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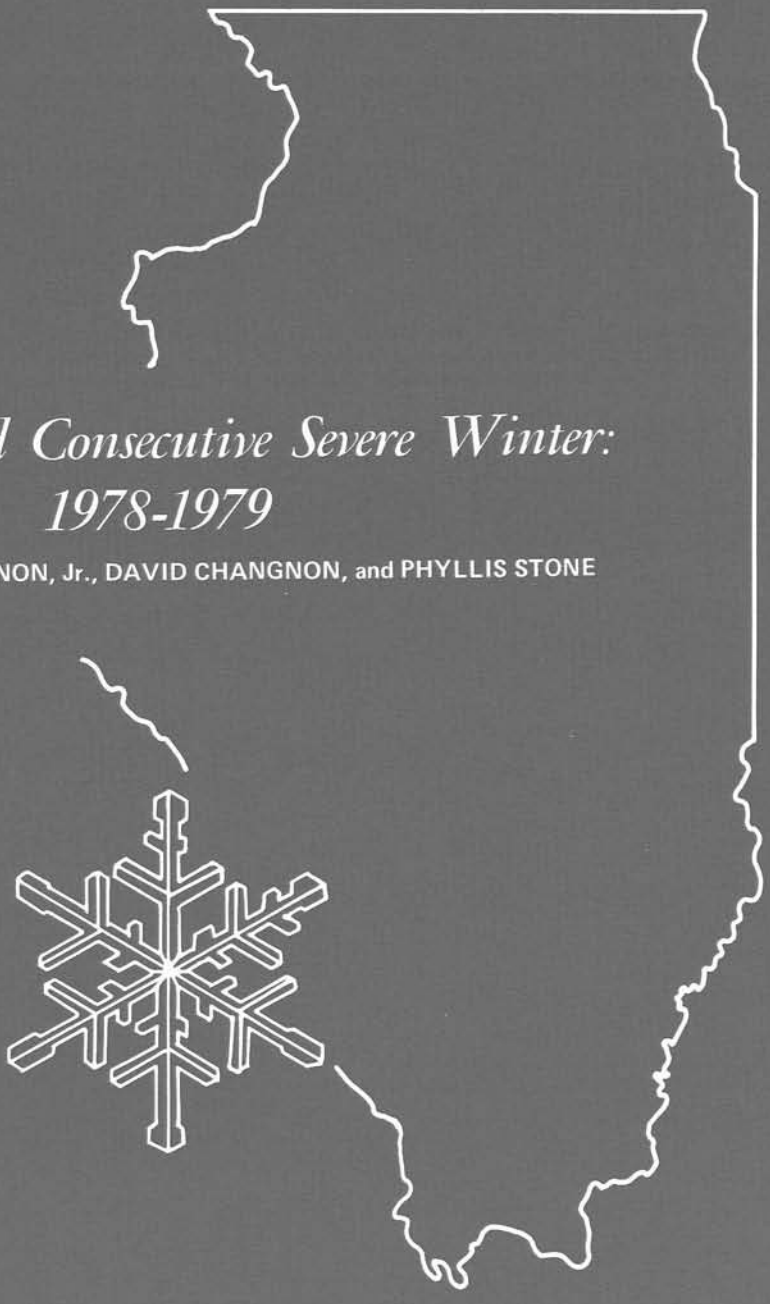

Illinois Third Consecutive Severe Winter: 1978-1979

by STANLEY A. CHANGNON, Jr., DAVID CHANGNON, and PHYLLIS STONE

ILLINOIS STATE WATER SURVEY

URBANA

1980

REPORT OF INVESTIGATION 94

Illinois Third Consecutive Severe Winter: 19784979

by STANLEY A. CHANGNON, Jr., DAVID CHANGNON, and PHYLLIS STONE

Title: Illinois Third Consecutive Severe Winter: 1978-1979

Abstract: For the first time since records began in the 1880s, a third consecutive severe winter occurred in Illinois in 1978-1979. Seventeen major winter storms, the state's record coldest January-February (15.9°F, or 14° below normal), and record snow depths (≥ 40 inches) gave the winter of 1978-1979 a rank as the second worst statewide for Illinois, exceeded only by the prior winter of 1977-1978 (18 storms, coldest statewide December-March, record longest lasting snow cover). The 1978-1979 winter was the worst on record in the northern fourth of the state, where snowfall averaged 68 inches and point record totals of up to 100 inches occurred. Average snowfall for the state was 42.8 inches, or 23.3 inches above normal. In other parts of the state snowfall averages were: 40 inches (20 above) north central, 32 inches (12 above) south central, and 31 inches (22 above) southern Illinois. Severe storms began in late November and extended into March; fourteen storms also had freezing rain, but ice was moderately severe in only two cases. High wind and blizzard conditions occurred in only three storms (compared with eight in prior winter), suggesting a lack of extremely deep low pressure centers. The 1978-1979 winter had a myriad of socio-economic impacts, the most serious ones in the Chicago metropolitan area. Surface and air transportation was hardest hit, but utilities, businesses and industries, institutions, farm operations, and many human activities were also affected. Ten deaths and at least 60 serious injuries were attributed to the storms.

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Indexing Terms: blizzards, glaze, heavy snow, ice storms, Illinois, lake effect, severe storms, snow, storm damages, synoptic analysis.

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Illinois Third Consecutive Severe Winter: 1978-1979

Stanley A. Changnon, Jr., David Changnon, and Phyllis Stone

ABSTRACT

For the first time since modern weather records began in the 1880s, a third consecutive severe winter occurred in Illinois in 1978-1979. Seventeen major winter storms, the state's record coldest January-February, and record snow depths on the ground gave the winter of 1978-1979 a rank as the second worst statewide for Illinois, exceeded only by the prior winter of 1977-1978 (18 storms, coldest statewide December-March, record longest lasting snow cover). In the northern fourth of Illinois, 1978-1979 was the worst winter on record.

Severe storms began in late November and extended into March; the seven major storms in January set a new record high for the month, the four in February tied the previous record, and the four in December fell one short of the record. Fourteen storms also had freezing rain, but ice was moderately severe in only two cases. High wind and blizzard conditions occurred in only three storms (compared with eight in prior winter), suggesting a lack of extremely deep low pressure centers. Most storms occurred with Texas lows, Colorado (north track) lows, and miscellaneous synoptic conditions. The super storm of 11-14 January set a point snow record of 24 inches, left snow cover of more than 3 inches over 77% of the state, and lasted 56 hours.

Snowfall for the 1978-1979 winter averaged 68 inches (38 inches above normal) in northern Illinois, 40 inches (20 above) in the north central part, 32 inches (12 above) in south central Illinois, and 31 inches (22 above) in southern Illinois. Record totals of 60 to 100 inches occurred in northern Illinois. The winter temperatures averaged 7.8 F below normal in northern Illinois and about 7 below in the rest of the state. January-February temperatures averaged a record low of 15.9 F, 14 degrees below normal, and prevented melting between storms so that record snow depths of more than 40 inches occurred in northern Illinois.

The 1978-1979 winter had a myriad of socio-economic impacts, the most serious ones in the Chicago metropolitan area. Surface and air transportation was hardest hit, but utilities, businesses and industries, institutions, farm operations, and many human activities were also affected. Ten deaths and at least 60 serious injuries were attributed to the storms. Highest dollar costs were for snow removal, roof repairs, and pothole repairs, but loss of business sales or services and absenteeism were also costly, as were several delayed impacts such as spring flooding.

INTRODUCTION

Record winter storms with resulting record totals of snowfall, accumulations of snow depth, and record cold occurred in Illinois during the winter of 1978-1979. Seventeen major winter storms occurred during a 3½-month period, and the state's record coldest January-February period produced an enormous economic impact in Illinois and great human suffering including at least 10 deaths. Ironically, this was the third consecutive severe winter in Illinois, the first time for such a series of events since detailed state weather records began in the 1880s, and this one was a unique combination of extreme cold and heavy snowfall.

It is not easy to identify a given winter as being

worse than any other over an area as large as Illinois, particularly when one assesses collectively the duration of the severe winter conditions, the amount of snowfall, accumulated snow depth, the number of severe winter storms, and the departures of the temperatures. However, by several standards, but not all, and in some areas of Illinois, the winter of 1978-1979 ranks as the worst since detailed weather records began about 100 years ago.

Coming in the aftermath of two prior severe winters (1976-1977 and 1977-1978), this third blow to the state's economy and its populace has had lasting impacts, particularly in the Chicago region, affecting many institutions and leading to considerable emigration from the state.

Climatologically, the occurrence of three consecutive extremely severe winters was unique, within the context of the 1880-1979 period. However, examination of statewide average temperatures since 1880 reveals that the state's average temperature steadily increased from 1880 to 1940 but has been declining since 1940, becoming particularly lower in the colder half year (October-March). In fact, statewide average temperatures in the 1970s matched those of the 1890-1910 period. Furthermore, the only somewhat comparable sequence of cold snowy winters during the 1880-1976 period occurred in 1903-1906. Thus, although the winter of 1978-1979 was very abnormal, and the occurrence of three bad winters in a row was a first, severe winters may become more frequent in the future, at least with respect to conditions of the 1920-1970 period.

Assessment of Severe Winters in Illinois

Severe winters in a continental climate such as that of Illinois are often identified by certain conditions, typically heavy snows and/or extremely cold temperatures. As noted in a prior study (Changnon and Changnon, 1978), one type of severe winter is based on those that have *extremely cold periods of 1 to 2 months duration,* either with or without much snowfall. Examples of such extremely cold, short winters of this type are the December 1976-January 1977 period with an avciage temperature of 17.0° F, and the December 1917-January 1918 period with a mean temperature of 16.8° F.

Interestingly, neither of these 2-month cold periods was associated with excessive snowfalls nor with prolonged winter seasons. The winter of 1978-1979 was similar in that it had two extremely cold months, January and February 1979. The average state temperature in this 2-month period was 15.9° F, the two coldest consecutive months on record (since 1880) in the state. However, the winter of 1978-1979 had heavy snows, unlike the 1917-1918 and 1976-1977 severely cold periods.

The other basic type of severe winter in Illinois is one with *severe ice storms and heavy snowfalls occurring repeatedly over a period of 6 weeks up to 12 weeks.* The prior winter of 1977-1978 was notable as having these frequent prolonged heavy snows (18 major storms) lasting from late November into late March. It did not have the prolonged (≥ 2 months) severe cold. The winter of 1978-1979 also qualified for the snowy winter type. It had 17 major winter storms (each with more than 4 inches of snow at a point in Illinois) between late November and mid-March 1979. Thus, the winter of 1978-1979 qualified as a severe winter by having both 1) two extremely cold months with temperatures averaging 14.0° F below normal, and 2) frequent storms resulting in excessively heavy snowfalls that became winter records in the northern fourth of the state. Thus, it qualified in both types of severe winters.

A major question is raised: "How does the winter of 1978-1979 rank among other severe Illinois winters, and particularly in regard to the two prior extremely severe winters?" With all factors considered, this third consecutive bad winter ranks as the second worst, on a state basis, since the first detailed and widespread weather records began in the 1880s. In the extreme northern parts of Illinois, the winter of 1978-1979 ranks as the worst, but on a statewide basis it ranks slightly behind the winter of 1977-1978. This ranking is based on consideration of the temperatures, number of storms, and the duration and depth of the snow cover.

Temperature/Snow Comparisons

A most interesting assessment of the 1978-1979 winter, when compared with those that have occurred since 1880, is offered by a direct comparison with the prior winter, 1977-1978 (table 1). Both had numbers of severe winter storms that exceeded

Table 1. Comparison of Recent Illinois Winters

1977-1978	*1978-1979*
Storm Characteristics	
Record total number of storms — 18	Second largest total of storms — 17
One super ice storm and 7 with ice	14 storms with ice, but only 2 moderately severe
Blizzard conditions — 8	Blizzard conditions — 3
Storm maximum totals (10 to 15 inches)	New record storm maximum snowfalls (20 to 24 inches)
Snow covered Illinois in 5 storms	Snow covered Illinois only once
Above average duration of storms — 18 hours	Record long-lasting storms — 24 hours
Super storm was 24-26 January	Super storm was **12-14** January
Relatively large number of Alberta lows and Colorado (south track) lows	Relatively large number of Texas lows and stationary fronts
Temperature	
Coldest Dec-Mar (22.4° at CHI 28.1 ° at MTV)	Second coldest winter (22.7° at CHI 29.7° at MTV)
No record cold for 2 months	Coldest Jan-Feb (15.9°F, 14°F below normal)
Few record low temperatures, but persistent below normal values	Several daily record lows
Snowfall	
Total snowfall in most of central and southern Illinois was record (35 to 70 inches)	Total snowfall in northern Illinois was record (60 to 100 inches)
Record longest-lasting snow cover — most of Illinois	Long lasting snow cover (record in northern Illinois)
Third or 4th greatest snow depths (>15 inches in southern Illinois)	Greatest snow depths on record (>40 inches)
Severity Assessment	
Record deaths — 62	Above normal deaths — 10
Damages widespread over state	Most damage in Chicago and northern Illinois
Record worst winter in southern 3/4	Record worst winter in northern 1/4
Worst winter ever on statewide basis	Second worst winter on statewide basis

1976-1977 Winter

1. Dec-Jan period was 3rd coldest 2-month period at 17.0° F
2. Record snows for January in central Illinois
3. Winter snows were 50% above normal in central and southern Illinois
4. Seventh worst statewide winter (1911-12,1917-18,1903-04, & 1959-60)

the pre-1977 record, and both had record total winter snowfall impacts. Their major differences were in the temperature records. The 1978-1979 winter had extremely low temperatures in two months, January-February, whereas the 1977-1978 winter had no comparable extremely cold 60-day period. The winter of 1978-1979 had more days with record low temperatures than occurred in 1977-1978. However, the statewide mean temperatures of the 1978-1979 winter season (December-March) ranked slightly behind (higher values) the record seasonal low set in 1977-1978.

For example, the Chicago (Midway) winter average temperature in 1978-1979 was 22.7°F, which is only 0.3° F higher than the record seasonal low of 1977-1978 (22.4° F) and the second coldest winter on record at Chicago since 1855. At Urbana, the 1978-1979 winter average temperature was 24.9° F, 1.4° F above the record of the prior winter (23.5°), which was the seasonal coldest since records began in 1888. Mt. Vernon, in southern Illinois, had a winter mean temperature of 29.7° F, 1.6° below the record low set at Mt. Vernon for 1977-1978.

The 1978-1979 winter temperatures at points across Illinois were generally 7 to 8°F below 1941-1970 normals, being relatively colder in the north than in the south. Temperatures throughout Illinois

in January and February were generally 13 to 14° F below normal. In December and March, the northern third of Illinois also had below normal temperatures (4.0° F below in December and 1.0° F below in March), but in southern Illinois the December and March temperatures were normal.

As noted above, the 1977-1978 winter had a longer period of below normal temperatures, lasting from early December through March. Consequently, this bad winter had a more prolonged period of snow on the ground than existed in the winter of 1978-1979. However, the heavy snowfalls of 1978-1979 coupled with the extremely low temperatures in January-February 1979 produced greater snow depths (less melting between storms), particularly in the northern third of Illinois. Thus, snow cover (depth) in 1979 caused more structural damage due to the greater weight of the snow than in the 1977-1978 winter.

As shown in Changnon and Changnon (1978), the 1977-1978 snow cover greater than 1 inch in northern, central, and southern Illinois persisted from late November through the end of March, ranging from 2 to 16 inches in depth. In the 1978-1979 winter, snows that fell in central and northern Illinois in early December produced snow cover with at least 1 inch depth, lasting until mid-March, a 3-week shorter period than in 1977-1978. However, depths of snowfall by early January 1979 had reached 10 to 20 inches in all of northern Illinois, achieving depths of up to 40 inches in extreme northern Illinois by mid-January. Snow depths remained above 20 inches from the middle of January until the end of February throughout the northern third of the state. Needless to say, the two winters were the worst back-to-back winters in the past 100 years, the period of quality weather records for most of the state.

Figure 1 summarizes the temperature and snowfall values for the winter (December-March) of 1978-1979. The snowfall totals in the northern fourth of the state were largely in excess of 60 inches, and were new records, exceeding by anywhere from 2 to 12 inches (at a point) the record high values set in the prior winter. The heaviest total snowfall, greater than 100 inches, fell at Antioch. Also shown in figure 1 are the average winter temperatures for the 4-month period. Note that the temperatures in the extreme northwestern corner of the state were new record lows.

Regional Analysis

Another assessment of the 1978-1979 winter was made by studying the state on a regional basis. The state was divided into four areas shown in figure 2. The areas were formed along the east-west oriented boundaries of crop reporting districts, and then the values of some 20 stations in each area were averaged. Regional calculations were made (for December-March) of mean temperature and total snowfall, and then of their departures from normal. The resulting values and their departures appear on figure 2. The northern area's mean temperature was 20.0° F which was 7.8° F below normal. The area's average snowfall was 67.9 inches, being 38.3 inches above normal, or more than double the 1941-1970 normal. Inspection of the other areas reveals that temperature departures were slightly less below normal in the southern part of Illinois (—7.0°F) than in the northern fourth. Mean snowfall in the south central area was 31.7 inches, representing the least departure, being 12.2 inches above normal. The excesses of both temperature and snowfall in the southern three-fourths of Illinois occurred largely in January and February with near normal temperatures and snowfall in December and in March. However, the severe winter conditions arrived earlier in the northern fourth. For example, the northern area averaged 22.4 inches of snow in December, 14 inches above normal. The state's average snowfall in the winter was 42.8 inches, which was 23.3 inches above normal, or more than twice the normal.

As shown in figure 1, the excessive snowfall in northern Illinois ranked as the greatest snow totals on record, exceeding the record highs set there in the prior winter, 1977-1978. The total snowfall values in the western and central areas typically ranked as the second or third highest on record. Snowfalls in 1978-1979 at south central locations, such as Effingham, Lawrenceville, and Greenville, typically ranked as the fourth or fifth highest in the past 100 years. However, the relatively heavier snowfalls in the extreme southern fourth of Illinois ranked as the second or third highest on record at places like Mt. Vernon, Du Quoin, and McLeansboro.

