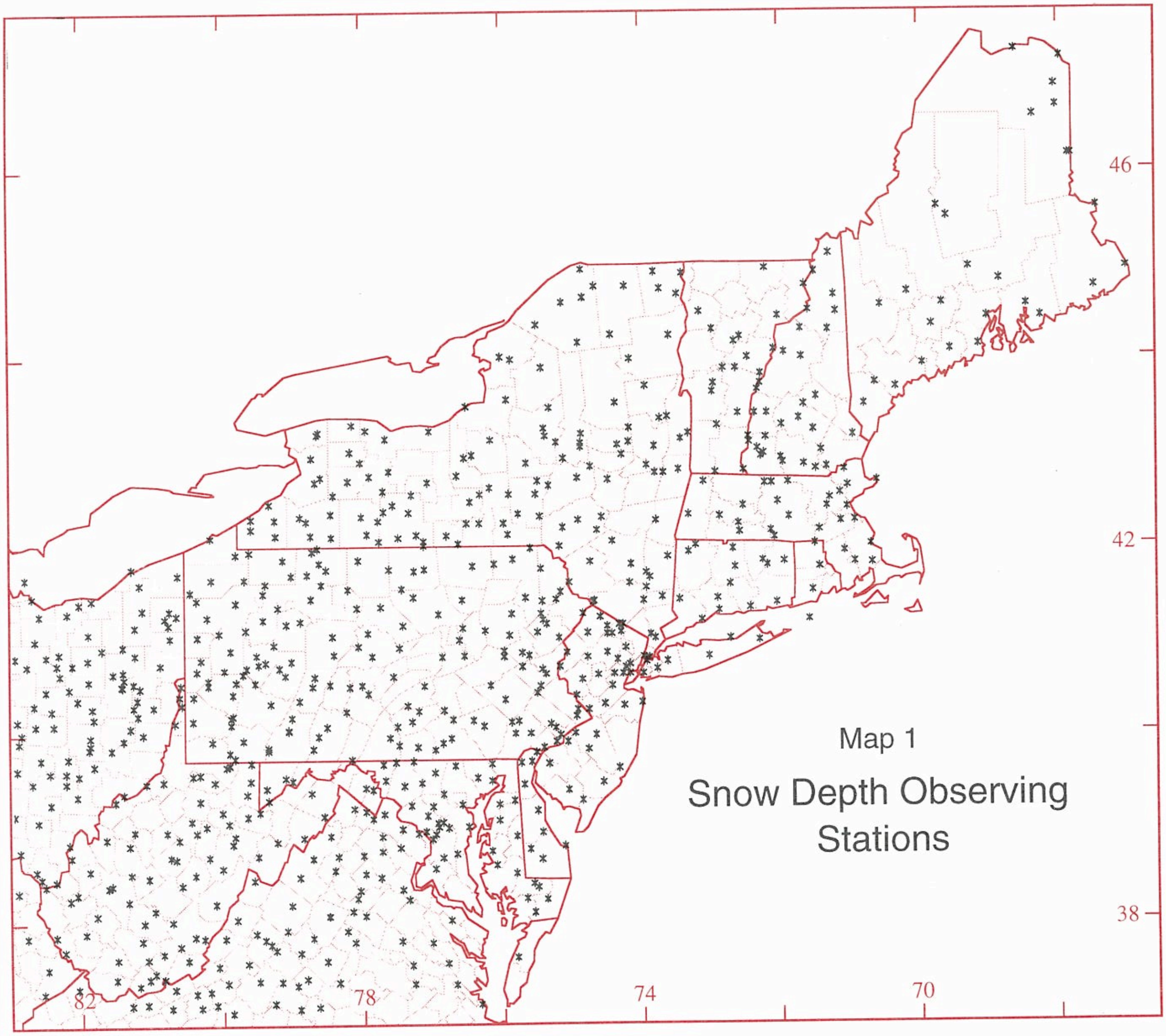
VIRGINIA (continued)

