within a single storm system. This is very evident for the storm of August 16-18, 1946, which accounted for the largest outliers for rain periods of 48 hours to 10 days. Outliers for rain periods of 24 to 72 hours occurred in the storm systems of October 10-11, 1954, at Aurora and June 27-28, 1957, at Paris. However, the 72-hour amounts in these two storms occurred within less than 48 hours and generally in less than 24 hours. The 48-hour amounts were so large that they also qualified as 72-hour totals. Of the nine field-surveyed storms listed in table 22, five had durations of less than 12 hours.

This presents a problem that warrants consideration. Statistically, when a single storm event is included in the sample for several storm durations, the samples are not independent. Furthermore, it is questionable whether a storm event lasting a certain number of hours should be included in the sample for longer durations, such as the Aurora and Paris examples mentioned above. A study of this factor and how it affects heavy rainfall frequency distributions is feasible and should be considered.

The results in tables 22 through 26 indicate that approximately 15% of the state (9 of 61 stations) received 24-hour rainfalls that meet our definition of an outlier or extreme rain event. This increased to 16% with 48-hour storms (10 of 61 stations) and to 18% (11 of 61 stations) for 72-hour storm periods. Extreme events appear to be less likely for 5- to 10-day periods, as indicated by the occurrence frequencies of 11% (7 of 61 stations) for 5-day periods and 7% (4 of 61 stations) for 10-day storm periods.

6. SEASONAL DISTRIBUTIONS OF HEAVY RAINFALL EVENTS

In the design of some hydrologic systems or structures, it is pertinent to know not only the frequency distributions of maximum storm rainfall amounts for various storm durations, but also the seasonal distribution characteristics of the heavy rainstorms. For example, a storm of intensity equivalent to a 5-year recurrence interval occurring in spring when the soil is near saturation may have different consequences than the same 5-year storm occurring in a drier summer month. Winter storms, generally producing less precipitation than summer storms, can be devastating if they occur over frozen ground. With or without snow cover, they can cause rapid flooding.

Consequently, it was decided to investigate the seasonal frequency distributions of heavy rainfall events, in addition to the standard type of frequency distribution derived from combining all storm data without regard to month or season. For this investigation, it was decided to study the four traditional seasons: winter (December-February), spring (March-May), summer (June-August), and fall (September-November).

Method of Analysis

In developing the frequency distributions of heavy rainfall events by season from the 1901-1983 sample, relations were determined for rain periods varying from 30 minutes to 10 days and for recurrence intervals of 1 year to 100 years. Frequency relations were computed for individual stations and for each of the ten climatic sections (figure 7), as was done for the total sample analysis in Section 3.

One problem faced in the seasonal analyses was the likelihood of substantially larger sampling errors (sampling variability) because of the division of the annual (total) sample into four seasons. Another concern was the derivation of accurate climatic trend factors for the smaller, more variable seasonal samples. An effort was made to minimize these problems by relating the seasonal frequency relations to those derived from the annual data in Section 3.

In doing this, seasonal frequency relations were developed from the raw data for each of the ten climatic sections. For each recurrence interval and rain period, the ratio of the seasonal to the annual rainfall value was calculated. These seasonal ratios were then used in conjunction with the annual frequency curves to obtain adjusted seasonal curves. The sectional ratios were also applied to the annual curves for each station within each section to obtain station (point) seasonal curves for the 61 Illinois stations. Spot-checking of the adjusted (annual-related) curves with those obtained directly from the seasonal data showed relatively small differences overall, but the adjusted curves provided a more logical and consistent pattern between the various recurrence intervals, rain periods, and climatic sections.

Table 27 illustrates the relations between summer and annual frequency distributions for 24-hour storm periods and recurrence intervals of 1 to 100 years in each of the ten climatic sections. The ratio

Table 27. Relations between Summer and Annual Frequency Distributions for 24-Hour Storm Periods and 1- to 100-Year Recurrence Intervals

Ratio, summer/annual for given recurrence interval

Section	*1 yr*	*2 yrs*	*5 yrs*	*10 yrs*	*25 yrs*	*50 yrs*	*100 yrs*
NW	.79	.83	.86	.88	.90	.91	.92
NE	.83	.86	.88	.91	.94	.96	.98
W	.80	.84	.88	.91	.94	.96	.98
C	.81	.82	.84	.85	.87	.88	.90
E	.82	.84	.87	.89	.92	.94	.96
WSW	.82	.83	.84	.85	.86	.87	.88
ESE	.79	.82	.85	.88	.91	.94	.96
SW	.69	.75	.82	.87	.91	.94	.96
SE	.72	.74	.77	.79	.81	.82	.84
S	.66	.69	.73	.77	.82	.86	.88

becomes progressively larger with increasing recurrence interval in each section. For example, in the northwestern section the summer 2-year frequency is 83% of the annual frequency. This increases gradually to 92% for the 100-year frequency. Thus the intensity of the seasonally derived storms approaches that of the annually derived storms as the recurrence interval lengthens.

Table 27 also shows a decrease in the ratio from north to south in the state. This decrease results from the seasonal variation in precipitation climate within Illinois. As discussed previously, in the extreme north, heavy rainfall events occur largely in the summer and seldom occur from mid-fall to mid-spring. In the extreme south, heavy rainfall events are more evenly distributed among the seasons than in central and northern Illinois. The ratios shown in table 27 are typical of the trends found for other storm periods in summer.

However, the north-south trend is reversed in the other seasons; that is, the ratios tend to increase from northern to southern Illinois in spring, fall, and winter with thunderstorms of increasing magnitude. The probability of a heavy rain event occurring in each of these seasons gradually increases southward. For example, in the winter, a heavy rainstorm with a 2-year or longer recurrence-interval value is very unlikely to occur at Chicago, but is not a rare event at Cairo. This is in close agreement with the average pattern of thunderstorms in winter in the state.

Spring Frequency Relations

Table 28 summarizes spring frequency relations for each of the ten climatic sections (zones) for storm periods of 30 minutes to 10 days and recurrence intervals ranging from 1 to 100 years. Appendix B provides similar information for each of the precipitation stations used in the present study. Figure 24 illustrates the spatial distribution characteristics of the spring frequency relations. These isohyetal maps for 24-hour storm periods having recurrence intervals of 2 to 100 years are typical of the isohyetal patterns associated with the various storm periods analyzed in the present study. They were derived from the station data in Appendix B. Isohyetal maps for other storm periods of interest to the user may readily be derived from this appendix. However, as pointed out in Section 3, the authors recommend the use of sectional relations rather than individual station values.

Most of the distribution characteristics of the 24-hour spring storms are similar to those shown in figure 15 (see pages 44-45) for 24-hour storms for all seasons combined. Both map sets show highs in southern and western Illinois and in the southwestern part of the state east of St. Louis. Lows are indicated on both map sets in northeastern Illinois (Waukegan region) and southwestward along or in the vicinity of the Illinois River valley.

Summer Frequency Relations

Sectional and individual station relations are shown for summer in table 29 and Appendix C, respectively. Illustrative isohyetal patterns similar to those for spring are shown in figure 25. The summer isohyetal patterns are even more similar to those derived from the total data sample in figure 15 than are the spring patterns. Summer storm events predominate in frequency and intensity, and therefore they exert a strong influence on the annual patterns.

Fall Frequency Relations

Sectional and station frequency distributions for fall, similar to those for spring and summer, are provided in table 30 and Appendix D, respectively. The fall isohyetal patterns are illustrated in figure 26, and again are very similar to the annual patterns (figure 15) with respect to major features.

Winter Frequency Relations

Sectional and station frequency relations for winter are given in table 31 and Appendix E, respectively. Figure 27 shows the typical isohyetal patterns of the winter frequency distributions based on 24-hour storms and recurrence intervals of 2 to 100 years. The winter patterns are characterized by relatively heavy amounts over extreme southern and southwestern Illinois and a general decrease from south to north in the state. The relatively pronounced low extending from Waukegan southwestward along or near the Illinois River valley on the annual, spring, summer, and fall maps is not apparent. Rather, that low appears to have been displaced farther to the north and northwest in winter. For a given recurrence interval, the amounts in extreme southern Illinois are nearly double those in the extreme northern part of the state in winter.

Seasonal Variations in Frequency Distributions

Major differences in the frequency distributions of heavy storm rainfall occur between seasons in each climatic section. Within seasons, large regional differences exist. The magnitude of the differences is illustrated in table 32 (page 94), which shows seasonal comparisons of 24-hour rainfall amounts for a 5-year recurrence interval in the ten climatic sections. In all but the south section, the most intense storms (heavier rainfall for a given recurrence interval) occur in summer. In the south, spring storms tend to be more intense than summer storms. As expected, winter storms are least intense for a given frequency in all sections. Spring and fall storms are nearly equivalent except in the northwest, west, and south sections.

The difference between summer and winter values generally decreases from north to south and from west to east. In the northwest section, the summer/ winter ratio is 2.44, compared with 1.54 in the southwest section. It is 2.38 in the west, compared with 2.02 in the east section. The differences between sections (statewide variation) are least in fall and greatest in winter. The ratios of maximum/ minimum amount are 1.91, 1.49, 1.23, and 1.18, respectively, for winter, spring, summer, and fall. The maximum difference in inches among the ten sections is 1.27 in winter (northwest, south), 1.17 in spring (northeast, south), 0.70 in summer (southeast, west), and 0.47 in fall (northeast, south). The foregoing statistics correspond strongly with the mean thunderstorm distribution.

Further investigation was made of the seasonal distribution characteristics by determining when those storms with recurrence intervals of 2 years or longer are most likely to occur. In doing this, counts were made of the qualifying storms in each season for storm periods of 24 hours to 10 days and recurrence intervals of 2, 10, and 40 years. The data were divided in this fashion to determine if the distribution changes as the recurrence interval increases.

Results for each of the ten climatic sections are summarized in table 33 (page 94). This table shows the percentage contribution of qualifying storms by season for the selected recurrence intervals. For example, for all storms having rainfall amounts equaling or exceeding a 2-year frequency value, table 33 shows winter contributing only 1% of the northwestern qualifying storms, whereas winter produced 21% of the total number in the southern section. Likewise, summer contributed 54% of all qualifying storms in the northwest and 25% of storms in the southern section. From the three analyses (2, 10, and 40 years), it was found that the ten climatic regions could be consolidated into four areas of similar seasonal response. These four areas were then used for further evaluation of seasonal distribution characteristics.

Table 34 (page 95) shows the criteria used to define four categories of seasonal contribution to heavy rainfall events. Figure 28 (page 95) shows the four regional divisions of the state and the ratings of the seasonal contributions to the total number of storms in the 1901-1983 data sample that have recurrence intervals of 2 years or longer.

Of the storms with recurrence intervals of 2 years or more, the storms in the northernmost area (northwest, northeast, and west sections) occurred predominantly in the summer. Fall made a moderate contribution to the number of storms, whereas spring and winter contributions were of little consequence. The central area (central, east, and west southwest sections) had a strong contribution from summer storms. Spring and fall made moderate contributions, whereas the winter contribution was still of little consequence. The south central area (east southeast, southwest, and southeast sections) had moder-

ate contributions of approximately equal amounts from spring, summer, and fall. Again, the winter contribution was small. The most southern area (south section) had a strong spring contribution and moderate contributions from the other seasons.

