NOAA Technical Memorandum NWS ER-63

SNOW IN WEST VIRGINIA

Marvin E. Miller
WSFO Cleveland, OH

Scientific Services Division
Eastern Region Headquarters
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Elliot L. Richardson, Secretary / NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Robert M. White, Administrator / National Weather Service
George P. Cressman, Director

SNOW IN WEST VIRGINIA

Marvin E. Miller*
WSFO Cleveland, Ohio

1. INTRODUCTION

Next to the problems associated with flooding and flash flooding, forecast problems related to snow are most frustrating and difficult for forecasters at the Charleston Weather Service Forecast Office.

Using the best and most complete snowfall records available for West Virginia, this study provides information on: mean monthly and annual snowfall amounts; frequency of 1-inch and 3-inch snowfalls; threshold dates of first 1-, 3-, and 4-inch snowfalls and the last 1-inch snow of the winter season; duration of snow cover and extreme snowfall and snow depths.

Topography plays a vital role in explaining much of the variation in snowfall in West Virginia. Figure 1 shows the approximate range in elevation (feet) above mean sea level across West Virginia. With the exception of the Monongahela Valley in Lewis, Harrison, Marion and Monongalia counties the elevation increases southeastward from the Ohio River to the ridge line of the Allegheny Mountains. Elevations decrease rapidly east of this ridge line in the Mountain State's eastern panhandle.

The effect which topography plays on snowfall is expecially noticeable in the south, central mountain and northern mountain zones. Locally heavy snowfall occurs along the Allegheny Mountains' ridge line in West Virginia during every winter. Such storms need not be associated with a major storm center but may occur after a cold front passes across the area. With a general wind trajectory from the north, the cold air may pick up both heat and moisture as it moves across the lower Great Lakes. Some of this moisture may be lost in Ohio but orographic lifting which occurs as this air reaches West Virginia is usually sufficient to cause snow especially at the higher elevations. As long as the wind trajectory remains from the north, i.e., other things being equal (cloudiness, temperature and surface-500 mb thickness), snow will continue to fall at least intermittently over the high elevations.

2. MONTHLY AND SEASONAL SNOWFALL

Snow is the most capricious meteorological element which weather observers are asked to measure. Consider for example, a day when it snows for several hours and then changes to rain. The rain may either cause settling, thus increasing the snow density, and/or melt all or part of the new snow. In this example and numerous other cases not cited, the observer is faced with the difficult decision of accounting for all losses which occur to snow during each 24-hour period. Such personal judgments obviously affect statistics related to snowfall.

*Study conducted while at Charleston, WV

Monthly and seasonal snowfall amounts for selected locations within each public forecast zone in West Virginia are given in Table 1. Figure 2 shows that most of the northern panhandle, northwest, west and southwest zones receive on an average 20 to 30 inches of snow a year, the south receives from 20 to 60 inches, the north central from 30 to 90 inches, the central mountains from 40 to 150 inches, the northern mountains from 40 to 170 inches and the eastern panhandle from 30 to 110 inches. These average seasonal snowfall patterns are highly dependent upon average elevations within the respective zones. While nearly all of West Virginia consists of high rolling land surfaces, the highest average elevations are located in the central and northern mountains. The 110-inch Preston County contour shown in Figure 2 is closely related to a 2500-foot elevation contour, the 130-inch center in northeastern Randolph County and southeastern Tucker County is centered over a 3000-foot elevation contour; and the 150-inch contour in Randolph County is just to the north of the 4500-foot contour.

The large ranges in average seasonal snowfalls within the south, north central, central mountains, northern mountains and eastern panhandle zones would indicate potential problems in forecasting snowfall amounts and wording of forecasts. Table 1 for example shows the average range of seasonal snowfall within Zone 8 is from 31 inches at Petersburg to 168 inches at Pickens. Therefore, for every inch of snow at Petersburg, approximately 5 inches can be expected at the higher elevations. This large average variation suggests our current (ROML E-32-75) 6-inch heavy snow criterion would commonly be met at higher elevations within the northern mountains zone but not at lower eleveations. In addition, snow would occur more often and for longer durations at the higher elevations.

Snowfall within the winter season and from season to season can and does vary greatly. Examples of the seasonal variation can be found by examining snowfall records from any location in the state. Monthly comparisons of total snowfall during most winters would reveal a similiar unpredictability concerning the distribution of snowfall within any winter season. However, when averaged with snowfall data for other years, the non-uniformity in distribution of snowfall within any single season becomes more uniform and even fairly symmetrical about January.

3. FREQUENCY OF SELECTED SNOWFALLS

The mean number of days each month and for the winter season with snowfalls equal or greater than 1 and 3 inches are given for selected West Virginia locations in Table 2. Snowfall records for the period 1961-1975 were used in calculating these means.

Table 2 shows the frequency of snowfalls of 1 inch or more is from about 6 to 12 days per winter season over the western portions of the Mountain State, but up to 37 days at higher elevations within the central mountains and northern mountains zones. Snowfalls of 3 inches or more occur on the average only 2 or 3 times per season in the western half of the Mountain State, but up to 18 days per winter season at the high elevations.