Station number	Station name	Latitude (degrees)	Longitude (degrees)	Years of data
440670	BERRYVILLE	39.15	77.98	40
440720	BIG MEADOWS 2	38.52	78.43	41
440766	BLACKSBURG 2	37.21	80.42	40
440792	BLAND	37.10	81.11	40
441082	BROOKNEAL 2 NE	37.04	78.94	32
441121	BUCHANAN	37.53	79.68	51
441136	BUCKINGHAM 1 E	37.55	78.55	44
441159	BUENA VISTA	37.73	79.35	37
441209	BURKES GARDEN	37.09	81.33	43
441585	CHARLOTTE COURT HOUSE	37.06	78.67	39
441593	CHARLOTTESVILLE 2 W	38.03	78.52	43
441598	CHARLOTTESVILLE 1 SW	38.03	78.51	34
441929	COLUMBIA	37.75	78.15	57
441955	CONCORD 5 S	37.29	78.98	42
441999	COPPER HILL	37.09	80.13	43
442009	CORBIN	38.20	77.37	34
442041	COVINGTON	37.80	80.00	44
442044	COVINGTON FILTER PLANT	37.80	80.00	32
442155	CULPEPER	38.48	77.99	59
442208	DALE ENTERPRISE	38.45	78.93	44
442729	ELKWOOD 7 SE	38.44	77.77	34
442941	FARMVILLE	37.32	78.38	62
443192	FREDERICKSBURG	38.31	77.46	60
443397	GLEN LYN	37.37	80.87	52
443466	GORDONSVILLE 3 S	38.08	78.18	31
443640	GRUNDY	37.27	82.09	33
444101	HOPEWELL	37.30	77.30	60
444128	HOT SPRINGS	38.00	79.83	43
444565	KERRS CREEK	37.85	79.56	40
444676	LAFAYETTE 1 NE	37.23	80.22	38
444720	LANGLEY AIR FORCE BASE	37.08	76.35	62
444876	LEXINGTON	37.78	79.43	43
444909	LINCOLN	39.12	77.72	60
445050	LOUISA	38.03	78.00	44
445096	LURAY 5 E	38.67	78.38	42
445120	LYNCHBURG WSO AIRPORT	37.33	79.20	63
445213	MANASSAS	38.76	77.49	35
445685	MONTEBELLO	37.88	79.12	30
445698	MONTEREY	38.42	79.58	32
445851	MOUNT WEATHER	39.07	77.88	43
446012	NEW CASTLE	37.50	80.10	35
446475	PAINTER 2 W	37.58	75.82	36
446491	PALMYRA 2	37.87	78.26	35
446593	PEDLAR DAM	37.67	79.28	31
446712	PIEDMONT FIELD STN	38.22	78.11	44
446723	PILOT	37.06	80.35	35
446955	PULASKI	37.06	80.77	32
447033	RAPIDAN	38.30	78.07	34
447201	RICHMOND WSO AIRPORT	37.50	77.33	43
447285	ROANOKE WSO AIRPORT	37.32	79.97	44
447312	ROCKFISH	37.80	78.75	43
447338	ROCKY MOUNT	37.00	79.90	42
448022	STAFFORDSVILLE	37.26	80.72	41
448062	STAUNTON D AND B INST	38.15	79.05	39
448396	THE PLAINS 2 SE	38.88	77.75	39
448448	TIMBERVILLE 2 N	38.65	78.74	42
448600	TYE RIVER	37.64	78.93	39
448737	VIENNA TYSONS CORNER	38.91	77.23	44
448829	WALKERTON	37.74	77.04	60
448888	WARRENTON 5 NE	38.72	77.75	41
448894	WARSAW 2 N	37.98	76.77	42
448903	WASHINGTON DULLES APRT	38.96	77.46	30
448906	WASHINGTON NATL WSO AP	38.85	77.03	42
449025	WEST POINT 2 SW	37.52	76.82	38
449151	WILLIAMSBURG	37.29	76.70	38
449186	WINCHESTER RESEARCH LAB	39.18	78.15	44
449263	WOODSTOCK	38.89	78.49	63