The state experienced 17 severe winter storms, each of which produced 4 inches or more snowfall somewhere in the state. Six of these storms were accompanied by extensive freezing rain. This was one less severe winter storm than the record number

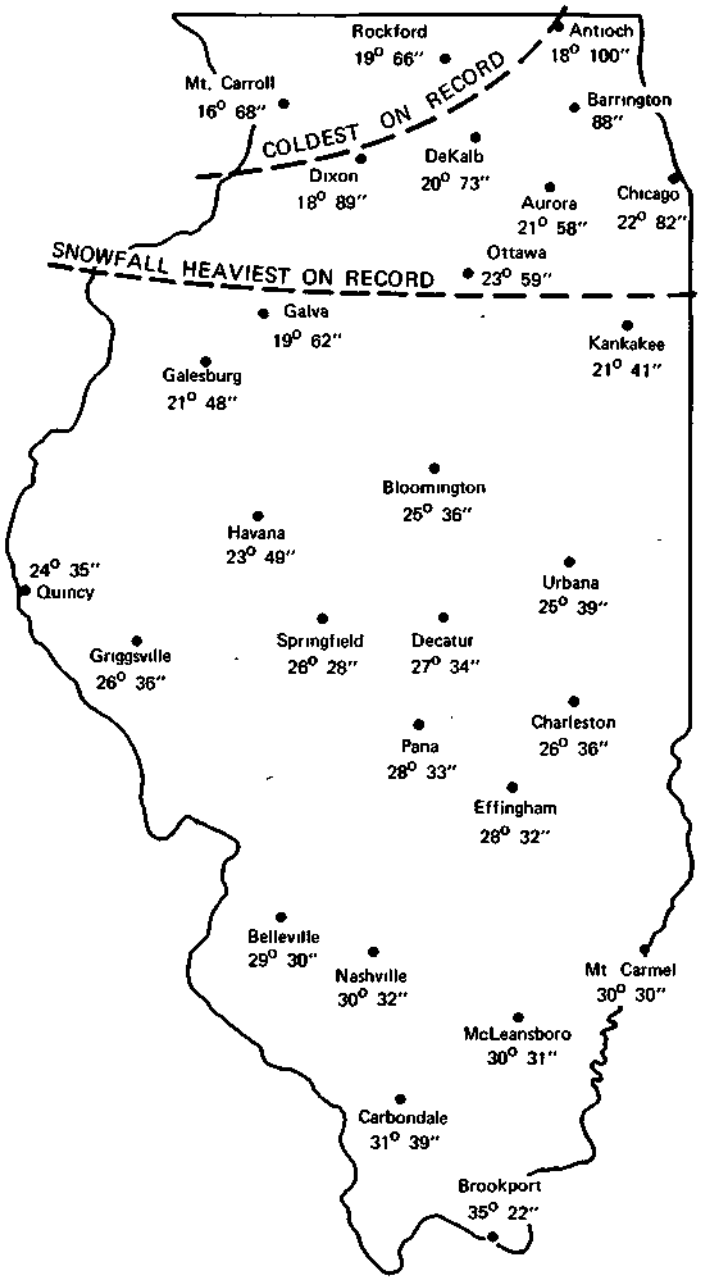


Figure 1. Temperature and snowfall values for the winter (December-March) of 1978-1979

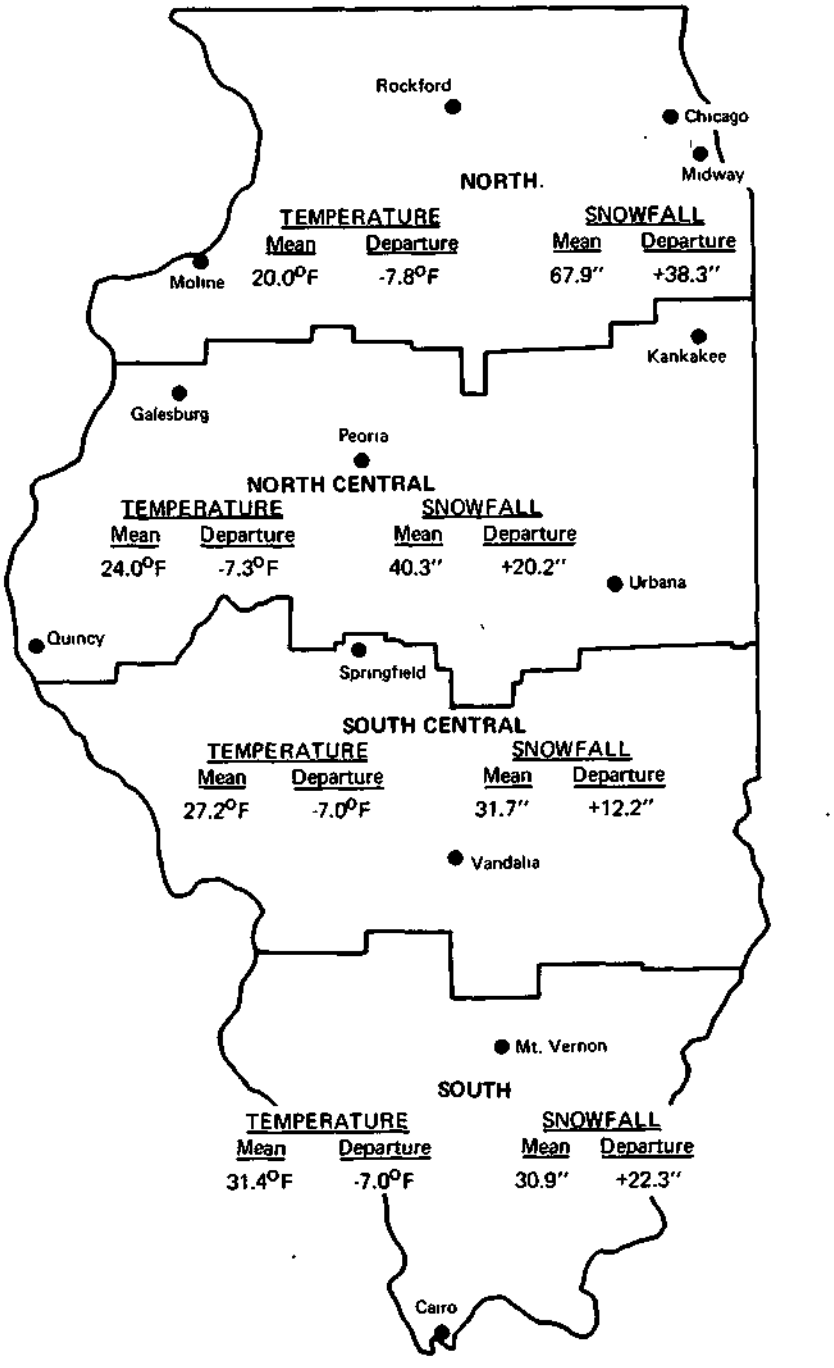


Figure 2. Regional mean temperatures and total snowfall and their departures from normal, winter of 1978-1979

of 18 that occurred in 1977-1978 (Changnon and Changnon, 1978). All locales in the state experienced four or five severe storms in 1978-1979 with a high frequency of severe storms in the northern fourth (nine storms) and southern fourth (six storms) of the state. Examples of places that had large numbers of extreme storms are revealed by snowfalls at Chicago O'Hare Airport. The sequence of storms at that location included 5.2 inches on 26 November, 9.5 inches on 1-2 December, 5.4 inches on 6-8 December (20.1 inches in 13 days), then 17.0 inches in two late December storms, and 31.8 inches in 4 storms in 14 days (11-24 January). Locales in extreme southern Illinois, where total winter snowfall is typically 10 to 12 inches, also had unbelievable sequences of heavy storms. For example, Marion had 9 inches in two late January storms and then 21 inches in a late February storm.

The state had three periods of very severe storms. In the northern third of Illinois, there was a series of three severe storms in late November and early December. This area and central Illinois were hard hit in the last five days of December with two major storm systems. The state's third and worst sequence of storms occurred during 11-28 January when five storms crippled most of the state. These stormy periods and their severest storms are discussed in the next section.

Notable Severe Winter Storms and Storm Periods

The first of a series of three major stormy periods occurred during 26 November-8 December 1978. Three storms were concentrated in the northern fourth of Illinois during this period with more than 5 inches of snow produced by each storm and with narrow belts of heavy snow occurring in and westward from Chicago. The second of these three storms, which occurred on 1-3 December and produced 13.3 inches of snow at Dixon, was rated as the fifth worst of the 17 storms of the 1978-1979 winter. The third and final storm of this 12-day stormy period occurred on 6-8 December. It too was an extremely damaging storm. The storm was preceded by thunderstorms followed by freezing rain over most of the state and then widespread heavy snow over the northern third of Illinois (16,500 square miles had more than 6 inches of snow). The layer of ice followed by heavy blowing snows ranked this as the third worst of the winter's 17 storms. At the end of this 12-day period, northern Illinois had suffered through three successive severe storms and was covered by more than 6 inches of snow which only partially melted before the next series of severe storms began 3 weeks later, in late December.

The winter's second stormy period lasted only five days and consisted of basically two major storm periods. However, nearly continuous snow occurred over the period in much of northern Illinois. This was the second stormy siege in the northern third of Illinois, but also there was an extremely damaging ice storm in central Illinois. The storm on 31 December-1 January produced up to 21 inches of snow at Marengo and more than 6 inches of snow over 23,000 square miles (nearly half of Illinois). This storm, rated as the second worst of the winter, led to a near stoppage of air, rail, and surface vehicle travel in most parts of central and northern Illinois for several days. Two lesser snow storms occurred in southern Illinois during 4-7 January, becoming the winter's first storms of any consequence in that area.

The third and worst period of storms of the winter began on 11 January and ended on 28 January. This 18-day period had five major winter storms all maximizing in either northern or central Illinois. The first of the five storms, on 11-14 January, was the worst of the winter. Snowfall lasted on the average 56 hours in the major snow belt of northern Illinois, and the maximum fall was 24 inches at Barrington. More than 6 inches of snow fell over 31,000 square miles, 60% of the state. At the end of this 2½-day storm, most of the state was at a standstill. All transportation in northern Illinois was cut off and business and industry were severely crippled. Four days later, a second storm hit extreme northern Illinois (6 inches at Rockford), and in the subsequent two days (20-21 January) another storm occurred but in central and southern Illinois.

The fourth storm of the period focused on northeastern Illinois, producing 10 inches at McHenry and more than 6 inches over 13,000 square miles of the state. Blizzard conditions existed north of a line from St. Louis to Danville with freezing rain to the south. This ranked as the fourth worst of the winter. During this 18-day stormy period, which ended with a 2-day storm on 26-28 January cen-

tered in south central Illinois, the accumulated snow was producing excessive damages. Roofs of garages, homes, and buildings were sagging and collapsing, particularly in the northern third of Illinois. Transportation was either stopped or minimal through this 18-day period, particularly in the northern half of Illinois. The state was truly a disaster area as record January low temperatures, averaging 14° F below normal, persisted throughout the month.

After this third stormy period, Illinois had five more severe winter storms which were scattered throughout February and early March. The only storm of consequence in this group was that of 24-25 February which struck extreme southern Illinois. A severe ice storm preceded the snowfall which produced up to 20 inches at Marion and Anna, and brought great damage to the extreme southern end of the state.

Some of the immediate impacts of the storms during this period are illustrated in figure 3. These headlines from papers in the northern, central, and southern parts of the state reveal the kinds of immediate problems the citizens and institutions of Illinois were experiencing during December and January. Counties in the northern third of Illinois were declared disaster areas by the Governor by mid-January, and southern Illinois counties were declared disaster areas after the late February storm.

The combination of the heavy storms, particularly in northern Illinois, from early December through late January, coupled with the extremely cold temperatures in December, January, and February (which minimized snowmelt) resulted in record accumulations of snow depth. Snow depths greater than 24 inches and ranging up to 40 inches existed throughout the area north of the line from Galesburg to Kankakee in late January. These record depths exceeded prior records by 5 to 15 inches at most locales. The weight of the water exceeded design values on many structures producing damages resulting in leaks along wall lines and in some instances, collapse of the roofs. The snow cover lasted in northern Illinois from late November through mid-March ranking as the longest period of greater than 1 inch of snow on the ground in that area. In most areas of northern Illinois new records for depth of snow cover were set.

When all the aspects were considered (record 2-month cold, near record number of severe winter storms, and record depth of snow), the winter of 1978-1979 ranks the second worst in Illinois since detailed weather records began in Illinois in the 1880s. As a consequence, an in-depth investigation of the winter conditions of 1978-1979 was made.

The first part of this report examines in detail the 17 severe winter storms, including an examination of their magnitude, the storm motion, the areal extent of the heavy snow, the time of occurrence, and the synoptic weather conditions that produced them. The discussion of the individual storms is followed by an assessment of the monthly and winter snowfall and snow depths. In the next section, detailed winter precipitation measurements in the Chicago area are presented. The final section of the report discusses the kinds of impacts noted during the winter.

A major reason for this study was to provide information to those concerned with design and operations affected by heavy snowfalls and snow depths. This includes most businesses and industry, transportation systems, and those governmental institutions that must deal with severe winter conditions.

Acknowledgments

Credit is due the Publications-Communications Unit of the Water Survey under the leadership of Loreena Ivens. In particular the assistance of John Brother and William Motherway in drawing the illustrations and of Marilyn Innes in producing the camera copy was helpful.

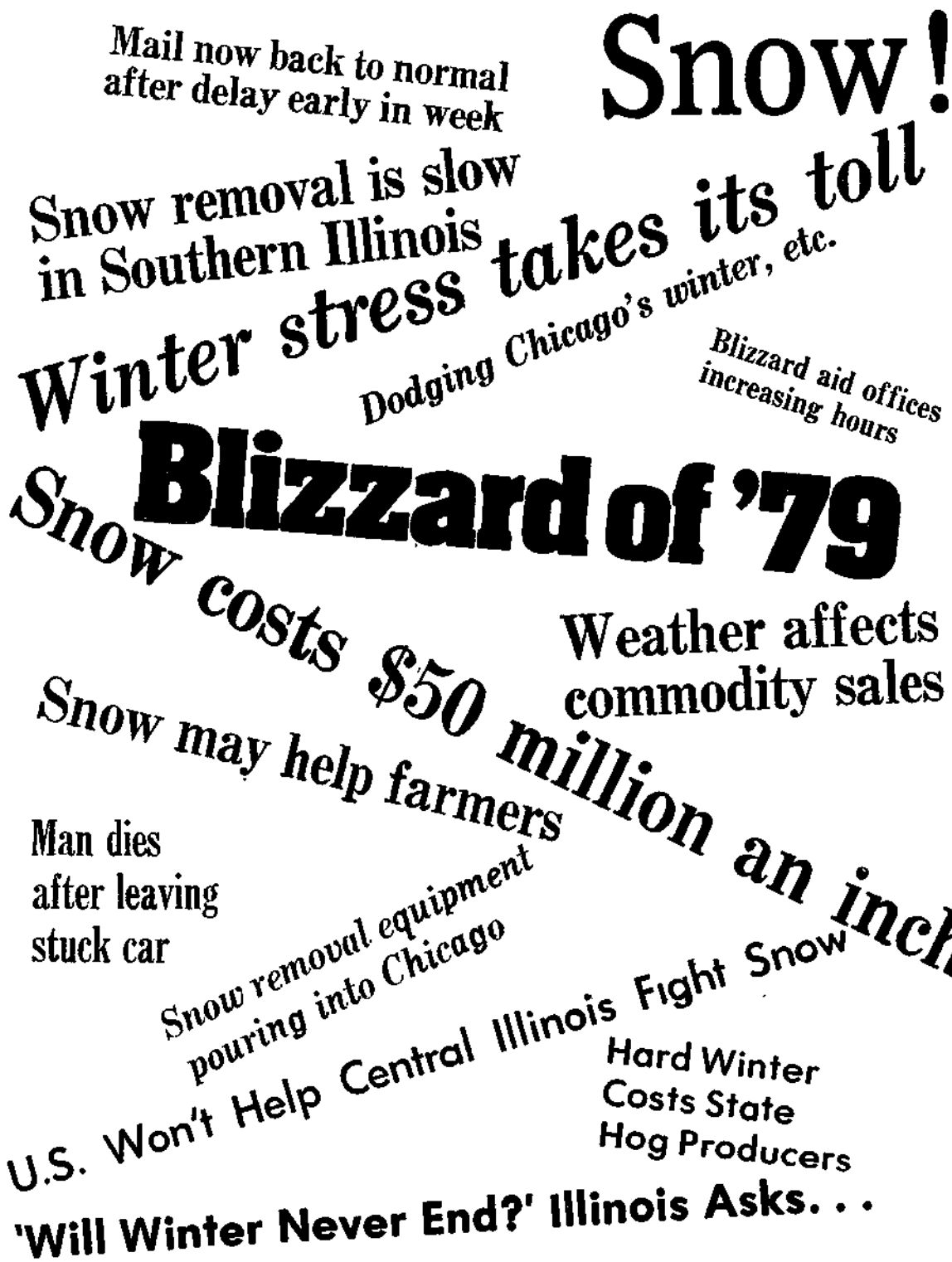


Figure 3. Newspaper headlines illustrating impacts of severe storms in winter of 1978-1979

ANALYTICAL METHODS

The analysis of the individual storms began with the weather records of each station. Records from 80 stations in Illinois that report snowfall were used to plot "storm maps." This procedure was identical to that used to define winter storms in 1900-1960 (Changnon, 1969). These maps represented periods, ranging from a few hours duration up to 56 hours, during which the winter precipitation, snow and/or glaze, fell nearly continuously over all or parts of the state. At each station, the following information was plotted on individual storm maps: the beginning and ending times and dates, the amount of snowfall, the amount of precipitation, and the occurrence of other weather phenomena such as high winds, sleet, and glaze. These maps then became the basis for further analysis of the" storm.

The beginning times were used to plot isochrones across the state, allowing determination of the direction in which the advancing storm moved. The times also allowed determination of the earliest beginning and latest ending times of the storm within the state. The beginning and ending times at the stations in the heavier storm area (typically 5 to 10 stations) were used to develop and calculate, point durations, and these values were averaged to get a mean storm point duration. Isohyetals, based on the point snowfall values on each map, were constructed to develop the storm snowfall pattern. The extent of areas greater than 3 inches and greater than 6 inches was determined by planimetering these maps. The highest and lowest snowfall values in each storm were also identified. Examples of the storm maps appear in figures 4, 5, and 6.

Snowfall totals for each month in the season were obtained from the climatological data for Illinois (EDIS, 1978, 1979). Monthly and seasonal maps were constructed from these values. These totals were compared with records for 50 Illinois stations distributed throughout the state and with records back to 1880 so as to determine the ranks of the 1978-1979 values. In a similar approach, the snow depth data taken at representative stations in northern, central, and southern Illinois were analyzed and compared with their historical records.

The Water Survey was operating a dense network of 71 recording raingages in the Chicago area during the winter of 1978-1979. These gages measured the amount of water in the snowfall. These data were used to develop precipitation maps for each month and for the "winter to examine, in detail, the patterns of precipitation in the Chicago region where the excesses of the winter were severe.

The variety and magnitude of impacts resulting from the severe winter conditions were studied. Damage information as reported in Storm Data (EDIS, 1979) was used. Much of the impact information came from study of Illinois newspapers published throughout the November 1978-January 1980 period. Emphasiswas placed on finding second order and tertiary impacts resulting many months after the storm ended. Absolute measures of the economic and human costs of the winter storms cannot be derived by this approach. However, the information available presents a useful estimate of the types of impacts and some measure of their severity.