For very heavy storms, defined here as those with recurrence intervals of 40 years or longer, the northern area showed a very strong contribution from summer storms, followed by a moderate contribution from fall storms. Spring and winter had little effect. The central area had a very strong contribution from summer activity, along with a moderate contribution from fall storms, similar to the northern area. However, the influences of spring and winter storms were a little stronger than in the northern area.

The south central area lacked coherence, so the seasonal distribution can be described best by climatic section. The east southeast section showed a strong contribution from summer storms, a moderate contribution from spring and fall storms, and an insignificant winter contribution. The southwest section showed a very strong (81%) contribution from summer storms, with little contribution from storms in other seasons. The southeast section showed a very strong contribution from spring storms (62%) and moderate contributions from summer and fall storms.

The extreme southern area, represented by the south section, showed the strongest contribution from spring and fall storms.

In general, when moving from north to south, the season with the heaviest storms changes from summer in the north, to the warm spring through fall period across the large central portion of the state; in the extreme south, significant contributions are made by storms in all seasons. A primary force behind the intrastate storm distributions is the duration of the convection season, which is relatively short in northern Illinois but essentially present in all months in the extreme southern part of the state. Again, the seasonal distributions are strongly related to the pattern of thunderstorm occurrences in the state.

Table 28. Sectional Frequency Distributions for Storm Periods of 30 Minutes to 10 Days and Recurrence Intervals of 1 to 100 Years in Spring

Storm codes

1 – 10 days
2 – 5 days
3 – 72 hours
4 – 48 hours
5 – 24 hours
6 – 18 hours
7 – 12 hours
8 – 6 hours
9 – 3 hours
10 – 2 hours
11 – 1 hour
12 – 30 minutes

Sectional (zone) codes

1 – Northwest
2 – Northeast
3 – West
4 – Central
5 – East
6 – West Southwest
7 – East Southeast
8 – Southwest
9 – Southeast
10 – South

		Spring rainfall (inches) for given recurrence interval						
Storm code	*Zone code*	*1-year*	*2-year*	*5-year*	*10-year*	*25-year*	*50-year*	*100-year*
1	1	3.02	3.50	4.22	4.93	5.96	7.13	8.54
1	2	2.93	3.42	4.11	4.69	5.56	6.43	7.52
1	3	3.17	3.75	4.56	5.21	6.10	6.84	7.85
1	4	3.17	3.79	4.64	5.32	6.31	7.19	8.14
1	5	3.44	4.12	5.03	5.72	6.67	7.39	8.33
1	6	3.21	3.85	4.77	5.51	6.58	7.64	9.02
1	7	3.29	4.13	5.30	6.16	7.36	8.63	10.00
1	8	3.31	4.01	5.03	5.77	6.90	7.83	9.09
1	9	3.42	4.36	5.74	6.78	8.49	9.93	11.32
1	10	3.79	4.77	6.09	7.21	8.79	9.88	11.25

Table 28. Continued

Spring rainfall (inches) for given recurrence interval

Storm code	*Zone code*	*1-year*	*2-year*	*5-year*	*10-year*	*25-year*	*50-year*	*100-year*
2	1	2.31	2.81	3.52	4.20	5.31	6.33	7.58
2	2	2.20	2.59	3.19	3.70	4.57	5.34	6.47
2	3	2.45	2.92	3.54	4.12	4.96	5.80	7.04
2	4	2.64	3.09	3.83	4.42	5.44	6.40	7.45
2	5	2.53	3.05	3.77	4.37	5.34	6.15	7.15
2	6	2.53	2.97	3.78	4.46	5.51	6.48	7.74
2	7	2.61	3.21	4.10	4.83	5.97	7.03	8.30
2	8	2.61	3.21	4.04	4.82	5.99	7.10	8.41
2	9	2.59	3.27	4.29	5.33	6.88	8.43	10.15
2	10	2.91	3.64	4.77	5.77	7.10	8.22	9.64
3	1	2.03	2.47	3.09	3.69	4.67	5.56	6.66
3	2	1.99	2.34	2.93	3.42	4.23	4.96	5.87
3	3	2.08	2.53	3.17	3.76	4.64	5.44	6.51
3	4	2.24	2.68	3.33	3.94	4.87	5.73	6.69
3	5	2.14	2.60	3.29	3.85	4.75	5.51	6.34
3	6	2.25	2.67	3.39	4.03	4.99	5.74	6.78
3	7	2.25	2.72	3.48	4.04	4.98	5.81	6.83
3	8	2.29	2.80	3.54	4.19	5.23	6.25	7.41
3	9	2.26	2.80	3.69	4.60	6.06	7.57	9.12
3	10	2.58	3.31	4.32	5.27	6.56	7.73	8.87
4	1	1.80	2.19	2.74	3.27	4.13	4.93	5.90
4	2	1.84	2.18	2.70	3.17	3.94	4.65	5.53
4	3	1.87	2.31	2.87	3.42	4.22	5.02	5.94
4	4	1.98	2.37	3.02	3.60	4.39	5.16	6.01
4	5	1.89	2.35	3.00	3.53	4.36	5.06	5.80
4	6	1.99	2.41	3.11	3.70	4.58	5.27	6.14
4	7	2.02	2.45	3.15	3.71	4.56	5.33	6.30
4	8	2.08	2.55	3.25	3.84	4.76	5.52	6.45
4	9	1.95	2.45	3.36	4.20	5.54	6.80	8.09
4	10	2.34	3.00	3.97	4.81	6.10	7.23	8.35

Table 28. Continued

Storm code	Zone code	Spring rainfall (inches) for given recurrence interval						
		1-year	2-year	5-year	10-year	25-year	50-year	100-year
5	1	1.63	1.98	2.48	2.96	3.74	4.46	5.34
5	2	1.58	1.92	2.39	2.82	3.53	4.13	4.85
5	3	1.67	2.10	2.66	3.11	3.82	4.44	5.25
5	4	1.66	2.02	2.59	3.16	3.88	4.56	5.26
5	5	1.61	2.02	2.60	3.11	3.83	4.55	5.29
5	6	1.76	2.11	2.67	3.16	3.79	4.39	5.07
5	7	1.81	2.15	2.74	3.20	3.92	4.55	5.38
5	8	1.90	2.30	2.85	3.38	4.09	4.81	5.60
5	9	1.73	2.18	2.96	3.60	4.81	5.84	7.03
5	10	2.11	2.68	3.56	4.32	5.42	6.47	7.77
6	1	1.50	1.83	2.29	2.73	3.45	4.11	4.93
6	2	1.45	1.76	2.20	2.59	3.24	3.81	4.46
6	3	1.54	1.94	2.45	2.86	3.52	4.08	4.83
6	4	1.54	1.88	2.39	2.90	3.58	4.19	4.84
6	5	1.48	1.86	2.39	2.86	3.52	4.19	4.86
6	6	1.62	1.94	2.45	2.91	3.48	4.05	4.66
6	7	1.67	1.98	2.51	2.94	3.61	4.18	4.94
6	8	1.74	2.11	2.62	3.12	3.77	4.43	5.16
6	9	1.59	2.01	2.72	3.31	4.42	5.37	6.47
6	10	1.95	2.46	3.28	3.98	4.99	5.95	7.15
7	1	1.42	1.73	2.16	2.58	3.26	3.89	4.66
7	2	1.37	1.66	2.09	2.45	3.07	3.60	4.22
7	3	1.46	1.82	2.31	2.71	3.33	3.86	4.57
7	4	1.43	1.76	2.26	2.75	3.38	3.97	4.58
7	5	1.40	1.76	2.26	2.71	3.33	3.96	4.60
7	6	1.53	1.84	2.31	2.70	3.29	3.82	4.41
7	7	1.58	1.87	2.38	2.78	3.41	3.96	4.67
7	8	1.64	2.00	2.48	2.96	3.56	4.18	4.88
7	9	1.50	1.90	2.58	3.14	4.18	5.08	6.12
7	10	1.84	2.33	3.10	3.76	4.72	5.63	6.77
8	1	1.23	1.49	1.87	2.23	2.82	3.36	4.02
8	2	1.18	1.44	1.80	2.11	2.64	3.10	3.64
8	3	1.26	1.57	2.00	2.34	2.87	3.33	3.94
8	4	1.25	1.51	1.95	2.36	2.91	3.42	3.94
8	5	1.20	1.51	1.95	2.34	2.87	3.42	3.97
8	6	1.32	1.58	2.01	2.37	2.84	3.30	3.80
8	7	1.33	1.61	2.05	2.40	2.94	3.41	4.04
8	8	1.42	1.72	2.14	2.56	3.07	3.60	4.23
8	9	1.30	1.64	2.22	2.71	3.60	4.38	5.28
8	10	1.58	2.02	2.68	3.25	4.07	4.83	5.84

Table 28. Concluded

Storm code	Zone code	Spring rainfall (inches) for given recurrence interval						
		1-year	2-year	5-year	10-year	25-year	50-year	100-year
9	1	1.05	1.27	1.59	1.90	2.40	2.86	3.43
9	2	1.01	1.22	1.53	1.80	2.26	2.65	3.10
9	3	1.07	1.35	1.71	1.99	2.45	2.84	3.36
9	4	1.06	1.29	1.66	2.02	2.49	2.92	3.37
9	5	1.03	1.29	1.66	1.99	2.45	2.92	3.38
9	6	1.13	1.35	1.71	2.03	2.42	2.82	3.24
9	7	1.16	1.38	1.75	2.04	2.51	2.91	3.45
9	8	1.21	1.47	1.86	2.21	2.62	3.07	3.62
9	9	1.11	1.39	1.89	2.31	3.08	3.73	4.50
9	10	1.35	1.72	2.28	2.76	3.47	4.14	4.97
10	1	0.96	1.17	1.47	1.75	2.21	2.64	3.16
10	2	0.93	1.13	1.41	1.66	2.08	2.44	2.86
10	3	0.99	1.23	1.57	1.83	2.26	2.61	3.10
10	4	0.98	1.19	1.53	1.86	2.29	2.69	3.10
10	5	0.95	1.19	1.53	1.84	2.26	2.68	3.12
10	6	1.04	1.25	1.58	1.86	2.23	2.59	2.99
10	7	1.06	1.27	1.61	1.89	2.31	2.68	3.20
10	8	1.12	1.36	1.72	2.03	2.41	2.86	3.36
10	9	1.02	1.28	1.75	2.12	2.83	3.45	4.15
10	10	1.25	1.58	2.10	2.55	3.20	3.82	4.59
11	1	0.77	0.94	1.17	1.40	1.77	2.11	2.53
11	2	0.74	0.90	1.13	1.32	1.66	1.95	2.28
11	3	0.79	0.98	1.25	1.46	1.80	2.09	2.46
11	4	0.78	0.95	1.22	1.48	1.83	2.14	2.47
11	5	0.75	0.94	1.22	1.46	1.82	2.14	2.49
11	6	0.82	0.99	1.26	1.49	1.78	2.07	2.38
11	7	0.85	1.01	1.28	1.50	1.84	2.14	2.54
11	8	0.88	1.08	1.36	1.62	1.93	2.26	2.64
11	9	0.81	1.03	1.39	1.72	2.26	2.74	3.30
11	10	0.99	1.26	1.67	2.03	2.55	3.04	3.66
12	1	0.60	0.73	0.91	1.09	1.38	1.64	1.97
12	2	0.59	0.71	0.89	1.04	1.31	1.53	1.79
12	3	0.62	0.77	0.99	1.14	1.42	1.64	1.94
12	4	0.61	0.75	0.96	1.16	1.44	1.69	1.95
12	5	0.59	0.74	0.96	1.15	1.42	1.68	1.96
12	6	0.65	0.78	0.99	1.17	1.40	1.63	1.87
12	7	0.66	0.80	1.02	1.18	1.45	1.69	2.03
12	8	0.70	0.85	1.06	1.26	1.53	1.78	2.07
12	9	0.64	0.81	1.09	1.35	1.78	2.16	2.60
12	10	0.78	0.99	1.31	1.60	2.01	2.39	2.88