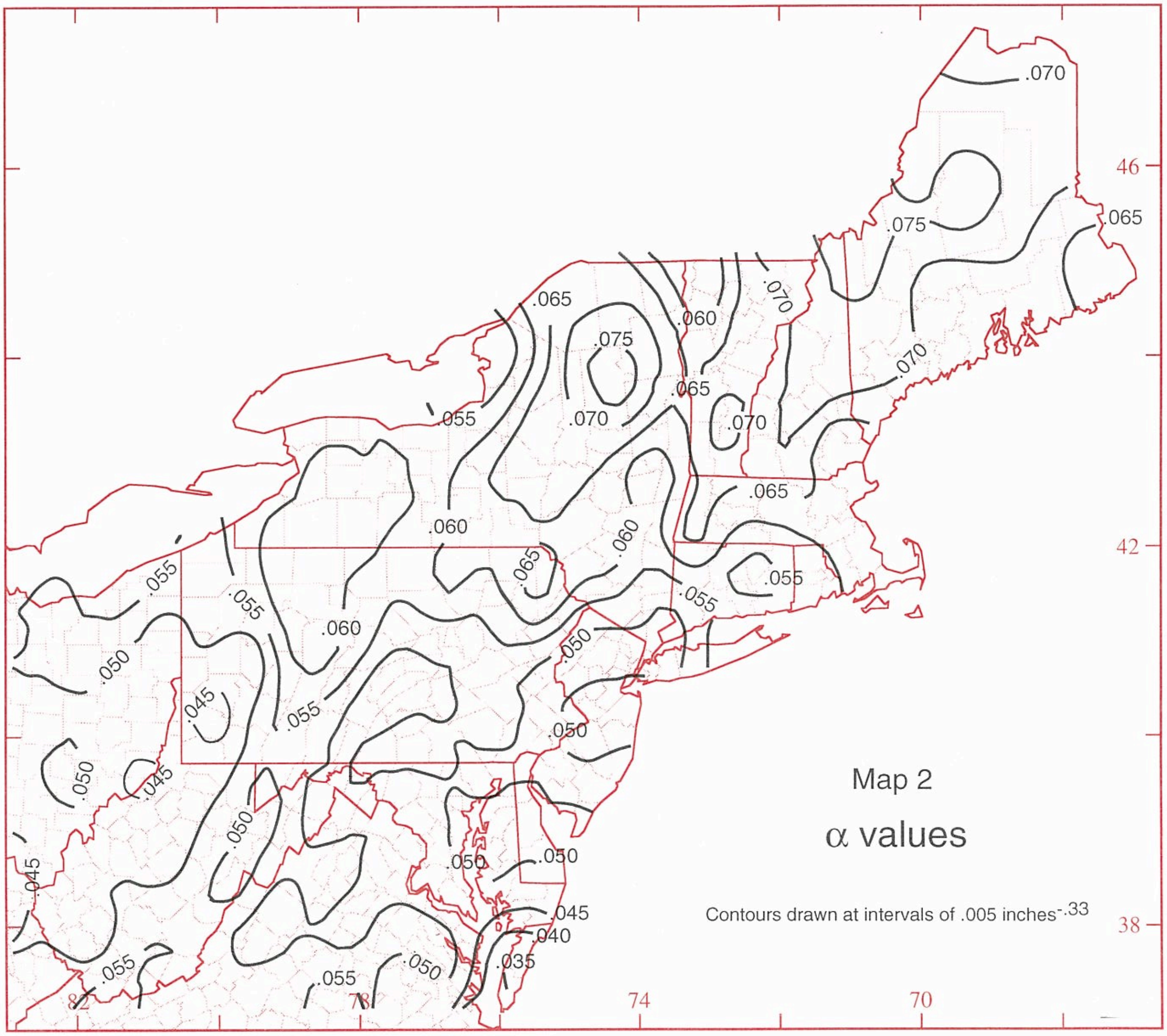
WEST VIRGINIA

Station number	Station name	Latitude (degrees)	Longitude (degrees)	Years of data
460094	ALBRIGHT	39.48	79.63	31
460102	ALDERSON	37.72	80.64	39
460355	ATHENS 1 E	37.43	81.00	39
460527	BAYARD	39.27	79.37	65
460580	BECKLEY VA HOSPITAL	37.78	81.18	42
460633	BELINGTON	39.03	79.94	42
460687	BENS RUN	39.46	81.11	35
460921	BLUEFIELD FAA AP	37.30	81.22	33
460939	BLUESTONE DAM	37.64	80.88	43
461075	BRANCHLAND	38.22	82.20	40
461083	BRANDONVILLE	39.67	79.62	32
461204	BRUSHY RUN	38.83	79.25	32
461215	BUCKEYE	38.17	80.13	39
461220	BUCKHANNON 2 W	39.00	80.26	42
461282	BURNSVILLE	38.86	80.65	41
461363	CAMDEN ON GAULEY	38.37	80.61	43
461570	CHARLESTON WSO AIRPORT	38.37	81.60	44
461575	CHARLESTON 1	38.35	81.65	41
461677	CLARKSBURG 1	39.27	80.35	63
461696	CLAY 1	38.45	81.08	40
461723	CLENDENIN	38.49	81.33	39
462054	CRESTON 1 SSW	38.95	81.28	40

Station number	Station name	Latitude (degrees)	Longitude (degrees)	Years of data
WEST VIRGINIA (continued)				
462151	DAILEY 1 NE	38.81	79.88	30
462718	ELKINS WSO AIRPORT	38.89	79.85	67
462920	FAIRMONT	39.47	80.14	66
463072	FLAT TOP	37.58	81.10	58
463353	GARY	37.37	81.55	54
463361	GASSAWAY	38.67	80.77	35
463544	GLENVILLE 1	38.94	80.82	64
463846	HAMLIN	38.28	82.10	44
464128	HICO	38.10	81.00	37
464200	HOGSETT GALLIPOLIS DAM	38.68	82.18	40
464378	HUNTINGTON 1	38.42	82.40	33
464393	HUNTINGTON FAA AIRPORT	38.37	82.55	32
464763	KEARNEYSVILLE 1 NW	39.38	77.88	47
464816	KERMIT	37.83	82.40	33
465002	LAKE LYNN	39.72	79.85	43
465224	LEWISBURG	37.82	80.43	36
465353	LOGAN	37.86	81.98	43
465365	LONDON LOCKS	38.20	81.37	47
465563	MADISON	38.05	81.82	41
465621	MANNINGTON 1 N	39.55	80.35	53
465626	MANNINGTON 2	39.54	80.45	41
465707	MARTINSBURG MUNICIPAL AP	39.40	77.98	65
465739	MATHIAS	38.87	78.87	40
465871	MCROSS	37.98	80.75	34
465963	MIDDLEBOURNE 2 ESE	39.48	80.87	44
466202	MORGANTOWN MUNICIPAL AP	39.65	79.92	44
466212	MORGANTOWN LOCK 1O	39.63	79.97	40
466442	NEW CUMBERLAND DAM 9	40.50	80.61	35
466591	OAK HILL	37.97	81.15	44
466849	PARKERSBURG FAA AP	39.35	81.43	44
466859	PARKERSBURG WSO	39.27	81.55	65
466867	PARSONS	39.10	79.67	43
466982	PHILIPPI	39.15	80.03	44
466991	PICKENS 1	38.67	80.22	39
467004	PIEDMONT 1 SE	39.48	79.03	38
467029	PINEVILLE 1 NE	37.58	81.53	45
467207	PRINCETON 1 SW	37.37	81.08	44
467552	RIPLEY	38.87	81.68	41
467730	ROMNEY	39.35	78.76	40
467785	ROWLESBURG 1	39.34	79.68	44
468384	SPENCER	38.80	81.35	50
468433	SPRUCE KNOB	38.68	79.52	39
468662	SUTTON DAM	38.65	80.69	42
468807	THOMAS	39.15	79.50	44
469011	UNION	37.57	80.53	38
469086	VALLEY HEAD	38.55	80.03	44
469104	VANDALIA	38.93	80.40	31
469281	WARDENSVILLE RM FARM	39.10	78.58	60
469333	WEBSTER SPRINGS	38.48	80.42	39
469368	WELLSBURG 3 NE	40.29	80.60	39
469436	WESTON	39.06	80.47	44
469492	WHEELING WARWOOD DAM 12	40.10	80.70	51
469522	WHITE SULPHUR SPRINGS	37.80	80.30	45
469605	WILLIAMSON	37.67	82.28	46
469683	WINFIELD LOCKS	38.53	81.92	43