Following cold frontal passages, days with snow showers which result in an accumulation of 1 inch or more over all but the eastern panhandle are highly dependent on northerly winds. In general, the higher terrain within West Virginia (as compared to Ohio) exerts orographic influences on the cold but moist air from Lake Erie. A good forecast rule of thumb, given cold temperatures, is to keep snow in the forecast until the wind trajectory is something other than north.

Data given in Table 2 show some of the problems which a forecaster faces when he prepares his West Virginia zone forecasts. For example, in the south, Bluestone has about 10 days each winter season with 1 inch or more of snow, Beckley has 15 days and Flat Top 22 days. These variations within the same zone clearly indicate markedly different snow climates within the same forecast zone.

4. THRESHOLD DATES

Thom (1964) has suggested the normal distribution without modification for use in computing threshold dates for a data series which is complete. In cases where threshold dates do not occur in all years, Thom used the equation:

$$t_g = \sigma N^{-1} \{G(X)/p\} + \bar{t}$$

where t_g = desired threshold date
σ = standard deviation
N^{-1} = normal deviate corresponding to probability $\{G(x)/p\}$
$G(x)$ = desired threshold probability
p = probability of a threshold occurrence
$\bar{t}$ = mean threshold date

to find desired threshold dates with probability G(x). Desired threshold dates can not be determined when the computed quantile probability, {G(x)/p}, exceeds p.

Tables 3, 4 and 5 give 1-, 3-, and 4-inch 24-hour (Data used in this study were for the observational day. Precipitation data for most locations were not in sufficient detail to allow the computation of snowfalls for any 24-hour period.) snowfall statistics for selected locations in West Virginia. Table 6 gives statistics on the last 1-inch snow (in 24 hours) of the season. Data from the winter seasons 1961-1975 were used in determining threshold dates given in these tables. For the period of record covered by this study, 1-inch snowfall thresholds occurred in every winter season. Therefore, data in Tables 3 and 6 were developed by using the unmodified Gaussian distribution.

The procedure for finding the desired threshold probability dates in Tables 4 and 5 may be best exemplified by using data for the first station in Table 4. For this location, Weirton, $\bar{t}$ = 82.0, σ = 29.2, and p = .80 (12 of 15 winter seasons had at least one 3-inch snowfall). In this study, days were numbered consecutively from September 30. For the .10 quantile, Thom's equation becomes $t_{.10} = 29.2\ N^{-1}\{.10/.80\} + 82.0$. In this case (G(x)/p) = .125 and by referring to a table of the normal curve $N^{-1}(.125)$ is found to be -1.15. Therefore, $t_{.10} = 29.2(-1.15) + 82.0 = 48.4$. After converting day 48 (from September 30) to date, $t_{.10}$ = November 17. Thus, at Weirton the first 3-inch snowfall within a 24-hour period has a 90 percent chance of falling after November 17.

On the average, the first daily snowfall totaling 1 inch or more falls during the first week in December over lower terrain in western portions of the state but up to 3 to 4 weeks earlier on the higher ridges of the Allegheny Plateau.

The first 3-inch snowfall west of a line from Parkersburg to Charleston occurs on the average about one month after the first 1-inch snowfall, i.e., January 1-5. Average dates of the first 3-inch snowfall elsewhere are as early as the last week in November at the higher elevations.

Within any forecast zone, the variation in occurrences of first seasonal snowfalls of selected amounts generally increases as the snowfall in question increases. For example, at Morgantown the standard deviations associated with first 1-, 3- and 4-inch snowfalls as given in Tables 3, 4, and 5 are 10.2, 20.3 and 32.2 days, respectively. Excluding meteorology there are at least two other reasons for this increase in variability. They are: 1. the larger the snowfall, the harder it is for the observer to obtain a representative average estimate of total snowfall, and 2. melting and settling are obvious problems which are difficult to overcome.

5. DURATION AND SNOW COVER

The duration of snow cover is longest and most continuous at elevations above 3,000 feet in the central and northern mountain zones. About one season in five (Leffler and Foster 1974) will have continuous snow cover of 1 inch or more at elevations of 4,000 feet and higher. However, in most winters even the higher elevations have periods without snow on the ground. On the average, western zones experience less than 25 days per winter season with snow cover of 1 inch or more while up to 80 days per season is common in the central and northern mountains. (Table 7).

At least one ski resort has attempted to take advantage of the frequency and duration of snow near the highest point along the Allegheny Plateau. Two successive mild winters have placed a financial strain on this resort.

6. EXTREME SNOWFALLS AND SNOW DEPTHS

Following the Gumbel (1958) method of fitting the Fisher-Trippett Type I distribution, extreme 24-hour snowfalls and extreme snow depths with mean recurrence intervals of 2, 5, 10, 25, 50 and 100 years were determined for selected West Virginia locations. These extreme snowfall and snow depth data for the selected return intervals are presented in Table 8.