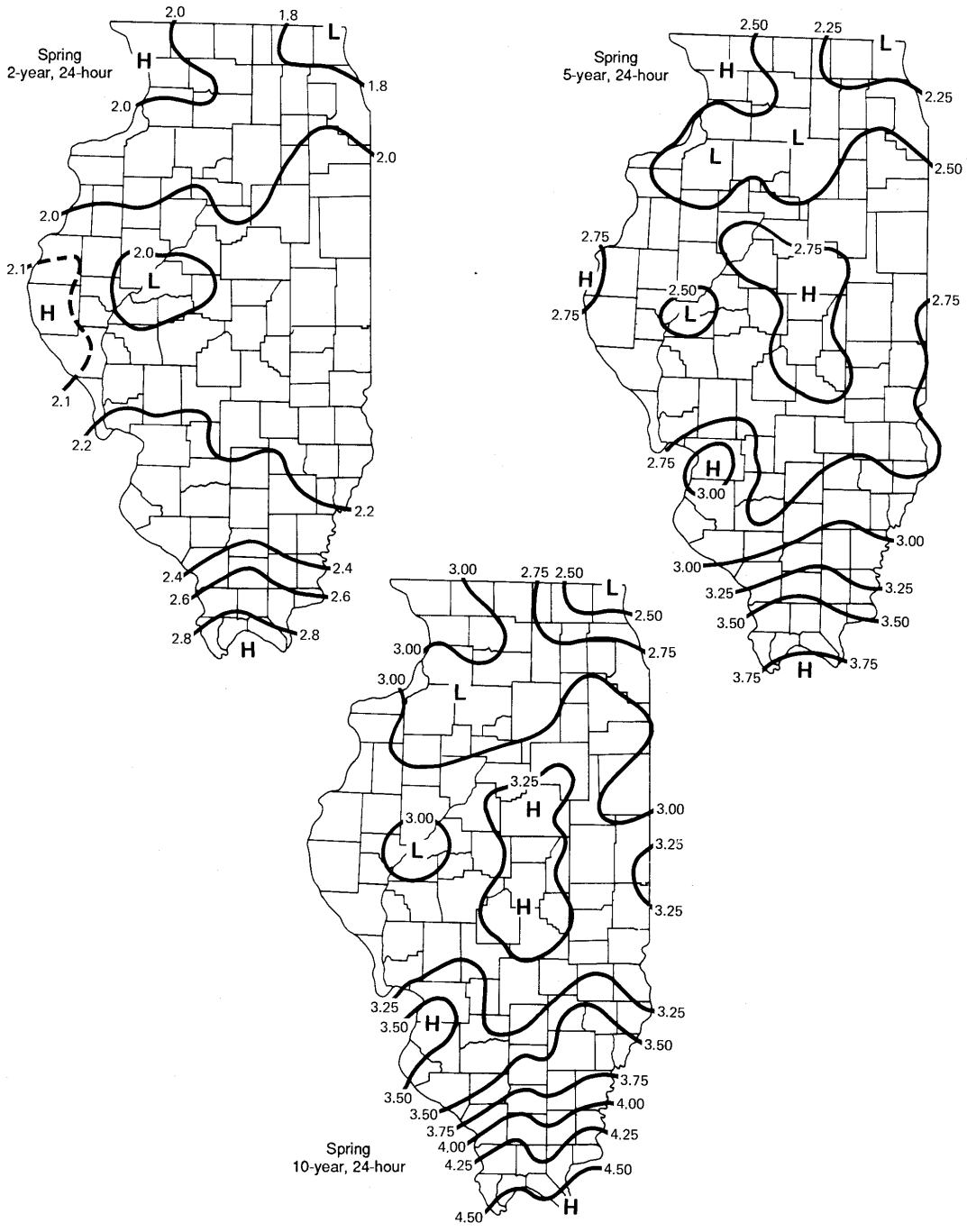

Figure 24. Isohyetal patterns (inches) of 24-hour rain periods in spring

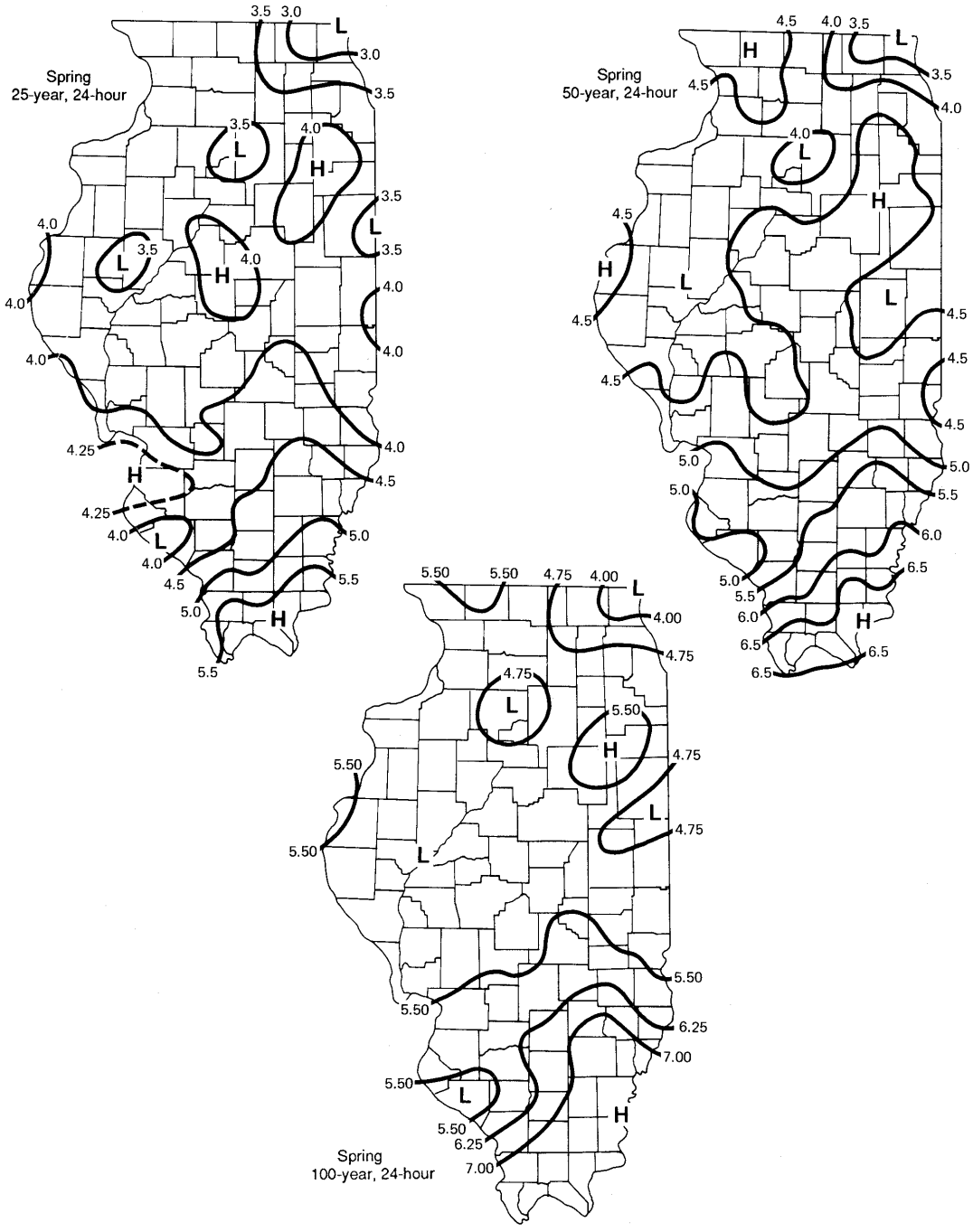

Figure 24. Concluded

Table 29. Sectional Frequency Distributions for Storm Periods of 30 Minutes to 10 Days and Recurrence Intervals of 1 to 100 Years in Summer

Storm codes

1 – 10 days
2 – 5 days
3 – 72 hours
4 – 48 hours
5 – 24 hours
6 – 18 hours
7 – 12 hours
8 – 6 hours
9 – 3 hours
10 – 2 hours
11 – 1 hour
12 – 30 minutes

Sectional (zone) codes

1 – Northwest
2 – Northeast
3 – West
4 – Central
5 – East
6 – West Southwest
7 – East Southeast
8 – Southwest
9 – Southeast
10 – South

		Summer rainfall (inches) for given recurrence interval						
Storm code	*Zone code*	*1-year*	*2-year*	*5-year*	*10-year*	*25-year*	*50-year*	*100-year*
1	1	3.71	4.50	5.48	6.35	7.63	8.97	10.54
1	2	3.30	4.11	5.25	6.20	7.53	8.72	10.48
1	3	3.86	4.82	6.15	7.26	8.69	9.84	11.42
1	4	3.32	4.10	5.27	6.11	7.21	8.19	9.37
1	5	3.48	4.27	5.28	6.06	7.24	8.19	9.32
1	6	3.39	4.23	5.49	6.41	7.71	9.01	10.70
1	7	3.48	4.35	5.51	6.47	7.79	8.92	10.22
1	8	3.22	4.16	5.44	6.63	8.28	9.81	11.57
1	9	3.14	3.96	5.18	6.13	7.44	8.54	9.67
1	10	3.26	4.20	5.47	6.59	7.96	9.09	10.25

Table 29. Continued

Storm code	Zone code	Summer rainfall (inches) for given recurrence interval: 1-year	2-year	5-year	10-year	25-year	50-year	100-year
2	1	2.86	3.47	4.44	5.26	6.56	7.77	9.17
2	2	2.60	3.22	4.17	5.02	6.38	7.56	9.36
2	3	2.86	3.70	4.93	5.85	7.35	8.59	10.29
2	4	2.70	3.33	4.24	4.96	5.99	6.94	8.10
2	5	2.80	3.38	4.22	4.93	6.02	6.96	8.08
2	6	2.72	3.32	4.30	5.15	6.47	7.68	9.14
2	7	2.72	3.39	4.32	5.13	6.43	7.63	8.98
2	8	2.53	3.26	4.31	5.26	6.84	8.31	10.26
2	9	2.59	3.18	4.07	4.88	6.09	7.24	8.56
2	10	2.54	3.29	4.34	5.19	6.25	7.09	8.22
3	1	2.56	3.17	4.02	4.77	6.06	7.11	8.25
3	2	2.41	2.98	3.82	4.61	5.88	7.11	8.60
3	3	2.57	3.35	4.45	5.22	6.59	7.74	9.21
3	4	2.44	3.00	3.83	4.53	5.51	6.45	7.43
3	5	2.60	3.15	3.98	4.58	5.55	6.48	7.52
3	6	2.50	3.02	3.98	4.77	6.02	7.06	8.30
3	7	2.33	2.87	3.71	4.52	5.81	6.98	8.37
3	8	2.32	2.92	3.89	4.76	6.27	7.75	9.36
3	9	2.22	2.74	3.49	4.20	5.34	6.34	7.43
3	10	2.31	2.96	3.84	4.65	5.50	6.58	7.62
4	1	2.32	2.87	3.72	4.41	5.54	6.48	7.40
4	2	2.24	2.77	3.52	4.28	5.48	6.56	7.87
4	3	2.38	3.09	4.13	4.91	6.10	7.21	8.46
4	4	2.19	2.67	3.44	4.13	5.14	5.96	6.83
4	5	2.35	2.86	3.62	4.25	5.09	5.97	6.88
4	6	2.31	2.82	3.62	4.32	5.53	6.41	7.45
4	7	2.15	2.67	3.41	4.15	5.31	6.41	7.76
4	8	2.07	2.66	3.53	4.37	5.87	7.07	8.63
4	9	2.03	2.53	3.30	3.91	4.94	5.91	6.91
4	10	2.14	2.66	3.55	4.33	5.30	6.28	7.32