46
42
38
82
78
74
70
Map 1
Snow Depth Observing Stations



Map 2
α values
Contours drawn at intervals of .005 inches^-.33
46
42
38
82
78
74
70
.070
.075
.065
.070
.060
.065
.075
.070
.065
.070
.065
.055
.060
.060
.065
.055
.055
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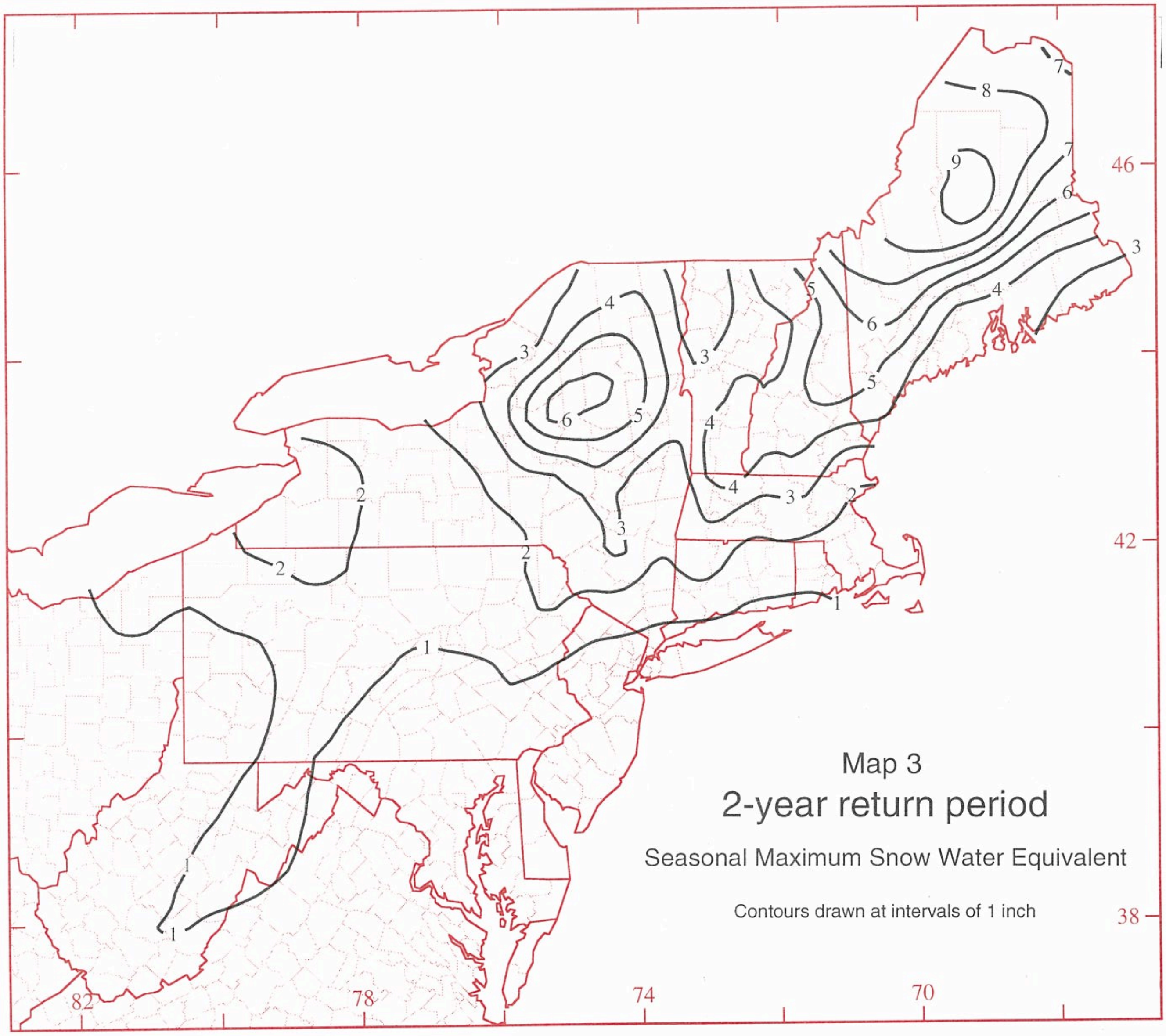
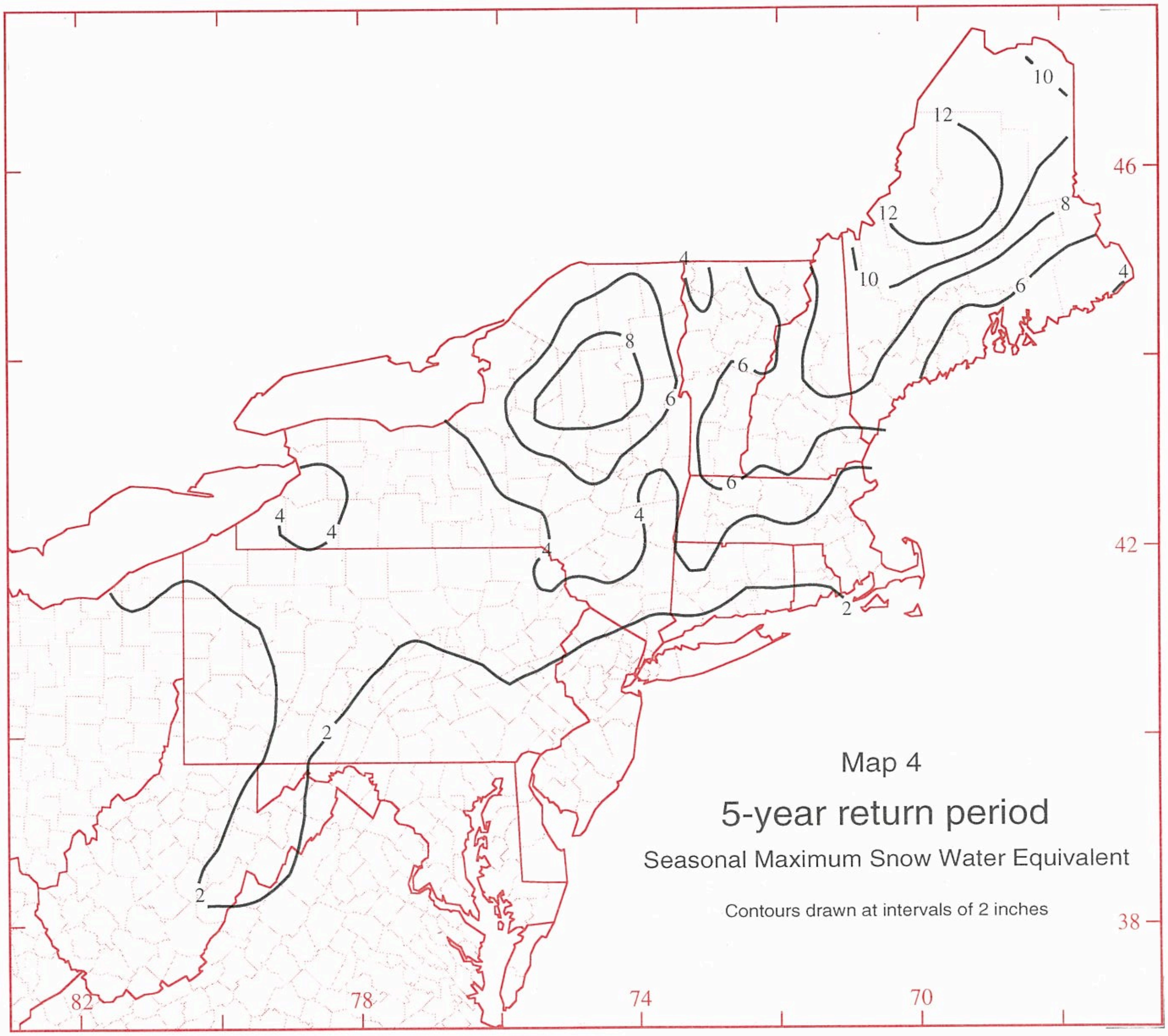