STORM ANALYSIS

Storm Patterns

The patterns of the 17 severe winter storms of 1978-1979 are illustrated in figures 4-6. These show that one occurred in late November, four in December, seven in January, four in February, and one in March. Normally, severe winter storms in Illinois are a little more common in January with an average of slightly more than one (per year). The months of December, February, and March (Changnon, 1969) average slightly less than one. The total of 17 during the winter of 1978-1979 was four times the average frequency and only one less than the prior record (18 storms in 1977-1978). Maximum values for each month prior to 1978-1979 included one storm in October, three in November, five in December, four in January (this record was broken in January 1979), four in February (this

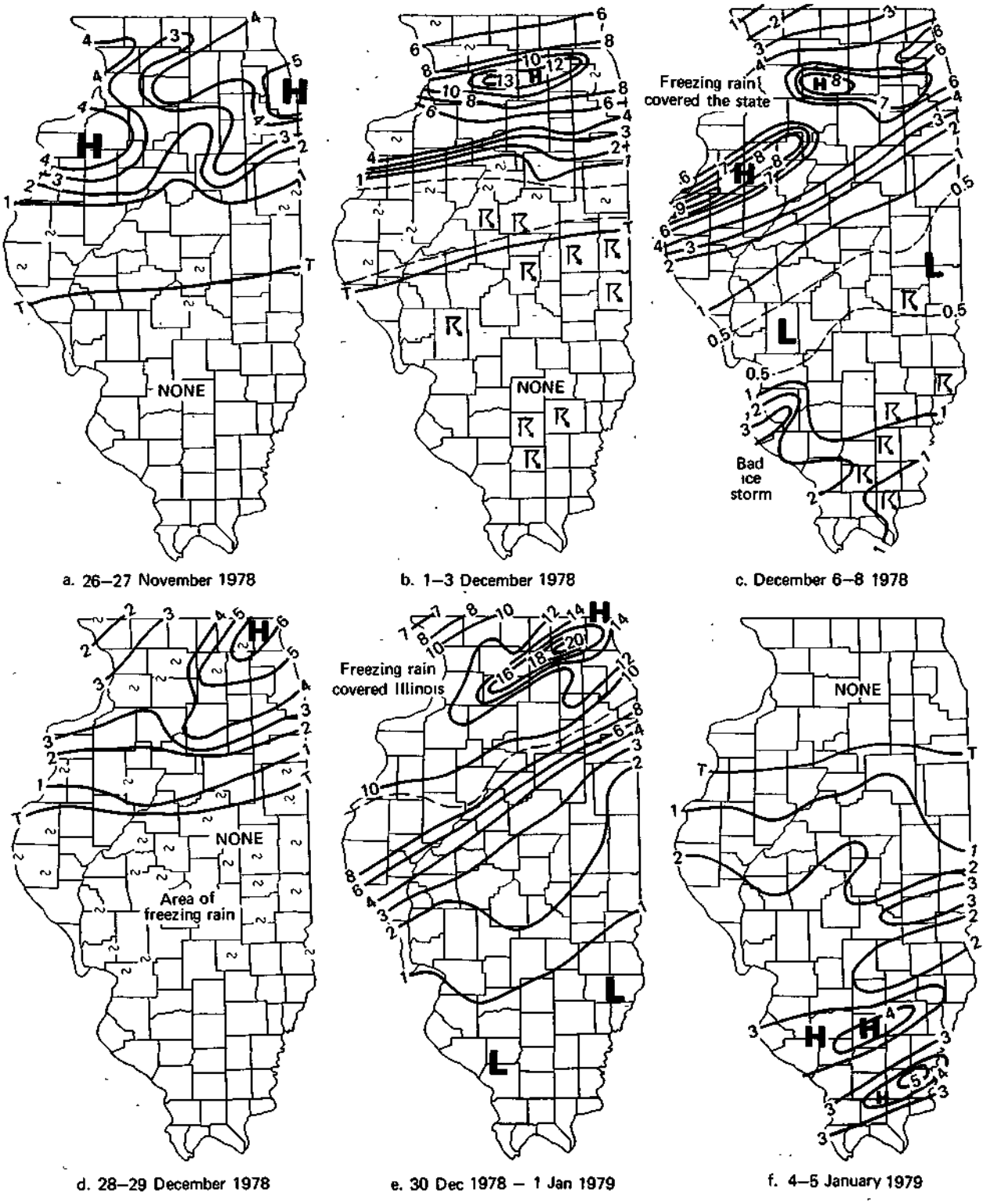


Figure 4. Snowfall patterns of the first six severe winter storms of 1978-1979

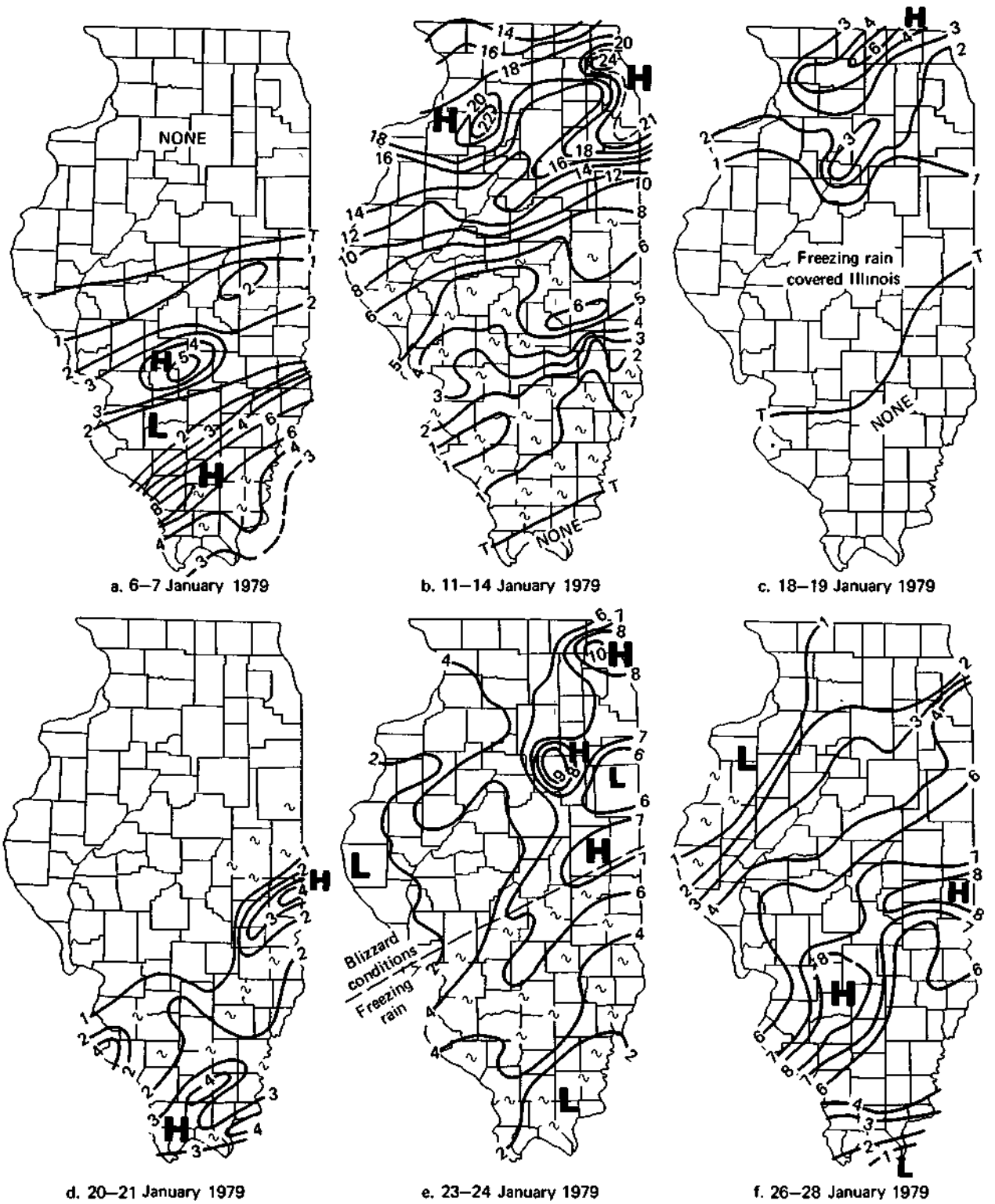


Figure 5. Snowfall patterns of the second six severe winter storms of 1978-1979

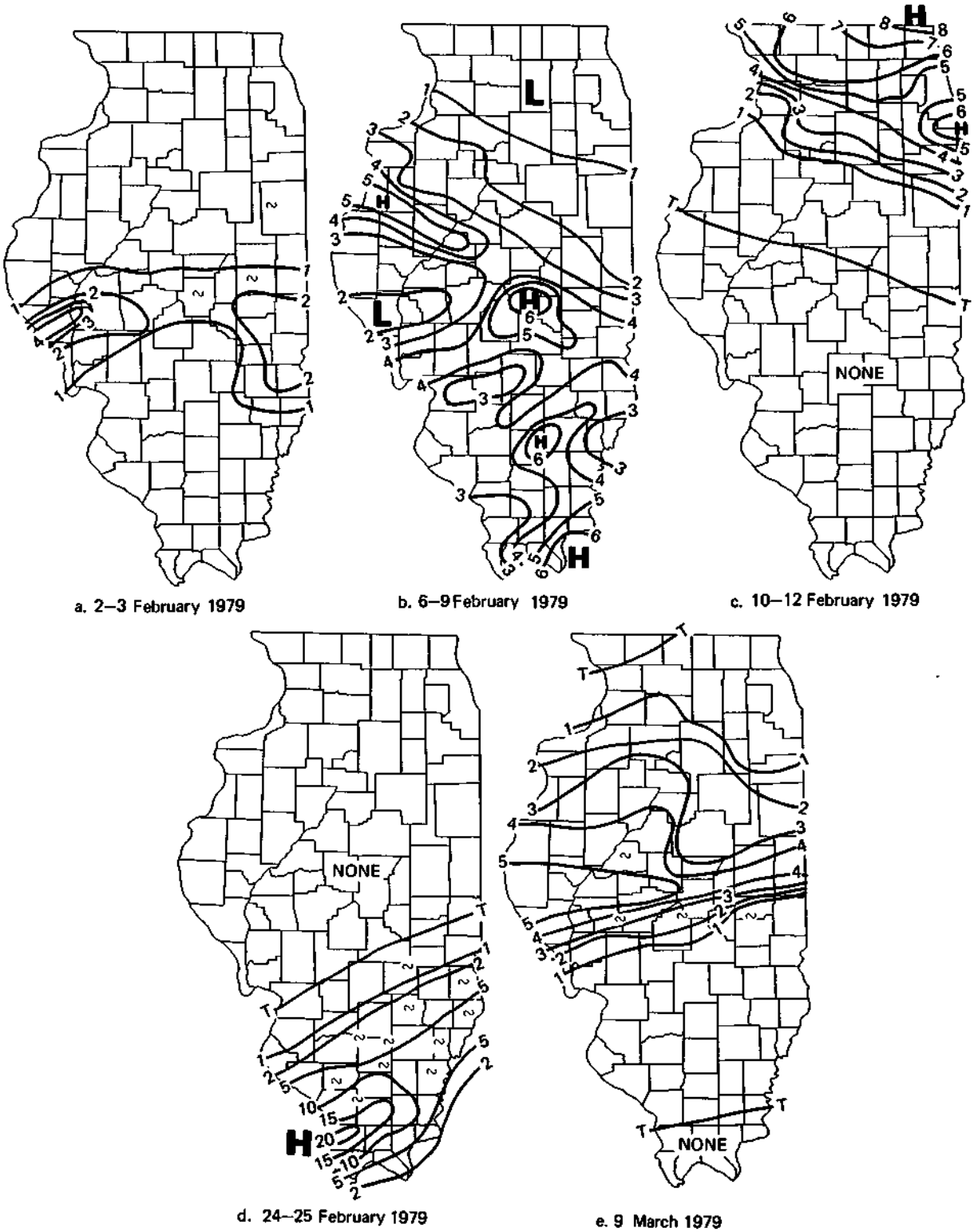


Figure 6. Snowfall patterns of the last five severe winter storms of 1978-1979

record was tied in February 1979), and five in March. Hence, record monthly frequencies occurred in January and February with near record values in December. This reveals the prolonged and intense storminess that characterized the winter of 1978-1979.

Analysis of the 17 patterns reveals that effects of Lake Michigan to increase snowfall were apparent in at least three of the storms including those on 26-27 November, 28-29 December, and 11-14 January. Prior Water Survey studies (Changnon, 1969) revealed that lake effects to induce heavier snowfalls occur in extreme northeastern Illinois as a result of passage of low pressure areas to the south and east of Illinois. These conditions produce strong return flow from the northeast across Lake Michigan. The moister air from the lake is precipitated in the land area adjacent to the lake as the air is cooled and lifted.

Other interesting snowfall patterns were obvious in several storms when relatively narrow bands of heavy snowfall extended across the state. The dates of these storms are 1-3 December, 30 December-1 January, and 24-25 February.

Several of the lesser storms produced localized but very small areas of heavy snowfall, typically of 4 to 6 inches in localized areas of the state. Included in this classification are storms of 4-5 January, 20-21 January, 2-3 February, and 6-9 February. These storms typically have shorter durations than the other winter storms and are much less damaging, except in very localized areas.

Examination of the 17 storm maps reveals that in 14 of the 17 storms freezing rain occurred somewhere in Illinois. It covered the entire state in three storm cases (6-8 December, 30 December-1 January, 18-19 January). Freezing rain was extremely bad in the storm of 6-8 December when it produced ice on wires ranging from ½ to 1 inch thick in the southern half of the state. Freezing rain was severe and quite damaging in east central Illinois on 1 January, and also quite damaging in extreme southern Illinois on 24-25 February. However, none of the ice storms reached the severity of the storm of 24-25 March 1978.

Another interesting aspect of the storms relates to the occurrence of fog. Widespread fog occurred with 11 of the 17 storms. Fog was extremely dense and prolonged in three of the storms (28-29 December, 18-19 January, 24-25 February). Typically the areas of fog were not in the heavy snow zones, but were located generally to the south in warmer air sectors. The fog compounded the transportation problems created by the snow and freezing rain and was an integral part of the total severity of the severe winter storms in Illinois.

An interesting situation relating to the 17 winter storms of 1978-1979 was the fact that high wind and blizzard conditions, which were typical in 8 of the 18 winter storms of the prior winter, occurred in only 3 of the 17 storms. Blizzard-like conditions existed over the northern half of Illinois on 11-14 January and in the same area again on 23-24 January. A third blizzard struck on 24-25 February in southern Illinois. A lack of high winds, drifting snow, and blizzard-like conditions in the other storm periods suggests the lack of extremely deep low pressure centers in many storm cases. Of some interest is the fact that thunderstorms occurred in Illinois during the initial stages of three of the winter storms. Widespread thunderstorms occurred on 1-December, 6-7 December, and 24 February (in southern Illinois snow area only).

Several of the patterns on figures 4-6 reveal the more typical snow storm patterns found in the state. The typical severe winter storm in Illinois has its heaviest snow area oriented WSW-ENE lying across north central Illinois. Areas of the most frequent snow maximization, as based on prior study of 304 storms in the 1900-1960 period in Illinois, are in 1) the area from near Moline to Rockford, 2) the Chicago region, 3) the region from St. Louis to Urbana, and 4) in extreme southeastern Illinois. Interestingly, the locations of the cores of the 17 storms in the 1978-1979 winter revealed most maximizations occurred in all four of these state centers. Very few of the 1978-1979 winter storms maximized in western or central Illinois. In general, the 17-storm sample appears representative of the general distribution of heavy snowfall areas in severe winter storms of Illinois (Changnon, 1969).

Storm Characteristics

Table 2 presents for each storm its beginning time in Illinois and the ending time. The 17 storms began during most hours of the day but 11 of the 17 began during nocturnal hours, 1800-0600 CST. This

Table 2. Storm Time and Motion Inventory

Storm date	Begin		End		Average duration (hours) at locales with heaviest snow	Direction from which snow moved
	Hour (CST)	Locale	Hour (CST)	Locale		
26-27 Nov	1230	Galena	1500	Kankakee	24.7	NW
1-3 Dec	0200	Galena	0200	Chicago	28.5	WNW
6-8 Dec	1800	Chester	2000	Brookport	26.0	SW
28-29 Dec	1530	Keithsburg	2400	Antioch	19.3	WSW
30 Dec-1 Jan	0500	Anna	2330	Chicago	26.8	SSW
4-5 Jan	1400	Quincy	1700	Shawneetown	15.1	NW
6-7 Jan	0500	Anna	1300	Albion	22.4	SW
11-14 Jan	1030	Quincy	0300	Chicago	56.0	WSW
18-19 Jan	2130	Gladstone	2400	Antioch	15.0	SW
20-21 Jan	2330	Anna	1800	Paris	6.4	SW
23-24 Jan	0500	Mt. Carroll	1600	Peotone	24.2	W
26-28 Jan	1300	Jerseyville and Red Bud	1200	Newton, Paris	25.8	WSW
2-3 Feb	1400	Rockport	1500	Marshall	7.0	W
6-9 Feb	1800	Brookport	0700	Carmi	49.3	WSW
10-12 Feb	1900	Freeport	1900	Chicago, Kankakee	42.0	NW
24-25 Feb	1900	Grand Tower	1700	Flora, Fairfield	12.8	SSW
3 Mar	0100	Quincy	1900	Danville	12.0	W

nocturnal-focus differs from the historical storm distribution which shows maximization of initiations between 0900 and 1400 CST.

The average point duration at locales within the heaviest snowfall areas, showing values ranging from 6.4 to 56.0 hours, is also listed for each of the 17 storms in table 2. The median duration of the 17 storms was 24.2 hours. Study of the 304 storms of the 1900-1960 period revealed a median point duration of 14.2 hours which is considerably less than that of the 1978-1979 sample. The median for the 18 severe winter storms of the prior winter, 1977-1978, was 18 hours. Essentially, the duration information for the 17 storms reveals that they were much longer lasting and typically heavier (point) snow producers than the average. This suggests slower moving synoptic weather conditions and/or more extensive snow areas which could result in greater point precipitation and potentially more damage". However, the lack of high wind conditions with most of the 1979 winter storms suggests the lack of extremely deep low pressure centers.

Also shown in table 2 is the direction which the storms moved across the state. The frequency by direction includes four storms from the WSW and four from SW, three from the west, three from northwest, two from the SSW, and one from WNW. The preferred motion from WSW and SW shown in 1978-1979 winter storms is common to the motions found in many of the storms of the prior winter and in the 61-year storm sample.

Table 3 presents a summary of the snowfall with the 17 storms". Shown are the maximum and minimum point' amounts and the locale where they occurred. Examination of the lowest measurable values (those greater than a trace) reveals that only one storm had measurable snowfall over the entire state, 56,400 square miles (23-24 January). Five storms in the 1977-1978 winter produced measurable snow over the entire state. In four storms of 1978-1979, more than 3 inches fell over 30,000 square miles or more. Interestingly, none of the three storms producing the highest point amounts, > 20 inches, produced snow over the entire state.

One of the interesting differences between the winter storms of 1978-1979 and those of the prior winter was the fact that three storms had point maximums greater than the highest achieved in the prior winter (15.5 inches). As noted previously in the text, however, very few of the storms of 1978-1979 came with high wind, blizzard conditions as opposed to eight in the prior winter. Furthermore, the median duration of the winter storms of 1978-1979 was 6 hours greater than that in the prior

Table 3. Storm Snowfall Summary

Storm date	Highest state values (inches) and locale	Lowest state values (inches) and locale*	Areal extent (square miles) ≥ 3 inches	≥ 6 inches
26-27 Nov	5.8 Chicago (Midway)	0	12,400	6,900
1-3 Dec	13.3 Dixon	0	11,100	8,600
6-8 Dec	9.5 La Harpe	0	20,700	16,500
28-29 Dec	6.5 Antioch	0	10,000	1,000
30 Dec -1 Jan	21.0 Marengo	0	30,000	23,000
4-5 Jan	5.0 Harrisburg	0	7,500	0
6-7 Jan	8.0 Carbondale	0	10,000	2,000
11-14 Jan	24.0 Barrington	0	43,000	31,000
18-19 Jan	6.0 Rockford	0	4,500	300
20-21 Jan	4.5 Paris	0	2,500	0
23-24 Jan	10.1 McHenry	1.1 Cairo	41,000	13,000
26-28 Jan	9.0 Highland	T La Harpe	37,000	17,500
2-3 Feb	4.0 Griggsville	0	400	0
6-9 Feb	6.5 Mt. Vernon	T	27,000	1,500
10-12 Feb	8.0 Antioch	0	10,500	4,200
24-25 Feb	21.0 Marion	0	12,000	7,700
9 Mar	5.9 Springfield	0	15,000	0

** If more than one locale, the place is not shown*

winter. Thus, the "typical" storm of the 1977-1978 winter was one that was faster moving, shorter lived, with stronger wind conditions, more widespread snow, but with generally less heavy snow at a point. The storms of the winter of 1978-1979 were slower moving storms resulting in heavier point totals and with less intense low pressure areas. The point values in excess of 20 inches found in the storms of 30 December-1 January, 11-14 January, and 24-25 February were all record high storm totals at the locations where they occurred in northern and southern Illinois.