Table 29. Continued

Summer rainfall (inches) for given recurrence interval

Storm code	*Zone code*	*1-year*	*2-year*	*5-year*	*10-year*	*25-year*	*50-year*	*100-year*
5	1	2.03	2.58	3.40	4.07	5.04	5.94	6.77
5	2	2.08	2.61	3.34	4.07	5.18	6.20	7.43
5	3	2.23	2.90	3.78	4.49	5.71	6.76	8.04
5	4	2.04	2.48	3.16	3.78	4.63	5.35	6.23
5	5	2.03	2.53	3.23	3.79	4.64	5.48	6.35
5	6	2.12	2.58	3.30	3.95	4.89	5.72	6.66
5	7	2.01	2.48	3.23	3.91	4.89	5.86	7.11
5	8	1.87	2.46	3.34	4.14	5.48	6.65	7.88
5	9	1.89	2.34	3.08	3.65	4.64	5.50	6.49
5	10	1.96	2.50	3.29	4.01	5.01	5.98	7.02
6	1	1.87	2.37	3.12	3.75	4.63	5.47	6.37
6	2	1.91	2.40	3.08	3.74	4.76	5.71	6.83
6	3	2.06	2.67	3.48	4.12	5.25	6.21	7.40
6	4	1.90	2.30	2.96	3.48	4.26	4.92	5.73
6	5	1.86	2.33	2.97	3.49	4.26	5.05	5.84
6	6	1.95	2.37	3.03	3.64	4.50	5.28	6.13
6	7	1.86	2.29	2.97	3.59	4.50	5.39	6.54
6	8	1.72	2.27	3.12	3.81	5.04	6.12	7.25
6	9	1.74	2.15	2.83	3.36	4.28	5.06	5.97
6	10	1.81	2.30	3.03	3.69	4.71	5.62	6.70
7	1	1.77	2.25	2.95	3.55	4.39	5.15	5.99
7	2	1.81	2.27	2.91	3.54	4.50	5.40	6.46
7	3	1.94	2.50	3.28	3.90	4.96	5.88	7.00
7	4	1.76	2.15	2.75	3.29	4.03	4.66	5.42
7	5	1.76	2.20	2.81	3.30	4.03	4.78	5.52
7	6	1.85	2.25	2.85	3.37	4.26	4.99	5.80
7	7	1.75	2.16	2.81	3.40	4.25	5.09	6.19
7	8	1.62	2.14	2.95	3.60	4.77	5.78	6.85
7	9	1.64	2.04	2.68	3.18	4.04	4.79	5.64
7	10	1.71	2.17	2.87	3.49	4.44	5.32	6.34
8	1	1.52	1.93	2.55	3.06	3.78	4.46	5.23
8	2	1.56	1.96	2.51	3.05	3.88	4.66	5.57
8	3	1.68	2.14	2.83	3.37	4.28	5.07	6.03
8	4	1.53	1.85	2.37	2.83	3.47	4.01	4.67
8	5	1.52	1.90	2.42	2.85	3.48	4.12	4.76
8	6	1.59	1.93	2.48	2.96	3.69	4.32	5.02
8	7	1.48	1.86	2.42	2.93	3.67	4.39	5.34
8	8	1.40	1.84	2.54	3.11	4.11	4.98	5.91
8	9	1.42	1.75	2.29	2.74	3.47	4.12	4.87
8	10	1.47	1.88	2.47	3.01	3.84	4.57	5.46

Table 29. Concluded

Summer rainfall (inches) for given recurrence interval

Storm code	*Zone code*	*1-year*	*2-year*	*5-year*	*10-year*	*25-year*	*50-year*	*100-year*
9	1	1.30	1.65	2.18	2.61	3.23	3.80	4.51
9	2	1.33	1.67	2.14	2.60	3.32	3.97	4.75
9	3	1.43	1.86	2.42	2.87	3.66	4.33	5.14
9	4	1.30	1.58	2.02	2.42	2.97	3.42	3.99
9	5	1.30	1.62	2.06	2.43	2.96	3.52	4.06
9	6	1.36	1.65	2.11	2.53	3.16	3.70	4.30
9	7	1.29	1.59	2.07	2.50	3.13	3.75	4.55
9	8	1.19	1.57	2.16	2.68	3.51	4.25	5.04
9	9	1.21	1.49	1.97	2.34	2.98	3.52	4.16
9	10	1.25	1.60	2.11	2.56	3.27	3.91	4.66
10	1	1.20	1.52	2.00	2.41	2.98	3.51	4.11
10	2	1.23	1.54	1.97	2.40	3.06	3.67	4.38
10	3	1.32	1.70	2.23	2.65	3.37	3.98	4.74
10	4	1.20	1.46	1.86	2.23	2.73	3.16	3.67
10	5	1.20	1.50	1.91	2.24	2.73	3.23	3.74
10	6	1.25	1.53	1.95	2.33	2.92	3.41	3.96
10	7	1.19	1.47	1.90	2.31	2.88	3.45	4.21
10	8	1.10	1.46	2.00	2.50	3.23	3.95	4.65
10	9	1.10	1.37	1.82	2.15	2.73	3.25	3.83
10	10	1.16	1.48	1.94	2.36	3.02	3.61	4.29
11	1	0.96	1.21	1.60	1.92	2.37	2.79	3.23
11	2	0.98	1.23	1.58	1.91	2.43	2.92	3.49
11	3	1.05	1.34	1.78	2.11	2.69	3.18	3.77
11	4	0.96	1.16	1.49	1.78	2.17	2.52	2.92
11	5	0.95	1.18	1.51	1.78	2.20	2.58	2.99
11	6	0.99	1.21	1.55	1.86	2.35	2.74	3.18
11	7	0.95	1.16	1.51	1.84	2.29	2.75	3.34
11	8	0.87	1.15	1.58	1.97	2.58	3.12	3.71
11	9	0.89	1.10	1.45	1.74	2.18	2.58	3.05
11	10	0.92	1.17	1.55	1.89	2.40	2.87	3.42
12	1	0.75	0.95	1.26	1.50	1.86	2.20	2.55
12	2	0.77	0.96	1.24	1.50	1.92	2.29	2.74
12	3	0.84	1.07	1.40	1.66	2.12	2.51	2.97
12	4	0.75	0.92	1.17	1.39	1.71	1.98	2.30
12	5	0.75	0.93	1.19	1.40	1.72	2.03	2.35
12	6	0.79	0.95	1.23	1.46	1.87	2.18	2.52
12	7	0.75	0.92	1.20	1.44	1.81	2.17	2.63
12	8	0.69	0.92	1.25	1.55	2.05	2.46	2.91
12	9	0.70	0.87	1.13	1.37	1.73	2.03	2.40
12	10	0.73	0.92	1.21	1.49	1.89	2.26	2.69