All available extreme 24-hour snowfall and snow depth data from the winter seasons of 1961-1974 were used in calculating the data in Table 8. An illustration for determining the mean recurrence interval associated with some heavy 24-hour snowfalls or the probability of snow accumulating to some depth can be made by referring to data for Charleston. At Charleston, the mean recurrence interval for 24-hour snowfall of 14.6 inches is 25 years; i.e., on the average a storm of this magnitude will occur once in 25 years. For the same recurrence interval, Charleston can expect snow to accumulate to a depth of at least 16 inches.

Table 8 does not hold any particular surprises; i.e., the higher the elevation the greater the 24-hour snowfall and snow depth for each recurrence interval. For example, the 2-year 24-hour extreme snowfall recurrence interval range for all Mountain State locations is generally between 5 and 12 inches while the 100-year 24-hour storm range is between 15 and 35 inches. For all cases the higher amounts are at higher elevations.

Much confusion exists concerning the meaning of extreme value statistics; e.g., the 24-hour extreme snowfall with a mean recurrence interval of 10 years at Elkins is 14.9 inches. On December 17, 1967, Elkins recorded 17.8 inches of snow and on January 20, 1971 (3.07 years later), they received 18.7 inches. In looking at such data, one might begin to question the 10-year recurrence interval. Before doing so, however, one should determine the probability, $P(x)$, that a snowfall or any extreme event with a recurrence interval, T, will happen within x years from the equation:

$$P(x) = 1 - \exp(-x/T)$$

For the above example, the equation becomes:

$$P(x) = 1 - \exp(3.07/10) = 1 - .73 = .27$$

Therefore, there is a 27 percent chance that a snowfall $\geq$ 14.9 inches can occur within an interval of 3.07 years. To be 95 percent sure of estimating the time interval between January 20, 1971 and the next 24-hour snowfall $\geq$ 14.9 inches, it is necessary to solve the above equation for x which is 30.0 years.

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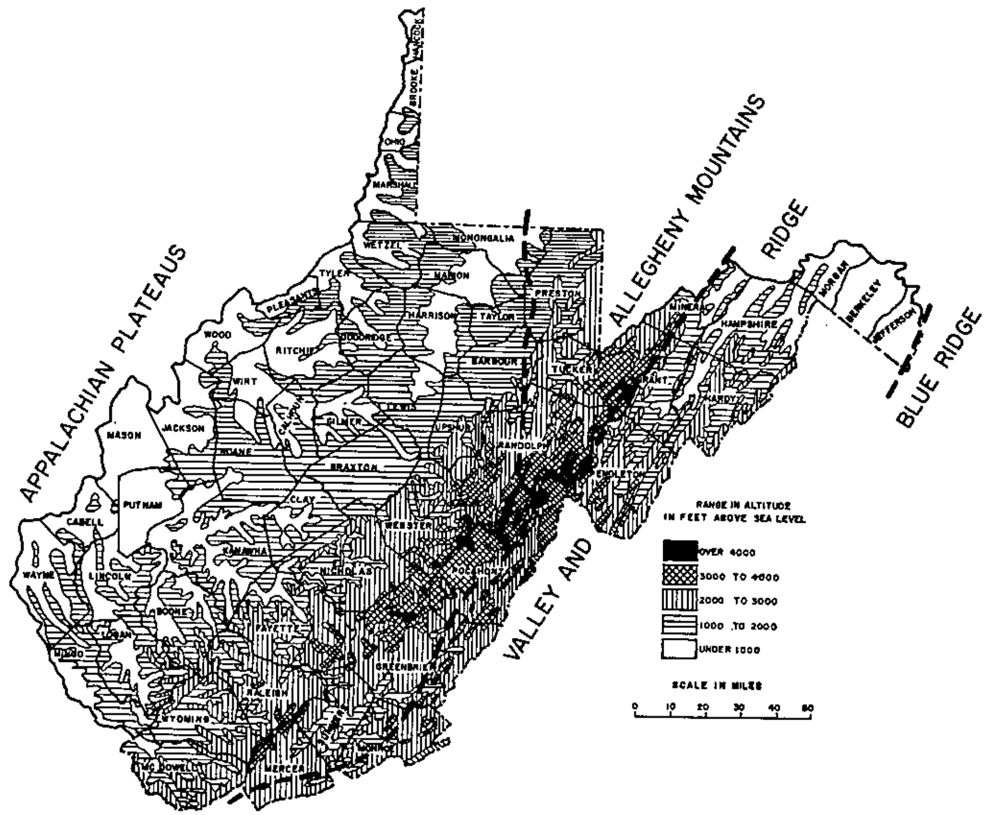

Figure 1. Approximate range in elevation (ft.) above sea level.