Also shown in table 3 are values for the areal extent of regions with more than 3 inches and more than 6 inches of snowfall for each storm. In six storms, snow in excess of 3 inches fell over more than one-third of Illinois; this is three less storms than the nine storms in this category during the prior winter of 1977-1978. In five storms about half of the state was covered by 3 inches or more of snow (as compared to six storms in the prior winter). In one storm, that on 11-14 January, snow covered 77% of Illinois at a depth of 3 inches or more. Eight storms produced snowfall of 6 inches or more over more than 5000 square miles (about 10% of Illinois). In comparison, seven storms in the prior winter rated at this level. Thus, the comparison of the storms of the two winters based on the areal extent of their 3- and 6-inch snow areas shows reasonably similar characteristics. The most extensive storms of the winter of 1978-1979, based on the areas of 6 inches or more snowfall, were those on 30 December-1 January, 11-14 January, and 26-28 January. In these three storms more than 30% of Illinois was covered by 6 inches or more snowfall.

The basic synoptic weather type (cyclone and/or front) that produced each of the 17 severe winter storms was determined. These were categorized in six synoptic types (table 4) according to the typing derived from the study of 304 past winter storms in Illinois (Changnon, 1969). The first five are classified as to their source area, and in the case of the Colorado types, the general direction of travel of the track of the storm is also employed. Most miscellaneous typings relate to frontal passages without any notable low center in or within a few hundred miles of Illinois . No obvious low center nor frontal passage existed in two of the winter storms of 1978-1979. Those storms developed as large regions of light snowfall over the snow-covered areas of the Great Plains and western Midwest that slowly moved eastward in a broad trough.

The frequency of the winter storms with each of these synoptic types is listed in table 4. Since one

Table 4. Synoptic Weather Types with Winter Storms

	Synoptic type	1978-1979 Storms Number	1978-1979 Storms Percent	Historical frequency (percent) *	1977-1978 frequency (percent)
1	Alberta low	1	6	11	26
2	Colorado low (south to north track)	1	6	45	32
3	Colorado low (north track)	4	22	8	0
4	Colorado low (south track)	1	6	7	16
5	Texas low	5	28	24	10
6	Miscellaneous	6	32	5	16
		18**	100	100	100

* *Based on 304 winter storms during 1900-1960*
** *There were 17, not 18, storms but in one storm (23-24 January 1979) two Colorado lows (north track and south-north track) occurred and a count was given to each*

storm, that of 23-24 January, was produced by two types, a type 2 and type 3 condition, a count was given to each of those types in table 4 resulting in a total of 18 counts. The frequencies in each type are expressed as a percent of the total 18 events. Also shown in table 4 are two sets of percentages, one based on the historical frequencies of 304 storms for 1900-1960, the other for the 18 storms of the winter of 1977-1978. Comparison of the three sets of percentages helps reveal the unique characteristics of the storms of the winter of 1978-1979. For example, comparison of the 1978-1979 percentages with those of the historical sample reveals that the recent winter had relatively more storms of type 3 (Colorado low with north track) and many more in the miscellaneous category. It should be noted that four of the six in the miscellaneous category were related to stationary frontal situations, typically positioned just south of Illinois in a broad trough. Precipitation with these two types typically moves from the west and southwest, which is reflected in the predominance of storm motions shown' in table 2. The 1978-1979 winter had relatively fewer instances of storms with Alberta lows, and Colorado lows (south to north track) than occurred in the historical sample.

Comparison of the percentages for the 1978-1979 storms with the percentages for the prior winter (1977-1978) also shows marked differences between the two winters, as has been noted in many of the storm characteristics such as duration, intensity, and area. The most recent winter had more type 3, type 5, and type 6 conditions than did the winter of 1977-1978.

The earlier climatological study of the 304 severe winter storms found that the Colorado low types 2 and 4 were primary producers of "extreme damage" storms, defined as those producing more than $200,000 in damages (1960 dollars) and one or more deaths in the state. The examination of the deaths and damages for the 17 storms in the 1978-1979 winter reveals that six of these storms were extremely damaging including that on 23-24 January when two synoptic types were involved. The synoptic types with these bad storms included 23-24 January (type 2); 18-19 January and 23-24 January (both type 3); 6-8 December (type 4); and 30 December-1 January, 11-14 January, and 24-25 February (type 5). It is notable that all of these six most severe storms occurred with lows (as opposed to miscellaneous types). Furthermore, the more damaging storms of 1978-1979 came with the Texas lows, type 5. This is a different result than found in the climatological sample which showed that types 2 and 4 were the most frequent producers of extreme damages in Illinois.

Examination of surface pressure patterns for the period of 26 November through 10 March 1979, which encompasses the 17 storms, revealed that 29 cyclones passed either across Illinois or adjoining

states. Twelve of the 29 cyclones, or 40%, produced severe winter storms in Illinois, a much higher ratio than the 10% noted in prior studies (Changnon, 1969). Thus, in one sense, the high frequency of severe winter storms and the resulting record snowfalls in the northern end of Illinois occurred because more of the winter cyclones in the Midwest, typically those with north tracks, produced heavy snow and damaging storms in the state.

An extensive synoptic analysis of the storms was not pursued. However, the results from the analyses of storm characteristics and the synoptic conditions do indicate the key atmospheric ingredients. First, there was not a great frequency of high wind conditions, with only 3 of the 17 storms having blizzard conditions as compared to 8 of the 18 in the prior winter. This indicates that most of the storm-producing conditions in the winter of 1978-1979 did not have excessively deep low pressure centers within the cyclones. However, the relatively long point durations of the severe winter storms of the 1978-1979 winter and the record high point snowfall totals in several storms suggest that many of the cyclones and frontal systems were broad and slower-moving than normal. The greater frequency of type 3 (Colorado north track) and type 6 (miscellaneous-stationary front) conditions reveals broad and shallow low pressure systems associated with or behind the southward penetrations of cold air.

SEVERITY OF THE WINTER CONDITIONS

Snow Cover

The near record numbers of severe winter storms distributed throughout a 3½-month period beginning in late November 1978, coupled with long periods with below normal temperatures, particularly in northern Illinois, led to both prolonged accumulations of snow on the ground and to great depths of snow cover.

Data from stations in northern, central, and southern Illinois were chosen to reflect the snow cover conditions. Those from four stations are shown on figure 7. Here, the height profiles of the daily recorded values of snow on the ground, or snow cover, for these stations are depicted. In northern Illinois the impacts of the late November-early December heavy storms are clearly reflected as peaks on the graph followed by gradual lowering with rapid enhancement in late December and in mid-January. The sustained record cold temperatures of January and February kept melting at a low rate and snow depths at great heights. The advent of snow storms during January in southern Illinois brought snow cover there that persisted until midrFebruary.

As shown in figure 7, Mt. Vernon reached a snow cover maximum of 14 inches by late January, 2 inches below the record depth set in mid-January 1978. Urbana reached its maximum depth of 18 inches for several days from late January through mid-February, but this too was 2 inches less than the prior record depth on the ground. Antioch achieved its maximum depth of 39 inches in mid-January, a value 16 inches above its all time record depth.

Thus, the maximum depths obtained were of record proportions in northern Illinois but slightly less than record levels in central and southern Illinois. The reasons for the considerable structural damage to roofs in northern Illinois were the great depth of snow and its prolongation.

The snow cover durations of the representative north, central, and southern stations are displayed in table 5. Shown are the longest consecutive runs of days (and the dates beginning and ending) for snow depths of 1 inch or more, 10 inches or more, and 20 inches or more. All of the consecutive duration values for Antioch (shown in table 5) were new records, and the 31 consecutive days with snow depth greater than 10 inches in Urbana is also a new record. The other duration values shown in table 5 for Urbana (1 inch or more), and for Mt. Vernon are much below prior records, but much above normal.

Also shown in table 5 are the totals, not just for consecutive days, but for the total number of days of snow cover greater than 1 inch. For example, Antioch had a run of 116 days with snow cover

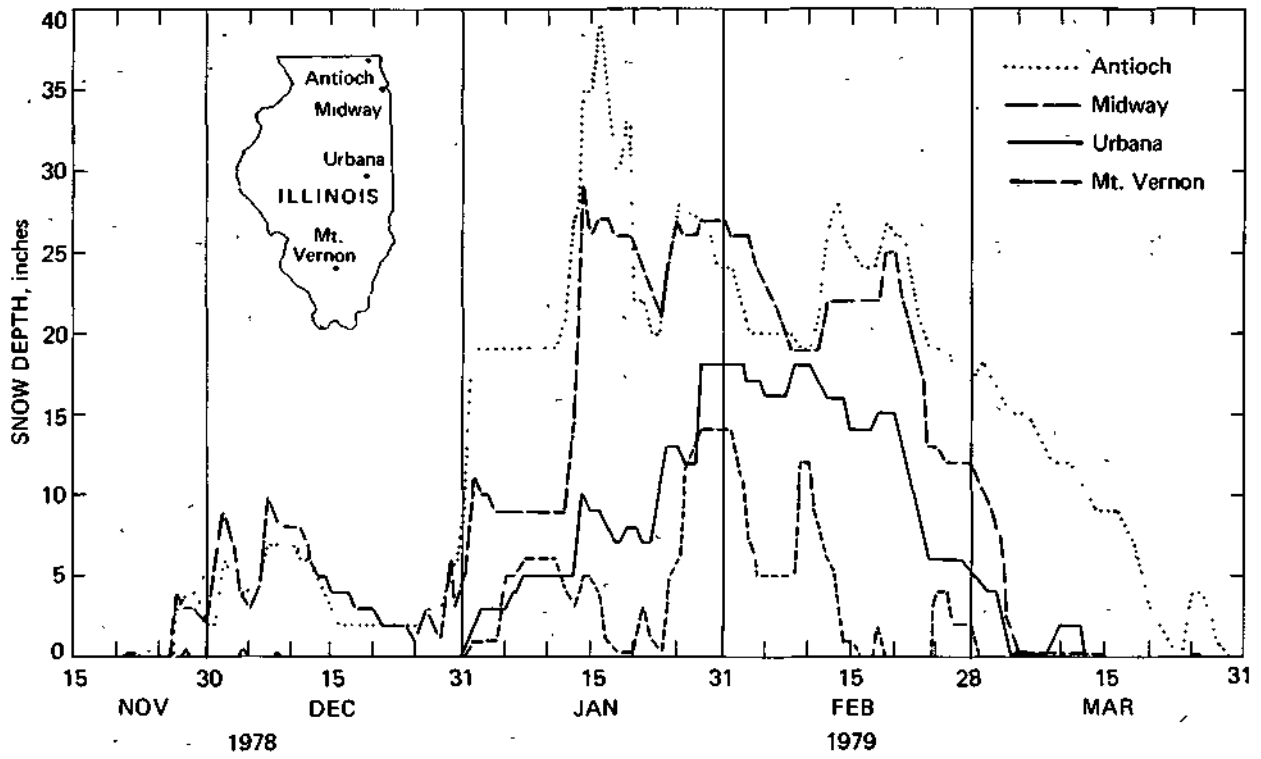


Figure 7. Height profiles of snow cover at four stations during 1978-1979 winter

Table 5. Snow Cover Statistics

Longest consecutive runs

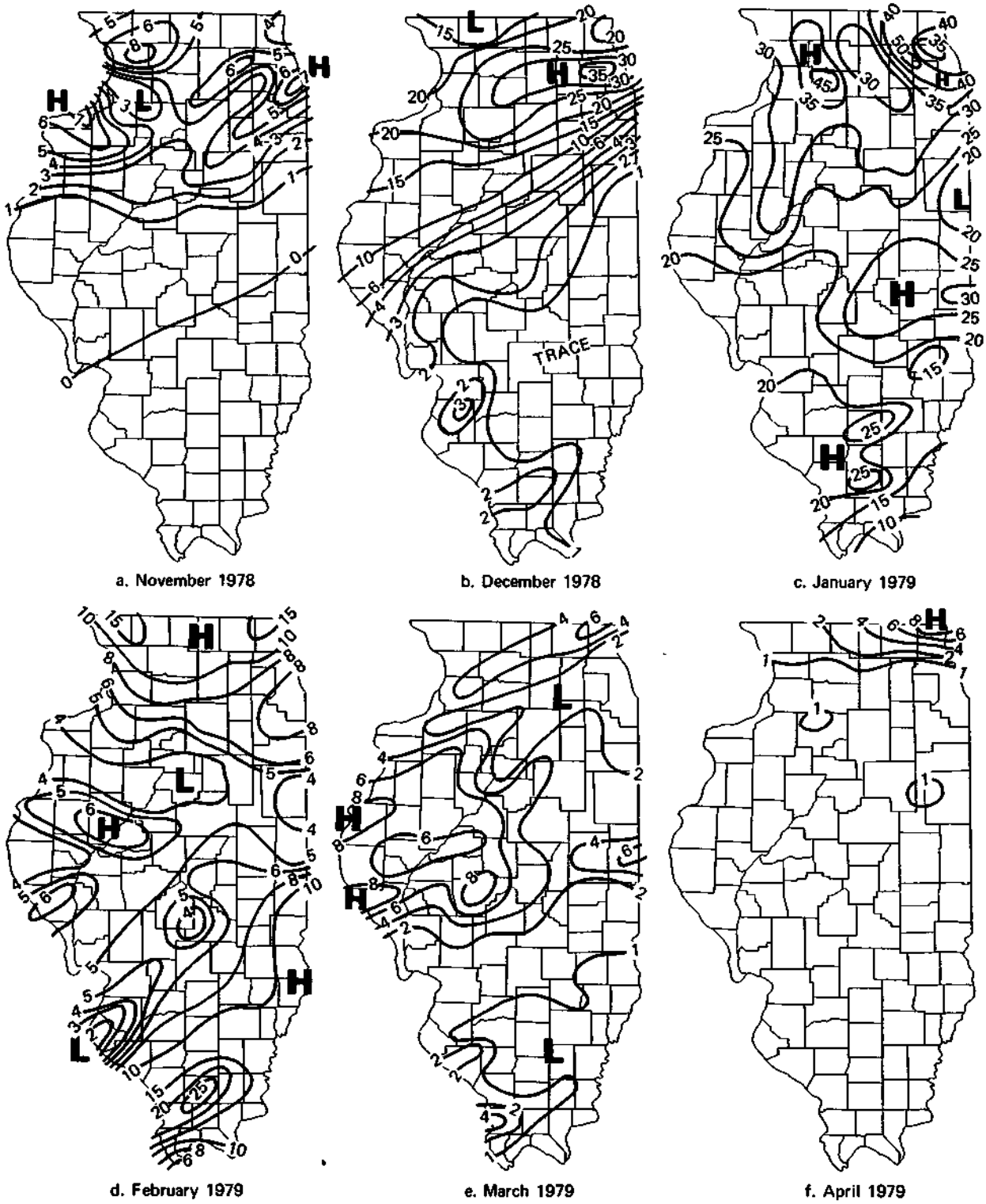
	Cover ≥ 20 inches			*Cover ≥ 10 inches*			*Cover ≥ 1 inch*			*Total days snow cover ≥ 1 inch*
	Dates from	*to*	*Total days*	*Dates from*	*to*	*Total days*	*Dates from*	*to*	*Total days*	
Antioch (north)	1/12	2/23	43	1/1	3/13	72	11/27	3/22	116	120
Urbana (central)			0	1/23	2/22	31	1/1	3/3	62	70
Mt. Vernon (south)			0	1/26	2/3	9	1/21	2/15	26	48

with 1 inch or more (from 27 November through 22 March), but it also had another four days in March which collectively produced a total of 120 days greater than 1 inch. This is two days more than occurred there in the prior record winter of 1977-1978.

Monthly and Seasonal Snow Totals

November snowfall was relatively high throughout the northern third of Illinois (figure 8a). Average snowfall in that area for November ranges between 1.5 and 2 inches, and thus many locations had totals two or four times their averages. None of the values was a record high, however, although at most locations the November 1978 totals ranked as the third or fourth highest on record.

The December snowfall pattern (figure 8b) reflects the repeated occurrences of heavy snowstorms in the northern third of Illinois, with more than 30 inches in a narrow east-west band. Comparison of December averages with the values on figure



a. November 1978 b. December 1978 c. January 1979

d. February 1979 e. March 1979 f. April 1979

Figure 8. Monthly snowfall patterns during 1978-1979

8 reveals that totals in the northern third of the state were much above average, but values were average or below south of the 4-inch line. The snowfall totals north of the line from Moline to Kankakee to Chicago were at least four times the average December values, but were not record highs at many stations. The 20 inches at Ottawa ranked as the third greatest, and the 26 inches at Aurora ranked as the second heaviest snowfall on record. The 34.5 inches at DeKalb was the record highest at that location.

The January 1979 snowfall pattern (figure 8c) represents record high values throughout most of Illinois. The average January snow totals in Illinois vary from 3 inches in extreme southern Illinois to 8 inches in northern Illinois. The 1979 totals ranged from three to six times the averages in most parts of the state. The dimensions of the January 1979 snowfall are reflected by listing the values at several locations around the state and their prior records:

Aurora with 32.6 inches in 1979 (32 inches in 1918)
Bloomington-Normal with 24.6 inches (26.2 in 1918)
Carbondale with 20.6 inches (19.2 in 1978)
Charleston with 25.8 inches (19.9 in 1904)
Decatur with 25.0 inches (20.5 in 1918)
Hillsboro with 20.0 inches (16.0 in 1904)
Kankakee with 29.0 inches (25.7 in 1918)
Ottawa with 30.5 inches (17.7 in 1934)
Quincy with 19.5 inches (17.4 in 1940)
Chicago with 40.4 inches (30 in 1978)

The February total snowfall pattern is revealed in figure 8d. Average values in Illinois range from 2 inches in the south to 8 inches in the north. Comparison of the resulting average gradation with the pattern in February 1979 reveals large areas of Illinois with near average snowfall in the northern half of the state. However, much above average total February snowfalls occurred in the southern half of Illinois. The totals in the southern third of Illinois were three to five times their averages. The 15.1 inches at Carbondale was a record high, as was the 18.0 inches at Harrisburg.