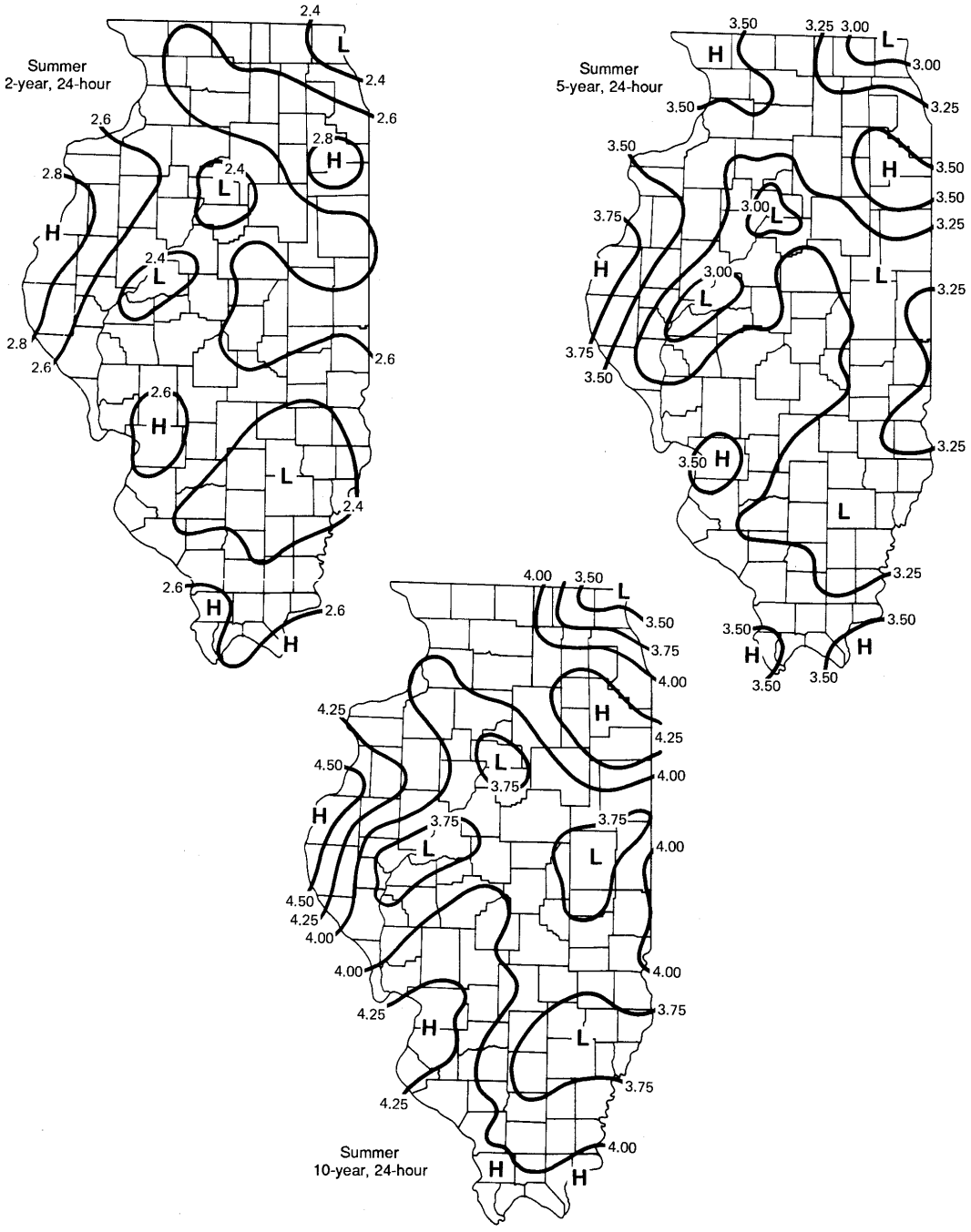

Figure 25. Isohyetal patterns (inches) of 24-hour rain periods in summer

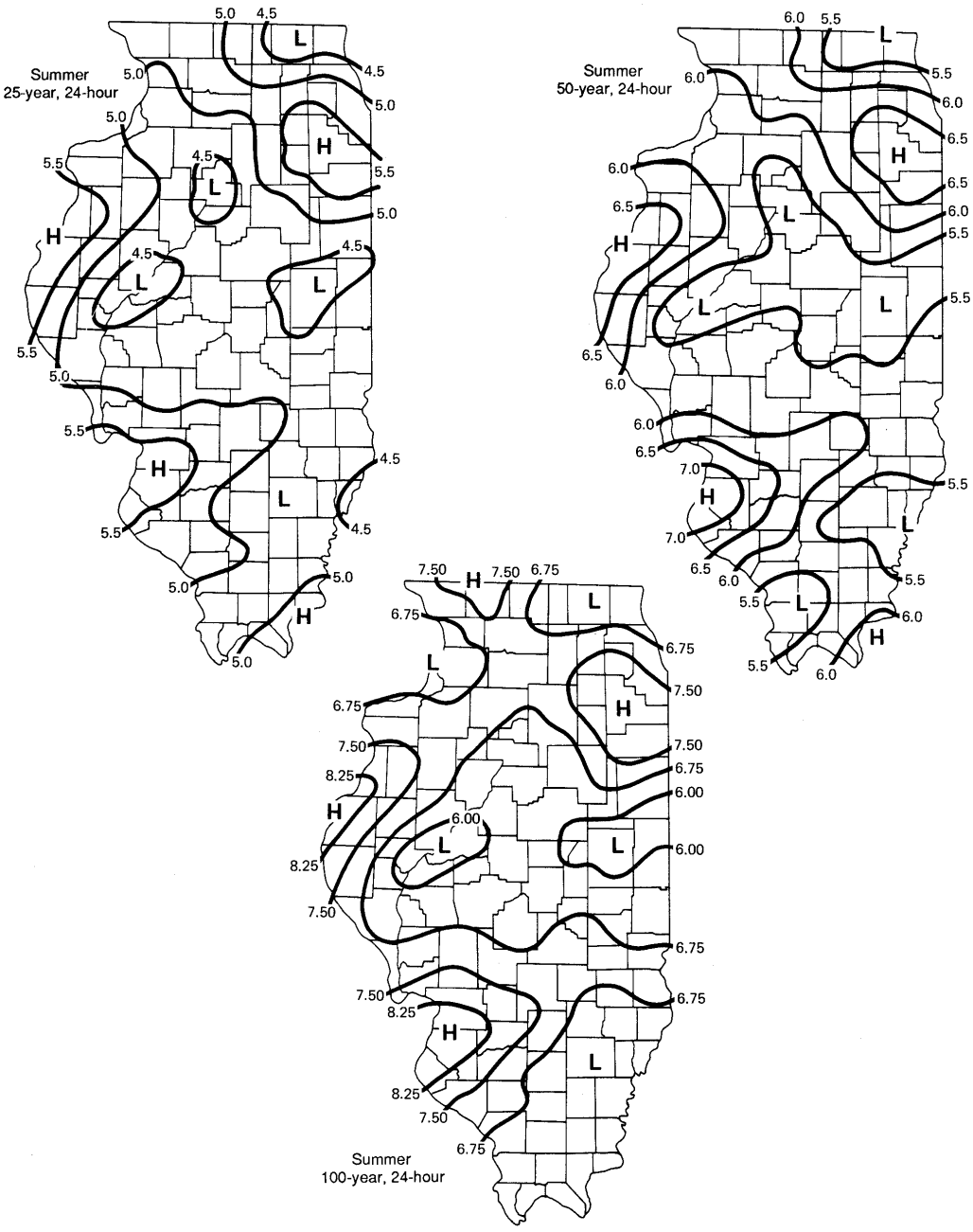

Figure 25. Concluded

Table 30. Sectional Frequency Distributions for Storm Periods of 30 Minutes to 10 Days and Recurrence Intervals of 1 to 100 Years in Fall

Storm codes

1 – 10 days
2 – 5 days
3 – 72 hours
4 – 48 hours
5 – 24 hours
6 – 18 hours
7 – 12 hours
8 – 6 hours
9 – 3 hours
10 – 2 hours
11 – 1 hour
12 – 30 minutes

Sectional (zone) codes

1 – Northwest
2 – Northeast
3 – West
4 – Central
5 – East
6 – West Southwest
7 – East Southeast
8 – Southwest
9 – Southeast
10 – South

		Fall rainfall (inches) for given recurrence interval						
Storm code	*Zone code*	*1-year*	*2-year*	*5-year*	*10-year*	*25-year*	*50-year*	*100-year*
1	1	2.75	3.45	4.46	5.44	6.80	7.91	9.20
1	2	2.47	3.17	4.29	5.24	6.54	7.69	9.02
1	3	2.81	3.58	4.84	6.08	7.85	9.32	10.95
1	4	2.66	3.38	4.58	5.58	7.04	8.19	9.57
1	5	2.61	3.24	4.37	5.31	6.75	7.83	9.13
1	6	2.86	3.53	4.73	5.81	7.36	8.62	9.91
1	7	2.95	3.57	4.62	5.58	7.00	8.05	9.24
1	8	3.01	3.69	4.69	5.54	6.82	8.04	9.45
1	9	2.99	3.67	4.82	5.81	7.25	8.54	10.02
1	10	3.10	3.94	5.15	6.14	7.86	9.32	10.88

Table 30. Continued

Fall rainfall (inches) for given recurrence interval

Storm code	*Zone code*	*1-year*	*2-year*	*5-year*	*10-year*	*25-year*	*50-year*	*100-year*
2	1	2.28	2.81	3.61	4.43	5.62	6.77	8.18
2	2	2.11	2.66	3.54	4.33	5.61	6.67	7.97
2	3	2.33	2.94	3.94	4.85	6.38	7.53	9.03
2	4	2.26	2.84	3.68	4.44	5.64	6.63	7.85
2	5	2.19	2.72	3.52	4.20	5.31	6.27	7.44
2	6	2.23	2.81	3.72	4.61	5.95	7.08	8.44
2	7	2.42	2.90	3.69	4.47	5.68	6.77	8.08
2	8	2.38	2.90	3.71	4.44	5.68	6.74	8.07
2	9	2.38	2.99	3.95	4.81	6.17	7.51	9.09
2	10	2.54	3.14	4.09	4.97	6.52	7.89	9.53
3	1	1.99	2.46	3.22	3.91	5.07	6.11	7.36
3	2	1.80	2.27	3.02	3.69	4.79	5.69	6.80
3	3	2.09	2.63	3.53	4.35	5.72	6.75	8.09
3	4	1.98	2.49	3.23	3.90	4.95	5.82	6.89
3	5	1.93	2.40	3.11	3.71	4.69	5.54	6.57
3	6	2.01	2.53	3.35	4.15	5.36	6.38	7.60
3	7	2.22	2.66	3.39	4.11	5.22	6.22	7.42
3	8	2.17	2.65	3.39	4.06	5.19	6.16	7.37
3	9	2.19	2.74	3.59	4.43	5.66	6.95	8.41
3	10	2.28	2.82	3.67	4.46	5.85	7.08	8.55
4	1	1.76	2.22	2.95	3.62	4.67	5.62	6.78
4	2	1.66	2.09	2.78	3.40	4.41	5.24	6.26
4	3	1.89	2.38	3.19	3.93	5.17	6.10	7.31
4	4	1.82	2.29	2.97	3.58	4.55	5.35	6.34
4	5	1.79	2.22	2.87	3.42	4.33	5.11	6.07
4	6	1.84	2.32	3.07	3.80	4.91	5.84	6.97
4	7	1.98	2.37	3.02	3.66	4.65	5.54	6.61
4	8	2.00	2.44	3.12	3.73	4.78	5.67	6.79
4	9	2.01	2.48	3.30	4.02	5.10	6.14	7.47
4	10	2.09	2.59	3.37	4.10	5.37	6.50	7.85

Table 30. Continued

Storm code	Zone code	Fall rainfall (inches) for given recurrence interval						
		1-year	2-year	5-year	10-year	25-year	50-year	100-year
5	1	1.57	2.05	2.73	3.38	4.31	5.19	6.24
5	2	1.52	1.92	2.55	3.12	4.04	4.80	5.74
5	3	1.77	2.24	3.00	3.69	4.86	5.73	6.88
5	4	1.62	2.03	2.63	3.17	4.03	4.74	5.61
5	5	1.59	1.98	2.56	3.05	3.86	4.56	5.41
5	6	1.65	2.08	2.75	3.41	4.40	5.23	6.24
5	7	1.82	2.18	2.77	3.36	4.26	5.08	6.07
5	8	1.80	2.20	2.81	3.36	4.30	5.10	6.11
5	9	1.83	2.24	2.92	3.56	4.57	5.50	6.65
5	10	1.88	2.32	3.02	3.67	4.81	5.83	7.04
6	1	1.45	1.89	2.50	3.11	3.97	4.79	5.77
6	2	1.40	1.77	2.35	2.87	3.72	4.43	5.29
6	3	1.64	2.07	2.77	3.41	4.49	5.29	6.35
6	4	1.49	1.87	2.42	2.92	3.71	4.36	5.16
6	5	1.46	1.82	2.35	2.80	3.55	4.19	4.97
6	6	1.52	1.91	2.53	3.14	4.05	4.82	5.74
6	7	1.67	2.00	2.55	3.09	3.93	4.68	5.58
6	8	1.66	2.02	2.58	3.09	3.95	4.69	5.61
6	9	1.69	2.07	2.69	3.27	4.21	5.06	6.11
6	10	1.73	2.13	2.78	3.38	4.43	5.36	6.48
7	1	1.37	1.79	2.37	2.94	3.76	4.49	5.44
7	2	1.32	1.67	2.22	2.72	3.52	4.18	5.00
7	3	1.54	1.95	2.61	3.21	4.23	4.99	5.98
7	4	1.41	1.77	2.29	2.76	3.51	4.13	4.88
7	5	1.39	1.72	2.23	2.66	3.36	3.97	4.71
7	6	1.42	1.79	2.37	2.94	3.79	4.51	5.38
7	7	1.58	1.89	2.41	2.92	3.71	4.42	5.28
7	8	1.57	1.92	2.45	2.93	3.75	4.45	5.33
7	9	1.60	1.95	2.54	3.10	3.98	4.79	5.78
7	10	1.63	2.02	2.63	3.20	4.19	5.07	6.13
8	1	1.18	1.55	2.04	2.54	3.23	3.89	4.77
8	2	1.14	1.44	1.91	2.34	3.03	3.60	4.30
8	3	1.33	1.68	2.25	2.77	3.64	4.30	5.16
8	4	1.21	1.52	1.97	2.38	3.02	3.55	4.20
8	5	1.19	1.48	1.92	2.29	2.90	3.42	4.06
8	6	1.24	1.56	2.07	2.57	3.31	3.94	4.70
8	7	1.36	1.63	2.08	2.52	3.20	3.82	4.55
8	8	1.35	1.65	2.11	2.53	3.23	3.83	4.59
8	9	1.38	1.68	2.19	2.67	3.43	4.12	4.99
8	10	1.41	1.74	2.27	2.76	3.62	4.38	5.29