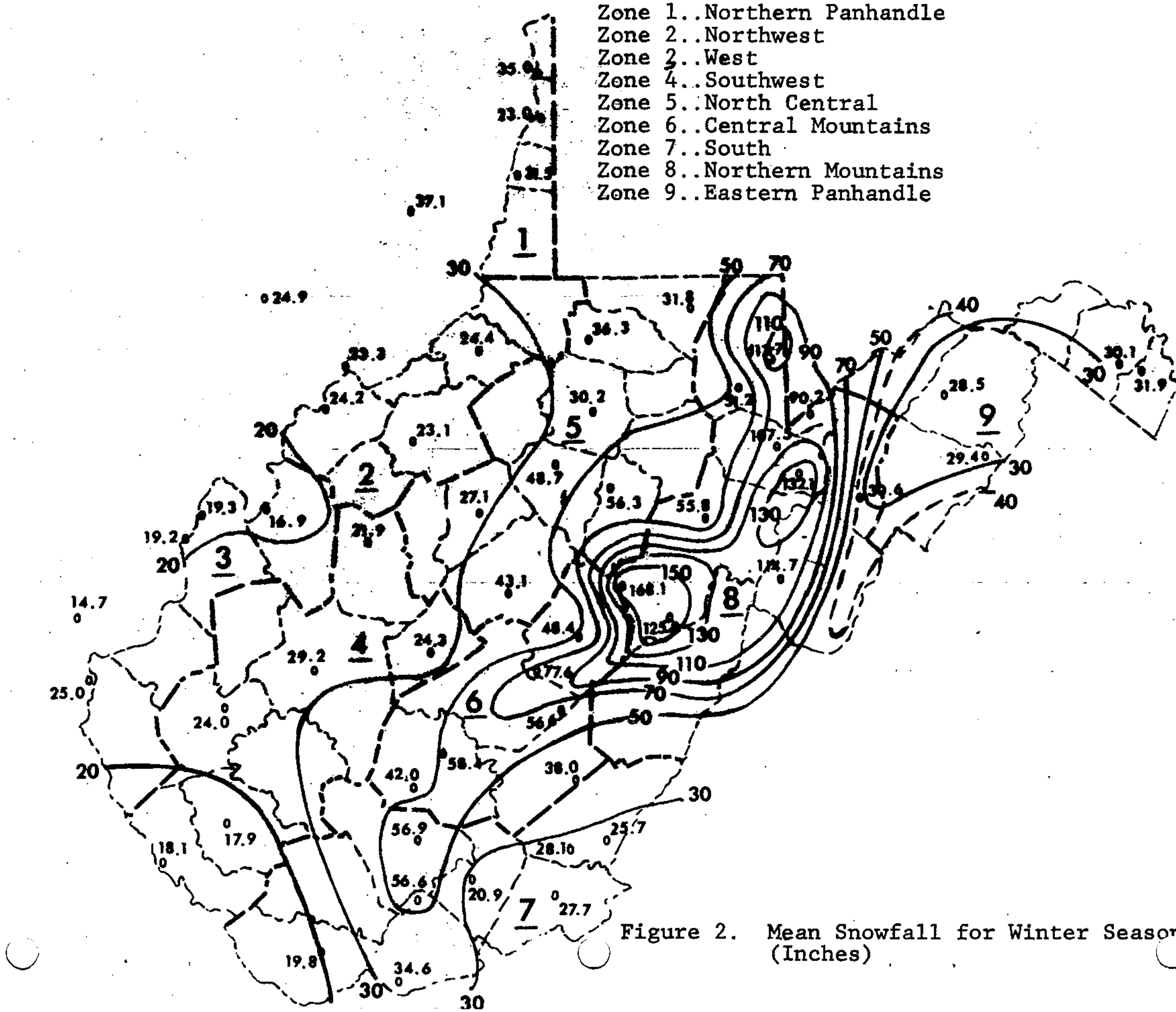

Figure 2. Mean Snowfall for Winter Season (Inches)

Table 1. Mean Monthly and Seasonal Snowfall (Inches) for Selected West Virginia Locations