Map 3

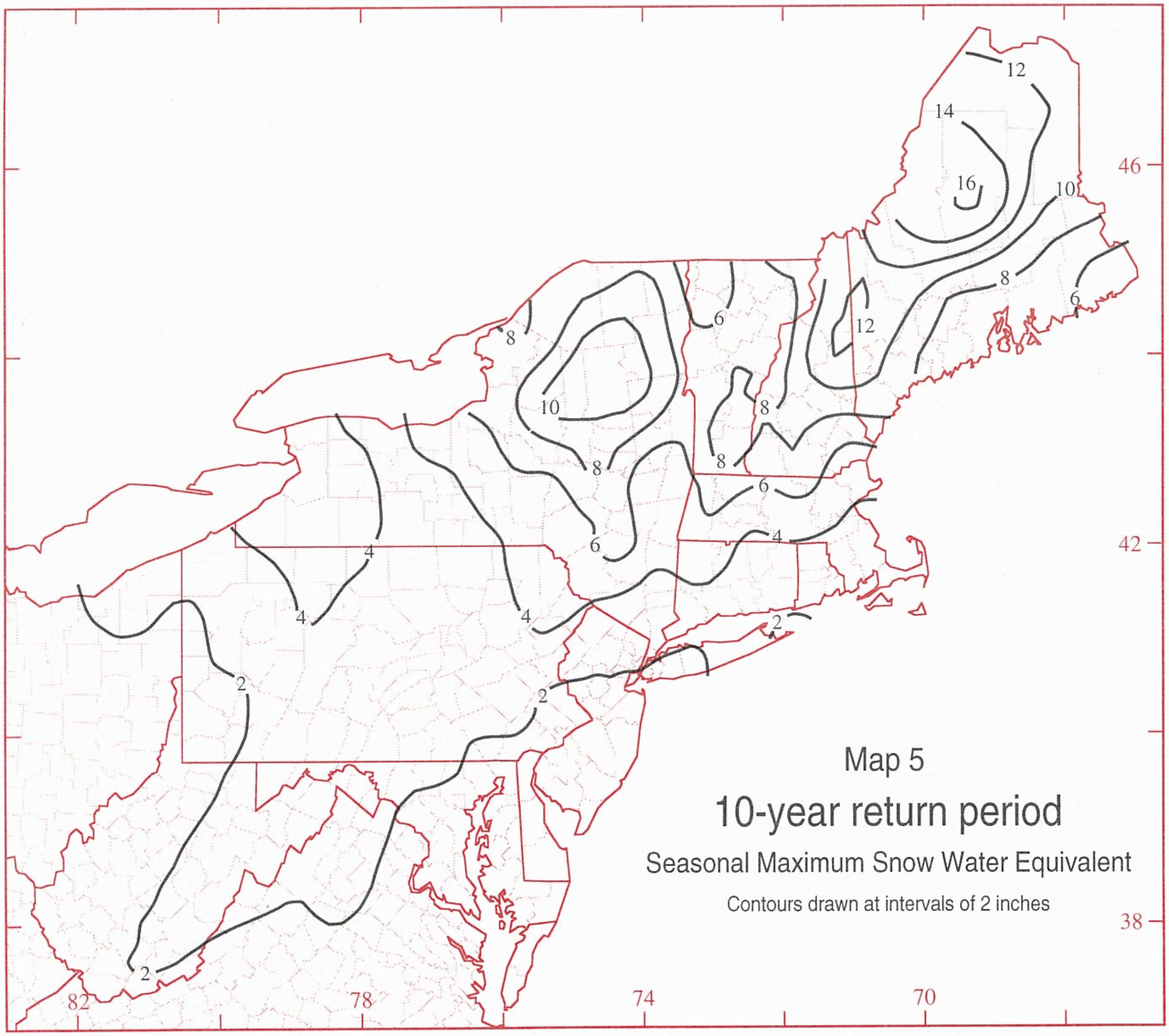
2-year return period

Seasonal Maximum Snow Water Equivalent

Contours drawn at intervals of 1 inch



Map 4
5-year return period
Seasonal Maximum Snow Water Equivalent
Contours drawn at intervals of 2 inches
46
42
38
82
78
74
70
12
12
10
10
8
8
6
6
6
6
4
4
4
4
4
4
2
2
2
2