Table 30. Concluded

Storm code	Zone code	Fall rainfall (inches) for given recurrence interval						
		1-year	2-year	5-year	10-year	25-year	50-year	100-year
9	1	1.01	1.32	1.75	2.17	2.76	3.33	4.12
9	2	0.97	1.22	1.63	1.99	2.58	3.07	3.67
9	3	1.14	1.43	1.92	2.36	3.11	3.67	4.40
9	4	1.04	1.30	1.69	2.04	2.59	3.04	3.61
9	5	1.02	1.27	1.64	1.96	2.47	2.92	3.47
9	6	1.06	1.33	1.76	2.18	2.82	3.35	3.99
9	7	1.16	1.39	1.77	2.14	2.72	3.25	3.88
9	8	1.15	1.40	1.79	2.14	2.74	3.25	3.89
9	9	1.18	1.43	1.87	2.28	2.93	3.52	4.26
9	10	1.20	1.49	1.94	2.36	3.09	3.74	4.52
10	1	0.93	1.21	1.61	2.00	2.55	3.06	3.74
10	2	0.89	1.13	1.50	1.83	2.38	2.83	3.38
10	3	1.05	1.32	1.77	2.18	2.87	3.38	4.06
10	4	0.95	1.20	1.55	1.87	2.38	2.79	3.31
10	5	0.94	1.17	1.51	1.80	2.28	2.69	3.19
10	6	0.97	1.22	1.62	2.01	2.59	3.08	3.68
10	7	1.08	1.29	1.64	1.99	2.52	3.01	3.59
10	8	1.06	1.30	1.66	1.99	2.54	3.02	3.61
10	9	1.08	1.31	1.72	2.09	2.69	3.25	3.92
10	10	1.11	1.37	1.78	2.16	2.84	3.43	4.15
11	1	0.74	0.97	1.28	1.59	2.03	2.44	2.93
11	2	0.72	0.90	1.20	1.47	1.90	2.26	2.70
11	3	0.83	1.05	1.41	1.74	2.28	2.69	3.23
11	4	0.76	0.96	1.24	1.50	1.90	2.23	2.65
11	5	0.75	0.93	1.20	1.43	1.81	2.14	2.54
11	6	0.77	0.97	1.29	1.60	2.06	2.46	2.93
11	7	0.85	1.02	1.30	1.57	2.00	2.39	2.85
11	8	0.84	1.02	1.31	1.57	2.01	2.38	2.85
11	9	0.86	1.06	1.37	1.69	2.15	2.58	3.12
11	10	0.88	1.09	1.42	1.73	2.26	2.74	3.31
12	1	0.58	0.75	1.01	1.25	1.59	1.94	2.29
12	2	0.56	0.71	0.94	1.15	1.49	1.77	2.12
12	3	0.66	0.83	1.11	1.37	1.80	2.12	2.54
12	4	0.60	0.75	0.97	1.17	1.49	1.75	2.07
12	5	0.59	0.73	0.95	1.13	1.43	1.69	2.01
12	6	0.61	0.77	1.02	1.26	1.63	1.94	2.31
12	7	0.68	0.81	1.03	1.25	1.59	1.89	2.26
12	8	0.67	0.81	1.04	1.24	1.59	1.89	2.26
12	9	0.68	0.83	1.07	1.33	1.69	2.03	2.46
12	10	0.69	0.85	1.11	1.35	1.77	2.14	2.59

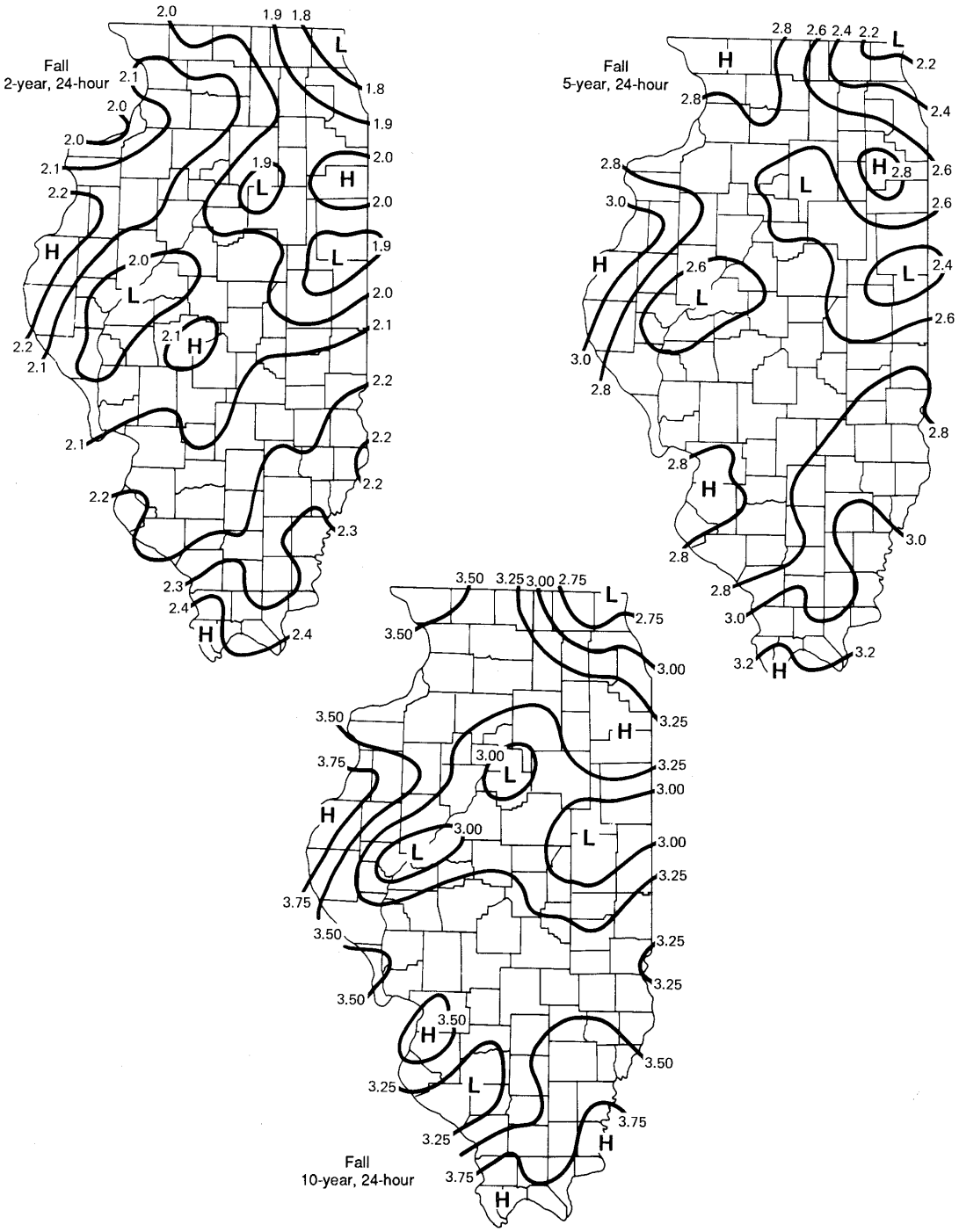

Figure 26. Isohyetal patterns (inches) of 24-hour rain periods in fall

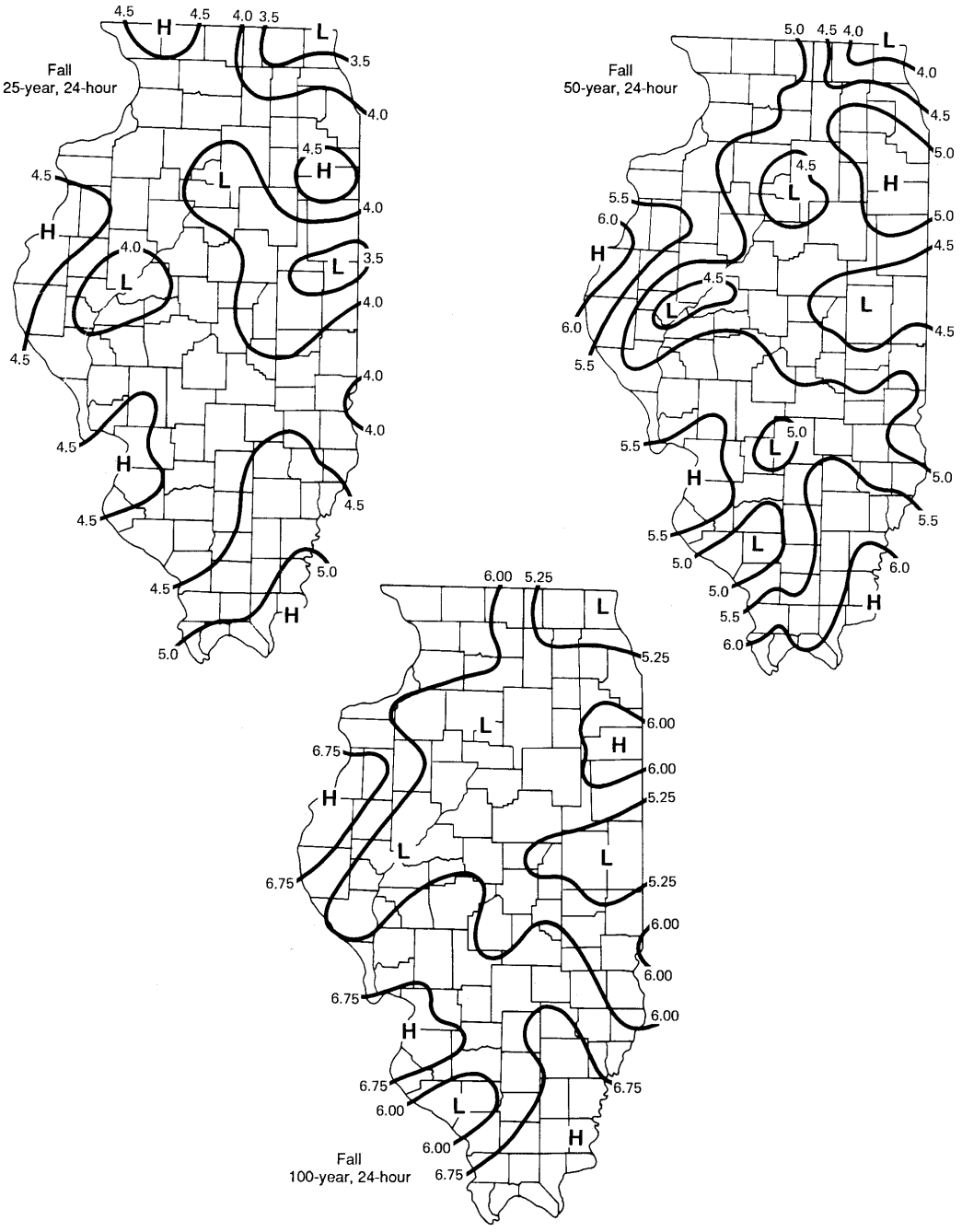

Figure 26. Concluded

Table 31. Sectional Frequency Distributions for Storm Periods of 30 Minutes to 10 Days and Recurrence Intervals of 1 to 100 Years in Winter

Storm codes

1 – 10 days
2 – 5 days
3 – 72 hours
4 – 48 hours
5 – 24 hours
6 – 18 hours
7 – 12 hours
8 – 6 hours
9 – 3 hours
10 – 2 hours
11 – 1 hour
12 – 30 minutes

Sectional (zone) codes

1 – Northwest
2 – Northeast
3 – West
4 – Central
5 – East
6 – West Southwest
7 – East Southeast
8 – Southwest
9 – Southeast
10 – South