	Elevation	Years	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	Season
Zone 1											
Weirton	1040	50-74	T	3.9	6.7	8.3	8.6	7.2	0.7	T	35.4
Wheeling Dam 12	659	35-60	T	3.3	6.3	6.9	7.3	6.5	1.0	T	31.3
Zone 2											
Cairo	680	51-73	T	1.7	3.9	7.7	5.5	3.2	0.1	0	22.1
Middlebourne	750	51-73	T	1.5	4.6	7.7	6.0	4.2	0.4	0	24.4
Parkersburg	615	41-70	0.1	1.8	4.4	6.9	6.2	4.1	0.7	T	24.2
Zone 3											
Huntington	827	41-70	T	2.0	4.9	7.3	6.6	4.2	T	T	25.0
Point Pleasant	540	36-65	T	2.0	3.4	5.8	4.4	3.4	0.3	0	19.3
Ravenswood	584	51-73	T	0.9	2.7	5.5	4.7	3.1	T	0	16.9
Zone 4											
Charleston	939	41-70	0.2	3.0	5.0	8.4	7.9	4.4	0.3	0	29.2
Clay	720	53-74	0.2	1.7	5.0	7.0	5.5	4.7	0.2	0	24.3
Hamlin	642	51-73	T	1.5	4.5	7.5	6.1	4.2	0.2	0	24.0
Logan	700	51-73	T	1.3	3.4	6.1	4.9	2.2	0	0	17.9
Spencer	964	51-73	0.1	1.3	4.0	7.2	6.0	3.2	0.1	0	21.9
Williamson	659	45-74	T	1.1	4.1	5.3	4.9	2.6	0.1	0	18.1
Zone 5											
Buckhannon	1445	51-73	0.2	4.2	11.6	14.6	14.8	9.3	1.6	0	56.3
Clarksburg	977	51-73	0.1	1.4	6.1	9.2	8.0	4.9	0.5	0	30.2
Glenville	840	94-60	0.1	2.3	4.9	7.2	7.2	4.6	0.8	0	27.1
Mannington	975	51-73	0.3	2.6	8.3	10.1	7.9	6.0	1.0	0	36.2
Morgantown	825	51-73	T	2.1	6.8	8.2	7.9	6.2	0.6	0	31.8
Sutton	835	48-74	0.2	2.2	9.7	11.1	11.7	7.3	0.9	0	43.1
Weston	1026	45-74	0.4	4.3	10.1	11.5	12.1	8.7	1.6	0	48.7
Zone 6											
Camden-on-Gauley	1363	45-74	0.8	6.8	16.9	16.7	18.6	14.5	3.3	T	77.6
Nuttallburg	2252	06-30	0.2	3.8	10.0	14.6	11.8	7.6	2.4	0	50.4
Oak Hill	1992	51-73	0.4	2.7	8.8	12.0	10.3	7.2	0.6	0	42.0
Renick	1950	58-74	0.4	3.9	8.9	8.0	10.7	4.9	1.2	T	38.0

Table 1 (cont'd)

	Elevation	Years	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	Season
Richwood	3000	58-74	0.4	7.3	11.0	9.6	15.2	10.1	3.0	T	56.6
Webster Springs	1540	51-73	0.2	3.9	11.2	11.8	11.7	8.2	1.0	0	48.0
Zone 7											
Beckley	2504	41-70	T	4.7	10.2	14.1	17.2	8.8	1.9	T	56.9
Bluefield	2610	31-75	0.3	3.2	8.8	6.6	8.6	5.6	1.5	T	34.6
Bluestone Dam	1388	48-75	T	1.0	4.8	5.2	5.8	4.0	0.1	T	20.9
Flat Top	3225	40-75	1.0	5.4	11.0	10.7	13.9	12.0	2.5	0.1	56.6
Gary	1426	51-73	T	0.9	4.2	6.0	5.2	3.2	0.3	T	19.8
Lewisburg	2250	14-75	0.2	1.7	5.6	7.8	7.0	5.0	0.8	T	28.1
Union	1975	31-73	0.3	1.2	5.2	7.1	8.3	4.9	0.7	T	27.7
White Sulphur Springs	1914	51-73	0.3	1.9	5.3	6.7	6.6	4.4	0.5	T	25.7
Zone 8											
Bayard	2375	51-73	0.4	7.5	20.7	21.7	21.7	19.2	5.0	0	96.2
Canaan Valley	3250	61-75	2.3	12.1	29.2	22.9	30.0	25.2	10.0	0.4	132.1
Elkins	1970	51-73	0.2	6.0	12.1	11.9	13.4	9.9	2.3	T	55.8
Kumbrabow St. Forest	3210	45-60	0.9	15.5	24.7	30.4	23.6	21.1	8.6	1.0	125.8
Petersburg	1013	51-73	T	1.6	7.0	7.4	7.8	6.2	0.6	T	30.6
Pickens	2695	61-75	1.9	13.4	40.3	30.6	41.5	30.6	9.5	0.3	168.1
Rowlesburg	1375	97-75	0.7	3.6	11.1	12.3	11.1	9.7	2.7	T	51.2
Spruce Knob	3050	51-70	1.4	7.7	21.4	23.9	25.6	25.9	8.3	0.6	114.7
Terra Alta	2540	66-75	0.1	8.9	27.1	19.6	26.6	24.3	5.1	T	111.7
Thomas	3010	61-75	1.0	10.7	23.6	18.7	24.6	20.1	8.6	0.2	107.5
Zone 9											
Kearneysville	550	51-73	T	2.0	7.4	7.0	8.0	6.7	0.8	0	31.9
Martinsburg	537	51-73	T	2.1	7.0	6.0	8.0	6.5	0.5	0	30.1
Mathias	1625	53-75	0.1	3.2	7.7	8.7	10.6	9.3	2.8	T	42.4
Romney	640	54-70	T	0.6	5.8	8.3	7.3	6.1	0.4	0	28.5
Wardensville	1200	51-73	T	1.7	5.7	8.1	6.9	6.1	0.9	T	29.4

Table 2. Mean Number of Days with Snowfall ≥ 1.0, and 3.0 Inches (1"/3").