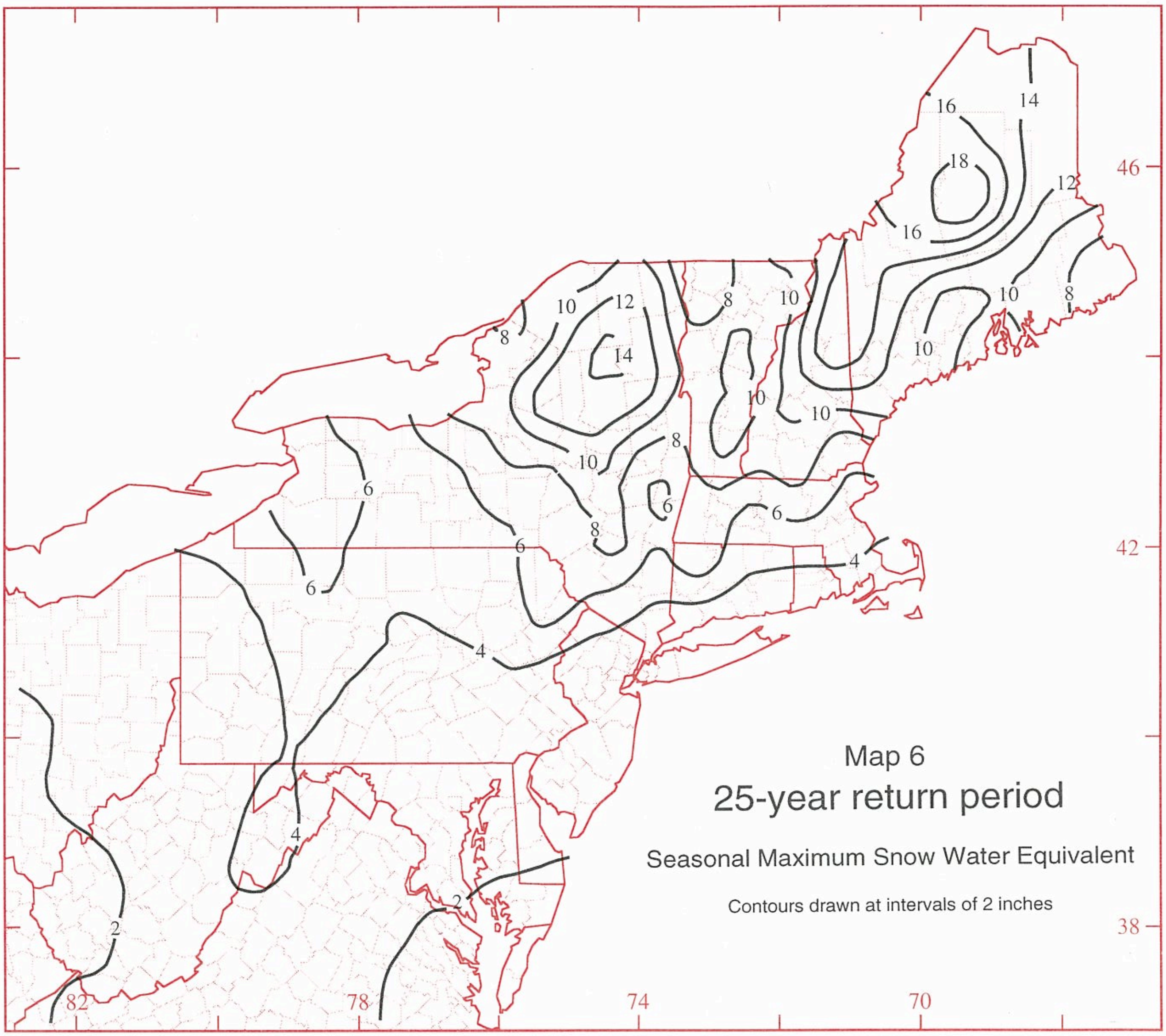


Map 5

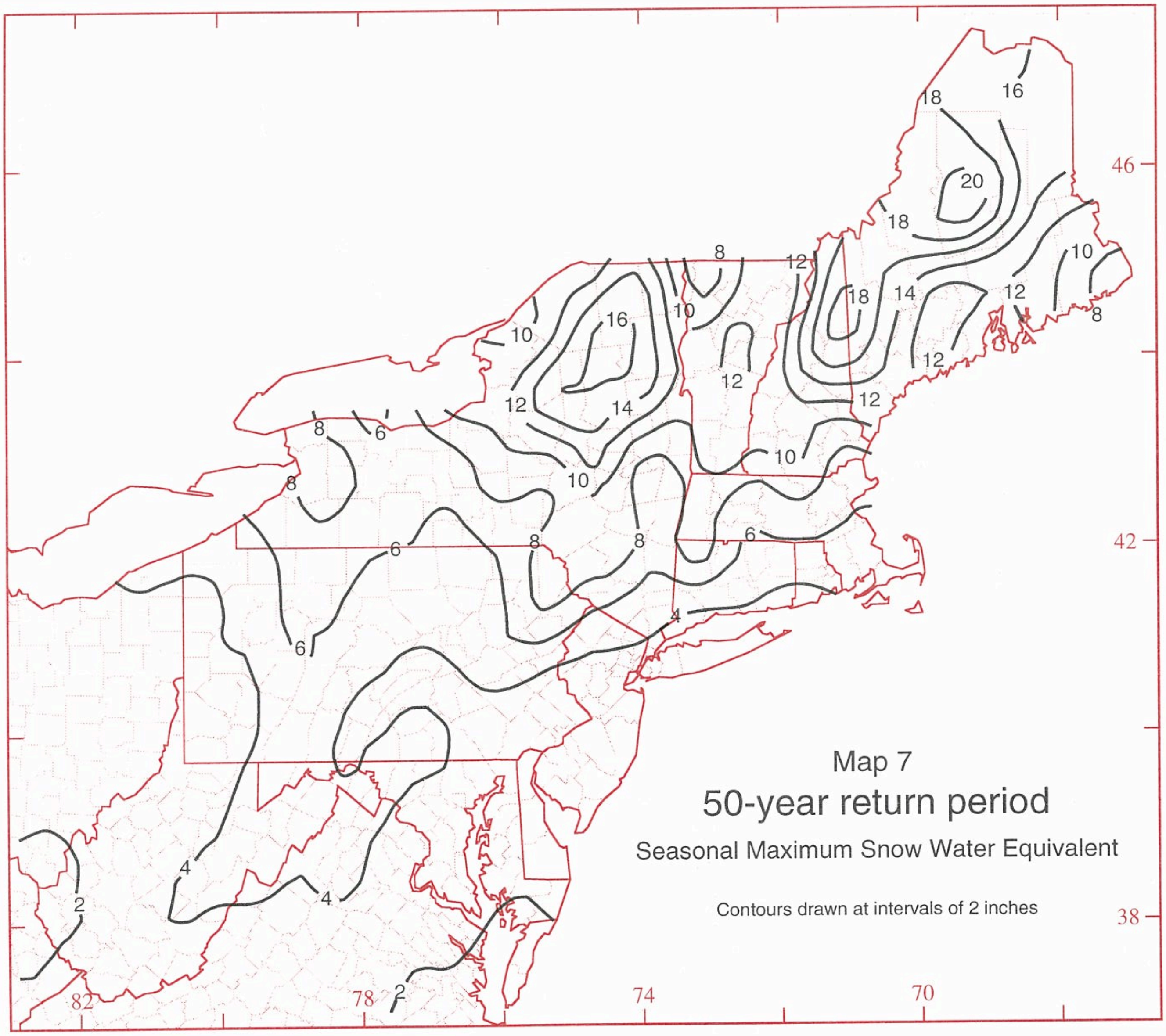
10-year return period

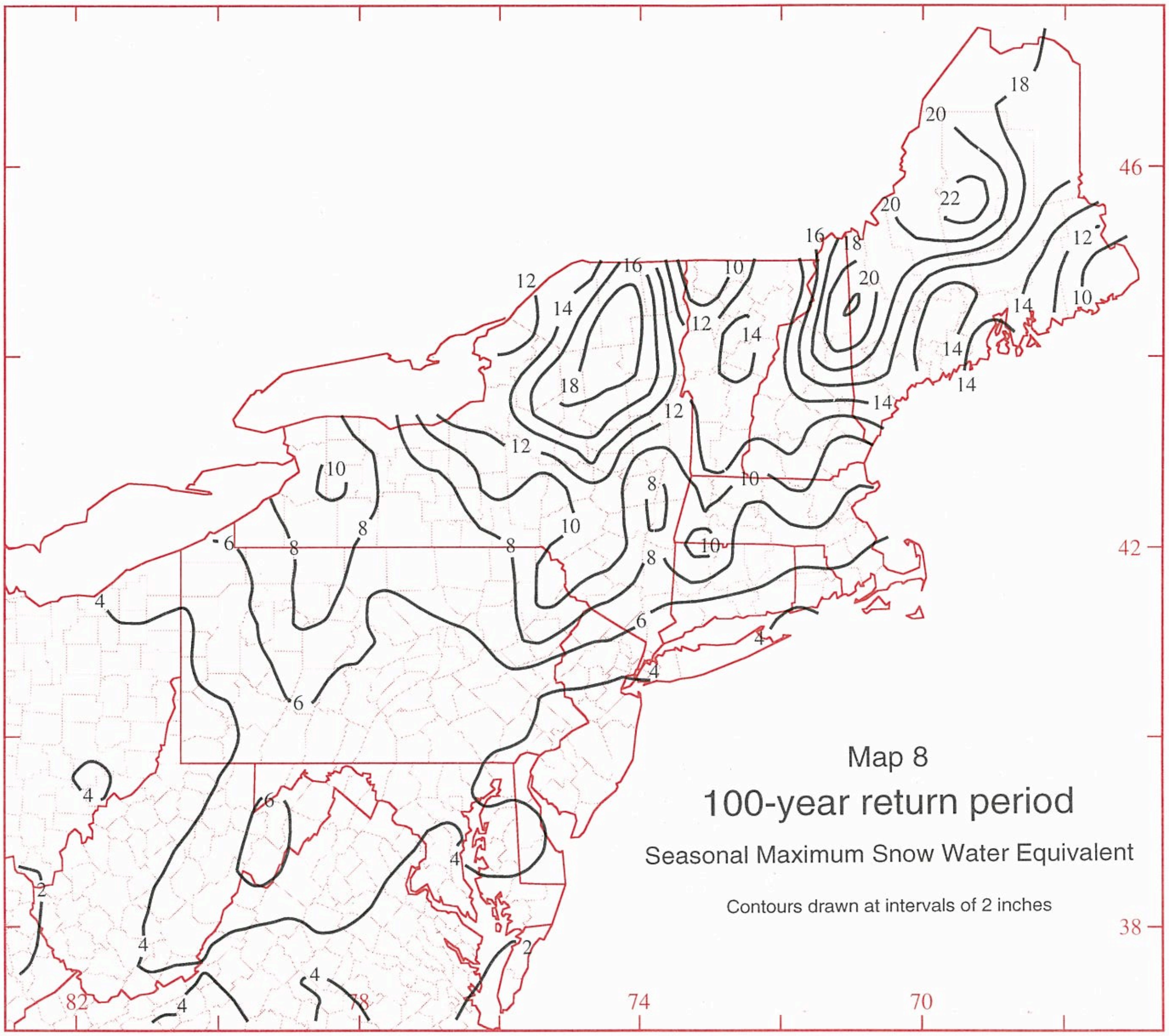
Seasonal Maximum Snow Water Equivalent

Contours drawn at intervals of 2 inches



Map 6
25-year return period
Seasonal Maximum Snow Water Equivalent
Contours drawn at intervals of 2 inches
46
42
38
82
78
74
70