Winter rainfall (inches) for given recurrence interval

Storm code	*Zone code*	*1-year*	*2-year*	*5-year*	*10-year*	*25-year*	*50-year*	*100-year*
1	1	1.53	1.83	2.33	2.78	3.44	4.15	4.88
1	2	1.57	1.92	2.48	3.03	3.84	4.60	5.34
1	3	1.70	2.07	2.69	3.23	4.07	4.97	6.07
1	4	1.72	2.10	2.82	3.48	4.59	5.55	6.72
1	5	1.91	2.32	3.04	3.69	4.58	5.34	6.25
1	6	1.94	2.35	3.05	3.65	4.68	5.58	6.64
1	7	2.32	2.90	3.74	4.52	5.54	6.40	7.39
1	8	2.27	2.83	3.74	4.60	5.80	6.99	8.27
1	9	2.80	3.48	4.40	5.36	6.49	7.26	8.25
1	10	3.21	4.01	5.23	6.41	8.07	9.32	10.75

Table 31. Continued

Storm code	Zone code	Winter rainfall (inches) for given recurrence interval						
		1-year	2-year	5-year	10-year	25-year	50-year	100-year
2	1	1.21	1.47	1.89	2.25	2.81	3.28	3.95
2	2	1.33	1.62	2.05	2.50	3.17	3.83	4.61
2	3	1.37	1.69	2.19	2.69	3.52	4.29	5.31
2	4	1.43	1.75	2.30	2.86	3.76	4.61	5.70
2	5	1.54	1.88	2.38	2.89	3.65	4.37	5.27
2	6	1.60	1.93	2.45	2.98	3.79	4.57	5.51
2	7	1.92	2.34	2.98	3.60	4.47	5.23	6.14
2	8	1.86	2.33	3.06	3.80	4.90	5.79	6.96
2	9	2.25	2.73	3.56	4.19	5.12	5.64	6.24
2	10	2.71	3.34	4.28	5.19	6.51	7.47	8.33
3	1	1.11	1.35	1.73	2.06	2.57	3.00	3.62
3	2	1.19	1.44	1.89	2.28	2.95	3.56	4.24
3	3	1.23	1.52	2.00	2.47	3.21	3.91	4.78
3	4	1.28	1.56	2.09	2.61	3.44	4.13	4.98
3	5	1.38	1.68	2.13	2.59	3.27	3.91	4.72
3	6	1.38	1.68	2.18	2.61	3.35	3.96	4.64
3	7	1.71	2.08	2.65	3.20	3.97	4.65	5.46
3	8	1.70	2.13	2.80	3.48	4.48	5.30	6.37
3	9	1.99	2.43	3.15	3.76	4.43	4.88	5.45
3	10	2.48	2.96	3.78	4.50	5.57	6.49	7.62
4	1	0.98	1.19	1.53	1.82	2.27	2.66	3.20
4	2	1.05	1.32	1.72	2.12	2.70	3.21	3.79
4	3	1.11	1.40	1.87	2.31	3.00	3.65	4.41
4	4	1.08	1.35	1.86	2.28	3.04	3.69	4.41
4	5	1.20	1.47	1.86	2.26	2.85	3.42	4.12
4	6	1.24	1.52	1.95	2.35	2.97	3.47	4.18
4	7	1.51	1.84	2.34	2.83	3.51	4.11	4.82
4	8	1.54	1.93	2.54	3.15	4.07	4.81	5.78
4	9	1.77	2.12	2.74	3.28	4.00	4.40	4.83
4	10	2.18	2.64	3.42	4.06	4.99	5.74	6.77

Table 31. Continued

Storm code	Zone code	Winter rainfall (inches) for given recurrence interval						
		1-year	2-year	5-year	10-year	25-year	50-year	100-year
5	1	0.89	1.08	1.39	1.65	2.07	2.41	2.91
5	2	0.86	1.09	1.44	1.79	2.26	2.65	3.18
5	3	0.88	1.14	1.59	2.00	2.52	2.95	3.45
5	4	0.93	1.18	1.58	1.96	2.55	3.04	3.74
5	5	1.04	1.26	1.60	1.94	2.45	2.94	3.54
5	6	1.09	1.31	1.61	1.91	2.34	2.78	3.20
5	7	1.26	1.53	1.95	2.36	2.92	3.42	4.02
5	8	1.32	1.65	2.17	2.69	3.47	4.11	4.94
5	9	1.44	1.74	2.20	2.59	3.13	3.49	3.87
5	10	1.72	2.06	2.66	3.18	3.92	4.62	5.29
6	1	0.81	0.98	1.26	1.50	1.87	2.19	2.63
6	2	0.78	1.00	1.33	1.64	2.07	2.44	2.93
6	3	0.82	1.05	1.46	1.83	2.32	2.71	3.19
6	4	0.84	1.07	1.45	1.80	2.35	2.80	3.44
6	5	0.95	1.16	1.47	1.78	2.25	2.70	3.25
6	6	1.00	1.20	1.48	1.75	2.15	2.56	2.95
6	7	1.11	1.36	1.73	2.09	2.59	3.04	3.56
6	8	1.21	1.52	1.99	2.47	3.19	3.77	4.53
6	9	1.33	1.60	2.02	2.38	2.88	3.21	3.56
6	10	1.59	1.90	2.45	2.92	3.62	4.25	4.87
7	1	0.75	0.91	1.17	1.39	1.74	2.03	2.45
7	2	0.74	0.95	1.26	1.56	1.96	2.30	2.77
7	3	0.77	0.98	1.38	1.74	2.19	2.56	3.01
7	4	0.80	1.02	1.37	1.70	2.22	2.64	3.25
7	5	0.90	1.10	1.39	1.69	2.13	2.55	3.08
7	6	0.94	1.14	1.39	1.63	2.03	2.42	2.79
7	7	1.04	1.26	1.61	1.94	2.41	2.83	3.32
7	8	1.14	1.42	1.87	2.32	2.99	3.54	4.25
7	9	1.25	1.51	1.91	2.25	2.72	3.04	3.36
7	10	1.50	1.80	2.32	2.76	3.41	4.02	4.61
8	1	0.65	0.79	1.01	1.20	1.50	1.75	2.11
8	2	0.64	0.82	1.08	1.34	1.69	1.99	2.39
8	3	0.66	0.85	1.19	1.50	1.90	2.21	2.60
8	4	0.70	0.88	1.18	1.47	1.92	2.28	2.80
8	5	0.78	0.95	1.20	1.46	1.84	2.20	2.66
8	6	0.81	0.98	1.21	1.43	1.76	2.09	2.40
8	7	0.91	1.12	1.42	1.72	2.13	2.49	2.93
8	8	0.98	1.23	1.61	2.00	2.58	3.05	3.66
8	9	1.08	1.30	1.65	1.94	2.34	2.62	2.90
8	10	1.29	1.56	2.00	2.39	2.95	3.45	3.97

Table 31. Concluded

Storm code	Zone code	Winter rainfall (inches) for given recurrence interval: 1-year	2-year	5-year	10-year	25-year	50-year	100-year
9	1	0.55	0.67	0.86	1.02	1.28	1.49	1.80
9	2	0.54	0.70	0.92	1.14	1.45	1.70	2.04
9	3	0.56	0.73	1.02	1.27	1.62	1.89	2.22
9	4	0.60	0.75	1.01	1.25	1.64	1.95	2.39
9	5	0.66	0.81	1.02	1.24	1.56	1.87	2.26
9	6	0.70	0.84	1.03	1.22	1.50	1.78	2.05
9	7	0.79	0.96	1.22	1.47	1.83	2.14	2.51
9	8	0.83	1.04	1.37	1.70	2.19	2.59	3.12
9	9	0.92	1.11	1.41	1.66	2.00	2.23	2.47
9	10	1.10	1.32	1.71	2.03	2.51	2.96	3.39
10	1	0.51	0.61	0.79	0.94	1.17	1.37	1.65
10	2	0.50	0.64	0.85	1.06	1.33	1.57	1.88
10	3	0.51	0.67	0.94	1.18	1.49	1.74	2.04
10	4	0.55	0.69	0.93	1.15	1.51	1.79	2.20
10	5	0.61	0.74	0.94	1.14	1.44	1.73	2.08
10	6	0.64	0.77	0.95	1.12	1.38	1.64	1.89
10	7	0.72	0.88	1.12	1.35	1.68	1.97	2.31
10	8	0.77	0.97	1.27	1.58	2.03	2.40	2.89
10	9	0.85	1.02	1.30	1.52	1.84	2.06	2.28
10	10	1.02	1.22	1.57	1.87	2.32	2.73	3.12
11	1	0.40	0.49	0.63	0.75	0.94	1.09	1.32
11	2	0.40	0.51	0.68	0.84	1.06	1.25	1.50
11	3	0.41	0.53	0.75	0.93	1.19	1.39	1.63
11	4	0.44	0.55	0.74	0.92	1.20	1.43	1.76
11	5	0.49	0.59	0.75	0.91	1.15	1.38	1.66
11	6	0.51	0.61	0.76	0.90	1.10	1.31	1.50
11	7	0.57	0.70	0.89	1.08	1.33	1.56	1.83
11	8	0.61	0.76	1.00	1.24	1.60	1.89	2.27
11	9	0.68	0.82	1.03	1.23	1.47	1.64	1.82
11	10	0.81	0.97	1.25	1.49	1.85	2.17	2.49
12	1	0.32	0.39	0.50	0.60	0.74	0.87	1.04
12	2	0.31	0.40	0.54	0.66	0.84	0.98	1.18
12	3	0.32	0.42	0.59	0.73	0.93	1.10	1.28
12	4	0.34	0.44	0.58	0.72	0.95	1.13	1.38
12	5	0.38	0.47	0.59	0.72	0.90	1.08	1.31
12	6	0.40	0.48	0.60	0.71	0.87	1.03	1.18
12	7	0.45	0.55	0.70	0.85	1.05	1.23	1.44
12	8	0.49	0.61	0.80	0.99	1.28	1.51	1.82
12	9	0.53	0.64	0.81	0.97	1.16	1.29	1.43
12	10	0.64	0.76	0.98	1.18	1.46	1.71	1.96