	OCT 1"/3"	NOV 1"/3"	DEC 1"/3"	JAN 1"/3"	FEB 1"/3"	MAR 1"/3"	APR 1"/3"	MAY 1"/3"	SEASON 1"/3"
Zone 1..Northern Panhandle									
Weirton	0.0/0.0	0.5/0.2	2.7/0.7	3.1/0.7	4.2/1.0	2.1/0.7	0.1/0.1	0.0/0.0	12.7/3.3
Zone 2..Northwest									
Parkersburg	0.0/0.0	0.7/0.2	2.0/0.5	2.3/0.9	1.9/0.5	0.9/0.3	0.1/0.1	0.0/0.0	7.9/2.4
Pt. Pleasant	0.0/0.0	0.6/0.2	1.4/0.4	2.3/0.7	1.9/0.5	1.5/0.4	0.3/0.0	0.0/0.0	7.8/2.2
Zone 3..West									
Huntington	0.0/0.0	0.7/0.2	1.2/0.4	1.8/0.5	1.6/0.4	1.0/0.3	0.0/0.0	0.0/0.0	6.1/1.8
Zone 4..Southwest									
Charleston	0.0/0.0	1.0/0.3	1.8/0.4	2.6/0.7	2.4/0.8	1.5/0.4	0.4/0.0	0.0/0.0	9.3/2.6
Zone 5..North Central									
Morgantown	0.0/0.0	0.7/0.5	1.6/0.9	3.1/0.9	3.5/0.9	2.0/0.4	0.5/0.0	0.0/0.0	12.4/3.6
Zone 6..Central Mountains									
Camden/Gauley	0.5/0.1	3.0/0.9	7.7/3.3	7.5/3.1	8.9/3.8	6.4/3.1	2.3/0.5	0.3/0.0	36.5/14.7
Oak Hill	0.1/0.1	1.0/0.4	4.0/1.4	4.3/0.9	4.5/1.5	2.5/0.9	0.1/0.1	0.0/0.0	16.6 5.1
Zone 7..South									
Beckley	0.2/0.0	1.5/0.5	3.0/0.9	4.0/0.9	3.7/1.3	2.6/0.5	0.6/0.2	0.0/0.0	15.5/4.3
Bluestone Dam	0.1/0.0	0.4/0.0	2.5/0.9	2.6/0.7	2.3/1.0	1.7/0.5	0.1/0.0	0.0/0.0	9.7/3.1
Flat Top	0.5/0.3	2.1/0.7	4.4/1.6	4.7/1.1	6.1/2.6	3.7/1.3	0.5/0.1	0.0/0.0	21.9/7.8
Zone 8..Northern Mountains									
Bayard	0.2/0.1	2.8/0.9	7.6/3.3	7.3/2.7	8.0/3.1	6.6/2.7	2.0/0.7	0.1/0.0	34.5/13.5

Table 2 (cont'd)

	OCT 1"/3"	NOV 1"/3"	DEC 1"/3"	JAN 1"/3"	FEB 1"/3"	MAR 1"/3"	APR 1"/3"	MAY 1"/3"	SEASON 1"/3"
Elkins	0.2/0.0	2.0/0.6	3.9/1.2	4.1/1.2	4.9/1.1	3.4/0.7	0.9/0.2	0.0/0.0	19.4/5.0
Spruce Knob	0.7/0.1	2.6/1.2	7.2/3.7	6.7/3.6	8.8/4.2	8.4/3.9	3.2/1.3	0.1/0.0	37.9/18.0
Zone 9..Eastern Panhandle									
Mathias	0.1/0.1	1.0/0.4	2.6/1.3	2.1/1.1	3.7/1.8	2.1/0.9	0.7/0.3	0.0/0.0	12.3/5.8
Martinsburg	0.0/0.0	0.5/0.1	2.1/1.5	2.1/0.6	3.0/1.2	1.6/0.9	0.2/0.1	0.0/0.0	9.6/4.4

Table 3. One-Inch Snowfall Threshold Statistics for Selected Locations in West Virginia. Entries Under tg Indicate Month/Day.

	σ	P	$t_{.05}$	$t_{.10}$	$t_{.25}$	$t_{.50}$	$t_{.90}$
Zone 1..Northern Panhandle							
Weirton	17.9	1.0	11/4	11/10	11/21	12/3	12/26
Zone 2..Northwest							
Parkersburg	16.6	1.0	11/6	11/12	11/22	12/4	12/25
Zone 3..West							
Huntington	20.0	1.0	11/3	11/10	11/22	12/6	12/31
Zone 4..Southwest							
Charleston	17.5	1.0	11/2	11/9	11/19	12/1	12/23
Zone 5..North Central							
Morgantown	10.2	1.0	11/14	11/18	11/24	12/1	12/14
Zone 6..Central Mountains							
Camden-on-Gauley	16.0	1.0	10/12	10/18	10/27	11/7	11/28
Oak Hill	16.2	1.0	10/31	11/6	11/15	11/26	12/17
Zone 7..South							
Beckley	15.5	1.0	10/23	10/28	11/7	11/7	12/7
Bluestone	19.6	1.0	10/29	11/5	11/17	11/30	12/25
Flat Top	17.3	1.0	10/12	10/19	10/29	11/10	12/2
Zone 8..Northern Mountains							
Bayard	11.1	1.0	10/25	10/29	11/5	11/12	11/26
Elkins	17.3	1.0	10/22	10/28	11/7	11/19	12/11
Spruce Knob	20.9	1.0	10/8	10/15	10/28	11/11	12/7
Zone 9..Eastern Panhandle							
Mathias	22.0	1.0	10/19	10/27	11/9	11/24	12/22
Martinsburg	17.6	1.0	11/13	11/19	11/30	12/12	1/3

Table 4. Three-Inch Snowfall Threshold Statistics for Selected Locations in West Virginia. Entries Under tg Indicate Month/Day.