18
16
16
14
14
12
12
10
10
10
10
10
10
10
8
8
8
8
8
6
6
6
6
6
4
4
4
2
2


Map 7
50-year return period
Seasonal Maximum Snow Water Equivalent
Contours drawn at intervals of 2 inches
46
42
38
82
78
74
70

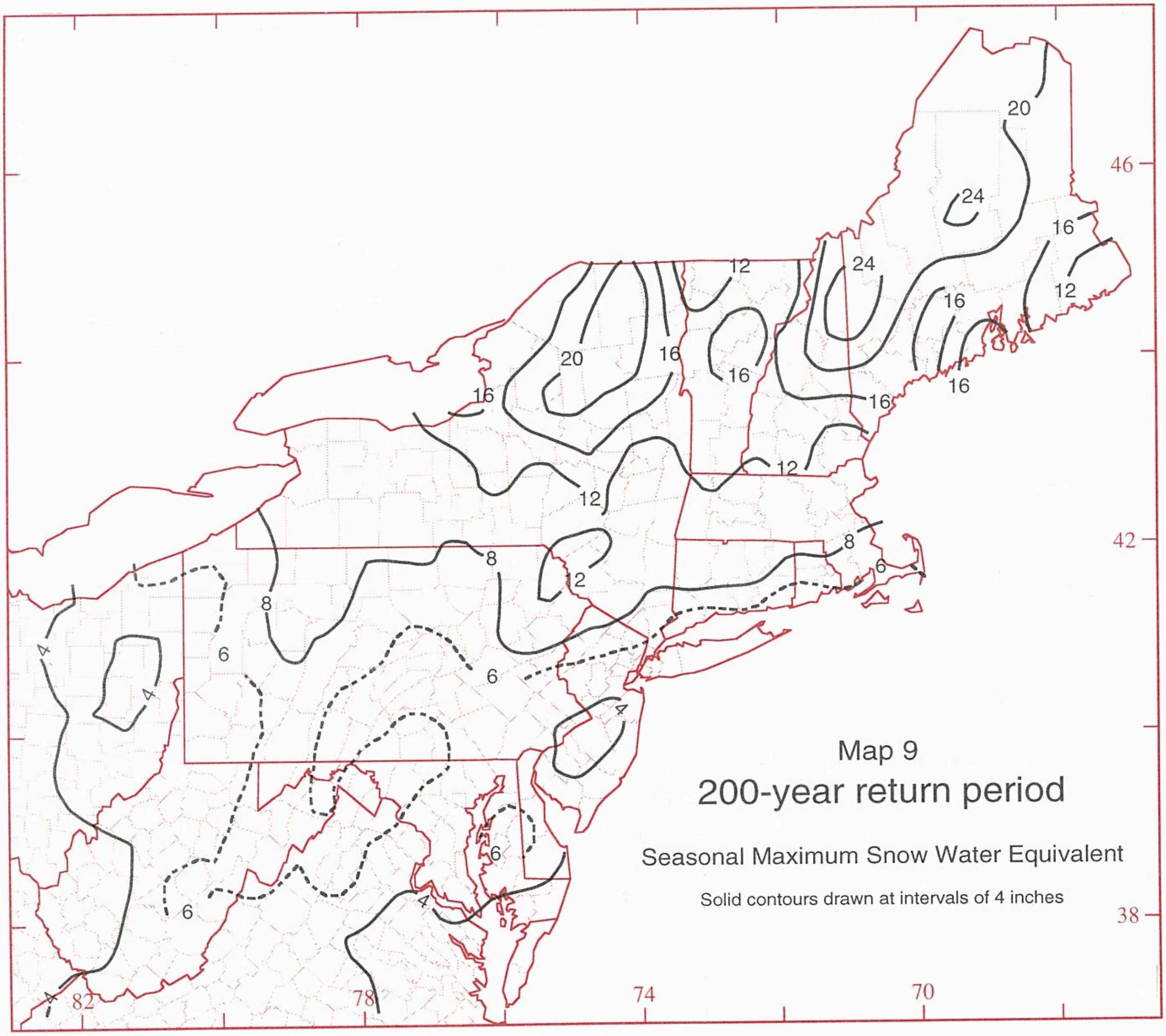


Map 8

100-year return period

Seasonal Maximum Snow Water Equivalent

Contours drawn at intervals of 2 inches



Map 9
200-year return period
Seasonal Maximum Snow Water Equivalent
Solid contours drawn at intervals of 4 inches
46
42
38
82
78
74
70

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Knapp, W.W. and K.L. Eggleston, *Some Impacts of Recent Climate Variability on the Northeast,* NRCC Research Publication RR 91-1.

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