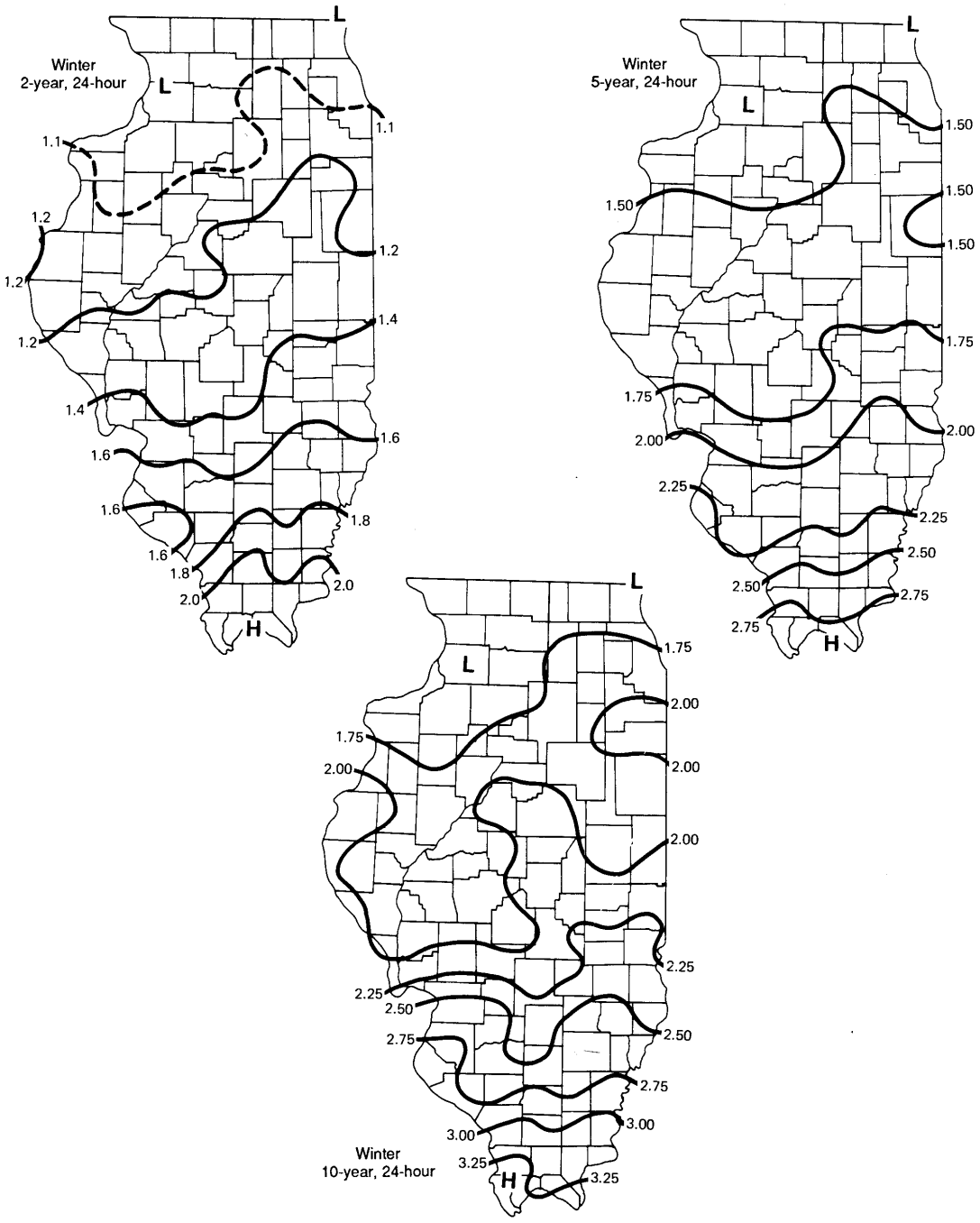

Figure 27. Isohyetal patterns (inches) of 24-hour rain periods in winter

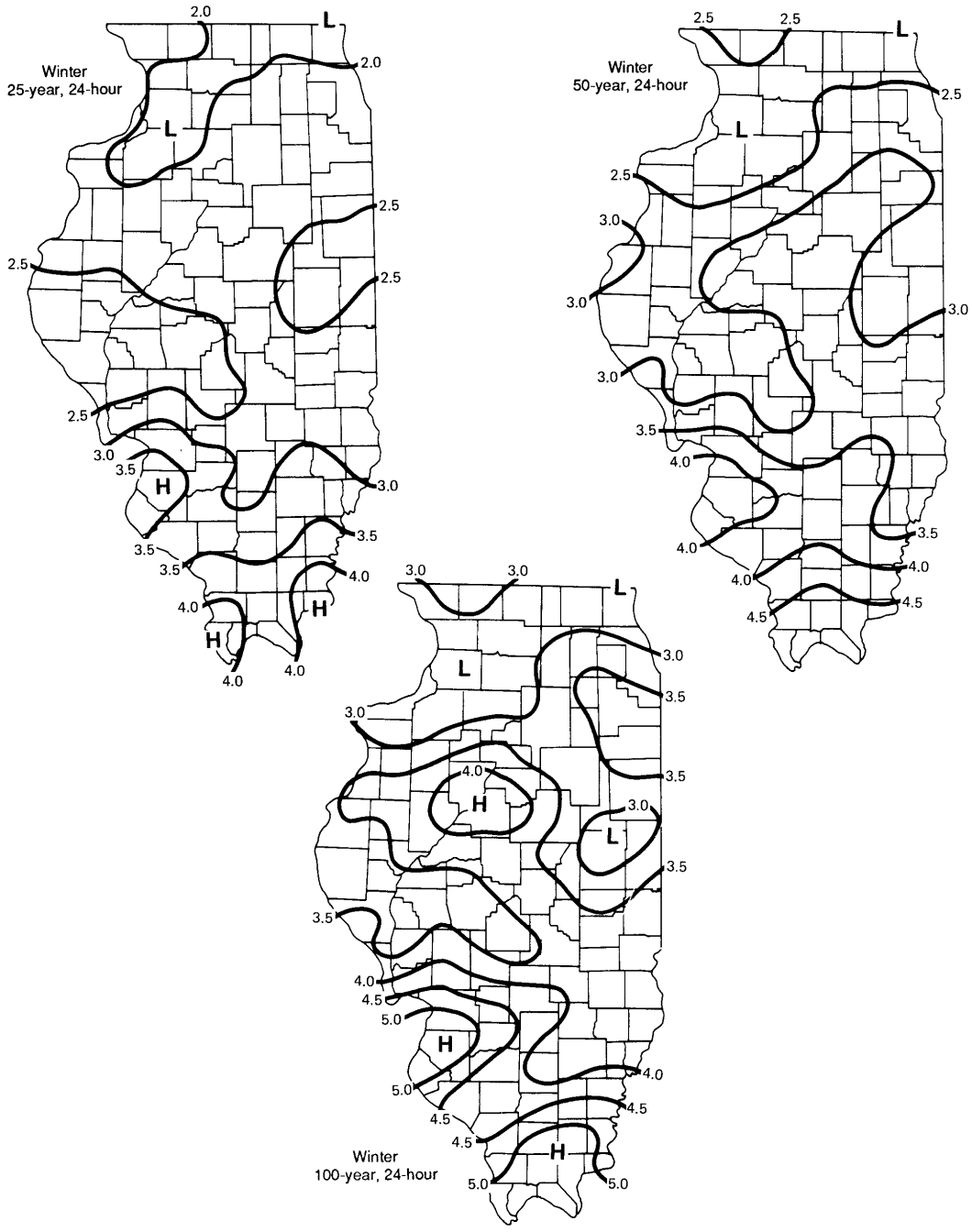

Figure 27. Concluded

Table 32. 24-Hour, 5-Year Rainfall Amounts in the Ten Climatic Sections during the Four Seasons of the Year

Climatic section	*Rainfall (inches) for given season*				*Ratio*
	Winter	*Spring*	*Summer*	*Fall*	*Summer / Winter*
NW	1.39	2.48	3.40	2.73	2.44
NE	1.44	2.39	3.34	2.55	2.32
W	1.59	2.66	3.78	3.00	2.38
C	1.58	2.59	3.16	2.63	2.00
E	1.60	2.60	3.23	2.56	2.02
WSW	1.61	2.67	3.30	2.75	2.05
ESE	1.95	2.74	3.23	2.77	1.66
SW	2.17	2.85	3.34	2.81	1.54
SE	2.20	2.96	3.08	2.92	1.40
S	2.66	3.56	3.29	3.02	1.24

Table 33. Average Percentage Contribution by Season of Combined Storms of 24-Hour, 48-Hour, 72-Hour, 5-Day, and 10-Day Durations

Recurrence intervals greater than or equal to 2 years

	NW	*NE*	*W*	*C*	*E*	*WSW*	*ESE*	*SW*	*SE*	*S*
Winter	1	3	3	6	4	5	9	12	15	21
Spring	14	14	13	23	24	25	27	27	30	36
Summer	54	53	54	43	48	41	38	37	27	25
Fall	31	30	30	28	24	29	26	24	28	20

Recurrence intervals greater than or equal to 10 years

	NW	*NE*	*W*	*C*	*E*	*WSW*	*ESE*	*SW*	*SE*	*S*
Winter	0	0	2	6	3	5	6	8	1	19
Spring	14	7	5	17	19	13	24	20	46	43
Summer	53	61	58	42	51	50	44	53	23	19
Fall	33	32	35	35	27	32	26	19	30	19

Recurrence intervals greater than or equal to 40 years

	NW	*NE*	*W*	*C*	*E*	*WSW*	*ESE*	*SW*	*SE*	*S*
Winter	0	0	0	9	4	7	0	3	0	5
Spring	16	0	3	9	11	7	18	4	62	43
Summer	56	76	60	46	56	56	50	84	15	8
Fall	28	24	37	36	29	30	32	12	23	44

Table 34. Criteria Used in Developing Four Categories of Seasonal Contribution to Heavy Rainfall Events

Percent contribution	*Category*
0 - 5	Insignificant
6 - 15	Weak
16 - 35	Moderate
36 - 100	Strong

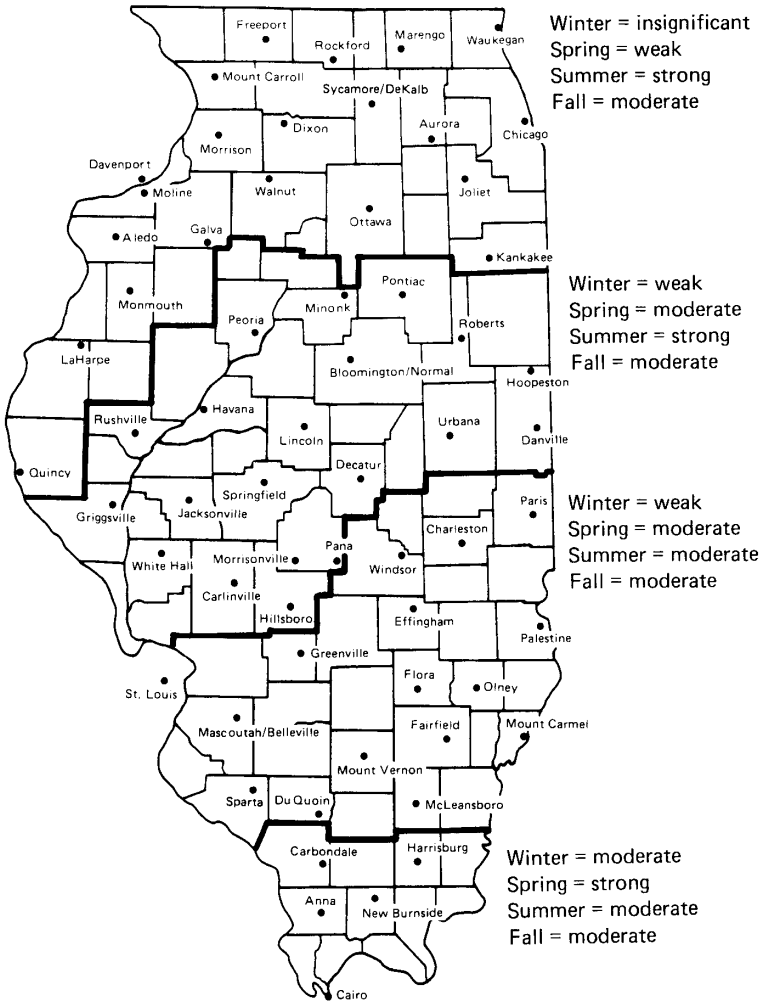

Figure 28. Categories (insignificant, weak, moderate, and strong) defining seasonal contributions to total number of rainfall events with recurrence intervals of 2 years or longer in four areas of Illinois