	σ	P	t.05	t.10	t.25	t.50	t.90
Zone 1..Northern Panhandle							
Weirton	29.2	.80	11/6	11/17	12/7	12/21	
Zone 2..Northwest							
Parkersburg	42.3	.92	10/25	11/14	12/5	1/1	2/18
Zone 3..West							
Huntington	32.4	.76	11/17	11/30	12/22	1/5	
Zone 4..Southwest							
Charleston	36.1	.88	11/8	11/25	12/14	1/4	
Zone 5..North Central							
Morgantown	20.3	1.00	11/7	11/14	11/27	12/10	1/5
Zone 6..Central Mountains							
Camden-on-Gauley	20.1	1.00	10/21	10/28	11/9	11/23	12/19
Oak Hill	27.1	1.00	10/28	11/7	11/23	12/12	1/4
Zone 7..South							
Beckley	30.6	1.00	10/23	11/3	11/21	12/12	1/20
Bluestone	24.1	1.00	11/28	12/7	12/21	1/6	2/6
Flat Top	22.9	1.00	10/20	10/28	11/11	11/26	12/26
Zone 8..Northern Mountains							
Bayard	16.7	1.00	11/2	11/8	11/18	11/29	12/20
Elkins	42.0	1.00	10/12	10/28	11/23	12/21	2/12
Spruce Knob	22.7	1.00	10/20	10/28	11/11	11/26	12/25
Zone 9..Eastern Panhandle							
Martinsburg	21.0	.93	11/19	11/27	12/10	12/23	1/8
Mathias	23.4	1.00	10/27	11/5	11/19	12/5	1/4

Because of sample size and variability of 3-inch snowfalls, dates associated with specific probabilities given in this table can show 3-inch snowfalls occurring before the date associated with the same probability for a 1-inch snowfall as given in Table 3.

Table 5. Four-Inch Snowfall Threshold Statistics for Selected Locations in West Virginia. Entries Under tg Indicate Month/Day.

	σ	P	t.05	t.10	t.25	t.50	t.90
Zone 1..Northern Panhandle							
Weirton	25.1	.80	12/14	12/24	1/9	1/22	
Zone 2..Northwest							
Parkersburg	44.0	.60	11/11	11/29	1/1	1/10	
Zone 3..West							
Huntington	29.4	.60	11/24	12/6	12/28	1/3	
Zone 4..Southwest							
Charleston	34.9	.72	11/26	12/10	1/3	1/7	
Zone 5..North Central							
Morgantown	32.2	.93	11/5	11/17	12/7	12/27	
Zone 6..Central Mountains							
Camden-on-Gauley	29.5	1.00	10/12	10/23	11/10	11/29	1/6
Oak Hill	36.4	.93	10/31	11/13	12/5	12/28	2/10
Zone 7..South							
Beckley	37.1	1.00	11/5	11/18	12/11	1/5	2/12
Bluestone	31.2	.80	11/23	12/5	12/25	1/9	
Flat Top	35.4	1.00	10/21	11/3	11/24	12/18	2/1
Zone 8..Northern Mountains							
Bayard	19.2	1.00	11/1	11/8	11/19	12/2	12/27
Elkins	48.7	.95	10/14	11/1	11/31	12/31	3/1
Spruce Knob	31.3	1.00	10/14	10/26	11/14	12/5	1/14
Zone 9..Eastern Panhandle							
Martinsburg	18.5	.93	11/24	12/1	12/12	12/23	1/15
Mathias	38.0	1.00	10/19	10/23	11/25	12/20	1/19

Because of sample size and variability of 4-inch snowfalls, dates associated with specific probabilities given in this table can show 4-inch snowfalls occurring before the date associated with the same probability for a 1- and/or 3-inch snowfalls as given in Tables 3 and 4.

Table 6. Statistics of Last One-Inch Snowfall of Season for Selected West Virginia Locations. Entries Under tg Indicate Month/Day.