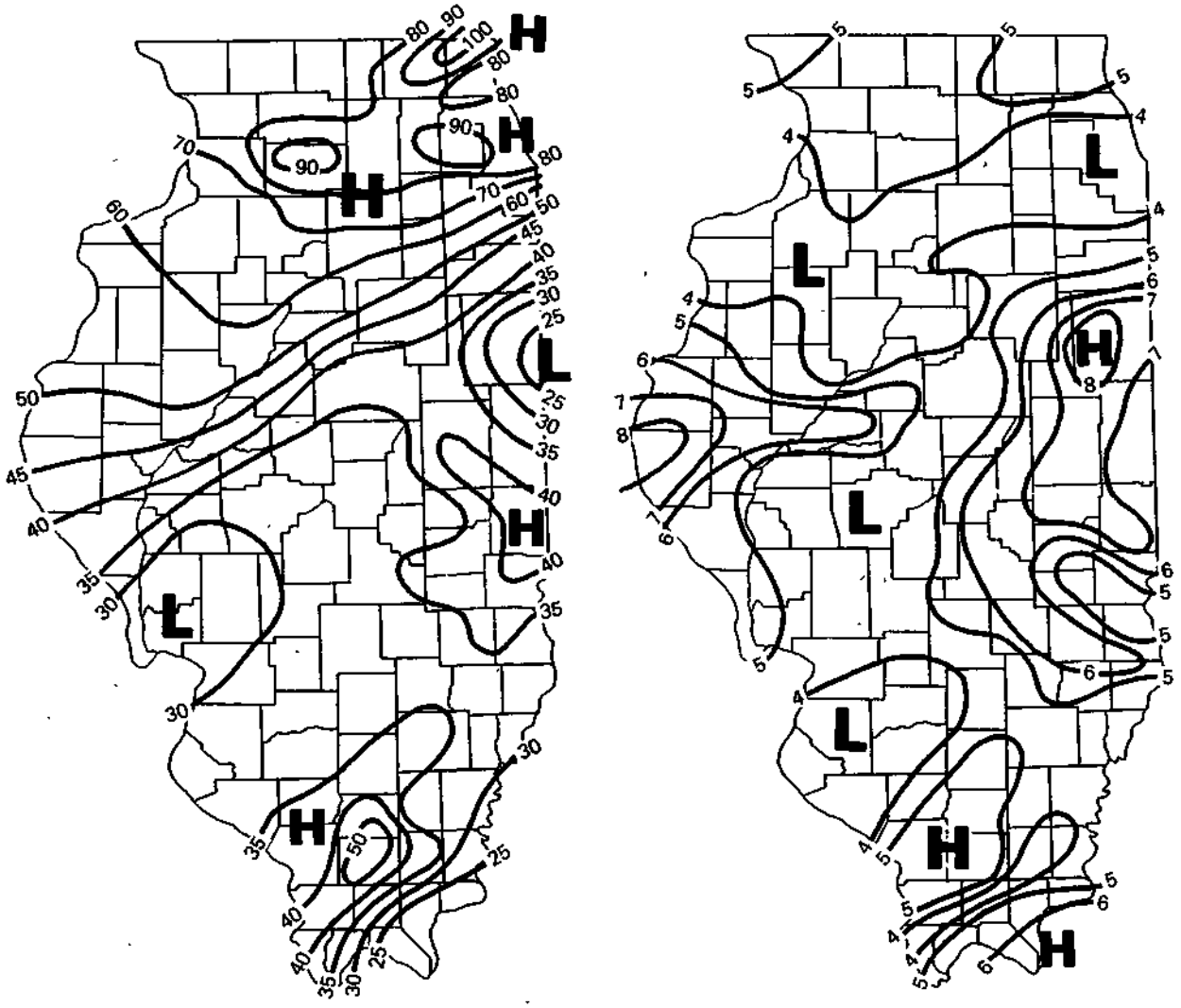
The March snowfall pattern (figure 8e) shows the heaviest snowfalls occurred in central Illinois. The average March snowfall totals in extreme southern Illinois are 2 to 3 inches, becoming 3 to 4 inches in central Illinois, and 5 to 6 inches in northern Illinois. Thus, the totals in central Illinois, particularly in the western section, were 3 to 4 inches above normal. However, none of the March totals in Illinois approached record proportions.

Figure 8f presents the total snowfall for April 1979. One storm in extreme northern Illinois resulted in the exceptionally high values near the Wisconsin border. April average snowfall in this area is 1.5 inches, but the 9.4 value at Antioch was not a record.

When one reviews the monthly snow results, one finds that in the northern fourth of Illinois, the monthly totals were above average in November, December, January, and February (four consecutive months) and were record highs in certain locales in December and at most locations in January.

Figure 9a presents the total snowfall for the winter (November 1978-April 1979). The frequent intensification of snow storms in the northern sector of Illinois is reflected in the pattern with more than 60 inches extending over this entire area. Average winter snowfall in Illinois typically varies from 10 to 15 inches in extreme southern Illinois, from 20 to 25 inches in central Illinois, and from 28 to 33 inches in northern Illinois. Hence, the totals shown in figure 9a reveal the winter snowfall was more than twice the average fall in northern Illinois and at some points three times the average. All locations in the area enveloped by 60 inches in figure 9a had new record seasonal snowfall totals. Much of the small area of extreme southern Illinois enveloped by the 35-inch line also had new record totals. Here also, the snowfall totals were two to four times the average. Generally, the seasonal snowfall totals in central and south central Illinois were 5 to 20 inches above normal, but were not record values. Prior winters with greater totals in these locations included 1911-1912, 1917-1918, 1959-1960, and 1977-1978.

Figure 9b presents the pattern based on the point frequencies of freezing rain events during the winter of 1978-1979. One finds that the greatest frequency occurred in central Illinois where some points like Quincy and Watseka had eight storms with freezing rain. Prior studies of winter storms (Changnon, 1969) show that the area of greatest frequency of severe ice storms in Illinois extends across central Illinois with an average of five to six days per year. Lesser frequencies of freezing rain occurred in northern Illinois, and secondary high incidence areas (greater than five storm events with freezing rain) occurred in extreme southeastern Illinois.



a. Snow totals for winter 1978–1979

b. Number of storms producing freezing rain

Figure 9. Patterns of total snowfall and freezing rain in winter of 1978-1979

CHICAGO AREA PRECIPITATION

The severity of the 1978-1979 winter was greatest in the northern fourth of the state, with the heaviest snowfall totals found in and within 60 miles of Chicago. This record winter, in terms of snowfall, snow depth, and cold temperatures, had enormous impacts on every facet of human life and the environment in this area.

Because of the severity of the Chicago winter and its implications on structural design and operations of various transportation and institutional facilities, a study was made of the precipitation in the three winter months when the snowfall was heaviest (December-February) and when most damages occurred. • Statistics from the Chicago National Weather Service Office at Midway Airport are presented in the Appendix. These give the daily values of snowfall, snow depth, maximum and minimum temperatures, and wind speed and direction for the December through March period. These should be useful for those wishing to identify and study specific snowfall events and winter conditions in the city. Figure 7 shows the snow depth curve at

Chicago Midway. It remained above 1 inch from 24 November through 5 March attaining a maximum of 29 inches on 14 January and remaining above 20 inches until 22 February.

The State Water Survey began operations of a dense raingage network in the Chicago area in 1976 (Changnon and Semonin, 1978). This network was installed to collect precipitation data to serve a variety of applications. The advent of the heavy precipitation, largely in the form of snow, during December, January, and February of 1978-1979 offered an opportunity to examine in detail the monthly and seasonal precipitation patterns in the area. Figure 10 presents the monthly and the 3-month total precipitation values from this dense raingage network. Also presented are data from the available National Weather Service raingages, along with their total snowfall amounts in inches.

In general, each of the monthly-maps indicates two features. One is the presence of a band of increased snowfall 3 to 10 miles inland from the lake, and generally parallel to the lake shore. It extends from the north side of the network and through the network to the southeast side. This presumably reflects lake effects on the atmosphere which tend to aid in the production of snowfall under certain water-wind regimes. The other feature on all monthly maps is an extension of high values westward from the network. This appears in different areas (NW in December, WE in January, and SW in February) and reflects positions of E-W oriented storm cores.

Since the winter snowfall in the area was a record, the values and patterns of figure 10 should serve as future extreme design values for snowfall and snow-loading in the Chicago region. The total 3-month precipitation pattern (figure 10d) shows the maximization belt inland and generally parallel to the lake with amounts 10 to 25% more than elsewhere.

It is important to note the position of the two National Weather Service stations in Chicago (Midway and O'Hare) with respect to the pattern. The historical" snowfall records of Chicago were collected since 1855 in a series of three locations: 1) in the central business district (the Loop) from 1855 to 1926, 2) at the University of Chicago campus from 1926 through 1942, and 3) at Midway Airport" since 1942. Thus, the "design snowfall values" of Chicago have actually come from three different locations, and the snow and precipitation patterns of the severe winter of 1978-1979 suggest that the first two locations (shown on figure lOd) are samples of different snowfall regimes, at least in severe winter conditions.

IMPACTS OF STORMS

The near-record number of 17 severe winter storms of 1978-1979 and the ensuing record (or near-record) seasonal totals, the prolonged deep snow cover, and record low January and February temperatures produced an unbelievable myriad of socio-economic impacts in Illinois. Most of these were of a detrimental nature, although some presented advantages to certain groups and institutions. Many of the worst impacts occurred in the northern fourth of Illinois where the winter snowfall, snow depths, and temperatures were new extremes since record keeping began at many places in that area in the 1880s. Many of the impacts were most serious in the Chicago metropolitan area because of the locally great concentration of population, transportation networks, business, industry, and other facilities. In such metropolitan areas, severe prolonged weather over a few days tends to produce a "domino effect" in that, when one system fails, others are likely to be hurt or to fail, or to be affected in some way.

Major Impacts

Major impacts were initially felt in metropolitan-oriented transportation systems. These included blockage and halting of surface transportation (involving both trains and vehicles) and stoppage of air transportation. In essence, the transportation problems led to a series of secondary impacts related to the change in human and commercial activities because of delays or cancellation of transportation systems. The absenteeism from employment, lack of deliveries, lack of shopping, and cancelling of

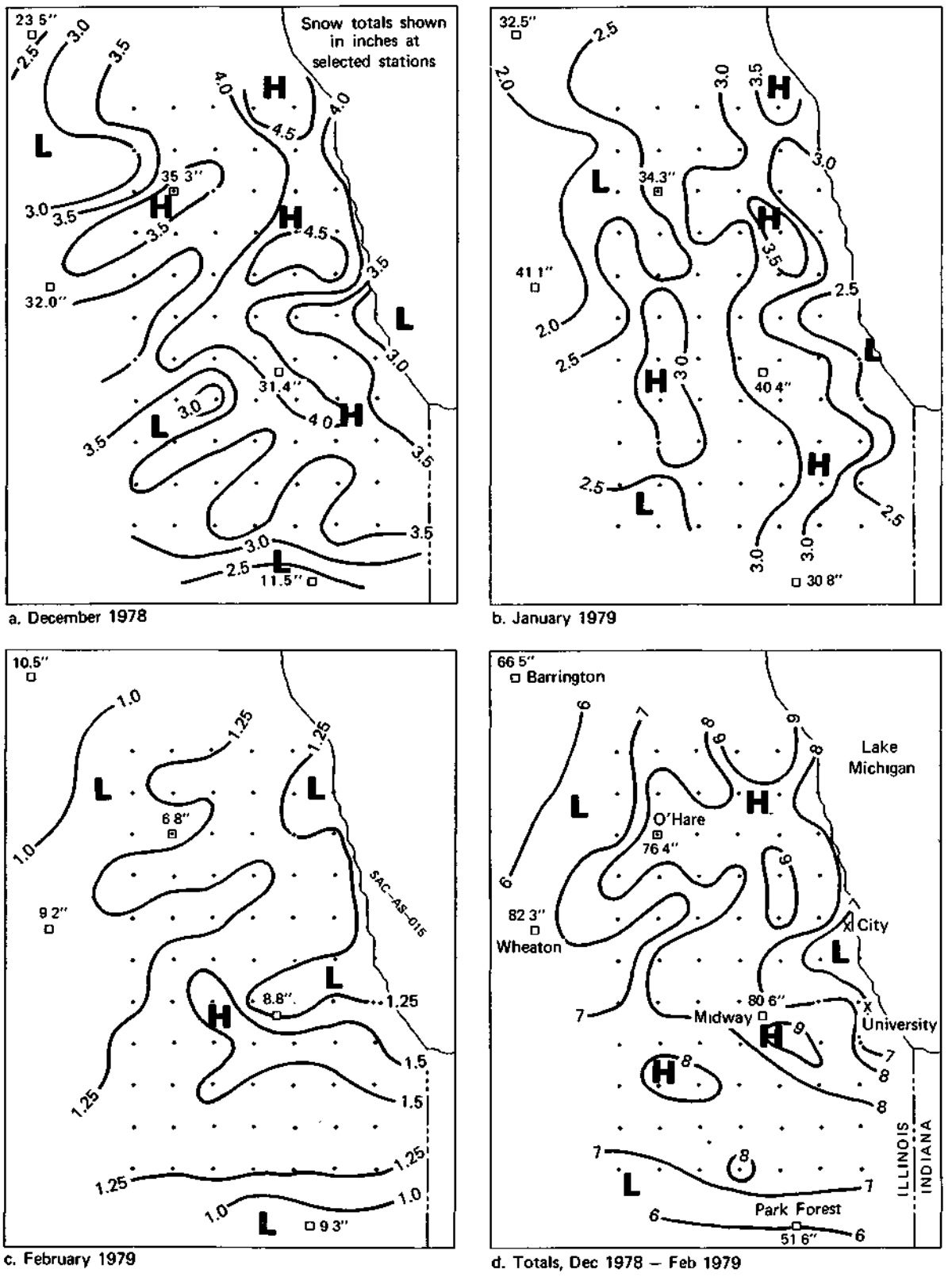


Figure 10. Monthly and 3-month (December, January, February) precipitation in the Chicago area, 1978-1979

meetings and vacations had subsequent effects on commerce and industry. The problems were compounded in another series of major secondary, or ensuing, impacts on government institutions involved with snow removal, street repair, delivery of mail, and fire fighting.

Another major set of direct impacts of the severe winter related to structures. Here, damages to roofs were a notable problem. These led to secondary impacts on human activities, personal losses, costs to individuals and businesses, and subsequently more business for repair companies.

Public utilities formed another area of initial impacts. The severity of the storms, although not as bad in 1978-1979 as in the prior winter (because of fewer severe ice storms and blizzards), led to impacts on the utility companies as reflected by damage to their lines, poles, and structures. The intense cold also brought record consumption of electricity and natural gas, which ultimately led to a myriad of secondary and tertiary impacts, including utility requests for rate increases in 1980.

This discussion of impacts is largely focused on those that occurred during the severe winter. Furthermore, much of the information available is based on data for the Chicago region. However, the collection of information about "tertiary" impacts, those occurring months and up to a year after the winter, allowed a description of those identified. It should be noted that a detailed quantification of the losses and benefits was not attempted. It would be practically impossible to calculate accurately the economic costs and limited benefits of the 1978-1979 winter to Illinois citizens, businesses and industries, and our government institutions. It seems likely that the costs were well in excess of $1 billion.

Table 6 presents a list of identified impacts that have been grouped and sorted into 10 categories, excluding deaths and injuries. As noted earlier, these came largely from a study of newspaper accounts of the storms and their aftermath, although data were also extracted from Storm Data (EDIS, 1979).

Accounting of deaths and injuries attributable to the winter is extremely difficult. Ten deaths could be clearly identified as due directly to winter conditions, and this does not include the potential murders that Chicago police considered to be due to domestic quarrels related to the severe winter and prolonged enclosure. This total of 10 deaths does not agree with one news story found in a Midwestern newspaper in mid-January 1979 which indicated that "nearly 50 had died" in Illinois. Deaths relating to heart attacks, and "after effects" related to pulmonary and heart problems in the succeeding months are not known.

However, it seems likely that there were fewer deaths in this winter than in the prior winter of 1977-1978. In that winter, with more major ice storms and more severe blizzards, many more were killed in highway type accidents or frozen in stalled vehicles than in the 1978-1979 winter. Our limited records indicate that there were at least 60 people injured seriously during the 1978-1979 winter, primarily in the storms of 11-14 January, 23-24 January, 2-3 February, and 24-25 February. From a death and injury standpoint, the storm of 11-14 January in the Chicago metropolitan area was the worst. Five people were killed (one hit by a snowplow, one slipped and fell in front of a train, one lineman fell, and 2 people died of heart attacks), and at least 15 major injuries occurred largely because of falling or overwork.

Table 7 presents several tertiary or delayed impacts relating to events that occurred from 1 month up to 1 year after the severity of the 1978-1979 winter had ended. These are illustrated in figure 11. Many relate to expenditures for equipment and supplies in anticipation of future severe winters. Probably one of the major perceived impacts of the winter was the ultimate shift in the political leadership of the city of Chicago. The administration during the winter of 1978-1979 was perceived as lax in having the city equipped to deal with the record winter storm. The aggravated suffering of the city and suburban dwellers was considered a major factor in the election of a new mayor later in 1979. This mayoral shift represents one of the delayed, but major institutional impacts of the severe winter.