	σ	P	t.10	t.25	t.50	t.75	t.90	t.95
Zone 1..Northern Panhandle								
Weirton	13.0	1.0	3/2	3/10	3/18	3/27	4/4	4/8
Zone 2..Northwest								
Parkersburg	23.7	1.0	2/6	2/21	3/9	3/25	4/8	4/17
Zone 3..West								
Huntington	20.0	1.0	2/3	2/15	2/28	3/14	3/26	4/2
Zone 4..Southwest								
Charleston	21.7	1.0	2/8	2/21	3/8	3/22	4/4	4/12
Zone 5..North Central								
Morgantown	15.5	1.0	3/7	3/17	3/27	4/7	4/16	4/22
Zone 6..Central Mountains								
Camden-on-Gauley	16.2	1.0	4/1	4/11	4/9	4/19	5/12	5/8
Oak Hill	13/4	1.0	3/2	3/10	3/19	3/28	4/5	4/10
Zone 7..South								
Beckley	15.2	1.0	3/5	3/14	3/25	4/4	4/13	4/19
Bluestone	15.3	1.0	2/21	3/1	3/12	3/23	4/1	4/6
Flat Top	10.6	1.0	3/16	3/23	3/30	4/6	4/12	4/16
Zone 8..Northern Mountains								
Bayard	16.7	1.0	3/16	3/26	4/16	4/17	4/28	5/4

Table 6 (cont'd)

	σ	P	t.10	t.25	t.50	t.75	t.90	t.95
Elkins	13.5	1.0	3/16	3/24	4/2	4/11	4/20	4/24
Spruce Knob	11.1	1.0	3/29	4/5	4/12	4/20	4/27	5/1
Zone 9..Eastern Panhandle								
Martinsburg	19.7	1.0	2/18	3/2	3/15	3/28	4/9	4/17
Mathias	15.1	1.0	3/5	3/14	3/24	4/3	4/12	4/18

Table 7. Mean Number of Days with Snow Cover on the Ground $\geq$ 1 Inch for Selected West Virginia Locations#

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	Season
Zone 1..Northern Panhandle									
Weirton	0	1	5	9	7	2	0	0	24
Zone 2..Northwest									
Parkersburg	0	1	4	10	7	2	0	0	24
Zone 3..West									
Huntington	0	1	3	8	5	2	0	0	19
Zone 4..Southwest									
Charleston	0	1	4	8	7	2	0	0	22
Zone 5..North Central									
Morgantown	0	1	7	10	10	5	0	0	33
Zone 6..Central Mountains									
Camden-on-Gauley	0	3	12	16	16	7	1	0	55
Oak Hill	0	2	9	12	11	4	0	0	38
Zone 7..South									
Beckley	0	2	9	12	12	5	1	0	41
Bluestone	0	1	6	8	6	2	0	0	23
Flat Top	0	4	12	15	16	8	1	0	56
Zone 8..Northern Mountains									
Bayard	0	5	18	22	24	13	2	0	84
Elkins	0	3	12	13	15	7	1	0	51
Spruce Knob	1	4	13	16	17	13	3	0	67
Zone 9..Eastern Panhandle									
Martinsburg	0	1	5	11	9	3	0	0	29
Mathias	0	1	7	13	12	3	1	0	37

Means for period October 1960 - May 1975.

Table 8. Statistics on Maximum 24-hour Snowfall and Maximum Snow on the Ground for Selected West Virginia Locations

	Snowfall (Inches) Mean Recurrence Interval in Years						Snow Depth (Inches) Mean Recurrence Interval in Years					
	2	5	10	25	50	100	2	5	10	25	50	100
Zone 1..Northern Panhandle												
Weirton	5.7	9.8	12.6	16.0	18.6	21.1	6	12	16	21	25	28
Zone 2..Northwest												
Parkersburg	4.6	7.6	9.6	12.1	13.9	15.7	6	13	18	24	28	33
Zone 3..West												
Huntington	4.8	7.8	9.8	12.4	14.3	16.1	5	8	10	13	15	17
Zone 4...Southwest												
Charleston	5.8	9.3	11.6	14.6	16.8	18.9	6	10	12	16	18	21
Zone 5..North Central												
Morgantown	6.1	8.8	10.6	12.9	14.6	16.3	8	12	15	19	22	24
Zone 6..Central Mountains												
Camden-on-Gauley	10.5	15.4	18.7	22.8	25.8	28.8	13	18	21	25	28	31
Oak Hill	6.6	10.4	12.9	16.1	18.5	20.8	8	11	14	17	19	21
Zone 7..South												
Beckley	8.2	11.4	13.4	16.1	18.0	19.9	9	13	15	18	21	23
Bluestone	5.3	7.8	9.5	11.6	13.2	14.8	6	10	13	16	19	22
Flat Top	7.2	10.5	12.6	15.3	17.3	19.3	12	17	21	26	29	33

Table 8 (con't)

	Snowfall (Inches) Mean Recurrence Interval in Years						Snow Depth (Inches) Mean Recurrence Interval in Years					
	2	5	10	25	50	100	2	5	10	25	50	100
Zone 8..Northern Mountains												
Bayard	10.9	15.5	18.5	22.4	25.2	28.1	19	26	31	37	42	46
Elkins	7.2	11.8	14.9	18.7	21.6	24.5	8	13	16	21	24	28
Spruce Knob	12.3	18.5	22.6	27.7	31.6	35.4	23	35	43	54	61	68
Zone 9..Eastern Panhandle												
Martinsburg	8.0	12.7	15.9	19.8	22.7	25.7	11	20	26	34	40	45
Mathias	10.4	15.3	18.6	22.8	25.9	29.0	12	20	26	33	38	43