Summary of Impacts

Many of the impacts noted in the winter of 1978-1979 which were based largely on happenings in the Chicago urban area were also noted in the winter of 1977-1978 (Changnon and Changnon, 1978). However, it appeared that the statewide problems,

Table 6. Assorted impacts of the Severe Winter of 1978-1979

7. *Transportation Systems and Vehicles*
   - Public transportation
     - Suburban and in-city buses
       - **Stopped in the metropolitan area of Chicago**
       - **Often many hours late**
       - **Several wrecks and many stuck and abandoned**
     - Trains
       - **Chicago transit delayed by snow and broken wheels caused by cold temperatures**
       - **Rails and switch yards frozen, cracked, and broken**
       - **Several CTA lines and suburban rail lines closed, in somes cases because of ice cover on electrical rails**
       - **Commuter trains delayed**
       - **In February two trains collided because of poor visibility**
       - **Chicago and Northwestern transportation company lost $30 million and Federal government agreed to pay up to half, but the railroad and its customers ended up paying over $10 million**
     - **Airlines**
       - **O'Hare Airport closed 96 hours in January (13-15 January)**
       - **Losses to airlines estimated in the millions of dollars**
       - **Airlines paid for housing for up to 5000 people per night during storm-caused delays**
       - **Luggage deliveries delayed by several days**
   - Other Transportation
     - Mail trucks delayed 2 to 4 days because of road conditions
     - Food trucks delayed and perishable food lost
     - Fire trucks unable to get through city streets because of snow and stalled cars, leading to 1 death and 23 injuries in one Chicago apartment fire
     - Barge traffic on the Mississippi and Illinois Rivers stopped from mid-January until March as far south as Peoria
     - Street and highway deterioration caused delays and damages
     - Delivery of livestock to market reduced and prices rose because empty freight cars were snowbound in Chicago freight yard

2. *Utilities*
   - Power lines were down in southern Illinois in February
   - Telephones were out for several days in southern Illinois
   - One repairman fell from a utility pole and died

3. *Commercial and Industrial Establishments*
   - 50 commercial buildings in Chicago collapsed due to snow on roof (12-14 January)
   - $200 million in payrolls lost (11-16 January in Chicago)
   - $1 billion lost in sales (11-16 January in Chicago)
   - Garbage trucks helped remove snow in major storms
   - Restaurants lost food business estimated at 60% for 30 days
   - Display windows were broken and merchandise stolen
   - Dairys could not get milk and farmers had to dump it
   - One Chicago area roofing firm received 500-1000 calls a day in last two weeks of January with 80% reporting leaking home and apartment roofs
     - **Quote of president of one roofing company in a Chicago suburb from late January: "We have been getting 75 to 100 calls a day on collapsed roofs, cracks and severe depressions, with many problems due to thermal shock (warming and freezing repeatedly leads to splitting and cracking). Costs of repair range from $200 to $4,000 per home. Usually we have 70 people on emergency work, but now we have about 150. Company is working 18 hours a day, 7 days a week. In 1967 it was not as serious. Advice to those with a leak, 'Punch a hole in the ceiling and let water come through. It is easier to repair than a caved-in ceiling'."**
   - Many factories had to close
   - Hotel rooms were largely empty (10 to 20% filled)
   - Many 4-wheel vehicles (over 200 by one dealer) and snowmobiles sold

Table 6. Continued

800 snowblowers (worth $230,000) were sold in one storm
Chicago area towing firms had increased income, both from motorists and city (for removing illegally parked vehicles)

4. *Insurance Business*

Paid $50 million in claims for damage to estimated 40,000 Illinois homes ($40 million in Chicago area)
Insurance on snow removers

Country Mutual Insurance Company:
***removing snow for pay* — need commercial insurance for liability protection**
***removing snow no charge or with an exchange labor agreement* — should have a snow plow endorsement so liability coverage will be provided while plowing or pushing snow**

5. *Human Activities*

Strain, anxiety, and acts of mercy

Snow plow driver on rampage in Chicago, hitting 34 cars and crushing a man to death
Man stabbed after honking horn at a blocked car on snow packed streets in Chicago
69% increase in murders, 16 of 52 attributed to being closed in and resulting arguments
A woman died of a heart attack in a snow drift, and her husband died after carrying her into the house
Motorist in shoveling parking space in front of house found another car there and smashed out windows
Doctor on a walk found a man trying to dig his car out to get wife to hospital; the doctor stayed and delivered her baby at no charge
Two helicopters and crew rescued four men who had been trapped two days without food on a fishing boat during 50 mph winds
Woman jumped in front of train and was killed
People delivered food and shoveled walks for elderly people without pay
Man walking to grocery store had heart attack, and a man passing by carried him two blocks to a hospital
Several babies were delivered at home by the family or with help of neighbors
College students helped dig out rapid transit tracks

Beneficial Activities

Crime rate was down 30% at height of January storms in Chicago
Flu was reduced because people had to stay in and public gatherings were cancelled
People could not fly home to Chicago from warm area vacations
People became friendlier (e.g., block parties, neighbors became better acquainted, commuters talked to one another, etc.)
People got more exercise
More use of such winter sports as tobogganing, sledding, cross-country skiing, snow-mobiling, ice skating, and ice fishing
More time for reading, cooking, relaxing (e.g., TV ratings went up, and income tax reports were done and in earlier)
Snow was pretty and many photos were taken

6. *Institutional Impacts*

Post office mail delayed because airlines closed and trucks delayed
Schools closed more than 1 week in Chicago from 12-24 January
Red Cross heavily involved
Fire department rescue squads helped people
Hospitals were used as storm refuges, and in other cases hospitals made sheets and blankets available to stranded travelers in schools
Governor asked for federal aid for 31 central Illinois counties after 23-24 January
Governor requested federal aid for 35 northern Illinois counties in early January but federal storm aid was denied
Federal aid comes through after second request in late January
Governor requested federal disaster assistance for southern 23 counties after 24-25 February storm
Governor signed bill to limit maximum amount that could be charged for vehicle towing
Federal snow removal funds made available

Table 6. Concluded

7. *Snow Removal Issues*
   - Six hundred pieces of equipment from Chicago contractors and hundreds more from Michigan, Massachusetts, New York, Ohio, Minnesota, Indiana, Kentucky, and Canada were used to clear 4000 miles of streets (after 11-14 January) at a cost of about $50 per hour per piece of equipment and operatinq crew
   - President Carter agreed to pay 2/3 of costs of snow removal on main roads in 22 counties in northern Illinois
   - Blizzard aid office set up at federal Small Business Administration disaster offices for victims of "Blizzard 79" for snow and later for flood damages
   - Snow removal cost the Park District of Chicago $10 million and threatened to cut summer services for lack of money
   - Cost of winter snow removal to one suburb (Evanston) was $1.5 million
   - Taxicab and trucking firms had no direct costs for added plowing of streets
   - Property owners had to pay entire cost of clearing driveways and roofs without tax relief
   - Senators Stevenson and Percy launched efforts to get federal government to provide more money faster to local governments for snow removal
8. *Institutional Problems due to Potholes*
   - As a result of three severe winters that left Illinois highway systems in great disrepair, Illinois ranked 4th in nation with 4,200,000 potholes, averaging nearly 40 per mile of paved roads in Illinois (survey by highway department)
   - Illinois Department of Transportation indicated it would need $4.5 million in 1979 to fill potholes on 75,000 miles of state highways, $500,000 more than in 1978 and twice as much as in 1977, when state spent $2.9 million on potholes
   - Governor came out with a state program to fix roads with increased gas tax and license tax
     a. gas tax raised from 7½ cents to 9 cents per gallon
     b. license raised
        small cars $18 to $30
        large cars $30 to $50
        trucks average increase of $15 per year up to 1983
   - State Court of Claims had backlog of 5500 cases, many of them the result of potholes (to collect, a motorist must file with Court of Claims in Springfield and be prepared to prove the state was legally negligent in failing to fix the road)
   - Highway deterioration in Illinois added $100 a year to cost of operating a car, cutting gas mileage, causing faster tire wear, and speeding deterioration of car's brakes, steering, and suspension systems
9. *Farmer Problems*
   - Stops and delays of commodity shipping because Mississippi and Illinois Rivers frozen in January and February (then in March, flooding of melted snow caused problems getting empty tows up rivers to move grain)
   - Snow cover helped farmers by keeping soil warm so that moisture could move into soil
   - Reduced truck and rail delivery of livestock to market caused a slight rise in prices
   - Severe cold added a month to prepare a hog for market
   - Cattle ate more during extreme cold to maintain their body heat
   - It was estimated that for every two litters of pigs born, one baby pig died (heavier than normal loss) as larger pigs piled together to keep warm, crushing baby pigs
   - Dairy production fell off in cold weather, and loss of power was a critical problem for dairy farmers
   - Milk was dumped because it could not be shipped
   - Purchases by Illinois farmers of emergency electric generators increased notably
   - Record cold helped push futures prices higher for such weather-sensitive commodities as cattle and hogs, e.g., at the Chicago Mercantile Exchange, cattle were $.15 to $.75 a pound higher for January 1979, and hog futures were $.38 to $.77 a pound higher in February

Table 7. Selected Tertiary (or Delayed) Impacts Resulting from the Severe Winter of 1978-1979

1. Businesses heavily stocked winter clothing, boots, and snowmobiles for 1979-1980, but were unable to sell them during the mild winter of 1979-1980, producing a loss in revenue and purchasing power for wholesalers and retailers.
2. Subsequent flooding from the record snow depths in northern Illinois occurred in the Rock, Illinois, and Mississippi Rivers and their tributaries in northern and central Illinois. For example, 50 people were evacuated from homes in the Chicago suburbs and hundreds were involved in sandbagging, with over 2000 persons homeless along the Illinois River in late March.
3. The city of Chicago developed a major "snowplan 1980" which was in force from December 1979 through 31 March 1980. This called for no parking on 105 miles of city streets between 0300 and 0700 and involved loss of 33,000 parking spaces. The plan also called for identification of snow routes when 2 inches or more snow occurred and the removal of on-street parking leading to loss of 187,000 additional parking spaces. The snow routes incorporated over 500 miles of city streets. The city purchased $15,000,000 in snow removal equipment, including 165 4-wheel drive vehicles equipped with plows. These were divided between the 50 city wards. Calcium chloride was purchased to be added to the salt, and those involved in snow removal were officially trained with a new manual.
4. Ex-city snow worker was indicted for giving payment forms for snow removal to two men who did not work and submitted over $100,000 in false charges.
5. Twenty-five city firms were tied to a snow crisis fraud. The city claimed that these firms were padding their snow removal bills. One Chicago newspaper claimed that at least $2 million in fraudulent bills for snow removal had been submitted to the city of Chicago. The city paid $300,000 before the fraud was uncovered, but has since refused to pay bills worth $1.7 million. The $2 million in fraudulent claims is 10% of the $19.5 million in bills submitted to the city by private contractors for snow removal during the winter of 1978-1979. The full cost of snow removal, including funds paid to city workers, was approximately $72 million.
6. In the fall of 1979, O'Hare Airport purchased $3.5 million of snow removal equipment, including special snow-blowers, plows, salt spreaders, ice cutters, and vans.
7. River flooding caused problems in getting tow boats up the Illinois and Mississippi Rivers to begin to move grain barges in March and April 1979.
8. Most Illinois power utilities sought rate hikes for natural gas and/or electricity in the winter of 1979-1980, often claiming that the prime reason was the unusually severe winter of 1978-1979 and its cost in their purchases of extra gas and electricity, and in storage problems.
9. The predicted increase in "snow babies" due to people being enclosed during the winter was recognized in October-November 1979 with 27% more births than normal in Chicago during those two months. Hospital officials reported many of the mothers were depressed because during the snow period they had gained weight and became pregnant.
10. Businesses and industry groups analyzed the absenteeism and loss of work in 1978-1979. They found that 96 percent of the members of the Administrative and Management Society allowed employees to leave work early when the city streets and highways were icy and snow-covered. Furthermore, 69% of the companies (or plants) that shut down indicated that the companies paid for the lost wages due to storm outages.

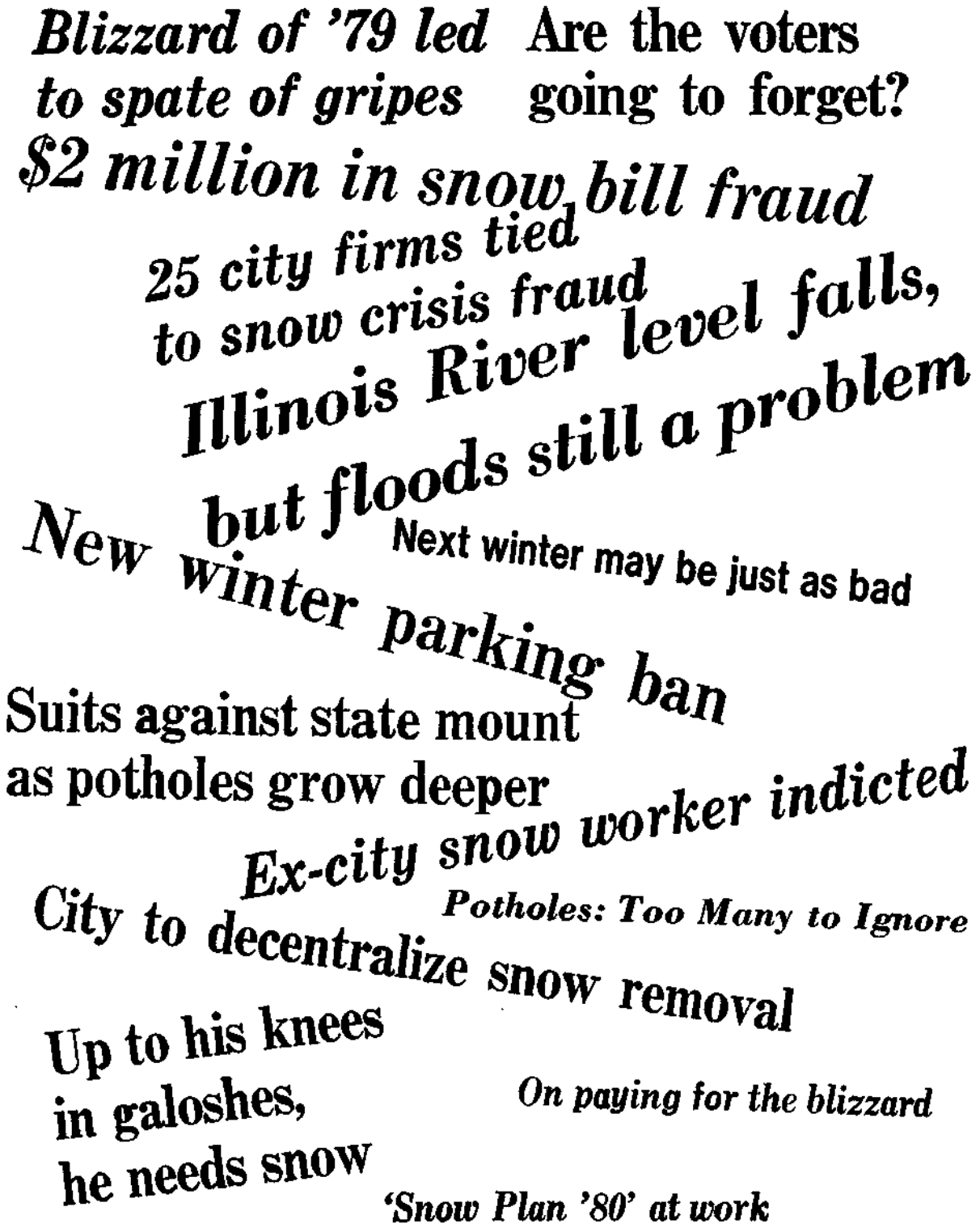


Figure 11. Headlines reflecting some of the delayed impacts of the winter of 1978-1979

particularly related to downstate transportation, were much less in the 1978-1979 winter. This is likely due to the fewer blizzards and severe ice storms in the 1978-1979 winter. However, the Chicago metropolitan area, with its record cold, snow storms, and snow depths likely raised the total statewide economic loss to a level as high or higher than experienced in the prior winter.

The most spectacular problems noted in the metropolitan area related to all transportation systems. Every form of surface and air transportation was seriously affected, and for prolonged periods. There were major impacts related to the movement of automobiles and trucks. The first of these was snow removal. The difficulties here produced enormous costs, inability to move automobiles and to find parking places, towing fees, the simple inability to move from point A to point B, and much prolonged anxiety.

The second major impact, related to travel of automobiles and trucks, was potholes. The winter of 1978-1979 added to the rapid deterioration of rural roads, city streets, and major highways throughout Illinois. The cost to public and commercial vehicles, the danger, and the ensuing public unhappiness led to many institutional impacts. These have included many court cases and higher taxes for road repairs in 1979 and subsequent years.

Ironically, the third severe winter in Illinois led many government institutions to finally develop winter "disaster" plans, to purchase winter equipment, and to issue restrictions concerning winter conditions in future years. Since the three severe winters of 1976-1979 are clearly extreme events and unlikely to occur again for decades, the utility of these "after the fact" endeavors is open to question.

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APPENDIX

Local Climatological Data,
Chicago Midway Airport,
December 1978 through March 1979

DECEMBER 1978
CHICAGO, ILLINOIS
NATIONAL WEATHER SERVICE OFC
MIDWAY AIRPORT

Local Climatological Data

MONTHLY SUMMARY

LATITUDE 41° 47′ N LONGITUDE 87° 45′ W ELEVATION (GROUND) 607 FT STANDARD TIME USED: CENTRAL WBAN #14819

DECEMBER 1978 CHICAGO, ILLINOIS

DATE	TEMPERATURE °F MAXIMUM	MINIMUM	AVERAGE	DEPARTURE FROM NORMAL	AVERAGE DEW POINT	DEGREE DAYS BASE 65° HEATING (SEASON BEGINS WITH JULY)	COOLING (SEASON BEGINS WITH JAN.)	WEATHER TYPES ON DATES OF OCCURRENCE 1 FOG 2 HEAVY FOG 3 THUNDERSTORM 4 ICE PELLETS 5 HAIL 6 GLAZE 7 DUSTSTORM 8 SMOKE, HAZE 9 BLOWING SNOW	SNOW, ICE PELLETS OR ICE ON GROUND AT 0BAM IN	PRECIPITATION WATER EQUIVALENT IN	SNOW, ICE PELLETS IN	AVG STATION PRESS. IN ELEV 623 FEET M.S.L.	WIND RESULTANT DIR	RESULTANT SPEED M.P.H.	AVERAGE SPEED M.P.H.	FASTEST MILE SPEED M.P.H.	FASTEST MILE DIRECTION	SUNSHINE MINUTES	SUNSHINE PERCENT OF POSSIBLE	SKY COVER TENTHS SUNRISE TO SUNSET	SKY COVER TENTHS MIDNIGHT TO MIDNIGHT	DATE
1	34	24	29	-4	26	36	0	1	5	64	7.6	29.27	35	1.2	6.0	14	N	0	0	10	10	1
2	32	21	27	-6	20	38	0	1 3 6	8	.05	4	29.47	04	11.0	14.1	24	NE	0	0	10	10	2
3	43	14	29	-3	31	36	0	23 6 8	7	41	T	29.04	22	4.9	13.1	27	SE	0	0	10	10	3
4	34	7	21	-11	12	44	0		4	T	T	28.96	23	18.2	19 8	27	SE	343	61	3	6	4
5	35	32	34	2	28	31	0	1	3	08	1 9	28.89	23	8.6	9.4	17	SE	0	0	10	10	5
6	32	20	26	-5	16	39	0		4	T	T	29.44	31	7.7	8 8	14	W	22	4	10	10	6
7	33	16	25	-6	23	40	0	1 6 8	10	.69	8.9	29.45	02	8.9	11.7	23	NE	0	0	10	10	7
8	21	12	17	-14	6	48	0	6	9	T	T	29.50	31	10.4	10 6	18	NW	1	0	10	9	8
9	14	0	7	-23	0	58	0		8	0	0	29.44	26	9.7	10 4	17	SW	554	100	0	1	9
10	21	-8*	7*	-23	-8	58	0		8	0	0	28.85	24	6.9	8.1	13	W	497	90	1	3	10
11	33	21	27	-3	22	38	0	8	8	T	T	29.58	20	9 1	10.4	14	W	3	1	9	10	11
12	41	31	36	7	29	29	0	8	7	0	0	29.46	19	14.2	14.2	23	S	115	21	10	9	12
13	39	21	30	1	19	35	0		5	0	0	29.48	27	17.0	17.5	33	W	186	36	7	5	13
14	37	17	27	-2	19	38	0		5	0	0	29.45	22	15.2	15.7	27	SW	235	43	9	7	14
15	39	29	34	6	24	31	0		4	0	0	29.21	22	12 9	13.1	22	SW	550	100	1	1	15
16	38	24	32	4	26	33	0	1 8	4	0	0	29.29	24	9.6	11.4	25	W	252	46	4	4	16
17	34	20	27	-1	19	38	0		4	0	0	29.65	24	10 3	11.2	17	W	548	100	1	1	17
18	41	31	36*	8	26	29	0		3	0	0	29.38	19	4.5	6.8	18	S	248	46	8	8	18
19	35	31	33	6	27	32	0	1 6 8	3	05	0	29.26	09	12.1	12.5	19	E	0	0	10	10	19
20	37	26	32	5	31	33	0	2 6	3	05	0	28 80	24	4.3	10 6	33	W	0	0	10	10	20
21	28	15	22	-5	16	43	0		2	T	T	29.08	25	12 8	13.4	24	SW	451	82	1	3	21
22	35	24	30	3	23	35	0		2	0	0	29.18	23	13.9	15.1	25	SW	549	100	0	2	22
23	43*	20	32	6	22	33	0		2	01	0	28 29	18	6.1	9 4	17	SE	145	26	8	8	23
24	41	23	32	6	29	33	0	1 8	2	04	T	28.88	25	5.0	10.9	18	N	0	0	10	10	24
25	25	13	19	-7	14	46	0		1	01	.7	29 20	26	7.0	8 2	15	W	301	55	4	6	25
26	22	12	17	-8	11	48	0		3	04	.7	29 45	28	8.7	10 2	17	W	467	85	0	3	26
27	22	6	14	-12	6	51	0		2	0	0	29.73	27	5.0	6 3	13	W	487	88	2	2	27
28	28	18	24	-2	13	41	0	1 4 9	1	.12	1 7	28.60	12	14.3	15.0	25	SE	187	34	9	10	28
29	37	26	32	7	28	33	0	1	6	78	2 9	29.54	15	12.7	13 8	17	S	0	0	10	10	29
30	37	23	30	5	32	35	0	2 6	3	.25	T 8	29.54	02	.9	7.1	14	N	0	0	10	10	30
31	33	23	28	3	27	37	0	1 4 6 9	5	88	7 6	29.46	36	13.5	14.0	24	NE	0	0	10	10	31
	SUM	SUM				TOTAL	TOTAL			TOTAL	TOTAL	FOR THE MONTH:						TOTAL	%	SUN	SUN	
	1026	592				1188	0	NUMBER OF DAYS		4.11	31.4	29.35	24	4.8	11 6	33	W	8152	FOR	205	218	
	AVG.	AVG	AVG	DEP	AVG.	DEP.	DEP	PRECIPITATION		DEP						DATE	20+	POSSIBLE	MONTH	AVG.	AVG.	
	33 1	19 1	26 1	-2.4	20	67	0	≥ .01 INCH	15	2 00								17130	36	6.6	7.0	
						SEASON TO DATE		SNOW, ICE PELLETS														
	NUMBER OF DAYS					TOTAL	TOTAL	≥ 1.0 INCH	6	GREATEST IN 24 HOURS AND DATES						GREATEST DEPTH ON GROUND OF SNOW, ICE PELLETS OR ICE AND DATE						
	MAXIMUM TEMP ≥ 90°	≤ 32°	MINIMUM TEMP ≤ 32°	≤ 0°		2335	882	THUNDERSTORMS	2	PRECIPITATION		SNOW, ICE PELLETS										
						DEP.	DEP	HEAVY FOG	3	.94	30-31	7.8		1		12	31+					
	0	10	31	2		84	57	CLEAR 9	PARTLY CLOUDY 4		CLOUDY 18											

* EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE
T TRACE AMOUNT
+ ALSO ON AN EARLIER DATE, OR DATES
HEAVY FOG - VISIBILITY 1/4 MILE OR LESS
FIGURES FOR WIND DIRECTIONS ARE TENS OF DEGREES CLOCKWISE FROM TRUE NORTH. 00 = CALM. DATA IN COLS 6 AND 12-15 ARE BASED ON 7 OR MORE OBSERVATIONS PER DAY AT 3-HOUR INTERVALS. FASTEST MILE WIND SPEEDS ARE FASTEST OBSERVED ONE-MINUTE VALUES WHEN DIRECTIONS ARE IN TENS OF DEGREES. THE / WITH THE DIRECTION INDICATES PEAK GUST SPEED.
ANY ERRORS DETECTED WILL BE CORRECTED AND CHANGES IN SUMMARY DATA WILL BE ANNOTATED IN THE ANNUAL SUMMARY

SUMMARY BY HOURS

HOUR LOCAL TIME	AVERAGES SKY COVER TENTHS	STATION PRESSURE IN	TEMPERATURE AIR °F	TEMPERATURE WET BULB °F	TEMPERATURE DEW PT. °F	RELATIVE HUMIDITY %	WIND SPEED M.P.H.	RESULTANT WIND DIRECTION	RESULTANT WIND SPEED M.P.H.
00	7	29 36	26	24	20	77	11.6	25	4.5
03	7	29.36	25	24	19	79	10.5	24	3.8
06	7	29.36	24	23	19	80	11.2	23	4.8
09	7	29.37	25	24	20	79	11.2	22	5.3
12	8	29 35	29	27	21	73	11 4	23	6.0
15	6	29.33	30	27	21	70	12.3	24	5.1
18	8	29.34	28	26	21	73	12.5	25	3.8
21	7	29.35	27	25	20	75	12.2	24	5.2

HOURLY PRECIPITATION (WATER EQUIVALENT IN INCHES)

DATE	A.M. HOUR ENDING AT 1	2	3	4	5	6	7	8	9	10	11	12	P.M. HOUR ENDING AT 1	2	3	4	5	6	7	8	9	10	11	12	DATE
1	T	T	05	.11	06	02	04	01	01	05	01	10	03	02	06	02	02	T	T	T	.02	01	T	T	1
2	01	T											T	T	T	02	1	T	T	.01	T	01	T	T	2
3	05	24	.05	03	T	T	01	03	T	T	T	T	T										T	T	3
4																T	T								4
5									T	01	01	03	T	01	01	T	T	T	T	T	01				5
6						T																			6
7		.05	.18	.05	.13	07	12	06	T	T	T	T	T	T	T	T	T	03	T	T					7
8								T	T	T	T														8
9																									9
10																									10
11	T	T	T	T																					11
12																									12
13																									13
14																									14
15																									15
16																									16
17																									17
18																									18
19																		T	T	T	.01	02	.01	01	19
20	T	T	01	T	T	T	01	01	01	T	T	T	.01	T											20
21				T	T																				21
22																									22
23																								01	23
24	T	T	02	02	T	T	T			T	T		T	T	T							T	T	T	24
25		T	T																			T	T	01	25
26	T	02	02	T	T																				26
27																									27
28																					T	01	04	.07	28
29	12	10	.05	04	01	T	T						T	T	01	03	08	05	05	04	04	05	05	.06	29
30	.07	04	01	01	T								T	T	T	T	T	.01	T	03	02	01	.03	02	30
31	01	T		T	.01	03	.02	.04	06	.06	05	.04	09	10	.08	06	06	05	06	04	.01	01	T	.01	31

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noaa NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION / ENVIRONMENTAL DATA AND INFORMATION SERVICE

Daniel B. Mitchell
DIRECTOR, NATIONAL CLIMATIC CENTER

USCOMM--NOAA--ASHEVILLE 01/25/79 2000

JANUARY 1979
CHICAGO, ILLINOIS
NATIONAL WEATHER SERVICE OFC
MIDWAY AIRPORT

Local Climatological Data

MONTHLY SUMMARY

LATITUDE 41° 47 'N LONGITUDE 87° 45 'W ELEVATION (GROUND) 607 FT. STANDARD TIME USED: CENTRAL WBAN #14819

DATE	TEMPERATURE °F MAXIMUM	MINIMUM	AVERAGE	DEPARTURE FROM NORMAL	AVERAGE DEW POINT	DEGREE DAYS BASE 65° HEATING (SEASON BEGINS WITH JULY)	COOLING (SEASON BEGINS WITH JAN.)	WEATHER TYPES ON DATES OF OCCURRENCE 1 FOG 2 HEAVY FOG 3 THUNDERSTORM 4 ICE PELLETS 5 HAIL 6 GLAZE 7 DUST/SAND 8 SMOKE, HAZE 9 BLOWING SNOW	SNOW ICE PELLETS OR ICE ON GROUND AT 0800 LST IN	PRECIPITATION WATER EQUIV. IN	SNOW, ICE PELLETS IN	AVG STATION PRESS. IN ELEV 623 FEET MSL	WIND RESULTANT DIR	RESULTANT SPEED M.P.H	AVERAGE SPEED M.P.H	FASTEST MILE SPEED M.P.H	FASTEST MILE DIRECTION	SUNSHINE MINUTES	SUNSHINE PERCENT OF POSSIBLE	SKY COVER TENTHS SUNRISE TO SUNSET	SKY COVER TENTHS MIDNIGHT TO MIDNIGHT	DATE
1	25	4	15	-10	13	50	0	4 6	11	.08	9	28.43	33	15.2	15.7	25	NW	0	0	10	10	1
2	4	-13	-5	-30	-17	70	0	6 8	10	0	0	29.55	26	13.7	14.4	17	SW	546	99	1	0	2
3	3	-12	-5	-30	-12	70	0	6	10	0	0	29.71	23	13.4	13.7	27	SW	554	100	0	0	3
4	4	-5	-1	-26	-10	66	0	6	9	0	0	29.92	25	11.2	11.4	16	W	412	74	4	5	4
5	5	-8	-2	-27	-10	67	0	6	9	0	0	29.93	26	7.6	8.3	13	SW	176	32	8	6	5
6	10	-12	-1	-25	-8	66	0		9	0	0	29.82	20	10.4	10.9	18	S	318	57	7	4	6
7	16	0	8	-16	-1	57	0		9	0	0	29.52	30	7.4	8.3	12	W	286	51	7	6	7
8	6	-7	-1	-25	-10	66	0		9	0	0	29.57	25	9.9	11.4	20	SW	559	100	0	2	8
9	18	0	9	-15	-2	56	0		9	T	T	29.58	24	10.2	11.1	17	S	391	70	4	3	9
10	3	-7	-2	-26	-12	67	0		9	0	0	29.65	28	10.7	10.9	17	W	475	85	8	3	10
11	14	-10	2	-22	-7	63	0	8	9	.01	3	29.83	21	3.2	6.2	12	SE	106	19	9	7	11
12	24	10	17	-7	13	48	0	1 8	9	.10	1.9	29.51	15	6.5	7.8	13	SE	0	0	10	10	12
13	31	20	26	2	27	39	0	1 9	14	1.11	10.5	29.07	03	11.2	12.5	28	NW	0	0	10	10	13
14	20	-14	3	-21	-4	62	0	1 9	29	.17	2.3	28.36	29	15.5	18.1	30	NW	566	100	0	2	14
15	9	-16*	-5*	-29	-15	70	0	8	28	.07	2.0	29.89	21	9.2	11.8	15	SE	74	13	10	7	15
16	22	-2	10	-14	2	55	0	8	27	.01	.3	29.64	21	1.3	7.5	11	SE	360	63	4	7	16
17	33	4	19	-5	14	46	0	1 6 8	27	.13	2.3	29.41	29	10.4	12.9	29	W	365	64	6	5	17
18	21	-3	9	-15	3	56	0	8	26	T	T	29.75	30	1.7	6.5	18	E	55	10	9	8	18
19	34	18	25	1	20	40	0	1 6 8	26	.18	1.2	29.33	13	12.2	12.8	21	E	0	0	10	10	19
20	35*	32	34*	10	32	31	0	1 6	26	T	0	28.94	30	3.0	5.5	14	NW	0	0	10	10	20
21	34	24	29	5	25	36	0	1 6	24	.01	.1	28.83	32	12.0	13.7	23	N	0	0	10	10	21
22	24	11	18	-6	14	47	0	6 8	23	T	T	29.19	23	8.3	11.8	18	S	284	49	7	6	22
23	34	23	29	5	24	36	0	1 6 8	21	.20	2.1	29.00	16	11.0	11.7	20	SE	0	0	10	10	23
24	33	14	24	0	20	41	0	1 9	24	.55	5.2	28.77	32	12.2	13.4	20	NW	66	11	10	10	24
25	17	3	10	-14	2	55	0		27	0	0	29.26	29	10.2	10.5	17	NW	588	100	5	3	25
26	27	7	17	-7	9	48	0	8	26	T	.1	29.32	28	3.2	3.5	9	N	163	28	9	7	26
27	32	24	28	+4	25	37	0	1 8	26	.34	4.2	28.06	36	2.6	4.2	14	NE	0	0	10	10	27
28	31	26	29	4	25	36	0		27	T	1	29.13	30	11.1	11.5	20	W	0	0	10	10	28
29	27	8	18	-7	15	47	0	8	27	0	0	29.39	26	9.0	9.4	17	SW	253	42	8	6	29
30	23	7	15	-10	10	50	0	1 8	27	.03	.7	29.41	26	5.6	6.5	9	S	334	56	7	7	30
31	21	8	15	-10	11	50	0	1 8	27	.01	.2	28.35	28	10.0	10.2	16	NW	188	31	8	7	31
	SUM 640	SUM 129				TOTAL 1620	TOTAL 0	NUMBER OF DAYS		TOTAL 3.00	TOTAL 40.4	FOR THE MONTH: 29.42	27	6.4	10.9	30	NW	TOTAL 7123	% FOR 219	SUM 219	SUM 199	
	AVG 20.6	AVG. 4.2	AVG 12.9	DEP -11.9	AVG 6	DEP 386	DEP 0	PRECIPITATION ≥ .01 INCH	15	DEP. 1.15						DATE: 14		POSSIBLE 17757	MONTH 40	AVG 7.1	AVG 8.4	

NUMBER OF DAYS				SEASON TO DATE	
MAXIMUM TEMP.		MINIMUM TEMP		TOTAL	TOTAL
≥ 90°	≤ 32°	≤ 32°	≤ 0°	DEP	DEP
0	25	31	14	450	0

SNOW, ICE PELLETS	
≥ 1.0 INCH	0
THUNDERSTORMS	0
HEAVY FOG	0
CLEAR 4	PARTLY CLOUDY 10 CLOUDY 17

GREATEST IN 24 HOURS AND DATES			
PRECIPITATION		SNOW, ICE PELLETS	
1.18	13-14	16.5	13

GREATEST DEPTH ON GROUND OF SNOW, ICE PELLETS OR ICE AND DATE	
29	14

- EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE
T TRACE AMOUNT
+ ALSO ON AN EARLIER DATE, OR DATES
HEAVY FOG - VISIBILITY 1/4 MILE OR LESS
FIGURES FOR WIND DIRECTIONS ARE TENS OF DEGREES CLOCKWISE FROM TRUE NORTH: 00 = CALM
DATA IN COLS. 6 AND 12-15 ARE BASED ON 7 OR MORE OBSERVATIONS PER DAY AT 3-HOUR INTERVALS.
FASTEST MILE WIND SPEEDS ARE FASTEST OBSERVED ONE-MINUTE VALUES WHEN DIRECTIONS ARE IN TENS OF DEGREES. THE / WITH THE DIRECTION INDICATES PEAK GUST SPEED.
ANY ERRORS DETECTED WILL BE CORRECTED AND CHANGES IN SUMMARY DATA WILL BE ANNOTATED IN THE ANNUAL SUMMARY

TOTAL MONTHLY SNOWFALL IS A NEW RECORD FOR THIS LOCATION.

SUMMARY BY HOURS

HOUR LOCAL TIME	AVERAGES SKY COVER TENTHS	STATION PRESSURE IN	TEMPERATURE AIR °F	TEMPERATURE WET BULB °F	TEMPERATURE DEW PT °F	RELATIVE HUMIDITY %	WIND SPEED M.P.H	RESULTANT WIND DIRECTION	RESULTANT WIND SPEED M.P.H
00	6	28.41	13	12	7	77	10.1	27	5.3
03	6	28.41	11	11	5	77	9.6	28	5.2
06	6	28.41	10	8	4	77	10.4	28	5.4
09	7	29.44	11	10	4	76	10.0	27	5.4
12	7	29.43	15	14	7	71	10.7	26	6.3
15	7	29.40	16	15	8	71	11.1	25	6.0
18	7	29.41	14	13	7	74	11.3	28	5.5
21	6	29.42	13	12	7	75	10.2	26	4.7

HOURLY PRECIPITATION (WATER EQUIVALENT IN INCHES)

DATE	A M HOUR ENDING AT 1	2	3	4	5	6	7	8	9	10	11	12	P M HOUR ENDING AT 1	2	3	4	5	6	7	8	9	10	11	12	DATE
1	T	T		T	T	.01	02	01	01	01	01	T	T	T	T	01	T	T	T	T	T	T	T		1
2																									2
3																									3
4																									4
5																									5
6																									6
7																									7
8																									8
9										T															9
10																									10
11																			T	T	T	T	T	01	11
12	T	01	T	T	T	T	T	T	T	T			T	T	T	T	.01	T	T	02	01	02	.02	01	12
13	T	05	.05	.03	.04	08	03	.05	07	.05	05	09	05	05	06	04	03	.05	03	03	.04	05	04	.05	13
14	.04	05	08																						14
15														T	.02	T	.01	03	01	T			T	T	15
16	T	T	T	01	T																				16
17	.03	04	.04	.02																					17
18								T	T	T	T			T	T										18
19				.04	05	02	.02	T	T	T	01	T	T	T	T	01	01	02	T	T	T	T			19
20																T	T	T	T	T					20
21					T	T	T	T	T		T		T	T	T	01	T	T					T		21
22										T				T	T										22
23																T	T	.04	01	01	T	01	05	.08	23
24	05	.08	08	T	.03	03	.04	04	T	01	03	.01	.01	01	.02	02	04	.03	01	01	T				24
25																									25
26																					T	T	T		26
27										T	T	02	01	.03	02	04	.06	.04	08	01	02	T	.01	T	27
28		T	T	T	T	T	T	T	T			T	T	T	T										28
29																									29
30																	.01	.01	01	T	T	T	T	T	30
31	T	T	01	T	T	T	T	T	T	T							T	T							31

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USCOMM--NOAA--ASHEVILLE 03/07/79 2000

JANUARY 1979 CHICAGO, ILLINOIS

FEBRUARY 1979
CHICAGO, ILLINOIS
NATIONAL WEATHER SERVICE OFC
MIDWAY AIRPORT

Local Climatological Data

MONTHLY SUMMARY

LATITUDE 41° 47 ′ N LONGITUDE 87° 45 ′ W ELEVATION (GROUND) 607 FT STANDARD TIME USED: CENTRAL WBAN #14819

FEBRUARY 1979 CHICAGO, ILLINOIS

DATE	TEMPERATURE °F MAXIMUM	MINIMUM	AVERAGE	DEPARTURE FROM NORMAL	AVERAGE DEW POINT	DEGREE DAYS BASE 65° HEATING (SEASON BEGINS WITH JULY)	COOLING (SEASON BEGINS WITH JAN)	WEATHER TYPES ON DATES OF OCCURRENCE (1 FOG, 2 HEAVY FOG, 3 THUNDERSTORM, 4 ICE PELLETS, 5 HAIL, 6 GLAZE, 7 DUSTSTORM, 8 SMOKE, HAZE, 9 BLOWING SNOW)	SNOW ICE PELLETS OR ICE ON GROUND AT 0BAM IN	PRECIPITATION WATER EQUIV IN	SNOW ICE PELLETS IN	AVG STATION PRES SURE IN (-EV 623 FEET MSL)	WIND RESULTANT DIR	RESULTANT SPEED M P H	AVERAGE SPEED M P H	FASTEST MILE SPEED M P H	FASTEST MILE DIRECTION	SUNSHINE MINUTES	SUNSHINE PERCENT OF POSSIBLE	SKY COVER TENTHS SUNRISE TO SUNSET	SKY COVER TENTHS MIDNIGHT TO MIDNIGHT	DATE
1	18	3	11	-14	3	54	0		26	0	0	29 57	28	7 4	7 8	14	NW	575	95	1	3	1
2	18	7	13	-12	6	52	0	8	26	T	T	29 56	19	8 0	8.8	17	S	184	32	8	9	2
3	24	4	14	-11	11	51	0	8	26	T	T	29 39	23	8 3	9 9	16	SW	0	0	10	8	3
4	4	-6	-1	-26	-10	66	0		24	0	0	29 52	26	11 6	12.1	18	W	610	100	0	0	4
5	2	-17*	-8*	-33	-17	73	0		23	0	0	29 64	25	7 7	9 9	15	W	576	94	0	1	5
6	23	-7	8	-18	0	57	0		22	0	0	29.34	19	10 1	10 2	21	S	230	37	8	7	6
7	21	-2	10	-16	5	55	0	1 8	20	T	T	29 23	28	10 6	10.8	20	W	528	86	2	4	7
8	14	-3	6	-20	- 6	59	0		20	.01	.2	28 55	32	10 6	11.8	22	NW	414	67	9	7	8
9	9	-4	3	-23	-10	62	0		19	0	0	29 73	27	5 7	9 9	17	N	606	97	6	5	9
10	16	-1	8	-18	- 5	57	0		19	T	1	29 72	27	4 2	6.3	10	W	308	49	8	9	10
11	19	10	15	-11	10	50	0	1 8	19	14	1 8	29 62	13	9 6	9.8	14	SE	0	0	10	10	11
12	23	16	20	-7	15	45	0	1 8	22	.26	2 9	29 52	05	12 3	13.2	24	NE	0	0	9	9	12
13	28	18	22	-5	13	43	0	8	22	0	0	29.85	16	6 8	7 3	15	SE	140	22	9	9	13
14	27	18	23	-4	17	42	0	2 6 8	22	T	0	29.30	14	7 9	8 3	16	SE	0	0	10	10	14
15	28	20	24	-3	23	41	0	1 6	22	T	T	29.23	03	5.9	10 1	20	NW	0	0	10	10	15
16	20	10	15	-13	8	50	0	1 6	22	T	T	29.80	35	14 3	16.5	21	N	0	0	7	6	16
17	10	1	6	-22	- 1	59	0	6	22	T	T	30 11	07	15 9	16.3	30	E	138	21	5	5	17
18	14	1	8	-20	1	57	0	6 8	22	26	3 4	29 76	08	8 7	8.8	23	E	0	0	10	9	18
19	17	-2	8	-20	2	57	0	1 6 8	25	0	0	29.75	21	7.6	8 8	20	S	586	91	6	6	19
20	36	12	24	-4	18	41	0	1 6 8	25	01	0	29 49	18	13 7	14 0	22	S	330	51	8	6	20
21	37	25	31	2	30	34	0	1 8	22	25	3	29.25	22	13.3	15 7	32	SW	105	6	9	8	21
22	38	26	32	3	28	33	0	1 8	20	T	0	29.49	13	7 5	8.3	21	SE	0	0	10	9	22
23	42	27	35	6	34	30	0	23 8	18	14	0	29.23	22	6.8	11.8	15	SE	244	37	8	6	23
24	32	25	29	-1	22	36	0		13	0	0	28 63	02	12 2	14.8	21	NE	51	7	10	6	24
25	29	22	26	-4	19	39	0		13	0	0	28 58	02	21.4	22.0	38	N	346	52	9	6	25
26	38	21	29	-1	20	38	0		12	0	0	29 50	01	12 4	12 9	27	N	617	93	1	1	26
27	40	18	29	-1	20	36	0	8	12	0	0	29.49	20	2 0	4 5	12	S	605	90	6	5	27
28	42*	27	35*	4	27	30	0	1 8	12	04	T	29.39	10	3 8	5.0	10	E	30	4	10	8	28
	SUM 667	SUM 266				TOTAL 1345	TOTAL 0			TOTAL 1.11	TOTAL 8 8	29.54	FOR THE MONTH: 30	3	10 8	38	N	TOTAL 7233	7 FOR 197	SUM 197	SUM 182	
	AVG 23.8	AVG 9 5	AVG 16.7	DEP -10 7	AVG 10	DEP 292	DEP 0	NUMBER OF DAYS PRECIPITATION > 01 INCH	8	DEP -0.48						DATE 25		POSSIBLE 17818	MONTH 41	AVG 7 0	AVG 6.5	
	NUMBER OF DAYS MAXIMUM TEMP ≥ 90° 0	MAXIMUM TEMP ≤ 32° 21	MINIMUM TEMP ≤ 32° 28	MINIMUM TEMP ≤ 0° 8		SEASON TO DATE (JULY) TOTAL 5308	TOTAL 0	SNOW ICE PELLETS > 1 0 INCH	3	GREATEST IN 24 HOURS AND DATES PRECIPITATION 33	11-12	SNOW 3 4	ICE PELLETS 16		GREATEST DEPTH ON GROUND OF SNOW, ICE PELLETS OR ICE AND DATE 26	3+			
								THUNDERSTORMS	1													
								HEAVY FOG	2													
						242	0	CLEAR 5	PARTLY CLOUDY 6	CLOUDY 17												

* EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE
T TRACE AMOUNT
+ ALSO ON AN EARLIER DATE, OR DATES
HEAVY FOG - VISIBILITY 1/4 MILE OR LESS
FIGURES FOR WIND DIRECTIONS ARE TENS OF DEGREES CLOCKWISE FROM TRUE NORTH 00 = CALM
DATA IN COLS. 6 AND 12-15 ARE BASED ON 7 OR MORE OBSERVATIONS PER DAY AT 3-HOUR INTERVALS
FASTEST MILE WIND SPEEDS ARE FASTEST OBSERVED ONE-MINUTE VALUES WHEN DIRECTIONS ARE IN TENS OF DEGREES. THE / WITH THE DIRECTION INDICATES PEAK GUST SPEED
ANY ERRORS DETECTED WILL BE CORRECTED AND CHANGES IN SUMMARY DATA WILL BE ANNOTATED IN THE ANNUAL SUMMARY

SUMMARY BY HOURS

HOUR LOCAL TIME	AVERAGES SKY COVER TENTHS	STATION PRESSURE IN	TEMPERATURE AIR °F	TEMPERATURE WET BULB °F	TEMPERATURE DEW PT °F	RELATIVE HUMIDITY %	WIND SPEED M P H	RESULTANT WIND DIRECTION	RESULTANT WIND SPEED M P H
00	6	29 54	15	14	9	76	10.1	22	1 2
03	6	29 52	14	13	8	75	10.0	10	.9
06	6	29.53	14	13	7	75	9 8	10	.4
09	7	29 55	17	15	10	75	11 2	35	1.2
12	7	29 55	21	19	13	73	12 2	28	.8
15	7	29 52	22	20	13	70	11 7	28	1 1
18	7	29 54	19	18	12	72	10 8	32	7
21	6	29 54	17	16	10	73	10 6	04	.3

HOURLY PRECIPITATION (WATER EQUIVALENT IN INCHES)

DATE	A M HOUR ENDING AT 1	2	3	4	5	6	7	8	9	10	11	12	P M HOUR ENDING AT 1	2	3	4	5	6	7	8	9	10	11	12	DATE
1																									1
2																									2
3			T	T		T	T	T	T				T	T	T	T	T								3
4																									4
5																									5
6																									6
7	T	T	T	T	T		T	T	T	T															7
8					T	T	T	01	T										T	T	T				8
9																									9
10																			T	T	T	T	T	T	10
11	.01	02	01	T	01	01	01	T	T												T	01	03	.03	11
12	.05	03	03	.01	.06	.04	01	T	T	T	01	T	T	T		.01	.01	T	T						12
13																									13
14										T	T	T	T	T	T	T	T	T	T	T					14
15			T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T		T		T		15
16										T	T	T				T	T	T		T	T	T	T	T	16
17	T																								17
18								T	T	01	01	05	05	.05	03	01	01	.01	01	01	01	T			18
19																									19
20																					T	T	01		20
21	.07	06	05	06	T	T	T	T	01																21
22																						T	T		22
23	T	01	13	T	T	T	T	T	T																23
24																									24
25																									25
26																									26
27																									27
28																	T	T	T	T	T	T	02	02	28

SUBSCRIPTION PRICE $2 55 PER YEAR (INCLUDING ANNUAL SUMMARY) FOREIGN MAILING $1 85 EXTRA SINGLE COPY, 20 CENTS FOR MONTHLY OR ANNUAL ISSUE THERE IS A MINIMUM CHARGE OF $2 00 FOR EACH ORDER OF SHELF-STOCKED ISSUES OF PUBLICATIONS MAKE CHECKS PAYABLE TO DEPARTMENT OF COMMERCE NOAA SEND PAYMENTS, ORDERS, AND INQUIRIES TO NATIONAL CLIMATIC CENTER, FEDERAL BUILDING, ASHEVILLE, NORTH CAROLINA 28801

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noaa NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION / ENVIRONMENTAL DATA AND INFORMATION SERVICE

Daniel B. Mitchell
DIRECTOR, NATIONAL CLIMATIC CENTER

USCOMM -NOAA--ASHEVILLE 05/21/79 2000

MARCH 1979
CHICAGO, ILLINOIS
NATIONAL WEATHER SERVICE OFC
MIDWAY AIRPORT

Local Climatological Data

MONTHLY SUMMARY

LATITUDE 41° 47 'N LONGITUDE 87° 45 'W ELEVATION (GROUND) 607 FT STANDARD TIME USED: CENTRAL WBAN #14819

DATE	TEMPERATURE °F MAXIMUM	MINIMUM	AVERAGE	DEPARTURE FROM NORMAL	AVERAGE DEW POINT	DEGREE DAYS BASE 65° HEATING (SEASON BEGINS WITH JULY)	COOLING (SEASON BEGINS WITH JAN 1)	WEATHER TYPES ON DATES OF OCCURRENCE (1 FOG, 2 HEAVY FOG, 3 THUNDERSTORM, 4 ICE PELLETS, 5 HAIL, 6 GLAZE, 7 DUSTSTORM, 8 SMOKE HAZE, 9 BLOWING SNOW)	SNOW, ICE PELLETS OR ICE ON GROUND AT 0&AM IN	PRECIPITATION WATER EQUIVALENT IN	SNOW, ICE PELLETS IN	AVG STATION PRESS- URE IN ELEV 623 FEET M.S.L.	WIND RESULTANT DIR	RESULTANT SPEED M.P.H.	AVERAGE SPEED M.P.H.	FASTEST MILE SPEED M.P.H.	FASTEST MILE DIRECTION	SUNSHINE MINUTES	SUNSHINE PERCENT OF POSSIBLE	SKY COVER TENTHS SUNRISE TO SUNSET	SKY COVER TENTHS MIDNIGHT TO MIDNIGHT	DATE
1	38	29	34	3	31	31	0	2 8	10	08	T	29 39	34	3.3	5.5	15	NW	262	37	8	9	1
2	34	30	32	1	31	33	0	2	9	0	0	29.57	16	7.7	7 9	16	SE	1	0	10	10	2
3	45	32	39	7	38	26	0	1	7	64	0	28.16	14	11.2	11 9	20	SE	10	1	10	10	3
4	45	30	38	6	36	27	0	1 6	8	74	0	29 00	21	13.0	13 7	22	SW	24	4	10	10	4
5	30	28	29	-3	26	36	0	1 3 6	T	07	T	29 30	22	11 5	11.8	17	W	84	8	10	10	5
6	41	21	31	-2	25	34	0	1 8	T	01	T	29 24	20	9 3	10.2	18	S	640	93	1	5	6
7	37	33	35	2	33	30	0	1	T	.01	0	29.12	10	3.5	4 8	9	NW	16	2	10	10	7
8	42	33	38	4	32	27	0	1 8	T	0	0	29.27	28	1 8	5.0	10	SW	482	69	7	9	8
9	35	22	29	-5	31	36	0	1 8	T	12	1.0	29 31	21	7 4	8.5	15	W	54	8	10	9	9
10	22	7	15	-19	6	50	0		T	T	T	29.42	27	12 8	13 4	20	SW	603	86	7	6	10
11	26	3x	15x	-20	5	50	0		T	T	T	29.37	25	7 0	7.9	21	SW	559	80	7	5	11
12	35	17	26	-9	20	39	0		T	0	0	29.51	20	4 4	5.8	16	S	680	98	2	2	12
13	52	30	41	6	32	24	0		T	T	0	29.09	21	12 2	15.0	36	W	372	52	8	8	13
14	33	16	25	-11	18	40	0		T	T	T	29 38	28	17.4	18.7	38	NW	498	70	6	5	14
15	24	12	18	-18	4	47	0		T	0	0	29 84	29	8 0	11.2	23	NW	714	100	0	0	15
16	43	17	30	-7	22	35	0		T	0	0	29 78	20	10.0	10 4	20	S	717	100	0	0	16
17	47	27	37	0	30	28	0	1	0	09	0	29.66	17	9.8	10.2	18	S	141	20	10	8	17
18	69x	40	55	18	48	10	0	1 8	0	09	0	29.49	17	8.9	9.2	18	SE	575	80	10	9	18
19	62	55	58x	20	54	7	0	1	0	.38	0	29.39	17	10.5	10.8	21	S	243	34	10	10	19
20	56	37	47	9	44	18	0	1 8	0	.01	0	29.44	34	1 6	5 0	14	SE	298	41	8	8	20
21	43	31	37	-2	33	28	0	1 8	0	0	0	29.55	04	8.7	8.8	15	NE	859	82	4	5	21
22	65	31	48	9	37	17	0	1 8	0	T	0	29.27	07	8 8	9 9	20	SE	603	82	8	8	22
23	59	48	54	14	53	11	0	1 8	0	13	0	28.70	16	12 1	12.9	24	SE	12	2	10	9	23
24	50	19	35	-5	28	30	0	1 4 9	0	.13	1	28 65	33	14.5	16.8	32	N	52	7	10	10	24
25	24	18	21	-20	13	44	0		T	03	2	29.05	32	14.5	14.7	37	NW	328	44	10	10	25
26	31	20	26	-15	17	39	0		T	T	T	29.40	28	9 2	9 5	30	W	487	65	9	8	26
27	36	23	30	-12	20	35	0	8	T	0	0	29.64	03	2 7	6.9	23	E	683	89	3	2	27
28	57	30	44	2	38	21	0	1 8	0	16	0	29 33	17	13.9	14.7	39	SE	3	0	10	9	28
29	56	40	48	6	40	17	0	1 3	0	1 33	0	28.25	15	5 0	11 5	44	S	0	0	10	10	29
30	63	42	53	10	55	12	0	1 3	0	.29	0	29 16	20	16.7	18.6	46	S	43	5	10	10	30
31	42	32	37	-6	31	28	0	1	0	T	0	29.51	01	10 4	12 9	23	NE	136	18	10	10	31
	SUM	SUM				TOTAL	TOTAL			TOTAL	TOTAL	FOR THE MONTH:						TOTAL	%	SUM	SUM	
	1342	852				810	0	NUMBER OF DAYS		4.31	2.0	29 33	22	3.8	10.8	46	S	8848	FOR	240	228	
	AVG	AVG	AVG	DEP.	AVG.	DEP	DEP	PRECIPITATION .01 INCH OR MORE	17	DEP						DATE:	30	POSSIBLE	MONTH	AVG.	AVG.	
	43.3	27.5	35.4	-1.4	30	36	0			1.56								22218	45	7.7	7.4	

NUMBER OF DAYS MAXIMUM TEMP. ≤ 90°	≤ 32°	MINIMUM TEMP ≤ 32°	≤ 0°	SEASON TO DATE DEP.	SEASON TO DATE DEP.
0	6	23	0	778	0

SNOW, ICE PELLETS: ≥ 1.0 INCH 1; THUNDERSTORMS 3; HEAVY FOG 2

GREATEST IN 24 HOURS AND DATES PRECIPITATION		SNOW, ICE PELLETS		GREATEST DEPTH ON GROUND OF SNOW, ICE PELLETS OR ICE AND DATE	
1.38	3- 4	1.0	9	10	1

CLEAR 5 PARTLY CLOUDY 5 CLOUDY 21

* EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE
T TRACE AMOUNT
- ALSO ON AN EARLIER DATE, OR DATES.
HEAVY FOG: - VISIBILITY 1/4 MILE OR LESS
FIGURES FOR WIND DIRECTIONS ARE TENS OF DEGREES CLOCKWISE FROM TRUE NORTH 00 = CALM
DATA IN COLS 6 AND 12-15 ARE BASED ON 7 OR MORE OBSERVATIONS PER DAY AT 3-HOUR INTERVALS.
FASTEST MILE WIND SPEEDS ARE FASTEST OBSERVED ONE-MINUTE VALUES WHEN DIRECTIONS ARE IN TENS OF DEGREES. THE / WITH THE DIRECTION INDICATES PEAK GUST SPEED
ANY ERRORS DETECTED WILL BE CORRECTED AND CHANGES IN SUMMARY DATA WILL BE ANNOTATED IN THE ANNUAL SUMMARY

SUMMARY BY HOURS

HOUR LOCAL TIME	AVERAGES SKY COVER TENTHS	STATION PRESSURE IN.	TEMPERATURE AIR °F	TEMPERATURE WET BULB °F	DEW PT °F	RELATIVE HUMIDITY %	WIND SPEED M.P.H.	RESULTANT WIND DIRECTION	RESULTANT WIND SPEED M.P.H.
00	7	29.33	34	33	30	84	8.5	22	4.5
03	7	29 32	34	32	29	85	8.9	23	2.8
06	7	29.33	32	31	28	86	10 1	23	2 3
09	7	29.35	34	33	29	83	11.2	21	3.3
12	8	29.34	38	35	31	77	12 9	20	4.9
15	8	29 31	39	38	32	78	12.3	21	5.7
18	8	29.32	38	36	31	78	11 2	22	4 0
21	7	29.34	36	34	30	81	9.8	21	3.4

HOURLY PRECIPITATION (WATER EQUIVALENT IN INCHES)

DATE	A.M. HOUR ENDING AT 1	2	3	4	5	6	7	8	9	10	11	12	P.M. HOUR ENDING AT 1	2	3	4	5	6	7	8	9	10	11	12	DATE
1	01	.02	01	.01	T	02	01																		1
2																									2
3									.01	01	15	T	02	01	.02	04	T		01	.02	T	.07	08	20	3
4	10	.23	.11	T	T	23	07		-		T	T	T			T	T								4
5					T	T			T	T	T	T	T	T	01	T	01	01	01	02	T	01	T	T	5
6	T	T																			T	T	T	.01	6
7	T	T	T	T	T	T	T	T	01	T	T						T	T	T	T					7
8																									8
9								.01	02	.02	03	02	.01	T	T	T	01	T							9
10											T	T	T		T	T	T	T				T	T	T	10
11	T																								11
12																									12
13											T	T													13
14													T	T	T	T									14
15																									15
16																									16
17												T	02	02	01	01	02	.01							17
18																							.06	03	18
19	09	.08	.05	.05	09	02																			19
20					T	01																			20
21																									21
22																					T	T			22
23	T	T	.02	.03	02	01	T	T	T	T	01		01	02	T	T	T	01	T						23
24	01	.02	.01	T	T	01	01	01	02	01	T	T	T	T	T	.01	T		T	T	T	T	.01	.01	24
25	T	.01	T	T	T	T	T	T	T	T	T	T	T	.01	T	T	01	T	T	T		T	T		25
26													T	T				T	T						26
27																									27
28									T	02	02	02	10	T											28
29	42	T					T	T	T	01	.25	20	20	.06	07	T	T	.03	01	T			.06	02	29
30	T										T	04	T		T	16	04	03	T						30
31						T	T	T	T																31

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